

Yamato

Water Bath

BM500/510

Oil Bath

BO400/410

Instruction Manual

- First Edition -

- Thank you for choosing BM/BO Series Baths from Yamato Scientific Co., Ltd.
- For proper equipment operation, please read this instruction manual thoroughly before use. Always keep equipment documentation safe and close at hand for convenient future reference.

⚠ WARNING:

Read instruction manual warnings and cautions carefully and completely before proceeding.

**Yamato Scientific America Inc.
Santa Clara, CA**


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1. SAFETY PRECAUTIONS

Explanation of Safety Symbols

A Word Regarding Symbols

Various symbols are provided throughout this text and on equipment to ensure safe operation. Failure to comprehend the operational hazards and risks associated with these symbols may lead to adverse results as explained below. Become thoroughly familiar with all symbols and their meanings by carefully reading the following text regarding symbols before proceeding.

 **Warning** Signifies a situation which may result in serious injury or death (Note 1)


 **Caution** Signifies a situation which may result in minor injury (Note 2) and/or property damage (Note 3)


(Note 1) Serious injury is defined as bodily wounds, electrocution, bone breaks/fractures or poisoning, which may cause debilitation requiring extended hospitalization and/or outpatient treatment.


(Note 2) Minor injury is defined as bodily wounds or electrocution, which will not require extended hospitalization or outpatient treatment.

(Note 3) Property damage is defined as damage to facilities, equipment, buildings or other property. (Note 1) Serious injury is defined as bodily wounds,

Symbol Meanings

 Signifies warning or caution.
Specific explanation will follow symbol.

 Signifies restriction.
Specific restrictions will follow symbol.

 Signifies an action or actions which operator must undertake.
Specific instructions will follow symbol.

1. SAFETY PRECAUTIONS

Symbol Glossary

Warning



General Warning



Danger!: High Voltage



Danger!: Extremely Hot



Danger!: Moving Parts



Danger!: Blast Hazard

Caution



General Caution



Caution: Electrical Shock Hazard!



Caution: Burn Hazard!



Caution: Do Not Heat Without Water!



Caution: May Leak Water!



Caution: Water Only



Caution: Toxic Chemicals

Restriction



General Restriction



No Open Flame



Do Not Disassemble



Do Not Touch

Action



General Action Required



Connect Ground Wire



Level Installation Required



Disconnect Power



Inspect Regularly

1. SAFETY PRECAUTIONS

Warnings & Cautions



Never operate equipment near combustible gases/fumes.

Do not install or operate BM/BO series units near flammable or explosive gases/fumes. Unit is NOT fire or blast resistant. Negligent use could cause a fire/explosion. See "List of Hazardous Substances" (P.40).



Always ground equipment.

Always ground this unit properly to avoid electric shock.



DO NOT operate equipment when abnormalities are detected.

If smoke or unusual odors begin emitting from unit, or if any other abnormalities are detected, terminate operation immediately, turn off main power switch and disconnect power cable. Continued operation under such conditions may result in fire or electric shock.



DO NOT operate with bundled or tangled power cable.

Operating unit with the power cable bundled or otherwise tangled, may cause power cable to overheat and/or catch fire.



DO NOT damage power cable.

Damaging the power cable by forcibly bending, pulling or twisting may cause fire or electric shock to the operator.



Perform periodic equipment inspections.

Inspect unit as frequently as possible for dust and other contaminants on wiring terminals and electrical components. Clean with a soft, damp cloth. Allowing contaminants to remain may result in a fire or electric shock.



DO NOT process explosive or flammable substances.

Never place or process explosive/flammable substances, nor substances that contain explosive/flammable substances in this unit. An explosion or fire may occur. See "List of Hazardous Substances" (P.40).



Avoid touching hot surface areas.

The metal bath container and main unit interior become hot during operation and may remain hot following operation. Avoid contacting these areas with bare fingers and hands. Burns or other injury may result.



DO NOT disassemble or modify equipment.

Attempting to dismantle or modify unit in any way, may cause malfunction, fire or electric shock.

1. SAFETY PRECAUTIONS

Warnings & Cautions



! **DO NOT operate equipment during thunderstorm.**

In the event of a thunderstorm, terminate operation and turn off main power switch immediately. A direct lightning strike may cause damage to equipment, or result in fire or electric shock.

! **Power Outages**

Operation is stopped when power failures occur. Turn off main power switch for safety.

2. PRE-OPERATION PROCEDURES

Installation Precautions & Preparations



1. Ground wire **MUST** be connected properly.



- Ground wire must be connected to a proper grounding line or terminal in order to prevent electric shock.



- Never connect ground wire to gas lines or water pipes.
- Never connect ground wire to telephone grounding lines or to lightning conductor rods. Fire or electrical shock may result.
- Never insert multiple plugs into a single outlet. Doing so may result in power cable overheating, fire or drop in voltage
- Use an outlet with a dedicated ground terminal for the larger capacity single-phase 100V to 120V BM500 and B0400 models.
- Use an outlet with a dedicated ground terminal for the single-phase 200V to 240V BM510 and B0410 models.

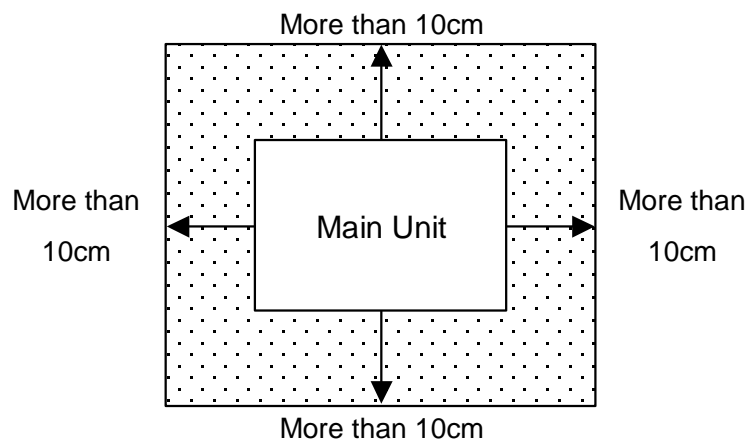
2. Choose an appropriate installation site.



- DO NOT install unit:
 - ◆ where flammable or corrosive gases/fumes will be generated.
 - ◆ where ambient temperature will exceed 35°C, will fall below 5°C or will fluctuate.
 - ◆ in excessively humid or dusty locations.
 - ◆ where there is constant vibration.
 - ◆ where power supply is erratic.
 - ◆ in direct sunlight or outdoors.
 - ◆ where there is no exhaust/ventilation hood.



- Install BM/BO series unit in a location with sufficient space, as specified as below.



2. PRE-OPERATION PROCEDURES

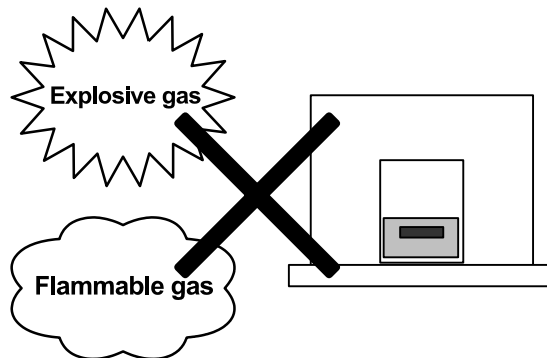
Installation Precautions & Preparations



3. Install in a location free of flammables and explosives.



Never install near flammables or explosives. This unit is NOT fire or blast resistant. Simply switching the main power switch “ON” or “OFF” can produce a spark, which could be relayed during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes. See “List of Hazardous Substances” (P.40).

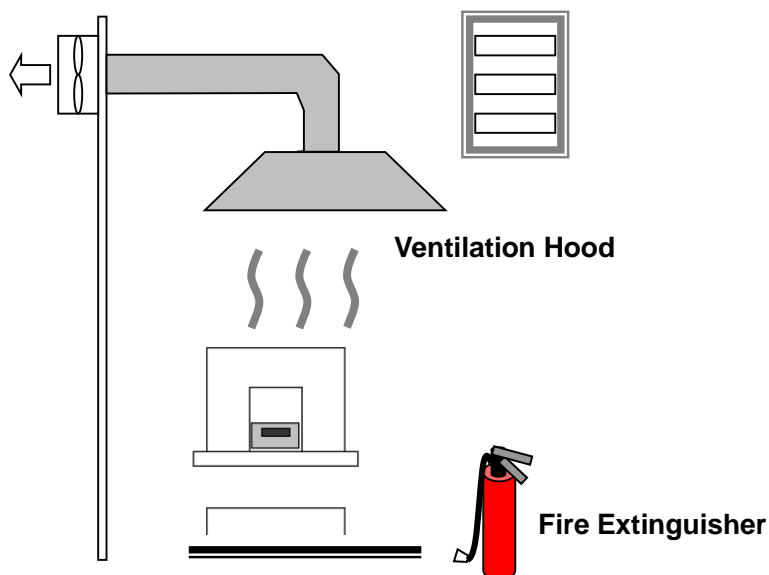


4. Installation Requirements



BO400 and BO410 models:

The oily smoke and steam generated from heating silicon oil is flammable and may cause a fire hazard. Silicon oil also emits harmful gases when heated to high temperatures. A ventilation hood must be installed above unit, with a fire extinguisher in close proximity.



2. PRE-OPERATION PROCEDURES

Installation Precautions & Preparations

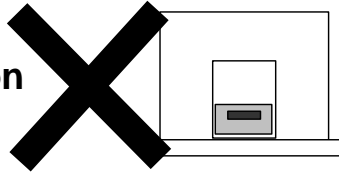


5. DO NOT disassemble or modify.



Never attempt to disassemble or modify BM/BO units. Doing so may cause equipment malfunction, fire or electric shock.

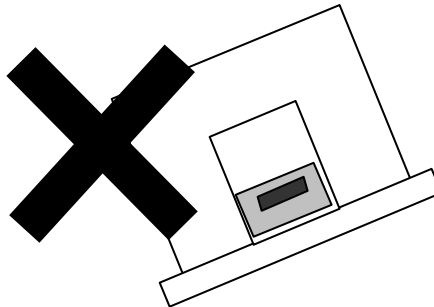
Modification



6. Install on a level surface.



Install unit on level and even surface. Failure to do so may cause abnormal vibrations or noise, resulting in possible complications and/or malfunction.



7. Connect to an appropriate power source.



- Use a dedicated power supply that matches electrical capacity of unit.

Electrical capacity: BM500/BO400: 100 to 120V AC, 12.5A
BM510/BO410: 200 to 240V AC (single phase), 6.5A

NOTE)

In the unlikely event that unit does not run after turning power ON, inspect whether power supply voltage of the main power is lower than specified, or whether other device(s) are sharing the same supply or line. Change to a dedicated power supply if unit will not run due to low voltage or shared power supply line.

8. Install equipment out of harm's way.



- Unit may fall or shift in an earthquake or other unforeseen incident, resulting in personal injury. Taking appropriate safety measures and installing unit out of harm's way is strongly recommended.
- Install a ventilation hood above the unit, with a fire extinguisher in close proximity.

2. PRE-OPERATION PROCEDURES

Installation Precautions & Preparations

9. Handle power cable with care.

1.Warning

- ⊘ Never operate unit with power cable bundled or tangled; and do not modify, bend, forcibly twist or pull on power cable. Doing so may cause fire and/or electrical shock.
- Do not risk damage to power cable by positioning it under desks or chairs, or by pinching it between objects. Doing so may cause fire and/or electrical shock.
- Do not place power cable near kerosene/electric heaters or other heat-generating devices. Doing so may cause power cable insulation to overheat, melt and/or catch fire, which may result in electric shock.
- Turn off power switch immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Failure to do so may result in fire or electric shock.
- ! Contact a local dealer or Yamato sales office for information about replacing power cable if it is damaged.
- Always connect power cable to appropriate facility outlet or terminal.

2. Attach power cable to unit



Use the supplied 15A rated power cable.



Plug the supplied power cable securely to unit receptacle.

Overseas Use

Select a power cable appropriate to the safety standards of the country in which unit will be used.



2. PRE-OPERATION PROCEDURES

Prior Confirmation



BM500/510 water bath operation precautions:

Exercise caution in regard to the following.

- ① Connect unit to a power outlet having sufficient capacity.
- ② Do not move unit while in operation.
- ③ Avoid touching hot surface areas or bath fluid during operation.
- ④ Do not drain unit until water temperature falls below 45°C.
- ⑤ Be sure not to spill water on or around unit while adding. Electric shock or fire may result.
- ⑥ Do not leave unit unattended during operation.
- ⑦ Use water for bath fluid. Using purified or distilled water is recommended to prevent buildup of mineral deposits.
- ⑧ Do not place or operate unit outdoors.
- ⑨ Turn power OFF when removing bath container from the main unit.
- ⑩ Do not heat bath container without water.



BO400/410 oil bath operation precautions:

Exercise caution in regard to the following.

- ① Connect unit to a power outlet having sufficient capacity. BO400:100 to 120V AC, 12.5A. BO410: 200 to 240V AC, 6.5A.
- ② Do not move unit while in operation.
- ③ Avoid touching hot surface areas or bath fluid during operation.
- ④ Do not drain unit until oil temperature falls below 45°C.
- ⑤ Be sure not to spill oil on or around unit while adding. Electric shock or fire may result.
- ⑥ Do not leave unit unattended during operation.
- ⑦ Use ONLY silicon oil for bath fluid.
- ⑧ Do not place or operate unit outdoors.
- ⑨ Turn power OFF when removing bath container from the main unit.
- ⑩ Do not heat bath container without oil.
- ⑪ Be careful not to allow oil to overflow while heating.

2. PRE-OPERATION PROCEDURES

Prior Confirmation

Fluid medium for BO400/BO410 oil baths

Maximum operating temperature for BO400/410 model oil baths is 180°C.

Use heat-resistant dimethyl silicon oil for open system heat transfer only, and Kinematic viscosity of 50mm²/s (cSt) or less.

Recommended:

TSF458-50 silicon oil for operating temperatures to 200°C, by Toshiba Silicon Co.

Silicon oil characteristics	Manufacturer	Toshiba Silicon
	Recommended temperature	200°C or below
	Product name	TSF458-50
	Appearance	Light yellow, transparent
	Specific gravity (@25°C)	0.961
	Kinematic viscosity (@25°C) (mm ² /s (cSt))	50
	Volatility (150°C, 24h)%	0.3
	Viscosity temperature coefficient	0.59
	Flash point (°C)	325
	Pour point (°C)	<-50°C
	Viscosity increase rate (300°C, 168h)%	40

Silicon oil deterioration rate (viscosity change) varies with operation temperature. Please contact silicon oil manufacturer for product details at time of purchase.

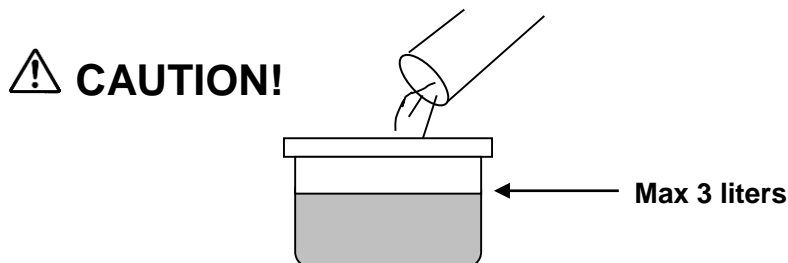
Water/oil bath levels

Maximum fluid bath level (water/silicon oil) when heated should be approximately 30 mm or less from top of bath container when specimen flasks are submersed.

Exercise caution in the amount of silicon oil supplied to oil bath.

Do not use more than three (3) liters in the bath container.

Silicon oil has a broad thermal expansion capacity and may overflow from bath when heated, if too much oil is added.



2. PRE-OPERATION PROCEDURES

Prior Confirmation

Bath container water/oil supply precautions.

The bath container installed in main unit is removable for easy filling and draining. Use caution in regard to the following when adding water or oil.

BM series water bath

- Fill so that bath will not overflow when specimen flask(s) is submersed.
- Wash bath container regularly with water to keep it clean. Before setup, remove dirt and other contaminants from bath container interior, and also from the outer surface, especially where heater and temperature sensor contact the container surface.
- Be sure to remove all excess water after washing, and dry outer surface of bath container thoroughly before use. Allowing water to remain on the outer surface of bath container may cause inaccurate temperature readings and longer heating times.
- Do not place flammable substances inside unit or near heater. A fire or explosion may result.
- Clean heater and inside of unit regularly to maintain cleanliness and safety. Malfunction or fire may result if contaminants are allowed to remain and build up on heater or inside of unit.
- To prepare unit for cleaning, turn off power switch, disconnect the power cable and clean **ONLY** after confirming that heater and unit have cooled sufficiently.

Oil supply for BO model water bath

- Fill with maximum 3 liters of oil. Bath should not overflow when oil is heated and specimen flask(s) is submersed.
- Wash bath container with mild detergent to keep it clean. Before setup, remove dirt and other contaminants from bath container interior, and also from the outer surface, especially where heater and temperature sensor contact the container.
- Be sure to remove all excess water after washing, and dry outer surface of bath container thoroughly before use. Allowing water to remain on the outer surface of bath container may cause inaccurate temperature readings and longer heating times.
- Do not place flammable substances inside unit or near heater. A fire or explosion may result.
- Clean the heater and inside of unit regularly to maintain cleanliness and safety. Malfunction or fire may result if contaminants are allowed to remain and build up on heater or inside of unit.
- To prepare unit for cleaning, turn off power switch, disconnect the power cable and clean **ONLY** after confirming that heater and unit have cooled sufficiently.

Handle with care.



Do not overfill.

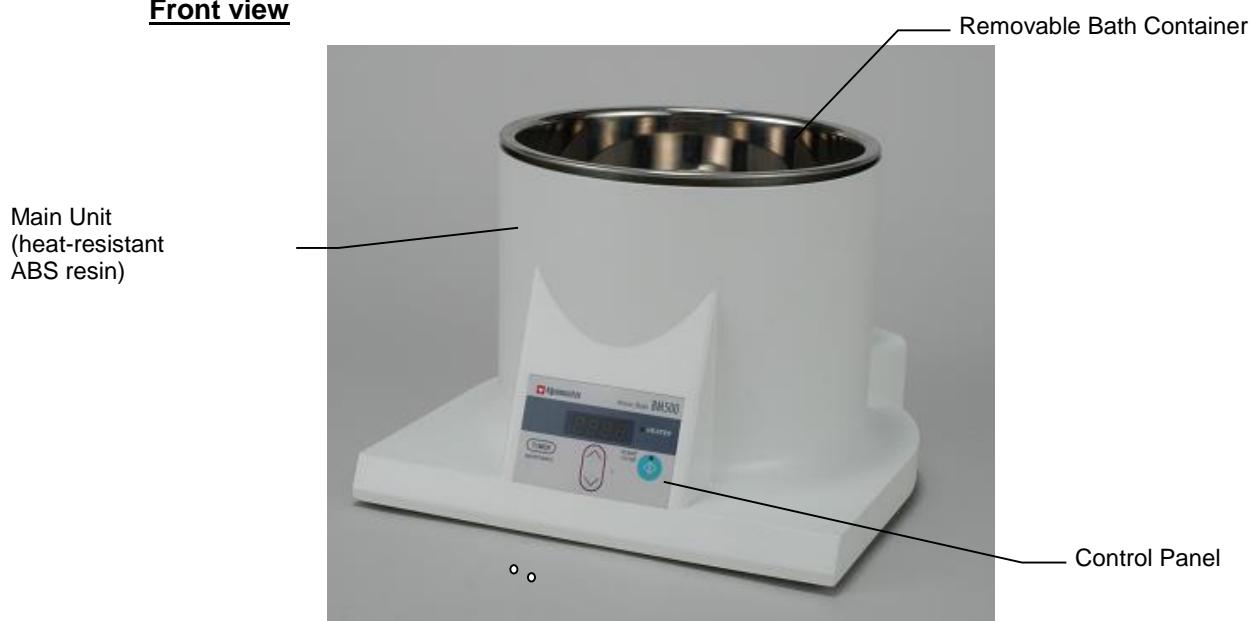
Keep bath container, unit and heater clean.

Do not spill bath fluid.

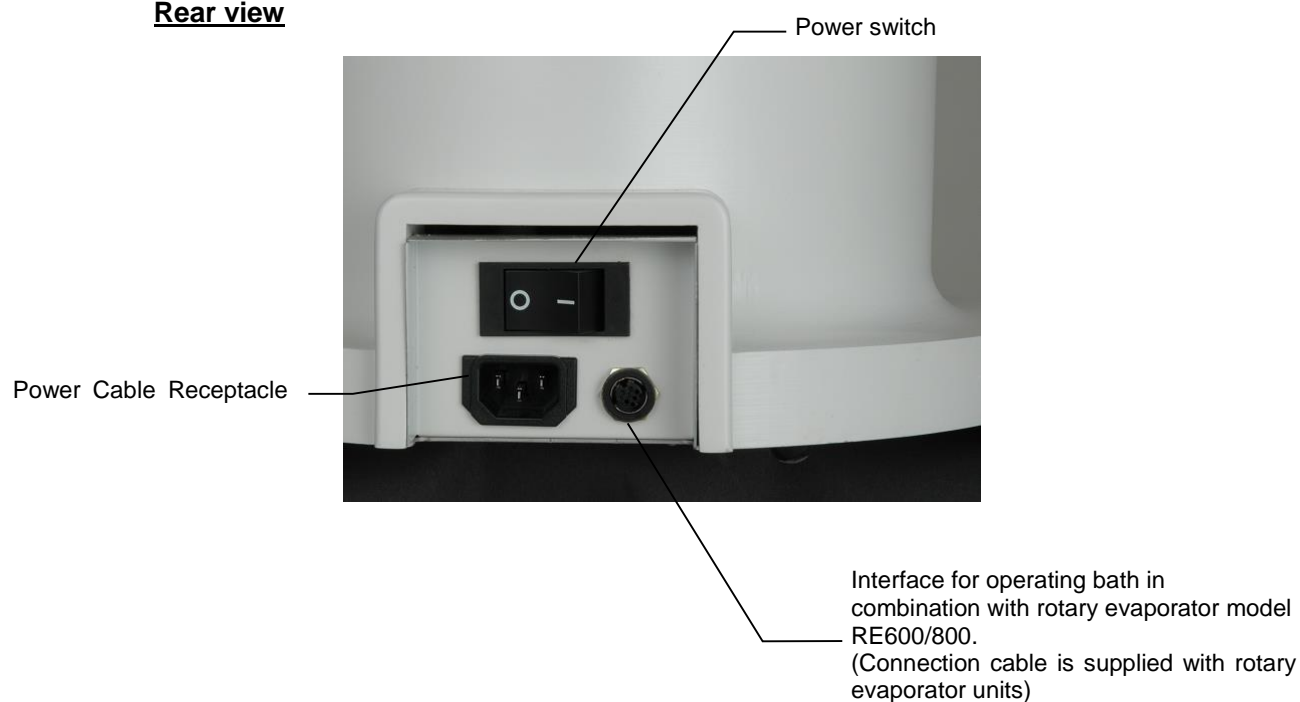
3. COMPONENT NAMES & FUNCTIONS

Main Unit Overview

Front view



Rear view

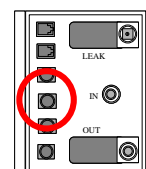


3. COMPONENT NAMES & FUNCTIONS

Control Panel



Interface for operating bath in combination with rotary evaporator model RE600/800. (Connection cable is supplied with rotary evaporator units)













VR600/800 Vacuum controller

No.	Name	Markings	Function
①	LED Display Screen	—	Shows bath temperature reading, temperature setting and other setting and menu information.
②	HEATER Lamp	HEATER	Lights when heater is running.
③	UP Key	▲	Increases setting values.
④	Down Key	▼	Decreases setting values.
⑤	START/STOP Key	⬇ START/STOP	Starts/stops unit operation when pressed and held for one second.
⑥	Operation Lamp	⬇	Lights during constant temperature operation. Flashes during timed operation.
⑦	TIMER Key	TIMER	Setting key for quick auto stop, auto stop and auto start operation modes.
⑧	MAINTENANCE Access	MAINTENANCE	Allows access to maintenance menu when TIMER key is pressed for 4 seconds.
⑨	Special function connection port	—	For use with rotary evaporator model RE600/800.

3. COMPONENT NAMES & FUNCTIONS

Display Characters

Display characters used in BM/BO unit control panels are defined in the table below:

Character	Identifier	Meaning	Function/Description
Timer selection menu:			
	AStP	Auto Stop	Selection/standby display for quick auto stop/auto stop operation modes
	AStP	Auto Start	Selection/standby display for auto start operation mode
Maintenance menu:			
	Lock	Keypad Lock	Selection menu display for keypad lock function which disables keys to avoid setting changes. On: all key disabled except TIMER key, Off: all keys enabled.
	bSEt	Bath Set	Selection menu display for selecting whether to stop bath automatically or retain heat upon operation completion, through remote signals from rotary evaporator unit. Only available when RE600/800 rotary evaporator unit is connected.
	StoP	Stop	Displayed to select bath auto stop mode. Only available when RE600/80 rotary evaporator unit is connected.
	KEeP	Keep	Displayed to select bath auto heat-retention mode. Only available when RE600/800 rotary evaporator unit is connected.
	mnL	Manual	Displayed to select when RE600/800 model rotary evaporator is not connected and bath is to be used by itself (factory default setting).
	Sv2	Setting Value 2	Displayed when setting heat-retention temperature of bath and KEEP is selected in bSet menu. Only available when RE600/80 rotary evaporator unit is connected.
	cAL	Calibration Offset	Indicates when calibration offset temperature input menu is selected.
	Pon	Power On	Displayed to set whether or not to continue an operation after power failure. ON: recovers and continues operation. OFF: terminates operation (factory default).

* See also "Mode & Function Flow (P.17).

4. OPERATION PROCEDURES

Operation Modes & Functions

BM/BO series operation modes are outlined in the table below:

No.	Name	Description	Page
1	Constant Temp Mode	Set desired temperature with $\Delta \nabla$. Press and hold START/STOP to start operation. Press START/STOP again to stop operation.	18
2	Quick Auto Stop Mode	Press TIMER key while constant temp mode is running. Select ASTP and set stop timer using $\Delta \nabla$. Press and hold START/STOP to start quick auto stop mode.	19
3	Auto Stop Mode	Press TIMER key while unit is in standby. Select ASTP and set operation time using $\Delta \nabla$. Press and hold START/STOP to start auto stop mode.	21
4	Auto Start Mode	Press TIMER key twice while unit is in standby. Select ASTP and set operation time using $\Delta \nabla$. Press and hold START/STOP to start auto start mode.	23

BM/BO series safety features are outlined in the table below:

No.	Name	Description	Page
1	Overheat Prevention Devices	<p>① Overheat prevention function: This function is set to automatically activate (manual reset) when actual temperature exceeds setting by 40°C. [Er06] appears in the display screen. Turn off the main power switch and call for service. Unit recovers when problem source is eliminated and unit is restarted.</p> <p>② Thermal fuse: Unit contains a thermal fuse which will cut power to the heater in the event that the overheat prevention function mentioned above fails to operate.</p>	25
2	Main Power Switch	Circuit breaking power switch located on the rear panel of unit.	-

4. OPERATION PROCEDURES

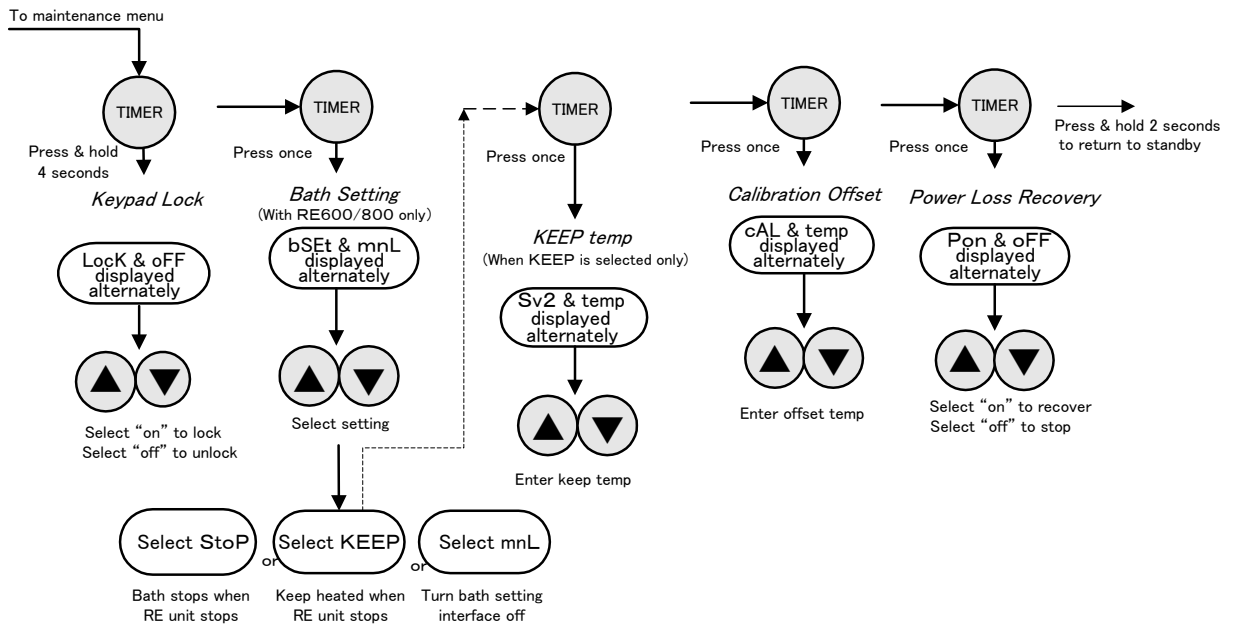
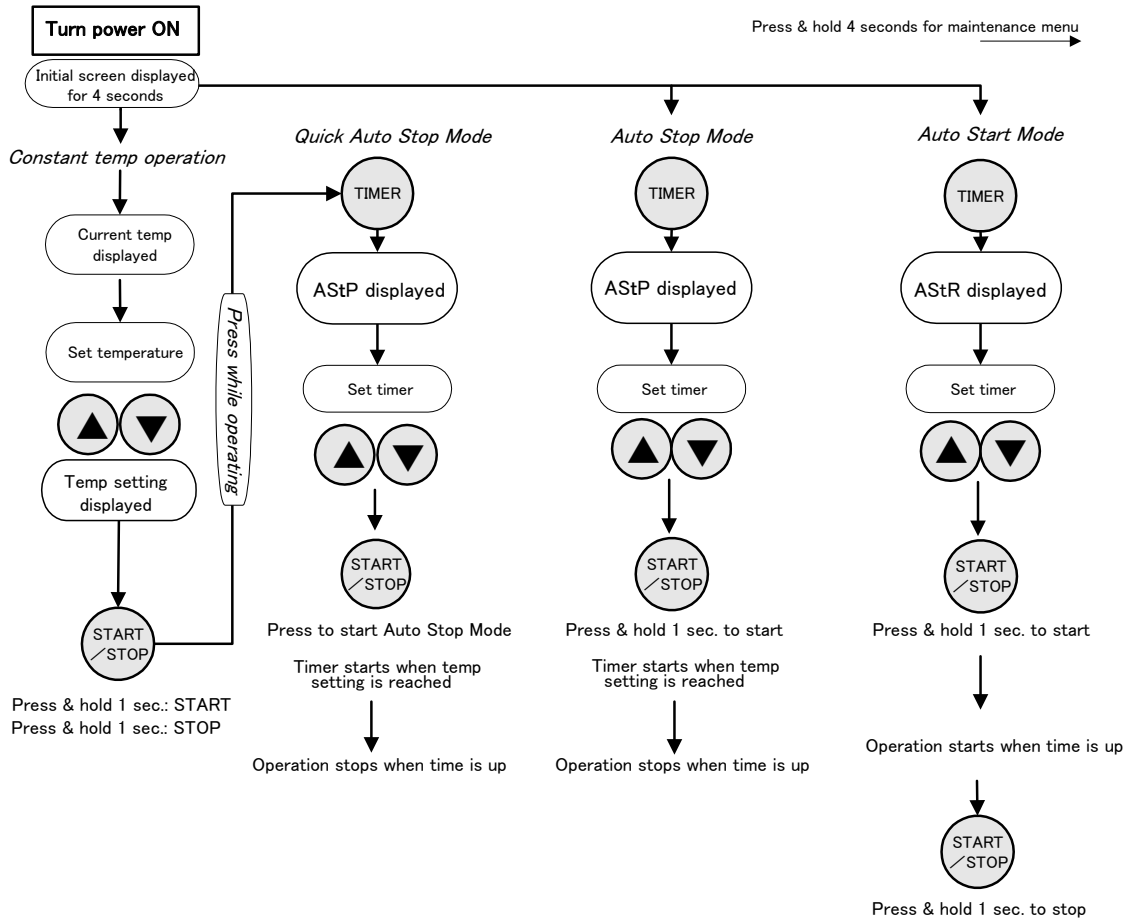
Operation Modes & Functions

BM/BO maintenance functions are outlined in the table below.
To enter the maintenance menu, press and hold TIMER for four seconds.

	Name	Description	Page
1	Keypad Lock	This function prevents changes to temperature and other setting by disabling the keypad during operation. Select [on] or [oFF] using $\Delta \nabla$. [on] disables all keys except TIMER. [oFF] cancels keypad lock, enabling all keys.	26
2	Bath Setting (exclusive function available only when RE600/800 rotary evaporator unit is connected)	By interfacing with a compatible rotary evaporator vacuum controller, this function can be made to stop bath operations automatically or to retain heat at a desired temperature, after the rotary evaporator unit completes an operation. Press TIMER from maintenance mode to display the bSEt nonL alternating display. Select StoP using $\Delta \nabla$ to automatically stop bath operation when the rotary evaporator unit completes its own operation. Select KEEP using $\Delta \nabla$ to keep bath heated when the rotary evaporator unit completes an operation. The factory default setting is nonL which disables interface operation. Setting heat-retention temperature Select KEEP , then press TIMER to set heat-retention temperature. Set desired temperature using $\Delta \nabla$.	26
	Calibration Offset	The offset function works to correct discrepancies found between the bath temperature reading, as seen on the display and actual bath temperature, as taken manually, by matching temperature setting to the actual temperature. Values may be adjusted either positively (+) or negatively (-) over the entire thermal bandwidth of unit. Press TIMER to display cAL . Enter a correction value. Negative values increase temperature and positive values decreases temperature. (Example: a value of -2 would increase bath temperature by 2°C.)	27
4	Power Failure Recovery	The recovery function selects whether or not to continue an operation following a power failure. On: recovers and continues operation. OFF: terminates operation (factory default). Select Pon using TIMER, then select [on] or [oFF] using $\Delta \nabla$.	28

4. OPERATION PROCEDURES

Mode & Function Flow



4. OPERATION PROCEDURES

Constant Temperature Mode

Constant Temperature mode is a general use, continuous operation mode (started/stopped manually).

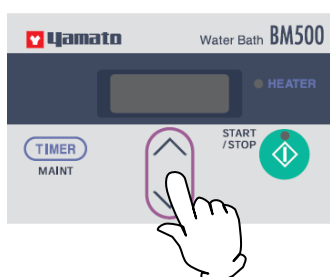
Constant temperature operation procedures



Temperature reading/setting display:

Current bath temperature is displayed in standby.

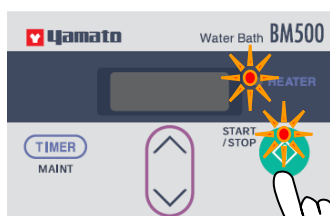
❖ See “Display Characters” (P.14).



2. Set temperature

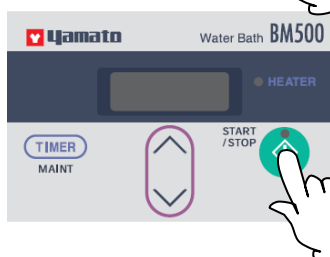
- Set the desired temperature using Δ / ∇ . Press Δ or ∇ . Temperature setting is shown. Press Δ to increase value. Press ∇ to decrease value. After three seconds, display will revert to current bath temperature (standby).

CAUTION: If hot water is added during operation, bringing temperature to 40°C or more beyond temperature setting, the unit interprets this as an overheating event. Power is cut to the heater, and error 6 is displayed. If bath water level becomes too low while unit is running, cancel operation before adding.



3. Start operation

- Press and hold START/STOP. Operation begins. The operation and HEATER lamps light and temperature begins to build.



4. Stop operation

- Press and hold START/STOP. Operation stops. The operation and HEATER lamps go out. The display reverts to standby (current bath temperature).

Correcting or viewing settings.

Use Δ / ∇ at any time to correct or view settings.

Press either Δ or ∇ once to view temperature setting. Display will automatically revert to temperature reading after 4 seconds. To change the setting, continue operating Δ / ∇ until desired temperature is entered. Unit will continue operation under new temperature setting.

4. OPERATION PROCEDURES

Quick Auto Stop Mode

Quick Auto Stop mode adds auto stop timer function to running constant temperature mode.

Quick auto stop operation procedures



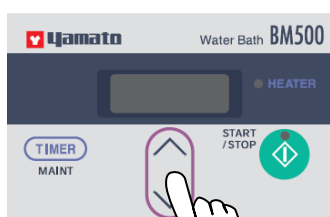
1. Turn ON main power switch.

- When power switch is turned ON, display will show initial values for about four seconds before entering standby, which shows current bath temperature in display.

Temperature reading/setting display:

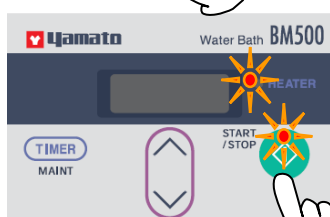
Current bath temperature is displayed in standby.

- ❖ See “Display Characters” (P.14).



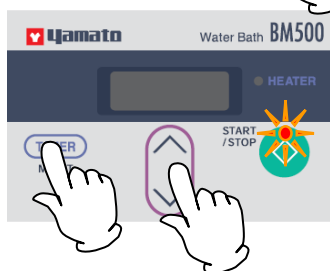
2. Set temperature

- Set the desired temperature using Δ / ∇ . Press Δ or ∇ . Temperature setting is shown. Press Δ to increase value. Press ∇ to decrease value. After three seconds, display will revert to current bath temperature (standby).



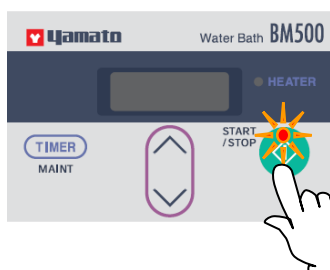
3. Start operation

- Press and hold START/STOP. Operation begins. The operation and HEATER lamps light and temperature begins to build.



4. Set auto stop timer

- Press TIMER. The screen displays [AstP] and timer setting alternately. Set auto stop time using Δ / ∇ .

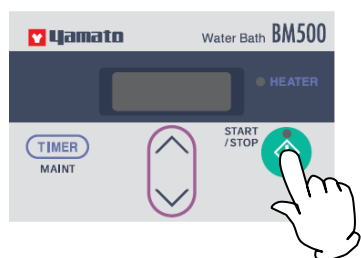


5. Start timed operation

- Press and hold START/STOP. The operation lamp flashes and quick auto stop operation begins. When bath temperature reaches temperature setting, timer begins and timed operation starts. From this point, the display shows current bath temperature and remaining time alternately.

4. OPERATION PROCEDURES

Quick Auto Stop Mode



6. Stop operation

- Press and hold START/STOP. Operation stops. The operation and HEATER lamps turn off. Display reverts to standby (current temp).

Correcting or viewing settings.

Use Δ / ∇ at any time to correct or view settings.

Press either Δ or ∇ once to view temperature setting. Display will automatically revert to temperature reading after 4 seconds. To change the setting, continue operating Δ / ∇ until desired temperature is entered. Unit will continue operation under new temperature setting.

Correcting timer setting.

Press TIMER during operation to change timer setting. Unit enters setting menu and timer setting can be changed. When timer has been set using Δ / ∇ , unit continues operation under new timer setting. Note: when changing timer settings, new setting total must be longer than time already passed.

4. OPERATION PROCEDURES

Auto Stop Mode

Auto Stop mode allows an automatic stop time to be set in advance of operation.

Auto stop operation procedures



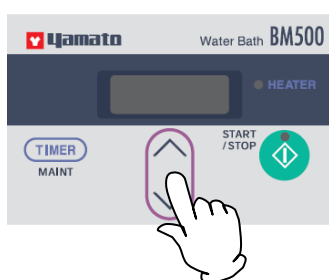
1. Turn ON main power switch.

- When power switch is turned ON, display shows initial values for about four seconds before entering standby, which shows current bath temperature in display.

Temperature reading/setting display:

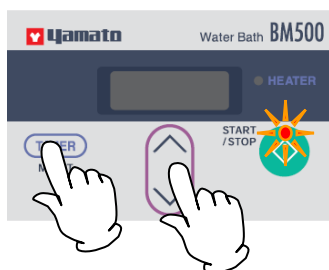
Current bath temperature is displayed in standby.

- ❖ See “Display Characters” (P.14).



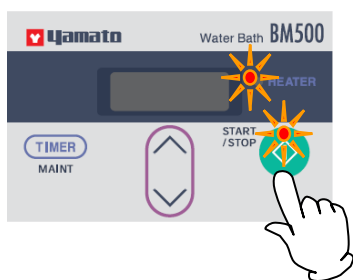
2. Set temperature

- Set the desired temperature using Δ / ∇ . Press Δ or ∇ . Temperature setting is shown. Press Δ to increase value. Press ∇ to decrease value. After three seconds, display will revert to current bath temperature (standby).



3. Set auto stop timer

- Press TIMER and select [AstP]. The screen displays [AstP] and timer setting alternately. Set auto stop time using Δ / ∇ .



4. Start operation

- Press and hold START/STOP. The operation lamp flashes and quick auto stop operation begins.
- When bath temperature reaches temperature setting, the timer begins and timed operation starts. From this point, the display shows current bath temperature and remaining time alternately.



5. End of operation

- Operation automatically stops at the preset time. Display reverts to standby (current time) and HEATER lamp goes out.

Correcting or viewing settings.

Use $\Delta \nabla$ at any time to correct or view settings.

Press either Δ or ∇ once to view temperature setting. Display will automatically revert to temperature reading after 4 seconds. To change the setting, continue operating $\Delta \nabla$ until desired temperature is entered. Unit will continue operation under new temperature setting.

Correcting timer setting.

Press TIMER during operation to change timer setting. Unit enters setting menu and timer setting can be changed. When timer has been set using $\Delta \nabla$, unit continues operation under new timer setting.

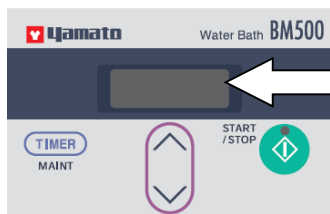
Note: when changing timer settings, new setting total must be longer than time already passed.

4. OPERATION PROCEDURES

Auto Start Mode

Auto Start mode allows an automatic start time to be set in advance of operation.

Auto start operation procedures



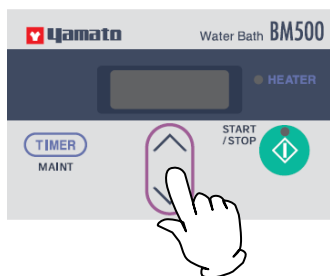
1. Turn ON main power switch.

- When power switch is turned ON, display shows initial values for about four seconds before entering standby, which shows current bath temperature in display.

Temperature reading/setting display:

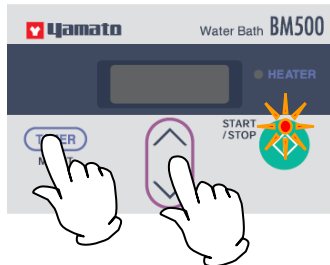
Current bath temperature is displayed in standby.

- ❖ See “Display Characters” (P.14).



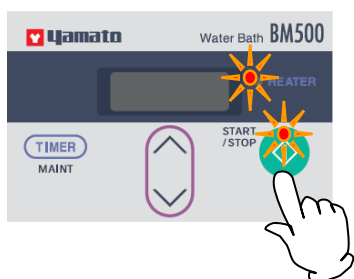
2. Set temperature

- Set the desired temperature using Δ / ∇ .
Press Δ or ∇ . Temperature setting is shown. Press Δ to increase value. Press ∇ to decrease value.
After three seconds, display will revert to current bath temperature (standby).



3. Set auto start timer

- Press TIMER and select [Astr].
Display shows [Astr] and timer setting alternately.
Set auto start time using Δ / ∇ .

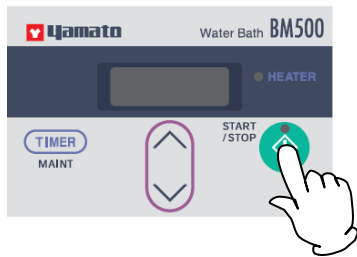


4. Start operation

- Press and hold START/STOP.
Auto start operation begins and the operation lamp flashes.
The HEATER lamp lights and temperature begins building at the preset time.
Current temperature and remaining time until start are alternately shown in display.

4. OPERATION PROCEDURES

Auto Start Mode



5. Stop operation

- Press and hold START/STOP.
Operation stops. Operation and HEATER lamps go out.
Display reverts to standby (current temp).

Correcting or viewing settings.

Use Δ / ∇ at any time to correct or view settings.

Press either Δ or ∇ once to view temperature setting. Display will automatically revert to temperature reading after 4 seconds. To change the setting, continue operating Δ / ∇ until desired temperature is entered. Unit will continue operation under new temperature setting.

Correcting timer setting.

Press TIMER during operation to change timer setting. Unit enters setting menu and timer setting can be changed. When timer has been set using Δ / ∇ , unit continues operation under new timer setting.
Note: when changing timer settings, new setting total must be longer than time already passed.

4. OPERATION PROCEDURES

Overheat Prevention Settings

BM/BO series units feature a built-in safety device to automatically prevent overheating, plus a thermal fuse for redundancy.

How overheating prevention devices work:

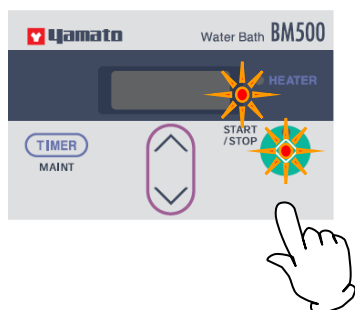
The main overheat prevention device is set to activate at temperature setting plus 40°C, at which point power is cut and Error 6 is displayed. Recovery takes place when the source of overheat is eliminated and the unit is restarted by turning the main power switch off and back on. The thermal fuse is set to break at 128°C (for BM500 and 510 models) or 192°C (for BO400 and 410 models), cutting power to the heater.

Caution:

- If hot water is added during operation, bringing temperature to 40°C or more beyond temperature setting, the unit interprets this as an overheating event. Power is cut to the heater, and error 6 is displayed. If bath water level becomes too low while unit is running, cancel operation before adding.
- If overheating prevention devices activate outside of the above parameters, unit may be faulty. Turn OFF main power switch immediately, disconnect the power cable and call for service.
- Overheating prevention functions are to prevent abnormal overheating and protect BM/BO unit. They are NOT intended as test sample or specimen protection measures, nor are they intended as prevention against accidents resulting from the negligent use of this product.

Power failures.

- When a power failure occurs, BM/BO units stop and keep operation in standby to maintain safety.



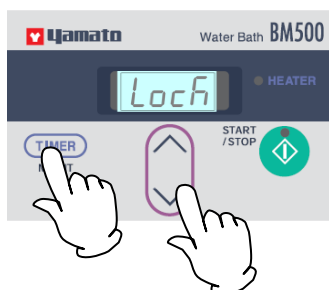
- Press and hold START/STOP to re-start the operation.
- Select [on] under [Pon] (power loss recovery) in the MAINTENANCE menu for automatic operation recovery. Do not leave unit unattended when unit has been set to continue operation after a power loss. (See P.28)

4. OPERATION PROCEDURES

Keypad Lock Function

Using keypad lock function

This function locks the keypad, preventing unwanted interruptions or setting changes during unit operation. Use the TIMER key to set or cancel this function.



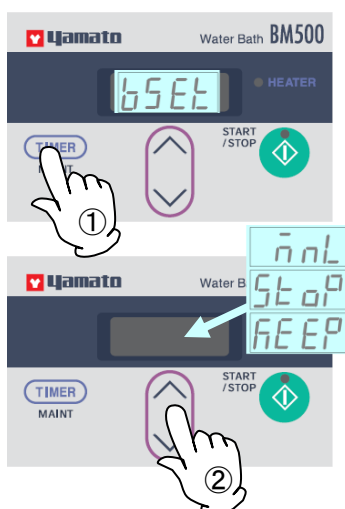
- ① Press and hold TIMER for about four seconds. Select [Lock] to enter menu.
- ② [Lock] and [off] are displayed alternately. Select [on] using Δ to lock keypad.
- ③ Select [off] using ∇ to unlock.
 - ❖ When function is set to [on], all keys except TIMER are locked.

Bath Setting Function

This function is available only when RE600/800 rotary evaporator unit is connected.

Connect the RE unit vacuum controller and BM/BO bath unit interfaces using the connection cable supplied with the RE600/800 unit. Refer to the VR600/VR800 instruction manual for details.

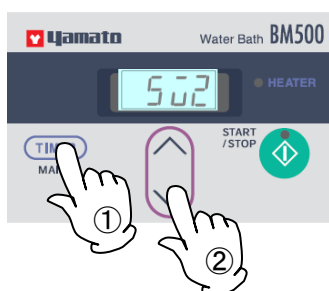
Bath operation setting



- Using signals from/to the RE unit vacuum controller, this function stops bath completely or retains heat in bath when the rotary evaporator completes an operation.

- ① Press and hold TIMER for about four seconds and then press it repeatedly until [bSEt] and [mnL] are displayed alternately.
- ② Select [StoP] with $\Delta\nabla$ to automatically stop the bath when rotary evaporator unit completes an operation.
- ③ Select [KEEP] with $\Delta\nabla$ to automatically retain heat in the bath when rotary evaporator unit completes an operation.
 - ❖ The factory default setting is "mnL" which disables the bath setting function.

Set heat retention temperature



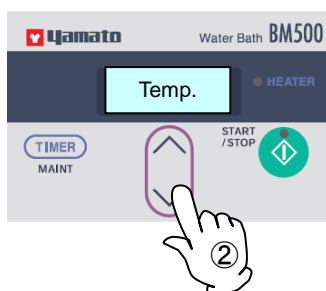
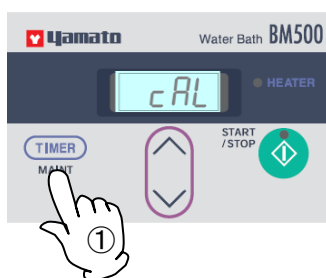
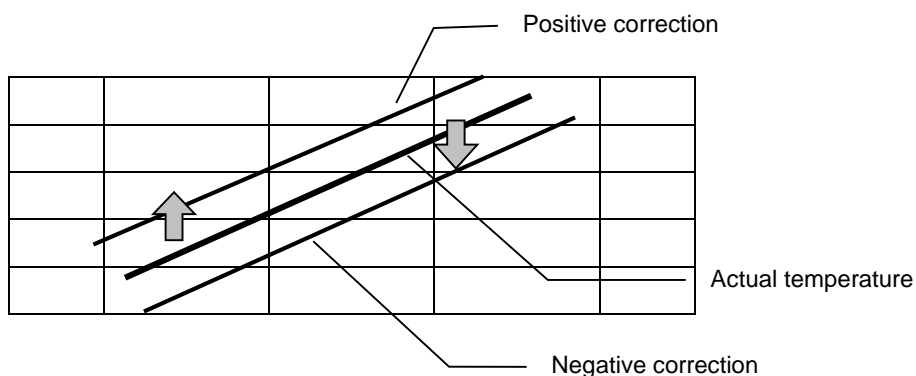
- Set heat-retention temperature when "KEEP" is selected. Use MAINTENANCE to display [Sv2] and enter the desired value for heat-retention temperature.

4. OPERATION PROCEDURES

Calibration Offset Function

Set Calibration Offset

The offset function works to correct discrepancies found between the bath temperature reading, as seen on the display and actual bath temperature, as taken manually, by matching temperature setting to the actual temperature. Enter a positive difference value when the bath temperature is found to be higher than the control panel reading. Enter a negative difference value when bath temperature is found to be lower than the control panel reading. Use the MAINTENANCE menu to set or cancel this function. **The factory default calibration offset value is [0]**



- ① Start a constant temperature operation at any temperature. When temperature stabilizes, measure bath temperature using a temperature recorder or other precision thermometer.
- ② If control panel temperature reading and manually taken temperature differ, follow the steps below:
- ③ Press and hold TIMER for about four seconds, then press it repeatedly until [cAL] is displayed.
- ④ The screen displays [cAL] and correction temperature. Enter the difference (negative or positive) using Δ / ∇ while digits are flashing. This completes the setting.

- ❖ If a negative value is entered, bath temperature rises according to the value entered. If a positive value is entered, bath temperature decreases by the value entered.

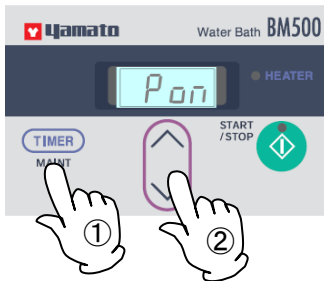
Example:

A temperature reading of 60°C and an actual temperature of 58°C would call for an offset value of -2, bringing the actual temperature up 2°C, to 60°C.

4. OPERATION PROCEDURES

Power Failure Recovery

This function is to select recovery options, auto return or stop, following a power failure.



Press and hold TIMER for about four seconds, then press it repeatedly until [Pon] is shown. Select [on] or [oFF] using Δ ∇ .

On: continues operation when power is restored.

OFF: terminates operation when power is restored.


Caution:

Do not leave unit unattended while there is a power failure in progress, if the [on] option has been selected.


5. HANDLING PRECAUTIONS




1. DO NOT process hazardous or harmful substances.

 Never process, place or use explosive/flammable substances or materials that contain explosives or flammables in this unit. Explosion or fire may be caused resulting in serious injury or death. (Refer to P.40)


2. DO NOT leave operating equipment unattended.

 Do not leave units requiring oil unattended while in operation. Heated oil presents a fire hazard which could result in serious injury or death.

3. Install ventilation hood and fire extinguisher.


 Devices which heat silicon oil present a fire hazard and may emit harmful fumes. Always be sure that a ventilation hood is installed over such devices, with a fire extinguisher in close proximity.

4. DO NOT operate equipment when abnormalities are detected.


 If unit begins emitting smoke or abnormal odors for reasons unknown, turn off main power switch immediately, disconnect power cable from power supply, and contact a local dealer or Yamato sales office for assistance. Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should be always be performed by a certified technician.




1. DO NOT climb on equipment.

 Do not attempt to climb onto unit or substitute it for a proper step ladder. Units are not designed to support bodily weight and damage may result. In addition, unit may become unstable and tip over or fall resulting in equipment damage, serious injury or death.

2. DO NOT place items on equipment.

 Placing items or objects of any kind on unit may cause it to become unstable and tip over, possibly resulting in equipment damage, injury or death.

3. DO NOT operate equipment during thunderstorms.

 In the event of a thunderstorm, turn off main power switch, and disconnect power cable immediately. A direct lightning strike may cause equipment damage fire or electric shock, resulting in serious injury or death.

5. HANDLING PRECATIONS



4. Overnight and extended storage.



Whenever unit is not in operation, stored overnight or put in storage, always turn off main power switch and disconnect power cable.

5. Use proper bath fluids.



Using purified or distilled water in BM model water bath is recommended to prevent mineral deposit accumulation.

Never use any fluid other than proper specification silicon oil in BO model oil bath. Periodically change oil and wash the bath container. See P.31.

6. MAINTENANCE PROCEDURES

Inspection & Maintenance

Be sure to conduct daily inspections to maintain optimal equipment performance.

WARNING!

- Disconnect power cable before conducting inspection and maintenance on unit.
- Clean off any water/oil on or around the control panel and heater to prevent a short circuit or an electric shock.
- Do not drain unit until bath water/oil temperature falls to 45°C or below.
- Do not attempt to dismantle or disassemble unit.

CAUTION!

- Clean main unit exterior with a soft, damp cloth and mild detergent. Do not use benzene, thinner, cleansers or other harsh chemicals and do not scrub with brushes, brillo-type pads, scouring power or other abrasive cleaners. Deformity, discoloration or other cosmetic damage may result.
- Wipe contaminants, excess fluids and oil from bath container with a clean, dry cloth.
- Clean heater and sensor with care.

For further assistance, contact a local dealer or the nearest Yamato sales office.

7. STORAGE & DISPOSAL

CAUTION!

Extended storage.

- Turn off main power switch and disconnect power cable.
- Drain the oil/water from bath container and wipe down thoroughly to remove excess fluid.

WARNING!

Disposal

- Drain oil completely for disposal.
- Place out of reach of children.
- Dispose of as bulky waste.

Disposal Considerations

Dispose of or recycle this unit in a responsible and environmentally friendly manner. Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

Major components and materials, comprising BM/BO series units are listed in table below:

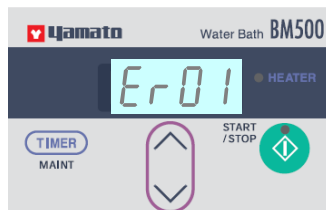
Component Name	Material
Exterior	
Outer Shell	Heat-resistant ABS resin, resin coating
Bath Container	Stainless steel SUS316
Heat Insulation Material	Rockwool
Badges & Seals	PET resin film
Rubber Feet	Chloroprene rubber
Electrical	
Switches, Relay	Resin, copper and other composites
Circuit Boards	Glass fiber and other composites
Heater	Inconel (nickel-chromium alloy)
Power Cable	Synthetic rubber composites, copper, nickel and other materials

8. TROUBLESHOOTING

Error Codes

Possible error messages are outlined below.

Power output to heater is stopped and users are notified of abnormalities by a corresponding error code on the display. Make note of the code, turn off power and call for service, if necessary.



Error Code		Cause/Solution	
Er01	Er01	Temperature sensor error	Temperature sensor faulty or severed from circuit. Check/replace the sensor. Restart to clear error.
Er06	Er06	Overheat	Overheating prevention device has been activated by overheating, or by a temperature control error. Restart to clear error. If restarting does not clear error, the control board may need replacing. Call for service.
Er15	Er15	Memory error	Setting value memory error. Replace memory board.
Blank Display		Thermal fuse thrown	Thermal fuse has been thrown. Replace fuse. Call for service.

8. TROUBLESHOOTING

Troubleshooting Guide

Symptom	Check
Unit does power on.	<ul style="list-style-type: none">• Check to make sure power cable is securely inserted into the receptacle on back of unit• Check to see whether power failure is in progress.• Check whether water/oil level is low.
Circuit breaker (main power switch) trips.	<ul style="list-style-type: none">• Check whether unit exterior is wet.• Short-circuit (call for service.)
Er06 appears in display.	<ul style="list-style-type: none">• Check whether temperature setting is lower than bath temperature.
Temperature does not come down.	<ul style="list-style-type: none">• Check whether temperature setting is lower than bath temperature.
Temperature reading too high/low.	<ul style="list-style-type: none">• Temperature may not have stabilized yet.• Check to see whether an incorrect calibration offset value has been entered. (See P.27)• Check to see whether bath temperature sensor has contaminant buildup, and whether it is properly contacting bottom surface of bath container.

If problems persist, turn off main power switch immediately, disconnect power cable and call for service.

Requests for Repair

When a problem occurs, terminate operation immediately, turn off main power switch and disconnect power cable.

Contact a local dealer or Yamato sales office for assistance.

The following information is required for all repairs.

- Model name
 - Serial Number
 - Date (year/month/day) of purchase
 - Description of problem in as much detail as possible
- } Refer to production ID plate on unit

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for BM/BO series water/oil baths. "Repair parts" is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

Product Name	Water Bath		Oil Bath	
Model	BM500	BM510	BO400	BO410
Bath capacity	Approx. 4 liters (water/oil added to approx. 30mm from upper lip of bath container)			
Effective bath capacity	Approx. 4 liters			
Bath container material	SUS316			
Temperature control range	Room temp.+5°C~90°C		Room temp.+5°C ~180°C	
Temperature setting range	0°C ~100°C		0°C ~180°C	
Temperature adjustment accuracy*	±1.5°C (when stirred)		±2°C (when stirred)	
Temperature control system	PID control			
Temperature setting system	Digital setting with Δ ∇ keys			
Temperature setting min. range	1°C			
Temperature display system	7-segment digital LED			
Sensor	K-thermocouple			
Heater	100V: 1000W 120V: 1440W	200V: 1000W 240V: 1440W	100V: 1000W 120V: 1440W	200V: 1000W 240V: 1440W
Safety functions	Self-diagnosing circuit, temperature error sensor, keypad lock, power failure recovery, overheat prevention (manual return at temperature setting plus 40°C), thermal fuse, micro switch to detect heating without water/oil, circuit protector			
Modes	Constant temperature, Quick auto stop, Auto stop, Auto start, Operation lamp, Maintenance (for selecting operation stop, or heat-retention, when interfaced with RE600/800 units)			
External dimensions	Approx. 340W × 349D × 231H (Height of in-bath: H)			
Bath container dimensions	Approx. 263W × 124H (bottom diameter: ϕ 165)			
Weight	Approx 5.5kg			
Power supply	100V AC, 10.5A 120V AC, 12.5A	200V AC, 5.5A 240V AC, 6.5A	100V AC, 10.5A 120V AC, 12.5A	200V AC, 5.5A 240V AC, 6.5A
Included items	Instruction manual, bath container, power cable			

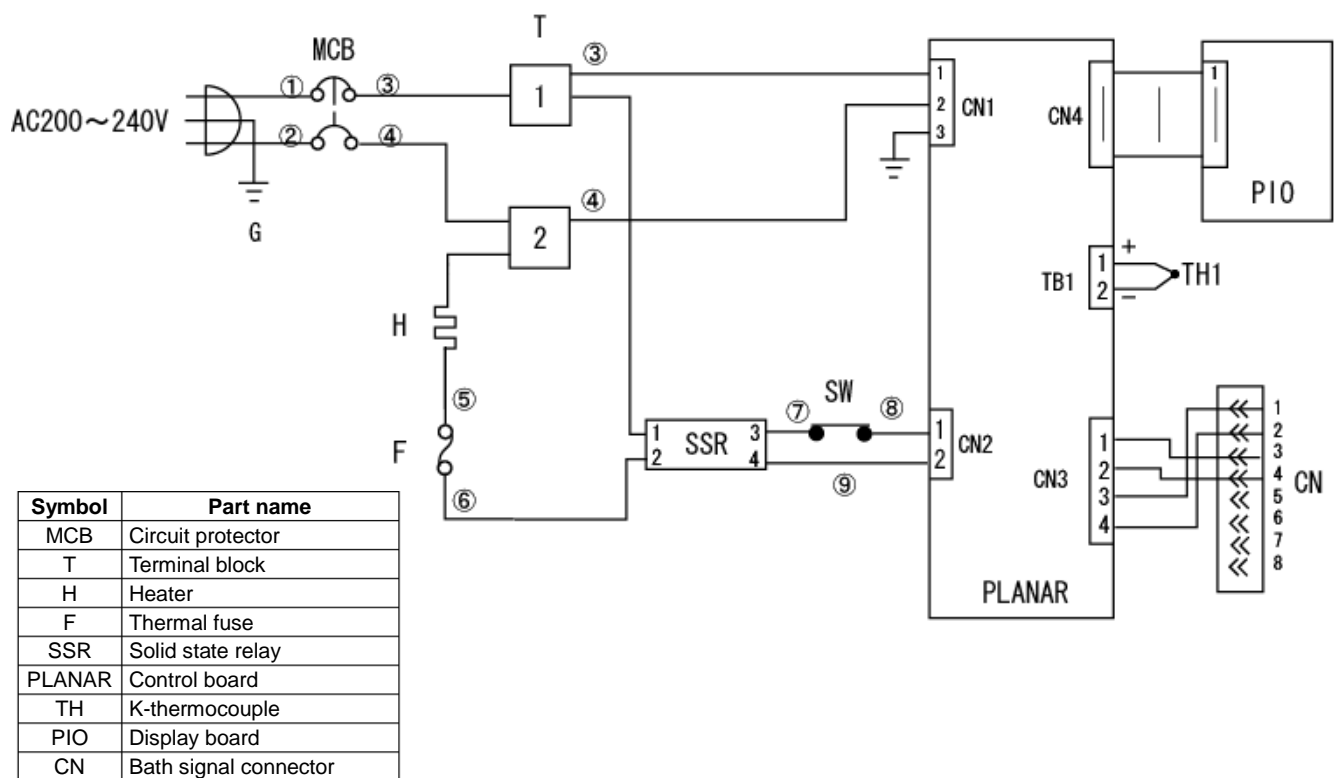
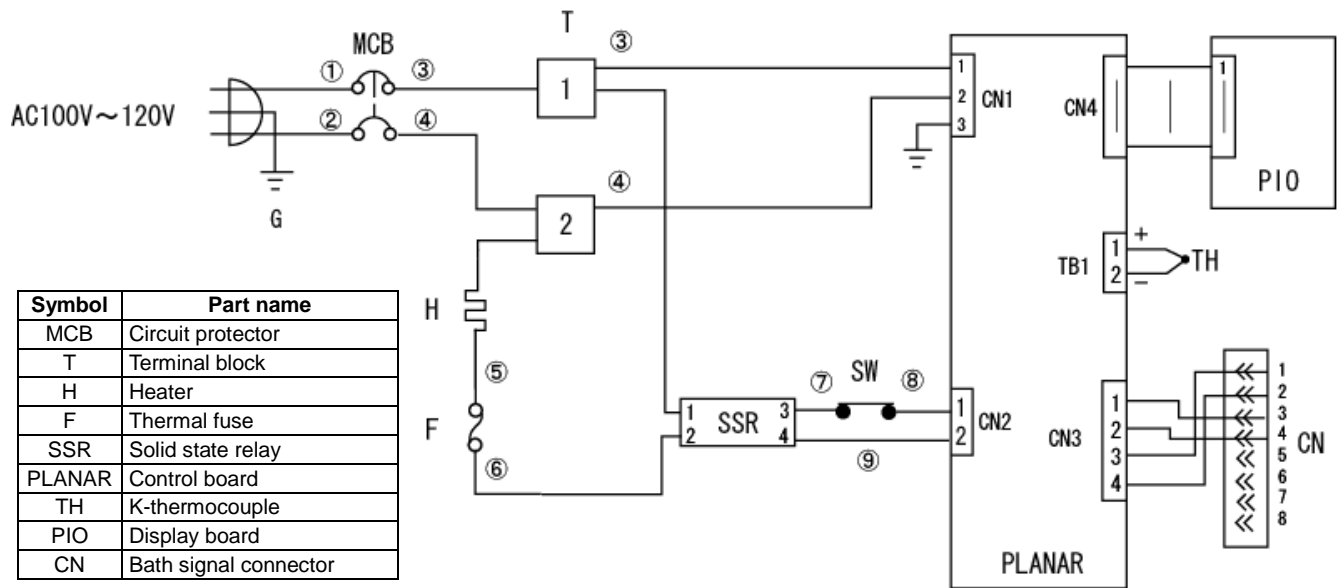
* Performance based on 100V, 120V, 200V and 240V AC power supply, room temp. 23°C±5°C humidity 65%RH±20%. Usable external temperature for unit is 5°C to 35°C.

* Silicon oil TSF485-50, made by Toshiba Silicon Co., Ltd. was used to gauge temperature control accuracy on BO models.

* Protruding components not included in dimension measurements.

11. WIRING DIAGRAM

BM500/510



12. REPLACEMENT PARTS

All models

Part Name	Code No.	Specification	Manufacturer
Micro switch to detect heating without water/oil	LT00015305	D2VW-01L1-1M	OMRON
SSR	LT00014941	S5C-225MV-(S)	Toho Denshi
Control board	LT00013602	BM/BO PLANAR board	Yamato Scientific
Display board	LT00013603	BM/BO display board	Yamato Scientific
Sensor	LT00026845	BM/BO K-thermocouple	Yamato Scientific
Pillar fitting	LT00012102	Φ15×L20 M4	Yamato Scientific

BM500 only

Part Name	Code No.	Specification	Manufacturer
Thermal fuse	LT00036306	128°C G4A50128C	Sakaguchi Dennetsu
Heater	LT00028682	120V 1440W	Yamato Scientific
Circuit breaker	LT00037124	3120-F521-P7T1-W01J-15A	ETA
Power cable	LT00034726		Yamato Scientific

BM510 only

Part Name	Code No.	Specification	Manufacturer
Thermal fuse	LT00036306	128°C G4A50128C	Sakaguchi Dennetsu
Heater	LT00028683	240V 1440W	Yamato Scientific
Circuit breaker	LT00037119	3120-F521-P7T1-W01J-10A	ETA
Power cable	LT00024798		Yamato Scientific

BO400 only

Part Name	Code No.	Specification	Manufacturer
Thermal fuse	LT00036305	192°C G4A50192C	Sakaguchi Dennetsu
Heater	LT00028682	120V 1440W	Yamato Scientific
Cooling fan (BO400)	LT00014943	UF60D-AC115V	AUTONICS
Circuit breaker	LT00037124	3120-F521-P7T1-W01J-15A	ETA
Power cable	LT00034726		Yamato Scientific

BO410 only

Part Name	Code No.	Specification	Manufacturer
Thermal fuse	LT00036305	192°C G4A50192C	Sakaguchi Dennetsu
Heater	LT00028683	240V 1440W	Yamato Scientific
Cooling fan (BO410)	LT00014954	UF60D-AC230V	AUTONICS
Circuit breaker	LT00037119	3120-F521-P7T1-W01J-10A	ETA
Power cable	LT00024798		Yamato Scientific

13. LIST OF HAZARDOUS SUBSTANCES



Never attempt to process explosives, flammables or any items which contain explosives or flammables.

EXPLOSIVE

EXPLOSIVE:	Ethylene glycol dinitrate (nitro glycol), Glycerin trinitrate (nitroglycerine), Cellulose nitrate (nitrocellulose), and other explosive nitrate esters
	Trinitrobenzene, Trinitrotoluene, Trinitrophenol (picric acid), and other explosive nitro compounds
	Acetyl hidroperoxide (peracetic acid), Methyl ethyl ketone peroxide, Benzyl peroxide, and other organic peroxides

FLAMMABLE

COMBUSTIBLE:	Lithium (metal), Potassium (metal), Sodium (metal), Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid compounds, Calcium carbide, Lime phosphate, Magnesium (powder), Aluminum (powder), Powder of metals other than magnesium and aluminum, Sodium hydrosulfite
OXIDIZING:	Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorate
	Potassium perchlorate, Sodium perchlorate, Ammonium perchlorate, and other perchlorate
	Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxide
	Potassium nitrate, Sodium nitrate, Ammonium nitrate, and other nitrate
	Sodium chlorite and other chlorites
INFLAMMABLE LIQUID:	Calcium hypochlorite and other hypochlorites
	Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and other flammable substances having a flash point of lower than -30°C
	Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone, and other flammable substances having a flash point of -30°C or higher but lower than 0°C
	Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and other flammable substances having a flash point of 0°C or higher but lower than 30°C
FLAMMABLE GAS:	Kerosene, Light oil (gas oil), Oil of turpentine, Isopentyl alcohol (isoamyl alcohol), Acetic acid, and other flammable substances having a flash point of 30°C or higher but lower than 65°C
	Hydrogen, Acetylene, Ethylene, Methane, Propane, Butane, and other flammable substances which assume a gaseous state at 15°C and 1 atm

(Source: Appendix Table 1 of Article 6 of the Industrial Safety and Health Order, Japan)

14. SETUP CHECKLIST

* Set unit up according to the following: (Confirm optional items or special specifications separately)

Model	Serial number	Date	Installed by (company or personnel name)	Installation approved by	Assessed by

No.	Item	Procedure	Instruction manual reference	Assessed by
Specifications				
1	Included Items	Confirm actual items against list of included items.	10. Specifications – pg. 36	
2	Installation	<ul style="list-style-type: none"> Visually check the surrounding area. Caution: check for operational hazards. 	2. Pre-operation Procedures – pg. 5	
Operation				
1	Power voltage	<ul style="list-style-type: none"> Measure line voltage (power terminal or outlet) with a voltmeter. Measure line voltage during operation. (must meet required rating). Caution: Confirm outlet rating or breaker power rating meets unit requirements. 	2. Pre-operation Procedures – pg. 7	
			10. Specifications – pg. 36	
2	Operation	<ul style="list-style-type: none"> Start operation. BM: Add water, set the temperature to 50°C, and confirm stability. BO: Add silicon oil, set temperature to 100°C, and confirm stability. 	2. Pre-operation Procedures – pg. 5	
			4. Operation Procedures – pg. 15	
			5. Handling Precautions – pg. 29	
3	Stop Operation	<ul style="list-style-type: none"> Stop operation. BO: Notify surrounding personnel of high oil temperature, and complete installation. 	4. Operation Procedures – pg. 15	
			5. Handling Precautions – pg. 29	
Orientation				
1	Operational Descriptions	Explain unit operation as written in instruction manual.	1. Safety Precautions ~ 13. List of Hazardous Substances pgs. 1~40	
2	Error code	Explain function of each component as written in instruction manual.	8. Troubleshooting ~ 9. Service & Repair – pgs. 33~35	
3	Maintenance & Inspection	Explain of inspection and maintenance procedure as written in instruction manual.	6. Maintenance Procedures – pg. 31	
4	Installation Data Entry Completion	<ul style="list-style-type: none"> Fill in installation date and name of installing personnel or company on unit "OK and Service Sticker". Explain how to contact technician. 	9. Service & Repair – pg. 35	

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death, resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure on BM/BO units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Note

- ◆ Instruction manual descriptions and specifications are subject to change without notice.
- ◆ Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.

Instruction Manual

**Water Bath
Model BM500/510**

and

**Oil Bath
Model BO400/410**

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