



OPERATING MANUAL

EchoTherm
DIGITAL, ELECTRONIC CHILLING/HEATING DRY BATH
MODELS IC22 & IC22XT
Applies to version 5.2 and higher

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Table of Contents

I. INTRODUCTION	4
II. WARRANTY	4
III. RETURN OF ITEMS	4
IV. LABELS	5
V. CAUTIONS	5
CHILLER/HEATER PLATE SURFACE	5
ELECTRICAL.....	5
VI. GENERAL DESCRIPTION	6
HEATER/CHILLER PLATES	6
TIMER.....	6
ALARM	6
DATA LOGGER.....	6
VII. FRONT AND REAR PANEL CONTROLS	8
FRONT PANEL.....	8
REAR PANEL	9
VIII. SET UP PARAMETERS	10
SET UP PARAMETERS	10
SET UP INSTRUCTIONS	10
ENVIRONMENTAL INFORMATION	10
IX. DISPLAY AND KEYBOARD DESCRIPTIONS.	11
DISPLAY.....	11
PUSH BUTTONS.....	12
X. SETTING TEMPERATURE AND OTHER FEATURES	14
SETTING TEMPERATURE	14
SETTING TIMERS.....	15
SETTING THE UNIT TO “IDLE MODE”	17
DATA LOGGER.....	19
XI. TEMPERATURE CALIBRATION	21
Two-Point User Calibration	21

Single-Point User Calibration.....	22
MENU: Calibrate.....	23
MENU: Reset Cal Points.....	24
XII. TEMPERATURE MEASUREMENT ERROR CODES	25
XIII. RS232 SERIAL COM INTERFACE	26
Cable Pinout	26
COM Settings	26
XIV. CLEANING, MAINTENANCE, AND CONSUMABLE PARTS	27
CLEANING	27
MAINTENANCE.....	27
SPARE PARTS AND CONSUMABLES.....	28
XV. ADDITIONAL SYMBOLS.....	28
APPENDIX A: Commands Using the Serial Port.....	29

I. INTRODUCTION

Congratulations on your purchase of an *EchoTherm* 2-Position, Digital Electronic Chilling/Heating Dry Bath Model IC22 or IC22XT. 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 IC22/IC22XT models are capable of chilling and heating each plate surface from -10°C to 100°C (IC22) or -20°C to 100°C (IC22XT). 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).**

ELECTRICAL

The cooling/heating module in the IC22/IC22XT Series operates at 12 volts DC at 8.4 Amps. 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 IC22/IC22XT units are Peltier driven for chilling & heating. They come with a universal power suppl. The units have only one moving part, the DC fan that cools the unit. 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 PLATES

The temperature controlled surfaces are very flat aluminum plates designed for good contact with any flat surfaced item placed on them. The plate sizes on the IC22 are 2.875" (73 mm) x 4.375" (111 mm). They will chill and heat quickly without a load on them. The temperature of the plates are sensed by a platinum RTD mounted under each plate. Each individual plate has a dedicated Peltier heating/chilling assembly and is controlled separately. The temperature controller in the unit compares the plate temperature with the target temperature for each plate, and instructs the individual Peltier module to heat or chill the plate as required to keep each Plate Temperature equal to its Set Point temperature.

TIMER

All units have a countdown timer for each plate reading in hours, minutes, and seconds. It can be set to a maximum of 99 hours 59min 59sec. The timer will be displayed in place of the Set Point temperature for the plate for which the timer has been set. Pressing either the UP or DN button will display the Set Point then return to displaying the timer after 5 seconds. An AUTO-OFF feature is provided in the Menu under "Timer Options". If AUTO-OFF is enabled, the specific plate will go into idle mode when the timer counts down to zero. See "Setting Timer" and "Setting Idle Mode" sections in this manual for more details.

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. The alarm can be disabled using "Timer Options" in the Menu.

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. The data can be retrieved using the RS232 serial port. 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, MENU options, user changed calibration points, and logged data points. 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 IC22/IC22XT series shown above has a tactile touch membrane keyboard with an audible feedback button press beep. 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 (“sp”) and Plate Temp. (“T”) for both the front (“F”) and back (“B”) plates. Each set point temperature is set by pressing the up arrow button to increment the value, and the down arrow button to decrement the value. The arrow cursor on the display indicates which plate is selected. Pressing both up and down arrow buttons at the same time will toggle the cursor between the front and back plates. The displayed plate temperatures are the actual temperature of the center of the plate surface. 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, to set a timer, and to calibrate the temperature against a local standard. Figure 1 below describes the screens for different modes of operation.

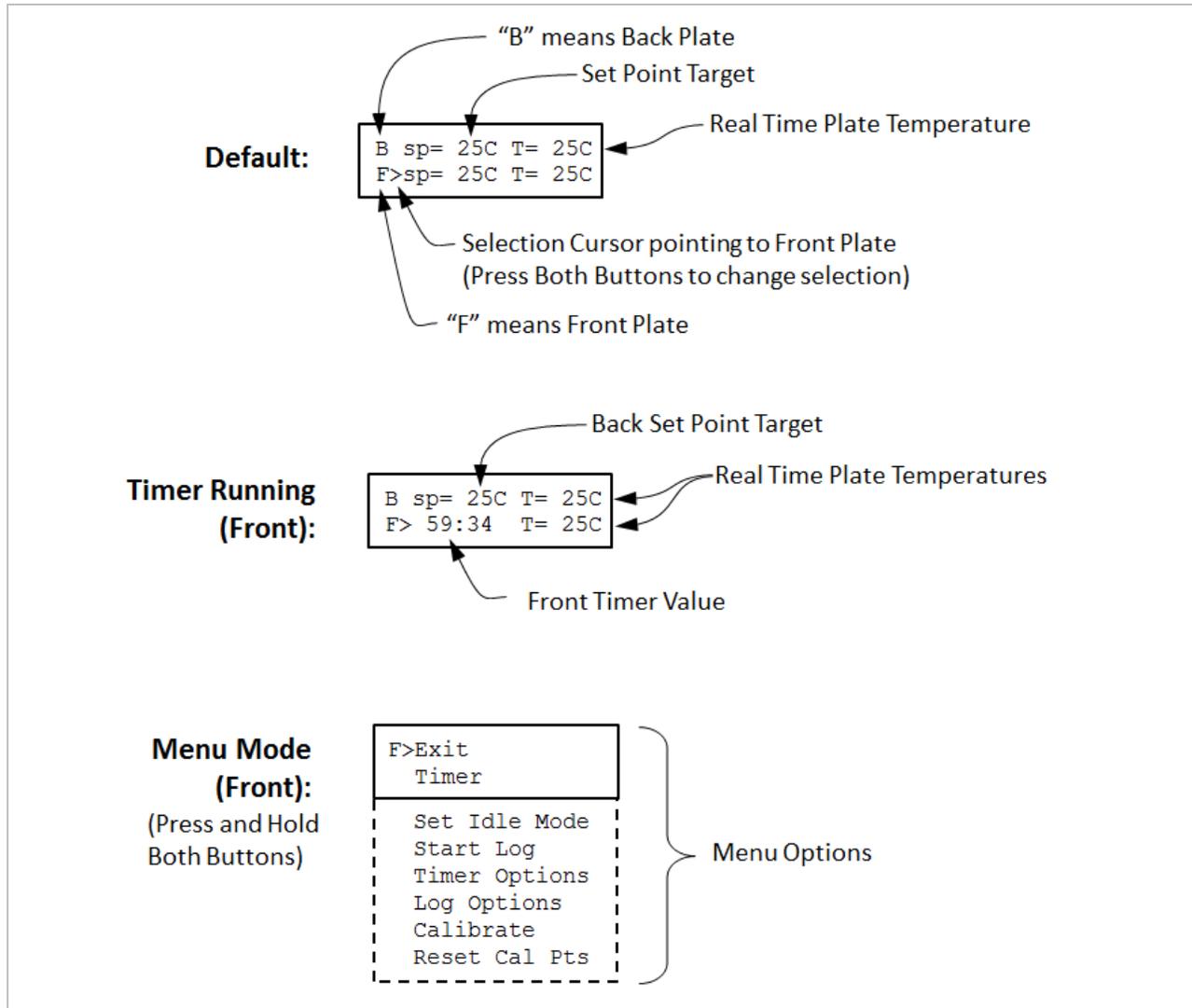


Figure 1: Display Screens for Different Modes of Operation

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 IC22/IC22XT is accomplished via single and double key presses as well as press-and-hold double key presses.

Single key presses are accomplished by briefly pressing and releasing an UP ARROW or a 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 main IC22/IC22XT LCD 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. For example, in the main IC22/IC22XT LCD display, briefly pressing and releasing both arrows will toggle between control of the front or back plates. When the arrow cursor is after the "F" on the bottom line of the display("F>"), single key presses will increase or decrease the set point of front plate. Likewise, performing a double key press that results in the cursor moving to after the "B" on the top line of the display("B>"), single key presses will then increase or decrease the set point of back plate.

A press-and-hold double key press is described as simultaneously pressing and continuing to press both UP and DOWN ARROW keys for approximately 3 seconds. For example, in

the main IC22/IC22XT LCD display with the cursor referencing the front plate (“F>”), pressing-and-holding both arrows will bring up the Menu of front plate features on the LCD display. Likewise, with the cursor referencing the back plate (“B>”), pressing-and-holding both arrows will bring up the Menu of back plate features 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 IC22 and 100 watts for the IC22XT. 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 the IC22/IC22XT. Note that the IC22XT has twice the power as the IC22 and will move samples blocks faster and farther away from room temperature than the IC22.

SETTING TEMPERATURE

As described in the "KEYBOARD" section of this manual, use double key presses to pick the front or back plate. To set a temperature for the front or back plate, simply press the UP or DOWN ARROW until the set point (sp=) shows the desired temperature. See Figure 2 for details. The unit will now control the temperature of the plate to that temperature. Note that the actual plate temperature will be shown in the display as "T=". 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 for the front plate is out of range, the unit will display "T=cal1" for the front plate temperature. 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.

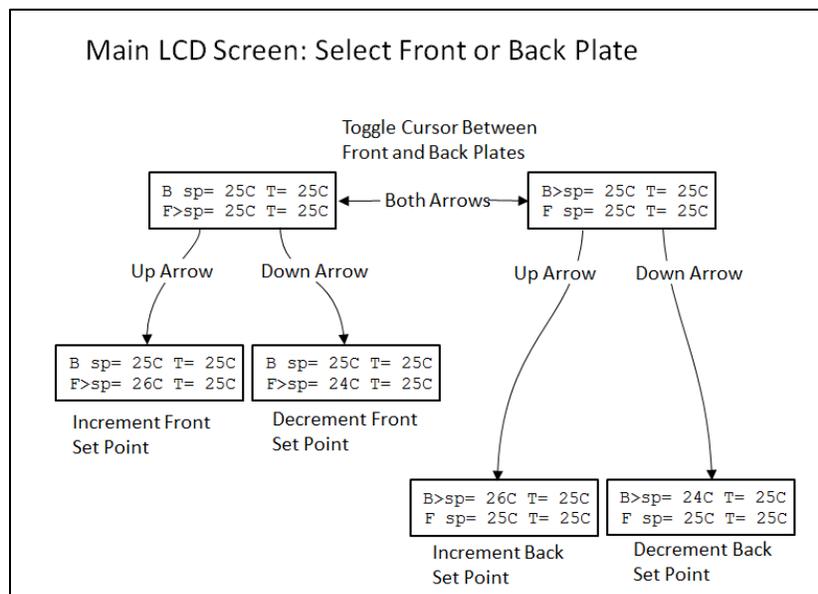


Figure 2: How to Select Front or Back Plate then Change Set Point

SETTING TIMERS

The timer is a countdown timer that reads in hours, minutes, and seconds continuously. A separate timer may be set for the front and back plates by entering the menu when the cursor is referencing the front or back plate on the display. Timers 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 audible alarm feature can be disabled in the “Timer Options” section in the menu (see Figure 5).

The timer is set by accessing the Timer option in the Menu. See Figure 3 for details on setting and starting the Timer. Figure 4 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 Figure 5 for details on Timer Options and the Idle Mode section of this manual for more details.

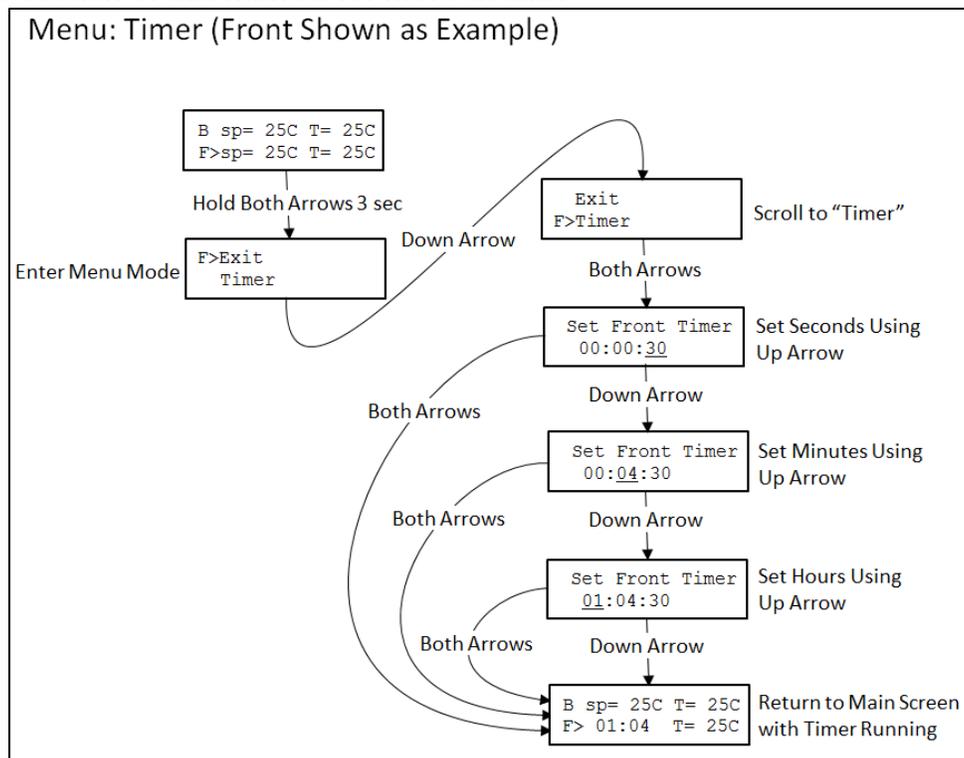


Figure 3: Menu Map to Set and Start the Timer for the Front Plate

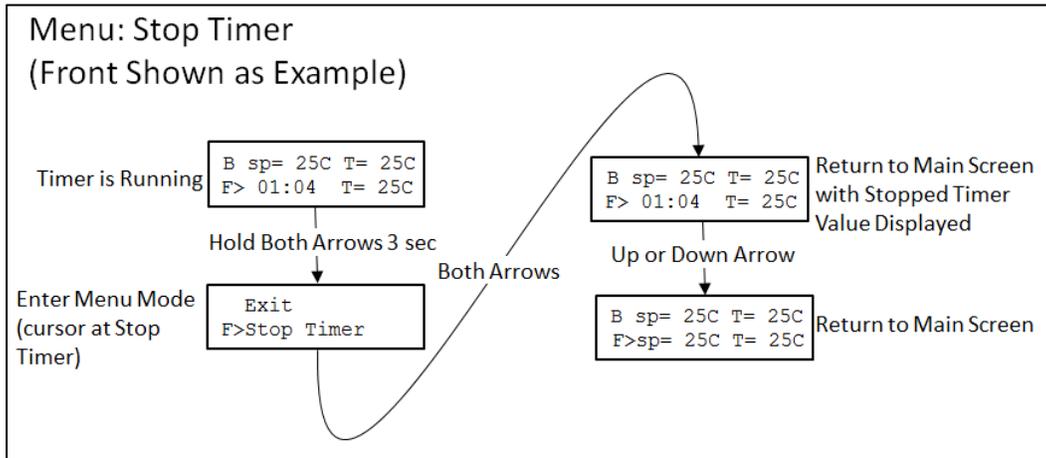


Figure 4: Menu Map to Stop the Running Timer

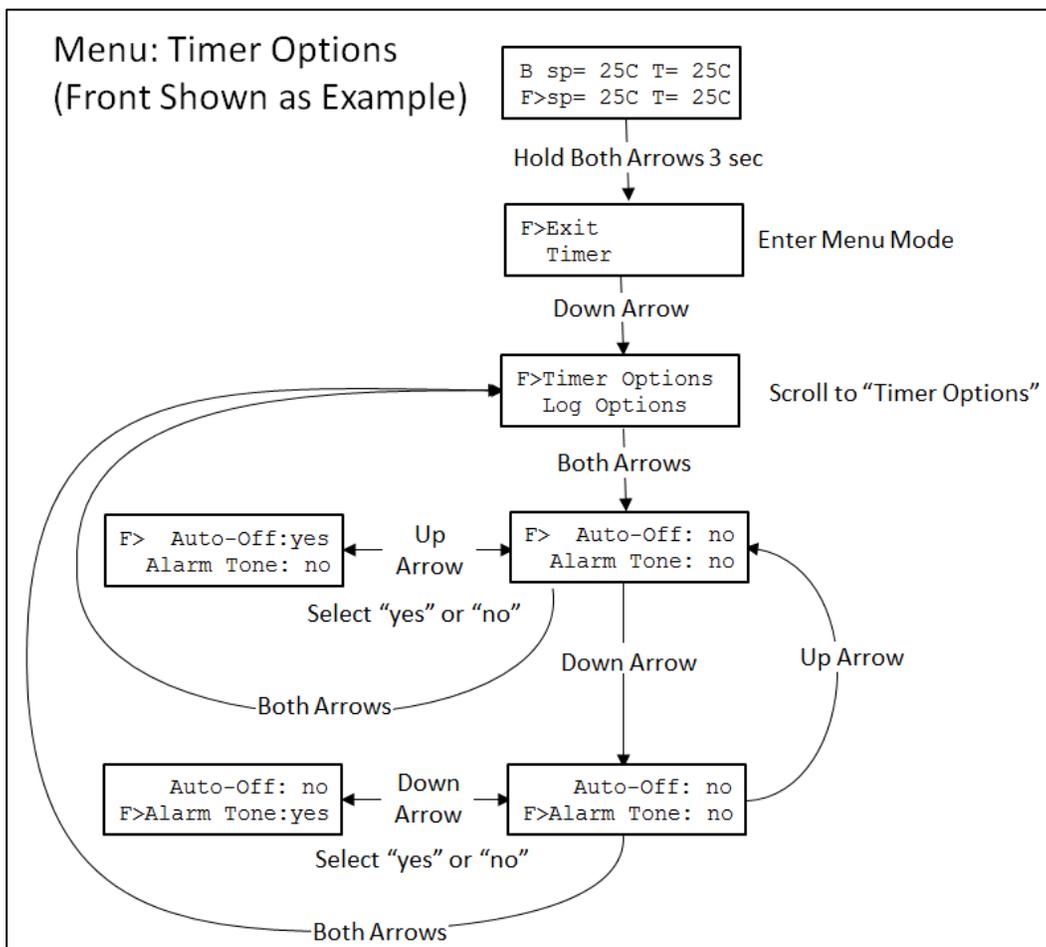


Figure 5: Menu Map to Select Timer Options

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 depending on the method used (See below). See Figure 6 and Figure 7 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 IC22/IC22XT will enter Idle mode when the countdown timer reaches 00:00:00 at the end of a timer period.

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

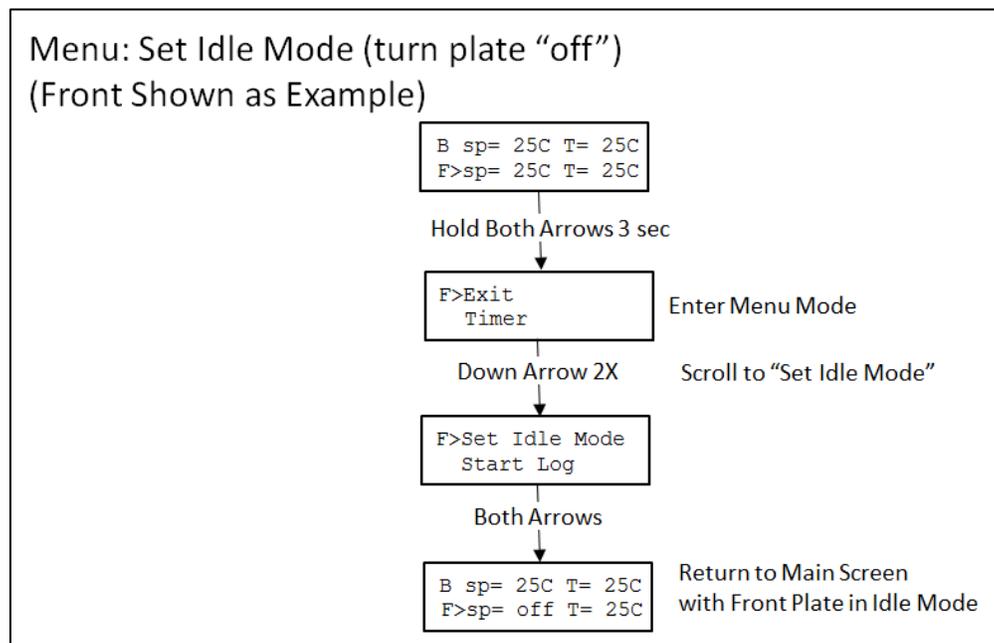


Figure 6: Menu Map to Set Idle Mode using the Menu

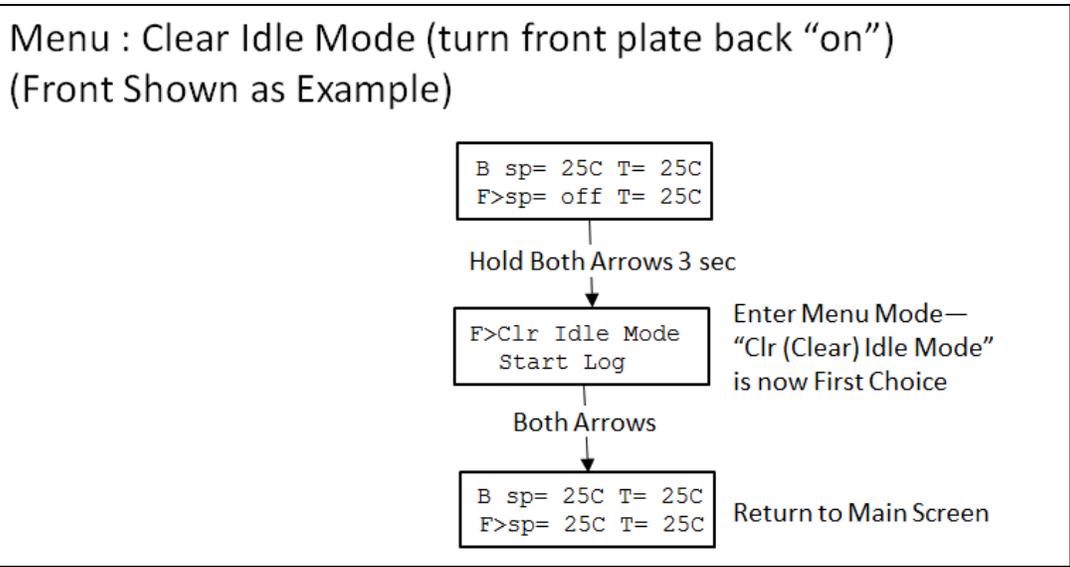


Figure 7: Menu Map to Clear Idle Mode using the Menu Using the Menu

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. Front, Back or both plate temperatures may be logged by starting and stopping log sessions per the plate selection cursor on the display. The data buffer can then be downloaded via the RS232 I/O port (ref XIII. RS232 INTERFACE). Figures 8, 9, and 10 show the steps to set the log period and how to start and stop a logging session.

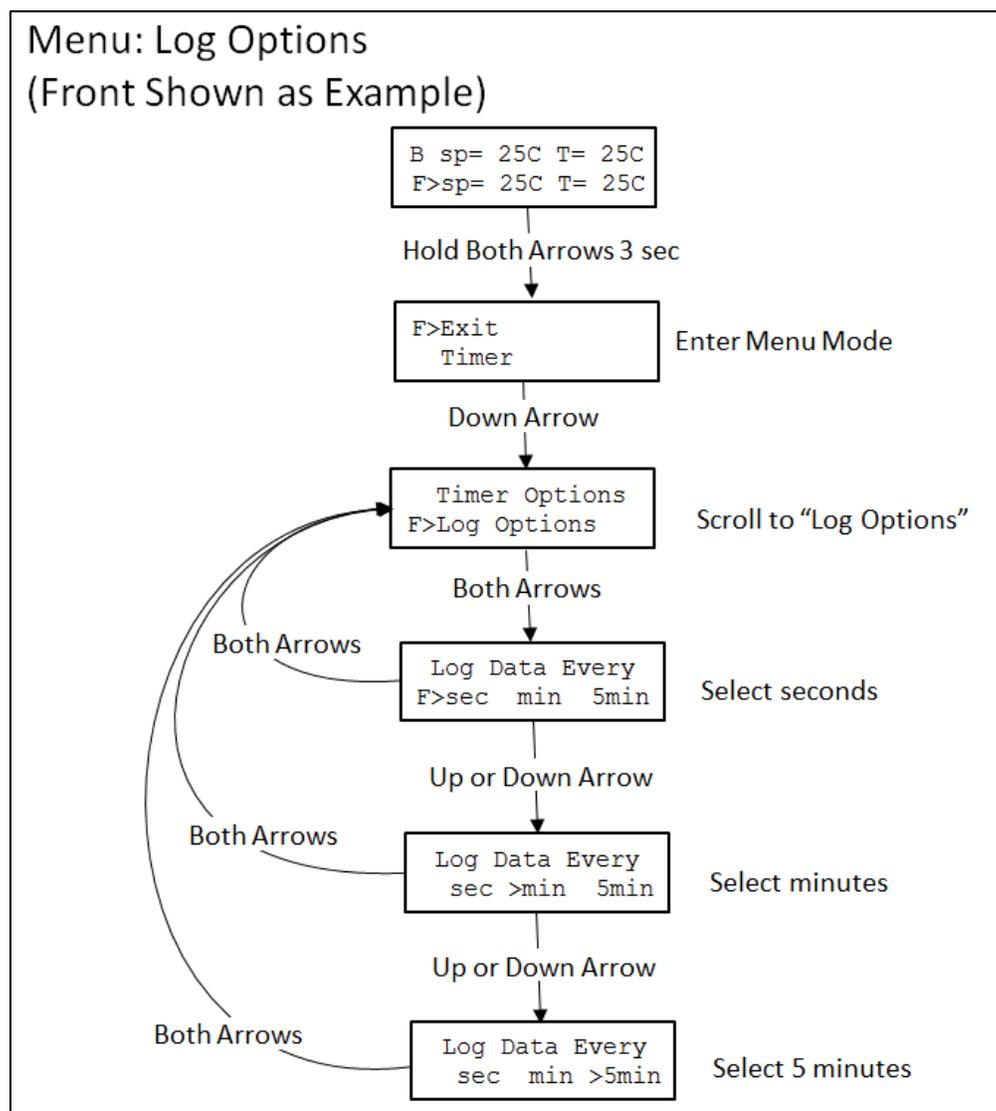


Figure 8: Menu Map to Set Log Period

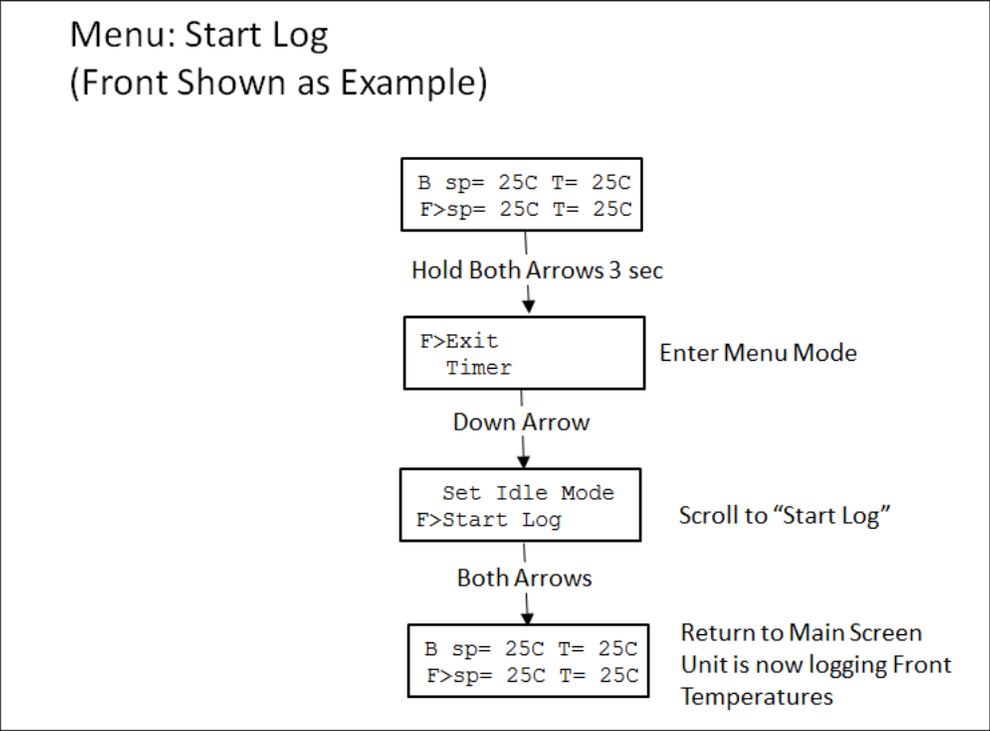


Figure 9: Menu Map to Start Logging Session

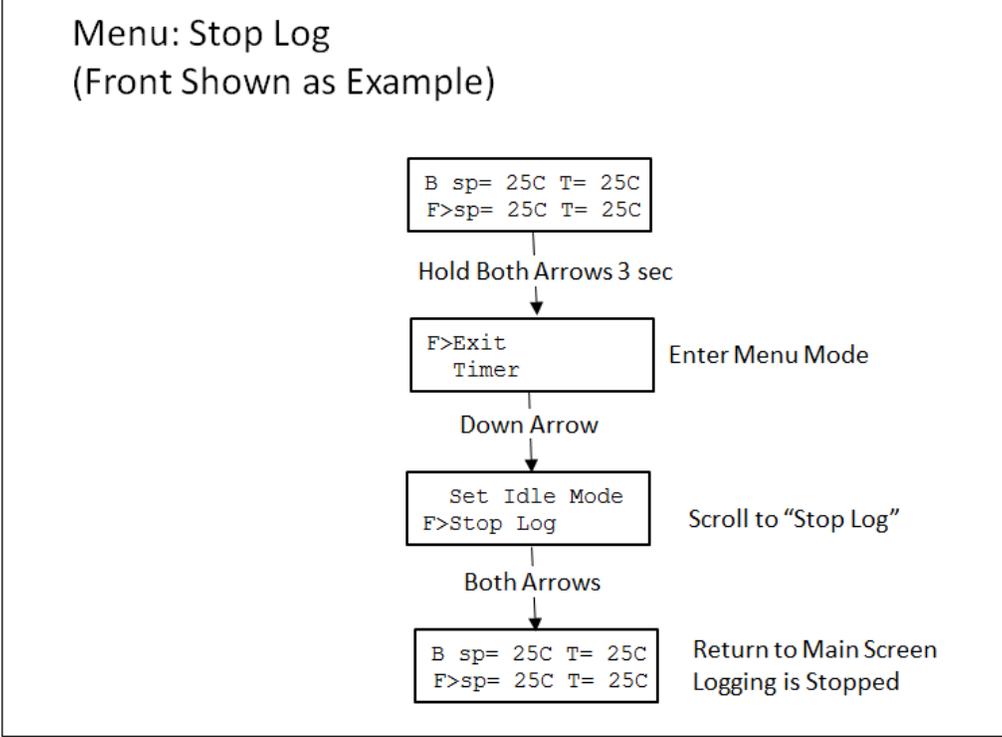


Figure 10: Menu Map to Stop Logging Session

XI. TEMPERATURE CALIBRATION

In the factory, a NIST traceable calibration is performed on all IC22* 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 surfaces on the IC22 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 IC22 enables the user to re-calibrate the unit at the center of the plates 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 IC22

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.

**IC22” in the above text applies to models IC22 and IC22XT

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 11. To replace calibration values with those obtained at the factory prior to shipment, follow steps shown in Figure 12.

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.

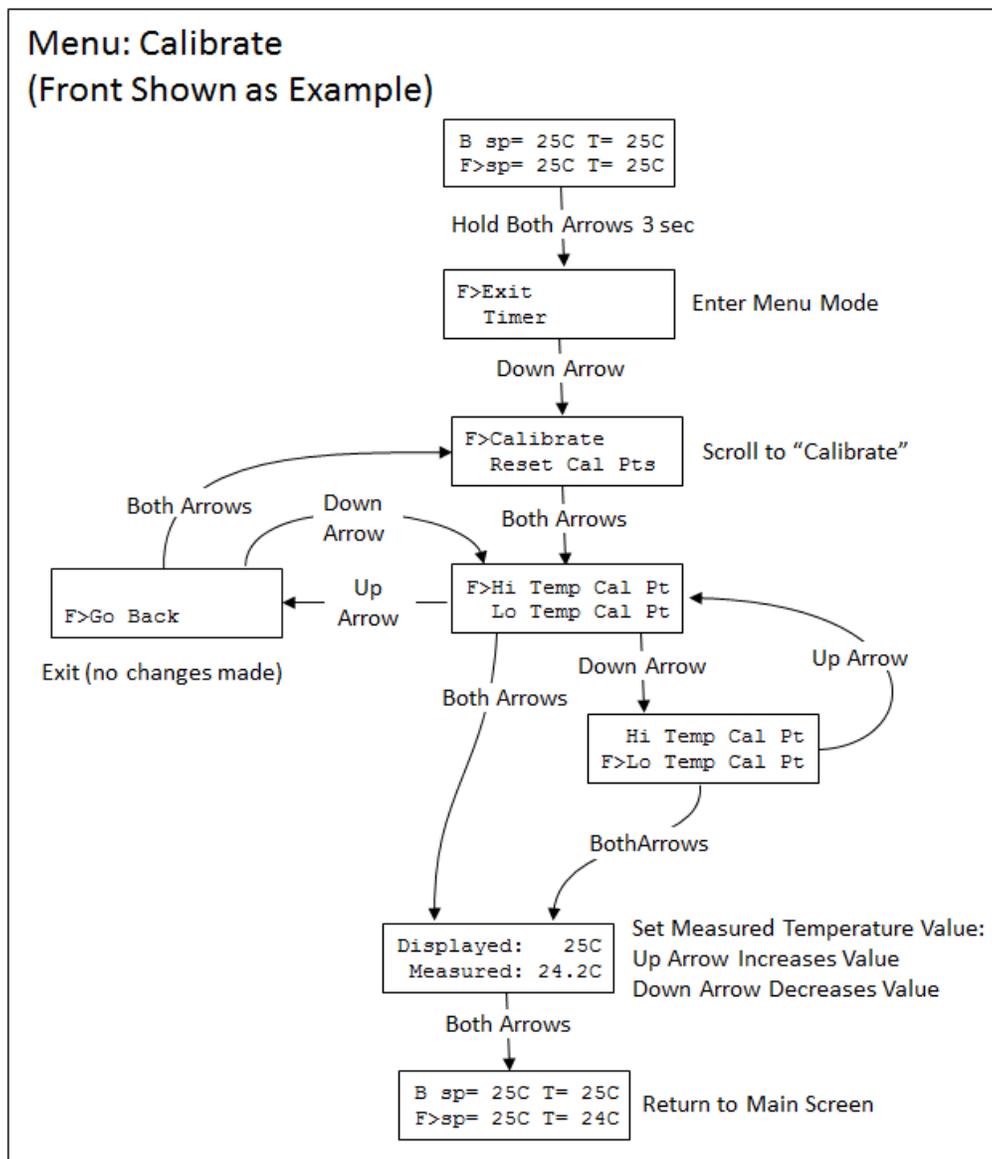


Figure 11: Menu Map to Calibrate the Front Plate Temperatures

MENU: Reset Cal Points

Figure 12 shows the keystrokes to reset the calibration points. Select “Reset Cal Pts” and the unit will retrieve the calibration values obtained when the unit was calibrated at the factory prior to shipment.

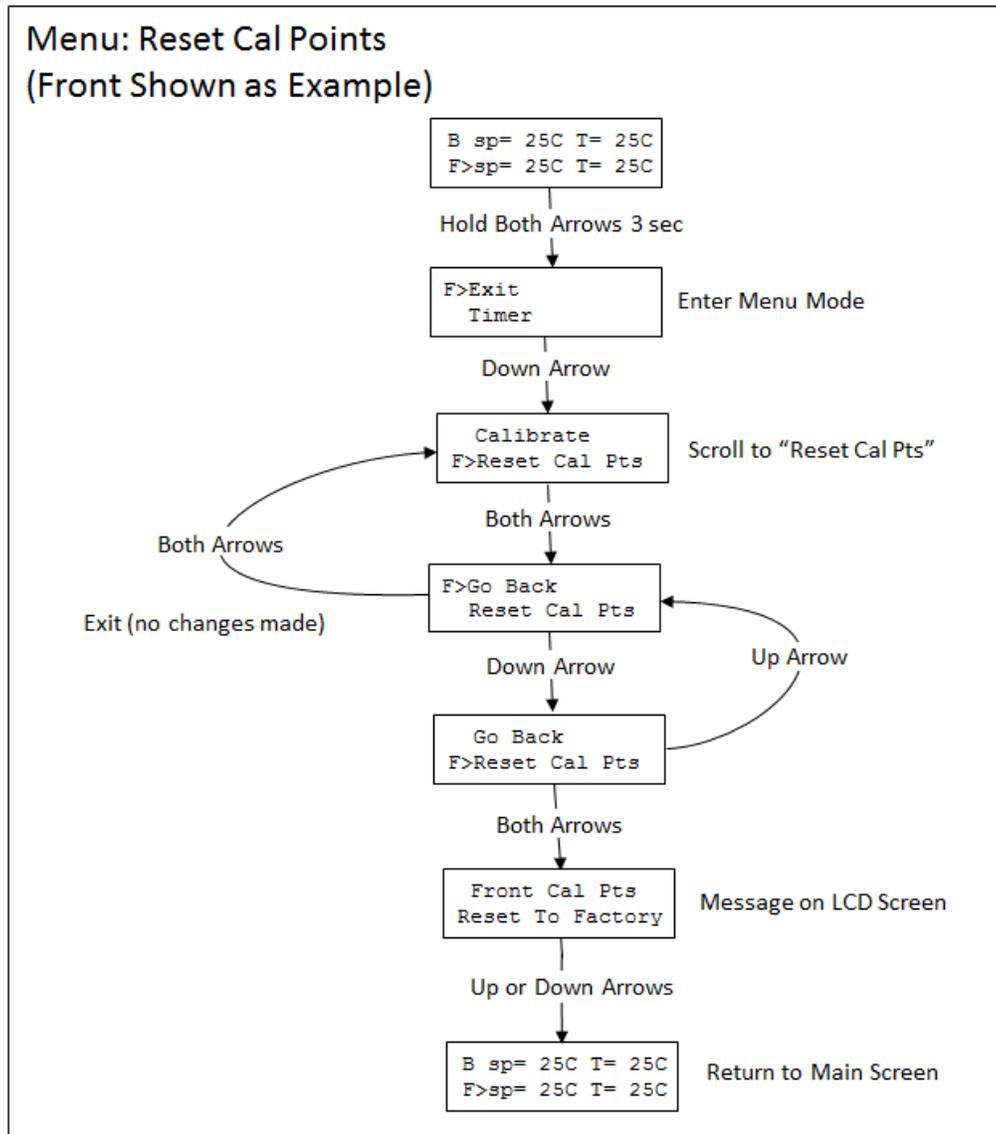


Figure 12: Menu Map to Reset Cal Points to Factory

XII. 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 11). 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 Figure12)
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

XIII. 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 IC22/IC22XT unit.

Refer to Appendix A 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 13 below. Additionally, a DB9 to USB dongle may be used if the PC does not have a DB9 serial COM connector.

Cable Pinout

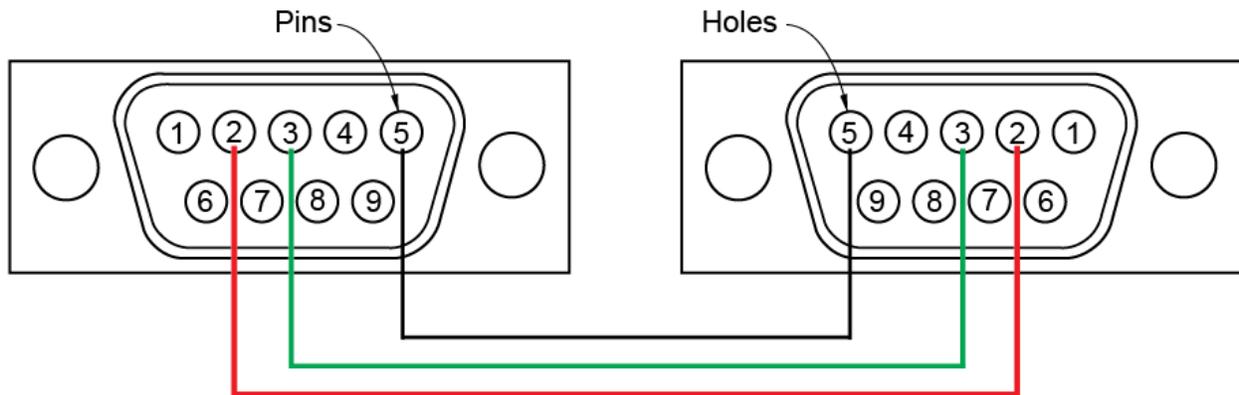


Figure 13: RS232 DB9 “Straight Through” Cable Pinout (Pins 2,3,5 only)

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.

XIV. 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

XV. 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: Commands Using the Serial Port

As described in Section XIII. (“RS232 SERIAL COM INTERFACE”) communication between the IC22/IC22XT 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 IC22/IC22XT 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 IC22/IC22XT 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 IC22/IC22XT will be terminated with this character. Actually, every string that is returned from the IC22/IC22XT 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 IC22/IC22XT Model and Version**

Description: When the command v<CR> is received by the IC22/IC22XT 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: IC22 v5.2 <CR><LF>

Command: **V**

Function: **Return Serial Number**

Description: When the command V<CR> is received by the IC22/IC22XT unit, the 8 character serial number will be returned in a text string terminated by <CR><LF>. The serial number for every IC22/IC22XT 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** (for FRONT plate, **S** for BACK plate)

Function: **Return Set Point Temperature**

Description: When the command s<CR> is received by the IC22/IC22XT 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 IC22/IC22XT 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 for the front plate:

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** (for FRONT plate, **N** for BACK plate)

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

Description: When the command n(new_temperature)<CR> is received by the IC22/IC22XT 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 IC22/IC22XT 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 (for FRONT plate, I for BACK plate)

Function: Set Plate to Idle Mode

Description: When the command i<CR> is received by the IC22/IC22XT 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 j (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: j (for FRONT plate, J for BACK plate)

Function: Clear Idle Mode

Description: When the command j<CR> is received by the IC22/IC22XT unit, Idle Mode will cease and the unit will return to the previous set point. If the command is not received in the proper syntax, e<CR><LF> will be returned.

Example – Clear Idle Mode:

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

Command: p (for FRONT plate, P for BACK plate)

Function: Return the current Plate Temperature

Description: When the command p<CR> is received by the IC22/IC22XT 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>

Logging Commands

Command: **I (for FRONT plate, L for BACK plate)**

Function: **Return the Current Log File**

Description: When the command I<CR> is received by the IC22/IC22XT 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: I<CR>

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

Command: **Ic (for FRONT plate, Lc for BACK plate)**

Function: **Clear the Log File**

Description: When the command Ic<CR> is received by the IC22/IC22XT 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: Ic<CR>

returned: ok <CR><LF>

Command: **Is (for FRONT plate, Ls for BACK plate)**

Function: **Start Logging**

Description: When the command Is<CR> is received by the IC22/IC22XT unit, the unit will begin to log plate temperature values at the rate defined by the log period setting (ref Ie, Im, or I5 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: Is<CR>

returned: ok <CR><LF>

Command: **Ip (for FRONT plate, Lp for BACK plate)**

Function: **Stop or Pause Logging**

Description: When the command Ip<CR> is received by the IC22/IC22XT unit, the unit will stop logging log plate temperature values. If the command Is 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: Ip<CR>

returned: ok <CR><LF>

Command: **Ie (for FRONT plate, Le for BACK plate)**

Function: **Set Logging Period to 1 second**

Description: When the command Ie<CR> is received by the IC22/IC22XT 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: Im (for FRONT plate, Lm for BACK plate)

Function: **Set Logging Period to 1 minute**

Description: When the command Im<CR> is received by the IC22/IC22XT 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: le<CR>
returned: ok <CR><LF>

Command: I5 (for FRONT plate, L5 for BACK plate)

Function: **Set Logging Period to 5 minutes**

Description: When the command I5<CR> is received by the IC22/IC22XT 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 IC22/IC22XT unit, the unit will return 4 values separated by commas and terminated by <CRLF>.

The values and order are:

Calibration_Temp_Lo_FRONT, Calibration_Temp_Lo_BACK, Measured_Temp_Lo_FRONT,
Measured_Temp_Lo_BACK, Calibration_Temp_Hi_FRONT, Calibration_Temp_Hi_BACK,
Measured_Temp_Hi_FRONT, Measured_Temp_Hi_BACK <CRLF>

Where:

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: 37,37,36.4, 36.2, 70,70, 71.1, 69.8<CR><LF>

Command: #F

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

Description: When the command #F<CR> is received by the IC22/IC22XT unit, the unit will reset and store all calibration values for both plates 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 IC22/IC22XT 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

			Example	
	Command	Function	sent	returned
ID	v	return model and version	v <CR>	IC22 v5.2 <CR LF>
	V	return serial number	V <CR>	12345678 <CR LF>
Temperature	s S	return set point temperature FRONT return set point temperature BACK	s <CR>	-10.0 <CR LF> off <CR LF> if idle mode
	n(xxx) N(xxx)	set new set point temperature FRONT set new set point temperature BACK	n25 <CR>	ok <CR LF>
	i I	set idle mode FRONT set idle mode BACK	i <CR>	ok <CR LF>
	j J	clear idle mode FRONT clear idle mode BACK	j <CR>	ok <CR LF>
	p P	return plate temperature FRONT return plate temperature BACK	p <CR>	-10.0 <CR LF> or error_code<CR LF>
	Logging	I L	return log file FRONT return log file BACK	I <CR>
lc Lc		clear log file FRONT clear log file BACK	lc<CR>	ok <CR LF>
ls Ls		start logging FRONT start logging BACK	ls <CR>	ok <CR LF>
lp Lp		stop logging FRONT stop logging BACK	lp<CR>	ok <CR LF>
le Le		set log period to 1 second FRONT set log period to 1 second BACK	le <CR>	ok <CR LF>
lm Lm		set log period to 1 minute FRONT set log period to 1 minute BACK	lm<CR>	ok <CR LF>
l5 L5		set log period to 5 minutes FRONT set log period to 5 minutes BACK	l5 <CR>	ok <CR LF>
b B		return current log period FRONT return current log period BACK	b<CR>	s, m, or 5 <CR LF>
Utility	#m	return all calibration points	#m<CR>	See Detailed Description
	#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')