

EYELA

Thermo Regulating Bath

NTT-2100
NTT-2200**Instruction Manual**

This manual is designed to use this unit safely with its best performance.



Please read this manual carefully, especially on Important 'Safety precautions'.

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

Tokyo Rikakikai Co., Ltd.

Safety precautions

1. Signal word

Due to this product's characteristics and functions, some parts of the unit are subject to high temperature and touching these parts during operation may burn or injure yourself. However, if you have proper information before use, you can avoid almost all these troubles.

Therefore, this manual categorizes the level of importance and danger as below with alert mark and signal word. Please follow the instructions and use the product safely.

Alert mark Signal word	Definition
 Warning	Mishandling the product may cause users serious personal injury or loss of life.
 Caution	Mishandling the product may injure users or cause property damage.

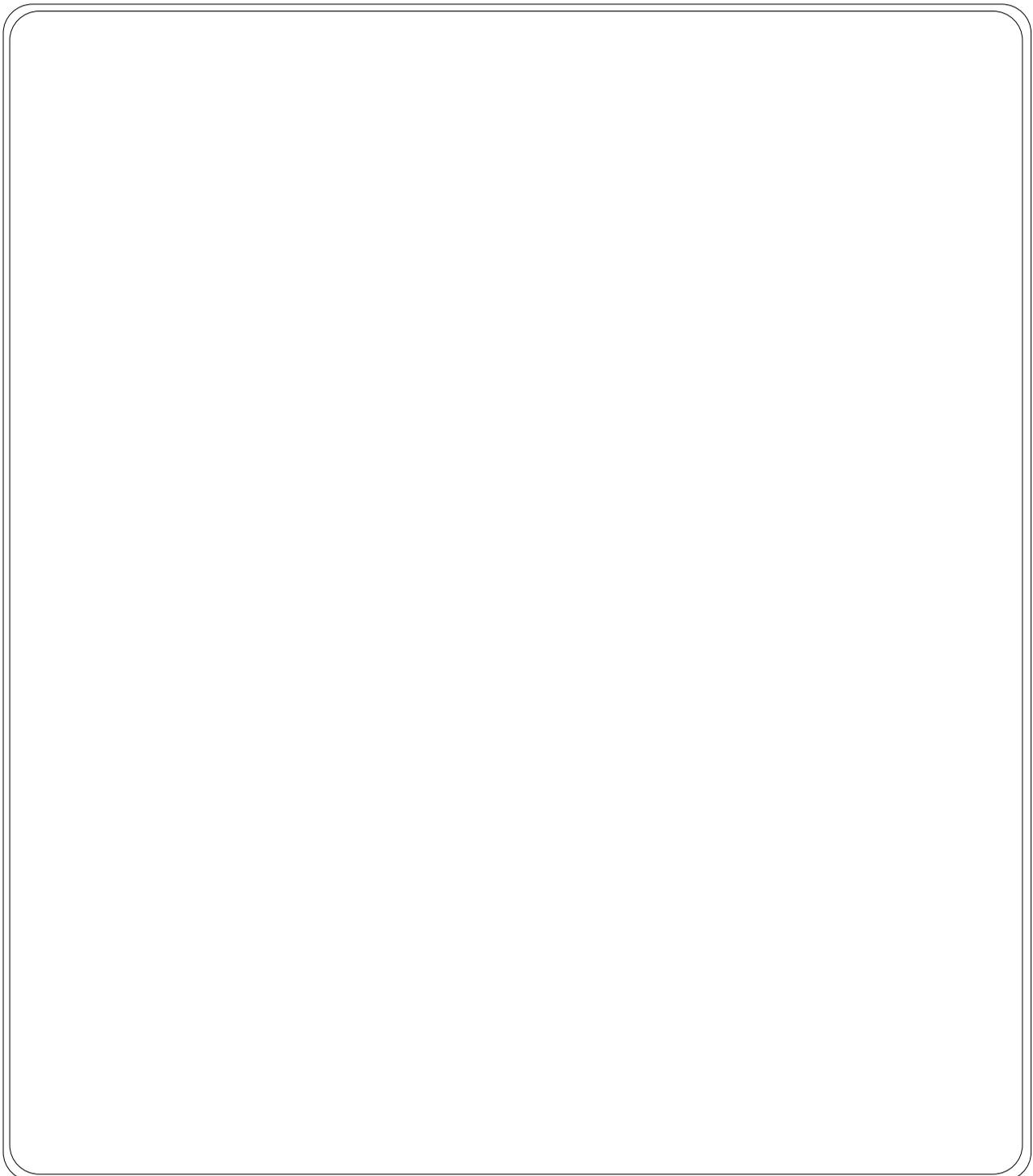
Though we are trying to look into conceivable risk of using the product, it is very difficult for us to expect all of it. It means that all the instructions in this manual do not cover all the types of risks that may be caused by the product. However, if you follow the instructions, you surely can handle and operate the product safely. Please sue extreme care when handling this product and try to prevent all the potential accidents and mechanical failures.

2. Warning label

For highly priority danger, warning labels are attached on the specified position of product body as shown below.

Please read it carefully and pay your full attention when operating the product.

* if you have any trouble reading the label because of worn-out and etc., please replace with new one. Please contact us if you require new label.



Thank you for choosing the products of .



Introduction

This instruction manual describes the procedures of installation, operation, troubleshooting, maintenance / checkup, and disposal for Thermo regulating bath model NTT-2100 and NTT-2200. Read this manual carefully before you start the operation.

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Packing list

Check the following items are bundled with each quantity before your installation.

		NTT-2100	NTT-2200
1	Main unit	1	1
2	Ground adapter	1	1
3	Bath (SB-9)	1	1
4	Protection cover	1	1
5	Instruction manual	1	1

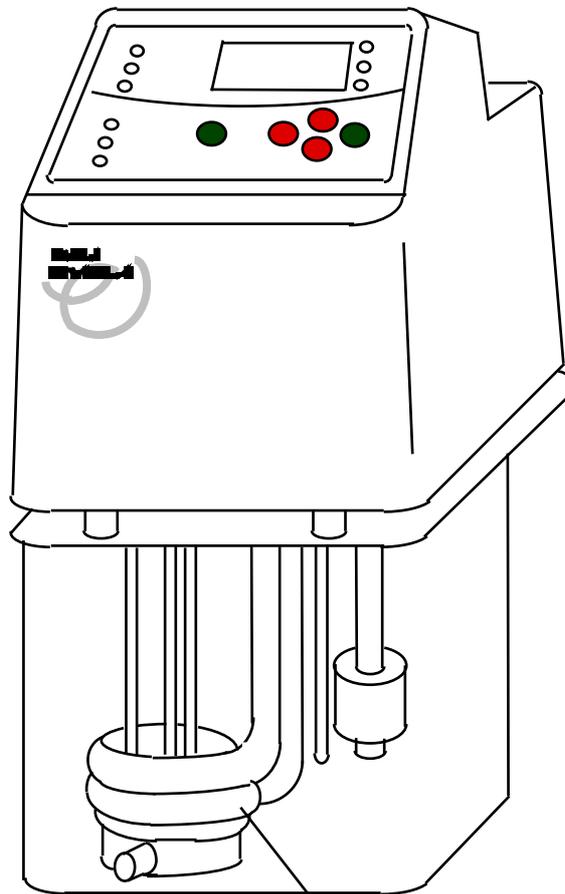
1

For your safety operation

This unit subjects to high temperature.
Use extreme care when handling it.

Do not turn on the switch while holding the heater.

If turning on the main power without setting the unit into the water bath, the surface of heater may have high temperature and it may incur burns on users. For its usage, please make sure to mount the protection cover and then place the property of heater completely into the water bath before turning on the switch.



Highly heated portion

2-1 Use application

**Warning**

Do not remodel.
Do not use out of applications.

Remodeling or use out of applications may cause an electric shock or mechanical troubles.

This unit is applicable for wide variety of experiments / examinations of reaction, crystallization, synthesis, deposition of organic steel, environmental tests of materials, breakdown tests, endurance test, and such.

2-2 Specifications

Name of product	Immersion type Thermo regulating bath	
Model	NTT-2100	NTT-
Temp. control range	Room Temperature (RT) +5 ~ 80 (If you use a supplied bath, Max. 70°C) * 1 (If you use this with a cooling bath, -20 ~ RT+5)	
Temp. control accuracy *2	± 0.1 ~	± 0.05 ~
Temperature control	PID microprocessor control, SSR output	
Temp. settings / indication	Digital setting by membrane switch, digital read-out by 0.1°C	
Safety features	Alarm function (Low water level, Over shoot, Control, Sensor), Variable independent over temperature protector, Circuit protector	
Additional functions	Auto-tuning, Temperature calibration, Auto-stop 1, Auto-stop 2, Auto-start, Selectable operation after power failure	
Heater output	500W (SUS316L)	1kW (SUS316L)
Stirring method	Propeller by stirring speed control	Changeable jet flow (Possible external circulation)
Max. flow rate of circulation pump	—	7L / min (50 / 60 Hz / water / high circulation)
Max. head of circulation pump	—	1.2m / 1.5m (50 / 60 Hz / water / high circulation)
Temperature sensor	Thermistor	
Applicable ambient temp. range	5 ~ 35°C	
Overall dimensions	138W x 150D x 312H (Excluding any projection)	
Net weight	3.5kg	
Rated power source	AC-100V 50/60Hz	
Power source input	6A, 0.6kVA	11A, 1.1kVA
Protection cover	Anti-bacterial stainless steel-made	
Water bath	Self-extinguishing resin (Max. 70°C) 9L capacity	

* 1 Use an anti-freeze solution when the temperature is 10°C or lower.

If you use at Room temperature + 5°C or lower, combine with other cooling unit such as an immersion cooler or a cooling water circulator, etc.

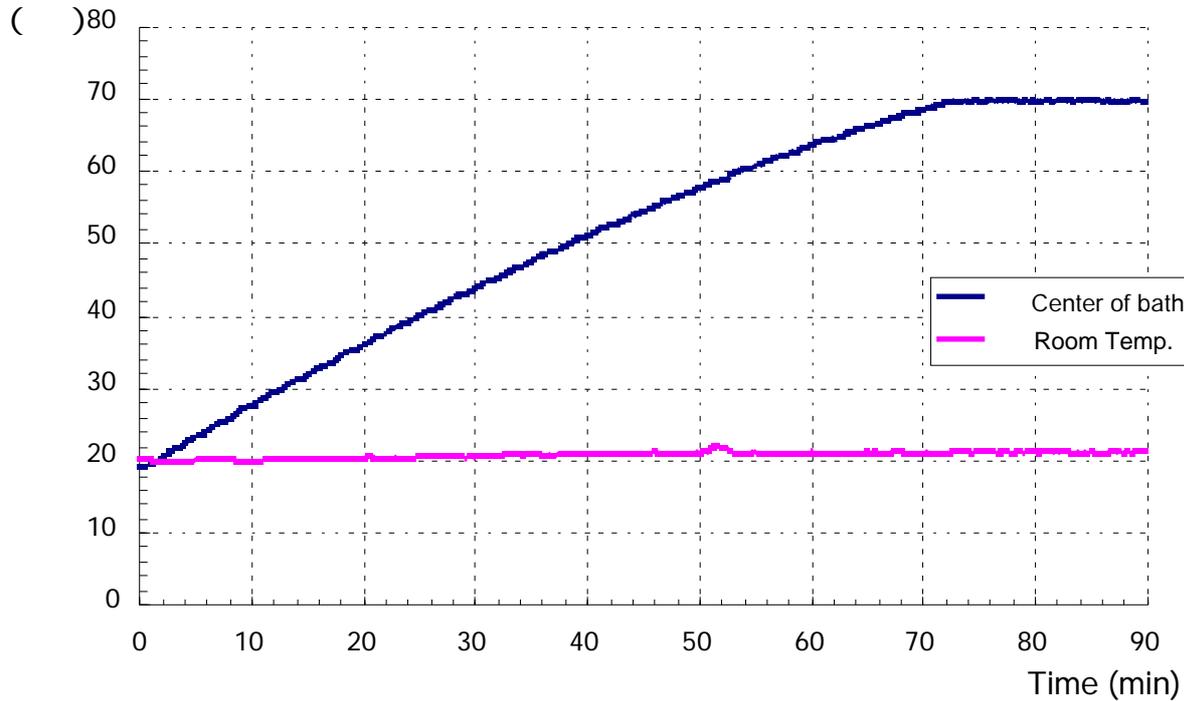
* 2 The performance is shown at room temperature 20°C , 100V, 50Hz, using a supplied water bath filled with 7L water without lid.

2-3 Heating curve (Referable data)

1) NTT-2100

Applied conditions : Ambient temperature : 20°C
 AC100V 50Hz
 Using a supplied water bath with lid
 Slow stirring
 Coolant medium : water (7L)
 With no load

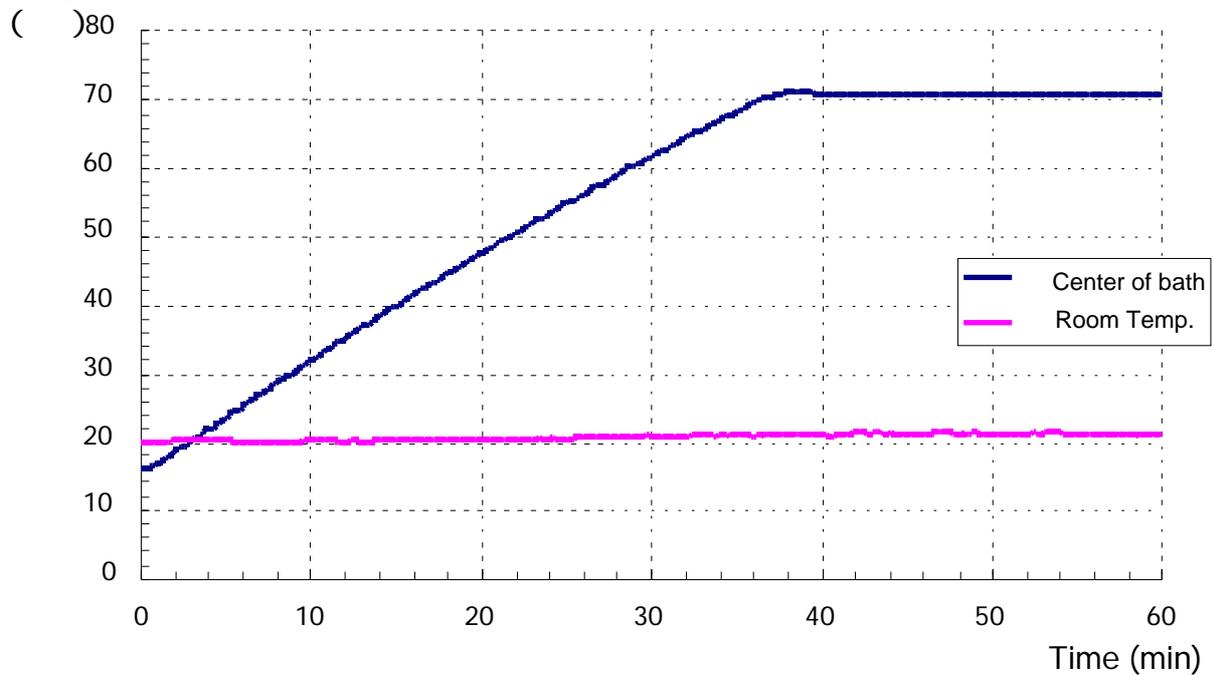
Temperature



2) NTT-2100

Applied conditions Ambient temperature : 20°C
 AC100V 50Hz
 Using a supplied water bath with lid
 Slow stirring
 Coolant medium : water (7L)
 With no load

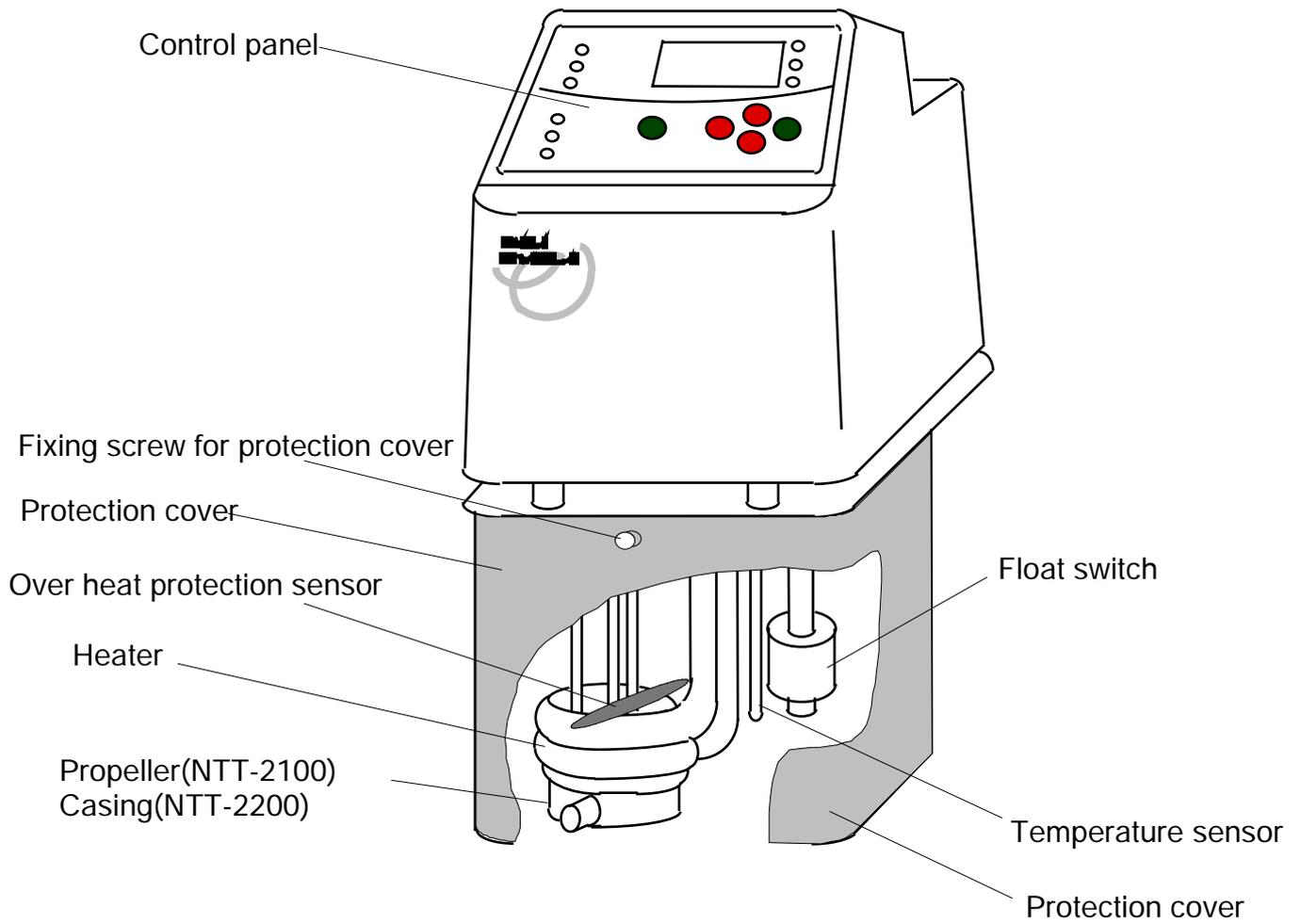
Temperature



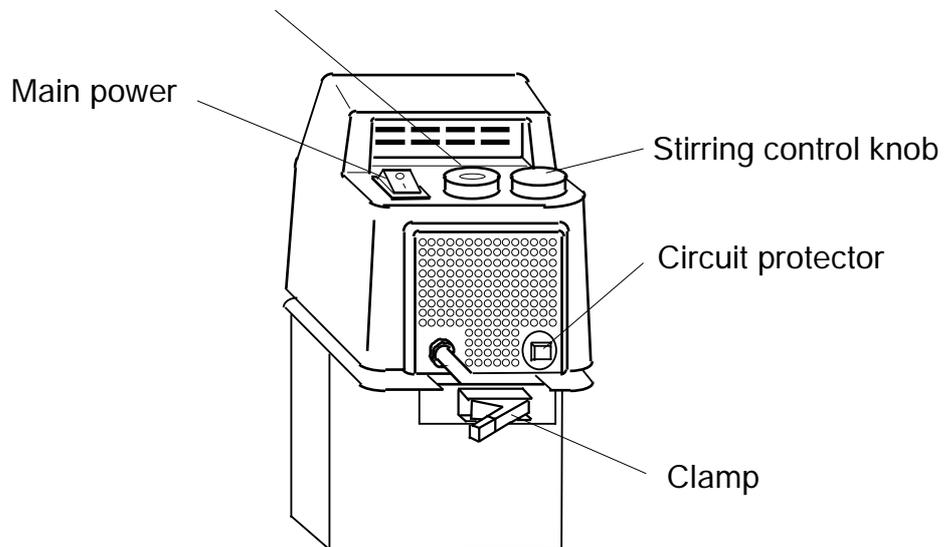
Note :

The maximum temperature and a required time to heat depends on the applicable ambient temperature, power source voltage, presence or absence of load.

2-4 Descriptions



Setting dial for overheat stopper and reset switch



2-5 Optional accessories

Refer to [5-2 Attaching optional accessories] for how to attach / to use.

Cooling coil

Applicable to circulate cooling water for controlling the bath water at the room temperature or lower.

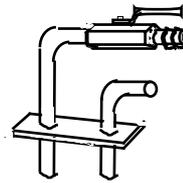
Model	Cat. No.
CC - 1	114250



External circulation nozzle (NTT-2200)

Applicable to circulate the heated bath water to the external jacket or coil.

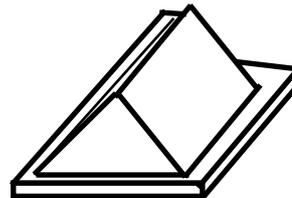
Model	Cat. No.
ON - 1	114260



Bath lid

Reduces the evaporation of bath water and the influence of the room air when the unit is used at high temperature or for a long time.

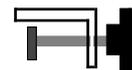
Model	Cat. No.
SBK - 1	196190



Bath clamp

Necessary when fixing this unit into an optional water bath.

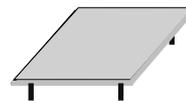
Model	Cat. No.
B - CRAMP	196180



Bath rack

Enables the bath depth change when a small container is placed in the bath.

Model	Cat. No.
TB - 1	114210

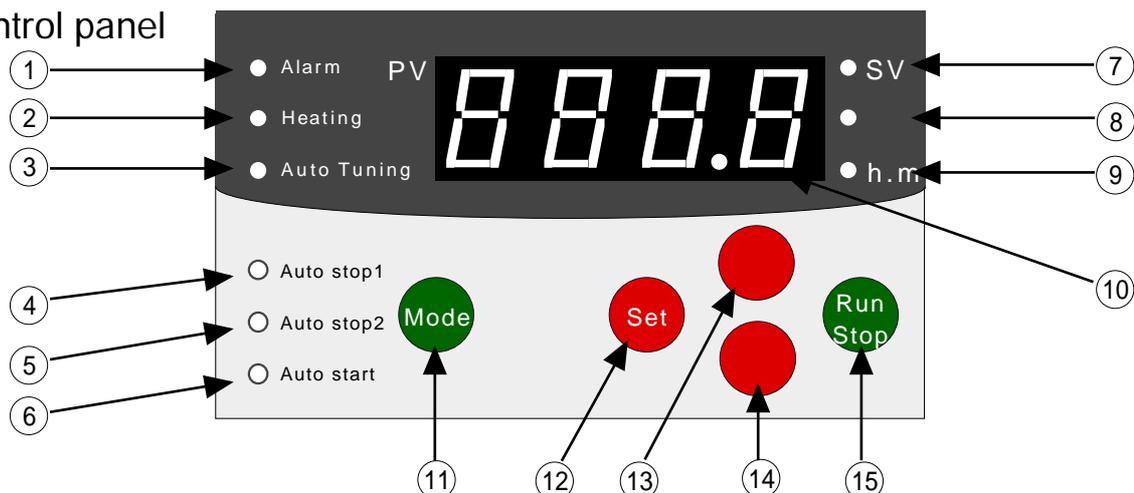


Water bath

The following optional water baths are applicable for each required water quantity except a supplied standard bath. The interior of each bath is stainless steel SUS 304- made.

Model	Cat. No.	Capacity	Valid inner dimensions in mm	Overall dimensions in mm
SB - 6	164510	5.5	260W × 150D × 150H	305W × 195D × 198H
SB - 11	114650	10	281W × 222D × 150H	330W × 270D × 190H
SB - 15	164520	16	298W × 274D × 150H	390W × 370D × 200H
SB - 24	114630	24	507W × 302D × 160H	573W × 362D × 195H

3-1 Control panel



No.	Name	Function
①	Alarm LED	Flashes when alarming.
②	Heater LED	Lights up when heater is turned on.
③	Auto tuning LED	Flashes while tuning automatically.
④	Auto stop 1 LED	Lights up when Auto stop 1 (for temp. priority) is selected. Flashes once switched to timer display during Auto stop 1 in control.
⑤	Auto stop 2 LED	Lights up when Auto stop 2 (for timer priority) is selected. Flashes once switched to timer display during Auto stop 2 in control.
⑥	Auto start LED	Lights up when Auto start is selected. Flashes once switched to timer display during Auto start in control.
⑦	Set (Preset) LED	Lights up when preset temp. / timer display mode is on.
⑧	Temperature LED	Lights up on when temp. display mode is on. Flashing while controlling (or, while not counting time).
⑨	Time LED	Lights up while displaying time. Flashing while counting time.
⑩	Display	Shows the temperature, time, set character, and alarm mode.
⑪	Mode key	Switches the timer mode by every pressing. Stationary operation Auto stop 1 Auto stop 2 Auto start
⑫	Set key	Functions to switch to measured / preset values. When alarming, with this key the displayed alarming mode / numerical characters can be cancelled.
⑬	key	Available only with displaying the preset values. Every single press of the key adds 0.1 (1 min.) in case of any preset numerical values. Then, holding down the key makes sequential addition possible. Also, every 1.0 (10 min.) addition is made possible by holding down the key for longer than 3 sec. In case of presetting with characters, the characters are switchable.
⑭	key	Available only with displaying the preset values. Every single press of the key deducts 0.1 (1 min.) in case of any preset numerical values. Then, holding down the key makes sequential deduction possible. Also, every 1.0 (10 min.) deduction is made possible by holding down the key for longer than 3 sec. In case of presetting with characters, the characters are switchable.
⑮	Run/Stop key	.Functioning for start and stop of the control operation.

3-2 Stationary operation and Timer mode control

In accordance with purposes of usage, it is operational to preset the timer mode in the unit. The preset conditions are entered with the control panel. Even in the mid of running the unit, it is still available to change the preset temperature, time, timer mode, or to quit the preset timer operation.

To preset desirable modes, please read '5-3-3. How to preset / start / stop stationary operation', and '5-3-4. How to set / start / stop timer mode'.

Stationary operation

1. Stationary operation

Once any temperature is set and the unit starts to run, that preset temp. is sustained while running the unit.

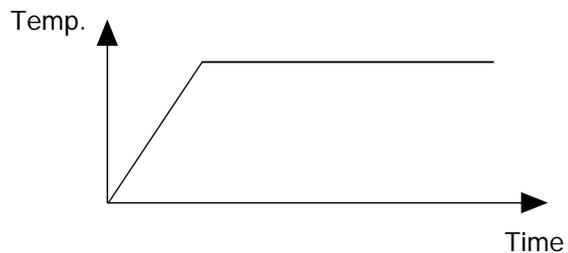
With [Run / Stop] key, the unit starts / stops.

* Preset temperature range

Room temp. + 5°C ~ 80°C

(with the supplied water bath : ~ 70°C,

with the a cooling device : -20°C ~)



* Every single press of [Mode] key changes the timer mode in the following order.

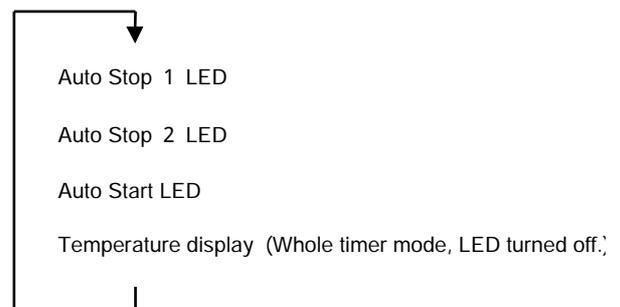
Timer mode

Through presetting the timer, the stationary operation starts / stops.

There are 3 timer modes such as Auto stop 1, Auto stop 2, and Auto start.

In addition, this timer setting method is common to others.

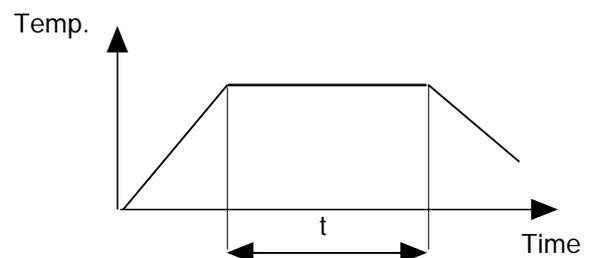
* Available timer range : 0 h 00 min. ~ 99 h 59 min.



1. Auto stop 1 mode

After setting a timer and starting the operation, once the temperature reaches the preset temperature, the stationary operation starts to run just for the preset length of time.

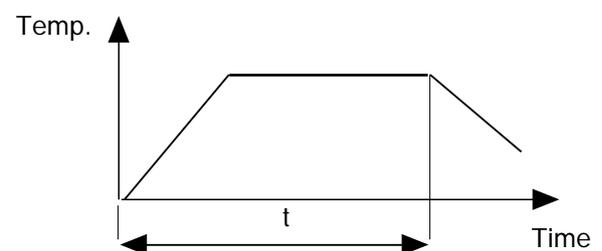
After the passage of preset time (t), the control operation stops automatically.



2. Auto stop 2 mode

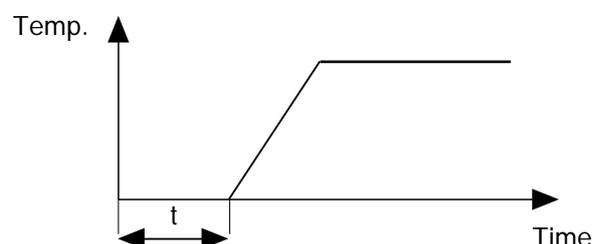
After setting a timer and starting the operation, once the temperature reaches the preset temperature, the stationary operation starts to run just for the preset length of time.

After the passage of preset time (t), the control operation stops automatically.



3. Auto start mode

Once a timer is preset and the unit starts to run, after the passage of preset time (t), the stationary operation starts automatically.



3-3 Adjustment mode

There are 5 functions such as Temperature display compensation, Upper temperature limit alarm, Lower temperature limit alarm, Auto tuning, Power failure recovery mode.

No matter whenever the operation in progress is, the adjustment mode is always resettable except any timing while displaying time. If in such a situation, click 'No key operation for 1 min.', or press [Mode] key to switch to show a measured temp. value. Then, set a desirable adjustment mode.

1. Displayed temperature compensation

Able to comply this machine-measured temp. with an appropriate one measured by a standard thermometer.

* Temperature display compensation range:
-20 ~ + 20°C
Default : 0°C

1) Press [set] key for 5 sec.

"SnS" comes up to the display, and the adjustment mode is on.

2) Every single press of [] or [] key changed the setting mode.

2. Upper temperature limit alarm

Able to change the preset value of upper limit temperature alarm.

*Preset range for upper limit temperature :
0 ~ 30°C
Default : 5 °C

3. Lower temperature limit alarm

Able to change the preset value of lower limit temperature alarm.

*Preset range for lower limit temperature :
0 ~ 30°C
Default : 5 °C

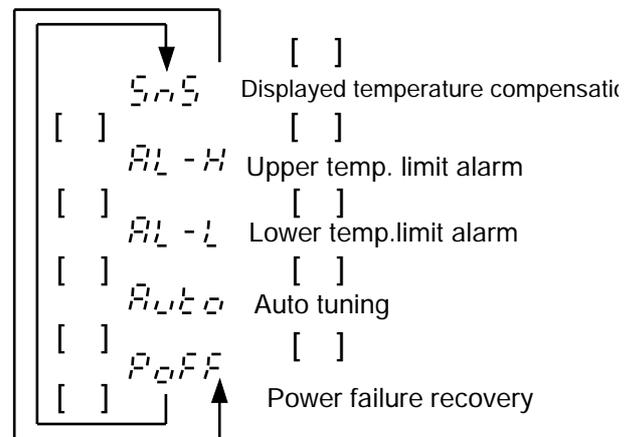
4. Auto tuning

P.I.D constant is performed for temperature control upon this unit. Although the optimum P.I.D constant is already preset at outgoing of the products from the factory, due to some conditions and unexpected load during storage in the warehouse, the preset conditions are altered somehow. Even such situations, the P.I.D constant is still available for automatic tuning in accordance with each requirement. It is also able to return to the P.I.D constant, which was once preset at the outgoing from the factory.

Auto-tuning setting range:

- oFF : Atop the auto-tuning
 - on : Start the auto-tuning
 - cLr : Change the PID constants to the pre-shipment value
- Initial setting : off

The adjustment modes change in the following order



Refer to [5-4. Operation in adjustment mode] to know more details on how to set each mode.

5. Power failure recovery

Able to select any operation mode after recovery from power failure.

* Selectable preset conditions as follows.

- cont : The same control mode returns after recovery.
 - oFF : The control mode stops after recovery.
 - on : Although the same control mode returns, the timer restarts if the preset temp. falls 5 or more.
- Default : cont

3-4 Safety features and alarm functions

This unit provides the following safety features and alarm functions.
 In the event of any trouble occurrence, please refer to [6. Trouble shooting] for due appropriate solutions.

Safety features

Safety device	Task	Cause of trouble
Circuit breaker	The button pops up to shut down the power. * No alarm output.	Short circuit, or surge current.
stand-alone overheat stopper	When the in-bath temp. raises and exceeds the temp. preset in the overheat stopper, the power automatically shuts down. *No alarm output.	<ul style="list-style-type: none"> Low preset temperature in the overheat stopper. Exceedingly overheat in the bath beyond the temp. preset in the overheat stopper due to malfunction on the temp. controller or SSR.

Alarm functions

Name of alarm	Alarm display & task	Causes
Upper temperature limit alarm	<ul style="list-style-type: none"> Beeps for 15 sec. Control in progress. Presence of alarm output. Alarm display.  <p>Switching display mode</p> 	<p>Operational condition</p> <p>The in-bath temperature exceeds [the preset temp. + the upper limit temp. preset value] temporarily, this function senses it.</p> <p>Cancellation of alarm</p> <ul style="list-style-type: none"> This function is canceled automatically when any measured temp. is lower than [the preset temp. + the upper limit temp. alarm preset value]. The alarm is also canceled with [SET] key. <p>* The upper limit value can be changed. (Refer to 5-4-2. Upper limit temperature alarm.)</p>
Lower temperature limit alarm	<ul style="list-style-type: none"> Beeps for 15 sec. Control in progress. Presence of alarm output. Alarm display.  <p>Switching display mode</p> 	<p>Operational condition</p> <p>When the in-bath temp. falls below [the preset temp. + the lower limit alarm preset value] temporarily, this functions senses it.</p> <p>Release of alarm</p> <ul style="list-style-type: none"> The alarm is released automatically when the measured temperature is less than [the set temperature + the lower limit value]. The alarm is also canceled by [SET] key. <p>* The lower limit value is resettable. (Refer to 5-4-3. Lower limit temperature alarm.)</p>
Level alarm	<ul style="list-style-type: none"> Control in suspension. Beeps after 5 min. Presence of alarm output. Alarm display. 	<p>The operation starts as the water level lowers. Or, the water level lowers while operating.</p> <p>Cancellation of alarm</p> <p>Turn off the mains switch and refill the liquid. Then, turn on the mains switch again. (When the liquid level recovers, the alarm function automatically recovers.)</p>

Name of alarm	Alarm display & task	Cause of alarming
Power failure alarm	<ul style="list-style-type: none"> • According to its preset recovery conditions, control mode, keeps working. • Alarm display after recovery. • Display of in-progress control  <p style="text-align: center;">Switching display mode</p>  <ul style="list-style-type: none"> • Display mode when control stops.  <p style="text-align: center;">Switching display mode</p> 	<p>Operational conditions In the case of power failure while controlling, or of power cut-off without stopping the control function, this function senses it.</p> <p>Cancellation of alarm With [Set] key, the alarm can be cancelled.</p> <p>* Operation mode after recovery from power failure is resettable. Please refer to '5-4-5. How to preset power failure recovery mode'.</p>
Uncontrollable temperature alarm	<ul style="list-style-type: none"> • Control mode stops. • Buzzering for 15 sec. • Presence of alarm output. • Alarm display. 	<p>Operational conditions</p> <ul style="list-style-type: none"> • Even though the displayed temp. goes beyond the preset temp., if that temp. keeps raising for longer than 10 min., and SSR for the heater goes to short circuit mode, this function senses it. • Even though the displayed temp. lowers than the preset temp., if the temp. does not raise (or, because of the heater's breaking) for longer than 10 min., this function senses it. • Even under cooling mode, if cool down mode does not function for longer than 10 min., this function senses it. <p>Cancellation of alarm</p> <ul style="list-style-type: none"> • With [Set] key, the alarm can be cancelled. • The control mode restarts once the alarm is cancelled.
Sensor alarm	<ul style="list-style-type: none"> • Control mode stops. • Buzzering for 15 sec. • Alarm output / display. 	<p>Operational condition Disconnected in-bath temp. sensor.</p> <p>Cancellation of alarm Turn off the power and replace the sensor.</p>
Watchdog	<ul style="list-style-type: none"> • Micro-computer goes to be reset to restart its control mode. If the micro-computer does not return to normal, the control mode stops. • No alarm output. / Uncertain display mode on a PC 	<p>Operational conditions Temp. controller somehow turns irregular mode due to noise or so. Ambient temp. goes beyond 35 .</p> <p>Cancellation of alarm Change applicable environment / circumstance and power source.</p>

4 Installation

4-1 Place to install



Warning

Do not install at a potentially dangerous circumstance.

This is a heater-mounted unit.
If installed in a place surrounded by risky factors, it may cause fire.



Caution

Be aware of circumstances to be installed.

If applicable circumstances seem poorly contioned, it may cause to accelerate deterioration of the machine, or to interrupt demonstration of the machine's full performance.

For installation of the applicable machine, please choose a place having the following conditions.

No inflammable / burnable solids, liquids, and gas around the intended location.

No direct sunlight.

Ambient temp. between 5 and 35 .

Full ventilation.

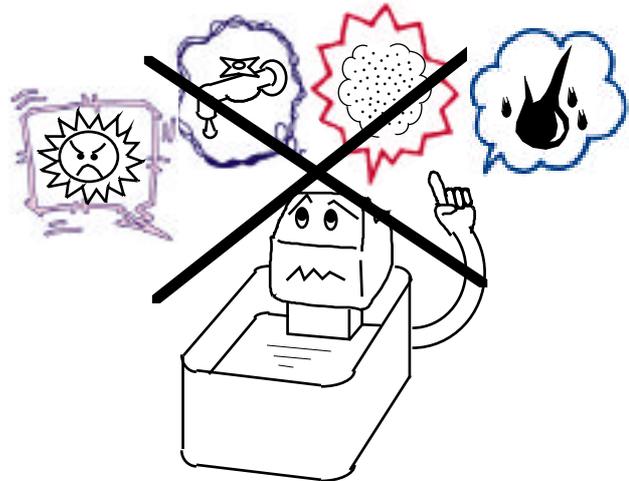
No condensation.

None or less humidity, no water drops.

None or less dust.

Stably horizontal and firm place.

(Please check the machine's weight when in operation.)



4-2 Requirements for installation



Caution

Do not move the unit while operating.

In case some liquid spatters from the bath, you may get burned. Therefore, please do not move the machine during or for a while after the operation.

* When intending to move the machine, please make sure to unplug the power with no water in the bath.

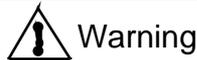
4-3 Connecting to utility



Warning

Please make sure to check the voltage, phase, and capacity for proper connection.

Wrong connection may cause fire or electrical shock.



Warning

Do not use a branching socket or power strip.

Excess current and etc. may burn cable or cause fire.

(1) Check the voltage, phase, current capacity of this unit.
For connectivity, it is shown in the right table.

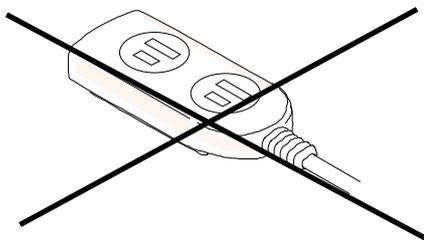
(2) Check what type of AC plug outlet is suitable.
(Do not plug in yet.)

With an earth-equipped connector, a normal mains connector is directly applicable.

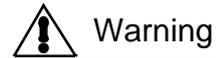
If no earth-equipped, please equip an earth to a mains connector.

Please connect the mains connector's earth lead to an earth.

If no earth, please contact any electrician near you to ask for organizing an earth.



For connecting to a power outlet, do not use a branching socket or power strip.



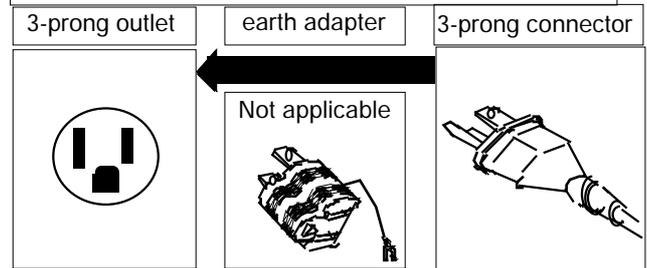
Warning

Connect earth properly.

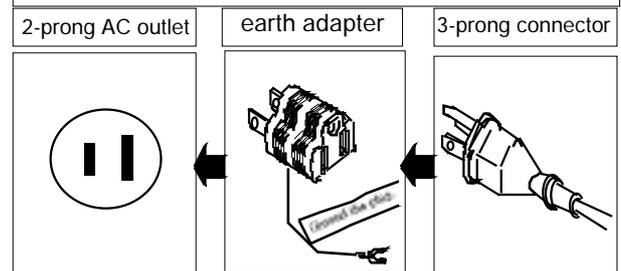
For prevention against electrical shock, do not earth the cable to a gas pipe or to a water pipe.

Model	Power source	
	Voltage	Capacity
NTT-2100 NTT-2200	AC-100V	15A

With an earth-equipped plug (100V)



With a plug with no earth (100V)



5-1 Preparation



Caution

Do not use any other optional resin bath except the supplied standard water bath.

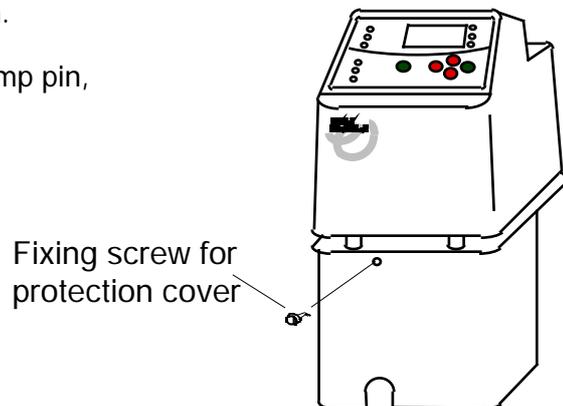
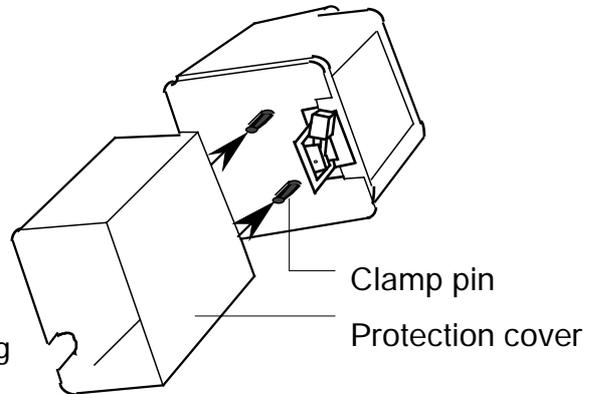
Applied heat may cause to deform other types of resin bath, or it may be ignition.

1. Attaching protection cover

Make sure to attach the protection cover before mounting the unit to the supplied resin-made water bath.

The protection cover can protect the resin bath from heat / radiant heat when any hot portion touches the bath.

Insert the protection cover's fixing spring to the clamp pin, and fix the protection cover with a fixing screw.

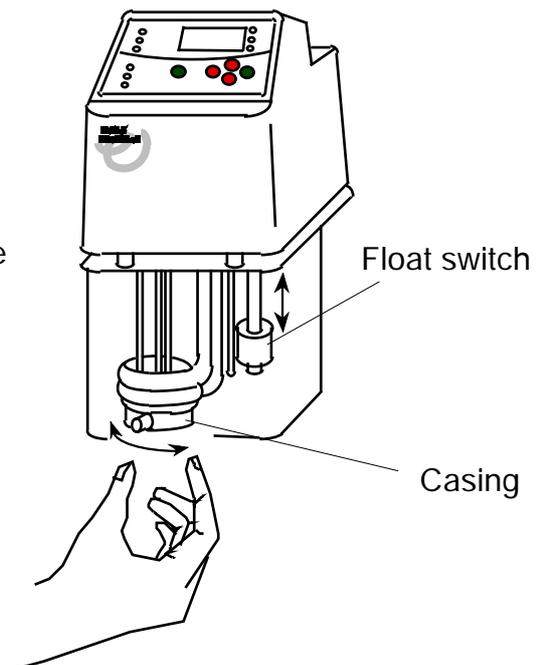


2. Adjusting the outlet direction (NTT-2200)

Turn the casing to adjust the outlet direction of jet stream.

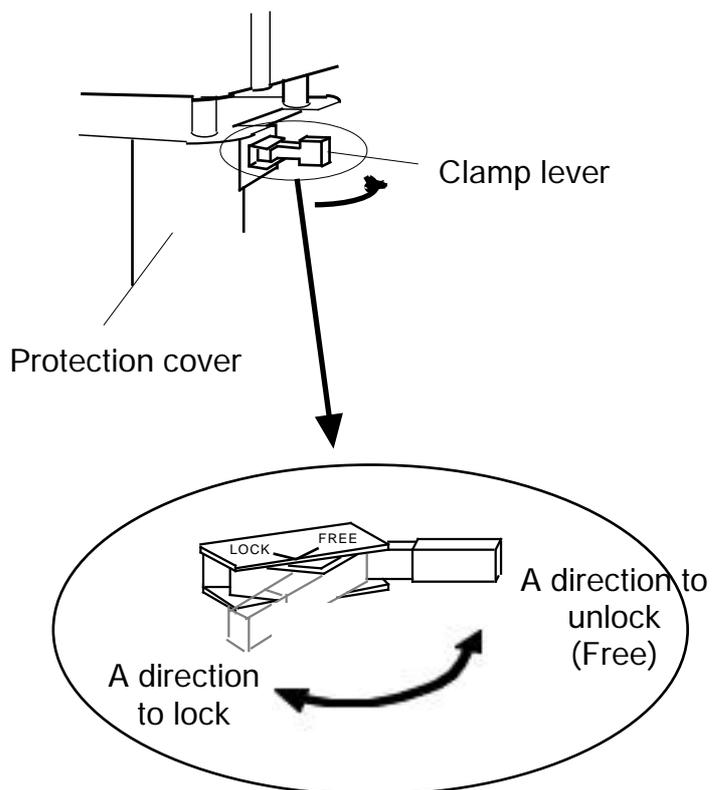
If the direction of jet flow is blocked off by something, change the outlet direction to make the stirring performance better.

Also, make sure that the float switch goes up and down smoothly.

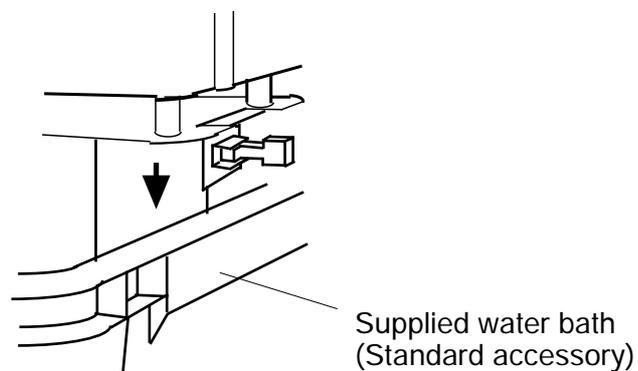


3. Fixing the main unit

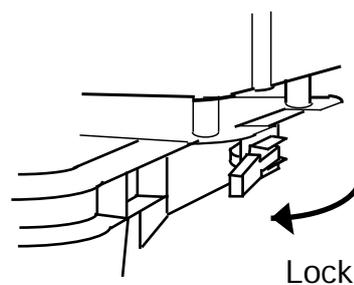
- (1) Turn the clamp lever to the FREE position.



- (2) Mount the unit with the protection cover and the clamp as if sandwiching the water bath surroundings.



- (3) Turn the clamp lever to the LOCK position to fix the unit to the bath.



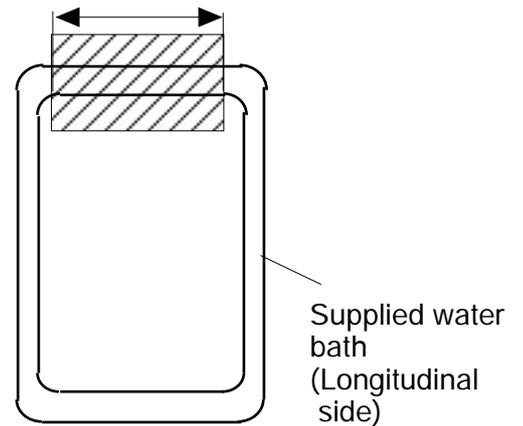
* This clamp is dedicated for the supplied standard bath.

Please make sure to attach it to the specified position as shown in the right drawing.

If intending to fix any other optional water bath, or if intending to attach the main unit to another position within the specified range, use an optional clamp.

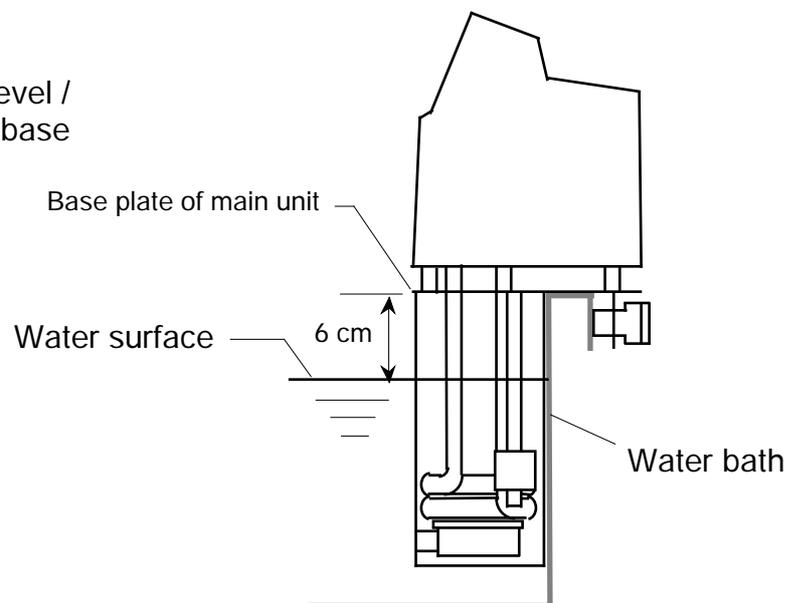
Bath clamp for NTT [B-CLAMP]
Cat. No. 196180

Applicable range to fix
the main unit



4. Applying water

Fill water in the bath until the water level / surface reaches 6cm lower from the base plate of main unit.



5. Connecting to a mains plug

Make sure that the main power switch is turned off.
Then, plug in to an AC outlet.

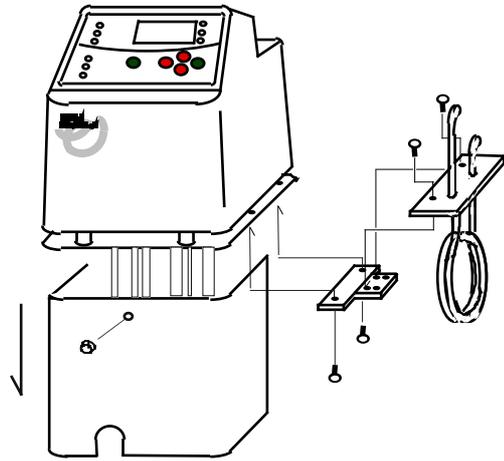
5-2 Attaching optional accessories

Cooling coil

When controlling temperature at room temperature or lower, attach an optional cooling coil to the main unit to circulate the cooling water.

Model	Cat. No.
CC - 1	114250

Detach the protection cover, and fix the coil with the supplied screws as shown in the right figure. After fixing the coil, attach the protection cover again.

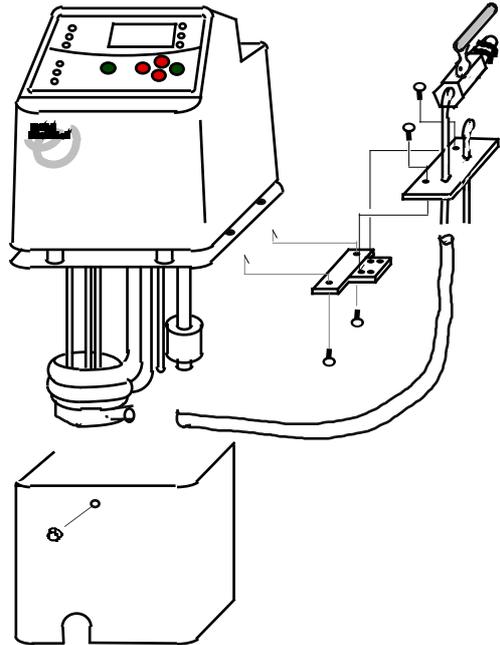


External circulation nozzle

In case of externally circulating the in-bath water to the jacket or to the coil, attach an optional external circulation nozzle to the main unit.

Model	Cat. No.
ON - 1	114260

Remove the protection cover, and fix the nozzle with the supplied screws as shown in the right figure. Connect a silicon tubing to the nozzle part of casing cover. After fixing the nozzle, mount the protection cover again.

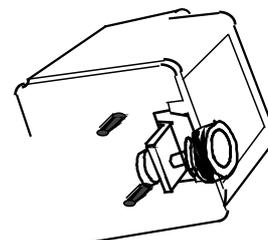
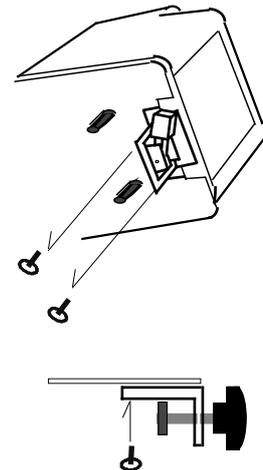


Bath clamp

In case of using any other optional bath, use the bath clamp.

Model	Cat. No.
B - CRAMP	196180

Remove the protection cover, and loosen the fixing screw for clamp lever to replace the standard clamp with this optional bath clamp. After fixing the bath clamp, attach the protection cover again.



5-3 Operation

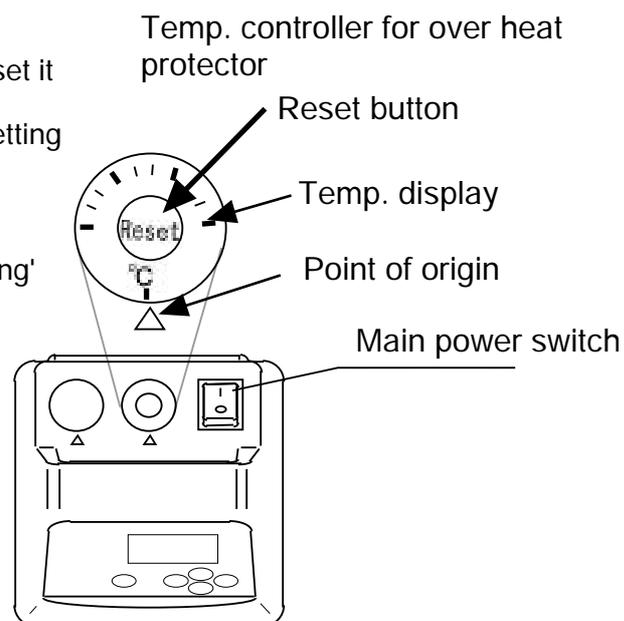
 Caution
<p>Do not touch the unit during operation or for a while after operation.</p> <p>If the preset temp. is high, during or right after running the unit, the bath is very hot. You may get burned if you should touch it directly.</p>

 Caution
<p>Stop using the product if you find any malfunctions.</p> <p>If any irregularity takes place, turn off the circuit breaker, and refer to '6. Troubleshooting'.</p>

5-3-1. Setting the overheat protector

For setting the overheat protector, please turn knob and set it at the origin's position.
Normally, set any temperature 10 higher than that of setting with a control panel.

* For the procedure to reset the overheat protector after starting operation, please refer to '6. Troubleshooting' for any cause of applicable trouble case, and the press the reset switch.

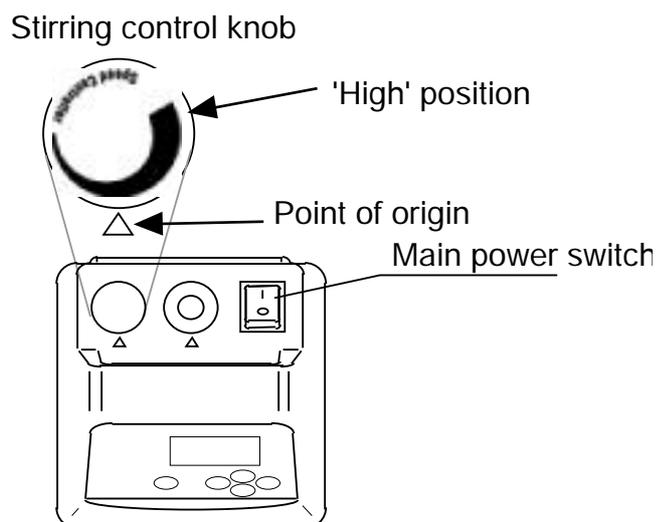


5-3-2. Controlling the stirring speed

 Caution
<p>When using some oil, set the stirring speed high.</p> <p>If you set the low stirring speed even though the viscosity of oil is high, expected performance may not be acquired. And sometimes the additional safety features may function.</p>

Control the stirring speed knob to your desirable mode.

* Turn the stirring control knob to control its speed / strength.



3. How to set / start / stop stationary operation

Turn on the main power.

The initial display mode [cP**] appears for 5 sec. and then a measured temperature value comes up to the display.

Note) Two asterisks, **, represent numerical characters.

(1) Setting temperature

Regardless of in-control or in-suspension mode, to set / reset temperature is available.

The preset temperature is common to whole timer mode together with the stationary operation.

1) Press [set] key.

The display mode changes to blinking preset temperature mode.

To set / preset temperature is available.

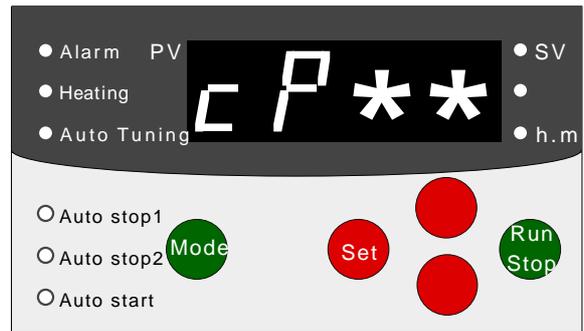
* The display shows the previous set temperature before changing.

The initial value before shipment is set to 0.0°C.

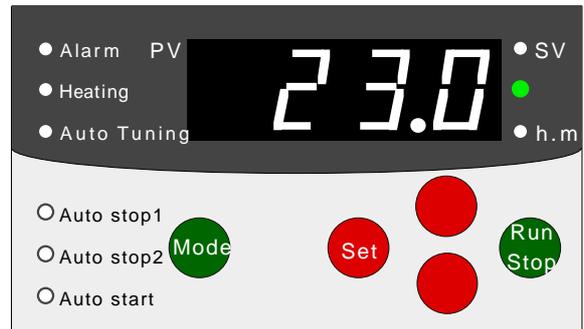
2) Press or key to enter a desirable temperature value.

* Every single press of  or  key changes the value by 0.1 .

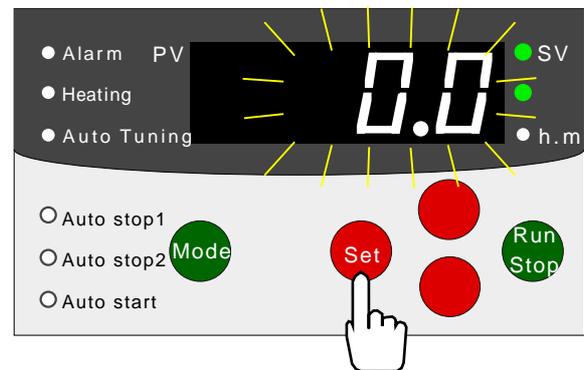
Holding down the key makes sequential numerical changes in order, and holding down the key for longer than 3 sec. makes changes by every 1.0 .



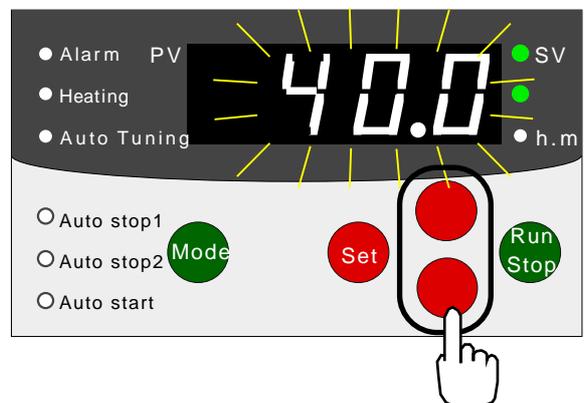
(1) Initial display mode appearing for 5 sec., and a measured temperature coming up to the display.



1) Setting temperature



2) Resetting / changing temperature

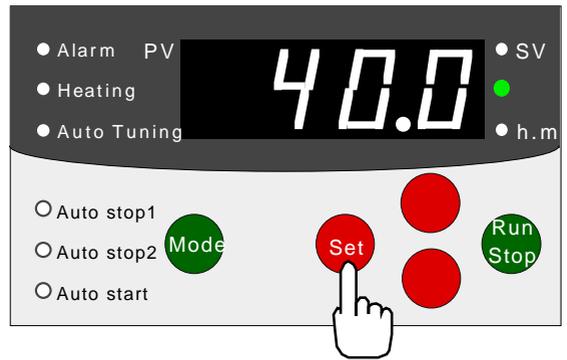


- 3) Press [set] key.
 The blinking preset temperature value is defined.
 The display mode changes to a measured temp. value.

Preset LED (SV) is turned off.

* If the unit is left for longer than 1 min. with no key operation while setting temperature, the indication changes to a measured temp. value.
 In this case, repeat the setting procedures from 1).

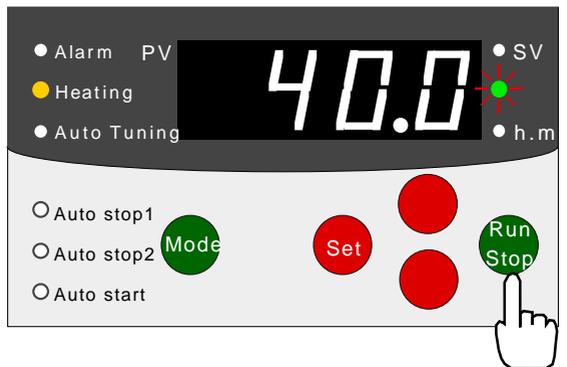
3) Entering a preset temperature value



2) Starting stationary operation

Press [Run/Stop] key to start stationary operation.
 Temperature LED (°C) starts to blink.
 Heater LED (Heating) illuminates while the heater is on.

(2) Starting stationary operation



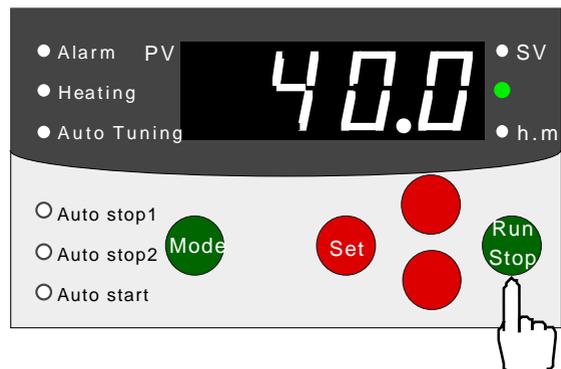
(3) Stopping stationary operation

Press [Run/Stop] key to stop stationary operation.
 - Blinking mode of LED of Temperature (°C) changes to the illumination mode.
 - 'Heater LED (Heating)' becomes turned off.
 - 'Freezer LED (Cooling)' becomes turned off.

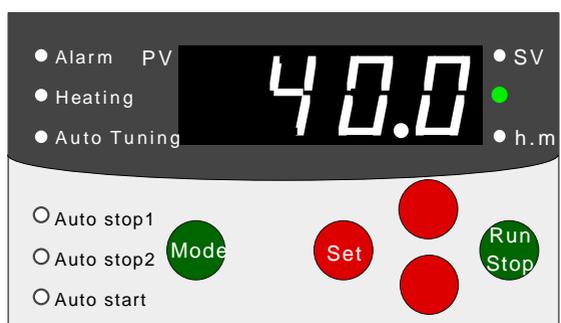
* When intending to finish the operation, please make sure to stop it and then turn OFF the main power.
 If the main power is turned OFF without stopping the operation mode, in the next time it turns the power failure recovery mode.

* In case of no usage of the unit for a long period of time, please make sure to turn OFF the main power, and unplug.

(3) Stopping stationary operation



In pause of stationary operation



4. How to set / start / stop timer mode

* Please make sure to set temperature for stationary operation first, and then set timer mode and timer.

1) Setting timer mode and timer

The preset time for timer is common to whole timer operation. Regardless of in-control or in-suspension mode, the preset time is resettable with any timer mode.

(1) Press [Mode] key.

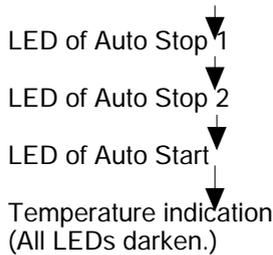
The display mode changes to show a measured length of time, and it is available to select any timer mode.

- a) In case of stationary operation under control / suspension mode, 'Auto Stop 1 LED' starts to illuminate.
- b) In case of timer mode under control, 'operating mode LED' starts to illuminate.
 - Time LED (h.m) starts to illuminate.
 - Temperature LED (°C) becomes turned off.

(2) Every single press of [Mode] key changes timer mode.

Then, please select a desirable mode.

* Timer mode changes in the following order.



3) Press [set] key.

The display mode changes to the blinking preset time, and it is available to set the time.

- 'Preset LED (SV)' starts to illuminate.

* The previously set time is indicated.

The initial value before shipment is 0 hour 00 minute. [000]

4) Press or key to enter a desirable preset time.

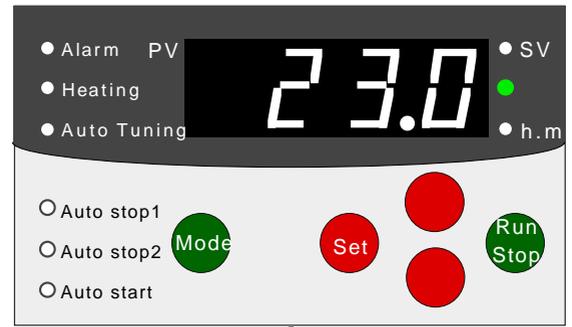
* Every single press of or key changes the value by 1 min.

Holding down the key makes sequential numerical changes, and holding down the key for longer than 3 sec. makes changes by every 10 min.

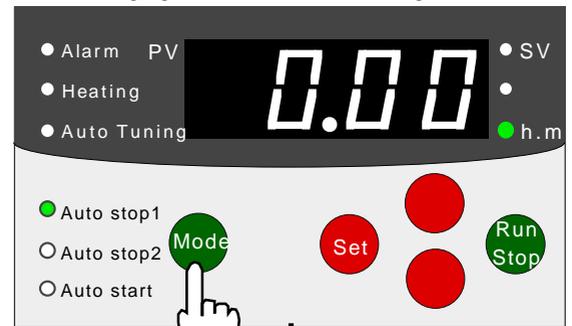
5) Press [set] key.

- a) In case of under control, the blinking preset time is defined. Then, the selected timer mode starts to be controlled.
- b) If the unit is in suspension mode, the indicated preset time in blinking is defined.
 - The display mode changes to show a measured time.
 - Set LED (SV) becomes turned off.

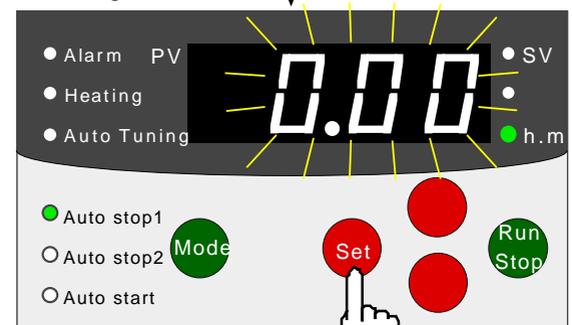
* If the unit is left for longer than 1 min. with no key operation while setting time, the display mode changes to a measured temperature value. In this case, repeat the setting procedures from 1).



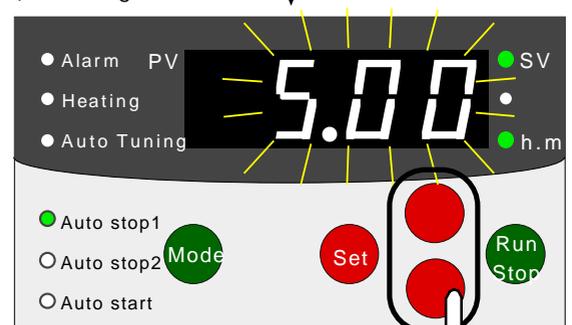
1), 2) Changing to timer mode, selecting a mode.



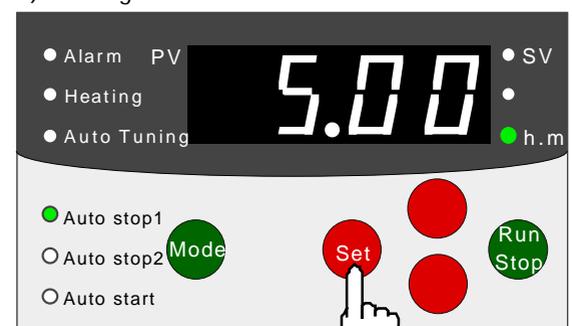
3) Setting time



4) Resetting time



5) Entering the reset time



Refer to P.21 for start or stop of Auto Stop 1 & 2.

Refer to P.22 for start or stop of Auto Start.

* Unnecessary to press the key if already in the operation mode

(2) Starting Auto Stop operation 1 & 2.

- a) In case of stationary operation under control mode, once [Set] key is pressed, its operation starts.
- b) In case of stationary operation in suspension mode, press [Run/Stop] key while selecting Auto Stop 1 & 2. The Auto stop 1 & 2 operation starts.

- * 1. Indication mode before commencing timer count. (only with Auto Stop 1)
 - A measured temperature value is indicated.
 - Temperature LED (°C) starts to blink.
 - Heating LED is turned on while the heater is on.
- * 2. Indication mode after starting timer count.
 - A measured temperature value still remains on the display.
 - Time LED (h.m) starts to blink.
 - Temperature LED (°C) becomes turned on.
 - Heating LED is turned on while the heater is turned on.

* If the operation does not start within 1 minute even after selecting Auto stop 1 & 2 and pressing [Mode], the display mode changes to the stationary operation mode. In this case, reselect Auto stop 1 & 2 again with [Mode] key.

(3) Auto Stop Timer

- a) To check the rest of time length with the timer count, press [Mode] key to switch the display mode to the measured time length mode.
 - [Auto Stop LED 1 & 2] starts to blink.
 - [Temperature LED (°C)] is turned off.
- * If the unit is left for longer than 1 min. with no key operation, the display mode returns to show a measured temperature value.
- b) The applicable time count method on the display is backward count.
- c) Holding down [Mode] key for longer than 5 sec. during the timer count enables the timer count mode stop even in the mid of operation.
 - In case of Auto stop 1 & 2 mode, only the stationary operation is applicable.

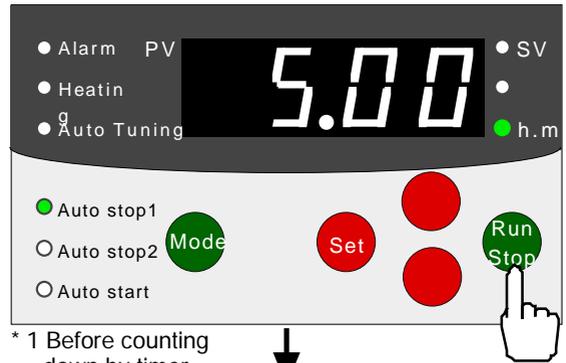
(4) Stopping Auto Stop operation 1 & 2.

- The Auto Stop 1 & 2 operation automatically stops as soon as the time count function completes. After stopping the operation, the stationary operation mode comes up to the display.
- [Auto stop 1 & 2 LED] is turned off.
 - [Time LED (h.m)] is turned off.
 - [Temperature LED (°C)] starts to illuminate.
- * If stopping the operation before the time count completes, press [Run/Stop] key.

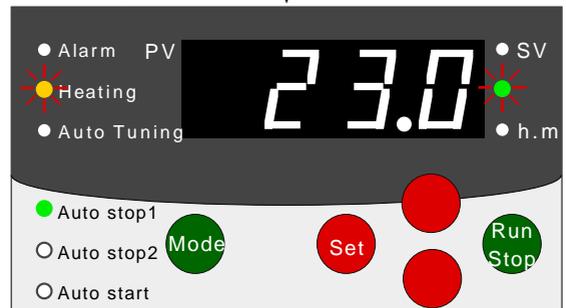
* When finishing the operation of the unit, make sure to stop the operation mode first, and then turn off the main power. Otherwise, in the next operation, the power failure alarm starts to work.

* If intending no operation on the unit for a long period of time, turn off the main power switch and unplug.

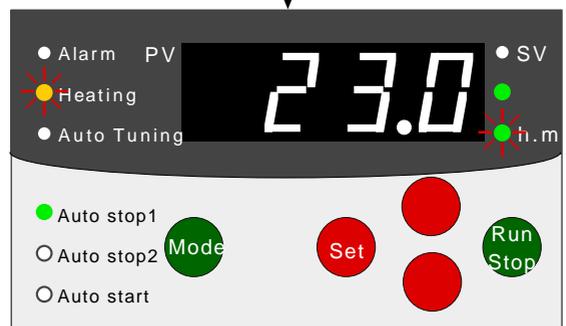
(2) Starting Auto Stop 1 & 2.



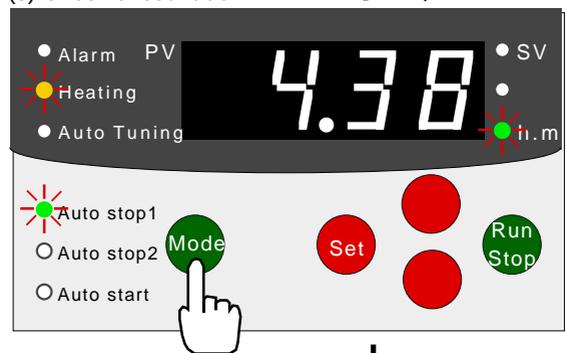
* 1 Before counting down by timer



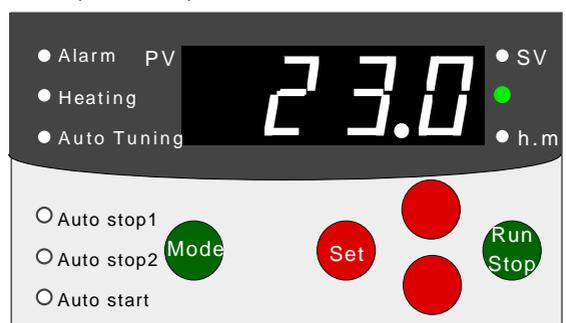
* 2 Start counting down



(3) Check of count down * Without key operation for 1 min.



(4) Stop Auto Stop 1 & 2.



* Unnecessary to press the key if already in the operation mode

(5) Starting Auto Start operation

- a) In case of stationary operation under control mode, when [Set] key is pressed, the stationary operation stops and its automatic start operation begins.
- b) In case of stationary operation under suspension mode, press [Run/Stop] key while selecting Auto Start. The Auto Start operation begins.

- * Indication mode after starting timer count.
- A measured temperature value still remains on the display.
 - Time LED (h.m) starts to blink.
 - Temperature LED (°C) starts to illuminate.
 - Heating LED is turned on while the heater is on.

* If the operation does not start within 1 min. even after selecting Auto start, the display mode returns to show the stationary operation mode. In this case, reselect the auto start with [Mode] key.

(6) Auto Start Timer

- a) To check the rest of time length with the timer count, press [Mode] key to switch the display mode to the measured time length mode.
 - [Auto Start LED] starts to blink.
 - [Temperature LED (°C)] is turned off.
- * If you leave the unit for longer than 1 min. with no key operation, the display mode returns to show a measured temperature value.
- b) The applicable time count method on the display is backward count.
- c) Holding down [Mode] key for longer than 5 sec. during the timer count enables the timer count mode stop even in the mid of operation.
 - In case of Auto Start, the control operation stops.

(7) Stopping Auto Start operation.

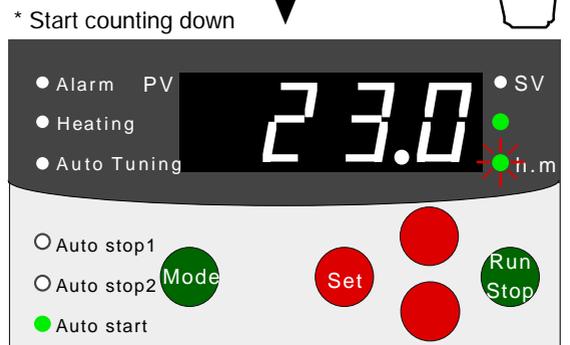
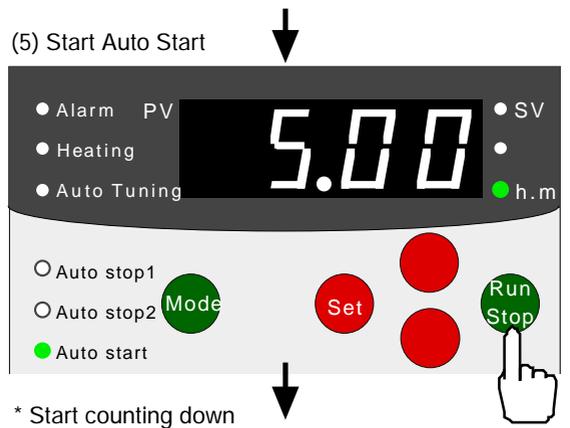
- For auto start, as soon as the time count function completes, the stationary operation control mode automatically starts to work.
- [Auto Start LED] is turned off.
 - [Time LED (h.m)] is turned off.
 - [Temperature LED (°C)] starts to illuminate.

* If stopping the operation prior to completion of timer count, press [Run/Stop] key.

- [Temperature LED (°C)] is turned on.

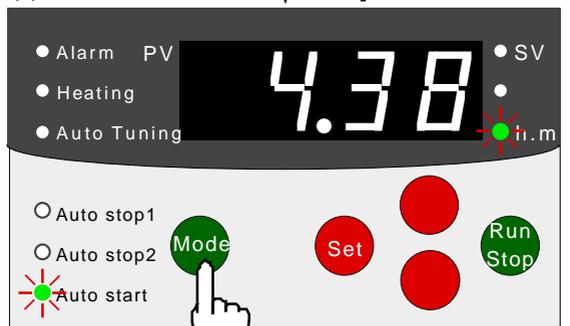
* When finishing the operation, make sure to stop the stationary operation first, and then turn off the main power. Otherwise, in the next operation, the power failure alarm starts to work.

* If intending no operation on the unit for a long period of time, turn off the main power and unplug.

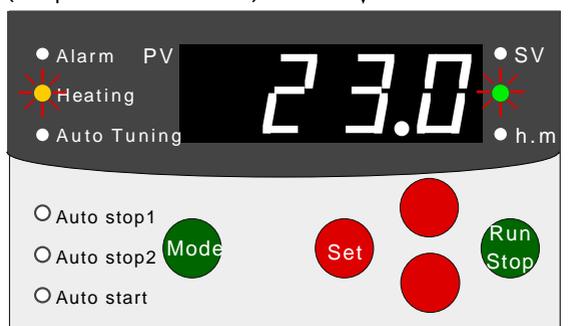


(6) Check of count down

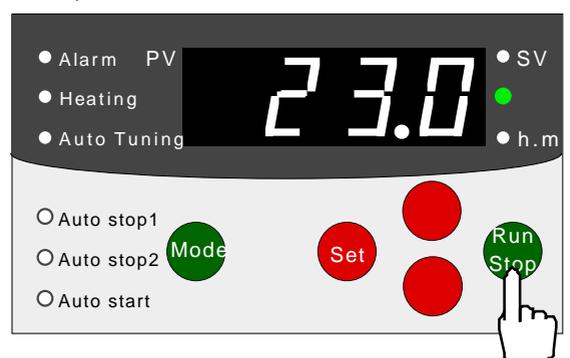
* With no key operation for 1 min.



The time count is finished. (Set point control starts.)



(7) Stop Auto start control



5-4 Operation for adjustment mode

1. How to operate displayed temp.compensation

If the displayed measured temperature is different from the value measured by a standard thermometer, you can compensate the unit's displayed temperature value.

* Do not use this function out of specified temperature range. If you set incorrectly, it may cause malfunction.

Setting compensation value of temperature

- 1) Press [set] key for longer than 5 sec.
The indication changes to adjustment mode, and shows [5 n 5], which means that the temperature compensation mode is active.

- [Temperature LED (°C)] is turned off.

- 2) Press [set] key.
The display shows the blinking temp. compensation value.

- * The blinking temperature value is a previously set temperature.
The pre-shipment value is 0°C.

- 3) Press or key to enter a desirable temperature compensation value.

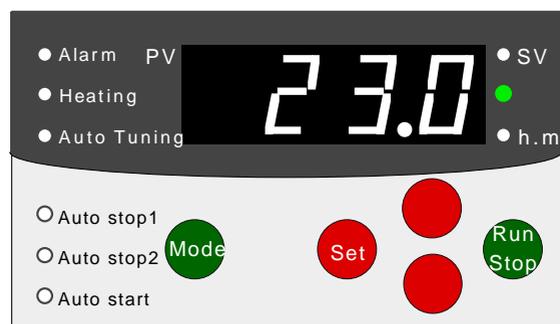
- * Every single press of or key changes the value by 1°C.
Holding down the key makes sequential numerical changes.
Holding down the key for longer than 3 sec. makes changes by every 1.0°C.

- 4) Press [set] key.
The blinking indication on the display is defined.
The display shows [AL - H] and changes to the upper limit temperature alarm mode.
The changed temp. value can not be valid unless [set] key is pressed.

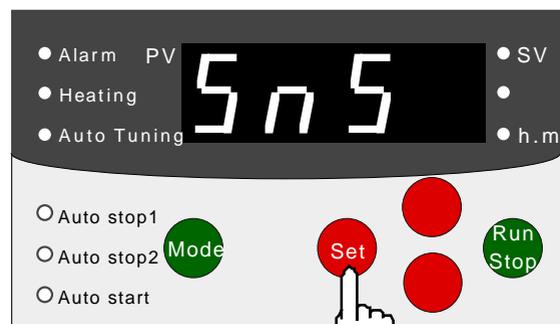
- * Press or key to select other adjustment mode.

- * Press [set] key for longer than 5 sec. if you do not change to any other values in adjustment mode.
The [measured temperature] is indicated on the display.

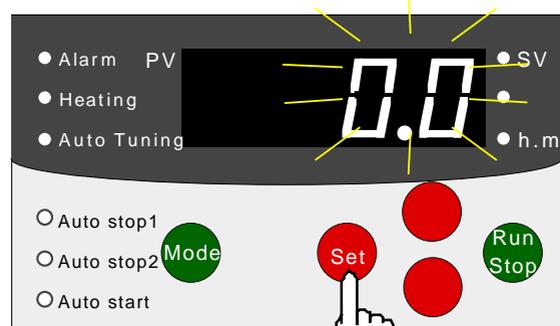
- * If you leave the unit for longer than 1 min. with no key operation while setting temperature, the indication changes to the measured temperature value.
In this case, repeat the setting procedures from 1).



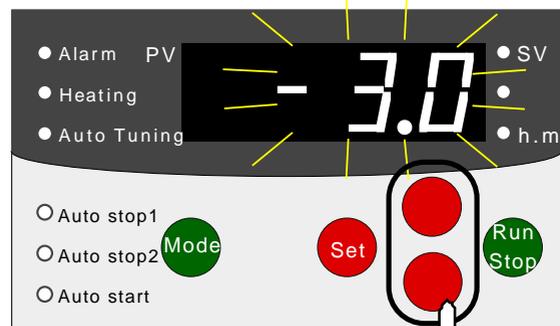
- 1) Changing to setting mode.



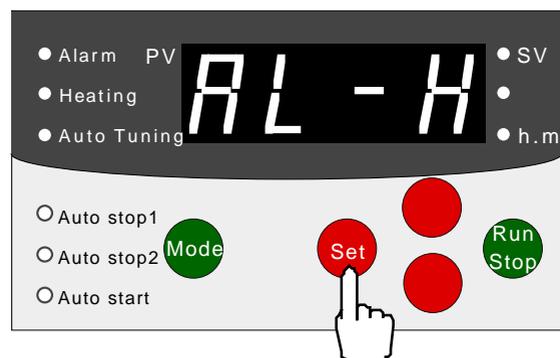
- 2) Setting temperature compensation mode. Press for longer than 5 sec



- 3) Setting a desirable compensation value.



- 4) Entering the compensation value. Changing to upper limit temp. mode.



2. How to operate upper temperature limit alarm

Through this, the sensing temperature mode of upper temperature limit alarm becomes resettable.

* If you set the value below 5°C, the alarm turns to readily work. Do not set the temperature value below 5°C.

Setting upper limit temperature alarm

1) Press [set] key for longer than 5 sec.
The display mode changes to adjustment mode, and show [5 n 5], telling that the displayed temperature compensation mode is active.
[Temperature LED (°C)] is turned off.

2) Press  key to change the display mode to upper temperature limit alarm as [AL - H].

3) Press [set] key.
The display shows the blinking preset temperature for upper temperature limit alarm.
* The blinking temperature value is a previously set-up temp. value.
The pre-shipment value is 5°C.

4) Press  or  key to enter a desirable temperature value.

* Every single press of  or  key changes the value by 0.1°C.
Holding down the key makes sequential numerical changes, and holding down the key for longer than 3 sec. makes changes by every 1.0°C.

5) Press [set] key.
The blinking indication on the display is defined.
The display shows [AL - L] and then changes to the lower temperature limit alarm mode.

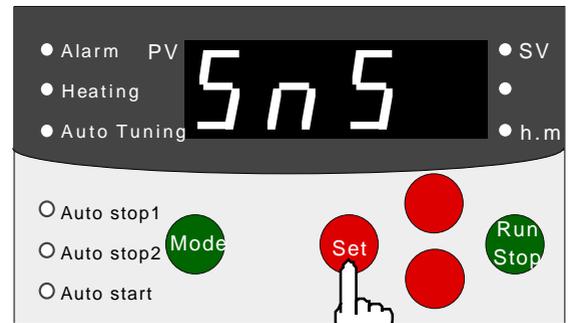
*The changed temp. value can not be valid unless [set] key is pressed.

* Press  or  key to select a desirable mode when you change any other values in adjustment mode.

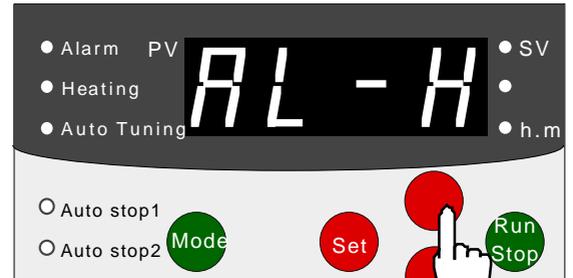
* Press [set] key for longer than 5 sec. if you do not change any values in adjustment modes.
The [measured temperature] is indicated on the display.

* If you leave the unit for longer than 1 min. with no key operation while setting temperature, the indication changes to the measured temperature value.
In this case, repeat the setting procedures from 1).

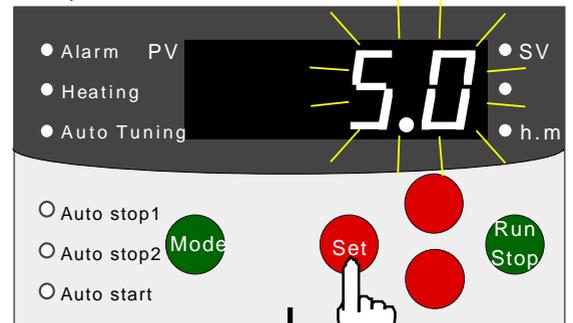
1) Hold down [set] key for longer than 5 sec. to change to adjustment mode.



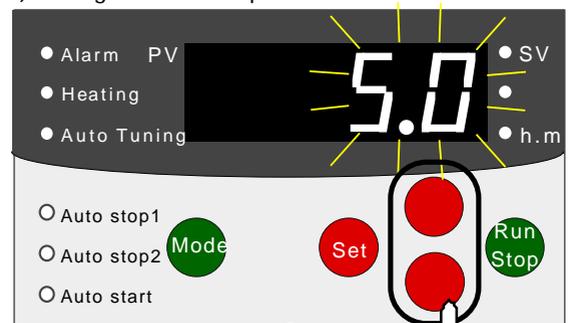
2) Changing to upper temperature limit alarm mode.



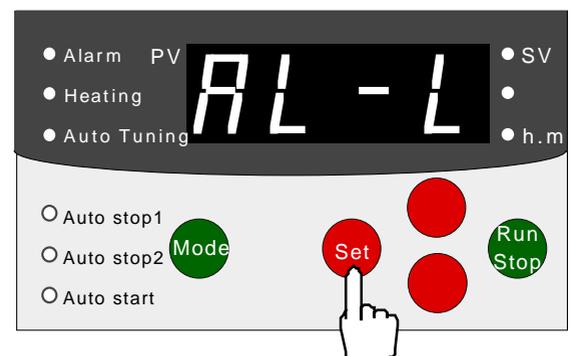
3) Setting upper temperature limit alarm mode.



4) Setting an alarm temperature value.



5) Entering alarm temperature. Changing to lower limit temperature alarm mode.



3. How to operate lower temperature limit alarm

Through this, the sensing temperature mode of lower limit temperature alarm becomes resettable.

* If you set the value below 5°C, the upper temp. limit alarm turns to readily work. Do not set value below 5°C.

Setting lower temperature limit alarm

1) Press [set] key for longer than 5 sec.
The display mode changes to adjustment mode, and show [5n5], which means that the displayed temperature compensation mode is active. [Temperature LED (°C)] is turned off.

2) Press  key twice to change the display mode to lower temperature limit alarm as [AL-L].

3) Press [set] key.
The display shows the blinking preset temperature for lower temperature limit alarm.
* The blinking temperature value is a previously set -up temperature value.
The pre-shipment value is 5°C.

4) Press  or  key to select a desirable temperature alarm value.
* Every single press of  or  key changes the value by 0.1°C.
Holding down the key makes sequential numerical changes, and holding down the key for longer than 3 sec. makes changes by every 1.0°C.

5) Press [set] key.
The blinking value on the display is defined.
The display shows [Auto], and changes to auto tuning mode.

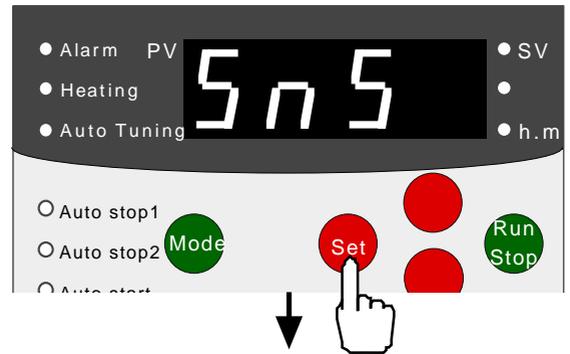
* The changed temp. value can not be valid unless [set] key is pressed.

* Press  or  key to select a desirable mode when you change any other values in adjustment mode.

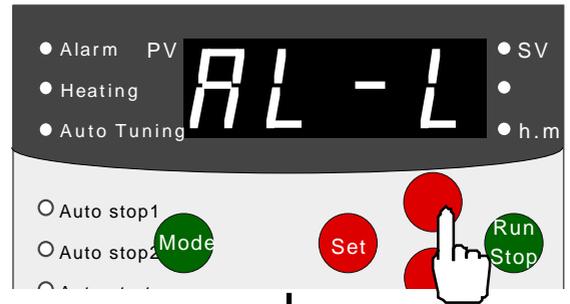
* Press [set] key for longer than 5 sec. if you do not change any values in other adjustment mode.
The [measured temperature] is indicated on the display.

* If you leave the unit for longer than 1 min. with no key operation while setting temperature, the indication changes to the measured temp. value.
In this case, repeat the setting procedures from step 1).

1) Hold down [set] key for longer than 5 sec. to change to adjustment mode.

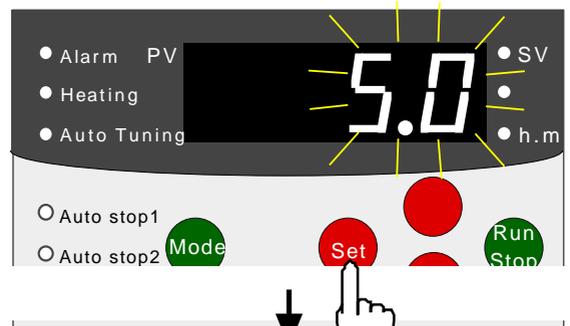


2) Changing to lower limit temperature alarm mode.

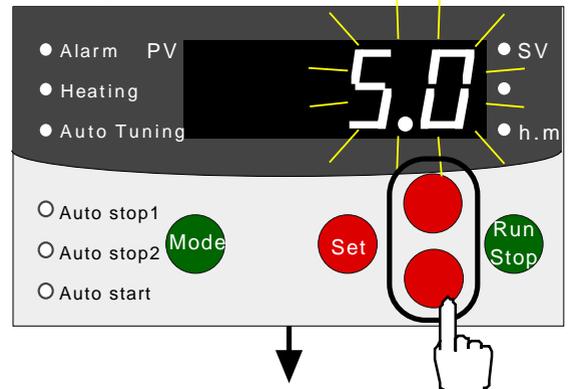


Press twice.

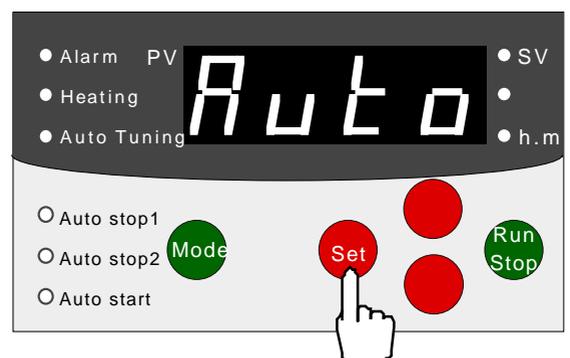
3) Setting lower limit temperature alarm mode.



4) Setting an alarm temperature value.



5) Entering alarm temperature.
Changing to auto tuning mode.



4. How to operate auto tuning

In case of unstable control mode caused by applicable conditions or thermal load, any P.I.D constant in compliance with these conditions is automatically resettable.

* In addition, in the mid of control suspension mode, 'on' setting in auto tuning mode is unavailable. If desirable, do it during the control mode.

Setting auto tuning

- 1) Press [set] key for longer than 5 sec.
The display mode changes to adjustment mode, and show [*S n S*], which means that the temperature display compensation mode is active.
[Temperature LED (°C)] is turned off.
- 2) Press key 3 times (or, press key twice) to change the display mode to auto tuning mode [*Auto*].
- 3) Press [set] key.
The display shows a blinking preset character for auto tuning.
* The blinking indication is a previously set character. However, if in case of setting to 'on' in the last time, 'off' is automatically set when the auto tuning is over. The pre-shipment value is set to [off].

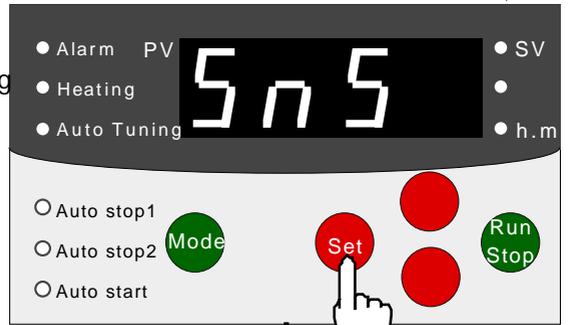
- 4) Press or key to select a desirable preset character.
* Preset characters change in the following order.

- [*off*] : Stop of Auto tuning
- [] []
- [*on*] : Start of Auto tuning
- [] []
- [*clr*] : Clear of P.I.D. constant

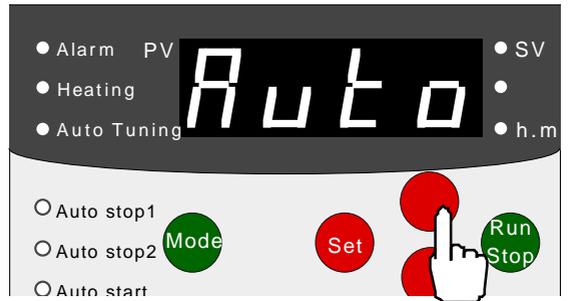
- 5) Press [set] key.
The blinking preset character is defined.
The display shows [*Poff*] and changes to the power failure recover mode.
The modified character can not be valid unless [set] key is pressed.
* Press or key to select a desirable mode when you change values in other adjustment mode.
* Press [set] key for longer than 5 sec. if you do not change any values in adjustment mode.
The [measured temperature] is indicated on the display.

* If you leave the unit for longer than 1 min. with no key operation while setting temperature, the indication changes to a measured temperature value.
In this case, repeat the setting procedures from 1).

- 1) Hold down [set] key for longer than 5 sec. to change to adjustment mode.

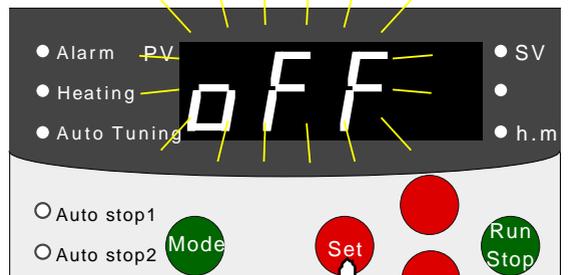


- 2) Changing to auto tuning mode.

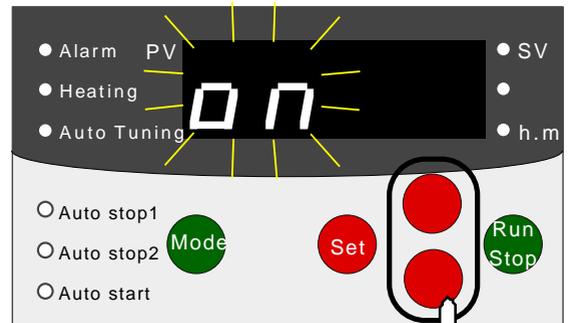


Press 3 times.

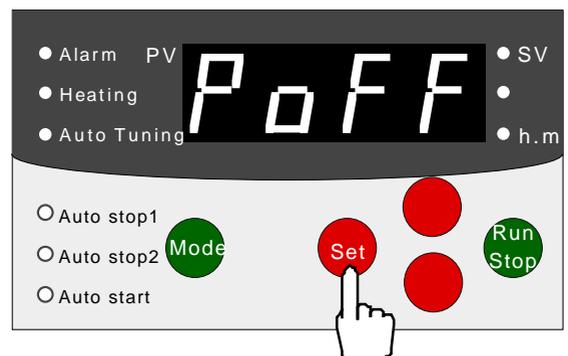
- 3) Setting auto tuning mode.



- 4) Setting auto tuning mode.



- 5) Entering auto tuning mode.
Changing to power failure recovery mode.



5-3-5. How to set power failure recovery mode

This enables a preset operation mode work immediately after recovering from power failure on the machine under control, including a conceivable case that the main power is turned off without finalizing the control mode.

How to set the power failure recovery mode

- 1) Press [set] key for longer than 5 sec.
The display mode changes to adjustment mode, and show [SnS], which means that the temperature display compensation mode is active.

[Temperature LED (°C)] is turned off.

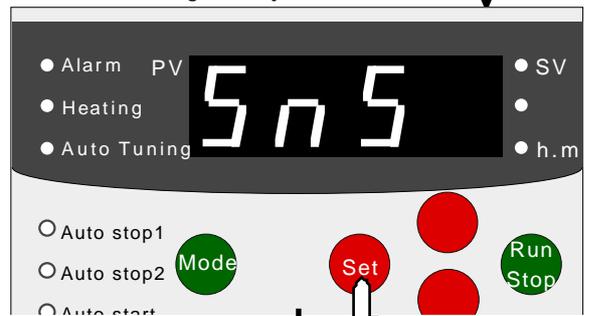
- 2) Press [] key 4 times, or press [] key once, to change the display mode to power failure recovery mode [POFF].
- 3) Press [set] key.
The display shows the blinking preset character for power failure recovery mode.
* The blinking indication is a previously set character. The pre-shipment value is [cont].
- 4) Press [] or [] key to select a desirable preset character.
* Preset characters can change in the following order.

- [cont]: Continuation of control operation
- [] []
- [off]: Stop of control operation
- [] []
- [on]: Continuation of control operation
The timer restarts to count the time if the measured temperature falls 5°C below the preset temperature.

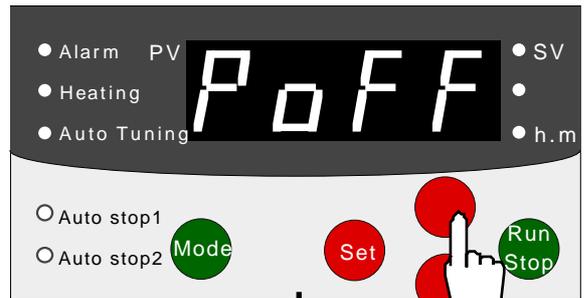
- 5) Press [set] key.
The blinking indication on the display is defined. The display shows [SnS] and then changes to the temperature display compensation mode.

- * The changed temp. value can not be valid unless [set] key is pressed.
- * Press [] or [] key to select a desirable mode when you change to any other values in adjustment mode.
- * Press [set] key for longer than 5 sec. if you do not change to any other values in adjustment mode. The [measured temperature] is indicated on the display.
- * If you leave the unit for longer than 1 min. without any key operation while setting temperature, the indication changes to the measured temp. value. In this case repeat the setting procedures from 1).

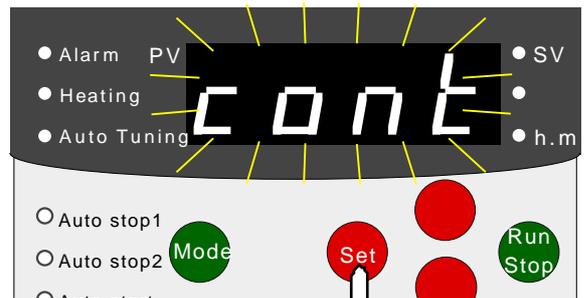
- 1) Hold down [set] key for longer than 5 sec. to change to adjustment mode.



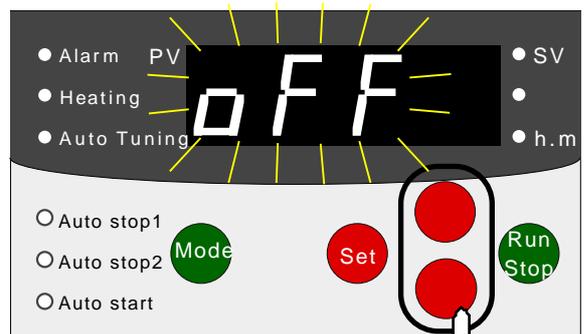
- 2) Changing to a display of preset power failure recovery mode.



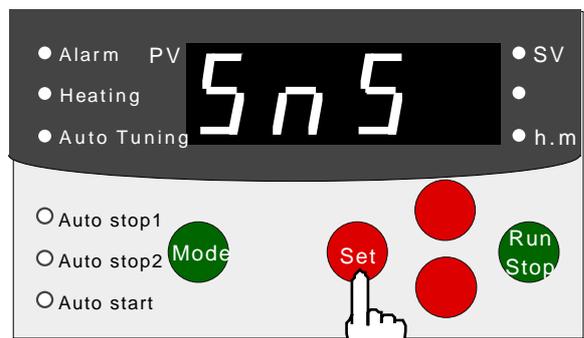
- 3) Setting lower limit temp. alarm mode



- 4) Setting power failure recovery mode.



- 5) Entering power failure recovery mode. Changing to temp. display compensation mode.



6 Trouble shooting

Trouble mode	Cause of trouble	Countermeasures
The display does not show anything even after the power switch is turned on.	A mains connector is unplugged (Out of position from a power outlet), or not firmly plugged in.	Turn off the main power switch, and then plug in to an AC outlet.
	No power supply.	Turn on the breaker of switch board.
	Main power switch is out of order.	Stop operation immediately and contact your local dealer or closest customer service center.
	The circuit protector works.	
	Temperature controller is out of order.	
Over heat protector still works.	Please trace its cause first after the in-bath temp. lowers. Then, press the reset button on reverse of the controller's top in order to cancel the mode. However, even after the cancellation, if it still starts to work, please stop the operation promptly and contact our sales office or service center near you.	
The unit stops in the mid of operation.	Over heat protector still works.	
	The preset temperature for overheat protector is lower than that of the temp. controller.	Press the overheat protector's reset switch, and change the preset temp. value. In addition, set normally its applicable temp. value approx. 10 higher than the preset value. (Refer to 5-3-1. How to set the overheat stopper.)
	The circuit protector starts to work due to surge current.	Stop operation immediately and contact your local dealer or closest customer center.
No heating	Unmatching preset temp.	Check the preset temp. value.
	Ambient temp. below 5°C.	Set the ambient temp. to higher than 5 .
	Low power source voltage.	Upgrade the power source voltage.
Unstable temp. control	P.I.D constant modified after conducting auto tuning.	Reset to the default value as the same with that of outgoing from the factory.
	Fully or excessively packed samples /containers in the water bath. (Causing poor stirring mode.)	Reduce the No. of samples / containers.
	Insufficient in-bath stirring caused by contaminated or clogged casing.	Refer to [7. Maintenance and checkout] for cleaning.
Displayed temp. value unmatching a measured value	Due to the set-up for temperature compensation, there is a difference between displayed value and actual measured value.	Reset to 「0.0」 of temp. display compensation value. (Refer to [5-4-1 Indicated temperature compensation])
	Presence of numerical gap between another standard thermometer-measured value and the one displayed on this unit.	Compensate the indicated temperature value. (Refer to [5-4-1 Indicated temperature compensation])
	Insufficient in-bath stirring caused by contaminated or clogged casing.	Refer to [7. Maintenance and checkup] for cleaning.

Trouble	Caus	Remed
No function on a stirring pump.	Contaminated or clogged casing.	Refer to [7. Maintenance and checkup for cleaning.
	No rotation in the pump's motor.	Stop operation immediately, and contact your local dealer or closest customer service center.
Reduced amount of circulation	Closed valve for external circulation.	Open the valve.
	Bent / deformed hose.	Straighten / fix the form of it.
	Excessive / huge pressure loss in the circulation.	Shorten the circulation line.
Output of sensor alarm as [SnS].	Disconnection of temperature sensor.	Stop operation immediately, and contact your local dealer or closest customer service center.
Output of uncontrollable temperature alarm as [cont]	It is detected when the temperature keeps rising for 10 minutes or longer even though the measured temperature is higher than the set temperature. Or the temperature does not rise for 10 minutes or longer even though the measured temperature is lower than the set temperature.	Stop operation immediately, and contact your local dealer or closest customer service center.
Output of power failure alarm [PoFF]	Sensing power failure while controlling, or turning off the main power without finishing the control mode.	Stop the control operation first, and turn off the main power.
Output of level alarm [LEvL]	Extremely low level of in-bath liquid.	Refill the liquid.
Output of upper limit temperature alarm as [AL-H]	Sensing at momentarily exceeding preset temp. + upper limit temp. alarm preset value	Review the alarm value. * The pre-shipment value is 5°C. Refer to [5-4-2. How to set upper limit temp. alarm].
Output of lower limit temperature alarm as [AL-L]	Sensing at momentarily exceeding preset temp. - lower limit temp. alarm preset value.	Review the alarm value. * The pre-shipment value is 5°C. Refer to [5-4-3. How to set lower limit temp. alarm].
Control operation stop with no alarm output. <<Uncertain display mode on a PC screen>>	Malfunction on temperature controller caused by some noise. Ambient temperature over 35°C.	Try any other power outlet. Set the ambient temperature to 35°C or lower. In addition, even by doing so but still alarming, please stop the operation immediately and contact our sales office or service center near you.

7 Maintenance and Checkup

7-1 Test of switch

7-1-1. Test of float switch

Set the stirring speed to minimum, and slowly lift the unit from the water bath while the main power is turned on. The level alarm starts to work when about two thirds of the property of protection cover is exposed from the water surface.

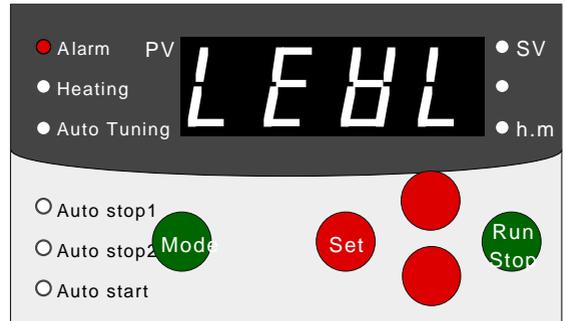
In controlling mode, the control mode stops and the alarm is output.

[Alarm LED (alarm)] is turned on.

[LEvL] is displayed on the panel.

* When the in-bath water is very hot, do not perform the operation test. It may cause burning.

* Do not lift the jet flow port. It may diffuse an applied heating medium.



7-2 Cleaning and Care

Warning

Do not disassemble the unit.

Inside the unit there are some portions where voltage is applied or high temperature exists. Hence, if disassembling, it may cause electric shock or injury.

Caution

Clean properly the machine with appropriate method and supplies.

Do not apply water directly on to interior or exterior of the unit. Also, do not use cleanser, thinner, petroleum, coal oil, acid, and equivalent. Usage of such materials may cause electrical shock or damage of the unit.

Caution

Remove scale on the surface of heater.

Using the heater with scale remaining on the surface may cause to damage a pin hole or so on the heater surface, and may lead to short circuit.

Caution

Clean the unit after it is cool down enough.

Clean the unit after it becomes cool down enough to avoid burning your hands.

Caution

Unplug if no usage of the unit for a long time.

If leaving the main power plugged in for a long time, there would be dusty in a gap between an outlet and a plug, and when the dust is combined with humidity, there would generate discharging condition among poles. Consequently, it may obtain heat and due ignition.

Caution

Please make sure to unplug the main power before cleaning.

For cleaning the machine, please make sure to turn off the main power and the circuit breaker, and unplug them. Otherwise, if not doing so, it may cause electrical shock or malfunction of the unit.

Caution

Dry enough the unit before operation.

After using water for cleaning the unit, wait until it is dried enough. If some water remains in the bath, it will be vaporized explosively in oil and the oil may be spattered.

1. Cleaning the unit

- (1) Turn off the main power switch, and unplug.
- (2) Make sure to use a fully squeezed wet soft cloth for wiping off.
For greasy dirt, use mild detergent, and wipe off with a dry cloth after using such detergent.



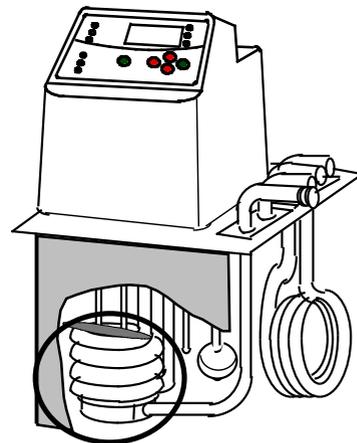
Make sure to drain the in-bath water if intending no usage for a long time

Please make sure to drain the pooled water in the water bath and the piping system. It may cause any mechanical irregularity in the circulation system if water stain or alga would generate in the water bath / piping system.

2. Disassembling and cleaning the casing



Do not touch the impeller with bare hands.
Do not touch the impeller with bare hands.
Due to its sharp edge, it may cause physical injury.



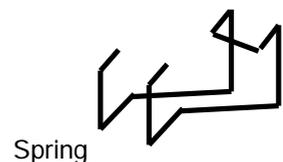
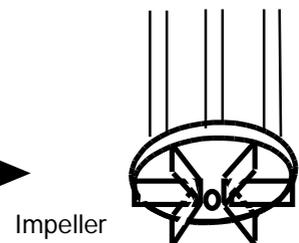
Disassemble the casing, which is situated beneath the controller, and clean it.

Remove the spring, and bring out the casing as shown in the right drawing. (With NTT-2200).

Use a brush for cleaning / washing.
For greasy dirt, use mild detergent in washing.

Then, make sure to avoid any migration of water / liquid drops in to the controller.

After cleaning / washing, follow the above-mentioned disassembling procedures backward for assembly, such as mounting the casing and fixing it with the spring.



8 Disposal of the product

For disposal of the product or its relevant parts, please comply with the appropriate disposal method.

Main components and its disposal method

Configu-ration	Model	Net weight	Overall dimensions
Main unit	NTT-2100 NTT-2200	3.5kg	138W x 150D x 312H in mm

* For disposal of used packaging stuff, please make sure to separate material by material.

9 After-Sales Services

1. In case malfunction, please refer to the section of troubleshooting to check whether that case is actually malfunction or not.
2. If that failure mode still remains, please contact your local dealer or closest customer service center mentioned in this manual.
3. Repair services during warranty period will be conducted in accordance with the warranty regulations.
4. Any repair services after the warranty period will be charged.

Warranty regulations

1. Repair services are available with free of charge during warranty period (one year after the date of purchase), in the condition that the product is used as specified in this manual.
2. Repair services for the following cases will be charged even during the warranty period.
 - (a) Malfunction caused by misuse or invalid remodeling.
 - (b) Malfunction caused by drop on the move to a place to install after purchase.
 - (c) Malfunction caused by any uncontrollable disaster such as fire, earthquake, windstorm, flood, thunder, salt damage, or so.
 - (d) Replacement of consumables.
 - (e) No presentation of the warranty.