



AUTOCLAVE

High Pressure Steam Sterilizer

Models SM201/301/311/501/511

Instruction Manual

First Edition

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

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

Yamato Scientific America, Inc.


1. SAFETY PRECAUTIONS	1
Explanation of Symbols	1
Symbol Glossary	2
Warning & Cautions	3
2. PRE-OPERATION PROCEDURES	5
Installation Procedures	5
Installation Precautions.....	12
3. COMPONENT NAMES AND FUNCTIONS	14
Main Unit Overview 1	14
Main Unit Overview 2.....	15
Main Unit Overview 3.....	16
Plumbing System	17
Control Panel	18
4. OPERATION PROCEDURE	19
Mode & Function Flow	19
Mode Key Overview.....	20
Display Symbol Glossary	20
Time & Temperature Settings.....	21
Setting Alert Tone	22
Sterilize.....	23
Sterilize & Dry	26
Other Functions.....	27
5. HANDLING PRECAUTIONS.....	29
6. MAINTENANCE PROCEDURE	30
Inspection & Maintenance.....	30
7. EXTENDED STORAGE & DISPOSAL	32
Extended Storage / Unit Disposal	32
Disposal Considerations	32
8. TROUBLESHOOTING	33
Error Code Guide.....	33
Troubleshooting Guide.....	34
9. SERVICE & REPAIR.....	35
10. SPECIFICATIONS	36
11. WIRING DIAGRAM	38
SM201	38
SM301/501.....	38
SM311/511	39
12. LIST OF HAZARDOUS SUBSTANCES	40
13. REPLACEMENT PARTS LIST.....	41


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



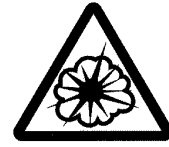
Danger!: High Voltage



Danger!: Extremely Hot



Danger!: Moving Parts



Danger!: Blast Hazard

Caution



General Caution



Caution: Electrical Shock!



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

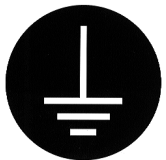


Do Not Touch

Action



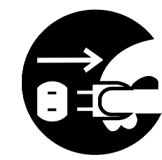
General Action Required



Connect Ground Wire



Level Installation Required



Disconnect Power



Inspect Regularly

1. SAFETY PRECAUTIONS

Warning & Cautions

**Never operate equipment near combustible gases/fumes.**

Do not install or operate SM 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.40).

**Always ground equipment.**

Always ground this unit properly to avoid electric shock.

**DO NOT operate equipment when abnormalities are detected.**

If smoke or unusual odors begin emitting from unit, or if any other abnormalities are detected, terminate operation immediately, turn off main power switch (Moldedcase circuit Breaker – "MCB") 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.

**NEVER disassemble or modify equipment.**

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

**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.

**DO NOT touch or block exhaust port**

The exhaust port located on right side of unit emits steam during operation and becomes extremely hot. Do not put hands or face near exhaust port and do not attempt to block or obstruct it in any way. Equipment damage, explosion or personal injury may result.

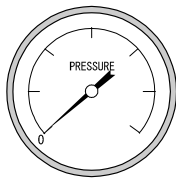
**DO NOT operate equipment during thunderstorm.**

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

1. SAFETY PRECAUTIONS

Warning & Cautions

Equipment under pressure.



DO NOT open unit lid until pressure gauge reads "0" (zero) psi. Opening while pressurized will allow high temperature, high pressure steam to abruptly escape chamber, possibly causing serious burns or other personal injury. When opening unit, always confirm pressure gauge reads "0" (zero) psi, then open cautiously, keeping hands and face away from chamber opening. Likewise, opening drain valve while unit is pressurized will cause the same results as above. DO NOT open drain valve until pressure gauge reads "0" (zero) psi.



Drain bottle.

The drain bottle, located behind the front panel of SM units contains hot water following an operation run. Do not touch or remove drain bottle while water is still hot. Serious burns or other personal injury may result. Wait until bottle cools before attempting to remove or drain.



Avoid hot surface areas

The lid, bottom plate and other areas surrounding the chamber are very hot following operation. To avoid being burned, do not touch these surface areas with bare fingers or hands. Always wear gloves and other protective gear when removing process loads.



Heat vents.

Vents located on the side and rear panels of SM unit dispell heat and steam during operation. Keep away from these vents while unit is in operation, to avoid being burned, and do not obstruct or attempt to block these vents in any way. Equipment malfunction or damage my result, possibly causing injury.



Pressure relief button.

When using the pressure relief button, located on the the side panel of SM unit, be sure there is no one near the exhaust port. High temperature, high pressure steam is expelled, which could cause burns or scalding.



DO NOT operate without water.



When sterilizer water heaters are run with low or no water, and exposed to air while heated, they quickly degrade and become damaged.



Confirm that chamber has been filled to the proper level with water before operating.
(See P.10)

2. PRE-OPERATION PROCEDURES

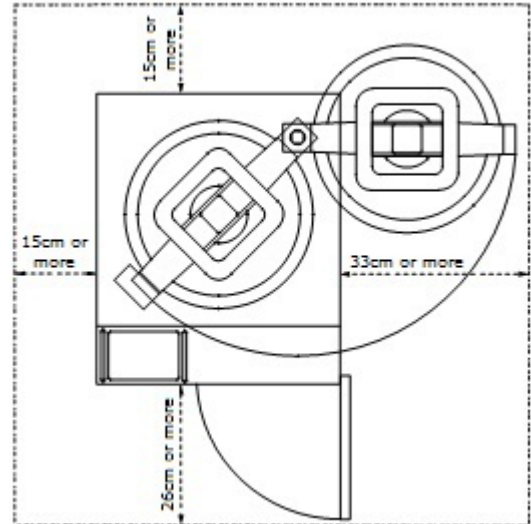
Installation Procedures



1. Choose an appropriate installation site.

- Do not install SM unit:
 - where flammable or corrosive gases/fumes will be generated.
 - where external 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 SM unit in a location with sufficient space, and ventilation as specified as below.

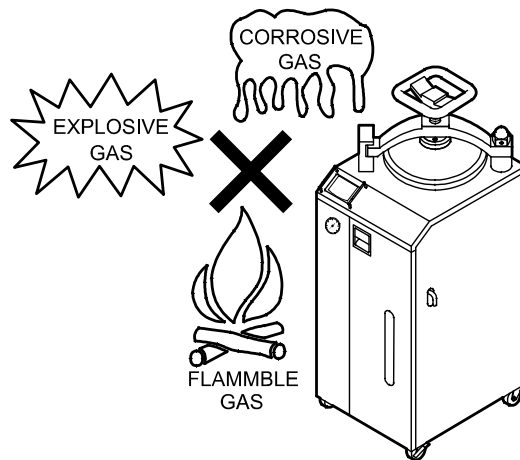


2. Install in a location free of flammables and explosives.

- Never install near flammables or explosives. SM unit is NOT fire or blast resistant. Simply switching the main power switch (MCB) "ON" or "OFF" can produce a spark, which can relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes.

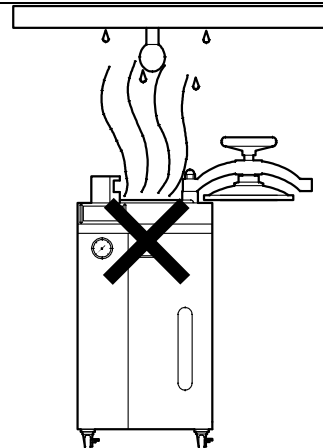


See "List of Hazardous Substances" (P.40).



3. DO NOT install under low ceilings.

- ! SM units emit a substantial amount of steam when opened, which can cause condensation build-up on/in objects above. Do not install or place unit in areas where there are objects immediately overhead, especially light or alarm fixtures. A short circuit or fire may result.

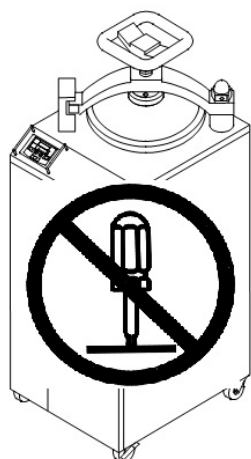


2. PRE-OPERATION PROCEDURES

Installation Procedures

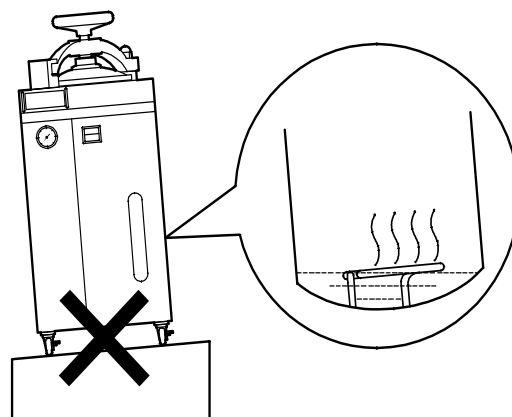
6. Never disassemble or modify.

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



7. Install on a level surface.

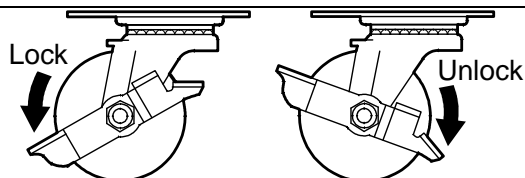
- ⊘ 水平 In order to keep water inside the unit level, be sure to install/place unit on a level and even surface. If water is not level, the heater may be exposed, causing operation to be terminated and may result in damage to the heater.



- ⚠ Approximate unit weight:
SM201: approx.65kg /SM301,311: approx.80kg/SM501,511: approx.85kg
Handle with care. Transportation and installation should always be performed by two or more people.

8. Lock casters.

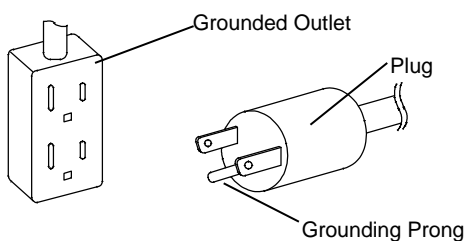
- ⊘ SM units come equipped with locks on front casters. Once unit is positioned, be sure to lock casters in place to stabilize unit and to keep it from rolling while in operation.



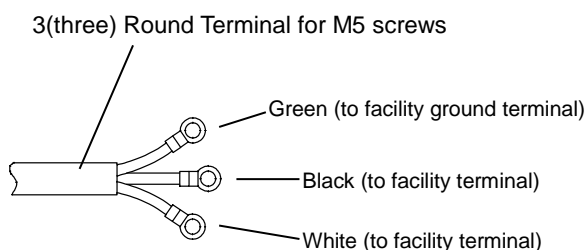
9. Ground wire MUST be connected properly.

- ⚠ Confirm that unit is properly grounded to avoid electric shock and equipment damage. Contact a local dealer, certified electrician, or Yamato Sales office for local electrical requirements.
- ⚠ Connect round terminals securely to facility terminal or to an appropriate connector.

SM201



SM301/311/501/511



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

2. PRE-OPERATION PROCEDURES

Installation Procedures



10. Connect to adequate power source.

<p>! Be sure unit is connected to a sufficiently rated power source (see table to right).</p>	Type	Power Source	Capacity
	SM201	AC115V single-phase	13A or more
	SM301	AC115V single-phase	15A or more
	SM311	AC220V single-phase	9.5A or more
	SM501	AC115V single-phase	15A or more
	SM511	AC220V single-phase	9.5A or more

11. Observe wire color designation.

<p>! 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 CF series units. Where required, purchase an appropriate plug and properly connect using the round terminals (see table to right).</p>	Wire color	Facility terminal
	Black	Live side
	White	Neutral side
	Green	Ground

12. Connect power cable.

<p>! Confirm main power switch is turned off prior to connecting the power cord. SM311 and 511 models do not include plugs. Select a power connection device (i.e. plug) appropriate to rating and power source.</p>

13. Install drain filter

<p>! Be sure filter is installed prior to operation.</p>	
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14. Install heater baffle

<p>! The heater baffle supports process load in chamber and protects heater 1 and sensor 2. Do not attempt to operate unit without installing heater baffle.</p>	
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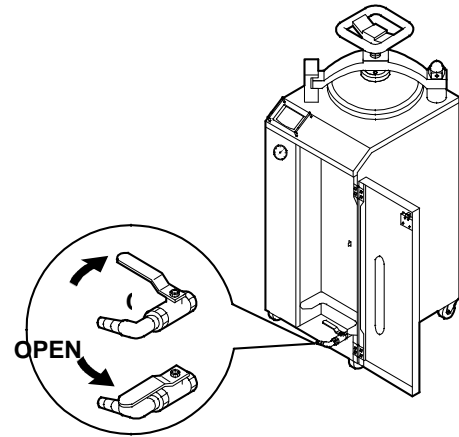
2. PRE-OPERATION PROCEDURES

Installation Procedures

15. Close the drain valve.



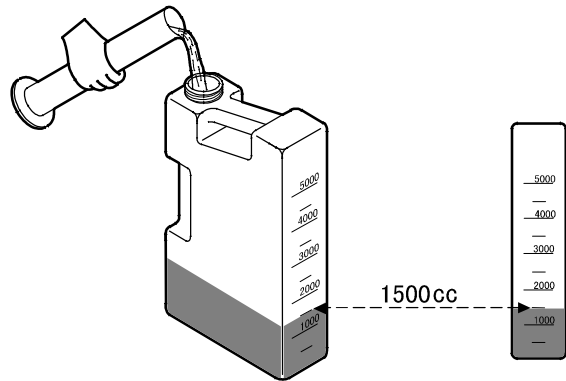
Be sure drain valve is closed prior to operation. Forgetting to close this valve or leaving it partially open will cause water to leak from chamber, resulting in equipment damage from overheating or fire.



16. Fill drain bottle to proper level.




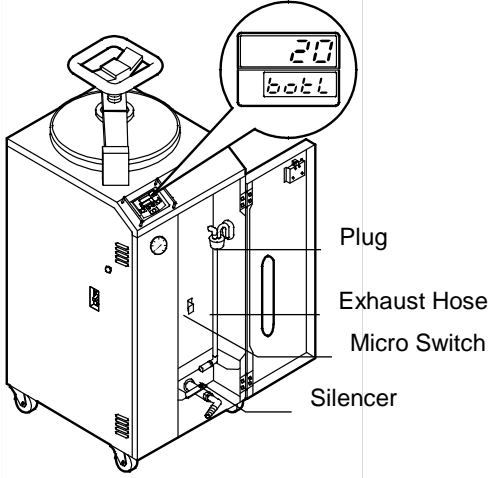
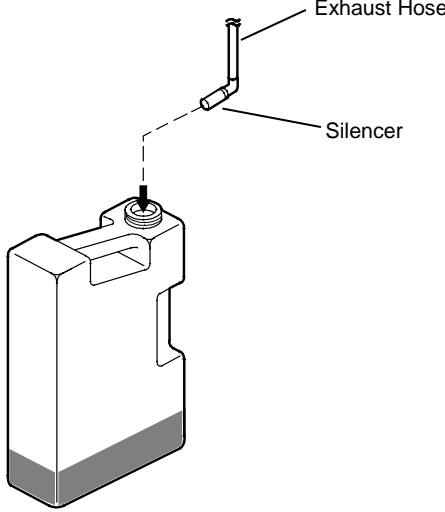
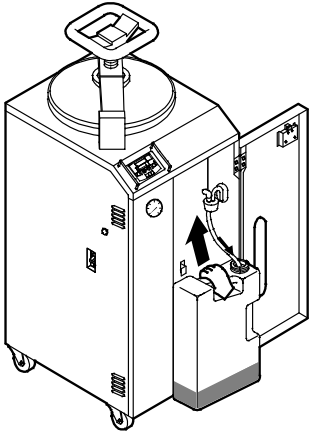
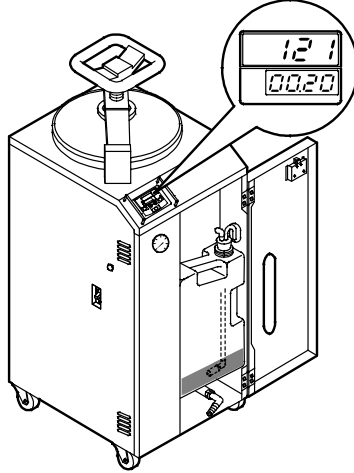
Fill the drain bottle with 1500cc of water to cool the steaming hot water that is pressure drained from the chamber into the drain bottle before unit enters the sterilization and drying process. Do not overfill the bottle or it may overflow and cause a short circuit or fire, resulting in equipment damage and/or serious injury. Observe the 1500cc fill limit.



2. PRE-OPERATION PROCEDURES

Installation Procedures

17. Install drain bottle.

	<p>For the safety of equipment and operators, SM series units feature a safety switch, which does not allow the the sterilizer to run without the drain bottle installed. Always be sure the drain bottle is installed before each operation. Do not attempt to operate unit without the bottle installed and do not attempt to modify or remove the drain bottle safety switch.</p>
<p>① Open the front panel door. The display will flash <i>botL</i>, indicating drain bottle is not installed.</p> 	<p>② Insert the end of the drain hose, with silencer attached, into the drain bottle containing 1500cc of water.</p> 
<p>③ While lifting the bottle into place, insert the drain hose the rest of the way into the bottle.</p> 	<p>④ Once the bottle is in place, the safety switch is depressed, allowing the sterilizer to be run.</p> 

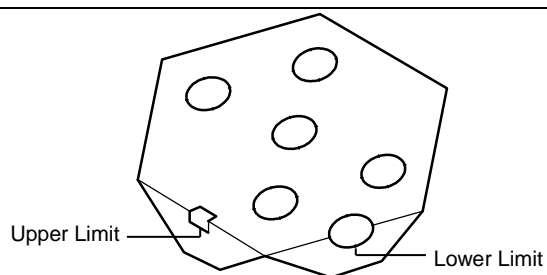
2. PRE-OPERATION PROCEDURES

Installation Procedures

18. Add water to chamber.

! Using the heater baffle as a gauge, add water to the chamber.

An inadequate amount of water will result in sterilization process interruption. Confirm water level before each operation run and be sure to add water before level reaches the lower limit.



SEE TABLE ON RIGHT FOR CHAMBER WATER CAPACITIES. USING MORE THAN THE MAXIMUM CAPACITY WILL RESULT IN HOT WATER OVERFLOWING FROM THE DRAIN BOTTLE.

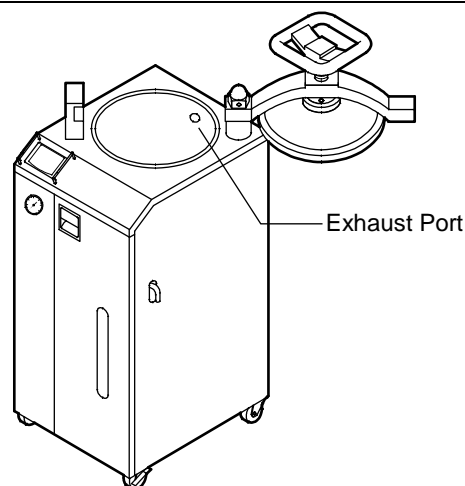
Requirement	
SM201	1900~2000ml
SM301	2800~3000ml
SM311	2800~3000ml
SM501	2800~3000ml
SM511	2800~3000ml

19. Use distilled water in chamber

! Well water and tap water is not recommended. To prevent mineral deposits from forming and to protect chamber components from corrosion, use distilled water in the chamber.

20. Place sterilization load in chamber.

! Place process load into basket and insert basket into chamber. Do not block the exhaust port. Always use basket for process load.



21. Close front panel door before operation.

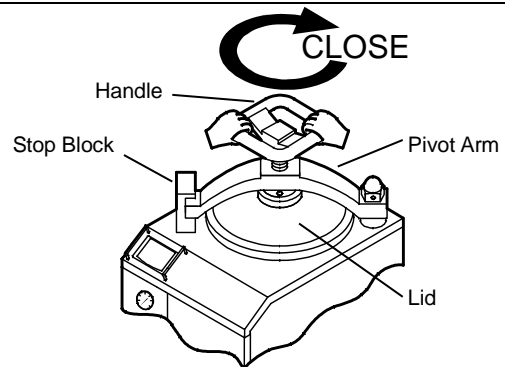
! Be sure that the front panel door of sterilizer is closed before operation. If door is left open, the drain bottle may fall out and spill, possibly causing a short circuit or fire, resulting in equipment damage and/or injury. Likewise, do not open the front panel door during operation.

2. PRE-OPERATION PROCEDURES

Installation Procedures

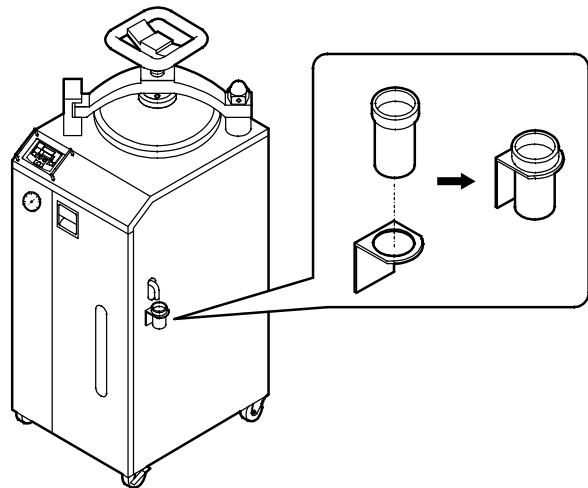
22. Close lid.

- !** Rotate lid pivot arm to the right until it interlocks with stop block and cannot be rotated further. Turn handle clockwise in 1/4-1/2 turns until lid is sealed securely. Do not overtighten. If lid is not closed completely, steam will escape from the chamber and contents will not be sterilized properly. Be sure that end of pivot arm is completely inserted into stop block and that lid has a good seal.



23. Position the condensation trap.

- !** Place the condensation trap cup into the magnetic holder and position under the steam condensation outlet, to catch condensation buildup so it does not drip onto the floor. See illustration to the right.



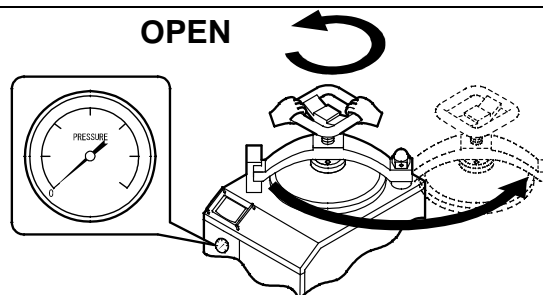
2. PRE-OPERATION PROCEDURES

Installation Precautions

1. Opening lid.



Before opening unit lid, be sure that the pressure gauge reads "0 psi". Then, proceed to open slowly. If lid is opened while unit is still under pressure, hot steam will abruptly escape chamber, possibly resulting in burns or other serious personal injury, caused by sudden reflexive movements.



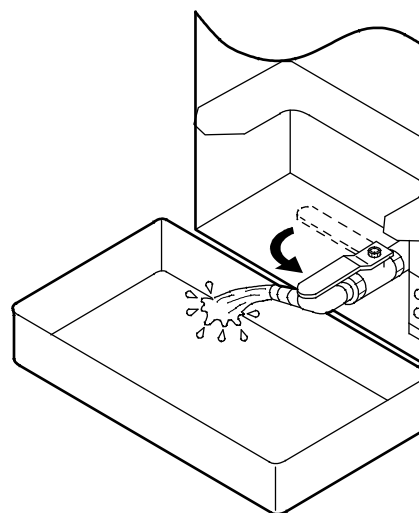
2. Draining sterilization chamber.



Water in chamber is very hot following operation runs. Allow water to cool sufficiently before draining. Place a drain pan less than 2 inches deep under the drain outlet or connect a drain hose routed to an appropriate drain before opening the drain valve.



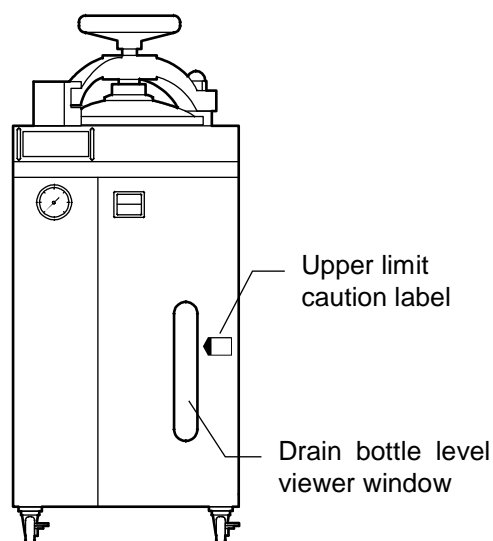
Never drain water during operation. If drain valve is opened while unit is pressurized, hot water will spray out, possibly causing burns or other serious injury.



3. Drain bottle view window.



Check the drain bottle level regularly by looking through the view window, located on the front panel. If water level is near the upper limit caution label, be sure to drain some water before proceeding with any further operations.



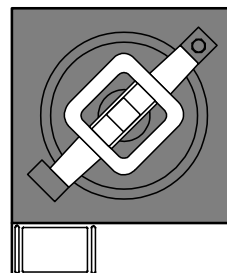
2. PRE-OPERATION PROCEDURES

Installation Precautions

4. Caution: HOT!

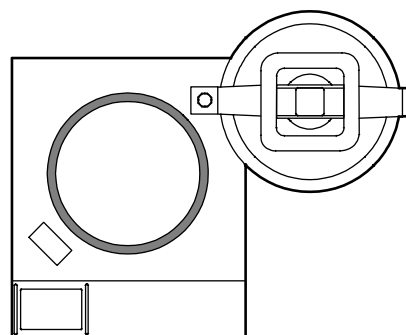
⚠ During and following operation, areas surrounding the lid become very hot. Do not touch these areas.

◆ Areas in gray signify HOT surfaces, in illustration to the right.



5. Chamber lid seal.

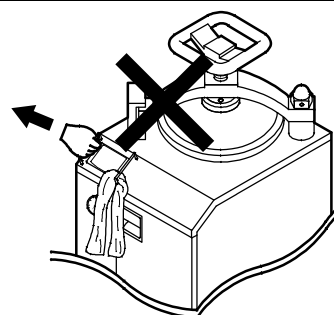
⊘ Any damage to or contaminants on the lid seal/chamber flange (area shown in gray to the right) will allow steam to escape, resulting in pressure loss and substandard sterilization. Keep this surface clean and avoid letting basket or other items come in contact with seal, when loading or removing items from the chamber. Overtightening lid may also result in premature seal deterioration.



The chamber lid seal may deteriorate with time and use. If steam is found to be escaping and chamber is losing pressure during normal use, the lid seal may need to be replaced.

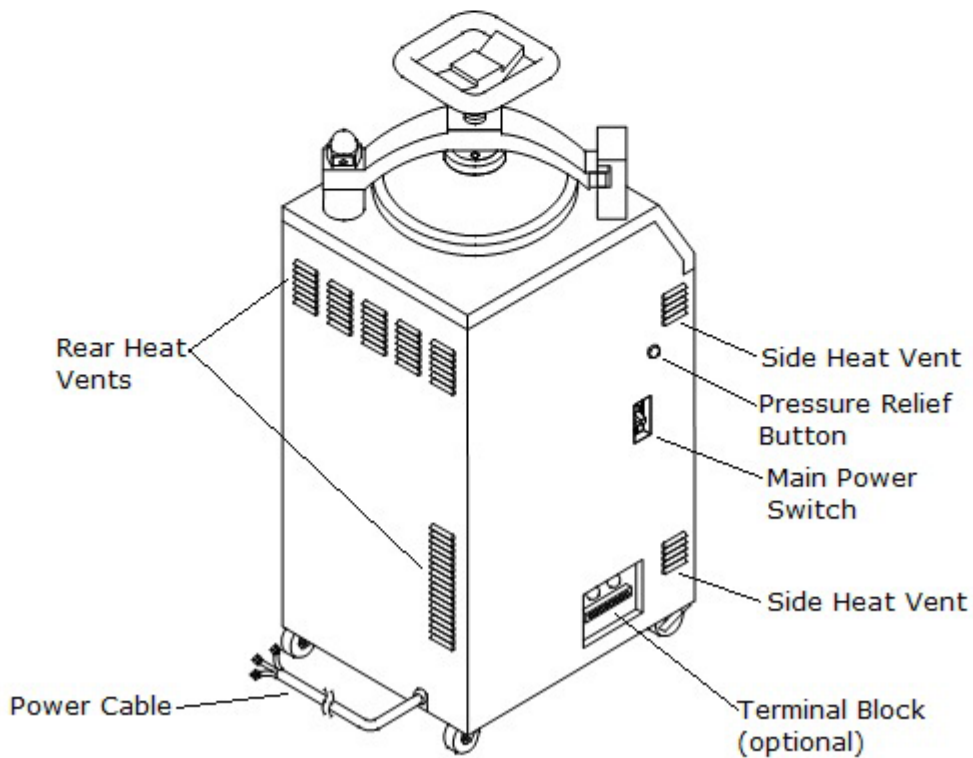
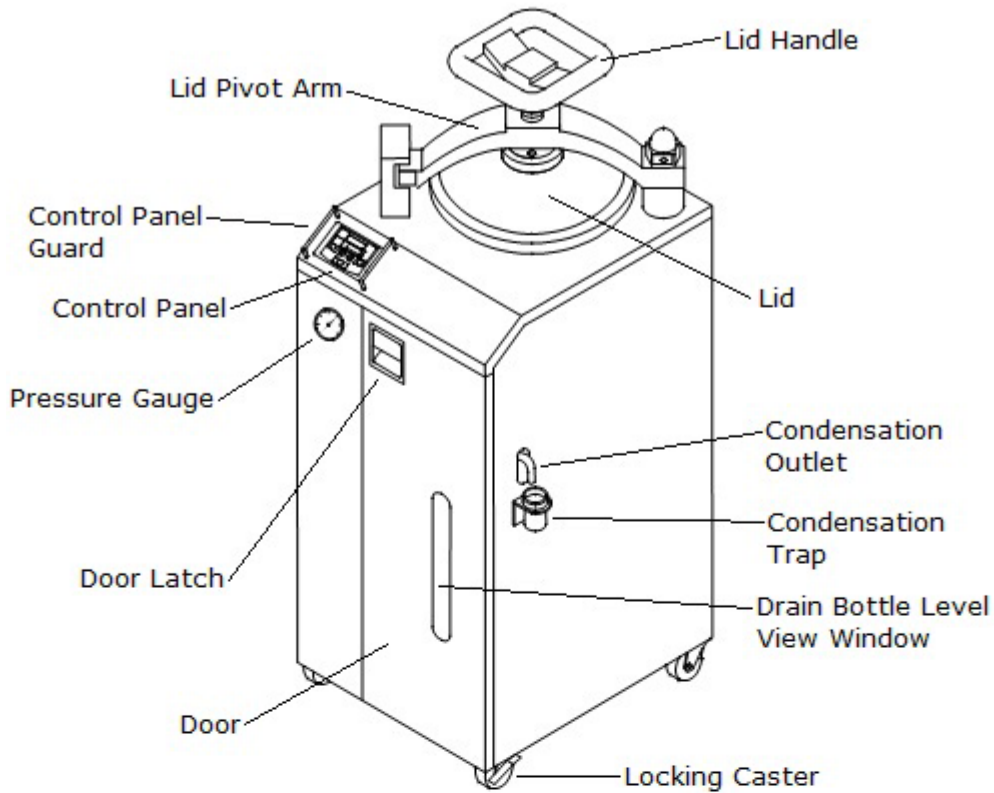
6. Control panel guard.

⊘ The control panel guard is designed to protect the display/keypad. Do not use the panel guard to move or reposition SM sterilizer unit.



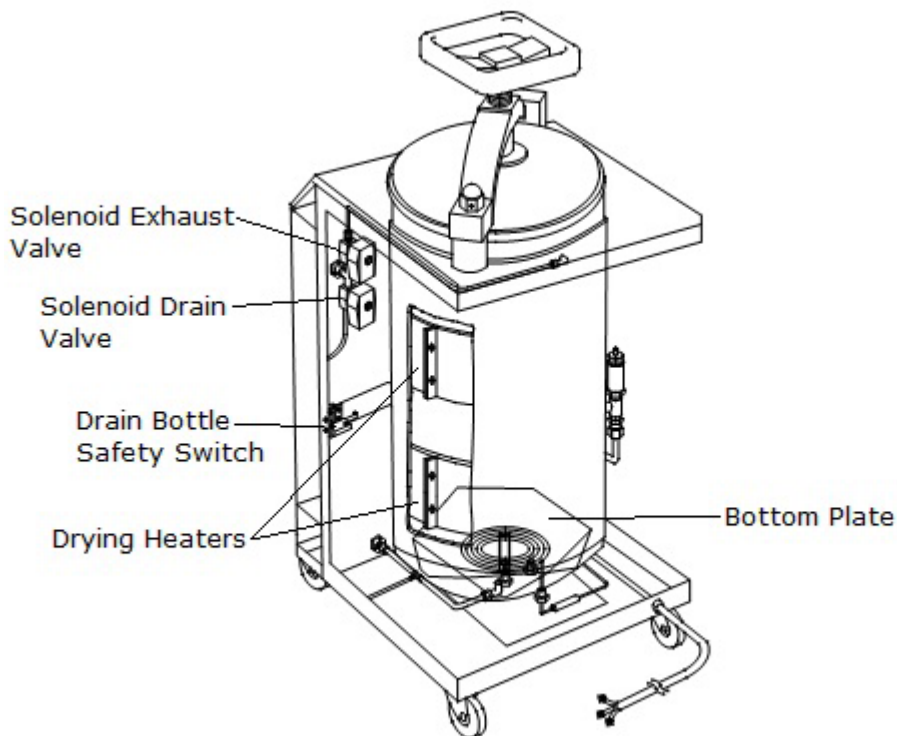
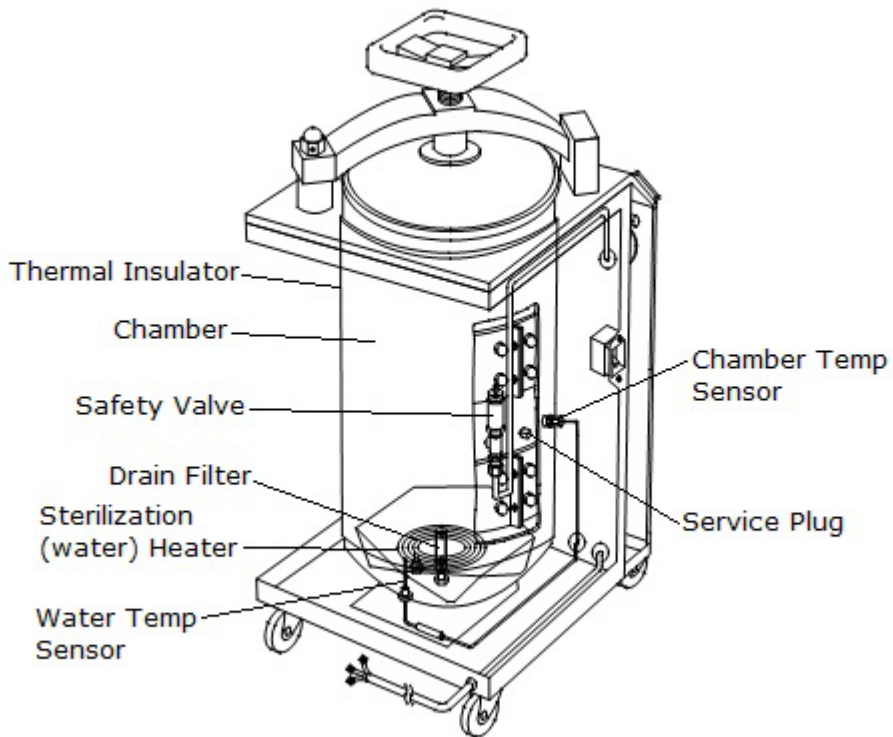
3. COMPONENT NAMES AND FUNCTIONS

Main Unit Overview 1



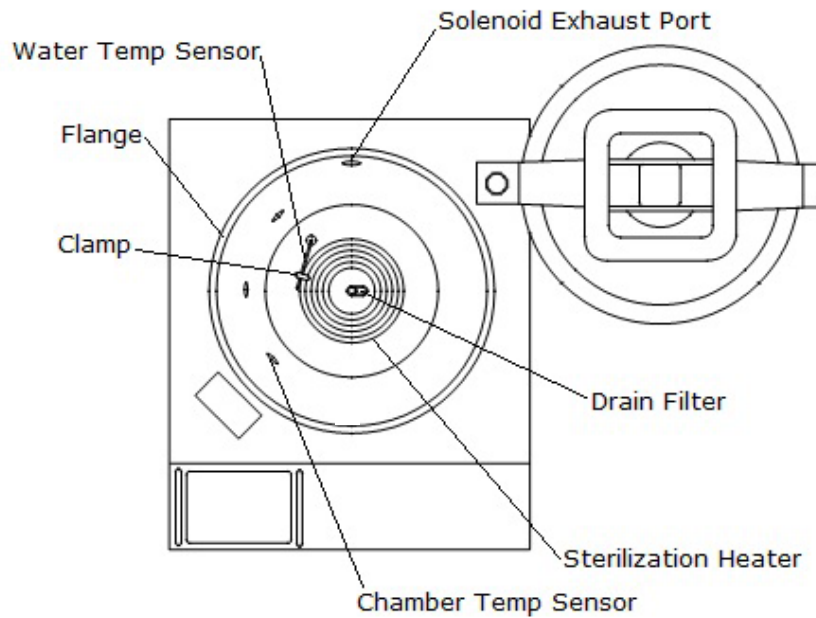
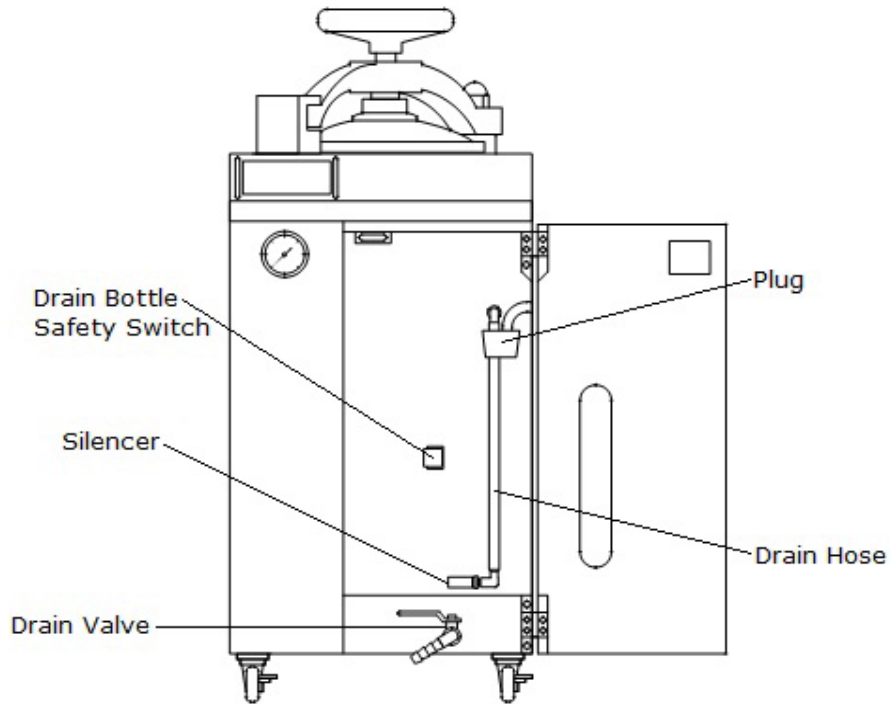
3. COMPONENT NAMES AND FUNCTIONS

Main Unit Overview 2



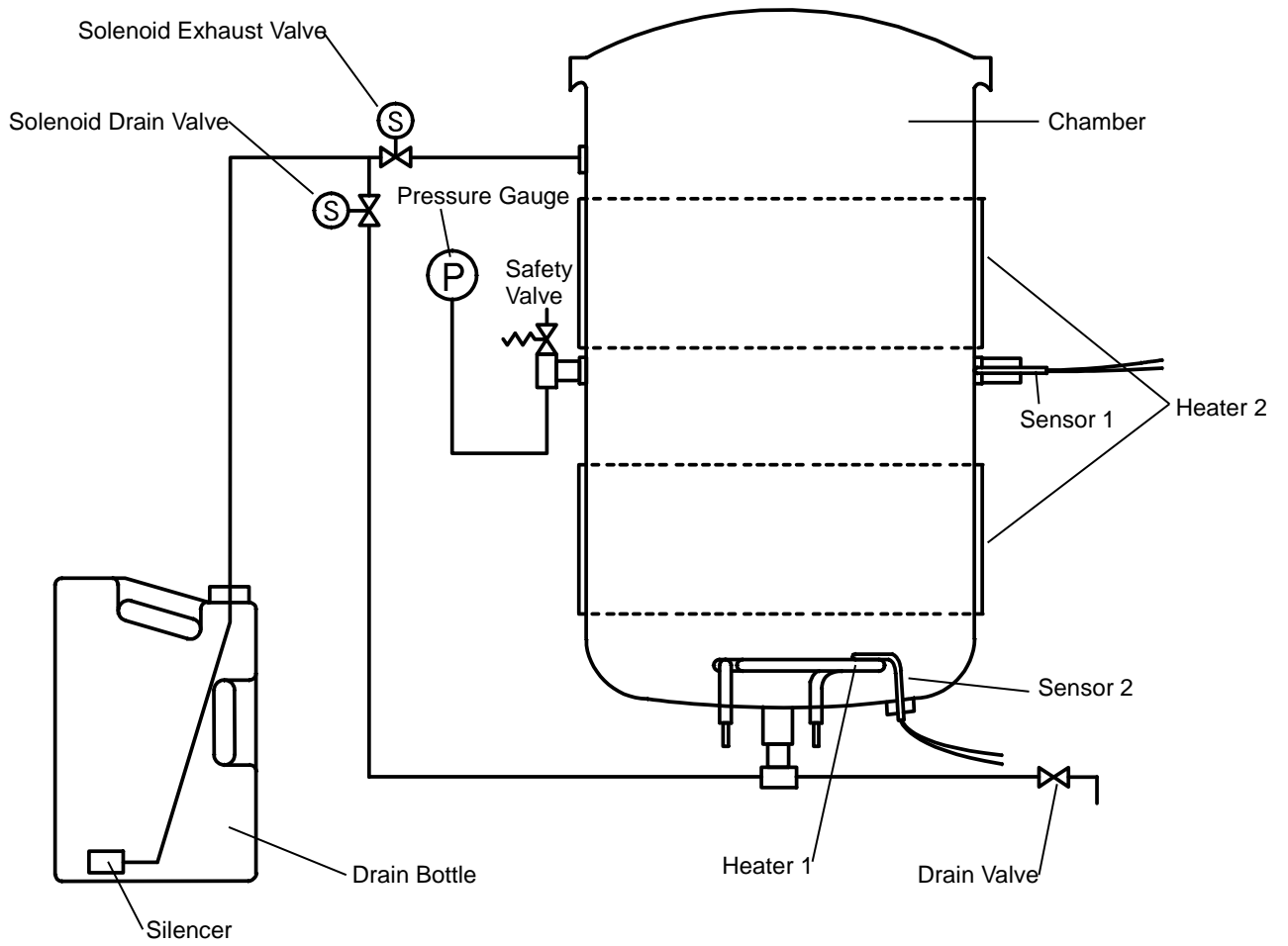
3. COMPONENT NAMES AND FUNCTIONS

Main Unit Overview 3



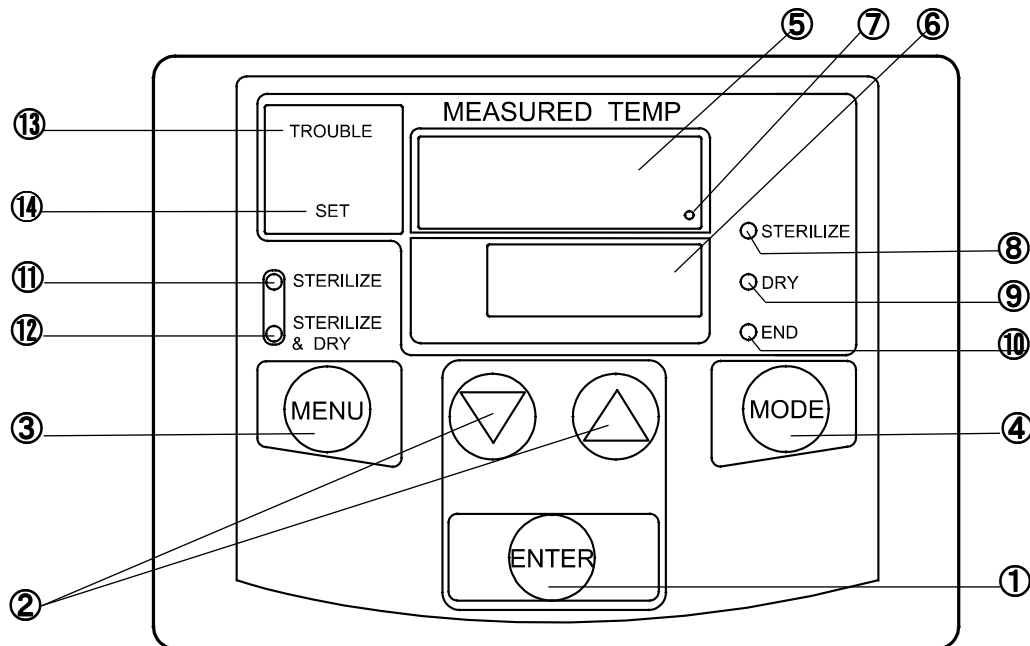
3. COMPONENT NAMES AND FUNCTIONS

Plumbing System



3. COMPONENT NAMES AND FUNCTIONS

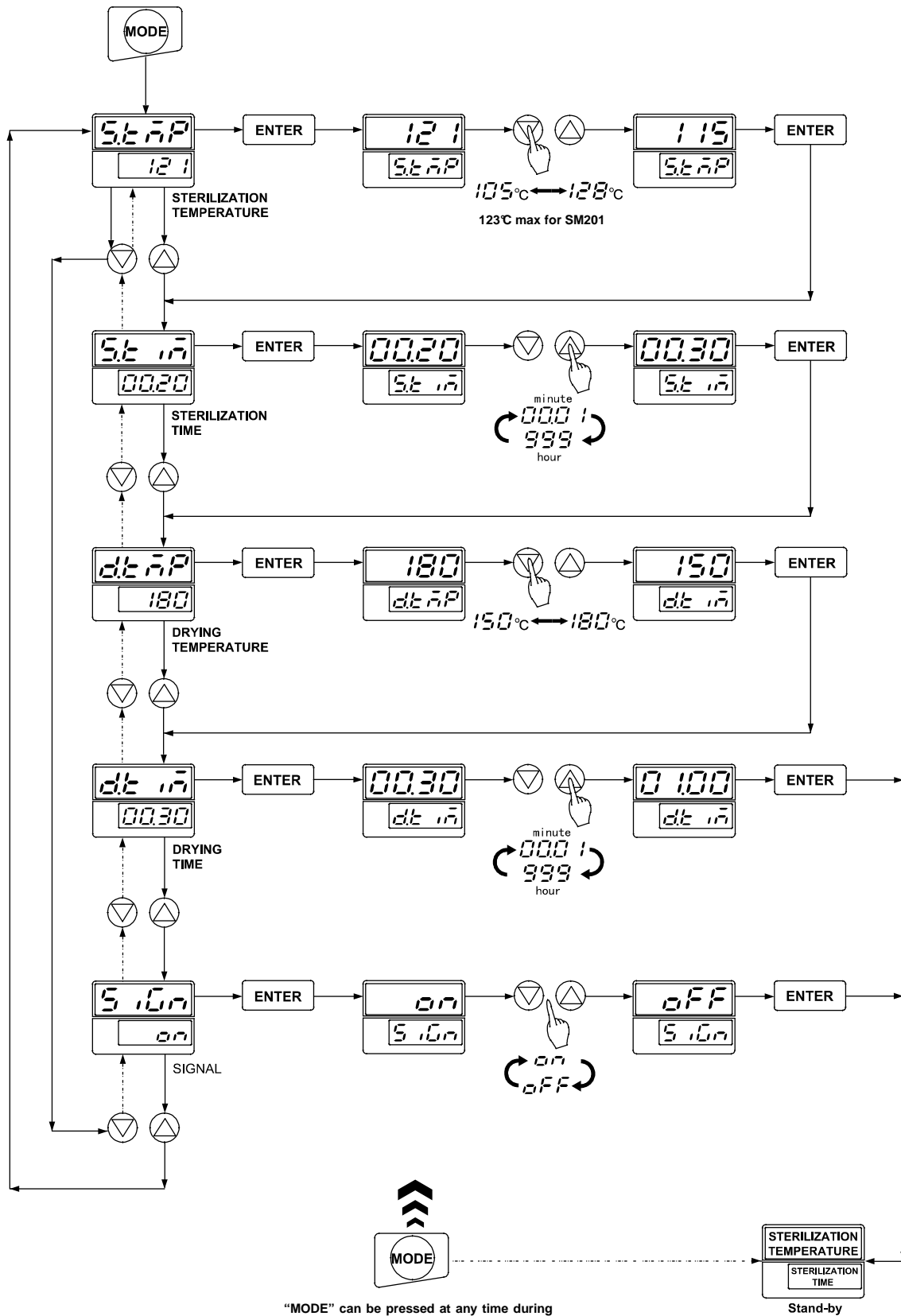
Control Panel



①	ENTER key	Starts or stops operation, finalizes settings or changes made.
②	$\Delta \nabla$ (up down) key	Press to decrease/increase setting values.
③	MENU key	Press to select "STERILIZE" mode or "STERILIZE & DRY" mode.
④	MODE key	Press to change or confirm settings. See P.20
⑤	Main display	Readout for temperature reading (chamber temp) and temperature setting.
⑥	Sub display	Readout for time remaining and time setting.
⑦	Heater lamp	Lights when heat is stabilized. Flashes when heat is building.
⑧	STERILIZE lamp	Lights or flashes during sterilization process.
⑨	DRY lamp	Lights or flashes during drying process.
⑩	END lamp	Lights when a process ends.
⑪	STERILIZE lamp	Flashes when "STERILIZE" menu is selected. Lights during process.
⑫	STERILIZE & DRY lamp	Flashes when "STERILIZE & DRY" menu is selected. Lights during process.
⑬	TROUBLE lamp	Lights when unit malfunctions.
⑭	SET lamp	Lights while pressing MODE key to check settings, etc.,

4. OPERATION PROCEDURE

Mode & Function Flow



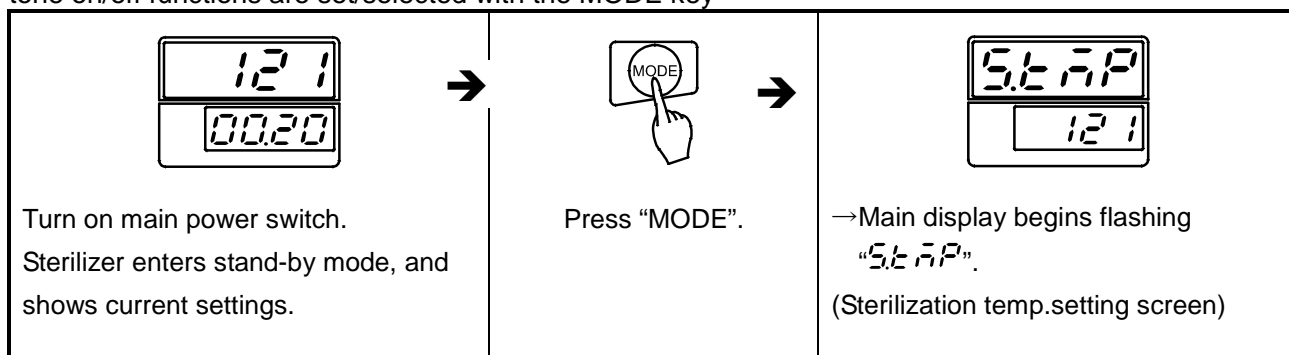
"MODE" can be pressed at any time during the above procedure to exit settings and return to standby screen

4. OPERATION PROCEDURE

Mode Key Overview

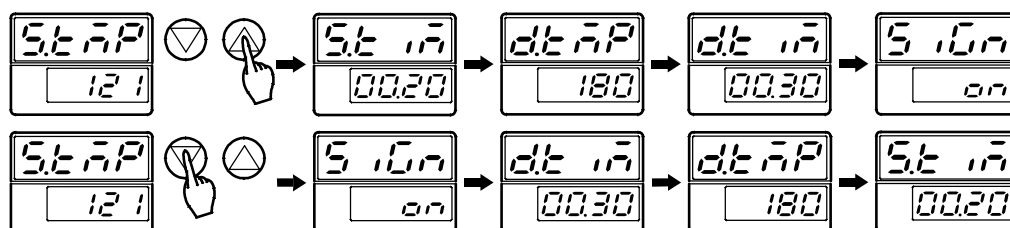
Using the MODE key.

The MODE key is used to change settings/modes and to monitor settings during operation. Sterilization temperature, sterilization time, drying temperature and drying time, as well as signal on/off and keypad tone on/off functions are set/selected with the MODE key



Other parameters

- Turn on main power switch.
- Press "MODE".
- Use ∇/Δ to toggle thru setting options.



Display Symbol Glossary


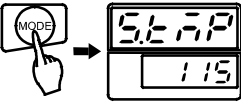
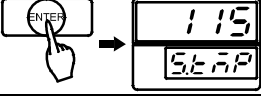

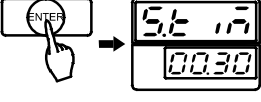
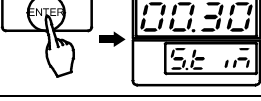
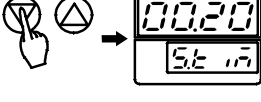
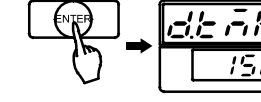
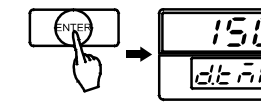
	Symbol	Meaning	Description
B	<i>botL</i>	BOTTLE	Indicates drain bottle not properly set or installed.
D	<i>dtAP</i>	DRY TEMPERATURE	Drying temperature setting indicator.
	<i>dt iA</i>	DRY TIME	Drying time setting indicator.
E	<i>End</i>	END	End of operation indicator.
	<i>Er.**</i>	ERROR	Operational error or malfunction indicator
O	<i>off</i>	OFF	Signal function off indicator.
	<i>on</i>	ON	Signal function on indicator.
S	<i>StAP</i>	STERILIZE TEMPERATURE	Sterilization temperature setting indicator.
	<i>St iA</i>	STERILIZE TIME	Sterilization time setting indicator.
	<i>Stop</i>	STOP	Operation stop/pause indicator.
	<i>S iOn</i>	SIGNAL	Alert tone setting indicator

4. OPERATION PROCEDURE

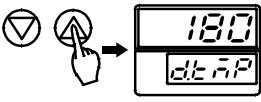
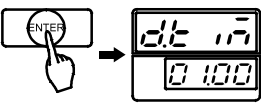
Time & Temperature Settings

Setting sterilization mode temp/time

- ◆ Set the sterilization temp/time.
- ◆ Simply press “MODE” to cancel settings at any point during setup.
- ◆ Screen automatically reverts to standby (no settings saved) if keys go unpressed for more than a minute during set up.






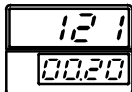
Standby		Turn main switch ON. Main display flashes sterilization temperature. Sub display flashes sterilization time.
Sterilization Temperature		Press “MODE”. Main display flashes <i>St AP</i> . Sub display flashes sterilization temperature.
		Press “ENTER”. Sterilization temperature can now be set.
		Enter desired sterilization temperature using ∇/Δ . ∇ ...decreases temperature value. Δ ...increases temperature value.
		Press “ENTER”. Sterilization temperature setting is finalized. Displays show sterilization time setting.
Sterilization Time		Press “ENTER” again. Sterilization time can now be set.
		Enter desired sterilization time using ∇/Δ . ∇ ...decreases time value. Δ ...increases time value.
		Press “ENTER”. Sterilization time setting is finalized. Displays show drying temperature setting.
		Press “MODE” to exit setup menu at this point, if drying mode will not be used. Otherwise, press “ENTER” and proceed to the next step.

Setting drying mode temp/time.


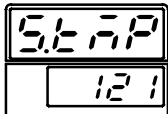
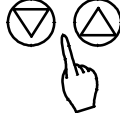
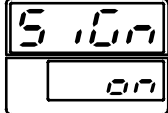
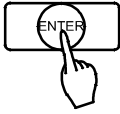
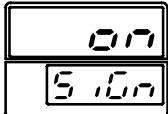

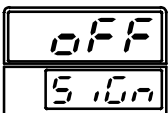
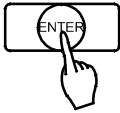
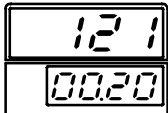
Drying Temperature		Enter desired drying temperature using ∇/Δ . ∇ ...decreases temperature value (min.150°C). Δ ...increases temperature value (max.180°C).
		Press “ENTER”. Drying temperature setting is finalized. Displays show drying time setting.

4. OPERATION PROCEDURE

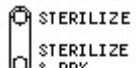
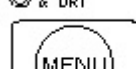

Time & Temperature Settings

Drying Time	 	<p>Press "ENTER" again. Drying time can now be set.</p>
	 	<p>Enter desired time using $\nabla\Delta$.</p>
	 	<p>Press "ENTER". Drying time setting is finalized. Displays automatically return to standby and flash newly set sterilization temperature and time.</p>

Setting Alert Tone

 	<p>Press "MODE". Main display flashes <i>5:00</i>. Sub display flashes sterilization temperature.</p>
 	<p>Use $\nabla\Delta$ keys to scroll through settings until <i>5:00</i> is displayed (as illustrated on the left).</p>
 	<p>Press "ENTER". <i>on</i> is displayed in the main display and setting can be changed.</p>
 	<p>Using $\nabla\Delta$, select either <i>on</i> or <i>off</i>.</p>
 	<p>Press "ENTER". Alert tone setting is finalized, displays return to initial stand by screen.</p>

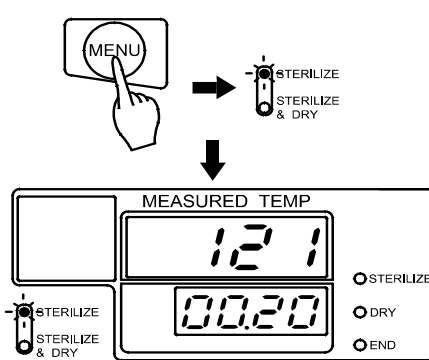
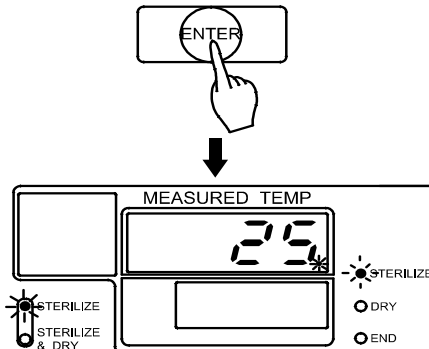
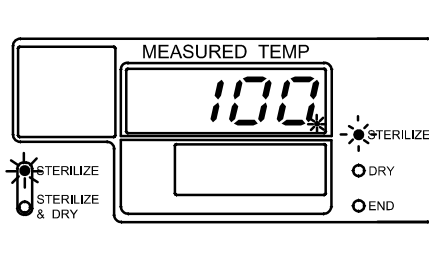
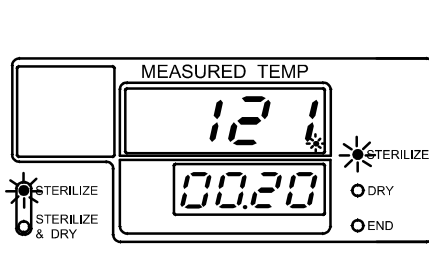
Select between the two operation processes

  	<ul style="list-style-type: none"> • Turn on main power switch. • Press "MENU" to select STERILIZE only process. Press "MENU" again to select STERILIZE & DRY process. ● Process setting change can be made only in stand-by mode. Once operation begins process setting cannot be changed.
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4. OPERATION PROCEDURE

Sterilize

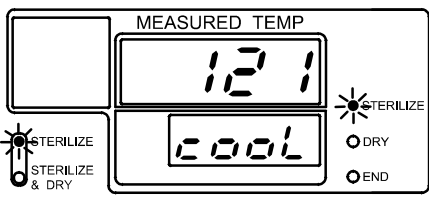
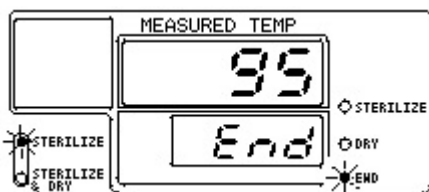
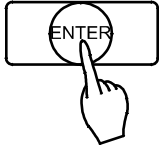
STERILIZE operation process

	<p>! Confirm the following:</p> <ol style="list-style-type: none"> ① Is the drain valve closed? P.8 ② Is the drain filter installed? P.7 ③ Is the bottom plate in place? P.7 ④ Is the drain bottle in place? P.9 ⑤ Does chamber have proper amount of water? P.10 ⑥ Is the lid closed completely? Pg.11
Setup	 <ul style="list-style-type: none"> ◆ Turn on main power switch. ◆ Press “MENU” key and select “STERILIZE” (See P.22). ◆ Set the sterilization temperature and time as desired (See P.21). <p>→ Main display flashes temperature setting. → Sub display flashes time setting. → Sterilize menu lamp flashes.</p>
Operation Start / Air Purge	 <ul style="list-style-type: none"> ◆ Press “ENTER”. <p>Operation begins. Sterilization heater turns on. The solenoid exhaust valve opens. Air is purged from chamber. (Approximately 20-25 minutes)</p> <p>→ Main display shows water temp and heater lamp status. → Sub display remains blank. → Sterilize process lamp (right) flashes. → Sterilize menu lamp (left) lights.</p>
Pressurization	 <p>When air purge stage is completed, the solenoid exhaust valve closes, and pressurization stage begins. (Approximately 20-25 minutes)</p> <p>→ Main display shows chamber temperature. → Sterilize process lamp lamp flashes. → Sterilize menu lamp lights.</p>
Sterilization	 <p>When the chamber temperature reaches temperature setting, sterilization process begins and the timer begins counting. At this point, sub display shows remaining sterilization time.</p> <p>→ Main display shows chamber temperature. → Sub display shows remaining time. → Sterilize process lamp is lights. → Sterilize menu lamp is lights.</p>

4. OPERATION PROCEDURE

Sterilize

STERILIZE process (continued)

Cooling		<p>Cooling begins when sterilization time ends and heater automatically turns off.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display flashes <i>cool</i>. → Sterilize process lamp lights. → Sterilize menu lamp lights.
End		<p>To prevent sudden boilups (bumping), the solenoid exhaust valve opens once the chamber temperature falls below the boiling point.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display shows <i>End</i>. → End lamp lights. → Sterilize menu lamp lights.
		<ul style="list-style-type: none"> ◆ Press "ENTER" to clear <i>End</i> and return to standby screen. Another cycle may now be run.

STERILIZE operation using a sterilization bag

- ① Leave bag unsealed and open so that steam will be able to enter.
- ② Be sure that bag height reaches no more than 2/3 the height of chamber. If bag is allowed to exceed this height, steam will be unable to circulate efficiently and exhaust port may be obstructed, resulting in substandard sterilization.
- ③ Do not set temperatures higher than the capacity of sterilization bag to resist heat.
- ④ Time settings will depend on quality and quantity of items being sterilized. Give due diligence to inquiring after and confirming item specifications, so that proper temperatures and times are used.

Examples

Sample	Temperature	Time	Quantity
Gauze	121°C	30min.	Five rolls gauze (approx 3.3m ² ea.)
Petri Dish	121°C	40min.	30 petri dishes with lids

◆ Above data is for reference only. Sterilization results may vary.

◆ Never place items directly on top of heater or bottom plate. Always use sterilizer basket.

4. OPERATION PROCEDURE

Sterilize & Dry

STERILIZE & DRY operation process



Confirm the following.

- ① Is the drain valve closed? P.8
- ② Is the drain filter installed? P.7
- ③ Is the bottom plate in place? P.7
- ④ Is the drain bottle in place? P.9
- ⑤ Does chamber have proper amount of water? P.10
- ⑥ Is the lid closed completely? P.11

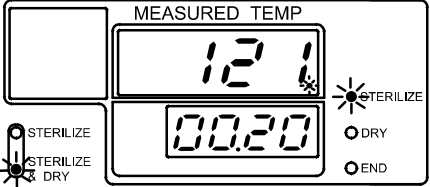
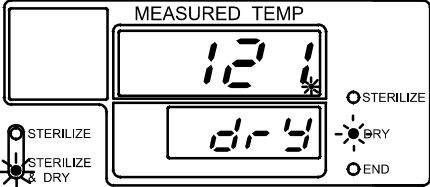
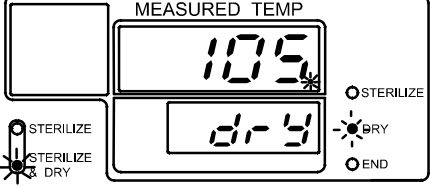
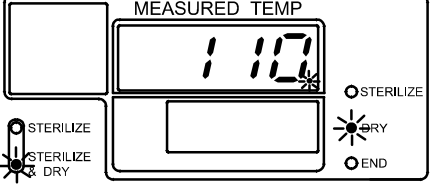
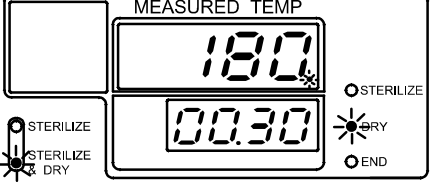


In the “STERILIZE & DRY” process, water is automatically drained from the chamber to the drain bottle before the drying process begins. Check water level in the drain bottle prior to operation and drain as necessary to prevent an overflow.

Setup		<ul style="list-style-type: none"> ◆ Turn on the main power switch. ◆ Select “STERILIZE & DRY” with the “MENU” key. (See P.22) ◆ Set temperature and time as desired. (See P.21 & 22) <p>→ Main display flashes temperature setting. → Sub display flashes time setting. → Sterilize & Dry menu lamp flashes.</p>
Operation Start / Air Purge		<ul style="list-style-type: none"> ◆ Press “ENTER”. <p>Operation begins. Sterilization heater turns on. Solenoid exhaust valve opens to purge air from chamber.</p> <p>→ Main display shows water temperature. → Sub display is blank. → Sterilize process lamp flashes. → Sterilize & Dry menu lamp lights.</p>
Pressurization		<p>When air is purged, the solenoid exhaust valve closes, and pressurization stage begins. (Approximately 20-25 minutes)</p> <p>→ Main display shows chamber temperature. → Sterilize lamp flashes. → Sterilize & Dry menu lamp lights.</p>

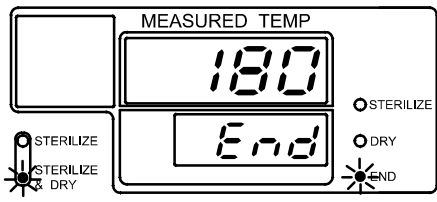

4. OPERATION PROCEDURE

Sterilize & Dry

Sterilization		<p>When chamber temperature reaches temperature setting, the sterilization stage begins.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display shows remaining sterilization time. → Sterilize process lamp flashes. → Sterilize & Dry menu lamp lights.
Drain		<p>When sterilization is complete, the solenoid drain valve opens, draining all water from the chamber, and the drying heater turns on.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display flashes <i>dry</i>. → Dry process lamp flashes. → Sterilize & Dry menu lamp lights.
Air Purge		<p>When chamber has drained, the solenoid drain valve closes. The solenoid exhaust valve opens to purge air from the chamber.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display flashes <i>dry</i>. → Dry process lamp flashes. → Sterilize & Dry menu lamp lights.
Heating		<p>When all air has been purged from the chamber, temperature begins building.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display is blank. → Dry process lamp lights. → Sterilize & Dry menu lamp lights.
Drying		<p>The drying stage begins when chamber temperature comes to within 4°C of temperature setting.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display shows remaining time. → Dry process lamp lights. → Sterilize & Dry menu lamp lights.

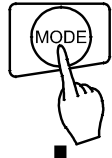

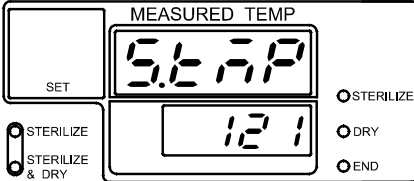
4. OPERATION PROCEDURE

Sterilize & Dry

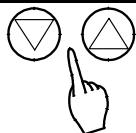
Cooling / End		<p>When drying process ends, heater turns off and chamber begins cooling.</p> <ul style="list-style-type: none"> → Main display shows chamber temperature. → Sub display flashes <i>End</i>. → End lamp lights. → Sterilize & Dry menu lamp lights.
		<ul style="list-style-type: none"> ◇ Press “ENTER” to clear <i>End</i> and return to standby screen. <p style="text-align: center;">Another cycle may now be run.</p>
<p>! Drain some water from the drain bottle after “STERILIZE & DRY” process. Failure to do so may cause hot water to overflow during next operation run.</p> <p>Water in drain bottle is hot immediately following operation. Wait for water to cool before draining.</p>		

Other Functions

Monitoring settings during operation.

	<ul style="list-style-type: none"> ◇ Press “MODE”.
	<ul style="list-style-type: none"> → Main display flashes <i>SET</i> (temp setting). → Sub display shows temperature setting. → SET lamp lights.
	<p>To check other settings, use ∇ \triangle to show the desired indicator (flashing) in main display and view the settings in sub display. Press “MODE” to return to operation screen.</p> <p>Note: settings are read-only in monitoring mode. They cannot be changed.</p>

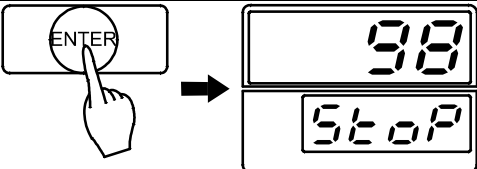
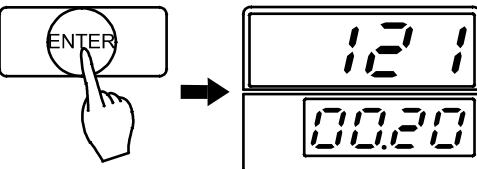
Monitoring chamber temperature in standby

	<p>Press ∇ or \triangle.</p> <p>Main display shows temperature inside the chamber. Release key to go back to stand-by.</p>
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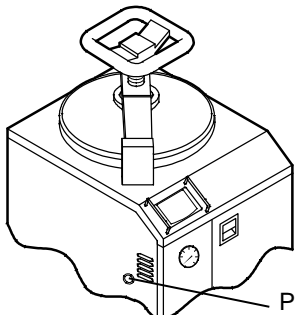

4. OPERATION PROCEDURE

Other Functions

Pausing operation.

	<ul style="list-style-type: none">◇ Press "ENTER".Operation stops. Steam is purged if pressurized.→ Main display shows current chamber temp.→ Sub display flashes <i>Stop</i>.
	<ul style="list-style-type: none">◇ Press "ENTER" twice to resume operation.→ Main display flashes temperature setting.→ Sub display flashes time setting.

Using the pressure relief button.

	<ul style="list-style-type: none">◇ Push the pressure relief button to depressurize the chamber when necessary. <p>Pushing the pressure relief button opens the solenoid exhaust valve and steam inside the chamber is routed to the drain bottle, decreasing chamber pressure and temperature.</p>
	<p>The pressure relief button may only be used when the solenoid exhaust valve is closed. Be sure that process load is not prone to sudden boilups. Do not touch exhaust areas on sterilizer. Burns or other injury may result. Sudden boilups or steam spray, due to the abrupt pressure decrease may damage container or cause bodily injury.</p>

5. HANDLING PRECAUTIONS



Warning

1. Hazardous substances.



Never process explosive or flammable items. Fire or explosion causing serious injury or death may result. See "List of Hazardous Substances" (P.40) for more information on these items.

2. DO NOT operate equipment when abnormalities are detected.



If unit begins emitting smoke or abnormal odors for reasons unknown, turn off main power (MCB) 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 top of 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 top of equipment.



Do not place any objects on unit. Doing so may cause unit to become unstable and tip over, resulting in possible equipment damage, injury or death.

3. DO NOT operate equipment during thunderstorms.



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

6. MAINTENANCE PROCEDURE

Inspection & Maintenance

Conduct daily general inspections and maintenance for optimal performance.

Warning

- Turn off main power switch and disconnect power cable before daily inspection and maintenance.
- Inspect and perform maintenance on unit when chamber is at room temperature.
- Never disassemble equipment.

Caution

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

Daily.

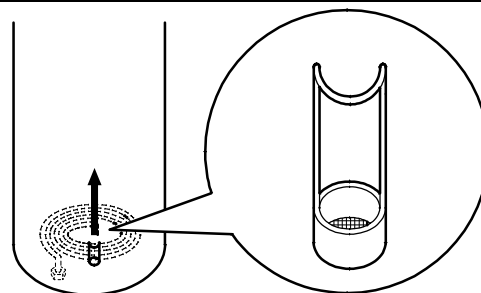
- When processing biological media, clean chamber daily with a damp cloth.

Weekly.

- Thoroughly clean the inside of chamber with a clean damp cloth, weekly, regardless of processing item type. Do not remove drain filter for cleaning, otherwise drain pipe may become clogged with debris.

Clean Filter.

- Draining may be hampered if filter is allowed to become clogged. Clean filter at appropriate intervals, according to frequency of use. Remove filter from bottom drain port and clean with tap water.



Lid seal cleaning & replacement.

- The lid seal may be wiped clean with a clean damp cloth, and should be examined regularly for cracks or damage. To replace, contact a local dealer Yamato sales office for assistance.

Cleaning coil heater.

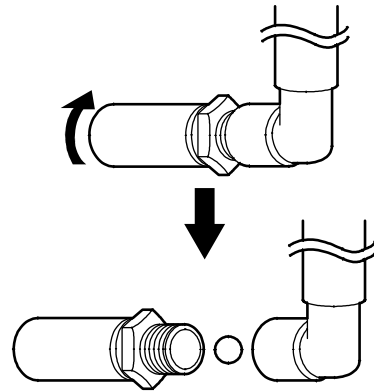
- The coil heater in the bottom of chamber should be cleaned twice a month. Mineral deposit buildup on heater will result in poor heat transfer and will cause sheathing to overheat.

6. MAINTENANCE PROCEDURE

Inspection & Maintenance



Cleaning silencer

! SM sterilizers are equipped with a silencer, attached to the end of exhaust hose, to reduce the noise caused by purging air and steam. Remove silencer and clean once a month. A ball valve prevents water from flowing back into chamber. Be careful not to allow ball to drop out and be lost when removing the silencer. Be sure to replace ball along with silencer after cleaning.



7. EXTENDED STORAGE & DISPOSAL

Extended Storage / Unit Disposal

 Warning	 Caution
<p>If unit will be out of service for an extended period:</p> <ul style="list-style-type: none">● Turn off main power switch (MCB) and disconnect power cable from facility outlet or terminal.● Drain water from chamber and drain bottle.	<p>Unit disposal:</p> <ul style="list-style-type: none">● Remove lid pivot arm and hinges to prevent unit from being locked..● Do not leave unit unattended, or in a place where children may 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 America, Inc. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

8. TROUBLESHOOTING

Error Code Guide

Self-diagnostics

SM series sterilizers feature self-diagnostic circuitry to monitor operation. In the event of a malfunction, a flashing error code appears on the display and an alert sounds. Power to the heater is also disabled. Confirm the error code and turn off the main power switch immediately.

A safety valve activates when pressure inside the chamber is determined to be abnormal. No alert is emitted in this case. A significant amount of steam, however, will discharge from the rear vents and other exterior openings. When this happens, there may be an air purge problem or the temperature controller may be faulty. Press "ENTER" immediately to terminate operation and turn off the main power switch when steam emission settles.

Error Code Table

Symbol	Definition	Indicators	Fail-safe	Solution
<i>Er.01</i>	Sensor error	Display with alert tone	Heater circuit disabled	Replace sensor, etc.,
<i>Er.02</i>	Triac error	Display with alert tone	Heater circuit disabled	Replace triac, etc.,
<i>Er.03</i>	Heater error	Display with alert tone	Heater circuit disabled	Replace heater, etc.,
<i>Er.10</i>	Main relay error	Display with alert tone	Heater circuit disabled	Replace relay, etc.,
<i>Er.14</i>	Back-up battery error	Display with alert tone	Unit remains in standby.	Turn on main power switch to battery
<i>Er.20</i>	Heater water low	Display with alert tone	Heater circuit disabled	Add water to chamber

What to do in the event of a power failure



When the main power switch is accidentally turned off, or when power is temporarily interrupted during operation:

1. SM sterilizer will remain in the same state it was in when disabled. If chamber was under pressure at the time of the failure, it will remain pressurized.
2. When power is restored the operation program is lost and the solenoid exhaust valve remains closed until chamber temperature drops below the boiling point.

Do not open the chamber at this point. Otherwise hot, pressurized steam will discharge rapidly, possibly resulting in burns or other injury.

If opening unit becomes necessary, push the pressure relief switch to reduce chamber pressure to "0" psi before proceeding to open.

8. TROUBLESHOOTING

Troubleshooting Guide

Troubleshooting table

Symptom	Check Points
Display does not come up when main power switch is turned on.	<ul style="list-style-type: none">• Is the power cable connected?• Is a power outage in progress?• Is power source voltage adequate?
Air does not purge. Safety valve is activated.	<ul style="list-style-type: none">• Is the exhaust hose kinked or clogged?• Is the line clogged with debris?
Water does not drain. Water does not drain in drying process.	<ul style="list-style-type: none">• Is drain filter clogged?
Sterilization temperature does rise. Pressure does not build.	<ul style="list-style-type: none">• Is the lid closed securely?• Is seal or flange damaged?
Pressure increases when solenoid valve is open.	<ul style="list-style-type: none">• Is the chamber exhaust port clogged?
Temperature fluctuates during operation.	<ul style="list-style-type: none">• Are there considerable changes in external temperature?
Steam discharges rapidly.	<ul style="list-style-type: none">• Is there water in the drain bottle?• Is exhaust hose positioned incorrectly or damaged?
Water leaks.	<ul style="list-style-type: none">• Is drain valve closed all the way?• Is the drain bottle overfilled?
Operation does not start from stand-by.	<ul style="list-style-type: none">• Is drain bottle in position?
Loud noise during air purge.	<ul style="list-style-type: none">• Is the silencer installed correctly?

◆ For further technical assistance, contact Yamato Scientific at (800) 292-6286

9. SERVICE & REPAIR

Requests for Repair

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

Contact a local dealer or Yamato sales office for assistance.

The following information is required for all repairs.

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

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for SM series autoclave sterilizers. "Repair parts" is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

SM201/301/501

Model		SM201	SM301	SM501
System		Automatic high pressure steam sterilizer		
Temperature Setting Range	Sterilization	105°C~123°C	105°C~128°C	105°C~128°C
	Drying	150°C~180°C		
Maximum Operational Pressure		0.18MPa (26.1psi)	0.2MPa (29.0psi)	0.2MPa (29.0psi)
Power Requirement		AC115V 13A (50/60Hz)	AC115V 15A (50/60Hz)	AC115V 15A (50/60Hz)
Control Unit		HiTec IV CR Type Microprocessor Control		
Sensor 1 (Chamber Temp.)		Pt100Ω resistance thermometer sensor		
Sensor 2 (Water Temp.)		Thermocouple (Type T)		
Timer		1min. ~ 99hours and 59min. 100 ~ 999hours		
Heater 1 (Sterilization)		1.3kW	1.7kW	1.7kW
Heater 2 (Drying)		1.0kW	1.5kW	1.5kW
Safety Devices		Main circuit breaker, Over pressure safety valve, Self-diagnostic circuitry; Monitors any abnormality of the temp sensor, Low water sensor, SSR, and heater		
External Dimensions (W × D × H)		16.1" × 18.5" × 37.4" 41cm × 47cm × 95.3cm	17.3" × 20.9" × 38.0" 44cm × 53cm × 96.5cm	17.3" × 20.9" × 42.7" 44cm × 53cm × 108.5cm
Interior Dimensions (Diameter, Depth):		9.4", 17.5" 24cm, 44.5cm	11.8", 17.5" 30cm, 44.5cm	11.8", 26.2" 30cm, 66.5cm
Capacity (cu. ft):		0.8	1.2	1.8
Capacity (liters):		22	36	51
Weight		143.3 pounds 65kg	176.4 pounds 80kg	187.4 pounds 85kg

Included accessories

Drain Bottle	1
Basket	2
Bottom Plate	1
Condensation Trap	1
Instruction Manual	1

10. SPECIFICATIONS

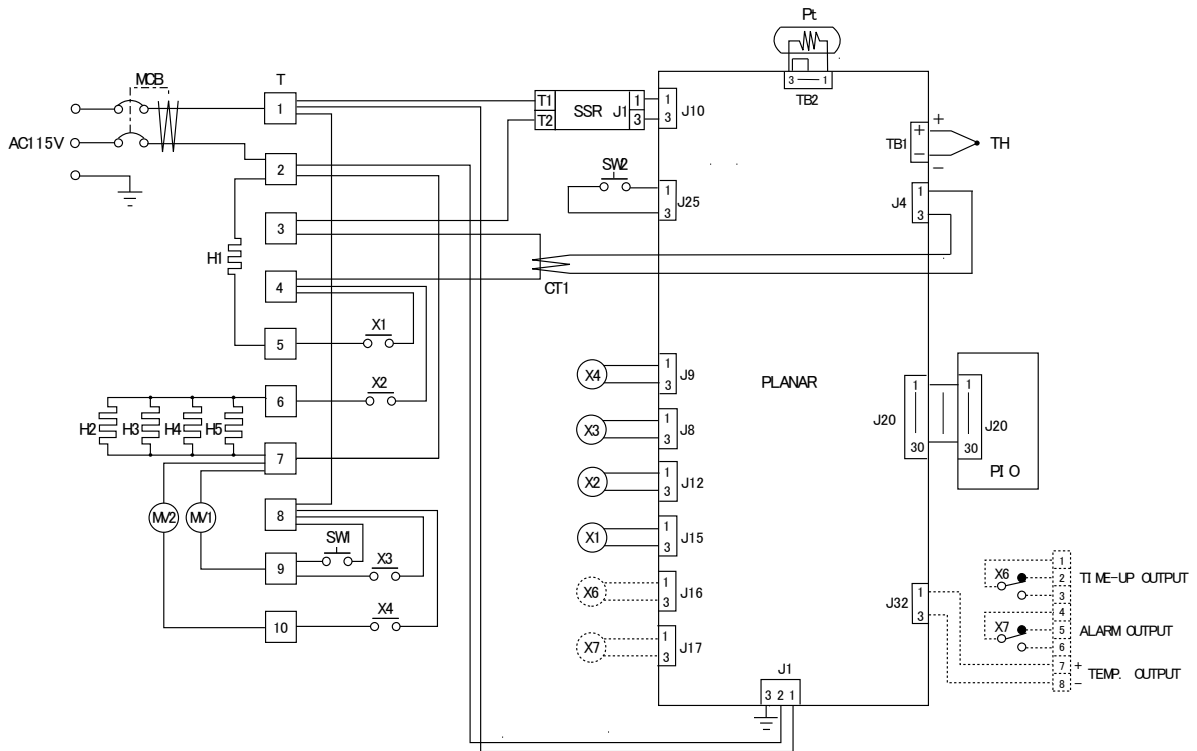
SM311/511

Model		SM311	SM511
System		Automatic High pressure steam sterilizer	
Temperature Setting Range	Sterilization	105°C~128°C	
	Drying	150°C~180°C	
Maximum Operational Pressure		0.2MPa (29.0psi)	
Power Requirement		AC220V 9.5A (50/60Hz)	
Control Unit		HiTec IV CR Type Microprocessor Control	
Sensor 1 (Chamber Temp.)		Pt100Ω thermometer sensor	
Sensor 2 (Water Temp.)		Thermocouple (Type T)	
Timer		1min. ~ 99hours and 59min. 100 ~ 999hours	
Heater 1 (Sterilization)		2.0kW	
Heater 2 (Drying)		1.5kW	
Safety Devices		Main circuit breaker, Over pressure safety valve, Self-diagnostic circuitry; temp sensor abnormality monitor, Low water sensor, SSR, and heater	
Exterior Dimensions (W × D × H):		17.3" × 20.9" × 38.0" 44cm × 53cm × 96.5cm	17.3" × 20.9" × 42.7" 44cm × 53cm × 108.5cm
Interior Dimensions (Diameter, Depth):		11.8", 17.5" 30cm, 44.5cm	11.8", 26.2" 30cm, 66.5cm
Capacity (cu. ft):		1.2	1.8
Capacity (liters):		36	51
Weight		176.4 pounds 80kg	187.4 pounds 85kg

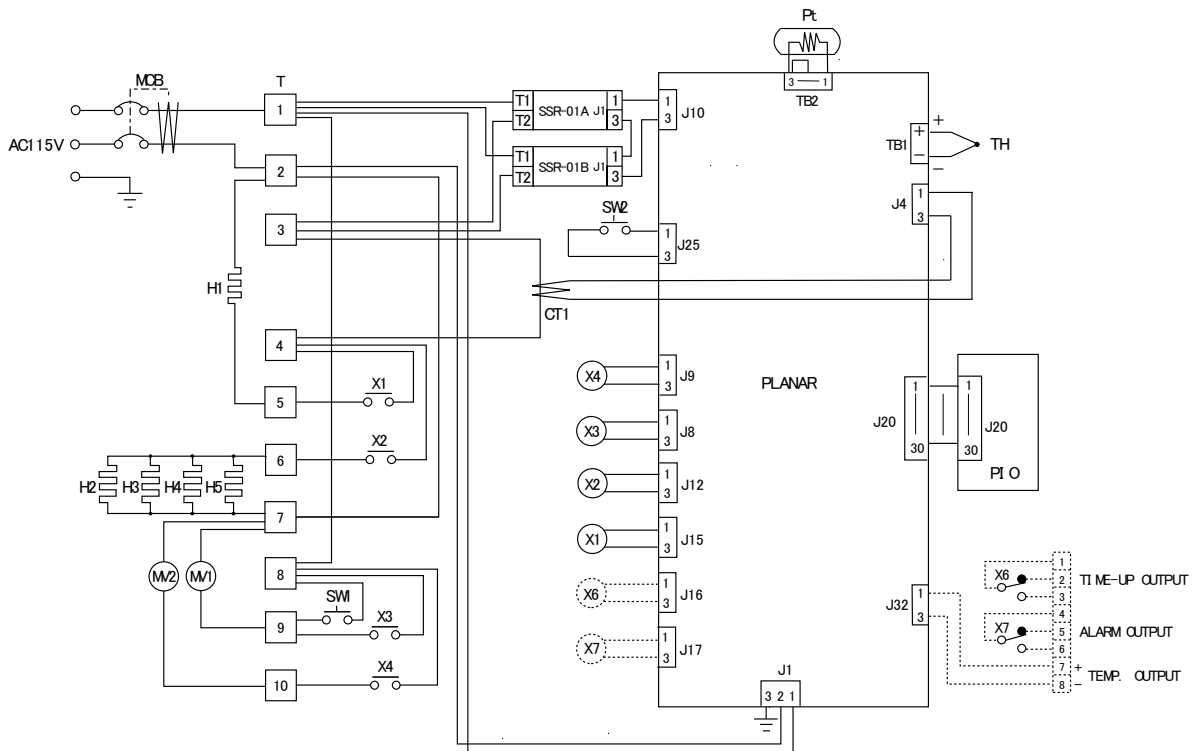
Drain Bottle	1
Basket	2
Bottom Plate	1
Condensation Trap	1
Instruction Manual	1

11. WIRING DIAGRAM

SM201



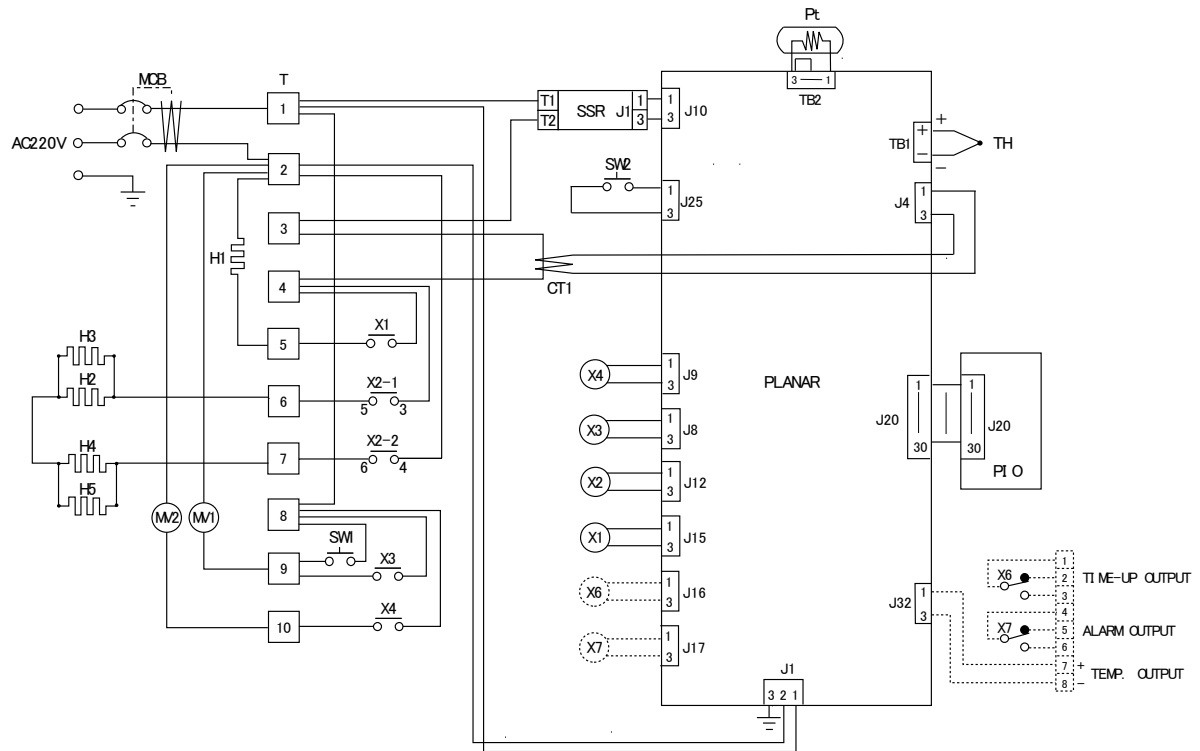
SM301/501



◆ Dashed line indicates optional items

11. WIRING DIAGRAM

SM311/511



◆ Dashed line indicates optional items

Wiring diagram glossary

Symbol	Description	Symbol	Description
X	Relay	PIO	Display Board
CT	Current Transformer	SW1	Pressure Relief Switch
SSR	Solid State Relay	SW2	Micro Switch
MCB	Circuit Breaker	TH	Sensor 2 (Thermocouple)
T	Terminal	Pt	Sensor 1 (Pt100Ω thermometer)
MV1	Solenoid Exhaust Valve	H1	Heater 1 (Sterilization)
MV2	Solenoid Drain Valve	H2~5	Heater 2 (Drying)
PLANAR	Control Board		

12. 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 Phosphorus⑦Phosphorus Sulfide
	⑧Celluloids, Calcium Carbide (a.k.a, Carbide)⑨Lime Phosphide⑩Magnesium Powder
	⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder
	⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing Substances	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
Flammable Substances	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a.amyl n-acetate) and other substances with ignition point between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyl Alcohol(a.k.a. Isoamyl Alcohol), Acetic Acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible Gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°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)

13. REPLACEMENT PARTS LIST

All models (unless otherwise noted)

Part Name	Part No.	Specifications
Control Board	LT00037120	
PIO Board	1240000028	IV _{FR}
SSR1 (SM301/501)	LT00028427	SSR-01A
SSR2 (SM301/501)	LT00028425	SSR-01B
SSR (SM201/311/511)	LT00028423	
Relay (SM301/501)	2050000010	
Relay (SM311/511)	2050000031	
Relay	2050000028	
Adhesive Keypad	SM51A-30490	W467
Current Transformer	2170010002	URP CTL-6-5-400
Pressure Relief Switch	2010010014	A2A-4W
Circuit Breaker(SM201/311/511)	2060010003	FB32B-15
Circuit Breaker(SM301)	A0195	FB32B-20
Circuit Breaker(SM501)	2060000014	BS2022
Heater 1 (SM201)	2240000057	AC115V 1.3kw
Heater 1 (SM301/501)	2240000058	AC115V 1.7kw
Heater 1 (SM311/511)	2240000059	AC220V 2.0kw
Heater 2 (SM201)	2260000003	AC115V 500W
Heater 2 (SM301/311/501/511)	2260000004	AC115V 750W
Sensor 1	1160030035	Pt100ΩThermometer Sensor
Sensor 2	1160030034	T type Thermometer
Solenoid Exhaust Valve (SM201/301/501)	3020010016	AB41-02-7-C4A PT1/4 AC100V CKD
Solenoid Exhaust Valve (SM311/511)	3020020008	AB41-02-7-K4A PT1/4 AC200V CKD
Solenoid Drain Valve (SM201/301/501)	3020010016	AB41-02-7-C4A PT1/4 AC100V CKD
Solenoid Drain Valve (SM311/511)	3020020008	AB41-02-7-K4A PT1/4 AC200V CKD
Micro Switch (for drain bottle)	2020010005	ABV163661
Safety Valve (SM201)	3180016003	M3D-B1.6±0.2Kgf/cm ²
Safety Valve (SM301/311/501/511)	3180016002	M3D-B2.0±0.2Kgf/cm ²
Plug	SM500-30280	
Silencer	SM500-30340	
Lid Gasket (SM201)	SM200-40170	SH75UN
Lid Gasket (SM301/311/501/511)	SM500-40170	SH75UN
Bottom Plate (SM201)	SM200-30750	
Bottom Plate (SM 301/311/501/511)	SM500-30750	
Filter	SM500-30700	
Drain Valve	3-15-0003-6002	Type BSB PT3/8
Mesh	(WG)253003-172-2	
Drain Bottle	7260000006	5000cc
Pressure Gauge	5050000002	GS58-201

Limited liability

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

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

Never attempt to disassemble, repair or perform any procedure on SM 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 America will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

Instruction Manual

Autoclave High Pressure Steam Sterilizer

SM201/301/311/501/511

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