



Laboratory Drying Sterilizer

SK401/601/801/811

Instruction Manual

Second Edition

- Thank you for choosing SK Series Laboratory Drying Sterilizers by 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 Co., Ltd.

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1. SAFETY PRECAUTIONS

Explanation of 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



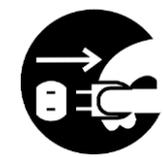
General Action Required



Connect Ground Wire



Level Installation Required



Disconnect Power



Inspect Regularly

1. SAFETY PRECAUTIONS

Warnings and Cautions

Warning



Never operate equipment near combustible gases/fumes.

Do not install or operate SK series unit 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.55).



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 (Earth Leakage Breaker - "ELB") 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.



DO NOT disassemble or modify equipment.

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



DO NOT touch hot surfaces.

Some surfaces on this unit become extremely hot during operation. Exercise vigilance in order to avoid getting burned.



DO NOT insert multiple power cables into a single outlet.

Inserting multiple cords into a single outlet, using branch outlets or extension cords, may cause power cable to overheat and/or catch fire. Other issues may include a drop in voltage, which may affect performance, resulting in failure to control or maintain proper temperatures.

Caution



DO NOT operate equipment during thunderstorms.

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

2. PRE-OPERATION PROCEDURES

Installation Precautions & Procedures

1. Choose an appropriate installation site.

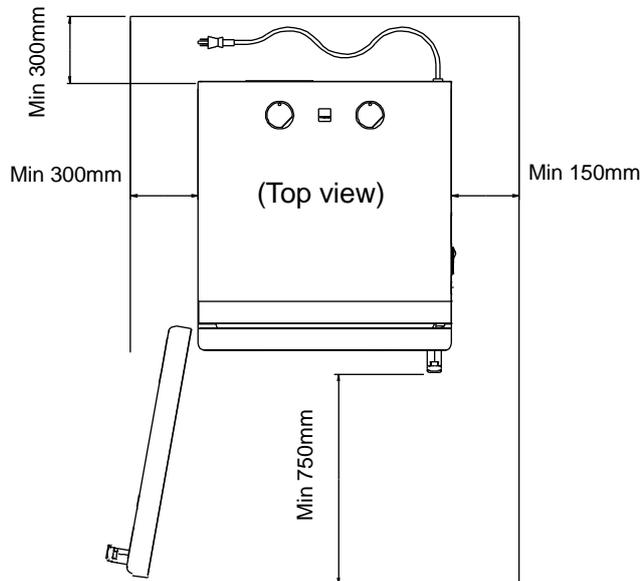


Do not install SK series unit:

- where flammable or corrosive gases/fumes will be generated.
- where exterior 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.



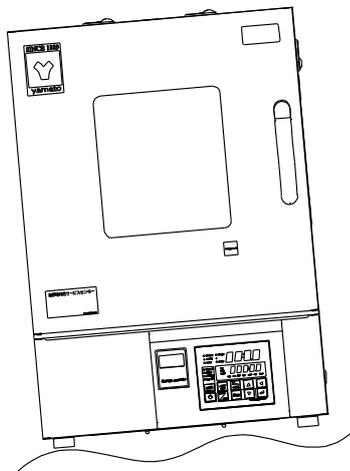
Install SK series units in a location with sufficient space and ventilation as specified as below.



2. Install on a level surface.



Install unit on a level and even surface. Failure to do so may result in abnormal vibrations or noise, possibly causing complications and/or malfunction.



Approximate unit weight:

SK401: approx.50 kg, SK601: approx.62kg, SK801/811: approx.108kg

Handle with care. Transportation and installation should always be done by two or more people.

2. PRE-OPERATION PROCEDURES

Installation Precautions & Procedures

3. Install in a safe location.



In the event of an earthquake or other unforeseen incident, equipment may unexpectedly shift or fall, causing injury. Taking preventative steps to install unit in a safe location, away from room access doors and out of other danger is strongly recommended.

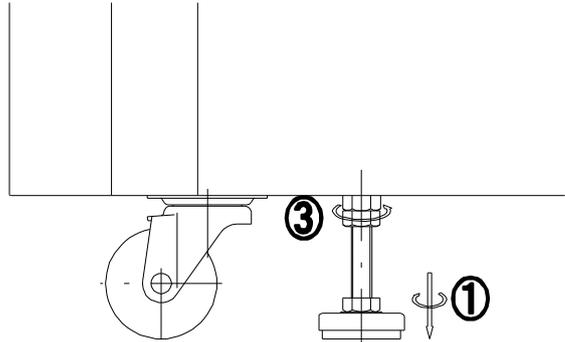
4. Position adjustable leveling feet (SK801/811)



Position the 2 (two) adjustable leveling feet, located on the undercarriage of SK801/811 units.

After unit is installed, position the adjustable leveling feet using the following procedure:

- ① Rotate leveling feet down until unit stands securely on the floor.
- ② Check for any gaps between the floor and 4 (four) contact points (e.g. the 2 'two' front leveling feet and the 2 'two' rear casters).
- ③ Once unit is secure, tighten both leveling feet stop nuts firmly against the topmost nut, to prevent leveling feet from turning under vibration.



5. Install in a well-ventilated area.

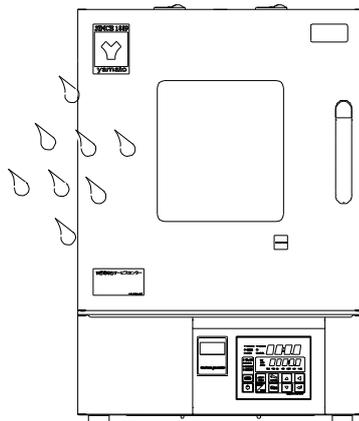


Install unit so that side panel heat vents (see P.9~10 for location) are unobstructed and allowed to sufficiently diffuse heat. Failure to do so may result in excessive temperatures inside the unit control panel, causing possible degraded CPU board performance, malfunction or fire. See installation specifications above.

6. Install in a dry location.



Install unit where it will be free from liquid spray and other moisture. Failure to do so may result in control mechanisms becoming wet, causing malfunction, electrical shock and/or fire.



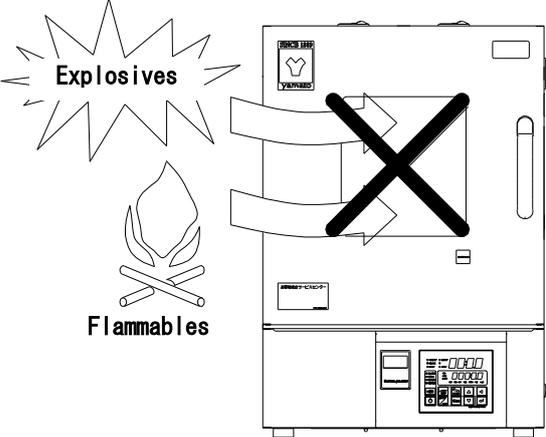
2. PRE-OPERATION PROCEDURES

Installation Precautions & Procedures

7. 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 (ELB) "ON" or "OFF" can produce a spark, which could relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes. See "List of Hazardous Substances" (P.55).

⚠



The diagram shows a front view of a rectangular unit with a control panel at the bottom. A large black 'X' is drawn over the unit, indicating it should not be installed near hazardous materials. To the left of the unit, there are two hazard icons: a starburst labeled 'Explosives' and a flame labeled 'Flammables'.

8. Connect to power supply.

⚠ Connect power cable to a suitable facility outlet or terminal, according to the following electrical requirements.

Electrical requirements:	SK401	AC100V 50/60Hz	12.5A	or more
	SK601	AC100V 50/60Hz	14.1A	or more
	SK801	AC100V 50/60Hz	24.5A	or more
	SK811	AC200V Single phase 50/60Hz	12.5A	or more

※Check the line voltage on outlet or terminal to be used and properly evaluate whether to utilize a line being shared by other equipment. If the unit is not activated by turning on the main power switch (ELB), take an appropriate course of action, such as connecting the unit to a dedicated power source.

※Multiple power cables connected to a single outlet may cause unit input voltage to drop, resulting in degraded heating and temperature control performance.

9. Handle power cable with care.

⊘ 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 main power switch (ELB) 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. PRE-OPERATION PROCEDURES

Installation Precautions & Procedures

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

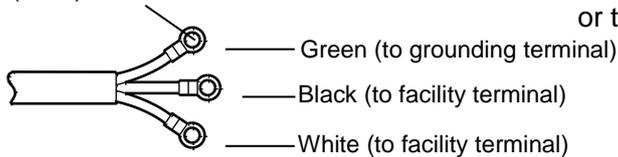
* Grounding to Electrical Equipment Technical Standards, Section 19, class D (Grounding Resistance Max. 100Ω) is required in Japan where no grounding terminal is provided. Contact a local dealer, electrician, or Yamato Sales office for location-specific electrical requirements.

* Connect terminals securely to facility terminal or to an appropriate connector.



3(three) Round Terminal for M5 screws

Plugs and connectors are not included with this unit. Ground unit properly to facility outlet or terminal as required.



Never connect ground wire to gas lines, water pipes, telephone grounding lines or lightning rods. Doing so may result in fire or electrical shock.

11. Observe wire color designation when connecting to facility terminal.



Confirm that the facility main breaker is OFF before connecting the round terminals from the power cable. No power plugs or connectors of any kind are included with SK801/811 units. Where required, purchase an appropriate plug and properly connect using the round terminals.

Color	Facility
Black	Live side
White	Neutral side
Green	Ground

12. **DO NOT** disassemble or modify.



Attempting to disassemble or modify this unit in any way may result in malfunction, fire or electric shock.



2. PRE-OPERATION PROCEDURES

Installation Precautions & Procedures

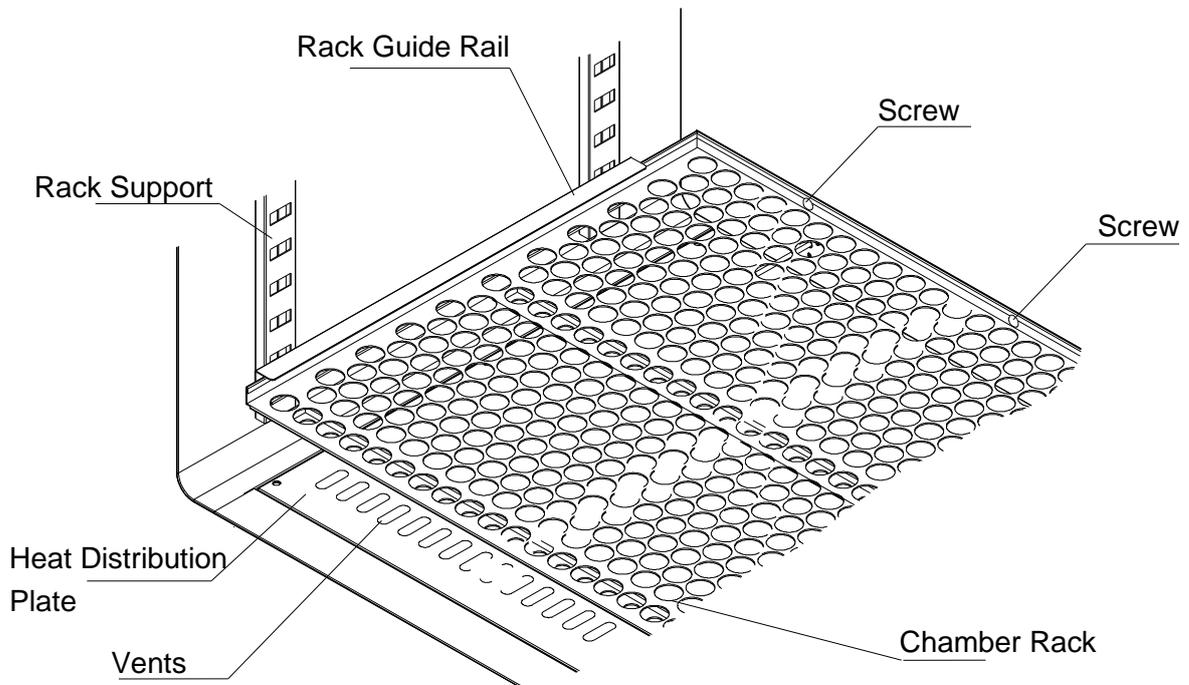
13. Heat distribution plate



The SK401/601 and SK801/811 include two and four chamber racks respectively, with one of the racks secured into place at the lowest position with screws. This is to provide added stability during transport and to discourage placing items directly on top of the heat distribution plate (chamber floor). Other supplied racks may be arranged as desired.

Unit heaters are installed directly under the the distribution plate, making temperatures immediately surrounding the plate typically higher than the selected temperature setting. Placing samples directly on distribution plate will damage samples/specimens and may cause a fire.

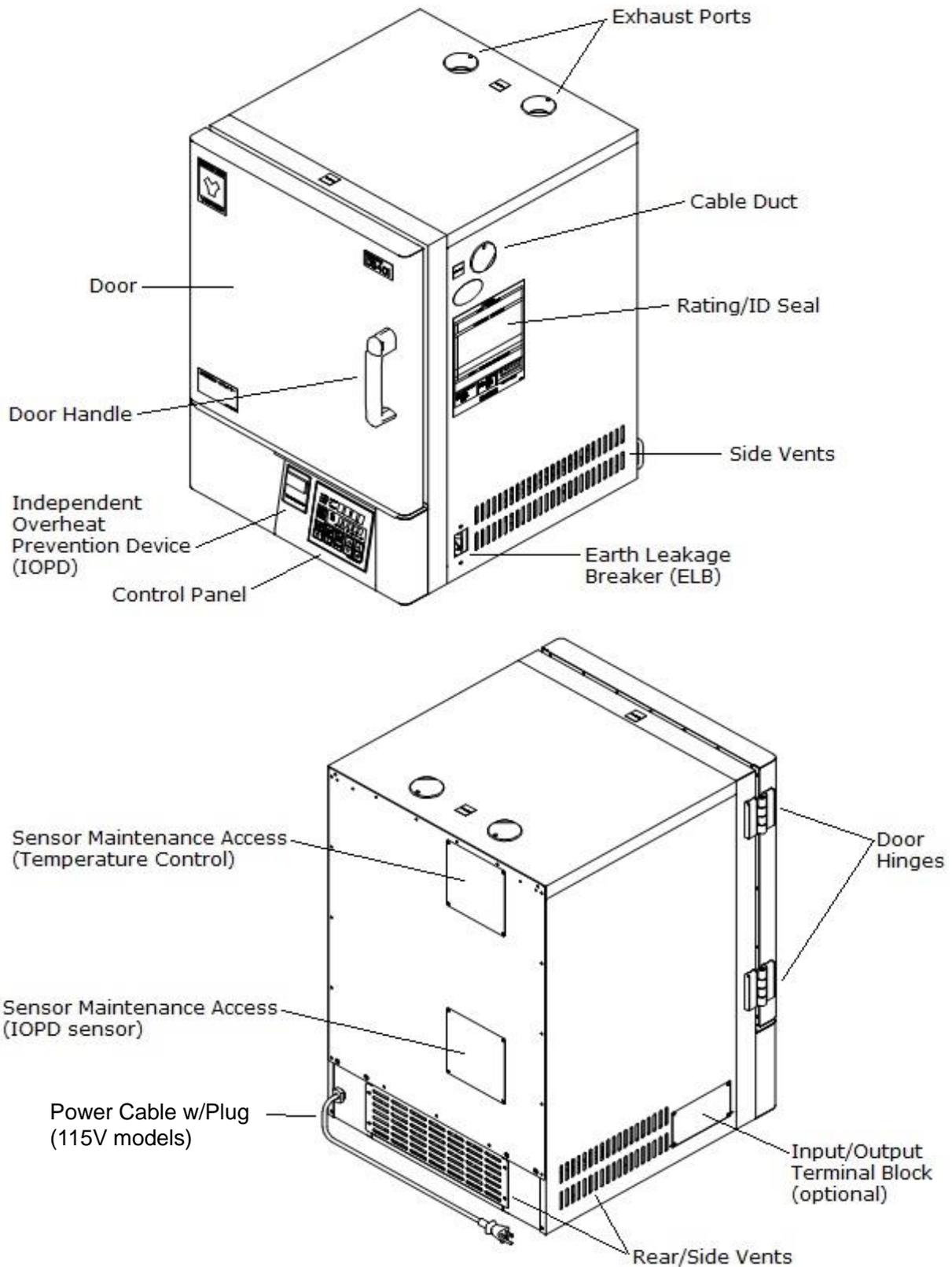
Likewise, if distribution plate vents are covered by specimens or other items, proper temperature control will not be possible, and may result in burned/damaged samples and fire possibly causing serious injury or death. Always place test samples/specimens on the provided chamber racks, never directly on top of the heat distribution plate.



3. COMPONENT NAMES AND FUNCTIONS

Unit Overview 1

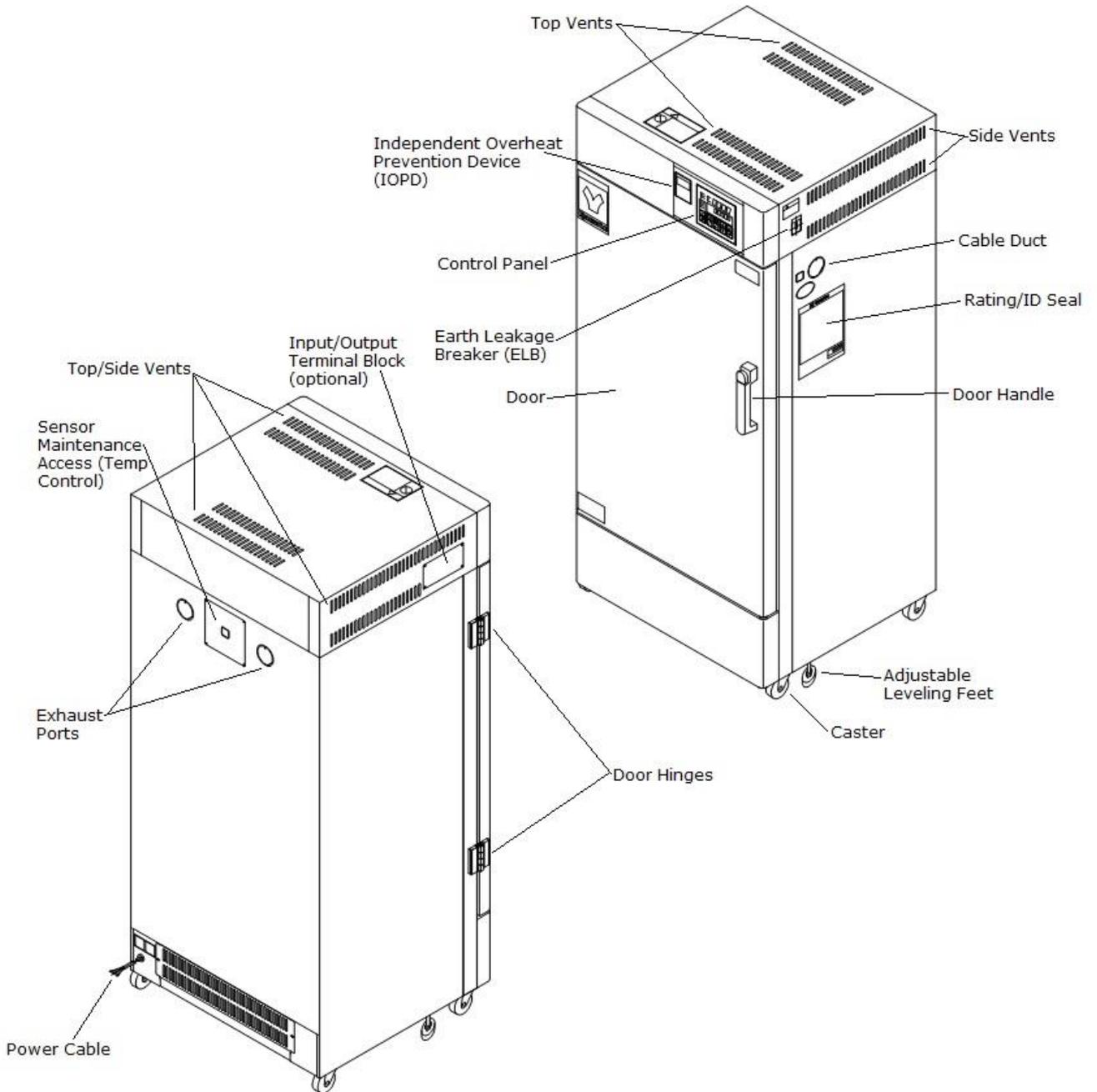
SK401/611



3. COMPONENT NAMES AND FUNCTIONS

Unit Overview 2

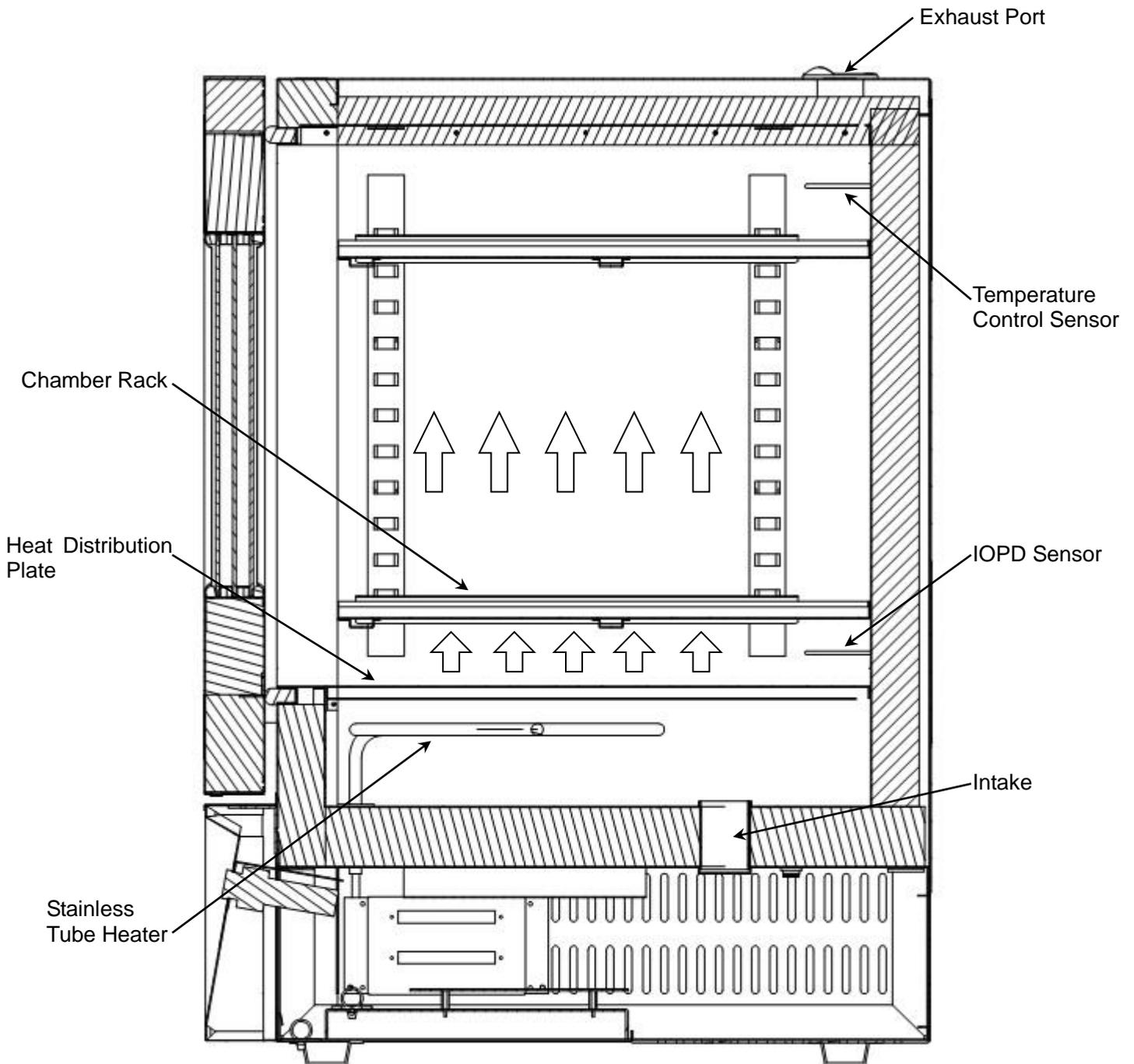
SK801/811



3. COMPONENT NAMES AND FUNCTIONS

Main Unit Structure & Function

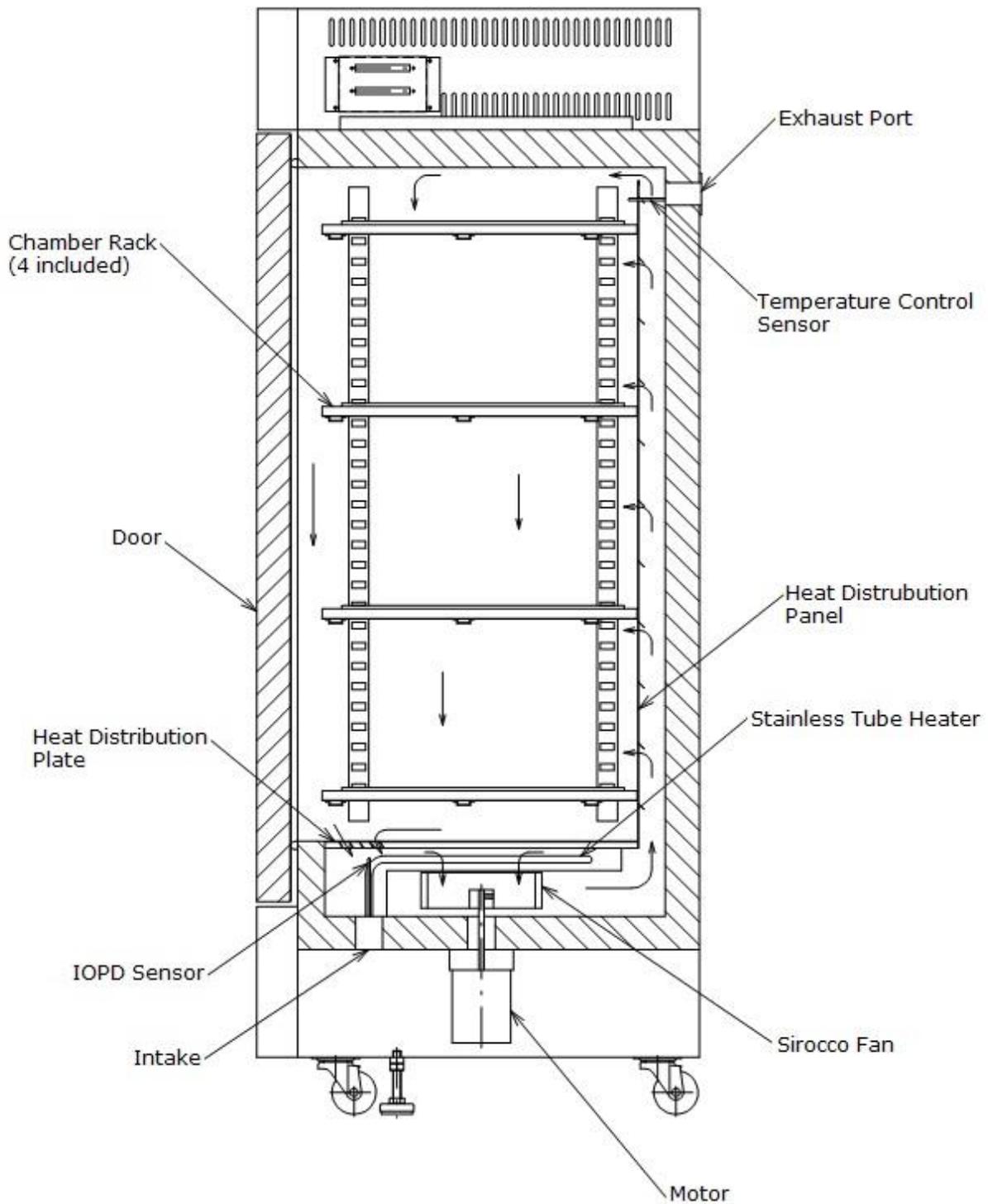
SK401/611



3. COMPONENT NAMES AND FUNCTIONS

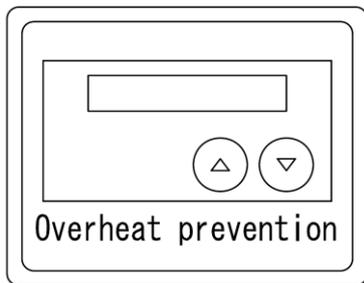
Main Unit Structure & Function

SK801/811

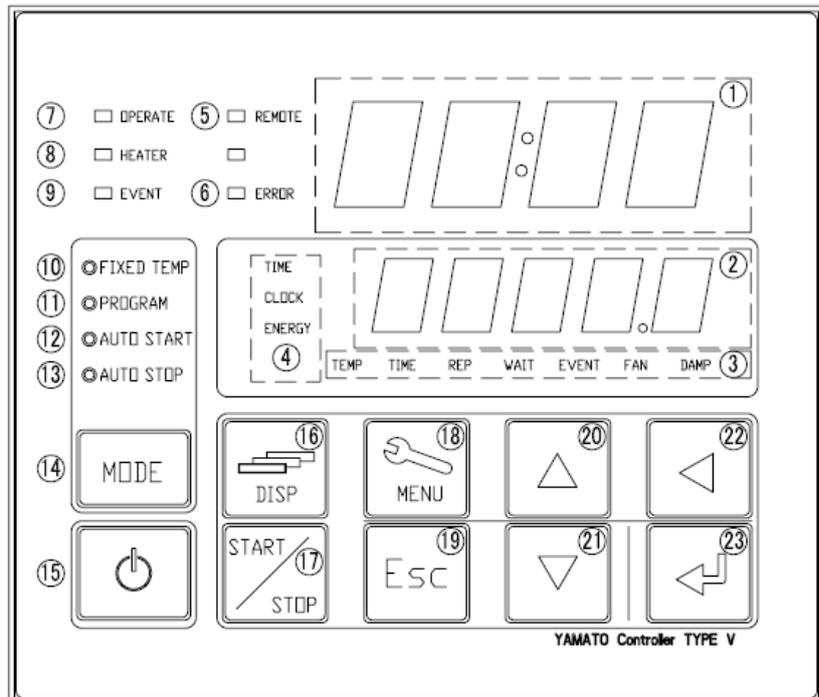


3. COMPONENT NAMES AND FUNCTIONS

Control Panel



24



No	Name	Description
1	Upper Display	Readout for temperature reading (current chamber temp), error codes, etc.
2	Lower Display	Readout for temperature setting, clock, timer, etc.
3	Function Indicator Lamps	Illuminates (one or more) to show which function is currently running or active
4	Mode Indicator Lamps	Illuminates (only one) to show which mode is currently running.
5	REMOTE Indicator Lamp	Illuminates while remote comm (optional item) transmission is in progress.
6	ERROR Indicator Lamp	Illuminates when an error occurs.
7	OPERATE Indicator Lamp	Illuminates during operation. Flashes in operation standby mode.
8	HEATER Indicator Lamp	Illuminates when heaters are receiving power.
9	EVENT Indicator Lamp	Illuminates when event output (optional item) is transmitted.
10	FIXED TEMP Indicator Lamp	Illuminates during constant temperature operation.
11	PROGRAM Indicator Lamp	Illuminates during programmed operation. Flashes while entering program settings.
12	AUTO START Indicator Lamp	Illuminate during auto start operation.
13	AUTO STOP Indicator Lamp	Illuminates during auto stop operation.
14	MODE key	Press to switch between operation modes, ⑩~⑬ on control panel.
15	POWER key	Press and hold to switch between unit idle and unit standby.
16	DISP key	Press to switch between monitoring options in lower display.
17	START/STOP key	Press to start or stop an operation.
18	MENU key	Press to switch between setting options.
19	Esc key	Press to return to previous menu without finalizing settings.
20	▲(Up) key	Press to increase setting value.
21	▼(Down) key	Press to decrease setting value.
22	◀ key	Press to move cursor left.
23	ENTER key	Press to finalize setting items.
24	Independent Overheat Prevention Device	Set device to keep unit from exceeding a certain temperature.

4. OPERATION PROCEDURE

Prior Confirmation

- (1) Power source and ground wire
Be sure to connect power cable to an appropriate power source and confirm that ground wire is connected.
- (2) Main power switch (ELB)
Turn ELB ON.
Test ELB function once a month or before extended operation. See "Maintenance Procedures" (P.43) for details.
Check the lower display on the control panel when ELB is turned on and confirm it is showing current time.
- (3) Independent Overheat Prevention Device (IOPD)
Be sure to set IOPD temperature 20°C over the chamber temperature setting.
Test IOPD function before each instance of extended operation. See "Maintenance Procedures" (P.43) for details.
- (4) Exhaust port
Adjust exhaust port aperture as needed to regulate exhaust volume. When utilizing unit as a dryer, the exhaust port is typically left open 1/3 of the way. When utilized as a constant temperature oven, the exhaust port is typically closed. Do not operate unit with exhaust ports fully open. If unit is to be run at high temperature, use caution when opening/closing cable duct and exhaust ports. Both will be extremely hot.

4. OPERATION PROCEDURE

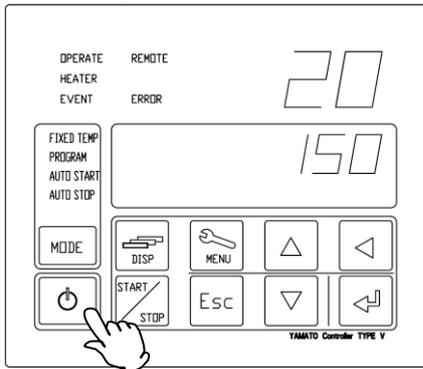
Date & Time Setting

The backup battery installed in SK series units is a wear item and has an estimated life of approximately 5 years. Replacing battery within the 5-year lifespan is recommended.

※ Contact a local dealer or Yamato sales office to request a replacement battery. If unit has program data in memory, make a data backup file before replacing backup battery. See “Data Backup” (P.35) in this section for details.

To set the current date & time, after replacing backup battery, follow the steps below.

1 Turn on power.

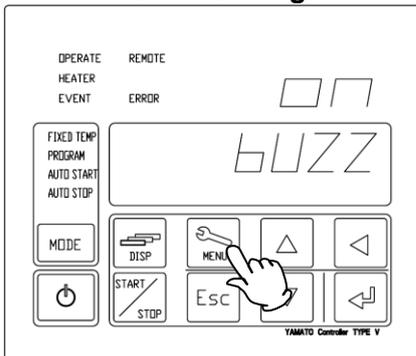


Turn ON the main power switch (ELB), located on the right panel of the SK series units.

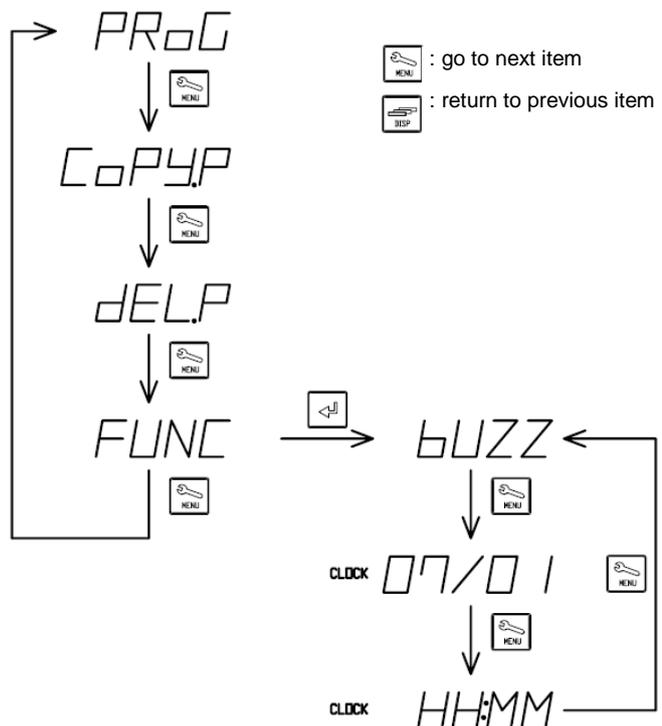
Lower display on the control panel will show the time. This indicates that the machine is in “idle”.

Press and hold to display the standby screen. Upper display shows current temperature in the chamber while lower display shows current temperature setting. This indicates that the machine is in “standby”.

2 Go to date/time setting menu.



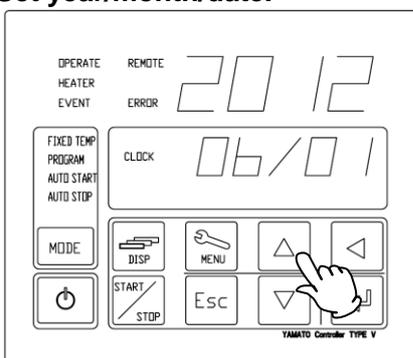
- ① Press .
- ② Press repeatedly until FUNC is shown in lower display. Press . OFF and BUZZ show in upper and lower displays respectively.
- ③ Press . Year shows in upper display. Month/date shows in lower display. CLOCK indicator lamp flashes.



4. OPERATION PROCEDURE

Date & Time Setting

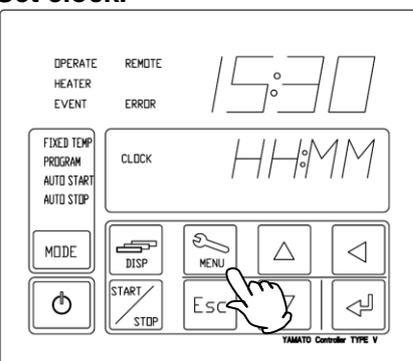
3 Set year/month/date.



Setting the year/month/date and clock.

- ① Year and month/date are shown on upper and lower displays respectively.
- ② Press . Settable value begins flashing.
- ③ Set calendar year with and . Press .
- ④ Set month/date with and . Press .

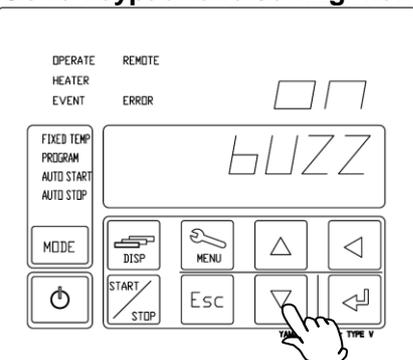
4 Set clock.



- ① Press .
- ② Press . Set clock time with and (24-hour time system only). Press .
- ③ Press twice to return to initial screen, when time/date settings are completed.

Keypad Tone Function

1 Go to keypad tone setting menu.

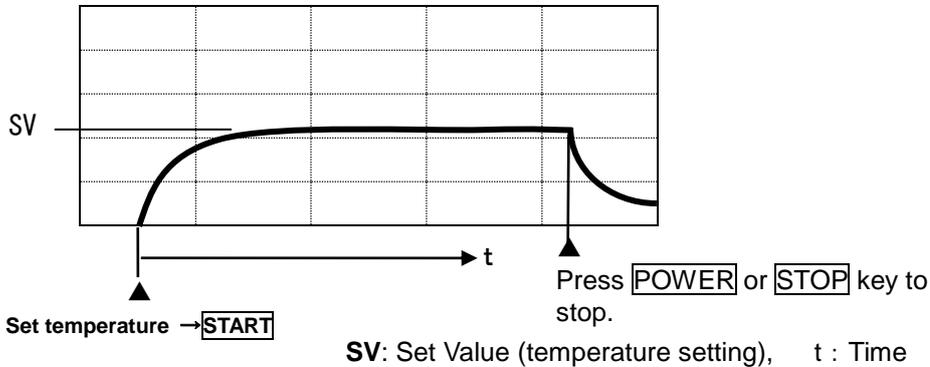


- ① Press repeatedly until FUNC is shown, then press to bring up BUZZ in lower display. Press . oFF begins flashing in upper display
- ② Select one of three keypad tone modes using and press .
 - on: Activates tone for all keys. (factory default).
 - CLK: Activates tone for POWER and ENTER keys only.
 - oFF: Deactivates tone for all keys.
- ③ Press twice to return to initial screen, when time/date settings are completed.

4. OPERATION PROCEDURE

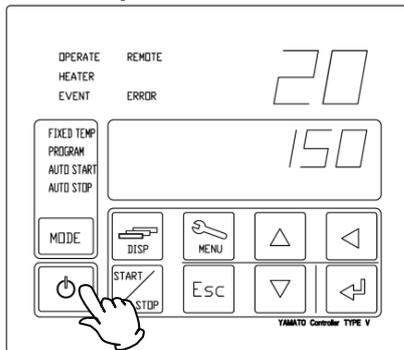
Constant Temperature Operation

FIXED TEMP (constant temperature) mode runs SK series unit at a constant selected temperature until START/STOP key is pressed, manually terminating operation.



Setting constant temperature mode.

1 Turn on power.

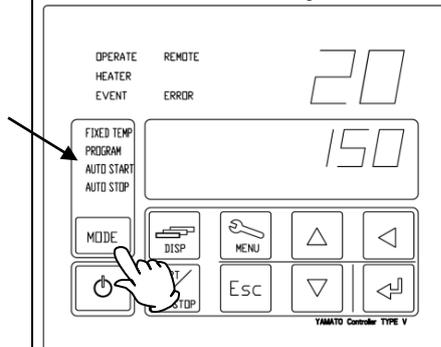


Turn on main power switch (ELB) (idle).

Press and hold to turn on power. (standby)

Chamber temperature is shown in upper display, Temperature setting is shown in lower display.

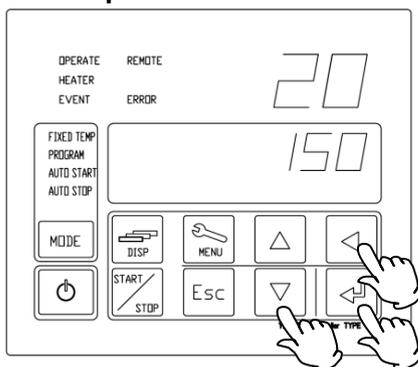
2 Select constant temperature mode.



Press repeatedly until FIXED TEMP indicator lamp comes on.

※Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

3 Set temperature.



① Press . Changeable digits flash in lower display.

② Switch between digits using and change value using .

Working temperature range:

0~260°C (SK401/601)

0~210°C (SK801/811)

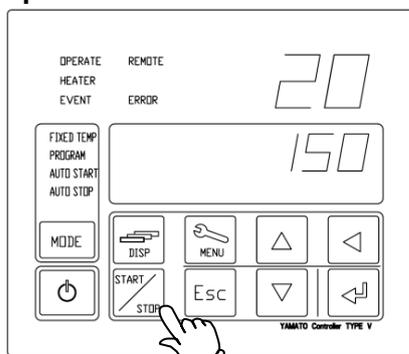
③ Press after temperature setting has been entered.

Press once or twice to cancel setting.

4. OPERATION PROCEDURE

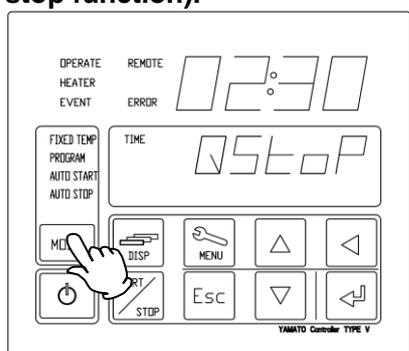
Constant Temperature Operation

4 Start/stop constant temperature operation.



- ① Press key to start or stop constant temperature operation.

5 Stop constant temperature operation using timer (quick auto stop function).

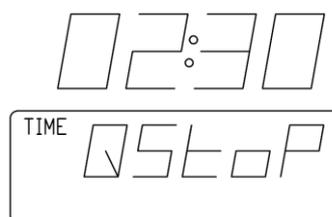


The quick auto stop function is used to automatically stop constant temperature operation at a certain time or after a certain time has passed. **(decided during operation).**

- ① Press while constant temperature operation is in progress.
- ② QStoP shows in lower display. Start [TIME] lamp flashes.
- ③ Select TIME/CLOCK (timer or clock) with and press .
- ④ Set TIME (setting range: 0~99hr : 59min) or CLOCK (24-hour time system only) in upper display and press .
- ⑤ "ENd" appears in lower display and operation stops when timer reaches 0 or when clock reaches time setting.
- ⑥ Press to clear "ENd".

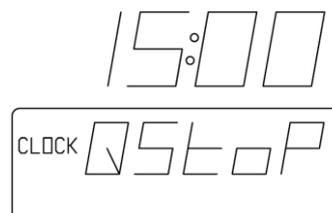
Example 1. Timer:

Operation is automatically stopped, 2 hours and 30 minutes **after temperature setting is reached.**



Example 2. Clock:

Operation is automatically stopped at 3:00PM **regardless of when temperature setting is reached.**



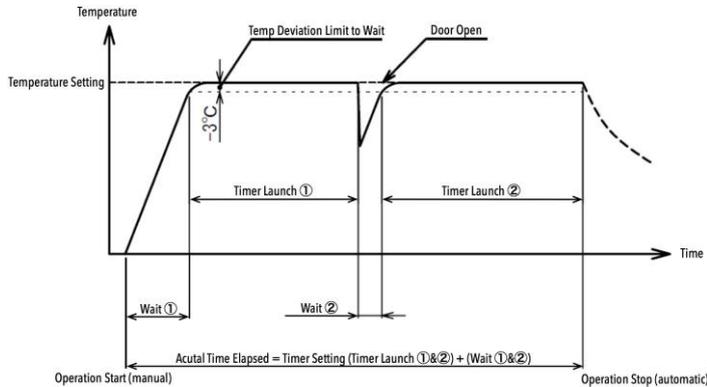
※Press to monitor remaining time during operation, if necessary.

4. OPERATION PROCEDURE

Auto Stop Operation

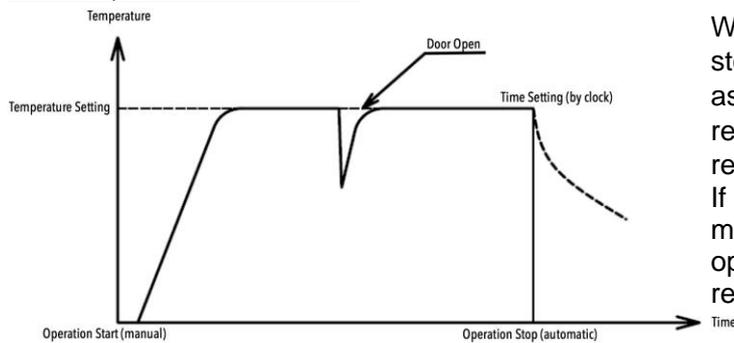
AUTO STOP (Automatic Stop) utilizes timer or clock to automatically stop an operation. Operation must be started manually. See below.

Auto stop mode set to timer:



When auto stop mode is set to the timer, unit enters a wait period, and remains “waiting” without counting down time until chamber temperature is within a set deviation range ($-3^{\circ}\text{C} \sim +6^{\circ}\text{C}$) of the temperature setting. Countdown begins once chamber temperature is within the deviation range. If temperature drops below or exceeds the deviation range after stabilizing, such as when door is opened, allowing heat to escape; countdown stops and unit once again enters wait period until heat builds to within deviation range once again.

Auto stop mode set to clock:

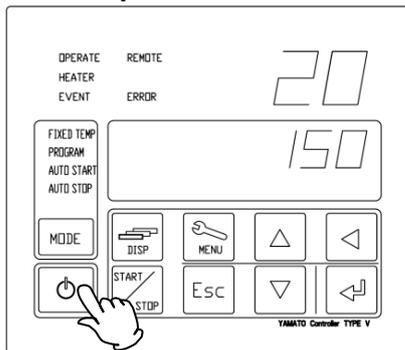


Wait function does not operate when auto stop mode is set to the clock. Operation stops as soon as clock and set time agree, regardless of when temperature setting is reached.

If a power failure occurs while auto stop mode is set to clock, unit will recover operation automatically when power is restored and run until stop time.

Setting automatic stop mode

1 Turn on power

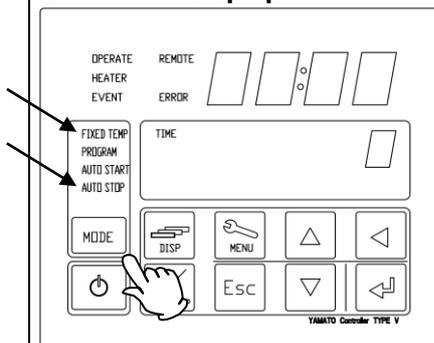


Turn on main power switch (ELB) (idle).

Press and hold  to turn on power (standby).

Chamber temperature is shown in upper display.
Temperature setting is shown in lower display.

2 Select auto stop operation



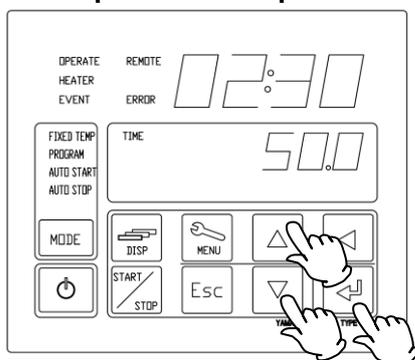
Press  repeatedly until both the FIXED TEMP (constant temperature mode) and AUTO STOP (automatic stop mode) indicator lamps are illuminated.

※ Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

4. OPERATION PROCEDURE

Auto Stop Operation

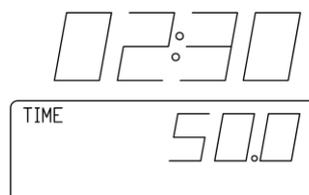
3 Set temperature and operation time.



- ① Press .
- Select TIME/CLOCK using and press .
- ② Enter TIME (setting range: 0~99hr : 59min) or CLOCK (24-hour time system only) setting in upper display and press .
- ③ Enter temperature in lower display and press .

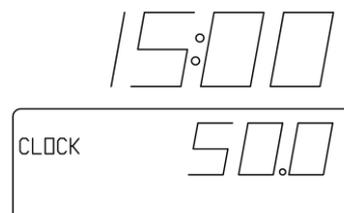
Example 1. Timer:

Operation is automatically stopped 2 hours and 30 minutes **after chamber temperature reaches 50°C temperature setting.**

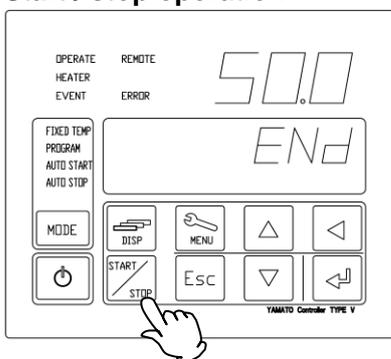


Example 2. Clock:

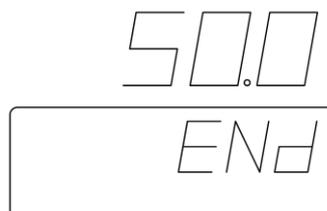
Operation is automatically stopped at 3:00 p.m. **regardless of when target temperature is reached.**



4 Start / stop operation



- ① Press to start or stop operation.
- ⑦ "END" appears in lower display and operation stops when timer reaches 0 or when clock reaches time setting:



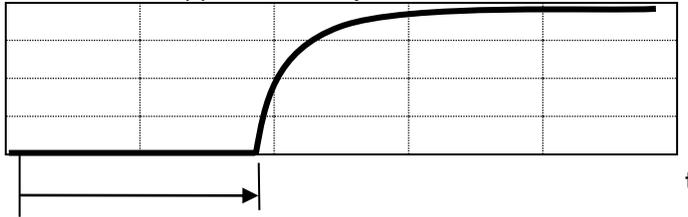
- ② Press to clear "END".

※ Press to monitor remaining time during operation, if necessary.

4. OPERATION PROCEDURE

Auto Start Operation

AUTO START (Automatic Start) mode utilizes timer or clock to automatically begin an operation. Operation must be stopped manually.

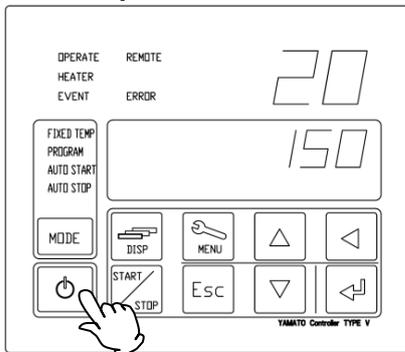


Timer countdown start

Start operation (automatically)

Setting auto start mode

1 Turn on power

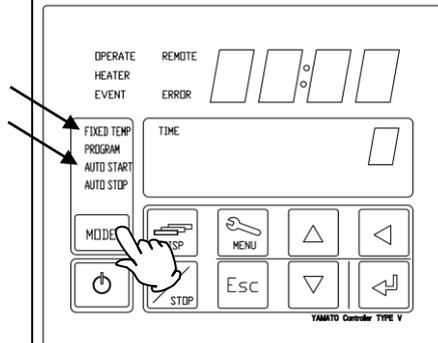


Turn on main power switch (ELB) (idle).

Press and hold to turn on power (standby).

Chamber temperature is shown in upper display. Temperature setting is shown in lower display.

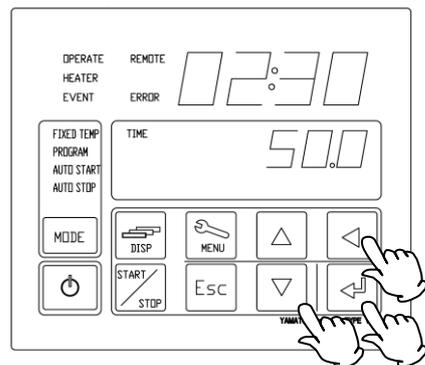
2 Select auto start mode



Press repeatedly until both FIXED TEMP (constant temperature mode) AUTO START (automatic start mode) lamps illuminate.

※Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

3 Set temperature and time.



① Press .

Select TIME/CLOCK using and press .

② Enter TIME (setting range: 0~99hr : 59min) or CLOCK settings (24-hour time system only) in upper display and press .

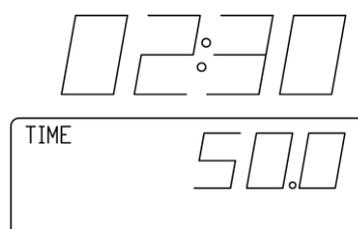
③ Enter temperature in lower display and press .

4. OPERATION PROCEDURE

Auto Start Operation

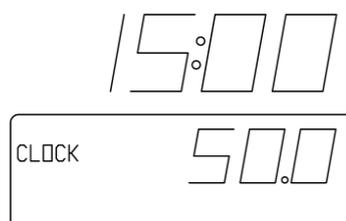
Example 1. Timer:

Operation will automatically begin 2 hours and 30 minutes, after the  key is pressed.

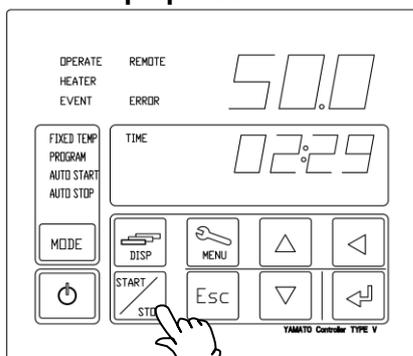


Example 2. Clock:

When  is pressed, operation is set to begin automatically at 3:00p.m.

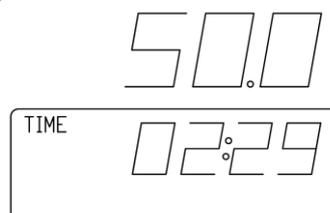


4 Start /stop operation



④ Press  to enter standby (wait) mode.

⑤ The OPERATE indicator lamp will begin flashing and timer countdown or clock time will show in the lower display.



※ Temperature reading (chamber temp) will be shown in upper display. Timer countdown or clock will show in lower display, depending on which mode was selected to count down to start time.

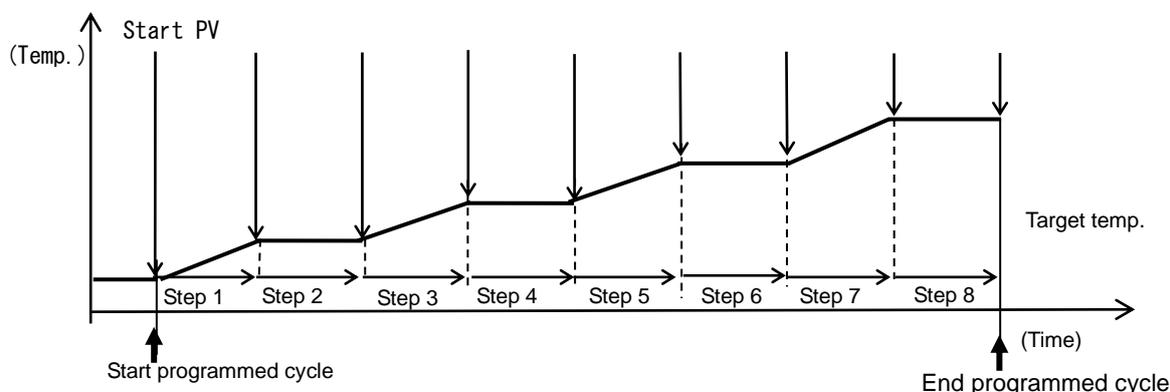
⑥ Press  to stop operation at any time.

※ Press  to monitor remaining time during operation, if desired.

4. OPERATION PROCEDURE

Programmed Operation

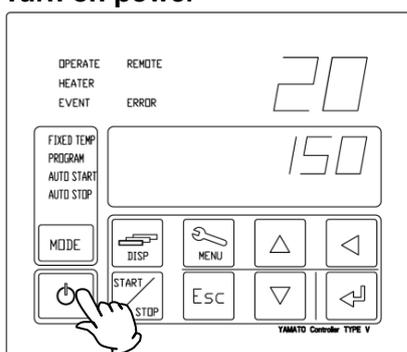
PROGRAM mode runs a combination of times and temperatures in a series of programmed steps as one operation. See below.



PV: Process Value

Entering programs

1 Turn on power



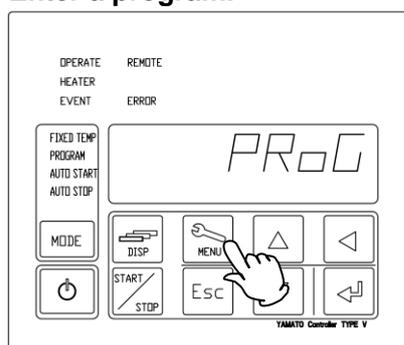
Turn on main power switch (ELB) (idle).

Press and hold  to turn on power (standby).

Chamber temperature is shown in upper display.
Temperature setting is shown in lower display.

* Enter a target program prior to running first cycle.

2 Enter a program.



Program steps entered and program patterns saved may not exceed 99 in total.

Example:

Up to 11 program patterns with a maximum of 9 programmed steps each may be saved.

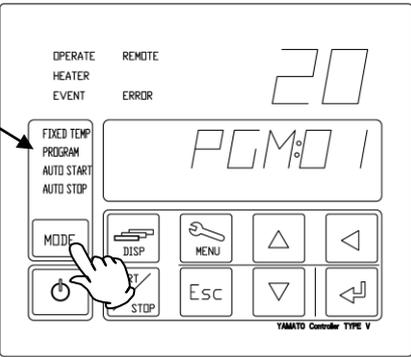
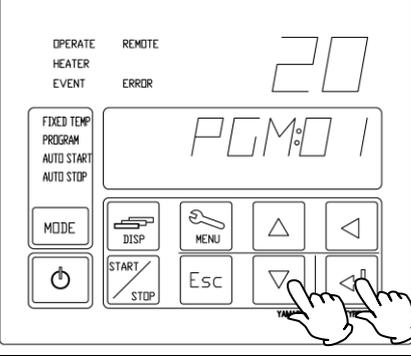
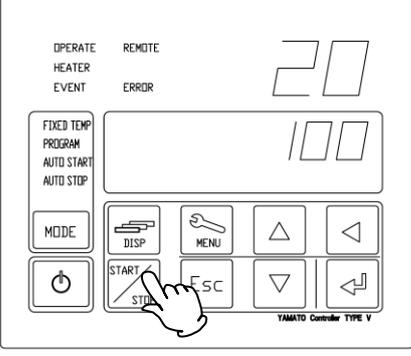
※Note when using "program repeat function":

It is not possible to cut into and repeat process steps, in part (crossing) or in full (reduplication), from anywhere upstream in a program pattern, while programmed operation is in progress.

See "Programming Procedure" (P.26) for details on program entry.

4. OPERATION PROCEDURE

Programmed Operation

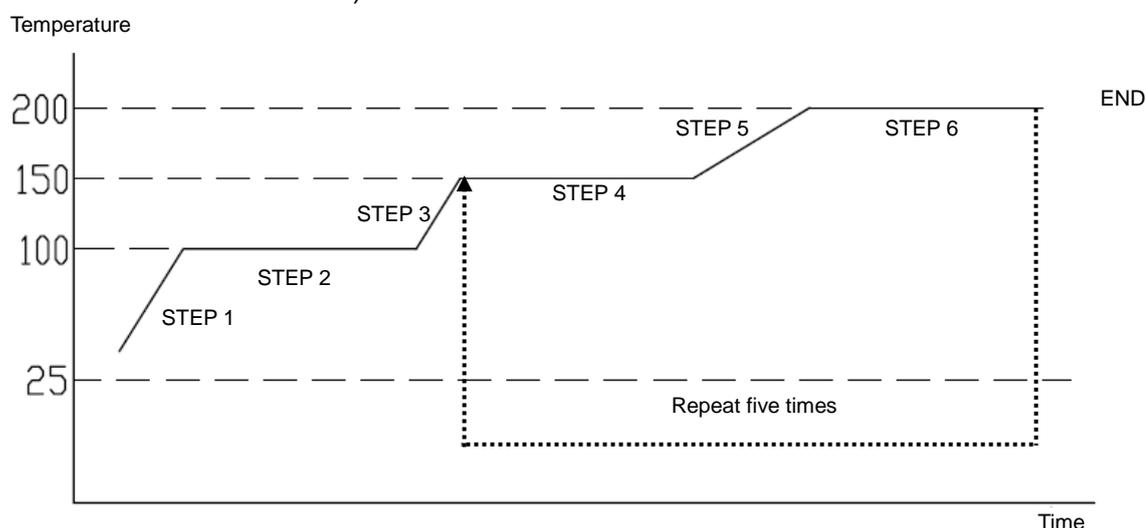
<p>3 Select program mode</p>  <p>The diagram shows a control panel with a top display showing '20' and a bottom display showing 'PGM:01'. A hand icon is pointing to the 'MODE' button. The panel includes buttons for 'OPERATE', 'REMOTE', 'HEATER', 'EVENT', 'ERROR', 'FIXED TEMP', 'PROGRAM', 'AUTO START', 'AUTO STOP', 'MODE', 'DISP', 'MENU', 'START/STOP', 'Esc', and directional arrows.</p>	<p>Press MODE repeatedly (if necessary) until PROGRAM indicator lamp illuminates.</p> <p>“PGM:XX” will show in lower display (last program entered or last program used will always be the one shown in the display on start-up).</p> <p>※Fixed temperature mode is the factory default setting and will be the mode selected on first-time startup. On all subsequent operations, the last mode run is shown on startup.</p>
<p>4 Select program pattern number</p>  <p>The diagram shows the same control panel as in step 3. A hand icon is pointing to the '01' button on the keypad. The bottom display still shows 'PGM:01'.</p>	<p>Press 01. “01” flashes in the lower display. Select the desired program pattern number with ▲ ▼ and press 01.</p>
<p>5 Start program mode</p>  <p>The diagram shows the same control panel as in step 4. A hand icon is pointing to the 'START/STOP' button. The bottom display now shows '100'.</p>	<p>Press START/STOP to start programmed operation.</p> <p>※If the “end” setting is left out on the final step of a program pattern, the entire program will not run. If newly entered programs fail to run, confirm that all settings have been entered correctly.</p>

4. OPERATION PROCEDURE

Programming Procedure

Building & entering new programs.

Example 1: Program pattern below has 6 steps and contains a repeat cycle which repeats steps 4 to 6, five times and ends (STEP1,2,3→STEP 4, 5 and 6→repeat steps 4~6 five times→END).



Program criteria:

STEP1 : Set 100°C, 0 minute, wait ON

STEP2 : Set 100°C, 2 hours, wait OFF

STEP3 : Set 150°C, 0 minute, wait ON

STEP4 : Set 150°C, 2 hours, wait ON

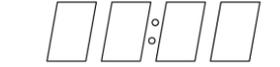
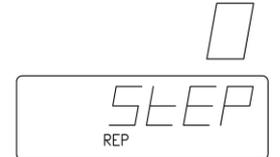
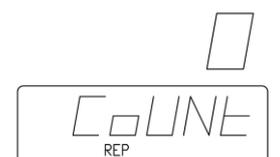
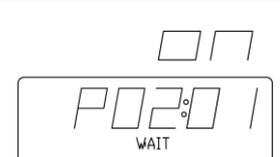
STEP5 : Set 200°C, 1 hour, wait OFF

STEP6 : Set 200°C, 2 hours, repeat beginning at step #4, repeat 5 times, wait ON, end ON

- ★ When time settings on heat building or cooling steps are beyond the heating or cooling capacity (0 minutes in steps 1, 3 & 7 above) of the unit, it will operate at full power for a short time in wait (**ON**) mode until temperature setting has been reached. With wait set to **OFF**, unit will proceed to the next step regardless of whether temperature setting has been reached. Use caution when setting short heating/cooling times.
- ★ When the time setting on heat building or cooling steps is set longer than unit normally takes build heat or cool, unit will adjust itself to do so within the set timeframe.
- ★ When wait is set to ON for heating or cooling steps in program operation, the process moves on to the next step as soon as temperature is within the wait deviation range (-3~6°C of temp setting). If wait is set to **OFF**, however, the process will proceed to the next step after time setting has passed regardless of whether temperature setting is reached.
- ★ Once a step temperature has been set with wait **ON**, unit will enter wait mode whenever temperature in the chamber drops below (or exceeds) the temperature deviation range, due to instances such as opening the chamber door, until temperature builds back to within the deviation range (-3~6°C of temp setting). If wait is set to **OFF**, however, the process will proceed to the next step after the set time has passed, regardless of any extreme temperature changes occurring in the chamber.
- ★ When using the repeat function, programming the operation so that chamber temperature is identical to destination step temperature setting before the repeat executes, is recommended to facilitate smoother transition.
- ★ Unit heating and cooling capacities may vary depending on environmental and operating conditions. Taking these factors in to consideration before programming is therefore recommended.

4. OPERATION PROCEDURE

Programming Procedure

NO	Display	Input procedures (for Example 1 above)
1-1	Standby screen	
1-2		
Step1 1-3		Enter 02:01 (Pattern #02, step #01)       
1-4	 	Enter 100 (100°C)       
1-5	 	Enter 00:00 (00 hr 00 min)         
1-6		Enter 0 (no repeat)         
1-7		Enter 0 (no repeat)         
1-8		Select "on" (to activate wait function) (Set time to when temperature reading (chamber temp) is within $\pm 1^\circ\text{C}$ of temperature setting)         
1-9	 	Select "oFF" (Select "oFF" to program next step. Select "on" to program current step as "end step")        
1-10	Programming for Step #1 complete. Now:	Press and hold  .

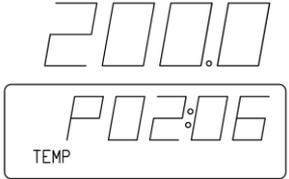
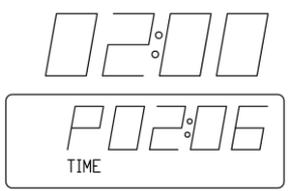
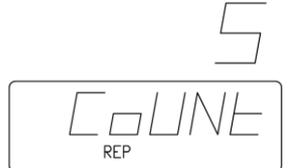
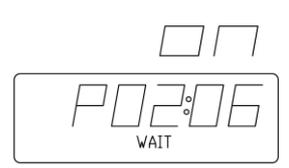
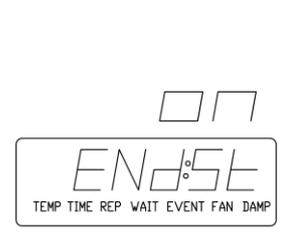
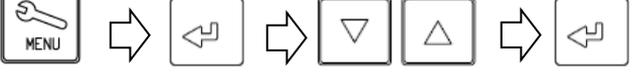
4. OPERATION PROCEDURE

Programming Procedure

<p>2-1</p>	<p>-----</p> 	<p>Enter 02:02 (Pattern #02, step #02)</p> 
<p>} Step2 } Step3 } Step4 } Step5 }</p>	<p>Enter the parameters for steps #2 to #5 in the same manner as step #1. (repeat entry procedures 1-3~1-9)</p>	<p>※  at any time while entering a program to show [RESt.P] in lower display and see the remaining available steps in upper display.</p>

4. OPERATION PROCEDURE

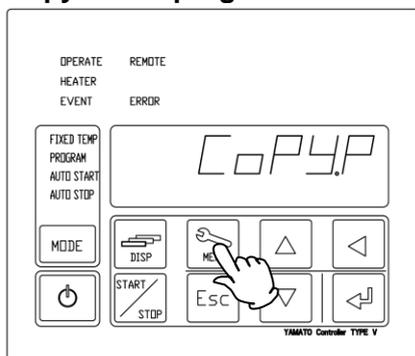
Programming Procedure

<p>Step6 6-1</p>		<p>Enter 02:06 (Pattern #02, step #06)</p> 
<p>6-2</p>		<p>Enter 200 (200°C)</p> 
<p>6-3</p>		<p>Enter 02:00 (02 hr 00 min)</p> 
<p>6-4</p>		<p>Enter 4 (to repeat step #4 from the beginning)</p> 
<p>6-5</p>		<p>Enter 5 (to repeat five times)</p> 
<p>6-6</p>		<p>Select "on" (to activate wait function) (Set time to when temperature reading (chamber temp) is within $\pm 1^{\circ}\text{C}$ of temperature setting)</p> 
<p>6-7</p>		<p>Select "oFF" (Select "oFF" to program next step. Select "on" to program current step as "end step")</p>  <p>※Last step in the program MUST include "END setting".</p>

4. OPERATION PROCEDURE

Programming Procedure

Copy/delete program



• Copy program.

- ① Press repeatedly until [CoPY.P] appears in lower display and press .
- ② [SrC] shows in upper display. Use to select program to copy in lower display and press . Program is copied.
- ③ [dEst] appears in upper display. Using , select a number which the copied program will be stored as and press . Program is duplicated with new designation.

• Delete program.

- ① Press repeatedly until [dEL.P] appears in lower display, then press .
- ② [dEL] appears in upper display. Select a program number to delete using , then press and hold .
- ③ [dEL] flashes in upper display as warning that the program number shown is about to be deleted. Press again. Program is deleted.

4. OPERATION PROCEDURE

Wait Function

When the wait function is set to ON, the system “waits”, without counting down time, until chamber temperature (reading) is within the deviation zone of between -3°C and $+6^{\circ}\text{C}$ of the temperature setting. When time is set to 0 minutes, the system will build heat at full power to reach setting as quickly as possible. When time is set longer than system normally takes to heat or cool to selected temperature, unit will automatically control heating and cooling so that temperature setting is reached (staying within the deviation range) at the time setting.

If chamber temperature drops during temperature stabilization, such as when opening chamber door, system will “wait” and pause countdown time if deviation zone’s upper or lower limit is exceeded.

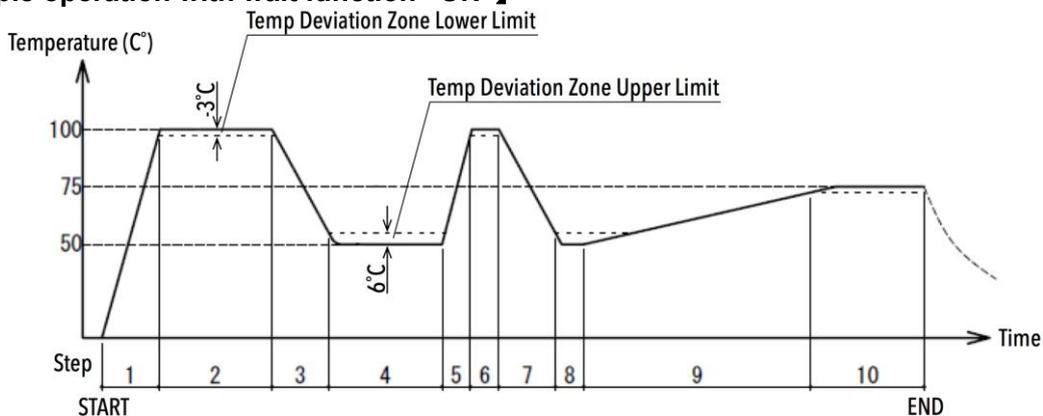
When wait function is set to OFF, the system proceeds to next step when time setting is reached regardless of whether temperature setting is reached or whether chamber temperature falls below or exceeds the deviation zone.

When time is set beyond unit capacity to heat or cool (e.g. too short), unit proceeds to next step before temperature setting is reached. Wait function should be set to ON for short ramp (build) times.

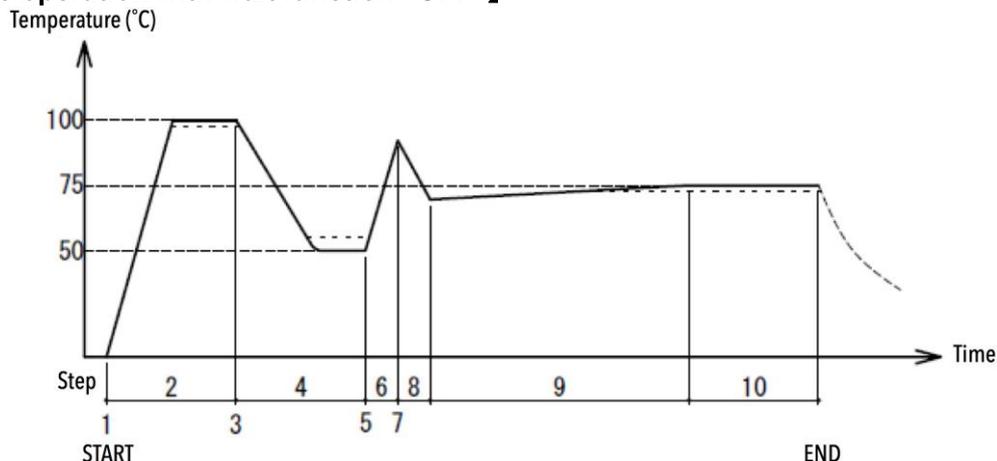
Examples of estimated heating/cooling times with settings designated to WAIT “ON” and WAIT “OFF”.

Step	1	2	3	4	5	6	7	8	9	10
Set temp($^{\circ}\text{C}$)	100	100	50	50	100	100	50	50	75	75
Set time	0 min	30 min	0 min	30 min	0 min	5 min	0 min	5 min	2 hr	30 min
Heating and cooling times for steps (1), (3), (5) and (7) are set to 0 min. (full power).										
Heating time for step (9) is set beyond capacity.										

【Example operation with wait function “ON”】



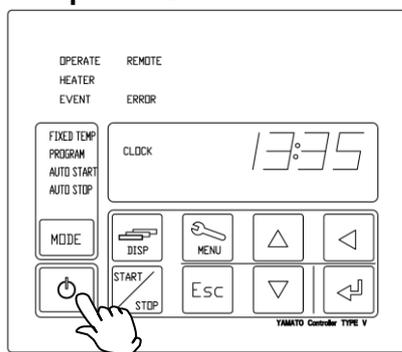
【Example operation with wait function “OFF”】



4. OPERATION PROCEDURE

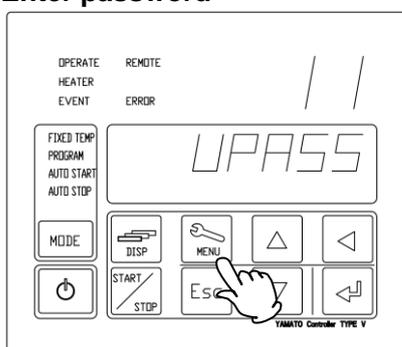
Keypad Lock Function

1 Turn power OFF



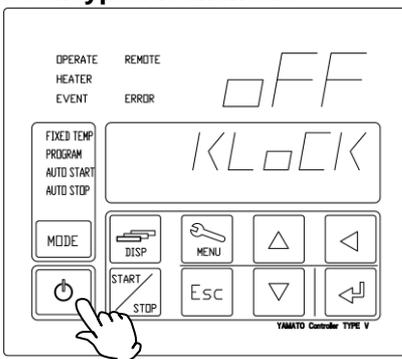
Press and hold  to turn power OFF so that current time is showing in lower display (idle).

2 Enter password



- ① Press and hold .
[UPASS] appears in lower display. "00" shows in upper display with right digit flashing.
- ② Use   and  to enter password "11" in upper display and press  (password is locked to "11").

3 Set keypad lock mode



- ① [KLoCK] is shown in lower display. Press .
- ② Use   to select keypad lock mode and press .

 : All keys enabled. (factory default)

 : All keys disabled except  key and START key.

 : All key are locked except ,  and  key.

 :  key only is disabled.

- ③ Press and hold  to return to initial idle screen.

4. OPERATION PROCEDURE

Calibration Offset Function

The calibration offset feature makes it possible to compensate for any difference between temperature reading on the control panel and actual chamber temperature (taken manually). This enables parallel compensation in either direction (+ or -) over the entire temperature setting range on all SK series units.

Example

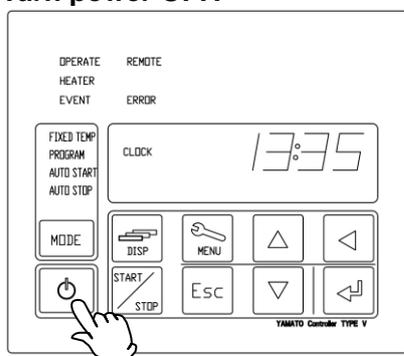
Actual chamber temperature is lower than the control panel temperature reading by 2°C:

Temperature reading can be calibrated by entering a calibration offset value of -2.0 to compensate against the actual temperature deficiency of 2°C.

If the initial temperature reading was 200°C, it will read 198°C after offset calibration, and be brought into agreement with the actual temperature.

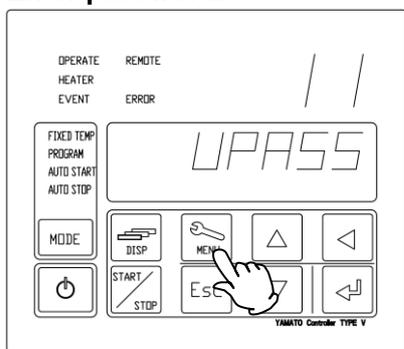
※The -2°C calibration in the example above is applied over the entire temperature setting range (SK401/601: 0~260°C, SK801/811: 0~210°C). Note that offset values may change slightly depending on specimen arrangement in the chamber and/or temperature setting.

1 Turn power OFF.



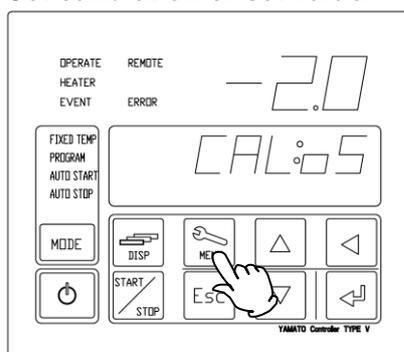
Press and hold to turn power OFF so that current time is showing in lower display (idle).

2 Enter password.



- ① Press and hold . [UPASS] appears in lower display. "00" shows in upper display with right digit flashing.
- ② Use , , and to enter password "11" in upper display and press (password is locked to "11").

3 Set calibration offset value.



- ① Press . [CAL:0S] is shown in lower display and [0.0] in upper display. Press . Right-most digit flashes.
- ② Enter offset value using , , and and press .

Example

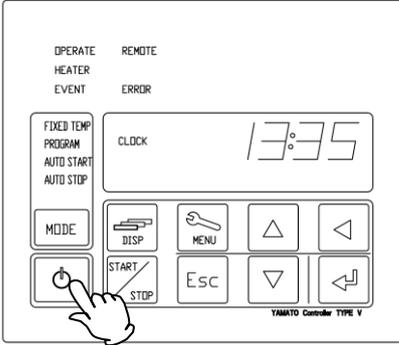
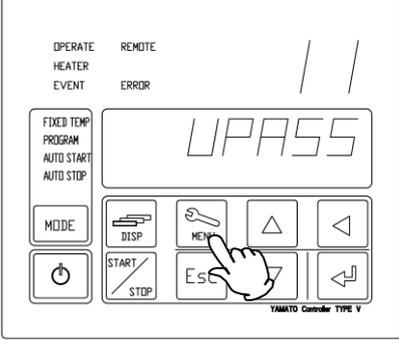
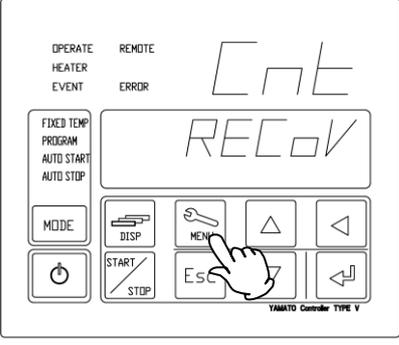
Temperature reading is 200°C, while actual temperature (manually taken) is 198°C

⇒ Offset input value: -2

- ③ Press and hold to return to initial idle screen.

4. OPERATION PROCEDURE

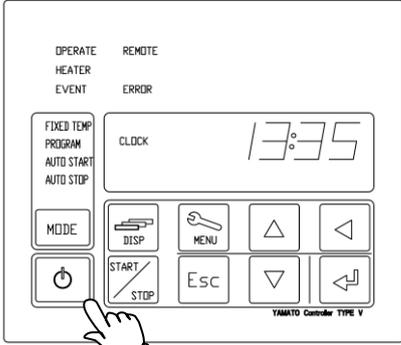
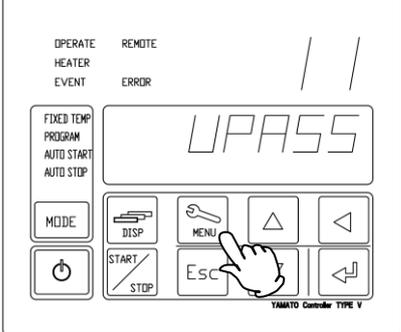
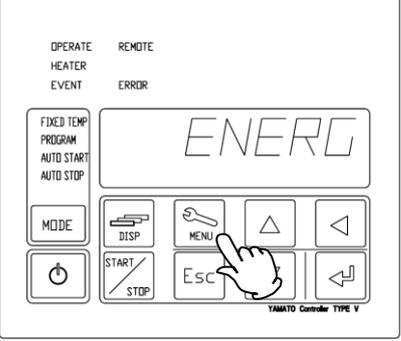
Recovery Modes

<p>1</p>	<p>Turn power OFF</p>  <p>The diagram shows a control panel with a digital display showing '13:35'. A hand is pointing to the power button (a circle with a vertical line) on the left side of the panel. The panel includes buttons for MODE, DISP, MENU, and directional arrows, as well as START/STOP, Esc, and a return key.</p>	<p>Press and hold  to turn power OFF so that current time is showing in lower display (idle).</p>
<p>2</p>	<p>Enter password</p>  <p>The diagram shows the control panel with the display showing 'UPASS'. A hand is pointing to the MENU button (a key icon) on the panel.</p>	<p>① Press and hold . [UPASS] appears in lower display. "00" shows in upper display with right digit flashing.</p> <p>② Use ,  and  to enter password "11" in upper display and press  (password is locked to "11").</p>
<p>3</p>	<p>Set recovery mode</p>  <p>The diagram shows the control panel with the display showing 'Cnt' in the upper part and 'RECoV' in the lower part. A hand is pointing to the MENU button on the panel.</p>	<p>① Press  twice. [RECoV] is shown in lower display. Press .</p> <p>② Using , , select recovery mode and press .</p> <p>Cnt: Operation will resume where it left off at power failure. (factory default) StoP: Operation will terminate and unit will be idle when power is restored.</p> <p>③ Press and hold  to return to initial idle screen.</p>

4. OPERATION PROCEDURE

CO2 Emissions & Power Consumption Settings

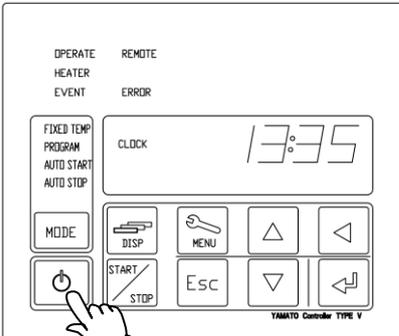
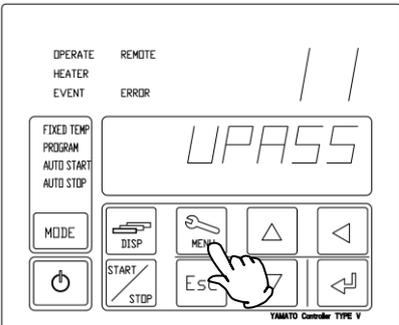
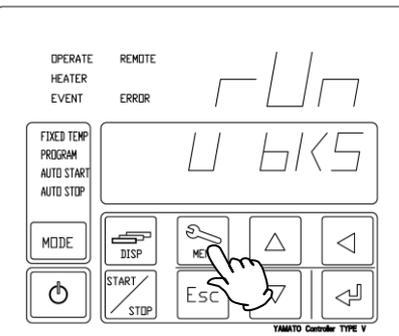
Setting CO2 conversion factor & resetting total CO2 emissions/power consumption.

<p>1 Turn power OFF.</p>		<p>Press and hold  to turn power OFF so that current time is showing in lower display (idle).</p>
<p>2 Enter password.</p>		<p>① Press and hold . [UPASS] appears in lower display. "00" shows in upper display with right digit flashing</p> <p>② Use   and  to enter password "11" in upper display and press  (password is locked to "11").</p>
<p>3 Set/reset monitored items.</p>		<p>① Press  repeatedly to show [ENERG] in lower display, Press .</p> <p>② Press  to select an item in lower display :</p> <p>"PoW:Rt" ("oFF" in upper display) : Press  to change "oFF" (constant) to → rUn (flashing) in lower display. Press  to reset accumulated power consumption. Press  to return to [PoW:Rt] screen. KG.K 0555 (denoting 0.555 - factory default value) : Press  to make value changeable (flashing). Use   and  to change conversion factor value. Press , then  to return to [KG.K] screen.</p> <p>"Co2:Rt" ("oFF" in upper display) : Press  to change "oFF" (constant) to → "rUn" (flashing) in upper display. Press  to reset accumulated CO2 emissions. Press  to return to [Co2:Rt] screen.</p> <p>③ Press and hold  to return to initial idle screen.</p>

4. OPERATION PROCEDURE

Data Backup & System Reset

Back up, read out and reset controller for various setting information.

<p>1 Turn power OFF.</p> 	<p>Press and hold  to turn power OFF so that current time is showing in lower display (idle).</p>
<p>2 Enter password.</p> 	<ol style="list-style-type: none"> ① Press and hold . [UPASS] appears in lower display. "00" shows in upper display with right digit flashing. ② Use   and  to enter password "11" in upper display and press  (password is locked to "11").
<p>3 Save data/show saved data/reset.</p> 	<ol style="list-style-type: none"> ① Press  repeatedly to toggle through the following items respectively in lower display: <ul style="list-style-type: none"> U Bks: Backs up all setting information. U bKR: Displays back up data. INI.U: Resets all settings to factory default. <p>* Backup items include programs entered, temperature offset values and other data, such as keypad lock modes, calibration offsets, recovery modes, etc.</p> <ol style="list-style-type: none"> ② Select one of the 3 modes described above. <ul style="list-style-type: none"> Press . [rUn] will be shown in upper display. Press .

4. OPERATION PROCEDURE

Data Monitoring

※Current power consumption, accumulated hours of operation, etc. can be viewed by using the data monitoring feature on this unit.

Setting information shown in upper display cannot be modified.

<p>1</p>	<p>Values appear in upper display</p> <p>※Data can be viewed in standby mode or during operation.</p> <p>Press and hold the  key to view current power consumption (kW).</p> <p>Now press the  key repeatedly to scroll through and view the following items respectively:</p> <p>↓Accumulated power consumption (tot:MW)</p> <p>↓Accumulated power consumption (tot;kW)</p> <p>↓Total CO2 Emission (Co2:t)</p> <p>↓Total CO2 Emissin (Co2:KG)</p> <p>↓Heater output (PID:MV)</p> <p>↓Accumulated hours in power-on (PoW:tM) (0xxxx) Shows first (of 5) digit only.</p> <p>↓Accumulated hours in power-on (PoW:tM) (x0000) Shows last four (of 5) digits only.</p> <p>↓Accumulated operation run hours (RUN;tM) (0xxxx) Shows first (of 5) digit only.</p> <p>↓Accumulated operation run hours (RUN:tM) (x0000) Shows last four (of 5) digits only.</p> <p>↓Return to standby or mode screens.</p>	<p>* Current power consumption is power consumed from moment of activation and calculated in hourly increments. Accumulated power consumption is updated hourly by using the sum total of current power consumption.</p> <p>* CO2 emission (CE) is calculated using CE=(Conversion Coefficient)x(Power Consumption) Coefficient value will differ by local power supply company and must be confirmed and set accordingly in order to view accurate data. (Coefficient of -0.555 is set for TEPCO by default)</p> <p>* Heater operation output is a parameter to control the output power ratio of heater's rated capacity in percentile units. Heater output will be controlled by a PID operation value between 100 and 0% until reaching objective temperature.</p> <p>* Accumulated hours in power-on is the sum total of hours, aggregated between ELB ON and OFF. Maximum total for this value is 65,535 hours.</p> <p>Example First digit : 2 last four digits : 35 ⇒Accumulated hours in power-on: 20035 hours</p> <p>* Accumulated operation run hours is the sum total of hours, aggregated between the start and end of operation runs. Maximum total for this value is 65,535 hours.</p> <p>Example Top digit : 0 Lower four digits : 135 ⇒Accumulated operation run hours: 0135 hours</p>
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4. OPERATION PROCEDURE

Independent Overheat Prevention Device

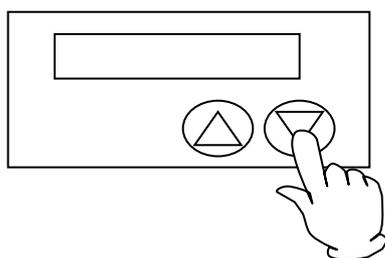
SK series units feature redundant safety devices: 1) The internal automatic overheat prevention (automatic reset) feature, and 2) the Independent Overheat Prevention Device (IOPD) with discrete power supply, circuit and sensor; completely independent of the CPU board.

The IOPD main relay functions to activate and cut power to the heater when chamber temperature goes too far beyond objective temperature.

These functions are enabled while the main power switch (ELB) is ON.

Set temperature on Independent Overheat Prevention Device(IOPD)

* Set temperature using ▼▲ on IOPD panel.



Operation may be terminated by Independent Overheat Prevention Device (IOPD) activation, when IOPD temperature setting and target temperature are less than 20°C apart. IOPD temperature should be set at least 20°C higher than target temperature.

Note: main function of IOPD is to keep SK unit from overheating, NOT to protect test samples from damage. Likewise, it is NOT intended for protection against accident or injury resulting from the negligent use of explosives and flammables.

IOPD factory settings and temperature setting ranges are shown below by model:

Model	Factory default temperature setting	Temperature setting range
SK401	300°C	0°C ~300°C
SK601	300°C	0°C ~300°C
SK801	250°C	0°C ~250°C
SK811	250°C	0°C ~250°C

To confirm whether IOPD functions as intended, set chamber temperature to any value within unit specification range and allow temperature to stabilize. Gradually lower IOPD temperature setting. If IOPD activates within 10°C of temperature setting, it is functioning normally.

Note: it normally takes 5 (five) seconds for IOPD to activate. Waiting 5 seconds each time temperature is lowered in the confirmation test above, is therefore recommended. When IOPD activates, error code Er07 shows in the display and operation will be terminated.

When changing the IOPD temperature setting, it takes a few seconds for the changes to finalize. For this reason, wait 5 seconds after entering the change before turning the power off.

5. HANDLING PRECAUTIONS

Warning

1. DO NOT process hazardous or harmful substances.

 Never process explosive or flammable items. Fire or explosion causing serious injury or death may result. See “List of Hazardous Substances” (P.55) for more information on these items.

2. Using resin containers.

 Be sure to check the temperature rating of intended resin container before using. Processing specimens/samples in a resin container which is not rated to withstand the processing temperature may cause the resin to melt or burn, possibly resulting in a fire or an explosion.

3. DO NOT operate equipment when abnormalities are detected.

 If unit begins emitting smoke or abnormal odors for reasons unknown, turn off main power (ELB) 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.

Caution

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.

 Other than stacking units using the proper two-teir stacking clamps, do not place any items on SK401/601 units. Likewise, do not place any items (especially large or heavy items) on SK801/811 units. Doing so may cause unit 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 (ELB), and disconnect power cable immediately. A direct lightning strike may cause equipment damage fire or electric shock, resulting in serious injury or death.

4. DO NOT leave chamber door open.

 Do not leave SK unit door open (i.e. to cool test samples in the chamber down, etc.) following an operation run. Heat from chamber may damage and/or deform control panel, causing CPU board malfunction or failure. Always remove processed test samples and close chamber door.

5. DO NOT process corrosive items.

 Do not process items containing corrosive chemicals of any kind. Although chamber interior is manufactured of 304 stainless steel, damage may still occur from exposure to strong chemicals.

6. Drying Sterilizer Precautions

 SK series units are designed to process items which remain stable when heated, such as glass, ceramics, metal, mineral oil, grease, powdered substances, etc. Observe the provisions in the table on the right and confirm sterilization indicators when running dry sterilizer operations.	Sterilization Provisions	
	Temperature	Duration
	160~170°C	120 minutes
	170~180°C	60 minutes
	180~190°C	30 minutes

5. HANDLING PRECAUTIONS



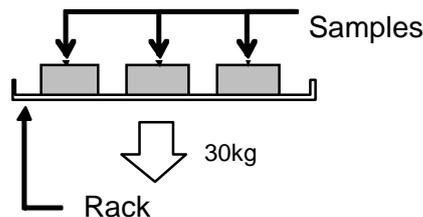
Caution

7. ALWAYS run equipment within specified temperature range.

- ⊘ Operating temperature range is 5°C~260°C (SK401/601) and 5°C~210°C (SK801/811). Never attempt to operate unit outside of this range. Doing so may cause equipment malfunction or damage.

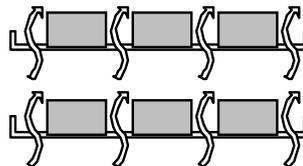
8. Arrange test samples appropriately.

- ⊘ Weight capacity for one chamber rack is approximately 15kg. Test sample load total for each rack should not exceed this specification. Arrange test samples evenly on racks, leaving as much space between them as possible.



Do not place too many test samples on rack at once. Doing so may prevent proper temperature control in chamber. Test samples should be managed in the following way;

1. Install the supplied chamber racks, 2. Leave as much space between test samples as possible. 3. As a rule of thumb, leave 30% or more of the total space on each rack unoccupied.



Leave 30% of total rack space open.

9. DO NOT place items in bottom of chamber.

- ⚠ Operating unit with test samples placed directly on bottom surface of chamber may cause unit to perform poorly. Likewise, chamber temperature may become excessive, causing malfunction or damage. Always use the supplied chamber racks, supported on the standard supports, and avoid placing any items on bottom surface. Do not allow test samples to contact chamber walls.

10. Power outages.

⚠ In the event of a power loss during operation, one of the following will occur when power is restored, depending on what settings have been selected:

- Continued operation: if power recovery settings have been set to continue (factory default), the START/STOP key can be pressed and operation will pick up where it left off with the power failure.
- Stop operation: if recovery settings have been set to stop, operation will be terminated and unit will go into idle when power is restored.

See "Recovery Modes" (P.33) for details.

11. Confirm equipment stability.

- ⚠ If unit has not been stabilized, it may tip over or fall, causing injury or death, during an earthquake or other unforeseen incident. Be sure to stabilize unit properly (adjustable leveling feet securely positioned, etc.) to ensure safe operation.

5. HANDLING PRECAUTIONS



Caution

12. Chamber door seal.

- ⊘ Chamber door seals are manufactured from silicon rubber. Benzoic acid, oil, and other components, used during the silicone rubber manufacturing process, may be emitted during operation, spoiling incompatible test samples. If test samples, sensitive to silicone rubber by-products, are to be processed; specially formulated fluoro-rubber seals may be requested as an option.
Note that acids, alkaline, and halogenated solvents are corrosive to rubber.

【Caution】

Substances that are corrosive to the silicon or fluoro rubber used for chamber door seals are shown in Table 5.1.
Do not process test samples that contain any of the substances shown in this table.
For further assistance, contact a Yamato sales office or dealer.

Table 5.1 - Substances harmful to chamber door seal

Substance Classification	Silicon Rubber	Fluoro-rubber
Hydrocarbons	Butane, Isooctane, Benzine, Toluene, Xylene, Styrene, Diphenyl, Pinene, Kerosene	Propane
Halogen, Haloid Hydrocarbon	Methyl Chloride, Methylene Chloride, Chloroform, Carbon Tetrachloride, Trichloroethylene, Phlorobenzene, Monochloronaphthalene, R-11, R-12, R-21, R-22, R-113, R-114, Bromine	R-21, R-22
Ketone, Aldehyde	Methyl Ethyl Ketone, Diisopropyl Ketone, Dichlohexanon, Acetophenone	Acetone, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Diisopropyl Ketone, Dichlohexanon, Acetophenone
Ester	Methyl Acetate, Ethyl Acetate, Propyl Acetate, Butyl Acetate, Amyl Acetate, Methyl Acetoacetate, Butyl Acrylate, Ethyl Methacrylate	Methyl Acetate, Ethyl Acetate, Propyl Acetate, Isopropyl Acetate, Butyl Acetate, Amyl Acetate, Ethyl Acetoacetate, Ethyl Acrylate, Butyl Acrylate, Ethyl Methacrylate
Ether	Diethyl Ether, Dibutyl Ether, Ethylene Oxide, Dioxane, Epichlorohydrin, Tetrahydrofuran	Diethyl Ether, Isopropyl Ether, Dibutyl Ether, Dibenzyl Ether, Ethylene Oxide, Dioxane, Epichlorohydrin, Furfural, Tetrahydrofuran
Alcohol	Amyl alcohol	
Multiple Alcohol Derivative		Cellosolve Acetate, Butyl Cellosolve, Triacetin
Fatty Acid, Phenol	Acetic Anhydride, Oleic Acid, Phenol Palmitate	Formic Acid, Acetic Anhydride, Hydroquinone

5. HANDLING PRECAUTIONS



Table 5.1 - Substances harmful to chamber door seal (continued)

Substance Classification	Silicon Rubber	Fluoro-rubber
Nitrogen Chemical Compounds	Nitromethane, Nitroethane, Nitropropane	Nitromethane, Nitroethane, Nitropropane, Ethylenediamine, Dimethylaniline, Ethanol amine, Hydrazine, Triethanol Amine, Dimethyl Formamide, Pyridine, Piperidine
Sulfur and phosphorus compounds	Hydrosulfuric	Hydrosulfuric, Tributyl Phosphate
Other Chemical Compounds	Nickel Acetate, Lead Acetate, Zinc Acetate, Tetraethyl Lead, Vegetable Oil, Silicon Oil	Calcium Acetate, Nickel Acetate, Lead Acetate, Zinc Acetate
Inorganic Solvent	Hydrochloric Acid, Nitric Acid, Sulfuric Acid, Hydrobromic Acid, Phosphoric Acid, Hypochlorous Acid, Chromic Acid, Perchloric Acid, Sodium Hydrate	Sodium Hydrate, Aqueous Ammonia

13. Temperature sensor.

- The temperature sensor for this unit is installed on the inside wall of the chamber and used to control chamber temperature. The chamber temperature reading, as read by the sensor, may not always agree with the temperature of test specimens. Indeed, chamber and test sample temperatures may differ vastly just after opening or closing chamber door.

14. Inspect equipment regularly.

- The main power switch (ELB) and Independent Overheat Prevention Device (IOPD) in particular, are key devices in maintaining the safety of SK series units, and must be inspected/maintained regularly.
 See "Inspection & Maintenance" (P.43) for details.

15. Independent Overheat Prevention Device temperature limit must be set.

- Activation temperature for the Independent Overheat Prevention Device (IOPD) must be set in order to protect unit from damage, if overheating occurs.
 Note that temperature on the IOPD should be set to 20°C higher than objective temperature.
 See "Independent Overheat Prevention Device" (P.37) for more on setting up this device and for other warnings.

16. Solvents and excess moisture in test samples.

- Remove excess and unneeded moisture and water from test samples (i.e. thoroughly dry test sample container exterior, etc.) before processing.

17. Initial operation.

- When operating unit for the first time, organic substances in the heat insulator may burn and produce smoke, which is normal and not a malfunction. An accompanying odor may also be present, but will subside with continued operation.

5. HANDLING PRECAUTIONS



18. Processing test samples/specimens

-  ● Use caution when processing samples/specimens, which contain powder or small particles, so they are not disbursed by sudden movements or abrupt air pressure changes. Allowing flammable or metallic items to contact the heater assembly may cause a fire or shock hazard.
- Be advised that more time may be required for chamber temperature to rise when processing a larger amount of samples/specimens or those with a higher heat load capacity. Do not process more samples than necessary. Also note that temperature reading may not be consistent when processing heat-generating specimens.

19. High temperature operation.

-  When running SK series units at high temperature, exercise extreme caution so that hands and skin do not contact any hot surfaces. Always wear heat-resistant gloves when putting in and removing test samples
Also note that extended high temperature use may cause chamber door seal to adhere to window glass, preventing the door from being opened. Avoid more than 72 hours of continuous operation.

20. DO NOT apply paint thinner, alcohol or other solvents to equipment.

-  Never attempt to clean SK series units with paint thinner, alcohol or solvents of any kind. Doing so may cause coating to peel, discoloration, superficial damage and deformity to some components.
Note: always turn off main power switch (ELB) prior to cleaning or maintenance.

21. Modifications

-  Any malfunction resulting from unauthorized modifications or customizations to equipment will void the warranty and are not the responsibility of Yamato.

22. Exhaust ports.

-  Do not run SK units with exhaust ports fully open. Unit will be unable to perform at maximum capacity or to reach maximum temperatures (SK401/601: 260°C, SK801/811: 210°C).

23. Fan motor operation (SK801/811).

-  The fan motor will begin running when unit starts an operation, and stops when an operation has finished. Fan motor does not run when unit is in idle or standby.

24. Read instruction manual thoroughly before operation.

-  Always read instruction manual(s) for all equipment, thoroughly, before beginning setup, installation or operation.

6. MAINTENANCE PROCEDURES

Inspection & Maintenance



Warning

- Be sure that main power switch (ELB) is OFF before daily inspection and maintenance of SK series units.
- Perform inspections and maintenance when inside of chamber is at room temperature.
- Never attempt to disassemble unit.



Caution

- Clean unit using soft damp cloth.
- Never use benzene, paint thinner, scouring powder, scrubbing brush or other abrasives and solvents to clean unit. Superficial damage and/or discoloration, as well as deformity to some components may result.

Inspect monthly.

- Inspect main power switch (ELB) ON and OFF function.
 - Prepare unit for inspection by connecting power cable to a facility outlet or terminal.
 - Confirm that main switch (ELB) is "OFF" then, turn main switch (ELB) back "ON".
 - With the main switch "ON", depress the test button on the main switch (ELB) using a ball-point pen or other fine-tipped object. If main switch (ELB) shuts off, it is functioning normally.
 - Test Independent Overheat Prevention Device (IOPD).
 - Run unit in constant temperature mode and allow temperature to stabilize.
 - Set the activation temperature for the IOPD to approximately 5°C below chamber temperature.
 - If overheating prevention device is functioning normally, heater will shut off within few seconds and error code "Er07" will appear in the upper display. An alarm will also sound and ERROR lamp will illuminate.
- * Main power switch (ELB) and overheat prevention device must be inspected, as prescribed above, prior to every instance of extended or overnight operation.

◆ Contact a local dealer or Yamato sales office for further assistance.

7. EXTENDED STORAGE AND DISPOSAL

Extended Storage / Unit Disposal

 Warning	 Caution
<p>If unit will be out of service for an extended period, turn off main power switch (ELB) and disconnect power cable from facility outlet or terminal.</p>	<p>Unit disposal.</p> <ul style="list-style-type: none"> ● Remove door handle and hinges to prevent it from locking. ● Do not leave unit unattended, or in a place where children can have access. ● Dispose of this unit in accordance with local laws and regulations.

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 SK series units are listed in table below:

Component	Material
External Structure	Chrome free electrogalvanized carbon steel, sheet coated w/chemical-proof baked-on finish
Chamber	Stainless steel
Heat Insulator	Ceramic fiber + glass wool
Door seal	Silicon rubber
Window glass	Chemically reinforced glass
Switches and Relays	Resin composites, copper and other materials
Control Panel	Polycarbonate resin
Printed Circuit Boards	Fiber glass composites and other materials
Heater	Stainless steel tubing
Power Cable	Composites of synthesized rubber coating, copper, nickel and other compound materials
Wires	Composite of fiber glass, fire-retardant vinyl, copper, nickel and other materials
Stickers	Resin materials
Sensor (Pt & K TC Sensor)	Stainless steel and other material

8. TROUBLESHOOTING

Error Code Guide

All possible error codes are shown in Table 8.1 below.

On SK series units, operation stops and a sounding alarm accompanies occurring errors.

Error codes will appear in the upper display of control panel. Confirm code and see associated details in Table 8.1 below.

Turn off main power switch (ELB) immediately and block access to unit.

Table 8.1 Table of Error Code

Display code	Description	Possible causes and solutions
<i>Er01</i>	Sensor Failure	<ul style="list-style-type: none"> ● Failure in temperature input circuit. ● Open circuit in temperature sensor line. ● Temperature out of specification range. Contact a local dealer or Yamato sales office.
<i>Er02</i>	SSR Short Circuit	<ul style="list-style-type: none"> ● Electrical short in SSR circuit. ● Failure in current transformer (CT) sensor. Contact a local dealer or Yamato sales office.
<i>Er03</i>	Faulty Heater Line	<ul style="list-style-type: none"> ● Heater line faulty or severed. ● Failure in current transformer (CT) sensor. ● Drop in supply voltage. Contact a local dealer or Yamato sales office.
<i>Er07</i>	Independent Overheat Prevention Device (IOPD) activated	<ul style="list-style-type: none"> ● Independent Overheat Prevention Device (IOPD) activated. Turn ELB on again and check both chamber temperature and IOPD temperature setting. Contact a local dealer or Yamato sales office, if unit does not activate when ELB is switched back on.
<i>Er10</i>	Main relay contact failure	Turn ELB back on and confirm: <ul style="list-style-type: none"> ● whether contact point on main relay is damaged. ● whether current transformer (CT) sensor(s) has failed. Contact a local dealer or Yamato sales office.
<i>Er.14</i>	RAM Failure	Turn ELB back on and confirm whether there is a drop in backup battery capacity or whether backup battery is dead. Replace backup battery Contact a local dealer or Yamato sales office, if this error cannot be reset by turning ELB back on.
<i>Er.15</i>	EEPROM Failure	Turn ELB back on and confirm whether there is a change in data code on EEPROM. Replace backup battery Contact a local dealer or Yamato sales office, if this error cannot be reset by turning ELB back on.

8. TROUBLESHOOTING

Troubleshooting Guide

Table 8.2 - Troubleshooting Guide

Symptom	Possible causes	Possible solutions
Unit does not turn on/operate when main power switch is turned "ON".	<ul style="list-style-type: none"> No power ELB failure CPU board failure 	<ul style="list-style-type: none"> Check connection to power supply and confirm power supply voltage. Replace ELB. (※) Replace CPU board. (※)
Nothing displayed in upper and lower displays when START/STOP key is pressed and held	<ul style="list-style-type: none"> Power supply failure (must be within $\pm 10\%$ voltage rating) CPU board failure 	<ul style="list-style-type: none"> Connect to adequate power supply Replace CPU board (※)
Temperature in chamber does build.	<ul style="list-style-type: none"> IOPD and/or built-in self-diagnosis function has shut heater circuit down (error code displayed). 	<ul style="list-style-type: none"> Refer to Table 8.1 in this chapter (※)
Temperature reading fluctuates during operation.	<ul style="list-style-type: none"> Heavily fluctuating external temperature Power supply failure (must be within $\pm 10\%$ of voltage rating) Temperature affected by test samples CPU board failure Temperature sensor failure 	<ul style="list-style-type: none"> Re-evaluate installation site Connect to adequate power supply Reduce test sample load (see P.39) Replace CPU board (※) Replace temperature sensor (※)

※Contact a local dealer or Yamato sales office for further assistance.

If problem(s) persists, turn off power immediately, disconnect power cable from outlet or terminal and contact a local dealer or Yamato sales office for further assistance.

Recovering from a power outage.

Selecting whether or not to restore an interrupted operation process must be done prior to a power outage event, according to the following:

* **Resume operation after a power outage by selecting [Cnt] from the recovery function menu:**

Restores unit to the status it was in just before power outage occurred.

Resumes process from where it left off at power loss.

* **Terminate operation by selecting [StoP] from the recovery function menu:**

Unit goes into idle when power is restored.

Stops process when power outage occurs.

See P.33 for details.

9. SERVICE AND REPAIR

Requests for Repair

When a problem occurs, terminate operation immediately, turn off main power switch (ELB) 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

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for SK401/601/801/811 laboratory drying sterilizers. "Repair parts" is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

Specifications Table

Product Name		Laboratory Drying Sterilizer ※1			
Model Name		SK401	SK601	SK801	SK811
System		Natural convection		Forced convection	
Power supply		Single-phase 100V 12.5A	Single-phase 100V 14.1A	Single-phase 100V 24.5A	Single-phase 200V 12.5A
		50/60Hz all models, useable source voltage range : ±10%			
Performance ※2	Temperature control range	Room temp. +5°C~260°C		Room temp.+10°C~210°C	
	Temperature control precision	±1°C (at 260°C) JTM K05		±1°C (at 210°C) JTM K05	
	Temperature fluctuation	±1.5°C (at 260°C) JIS C60068		±1°C (at 210°C) JIS C60068	
	Temperature distribution precision	±5°C (at 260°C) JTM K05		±3.5°C (at 210°C) JTM K05	
	Temperature slope ※3	20°C (at 260°C) JIS C60068		12°C (at 210°C) JIS C60068	
	Temperature rise time	Approx. 60min.			
Composition	Exterior	Cold rolled steel paneling, chemical-proof baked-on finish			
	Chamber	Stainless steel			
	Insulation material	Glass wool			
	Door	Single swing (left side)			
	Heater (stainless steel tube)	1.2kW	1.36kW	2.4kW	
	Cable duct	I.D. 33mm (right side)			
	Exhaust port	I.D. 33mm×2 (top side)			
Control Devices	Temperature control type	PID Z control			
	Temperature setting type	Digital setting with ▲/▼ keys.			
	Temperature display type	Top Screen : Green 4-digit LED Digital Display (increment : 1°C) Bottom Screen : Orange 5-digit LED Digital Display (increment : 1°C)			
	Other displays	LED indicates temperature patterns for heating/stable/cooling			
	Timer	0 min~99 hrs 59 min (increment : 1 minute or 1 hour)			
	Operation modes	Fixed Temperature Operation/Quick Automatic Stop Operation			
		Automatic Start Operation			
		Automatic Stop Operation			
		Programmed Operation (Repeatable Operation Function up to max 99 steps or 99 patterns)			
	Built-in functions	Power on and Operation Time Accumulation Function (up to 65,535 hours); Calendar Time (24 hours); Calibration Offset; Accumulated Power Consumption Monitoring, Total CO2 Emission, and Heater Output; Power Recovery Mode; Save and Access Operater Setting Information;			
Heater control	Triac with Zero-cross control				
Sensor	K type Thermocouple (for temperature control and independent overheat preventive device)				

10. SPECIFICATIONS

Specifications (continued)

Model Name		SK401	SK601	SK801	SK811
Safety Devices	Earth Leakage Breaker (ELB)	15A	20A	30A	15A
		Leak Current/Short Circuit/Over-current Protection, Rated Sensitivity Current 30mA			
	Independent Overheat Prevention Dvice (IOPD)	Temperature setting range: 0~300°C		Temperature setting range: 0~250°C	
	CPU Control Board	Self-diagnosing functions (Sensor Failure, SSR Short Circuit, Heater Failure, Main Relay Contact Failure, Automatic Overheat Prevention), Key Lock Function			
Standard Measurements	Chamber dimensions (WxDxH) ※2	450×490×450 mm	600×540×500 mm	600×500×1000 mm	
	External dimensions (WxDxH) ※2	560×600×820 mm	710×650×870 mm	710×650×1640 mm	
	Volume	99ℓ	162ℓ	300ℓ	
	Mass	Approx. 50 kg	Approx. 62 kg	Approx. 108 kg	
Supplied Items	Racks and guide rails	2 stainless steel punched metal racks, 4 rack guide rails		4 stainless steel punched metal racks, 8 rack guide rails	
	Operation manual	One copy			
Notes	※1 Not designed for medical applications. ※2 Rated performance is based on power supplied at specification rating, 23°C ±5°C external temperature, 65%RH ±20% humidity, exhaust port 1/3 open and no process load. ※3 This laboratory drying sterilizer and its temperature slope is designed to maintain a temperature range higher than temperature setting. (Based on our inspection standards) ※4 Dimensions do not include protruding components..				

11. ACCESSORIES

Optional Accessory Guide

Tables 11.1 & 11.2 below show a list of accessories, which provide a wide array of options for SK series laboratory drying sterilizers.

Table 11.1 Option List (factory installation not required)

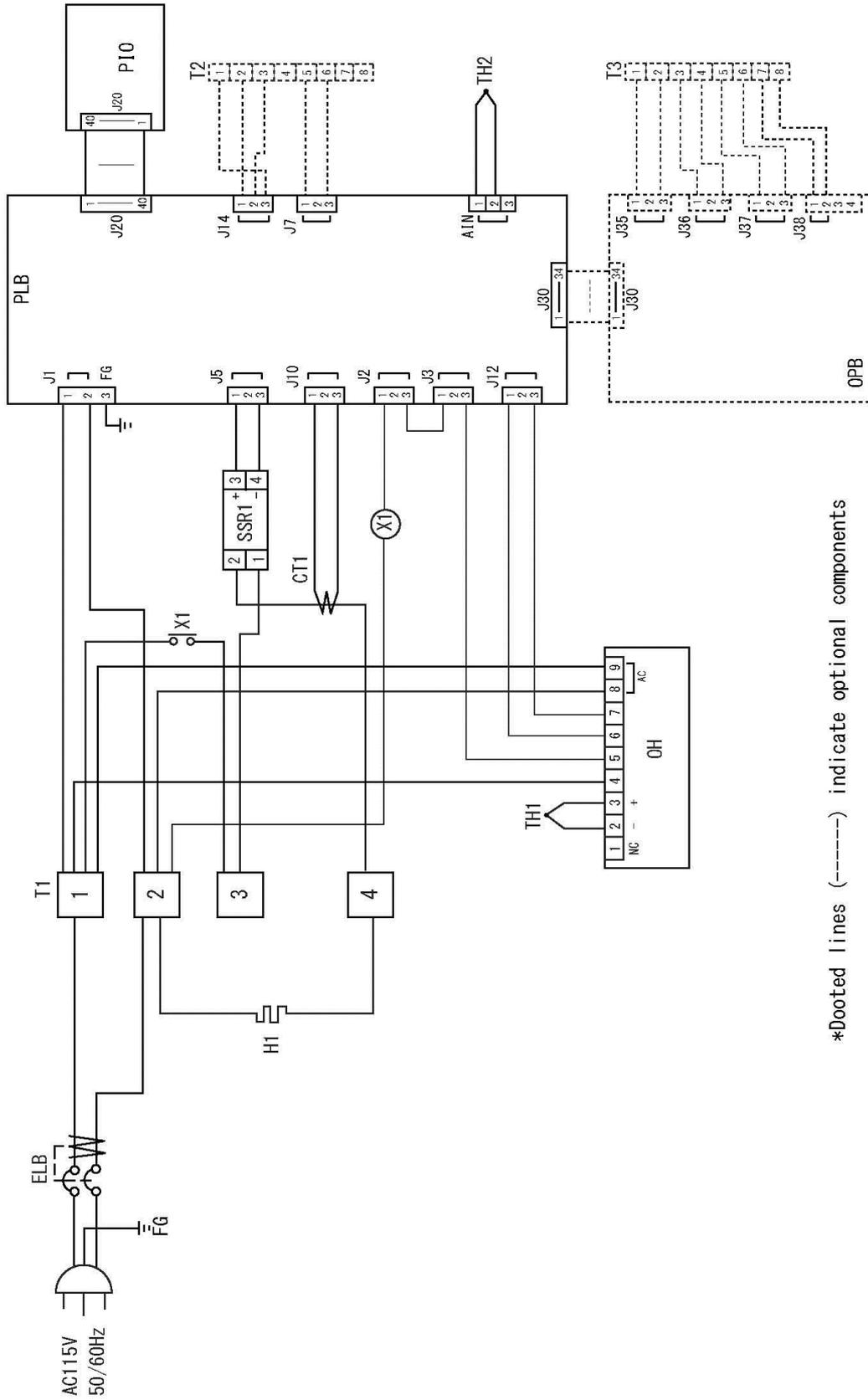
Option	Product Code No.	Model Name	Applicable model	Discription
Stand	211856	ON61	600 type	
	212348	OT42	400 type	
	212349	OT62	600 type	
Stacking clamps	212822	OD40	400 type	
	212823	OD60	600 type	
Chamber racks (with guide rails)	212246	ODN20	400 type	
	212266	ODN22	600 type 800 type	
Seismic isolation mat	296902	-	400 type 600 type	

Table 11.2 Option List (factory installation required)

Option	Product Code No.	Model Name	Applicable model	Discription
Remote comm terminal	212981	ODS16	All models	Allows SK units to be monitored and controlled remotely.
Remote comm adaptor kit	211880	OIN90	All models	Allows SK units to be interfaced to, monitored and controlled via PC. Software included.
Temperature output terminal	212982	ODS18	All models	4 ~20 milli ampere analog signal output for external temperature sensors.
External alarm output Terminal	212983	ODS22	All models	Allows alert signals to be output to an external device.
Timeup output terminal	212984	ODS24	All models	Allows "end" signal for auto stop or programmed operations to be sent to an external device.
Operation signal output terminal	212985	ODS26	All models	Allows an "in progress" signal to be sent to an external device, during unit operation.
Event output terminal	212986	ODS28	All models	Allows ON-OFF event output signals, such as standby, operating, end of operation, and program steps to be sent to an external device.

12. WIRING DIAGRAM

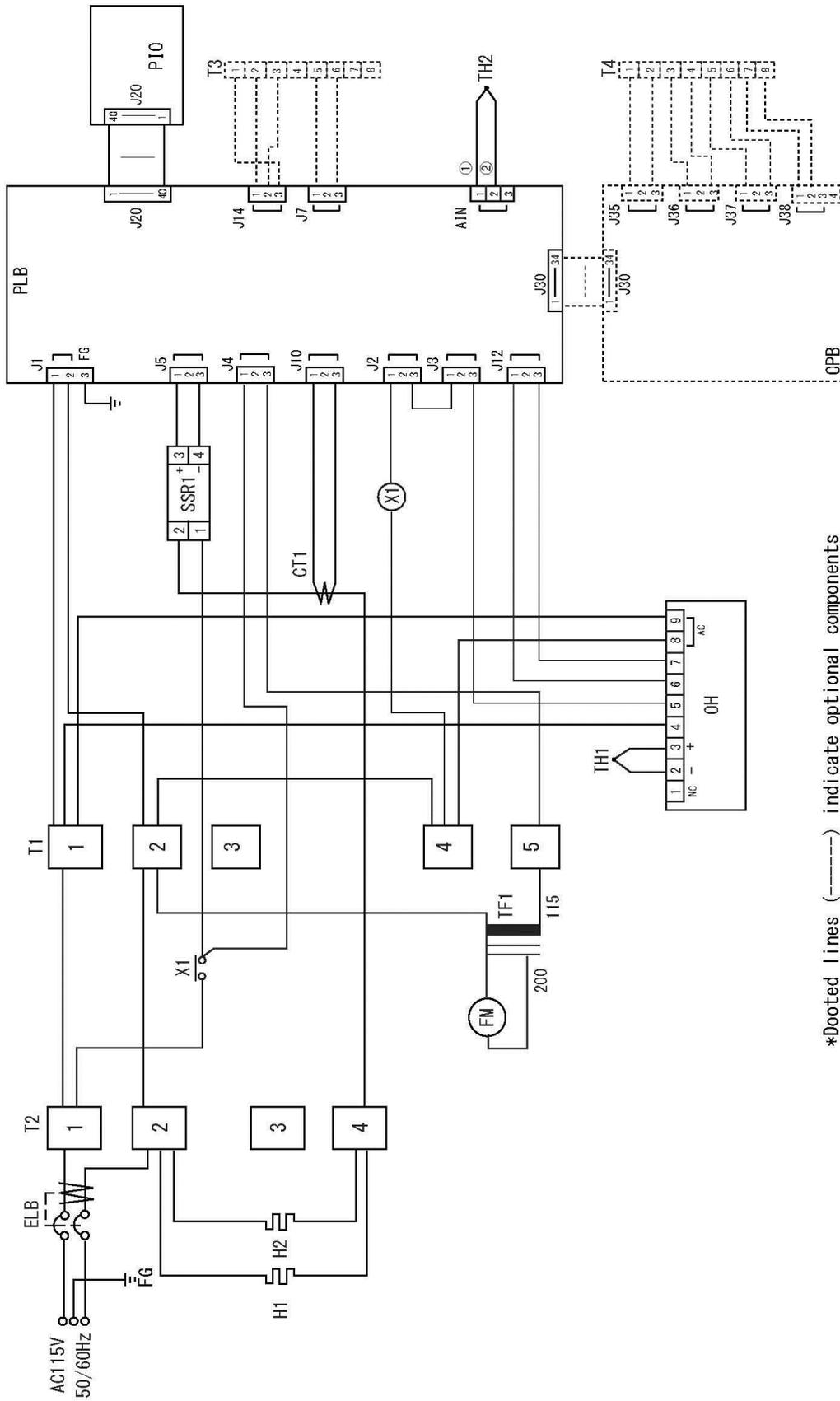
SK401/601 Wiring Diagram



*Dotted lines (-----) indicate optional components

12. WIRING DIAGRAM

SK801 Wiring Diagram



*Dotted lines (-----) indicate optional components

12. WIRING DIAGRAM

Wiring Diagram Glossary

SK401/601

Symbol	Component	Symbol	Component
ELB	Earth Leakage Breaker (ELB)	PLB	V model control board
T1	Terminal Block	PIO	V model display board
X1	Heater circuit cutoff relay	OH	Independent Overheat Prevention Device
SSR1	Solid State Relay (SSR) for heater	TH1	IOPD sensor
H1	Heater	TH2	Temperature control sensor
CT1	Current detection element		
Optional Component Designations			
Symbol	Component	Symbol	Component
T2	Terminal block for external output	OPB	Optional V model circuit board
T3	Terminal block for external output		

SK801

Symbol	Component	Symbol	Component
ELB	ELB	PLB	V model control board
T1	Terminal block	PIO	V model display board
T2	Terminal block	OH	Independent Overheat Prevention Device
X1	Heater circuit cutoff relay	TH1	IOPD sensor
SSR1	Solid State Relay (SSR) for heater	TH2	Temperature control sensor
H1	Heater	FM	Fan motor
H2	Heater	TF1	Transducer
CT1	Current detection element		
Optional Component Designations			
Symbol	Component	Symbol	Component
T3	External output terminal block	OPB	Optional V model circuit board
T4	External output terminal block		

SK811

Symbol	Component	Symbol	Component
ELB	ELB	PLB	V model control board
T1	Terminal block	PIO	V model display board
X1	Heater circuit cutoff relay	OH	Independent Overheat Prevention Device
SSR1	Solid State Relay (SSR) for heater	TH1	IOPD sensor
H1	Heater	TH2	Temperature control sensor
H2	Heater	FM	Fan motor
CT1	Current detection element		
Optional Component Designations			
Symbol	Component	Symbol	Component
T2	External output terminal block	OPB	Optional V model circuit board
T3	External output terminal block		

13. LIST OF HAZARDOUS SUBSTANCES



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

Explosive Substance	①Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	②Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④Metallic Azide, including Sodium Azide, etc.
Explosive Substances	①Metal "Lithium" ②Metal "Potassium" ③Metal "Natrium" ④Yellow Phosphorus
	⑤Phosphorus Sulfide ⑥Red Phosphorus ⑦Phosphorus Sulfide
	⑧Celluloids, Calcium Carbide (a.k.a, Carbide) ⑨Lime Phosphide ⑩Magnesium Powder
	⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder
	⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing Substances	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
Flammable Substances	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances having ignition point of 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a.amyl n-acetate) and other substances with ignition point between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyll Alcohol(a.k.a. Isoamyl Alcohol), Acetic Acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible Gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°C under air pressure.

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

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 SK series units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- 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.

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Laboratory Drying Sterilizer
SK401/601/801/811
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