MOORE INDUSTRIES

CPT

PC-Programmable Temperature Transmitter
and Signal Isolator/Converter

September 2004

Description

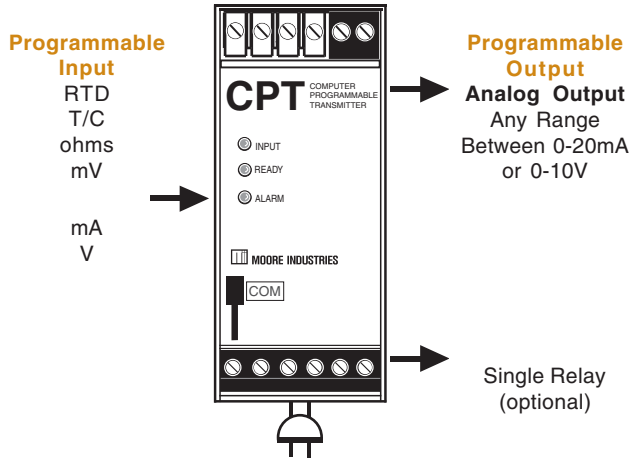
The universal CPT PC-Programmable Temperature Transmitter and Signal Isolator/Converter accepts a direct signal input from a wide array of sensors and analog devices:

- **23 RTD Types**
- **9 Thermocouple Types**
- **Current and Voltage Signals**
- **Resistance and Potentiometer Devices**
- **Direct Millivolt Sources**

The 4-wire (line/mains-powered) CPT provides an isolated and linear current or voltage output (any range within 0-20mA or 0-10V) proportional to the input. The signal is ready for direct interface with readout instruments, recorders, PLC, DCS, or PC-based SCADA systems.

User-Selectable Failure Mode
Upon input failure, the CPT's analog output can be user-set for upscale or downscale drive, fail to last value, or fail to selected value.

Figure 1. *Available CPT models deliver versatile and programmable input and output choices.*



4-Wire (Line/Mains) Powered
24Vdc, 117Vac, 230Vac

The CPT features a metal, RFI resistant *housing that snaps onto standard DIN-style rails.*

Features

- **Universal plant standard.** There's no need to stock dozens of different fixed range transmitters.
- **20-bit input resolution.** Delivers industry-best digital accuracy for both sensor (RTD and thermocouple) and analog (current/voltage) inputs.
- **PC-programmable with Windows® software.** From a single screen, you can choose, and then view to confirm, all of your application specific operating parameters from a PC.
- **Long-term stability.** Provides up to 5 years between scheduled calibrations.
- **Combined alarm trip and transmitter.** The alarm trip (-C) option reduces costs and installation time when both transmitter and alarm functions are needed at the same location.
- **Isolated and RFI/EMI protection.** Delivers superior protection against the effects of ground loops and plant noise, and radio frequency and electromagnetic interference.

Certifications*

CE **CE Conformant** – EMC Directive 89/336/EEC
EN 61326; Low Voltage Directive 73/23/EEC EN 61010

* ATEX, CSA and FM certifications are in submittal.

CPT

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One Window. One Minute. One Setup.

All operating parameters configure quickly and easily using our Intelligent PC Configuration Software. Programmable functions include:

- Input type and measurement range (zero and full scale values)
- Input and output trimming
- Analog output range
- Analog signal output damping (0-120 seconds)
- On input failure, upscale or downscale drive, fail to last value, or fail to selected value
- T/C reference junction compensation (on/off)
- Standard and custom linearization curves
- High or low alarm with trip point*
- Failsafe or non-failsafe and normally open or normally closed alarm relay*
- Alarm deadband (0-100%) and alarm time delay (0-120 seconds)*

*Models with alarm trip (-C) option.

Figure 2. *The CPT programs quickly from a single software window.*

Quick Ranging Calibration

Using the PC software (instead of potentiometers which can drift), precise zero and span settings can be made in seconds. Just select the zero and span values, and a push of a button on the PC keyboard locks the values into the CPT's memory.

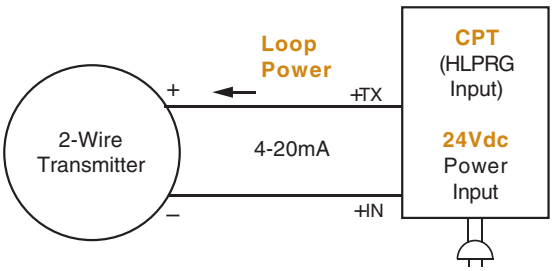
Total Sensor Diagnostics for RTD Inputs

If the RTD input breaks, the user can decide whether or not to trip one alarm to indicate trouble. A plain-English error message on the PC software tells exactly which RTD wire has broken. Specific error messages eliminate the work of removing the sensor or checking all lead wires to diagnose a problem.

Powers a 2-Wire Transmitter

The CPT (HLPRG: current/voltage input model) comes standard with 2-wire transmitter excitation that provides 24Vdc to power the loop. This saves the cost of specifying and installing an additional instrument power supply.

Figure 3. *The CPT provides transmitter excitation to power a 2-wire transmitter.*



Superior Reference Junction Compensation

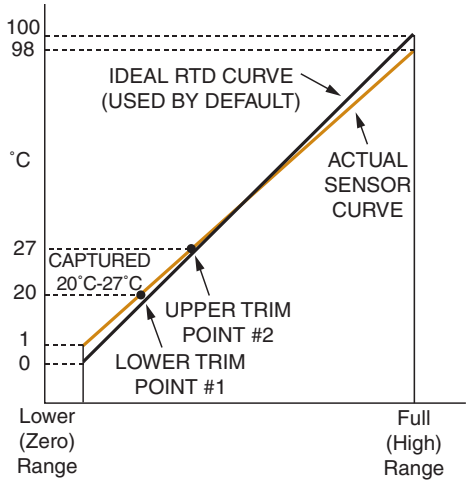
Uncompensated plastic terminals are very susceptible to ambient temperature changes that may result in readings that are "off" by several degrees. CPT models that accept temperature inputs (TPRG input) feature metal terminals and advanced electronic compensation techniques that provide a stable measurement in fluctuating ambient temperature conditions.

Trim to Specific Curve Segments

The CPT can be trimmed with two data points within the selected zero and span measurement range. This allows a complete process range to be monitored, while placing measurement emphasis on a critical segment of the range.

In the figure below, the ideal RTD curve is optimized between 20°C and 27°C to match the curve of the sensor used. This provides incredible precision over a limited portion of the span, while measuring the remainder of the span with outstanding accuracy.

Figure 4. *The CPT can be set to measure the segment most critical to the process.*



Combination Isolated Transmitter and Alarm Trip

When ordered with the Alarm Trip (-C) option, the CPT provides a relay (contact closure) output that can be set to trip when a variable falls outside of user-set high or low limits. All alarm trip parameters can be selected using the CPT Intelligent PC Configuration Software. Alarm trip options include:

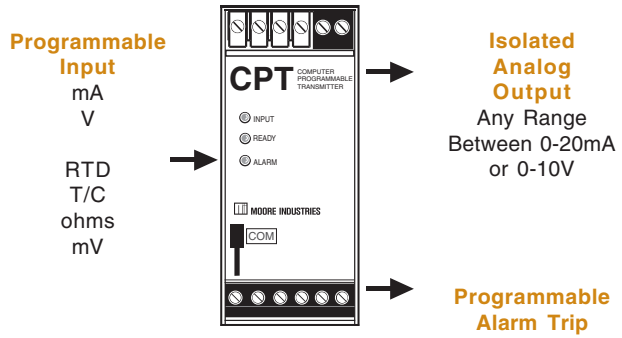
High or Low Process Alarm

Monitor a temperature, pressure, level, flow, position or status variable, and use to warn of unwanted process conditions, provide on/off control or provide emergency shutdown.

Input Fault Alarm

Setting the CPT's relay to trip on input or self-diagnostic failure is typically implemented to warn of a failure, such as a broken sensor, without tripping more critical process alarms or shutting down the process.

Figure 5. *When ordered with the Alarm Trip (-C) option, the CPT is a combination signal transmitter and alarm trip.*



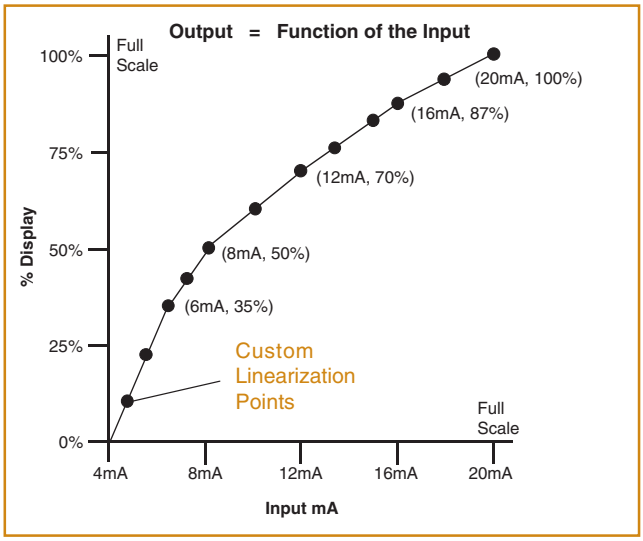
Self-Diagnostic Alarm

The CPT checks its own operation and configuration upon start up, and then continuously monitors its status during operation. The CPT's relay can be set to trip if it senses that it is not operating properly.

Custom 128-Point Linearization Curves

The ability to plot a custom linearization curve is beneficial when non-linear input signals must be converted to linear output representations. Typical applications include monitoring a non-linear transducer, the level of odd-shaped tanks, and flow meter linearization.

Figure 6. *Custom linearization points can be selected and saved in the CPT's memory to compensate for non-linear input signals.*



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PC-Programmable Temperature Transmitter
and Signal Isolator/Converter

Specifications (HLPRG: mA and V Input Model)

Performance

Input Accuracy: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)
Output Accuracy: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)
Overall Accuracy: The overall accuracy of the unit is the combined input and output (if any) accuracies. It includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution. It does not include ambient temperature effect
Mimimum Span at Specified Accuracy: Current, 4mA; Voltage, 1V
Stability: See Table 1
Response Time: 256msec maximum (128msec typical) for the output to change from 10 to 90% of its scale for an input step change of 0 to 100%
Ripple: 50mVp-p maximum on voltage output; 10mVp-p measured across a 250 ohm load resistor for current output (Frequencies up to 120Hz)
Output Limiting: Input over range, -0.2V/0mA and 10.5V/21.4mA; Input failure, -0.5V/0mA and 11V/24mA
Output Current Limiting: 25mA maximum
Load Effect: 0.01% of span from 0 to maximum load resistance

Performance (continued)

Maximum Load Resistance: 1 kohm
Line Voltage Effect: ±0.002% of span per 1% change in line voltage (AC or DC)
Isolation: STANDARD UNIT: 1000Vrms between case, input and output. 1500Vrms between power and input and between power and output; WITH -RF OPTION: 500Vrms between case, input, output and power
Power Consumption: 2.5W typical, 3W maximum
Power Supply Effect: ±0.002% of span per 1% of line change
Input Impedance: 20 ohms for current inputs; 1.1 Mohms for voltage inputs
Input Over-Range Protection: ±100mA for current inputs; ±30Vdc for voltage inputs

Performance with Alarm Trip (-C Option)

WITH ALARM TRIP OUTPUT:
Alarm Trip Repeatability: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1 mV)
Response Time: 300msec (Defined as time from step change on input to alarm state change when alarm is set to trip midpoint)
Alarm Deadband: Programmable from 0-100%
Alarm Trip Delay: 0-120 seconds

Indicators

LED Type: INPUT LED: Dual color LED indicates input failure
READY LED: Green LED indicates unit is operating properly
ALARM 1 LED: Dual color LED indicates alarm status

Ambient Conditions

Operating & Storage Range: -40°C to +85°C (-40°F to +185°F)
Relay Range: -25°C to +70°C (-13°F to +158°F)
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: ±0.015% of maximum span/°C
RFI/EMI Immunity STANDARD UNIT: 10V/M@20-1000MHz, 1kHz when tested according to IEC1000-4-3-1995 with 0.5% of span or less error WITH -RF OPTION: 30V/M@20-1000MHz, 1kHz AM when tested according to IEC1000-4-3-1995 with 0.5% of span or less error
Noise Rejection: Common mode: 100dB@50/60Hz; Normal Mode: Current Input, 100dB typical at 50mAp-p@50/60Hz; Voltage Input, 100dB typical at 1Vp-p@50/60Hz

Weight

535 g (17.2 oz)

Table 1. *Long-Term Stability for HLPRG (mA and V) Input Model*

Stability (% of maximum span)	Input-to-Analog Output (Years)			Input-to-Relay Output (Years)		
	1	3	5	1	3	5
Current Inputs	0.081	0.14	0.18	0.047	0.081	0.105
Voltage Inputs	0.093	0.16	0.21	0.066	0.114	0.147

Specifications (TPRG: RTD, T/C, Ohm, mV and Pot Input Model)

Performance

Input Accuracy: See Table 4
Output Accuracy: Current, ±0.01% of maximum span (±2 microamps); Voltage, ±0.01% of maximum span (±1mV)
Overall Accuracy: The overall accuracy of the unit is the combined input and output (if any) accuracies. It includes the combined effects of linearity, hysteresis, repeatability, and adjustment resolution. It does not include ambient temperature effect
Mimimum Span at Specified Accuracy: See Table 4
Reference Junction Compensation Accuracy (T/C Inputs Only): ±0.45°C
Stability: See Table 2
Response Time: 256msec maximum (128msec typical) for the output to change from 10 to 90% of its scale for an input step change of 0 to 100%
Ripple: 50mVp-p maximum on voltage output; 10mVp-p measured across a 250 ohm load resistor for current output. (Frequencies up to 120Hz)
Output Limiting: Input over range, -0.2V/0mA and 10.5V/21.4mA; Input failure, -0.5V/0mA and 11V/24mA
Output Current Limiting: 25mA maximum
Load Effect: 0.01% of span from 0 to maximum load resistance on current output
Maximum Load Resistance: 1 kohm
Line Voltage Effect: ±0.002% of span per 1% change in line voltage (AC or DC)
Isolation: STANDARD UNIT: 1000Vrms between case, input and output. 1500Vrms between power and input and between power and output; WITH -RF OPTION: 500Vrms between case, input, output and power
Power Consumption: 2.5W typical, 3W maximum
Power Supply Effect: ±0.002% of span per 1% of line change
Input Impedance: T/C and mV inputs, 40 Mohms, nominal
Input Over-Range Protection: ±5Vdc
Excitation Current (RTD and Ohm Inputs Only): 250 microamps, ±10%

Performance with Alarm Trip (-C Option)

WITH ALARM TRIP OUTPUT:
Alarm Trip Repeatability: See Table 4
Response Time: 300msec (Defined as time from step change on input to alarm state change when alarm is set to trip midpoint)
Alarm Deadband: Programmable from 0-100%
Alarm Trip Delay: 0-120 seconds

Indicators

LED Type: INPUT LED: Dual color LED indicates input failure
READY LED: Green LED indicates unit is operating properly
ALARM 1 LED: Dual color LED indicates alarm status

Ambient Conditions

Operating & Storage Range: -40°C to +85°C (-40°F to +185°F)
Relay Range: -25°C to +70°C (-13°F to +158°F)
Effect of Ambient Temperature on Reference Junction Compensation (T/C Inputs Only): ±0.005°C per °C change of ambient temperature
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: ±0.015% of maximum span/°C
RFI/EMI Immunity STANDARD UNIT: 10V/M@20-1000MHz, 1kHz when tested according to IEC1000-4-3-1995 with 0.5% of span or less error WITH -RF OPTION: 30V/M@20-1000MHz, 1kHz AM when tested according to IEC1000-4-3-1995 with 0.5% of span or less error
Noise Rejection: Common mode, 100dB@50/60Hz; Normal Mode, refer to Table 3

Weight 535 g (17.2 oz)

Table 2. *Long-Term Stability for TPRG (RTD, T/C, mV, Ohm, Pot) Input Model*

Stability (% of maximum span)	Input-to-Analog Output (Years)			Input-to-Relay Output (Years)		
	1	3	5	1	3	5
RTD, Ohm, & Pot Inputs	0.066	0.114	0.147	0.47	0.081	0.104
T/C & mV Inputs	0.047	0.082	0.106	0.008	0.014	0.019

Table 3. *Normal Mode Rejection Ratio Table*

Sensor Type		Max. p-p Voltage Injection for 100dB at 50/60Hz
T/C: J, K, N, C, E		150mV
T/C: T, R, S, B		80mV
Pt RTD: 100, 200, 300 ohms		250mV
Pt RTD: 400, 500, 1000 ohms		1V
Ni: 120 ohms		500mV
Cu: 9.03 ohms		100mV
Resistance	**mV**	
1-4 kohms	250-1000	1V
0.25-1 kohms	62.5-250	250mV
0.125-0.25 kohms	31.25-62.5	100mV

Table 4. *Accuracy with RTD, Thermocouple, Ohms, and Millivolt Inputs (Models with TPRG Input).*

Input	Type	α	Ohms	Conformance Range	Minimum Span	Input Accuracy/Repeatability	Maximum Range
RTD (2-, 3-, 4-Wire)	**Platinum**	0.003850	100	-200 to 850°C -328 to 1562°F	10°C (18°F)	±0.1°C (±0.18°F)	-240 to 960°C -400 to 1760°F
			200				
			300				
			400				
			500				
			1000				
		0.003902	100	-100 to 650°C -148 to 1202°F			-150 to 720°C -238 to 1328°F
			200				
			400				
			500				
			1000				
		0.003916	100	-200 to 510°C -328 to 950°F			-240 to 580°C -400 to 1076°F
	Nickel	0.00672	120	-80 to 320°C -112 to 608°F			-100 to 360°C -148 to 680°F
	Copper	0.00427	9.035	-50 to 250°C -58 to 482°F		±0.85°C (±1.53°F)	-65 to 280°C -85 to 536°F
Ohms	**Direct Resistance**	n/a	0-4000	0-4000 ohms	10 ohms	±0.4 ohms	0-4000 ohms
	Potentiometer		4000 max.	0-100%	10%	±0.1%	0-100%
T/C	**J**	n/a	n/a	-180 to 760°C -292 to 1400°F	35°C 63°F	±0.25°C (±0.45°F)	-210 to 770°C -346 to 1418°F
	K	n/a	n/a	-150 to 1370°C -238 to 2498°F	40°C 72°F	±0.3°C (±0.54°F)	-270 to 1390°C -454 to 2534°F
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C 63°F	±0.2°C (±0.36°F)	-270 to 1013°C -454 to 1855.4°F
	T	n/a	n/a	-170 to 400°C -274 to 752°F	35°C 63°F	±0.25°C (±0.45°F)	-270 to 407°C -454 to 764.6°F
	R	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F
	S	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.55°C (±0.99°F)	-50 to 1786°C -58 to 3246.8°F
	B	n/a	n/a	400 to 1820°C 752 to 3308°F	75°C 135°F	±0.75°C (±1.35°F)	200 to 1836°C 392 to 3336.8°F
	N	n/a	n/a	-130 to 1300°C -202 to 2372°F	45°C 81°F	±0.4°C (±0.72°F)	-270 to 1316°C -454 to 2400.8°F
	C	n/a	n/a	0 to 2300°C 32 to 4172°F	100°C 180°F	±0.8°C (±1.44°F)	0 to 2338°C 32 to 4240.4°F
mV	**DC**	n/a	n/a	-50 to 1000mV	4mV	15 microvolts	-50 to 1000mV

Ordering Information

Unit	Input	Output	Power	Options	Housing
CPT PC-Programmable Temperature Transmitter and Signal Isolator/Converter	**HLPRG** Programs to accept: Current: Any range between 0-50mA including: 0-20mA 4-20mA 10-50mA Voltage: Any range between 0-10Vdc including: 0-5Vdc 1-5Vdc 0-10Vdc **TPRG** Programs to accept (see Table 4 for details): RTD: 2-, 3-, and 4-wire; platinum, copper and nickel Thermocouple: J, K, E, T, R, S, N, C, B Ohms: 0-4000 ohms (potentiometer, 4000 ohms maximum) Millivolts: -50 to +1000mV	**0-20MA** Analog output (isolated and linearized) programs to output: Current: Any range between 0-20mA including: 0-20mA 4-20mA **0-10V** Analog output (isolated and linearized) programs to output: Voltage: Any range between 0-10Vdc including: 0-5Vdc 1-5Vdc 0-10Vdc **IMPORTANT NOTE:** Unit is factory set for internal (source) power. For external (sink) power, see the -SINK option	**24DC** ±10% **117AC** ±10% **230AC** ±10%	**-C** Single Relay (Relay is single-pole/double-throw (SPDT, 1 form C, rated 5A@250Vac, 50/60Hz, non-inductive) Configures for: High or Low Trip Normally Open or Normally Closed Failsafe or Non-Failsafe **-FMEDA** Unit comes with Failure Modes, Effects and Diagnostic Analysis (FMEDA) data for evaluating the instrument for suitability of use in a safety-related application **-RF** Enhanced RFI/EMI protection (see "Specifications" for details) **-SINK** Unit is factory set for external (sink) power	**DIN** Universal DIN-style housing mounts on 32mm (EN50035) G-type and 35mm (EN50022) Top Hat DIN-rails **FLB** Externally-mounted flange provides a secure mount and ensures resistance to vibration

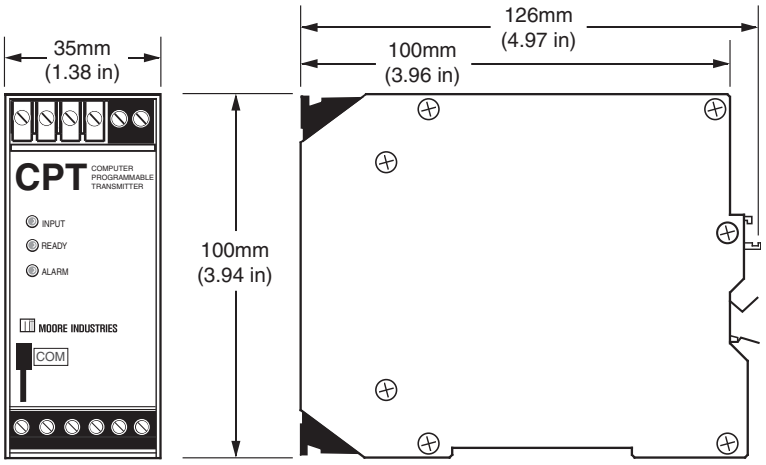
When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: CPT / TPRG / 0-20MA / 117AC / -C -RF [DIN]

Accessories

Each CPT order comes with one copy of our Intelligent PC Configuration Software (Windows®'95, '98, 2000, NT and XP compatible) and a configuration cable. Use the chart below to order additional parts.

Part Number **225-75120-01**	**CPA/CPT Intelligent PC Configuration Software** (One copy provided free with each order)
Part Number **803-053-26**	**CPA/CPT Configuration Cable** for use in connecting the CPA/CPT to the PC (one cable provided free with each order)

Figure 7. *Installation Dimensions*



NOTE: While all CPT models (model with TPRG input shown) are dimensionally identical, the CPT that accepts temperature inputs features metal terminal blocks for enhanced cold junction compensation.

Table 5. *Terminal Designations*

Input Type	Top Terminals (Left to Right)					
	T1	**T2**	**T3**	**T4**	**T5**	**T6**
Current Input (HLPRG)	Tx	+I	COM	Not Used	+OUT	–OUT
Voltage Input (HLPRG)	Not Used	Not Used	COM	+V	+OUT	–OUT
RTD, Ohm & Pot Input (TPRG)	See Figure 8				+OUT	–OUT
T/C & mV Input (TPRG)					+OUT	–OUT

Power/Options	Bottom Terminals (Left to Right)					
	B1	**B2**	**B3**	**B4**	**B5**	**B6**
Standard Unit	Not Used	Not Used	Not Used	AC/DC	ACC/DCC	GND
With Alarm Trip (-C) Option	NO	CM	NC	AC/DC	ACC/DCC	GND

NOTES:
1. Terminal blocks can accomodate 14-22 AWG solid wiring.
2. NO/CM/NC labeling is present only when the unit is equipped with the Alarm Trip (-C) option.

KEY:
AC/DC = Power Input
ACC/DCC = Power Input
CM = Relay Common
COM = Analog Common
GND = Ground
I = Current Input
OUT = Current Output
NO = Normally Open
NC = Normally Closed
Source = Current Source
SPDT = Single-Pole/Double-Throw
TX = Power for 2-wire transmitter

Figure 8. *Temperature Sensor Hook-Up Guide (Models with TPRG Input)*