User Manual

Hotplate & Magnetic Stirrer

HPS RT2 Advanced

Operation Manual 9240-11-012

Thermo SCIENTIFIC

Important Before using this product, read this entire operation manual carefully. Users should follow all of the operational guidelines contained in this manual and take all necessary safety precautions while using this product. Failure to follow these guidelines could result in potentially irreparable bodily harm and/or property damage. ▲

Caution All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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MANUAL NUMBER 9240-11-012

REV	ECR/ECN	DATE	DESCRIPTION	By
0	--	11/20/13	Original	ccs

This manual contains important safety and operation information. You must carefully read, understand, and follow all the instructions in this manual prior to operating this instrument. Keep this manual in a safe place nearby for reference and make it easily available to all users.

1) This manual highlights DANGER/WARNING/CAUTION/NOTICE alerts to prevent injury or property damage and also to achieve optimum performance of your instrument.

(2) These alerts are classified into four types in this manual depending on the importance and the risk levels as described below:

Symbols	Meaning
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	Ignoring this warning could cause serious injury or even death.
⚠CAUTION	Ignoring this caution could cause injury or property damage.
NOTICE	Ignoring this notice could cause operational problems.

3) The claim which is out of the quality guarantee published by the Manufacturer is out of Manufacturer's responsibility.

4) The damage which is from unexpected fault or damage of user by Acts of God is out of Manufacturer's responsibility.

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Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

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Section 1 Warnings and Cautions

⚠WARNING

Ignoring the following warnings could cause serious injuries or even fatal accidents.

Check and connect properly -the voltage, phase and capacity of power supply on the ID plate before installation.

Power supply must be properly grounded. Abnormal grounded connection causes serious damage. Grounded connection must not be on the water pipe and gas pipe.

Use correct and provided power code

Do not install the product in the place that the gas could leak out. Do not use in the place that has industrial oil smoke and/or metallic dust. It causes fire or electric shock.

Do not use the machine near to places where explosion can occur due to organic evaporating gases.
Explosive materials: Acid, Esther, Nitro compound.
Inflammable materials: salt peroxides, inorganic peroxide, salt acids.

Check equipment for permissible environmental condition. It can be the cause fire or trouble by electricity, electronic, and damage of motor. Permissible environmental condition - Temperature 2°C to 60°C, Maximum relative humidity 80%.

Wear your personal protective equipment in accordance with the hazard category of the medium to be processed; splashing liquids, projectile parts, body parts, hair, clothing and jewelery getting caught.

Unplug, if there is strange sound, smell and smoke from the product. Stop operating and request service.

Keep out of direct sunlight. It may influence product life and proper operation.

Do not use the machine in places where moisture is high and flooding can occur.

Do not assemble, repair, modify on your own. The product may not work well and electric shock in the efficiency of the product. Also you will void the warranty.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

Do not touch the top plate or any object near it even when the heater is turned off. You may get burned due to residual heat.

After using this equipment, make sure to turn off the main power switch and also to disconnect the power cord from the power outlet for the safety of other users.

Do not place heavy objects, including this equipment, on top of the power cord and do not strip, scratch, bend, twist, pull, or heat the power cord. A damaged power cord is a fire and electrical shock hazard.

Make sure to set up this equipment on a flat, stable, clean, non-slip, dry, and fireproof surface inside a lab with proper safety measures.

Do not place any device which can be affected by the motor vibrations near this equipment.

Do not touch the power outlet, power socket, or power cord with wet hands. And make sure to connect the power cord directly and firmly to the power outlet and power socket.

Do not put or insert any objects (especially if conductive or flammable) inside this equipment.

Do not expose this equipment to any heat sources including direct sunlight.

Beware that mechanical shock or vibration can damage this equipment and pay extra attention while moving it. Damages caused by mechanical shock or vibration may result in injury or fire.

Do not impact the top plate or heat sink. You can damage the equipment or get injured.

Do not install this equipment near any device that generates high frequency noise such as high frequency welding machines, high frequency sewing machines, or SCR power controllers.

Before cleaning, make sure to unplug the power cord to avoid electric shock or fire.

Do not use chlorine bleach, ammonia-based cleaners, abrasives, ammonia, or metal scouring pads. Wipe with a soft damped cloth or a sponge soaked in water or diluted neutral detergent.

Use Caution -
Electric Shock

Use Caution -
Surface Temperature

Section 2 Functional Description

HPS RT2 Advanced model offers to show temperature and control by external temperature probe. Above models boast quick heat-up time thanks to ample heating capacity as well as the superb heat transfer rate enabled by the tightly integrated structure of the heater and the ceramic-coated aluminum alloy top plate. Also provides a variety of temperature modes relating to temperature control, heat-up time.

Features

- By adopting a special magnet with exceptionally strong magnetic coupling power as well as smooth-start stirring mechanism. You will experience virtually no decoupling of magnetic stir bars even with viscous media or at high speeds (30~2000rpm, guaranteed). The BLDC motor and the special magnet also provide big stirring power.
- Real-time stirring with quick operation or stop
- When the external temperature probe is coupled, it automatically changes to external sensor mode. User can check media temperature also control.
- Microprocessor PID Feedback Control - Fast and precise temperature control is provided by the microprocessor PID controller.
- Selection of the Temperature Control Modes - Three user-selectable temperature control modes are provided for your convenience; Optimum, Fast, and Slow.
- Auto-Tuning - Automatic tuning of the PID parameters provides more accurate temperature control.
- Changing Temperature Limit - The top plate temperature control range can be changed to protect media by changing overtemperature limit value or low temperature limit value.
- Offset - To use your own thermometer for temperature control in specific applications, there can be some differences between the temperature of your thermometer and the displayed temperature of this unit. If needed, you can offset such temperature differences ranging from -10°C to ±50°C at 0.1°C intervals.

Features (continued)

- Selection of the Timer Mode - Immediate Activation (T1): The timer starts immediately after setting the timer, Delayed Activation (T2): The timer is activated only when the set temperature is reached.
- Quick Heat Up Time - Ample heating capacity and superb heat transfer rate of the tightly integrated structure of heater and ceramic-coated aluminum alloy top plate allow quick heat up time.
- The ceramic-coated top plate is highly resistant to heat and corrosion. In addition, its white color is optimal for monitoring color changes of the media during operation.

Safety

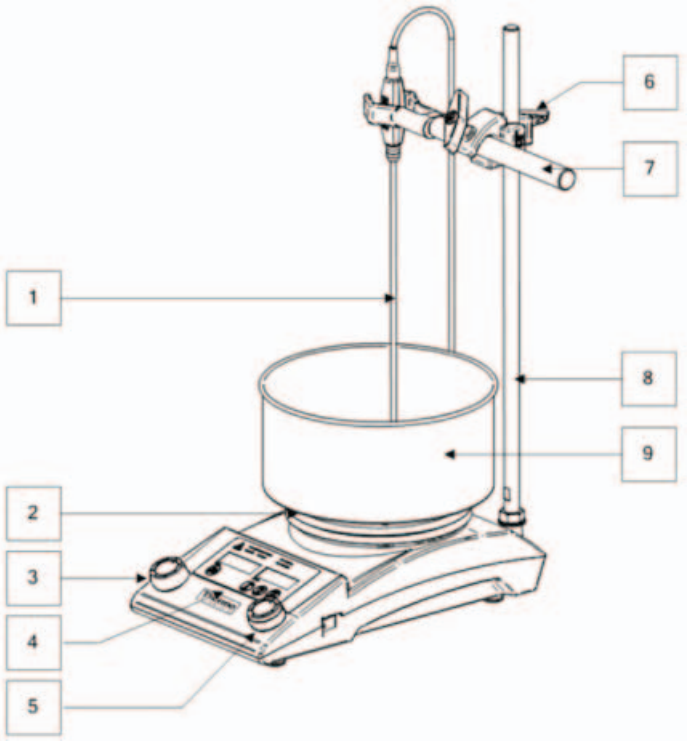
- Hot Top Warning Indicator - The top plate temperature can remain very hot for some time even after the heater is turned off. To prevent injury or fire under such circumstances, this instrument has a hot top warning indicator on the control panel. This indicator will illuminate if the top plate temperature is over 50°C. Even so, do not rely on this indicator alone for your safety
- Overheating prevention device - Basically built in electronic overheating prevent device and mechanical body overheating prevent device.
- Heating plate overheating prevention device - A heating plate overheating prevention device is particularly built-in.
- The devices overheat warning function - The devices WARNING LED will be light. In case of the devices temperature goes over safe range.
- Error indication regarding external temperature sensor - In case of Error message, the Probe does not contain enough in media or on air.
- A transparent shield is also provided to allow you to monitor your operations more safely by shielding you against decoupled stir bars or liquid splashes. (Option)
- Heating Bath (Option) - A specially designed non-slip heating bath comes with the instrument. To prevent unintentional slips of the bath during operation, this bath has concavo-convex bottom shown below so that it can sit stably on top of the top plate.

Convenience

Convenient set or indicating temperature and stirring speed by 2 difference knob.

- In case of external temperature probe coupled, automatically change to external sensor mode.
- The external temperature probe (sensor) is made by PP material. So, the probe (sensor) can be fix easily on labware.
- Showed on digital display- top plate temperature, Probe measuring temperature, stirring speed, timer setting value, and remaining time value.
- In case of the stirring media viscosity change, the feedback function maintains regular speed.
- Smooth-start stirring system reduce magnetic bar decoupling.
- Two support rods are provided to hold various kinds of devices such as temperature sensors, thermometers, laboratory glassware, etc. (option).
- User designation temperature range - Your own temperature limit can be easily set and protect simple from controlling time or user mistake.
- User designation stirring speed range - User can set up the lowest stirring speed. So the device can be stirring as quickly as possible time.

Construction



(1) Temperature probe : This is PT100 sensor to check media temperature. (Optional 2 different temperature probe series. Refer to Accessories list)

(2) Heat sink

(3) Heater knob

(4) Control panel

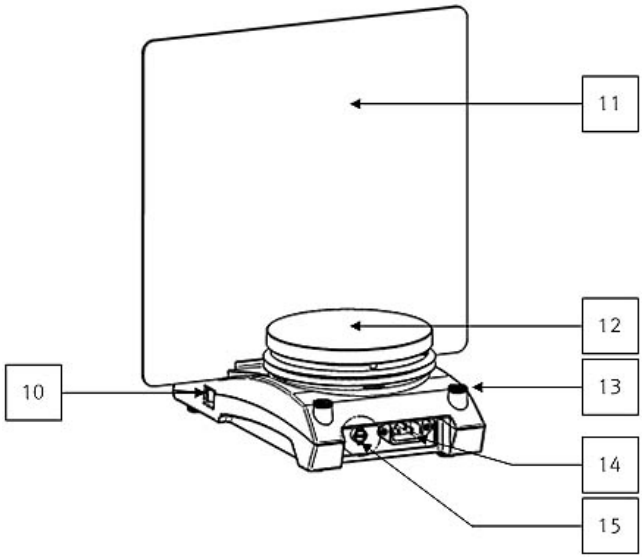
(5) Stirrer knob

(6) Clamp holder (Optional)

(7) 3 Prong clamp (Optional)

(8) Support rod (Optional)

(9) Heating bath (Optional)



(10) Power switch.

(11) Transparent Shield (Optional)

(12) Top plate

(13) Threaded hole

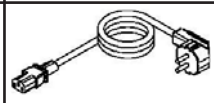
(14) Power socket

(15) Temperature probe cap

Section 3 Unpacking and Installation

Upon receiving the instrument, check to ensure that no damage has occurred during shipment. It is important that any damage that occurred during shipment must be detected before unpacking. If such damage is found, notify the carrier immediately.

After unpacking, check to ensure that all the following parts and accessories are included in the package. If not, contact your dealer or Thermo Scientific immediately.

Item	Figure	Quantity	Description
Main body		1	--
Power cord		1	--
Operation Manual		1	--
Temperature probe		1	B Class : Max 250°C

Location Conditions

Place the unit on the wrench, or table when in use, and observe minimum distances in 30cm between the other devices.

⚠WARNING

The unit should be located away from naked flame sources, direct sunlight. It can come with the malfunction or lower the function.

Pre-startup Check

- Check the unit is balanced well.
- Never install or use this instrument with or near to hazardous or flammable substances.
- Do not install this instrument near any device that generates high frequency noise.
- Do not install with short circuit, water leak, and risk of flooding places.
- Do not install with industrial harmful gas, metal dirt environments.

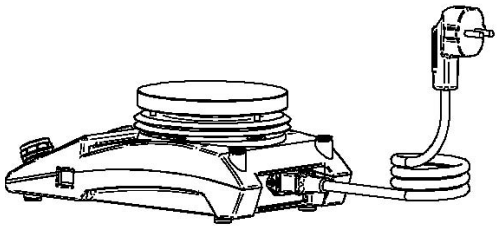
Connecting to Main Power Supply

When connecting power, use only the power cord that came with your instrument. The power connection procedures are as follows:

(1) Before connecting the power cord, make sure that the main power switch is turned off.

(2) Plug the power cord into the power socket at the back of your instrument as shown in the diagram below.

(3) Plug the other end into a properly grounded and dedicated power outlet nearby.

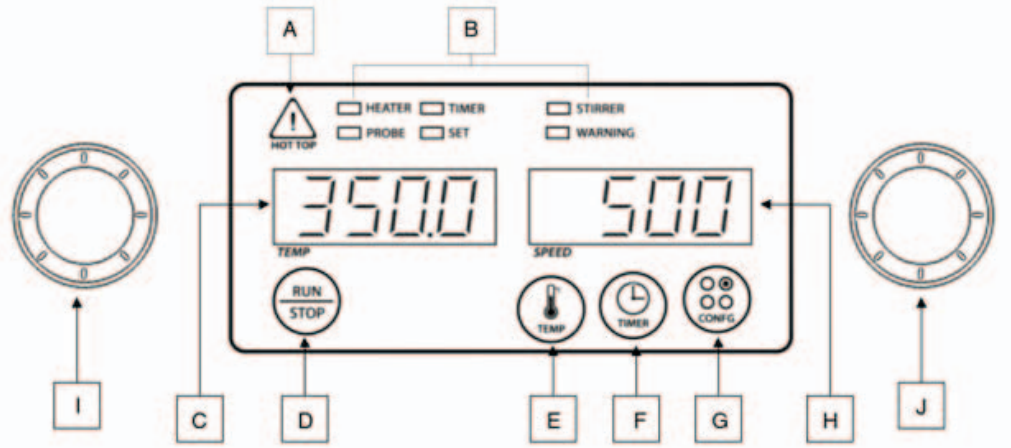


⚠WARNING

Electrical Shock Hazard.

- Check voltage, phase and capacity of power supply and connect properly.
- Do not insert damaged line cord or multiple plugs into outlet at the same time.
- DO NOT use without safety PPE (working clothes, gloves, glasses)
- DO NOT handle or touch electrical cord or electrical parts with wet hands.
- Make sure to connect this instrument only to properly grounded power outlets to protect you and your instrument.

Section 4 Control Panel



Control panel

A	HOT TOP 	Although this instrument has a hot top warning indicator, which is turned on when the top plate temperature is over 50°C, do not rely on this indicator alone for your safety.
B	HEATER	During heater operation
	TIMER	During timer operation
	STIRRER	During stirrer operation
	PROBE	During the Probe measurement temperature indication.
	SET	During temperature, Timer, Config. set
	WARNING	Overheating warning
C	Temperature indication display	Hot plate temperature, measurement temperature , and setting temperature showed
D	RUN/STOP button	Heater ON/OFF, End of Timer, Scope function during button operation
E	TEMP button	Setting temperature confirmation of a heating plate. Temperature setting.
F	TIMER button	Elapsed time, remaining time, and timer settings.

Control panel (continued)

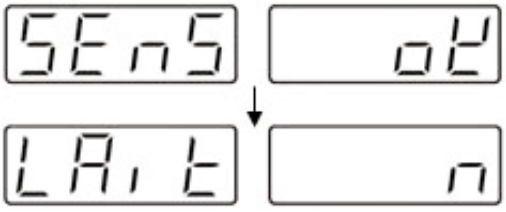
G	CONFIG button	When this device is stop conduction, Configuration Functions can be set. When user wants to change mode, press the Config. Button with stirrer knob to clockwise turning. Then the mode can be switching in the following order.	
		Unit	Changing the temperature unit "Cels" - Celsius, "Fahr" - Fahrenheit
		Time	Changing timer mode
		Offset	Changing Offset setting
		Limit	Set maximum heater rate when used to temperature control.
		t-H	Highest temperature set top plate and external temperature sensor
		t-L	Lowest temperature set top plate and external temperature sensor
		List	Indicating the set value to turning stirrer knob.
		Calibration	Matching Auto tuning the device to current situation or best condition.
		Coefficient	Select to using control temperature coefficient.
		Default	Change all the settings to the default values
		Motor Minimum	Minimum stirring speed set (range : 1~1000rpm)
		Escape	Config. mode to be end
H	Speed display		STIRRER speed, timer

Knob – Set a value and select an function, turn knob left or right.

I	Heater knob	Temperature setting
J	Stirrer knob	STIRRER speed setting, value setting on Config.

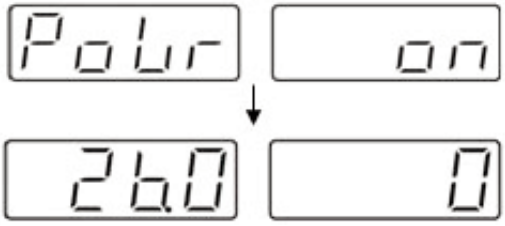
Checking Power Status

(1) The following displays will appear in sequence together with a beep sound when the power cord is connected:



- Note that the following display will also appear momentarily if the main power switch is off:

(2) If you turn on the main power switch, the following display will appear in sequence:

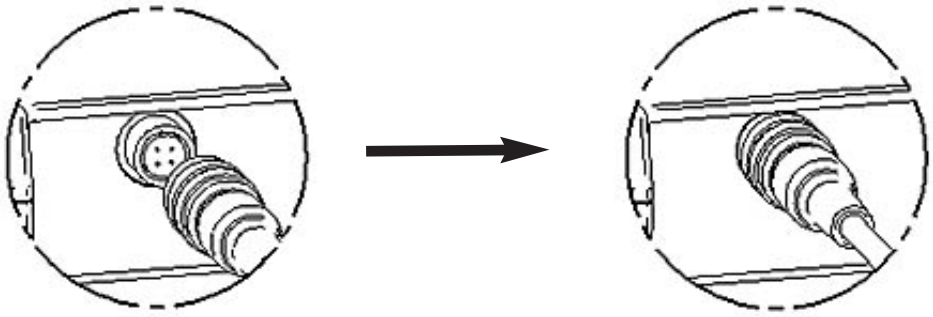


Connecting the Temperature Probe

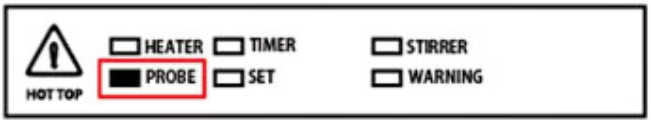
When the external temperature probe connects with body, the temperature display part shows Probe measuring temperature. If the probe disconnect with body, The temperature display part shows top plate temperature.

(1) Open the external temperature probe cap and turn right.

(2) Insert external temperature probe with body.

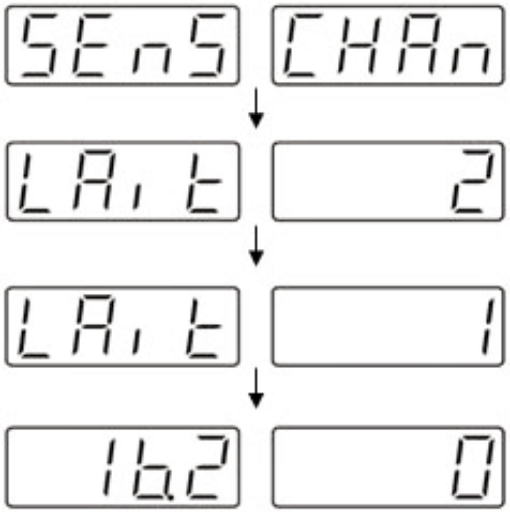


(3) When you connect with temperature probe, the LED lamp is automatically turned on.

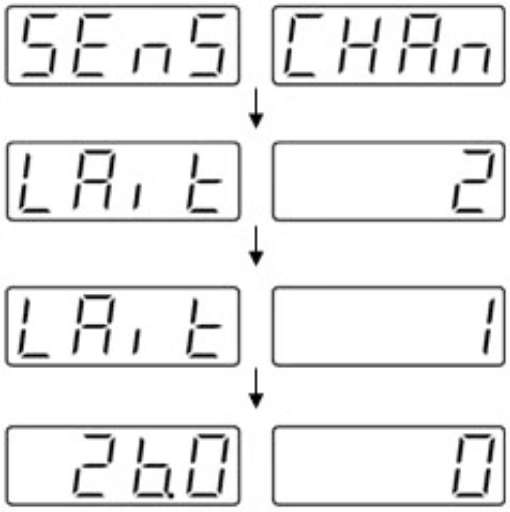


Connecting Temp Probe (continued)

Temperature display windows are showed on “Sensor change” message. After then, the display windows showed “Probe” measuring temperature.



(4) In case of separating temperature probe from main body, the temperature display windows are showed follow message;



⚠ CAUTION

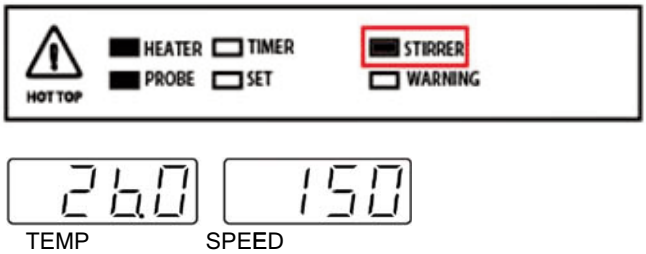
- When you connect with temperature probe, check first hotplate temperature.
- When you connect with temperature probe and hotplate temperature is over 50°C, the “HOT TOP” LED will be lit.

- Pay attention to a high temperature.
- Set the Probe under 20mm from Media. If Probe is not set perfectly or on air, the Probe will be “Error” or the hotplate will be overheating.

Stirrer Knob

When the stirrer knob is turned right, the device will start operating. And the stirrer function is operating individually without heating part.

[Turning STIRRER operation, State indication LED]



During STIRRER function operating, the stirrer value will be showed on display window. When you push the stirrer knob, you can check current stirrer operating value.

In case user wants to stop stirrer operation, just turn knob all the way left.

NOTICE

- Stirrer speed range 1~2000rpm, you can control more correctly from 30 to 2000rpm.

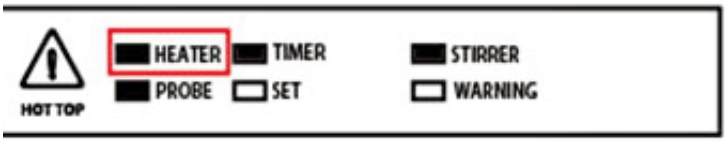
Run / Stop Button

Even if the main power switch is turned on, you have to press the RUN/STOP Button to start or to finish the operation.

The RUN LED illuminates only when the unit is operating and the HEAT LED blinks only when the heater is activated.

If you press the RUN/STOP Button to start the operation and the current temperature is below the set temperature, both the HEAT and the RUN LEDs will light up as shown below.

[During heater operating, the state indication LED]



Note, however, that the HEATER LED will be turned on and off during the operation because the heater is automatically activated or deactivated to maintain the set temperature.

Run / Stop Button (continued)

⚠ CAUTION

- Hot Top Warning Indicator will illuminate if the top plate temperature is over 50°C.
- Be aware and careful of surface temperature.
- Even if the instrument is turned off, the surface of the top plate and the vessel on top of it will remain very hot for some time. Never leave your instrument accessible to others while it is hot and never touch it unless you are absolutely sure.

NOTICE

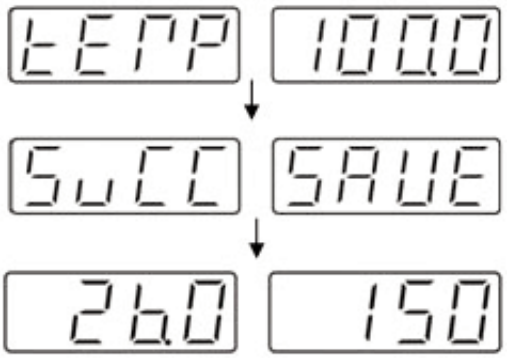
- You can check set temperature during heater operating. Press the heater knob.
- In case of user requirements, press TEMP button to change set temperature during operating.
- User can check the elapsed time during operation by pressing TIMER button.
- If user wants to go TIMER setting mode during operation, just press timer button one more time.

Temperature Setting

The temperature setting procedures are proceeded by using TEMP button and the Heater Knob(left control knob).

Step 1: Press the TEMP Button and check the display showing the current temperature setting.

Step 2: If you want to change the temperature setting, select the desired temperature by turning and press the Heater Knob.



Temperature Setting (continued)

Step 3: Push the RUN/STOP Button.

Heater LED will be on and heater will be activated.

If the external temperature probe is connected, the temperature which probe detects will be displayed. If not, top plate's temperature will be displayed.

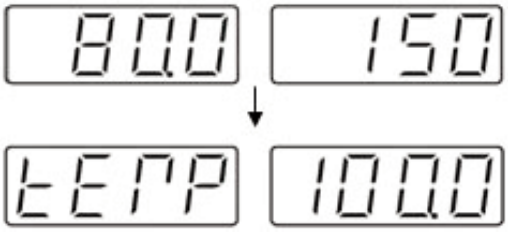
NOTICE

- Changing the temperature setting is allowed only within the low and high temperature limits. If changing the temperature setting cannot be done properly, check the low and high limits first. (Refer to Check the Configuration Settings)
- You can set the low and high temperature limits at any value between 0°C and 350°C.

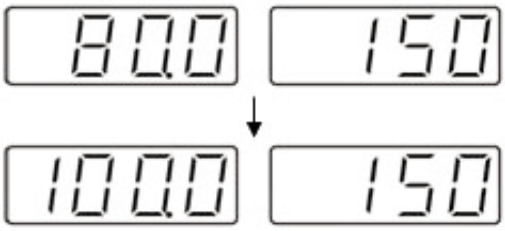
Temperature Setting During Operation

Press TEMP Button or the Heater Knob during operation to see the set temperature.

If you press TEMP Button, set temperature is shown on the right. After 15 seconds, the mode will be escaped automatically.

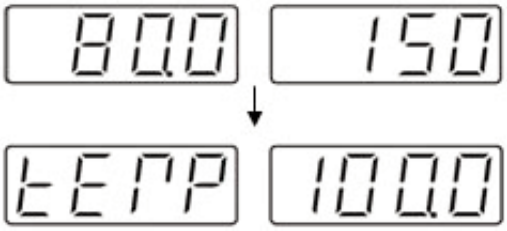


If you press the Heater Knob, set temperature is shown on the left. After 3 seconds, the mode will be escaped automatically.

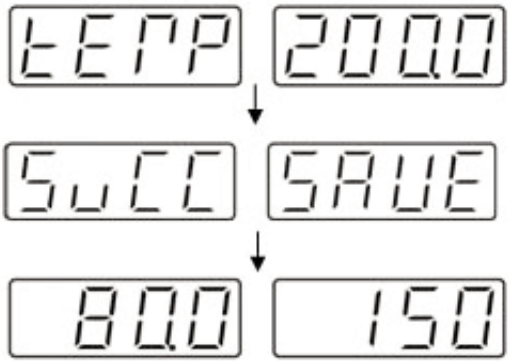


Resetting Set Temp During Operation

Step 1 : Press TEMP Button during operation.



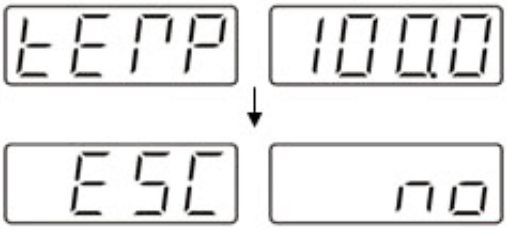
Step 2 : Select the desired temperature by turning and press the Heater Knob.



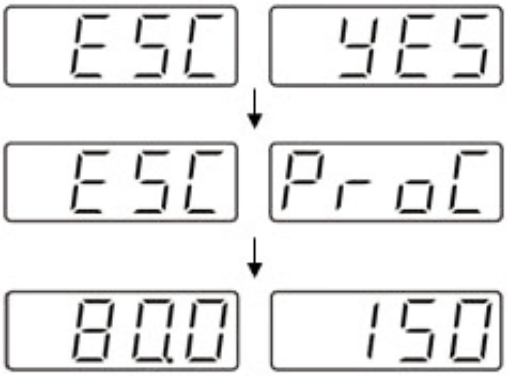
After 15 seconds, the mode will be escaped automatically.

Or push RUN/STOP Button as shown below to escape the mode.

Step 1 : Push RUN/STOP Button during resetting the set temperature.



Step 2 : Turn the Heater Knob clockwise and press the Heater Knob as shown below.



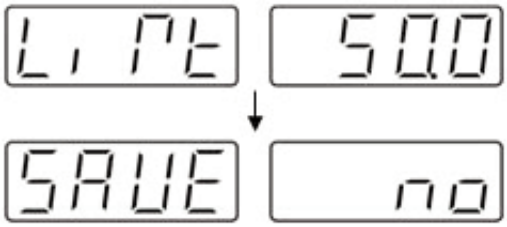
Maximum Heating Rate Setting

The higher the heating rate, the faster the heat up time but the wider the temperature overshoot and undershoot. Therefore, if you want to reduce the temperature fluctuation, you need to limit the heating rate to a certain degree by limiting maximum heating rate. [Same function as 4.3.4]

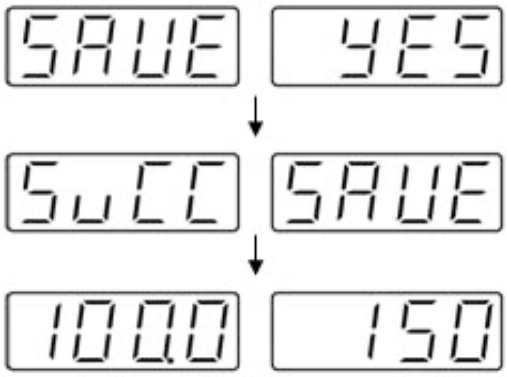
If, for example, the current heating rate is 100% but you want to set the heating rate limit at 50%, do as follows:

Step 1: Press the CONFIG Button. The default value is 100%.

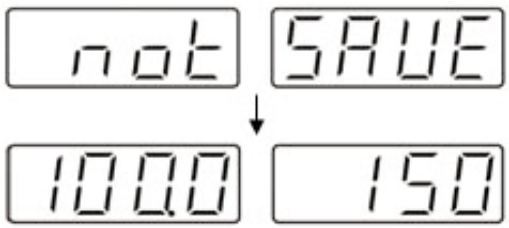
Step 2 : Change the limit to the desired value by turning the Stirrer Knob and press the Stirrer Knob.



Step 3 : Save the desired limit by using the Stirrer Knob as shown below. [When you need to save the changes]



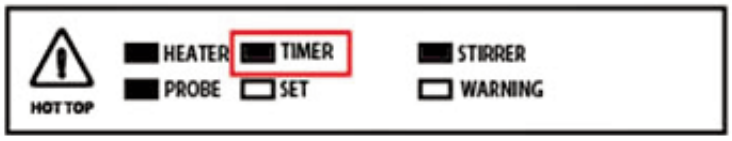
If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



Step 3: Terminate the configuration mode as described in Configuration Mode.

Timer Setting

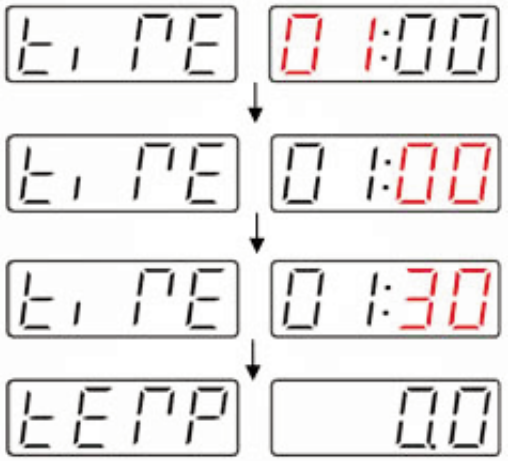
This unit provides two types of timer mode: immediate timer activation and delayed timer activation. (For selecting the timer mode, Refer to 4.3.2 Selection of the Timer Mode)
[Indicating LED status during timer is activating]



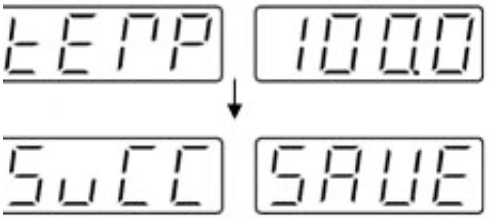
You can stop timer by pushing RUN/STOP Button during timer's activation. For both timer modes, the timer setting procedures are the same:

Step 1: Press the Timer Button to begin the timer setting and also to check the display showing the current timer setting. Note that the hour frame is blinking first as shown below.

Step 2: If you want to change the timer setting, select and then save the desired values into the hour frame and the minute frame by turning the Stirrer Knob and pushing it for confirmation as shown below.

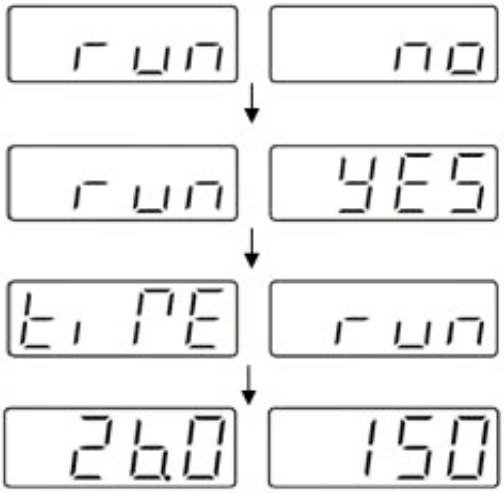


Step 3: Now, the unit will display the set temperature for verification as shown below. Turn the Stirrer Knob to select the desired value and then press it for confirmation. The following display will appear momentarily.
[If you change the set temperature]

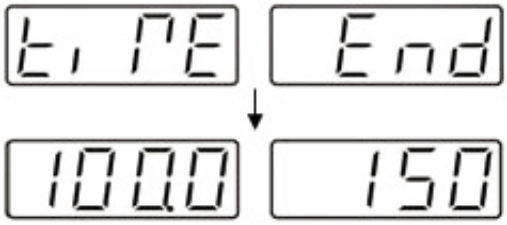


Timer Setting (continued)

Step 4: Then, the following display will appear asking whether you want to start the timer operation or not. If you want to save the new timer setting and to start the timer operation, you are required to change 'NO' to 'YES' by turning the Stirrer Knob and press it for confirmation as shown below.
[Operating confirmation]



Step 5: When the timer operation ends, you will be alerted by audible signals as well as the following display.



Terminate the timer operation either by pressing the RUN/STOP Button or by turning off the main power switch.

Timer Setting During Heating

Press TIMER Button once to check run(remained) time of heating if heater is in operation.

Press TIMER Button twice to set timer during heating and follow above instruction (1) for timer setting.

Check Remaining Run Time

Check the remaining run time during a timed operation by performing the following.

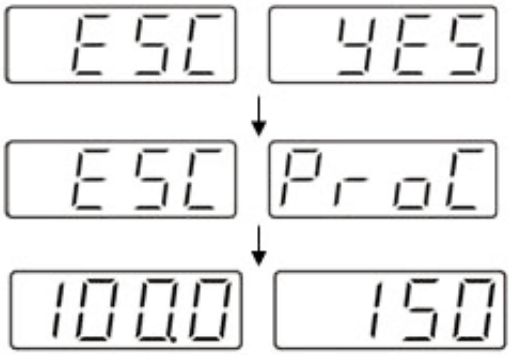
(1) Press TIMER Button once to check the remaining time during timed operation.

After 15 seconds, the mode will be escaped automatically.

Escape of timer mode is shown as below.

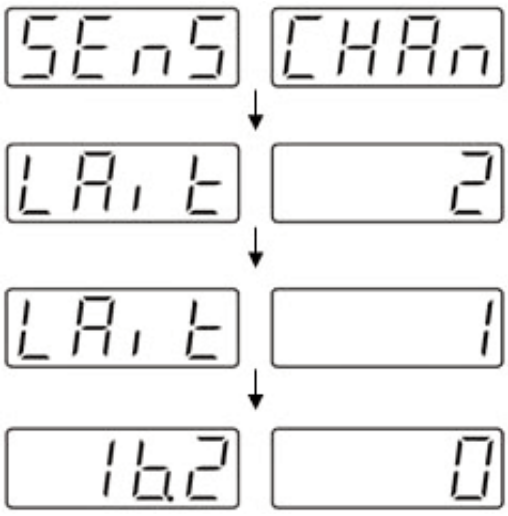
Step 1 : Press RUN/STOP Button.

Step 2 : Turn the Stirrer Knob clockwise and press the Stirrer Knob.



Temperature Probe Control Mode

Connect temperature probe to the unit. The default mode will be automatically changed to the Temperature Probe Control Mode and display shows the temperature value detected by the probe.
[For the temperature probe connection to the unit, Refer to Connecting Temperature Probe]



Temperature Probe Control Mode (cont.)

For temperature and timer setting on the Temperature Probe Control Mode, see Temperature Setting and Timer Setting.

In case of low smoke point media heating, High temperature limit value should be lower than smoke point. [Refer to High Temperature Limit Setting]

(1) Temperature Probe Errors

On temperature control mode if the external probe is in the air or is not enough socked into the media, error message will be shown on display and heater will be automatically turned off.

For correct control media by the external temperature probe, make sure the sensor to completely sock into the media (more than 20mm deep). If the sensor is in the air due to evaporation of media, precise temperature control may fails.
[Refer to Error Message]

Error code	Cause		Effect
ERRO NO 6	Temperature Probe Errors	If the temperature probe is in the air	Heater off
ERRO NO 7		If the temperature probe is not completely socked into the media	Heater off

⚠ CAUTION

- Hot Top Warning Indicator will illuminate if top plate temperature is over 50°C.
- For correct control media by the temperature probe, make sure the sensor to completely sock into the media (more than 20mm deep). If the sensor is in the air due to evaporation of media, Errors will be shown on display.
- Probe operating temperature range is Max 250°C.(B Class)
  A Class: Max 400°C(Optional)

Configuration Mode

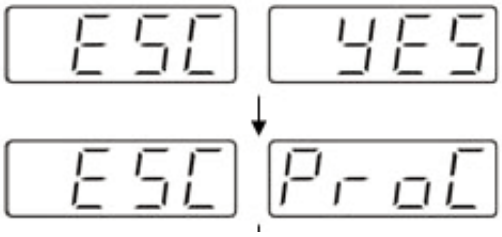
Various configuration settings can be adjusted under the configuration mode such as heating mode, timer mode, maximum heating rate, low and high temperature limits, temperature unit, temperature offsetting, temperature control mode, and so on.

You can enter this configuration mode by pressing the CONFIG Button when the unit is properly connected to a power outlet but not operating.

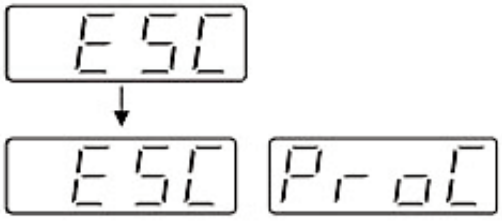
You can terminate the configuration mode by using one of the following methods:

Step 1 : Press the RUN/STOP Button.

Step 2 : Turn the stirrer knob to select YES and push it to confirm the termination as shown below.



Or turn the stirrer knob clockwise until you get the following ESC display and then push it to confirm the termination as shown below:

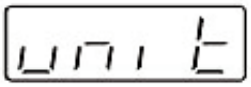


Note also that the configuration mode is automatically terminated if there is no button operation for more than 20 seconds.

Temperature Unit Conversion (°C ↔ °F

You can select the desired temperature unit as follows:

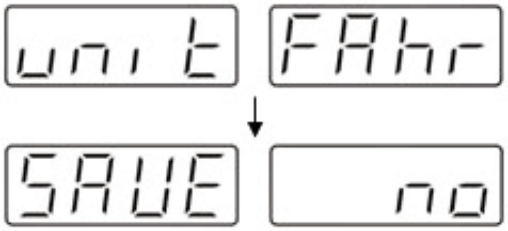
Step 1: Press the CONFIG Button



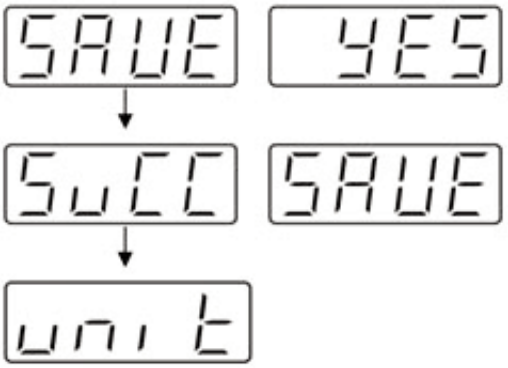
Step 2: Select the temperature unit conversion by turning the Stirrer Knob as shown below.

Temperature Unit Conversion (°C ↔ °F

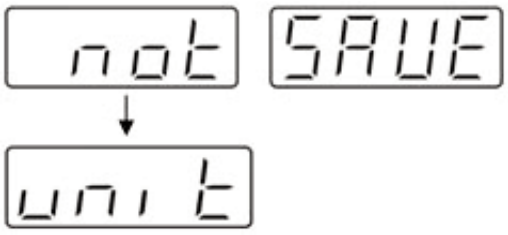
Step 3: Select either Celsius (°C) or Fahrenheit (°F) by turning and pressing the Stirrer Knob.



Step 4 : Save the selected temperature unit by using the Stirrer Knob as shown below.
[When you need to save the changes]



If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO".
[When you don't need to save the changes]



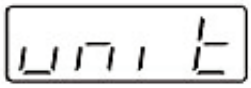
Step 5: Terminate the configuration mode as described in Configuration Mode.

Selection of the Timer Mode

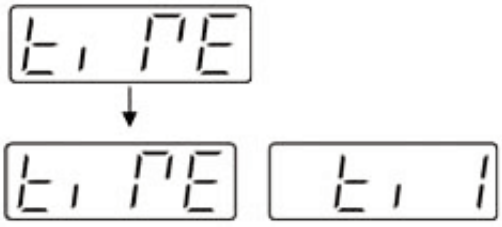
Two different timer modes are provided: Immediate Timer Activation (ti1) and Delayed Timer Activation (ti2). In case of the Immediate Timer Activation, timer starts immediately after setting the timer. In case of the Delayed Timer Activation, on the other hand, timer is activated only when the set temperature is reached.

The timer mode selection procedures are as follows:

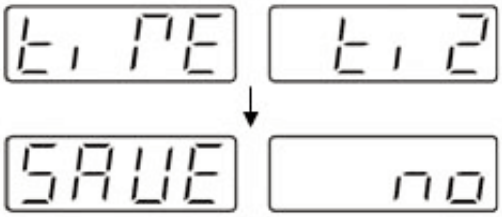
Step 1: Press the CONFIG Button.



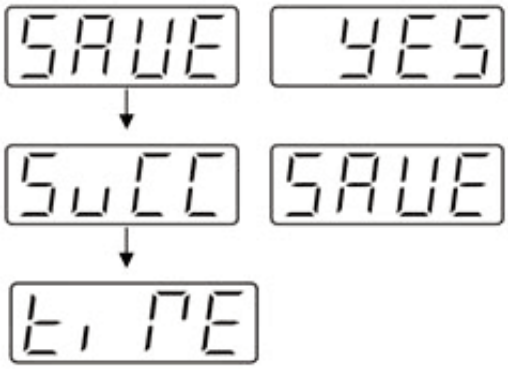
Step 2 : Select the timer mode shown below by turning and pressing the Stirrer Knob.



Step 3 : If you want to change the timer mode, then turn and press the Stirrer Knob.



Step 4 : Save the desired timer mode by using the Stirrer Knob as shown below. [When you need to save the changes]



Selection of the Timer Mode (continued)

If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]

Step 5: Terminate the configuration mode as described in Configuration Mode.

NOTICE

- Refer to Top plate's temperature influence on Heating bath and Erlenmeyer flask's temperature for understanding of temperature relation between top plate and samples.

Temperature Offsetting (OFST/OFSP*)

The temperature shown on the Actual Temperature Display is measured by a temperature sensor inside the unit. However, this temperature can be different from the temperature of the external temperature probe. If needed, you can offset such temperature differences at 0.1°C interval.

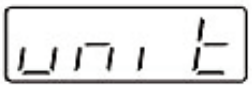
* Offsetting of top plate is displayed as OFST and offsetting of the external temperature probe is displayed as OFSP.

NOTICE

- The allowed range of the temperature offsetting:
  OFST (-10 ~ +50°C) / OFSP (-3 ~ +3°C)
- See the graph in Accessories which shows the temperature difference depending on the top plate temperature.
- Refer to Temperature Offsetting for the relation between top plate's actual temperature and the shown temperature on the display in case of the unload condition.

If, for example, the actual temperature of the top plate is 100°C but the displayed temperature is 95°C, you can match the displayed temperature with the actual temperature of the unit by selecting the offset value of +5°C and save it as described below:

Step 1 : Press the CONFIG Button.



Auto-tuning (PID Parameter Calibration

Step 2: Select the offsetting mode(OFST or OFSP) by turning the Stirrer Knob and press the Stirrer Knob as shown below.

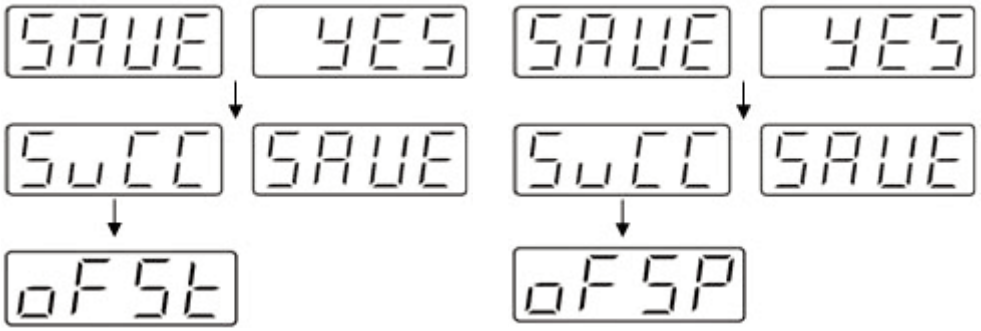
[OFST- Top plate offsetting] [OFSP- External temperature probe]

Step 3: Select the offset value by turning the Stirrer Knob.

The allowed ranges of the temperature offsetting are from -10 to +50°C for OFST and from -3 to +3°C for OFSP.

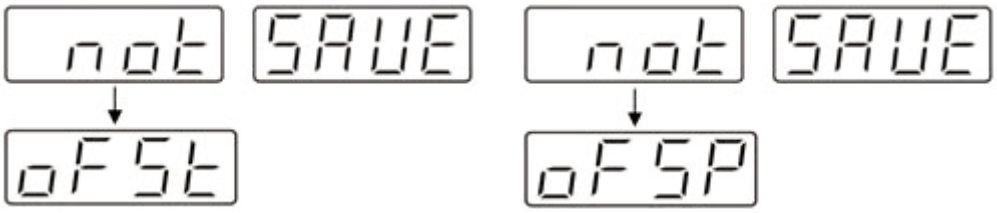
[OFST- Top plate offsetting] [OFSP- External temperature probe]

Step 4: Save the desired offsetting value by pressing the Stirrer Knob as shown below. [When you need to save the changes]



[OFST- Top plate offsetting] [OFSP- External temperature probe]

If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



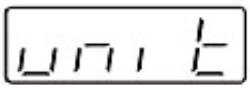
[OFST- Top plate offsetting] [OFSP- External temperature probe]

Step 5: Terminate configuration mode as described in Configuration Mode.

Maximum Heating Rate Setting (LIMt)

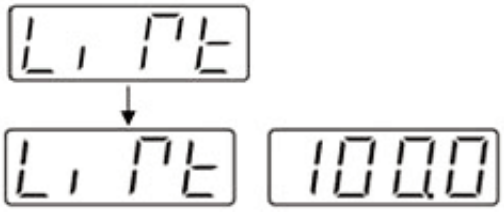
The higher the heating rate, the faster the heat up time but the wider the temperature overshoot and undershoot. Therefore, if you want to reduce the temperature fluctuation, you need to limit the heating rate to a certain degree by limiting maximum heating rate. [Same function as Temperature Setting].

If, for example, the current heating rate is 100% but you want to set the heating rate limit at 60%, do as follows:

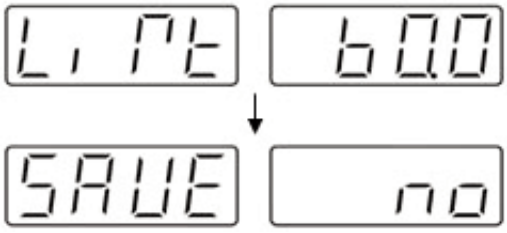


Step 1 : Press the CONFIG Button.

Step 2 : Select Limit (LIMt) turning and pressing the Stirrer Knob.

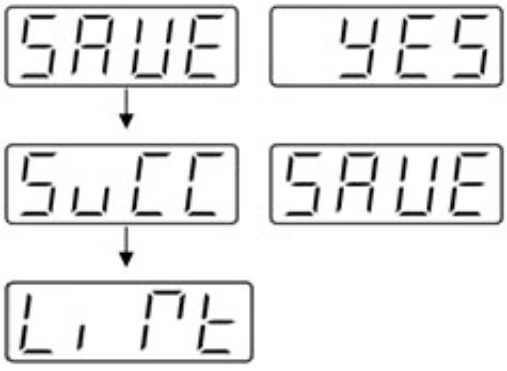


Step 3 : Change the limit to the desired value by turning the Stirrer Knob and press the Stirrer Knob.

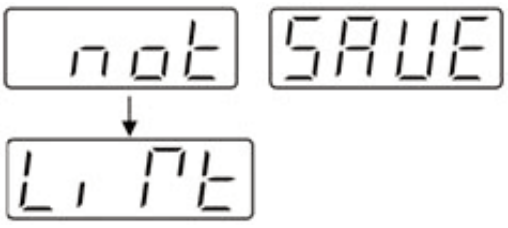


Step 4 : Save the desired limit by using the Stirrer Knob as shown below.

[When you need to save the changes]



If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



Max. Heating Rate Setting (LIMt) cont.

Step 5: Terminate the configuration mode as described in Configuration Mode.

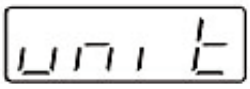
NOTICE

- When the heat up time is too slow, check whether the maximum heating rate is set too low.
- Maximum heating rate set point can only be applied in top plate's control mode, not the external temperature probe mode.

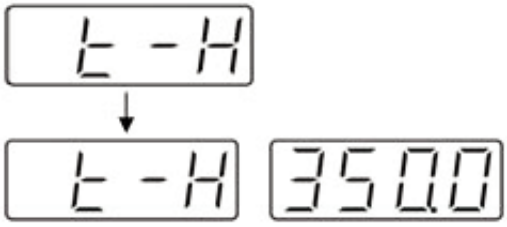
Changing the High Temp Limits (t-H)

Note that the default setting of the high temperature limit [t-h] 350°C. If needed, however, you can set your own temperature limits. If, for example, you want to set the high temperature limit at 200°C, do as follows:

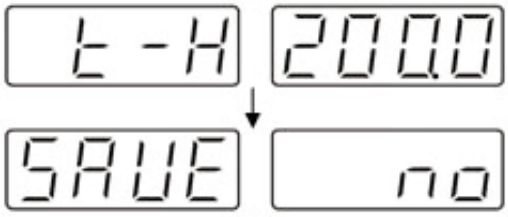
Step 1 : Press the CONFIG Button.



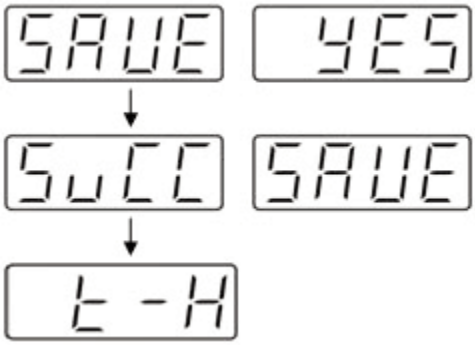
Step 2 : select the temperature limit mode shown below by turning the Stirrer Knob. Press the Stirrer Knob and check the current high temperature limit:



Step 3 : Change the limit to the desired value by turning the Stirrer Knob.

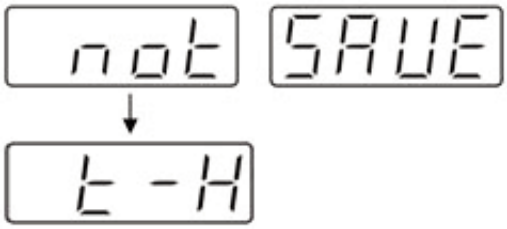


Step 4 : Save the desired limit by using the Stirrer Knob as shown below. [When you need to save the changes]



Changing High Temp Limits (t-H) cont.

If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



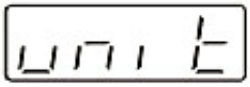
Step 5 : Terminate the configuration mode as describe in Configuration Mode.

NOTICE

- The allowed range of the temperature limit setting is 0°C ~ 350°C.
- After terminating the configuration modes, new temperature setting should be arranged within the range of the temperature limit.

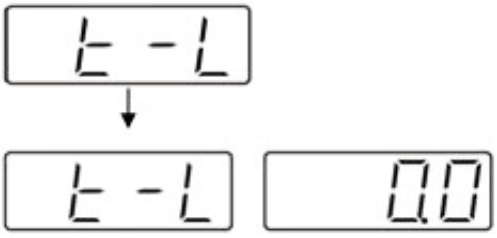
Changing the Low Temp Limits (t-L)

Note that the default setting of the low temperature limit [t-L] 0°C. If needed, however, you can set your own temperature limits. If, for example, you want to set the high temperature limit at 100°C, do as follows:

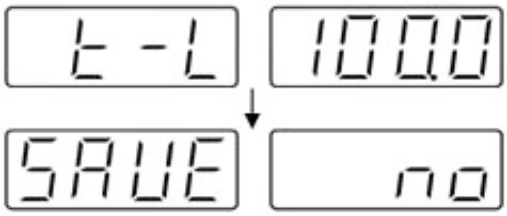


Step 1 : Press the CONFIG Button.

Step 2 : Select the temperature limit mode shown below by turning the Stirrer Knob. Press the Stirrer Knob and check the current low temperature limit:

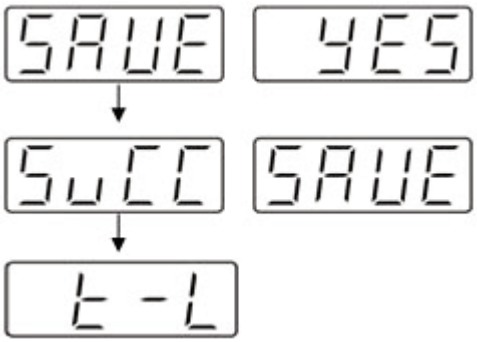


Step 3 : Change the limit to the desired value by turning the Stirrer Knob.

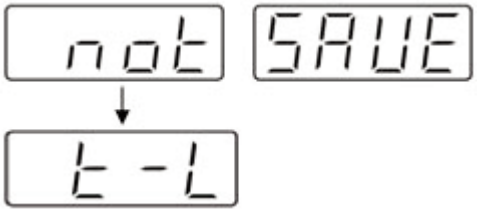


Changing Low Temp Limits (t-L) cont.

Step 4: Save the desired limit by using the Stirrer Knob as shown below. [When you need to save the changes]



If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



Step 5 : Terminate the configuration mode as described in Configuration Mode.

NOTICE

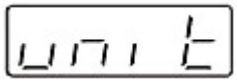
- The allowed range of the temperature limit setting is 0°C ~ 350°C.
- However, low temperature limit [t-L] set point should not be more than high temperature limit [t-H] set point.

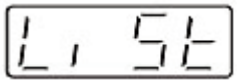
Check Configuration Settings (LISt)

You can check the current configuration settings as follows:

Step 1: Press the CONFIG Button.

Step 2: Select the configuration checking mode [LiSt] shown below by turning the Stirrer Knob.





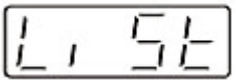
Step 3 : Press the Stirrer Knob and check the current settings by turning the Stirrer Knob.

Check Configuration Settings (LISt) cont.

The default configuration settings are as follows:

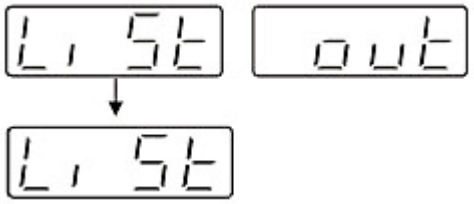
MODE	Default Setting	MODE	Default Setting
Unit	Cels	Time	ti1
OFST/OFSP	0.0	Limt	100.0
t-H	350.0	t-L	0.0
Coef	Opti	Mmin	1

Step 4 : After checking the settings, terminate the checking mode. [Either by pressing RUN/STOP Button]:



[Or by pressing the Stirrer Knob]:

Step 5: Terminate configuration mode as described in Configuration Mode.



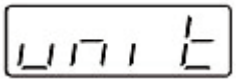
Auto-tuning (PID Parameter Calibration)

The PID parameters for temperature control can be automatically tuned to take your specific operating circumstances into consideration.

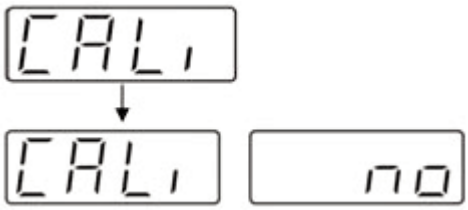
If you select User Mode [Coefficient], the unit will be operated with the auto tuning value.

The auto-tuning (calibration) procedures are as follows:

Step 1 : Press the CONFIG Button.

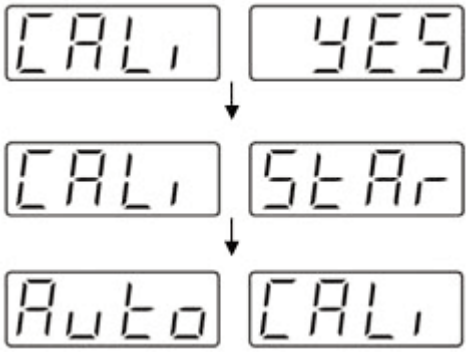


Step 2 : Select the auto-tuning mode [CALi] shown below by turning the Stirrer Knob.



Auto-tuning (PID Parameter Calibration)

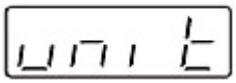
Step 3 : Press the Stirrer Knob and select YES by turning the Stirrer Knob. Press the Stirrer Knob again to start the auto-tuning



Step 4 : Terminate configuration mode as described in Configuration Mode. To cancel the auto-tuning during the process, turn off the main power switch. If cancelled, the Optimal Mode will be selected automatically with an alarm.

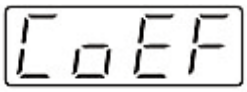
Coefficient (COEF)

Five user-selectable temperature control modes are provided for your convenience.

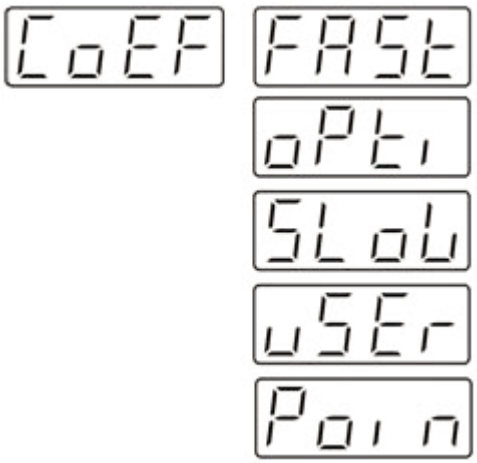


Step 1: Press the CONFIG Button.

Step 2: Select temperature control mode selection [CoEF] shown at right by turning the Stirrer Knob.



Step 3 : Turn the Stirrer Knob to check the five temperature control modes in order. And select the desired mode by using the Stirrer Knob as shown below.



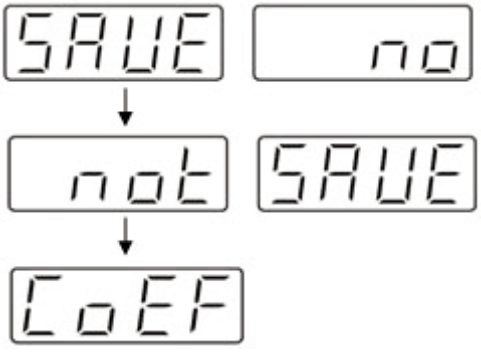
Coefficient (COEF) continued

[User-selectable temperature control modes]

Fast Mode	Provide the fastest heat up time but the widest fluctuation range of temperature overshoot and undershoot
Optimal Mode	Provide the optimal balance between the heat up time to reach the target temperature and the allowed fluctuation range of temperature overshoot and undershoot (factory default)
Slow Mode	Provide the slowest heat up time but the narrowest fluctuation range of temperature overshoot and undershoot
User Mode	Allow auto-tuned parameters to be used for temperature control
Point Mode	Allow linear heating up to the target temperature using the maximum heating rate and switching on and off the heater based on the target temperature (Note that this mode shows the widest fluctuation range of temperature overshoot and undershoot.)

Step 4: Save the desired mode by using the Stirrer Knob as shown at right. [When you need to save the changes]

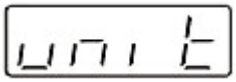
If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



Step 5: Terminate configuration mode as describe in Configuration Mode.

Default (DEFA)

If you want to change the current settings back to the default settings described in Selection of TImer Mode, do as follows:

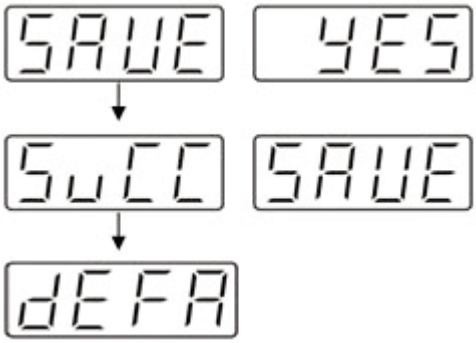


Step 1 : Press the CONFIG Button.

Step 2 : Select the default setting [dEFA] shown below by turning the Stirrer Knob.

Step 3 : Press the Stirrer Knob and confirm the change to the default settings by using the Stirrer Knob as shown below:

[When you need to save the changes]

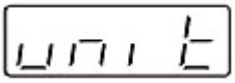


If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]

Step 4: Terminate configuration mode as described in Configuration Mode.

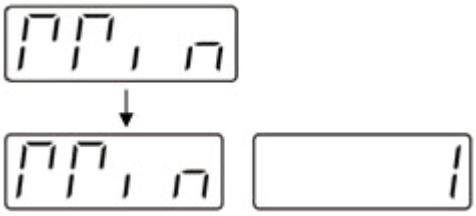
Motor Minimum (Mmin)

You can limit the stirring speed to a certain point by setting the limit of maximum stirring speed. The range of speed adjustable is from 1 to 1000rpm.

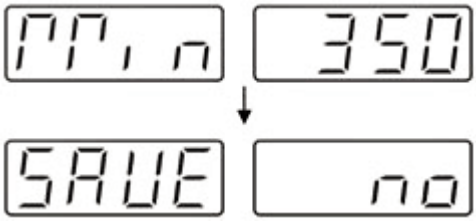


Step 1: Press the CONFIG Button.

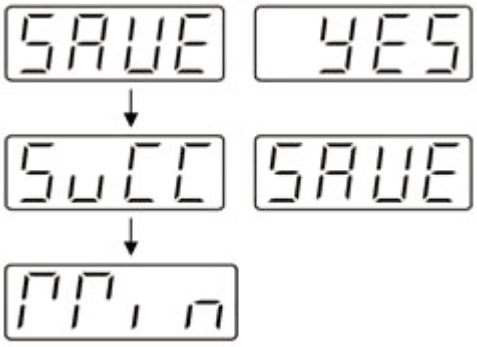
Step 2: Select the Motor Minimum [Mmin] shown below by turning the Stirrer Knob.



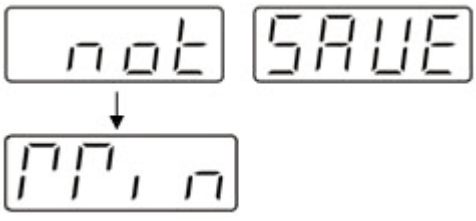
Step 3: Change the limit to the desired value by turning the Stirrer Knob and press the Stirrer knob.



Step 4: Save it by using the Stirrer Knob as shown below.



If you don't want to save it, press the Stirrer Knob when display shows "SAVE NO". [When you don't need to save the changes]



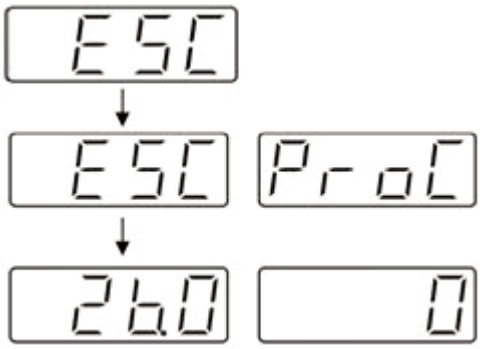
Step 5: Terminate configuration mode as described in Configuration Mode.

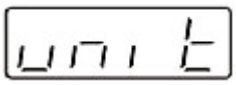
Escape (ESC)

Terminate the configuration mode.

Step 1 : Press the CONFIG Button.

Step 2 : Select and press ESC by turning the Stirrer Knob.





Section 5 Safety Device

(1) High and Low Temperature Limits

The high temperature limit of the top plate is set to 350°C to protect you and your media. However, you can set your own high and low temperature limits to reduce operation time and also to avoid inadvertent mistakes.

(2) If the temperature of the top plate exceeds the set temperature range, the heater will be automatically turned on and off and the Heater LED will be turned on and off accordingly.

(3) Multiple Overheat Prevention Measures (ERROR 1 / ERROR 3)

Built-in overheat prevention circuit will turn off the heater if the plate temperature reaches 450°Cfor any reason. In addition, if the temperature of the main body exceeds 85°C the overheat prevention circuit also stops heating to protect the motor and the PCB. You will be alerted by both audible and visible signals will be activated.

(4) In such cases, turn off the power switch and disconnect the power cord first. Then allow your unit to cool down completely before operating it again.

(5) Hot Top Warning Indicator

The top plate temperature can remain very hot for some time even after the heater is turned off. To prevent injury or fire under such circumstances, this equipment has a hot top warning indicator on the control panel. This indicator will illuminate if the top plate temperature is over 50°C. Even so, do not rely on this indicator alone for your safety.

(6) Temperature Probe Warning (ERROR6,7)

On temperature control mode if the external probe is in the air or is not enough socked into the media, error message will be shown on display and heater will be automatically turned off.

(7) In such cases, turn off the power switch and disconnect the power cord first. Then allow the temperature probe to completely sock into the media(more than 20mm deep) and operate it again.

NOTICE

- If any overheat prevention activates or warning sound is alarming, turn off the power switch and disconnects the power cord first. Then allow your unit to cool down completely before operating it again.

Section 6 Maintenance

Item	Inspection Interval	
	Daily	Weekly
Connection status of power cord or plug	•	
Damages in power cord or plug	•	
Damages or cleanliness of top plate		•
Cleanliness of main body and accessories		•
Damages in external temperature probe, switches, buttons, LED's, dial knobs	•	
Heating capability check (up to 350°C)	•	
Stirring capability check (up to 2000 rpm)	•	
Assembly status of all parts or accessories		•

Cleaning Product

⚠WARNING

- Never immerse this unit in water or any other liquid.
- Do not allow any liquid or wet material to get inside the unit when cleaning.
- Do not reconnect this unit to power outlets until all cleaned surfaces have dried.

⚠CAUTION

- Do not use chlorine bleach, ammonia-based cleaners, abrasives, ammonia, or metal scouring pads when cleaning.
- During cleaning and general operation take care not to scratch the surface of the ceramic-coated top plate as this could result in subsequent thermal breakage.

Cleaning Product (continued)

Always make sure to keep top plate, main body, and accessories clean. Dirt and other foreign substances can cause fire or electric shock. Before attempting cleaning,

- Disconnect the power cord from the power outlet and ensure that the equipment is cool enough,
- Wipe with a soft dry cloth first to remove any foreign matter. If not enough,
- Wipe with a soft damp cloth or a sponge soaked in water or diluted neutral detergent when necessary.

Note that cleaning is much easier if spills are attended to promptly.

Relocation

If you need to move the equipment to another place,

(1) Disconnect the power cord from the power outlet,

(2) Pack the equipment and its accessories into the original packaging or any other suitable container before moving

⚠ CAUTION

- Pay attention to avoid mechanical shock or vibration while moving instrument. Damages caused by mechanical shock or vibration may result in injury or fire.

Keeping Product

If you know you will not use this equipment for an extended period of time,

(1) Disconnect the power cord from the power outlet and

(2) Clean the equipment with soft cloth.

(3) Pack the equipment properly and make sure to store it in dry place.

Section 7 Troubleshooting

Electrical Problems	Cause	Corrective Action
No power	Unsuitable power supply	Meet the electrical requirements of this instrument before use.
	Power cut-off by a circuit breaker or power blackout	Find out why blackout or cut-ff happened and restore power. If there is a short circuit or leakage, trace the source of the problem and fix it.
	Loose power connection	Reconnect the power cord firmly to the power outlet as well as to the power socket at the back of the instrument
	Damages in power cords, power outlets, or plugs,	Replace the damaged part with a proper one.
	Internal circuit failure	Contact Thermo Scientific for service.
Repetitive tripping of circuit breaker	electrical overload	Disconnect all the appliances connected to the breaker first and reconnect them one by one to find the reason for the overload.
	Internal circuit failure	Contact Thermo Scientific for service.
No operation with power on	Power cut-off by built-in overheat prevention circuit	If the main body is overheated, the built-in overheat prevention circuit stops heating to protect the instrument. In such cases, let the instrument cool down for some time before power reconnection.
	Internal circuit failure	Contact Thermo Scientific for service.

Problems During Operation	Cause	Corrective Action
No heat	Failure to push RUN/STOP button	Push RUN/STOP button.
	Set point value is lower than present temperature value.	Adjust Set point lower than Present temperature value.
	Power cut-off by built-in overheat prevention circuit	Turn off the main power switch and wait until the heater cools down. Then, turn on the main power switch.
	Internal circuit failure	Contact Thermo Scientific for service
	Button switch failure	Contact Thermo Scientific for service
No or too slow temperature change during heating	Probe is not enough soaked into the media.	Soak probe into the media more than 20mm of it.
	Too low setting of the heating level	Turn the heater knob clockwise to increase the heating level
	Too much media	Reduce the media volume.
	Internal circuit failure	Contact Thermo scientific for service.
Stir bar decoupling	Too much media	Reduce the media volume or increase the rpm more gradually.
	High viscosity of the media	Increase the rpm more gradually or change the stir bar with a small friction resistance one (ex. cone type).
	Decreased magnetic strength of stir bar	Replace the old stir bar with a new one.
Knocking noise during stirring	Uneven bottom of the vessel	Use a vessel with thin, flat bottom.
	Loosened internal parts	Contact Thermo Scientific for service.
Abnormal speed control operation	Too much media	Reduce the media volume.
	Internal circuit failure or damaged motor	Contact Thermo Scientific for service.
Knob malfunction	Damaged knob	Take out the knob and relocate it. Contact Thermo Scientific for service.
LED display malfunction	Damage due to chemical spill or overheat	Contact Thermo Scientific for service.
Probe lamp is not ON	Probe connection failure.	Reconnect probe in right way.
	Damage due to chemical spill or overheat.	Contact Thermo Scientific for service.

Error Messages

If you see below “Error codes”, turn off the power. Restart after having the unit rest enough.

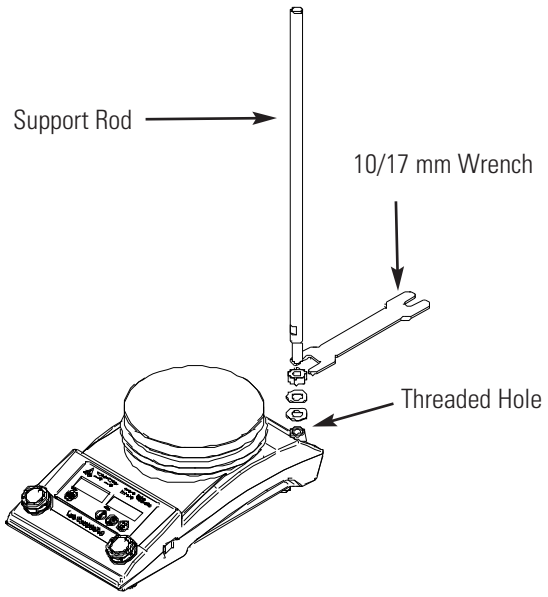
Error code	Cause		Effect
ERRO NO 1	Related to Heater system	if Top plate is overheated	Heater off
ERRO NO 2		if sensor detects a sudden temperature changes	Heater off
ERRO NO 3		if PCB is overheated	Heater off
ERRO NO 4		if sensor is not connected correctly	Heater off
ERRO NO 5		if temperature difference has arisen between two sensors	Heater off
ERRO NO 6	Related to temperature probe	if temperature probe is in the air	Heater off
ERRO NO 7		temperature probe is not soaked enough into media	Heater off

Section 8 Accessories

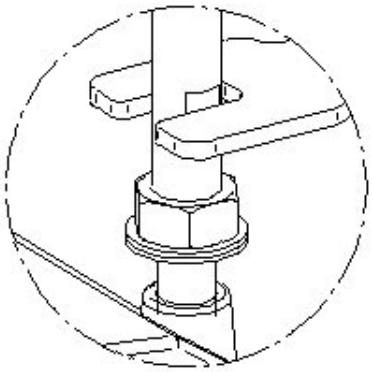
Designation	Order No.	Description
Temperature probe	88880147	Temperature Probe (PT 100, SN-8-4 connector sensor)
Temperature Probe Advanced	88880150	Temperature Probe (PT100, A Class, 400°C)
Heating Bath	88880141	-
Transparent Shield(PC)	88880142	-
Support rod	88880143	M10 (Ø12mm, 400mm, M10)
C-5, Clamp Holder	88880148	C-5 (PP body, Ø12mm)
3 Prong clamp	88880149	60mm grip

Assembly of the Support Rods

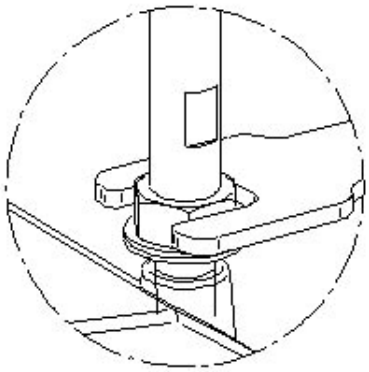
Hand screw the support rod into the threaded hole as shown in the diagram. To firmly tighten the rod, use an 10/17 mm wrench or an adjustable wrench.



Assembly of the Support Rods (cont.)



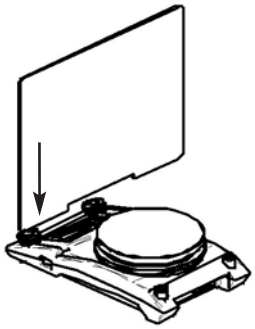
10mm wrench

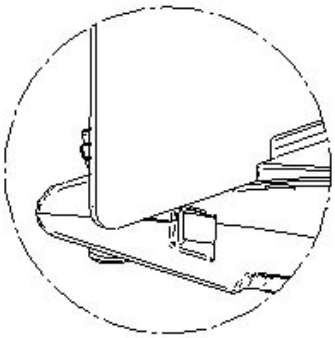


17mm wrench

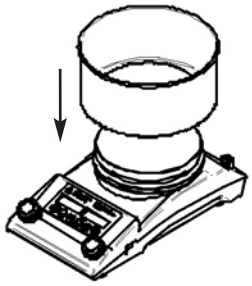
Transparent Shield/ Heating Bath Assy

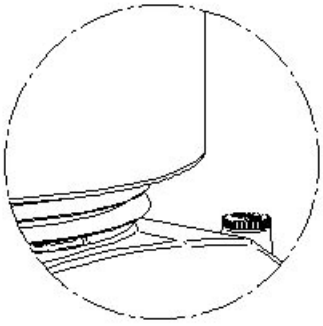
When necessary, the transparent safety shield and/or the non-slip heating bath can be easily assembled as shown below:





Transparent Shield





Heating Bath

Section 9 Technical Specifications

Item / Model		HPS RT2 Advanced
Heater	Heating temperature range (°C/°F)	50 to 350 / 122 to 662
	Heating plate, temperature range, Max. (°C/°F)	350 / 662
	Temperature control mode	PID (optimal, fast, slow)
	Function	Offset, Auto tuning
	Temperature display	up to 350°C, 0.1°C resolution
	Heater output, max. (W)	600
Stirrer	Speed range (Guarantee rpm)	30~2,000
	Speed display resolution (rpm)	1
	Stirring capacity, Max (L/ cu ft, H2O)	20 / 0.7
	Motor type	BLDC
	Magnetic Stir Bar, Max. (Ø x L, mm/ inch)	8 x 40 / 0.31 x 1.57
Probe	Type	PT100, B class
	Accuracy (°C, at 0°C)	±0.3
Timer	2 type, 1min to 99 hrs 59 min	
Safety	Hot top warning	above 50°C
	Overheat Prevention	Top plate, Main body, PCB
Dimension of top plate (Φ, mm)		140
Overall Dimensions (W x D x H, mm)		161 x 290 x 100
Weight (kg/lbs)		2.8 / 6.17
Electrical requirements		230V, 50/60Hz
Current consumption		3A
Electrical requirements		120V, 60Hz
Current consumption		5A
Maximum load (Kg/ lbs)		25 / 55.1
Material	Top plate	Ceramic coated aluminum
	Main body	Aluminum
※ Unless otherwise specified, the above-mentioned data represent values at 25℃ and 60% relative humidity.		
※ Thermo Scientific reserves the right to make changes in design and specification without prior notice.		

Disposing of the Product

Disposing of this equipment must be done in an environmentally responsible way if it has been potentially exposed to bio-agents or radioactive samples. Failure to follow stringent requirements for equipment disposal may lead to actions against you and your organization.

(1) First, check with your laboratory or organization to ensure that you are following all the policies and procedures for disposal of laboratory equipments.

(2) If not possible, contact your local governing body for regulations regarding disposal of laboratory equipments. Thermo Scientific highly recommends you to find a local service provider that can properly dispose of your instrument.

THERMO FISHER SCIENTIFIC STANDARD PRODUCT WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first two (2) years, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. Installation and calibration are not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo Fisher Scientific postage paid and replacement parts are shipped FOB destination.

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Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

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