AS ONE

Instruction Manual

# Thermax water bath

## TMK-1A-F (1-4594-31-90)
## TMK-1A-I (1-4594-31-91)
## TMK-2A-F (1-4594-32-90)
## TMK-2A-I (1-4594-32-91)



Thank you for purchasing AS ONE products.
Before using the product, be sure to read this user manual carefully and use it safely and correctly. When transferring or renting the product, attach and pass this instruction manual to a conspicuous place on the device.
This is for researchers and businesses. It is not a product for home use or general use.

# Please Read First

## ＜Safety Precautions＞

Before using the product, read “Safety Precautions” carefully and use the product safely and correctly. Indicates important matters to prevent damage or loss due to incorrect usage.

●The degree of risk or damage caused by incorrect use is as follows.

| | |
|---|---|
| ⚠ Warning | Riskiness of death or serious injury may occur with wrong handling. |
| ⚠ Caution | Injury and physical loss only may occur with wrong handling. |

●The meanings of pictograms used in this document or device are as follows.

| | |
|---|---|
|  | 「Must to do」※ |
|  | 「NOT to do」※ |
|  | 「Things to note」※ |

※ This document is categorized by major chapter.

| | |
|---|---|
|  | Do NOT touch. |
|  | There is a risk of electric shock. |
|  | For products with a safety ground terminal, it is connected to the ground wire. |
|  | Disassembly or modification is prohibited. |
|  | Disconnect the power plug from the outlet. |
|  | Improper use may cause a fire. |
|  | There is a risk of burns if you touch it because of the high temperature. |
|  | There is a risk of explosion. |

| ⚠ Warning | In order to use the product safely and correctly, be sure to follow the instructions below. |
|---|---|
| Install | When installing the device, be sure to use a single outlet that meets the rated power voltage, frequency, and capacity. Do not use branch sockets or table taps. It may cause fire or electric shock.<br>➡The power supply voltage of this product is AC220V. |
| | Be sure to ground the grounding wire to prevent electric shock.<br>(Use an outlet with a ground terminal) |
| Operation | Stop using the device immediately if it emits odor, noise, smoke, or if it is dropped or damaged.<br>Turn off the power switch and remove the power plug from the outlet. Then contact your dealer or repair window. |
| | Use the device in a place where there is no combustible gas and no volatile or inflammable materials nearby.<br>There is a risk of fire or burns due to smoke or ignition. |
| Operation | Do not put flammable substances such as organic solvents. Do not leave these substances near the product.<br>It may cause ignite or explode and dangerous.<br>➡For example, major explosive substances include nitrate esters and nitro compounds, and flammable substances include peroxides, inorganic peroxides, nitrates, organic solvents, etc. |
| | Do not touch the heating medium in the bath or the housing of this product when the power is turned on or immediately after the power is turned off.<br>Depending on the set temperature, it may become hot and may cause burns. |
| | Do not put metal objects inside of the device.<br>It may cause fire or electric shock. |
| | Do not touch the power plug or operate the switch with wet hands.<br>It may cause electric shock. |
| | Do not modify or disassemble this product.<br>It may cause fire or electric shock.<br>➡In case of remodeling or disassembly, the company does not take any responsibility in case of remodeling or disassembly. |
| | Do not use the device for anything other than its intended purpose.<br>Do not use for purposes other than controlling heating or coolers (resistive loads).<br>It may cause an unexpected accident. |

| ⚠ Caution | In order to use the product safely and correctly, be sure to follow the instructions below. |
|---|---|
| Install | When installing, make sure that no dust or moisture adheres to the power cord or power plug. Be sure to insert the power plug all the way in to avoid scratches.<br>It may cause fire or electric shock. |
| Install | Do not use anything other than the supplied power cord.<br>Do not use the supplied power cord for other equipment.<br>It may cause a fire due to smoke or ignition. |
| Operation | This product is a laboratory temperature controller.<br>Do not use for unattended operating use or incorporation of lines.<br>Keep an eye on your device while operating. |
| | Use the device only under the direction of a knowledgeable person. |
| | If lightning starts, immediately turn off the power and unplug the device from the electrical outlet. It may cause electric shock. |
| Operation | Do not damage the power cord.<br>[ • Process • Forcibly bend • Pull<br>• Binding • Tensioning • Loading heavy objects<br>• Approaching a hot air device • Putting in ]<br>It may damage the power cord and cause fire or electric shock. |
| Operation | Be careful that children do not touch or use it. |
| Cleaning / Check | When cleaning, turn off the power and remove the power plug from the outlet.<br>It may cause fire, electric shock or burns. |
| | Check regularly that there is no dust adhering to the pins and the pin installation surface of the power plug, and insert it firmly all the way to the root of the blade without shaking.<br>If dust adheres to it or the connection is incomplete, it may cause electric shock or fire. |
| Storage | If the device is not to be used for a long period of time, unplug from the outlet to avoid the risk of electric shock or short circuit fire due to insulation deterioration. |

## <Requirement for Installation and Assembly>

| ⚠ Require | It may affect product performance or cause a malfunction.<br>Be sure to observe the items below. |
|---|---|
| | Do not block the heat radiation vents of the product. Also, please install it in a place that does not interfere with the heat radiation of the product. |
| | Install the device in a horizontal and stable place indoors. |
| | Install the device in a location with little dust and no corrosive gas. |
| | Do not install in the following places.<br>• Locations with condensation<br>• Unstable locations<br>• Lots of moisture<br>• Locations subject to water droplets<br>• Places exposed to direct sunlight<br>• Near heaters<br>• Places subject to direct heat from heaters<br>• Places with a lot of vibration |
| | Avoid places with a lot of dust or where corrosive gas is generated. |
| | Avoid places with a lot of shock or vibration. |
| | Keep it as far away from noisy devices as possible. |

## <Requirement for Usage>

| ⚠ Require | It may affect product performance or cause a malfunction.<br>Be sure to observe the items below. |
|---|---|
| The specified ambient temperature is 5 to 35°C. Do not operate outside of this range. | |
| The specified ambient humidity is 35 to 85%RH. Use this product in an environment where condensation does not occur. | |
| Do not use this product outdoors.<br>➡ This product is made for indoor use. Do not use outdoors or where it comes into contact with water. | |
| Use this product as far away as possible from noisy devices. | |
| Do not drop, topple, or subject this product to strong impact. | |
| Make sure that water does not come into contact with the control unit case.<br>➡ This product is NOT waterproof. | |
| After use, turn off the power and disconnect the power cord from the outlet. | |

## ⚠ Require

It may affect product performance or cause a malfunction.
Be sure to observe the items below.

Do not use in corrosive gas atmosphere. Parts may corrode and cause malfunction.

Note the following when placing a container containing a sample in the bath.

- Prevent the heat medium from overflowing when the container is placed in the bath
- Be careful not to deform or burst the container due to heat
- Use appropriate weights and floaters to prevent the container from overturning due to buoyancy

Ventilate the room regularly. If there is a risk of toxic gas generation, use proper ventilation such as a fume hood.
Be sure that using in a fume hood may significantly impair the durability of the product.

Do not use this product for a long-term operation or neglected operation with the power on. Keep an eye on this product while driving, especially be careful not to boil it dry.

TMK-1A-F, TMK-1A-I, TMK-2A-F, TMK-2A-I are water heating equipment.
Do not use to heat liquids other than water (solvents, aqueous solutions, oils, etc.).
Please use tap water. Using high-purity water such as ultra pure water or salt water such as seawater may corrode metal and significantly deteriorate the product.

These products are general-purpose equipment for experiments and research, and are not intended to be used as cooking utensils (fryers). In the worst case, there is a risk of fire, so do not use it.
Concerns about commonly distributed edible oils are as follows.

- Because some have low smoke points and low ignition temperatures, the risk of fire is high.
- There is oil that contains a lot of impurities, and if it adheres (precipitates) to the surface of the heater, it may cause poor heat conduction and cause the heater to overheat.
- There is a possibility that oil with low thermal conductivity and high specific heat exists, which may cause the heater to overheat.

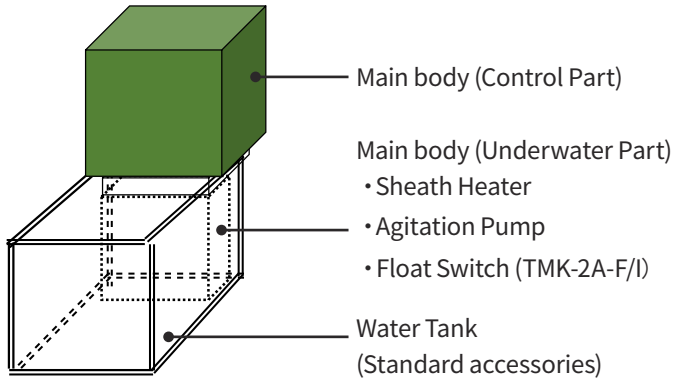
After use, turn off the power and disconnect the power cord from the outlet.

After operation is finished, drain the liquid in the bath and dry the product.
When discharging, be careful not to cause accidents such as burns due to the hot liquid.

When discharging the heat medium (water, oil, etc.) in the bath, be careful not to cause burns or other accidents.

# Product Characteristics

Thermax is a constant temperature water tank that can be separated and replaced.




| | | |
|---|---|---|
| Heat Medium | Tap water | TMK-1A-F/I<br>TMK-2A-F/I |
| Control method | PID | |
| Internal thermal sensor | Pt 100Ω (Platinum) | |
| Display method | LCD | |
| Setting method | By setting keys and Jog switch | |
| Thermostat | Bimetal | |
| Operation setting method | Manual and Timer (4 types) control | TMK-1A-F/I |
| | Manual, Timer (4 types) and Program control | TMK-2A-F/I |
| Preventing dry firing | Float switch | TMK-2A-F/I |

# Specifications

| Model | | TMK-1A-F | TMK-1A-I | TMK-2A-F | TMK-2A-I |
|---|---|---|---|---|---|
| Product code | | 1-4594-31-90 | 1-4594-31-91 | 1-4594-32-90 | 1-4594-32-91 |
| Power voltage | | AC 220 V 50/60 Hz | | | |
| Heat medium type | | Water type | | | |
| Power consumption | | Max. 1100 W | | | |
| Heater capacity | | Approx. 1 kW | | | |
| Display method | | LCD Display | | | |
| Internal thermal sensor | | RTD: Pt100Ω | | | |
| Temperature control range | | -20.0 to 80.0 °C (by 0.1 °C) ※1 | | | |
| Display temperature range | | -40.0 to 200.0 °C ※1 | | | |
| Display accuracy | Internal sensor | ±1 °C ※2 | | | |
| Input sampling period | | 100 ms | | | |
| Control output | | TRIAC drive output | | | |
| Control method | | ON/OFF control, PID control | | | |
| Hysteresis (ON/OFF) | | 0.1 to 100.0 °C | | | |
| Proportional band (P) | | 0.0 to 100.0 °C | | | |
| Integral time (I) | | 0 to 3600 s | | | |
| Differential time (D) | | 0 to 3600 s | | | |
| Control cycle (T) | | 1 to 120 s | | | |
| Control function | | Timer function | | Timer function<br>Program function | |
| Ambient | Operation | Temperature: 5 to 35 °C<br>Humidity: 35 to 85 %RH | | | |
| | Storage | Temperature: -10 to 50 °C<br>Humidity: 35 to 85 %RH | | | |
| | | (No freezing or condensation) | | | |
| Safety device | | Circuit protector (using with power switch) | | | |
| | | Bimetal switch | | Bimetal switch,<br>Float switch | |
| Accessories | | Tank (Material: PP, Capacity: Approx. 8 L) | | | |
| Power cable length | | Approx. 2.5 m | | | |
| Power plug | | CEE 7/7※3  | IEC type I  | CEE 7/7※3  | IEC type I  |
| Approval | | CE UK CA | | | |
| Weight | | Approx. 4.3 kg<br>(Main body Approx. 3.1 kg, Tank Approx. 1.2 kg) | | | |

The above product specifications are subject to change without notice for improvement. Please understand beforehand.

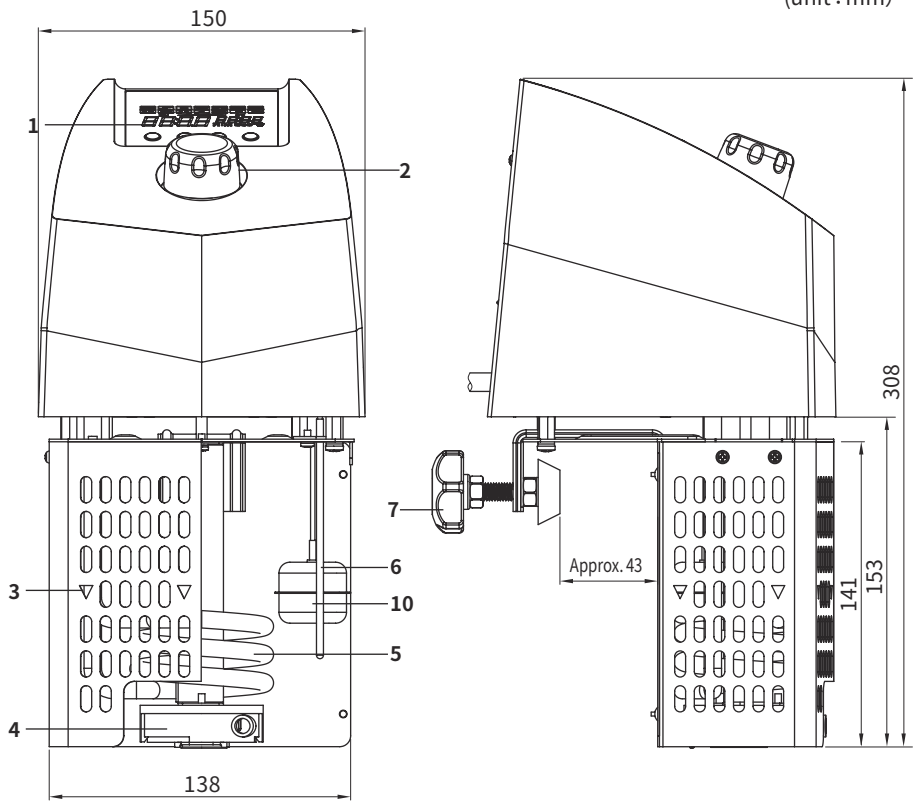
※1. This product is for heating only. It does not have a cooling function.

※2. Our test value

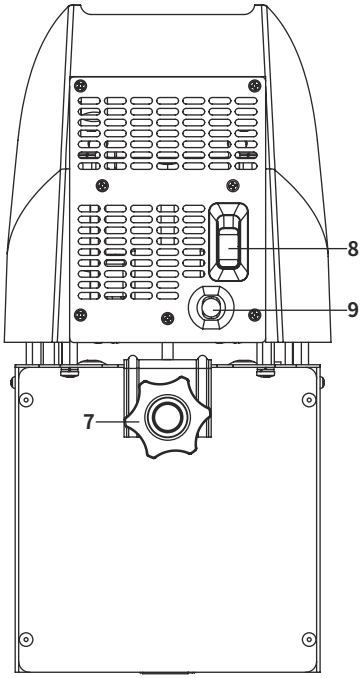
※3. CEE 7/7 plug is compatible with IEC type E and type F.

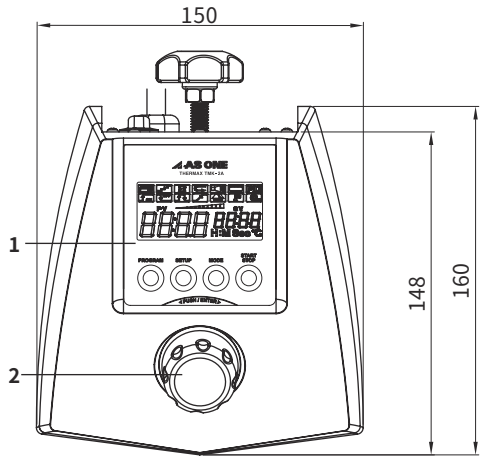
# Main Body

(unit：mm)

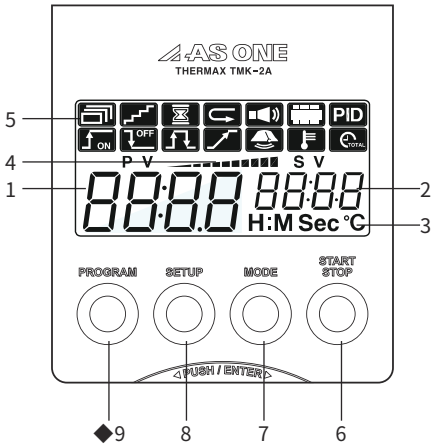



1. LCD display/operation section(See page 10 for details.)
2. Jog Switch(Temperature/parameter settings)
3. Water level lower limit mark (See page 15)
4. Agitating pump(for agitating inside the tank, see page 12)
5. Heater (for heating inside the tank. Material: Stainless steel)
6. Internal thermal sensor
   (Measure the temperature inside the tank, Material: Stainless steel)
7. Fixing knob (Fixing the main body to the tub)
8. Power switch (and circuit protector)
9. Power cable (directly connected to the main body)
10. Float switch (Dry firing prevention device)
    (TMK-2A-I and TMK-2A-F only)


8
9
7


150
1
2
148
160

# Display / Operation Panel



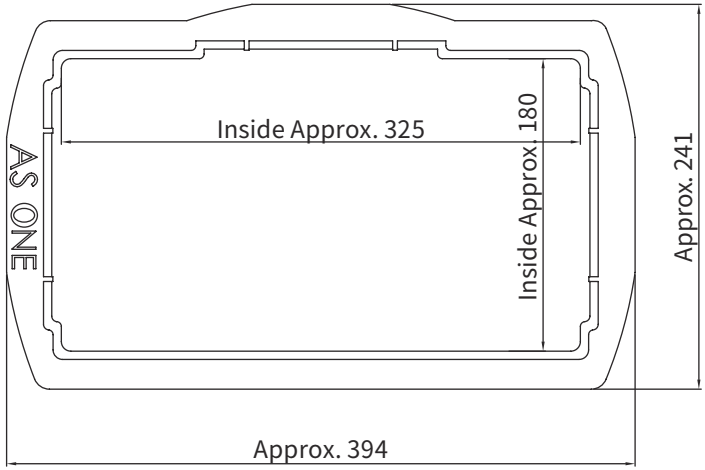

1. Process Variable (PV)
2. Set Point Variable (SV)
3. Unit
   (Hours: Minutes, Seconds, Temperature °C)
4. Control output
5. Icons *
6. START/STOP key
7. MODE key
8. SETUP key
9. PROGRAM key
   (TMK-2A-I and TMK-2A-F only)

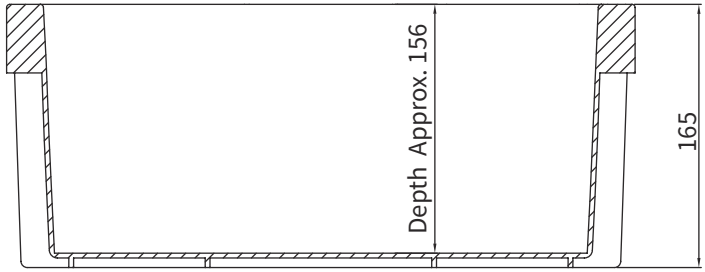
* Icons

| Icon | Description | Applied model | Icon | Description | Applied model |
|---|---|---|---|---|---|
| | Program control ON | TMK-2A-I/F | | ON timer (T-1) | All models |
| | Program control lamp zone ON | | | OFF timer (T-2) | |
| | Program control wait zone ON | | | ON/OFF timer (T-3) | |
| | Program control repeat ON | | | SV timer (T-4) | |
| | Buzzer ON | All models | | Alarm ON | |
| PID | PID control (not displays for ON/OFF control) | | | Temperature correction function ON | |
| | | | | Total operating time (when checking time) | |

# Water Tank

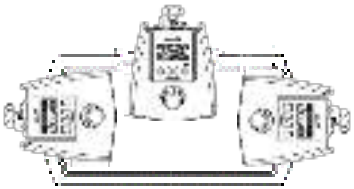
(unit: mm)




| | |
|---|---|
| Material: | PP (polypropylene) |
| Heat resistance: | 100°C |
| Capacity: | Approx. 8ℓ |
| Heat medium: | Water |
| Thickness of mounting part: | 29.5 mm |

The Positions where the main bodies can be installed



⚠ Do not use any heat medium other than water.
Using chemicals in water may have a negative effect on plastic parts (stirring pump, attached water tank).

# Ready to operation

## (1) Setting the Discharge Port of the Agitating Pump

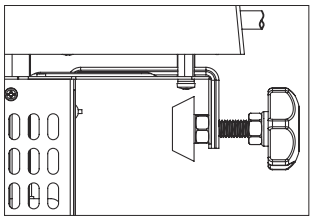
Closed

Full Opened

① Turn the main unit upside down and set the water intake cover.
(half open to fully open)

② Direct the spout in any direction.
(rotates about 40°)

## (2) Install the Tank

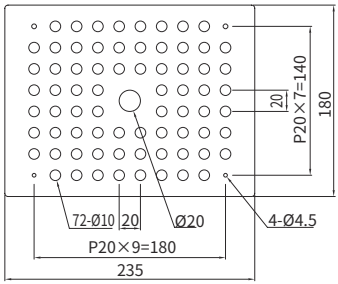


Turn the fixing knob to secure it, and make sure there is no shakiness or looseness.
Be careful not to tighten the fixed knob too tightly as this may lead to damage to the knob or the tank.

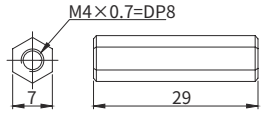
## (3) Assemble the parts of the Thermax option Drainboard (sold separately : No.1-4594-17)

After assembling A, B, C, set them into the tank as shown in the diagram on the next page.

A. Drainboard




B. Hexagonal Spacer

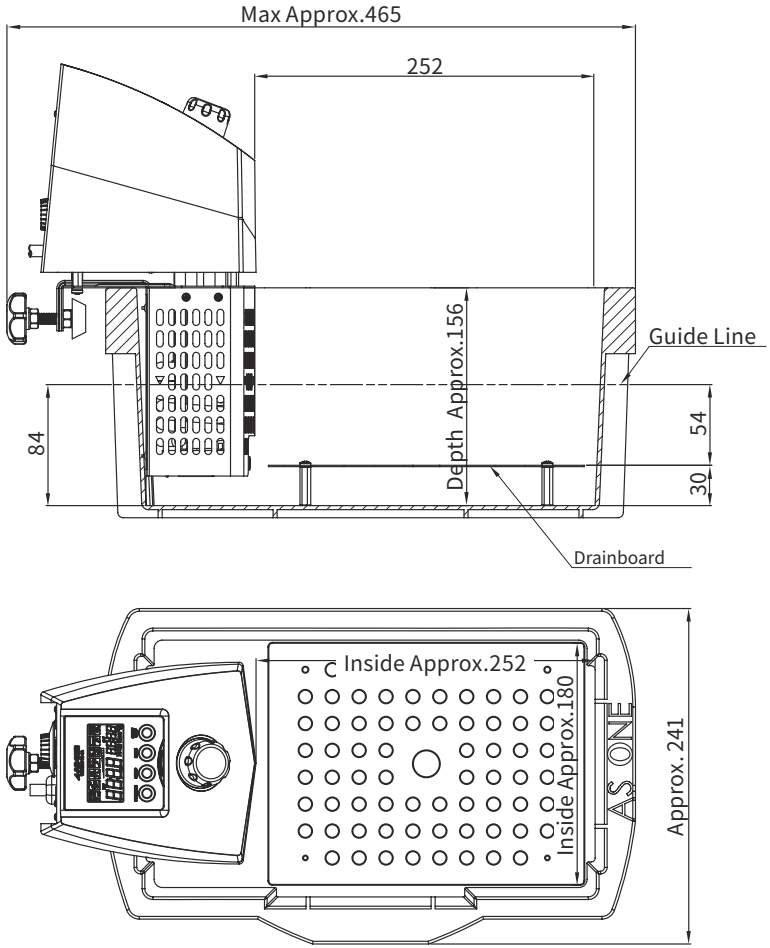



C. M4 screw

TMS+M4×0.7, 8L

Drainboard (sold separately) set in the Tank

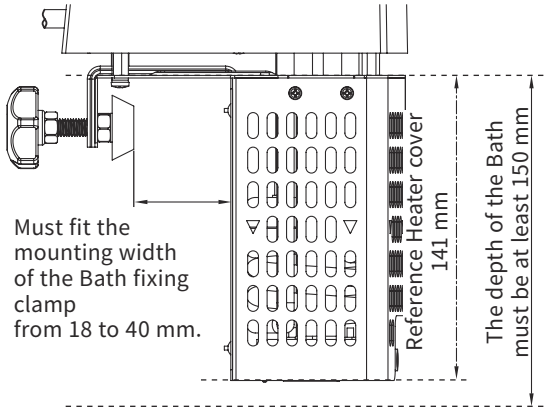
(unit: mm)

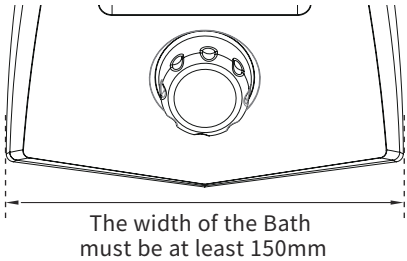


## (4) Conditions for selecting a Separately Sold Tank

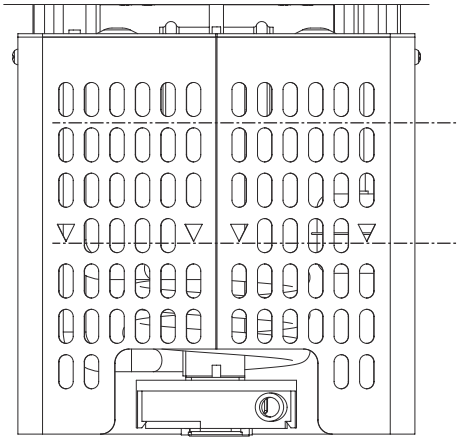
| | |
|---|---|
| Heat-resistant | 81°C or higher<br>(upper limit of operating temperature 80°C) |
| Material | Plastic or Metal |
| Capacity | 8L or more recommended |

Dimension of the mounting part



## (5) Water filling in the Tank



Upper limit water level (approximate)
Please adjust the filling amount so that the water being stirred during operation does not come into contact with the Thermax body.

Lower limit water level

The ▽ hole in the heater case is the lower limit water level.

If the water level falls below this level, the heater will be exposed above the water surface and will run dry, creating a risk of fire, so be sure to fill the heater above this water level.
Also, during operation, the water level will drop due to evaporation due to high temperatures. During operation, pay close attention to the water level and stirring conditions, and fill the tank in a timely manner.

Fill the tank slowly and carefully.
Splashing water onto the main unit may cause malfunction.

### About the “Dry-firing Prevention” function

- TMK-2A-F/I has a “Dry-firing Prevention” function using a float switch.
  If the water level is detected to be below the lower limit during operation, it will be forcibly stopped.
- TMK-1A-F/I does not have a “Dry-firing Prevention” function.
  So please replenish water in a timely manner.

# Operation Method

Operation

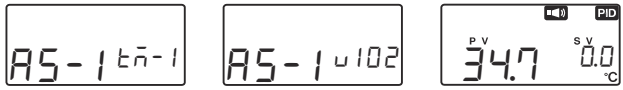
## (1) Before turn ON the power

- Make sure that the power is turned off switch (on the back of the main unit) before inserting the power plug into the outlet.

> This product uses a 3P plug with a grounding pole.
> Be sure to connect it to the ground wire before use.

## (2) Turn ON the power

- Turn ON the power switch and the Agitation Pump will start operating.
- Immediately after the power is turned on, the LCD will display as shown below, and in about 5 seconds PV and SV will be displayed and settings can be entered.




## (3) Setting the Set Point Variable (SV)

Example when setting to 75.0 °C

Method - A

Turn the jog switch one click. (Can be left or right) The first decimal place will blink.


↓

MODE

Press the MODE key once within 3 seconds* to move to the ones digit.

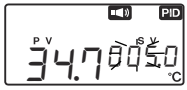

↓

Within 3 seconds*, turn the jog switch 5 clicks to the right to set the ones digit to 5.


↓

MODE

Press the MODE key once within 3 seconds* Please move to the tens digit.




↓

Within 3 seconds*, turn the jog switch 7 clicks to the right to change the tens place to 7.


↓

When finished, please save the settings*.

Method - B

Turn the jog switch 751 clicks to the right. The display will be "75".

↓

* If you leave it for more than 3 seconds, the SV display will return from blinking one digit to blinking all SVs while the input contents up to that point are saved. The contents can also be saved by pressing the jog switch once.

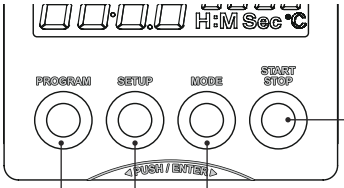
## (4) START/STOP

START/
STOP

Push the START/STOP key for 3 seconds or more to start Operation. The SV display will stop blinking, and the heater output status ▬▬▬▬▬ will be displayed.


To end the operating state, push the START/STOP key for more than 3 seconds.

## (5) Operation Keys and Parameter settings




START STOP

Push more than 3 seconds → Start ↔ Stop

Switch between Start/Stop

MODE

Push Once

In operation → Accumulated operation time display (See page 33)

Stopped → Timer setting time display (See page 21)

SETUP

Push Once while stopped → Enter "SETUP settings group" (See page 19)

Push more than 3 seconds while stopped → Key lock setting (See page 33)

PROGRAM

Push Once (TMK-2A-I/F Only) → Program control settings (See page 25)

## (6) Factory parameter settings for “SETUP setting group” (initial values)

- This is a list of Thermax functions that can be set before starting operation.

Enter : Press the SETUP key once.

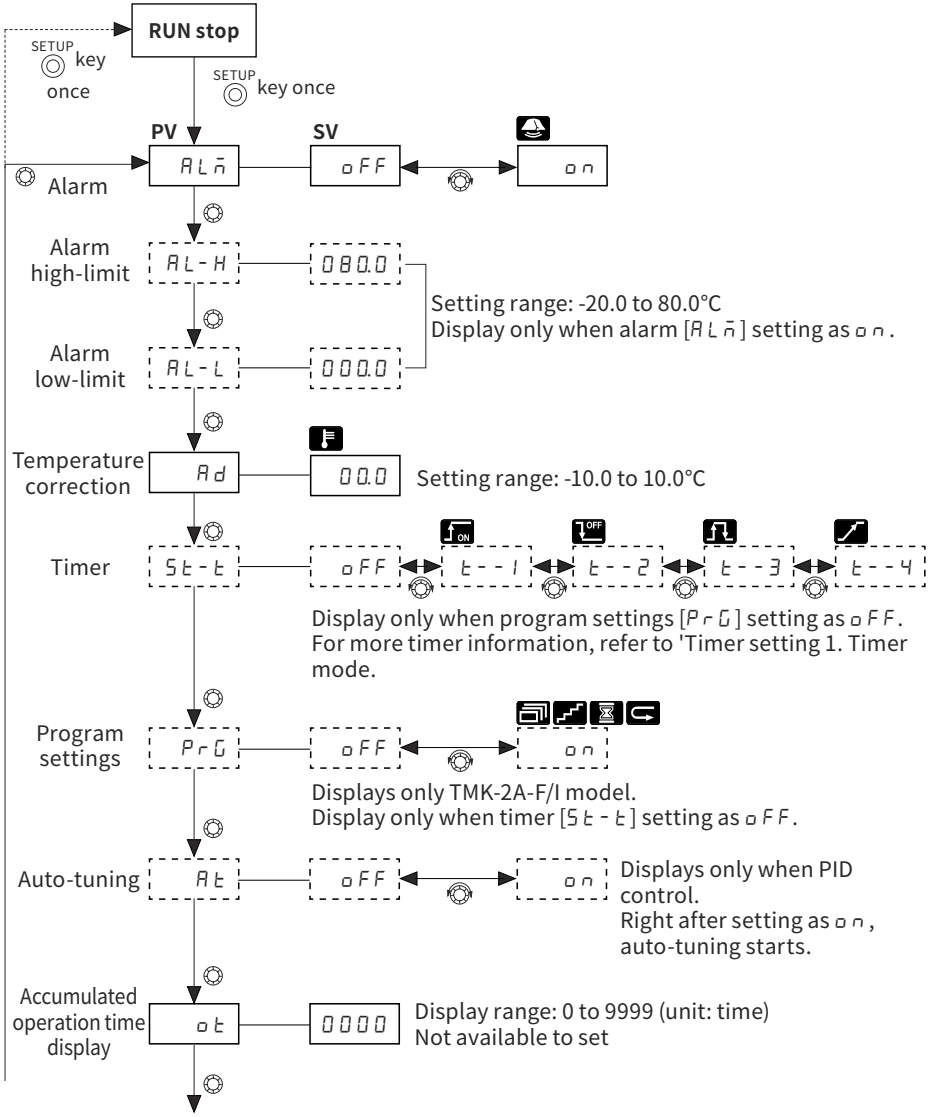
| Parameter | Description | Setting range (initial value) | Unit | Display conditions |
|---|---|---|---|---|
| AL1 | Alarm | OFF, ON (OFF) | - | |
| AL-H | Alarm high-limit | -20.0 to 80.0°C (80.0) | °C | Alarm [AL1]: on |
| AL-L | Alarm low-limit | -20.0 to 80.0°C (0.0) | | |
| Ad | Temperature correction | -10.0 to 10.0 (0.0) | °C | |
| St-t | Timer | OFF, T--1, T--2, T--3, T--4 (OFF) | - | Program settings [PrG]: oFF |
| PrG | Program settings | [TMK-2A-F/I] OFF, ON (OFF) | - | Timer [St-t]: oFF |
| At | Auto-tuning | OFF, ON (OFF) | - | Proportional band [P]: Over 000.1 |
| ot | Accumulated operation time display | 0 to 9999 | Time | |
| buZ | Buzzer | OFF, ON (ON) | - | |
| P | Proportional band | 0.0 to 100.0 (2.0) | °C | |
| I | Integral time | 0 to 3600 (15) | Sec | Proportional band [P]: Over 000.1 |
| d | Differential time | 0 to 3600 (10) | Sec | |
| t | Control cycle | 1 to 120 (2) | Sec | |
| HYS | Hysteresis | 0.1 to 100.0 (2.0) | °C | Proportional band [P]: 000.0 |
| rESt | Manual reset | 0.0 to 100.0 (50.0) | % | Proportional band [P]: Over 000.1 Integral time [I]: 0000 |

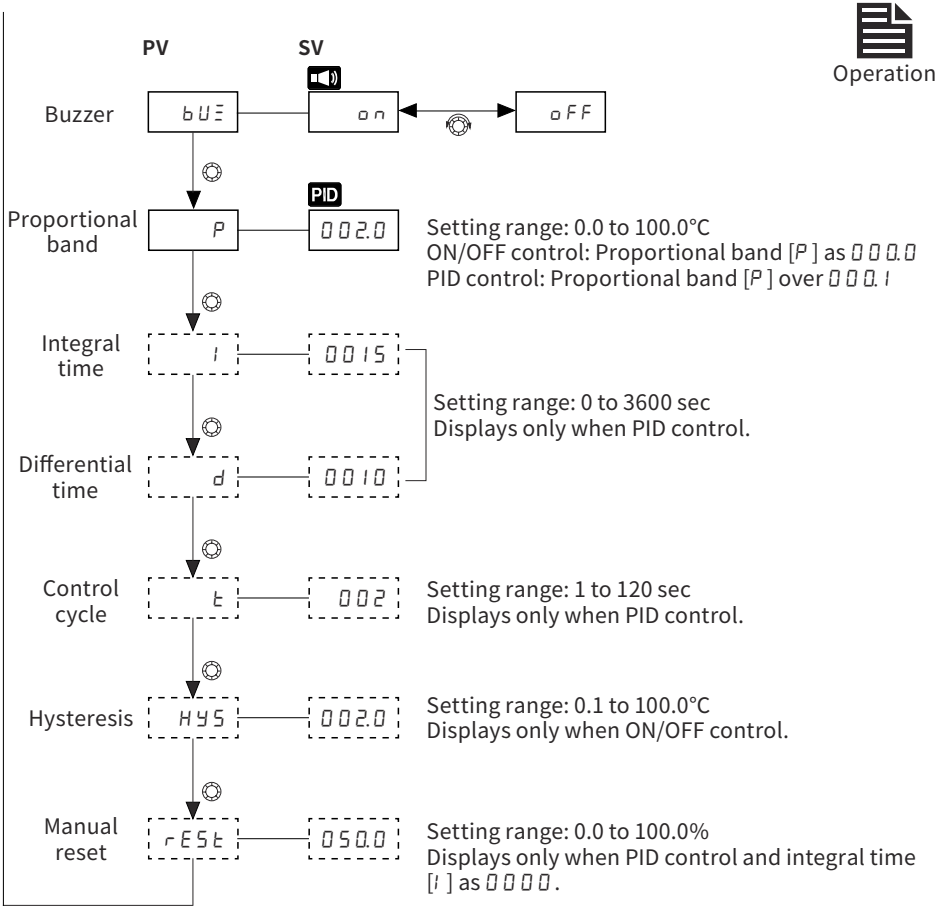
## SETUP Setting Group

Operation

: This is the action of pushing the jog switch once.
Save settings and move parameters.

: This is the action of turning a jog switch. Change the settings.






* Press the SETUP key once during operation to check the parameter values of the SETUP setting group. (Settings cannot be changed)

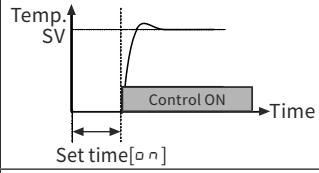
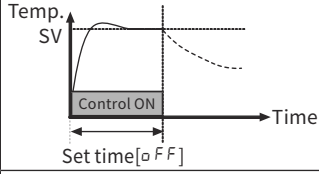
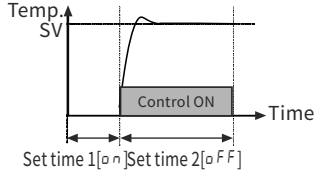
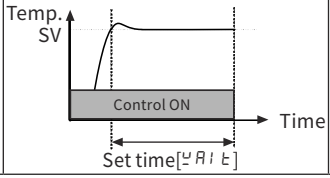
* Press the SETUP key once anywhere to return to operation mode.

* If no key is pressed for 30 seconds after entering the SETUP setting group, the device will automatically return to operation mode with the existing settings.

## (7) How to set the timer

Operation pattern of each timer mode

Operation

| Mode | Operation | Description |
|---|---|---|
| ① ON timer [t--1] |  | ON time [on] proceeds simultaneously with the operation start signal.<br>Control turns OFF during ON time [on].<br>Control is turned ON after ON time [on]. |
| ② OFF timer [t--2] |  | OFF time [oFF] proceeds simultaneously with the operation start signal.<br>Control turns ON during OFF time [oFF].<br>After the OFF time, the control is turned OFF [oFF]. |
| ③ ON/OFF timer [t--3] |  | ON time [on] proceeds at the same time as operation start signal and control is turned OFF.<br>After the ON time [on] , the OFF time [oFF] proceeds and the control is turned ON.<br>After the OFF time [oFF], the control is turned OFF. |
| ④ SV timer [t--4] |  | It starts control simultaneously with the operation start signal.<br>When the current temperature (PV) is higher than the set temperature (SV), the control output is maintained for the set time [WAIt] and then the control is turned OFF. |

- The settable time for operating modes ① to ④ is 00:00 to 99:59 (hours: minutes).
- While the timer is operating, the icons ① to ④ displayed on the LCD will flash at 0.5 second intervals.
- The “SV” cannot be changed while the timer is running. Please interrupt operation and reset.
- If you want to check the “SV” while the timer is running, turn the jog switch. It will be displayed blinking for 2.5 seconds on the SV display.
- If the operation sound is set to ON, it will sound once when the timer operation finished.
- If you change operation mode ① to ④ to another mode, the setting time (ON, OFF, WAIT) will be initialized.
- Program functions cannot be set while the timer is in use.

## ◆How to select Timer Mode from SETUP group

Operation

START/STOP

STOP Be sure to do this while stopped.

SETUP

Push Once Enter to SET UP Setting group. ALM is indicated

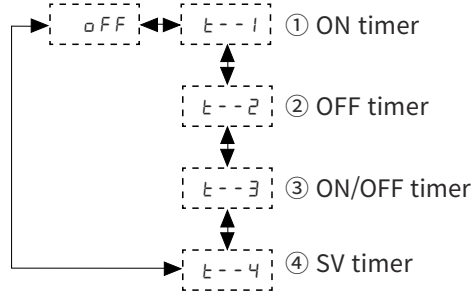
Push the jog dial the following number of times.
- When alarm is OFF: 2 times
- When alarm is ON : 4 times

PV

ST-T

After displaying "ST-T", turn the jog switch to select from the four timer modes.

SV




The timer mode selection is confirm by pushing the jog switch.

SETUP

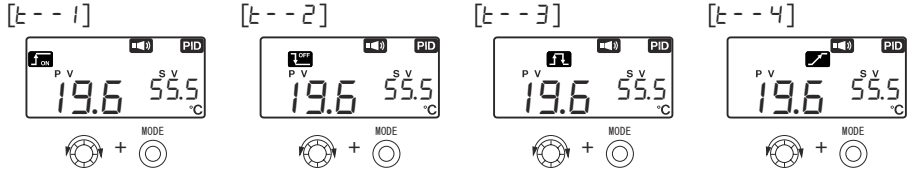
Push Once Exit from SETUP settings group.

Timer

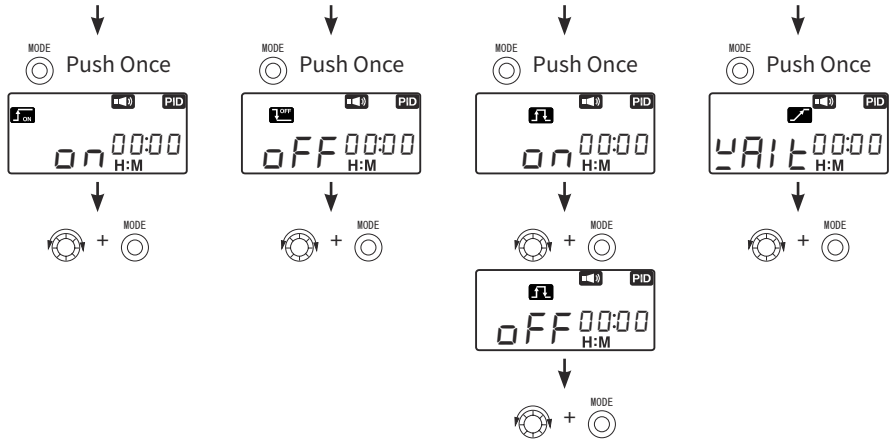
## ◆Setting the Set Point Variable (SV) and Operation Time

Operation

These inputs must be made after you have selected the timer mode in the SETUP setting group.




Enter SV with the jog switch (rotation) and MODE key (digit selection).
(See page 16 for input method.)
After completing the input, press the jog switch once to confirm the SV.

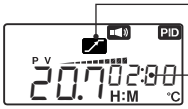



Enter Timer Operation time with the jog switch (rotation) and MODE key (digit selection).
(This is the same setting method as SV. Please refer to page 16.)
After completing the input, press the jog switch once to confirm the Timer Operation time .

START/
STOP
Push for 3sec

Start Timer Operation

## ◆Checking Operating Status in Timer Mode




Icon “Timer Mode”

1 out of 4 is displayed

The remaining time is displayed


When you rotate the jog switch, SV is displayed for 2.5 sec.



When you push the MODE key, the cumulative operating time is displayed for 2.5 sec.

If the operation sound is set to ON, an alarm sounds once when SV is reached.

Three timer modes "②OFF" "③ON/OFF" "④SV" The operation stop automatically after the end of them, but the power remains on and the agitation pump continues to rotate. So please turn off the power manually.

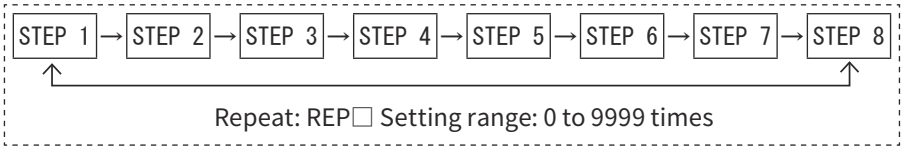
# (8) Program Temperature Control (TMK-2A-F/I)

Operation

## ◆What is Program Temperature Control?

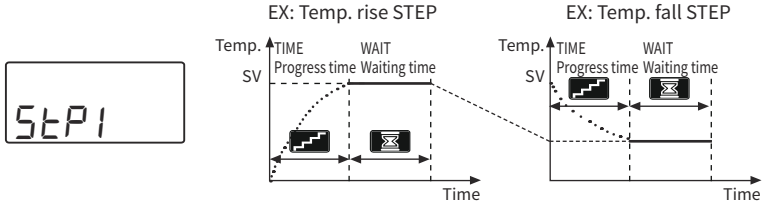
This is a function that allows SV to change over time.

Thermax (TMk-2A-F/I) program configuration




## ◆Contents of program temperature control

① STEP Control value setting




### 3 conditions for STEP settings

[Sυ□] Set Point Variable (SV)

Set the target temperature (setting range: -20.0 to 80.0 °C) for that step.

[tIm□] Progress time Display during setting : TIME Driving icon

Set the time※ to change the temperature
(range: 00:00 to 99:59 (hour: min)) from the previous step.

[WAt□] Waiting time Display during setting: WAIT Driving icon

Set the time※ for which the temperature must be maintained after it has finished rising or falling.

※Setting range: 00:00 to 99:59 (hour: min)) from the previous step.

② Program STEP Number setting

If you do not use all 8 STEPs, set the progress "TIME" to 0:00 for the next STEP after the last STEP.

Ex : When changing all STEP (1 to 8) control to only STEP 1 to 3 control

1 to 8 STEP control

| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ |
|---|---|---|---|---|---|---|---|---|
| SV(°C) | 080.0 | 075.0 | 040.0 | 080.0 | 070.0 | 045.0 | 055.0 | 060.0 |
| TIME | 00:40 | 00:20 | 00:40 | 01:00 | 00:20 | 00:40 | 00:30 | 00:20 |
| WAIT | 01:20 | 01:40 | 02:00 | 01:40 | 00:40 | 01:40 | 02:00 | 01:40 |

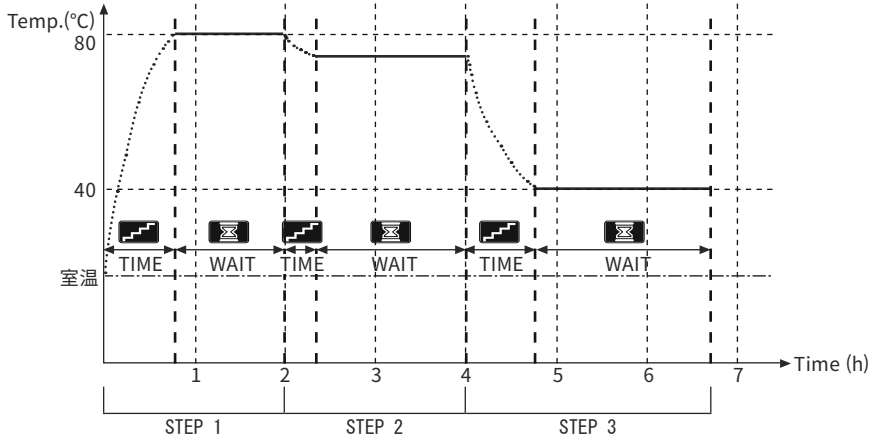
1 to 3 STEP control

| | | | | ~~④~~ | ~~⑤~~ | ~~⑥~~ | ~~⑦~~ | ~~⑧~~ |
|---|---|---|---|---|---|---|---|---|
| SV(°C) | 080.0 | 075.0 | 040.0 | ~~080.0~~ | ~~070.0~~ | ~~045.0~~ | ~~055.0~~ | ~~060.0~~ |
| TIME | 00:40 | 00:20 | 00:40 | 01:00 | ~~00:20~~ | ~~00:40~~ | ~~00:30~~ | ~~00:20~~ |
| WAIT | 01:20 | 01:40 | 02:00 | ~~01:40~~ | ~~00:40~~ | ~~01:40~~ | ~~02:00~~ | ~~01:40~~ |

Controlled Step

If TIME in ④ is set to 00:00,
Steps 4 to 8 are not controlled.

Control image of the above 3 STEPs




③ Repeat Program setting

After setting STEP 1 to 8 for each program, [ rEP1 ] will be displayed.

You can set the number of times you want to repeat the same program.
The range is 0 to 9999.

④ Number of programs that can be set and saved

[ PrG1 ] to [ PrG9 ] You can set and save up to 9 different programs.

## ◆How to set up Program Temperature Control

### ① How to select program mode from SETUP group

START/STOP

STOP Be sure to do this while stopped.

↓

SETUP

Push Once Enter to SET UP Setting group. ALM is indicated

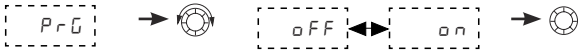
↓

Push the jog dial the following number of times.

- When alarm is OFF: 3 times
- When alarm is ON : 5 times

↓

PV SV




After displaying "PRG", turn the jog switch to select "ON", and push it to confirm the setting, and an icon indicating program control use is be displayed on the LCD.


When PRG is turned ON, the previous "ST-T" (Timer Setting) will disappear and timer operation and control will be blocked.
The number of times you have to press the jog switch to display PRG is one less time.

↓

SETUP

Push Once Exit from SETUP settings group.

↓

After completing the settings, you can operate the program mode.

② How to set program mode contents

Operation

PROGRAM

Push Once — PrG1 Program number display

The program number will display the same one as the last time you exited.

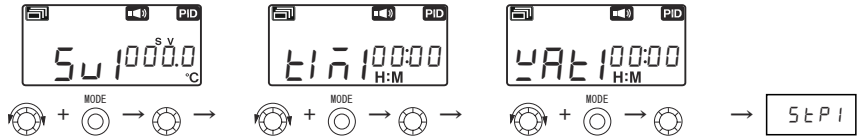
Turn the jog switch — PrG1 to PrG9 Select from programs 1 to 9

After selecting the program, press the jog switch.
StP1 is indicated.

StP1 to StP8 Select from STEP 1 to 8.

rEP1 Set the number of program repetitions.
(Setting range: 0 to 9999)

After selecting STEP, push the jog switch.




Enter SV with the jog switch (rotation) and MODE key (digit selection).

- See page 16 for input method
- See page 25 for setting range.

Enter the "Progress Time" and "Waiting Time" for each STEP using the jog switch (rotation) and MODE key (digit selection).

- See page 16 for input method (Same as SV setting method)
- See page 25 for setting range.

After completing the input, press the jog switch to move to the next display.
The order is STEP□→ TIME□→ WAIT□→ (return) STEP□

StP2 ...

PROGRAM

After completing the necessary STEP settings for each program, press the program key to exit.

## ◆Starting Program Mode Operation

### ① Selecting the Program to Run

Only one program can be controlled at a time. We will explain how to select and confirm them.

PROGRAM

Push Once to enter program mode.

`PrG1` Program number

↓

Select by rotating the jog switch

`PrG1` to `PrG9` Select program 1 to 9.

> ⚠ The program number displayed here is the one that will actually be operated.
> Please be careful not to make any mistakes.

↓

PROGRAM

Push Once — After confirming that the program you want to run is displayed, press the program key to exit.

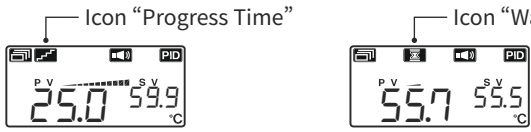
### ② Start program operation

START/STOP

Push for 3sec → Start Program Operation

## ◆ Checking Operating Status in Program Mode

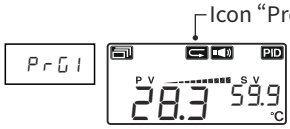
Operation




Program mode progresses by repeating “TIME + WAIT = STEP”.
The icon flash at 0.5 second intervals.


When you rotate the jog switch, the running STEP number is displayed for 2.5secs.


When you push the MODE key, the cumulative operating time is displayed for 2.5secs.




The icon is displayed in this position whenever you set a program repetitions.

If the operation sound is set to set to ON, alarms sound as shown below.

- At the end of STEP: 1 alarm
- Program completion: 5 alarms

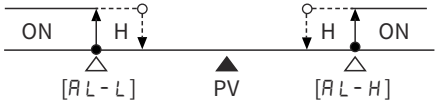
> Program Mode Operation stop automatically after the end of them, but the power remains on and the agitation pump continues to rotate. So please turn off the power manually.

# ◆SETUP Group Function

Operation

## ■ Alarm [AL1]

Alarm function is available. Alarm [AL1] setting as on when an alarm is used, and set to oFF when an alarm is not used.
When setting as on, the icon displays.
Set alarm high-limit [AL-H] and alarm low-limit [AL-L].




●: ON, ○: OFF
H: Alarm hysteresis (fixed 2°C)

When an alarm operates, the control output is turned OFF, the buzzer is ON regardless of the buzzer [buZ] setting and the icon flashes every 0.5 second.

## ■ Temperature correction [Ad]

It compensates the errors generated by internal/external temperature sensors.
When setting the correction value, the icon displays.(when setting value is 0.0, it does not appear.)
When the present temperature (PV) is out of display temperature range, it displays HHHH or LLLL regardless of the temperature correction setting.

## ■ Auto-tuning [At]

It measures the thermal characteristics and thermal response speed of various control objects, calculates the PID time constant required for optimal control, and sets the value to achieve fast response characteristics and high stability.
When auto-tuning [At] is set as on, the icon PID flashes every 0.5 second and auto-tuning is executed. When auto-tuning ends (normally or forcedly), the icon PID does not flash and the operation stops and at the same time, the set value of auto-tuning [At] is automatically changed to oFF.

- In case of ON/OFF control, auto-tuning [At] does not appear.
- Auto-tuning [At] can be executed (set to ON) only in the operation stop state.
- During auto-tuning, even if the current temperature (PV) is over/under the display range, auto-tuning continues.
- During auto-tuning, other parameters except auto-tuning [At] cannot be set.
- When auto-tuning is forcedly terminated, set auto-tuning [At] as oFF.
  [P, I , d] setting values before auto-tuning are maintained.
- If a sensor disconnection error [oPEn]occurs during auto-tuning, auto-tuning is forcibly terminated.
  [P, I , d] setting values before auto-tuning are maintained.
- If the power of the main unit is turned off and then turned on while auto-tuning is running, auto-tuning is terminated.
- [P, I , d] value calculated by auto-tuning can be changed/set by the user after auto-tuning is finished.
- In the case of difficult control conditions, auto-tuning may take a long time, so be careful.

## ■ Accumulated operation time display [ot]

This parameter displays the total operating time of the product in units of 1 hour. It cannot be set, and the operation stop time is not integrated.

## ■ Buzzer [bUZ]

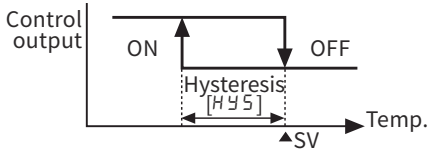
Set buzzer ON/OFF. When buzzer [bUZ] is set on, icon displays.
Buzzer sound is generated in the following cases.

- When pressing the front key and jog switch (except for jog switch rotation)
- When the timer action progress time is complete
- When the step progress time of the program operation is completed
- When the present temperature (PV) reaches the setting temperature (SV) ±0.5℃ during operation

## ■ Hysteresis [HYS]

Set the ON/OFF interval of control output in ON/OFF control.

- If the control sensitivity is too narrow, hunting (oscillation, chattering) may occur in the control output due to external noise.
- In the case of ON/OFF control, hunting occurs at regular intervals even when the control is stable. The cause of this hunting is caused by a combination of the value set in the control sensitivity [HYS], the response characteristics of the control object, and the location of the sensor.
  In order to minimize this hunting width, set the control sensitivity considering the appropriate control sensitivity [HYS], the capacity and thermal characteristics of the heater, and the response and location of the sensor.



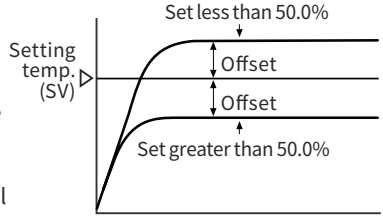

## ■ Manual reset [rESt]

When used in proportional control (P/PD control), a certain amount of deviation generally occurs even when the control is stable because the rise time and fall time of the heater are different depending on the heat capacity and heater capacity of the control target. This deviation is called OFFSET and can be set/corrected with manual reset [rESt].

- Setting method
  When the present temperature (PV) and the setting temperature (SV) are the same, the manual reset set value is 50.0%, and after the control is stabilized, if the current temperature (PV) is lower than the setting temperature (SV), set the set value to exceed 50.0%, and vice versa. If the present temperature (PV) is higher than the setting temperature (SV), set the set value to less than 50.0%.

※It can be set only in case of proportional control (P/PD control). Manual reset [rESt] appears only when integral time [I ] is set as 0000.

· Manual reset [rESt] adjustment method according to control result



## ◆ Key Lock (SETUP key for 3 sec)

Lock the front key and jog switch. Unintentional change of settings can be prevented in advance.

Lock/Unlock the key by pressing the SETUP key for more than 3 seconds in the operation stop state.

- [LoCK]: The keys and jog switch on the front panel cannot be used.
  (Excluding SETUP key and START/STOP key operation)
- [FrEE]: All keys and jog switches on the front panel can be used.

## ◆ Total Operating Time

Pressing the MODE key once in operation mode, the icon TOTAL flashes every 0.5 second and the accumulated total operation time is displayed for 3 seconds.
Only operation time is integrated, stop time is not.
When the power is re-applied, the accumulated operation time is initialized.
In case of timer operation, only the operation time of the control section is integrated, and in case of program control, the time from start to finish (including repetition) of the set program is integrated.

- Display range: 00:00 to 99:59 (hour:minute)
  (Fixed display at 99:59 (hour:minute) after exceeding the display range)

## ◆ Notice of Reaching the Setting Temperature (SV)

When buzzer [buZ] of the SETUP group is set to on when the current temperature (PV) reaches the set temperature (SV)±0.5°C during operation, buzzer sound occurs once.
Operates only during normal control and timer operation. (except program control)
In the case of a restart after shutdown or a set temperature (SV) reset, the notice buzzer is reapplied.

## ◆ Water Level Detection (TMK-2A-F/I)

TMK-2A-F has a swim bladder at the bottom of the product, and when the water level falls below a certain level, the control output is automatically turned off and an alarm sounds. (Regardless of the buzzer [buZ] setting in the SETUP group)
When the water level returns, the alarm stops and normal operation resumes.

## ◆ LBA Monitoring Error

The control loop is monitored through the temperature change of the controlled object and the LBA error message [LbA] is displayed.
During operation (output 100%) loop disconnection alarm If the current temperature (PV) does not rise above the LBA detection band (2°C) during the monitoring time (900 seconds), it is judged that there is an error in the loop.
The LBA error message [LbA]is displayed on the front display every 0.5 second and an alarm sounds. (Regardless of the buzzer [buZ] setting in the SETUP group
When the operation is stopped, the LBA error message[LbA] and alarm sound are canceled.
Recheck the connection of the product.

- In [HHHH/LLLL/oPEn] error state, LBA monitoring does not operate.

## <Error Display>

When an error occurs, the message displays and buzzer sounds.
(Regardless of buzzer[bUZ] setting of SETUP group)

| Message | Cause | Troubleshooting |
|---|---|---|
| HHHH | If the present temperature (PV) is higher than the display range, the PV display flashes every 0.5 second. | Automatically released when the current temperature (PV) is within the display range. |
| LLLL | If the present temperature (PV) is lower than the display range, the PV display display flashes every 0.5 second. | Automatically released when the current temperature (PV) is within the display range. |
| oPEn | If the input is disconnected or the sensor is not connected, the PV display flashes every 0.5 second. | Contact your dealer for repair. |
| LbA | During operation (output 100%), if the present temperature (PV) does not rise/fall more than the LBA detection band (2 °C) within the loop break alarm monitoring time (900 seconds), the PV display flashes every 0.5 second. | If the amount of water is too much, reduce the amount of liquid. |
| CAL | A problem has occurred inside the main unit. Normal driving is impossible. | Body inspection is required. Please inquire at the place of purchase. |
| Err | In timer mode, if the set time is 00:00, the PV flashes every 0.5 second. | Set the setting time to 00:00 or higher. |

## <Activated Safety Device>

### ■ Bimetal switch

It works when the main body is not sufficiently cooled, or when an empty water bath is heated without water. Customer recovery is difficult. Request a repair.

### ■ Circuit protector operation

When overcurrent is detected, the power supply to the main body is cut off for safety.
The switch can be released manually, but since it is difficult to identify the cause, it is recommended to request repair/inspection.

## ＜Maintenance Inspection and Management＞

Be sure to remove the power plug from the outlet before performing maintenance, inspection and maintenance.

### ■Everyday Care

- If there is dirt or garbage on the stirring pump part, remove it with tweezers, etc.
- Wipe any stains on the body with a soft, dry towel.
- For stubborn stains, apply a little neutral detergent and wipe.
- Do not use liquid, solvents such as benzene, cleaning agents, or hot water. (The surface of the body may be discolored or damaged, and the rubber or plastic part may be discolored or deteriorated.)
- When using a neutral detergent, be sure to wipe clean with a dry towel.
- Always store the product in dry conditions.
- Never spray water on the main body. (Especially, if water touches the front part, there is a risk of performance degradation.)
- Please note that incorrect care methods may not only damage the product, but also cause malfunction.
- If not using for a long period of time, unplug the power plug and store in a dry place.
- The heater is a consumable and may require replacement. This applies to cases where the temperature does not rise due to a disconnection of the heater. If you need to replace the heater, please contact the dealer.

- Never disassemble, repair or modify this product.
  It may cause electric shock, fire or injury due to abnormal operation.

# ＜After-sales Service＞

## ■When requesting repairs

If you think the product is malfunctioning, read the troubleshooting section carefully and check again. If there is still an abnormality, discontinue use, unplug the power plug, and consult with the store where you purchased the product.

# ＜Troubleshooting＞

## ■If you think there is a problem

Before requesting repairs, check the following.

| Status | Check and Action |
|---|---|
| Power does not turn on. | • Check power outages, breakers, etc., and make sure there is electricity at the power outlet.<br>• Make sure the power plug is firmly connected to the outlet.<br>• Check if the main unit's power switch is turned on. |
| Temperature cannot be set. | • Make sure it is key-locked.<br>• Check whether the timer function or program function is operating.<br>• Temperature cannot be set during auto-tuning. Check if auto-tuning is running. |
| Temperature control is not good. | • Press the START/STOP key for more than 3 seconds to run the operation.<br>• If an error indication appears on the LCD display, check the problem according to the type of error. See Error Display.<br>• Make sure each setting is appropriate.<br>• If the displayed value is different from the thermometer you have, check if the temperature correction [AD] value is correct.<br>• Check if there is a device that generates strong high-frequency noise around the product.<br>• Factory default for temperature control is PID control. ([P] =2, [I] =15, [D] =10) Set the PID value suitable for the purpose of use or use the auto-tuning function.<br>• Check the characteristics of the control target according to the specifications of this product.<br>• Check that there are no fluctuations in the water level (liquid volume).<br>• Check if the liquid volume and agitation conditions in the bath are appropriate.<br>• Check if the operating environment conditions are appropriate. (Severe temperature difference, etc.)<br>• If none of the above apply, check the heater for a disconnection. |

| Status | Check and Action |
|---|---|
| Timer operation cannot be performed. | • Check if the timer [ST-T] of SETUP group is set correctly. (The timer does not operate when the program setting [PRG] is ON.)<br>• Check if auto-tuning is running.<br>• Check if the time setting is appropriate. (Minimum setting unit: 1 minute) |
| Program operation cannot be performed. (TMK-2A-F) | • Check that the program setting [PRG] of SETUP group is set correctly. (If timer [ST-T] is T--□, program setting does not work.)<br>• Check if auto-tuning is running.<br>• Check that each setting value of the program is set correctly. |
| Auto tuning cannot be performed. | • During ON/OFF control, the auto-tuning function cannot be used.<br>• Check that auto-tuning [AT] of SETUP group is set as ON.<br>• Check the characteristics of the control target according to the specifications of this product. |

■If the malfunction is not corrected even after taking the above measures,stop using the product, turn off the power, and contact the dealer.
For the safety of repair workers, if there is contamination that may harm the human body, such as biological samples or radio active materials,please contact the dealer.

## ＜Frequently Asked Questions＞

**Q1.** The LBA error is displayed and the temperature hardly rises.

**A1.** For example, when the water temperature is 25°C (PV) and the target is 37°C (SV), and there is a difference between PV and SV, the heater output becomes 100%. If the water temperature does not rise by 2°C after 15 minutes (900 seconds) in that state, an error occurs.

- Check that the setting is not set to OFF.
- Is the quantity of water appropriate? When there is too much, it does not rise more than 2 degrees Celsius. Please reduce the water.

**Q2.** If it is a non-attached water bath, how many liters can it be used for?

**A2.** It is difficult to tell you in general, but it's about 10 liters.

**Q3.** Can the power (or heater output) be turned ON by external input?

**A3.** Impossible. It doesn't work even when communicating with the PC.

**Q4.** Is it explosion-proof?

**A4.** It is not an explosion-proof specification.

**Q5.** Please give me a detailed drawing (because I want to put it in the device)

**A5.** We are sorry, but we can not reveal it.

**Q6.** Beep-beep-beep, short, continuous sounds. Display is normal.

**A6.** The water level sensor is detecting water shortage. The occasional short duration is because the float is floating and sinking.

**Q7.**The building's circuit breaker went out.

**A7.** Since the current consumption of this product is relatively large, check the maximum capacity of the used outlet . There is a possibility of a short circuit due to wet or condensation※ on the main unit. Request a repair.

※This is internal condensation, but it occurs when the inside is not kept dry by fan blowing, such as when used in a high-temperature environment close to airtight or wrapped around the main unit.

## Reference：Separately sold Bath recommended by AS ONE

### Large capacity Tank

- HSS-01 (1-7549-01)
  Stainless steel Bath, square type,
  22 L, No cover

Dimensions
External (mm)：330×575×165
Internal (mm)：310×530×155

- HSS-02 (1-7549-02)
  Stainless steel Bath, square type,
  22 L, With cover

Dimensions
External (mm)：370×600×180
Internal (mm)：310×530×155

The maximum operating temperature is approximately 70°C.
(Conditions: indoors, without lid, using water)

### High temperature Tank

- SKOB-01(1-4312-01)
  Stainless steel Bath, square type,
  10 L, With cover, with Handle

Dimensions
External (mm)：390×253×175
Internal (mm)：335×198×155

- SKOB-02(1-4312-02)
  Stainless steel Bath, square type,
  10 L, With cover, no Handle

Dimensions
External (mm)：413×256×197
Internal (mm)：335×198×155

The maximum operating temperature is approximately 250°C.
No insulation material is used, instead air insulation is used.
The inner water tank is removable for easy drainage.

Contact Us

AXEL GLOBAL
https://www.axel-gl.com/en/

The latest product information is available on our website.

TMK-1A-F
(1-4594-31-90)

TMK-1A-I
(1-4594-31-91)

TMK-2A-F
(1-4594-32 -90)

TMK-2A-I
(1-4594-32-91)



## CONTACT INFORMATION

Corporate Headquarters :
AS ONE Corporation International Group
2- 1- 27, Edobori, Nishi - ku
Osaka 550 - 8527
Japan
Tel : 81 - 6- 6447 8631
Fax : 81- 6- 6447 8681
E- mail: intl-sales@so.as-1.co.jp

AS ONE CORPORATION
TCD230019AA
Made in Japan
1st edition, Feb 2024