



► SECTION 5: INSTRUMENTS

- RTD and thermocouple Temptran™ transmitters provide accurate signals over thousands of feet.
 - Fixed range or field rangeable
 - Miniature, hockey puck, and isolated versions
 - High-accuracy calibration available matched to individual RTDs
- Controllers, indicators and alarms for precise monitoring and control

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Miniature Temptran™ RTD Transmitters



TT111, TT211

Overview

- Two models:
 - TT111: UL-recognized component for Canada and United States.
 - TT211: Wider ambient rating; Factory Mutual (FM) approved intrinsically safe and nonincendive.
- Optional high-accuracy calibration to Minco RTDs for improved accuracy; see next page and page 5-18 for more information.

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:

TT111: 0 to 50°C (32 to 122°F).

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

$V_{supply} = 24$ 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 Ω .

Minimum span: 27.8°C (50°F).

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

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

Connections:

Terminal block for wires AWG 22 to AWG 14.

Physical: Polycarbonate case, epoxy potted for moisture resistance.

Weight: 1.1 oz. (30 g).

Hazardous area requirements

Refer to Minco's Application Aid #19 entitled "Specifying Temperature Sensors for Hazardous Areas" for more information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX). Application Aid #19 is available at www.minco.com/sensoraid/.

Specifications subject to change

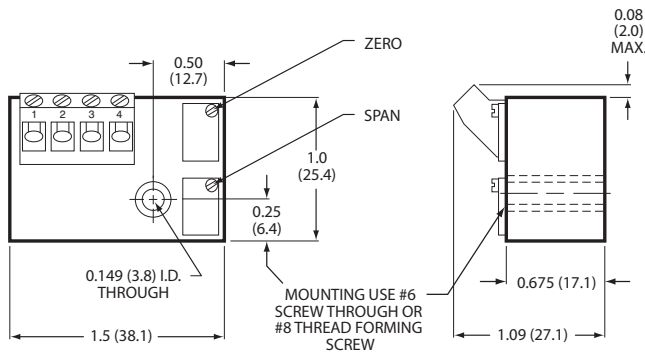
Miniature RTD Transmitters

RTD input types

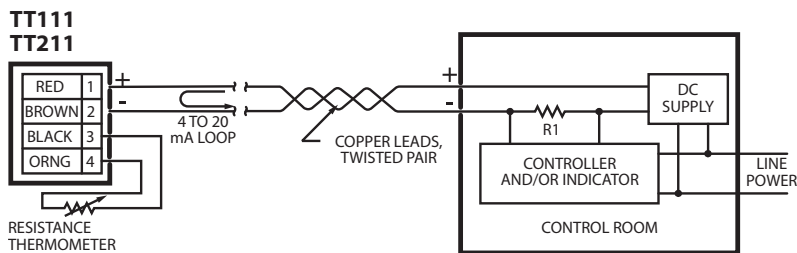
2-wire resistance thermometer:

Element		Code
Platinum (0.00392 TCR)	100 Ω at 0°C	PA
Platinum (0.00391 TCR)	100 Ω at 0°C	PB
Platinum (0.00385 TCR)	100 Ω at 0°C	PD, PE
Platinum (0.00385 TCR)	1000 Ω at 0°C	PF
Platinum (0.00375 TCR)	1000 Ω at 0°C	PW
Nickel-iron (0.00518 TCR)	604 Ω at 0°C	FA
Nickel-iron (0.00527 TCR)	1000 Ω at 70°F	FB
Nickel-iron (0.00527 TCR)	2000 Ω at 70°F	FC
Nickel (0.00672 TCR)	120 Ω at 0°C	NA

Dimensions in inches (mm)



Wiring Diagram



Special high-accuracy calibration

To order a Temptran with special calibration, replace the standard model (eg. TT110) with the special calibration model (eg. TT150). See page 5-18 for more information.

Standard model	Special calibration
TT111	TT151
TT211	TT711

Note: Specifications for special calibration units are identical to their standard counterparts.

Specification and order options:

TT111	Model number: TT111 or TT211
PD	RTD element code from table
1	Output: 4 to 20 mA DC
C	Temperature range code from pages 5-16 [Ex: C = 0 to 100°C (32 to 212°F)]
TT111PD1C = Sample part number	

Specifications subject to change

TT176, TT246 RTD Transmitters



TT176 RTD Transmitter,
current output



TT246 RTD Transmitter,
voltage output

Overview

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.

- TT176: 4 to 20 mA current signal
TT246: 1 to 5 VDC voltage signal
- 2 or 3-wire RTD input
- TT176: Factory Mutual (FM) approved intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)
- Fits DIN "B" style connection heads
- Optional high-accuracy calibration to Minco RTDs for improved accuracy; see next page and page 5-18 for more information.

Specifications

Output: Linear with temperature over specified range.

TT176: 4 to 20 mA

TT246: 1 to 5 VDC

Calibration Accuracy: ±0.1% of span (0.2% of span for spans less than 10 Ω)

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

Adjustments Zero and span, ±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:

±0.009% of span per °C

±0.014% of span per °C for spans less than 10 Ω

Warmup drift:

±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 ±0.001% of span per volt.

Reverse polarity protected.

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

Maximum load resistance: 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 Ω.

Minimum span: 10°C (18°F).

Minimum output current: 2.2 mA.

Maximum output current: 28 mA.

Leadwire compensation: (3-wire RTD) ±0.05% of span per Ω up to 25 Ω in each leg.

Hazardous atmospheres: Both models may be used with Minco explosionproof connection heads. Model TT176 is also Factory Mutual (FM) approved nonincendive for use in Class I, Division 2 areas and intrinsically safe for Class I, Division 1 areas (requires approved barrier). Transmitter entity parameters: $V_{max} = 35$ volts; $I_{max} = 150$ mA; $C_i = 0 \mu\text{F}$ and $L_i = 0$ mH.

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

Physical: Polycarbonate case, epoxy potted for moisture resistance.

Weight: 2.0 oz. (57 g).

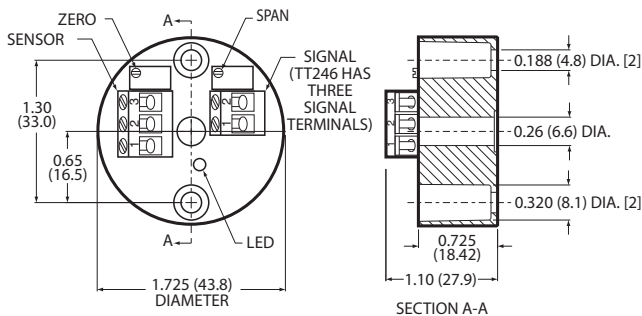
Specifications subject to change

RTD input types

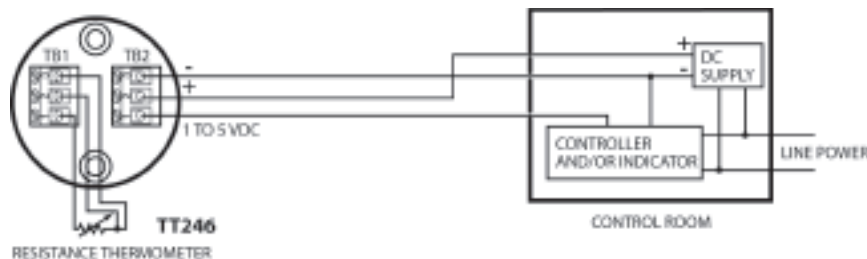
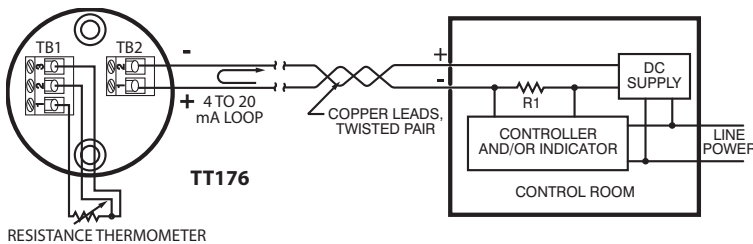
2 or 3-wire resistance thermometer:

Element		Code
Platinum (0.00392 TCR)	100 Ω at 0°C	PA
Platinum (0.00391 TCR)	100 Ω at 0°C	PB
Platinum (0.00385 TCR)	100 Ω at 0°C	PD, PE
Platinum (0.00385 TCR)	1000 Ω at 0°C	PF
Platinum (0.00375 TCR)	1000 Ω at 0°C	PW
Copper (0.00427 TCR)	10 Ω at 25°C	CA
Nickel-iron (0.00518 TCR)	604 Ω at 0°C	FA
Nickel-iron (0.00527 TCR)	1000 Ω at 70°F	FB
Nickel-iron (0.00527 TCR)	2000 Ω at 70°F	FC
Nickel (0.00672 TCR)	120 Ω at 0°C	NA

Dimensions in inches (mm)



Wiring Diagrams



Special high-accuracy calibration

To order a Temptran with special calibration, replace the standard model (eg. TT176) with the special calibration model (eg. TT676).

Standard model	Special calibration
TT176	TT676
TT246	TT746

Note: Specifications for special calibration units are identical to their standard counterparts.

Specification and order options:

TT176	Model Number: TT176: 4 to 20 mA TT246: 1 to 5 VDC
PB	RTD element code from table
1	
K	Temperature range code from pages 5-16 [Ex: K = 0 to 200°C (32 to 392°F)]
TT176PB1K = Sample part number	

Hazardous area requirements

Refer to Minco's Application Aid #19 entitled "Specifying Temperature Sensors for Hazardous Areas" for more information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX). Application Aid #19 is available at www.minco.com/sensoraid/.

Specifications subject to change

TT190, TT205 Thermocouple Transmitters



TT190 Thermocouple Transmitter



TT205
Thermocouple Transmitter

Overview

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 superior performance in an economical and small package.

- TT190: "Hockey puck" style industrial transmitter
- TT205: Miniature economy version
- 4 to 20 mA current signal
- Thermocouple input
- Factory Mutual (FM) approved intrinsically safe, nonincendive for hazardous locations
- Fits DIN "B" style connection heads

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 $V_{supply} = 24$ 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:

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

Example: With supply voltage 24 VDC, maximum loop resistance is 700 Ω .

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 (FM) approved nonincendive for use in Class I, Division 2 areas and intrinsically safe for Class I, Division 1 areas (requires approved barrier). Transmitter entity parameters: $V_{max} = 35$ volts; $I_{max} = 150$ mA; $C_i = 0 \mu\text{F}$ and $L_i = 0$ mH.

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

Physical: Polycarbonate case, epoxy potted for moisture resistance.

Weight:

TT190: 2.0 oz. (57 g).

TT205: 1.8 oz. (52 g).

Hazardous area requirements

Refer to Minco's Application Aid #19 entitled "Specifying Temperature Sensors for Hazardous Areas" for more information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX). Application Aid #19 is available at www.minco.com/sensoraid/.

Specifications subject to change

TT220 Isolated RTD Transmitter



TT220 Isolated RTD Transmitter

Overview

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.

- 4 to 20 mA current signal
- 2 or 3-wire RTD input
- Input/output isolated to 600 VRMS
- Factory Mutual (FM) approved intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)
- Optional high-accuracy calibration to Minco RTDs for improved accuracy; see next page and page 5-18 for more information

Specifications

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

Calibration accuracy: ±0.1% of span (0.2% of span for spans less than 10 Ω).

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

Adjustments: Zero and span, ±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: ±0.018% of span per °C.

Warmup drift: ±0.1% of span max., with

$V_{supply} = 24$ VDC and $R_{loop} = 250$ Ω.

Stable within 15 minutes.

Input/output isolation: 600 VRMS.

Supply voltage: 13 to 45 VDC. Voltage effect ±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 Ω.

Minimum span: 10°C (18°F).

Minimum output current: 2.5 mA.

Maximum output current: 28 mA.

Leadwire compensation: (3-wire RTD) ±0.05% of span per Ω up to 25 Ω in each leg.

Hazardous atmospheres:

Model TT220 may be used with Minco explosionproof connection heads. This model is Factory Mutual (FM) approved nonincendive for use in Class I, Division 2 areas and intrinsically safe for Class I, Division 1 areas (requires approved barrier).

Transmitter entity parameters:

$V_{max} = 35$ volts; $I_{max} = 150$ mA; $C_i = 0$ μF and $L_i = 0$ 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).

Hazardous area requirements

Refer to Minco's Application Aid #19 entitled "Specifying Temperature Sensors for Hazardous Areas" for more information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX). Application Aid #19 is available at www.minco.com/sensoraid/.

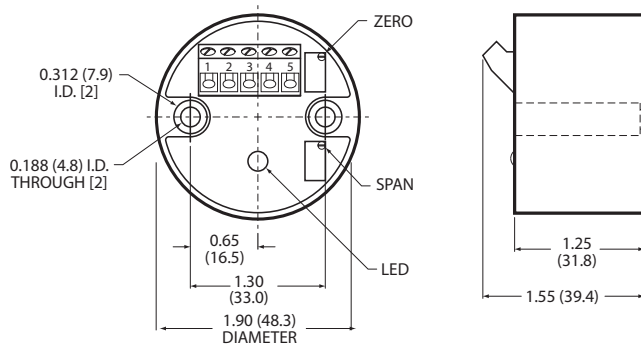
Specifications subject to change

RTD input types

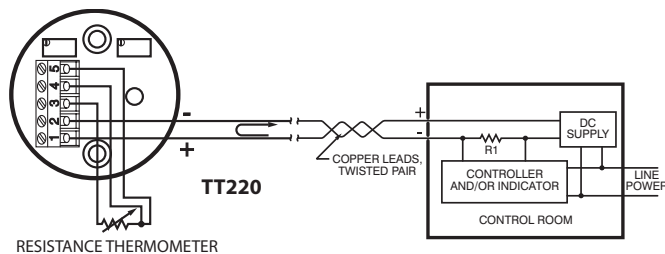
2 or 3-wire resistance thermometer:

Element		Code
Platinum (0.00392 TCR)	100 Ω at 0°C	PA
Platinum (0.00391 TCR)	100 Ω at 0°C	PB
Platinum (0.00385 TCR)	100 Ω at 0°C	PD, PE
Platinum (0.00385 TCR)	1000 Ω at 0°C	PF
Platinum (0.00375 TCR)	1000 Ω at 0°C	PW
Copper (0.00427 TCR)	10 Ω at 25°C	CA
Nickel-iron (0.00518 TCR)	604 Ω at 0°C	FA
Nickel-iron (0.00527 TCR)	1000 Ω at 70°F	FB
Nickel-iron (0.00527 TCR)	2000 Ω at 70°F	FC
Nickel (0.00672 TCR)	120 Ω at 0°C	NA

Dimensions in inches (mm)



Wiring Diagram



Special high-accuracy calibration

To order a Temptran with special calibration, replace the standard model (eg. TT220) with the special calibration model (eg. TT720).

Standard model	Special calibration
TT220	TT720

Note: Specifications for special calibration units are identical to their standard counterparts

Specification and order options

TT220	Model number
PA	RTD element code from table
1	Output: 4 to 20 mA DC
GH	Temperature range code from page 5-16 [Ex: GH = -40 to 100°C (-40 to 212°F)]
TT220PA1GH = Sample part number	

Specifications subject to change

TT221 Isolated Thermocouple Transmitter



TT221 Isolated RTD Transmitter

Overview

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 thermocouple.

- 4 to 20 mA current signal
- Thermocouple input
- Input/output isolated to 600 VRMS
- Factory Mutual (FM) approved intrinsically safe, nonincendive for hazardous locations
- Ambient rated to 85°C (185°F)

Specifications

Output: 4 to 20 mA over specified range.

Accuracy: ±0.2% of span.

Linearity: Voltage linear.

Adjustments: Zero and span, ±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: ±0.036% of span per °C.

Cold junction compensation drift:

±0.03°C per °C, -25 to 70°C.

±0.06°C per °C, -40 to -25°C and 70 to 85°C.

Warmup drift: ±0.2% of span max., with

$V_{supply} = 24$ VDC and $R_{loop} = 250$ Ω.

Stable within 15 minutes.

Input/output isolation: 600 VRMS

Supply voltage: 13 to 45 VDC. Voltage effect ±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 Ω.

Minimum span: 100°C (180°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 (FM) approved nonincendive for use in Class I, Division 2 areas and intrinsically safe for Class I, Division 1 areas (requires approved barrier).

Transmitter entity parameters:

$V_{max} = 35$ volts; $I_{max} = 150$ mA; $C_i = 0$ μF and $L_i = 0$ mH.

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

Physical: Polycarbonate case, epoxy potted for moisture resistance.

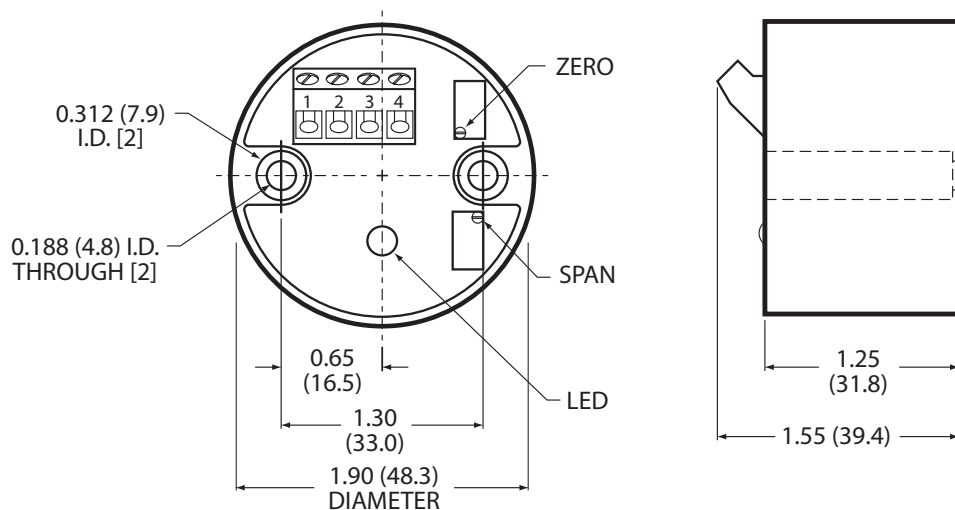
Weight: 3.0 oz. (85 g).

Specification and order options

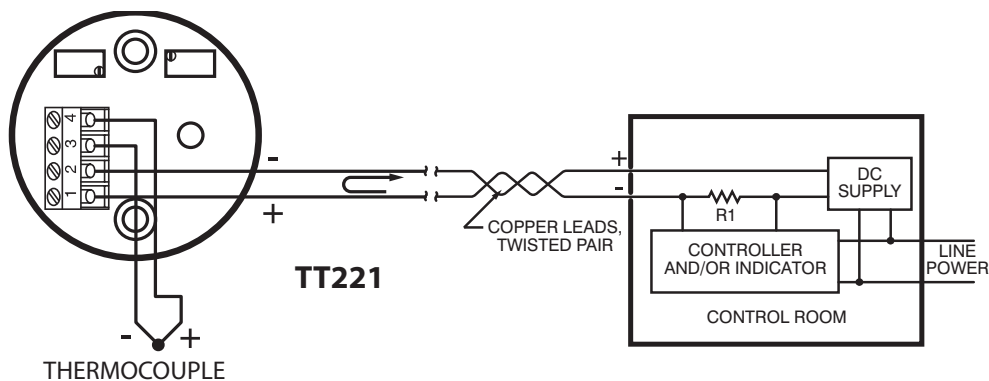
TT221	Model number
J	TC junction type: E = Chromel-Constantan J = Iron-Constantan K = Chromel-Alumel T = Copper-Constantan
1	Output: 4 to 20 mA DC
BW	Temperature range code from page 5-16 [Ex: BW = 0 to 250°C (32 to 482°F)]
TT221J1BW = Sample part number	

Specifications subject to change

Dimensions in inches (mm)



Wiring Diagram



Hazardous area requirements

Refer to Minco's Application Aid #19 entitled "Specifying Temperature Sensors for Hazardous Areas" for more information on how to classify a hazardous area, methods of protection, and the various standards and agencies (including FM, CSA, CENELEC and ATEX). Application Aid #19 is available at www.minco.com/sensoraid/.

Specifications subject to change

TT273 Field Rangeable RTD Temperature Transmitter



TT273 RTD
Temperature Transmitter

Overview

Model TT273 is a 2-wire temperature transmitter for 2 or 3-lead 100 Ω platinum RTDs. The transmitter converts the RTD 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.

- 4 to 20 mA current signal
- Fits standard 35 mm DIN rail
- Field-calibrate to your temperature range
- Optional high-accuracy calibration to Minco RTDs for improved accuracy; see next page and page 5-18 for more information
- Optional Input/Output isolation to 600 VRMS

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 to 150°C (-58 to 302°F).

Span: 50 to 600°C (90 to 1080°F).

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/ $^\circ\text{C}$ ($\pm 0.01\%$ 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 Ω , up to 25Ω 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 g).

Specifications subject to change

RTD input types

2 or 3-wire 100 Ω platinum RTD.

Element	Code
Platinum (0.00392 TCR) 100 Ω at 0°C	PA
Platinum (0.00391 TCR) 100 Ω at 0°C	PB
Platinum (0.00385 TCR) 100 Ω at 0°C	PD, PE

Special high-accuracy calibration

To order a Temptran with special calibration, replace the standard model (eg. TT273) with the special calibration model (eg. TT773)

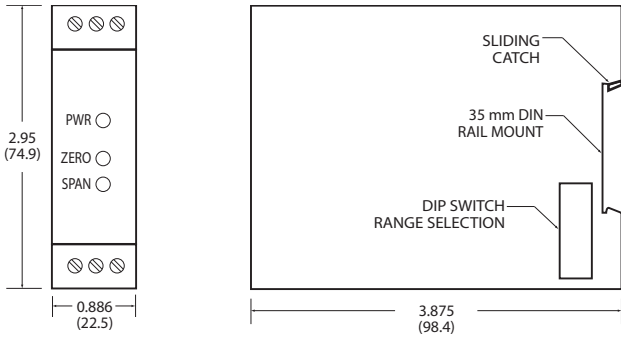
Standard model	Special calibration
TT273	TT773

Note: Specifications for special calibration units are identical to their standard counterparts.

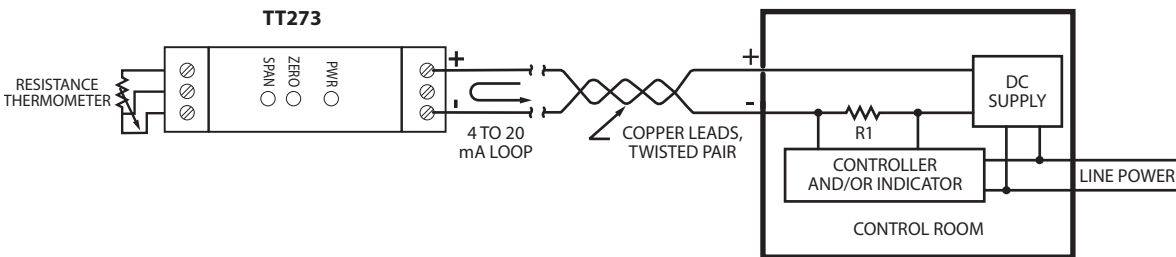
Specification and order options

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.
C	Temperature scale: F = Fahrenheit C = Celsius
TT273PD1N(-25/50)C = Sample part number	

Dimensions in inches (mm)



Wiring diagram



Specifications subject to change

TT274 Field Rangeable Thermocouple Temperature Transmitter

Overview

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.

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

Specifications

Input: Type J or K thermocouple (field selectable).

Output: 4 to 20 mA DC over specified range.

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

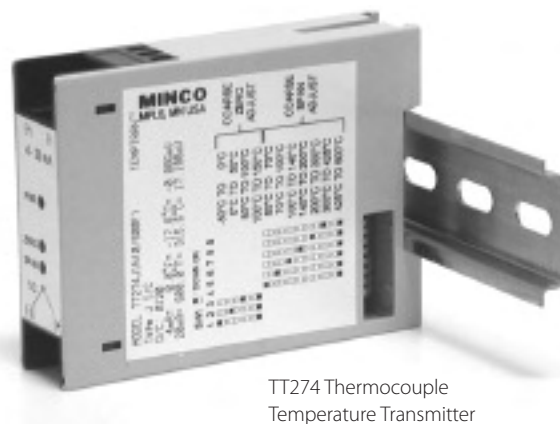
Linearity: Voltage linear.

Adjustments:

Zero: -50°C to 150°C (-58°F to 302°F).

Span: Type J: 125 to 850°C (225 to 1530°F).

Type K: 150 to 1200°C (270 to 2160°F).



TT274 Thermocouple Temperature Transmitter

Ambient temperature:

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

Storage: -55 to 100°C (-67 to 212°F).

Ambient temperature effects: $\pm 0.036\%$ 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°C ambients. $\pm 0.06^{\circ}\text{C}/^{\circ}\text{C}$ for -40 to -25°C and 70 to 85°C ambients.

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

$V_{\text{supply}} = 24$ 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:

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

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

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 g).

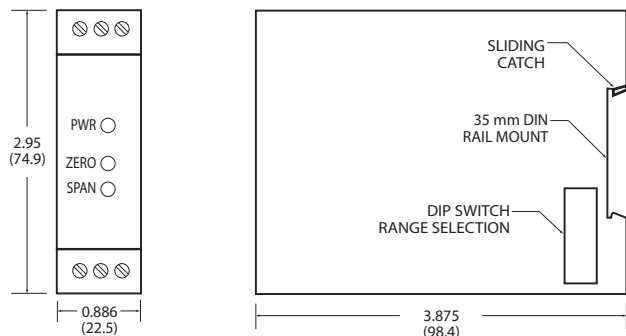
Specifications subject to change

Specification and order options

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

Specify and order products at:
www.minco.com/sensors_config

Dimensions in inches (mm)



Wiring diagram



Specifications subject to change

Temptran™ Temperature Ranges

Below is a list of commonly selected 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.

If you do not find the temperature range required by your application, go to www.minco.com/rangecode/ for a complete list of temperature ranges. Custom ranges are also available for a small setup charge. Contact Access: Minco Sales and Support for more information.

For more temperature ranges (over 400 options) go to www.minco.com/rangecode/

Range code	Temperature Range				RTD Temptrans			Thermocouple Temptrans	
	Zero °F	Span °F	Zero °C	Span °C	TT111, TT115, TT211, TT829	TT176, TT246, TT220	TT190, TT221	TT205	
					Platinum elements*	Other elements	Elements	T/C types	T/C types
MH	-328	-148	-200.0	-100.0	PA PB PD PE				
HG	-325	100	-198.3	37.8	PA PB PD PE PF PW			JT	
QS	-300	150	-184.4	65.6			PA PB PD PE		
EZ	-148	32	-100.0	0.0	PA PB PD PE PF PW		PA PB PD PE		
LN	-148	212	-100.0	100.0	PA PB PD PE				
SA	-140	100	-95.6	37.8			PA PB PD PE		
UL	-103	752	-75.0	400.0				K	
M	-58	122	-50.0	50.0	PA PB PD PE PF PW		PA PB PD PE		
EO	-58	212	-50.0	100.0	PA PB PD PE	NA	PA PB PD PE	T	ET
JD	-58	302	-50.0	150.0	PA PB PD PE		PA PB PD PE	J	
MR	-58	500	-50.0	260.0			PA PB PD PE CA NA		
SD	-50	100	-45.6	37.8	PA PB PD PE				
MI	-50	150	-45.6	65.6	PA PB PD PE		PA PB PD PE	T	
AI	-50	275	-45.6	135.0	PA PB PD PE PF PW	FB FC FL NA	PA PB PD PE		
MS	-50	650	-45.6	343.3	PA PB PD PE		PA PB PD PE		
AD	-40	120	-40.0	48.9	PA PB PD PE	FB FC	PA PB PD PE		
AK	-40	140	-40.0	60.0	PA PB PD PE PU		PA PB PD PE		
BE	-40	160	-40.0	71.1	PA PB PD PE	FB	PA PB PD PE		
GH	-40	212	-40.0	100.0	PA PB PD PE		PA PB PD PE		
UE	-40	302	-40.0	150.0	PA PB PD PE		PA PB PD PE		
L	-30	120	-34.4	48.9	PA PB PD PE PF PW	FB FC			
AS	-30	130	-34.4	54.4	PA PB PD PE PF PW	FB	PA PB PD PE		
R	-30	150	-34.4	65.6	PA PB PD PE	FB FC	PA PB PD PE		
DN	-22	122	-30.0	50.0	PA PB PD PE		PA PB PD PE		
EE	-22	302	-30.0	150.0	PA PB PD PE		PA PB PD PE		
DO	-20	120	-28.9	48.9	PA PB PD PE PF PW	ND	PA PB PD PE		
EN	-20	140	-28.9	60.0	PA PB PD PE PF PW	FB	PA PB PD PE		
B	-20	180	-28.9	82.2	PA PB PD PE	FB FC NA	PA PB PD PE CA		
BP	-4	104	-20.0	40.0	PA PB PD PE	FC	PA PB PD PE		
SH	-4	122	-20.0	50.0	PA PB PD PE				
DB	-4	212	-20.0	100.0	PA PB PD PE		PA PB PD PE		
JZ	0	65	-17.8	18.3	PA PB PD PE		PA PB PD PE		
S	0	100	-17.8	37.8	PA PB PD PE PF PG PW	FB	PA PB PD PE PW		
JH	0	120	-17.8	48.9	PA PB PD PE PF PW	FC	PA PB PD PE		
HD	0	130	-17.8	54.4	PA PB PD PE PF PW		PA PB PD PE		
DV	0	150	-17.8	65.6	PA PB PD PE	FB	PA PB PD PE		
EI	0	160	-17.8	71.1	PA PB PD PE				
AC	0	200	-17.8	93.3	PA PB PD PE PF PW	FB NA	PA PB PD PE CA	EJKT	T
EY	0	250	-17.8	121.1	PA PB PD PE PF PW	NA	PA PB PD PE	JK	JKT
AN	0	300	-17.8	148.9	PA PB PD PE PF PW	FB FC NA	PA PB PD PE CA NA	EJKT	K
JA	0	350	-17.8	176.7	PA PB PD PE		PA PB PD PE	KJ	
DS	0	400	-17.8	204.4	PA PB PD PE	NA	PA PB PD PE CA NA	JK	
AG	0	500	-17.8	260.0	PA PB PD PE PF PW	NA	PA PB PD PE CA	EJT	JKT
QN	0	550	-17.8	287.8	PA PB PD PE		PA PB PD PE		
AB	0	600	-17.8	315.6	PA PB PD PE PF PW	NA	PA PB PD PE	EJK	J
AA	0	800	-17.8	426.7	PA PB PD PE PF PW		PA PB PD PE	J	JK
BZ	0	1000	-17.8	537.8	PA PB PD PE		PA PB PD PE	JK	EJ

* Element codes (PA, PB, PD, PE, etc.) are defined in the Resistance/Temperature Tables on page 1-13

Specifications subject to change

For more temperature ranges (over 400 options) go to www.minco.com/rangecode/

Range code	Temperature Range				RTD Temptrans				Thermocouple Temptrans	
	Zero °F	Span °F	Zero °C	Span °C	TT111, TT115, TT211, TT829		TT176, TT246, TT220		TT190, TT221	TT205
					Platinum elements*	Other elements	Elements		T/C types	T/C types
HU	0	1300	-17.8	704.4					K	
BY	14	104	-10.0	40.0	PA PB PD PE		PA PB PD PE			
AJ	14	122	-10.0	50.0	PA PB PD PE		PA PB PD PE			
AP	20	70	-6.7	21.1	PA PB PD PE PF PW		PA PB PD PE			
GV	20	100	-6.7	37.8	PA PB PD PE PF PW		PA PB PD PE			
A	20	120	-6.7	48.9	PA PB PD PE PF PW	FA FB FC NA	PA PB PD PE PF			
HE	20	240	-6.7	115.6	PA PB PD PE					
AF	20	320	-6.7	160.0	PA PB PD PE	FA FB				
QE	22	122	-5.6	50.0	PA PB PD PE					
GW	23	131	-5.0	55.0	PA PB PD PE					
U	30	80	-1.1	26.7	PA PB PD PE PF PW	FB FC	PA PB PD PE			
DA	30	90	-1.1	32.2	PA PB PD PE PF PW	FC	PA PB PD PE			
DP	30	100	-1.1	37.8	PA PB PD PE PF PW					
BI	30	130	-1.1	54.4	PA PB PD PE PF PW		PA PB PD PE PF PW			
DQ	30	150	-1.1	65.6	PA PB PD PE	FB	PA PB PD PE			
KK	30	180	-1.1	82.2	PA PB PD PE					
EV	30	230	-1.1	110.0	PA PB PD PE		PA PB PD PE			
BN	30	240	-1.1	115.6	PA PB PD PE PF PW	FB	PA PB PD PE			
BJ	30	250	-1.1	121.1	PA PB PD PE PF PW	NA	PA PB PD PE FA			
GQ	32	100	0.0	37.8	PA PB PD PE PF PW		PA PB PD PE			
EG	32	104	0.0	40.0	PA PB PD PE PF PW		PA PB PD PE			
N	32	122	0.0	50.0	PA PB PD PE PF PW	FB FC	PA PB PD PE			
HL	32	167	0.0	75.0	PA PB PD PE		PA PB PD PE			
C	32	212	0.0	100.0	PA PB PD PE PF PW	FB FC NA	PA PB PD PE CA NA	JT		
QR	32	257	0.0	125.0	PA PB PD PE					
DL	32	280	0.0	137.8	PA PB PD PE		PA PB PD PE			
J	32	302	0.0	150.0	PA PB PD PE PF PU PW	FC NA	PA PB PD PE CA	J		J
K	32	392	0.0	200.0	PA PB PD PE PU	NA	PA PB PD PE CA	JK		J
LX	32	400	0.0	204.4	PA PB PD PE					
BW	32	482	0.0	250.0	PA PB PD PE	NA	PA PB PD PE	EJKT		J
LF	32	572	0.0	300.0	PA PB PD PE		PA PB PD PE	JT		
JW	32	932	0.0	500.0	PA PB PD PE		PA PB PD PE	JK		K
HA	32	1112	0.0	600.0	PA PB PD PE PF PW			K		
GF	32	1472	0.0	800.0	PA PB PD PE		PA PB PD PE	K		K
SG	33.8	123.8	1.0	51.0	PA PB PD PE					
H	40	90	4.4	32.2	PA PB PD PE PF PW	FB	PA PB PD PE			
BU	40	100	4.4	37.8	PA PB PD PE PF PW					
QL	40	120	4.4	48.9	PF PW	FC				
BK	40	140	4.4	60.0	PA PB PD PE PF PW	FB	PA PB PD PE			
KH	40	240	4.4	115.6	PA PB PD PE PF PW		PA PB PD PE			
KP	42	92	5.6	33.3	PA PB PD PE					
DU	45	95	7.2	35.0	PA PB PD PE		PA PB PD PE			
DX	50	100	10.0	37.8	PA PB PD PE PF PW		PA PB PD PE			
AH	50	110	10.0	43.3	PA PB PD PE	FB	PA PB PD PE			
ED	50	120	10.0	48.9	PA PB PD PE PF PW	FB				
V	50	150	10.0	65.6	PA PB PD PE PF PW	FA FB NA	PA PB PD PE			
AV	50	230	10.0	110.0	PA PB PD PE PF PW		PA PB PD PE	J		
BF	50	250	10.0	121.1	PA PB PD PE PF PW		PA PB PD PE PF PW	ET		
AO	50	300	10.0	148.9	PA PB PD PE		PA PB PD PE CA FA			
KF	50	400	10.0	204.4	PA PB PD PE		PA PB PD PE			
D	70	220	21.1	104.4	PA PB PD PE PF PW	FB FC	PA PB PD PE			
E	100	500	37.8	260.0	PA PB PD PE PF PW		PA PB PD PE			
BH	122	302	50.0	150.0	PA PB PD PE		PA PB PD PE	T		
BL	200	500	93.3	260.0	PA PB PD PE PF PW			K		

* Element codes (PA, PB, PD, PE, etc.) are defined in the Resistance/Temperature Tables on page 1-13

Specifications subject to change

Temptran™ Calibration & Accessories

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.

Free NIST traceability

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 9001 and other quality standards.

Specifications and order options

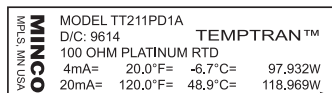
To order a Temptran with special calibration, replace the standard model (eg. TT111) with the special calibration model (eg. TT151). Specifications for special calibration models are identical to their standard model counterparts.

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

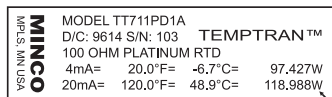
Recalibration

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°C or better), you can trust the printed values for many years.



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



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

Temptran Accessories

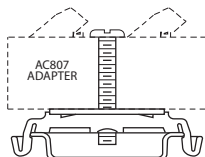
DIN rail mounting

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



AC807 adapter for EN50022

Dual mounting kits

The AC103528 mounting kit fits connection head models CH105, CH107, CH328, CH330, CH342, CH343, CH357, CH358, CH405 and CH407. It holds two miniature Temptrans in a single head for use with dual RTDs.

Use AC103133 for connection head models CH104, CH106 and CH306, and CH356. CH106, CH306 and CH356 also require AC103625 connection head modification.



AC103528
mounting kit



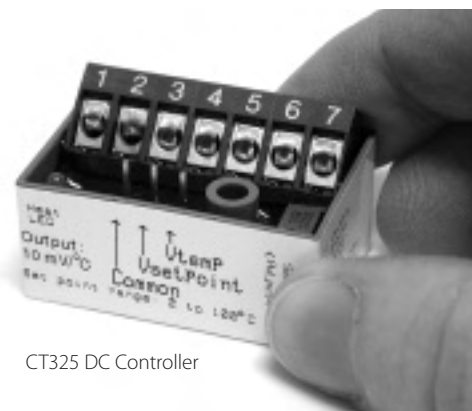
AC103133
mounting kit

Specifications subject to change

Design Notes

Specifications subject to change

CT325 Miniature DC Temperature Controller



CT325 DC Controller

Overview

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. Easily read and adjust the set point temperature using a 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.

- Tight control in a small package means that enclosures or panel spaces are not required which allows successful portable device implementation
- Simple control without complicated programming can reduce set-up time
- Three-wire RTD connection cancels lead resistance for highly accurate temperature readings
- Solid state on-off control with adjustable set point improves durability compared to electro-mechanical devices
- Flexible heating control compliments all Minco Thermofoil™ Heaters for convenient off the shelf operation
- Uses standard 100 Ω or 1000 Ω platinum RTD or 50 k Ω thermistor sensor input
- Single DC power source provides power to the controller and heater up to 240 watts

Applications

- IV solutions for medical/surgical applications
- Military batteries
- Enclosures to maintain the temperature of electronics
- Ruggedized laptop LCDs and harddrives

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.

Specifications

Input: 100 Ω or 1000 Ω platinum RTD, 0.00385 $\Omega/\Omega/^\circ\text{C}$, 2 or 3-leads, or 50 k Ω 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_{temp} signal: 0.010 V/ $^\circ\text{C}$ over specified range.

Platinum RTD sensor		Thermistor sensor	
2 $^\circ\text{C}$	0.02 V	25 $^\circ\text{C}$	0.25 V
50 $^\circ\text{C}$	0.50 V	50 $^\circ\text{C}$	0.50 V
100 $^\circ\text{C}$	1.00 V	75 $^\circ\text{C}$	0.75 V
200 $^\circ\text{C}$	2.00 V		
Accuracy:	$\pm 1\%$ of span	Accuracy:	$\pm 2\%$ of span
Linearity:	$\pm 0.1\%$ of span	Linearity:	$\pm 2\%$ of span

Deadband: $\pm 0.1^\circ\text{C}$ (0.2 $^\circ\text{F}$).

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 Ω or 1000 Ω platinum up to 25 Ω 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.

Specifications subject to change

Sensor type	Code
100 Ω platinum RTD (0.00385 TCR)	PD
1000 Ω platinum RTD (0.00385 TCR)	PF
50 kΩ thermistor R25/R125 = 31.2	TF

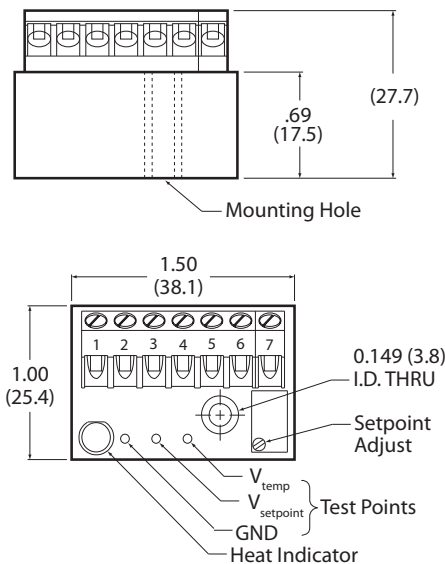
Note: 50kW thermistor sensor TS665TF is available on page 10-6

Specification and order options

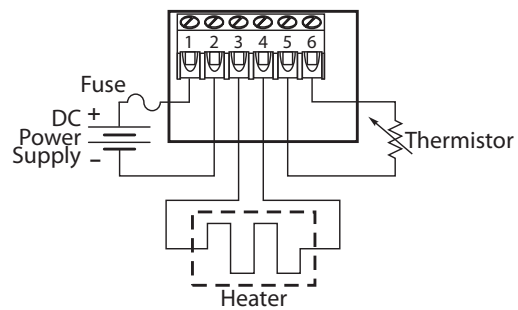
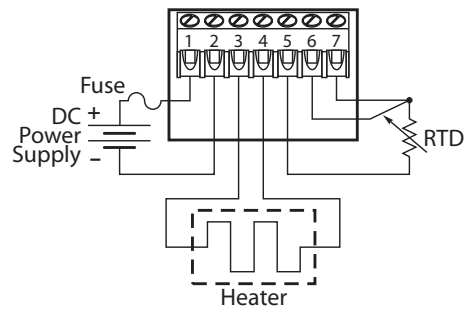
CT325	Model number
PD	Sensor type from table
1	Power supply: 1 = 4.75 to 10 VDC 2 = 7.5 to 60 VDC
C	Temperature range: A = 25 to 75°C (thermistor only) C = 2 to 200°C (RTD only)
1	Dead band: 1 = 0.1°C
CT325PD1C1 = Sample part number	

Specify and order products at:
www.minco.com/sensors_config

Dimensions in inches (mm)

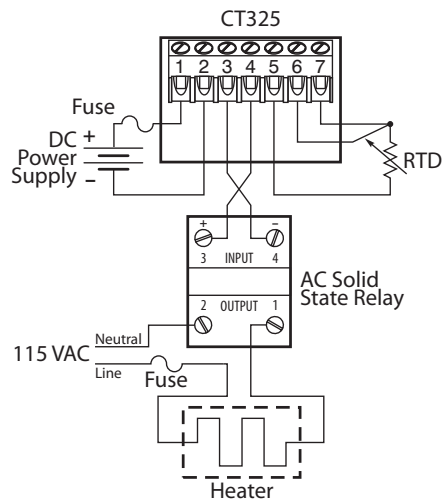


Wiring diagrams



AC powered heaters

The CT325 can provide the control signal to an external solid state relay to switch AC power. Use a DC supply voltage suitable for both the CT325 and SSR.



Specifications subject to change

Loop-powered Indicators



TI196 Head-mounted Indicator



AC102765 Pipe Mounting Hardware Kit



TI350 Indicator

Overview

The display range is field programmable via coarse dip switches and two fine adjustment potentiometers. Wiring is easy. Simply connect the indicator in series with the 4 to 20 mA loop. Forward voltage drop is only 2.8 VDC.

- Local indication of process variable for convenient visual verification
- Enclosures are sealed from harsh environments to enhance product reliability and longevity
- Variety of mounting options allows for flexible and easy installation
- Compatible with 4 to 20 mA temperature transmitters for easy sensor interchangeability

TI196 head-mounted indicator

The TI196 includes an explosionproof connection head and digital indicator for local indication of temperature. Sensors and transmitters are specified separately. Optional Temptran models TT111, TT151, TT164, TT291, TT211, TT711, TT176, TT676, TT205 or TT190 will fit inside the connection head along with the meter.

TI196 Hazardous Area Certification (explosionproof/flameproof):

Class I, Div I, Groups B,C and D
Class II, Div I, Groups E,F and G
Class III
EEx d IIC

TI350 indicator

The TI350 features a washdown compatible digital readout for local indication of temperature. Sensors and transmitters are specified separately. Optional Temptran models TT321, TT821, TT831 or TT921 will fit inside the case along with the meter. Other 4 to 20 mA transmitters may be mounted outside the case and used with this device.

- NEMA 4X enclosure
- Cable glands are installed for 0.118" to 0.256" (3mm to 6.5mm) cable

AC102765 pipe mounting hardware kit

Use AC102765 for mounting TI196 or TI350 to vertical or horizontal pipe. Kit includes plate, stainless U-bolts, nuts and washers for 2" schedule 40 pipe [Ø 2.375" (60mm)].

Order model number AC102765

Specifications subject to change

TI196 head-mounted indicator

Specifications

Input: 4 to 20 mA DC series connection

Range: User adjustable.
Zero: -500 to +1000 counts.
Span: 10 to 2000 counts.

Accuracy: \pm (0.1% reading + 1 count).

Temperature Coefficient:
Zero: \pm 0.075 counts/ $^{\circ}$ C typ.
Span: \pm 0.005% of span/ $^{\circ}$ C typ.

Linearity: \pm (0.1% of span + 1 count).

Forward Voltage Drop: 2.8 volts DC maximum.

Display: 0.59" (15mm) high, 3-1/2 digit LCD, with $^{\circ}$ C/ $^{\circ}$ F descriptor.

Display Update: 3 times per second.

Underrange Indication: -1 in MSD (Most Significant Digit).

Overrange Indication: 1 in MSD.

Connections: Terminal Block, Pluggable

Decimal: User programmable to 1 position or absent (i.e. 1XX.X or 1XXX).

Ambient Temperature Range:
Operating: 32 to 122 $^{\circ}$ F (0 to 50 $^{\circ}$ C).
Storage: -4 to 149 $^{\circ}$ F (-20 to 65 $^{\circ}$ C).

Weight: 50 oz. (1420 g.)

Enclosure: Aluminum, polyester-coated

Enclosure Rating: NEMA 4X, IP66

Dimensions (connection head): 4.5" W x 4.5" H x 3.4" D
(144 mm W x 114 mm H x 87 mm D).

TI196 specification and order options

TI196	Model number TI196
P3	Pipe thread size: P2 = $\frac{3}{4}$ - 14 NPT (sensor and conduit) P3 = $\frac{1}{2}$ - 14 NPT (sensor and conduit)
(0/100)	Temperature range: (4 mA temp./20 mA temp.), user adjustable
C	Display: C = Celsius F = Fahrenheit
TI196P3(0/100)C = Sample part number	

Note: Sensors and transmitters are specified separately.

TI350 indicator

Specifications

Input: 4 to 20 mA DC series connection

Range: User adjustable.
Zero: -500 to +1000 counts.
Span: 10 to 2000 counts.

Accuracy: \pm (0.1% reading + 1 count).

Temperature Coefficient:
Zero: \pm 0.075 counts/ $^{\circ}$ C typ.
Span: \pm 0.005% of span/ $^{\circ}$ C typ.

Linearity: \pm (0.1% of span + 1 count).

Forward Voltage Drop: 2.8 volts DC maximum.

Display: 0.59" (15mm) high, 3-1/2 digit LCD, with $^{\circ}$ C/ $^{\circ}$ F descriptor.

Display Update: 3 times per second.

Underrange Indication: -1 in MSD (Most Significant Digit).

Overrange Indication: 1 in MSD.

Connections: Terminal Block, Pluggable

Decimal: User programmable to 1 position or absent (i.e. 1XX.X or 1XXX).

Ambient Temperature Range:
Operating: 32 to 122 $^{\circ}$ F (0 to 50 $^{\circ}$ C).
Storage: -4 to 149 $^{\circ}$ F (-20 to 65 $^{\circ}$ C).

Weight: 7 oz. (200 g.)

Enclosure: Polycarbonate, NEMA 4X.

Dimensions (box only): 2.6" W x 4.5" L x 2.2" D
(65 mm W x 115 mm H x 56 mm D).

TI350 specification and order options

TI350	Model number TI350
(0/100)	Temperature range: (4 mA temp./20 mA temp.), user adjustable
C	Display: C = Celsius F = Fahrenheit
TI350(0/100)C = Sample part number	

Note: Sensors and transmitters are specified separately.

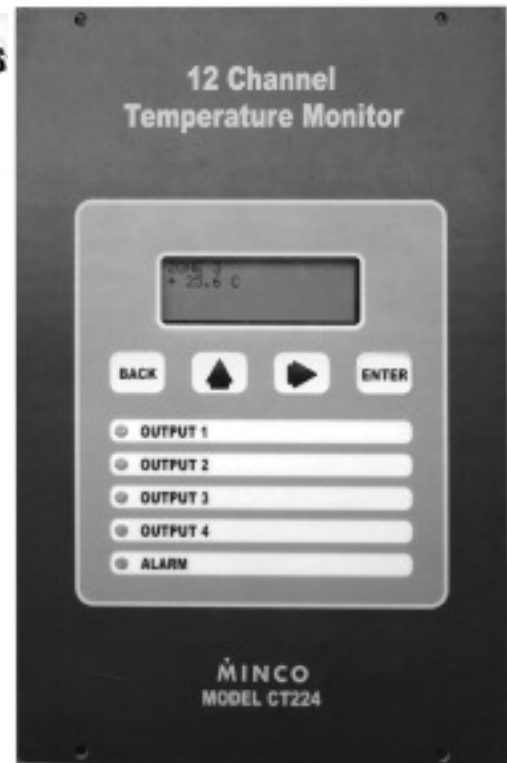
Specifications subject to change

CT224 12-Channel Temperature Alarm/Monitor

Overview

The CT224 consists of a 12-Channel temperature monitor/over-temperature alarm and MincoSoft™ CT224 Software. It is the next generation in temperature monitoring equipment from Minco designed to meet the needs of electric machinery protection. The 12-channel scanning capability, standard RS485/RS232 interface and Windows-compatible software utility for system configuration and data logging provide over-temperature and under-temperature protection and critical feedback to safeguard expensive machinery.

- UL and cUL recognized to help meet regulatory compliance
- PC programmable with Windows compatible software makes monitoring easy and efficient, allowing quick reprogramming and extensive data logging
- Mix and match sensor input types for freedom to adapt to pre-installed bearing and apparatus sensors
- Ability to monitor 12 inputs allows you to monitor stator sensors from two motors
- Five outputs, relays or logic offers either internal relay trips or flexibility of external control
- Logic outputs can be used with external SSRs
- Prevent costly damage to motors, generators, transformers, and other equipment
- Power loss protection
- 24 independent trip points (2 per channel)
- Programmable deadband (hysteresis)
- Rugged steel enclosure
- Can be used as a 4-channel on/off controller
- Display High, Low, or Any valid zones
- Self-calibrating



Software

MincoSoft™ CT224 software features:

- Compatibility with Microsoft® Windows® operating system
- User-friendly configuration program
- Save unlimited set-up configurations
- Commission mode to test configurations before implementation
- Continuously displayed measurement and relay status of all 12 channels
- Data-logging

Applications

- Generators
- Motors
- Turbines
- Compressors
- Pumps

Specifications subject to change

Specifications

Input: 1 to 12 RTDs (2 or 3-wire), thermocouples, or 4 to 20 mA current loops. Accepts any combination of input types.

Standard Input types:

RTD:

- 200 to 700°C: PA (Platinum / 100 Ω / 0.00392 Ω/Ω/°C)
- 200 to 700°C: PB (Platinum / 100 Ω / 0.00391 Ω/Ω/°C)
- 200 to 850°C: PD/PE (Platinum / 100 Ω / 0.00385 Ω/Ω/°C)
- 200 to 600°C: PF (Platinum / 1000 Ω / 0.00385 Ω/Ω/°C)
- 80 to 260°C: NA (Nickel / 120 Ω / 0.00672 Ω/Ω/°C)
- 100 to 260°C: CA (Copper / 10 Ω / 0.00427 Ω/Ω/°C)

Thermocouple:

- 270 to 1000°C: Type E
- 200 to 1200°C: Type J
- 270 to 1150°C: Type K
- 270 to 400°C: Type T

4 to 20 mA current loop: Pressure (PSI, Bar), Humidity (%), Temperature (°F, °C), Vibration (G), and process variable (mA, VDC)

Note: 4 to 20 mA inputs must be linear with respect to the measured variable.

Input scan rate: 1.5 seconds maximum to scan all 12 channels.

Input fault detection: Options for ignoring, sounding alarm, or tripping relays associated with the failed sensor. Other zones are unaffected.

Output: 24 independent trip points (2 per channel): 5 relays, one relay is intended for use as an alarm function (but can be configured as a trip point), and one internal audible alarm. Alarm may be programmed to sound when selected relays trip. Logic output option is available for controlling external SSRs or sending a signal to another device.

Relays: Form C, SPDT 10 A @ 250 VAC/24 VDC resistive load; 10 A make current; 2500 VA breaking capacity, / HP at 120 VAC motor load.

Trip point hysteresis (deadband): Programmable from 0 to 20 (°C or °F).

Display: 20 x 4 line backlit LCD. 0.1°C or 0.1°F resolution. Front panel LEDs indicate relay and alarm status.

Accuracy: 2°C (3°F) in 0 to 60°C (32 to 158°F) ambient, over entire range of the input.

Supply power: 85 to 240 VAC @ 50/60 Hz. or 110 to 250 VDC, 5 watts max.; or 18 to 36 VDC, 6 watts max.

Keyboard: 4 membrane type keys with audible feedback.

Serial interface: RS485 or RS232 (Modbus protocol).

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

Programming: Programmable from front panel or via RS485 or RS232 interface using Modbus protocol. PC software is included for data logging, commissioning, and configuration. Program settings may be password protected.

Firmware fault protection: Watchdog resets microprocessor if it fails to perform program sequence.

Enclosure: Steel case; NEMA 4 front panel.

Ambient temperature rating: 0 to 60°C (32 to 158°F).

Connections: Terminal blocks at rear accept wires to AWG 12.

Leadwire resistance compensation: Up to 30 Ω per leadwire for RTDs with no effect on reading.

Dimensions: 7.5 x 11.5 x 2" (191 x 292 x 51 mm).

Mounting: Panel mount enclosure. Cutout size of 6.8" x 10.6" (173 x 269 mm).

Weight: 3.8 lbs. (1.72 kg.).

Approvals: UL 508, CSA C22.2 No. 14-M91.

Accessories

AC102734: Communication package. Includes isolated RS232 to RS485 converter, power supply, cable, and adapter.

Specification and order options

CT224	Model number
A	Power supply A: 85-240 VAC @ 50/60 Hz / 110-250 VDC B: 18-36 VDC
1	Output 1: Relays 2: Logic (5 VDC)
A	Interface A: RS232 B: RS485
CT224A1A = Sample part number	

Specifications subject to change

CT15 Temperature Controller & Alarm



CT15 Controller

Overview

The CT15 is 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) to monitor motors and generators for overheating.

- 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
- Four 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 controls a single electromechanical relay with voltage-free contacts

Specifications

Selectable inputs:

RTD: 2 or 3-wire, Minco types PD or PE (100 Ω EN60751 platinum).
Thermocouple: Type J (factory default), K, T (selectable).

Input impedance:

Thermocouple: 3 megohms minimum.
RTD current: 200 μ 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 LED. 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.

Specifications subject to change

Specifications continued

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

Resolution: 1° or 0.1° , selectable.

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

Temperature stability: $4 \mu V/^\circ C$ ($2.3 \mu V/^\circ F$) typical, $8 \mu V/^\circ C$ ($4.5 \mu V/^\circ F$) max. (100 ppm/ $^\circ C$ typical, 200 ppm/ $^\circ C$ 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 $55^\circ C$ (14 to $131^\circ F$).

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

Control output ratings:

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

Minimum 48 VAC and 100mA required.

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

Switched voltage (non-isolated):

5 VDC @ 25 mA.

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.

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: 227g (8 oz.).

Agency approvals: UL & CSA.

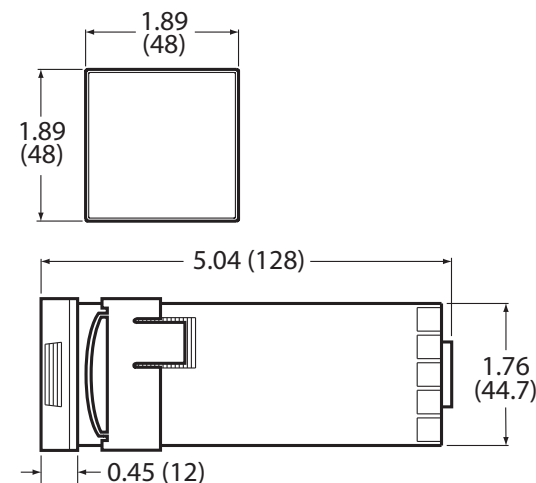
Front panel rating: Type 4X (IP66).

Specification and order options

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

Note: See page 5-30 for controller accessories.

Dimensions shown in inches (mm)



PANEL CUTOUT: 1.775" \times 1.775" (45 mm \times 45 mm)

MAXIMUM PANEL THICKNESS: 0.25" (6.35 mm)

DIMENSIONS IN INCHES (mm)

Specifications subject to change

CT16A Temperature Controller



CT16A Controller

Overview

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.

- 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 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)
- 4-Stage Set Point to quickly switch from one temperature to the next (optional)

Specifications subject to change

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 μ A.

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 LEDs. 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: $\pm 0.25\%$ of span ± 1 count.

Resolution: 1° or 0.1°, selectable.

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

Temperature stability: 4 μ V/°C (2.3 μ V/°F) typical, 8 μ V/°C (4.5 μ V/°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).

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.

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.

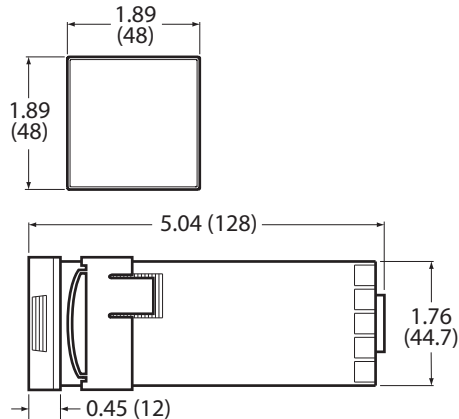
Specifications and order options

CT16A	Model number
2	Feature set: 2 = Standard 3 = Enhanced (ramp & soak, Auto/manual)
1	Alarm relay: 0 = No 1 = Yes
1	Output A: 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	Output 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
-948	Options on next page (leave blank for none)
CT16A2110-948 = Sample part number	

Specifications subject to change

CT16A - Options and Accessories

Dimensions shown in inches (mm)



PANEL CUTOUT: 1.775" x 1.775" (45 mm x 45 mm)
MAXIMUM PANEL THICKNESS: 0.25" (6.35 mm)

Additional options for CT16A (board level)

934: Analog retransmission of Process Variable or Set Variable: (4 to 20 mA DC) For use as recorder, transmitter or computer A/D input. Linearized 4 to 20 mA DC signal follows the Process or Set variable. Scalable.

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.

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 heat sink 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 / DIN adapter plate. 127 x 127 mm gray steel with 45 x 45 mm centered hole.

