



# SensiStat™ Energy Saver Refrigeration Controller

Revision 2.05

(Applies to SensiStat Revision 2.x products)

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The SCAD SensiStat™ Energy Saver refrigeration controller works with your 12 or 24-volt holding (aka holdover) plate refrigeration system and reduces your battery usage by:

- Providing extremely precise thermal control thus reducing excess running of your refrigeration compressor
- Automatically utilizing available “excess” power while your batteries are charging. This reduces the amount of battery energy used each day for refrigeration and saves you hours of battery charging time each week. This savings translates to real dollars as you will use less fuel for battery charging and reduce wear-and-tear on your engine or generator.

**NOTE:** If you connect power to your SensiStat while the temperature probes are above 16 degrees F, after two minutes, the high temperature alarm will sound and "E04" will be displayed. This is normal and correct behavior. To mute the beeping, press the PRG key briefly. To adjust the high temperature alarm threshold, delay, or to disable the high temperature alarm, refer to the high temperature alarm section of this manual.

## HOW IT WORKS

A typical thermostat turns on your refrigeration compressor to freeze holding plates solid. The plates are then allowed to defrost to a temperature approximately 8° F higher before the compressor is turned on again and the plates are refrozen. The difference between the freezing temperature and the “defrosted” temperature is known as hysteresis or differential. This is the most energy efficient method and the more precise the control, the more efficient the system and the more likely your ice cream will remain solid. The SensiStat refrigeration controller, with a resolution of 1/10° F provides unparalleled precision of control. What’s more, the SensiStat comes with temperature sensors to allow you to monitor and display both the holding plate temperature and refrigeration box temperature.

Normal thermostats also do not take advantage of randomly available “free” or “excess” power provided whenever your engine or generator are running and charging your batteries. Since batteries can only charge so fast, there is normally plenty of extra generation capacity available to run your refrigeration system “for free”, that is using energy without depleting your batteries. When the SensiStat refrigeration controller detects charging level voltages, it closes down the hysteresis to only 1° F and uses the available free power to “top-up” the freeze on your holding plates. For example, when you are motoring into an anchorage at the end of the day, the SensiStat will automatically run your refrigeration compressor while your engine is running and save you all the battery

energy that would have been used later in the evening running the refrigeration compressor for the same amount of time directly off the batteries.

You can also tell the SensiStat refrigeration controller to ignore extra power (such as while plugged in a dock) or to force a freezing of the holding plates for up to 60 minutes.

Additionally, the SensiStat detects excess voltages which might damage your refrigeration system, alerts you, and does not over-ride the differential when excess voltages are present.

Your SensiStat also includes an over-temperature alarm. If the plate temperature reaches 16 ° F over the set point for more than two minutes, a mutable alarm will sound. You can change the settings and behavior of the over-temperature alarm and even disable it.

Finally, although the factory settings will work for most sailors, you can custom program the voltage threshold at which the SensiStat overrides the differential. You can also set the holding plate freezing temperature, the normal and override differentials, the displayed temperature scale (Fahrenheit or Centigrade), and whether the holding plate or box temperature is displayed by default.

## INSTALLATION

The SensiStat refrigeration controller simply replaces your current thermostat, switch, or timer. Find a convenient place to mount your SensiStat and cut the appropriate hole using the template found at the end of this manual.

The SensiStat has removable terminal connectors to make the wiring task easier. Note that the screws of the connectors face down. Do not force the connectors into place. If you have to push hard, you have the connectors mis-located – double-check the color of the connector and its position. (Green connector goes to green connector, orange to orange).

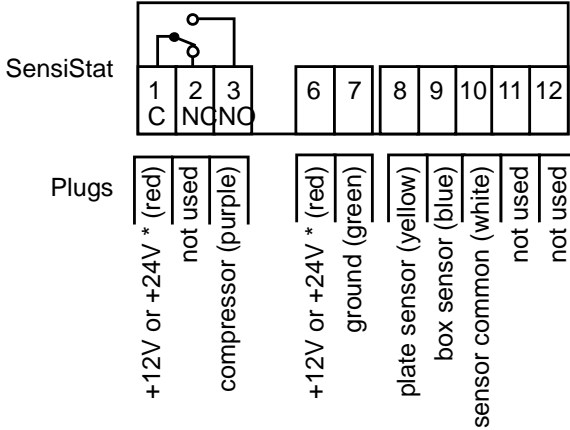
We have also painted reference colors on each of the connectors to help make the wiring easier. Here are the color codes (see also Figure 1):

- Red: plus voltage (+12V or +24V)
- Green: ground
- White: common leads of temperature probes
- Yellow: holding plate temperature probe lead
- Blue: box temperature probe lead
- Purple: control line to your refrigeration system

If your current thermostat does not have a ground wire (a third wire), you need to add one. This wire is typically color-coded black and should tie back eventually to the battery's negative terminal. Most thermostats and all switches or timers use two wires. One is positive voltage wire (+12 volts on a 12V boat or +24 volts on a 24 volt boat) when the refrigeration circuit breaker is turned on, the other returns to the refrigeration system to turn on the compressor. By disconnecting both of these wires from your current thermostat, switch, or timer you can determine which is the positive voltage wire by testing each in turn with either a light bulb or a voltmeter. One lead of your test bulb or voltmeter would go to ground (battery negative) and the other to the wire being tested. The wire, which lights the bulb (when the refrigeration circuit breaker is turned on), or shows around +12 or +24 volts on your voltmeter, is the +12V/+24V lead. You may want to mark it with some red tape. **TURN OFF POWER TO THE REFRIGERATION SYSTEM** until all connections to the SensiStat are completed. Connect the +12V/+24V wire to terminals 1

and 6 of the SensiStat, per the illustration below. The other wire connects to terminal 3 per the illustration below.

If you have a 120V AC or 220V AC refrigeration system, it is likely that the switched line will be switching that high voltage. If this is the case, terminal 1 will not be connected to the lower DC voltage of your boat (12V or 24V) and the red jumper wire provided that connects between terminals 1 and 6 should be removed and disposed of. The two wires that connected to your old thermostat should be connected to terminals 1 and 3.



\* If you have a 120V AC or 220VAC refrigeration system, please refer to special instructions above.

**Figure 1**

Your new SensiStat includes two temperature sensors. They are both the same, but each is color coded to help you trace which is used for the box temperature and which is used for the holding plate temperature. The temperature sensors have been calibrated and matched to your SensiStat. You must match the blue and yellow coded wires to the connectors on the SensiStat or you will defeat the calibration.

It is critical that the holding plate temperature sensor be placed in intimate contact with the holding plate as close as possible to the point where its coolant line returns to the compressor. If you have multiple plates in series, place the sensor on the last plate. You can tell which line is the return line by feeling the lines shortly after starting the compressor. The warmer line is the return line. There will typically be frost on the source line and none on the return line.

Some holding plates have wells specifically intended to hold the temperature sensor. If your plates have such as well, insert the sensor into the well. You can seal the hole and hold the sensor in with a bit of silicon sealer, putty, chewing gum, or the like.

If your holding plates do not have a temperature sensor well, you will need to tape the sensor to the holding plate. You should be able to tell where the cooling coils run within the holding plate by observing a light layer of frost on the holding plate. Avoid placing the sensor directly over the coil. The silver tape provided with your SensiStat will adhere well to a holding plate BUT YOU MUST ONLY APPLY THE TAPE WHEN THE PLATE IS AT ROOM TEMPERATURE. The tape will not stick at all if applied to a cold holding plate. If applied to a warm holding plate, the tape will bond well and not come off when the plate is

frozen. Smooth any air bubbles out from under the tape. It is best to have the wire lead downward so moisture will not collect under the tape.

The temperature sensor for monitoring the icebox temperature should be mounted away from the plates and may be taped to the wall of the box. Route the wires in such a manner that they will not be easily snagged or caught on food items.

The temperature sensor wires may be shortened or just coiled up behind the thermostat with the provided wire tie. Should you shorten the temperature sensor wires, you may replace the color-coded heat shrink tubing with the short pieces provided. Use only warm air to shrink the tubing, such as well above a candle; do not pass the tubing through an open flame.

One conductor from each temperature sensor is connected to terminal 10 of the SensiStat. These are the white coded wires. The second conductor from the holding plate sensor (yellow) is connected to terminal 8. The second conductor from the box temperature sensor (blue) is connected to terminal 9 on the SensiStat. DO NOT connect anything to terminals 11 or 12.

## OPERATION

**Components of the SensiStat refrigeration controller:** The SensiStat consists of an industry standard digital thermostat manufactured by the world leader in thermostatic controls, Carel, married to a SCAD-designed microprocessor-based daughter board mounted within the thermostat. The thermostat is custom programmed to respond to the daughter board's commands to override its differential. The daughter board recognizes the voltage of the battery system of your boat and decides when to override the differential. It also monitors over voltage conditions, allows you to manually override the differential for a period of 60 minutes, to disable the override function, or to change the threshold voltage at which the override function is enabled.

You control the functions of the daughter board via the function button and receive feedback from the daughter board via the function LED.

You may change the settings of the thermostat, including the holding plate freezing temperature, differentials, and display units (Fahrenheit or Centigrade) using the buttons on the thermostat.

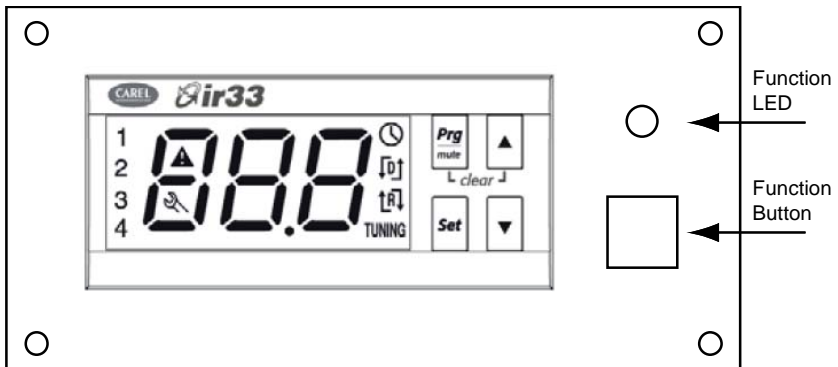






Figure 2: Front Panel of SensiStat Energy Saver

## Icons you may see:

(small) 1	When on it means the thermostat is asking the compressor to run. When flashing, the thermostat wants the compressor to run but compressor protection is enabled. (To protect your refrigeration compressor, we only allow it to start once every 5 minutes).
	Alarm: Flashes when an alarm is active <ul style="list-style-type: none"><li>• E01 = Probe 1 fault (usually means it is not properly connected)</li><li>• E02 = Probe 2 fault (usually means it is not properly connected)</li><li>• E04 = High temperature alarm</li><li>• E05 = Low temperature alarm (you should not see this alarm unless your set point temperatures are set to unusual values)</li></ul>
	Direct Mode Operating: When on it means the thermostat is asking the compressor to run.
<b>Prg</b> mute	<ul style="list-style-type: none"><li>• If pressed for more than 5 seconds, accesses the menu for setting type P parameters;</li><li>• Mutes the audible alarm buzzer;</li><li>• When editing the parameters, pressed for 5 seconds, permanently saves new values for the parameters;</li><li>• If pressed for more than 5 seconds together with Set, accesses the menu for setting the type C parameters (configuration);</li><li>• If pressed for more than 5 seconds at startup, activates the procedure for loading the default parameters.</li></ul>
 (Up)	<ul style="list-style-type: none"><li>• Increases the value of the set point or any other selected parameter</li></ul>
 (Down)	<ul style="list-style-type: none"><li>• Decreases the value of the set point or any other selected parameter.</li><li>• In normal operation accesses the display of the second probe and digital inputs.</li></ul>
<b>Set</b>	<ul style="list-style-type: none"><li>• If pressed for more than 1 second displays and/or sets the set point;</li><li>• If pressed for more than 5 seconds together with Prg/mute, access the menu for setting the type C parameters (configuration).</li></ul>


**Power-on self-test:** Each time the SensiStat refrigeration controller receives power, it conducts a self-test and determines the voltage of your batteries. The indicator LED will display a string of 8 rapid flashes, pause, flash the revision code of the firmware (such as two long, and one short flashes for revision 2.1), pause, and then display another string of 8 rapid flashes. At this point you are assured the system is working correctly. The thermostat display will conduct a self-test also. All of the elements of the display will light briefly. It is very important that you do not press any buttons during the self-test or you may put the thermostat into an undesired diagnostic mode. Should this happen, just remove power from your SensiStat, wait a few seconds, and return power to your SensiStat.

**Factory Settings:** The SensiStat refrigeration control comes from the factory set for most marine freezer holding plate systems with the freezing point set to 0° F and the differential set to 8° F. Consult your refrigeration manual or manufacturer to determine their preferred settings. Refrigerator-only holding plates typically freeze at 24° F.

**Normal Thermostat Mode:** When battery voltages are below charging voltage, the SensiStat will operate as a very precise thermostat. When demanding the compressor to run, the “direct” LED will flash slowly. By default, the temperature of the icebox is

displayed. (See “Customization” below if you prefer the holding plate temperature to be displayed by default).

**“Free Power” Mode:** The SensiStat will override the differential, down to 1° F when “Free Power” is available for 30 seconds. “Free Power” means charging voltage exceeding 14 volts on a 12-volt system or 28 volts on a 24-volt system. The SensiStat automatically determines if you have a 12 or 24-volt system each time it is turned on.

The SensiStat indicator LED flashes (1/2 second on - 1/2 second off) when “Free Power” first becomes available. After 30 seconds, the LED will light continuously and the differential will be overridden. When the SensiStat is asking the compressor to run, the symbol  “Direct” and a small “1” will be displayed.

**Over Voltage Alert:** Should the SensiStat detect an over voltage condition, the Free Power and Manual Override modes will be temporarily disabled and the function LED will illuminate. The thermostat will otherwise function normally during an over voltage alert. The over voltage level is factory set at 15 volts for 12 volt systems and 30 volts for 24 volt systems.

**Manual Override Mode:** Manual override mode allows you to force a “topping-up” of your holding plates. When in manual override mode, the differential is overridden, unless an over-voltage condition is detected. The manual override mode resets automatically after approximately 60 minutes.

- To start the manual override mode, briefly press the function button. The function LED will flash once per second during manual override mode. The “direct” LED will flash indicating the thermostat is asking your refrigeration compressor to run. The “direct” LED will continue to flash until the holding plate is re-frozen or 60 minutes have elapsed.
- To cease the manual override mode, briefly press the function. The function LED will cease flashing once per second. The SensiStat will return to normal operation. If “Free Power” is available, the SensiStat will respond accordingly.


**Disabled Mode:** You may choose to prevent your SensiStat from responding to “Free Power”. You may want to do this for example, when you are plugged in at a dock. The thermostat will continue to operate normally. Only “Free Power” mode will be defeated while in disabled mode.

- To enter disabled mode, press and hold the function button until one string of rapid flashes is displayed, then release the function button. The SensiStat will enter disabled mode. The function LED will flash briefly once every 15 seconds or so. This brief occasional flashing is just a reminder to you that the SensiStat is in disabled mode.
- To exit disabled mode, press and hold the function button until one string of rapid flashes is displayed, then release the function button. The SensiStat will exit disabled mode and resume normal operation.

**Compressor Protection:** The SensiStat provides protection against short cycling your refrigeration compressor. Once the SensiStat turns off your compressor, it will not be turned on again for at least 5 minutes.

**High Temperature Alarm:** The SensiStat is now equipped with an audible high temperature alarm. From the factory, the alarm is set in “relative mode” and will alarm

when the plate temperature exceeds the set point by 16 deg F for two minutes. You may change the relative offset or set an “absolute” high temperature alarm. (See customization/programming section).

A high temperature alarm will display . The current probe temperature and “E04” will flash on the display and the SensiStat will beep. To mute the beeping, press the Prg/mute key briefly.

## **CUSTOMIZATION / PROGRAMMING**

If the factory settings do not meet your needs, you may easily change the settings.

*Please do not attempt to change any setting other than those outlined below. Changing other setting may make the unit behave in unpredictable ways and could void your warranty.*

*“P” settings can be changed by entering programming mode or advanced programming mode. “C” settings can only be changed using advanced programming mode.*

### **Changing “P” Parameter Settings – Entering Programming Mode:**

1. To enter programming mode, press and hold the PRG key for 5 seconds.
2. The display will show “P1”.
3. Release the PRG key.
4. Use the ▲(Up) and ▼(Down) keys to reach the desired “P” parameter you wish to set.
5. Press the SET key briefly to select the “P” parameter.
6. The current setting of the selected “P” parameter will be displayed.
7. To change the parameter value, press either the ▲(Up) and ▼(Down) keys until you reach the desired value.
8. Press the SET key briefly to confirm the new value. (If you do not wish to make a change, pressing SET will preserve the current setting).
9. You may select other “P” parameters by repeating steps 4 through 8 above or exit programming mode by holding the PRG key for several seconds until the normal mode is displayed (temperature display).

NOTE: If you do not exit the programming mode by holding down the PRG key, your new settings will not be saved and your prior settings will be restored. If you remain in programming mode too long without doing anything, the display will flash for several seconds and then return to normal mode. NONE of your changes will be saved.

### **Changing “C” and “P” Parameter Settings - Entering Advanced Programming Mode:**

To change the settings of the “C” and “P” parameters you must first enter *advanced programming mode*. Care should be taken to first plan and write down your setting changes before entering *advanced programming mode*. Near the end of this manual you will find a worksheet entitled “My SensiStat Custom Settings”. This shows the factory settings and provides a worksheet for recording your changes to those settings. Again, as we cannot emphasize this enough, there are dozens of “C” and “P” parameters - do not change “C” or “P” parameter values other than those specified in the instructions below.

1. Press and hold the PRG and SET keys down for 5 seconds.
2. The display will show “0”.
3. Release the PRG and SET keys.
4. Use the ▲(Up) and ▼(Down) keys to change the display to show “77”.

5. Briefly press the SET key.
6. The display will show "C0". You are now in *advanced programming mode* and can alter the "C" and "P" parameter settings.
7. Use the ▲(Up) and ▼(Down) keys to change the display to select the "C" or "P" parameter you wish to change.
8. Briefly press the SET key to program the selected parameter.
9. The current setting for the selected "C" or "P" parameter will be shown. If you wish to change the displayed unit setting, use the ▲(Up) and ▼(Down) key to change the value.
10. Briefly press the SET key to lock-in your selection. (If you do not wish to make a change, pressing SET will preserve the current setting).
11. Hold the PRG key for several seconds to exit the programming mode until the normal mode is displayed (temperature display).

NOTE: If you do not exit the *advanced programming mode* by holding down the PRG key, your new settings will not be saved and your prior settings will be restored. If you remain in advanced programming mode too long without doing anything, the display will flash for several seconds and then return to normal mode. NONE of your changes will be saved.

### To Change Displayed Units (Fahrenheit or Centigrade):

We recommend using Fahrenheit units as this provides a finer level of precision than Centigrade. (0.1° F is a smaller unit of measurement than 0.1° C).

NOTE: After changing the displayed units, your SensiStat will automatically convert all temperature related settings to the new scale. (For example a value set to 32.0° F will be converted to 0.0° C). It is nonetheless suggested that you confirm that all of the settings are now at the values you intend.

*Caution: This procedure will place the thermostat in advanced programming mode. DO NOT CHANGE ANY SETTINGS OTHER THAN C18 with this procedure. Doing so could create unpredictable behavior, render your unit inoperable, and void your warranty.*

1. Enter *advanced programming mode* following the instructions above.
2. Select parameter "C18"
3. Change "C18" value to 1 for ° F or to 0 for ° C
4. Briefly press the SET key to lock-in your selection. (If you do not wish to make a change, pressing SET will preserve the current setting).
5. Hold the PRG key for several seconds mode until the normal mode is displayed (temperature display) to exit the programming mode.

### High temperature alarm:

- **Relative mode:** Relative mode is the default for the high temperature alarm. Relative mode sets high temperature alarm value relative to the set point. The number of degrees of this offset is set to 16 by default. So, since the default set point is 0 degrees, with a relative alarm offset of 16 degrees, if the plate temperature reaches 16 degrees F, and this temperature is maintained for 2 minutes (default setting), the SensiStat will beep, the SensiStat will display ▲ and the current probe temperature and "E04" will flash on the display. To mute the beeping, press the Prg/mute key briefly.

We like and recommend relative mode because you don't have to change the alarm settings if you change the set point. You may change the relative offset by altering

the value of parameter P26 in programming mode. For relative mode, P25 and P29 must be set to 0. Use programming mode, as explained above to change these settings.

- **Absolute mode:** Alternatively you can set an absolute high temperature alarm. That is, you can set a particular temperature at which the alarm is activated. First you must change the alarm mode to absolute by changing P29 to 1. Next you must change P25 to -50. Finally you can set P26 to the temperature at which you wish the alarm to occur.
- **High temperature alarm delay:** By default, the high temperature must be maintained for two minutes before the alarm sounds. You may change this value (in minutes) by changing P28.
- **To disable the beeper:** Change the value of C53 to 1 in programming mode. To re-enable the beeper, change the value of C53 back to 0.

### **To change default temperature sensor display:**

Your SensiStat by default displays the temperature sensed by the icebox temperature sensor (probe 2, also known as “b2”). Probe 1, also known as “b1”, is the probe on your holding plate and the one that controls the behavior of the SensiStat. By pressing the ▼ (Down) key, and then using the ▼ (Down) or ▲ (Up) keys you can scroll between display choices. This can be a bit confusing, so experiment a bit to get the feel of it. What you will see is an alternating display, first what is going to be displayed, like “b1” and then the value of that probe. The alternating will continue until you lock in your choice by holding down the **Set** button for a few seconds. You will also see “din1” and “din2” as choices for display. Please just ignore these choices.

### **To display or set the freezing temperature:**

1. To enter the set point programming mode, press and hold the SET key for 5 seconds.
2. The display will show “St1”, the variable for the freezing temperature for normal operation.
3. Release the SET key. The display will now show the current setting for St1. (Factory default is 0° F).
4. If you wish to change this value, press either the ▲(Up) and ▼(Down) keys until you reach the new desired value.
5. Press the SET key briefly to confirm the current or new value of St1.
6. The display will show “St2”. This is the variable for the freezing temperature for override mode. This value should be set to the same value as St1.
7. The value of St2 will be displayed. (Factory default is 0° F).
8. If you wish to change this value, press either the ▲(Up) and ▼(Down) until you reach the new desired value.
9. Press the SET key briefly to confirm the current or new value of St2.
10. The SensiStat will return to its normal display mode.

### **To display or set the differential settings:**

*Generally, there is no need to change the differential settings unless your refrigeration manufacturer specifies a different differential. Remember, the override differential is critical for the “Free Power” mode to operate correctly. Avoid changing the “P2” value unless you are certain you know why you are changing it.*

1. Enter programming mode following the instructions above.
2. Select parameter “P1” (differential for normal operation) or “P2” mode (differential for override operation).
3. After changing these values, exit programming mode by holding the PRG key for several seconds until the normal display (temperature display) appears.

### To Display or Change the “Free Power” Threshold Voltage:

The voltage at which the “Free Power” mode will be engaged is factory set to 14 volts for 12 volt systems and 28 volts for 24 volts systems. The ranges of settings are:

- For 12-volt systems: 13.0 volts to 14.5 volts in 0.1-volt steps.
- For 24-volt systems: 26.0 volts to 29.0 volts in 0.2-volt steps.

*You may only change the value for the voltage at which your SensiStat is currently operating. That is, if you are on a 12-volt boat, you can only change the settings for 12 volt systems.*

1. Press and hold the function button.
2. Release the function button only after two strings of rapid flashes are displayed. (but before the third string of rapid flashes is displayed)
3. The function LED will begin to flash out voltage setting options in a Morse code-like fashion. The selections will be displayed as follows:

12 Volt Systems		
Volts	Long Flash	Short Flash
13.0	1	3
13.1	3	1
13.2	3	2
13.3	3	3
13.4	3	4
13.5	3	5
13.6	3	6
13.7	3	7
13.8	3	8
13.9	3	9
14.0	1	4
14.1	4	1
14.2	4	2
14.3	4	3
14.4	4	4
14.5	4	5

24 Volt Systems		
Volts	Long Flash	Short Flash
26.0	2	6
26.2	6	2
26.4	6	4
26.6	6	6
26.8	6	8
27.0	2	7
27.2	6	2
27.4	6	4
27.6	6	6
27.8	6	8
28.0	2	8
28.2	8	2
28.4	8	4
28.6	8	6
28.8	8	8
29.0	2	9

4. If you wish to only display the value of the current threshold voltage setting your SensiStat is using, instead of changing the setting, you may do this by now pressing and holding the function button until a long string of flashes is displayed. As soon as the long string of flashes is displayed, release the function button. After a brief pause, the function LED will flash out the current threshold voltage setting, for example: “- ....”, one long, four shorts, for the factory default for 12 volt systems, 14.0 volts. The SensiStat will then exit the threshold voltage programming mode, retaining the current setting, and resuming normal operation. If you now wish to change the value of the threshold voltage, return to step 1 above, and skip step 4.

5. If you wish to change the value of the threshold voltage, simply briefly press the function button immediately after your desired setting is displayed. The function LED will display a brief rapid string of flashes to acknowledge acceptance of the new setting. The SensiStat will return to normal operation, using your new threshold setting. This setting will be retained in memory until you wish to change it again.
6. If you enter programming mode and fail to select any of the threshold voltage choices, the SensiStat will execute a factory reset of the set the threshold value to the factory default values.
7. Should you enter the programming mode accidentally, the easiest way to exit, retaining current setting, is to enter the display of threshold voltage mode. You may do this at any time while the threshold voltage choices are being displayed. See step 4 above.

### **To Change Free Power Threshold Hysteresis:**

When Free Power is detected at the set threshold voltage, Free Power will be considered to be available until the voltage drops to the set threshold voltage minus the threshold hysteresis. The factory default for the threshold hysteresis is 0.1 volts. If you find your battery voltage drops by more than 0.1 volts below the threshold voltage when the refrigeration compressor starts while your engine or generator is charging your batteries, you may need to increase the threshold hysteresis. You may view the threshold hysteresis or set the threshold hysteresis to a value between 0.1 and 0.5 volts in increments of 0.1 volts.

#### To view the current threshold hysteresis setting:

1. Press and hold the function button.
2. Release the function button only after two strings of rapid flashes are displayed. (But before three strings of rapid flashes are displayed). You are now in threshold voltage programming mode.
3. Press and hold the function button once again.
4. Release the function button only after two strings of rapid flashes are displayed. (But before the third string of rapid flashes is displayed). You are now in threshold hysteresis programming mode.
5. To view the current threshold hysteresis setting, press and hold the function button until a string of rapid flashes is displayed. Shortly thereafter the function LED will flash the threshold hysteresis level; one flash for each tenth of a volt. After displaying the threshold hysteresis level, the SensiStat returns to normal operation.

#### To change the threshold hysteresis:

1. Press and hold the function button.
2. Release the function button only after two strings of rapid flashes are displayed. (But before the third string of rapid flashes is displayed). You are now in threshold voltage programming mode.
3. Press and hold the function button once again.
4. Release the function button only after two strings of rapid flashes are displayed. (But before the third string of rapid flashes is displayed). You are now in threshold hysteresis programming mode.
5. The function LED will begin to flash your options for the new threshold hysteresis value. Each group of flashes indicates a number of 0.1 volt increments.

6. To select one of the options, just press the function button briefly after your choice is displayed. A string of rapid flashes of the function LED will indicate acceptance of your choice. The SensiStat will then return to normal operation. If you do not select any of the five options, the SensiStat will continue to use the currently set threshold hysteresis value. A long string of flashes will be displayed by the function LED to indicate that no new setting was selected then the SensiStat will return to normal operation.

Flashes	Volts
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5

## TROUBLE SHOOTING

- **“E01” or E02” is displayed:** This error indicates that probe 1 (E01) or probe 2 (E02) are not connected correctly to the SensiStat or the probe wires have been physically damaged. Turn off power at the refrigeration system circuit breaker. Check the connections at the back of the SensiStat. Turn power back on. If this does not correct the problem, check the temperature sensors and wires for physical damage.
- **I can’t understand the pattern of flashing of the function LED:** Although we have tried to capture all possible software glitches in our design and testing, the microprocessor may have found itself lost at sea. Usually just turning off the refrigeration system at the circuit breaker and turning it back on after 10 seconds or more will fix the problem. If that does not work for some reason, you may conduct a hard reset of the daughter board by holding the function button down until after three strings of rapid flashes are displayed on the function LED. The daughter board will reset all its values, including the “Free Power” threshold voltage to factory defaults, conduct a power-up self-test, and then resume normal operation. NOTE: This reset does not change any of the “C”, “P”, or “St” parameter settings.
- **I failed to listen to your cautions and changed variables on the thermostat that I should not have. Now I can’t get the thermostat to operate correctly:** Well now you’ve done it... If you have any friends left to go along with your warm or frozen beer, grab one (a friend, not a beer), the first part of this procedure is a two-person job... (Now don’t say mean things about SCAD to your friend. After all, we did warn you not to fiddle around with the settings).

*You must first conduct a factory reset of the thermostat and then re-program it. Please read these instructions through and understand them completely before attempting this procedure.*

1. Turn the power off at the breaker. Disconnect the green three terminal connector from the back of your SensiStat. This will keep your compressor from cycling while you are conducting this procedure.
2. With your friend at the refrigeration circuit breaker and you at the SensiStat, hold down the PRG key while your friend turns the power back on. After several seconds “Std” will be displayed. Release the PRG key. Your thermostat is now completely dumb, but in a known state. (Now give your friend one of those warm or frozen beers; his job is done).
3. We can now return the unit to the settings it had when shipped to you. Follow the instructions above for entering advanced programming mode and

set all of the following parameter settings. Be patient... setting some of these values require scrolling through lots of possible values. Holding the ▲(Up) and ▼(Down) key for several seconds will cause the scrolling of values to advance faster. NOTE: Set the parameters in the order listed, not doing so will be very frustrating as some parameters automatically change others, even after you have entered your desired settings.

- a. "C0" = 7
- b. "C7" = 5
- c. "C18" = 1 (1 for Deg F, 0 for Deg C)
- d. "C19" = 1
- e. "P29" = 0
- f. "C52" = 1
- g. "P26" = 16.0 (Be very careful not to set the value to -16.0, this is an easy mistake to).
- h. "P25" = 0.0
- i. "P27" = 1.0
- j. "P28" = 2
- k. "P1" = 8
- l. "P2" = 1

It is worth your time to check all of the parameter values again before exiting the advanced programming mode.

4. Now using the procedure from **"To display or set the freezing temperature"** above to set the following values:
  - a. "St1" to 0.0
  - b. "St2" to 0.0
5. When your SensiStat was assembled and tested, the two temperature probes were matched to each other and calibrated. The P14 and P15 calibration values are written on the top of your SensiStat body. For example: ... "Cal 060909 P14 = -0.2 P15 = 0.3. Find this value. If both values are 0.0, you may skip this step. (Early models of the SensiStat may not have this value written on them (if the value is not there, you can skip this step). Enter programming mode per the instructions above and set the P14 and P15 values to match the calibration sticker.  
NOTE: Setting the P14 and P15 parameters is a bit different that setting all other parameters. When you select parameter P14 or P15, the offset value will be shown. After you press SET, the actual temperature for the respective probe will be displayed. You must press SET one more time in order to complete the setting of the parameter.

Don't forget to hold down the PRG key for several seconds until the normal mode is displayed (temperature display) to exit programming mode or your values will not be saved.

6. Using the procedure from **"To change default temperature sensor display"**, set your displayed probe to the factory value of "b2".
7. Finally, turn the power off again at the breaker, reconnect the three-terminal connector, and turn the power back one.

Your SensiStat should now behave exactly as it did when you first installed it.

# MY SENSISTAT CUSTOM SETTINGS

Value	Meaning	Available Values	Factory Setting	My Value
ST1, ST2	Set points (should be equal to each other)	-50 to 60 degrees	0.0	
P1	Normal Mode Differential	0.1 to 50 degrees	8.0	
P2	Free Power Mode Differential	Recommended value is 1 deg F*	1.0 degree F**	
C7	Minutes between Starts	0 to 15 minutes	5*	
P14	Probe 1 Calibration		See calibration sticker on unit	
P15	Probe 2 Calibration		See calibration sticker on unit	
C18	Temperature units	0 = deg C 1 = deg F**		
P25	Low Temp Threshold	If P29 set to 0, set P25 to 0 If P29 set to 1, set P25 to -50	0.0	
P26	High Temp alarm	Value of P25 to 150	16.0	
P27	Alarm Differential	SHOULD ALWAYS BE SET TO 1	1.0	1.0
P28	Alarm Delay Time	0 to 120 minutes	2	
P29	Type of alarms	0 = relative 1 = absolute	0	
C52	Displayed probe	0 = probe 1 1 = probe 2	1	
C53	Buzzer enable/disable	0 = enables 1 = disabled	0	

\* = We strongly recommend against changing this value.

\*\* = if C18 is set to 0, use 0.7 deg C for P2.

## Note:

P26 Special values:

- If P29 is set to 0 (relative mode), setting P26 to 0.0 disables high temperature alarm. P26 is the number of degrees above ST1 at which the high temperature alarm will occur.
- If P29 is set to 1 (absolute mode), setting P26 to 200 disables high temperature alarm. P26 is the absolute temperature at which the high temperature alarm will occur.

# FACEPLATE TEMPLATE

This template may not be to scale.

