



## Section 5: Temperature Instruments

- RTD and thermocouple Temptran™ transmitters give accurate signals over thousands of feet. Select fixed range or field rangeable; miniature, “hockey puck,” and isolated versions
- Microprocessor based controllers with optional alarm features
- Miniature DC temperature controller

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**[www.minco.com](http://www.minco.com)**

Note: Dozens of other instruments are listed at [www.minco.com](http://www.minco.com)



TT110, TT111 only



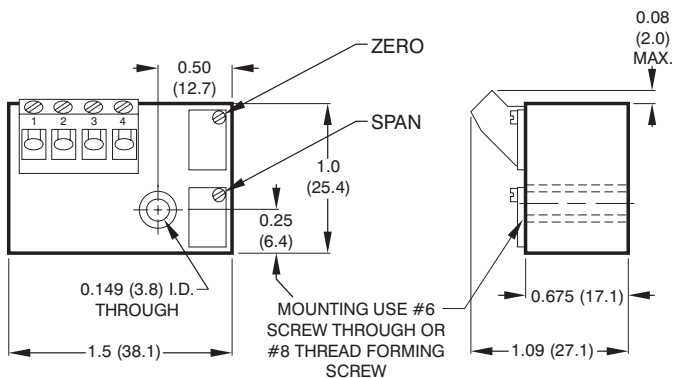
TT210, TT211 only



TT110, TT210



TT111, TT211



DIMENSIONS IN INCHES (mm)  
SEE PAGE 5-14 FOR WIRING DIAGRAM

## Miniature RTD Transmitters

- Small size, low cost
- Four models:  
TT110, TT111: UL recognized component for Canada and United States.  
TT210, TT211: Wider ambient rating; FM approved intrinsically safe and nonincendive
- Optional match calibration to Minco RTDs for improved accuracy

### Specifications

**Output:** 4 to 20 mA over specified range, linear with temperature.

**Calibration accuracy:**  $\pm 0.1\%$  of span.

**Linearity:** Referenced to actual sensor temperature.

Platinum RTD input:  $\pm 0.1\%$  of span.

Nickel and nickel-iron RTD input:

$\pm 0.25\%$  of span for spans less than 100°C.

$\pm 0.25\%$  of span per 100°C of span for spans greater than 100°C.

**Adjustments:** Zero and span,  $\pm 5\%$  of span. Factory set.

**Ambient temperature:**

TT110, TT111: 0 to 50°C (32 to 122°F).

TT210, TT211: -25 to 85°C (-13 to 185°F).

Storage: -55 to 100°C (-67 to 212°F).

**Ambient temperature effects:**

$\pm 0.013\%$  of span per °C.

$\pm 0.025\%$  of span per °C for spans less than 55°C.

**Warmup drift:**  $\pm 0.1\%$  of span max., with

$V_{supply} = 24 \text{ VDC}$  and  $R_{loop} = 250 \Omega$ .

Stable within 30 minutes.

**Supply voltage:** 8.5 to 35 VDC. Voltage effect  $\pm 0.001\%$  of span per volt. Reverse polarity protected.

**Maximum load resistance:** The maximum allowable resistance of the signal carrying loop is:

$$R_{loop \max} = \frac{V_{supply} - 8.5}{0.020 \text{ amps}}$$

Example: With supply voltage 24 VDC, maximum loop resistance is 775  $\Omega$ .

**Minimum span:** 27.8°C (50°F).

**Hazardous atmospheres:** All models may be used with Minco flameproof/explosionproof connection heads. Models TT210 and TT211 are Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:

$V_{max} = 35 \text{ volts}$ ;  $I_{max} = 150 \text{ mA}$ ;  $C_i = 0 \mu\text{F}$  and  $L_i = 0 \text{ mH}$ .

**Connections:**

TT110, TT210: Four AWG 22 leads, 5" (127 mm).

TT111, TT211: Terminal block for wires AWG 22 to AWG 14.

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 1.1 oz. (30 g).

**IN STOCK**

Contact Minco for currently available transmitter ranges and models

### RTD input types

2-wire resistance thermometer:

Element	Code
Platinum 392, 100 $\Omega$ at 0°C	PA
Platinum 391, 100 $\Omega$ at 0°C	PB
Platinum 385, 100 $\Omega$ at 0°C	PD, PE
Platinum 385, 1000 $\Omega$ at 0°C	PF
Platinum 375, 1000 $\Omega$ at 0°C	PW
Nickel-iron, 604 $\Omega$ at 0°C	FA
Nickel-iron, 1000 $\Omega$ at 70°F	FB
Nickel-iron, 2000 $\Omega$ at 70°F	FC
Nickel, 120 $\Omega$ at 0°C	NA

### How to order

TT111	<b>Model number:</b> TT110, TT111, TT210, or TT211
PD	<b>RTD element code from table</b>
1	<b>Output:</b> 4 to 20 mA DC
C	<b>Temperature range code from table on page 5-10</b> [Ex: C = 0 to 100°C (32 to 212°F)]
TT111PD1C ← Sample P/N	

See page 5-13 for high-accuracy calibration option.

### Hazardous Area Requirements

Request Application Aid #19 for information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX).

# Temperature Instruments



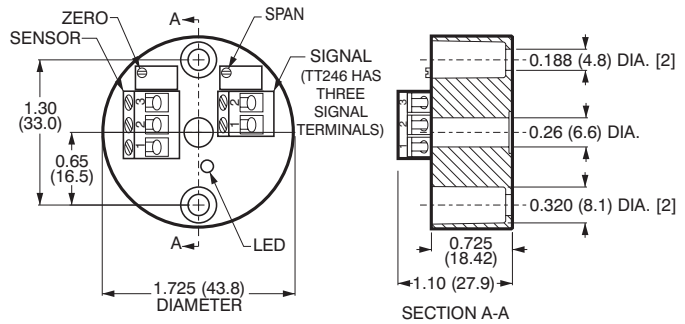
APPROVED  
TT176 only



TT176 CURRENT OUTPUT



TT246 VOLTAGE OUTPUT



DIMENSIONS IN INCHES (mm)  
SEE PAGE 5-14 FOR WIRING DIAGRAM

## TT176, TT246 RTD Transmitters

- “Hockey puck” style industrial transmitters
- TT176: 4 to 20 mA current signal  
TT246: 1 to 5 VDC voltage signal
- 2 or 3-wire RTD input
- Intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)
- Fits DIN “B” style connection heads
- Optional match calibration to Minco RTDs for improved accuracy

Specify these rugged, accurate transmitters for process control and other industrial applications.

Model TT176 provides a linearized 4 to 20 mA current signal for long distance transmission. It has a built-in LED indicator to monitor operation.

TT246 outputs 1 to 5 VDC proportional to temperature. It draws only 3 mA of quiescent current, making it ideal for solar or battery powered systems.

### Specifications

**Output:** Linear with temperature over specified range.

TT176: 4 to 20 mA.

TT246: 1 to 5 VDC.

**Calibration accuracy:**  $\pm 0.1\%$  of span (0.2% of span for spans less than 10  $\Omega$ ).

**Linearity:** 0.1% of span, referenced to actual sensor temperature.

**Adjustments:** Zero and span,  $\pm 5\%$  of span, non-interacting. Factory set.

**Ambient temperature:**

Operating: -40 to 85°C (-40 to 185°F).

Storage: -55 to 100°C (-67 to 212°F).

**Ambient temperature effects:**

$\pm 0.009\%$  of span per °C.

$\pm 0.014\%$  of span per °C for spans less than 10  $\Omega$ .

**Warmup drift:**  $\pm 0.1\%$  of span max., with  $V_{supply} = 24$  VDC and  $R_{loop} = 250 \Omega$ .  
Stable within 15 minutes.

**Supply voltage:**

TT176: 10 to 35 VDC.

TT246: 7.5 to 35 VDC.

Voltage effect  $\pm 0.001\%$  of span per volt.  
Reverse polarity protected.

**Supply current (TT246):** 3 mA max. with no load.

**Maximum load resistance (TT176):** The maximum allowable resistance of the signal carrying loop is:

$$R_{loop\ max} = \frac{V_{supply} - 10}{0.020\ \text{amps}}$$

Example: With supply voltage 24 VDC, maximum loop resistance is 700  $\Omega$ .

**Minimum span:** 10°C (18°F).

**Minimum output current:** 2.2 mA (TT176).

**Maximum output current:** 28 mA (TT176).

**Leadwire compensation:** (3-wire RTD)  $\pm 0.05\%$  of span per  $\Omega$  up to 25  $\Omega$  in each leg.

**Hazardous atmospheres:** Both models may be used with Minco explosionproof connection heads. Model TT176 is Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:  $V_{max} = 35$  volts;

$I_{max} = 150$  mA;  $C_i = 0$   $\mu$ F and  $L_i = 0$  mH.

Request Application Aid #19 for information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX).

**Connections:** Terminal block for wires AWG 22 to AWG 14.

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 2.0 oz. (57 g).

### RTD input types

2 or 3-wire resistance thermometer:

Element	Code
Platinum 392, 100 $\Omega$ at 0°C	PA
Platinum 391, 100 $\Omega$ at 0°C	PB
Platinum 385, 100 $\Omega$ at 0°C	PD, PE
Platinum 385, 1000 $\Omega$ at 0°C	PF
Platinum 375, 1000 $\Omega$ at 0°C	PW
Copper, 10 $\Omega$ at 25°C	CA
Nickel-iron, 604 $\Omega$ at 0°C	FA
Nickel-iron, 1000 $\Omega$ at 70°F	FB
Nickel-iron, 2000 $\Omega$ at 70°F	FC
Nickel, 120 $\Omega$ at 0°C	NA

### How to order

TT176	<b>Model number:</b> TT176: 4 to 20 mA TT246: 1 to 5 VDC
PB	<b>RTD element code from table</b>
1	
K	<b>Temperature range code from table on page 5-10</b> [Ex: K = 0 to 200°C (32 to 392°F)]
TT176PB1K ← Sample P/N	

See page 5-13 for high-accuracy calibration option.

**IN STOCK**

Contact Minco for currently available transmitter ranges and models

# Temperature Instruments

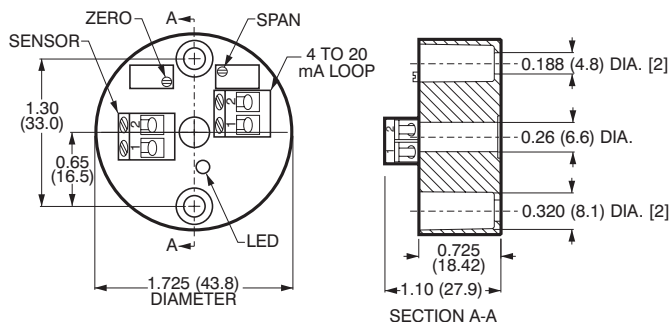


TT190



TT205

DIMENSIONS SAME  
AS ON PAGE 5-2



DIMENSIONS IN INCHES (mm)  
SEE PAGE 5-14 FOR WIRING DIAGRAM

## TT190, TT205 Thermocouple Transmitters

- TT190: "Hockey puck" style industrial transmitter TT205: Miniature economy version
- Thermocouple input
- Intrinsically safe, nonincendive for hazardous locations
- Fits DIN "B" style connection heads

Model TT190 interfaces with thermocouples for use in process control and other industrial applications. It has a built-in LED indicator to help troubleshoot signal loops. A dark LED signals loss of current loop power or an open thermocouple.

Model TT205 offers performance and economy over a reduced ambient temperature range. Its compact size takes up little space.

### Specifications

**Output:** 4 to 20 mA over specified range.

**Accuracy:**  $\pm 0.2\%$  of span.

**Linearity:** Voltage linear.

**Adjustments:** Zero and span,  $\pm 5\%$  of span, non-interacting. Factory set.

**Warmup drift:**  $\pm 0.2\%$  of span max., with

$V_{supply} = 24 \text{ VDC}$  and  $R_{loop} = 250 \Omega$ .

Stable within 15 minutes.

**Supply voltage:**

TT190: 10 to 35 VDC.

TT205: 8.5 to 35 VDC.

Voltage effect  $\pm 0.001\%$  of span per volt.

Reverse polarity protected.

**Maximum load resistance:** The maximum allowable resistance of the signal carrying loop is:

$$R_{loop \max} = \frac{V_{supply} - V_{min}}{0.020 \text{ amps}}$$

Example: With a TT190 ( $V_{min} = 10$ ) operated at 24 VDC, maximum loop resistance is 700  $\Omega$ .

**Minimum output current:** 1.5 mA.

**Maximum output current:** 28 mA.

**Burnout:** Downscale burnout standard; upscale optional.

**Hazardous atmospheres:** Both models may be used with Minco explosionproof connection heads. Model TT190 is Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:  $V_{max} = 35 \text{ volts}$ ;

$I_{max} = 150 \text{ mA}$ ;  $C_i = 0 \mu F$  and  $L_i = 0 \text{ mH}$ .

**Connections:** Terminal block for wires AWG 22 to AWG 14.

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 1.8 oz. (52 g).

### TT190

**Ambient temperature:**

Operating:  $-40$  to  $85^\circ\text{C}$  ( $-40$  to  $185^\circ\text{F}$ ).

Storage:  $-55$  to  $100^\circ\text{C}$  ( $-67$  to  $212^\circ\text{F}$ ).

**Ambient temperature effects:**

$\pm 0.018\%$  of span per  $^\circ\text{C}$ .

**Cold junction compensation drift:**

$\pm 0.03^\circ\text{C}$  per  $^\circ\text{C}$ ,  $-25$  to  $70^\circ\text{C}$ .

$\pm 0.06^\circ\text{C}$  per  $^\circ\text{C}$ ,  $-40$  to  $-25^\circ\text{C}$  and  $70$  to  $85^\circ\text{C}$ .

**Minimum span:**  $100^\circ\text{C}$  ( $180^\circ\text{F}$ ).

### TT205

**Ambient temperature:**

Operating:  $-10$  to  $60^\circ\text{C}$  ( $14$  to  $140^\circ\text{F}$ ).

Storage:  $-55$  to  $100^\circ\text{C}$  ( $-67$  to  $212^\circ\text{F}$ ).

**Ambient temperature effects:**

$\pm 0.036\%$  of span per  $^\circ\text{C}$ .

**Cold junction compensation drift:**

$\pm 0.05^\circ\text{C}$  per  $^\circ\text{C}$ .

**Minimum span:**  $150^\circ\text{C}$  ( $270^\circ\text{F}$ ).

### How to order

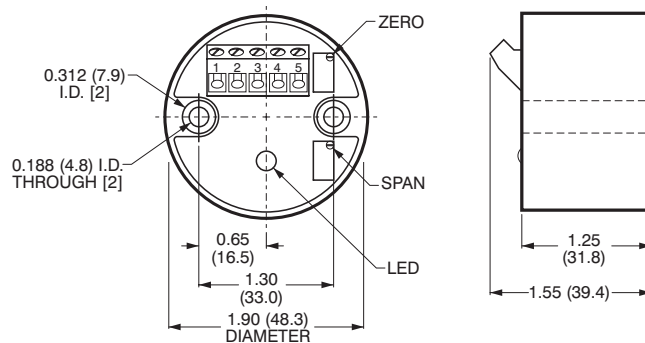
TT190	<b>Model number:</b> TT190: Round TT205: Rectangular
J	<b>TC junction type:</b> E = Chromel-Constantan J = Iron-Constantan K = Chromel-Alumel T = Copper-Constantan
U	<b>U = Ungrounded junction (required)</b>
1	<b>Output: 4 to 20 mA DC</b>
GX	<b>Temperature range code from table on page 5-10</b> [Ex: GX = $93.3$ to $760^\circ\text{C}$ ( $200$ to $1400^\circ\text{F}$ )]
TT190JU1GX ← Sample P/N	

### Hazardous Area Requirements

Request Application Aid #19 for information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX).



# Temperature Instruments



DIMENSIONS IN INCHES (mm)  
SEE PAGE 5-14 FOR WIRING DIAGRAM

## TT220 Isolated RTD Transmitter

- 2 or 3-wire RTD input
- Input/output isolated to 600 VRMS
- Factory Mutual approved intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)
- Optional match calibration to Minco RTDs for improved accuracy

Model TT220 is a rugged industrial transmitter designed for process control and other applications. It provides electrical isolation to 600 VRMS between the input and output.

The TT220 has a built-in LED indicator to help troubleshoot signal loops. A very bright LED indicates an open sensor; a dark LED signals a shorted sensor or loss of current loop power.

### Specifications

**Output:** 4 to 20 mA over specified range, linear with temperature.

**Calibration accuracy:**  $\pm 0.1\%$  of span (0.2% of span for spans less than 10  $\Omega$ ).

**Linearity:** 0.1% of span, referenced to actual sensor temperature.

**Adjustments:** Zero and span,  $\pm 5\%$  of span, non-interacting. Factory set.

**Ambient temperature:**

Operating: -40 to 85°C (-40 to 185°F).

Storage: -55 to 100°C (-67 to 212°F).

**Ambient temperature effects:**  $\pm 0.018\%$  of span per °C.

**Warmup drift:**  $\pm 0.1\%$  of span max., with

$V_{supply} = 24 \text{ VDC}$  and  $R_{loop} = 250 \Omega$ .

Stable within 15 minutes.

**Input/output isolation:** 600 VRMS.

**Supply voltage:** 13 to 45 VDC. Voltage effect  $\pm 0.001\%$  of span per volt. Reverse polarity protected.

**Maximum load resistance:** The maximum allowable resistance of the signal carrying loop is:

$$R_{loop\ max} = \frac{V_{supply} - 13}{0.020\ \text{amps}}$$

Example: With supply voltage 24 VDC, maximum loop resistance is 550  $\Omega$ .

**Minimum span:** 10°C (18°F).

**Minimum output current:** 2.5 mA.

**Maximum output current:** 28 mA.

**Leadwire compensation:** (3-wire RTD)  $\pm 0.05\%$  of span per  $\Omega$  up to 25  $\Omega$  in each leg.

**Hazardous atmospheres:** Model TT220 may be used with Minco explosionproof connection heads. This model is Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:  $V_{max} = 35 \text{ volts}$ ;

$I_{max} = 150 \text{ mA}$ ;  $C_i = 0 \mu\text{F}$  and  $L_i = 0 \text{ mH}$ .

**Connections:** Terminal block for wires AWG 22 to AWG 14.

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 3.0 oz. (85 g).

### RTD input types

2 or 3-wire resistance thermometer:

Element	Code
Platinum 392, 100 $\Omega$ at 0°C	PA
Platinum 391, 100 $\Omega$ at 0°C	PB
Platinum 385, 100 $\Omega$ at 0°C	PD, PE
Platinum 385, 1000 $\Omega$ at 0°C	PF
Platinum 375, 1000 $\Omega$ at 0°C	PW
Copper, 10 $\Omega$ at 25°C	CA
Nickel-iron, 604 $\Omega$ at 0°C	FA
Nickel-iron, 1000 $\Omega$ at 70°F	FB
Nickel-iron, 2000 $\Omega$ at 70°F	FC
Nickel, 120 $\Omega$ at 0°C	NA

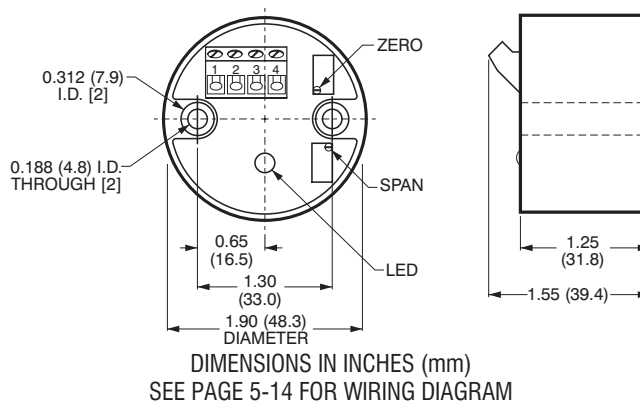
### How to order

TT220	Model number
PA	RTD element code from table
1	Output: 4 to 20 mA DC
GH	Temperature range code from table on page 5-10 [Ex: GH = -40 to 100°C (-40 to 212°F)]
TT220PA1GH ← Sample P/N	

See page 5-13 for high-accuracy calibration option.

### Hazardous Area Requirements

Request Application Aid #19 for information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX).



## TT221 Isolated Thermocouple Transmitter

- Thermocouple input
- Input/output isolated to 600 VRMS
- Factory Mutual approved intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)

Model TT221 is a rugged thermocouple transmitter designed for process control and other applications. It provides electrical isolation to 600 VRMS between the input and output. You can use thermocouples with either grounded or ungrounded junctions.

The TT221 has a built-in LED indicator to help troubleshoot signal loops. A dark LED signals loss of loop power or an open sensor.

### Specifications

**Output:** 4 to 20 mA over specified range.

**Accuracy:**  $\pm 0.2\%$  of span.

**Linearity:** Voltage linear.

**Adjustments:** Zero and span,  $\pm 5\%$  of span, non-interacting. Factory set.

**Ambient temperature:**

Operating:  $-40$  to  $85^\circ\text{C}$  ( $-40$  to  $185^\circ\text{F}$ ).

Storage:  $-55$  to  $100^\circ\text{C}$  ( $-67$  to  $212^\circ\text{F}$ ).

**Ambient temperature effects:**

$\pm 0.036\%$  of span per  $^\circ\text{C}$ .

**Cold junction compensation drift:**

$\pm 0.03^\circ\text{C}$  per  $^\circ\text{C}$ ,  $-25$  to  $70^\circ\text{C}$ .

$\pm 0.06^\circ\text{C}$  per  $^\circ\text{C}$ ,  $-40$  to  $-25^\circ\text{C}$  and  $70$  to  $85^\circ\text{C}$ .

**Warmup drift:**  $\pm 0.2\%$  of span max., with

$V_{\text{supply}} = 24 \text{ VDC}$  and  $R_{\text{loop}} = 250 \Omega$ .

Stable within 15 minutes.

**Supply voltage:** 13 to 45 VDC. Voltage effect

$\pm 0.001\%$  of span per volt. Reverse polarity protected.

**Maximum load resistance:** The maximum allowable resistance of the signal carrying loop is:

$$R_{\text{loop max}} = \frac{V_{\text{supply}} - 13}{0.020 \text{ amps}}$$

Example: With supply voltage 24 VDC, maximum loop resistance is  $550 \Omega$ .

**Minimum span:**  $100^\circ\text{C}$  ( $180^\circ\text{F}$ ).

**Minimum output current:** 2.5 mA.

**Maximum output current:** 28 mA.

**Burnout:** Downscale burnout standard; upscale optional.

**Hazardous atmospheres:** Model TT221 may be used with Minco explosionproof connection heads. This model is Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:  $V_{\text{max}} = 35 \text{ volts}$ ;

$I_{\text{max}} = 150 \text{ mA}$ ;  $C_i = 0 \mu\text{F}$  and  $L_i = 0 \text{ mH}$ .

**Connections:** Terminal block for wires AWG 22 to AWG 14

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 3.0 oz. (85 g).

### How to order

TT221	<b>Model number</b>
J	<b>TC junction type (may be grounded or ungrounded):</b> E = Chromel-Constantan J = Iron-Constantan K = Chromel-Alumel T = Copper-Constantan
1	<b>Output: 4 to 20 mA DC</b>
BW	<b>Temperature range code from table on page 5-10</b> [Ex: BW = $0$ to $250^\circ\text{C}$ ( $32$ to $482^\circ\text{F}$ )]
TT221J1BW ← Sample P/N	

### Hazardous Area Requirements

Request Application Aid #19 for information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX).

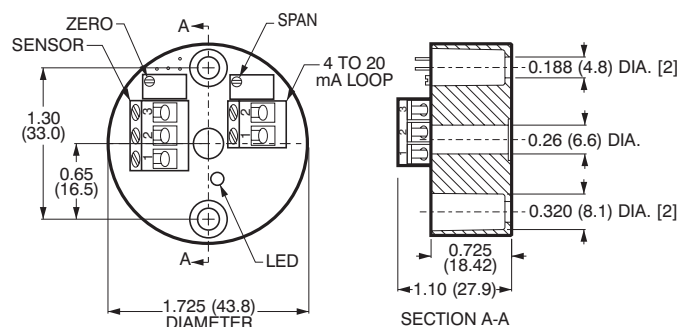
# Temperature Instruments



TT216



TT230



DIMENSIONS IN INCHES (mm)  
SEE PAGE 5-14 FOR WIRING DIAGRAM

## Field Rangeable Transmitters

- Wide ranging zero and span adjust to desired temperature range
- LED indicates status of current loop

Rangeable transmitters let you stock standard models, then calibrate to the exact range when a need arises. There are three broad range codes for platinum RTDs, one for copper RTDs, and two for thermocouples. Each range code contains three intervals for temperature span. You select the desired interval by making a solder link between two pins atop the transmitter. Zero and span potentiometers give fine adjustments.

### Specifications

**Output:** 4 to 20 mA over specified range.

**Adjustments:** See temperature range chart at right. Normally shipped uncalibrated; factory calibration available.

**Ambient temperature:**

Operating: -40 to 85°C (-40 to 185°F).

Storage: -55 to 100°C (-67 to 212°F).

**Supply voltage:** 10 to 35 VDC. Voltage effect  $\pm 0.001\%$  of span per volt. Reverse polarity protected.

**Maximum load resistance:** The maximum allowable resistance of the signal carrying loop is:

$$R_{loop\ max} = \frac{V_{supply} - 10}{0.020\ amps}$$

Example: With supply voltage 24 VDC, maximum loop resistance is 700  $\Omega$ .

**Hazardous atmospheres:** Factory Mutual approved intrinsically safe for Class I, Division 1 areas (requires approved barrier) and nonincendive for use in Class I, Division 2 areas. Transmitter entity parameters:  $V_{max} = 35\ volts$ ;  $I_{max} = 150\ mA$ ;  $C_i = 0\ \mu F$  and  $L_i = 0\ mH$ . Request Application Aid #19 for information on hazardous area classifications.

**Connections:** Terminal block for wires AWG 22 to AWG 14.

**Physical:** Polycarbonate case, epoxy potted for moisture resistance.

**Weight:** 2.0 oz. (57 g).

**Temperature range:** The range code determines which values of zero and span are available on the transmitter you order. The actual values are chosen by shorting two pins on top the transmitter, then adjusting the two potentiometers.

Zero ( $T_{4mA}$ )		Span ( $T_{20mA} - T_{4mA}$ )		RTD code	Thermocouple input type	Range code
Minimum	Maximum	Minimum	Maximum			
-25°C	25°C	25°C	100°C	PX		RA
-50°C	50°C	50°C	200°C	PX		RB
-100°C	200°C	150°C	600°C	PX	E, J, K, T	RC
-100°C	100°C	100°C	300°C	CA		RD
-100°C	500°C	300°C	1200°C		K	RE

### TT216 RTD transmitter

**Calibration accuracy:**  $\pm 0.2\%$  of span when factory calibrated.

**Linearity:** 0.2% of span, referenced to actual sensor temperature.

**Ambient temperature effects:**  $\pm 0.013\%$  of span per °C.

**Warmup drift:**  $\pm 0.1\%$  of span max., with  $V_{supply} = 24\ VDC$  and  $R_{loop} = 250\ \Omega$ . Stable within 15 minutes.

**Minimum output current:** 2.2 mA.

**Maximum output current:** 28 mA.

**Leadwire compensation:** (3-wire RTD)  $\pm 0.05\%$  of span per  $\Omega$  up to 25  $\Omega$  in each leg.

**RTD input types:**

2 or 3-wire resistance thermometer:

Element	Code
Platinum, 100 $\Omega$ at 0°C (Includes all TCRs)	PX
Copper, 10 $\Omega$ at 25°C	CA

### How to order

TT216	Model number
PX	RTD element code from table
1	Output: 4 to 20 mA DC
RB	Range code from table
TT216PX1RB ← Sample P/N	

### TT230 thermocouple transmitter

**Calibration accuracy:**  $\pm 0.3\%$  of span when factory calibrated.

**Linearity:** Voltage linear.

**Ambient temperature effects:**

$\pm 0.025\%$  of span per °C.

**Cold junction compensation drift:**

$\pm 0.03\%$  per °C, -25 to 70°C.

$\pm 0.06\%$  per °C, -40 to -25°C and 70 to 85°C.

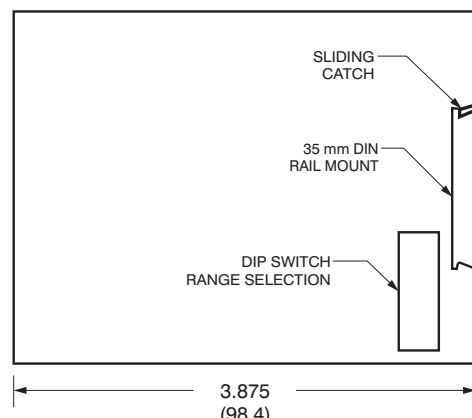
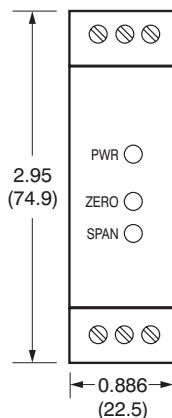
**Minimum output current:** 1.5 mA.

**Maximum output current:** 28 mA.

**Burnout:** Downscale burnout standard; upscale optional.

### How to order

TT230	Model number
T	TC junction type:
	E = Chromel-Constantan
	J = Iron-Constantan
	K = Chromel-Alumel
	T = Copper-Constantan
U	Ungrounded junction (required)
1	Output: 4 to 20 mA DC
RC	Range code from table above
TT230TU1RC ← Sample P/N	



DIMENSIONS IN INCHES (mm)

SEE PAGE 5-14 FOR WIRING DIAGRAMS

## TT273 RTD Temperature Transmitter

- Accurate, stable 4 to 20 mA signal
- Fits standard 35 mm DIN rail
- Field-calibrate to your temperature range
- Optional match calibration to Minco RTDs for improved accuracy
- Optional Input/Output isolation to 600 VRMS

The Model TT273 is a 2-wire temperature transmitter for 2 or 3-lead 100  $\Omega$  platinum RTDs. The transmitter converts the RTDs temperature into a linearized 4 to 20 mA DC current signal. Because this current signal is immune to leadwire and electrical noise, the TT273 lets you obtain accurate temperature readings from RTDs thousands of feet away. An ordinary twisted pair of wires carries both the temperature signal and power for the transmitter's electronics.

An LED conveniently indicates the status of the control loop. The brightness is directly proportional to the loop current. A very bright LED indicates an open RTD; a dark LED signals a shorted RTD or loss of current loop power.

### Specifications

**Output:** 4 to 20 mA DC over specified range.

**Calibration accuracy:**  $\pm 0.2\%$  of span.

**Linearity:**  $\pm 0.2\%$  of span, reference to actual sensor temperature.

**Adjustments:**

Zero:  $-50^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$  to  $302^{\circ}\text{F}$ ).

Span:  $50^{\circ}\text{C}$  to  $600^{\circ}\text{C}$  ( $122^{\circ}\text{F}$  to  $1112^{\circ}\text{F}$ ).

**Ambient temperature:**

Operating:  $-40$  to  $85^{\circ}\text{C}$  ( $-40$  to  $185^{\circ}\text{F}$ ).

Storage:  $-55$  to  $100^{\circ}\text{C}$  ( $-67$  to  $212^{\circ}\text{F}$ ).

**Ambient temperature effects:**

$\pm 0.018\%$  of span/ $^{\circ}\text{C}$  ( $\pm 0.01\%$  of span/ $^{\circ}\text{F}$ ).

**Warmup drift:**  $\pm 0.1\%$  of span max., assuming  $V_{\text{supply}} = 24 \text{ VDC}$  and  $R_{\text{loop}} = 250 \Omega$ .

Stable within 15 minutes.

**Input/output isolation (optional):**

600 VRMS, 1 minute.

**Supply voltage:**

Non-Isolated: 10 to 45 volts DC with no load.

Isolated: 13 to 45 volts DC with no load.

Reverse polarity protected.

**Voltage effect:**  $\pm 0.001\%$  of span per volt.

**Lead wire compensation:** (3-wire RTD)

$\pm 0.05\%$  of span per  $\Omega$ , up to  $25 \Omega$  in each leg.

**Maximum load resistance:** The maximum allowable resistance of the signal-carrying loop is given by this formula:

$$\text{Non-Isolated: } R_{\text{loop max}} = \frac{V_{\text{supply}} - 10}{0.020 \text{ amps}}$$

$$\text{Isolated: } R_{\text{loop max}} = \frac{V_{\text{supply}} - 13}{0.020 \text{ amps}}$$

**Maximum output current:** 28 mA.

**Connections:** Terminal block accepts wires from AWG 22 to AWG 14.

**Physical:** Polycarbonate, DIN rail enclosure.

**Weight:** 4.2 oz. (119 grams).

### RTD input types

2 or 3-wire 100  $\Omega$  platinum RTD.

Element	Code
Platinum 392, 100 $\Omega$ at $0^{\circ}\text{C}$	PA
Platinum 391, 100 $\Omega$ at $0^{\circ}\text{C}$	PB
Platinum 385, 100 $\Omega$ at $0^{\circ}\text{C}$	PD, PE

### How to order:

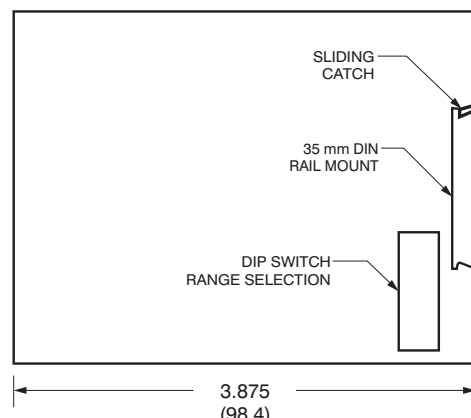
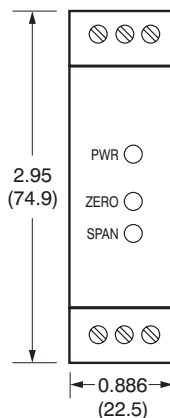
TT273	Model number
PD	RTD element code from table
1	Output: 4 to 20 mA DC
N	Input/Output: N = Non-isolated I = Isolated
(-25/+50)	Factory preset temp. range: (4 mA/20 mA temperature) Range is user adjustable. Refer to the Zero and Span specifications at left.
C	Temperature scale: F = Fahrenheit C = Celsius
TT273PD1N(-25/+50)C ← Sample P/N	

See page 5-13 for high-accuracy calibration option.





SEE PAGE 5-14 FOR WIRING DIAGRAMS



DIMENSIONS IN INCHES (mm)

## TT274 Thermocouple Temperature Transmitter

- Accurate, stable 4 to 20 mA signal
- Fits standard 35 mm DIN rail
- Field-calibrate to your thermocouple type and temperature range
- Optional Input/Output isolation to 600 VRMS

The Model TT274 is a 2-wire temperature transmitter for types J and K thermocouples. The transmitter converts the thermocouple's millivolt signal to a 4 to 20 mA DC current signal. Because this current signal is immune to leadwire and electrical noise, the TT274 lets you obtain accurate temperature readings from thermocouples thousands of feet away. An ordinary twisted pair of wires carries both the temperature signal and power for the transmitter's electronics.

With the isolation option, the mV input signal from the thermocouple is electrically isolated from the 4 to 20 mA output, allowing use of grounded thermocouples with multiple TT274s operating from the same power supply.

An LED conveniently indicates the status of the control loop. The brightness is directly proportional to the loop current. A dark LED signals an open sensor or loss of current loop power.

The output signal of the TT274 is voltage linear (not temperature linear) and is intended for use with instruments which compensate for the nonlinear signal output of the thermocouple sensor.

### Specifications

**Input:** Type J or K thermocouple.  
**Output:** 4 to 20 mA DC over specified range.  
**Accuracy:**  $\pm 0.2\%$  of span.  
**Linearity:** Voltage linear.  
**Adjustments:**  
 Zero:  $-50^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$  to  $302^{\circ}\text{F}$ )  
 Span: Type J:  $125$  to  $850^{\circ}\text{C}$  ( $257$  to  $1562^{\circ}\text{F}$ )  
 Type K:  $150$  to  $1200^{\circ}\text{C}$  ( $302$  to  $2192^{\circ}\text{F}$ )  
**Ambient temperature:**  
 Operating:  $-40$  to  $85^{\circ}\text{C}$  ( $-40$  to  $185^{\circ}\text{F}$ ).  
 Storage:  $-55$  to  $100^{\circ}\text{C}$  ( $-67$  to  $212^{\circ}\text{F}$ ).  
**Ambient temperature effects:**  $\pm 0.036\%$  of span/ $^{\circ}\text{C}$  ( $\pm 0.02\%$  of span/ $^{\circ}\text{F}$ ).  
**Cold junction compensation drift:**  $\pm 0.03^{\circ}\text{C}/^{\circ}\text{C}$  for  $-25$  to  $70^{\circ}\text{C}$  ambients.  $\pm 0.06^{\circ}\text{C}/^{\circ}\text{C}$  for  $-40$  to  $-25^{\circ}\text{C}$  and  $70$  to  $85^{\circ}\text{C}$  ambients.  
**Warmup drift:**  $\pm 0.1\%$  of span max., assuming  $V_{\text{supply}} = 24 \text{ VDC}$  and  $R_{\text{loop}} = 250 \Omega$ .  
 Stable within 15 minutes.  
**Input/output isolation (optional):**  
 600 VRMS, 1 minute.  
**Supply voltage:**  
 Non-Isolated: 10 to 45 volts DC with no load.  
 Isolated: 13 to 45 volts DC with no load.  
 Reverse polarity protected.  
**Voltage effect:**  $\pm 0.001\%$  of span per volt.  
**Maximum load resistance:** The maximum allowable resistance of the signal-carrying loop is given by this formula:  
 Non-Isolated:  $R_{\text{loop max}} = \frac{V_{\text{supply}} - 10}{0.020 \text{ amps}}$   
 Isolated:  $R_{\text{loop max}} = \frac{V_{\text{supply}} - 13}{0.020 \text{ amps}}$   
**Maximum output current:** 28 mA.  
**Connections:** Terminal block accepts wires from AWG 22 to AWG 14.  
**Physical:** Polycarbonate, DIN rail enclosure.  
**Weight:** 4.2 oz. (119 grams).

### How to order:

TT274	<b>Model number</b>
K	<b>T/C element code:</b> J = Type J thermocouple K = Type K thermocouple
1	<b>Output: 4-20 mA DC</b>
N	<b>Input/Output:</b> N = Non-isolated I = Isolated
(-25/+200)	<b>Factory preset temp. range:</b> (4 mA/20 mA temperature) Range is user adjustable. Refer to the Zero and Span specifications at left.
C	<b>Temperature scale:</b> F = Fahrenheit C = Celsius
TT274K1N(-25/+200)C ← Sample P/N	

## Temptran™ Temperature Ranges

The endpoints of the temperature range correspond to the Temptran's 4 and 20 mA signals. Choose the smallest possible span for best accuracy. Be sure to check the temperature limits of the sensor you specify.

New ranges are available for a small setup charge.

Minco sets the range for each Temptran using high-quality fixed resistors, then finely calibrates them with high resolution multi-turn zero and span potentiometers. Because the potentiometers represent only 5% of span, Minco Temptrons are much less susceptible than other transmitters to drift caused by vibration and temperature change.

Range Code	Temperature range				Sensor input types for Temptran model:			
	°F		°C		TT110, TT111, TT115, TT210, TT211	TT176, TT246, TT220	TT190, TT221	TT205
	4 mA	20mA	4mA	20mA				
MH	-328	to -148	-200.0	to -100.0	PA PB PD PE			
LC	-328	to -58	-200.0	to -50.0				T
MC	-328	to 149	-200.0	to 65.0	PF PW	PA PB PD PE		
DH	-328	to 212	-200.0	to 100.0	PA PB PD PE	PA PB PD PE		
HG	-325	to 100	-198.3	to 37.8	PA PB PD PE PF PW		J T	
QS	-300	to 150	-184.4	to 65.6		PA PB PD PE		
AT	-148	to -40	-100.0	to -40.0	PA PB PD PE PF PW			
EZ	-148	to 32	-100.0	to 0.0	PA PB PD PE PF PW	PA PB PD PE		
TK	-148	to 122	-100.0	to 50.0	PA PB PD PE PF PW			
LN	-148	to 212	-100.0	to 100.0	PA PB PD PE			
EB	-120	to 60	-84.4	to 15.6	PA PB PD PE			
UL	-103	to 752	-75.0	to 400.0			K	
ET	-85	to 32	-65.0	to 0.0	PA PB PD PE PF PW			
AR	-60	to 10	-51.1	to -12.2	PA PB PD PE FB	PA PB PD PE		
BO	-60	to 120	-51.1	to 48.9	PA PB PD PE	PA PB PD PE		
M	-58	to 122	-50.0	to 50.0	PA PB PD PE PF PW	PA PB PD PE		
EO	-58	to 212	-50.0	to 100.0	PA PB PD PE NA	PA PB PD PE	T	E T
JD	-58	to 302	-50.0	to 150.0	PA PB PD PE	PA PB PD PE	J	
MR	-58	to 500	-50.0	to 260.0		PA PB PD PE CA NA		
Y	-50	to 50	-45.6	to 10.0	PA PB PD PE PF PW FB FC	PA PB PD PE		
MI	-50	to 150	-45.6	to 65.6	PA PB PD PE	PA PB PD PE	T	
AI	-50	to 275	-45.6	to 135.0	PA PB PD PE PF PW FB FC FL NA	PA PB PD PE		
DG	-40	to 85	-40.0	to 29.4	PA PB PD PE FB FC	PA PB PD PE		
MU	-40	to 86	-40.0	to 30.0	PA PB PD PE			
AD	-40	to 120	-40.0	to 48.9	PA PB PD PE FB FC	PA PB PD PE		
AK	-40	to 140	-40.0	to 60.0	PA PB PD PE PU	PA PB PD PE		
BE	-40	to 160	-40.0	to 71.1	PA PB PD PE FB	PA PB PD PE		
GH	-40	to 212	-40.0	to 100.0	PA PB PD PE	PA PB PD PE		
TY	-40	to 248	-40.0	to 120.0	PA PB PD PE PF PW			
WB	-40	to 257	-40.0	to 125.0	PF PW			
EX	-40	to 482	-40.0	to 250.0	PA PB PD PE	PF		
L	-30	to 120	-34.4	to 48.9	PA PB PD PE PF PW FB FC			
AS	-30	to 130	-34.4	to 54.4	PA PB PD PE PF PW FB	PA PB PD PE		
R	-30	to 150	-34.4	to 65.6	PA PB PD PE FB FC	PA PB PD PE		
DR	-30	to 212	-34.4	to 100.0	PA PB PD PE FC			
LJ	-30	to 240	-34.4	to 115.6	PA PB PD PE FC		T	
BG	-30	to 500	-34.4	to 260.0	PA PB PD PE PF PW			
MT	-25	to 125	-31.7	to 51.7	PA PB PD PE	PA PB PD PE		
BC	-22	to 86	-30.0	to 30.0	PA PB PD PE	PA PB PD PE		
DN	-22	to 122	-30.0	to 50.0	PA PB PD PE	PA PB PD PE		
TQ	-22	to 158	-30.0	to 70.0	PA PB PD PE			
ES	-22	to 212	-30.0	to 100.0	PA PB PD PE	PA PB PD PE		
EE	-22	to 302	-30.0	to 150.0	PA PB PD PE	PA PB PD PE		
DO	-20	to 120	-28.9	to 48.9	PA PB PD PE PF PW ND	PA PB PD PE		
EN	-20	to 140	-28.9	to 60.0	PA PB PD PE PF PW FB	PA PB PD PE		
B	-20	to 180	-28.9	to 82.2	PA PB PD PE FB FC NA	PA PB PD PE CA		
UB	-20	to 350	-28.9	to 176.7				T
G	-10	to 40	-23.3	to 4.4	PA PB PD PE PF PW	PA PB PD PE		

▲ Additional ranges are available. Call Minco for details.

# Temperature Instruments

Range Code	Temperature range					Sensor input types for Temptran model:			
	°F		°C			TT110, TT111, TT115, TT210, TT211	TT176, TT246, TT220	TT190, TT221	TT205
	4 mA	20mA	4mA	20mA					
JX	-10	to 250	-23.3	to 121.1		PA PB PD PE			K
BP	-4	to 104	-20.0	to 40.0		PA PB PD PE FC	PA PB PD PE		
SH	-4	to 122	-20.0	to 50.0		PA PB PD PE			
DB	-4	to 212	-20.0	to 100.0		PA PB PD PE	PA PB PD PE		
JZ	0	to 65	-17.8	to 18.3		PA PB PD PE	PA PB PD PE		
S	0	to 100	-17.8	to 37.8		PA PB PD PE PF PG PW FB	PA PB PD PE PW		
JH	0	to 120	-17.8	to 48.9		PA PB PD PE PF PW FC	PA PB PD PE		
HD	0	to 130	-17.8	to 54.4		PA PB PD PE PF PW	PA PB PD PE		
DV	0	to 150	-17.8	to 65.6		PA PB PD PE FB	PA PB PD PE		
EI	0	to 160	-17.8	to 71.1		PA PB PD PE			
AC	0	to 200	-17.8	to 93.3		PA PB PD PE PF PW FB NA	PA PB PD PE CA	E J K T	T
KJ	0	to 240	-17.8	to 115.6		PA PB PD PE PF PW	PA PB PD PE CA		
EY	0	to 250	-17.8	to 121.1		PA PB PD PE PF PW NA	PA PB PD PE	J K	J K T
KA	0	to 255	-17.8	to 123.9		PA PB PD PE			
AN	0	to 300	-17.8	to 148.9		PA PB PD PE PF PW FB FC NA	PA PB PD PE CA NA	E J K T	K
JA	0	to 350	-17.8	to 176.7		PA PB PD PE	PA PB PD PE	K J	
DS	0	to 400	-17.8	to 204.4		PA PB PD PE NA	PA PB PD PE CA NA	J K	
AG	0	to 500	-17.8	to 260.0		PA PB PD PE PF PW NA	PA PB PD PE CA	E J T	J K T
QN	0	to 550	-17.8	to 287.8		PA PB PD PE	PA PB PD PE		
AB	0	to 600	-17.8	to 315.6		PA PB PD PE PF PW NA	PA PB PD PE	E J K	J
AA	0	to 800	-17.8	to 426.7		PA PB PD PE PF PW	PA PB PD PE	J	J K
BZ	0	to 1000	-17.8	to 537.8		PA PB PD PE	PA PB PD PE	J K	E J
HU	0	to 1300	-17.8	to 704.4				K	
JT	0	to 1400	-17.8	to 760.0				J K	J
JC	0	to 1500	-17.8	to 815.6		PA PB PD PE	PA PB PD PE	K	
KC	0	to 1750	-17.8	to 954.4				K	K
KZ	0	to 2000	-17.8	to 1093.3				K	
LV	0	to 2400	-17.8	to 1315.6				K	
BM	10	to 60	-12.2	to 15.6		PA PB PD PE	PA PB PD PE		
HB	10	to 70	-12.2	to 21.1		PA PB PD PE PF PW	PA PB PD PE		
BY	14	to 104	-10.0	to 40.0		PA PB PD PE	PA PB PD PE		
AJ	14	to 122	-10.0	to 50.0		PA PB PD PE	PA PB PD PE		
EA	15	to 65	-9.4	to 18.3		PA PB PD PE PF PW			
AP	20	to 70	-6.7	to 21.1		PA PB PD PE PF PW	PA PB PD PE		
KW	20	to 80	-6.7	to 26.7		PA PB PD PE	PA PB PD PE		
GV	20	to 100	-6.7	to 37.8		PA PB PD PE PF PW	PA PB PD PE		
A	20	to 120	-6.7	to 48.9		PA PB PD PE PF PW FA FB FC NA	PA PB PD PE PF		
ST	20	to 170	-6.7	to 76.7		PA PB PD PE			
HE	20	to 240	-6.7	to 115.6		PA PB PD PE			
AF	20	to 320	-6.7	to 160.0		PA PB PD PE FA FB			
QE	22	to 122	-5.6	to 50.0		PA PB PD PE			
GW	23	to 131	-5.0	to 55.0		PA PB PD PE			
U	30	to 80	-1.1	to 26.7		PA PB PD PE PF PW FB FC	PA PB PD PE		
DA	30	to 90	-1.1	to 32.2		PA PB PD PE PF PW FC	PA PB PD PE		
DP	30	to 100	-1.1	to 37.8		PA PB PD PE PF PW			
HC	30	to 120	-1.1	to 48.9		PA PB PD PE PF PW			
BI	30	to 130	-1.1	to 54.4		PA PB PD PE PF PW	PA PB PD PE PF PW		
DQ	30	to 150	-1.1	to 65.6		PA PB PD PE FB	PA PB PD PE		
KK	30	to 180	-1.1	to 82.2		PA PB PD PE			
EV	30	to 230	-1.1	to 110.0		PA PB PD PE	PA PB PD PE		
BN	30	to 240	-1.1	to 115.6		PA PB PD PE PF PW FB	PA PB PD PE		
BJ	30	to 250	-1.1	to 121.1		PA PB PD PE PF PW NA	PA PB PD PE FA		
GQ	32	to 100	0.0	to 37.8		PA PB PD PE PF PW	PA PB PD PE		
EG	32	to 104	0.0	to 40.0		PA PB PD PE PF PW	PA PB PD PE		
N	32	to 122	0.0	to 50.0		PA PB PD PE PF PW FB FC	PA PB PD PE		
HL	32	to 167	0.0	to 75.0		PA PB PD PE	PA PB PD PE		
C	32	to 212	0.0	to 100.0		PA PB PD PE PF PW FB FC NA	PA PB PD PE CA NA	J T	
MQ	32	to 248	0.0	to 120.0			PA PB PD PE		

▲ Additional ranges are available. Call Minco for details.

# Temperature Instruments

Range Code	Temperature range				Sensor input types for Temptran model:			
	°F		°C		TT110, TT111, TT115, TT210, TT211	TT176, TT246, TT220	TT190, TT221	TT205
	4 mA	20mA	4mA	20mA				
QR	32	to 257	0.0	to 125.0	PA PB PD PE			
DL	32	to 280	0.0	to 137.8	PA PB PD PE			
J	32	to 302	0.0	to 150.0	PA PB PD PE PF PU PW FC NA	PA PB PD PE CA	J	J
LK	32	to 350	0.0	to 176.7			K	
K	32	to 392	0.0	to 200.0	PA PB PD PE PU NA	PA PB PD PE CA	J K	J
LX	32	to 400	0.0	to 204.4	PA PB PD PE			
BW	32	to 482	0.0	to 250.0	PA PB PD PE NA	PA PB PD PE	E J K T	J
LF	32	to 572	0.0	to 300.0	PA PB PD PE	PA PB PD PE	J T	
EU	32	to 662	0.0	to 350.0	PA PB PD PE	PA PB PD PE	J	
GE	32	to 752	0.0	to 400.0	PA PB PD PE PF PW	PA PB PD PE	J K	
JW	32	to 932	0.0	to 500.0	PA PB PD PE	PA PB PD PE	J K	K
HA	32	to 1112	0.0	to 600.0	PA PB PD PE PF PW		K	
GF	32	to 1472	0.0	to 800.0	PA PB PD PE	PA PB PD PE	K	K
MG	32	to 2100	0.0	to 1148.9				K
SG	33.8	to 123.8	1.0	to 51.0	PA PB PD PE			
HJ	35	to 65	1.7	to 18.3		PA PB PD PE		
MF	35	to 120	1.7	to 48.9	PA PB PD PE			
ME	40	to 85	4.4	to 29.4				
H	40	to 90	4.4	to 32.2	PA PB PD PE PF PW FB	PA PB PD PE		
BU	40	to 100	4.4	to 37.8	PA PB PD PE PF PW			
BK	40	to 140	4.4	to 60.0	PA PB PD PE PF PW FB	PA PB PD PE		
KG	40	to 150	4.4	to 65.6	PA PB PD PE			
MX	40	to 200	4.4	to 93.3	FB			
LT	40	to 210	4.4	to 98.9	PA PB PD PE	PA PB PD PE		
KH	40	to 240	4.4	to 115.6	PA PB PD PE PF PW	PA PB PD PE		
KP	42	to 92	5.6	to 33.3	PA PB PD PE			
DU	45	to 95	7.2	to 35.0	PA PB PD PE	PA PB PD PE		
WY	50	to 70	10.0	to 21.1		PA PB PD PE		
DX	50	to 100	10.0	to 37.8	PA PB PD PE PF PW	PA PB PD PE		
AH	50	to 110	10.0	to 43.3	PA PB PD PE FB	PA PB PD PE		
ED	50	to 120	10.0	to 48.9	PA PB PD PE PF PW FB			
V	50	to 150	10.0	to 65.6	PA PB PD PE PF PW FA FB NA	PA PB PD PE		
KQ	50	to 200	10.0	to 93.3	PA PB PD PE	PA PB PD PE		
AV	50	to 230	10.0	to 110.0	PA PB PD PE PF PW	PA PB PD PE	J	
BF	50	to 250	10.0	to 121.1	PA PB PD PE PF PW	PA PB PD PE PF PW	E T	
AO	50	to 300	10.0	to 148.9	PA PB PD PE	PA PB PD PE CA FA		
KM	50	to 350	10.0	to 176.7	PA PB PD PE PF PW	PA PB PD PE		
KF	50	to 400	10.0	to 204.4	PA PB PD PE	PA PB PD PE		
DW	50	to 550	10.0	to 287.8	PA PB PD PE	PA PB PD PE	K	
EH	50	to 1200	10.0	to 648.9				J
AU	55	to 105	12.8	to 40.6	PA PB PD PE			
KO	60	to 110	15.6	to 43.3	PA PB PD PE	PA PB PD PE		
WX	68	to 176	20.0	to 80.0	PA PB PD PE			
DZ	70	to 120	21.1	to 48.9	PA PB PD PE			
DM	70	to 130	21.1	to 54.4	PA PB PD PE	PA PB PD PE		
D	70	to 220	21.1	to 104.4	PA PB PD PE PF PW FB FC	PA PB PD PE		
AM	70	to 550	21.1	to 287.8	FB	PA PB PD PE		
W	100	to 200	37.8	to 93.3	PA PB PD PE	PA PB PD PE		
Z	100	to 250	37.8	to 121.1	PA PB PD PE PF PW FB	PA PB PD PE		
P	100	to 355	37.8	to 179.4	PA PB PD PE PF PW	PA PB PD PE		
JO	100	to 400	37.8	to 204.4	PA PB PD PE	PA PB PD PE		
E	100	to 500	37.8	to 260.0	PA PB PD PE PF PW	PA PB PD PE		
QZ	122	to 212	50.0	to 100.0	PA PB PD PE			
AQ	125	to 275	51.7	to 135.0	PA PB PD PE PF PW	PA PB PD PE		
BS	200	to 400	93.3	to 204.4	PA PB PD PE	PA PB PD PE		
BL	200	to 500	93.3	to 260.0	PA PB PD PE PF PW		K	
GX	200	to 1400	93.3	to 760.0			J K E	K

▲ Additional ranges are available. Call Minco for details.



## Why Use Temptrans?

### Long distance accuracy

Temptran transmitters amplify the low-level signals from RTDs or thermocouples to an industry-standard 4 to 20 mA current signal proportional to temperature. Unlike resistance or voltage, current signals are immune to resistance in extension wires and stray electrical noise. This lets you receive accurate signals from a sensor located thousands of feet away.

The 4 to 20 mA output signal and DC power share the same wire pair. You don't need to run power wires to every sensor location.

RTD transmitters also linearize the signal to temperature, making them excellent low cost signal conditioners.

### Engineered for reliability

Over 500,000 Minco transmitters are currently giving trouble-free service in installations around the world. Two factors behind Temptrans' exceptional stability and longevity are:

- Minco encapsulates all electronics in epoxy to exclude contaminants and protect components.
- Standard fixed-range transmitters feature  $\pm 5\%$  adjustability using 20 turn trim pots. Because a complete rotation of the trim pot represents only 0.25% of the span, slight movements from mechanical shock cause only negligible output change. In contrast, many competitive transmitters have wide ranging zero and span. Some even use single-turn potentiometers. With zero and span far more sensitive to potentiometer shifts, a minor bump can void the transmitter's calibration.

### Easy to install

Compact Temptrans fit nearly anywhere. You can install most models in standard electrical utility boxes and elbows. Or Minco offers a complete selection of complementary connection heads (pages 4-2, 4-3 and 5-14).

For DIN rail mounting inside instrument cabinets, see the mounting accessories on page 5-14.

### Intrinsic safety

Most Temptrans are rated intrinsically safe by Factory Mutual (FM), a recognized testing authority for safety in hazardous areas. Installations must include a suitable barrier. Contact Minco for a list of barriers FM approved under the system concept for use with Temptrans.

Request Application Aid #19 to learn more about the use of sensors in hazardous areas.

## Special High-Accuracy Calibration

Standard transmitters are calibrated to the *nominal* resistance values of the RTD at the zero and span points. Total system error includes the tolerance of both the transmitter and the RTD sensor.

If you order Minco Temptrans calibrated to the *actual* resistance of the RTD (traceable to NIST), this effectively subtracts the sensor tolerance from system accuracy specifications.

For example, consider a transmitter with a range of 0 to 500°C. The transmitter itself is accurate to  $\pm 1.0^\circ\text{C}$  ( $\pm 0.2\%$  of span, including calibration accuracy and linearity). The RTD interchangeability contributes an additional error of  $\pm 0.3^\circ\text{C}$  at  $0^\circ\text{C}$  and  $\pm 2.8^\circ\text{C}$  at  $500^\circ\text{C}$ . Total system error would be  $\pm 1.3^\circ\text{C}$  at  $0^\circ\text{C}$  and  $\pm 3.8^\circ\text{C}$  at  $500^\circ\text{C}$ . Calibration of the sensor and transmitter as a set cancels the sensor error, reducing system error to  $\pm 1.0^\circ\text{C}$  over the full range — all for a nominal extra cost.

### NIST traceability at no cost

With each matched sensor/transmitter set, Minco sends you calibration data traceable to the National Institute of Standards & Technology. This helps your process comply with ISO 9000 and other quality standards.

### How to order special calibration

To specify a specially calibrated transmitter, substitute the model number at right in the Temptran part number:

Standard model	Special calibration
TT110	TT150
TT111	TT151
TT115	TT155
TT176	TT676
TT210	TT710
TT211	TT711
TT220	TT720
TT246	TT746
TT273	TT773

### Recalibration

Minco prints RTD resistance values right on the Temptran label to simplify recalibration. You simply connect a resistance decade box or "RTD simulator" in place of the RTD, dial in the correct values, and adjust zero and span.

Because Minco platinum RTDs are extremely stable in typical installations ( $0.1^\circ\text{C}$  or better), you can trust the printed values for many years without recalibration of the sensor.

NIST MINCO MPLS, MN USA	MODEL TT211PD1A
	D/C: 9614
	TEMPTRAN™
	100 OHM PLATINUM RTD
	4mA= 20.0°F= -6.7°C= 97.932Ω 20mA= 120.0°F= 48.9°C= 118.969Ω

RTD resistances are printed on Temptran labels for easy recalibration of zero and span. A standard Temptran shows nominal values.

NIST MINCO MPLS, MN USA	MODEL TT711PD1A
	D/C: 9614 S/N: 103
	TEMPTRAN™
	100 OHM PLATINUM RTD
	4mA= 20.0°F= -6.7°C= 97.427Ω 20mA= 120.0°F= 48.9°C= 118.988Ω

A specially calibrated Temptran shows *actual* resistance of the serialized, connected RTD.

## Temptran Wiring Diagrams

Shown below are schematics of the transmitter signal loop. R1 is a fixed load resistor, typically part of the input instrument, to convert the current signal

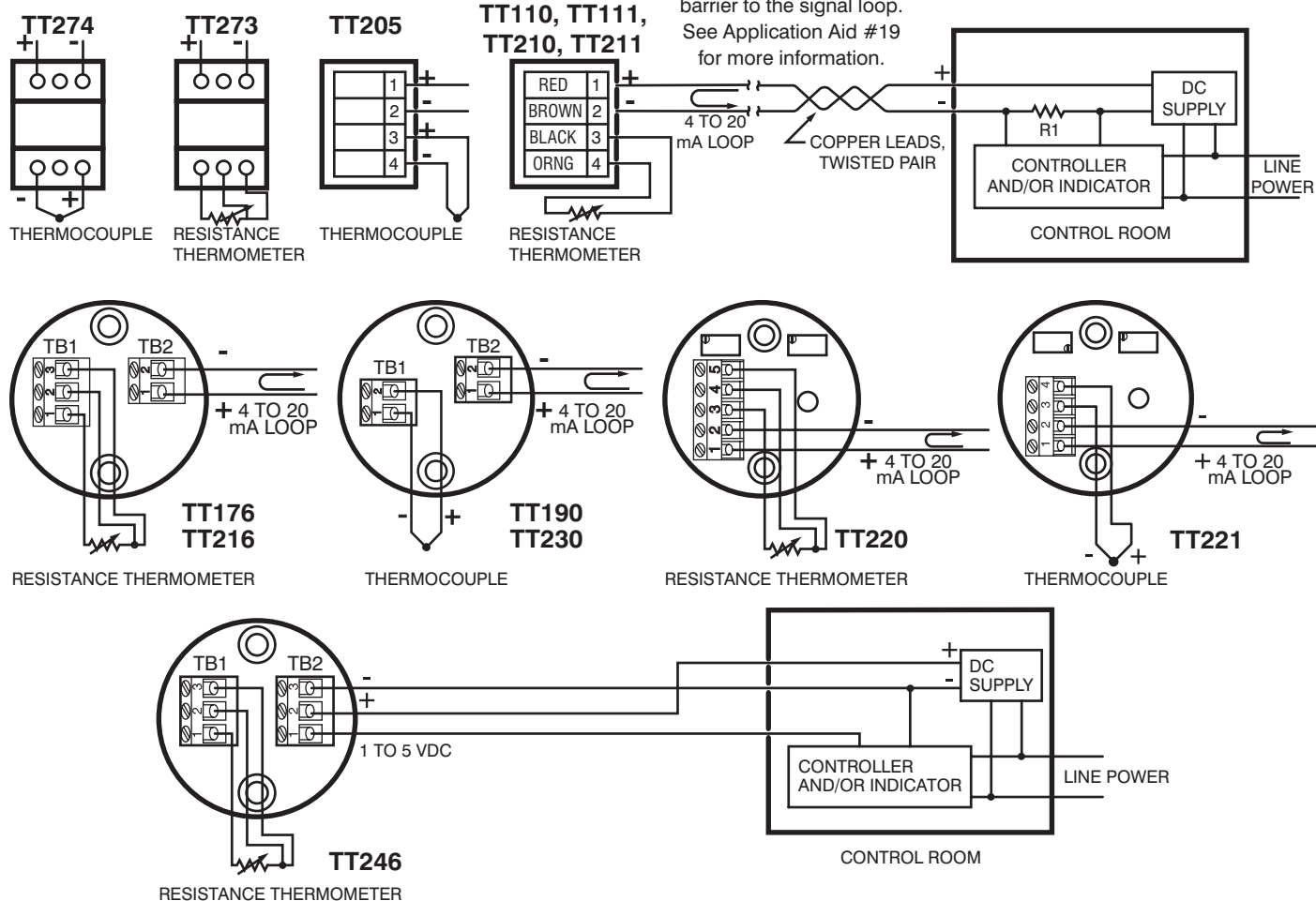
to voltage. Total resistance of R1, signal wires, and any stray resistances such as contacts, must be less than the maximum allowable resistance for the transmitter.

An R1 value of 250  $\Omega$  will produce a voltage drop of 1 to 5 VDC from 4 to 20 mA.

[www.minco.com/support](http://www.minco.com/support)

Note: Wiring diagrams, literature and application aids are available at [www.minco.com/support](http://www.minco.com/support)

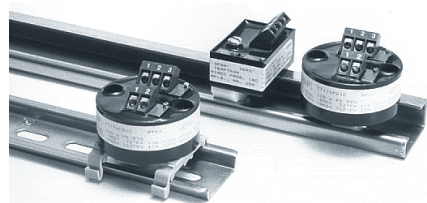
**Intrinsically safe** installations require the addition of a safety barrier to the signal loop. See Application Aid #19 for more information.



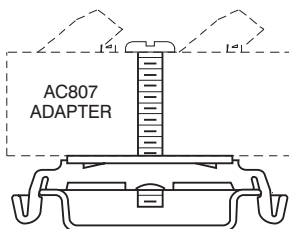
### DIN rail mounting

For easy installation in instrument cabinets. Adapters fit all Temptran models. Specify length when ordering rails.

Model	Description
AC805	DIN EN50022 Rail
AC807	Adapter for EN50022



Temptrans mounted to DIN rail.



AC805 RAIL

### AC781 dual mounting kit

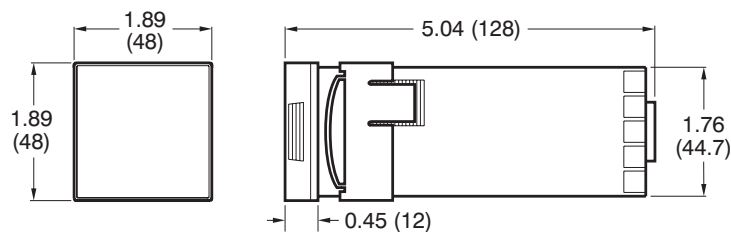
The AC781 mounting kit fits connection head models CH104, CH106, and CH330 on page 4-3. It holds two miniature Temptrans in a single head for use with dual RTDs.



# Temperature Instruments



Compact 1/16 DIN size



PANEL CUTOUT: 1.775" × 1.775" (45 mm × 45 mm)

MAXIMUM PANEL THICKNESS: 0.25" (6.35 mm)

DIMENSIONS IN INCHES (mm)

## CT15 Temperature Controller & Alarm

An easy to use controller with sophisticated PID control. It can also be a single or 2-stage alarm (using alarm feature plus control relay): monitor motors and generators for overheating.

### Features

- RTD or thermocouple input
- Control modes: Self-Tune, pre-set or programmable PID, or On/Off
- Bright red LED display
- Ramp to setpoint
- Digital sensor input correction
- Digital input filter adjustable for noisy or jittery processes
- 4 security levels
- Setpoint limits
- Non-volatile memory needs no battery backup
- Input fault timer
- Alarms at one or two temperatures
- Alarm Relay option is programmable for high, low, absolute, or deviation, can be reset manually or automatically, and it controls a single electromechanical relay with voltage-free contacts

### Specifications

#### Selectable inputs:

RTD: 2 or 3-wire, Minco types PD or PE (100  $\Omega$  EN60751 platinum).

Thermocouple: Type J (factory default), K, T (selectable).

#### Input impedance:

Thermocouple: 3 megohms minimum.

RTD current: 200  $\mu$ A maximum.

**Sensor break or short protection:** De-energizes control outputs to protect system.

**Loop break protection:** Error message is initiated and output is turned off in case of shorted sensor or open heater circuit. Break time adjustable from OFF to 99 minutes.

**Cycle rate:** 1 to 80 seconds.

**Setpoint range:** Selectable from -212 to 1371°C (-350 to 2500°F), input dependent.

**Display:** One: 4 digit, 7 segment 0.3" high LEDs. Display shows the measured temperature, unless a control key is pressed, then it will display the item value.

**Control action:** Reverse (usually heating) or Direct (usually cooling), selectable.

**Ramp/Soak:** One ramp, 0 to 100 hours.

**Accuracy:**  $\pm 0.25\%$  of span  $\pm 1$  count.

**Resolution:** 1° or 0.1°, selectable.

**Line voltage stability:**  $\pm 0.05\%$  over supply voltage range.

**Temperature stability:** 4  $\mu$ V/°C (2.3  $\mu$ V/°F) typical, 8  $\mu$ V/°C (4.5  $\mu$ V/°F) max. (100 ppm/°C typical, 200 ppm/°C max.).

**Isolation:** Relay and SSR outputs are isolated. Pulsed voltage output must not share a common ground with the input.

Supply voltage: 100 to 240 VAC nom., +10/-15%, 50 to 400 Hz, single phase; 132 to 240 VDC, nom., +10/-20%. 5 VA maximum.

**Note:** Do not confuse controller power with heater power. The controller does not supply power to the heater, but only acts as a switch. For example, the controller could be powered by 115 VAC, but controlling 12 VDC to the heater.

#### Operating temperature range:

-10 to 55°C (14 to 131°F).

**Memory backup:** Non-volatile memory (no batteries required).

#### Control output ratings:

AC SSR (SPST): 3.5 A @ 250 VAC @ 25°C (77°F); derates to 1.25 A @ 55°C (130°F).

An SSR is recommended for longer life than a mechanical relay.

Mechanical relay, SPST Form A (Normally Open):

3 A resistive, 1.5 A inductive @ 250 VAC; pilot duty: 250 VA; 2 A @ 125 VAC or 1 A @ 250 VAC.

Switched voltage (non-isolated):

5 VDC @ 25 mA.

Alarm relay, SPST Form A (Normally Open):

3 A resistive, 1.5 A inductive @ 250 VAC; pilot duty: 250 VA; 2 A @ 125 VAC or 1 A @ 250 VAC.

**Weight:** 227 g (8 oz.).

**Agency approvals:** UL & CSA.

**Front panel rating:** Type 4X (IP66).

### How to order

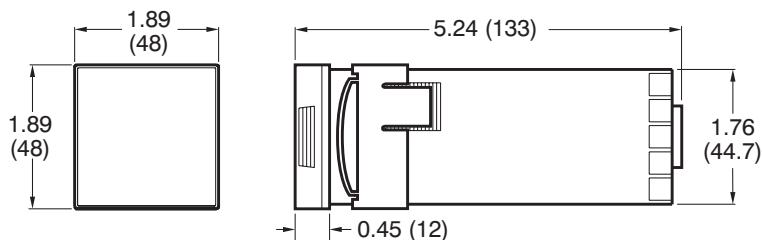
CT15	Model number
1	<b>Alarm:</b> 0 = No 1 = Yes
2	<b>Input:</b> 1 = J, K, or T thermocouple 2 = 100 W platinum RTD, type PD or PE
1	<b>Output:</b> 1 = Built-in AC SSR 2 = Pulsed voltage (5 VDC) 3 = Mechanical relay
CT15121 ← Sample P/N	

**IN STOCK**

Contact Minco for currently available models



Compact 1/16 DIN size



PANEL CUTOUT: 1.775" × 1.775" (45 mm × 45 mm)

MAXIMUM PANEL THICKNESS: 0.25" (6.35 mm)

DIMENSIONS IN INCHES (mm)

## CT16A Temperature Controller

This economical controller packs sophisticated PID control into a compact 1/16 DIN enclosure. A wide range of control modes, sensor input types, and relay or SSR outputs give versatile control of Thermofoil™ heaters and lets you easily connect to other electronics.

### Features

- Dual displays continuously show the set point and the actual temperature reading in resolutions of 1°, 0.1°, or engineering units
- Universal Input fits any sensor: Select from 10 thermocouple types, 4 RTD types, voltage, and current signals
- Isolated Outputs for safe, easy wiring
- Loop Break protection handles sensor or heater failure
- Peak / Valley records the maximum and minimum temperatures
- Front panel is waterproof and corrosion-resistant, making it ideal for sanitary applications. Illuminated keypad for easy operation
- Limit the temperatures which the operator can set via four password-protected Security Levels
- Controller can Self-Tune for best PID control
- Control modes: Self-Tune, pre-set or adjustable PID values, simple On/Off control, and open loop
- Fuzzy Logic provides better response time and reduces overshoot in processes with unpredictable inputs
- Alarms at one or two temperatures
- Alarm Relay option is programmable for high, low, absolute, or deviation, can be reset manually or automatically, and it controls a single electromechanical relay with voltage-free contacts

- Ramp & Soak option handles complex heating profiles of 16 segments with front-panel activation and a selectable time base (CT16A3)
- Auto / Manual option easily switches to manual control for set up or experiments (CT16A3)
- RS-232 or RS-485 Serial Communications access the temperature readings and all control parameters (optional)
- Retransmit either the sensed temperature or the set point as a voltage or current signal to a computer or recorder (optional)
- Vary the Set Point using a potentiometer, a voltage, or a current signal (optional)
- 4-Stage Set Point to quickly switch from one temperature to the next (optional)

### Specifications

#### Selectable inputs:

RTD: 2 or 3-wire, Minco types  
PD or PE (100 Ω EN60751 platinum),  
PA (100 Ω NIST platinum),  
PF (1000 Ω EN60751 platinum), or  
NA (120 Ω Nickel).

Thermocouple: Type J (factory default), K, T, L, E, R, S, B, C, or N.

DC current: 0-20 mA or 4-20 mA (use with Temptran™ transmitters).

DC voltage: 0-10 or 2-10 VDC,  
-10 to 10 mVDC, scalable.

#### Input impedance:

Voltage: 5000 Ω.

Thermocouple: 3 megohms minimum.

Current: 10 Ω.

RTD current: 200 μA.

#### Sensor break or short protection:

Selectable output: disabled, average output before fault, or preprogrammed output.

Adjustable delay: 0.0 to 540.0 minutes.

**Loop break protection:** Error message is initiated and output is turned off in case of shorted sensor or open heater circuit. Break time adjustable from OFF to 9999 seconds.

**Cycle rate:** 1 to 80 seconds.

**Setpoint range:** Selectable from -212 to 2320°C (-350 to 4208°F), input dependent.

**Displays:** Two 4 digit, 7 segment 0.3" high LED's. Process Value red, Setpoint Value green. °C or °F.

**Control action:** Reverse (usually heating) or Direct (usually cooling), selectable.

**Ramp/soak:** (CT16A3 only) 16 separate ramp and soak times are adjustable in minutes or seconds from 0 to 9999. When the program has ended, you may choose to repeat, hold, revert to local setpoint, or turn the outputs off.

**Accuracy:** ±0.25% of span ±1 count.

**Resolution:** 1° or 0.1°, selectable.

**Line voltage stability:** ±0.05% over supply voltage range.

**Temperature stability:** 4 μV/°C (2.3 μV/°F) typical, 8 μV/°C (4.5 μV/°F) max. (100 ppm/°C typical, 200 ppm/°C max.).

#### Isolation:

Relay and SSR: 1500 VAC to all other inputs and outputs.

SP1 and SP2 current and voltage: 500 VAC to all other inputs and outputs, but not isolated from each other.

Process output (options 934, 936): 500 VAC to all other inputs and outputs.

**Supply voltage:** 100 to 240 VAC nom., +10/-15%, 50 to 400 Hz, single phase; 132 to 240 VDC, nom., +10/-20%. 5 VA maximum. 12 & 24 volt AC/DC optional.

**Note:** Do not confuse controller power with heater power. The controller does not supply power to the heater, but only acts as a switch. For example, the controller could be powered by 115 VAC, but controlling 12 VDC to the heater.

#### Operating temperature range:

-10 to 55°C (14 to 131°F).



# Temperature Instruments

**Memory backup:** Non-volatile memory (no batteries required).

**Control output ratings:**

AC SSR (SPST): 2.0 A combined outputs

A & B @ 240 VAC @ 25°C (77°F);

derates to 1.0 A @ 55°C (130°F).

An SSR is recommended for longer life than a mechanical relay.

Mechanical relay, SPST Form A (Normally Open) or Form B (Normally Closed):

3 A resistive, 1.5 A inductive @ 240 VAC;

pilot duty: 240 VA; 2 A @ 120 VAC or

1 A @ 240 VAC.

Switched voltage (isolated): 15 VDC @ 20 mA.

Proportional current (isolated):

0 to 20 mA, 600 Ω max.

DC SSR: 1.75 A @ 32 VDC max.

Alarm relay, SPST Form A (Normally Open):

3 A @ 240 VAC resistive;

1/10 HP @ 120 VAC.

**Weight:** 227 g (8 oz.).

**Agency approvals:** UL & CE.

**Front panel rating:** Type 4X (IP66).

## Additional options for CT16A (board level)

**924: Analog remote setpoint:** (0 to 10 VDC)

Vary the setpoint using a voltage signal.

**926: Analog remote setpoint:** (4 to 20 mADC)

Vary the setpoint using a current signal.

**928: Analog remote setpoint:** (0 to 10,000 Ω)

Vary the setpoint using a potentiometer.

**934: Analog retransmission of Process**

**Variable or Set Variable:** (4 to 20 mADC) For

use as recorder, transmitter or computer A/D

input. Linearized 4 to 20 mA DC signal follows

the Process or Set variable. Scaleable.

**936: Analog retransmission of Process**

**Variable or Set Variable:** (0 to 10 VDC) Similar

to option 934, but output signal is linearized 0 to 10 VDC.

**948: 4-Stage setpoint.** Four preset setpoints

may be selected by external contacts. Each set

point has its own set of PID values giving

controller 4 distinct "recipes" for different

process situations.

**992: RS-485 Computer communication link:**

Allows remote computer to read and write all control parameters.

**993: RS-232 Computer communication link:**

Allows remote computer to read and write all control parameters.

**9502: 12 to 24 VDC / VAC power option:**

Controller is powered by low voltage instead of line voltage.

*Note:* Only option 9502 can be combined with another board level option.

## How to order CT16A

CT16A	Model number
2	<b>Feature set:</b> 2 = Standard 3 = Enhanced (ramp & soak, Auto/manual)
1	<b>Alarm relay:</b> 0 = No 1 = Yes
1	<b>Output A:</b> 1 = Built-in AC SSR 2 = Pulsed voltage (15 VDC) for external SSR 3 = Mechanical relay, SPST (normally open) 4 = Mechanical relay, SPST (normally closed) 5 = Current 8 = DC SSR
0	<b>Output B:</b> 0 = None 1 = Built-in AC SSR 2 = Pulsed voltage (15 VDC) for external SSR 3 = Mechanical relay, SPST (normally open) 4 = Mechanical relay, SPST (normally closed) 5 = Current 8 = DC SSR
-948	<b>Options (leave blank for none)</b>
CT16A2110-948 ← Sample P/N	

## Accessories

**AC744:** 1-10 A, 24 to 280 VAC SSR

**AC745:** 1-25 A, 24 to 280 VAC SSR

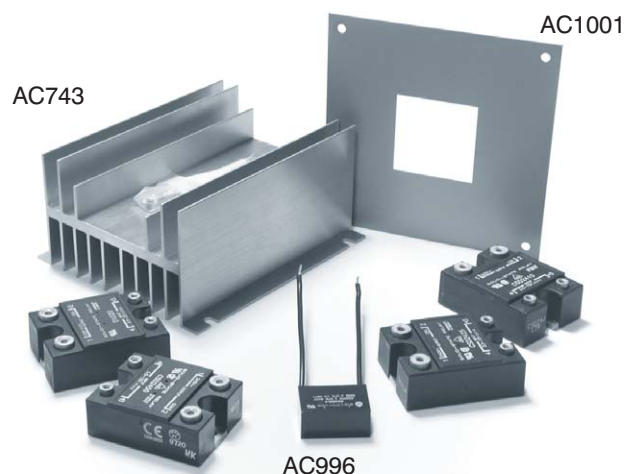
**AC746:** 1-50 A, 24 to 280 VAC SSR

**AC1009:** 1-20 A, 0 to 100 VDC SSR

**AC743:** SSR heatsink for high current or ambient temperature

**AC996 R/C Snubber:** Highly recommended to prolong relay contact life, if using the mechanical relay or SSR output to drive a relay or solenoid. Also, for the CT16A AC SSR output, make sure that the coil HOLDING current is greater than 100 mA and voltage is minimum 48 VDC.

**AC1001:** Steel 1/16 to 1/4 DIN adapter plate. 127×127 mm gray steel with 45×45 mm centered hole.



**IN STOCK**

AC743, AC744, AC745, AC746, AC1009

Call Minco for CT16A models in stock

## CT124 8-channel Temperature Monitor

- Protect motors, generators, transformers, other equipment
- Monitor 1 to 8 resistance temperature detectors (RTDs)
- 4 internal relays and audible alarm with independent trip points
- Overtemperature or undertemperature protection
- Microprocessor based; fully programmable
- Large, bright LED display shows °F or °C
- Stores high and low temperature peaks
- Trip points, programs, peaks stored in non-volatile memory
- Programmable silence button
- Versatile override switch permits manual relay toggling
- Rugged enclosure with sealed front panel

The CT124 8-channel Temperature Monitor offers flexible protection and control of temperature-critical equipment and processes. It scans up to eight RTDs and activates four relays plus a built-in audible alarm.

In a typical application, the CT124 provides early warning of possible large machine failure by monitoring the temperature of bearings, stators, transformer coils, and oil outlets. You can configure the CT124 to many other situations such as on/off control or undertemperature alarms. The CT124 can even monitor and control several loops at one time since you can group input zones with output relays in any combination.

### Operation

The CT124 continuously scans all RTD inputs. The display normally shows the highest, lowest, or any other zone temperature according to your instructions. Press up and down arrows to display other zones, Peak Temp to recall high and low peaks, and Trip Temp to indicate trip temperatures.

Each relay has its own trip temperature, either high or low, and may be programmed to react to any or all scanned input zones. Relays may control cooling fans, remote alarms, contactors, or programmable controller inputs. You can set the audible alarm to sound when certain relays trip, and also at its own setpoint. The silence button quiets the alarm for a programmed length of time.

### Programming

In the CT124's program mode you simply step through the included setup worksheet, change each parameter with the up and down arrows, and press Done to proceed. The CT124 retains all program data and setpoints with power off.



### Installation

The CT124 fits in a standard ¾ DIN panel cutout. Plug-in terminal blocks at the rear let you remove the unit without disconnecting wires. Front panel keys and indicators are sealed against dust and moisture.

### Special features

**Override:** The programmable Override button manually toggles a selected set of relays on and off. With it you can bypass automatic functions to assume direct control. For example, you could turn on fans or shut a machine down at temperatures below the trip point.

**Sensor failure protection:** If any scanned RTD circuit shorts or opens the CT124 sounds its alarm and locks out that zone. Other zones continue to scan normally. The Error light stays on until the faulty input is repaired and the self-test run.

**Self-test:** Press the Test button to test all panel lights and inputs. You can also program the Test button to trip relays connected to external alarms, fans, etc.

# Temperature Instruments

## Specifications

**Range:** Platinum input: -40 to 530°C or -40 to 986°F

Copper or nickel input: -40 to 250°C or -40 to 500°F.

**Input:** 1 to 8 RTDs (Resistance Temperature Detectors), 2 or 3 wire.

Code	Element	TCR ( $\Omega/\Omega/^{\circ}\text{C}$ )
PA	Platinum, 100 $\Omega$ at 0°C	0.00392
PB	Platinum, 100 $\Omega$ at 0°C	0.00391
PD	Platinum, 100 $\Omega$ at 0°C	0.00385
PF	Platinum, 1000 $\Omega$ at 0°C	0.00385
CA	Copper, 10 $\Omega$ at 25°C	0.00427
NA	Nickel, 120 $\Omega$ at 0°C	0.00672

**Input scan rate:** 8 readings per second.

**Input fault detection:** Open or shorted circuit sounds alarm and locks out faulty zone. Other zones unaffected.

**Input protection:**  $\pm 30$  VDC continuous, any input to ground.

**Output:** 5 independent trip points: 4 relays and one audible alarm. Alarm may be programmed to sound when selected relays trip.

**Relays:** Form C, SPDT, 10 Amps at 250 VAC resistive load, ¼ HP at 120 VAC.

**Trip point hysteresis (deadband):** Programmable from 2 to 20°C or °F.

**Display:** 0.56" (14 mm) LED, 1°C or 1°F resolution. 16 LED indicators.

**Accuracy:**  $\pm 2^{\circ}\text{C}$  ( $3^{\circ}\text{F}$ ) at 10 to 30°C (50 to 86°F) ambient.  $\pm 3^{\circ}\text{C}$  ( $5^{\circ}\text{F}$ ) at 0 to 55°C (32 to 131°F) ambient.

**Zone and relay labels:** Replaceable from rear for custom labeling.

**Supply power:** 115 or 230 VAC  $\pm 10\%$ , 50/60 Hz. 15 W max. Selection switch inside enclosure. 24 VDC factory option.

**Power loss protection:** Trip points, peaks, and program parameters stored in non-volatile memory. Normal operation resumes when power is restored.

**Keyboard:** 10 membrane type keys with audible feedback.

**Programming:** Programmable from front panel. Access to program mode requires special key sequence.

**Program fault protection:** Watchdog circuit resets microprocessor if it fails to perform program sequence.

**Enclosure:** ABS case, water and dust resistant front panel.

**Ambient temperature rating:** 0 to 55°C (32 to 131°F).

**Connections:** Plug-in terminal boards at rear accept wires to 14 AWG.

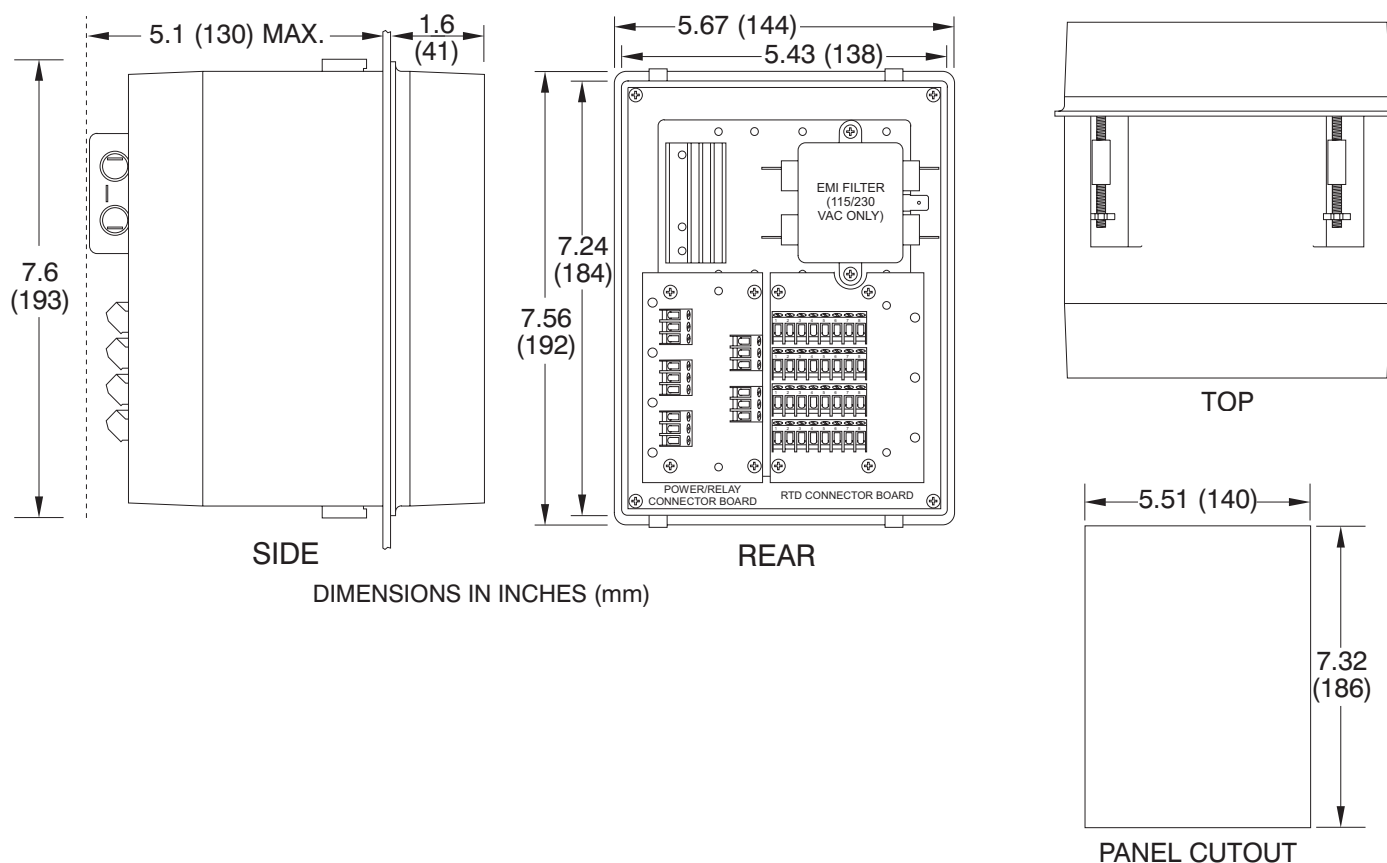
**Mounting:** ¾ DIN (DIN 43700). Panel-mounted in 5.51"  $\times$  7.32" (140  $\times$  186 mm) opening. Extends behind panel 5.1" (130 mm) max.

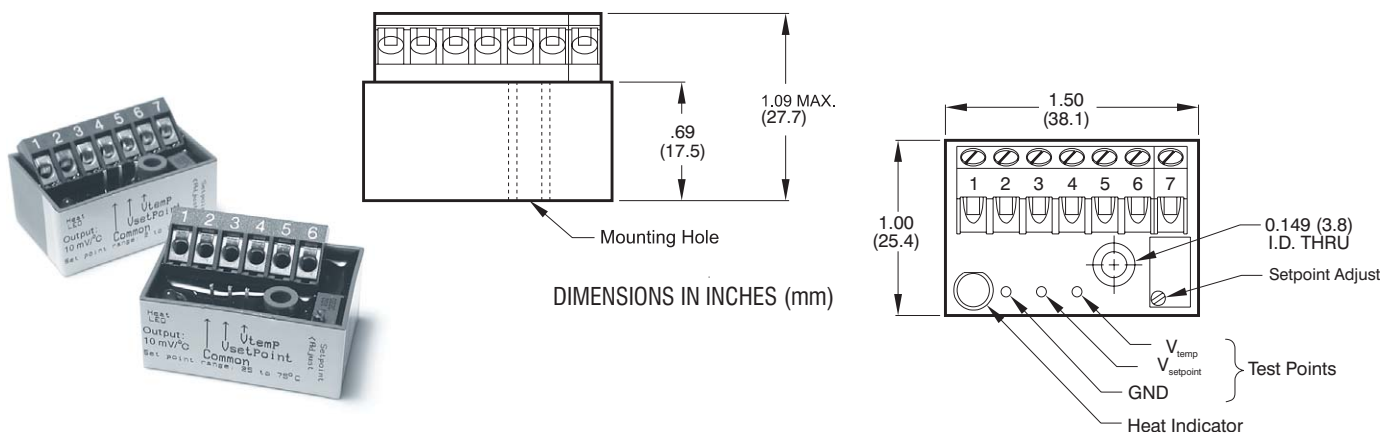
**Instructions:** Instruction manual and setup worksheets furnished with each unit.

**Weight:** 4 lb. (1.8 kg).

## How to order:

CT124	<b>Model number CT124</b>
PA	<b>RTD type:</b>
	CA = 10 $\Omega$ copper
	NA = 120 $\Omega$ nickel
	PA = 100 $\Omega$ platinum, TCR = 0.00392
	PB = 100 $\Omega$ platinum, TCR = 0.00391
	PD = 100 $\Omega$ platinum, TCR = 0.00385
	PF = 1000 $\Omega$ platinum, TCR = 0.00385
1	<b>Supply power:</b>
	1 = 115/230 VAC
	2 = 24 VDC
CT124PA1 ← Sample part number	





## CT325 Miniature DC Temperature Controller

- Tight control with  $\pm 0.1^\circ\text{C}$  ( $0.2^\circ\text{F}$ ) deadband!
- Miniature package  $1 \times 1 \times 1.5"$
- Solid state on/off control with adjustable setpoint
- Uses standard  $100\ \Omega$  or  $1000\ \Omega$  platinum RTD or  $50\ \text{k}\Omega$  thermistor sensor input
- Single DC power source provides power to the controller and heater up to 240 watts
- Simple setup with voltage output pins for process and setpoint temperatures
- 3-wire RTD connection cancels lead resistance

The CT325 Miniature DC Temperature Controller is designed for use with Minco Thermofoil™ heaters and RTD or thermistor sensors. It offers inexpensive on/off temperature control of your process or equipment with accuracy many times better than bimetal thermostats.

You can control temperatures up to  $200^\circ\text{C}$  (RTD sensor) or  $75^\circ\text{C}$  (thermistor). Easily read and adjust the set point temperature using your voltmeter, then monitor the actual signal temperature at the other end.

Operating from your 4.75 to 60 volt DC power supply, the controller can switch up to 4 amps power to the heater. A bright LED indicates when power is applied to the heater.

The entire unit is epoxy filled for moisture resistance, with a through-hole for a mounting bolt. A terminal block provides the power input, sensor input and heater output connections.

### Custom design options

Minco can customize the design of the CT325 for special applications. Specific temperature ranges, other sensor options, and special packaging are possible for volume OEM applications. Proportional controllers are available in a slightly larger package.

### Specifications

**Input:**  $100\ \Omega$  or  $1000\ \Omega$  platinum RTD,  $0.00385\ \Omega/\Omega/^\circ\text{C}$ , 2 or 3-leads, or  $50\ \text{k}\Omega$  NTC thermistor, 2-lead.

**Setpoint range:**  $2$  to  $200^\circ\text{C}$  ( $36$  to  $392^\circ\text{F}$ ) for platinum RTD input.  $25$  to  $75^\circ\text{C}$  ( $77$  to  $167^\circ\text{F}$ ) for thermistor input. Consult factory for other ranges.

**Setpoint stability:**  $\pm 0.02\%$  of span/ $^\circ\text{C}$ .

**$V_{\text{temp}}$  signal:**  $0.010\ \text{V}/^\circ\text{C}$  over specified range.

#### Platinum RTD sensor

$2^\circ\text{C}$	$0.02\ \text{V}$
$50^\circ\text{C}$	$0.50\ \text{V}$
$100^\circ\text{C}$	$1.00\ \text{V}$
$200^\circ\text{C}$	$2.00\ \text{V}$

Accuracy:  $\pm 1\%$  of span

Linearity:  $\pm 0.1\%$  of span

#### Thermistor sensor

$25^\circ\text{C}$	$0.25\ \text{V}$
$50^\circ\text{C}$	$0.50\ \text{V}$
$75^\circ\text{C}$	$0.75\ \text{V}$

Accuracy:  $\pm 2\%$  of span

Linearity:  $\pm 2\%$  of span

**Deadband:**  $0.1^\circ\text{C}$ .

**Input power:** 4.75 to 60 VDC.

**Output:** Open drain, 4 amps max. DC.

**Leadwire compensation:** (3-wire RTD)

$\pm 0.06^\circ\text{C}/\Omega$  for  $100\ \Omega$  or  $1000\ \Omega$  platinum up to  $25\ \Omega$  per leg.

**Fault protection:** Heater disabled on RTD short or thermistor open. No heater protection; external fuse is recommended.

**Operating ambient temperature range:**

$-40$  to  $70^\circ\text{C}$  ( $-40$  to  $158^\circ\text{F}$ ).

**Relative humidity:** 0 to 95% non-condensing.

**Physical:** Polycarbonate case, epoxy sealed for moisture resistance.

**Weight:** 1 oz. (28g).

**Connections:** Terminal block for wires AWG 22 to AWG 14.

**Mounting:** Mounting hole for #6 screw through or #8 thread forming screw.

Code	Sensor type
PD	$100\ \Omega$ platinum RTD
PF	$1000\ \Omega$ platinum RTD
TF	$50\ \text{k}\Omega$ thermistor

### How to order:

CT325	<b>Model number</b>
PD	<b>Sensor type from table</b>
1	<b>Power supply:</b> 1 = 4.75 to 10 VDC 2 = 7.5 to 60 VDC
C	<b>Temperature range:</b> A = $25$ to $75^\circ\text{C}$ (thermistor only) C = $2$ to $200^\circ\text{C}$ (RTD only)
1	<b>Dead band:</b> 1 = $0.1^\circ\text{C}$
CT325PD1C1 ← Sample P/N	

▲ **50k $\Omega$  thermistor sensor TS665TF is available on page 10-5.**