User Manual

Digi-Sense® TC9000 Advanced PID and On/Off Temperature Controller with Thermocouple Input

Models 89800-01 and 89800-02

THE STANDARD IN PRECISION MEASUREMENT

Table of Contents

Introduction

The Digi-Sense TC9000 Advanced PID and On/Off Temperature Controller (Models 89800-01 and 89800-02) is designed to regulate a user-defined output device at a set point temperature. The microprocessor control uses a PID algorithm that provides precise heating/cooling tolerances for demanding applications in the laboratory or industrial setting.

The TC9000 is a microprocessor-based, digital indicating, single-loop temperature controller. It has a single output located on the back of the controller. It features an auto-tuning function that allows automatic configuration of the PID parameters with minimum user configuration required. The TC9000 has a single thermocouple input that accepts J, K, N, R, S, T, B, and E sensors.

The controller automatically sets the PID parameters through a "learning" sequence in the auto tune mode. PID parameters include proportional band, reset/integral, and rate/derivative. The user-friendly LED display is to aid in monitoring and setup of the controller. The controller automatically stores all user-defined information in nonvolatile memory.

Unpacking

Check individual parts against the list of items below. If anything is missing or damaged, please contact your instrument supplier immediately.

1. Temperature controller
2. Grid support bracket (attached to the back of the controller)
3. 6-ft (3-m) detachable IEC power cord. Model 89800-01 comes standard with a US 120 VAC plug; Model 89800-02 comes standard with a US 220 VAC plug. See page 32 for additional cords.
4. Electrical noise canceling ferrite clip (connects to sensor input; see page 31 for reference)
5. User manual
6. Quick-start guide

Controller Description — Front Panel

1. RUN/STOP Button
Pressing RUN/STOP once will start the control process if the temperature Controller is stopped, or stop the control process if the temperature controller is running. If the controller is running, “Heat” and “Cool” on-screen indicators will illuminate appropriately in the “Alarm/Action Display”.

2. TUNE Button
Pressing TUNE once will start the AUTO TUNE cycle. AUTO TUNING must be enabled in the setup mode for this key to function. (See page 14, Screen 16)

3. ALARM Button
In an ALARM situation, the screen will display either “WARNING” or “ERROR” with the corresponding message. A “WARNING” will not stop the control process. An “ERROR” will stop the control process.

A. MANUAL RESET mode: Pressing ALARM once will silence the audible alarm and clear the on-screen alarm message. If the alarm situation is still present, the “Alarm/Action Display” will remain illuminated. The alarm and on-screen message will not clear automatically, even if the system is no longer in an alarm situation.

B. AUTO RESET mode: Pressing ALARM once will silence the audible alarm and clear the on-screen alarm message. If the alarm situation is still present, the “Alarm/Action Display” will remain illuminated. If the system leaves an alarm situation, the system will automatically silence the alarm and clear the on-screen alarm message.

4. SELECT Button
Pressing SELECT once will cycle through user-configurable control set points. All user-configurable set points will be **underlined** with a greyed out line. The selected set point will be underlined. Change the set point with the UP and DOWN arrow buttons.

5. MENU Button
The MENU button provides access to all user-configurable setup parameters of the controller. Pressing this key once will scroll through parameter options. Pressing and holding this key will exit to the home screen, saving any changes made up to that point.

6. UP, DOWN, LEFT Arrow Buttons
The UP and DOWN arrow buttons will increase or decrease the value of the set point selected (underlined). Pressing the UP or DOWN arrow keys will increase or decrease *numerical* entries by the least significant digit. The rate of acceleration will increase as shown in the table below, starting from the least significant digit. Pressing and holding the UP or DOWN arrow key will increase or decrease *text* entries without an acceleration factor. The LEFT arrow button moves backwards through the General and Advanced Setup Menus. To exit to the main screen from either menu, press and hold the MENU button.

Numbers…	Increase/Decrease by…
0.0 – 0.9	0.1
0 – 9	1
10 – 100	10
100 +	50

Table 1. Acceleration Factor Table

7. HEAT, COOL, AND TUNE Indicators
When any of these modes are active they will have a block indicator on the display showing they are active. **Example:** When the controller is in the heat mode and it is applying power to the heater output there will be an indicator block on the display to show the heater output is active.

Controller Description — Back Panel

Heater/Cooler output based on model

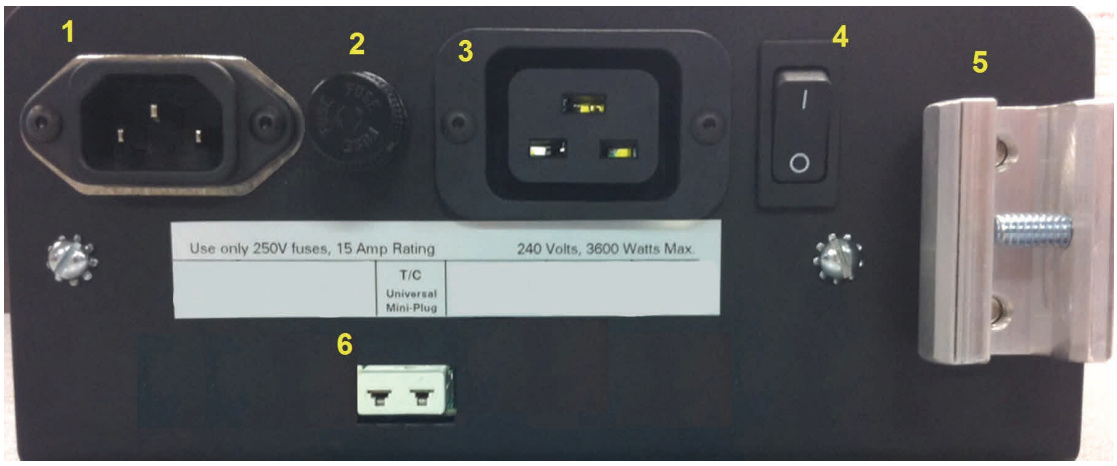
5-15R ,115 VOLT

Model 89800-01

IEC 60320 C19, 230 VOLT

(Image shows this receptacle)

Model 89800-02



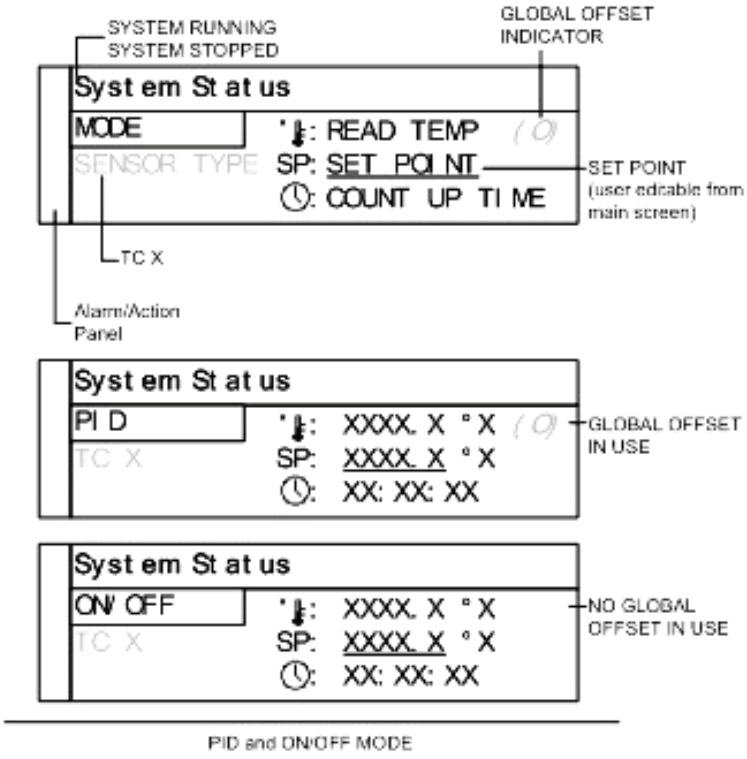
1. IEC power cord connection (see page 32 for additional cords)
2. Fuse
3. Heater/cooler output (see pages 33-34 for optional output cord adapters dependent on country)
4. Power switch
5. Grid support bracket
6. Thermocouple input (accepts type J, K, N, R, S, T, B, and E with mini-connector)

Controller Description — Active Display Screen

editable value
static text
greyscale Text
situational text

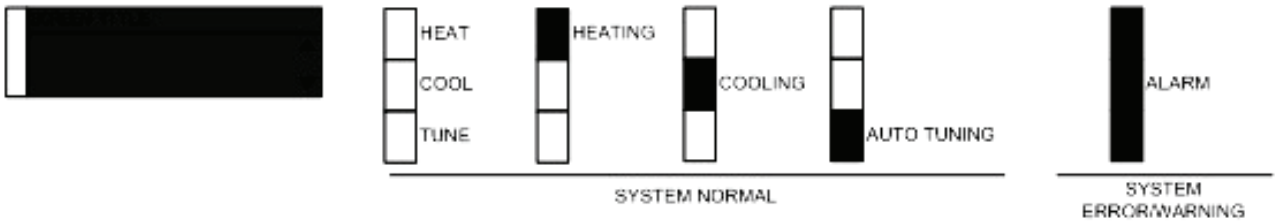
TEXT EXPLANATION

MAIN SCREENS



PID and ON/OFF MODE

ALARM/ACTION PANEL



SYSTEM NORMAL

SYSTEM ERROR/WARNING

NAVIGATION

Setup and Operation

Initial Setup

- Install controller in safe operating area.
- Plug the heater or cooler (sold separately) into the output connector located on the back of the controller.
- Connect the thermocouple sensor to the thermocouple input connector located on the back of the controller.
- Place the ferrite clip over the lead wire of the thermocouple sensor. (See page 31 for reference picture of installation of ferrite clip.)
- Plug the supplied AC cord into the IEC power connector located on the back of the controller.

Basic Operation Setup

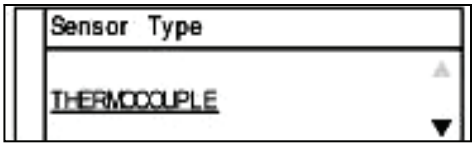
- Turn power switch ON, located on the back of controller.
- Follow the instructions on the “welcome” screen.
    - Press SELECT key to read a brief description of each key on the front of controller.
    - Press the MENU key to skip the instructions and enter the main operation screen.
- Press the SELECT key to make a user-editable field active. A line will appear under the field when the field is active for editing.
- Use the UP/DOWN arrow keys to adjust the value that is active in a user-editable field.
- Enter the user-configurable setup by pressing the MENU key from the system status screen.
- Use the MENU key to advance through each menu setting.
- Depending on process operation, follow the directions to set up the controller for the proper operation of your process:
    - PID (Factory default) on pages 8-16
    - ON/OFF on pages 17-24
- All changed settings will be retained in memory when returning to the System Status screen.
- Use the flow charts (see pages 29-30) to have a visual of the controls menu layout.

Auto Tune Setup

- Set up your process as noted in the initial setup.
- Verify that the Auto Tune feature is enabled in the menu settings.
- From the main operation screen, set the set point temperature.
- Press the TUNE button and the indicators showing Heat and Tune will be illuminated on display.
- The Set Point value can not be altered after the Tune process has started. The value is locked until the Tune process is complete or aborted by the user.
- Stopping the Tune operation prior to it finishing will cause the PID settings to be returned to factory default values.
- PID values will be saved in nonvolatile memory.

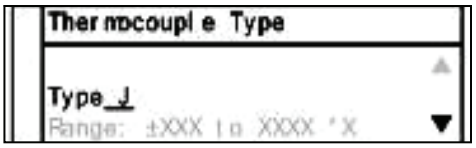
PID Control Mode Setup: (FACTORY DEFAULT MODE)

Screen # 1 - Selecting Sensor Type



- The TC9000 is set to thermocouple.
- Press MENU key to advance to next screen.

Screen # 2 - Selecting Thermocouple Type



- Thermocouple is preselected on screen # 1.
- Use the UP/DOWN arrow keys to select the desired thermocouple type: J, K, N, R, S, T, B, or E.
- Press MENU key to advance to screen # 3 after selection has been made.

Screen # 3 - Selecting Temperature Scale

- Use the UP/DOWN keys to select the desired temperature scale: Celsius °C, Fahrenheit °F, Kelvin K, Reaumur °Ré, or Rankine °Ra.
- Press MENU key to advance to screen # 4 after selection has been made.

PID Control Mode Setup:

Screen # 4 - Selecting Alarm Setting

- Use the UP/DOWN arrow keys to change between Auto Reset, Manual Reset, and Off.
- Press MENU key to advance to next screen.
  - If Auto or Manual is selected, the controller will advance to screen # 5.
  - If selection is OFF, the controller will advance to screen # 9.

Screen # 5 - Selecting Alarm Mode

- Use the UP/DOWN arrow keys to select alarm mode.
- Selectable alarm modes:
  - **Process High:** The alarm will be activated if the temperature rises above the user set alarm value.
  - **Process Low:** The alarm will be activated if the temperature goes below the user set alarm value.
  - **Process High/Low:** The alarm will be activated if the temperature goes above or below the high and low temperature levels set by user.
  - **Deviation High:** Alarm activation point that changes with the change of the process set point. **Example:** The user sets deviation high alarm at 30°C and has a process set point of 100°C. If the temperature reaches 130°C, the alarm will be activated. The user changes process set point to 60°C. If process temperature reaches 90°C, the alarm will be activated.
  - **Deviation Low:** Alarm activation point that changes with the change of the process set point. **Example:** The user sets the deviation low alarm 30°C and the process set point is 100°C. If the process temperature is 70°C or less, the alarm will be activated. If the process set point temperature is set at 70°C, then if the process temperature is 40°C or less it will activate the alarm.
  - **Deviation High/Low:** Same as Deviation High and Deviation Low alarms. It has the capability of having an alarm activate when the set point temperature goes above or below a set point temperature.
  - **Deviation Band:** Allows the user to set the alarm to be activated within a specified temperature range.
- Press the MENU key to advance to screen # 6 after selecting alarm mode.

PID Control Mode Setup:

Screen # 6 - Setting Alarm Mode Variables

- This screen reflects the variable settings for the selected alarm mode from screen # 5.

-Set Point—Process High

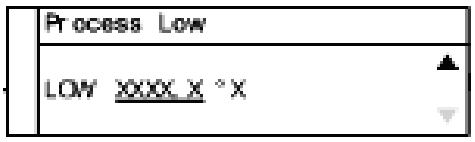
- Press the UP/DOWN arrow keys to adjust the temperature value.

- When complete, press MENU key to advance to screen # 7.

- Set Point—Process Low

- Press the UP/DOWN arrow keys to adjust the temperature value.

- When complete, press MENU key to advance to screen # 7.



- Set Point—Process High/Low

- Press the UP/DOWN arrow keys to adjust the temperature value.

- Press the SELECT key to toggle between High and Low. There will be a line below the active field.

- When complete, press MENU key to advance to screen # 7.

- Set Point—Deviation High

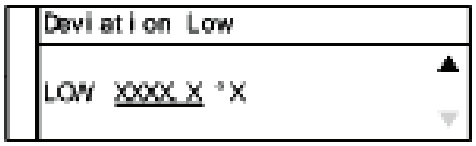
- Press the UP/DOWN arrow keys to adjust the temperature value.

- When complete, press MENU key to advance to screen # 7.

- Set Point—Deviation Low

- Press the UP/DOWN arrow keys to adjust the temperature value.

- When complete, press MENU key to advance to screen # 7.



PID Control Mode Setup:

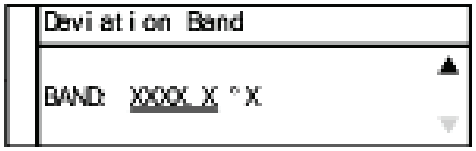
-Set Point—Deviation High/Low

- Press the UP/DOWN arrow keys to adjust the temperature value.

- Press the SELECT key to toggle between High and Low. There will be a line below the active field.

- When complete, press MENU key to advance to screen # 7.

-Set Point—Deviation Band



- Press the UP/DOWN arrow keys to adjust the temperature value.

- When complete, press MENU key to advance to screen # 7.

PID Control Mode Setup:

Screen # 7 - Setting Hysteresis Alarm

- Use the UP/DOWN arrow keys to adjust value.
- The user-defined value when the alarm will exit an alarm condition. **Example:** User has a Process High alarm programmed with a value of 150°C and has set the Alarm Hysteresis of 1°C. The alarm has been activated after the temperature reached 160°C. When temperature reaches 149°C, the alarm condition will not be active.
- When complete, press MENU key to advance to screen # 8.

Screen # 8 - Setting Audible Alarm

- Use UP/DOWN arrow keys to change value to either ON audible alarm or OFF audible alarm.
- When complete, press MENU key to advance to screen # 9.

Screen # 9 - Advanced Menu Gateway

- Use the UP/DOWN arrow keys to change selection to ENTER.
- When complete, press MENU key to advance to screen # 10.
- The following screens are in the advanced portion of the setup menu:

Screen # 10 - Calibration Gateway

Screen # 11 - Global Sensor Offset

Screen # 12 - Over Temperature Stop

Screen # 13 - Loop Break Stop

Screen # 14 - Control Action

Screen # 15 - Control Mode

Screen # 16 - Auto Tune

Screen # 17 - Proportional Band Setup

Screen # 18 - Proportional Gain Setup

Screen # 19 - Integral Time Setup

Screen # 20 - Integral Gain Setup

Screen # 21 - Derivative Rate Setup

Screen # 22 - Derivative Rate Gain Setup

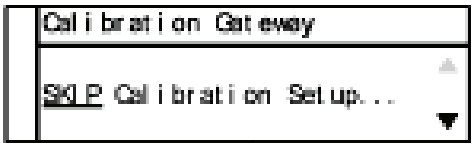
Screen # 23 - Power Rate Control

Screen # 24 - Run Time

Screen # 25 - Power Failure Control

PID Control Mode Setup:

Screen # 10 - Calibration Gateway



- Screen will default to SKIP Calibration Setup.
- **WARNING:** Do not enter the calibration gateway unless you have the proper calibration equipment to calibrate the sensor inputs associated with this control. Changing calibration settings in the controller can cause errors in sensor temperature readings and operation of the control. For instructions on how to use the calibration functions, contact your instrument supplier.
- With SKIP selected, press the MENU key to advance to screen # 11.

Screen # 11 - Global Sensor Offset Calibration

- Use the UP/DOWN arrow keys to change the offset value.
- The use of another temperature device is required to determine the correct offset needed.
- Adjusting this value is offsetting the sensor input temperature being displayed.
- When complete, press MENU key to advance to screen # 12.

Screen # 12 - Over Temperature Stop

- Use UP/DOWN arrow keys to change the value.
- When sensor temperature goes above this value, the output device will be turned off.
- When complete, press MENU key to advance to screen # 13.

Screen # 13 - Loop Break Stop

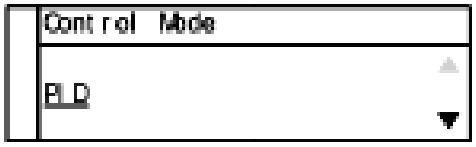
- Default value is ENABLED. Use UP/DOWN arrow keys to change the value.
- Loop Break Stop is a feature that will stop the process output while the controller is in the run mode. If the controller senses there is no change in temperature in a user set amount of time, the output will be turned off and error message will be displayed on the screen along with an audible alarm.
- Set to DISABLED if this function is not required.
- When complete, press MENU key to advance to screen # 14.

PID Control Mode Setup:

Screen # 14 - Control Action

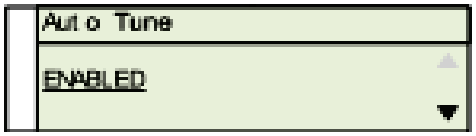
- Use UP/DOWN arrow keys to change the value.
- Set for the process that is being performed: Heat or Cool
- When complete, press MENU key to advance to screen # 15.

Screen # 15 - Control Mode



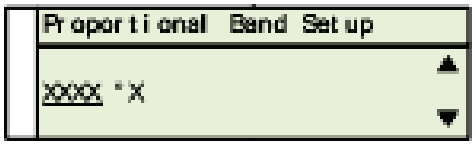
- Use UP/DOWN arrow keys to change the value.
- Default value is PID mode. (If different, select PID mode)
- When complete, press MENU key to advance to screen # 16.

Screen # 16 - Auto Tune



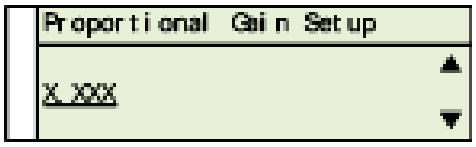
- Default value is ENABLED. Use UP/DOWN arrow keys to toggle between ENABLED and DISABLED.
- Select ENABLED to use the Tune key on the front panel to activate the Auto Tune function. This function needs to remain ENABLED until the controller has been properly tuned to the user's particular application.
- When complete, press MENU key to advance to screen # 17.

Screen # 17 - Proportional Band Setup



- Use UP/DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller. These values are derived from running the auto tune function. Altering the value after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 18.

Screen # 18 - Proportional Gain Setup



- Use UP/DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller. These values are derived from running the auto tune function. Altering the value after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 19.

PID Control Mode Setup:

Screen # 19 - Integral Time Setup

- Use UP/DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller These values are derived from running the auto tune function. Altering the value after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 20.

Screen # 20 - Integral Gain Setup

- Use UP/DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller. These value are derived from running the auto tune function. Altering the values after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 21.

Screen # 21 - Derivative Rate Setup

- Use UP / DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller. These values are derived from running the auto tune function. Altering the value after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 22.

Screen # 22 - Derivative Rate Gain Setup

- Use UP / DOWN arrow keys to change the value.
- **WARNING:** Do not change these values unless you have experience in manual setup of PID (Proportional, Integral, and Derivative) of this controller. These values are derived from running the auto tune function. Altering the value after auto tune has been completed will affect the performance of the system.
- When complete, press MENU key to advance to screen # 23.

PID Control Mode Setup:

Screen # 23 - Power Output Control

- Use UP/DOWN arrow keys to change the value.
- Default value is 100 percent.
- This feature allows the user to reduce the output power to the output heating device—useful in applications were temperature overshoot is occurring after auto tune has been completed.
- Experimenting with this value will be necessary because every process setup is different.
- When complete, press MENU key to advance to screen # 24.

Screen # 24 - Run Time

- Use UP/DOWN arrow keys to change the value.
- Use SELECT key to toggle between the HR and MIN fields.
- Run Time is a safety feature while the control is in the ON/OFF or PID mode. The user can set a timer to have the output turned OFF if the time expires.
- When complete, press MENU key to advance to screen # 25.

Screen # 25 - Power Failure Control

- Use UP/DOWN arrow keys to change the value.
- Default value is STOP:

  STOP — If the controller loses power while in the run mode, it will not resume the process once the power has been restored.

  RESUME — If the controller loses power while in the run mode, it will resume the operating process once the power has been restored.

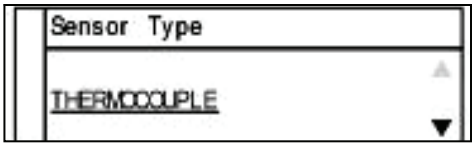
- When complete, press MENU key to advance to screen # 26.

Screen # 26 - Advanced Menu Exit

- Setup is complete.
- Automatically exit to the main operation screen.

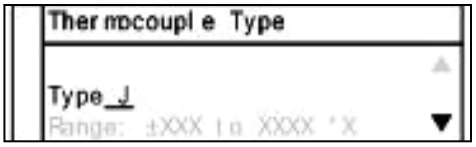
ON/OFF Control Mode Setup:

Screen # 1 - Selecting Sensor Type



- The TC9000 controller is set to thermocouple.
- Press MENU key to advance to next screen.

Screen # 2 - Selecting Thermocouple Type



- Thermocouple is preselected on screen # 1.
- Use the UP/DOWN arrow keys to select the desired thermocouple type: J, K, N, R, S, T, B, or E.
- Press MENU key to advance to screen # 3 after selection has been made.

Screen # 3 - Selecting Temperature Scale

- Use the UP/DOWN keys to select the desired temperature scale: Celsius °C, Fahrenheit °F, Kelvin K, Reaumur °Ré, or Rankine °Ra.
- Press MENU key to advance to screen # 4 after selection has been made.

ON/OFF Control Mode Setup:

Screen # 4 - Selecting Alarm Setting

- Use the UP/DOWN arrow keys to toggle between Auto Reset, Manual Reset, and Off.
- Press MENU key to advance to next screen:
  - If Auto or Manual is selected, the controller will advance to screen # 5.
  - If OFF is selected, the controller will advance to screen # 9.

Screen # 5 - Selecting Alarm Mode

- Use the UP/DOWN arrow keys to select alarm mode.
- Selectable alarm modes:

  - **Process High:** The alarm will be activated if the temperature rises above the user set alarm value.

  - **Process Low:** The alarm will be activated if the temperature goes below the user set alarm value.

  - **Process High/Low:** The alarm will be activated if the temperature goes above or below the high and low temperature levels set by user.

  - **Deviation High:** Alarm activation point that changes with the change of the process set point. **Example:** The user sets deviation high alarm at 30°C and has a process set point of 100°C. If the temperature reaches 130°C the alarm will be activated. The user changes process set point to 60°C. If process temperature reaches 90°C the alarm will be activated.

  - **Deviation Low:** Alarm activation point that changes with the change of the process set point. **Example:** User sets the deviation low alarm 30°C and the process set point is 100°C. If the process temperature is 70°C or less, the alarm will be activated. If the process set point temperature is set at 70°C, then if the process temperature is 40°C or less it will activate the alarm.

  - **Deviation High/Low:** Same as Deviation High and Deviation Low alarms. It has the capability of having an alarm activate when the set point temperature goes above or below a set point temperature.

  - **Deviation Band:** Allows user to set the alarm to be activated within a specified temperature range.

- Press the MENU key to advance to screen # 6 after selecting alarm mode.

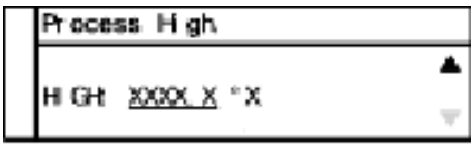
ON/OFF Control Mode Setup:

Screen # 6 - Setting Alarm Mode Variables

- This screen reflects the variable settings for the selected alarm mode from screen # 5.

-Set Point—Process High

- Use UP/DOWN arrow keys to adjust the temperature value.
- When complete, press MENU key to advance to screen # 7.



- Set Point—Process Low

- Use UP/DOWN arrow keys to adjust the temperature value.
- When complete, press MENU key to advance to screen # 7.

- Set Point—Process High/Low

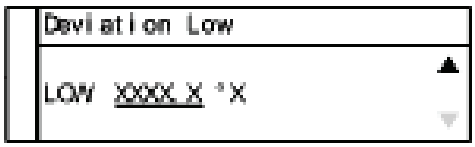
- Use UP/DOWN arrow keys to adjust the temperature value.
- Press the SELECT key to toggle between High and Low. There will be a line below the active field.
- When complete, press MENU key to advance to screen # 7.

- Set Point—Deviation High

- Use UP/DOWN arrow keys to adjust the temperature value.
- When complete, press MENU key to advance to screen # 7.

- Set Point—Deviation Low

- Use UP/DOWN arrow keys to adjust the temperature value.
- When complete, press MENU key to advance to screen # 7.

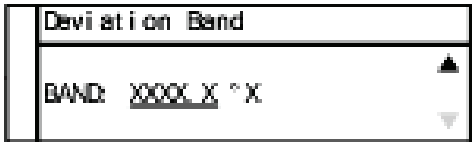


ON/OFF Control Mode Setup:

-Set Point—Deviation High/Low

- Use UP/DOWN arrow keys to adjust the temperature value.
- Press the SELECT key to toggle between High and Low. There will be a line below the active field.
- When complete, press MENU key to advance to screen # 7.

- Set Point—Deviation Band



- Use UP/DOWN arrow keys to adjust the temperature value.
- When complete, press the key to advance to screen # 7.

ON/OFF Control Mode Setup:

Screen # 7 - Setting Hysteresis Alarm

- Use the UP/DOWN arrow keys to adjust value.
- The user-defined value when the alarm will exit an alarm condition. **Example:** The user has a Process High alarm programmed with a value of 150°C and has set the Alarm Hysteresis of 1°C. The alarm has been activated after the temperature reached 160°C. When temperature reaches 149°C, the alarm condition will not be active.
- When complete, press MENU key to advance to screen # 8.

Screen # 8 - Setting Audible Alarm

- Use UP/DOWN arrow keys to change value to either ON audible alarm or OFF audible alarm.
- When complete, press MENU key to advance to screen # 9.

Screen # 9 - Advanced Menu Gateway

- Use UP/DOWN arrow keys to change selection to ENTER.
- When complete, press MENU key to advance to screen # 10.
- The following screens are in the advance portion of the setup menu:

Screen # 10 - Calibration Gateway

Screen # 11 - Global Sensor Offset

Screen # 12 - Over Temperature Stop

Screen # 13 - Loop Break Stop

Screen # 14 - Control Action

Screen # 15 - Control Mode

Screen # 16 - On/Off Control

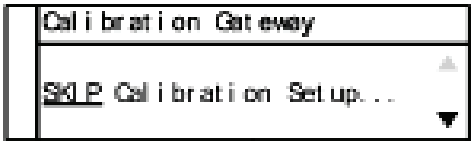
Screen # 17 - Power Output Control

Screen # 18 - Run Time

Screen # 19 - Power Failure Control

ON/OFF Control Mode Setup:

Screen # 10 - Calibration Gateway



- Screen will default to SKIP Calibration Setup.
- **WARNING:** Do not enter the calibration gateway unless you have the proper calibration equipment to calibrate the sensor inputs associated with this controller. Changing calibration settings in the control can cause errors in sensor temperature readings and operation of the control. For instructions on how to use the calibration functions, contact your instrument supplier.
- With SKIP selected, press the MENU key to advance to screen # 11.

Screen # 11 - Global Sensor Offset Calibration

- Use the UP/DOWN arrow keys to change the offset value.
- The use of another temperature device is required to determine the correct offset needed.
- Adjusting this value is offsetting the sensor input temperature being displayed.
- When complete, press MENU key to advance to screen # 12.

Screen # 12 - Over Temperature Stop

- Use the UP/DOWN arrow keys to change the value.
- When sensor temperature goes above this value, the output device will be turned off.
- When complete, press MENU key to advance to screen # 13.

Screen # 13 - Loop Break Stop

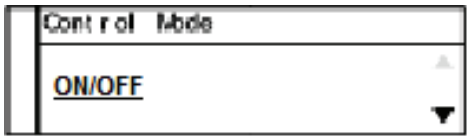
- Default value is ENABLED. Use the UP/DOWN arrow keys to change the value.
- Loop Break Stop is a feature that will stop the process output while the control is in the run mode. If the control senses there is no change in temperature in a user set amount of time the output will be turned off and error will be displayed on the screen along with a audible alarm.
- Set to DISABLED if this function is not required.
- When complete, press MENU key to advance to screen # 14.

ON/OFF Control Mode Setup:

Screen # 14 - Control Action

- Use the UP/DOWN arrow keys to change the value from Heat to Cool.
- Set for the particular process that is being performed.
- When complete, press MENU key to advance to screen # 15.

Screen # 15 - Control Mode



- Use UP/DOWN arrow keys to change the value from the default mode of PID to On/Off.
- When complete, press MENU key to advance to screen # 16.

Screen # 16 - ON/OFF Control

- Use the UP/DOWN arrow keys to adjust value.
- Cycle time is the rate that the output cycles on and off. The recommended time is 1 second.
- If a mechanical relay is being used from the output, it is recommended that the time be increased to more than 1 second. Mechanical relays are slower than solid-state relays and require more time to operate correctly. Damage to the relay and control can occur if not set correctly.
- When complete, press MENU key to advance to screen # 17.

Screen # 17 - Power Output Control

- Use UP/DOWN arrow keys to change the value.
- Default value is 100 percent.
- This feature allows the user to reduce the output power to the output heating device—useful in applications were temperature overshoot is occurring after Auto Tune has been completed.
- Experimenting with this value will be necessary because every process setup is different.
- When complete, press MENU key to advance to screen # 18.

ON/OFF Control Mode Setup:

Screen # 18 - Run Time

- Use the UP/DOWN arrow keys to change the value.
- Use the SELECT key to toggle between HR and MIN fields.
- Run Time is a safety feature while the control is in the On/Off or PID mode. The user can set a timer to have the output turned OFF if the time expires.
- When complete, press MENU key to advance to screen # 19.

Screen # 19 - Power Failure Control

- Use the UP/DOWN arrow keys to change the value.
- Default value is STOP:

  STOP — If the controller loses power while in the run mode, it will not resume the process once the power has been restored.

  RESUME — If the controller loses power while in the run mode, it will resume the operating process once the power has been restored.
- When complete, press MENU key to advance to screen # 20.

Screen # 20 - Advanced Menu Exit

- Setup is complete.
- Automatically will exit to the main operation screen.

Safety Precautions

DANGER: DO NOT REMOVE COVER! HIGH VOLTAGE IS PRESENT IN THE CONTROLLER. Contact supplier for service.

DANGER: If high voltage is present on external temperature sensor from outside source, high voltage will be present at the control.

DANGER: Fire protection and control damage: Replace all fuses with the correct fuse replacement. Reference page 26 for model 89800-01 and page 27 for model 89800-02.

WARNING: Specifications for the power cord: see page 26 for model 89800-01 and page 27 for model 89800-02 for proper replacement cord. Additional input power cords for various countries are listed on page 32.

WARNING: Use of separate temperature limit control is recommended were a fault condition could occur and result in a fire or other hazardous condition.

Specifications for TC9000 Controller — Model 89800-01

Power input: 120 VAC ±10%, 50/60 Hz ±3%, 15 amp, 1800 watts max load

Operating environment: 32 to 77ºF (0 to 25ºC); 90% RH, noncondensing

Maximum altitude: 2187 yd (2000 m)

Pollution degree: 2 (normally only nonconductivity pollution occurs)

Installation category II: local level (connect to branch circuit and not directly to a main circuit, such as a fuse panel)

Storage: 32 to 140ºF (0 to 60ºC); 5 to 80% RH, noncondensing

Fuse: 250 volt, 15 amp rated (fast-acting)

AC line cord: SJT-14-3 14 AWG, 15 amp, 125 VAC, less than 9 ft (3 m) in length

Heater/cooler output: max voltage: 120 VAC ±10%, 15 amp, 50/60 Hz, 1800 watts max load

Process memory: data retention upon power failure via nonvolatile memory

Dimensions (W x H x D): 8" x 3.75" x 9" (20.3 x 9.5 x 22.9 cm)

Specifications for TC9000 Controller — Model 89800-02

Power input: 230 VAC ±10%, 50/60 Hz ±3%, 10 amp, 2300 watts max load

Operating environment: 32 to 77ºF (0 to 25ºC); 90% RH, noncondensing

Maximum altitude: 2187 yd (2000 m)

Pollution degree: 2 (normally only nonconductivity pollution occurs)

Installation category II: local level (connect to branch circuit and not directly to a main circuit, such as a fuse panel)

Storage: 32 to 140ºF (0 to 60ºC); 5 to 80% RH, noncondensing

Fuse: 250 volt, 10 amp rated (fast-acting)

AC line cord: SJT-14-3 14 AWG, 15 amp, 240 VAC, less than 9 ft (3 m) in length

Heater/cooler output: max voltage: 230 VAC ±10%, 15 amp, 50/60 Hz ±3%, 3450 watts max load

Process memory: data retention upon power failure via nonvolatile memory

Dimensions (W x H x D): 8" x 3.75" x 9" (20.3 x 9.5 x 22.9 cm)

Specifications for Sensor Input

- Thermocouple (grounded or nongrounded)
- Automatic cold junction compensation and break protection for sensor

Range

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

Sensor accuracy

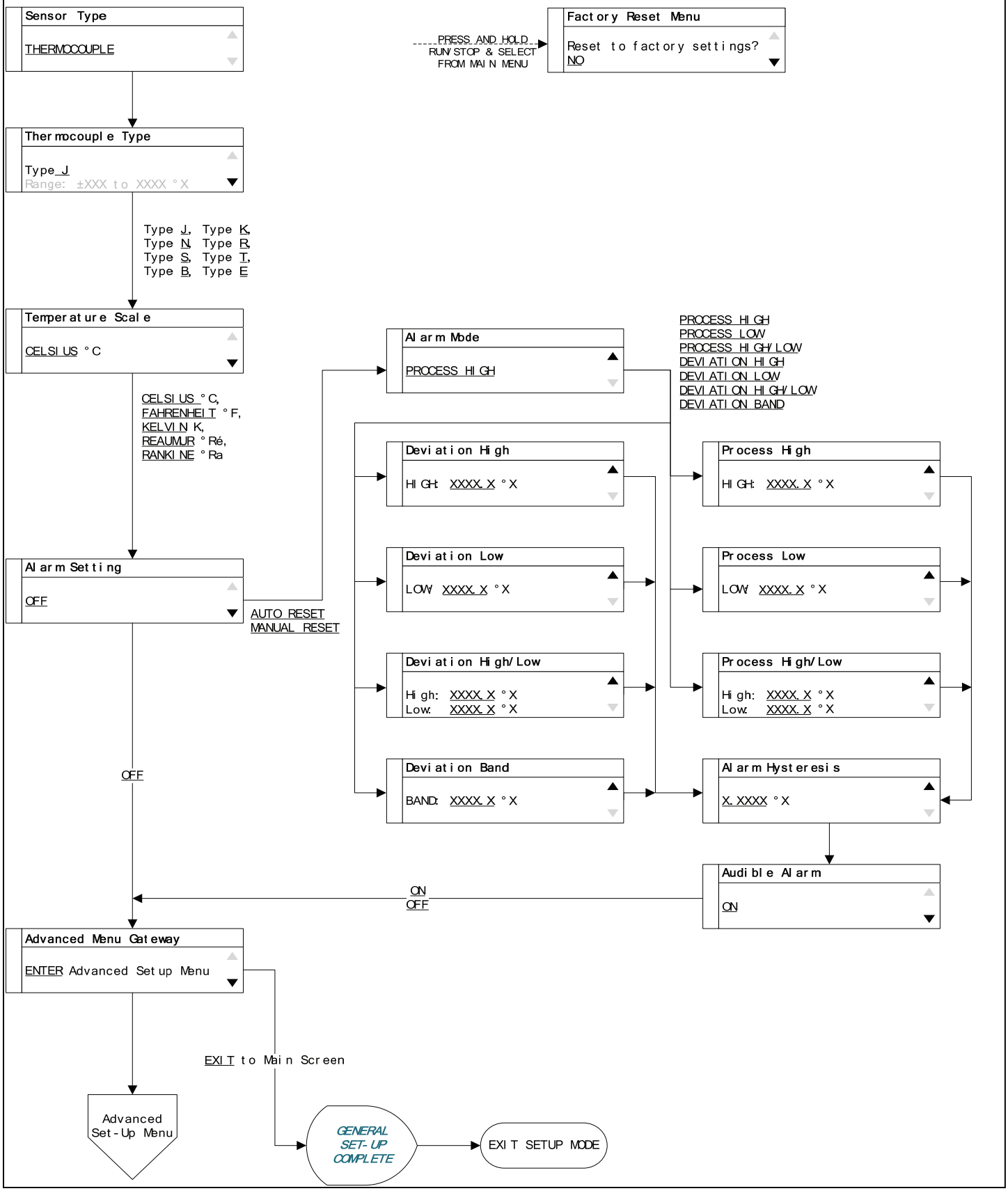
Calibration accuracy

Types J, K, T, E, N: ±0.1% of span or ±1°C

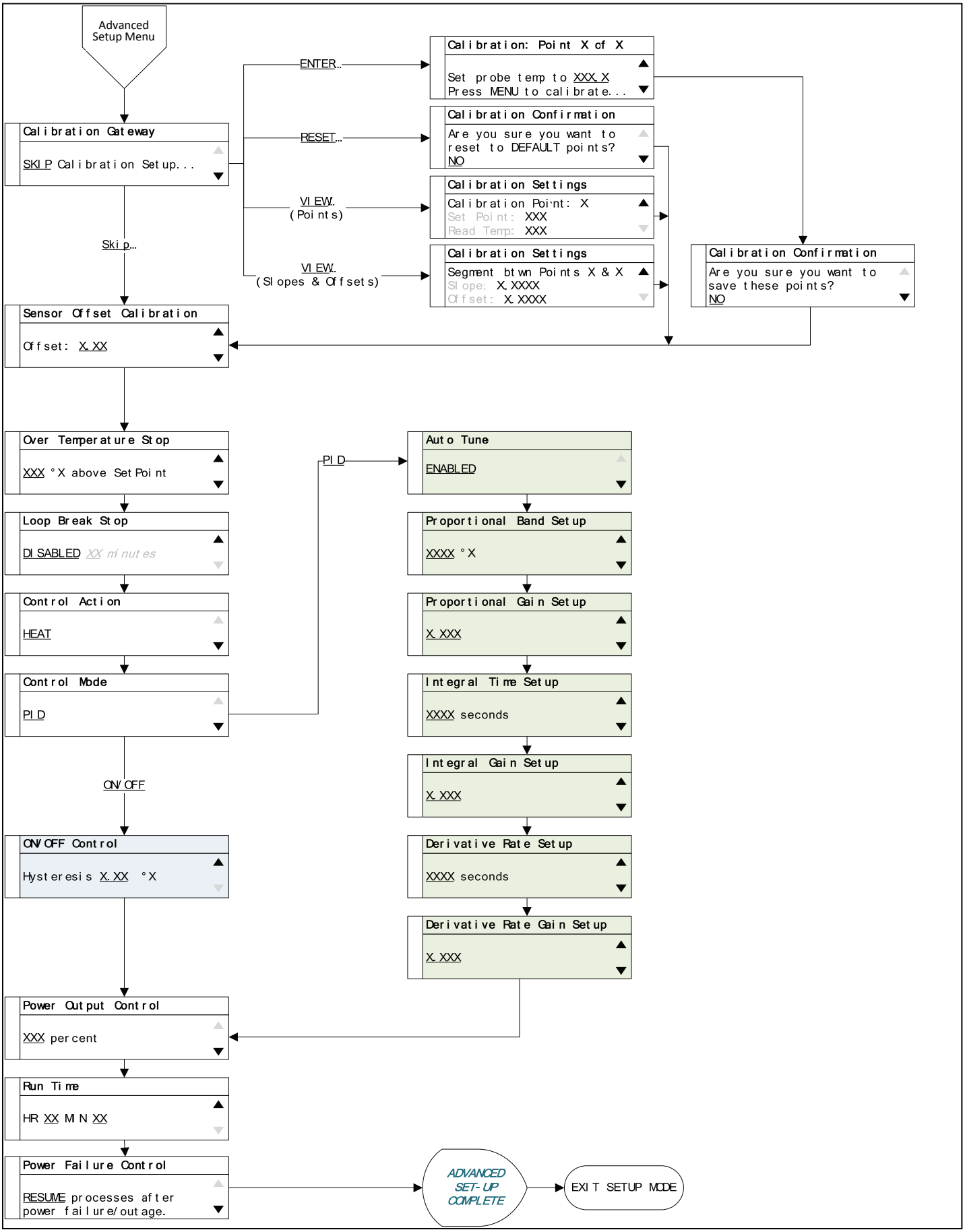
Types B, R, S: ±0.2% of span

Accuracy span is 1000°F (540°C) minimum

Screen Flow Charts



Screen Flow Charts



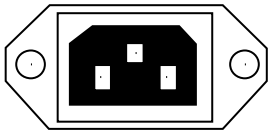
Ferrite Clip Installation

Example picture Digi-Sense Temperature Controller TC9500 Model 89800-03

Alternative Power Cords — for Various Countries

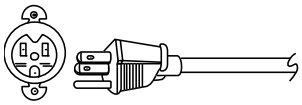
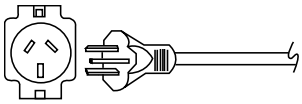
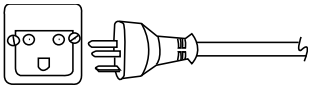
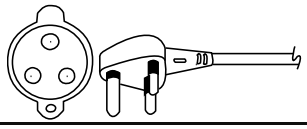
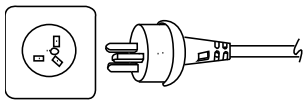
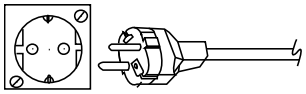
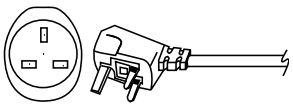
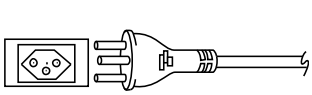
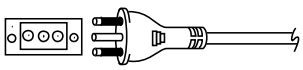
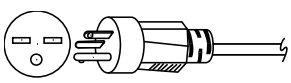
A detachable cord/plug set is automatically included with both models of the temperature controller:

- Model 89800-01 includes a US 120 VAC plug
- Model 89800-02 includes a US 220 VAC plug



IEC 320 socket

Below is a ordering table for the available cord/plug sets. Cord/plug sets feature a country-specific male plug on one end and an IEC 320 female plug on the other end. Order a cord/plug set to replace a lost or damaged set or to use your temperature controller in another country.

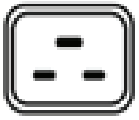
Illustration	Country	Catalog number
	US Standard	50001-68
	Australia, Japan	50001-60
	Denmark	50001-62
	India	50001-64
	Israel	50001-69
	Europe	50001-70
	England	50001-72
	Switzerland	50001-74
	Italy	50001-76
	US (NEMA)	50001-78

Output Cord Adapters — for Various Countries

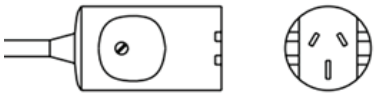
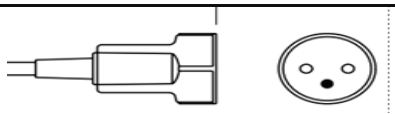
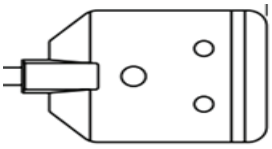
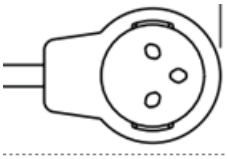
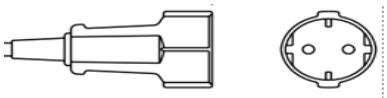
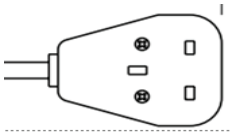
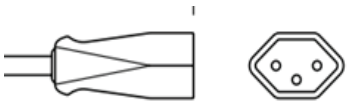
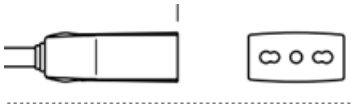
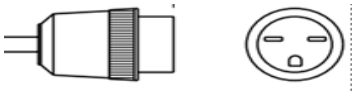
A detachable cord set is not included with the temperature controller:

- Model 89800-01 includes a US 120 VAC female plug
- Model 89800-02 includes a IEC 60320 C19, 230 VAC female plug

Below is a ordering table for the available cord sets. Cord sets feature a country-specific female plug on one end and an IEC 360320 C19 male plug on the other end that will plugs into the controller.. Order a cord set to use your heating or cooling devices with your 230 VAC temperature controller in another country. Each cord set is 12 in ((30.5 cm) in length.



IEC 60320 C19

Illustration	Country	Catalog number
	Australia, Japan	80800-24
	Denmark	80800-21
	India	80800-23
	Israel	80800-28
	Europe	89800-19
	England	89800-22
	Switzerland	80800-26
	Italy	80800-27
	US (NEMA)	80800-29

CE Approval

Conforms to the following Product Specifications:

EMC: EC Directive 204/108/EC
Using the following: EN 61326-1-2006
EN 55011 : 2009 ISM RADIO FREQUENCY EQUIPMENT, CLASS B
EN 61000-3-2:2006 (IEC 61000-3-2 : 2005) HARMONICS
En 61000-3-3:2008 (IEC 6100-3-3:2008) FLICKER
Immunity Test:

EN 61000-4-2: 2001-4	ESD
EN 61000-4-3: 2006-02	RADIATED RF SUSCEPTIBILITY
EN 61000-4-4:2004-07	ELECTRICAL FAST TRANSIENT / BURST
EN 61000-4-5:2001-04	SURGE
EN 61000-4-6:2004-11	RF CONDUCTED SUSCEPTIBILITY, COMMON MODE
EN 61000-4-11:2004-03	VOLTAGE DIPS AND INTERRUPTIONS

Safety: 2006/95/EC using EN61010-1

UL File E207546, Vol. 1

Standard:	UL 61010-1, 3rd Edition, 2012-04-17 (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements) CAN/CSA-C22.2 No. 61010-1, 3rd Edition, 2012-04, (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements)
Certification Type:	Listing
CCN:	OGTK, OGTK7 (Laboratory Use Electrical Equipment)

Maintenance

- Simple preventive maintenance steps include keeping the controller clean. Protect it from overload, excessive dirt, oil and corrosion.
- Cleaning: If cleaning is necessary, use only a damp cloth with water only. Wipe only the exterior of the control chassis.

CATALOG NUMBERS **89800-01 and 89800-02**

SERIAL NUMBER _____

DATE OF PURCHASE _____

For Product and Ordering Information, Contact:

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