



OPERATING MANUAL

**EchoTherm ORBITAL MIXING,
DIGITAL, ELECTRONIC, CHILLING/HEATING DRY BATH
MODELS SC25, SC25XT, SC25XR
Applies to version 6.0 and higher**

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I. INTRODUCTION

Congratulations on your purchase of an *EchoTherm* Digital Electronic Chilling/Heating Dry Bath Series SC25. Please read the instructions carefully to insure that you receive the maximum benefit from it. Also, be sure to go to our web site and register your unit for warranty coverage.

II. WARRANTY

Torrey Pines Scientific warrants this product to be free from defects in material and workmanship for a period of one year from the date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the one year period, please return---freight prepaid---and correction of the defect will be made without charge. Out of warranty products will be repaired on a charge basis.

III. RETURN OF ITEMS

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. For your protection, items must be **carefully packaged** to prevent damage in shipment and **insured** against possible damage or loss. Torrey Pines Scientific will not be responsible for damage resulting from careless or insufficient packing. A 15% restocking charge will be made on all unauthorized returns.

Note: Torrey Pines Scientific reserves the right to make improvements in design, construction, and appearance without notice.

IV. LABELS

There are various labels on the body of this unit. Listed below are the labels and their meanings.



This symbol means: ATTENTION. The INSTRUCTION MANUAL IS TO BE CONSULTED FOR FURTHER INFORMATION



This symbol means: WARNING. HOT SURFACE.



This symbol means: GROUND OR EARTH CONNECTIONS

V. CAUTIONS

CHILLER/HEATER PLATE SURFACE

The SC25 Series are capable of chilling and heating the plate surface from -10°C (-20°C on XT versions) to 100°C (110°C on XR versions). Temperatures from 44°C (110°F) to 100°C (212°F) are hot enough to burn the skin if touched. **Use extreme caution at all times.** Never leave your unit accessible to others when it is hot. Never touch the plate surface unless you are sure it is cool. **Note that there is a red LED on the front panel marked HOT. This will illuminate when the heater surface goes above 50.0°C (122°F).**

ORBITAL MIXER

The plate that holds the sample blocks is mounted on the orbital mixing mechanism. Note that there are two cardboard restraints wedged under the spill shield around the heater plate. Be sure to remove these before using the mixer to prevent damage.

ELECTRICAL

The cooling/heating module in the SC25 Series runs using 12 volts DC at 4.2 amps for the SC25 and 8.4 amps for the SC25XR, SC25XT. The units are supplied with a universal power supply that can take inputs from 100 to 260 volts AC, 50/60 Hz. The units are supplied with an AC input cord for the power supply. Be certain to use a line cord with the same rating and of the same type as the one supplied by the manufacturer. Use the normal care and precaution one would use with any electrical appliance.

VI. GENERAL DESCRIPTION

Torrey Pines Scientific SC25 units are Peltier driven for chilling & heating. They come with a universal power supply and the chilling/heating module. The units have two moving parts, the DC fan that cools the unit and the DC motor that oscillates the plate. Everything else is solid state and should last years without problem. All functions of the unit are accessible from the front panel via the membrane switch and accompanying digital display.

HEATER/CHILLER PLATE

The surface is a very flat aluminum plate designed for good contact with any flat surfaced item placed on it. The plate size of the SC25 is 2.875" (73 mm) x 4.375" (111 mm). It will chill and heat quickly without a load on it. The temperature of the plate is sensed by a platinum RTD mounted under the plate. The temperature controller in the unit compares the plate temperature with the target temperature and instructs the Peltier module to heat or chill the plate as required to keep them equal.

ORBITAL MIXER

The plate, and therefore the sample blocks placed on it, can be instructed via the membrane switch to rotate from 200 to 1000 rpm. The plate is supported by a flexure leaf spring mechanism that is driven by a motor at the rear of the unit. The orbit is about 2mm peak to peak and works well for mixing small samples in centrifuge tubes at faster speeds and larger samples in larger vessels at slower speeds. **This is a rugged mechanism, but take care not to drop anything heavy on the plate surface.**

PROGRAMMABLE

All SC25 units enable the user to define up to 5 individual programs consisting of up to 10 steps per sequence. All sequence steps are stored in non-volatile memory.

TIMER

All units have a countdown timer reading in hours, minutes, and seconds. It can be set to a maximum of 99 hours 59min 59sec. The timer will be displayed at the same time as the SET POINT and PLATE TEMP. It has a user settable AUTO-OFF as well. This works to turn the chiller/heater target temperature off when the timer counts to zero.

ALARM

The units have an audible alarm that sounds for one minute when the timer counts down to zero. Touching the UP ARROW will turn the alarm off during this first minute. However, if the alarm sounds for the entire minute, it will shut-off the sound automatically. When the

alarm first sounds, the timer will start to count up. This lets the user know how much time has passed since the timer first sounded.

DATA LOGGER

The units are supplied with a built-in data logger. The data logger can be made to collect up to 27,000 data points in intervals of 1/second, 1/minute, or one every 5 minutes. See the instructions later for use.

NON-VOLATILE MEMORY

The units are equipped with EEPROM memory that will store user settings such as the last set point, motor speed, MENU options, user changed calibration points, and logged data points, and all programmed sequence values. . The stored values will be recalled each time the unit powers up to maintain the configuration of the previous session.

VII. FRONT AND REAR PANEL CONTROLS

FRONT PANEL



The front panel of the SC25 series shown above has a tactile touch membrane keyboard with audible feedback. The keyboard is used to set all operating parameters. The display is a two-line alphanumeric LCD with backlighting. When the unit is turned on the display will light and show the Set Point, Plate temperature will be displaying the actual temperature of the plate surface and the Orbital Mixing Speed setting. There are two LEDs on the front panel. One is a power-on indicator and the other is the plate surface hot indicator that will illuminate when the plate is at or above 50C.

REAR PANEL



The rear panel shown has the on/off power switch at the left, the 12 volt dc power input jack in the middle, the DB9 connector for the RS232 I/O port is on the right.

VIII. SET UP PARAMETERS

SET UP PARAMETERS

1. Ambient operating room temperature range is from 5°C to 40°C.
2. Maximum altitude of operation should not exceed 2000 meters.
3. Maximum ambient operating relative humidity should not exceed 80% at 31°C decreasing linearly to 50% relative humidity at 40°C.

SET UP INSTRUCTIONS

1. Place the unit on a level, dry surface.
2. Plug the power supply into the line cord provided and then into a properly grounded, 3-wire outlet of proper voltage.
3. Plug the power supply cable into the rear of the chilling/heating module.
4. Place the sample on the plate surface.
5. Turn the unit on by the switch on the rear of the chilling/heating module. The unit display will light and the power LED will illuminate.
6. Set target temperature and timer, if wanted, according to the instructions that follow.

Note: Do not use this equipment in any manner not specified by the manufacturer.

ENVIRONMENTAL INFORMATION

1. This unit is for installation category II.
2. This unit is rated pollution degree 2.

IX. DISPLAY AND KEYBOARD DESCRIPTIONS.

DISPLAY

The display is a two-row alphanumeric LCD with backlighting for easy viewing. It is used to set all the parameters of the units. The two push buttons enable the user to set a temperature, set the orbital mixing speed, set a timer, and to calibrate the temperature against a local standard. Figure 1 below describes the screens for different modes of operation.

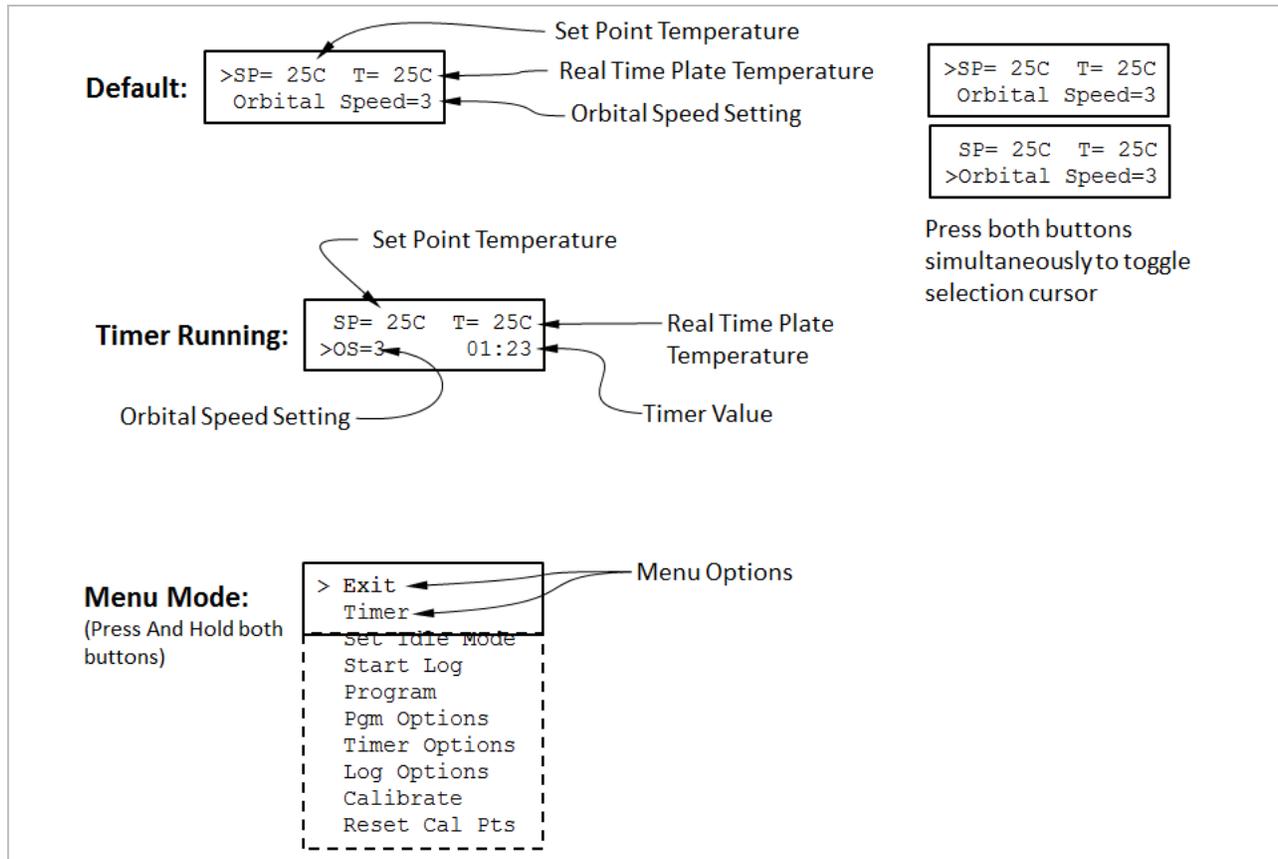


Figure 1: Display Screens for Different Modes of Operation

PUSH BUTTONS



Two push buttons are provided on the front of the unit for user input. One button is labeled with an UP ARROW and the other with a DOWN ARROW. When the buttons are pressed, an audible beep will occur. The keys also have tactile feedback when they are depressed.

Using the buttons to set all of the parameters of the unit is accomplished via single and double key presses.

Single key presses are accomplished by briefly pressing and releasing an UP ARROW or DOWN ARROW button. If a single button is pressed and held for 2 seconds, the setting will increase or decrease rapidly depending on the button pressed. For example, in the default display, briefly pressing and releasing the UP ARROW will increase the set point temperature by 1C with each press. If the UP ARROW is pressed and held down, the set point will increase by 1C after the first press but after holding for 2sec the set point temperature will rapidly increase until the button is released or until the maximum set point for the unit is reached.

A double key press is accomplished by simultaneously pressing and releasing both UP and DOWN ARROW buttons. In the default display, briefly pressing and releasing both arrows will toggle the cursor between the Set Point selection and the Orbital Speed selection. When the cursor is at the Set Point selection, use the UP and DOWN single key press to set the Set Point and likewise for the Orbital Speed(see Figure1). Pressing and holding both buttons simultaneously will bring up the Menu on the LCD display. Scrolling to the various options in the Menu is accomplished by pressing the UP and DOWN ARROW buttons. This manual contains details on accessing and setting the various Menu options.

X. SETTING TEMPERATURE AND OTHER FEATURES

Although the units can be set to -10°C (-20 on XT's), they can only go 30°C (40°C on XT's) below ambient. What that means is that the units may not reach -10°C (-20°C on XT's) if the ambient temperature is 25°C. Also, the power available to heat and chill the plate and samples on it is 50 watts for the SC25 and 100 watts for the SC25XR, SC25XR. This means that there are some larger loads that will not go as far hot or cold as wanted, or, if they do, it will take longer than the unloaded plate will. For best results, use the covers available as accessories. The part number for the cover for the aluminum blocks is 720-0009 for all SC25 models. Note that the SC25XR has twice the power as the SC25 and will move samples blocks faster and farther away from room temperature than the SC25.

SETTING TEMPERATURE

To set a temperature for the unit, simple press the UP or DOWN arrow until the set point temperature ("Set Point") on the display shows the desired temperature. The unit will now go to that temperature. Note that the actual plate temperature will be shown in the display as "Plate". You will be able to watch this number change as the unit drives to the set point entered. If there is a problem with the temperature measurement circuitry or if the calibration values are invalid, an error code will be displayed in the location of the "Plate:" temperature. For example, if the low calibration measured value is out of range, the unit will display "Plate: cal1". See the "XII Temperature Measurement Error Codes" section of this manual for a complete listing and the appropriate course of action should an error occur.

SETTING ORBITAL SPEED

To set the Orbital speed, ensure that the cursor is pointing to "Orbital Speed" or "OS" on the display. If the cursor is pointing to "SP", press both buttons simultaneously to move the cursor to "Orbital Speed". Pressing the UP or DOWN arrow buttons will increment or decrement the Orbital Speed setting. The speed values are from 0 (off) to 9 (approx 1000RPM). A value of 1 is approximately 200RPM.

SETTING TIMER

The timer is a countdown timer that reads in hours, minutes, and seconds continuously. It can be set to 99 hours, 59 minutes and 59 seconds maximum. When the timer counts down to zero, it will sound an audible alarm for one minute. When the alarm starts to sound, the unit will then count up so that the user may see how long it has been since the alarm timed out. The audible alarm can be turned off after it has sounded by depressing the UP or DOWN ARROW.

The timer is set by accessing the Timer option in the Menu. See Figure 2 for details on setting and starting the Timer. Figure 3 indicates how to stop the timer. When the timer is

stopped, the last timer value is “frozen” on the screen until either the Up or Down buttons are pressed. This enables the user to capture the last value.

The Menu also includes Timer Options to control the features of the timer. The audible alarm may be enabled or disabled when the timer reaches zero. If the “Auto-Off” feature is disabled (“Auto-Off: no”), the unit will continue to control the plate to the set point temperature when the timer reaches zero. If the “Auto-Off” feature is enabled (“Auto-Off:yes”), the unit will go into “Idle Mode” when the timer reaches zero. When the unit is in Idle Mode, no power will be directed to the plate—the plate is essentially “turned off” and will naturally return to room temperature. See the Idle Mode section of this manual for more details.

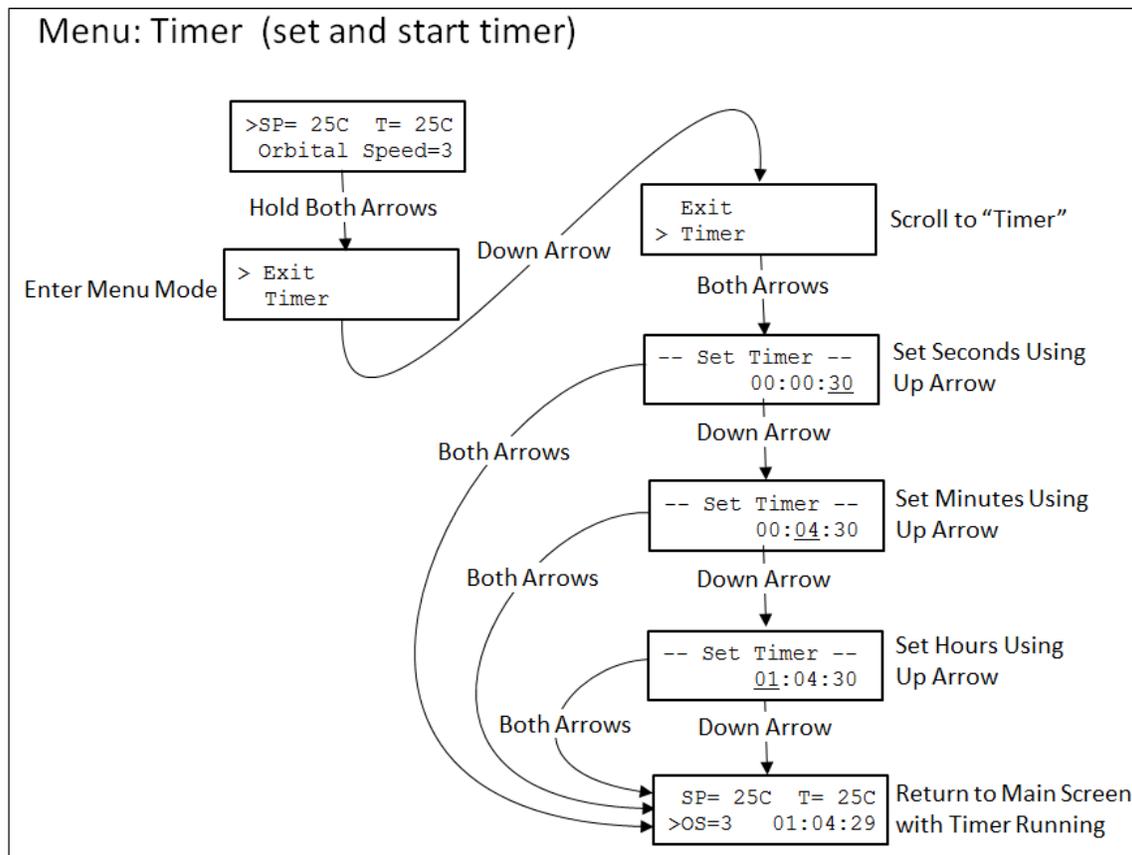


Figure 2: Menu Map to Set and Start the Timer

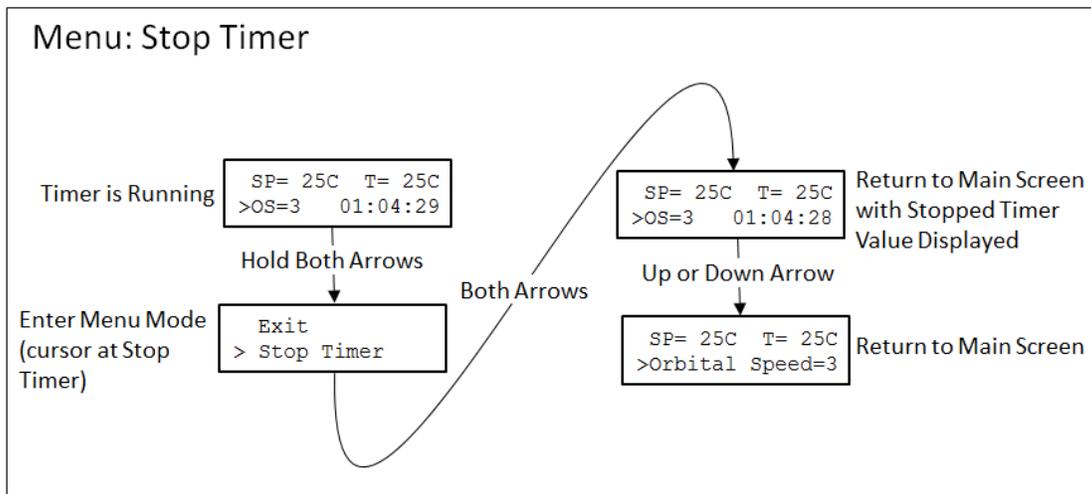


Figure 3: Menu Map to Stop the Running Timer

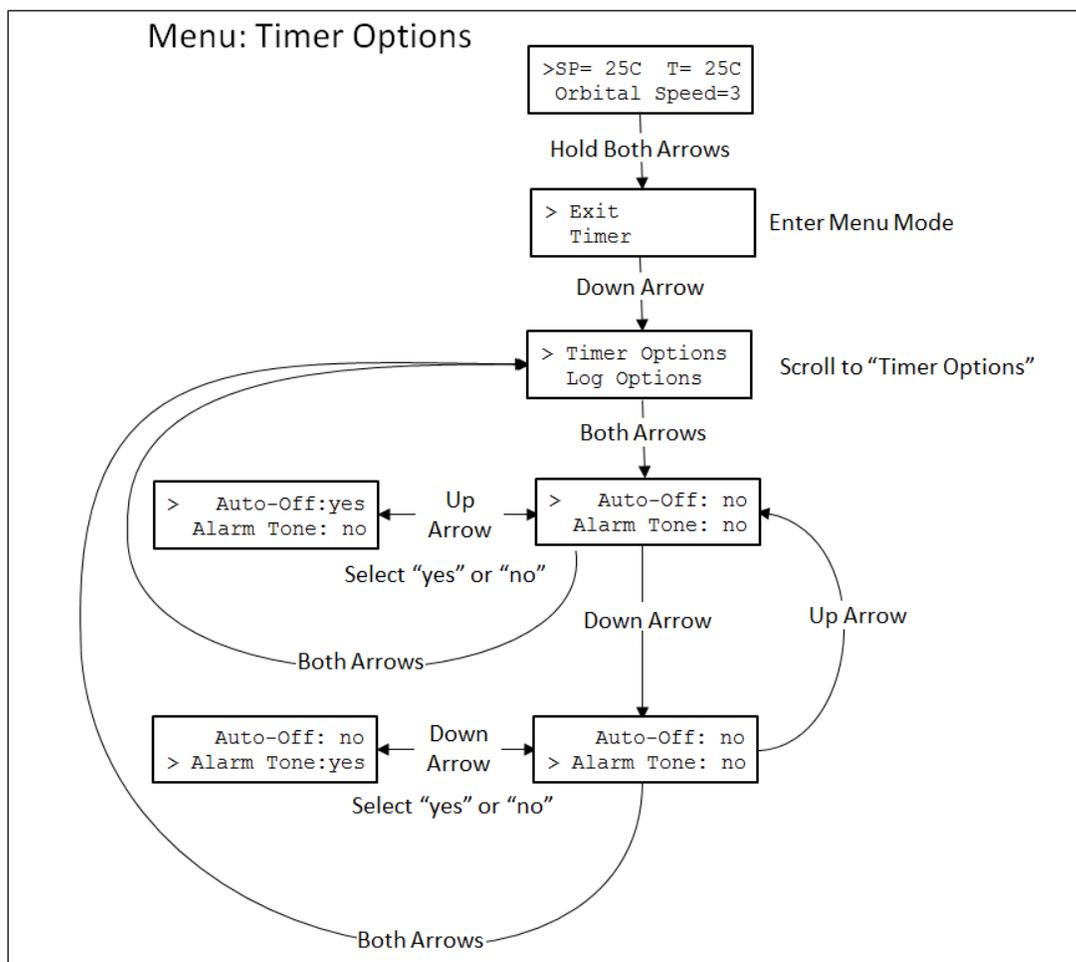


Figure 4: Menu Map to Select Timer Options

SETTING THE UNIT TO “IDLE MODE”

Setting the unit to “Idle Mode” will internally turn off power to the heater/chiller assembly and allow the sample to heat up or cool off naturally to ambient conditions. It is essentially turning the set point off, which is why the set point on the LCD indicates “off” when the unit is in Idle Mode. Idle mode may be set and cleared in different ways and the previous set point value may be cleared or retained as described below. See Figure 5 and Figure 6 for details on setting and clearing Idle Mode using the menu.

The unit will enter Idle Mode in two ways:

1. By using the Menu option (“Set Idle Mode”)
2. By setting the “Auto-Off” option to “yes” in the Timer Options menu. The SC25 will enter Idle mode when the countdown timer reaches 00:00:00 at the end of a timer period or when a program has ended.

The unit will exit Idle Mode in the following ways:

1. By pressing either arrow button –the set point will be set to 20C.
2. By selecting “Clr Idle Mode” from the menu—the set point before the unit was set to Idle Mode will be restored

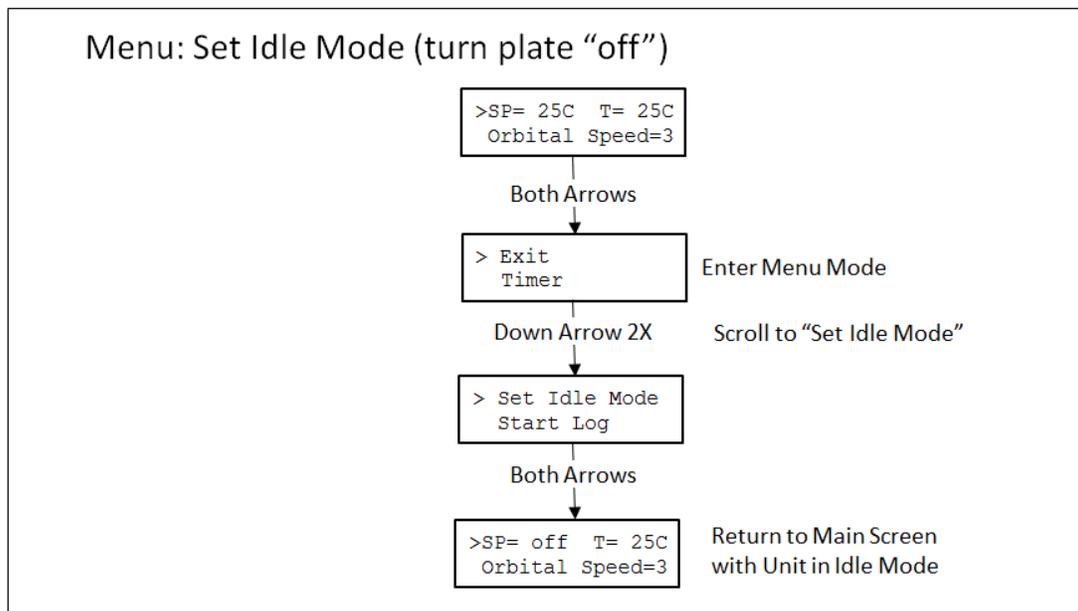


Figure 5: Menu Map to Set Idle Mode Using the Menu

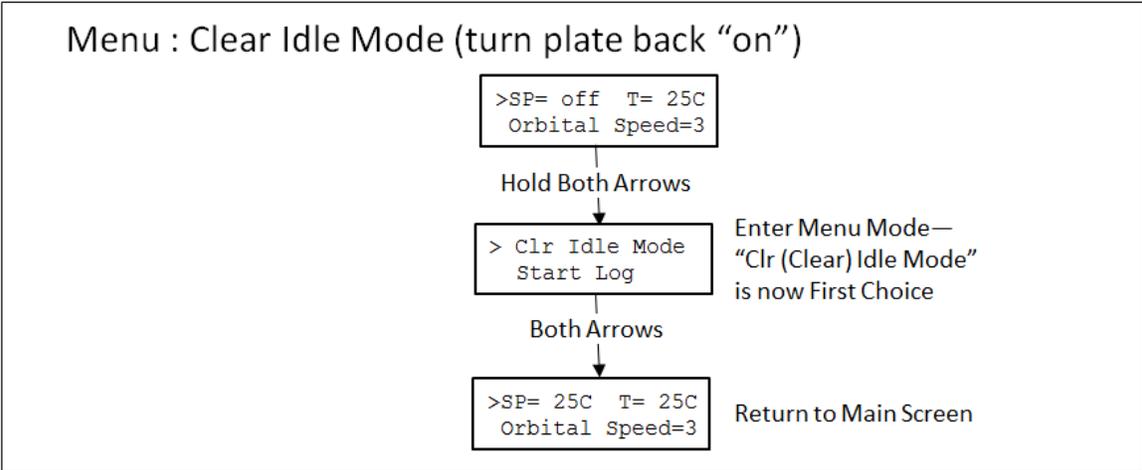


Figure 6: Menu Map to Clear Idle Mode Using the Menu

DATA LOGGER

The data logger collects values of actual plate temperature at intervals that can be set by the user. The data points, 29,670 maximum, may be collected every second, every minute, or every five minutes as set by the user. When the unit is in Log mode, the character “L” will be displayed on the LCD screen in the lower left corner. The data buffer can then be downloaded whenever wanted via the RS232 I/O port (ref XIII. RS232 INTERFACE). Figures 7, 8, and 9 show the steps to set the log period and how to start and stop a logging session.

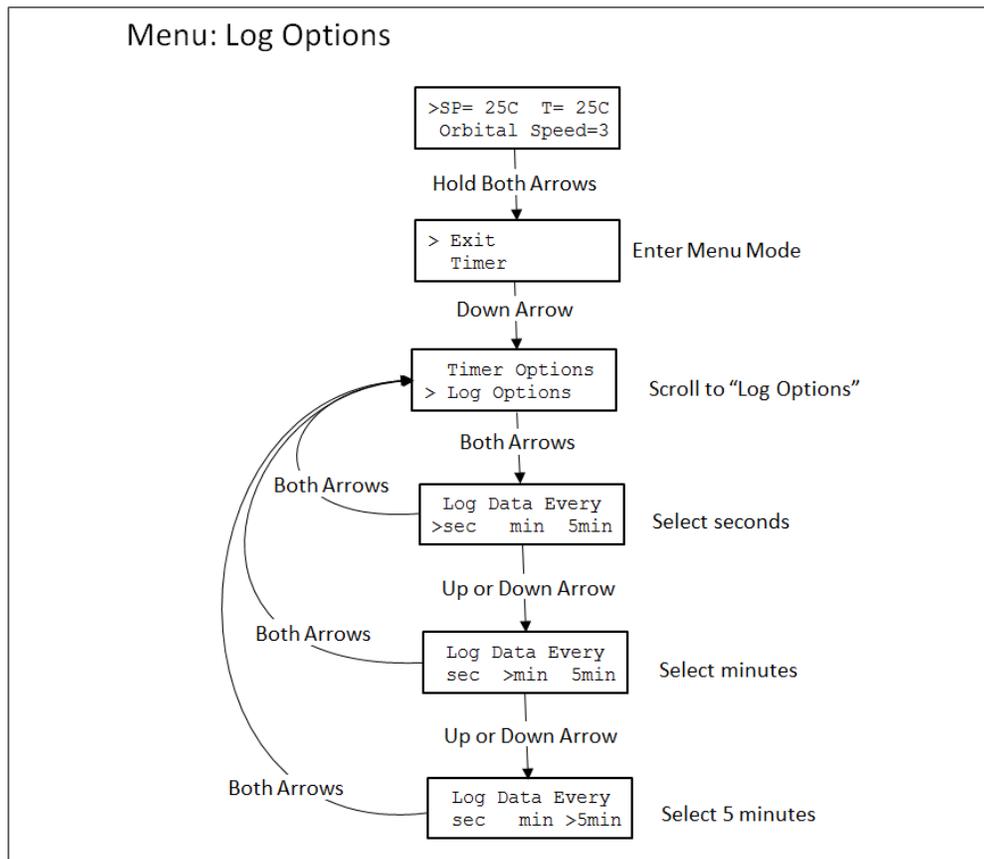


Figure 7: Menu Map to Set Log Period

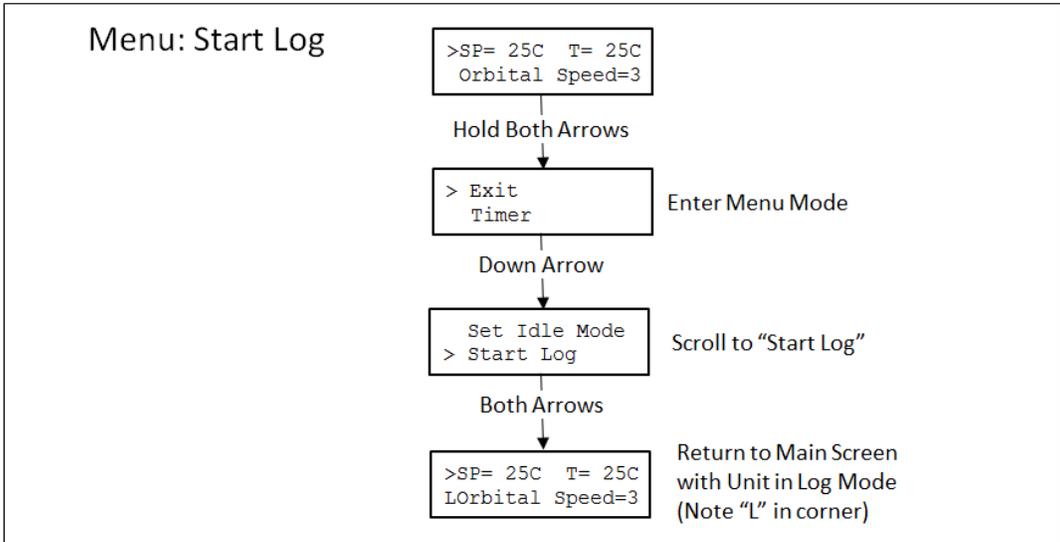


Figure 8: Menu Map to Start Logging Session

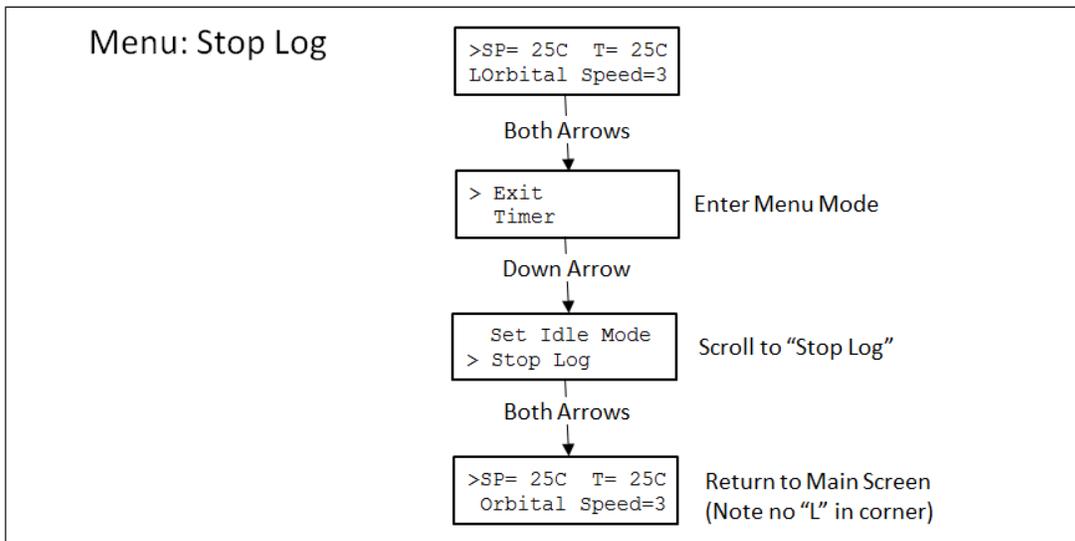


Figure 9: Menu Map to Stop Logging Session

XI. PROGRAMMING

The SC25 enables the user to define up to 5 individual programs consisting of up to 10 steps per sequence. The “Program” Menu option provides the ability to choose a program to run or to edit. The following sections and figures detail the steps to define and edit program steps and to run the programmed sequences.

The programmed sequences may also be enhanced by enabling the Program Option “wait until” feature and/or the Timer Options “Auto-off” and/or “Alarm Tone”. global settings.

The typical steps to programming a sequence is to select the program number 1 through 5 then specify the temperature and time for each step (up to 10 steps/program) in the sequence. To run the program, select the program number and the number of times to repeat the sequence (1-99 cycles or infinite) then start the program. The following sections describe the keystrokes and other programming details.

See Appendix A for examples of defined the program steps and the effects of using the global Program Option and Timer Option settings.

MENU: Program

The SC25 enables the user to define up to 5 individual programs consisting of up to 10 steps per sequence. The “Program” Menu option provides the ability to choose a program to run or to edit. Figure 10 below shows the menu map for the Program feature.

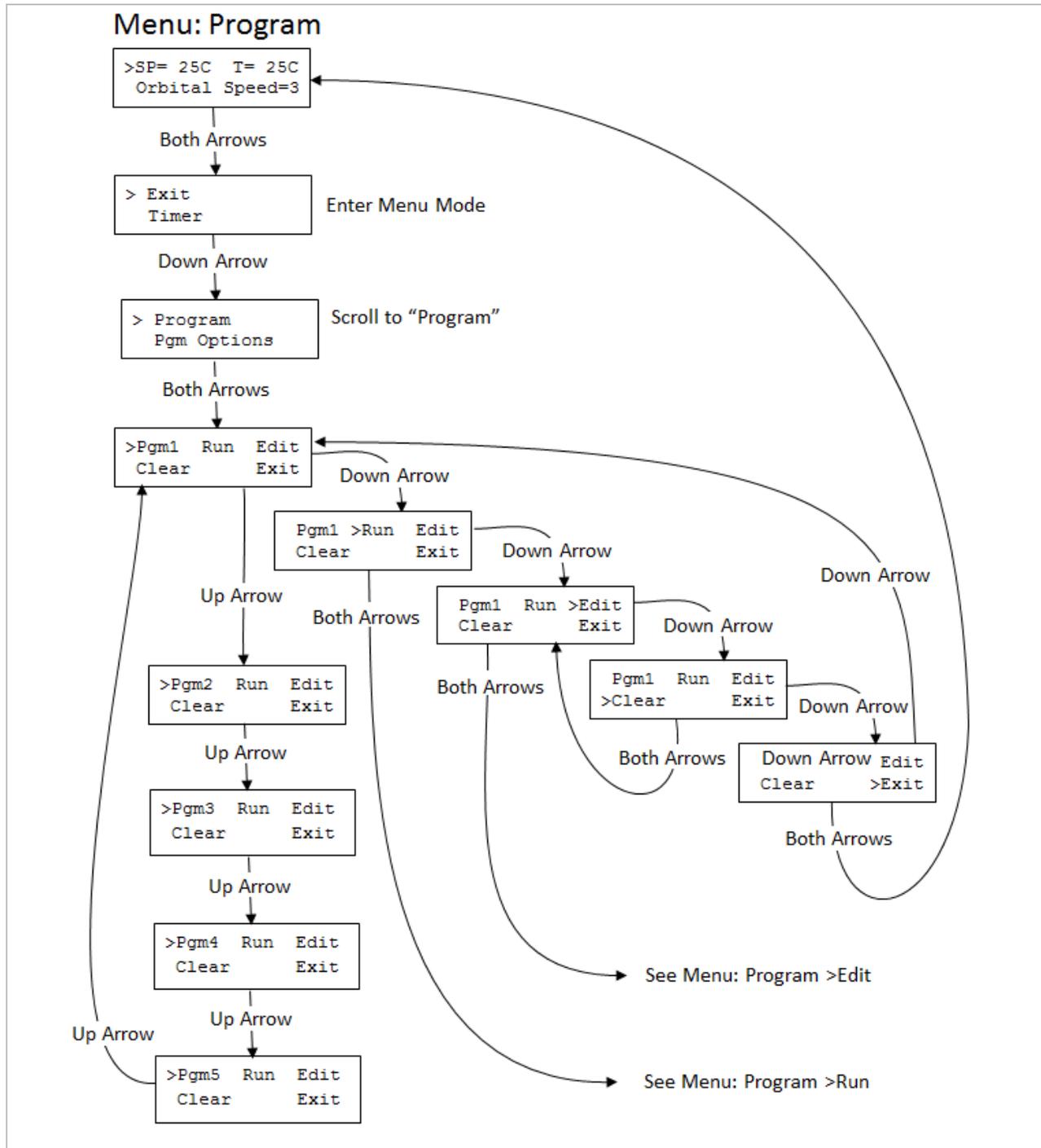


Figure 10: Menu Map For Program Control

MENU: Program >Edit

To start a program from scratch, select the “clear” option in the Program Menu before selecting “Edit”.

The Program >Edit sub-menu selection enables the user to specify the values for the Set Point and time for each step in the program sequence. Figure 11 below provides a description of the items shown on the LCD in the Program >Edit mode.

See Appendix A for examples of defined the program steps and the effects of using the global Program Option and Timer Option settings.

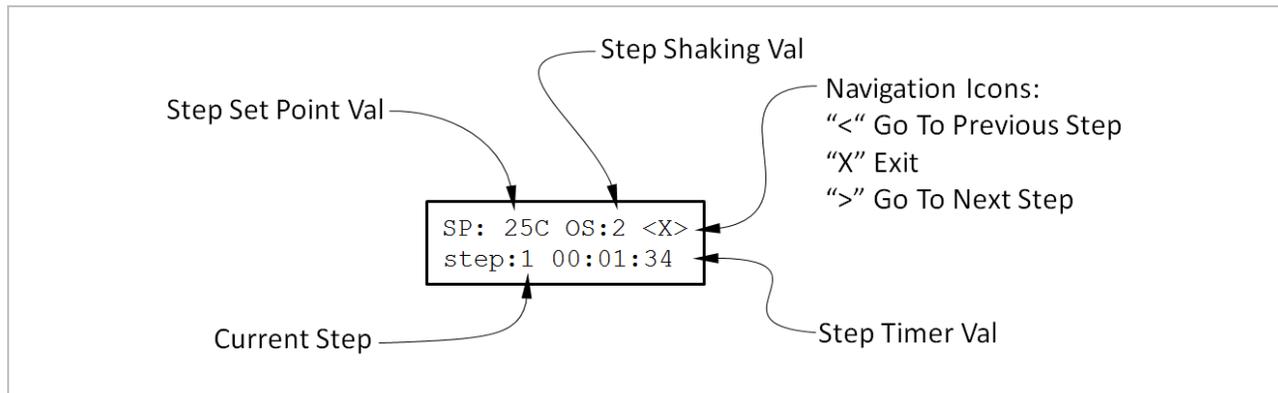


Figure 11: Description of Items in Program >Edit Screen

Figure 12 below shows the keystrokes required to set the values for each step parameter and how to navigate from one step to the next.

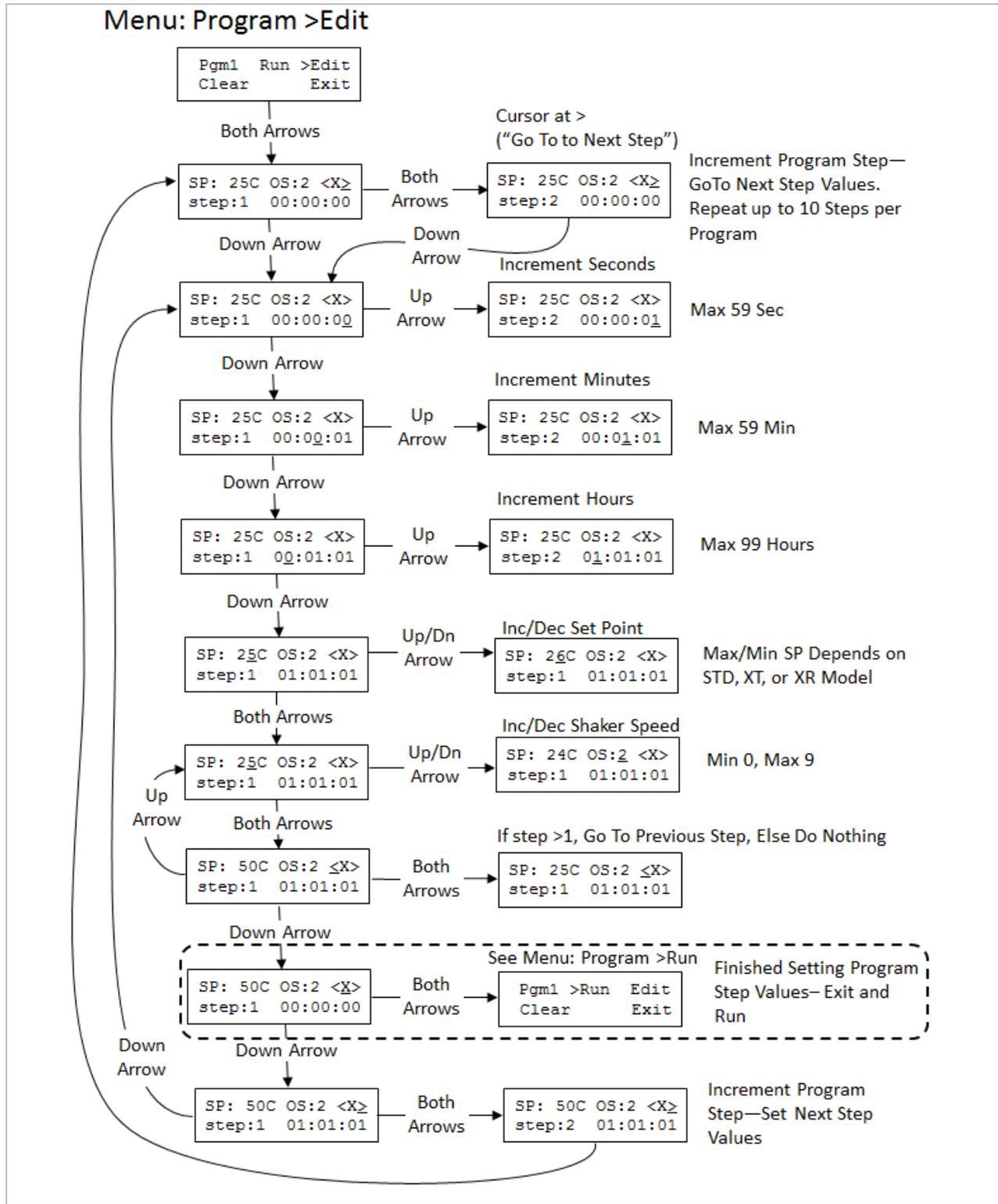


Figure 12: Menu Map For Defining or Editing Program Steps

MENU: Program >Run

The Program >Run sub-menu selection enables the user to specify the number of cycles that the program will repeat before ending. The range for cycle values are 1 to 99 and "in" which means infinite. When infinite (in) is set, the program sequence will repeat until the user stops the program.

Figure 13 below provides a description of the steps and keystrokes required to define the program cycles and to start the program running.

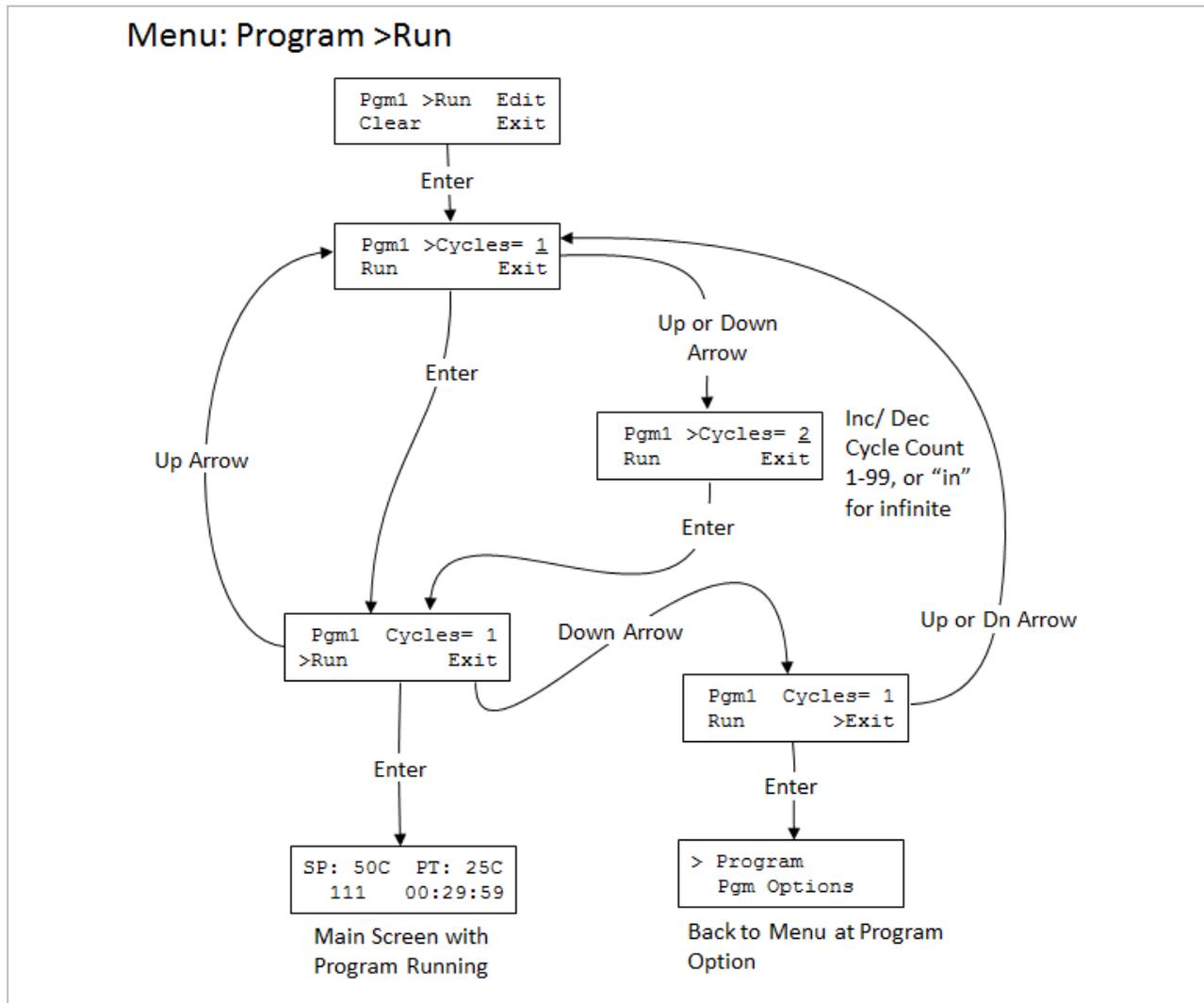


Figure 13: Menu Map For Setting Program Cycles and Running Program

Figure 14 below provides a description of the LCD screen when a program is running.

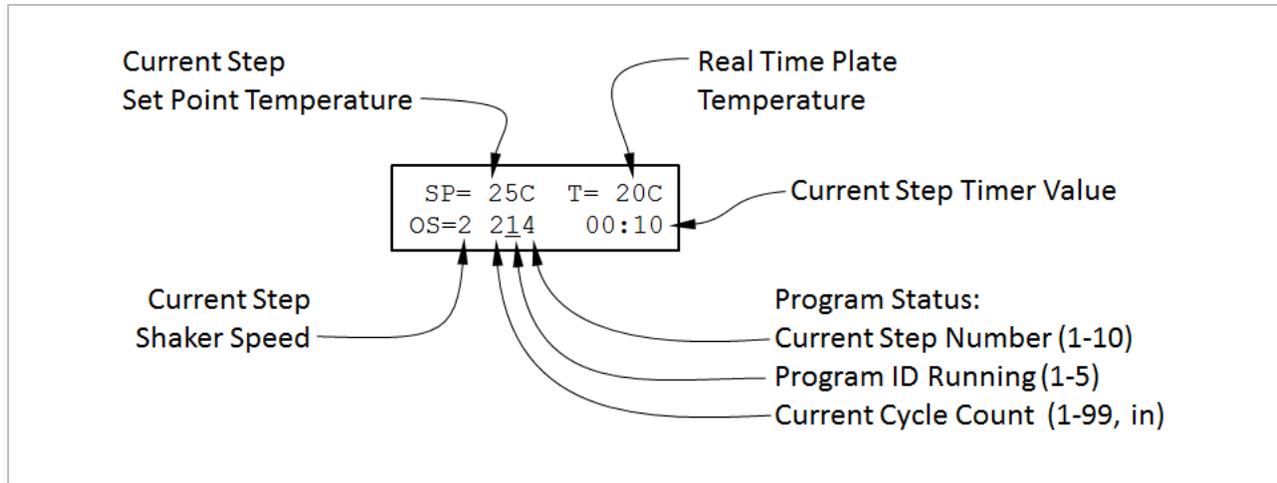


Figure 14: Description of the Display While a Program is Running

MENU: Pgm Options

The menu option “Pgm Options” enables the user to specify if each step in a program sequence should wait for the Plate temperature to equal the Set Point temperature for the program step before beginning to decrement the step timer. If the option is set to “no”, the step timer will begin to decrement immediately when the next program step starts. This means that the transition time required to go from one step temperature to the next will be included in the step time.

The Program Option setting is global meaning that it applies to every step in the program. It is not possible to specify that some steps “wait” and other steps “don’t wait” within a program sequence.

See Appendix A for examples of defined the program steps and the effects of using the global Program Option and Timer Option settings.

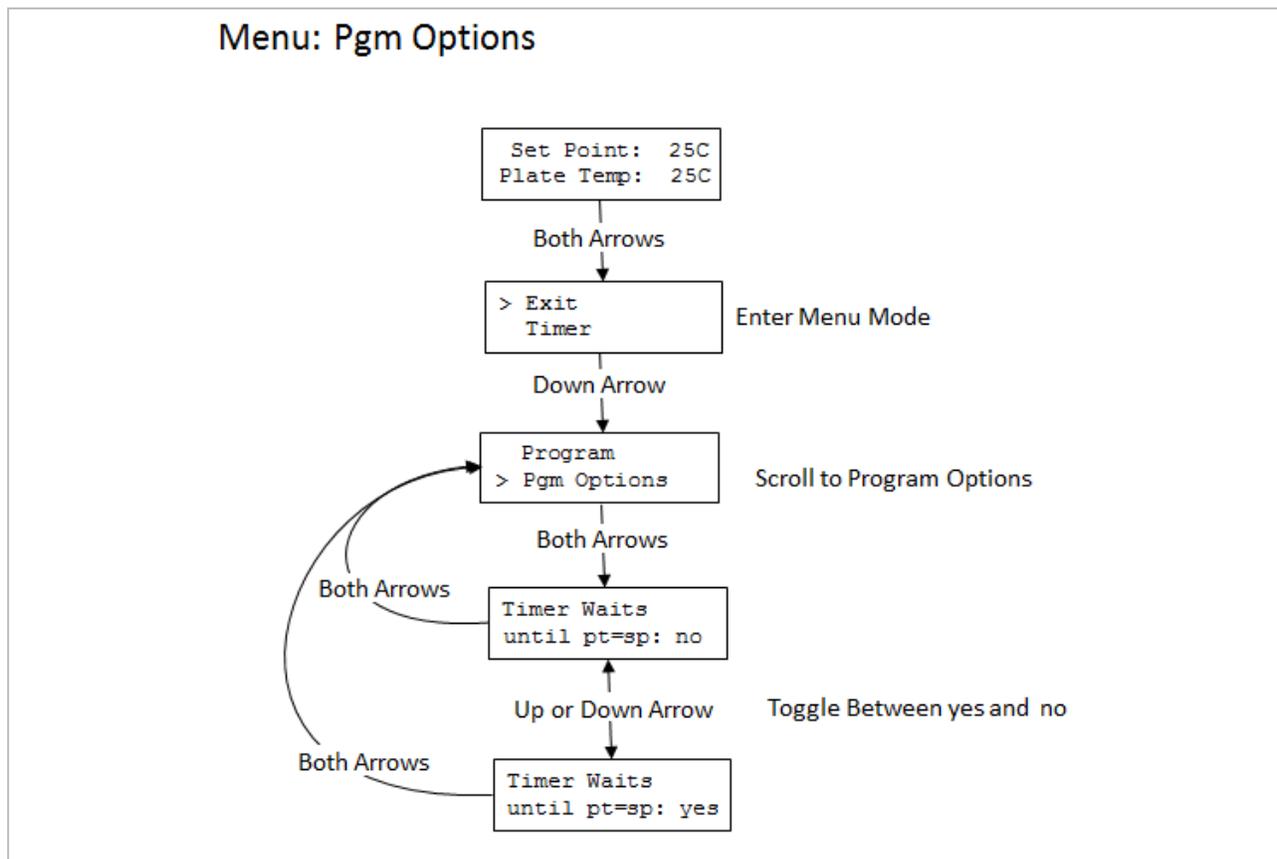


Figure 15: Menu Map For Setting the “Timer Waits” Program Option

XII. TEMPERATURE CALIBRATION

In the factory, a NIST traceable calibration is performed on all SC25* units before they are shipped. The units utilize a two-point calibration algorithm and are calibrated at 4C for the low temperature calibration point, and 95C for the high temperature calibration point. The external temperature measurements are taken at the center of the top plate surface on the SC25 unit. If the user has not recalibrated the unit, the factory calibration offsets are retrieved from memory each time the unit is powered up. The calibration feature in the menu of the SC25 enables the user to re-calibrate the unit at the center of the plate as was done in the factory, or to calibrate the unit relative to some other location of interest. When the unit has been calibrated by the user, the new user calibration offsets will be retrieved from memory at power up. The original factory calibration offsets can be easily restored anytime using the menu function “Reset Cal Points”, which will also erase any user set calibration points.

Default operation uses two-point calibration to ensure accuracy across the entire settable range. The user may perform a two-point calibration at different temperatures and different locations if desired. It also is possible for the unit to operate using single-point calibration. Details on both are provided below. The choice is based on the requirements of the user’s specific process. If it is important for multiple temperatures in a range to be accurate, then two-point calibration should be done with the low and high calibration temperatures equal to the corresponding low and high temperatures in the expected range. If operation at only a single temperature is required, then single-point calibration may be appropriate with the understanding that displayed and measured temperature values will only match at the single calibration temperature and not at other temperatures. Executing the menu function “Reset Cal Points” will erase any user set single-point calibration and return the unit to the default two-point calibration.

It is important to note that user calibration requires the unit to be stable at the calibration temperature for a minimum of 10 minutes and potentially much longer depending on the particular system. Also, the tool used for measuring the temperature at the point of interest must be appropriate, accurate, and repeatable. For example, when measuring the temperature of a surface, a capable surface temperature probe must be used and the location of the measurement must be consistent. If an immersion probe is used in a liquid, the fluid volume and the depth and location of the probe in the fluid must be consistent. Typically, consistent and accurate temperature measurement requires a skilled technique by the user regardless of the method or hardware used. Variation in the measurement of the temperature at the low or high calibration points will affect the temperature measurement accuracy across the entire range of the unit so care must be taken both during the calibration process and during verification of the calibration.

Two-Point User Calibration

Proper two-point calibration requires the unit to be calibrated by the user at both a low temperature and a high temperature. After calibration, the control algorithm inside the SC25

unit will control the power to the plate utilizing temperature measurement values from a “straight line” that passes through both of the low and high calibration points. This ensures that the temperature values both outside and between the high and low temperature calibration points will be proportionately adjusted to achieve an accurate temperature reading. If the need arises for the user to calibrate the unit at a point other than the center of the plate surface (factory location), it is important that the calibration procedure be performed at the same point at both the low and the high temperatures to ensure accuracy across the new calibrated temperature range. For example, if the user process requires the unit to display and heat a block to 4C, 37C, and 75C, the surface of the block should be measured at a specific location, and all temperature measurements related to calibration should be at that same location. In this example the low temperature calibration should be performed at 4C and the high temperature calibration should be performed at 75C. Furthermore, the display must be stable for 10 minutes or more before the temperature measurements are made and entered into the unit.

Single-Point User Calibration

If the unit is expected to be operated at a single temperature point only, and calibration at only that point is important, then single-point calibration may be considered. For single-point calibration, the unit must be calibrated at either the low or high temperature calibration point—but not both. The rule of thumb is if the single-point calibration point is less than 50C, calibrate using the low temperature calibration point and if greater than 50C, then calibrate using the high temperature calibration point. For example, if the unit is to be single-point calibrated at 37C, the low temperature calibration point should be selected (37C is less than 50C). First reset the calibration points to factory values (see Figure 11). Then calibrate the unit at 37C and store the value in the low temperature calibration point. The display must be stable for 10 minutes or more before the temperature measurement is made and entered into the unit.

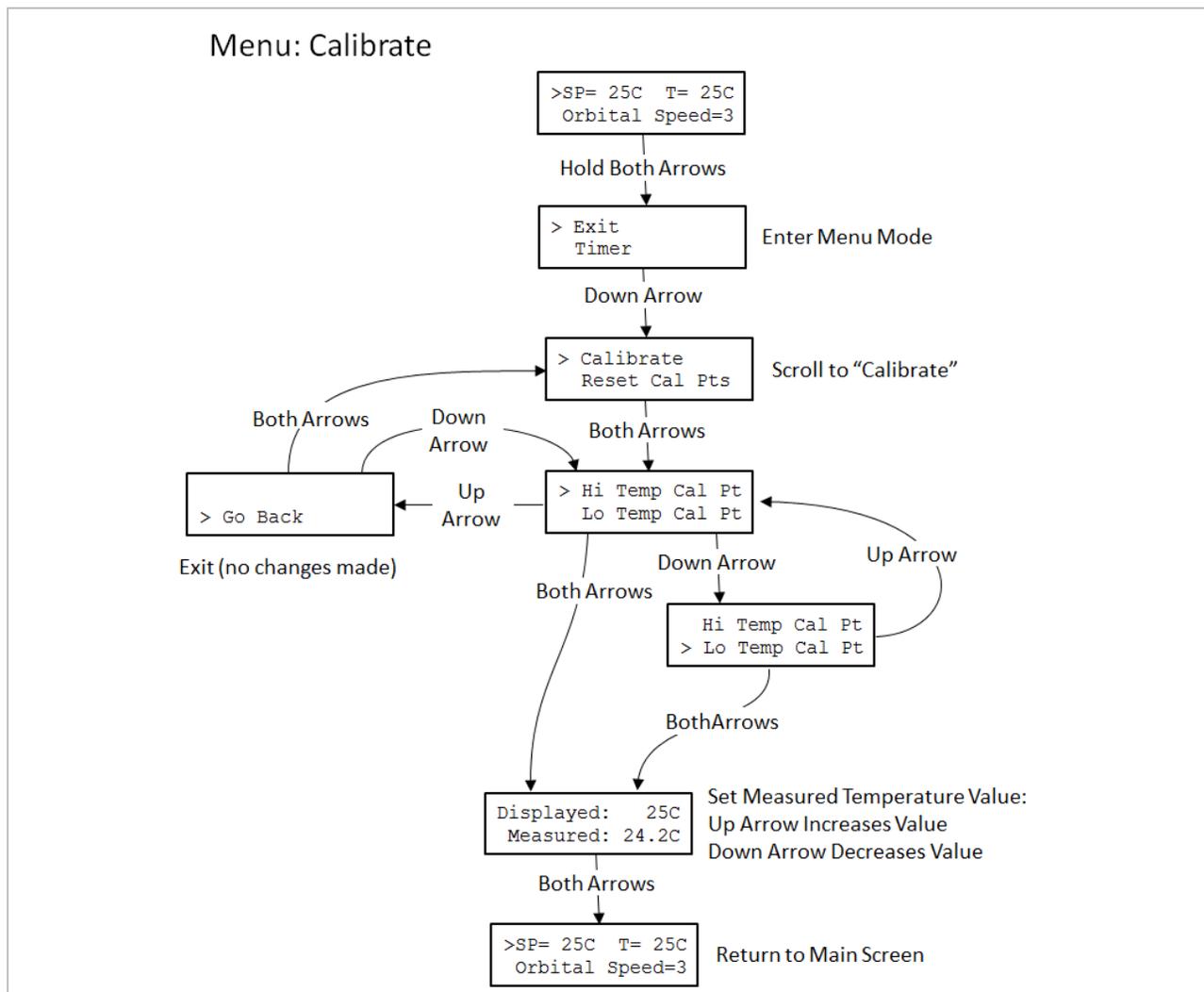
Be aware that temperature values are adjusted based on a “straight line” between the low and high temperature calibration points as described above. For single-point calibration, either the low or high calibration point has been calibrated to the process, but the other calibration point has not. This means that when single-point calibration is utilized, the display will only match the measurement at the calibration temperature. In other words, the displayed temperature on the unit will not match the measured temperature for any temperature other than the single-point calibration temperature. In the previous single-point calibration example where the low temperature calibration point was calibrated at 37C, the measured value when the unit reads 37C will be 37C, but when the unit reads 25C the measured value will likely be higher or lower than 25C.

* “SC25” in the above text applies to models SC25 STD, XT, and XR

MENU: Calibrate

To re-calibrate the unit based on the center of the plate or to calibrate relative to another location, follow the steps below in Figure 16. To replace calibration values with those obtained at the factory prior to shipment or to clear all calibration offsets, follow steps shown in Figure 17.

NOTE: THE PLATE SURFACE AND BLOCK SURFACE MEASUREMENTS ARE DIFFICULT TEMPERATURE MEASUREMENT TO MAKE ACCURATELY. Ensure that the unit and the measurement device have had sufficient time (>10 mins) to stabilize at the new calibration temperature prior to entering in Measured Temperature Value. If the temperatures are not stable when the measured temperature value is entered, significant display and unit performance error may result. Check with the factory if help is needed. Also, calibration kits are available.



MENU: Reset Cal Points

Figure 17 shows the keystrokes to reset the calibration points. In most cases, select “Set to Factory” and the unit will retrieve the calibration values obtained when the unit was calibrated at the factory prior to shipment. Selecting “Set to Not Cal” will remove all calibration corrections and the unit will be “uncalibrated”.

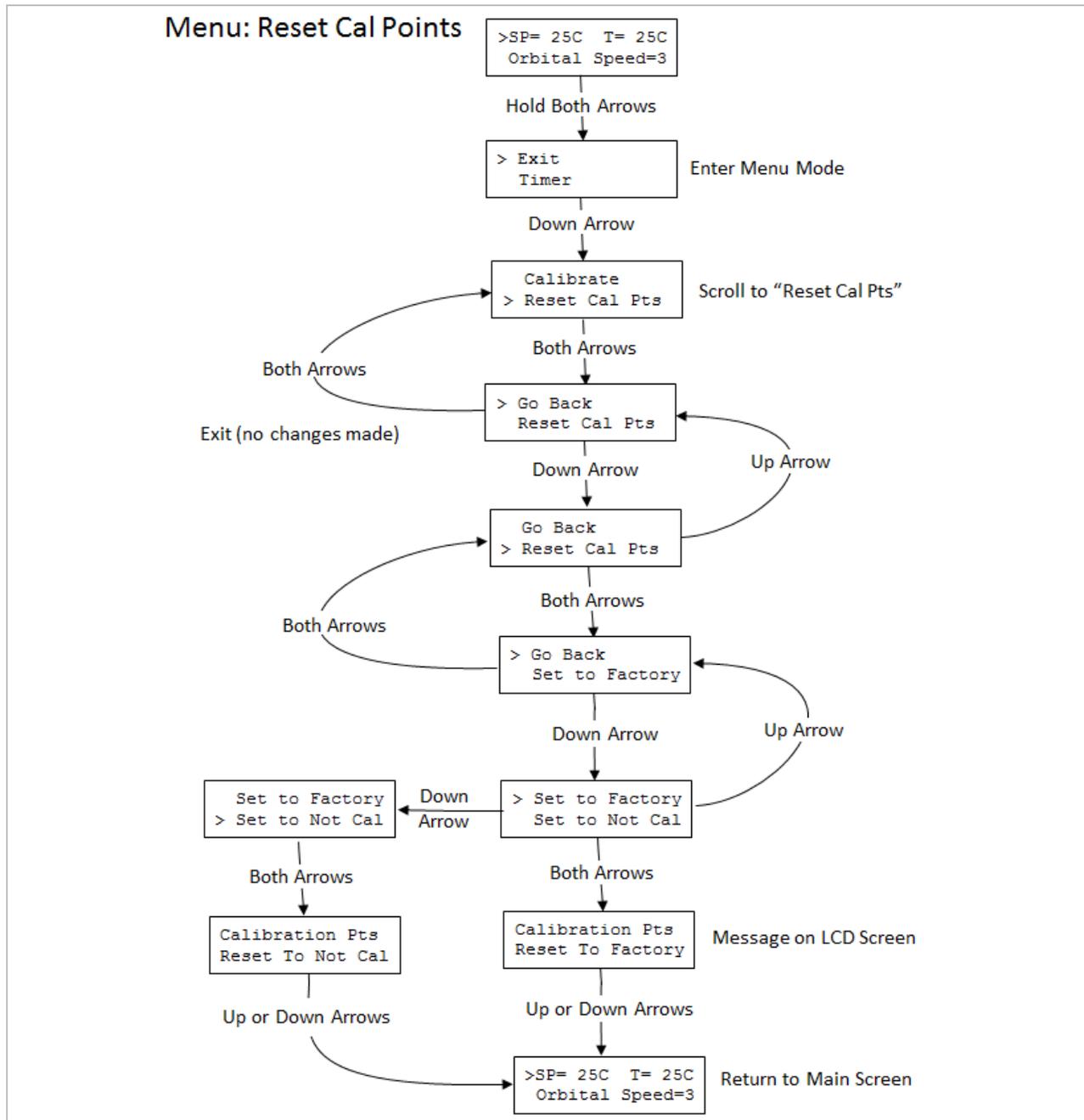


Figure 17: Menu Map to Reset Calibration Points

XIII. TEMPERATURE MEASUREMENT ERROR CODES

The temperature measurement functionality of the unit may be adversely affected by hardware issues as well as user input error during calibration. Examples include the temperature sensor malfunctioning (rarely occurs) or the user inadvertently entering the incorrect measured temperature value during calibration. There are other possibilities where the calibration value stored in memory is somehow corrupted and an invalid value is retrieved at startup. If an issue occurs with the temperature measurement circuitry or with a calibration value that has been restored from memory, the unit will display the error code in place of the plate temperature value. If an error is detected, all power to the heater plate will be turned off and an error code will be displayed instead of the temperature value for “Plate:”.

Table 1 below lists the error codes, the possible cause, and recommended action to address the error and return the unit to proper operating condition. Calibration errors (cal0-cal4) are addressed by entering the Menu and resetting the unit to the factory settings or to the Not Cal settings(see Figure 17). The unit can then be re-calibrated if necessary.

Error Code	Possible Cause	Recommended Action
RTDo	The RTD Sensor is not connected or has failed	Inspect Sensor and Sensor Connector and/or Contact Torrey Pines Scientific
RTDs	The RTD Sensor has shorted or has failed	
cal0	The Calibrated Temperature Value is out of range	Using the Menu, reset Cal Points to Factory or to Not Cal (see Figure17)
cal1	Low Cal Point out of range	
cal2	High Cal Point out of range	
cal3	High Point Measured Cal Value is Lower than Low Point Measured Value (or reverse)	
cal4	High Point Temperature Value is Lower than Low Point Temperature Value (or reverse)	

Table 1: Temperature Measurement Error Codes

XIV. RS232 SERIAL COM INTERFACE

The RS232 serial communication is available through the 9-pin D-subminiature connector on the rear of the unit. Only pins 2, 3 and 5 on the connector are used. The COM parameters are 9600 baud, 1 stop bit, no parity. no handshake. All communications settings and queries are done using ASCII characters with carriage return as the terminating character. It is also recommended that a delay of 100ms be included following each command that is sent to the SC25 unit.

Refer to Appendix B of this document for a detailed description of the commands available when using the serial port.

The interface cable should be the straight through type with the minimum connections shown in the Figure 18 below. Additionally, a DB9 to USB dongle may be used if the PC does not have a DB9 serial COM connector.

Cable Pinout

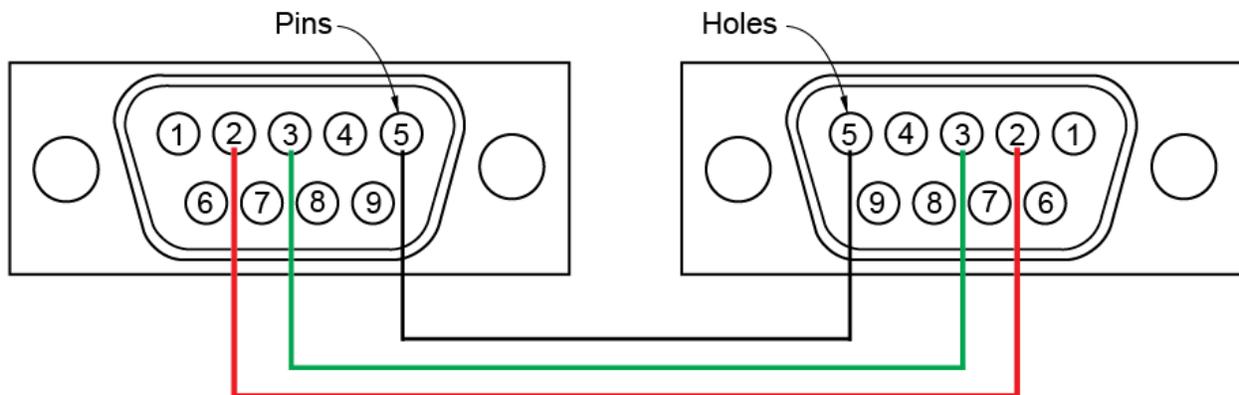


Figure 12: RS232 DB9 “Straight Through” Cable Pinout (Pins 2,3,5 only)

COM Settings

9600 baud
1 stop bit
no parity
no hardware handshake
100ms delay after each command sent (after \r)

Note: To comply with CE and to avoid possible EMI radiation from the RS232 cable, use a shielded cable.

XV. CLEANING, MAINTENANCE, AND CONSUMABLE PARTS

CLEANING

The units are subject to splashes and spills during normal use. Also, condensation may occur when heating after chilling. Be sure to wipe up all spills and condensation with a soft cloth or paper towel as they occur. If a cleaning solution is necessary, use a mild soap or detergent solution and a soft cloth. Do not use solvents. They could damage the paint or display window on the unit.

Caution: Do not attempt to clean the plate surface when hot. Burns might occur.

MAINTENANCE

There is no ongoing maintenance program needed with the units other than the normal care and cleaning as instructed above, and a simple inspection done whenever the unit is to be used. This simple inspection should include:

1. Checking that the AC cord and the DC cable to and from the power supply module are not frayed or burned.
2. Checking that the unit is not dirty to a point where proper performance is impaired. This is especially important relative to the membrane switch and LCD window.
3. Being certain to store the unit properly, when not in use, in an area that will not have items placed on top of the unit, and covering the unit in a way that will keep dirt and other foreign bodies out of the unit.

Note: Outside electrical interference such as lightning might on occasion cause the unit to lock up or change target temperature without being instructed to do so. The unit should be reset if this happens. After the unit has been reset, the set point will be set to 20C, all menu options will be set to default, the data log will be cleared, and the calibration values will be reset to factory calibration values. The need to reset the unit is expected to be very rare. To reset the unit, turn it off using the rear panel switch then turn it on again while pressing and holding either the UP or the DOWN Arrow buttons. Three dots (“---”) should appear on the LCD display—continue pressing the button until the message “Unit Reset” appears on the LCD display.

SPARE PARTS AND CONSUMABLES

There are very few spare or consumable parts. A simple list is below.

<u>Part Number</u>	<u>Description</u>
730-0001	Power Cord, US
730-0002	Power Cord, Germany (European)
730-0003	Power Cord, UK
730-0004	Power Cord, Italy
730-0005	Power Cord, Australia/China

XVI. ADDITIONAL SYMBOLS

The following are additional symbols found on labels on the instrument

<u>Symbol</u>	<u>Description</u>
V	Voltage
~	Alternating Current
A	Current
Hz	Frequency
W	Power

APPENDIX A: Example Programming Scenarios

The programming functionality available in the model SC25 enables the user to define up to 10 specific sequences and run the sequences automatically for a specific number of cycles or infinitely. There are 5 possible programs available which means that up to 5 different 10step sequences can be defined.

Each program step is the value for the set point and the starting value for the countdown timer. When the countdown timer reaches 00:00:00, and another program step is available, the values for the next step are loaded until the last step is reached.

There are global settings which can modify the behavior of both the running and the finished program. If MENU:Pgm Options, "Timer Waits for PI Temp = SP" is set to "no", then each step timer will start to decrement immediately after the step is loaded. If it is set to "yes", then the timer will wait until the plate temperature is equal to the set point temperature for that step before it begins to decrement. In other words, if set to "no", then the time to get to the set point and the time at the set point are combined in the step time. If set to "yes", the step timer value only refers to the time at the set point temperature. The "wait until" feature is global meaning that when set, all steps in a running program will wait until the plate temperature reaches the set point before the step timer will begin to decrement. It is not possible to program so that some steps are "wait until" and some steps are not.

If MENU: Timer Options, "Auto-Off" is set to "no", then the unit will remain at the last step set point value when the program ends. If it is set to "yes", then the unit will enter "Idle Mode" when the program ends which means that power will be removed from the heater plate and the unit will naturally cool down or warm up as if it were unplugged (SP will read "off").

The "wait until" and "Auto-Off" features are global—they cannot be assigned to individual steps. However, the Heater OFF mode is an available set point in each of the program steps. Using the appropriate combination of global settings and step settings offers flexibility in defining the behavior of a program both running and upon completion.

The following examples are provided to illustrate the settings for four sample programming scenarios.

Programming Example 1: No Wait-Until, No Auto-Off

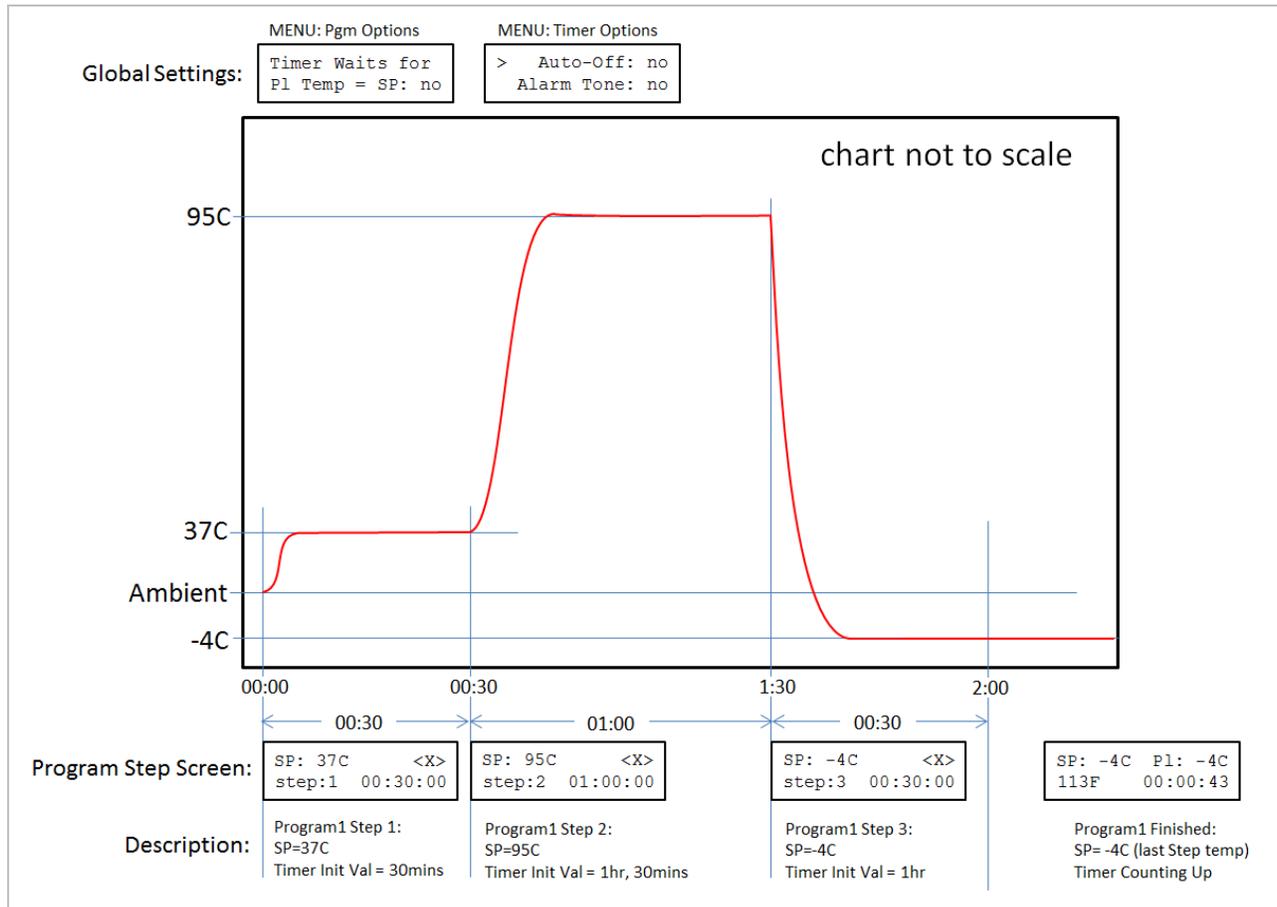


Figure A1: Global Wait-Until and Auto-off are Both Disabled

If the “wait until” and “Auto-Off” features are set to “no”, then Figure A1 above illustrates a three step program where the first step has a set point of 37C and the countdown timer starts at 30mins. When the first step is running, the plate will heat until the plate temperature is 37C. The plate temperature will then remain at 37C for the remainder of the 30minutes. When the timer reaches 00:00:00, step 2 loads its values and begins to execute. In step 2, the set point is 95C and the countdown timer value is 1 hour. In step 3 the set point is -4C for 30mins. When the program ends, the timer will begin counting up until the user presses a button on the SC25 front panel to return to the default screen. In this example, the unit continues operation at the same set point as the last programmed step.

Programming Example 2: Auto-Off is Enabled

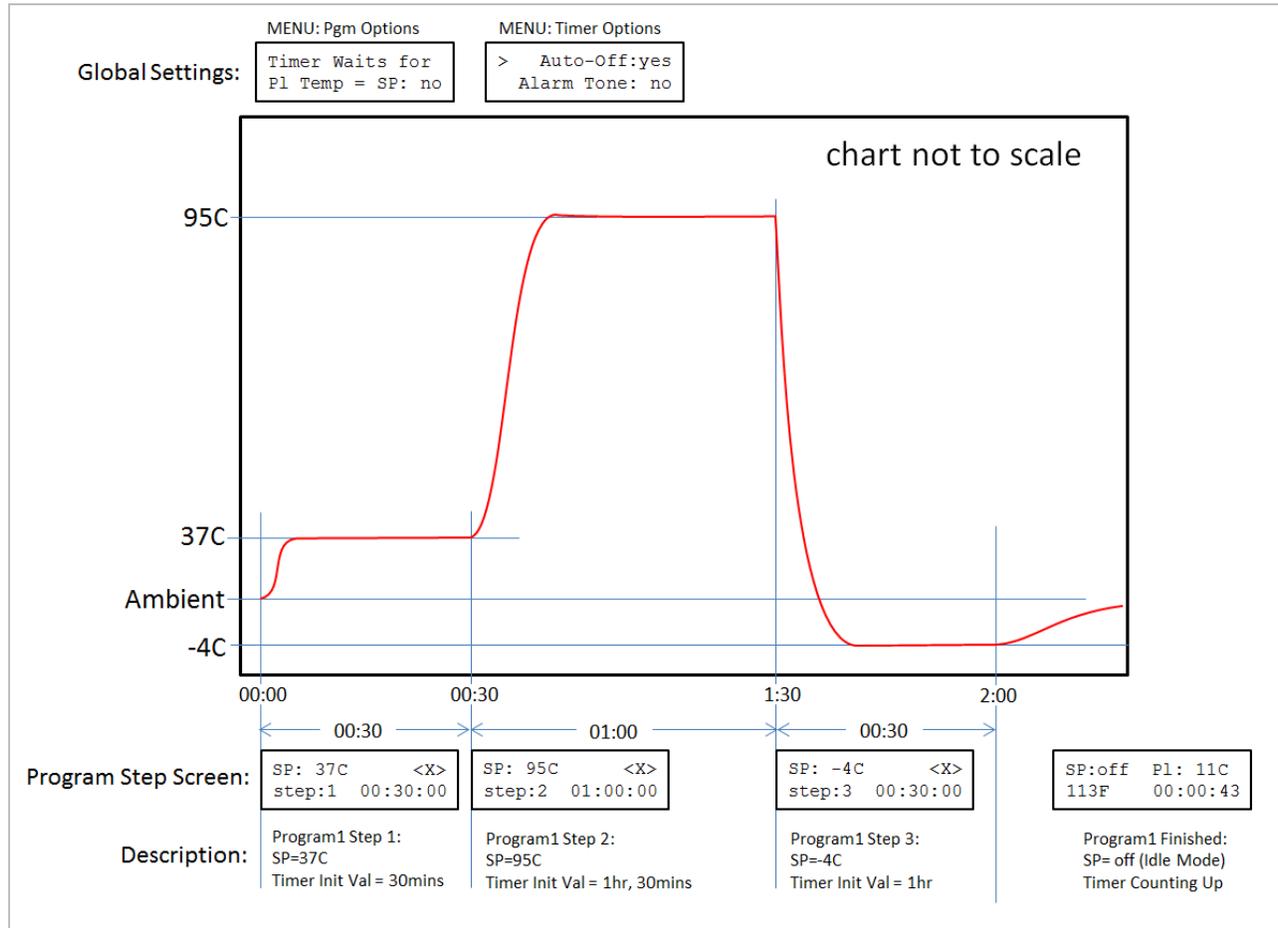


Figure A2: Global Wait-Until is “off” and Auto-off is “on”

In Programming Example 1, it may not be necessary to define a specific temperature for the last step—it may be sufficient or required to simply “turn the plate off” on the last step. Figure A2 above shows the modifications to the Example 1 sequence shown previously in Figure A1. First, set the global setting MENU: Timer Options “Auto-Off” parameter to “yes”. This means that on the last step the unit will enter Idle Mode and “automatically turn off power to the plate”. Figure A2 above shows the effect of setting the Timer Options Auto-Off option to “yes” The three program steps are defined exactly the same as for Example 1 but now when step 3 completes, the set point will be “off” and the unit will stop powering the plate. The effect is that the plate and sample will naturally return to the ambient temperature. The timer will continue to count up from the end of step 3 until the user presses a button on the front panel. Additionally, the user must use the Menu to Exit Idle Mode to enable setting a new set point temperature.

Programming Example 3: Wait-Until is Enabled and Auto-Off is Enabled

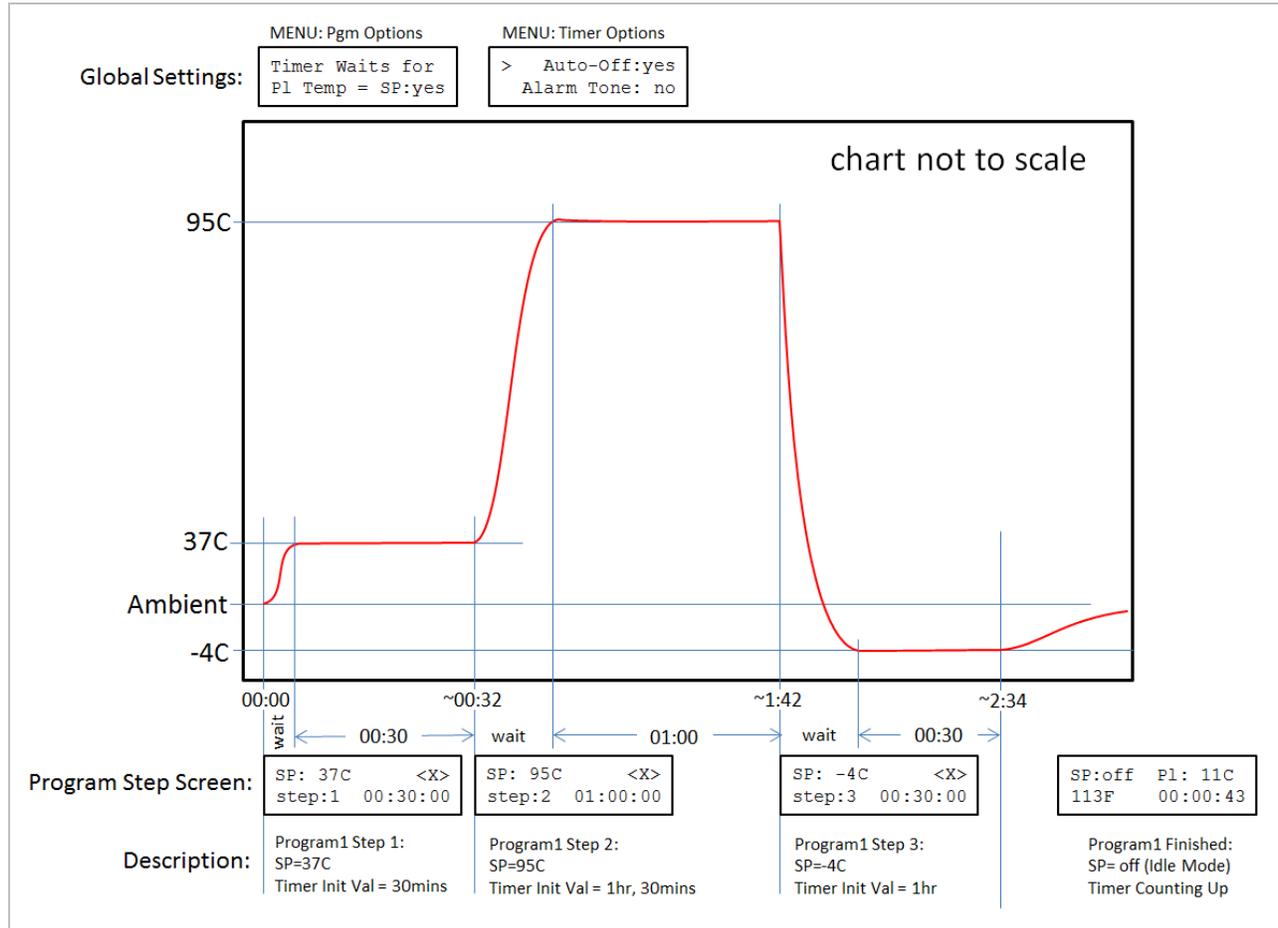


Figure A3: Global Wait-Until is “yes” and Auto-off is “yes”

In both Programming Examples 1 and 2, the time to reach the set point temperature was included in the step countdown timer value. In situations where the time at the set point temperature is important, the global MENU: Pgm Options “Timer Waits for PI Temp = SP: yes” option causes the unit to wait until the plate temperature is equal to the new set point temperature before the timer begins to decrement the step timer value. The behavior is illustrated in Figure A3 above where the step timer simply “waits” during the temperature change periods before starting to decrement. This example is the same as Programming Example 2 with the Program Options wait-until feature enabled. It should be obvious that enabling the wait-until global setting will result in an increase in the total time to complete an entire sequence since the time to get to temperature is no longer included in the programmed times for each step.

NOTE: The setting for “Timer waits for PI Tem = SP” in the Pgm Options menu is global meaning that if it is set to “yes”, all steps in a running program will wait until the step set point is reached before the timer decrements and vice versa. It is not possible to program a sequence where some steps are “wait until” and some are not.

APPENDIX B: Commands Using the Serial Port

As described in Section XIII. (“RS232 SERIAL COM INTERFACE”) communication between the SC25 units and an external computer is accomplished using the RS232 protocol via the DB9 connector. See Section XIV for cable wiring and COM parameters. Appendix B describes each command available to get information from and/or to control the behavior of the SC25 unit using a terminal emulator program running on the PC (like HyperTerminal). The interface also enables automated operation via a user written application written in any of several languages like C# or Python.

Appendix A Conventions

<CR>

The notation “<CR> “ refers to the ASCII character for “carriage return” which is decimal 13 or hex D. Every valid SC25 command must be terminated by this character. In HyperTerminal the character is sent when the “enter” key is pressed. Programs written in C for example, typically send this character when “\r” is appended to the transmitted command string.

<LF>

The notation “<LF> “ refers to the ASCII character for “line feed” or “new line” which is decimal 10 or hex A. Every string that is returned from the SC25 will be terminated with this character. Actually, every string that is returned from the SC25 will be terminated with a <CR> then a <LF>. In HyperTerminal the combined characters will cause the cursor to return to the beginning of the next line. Programs written in C for example, can use this character (often “\n”) for parsing returned strings.

(string)

Characters within parenthesis are strings consisting of 7-bit ASCII characters and the string itself is the argument for a command. The length of the string is clarified in the discussion of the command and the two parentheses are not included in the transmission of the command string.

Unit Identification Commands

Command: **v**

Function: **Return SC25 Model and Version**

Description: When the command v<CR> is received by the SC25 unit, the model number and the firmware version will be returned in a text string terminated by <CR><LF>. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example:

send: v<CR>

returned: SC25 v6.0<CR><LF>

Command: **V**

Function: **Return Serial Number**

Description: When the command V<CR> is received by the SC25 unit, the 8 character serial number will be returned in a text string terminated by <CR><LF>. The serial number for every SC25 unit is unique. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – Return the 8 char serial number:
send: V<CR>
returned:12345678 <CR><LF>

Temperature Commands

Command: s

Function: **Return Set Point Temperature**

Description: When the command s<CR> is received by the SC25 unit, the current set point temperature will be returned in a text string terminated by <CR><LF>. The set point format length is variable depending on the number of digits in the set point temperature and whether the value is negative. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Note: Putting the SC25 into Idle Mode (see “Command: i”) will turn off the temperature controller and the set point will be read as “off”.

Example—Return the current set point:

send: s<CR>

returned example 1: -10<CR><LF>

returned example 2: 9 <CR><LF>

returned example 3: 100 <CR><LF>

returned example 4: off<CR><LF> if unit is in Idle Mode (see “Command: i”)

Command: n

Function: **Set and Store New Set Point Temperature**

Description: When the command n(new_temperature)<CR> is received by the SC25 unit, the set point will be changed to new_temperature and the text string “ok” will be returned terminated by <CR><LF>. The format for new_temperature is variable depending on the number of digits in the desired new set point temperature and whether the value is negative. The settable range for an SC25 is -10 to +110 degrees (C).

If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example1— Change set point to -10C:

send: n-10<CR>

returned: ok <CR><LF>

Example2 – Change set point to 9C :

send: n9<CR>

returned: ok <CR><LF>

Example3 – Change set point to 100C :

send: n100<CR>

returned: ok <CR><LF>

Command: i

Function: Set SC25 Unit to Idle Mode

Description: When the command i<CR> is received by the SC25 unit, the temperature controller will be switched "off", meaning that the plate will no longer heat or cool. In Idle Mode, the unit will report a set point of "off". To exit Idle Mode, use command l (see below) or set the set point to a new value using cmd n. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – Set Idle Mode:

send: i<CR>
returned: ok <CR><LF>

Example – verify Idle Mode:

send: s<CR>
returned: off<CR><LF>

Example – exit Idle Mode by setting new set point to 25C

send: n25<CR>
returned: ok <CR><LF>

Example – verify no longer in Idle Mode and set point is 25C:

send: s<CR>
returned: 25<CR><LF>

Command: l

Function: Clear SC25 Idle Mode and Return to Last Set point

Description: The command l<CR><LF> will exit Idle Mode and return the SC25 set point to the value that it was before the unit entered Idle Mode. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – verify Idle Mode:

send: s<CR>
returned: off<CR><LF>

Example – Clear Idle Mode (set point was 25C before entering Idle Mode):

send: l<CR>
returned: ok <CR><LF> (set point now 25C)

Example – verify no longer in Idle Mode and set point is 25C:

send: s<CR>
returned: 25<CR><LF>

Command: p

Function: Return the current Plate Temperature

Description: When the command p<CR> is received by the SC25 unit, the current plate temperature will be returned in a text string terminated by <CR><LF>. The format length is variable depending on the number of digits in the plate temperature and whether the value is negative. If an internal RTD temperature sensor or calibration error has occurred, the specific error code will be returned as indicated in the following table. If the command is not received in the proper syntax, e<CR><LF> will be returned.

See Command: #F or Figure 10 to reset cal points if a calibration error has occurred

Example—Return the plate temperature:

send: p<CR>
returned example 1: -10 <CR><LF>

returned example 2: 9 <CR><LF>
returned example 3: cal1 <CR><LF>

Orbital Speed Commands

Command: r

Function: Return the Orbital Speed Setting

Description: When the command r<CR> is received by the SC25 unit, the current orbital speed setting will be returned terminated by <CR><LF>. If the command is not received in the proper syntax, e<CR><LF> will be returned. This command is included as a legacy command. Command "m" will perform both the set and return functions.

Example – return the orbital speed which is currently displayed as 3 on the LCD display.

send: r<CR>
returned: 3<CR><LF>

Command: m

Function: Return or Set the Orbital Speed

Description: When the command lc<CR> is received by the SC25 unit, the current log values will be erased and ready to start a new file. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – return the orbital speed which is currently displayed as 3 on the LCD display.

send: r<CR>
returned: 3<CR><LF>

Example – set the orbital speed to 3.

send: m3<CR>
returned: ok<CR><LF>

Logging Commands

Command: l

Function: Return the Current Log File

Description: When the command l<CR> is received by the SC25 unit, the current log file will be returned one data point at a time with each value terminated by <CR><LF>. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – return the log file

send: l<CR>
returned: 23<CR><LF> 23<CR><LF> 24<CR><LF> ... 70<CR><LF>

Command: lc

Function: Clear the Log File

Description: When the command lc<CR> is received by the SC25 unit, the current log values will be erased and ready to start a new file. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – clear the log file:
send: lc<CR>
returned: ok <CR><LF>

Command: ls

Function: Start Logging

Description: When the command ls<CR> is received by the SC25 unit, the unit will begin to log plate temperature values at the rate defined by the log period setting (ref le, lm, or l5 commands or front panel menu command). If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – start logging:
send: ls<CR>
returned: ok <CR><LF>

Command: lp

Function: Stop or Pause Logging

Description: When the command lp<CR> is received by the SC25 unit, the unit will stop logging log plate temperature values. If the command ls is issued, the unit will continued logging from the last log position. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – stop logging (or pause logging)
send: lp<CR>
returned: ok <CR><LF>

Command: le

Function: Set Logging Period to 1 second

Description: When the command le<CR> is received by the SC25 unit, the unit will set the logging period to 1 second which means that a data point will be stored once every second. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – set to log a data point every second
send: le<CR>
returned: ok <CR><LF>

Command: lm

Function: Set Logging Period to 1 minute

Description: When the command lm<CR> is received by the SC25 unit, the unit will set the logging period to 1 minute which means that a data point will be stored once every minute. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – set to log a data point every minute
send: lm<CR>
returned: ok <CR><LF>

Command: l5

Function: Set Logging Period to 5 minutes

Description: When the command l5<CR> is received by the SC25 unit, the unit will set the logging period to 5 minutes which means that a data point will be stored once every 5 minutes. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – set to log a data point every 5 minutes

send: le<CR>
returned: ok <CR><LF>

Utility Commands

Command: #m

Function: **Return all calibration values**

Description: When the command #m<CR> is received by the SC25 unit, the unit will return 4 values separated by commas and terminated by <CRLF>.

The values and order are:

Calibration_Temp_Lo, Measured_Temp_Lo, Calibration_Temp_Hi, Measured_Temp_Hi<CRLF>

Calibration_Temp_Lo: Set Point temperature when calibration at low temperature was done.

Measured_Temp_Lo: Measured temperature entered when calibration at low temperature was done.

Calibration_Temp_Hi: Set Point temperature when calibration at high temperature was done.

Measured_Temp_Hi: Measured temperature entered when calibration at low temperature was done.

Example – return the stored calibration values

send: #m<CR>

returned: 37, 36.2, 70, 71.1<CR><LF>

Command: #F

Function: **Reset all Calibration Values to Factory Set Values**

Description: When the command #F<CR> is received by the SC25 unit, the unit will reset and store all calibration values to those measured and set in the factory prior to shipment.

Example – reset cal vals back to factory

send: #F<CR>

returned: ok<CR><LF>

Command: #Z

Function: **Reset Unit to Default Configuration**

Description: When the command #Z<CR> is received by the SC25 unit, the unit will reset all non-volatile memory to default factory values.

Example – reset Unit

send: #Z<CR>

returned: Unit Reset<CR><LF>

Serial Command Quick Reference Table

	Command	Function	Example	
			sent	returned
ID	v	return model and version	v <CR>	SC25 v1.0 <CR LF>
	V	return serial number	V <CR>	12345678 <CR LF>
Temperature	s	return set point temperature	s <CR>	-10.0 <CR LF> off <CR LF> if idle mode
	n(xxx)	set new set point temperature (x.x min)	n25 <CR>	ok <CR LF>
	i/l	set/clear idle mode (plate power is off when set)	i <CR> or l <CR>	ok <CR LF>
	p	return plate temperature	p <CR>	-10.0 <CR LF> or error_code <CR LF>
Orbital Speed	r	return Orbital Speed (legacy)	r <CR>	3 <CR LF>
	m	set/return Orbital Speed (0-9)	m <CR>	3 <CR LF>
			m3 <CR>	ok <CR LF>
Logging	l	return log file	l <CR>	log_data(0) <CR LF>... log_data(n) <CRLF>
	lc	clear log file	lc <CR>	ok <CR LF>
	ls	start logging	ls <CR>	ok <CR LF>
	lp	stop logging	lp <CR>	ok <CR LF>
	le	set log period to 1 second	le <CR>	ok <CR LF>
	lm	set log period to 1 minute	lm <CR>	ok <CR LF>
	l5	set log period to 5 minutes	l5 <CR>	ok <CR LF>
	b	return current log period	b <CR>	s, m, or 5 <CR LF>
Utility	#m	return all calibration points	#m <CR>	C_LO,M_LO,C_HI, M_HI <CR><LF>
	#F	Restore calibration to factory values	#F <CR>	ok <CR LF>
	#Z	Reset unit to default configuration (rarely necessary)	#Z <CR>	Unit Reset <CR LF>

<CR> is ASCII return char (for example: "enter" keyboard press for HyperTerminal, "\r" for C pgms, ASCII hex char "D")
 <LF> is ASCII linefeed char (d'10 or '\n')