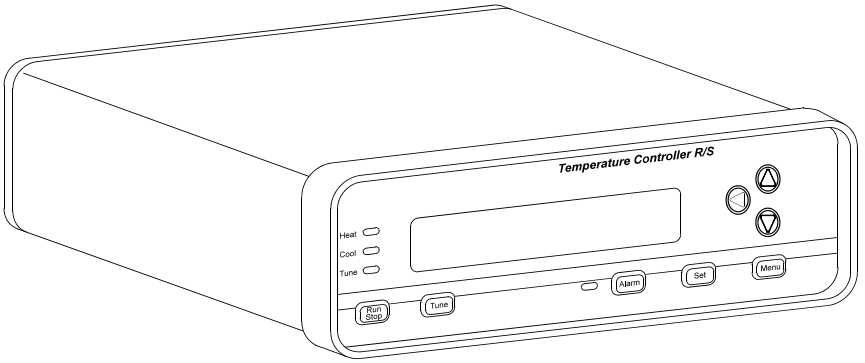
Digi–Sense®

INSTRUCTION MANUAL

Temperature Controller R/S (Advanced Model) 68900-11 68900-13



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68X329503 Rev 1 04/04

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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 R/S (advanced model).

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

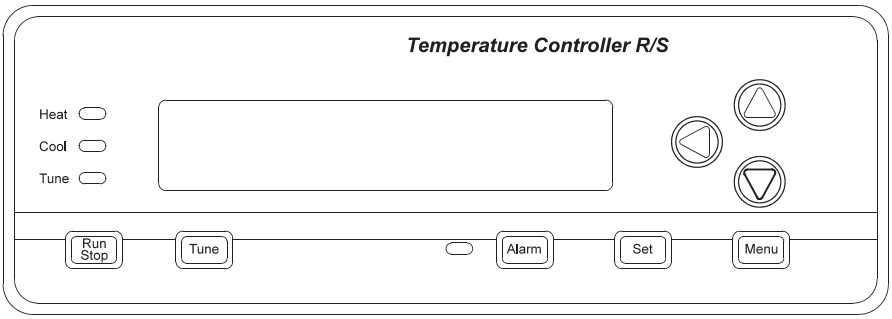


FIGURE 1. TEMPERATURE CONTROLLER R/S

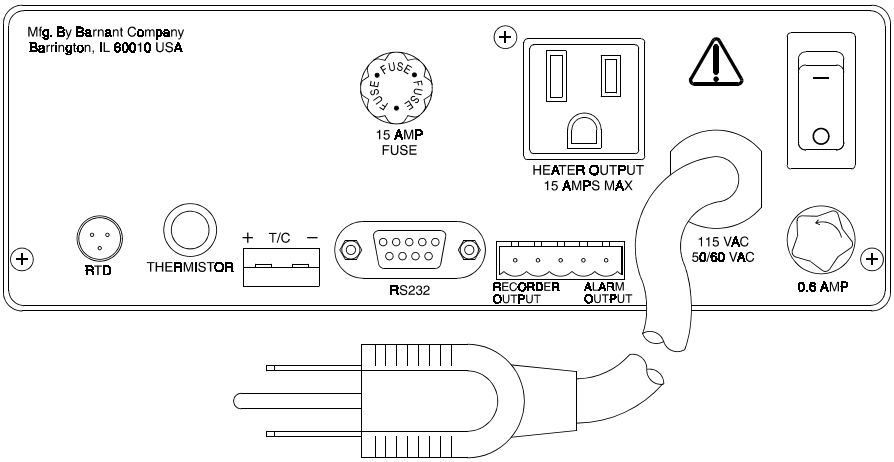


FIGURE 2. TEMPERATURE CONTROLLER R/S, BACK PANEL (115 V MODEL)

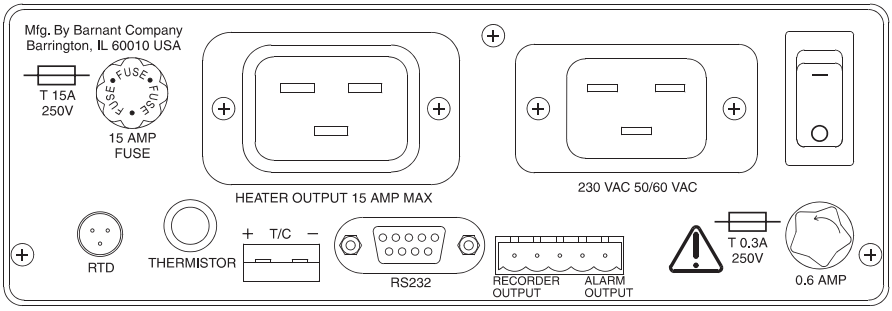


FIGURE 3. TEMPERATURE CONTROLLER R/S, BACK PANEL (230 V MODEL)

APPLICATION DATA

Applications for the Temperature Controller R/S 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 the software program included with the unit.

DESCRIPTION

GENERAL

The Temperature Controller R/S 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 R/S is a single-loop controller intended for laboratory or industrial applications. The unit can control loads of up to 15 amperes (A).

The Temperature Controller R/S 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 opera-

tion. 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 deluxe model of the Temperature Controller, including various types of temperature sensors, heating units, cooling units (such as fans or pumps), remote alarms, and recorders.

One of several additional R/S model features (not available in the standard models) is “Ramp and Soak,” which uses a timed sequence pre-set user temperature set points.

The unit also has RS-232-C Serial Communications, so that it can be set up and controlled by a computer. An IBM®-compatible PC (personal computer) disk is included with the R/S controller, along with a separate operator's manual. It can be used to set up the controller and perform logging and other functions. For advanced users, a serial communications specification is included on disk for customized programming.

CONTROL PANEL DESCRIPTION

Refer to Figure 4 and the following paragraphs.

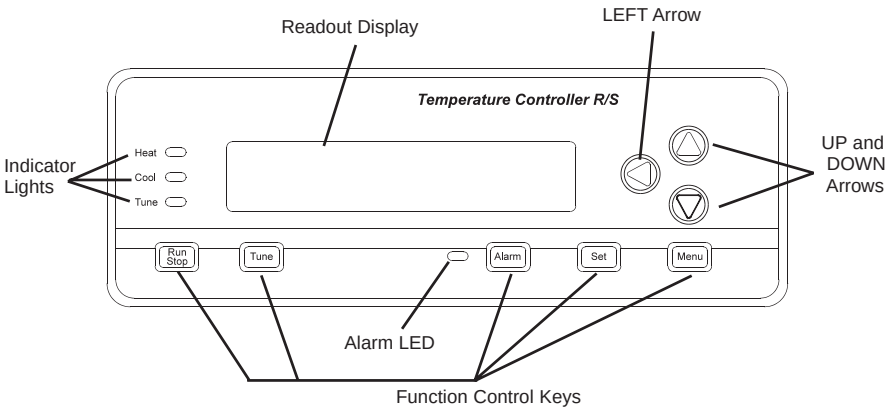


FIGURE 4. FRONT PANEL DISPLAYS

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 default 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 Procedures** 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. In the Ramp and Soak mode, the SET key will toggle the display between setpoint and run time remaining. Refer to the **Operation** section for additional information on changing the setpoint.

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. If manual Reset mode is selected in setup, the **ALARM** key will also de-energize the alarm relay.

Refer to **Setup Procedures** section 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 R/S.

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 sensor to the rear panel (thermocouple, RTD or thermistor) and install in your process.

   Optional installation connections:

   Connect a recorder to the recorder contacts on the rear panel.
   Connect an external alarm to the alarm output connection on the rear panel.
   Connect a serial cable between the Controller RS232 connector and a PC and follow the instructions for setup in the separate PC program operator manual.

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, on/off or Ramp/Soak).
   Setup recorder output temperatures, if a recorder is connected.
   Set baud rate for serial connection, if a PC is connected.

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

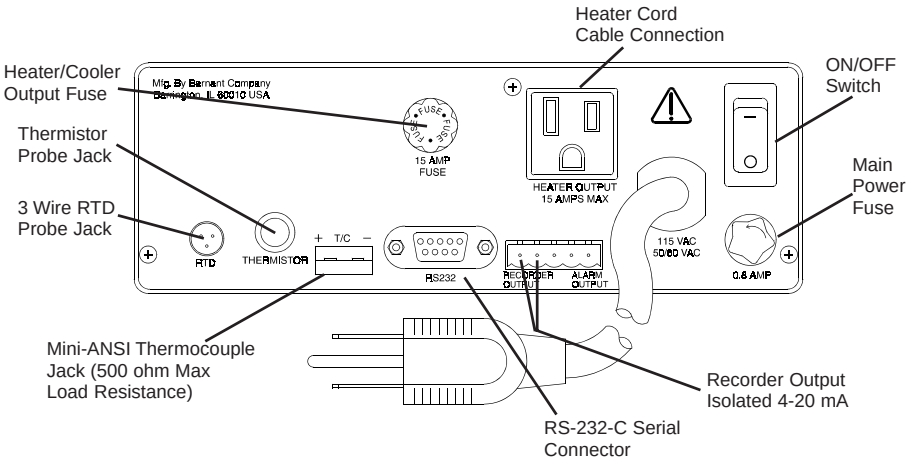
INITIAL HARDWARE SETUP

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.

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

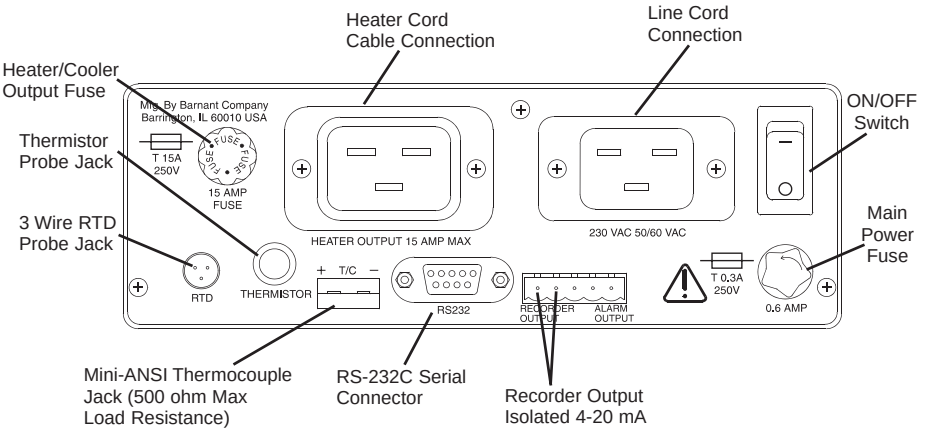
Caution: ***Install an independent temperature limit control protection system where a fault condition could result in fire or other hazard. Failure to install such a system could result in injury to personnel or damage to property.***

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.



115 V

FIGURE 5. 115 V BACK PANEL



230 V

FIGURE 5. 230 V BACK PANEL

4. Connect one of the three types of sensors to the unit (refer to **Accessories** section for a listing of compatible probes).
5. Connect the heater or cooler (maximum of 15 A) to the unit.
6. Install the PC (personal computer) cable to the RS-232-C serial communications terminal, if desired. Refer to your PC hardware guide for PC connections.
7. The following charts show the required connections for interfacing to an IBM-compatible computer with either a 9-pin or 25-pin plug. The cables listed in the Accessories section are properly wired for use.

Temperature Controller DB-9	Computer DB-9	Computer DB-25
Pin 2	Pin 3	Pin 2
Pin 3	Pin 2	Pin 3
Pin 5	Pin 5	Pin 7

RS-232-C Connection Chart

NOTE: The serial data format is full duplex, 1 start bit, 8 data bits, no parity, and 1 stop bit. The baud rate is user-selected.

8. Recorder output and alarm output devices may be installed on the temperature controller (refer to Figure 5). The 4/20mA recorder output is designed for a left positive (+) and a right negative (-) connection. Alarm output is designed for a left–NO (normally open), center–COM (common), and right–NC (normally closed) connector.

SETUP PROCEDURE

NOTES:
a. 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.
b. For experienced operators, a flow chart may be used for setup. Refer to **Appendix A**.
c. The setup mode can only be entered when the Temperature Controller is stopped.

1. 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.
2. 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.

3. Press MENU once to begin the setup process.

Sensor Types

1. To select a sensor type, press the DOWN arrow key. The following screen will appear, with the default, or last selected, sensor indicated (refer to Figure 7).

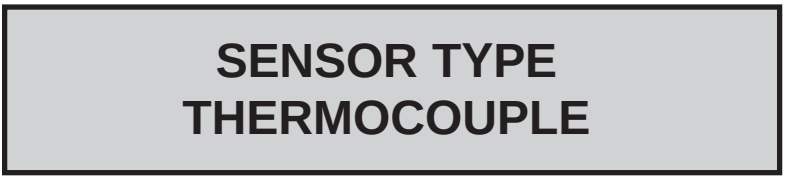


FIGURE 7. SENSOR TYPE SELECTION SCREEN

2. Press the DOWN arrow key to select one of the three sensor types, which are described as follows:

Thermocouple

1. To select a thermocouple type, press the MENU key (refer to Figure 8).
2. The screen will display the last thermocouple selected. To chose 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.
3. 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 program.

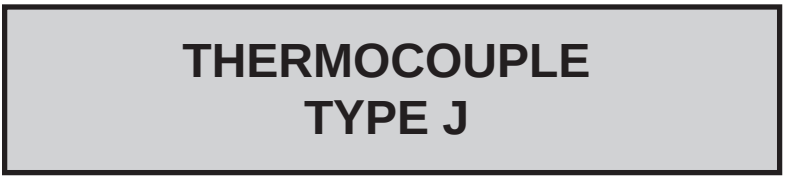


FIGURE 8. THERMOCOUPLE SELECTION SCREEN

Thermistor

1. The second sensor type available is the thermistor. Press the MENU key at the SENSOR TYPE - THERMISTOR screen to display the following screen (refer to Figure 9).
2. Use the UP or DOWN arrow key to chose either YSI 400 or YSI 700 thermistors.
3. After selecting the correct thermistor, press the MENU key.

FIGURE 9. THERMISTOR SELECTION SCREEN

Platinum RTD

1. The Platinum RTD is the third sensor type that can be selected. Press the MENU key at the SENSOR TYPE - PLATINUM RTD screen and the following screen will appear (refer to Figure 10).
2. Select either Alpha .003850 or Alpha .003916. Select an Alpha of 0.003850 (default setting) for all probes listed in the **Accessories** section.
3. After selecting the platinum RTD type, press the MENU key to advance to Temperature Scale selection.

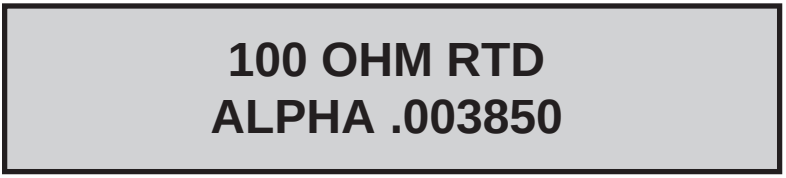


FIGURE 10. PLATINUM RTD SELECTION SCREEN

Temperature Scale

1. After pressing the MENU key in the SENSOR-TYPE screen, the program 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 11.
2. Press the DOWN arrow key to switch to a desired temperature scale. Press the MENU key to select the appropriate scale.

FIGURE 11. 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 relay will energize, the alarm LED will flash, the audible alarm will sound intermittently and the display will flash the type of alarm. There are three possible alarm mode selections: MANUAL RESET, AUTO RESET, or OFF. Refer to Figure 12.
2. If you select ALARM SETPOINTS - OFF, no process or deviation alarms will actuate. Both AUTO RESET and MANUAL RESET will result in alarms actuating. If you select AUTO RESET, the relay will automatically shut off when the PV temperature falls out of the alarm setpoint temperature. For MANUAL RESET, the alarm relay is turned off when the ALARM key is pressed. The alarm LED remains on until the alarm condition clears. For both AUTO and MANUAL, the flashing message and the audible alarm are turned off.

FIGURE 12. ALARM SETPOINTS SELECTION SCREEN

3. The first Alarm screen will display ALARM SETPOINTS - MANUAL RESET. Refer to Figure 13.

FIGURE 13. ALARM SETPOINTS MANUAL RESET SCREEN

4. To go to the Auto Reset Screen, press the DOWN arrow key. Refer to Figure 14.

FIGURE 14. ALARM SETPOINTS AUTO RESET SCREEN

5. To select an automatic alarm reset, press the MENU key when the Auto Reset screen is blinking.
6. To go to the Alarms Off Screen, press the DOWN arrow key. Refer to Figure 15. If selected, refer to Alarms Auto Reset procedure, below.

FIGURE 15. ALARM SETPOINT OFF SCREEN

7. To select alarms off, press the MENU key when the ALARMS - OFF screen is blinking.
8. 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.

Process Alarms

Process alarms are absolute values. These values remain the same no matter what the setpoint temperature is set to. For example: if the operator sets an alarm to trigger at 60 degrees Celsius and the SP (setpoint) temperature is set at 55 degrees Celsius, the alarm will trigger at 60 degrees. If the operator resets the SP temperature to 57 degrees, then the process alarm value will stay at the already set 60 degrees.

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

Process HI

1. Process HI is a fixed value and will not change if the SP temperature value is changed. It activates the alarm when the PV temperature exceeds the set alarm temperature. Refer to Figure 16. 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 without activating the alarm.

FIGURE 16. PROCESS HI SCREEN

2. Select the PROCESS - HI screen by pressing the MENU key. The following screen will appear (refer to Figure 17). Set the Process HI temperature by using the arrow keys.

FIGURE 17. PROCESS HI SETTINGS SCREEN

Process LO

1. Process LO is a fixed value and will not change if the SP temperature value is changed. It activates the alarm when the PV temperature drops below the alarm temperature. Refer to Figure 18. 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 setpoint before the low alarm is enabled. This allows for normal system startup without activating the alarm.

FIGURE 18. PROCESS LO SCREEN

2. Select the PROCESS - LO screen by pressing the MENU key. The following screen will appear (refer to Figure 19). Set the Process LO temperature by using the arrow keys.

FIGURE 19. PROCESS LO SETTINGS SCREEN

Process HILO

1. Process HILO is a fixed value (a fixed high and a fixed low alarm setpoint) and will not change if the SP temperature value is changed. The purpose for process HILO is to set the fixed HI and LO value at which to trigger the alarm relay. Refer to Figure 20. Refer to the Process HI and Process LO sections for detailed descriptions of the operation of each alarm setpoint.

FIGURE 20. PROCESS HILO SCREEN

2. Select PROCESS - HILO by pressing the MENU key. The following screen will appear (refer to Figure 21). 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 21. PROCESS HILO SETTINGS SCREEN

Deviation Alarms

Deviation alarms are offset values relative to the setpoint (SP). The values change with the SP temperature setting. For example: if an operator sets the deviation HI alarm to 10 degrees Fahrenheit and the SP temperature is at 50 degrees Fahrenheit, the alarm will trigger when the PV reaches 60 degrees Fahrenheit. If the operator then changes the previously set SP temperature to 55 degrees Fahrenheit, then the alarm will trigger at 65 degrees Fahrenheit. The 10-degree Fahrenheit difference stays the same.

There are four possible deviation alarms settings: DEVIATION LO, DEVIATION HI, DEVIATION HILO, and DEVIATION BAND. Refer to the following paragraphs.

Deviation LO

Deviation LO adjusts the alarm value as the SP temperature value is adjusted. Whatever value deviation LO is set at, it will remain the same until changed. Refer to Figure 22.

FIGURE 22. DEVIATION LO SCREEN

For example: if the Deviation LO value is set for 10 degrees Fahrenheit and the SP temperature is set for 50 degrees Fahrenheit, the alarm will trigger at 40 degrees Fahrenheit. If the SP temperature value is changed to 45 degrees Fahrenheit, the Deviation LO will trigger the alarm at 35 degrees Fahrenheit. If the Control Action is set to HEAT and the alarm condition exists when the **RUN** key is pressed, the alarm will not be activated. The PV temperature must first rise above the alarm setpoint before the alarm is enabled. This allows for normal system startup without activating the alarm.

Select the DEVIATION - LO screen by pressing the MENU key. The following screen will appear (refer to Figure 23). Move the cursor to the left using the LEFT arrow key. When the setting is correct, press the MENU key to enter that setting and to move the program to the alarm hysteresis screen.

FIGURE 23. DEVIATION LO SETTINGS SCREEN

Deviation HI

Deviation HI will adjust the alarm value as the SP temperature value is adjusted. Whatever value Deviation HI is set at, it will remain the same until changed. Refer to Figure 24.

FIGURE 24. DEVIATION HI SCREEN

For example: if the Deviation HI value is set for 10 degrees Fahrenheit and the SP temperature is set for 50 degrees Fahrenheit, the alarm will trigger at 60 degrees Fahrenheit. If the SP temperature value is changed to 55 degrees Fahrenheit, the deviation HI will not trigger the alarm until it reaches 65 degrees Fahrenheit. If the Control Action is set for COOL and the alarm condition exists when the **RUN** key is pressed, the alarm will not be activated. The PV temperature must first fall below the alarm setpoint to enable the high alarm. This allows for normal system startup without activating the alarm.

Select DEVIATION - HI by pressing the MENU key. The following screen will appear (refer to Figure 25). Set the Deviation HI temperatures by using the arrow keys. Once the alarm value is set, press the MENU key to advance to one of the other alarm variables.

FIGURE 25. DEVIATION HI SETTINGS SCREEN

Deviation HILO

1. Deviation HILO allows the operator to set the alarm to actuate below and above the SP temperature. Refer to Figure 26.

FIGURE 26. DEVIATION HILO SCREEN

For example: if the SP temperature is set at 50 degrees Fahrenheit and the operator sets the Deviation HILO value at 10 degrees Fahrenheit, the alarm will sound below 40 degrees Fahrenheit and above 60 degrees Fahrenheit. To allow for normal system startup, the alarm may not be activated under certain conditions. Refer to the **DEVIATION HI** and **DEVIATION LO** sections for additional information on alarm activation.

2. Select the DEVIATION- HILO screen by pressing the MENU key. The following screen will appear (refer to Figure 27). Set the Deviation temperature by using the arrow keys.
3. After selecting values, press the MENU key to continue.

FIGURE 27. DEVIATION HI/LO SETTINGS SCREEN

Deviation BAND

1. Deviation **BAND** allows the operator to set the alarm to sound while the temperature is in a temperature window. Refer to Figure 28.

FIGURE 28. DEVIATION BAND SCREEN

For example: if the SP temperature is set for 50 degrees and the Deviation BAND is set for 25 degrees, the alarm will trigger at 25 degrees and continue to sound up to 75 degrees. In this example, the alarm window is 25 degrees below 50 and 25 degrees above 50.

2. Select DEVIATION BAND by pressing the MENU key. The following screen will appear (refer to Figure 29). Set the Deviation BAND temperature value by using the arrow keys. Once the value is set, press the MENU key to advance to Alarm Hysteresis.

FIGURE 29. DEVIATION BAND 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.

2. Set the hysteresis by using the arrow keys.

FIGURE 30. ALARM HYSTERESIS SCREEN

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 31.

FIGURE 31. AUDIBLE ALARM SCREEN

Advanced Set-Up

1. After pressing the MENU button, the ENTER ADVANCED SETUP screen will be displayed (refer to Figure 32).
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 32. 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 33. Calibration offset and PV (actual) temperatures are displayed.

FIGURE 33. SENSOR CALIBRATE SCREEN

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 34.)

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 34.

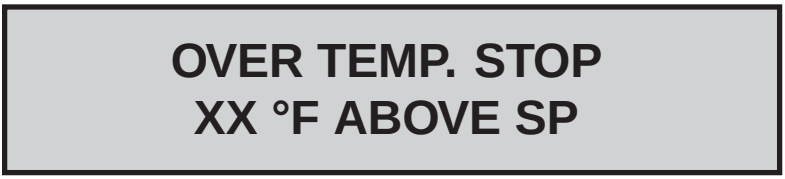


FIGURE 34. OVERTEMP SCREEN

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 10°F. Refer to Figure 35.

FIGURE 35. 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 36. 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 36. 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 three options: PID (proportional band, integral and derivative), Ramp and Soak, and ON/OFF. Refer to Figure 37.

FIGURE 37. 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 or Ramp and Soak 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 38.

FIGURE 38. 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.

NOTE: PID Settings should not be changed from the manufacturers AUTO TUNE settings unless the operator has advanced training in the understanding of PID.

AUTO Tune

1. After selecting the PID screen the next screen to appear will be AUTO TUNE. Refer to Figure 39. 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 39. 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 RUN 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 40).

FIGURE 40. PROPORTIONAL BAND SCREEN

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

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 41.

FIGURE 41. INTEGRAL SCREEN

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

Derivative Rate

1. The derivative rate reduces or eliminates overshoot. Refer to Figure 42. It is measured in seconds and must be tuned to work with the overall system cycle time.

FIGURE 42. DERIVATIVE SCREEN

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

Ramp and Soak

Ramp and Soak is a means of automatically increasing or decreasing setpoint temperatures within specific time periods using an operator pre-set program. By setting the values on the segment screens an operator can tell the temperature controller to ramp up or down 16 levels.

1. The Ramp and Soak screen offers a selection of nine profiles which can be changed, if required. Each **profile** has 16 possible **segments**.
2. Use the arrow keys to select a profile. Refer to Figure 43.

FIGURE 43. RAMP AND SOAK SCREEN

3. Press the MENU key to advance to the segment setup.

Assured Soak

Assured Soak applies only to Ramp and Soak. Refer to Figure 44. In selecting Assured Soak, each segment is extended until the actual temperature reaches the setup temperature specified in that segment (before moving on to the next segment). If Assured Soak is not selected, then the unit advances to the next segment at the specified time, whether or not the specified temperature has been reached. This will not be a factor if a heating or cooling element is properly sized for the material to be acted upon.

1. Use the arrow keys to select YES or NO.
2. Press the MENU key to advance to segment definition.

FIGURE 44. ASSURED SOAK SCREEN

FIGURE 45. PROFILE ALTERATION SCREEN

Segment Definition

The segment temperature displayed indicates the desired temperature at the end of the segment time. The starting temperature will be the temperature from the previous segment, except for segment 01, which will be the current sensor temperature.

The end of a ramp and soak occurs when segment 16 is completed, or when a segment with 0 HR and 0 MIN is reached.

The Temperature Controller will continue running at the last specified temperature until the RUN/STOP key is pressed.

1. Adjust the Segment number using the arrow keys. There are 16 possible segments.
2. As each segment number is changed, adjust the segment end temperature value and the time values using the arrow keys. In the bottom, right corner of the Segment Screen is the CP (Control Parameter) number.

Each CP number represents a set of proportional band, integral time, and derivative rate values. This is included for convenience in setting ramp and soak PID values when individual segments have different stability requirements. Specific CP values are set in Control Parameters, below. **Selecting CP 0 will assign the auto tune PID values to the segment.**

3. Press the MENU key to advance to CP setup.

Control Parameters (CP)

1. Nine control parameter numbers are available for storing up to nine sets of PID values. The PID values can be determined experimentally but auto tune values can be used by selecting CP 0. Use the arrow keys to set the P, I, and D values for that CP value.
2. Press the MENU key to advance to Cycle Time set up.

Cycle Time

Cycle Time will only appear after programming the Ramp and Soak and PID functions. Cycle time is the rate at which 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 46.

FIGURE 46. CYCLE TIME SCREEN

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

Run Time

Run Time is a safety feature that sets the Temperature Controller operating time in the on/off and PID control modes. 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 47.

FIGURE 47. RUN TIME SCREEN

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

Recorder Output

Recorder Out consists of two selections: Recorder Out at 4mA and Recorder Out at 20mA screens. Refer to Figure 48. This function allows the operator to scale the temperature between 4mA and 20mA, to allow proportional scaling of the recorder output.

FIGURE 48. RECORDER OUT SCREENS

1. Adjust the temperatures to be equivalent to 4mA using the arrow keys.
2. Advance from the 4mA screen to the 20mA screen by pressing the MENU key and set the temperature to be equivalent to 20mA.
3. After adjusting the 20mA screen, press the MENU key to advance to the SERIAL BAUD MENU.

Serial Baud

Six baud rates are available for communicating over the serial port: 300, 600, 1200, 2400, 4800, and 9600. Refer to Figure 49. Select the highest number compatible with your PC.

FIGURE 49. SERIAL BAUD SCREEN

1. Set the SERIAL BAUD rate using the arrow keys.
2. Press the MENU key to advance to the POWER UP CONTROL screen.

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 50.

FIGURE 50. 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 or the unit is in the RAMP and SOAK mode, 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 51) if a previous run was stopped before it completed.

FIGURE 51. RUN SCREEN

Select either CONTINUE or RESTART using the arrow keys and then press RUN/STOP key. CONTINUE will start a run at the point where it was stopped. RESTART will reset the run time and start at segment 1 if in Ramp and Soak mode. 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.

CONTROL MODE

If you selected Control Mode On or PID during setup, the following screen will appear. Refer to Figure 52. Press SET to enter desired setpoint temperature.

FIGURE 52. DISPLAY OF PROCESS VARIABLES/
SETPOINT IN CONTROL 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.

RAMP AND SOAK MODE

If you selected Ramp and Soak during the setup, the following screen will appear (refer to Figure 53).

FIGURE 53. TEMPERATURE/TIME/SEGMENT DISPLAY FOR RAMP/SOAK MODE

During the ramp and soak operation, the temperature, segment number, time remaining, and status (i.e., RAMP or SOAK) will be displayed.

To advance to the next segment, press and hold down the RUN/STOP key until the displayed segment number advances (about 3 seconds).

Setpoint or time remaining can be displayed by pressing the SET key.

TROUBLESHOOTING AND MAINTENANCE

Warning: ***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.***

Warning: ***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 15 A. Replace it with a fuse having identical voltage and current ratings.

Caution: ***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 0.6 A for 115 V applications and 0.3 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): ±0.1% reading, ±0.4°C (±0.7°F)
below –100°C (–148°F): ±0.1% reading, ±1°C (±1.8°F)

Type R,S and B
±0.1% reading, ±1°C (±1.8°F)

Thermistor, RTD
±0.1% reading, ±0.4°C (±0.7°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)

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)

SPECIFICATIONS (Continued)

Thermistors:

YSI 400:	–40 to 100°C	(–40 to 212°F)
YSI 700:	–30 to 100°C	(–22 to 212°F)

Platinum RTD

100 ohm:	–200 to 850°C	(–328 to 1562°F)

INPUTS

AC Line Input

	115V Model	230V Model
Input:	115V AC ±15%, 49/61 Hz 15A Max	230V AC ±15%, 49/61 Hz 15A Max
Connector:	Standard Line Cord	IEC 320 C-20 Inlet
Fuse:	0.630A/230V Slo-Blo (T) 5x20mm	0.315A/230V Slo-Blo (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 V max

Thermistor Probe Input

Any of the YSI series 400 and 700 series probes and YSI 44004, 44033, 44018 and 44104 composite thermistor elements.

Connector: 3-pin 1/4 in phone jack

CONTACT	400 series	700 series
TIP:	Therm.	Therm. (T1)
RING:	not used	Therm. (T2)
BARREL:	Therm.	Therms. (Common)

	400 series	700 series
Calibration:	YSI 44033	YSI 44018
Impedance:	2252 ohm @ 25°C (77°F)	(T1) 6,000 ohm @ 25°C (77°F) (T2) 30,000 ohm @ 25°C (77°F)
Interchangeability:	±0.10°C	±0.15°C
Lead Resistance:	0.45 ohm max	1.2 ohm max
Power Dissipation:	0.5 mW max	1.3 mW max

Impedance:	2252 ohm @ 25°C (77°F)	(T1) 6,000 ohm @ 25°C (77°F) (T2) 30,000 ohm @ 25°C (77°F)
Interchangeability:	±0.10°C	±0.15°C
Lead Resistance:	0.45 ohm max	1.2 ohm max
Power Dissipation:	0.5 mW max	1.3 mW max

RTD Probe Input

Connector:	3-pin circular (mate to Switchcraft TA3F plug) Pin 1: RTD (–) Pin 2: RTD (+) sense line Pin 3: RTD (+)
Calibration:	DIN IEC 751
Impedance:	100 ohm ±0.1 ohm @ 0°C (32°F)
Sensitivity:	0.003850 or 0.003916 ohm/ohm/°C selectable
Lead Resistance:	30 ohm maximum each lead (balanced)

OUTPUTS

AC Line Output

	115V Model	230V Model
Output:	115V AC typical, 15A max	230V AC typical, 15A max
Connector:	NEMA 5-15R	Reverse IEC 320-C20
Fuse:	15A/230V 3AG Slo-Blo	15A/230V 3AG Slo-Blo

Alarm Output

Output:	Isolated Form C contact closure
Rating:	Class 2 –30 V AC/DC 2 A
Connector:	Screw terminal

Recorder Output

Output:	Isolated 4-20 mA
Resolution:	12 bit
Range:	User scalable
Supply:	Internal 26 VDC
Loop load:	1000 ohm max
Connector:	Screw terminal

Serial Output

Output:	Isolated RS-232-C serial communications
Mode:	Bi-directional Male
Connector:	9-pin male D-sub connector Pin 2: Receive Pin 3: Transmit Pin 5: Ground All others not connected

WARRANTYT

The Manufacturer 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 the Manuacturer. Repair costs outside the warranty period, or those resulting from product misuse or abuse, may be invoiced to you.

PRODUCT RETURN

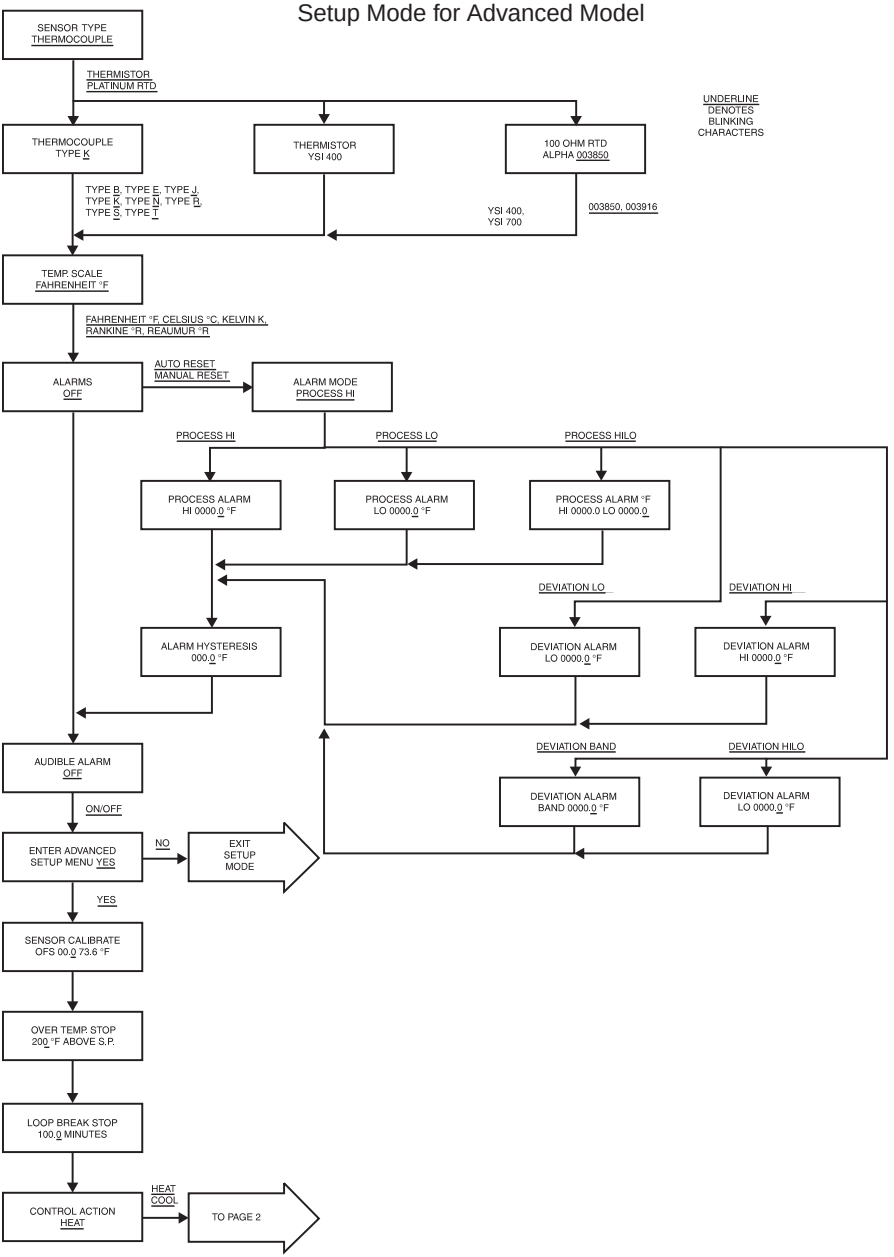
To limit charges and delays, contact the seller or manufacturer for authorization and shipping instructions before returning the product, either within or outside of the warranty period. When returning the product, please state the reason for the return. For your protection, pack the product carefully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

TECHNICAL ASSISTANCE

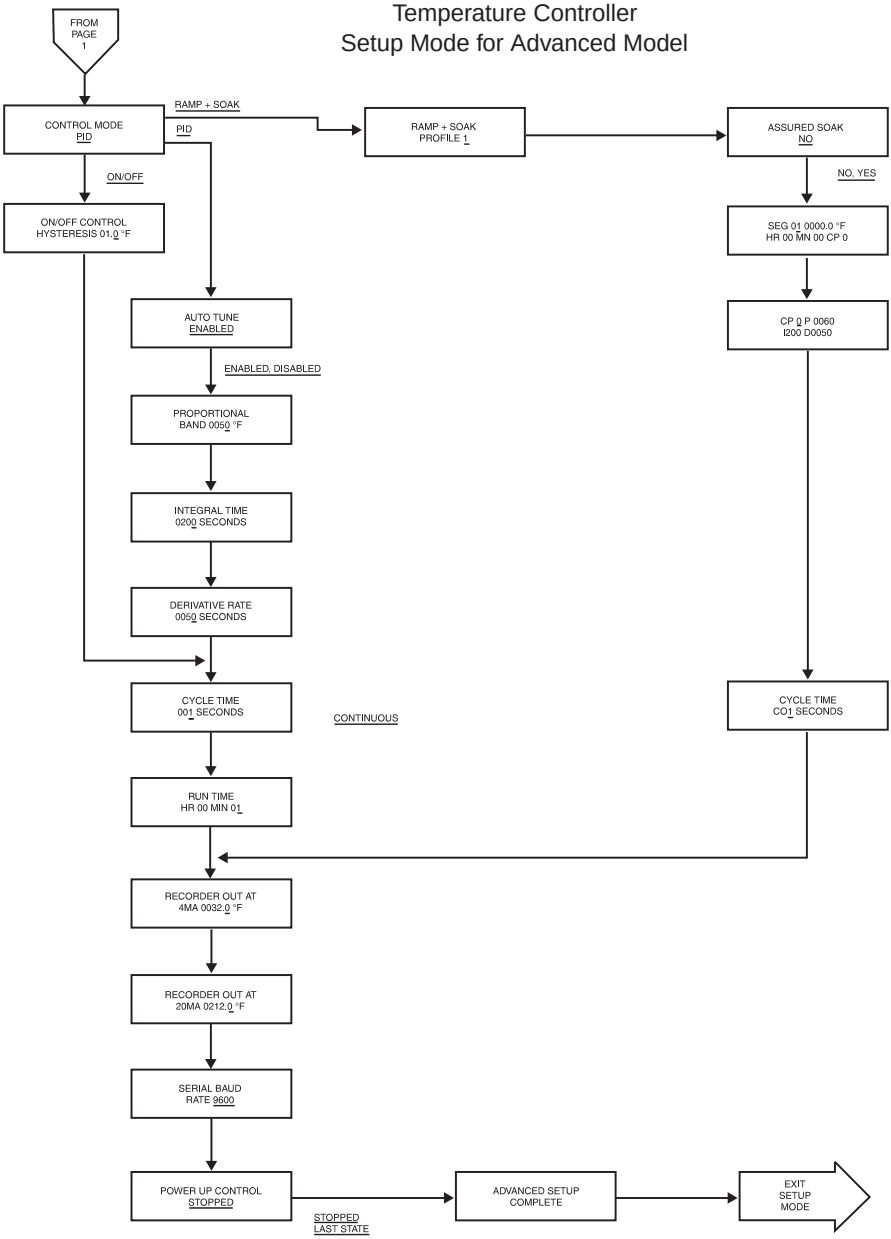
If you have any questions about the use of this product, contact the manufacturer or authorized seller.

APPENDIX A

Temperature Controller
Setup Mode for Advanced Model



Temperature Controller
Setup Mode for Advanced 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 15 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.

EUTECH / OAKTON ADVANCED MODELS
68900-10 115V
68900-15 230V

Catalog #	MODEL	DESCRIPTION
68900-50	All models	Panel Mount Kit
68900-98	All models	Heater Sizing Software
68900-97	All models	Alarm/Recorder Output Connector
68900-78	230V only	Input Cord - IEC320/NEMA 6-15P
68900-80	230V only	Input Cord - IEC320/BARE END
68900-85	230V only	Heater Output Connector, IEC 16A

For more information on Eutech Instruments/ Oakton Instruments' products, contact your nearest distributor or visit our website listed below:

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