



Shaking Constant Temperature Water Bath BT220

Instruction Manual

Ver. 1

- Thank you very much for purchasing this Yamato Shaking Constant Temperature Water Baths BT220.
- Please read the “Operating Instructions” and “Warranty” before operating this unit to assure proper operation. After reading these documents, be sure to store them securely together with the “Warranty” at a handy place for future reference.

⚠ Warning: Before operating the unit, be sure to read carefully and fully understand important warnings in the operating instructions.

Yamato Scientific Co., Ltd.

1. Safety precautions	1
Explanation of pictograms	1
List of symbols	2
Warning • Cautions	3
2. Before operating the unit	4
Precautions on installation	4
3. Names and Functions of Parts	7
Main unit	7
Control panel	8
Description of characters	9
4. How to Install	10
Installation procedures	10
4. Operating procedures	11
List of operation modes and functions	11
List of operation modes and functions	12
Operation mode, function setting keys and character codes	13
Setting the overheat prevention timing	14
About the no-liquid heating prevention function	14
Operating procedures (fixed value operation)	15
Operating procedures (Quick auto stop operation)	16
Operating procedures (quick auto stop operation)	17
Operating procedures (auto stop operation)	18
Operating procedures (auto stop operation)	19
Operating procedures (auto start operation)	20
Operating procedures (auto start operation)	21
Useful functions (power failure compensation function)	22
Useful functions (calibration offset function)	23
Useful functions (setting key lock function)	24
Setting the number of shaking	25
6. Handling precautions	26
7. Maintenance	28
Daily inspection/maintenance	28
8. When the unit is not to be used for a long time or when disposing	29
When the unit is not to be used for a long time or when disposing	29
Notes about disposition	29
9. When a Trouble Occurs	30
Safety units and error codes	30
If a malfunction is suspected	31
10. After sales service and warranty	32
When requesting a repair	32
11. Specifications	33
12. Wiring Diagram	34
13. Replacement Parts Table	35
14. List of dangerous materials	36
15. Standard installation manual	37


1.Safety precautions


Explanation of pictograms

About pictograms

A variety of pictograms are indicated in this operating instruction and on products for safe operation. Possible results from improper operation ignoring them are as follows.

Be sure to fully understand the descriptions below before proceeding to the text.

 **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 pictograms



This pictogram indicates a matter that encourages the user to adhere to warning ("caution" included).

Specific description of warning is indicated near this pictogram.



This pictogram indicates prohibitions

Specific prohibition is indicated near this pictogram.



This pictogram indicates matters that the user must perform

Specific instruction is indicated near this pictogram.

1.Safety precautions

List of symbols

Warning



General warnings



Danger!: High voltage



Danger!: High temperature



Danger!: Moving part



Danger!: Hazard of explosion

Caution



General cautions



Electrical shock!



Burning!



Caution for no liquid heating!



Caution for water leak!



For water only



Poisonous material

Prohibitions



General bans



Fire ban



Do not disassemble



Do not touch

Compulsions



General compulsions



Connect ground wire



Install levelly



Pull out the power plug



Regular inspection

1.Safety precautions

Warning · Cautions

Warning



Never operate the unit in an atmosphere containing flammable or explosive gas

Never operate the unit in an atmosphere containing flammable or explosive gas. Otherwise, an explosion or a fire may result since the unit is not explosion-proof. See "13. List of dangerous materials" on page 36.



Be sure to connect the ground wire.

Be sure to connect the ground wire correctly. Otherwise, electrical leak may result and cause an electrical shock or a fire.



Ban on operation when an abnormality occurs

When a smoke or a unusual odor is seen or sensed, immediately turn the electric leakage breaker on the main unit off and pull out the power plug. A fire or an electrical shock may result.



Never use electrical power cords bundled.

When these are used bundled, they might overheat causing a fire.



Take care not to damage electrical power cords.

Avoid tightly bend, pull with a strong force or twist to prevent electrical power cords from damaging. A fire or an electrical shock may result.



Never use an explosive or a flammable material with this unit.

Never use an explosive material, a flammable material or a material containing them. Otherwise, an explosion or a fire may result. See "13. List of dangerous materials" on page 36.



Never try to disassemble or alter the unit.

Never try to disassemble or alter the unit. A malfunction, a fire or an electrical shock may result.



Caution



When a thunder is heard.

When a thunder is heard, turn the main power off immediately. A malfunction, fire or an electrical shock may result.

2. Before operating the unit

Precautions on installation

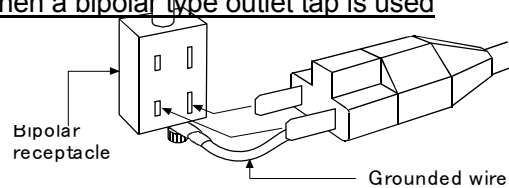
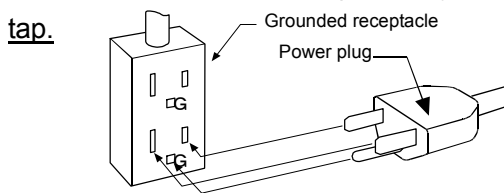


1. Be sure to connect the earth.



- Be sure to connect the earth wire (green core wire of the power cord) to the earth wire or the earth terminal to avoid an electrical shock due to earth leakage.
- Never connect the earth wire to a gas pipe or a water pipe. Otherwise, a fire may result.
- Never connect the earth wire to the earth terminal for a telephone line or to a lightning conductor. Otherwise, a fire or an electrical shock may result.
- Never use a branching outlet, which might generate heat and cause a danger.

We recommend use of a ground type outlet tap. When a bipolar type outlet tap is used



When there is no ground terminal.

In this case, type D grounding work is necessary and please consult your dealer or our nearest sales office.

Insert the ground adaptor included as an option, into a power plug confirming the polarity of the outlet. Connect the grounding wire (green) of the ground adaptor to the ground terminal on the power supply equipment.

- Electric capacity of BT220 is single phase, 100V, 13A. Connect it to a dedicated receptacle.

2. Carefully select an installation site.

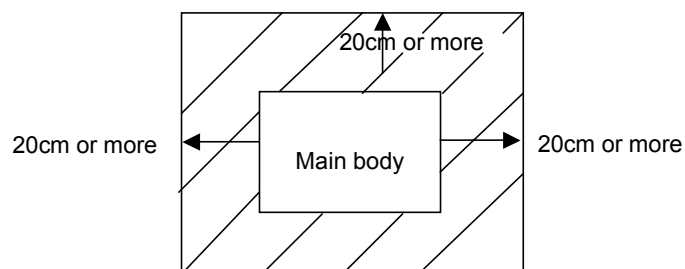


Take special care not to install the unit at a place described below:

- Uneven surfaces or dirty surfaces
- Where flammable gas or corrosive gas exists
- Where the ambient temperature is 35°C or more
- Where temperature changes severely
- Where humidity is high
- Where subject to direct sunlight
- Where vibration is severe



Install this unit at a place with spaces shown below.



2. Before operating the unit

Precautions on installation

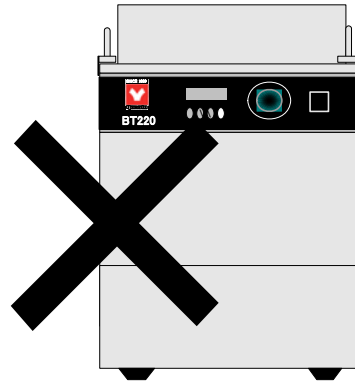
3. Never operate the unit in an atmosphere containing flammable or explosive gas.



Never operate the unit in an atmosphere containing flammable or explosive gas. Since the unit is not explosion-proof, an arc is discharged when turning power supply (ELC) "ON" and "OFF" and during operation and a fire or an explosion may result.



**Never use in flammable
or explosive atmosphere**

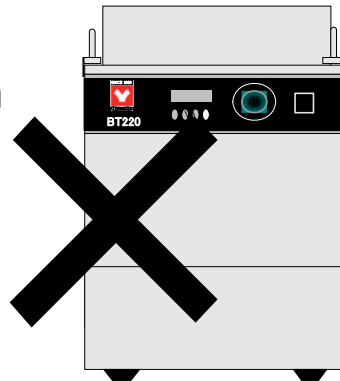


4. Do not attempt to alter the unit



Place the unit on a place as level as possible. Vibrations or noises may be caused unless four rubber feet contact the floor surface evenly. Also, it might cause unexpected troubles or malfunctions.

No modification

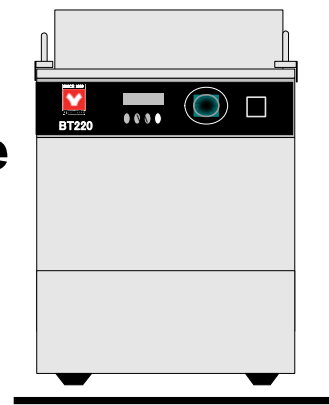


5. Install the unit on a level surface



Install the unit on a level surface. If four rubber feet of the unit does not contact the surface evenly, vibrations or noises may result. This might cause unexpected troubles or malfunctions.

On a level surface



2. Before operating the unit

Precautions on installation

6. Connect the power plug to the dedicated outlet



Use an outlet that is suited to the electrical capacity.

Electrical capacity : AC100V 13A

※When the unit does not start even when power is turned ON, check if main voltage is too low or if the unit is connected to the same power line as other devices. If this is the case, use a different power line from those for other devices as the power supply.

7. On installation



An earthquake or a shock may cause the unit fall over or move and personal injuries may result. We recommend exercising safety precautions including selecting an installation place where less people are passing by.

8. Handling of a power cord



Never use electrical power cords bundled. When these are used bundled, they might overheat causing a fire.

Do not convert, forcibly bend, twist or pull the power cord. Otherwise, a fire or an electrical shock may result.

Do not place the power cord under a desk or a chair, or sand between objects to avoid it from being damaged.

Otherwise, a fire or an electrical shock may result.

Do not place the power cord close to a stove or other heat generating device. Sheath of the cord may burn and result in a fire or an electrical shock.



If the power cord should be damaged (exposure of core wire or disconnection), immediately turn the ELB off, pull out the power cord (plug) out of the power supply and ask your dealer to replace the cord. Operating the unit with a damaged power cord may cause a fire or an electrical shock.



Connect the power cord to an appropriate wall outlet.

9. Do not use the product at a temperature of 80°C or more or at or below the room temperature.



The operating temperature of this unit is the room temperature+5°C~80°C.

Operating the unit at a temperature of 80°C or more will increase the internal temperature and may cause a malfunction of electric components or deterioration of packing, which might lead to unexpected troubles or malfunctions.

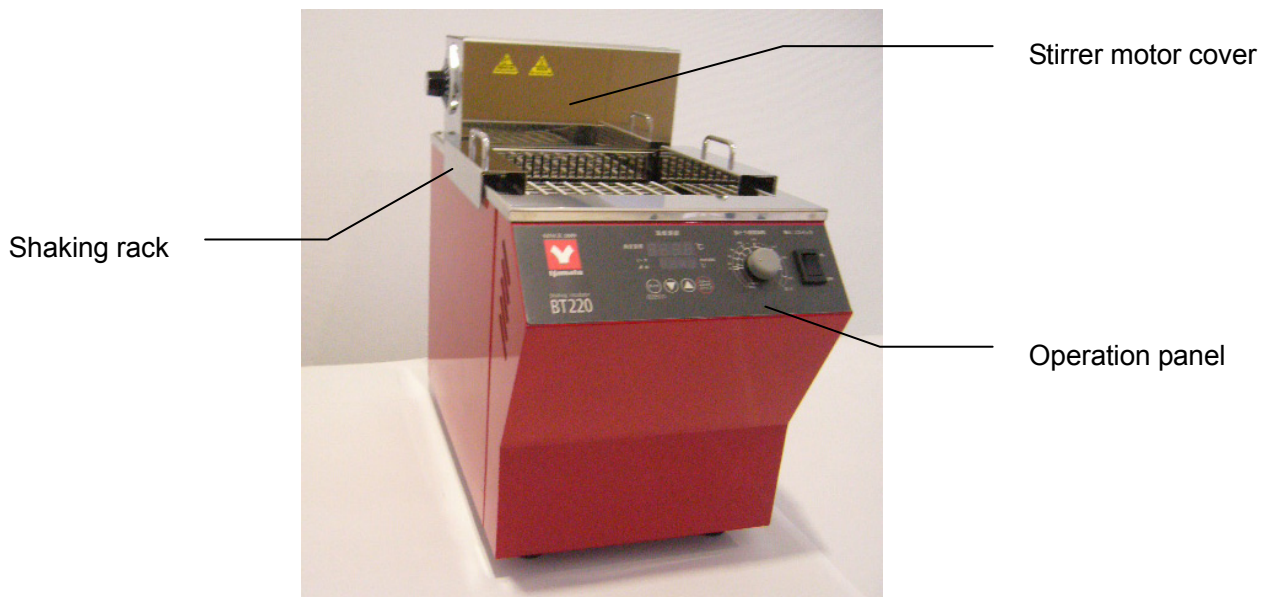
You cannot use this unit at the room temperature or below, in which range temperature control is impossible.

This unit has been designed for water only. Do not use it as an oil bath.

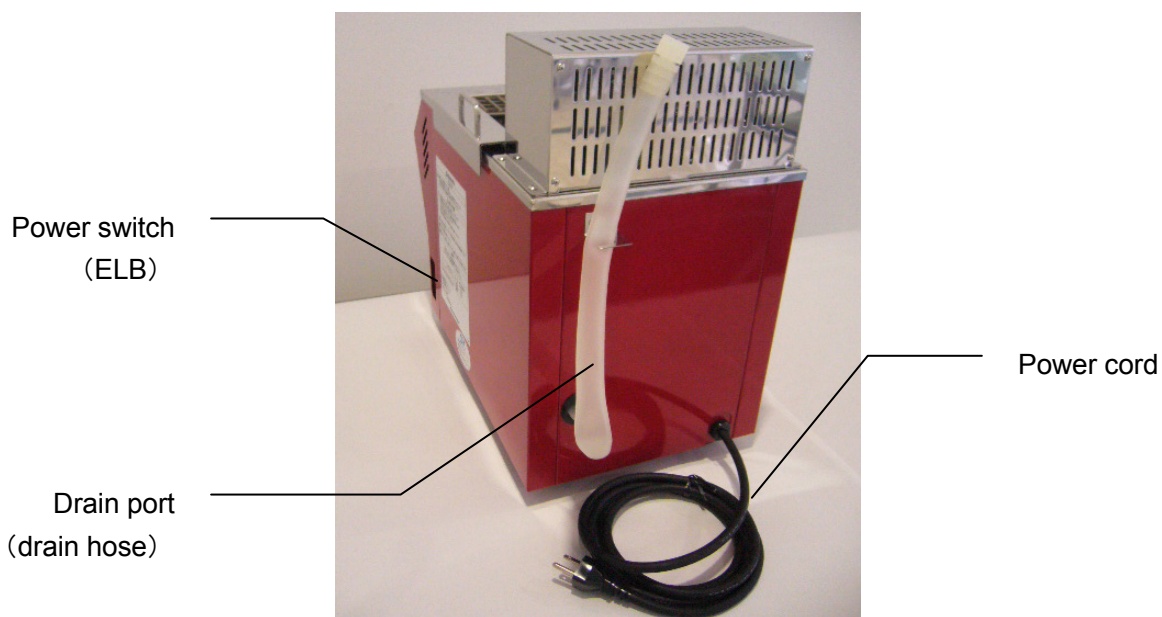
3.Names and Functions of Parts

Main unit

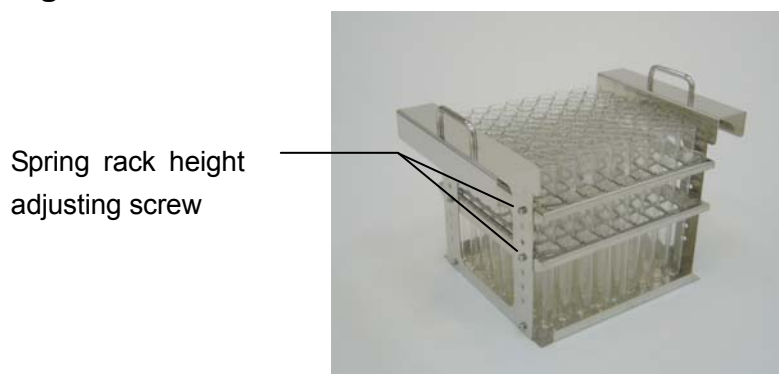
Front



Rear



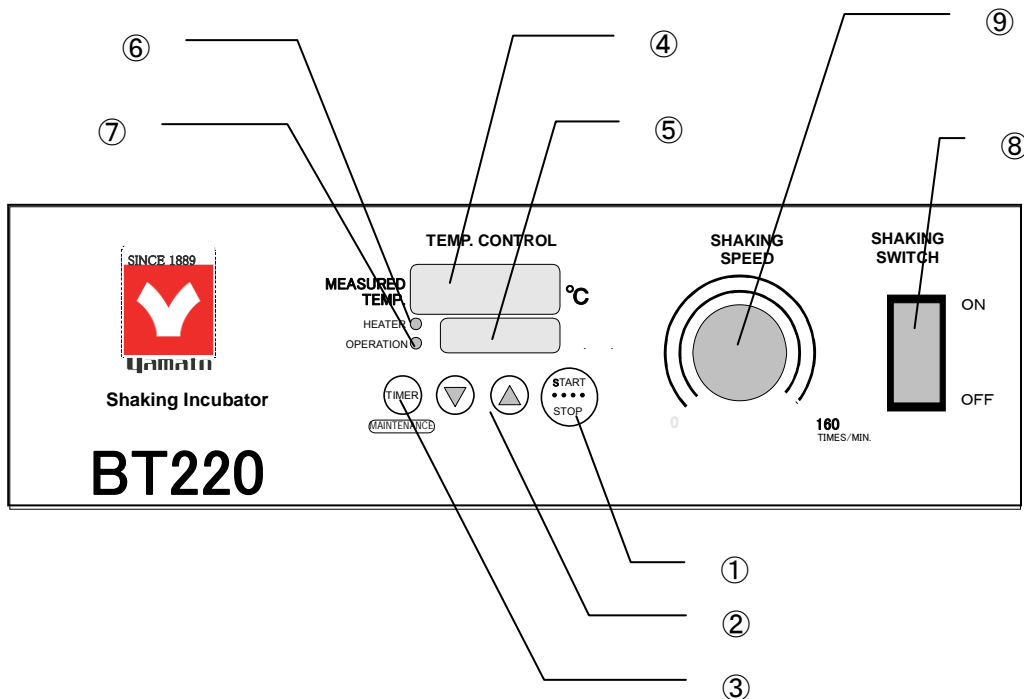
Shaking rack



Note : Test tubes are not included.

3.Names and Functions of Parts

Control panel



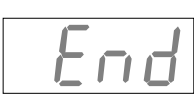

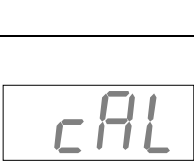
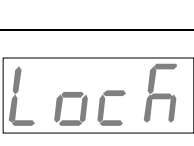


No	Name	Control/operation
①	Start/Stop key	This key is used to start/stop heating operation or timer operation.
②	▼▲ keys	This key is used to select settings for temperature, timer, and various functions.
③	Timer key	This key is used to select the timer operation. You can select from Quick Auto Stop operation, Auto Stop operation, and Auto Start operation.
	Maintenance key	You can move to the maintenance mode by pressing the Timer key longer. This key is used to select settings for calibration offset temperature compensation, key lock, and power failure compensation.
④	Measured temp indicator	This indicator shows measured temp in the bath and various characters.
⑤	Set temp indicator	This indicator shows measured temp, timer setting, and timer remaining time. You can set a temperature to the first place of decimals.
⑥	Heater lamp	The lamp stays on while power is supplied to the heater.
⑦	Operation lamp	The lamp stays on during fixed-value operation and flashes during timer operation.
⑧	Shaking switch	This switch is used to turn ON/OFF of the shaker.
⑨	Shaking speed adjusting volume	This volume is used to adjust the shaking speed.

3. Names and functions of parts

Description of characters

Character codes used for the controller will be described below.

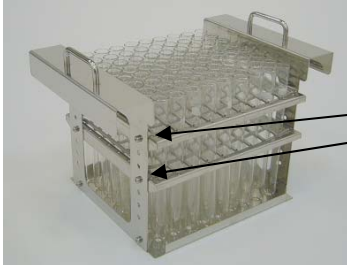
Character codes	Descriptor	Name	Application
	AStP	Auto Stop setting	Used for setting quick auto stop or auto stop operation.
	AStR	Auto Start setting	Used for setting auto start operation.
	End	Time up	Displayed when auto stop timer operation finishes. See P.16 and 18.
	Pon	Power failure compensation setting	You can select whether operation shall continue automatically when recovered from a power failure or operation shall remain stopped. See P.22.
	cAL	Calibration offset setting	Used for inputting a calibration offset temperature. See P.23 "Using the calibration offset function".
	Lock	Key lock of a setting	Locks keys to prevent changes of settings. See P.24.

※ For operation modes and function character codes, see P.13 "Operation mode, function setting keys and character codes".

4. How to Install

Installation procedures

- ① Adjust the shaking rack.



Adjust the spring shelf position and install/remove springs to the shape and the size of specimen containers. The spring shelves are fixed to the rack side with screws. Remove the screws with a screwdriver and set them to positions you want.

- ② Set shaking racks.

Set the shaking rack to the rack installation clamps.

- ③ Pour water into the water bath.

The water level over which water will flow over differs depending on the number of shakes, the shape or the number of containers. The appropriate water level is at 40mm from the top of the water bath.

Always observe the correct water level because the no-liquid heating preventive float switch may be triggered or the heater may be burnt when the unit is operated with insufficient water level.

We recommend using ion exchange water or distilled water which generates less scale or stone.

(Do not use ultra pure water which may damage the heater.)

4. Operating procedures

List of operation modes and functions

Operation modes of this unit are as follows.

No.	Name	Description	Page
1	Fixed value operation	Operates continuously at the set temperature from start to stop of operation. After turning the main switch ON, use the ▼▲ keys to set the temperature. Press the START/STOP key to start operation and press the START/STOP key again to stop operation.	P.15
2	Quick auto stop operation	Used to “stop operation after several hours in the middle of operation”. Press the TIMER key during fixed value operation and select ASTP . You can set a time until operation stops. Select ASTP and set a time using the ▼▲ keys. Press the START/STOP key to start quick auto stop operation, the timer starts in the middle of operation to automatically stop operation after the set time.	P.16
3	Auto stop operation	Used to “set auto stop before starting operation”. First set a temperature with the ▼▲ keys. Then press the TIMER key to select ASTP and set a time you want with the ▼▲ keys. Press the START/STOP key to start auto stop operation.	P.17
4	Auto start operation ※	Used to “start auto start automatically after certain hours”. First set a temperature with the ▼▲ keys. Then press the TIMER key to select ASTr and set a time you want with the ▼▲ keys. Press the START/STOP key to start auto start operation.	P.20
<p>※You cannot switch the operation mode to 3 auto stop operation nor 4 auto start operation while the unit is in operation. First stop operation when you want to change the operation mode.</p>			

4. Operating procedures

List of operation modes and functions

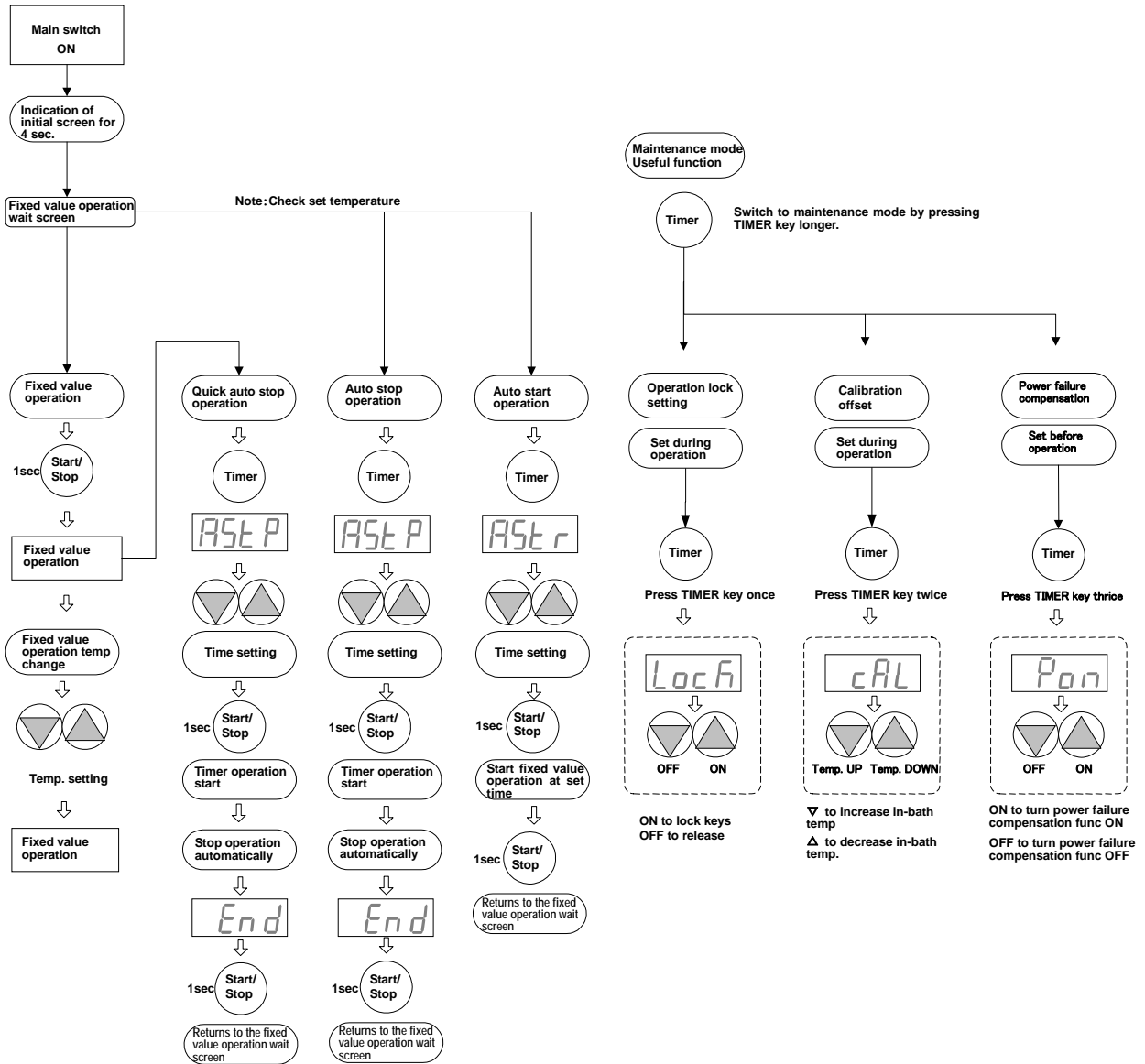
Operation functions of the unit are as follows.

No.	Name	Description	Page
1	Overheat prevention function	<p>Automatic overheat prevention function :</p> <p>The function is set to activate automatically (automatically return) at a temperature 6 °C above that in the bath when it has risen together with the unit set temperature.</p> <p>Overheat preventive device :</p> <p>There is a volume on the left side of the stirrer motor case of the main unit for setting the over heat prevention temperature.</p> <p>Set this temperature to about 30°C higher than the actual operating temperature.</p> <p>If the overheat preventive device has activated, the unit will stop and will not recover until the recovery button of the device is pressed.</p> <p>(Manual recovery)</p>	P.14
2	No-liquid heating prevention function	The internal float switch stops the heater circuit when the water level drops below the predefined level.	P.14
3	Power failure compensation function	<p>When this function is set and a power failed occurs during operation, operation resumes at the state immediately before the power failure.</p> <p>This function is set with MAINTENANCE key.</p>	P.22
4	Calibration offset function	<p>The calibration offset function is used to compensate any differences generated between the target in-bath temperature and the control temperature of the controller (sensor temperature).</p> <p>Compensation is possible for the plus or the minus direction for the entire temperature band of the unit.</p> <p>The MAINTENANCE key is used for setting.</p>	P.23
5	Setting lock function	<p>This function locks the set status currently in operation.</p> <p>You can set or cancel the function with the MAINTENANCE key.</p>	P.24

4. Operating procedures

Operation mode, function setting keys and character codes

Operation modes and functions require the following key operations and character codes below for setting.



5. Operating Procedures

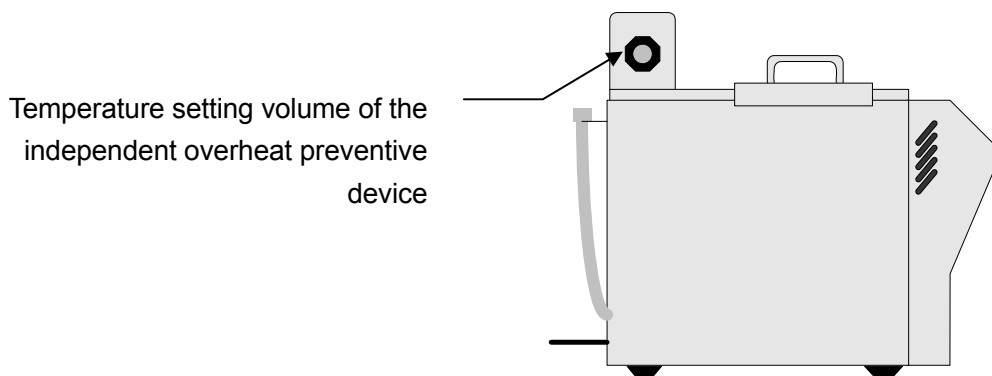
Setting the overheat prevention timing

The safety functions for preventing overheat is two-fold, namely, the automatic overheat preventive function of the controller (automatic recovery) and the independent overheat preventive device (manual recovery).

Range and function of temperature setting

The overheat preventive function of the unit is two-fold. The one is the internal function of the controller which has been set at the factory to trigger automatically at the temperature 6°C higher than the setting temperature on the temperature adjusting device (The heater repeats ON/OFF at 6°C higher than the setting).

The other is set by operating the independent liquid pressure overheat preventive device.



This setting adds the secondary overheat preventive function.

The rough standard for the setting temperature of the independent overheat preventive device shall be “unit set temperature +30°C” in order to prevent a malfunction.

If the automatic overheat preventive function does not work even if the controller set temperature is exceeded, the in-bath temperature keeps rising and reaches to the set temperature of the independent overheat preventive device, the heater, the circulation pump, and the shaking motor will stop.

Once this independent overheat preventive device is triggered, it will keep that state until you turn the power switch on again.

<p>⚠ Cautions</p> <ul style="list-style-type: none">① Set the temperature for the independent overheat preventive device to “set temperature +30°C”, the rough standard. Raise the setting as necessary when the unit malfunctions at this setting.② The maximum temperature of the overheat preventive device has been set at 110°C at the time of factory shipping.③ The independent overheat preventive device is not used to protect specimen but to prevent abnormal overheat of devices. Also, the device does not prevent accidents caused by use of an explosive or a flammable material.

About the no-liquid heating prevention function

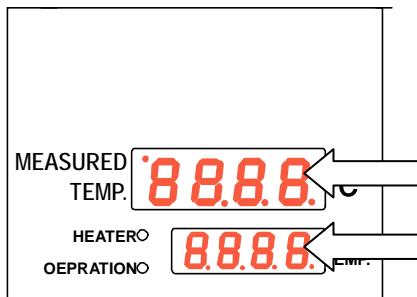
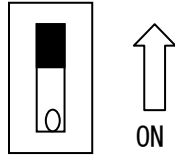
The unit has an internal float switch to prevent no-liquid heating. The switch shuts the heater off at a water level lower than the predefined level to prevent no-liquid heating. Replenishing water will return power to the heater.

5. Operating procedures

Operating procedures (fixed value operation)

Procedures for fixed value operation

ELB ON



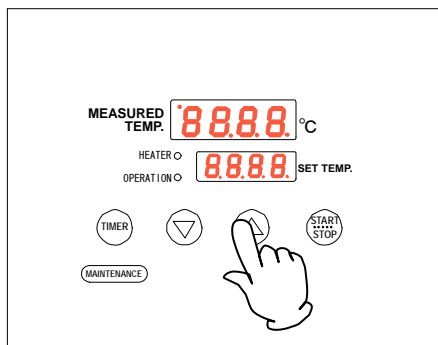
1. Turn the ELB on (Turn the ELB on the right side of the main unit ON).

When the ELB is turned on, the temperature adjusting device will show the initial settings for about four seconds, then returns to the initial setting screen and indicators show the current in-bath temperature and the last temperature setting.

Turning the ELB on will start the circulation pump and water will start circulating in the water bath.

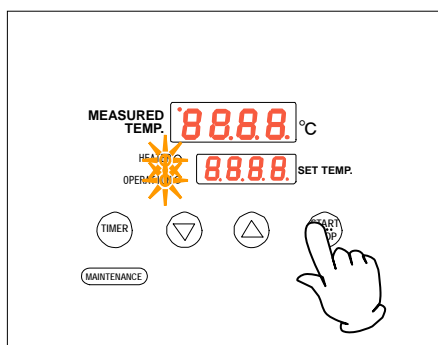
MEASURED TEMP. screen : Displays the current temperature in the bath

SET TEMP screen : Displays the last set temperature



2. Setting the temperature

Set the temperature you want using the ▼▲ keys.



3. Starting operation

Press the **START/STOP** key longer.

The fixed value operation will start and the operation lamp and the heater lamp will come on.

4. Stopping operation

Press the **START/STOP** key longer.

The operation will stop, the operation lamp will go off and the screen will change to the initial setting screen.

Changing the temperature

You can change the set temperature by simply pressing the ▼▲ keys.

Pressing the ▼▲ keys during operation immediately brings you to the setting mode where you can change the temperature.

After setting a new temperature, wait a while until the new temperature will be active and then the screen returns to the previous one.

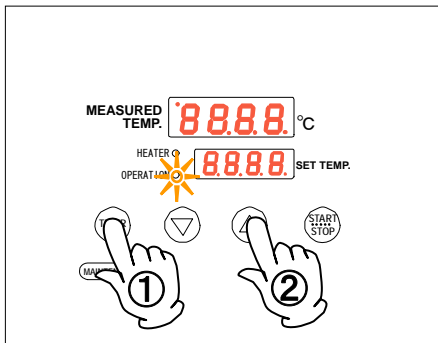
5. Operating procedures

Operating procedures (Quick auto stop operation)

This is used to “stop operation automatically after several hours in the middle of the fixed value operation”.

The quick auto stop operation allows setting of auto stop timer during operation.

How to start auto stop operation



1. Setting time before stop during fixed value operation

① Confirm that the operation lamp is on, which indicates the unit is in operation.

Press the **TIMER** key.

The character AstP **ASTP** that indicates the auto stop operation mode appears in the MEASURED TEMP. screen and the set time flashes in the SET TEMP. screen.

② Use the **▼▲** keys to set the time you want.

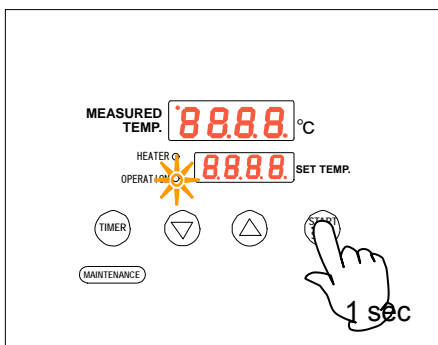
About the timer function

The maximum settable time of the timer is 999 hours 50 minutes.

You can set time in the unit of minutes up to 99 hours 59 minutes.

Time of 100 hours or longer shall be set in the unit of 10 minutes.

You can continuously change the set time and find the time you want quickly by keeping the **▼▲** keys pressed. To fine adjust the time, press the **▼▲** keys for one digit at a time.



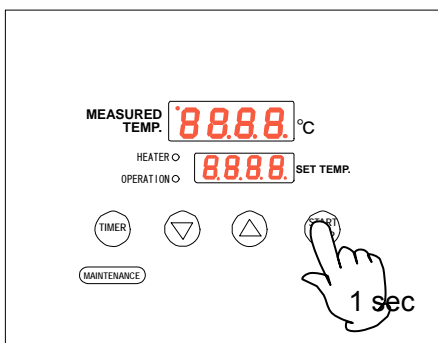
2. Starting the timer operation

When you have set the time you want, press the **START/STOP** key again while it is flashing.

The operation lamp will flash and timer operation will start.

Note : Timer counting starts when the temperature in the bath reaches the set temperature.

When the timer starts counting, the SET TEMP. screen will switch to the remaining time indication.



3. Stopping/finishing the timer operation

When the set time has passed, the timer will stop automatically but the character End **End** flashes in the set temperature indicator to indicate that operation has finished.

To return to the initial setting screen, press the **START/STOP** key longer for about one second to finish the timer operation mode.

The screen will return to the initial setting screen.

5. Operating procedures

Operating procedures (quick auto stop operation)

To change the set temperature or the set time

Pressing the ▼▲ keys during operation immediately brings you to the setting mode where you can change the temperature.

Pressing the TIMER key during operation immediately brings you to the setting mode where you can change the set time.

In this case, you need to set a time obtained by adding time that has already passed to time you want to add.

After you have changed time, press the START/STOP key to finish.

The remaining time indication 1.30 indicates count down while its dot is flashing.

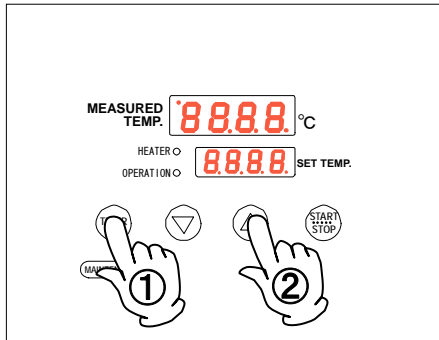
When the dot stays on, it indicates the wait status (temperature is increasing or decreasing to the set temperature) during which timer count is stopped.

5. Operating procedures

Operating procedures (auto stop operation)

The timer is set from the start of fixed value operation and the operation is automatically stopped when the set temperature comes.

How to start auto stop operation



1. Setting the stop time

① Confirm that the temperature you want is set and then press the **TIMER** key.

The character **ASTP** that indicates the auto stop operation appears in the MEASURED TEMP. and the set time flashes in the SET TEMP. screen.

② Use the **▼▲** keys to set the time you want.

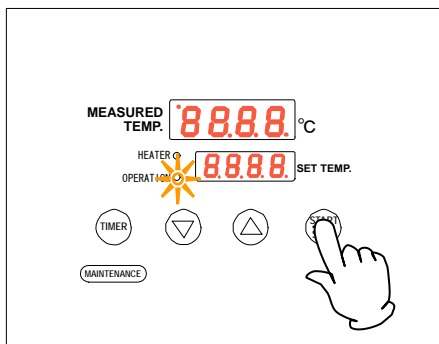
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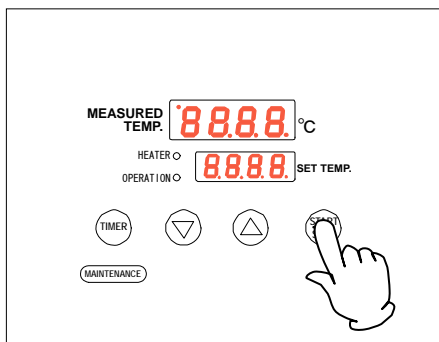
2. Starting the timer operation

When you have set the time you want, press the **START/STOP** key longer for about one second. Press the **START/STOP** key longer for about one second.

The operation lamp flashes and the timer operation starts.

Note : Timer counting starts when the temperature in the bath reaches the set temperature.

When the timer starts counting, the SET TEMP screen will switch to the remaining time indication.



3. Stopping/finishing the timer operation

When the set time has passed, the unit will stop operation automatically.

The character **End** flashes in the set temperature indicator to indicate that operation has finished.

Press the **START/STOP** key longer for about one second to finish the timer operation mode. The screen will switch to the initial setting screen.

5. Operating procedures

Operating procedures (auto stop operation)

To change the set temperature or the set time Pressing the ▼▲ keys during operation immediately brings you to the setting mode where you can change the temperature.
Pressing the TIMER key during operation immediately brings you to the setting mode where you can change the set time.
In this case, you need to set a time obtained by adding time that has already passed to time you want to add.

The remaining time indication 1.30 indicates count down while its dot is flashing.

When the dot stays on, it indicates the wait status (temperature is increasing or decreasing to the set temperature) during which timer count is stopped.

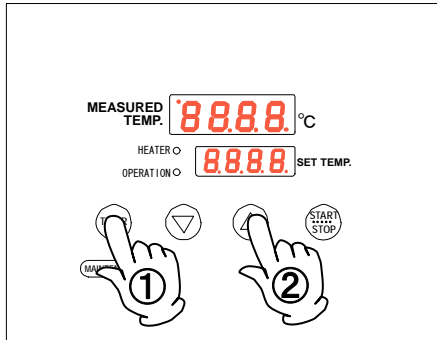
5. Operating procedures

Operating procedures (auto start operation)

The mode starts operation automatically after the time set with the timer has passed.

Note that the operation will not stop automatically but must be stopped manually in this mode.

To start auto start operation



1. Setting the operation start time

① Confirm that the temperature you want has been set and press the **TIMER** key.

The character AStr **8567** that indicates the auto start operation appears in the MEASURED TEMP. screen and the set temperature flashes in the SET TEMP. screen.

② Use the **▼▲** keys to set the time you want.

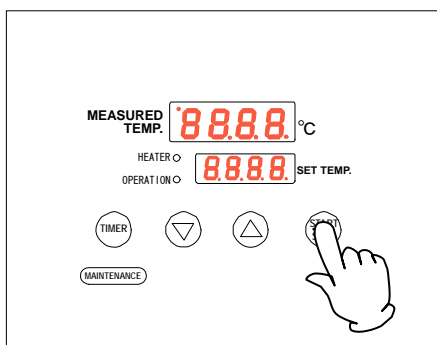
About the timer function

The maximum settable time of the timer is 999 hours 50 minutes.

You can set time in the unit of minutes up to 99 hours 59 minutes.

Time of 100 hours or longer shall be set in the unit of 10 minutes.

You can continuously change the set time and find the time you want quickly by keeping the **▼▲** keys pressed. To fine adjust the time, press the **▼▲** keys for one digit at a time.



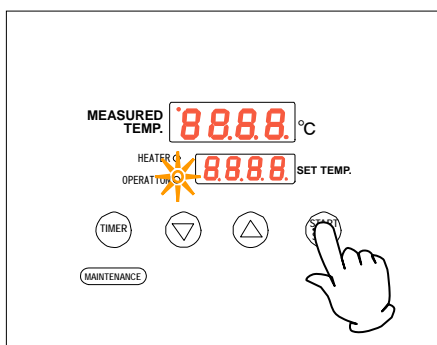
2. Starting the timer operation

When you have set the time you want, press the **START/STOP** key longer for about one second while it is flashing.

Timer counting starts when the **START/STOP** key is pressed.

The MEASURED TEMP. screen switches indication from the set time to the remaining time.

Operation starts automatically when the set time comes and the operation lamp will come on.



3. Stopping/finishing the timer operation

To stop operation, press the **START/STOP** key longer for about one second to finish the timer operation mode. The screen will switch to the initial setting screen.

5. Operating procedures

Operating procedures (auto start operation)

To change the set temperature or the set time

If you want to change the set temperature or the set time during operation, press the **TIMER** key during operation and set the temperature or time for auto start operation using the **▼▲** keys. However, to change the set time, you need to set a time obtained by adding time that has already passed to time you want to add.

Note : You cannot change time once the auto start time has passed and operation has started. Since the operation mode is fixed value, first stop operation using the **START/STOP** key and make settings from the beginning.

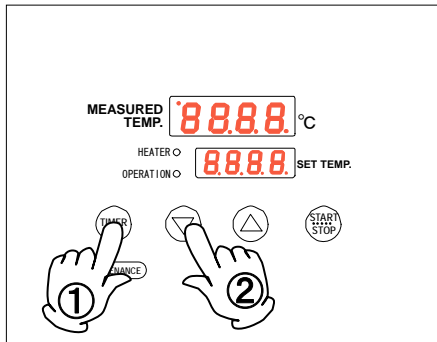
5. Operating procedures

Useful functions (power failure compensation function)

When a power failure occurs in the middle of operation, the unit resumes operation in the state immediately before the power failure after recovering from the power failure.

(The unit may remain stopped in the case of timer operation.)

If you want to keep the unit stopped when recovering from a power failure, release the power failure compensation function (OFF).



- ① Operate the unit with the initial screen status.
- ② Press the **TIMER** key longer to switch to the MAINTENANCE menu mode. (You are already in the MAINTENANCE menu mode if LOCK **LocH** indication appears.)
Press the **TIMER** key several times to select the character Pon **Pon** that indicates the power failure compensation function.
- ③ Turn “on” in the MEASURED TEMP. screen to “oFF” using the ▼ key and you have finished setting.

5. Operating procedures

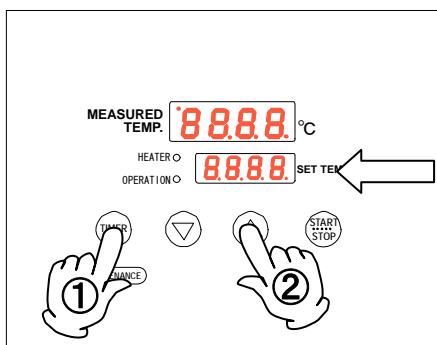
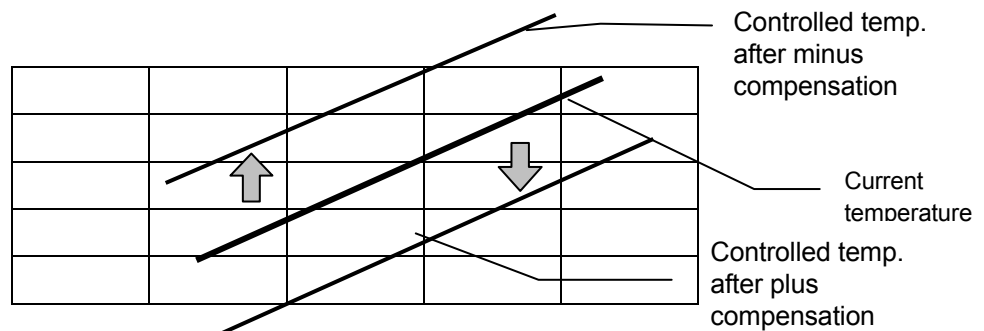
Useful functions (calibration offset function)

Using the calibration offset function

The calibration offset function is a function that compensates differences that may be generated between the temperature in the bath and the set temperature.

This function can make parallel compensation to the plus or minus side for the entire temperature range. You can set/release using the **MAINTENANCE** key.

The offset is set at "0" at the time of shipping from the factory.



① Start operation at the target set temperature, and after the temperature has become stable, check the temperature in the bath with a temperature recorder.

② Check difference between the set temperature and the temperature in the bath.

③ Press the **TIMER** key longer to switch to the MAINTENANCE menu mode. (You are already in the MAINTENANCE menu mode if LOCK **LoCh** indication appears.)

Press the **TIMER** key several times to select the character **cAL** **cAL** that indicates the calibration offset function.

④ Enter the difference between the set temperature and the temperature in the bath using the **▼▲** keys to complete setting.

※ Offset temperature may be set to either of + or – side. Setting to the – side will decrease the displayed measured temperature by the offset amount while the temperature in the bath will increase by the same amount.

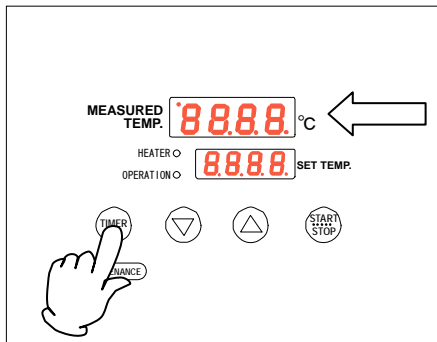
Setting to the + side will increase the displayed measured temperature by the offset amount while the temperature in the bath will decrease by the same amount.

Note : Temperature in the bath changes tentatively immediately after placing a specimen. Therefore, wait until the temperature in the bath become stable before checking for a temperature difference.

5. Operating procedures

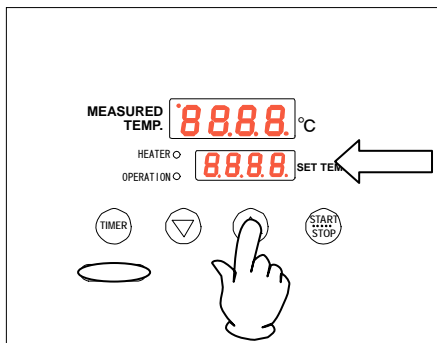
Useful functions (setting key lock function)

The function is to lock the settings during operation for safety. You can set or release this function with the **MAINTENANCE** key.

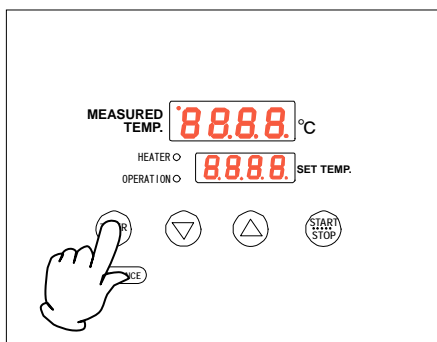


- ① Press the **TIMER** key longer to switch to the MAINTENANCE menu mode.

Press the **TIMER** key to select the character Lock **Loch** that indicates the settings lock.



- ② "oFF" will appear in the SET TEMP screen. You can switch this to "on" with the **▲** key to lock the settings.



- ③ If you want to cancel lock, press the **TIMER** key longer again and select the character Lock **Loch** that indicates the setting lock using the **▼▲** keys. Selecting "oFF" with the **▼** key releases the lock.

※ While the lock function is "on", any keys other than the **START/STOP** key and **TIMER** key are locked.

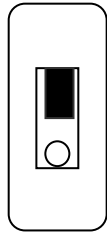
5. Operating Procedures

Setting the number of shaking

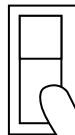
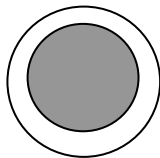
The shake adjusting device and the temperature adjusting device of the unit are independent from each other.

Setting procedures for the shaker are as follows.

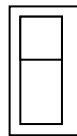
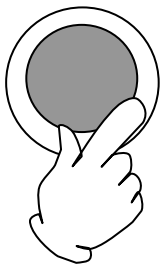
How to set the number of shaking



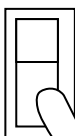
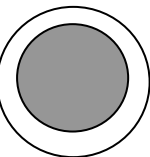
ELB ON



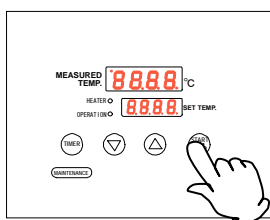
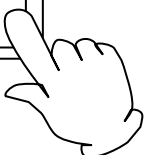
Shake switch ON



Set the number of shaking



Shake switch OFF



Turn the temperature adjusting device OFF

To prevent a danger, first turn the shake number adjusting volume to the minimum before turning the shake switch on.

① Turn the power switch of the main unit (ELB) "ON".

② Turn the shake switch "ON".

Press the upper part of the shake switch to activate shaking.

③ Set the number of shaking.

Turn the shake number adjusting volume clockwise to accelerate shaking.

Set the number of shaking to the indication on the scale. (Note that the scale positions will differ depending on the commercial power frequency.)

* The max number of shaking is 160/min.

④ To stop shaking

Press the lower part of the shake switch to stop shaking. Power is still supplied to the unit. Turn the ELB off if you are not going to operate the unit. Return the shake number adjusting volume to the minimum to prevent a danger.

Be sure to turn the Start/stop key of the temp adjusting device OFF.

6. Handling precautions



Warning

1. About materials that cannot be used



Never use an explosive material, a flammable material, or a material that contains such materials for this unit. They may cause an explosion or a fire. (See P.36 “List of dangerous materials”.)

2. About banning of operation/solutions when an abnormality occurs



When smoke or strange odor is generated from this unit for some reason, immediate turn power of the unit off, shut the power supply off and ask inspection to your dealer, one of our sales offices, or the customer center. Leaving the unit as it is may cause a fire or an electrical shock. The user must not attempt a repair, which may cause a danger.

3. About the shaking rack



Adjust shelf board position and remove or install springs of the shaking rack according to the shape and the size of specimen containers. Securely place the shaking rack onto the groove of the rack installation clamps.

4. Caution during shaking



Take extreme care so that your hand may be caught in the driving mechanism during shaking.



Caution

1. Never climb on the unit.



Never climb on the unit. The unit may topple over or be damaged and a personal injury or a malfunction may result.

2. Do not put any object on the unit



Do not put any object on the unit. It might fall off and cause a personal injury.

3. During a thunder storm



When a thunder begins, immediately turn power of the unit off, shut the power supply off. Leaving the unit as it is might cause a malfunction or a fire from lightening.

4. Thoroughly wash the water bath



The water bath of the unit has been washed. But thoroughly wash it when you use it for the first time or you have not used it for a long time.

5. About replenishment of water



When replenishing water, take care so that water will not spill over the bath or splash over the bath. If the control panel is splashed with water, completely wipe water off. Otherwise, an electrical leakage or an electrical shock may result.

6. Handling Precautions

Cautions

6. About water used for the unit



Never operate the unit using any liquid other than water.

We strongly recommend using ion exchange water or distilled water and clean the unit sometimes. If you use underground water or tap water, clean the unit as appropriate because such water will cause scale or stones accumulate in the water bath and soil it as well as degrade heater efficiency and heater life time.

7. Take care to avoid no-liquid operation



Although the unit has an internal float switch to prevent no-liquid heating, be sure to check the water level in the water bath before starting operation and always operate the unit at an appropriate level.

8. About appropriate water level



The maximum water level is at 40 mm from the top of the bath when specimen containers are installed. Water may spill over the bath during shaking when water level is too high or temperature conditions may deteriorate when the level is too low.

9. When you are going to stop the unit for a long time



Turn the power switch (ELB) "OFF" to drain water from the water bath when you are going to stop the unit for a long time.

10. About recovery from power failure



When a power failure occurs during operation and power is supplied again, the unit will automatically return to the status immediately before the failure and resume operation.

Turn the power switch off if you do not want to rely on automatic recovery to resume operation.

7. Maintenance

Daily inspection/maintenance

We strongly recommend daily inspection and maintenance to assure stable operation of the unit. The major objective of inspection and maintenance is checking for stones which will increase when municipality water is used for the unit.

Warning

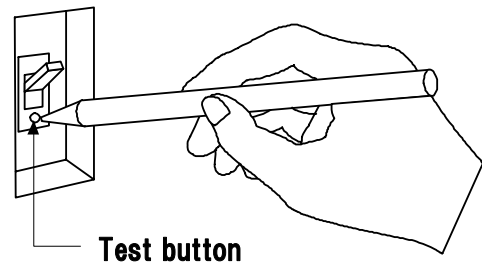
- Be sure to remove the power cord before inspection or maintenance unless necessary.
- Start working after the unit temperature has returned to the normal temperature. (Check if the water in the bath is cooled)
- Never attempt to disassemble devices.

Caution

- Wipe off any dirt with a well wrung out soft cloth. Never use benzene, thinner, or scorching powder or rub with a hard brush. Otherwise, deformation, deterioration, or discoloration may result.

Monthly

- Inspect the function of the ELB.
Connect the power cord and conduct a test while it is activated.
 - First turn the ELB “off”.
 - Then turn it “on” and push the test button of the ELB with a pointed object such as a ball point pen and it is normal if it is turned off.



Maintenance of the water bath

Water in the bath will become thicker after continued operation and will accelerate accumulation of stones. When the water bath becomes dirty with scale or stones, drain water with the drain hose and then wash the bath clean.

Remove foreign objects or glass pieces in the water bath frequently. Leaving such matters inside may cause malfunction of the circulation pump.

Replacement of hoses

To assure stable performance of the product, replace the hose once every two years as a guide. Ask Yamato Scientific for replacement.

- ◆ If you have any questions, immediately contact your dealer, one of our sales offices, or the general customer service center.

8. When the unit is not to be used for a long time or when disposing

When the unit is not to be used for a long time or when disposing



Caution

When the unit is not going to be used for a long time

- Turn the power to off and pull out the power cord.



Warning

When disposing the unit

- Do not leave the unit in the area where children may have access.
- Be sure to remove handles before disposing the unit to prevent the doors from locking.
- In general, dispose the unit as a bulky waste.

Notes about disposition

Always pay attention to the preservation of the global environment.

- We highly recommend taking the unit apart as far as possible for separation or recycling to contribute to the preservation of the global environment. Major components and materials for the unit are as follows:

Major part name	Material
Major components of the exterior	
Exterior	Stainless steel plate Melamine resin baking finish
Internal bath	Stainless steel
Nameplate	Polyethylene terephthalate resin (PET) film
Major components of the electric system	
Switches and relays	Resin, copper and other composite components
Substrate	Glass fiber and other composite components
Pipe heater	Copper, nichrome wire and other composite components
Power cord	Synthesized rubber coating, copper, nickel and other composite components
Major components of the piping system	
Drain hose	Silicone (66 nylon)
Hose clamp	66 nylon
Drain port cap	Polyacetal
Accessories	
Shaking rack	Stainless steel



9. When a Trouble Occurs

Safety units and error codes

The unit has a self diagnostic function integrated in the controller and safety units independent from the controller. The table below shows possible causes and countermeasures for when any of those safety units is activated.

[Error codes]

When an abnormality occurs during operation or due to a malfunction of a unit, the corresponding error code will be displayed on the measured temperature indicator. When an abnormality occurs, check the error code and immediately stop operation.

Safety unit	Symptom	Causes and countermeasures
Sensor detected an abnormality	 indication	<ul style="list-style-type: none"> Disconnection or an abnormality of the temperature sensor. Contact the general customer service center.
Memory error	 indication	<ul style="list-style-type: none"> Errors in memory settings Contact the general customer service center.
Independent overheat preventive device activated	Shake motor, circulation pump, and heater stop (no changes in indication)	<ul style="list-style-type: none"> Activation of the independent overheat preventive device Reset the power supply once, then check the temperature in the bath and the set temperature of the independent overheat preventive device. Contact the general customer service center.
No-liquid heating	Heater circuit stopped	<ul style="list-style-type: none"> The water level is low. Malfunction of the float switch. Contact the general customer service center when the malfunction of the float switch is suspected.

9. When a trouble occurs

If a malfunction is suspected

In such cases

Symptom	Check
The unit will not start even if the power switch is turned on.	<ul style="list-style-type: none">● If the power cable is connected to an outlet securely.● If a power failure has not occurred.
The temperature will not rise.	<ul style="list-style-type: none">● If the set temperature is lower than the in-bath temperature.
The unit will not start even if the shake switch is turned on.	<ul style="list-style-type: none">● If the power switch (ELB) is turned "OFF".● If the shake number adjusting volume is set at zero.● If the shaking rack touches some object.● The thermal protector for the shaking motor may have activated. Remove the cause, turn power off once, wait a while and then turn power on again.

If a power failure occurs

When a power failure occurs during operation and power is supplied again, the unit will automatically return to the status immediately before the failure and resume operation.
Turn the power switch off or set the power failure compensation function to OFF if you do not want to rely on automatic recovery to resume operation (see P.22).

- ◆ When the symptom does not correspond to any of the above, immediately turn the power switch off, pull out the power plug and contact your dealer, one of our sales offices, or our customer service center.

10. After sales service and warranty

When requesting a repair

When requesting a repair

If any trouble occurs, immediately stop operation, turn the power switch off, pull out the power plug and contact your dealer, our sales office or our customer service center.

Information necessary for requesting a repair

- Model name of the product
 - Serial number
 - Date (y/m/d) of purchase
 - Description of trouble (as in detail as possible)
- } See the warranty card or the nameplate on the unit.
(See P.7)

Be sure to indicate the warranty card to our service representative.

Warranty card (attached separately)

- Warranty card is given by your dealer or one of our sales offices and please fill in your dealer, date of purchase and other information and send it to our customer service center by Facsimile (03-3231-6523). Then, store it securely.
- Warranty period is one full year from the date of purchase. Repair service for free is available according to the conditions written on the warranty card.
- For repairs after the warranty period consult your dealer, one of our sales offices or our customer service center.
Paid repair service is available on your request when the product's functionality can be maintained by repair.

Minimum holding period of repair parts

The minimum holding period of repair parts for this product is seven years after end of production. Repair parts here refer to parts necessary for maintaining performance of the product.

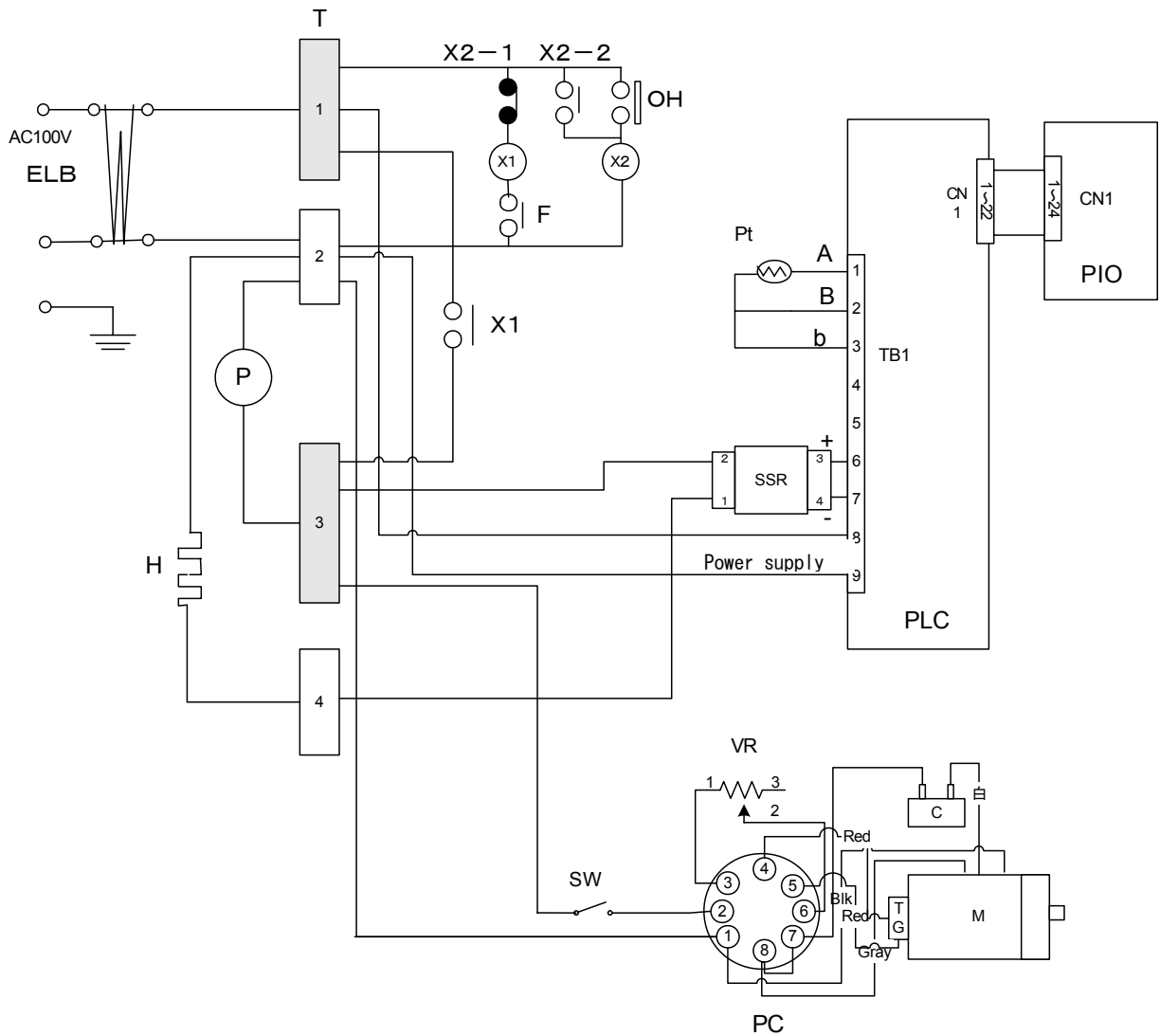
11. Specifications

Model	BT220
Shaking system	Reciprocating horizontal shaking
Operating temp. range※	Room temperature +5°C~80°C
Temperature adjusting precision	±0.05°C (at40°C)
Temperature distribution precision	±0.1°C (at40°C)
Temperature rise time	Approx. 40 min.
Shaker motor	Gear motor
Number of shaking	Analogue setting/scale indication Step-less variable speed 20~160 times/min.
Shaking stroke	20mm
Number of containers that can be held	Test tubes: 16.5φ × 72
	Flask 100mL × 5
	200mL × 4
	300mL × 3
	500mL × 1
Controller	PID controller Fixed value/timer operation function Digital indication
Stirrer	Jet stirring system
Heater	1.2Kw Nickel plated copper pipe
Safety functions	Automatic overheat prevention function, independent overheat preventive device, sensor disconnection function, over current ELB, float switch for preventing no-liquid heating
Rack size	200W × 186D × 175H
Internal size of bath	224W × 328D × 200H
Exterior size	280W × 459D × 450H
Interior size	Stainless steel
Power supply	AC100V 13A
Weight	Approx. 19kg
Accessory	Spring rack x 1, operation manual x 1, warranty card x 1

※ The temperature may not reach 80°C depending on the external temperature and the amount of samples.

The temperature adjusting precision and the temperature distribution precision are measured at no-load, room temperature of 23°C, and AC100V(according to our testing standards).

12. Wiring Diagram



Symbol	Part name	Symbol	Part name
ELB	Earth Leakage Breaker	SSR	Contact less relay
T	Terminal block	F	Float switch
H	Pipe heater	SW	Shake switch
P	Circulation pump	PC	Power controller
PLC	Planar substrate	VR	Shaking number adjusting volume
PIO	Display substrate	X2	Self holding relay
Pt	Temperature sensor (Pt100)	M	Shaking motor
X1	Main relay	OH	Independent overheat preventive device

13. Replacement Parts Table

Part name	Code No.	Specifications	Maker
Pipe heater	LT00016689	AC100V 1.2KW Cupper nickel	Yamato
Temp sensor	LT00016690	Pt100	Yamato
Planar substrate	LT00007640	CN40BY planar substrate	Yamato
Display substrate	LT00007639	CN40BY display substrate	Yamato
Terminal block	LT00004736	ATK-20-4P	TOYOGIKEN
FASTON terminal block	2070230001	MO11-0FX4P	TOYOGIKEN
Shaking switch	LT00016692	JWMW11RKK	Nikkai
Float switch	020010003	1A 250V AC	Matsushita
Actuator lever for float switch	2340000016	AHR5801	Matsushita
Pipe heater	BT10040040	100V 1.2KW (12A)	Yamato
Circulation pump motor	2140000024	IS-3240SPJA BF400	Yamato
SSR	2160000035	TRS5225	Toho
Relay	2050000019	AHE1254 100V	Matsushita
Relay	LT00005140	AHE1274 100V 30 A	Matsushita
ELB	2060000019	FG32R/ 15—30MA 15A	Fuji
Shaking motor	2140000038	S8125GC-S12 (TP) 100V 25W	Narushin
Gear head	2140000041	S8KA7.5B1	Narushin
Speed controller	2140000043	SRC02 100V	Narushin
Volume (20KΩ)	LT00016752	RV24YN15S B203	Yoshida
Power cord	2130010010	3.5SQ×3 (1m)	Yamato
EGO thermostat	LT00016691	250V16A30~110°C C type EGO1302204	EGO
Over current ELB	ON104	BJS153 15A	Matsushita
Spring for shaking rack	BQ10040020	Length: 130mm	Yamato

Refer to the code No. in the table for replacement parts.

14. List of dangerous materials



Never use an explosive substance a flammable substance or a substance containing them for this device.

Explosive substance	Explosive substance	① Nitroglycol, glycerine trinitrate, cellulose nitrate and other explosive nitrate esters
		② Trinitrobenzen, trinitrotoluene, picric acid and other explosive nitro compounds
		③ Acetyl hydroperoxide, methyl ethyl ketone peroxide, benzoyl peroxide and other organic peroxides
Flammable substances	Explosive substances	Metal "lithium", metal "potassium", metal "natrium", yellow phosphorus, phosphorus sulfide, red phosphorus, celluloids, calcium carbide (a.k.a, carbide), lime phosphide, magnesium powder, aluminum powder, metal powder other than magnesium and aluminum powder, sodium dithionous acid (a.k.a., hydrosulphite)
	Oxidizing substances	① Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates
		② Potassium perchlorate, sodium perchlorate, ammonium perchlorate, and other perchlorates
		③ Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides
		④ Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates
		⑤ Sodium chlorite and other chlorites
		⑥ Calcium hypochlorite and other hypochlorites
	Flammable substances	① Ethyl ether, gasoline, acetaldehyde, propylene chloride, carbon disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
		② n-hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with ignition point between 30 degrees below zero and less than zero.
		③ Methanol, ethanol, xylene, pentyl acetate, (a.k.a.amyl acetate) and other substances with ignition point between zero and less than 30 degrees.
④ Kerosene, 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 Substance which is a flammable gas at 15°C, one air pressure.

(Quoted from the separate table 1 in Article 6, the enforcement order of the Industrial Safety and Health Law

15. Standard installation manual

※Install the unit according to the items below. (Confirm optional or special specifications.)

Model	Serial number	Date	Inst. Manager(company name)	Inst. manager	Judge

No.	Item	Implementation method	TOC No. Ref. column of manual	Judge
Specifications				
1	Accessories	Check items based on the accessories column	11.Specification column	
2	Installation	<ul style="list-style-type: none"> Visual check of the environmental conditions Caution : Surrounding environment		
		<ul style="list-style-type: none"> Securing a space 	2.Before operating the unit <ul style="list-style-type: none"> Precautions on installation... 	
		<ul style="list-style-type: none"> Add water in the water bath. Caution : No foreign matters	4.Before operating the unit <ul style="list-style-type: none"> Precautions on installation ... 	
Operation related matters				
1	Source voltage	<ul style="list-style-type: none"> Measure customer side voltage (at an outlet) with a tester. Measurement of an operating voltage (must meet the standard) Caution : Use a product that comply with the standard for installing to a plug or a breaker.	2.Before operating the unit <ul style="list-style-type: none"> Be sure to connect the earth... Connect the power supply to a dedicated outlet 11. Specifications <ul style="list-style-type: none"> Standard—power supply 	
2	Starting operation	<ul style="list-style-type: none"> Start operation Set to 40 °C and check the stability. Check : There is no water leak.	5.How to operate <ul style="list-style-type: none"> Operating procedures 2.Before use	
Description				
1	Description of operation	Explain operation of each part to the customer as per the instructions.	5.Operating procedures <ul style="list-style-type: none"> Operating method 1.Safety precautions ~14. List of dangerous substances	
2	Error codes	Explain error codes and how to release to the customer as per the instructions.	9.When a trouble occurs ~10.After sales service and warranty	
3	Maintenance and inspection	Explain operation of each part to the customer as per the instructions.	7.Maintenance procedures <ul style="list-style-type: none"> Daily inspection/ maintenance 	
4	Matters to note on completion of installation	<ul style="list-style-type: none"> Note the installation date and the manager on the nameplate. Note necessary matters in the warranty card and hand it to the customer. Explain the after sales service route. 	10.After sales service and warranty	

Limited liability

Be sure to use the unit strictly following the handling and operating instructions in this operating instruction.

Yamato Scientific Co., Ltd. assumes no responsibility for an accident or a malfunction caused by use of this product in any way not specified in this operating instruction.

Never attempt to perform matters prohibited in this operation instruction.


Otherwise, an unexpected accident may result.

Notice

- **Descriptions in this operating instruction are subject to change without notice.**
- **We will replace a manual with a missing page or paging disorder.**

Instruction Manual
Shaking Constant Temperature Water Bath
Model BT220

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