



Thermo Elite

BH 400
BH 500

Instruction Manual

- Thank you for your purchase of a Yamato Scientific Thermo Elite BH Series product.
- Before using the product, be sure to thoroughly read this operation manual and the warranty. Store these documents in a readily accessible place after reading.

Warning

Before using the product, be sure to carefully read and understand all the important warning items in this operation manual.

Yamato Scientific

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Explanation of picture display

MEANING OF ILLUSTRATED SYMBOLS

Illustrated Symbols Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below.
Be sure that you understand the warnings and cautions in this manual before operating the unit.



If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.



If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

Meaning of Symbols



This symbol indicates items that urge the warning (including the caution).
A detailed warning message is shown adjacent to the symbol.



This symbol indicates items that are strictly prohibited.
A detailed message is shown adjacent to the symbol with specific actions not to perform.



This symbol indicates items that should be always performed.
A detailed message with instructions is shown adjacent to the symbol.

Safety Precautions

WARNING

⊘ Do not use the unit in an area where there is flammable or explosive gas.

Never use the unit in an area where there is flammable or explosive gas. The unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result.

ⓘ Always ground the unit.

Always ground the unit on the power equipment side in order to avoid electrical shock due to a power surge.

ⓘ If a problem occurs, you should:

If smoke or strange odor should come out of the unit for some reason, **turn off** the power key right away, then **turn off** the earth leakage breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result.
Never perform repair work yourself, since it is dangerous and not recommended.

⊘ Do not use the power cord if it is bundled or tangled.

Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

⊘ Do not process, bend, wring, or stretch the power cord forcibly.

Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.

⊘ Do not put the power cord under the desk, chair, etc.,

Do not put the power cord under the desk, chair, etc., or through an object. Fire or electrical shock may be caused.

⊘ Do not run the power cord next to heating equipment such as a heater.

Do not run the power cord next to heating equipment such as a heater. The cover of the cord may melt and fire or electrical shock may result.

⊘ Substances that can not be used.

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in the reservoir of the unit. Explosion or fire may occur.

Safety Precautions

WARNING

 **Do not disassemble or modify the unit.**

Do not reconfigure the unit. Fire or electrical shock may be caused.

 **Do not touch the door during or immediately after operation.**

Do not touch the surface of the reservoir when you run this unit at high temperature. Severe burning injury may be caused due to the high temperature.

CAUTION

 **During a thunder storm . . .**

During a thunderstorm, **turn off** the power key immediately, then **turn off** the earth leakage breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

 **Periodic check of the safety component.**

The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically. (See chapter of independent temperature overheating prevention device on P.25.)

Requirements for installation

When using

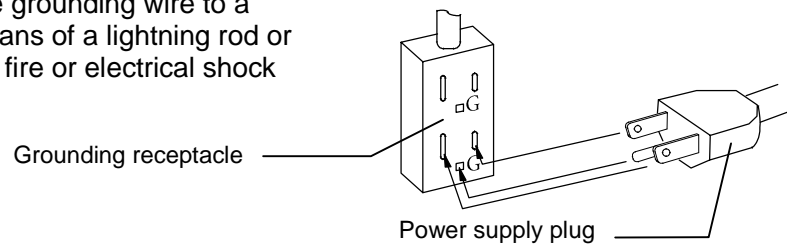
1. Always ground the unit



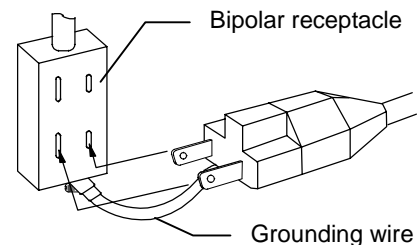
- Connect the Unit's power plug to a receptacle with grounding connectors.
- Do not forget to ground the Unit, to protect you and the unit from electrical shock in case of power surge. Choose a receptacle with grounding connectors as often as possible.



- Do not connect the grounding wire to a gas pipe, or by means of a lightning rod or telephone line. A fire or electrical shock will occur.



- If only bipolar receptacles are available for the unit, connect an optional grounding adapter to the unit's power plug. Check the polarity of the receptacle before connecting the adapter to the receptacle. Connect the adapter's grounding wire (green) to a grounding terminal to the power supply. Contact our sales representative in your vicinity or our service center for additional information or assistance.



- Do not forget to ground the unit, to protect you and the unit from electrical shock in case of power surge.
- Do not connect the grounding wire to a gas pipe, or by means of a lightning rod or telephone line. A fire or electrical shock will occur.

2. Choose a correct power distribution board.



- Choose a correct power distribution switchboard or receptacle that meets the unit's rated electric capacity.

Electric capacity BH400 : AC100V 11A , BH500 : AC100V 13A

- Do not connect the unit to an outlet that differs from the above specifications because a fire or electrical shock will occur.

3. Choose a proper place for installation.



- Do not install the unit in a place where:
 - ◆ Flammable gas or corrosive gas is generated.
 - ◆ Ambient temperature exceeds 35°C.
 - ◆ Ambient temperature fluctuates violently.
 - ◆ There is direct sunlight.
 - ◆ There is excessive humidity and dust.
 - ◆ There are constant vibrations.



- Install the space of 15 or more in the side and the back.

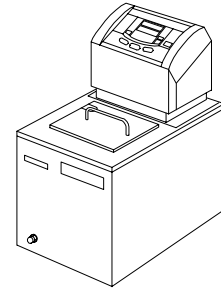
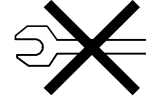
Requirements for installation

When using

4. Do not remodel



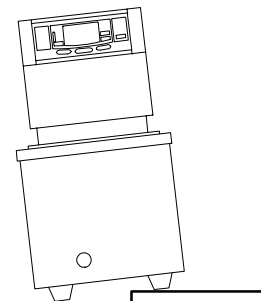
- The remodeling act causes the break-down. Please never do.



5. Install the unit on a level area.



- Do not installation the unit on a non level surface. This will cause hazards to the operator and create problems during actual operation.



6. After installed, you should:



- It may cause injure to a person if this unit falls down or moves by the earthquake and the impact, etc..
- To prevent, take measures that the unit cannot fall down.

7. When you use the liquid and cooling water:

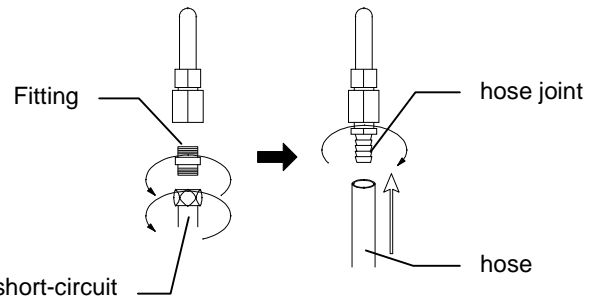


- Do not use the liquid with the explosion and toxicity.
- Do not let cooling flow to the cooling coil when working at high temperatures.
- Do not mix water when you use oil in the reservoir.

8. When you need circulation:



- Detach flexibility pipe or fitting for the short-circuit and install the attached hose joint when you need to circulation at a distance. Connect a hose with the hose joint and secure them with hose clamps not to leak water. When using silicon oil, select a hose to resist silicon oil (e.g. fluorine rubber).



9. When you use liquid, you should



- The liquid poured into the examination tank must use water or the silicon oil.
- It evaporates for water and alcohol, etc. while using .Replenish sometimes.
- Using well water or bad-quality water will cause accumulation of scale and copestone on the heater pump, etc. Be sure to use distilled water or pure water to prevent performance deterioration or malfunction.
- The viscosity must use the one to 50CST at 80 or more about the silicon oil.

| Density of ethanol | | Coagulation point () |
|--------------------|-------|-----------------------|
| Wt % | Vo1 % | |
| 4.8 | 6.0 | -2.0 |
| 11.3 | 14.0 | -5.0 |
| 13.8 | 17.0 | -6.1 |
| 16.4 | 20.2 | -7.5 |
| 17.5 | 21.5 | -8.7 |
| 18.8 | 23.1 | -9.4 |
| 20.3 | 24.8 | -10.6 |
| 22.1 | 27.0 | -12.2 |
| 24.2 | 29.5 | -14.0 |
| 26.7 | 32.4 | -16.0 |
| 29.9 | 36.1 | -18.9 |
| 33.8 | 40.5 | -23.6 |
| 39.0 | 46.3 | -28.7 |
| 46.3 | 53.8 | -33.9 |

10. Do not sprinkle water on the control part and the operation panel

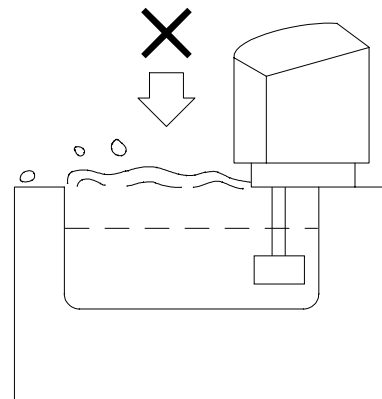


- When water splashes to an internal electrical component, the leak and the electric shock may be caused.
- Do not touch the upper surface in the reservoir when working at the high temperature. Failure to observe this caution may cause scald.

11. Confirmation of safety

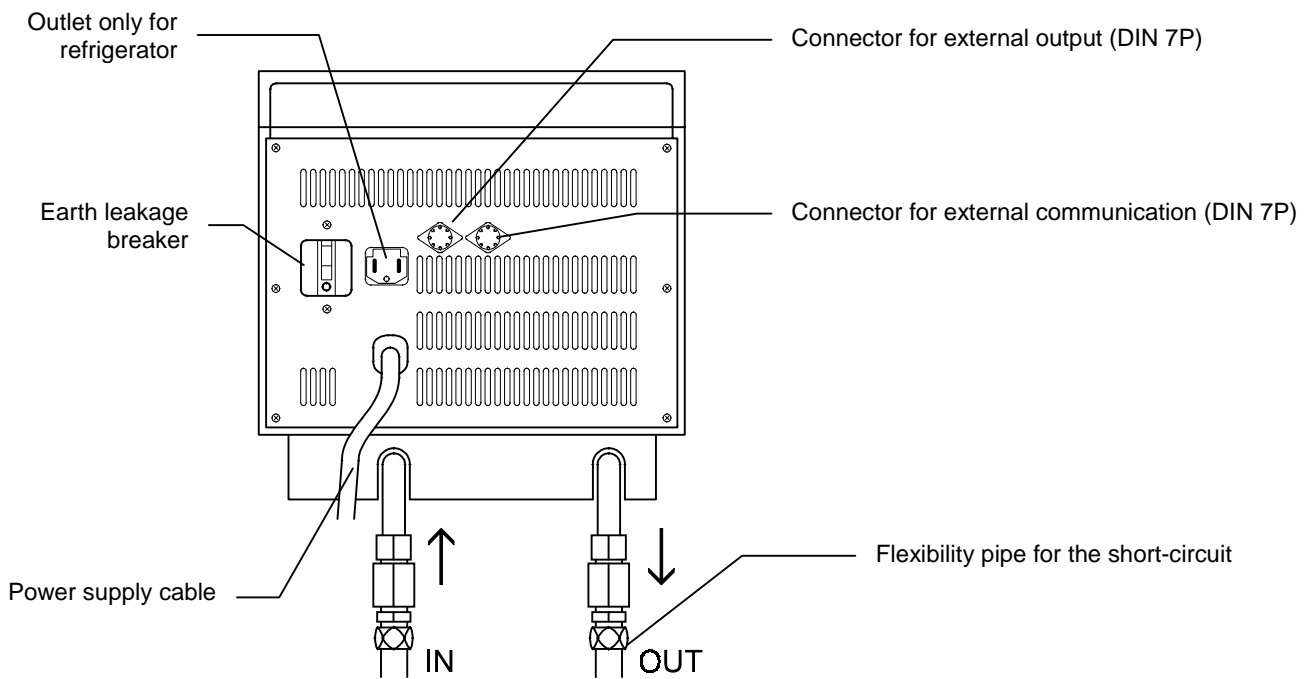
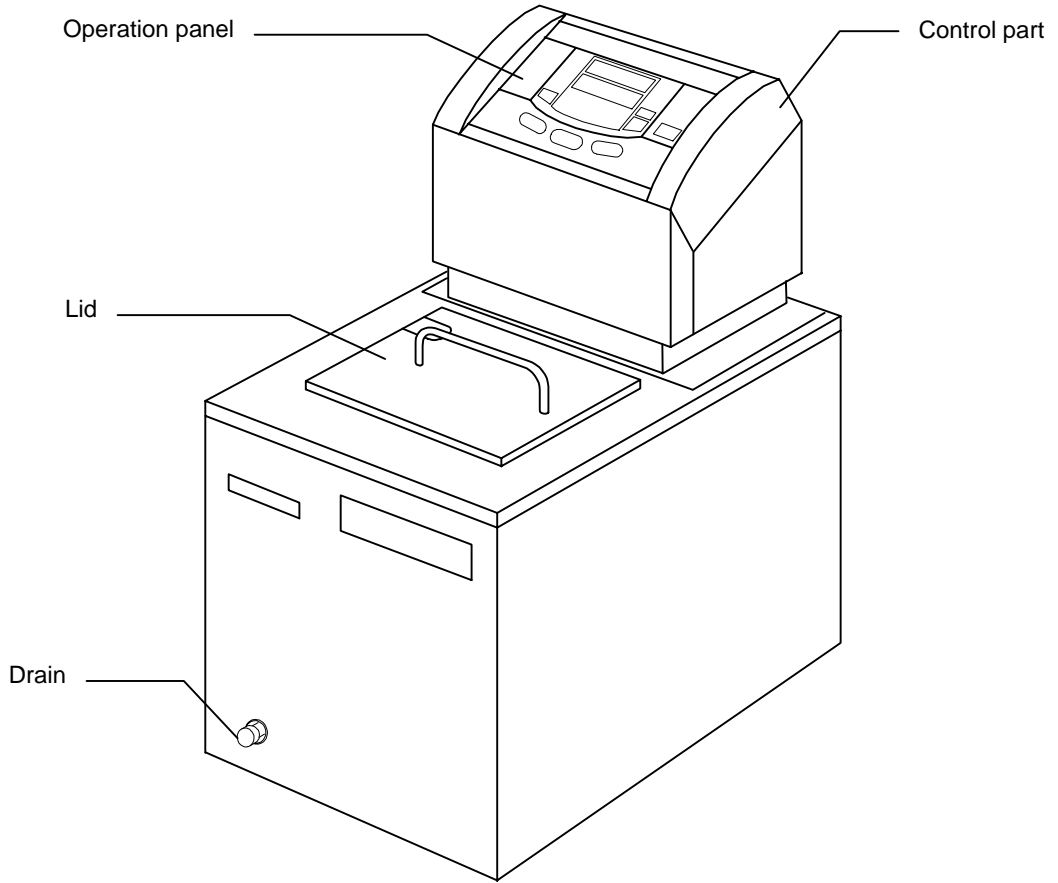


- Turn on the earth leakage breaker.
- Pour the liquid (water) into the reservoir tank.
- Water level should be 3 ~ 5 cm below the upper edge. When circulated at a distance, the water level will go down. Pour the water again into the reservoir to be a fixed water level.
- Be sure whether independent temperature overheating prevention device is set in a temperature which is 15 or more higher than the temperature of the tank used. (BH500)
- Stabilize by using stopper in the bottom in the reservoir when you use the throw type cooling device together.



Description and function of each part

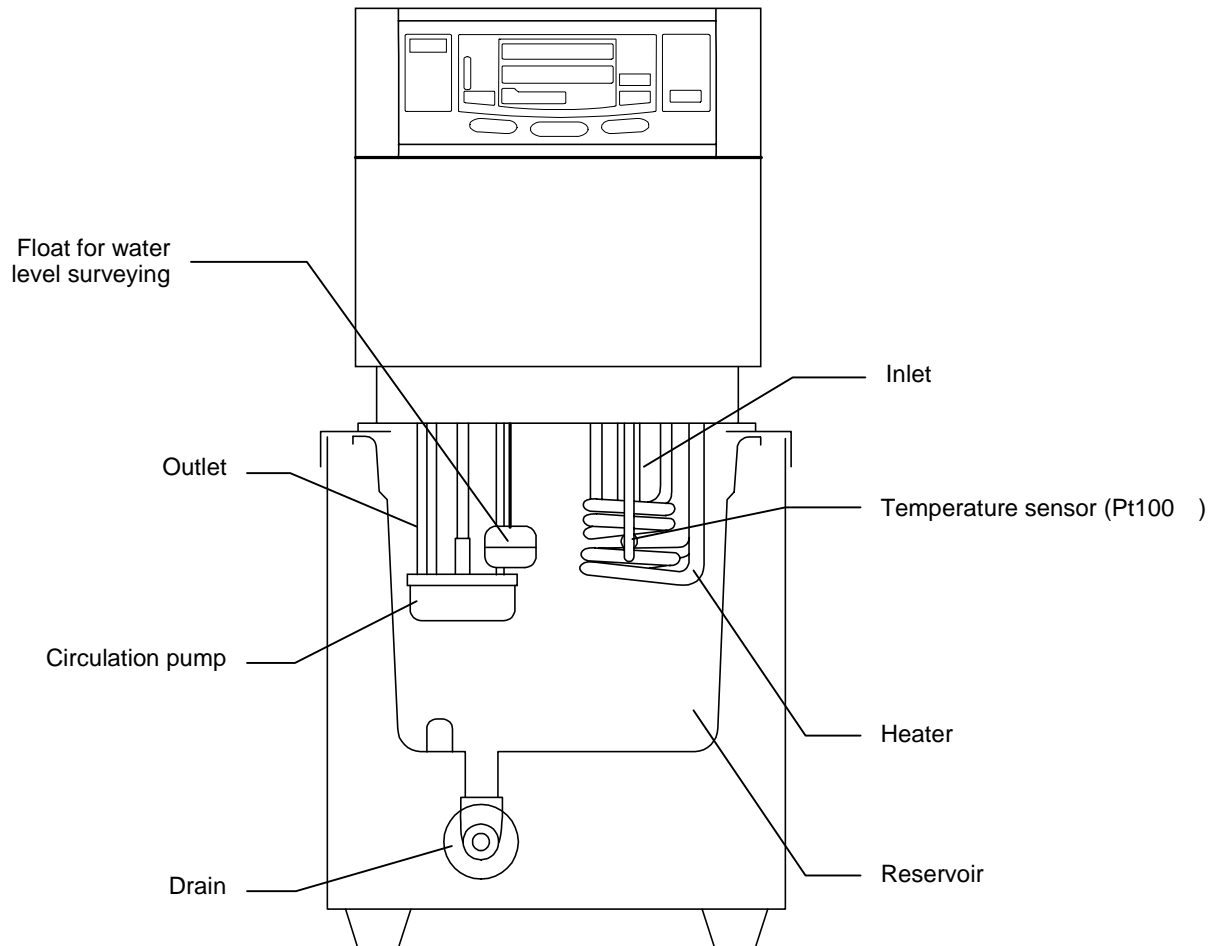
Main unit



The back of control part

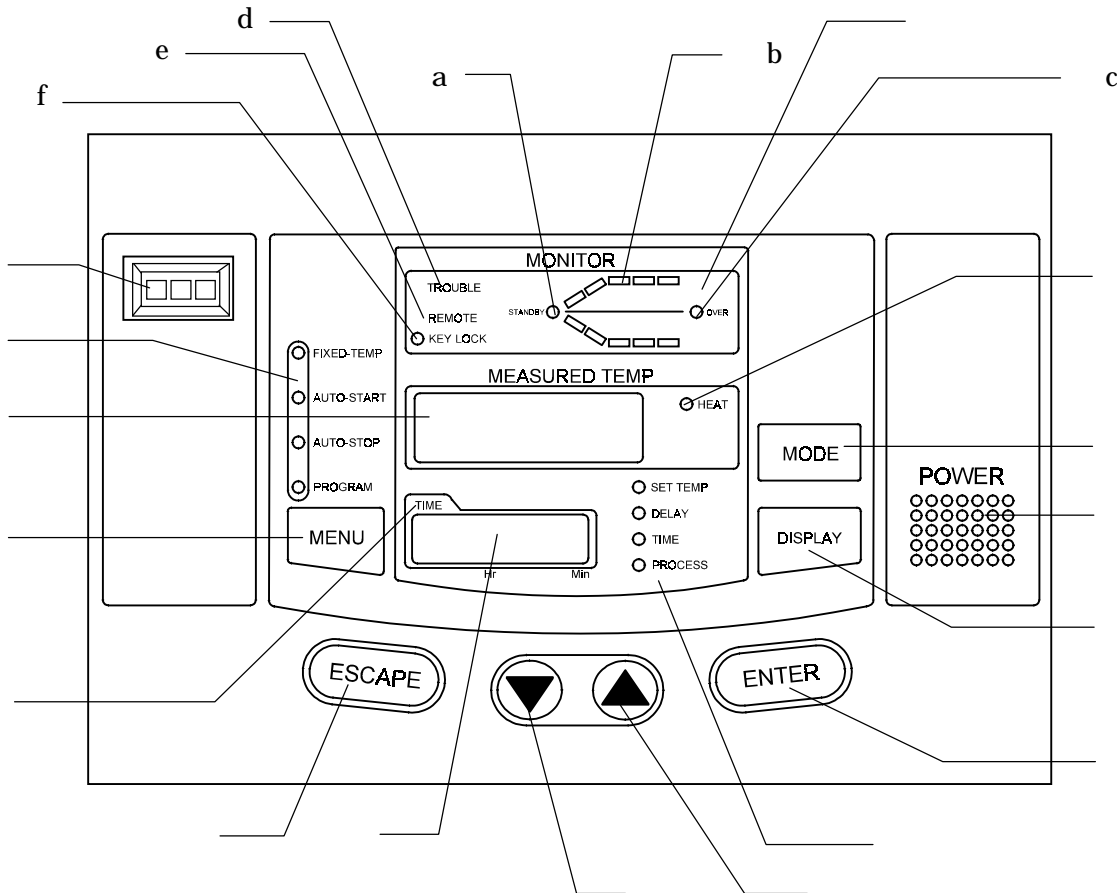
Description and function of each part

Main unit structural chart



Description and function of each part

Control panel



| | |
|---------------------|---|
| POWER key: | Key to change over the controller from the standby mode to the operation mode or from the operation mode to the standby mode. |
| MODE key: | Key to select a function from program input, edit, delete modes, hour/time setting, change-over mode, and other functions. |
| DISPLAY key: | Key to change-over the display content of the sub display (10). Display content is changed over to set temperature, remaining time, hour, execution segment No. |
| MENU key: | Key to select the operation mode. Each mode of fixed temperature, auto-start, auto-stop and program operation can be selected. |
| ENTER key: | Key to determine the input value of set value (temperature, time, hour, etc.), selection mode, execution segment No. etc. |
| / ▼▲(UP/DOWN) key: | Key to change set value (temperature, time, hour, etc.) and to choose a selection from various parameters on the function menu. |
| ESCAPE key: | Key to cancel the latest entry and recover the status that was valid prior to the making the latest selection. |
| Main Display: | It displays temperature measurements, set values (temperature, time, hour, etc.), program information, error information, etc. |

Description and function of each part

Control panel

| | |
|--|---|
| Sub Display: | It displays set temperature, remaining time, current hour and execution segment No. etc. |
| Operation monitor: | It indicates an operation mode. |
| -a STANDBY lamp: | It flashes to indicate that the instrument is in the preoperational standby mode. |
| -b Temperature pattern lamp: | It illuminates to indicate the heat treatment process pattern executed by the controller with flashing light indicating the point currently in execution. |
| -c OVER lamp: | It flashes to indicate the end of auto-stop or program operation. |
| -d TROUBLE indicator lamp: | It blinks when an error is detected and displays the corresponding code for that particular problem. |
| -e REMOTE operation indicator lamp: | It illuminates when the instrument is put into remote operation (optional) and displays the word " REMOTE. " |
| -f KEY LOCK indicator lamp: | It illuminates to indicate that the operation panel key lock function is in operation. |
| Operation menu indicator lamp: | It illuminates to indicate the active operation mode in the operation menu. |
| Sub display menu indicator lamp: | It illuminates to indicate the item (set temperature, remaining time, hour or execution segment) shown in the sub display. |
| HEAT ON indicator lamp: | It illuminates when the heater is on. |
| TIME indicator lamp: | It illuminates when the operation starting time of the auto-start and the operation completion time of the auto-stop is set in the hour setting mode. |
| Independent Temperature Overheating Prevention Device: | Setting the instrument to the operational temperature of the independent over rising prevention. |

attention : Operate according to the following procedures when the preparation for the operation is complete.

1. Turning on of power supply

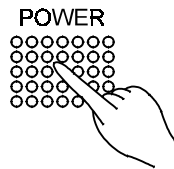
Turn on the leak breaker in the back of the controller.



The lighting display is done by a sub display at present time.



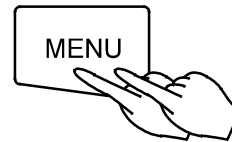
Push the POWER key in the operation panel.



This machine becomes a stand-by state by turning on the power supply. Under such a condition, it is possible to shift to all operation modes by pushing the MENU key.

2. Selection of operation menu

Press the MENU key several times to select desired operating method.



It allows you to enter each parameter into a flashing menu.

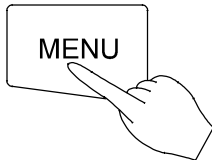
3. Explanation of operation menu

- Fixed temperature : It is a drive method of setting the temperature of the target and keeping the temperature constant.
- Auto stop : It is a drive method of stopping the state that a fixed value is driven at arbitrary after time passes or clock time.
- Auto start : It is a drive method the fixed value drive's beginning at after arbitrary time passes or clock time.
- Program : The operation is begun and is stopped at after arbitrary time passes or clock time. Moreover, the temperature can be changed at arbitrary set time and it be repeated.

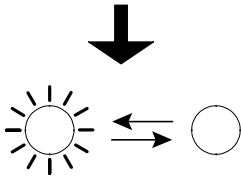
Fixed temperature operation instructions

1. Selection of operation menu

Push the MENU key and select the fixed temp



The MENU key is pushed.



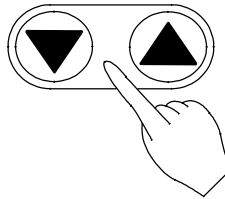
The indicator of the FIXED TEMP blinks.



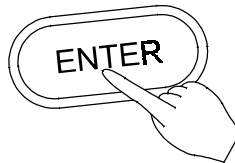
The temperature set last time is blinking and enters the state that a set temperature can be input in a sub-display.

2. Input of set temperature

Push the ENTER key after making a sub-display display an arbitrary set temperature pushing keys.



Press ▲▼ keys several times.
A sub-display is made to display the hoping set temperature.

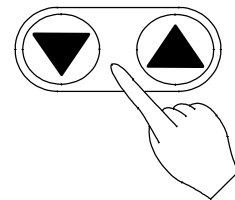


The ENTER key is pushed.

The fixed temperature operation is begun.

3. Change in set temperature when fixed temp operation is being driven

Push the ENTER key after making a sub-display display an arbitrary set temperature pushing keys.



Press ▲▼ keys several times.
A sub-display is made to display the hoping set temperature.



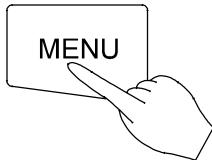
The ENTER key is pushed.

The fixed temperature operation in the temperature newly set is begun.

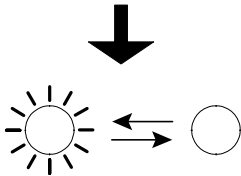
Auto start operation instructions

1. Selection of operation menu

Select an AUTO START pushing the MENU key.



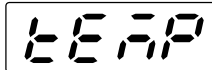
The MENU key is pushed.



The operation menu indicator of an AUTO START blinks.

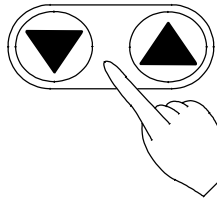


The sub-display displays TEMP allowing you to enter set temperature.

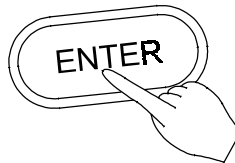


2. Input of set temperature

Make a main display display an arbitrary set temperature by pushing \blacktriangle and \blacktriangledown keys and push the ENTER key.



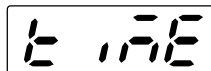
Press \blacktriangle and \blacktriangledown keys several times. A main display is made to display the hoping set temperature.



The ENTER key is pushed.

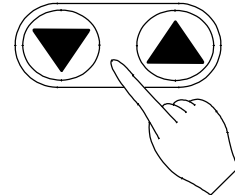


Sub-display displays TIME allowing you to enters when to begin the operation.



3. Input of time

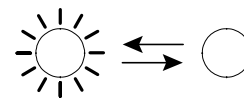
Press \blacktriangle and \blacktriangledown keys to blink start time (or clock time) on the main display, and press the ENTER key.



Press \blacktriangle and \blacktriangledown keys several times. A main display is made to display the hoping set time.



The ENTER key is pushed.

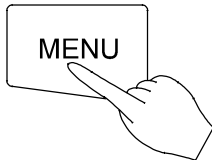


The STANDBY indicator of the operation monitor blinks on standby waiting for starting operation. The operation is begun after the set time passes.

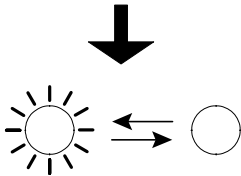
Auto stop operation instructions

1. Selection of drive menu

Select an AUTO STOP pushing the MENU key.

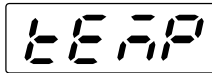


The MENU key is pushed.



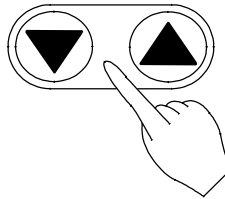
The menu indicator of an AUTO STOP blinks.

It is displayed in a sub-display as TEMP and enters the state that a set temperature can be input.

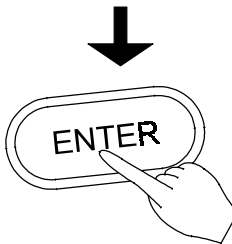


2. Input of set temperature

Make a main display display an arbitrary set temperature pushing keys and push the ENTER key.

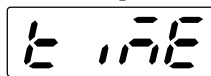


Press ▲▼ keys several times. A main display is made to display the hoping set temperature.



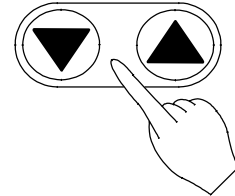
The ENTER key is pushed.

Sub-display displays TIME allowing you to enter when to end the operation.

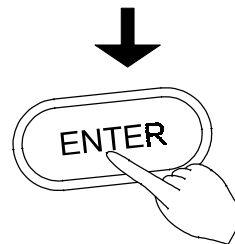


3. Input of time

Press ▲▼ keys to blink stop time (or clock time) on the main display, and press the ENTER key.

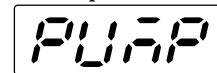


Press ▲▼ keys several times. A main display is made to display the hoping set time.





The ENTER key is pushed.

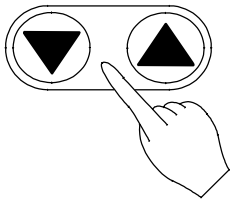
The sub-display displays PUMP allowing you to select pump status after time is up.





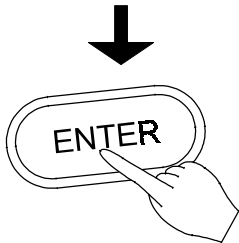
Auto stop operation instructions

4. Setting pump operation status

Press   keys to indicate pump status (ON or OFF) on the main display after operation stop. Push the ENTER key afterwards.

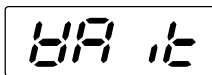


Press   keys several times. A main display displays ON or OFF.





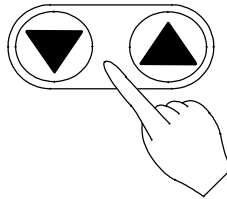
The ENTER key is pushed.



The sub-display displays WAIT allowing you to set the wait function.

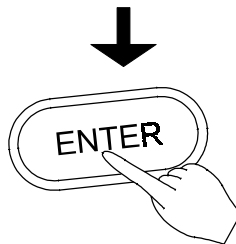
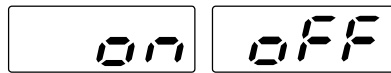


5. Selection of wait function

Press   keys to indicate waiting function (ON or OFF) on the main display. Then press ENTER key.



Press   keys several times. A main display displays ON or OFF.



The ENTER key is pushed.

The sub-display displays WAIT allowing you to set the wait function.

Count time

The timer of an auto stop starts to count down at the following.

When the wait function is turning on



It starts when set temperature has reached target value.

When the waiting function is OFF or when stop time is set in clock time.

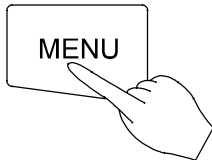


It starts right after the auto stop operation is started.

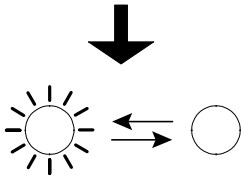
Programmed operation instructions

1. Selection of operation menu

Select the PROGRAM pushing the MENU key.

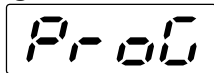


The MENU key is pushed.



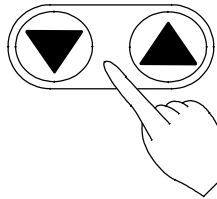
The operation menu indicator of the PROGRAM blinks.

PROG is displayed in a sub-display allowing you to input the execution program number.



2. Input of execution program number

Press \blacktriangledown keys to indicate an desired program number on the main display, and press the ENTER key.



Press \blacktriangle \blacktriangledown keys several times. A main display displays the program number.

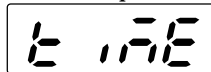
ATTENTION
If the program does not exist, ----- is blinking. Please create the new program.



The ENTER key is pushed.

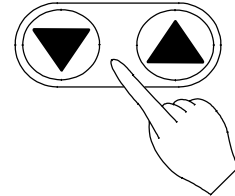


Sub-display displays TIME allowing you to enter when to end the operation.



3. Input of time

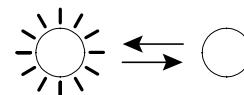
Press \blacktriangle \blacktriangledown keys to blink start time (or clock time) on the main display, and press the ENTER key.



Press \blacktriangle \blacktriangledown keys several times. A main display displays the hoping set time.



The ENTER key is pushed.



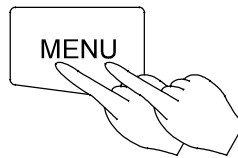
The standby indicator on the operation monitor blinks waiting for programmed operation to start. The operation begins after the set time passes.

To switch to other operation modes while operating

This machine can be switched to other operation modes without stopping operation (seamless operation change).

Selection of operation menu

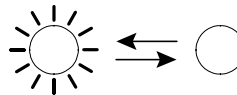
- During operation in a certain mode, press the MENU key to blink another operation menu indicator. In this time the operation menu indicator of current operation remains lighting.



Press MENU key several times.



- This status allows you to enter each parameter into blinking or lighting operation menu.



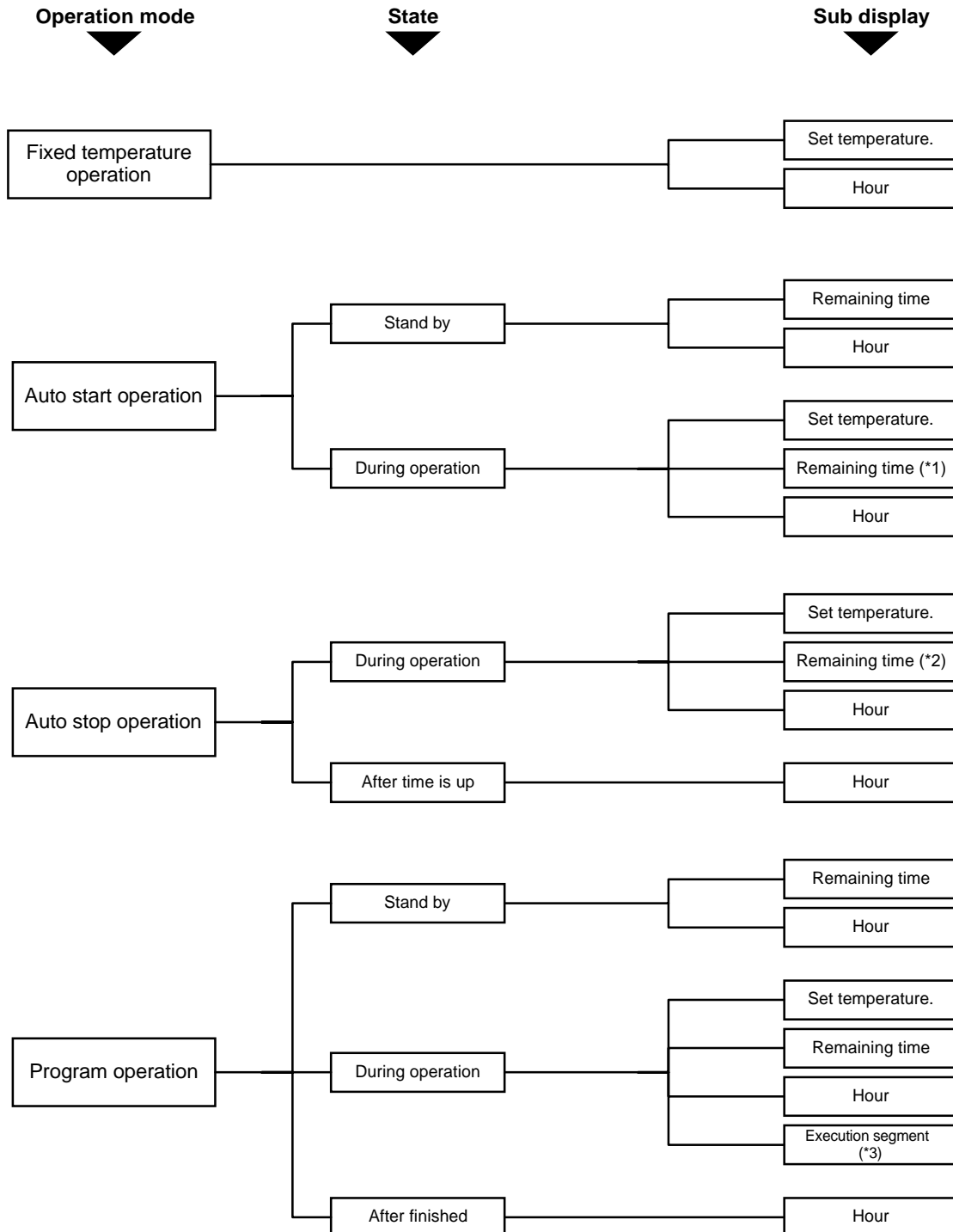
The indicator blinks or lights.



- The subsequent operation procedure is the same as the operation procedure of each mode.

Method of using DISPLAY key

The display content of the sub display can be changed over by turns when pushed the DISPLAY key.







*1: HOLD is displayed.

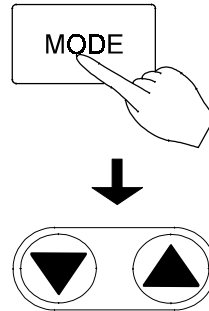
*2: When the wait function is set to on,  is displayed in the waiting status.

*3: The DISPLAY key will enable to show the rest of the repeat count while the repeat operation.



Content of function menu

An undermentioned function is equipped in this machine. Use of these functions is initiated by MODE key.

Press the MODE key and display your desired function on the main display by pushing either the  key or the  key. Each function will appear by turns whenever pushing the  keys. The menus can be brought up one by one with  keys.




Press the MODE key.

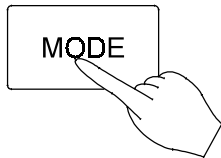
Select the function by pushing either the  key or the  key.

| Main display | Function | |
|--------------|--|---|
| <i>PUMP</i> | Strength setting of circulating pump | It is a function to set strength of circulating pump by the kind of the liquid and the humidity region examination purpose, etc. in the tank. |
| <i>comL</i> | Communication lockout | It is a function to select whether to respond to it when there is a communication demand from the host computer connected via the communication interface. |
| <i>clock</i> | Setting at date and time | It is a function to set a present date and time. |
| <i>Pr oG</i> | Program edit | It is a function to input and to edit the drive program. |
| <i>delP</i> | Program deletion | It is a function to delete the program of the current which became unnecessary. |
| <i>t ime</i> | Switching between duration and clock time. | This function is used to select either clock time setting or duration setting, for example, in auto start mode etc. When the product is shipped, duration is set. |
| <i>Lock</i> | Setting and release of key lock | It is a function to invalidate input to the key and to prevent the mis-operation. |
| <i>beep</i> | Warning buzzer | It is a function to select whether to operate the warning buzzer when abnormality occurs. |
| <i>Accñ</i> | Display accumulated time | This function displays accumulated time of POWER key on state in the range from 0 to 49999. |
| <i>Hold</i> | Hold | It is a function to interrupt the passage of set time. |

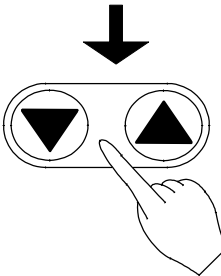
Strength setting of circulating pump


1. Function menu selection

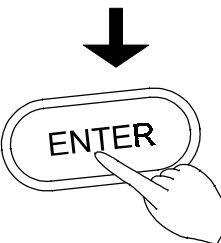
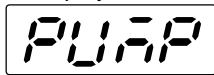
First of all, Push the MODE key. Next, Make a main display display PUMP with  keys and push the ENTER key.



The MODE key is pushed.



Press  keys several times.
A main display is made to display PUMP.

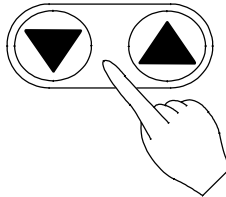



The ENTER key is pushed.

Sub-display displays PUMP allowing you to set strength of circulating pump to a sub display.

2. Set input

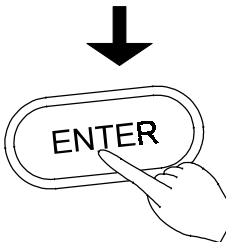
Make a main display blinking display arbitrary strength by pushing keys and push the ENTER key.



Press  keys several times.
A main display displays strength of the pump.

ATTENTION

Strength of the pump is 1-10.
10 is strongest circulation strength.



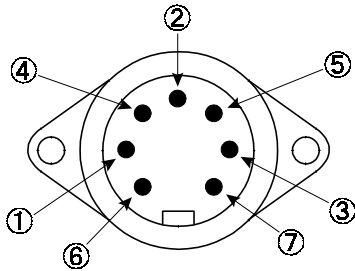
The ENTER key is pushed.

Usage of external output

attention : The program method, the set method, and the communication interface are described in detail to the appended owner guide only for the controller. Refer to it.

1. Specification of connector

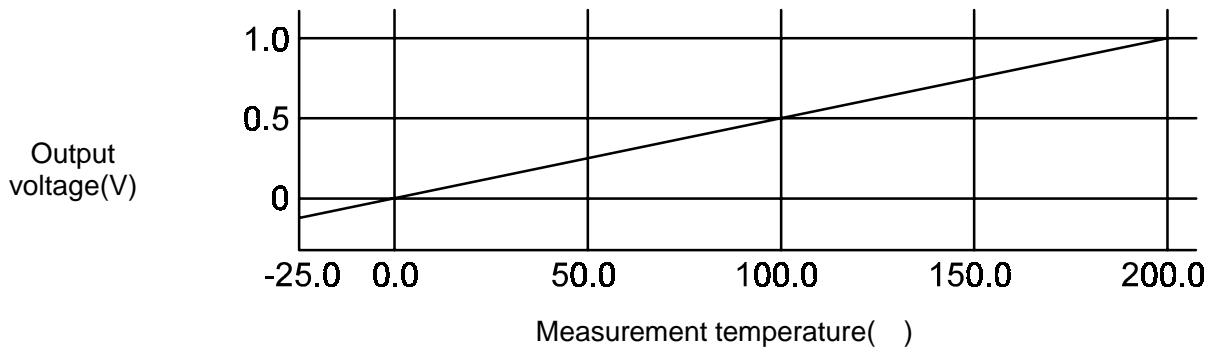
From the back of Thermo Elite



| Pin number | Name of signal |
|------------|--|
| | DC+12V |
| | Time-up output(open collector) |
| | DC+12V |
| | External warning output (open collector) |
| | Temperature output (+) |
| | Temperature output (-) |
| | Shield (analog signal) |

2. Notes concerning liquid used

- Unit of output voltage : 5mV/
- The output is 0mV at 0 in measurement temperature.



3. External warning output

- Transistor open collector output

| | |
|---|--|
| Output load | Power supply DC12V |
| sink current | MAX 100mA |
| Specification of out-put relay | MATSUSHITA JAI-F-TM-DC12V / OMRON G2R-1A-T DC12V |
| TROUBLE sign (Blink to a main display the error code) | |
| External warning output | |

4. Time-out output

- Transistor open collector output

| | |
|--------------------------------|--|
| Output load | Power supply DC12V |
| sink current | MAX 100mA |
| Specification of out-put relay | MATSUSHITA JAI-F-TM-DC12V / OMRON G2R-1A-T DC12V |
| Blink to the FI-NISH indicator | |
| Time-out output | |

Behavior after Power Restoration

in case of auto return

In case of power failure during operation, the controller resumes the following operations after the power restoration.

1. In case of power failure during the program operation

The controller automatically resumes the program operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows F. 00.

The timer built-in the controller does not count as running time for a period of power failure.

2. In case of power failure during the Auto-Stop operation

The controller automatically resumes the Auto-Stop operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature after the power restoration, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows F. 00. (Forced Wait)

In case that the operation stop time is set in a period of time, the timer built in the controller does not count as running time for a period of power failure. On the contrary, in case that the operation stop time is set in hours, the timer built in the controller counts as running time for a period of power failure.

When the operation stop time reaches during power failure, the controller stops running just after the power restoration.

3. In case of power failure while the controller is in standby condition

In case that the operation start time is set in a period of time, the timer built in the controller does not count as standby time for a period of power failure. On the contrary, in case that the operation start time is set in hours, the timer built in the controller counts as standby time for a period of power failure.

When the operation start time reaches during power failure, the controller starts running just after the power restoration.

4. In case of power failure during the fixed temperature operation and a soak period of the Auto-Start operation

The controller resumes running toward to the preset temperature after the power restoration.

5. Notes

The BH series of a standard specification automatically restarts the drive when fed power again after blacking out.

Safety device and error code

The self-diagnosis function built into by the controller and the independent safety device from the controller are installed in this machine. The table below shows the cause and the processing method when the safety device operates. When the safety device operates, the error code is displayed to a main display. Deal with it according to the processing method shown here.

| Safety device | Display | Cause and counter-measures | Notes |
|---|---|--|---|
| Earth leakage breaker with over current protector | No display | Report to our service office and check the cause of problem. | |
| Motor thermal protector | No display | Overheating of motor: Report to our service office. | |
| Automatic overheat protector. | No display | Heating of samples: Reduce the amount of the sample. | |
| Sensor malfunction detector | TROUBLE lamp flashes <i>Er.01</i> flashes | Break in temperature sensor circuit: Report to our service office. | |
| Triac short-circuit detection | TROUBLE lamp flashes <i>Er.02</i> flashes | Short-circuit of Triac: Report to our service office. | |
| Heater short-circuit detection | TROUBLE lamp flashes <i>Er.03</i> flashes | Heater circuits disconnected: Report to our service office. | |
| Independent temperature overheating prevention device | TROUBLE lamp flashes <i>Er.07</i> flashes | Incorrect setting of independent temperature overheating prevention device: Set correctly. | BH500 and the machine equipped with independent temperature overheating prevention device |
| | | Heating of samples: Reduce the amount of the sample. | |
| | | Malfunction of the independent temperature overheating prevention device: Report to our service office. | |
| Main relay defect detection | TROUBLE lamp flashes <i>Er. 10</i> flashes | Malfunction of main relay Report to our service office. | |
| Water level abnormality detection | TROUBLE lamp flashes <i>Er.20</i> flashes | Decrease in water level: Supply water. | The unit resume to working when liquid level becomes normal. |
| | | Rise of water level (thermal expansion): Decrease liquid from reservoir. | |
| | | Malfunction of water level detector: Report to our service office. | |

Warning

1. Never disassemble and modify this unit.



- Do not disassemble the unit.
- If the unit is disassembled, an electric shock and problems may be caused.

Caution

2. Maintenance Precautions



- Before starting inspection or maintenance, disconnect the power plug from the receptacle.
- Conduct inspection and maintenance only after the unit has cooled down.
- When you remove dirt or stains from the unit's resin parts and the control panel, use a soft wet cloth. Do not use benzene, thinner, cleanser or a hard brush; it will cause deformation, qualitative deterioration and/or discoloring of the components.

3. Monthly inspection



- The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically. (See chapter of **Operation check of independent temperature overheating prevention device** on this page)

4. Operation check of independent temperature overheating prevention device



- After executing the fixed temperature operation at the set temperature 0°C, set the operation temperature of the Independent Temperature Overheating Prevention Device to 0°C.
- Under normal circumstances, the heater circuit is cut off in a few seconds and the **TROUBLE** lamp and *E-07* flashes at the same time, and the alarm buzzer sounds if the alarm buzzer function is ON.
- After confirming, turn off the earth leakage breaker once, and then return the setting of the Independent Temperature Overheating Prevention Device to the proper value. Turn the earth leakage breaker back ON.
- Always perform inspection before a long continuous operation or an unattended operation.

Caution

1. When you dispose of the unit



- Do not leave this unit where children can access.

2. when you do not use the unit for a long period of time



- Turn off the power supply and pull out the power supply plug.
- Pull out the liquid in the examination tank.
- Dust must not enter when you use the silicon oil.
- Do the lid to the examination tank or transfer the liquid to a fixed container.

After service and warranty

If a service call is required:

1. If a Service Call is required

- If a problem occurs with this unit, record the error code on the display and stop the operation immediately, turn off the power switch, and disconnect the power plug from the receptacle. Contact our sales or service representative.
- Check the warranty card or the name plate of your water bath and give us the information below.
 - ◆ Model of your unit;
 - ◆ Serial product number of your unit;
 - ◆ Date of purchase; and
 - ◆ Problem with your unit (as detailed as possible).

2. Warranty Card (attached to your Unit)

- Please fill out completely and return the bottom portion of the warranty card when the unit is received. The completed top portion is your Registration Card that should be retained for your records.
- Warranty period is one (1) year after the date of your purchase. During this warranty period, we will offer free repair service on the basis of the conditions provided on the warranty card.
- If you need repair service after expiration of the warranty period, contact our sales or service representative in your vicinity or service office for advice.

3. Warranty Card (attached to your unit)

- Repair parts will be available for at least 7 years after termination of our production of the BH series. Repair parts mean the parts that are necessary to maintain the performance of the units.

Troubleshooting

| Problem | Cause/Solution |
|---|---|
| No display of current hour in the sub-display at the activation of the circuit breaker. | <ul style="list-style-type: none">◆ Check if the power cable is firmly connected to a receptacle.◆ Check for power failure. |
| Temperature fluctuates during the operation | <ul style="list-style-type: none">◆ Does ambient temperature fluctuate violently?◆ Are there too many samples in the chamber?◆ Are the samples too moist? |
| It takes too much time for temperature to rise. | <ul style="list-style-type: none">◆ Are there too many samples in the chamber? |

Specification table

| | BH400 | BH500 |
|---|--|---|
| Range of temperature setting () | -30.0 ~ +120 | -30.0 ~ +220 |
| Range of operation temperature () | Ambient temperature +10 ~ 100 | Ambient temperature +10 ~ 200 |
| Temperature stability () | ± 0.01 ~ 0.02 (Water, at ambient temperature +15 ~ 80 , RT25 , No-load) ± 0.05 ~ 0.1 (silicon oil , KF96 / viscosity:50cs , liquid temperature at 70 ~ 200) | |
| Pump capacity | Max. pump head : 3(mH ₂ O), Max. stream flow : 20 (ℓ /min) (Refrigerant : Water , Water temperature : 25) | |
| Temperature adjustment machine | IV-CR type controller (Zero crossover switching, PID microprocessor control) | |
| Sensor | Pt100 class A (three line type) | |
| Temperature set method | Digital setting depending on keys | |
| Temperature display method | Digital on a main display (A set temperature is displayed to a sub display) | |
| Resolution of setting and display temperature | 0.1 | |
| Other displays | Drive monitor (represents the state of control) | |
| Timer function | 1 minute to 99 hours 59 minutes , 100 hours to 999 hours | |
| Timer resolution | 1 minute or 1 hour | |
| Drive function | Fixed temperature drive, Auto start drive, Auto stop drive, Program drive : Arbitrary pattern, Max.16 segment (repetition and ramp operation, etc.) | |
| Other incidental functions | <ul style="list-style-type: none"> • Memory backup • Key lock • Multiplication time function (up to 49999 hours) • Holding • Function that enable to change the strength of jet stream (10 step changeability) • Calendar timer • Clock • Analogue external warning output • Time-up output • External communication (RS422A correspondence) <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="font-size: 2em;">}</div> <div>Output terminal (7 pin connector)</div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="font-size: 2em;">}</div> <div>Communication terminal (8pin connectors)</div> </div> | |
| Heater (made of SUS) | 1.0kw | 1.2kw |
| stirring mechanism | Stirring by jet stream | |
| Other compositions | Drain (with plug) , Stainless flexibility tube with heat insulation , Inlet for Immersion cooler (BE series) , cooling coil (O.D 9.5mm) | |
| Safety device | <ul style="list-style-type: none"> • Earth leakage breaker • The float type High/Low liquid level detector (Low level only for BH400) • Self-diagnosis function (Automatic overheat protector, The sensor is abnormal, Heater disconnection, Triac short-circuit, Main relay is defective, Buzzer warning in abnormal circumstances, The refrigerator is abnormal) | |
| | none | • independent temperature overheating prevention device (BH500) |
| Capacity of reservoir (ℓ) | 13 | |
| Size of reservoir (W × D × H mm) | 389 × 226 × 150 | |
| The outside size (W × D × H mm) | 654 × 492 × 615 | |
| Power supply | AC100V 11A | AC100V 13A |
| Standard attached goods | Stainless hose entrance for external circulation (Rc1/2 × Outside diameter 14mm) × 2 | |
| Attached goods outside standard | <ul style="list-style-type: none"> • Digital printer • By-pass tube for external circulation, Insulated hose for external circulation • Cable for external communication, Personal computer connection interface, (RC23), Multi wick cable for output (All model commonness) • independent temperature overheating prevention device (for BH400) | |

Chart of connecting wires

BH400

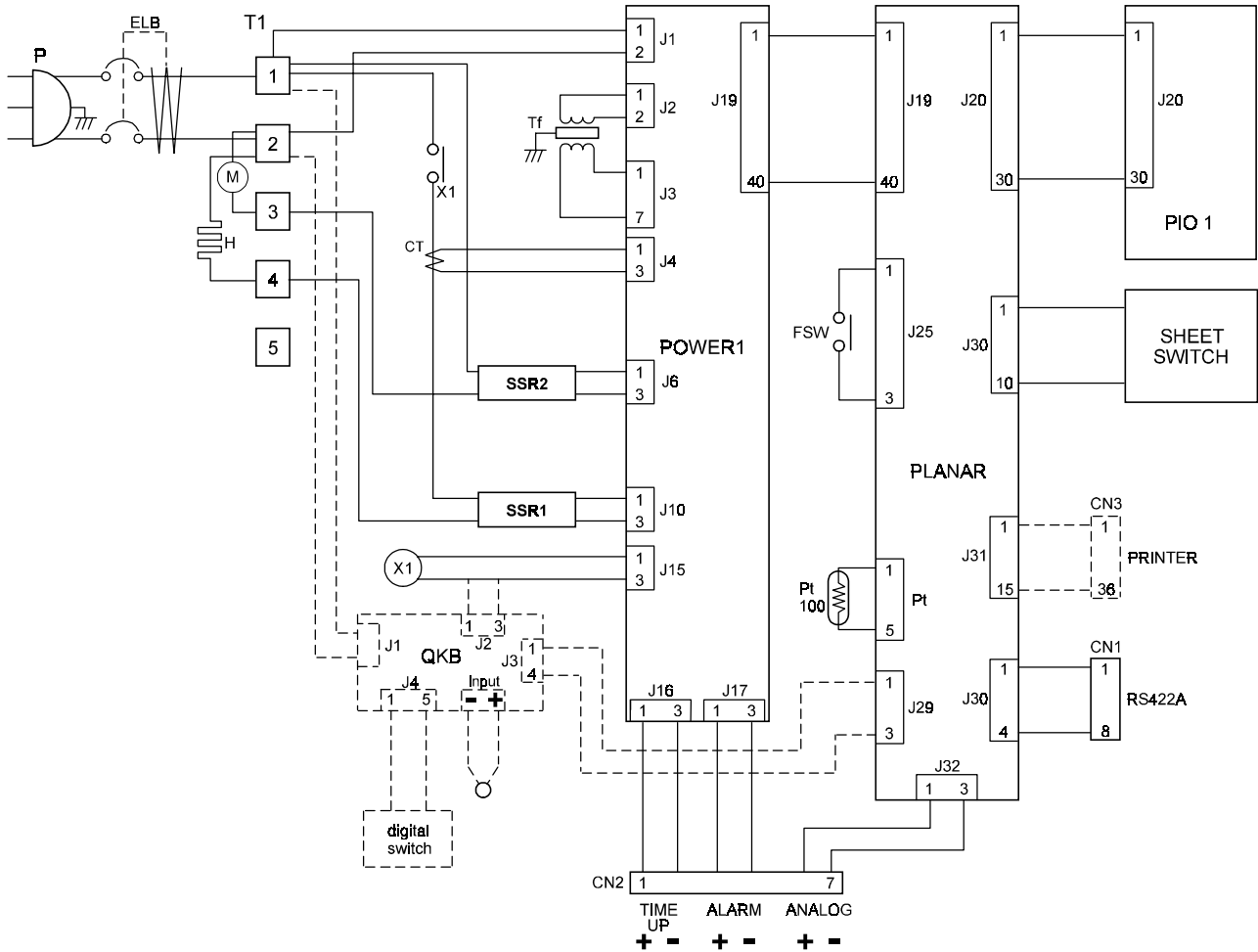
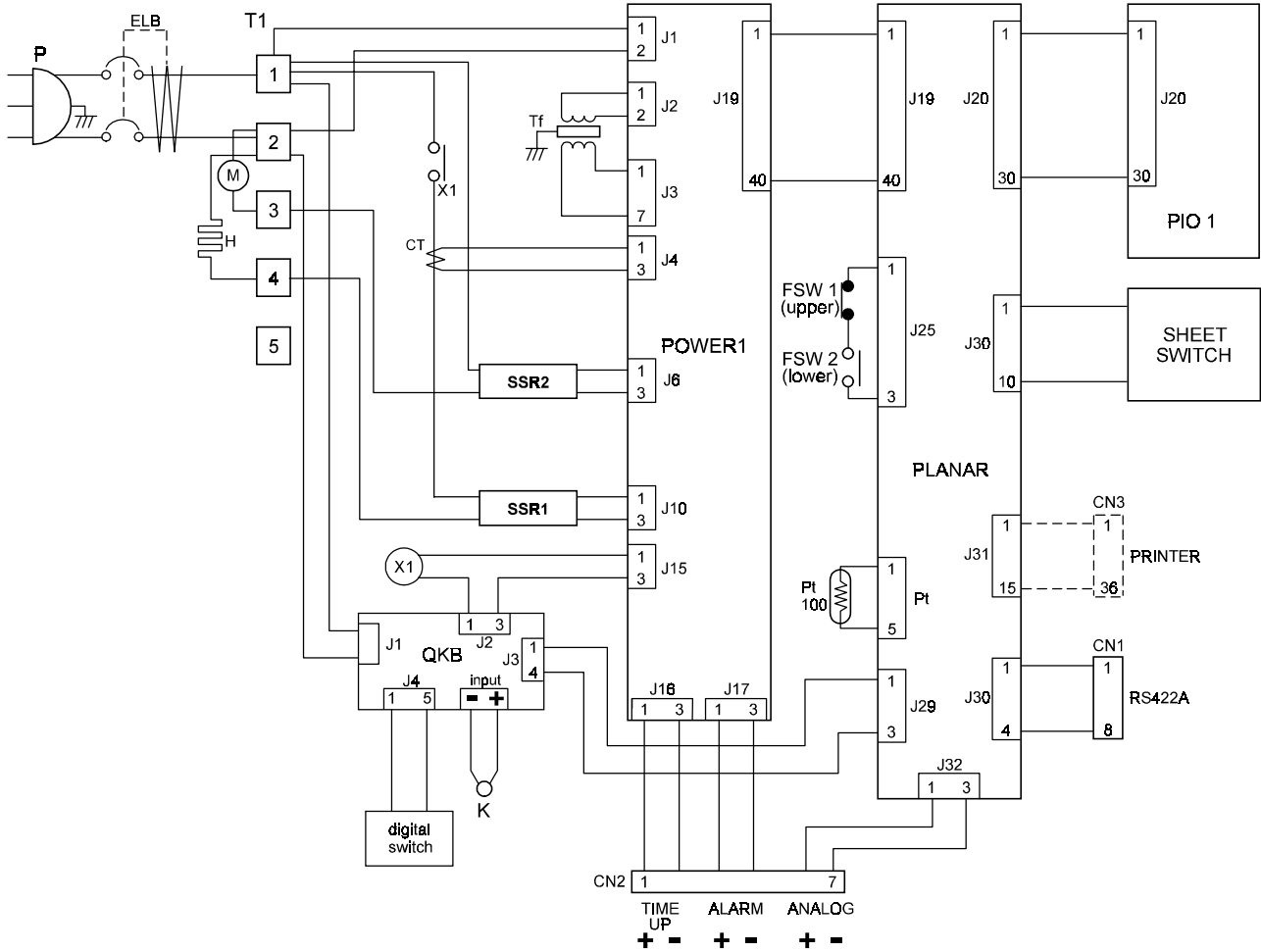


Chart of connecting wires

BH500



Replacement parts

| Sign | Part name | Code number | Specification | Note |
|---------|---------------------------|---------------|-------------------|-------|
| P1 | Power supply cable | 2-13-001-0006 | T2-3-c | |
| ELB | Leak Breaker | 2-06-005-0019 | BJS1531 | |
| T1 | Terminal block | 2-07-023-0002 | Moll-Ofx5p | BH400 |
| H | Heater | BF400-30020 | AC100V 1KW | |
| | | BF600-30020 | AC100V 1.2KW | BH500 |
| M | Motor for pump | 2-14-007-0002 | U-2035-1 | |
| Tr | Transformer | 2-18-000-0022 | AC100V | |
| POWER 1 | Power supply substrate | 1-24-000-0010 | Hitec -CR | |
| PLANAR | Control substrate | 1-24-000-0008 | Hitec -CR | |
| PIO 2 | Display substrate | 1-24-000-0009 | Hitec -CR | |
| SSR 1 | Solid-state relay | 2-16-000-0010 | YLT-SSR-01 | |
| SSR 2 | Solid-state relay | 2-16-000-0017 | G3R-102SLN | |
| X1 | Relay | 2-05-000-0011 | | BH400 |
| | | 2-05-012-0001 | JAIa-TM-DC12V | BH500 |
| CT1 | Current detection element | 2-17-001-0002 | CLT-6-S-400 | |
| Pt | Sensor | 1-16-003-0029 | Pt100 A class | BH400 |
| | | 1-16-001-0046 | Pt100 A class + K | BH500 |
| FSW1 | Float switch | 2-02-001-0004 | AHR541161 | |
| FSW2 | Float switch | 2-02-001-0003 | AHR540161 | BH500 |
| CN1 | receptacle | 2-08-000-0039 | DIN8P | |
| CN2 | receptacle | 2-08-000-0038 | DIN7P | |

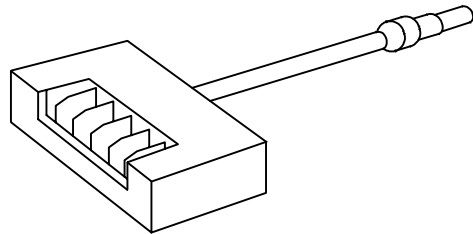
About attached goods outside the standard

A variety of attached goods outside the standard are prepared in the Thermo Elite BH series.

1. Cable for external communication

OBK 10

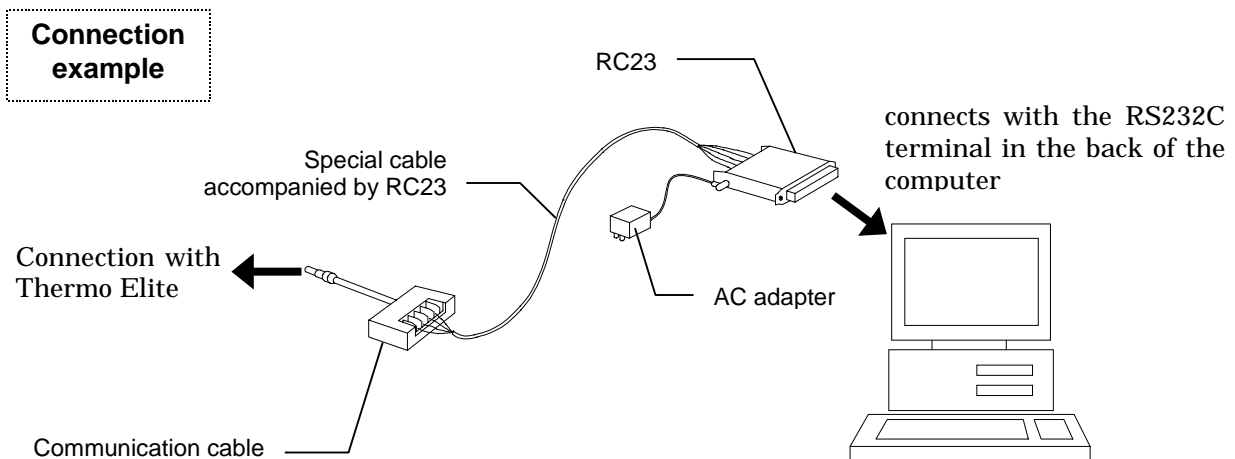
- Cable which combined plugs connected with connector in the back of control part with terminal box



2. Communication protocol converter

RC 23

- RC23 is a converter which converts RS232C of the personal computer into RS422A. There is no need for RC23 when your computer has RS422A communication interface.

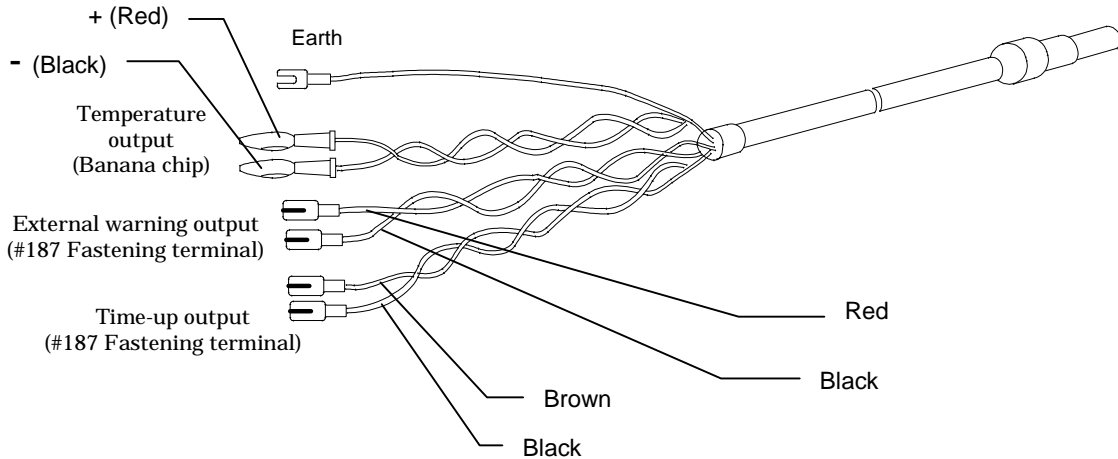


- Auxiliary goods : Exclusive use AC adapter, Special cable (The terminating resistance of 100 has been connected. Two kinds of cables (3 meter long and 10 meter long) are available. Specify which cable you need when you place an order.)
- To drive two or more Thermo Elites at the same time, another special cable and the change of communication ID number are needed. In that case, please consult the our company office.

About attached goods outside the standard

3. Multi wick cable for temperature output, alarm output and end output

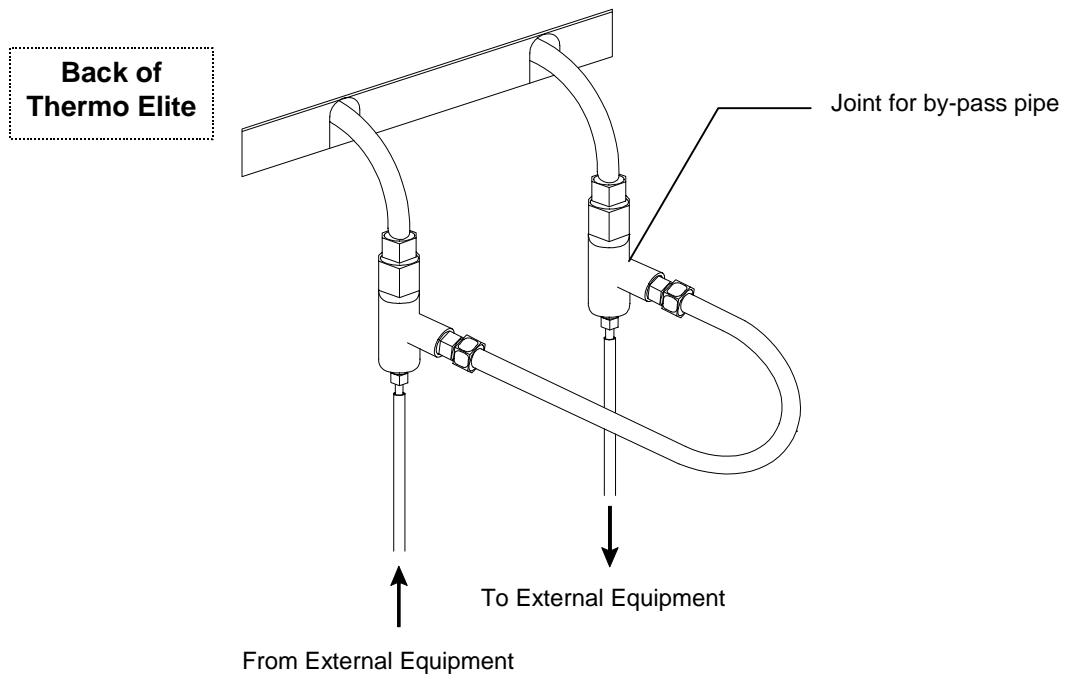
OBL 10



4. Joint for by-pass pipe

OBH 30

- It is a joint which can do the circulation cooling to the spectrophotometer etc. at the same time by diverging from the short-circuit pipe of the pump circulation. The divergence connection part is a hose entrance of 6 mm. The divergence flowing quantity is a range of a-b. Divergence pump head is a range of a-b.



About attached goods outside the standard

attention : Request the following options when you place an order of Thermo Elite. After installation the order for these options cannot be accepted.

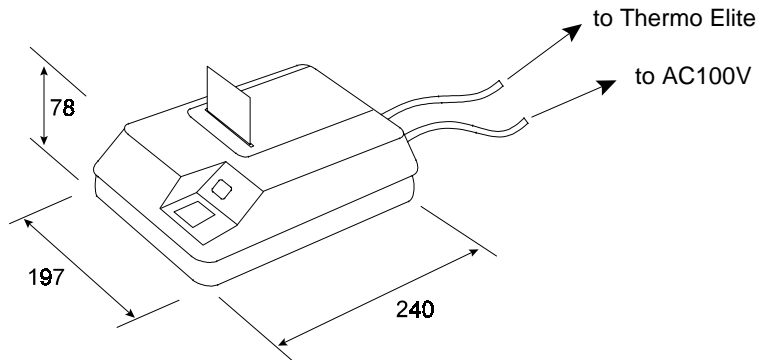
5. Digital printer OBH60

OBH 60

- The following information can be printed out by using Digital Printer OBH60.

Character Record Mode

- Measured Temperature
- Set point
- Wait state
- Strength of pump
- Alarming state
- Accumulated time
- Time of the record



Graphic Record Mode

The measured temperature of the liquid in the reservoir is recorded by the time based graph.

Immediate Date Record Mode

The information at desired time can be recorded. The contents of the information is the same as that of Character Record Mode.

- When the main body of the equipment detects abnormality, information when generated abnormally is printed.
- When the power supply is intercepted due to the power failure etc. , the date, the time of the intercepted point, and the date and the time of the returning point are printed immediately after the power supply return.

6. Independent temperature overheating prevention device (BH500 is equipped normally)

OBH 50

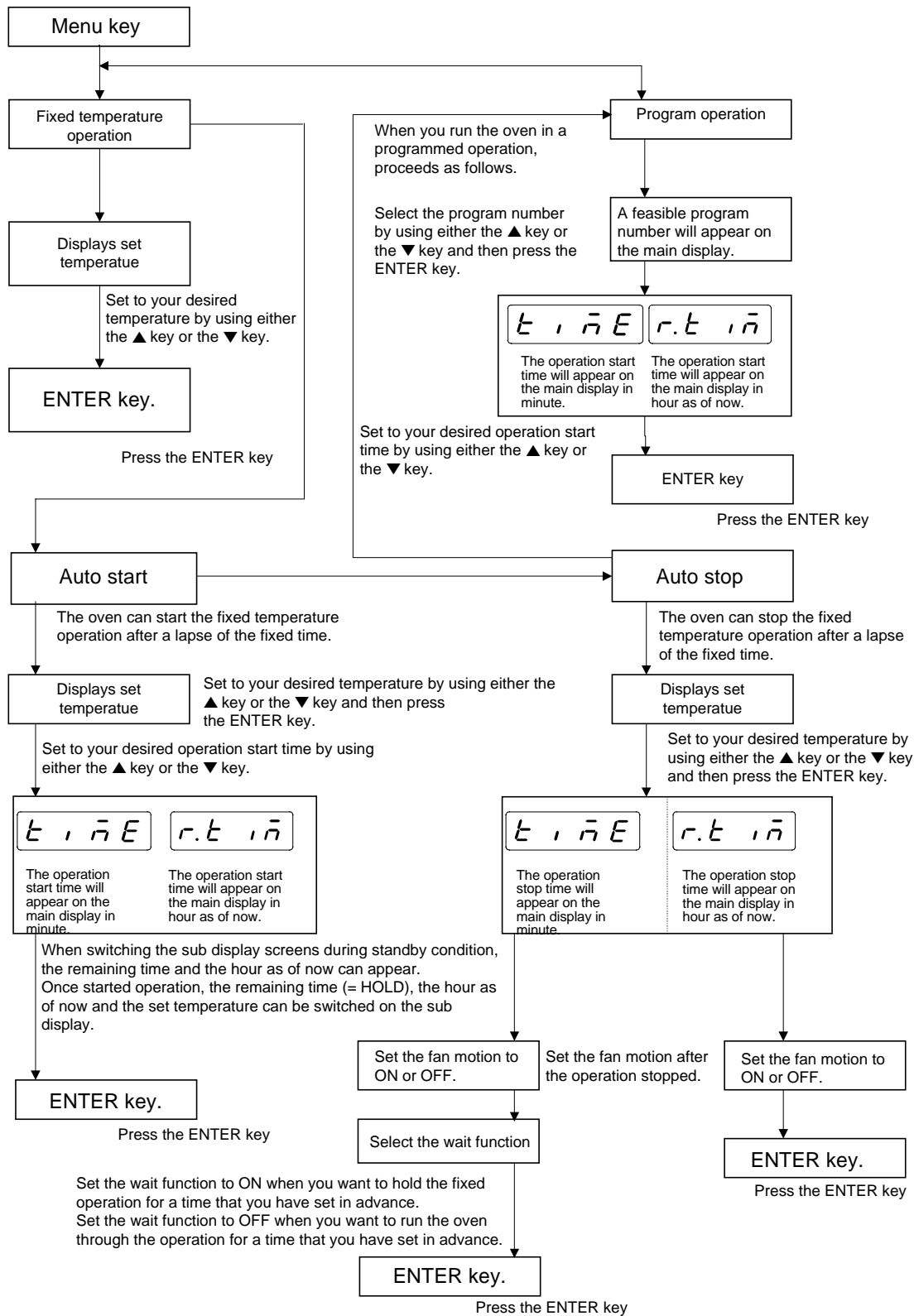
- The equipment is independent safety device besides the one built into the controller. Double safety measures can be considered.

Range of temperature setting : 0 ~ 399 3-digit digital switch

Sensor : K-thermocouple (Control sensor : Double sensor stored in the same protection tube as Pt100)

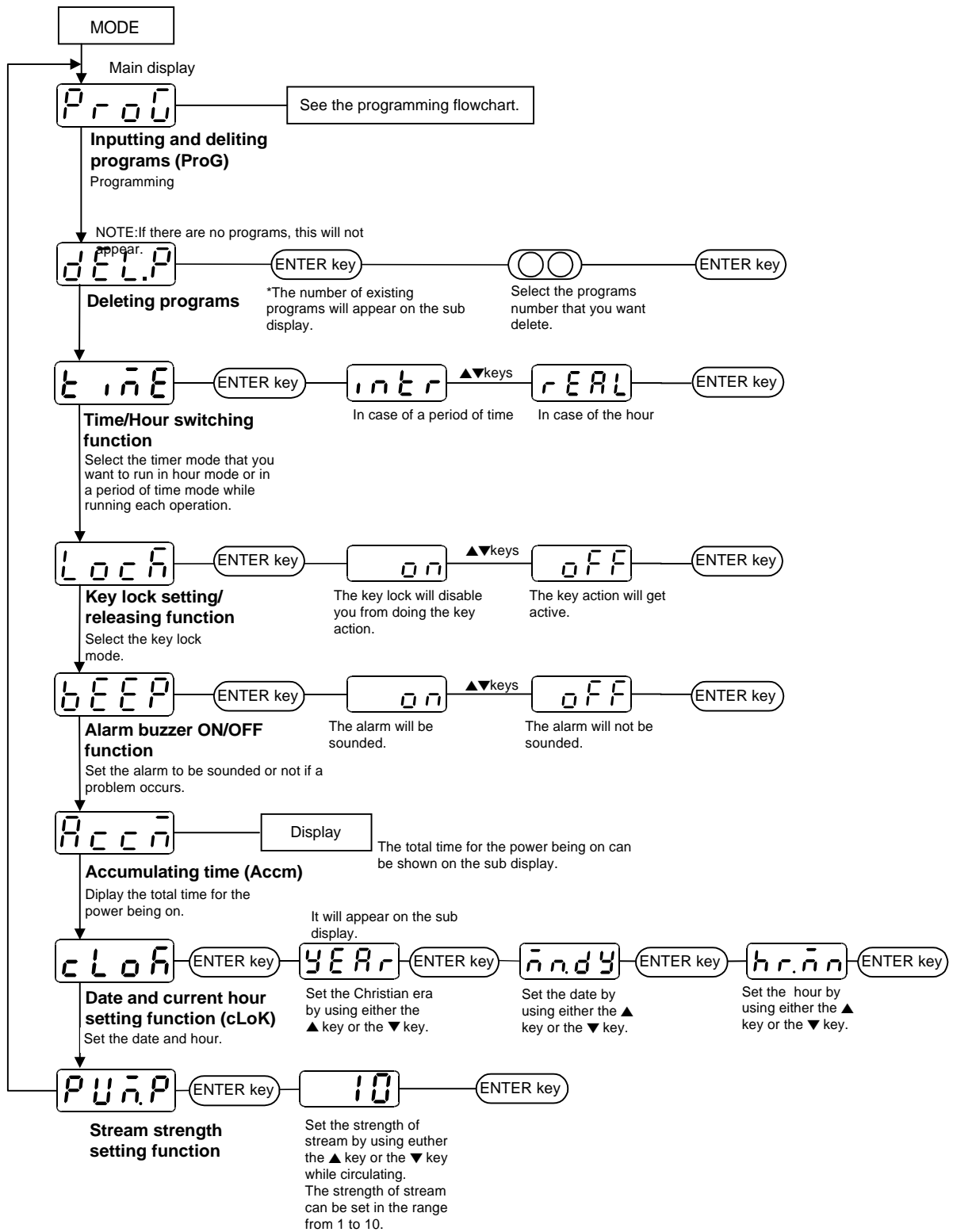
Flowchart of Operational Procedures

Run "MENU"



Flowchart of Operational Procedures

Program "MODE"

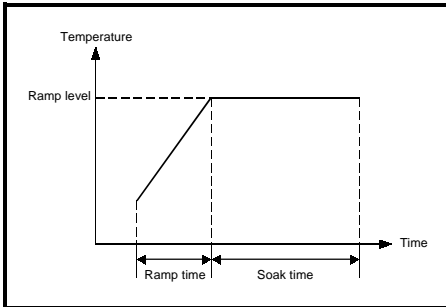


Flowchart of Operational Procedures

Flowchart for programming

Segment configuration

: Segments are made up of the following items, and must be input in this order.



Ramp time

Rising time

Ramp level

Target temperature

Soak time

Time held at ramp level

Wait function

Selects whether to give priority to soak time (OFF), or to hold process time at ramp level (ON).

MODE key

Press

Key

PrO

ENTER key

Key

Pr. 1

ENTER key

Key

SO. 1

ENTER key

Key

r t. 1

ENTER key

Key

r l. 1

ENTER key

Key

s t. 1

ENTER key

Key

w t. 1

ENTER key

Key

PURP

ENTER key

Key

SO. 2

ENTER key

Key

r t. 2

ENTER key

Key

PURP

ENTER key

Key

Settings finished

Call up the program mode.

Call up the program number that you want to input or edit.

When you want to rewrite programs, call up your desired segment number on the main display.
Note that this will appear in case of editing.

Input Ramp time.
Note: When you run this unit with full power, input *STEEP*.

Input Ramp level.

Input Soak time.

Note: If there is no soak time (changing immediately to next temperature), input 0.
To hold, select *Hold*

Select wait function.

Set the strength of stream while circulating by pushing either the key or the key. The strength of stream can be changed in the range from 1 to 10.

The next segment will appear.

Note: To repeat, press either the key or the key to display *REP*, and select it with the ENTER key. Input the segment number that you want to repeat, and then do the repeat count.

* Input all the settings in the same way.

When finished inputting all items, select *END* for the ramp time, and press the ENTER key.

Set the strength of stream while circulating by pushing either the key or the key. The strength of stream can be changed in the range from 1 to 10.

