• RTD and thermocouple Temptran™ transmitters provide accurate signals over thousands of feet.
  • Fixed range, dip switch field rangeable or programmable
  • 4-20mA output or HART® protocol
  • Miniature, hockey puck, DIN rail and isolated versions
  • High-accuracy calibration available matched to individual RTDs

• Controllers, indicators and alarms for precise monitoring and control

<table>
<thead>
<tr>
<th>RTD transmitters</th>
<th>5-2 to 5-5, 5-8 to 5-9, 5-12 to 5-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple transmitters</td>
<td>5-6 to 5-7, 5-10 to 5-11, 5-14 to 5-15</td>
</tr>
<tr>
<td>Isolated transmitters</td>
<td>5-8 to 5-11</td>
</tr>
<tr>
<td>Field rangeable transmitters</td>
<td>5-12 to 5-15</td>
</tr>
<tr>
<td>Programmable transmitters</td>
<td>5-16 to 5-17</td>
</tr>
<tr>
<td>HART® transmitters</td>
<td>5-18 to 5-19</td>
</tr>
<tr>
<td>Temperature range table</td>
<td>5-20 to 5-21</td>
</tr>
<tr>
<td>High accuracy calibration</td>
<td>5-22</td>
</tr>
<tr>
<td>Mounting accessories</td>
<td>5-22</td>
</tr>
</tbody>
</table>

| Loop-powered indicators | 5-23 to 5-24 |
| CT224 12-channel monitor | 5-25 to 5-26 |
| CT424 alarm/monitor | 5-27 to 5-28 |
| CT325 miniature DC temperature controller | 5-29 to 5-30 |
| CT335 PC board mount temperature controller | 5-31 to 5-32 |
| CT15 controller/alarm | 5-33 to 5-34 |
| CT16A temperature controller | 5-35 to 5-36 |
| CT15/CT16A accessories | 5-37 |
Miniature Temptran™ RTD Transmitters

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 5-22 for more information.

Specifications

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

 Calibration accuracy: ±0.1% of span.

 Linearity: Referenced to actual sensor temperature.

 Platinum RTD input: ±0.1% of span.
 Nickel and nickel-iron RTD input:
  ±0.25% of span for spans less than 100°C.
  ±0.25% of span per 100°C of span for spans greater than 100°C.

 Adjustments: Zero and span, ±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:
  ±0.013% of span per °C.
  ±0.025% of span per °C for spans less than 55°C.

 Warmup drift: ±0.1% of span max., with
  $V_{	ext{supply}} = 24$ VDC and $R_{	ext{max}} = 250$ Ω.
  Stable within 30 minutes.

 Supply voltage: 8.5 to 35 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:

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

 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:

  $V_{\text{max}} = 35$ volts; $I_{\text{max}} = 150$ mA; $C = 0 \mu F$ and $L = 0$ 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

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), visit www.minco.com.

Specifications subject to change.
RTD input types
2-wire resistance thermometer:

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

Special high-accuracy calibration
For high system accuracy, specify transmitters with matched calibration. Temprs match calibrated to a sensor are always ordered as assemblies. Common examples are shown in Section 2.

Specification and order options:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT111</td>
<td>Model number: TT111 or TT211</td>
</tr>
<tr>
<td>PD</td>
<td>RTD element code from table</td>
</tr>
<tr>
<td>1</td>
<td>Output: 4 to 20 mA DC</td>
</tr>
<tr>
<td>C</td>
<td>Temperature range code starting on page 5-20 [Ex: C = 0 to 100°C (32 to 212°F)]</td>
</tr>
</tbody>
</table>

TT111PD1C = Sample part number

Dimensions in inches (mm)

Wiring Diagram

Specifications subject to change
TT246 RTD Transmitters

Overview
Specify this rugged, accurate transmitter for process control and other industrial applications.

Model 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.

- 2 or 3-wire RTD input
- 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 5-22 for more information.

Specifications

Output: Linear with temperature over specified range.
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 \( V_{\text{supply}} = 24 \text{ VDC} \) and \( R_{\text{loop}} = 250 \Omega \).
Stable within 15 minutes.

Supply voltage:
TT246: 7.5 to 35 VDC
Voltage effect ±0.001% of span per volt.
Reverse polarity protected.

Supply current: 3mA max. with no load.

Maximum load resistance: The maximum allowable resistance of the signal carrying loop is:
\[
R_{\text{loop\, max}} = \frac{V_{\text{supply}} - 10}{0.020 \text{ amps}}
\]
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: May be used with Minco explosion-proof connection heads.

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:

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

Dimensions in inches (mm)

Wiring Diagram

Special high-accuracy calibration

For high system accuracy, specify transmitters with matched calibration. Temptrans match calibrated to a sensor are always ordered as assemblies.

Specification and order options:

<table>
<thead>
<tr>
<th>TT246</th>
<th>Model Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB</td>
<td>RTD element code from table</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Temperature range code starting on page 5-20</td>
</tr>
</tbody>
</table>

TT246PB1K = Sample part number

Specifications subject to change
Overview
Model TT205 interfaces with thermocouples for use in process control and other industrial applications.
Model TT205 offers superior performance in an economical and small package.
- Thermocouple input
- Fits DIN "B" style connection heads

Specifications
Output: 4 to 20 mA over specified range.
Accuracy: ±0.2% of span.
Linearity: Voltage linear.
The output signal is voltage linear (not temperature linear) and is intended for use with instruments which compensate for the nonlinear signal output of the thermocouples sensor.
Adjustments: Zero and span, ±5% of span, non-interacting. Factory set.
Warmup drift: ±0.2% of span max., with
\[ V_{\text{loop}} = 24 \text{ VDC and } R_{\text{loop}} = 250 \Omega. \]
Stable within 15 minutes.
Supply voltage: 8.5 to 35 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:
\[ R_{\text{loop max}} = \frac{V_{\text{supply}} - 10}{0.020 \text{ amps}} \]
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.
Connections: Terminal block for wires AWG 22 to AWG 14.
Physical: Polycarbonate case, epoxy potted for moisture resistance.
Weight: 1.8 oz. (52 g).
TT205

Ambient temperature:
Operating: -10 to 60°C (14 to 140°F).
Storage: -55 to 100°C (-67 to 212°F).

Ambient temperature effects: ±0.036% of span per °C.
Cold junction compensation drift: ±0.05°C per °C.
Minimum span: 150°C (270°F).

Specification and order options

<table>
<thead>
<tr>
<th>TT205</th>
<th>Model Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TT190: Round</td>
</tr>
<tr>
<td></td>
<td>TT205: Rectangular</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J</th>
<th>TC junction type:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E = Chromel-Constantan</td>
</tr>
<tr>
<td></td>
<td>J = Iron-Constantan</td>
</tr>
<tr>
<td></td>
<td>K = Chromel-Alumel</td>
</tr>
<tr>
<td></td>
<td>T = Copper-Constantan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U</th>
<th>U = Ungrounded junction (required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output: 4 to 20 mA DC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AN</th>
<th>Temperature range code starting on page 5-20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Ex: AN = -17.8 to 148.9°C (0 to 300°F)]</td>
</tr>
</tbody>
</table>

TT205 Dimensions in inches (mm)

Wiring Diagram

Specifications subject to change
Overview
This transmitter amplifies a signal from a RTD or linear resistance, and it turns the signal into a current which increases from 4 to 20 milliamperes as the temperature or input signal increases. This industry-standard 4-20mA signal travels thousands of feet over a pair of wires, ignoring electrical interference and bringing the temperature, accurately, into your computer or controller. Drawing power directly from the signal line, only 2 wires are needed for power and signal.

• RTD or Ohm input
• Accurate, Stable 4–20mA Output
• PC and field-programmable
• FM Approved Intrinsically Safe

Converts multiple inputs
Temperature measurement can be done with one of several RTD's: 100 Ω, 1000 Ω platinum, 100 Ω Nickel and 1000 Ω Nickel.

Because amplification and conversion of the input signal is performed within a few feet of the sensor, electrical interference in noisy environments is eliminated. The transmitter can be mounted at the field location in a standard DIN form B head or on a DIN rail inside a local box.

Applications
• Single temperature measurement

Configuration
The TT518 is delivered configured to the customer’s specifications, including the transmitter’s measurement range and RTD type.

PC Programming
The TT518 transmitter can be configured via a standard PC using a programming kit. It can be configured before installation or while installed in the process - even in hazardous areas. Communication is 2-way, so set-up and serial/tag numbers can be retrieved from the transmitter.

Electrical Specifications
Ambient temperature range: -40°C to +85°C

Common Specifications
Supply voltage: 8 -30 VDC
Warm-up time: 5 min.
Communication interface: PC Interface/Loop Link
Signal/noise ratio: Min. 60 dB
Response time (programmable): 0.33 sec. to 60 sec.
Update time: 135 msec.
Calibration temperature: 20 to 28°C
Effect of supply voltage change: < 0.005% of span / VDC
EMC-Immunity influence: < ±0.5% of span
Vibration: IEC 600 68-2-6 Test FC
Lloyd’s specification no. 1: 4 g / 2 - 100 Hz
Max. wire size: AWG14 (1.5 mm²)
Air humidity: 0 - 95% RH
Dimensions: Ø1.73 x 0.84 in (Ø44 x 20.2mm)
Tightness (enclosure/terminal): IP 68 / IP00
Weight: 50g

Specifications subject to change
**Inputs (common specifications)**

Max. offset: 50% of selected max. value  
Cable resistance per wire (max.): 10Ω  
Sensor current: >0.2mA, <0.4mA  
Effect of sensor cable resistance:  
(3-wire): < 0.002 Ω/Ω

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
<th>Minimum Span</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD (Pt100)</td>
<td>-200°C</td>
<td>+850°C</td>
<td>25°C</td>
</tr>
<tr>
<td>PF (Pt1000)</td>
<td>0 Ω</td>
<td>10000 Ω</td>
<td>30°C</td>
</tr>
</tbody>
</table>

Basic accuracy:  
PD/PF (Pt100/1000): <±0.3°C  
Linear Resistance: <±0.2Ω  

Temperature coefficient:  
PD/PF (Pt100/1000): <±0.01°C/°C  
Linear Resistance: <±20mΩ/°C  

Current output:  
Signal range: 4 - 20 mA  
Min. signal range: 16 mA  
Load resistance : < (Vsup. – 8) / 0.023 [Ω]  
Load stability: ± 0.01% of span / 100 Ω  

Sensor error detection:  
Programmable: 3.5 - 23 mA, or no action  
Namur NE43 Downscale/Upscale: 3.5 mA/ 23 mA

Approvals:  
EMC: EN 61326-1  
ATEX: KEMA 03ATEX1535  
FM: 2D5A7  
CSA: 1125003  
GOST R: Yes  
GOST Ex: Yes  
DNV Marine: Stand. F. Certification No. 2.4

**Output**

The 4-20 mA output follows the TT518 input configuration, reflecting the temperature and/or resistance. The unit is protected against polarity reversal. The output signal action can be reversed with respect to the input signal. Sensor and/or cable errors can be programmed to cause the output to go to a fixed value.

**Specification and order options:**

<table>
<thead>
<tr>
<th>TT518</th>
<th>Model Number: TT518 Temperature Transmitter</th>
</tr>
</thead>
</table>
| PD    | Sensor Type:  
|       | PD = 100 Ω Platinum RTD (0.00385)  
|       | PF = 1000 Ω Platinum RTD (0.00385) |
| (-25/200) | Ranging:  
|       | Specify temperature range in either °C or °F.  
|       | For example, -25° to +200°C = 4 to 20 mA.  
| C    | Display Units:  
|       | C = Celsius  
|       | F = Fahrenheit  
| I    | Calibration:  
|       | 1 = Nominal  
|       | 2 = Matched to sensor ±0.75% of span  
|       | For other calibration options, contact Minco |
| Z    | Sensor Leads: (3 Lead Recommended)  
|       | Y = 2-lead RTD (Supplied with jumper wire to connect terminals 3 and 4)  
|       | Z = 3-lead RTD  

**Input**

The input type is selected to be one of these types:  
- RTD (3-wire): PT100, PT1000  
- High level

Specifications subject to change.
Overview

This transmitter amplifies a signal from a thermocouple, and it turns the signal into a current which increases from 4 to 20 milliamperes as the temperature or input signal increases. This industry-standard 4-20mA signal travels thousands of feet over a pair of wires, ignoring electrical interference and bringing the temperature, accurately, into your computer or controller. Drawing power directly from the signal line, only 2 wires are needed for power and signal.

- Thermocouple or Voltage Input
- Accurate, Stable 4–20mA Output
- PC and field-programmable
- Galvanically Isolated

Converts multiple inputs

Temperature measurement can be done with multiple thermocouple types, which boast high operating temperature ranges.

Because amplification and conversion of the input signal is performed within a few feet of the sensor, electrical interference in noisy environments is eliminated. The transmitter can be mounted at the field location in a standard DIN form B head or on a DIN rail inside a local box.

Applications

- Single temperature measurement

Configuration

The TT519 is delivered configured to the customer’s specifications, including the transmitter’s measurement range and thermocouple type.

PC programming

The TT519 transmitter can be configured via a standard PC using a programming kit. It can be configured before installation or while installed in the process – even in hazardous areas. Communication is 2-way, so set-up and serial/tag numbers can be retrieved from the transmitter.

Electrical Specifications

Ambient temperature range: -40°C to +85°C

Common Specifications

Supply voltage: 7.2 -30 VDC
Warm-up time: 5 min.
Communication interface: PC Interface/Loop Link
Signal/noise ratio: Min. 60 dB
Response time (programmable): 1 sec. to 60 sec.
Update time: 440 msec.
Calibration temperature: 20 to 28°C
Effect of supply voltage change: < 0.005% of span/ VDC
EMC-Immunity influence: < ±0.5% of span
Electrical Isolation, test/operation: 1.5kVAC/50VAC
Vibration: IEC 600 68-2-6 Test FC
Lloyd’s specification no. 1: 4 g / 2 - 100 Hz
Max. wire size: AWG14 (1.5 mm²)
Air humidity: 0 - 95% RH
Dimensions: Ø1.73 x 0.84 in (Ø44 x 20.2mm)
Tightness (enclosure/terminal): IP 68 / IP00
Weight: 50g
**Inputs (common specifications)**

**Max. offset:** 50% of selected max. value

<table>
<thead>
<tr>
<th>Input</th>
<th>Type</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
<th>Minimum Span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>-100°C</td>
<td>+1000°C</td>
<td>50°C</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>-100°C</td>
<td>+1200°C</td>
<td>50°C</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>-180°C</td>
<td>+1372°C</td>
<td>50°C</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>-200°C</td>
<td>+400°C</td>
<td>50°C</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>+400°C</td>
<td>+1820°C</td>
<td>100°C</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>-180°C</td>
<td>+1300°C</td>
<td>50°C</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>-50°C</td>
<td>+1760°C</td>
<td>100°C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>-50°C</td>
<td>+1760°C</td>
<td>100°C</td>
</tr>
</tbody>
</table>

**Basic accuracy:**
- TC type E, J, K, L, N, T: <±1°C
- TC type B, R, S: <±2°C

**Temperature coefficient:**
- TC type E, J, K, T: <±0.05°C/°C
- TC type B, N, R, S: <±0.2°C/°C
- Voltage: <±1μV/°C
- Cold Junction Compensation: <±1°C

**Current output:**
- Signal range: 4 - 20 mA
- Min. signal range: 16 mA
- Load resistance: < (Vs - 7.2) / 0.023 [Ω]
- Load stability: ± 0.01% of span / 100 Ω

**Sensor error detection:**
- Programmable: 3.5 - 23 mA, or no action
- Namur NE43 Downscale/Upscale: 3.5 mA/23 mA

**Approvals:**
- EMC: EN 61326-1
- ATEX: KEMA 06ATEX0062
- GOST R: Yes
- GOST Ex: Yes
- DNV Marine: Stand. F. Certification No. 2.4

**Output**

The 4-20 mA output follows the TT519 input configuration, reflecting the temperature. The unit is protected against polarity reversal. The output signal action can be reversed with respect to the input signal. Sensor and/or cable errors can be programmed to cause the output to go to a fixed value.

**Specification and order options:**

<table>
<thead>
<tr>
<th>TT519</th>
<th>Model Number: TT519 Temperature Transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Sensor Type:</td>
</tr>
<tr>
<td></td>
<td>E=Type E Thermocouple</td>
</tr>
<tr>
<td></td>
<td>J=Type J Thermocouple</td>
</tr>
<tr>
<td></td>
<td>K=Type K Thermocouple</td>
</tr>
<tr>
<td></td>
<td>T=Type T Thermocouple</td>
</tr>
<tr>
<td></td>
<td>B=Type B Thermocouple</td>
</tr>
<tr>
<td></td>
<td>N=Type N Thermocouple</td>
</tr>
<tr>
<td></td>
<td>R=Type R Thermocouple</td>
</tr>
<tr>
<td></td>
<td>S=Type S Thermocouple</td>
</tr>
<tr>
<td></td>
<td>V = Voltage Input</td>
</tr>
<tr>
<td></td>
<td>(-25/200) Ranging: Specify temperature range in either °C or °F. For example, -25°C to +200°C = 4 to 20 mA.</td>
</tr>
<tr>
<td>C</td>
<td>Display Units:</td>
</tr>
<tr>
<td></td>
<td>C = Celsius</td>
</tr>
<tr>
<td></td>
<td>F = Fahrenheit</td>
</tr>
<tr>
<td>1</td>
<td>Calibration:</td>
</tr>
<tr>
<td></td>
<td>1 = Nominal</td>
</tr>
<tr>
<td>Y</td>
<td>Sensor Leads:</td>
</tr>
<tr>
<td></td>
<td>Y = 2-lead Thermocouple</td>
</tr>
</tbody>
</table>

**TT519K(-25/200)C1Y:** Sample part number

**Specifications subject to change**
TT273 Field Rangeable 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 5-22 for more information
- Optional Input/Output isolation to 600 VRMS

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

Calibration accuracy: ±0.2% of span.

Linearity: ±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:
±0.018% of span/°C (±0.01% of span/°F).

Warmup drift: ±0.1% of span max., assuming $V_{\text{supply}} = 24$ VDC and $R_{\text{loop}} = 250$ Ω.
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: ±0.001% of span per volt.

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

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 g).

Specifications subject to change
RTD input types

2 or 3-wire 100 Ω platinum RTD.

<table>
<thead>
<tr>
<th>Element</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum (0.00392 TCR)</td>
<td>PA</td>
</tr>
<tr>
<td>Platinum (0.00391 TCR)</td>
<td>PB</td>
</tr>
<tr>
<td>Platinum (0.00385 TCR)</td>
<td>PD, PE</td>
</tr>
</tbody>
</table>

Special high-accuracy calibration

For high system accuracy, specify transmitters with matched calibration. Temptrans match calibrated to a sensor are always ordered as assemblies. Common examples are shown in Section 2.

Dimensions in inches (mm)

![Dimensions Diagram]

Wiring diagram

![Wiring Diagram]

Specification and order options

<table>
<thead>
<tr>
<th>TT273</th>
<th>Model number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD</td>
<td>RTD element code from table</td>
</tr>
<tr>
<td>1</td>
<td>Output: 4 to 20 mA DC</td>
</tr>
</tbody>
</table>
| 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 |

Specifications subject to change
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.

- 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: ±0.2% of span.
Linearity: Voltage linear.
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.

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).

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/°C (±0.02% of span/°F).

Cold junction compensation drift: ±0.03°C/°C for -25 to 70°C ambients. ±0.06°C/°C for -40 to -25°C and 70 to 85°C ambients.

Warmup drift: ±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: ±0.001% of span per volt.

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

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

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

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

TT274K1N(-25/200)C = Sample part number

Dimensions in inches (mm)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR</td>
<td>2.95 (74.9)</td>
</tr>
<tr>
<td>ZERO</td>
<td>0.886 (22.5)</td>
</tr>
<tr>
<td>SRN</td>
<td>3.875 (98.4)</td>
</tr>
</tbody>
</table>

Wiring diagram

Specifications subject to change
Programmable Transmitters

Overview
Models TT520 and TT530 are programmable transmitters designed for process control and other applications. Both transmitters use a 4-20mA current loop output and are PC programmable to accept a signal from a thermocouple, a Resistance Temperature Detector (RTD), or a millivolt signal. Model TT520 can be mounted at the field location in a standard DIN form B head or on a DIN rail inside a local box (with an AC807 Minco DIN rail adapter), whereas model TT530 can be mounted vertically or horizontally on a DIN rail.

- T/C, RTD, or mV input
- Accurate, Stable 4-20mA Output
- PC and field-programmable
- Galvanically isolated
- FM Approved Intrinsically Safe
- Single temperature measurement

Specifications
Common Specifications:
Supply voltage: 7.2 - 30 VDC
Temperature coefficient: < ± 0.01% of span/ °C
Effect of supply voltage change: < 0.005% of span/ VDC
Max. wire size: AWG14 (1.5 mm²)
Air humidity: 0 - 95% RH

Dimensions:
TT520: Ø1.73 x 0.84 in (Ø44 x 20.2mm)
TT530: 4.29 x .93 x 4.09 in (109 x 23.5 x 104mm)

AC205817 USB Loop Link Programmer:
TT520 and TT530 transmitters are preconfigured for ease of use. The AC205817 USB Loop Link Programmer allows the user to reconfigure the transmitter using free, Windows-based software.

Tightness (enclosure/terminal):
TT520: IP 68 / IP00
TT530: IP50 / IP20

Weight:
TT520: 50 g
TT530: 145 g

TC Input:
Minimum measurement range:
Type E, J, K, T: 50°C
Max. offset: 50% of selected max. value

Basic accuracy:
Type E, J, K, T: ≤1°C
Cold junction compensation (CJC): ≤1.0°C

Temperature coefficient:
Type E, J, K, T: ≤± 0.05 °C / °C
Sensor error detection: yes

<table>
<thead>
<tr>
<th>RTD type</th>
<th>Minimum value</th>
<th>Maximum value</th>
<th>Minimum span.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD (Pt100)</td>
<td>-200°C</td>
<td>+850°C</td>
<td>25°C</td>
</tr>
<tr>
<td>PF (Pt1000)</td>
<td>-200°C</td>
<td>+850°C</td>
<td>25°C</td>
</tr>
</tbody>
</table>

RTD-input:
Basic accuracy PD/PF (Pt100/1000): ≤±0.2°C
Temperature coefficient: ≤±0.01°C / °C

Current output:
Signal range: 4 - 20 mA
Load resistance: < (Vsup. - 7.2) / 0.023 [Ω]

Intrinsic Safety data: FM Approved Intrinsically Safe for Class 1, Div. 1, Groups A-D, Entity Approval (pending)

<table>
<thead>
<tr>
<th>Vmax</th>
<th>C: 1 nF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imax</td>
<td>L: 10 μH</td>
</tr>
<tr>
<td>Pmax</td>
<td>0.84 W</td>
</tr>
</tbody>
</table>

Europe: ATEX II 1 G

Meets these European requirements:
EMC 2004/108/EC: Standard EN 61326

Specifications subject to change
### Specifications and order options

| Model Number | TT520 Temperature Transmitter  
|--------------|---------------------------------|

#### PD
- **Sensor Type:**
  - PD = 100Ω Platinum RTD (0.00385)  
  - PF = 1000Ω Platinum RTD (0.00385)  
  - E = Type E Thermocouple  
  - J = Type J Thermocouple  
  - K = Type K Thermocouple  
  - T = Type T Thermocouple

#### (-25/200)
- **Temperature Range:**
  - Specify temperature range in either °C or °F.  
  - For example, -25° to +200°C = 4 to 20 mA

#### C
- **Temperature Units:**
  - C = Celsius  
  - F = Fahrenheit

#### 1
- **Calibration:**
  - 1 = Nominal  
  - 2 = Matched to sensor ±0.75% span  
  - For other calibration options, contact Minco

#### Y
- **Sensor Leads:**
  - Y = 2-lead RTD (or thermocouple)  
  - Z = 3-lead RTD  
  - X = 4-lead RTD

#### TT520PD(-25/200)C1Y = Sample part number

### Dimensions in inches (mm)

#### TT520
- **Model Number:**
  - TT520 Temperature Transmitter  
  - TT530 DIN Rail Temperature Transmitter

#### Wiring Diagrams

**RTD to 4...20 mA**

**TC to 4...20 mA**

**RTD to 4...20 mA**

**TC to 4...20 mA**

**Specifications subject to change**
Programmable Transmitters w/ HART® Protocol

Overview
Models TT521 and TT531 are programmable transmitters designed for process control and other applications. Both models use HART® communication protocol and are PC programmable to accept a signal from a thermocouple, a Resistance Temperature Detector (RTD), or a millivolt signal. Model TT521 transmitter can be mounted at the field location in a standard DIN form B head or on a DIN rail inside a local box (with an AC807 Minco DIN rail adapter). Model TT531 can be mounted vertically or horizontally on a DIN rail.

- T/C, RTD, or mV input
- HART® Communication Protocol
- PC and field-programmable
- Galvanically isolated
- FM Approved Intrinsically Safe
- Single temperature measurement
- Difference temperature measurement
- Average temperature measurement

HART® Communication
By way of 2-wire HART® communication between the process computer and the TT521 or TT531, the transmitter is programmable, readable, and controllable.

- Up to 15 transmitters can be controlled in a multidrop system. (Parallel connection of all transmitters on 2 wires).
- Set-up, configuration and control can be done from a central monitoring room.

When each transmitter is connected to a 2-wire cable, a standard 4-20 mA signal can be used at the same time as the HART® communication.

Specifications
Common Specifications:
Supply voltage: 8.0 - 30 VDC
Specifications subject to change

Communication interface: HART® and PC interface
Temperature coefficient: < ±0.005% of span/ °C
Effect of supply voltage change: < 0.005% of span/ VDC
Max. wire size: AWG14 (1.5 mm²)
Air humidity: 0 - 95% RH
Dimensions:
TT521: Ø1.73 x 0.84 in (Ø44 x 20.2mm)
TT531: 4.29 x .93 x 4.09 in (109 x 23.5 x 104mm)
Tightness (enclosure/terminal):
TT521: IP 68 / IP00
TT531: IP50 / IP20
Weight:
TT521: 50 g
TT531: 145 g

AC205817 USB Loop Link Programmer:
TT521 and TT531 transmitters are preconfigured for ease of use. The AC205817 USB Loop Link Programmer allows the user to reconfigure the transmitter using free, Windows-based software.

TC Input:
Minimum measurement range:
Type E, J, K, T: +50°C
Max. offset: 50% of selected max. value

Basic accuracy:
Type E, J, K, T: <±0.5°C
Cold junction compensation (CJC): <±1.0°C

Temperature coefficient:
Type E, J, K, T: ± 0.025  °C / °Camb
Sensor error detection: yes

RTD-input:

<table>
<thead>
<tr>
<th>RTD type</th>
<th>Minimum value</th>
<th>Maximum value</th>
<th>Minimum span.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD (Pt100)</td>
<td>-200°C</td>
<td>+850°C</td>
<td>25°C</td>
</tr>
<tr>
<td>PF (Pt1000)</td>
<td>-200°C</td>
<td>+850°C</td>
<td>25°C</td>
</tr>
</tbody>
</table>

Basic accuracy PD/PF (Pt100/1000): ≤±0.1°C
Temperature coefficient: ≤±0.005°C / °C

Current output:
Signal range: 4 - 20 mA
Load resistance: < (Vsup. - 8) / 0.023 [Ω]

Intrinsic Safety data: FM Approved Intrinsically Safe for Class 1, Div. 1, Groups A-D, Entity Approval (pending)

Vmax: 30.0 VDC
C: 1 nF
Iemp: 120 mADC
L: 10 μH
Pmax: 0.84 W
Europe: ATEX II 1 G

Meets these European requirements:
EMC 2004/108/EC: Standard EN 61326-1
## Specifications and order options

<table>
<thead>
<tr>
<th>Model Number:</th>
<th>TT521 Temperature Transmitter with HART® Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT531 DIN Rail Temperature Transmitter with HART® Protocol</td>
<td></td>
</tr>
</tbody>
</table>

### Sensor Type:
- **PD** = 100Ω Platinum RTD (0.00385)
- **PF** = 1000Ω Platinum RTD (0.00385)
- **E** = Type E Thermocouple
- **J** = Type J Thermocouple
- **K** = Type K Thermocouple
- **T** = Type T Thermocouple

### Temperature Range:
Specify temperature range in either °C or °F. For example, -25°C to +200°C = 4 to 20 mA.

### Temperature Units:
- **C** = Celsius
- **F** = Fahrenheit

### Calibration:
- **1** = Nominal
- **2** = Matched to sensor ±0.75% span

For other calibration options, contact Minco

### Sensor Leads:
- **Y** = 2-lead RTD (or thermocouple)
- **Z** = 3-lead RTD
- **X** = 4-lead RTD

### Sample part number:
- TT521PD(-25/200)C1Y

---

### Dimensions in inches (mm)

![Diagram showing dimensions]

### Wiring Diagrams

#### RTD to 4...20 mA

![Diagram showing wiring for RTD to 4...20 mA]

#### TC to 4...20 mA

![Diagram showing wiring for TC to 4...20 mA]

#### HART® Multidrop Wiring Diagram

![Diagram showing multidrop wiring for HART transmitters]

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Specifications subject to change
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.

For more temperature ranges (over 400 options) go to [www.minco.com](http://www.minco.com).

### Specifications

<table>
<thead>
<tr>
<th>Range code</th>
<th>Zero °F</th>
<th>Span °F</th>
<th>Zero °C</th>
<th>Span °C</th>
<th>Platinum elements*</th>
<th>Other elements</th>
<th>Elements</th>
<th>T/C types</th>
<th>T/C types</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>-328</td>
<td>-148</td>
<td>-200.0</td>
<td>-100.0</td>
<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>HG</td>
<td>-325</td>
<td>100</td>
<td>-198.3</td>
<td>37.8</td>
<td>PA PB PD PE PW</td>
<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
<td>JT</td>
<td></td>
</tr>
<tr>
<td>OS</td>
<td>-300</td>
<td>150</td>
<td>-184.4</td>
<td>65.6</td>
<td>PA PB PD PE PW</td>
<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
<td>JT</td>
<td></td>
</tr>
<tr>
<td>EZ</td>
<td>-148</td>
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<td>-100.0</td>
<td>0.0</td>
<td>PA PB PD PE PW</td>
<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
<td>JT</td>
<td></td>
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<tr>
<td>LN</td>
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<td>PA PB PD PE</td>
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<td>SA</td>
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<td>PA PB PD PE</td>
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<tr>
<td>UL</td>
<td>-103</td>
<td>752</td>
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<td>PA PB PD PE</td>
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<td>260.0</td>
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<td></td>
</tr>
<tr>
<td>SD</td>
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<td>100</td>
<td>-45.6</td>
<td>37.8</td>
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<td>PA PB PD PE</td>
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<td>MI</td>
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<td>150</td>
<td>-45.6</td>
<td>65.6</td>
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<td>PA PB PD PE PW</td>
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<td>650</td>
<td>-45.6</td>
<td>343.3</td>
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<td>AD</td>
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<td>120</td>
<td>-40.0</td>
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<td>PA PB PD PE</td>
<td>PA PB PD PE</td>
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<td>AK</td>
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<td>140</td>
<td>-40.0</td>
<td>60.0</td>
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* * 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

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* 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 can be 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 eliminates the sensor tolerance from the system accuracy specifications.

Temptrans match calibrated to a sensor are always ordered as assemblies. Common examples are shown in Section 2.

**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.

**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.

**Temptran Accessories**

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

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<td>DIN ENS0022 Rail</td>
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<tr>
<td>AC807</td>
<td>Adapter for EN50022</td>
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**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.

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Specifications subject to change
Loop-powered Indicators

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
- IP66 NEMA 4X/7 rated (only for TI196)

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, TT211 or TT205 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
- Ex 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 model TT321 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:** ± (0.1% reading + 1 count).  

**Temperature Coefficient:**  
- Zero: ± 0.075 counts/°C typ.  
- Span: ± 0.005% of span/°C typ.  

**Linearity:** ± (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 °C/°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°F (0 to 50°C).  
- Storage: -4 to 149°F (-20 to 65°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**  

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<th>Model number TI196</th>
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| P3    | Pipe thread size:  
  P2 = 5/8 - 14 NPT (sensor and conduit)  
  P3 = 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  

**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:** ± (0.1% reading + 1 count).  

**Temperature Coefficient:**  
- Zero: ± 0.075 counts/°C typ.  
- Span: ± 0.005% of span/°C typ.  

**Linearity:** ± (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 °C/°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°F (0 to 50°C).  
- Storage: -4 to 149°F (-20 to 65°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**  

<table>
<thead>
<tr>
<th>TI350</th>
<th>Model number TI350</th>
</tr>
</thead>
</table>
| (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/°C)
-200 to 700°C: PB (Platinum / 100 Ω / 0.00391 Ω/°C)
-200 to 850°C: PD/PE (Platinum / 100 Ω / 0.00385 Ω/°C)
-200 to 600°C: PF (Platinum / 1000 Ω / 0.00385 Ω/°C)
-80 to 260°C: NA (Nickel / 120 Ω / 0.00672 Ω/°C)
-100 to 260°C: CA (Copper / 10 Ω / 0.00427 Ω/°C)

**Thermocouple:**
-270 to 1000°C: Type E
-270 to 1150°C: Type K
-200 to 1200°C: Type J
-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, ¼ 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 140°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 140°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 and power supply.

**Specification and order options**

<table>
<thead>
<tr>
<th>CT224</th>
<th>Model number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Power supply</td>
</tr>
<tr>
<td></td>
<td>A: 85-240 VAC @ 50/60 Hz / 110-250 VDC</td>
</tr>
<tr>
<td></td>
<td>B: 18-36 VDC</td>
</tr>
<tr>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>1: Relays</td>
<td></td>
</tr>
<tr>
<td>2: Logic (5 VDC)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Interface</td>
</tr>
<tr>
<td></td>
<td>A: RS232</td>
</tr>
<tr>
<td></td>
<td>B: RS485</td>
</tr>
</tbody>
</table>

CT224A1A = Sample part number

**STOCKED PARTS AVAILABLE**

Specifications subject to change.
CT424 Temperature Alarm/Monitor

User-programmable three input temperature monitor system

Overview
Minco’s CT424 consists of a 3-channel temperature monitor and alarm system that controls three relay outputs based on user-programmable set points to help safeguard expensive machinery.

Features
The CT424 offers users a completely programmable monitor and alarm with improved measurement range and universal inputs. The microprocessor-based design maintains accuracy over a wide range of temperatures and conducts regular self-checks to ensure correct operation. Additionally, one of the relay outputs is specifically designed for control of a cooling fan, and the user-configurable fan exercise option extends the fan life and reduces bearing lock-up. Other key features include:

- Universal inputs of 100 and 1000 Ω platinum RTDs and Types E and K thermocouples
- Configurable through the front-panel interface, MODBUS over USB or the isolated RS-485, PC software included for data logging and configuration
- User-configurable measurement range to Celsius or Fahrenheit scale
- Large, dimmable 7-digit LED display allows easy programming and visibility at various distances and lighting conditions
- Dual password design allows certain users to have full configuration access and others, set points only
- Non-volatile memory storage of per-channel min/max temperatures for recall in the event of power-loss
- Electrically isolated 4-20mA output signal allows for connection to PLCs or remote displays
- UL/cUL recognition (CT424A and CT424B) and CE certification (CT424A)

Applications
Minco’s CT424 temperature monitor and alarm is designed with the specifications for dry-type transformer monitoring and protection. Additional applications include use in pumps, compressors and motors.

Specification and order options

<table>
<thead>
<tr>
<th>Model</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT424</td>
<td>Model number</td>
</tr>
</tbody>
</table>
| CT424A| AC power, 120-240VAC
       | 50-60Hz, 120-240VDC |
| CT424B| DC power: 21-36VDC |

Specifications subject to change
# Technical Specifications

<table>
<thead>
<tr>
<th><strong>Performance</strong></th>
<th><strong>Measurement Range</strong></th>
<th>-50°C to 300°C (-58°F to 572°F), 1°C resolution, 2°C full-range accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relay Contact Ratings</strong></td>
<td>Voltage: 240V AC</td>
<td>Fan Relay: 30A or 1.5HP @ 55°C, derates to 22A or 1.5HP @ 72°C</td>
</tr>
<tr>
<td></td>
<td>Trip/Alarm Relays: 10A</td>
<td></td>
</tr>
<tr>
<td><strong>Current Loop Outputs</strong></td>
<td>Configuration: high value, low value, specific channel selection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scaling: Offset from -50°C to 250°C, span from 50°C to 350°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error signaling: 3.5mA or 23mA output during sensor failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power: isolated loop power –or– non-isolated self-power</td>
<td></td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>MODBUS over USB or isolated RS-485, RTU, 300-38400bps</td>
<td></td>
</tr>
<tr>
<td><strong>Certifications</strong></td>
<td>UL/cUL recognized (CT424A and CT424B) and CE certification (CT424A)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environment</strong></th>
<th><strong>Sensor Inputs</strong></th>
<th>RTD: 100Ω or 1000Ω Platinum, 0.00385Ω/°C TCR, 2- or 3-wire connection, Open and shorted sensor detection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermocouple: Type K or Type E thermocouple, open detection.</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>-30°C to 72°C (-22°F to 162°F), 95% humidity, non-condensing</td>
<td></td>
</tr>
<tr>
<td><strong>Output Relays</strong></td>
<td>Connection: terminal block, 30 AWG to 10 AWG wire</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mechanical</strong></th>
<th><strong>User Interface</strong></th>
<th>Display: LED, 7-segment, red, 0.56” height, dimmable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indicators: LED, red: Fan, Trip, Alarm, Peak, Manual Fan, Test</td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>Front-panel: 6.3” x 9.9”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cut-out: 5.67” x9.17”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depth: 1.9”</td>
<td></td>
</tr>
</tbody>
</table>

| **Enclosure** | Metal, corrosion-resistant | |

Specifications subject to change
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 kΩ 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 hardrives

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 Ω/°C, 2 or 3-leads, or 50 k Ω NTC thermistor; 2-lead.
Setpoint range: 2 to 200°C (36 to 392°F) for platinum RTD input. 25 to 75°C (77 to 167°F) for thermistor input. Consult factory for other ranges.
Setpoint stability: ±0.02% of span/°C.

<table>
<thead>
<tr>
<th>Platinum RTD sensor</th>
<th>Thermistor sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2°C</td>
<td>0.02 V</td>
</tr>
<tr>
<td>50°C</td>
<td>0.50 V</td>
</tr>
<tr>
<td>100°C</td>
<td>1.00 V</td>
</tr>
<tr>
<td>200°C</td>
<td>2.00 V</td>
</tr>
<tr>
<td>Accuracy: ±1% of span</td>
<td>Accuracy: ±2% of span</td>
</tr>
<tr>
<td>Linearity: ±0.1% of span</td>
<td>Linearity: ±2% of span</td>
</tr>
</tbody>
</table>

Deadband: ±0.1°C (0.2°F).
Input power: 4.75 to 60 VDC.
Output: Open drain, 4 amps max. DC.
Leadwire compensation: (3-wire RTD) ±0.06°C/ Ω 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°C (-40 to 158°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
Specifications subject to change

Specification and order options

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>100Ω platinum RTD (0.00385 TCR)</td>
<td>PD</td>
</tr>
<tr>
<td>1000Ω platinum RTD (0.00385 TCR)</td>
<td>PF</td>
</tr>
<tr>
<td>50 kΩ thermistor R25/R125 = 31.2</td>
<td>TF</td>
</tr>
</tbody>
</table>

Note: 50kW thermistor sensor TS66STF is available on page 10-6

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.

Dimensions in inches (mm)

STOCKED PARTS AVAILABLE

Specifications subject to change
Overview
The CT335 is an OEM micro-processor based temperature controller that offers two sensor inputs, and two outputs. This low cost, PCB mount style proportional controller is great for system integration.

The CT335 multiple output options make it more versatile than other temperature controllers. Option 1) one output capable of handling up to 6 Amps. Option 2) Two open drain outputs with 3 Amps each. Option 3) one open drain output that can handle up to 3 Amps and a logic output option to work with an external SSR for higher power.

• Proportional and On/Off control
• Two inputs and two outputs (solid state)
• Small package designed for PCB mounting
• Able to handle up to 6 Amps
• Operates on 7.5-60 volts DC
• Low cost

Specifications
Sensor Inputs:
100Ω at 0°C Pt RTD, 2-leads (0.00385 TCR)
1000 Ω at 0°C Pt RTD, 2-leads (0.00385 TCR)

Output Options:
One output of 6A
Two outputs of 3A each
One 3A output and one logic output (0-5V)

Controlling Parameters:
Dead-band for On/Off Control: 0.1 to 10°C
Proportional band for Proportional Control: 0.1 to 10°C

Ambient:
Operating temperature: -40 to 70°C (-40 to 158°F)
Storage temperature: -55 to 85°C (-67 to 185°F)
Relative humidity: 90%, non-condensing

Accuracy: ±1°C
System stability determined by overall system.

Power supply: 7.5 to 60VDC

Physical: ABS case, epoxy potted for moisture resistance

Case Dimensions: 1.49x1.03x0.36”
Mounting: Pins on 0.1” center for mounting on PCB

AC207473 USB to SPI Converter Kit:
The AC207473 allows the user to configure the CT335 from a PC. It is ideal for prototyping and early-stage development. It consists of a CT335 USB to SPI converter, power supply, USB cable, and software CD for easy user interface.

Operation
The CT335 controller can be configured to On/Off or Proportional control. On/Off control offers faster reaction time and better accuracy over thermostats. The CT335 Proportional control minimizes temperature overshoot and gives steadier temperature control by reducing the time the heater/load stays on as the process temperature approaches the set-point. Note that actual outputs depend on the system’s configuration and controlling parameters. See below.

Specifications subject to change
Wiring with Different Output Options:

Option 1: One output of 6A

Option 2: Two outputs of 3A each

Option 3: One 3A output and one logic output (0-5V)

Specifications and order options

<table>
<thead>
<tr>
<th>CT335</th>
<th>Model Number: CT335</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD</td>
<td>Sensor Types:</td>
</tr>
<tr>
<td></td>
<td>PD = 100Ω Platinum RTD (-40 to 200°C)</td>
</tr>
<tr>
<td></td>
<td>PF = 1000Ω Platinum RTD</td>
</tr>
<tr>
<td>I</td>
<td>Output Options:</td>
</tr>
<tr>
<td></td>
<td>1. one output of 6A</td>
</tr>
<tr>
<td></td>
<td>2. two outputs of 3A</td>
</tr>
<tr>
<td></td>
<td>3. one 3A output and 1 logic output</td>
</tr>
<tr>
<td>P</td>
<td>Control Method:</td>
</tr>
<tr>
<td></td>
<td>O = On/Off</td>
</tr>
<tr>
<td></td>
<td>P = Proportional</td>
</tr>
<tr>
<td>10</td>
<td>Dead-band or Proportional Band</td>
</tr>
<tr>
<td></td>
<td>1 = 0.1°C</td>
</tr>
<tr>
<td></td>
<td>10 = 1.0°C</td>
</tr>
<tr>
<td></td>
<td>100 = 10.0°C</td>
</tr>
<tr>
<td>T100</td>
<td>Setpoint Temperature</td>
</tr>
<tr>
<td></td>
<td>(Min = -40°C, Max = 200°C):</td>
</tr>
<tr>
<td></td>
<td>XXXX = Setpoint in 0.1°C increments</td>
</tr>
<tr>
<td></td>
<td>Example: 100 = 10.0°C</td>
</tr>
<tr>
<td></td>
<td>103 = 10.3°C</td>
</tr>
<tr>
<td></td>
<td>-200 = -20.0°C</td>
</tr>
<tr>
<td>CT335PD1T100</td>
<td>Sample part number</td>
</tr>
</tbody>
</table>

Dimensions

Specifications subject to change
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 μA 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:** ±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 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 (131°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**

<table>
<thead>
<tr>
<th>Model number</th>
<th>CT15</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Alarm:</td>
<td>0 = No</td>
</tr>
<tr>
<td></td>
<td>1 = Yes</td>
</tr>
<tr>
<td>2 Input:</td>
<td>1 = J, K, or T thermocouple</td>
</tr>
<tr>
<td></td>
<td>2 = 100 Ω platinum RTD, type PD or PE</td>
</tr>
<tr>
<td>3 Output:</td>
<td>1 = Built-in AC SSR</td>
</tr>
<tr>
<td></td>
<td>2 = Pulsed voltage (5 VDC)</td>
</tr>
<tr>
<td></td>
<td>3 = Mechanical relay</td>
</tr>
</tbody>
</table>

**CT15121 = Sample part number**

*Note:* See page 5-37 for controller 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)
- DIMENSIONS IN INCHES (mm)

---

**STOCKED PARTS AVAILABLE**

Specifications subject to change
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
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.
Specifications continued

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: ±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.  
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 (131°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

<table>
<thead>
<tr>
<th>CT16A</th>
<th>Model number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Feature set:</td>
</tr>
<tr>
<td></td>
<td>2 = Standard</td>
</tr>
<tr>
<td></td>
<td>3 = Enhanced (ramp &amp; soak, Auto/manual)</td>
</tr>
<tr>
<td>1</td>
<td>Alarm relay:</td>
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<tr>
<td></td>
<td>0 = No</td>
</tr>
<tr>
<td></td>
<td>1 = Yes</td>
</tr>
<tr>
<td>1</td>
<td>Output A:</td>
</tr>
<tr>
<td></td>
<td>1 = Built-in AC SSR</td>
</tr>
<tr>
<td></td>
<td>2 = Pulsed voltage (15 VDC) for external SSR</td>
</tr>
<tr>
<td></td>
<td>3 = Mechanical relay, SPST (normally open)</td>
</tr>
<tr>
<td></td>
<td>4 = Mechanical relay, SPST (normally closed)</td>
</tr>
<tr>
<td></td>
<td>5 = Current</td>
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<tr>
<td></td>
<td>8 = DC SSR</td>
</tr>
<tr>
<td>0</td>
<td>Output B:</td>
</tr>
<tr>
<td></td>
<td>0 = None</td>
</tr>
<tr>
<td></td>
<td>1 = Built-in AC SSR</td>
</tr>
<tr>
<td></td>
<td>2 = Pulsed voltage (15 VDC) for external SSR</td>
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<td></td>
<td>4 = Mechanical relay, SPST (normally closed)</td>
</tr>
<tr>
<td></td>
<td>5 = Current</td>
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<tr>
<td>-948</td>
<td>Options on next page (leave blank for none)</td>
</tr>
</tbody>
</table>

CT16A2110-948 = Sample part number

See page 5-37 for Accessories.

Specifications subject to change
CT16A - Options and Accessories

Dimensions shown in inches (mm)

Additional options for CT16A (board level)
934: Analog retransmission of Process Variable or Set Variable: (4 to 20 mA) 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 for CT15 and CT16A
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 ¼ DIN adapter plate. 127 x 127 mm gray steel with 45 x 45 mm centered hole.

Specifications subject to change.