

Thermo Elite

BH 200

BH 300

Version 1.1

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- Thank you very much for purchasing the product of Yamato Scientific Co., Ltd..
- Read this operating manual and the guarantee card thoroughly for the proper use of this product. Please keep both importantly after reading.

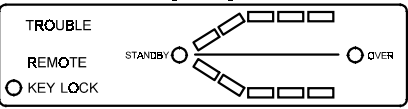

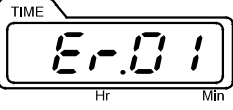
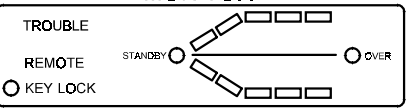

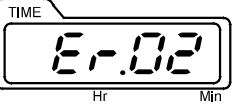
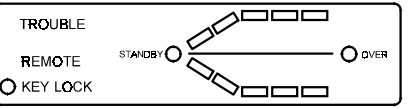

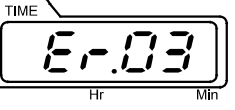
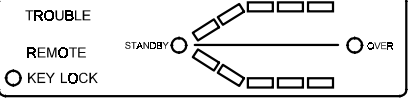

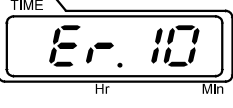
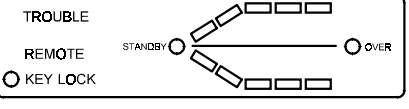

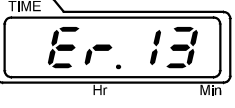
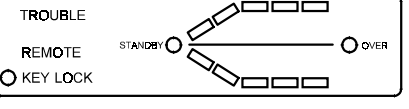

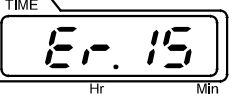
**Warning** : Before attempting to use the product, read the important warnings that appear in the text of this manual and get familiar with them.



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## TROUBLE sign and error code / Cause

<p><b>Abnormality of temperature sensor</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.01</i> Blinking</p>	<p><b>Breakdown of Triac circuit</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.02</i> Blinking</p>	<p><b>Disconnection of heater</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.03</i> Blinking</p>
<p><b>Defect of main relay</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.07</i> Blinking</p>	<p><b>Abnormality of Refrigerator</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.13</i> Blinking</p>	<p><b>Defect of electronic circuits</b></p>  <p>MEASURED TEMP</p>  <p>TIME</p>  <p>TROUBLE sign and <i>Er.15</i> Blinking</p>

## Treatment method

Please record the kind of the code and turn off the power supply at once if the error code is displayed.

When abnormality occurs, the exchange of parts or the check of the device is needed.

Please report to the shop where you bought the product or the our company office or the our company service agency.

Please inform of the generated error code when reporting.

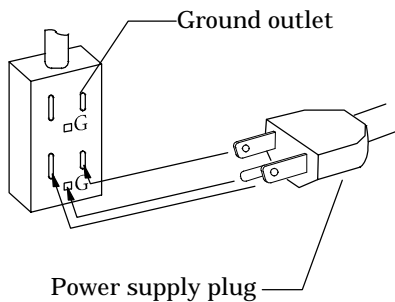
# Be sure to observe these rules

When using

## Warning

### 1. Please ground effectively to avoid the shock hazard by the leak.

- Please use the ground outlet as much as possible.

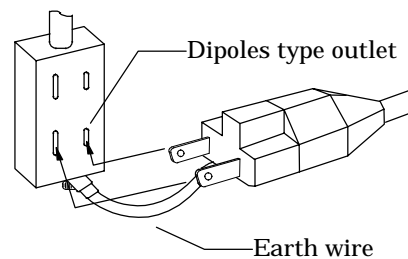


- If there is no earth terminal  
The earth construction is needed. Please consult the shop or the our company office.

### 2. Please note the installation place.

- Please do not ground to the following places.
  - Place where combustible gas and corroded gas are generated
  - Place where surrounding temperature becomes 35 or more
  - Place where temperature difference is violent
  - Damp place
  - Place which shines direct sunshine and adheres
  - Place where a lot of vibrations exist
- Please install the space of 15 or more in the side and the back.

- When you use the outlet of the dipoles type  
Please insert the earth adaptor which is attached outside standard goods in the power supply plug. Please confirm the polarity of the outlet thoroughly. Moreover, connect the earth wire of the earth adaptor (green) with the earth terminal on the power supply equipment side.



### 3. Please supply the power supply by a special switchboard and the outlet.

- Please use the switchboard and the outlet which suits electric capacity of this machine.

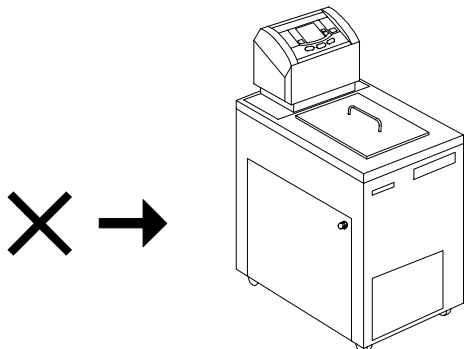
#### Electric capacity

BH200 : AC100V 13A  
BH300 : AC100V 14A

## Caution

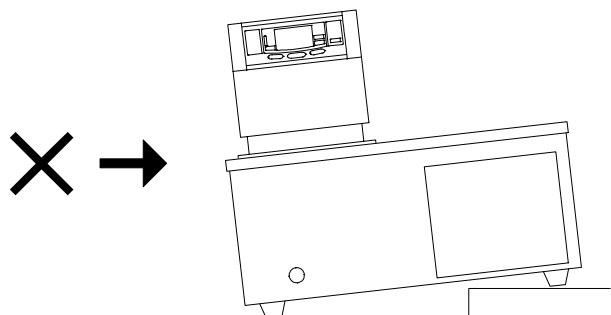
### 1. Please do not remodel

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



### 2. Please ground to the horizontal place.

- The trouble and the breakdown are caused when using while having inclined.





## Warning

### 1. About the use of the liquid and cooling water

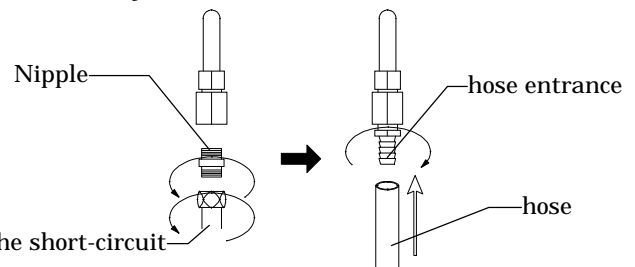
- Please do not use the liquid with the explosion and toxicity.
- Please do not flush cold water when using at high temperatures. (BH400/500)
- Please do not mix water when you use oil in the examination tank. (BH400/500)



## Caution

### 1. Please do the method of installing the hose correctly.

- Please detach flexibility pipe or nipple for the short-circuit and install the attached hose entrance when using as a circulation tank. Securely connect to prevent water leak. When using silicon oil as bath liquid, select a hose resistive to silicon oil (e.g. fluorine rubber).



Flexibility pipe for the short-circuit

### 2. Notes concerning liquid used

- The liquid poured into the examination tank must use water or alcoholic solution. (BH200/300)
- The liquid poured into the examination tank must use water or the silicon oil. (BH400/500)
- It evaporates for water and alcohol, etc. while using. Please replenish sometimes.
- Please use the ethyl alcohol solution about alcohol. Be careful please not to freeze referring to a right table in proportion to the service temperature. Do not use neither automotive antifreeze nor the ethylene glycol liquid. (BH200/300)
- 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.

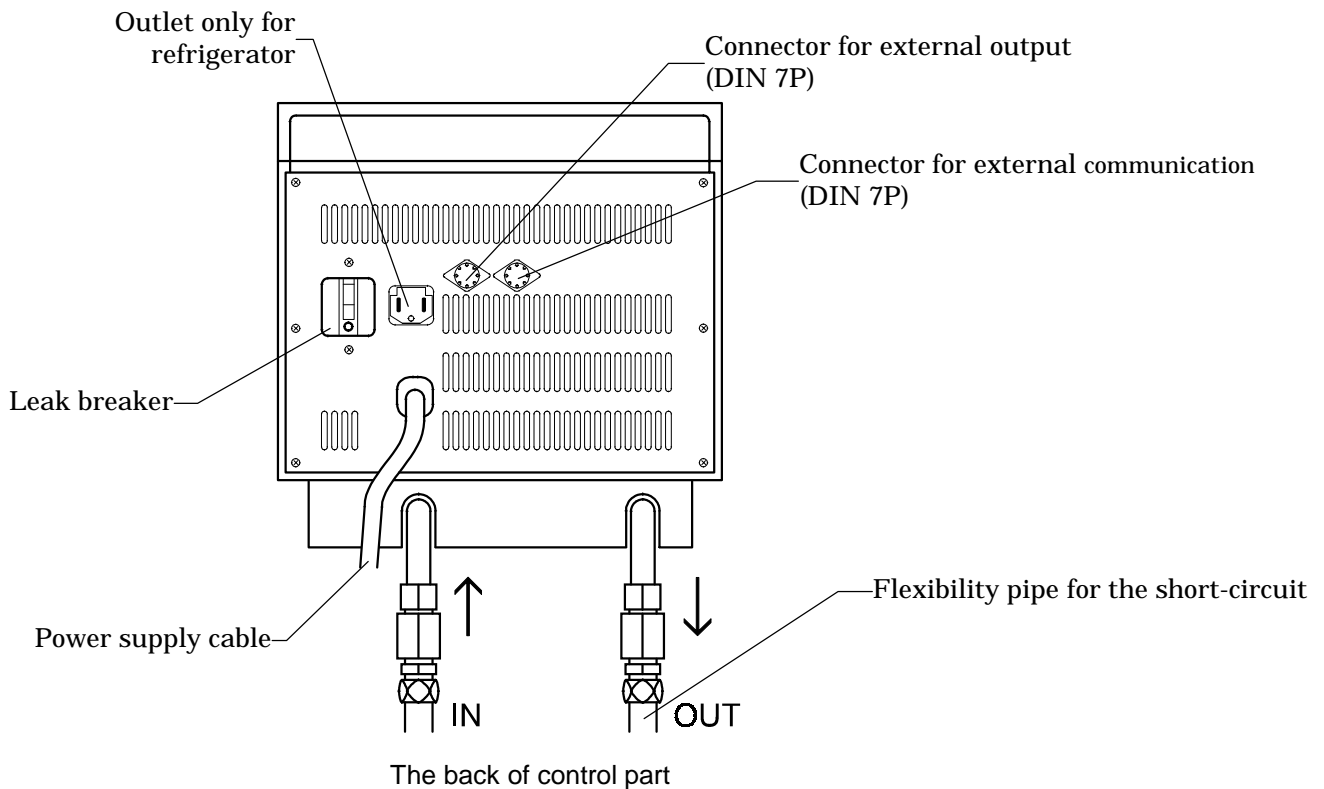
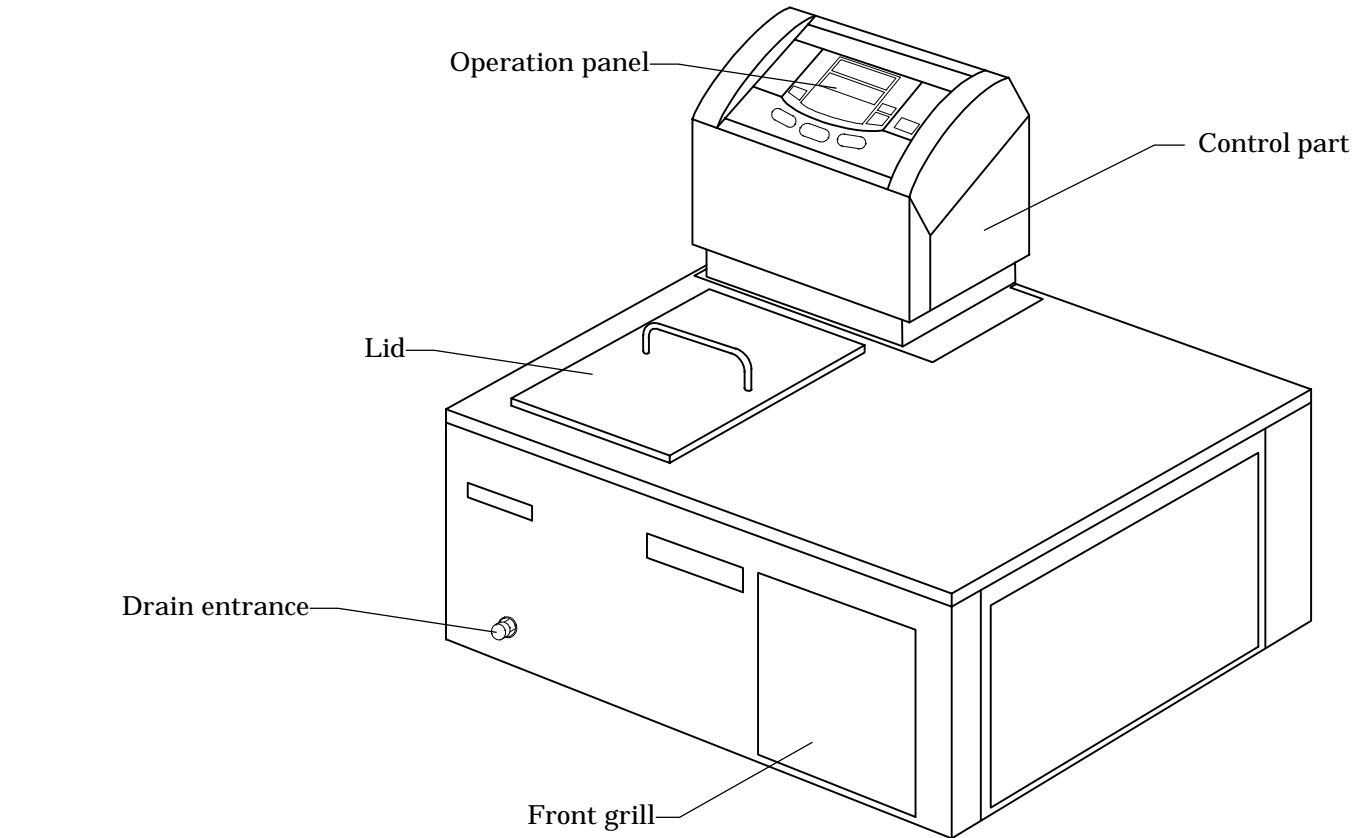
Density of ethanol		Coagulation point ( )
Wt %	Vo1 %	
4.8	6.0	-2.0
11.3	14.0	-5.0
13.8	17.0	-6.1
16.4	20.2	-7.5
17.5	21.5	-8.7
18.8	23.1	-9.4
20.3	24.8	-10.6
22.1	27.0	-12.2
24.2	29.5	-14.0
26.7	32.4	-16.0
29.9	36.1	-18.9
33.8	40.5	-23.6
39.0	46.3	-28.7
46.3	53.8	-33.9

### 3. Attention in handling

- Please 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 are caused.
- The upper surface in the tank etc. become high temperatures, too, when using at the high temperature. Please note handling enough.

# Name of each part and function

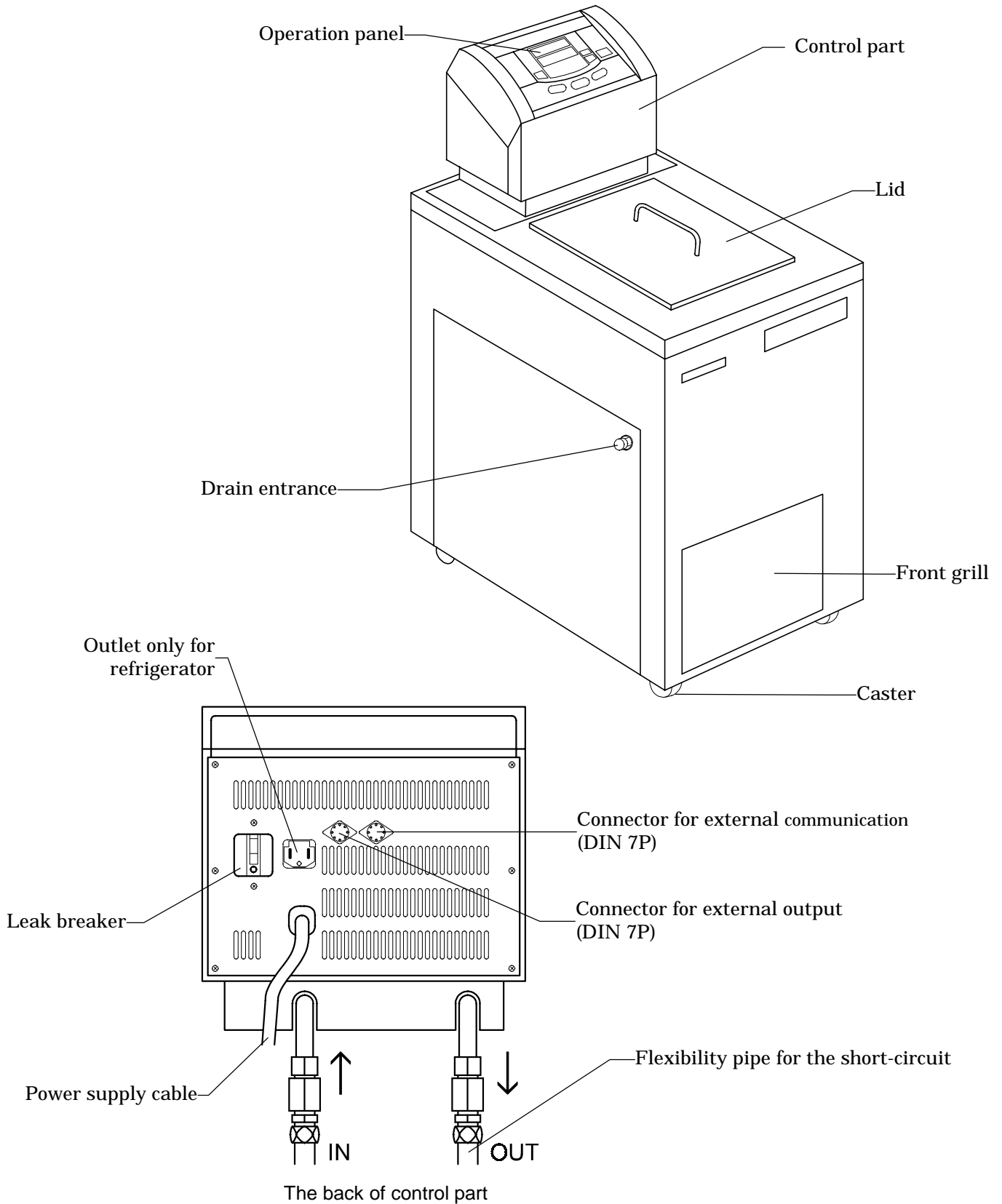
Main body : BH200





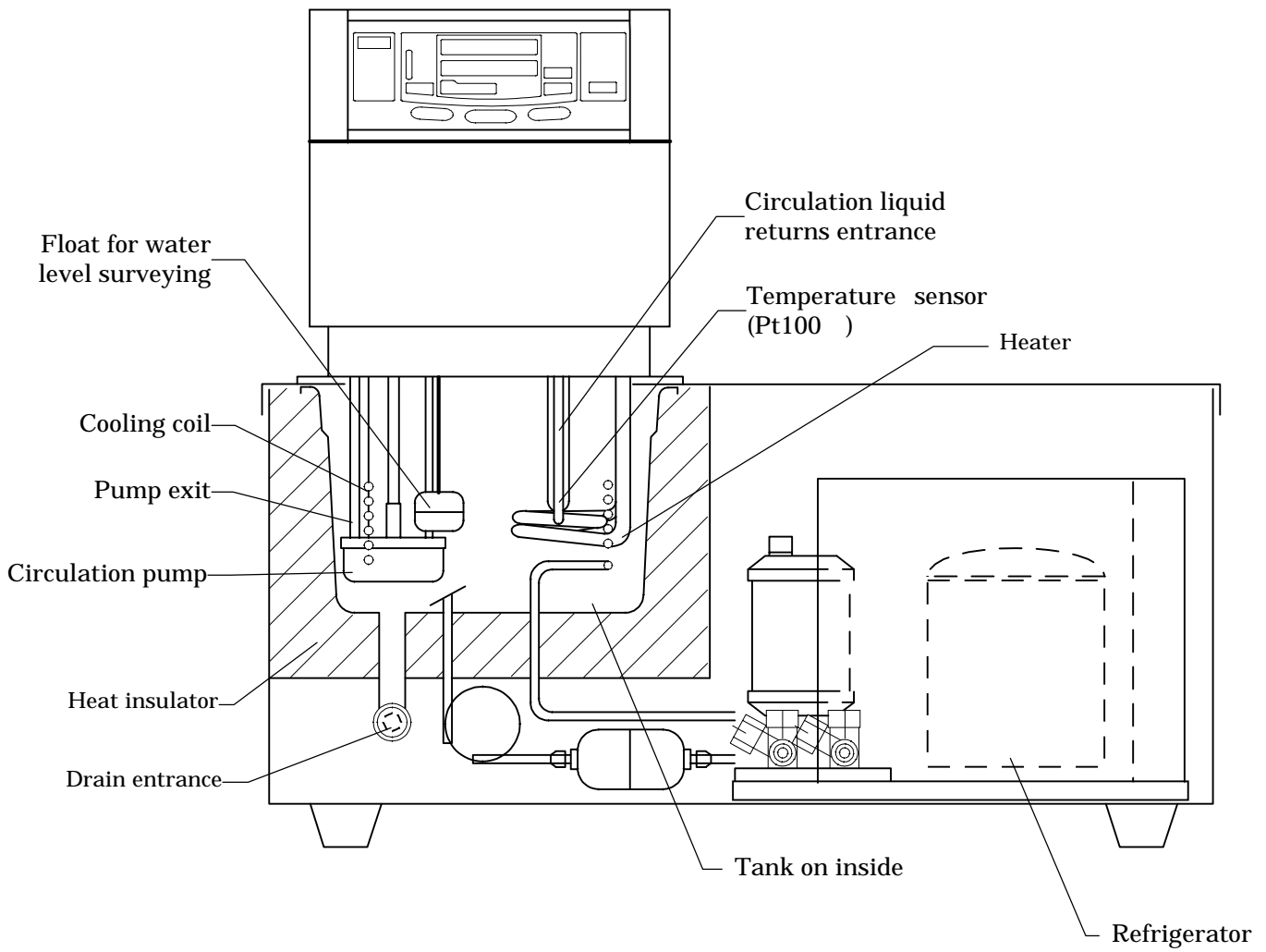
# Main body : BH300

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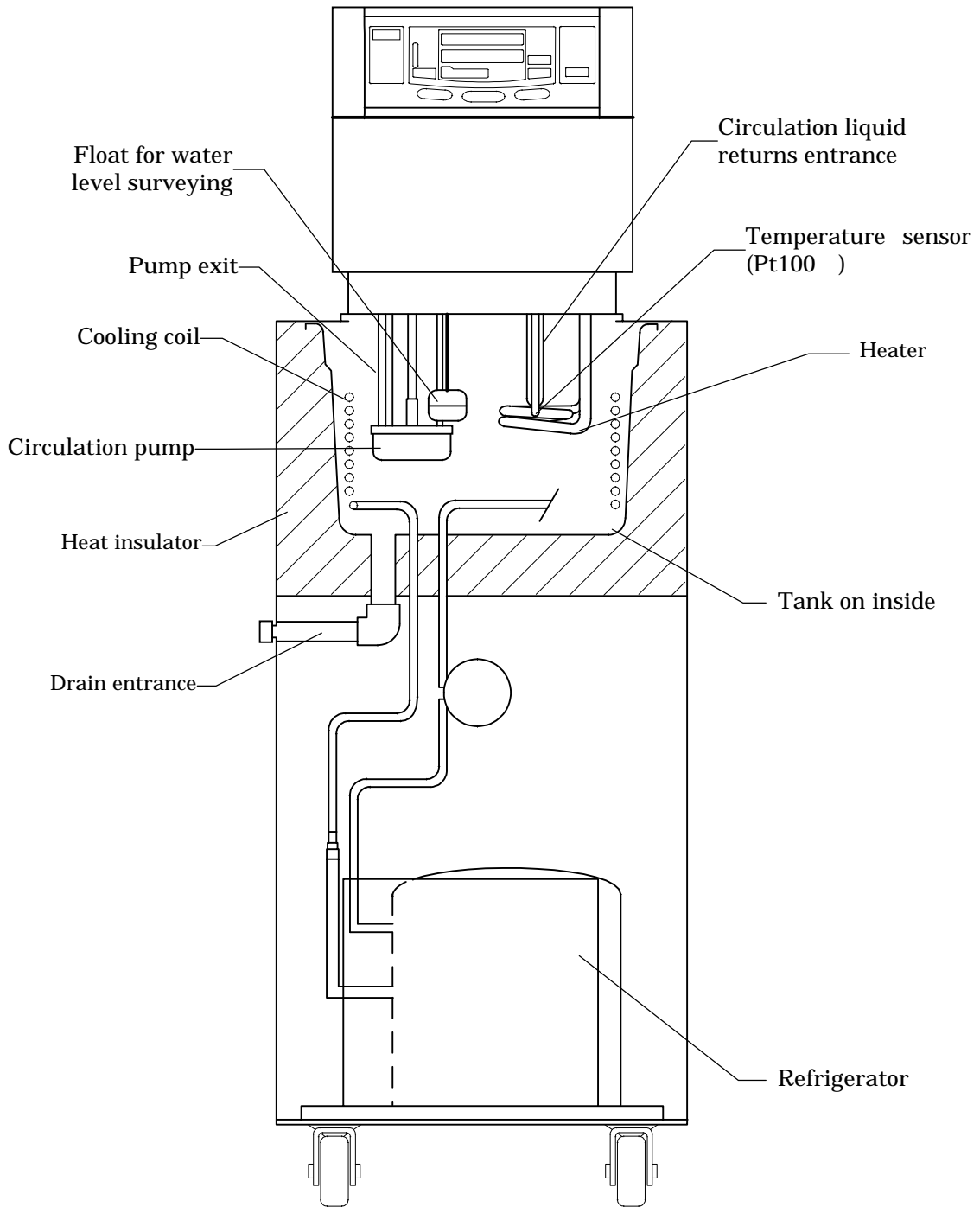
# Main body structural chart : BH200

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# Main body structural chart : BH300

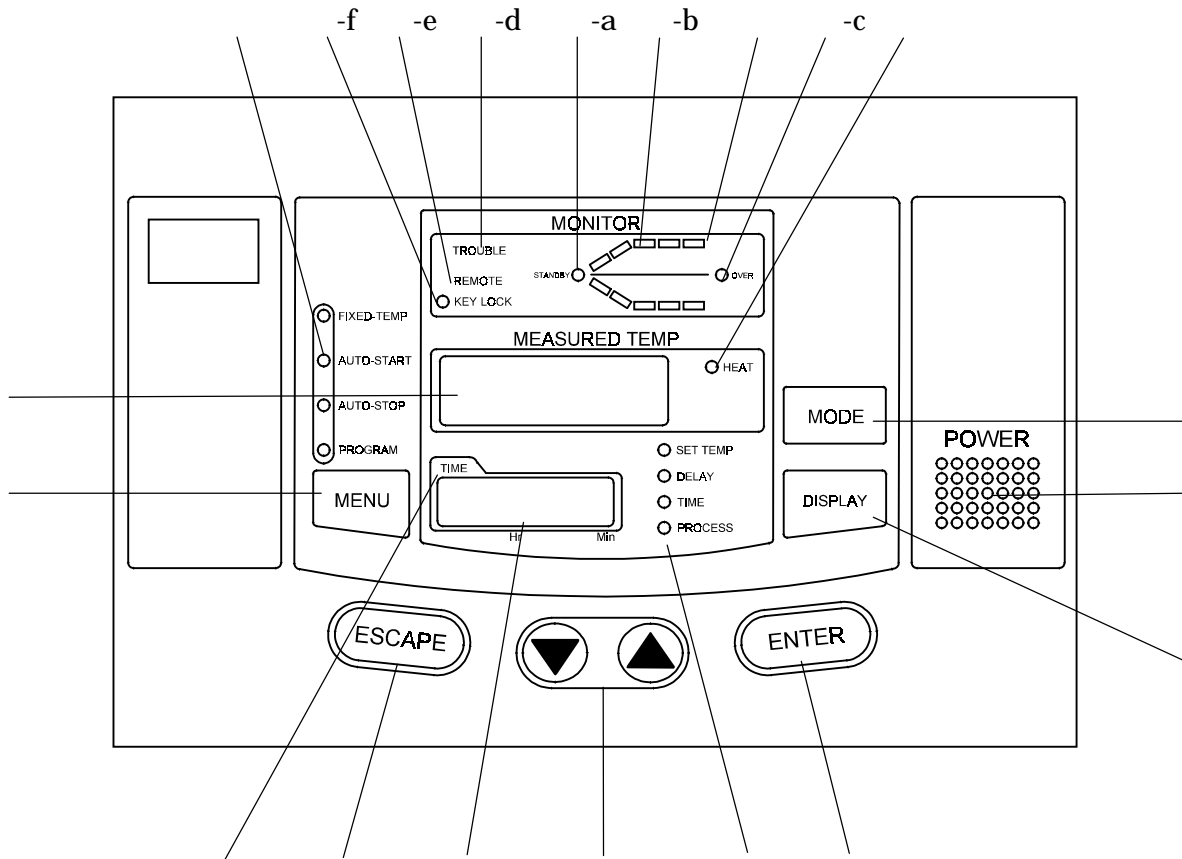
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## Operation panel

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**attention** : A detailed explanation of controller's specification, function, and operation method is described to the appended special owner guide. Please refer it.



- 
- POWER key : Switch the controller from the stand-by state to the operating state, and vice versa.
  - MODE key : Allow the functions, such as to enter, edit, and delete programs, to set the time, and to switch the time setting.
  - DISPLAY key : The content of the sub display is switched. The content of the display is a set temperature, the remainder time, clock time, and an execution segment number.
  - MENU key : The operation mode is selected. Each mode of the operation of a operation of a fixed value operation and an auto start and auto stops and the program operations can be selected.
  - ENTER key : Input values of the set value (temperature, time, and clock time, etc.), the selection modes, and the execution segment numbers, etc. are fixed.

(up and down)key	: The set value (temperature, time, and clock time, etc.) is changed and the function provided in the function menu is selected.
ESCAPE key	: It returns to the state before invalidating the content input immediately before and inputting.
Main display	: The measurement temperature and the set value (temperature, time, and clock time, etc.) are displayed. Moreover, program information and error information, etc. are displayed.
Sub display	: Time a set temperature, the remainder time, and now and the execution segment number, etc. are displayed.
Operation monitor	: The operation is displayed.
-a Standby indicator	: blinks at the standby before begin to be operation.
-b Temperature pattern indicator	: The set temperature pattern of the be in operation is lighting displayed. The part under execution does the blinking display.
-c OVER indicator	: When an auto stop or the program operation ends, it blinks.
-d TROUBLE Indicator	: When abnormality is detected, it blinks.
-e REMOTE indicator	: When remotely driving (optional), it lights.
-f Key Lock indicator	: It lights while the function to lock the key of the operation panel is operating.
Operation menu indicator	: The operation mode under execution is lighting displayed.
Sub display contents indicator	: The content (set temperature, remainder time, clock time, and execution segment) displayed in a sub-drop is lighting displayed.
Heater energizing indicator	: When the heater is energizing, it lights.
Time display indicator	: When the time setting is a clock time set mode, it lights.

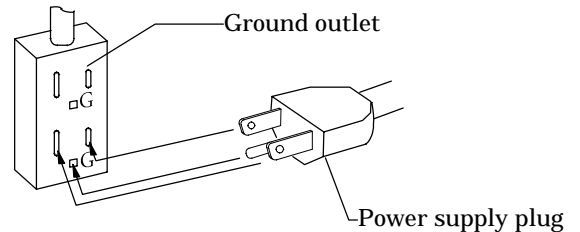
# Preparation and check before using



## Caution

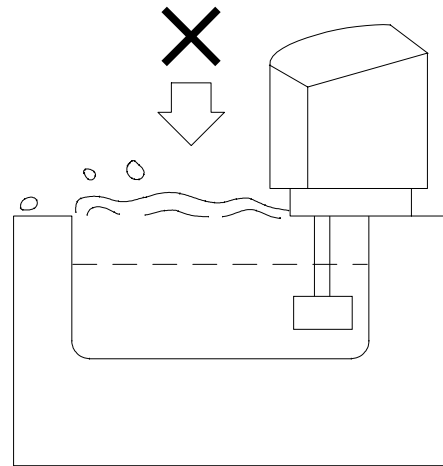
### 1. Confirmation of outlet

- Please insert the power supply plug in the outlet.
- Please confirm whether the Refrigerator plug is connected with the outlet in the back of the controller. (BH200/300)



### 2. Confirmation of safety

- Please turn on the leak breaker.
- Please pour the liquid (water) into the examination tank.
- Water level should be 3 ~ 5 cm below the upper edge. The external is made to circulate and the pump is operated and the water level falls when passing for a while when using. Please make to the above-mentioned water level by injecting the liquid again.
- Please confirm 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)
- Please stabilize by using stopper in the bottom in the tank when you use the throw type cooling device together. (BH400/500)



## Warning

- To avoid the shock hazard, the use of the ground outlet is recommended.
- Please use the earth adapter (attached goods outside the standard) when you use the outlet of the dipoles type.
- Please connect the earth wire of the earth adapter with the earth of the power supply equipment side. Please do not connect to gas pipe and water pipe.
- Please do not use the divergence outlet. Because heat etc. are caused, it is dangerous.
- Please do not ground to the place where a flammable gas and corroded gas are generated.

**Attention** : Please operate according to the following procedures when the preparation for the operation is complete.

## 1. Turning on of power supply

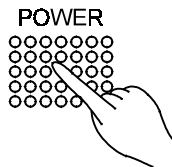
- Please turn on the leak breaker in the back of the controller.



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



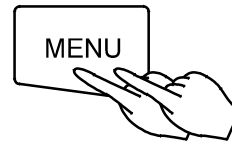
- Please push the POWER SUPPLY key in the operation panel.



- 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 DRIVE MENU key.

## 2. Selection of operation menu

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



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

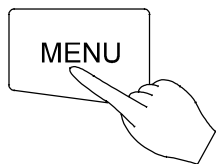
## 3. Explanation of operation menu

- |                   |  |
|-------------------|--|
| 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. |

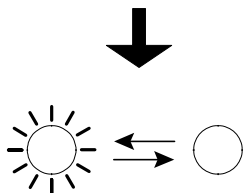
## Method of doing fixed temperature operation

### Selection of operation menu

- Please push the MENU key and select the fixed temp



The MENU key is pushed.



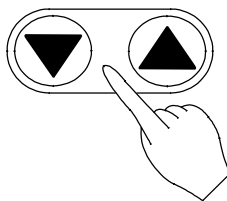
The indicator of the FIXED TEMP blinks.



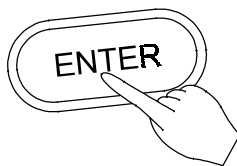
- The temperature set last time is blinking and enters the state that a set temperature can be input in a sub-display.

### Input of set temperature

- Please 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.

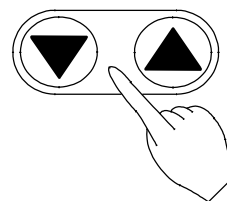


The ENTER key is pushed.

- The fixed temperature operation is begun.

### Change in set temperature when fixed temp operation is being driven

- Please 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.

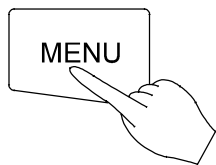
- The fixed temperature operation in the temperature newly set is begun.



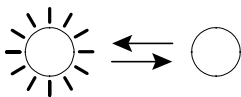
## Method of doing auto start operation

### Selection of operation menu

- Please select an AUTO START pushing the MENU key.



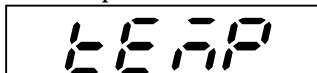
The MENU key is pushed.



The operation menu indicator of an AUTO START blinks.

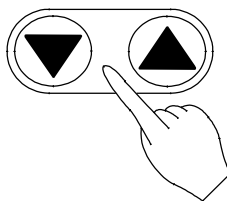


- The sub-display displays TEMP allowing you to enter set temperature.

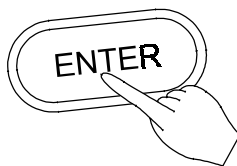


### Input of set temperature

- Please make a main display an arbitrary set temperature by pushing the up and down keys and push the ENTER key.



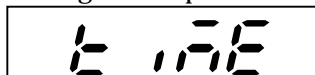
Press the up and down keys several times. A main display is made to display the hoping set temperature.



The ENTER key is pushed.

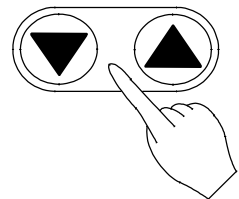


- Sub-display displays TIME allowing you to enter when to begin the operation.

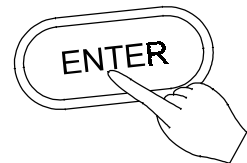


### Input of time

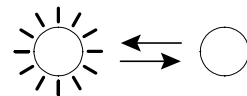
- Press the up and down keys to blink start time (or clock time) on the main display, and press the ENTER key.



Press the up and down keys several times. A main display is made to display the hoping set time.



The ENTER key is pushed.

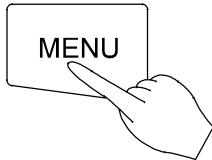


- The STANDBY indicator of the operation monitor blinks on standby waiting for starting operation. The operation is begun after the set time passes.

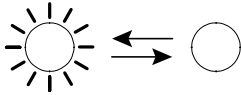
## Method of doing auto stop operation

### Selection of drive menu

- Please select an AUTO STOP pushing the MENU key.



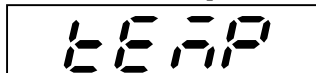
The MENU key is pushed.



The menu indicator of an AUTO STOP blinks.

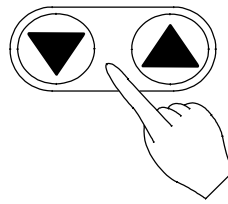


- It is displayed in a sub-display as TEMP and enters the state that a set temperature can be input.



### Input of set temperature

- Please make a main display an arbitrary set temperature pushing keys and push the ENTER key.



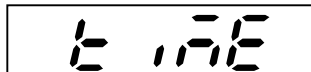
Press keys several times.  
A main display is made to display the hoping set temperature.



The ENTER key is pushed.

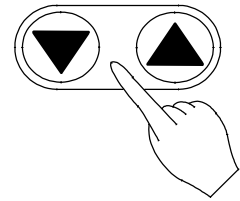


- Sub-display displays TIME allowing you to enter when to end the operation.



### Input of time

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



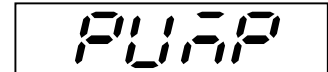
Press keys several times.  
A main display is made to display the hoping set time.





The ENTER key is pushed.

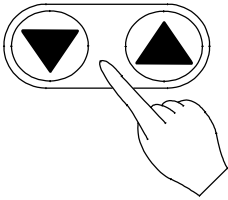




- The sub-display displays PUMP allowing you to select pump status after time is up.

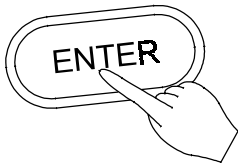
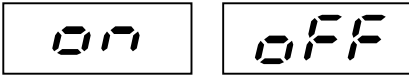


### Setting pump operation status

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



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





The ENTER key is pushed.

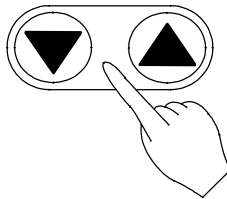




- The  sub-display displays WAIT allowing you to set the wait function.

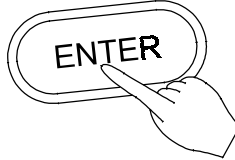


### Selection of wait function

- 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.



- This operation activates the auto stop operation

### 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.

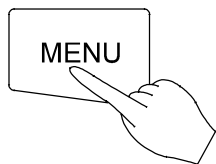


It starts right after the auto stop operation is started.

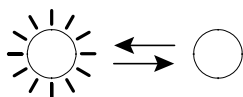
## Method of doing program operation

### Selection of operation menu

- Please select the PROGRAM pushing the MENU key.



The MENU key is pushed.



The operation menu indicator of the PROGRAM blinks.

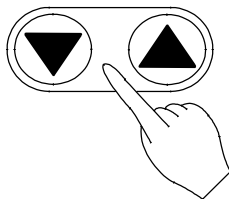


- PROG is displayed in a sub-display allowing you to input the execution program number.



### Input of execution program number

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



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

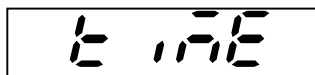
**Attention** : If the program does not exist, is blinking. Please create the new program.



The ENTER key is pushed.

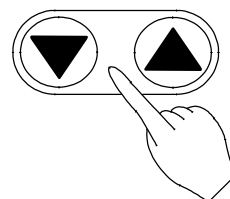


- Sub-display displays TIME allowing you to enter when to end the operation.



### Input of time

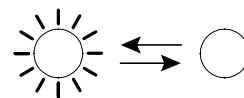
- Press keys to blink start time (or clock time) on the main display, and press the ENTER key.



Press 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.

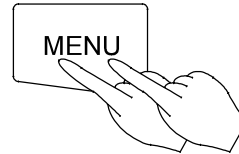
## To switch to other operation modes while operating

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

### Selection of operation menu

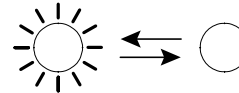
- During operation in a certain mode, press the MENU key to blink another operation menu indicator. In this time the operation menu indicator of current operation remains lighting.



Press MENU key several times.



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



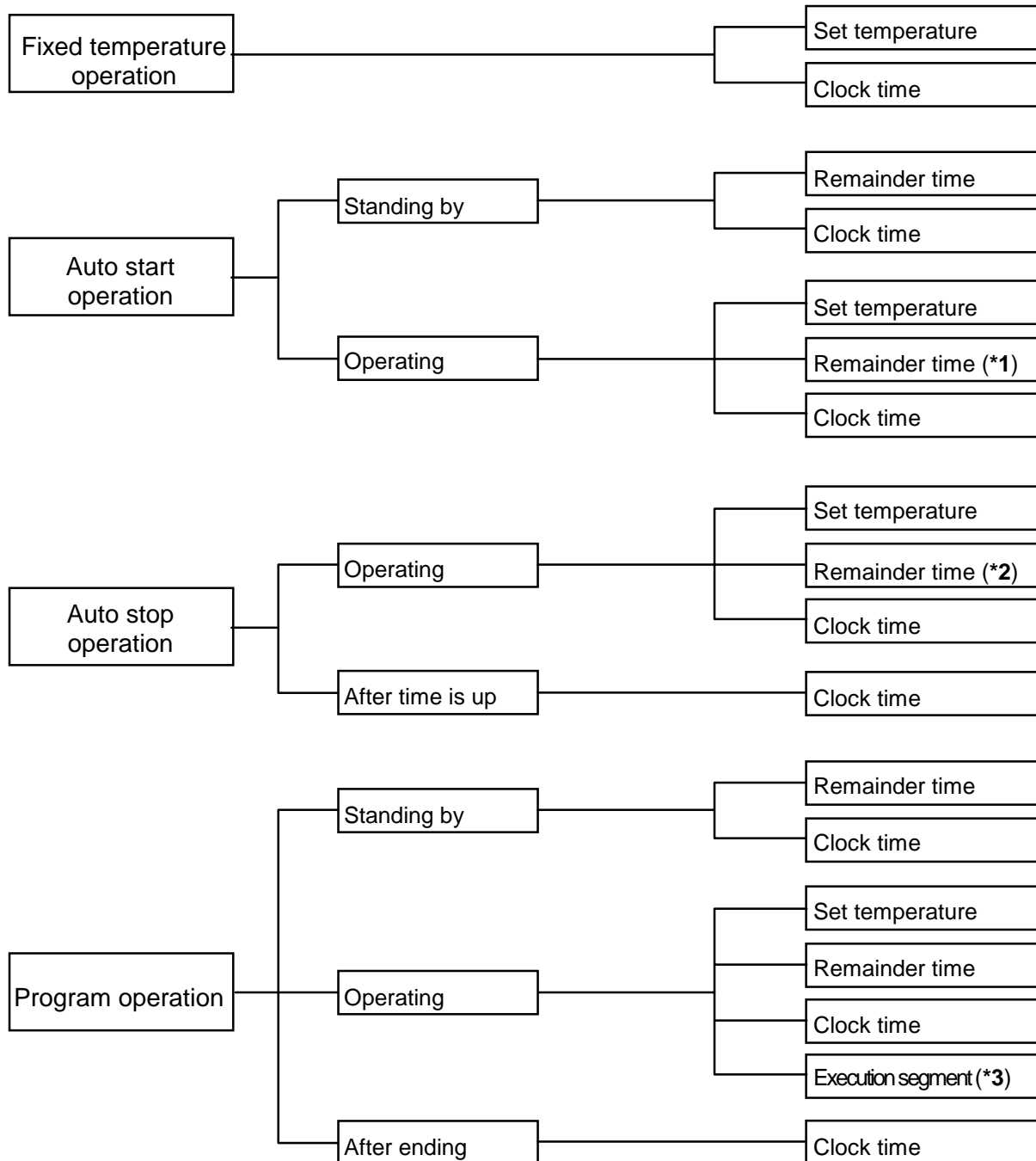
The indicator blinks or lights.



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

# Method of using DISPLAY key

The content of the display of a sub-display can be switched one by one as follows by pushing DISPLAY key.



\*1 : HOLD is displayed.

\*2 : However, WAIT is displayed in the waiting status.

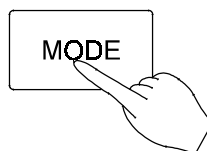
\*3 : During repeat operation, however, number of times for remaining repeat is displayed by the DISPLAY SELECTOR key.

# Usage of MODE

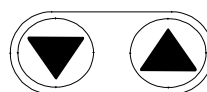
## Content of function menu

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

- Press the MODE key to display any of the following function menus on the main display. The menus can be brought up one by one with keys.



The mode key is pushed.

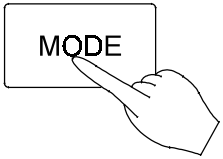


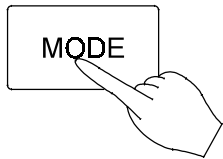
Selected by keys.

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>REF</i>	Refrigerator operation selection	It is a function that the drive can be stopped when the Refrigerator need not be driven according to a surrounding temperature and the examination temperature. (BH200/300)
<i>com</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>cl</i>	Setting at date and time	It is a function to set a present date and time.
<i>Pr</i>	Program edit	It is a function to input and to edit the drive program.
<i>del</i>	Program deletion	It is a function to delete the program of the current which became unnecessary.
<i>time</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>Acc</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.

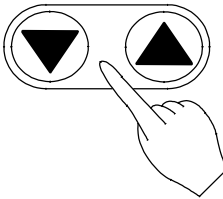
# Method of doing strength setting of circulating pump

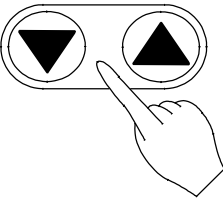
## Function menu selection

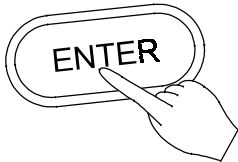
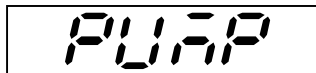
- First of all, please push the MODE key. Next, please make a main display display PUMP with  keys and push the ENTER key.



The MODE key is pushed.



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

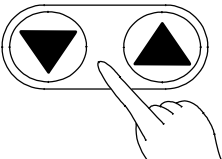


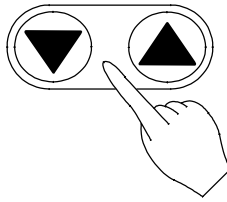
The ENTER key is pushed.

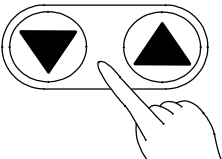


- Sub-display displays PUMP allowing you to set strength of circulating pump to a sub display.

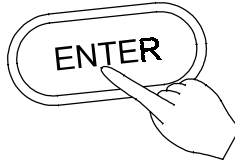
## Set input

- Please 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.



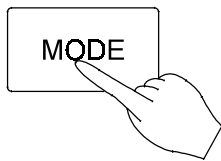
The ENTER key is pushed.



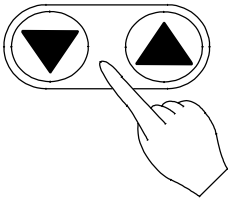
# Setting operation status of refrigerator

## Function menu selection

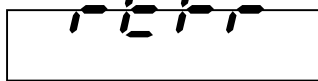
- First of all, please push the MODE key. Next, please make a main display display REFR with keys and push the ENTER key.



The MODE key is pushed.



- Press keys several times. A main display is made to display REFR.



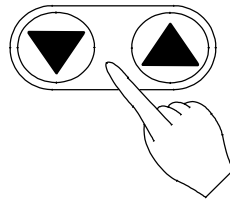
The ENTER key is pushed.



- Sub-display blinks REFR allows you to set the operation mode of the Refrigerator

## Set input.

- Press keys to display desired operation status on the main display, and press the ENTER key.



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



**Attention :** CONT means the continuous running and OFF mean the stop.



The ENTER key is pushed.

## Notes

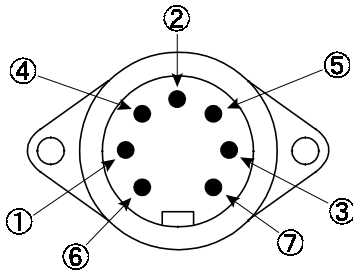
- This function is equipped only in BH200/300.
- When it is 45 or more in set temperature, the refrigerator stops automatically even if the refrigerator is continuously driving.
- The refrigerator is recommended to be set in turning off as long as there is no heat load special environmental temperature +10 or more a set temperature. It is from respect to a preferable usage of the saving of safety and the energy of the equipment.

## 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. Please refer to it.

### 1. Specification of connector

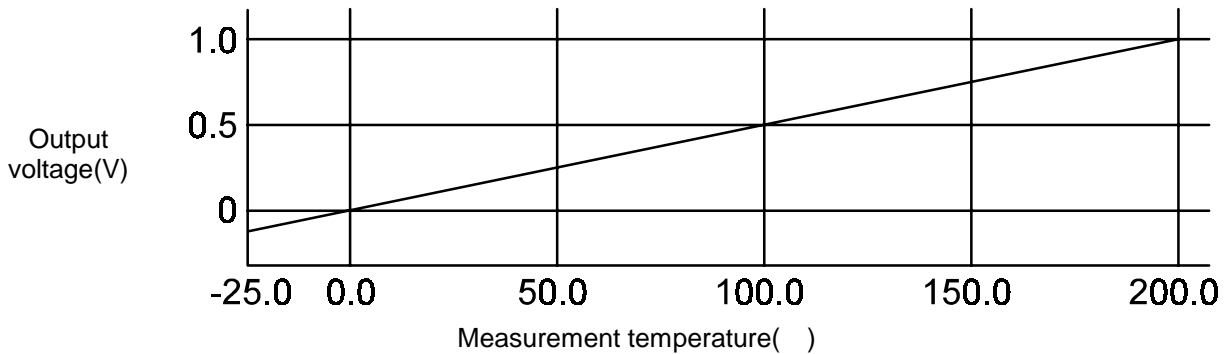
From the back of Thermo Elite



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)

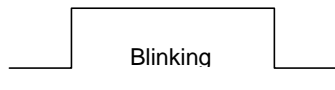
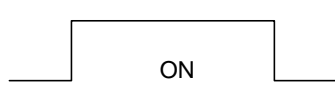
### 2. Notes concerning liquid used

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



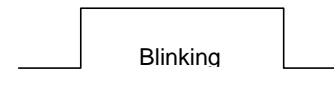
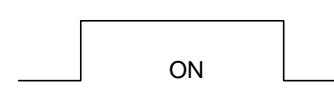
### 3. External warning output

- 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 FINISH indicator	
Time-out output	

## about an independent temperature overheating prevention device (BH500)

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There are two kinds of safety devices for overheat prevention. They are an automatic overheat prevention of controller (auto return) and an independent temperature overheating prevention device (manual return) composed of circuit and sensor independent of the controller. Double safety measures are considered to this machine.

### 1. Range of set temperature and function

Range of set temperature : 0 ~ 399

Input method : A digital switch of the treble is used. Please turn the drum of each digit and make to an arbitrary value. Please note that the digit of 100 can input only the numerical value to 0-3.

Function : When rising more than the temperature which the measurement temperature set in an independent temperature overheating prevention device, the heater output is intercepted. The leak breaker becomes and the function becomes effective while turned on. ER07 blinks to a main display when an independent temperature overheating prevention device operates and the blinking display is done and the sign of abnormality (TROUBLE) blinks. When the independent temperature overheating prevention device is activated during heater ON, ER07 and ER03 are alternately displayed.

### 2. How to use

- Please set 15 or more higher than set temperatures of this machine usually.
- Please make to a value which is very higher than the room temperature to set an appropriate value for the protection of the sample etc. Moreover, please set 15 or more higher than the highest, set temperatures in the driven temperature pattern.
- Be careful please not to lower more than an in-flight temperature and be careful not to drive a set temperature of an independent temperature overheating prevention device as a low setting. Please do setting over again after turning off the leak breaker once when you operate this machine by mistake. Please refer to item (P24) of the safety device and the error code when this machine operates depending on other causes.

### 3. Notes

- The digit of 100 of a digital switch can input only the numerical value to 0-3. There is a possibility damaging the switch when the drum is forcibly turned.
- It is likely not to notice to the change of a set temperature when a set switch is cleaned the hand's touching the switch. Please confirm whether a set temperature is an appropriate value before begin to be come in contact with this machine and to be driven.

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# Drive continuance after power supply returns

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(in case of auto return)

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The operation of the controller to whom the automatic return mode is set is as follows when blacking out while driving.

## 1. Power failure in program drive

When measured temperature after power restoration is out of the waiting band based on target temperature just before power failure, operation will enter the waiting status regardless of the wait setting of a segment currently executed. The timer that controls progress of operation will stop and operation will enter the waiting status even if the waiting function has been set to OFF in this segment. (This is called forced wait) When the remainder time is selected with the display change key at the forced wait, it is displayed in a sub-display as FW. The power failure period is not added as drive time. The remainder time immediately after the remainder time immediately before generation of the power failure and the return of the power supply is a par.

## 2. Power failure in auto stop drive

Only when the operation stop time is set to duration, not clock time, the compulsory waiting mode will be activated. When the remainder time is selected with the display change key at the forced wait, it is displayed in a sub-display as FW. The time under the power failure is not added as drive time. The remainder time immediately after the remainder time immediately before generation of the power failure and the return of the power supply is a par. However, when the drive end time is set at clock time, the power failure period is counted partially at the drive time. The remainder time immediately after the return of the power supply is a value by which the power failure period was subtracted at the remainder time immediately before the power failure. The drive begins immediately after the return of the power supply when becoming drive beginning time for the power failure period.

## 3. Power failure because of state of drive beginning waiting (auto start mode etc.)

When the operation start time is set to duration, not clock time, duration of power failure will not be counted as waiting time. The remainder time immediately after the remainder time immediately before generation of the power failure and the return of the power supply is a par. However, when the drive end time is set at clock time, the power failure period is counted partially at waiting time. The remainder time immediately after the return of the power supply is a value by which the power failure period was subtracted at the remainder time immediately before the power failure. The drive begins immediately after the return of the power supply when becoming drive beginning time for the power failure period.

## 4. Power failure during operation with fixed set point or during soak operation (auto start mode).

After the power supply returns when the power failure occurs while executing these drives which do not depend at time, this machine restarts the drive aiming at the temperature set before blacking out.

## 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 processing method	Notes
Leak Breaker	No display	Please report to our customer service section and confirm the cause.	
Motor thermal protector	No display	Overheating of motor : Please report to our customer service section.	
Automatic overheat protector.	No display	Heat of sample : Please decrease the sample.	
Sensor abnormality detection	TROUBLE sign blinking <i>Er.01</i> blinking	Disconnection of temperature sensor : Please report to our customer service section.	
Triac short-circuit detection	TROUBLE sign blinking <i>Er.02</i> blinking	Short-circuit of Triac : Please report to our customer service section.	
Heater short-circuit detection	TROUBLE sign blinking <i>Er.03</i> blinking	Disconnection of heater : Please report to our customer service section.	
independent temperature overheating prevention device	TROUBLE sign blinking <i>Er.07</i> blinking	Incorrect setting of independent temperature overheating prevention device : Please set correctly. Heat of sample : Please decrease the sample. Defect of independent temperature overheating prevention device : Please report to our customer service section.	BH500 and the machine equipped with independent temperature overheating prevention device
Main relay defect detection	TROUBLE sign blinking <i>Er. 10</i> blinking	Breakdown of main relay : Please report to our customer service section.	
Refrigerator abnormality detection	TROUBLE sign blinking <i>Er.03</i> blinking	Dropout of the plug of refrigerator : Please connect with the outlet in the back of the control part. The refrigerator is abnormal : Please report to our customer service section.	BH200/300
Water level abnormality detection	TROUBLE sign blinking <i>Er.20</i> blinking	Decrease in water level : Add liquid to reservoir. Rise of water level (thermal expansion) : Decrease liquid from reservoir. Defect of water level detector : Please report to our customer service section.	The equipment goes back to the normal state automatically when liquid level becomes normal.

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## Maintenance method

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### Check and maintenance usually

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#### Warning

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- Please pull out the power supply plug from the outlet if it is necessary when checking and maintaining.
- Please execute after the equipment returns to normal temperature.
- Please never decompose the equipment.



#### Caution

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- Please wipe the part of the resin and the dirt of the operation panel with the soft cloth often squeezed. Wiping with benzene, thinner or kurenzah etc., rubbing with the scrubbing brush will cause the transformation, changing in quality, and discoloration.
- Please check the function of leak Breaker according to an undermentioned procedure.
  - Please connect the power supply code and put into the energized state.
  - Please turn on the switch of leak Breaker.
  - Push the red test button of earth leakage circuit-breaker with the point such as pens. If the switch is turned off, the function is normal.
- Please clean the fin of the condenser according to an undermentioned procedure. (BH200/300)
  - Please remove the grill in front of the main body of the device.
  - Please remove the dust which is about the surface of the condenser fin with the cleaner etc. (Be careful please not to crush the fin)
- Please check the movement of an independent temperature overheating prevention device according to an undermentioned procedure. (BH500 and only equip with an independent temperature overheating prevention device)
  - Please execute the fixed value drive at a suitable set temperature.
  - Afterwards, please set the operating temperature of an independent temperature overheating prevention device in a value which is 5 °C lower than the driven temperature.
  - The heater circuit is intercepted several seconds later when the operation is normal and an TROUBLE sign and ER07 blink at the same time. The warning buzzer rings when the warning buzzer function is set in turning on.

**Attention :** Please check these every month. Moreover, execute the check on leak Breaker and an independent temperature overheating prevention device before an uninhabited drive at long period continuous running and nighttime.

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## When not used for a long term or abandoned

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#### Caution

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



#### Warning

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- Please do not leave this machine in the place where the child plays when you abandon.

# After-sales service and guarantee

## 1. When you request the repair

- Please record the error code, turn off the power supply switch, and pull out the power supply plug if abnormality occurs by any chance. Please report to the shop or the our company office.
- Content wanting to tell when reporting
  - Form of product
  - Product number
  - Date of purchase (Please look at the guarantee book or the rating plate pasted to the main body)
  - Content of breakdown (It is detailed)
- Please present the guarantee book when the person of the person in charge of service visits.

## 2. Guarantee book

- The guarantee book is passed from the shop or the our company office. Please keep it importantly after confirming the filling in matter such as the shop name and the purchase days and often reading.
- It is for one year at guaranteed term from purchase day. When the breakdown occurs within the guaranteed term, our company repairs free of charge according to the condition described to the guarantee book.
- Please consult the shop or the our company office about the following repair at the guaranteed term. When the function can be maintained by repair, we repair the equipment upon your request on charge basis.

## 3. The lowest possession periods of parts for repair

- After discontinuance of manufacturing, the lowest possession periods of parts for repair of this machine are for seven years. Parts for the repair are parts necessary to maintain the performance of the product.

## 4. When thinking the equipment breaks down

Symptom	Please confirm
Leak Breaker of turning on is not displayed to time now by a sub display.	<ul style="list-style-type: none"> <li>• Is the power supply code surely connected with the outlet or the switchboard?</li> <li>• The power will not be supplied.</li> </ul>
The temperature changes. Or, does not reach the temperature of hope.	<ul style="list-style-type: none"> <li>• The heat load will be too large.</li> <li>• The viscosity of the liquid will be too large. The passage resistance will be too large. (When using as a circulation tank)</li> <li>• Does not the voltage of the power supply decrease?</li> </ul>
The refrigerator does not work. (BH200/300)	<ul style="list-style-type: none"> <li>• Is the plug of the refrigerator connected with the outlet for the refrigerator in the back of the control part?</li> <li>• Is not the drive function selection of the refrigerator set in turning off?</li> </ul>

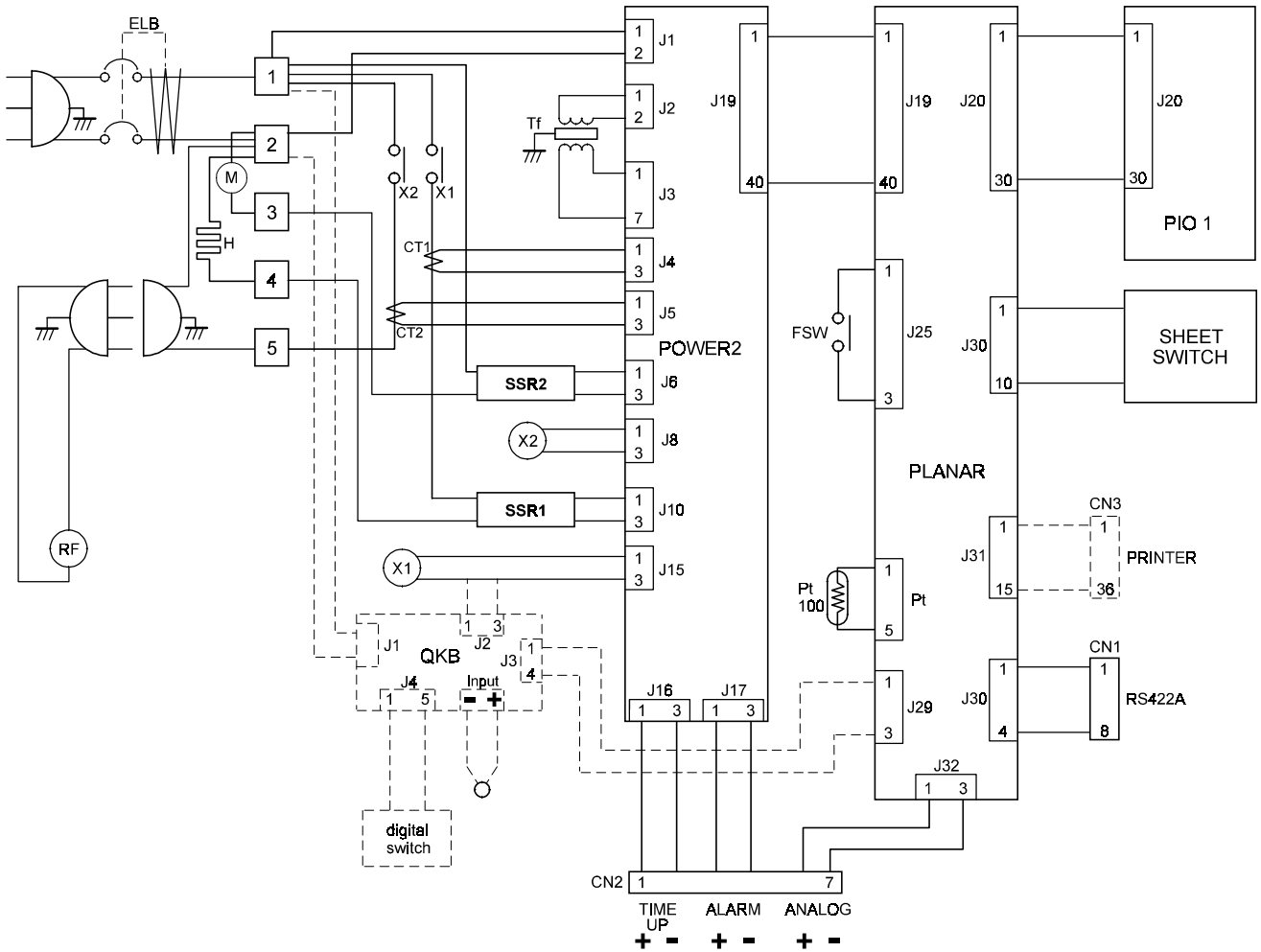
# Specification table

Form	BH200	BH300		
<b>Performance ↓</b>				
Range of temperature setting ( )	-30.0 ~ +100			
Range of operation temperature ( )	-20 ~ 80	-25 ~ 80		
Temperature adjustment accuracy ( )	± 0.01 ~ 0.02 (Ethanol 50% sol. ,RT25 ,No-load)			
Ability of circulating pump	Max. pump head : 3(mH <sub>2</sub> O), Max. stream flow : 20(l/min) (Refrigerant : Water , Water temperature : 25 )			
Cooling ability (kcal/h)	150(at20 ,RT25 )	200(at20 ,RT25 )		
<b>Function and composition ↓</b>				
Temperature adjustment machine	IVCR type controller (Zero crossover switching, PID microprocessor control)			
Sensor	Pt100 A class (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 value drive, Auto start drive., Auto stop drive Program drive : Arbitrary pattern, Max.16 segment (repetition and ramp operation, etc.) , Refrigerator drive function (There is no refrigerator energizing indicator)			
Other incidental functions	<ul style="list-style-type: none"> <li>• Memory backup</li> <li>• Key lock</li> <li>• Multiplication time function ( up to 49999 hours)</li> <li>• Holding</li> </ul>	<ul style="list-style-type: none"> <li>• Function that enable to change the strength of jet stream (10 step changeability)</li> <li>• Calendar timer</li> <li>• Clock</li> </ul>	<ul style="list-style-type: none"> <li>• Analogue warning output</li> <li>• Time-up output</li> <li>• External communication (RS422A correspondence)</li> </ul>	<ul style="list-style-type: none"> <li>Output terminal (Seven pin connector)</li> <li>Communication terminal (eight pin connectors)</li> </ul>
Heater (made of SUS)	1.0kw			
stirring mechanism	Stirring by jet stream			
Refrigerator	Compression machine output	150W	400W	
	Refrigerant	R22		
Other compositions	Drain entrance (with stopping) , Stainless flexibility tube with heat insulation for circulation			
Safety device	<ul style="list-style-type: none"> <li>• Leak Breaker</li> <li>• Thermal protector (for stirring motor)</li> <li>• The float type High/Low liquid level detector (Low level only for BH400)</li> <li>• 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)</li> </ul>			
	Refrigerator automatic operation stop (It is shutdown at 45 or more in set temperature)			
<b>Standard ↓</b>				
Capacity of reservoir ( l )	13	30		
Size of reservoir (W × D × H mm)	389 × 226 × 150	501 × 295 × 200		
The outside size (W × D × H mm)	654 × 492 × 615	385 × 589 × 1150		
Power supply	AC100V 13A	AC100V 14A		
<b>Standard attached goods</b>	Stainless hose entrance for external circulation (Rc1/2 × Outside diameter 14mm) × 2			
<b>Attached goods outside standard</b>	<ul style="list-style-type: none"> <li>• Digital printer</li> <li>• independent temperature overheating prevention device</li> <li>• By-pass tube for external circulation, Insulated hose for external circulation</li> <li>• Cable for external communication, Personal computer connection interface, (RC23), Multi wick cable for output (All model commonness)</li> </ul>			



# Chart of connecting wires

BH200/300



## Exchange part table

Sign	Part name	Code number	Specification	Note
P1	Power supply cable	2-13-001-0006	T2-3-c	
P2	Power cable for refrigerator	2-13-001-0005	T2-3b	
ELB	Leak Breaker	2-06-005-0019	BJS1531	
T1	Terminal block	2-07-023-0002	Moll-Ofx5p	
H	Heater	BF400-30020	AC100V 1KW	
M	Motor for pump	2-14-007-0002	U-2035-1	
Tr	Transformer	2-18-000-0022	AC100V	
POWER 2	Power supply substrate	1-24-000-0011	Hitec CR	
PLANAR	Control substrate	1-24-000-0008	Hitec CR	
PIO 2	Display substrate	1-24-000-0009	Hitec CR	
RF	Refrigerator	3-01-002-0006	UF-S210ML	BH200
	Refrigerator	3-01-002-0005	NU401ALE	BH300
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		
X2	Relay	2-05-000-0011		
CT1,2	Current detection element	2-17-001-0002	CLT-6-S-400	
Pt	Sensor	1-16-003-0029	Pt100 A class	
FSW	Float switch	2-02-001-0004	AHR541161	
CN1	receptacle	2-08-000-0039	DIN8P	
CN2	receptacle	2-08-000-0038	DIN7P	

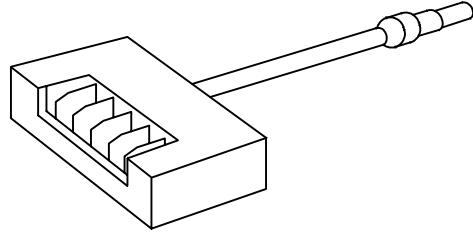
# About attached goods outside the standard

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

## 1. Cable for external communication

### OBK 10

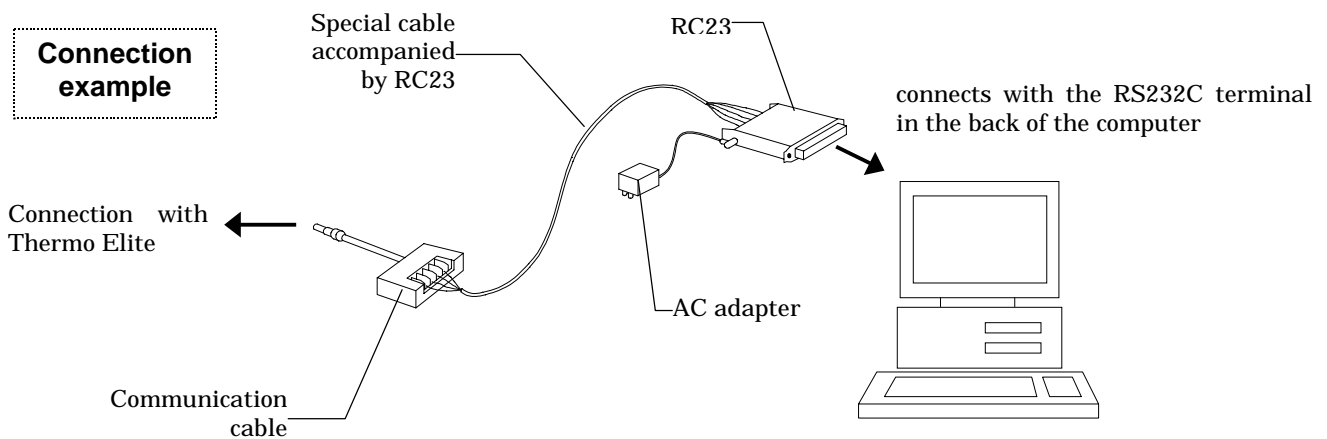
- Cable which combined plugs connected with connector in the back of control part with terminal box



## 2. Communication protocol converter

### RC 23

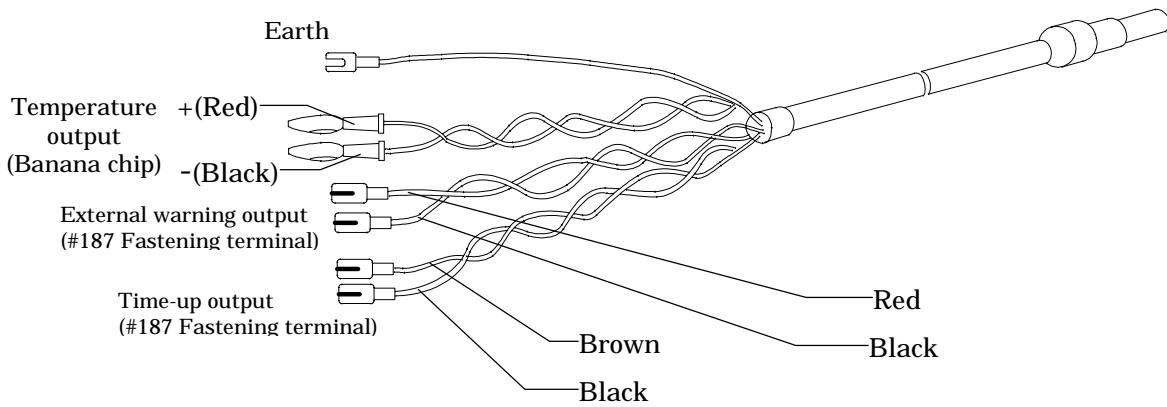
- RC23 is a converter which converts RS232C of the personal computer into RS422A. There is no need for RC23 when your computer has RS422A communication interface.



- 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.

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

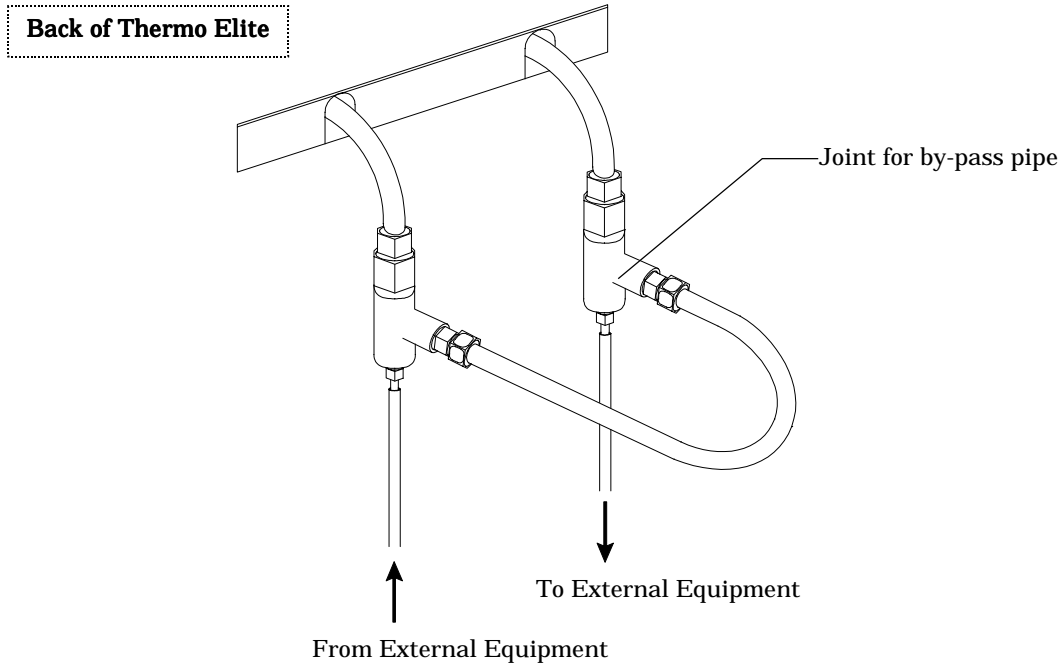
OBL 10



### 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.



**Attention :** Please 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

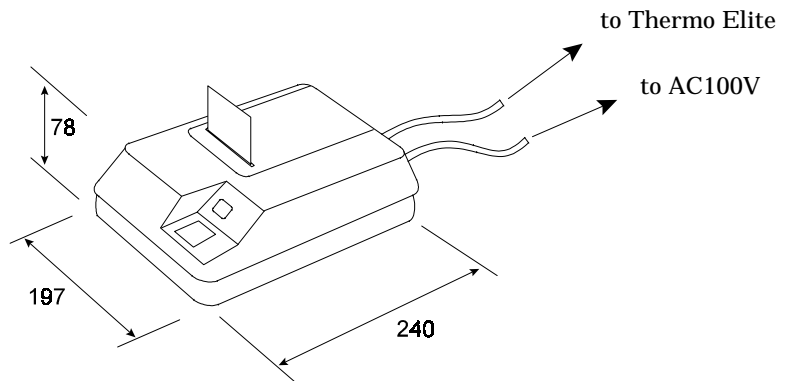
### OBH 60

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- 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

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- 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 )