

Eclipse Combustion Universal Digital Controller

DC 3000 Series

912
Bulletin
7/95

The Eclipse Combustion DC 3000 Digital Controller is a general purpose microprocessor-based, stand alone digital controller. It combines the highest degree of functionality and operating simplicity offered in a 1/4 DIN size. The bright dual displays with multi-language prompts make the operator interface easy to read, understand and operate.

Programmed sequences of displays assure quick and accurate entry of all configurable parameters. Simple keystrokes let you select input and range configuration; you can set the operating parameters for your current process control needs and change them later to meet new ones.

The controller is housed in a black metal case with a blue bezel, that can be panel mounted in a 1/4 DIN cutout. The plug-in chassis allows easy access to the controller board and its various option boards. All power, input and output wiring are connected to screw terminals on the rear panel.

Features

- **Dual Displays**—Vacuum fluorescent alphanumeric displays and indicator with dedicated PV display.
- **Deviation Bargraph**—“On Control” indication or up to $\pm 10\%$ deviation display.
- **Easy Configuration**—Multi-language prompts, in programmed sequence, provide guidance during configuration. Individual, reliable tactile keys provide positive operator feedback.
- **Universal Isolated Input**—Input 1 can be configured for any input type. It is isolated from Input 2 and all other circuits.
- **Thermocouple Failsafe**—Configurable upscale or downscale burnout and failsafe output level.
- **Manual/Automatic Modes**—Bumpless, balanceless transfer between control modes.
- **Two Local Setpoints**—Configurable to provide two local setpoints, keyboard or optional remote switch selectable.
- **Heat/Cool Capability**—Provides split range control with independent PID tuning constants—one for heating, one for cooling, plus mixed output forms.
- **Alarm Selection**—None, one or two relays to activate external equipment when preset high/low setpoints are reached. There is an indicator for each alarm.
- **Two Sets of Tuning Constants**—Two sets of PID parameters can be configured for each loop and automatically selected.
- **Decimal Point Location**—Configurable for none, one or two places.
- **Limit Control**—Provides a latching relay which is activated whenever the PV goes above or below a preset setpoint value. An alarm indicator will light when the output is activated. Reset is through a key on the front of the controller or an external switch.
- **Setpoint Rate**—Lets you define a ramp rate to be applied to any local setpoint change. A separate upscale or downscale rate is configurable. A single setpoint ramp is also available as an alternative.
- **Moisture Resistant Front Panel**—Capable of meeting NEMA 3 and IEC IP65 (i.e. hosedown) requirements.
- **Universal Switching Power**—Operates on any line voltage from 90 to 264 VAC 50/60 Hz without jumpers.
- **Setpoint Ramp**—Provides single programmable setpoint ramp of up to 255 minutes duration which is repeatable and activated by the Run/Hold key.
- **Output Rate Limiter**—A maximum output rate may be configured for both the upscale and downscale output directions.
- **Data Security**—Five levels of keyboard security protect tuning, configuration, and calibration data, accessed by a configurable four-digit code.
- **Quality/Support**—The DC 3000 is covered by a two year warranty.



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Optional Features

- **Accutune™ Adaptive Tuning**—Provides process response identification and readjustment of PID tuning parameters during start-up and whenever SP is changed.
- **Second Input**—Isolated high level input available for remote setpoint signal or PV signal via digital inputs.
- **Auxiliary Output***—This isolated output can be scaled from 4-20 mA for 0 to 100% for any range desired. It can be configured to represent Input 1, Input 2, PV, Setpoint, Deviation or the Control Output.
- **Communications***—Provides a communications link between the DC 3000 and a supplied interface capable of communicating via RS232 (DMCS), or direct communication via the RS422/485 communications option to a host computer. Available Aimax-Plus® software provides personal computer MMI for operation and configuration.
- **Two Digital Inputs**—Allows remote dry contact closure to select one of the following for each digital input:
 - Reset of limit controller
 - Manual control mode
 - Manual mode, failsafe output
 - Local setpoint 1
 - Hold SP ramp/programming
 - Local setpoint 2
 - Run SP ramp/programming
 - Select PID set 2
 - Disable PID integral action
 - PV= Input 2
 - External program reset
 - Direct controller actionAlso allows the following selections to be combined with the above selections:
 - Direct controller action
 - Select PID select 2
 - Disable adaptive tune
 - Local setpoint 2
- **Setpoint Ramp/Soak Programming**—Enables you to program and store 6 Ramp and 6 Soak segments for setpoint programming. Run or Hold of program is keyboard or remote switch selectable.
- **Transmitter Power**—Provides up to 34 volts to power a two wire transmitter (requires use of open collector output for alarm 2).

Inputs

The analog inputs are sampled three times a second. The sample signal is amplified and then converted to a digital signal which is isolate and passed to the microprocessor. The primary output can be one of various Thermocouple, RTD, RH or Linear actuations. A second input provides a remote setpoint function and accepts a 4-20 mA or a 1-5 Vdc range that can be characterized. All ranges are keyboard selectable. Cold junction compensation is provided. You can select upscale or downscale sensor break protection. A configurable digital filter of 0-120 seconds provides input signal smoothing if required.

Output Types

The following output types are available per the model selection guide:

- Electromechanical relays
- Current output
- Open collector output
- Solid state relays
- Solid state relay (10 amp) externally mounted (optional)
- Auxiliary current output (optional)

Output Algorithms

- **Time Proportional Duplex**—Provides On-Off or Time Proportional (Relay) Output.
- **Current Proportional**—Supplies proportional direct current output for final control elements which require a 4-20 mA signal.
- **Positive Proportional**—Positions a reversible motor with a feedback slidewire in proportion to the output of the control algorithm.
- **Time Proportional Duplex**—Depending on which control algorithm you select, this duplex output algorithm can provide On-Off Duplex, Time Proportional Duplex or 3 Position Step Control. The Time Proportional Duplex output provides independent PID tuning constants and two time proportional outputs: one for heat zone above the 50% output, and one for cool zone below 50% output.
- **Current Proportional Duplex**—Similar to Current Proportional, but provides a second set of tuning parameters and a split range current output or a second current output—via the Auxiliary output option—for the heat and cool zones.
- **Current/Relay Duplex (Relay=Heat)**—A variation of Duplex with Current active for 0 to 50% output (Tuning Set 2) and Relay active 50 to 100% output (Tuning Set 1).
- **Current/Relay Duplex (Relay=Cool)**—A variation of Duplex with Current active for 50 to 100% output and Relay active 0 to 50% output.

Configuration

You decide how the controller is to interact with the process by selecting the functions you want through simple key-strokes. Internal programs prompt the operator step-by-step through the configuration process assuring quick and accurate entry of all configurable parameters.

Control Modes

Manual or automatic control with bumpless, balanceless transfer between modes is a standard feature. In the manual mode, the operator directly controls the controller output level. In the automatic mode, the controller will operate from a local or remote setpoint, provided at the second input or via communications.

Alarms

Alarm output terminals are located at the rear terminal panel. One or two electromechanical alarm relays are available to activate external equipment when preset alarm setpoints are reached. Each of the two alarms can be set to monitor two independent setpoints Each alarm setpoint can be a high or low alarm. The alarm type can be selected to be either of the inputs, the PV, Deviation, Output or Shed from Communications. It can also be used as an On or Off event at the beginning or end of a Ramp/Soak segment.

* Auxiliary Output and Communications are mutually exclusive—only one can be specified.

Figure 1—Operator Interface

UPPER DISPLAY (Six characters)

- Normal Operation—four digits dedicated to display the process variable.
- Configuration Mode—displays parameter value or selection.

There are four possible letters which can show, all located in the same vicinity:

- F** = Degrees Fahrenheit being used
- C** = Degrees Centigrade being used
- R** = Run SP Ramp/Program
- H** = Hold SP Ramp/Program

ALM = Alarm conditions exist

DI = Digital input active

RSP = Remote SP or SP2 active

OUT = Control relay on

The numbers 1 or 2 may appear after the above abbreviations, signalling which control relay is active.

DEVIATION BARGRAPH

- Center bar indicates PV is within $\pm 1\%$ of setpoint.
- $\pm 10\%$ Deviation is shown in 1% increment/bar.

LOWER DISPLAY (Eight characters)

- Normal Operation—displays operating parameters and values.
- Configuration Mode—displays function groups and parameters.

MAN = Controller in manual mode

A = Controller in automatic mode

NOTE: when neither the MAN or A are visible, then the communications option is active.

KEY FUNCTIONS

FUNCTION = Selects function within each Set Up group.

LOWER DISPLAY = Returns controller to PV display from Set Up mode.

MANUAL/AUTO = Selects Manual or Automatic control mode.

SETPOINT SELECT = Alternately selects Local setpoint 1 and Remote setpoint 2 or between two local setpoints.

SET UP = Sequentially displays Set Up groups and allows Function key to display individual functions.

RUN/HOLD = Initiates or holds the single setpoint ramp or Ramp/Soak program.

Δ = Increases the configuration values or changes functions in Set Up groups.

∇ = Decreases the configuration values or changes functions in Set Up groups.



Operator Interface (Figure 1)

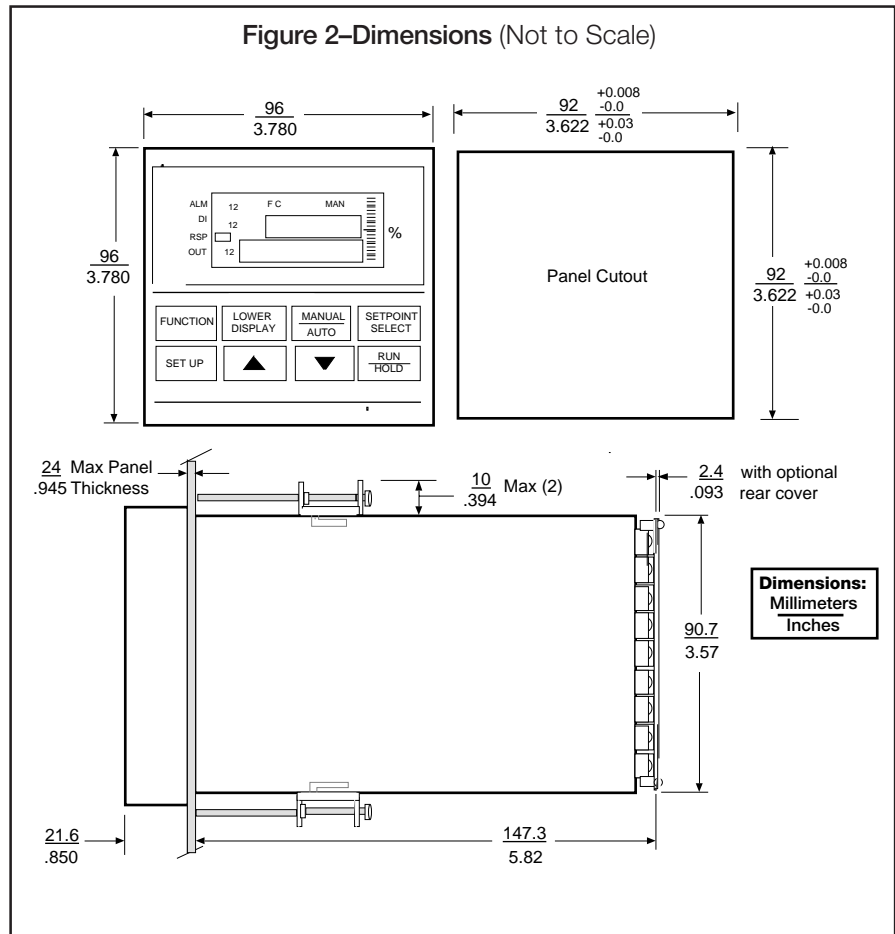
- **Indicators**—They provide alarm, control mode and temperature units indication. There is also indication of when Remote setpoint is active, the status of the control relays, and whether a setpoint program in Run or Hold mode.

A 21-segment bargraph displays deviation to $\pm 10\%$ of span and an “On-Control” indicator.

- **Displays**—A four-digit upper display is dedicated to the process variable during normal operation, with alternate six-character information displayed during configuration.

During normal operation, the lower display shows key selected parameters such as Output, Setpoints, Inputs, Deviation, active Tuning Parameter Set, or minutes remaining in a setpoint ramp (four digits). It also provides guidance through prompts for the operator during configuration.

Figure 2—Dimensions (Not to Scale)



Specifications

Design	
Accuracy	± 0.20% of span typical (± 1 digit for display) 14 bit resolution typical
Temperature Stability	± 0.01% for °C change
Input Signal Failure Protection	<i>Thermocouple Inputs:</i> Upscale or downscale burnout <i>Burnout Current:</i> 0.13 microamps <i>Failsafe Output Level:</i> Configurable 0-100%
Input Impedance	<i>4-20 Milliampere Input:</i> 250 Ohms <i>0-10 Volt Input:</i> 200K Ohms <i>All Other:</i> 10 Megohms
Stray Rejection	<i>Common Mode</i> AC (50 or 60 Hz): 120 db (with maximum source impedance of 100 Ohms) or ± 1 LSB ((least significant bit) whichever is greater. <i>Normal Mode</i> AC (50 or 60 Hz): 60 db (with 100% span peak-to-peak maximum)
Controller Output Types	<p>Current Output (Isolated) Range can be set between 0 to 21 mA, and as direct or reverse action. <i>Resolution:</i> 11 bits for 0 to 21 mA <i>Accuracy:</i> 0.5% full scale <i>Temperature Stability:</i> 0.15% F.S. / °C <i>Load Resistance:</i> 0 to 1000 ohms</p> <p>Electromechanical Relays SPDT contacts. Both Normally Open and Normally Closed contacts are brought out to the rear terminals. Internally socketed <i>Resistive Load:</i> 5 amps @ 120 Vac, 240 Vac or 30 Vdc <i>Inductive Load:</i> 50 VA @ 120 Vac or 240 Vac <i>Motor:</i> 1/6 H.P.</p> <p>Solid State Relays SPST solid state contact consisting of a triac N.O. output. Internally socketed <i>Resistive Load:</i> 1.0 amp @ 25 °C and 120 or 240 Vac 0.5 amp @ 55 °C and 120 or 240 Vac <i>Inductive Load:</i> 50 VA @ 120 Vac or 240 Vac</p> <p>Open Collector Outputs <i>Maximum Sink Current:</i> 20 mA <i>Overload Protection:</i> 100 mA Internally powered @ 30 Vdc Opto-isolated from all other circuits except current output, but not from each other. Socketed jumper assembly replaces relay.</p> <p>Solid State Relays (10 amps) One or two externally mounted triac N.O. outputs for use with open collector outputs. <i>Resistive Load:</i> 15 amps @ 25 °C and 120 or 240 Vac 10 amps @ 55 °C and 120 or 240 Vac <i>Inductive Load:</i> 50 VA @ 120 Vac or 240 Vac <i>Motor Rating:</i> 1 HP @ 25 °C 0.75 HP @ 55 °C</p>
Alarm Output	<p>One SPDT electromechanical relay.</p> <p>A second alarm is available using the second control relay. This is not available with Relay Duplex, Position Proportional, or Three Position Step control.</p> <p>Up to four setpoints are independently set as high or low alarm, two for each relay. Setpoint can be on either Input, Process Variable, Deviation, Communication Shed, or Output. A single adjustable hysteresis of 0.0 to 5.0% is provided. The controller can also be set to alarm on shed from communications. The alarm can also be set as an on or off event at the beginning of a setpoint ramp/soak segment.</p> <p><i>Alarm Relay Contacts Rating</i> <i>Resistive Load:</i> 5 ampere @ 120 Vac, or 30 Vdc</p>

Specifications (continued)

Design (continued)				
Digital Displays	Vacuum fluorescent, alphanumeric. A six-character upper display dedicated to the process variable (4 digits). Alternate information displayed during configuration mode. A eight-character lower display primarily shows key selected operating parameters (4 digits). Also provides guidance during controller configuration.			
Indicators	Alarm Relay Status (ALM 1 or 2) Control Mode (A or MAN) Temperature Units (F or C) Remote Set Point or SP2 Active (RSP) Control Relay Status (OUT 1 or 2) Digital Input Status (DI 1 and 2)			
Bargraph	21 segment, vertical Deviation bargraph Center bar lit when “on” control Deviation to ± 10% of PV span in 1% increments			
Modes of Operation	Manual Automatic with local setpoint Automatic with remote setpoint (2-input units only)			
Dimensions	See Figure 2.(page 3)			
Mounting	Panel-mounted, 5.82 inch depth			
Wiring Connections	Screw terminals on the rear of the case.			
Power Consumption	18 VA maximum			
Power Inrush Current	10A Max. 4 MS (under operating conditions)			
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">CAUTION</div> When applying power to more than one UDC3000, make sure that sufficient power is supplied. Otherwise, the controllers may not start up normally due to voltage drop from the inrush current.			
Weight	1.3 kg (3 lbs.)			
Environmental and Operating Conditions				
Parameter	Reference	Rated	Operative Limits	Transportation and storage
Ambient Temperature	25 ± 3°C 77 ± 5°F	15 to 55°C 58 to 131°F	0 to 55°C 32 to 131°F	-40 to 66°C -40 to 151°F
Relative Humidity	10 to 55*	10 to 90*	5 to 90*	5 to 95*
Vibration				
Frequency (Hz)	0	0 to 70	0 to 200	0 to 200
Acceleration (g)	0	0.1	0.5	0.5
Mechanical Shock				
Acceleration (g)	0	1	5	20
Duration (ms)	0	30	30	30
Voltage (Vac)	120 ± 1 240 ± 2	90 to 264	90 to 264	-- --
Frequency (Hz)	50 ± 0.2 60 ± 0.2	49 to 51 59 to 61	48 to 52 58 to 62	-- --

* The maximum rating only applies up to 40°C (104°F). For higher temperatures, the RH specification is derated to maintain constant moisture content.

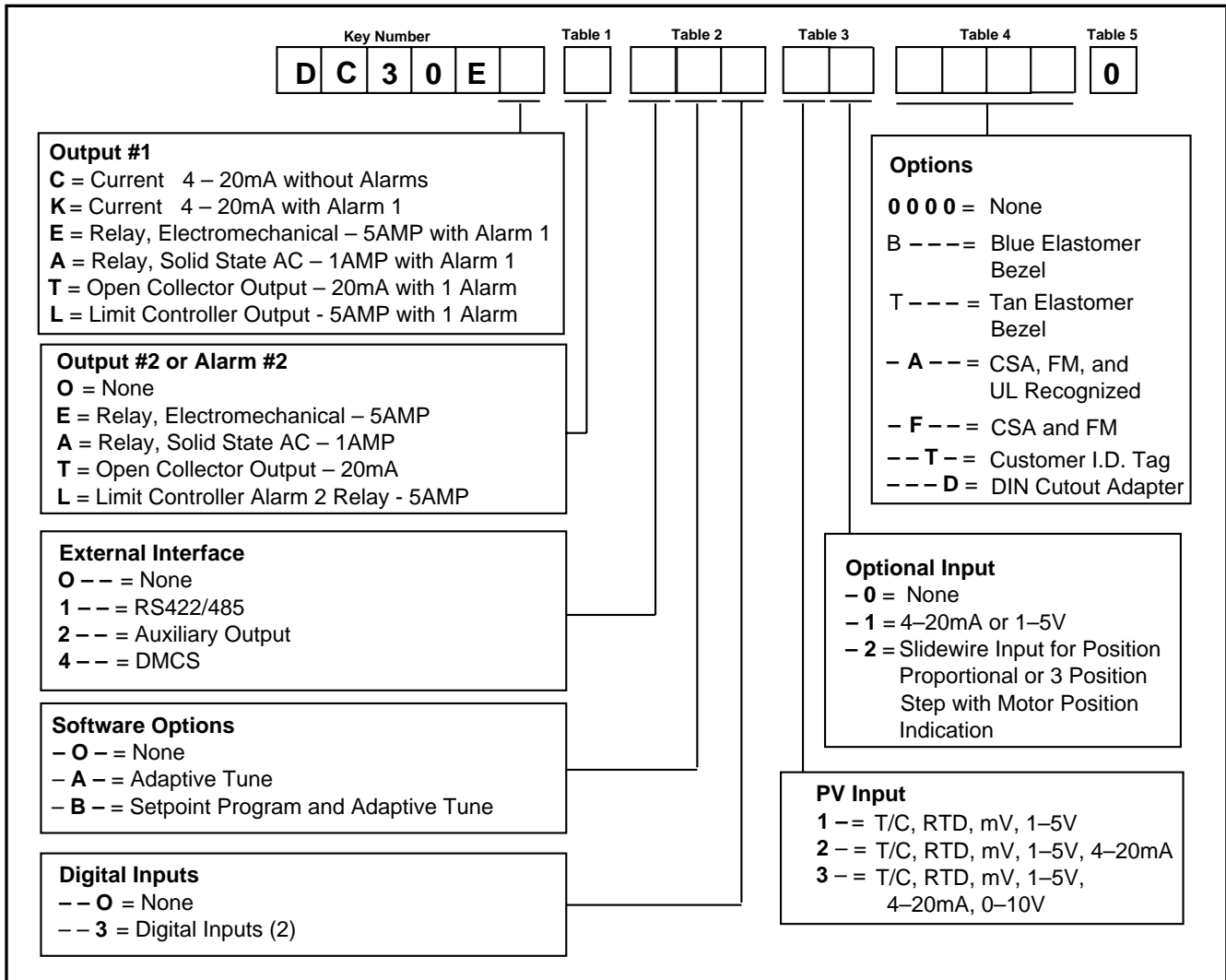
General Reference Data	
Isolation	All inputs and outputs are electrically isolated from each other and from case ground per UL873 and IEC 348. The power input and relay contact output can withstand a minimum HIPOT of 1800 Vac for one minute. The other field terminals can withstand a minimum HIPOT of 700 Vac for one minute.
Static Charge	<i>Susceptibility:</i> The exposed panel surface is capable of withstanding a discharge through 100 ohms from a 250 pf capacitor charged to 10 KV with no component failures.
Radio Frequency Interference (RFI)	<i>Susceptibility:</i> The UDC3000 Universal Digital Controller is capable of withstanding an EMI field generated from a 5 watt transmitter operating at 151.685 and 450 MHz. and held at a distance of 1 meter from the instrument, with no malperformance per SAMA standard PMC 33.3 - 1978 - - - Class 2.
Line Noise Effects	<i>Surge:</i> The field terminals and power line terminals are capable of withstanding the IEEE Std. 473 Surge Withstanding Capability (SWC) Test with no component failures, no reset and no incorrect outputs to 2.5 Kilovolts. The analog and digital input and output terminals are capable of withstanding the IEEE Std. 473 Surge Withstanding capability (SWC) test in common mode with no component failures, no reset and no incorrect outputs to 1.0 Kilovolts.

Table 1 - Input Actuations		
PV Input	Range	
	°F	°C
Thermocouples		
B*	0 to 3300	-18 to 1815
E*	-454 to 1832	-270 to 1000
E (low)	-200 to 1100	-129 to 593
J	0 to 1600	-18 to 871
J (low)	20 to 770	-7 to 410
K	0 to 2400	-18 to 1316
K (low)	-20 to 1000	-29 to 538
NiNiMoly (NNM)	32 to 2500	0 to 1371
NiNiMoly (NNM low)	32 to 1260	0 to 682
NIC (Nicrosil Nisil)	0 to 2372	-18 to 1300
R	0 to 3100	-18 to 1704
S	0 to 3100	-18 to 1704
T	-300 to 700	-184 to 371
T (low)	-200 to 500	-129 to 260
W5W26	0	-18 to 2316
W5W26 (low)	0 to 2240	-18 to 1227
RTD (IEC) ALPHA = 0.00385		
100 Ohms	-300 to 1200	-184 to 649
100 Ohms (low)	0 to 300	-18 to 149
500 Ohms	-300 to 1200	-184 to 649
Radiamatic RH	1400 to 3400	760 to 1871
Linear**		
Milliamps	4 to 20 mA	
Millivolts	0 to 10 mV	
	10 to 50 mV	
Volts	1 to 5V	
	0 to 10V	

*May require field calibration to achieve rated accuracy below 1000° F for type B and below -200° F for type E thermocouple.

**Not available on FM approved Limit models.

Figure 3—Model Selection Guide



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Offered By:

Power Equipment Company
2011 Williamsburg Road
Richmond, Virginia 23231
Phone (804) 236-3800
Fax (804) 236-3882

www.peconet.com