Thermomate

BF200/BF400
BF500/BF600

Seventh Edition

- **Thank you for purchasing "Thermomate BF Series" of Yamato Scientific Co., Ltd.**
- **In order to use this Equipment properly, please read this Instruction Manual and Warranty Card thoroughly before use. Keep them in safe place close to this Equipment so that you can refer to them any time.**

⚠ **Warning: Please read the important warning notes in this Manual carefully and thoroughly, and get the good understanding of their contents before using this Equipment.**

Yamato Scientific America Inc.

Santa Clara, CA

Contents

1. Safety Precautions

Explanation of symbols

About symbols

Various symbols are provided in this Instruction Manual and on the product to ensure safe operation. Improper handling of this Equipment without understanding their contents will lead to the results classified below. Be sure to fully understand the description of symbols below before proceeding to the text of this Manual.

Warning Indicates a situation which may result in death or serious injury (Note 1.)

Caution Indicates a situation which may result in minor injury (Note 2) and property damages (Note 3.)

（Note 1）Serious injury means a wound, an electrical shock, a bone fracture or intoxication that may leave after effects or require hospitalization or outpatient visits for a long time

（Note 2）Minor injury means a wound or an electrical shock that does not require hospitalization or outpatient visits for a long time.

（Note 3）Property damage means damage to facilities, devices and buildings or other properties.

Meanings of symbols

This symbol indicates a matter urging user to follow the warning (“caution” included).
Specific description of warning is indicated near this symbol.

This symbol indicates prohibitions.
Specific prohibition is indicated near this symbol.

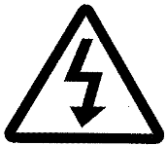
This symbol indicates matters that the user must perform.
Specific instruction is indicated near this symbol.

1. Safety Precautions

List of symbols

Warning

General Warnings



Danger!: High Voltage

Danger!: High Temperature

Danger!: Moving Part

Danger!: Explosion Hazard

Caution

General Cautions

Caution: Electrical Shock!

Caution: Burns!

Caution: Heating Container without water!

Caution: Water Leak!

Caution: For water only

Caution: Toxic Chemicals

Prohibitions

General Prohibited Actions

No open flame

Do not disassemble

Do not touch

Compulsions

General Mandatory Actions

Connect grounding wire

Leveled Installation

Disconnect Power

Regular Inspection

1. Safety Precautions

Warning and Cautions

⚠ Warning

Never operate the Equipment in an atmosphere where flammable or explosive gas is present.

Never operate this Equipment in an atmosphere where flammable or explosive gas is present. This Equipment is not explosion-proof. It will cause fire/explosion.
Refer to “Chapter 19. List of Dangerous Substances” on P.74.

Ground always the Equipment.

Ground always this Equipment properly in order to avoid electric shock due to electrical leakage.

Turn the power of the controller and the ELB off immediately when you notice any abnormality.

Turn the power of the controller and the ELB off immediately and unplug Power Cord from outlet or disconnect the breaker of switch board of facilities, If smoke or strange smell is generated from this Equipment by chance. It may cause fire or electrical shock.

Do not operate at Power Cord/Power Cable bundled state.

Do not operate at Power Cord/Power Cable bundled state. If it is operated in such a manner, it will overheat, and then cause fire.

Do not damage Power Cord/Power Cable.

Do not damage Power Cord/Power Cable by bending, pulling, or twisting with force. It may cause fire or electric shock.

Never use an explosive or a combustible substance.

Never use an explosive or a combustible substance or any substances that contain such a substance. Otherwise an explosion or a fire may result.
Refer to “Chapter 19. List of Dangerous Substances” on P.74.

Never touch high temperature sections.

Never touch high temperature sections. Some sections of this Equipment are heated during and right after operation. Watch out for getting burned.

Never disassemble nor modify the Equipment.

Never disassemble nor modify this Equipment. Those actions may cause malfunction, fire or electric shock.

⚠ Caution

Turn immediately the power of the controller and the ELB off at thundering.

Turn immediately the power of the controller and the ELB off at thundering. If not, it may cause fire or electric shock.

2. Before operating the Equipment

Precautions when installing the Equipment

1. Choose proper place for installation

Do not install this Equipment in the place where:
- the location is rough, dirty or un-leveled.
- flammable gas, explosive gas or corrosive gas will be generated.
- ambient temperature will be more than 35℃.
- ambient temperature will fluctuate.
- there is excessive humidity and dusty.
- there is direct sunlight.

Install the Equipment(s) at the place with sufficient space.

2. **Install the Equipment on leveled location.**

Install this Equipment on leveled floor. If it is installed on rough and/or slope floor, vibration or noise will be occurred, and unexpected trouble and malfunction may be happened.

3. Implement safety measures when installing the unit.

May be injured by moved and/or fallen this Equipment down by earthquake and/or unexpected impact. Recommend to install this Equipment at the place away from the access door and to take other safety steps.

4. Must connect grounding wire properly.

- Require to ground by Electrical Equipment Technical Standards Section 19-calss D in Japan, if grounding terminal is not provided. Please contact with local dealer, local electrician, or Yamato Customer Service Center.
- Connect the terminals firmly to switch board of facilities or appropriate power plug.

Never connect grounding wire to gas line pipe, water line pipe or telephone grounding wire due to fire or electric shock.

5. Never disassembly nor modify the Equipment.

Never disassemble nor modify this Equipment. Those actions may cause this Equipment malfunction, fire or electric shock.

6. Never operate in an atmosphere where flammable or explosive gas is present.

Never operate this Equipment in an atmosphere where flammable or explosive gas is present. This Equipment is not explosion-proof. Spark may be discharged by switching Earth Leakage Breaker (ELB) “ON(｜)” and “OFF(○)” and also relay during operation, and then it may cause fire or explosion.

See Chapter 19. “List of Dangerous Substances” for flammable and explosive gases on page .74

2. Before operating the Equipment

Precautions when installing the Equipment

7. Connect Power Cord/Power Cable to receptacle or switch board of facilities.

Connect Power Cord/Power Cable to suitable receptacle/switch board of facilities according to electrical requirements as follows.

Electrical requirements: : BF200/400/500 AC100V 11A , BF600 AC100V 13A

* Check line voltage of its receptacle/switch board of facilities and/or whether utilize the same line with other equipment or not, if this Equipment does not start up/operate even to turn Earth Leakage Breaker(ELB) On(|). Take correct action for the solution, such as changing its power source away from other equipment.

May drop input voltage to this Equipment and cause to degrade its heating and also temperature control performance, if multiple power plugs/power cables are connected with single outlet.

Never disassemble nor modify this Equipment. Those actions may cause this Equipment malfunction, fire or electric shock.

8. Take care for handling of the power cord.

Never operate this Equipment at bundled Power Cord/Power Cable. May heat its Cord/Cable and then cause fire, if operate at bundled it.

Do not modify, bend forcibly, twist or pull Power Cord/Power Cable. Otherwise, may cause fire and/or electrical shock.

Do not damage Power Cord/Power Cable by setting under any desk and/or chairs, or by pinching it between objects. Otherwise, may cause fire and/or electrical shock.

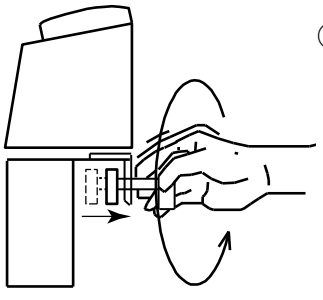
Do not place Power Cord/Power Cable close to kerosene heater, electric heater, or other heat-generating devices. Insulation of Power Cord/Power Cable may burn and cause fire or electrical shock.

Turn immediately off Earth Leakage Breaker (ELB) and also disconnect Power Plug/breaker of switch board of facilities, if it is damaged such as exposure of core wire or disconnection. May cause fire or electrical shock, if this Equipment is operated with damaged Power Cord/Power Cable.

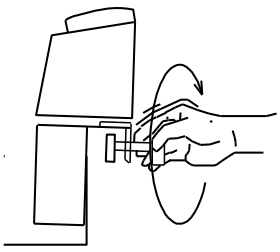
Connect Power Cord/Power Cable to appropriate receptacle or switch board of facilities.

9. Do not over-tighten the fixing knob.

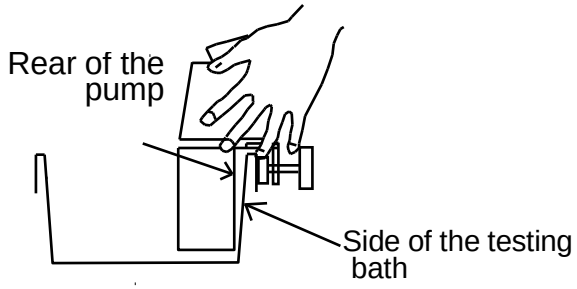
Over-tightening the fixing knob may deform the testing bath.



①Turn the fixing knob anticlockwise sufficiently.



②Place the BF unit on the testing bath.



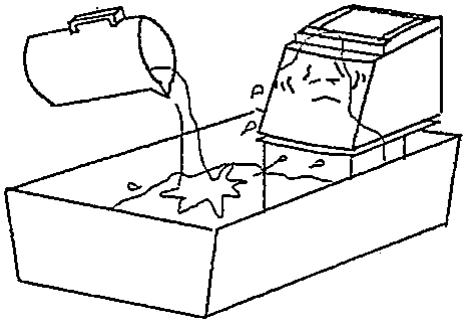
③ Turn the fixing knob clockwise to tighten until there is no gap between the rear of the pump cover and the side of the testing bath.

Do not tighten it any further.

Precautions on installation

10. Do not splash water on the unit

Never splash water on electric components to avoid possible electric leakage or an electric shock.



11. Do not use well water

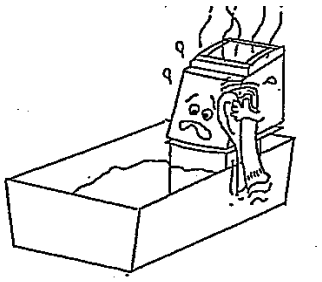
Use distilled water or pure water to use in the testing bath. Well water or low quality water will make scale or stone accumulate inside the heater and the pump, which compromises their performance or causes a malfunction.

◎	○	×
Distilled water Pure water	Tap water	Well water

12. When you use a silicon oil

You cannot use silicon oils on any models other than BF600, which supports silicon oils. Using a silicon oil on a model other than BF600 will subject the stirrer motor under burden leading to overheat or a malfunction. Use a silicon oil when the set temperature is 80℃ or higher.

- Use a silicone oil whose viscosity is 50cst or less. If you use a silicon oil of a high viscosity, preheat to lower the viscosity before using BF600.



Select a silicone oil designed especially for heat medium and with an open-system silicone oil (heat-resistance dimethyl silicone oil) viscosity of 100 ㎜ ^{2}/s (cSt).

Recommended silicone oil：

Operating temperature is 200℃ or lower　Toshiba Silicone TSF458-50

Operating temperature: 200℃～270℃　Toshiba Silicone　TSF458-100

Characteristics of silicone oils	Manufacturer	Toshiba Silicone	Toshiba Silicone
	Recommended temperature	200℃ or lower	200℃～270℃
	Product name	TSF458-50	TSF458-100
	Outer appearance	Transparent light yellow	Transparent light yellow
	Specific gravity(25℃)	0.961	0.963
	Viscosity(25℃）㎜ 2/s（cSt）	50	100
	Volatile content (150℃, 24h)%	0.3	0.3
	Viscosity temperature coefficient	0.59	0.59
	Ignition point (℃）	325	342
	Pour point (℃)	-50℃ or lower	-50℃ or lower
	Viscosity increase rate (300℃, 168h）%	40	35

The degradation rate (viscosity change) of a silicone oil will differ depending on the temperature used.

In particular, the TSF485-100 that is used at over 200℃, viscosity shows almost no changes at 200℃, the normally operated temperature and about 1000 hours at 250℃ and about 100 hours at 270℃.

Contact the silicone oil manufacturer for details.

2. Before using the unit

13. When you use an antifreeze liquid

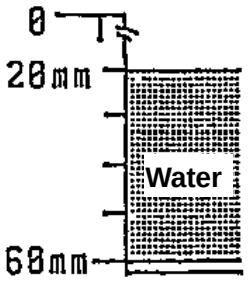
- Never use an ignitable, toxic or corrosive liquid.
- Never use glycerin or ethylene glycol.
- For a lower temperature range, use ethyl alcohol only and be sure to operate at 20℃ or lower by employing a cooling coil and a throw-in type cooler.

14. Use a stainless steel bath for 14.80℃ or higher temperatures

The withstand temperature of the testing bath included is 80℃(Lower limit temperature: −5℃). Purchase the optional stainless steel bath if you are going to operate the unit at a temperature other than that.

15. Check the water level

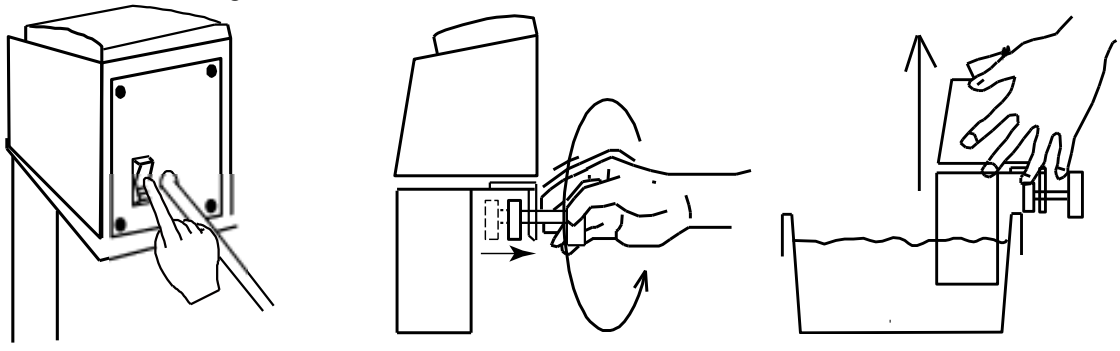
- Keep the water level shown in the right figure. (The vertical axis in the figure indicates the depth from the top part of the testing bath)
- If the water level is below 20mm, water flow during stirring may cause water overflow and when the water level goes down by 60mm or more, the water level detection sensor is activated to stop temperature control.
- When you use a silicone oil with BF600, take care not to make it overflow from increased volume at a higher temperature.
  Reference: 25℃→10.0ℓ 180℃→11.5ℓ



16. Cautions on draining

Do not incline the testing bath to drain with the BF unit installed to it. The BF unit may detach from the testing bath and may lead to damages or a malfunction.

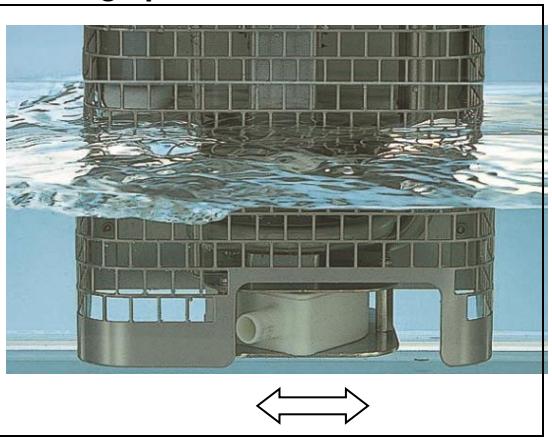
①Turn the power switch off at the rear of the BF unit.
②Remove the power plug from the outlet.
③Turn the fixing knob anticlockwise by several turns.
④Remove the BF unit.
⑤Drain water of the testing bath.
⑥Refer to the section on P5 “Do not over-tighten the fixing knob.” for the installation of the BF unit to the testing bath.



① ② ③ ④

17. You can change the direction of the pump discharge port

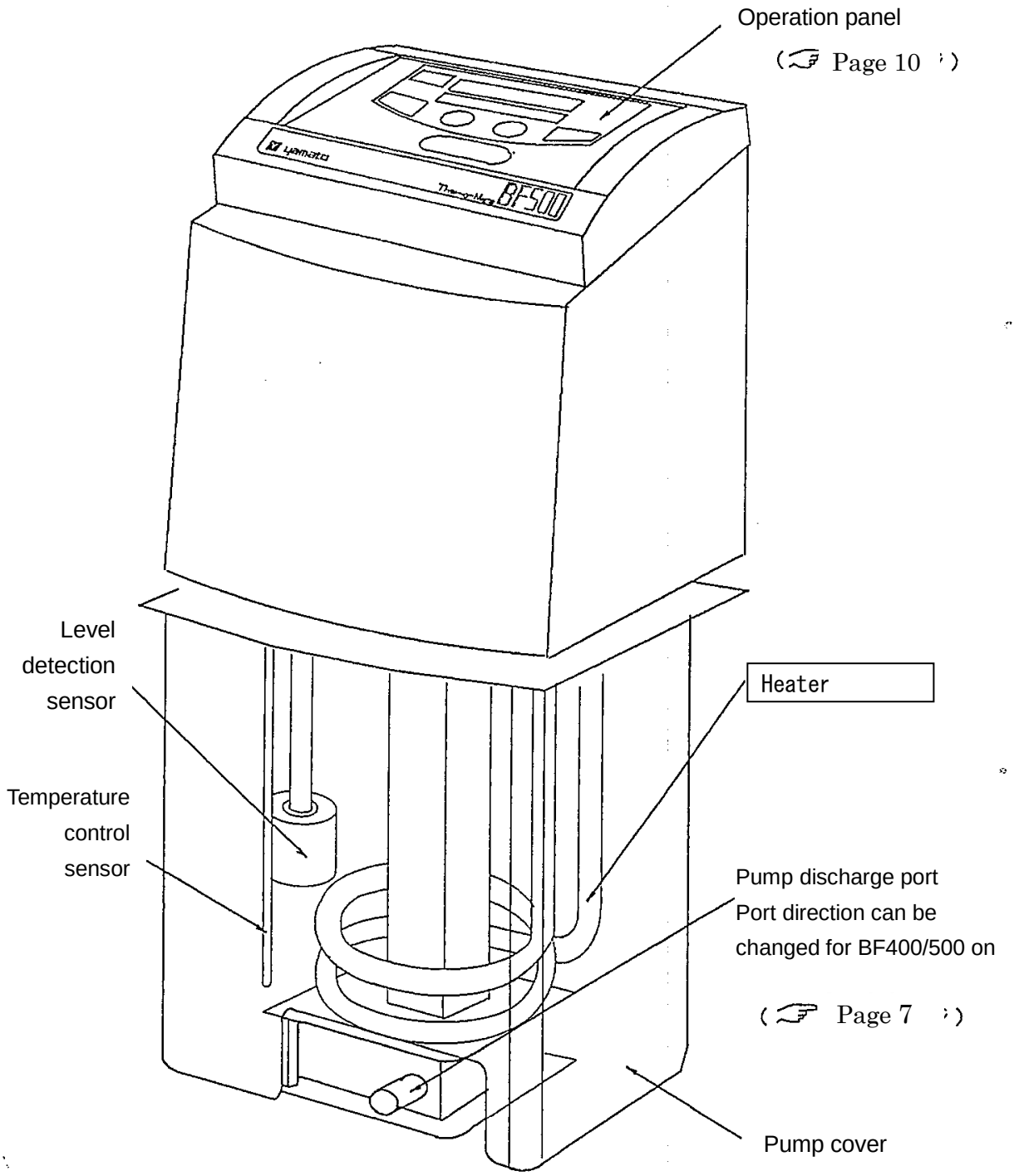
⚠ While BF400 or 500 is used, a specimen in front of the pump discharge port will interfere with circulation of water in the bath or cause splash, in which case the angle of the port shall be changed.



3. Names and functions of parts

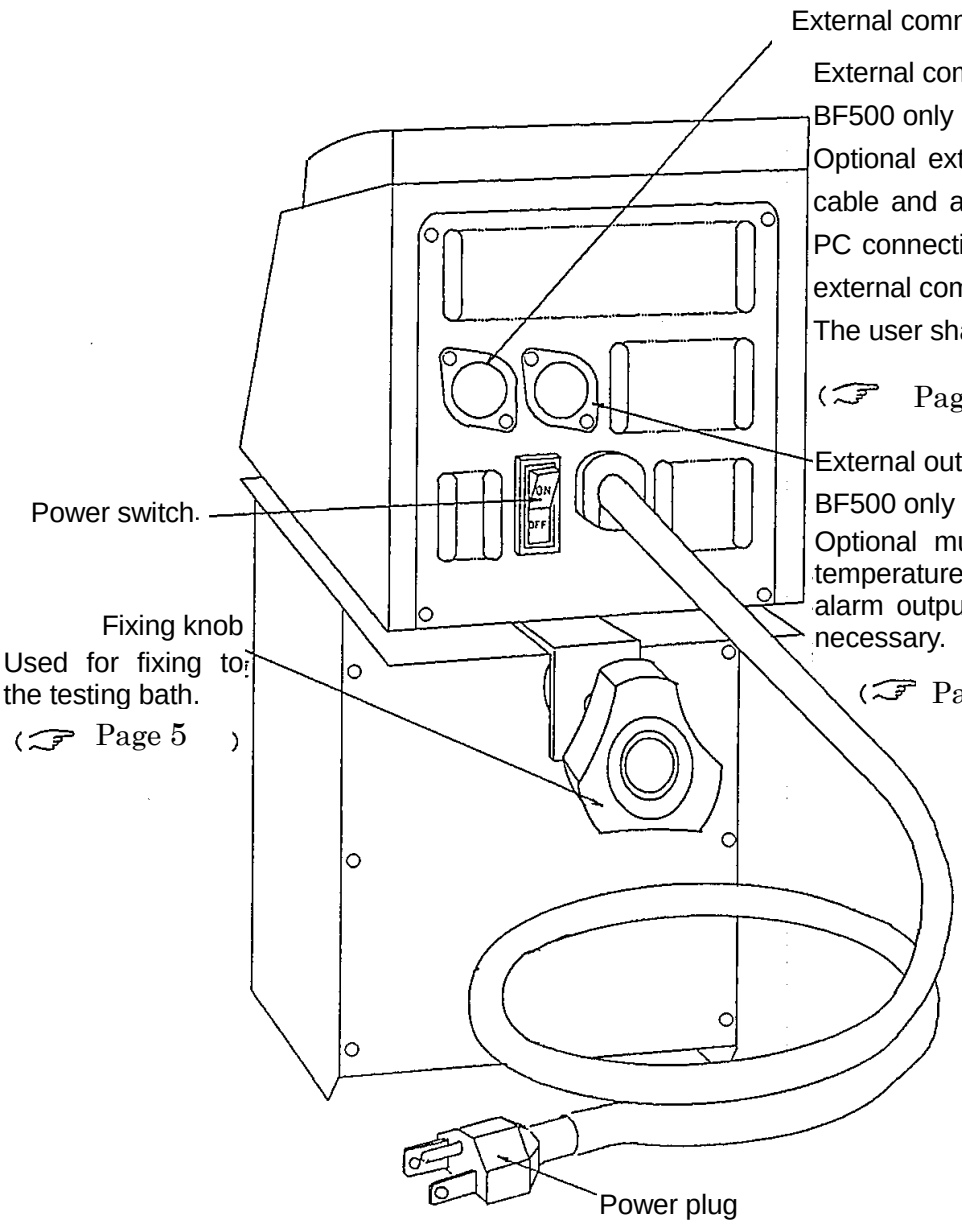
Main unit

BF500



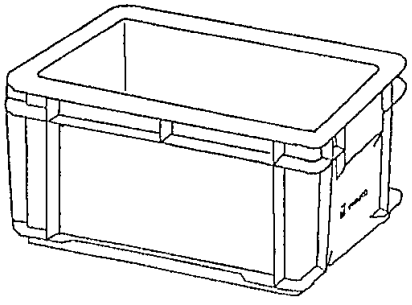
3. Names and functions of parts

Control box



Accessories

Testing bath BY100 Product code: No.221824
(Polypropylene)



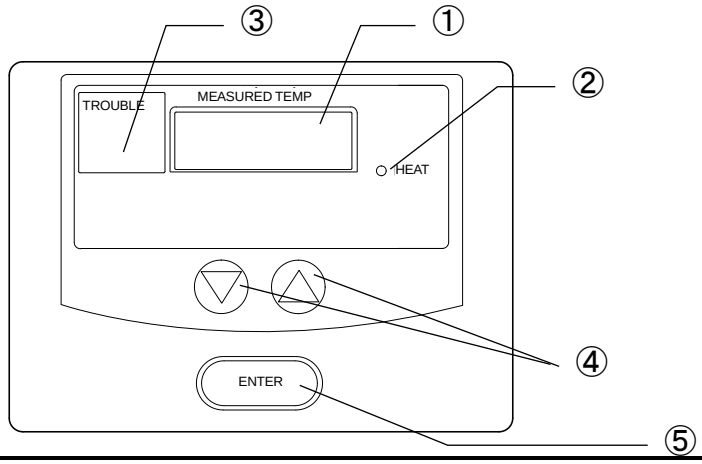
Accessory printed matter

- Instruction manual x 1
- Warranty card x 1

3. Names and functions of parts

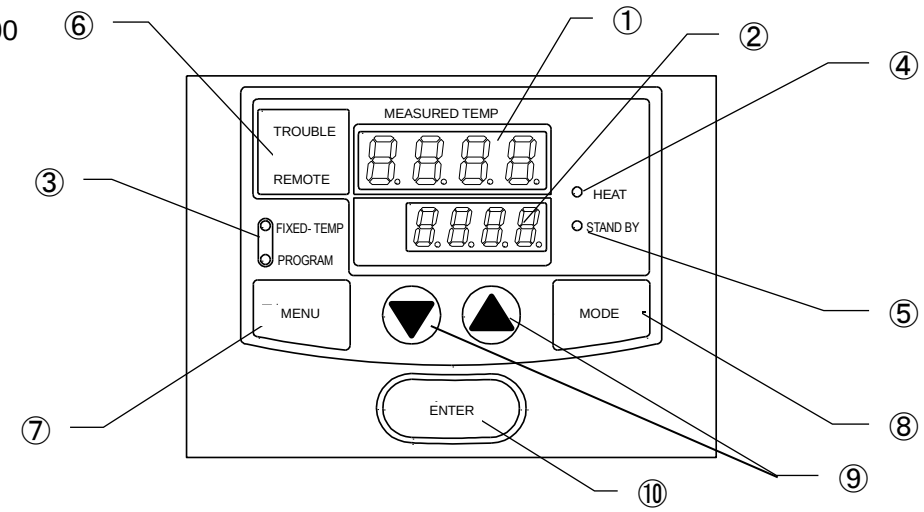
Operation panel

BF200



①	Display	Indicates the set temperature and the measured temperature.
②	HEATER	Stays lit while power is supplied to the heater.
③	Blind window	Indicates flashing “TROUBLE” when a trouble has occurred.
④	Up and Down keys	These keys are used to change settings.
⑤	ENTER key	This key is used to determine a setting.

BF400/500/600

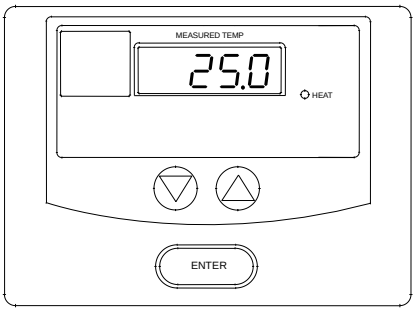
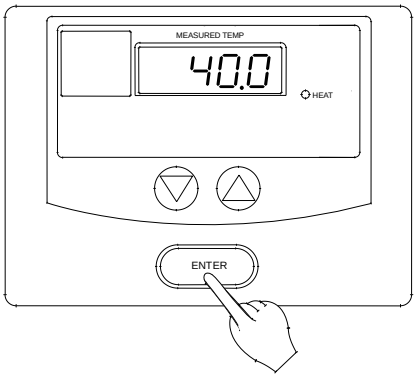
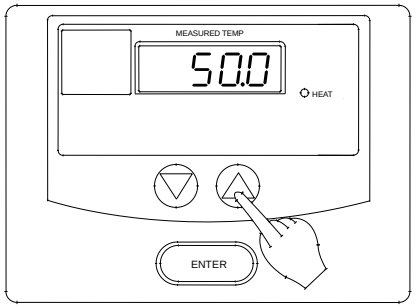
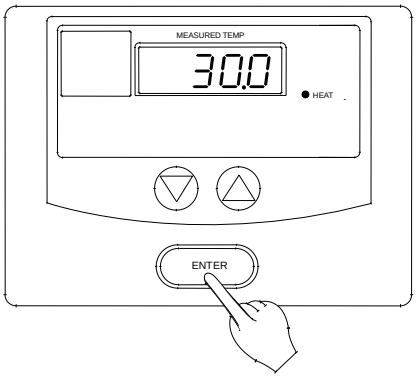


①	Main display	Mainly indicates the temperature in the bath.
②	Sub display	Indicates a set temperature, the remaining time, contents of the execution program or other information.
③	Operation mode indicator lamp	Indicates whether the present mode is the fixed-temperature mode or the program operation.
④	HEATER lamp	Stays on while power is supplied to the heater.
⑤	STAND BY lamp	Comes on during the standby mode for the program run or other operation modes.
⑥	Blind window	This windows shows nothing in the normal state. The [TROUBLE] lamp comes on when a trouble occurs to a device and the [REMOTE] lamp comes on when the optional communication function is used. (BF500 only)
⑦	MENU key	The key is used to switch the operation mode.
⑧	MODE key	The key is used to select different functions.
⑨	▼▲(UP/DOWN) key	The key is used to change settings.
⑩	ENTER key	The key is used to determine a setting or a mode.

4. Operating procedures (For BF200)

Operations after turning the power switch ON

Start operating the unit when it is ready.

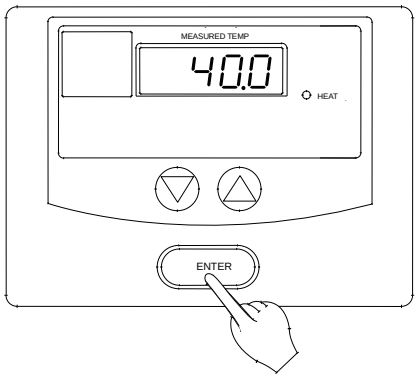
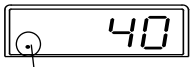
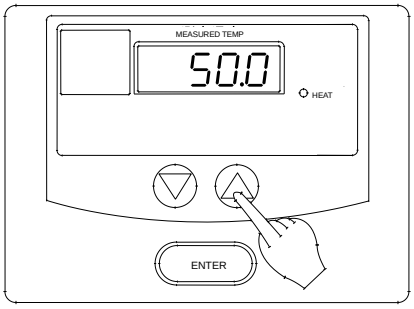
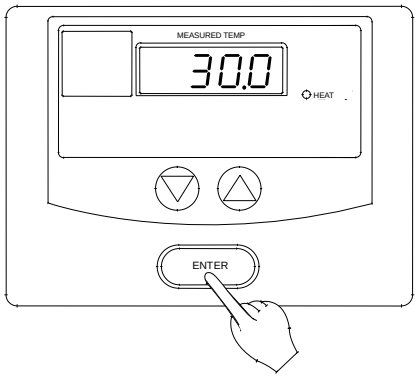
Display after operation and operating procedures	Description
 Turn the power switch at the rear of the unit ON. Example…Measured temperature: 25℃	Once power is turned on, fixed-temperature operation is started with the temperature set in the previous session as the target. →The display indicates the current measured temperature.
”To change the temperature setting”  Press the [SET] key. Example…Set temperature of 40℃ in the previous session	Press the [SET] key. →The display changes indication to the flashing temperature set in the previous session.
 Press either one of the [▽] or [△] keys. Example…Changing fixed-temperature mode at 40℃ to the same mode at 50℃.	Press either one of the [▽] or [△] keys until the temperature flashing in the display reaches the target temperature. ●Pressing the [▽] key decreases the value and the [△] increases the value.
 Press the [SET] key.	Press the [SET] key when you have adjusted to the temperature you want. →The display changes indication of flashing set temperature to the present measured temperature and fixed-temperature operation starts towards the set temperature. ●When the set temperature is higher than the present measured temperature, the “HEAT” lamp comes on and heating starts.

4. Operating procedures

How to use the temperature preset function

How to register a preset temperature

You can register a preset temperature any time except for during an error as long as the power switch is ON. Follow the procedures below to register. Operation will continue during registration of a preset temperature.

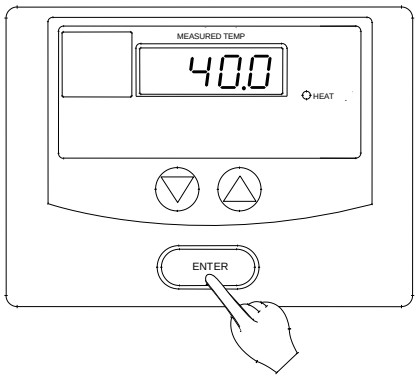
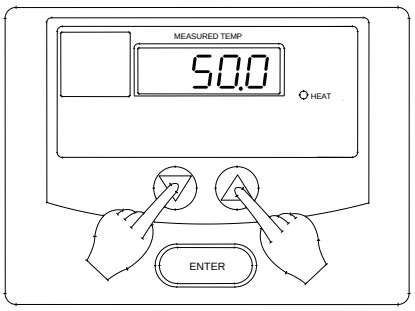
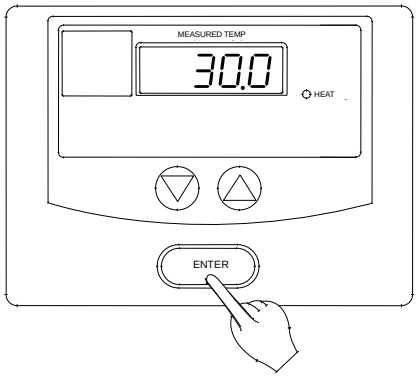
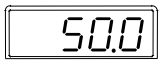
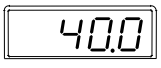
Display after operation and operating procedures	Description
Press the [SET] key twice. 	Press the [SET] key twice. →The mode will change to the preset temperature register mode and the indication of the display will change from the present measured temperature to the flashing temperature already registered. The leftmost dot on the display flashes to indicate the preset temperature registration mode is activated. Example…  Indication of the preset temperature registration mode The display indicates flashing  if no preset temperature is registered.
Press the [▽] or the [△] key.  Example…Registering 50℃	Press the [▽] or the [△] key to change the value in the display to a temperature you want to register.
Press the [SET] key.  Example… Present measured temperature: 30℃	Press the [SET] key when you have adjusted to the temperature you want. →Updated temperature will be registered and the previous temperature will be deleted. →The preset temperature has been registered and the display indication changes the flashing registered temperature to the present measured temperature.

4. Operating procedures

How to use the temperature preset function

How to call for/cancel the preset temperature

You call for the preset temperature when you set a target temperature. Be sure to follow the procedures below. Operation will continue while the preset temperature is being called for.

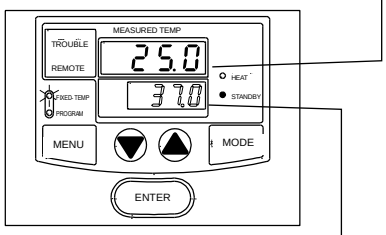
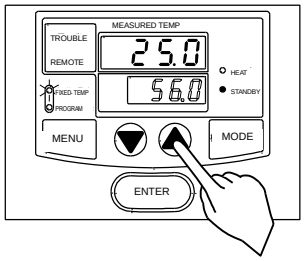
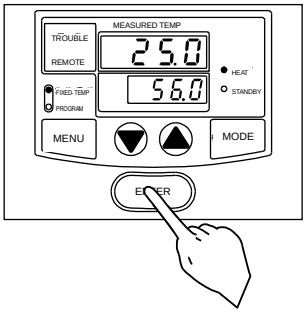
Display after operation and operating procedures	Description
 Press the [SET] key. Example…Previous set temperature:40℃	Press the [SET] key to change to the temperature setting mode. →The display indication changes from the present measured temperature to the flashing temperature set in the previous session.
 Press the [▽] and the [△] keys at the same time for more than 1 second.	Press the [▽] and the [△] keys at the same time for more than 1 second. →The mode changes to the temperature preset mode and the display indicates flashing registered temperature. The display indicates flashing [----] when no preset temperature is registered.
 Press the [SET] key. Example…Present measured temperature:30℃	When you have called for the preset temperature, press the [SET] key. →The preset temperature becomes the target temperature and the fixed temperature operation starts. →The display indications changes from the flashing registered temperature to the present measured temperature.
How to cancel Example…Temperature called for  Indication example of a temperature called for Abort → Example…Previous set temperature  Indication example before calling for a temperature	If you want to cancel the preset temperature immediately after you have called for, press the [▽] and the [△] keys at the same time for more than 1 second. The mode returns to the temperature setting mode immediately before calling for the temperature. The mode will return to the original in about 1 minute even if you do not press the [SET] key.

4. Operating procedures (For BF400/500/600)

Operations after turning the power switch ON

When operation is ready start operation following the procedures below.

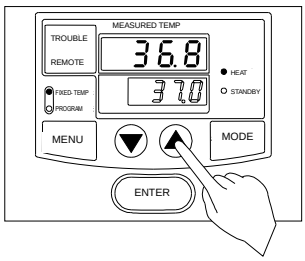
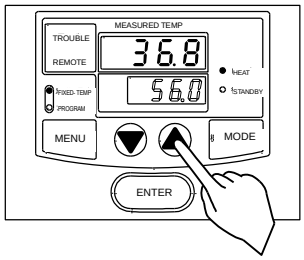
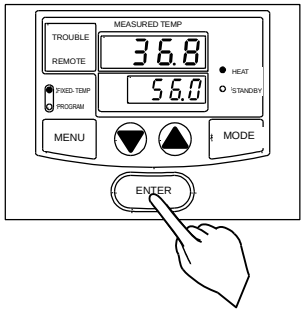
（Note：Model BF600 does not support indication of a temperature with a decimal point）

Display after operation and operating procedures			Description
1	Example：Measured temperature: 25.0℃  Example：Set temperature:37.0℃	Turn the power switch ON	□ When power is turned on, the main display indicates the present measured temeperature and the sub display indicates the flashing set temperature in the previous session. □ The [STAND BY] lamp comes on.。 □ The [FIXED-TEMP] lamp flashes.
2	Example：Fixed-temperature operation at 56.0℃  	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key until the temperature flahses in the sub display reaches the target temperature.
3	 	Press the [ENTER] key.	• When the target temperature is reached, press the [ENTER] key. □ The set temperature in the sub display changes its status from flashing to staying lit and fixed-temperature operation starts towards the set temperature. □ The [STAND BY] lamp goes off and the [FIXED TEMP] lamp changes its status from flashing to staying lit. □ When the set temperature is higher than the present measured temeperature, the [HEAT] lamp comes on and heating starts. <u>Now procedures for the fixed-temperature operation have been completed.</u>

4. Operating procedures

Changing the set temperature during operation

（Note：Model BF600 does not support indication of a temperature with a decimal point）

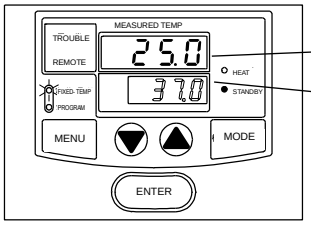
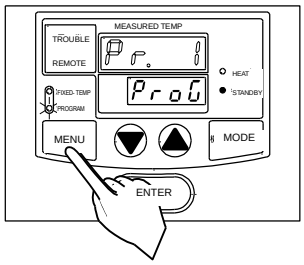
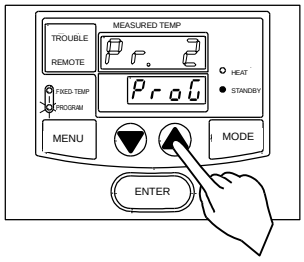
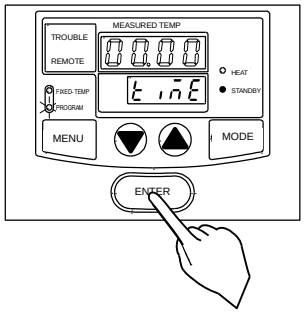
Display after operation and operating procedures			Description
1	Example: Changing fixed-temperature operation at 37.0℃ to the operation of the same mode at 56℃. 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key. □ The mode changes to the temperature setting mode and the set temperature in the sub display changes to flashing indication.
2		Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key until the temperature flahses in the sub display reaches the target temperature.
3		Press the [ENTER] key.	• When the target temperature is reached, press the [ENTER] key. The set temperature in the sub display changes its status from flashing to staying lit and fixed-temperature operation starts towards the set temperature. <u>Now procedures for changing the set temperature have been completed.</u> • When you want to finish operation, turn the power switch OFF. All circuits will be shut off including indications.

4. Operating procedures

Procedures for program operation

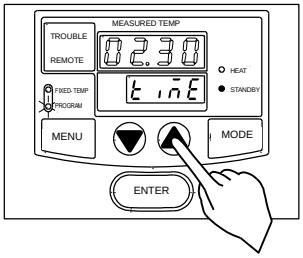
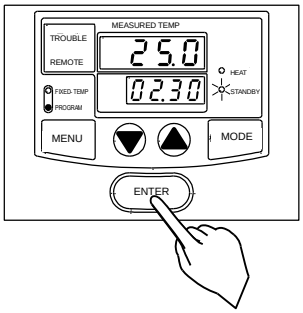
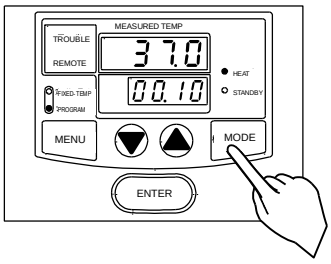
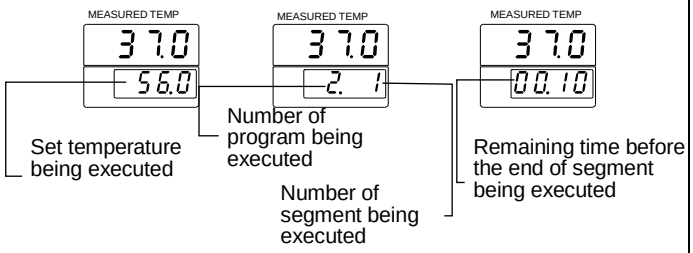
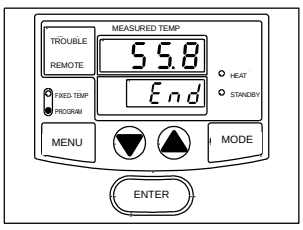
When operation is ready start operation following the procedures below.

（Note：Model BF600 does not support indication of a temperature with a decimal point）

Display after operation and operating procedures			Description
1	Example：Measured temperature:25.0℃  Example：Set temperature:37.0℃	Turn the power switch ON	□ When power is turned on, the main display indicates the present measured temeperature and the sub display indicates the flashing set temperature in the previous session. □ The [STAND BY] lamp comes on.。 □ The [FIXED-TEMP] lamp flashes.
2	Example：Operation by calling for program number 2  	Press the [MENU] key.	□ The main display indicates the flashing executable program number Pr. 1. □ The sub display indicates ProG. □ The [FIXED-TEMP] lamp goes off. □ The [PROGRAM] lamp flashes. ∗ When there is no executable programs, the main display indicates flashing - - - -. When you make a program anew, see P.38 “Programming procedures”.
3	 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to indicate the numbers of executable programs on the main display and the main display indicates executable program numbers in turn. Select a program number, such as Pr. 2 (This example means the program 2).
4	 	Press the [ENTER] key.	• Press the [ENTER] key when you have set the program number you want to execute. □ The mode switches to the program [Operation wait time] setting mode and 00.00 flashes in the main display. □ The sub display indicates t inE. • Follow the procedures on the following page to set a time you want to start operation.

4. Operating procedures

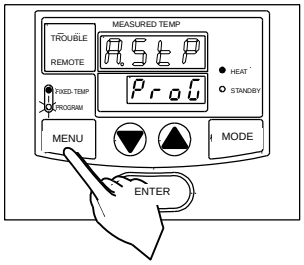
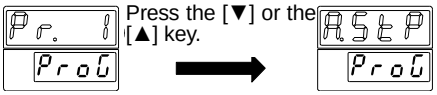
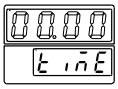
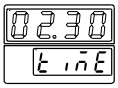
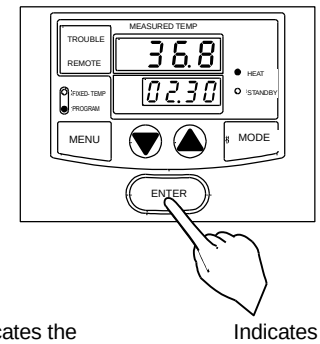
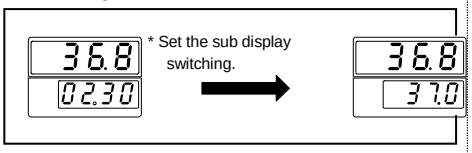
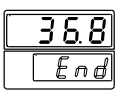
Procedures for program operation

Display after operation and operating procedures			Description
5	Example: To start operation after 2 hours and 30 minutes 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash the time to start the program you have called for on the main display. ∗ You can set a wait time in the range from one minute to 999 hours. Note, however, that a time longer than one hour cannot be set in the unit of minutes only (for example, 80 minutes). Example:99 hours 59 minutes : 9959 100 hours : 100H
6		Press the [ENTER] key.	• Press the [ENTER] key. □ Indication in the main display changes to the present measured temeperature. □ Indication in the sub display changes to the remaining time before starting operation. □ The [STAND BY] lamp changes to flashing to indicate that the unit is in the stand by state. □ The [PROGRAM] operation lamp changes its status from flashing to staying lit. □ When the operation time comes, the [STAND BY] lamp goes off and the program operation starts. □ At the operation start time, the sub display indicates the information set in the previous session. ∗ The example shows that the segment 1 of the program number 2 is in operation and the remaining time until the end of the 1st segment lamp or the soak interval is 10 minutes. ∗ During the program operation, you can select information in the sub display from among: “Remaining time before completion of the execution segment”, “Set temperature” and “Number of the program being executed”. (See P.26 “To change the sub display indication”.)
	＜To change the sub display indication＞ 	Press the [MODE] key to switch to the sub display switch mode.	
	Set temperature indication is set Execution program indication is set Remaining time is set 		
7		＜Program operation ends＞	□ Temperature control stops. □ The main display indicates the present measured temperature. □ The sub display indicates flashing End. □ The [HEAT] lamp goes off. □ The [PROGRAM] lamp stays lit.

4. Operating procedures

To switch to the Quick auto stop operation

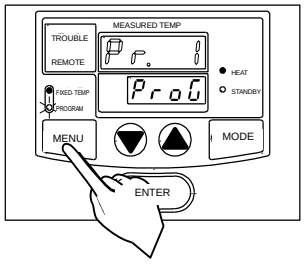
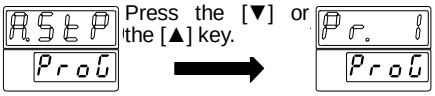
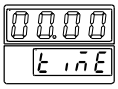
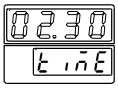
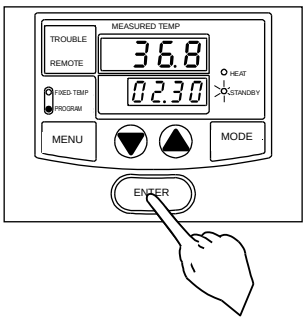
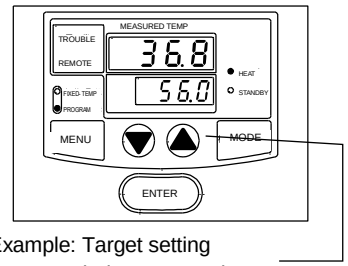
The Quick auto stop operation is used when you want to stop operation after specified time during the fixed-temperature operation.

Display after operation and operating procedures			Description
1	 ＜When program number is flashing＞  Example: The only executable program is number 1.	Press the [MENU] key.	• Press the [MENU] key during the fixed-temperature operation. □ The main display indicates the number executable program or flashing A.StP (meaning auto stop). The example indicates flashing A.StP. • When you have made the number of executable program flash, press the [▼] key or the [▲] key to flash A.StP in the main display. □ The [PROGRAM] lamp flashes. □ Since the fixed-temperature oparation is still active, the [HEAT] lamp comes on and goes off repeatedly according to the temperature control.
2		Press the [ENTER] key.	• Press the [ENTER] key. □ The inndication in the main display changes to the flashing 00.00. □ The sub displayy indicates t inE.
3	Example: Stopping operation after 2 hours and 30 minutes 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change the value in the main display to the “time before stopping operation” you want.
4	 Indicates the remaining time Indicates the set time 	Press the [ENTER] key.	□ When you press the [ENTER] key, the fixed-temperature operation will switch to the auto stop operation. □ The main display indicates the present measured temeperature. □ The sub display indicates either “remaining time” before stopping operation or the “set temperature”. ✻ The example indicates “remaining time”. Switch the sub display indication to indicate the set temperature.（See P.26 “To change the sub display indication”.） □ The status of the [PROGRAM] operation lamp changes its status from flashing to staying lit. □ The [FIXED-TEMP] lamp goes off.
5		＜Auto stop operation is completed＞	□ Temperature control stops when the preset time elapses. □ The sub display indicates flashing End.

4. Operating procedures

When you want to switch to program operation during fixed-temperature operation

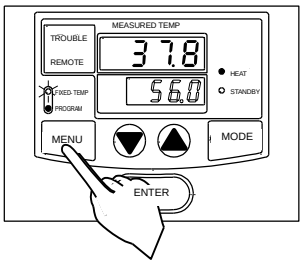
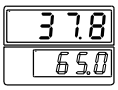
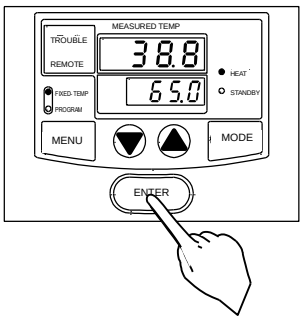
Below is an example of operation of the executable program number 1 during fixed-temperature operation.

Display after operation and operating procedures			Description
1	 <A.StP is flashing>  Example: Executable program calls for number 1	Press the [MENU] key.	• Press the [MENU] key during the fixed-temperature operation. □ The main display indicates the number executable program or flashing A.StP (meaning auto stop). The example indicates flashing Pr. 1 (program 1). • When A.StP is flashing, press the [▼] or the [▲] key to flash the number of program to execute in the main display. □ The [PROGRAM] lamp flashes. □ Since the fixed-temperature oparation is still active, the [HEAT] lamp comes on and goes off repeatedly according to the temperature control.。
2		Press the [ENTER] key	• Press the [ENTER] key. □ The inndication in the main display changes to the flashing 00.00. □ The sub displayy indicates t inE.
3	Example: Stopping operation after 2 hours and 30 minutes 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change the value in the main display to the “time before stopping operation” you want.
4		Press the [ENTER] key.	□ When you press the [ENTER] key, the fixed-temperature operation will switch to the auto stop operation. □ The main display indicates the present measured temeperature. □ The sub display indicates the remaining time before starting operation. □ The [STAND BY] lamp flashes to indicate the stand by states is active. □ The state of the [PROGRAM] lamp changes its status from flashing to staying lit. □ The [FIXED-TEMP] lamp goes off.
5	 Example: Target setting being executed	<Executing the program operation>	□ When the operation start time comes, the [STAND-BY] lamp goes off and program operation starts. □ The information on the sub display will change to the one set in the previous session.

4. Operating procedures

When you want to switch to a different operation mode

When you want to switch from the program operation to the fixed-temperature operation
（Note：Model BF600 does not support indication of a temperature with a decimal point）

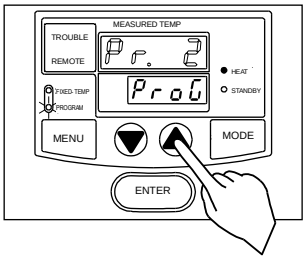
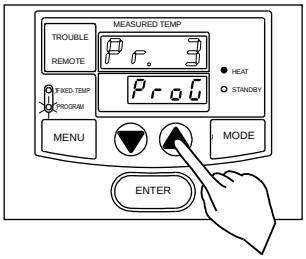
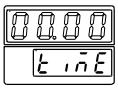
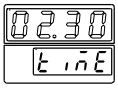
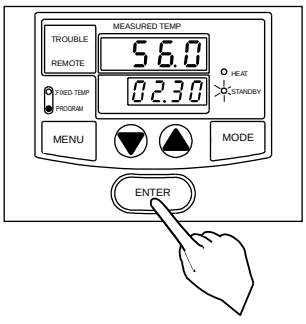
Display after operation and operating procedures			Description
1		Press the [MENU] key.	• Press the [MENU] key during PROGRAM operation. □ The mode is used for setting a target temperature for the [FIXED-TEMP] operation. □ The indication in the sub display changes to the flashing target temperature setting in the previous fixed-temperature operation. The example shows that the set temperaure in the previous session is 56.0℃.
2	Example: Setting to 65.0℃ 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change the temperature in the sub display to the one you want. ✻ If you do not change the setting, move to the step 3.
3		Press the [ENTER] key.	• Press the [ENTER] key when you have set the temperature you want. □ The program being executed is forced to finish when the [ENTER] key is pressed and operation switches to the fixed-temperature operation. □ The set temperature in the sub display changes its status from flashing to staying lit and the fixed-temperature operation starts. □ The [PROGAM] lamp goes off and the [FIXED-TEMP] lamp changes its status from flashing to staying lit.

4. Operating procedures

When you want to switch to a different operation mode

When you want to the program operation to a different program

You can change the “number of the program to execute” and “Operation start wait time” during the program operation (during execution, stand-by and at the completion of operation). Follow the procedures below when you want to change to another program operation during a program operation or to change the operation start wait time.

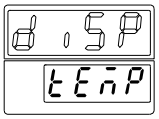
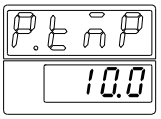
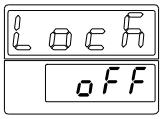
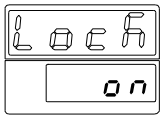
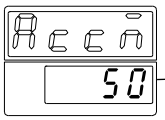
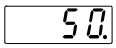
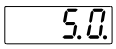
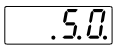
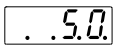
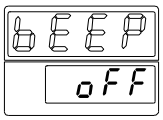
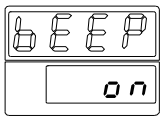
Display after operation and operating procedures			Description
1		Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key. □ The mode changes to the selection mode of a program to execute and the main display indicates the flashing number of the program being executed Pr. 2 (Example: program number 2). □ The sub display indicates ProG.
2		Press the [▼] or the [▲] key.	□ When two or more execution programs exist, press the [▼] or the [▲] key to flash numbers of executable programs in turn in the main display. • Make the number of the program to execute Pr. 3 ((Example: meaning program number 3) flash in the main display. ∗ Skip step 2 and move to step 3 directly if you want to change “Operation start wait time” only.
3		Press the [ENTER] key.	• Press the [ENTER] key. □ The program currently being executed stops and the [STAND BY] lamp comes on. □ The status of the [PROGRAM] lamp changes to flashing. □ The indication in the main display changes to staying-on 00.00 and the mode changes to the setting mode for the operation start wait time.
4	Example: Stopping operation after 2 hours and 30 minutes 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change to value in the main display to a wait time before operation starts. ∗ See step 5 of P.18 “Procedures for program operation
5		Press the [ENTER] key.	• Press the [ENTER] key. □ The status changes to standy-by for the program you have selected. □ The main display indicates the present measured temeperature. □ The sub display indicates the remaining time before starting operation. □ The [STAND BY] lamp flashes to indicate that the unit is in the stand-by mode. □ The status of the [PROGRAM] lamp changes from flashing to staying on.

5. How to use the function menu (MODE key)

Contents of the menu

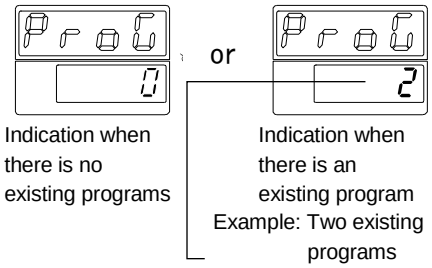
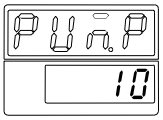
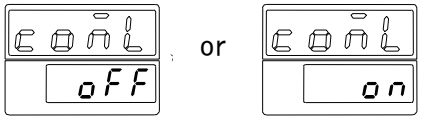
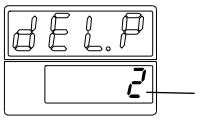
The function menu has the following functions. This section shows the indications of each function called for and explains each of functions briefly. For how to set and input functions, see the sections that explain those functions.

(Note：Model BF600 does not support indication of a temperature with a decimal point)

Display after operation and operating procedures			Description
1	**〈Sub display switching function〉**  Example of the sub display switching mode **〈Temperature preset function〉**  Example of the preset temperature registration mode	Press the [MODE] key	• Press the [MODE] key. When pressed during operation □ The indication changes to that of the sub display switching mode. ∗ See P.26 “To change the sub display indication”. When pressed during stand-by or at the end of a program □ The indication changes to that of the preset temperature registration mode. ∗ See P.31 “How to use the temperature preset function”.
2	**〈Panel key lock function〉**  or  Indication when the panel key lock is disabled Indication when the panel key lock is enabled	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key several times. □ The mode changes to the panel key lock select mode. ∗ The panel key lock is a function to prevent inadvertent changes of settings during operation or stand-by. When this function is [ON], any key operations other than the [MODE] key are disabled. ∗ See P.27 “Setting and cancelling the panel key lock”.
	〈Accumulated time display function〉  Example: Present accumulated time Display when accumulated time has exceeded 10,000 hours  → 10050 hours  → 20050 hours  → 30050 hours  → 40050 hours		• Press the [▼] or the [▲] key several times. □ The mode changes to the Accumulated time display mode and the indication in the main display changes to flashing Accn (meaaning Accumulation). □ The indicattion in the sub display changes to accumulated time display in the power ON status. ∗ Up to 4,999 hours can be indicated as accumulated time in the unit of hours. (You cannot reset the time) ∗ When the time exceeds 9999 hours, each time 10,000 hours are exceeded, dot at each digit will come on as shown in the example on the left (One dot means 10,000 hours.)
	〈Error beep ON/OFF function〉  or  Indication when error beep is disabled Indication when error beep is enabled		• Press the [▼] or the [▲] key several times. □ The mode changes to the error beep ON/OFF select mode. ∗ This function is used to enable or disable the buzzer alarm function when an error occurs to the unit. ∗ See P.28 “Setting and cancelling the error beep”.

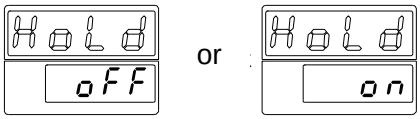
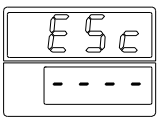
5.How to use the function menu (MODE key)

Menu contents

Display after operation and operating procedures			Description
2	**〈Program input/edit function〉**  Indication when there is no existing programs Indication when there is an existing program Example: Two existing programs	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key several times. □ The mode changes to the program input/edit mode. ∗ See P.38 “Programming procedures”. □ When any programs are not input, the sub display indicates “0”. □ When there are already some programs, the sub display shows the number of existing programs.
	〈Jet strength variable function〉  		• Press the [▼] or the [▲] key several times. □ Jet stirring strength switching mode. ∗ See P.34 ”How to change the jet strength”.
	〈Communication lockout function〉  Indication when lockout is disabled Indication when lockout is enabled		• Press the [▼] or the [▲] key several times. □ The mode is the communication lockout select mode. ∗ See P.35 “Setting and cancelling communication lockout”.
	〈Program delete function〉 *Calling is limited*  Example: There are two existing programs		• Press the [▼] or the [▲] key several times. □ The mode changes to the programaam delete mode. ∗ See P.46 “How to delete a program”. ∗ This function is available only when a program has been input. If nothing is input, the function will not appear and the mode shifts to the select mode for the next function.

5.How to use the function menu (MODE key)

Menu contents

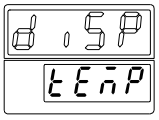
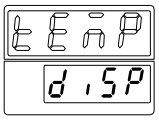
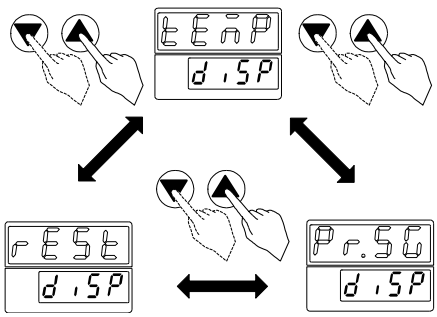
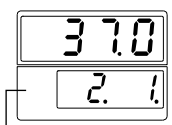
Display after operation and operating procedures			Description
2	**〈Hold function〉** *Calling is limited* 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key several times. □ The mode changes to the hold function select mode. ∗ See P.29 “Setting and cancelling the hold function”. ∗ Hold function holds the status at the time of setting and can be called for only while the quick auto stop operation or the program operation is being executed or in the stand-by for a program start. In other modes, the function will not appear and the mode shifts to the select mode for the next function.
	〈Escape function〉  Indication of the escape function		• Press the [▼] or the [▲] key several times. □ The mode changes to the escape function select mode. ∗ The escape function is used to abort selection of a function or cancel or finish input and edit of a program. ∗ See P.30 “How to use the escape function”.

5.How to use the function menu (MODE key)

How to use the sub display switching function

- You can change indication in the sub display while the quick auto stop operation or the program operation is eing executed.
- While the quick auto stop operation is being executed, you can select and indicate from “Set temperature” and “Remaining time before stopping operation” and while the program operation is being executed, you can select and indicate from “Set temperature”, “Remaining time before the end of the segment being executed”, “Contents of the segment being executed” and “Remaining number of repetitions” (possible only while repeat operation is being executed).

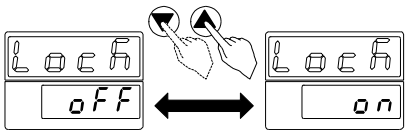
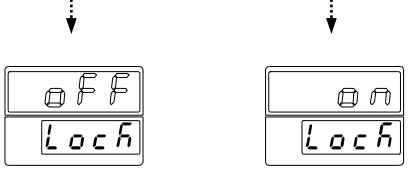
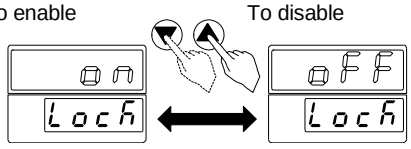
（Note：Model BF600 does not support indication of a temperature with a decimal point）

Display after operation and operating procedures			Description
1	 Example: Indications in the set temperature indication mode	Press the [MODE] key	• Press the [MODE] key while the quick auto stop operation or the program operation is being executed. □ The mode changes to the sub display switching mode and the main display indicates flashing （display）. □ The sub display indicates the contents off the mode currently set.
2		Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the sub display setting mode and the indication in the main display changes to the flashing of the contents that have been indicated in the sub display. □ The sub display indicates .
3		Press the [▼] or the [▲] key.	• Press the [▲] key or the [▼] key. □ Each time you press the key, the main display indicates flashing rESt （rest：Remaining time）, Pr.SG（program, segment：Execution program and execution segment） and tEnP in this order. ∗ While a program is repeatedly operated, you can indicate the remaining number of repetitions with the [▼] and the [▲] keys. The indication is flashing r.cnt （repeat count：Number of remaining repetitions）.
4	〈When indication of an execution program is set〉  Example: The number of program/segment being executed	Press the [ENTER] key.	• Press the [ENTER] key when you have changed the contents in the sub display. □ The main display indicates the present set temperature. □ The sub display indicates the set contents. Example is indication set for an execution program and an execution segment.

5.How to use the function menu (MODE key)

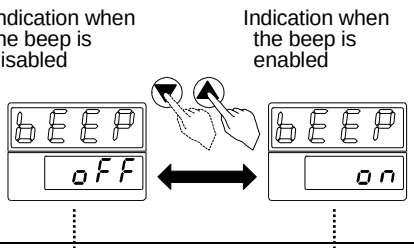
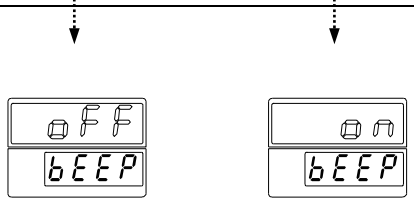
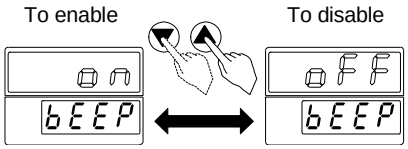
Setting and cancelling panel key lock

Panel key lock is a function to prevent inadvertent changes of settings during operation or stand-by. When it is [ON], any keys other than the [MODE] key are disabled.

	Display after operation and operating procedures		Description
1	Indication when panel key lock is disabled Indication when panel key lock is enabled  	Select a function （See P.23 ”Menu contents”.）	• Use the [MODE] to call for the [panel key lock] select mode. □ The sub display indicates the present panel key lock setting. Indication of oFF means the disabled status and on means the enabled status.
2	 	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the panel key lock setting/cancelling mode. □ Indication in the sub display changes to LocK.
3	To enable To disable  	Press the [▼] or the [▲] key.	• Select [on] to enable and select [oFF] to disable the lock. Press the [▼] or the [▲] key to flash [on] and [oFF] alternately.
4	〈Indication immediately before the MODE key is pressed〉	Press the [ENTER] key.	• Press the [ENTER] key. □ The panel key lock changes to the status you set (locked or unlocked). □ Indication will return to the status immediately before the [MODE] key is pressed.
5	〈How to check the key lock status〉	Press any key other than the [MODE]	• Press any key other than the [MODE]. □ A beep sounds and the sub display indicates flashing LocK.

5.How to use the function menu (MODE key)

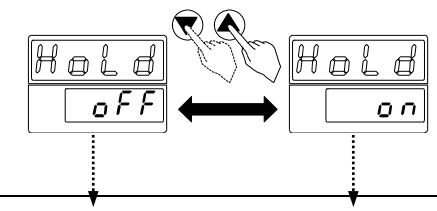
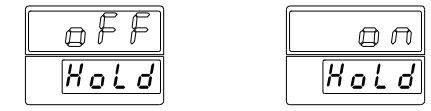
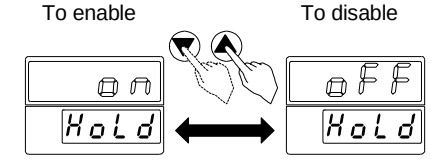
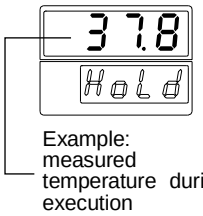
Setting and cancelling the error beep

Display after operation and operating procedures			Description
1		Select a function （See P.23 ”Menu contents”.）	• Call for the “error beep” select mode using the MODE. □ The sub display indicates the present beep setting. Indication of oFF means the disabled status and on means the enabled status.
2		Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the setting/cancelling mode for the error beep. □ Indication in the sub display changes to bEEP.
3		Press the [▼] or the [▲] key.	• Select [on] to enable and [oFF] to disable. Press the [▼] or the [▲] key to flash [on] and [oFF] alternately.
4	〈Indication immediately before the MODE key is pressed〉	Press the [ENTER] key.	• Press the [ENTER] key. □ Indication will return to the status immediately before the [MODE] key is pressed.

5.How to use the function menu (MODE key)

How to set and cancel the hold function

You can call for the hold function only during the quick auto stop operation and the program operation.

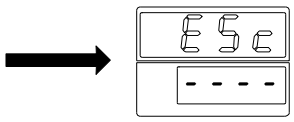
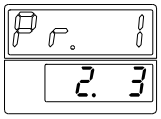
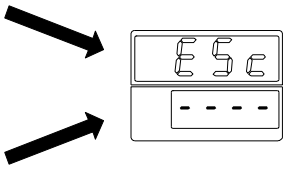
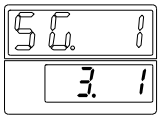
<table>
<tr><th colspan="3">Display after operation and operating procedures</th><th>Description</th></tr>
<tr><td>1</td><td colspan="2"> 
</td><td>Select a function
（See P.23 ”Menu contents”.）</td><td>• Call for the “Hold function” select mode using the MODE.
□ The sub display indicates the present setting of the hold function. Indication of oFF means the disabled status and on means the enabled status.</td></tr>
<tr><td>2</td><td colspan="2"> 
</td><td>Press the [ENTER] key.</td><td>• Press the [ENTER] key.
□ The mode changes to the setting/cancelling mode for the hold function.
□ Indication in the sub display changes to HoLd.</td></tr>
<tr><td>3</td><td colspan="2"> 
</td><td>Press the [▼] or the [▲] key.</td><td>• Select [on] to enable and [oFF] to disable.
Press the [▼] or the [▲] key to flash [on] and [oFF] alternately.</td></tr>
<tr><td>4</td><td> 
</td><td>When disabled
〈Indication immediately before the MODE key is pressed〉</td><td>Press the [ENTER] key.</td><td>• Press the [ENTER] key.
<u>While hold is enabled</u>
□ The main display indicates the measured temperature when the hold function is executed.
□ Indication in the sub display changes to flashing HoLd.
<u>While hold is disabled</u>
□ Indication will return to the status immediately before the [MODE] key is pressed.</td></tr>
</table>

5. How to use the function menu (MODE key)

How to use the escape function

- The escape function is used to abort calling for the MODE or cancel or finish input and edit of a program.
- This function can be executed in the “Program number setting mode” for inputting/editing a program, “Segment setting mode” for editing a program and “Program deletion mode” for deleting a program.
- The status will return to the one immediately before setting operations if you call for the escape function and press the [ENTER] key.

Note: You cannot escape and redo two or more segments or a loop command.

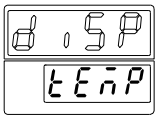
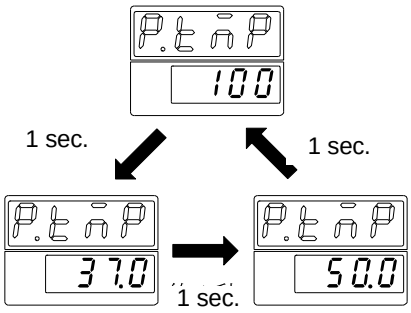
<table>
<tr><th colspan="2">Display after operation and operating procedures</th><th>Description</th></tr>
<tr><td>During MODE operation</td><td>After pressing the [MODE]key  </td><td rowspan="3">• Press the [▼] or the [▲] key during operation.
□ The main display indicates flashing ESc.
• Press the [ENTER] key.
□ The function select mode is cancelled and returns to the status immediately before setting operation.</td></tr>
<tr><td>Inputting/editing a program</td><td>In the program number setting mode
  Press the [▼] or the [▲] 
In the segment setting mode  Press the [▼] or the [▲] key.</td></tr>
<tr><td>Program delete mode</td><td>  Press the [▼] or the [▲] key.  </td></tr>
</table>

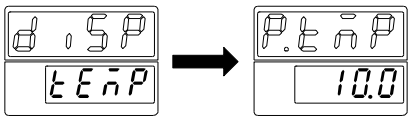
5.How to use the function menu (MODE key)

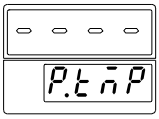
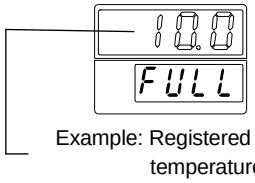
How to register a preset temperature

- You can register a preset temperature any time except for during the remote operation (optional specification) and during an error. Follow the procedures below to register.
- Up to 10 preset temperatures can be registered.

（Note：Model BF600 does not support indication of a temperature with a decimal point）

<table>
<tr><th colspan="2">Display after operation and operating procedures</th><th></th><th>Description</th></tr>
<tr><td rowspan="2">1</td><td>〈When pressed during operation〉
 
</td><td rowspan="2">Press the [MODE] key.</td><td rowspan="2">• Press the [MODE] key.
<u>When pressed during operation</u>
□ The display indicates flashing d.SP (meaning display).
□ The sub display indicates tEMP (temp: Abbreviation of temperature).
<u>When pressed during stand-by or at the end of a program</u>
□ The mode changes to the preset temperature registration mode and the main display indicates flashing P.tMP (preset temp：Abbreviation of preset temperature).
□ The sub display indicates registered temperature in the intervals of about 1 second from the lowest one first. When there is no preset temperature, the sub display indicates ----.
＊ In this case, move directly to step 3.</td></tr>
<tr><td>〈When pressed during stand-by or at the end of a program〉
 

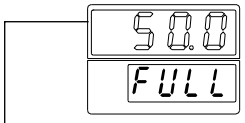
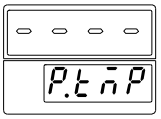
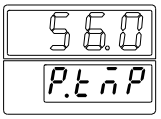
Example: 10.0, 37.0, and 50.0 are registered</td></tr>
<tr><td>2</td><td>〈When the sub display select mode is activated〉
 

Indication of sub display switching</td><td>Press the [▼] or the [▲] key.</td><td>• Press the [▼] or the [▲] key several times to flash P.tMP in the main display.</td></tr>
<tr><td rowspan="2">3</td><td>〈When the number of registered temperatures is 9 or less〉
 
</td><td rowspan="2">Press the [ENTER] key.</td><td rowspan="2">• Press the [ENTER] key.
<u>When the number of registered temperature is 9 or less</u>
□ The mode changes to the preset temperature registration mode and the main display indicates flashing ----.
□ The sub display indicates P.tMP.
• Move to step 4 and register a temperature.
<u>When the number of registered temperatures is 10</u>
□ The mode changes to the preset temperature overwrite select mode and the registered temperature flashes in the main display.
□ The sub display indicates FULL (FULL: Means the capacity is full).</td></tr>
<tr><td>〈When the number of registered temperatures is 10〉
 

Example: Registered temperature</td></tr>
</table>

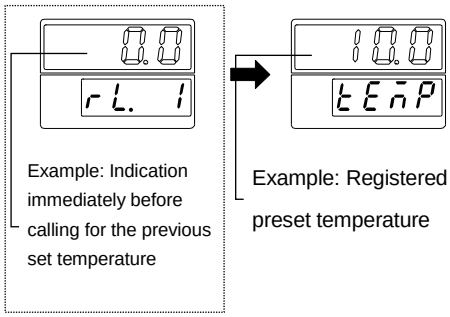
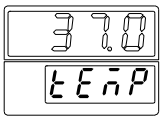
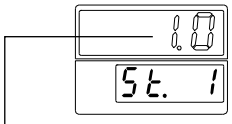
5.How to use the function menu (MODE key)

How to register a preset temperature

Display after operation and operating procedures			Description
4	〈When the number of registered temperatures is 10〉  Example: Over-writable temperature among registered ones、	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash an over-writable preset temperature in the main display. In the example, 50℃ is selected as an over-writable temperature.
	 	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the preset tempeature registration mode and the main display indicates flashing - - - -. □ The sub display indicates P.tnP.
5	Example: Registering 56.0℃  	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash the temperature to register in the main display. The example is for registering 56℃.
6	〈Indication immediately before the MODE key is pressed〉	Press the [ENTER] key.	• Press the [ENTER] key. □ The indication returns to the one immediately before the [MODE] key is pressed (immdiately before step 1 is carried out). 〈Now registration has been completed.〉

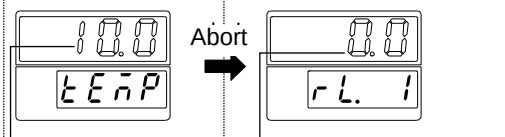
5.How to use the function menu (MODE key)

How to call for the preset temperature

Display after operation and operating procedures			Description
＜ When calling for at inputting/editing a program＞			
1	＜Example: Setting to the segment 1＞  Example: Indication immediately before calling for the previous set temperature Example: Registered preset temperature	Press the [▼] and the [▲] keys for 1 second or longer at the same time.	• At the time of inputting a ramp level (the sub display indicates rL. 1. Example: Indication of a ramp level in the segment 1), press the [▼] and the [▲] keys for 1 second or longer at the same time. □ The mode changes to the mode for calling-for the preset temperature and the main display indicates the flashing registered temperature. □ Indication in the sub display changes to tEnP.
2	Example: Calling for 37.0℃  	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash the temperature you want to call for in the main display. The example is calling for 37.0℃.
3	 Example: Soak time set to the segment 1	Press the [ENTER] key.	• Press the [ENTER] key. □ The ramp level (target temperature setting) is changed to the temperature you have called for and the indication in the main display changes to the flashing soak time (hold time of a ramp level) and the mode changes to the soak time setting mode. Indication in the sub display changes to St. 1 (Example: soak time in the segment 1).

How to cancel calling-for of the preset temperature

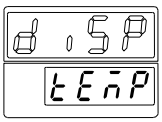
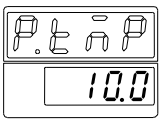
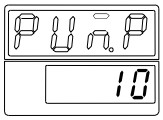
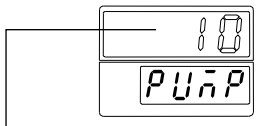
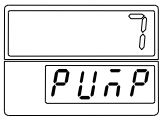
You can cancel calling-for of the preset temperature any time before pressing the [ENTER] key. Follow the procedures below. The status will return to the original in about 1 minute even if you do not press the [ENTER] key.

Display after operation and operating procedures			Description
1	＜Example: When you want to cancel at the time of inputting a program＞  Example: Temperature called for Example of indication at the time of calling-for Example: Set temperature in the previous session Example indication immediately before calling for	Press the [▼] and the [▲] keys for 1 second or longer at the same time.	• If you have called for the preset temperature and want to cancel it immediately, press the [▼] and the [▲] keys for 1 second or longer again. □ The mode returs to the temperature setting mode immediately before it was called for.

5.How to use the function menu (MODE key)

How to change the jet strength

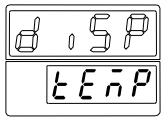
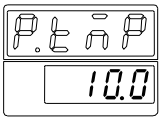
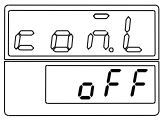
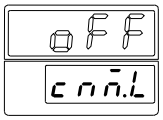
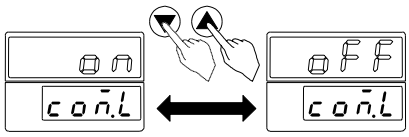
- You can change the jet strength any time except for during the remote operation or an error.
- You can select a jet strength from 10 different strengths. Strength is a rough standard and select an appropriate strength by checking stirring status in the bath.
- Follow the procedures below to change the strength.

Display after operation and operating procedures			Description
1	 Example of sub display switching mode or  Example indication of a registered preset temperature	Press the [MODE] key.	• Press the [MODE] key. □ When pressed during operation, the indication changes to the one in the sub display swithcing mode and when pressed during stand-by or at the end of a program the indiation in the preset temperature registration mode is indicated.
2		Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key several times. Make [PUMP] (meaning jet stirring) flash in the main display. □ The mode changes to the jet stirring strength switching mode and the sub display indicates the strength index at the time of change.
3	 Set temperature in the previous session	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the jet strength setting mode and the indication inf the main display changes to the flashing strength index at the time of change. □ The indication in the sub display changes to [PUMP].
4	＜Example: Changing the jet strength to 7＞ 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash the strength index you want in the main display. ● Strength index range is from 1 to 10. Low High 1 10 ● Press the[▲] key to increase the strength and the [▼] key to decrease.
5	〈Indication immediately before the MODE key is pressed〉	Press the [ENTER] key.	• Press the [ENTER] key. □ The jet strength will change to the one you have set. □ Indication will return to the status immediately before the [MODE] key is pressed.

5.How to use the function menu (MODE key)

How to set and cancel communication lock out

- The function is used to select a process to hand down the controller control to the host computer (communication lock out cancelled) in response to a communication request from the host computer connected via a communication interface, or to reject such request (communication lock out enabled). Communication will be forced to shut off when communication lock out is carried out while communication is active with the host computer.

Display after operation and operating procedures			Description
1	 or  Example of indication of the sub display switching mode / Example of indication of the preset temperature registration mode	Press the [MODE] key.	• Press the [MODE] key. □ When pressed during operation, the indication changes to the on in the sub display switching mode and when pressed during stand-by or at the end of a program, indication in the preset temperature registration mode will appear.
2		Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key several times. The main display indicates flashing [com.L] (abbreviation of communication lock out). □ The sub display indicates the latest settngs.
3		Press the [ENTER] key.	• Press the [ENTER] key.。 □ The mode changes to the mode for setting/cancelling the communication lock out function. □ Indication in the sub display changes to [com.L].
4	Communication lock out enabled / Communication lock out is disabled 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key. □ The main display indicates flashing [OFF] and [ON] alternately.
5	〈Indication immediately before the MODE key is pressed〉	Press the [ENTER] key.	• Press the [ENTER] key. □ Indication will return to the status immediately before the [MODE] key is pressed.

5.How to use the function menu (MODE key)

Program configuration

- Configuration elements of a program can roughly be classified into “segments” and the “repeat command”. “Segments” comprise of those defined with “ramp time”, “ramp level”, “soak time” and “wait” and a special segment that indicates the end of a program (called “end segment”). “Repeat command” is defined with “repeat start segment” and “number of repeats”.

Description

Contents of a segment

* Configuration elements of a segment

A program consists of segments and patterns of each segment is defined by setting three basic elements below:

1. Ramp level : Target temperature setting
2. Ramp time : Time necessary to attain the ramp level
3. Soak time : Ramp level hold time

* Constant rate gradient operation ＜See Figure 1＞

1. In the ramp interval (A), the constant rate gradient operation specified with a ramp level and a ramp time is carried out towards the temperature set with a ramp level.
2. In the soak interval (B), the temperature set with a ramp level is held for the time period set with a soak time.

→ Setting is made in the following order. （See P.38 and following pages “How to input a program”.）

〈Example of inputting to the segment 1〉

(Ramp time) (Ramp level) (Soak time)

* When constant rate gradient operation is not conducted ＜See Figure 2＞

1. Set $StEP$ as the ramp time if you want to reach the ramp level in the ramp interval as quickly as possible.

* When linking gradient operation <See Figure 3>

1. When carrying out different constant rate gradient operations consecutively, set the soak time for the first segment (segment A) to “0”. (There is no soak intervals.)

* Other segment-related elements

1. Wait function (See the wait input example on the right)

When the measured temperature does not attain or is different from the target temperature due to loads or externa disturbances, this function does not move the ramp interval to the next until the target temperature is attained and, for the soak intervals, suspends soak time count until the target temperature is attained. Set ON/OFF after entering a soak time.

2. End segment

Call for and enter End as the ramp time of the last segment when you want to complete inputting a new program. This procedure is not necessary when you have input a program up to the 5th segment.

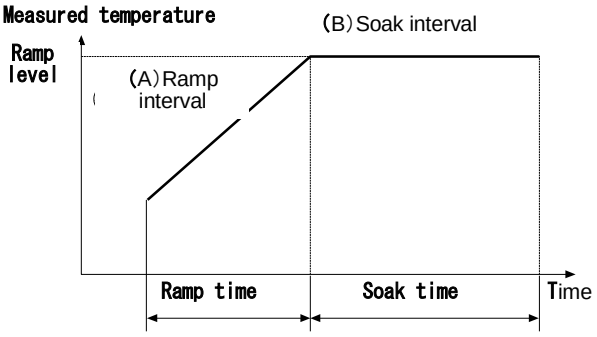


Figure 1: Conceptual figure of a segment of a gradient operation

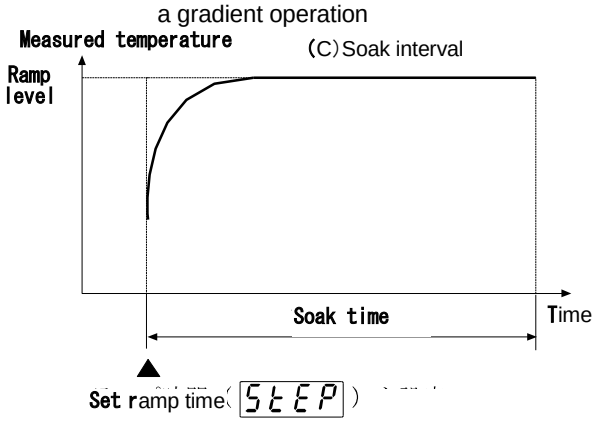


Figure 2: Conceptual figure of a segment without a gradient operation

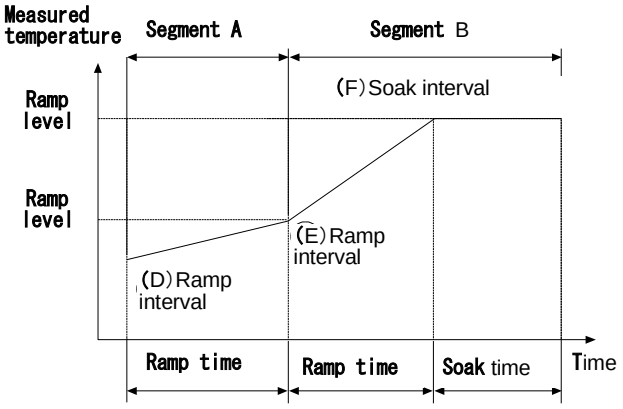
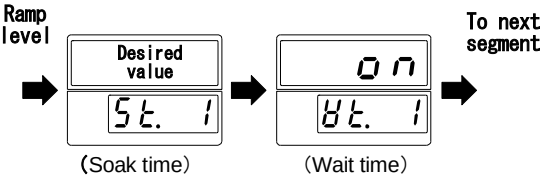


Figure 3: Conceptual figure of connected segments of a gradient operation

〈Input example of wait function ON〉



5.How to use the function menu (MODE key)

Program configuration

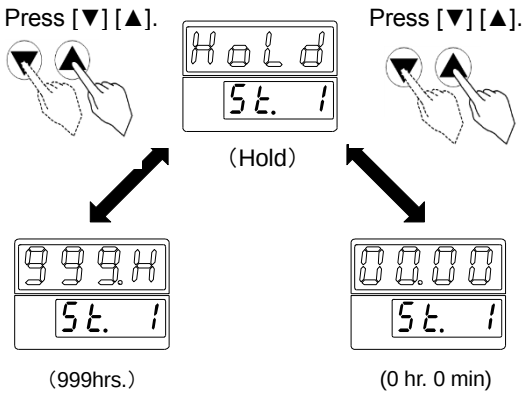
Description

3. Hold

- The program will maintain the target temperature setting (ramp level) if you set HoLd as the soak time. The program input mode will end.
- HoLd flashes at somewhere between 0 hour 0 minute and 999 hours when selecting a soak time. (See the indication example when hold is selected on the right)

Note:This function is different from the hold function of the MODE (status at the time of entering is maintained) and shall not be mixed up.

〈Indication example when hold is selected〉



Contents of the repeat command

■ Configuration of the repeat command

The repeat command is to repeat a group of segments many times and described with a “repeat start segment” and “number of repetitions”.

1. Repeat start segment

The mode is for inputting segments and is used to enter a number of segment at which you want to start repetitions. As a result, the part between the starting segment and the segment immediately before inputting is operated repeatedly. (See the sample indication of repeat input on the right〉

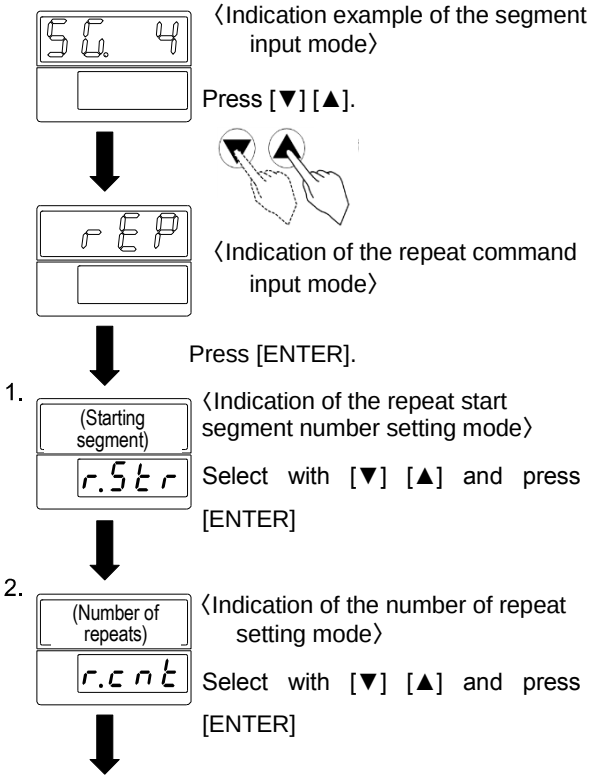
2. Number of repeats

You can set the number of repeats freely from 1 to 999 times.

Note: You cannot repeat a segment which is set after a repeat command in that repeat itself.

Note: You cannot make setting that overlaps a repeat command with the setting of a different repeat command (nesting) or crosses two repeat commands over.

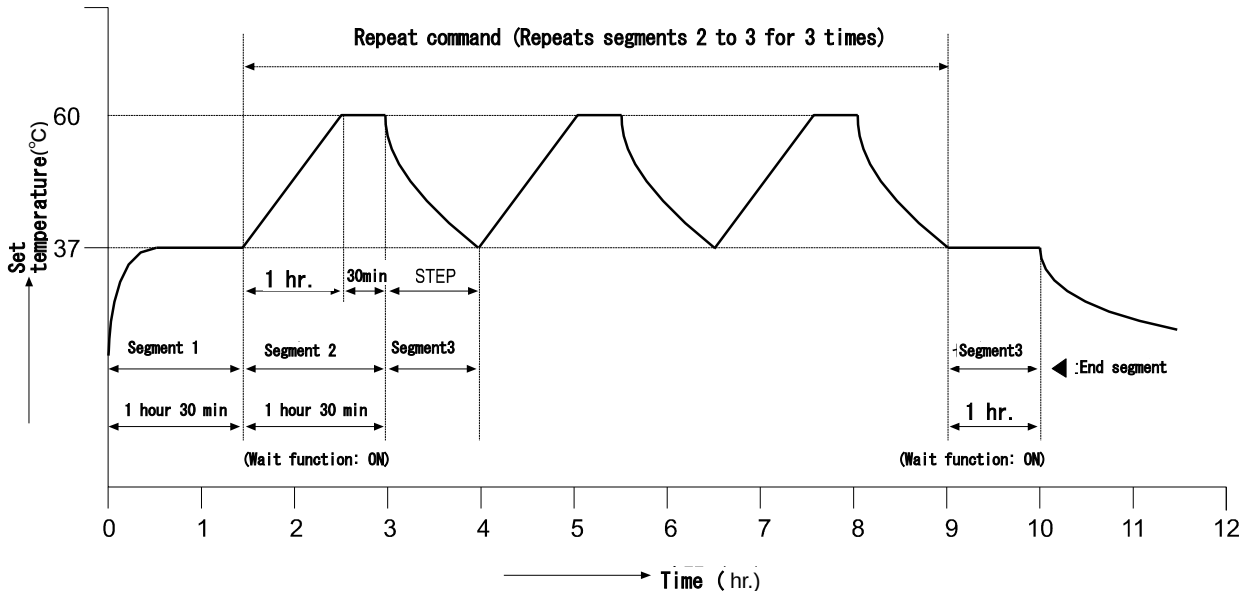
Note: Do not set “0” as the number of repeats. Program may not be executed properly.



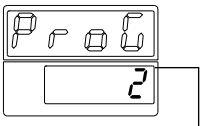
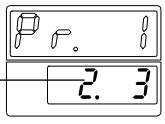
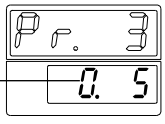
5.How to use the function menu (MODE key)

How to input a program

This section explains how to input a sample program shown in Figure 4.

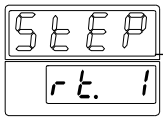
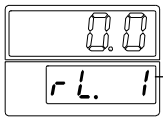
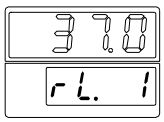
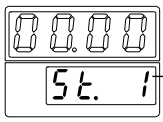
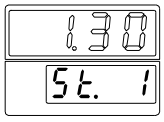
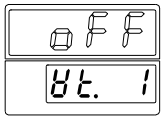


〈Figure 4 Example of program input〉

Setting a program number			
Display after operation and operating procedures			Description
1	 Example: Existing programs are 2	Press the [MODE] key and then press the [▼] key or the [▲] key several times.	• Press the [MODE] key to change to the function select mode and then press the [▼] key or the [▲] key several times. □ The mode changes to the program input select mode and the main display indicates flashing PrG. □ The sub display indicates the number of existing programs.
2	 Example: Number of used-up segments is 2 Example: Number of free segments is 3	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the program input/edit mode and the main display indicates flashing Pr. 1. □ The sub display indicates the number of used-up segments in the left most 2 digits and the number of free segments in the right most 2 digits for the program whose number is flashing.
3	Example: Inputting to program 3  Example: Number of used-up segments is 0 Example: Number of free segments is 5	Press the [▲] key.	• Press the [▲] key to change to Pr. 3 (meaning program 3). □ The program 3 has nothing programmed and the sub display indicates “0”(no used-up segments) in the left most 2 digits and the number of free segments of 5(maximum) in the right most 2 digits.

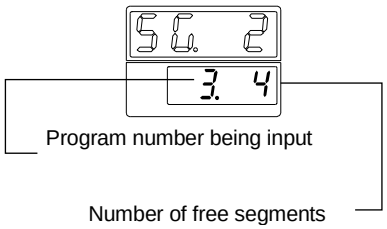
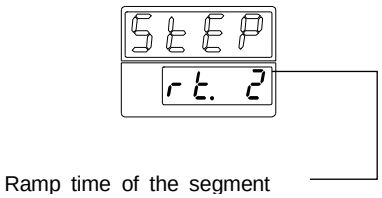
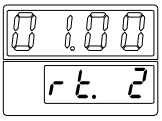
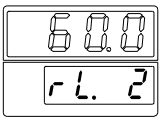
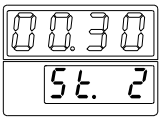
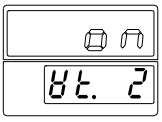
5.How to use the function menu (MODE key)

How to input a program

To set the segment 1			
Display after operation and operating procedures			Description
4	Example: Inputting the step operation  Segment 1 ramp time	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the program input mode for Pr. 3. □ The sub display indicates rt. 1 and prompts input of ramp time 1. □ When inputting a program anew, the main display indicates flashing StEP. ∗ When programming anew, the main display does not indicate SG. 1. ∗ The gradient operation is not carried out for the segment 1 of this example and you need to input StEP as it is.
5	 Ramp level of the segment 1	Press the [ENTER] key.	• Press the [ENTER] key. □ Ramp time 1 is determined. □ The sub display prompts input of the ramp level 1 instead of the indication of rL. 1. □ When programming anew, the main display indicates flashing 0.0.
6	Example: Setting to 37.0℃  	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to adjust to the target temperature of “37.0℃”.
7	 Soak time of the segment 1	Press the [ENTER] key.	• Press the [ENTER] key. □ Ramp level 1 is determined. □ The sub display prompts input of the soak time 1 instead of the indication St. 1. □ When programming anew, the main display indicates flashing 00.00.
8	Example: Set to 1 hour 30 minutes  	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to set to the target time of “1 hour 30 minutes”.
9	 	Press the [ENTER] key.	・ Press the [ENTER] key. □ Soak time 1 is determined. □ The sub display prompts input of the wait function 1 instead of the indication of Wt. 1. □ When programming anew, the main display indicates flashing oFF. ∗ In this example, setting is [OFF] because the rise time is included as the soak time.

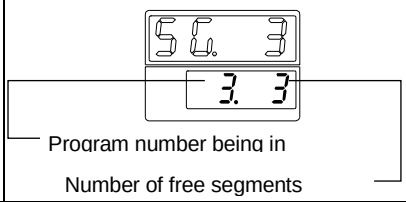
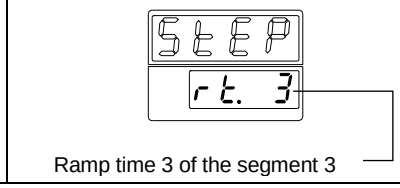
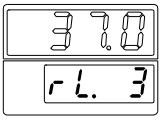
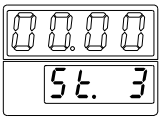
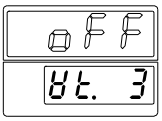
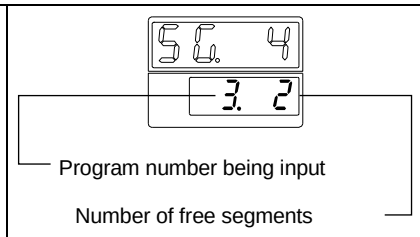
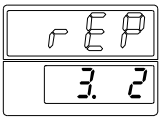
5.How to use the function menu (MODE key)

How to input a program

Setting the segment 2			
Display after operation and operating procedures			Description
10	Example: Inputting a constant rate gradient operation  	Press the [ENTER] key.	• Press the [ENTER] key. □ Settings for the segment 1 are determined and the mode changes to the segment 2 input mode. □ The main display indicates flashhing SG. 2 (abbreviation of segment 2) which indicates that the present mode is the segment 2 input mode. □ The sub display indicates the program number being input in the left most 2 digits and the number of free segments in the right most 2 digits.
11	 	Press the [ENTER] key.	• Press the [ENTER] key. □ The sub display indicates rt. 2 and prompts input of the ramp time 2. □ The main display indicates flashing StEP. ∗ Gradient operation is carried out for the segment 2 of this example and you need to set a value you want. The inputting procedures are the same as for the segment 1.
Enter a ramp time, a ramp level, a soak time and the wait function following the same procedures as for the segment 1.			
12	Example: Inputting 1 hour  	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to adjust to the time you want and then press the [ENTER] key. □ Ramp time 2 is determined.
13	Example: Inputting 60℃  	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to adjust to the temperature you want and then press the [ENTER] key. □ Ramp level 2 is determined.
14	Example: Inputting 30 minutes  	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to adjust to the temperature you want and then press the [ENTER] key. □ Soak time 2 is determined.
15	Example: Turning the wait function ON  	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to turn the wait function [ON] and then press the [ENTER] key. □ The wait function 2 is turned on.

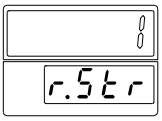
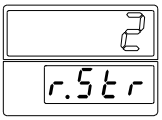
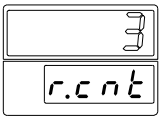
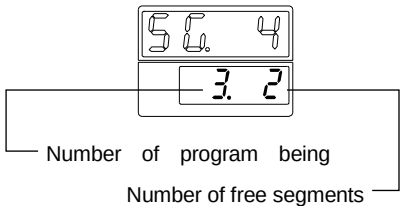
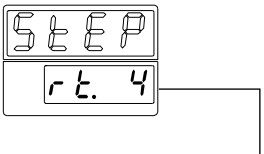
5.How to use the function menu (MODE key)

How to input a program

Setting the segment 3			
Display after operation and operating procedures			Description
16		Press the [ENTER] key.	• Press the [ENTER] key. □ Setting of the segment 2 is determined and the input mode for the segment 3 is enabled.
17		Press the [ENTER] key.	• Press the [ENTER] key. ∗ The gradient operation is not carried out for the segment 3 of this example and you need to input StEP as it is. □ Ramp time 3 is determined.
Enter a ramp time, a ramp level, a soak time and the wait function following the same procedures as for the segment 1.			
18	Example: Inputting 37.0℃ 	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to adjust to the target temperature and then press the [ENTER] key. □ Ramp level 3 is determined.
19	Example: Inputting 0 hour 0 minute 	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to adjust to the temperature you want and then press the [ENTER] key. □ Soak time 3 is determined.
20	Example: Turning the wait functionOFF 	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to set the wait function [OFF] and then press the [ENTER] key. □ The wait function 3 is determined.
Setting the repeat command			
21			□ Setting of the segment 3 is determined and the input mode for the segment 4 is enabled. ∗ Now press the [▼] or the [▲] key to switch to the repeat command input mode.
22		Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash rEP (abbreviation of repeat) in the main display. □ The mode changes to the repeat command input mode.

5.How to use the function menu (MODE key)

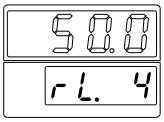
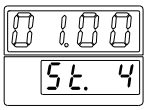
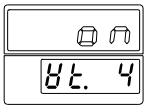
How to input a program

Setting the repeat command			
Display after operation and operating procedures			Description
23		Press the [ENTER] key.	• Press the [ENTER] key. □ The sub display requests input of the number segment at which repeat is started instead of r.Str (Abbreviation of Repeat Start). □ The main display flashes the smallest number among the selectable segment numbers.
24	Example: Repeating from the segment 2 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change the value in the main display to the target value of "2" (meaning 2nd segment).
25		Press the [ENTER] key.	• Press the [ENTER] key. □ Setting for the segment at which repeat is started is determined. □ Indication of the sub display changes to r.cnt (abbreviation of Repeat Count) and requests input of the number of repeats. □ The main display indicates flashing number of repeats. ✻ When programming anew, it displays flashing "1".
26	Example: Repeats 3 times. 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change the value in the main display to the target number of "3".
Setting the segment 4			
27		Press the [ENTER] key.	• Press the [ENTER] key. □ The number of repeats is input and the setting of the repeat command (segment to repeat and the number of repeats) is determined. □ This example contains a program that executes the portion between the segment 2 (see step 24) and the segment 3 (segment immediately before setting the repeat command) 3 times. □ The mode returns to the segment 4 input mode before switching to the repeat command.
28		Press the [ENTER] key.	• Press the [ENTER] key. ✻ The gradient operation is not carried out for the segment 4 of this example and you need to input as it is. □ The ramp time 4 is determined.

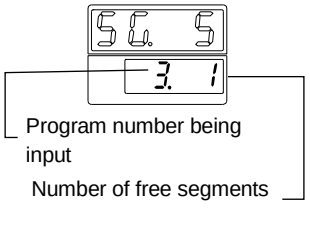
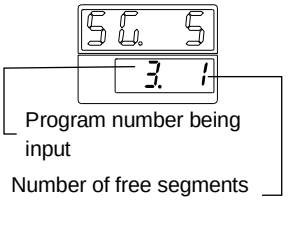
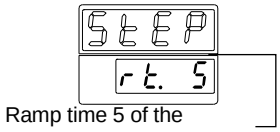
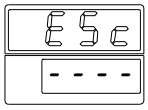
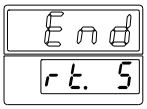
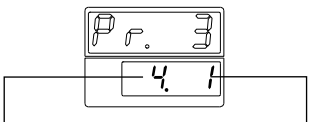
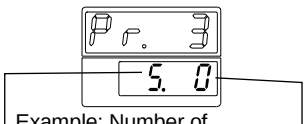
5.How to use the function menu (MODE key)

How to input a program

Enter a ramp time, a ramp level, a soak time and the wait function following the same procedures as for the segment 1.

Display after operation and operating procedures			Description
29	Example: Entering 37.0℃ 	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to set to the target temperature and then press the [ENTER] key. □ Ramp level 4 is determined.
30	Example: Entering 1 hour 	Set with the [▼] or the [▲] key and press the [ENTER] key.	• Press the [▼] or the [▲] key to set to the time you want and then press the [ENTER] key. □ Soak time 4 is determined.
31	Example: Turning the wait function ON 	Set with the [▼] or the [▲] key and press the [ENTER] key.	・ Press the [▼] or the [▲] key to turn the wait function [ON] and then press the [ENTER] key. □ The wait function 4 is determined.

Now you have completed programming and start procedures to finish inputting a program. There are two sets of procedures to finish inputting a program and follow either of them to finish inputting.

Setting an end			Complete using the escape	
32		□ Setting of the segment 4 is determined and the input mode for the segment 5 is enabled.		□ Setting of the segment 4 is determined and the input mode for the segment 5 is enabled.
33	 Ramp time 5 of the segment 5 Press the [ENTER] key	• Press the [ENTER] key. □ The sub display indicates rt. 5 and prompts input of ramp time 5. ∗ Now press the [▼] or the [▲] key to switch to the end segment input mode.	 Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash ESc in the main display.
34	 Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to flash End in the main display. □ The mode changes to the end segment input mode.	 Example: Number of used-up segments is 4 Example: Number of free segments1 Press the [ENTER] key.	• Press the [ENTER] key. □ The indication returns to that of the program input mode.
35	 Example: Number of used-up segments is 5 Example: Number of free segments is 0 Press the [ENTER] key	• Press the [ENTER] key. □ The end segment is input and the all program settings to the program 3 have been determined. □ The indication returns to the that of the program input mode.		

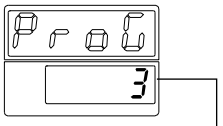
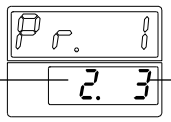
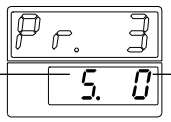
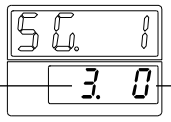
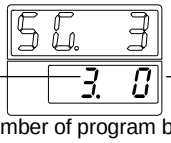
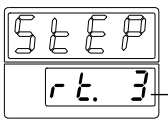
5.How to use the function menu (MODE key)

How to edit a program

- During program editing, you can change the “ramp time”, the “ramp level”, the “soak time”, the “wait function” that have already been input as well as the “repeat start segment” and the “number of repetitions” by one segment at a time.

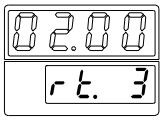
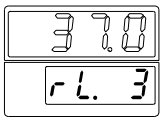
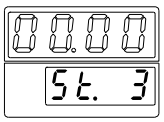
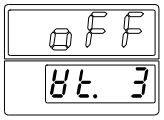
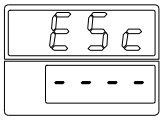
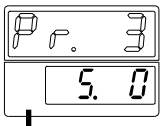
Note: You cannot delete a segment or the repeat command or insert a new segment or the repeat command.

- This section makes editing from the step operation to the fixed rate gradient operation for an example of the 3rd segment of the program 3 based on the input example for ”Programming procedures” (Figure 4) in the previous item.

Display after operation and operating procedures			Description
1	<Calling for the number of the program to edit>  Example: Existing program	Press the [MODE] key and then press the [▼] or the [▲] key.	• Press the [MODE] key to change to the function select mode and then press the [▼] or the [▲] key. □ The mode changes to the program input select mode and the main display indicates flashing PrOG.
2	 Example: Number of used-up Example: Number of free segments	Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the program input/edit mode and the main display indicates flashing Pr. 1.
3	Example: Editing the program 3  Example: Number of used-up segments Example: Number of free segments is 0	Press the [▲] key.	• Press the [▲] key to flash the number of program to edit in the main display. (Pr. 3 in this example) □ The sub display indicates the number of used-up segments in the left most 2 digits and the number of free segments in the right most 2 digits.
4	 Example: Number of program being executed Example: Number of free segments is 0	Press the [ENTER] key.	• Press the [ENTER] key. □ The main display indicates the flashing segment number included at the beginning of program 3. □ The sub display indicates the number of program being edited in the left digit and the number of free segments in the right digit.
5	＜Calling for segment 3＞  Example: Number of program being executed Example: Number of free segments is 0	Press the [▲] key.	• Press the [▲] key to flash the number of segment to edit in the main display. (SG. 3 in this example)
6	 Example: Ramp time 3 of segment 3	Press the [ENTER] key.	• Press the [ENTER] key. □ This indicates that the ramp time of the segment 3 is set as a step.

5.How to use the function menu (MODE key)

How to edit a program

Display after operation and operating procedures			Description
7	＜Changing to the gradient operation＞ Example: Entering 2 hours 	Press the [▼] or the [▲] key.	• Press the [▼] or the [▲] key to change to the time you want. ∗ Now change the segment 3 to the gradient operation.
8		Press the [ENTER] key.	• Press the [ENTER] key. □ Edited ramp time 3 is determined. ∗ This is a request for a ramp lavel but any editing is made and you need to press the [ENTER] key as it is.
9		Press the [ENTER] key.	• Press the [ENTER] key. □ Ramp level 3 is determined. ∗ This is a request for input of a soak time but any editing is made and you need to press the [ENTER] key as it is.
10		Press the [ENTER] key.	• Press the [ENTER] key. □ Soak time 3 is determined. ∗ This is a request for input of the wait function 3 but any editing is made and you need to press the [ENTER] key as it is.
11		Press the [▲] key.	∗ This example edits the segment 3 only and the process is now completed. • Press the [▲] key to call for ESc in the main display.
12	 Leave 1 minute or longer ＜Status immediately before the [MODE] key is pressed＞	Press the [ENTER] key.	• Press the [ENTER] key. □ Editing ends and the mode returns to the program edit mode. ∗ To finish the program edit mode, press the [▼] or the [▲] key to call for ESc and then press the [ENTER] key.（See P.30 “How to use the escape function”.） ∗ The status will return to the one immediately before pressing the [MODE] key if the unit is left for 1 minute or longer as it is.

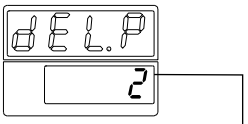
5.How to use the function menu (MODE key)

How to delete a program

- Program edit allows you to delete an already input program in the unit of program numbers.
- Here an example of deleting program 1 is shown.

Note: Take care before deleting a program using this function, which does not allow you to check the contents of it. Use the "Program input/edit function" to check the contents of a program.

Note: You cannot delete segments or the repeat command.

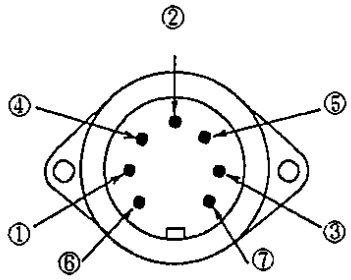
	Display after operation and operating procedures		Description
1	 Example: Number of existing programs is 2	Press the [MODE] key and then press the [▼] or the [▲] key.	• Press the [MODE] key to change to the function select mode and then press the [▼] or the [▲] key several times. □ The mode changes to the program delete mode and the main display indicates flashing dEL.P. □ The sub display indicates the number of existing programs.
2		Press the [ENTER] key.	• Press the [ENTER] key. □ The mode changes to the program delete mode and the main display indicates a flashing number which is the smaller among the existing programs. The example indicates Pr. 1 (abbreviation of program 1). □ The sub display indicates dEL.P.
3	＜Status immediately before the [MODE] key is pressed＞	Press the [ENTER] key.	• Press the [▼] key to flash the number of the program you want to delete in the main display and then press the [ENTER] key. ∗ In this example, the program 1 will be deleted and simply press the [ENTER] key. □ The program 1 is deleted and the indication will return to the one immediately before the [MODE] key is pressed.

6. How to use the external output

Only BF500 supports this function.

① Connector specification

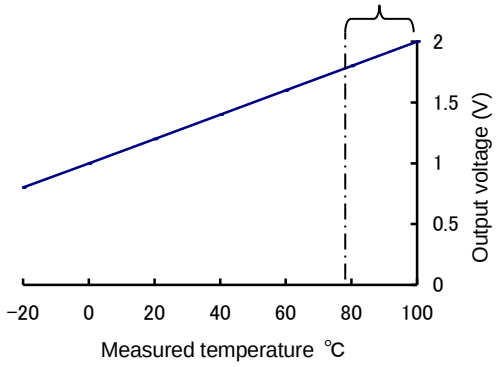
Rear of BF500



Pin number	Signal name
	DC + 6V
①	Time up output (open collector)
②	DC + 6V
③	External alarm output (open collector)
④	Temperature output +
⑤	Temperature output －
⑥	Shield (analogue signal)
⑦	

② Temperature output

●Output voltage



Although output is possible at 80～100℃,
80℃ or lower temperature is recommended.

●Output voltage unit：10mV/℃
●Resolution：1.25mV
●Precision：Within ±0.5% F.S.

③ External alarm output

●Transistor open collector output

Major load ：Power supply DC6V

Sink current：MAX.100mA

Output relay specification：Panasonic JR1aF-TM-DC6V, OMRON G2R-1A-T DC6V

"Trouble" sign
（Error code flashes in the sub display）

[External alarm] is output

④ Time up output

●Transistor open collector output

Major load ：Power supply DC6V

Sink current ：MAX 100mA

Output relay specification：Panasonic JR1aF-TM-DC6V, OMRON G2R-1A-T DC6V

"END" sign
（Flashes in the sub display）

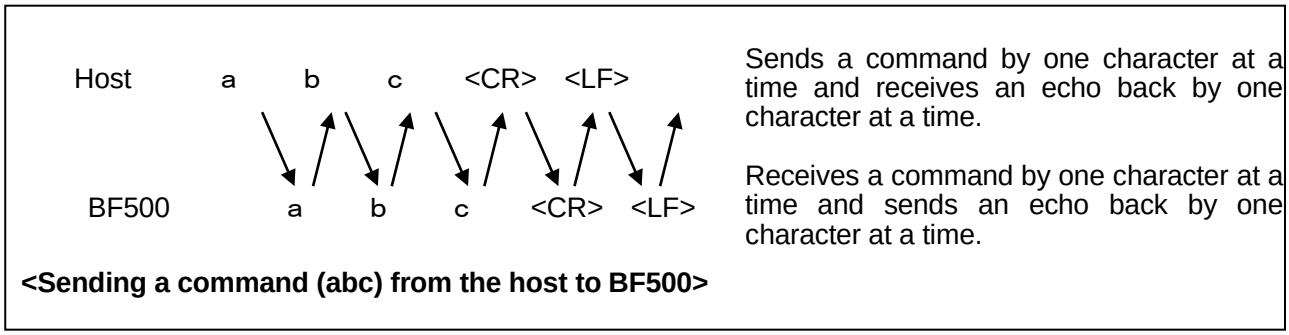
Time up output

7. How to use the communication interface

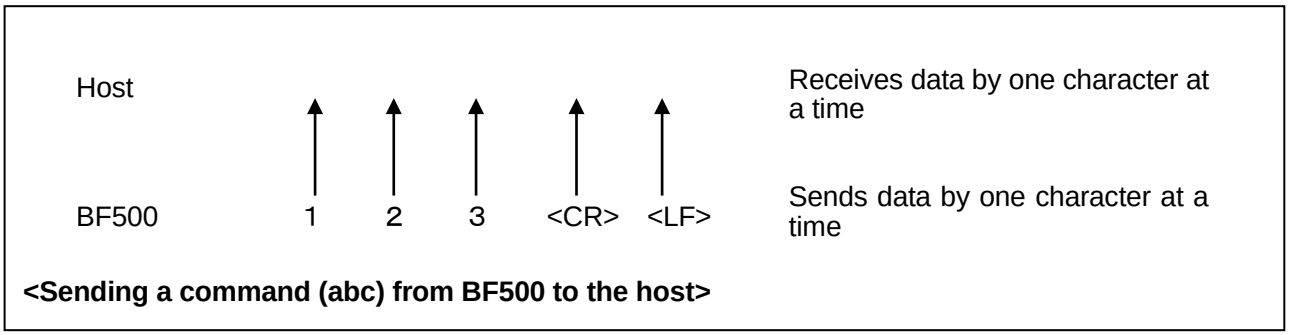
Overview of communication

Data communication between the BF500 and the host computer (hereafter, “host” is sent and received by one character at a time except for the terminal command. BF500 translates a command only after receiving the delimiter but transmits echo backs each time BF500 receeives a character. BF500 always appends a prompt symbol with an ID number at the end of data to transmit to prompt transmission of the next command from the host.

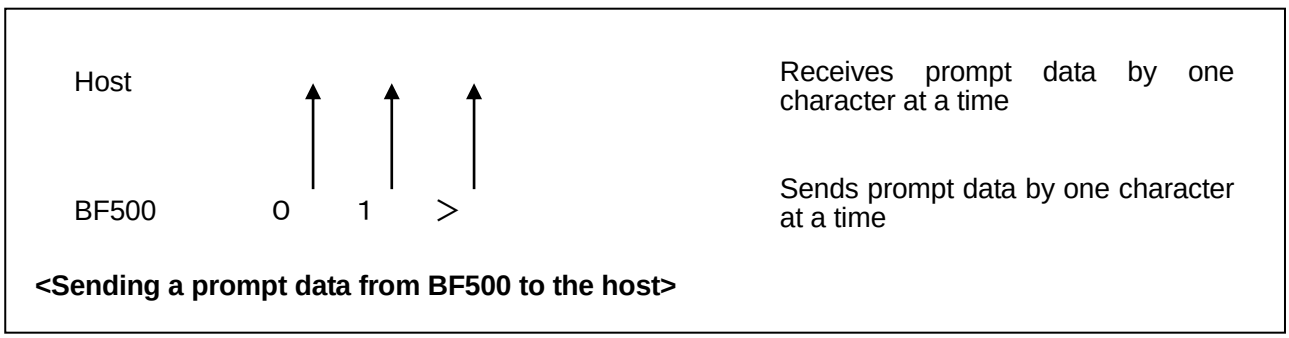
Assuming that the response of BF500 to the command abc from the host was “123”. Conceptual diagram of this process between the host and BF500 is as follows.



<Sending a command (abc) from the host to BF500>



<Sending a command (abc) from BF500 to the host>



<Sending a prompt data from BF500 to the host>

7. How to use the communication interface

Reception command and transmission data of the interface

The list below shows the reception commands of the BF500 communication interface.

Command types	Command name
Terminal command	<ESC>#nn:
General command	who
	meastemp
	Acctime
	Beepmode
Control command	Remote
	Settemp
	Setpump
Error command	alarm

 Caution Note that all command texts are lower-case characters.

When the host transmits a command, be sure to append a delimiter (<CR><LF>) at the end of the command.
BF500 always appends a prompt with an ID (hereafter, ID prompt) “nn>”(nn is a communication ID number allocated to the BF500) to the data to be transmitted in response to any command. Since any delimiter will not be appended to an ID prompt, regard a communication session has been completed between BF500 and the host when the host receives an ID prompt.

Bracketed symbols such as <CR> or <LF> later in this document. These symbols will be explained briefly in the following sections. Bracketed symbols are: <ESC>, <CR>, <LF> and <BEL> . All of them correspond to ASCII control codes as shown below:

<ESC> : Escape
<CR> : Carriage Return
<LF> : Line Feed
<BF> : Back Space
<BEL> : Bell

7. How to use the communication interface

Terminal command

<ESC>#nn	
■ Purpose	Open/Close of the BF500 communication terminal.
■ Parameter	nn, where nn is an integer between 01 to 15.
■ Description	A command beginning with <ESC> is a terminal command. When a BF500 whose ID number is nn receives this command from the host, it opens the communication circuit to enable communication. If another BF500 with a different ID number has been connected while communication was established, the communication line of that BF500 is closed. Note, however, that all lines will be closed if nn is other than 00 to 15. Ecoh back from BF500 to a terminal command is as follows: <ESC>#nn:<BS><BS><BS><BS><BS><CR><LF> (No echo back will be returned when nn is other than 01 to 15.)


Caution

Response of BF500 to the terminal command is different from response to other commands in the following points.

- BF500 will not send an echo back until it completes reception of all character strings and the delimiter.
- BF500 sends an echo back after appending 5 back spaces to <ESC>#nn.


Caution

The default communication ID number of BF500 is 01 and hereafter the ID prompts are indicates as <01>.

General command

who	
■ Purpose	Requests for identification information of the communicating controller
■ Description	BF500 sends a controller message after an echo back when it receives this command from the host. The controller message is “Hitec-IV(FR)”. The echo back and the transmission data are as follows: who <CR> <LF> message <CR> <LF> 01> The controller installed in BF500 is Hitec-IV. There are two types of Hitec-IV controllers, with names FR and CR. The type of the Hitec-IV controllers connected in a multi-drop network may be necessary information in some cases. The controller identification messages are as follows: Hitec-IV(FR): FR controller Hitec-IV(CR):CR controller

meastemp	
■ Purpose	Measured temperature request
■ Description	BF500 sends measured temperature data after an echo back when it receives this command from the host. Contents of the measured temperature data are the same as those on the operation panel. The echo back and the transmission data are as follows: meastemp <CR> <LF> n <CR> <LF> (n is measured temperature data) 01>

acctime	
■ Purpose	Request for accumulated operation time.
■ Description	BF500 sends accumulated operation time data after an echo back when it receives this command from the host. The echo back and the transmission data are as follows: acctime <CR> <LF> n <CR> <LF> (n is accumulated operation time data) 01>

beepmode	
■ Purpose	Confirmation of the beep mode status.
■ Description	BF500 allows setting ON/OFF of an alarm beep when the integrated trouble detection mechanism detects a trouble. The state of this setting (ON or OFF) is called beep mode state. BF500 sends the present beep mode state after an echo back when it receives this command from the host. The echo back and the transmission data are as follows: beepmode <CR> <LF> n <CR> <LF> n： 0：Beep mode OFF state 01> 1：Beep mode ON state

beepmode_n (The underbar "_" means a space)	
■ Purpose	Setting of the beep mode state.
■ Parameter	The parameter n has the following settings: 0：Beep mode OFF state 1：Beep mode ON state
■ Description	BF500 sends an echo back and the ID prompt and changes the present beep mode state according to the n setting. The echo back and the transmission data are as follows: Beepmode_n <CR> <LF> 01> (The underbar "_" means a space.)

7. How to use the communication interface

Control command

remote	
■ Purpose	Confirmation of the remote operation state.
■ Description	BF500 sends the present remote operation state after an echo back when it receives this command from the host. The echo back and the transmission data are as follows: Remote <CR> <LF> N <CR> <LF> n : 0 : Remote operation stopped 01> 1 : Remote operation activated -1 : Communication lock out


Caution

Remote operation is not available while communication is locked out. Communication lock out can be cancelled only on the operation panel of the main unit. See “Communication lock out function” on page 35 of this document for details.

Remote_n (The underbar “_” means a space)	
■ Purpose	Switching of a remote operation state.
■ Parameter	n where n means either of the following: 1 : Remote operation start 0 : Remote operation stop
■ Description	BF500 sends an echo back and the ID prompt when it receives this command and starts operation at the remotely set temperature when n is 1 unless BF500 is in a trouble state from which automatic recovery is not possible or in the communication lock out state. When n is 0, remote operation immediately stops. The echo back and the transmission data are as follows: Remote_n <CR> <LF> 01> (The underbar “_” means a space.)


Caution

The remote operation start command will be accepted as long as BF500 is in a state other than a trouble state from which automatic recovery is not possible or in the communication lock out state. BF500 stops, for example, program operation when it receives this command during that operation and starts remote operation at the remotely set target temperature and the pump speed at that time. Remotely set the target temperature and the pump speed using the target temperature setting command and the pump speed setting command described below before issuing a remote operation start command.

7. How to use the communication interface

settemp	
■ Purpose	Request for a target temperature setting.
■ Description	When BF500 receives this command, it sends an echo back and the target temperature set at the time of reception. The contents of the target temperature are the same as those on the operation panel of BF500. The echo back and the transmission data are as follows: Settemp <CR> <LF> n <CR> <LF> (n means a remote target temperature) 01>


Caution

The target temperature BF500 sends in response to this command is only the remote target temperature set using the target temperature setting command described in the next section.

Settemp_n (The underbar "_" means a space)	
■ Purpose	Setting a target temperature.
■ Parameter	n where n is a numeric value within the temperature setting range of BF500 and the effective digit is one decimal place (BF500 will ignore any numeric data of two decimal place of smaller).
■ Description	BF500 sends an echo back and the ID prompt when it receives this command from the host and sets n as the new target temperature. The echo back and the transmission data are as follows: settemp_n <CR> <LF> 01> （The underbar "_" means a space.）


Caution

BF500 accepts this command irrespective of whether it is in the remote state or not, which is because the remote target temperature has been set before the remote operation start command is issued.

setpump	
■ Purpose	Request for a speed level setting of the internal stirring pump (1 to 10 levels).
■ Description	BF500 sends an echo back and the remote pump speed level (1 to 10 levels) when it receives this command from the host. The echo back and the transmission data are as follows: setpump <CR> <LF> n <CR> <LF> (n means a remote pump speed level.) 01>

7. How to use the communication interface

Setpump_n (The underbar "_" means a space)	
■ Purpose	Setting of the speed level of the internal stirring pump (1 to 10 levels).
■ Parameter	n where n is an integer between 1 to 10.
■ Description	BF500 sends an echo back and the ID prompt when it receives this command from the host and sets n as a new remote pump speed level. The echo back and the transmission data are as follows: setpump_n <CR> <LF> 01> (The underbar "_" means a space.)


Caution

BF500 accepts this command irrespective of whether it is in the remote state or not, which is because the remote pump speed level has been set before the remote operation start command is issued.

Error command

alarm	
■ Purpose	Request for the number of errors and error codes.
■ Description	BF500 sends an echo back and then the number of errors that occurred simultaneously and an error code list when it receives this command from the host. BF500 accepts this command even if the integrated trouble detection mechanism does not detect any troubles, in which case the number of errors of 0(zero) only will be sent. For example, if the integrated trouble detection mechanism of BF500 has detected 3 errors that correspond to "Er.02", "Er.07" and "Er.10", the echo back and the transmission data will be as follows: Alarm <CR> <LF> 3 <CR> <LF> (Number of errors is 3) Er. 02 <CR> <LF> (Error 2 occurred) Er. 07 <CR> <LF> (Error 7 occurred) Er. 10 <CR> <LF> (Error 10 occurred) 01>

7. How to use the communication interface

Response to a communication error

When BF500 in the communication open state does not understand a command or a parameter sent from the host or finds an error in a command or a parameter, BF500 sends the following communication error message as an echo back.

<BEL> ERR_message <CR> <LF>
01>
(The underbar "_" means a space.)

The contents of the communication error message are as shown in the table below.

message	Contents of a communication error
COMMAND	Received an undefined command.
PARAM	Received a parameter whose data format is not supported on BF500 ※1 （numeric value format, numeric value range）.
EXEC	Received a command while BF500 is not ready to accept a command.※2

※1 Specific example includes when a temperature setting beyond the set temperature rangef of BF500 is received.

※2 Specific example includes when the communication start request "remote_n" command is received from the host while the trouble detection mechanism of BF500 has detected an error that cannot be automatically recoverd or during coomunication lock out.

Communication specification

Items	Specifications
Communication system	4-wire full duplex, EIA RS-422A compliant
Synchronization system	Asynchronous
Connection system	Multi-drop ※1
Communication distance	Max. 500m
Communication rate (bit/sec) *2	1200, 2400, 4800, 9600
Data length (bit)	8
Stop bit length (bit) *3	1 or 2
Parity	No parity
Communication sign	ASCII code
Delimiter	<CR> <LF>
Communication ID *4	Up to 10 from among 01 to 15 can be selected

※1 Up to 10 BF500 can be connected to one host.
※2 Default value is 9600 (bit/sec).
※3 Default is 1 (bit).
※4 Default is 01.

7. How to use the communication interface

Precautions when preparing a communication program

- Be sure to check the parameters in the communication specifications and the specifications of the PC to use.
- The host shall append delimiters (<CR> <LF>) at the end of a command to send. Since any commands other than the terminal command shall be sent/received in principle and sending or receiving by character strings will cause a hang-up.
- BF500 always appends an ID prompt (example:01>) at the end of data when sending it. The host shall regard one communication session has completed when it receives an ID prompt not delimiters (<CR> <LF>).
- Communication data for this interface is in the ASCII format without exceptions.
- A remote target temperature and a remote pump speed level shall be set before issuing a remote operation start command.
- When the standard communication interface of your PC is RS-232C only, use our optional RS-422A converter “RC-23”. And use our optional cable for connection between your PC and BF500 and between two or more BF500 units.
- Chack that power for BF500, your PC and the converter are OFF before connecting a cable.

8. Precautions on handling

⚠ Warning

1. Handling of ignitable or flammable solutions

This product is not of an explosion proof construction. Take special care for handling of explosive substances, flammable substances or substances that contain them that are used for this unit. Ignitable or flammable solutions will evaporate if left at a room temperature (or even lower temperature for some solutions) and might ignit or explode from a lighting source such as a switch. Assure sufficient ventilation when using these solutions.
See P.74 “19.”.

2. Turn the ELB off when an abnormality occurs.

Turn immediately off Earth Leakage Breaker (ELB) of this Equipment and disconnect Power Cord/Power Cable from receptacle or switch board of facilities, if smoke or strange smell is generated from it by any chance.
Contact with local dealer or Yamato sales office and/or Yamato Customer service Center and ask them to inspect it. If nothing is done to it, fire or electrical shock may result.
Never repair it by customer themselves to avoid any dangers.

3. Do not operate at the location of liquid splashing.

Do not operate this Equipment at the location of liquid splashing. If Controller of this Equipment will be wetted by splashing any kind of liquid, it may cause accident, controller malfunction, electrical shock and/or fire.

4. Never disassembly nor modify the Equipment.

Never disassemble nor modify this Equipment. Those actions may cause this Equipment malfunction, fire or electric shock.

⚠ Caution

1. Do not place or drop objects on the unit.

Do not place or drop objects on the unit. The unit contains precision components and a malfunction may result to them if they are subject to vibrations or mechanical shocks.

2. Turn immediately off the Breaker of the Equipment at thundering.

Turn immediately off the Breaker of the controller, when thundering and lightning start. If do not so, it may cause fire or electric shock by the thunderbolt.

3. Do not attempt to do any works not stipulated in this instruction manual.

Do not attempt to do any works not stipulated in this instruction manual. Otherwise, an accident may result.

9. Maintenance method

Daily inspection/maintenance

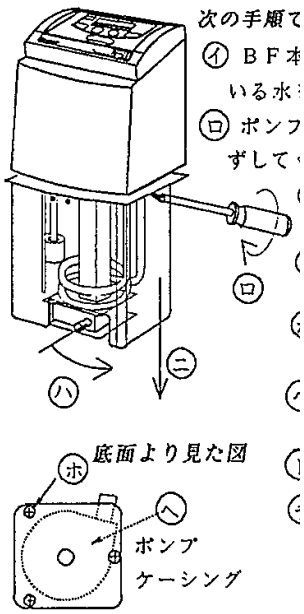
Conduct regular maintenance and inspection to assure reliable use of the product.

⚠ Warning

- Be sure to remove the power cord unless it is necessary when conducting inspection or maintenance.
- Wait until the device returns to the normal temperature before attempting any works.

⚠ Caution

- Wipe dirt off with wrung tightly soft cloth. Never clean this Equipment with benzene, thinner or scouring powder, or rub with a scrubbing brush. May cause deformation, degradation and/or discoloration.

Class.	Description of inspection and maintenance	Solutions
Everyday or each time of use	● Inspect and check that the water level in the testing bath is correct each time of use.	Add water before the level detection sensor is activated.
When an abnormal symptom is noticed	● Check for an abnormal noise or degradation of pump performance. (BF400/500 only) Disassemble and clean flowing the procedures below: ① Remove the BF unit from the testing bath and wipe off any remaining water. ② Remove 4 screws that secure the pump cover. ③ Turn the pump discharge port in the direction of arrow. ④ Remove the pump cover. ⑤ Remove 3 screws at the bottom of the pump. ⑥ The pump casing is detached. ⑦ Clean the inside. ⑧ Assemble the unit by following the procedures in the reversed order.	Check for clogging in the pump with foreign objects. 
Every month	● Operating the unit often at a higher temperature will make stone to attach shortening the heater life, which will necessitate more frequent inspection.	Remove the pump cover by referring to the disassembly and cleaning of the pump in the previous section (①～⑧) and remove stone.
	● Inspect the unit because scale will attach on the pump (BF400/500 only), the heater, the level detection sensor, and the temperature control sensor if the unit is operated at the incubation temperature.	Remove the pump cover by referring to the disassembly and cleaning of the pump in the previous section (①～⑧) and remove scale.

10. Long storage and scrap

When not using the Equipment for a long time / when scrapping

⚠ Caution

When you are not going to use the unit for an extended period of time.

- ●Remove the power cord.
- ●Discard water in the testing bath.
- ●If you are using a silicon oil, put a cover over the testing bath or replace it in the specified container to prevent dusts from entering.

⚠ Warning

Scrap this Equipment.

- ● Do not leave this Equipment alone where children may play and get at it.
- ●Remove the whole driving assembly.
- ●In general, discard as a bulky trash.

Matters to consider when scrapping the Equipment

Pay attention always to the preservation of the global environment.

We, as Yamato Scientific Co., Ltd. highly recommend taking this Equipment apart as far as possible for separation or recycling to contribute to the preservation of the global environment according to the specified garbage collection method stipulated by each local government..

List major components and their materials for this Equipment as follows:

Names of major parts	**Material**
Major components of the Equipment	
Exterior	Melamine resin finished steel plate
Inner bath	Stainless steel plate SUS304
Nameplates	PET resin film
Major components of electrical parts	
Switch and Relay	Composite of resin, cupper and other materials
Printed Circuit Boards	Fiber glass
Pipe heater	SUS321 and others
Power Cord/Cable	Composite of synthesized rubber coating, cupper, nickel and other compound materials
Wires	Iron, copper, resin, ceramic
Sensors	SUS304 and others
Operation panel	ABS resin, acryl, silicone, and others

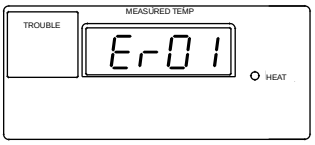
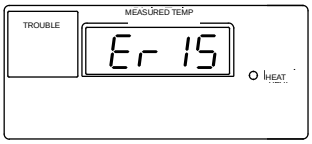
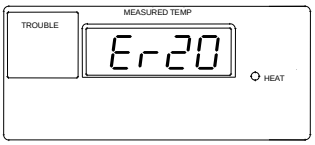
11. When a trouble occurred

Safety device and error codes

Error codes

This product has a self diagnostic function. When a trouble during operation or a malfunction to the unit occurs, a character “Trouble” and an error code flashes on the operation panel and an alarm buzzer sounds. When a trouble occurs, check the error code and immediately stop operation.

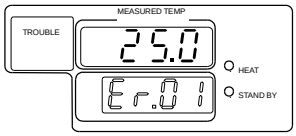
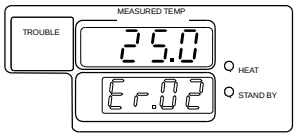
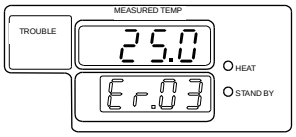
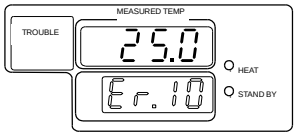
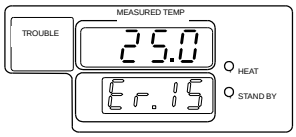
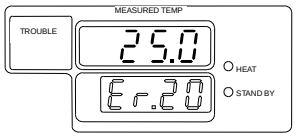
When model BF200 is used

Trouble sign and error codes/Causes	Solutions
 Trouble of the temperature sensor. ・”TROUBLE” sign flashes. ・Er01 flashes	●When these error codes are displayed, immediately turn the power switch on the rear of the unit [OFF]. ●Replacement of parts or inspection of the unit is necessary when a trouble occurs. Contact your dealer, one of our sales offices, or the service department. Remember to notify the error code when contacting one of the above listed facilities.
 Malfunction in the electric circuit. ・”TROUBLE” sign flashes. ・Er 15 flashes.	
 Water level is low or a malfunction of the water level detection sensor. ・”TROUBLE” sign flashes. ・Er20 flashes.	●Water level is low and the safety device has activated. Add water. ●If the error does not released even if you add water to the correct level, contact your dealer, one of our sales offices, or the service department.

11. When a trouble occurred

Safety device and error codes

When model BF400/500/600 is used

Trouble sign and error codes/Causes		Solutions
	**Temperature sensor trouble** =[TROUBLE] lamp flashes = Er.01 flashes	●When these error codes are displayed, immediately turn the power switch on the rear of the unit [OFF]. ●Replacement of parts or inspection of the unit is necessary when a trouble occurs. Contact your dealer, one of our sales offices, or the service department. Remember to notify the error code when contacting one of the above listed facilities.
	**Triac circuit trouble** =[TROUBLE] lamp flashes = Er.02 flashes	
	**Heater disconnection** =[TROUBLE] lamp flashes = Er.03 flashes	
	**Main relay trouble** =[TROUBLE] lamp flashes = Er.10 flashes	
	**Electronic circuit system trouble** =[TROUBLE] lamp flashes = Er.15 flashes	
	**Water level low or the water level detection sensor trouble** =[TROUBLE] lamp flashes = Er.20 flashes	●Water level is low and the safety device has activated. Add liquid. ●If the error does not released even if you add liquid to the correct level, contact your dealer, one of our sales offices, or the service department.

11. When a trouble occurs

When a trouble is suspected

In these cases

Symptoms	Items to check
Indicators on the operation panel do not light even if the power switch is turned on.	●If the power cord is connected to the outlet securely. ●If power failure has occurred. ●Turning the power switch [ON] and [OFF] quickly may prevent the indicators from lighting. Wait 2 to 3 seconds before turning [ON].
Temperature fluctuates during operation.	●If changes in the environmental temperature too large. ●If the water level in the testing bath is low. ●If the amount of specimen is too much. ●If the viscosity of the silicone oil is too high (BF600 only).
Performance of the pump and proper stirring have decreased.	●If inside the pump is clogged with a foreign object. ●If the source voltage is low. ●If the jet strength setting is low. (BF400/500)

If power failure occurred

When a power failure occurred during operation and recovered, the unit will automatically recover to the state immediately before the power failure and resume operation.
If you want to avoid restart by auto recovery, turn the power switch off.

◆If the symptom does not correspond to any of the above, immediately turn the ELB of the main unit off, remove the power cable from the power supply and contact your dealer, one of our sales offices, or the service department.

12. After sales service and warranty

*

Request to repair parts

When any abnormality occurs immediately stop operation, turn the controller power and the ELB off and contact your dealer, one of our sales offices or the customer service center.

Require the following information for repair.

- Model name of Yamato products
- Serial Number
- Date (year/month/date) of purchase
- Description of trouble in detail as possible

} See Warranty Card or caution rating nameplate on this Equipment.
(See Chapter 3. Names and functions of each part “on page 9 for details.

Be sure to present the warranty card to Yamato service representative.

Keep Warranty Card with care.(attached separately)

- Keep Warranty Card with care.
  Warranty Card would be given by local dealer or one of Yamato sales offices.
  Date of purchase of this Equipment and other information should be filled in Warranty Card.
  Please send Warranty Card to Yamato Customer Service Center(Yamato CSC) by facsimile described Fax number in the last page of this document.
  Then, keep its Card with good care.

- Repair this Equipment for free of charge according to the contents on Warranty Card.
  Warranty period is 1(one) year from date of purchase.

- Consult with local dealer, one of Yamato sales office or Yamato CSC for any repair after warranty ended.
  Charged repair service of this Equipment will be available on customer’s request when it can be maintained functional by its repair.

Guarantee for maximum storage period of repair parts.

Guarantee that maximum storage period of repair parts will be 7(seven) years after end of their production, Thermomate BF200/BF400/500/600.
Repair parts will be defined the parts to maintain this Equipment performance.

13. Specification

Model		BF200	BF400	BF500	BF600
Performance	Operating temperature range	Room temperature:＋5℃～80℃			Room temperature: ＋ 5℃ ～ 180℃
	Temperature adjusting precision	0.05～0.1℃	±0.02～0.05℃		±0.05～0.2℃※1
Configuration	Stirring mechanism	Propeller stirring	Jet stirring		Propeller stirring
	Heater	Stainless steel pipe heater			
		1Kw			1.2kw
	Temperature control system	PID control with the micro computer			
	Temperature setting system	Digital setting system with the [▲] and the [▼] keys			
	Temperature indication system	Digital display with green LEDs			
		Switching of settings and measured temperature	Indication on the main display (Sub display indicates the set temperature)		
	Timer	———	1～99 hours 59 minutes and 100 hours～999 hours		
	Timer resolution	———	1 minute or 1 hour		
	Operation-related functions	Fixed-temperature operation	Fixed-temperature operation Program operation：1～3 free patterns, max 5 segment pattern (Repeat, gradient operation, quick auto stop ※2)		
	Additional function	Temperature preset Stores and calls for temperature at 1 point	Temperature preset (Temperature at 10 points can be stored and called for) Accumulated time function (～49999 hours), key lock function		
			Jet strength variable function (10 levels variable)		—
			Pump discharge port variable function		—
		———	———	Temperature output (10mV/℃) ※3.4	———
		———	———	External alarm output※3.4	———
		———	———	Time up output※3.4	———
		———	———	External communication function※4 （RS422 compliant）	———
	Heater circuit control	Triac zero cross system			
	Sensor	Thermister			Platinum resistance temperature detector
	Safety device	Self diagnostic function (automatic overheat prevention, temperature sensor trouble, heater disconnection ※5, Triac short circuit※5, main relay trouble※5), circuit protector, water level detection sensor(float type), buzzer alarm for troubles			
Stan-dards	Outer dimensions	W140 x D150 x H305mm (excluding protrusions)			
	Clamp thickness allowed	Up to 35mm			
	Power supply (50/60Hz)	AC100V 11A			AC100V 13A

*1 Guaranteed values within the temperature range of 100 to 180℃

*2 Possible during fixed-temperature operation

*3 Output is mixed and is supported with one

*4 The dedicated cable is an optional accessory.

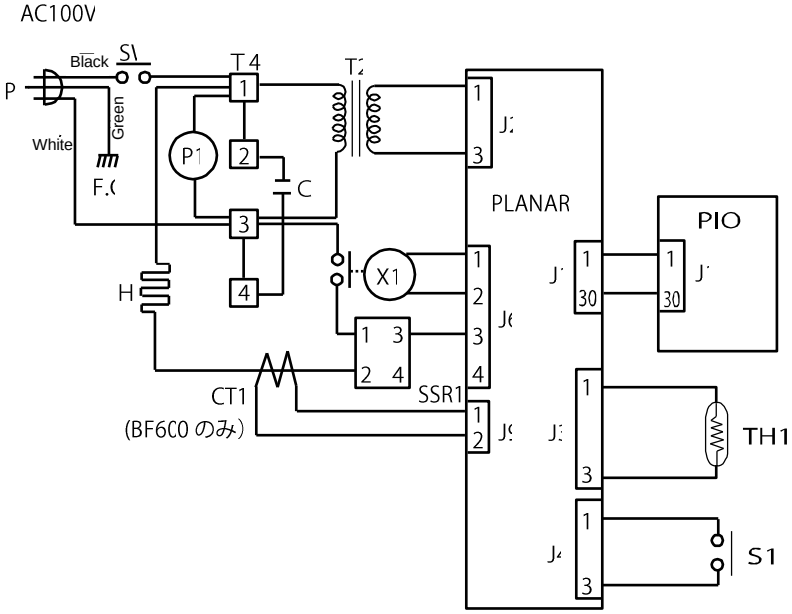
*5 BF200 does not detect this.

Performance→"Performances shown have been measured when the included BY100 water bath is used.

Note: When you use at a temperature +5℃ or lower, combine with the Neo Cool Dip BE.

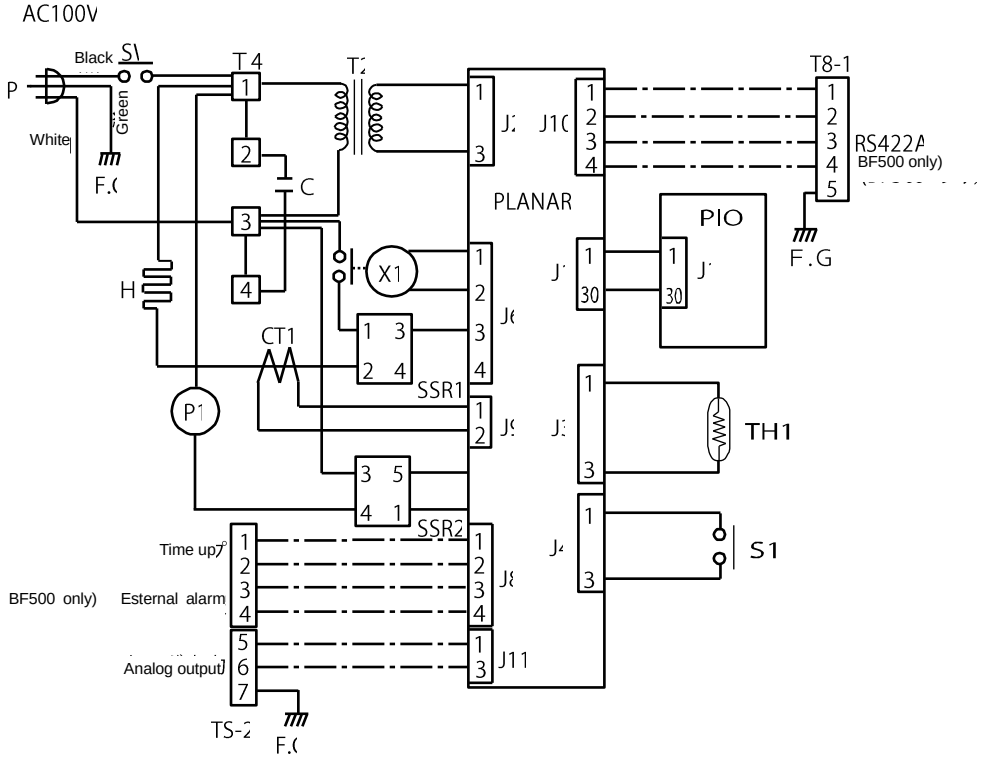
14. Wiring diagram

BF200/600



Symbol	Part name	Symbol	Part name
C	Capacitor	SSR 1	Solid state relay
CT1	Current detection element	SSR2	Solid state relay
H	Heater	SW	Circuit protector
P	Power plug	T2	Transformer
P1	Stirring motor	T4	Terminal block
PIO	Display board	T8-1	Receptacle
PLANER	Control board	T8-2	Receptacle
S1	Water level detection sensor	X1	Relay
TH1	Thermister (Platinum resistance temperature detection resistor for BF600)		

BF400/500



15. Replacement parts list

Common parts

Symbol	Part name	Code №	Specification	Manufacturer
C	Capacitor	2190010005	Film capacitor	Yamato Scientific
P	Power cord	LT00008924	T2-3C	Yamato Scientific
P1	Stirring motor	2140000024	IS-3240SPJA	Yamato Scientific
PLANER	Control board	1240000057	Hitec IV FR type	Yamato Scientific
SSR1	Solid state relay	2160000024	S5C-225L	Yamato Scientific
SW	ELB	LT00007359	NRLR1100F-20AAA-B	Yamato Scientific
T2	Transformer	2180000044	4FR 301N234	Yamato Scientific
T4	Terminal block	LT00036297	MKH-250AF-4P	Terminal
X1	Relay	2050000013	JR1aF-TM-DC6V	Panasonic

Non-common parts (Models are shown in parentheses)

Symbol	Part name	Code №	Specifications	Manufacturer
CT1	Current detection element(400/500/600)	2170010004	CLT-6-P-4-H	URD
H	Heater（200/400/500）	BF400-30022	AC100V 1kW	Yamato Scientific
H	Heater（600）	BF600-30010	AC100V 1.2kW	Yamato Scientific
PIO	Display board (200)	1240000030	Hitec IV FR type PIO3	Yamato Scientific
PIO	Display board (400/500/600)	1240000028	Hitec IV FR type PIO2	Yamato Scientific
S1	Water level detection sensor（200/400/500）	LT00037170	Float SW FD-114YA1	Yamato Scientific
S1	Water level detection sensor (600)	LT00017239	D2MC-01HL	Yamato Scientific
SSR2	Solid state relay（400/500）	LT00008920	G3R-0A202SLN 5-24V	Omron
T8-1	Receptacle (500)	2080000039	DIN8P D8-701B-00	Chuo Musen
T8-2	Receptacle (500)	2080000058	TCS0270-01-1201	Chuo Musen
TH1	Thermister （200/400/500）	BF400-40130		Yamato Scientific
TH1	Thermister (600)	BF600-40060		Yamato Scientific

16. Optional accessories

●Specification of optional accessories

Cooling pipe/level controller 	Bath cover 
External circulation nozzle 	Float for micro tubes 

Product name	Product code	Model	Specification
Level controller (Automatic water supply unit)	221570	OBF10	Certain water level can be maintained with the float type water level detection function.
Cooling pipe	221872	OBJ10	Use for operation at room temperature ＋5℃ or lower.
Bath cover	221578	OBI11	Stainless steel bath cover that can be installed on the included testing bath BY100 and accessories
External circulation nozzle	221573	OBG10	Circulation to an external shielded system is enabled by connecting to BF400/500.
Float for micro tubes	221575	OBH10	For diameter 8mm
	221576	OBH20	For diameter 11mm
Dedicated cable （For BF500 model）	221574	OBL10	Multi-core cable for temperature output, external alarm output, time up output
	221577	OBK10	Combination cable of connecting plug to be connected to the rear of the BF500 unit and the relay terminal box.
	281257	RC23	Converter used to convert RS232C to RS422A of a PC. RC23 is not necessary when your PC supports RS422A.

16. Optional accessory

●Testing bath　Select according to the purpose, sample amount and temperature.

Material	Product code	Model	Dimension in the bath (W×D×H)	Capacity	Permissible operating temperature
Stainless steel plate	221820	BZ100	230×390×150mm	12ℓ	Room temperature to ＋200℃ Use for a high temperature and an oil bath.
	221821	BZ100D	240×300×200mm	13ℓ	
	221822	BZ200	300×500×150mm	20ℓ	
	221823	BZ300	300×500×200mm	27ℓ	
Polypropylene※	221824	BY100	327×185×156mm	8ℓ	-5℃～＋80℃
	221825	BY200	455×300×160mm	18ℓ	
Acryl ※	221826	BX100	230×390×150mm	12ℓ	≦50℃ Dedicated for water
	221827	BX100D	240×300×200mm	13ℓ	
	221828	BX200	300×500×150mm	20ℓ	

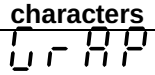
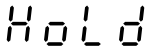
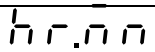
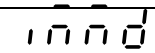
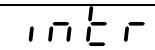
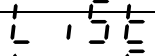
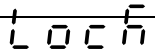
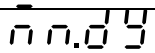
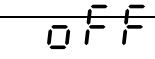
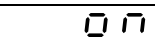
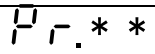
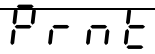
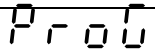
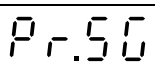
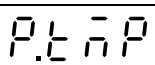
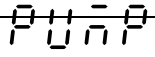
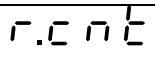
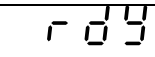
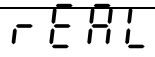
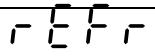
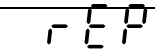
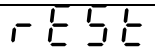
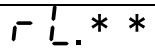
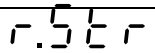
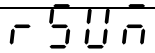
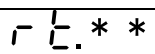
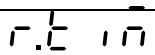
*Be sure keep within the permissible operating temperature when you use a resin bath.

17. Description of displayed characters

The controller of this unit employs a 7-segment LED as the indicator. The list below indicates meanings of displayed characters. Note that some characters may not be indicated on some models.

Sym-bol	Displayed characters	Complete characters	Meanings of indicated characters
A		abnd Abbreviation of abnormal end	Abnormal end
		abrt Abbreviation of abort	Abort：Forced operation stop function
		accm Abbreviation of accumulation	Accumulated time
		a.stp Abbreviation of auto stop	Quick auto stop
B		beep	Beep：Buzzer sound
		busy	During transmission：Data being transmitted to the printer
C		ch.** Abbreviation of character**	Character print mode： ** has 3 settings:01(unit of 1 minute), 10 (unit of 10 minutes), 60(unit of 60 minutes)
		clok Abbreviation of clock	Clock：Date and time setting
		com.l Abbreviation of communication lockout	Setting/cancel of the communication lock out function
		cont Abbreviation of continue	Freezer continuous operation mode
		cycl Abbreviation of cycle	Freezer cycle operation mode
D		damp Abbreviation of damper	Auto damper function
		d.cyc Abbreviation of defrost cycle	Cycle defrost operation mode
		def Abbreviation of defrost	Defrost operation function
		def.w Abbreviation of defrost wait	Wait time after defrost operation
		del.p Abbreviation of delete program	Deleting of a program
		disp Abbreviation of display	Display switch select mode
		door	Door open
		dp.** Abbreviation of damper**	Damper openness of a segment **
E		end	End：Program end setting
		er.** Abbreviation of error	** means an error number
		esc Abbreviation of escape	Escape function (to abort selection of a function or resume input/edit of a program)
F		fan	Fan
		fn.** Abbreviation of fan**	Fan function of a segment**
		full	The number of registration of preset temperatures is full.
		f.wt Abbreviation of forced wait	Forced wait (Forced to be the wait state after recovery from a power failure)

17. Description of displayed characters

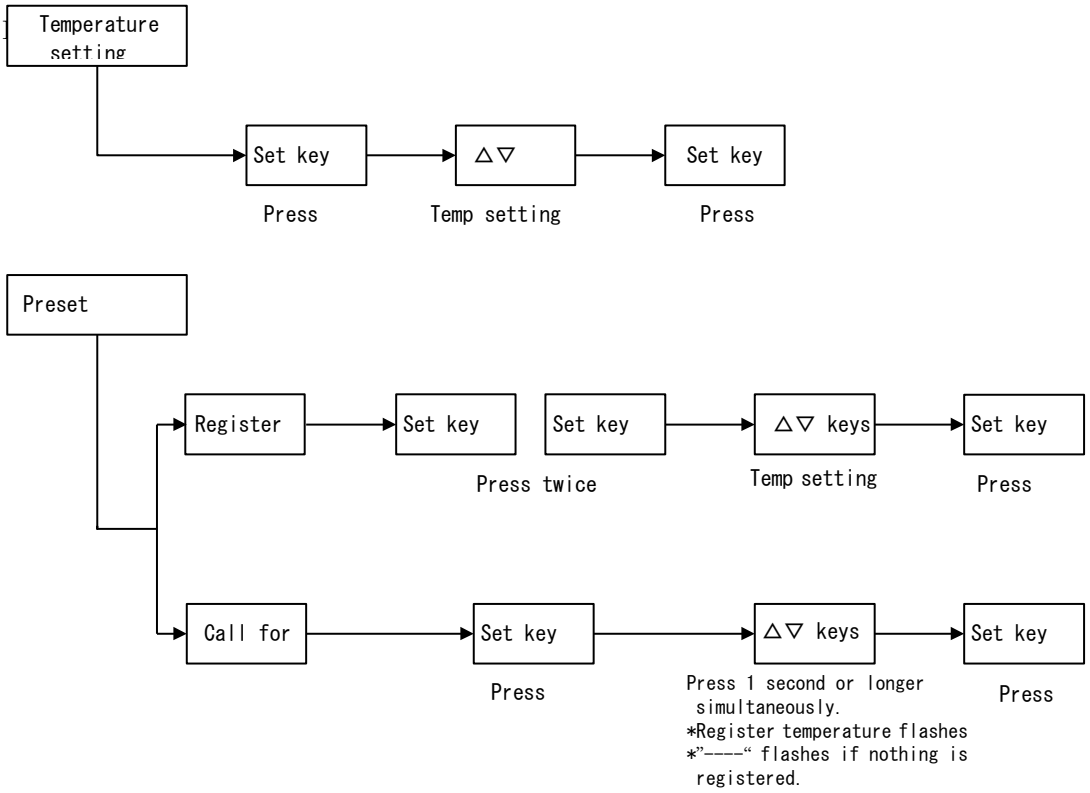
Sym-bol	Displayed characters	Complete characters	Meanings of indicated characters
G		grap Abbreviation of graphic	Graphic print mode
H		hold	Hold function (To stop the timer and hold the controller state at that time)
		hr.mn Abbreviation of hour. minute	Time: Hour and minute setting
I		immd Abbreviation of immediately	Immediate print mode
		intr Abbreviation of interval	Time interval：○○ hours ○○ minutes or ○○○ hours
L		list	Program list print mode
		lock	Panel key lock
M		mn.dy Abbreviation of month. day	Date: Month and day setting
O		off	Off：Does not use a function
		on	On：Uses a function
P		pr.** Abbreviation of program**	** means a program number
		prnt Abbreviation of print	Print function
		prog Abbreviation of program	Program
		pr.sg Abbreviation of program. segment	Execution program, execution segment
		p.tmp Abbreviation of preset temperature	Preset temperature
		pump	Pump
R		r.cnt Abbreviation of repeat count	Number of repeats
		rdy Abbreviation of ready	Preparation：Transmission to a printer is ready
		real Abbreviation of real time	Actual time (time): ○○ hours ○○ minutes
		refr Abbreviation of refrigerator	Freezer operation function
		rep Abbreviation of repeat	Repeat command mode
		rest Abbreviation of rest time	Remaining time
		rl.** Abbreviation of ramp level**	Ramp level of segment ** (Target set temperature)
		r.str Abbreviation of repeat start	Repeat start segment
		rsum Abbreviation of resume	Operation resume function
		rt.** Abbreviation of ramp time**	Ramp time of segment** (Time required to attain the ramp level)
		r.tim Abbreviation of real time	Actual time (time)

17. Description of displayed characters

Sym-bol	Displayed characters	Complete characters	Meanings of indicated characters
S	SG.**	sg.** Abbreviation of segment**	** means a segment number
	St.**	st.** Abbreviation of soak time**	Soak time of a segment ** (Ramp level hold time)
	StEP	step	Up and down at full power
	Sur-E	sure	Check：Check of execution of forced operation stop
T	tEmP	temp Abbreviation of temperature	Temperature
	t imE	time	Time
	t imr	timr Abbreviation of timer	Timer defrost operation mode
W	WA it	wait	Wait function (Function to guarantee a temperature within the certain range based on ramp level for the set soak time)
	Wt.**	wt.** Abbreviation of wait.**	Wait function of a segment**
Y	YEAr	year	Year

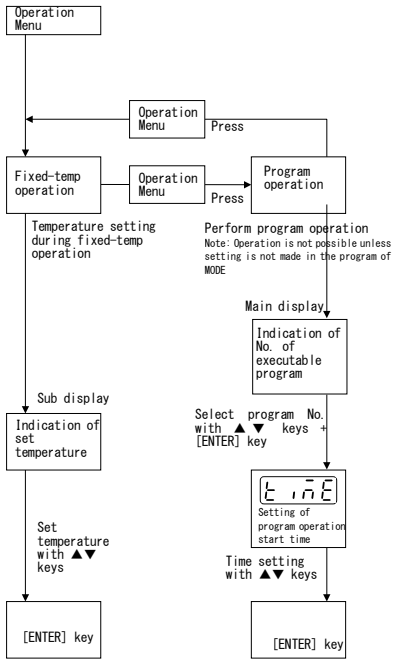
18. Ⅳ model Operating procedures

BF200



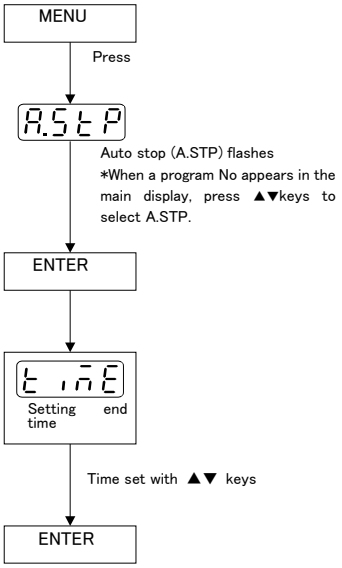
18. Ⅳ model operating procedures

Operation Menu

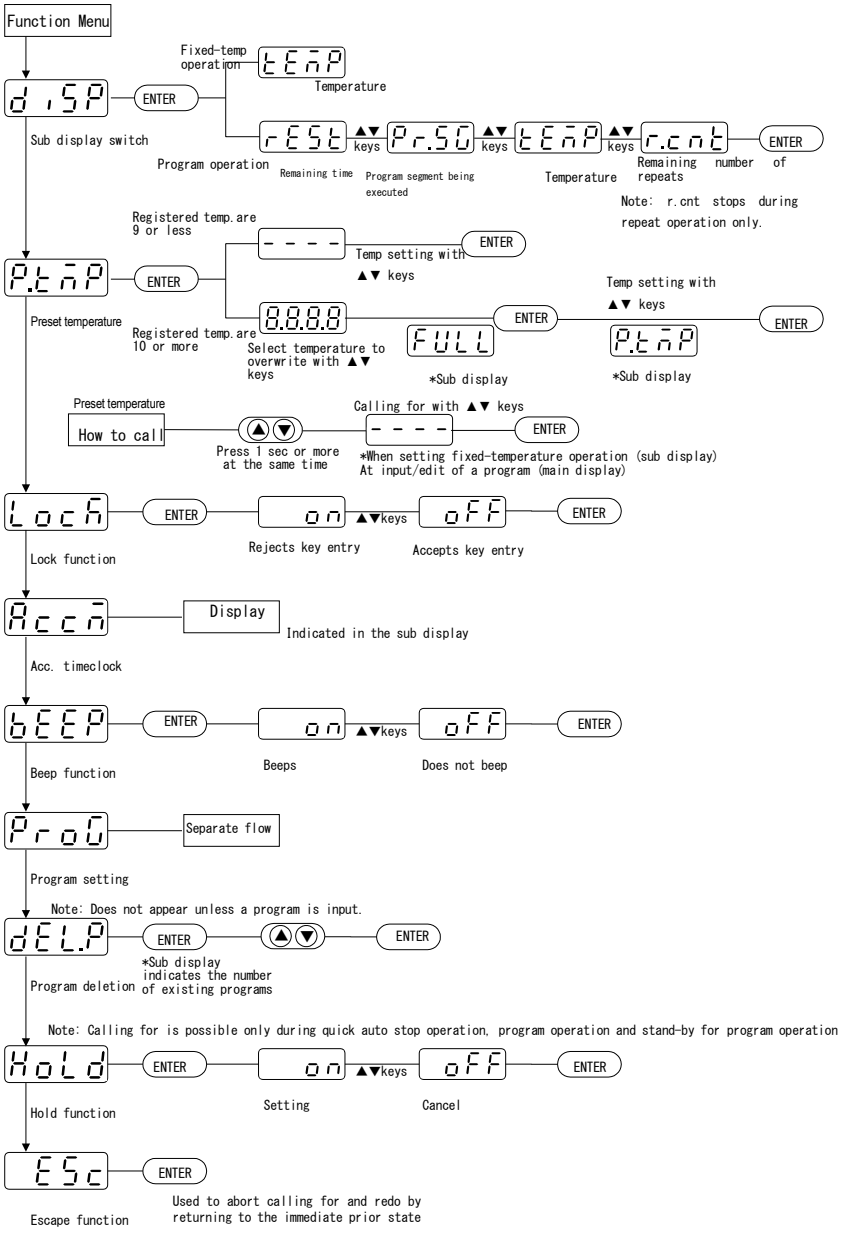


Quick Auto Stop

Stops fixed-temp operation being executed after a certain period of time



Function Menu (MODE)

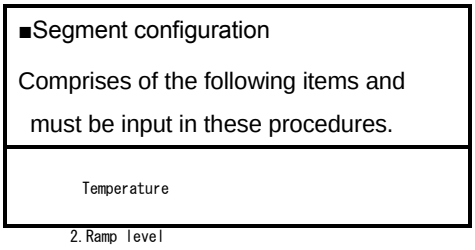


18. Ⅳ model operating procedures

Program menu

■Segment configuration

Comprises of the following items and must be input in these procedures.



1.Ramp time
rt.
Time to raise

2.Ramp level
rL.

3.Soak time
St.
Time to hold a ramp level

4.Wait function
Ut.
Select whether soak time shall be dependent on time (OFF) or process time shall be held at ramp level (ON).

MENU

Press ▲▼ keys

ProG — Call for/select the program mode

ENTER

▲▼ keys

Pr. 1 — Select the number of a program to store

ENTER

▲▼ keys

SG. 1 — Indication of a segment number
For rewriting, select the number of a segment to rewrite
Note: This is not indicated when a program is input for the first time.

ENTER

▲▼ keys

rt. 1 — Ramp time input
Note: Select StEP for up/down at full power

ENTER

▲▼ keys

rL. 1 — Ramp level input

ENTER

▲▼ keys

St. 1 — Soak time input
Note: Input 0 when setting no soak time (changes begins at the next temperature) and select HoLd to hold

ENTER

▲▼ keys

Ut. 1 — Select the wait function

ENTER

▲▼ keys

SG. 2 — Next segment number is indicated
Note: If you want to repeat, indicate rEP with the ▲▼ keys, select with the [ENTER] key and then input the number of the segment to repeat an then the number of repeats.
*Input all contents of the next segment in the same manner.

ENTER

▲▼ keys

rt. 2 — When input completely, select End in the ramp time of the next segment and then press [ENTER] key.

ENTER

▲▼ keys

Setting complete

19. List of Dangerous Substances

Never process any explosive, flammable samples and also samples contained with those substances.

Explosive Substance	①Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	②Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④Metallic Azide, including Sodium Azide, etc.
ExplosiveSsubstances	①Metal “Lithium” ②Metal “Potassium” ③Metal “Natrium” ④Yellow Phosphorus ⑤Phosphorus Sulfide ⑥Red Phosphorus⑦Phosphorus Sulfide ⑧Celluloids, Calcium Carbide (a.k.a, Carbide)⑨Lime Phosphide⑩Magnesium Powder ⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder ⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing Substances	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
Flammable Substances	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a.amyl n-acetate) and other substances with ignition point between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyl Alcohol(a.k.a. Isoamyl Alcohol), Acetic Acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible Gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15℃ at one air pressure.

Excerpt from Table 1, Hazardous Substances, of Cabinet Order of the Occupational Safety and Health Law (substances related to Articles 1, 6, and 9)

20. Standard setup manual

*Install this Equipment according to following format (Check the format for options or customized specifications)

Model	Serial number	Installation Date	Charged Personnel or Company Name for Installation	Installation proved by	Judgment

№	Item	Implementation Method	Chapter No. & Reference page of Instruction Manual	Judg-ment
Specifications				
1	Accessories	Check for number of accessories Against to Accessories Column.	10. Specification P.64	
2	Installation	・Check room environment visually. Caution: Take care for environment	2. Before operating the Equipment ・Precautions when installing t・・・ P.4	
		・Make installation space.		
		・Fixing to the bath	2. Before operating the Equipment ・Do not over-tighten the fixing knob P.5	
Equipment Operation				
1	Voltage of Power Source	・Measure line voltage (power distribution board of facilities, receptacle, etc.) with voltmeter. ・Measure line voltage during operation. (Must meet required voltage.) Caution: Check receptacle rating or breaker on power switch board rating to meet this Equipment requirement.	2. Before operating the Equipment ・Ground always the Equipment P.4 P.5 ・Connect Power Cord/Power Cable to receptacle P.64 13. Specification ・Standard－power supply	
2	Starting operation	・Start operation	4.Operating procedure ・BF200 P.11 ・BF400/500/600 P.14	
Description				
1	Operational descriptions	Explain operations of each component and handling precautions according to Instruction Manual.	4. Operating procedure P.11 5. How to use the function menu・・・ P.22 1.Safetu precautions ～19.List of Dangerous Substances P.1～74	
2	Error Codes	Explain about error codes and procedures for reset according to Instruction Manual.	11. When a trouble occurs ～12. After sales service and warranty P.60～63	
3	Maintenance and inspection	Explain operations of each component according to Instruction Manual.	9. Maintenance method ・Daily inspection/ maintenance P.58	
4	Completion of installation Entries	・Fill in Installation Date and Charged Personnel or Company Name on OK and Service seal of this Equipment. ・Fill in necessary information to Warranty Card and hand it over to customer. ・Explain how to contact with service personnel.	12. After sales service and warranty P.63	

Limited liability

Be sure to use this Equipment strictly following the handling and operating instructions in this Instruction Manual.
Yamato Scientific Co., Ltd. assumes no responsibility for accident or malfunction caused by use of this Equipment in any way not specified in this Instruction Manual.
Never attempt to perform matters prohibited in this Instruction Manual.
Otherwise, unexpected accident may result.

Notice

- **Descriptions in this Instruction Manual are subject to change without notice.**
- **WE, as Yamato Scientific Co., Ltd. will replace this Instruction Manual with missing page or paging disorder.**

Instruction Manual
Thermomate
BF200/BF400
BF500/BF600
7th edition August 17, 2016

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