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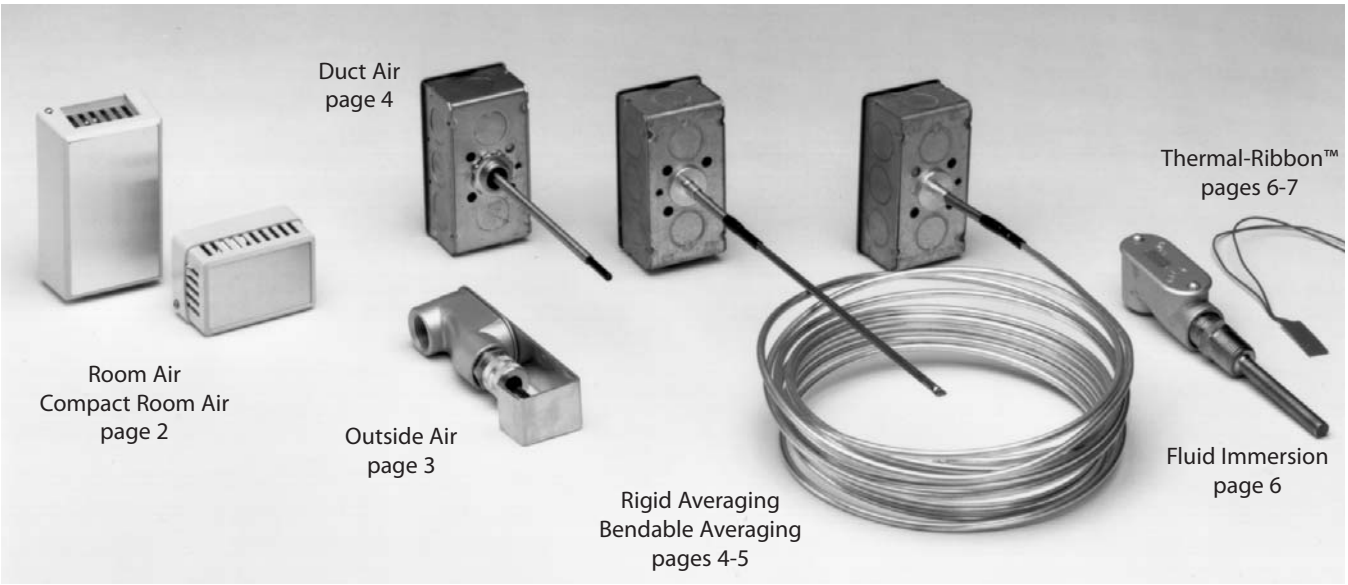
# Installation Guidelines: Resistance Thermometers and Temptran™ Thermometers for Building Automation Systems




The accuracy of a building automation system depends on the readings taken at each temperature sensing point. Resistance thermometers and Temptran™ thermometers are highly accurate temperature sensing devices for HVAC/R systems. They provide input to instruments which control building temperatures. Special thermometers are made to sense the temperatures of room air, outside air, duct air and heat exchange fluids. This application aid gives guidelines on where and how to install resistance thermometers and Temptran thermometers for optimum accuracy.

## Resistance thermometers

Resistance thermometers are called RTD's (resistance temperature detectors) or PRT's (platinum resistance thermometers). The electrical resistance of an RTD changes in a known and repeatable manner. As its temperature increases, so does its resistance. Minco's resistance thermometers contain wire elements, wound in configurations to best sense temperature changes in your application.

For more information on the principles and applications of resistance thermometers, request Minco Application Aid #18, *Resistance Thermometry*.

## Temptran™ thermometers

A "Temptran™ thermometer" is a temperature sensing apparatus consisting of a resistance thermometer connected to a Temptran temperature transmitter. The Temptran itself is a two-wire temperature transmitter used to convert a resistance reading to a 4 to 20 mA current signal. Temptrans connect to the resistance thermometers by either a terminal block or wire leads.

The Temptran's output signal wires can run thousands of feet to control instruments with no loss of accuracy because the current signal is unaffected by leadwire resistance. Many standard instruments accept the Temptran's signal.

Temptran thermometers are individually calibrated with resistance thermometers at the factory and supplied in matched sets to improve total system accuracy. For lower cost, some Temptrans are factory calibrated to nominal resistance/temperature curves.

For specifications and ordering information of resistance thermometers and Temptran thermometers, request Minco Bulletin TS-102, *Temperature Sensors & Transmitters*.

# Installation Guidelines: Resistance Thermometers and Temptran™ Thermometers for Building Automation Systems

## Duct Air Thermometers

### Duct air thermometer installation

1. Cut a 1-1/8" diameter hole in the duct wall; use Template 3 on page 5.
2. Open the utility box cover and remove the foam gasket inside. Adhesive side first, slip it over the thermometer probe, remove the white paper backing, and press it on the utility box. One side of the gasket may be cut or slit for easier installation.
3. Insert the thermometer into the duct and screw the utility box to the duct wall with two #10 sheet metal screws. The sensing tip of the duct air thermometer should be close to the center of the duct.
4. See page 8 for electrical connection instructions.
5. Screw the cover back on the utility box.

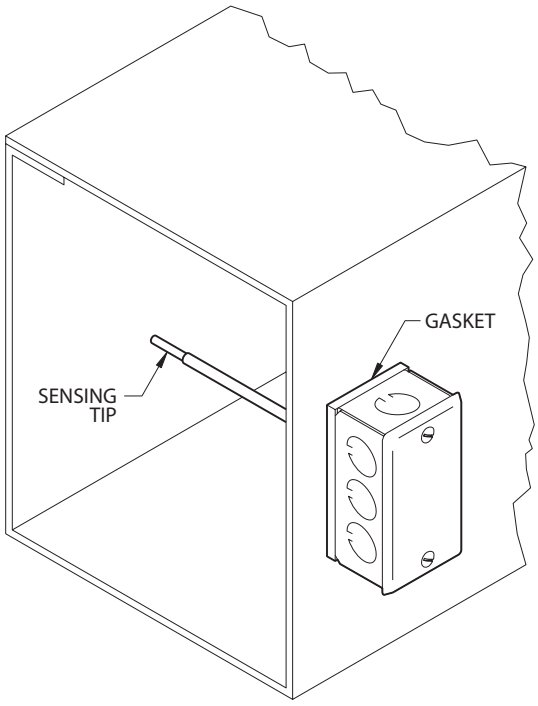



*Figure 4:* Duct air thermometer

### Rigid averaging thermometer installation

1. The rigid averaging thermometer senses temperature along its entire length. Cut a 1-1/8" diameter hole in the duct wall. Using the template on page 5, drill two holes for the mounting screws with a #27 drill bit.
2. Open the utility box cover and remove the foam gasket inside. Adhesive side first, slip it over the thermometer probe, remove the white paper backing, and press it on the utility box. One side of the gasket may be cut or slit for easier installation.
3. Screw the utility box to the duct wall with two #10 sheet metal screws.
4. If the rigid probe is longer than 24", it should be supported near the tip so that it will not bend or vibrate.
5. See page 8 for electrical connection instructions.
6. Screw the cover back on the utility box.

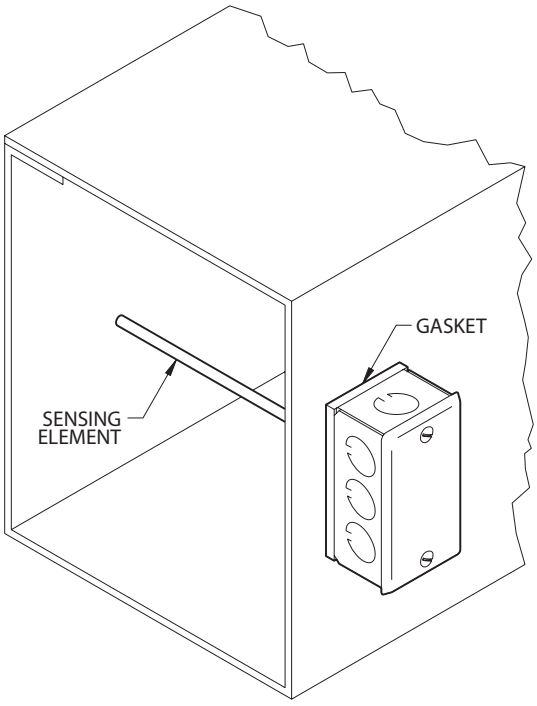



*Figure 5:* Rigid averaging thermometer

# Installation Guidelines: Resistance Thermometers and Temptran™ Thermometers for Building Automation Systems

## Duct Air Thermometers

### Bendable averaging thermometer installation

1. Area averaging thermometers sense temperature along their entire length. They are used where stratified hot and cold air layers might cause errors with single point sensors. Two suggested installations are shown below. You may design a different installation if you wish; just be sure the thermometer doesn't rattle and is evenly spaced across temperature zones.

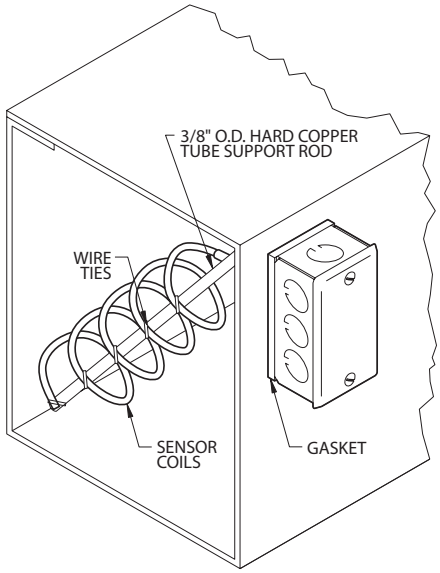



*Figure 6:* Bendable averaging thermometer, Installation A

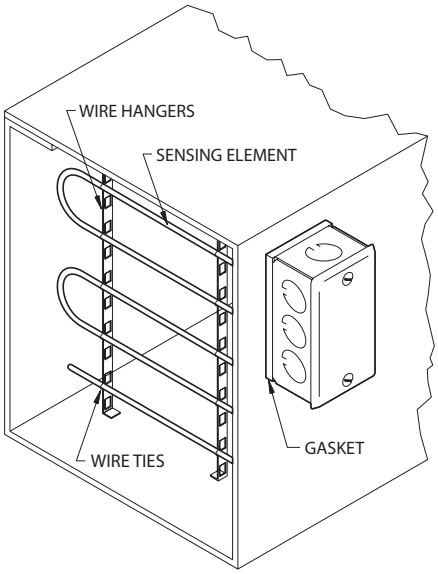
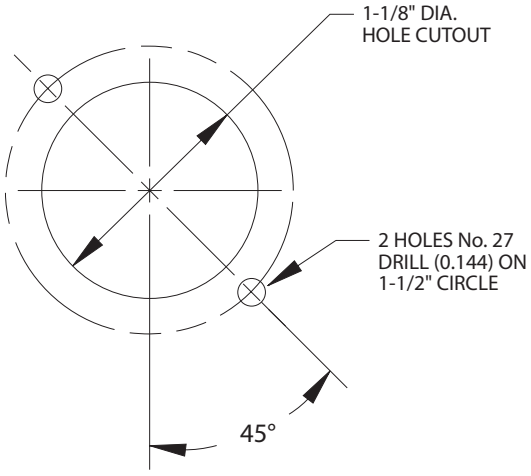



*Figure 7:* Bendable averaging thermometer, Installation B

2. Cut a 1-1/8" diameter hole in the duct wall; use Template 3, below.
3. Open the utility box cover and remove the foam gasket inside. Adhesive side first, slip it over the thermometer probe, remove the white paper backing, and press it on the utility box. One side of the gasket may be cut or slit for easier installation.
4. Installation A uses a 3/8" hard copper tube, or suitable equivalent, as a support rod for the thermometer. Cut the rod to size so its ends can be flattened and tightly set into the duct diagonally as shown in Figure 6. As an option, the support rod can be secured at each end with mounting flanges on the outside of the duct. Expand the coiled thermometer into a spiral and rotate the whole unit to screw the tubing through the hole and into the duct. Be sure to rotate the thermometer and utility box together. Screw the utility box to the duct wall with two #10 sheet metal screws. Attach the sensor coils to the copper support rod with wire ties.
5. Installation B uses two lengths of pipe hanger mounted inside the duct, parallel to the flow of air, to support the thermometer. Insert the thermometer through the hole in the duct, rotating the thermometer and utility box as a unit. Screw the utility box to the duct wall with two #10 screws. Carefully weave the thermometer back and forth horizontally in serpentine bends, with a minimum bend radius of 4 inches, and attach it to the pipe hangers with wire ties.
6. See page 8 for electrical connection instructions.
7. Screw the cover back on the utility box.




*Template 3:* Duct air thermometer



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# Installation Guidelines: Resistance Thermometers and Temptran™ Thermometers for Building Automation Systems

## Electrical Connections

### Resistance thermometer connections

Connect resistance thermometer leads to signal extension wires, Temptran input, or directly to instrument inputs. Use solder, wire nuts, crimp connectors, or terminal blocks. If the instrument requires a 3-wire input and you have a 2-wire resistance thermometer, simply connect one resistance thermometer lead to the two common extension wires or instrument inputs (Figure 12). If your instrument is designed for 4-wire input, attach extra extension leads to your 2 or 3-wire RTD (Figure 13). Attach the extension leads near the sensing element to reduce the effects of leadwire resistance.

For more information request Minco Application Aid #18, *Resistance Thermometry*.

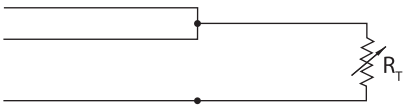


*Figure 12:* Extension leads for 2-wire RTD and 3-wire input

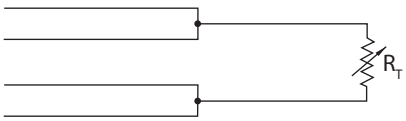


*Figure 13:* Extension leads for 2-wire RTD and 4-wire input

### Temptran thermometer connections

1. IMPORTANT: Temptran transmitters Models TT150, TT151, and TT155 are factory calibrated. Keep these RTD's and Temptrans together in matched sets.
2. The Temptran converts the RTD's temperature reading to a 4 to 20 mA current signal. The two field wires, usually a twisted pair color-coded to identify polarity, carry both the current signal and the power to run the Temptran. The field wires connect to positions 1(+) and 2 (–) on Temptrans with terminal blocks. Room air Temptran thermometers have no polarity — you may connect wires either way. If your Temptran has wire leads, use wire nuts, solder, or crimp connectors to connect the field wires to the red (+) and brown (–) leads.

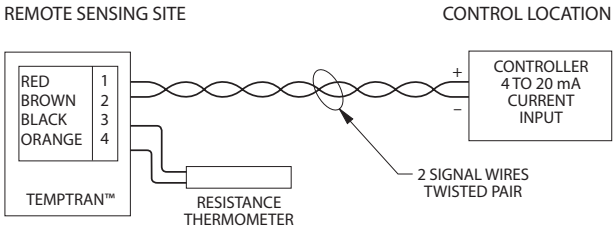


*Figure 14:* Typical hookup of a single current loop.

3. If the RTD and Temptran are mounted separately, resistance in extension leads between them will add to the RTD's readings. You should therefore use AWG #18 (or larger) wire for extension leads; and use solder, crimp connectors, or terminal blocks for all connections. RTD leads have no polarity to observe. Connect them to the Temptran's black and orange leads, or to positions 3 and 4 on the terminal block.

### Recalibration of Temptran thermometers

Resistance thermometers do not need to be recalibrated; they are passive devices with negligible drift. Temptrans may need periodic recalibration. The procedure is straightforward:

1. Disconnect wires to the resistance thermometer and connect the Temptran to a resistance decade box, sometimes sold as an "RTD simulator."
2. Set switches on the decade box to correspond to the lower resistance of the RTD as it is listed on the Temptran label. Use a small screwdriver to adjust the output of the Temptran's zero pot to 4 mA DC.
3. The Temptran's span adjustment is made in the same manner. Set switches on the decade box to correspond with the RTD's upper resistance as it is listed on the label. Adjust the Temptran's current to 20 mA.
4. Repeat steps 2 and 3 and readjust as necessary to correct for interaction between the zero and span.
5. Disconnect the Temptran from the decade box and reconnect it to the resistance thermometer.

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