

EYELA

Vacuum Constant
Temperature
Dryer **Vacuum Dry Oven**

VOS-210C
VOS-310C

Instruction Manual

This instruction manual is designed to use the product efficiently and safely with keeping its best performance.



IMPORTANT

**Be sure to read “Safety precautions”
before use.**

Please keep this manual in a place easily accessible to every user.




IMPORTANT SAFETY INFORMATION

1. Warning signal word

The product main body may become partially hot because of its functions and characteristics. Careless touch to such hot portion during operation and work may cause unexpected injury. Most of such troubles, however, can be prevented if you are well informed about them beforehand.

To ensure the safety, this manual defines the information on such matters as requiring particular care in the safety as follows in terms of the importance and risk and attaches the alert mark and signal word.

It is recommended to follow the instruction to ensure the safe use of the product.

Alert mark Signal word	Definition
 DANGER	Danger of death or severe injury is expected when handled improperly.
 Warning	Wrong handling is assumed to cause the possibility of the death or heavy injury of the user.
 Caution	Wrong handling is assumed to cause the risk of injury of the operator or physical damages.

We have undertaken thorough verification concerning the possible occurrence of risk in the course of use of the product, but the prediction of all and every kind of risk is extremely difficult. Namely, cautions contained in this manual are not necessarily all of possible risks.

However, if the product is operated according to the procedure described in this manual, the safe operation and work are ensured. Be sure to pay utmost care during handling of the product to prevent accident or failure of the product.

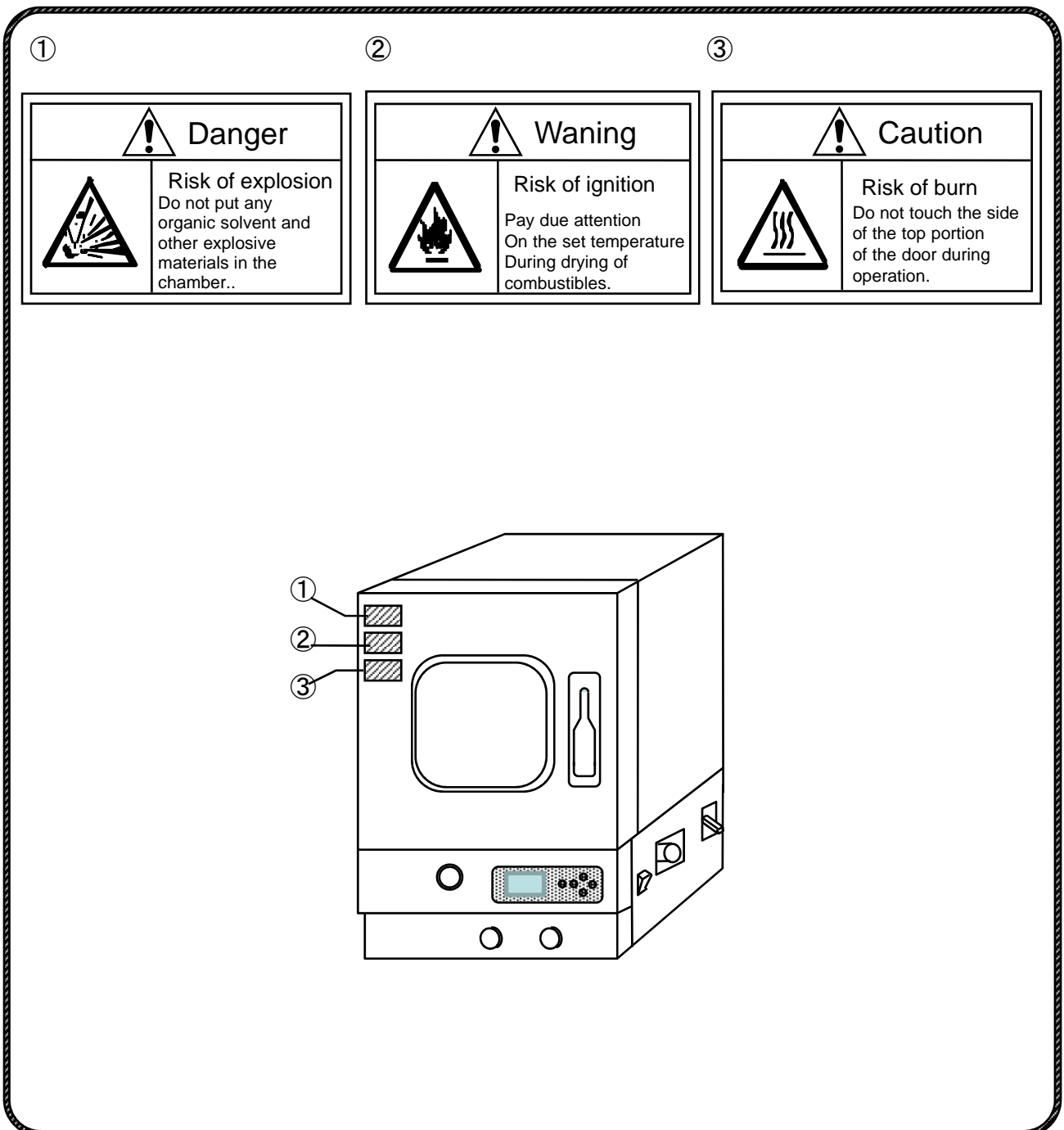
2. Warning Display on the Product

For particularly important warning instructions, the warning label is provided to the product main body.

The labeling position is shown below.

When using the product, be sure to pay due attention to the description of the warning.

* If damaged and illegible, be sure to change the warning label to the new one. Send the request for the new label to us.



Thank you for purchasing our
EYELA product.

Introduction

•This instruction manual explains installation, operation, troubleshooting, maintenance and inspection, and discarding procedures for the products below:

- Vacuum constant-temperature dryer
- Vacuum Dry Oven;
- VOS-210C/VOS-310C

Always read this manual before use to ensure familiarization of the product.

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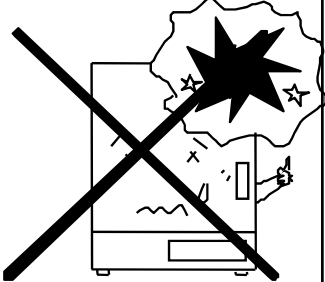

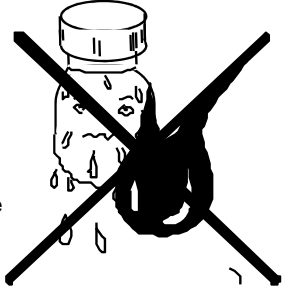

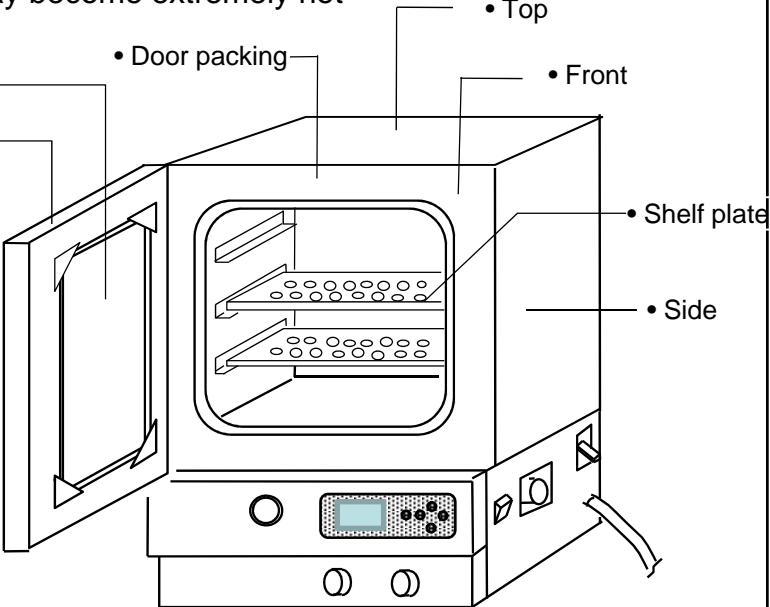
Items contained in your packing

Be sure to confirm the type and quantity of parts before setting.

Description of Package		Product	
		210C	310C
1	Main body	1	1
2	Shelf plate	2	2
3	Instruction Manual	1	1
4	Warranty	1	1


1 For safe operation

Pay due attention on the safety. The product may be extremely hot and is not of an explosion-proof structure.

 <p>Danger</p>	<p>Do not put any flammable materials, such as organic solvent, etc., in the chamber.</p> <p>The chamber interior may become extremely hot during drying, and flammable materials may be vaporized, resulting in an explosion inside the chamber.</p> <p>Explosive materials include nitrate, nitro compounds, etc. while flammable materials include perchloric acid, inorganic peroxides, nitrites, organic solvent.</p> <p>This device is not of an explosive-proof structure.</p> 
 <p>Warning</p>	<p>Pay due attention to the set temperature during drying of combustibles.</p> <p>For example, when drying resin-made containers or parts, setting too high temperature by mistake may cause melting and ignition of these containers and parts.</p> <p>Putting excessive amount of sample in the chamber may cause local temperature rise, possibly resulting in melting and ignition of combustibles.</p> 
 <p>Caution</p>	<p>During operation, take care not to touch the top surface and the upper portion of door because they become excessively hot.</p> <p>During operation and for a certain period after operation, the observation window and the top and side of door become extremely hot. Do not touch these portions to prevent burn.</p> <p>● Portions that may become extremely hot</p> <ul style="list-style-type: none"> • Observation window • Door upper portion • Door packing • Top • Front • Shelf plate • Side 

2 Description of the Product

2-1 Application

 WARNING
<p>Never attempt to modify the product. Operate the unit for the specified purpose only.</p> <p>An electric shock or a malfunction may result if the product is modified or used for any purposes other than that specified.</p>

This is the vacuum constant-temperature dryer that is used for water removal of various samples and materials in the depressurized environment and for drying and testing of various materials and parts in the oxygen-free condition by filling the interior with inactive gas.

Drying and testing in the absence of oxygen can be performed by flowing inactivated gas inside the chamber.

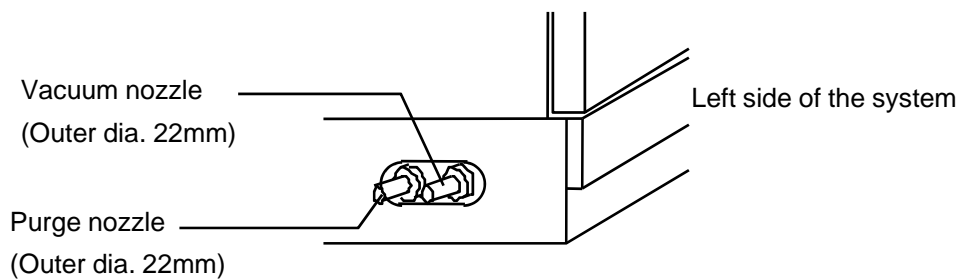
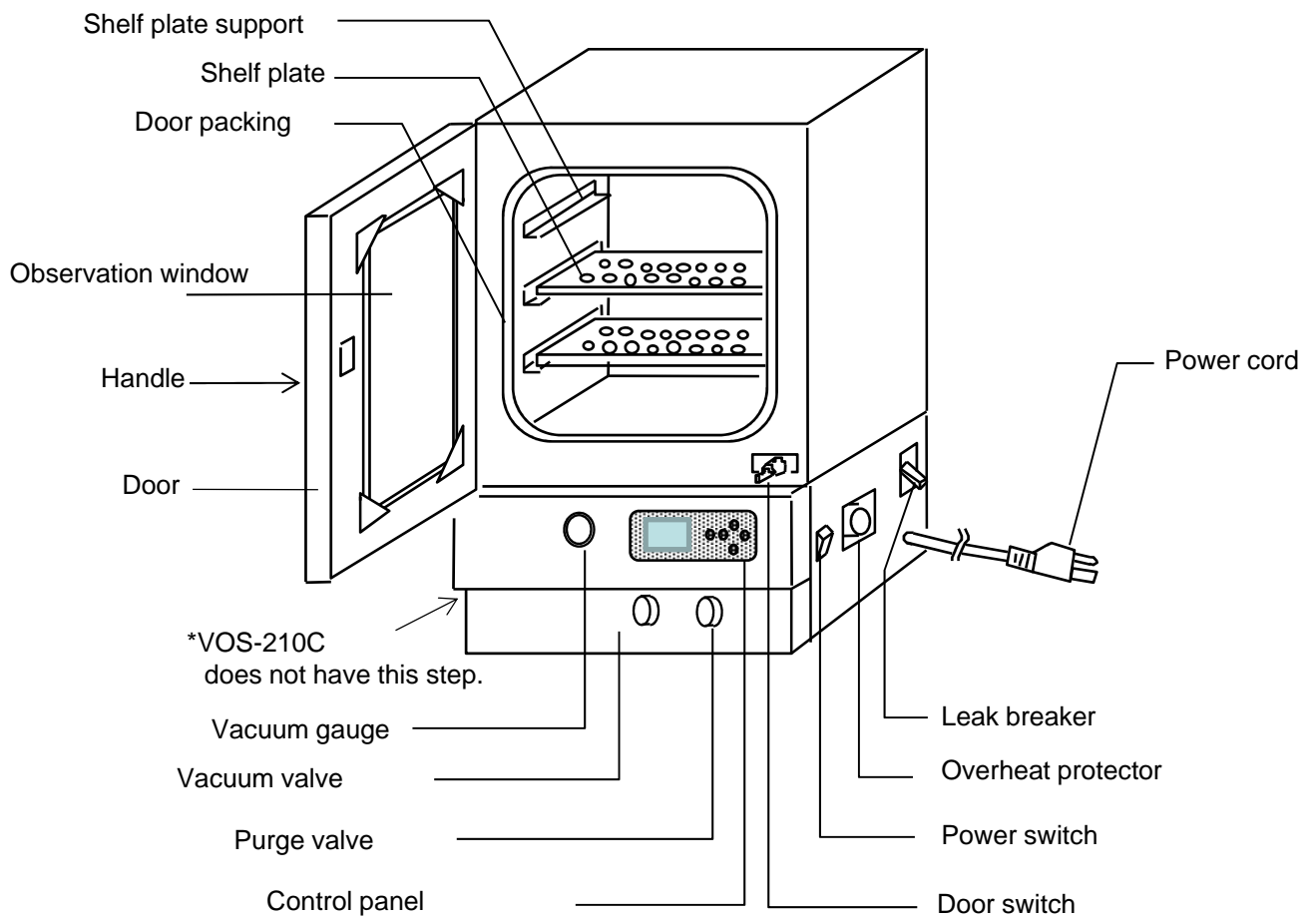
2-2 Specification

Product name		Vacuum Constant Temperature Dryer (Vacuum Oven)	
Model		VOS-210C	VOS-310C
Performance	Mode	Can body heating/pressure reduction	
	Range of temperature control	40 - 240°C	
	Range of level of vacuum in use	1.01 × 10 ⁵ to 1.33 × 10 ² Pa (760 to 1Torr)	
	Accuracy of temperature control*	± 1.5°C (at 240°C)	
	Time to reach temperature*	About 80 minutes	
Composition	Temperature controller	Microcomputer PID control	
	Temperature sensor	Pt 100Ω	
	Temperature setting/temperature display	Sheet key input, digital display	
	Heater capacity	0.72kW	1.2kW
	Observation window **	160W × 160Hmm	250W × 250Hmm
	Vacuum gauge	Bourdon tube type (scale 0-0.1MPa)	
	Interior	Stainless steel plate (SUS 304)	
Specification/Standard	Internal dimensions (Width × Depth × Height, mm)	192 × 270 × 192 (10 L)	300 × 300 × 300 (27 L)
	Outer dimensions (Width × Depth × Height, mm)	355 × 406 × 580	505 × 545 × 760
	Shelf plate load bearing	Uniform distribution MAX.15 kg/shelf / Stainless steel plate	
	Number of shelves	2 shelves	2 shelves
	Suction port	Vacuum nozzle outer dia. 22 mm , Purge nozzle outer dia. 22 mm	
	Power input	7.7A 0.77kVA	12.5A 1.25kVA
	Rated power	AC 100V 50/60Hz	
	Weight	About 40kg	About 60kg

*Unloaded at room temperature of 20°C at normal pressure. The time to reach the temperature is the value of the can body surface temperature in reduced pressure.

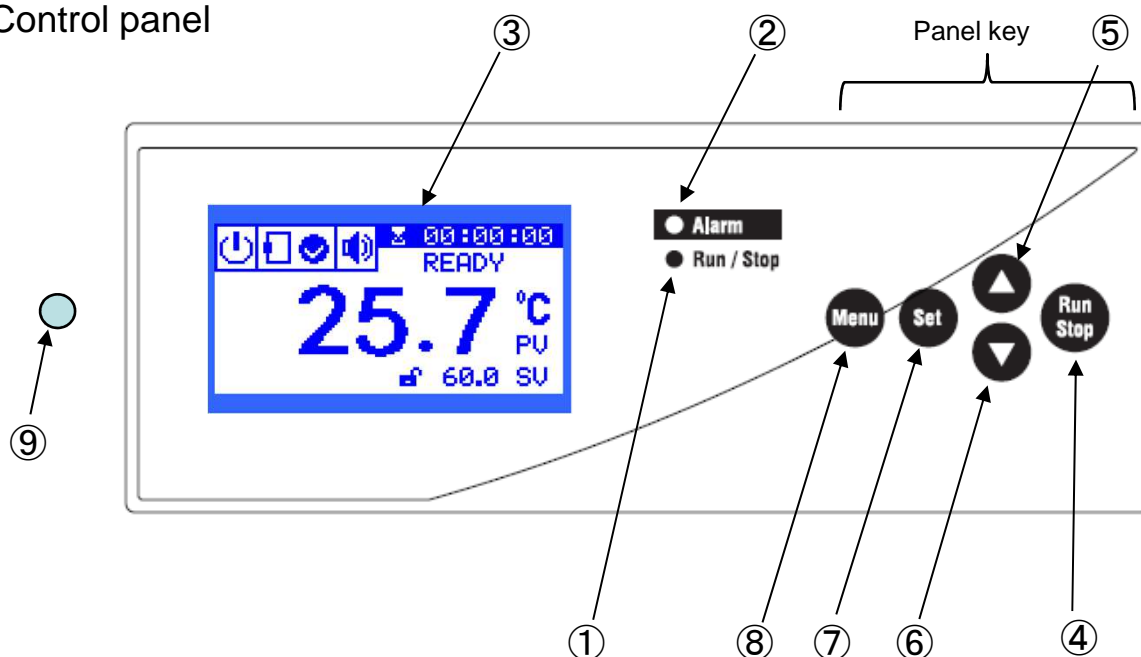
**Observation window: Tempered glass (12 mm thickness)+Polycarbonate protective cover

2-3 Names of parts



3 Names and function of operating parts

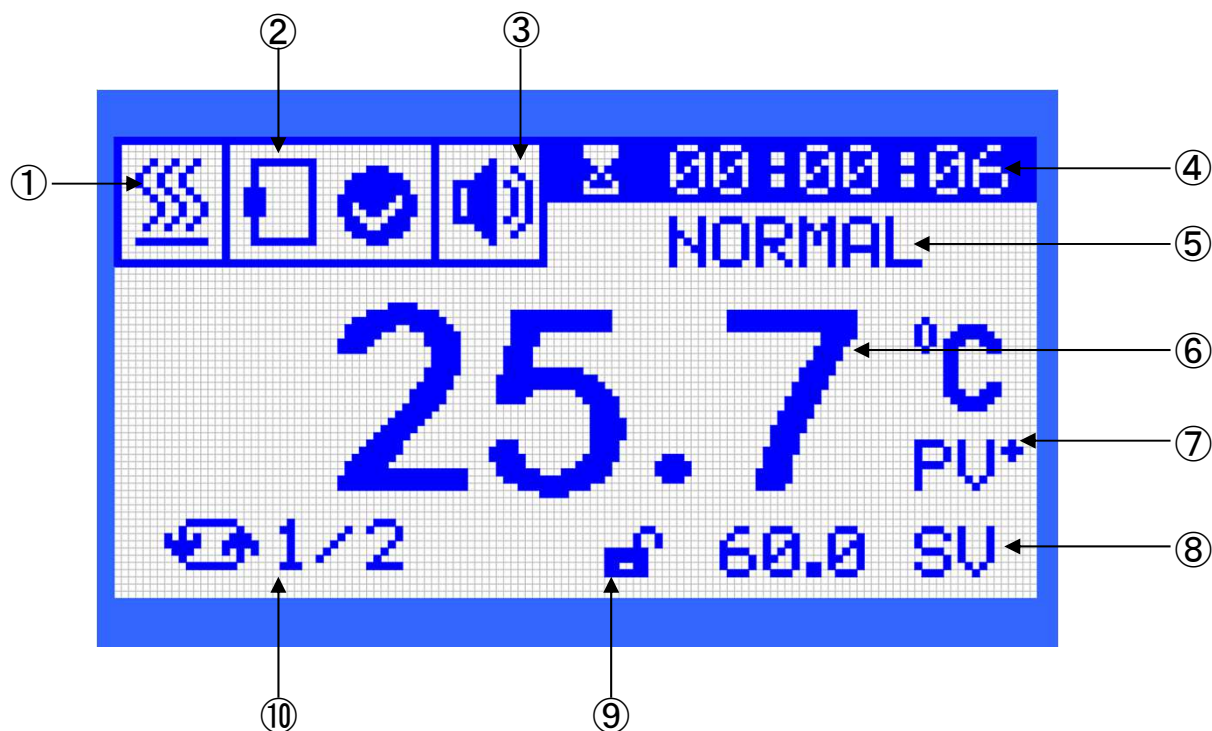
3-1 Control panel



No.	Name	Function
①	Run/Stop LED	This is turned on or off in connection with start/stop of temperature control.
②	Alarm LED	It is lit at alarm output.
③	Indicator	Temperature, time, set character and alarm detail are displayed.
④	Run/Stop Key	Control starts/stops.
⑤	▲ key	This is valid only when the setting is displayed. Every push of a set value will add one value and holding down the value will make serial values. If character setting is effective, the character is switched.
⑥	▼ key	This is valid only when the setting is displayed. If a set value is numeric, every push reduces one and holding it down makes serial reductions. If character setting is effective, the character is switched.
⑦	Set key	This switches a measured value to a set value and undertakes selection and confirmation of a set item. When the alarm is output, the alarm display is cleared.
⑧	Menu key	Various control modes/set items are displayed. Additionally, this key is used to return to the main screen from each subscreen.
⑨	Contrast adjusting part	This key adjusts contrast. Insert a plus driver into the hole, turn the inner knob either left or right to adjust to the position of giving good visibility of the display screen.

3-2 Display part (Main screen)

* This is reference for an explanation and is not different from the actual display screen.



No.	Name	Function
①	Heater/temp. controller state display	This is lit during output of the heater.
②	Alarm icon	An icon is displayed in relation to each alarm.
③	Buzzer icon	An icon is displayed according to the setting of the buzzer.
④	Time display	The elapsed time is displayed while the timer is in operation during temperature control.
⑤	Status display	The current control status and alarm are displayed.
⑥	Measured temperature	A temperature measured currently is displayed.
⑦	Measured temperature correcting function	"+" is displayed when the measured temperature correcting function is set to be effective.
⑧	Set temperature	A set temperature is displayed.
⑨	Keys lock status display	The keys lock status is displayed.
⑩	Loop display	During the two-step operation, the loop number is displayed.

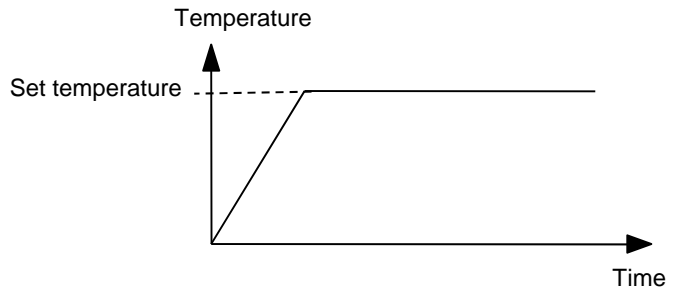
3-3 Constant-value operation and program run

Constant-value operation can be combined with program run according to a purpose of use. Setting is input on the control panel. The set temperature, time and program run can be discontinued on the half way of an operation round.

For detailed setting methods, see Setting, Operation and Stop of Constant-value Operation on page 16 and Setting, Operation and Stop of program run on page 18.

Constant-value operation

When a certain temperature is set and operation starts, continuous operation is run at the set temperature. Operation starts or stops with [Run/Stop] key.



Program run

Time setting on the timer can run/stop constant-value operation. Four types of program run are available, including Auto Start, Auto Stop, 1 Step and 2 Step.

- *Range of timer time settings
0 hours and 00 minute to 99 hours and 59 minutes
- * When program run is effective,

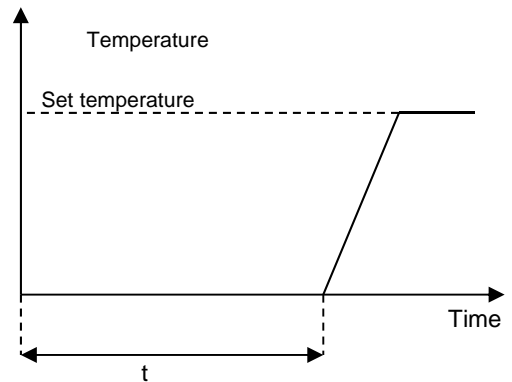


✓ mark display

(1) Auto Start

Set time and start operation: temperature control starts after the set time goes by. This can be used in combination with respective controls of Auto Stop, 1 Step and 2 Step.

- AUTO START + AUTO STOP
- AUTO START + 1STEP
- AUTO START + 2STEP



(2) Auto Stop

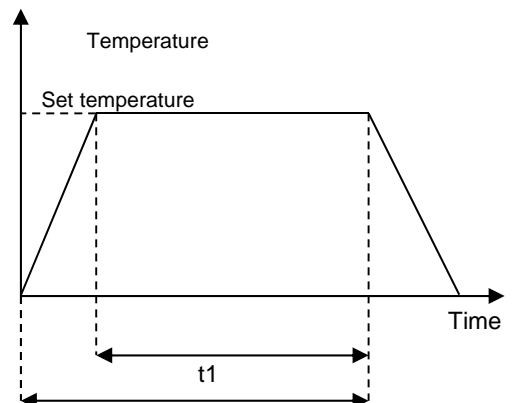
Set time and start operation: operation will be performed for the set time. The controls automatically stop when the time has gone by.

It can be used in combination with Auto Start.

You can choose either t1 or t2 for setting timer count time.

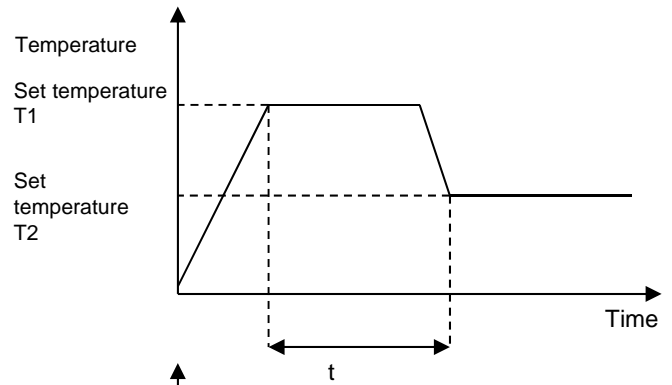
t1: The system runs for the set time once the measured value reaches the set temperature.

t2: Press RUN/STOP key and the system runs for the set time.



(3) 1Step

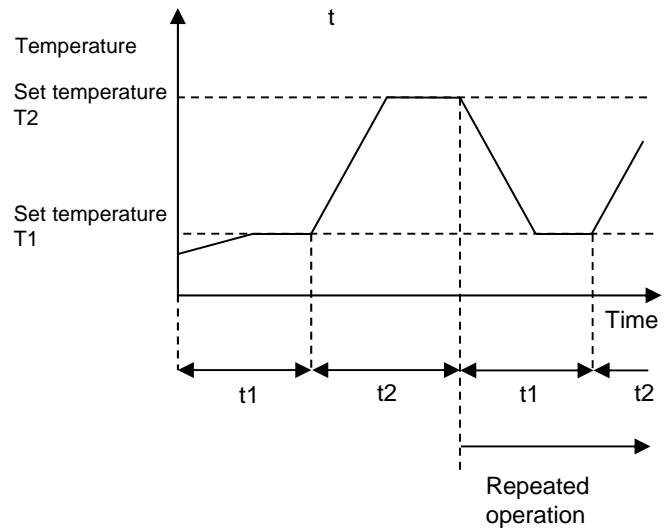
Set 2 temperatures and 1 time.
After the first set temperature is reached, the set time t goes by and then constant-value operation continues after moving to the second set temperature.



(4) 2 Step

Set 2 temperatures and 2 times and set the number of loops.
Once the temperature control starts, temperature is controlled at the set temperature T1 for t_1 time.

After that, the temperature control is done at the set temperature T2 until t_2 time goes by.
This movement is repeated for the set number of loops before the temperature control stops.



3-4 Setting modes

Various values and optional features can be set.

*To change the value in the set mode, do so in the state of temperature control stopped.

(1) PID channel setting

At shipment from the plant, a proper PID value is set to Default within the range of temperature control.

If the default PID does not provide good temperature control, temperature can be controlled at an optionally input PID value or at an Auto-tuned value.

To activate an optionally input PID or Auto-tuned value, select Custom.

(2) Set Custom PID

Temperature can be controlled at an optionally input PID.

To reflect the input value on control, it is necessary to choose Custom on PID channel setting.

(3) Setting Auto-Tuning

If the default PID does not provide good temperature control, the PID may be calculated automatically at the target temperature.

*Ineffective at factory shipment

Depending on the condition, an optimum value may not be obtained.

Execution of Auto-Tuning automatically selects Custom in PID Channel Setting.

Auto-tuned PID is reflected on Custom PID.

(4) Temperature correction

A measured value can be corrected.

*Ineffective at factory shipment

Range of correction: -50.0 - +50.0°C (Resolution0.1°C)

(5) Blackout recovery function setting

* Effective at factory shipment.

Movement at the time of blackout recovery can be set.

- When this is set to be effective (at factory shipment)

When power is recovered, the movement shortly before blackout continues.

- When this is set to be ineffective

When power is recovered, temperature control stops.

(6) Optional feature setting

- Buzzer

Buzzer ON/OFF can be set.

* On at factory shipment.

- Display

Display colors on the screen can be reversed.

* Set to Normal at factory shipment.

(7) Reset set values

- Return to factory shipment status.

Various set values will be reset.

3-5 Safety and alarm functions

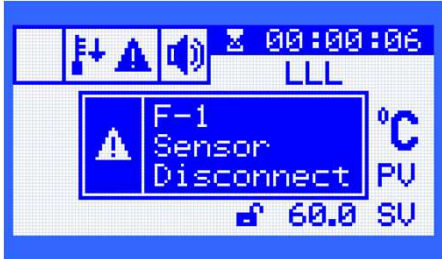


This product is equipped with the following safety and alarm functions.

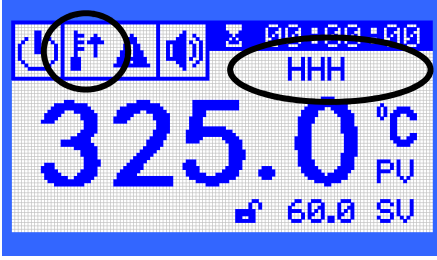

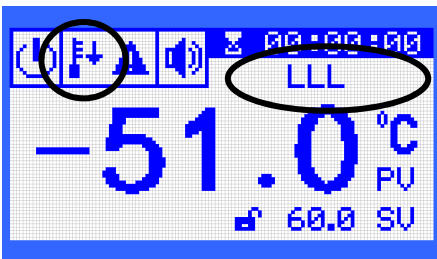

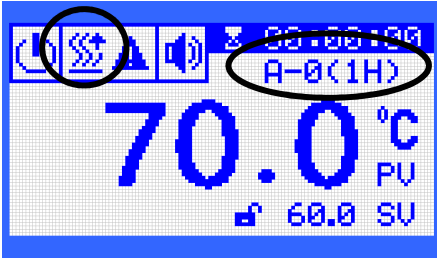

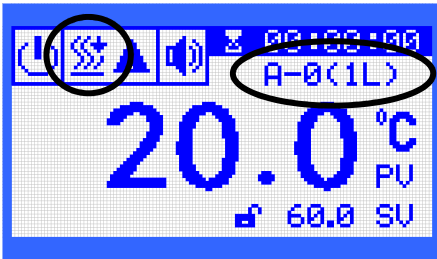

When abnormality occurs, take appropriate measures with reference to 6. Causes of Trouble and Countermeasures.

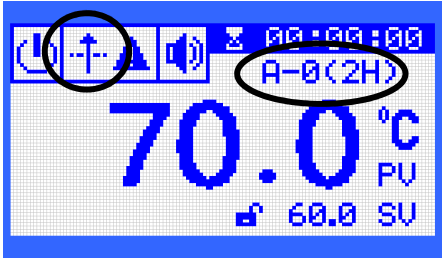

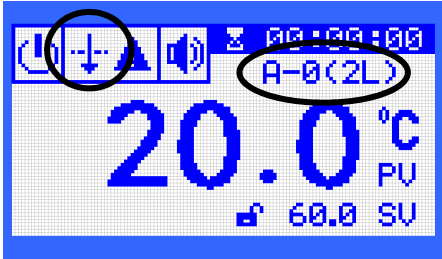

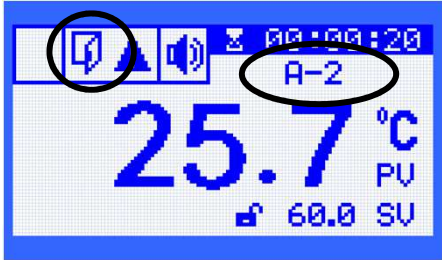

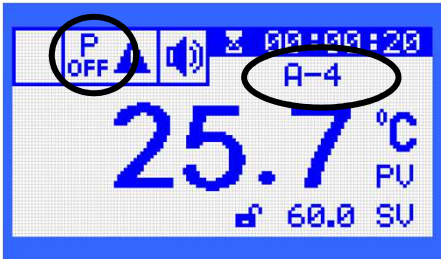

Safety functions

Safety mechanism	Movement	Cause of movement
Leak breaker	Turned off and power disconnected.	<ul style="list-style-type: none"> Electricity leaks or overcurrent flows.
Overheat protector	<p>When the temperature inside the chamber goes up more than the set temperature of the overheat protector, power is disconnected.</p> <p>*When it returns to a temperature below the setting, recovery is done according to the blackout recovery function.</p>	<ul style="list-style-type: none"> The set temperature of the overheat protector is low. The temperature controller and/or SSR were out of order and the temperature inside the chamber went up more than the set temperature of the overheat protector.

Alarm functions

Names of alarms	Alarm display and movement	Cause of alarm movement and countermeasures
<p>Temperature sensor Failure alarm</p> <p>Alarm code F-1</p>	 <p>Alarm sounds and control stops</p>	<p>The temperature sensor was disconnected or shorted. The control part was out of order. Not released unless the malfunction is resolved and power is reset. Stop operation and contact the company where you purchased the product or the nearby service center.</p>
<p>Heater disconnection Alarm</p> <p>Alarm code F-0</p>	 <p>Alarm sounds and control stops</p>	<p>The heater was disconnected. SSR went wrong in an OFF state. Not released unless the malfunction is resolved and power is reset. Stop operation and contact the company where you purchased the product or the nearby service center.</p>
<p>SSR's ON destruction</p> <p>Alarm code F-6</p>	 <p>Alarm sounds and control stops Safety functions run to disconnect energy to the heater.</p>	<p>SSR went wrong in an ON state. Not released unless the malfunction is resolved and power is reset. Stop operation and contact the company where you purchased the product or the nearby service center.</p>

Names of alarms	Alarm display and movement	Cause of alarm movement and countermeasures
<p>Measured temperature upper limit alarm</p> <p>Alarm code HHH</p>	 <p> Alarm Alarm sounds and control stops</p>	<p>The temperature exceeded the measurable temperature. *Range of measured temperatures: -50.0 - 320.0°C If there is any cause of heat inside the device, remove it when the temperature goes down to a safe level. If returned to the range of measurable temperatures, it can be released with "Set" key. Stop the operation and contact the company where you purchased the product or the nearby service center.</p>
<p>Measured temperature lower limit alarm</p> <p>Alarm code LLL</p>	 <p> Alarm Alarm sounds and control stops</p>	<p>The temperature went below the measurable range. *Range of measured temperatures: -50.0 - 320.0°C If there is any cause of cooling, remove it when the temperature goes up to a safe level. If returned to the range of measurable temperatures, it can be released with "Set" key. If clearly different from the actual temperature, stop the operation and contact the company where you purchased the product or the nearby service center.</p>
<p>Upper limiter</p> <p>Alarm code A-0(1H)</p>	 <p> Alarm Alarm sounds and control stops</p>	<p>The measured temperature exceeded the upper limit temperature. If the upper limit setting was wrong in relation to the target controlled temperature, change the upper limit set value to a higher value. If abnormally heated, check inside the chamber. If returned below the upper limit, it can be released with "Set" key. If the cause is unknown, contact the company where you purchased the product or the nearby service center.</p>
<p>Lower limiter</p> <p>Alarm code A-0(1L)</p>	 <p> Alarm Alarm sounds and control stops</p>	<p>The measured temperature went below the lower limit. If the lower limit setting is wrong in relation to the target controlled temperature, change the lower limit value to a lower value. If returned above the lower limit, it can be released with "Set" key. If the temperature is abnormally lowered, check inside the chamber. If the cause is unknown, contact the company where you purchased the product or the nearby service center.</p>

Names of alarms	Alarm display and movement	Cause of alarm movement and countermeasures
<p>Upper limit of set temperature Alarm</p> <p>Alarm code A-0 (2H)</p>	 <p> Alarm Alarm sounds Control continues.</p>	<p>After the set temperature (SV) was reached, the measured temperature exceeded the set temperature as the upper limit of SV. Released with "Set" key. Depending on the conditions, overshoot of about 10°C may occur: so please check before setting. When PID is not appropriate, temperatures may move up and down greatly: either set a PID constant or perform auto-tuning.</p>
<p>Lower limit of set temperature Alarm</p> <p>Alarm code A-0 (2L)</p>	 <p> Alarm Alarm sounds Control continues.</p>	<p>After reaching the test temperature (SV), a measured temperature went below the temperature set as the lower limit against SV. Released with "Set" key. When PID is not appropriate, temperatures may move up and down greatly: either set a PID constant or perform auto-tuning.</p>
<p>Door alarm</p> <p>Alarm code A-2</p>	 <p> Alarm Alarm sounds and control stops (In case of WFT, the fan will also stop)</p>	<p>The door was open during control. The alarm is released and operation resumed if the door is closed. The heater, if the door is kept open, is prevented from heating to overheat sample etc. (In the event of WFO, the fan will stop to prevent hot air from blasting out) In case of alarm when the door is firmly closed, stop the operation and contact the company where you purchased the product or the nearby service center.</p>
<p>Power off Alarm</p> <p>Alarm code A-4</p> <p>*Alternative display with the mode before blackout</p>	 <p> Alarm Alarm sounds Continuation or stop of control depends on the selection of the blackout recovery function.</p>	<p>Operation either continues or stops depending on the movement chosen in the blackout recovery function. Released with "Set" key. Since this may occur depending on the setting of the overheat protector, check whether a value higher than the target set temperature by 20°C has been set. If the overheat protector works at an optimum value, check whether too many articles are placed in the chamber or anything covers the bottom plate.</p>
<p>Watchdog</p>	<p>Control is reset without display of specific alarm.</p>	<p>The temperature controller is in an abnormal state due to noise etc. If there is any source of noise, distance it from the system. The ambient temperature exceeds 35°C. Stop the operation and start operation when the ambient temperature goes down. If the cause is unknown, stop the operation and contact the company where you purchased the product or the nearby service center.</p>

4 Installation

4-1 Installation environment

Warning

Do not install the product in a hazardous environment.

This product incorporates a heater. The use of the product in a hazardous environment, the fire may occur.

Caution

Select the location with care.

Poor installation environment may accelerate deterioration of the product or may result in failure of demonstrating the functions and performance fully.

Select the installation site that meets the following conditions.

- Place free of flammable gas, liquid, or solid materials in the vicinity of the product
- Place where the ambient temperature can be kept within a range of 5 ~ 34°C.
- Place free from condensation
- Place with less humidity and free from splashing water
- Place with minimum dust
- Place free from direct sunshine
- Place where airy or well-ventilated
- Level, stable, and firm place

(Check the product weight during operation.)



4-2 Installation conditions

CAUTION

Assure certain space around the unit.

Be sure to assure space between the unit and the walls and the ceiling as shown in the figure to maintain the performance of the product.

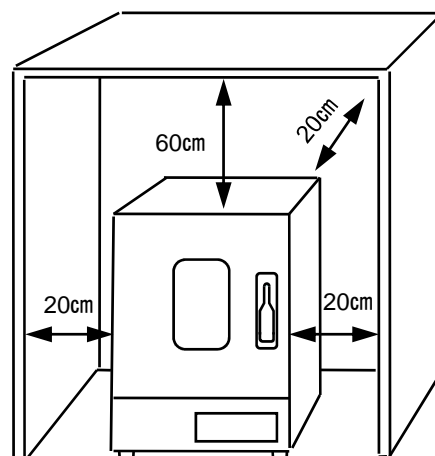
Caution

Do not place anything other than our specified object on top of the main body.

Caution

This is a heavy product. Take utmost care during transport.

VOS-210C (about 40kg),
VOS-310C (about 60kg)



4-3 Connecting utilities



Warning

Confirm the voltage, phase, capacity, and the type of receptacle of power supply.

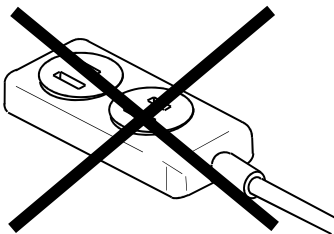
Wrong connection of power supply may cause fire or electric shock



Warning

Do not use the branching socket or table tap.

Burn-out of the cable or a fire may result from over current.



- (1) Check the product type as well as the voltage, phase, and capacity of power supply to be connected.
Power supply to be connected to the product is as shown in the right.

- (2) Check the receptacle of installation place.
(Do not connect the power plug yet.)
You can connect the power plug to an outlet with an earth terminal as it is.

Power cord specification

Length	Thickness (O.D)	Power plug	Section area of electric wire
2.9m	Approx. 9mm	Earth terminal with 3-pole	2mm ²

* Temporary set up

When you use an outlet without an earth terminal, set an earth adaptor to the power plug and be sure to connect the earth wire of the adaptor to the earth terminal.

*** The earth adaptor is not included.**

When no earth terminal is available, consult your electrical technician and make earth work of Class D earth work.

*** We recommend replacing with an outlet with an earth terminal.**



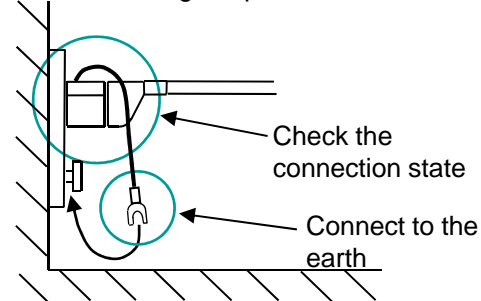
Warning

Always connect to the outlet with earth terminal.

When connection to the "outlet without earth terminal" is inevitable, be sure to connect the earth wire of the earth adaptor to the ground. Otherwise, leakage cannot be detected correctly, resulting in leakage or electric shock.

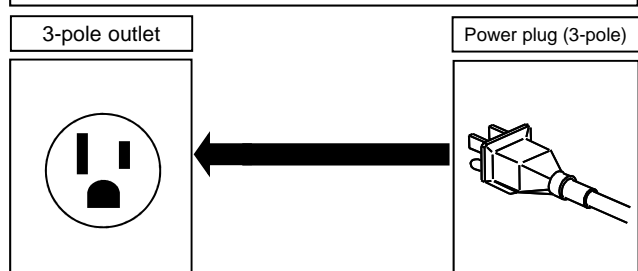
Pay attention to the connection state of the earth adaptor and power plug. Inclined or insufficient insertion may cause overheat or fire.

* An earthing adaptor is not attached.

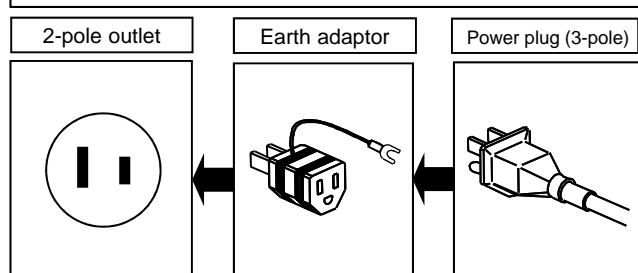


Model	Power supply to connect	
	Voltage	Capacity
VOS-210C	AC 100V	15A
VOS-310C		

When an outlet with an earth terminal is used



When an outlet with an earth terminal is used

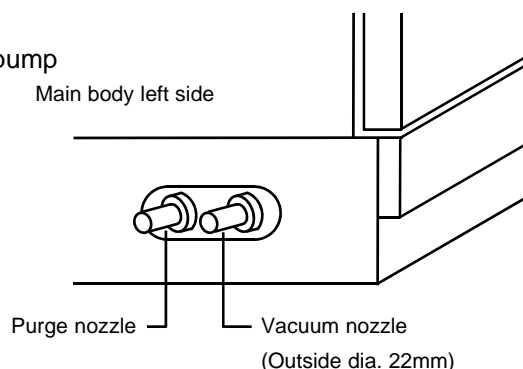


* The earth adaptor is not included.

5-1 Preparation

5-1-1. Setting the shelf plate and connecting with the vacuum pump

- (1) Set the shelf plate.
- (2) Connect the vacuum pump with this device using a vacuum hose. (A vacuum hose is not attached.)
Connect the vacuum nozzle (outside dia. $\Phi 22$) on the left side of main body with the suction port of the vacuum pump firmly enough to prevent air leakage.



5-1-2. Setting the sample and container in the chamber

Danger

Do not put any flammable materials, such as organic solvent, etc., in the chamber.

The chamber interior may become extremely hot during drying, and flammable materials may be vaporized, resulting in explosion inside the chamber.

Explosive materials include nitrate, nitro compounds, etc. while flammable materials include perchloric acid, inorganic peroxides, nitrites, organic solvent.

This device is not of an explosive-proof structure.

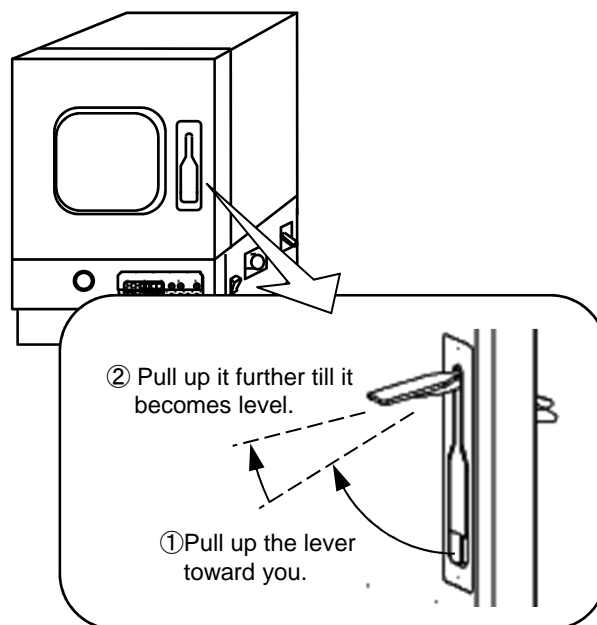
Warning

Pay due attention to the set temperature during drying of combustibles.

For example, when drying resin-made containers or parts, setting too high temperature by mistake may cause melting and ignition of these containers and parts.

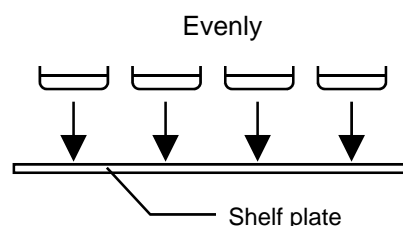
Putting excessive amount of sample in the chamber may cause local temperature rise, possibly resulting in melting and ignition of combustibles.

- (1) Drain water thoroughly from the sample and container.
- (2) Open the door.
Pull up the handle lever toward you, and then pull it further up till it becomes level. The door is unlocked and can be opened.
- (3) Place and align samples evenly on the shelf plate.
(The load capacity per shelf plate is 15kg.)
- (4) Close the door gently.
Push down the handle lever and return it to the original position.
The door glass contacts tightly with the packing.
* The operation cannot be started unless the door is firmly closed. (Door alarm is activated.)





5-1-3. Connecting the power plug

Confirm that the earth leakage breaker and the power switch are OFF, insert the power plug into the outlet.



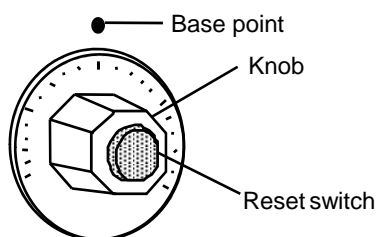
5-2 Operating method

 Caution
<p>Do not touch the hot parts during use and for a while after use.</p> <p>The observation window and upper and side parts of the door are at high temperatures during use and for a while after use. Touching any part of them may lead to burn.</p>

 Caution
<p>Stop using it if abnormality occurs.</p> <p>Turn off the power switch and leak breaker (power switch) immediately if abnormality occurs and see the section Causes of Trouble and Countermeasures.</p>


5-2-1. Setting the overheat protector

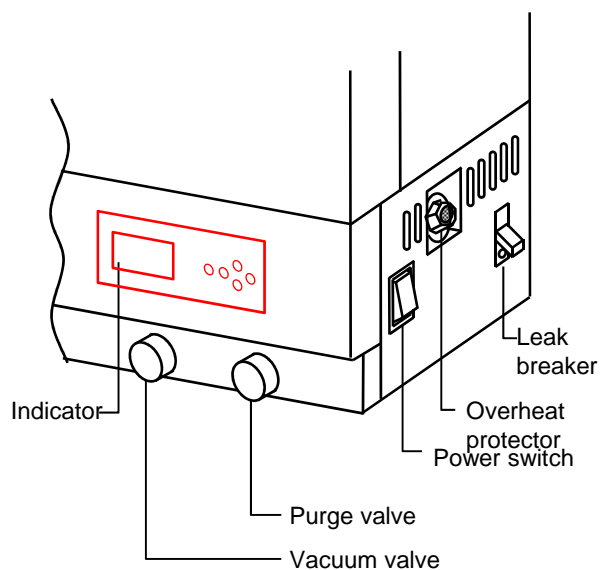
- (1) Turn on the leak breaker.
- (2) Set the over-temperature preventive device.
Turn the knob till the set temperature agrees with the base point position. Normally set to the temperature about 20°C higher than the temperature set with the panel key.



Over-temperature preventive device

*Remove the cause led to the movement with reference to the section Causes of Trouble and Countermeasures and press the reset switch.

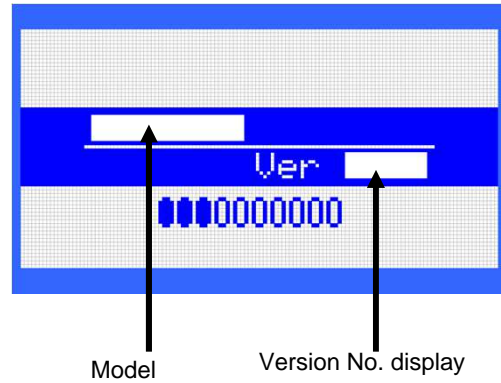
 Caution
<p>Ventilate immediately if odor is smelt.</p> <p>Provide ventilation well because a member such as insulating materials may volatilize and generate characteristic odor for a short time when the system runs for the first time.</p>



5-2-2. Setting, running and stopping constant-value operation

Turn on the leak breaker.
The main screen displays after 5 seconds of the initial screen.

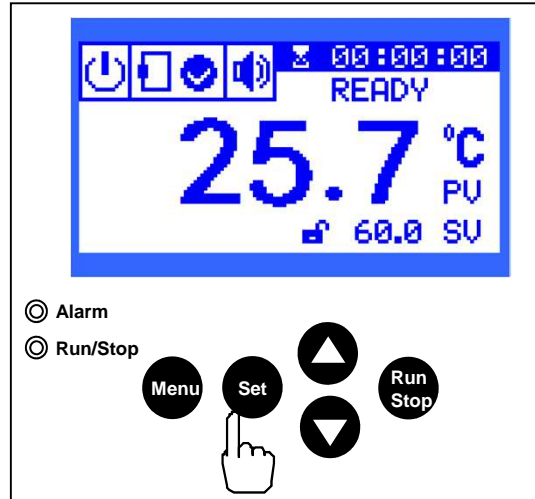
*The mode is shown on the upper part and a version number on the lower ver.



(1) Temperature setting
The set temperature can be changed irrespective of during control or during stop.

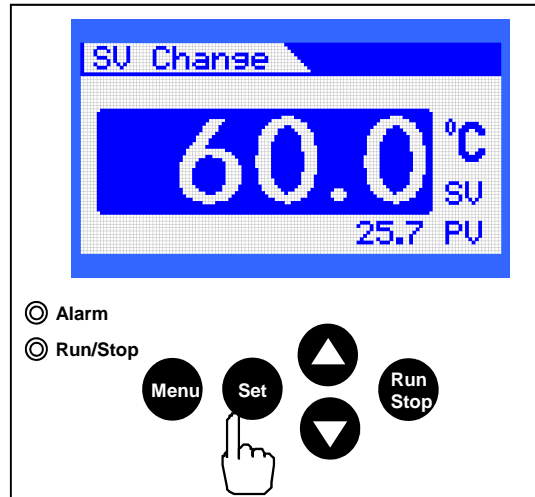
1) Press [Set] key.
The display changes to the set temperature (blinking) allowing you to set temperature.

* The set temperature is the one previously used. At factory shipment, this is set to 40°C.



2) Operate [▲] and/or [▼] keys and input the set temperature.

* One push of [▲] or [▼] key changes the temperature by 0.1°C each. Holding it down continuously change the value.



3) Press [Set] key.
The set temperature displayed (blinking) is confirmed and switch to the display of measured temperature.
The set temperature (SV) is displayed in the lower right of the screen.

* While setting a temperature, no key operation for 30 seconds or longer will return to the display of measured value.
In this case, start 1) all over again to set the value.

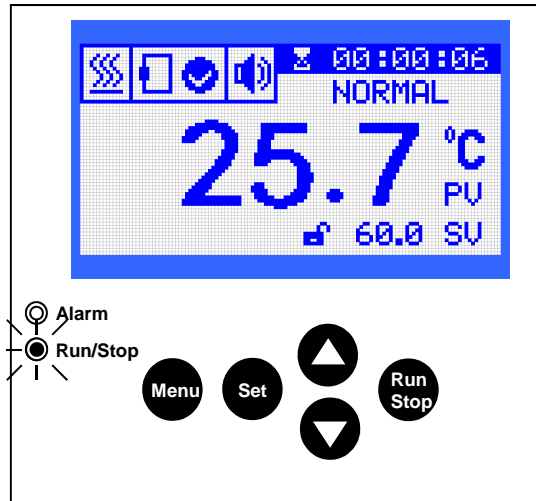
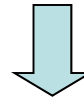
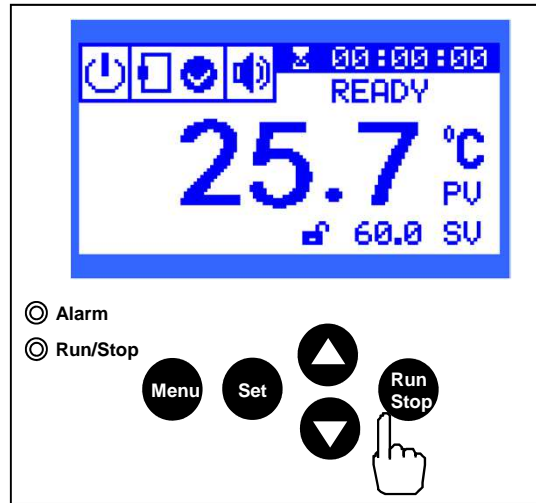
(2) Starting constant-value operation

Press [Run/Stop] key.

Constant-value operation starts.

- Run/Stop LED is lit.
- Status switches from READY to NORMAL.

• While the heater is energized, an icon is displayed in the left corner of the screen.



(3) Stopping constant-value operation

Press [Run/Stop] key. Constant-value operation stops.

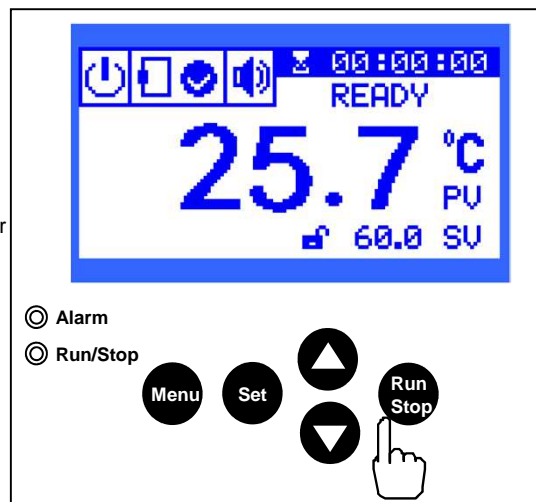
- "Run/Stop" LED disappears.
- Status switches from Normal to READY.

* To stop the operation, be sure to stop the operation and turn off the leak breaker.

* If the control is stopped, the time and count will be reset.

* All counts are reset when power is restored and control either resumes from the very beginning or stops according to the setting for blackout recovery.

* If the system is not used for a long time, turn off the leak breaker and then remove the power plug from the outlet.



5-2-3. Setting, running and stopping program run

* Set this one while temperature control is terminated.

You can choose from four modes of program run.

- 01 Auto Start
- 02 Auto Stop
- 03 1 Step
- 04 2 Step (Repeated operation possible)

* Program run that can be combined includes:

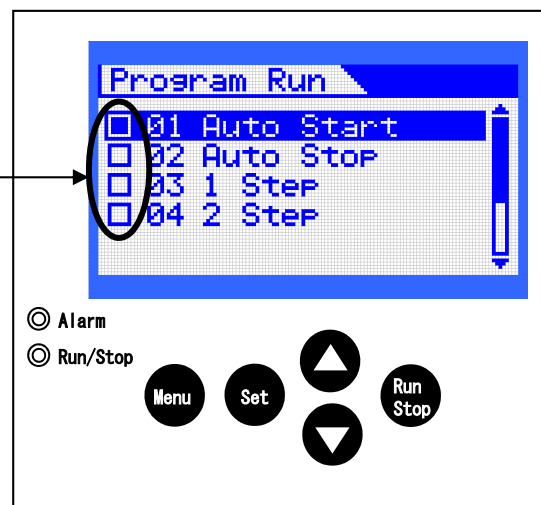
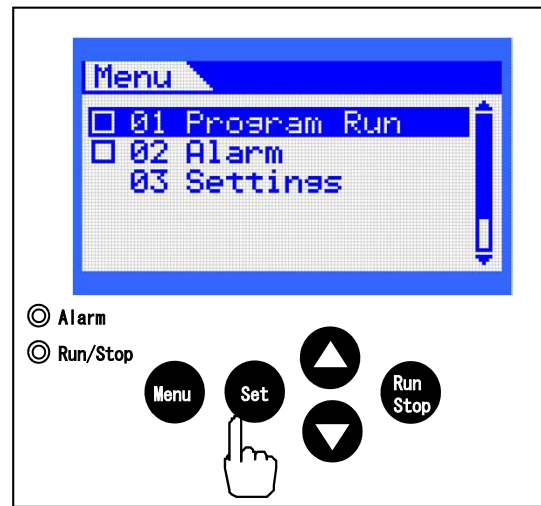
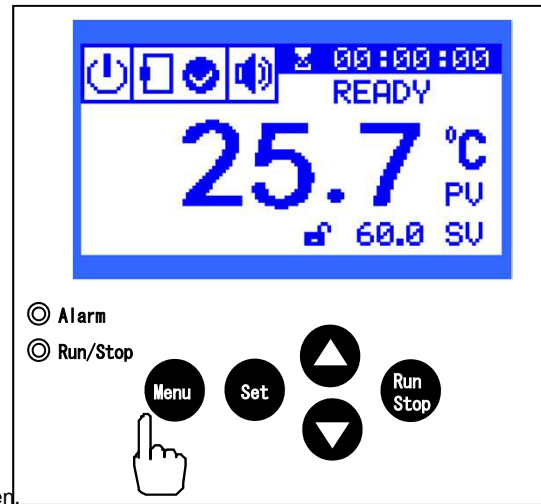
- AUTO START + AUTO STOP
- AUTO START + 1STEP
- AUTO START + 2STEP

(1) How to display the program run setting screen

- Press "Menu" key while the main screen is displayed.

- Select 01 Program Run with [▲] or [▼] key and press "Set" key.

* No key operation for 30 seconds or longer will return to the main screen



(2) Program run display screen

- When each program run is set to be effective, a check (✓) is displayed on the checkbox in the left screen.

(3) Auto Start

Temperature control starts after a set time goes by.

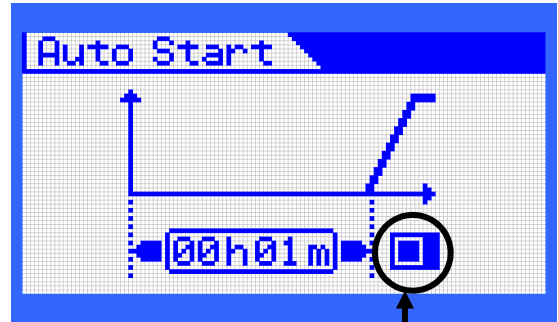
1) How to set Auto Start

- Choose 01 Auto Start in the "Program Run" Program Run screen on the previous page with [▲] or [▼] key by moving the cursor and press "Set" key.

- Activate Auto Start function.

Select the checkbox in the lower right screen and press "Set" key
While the checkbox is blinking, operate [▲] or [▼] key to display the check mark ✓.

Press "Set" key and confirm it.



Provide a check ✓ in the checkbox.

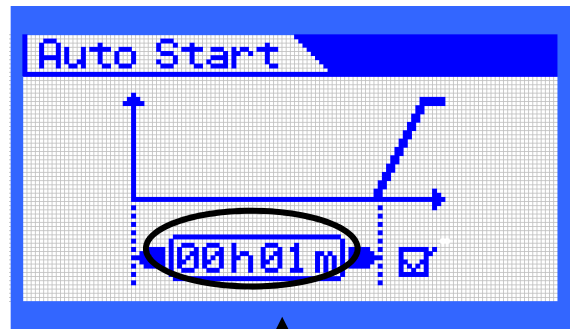
- The time to temperature control start is set.

Move the cursor to the number you wish to change in 00h01m with [▲] or [▼] key and press [Set] key.

While the number is blinking, operate [▲] or [▼] key, enter a numeric value and press "Set" key to confirm the value.

* Configurable up to 99h59m.

- Press "Menu" key 3 times to return to the main screen.



Enter the set time.

2) Start Auto Start control

- Press "Run/Stop" key on the main screen to start control.
- Run/Stop LED is lit.
- Status is displayed as "AUTO START."
- On the time display part, countdown value of the set time is displayed.

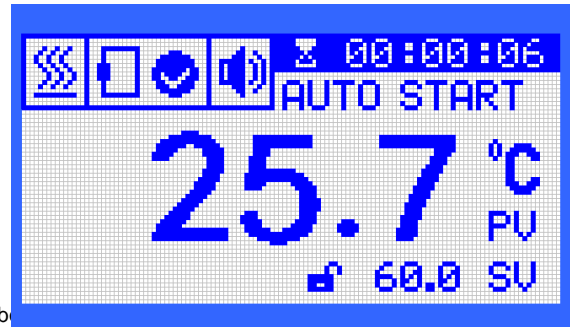
* If an alarm sounds during counting down, the countdown is suspended during the alarm.

3) Stop Auto Start control

- Press "Run Stop" key and the control stops.
- * If the control stops, the countdown value for the time will also be reset.
- * When power is recovered from blackout, the time count is reset and the control either resumes or stops from the very beginning according to the blackout recovery setting.

4) Disable Auto Start function

- If the Auto Start function is not used, remove the check ✓ in the checkbox in the right lower part of the screen.



(4) Auto Stop

After the set time goes by, the temperature control stops.

1) How to set Auto Stop

- Move the cursor with [▲] or [▼] key, select 02 Auto Stop in "Program Run and press "Set" key.

- Two timings of starting the countdown are available for selection on the Auto Stop.

*1 Once the measured temperature reaches the set temperature, countdown starts.

*2: Countdown starts from the start of control.

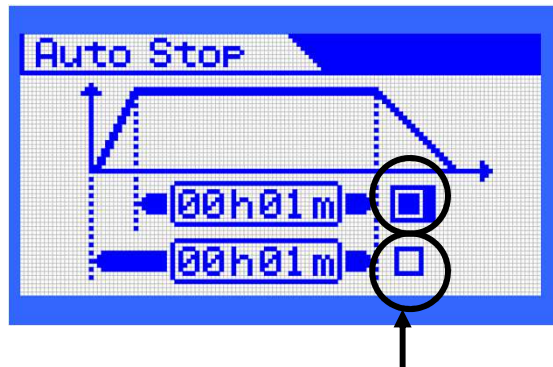
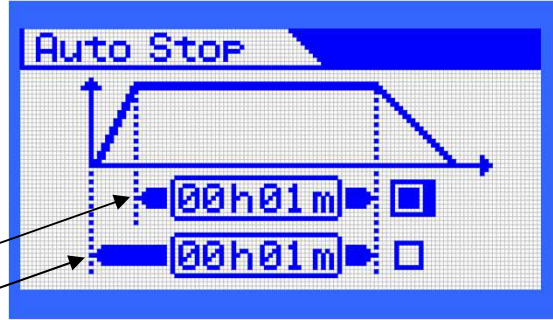
- Activate the Auto Stop function. Select the checkbox of the time to be controlled and press "Set" key.

* You can choose either one checkbox.
While the checkbox is blinking, operate [▲] or [▼] key to display the check mark ✓. Press "Set" key and confirm it.

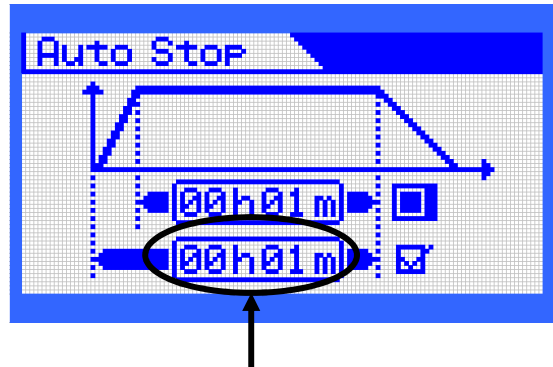
- Set time till the temperature control stops. Move the cursor to the number you wish to change in 00h01m and press "Set" key. While the number is blinking, operate [▲] or [▼] key, enter a numeric value and press "Set" key to confirm the value.

* Configurable up to 99h59m.

- Press "Menu" key 3 times to return to the main screen.



Provide a check ✓ to the checkbox to be controlled.



Enter the set time.

2) Start Auto Stop control

- Press "Run/Stop" key on the main screen to start control.
- Run/Stop LED is lit.
- Status displays AUTO STOP.
- Countdown value is displayed for the temperature control on the time display.

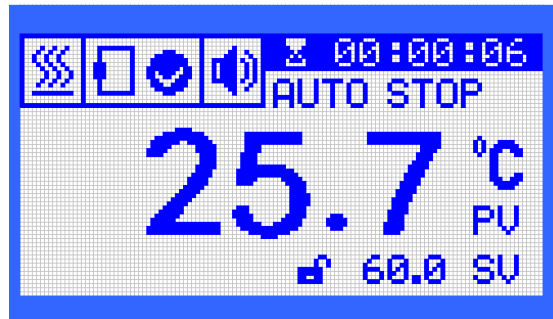
* If an alarm sounds during counting down, the countdown is suspended during the alarm.

3) Stop Auto Stop control

- Press "Run Stop" key and the control stops.
- * If the control stops, the countdown value for the time will also be reset.
- * When power is recovered from blackout, the time count is reset and the control either resumes or stops from the very beginning according to the blackout recovery setting.

4) Disable Auto Stop function

- If Auto Stop function is not used, remove the check ✓ in the checkbox in the right lower part of the screen.

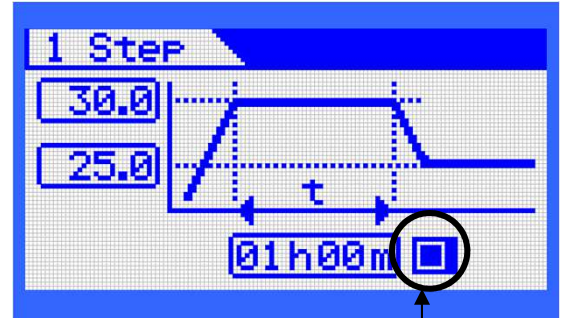
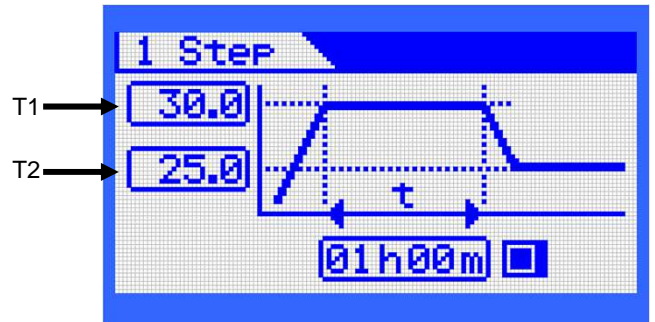


(5) 1 Step

This provides control for the set time at the set temperature T1 and control at the set temperature T2 after elapse of the set time.

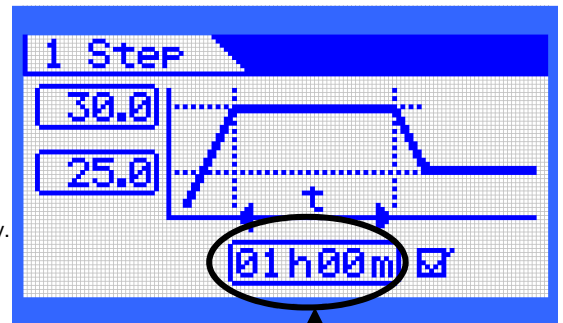
1) How to set 1 Step

- Move the cursor with [▲] or [▼] key, select 03 1 Step in Program Run. Press "Set" key.
- 1 Steps sets 1 time and 2 set temperatures (T1 and T2).
 - *T1: Set temperature used for control during the set time.
 - *T2: Set temperature used for control after the set time goes by.
- Activate 1 Step function.
 - Select the checkbox in the lower right screen and press "Set" key. While the checkbox is blinking, operate [▲] or [▼] key to display the check mark ✓. Press "Set" key and confirm it.



Provide a check ✓ in the checkbox.

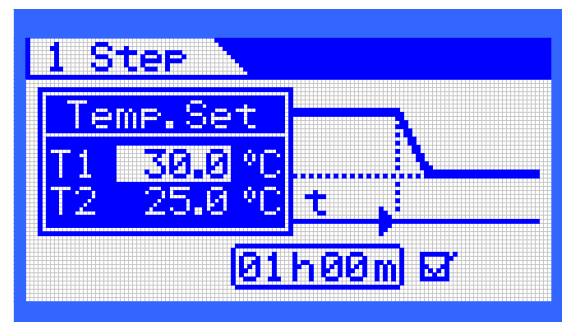
- Set the time to be controlled at the set temperature T1.
 - Move the cursor to the number you wish to change in 00h01m and press "Set" key.
 - While the number is blinking, operate [▲] or [▼] key, enter a numeric value and press "Set" key to confirm the value.
 - * Configurable up to 99h59m.



Enter the set time.

- Set the set temperature T1.
 - * T1 is the temperature to be controlled during the set time.
 - Operate [▲] or [▼] key to select T1.
 - Press "Set" key to blink the value, enter a number by operating [▲] or [▼] key, and press "Set" key to confirm the value.
- Set the set temperature T2.
 - * T2 is the temperature to be controlled after elapse of the set time.
 - Operate [▲] or [▼] key to select T2.
 - Press "Set" key to blink the value, enter a number by operating [▲] or [▼] key, and press "Set" key to confirm the value.

- Press "Menu" key 3 times to return to the main screen.



2) Start 1 Step control

- Press "Run/Stop" key on the main screen to start control.
- Run/Stop LED is lit.
- Status displays "1 STEP MODE."

• Time counted value is displayed on the time display.

• The current set temperature T1/T2 is displayed on the set temperature display.

* If the alarm sounds during counting, counting is suspended during the alarm.

3) During 1 Step control

• Count up until the temperature reaches the set temperature T1.

• The set temperature counts down after the set temperature T1 is reached.

• After the set time is counted down, control is provided at the set temperature T2.

4) Stop 1 Step control

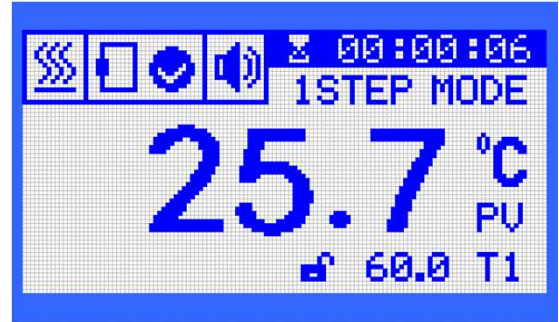
• Press "Run Stop" key and the control stops.

* Once the control stops, the counting value of time will be reset.

* When power is recovered from blackout, the time count is reset and the control either resumes or stops from the very beginning according to the blackout recovery setting.

5) Disable 1 Step function

• If 1 Step function is not used, remove the check in the checkbox in the right lower part of the screen.



(6) 2 Step

Provide control at the set temperature T1 for the set time t1, and after elapse of the set time, provide control at the set temperature T2 for the set time t2.

And also this step is repeated several times.

1) How to set 2 Step

- Move the cursor with [▲] or [▼] key, select 04 2Step in "Program Run" and press "Set" key.

- 2 Step sets 2 times (t1 and t2) and 2 set temperatures (T1 and T2).

- * T1: Set temperature used for control during the set time t1.
- * T2: Set temperature used for control during the set time t2.

- Activate 2 Step function.

Select the checkbox in the lower left of the screen. Press "Set" key.

While the checkbox is blinking, operate [▲] or [▼] key to display the check mark ✓.

Press "Set" key and confirm it.

- Set the number of replicates.

Select a number of loops in the lower left of the screen by operating [▲] or [▼] key and press "Set" key.

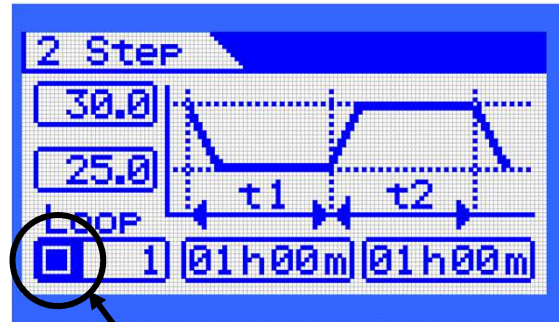
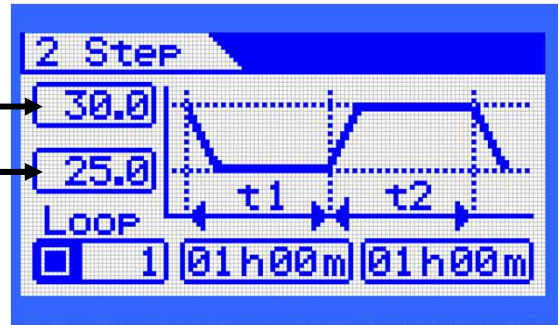
While the value is blinking, operate [▲] or [▼] key.

Press "Set" key and confirm it.

- * 1 to 999 can be chosen to set.

T2

T1



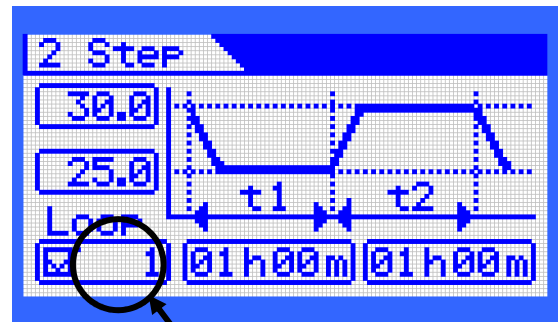
Provide a check ✓ in the checkbox.

- Set the control time t1 at the set temperature T1.

Move the cursor to the number you wish to change in 01h00m, and the press "Set" key.

While the number is blinking, operate [▲] or [▼] key, enter a numeric value and press "Set" key to confirm the value.

- * Configurable up to 99h59m.



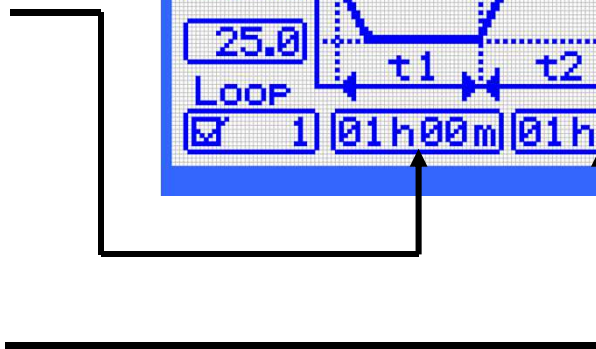
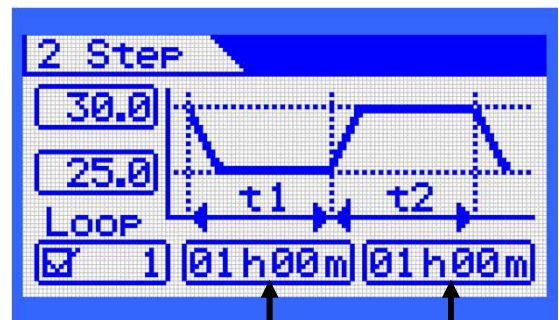
Set the number of replicates.

- Set the control time t2 at the set temperature T2.

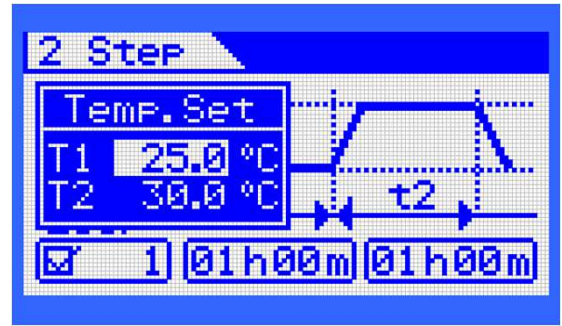
Move the cursor to the number you wish to change in 01h00m, and then press "Set" key.

While the number is blinking, operate [▲] or [▼] key, enter a numeric value and press "Set" key to confirm the value.

- * Configurable up to 99h59m.



- Set the set temperature T1.
 - * T1 is the temperature to be controlled for the set time t1
 - Operate [▲] or [▼] key to select T1.
 - Press "Set" key to blink the value, enter a number
 - Operate [▲] or [▼] key to enter a value and press "Set" key to confirm the value.
- Set the set temperature T2.
 - *T2 is the temperature to be controlled for the set time t2.
 - Operate [▲] or [▼] key to select T2.
 - Press "Set" key to blink the value, enter a number
 - Operate [▲] or [▼] key to enter a value and press "Set" key to confirm the value.
- Press "Menu" key 3 times to return to the main screen.



2) Start 2 Step control

- Press "Run/Stop" key on the main screen to start control.
- Run/Stop LED is lit.
- Status displays "2 STEP MODE."

- A time count value is displayed on the time display.
- The current set temperature T1/T2 is displayed on the set temperature display.
- * If the alarm sounds during counting, counting is suspended during the alarm.

3) During 2 Step control

- Provide temperature control at the set temperature T1 and count down the set time t1.
- After the set time t1 goes by, provide temperature control at the set temperature T2 and count down the set time t2.
- After the set time t2 goes by, temperature control is repeated according to the number of replicates.
- Once control is over for the number of replicates, control stops.

4) Stop 2 Step control

- Press "Run Stop" key and the control stops.
- * Once the control stops, the counting value of time will be reset.
- * When power is recovered after blackout, all counting is reset and the control either resumes or stops from the very beginning according to the blackout recovery setting.

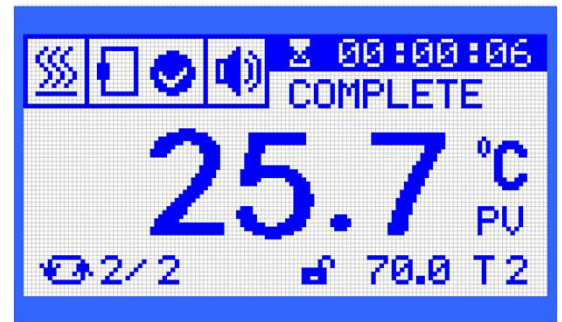
5) Disable 2 Step function

- If 2 Step function is not used, Remove the check ✓ in the checkbox in the right lower part of the screen.



Display the number of loops

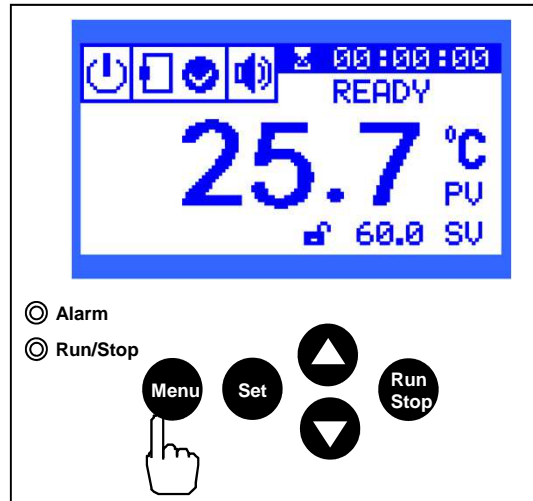
Display set temperature



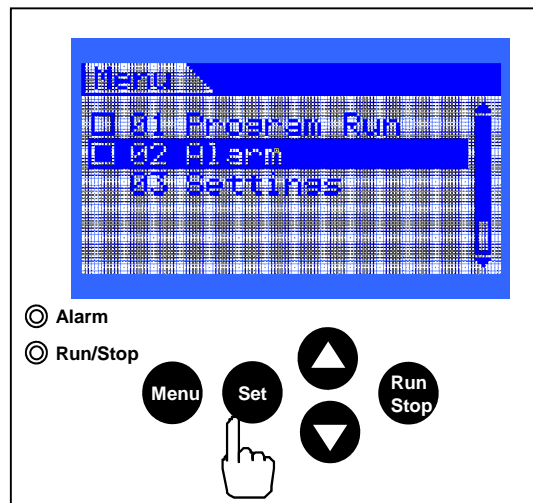
5-3 Alarm function of temperature controller

5-3-1. How to display alarm screen on the temperature controller

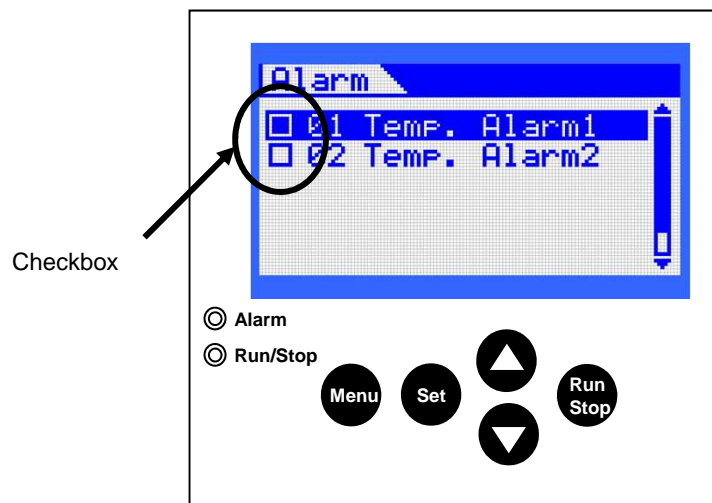
- Press "Menu" key on the main screen.



- Operate [▲] or [▼] key to move the cursor, select "02 Alarm" and press "Set" key.



- The Alarm screen appears.
- * If the alarm function is set to be effective, the check ✓ is displayed on the checkbox.



5-3-2. Alarm function of the temperature controller

- Two types of setting are available for the alarm of the temperature controller. 2 functions can be used at the same time.

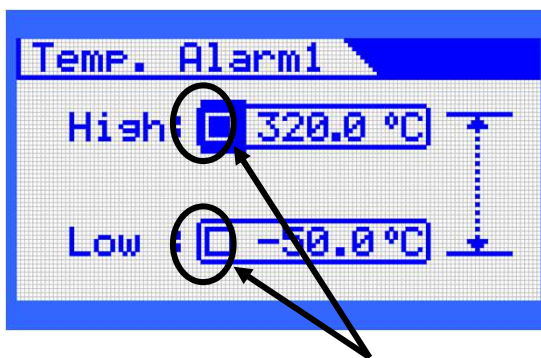
1	01 Temp. Alarm1	Upper/Low er limiter	<ul style="list-style-type: none"> • Control stop • Alarm display A-0 (1H, 1L) • Alarm sound 	The control is stopped w hen the measured temperature exceeds the upper and low er limit temperature.
2	02 Temp. Alarm2	Set Temperature Upper/Low er Limit Alarm	<ul style="list-style-type: none"> • Continue control • Alarm display A-0 (2H, 2L) • Alarm sound 	<p>An alarm indication is issued w hen the measured temperature exceeds the upper and low er limit temperature w ith respect to the target set temperature (SV).</p> <p>Alarm of w arning to continue control.</p> <p>* The alarm w ill be effective after the measured temperature reaches the set temperature.</p>

5-3-3. How to set Temp. Alarm 1 Upper/Lower limiter

- Select 01 Temp. Alarm 1 and press "Set" key.
- Activating 01 temp. Alarm 1
Activate the function by entering checks ✓ in the upper (High) and lower (Low) limits.

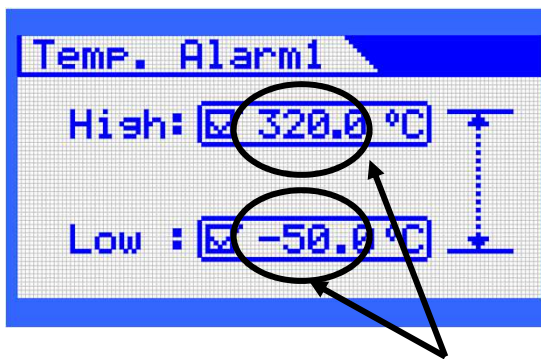
While the checkbox is selected, press " Set" key to blink the checkbox, operate [▲] or [▼] key to display ✓ mark. Press "Set" key again to confirm the value.

*Upper limit (High) only or lower limit (Low) only or both can be set.



Activate the function by entering a check ✓ to the checkbox.

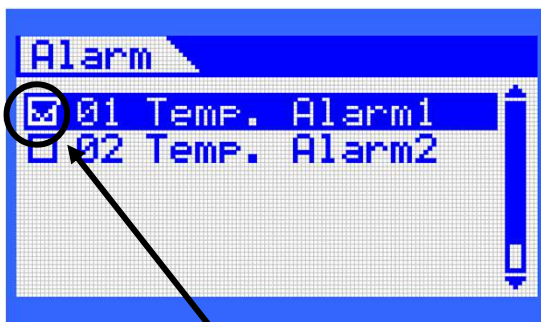
- How to set upper/lower limiter temperature
Enter the Upper limit (High) and Lower limit (Low). Operate [▲] or [▼] key, select the number you wish to change, and press "Set" key. While the value is blinking, operate [▲] or [▼] key to enter a value and press "Set" key to confirm the value.



Enter the upper/lower limiter value.

- Confirm the function
Once setting is over, press "Menu" key to return to the Alarm screen. * 01 Temp. Alarm 1 function becomes effective, ✓ mark is displayed on the checkbox of the left side of the Alarm screen.

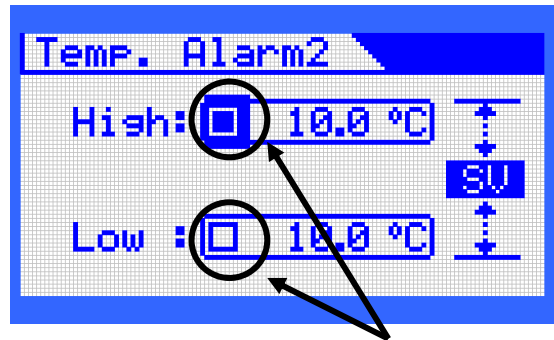
Press Menu key to return to the main screen.



✓ is displayed in the checkbox.

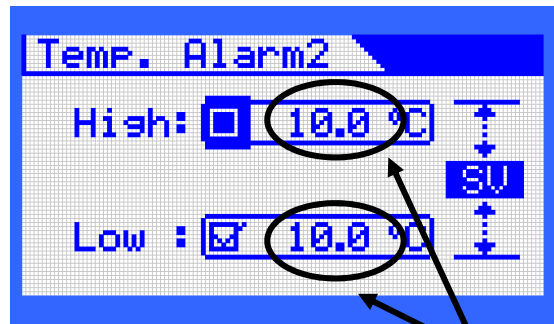
5-3-4. How to set Temp. Alarm 2 "Set Temperature Upper/Lower Limit Alarm"

- Show the Alarm screen.
- Select 02 Temp. Alarm 2 and press "Set" key.
- Activate the 02 Temp. Alarm 2 function
 Activate the function by entering checks ✓ in the upper (High) and lower (Low) limits.
 While the checkbox is selected, press "Set" key to blink the checkbox, operate [▲] or [▼] key to display ✓ mark.
 Press "Set" key again to confirm the value.
 * Upper limit (High) only or lower limit (Low) only or both can be set.



Activate the function by entering a check ✓ to the checkbox.

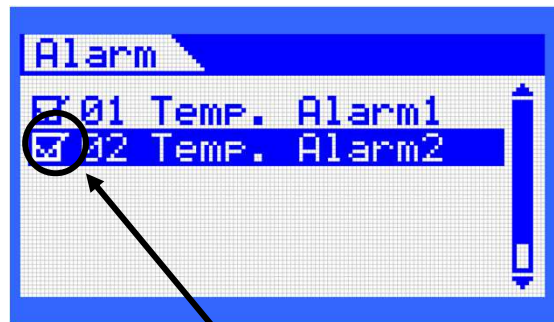
- How to set the upper/lower limit temperature against the set temperature (SV)
 Enter the Upper limit (High) and Lower limit (Low).
 Operate [▲] or [▼] key, select the number you wish to change, and press "Set" key.
 While the value is blinking, operate [▲] or [▼] key to enter a value and press "Set" key to confirm the value.



Enter the upper and lower limit values against the set temperature (SV).

- Confirm the function
 Once setting is over, press "Menu" key to return to the Alarm screen.
 * Once the 02 Temp. Alarm 2 function becomes effective, ✓ mark is displayed on the checkbox of the left side of the Alarm screen.

- Press "Menu" key to return to the main screen.



✓ is displayed in the checkbox.

5-4 Operating method of set mode

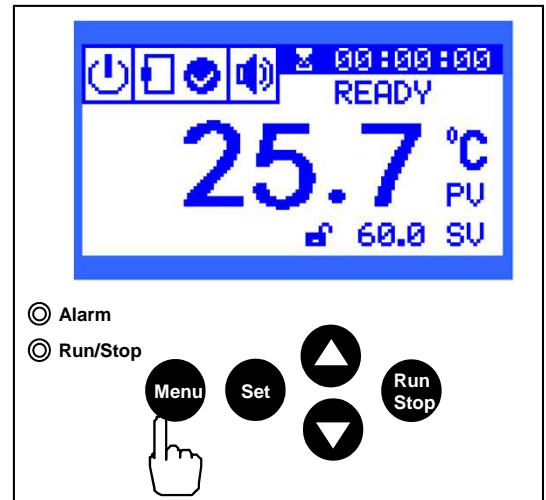
This mode sets various function settings.

Setting item

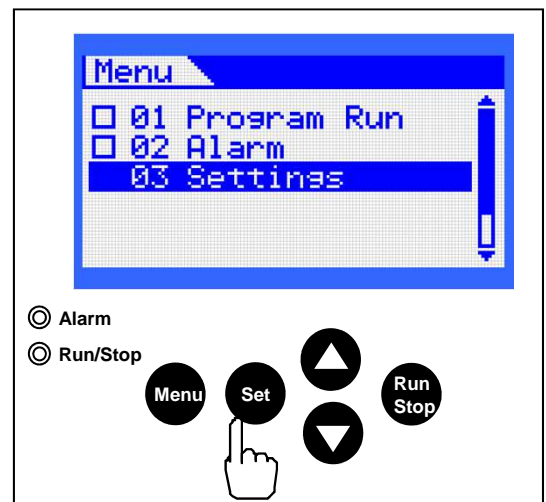
- 01 PID Channel: Select PID to be used for control.
- 02 Custom PID: Control is provided at the PID optionally entered.
Also the result of auto-tuning can be checked.
- 03 Custom AT: Auto tuning is carried out.
- 04 Temp Correction: Correction to the measured temperature is made.
- 05 Power Off: Movement at the time of blackout recovery can be set.
- 06 Options: Buzzer can be set and the display colors on the screen
can be reversed.
- 07 Default Settings: various settings will be returned to default.

5-4-1. How to display setting mode

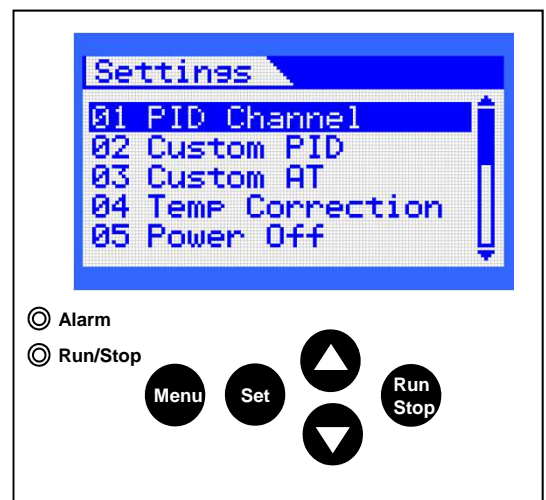
- Press "Menu" key on the main screen.



- Operate [▲] or [▼] key to move the cursor, select "03 Setting" and press ""Set" key.



- Settings screen appears.



5-4-2. PID channel

Select PID to be used for control. Two types of PID can be selected in this system.

* Do not make a change during control.

* They are set to default at factory shipment.

NO	Display name	Movement
1	Default	Usually used PID constant value. Previously entered at factory shipment. No need to change if there is no problem with temperature control.
2	Custom	This should be chosen when a PID constant value calculated through auto-tuning or a PID constant value entered optionally in the Custom PID item is used. * If Auto-Tuning starts, Custom is automatically chosen.

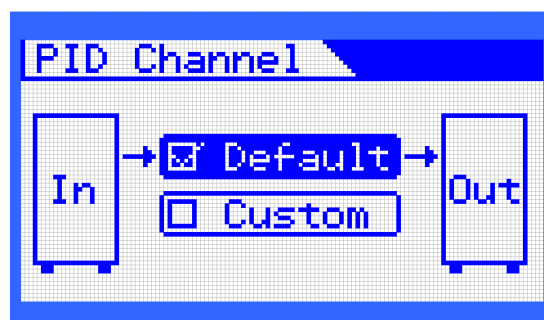
(1) How to set PID channel

- Select 01 PID Channel and press "Set" key.
- The site having a checkbox ticked with is the channel to be used.

To make a change, operate [\blacktriangle] or [\blacktriangledown] key to move the cursor and select the channel to be used.

Press "Set" key.

- One push of Menu key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.



5-4-3. Custom PID

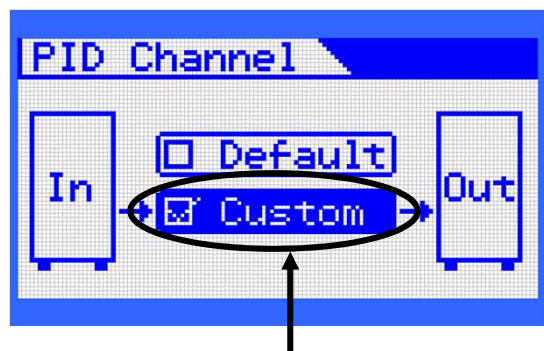
Optionally set a PID constant value and use it if you wish to control.

* This does not normally require to be set. Make a change if there is a problem with temperature control.

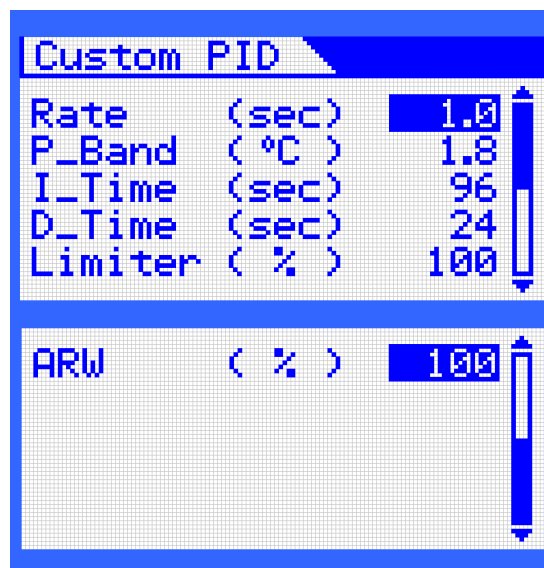
* Do not make any change during control.

(1) How to set Custom PID

- Select 02 PID Channel on the Setting screen, and press "Set" key.
- Provide a check in the checkbox.
- Press "Menu" key to return to the Setting screen.
- Select 02 Customer PID on the Setting screen and press "Set" key.



- Operate [\blacktriangle] or [\blacktriangledown] key to select the item you wish to change and press "Set" key.
- While the value is blinking, operate [\blacktriangle] or [\blacktriangledown] key to enter a value and press "Set" to confirm the value.
- One push of Menu key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.



2) Detail of Custom PID setting

This system employs PID control method for temperature control. Normally, there is no problem with the default PID, but the precision of temperature control may get worse depending on the condition of use. If this is the case, use either Auto-Tuning function or enter a PID value optionally.

- Respective items in Custom PID

Item	Unit	Setting range	Name	Note
Rate	(sec)	0.5~120	Control cycle	Period that reflects the result of PID calculation in control
P_Band	(°C)	0.1~200	Proportion	
I_Time	(sec)	0~3600	Integral	
D_Time	(sec)	0~3600	Differential	
Limiter	(%)	10~100	Output limiter	Percentage to be reflected on actual control output from calculation result.
ARW	(%)	0~100	Anti-reset windup	

5-4-4. How to use Auto-Tuning

This system employs PID control method for temperature control. Normally, there is no problem with the default PID but the precision of temperature control may get worse depending on the use condition. If this is the case, try the Auto-Tuning function.

* Start auto-tuning when the temperature is stable below 20°C from the temperature you wish to control.

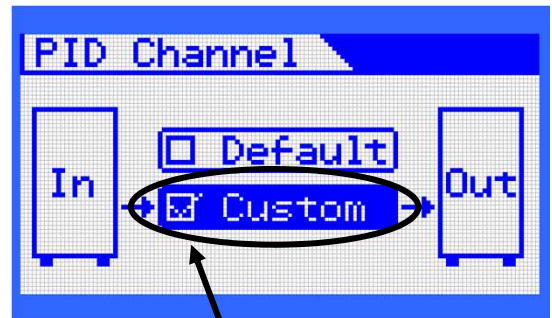
If the condition is not adequate, temperature control may get unstable.

Temperature control may get unstable at a temperature other than the target temperature through auto-tuning.

If you want to get better temperature control, adjust each PID constant value optionally. If overshoot occurs too often, it may be better if ARW is set at about 50%.

(1) How to set Auto-Tuning

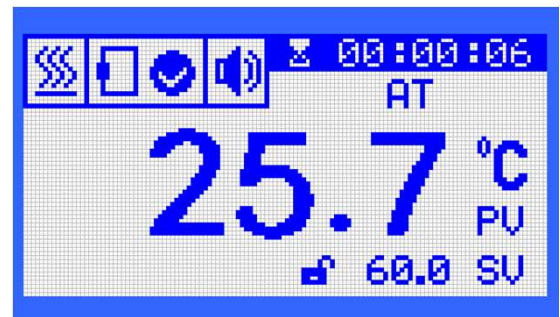
- Set the temperature you wish to control beforehand on the main screen.
- Select 03 PID Channel on the Setting screen and press "Set" key.
- Provide a check ✓ in the checkbox.
- Press "Menu" key to return to the Setting screen.
- Select 03 Custom AT on the Setting screen and press "Set" key.
- Custom AT screen appears.
- Press "Set" key to blink the checkbox, operate [▲] or [▼] key to display ✓ mark.
- Press "Set" key to start control.
- During auto-tuning, status on the main screen is displayed as AT.
- * For Auto-tuning, overshoot once occurs and it may take time till it becomes stable.
- The main screen appears and status displays AT to start auto-tuning operation.
- Once auto-tuning is over, the operation continues on the control mode.



Execution of auto-tuning automatically switches to Custom PID.



Provide a check ✓ in the checkbox.



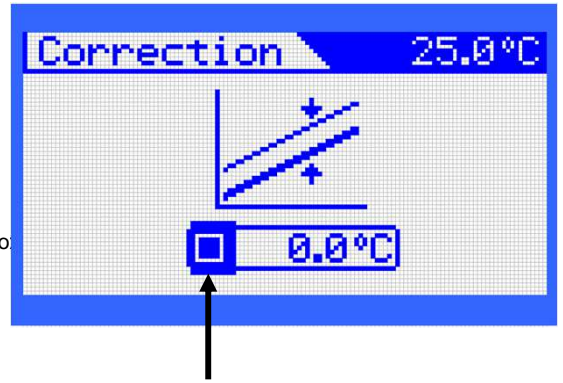
5-4-5. Measured temperature correction function

If any difference is found between the temperature measured with a standard thermometer and the measured value on the display, this is a function to correct the display temperature.

* Do not use the system beyond the range of temperatures in use using this function. Wrong setting may lead to a cause of failure.

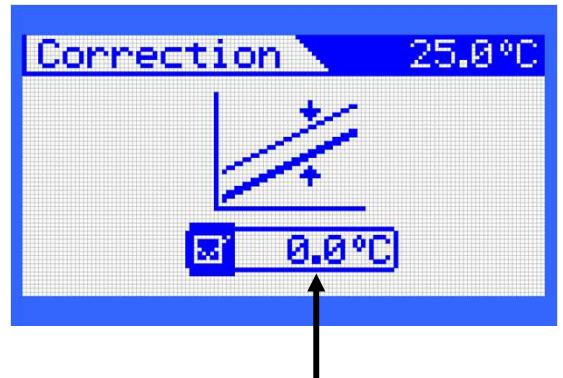
(1) Setting method

- Select 04 Temp Correction on the Setting screen and press "Set" key.
- Select the checkbox below the graph and press "Set" key to blink the checkbox.
- Operate [▲] or [▼] key to display ✓ mark and press "Set" key to confirm it.
- * The function becomes effective by displaying ✓ mark.



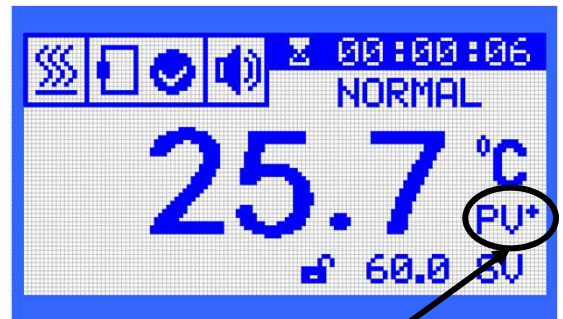
Provide a check ✓ in the checkbox.

- Move to the number from the checkbox with [▲] or [▼] key and press "Set" key to make it possible to enter a number.
- Operate [▲] or [▼] key to enter a value and press "Set" key to confirm the value.
- * The number can be entered in the range from -50.0°C to +50.0°C.
- One push of Menu key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.



Set a temperature to be corrected.

* If the measured temperature correction function is set to be effective, + mark is displayed beside the PV display on the main screen.



If the measured temperature correction function is set to be effective, + mark is displayed.

5-4-6. Blackout recovery function

The movement can be set when power is recovered after occurrence of blackout during control.

* The blackout recovery function is set to be effective at factory shipment.

- When the power recovery is effective: if is displayed in the checkbox, control continues in the state before blackout when power is recovered.
- When the blackout recovery is not effective: if is not displayed, control stops after blackout recovery irrespective of the state before blackout.

(1) Setting method

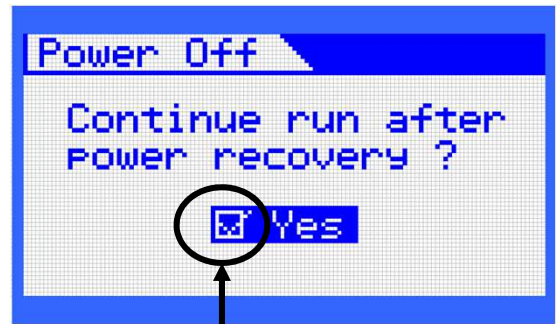
- Select 05 Power Off on the Setting screen and press "Set" key.

- Press "Set" key to blink the checkbox, operate [**▲**] or [**▼**] key to display or hide mark.

- Press "Set" key to confirm.

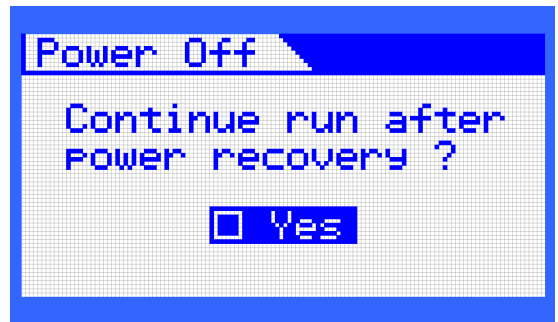
- One push of Menu key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.

When the blackout recovery function is effective



Set the blackout recovery function to be effective/not effective by displaying or hiding mark in the checkbox.

When the blackout recovery function is not effective



5-4-7. Optional features

Optional function has two setting items.

- Buzzer effectiveness/non-effectiveness setting
- Display colors on screen reverse setting

(1) How to set buzzer

The buzzer operation sound can be made ineffective.

If it is set to be ineffective, all operating sounds including alarms are mute.

* It is set to be On (effective) at factory shipment.

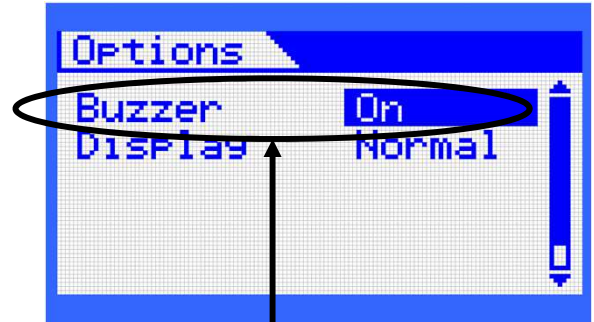
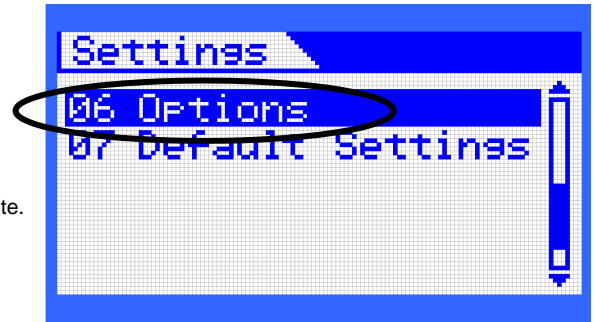
- Select 06 Options on the Setting screen and press "Set" key.

- Select Buzzer, press "Set" key to blink the display, operate [▲] or [▼] key so that On or Off is displayed.
On: The operating sounds are effective.
Off: Operating sounds are ineffective.

- Press "Set" key to confirm.

- One push of Menu key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.

* The icon on the main screen displays the setting status of buzzer.



Changing area to set buzzer



: When buzzer operating sound is effective



: When buzzer operating sound is ineffective

(2) How to reverse the display colors on the screen

The contrast of display colors (blue/white) on the screen can be reversed.

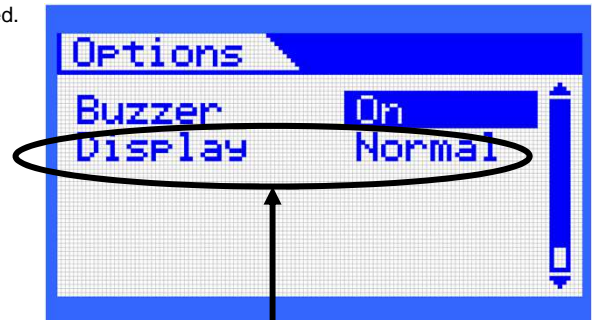
* Set to Normal at factory shipment.

- Select 06 Options on the Setting screen and press "Set" key.

- Select Display, press "Set" key to blink the display, operate [▲] or [▼] key so that Normal or Reverse is displayed.
Normal: Normal display colors.
Reverse: Display colors reversed.

- Press "Set" key to confirm.

- One push of "Menu" key returns to the Settings item.
2 pushes of "Menu" key return to the main screen.



Reverse setting changing area for display colors on screen



When the display colors on screen are reversed

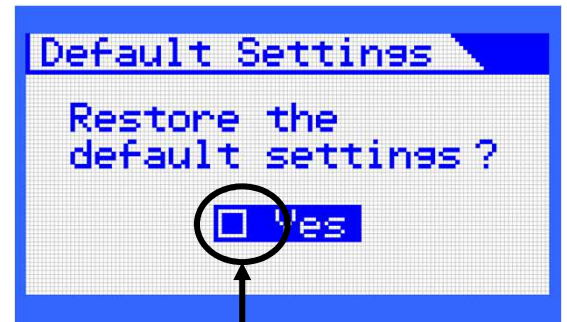
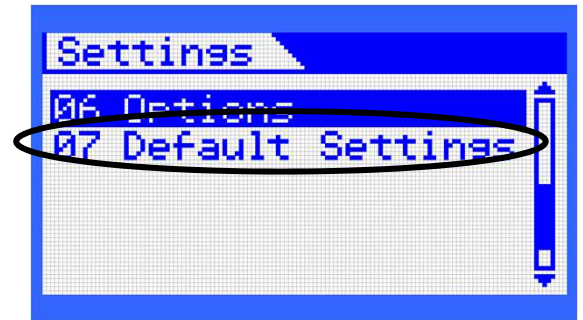
5-4-8. Reset setting items

An optionally set item can be reset to the factory shipment state. If this operation is done, all entered values will be reset.

* It is recommended to take note of any important value or setting before reset.

1) How to reset

- Select 07 Default Settings on the Setting screen and press "Set" key.
- Press "Set" key to select the checkbox and operate [▲] or [▼] key to display ✓ mark.
- Press "Set" key to reset.
- Once reset is over, the screen automatically return to the main screen.



Provide a check ✓ in the checkbox and press "Set" key.

5-4-9. Lock operation keys

The keys can be locked to prevent wrong operation.

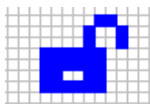
Setting keys lock disables all key operations.

To release the lock, carry out the method of releasing the keys lock.

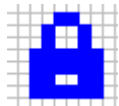
* If the system is shut down in emergency in the keys locked state, turn off the breaker. This can be set only when the main screen is displayed.

1) How to lock the operation keys

- Press [▲] twice.
- Keys lock? appears.
- Press "Set" key.
- Keys are locked.
- In the keys locked state all keys become ineffective.
- * The keys lock mark appears in the lower part of the main screen.



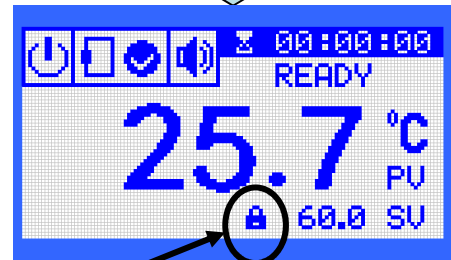
Keys lock unlocked



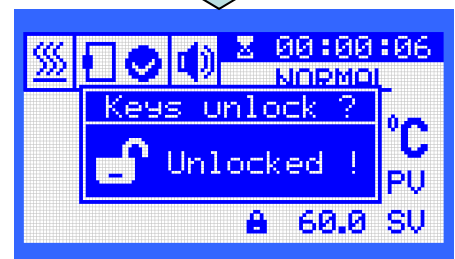
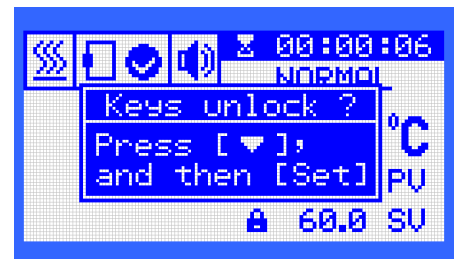
Keys locked

2) How to release the keys lock

- Press [▲] key once.
- Press [▼] key once.
- Keys unlock? appears.
- Press "Set" key.
- The keys lock is released.



Keys lock mark



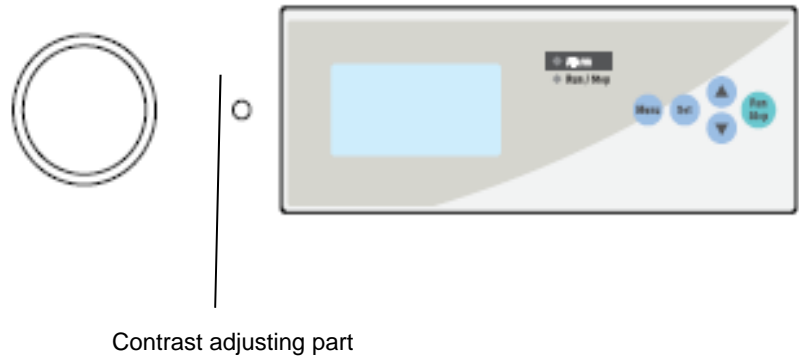
5-4-10. Adjust the display screen contrast

Display may be less-visible depending on the angle of visibility.
If this is the case, adjust the screen contrast.


1) How to adjust contrast

- Insert a + driver into the hole of the contrast adjusting part on the front part of the system, rotate the inside knob either right or left and adjust the position giving good visibility of the display screen.
- * When operating the rotating knob, operate it in a fine-tuning manner. If you operate it greatly, this may cause failure. Even fine-tuning greatly changes the contrast.
- * Do not operate the knob with strong force.

This would cause failure.

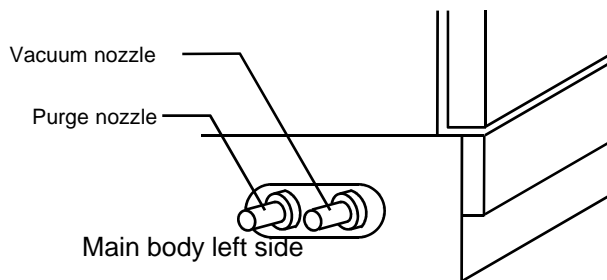


5-5. Vacuum Operation Method

 Caution
Change oil of the vacuum pump periodically.
<p>When used for a long period of time, oil of the vacuum pump is deteriorated, resulting in faulty ultimate vacuum or early damage to the pump before service limit. Be sure to change oil periodically.</p>

- (1) Connect the vacuum nozzle (outside dia. 22 mm) and vacuum pump with a vacuum hose.
 - * A vacuum hose is not an accessory and must be procured separately.
 - If the port of vacuum pump is for connection of the vacuum hose and has the outside diameter of 22 mm, use the vacuum hose with the inside dia. of 18 mm.
 - If the vacuum hose with the inside dia. of 28 mm does not fit. Connect according to the operation manual of the pump manufacturer.
 - Also available optionally is a different-diameter joint (vacuum hose adaptor).

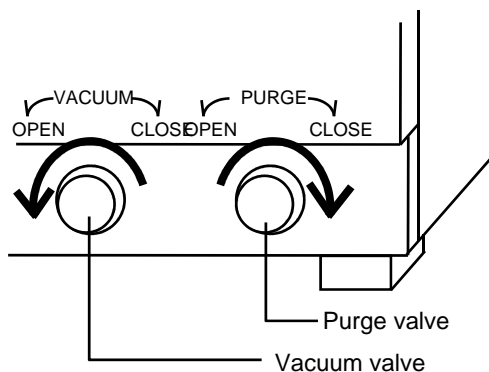
* In order to prevent deterioration of the vacuum pump and oil, remove steam, acid and alkaline corrosive gases, organic solvent, mercury vapor as much as possible by using a cold trap or dehydrating agent (molecular sieve) before inhalation.



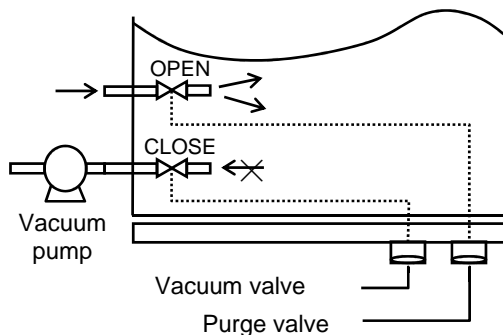
■ Vacuum hose adaptor

Model	Connection size	Code No.
Adaptor A	O.D. 22mm x O.D. 17mm	119240
Adaptor B	O.D. 17mm x O.D. 13mm	119250
Adaptor D	O.D. 22mm x O.D. 13mm	119270

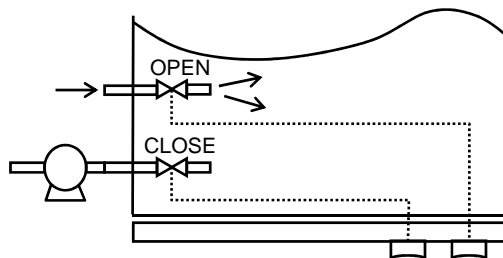
- (2) Turn the purge valve clockwise to confirm that it is closed. Turn ON power supply to the vacuum pump, and turn the vacuum valve counterclockwise slowly to purge.



- (3) When drying is over, turn the vacuum valve clockwise to close. Then, turn the purge valve counterclockwise to open, allowing the chamber inside to return to the atmospheric pressure.



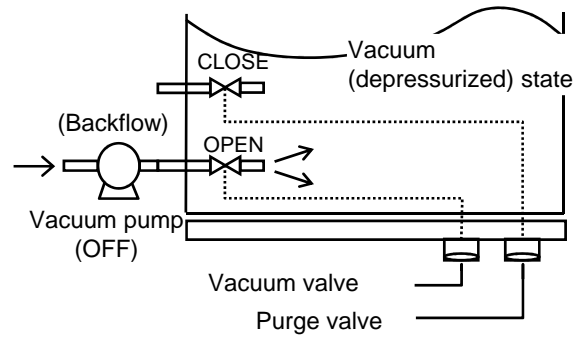
- (4) With the purge valve left open, turn the vacuum valve again counterclockwise to open, allowing purge of air by the vacuum pump for one minute.




- (5) Turn OFF power supply to the vacuum pump.

* After completion of drying, never turn OFF power supply to the vacuum pump without taking steps (3) and (4) of previous page. Otherwise, oil of the vacuum pump may backflow.

* For the experiment with the sample placed under depressurization, close the vacuum valve when the main body has been drawn to a vacuum or gas purge is completed. Then disconnect the piping between the main body and the vacuum pump (return the suction port of the pump to atmosphere), turn OFF power supply to the vacuum pump.
If power supply to the pump is turned OFF without disconnecting the vacuum hose beforehand, oil of the pump may backflow to the vacuum nozzle of the main body.



3. Gas Displacement Method

 Caution
<p>Always carry out gas replacement with the gas supply pressure of 19.6 kPa (0.2 kg/cm²) or less.</p> <p>For gas replacement inside the chamber, high gas supply pressure may cause deformation of can body or damage to the observation window.</p>

- (1) Connect a gas cylinder to the purge nozzle via a hose.
- (2) Adjust the gas supply pressure with a regulator to 19.6kPa (0.2kg/cm²) or less.
- (3) After the chamber interior is drawn to a vacuum with the vacuum pump, close the vacuum valve.
- (4) Carry out gas replacement while opening the purge valve gradually.
- (5) After gas replacement, close the purge valve to put the chamber interior to the airtight state.

* In an experiment in which gas purge is carried out under a gas atmosphere, after the main body reaches a vacuum or after the gas purge is completed, disconnect the piping between the main body and the vacuum pump (return the suction port of the pump to atmosphere), turn OFF power supply to the vacuum pump.
If power supply to the pump is turned OFF without disconnecting the vacuum hose beforehand, oil of the pump may backflow to the vacuum nozzle of the main body.

6

Troubleshooting Guide


For troubles other than those listed below, contact a shop from which you have purchased the product or our service center.

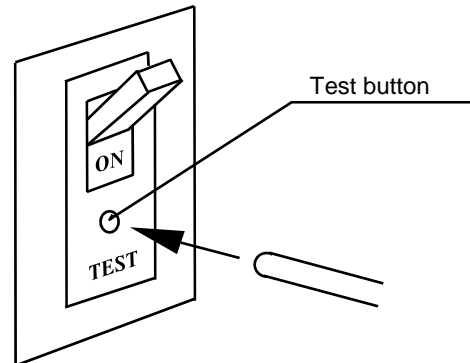
Situation	Cause	Countermeasure
The earth leakage breaker does not turn on. It turns off immediately.	There is electric leakage. Overcurrent flows. Earth leakage breaker is faulty.	Stop the operation and contact the company where you purchased the product or the nearby service center.
	Overheat prevention device is operating. The set temperature of the overheat protector is lower than the inside temperature of the device.	Turn the knob of the overheat preventer to the right to change the setting temperature. Set the overheat preventer to a temperature that is 20 °C higher than the set value that you want to set to control the temperature inside the compartment.
Even if the earth leakage breaker is turned on, nothing is displayed on the indicator.	Power is not supplied.	Check the main power supply such as the switchboard.
	The power plug is disconnected from the power outlet. Or it is not securely plugged in	Turn off the earth leakage breaker, securely plug the power plug into the outlet, then turn on the earth leakage breaker.
	The earth leakage breaker is faulty.	Stop the operation and contact the company where you purchased the product or the nearby service center.
	Temperature controller is faulty.	Stop the operation and contact the company where you purchased the product or the nearby service center.
	Overheat prevention device is operating. The set temperature of the overheat protector is lower than the targeted temperature.	Turn the knob of the overheat preventer to the right to change the setting temperature. Please set it to a temperature 20 °C or more higher than the set temperature.
The temperature does not rise to the set temperature.	There is a gap due to deformation of the door, deformation and breakage of the door packing.	Stop the operation and contact the company where you purchased the product or the nearby service center.
The display gets turned on or off during driving. The temperature control is stopped. Power off alarm occurs frequently.	Overheat prevention device is operating. The set temperature of the overheat prevention device is lower than the target setting temperature and the power failure recovery function is enabled.	Turn the knob of the overheat preventer to the right to change the setting temperature. Please set it to a temperature 20 °C or more higher than the set temperature.
	The temperature controller malfunctioned.	Stop the operation and contact the company where you purchased the product or the nearby service center.
An off-odor occurs.	Odorous components volatilized from heat insulating materials etc because we first performed high temperature operation. * There may be some offensive odor and smoke.	Please check whether there is burning on the inside of the sample or the top of the equipment. If it does not improve after several hours, please stop driving and contact your place of purchase or a service center near you.
Key operation is impossible.	Key lock function is enabled.	Please unlock according to P35 * In case of emergency stop with breaker.

Situation	Cause	Countermeasure
The temperature control is unstable and it is not stable.	PID value does not match.	Please try auto tuning or manual setting with the Custom PID setting on page 30.
	A lot of things are placed in the cabinet. There is an obstacle around the control internal temperature sensor.	Please remove the cause which is likely to disturb the transmission of the inside temperature.
The display on the indicator is indeterminate and the control stops.	The temperature controller is in an abnormal state due to noise or ambient temperature rise. Overheat prevention device is operating.	Please use a reliable power supply outlet. Please keep the ambient temperature below 35 °C. If it does not improve, stop the operation and contact the company where you purchased the product or the nearby service center.
"F - x" alarm symbol on the dialog display is displayed on the screen and control stops.	Refer to P.9 "3-5 Safety and alarm functions" and check the cause of the alarm.	Stop the operation and contact the company where you purchased the product or the nearby service center.
"A - x" alarm symbol is displayed under the time display. Control may be stopped in some cases.	Refer to P.9 "3-5 Safety and alarm functions" and check the cause of the alarm.	If the cause can not be identified or improved by referring to 3-5 Safety and alarm functions" on page 9, stop operation and contact the customer service center or nearest service center.
Even if pulled with a vacuum pump the vacuum gauge does not move.	The purge valve is open.	Close the purge valve completely.
	Vacuum valve closed.	Please open the vacuum valve.
	The gauge is broken.	Stop the operation immediately and contact the company where you purchased the product or the nearby service center.
	The size of the vacuum hose does not match.	Replace the hose.
	A crack has occurred in the vacuum hose.	

7 Maintenance and Inspection


7-1 Earth leakage breaker operation test


 Caution
<p>Carry out the earth leakage breaker operation test.</p> <p>If the earth leakage breaker is used in the faulty state, electric shock may occur in case of electric leakage. Carry out the operation test at least once a month.</p>





With the power plug inserted and the breaker ON, press the breaker test button with a thin rod. It is normal if the breaker is turned OFF.

7-2 Cleaning and care of the product

 Warning
<p>Never attempt to disassembly the product.</p> <p>The unit contains parts with high voltage applied or may become hot, and disassembly may cause an electrical shock or an injury.</p>

 Caution
<p>Do not attempt cleaning or servicing while the product is hot.</p> <p>Cleaning or servicing the product while it is still hot may cause burn.</p>

 Caution
<p>Use a correct method and items for cleaning or caring the product.</p> <p>When cleaning or maintaining the main unit and shaking table, never splash water to the exterior or the inside directly, do not put any foreign materials and never use the cleanser, thinner, oil, kerosene, acid, and equivalent. Otherwise, the user may suffer electric shock or damage to the product.</p>

 Caution
<p>Take care to remove dust from the outlet.</p> <p>If the device is used with the plug inserted in the outlet for a long period of time, dust may accumulate in a gap between the socket and power plug, causing failure or ignition (tracking).</p>

- (1) Turn the power switch (ELB) OFF and remove the power plug off the outlet before maintenance work.
- (2) Use a moistened and well wriggled soft cloth for cleaning. Use mild detergent for stubborn dirt and completely wipe remaining detergent after cleaning.

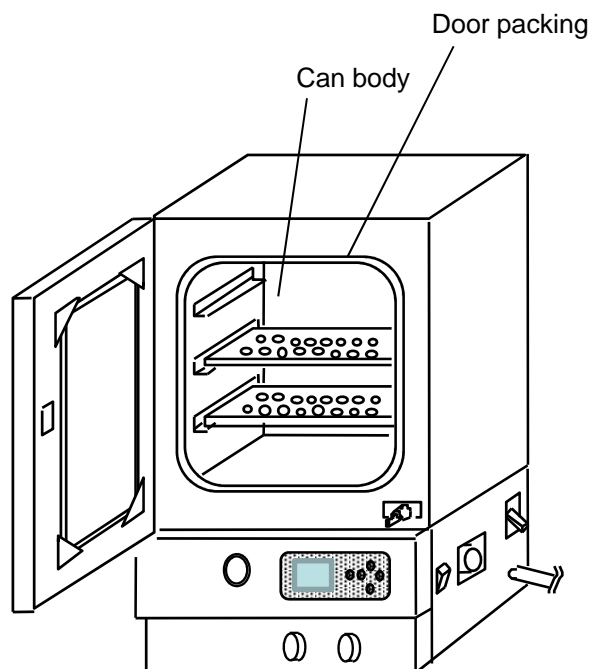
7-3 Consumables

The door packing (material: heat-resistant silicon) is a consumable. If the required vacuum cannot be achieved because of swelling or cracking of packing due to solvent, replace the packing.

•* For replacement, confirm beforehand that the can body temperature has lowered sufficiently. Otherwise, there is a risk of burn.

Name of part	CodeNo.
VOS-210Cdoor packing	100880
VOS-310Cdoor packing	100890

* For Model VOS-210C, the packing must be bonded to the main can body. Contact out service center.



8 Disposal of Products

Disposal of product or part must be done according to the specified disposal method.

Principal components parts and disposal method

Components	Model	Weight	External dimensions	How to discard
Main body	VOS-210C	Approx. 40kg	355 (W) x 406 (D) x 580 (H) (mm)	Request the disposal operator for disposal.
	VOS-310C	Approx. 60kg	505 (W) x 545 (D) x 760 (H) (mm)	

•* We ask you to discard packing materials after classifying them by material types.

9 After-sale Services

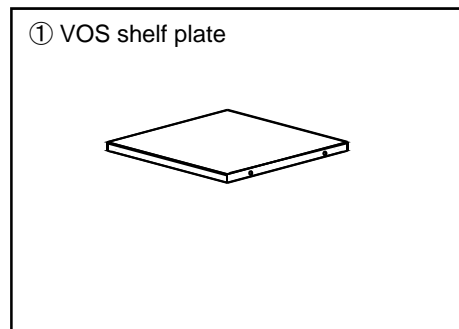
1. In case the product does not function satisfactorily, check first by referring to the page on troubleshooting to see if this is actually a trouble.
2. If the product remains unsatisfactory even after checking, contact the shop from which the user has purchased the product or the service center described in the manual and request repair.
3. Repair during the guarantee period will be made according to the guarantee stipulations.
4. After expiration of the guarantee period, the charged repair will be made at the customer's request.

Warranty Provisions

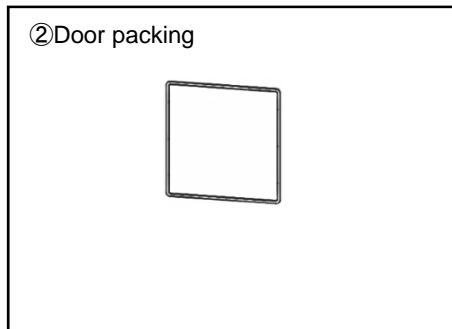
- 1 The warranty period of your product is 12 months from the date of purchase.
- 2 We will repair or replace your product free of charge for troubles occurred in your product during proper usage in the warranty period.
- 3 This warranty is limited to the product itself and shall not be construed to cover all and any consequential losses (operating losses, various expenses, etc.) from malfunctions or troubles of the product.
- 4 The provisions of this warranty are valid only in Japan.
When you are going to indirectly export the product you purchased to a foreign country, the provisions shall be exempted from application provided that a certification be issued that the product is not subject to the export control regulations and, in such case, all liabilities in relation to the product shall be borne by the exporting party .
- 5 Repair shall be paid by the user even during the warranty period for the following cases.
 - a) The user did not return the customer card or made user registration at our HP within one month from the date of purchase.
 - b) This warranty card was not presented or user registration could not be confirmed at the time of request for repair.
 - c) When the dealer name is not sealed on the warranty card or the date of the purchase is not indicated on it.
 - d) Malfunctions or damages caused by handling that is against cautions in the manual or labels on the product, or transportation from the installation site after purchase, dropping during use, or shocks.
 - e) Malfunctions or damages caused by mishandling, unauthorized modification or repair by the user.
 - f) Malfunctions or damages caused by a fire, an earthquake, wind and flood, salt damage, lightening, or other Acts of God or external factor including the power supply.
 - g) Degrading of performance or malfunctions resulted from consumption of consumable parts or replacement of consumable parts.
- 6 Warranty conditions may differ depending on specific products. Check the warranty conditions stipulated in the warranty space in the operation manual.
- 7 Ask your dealer or the nearest sales office for repair for malfunctions after the warranty period.
(In principle, the retention period of repair parts is five years after the end of production.)
- 8 Product warranty for products sold overseas by our overseas sales department shall be separately specified.

10 •List of Consumable and Replacement parts/ Optional parts

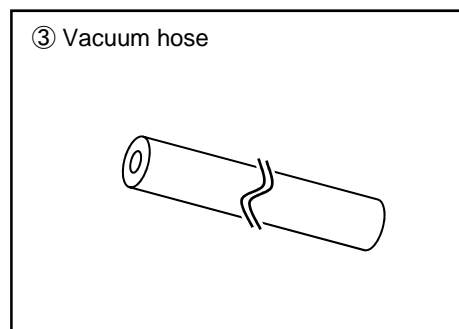
10-1 List of optional parts



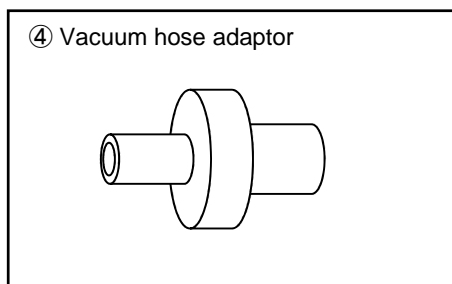
Code No	Name	Quantity	Target model
100800	Shelf plate	1	VOS-210C
100810	Shelf plate	1	VOS-310C



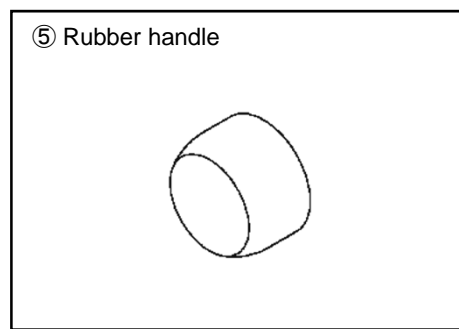
Code No	Name	Quantity	Target model
100880	Door packing	1	VOS-210C
100890	Door packing	1	VOS-310C



Code No	Specification [mm]	Length
119230	Inner dia. 18 × Outer dia. 42	5 m



Code No	Name	Connection port dia.[mm]	Quantity
119240	Adaptor A	Outer dia. 22 × Outer dia. 17	1
119250	Adaptor B	Outer dia. 17 × Outer dia. 13	1
119270	Adaptor C	Outer dia. 22 × Outer dia. 13	1



Code No	Name	Quantity
100940	Rubber handle	1