

TC-9102 Series Surface Mount Temperature Controllers

General Description & Applications

The TC-9102 Series Temperature Controller offers a versatile solution for a wide variety of applications that may require 30 amp relays, short cycle delays and independent dual stages in one convenient, easy to use controller.

The TC-9102 controller can accommodate input voltages from 12VAC to 240VAC. The TC-9102 comes with a temperature sensor with a temperature range of -40 to 300F (-40 to 148°C). An optional RTD sensor is also available.



Features

- Single or Dual stage models with independent relay control.
- Programmable set point, differential, short cycle delay time, and temperature sensor calibration mode.
- Fahrenheit or Celsius Mode Selectable.
- LED relay status indicator.
- NEMA 1, high-impact plastic enclosure.

- Tamper resistant features to lock out and limit set point adjustment and programming features.
- .56" high red LED display with three digit display in 1 degree increments.
- Displays current temperature.
- Durable touch-pad programming with LED display prompts.

Specifications

Power Requirements:

- Low Voltage (LV) models accept 12 to 24VAC & 24VDC.
- High Voltage (HV) models accept 120 to 240VAC.

Relay(s) Contact Rating:

1 relay on single stage models, 2 relays on dual stage models.

- SPST, normally open – switch up to 30A at 277 VAC

Ambient Operating Temp: 20 to 158°F (-6 to 70°C)

Ambient Operating Humidity: 90%RH at 95°F (35°C)

Accuracy: ± 2° F, ± 2°C

Temperature Sensor Range:

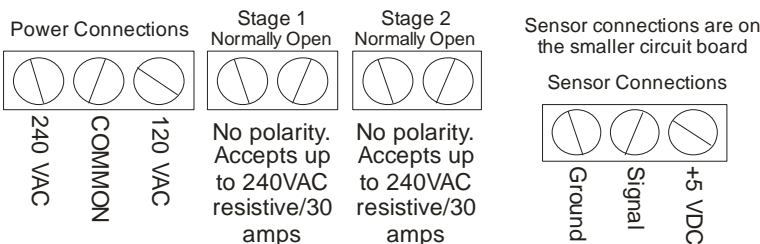
- PTC sensor included: -40 to 300°F (-40 to 148°C) with 36" (.91M) 24AWG, 2 conductor wire. Nickel plated copper sensor cap: 1.75" L (44mm) x .251" OD (6.38mm).
- Optional 1000 Ohm Platinum RTD sensor: 0 to 600°F (-17 to 316°C)

Relay Status Indicator: LED is on when relay is activated.

Dimensions: L 6.00" (15.24cm) x W 3.12" (7.92cm) x D 2.00" (5.08cm)

Agency Approvals: UL and CUL recognized. RoHS compliant.

Wiring Connections



Low Voltage Power: On low voltage (LV) models, the input voltage can be 12 to 24 VAC or 24 VDC. LV models will only have a two position terminal block marked "240" and "COM". There is no polarity with any of the low voltage inputs, so both power leads can go into either of these terminal positions.

| Sensor Type | Ground | Signal | +5 VDC |
|-------------------|--------|--------|--------|
| PTC or RTD sensor | Black | White | NA |

WARNING:

To avoid the risk of electrical shock, disconnect all power sources to the controller and the equipment before wiring any connections. More than one disconnect may be required to completely de-energize the control and the equipment.

IMPORTANT:

All wiring must conform to local, national and regional regulations. Use copper conductors only for all wire connections. Do not exceed the electrical ratings for the TC-9102 series control or the equipment it is wired to.

Connect the proper power supply to the power connections on the terminal block as shown in the Dimensions & Wiring section on page one. Note your model number indicates what input voltage is acceptable for this unit.

1. "HV" designates the unit can accept input voltage of between 110 and 240 VAC
2. "LV" designates the unit can accept input voltage of 12 or 24 VAC or 24 VDC. On low voltage versions, the TC-9102 will have only a 240VAC and Common terminal block. There is no polarity on this terminal block for low voltage inputs.

The input power is independent of the power that can run through the relays. On all models, regardless of the input voltage, the control relays can accept up to 240 VAC power at up to 30 AMPS. Connect the heating and cooling equipment to the normally open (NO) relay terminal block connectors as appropriate.

The sensor may already be connected, but if not or if you ordered the RTD sensor option, you may need to connect this sensor to the sensor connections. If you connected the optional RTD sensor, you will need to change the sensor selection menu in the Hidden Access menus to get an accurate temperature sensor reading. See sensor connections on previous page.

Once the unit is powered up and the proper sensor is connected, the controller will display the current temperature. If the current temperature does not appear to match the actual current temperature, you will have an opportunity to calibrate the sensor. If the display is showing "**Shrt**" or "**OPEn**", it means the sensor connection has a problem. "**Shrt**" indicates there is a short in one of the wires of the sensor or in the sensor itself. "**OPEn**" indicates a cut wire or open connection on one of the sensor's wires.

How the Controller Works

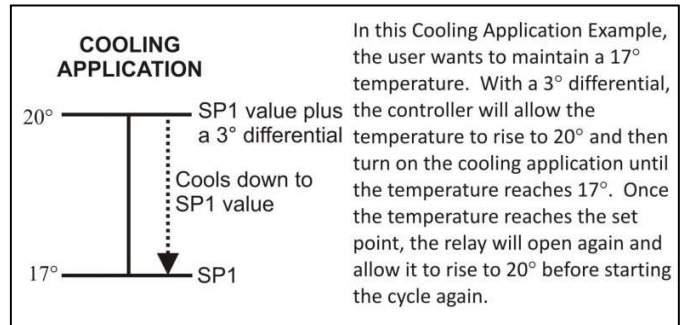
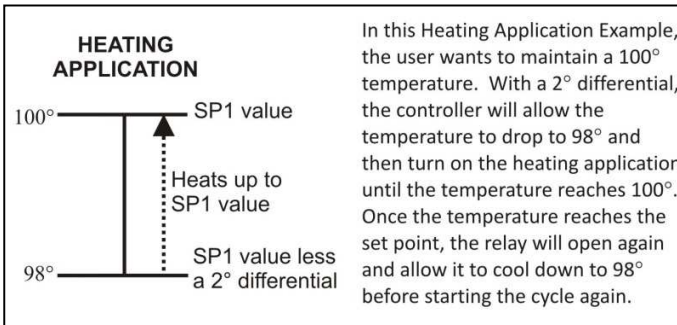
When programming the TC-9102 temperature controller, it is important to determine how the TC-9102 controller should operate for your specific application. You will need to know if you are using the controller in a heating application, a cooling application or with a dual stage unit, it can even be used for both a heating and cooling application.

There are three different programming parameters that determine how the TC-9102 controller will operate for your specific application. Dual stage units have separate programming parameters for each stage.

1. Temperature Set Point: The relays will always turn OFF or open when the temperature set point is reached.
2. Operating Mode (COOL, HEAT or OFF): This setting determines the application the controller is being used for.
3. Differential Setting: This is the number of degrees above or below the temperature set point the temperature is allowed to rise or fall (depending up on the Operating Mode).

Temperature Set-Point Programming Functions:**Single Stage Applications:**

On single stage models, the controller will either turn on or off the heating or cooling application based on the *Temperature Set Point* set in the Set Point Programming function and the *Differential* set in Hidden Access Programming Function. The diagrams below show how a single stage model operates for either a heating or cooling application.

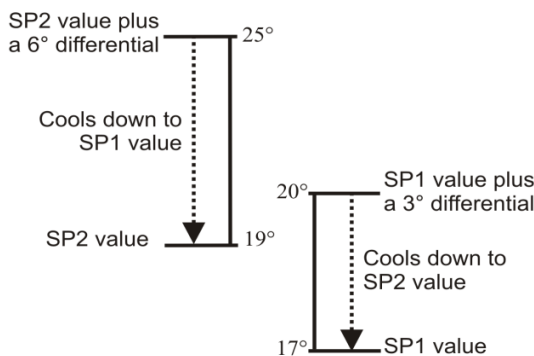


Dual Stage Applications:

With dual stage models, each stage is independent, so one stage can be set as a cooling stage and the other a heating stage, or both can be cooling or heating stages. When both stages are set to heating or cooling mode, each stage can have any set point or differential value desired. If one stage is heat and the other is cool, however, there is a limitation on how you can set the temperature set points to prevent the controller from having both heating and cooling applications running at the same time.

When both stages are in COOL or HEAT modes, the temperature set points can overlap or be separated by any number of degrees. When using both HEAT and COOL applications in a dual stage controller, the controller will not let the user set temperature set points that overlap. The TC-9102 controller automatically enforces a 2 second delay between one stage turning off and another stage starting. The following diagrams show examples of how the Dual Stage TC-9102 controller can be configured in different applications.

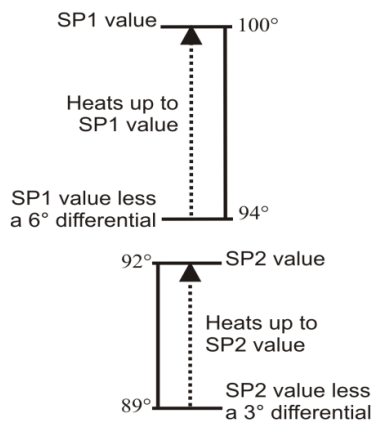
DUAL STAGE MODEL WITH BOTH STAGES IN COOLING MODE



With both stages in the cooling mode, one can “stage” cooling phases. The example on the left shows stage 1 turning on to cool to bring the temperature down to 17°. If the temperature continues to rise for some reason, stage 2 kicks in at 25° to boost the cooling down.

Alternately, each stage could be separated by any number of degrees.

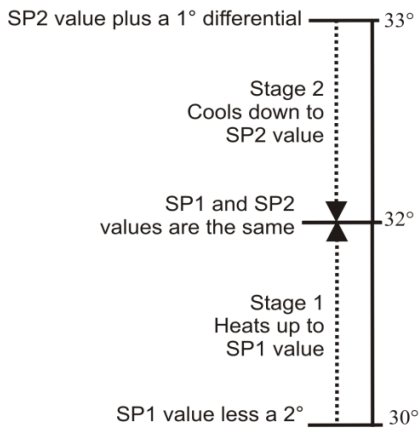
DUAL STAGE MODEL WITH BOTH STAGES IN HEATING MODE



In this example, both stages are set to HEAT, but the stages are separated by 2 degrees.

When both stages are set to either HEAT or COOL modes, the stages can have the same temperature set-point, be separated by any number of degrees or they can overlap as shown above.

With dual stages, the TC-9102 can be used in a wide variety of applications.

**DUAL STAGE MODEL WITH BOTH
HEAT AND COOL STAGES**


It is possible to maintain a very tight temperature range by setting one stage as a cooling stage and one stage as a heating stage.

In the example on the left, stage 1 will heat up to 32°. At 32°, the heating application will turn off and allow the application to rise to 33° at which time the cooling stage will turn on. The cooling stage will turn off when the temperature reaches 32°.

Although both temperature set points can be set at the same temperature, the TC-9102 requires a minimum differential of 1 degree or more. In addition, the controller enforces a 2 second delay between one stage turning off and the other stage turning on. This is designed to reduce the possibility of tripping circuit breakers should both the heating and cooling elements be on at the same time.

Programming Instructions

Programming the TC-9102 series temperature controller is completed through two separate programming sequences:

1. Temperature Set-Point Programming Functions
2. Hidden Access Programming Functions for operation mode, differential, high & low set point limits, calibration, F/C selection, short cycle delay time, temperature sensor selection and lock-out functions.

The programming menus are set up to display a program function first, followed by the numeric value or feature value. You can change that value and then press the ENTER key to save the value, then press the MODE key to move to the next programming function. The program functions are displayed with shortened text to represent the function that is to be programmed. For a detailed explanation of all the program functions, see page 7.

WHAT HAPPENS DURING A POWER FAILURE?

All settings on the TC-9102 temperature controllers are saved in non-volatile memory which means they will stay programmed even if the power is cut to the unit. This is crucial during a power failure since the unit will return to normal operating function once the power is restored.

SAVING YOUR CHANGES:

To save your changes, you MUST press the ENTER value whenever you make a change to any program setting.

EXITING THE MENUS:

You can exit the menus in one of several ways. If you make changes, you will need to press the ENTER button after every change or your values will not be saved!

1. Pressing the **MODE** button will cycle through each programming function and function value. At the end of the menu, the unit will go blank for several seconds and then return the current temperature to the display.
2. Pressing and holding the **MODE** button for five seconds will allow you to exit the menu without having to cycle through the menus.
3. When a programming function is displayed, you can press the down and up arrows to move through the various programming options to select the one you wish to change. If you get to the last menu and press the down arrow one more time, the unit's display will go blank for several seconds and then return with the current temperature displayed.



PROGRAMMING TEMPERATURE SET POINT:

- It is assumed the unit is powered up and the current temperature is displayed.
- Shaded sections are only applicable to Dual Stage Units.

| Step | PRESS | DISPLAYED | FUNCTION or INSTRUCTIONS |
|------|-------|--------------------------|---|
| 1 | | SP1 | SP1 represents Set Point #1 for the first stage. On single stage models, there will only be one set point value, but on dual stage models, there will also be a SP2 as shown below. |
| 2 | | Flashing Temp Value | Using the keys, adjust the temperature set point value for stage 1. |
| 3 | | SP1 value is displayed. | Pressing ENTER saves the value and displays it without flashing. |
| 4 | | SP2 | For DUAL STAGE models ONLY , SP2 will appear, giving you the ability to program the temperature set point for the second stage. |
| 5 | | Flashing Temp Value | DUAL STAGE MODELS ONLY: Using the keys, adjust the temperature set point value for stage 2. |
| 6 | | SP2's value is displayed | DUAL STAGE MODELS ONLY: Pressing ENTER saves the value and displays it without flashing. |
| Exit | | Blank Screen | For a few seconds, the screen will go blank and then the current temperature will be displayed. This signifies the end of this programming menu. |

PROGRAMMING THE HIDDEN ACCESS MENU FUNCTIONS:

- It is assumed the unit is powered up and the current temperature is displayed.
- Shaded sections are only applicable to Dual Stage Units.
- For detailed explanation of the individual programming options, go to the end of this programming guide.

| Step | PRESS | DISPLAYED | FUNCTION or INSTRUCTIONS |
|------|-------|--------------------------|--|
| 1 | + | OP1 | Press and hold the DOWN ARROW key and then press the MODE button. OP1 will be displayed representing the Operating Mode for Stage 1. |
| 2 | | Flashing OP1 value | Using the keys, select between the HEAT, COOL or OFF operating mode for stage 1. |
| 3 | | OP1's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 4 | | OP2 | On DUAL STAGE UNITS only, the unit displays OP2, representing the operating mode for Stage 2. |
| 5 | | Flashing OP2 value | Using the keys, select between the HEAT, COOL or OFF operating mode for stage 2. |
| 6 | | OP2's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 7 | | dF1 | dF1 will be displayed representing the differential for Stage 1. |
| 8 | | Flashing dF1's value | Using the keys, adjust the differential setting for stage 1. |
| 9 | | dF1's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 10 | | dF2 | ON DUAL STAGE UNITS only, dF2 will be displayed representing the differential for Stage 2. |
| 11 | | Flashing dF2's value | Using the keys, adjust the differential setting for stage 2. |



| | | | |
|----|--|----------------------------|---|
| 12 | | dif2's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 13 | | HSL1 | HSL1 will be displayed representing the High Set Point Limit for Stage 1. |
| 14 | | Flashing HSL1's value | Using the $\downarrow\uparrow$ keys, adjust the high set point limit for stage 1. |
| 15 | | HSL1's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 16 | | LSL1 | LSL1 is displayed representing the Low Set Point Limit programming parameter. |
| 17 | | Flashing LSL1's value | Using the $\downarrow\uparrow$ keys, adjust the low set point limit for stage 1. |
| 18 | | LSL1's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 19 | | HSL2 | On DUAL STAGE UNITS only, the unit displays HSL2, representing the High Set Point Limit for Stage 2. |
| 20 | | Flashing HSL2's value | Using the $\downarrow\uparrow$ keys, adjust the high set point limit for stage 2. |
| 21 | | HSL's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 22 | | LSL2 | On DUAL STAGE UNITS only, the unit displays LSL2, representing the Low Set Point Limit for Stage 2. |
| 23 | | Flashing LSL2's value | Using the $\downarrow\uparrow$ keys, adjust the low set point limit for stage 2. |
| 24 | | LSL2's value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 25 | | CAL | CAL is displayed, representing the temperature sensor calibration adjustment. |
| 26 | | Flashing CAL value | Using the $\downarrow\uparrow$ keys, adjust the calibration value of the temperature sensor. This can be adjusted $\pm 30^\circ$ from the reading on the display. |
| 27 | | CAL value is displayed. | Pressing ENTER saves the value and displays it without flashing. |
| 28 | | F or C is displayed | This is where you select if the unit should display in Fahrenheit or Celsius degrees. Press MODE to change the selection. |
| 29 | | Flashing F or C | Use the $\downarrow\uparrow$ keys to toggle between "F" and "C". |
| 30 | | F or C is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 31 | | SCYC | SCYC represents the Short Cycle Delay Time. You select a value in minutes anywhere from 0 to 15 minutes. Press MODE to change the selection. |
| 32 | | Flashing SCYC value | Using the $\downarrow\uparrow$ keys, set your desired Short Cycle Delay time. |
| 33 | | SCYC value is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 34 | | SEnS | SEnS allows you to select from one of two different sensor options. Press MODE to change the selection. |
| 35 | | Flashing Ptc or rtd | Use the $\downarrow\uparrow$ keys to toggle between "rtd" and "Ptc". |
| 36 | | Ptc or rtd is displayed | Pressing ENTER saves the value and displays it without flashing. |



| | | | |
|----|--|---------------------------|--|
| 37 | | LOC | This is the Lock-Out feature that prevents users from changing the temperature alarm set point or the temperature alarm set point. Press MODE to turn this ON or OFF. |
| 38 | | ALL or OFF flashes | Use the $\downarrow\uparrow$ keys to toggle between "ALL" or "OFF" |
| 39 | | ALL or OFF is displayed | Pressing ENTER saves the value and displays it without flashing. |
| 40 | | Display goes blank | Pressing MODE at the end of this menu results in the display going blank for several seconds followed by a display of the current temperature reading from the temperature sensor. |

EXPLANATION OF PROGRAMMING PARAMETER SETTINGS:

- SP1 & SP2 TEMPERATURE SET POINT** This is the temperature you wish to maintain for each stage. The TC-9102D model has two independent relay stages. The TC-9102S is a single stage model. See page 2 for an explanation of how the TC-9102 uses these set points in conjunction with the differential setting.
- OP1 and OP2 OPERATING MODE** Select the type of application this controller will be working with. Is it a heating application or a cooling application. If you don't wish to use this relay at all, select the OFF mode. Only Dual stage units will have a "OP2" mode. Factory default is COOL.
- df1 and df2 DIFFERENTIAL** This represents the number of degrees from the temperature set point the controller allows the temperature to rise or fall before closing the relay control. See diagrams above. This is always a positive number from 1 to 30. Zero is not allowed as a differential value. Only Dual Stage units will have a "df2" option. The factory default setting is 3.
- HSL1 and HSL2 LSL1 and LSL2 HIGH SET POINT LIMIT and LOW SET POINT LIMIT** This is a tamper proof option that allows a user to set maximum and minimum temperature set point limits to which a user can adjust the temperature set point. If a user only wants people to be able to adjust temperature a few degrees, they can set very tight High and Low Set Point Limits. Both High and Low set point limits can be set to the same temperature to prevent any change in temperature set point. Only dual stage units have HSL2 and LSL2 options. Factory default value is 100° for the High Set Point Limits and 0° for the Low Set Point Limits.
- CAL CALIBRATION** This option allows a user to field calibrate the temperature sensor. If the actual temperature is 2 degrees higher than what the TC-9102 is displaying, the user can enter a value of 2 in the calibration option to make the TC-9102 controller display the correct temperature. You can enter a calibration value anywhere from -30 to +30. Factory set at zero.
- F or C TEMPERATURE SCALE** This option allows you to have the TC-9102 display in either Fahrenheit or Celsius degrees. Factory default is Fahrenheit.
- SCYC SHORT CYCLE DELAY TIME** The short cycle protection feature prevents the controller from short cycling a compressor. A short cycle condition is when a relay controlling a compressor or other equipment cycles on and off too quickly, possibly causing compressor or equipment damage. The minimum time between relay state change is determined by the value entered in the Short Cycle Delay Time option. Enter a value anywhere from 0 to 15 minutes. Factory default is 5 minutes.
- SEnS SENSOR SELECTION** Choose if you have our PTC or RTD sensor connected. Factory default is PTC.
- LOC LOCK OUT FEATURE** This feature allows the user to prevent anyone from adjusting the temperature set point(s). If a person attempts to change any value, the display will show LOC for a short period of time to show the user these adjustments are off-limits. Two options are available. Factory default is OFF.
1. ALL Locks out all functionality of the Temperature Set Point menus. No changes can be made.
 2. OFF This turns off all lock-out features and allows a user full access to the Temperature Set Point menu.

Normal Operation

During normal operation, the current temperature will be displayed. Relay indicator lights will be illuminated only if relays are in the closed position.

Relay Operation:

1. Relays will always open when the temperature set point is reached.
2. Relays will always close when the temperature set point, plus or minus the differential value is reached.
3. On a dual stage unit, if using one relay for HEAT and the other for COOL, the TC-9102 will not allow the relays to be both on at the same time. There will be a minimum of 2 seconds between turning one stage off and turning another stage on. This is designed to eliminate the possibility of a simultaneous switch between heating and cooling that could cause a circuit breaker to trip.

FAILED TEMPERATURE SENSOR ALARM:

The TC-9102 can determine when the temperature sensor is defective or damaged and will alarm when such a condition occurs. If the sensor has a cut wire or an open circuit, the display will flash "OPEn". If there is a short in the sensor wire or the sensor element, the display will flash "Shrt". All controller functions will cease to operate until the problem with the sensor is fixed.

Technical Support & Contact Info

If you have further questions about the operation of your TC-9102 Temperature Controller and Alarm, please contact our Customer Service department in one of the following methods:

Phone: 952-448-2217
Fax: 952-361-9420
Email: customerservice@controlproductsinc.com
Web: www.controlproductsonline.com

MODELS AVAILABLE (Made in USA)

| | |
|-------------|--|
| TC-9102S-LV | Single stage, power = 12 or 24 VAC, 24 VDC |
| TC-9102D-LV | Dual stage, power = 12 or 24 VAC, 24 VDC |
| TC-9102S-HV | Single stage, power = 120 or 240 VAC |
| TC-9102D-HV | Dual stage, power = 120 or 240 VAC |

Warranty

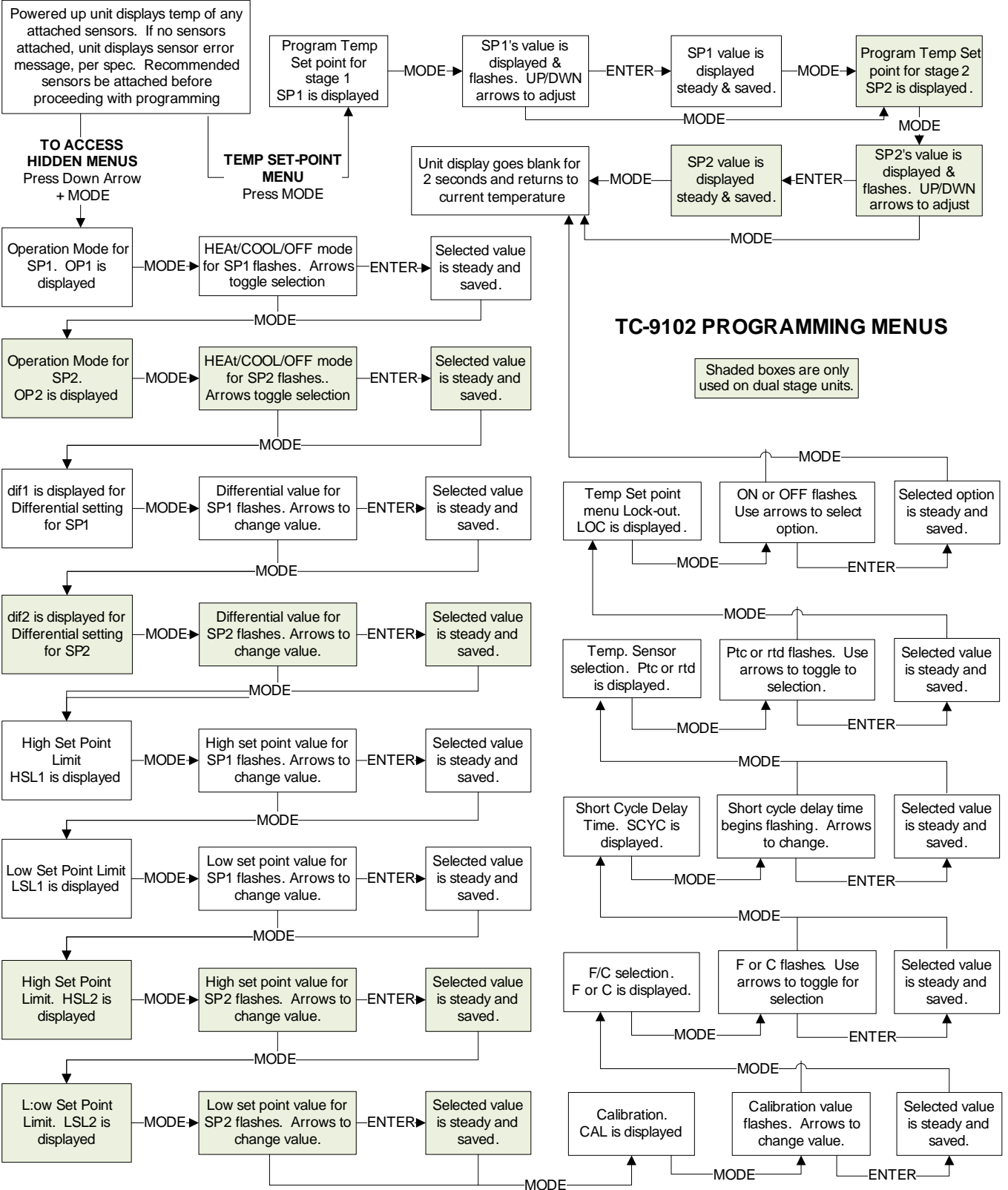
Control Products, Inc. warrants this product to be free from defects in material and workmanship under normal use for one year and is not responsible for consequential damages or installation costs of any nature. Exposure to contaminants and extreme environmental conditions such as moisture, temperature, chemicals, etc. may cause the unit to degrade or fail. Control Products accepts no liability for product applications or customer application testing.

Custom Design & Modifications

Control Products specializes in complete design and manufacture of electronic controls. In addition to making any desired modifications to this product, we can design a unique control specific to your application. Please consult our Customer Service Department for further information on these services.



Menu Flow Charts



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MADE IN USA
Printed in the USA

DOCUMENT #: 42420054B
REVISION B (0210)