BARNSTEAD|THERMOLYNE CORPORATION

DATAPLATE®
Digital Hot Plate/Stirrer

OPERATING MANUAL

SERIES 730

Table of Contents

Introduction

Congratulations on your purchase of a Digital Hot Plate/Stirrer.

Introduction

The unit is designed to do a number of jobs within your laboratory. Please read the instructions carefully to insure that you receive the maximum benefit from it. Also, be sure to fill out and return the enclosed warranty registration card. We would like to receive the information requested, and it will help us assure you of proper warranty coverage.

Important Information

This manual contains important operating and safety information. You must carefully read and understand the contents of this manual prior to using this equipment.

Safety Information

Your Dataplate Digital Hot Plate/Stirrer has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert boxes throughout the manual.

Warnings

Please note the following WARNINGS:

WARNING

THIS PRODUCT CONTAINS REFRACTORY CERAMIC, REFRACTORY CERAMIC FIBER OR FIBERGLASS (GLASS WOOL) INSULATION WHICH CAN PRODUCE RESPIRABLE FIBERS AND DUST WHEN HANDLED. THESE FIBERS OR DUSTS CAN CAUSE IRRITATION AND CAN AGGRAVATE PRE-EXISTING RESPIRATORY DISEASE. REFRACTORY CERAMIC INSULATIONS MAY CONTAIN OR MAY FORM CRYSTALLINE SILICA (CRYSTOBALITE) WHICH MAY CAUSE LUNG DAMAGE (SILICOSIS).

THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC) HAS CLASSIFIED REFRACTORY CERAMIC FIBER AND FIBERGLASS AS (2B) POSSIBLY CARCINOGENIC. IARC HAS CLASSIFIED CRYSTALLINE SILICA AS (2A) PROBABLY CARCINOGENIC.

The insulating materials are located in the door, the hearth collar, in the chamber of the product or the top plate assembly. Tests performed by the manufacturer indicate that there is no significant risk of exposure to dust or respirable fibers resulting from operation of this equipment under normal conditions. However, there may be a risk of exposure to respirable dusts or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing the materials in a manner which causes release of dust or fibers therefrom. Through the use of proper handling procedures you can work safely with these insulating materials and minimize any exposure. Accordingly, before you repair or replace any insulating materials, or perform any other servicing on this product which could disturb or cause exposure to dust from insulating materials, you should consult the appropriate Material Safety Data Sheets (MSDS's) for such products with respect to proper handling and appropriate protective equipment. For additional MSDS's, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department of **Barnstead|Thermolyne Corporation.**

WARNING

REFER SERVICING TO QUALIFIED PERSONNEL.

1-800-553-0039

Cautions

Heater Plate Surface

DATAPLATE Hot Plate/Stirrer Series 730 is capable of temperatures in excess of 370°C, ± tolerance, at the plate surface. Touching the heated surface will cause severe burns. USE EXTREME CAUTION AT ALL TIMES. Never leave your DATAPLATE Hot Plate/Stirrer accessible to others while it is hot. Although the unit is equipped with a "Hot Warning" indicator on the front panel, do not rely on this alone. Never touch the heating surface unless you are absolutely sure that it is cool.

Temperature Probe

When attempting to control PROBE TEMPERATURE, it is necessary to plug in a temperature probe and to place it in the sample AT ALL TIMES. If the probe is not placed into the sample, the unit will not be able to sense the rising temperature of the sample as heat is applied. This will result in driving the heater to its maximum and could result in ruining the sample.

Caution

Touching the heated surface will cause severe burns. USE EXTREME CAUTION AT ALL TIMES.

The optional temperature probe is made of 316 stainless steel and can be attacked by some chemicals. Coating the probe with Teflon spray or Teflon tubing may help. However, this coating may slow the probe response time and result in temperature errors until it equilibrates. Also available is our borosilicate glass temperature probe #710-0203 for use with very aggressive chemicals.

Electrical

The DATAPLATE Hot Plate/Stirrer 730 Series is made in models that operate at 100, 120 and 240 volts AC. Be certain that your voltage matches the unit that you receive. Check the plate on the bottom for the voltage setting on your unit. Take the normal care and precaution one would use with any electrical appliance. Be very careful to keep the AC line cord away from the hot plate.

General Description

The DATAPLATE Hot Plate/Stirrer Series 730 is a programmable, general purpose, digital laboratory hot plate with stirrer. The series includes the Model 731 single position stirrer the Model 735, 5-position stirrer and the Model 739, 9-position stirrer. All functions on the Series 730 are settable from a digital front panel keyboard and display. Both the plate temperature and the stirrer speed are controllable to an accuracy never before offered in similar devices.

The Series 730 contains a program memory of 75 steps. The user may enter a sequence or temperature, stir speeds and time delays which may then run by pressing a single button. The program memory is battery-powered so the program remains in the unit indefinitely when it is turned off.

The 730 Series also has an infrared remote control sensor circuit. The optional Model 475 remote control keyboard can be used to operate the various models from distances of up to 15 feet. This typically is used in situations where the unit is kept under a fume hood or is otherwise inaccessible.

Heater

Either the plate surface temperature or the actual sample temperature may be set by the user. A sensor in the plate is used to monitor surface temperature or alternatively a temperature probe may be connected to the rear of the unit and inserted into the sample. An optional 100Ω 3-wire Platinum RTD temperature probe is available with a 6" stainless steel or glass jacket. When a temperature is set by the user, power is applied to the heater to precisely control the temperature at the plate surface or at the sample, as directed.

An optional "ramp value" may be entered into the unit which causes the temperature to approach the target value at a controlled rate of temperature change. The unit may also be programmed to follow any temperature vs time profile which the user desires so long as the program does not exceed 75 steps. Temperature may be displayed in either °C or °F as set by a rear panel switch.

Stirrer

The stirrer is a motor-driven magnet which, in the model 731, revolves directly under the center of the heater plate. The Model 731 has five motors with one placed in the center and one at each corner of the plate. The Model 739 has nine stirrer motors placed in three rows of three each. It is common practice, when heating solutions, to spin a "stir bar" (Teflon-coated bar magnet) which is placed in the solution. This assures a more uniform temperature throughout the solution.

The stirrer speed is set from the front panel keyboard and may be one of the variables in programmed operation.

Timer

All Series 730 units have built-in timers. The timer counts down in hours, minutes and seconds, sounding an alarm when it reaches zero. The timer may be used independently of the heater and stirrer or may be used in conjunction with the "Auto Off" function to shut off both the heater and stirrer after a preset length of time.

Other Instruments

Barnstead|Thermolyne manufactures a full line of DATAPLATE Hot Plate/Stirrers and accessories. Some of the other products in this line are described below.

Series 720 Digital Hot Plate/ Stirrer

The Series 720, available in 1,5, and 9 position stirrer models, is a general purpose, digital laboratory hot plate/stirrer. The 720 Series has all of the features of the 730 Series with the exception of the programmed operation and the remote infrared sensor.

Model 740 Multi-Controller

Both Series 720 and 730 DATAPLATE Hot Plate/ Stirrers may be operated as remote stations to the Model 740 DATAPLATE Multi-Controller. The Multi-Controller connects to the units through a small cable, and is capable of controlling up to 8 units at a time. The Multi-Controller provides a

number of enhancements, including 0.1 degree temperature resolution, larger program memory, real-time clock and printer interface.

When connected to the Multi-Controller, front panel controls on both Series 720 and 730 Hot Plate/Stirrers remain operational. Also available for use with the Model 740 Multi-Controller is the Series 710 Hot Plate/ Stirrer which is the same unit as the Series 720 but has no front panel controls. It is designed to be operated remotely from the Model 740 Multi-controller.

Non-Programmed Operation

Front And Rear Panels

Front Panel

The front panel of the DATAPLATE 730 Series has a digital keyboard display for monitoring and controlling hot plate functions. The ON/Off switch is located on the right side of the front panel. When the unit is on, the display located on the left side of the unit will be lighted.

The display is a four-digit vacuum fluorescent type with a colon between the middle two digits. It is used to display the temperature, stirrer speed and timer value. The keyboard has 12 pushbutton keys and is used both for selecting the display function and for entering numerical values for the temperature, stirrer speed and timer.

A number of LED indicator lamps also are located on the front panel. These will be explained in a later section.

Note

Keyboard labels which refer only to programmed operation have been omitted from the illustration for clarity.
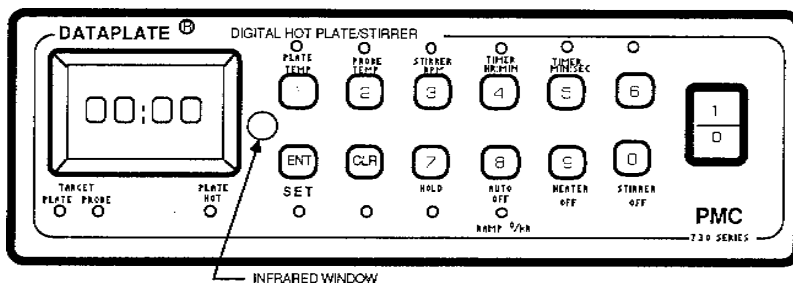
Front Panel

A thin plastic membrane which fits over the front panel is supplied with the unit to protect it from dust, dirt and possible chemical spills. The keyboard may be operated with the membrane in place. Replacement membranes are available.
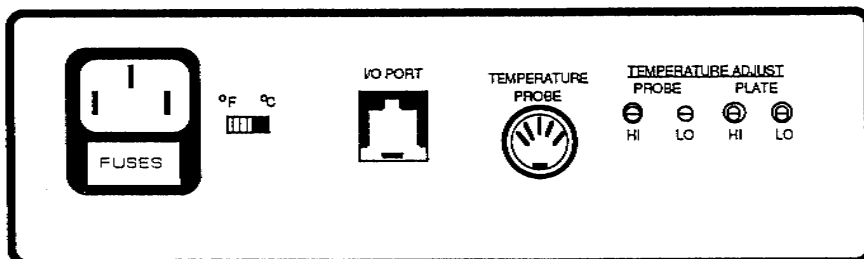
Rear Panel

The AC power connector jack and fuse holder combination is located on the left side of the rear panel. The °C/°F display switch is to its right, followed by the I/O port, the remote temperature sensor jack and the four temperature calibration pots on the right side of the panel.

The AC power jack is a three-prong, international-style jack combined with a dual, snap-in fuse holder. The type of fuse used in the unit is shown on the rear panel. Both neutral and high lines are fused.

The °C/°F display is controlled by the position of the slide switch to the right of the power jack. The front panel display will reflect the temperature units by displaying a °C or °F after the temperature readout.

Caution

If the fuse blows repeatedly, contact the distributor.

Rear Panel

The I/O port will, when used with the proper cable, allow for remote control of the unit by the Model 740 multicontroller.

The remote temperature sensor input is a DIN jack which is used with a three-wire, Platinum RTD temperature probe. The probe pinout arrangement is as follows:

Pin 1 - Positive
Pin 2, 3 - Negative

The two calibration potentiometers on the left are for calibrating the remote temperature sensor, the two on the right are for calibrating the hot plate temperature readout.

Operating Instructions

The DATAPLATE Digital Hot Plate/Stirrer is simple to use. Once you've learned, you won't want to twist a dial or knob on another hot plate/stirrer again.

Set-Up

1) Place the unit on a level, dry bench or surface.

2) Plug the unit into a properly grounded, three wire outlet of proper voltage.

3) Plug the temperature probe (if used) into the jack on the rear of the unit.

4) Place the sample on the heater plate and put the temperature probe and stir bar into the sample. Be sure the vessel is centered and that the stir bar is centered in the vessel. Also be sure that the temperature probe will not obstruct the rotation of the stir bar.

Try to match the stir bar to the sample and container size to optimize mixing. Generally, larger stir bars are needed to mix more viscous samples. However, two-inch long bars match the magnet in the stirrer best.

5) Turn the unit ON by the rocker switch on the front panel. Note that the unit will beep once and will be in the PLATE TEMPERATURE mode. At this point you can change the display modes by touching PLATE TEMP, PROBE TEMP, STIRRER RPM, TIMER HR:MIN, or TIMER MIN:SEC. Note that the display indications will change as you touch the different keys.

6) Set the target temperature, stirrer speed, timer and ramp rate according to the instructions that follow.

Display Functions

The display can be instructed to show any of five different functions. The function currently being displayed is indicated by a small LED lamp located above the corresponding display function key (top row of keys).

HEATER

PLATE
TEMP

1

Press this key to display the temperature of the heater plate surface. The display will be in °C or °F as selected by the rear panel C/F switch, and indicated by a "C" or "F" on the right portion of the display. If a target plate temperature has been set into the unit, the display will toggle at brief intervals to display the target temperature. The PLATE TARGET lamp will turn on during the time the target temperature is shown. The red PLATE HOT lamp located to the right and below the display, will blink if the plate temperature is above 50 °C (122 °F) as a safety reminder.

PROBE
TEMP

2

Press this key to display the temperature measured by the probe. The display will be in °C or °F as selected by the rear panel C/F switch and indicated as above. If a target probe temperature has been set, the display will toggle at brief intervals to display the target temperature. The PROBE TARGET lamp will turn on during the time that the target temperature is shown. If the probe is unplugged the display will show all dashes (- - - -). The same display will also appear if the temperature is out of range (0 - 400°C).

STIRRER SPEED

STIRRER
RPM

3

Press this key to display the speed of the stirrer. The speed is shown to the nearest ten RPM. On multi-position stirrer models the speed is taken from the center stirrer position.

TIMER
HR:MIN

4

TIMER

Press this key to display the hours and minutes left on the timer.

TIMER
MIN:SEC

5

Press this key to display the minutes and seconds left on the timer.

Setting Temperature, Ramp Rate, Stirrer Speed and Timer

The heater, stirrer and timer all may be set through the use of the SET/ENTER key. The settable functions are listed below, followed by an explanation of how values are entered for those functions.
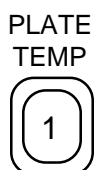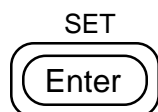
Heater

The heater may be set to control either the plate surface or the sample itself. This is done by entering a "target" temperature from the front panel keyboard. The control electronics in the hot plate will automatically apply power to the heater plate to reach the desired target temperature.

The user may enter either a target plate temperature or a target probe temperature. Only one target temperature is allowed at a time. Setting a target plate temperature erases any target probe temperature that may have been set previously and vice versa.

Target temperatures may be set anywhere in the range of 0 to 370°C (32 to 698°F).

To set a target plate temperature, press the SET key followed by the PLATE TEMP key; enter the temperature value desired and press the ENTER key. The target temperature is entered in °C or °F depending on the current mode as set by the C/F switch on the rear panel. Setting a target temperature enables the heater plate. This means that the heater plate will turn on as

SET

Enter

PLATE
TEMP

1
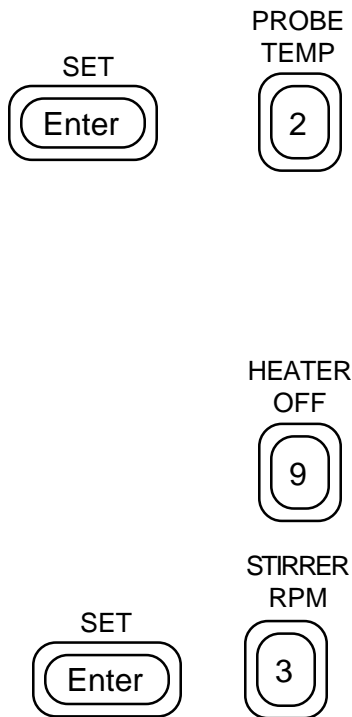
necessary to heat the plate surface to the target temperature. If the target is below the actual plate temperature, the heater plate will not turn on until the plate cools to near the target temperature.

SET PROBE TEMP

(Enter) (2)

To set a target probe temperature, press the SET key followed by the PROBE TEMP key; enter the temperature value desired and press the ENTER key. The target temperature is entered in °C or °F depending on the current mode as above. Setting the target temperature enables the heater plate. The heater plate will turn on as necessary to heat the sample until the sample probe reaches the target temperature. If the probe is unplugged, heating power will be disabled until the probe is plugged into the rear connector.

HEATER OFF

(9)

To disable the heater plate and erase the plate or probe target temperature, press the HEATER OFF key.

STIRRER RPM

SET

(Enter) (3)

Stirrer

The stirrer speed is set in a similar manner to the target temperature above except that the STIRRER RPM key is pressed after the SET key. The target stirrer speed is rounded internally

Caution

Be sure the temperature probe is in the sample solution and plugged into the rear panel when heating. Failure to do so could damage your sample because the hot plate will drive to maximum seeking a temperature it cannot find.

Note

Aluminum top, 10" x 10"
Digital Hot Plate/Stirrers
operate from 100 to 800
RPM.

STIRRER
OFF

8

to a multiple of ten RPM. The stirrer may be set
to any speed within the range 0 to 1500 RPM.
However, the majority of the units are specified to
operate from 100 to 1200 RPM.

To turn off the stirrer, press the STIRRER OFF
key. This is the same as setting the stirrer speed
to zero.

Timer

The timer counts in hours, minutes, and seconds.
However, the user may only display or set the
hours and minutes or the minutes and seconds at
a given time. Setting the hours and minutes also
sets the seconds to zero. Setting the minutes and
seconds sets the hours to zero.

The timer may be set to any count up to 99:99,
however when the minutes or seconds roll over
they will be set to 59 as on a clock. For example,
80 seconds may be set into the timer either as
1:20 or as :80 minutes/ seconds. When the timer
reaches zero it will alarm with three, unique,
audible chirps.

SET
Enter
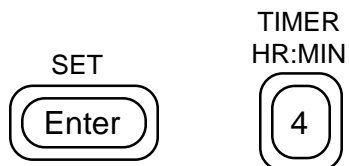
TIMER
HR:MIN
4

To set the timer in hours and minutes, press SET followed by TIMER HR:MIN. The seconds will be set to zero. Timing starts exactly when the ENTER key is pressed.

SET
Enter

TIMER
MIN: SEC
5

To set the timer in minutes and seconds, press SET followed by TIMER MIN:SEC key; enter the time value in minutes and seconds and press the ENTER key. The hours will be set to zero. Timing starts exactly when the ENTER key is pressed.

Ramp

The ramp setting controls the rate at which the temperature approaches the target temperature. The ramp values may be set within the range of 1 to 555°C/HR or 1 to 999°F/HR. The unit can ramp up or down depending on the target temperature. A target temperature above the sample temperature will make the unit ramp up at the specified rate. Likewise, a target temperature below the sample temperature will make the unit ramp down at the specified rate. The thermal characteristics of the sample and hot plate determine the maximum rate at which the temperature can ramp toward the target setting. If the ramp setting is higher than this rate it can not be attained.

SET   RAMP
        0/HR
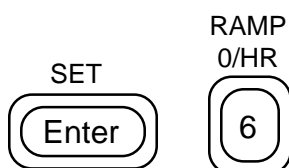
(Enter)   (6)

To set the temperature ramp, press the SET key followed by the RAMP $^{\circ}$/HR key; enter the ramp value desired and press the ENTER key. To turn off the ramping, set the ramp value to zero. This will allow the heater to reach the target temperature as rapidly as possible.

Entering Values

To set a value into the heater, stirrer, timer or ramp, first the SET function is selected, a numerical value is entered, and then the ENTER key is depressed.

SET   XXX

(Enter)   ( )
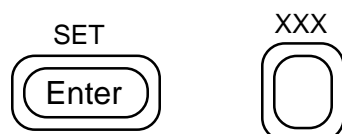
As described previously, the SET function is selected by pressing the SET key followed by the key of the function desired . When the SET key is pressed, the display shows all dashes with vertical doglegs (L L L L) . At this time only the six settable function keys and the CLEAR key are active. Pressing the CLEAR key will erase SET and return the unit to the function that was being displayed before SET was pressed. Pressing one of the function keys will cause the display to show all zeros. At this point, the keys become numeric and the value may be entered.

(0) – (9)

Key in the value you wish to set, one digit at a time, up to four digits. The digits enter the display from the right, calculator-style.

CLR

If you make a mistake, press the CLEAR key and the display will return to all zeros. If you wish to exit from the SET function without actually entering a value, press the CLEAR key again while the display shows all zeros.

Enter

Set

After keying in the desired value, press the ENTER key. The new value will be entered at this time and the function which was just set will be displayed. If the value entered is out of range, however, it will not be accepted, and will be held on the display until the CLEAR key is pressed. Once the value is accepted, the keys return to their normal functions and no longer represent numeric data.

Auto-Off And Hold Functions

When the auto-off function is enabled, a time-out of the timer automatically turns off the heater and the stirrer. This provides a convenient way to preset the length of time a sample is to be heated without the need for anyone to be present at the end of the period.

8

AUTO
OFF

To enable the auto-off function, press the AUTO-OFF key and the lamp under the key will turn on. To disable auto-off, press the key again and the lamp will go out.

Hold

When the HOLD function is enabled, the current settings of stirrer speed, target temperature and ramp are placed into battery backed-up memory. When the 730 loses power or is turned off, these settings will be held in memory so that the unit will return to them when power is restored. This feature is very useful in case of a power failure during unattended operation.

⌈7⌉

HOLD

To enable the HOLD function, press the HOLD key and the lamp under the key will turn on. To disable HOLD, press the key again and the lamp will go off.

Other Modes of Operations

To use the DATAPLATE as a temperature meter, bring the sample to the unit and place the temperature probe in the solution. Then touch PROBE TEMP and the temperature will be displayed.

Timer

To use your 04644 Digital Hot Plate/Stirrer as a laboratory timer, simply touch SET, TIMER HR:MIN (or TIMER MIN:SEC), the time desired, then ENTER. As soon as the ENTER key is touched the unit will start to count down. It will beep three times at zero.

Infrared Remote Control

The DATAPLATE 730 Series may be operated remotely via an infrared signal originating from the Model 745 remote controller unit. The Model 745 controller has the same functions as the Model 730 front panel. Infrared remote control is recommended for situations in which the Hot Plate/Stirrer unit is used under a closed fume hood or in a sealed chamber due to toxic conditions.

The 730 units may be operated at distances up to 15 feet from the control unit. The infrared beam will operate through glass windows. The intensity of the infrared signal decreases as the distance from the source increases. The strength of the signal will also decrease as the viewing angle of the receiver varies from straight on. These factors are important if one wishes to control more than one unit. It is recommended that the user experiment with the placement of the

controller module and the controlled units to find the optimum configuration for controlling multiple units.

Programs save you time on repetitive operations. They also free you to do other tasks while the Hot Plate/Stirrer is performing your program. Once a program is written and corrected for mistakes, it may be run time after time without error. The

Programmed Operation

The figure shown above is similar to that in Section VI except the key labels shown are those which refer to programmed operation only. The other labels have been excluded for the sake of clarity.

unit's program memory is backed by battery so the program will be retained indefinitely even during intervals when power is off. You can execute a program with just one keystroke. In the following sections you will find instructions on how to create and edit programs for unattended operation of the instruments in the 730 Series.

Editing A Program

During the creation of a program the display will show the programmed steps as they are entered. When a program is being edited, each step may
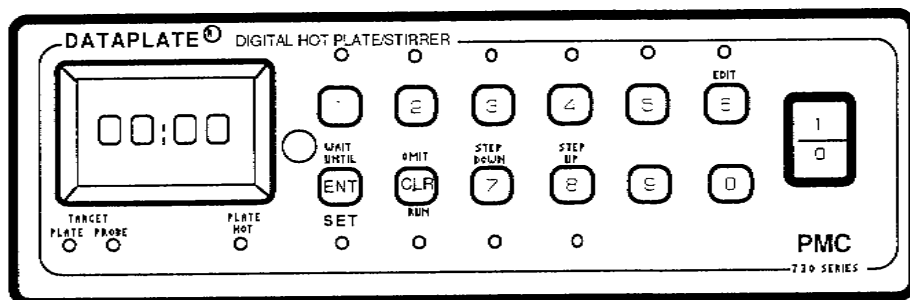
Front Panel

be displayed and edited as the program is viewed in forward or reverse sequence. The modified program may then be displayed prior to execution.

Press this key to enter or edit a program. When the EDIT key is pressed, the display will show two zeros to the left of a period. The zeros signify that you are at the beginning of a series of programmed steps. At this point you may create a program or edit one which already exists. When editing operation has been completed, press this key to exit the EDIT mode and return to normal operation.

EDIT

6

Press this key to view a program in forward sequence. Each time the STEP UP key is pressed the display will show the next step in the programmed sequence. When you have reached the last step in the program, pressing the key will have no effect.

STEP
UP

8

Press this key to view a program in reverse sequence. Each time the STEP DOWN key is pressed the display will go from a higher step to a lower step in the programmed sequence. Pressing this key will have no effect when you have reached step 00.

STEP
DOWN

7

The OMIT key has a dual function which depends on the mode in which the unit is operating. In the edit or programming mode, the OMIT function is operative. When this key is pressed, the

OMIT

CLR

Note

There are a maximum of 75 program steps allowable.

programmed step currently in the display will be erased. If step 00 is in the display, pressing this key will erase the entire program.

Placing a set of programmed steps into the memory of any of the models in the 730 Series of Hot Plate/Stirrer units is a simple task once the user is familiar with the functioning of the various programming keys.

There are four types of program steps. They are:

1. DISPLAY
Press a display key (PLATE TEMP, PROBE TEMP, STIRRER RPM, TIMER HR:MIN, or TIMER MIN:SEC) to enter a display step. When the program executes, this step will cause the display to indicate as instructed.

2. SET
Enter a target value as done normally. (EXAMPLE: SET, PROBE TEMP, 1, 0, 0, ENTER). When the program is run, the target value will be set.

3. HEATER OFF/STIRRER OFF
Press either of these keys to enter a step which will turn off the heater or stirrer when it executes.

4. WAIT UNTIL

A WAIT UNTIL step is similar to a SET step. When executed, it sets the target value just like the SET step, but the execution of the following program step is delayed until the target value is reached. WAIT UNTIL may only be used with a target temperature or a timer setting. It will not work with stirrer speed or ramp value. The operation of the WAIT UNTIL feature is described below.

WAIT
UNTIL

(ENT)

SET

In programmed operation this key will toggle between the SET and WAIT UNTIL functions. When the key is pressed once, it will be in the SET mode. When it is pressed a second time, it will be in the WAIT UNTIL mode.

If the WAIT UNTIL step sets the timer, then it will also introduce a time delay into the program. If the WAIT UNTIL step sets a target temperature, then the execution of the remainder of the program will be delayed until the target temperature has been attained.

To set a time delay into the program, first press the WAIT UNTIL key twice. The first time it is pressed a series of dog-legged dashes will fill the display. The second time it is pressed a series of U's will fill the display. The U's will be shown whenever the key is in the WAIT UNTIL mode. Next, press either the TIMER/HR:MIN or the TIMER/MIN:SEC key and set the time as described previously. Last, press the ENT key to indicate that the step is complete.

To cause the program to delay until a target temperature is reached, repeat the process above but press either the PLATE TEMP or PROBE TEMP key and then set the target temperature.

Running A Program

Once a program has been entered into the unit, it may be run at any time.

CLR
RUN

Pressing this key when the unit is not in the edit mode will initiate the program which is currently in program memory. While the program is running, the lamp under this key will light. Pressing this key while the program is running will cancel any remaining steps in the program and turn off the RUN lamp.

It is important to remember that all program steps take only an instant to execute with the exception of "WAIT UNTIL" steps. Compare the following program steps:

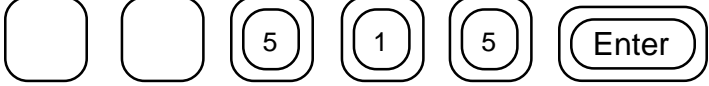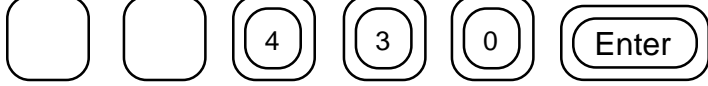| <u>STEP</u>	<u>ACTION</u>
SET PROBE 100°	Set target temperature. Executes next step while unit
OR	begins to go toward target.
WAIT UNTIL PROBE 100°C	Sets target temperature as above. Next program step does not execute until probe temperature reaches 100°.
SET TIMER MIN:SEC 00:05	Puts 5 seconds on the timer then executes next step as timer begins to count.
OR	
WAIT UNTIL TIMER MIN:SEC 00:05	Waits 5 seconds before continuing program.
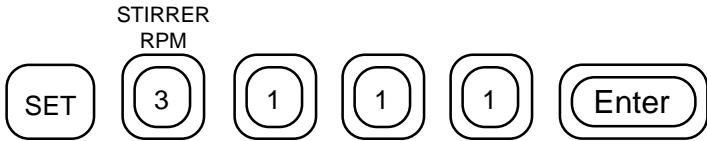
During the time that a program is running, you may press any key to change the display or to set new values of temperature, stir speed or time. You may not, however, edit a program while it is running. Pressing the EDIT key while a program is running has no effect.

If the power fails during the running of a program, the program is aborted. It must be run again from the beginning when power is restored. All of the stored program steps will be retained during the power failure.

EXAMPLE PROGRAM

Now that all of the key functions have been defined, it is time to place a program in memory and run it. We will begin with a very simple program. We wish to place the temperature probe in a liquid which will be heated to 105°C, held at that temperature for 30 minutes and then cooled back to room temperature. We will heat slowly at a predetermined rate and use the stirrer to spread the heat uniformly throughout the liquid. Here is the sequence of keystrokes along with the related display. (To enter the edit mode, remember to press the EDIT key).

STEP NUMBER	KEYSTROKE SEQUENCE	EXPLANATION
01.	STIRRER RPM [SET] [3] [1] [1] [1] [Enter]	Set stirrer to 100 RPM

STEP NUMBER	**KEYSTROKE SEQUENCE**	**EXPLANATION**

02.

STIRRER
RPM

[3]

Display stirrer RPM

03.

WAIT UNTIL   WAIT UNTIL   TIMER MIN:SEC

[ ] [ ] [5] [1] [5] (Enter)

Wait 15 seconds

04.

[ ] [8] [5] [0] (Enter)

SET   RAMP°/HR

Set ramp value to 50°/HR

05.

PROBE
TEMP

[2]

Display the probe temp

06.

WAIT UNTIL   WAIT UNTIL   PROBE TEMP

[ ] [ ] [2] [1] [0] [5] (Enter)

Wait until probe temp = 105°C

07.

WAIT UNTIL   WAIT UNTIL   TIMER HR:MIN

[ ] [ ] [4] [3] [0] (Enter)

Set 30 minute time delay

08.

[9]

HEATER
OFF

Turn heater off

STEP NUMBER	KEYSTROKE SEQUENCE	EXPLANATION

09. [WAIT UNTIL] [WAIT UNTIL] [TIMER HR:MIN / 4] [1] [0] [0] [Enter]   Wait another hour

10. [0 / STIRRER OFF]   Turn stirrer off

The program is now complete. Whenever the RUN key is pressed, the Hot Plate/Stirrer will execute the program steps in the order in which they were entered. It is now possible to leave the unit while it performs the task unattended.

Steps 2 and 5 were inserted as a check on program operation. The first will display stirrer RPM while the second displays the probe temperature throughout the remainder of the program operation. A 15 second delay was inserted after the "display stirrer RPM" command to allow time for the stir bar motor to reach target speed while the stirrer RPM is being displayed.

Before leaving the unit in unattended operation with a program which has not been previously run, it is a good idea to do a test run while in attendance. After the RUN key is pressed, the display will show stirrer RPM for 15 seconds. Make sure that the value is the same as that set into the program to within ±20 RPM. For the above example, this will be 100 RPM.

After the stirrer speed, the probe temperature will be displayed. Check to see that it ramps up at the programmed rate and then stops at the target temperature (1-5°C). If there have been no errors in entering the program, the temperature will remain at 105°C for 30 minutes before cooling down to room temperature. One hour after the cool down begins, the stirrer should cease rotating.

If the initial checkout does not yield all of the results described above, then the program has an error or omission in one or more steps. Correcting or modifying an existing program will be described in the next section.

Modifying A Program

The user can change any of the values of temperature, time, stirrer speed or ramp rate in the editing process. For example, assume that we wish to change the target probe temperature in the above example from 105° to 100°C. Use the STEP UP key to proceed to step 6 in the program. The display shows: 06.U2. Press the OMIT key to erase the step. The display will now read 06.U4 as step #7 has now become step #6. Next press the STEP DOWN key to display setup #5. Then press the SET and the PROBE TEMP keys followed by the digits 1, 0, 0. Finally press the ENTER key. The target temperature will now be 100°C for all subsequent runs of this program.

There are two rules to remember when deleting or inserting steps.
1. When a step is deleted, all of the steps which were entered after it move up one position in the program.
2. When a step is inserted, it is inserted after the step in the display. All subsequent steps are moved up one position. The preceding steps are not affected. For example, if you wish to insert a step between steps 8 and 9, step through the program until step 8 is in the display, then insert the key stroke sequence. When adding a step at the end of a program, step through the program until the last step is in the display, then add the step.

Maintenance

Temperature Calibration

The temperature readouts for both the plate surface and the probe may be calibrated by the user. Two rear panel adjustments are provided for each temperature channel.

PROBE READOUT CALIBRATION

Probe calibration is performed using an accessory calibration kit which precisely simulates fixed temperature points. The kit (part # 710-5001) has a high temperature "dummy" probe which when plugged into the probe connector presents the same value of resistance to the internal temperature analyzing circuitry as the RTD probe at the temperature which is written on the calibrator case. There is also a low temperature plug-in which simulates the response at the temperature called out on the calibrator case.

To calibrate the probe readout, first insert the high temperature "dummy" probe into the temperature probe DIN connector located on the rear panel. Then adjust the calibration pot

marked PROBE HI until the front panel readout agrees with the temperature stamped on the "dummy" probe. When the high temperature has been adjusted, repeat the procedure with the low temperature probe module by adjusting the potentiometer marked PROBE LO to agree with the temperature marked on the "dummy" probe. The probe readout calibration is now complete. The calibration must be carried out in the order specified above (Hi temp; Low temp).

PROBE CHECK

The optional probe supplied by Barnstead| Thermolyne comes with the following specifications:

PROBE TYPE - DIN 43760 "CLASS B"

<div align="center">

PROBE ACCURACY

<u>**TEMPERATURE (°C)**</u>	<u>**TOLERANCE**</u>
0	±0.3°
100	±0.8°
300	±1.8°

</div>

If it is desired to adjust the unit to compensate for an error at a particular temperature, this may be done using the LO TEMP pot. Place the probe in the liquid which is at the temperature of interest and adjust the LO TEMP pot until the readout is correct. This procedure will introduce error into

the system at other temperatures so remember to readjust the probe readout when using a new probe or when you wish to have readout accuracy over a broad range of temperatures.

The probe may not be used at temperatures below 0°C since the readout will not respond in that region.

Caution

Always disconnect the power cord before removing the bottom plate.

Helpful Hints

A. Use on a level surface when stirring, especially when stirring violently. If the unit is not level, the sample container will "walk", and could walk right off the plate.

B. Stirring thicker solutions may require using a larger stir bar. Generally, the more viscous a solution, the larger the stir bar needed. For best operation overall, it is recommended that the stir bar match the magnet poles in the stirrer. These are 2 inches apart.

C. Temperature targets may overshoot, especially with small liquid samples and when target temperature is close to ambient. If it is important not to overshoot, try ramping up to the target. Alternatively, target your temperature 5°C to 10°C below the desired temperature. When the temperature is reached, slowly ramp the unit to the final temperature.
Temperature overshoot is generally less than 5°C. Large samples and target temperatures over 100°C very seldom overshoot.

D. When entering a new program into memory, always clear the previous program. This is done by pressing the OMIT key when the display is showing step 00.

E. On multistirrer units, place the probe in one of the vessels on the corner of the unit. This will ensure the most uniform sample temperatures due to the symmetry of the arrangement.

BATTERY REPLACEMENT

The battery used in all 730 Series instruments is a 3 volt Lithium battery which should have a useful lifetime of at least 5 years. The replacement battery is available from Barnstead|Thermolyne. Instructions for replacing the battery are given below.

CLIP
HOLDER

PC BOARD
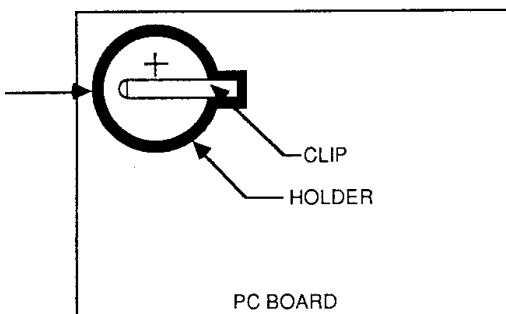
Battery Replacement

Turn the unit over so that it rests on the hot plate. Use a soft cloth or paper towel between the plate surface and the workbench to ensure that the plate is not marred or scratched in the operation. Use a phillips screwdriver to remove the four screws which hold the bottom in place.

With the unit arranged so that the keyboard faces forward, the battery PC board is directly behind the front panel display on the far right. The picture below shows the approximate location of the battery on the board.

The battery is held in place with a metal clip in a plastic case. To remove the old battery, place a small flat metal blade into the forward section of the case (as shown in the figure on page 44) and pry upward until the sides of the battery are exposed sufficiently to force the battery out with a finger placed on either side. A small, flat-blade screwdriver, pocket knife blade, metal nail file or similar object may be used for this operation.

To insert the new battery, hold the clip up and slide the battery into the case until it rests in a flat position. Make certain that the positive side of the battery faces up. The battery will not fall into place properly if it is not positioned correctly.

Now replace the bottom plate and the power cord and the unit is ready to operate.

Troubleshooting

PROBLEM	WHAT TO DO/EXPLANATION
1. The sample temperature does not rise as rapidly as the programmed ramp value.	Try heating a smaller sample. The heating capacity of the DATAPLATE Heater/Stirrer is probably not adequate to raise the sample temperature at the programmed rate.
2. The probe temperature does not display 100°C or 212°C when immersed in boiling water.	If you are in a location which is 1000 ft. or more above sea level your boiling point will decrease. OR perform the probe calibration procedure given on p.27.
3. The probe temperature readout does not display 0°C or 32°F when immersed in an ice bath.	Check the purity of the water. Dissolved substances will usually lower the freezing point of water. OR Perform the probe calibration procedure given on p. 27.
4. The sample temperature reading remains higher than the target temperature.	Check the ambient temperature. The target temperature may be below room temperature.
5. The probe temperature reads all dashes.	Check to see that the probe plug is seated tightly and making contact. If it is not making contact the readout will default to dashes (- - - -).
6. The stir bars are revolving erractically.	Check to see that the sample containers are centered over the stir bar motors. OR The stir bars may not be able to maintain proper coupling to the motor magnets due to the viscosity of the sample.

PROBLEM	WHAT TO DO/EXPLANATION
7. The unit or units do not respond to infrared remote control	Move the 745 controller closer. OR Check the angle between the controller and units. OR Clean the infrared windows on all units.
8. In programmed operation, the unit continues to execute commands after completing the program which has been entered.	Be sure that you have cleared the memory before entering the new program. If you have not, the extra steps may be erased with the unit in the EDIT mode.
9. The unit does not hold the program in memory with the power off.	The battery needs to be replaced.