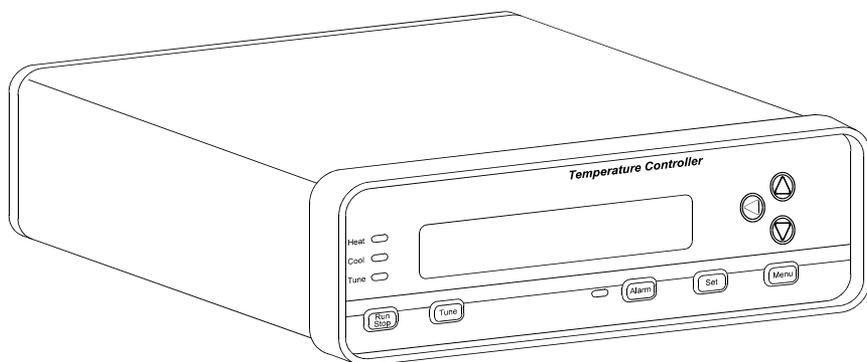


OPERATING MANUAL

TEMPERATURE CONTROLLER (STANDARD MODEL)

89000-00

89000-05



Cole-Parmer Instrument Co.

625 E. Bunker Court
Vernon Hills, Illinois U.S.A. 60061-1844

(847) 549-7600

(847) 247-2929 (Fax)

800-323-4340

www.coleparmer.com

e-mail: techinfo@coleparmer.com

A-1299-0611

Edition 03

68X329502 r. 0 01/03

EU Declaration of Conformity

Name of Apparatus: DIGI-SENSE® Temperature Controller

Model Number: 89000-05

Description of Apparatus: Standard Process Temperature Controller, 10A output.

Barnant Company declares that the above model is in conformity to the following harmonized standards and directives:

Applicable Directives	Applicable Specifications	Manufacturer's Report Number
73/23/EEC 93/68/EEC	EN61010-1/A2:1995 EN61010-2-010:1995	TR9755
89/336/EEC 92/31/EEC 93/68/EEC	EN61326-1/A1:1998	TR9756

The last two digits of the year in which the current configuration of the above model was assessed per the Low Voltage Directive is: 00.

Manufacturer: Barnant Company Division
Cole-Parmer Instrument Company
28W092 Commercial Avenue
Barrington, IL 60010-2392
USA
Tel: 847-381-7050

Manufacturer's Signature:



James W. Doll
Vice President, Engineering

3 October, 2000

Date

TABLE OF CONTENTS

Title	Page
SAFETY PRECAUTIONS	1
INTRODUCTION	2
APPLICATION DATA	3
DESCRIPTION	3
GENERAL	3
CONTROL PANEL DESCRIPTION	4
Vacuum Fluorescent Readout	4
UP, DOWN, LEFT Arrows	4
MENU Key	4
SET Key	5
ALARM Key	5
TUNE Key	5
RUN/STOP Key	5
HEAT, COOL, TUNE LED Annunciators	5
How To Use This Product	5
INSTALLATION	6
INITIAL HARDWARE SETUP	6
SETUP PROCEDURE	8
Thermocouple	8
Temperature Scale	9
Alarm Selections	9
HI Alarm	10
LO Alarm	11
HILO Alarm	11
Alarm Hysteresis	12
Audible Alarms	13
Advanced Set-Up	13
Sensor Calibrate	13
Over Temp Stop	14
Loop Break Stop	14
Control Action	15
Control Mode	15
Control Mode On/Off	16
PID - Proportional Band, Integral and Derivative	16
AUTO Tune	16
Proportional Band	17
Integral Time	17
Derivative Rate	18

TABLE OF CONTENTS (Continued)

Title	Page
Cycle Time	18
Run Time.....	18
Power Up Control	19
OPERATION	20
RUN MODE	20
TROUBLESHOOTING AND MAINTENANCE	21
TROUBLESHOOTING	21
CALIBRATION	21
MAINTENANCE/CLEANING	21
SPECIFICATIONS	22
INPUTS	23
OUTPUTS	23
WARRANTY	24
PRODUCT RETURN.....	24
TECHNICAL ASSISTANCE	24
APPENDIX A - SETUP MODE	A-1
APPENDIX B - ERROR MESSAGES/CORRECTIVE ACTION	B-1
ACCESSORIES	BACK PAGE

SAFETY PRECAUTIONS

DANGER: *There are no user-serviceable parts in this instrument. Do not remove cover, as high voltages exist inside the unit. Refer servicing to your dealer.*



DANGER: *If thermocouples are at a high voltage, this voltage will be present at other points inside the unit.*



DANGER: *For continued fire protection, replace fuse only with a fuse of the specified current, voltage, and type. Remove power cord from wall socket before checking or replacing a fuse. High voltages exist on fuse terminals.*



WARNING: *To avoid electric shock, the power cord protective grounding conductor must be connected to earth-ground.*



WARNING: *Install an independent temperature limit control protection system where a fault condition could result in fire or other hazard. Failure to install such a system could result in injury to personnel or damage to property.*



INTRODUCTION

This manual provides information for installing and operating the Temperature Controller (standard model).

Refer to Figure 1 for a view of the front panel of the Temperature Controller. Refer to Figures 2 and 3 for a view of the back panels of the 115 or 230 V versions.

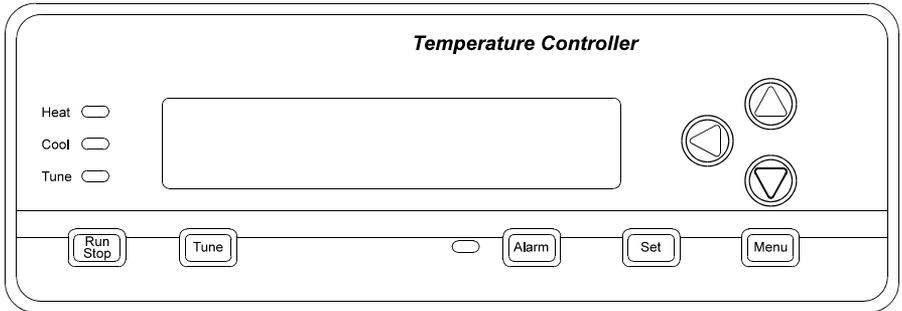


FIGURE 1. TEMPERATURE CONTROLLER

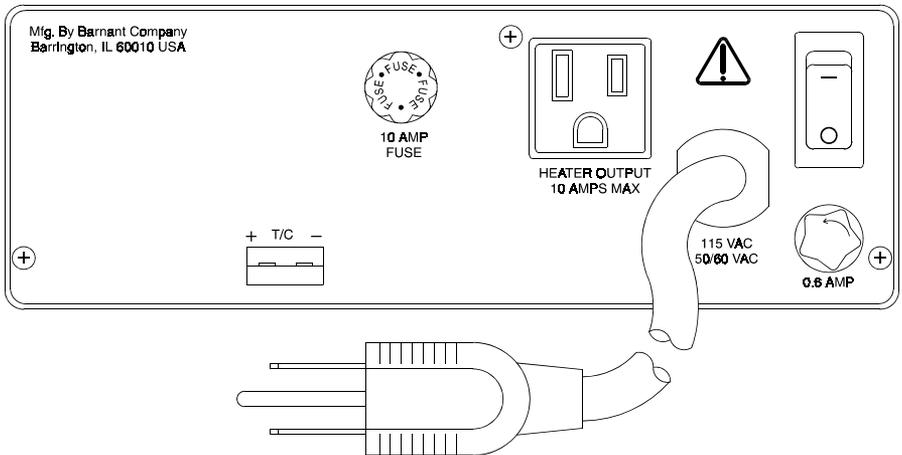


FIGURE 2. TEMPERATURE CONTROLLER, BACK PANEL (115 V MODEL)

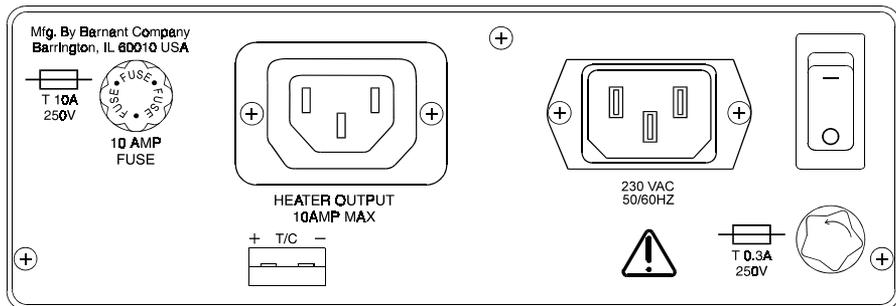


FIGURE 3. TEMPERATURE CONTROLLER, BACK PANEL
(230 V MODEL)

APPLICATION DATA

Applications for the Temperature Controller include heating and cooling of solids, liquids, and gases. For all applications, there are certain set-up operations that should be made carefully to assure optimum and safe performance. The power and type of heater, the positioning of the sensor, the amount of thermal insulation, the flash point of the heated material and the many controller set-up menu options are among the many variables to be considered in setting up the controller.

One of the most important of these considerations is the heater sizing. A heater that is too low powered may not be able to raise or even maintain the material at the desired set point. A heater that is too high powered will not maintain precise temperature control and may be unsafe. Because of the many system variables, optimum heater sizing must be determined experimentally; however, an approximation can be made through a few calculations. These calculations are included in a software program available from your dealer.

DESCRIPTION

GENERAL

The Temperature Controller is designed to maintain a constant, pre-set process temperature. It uses a temperature sensor to detect the temperature of the process. Using a microprocessor software algorithm, it adjusts a heater or cooler by varying the output duty cycle. The Temperature Controller is a single-loop controller intended for laboratory or industrial applications. The unit can control loads of up to 10 amperes (A).

The Temperature Controller is housed in a rectangular metal enclosure, with plastic bezels on the front and back. All connections are made on the rear of the unit. The display and keypad are on the front. A bail bar, or tilt stand, is used to elevate the front display panel for easy viewing and operation. The unit can also be mounted in a panel with the use of an optional panel mount

kit. A two-line, 16-character, 14-segment vacuum fluorescent display is used for display of operating, setup, and alarm parameters.

A number of accessories can be used with this Temperature Controller, including various types of temperature sensors, heating units, cooling units (such as fans or pumps), remote alarms, and recorders.

CONTROL PANEL DESCRIPTION

Refer to Figure 4 and the following paragraphs.

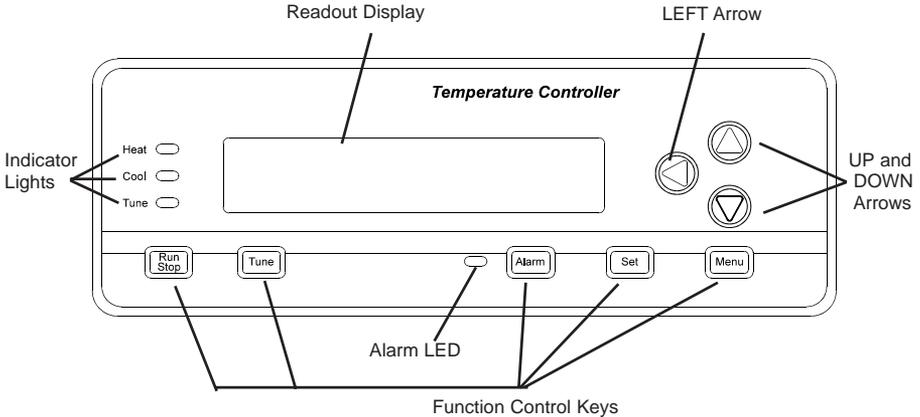


FIGURE 4. FRONT PANEL DISPLAYS

Vacuum Fluorescent Readout

The vacuum fluorescent readout displays operation and setup parameters. Alarm conditions are also displayed.

UP, DOWN, LEFT Arrows

The UP and DOWN arrow keys will increment or decrement the current values of displayed (blinking) numerals or enable you to scroll through a list where multiple-choice parameters are offered. The LEFT arrow key allows you to change numeric settings by moving the blinking cursor left to the next most significant digit. When you have reached the most significant digit (furthest left), the LEFT arrow key will move the flashing cursor back to the least significant digit (furthest right).

MENU Key

The MENU key allows you to access all of the user-configurable setup parameters of the temperature controller. Pressing the MENU key will scroll through the parameter options, using the arrow keys to change those parameters. Refer to the **Setup Procedure** section for additional information on each parameter.

SET Key

The SET key allows you to change the control setpoint (SP), using the arrow keys. Pressing the SET key again will exit the setpoint mode.

ALARM Key

The ALARM key enables you to acknowledge temperature control alarm conditions and silence the audible alarm. Pressing the ALARM key will erase any alarm messages on the display and stop the ALARM from flashing. If the alarm condition is still present, the ALARM LED will remain on until the PV (process variable) is out of the alarm condition.

Refer to **Setup Procedures** for additional information on setting the appropriate alarms.

TUNE Key

The TUNE key will start an AUTO tune cycle. Heat (or cooling) is automatically applied to determine PID values. AUTO tuning must be enabled in the setup mode for this key to function. Refer to the **AUTO Tuning** section for additional information on this setting.

NOTE: When the TUNE key is pressed, the output is turned full on three times for a period of time and overshoot of the setpoint will occur. Do not use the AUTO tune feature if this would have an adverse affect on your process.

RUN/STOP Key

Pressing this key when the Temperature Controller is stopped will start the control process and activate the load, if required. Pressing this key when the Temperature Controller is running will cause it to stop.

HEAT, COOL, TUNE LED Annunciators

These three indicators will light to indicate Temperature Controller functions. The green HEAT light will turn on when power is being applied to the heater output. The green COOL light will turn on when the Temperature Controller is in the cooling mode and power is applied to the cooler output. The yellow TUNE light will turn on when the Temperature Controller is in the AUTO tuning mode.

How to Use this Product

Here is a summary of the steps required to setup and operate the Temperature Controller.

1. Install the unit.
 - Setup your process.
 - Plug the Controller power cord to an AC outlet, turn unit on.
 - Plug the heater (or cooler) into the Controller rear panel and install in your process.
 - Connect a thermocouple sensor to the rear panel and install in your process.

2. Setup the operating parameters. Press MENU and follow the interactive setup selections. If your setup is the same as the factory set defaults, this step is not necessary. However, each of the setup options should be checked for desired or proper setting.

Set sensor type that was connected.

Select temperature scale.

Set alarms, if desired.

Calibrate system, if better accuracy is desired.

Set safety stops (over temperature and loop break).

Select control action and mode desired (PID or on/off).

Set max. run time.

3. Set the run temperature and begin controlling.

Press the SET key and enter the desired setpoint temperature.

Press TUNE if autotune is selected in setup and you want to automatically determine the PID settings.

Press the RUN/STOP key to begin temperature control.

The setpoint (SP) temperature and the actual temperature (or process variable, PV) are displayed.

Press ALARM to acknowledge an alarm condition.

INSTALLATION

INITIAL HARDWARE SETUP

1. Remove controller from packaging. Keep all packing material until proper operation has been verified.
2. Use the "bail" bar (or tilt-stand) at the bottom of the unit to adjust position for easy viewing of front panel.

WARNING: *To avoid electric shock, the power cord protective grounding conductor must be connected to earth-ground.*



WARNING: *Install an independent temperature limit control protection system where a fault condition could result in fire or other hazard. Failure to install such a system could result in injury to personnel or damage to property.*



3. Plug the unit in to a correctly rated AC outlet and turn on the power using the ON/OFF switch on the back panel. Refer to Figure 5.

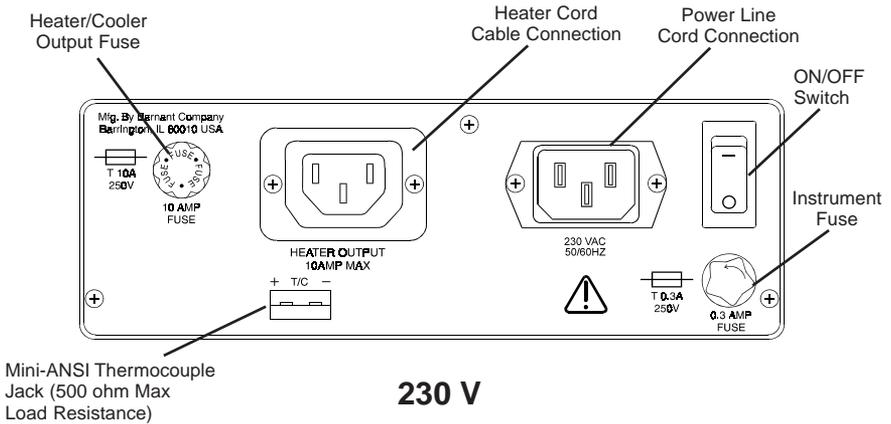
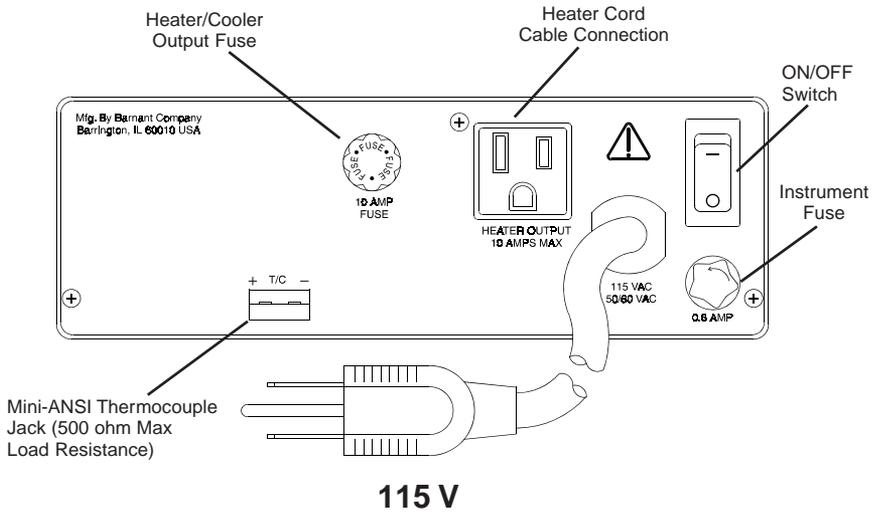


FIGURE 5. BACK PANEL VIEWS (115 V AND 230 V)

4. Connect one of the eight types of thermocouples to the unit.
5. Connect the heater or cooler (maximum of 10 A) to the unit.

SETUP PROCEDURE

- NOTES:**
- At any time during the setup procedure, you may return to the previous screen by pressing and holding down the LEFT arrow key and then pressing the MENU key.
 - For experienced operators, a flow chart may be used for set-up and operation. Refer to **Appendix A**.
 - The setup mode can only be entered when the temperature controller is stopped.
- Set the ON/OFF switch on the rear panel to ON. The LEDs will light and all segments will light temporarily as a check of the display.
 - After the diagnostics are complete, the Temperature Controller will display the unit identification screen (refer to Figure 6).



FIGURE 6. UNIT IDENTIFICATION SCREEN

This screen will be displayed for a few seconds. The unit will automatically progress to the RUN screen.

- Press MENU once to begin the set up process.

Thermocouple

- To select a thermocouple type, press the MENU key (refer to Figure 7).
- The screen will display the last thermocouple selected. To choose another thermocouple type, press the DOWN arrow key to move forward or, if passing a desired selection, the UP arrow key to move backward. Thermocouple selections include: K, J, E, B, T, S, R, and N.
- Select the thermocouple type by pressing the MENU key. To ensure proper operation, be sure that the correct thermocouple type is connected at the thermocouple jack before running the controller.

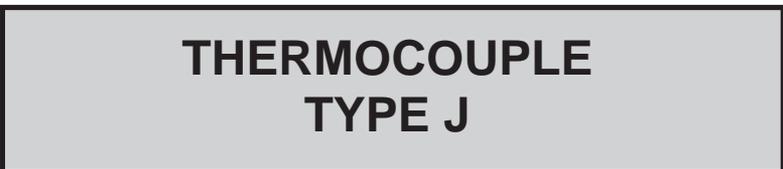


FIGURE 7. THERMOCOUPLE SELECTION SCREEN

Temperature Scale

1. After pressing the MENU key in the THERMOCOUPLE screen, the setup will progress to the Temperature Scale selection. The Temperature scale selection has five temperature scales from which to choose: Celsius (°C), Fahrenheit (°F), Reaumur (°R), Rankine (°R), or Kelvin (K). Refer to Figure 8.
2. Press the DOWN arrow key to switch to a desired temperature scale. Press the MENU key to select the appropriate scale.



FIGURE 8. TEMPERATURE SCALE SELECTION SCREEN

Alarm Selections

1. Alarms will activate only when the temperature controller is in the RUN mode. When an alarm occurs, the alarm LED will flash, the audible alarm will sound intermittently and the display will flash the type of alarm. There are two possible alarm setpoints selections: ON or OFF. Refer to Figure 9.
2. To go to the Alarm Setpoints Off Screen, press the DOWN arrow key.



FIGURE 9. ALARM SETPOINTS SELECTION SCREEN

3. To select alarm setpoints off, press the MENU key when the ALARM SETPOINTS OFF screen is blinking.
4. After alarm selection, press the MENU key to move on to Alarm Hysteresis. After setting Alarm Hysteresis, press the MENU key again to move on to the Audible Alarm screen.

There are three types of alarms: HI, LO and HILO. Refer to the following paragraphs for more information.

HI Alarm

1. HI Alarm activates the alarm when the PV temperature exceeds the set alarm temperature. Refer to Figure 10. If the Control Action is set to COOL and the PV temperature exceeds the alarm temperature when the RUN key is pressed, the alarm will not be activated. The PV temperature must first fall below the alarm temperature before the high alarm is enabled. This allows for normal system startup in COOL mode without activating the alarm.



FIGURE 10. HI ALARM SCREEN

2. Select the HI ALARM screen by pressing the MENU key. The following screen will appear (refer to Figure 11). Set the Process HI temperature by using the arrow keys.



FIGURE 11. HI ALARM SETTINGS SCREEN

LO Alarm

1. LO Alarm activates the alarm when the PV temperature drops below the alarm temperature. Refer to Figure 12. If the Control Action is set to HEAT and the PV temperature is below the alarm temperature when the RUN Key is pressed, the alarm will not be activated. The PV temperature must first rise above the alarm temperature before the low alarm is enabled. This allows for normal system startup without activating the alarm.



FIGURE 12. LO ALARM MODE SCREEN

2. Select the LO Alarm screen by pressing the MENU key. The following screen will appear (refer to Figure 13). Set the Process LO temperature by using the arrow keys.



FIGURE 13. LO ALARM SETTINGS SCREEN

HILO Alarm

1. HILO Alarm allows both a HI Alarm and LO Alarm to be set. Refer to the HI Alarm and LO Alarm sections for a detailed description of the operation of each alarm. Refer to Figure 14.



FIGURE 14. HILO ALARM SCREEN

2. Select HILO by pressing the MENU key. The following screen will appear (refer to Figure 15). Set the alarm temperatures by using the arrow keys. Once the first alarm value is set, press the LEFT arrow key to adjust for the other alarm variable.



FIGURE 15. HILO SETTINGS SCREEN

Alarm Hysteresis

1. Alarm Hysteresis determines when the alarm is going to be out of the alarm condition. Alarm hysteresis prevents actuation of nuisance, or recurrent, alarms. Hysteresis is either added or subtracted to the alarm point, depending on whether a HI or LO ALARM has been set.

For example: If hysteresis is set at 1 degree and the HI alarm has been set to trigger when the temperature reaches 100 degrees FAHRENHEIT, the alarm will trigger at 100 degrees. As soon as the temperature drops below 99 degrees the alarm condition will terminate.



FIGURE 16. ALARM HYSTERESIS SCREEN

2. Set the hysteresis by using the arrow keys.
3. After selecting values, press the MENU key to continue.

Audible Alarms

Audible Alarm permits the sound of an alarm. It has two options: On or Off. Use the arrow keys to select an option and press the MENU key to advance to the Advanced Setup MENU. Refer to Figure 17.



FIGURE 17. ALARM AUDIBLE SCREEN

Advanced Set-Up

1. After pressing the MENU button, the ENTER ADVANCED SETUP screen will be displayed (refer to Figure 18).
2. The flashing message YES will ask if you want to enter the Advanced Screen. Press the MENU key as the word YES blinks.

NOTE: If a change to that selection is not chosen within 3 seconds, the program will automatically exit the setup mode.



FIGURE 18. ADVANCED SETUP SCREEN

Sensor Calibrate

1. Sensor Calibrate enables the operator to calibrate out sensor error to give a more accurate reading. Refer to Figure 19. Calibration offset and PV (actual) temperatures are displayed.
2. To adjust the values in this option, the operator must know how many degrees off the sensor is. To determine how far off the sensor is, measure it against a secondary gauge known to be accurate.
3. Once the value is known, adjust the CAL offset value on the screen using the arrow keys until the displayed temperature matches the known temperature. Press the MENU key to advance to the Over temp screen. (Refer to Figure 20.)

**SENSOR OFFSET
CAL ±XX.X XXX.X °F**

FIGURE 19. SENSOR OFFSET CAL

NOTE: Calibration can also be done using an ice bath or boiling water and adjusting the offset until 32.0 °F or 212 °F is displayed.

Over Temp Stop

1. Over temp stop temperature, a safety feature, is added to the setpoint (SP) temperature. If the PV temperature exceeds this amount, the temperature controller will stop. Over temp stop does not operate if the COOL control action is selected. Refer to Figure 20.

**OVER TEMP. STOP
XX °F ABOVE SP**

FIGURE 20. OVERTEMP SCREEN

2. To change the Overtemp value, use the arrow keys. After the value has been set, press the MENU key to advance to the Loop Break Stop Screen.

Loop Break Stop

Loop break stop, a safety feature, is designed to stop the temperature controller if the heater output is on for the amount of time set in Loop Break Stop and the PV temperature does not increase more than 1.0 °F. If the COOL control action is selected, it is stopped if the PV temperature does not decrease more than 1.0°F. Refer to Figure 21.

**LOOP BREAK STOP
XXX.X MINUTES**

FIGURE 21. LOOP BREAK STOP SCREEN

Loop break stop is designed to terminate the process currently running if the process is interrupted for a preset period of time. The loop break stop senses that nothing is happening in the process and turns the process off.

Enter an elapsed time using the UP and DOWN arrow keys. For slow systems, a longer time should be entered.

Control Action

1. The Control Action screen allows selection of the type of process that will be performed; either HEAT or COOL. Refer to Figure 22. In the heat mode, the output is on when the actual temperature is below the setpoint temperature (inverse action). In the cool mode, the output is on when the actual temperature is above the setpoint temperature (direct action).



FIGURE 22. CONTROL ACTION SCREEN

2. The default setting is HEAT. Use the DOWN arrow key to select either heat or cool actions. Press the MENU key to enter your selection.

Control Mode

1. The Control screen has two options: PID (proportional band, integral and derivative), and ON/OFF. Refer to Figure 23.



FIGURE 23. CONTROL SCREEN

2. Select one of these options using the arrow keys. When the desired option appears on the screen, press the MENU key. Refer to the PID procedural paragraphs, following, for additional information.

Control Mode On/Off

1. The Control Mode On/Off turns off the output when the actual temperature exceeds the setpoint (heat control action). The output will turn on when the actual temperature falls below the setpoint temperature minus the hysteresis temperature. Refer to Figure 24.



FIGURE 24. ON/OFF CONTROL HYSTERESIS SCREEN

2. Adjust the hysteresis value on this screen using the arrow keys.
3. Press the MENU key to advance to the RUN TIME Screen.

PID - Proportional Band, Integral and Derivative

PID is the means of selecting the response speed or sensitivity of a proportioned controller to achieve stability in the system. It should be used when system stability or accuracy requirements are too great for use of on/off control.

AUTO Tune

1. After selecting the PID screen the next screen to appear will be AUTO TUNE. Refer to Figure 25. Two choices are available for this selection: AUTO TUNE ENABLED and AUTO TUNE DISABLED. The recommended choice for this screen is AUTO TUNE ENABLED.

The default setting is ENABLED. Use the DOWN arrow key to select either enabled or disabled. Press the MENU key to enter your selection.

NOTE: When AUTO TUNE DISABLED is selected, auto tuning cannot be initiated using the TUNE key on the front panel.



FIGURE 25. AUTO TUNE SCREEN

2. Select an option using the arrow keys.
3. If AUTO TUNE ENABLED is selected, press the MENU key four times to advance past the PID setup to the Cycle Time screen.

NOTE: AUTO TUNE DISABLED is also a safety feature to prevent accidental auto tuning.

Proportional Band

1. Select the proportional band by pressing the MENU key. The following screen will appear (refer to Figure 26).
2. Use the arrow keys to enter the correct value and press the MENU key.

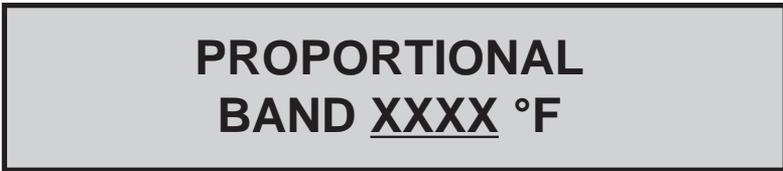


FIGURE 26. PROPORTIONAL BAND SCREEN

Integral Time

1. Integral time, measured in seconds per repeat, is tuned to correct for the droop (difference between setpoint and steady state actual temperatures) that is caused by the proportional output. Refer to Figure 27.
2. Use the arrow keys to enter the correct value and press the MENU key.



FIGURE 27. INTEGRAL SCREEN

Derivative Rate

1. The derivative rate reduces or eliminates overshoot. Refer to Figure 28. It is measured in seconds and must be tuned to work with the overall system cycle time.



FIGURE 28. DERIVATIVE SCREEN

2. Use the arrow keys to enter the correct value and press the MENU key.

Cycle Time

Cycle time is the rate at which the output is cycled or changed. The manufacturer's recommended cycle time is 1 second. If using a mechanical relay in the process, it is recommended to increase the cycle time to reduce the number of cycles a relay would have to endure. Refer to Figure 29.



FIGURE 29. CYCLE TIME SCREEN

1. Use the DOWN arrow key to increment the time period desired.
2. Press the MENU key to advance to the Run Time screen.

Run Time

Run Time is a safety feature that sets the Temperature Controller operating time. When the set value is reached, the output is turned off. To disable this feature, select CONTINUOUS by entering a run time of HR00 MIN00. Refer to Figure 30.



FIGURE 30. RUN TIME SCREEN

1. Use the DOWN arrow key to increment the time period desired.
2. Press the MENU key to enter your selection.

Power Up Control

This set up option allows you to specify one of two conditions for the temperature controller at turn on. Power Up Control has two options: Last State and Stopped. Refer to Figure 31.



FIGURE 31. POWER UP CONTROL SCREEN

The two selections are designed primarily to function in the event of a power failure. If a power outage occurs, Last State will start the process from where it last ended when the power went out, stopped will leave the process off. When a run time has been entered it will always power-up in the STOPPED mode.

1. Use the arrow keys to select one of the options and press the MENU key to advance to the ADVANCED SET UP COMPLETE screen.
2. Once at this screen, the unit will automatically default to a message screen which says SAVING SETUP. Setup is complete, and the operation screen will be displayed.

OPERATION

Once installation and setup are complete, press the RUN/STOP key to begin operation. The following screen will appear (refer to Figure 32) if a previous run was stopped before it completed.



FIGURE 32. RUN SCREEN

Select either CONTINUE or RESTART using the arrow keys and then press RUN/STOP key. CONTINUE will start a run with the time remaining from the previous run. RESTART will reset the run time and start a new run. The information displayed during the RUN mode will depend on the setup options selected. General display functions for each mode are shown below. Depending on the ALARM options set, alarm conditions will be displayed and alarms will sound.

RUN MODE

If you selected a run time during setup, the following screen will appear when running. Refer to Figure 33. Press SET to enter desired setpoint temperature.



FIGURE 33. DISPLAY OF PROCESS VARIABLES/SETPOINT IN RUN MODE - ON

The display shows the PV (process variable), the SP (setpoint), and the time remaining. Time remaining will not appear if CONTINUOUS is selected for RUN TIME.

TROUBLESHOOTING AND MAINTENANCE

DANGER: *There are no user-serviceable parts in this instrument. Do not remove cover, as high voltages exist inside the unit. Refer servicing to your dealer.*



DANGER: *If thermocouples are at a high voltage, this voltage will be present at other points inside the unit.*



TROUBLESHOOTING

If the heater output does not function correctly, check the fuse located on the rear of the unit left of the heater output receptacle. The fuse is rated at 10 A. Replace it with a fuse having identical voltage and current ratings.

DANGER: *For continued fire protection, replace fuse only with a fuse of the specified current, voltage, and type. Remove power cord from wall socket before checking or replacing a fuse. High voltages exist on fuse terminals.*



If the unit does not have power, check the fuse located below the ON/OFF switch. The fuse is rated at 0.3 A for 115 V applications and 0.6 A for 230 V applications. Replace this fuse with a fuse having identical voltage and current ratings.

CALIBRATION

System calibration is described in the setup portion of this manual. Instrument calibration is completed at the factory. No user calibration is required to meet stated specifications.

MAINTENANCE/CLEANING

Maintenance is limited to fuse replacement. All materials withstand standard cleaning solvents.

SPECIFICATIONS

Display: Two lines of 16 characters. Four-digit process value. Four-digit setpoint value.

Accuracy:

Type J,K,T,E and N

above -100°C (-148°F): $\pm 0.1\%$ reading, $\pm 0.4^{\circ}\text{C}$ ($\pm 0.7^{\circ}\text{F}$)

below -100°C (-148°F): $\pm 0.1\%$ reading, $\pm 1^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$)

Type R,S and B

$\pm 0.1\%$ reading, $\pm 1^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$)

Resolution: 0.1° auto-ranging to 1° above 999.9

Environment:

Temperature, Operating: 0 to 40°C

Temperature, Storage: -20 to 70°C

Temperature, Specification: 18 to 28°C

Humidity: 10 to 90% RH (non-condensing)

Altitude: less than 2000 m

Pollution Degree: Pollution degree 2 per IEC 664
(Indoor Usage—lab, office)

Warm-Up time: 10 minutes

Construction:

Dimensions: W:7.3 in H:3.7 in D:10.0 in

Weight: 5.3 lbs.

Enclosure: IP52 per IEC 529

Compliance:

115V and 230V: UL 916

230V (For CE mark): EN61010-1/A2:1995 and

EN61010-2-010:1995

(EU Low Voltage Directive) and

EN61326-1/A1:1998

(EU EMC Directive)

SPECIFICATIONS (Continued)

Sensor Input Range/Accuracy:

Thermocouples		Range	
Type	E:	-200 to 1000°C	(-328 to 1832°F)
	J:	-190 to 1000°C	(-310 to 1832°F)
	K:	-200 to 1372°C	(-328 to 2502°F)
	N:	-200 to 1300°C	(-328 to 2372°F)
	T:	-200 to 400°C	(-328 to 752°F)
	B:	200 to 1800°C	(392 to 3272°F)
	R:	0 to 1768°C	(32 to 3214°F)
	S:	0 to 1768°C	(32 to 3214°F)

INPUTS

AC Line Input

	115V Model	230V Model
Input:	115V AC $\pm 15\%$, 49/61 Hz 10A Max	230V AC $\pm 15\%$, 49/61 Hz 10A Max
Connector:	Standard Line Cord	IEC 320 C-20 Inlet
Fuse:	0.630A/230V (T) 5x20mm	0.315A/230V (T) 5x20 mm

Installation Category: Category II per IEC664
(Local level — appliances, portable equipment, etc.)

Thermocouple Probe Input

Connector:	Mini-ANSI flat blade thermocouple jack
Calibration:	ITS-90 (NIST monograph 175)
Lead resistance:	500 Ohm max
Common mode voltage:	5 Volts max

OUTPUTS

AC Line Input

	115V Model	230V Model
Output:	115V AC typical, 10A max	230V AC typical, 10A max
Connector:	NEMA 5-15R	Reverse IEC 320
Fuse:	10A/230V 3AG Slo-Blo	10A/230V 3AG Slo-Blo

WARRANTY

Cole-Parmer Instrument Co. supplies this product with a ONE-YEAR warranty to be free from significant deviations from published specifications. If repair or adjustment is necessary within the warranty period, the problem will be corrected at no charge if it is not due to misuse or abuse on your part as determined by Cole-Parmer Instrument Co. Repair costs outside the warranty period, or those resulting from product misuse or abuse, may be invoiced to you.

PRODUCT RETURN

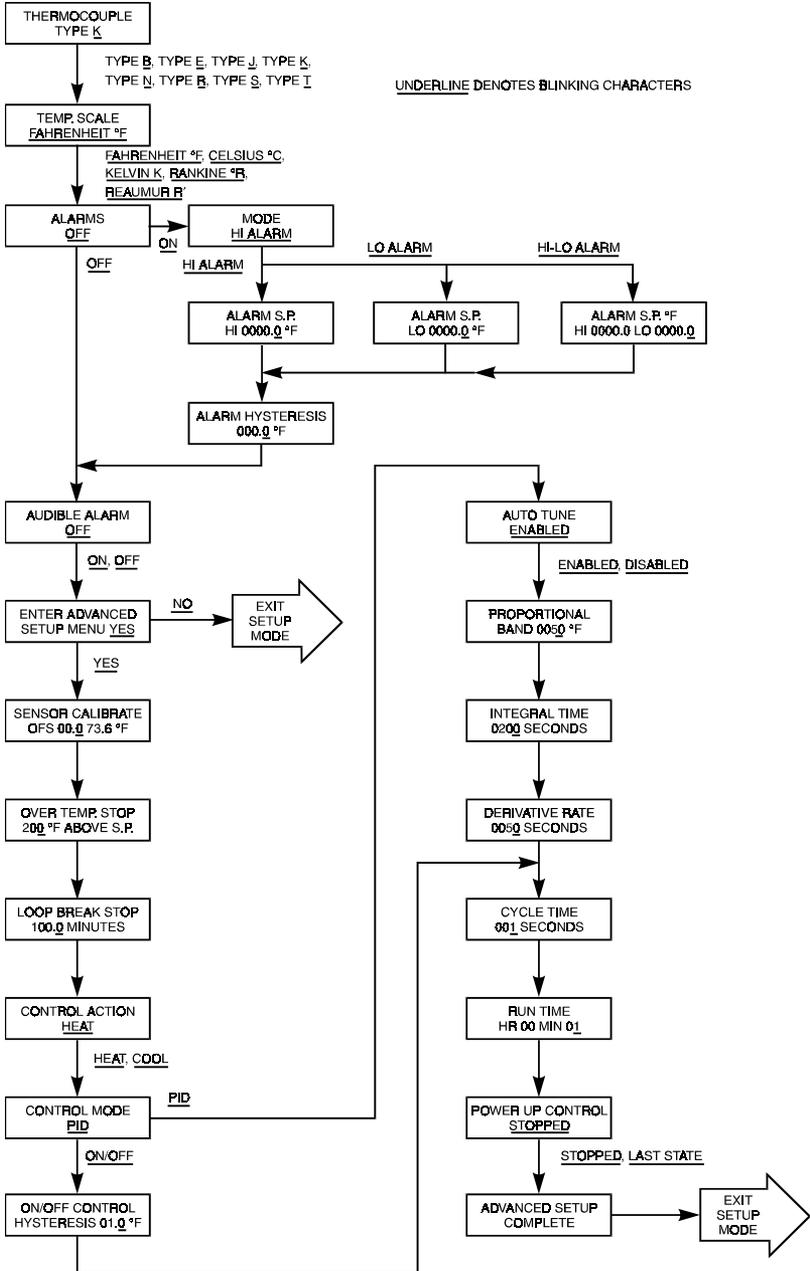
To limit charges and delays, contact the seller or Manufacturer for authorization and shipping instructions before returning the product, either within or outside of the warranty period. When returning the product, please state the reason for the return. For your protection, pack the product carefully and insure it against possible damage or loss. Any damages resulting from improper packaging are your responsibility.

TECHNICAL ASSISTANCE

If you have any questions about the use of this product, contact the Manufacturer or authorized seller.

APPENDIX A

EN 400 Temperature Controller - Setup Mode for Standard Model



APPENDIX B

The following is a list of error messages that may be displayed by the Temperature Controller and a description of corrective action.

Upper Display	Lower Display	Action
normal	OVER TEMP STOP	PV exceeded OVER TEMP STOP setting in user setup.
normal	LOOP BREAK STOP	No change in PV with output on for user settable time period. Adjust LOOP BREAK STOP in user setup.
normal	OPEN PROBE STOP	Detected open probe sensor while running. Check probe.
normal	OVER PROBE STOP	PV exceeded the upper limit of selected probe type.
normal	UNDER PROBE STOP	PV went below lower limit of selected probe type.
NO OUTPUT POWER	CHECK 10 A FUSE	No AC voltage detected at the heater output. Check the heater/cooler output fuse. If fuse is OK, return unit for service.
INTERNAL ERROR #	SERVICE REQUIRED	Return unit to your dealer.

Temperature Controller Accessories

COLE-PARMER STANDARD MODELS

89000-00 115V

89000-05 230V

Catalog #	MODEL	DESCRIPTION
89000-50	All models	Panel Mount Kit
89000-98	All models	Heater Sizing Software
50001-78	230V only	Input Cord - IEC320/NEMA 6-15P
89000-94	230V only	Heater Output Connector, IEC 10A