HEC-OM-P008
2011 Oct.

Operation Manual

PRODUCT NAME

Thermo Electric Bath

MODEL / Series / Product Number

INR-244-757

SMC Corporation

To the customers

Thank you for purchasing our Thermo Electric Bath (hereinafter called “product”).SMC always strives to provide the highest quality and high-performance temperature control devices to our customers by utilizing our original technology.
For the long-term and safe use of this product, be sure to read and understand this Operating Manual (hereinafter called “this manual”) thoroughly before use. Also, keep this manual available whenever necessary.
The contents of this manual may be changed for the improvement of the customer service.

1) When the product is received, check the contents of the package immediately.

Packaging content

	Item	Qty.
1	Thermo Electric Bath	1 pc
2	Power supply cable	1 pc
3	Drain tube (with CPC fitting)	1 pc

2) Observe the warnings and precautions defined in this manual.
3) This manual provides explanations of the installation and operation of this product. Only those who have a thorough understanding of the operating procedures and who have basic knowledge and skills in handling industrial equipment are qualified to perform installation and operation.
4) The contents of this manual and the related documents supplied with this product shall be neither regarded as a provision of the contract nor utilized to correct or modify the existing agreements, commitments and relations.
5) Copying, duplicating or transferring any part or the entirety of this manual without the prior permission of SMC is strictly prohibited.
6) The product is designed for use of industrial applications and research facilities of science. When it is used for applications that require the consideration additional safety precautions, e.g., for medical devices, investigate the safety needs for the application at the customer’s site before use.

Table of Contents

Chapter 1 Safety Instructions

Be sure to thoroughly read and understand the important precautions defined in this manual before using this product.

1.1 Dangers, Warnings, and Cautions Used in This Manual

1.1.1 Hazard Levels

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.”
DANGER, WARNING and CAUTION signs follow this order according to hazard severity (DANGER > WARNING > CAUTION).
They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1) , and other safety regulations.
*1) IEC 60204-1: Safety of machinery -- Electrical equipment of machines
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots -Safety.
etc.

⚠ DANGER

"DANGER" denotes that there is an imminent hazard which will cause serious personal injury or death during operation.

⚠ WARNING

"WARNING" indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ CAUTION

"CAUTION" indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

CAUTION

"CAUTION" without an exclamation point denotes that there is a hazard which may cause damage to or the failure of the system, facility, or devices.

[Tips]

Tips are provided when there is information and content that personnel are required to be aware of and refer to for product operation and maintenance of this product.

1.1.2 Definitions of “Serious injury” and “Minor injury”

- **“Serious injury”**

  This term describes injuries such as the loss of eyesight, wounds, burns, frostbite, electric shock, fractures, and toxicity that leave aftereffects, and/or injury requiring hospitalization and/or a prolonged stay in a hospital.

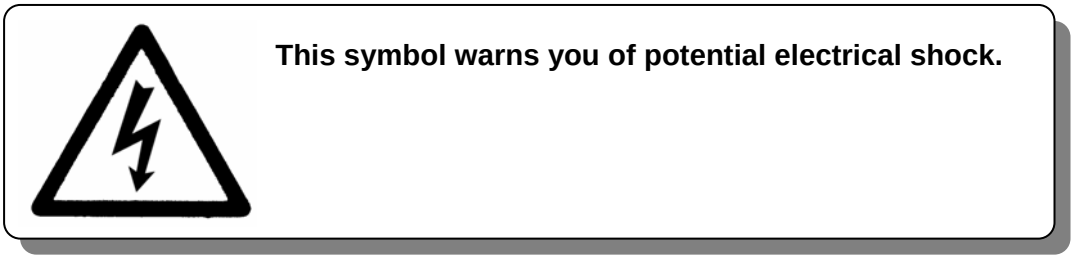
- **“Minor injury”**

  This term describes injuries that do not require hospitalization or a prolonged stay in a hospital (injuries other than the “serious injuries” described above).

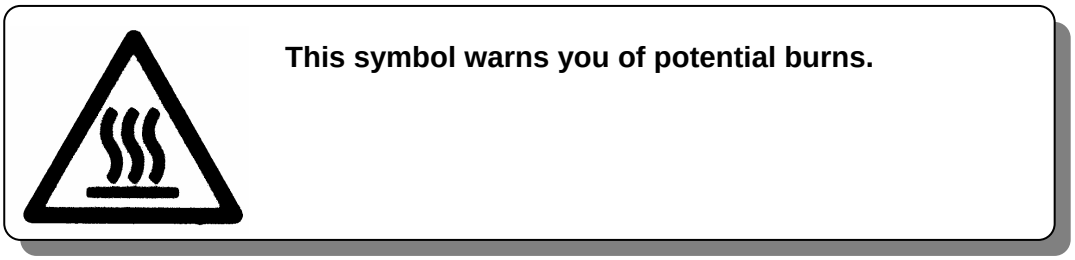
1.1.3 Symbols

This manual provides the following symbols in addition to “Danger”, “Warning”, and “Caution” to present warning details in an easy-to-understand manner.

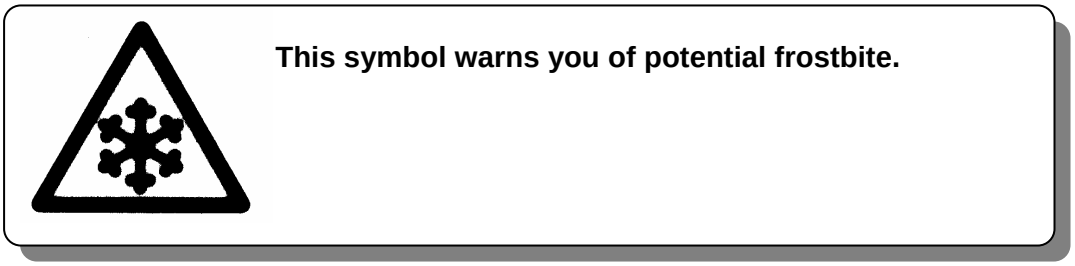
- **Symbol of electrical hazard**



- **Symbol of heat hazard**



- **Symbol of low temperature hazard**



■ Symbol for corrosion

This symbol warns of chemical corrosion. When handling chemical fluids, read the MSDS carefully and use appropriate protective equipment.

■ Symbol for inhalation

This symbol warns of chemical inhalation. When handling chemical fluids, read the MSDS carefully and use appropriate protective equipment.

■ “Don’t” Symbol

This symbol denotes actions which you must not perform in the operation of this product.

■ “Do” Symbol

This symbol denotes actions which you must perform and items you must observe in the operation of this product.

1.2 Warning labels and Caution label

Warning label and Caution label are applied to the sections of this product in which potential hazards are present during system operation and maintenance. Warning label and Caution label are presented in sizes and colors that will get the attention of the worker. They contain symbols in addition to the descriptions of warnings.

⚠ CAUTION

- **Do not peel off or deface the Warning label and Caution label.**

⚠ CAUTION

- **Confirm the location of the Warning label and Caution label.**
- **Read the contents of the Warning label and Caution label carefully and keep them in mind.**
- **Users are NOT allowed to change the location of the Warning label and Caution label. If replacing a peeled off or worn out label, affix the new label to exactly the same location as the replaced label.**

1.2.1 Location of Warning label and Caution label

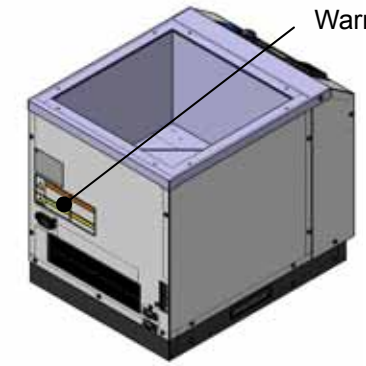


Fig 1-1 Position of Warning label and Caution label

Fig 1-2 Detail of Warning label and Caution label

1.3 Location of Model No. label

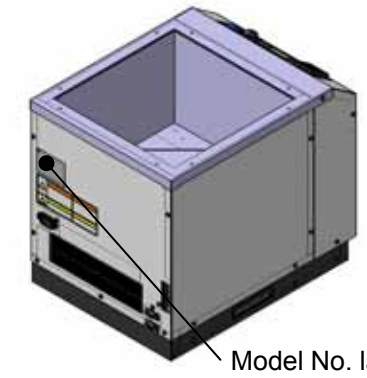


Fig 1-3 Position of Model No. label

Fig 1-4 Detail of Model No. label

1.4 Safety Measures

1.4.1 Precautions

This product is designed with consideration for safety. However, misuse or disregard of any contents in this manual may result in electrical shock or other accidents.

Be sure to keep the following instructions in mind to prevent accidents.

⚠ WARNING

- **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
  Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.
  The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.
  This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
- **Be sure that you understand how the chemical fluids use in this product affect the human body. Follow the MSDS when handling chemical fluids.**
- **Read the precautions described in this manual carefully and keep them strictly.**
- **Stop operation immediately after any abnormal occurrence.**
  If an abnormality (noise, odor, smoke, water leakage, etc.) occurs, stop this product (cutoff the power supply).

Abnormal noise, odor, smoke or water leakage occurs; → **1) Cutoff power supply**
2) Request repair

⚠ WARNING

- **Do not disassemble or retrofit this product.**
  The internal parts of this product cannot be retrofitted by the user. Contact the sales distributor or branch for all repairs. The user must not perform any repairs. A product repaired by the user cannot be guaranteed and carries the danger of causing electrical shock and other accidents.

⚠ CAUTION

- **The product is provided for use in manufacturing industries.**
  The product herein described is basically provided for peaceful use in manufacturing industries.
  If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

CAUTION

- **Keep within the margin of safety in relation to cooling and heating capacity.**
- **When restarting the power supply, wait 3 sec or more after the indications on the display and operating panel disappear.**

1.4.2 Protective Equipment

⚠ CAUTION

- **Wear protective equipment in order to maintain safety when installing and/or handling the product.**
  When handling chemicals for the product especially, note the contents of the MSDS and wear protective goggles, gloves, and a mask.
- **Touching the bath liquid and internal face of the liquid bath may cause burns or frostbite depending on the temperature set for this product. Be sure to use heat (cold) resistant gloves when handling this product.**

Protective goggles | Mask | Gloves | Safety shoes

Fig 1-5 Protective equipment

1.4.3 Long-term Storage

CAUTION

- **Cutoff the power supply and completely remove the bath liquid from the liquid bath. Also, do not allow foreign matter to enter the inside of the bath.**

1.4.4 Disposing of Product

The product contains electric circuit and components. When you dispose the product, please follow your local laws and regulations regarding disposal of electronic waste.

1.5 Precaution for running (safety interlock)

The product equips following device to prevent unexpected dangerous situations.

Please remove the cause of the failure when you restart the product.

Table 1-1 Interlock list

No.	Content	Installation part	Cause	Status of product after interlock works
1	Circuit protector to detect over current	AC power input	Cut of all AC power	Temperature control is stopped. ALARM LED (red) lights up.
2	Overheat in heat exchanger	Heat exchanger	Detects overheat in heat exchanger.	
3	Overheat in heat sink	Heat sink	Detects overheat in heat sink.	
4	Low liquid bath level	Reservoir	Detects lowering of liquid bath level.	
5	Detection of breakage of temp. sensor	Controller	Detects breakage and short circuit of temp.sensor and cable.	

Chapter 2 Description and Function of Each Part

2.1 Description of Thermo Electric Bath

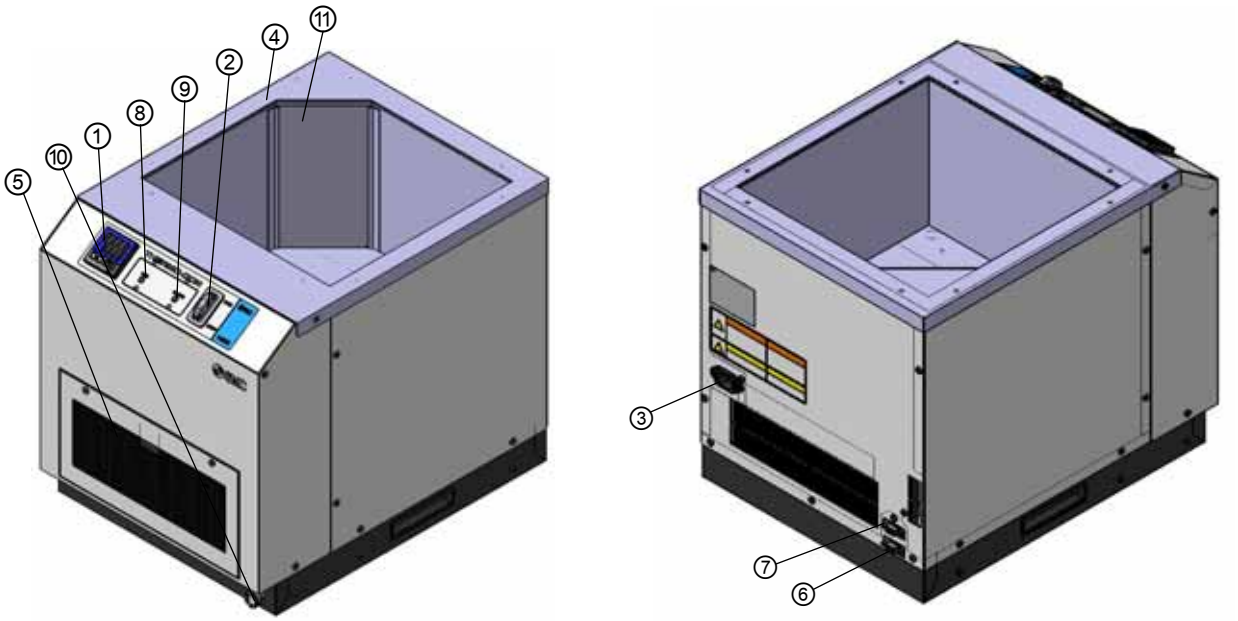


Fig 2-1 Thermo Electric Bath

Table 2-1 Thermo Electric Bath

No.	Description	Function
①	Operation and display panel	Various displays are shown and settings are input.
②	Circuit protector (Power switch)	Power ON/OFF switch with current protection.
③	Power supply connector (AC)	Connector for the single phase AC (AC100 to 240V) power supply. Refer to page 3-5 “3.3.2 Power Supply Cable and Connector”.
④	Liquid Bath	Vessel to store the liquid.
⑤	Air filter	Filter not to allow dust to enter easily inside.
⑥	Alarm output connector (ALARM)	Connector for the Alarm signal. The relay contact is opened when these alarms are output.
⑦	Communication connector (COMMUNICATION)	Connector for communication with RS-232C.
⑧	RUN LED (Green)	Lights up while the product is running.
⑨	ALARM LED (Red)	Lights up when an abnormality occurs. For details, refer to page 5-14 “5.2.1 Content of Alarms”, Table 5-3.
⑩	Drain Port	Drain the bath liquid. Refer to page 6-2 “6.1.1 Draining the Bath Liquid”.
⑪	Strainer (Perforated Metal Φ1)	Filtration of cicurated bath liquid.

2.2 Description of detail functions

The product controls the liquid temperature in the bath.

In addition to the main function, following functions are available to supplement the main temperature control function and the safe operation.

2.2.1 High/Low Temp. Alarm Function

This function generates an alarm when the measured temperature deviates from the set temperature by an amount outside of that defined as the high or low limit deviation. In that case, the **AL1** LED of the controller lights up and the alarm is generated via relay contact to a pin for the High/low Temp. alarm of the alarm output connector. After the measured temperature returns to within the high or low deviation, the alarm will be reset automatically. In its initial setting, the alarm comes on immediately after the power supply is turned on when the temperature at that time deviates from the set temperature by an amount outside of the high or low deviation limit.

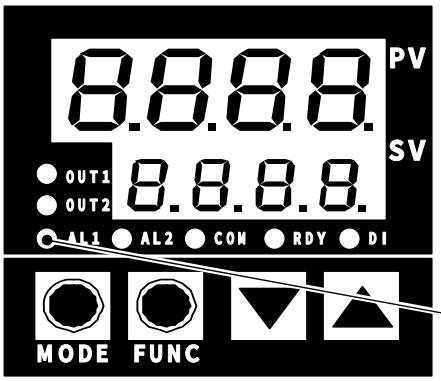


Fig 2-2 Operation and display panel

2.2.2 Offset Function

The temperature sensor can be calibrated by inputting offset (calibration value) between the temperatures of a standard thermometer and the temperature sensor in the product.

[Tips]

The Controller has already set the calibration value of 25deg.C independently by factory setting.

2.2.3 Set Value Memory (EEPROM back-up)

This function memorizes all set values input via the operation and display panel to nonvolatile memory EEPROM as back-up. Even if the power supply is turned off, the settings remain and do not need to be reset when the power supply is restarted.

CAUTION

- **Any set value input via the communication function is not stored. If they need to be stored, use a storage command.**
- **The overwrite limit is approx. 0.1 million times. If the setting is performed via the communication function, pay attention to how many times the overwrite has been done.**

2.2.4 Alarm Stop Function

The product stops operation when a serious abnormality occurs.

The ALARM LED lights up and the alarm signal is output via relay contact from the alarm output connector. The alarm can be reset by turnning ON/OFF the AC Power.

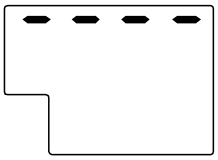
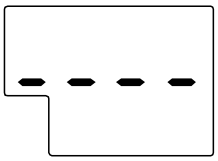
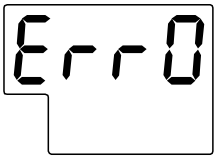
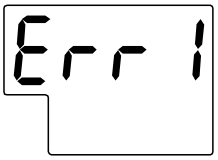
The alarm occurs typically caused by following case.

① Overheating of Liquid Tank (Thermostat is activated).
② Overheating of Heatsink (Thermostat is activated).
③ Lowering of Controller output voltage.
④ Lowering Bath Liquid level.

2.2.5 Controller Alarm

When an error in the controller occurs, the product stops operation and display following error code. The error can be reset by the AC power ON/OFF. In case it cannot be reset by the AC power ON/OFF, it must require the product repair.

Table 2-2 Indication of alarms on operation and display panel

Indicator	Content of alarm
	Shown when a temperature sensor is opened.
	Shown when a temperature sensor is short circuited.
	Shown when the Controller has a memory error.
	Shown when the Controller has an A/D conversion error.

2.2.6 Serial Communication Function

This product has a serial communication function conforming to communication protocol.

The contents of then serial communication on this product are as follows.

1) Setting and reading of target temperature

2) Reading of measured temperature

3) Setting and reading of offset value

4) Storage command of set value (Any set value input via the communication function is stored in the volatile memory. If they need to be stored in nonvolatile memory, use a storage request command.)

Chapter 3 Transporting and Installation

⚠ CAUTION

- **Proper procedure must be followed when using this product. Exercise caution to assure personal safety during the installation, transporting operation, maintenance, and inspection of the system.**
- **Only personnel with appropriate training should operate machinery and equipment.**

  The product specified here may become unsafe if handled incorrectly.
  The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

⚠ WARNING

- **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
  1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
  2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping,vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
  3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

3.1 Transporting

CAUTION

- **Avoid strong vibrations and impacts**
  This product is precision equipment and must not be subject to strong vibration and impact during transport.

3.2 Installation

3.2.1 Installation Conditions

The product is designed for indoor use.

⚠ CAUTION

- **Keep enough open space to access any AC power switch and cable connections.**
- **Keep enough ventilation for liquid vapor.**
- **This product should be installed on a vibration-free stable level place**
- **The mounting orientation of this product is horizontal.**
- **Place the product in a flat area which can handle its weight and take measures to prevent the tipping of the product. If installed improperly, the product might leak water or topple, resulting in injury.**

⚠ CAUTION

- **Do not use this product in the following environments, where the product may not work normally and may be damaged.**

- Environments containing splashing water, salt water, oil, or various chemicals (including chemical mists).
- Environments containing particles and dust.
- Environments containing corrosive gas, solvents and flammable gas.
- Environments containing direct sunlight and radiant heat.
- Environments having ambient temperatures over the following range:

  Operation 10 to 35 deg.C

  Storage 0 to 50 deg.C

  (with no liquid in the tank)
- Environments having ambient humidity over the following range:

  Operation 35 to 80%

  Storage 35 to 85%
- Environments with sharp temperature changes.
- Environments generating strong magnetic noise (having a strong electric or magnetic field that generates surges.)
- Environments generating electrical static discharge and conditions in which static electricity is applied to this product.
- Environments generating strong high frequency radiation (including radio frequency appliances such as mobile phones and transceivers).
- Environments generating strong vibrations and impacts.
- Environments that may be damaged by lightning.
- Altitude limit: 2000m

- Environments in which forces or gravity may deform the body of the product.
- Locating the cables of the product near the power lines of other machines.
- Conditions in which insufficient grounding for the power supply is provided
- Conditions that cause dew condensation.
- Environments containing harmful gases such as silicone.
- Places preventing the horizontal set-up of the product.

3.2.2 Installation in Clean Room

This product uses a fan and generates dust. When it is set up and operated in a clean room, take appropriate preliminary measures for dust.

3.2.3 Pollution Degree

The pollution degree is a classification from 1 to 4 degrees depending on the pollution present in the air. This product is suitable for environments with a pollution degree of 1 or 2.

Table 3-1 Thermo Electric Bath specifications

Degree 1	There is no pollution or only dry and nonconductive pollution occurs. An example of an environment of this degree is a clean room or a place using an air cleaner.
Degree 2	Normally, only nonconductive pollution occurs. The pollution may become conductive temporarily because of dew condensation. An example of an environment of this degree is a place where electric equipment can operate normally, such as a working office or a control panel.
Degree 3	Conductive pollution or dry and nonconductive pollution which can become conductive when dew condensation occurs. An example of an environment of this degree is a factory.
Degree 4	Conductive pollution that holds its conductivity due to conductive dust, rain or snow. An example of an environment of this degree is the outdoors.

CAUTION

This product can be used only in environments with a pollution degree of 1 or 2.

3.2.4 Ventilation requirement

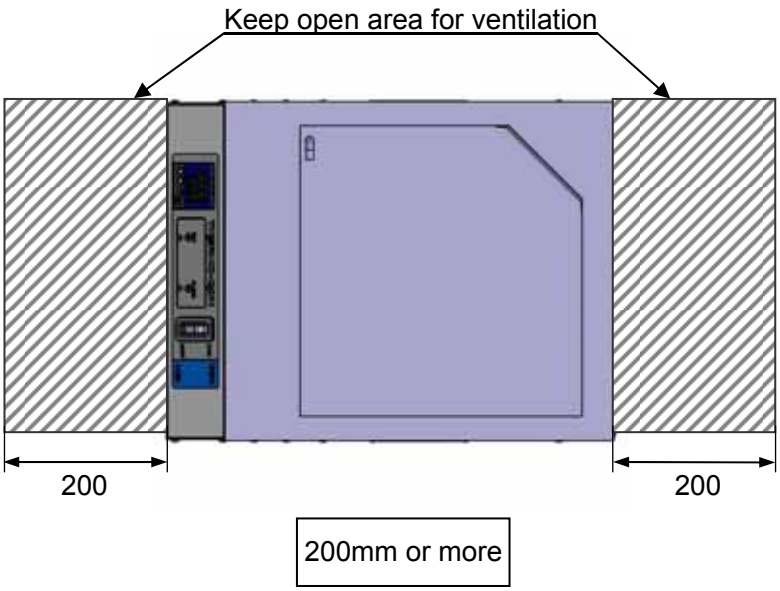
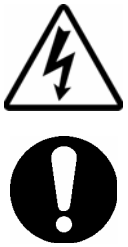


Fig3-1 Installation environment

3.3 Wiring

⚠ WARNING



- **Only qualified personal are allowed to install wiring.**
- **Be sure to turn OFF the power prior to wiring to assure safety. Do not do any wiring when the system is energized.**
- **The system wiring requires not only a through connection with the designated cable but also securing to prevent loose connection. Poor connection and securing may cause electric shock, heat spots, fire, or communication errors.**
- **Be sure to supply the power to this product according to the specification.**
- **Always establish a connection to a ground for safety.**
- **Be sure that no ground connection is made to a water pipe, gas pipe and lighting rod.**

3.3.1 Power Source Specification

Confirm that the power supply at your workplace has sufficient capacity and a voltage within that specified. It is recommended to install ground-fault circuit interrupter. Rated leakage current:30mA or less.

Table 3-2 Electrical specifications of power supply

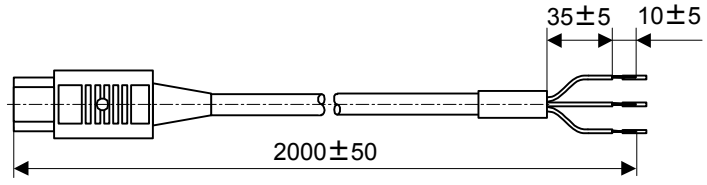
AC100-240V 50/60Hz 6A Single phase: 2-wire type + GND (PE) line

3.3.2 Power Supply Cable and Connector

The power supply shall be connected with attached power supply cable. Confirm the power supply at factory has enough capacity and the voltage is within specified value beforehand (with reference to electrical specifications of the power supply). This unit is provided with the power supply cable. The power supply cable shall be connected properly.

■ Power supply Cable

Table 3-3 Power Supply Cable



Content	
Black 1	AC100-240V (L)
Black 2	AC100-240V (N)
Green/Yellow	PE

■ Power supply connector

IEC60320 C-14 equivalent

Table3-4 Power supply connector

Pin No.	Content
N	AC 100-240V
L	AC 100-240V
E	PE

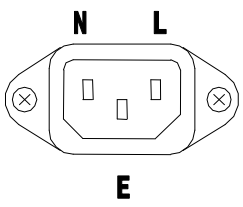


Fig3-2 Power supply connector

3.3.3 Grounding

⚠ WARNING

- **Be sure to provide protective ground. IEC protection class of the product is class I. Resistance for ground must be 100ohm or less. Grounding can be provided via the PE line of the power supply cable. For details of the power supply cable, refer to page 3-5, "3.3.2 Power Supply Cable and Connector". Do not use the same ground being used by equipment that generates strong electrical magnetic noise or high frequencies.**

3.3.4 Alarm output and Communication Connectors

The alarm output and the communication cables are not enclosed in the product. These cable shall be connected properly.

■ Alarm output connector

D-SUB 9pin (male)
Fixed screw: M2.6

Table3-5 Alarm output connector

Pin No.	Content
1	High/Low temp. alarm contact (opened for alarm)
2	High/Low temp. alarm common
3-4	Unused
5	Alarm output signal contact (opened for alarm)
6	Alarm output signal common
7-9	Unused

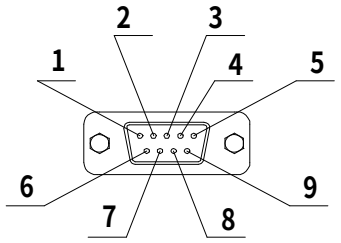


Fig3-3 Alarm output connector

Table3-6 Relay contact for alarm connector

Item	Specification
Output type	Relay contact output: Opened when an alarm occurs.
Contact rating	30VDC,2A (resistive load) 30VDC,1A (inductive load)
Minimum load	5VDC,10mA
Mechanical life	5 million cycles or more
Electrical life	0.2 million cycles or more

■ Communication connector

D-SUB 9pin (female)
Fixed screw: M2.6

Table3-7 Relay contact for alarm connector

Pin No.	Content
1	Unused
2	RS-232C SD
3	RS-232C RD
4	Unused
5	SG
6-9	Unused

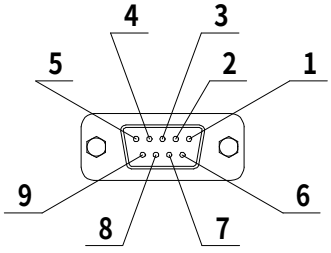


Fig3-4 Communication connector

3.4 Bath Liquid

3.4.1 Preparation of Bath Liquid

Refer the Table 3-8 for selecting bath liquid.

Table 3-8 Bath liquids

Bath fluid	Working Temp. Range	Remarks
Water	5 to 60 deg.C	Use distilled water or clean water based on reference of water quality. (Refer Table 3-10). Include Ethyleneglycol-water solution.
Ethyleneglycol-water solution	0 to 60 deg.C	Concentration of Ethyleneglycol must be lower than 40%

Table 3-9 Tank Capacity

Tank Capacity
17 Litter

CAUTION

- **Do not use tap water or hard water. Use of these water can cause the internal pump failure and the performance deterioration by generation of scale.**

CAUTION

- **High concentration EG can cause temperature control error or system failure.**
- **Attention should be taken on water quality. Ensure water quality is within specified range, and other foreign materials contaminate the bath liquid. Potential temperature control error, cooling error or system failure may occur if disregarded.**

Table 3-10 Reference of water quality

	Item	Standard value
Quality item	pH (25°C)	6.0 to 8.0
	Electric conductivity (25°C) (μs/cm)	100 to 300
	Chloride ion (mgCl-/L)	50 or less
	Sulphate ion ($mgSO_4^{2-}$/L)	50 or less
	Acid consumption (pH4.8) ($mgCaCO_3$/L)	50 or less
	Total hardness ($mgCaCO_3$/L)	70 or less
	Calcium hardness ($mgCaCO_3$/L)	50 or less
	Ion silica ($mgSiO_2$/L)	30 or less
	Iron (mgFe/L)	0.3 or less
	Copper (mgCu/L)	0.1 or less
	Sulphide ion (mgS^{2-}/L)	None detected
	Ammonium ion ($mgNH_4^+$/L)	0.1 or less
	Residual chlorine (mgCl/L)	0.3 or less
	Free carbon ($mgCO_2$/L)	4.0 or less
	Filtration (μm)	5 or less

3.4.2 Filling Bath Liquid

- Make sure the drain port is plugged.
- Fill bath liquid up to a maximum level of 50 mm below the top of the tank. In case the liquid level is low, it may have cooling capacity deteriorate because the internal circulating pump may have aeration.

⚠ CAUTION

- **Check at least once a day for the presence of foreign matter in the bath liquid.**
  If foreign matter enters the internal pump, the pump could break.
- **Use clean water that satisfies the quality standards shown in Table 3-7 for cooling water. If other liquids are used, the product could break and leak fluid, resulting in electrical shock or ground leakage.**

CAUTION

- **Do not operate without bath liquid. It must get the internal pump damaged.**
- **If water is used for the bath liquid, keep the temperature at 5 deg.C or more (considering the offset value). If the water freeze anywhere in the product, the internal pump may get damaged.**

CAUTION

- **Do not use in such a matter that the bath liquid overflows or splashes during operation. This could cause the machine failure.**

Chapter 4 Startup

4.1 Turning ON Power

1. Make sure that Main Power Switch is OFF. Turn ON the power breaker on primary side (your tool side)

2. Turn ON Main Power Switch.

3. Controller will indicate the current bath liquid temperature after approx. 6 sec

- If an alarm occurs after the power supply is turned on, check the indicated content of the alarm and turn off the power supply to find the cause so that appropriate measures can be taken.

4.2 Setting of Values

When the product starts operating normally, you can change any setting values such as temperature setting.

1. Perform offset adjustment if necessary, referring to page 5-4, “5.1.4 Details of Operation Mode”.

2. Set each value such as set temperature and high and low temperature limit.

- Set required values, referring to page 5-1, “5.1 Operation of Controller”.

  With this action, all preparation is complete. When the product is returned to the operation mode, it will operate with these set conditions.

3. Once values are set on the operation display panel, they will not be erased even when the power supply is turned off.

4.3 Cautions for Operation

⚠ CAUTION

- **Touching bath liquid or the internal face of the liquid tank may cause burns or frostbite, depending on the set temperature of this product. Be sure to use heat (cold) resistant gloves when handling this product**

CAUTION

- **When an antifreeze liquid (Ethyleneglycol water) is used as the recirculating fluid, wipe off the moisture on the surface of the liquid to prevent to deteriorate the performance and damage on the internal pump.**
- **Check the bath liquid level at least once a day.**
  The bath liquid may evaporate. To operate the product in very low liquid level may cause the temperature control function deteriorate and may cause the internal pump damaged.
- **Do not allow foreign matter to enter the recirculating fluid. The foreign matter could enter the inside of the recirculating pump and damage it.**
- **If an alarm comes on during operation, refer to page 5-14, “5.2.1 Content of Alarms”, for the remedy.**

Chapter 5 Operation

5.1 Operation of Controller

5.1.1 Details of Controller

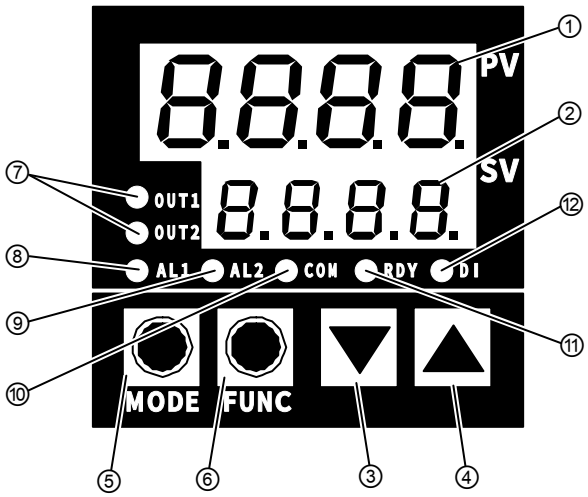


Fig 5-1 Details of operation and display panel

Table 5-1 Details of operation and display panel

No.	Name	Detail
①	LED1	Displays monitoring temp.,or mode indication.
②	LED2	Displays target temp.,or set value/mode
③	[▼] key (DOWN key)	Used to change set values
④	[▲] key (UP key)	Used to change set values
⑤	[MODE] key	Used to change screens.
⑥	[FUNC] key	Used to shift digits of SV
⑦	Output LED	OUT1: Lights up during heating. OUT2: Lights up during cooling.
⑧	AL1 LED	Lights up when High / Low Temp. alarm occurs.
⑨	AL2 LED	Unused
⑩	Communication LED	Flashes during communication. It remains on when the communication is not used.
⑪	RDY LED	Lights up when temperature control is stopped.
⑫	DI LED	Unused

5.1.2 Setting of Data

Controller has two modes, Operation Mode and Setting Mode. Each mode has the following content.

- Operation Mode: Normally used.
- Setting Mode: Used to set control values

■ Selection of mode

- Operation mode: Initial mode
- Setting mode: Press and hold [MODE] key for 2 sec.

■ Setting of functions and data in each mode

1. Press [MODE] key in each mode to select the required function.

2. Increase or decrease data with the [▲] or [▼] key.

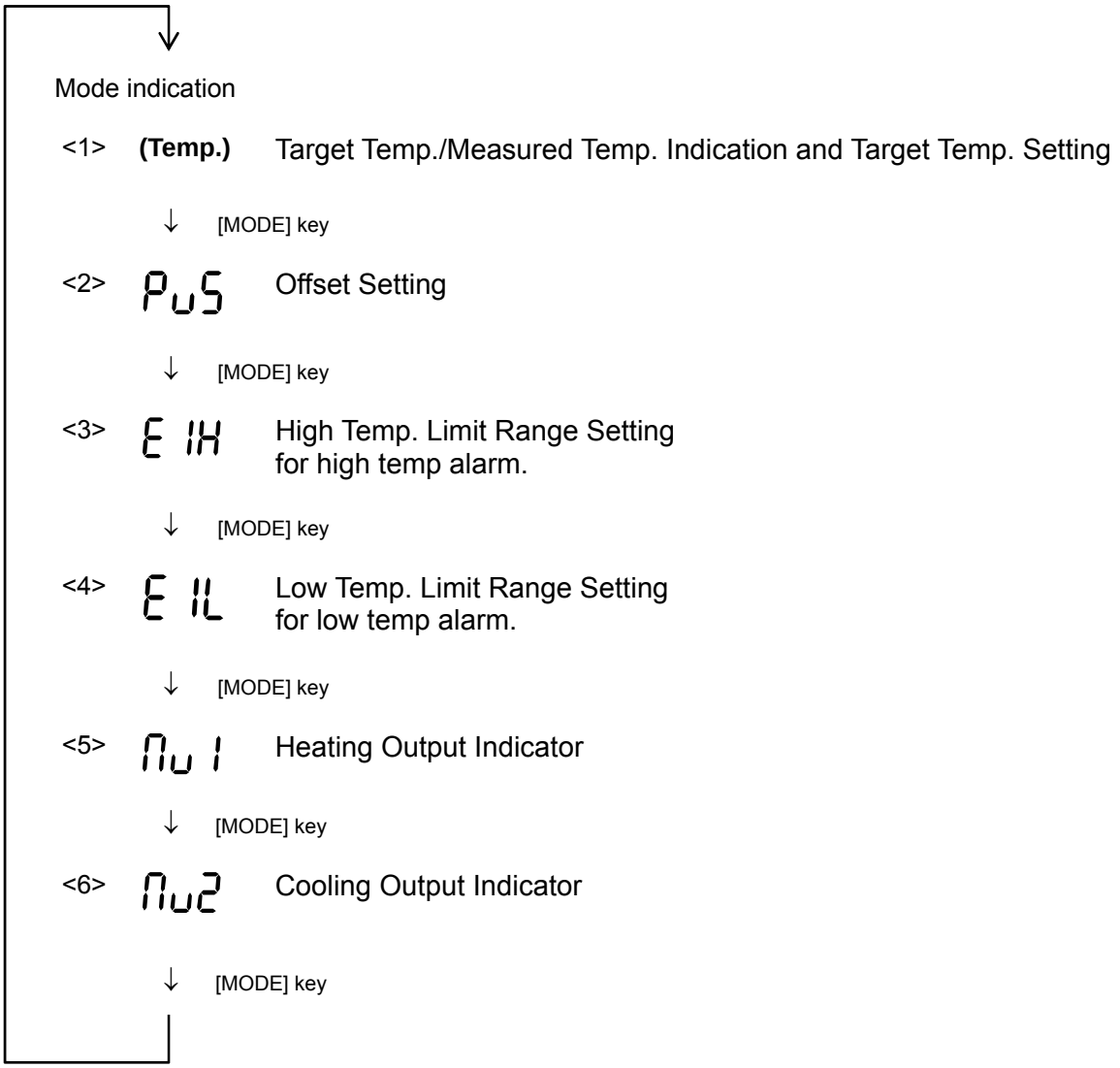
- Each press of the [▲] key increases the data by one count.
- Each press of the [▼] key decreases the data by one count.
- Holding the [▲] or [▼] key accelerates the increase or decrease.

CAUTION

- **Be sure to operate these keys of the controller by hand. Using tools such as a screwdriver, pen, or pencil may damage the panel.**

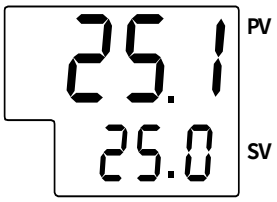
5.1.3 Selection of Operation Mode

When the power supply is turned on, the product is in operation mode. The target temperature is shown as well as the current measured temperature. Each presses of the [MODE] key changes the operation mode display as follows.



5.1.4 Details of Operation Mode

<1> Target Temp. / Measured Temp. Indication and Target Temp. Setting

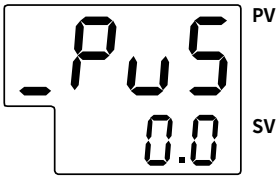


Function	Sets target temperature. Set with [▲] or [▼] key
	Indicates current temperature on PV and target temperature on SV.
Setting range	0 to 60.0 deg.C
Initial value	25.0 deg.C

[Tips]

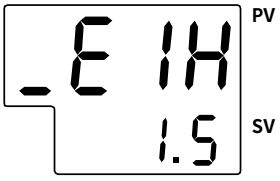
The temperature of the target set. Blinking the display stops when a few seconds pass. The setting is completed.

<2> Offset Setting



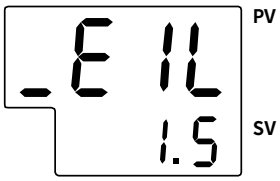
Function	Sets the offset (compensating) value of the PV. Set with [▲] or [▼] key
	Ex. if 0.5 is set, the temperature is actually controlled to a value that is lower by 0.5 deg.C.
Setting range	-1.0 to 1.0 deg.C (Please use it in this setting range.)
Initial value	Refer to the controller correction value of Inspection Record.

<4> High temp. limit range setting

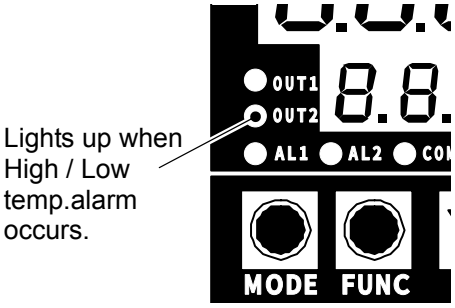


Function	Sets the high temperature limit value. Set with [▲] or [▼] key
	Input the differential from target temp. for high temp. alarm. AL1 LED lights up and the alarm signal output when alarm.
Setting range	0 to 10.0 deg.C
Initial value	1.5 deg.C

<4> Low temp. limit range setting



Function	Sets the lower temperature limit value. Set with [▲] or [▼] key
	Please input the value of the width of the lower temperature. It is output to the alarm output connector (AL1 LED).
Setting range	0 to 10.0 deg.C
Initial value	1.5 deg.C

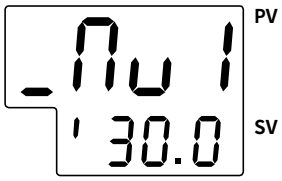


[Tips]

Status when High / Low temp. alarm occurs

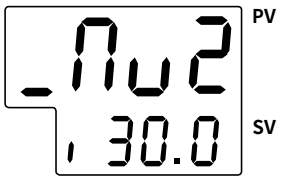
- AL1 LED lights up when High / Low temp. alarm occurs. The alarm signal is output from the alarm output connector.
- The product is continued operation even in this alarm is activated. The alarm will go off with the liquid temperature getting into the specified temperature width.

<5> Heating Output Indicator



Function	Indicates the heating output ratio
Display range	0.0 to 100.0%

<6> Cooling Output Indicator



Function	Indicates the cooling output ratio
Display range	0.0 to 100.0%

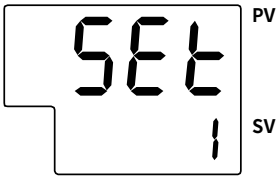
5.1.5 Selection of Setting Mode

Setting Mode can be displayed by pressing and holding the [MODE] key for approx. 2 sec.

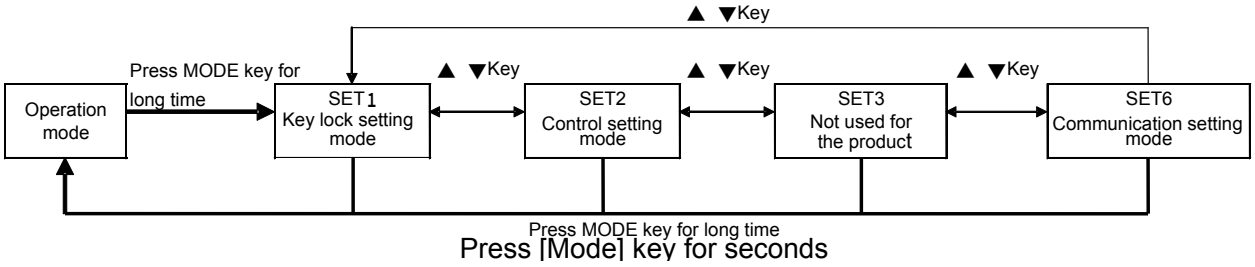
Pressing the [MODE] key for approx. 2 sec again will return Setting Mode to the Operation Mode.

Setting mode selection is indicated with "SEt" and the required setting mode can be selected by increasing or decreasing the indicated number with the [▲] or [▼] key.

Setting Mode Selection

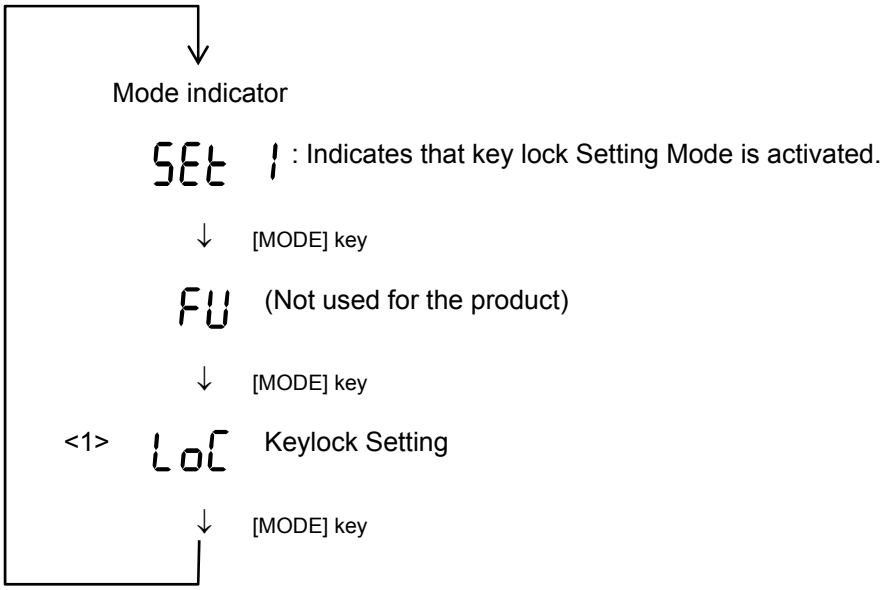


Function	Selects mode for each setting. Select with [▲] or [▼] key.
Selectable setting	1, 2, 3, 6 1: Initial Setting Mode 2: Control Setting Mode (3: Not used for the product) 6: Communication Setting Mode



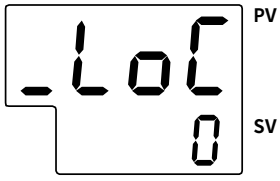
5.1.6 Selection of key lock Setting Mode

Inputting “1” in Setting Mode Selection ” SEt” activates the key lock Setting Mode. Each press of the [MODE] key changes key lock Setting Mode as follows.

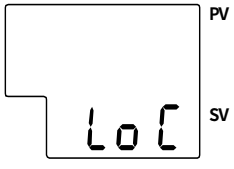


5.1.7 Details of key lock Setting Mode

<1> Key lock Setting



Function	Sets the key lock Select with [▲] or [▼] key.
Selectable setting	0 to 3 0: No key lock 1: Full lock (except key lock setting) 2: Lock for Operation Mode 3: Lock for Setting Mode
Initial value	0



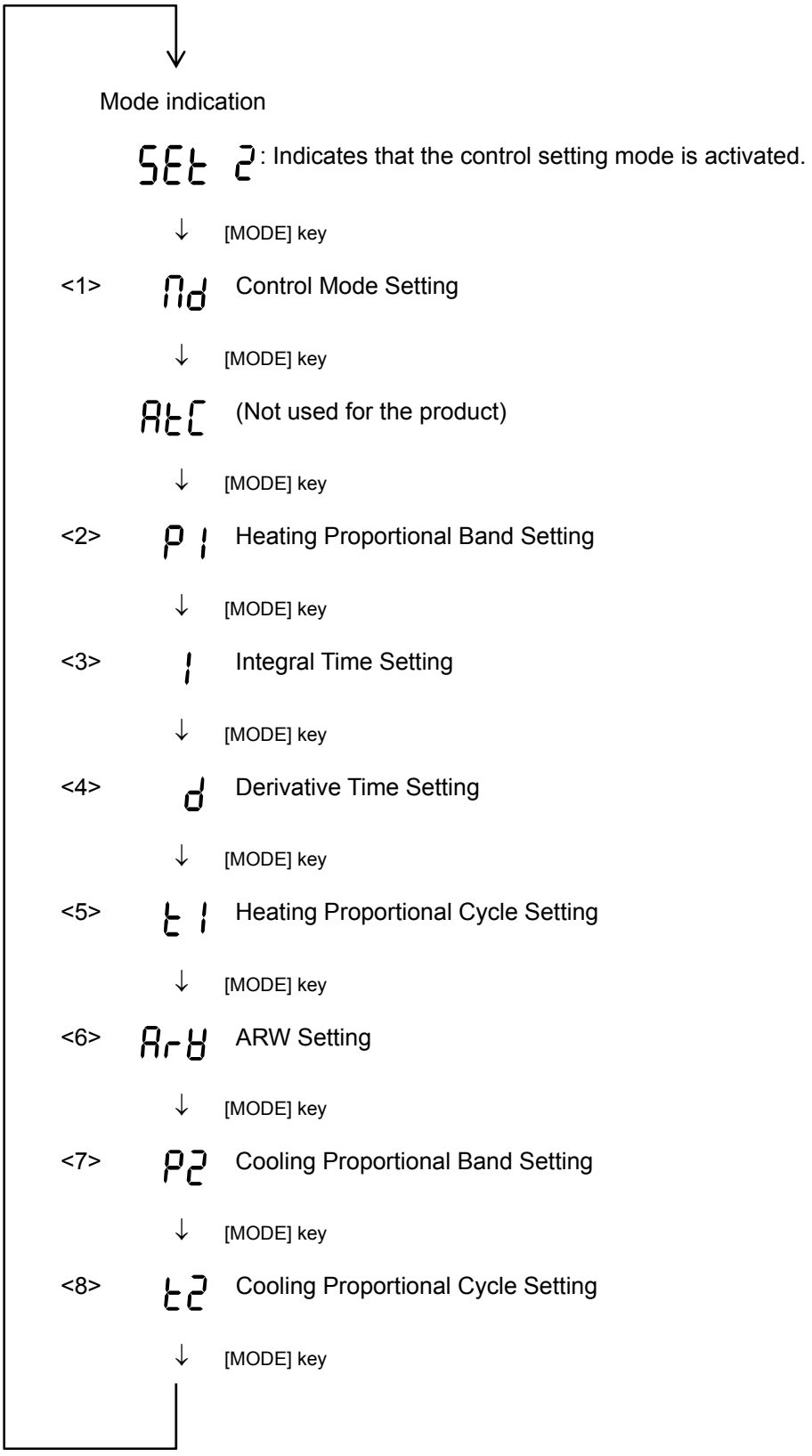
[Tips]

Indicator for unavailable change

If you try to change the key-locked parameter is attempted, the indicator shown on the left appears to show that change is not available. The indicator continues to be displayed while the key is pressed.

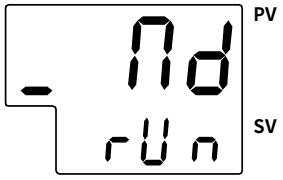
5.1.8 Selection of Control Setting Mode

Inputting “2” in Setting Mode Selection ” SEt” activates the control setting mode. Each press of the [MODE] key changes the operating mode as follows.



5.1.9 Details of Control Setting Mode

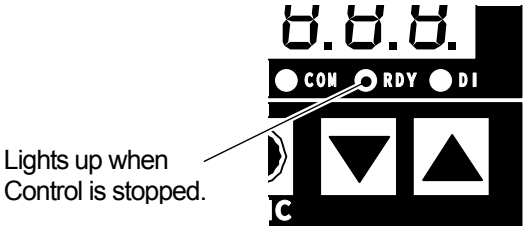
<1> Control Mode Setting



Function	Sets control mode. Select with [▲] or [▼] key
Selectable setting	run, (rdy) , (MAn) run: Temperature control enabled (rdy: Temperature control disabled) (MAn: Manual control)
Initial value	run

CAUTION

- **Should not select rdy or MAn.**
  Temperature control function is disabled when rdy or MAn is selected



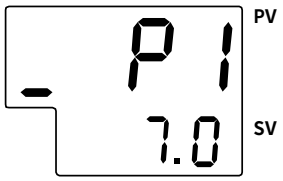
Lights up when Control is stopped.

[Tips]

Mis-setting to RDY

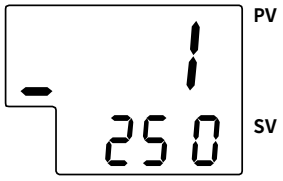
When control is stopped, the RDY LED lights up.

<2> Heating Proportional Band Setting



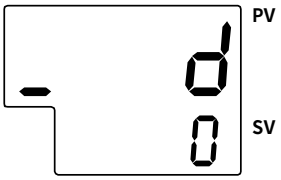
Function	Sets the proportional band for heating. Set with [▲] or [▼] key
	This range is a percentage of 60 deg.C (= -15.0 to 60.0 deg.C), which is the temperature setting range.
Setting range	0.1 to 200.0%
Initial value	4.0%

<3> Integral Time Setting



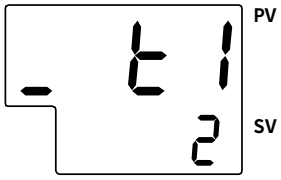
Function	Sets the integral time. Set with [▲] or [▼] key
Setting range	0 to 3600 sec. If “0” is set, integral control is disabled.
Initial value	50 sec.

<4> Derivative Time Setting



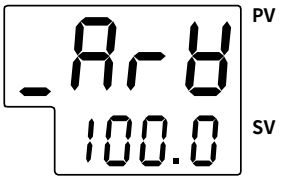
Function	Sets the derivative time used for PID control. Set with [▲] or [▼] key
Setting range	0 to 3600 sec. If "0" is set, derivative control is disabled.
Initial value	0 sec.

<5> Heating Proportional Cycle Setting



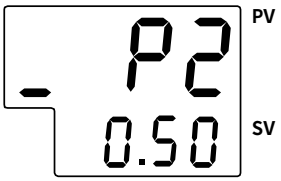
Function	Sets heating proportional cycle. Set with [▲] or [▼] key
	If the proportional cycle is set at 2 sec. and Heating Output is 70%, the output will be 1.4 sec. ON and 0.6 sec. OFF.
Setting range	1 to 120 sec.
Initial value	2 sec.

<6> ARW Setting



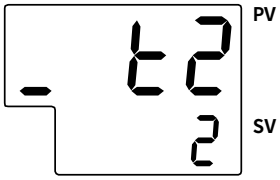
Function	Sets anti-reset wind-up. Set with [▲] or [▼] key
	Reduces overshoot in PID control due to integrating operation. The integration operation is not performed above the set value. The set value must be higher than the output for stable control.
Setting range	0.0 to 100.0 %
Initial value	100.0 %

<7> Cooling Proportional Band Setting



Function	Sets the proportional band for cooling. Set with [▲] or [▼] key
Setting range	0.10 to 10.00 times
Initial value	0.50 times of P1 set value.

<8> Cooling Proportional Cycle Setting



Function	Sets cooling proportional cycle. Set with [▲] or [▼] key
	If the proportional cycle is set at 2 sec. and Cooling Output is 70%, the output will be 1.4 sec. ON and 0.6 sec. OFF.
Setting range	1 to 120 sec.
Initial value	2 sec.

5.1.10 Selection of Communication Setting Mode

Inputting “6” in Setting Mode Selection ” SEt” activates the communication setting mode. Each press of the [MODE] key changes the operating mode as follows.

Mode indication

SEt b: Indicates that communication setting mode is activated.

↓ [MODE] key

<1> CoM Communication parameter setting

↓ [MODE] key

<2> bPS Communication speed setting

↓ [MODE] key

<3> Adr Communication address setting

↓ [MODE] key

<4> AWt Response delay time setting

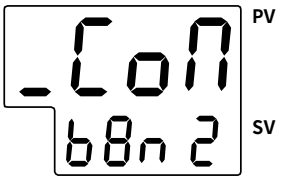
↓ [MODE] key

<5> Mod Communication-mode setting

↓ [MODE] key

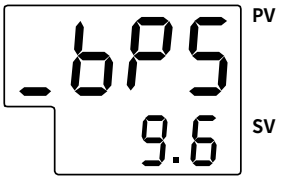
5.1.11 Details of Communication Setting Mode

<1> Communication Parameter Setting



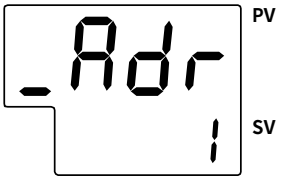
Function	Sets communication parameters.
Selectable setting	1st digit : Stop bit length 1 or 2 1: 1 bit, 2: 2 bit 2nd digit : Parity check n, o or E n: Without, o: Odd, E: Even 3rd digit : Data length 7 or 8 7: 7 bit, 8: 8 bit 4th digit : BCC check n or b n: Disable, b: Enable The number of digits is counted from the right side.
Initial value	b8n2

<2> Communication speed setting



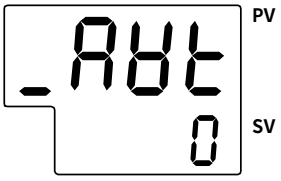
Function	Sets the communication speed. The set value can be scrolled with the ▲ and ▼ keys. 1.2 ⇔ 2.4 ⇔ 4.8 ⇔ 9.6 ⇔ 19.2
Selectable setting	1.2 to 19.2 (1200 bps to 19,200 bps)
Initial value	9.6

<3> Communication Address Setting



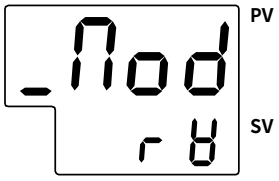
Function	Sets the communication address of the product.
Setting range	1 to 99 addresses
Initial value	1 address

<4> Response Delay Time Setting



Function	Sets the response delay time.
Setting range	0 to 250 ms
Initial value	0 ms

<5> Communication-mode Setting



Function	Sets the communication-mode setting.
Selectable setting	ro or rW ro: Readout only, rW: Readout and writing
Initial value	rW

5.1.12 Initial Value and Setting Range for Each Mode

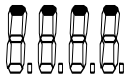
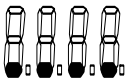
Table 5-2 Initial value and setting range for each mode

Item	Indication	Setting range	Initial value
Setting of target temp.	-	0 to 60.0 deg.C	25.0 deg.C
Offset setting	PuS	-1.0 to 1.0 deg.C	According to the Inspection Record
High Temp. limit range setting	E IH	0 to 10.0 deg.C	1.5 deg.C
Low Temp. limit range setting	E IL	0 to 10.0 deg.C	1.5 deg.C
Heating output indicator	Ou1	—	—
Cooling output indicator	Ou2	—	—
Key lock setting	LoC	0 to 3	0
Control mode setting	Md	rUn, rdY	rUn
PB (heating) range setting	P1	0.1 to 200.0 %	4.0 %
I constant setting	I	0 to 3600 sec	50 sec
D constant setting	d	0 to 3600 sec	0 sec
Heating for the proportional frequency setting	t1	1 to 120 sec	2 sec
ARW setting	ArW	0.0 to 100.0 %	100.0 %
PB (cooling) range setting	P2	0.10 to 10.00 times	0.50 times
Cooling for the proportional frequency setting	t2	1 to 120 sec	2 sec
Communication parameter setting	CoM	1st digit: Stop bit length 1: 1 bit, 2: 2 bit 2nd digit: Parity check n: Without, o: Odd, E: Even 3rd digit: Data length 7: 7 bit, 8: 8 bit 4th digit: BCC check n:Enable, b: Disable	b8n2
Communication speed setting	bPS	1.2 to 19.2 (1200bps to 19200bps)	9.6
Communication address setting	Adr	1 to 99	1
Response delay time setting	AWt	0 to 250 msec	0 msec
Communication-mode setting	Mod	ro, rW	rW

5.2 Alarms

5.2.1 Content of Alarms

Table 5-3 Content of alarm

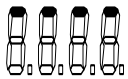
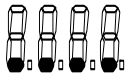
(Lit) 7seg. LED	Content of alarm	Alarm Output Singal	High / Low temp. alarm	Lit LED	Unit Status	Reset
Normal status	**High temp. alarm** Occurs when the bath fluid temp is higher than the alarm set point.	Contact opened	ON	**AL1**	Normal operation	Automatic -ally
Normal status	**Low temp. alarm** Occurs when the bath fluid temp is Lowerer than the alarm set point.	Contact opened	ON	**AL1**	Normal operation	Automatic -ally
Normal status	**Lowing of controller output voltage** Occurs when the internal DC power supply has trouble.	Contact opened	-	**ALARM**	Control stop 1	Restart the power supply
Normal status	**Thermostat alarm** Occurs when temp of heat exchanger is abnornaly high.	Contact opened	-	**ALARM**	Control stop 1	Restart the power supply
Normal status	**Low level alarm** Occurs when liquid level is low.	Contact opened	-	**ALARM**	Control stop 1	Restart the power supply
Err0	**Memory error** Occurs when there is an issue on the EEPROM of the controller.	-	-	-	Control stop 2	Replace the controller
Err1	**Controller error** Occurs when there is an issue on the controller.	-	-	-	Control stop 2	Replace the controller
	**High temp. sensor value** Occurs when the bath fluid temp is abnormaly high, or the temp sensor is disconnected.	Contact opened	ON	**AL1**	Control stop 2	Restart the power supply
	**Low temp. sensor value** Occurs when the bath fluid temp is abnormaly low, or the temp sensor is short-circuited.	Contact opened	ON	**AL1**	Control stop 2	Restart the power supply

★ Control stop 1: temperature control and pump are stopped.

★ Control stop 2: Only temperature control is stopped.

5.2.2 Troubleshooting

Table 5-4 Troubleshooting

Code	Cause	Countermeasure
ALARM LED (red) lights up.	High-level electric noise has been applied to the power supply line, ground line and/or signal line.	Move the product to an environment with less noise and restart. If no failure occurs, the noise caused the alarm.
	The power supply voltage to the product not correct.	Confirm that the power supply voltage is 100 to 240VAC.
	Malfunction of the internal DC power supply	If the trouble cannot be solved even after the power supply is restarted 3 or 4 min. after, contact SMC for repair.
	The internal temperature of the controller is high, and the protection circuit of the power supply activated.	Check that the air ventilation.
	The bath liquid has been excessively heated.	Confirm that the bath liquid is not excessively heated.
		Confirm that the bath liquid level is not too low.
Err0	The EEPROM of Controller is broken due to high-level electric noise.	If the trouble cannot be solved even after cycling the power supply, contact SMC for repair.
	The writing time to the EEPROM exceeds 0.1 million.	
Err1	The EEPROM of the controller is broken due to high-level electric noise.	If the trouble cannot be solved even after cycling the power supply, contact SMC for repair.
	The temperature sensor is broken (or the cable is disconnected).	Check if the cable is disconnected. If the trouble cannot be solved even after no disconnection is confirmed, confirm there is no broken wire. If the wire is broken, contact SMC for repair.
	The temperature sensor is short-circuited.	Confirm that the temp sensor and its cable are short-circuited. If they are short-circuited, contact SMC for repair.
The operation and display panel doesn't light up, or the display disappears.	Incorrect AC voltage	Confirm that the power supply voltage is 100 to 240ACV.
	The circuit protector of this product or GFCI which is installed on primary side of the unit has been tripped.	Confirm that an instantaneous power supply cutoff has not occurred at frequent rate.
		Confirm that a ground leakage has not occurred. If the trouble cannot be solved even after the power supply is restarted, contact SMC for repair.

Chapter 6 Maintenance

6.1 Regular Maintenance

- Check the bath liquid at least once a day.
- Check the strainer and filter clogging in regular interval.
- This product needs to be returned to the SMC factory for repair and maintenance.

Work sequence when replace the bath liquid or clean the strainer and the air filter

1.Power off

↓

2.Drain the Bath Liquid

Refer to 6.1.1 Draining the Bath Liquid

↓

3.Check the strainer and clean the bath

Refer to 6.1.2 Check the strainer and clean the bath

↓

4.Clean the air filter

Refer to 6.1.3 Cleaning the air filter

↓

5.Fill the Bath Liquid

Refer to 3.4.2 Filling Bath Liquid

↓

6.Power on

6.1.1 Draining the Bath Liquid

- Stop the product (cut the power supply).
- Please connect the drain tube (accessary) with the drain port and drain the liquid from the drain port.
- The drain tube is attached as a ship loose item.

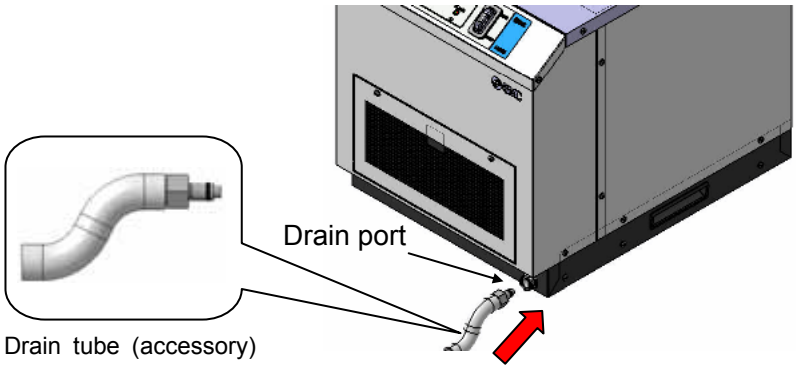


Fig 6-1 Drain

⚠ CAUTION

- **Stop the product (cut the power supply). Draining without stopping the product might cause dry run of the internal pump.**
- **Take care not to splash the bath liquid on the inside of the product and the connectors when draining. If water splashes on the connector or the product body, wipe them off and allow them to dry sufficiently to prevent electrical shock, a short circuit, or ignition.**
- **Please confirm the bath light is at safe temperature when you drain the liquid.**

6.1.2 Check the strainer and clean the bath

- Please remove clogging that strainer captured.
- Please clean the bath.
- Please confirm there are no clogging in the pump suction port.
- Please set the strainer in the bath any time the product running.

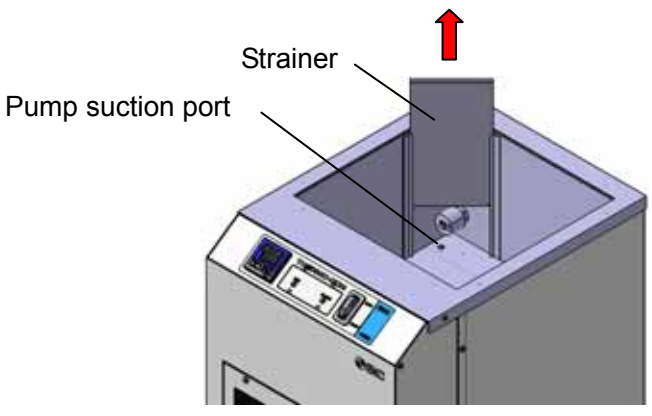


Fig 6-2 Strainer

6.1.3 Cleaning the air filter

- Please remove clogging that air filter captured.(the filter is taken out by removal of circled screws.)

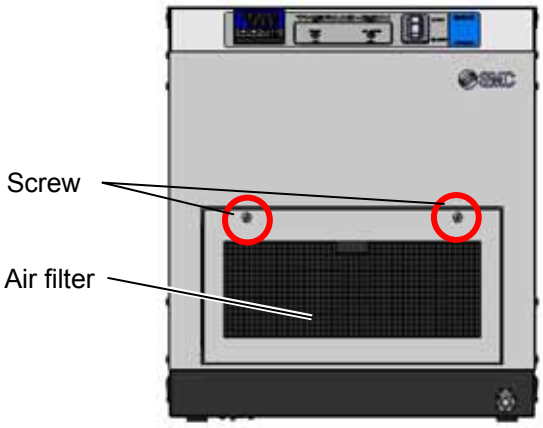


Fig 6-3 Air filter

CAUTION

- **Please keep air filter clean as performance decreases with dust build up. We will recommend the removal of dust once every three months. Please remove dust with the cleaner, do not use water to clean.**

6.2 Before returning the product

- This product needs to be returned to the SMC factory for repair and maintenance.
  Essentially, on-site repairs and maintenance cannot be offered.
- It is recommended that you prepare a back-up product to minimize machine downtime during repairs and maintenance.

⚠ CAUTION

- **Drain the liquid from the liquid bath completely and clean and dry the product before returning it to the SMC factory for repair and maintenance. Any liquid left in the product could cause damage to the equipment during transport.**

CAUTION

- **It is recommended to transport the product in an original packing box specific to the Thermo Electric Bath.**

Chapter 7 Appendix

7.1 Outline Dimensions

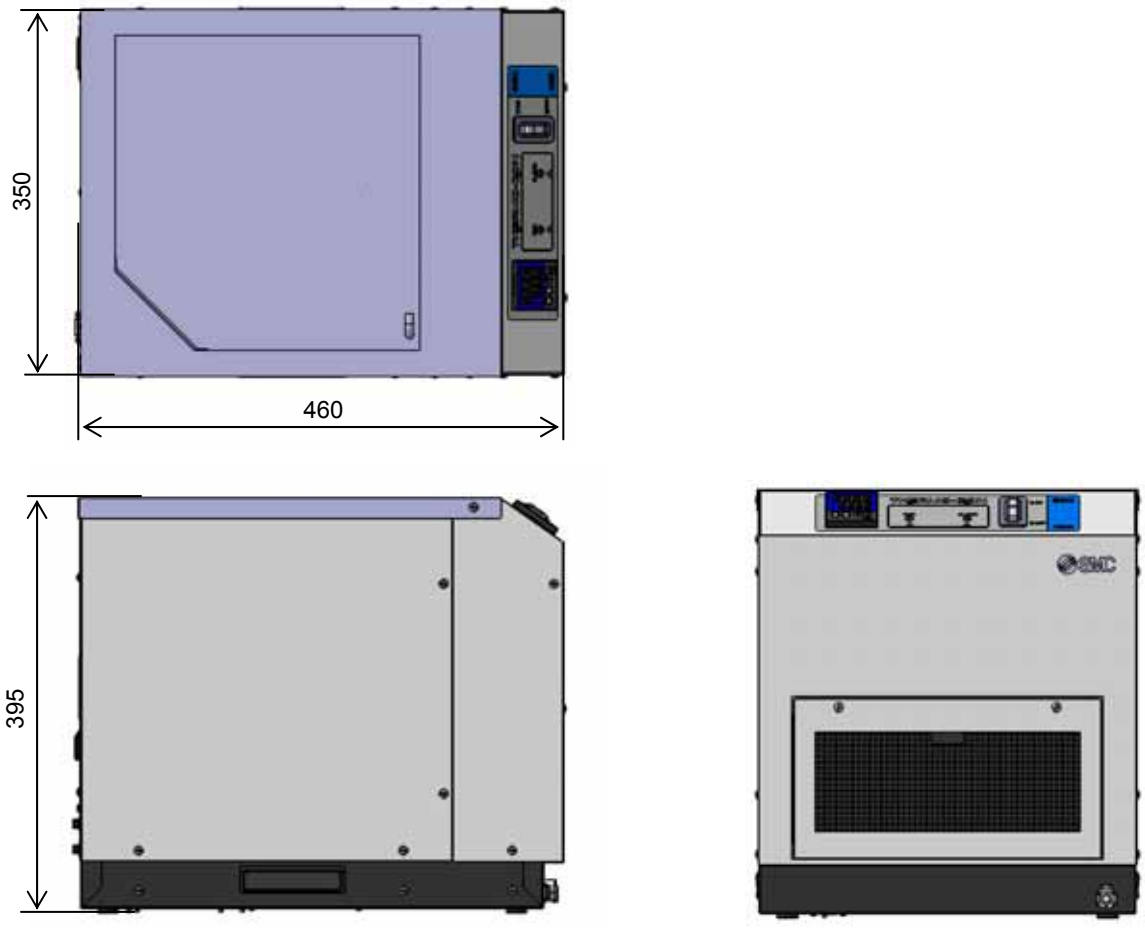
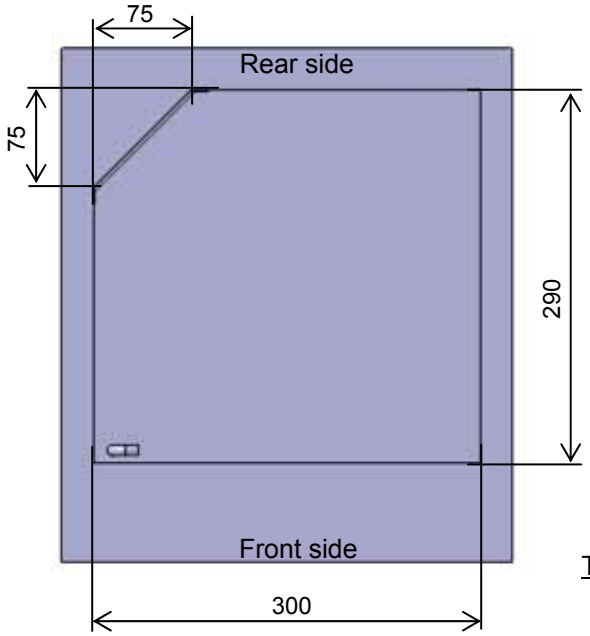


Fig 7-1 Outline Dimension



Tank depth: 200 mm

Fig 7-2 Internal dimensions of liquid tank

7.2 Specifications

Table 7-1 Thermo Electric Bath specifications

Part no.		INR-244-757
Cooling method		Air-cooled
Operation temp. range		0 to 60.0 deg.C (5 deg.C or more for water)
Ambient environment		Temp.:10 to 35 deg.C Humidity:35 to 80%RH (no dew cindensation) Environment: No corrosive gas, solvent such as thinner and flammable gas
Temp. stability		+/- 0.03 deg.C (Note 1)
Cooling capacity		Approx. 220W (Note 1)
Heating capacity		Approx. 600W (Note 1)
Bath liquid	Application fluid	5 to 60 deg.C (Water) 0 to 60 deg.C (Ethylene glycol must be lower than 40%)
	Tank dimensions	W 300 × D 290mm × Liquid level 200mm (excluding protrusion)
Power supply		100 to 240VAC, Single phase, 50/60Hz, Max 6A
Overcurrent protection		Circuit protector (acting as a power supply switch) with rated current 10A
Serial Communication		RS-232C
Drain port connector		CPC coupling PLCD 16004
Temperature sensor		Resistance thermometer sensor (Pt100Ω, 3- wire, Class A)
Alarm output signal		High / Low temp. alarm, Alarm output signal Relay contact output: opened when the alarm occurs 30VDC,2A (resistive load), 30VDC,1A (inductive load)
Dimensions		W 350 × H 395 × D 460mm (excluding protrusion)
Mass(at dry)		Approx. 22kg
Attached accessories		Power supply cable: 2m

Note1) Determined under the following conditions: water as the bath fluid, set temperature 25 deg.C, ambient temperature 25 deg.C, and sealed from outside air with a lid.

7.3 Performance Chart

The values shown on the performance chart are representative and not guaranteed. Allow a margin for safety to decide use of the product.

7.3.1 Cooling Capacity

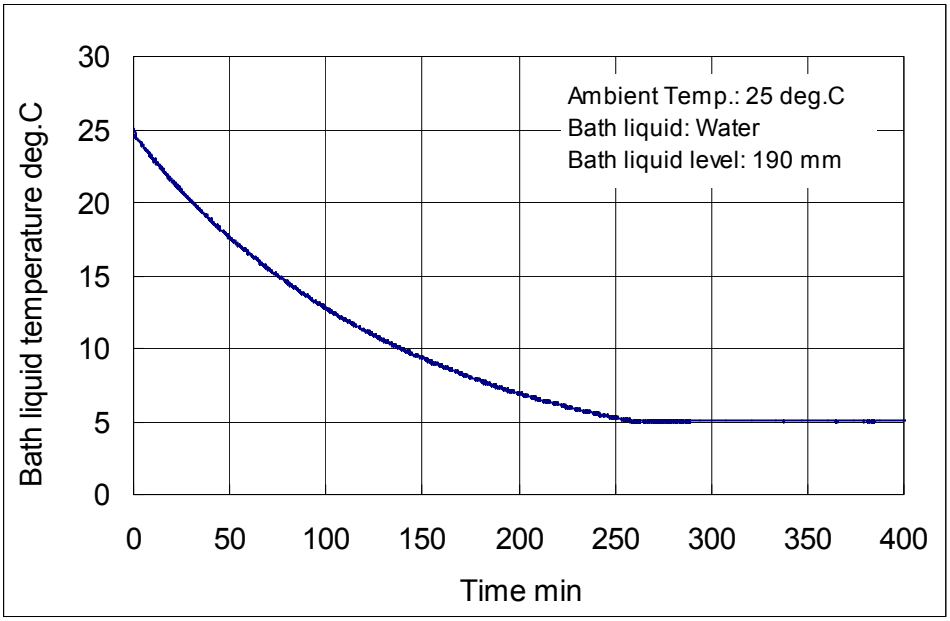


Fig 7-3 Cooling capacity

7.3.2 Heating Capacity

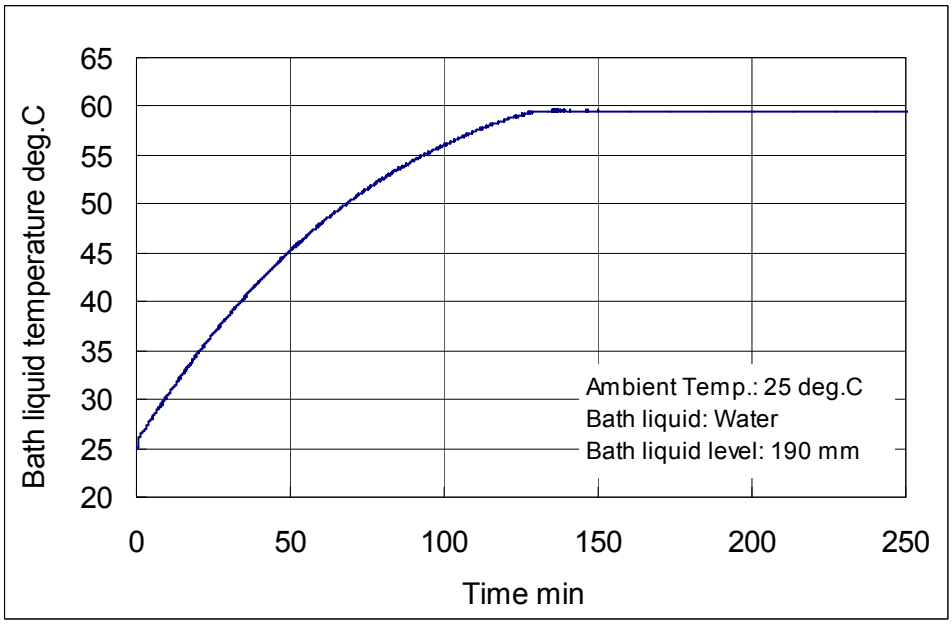


Fig 7-4 Heating capacity

7.4 Calculation of Dew Point Temperature (from psychrometric chart)

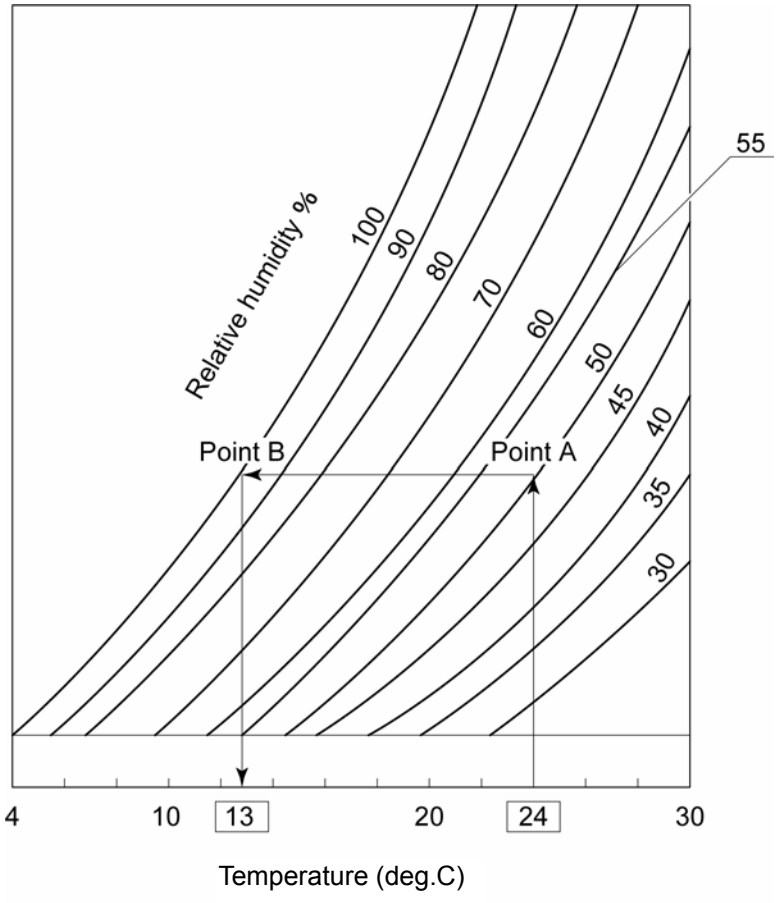


Fig 7-5 Psychrometric chart

1. Measure the ambient temperature and humidity.

2. Plot the ambient temperature on the X axis, “Temp.” (ex. 24 deg.C), and draw a vertical line from there.

3. Find the intersection (A) between the curve with the value closest to the ambient humidity and the straight vertical line.

4. Draw a line parallel to the X axis from intersection A and find the intersection (B) between this line and the curve representing 100% relative humidity.

5. Draw a vertical line to the X axis from intersection B. The temperature at the intersection between this line and the X axis is the dew point (in this example, 13 deg.C). If the temperature falls to this value, the moisture contained in the air will begin to form condensation.

Chapter 8 Warranty

8.1 Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

(1) Content

If the purchased product fails, it will be repaired at no cost within the period and requirements mentioned below.
Replacement, adjustment, and inspection of failed parts are all within the range of this warranty, i.e., will be performed at no cost. The parts removed for repair will belong to SMC.

(2) Period

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.∗2)
Also, the product may have time durability or replacement parts. Please consult your nearest sales branch.

(3) Scope of warranty

For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

(4) Out of scope

The following situations are out of the scope of this warranty.

① The failure was caused by operation different from that shown in this manual or operation over the SMC specified parameter limits.
② The failure was caused by retrofitting that SMC did not approve.
③ The failure was caused by a Bath liquid with specifications other than those specified by SMC.
④ The failure occurred naturally over time (such as discoloration of a painted or plated face).
⑤ The failure does not affect the functioning of the product (such as new sounds, noises and vibrations)
⑥ The failure was caused by a natural disaster such as an earthquake, typhoon, or flood, or by an accident or fire.
⑦ The failure was caused by installation of the product in an environment other than that specified in this manual.

(5) Disclaimer

The following are not covered by this warranty.

① Expenses to compensate for secondary damages to other equipment and goods due to the failure of the product

② Expenses for repairs performed by other companies

③ Expenses for transfer, installation and removal of the product

④ Expenses for replacement of parts other than those in the product and for the supply of liquids

⑤ Losses resulting from the inability to use the product (such as telephone charges, compensation
for workplace closings, and commercial losses)

⑥ Expenses and compensation not covered in “(1) Content”.

⑦ Expenses for returning the product

(6) Request for repair

When repair of the product is needed, contact the shop where the product was purchased. When this is done, the repair will then be performed under warranty by SMC.

No-cost repair of the product is assured within the period and requirements mentioned above. Failures which occur after the warranty period has passed will, in principle, be charged.

8.2 Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction(WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Revision history

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