MECHANICAL INERT OVEN

Model: DN410I

Version 2

Yamato Scientific Co., LTD.

Congratulations on your selection of Yamato Scientific's Mechanical Inert Oven!
Please read these operating instructions, user notes and the warranty card thoroughly before the initial operation of your Mechanical Inert oven. This will ensure proper operating procedures and extended life for the unit. Please keep the operating instructions together with the warranty card for easy access whenever you need them.

Attention: Read the warnings in the operating instructions carefully to familiarize yourself with the initial operation of your Mechanical Inert oven.

Depending on the extent and nature of danger, the warnings given in these operating instructions are classified into the following two categories by symbol.

To protect operators from accident --
Negligence of this warning may result in a serious accident.

To protect the Mechanical Inert Oven from damage --
Negligence of this warning may result in damage to the Mechanical Inert Oven. This warning also gives you tips on performance that are useful in its operation and maintenance or indicates the common mistakes that operators often make.

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MEANING OF ILLUSTRATED SYMBOLS

Illustrated Symbols Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below.

Be sure that you understand the warnings and cautions in this manual before operating the unit.

⚠ Warning	If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.
⚠ Caution	If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

Meaning of Symbols

This symbol indicates items that urge the warning (including the caution).

A detailed warning message is shown adjacent to the symbol.

This symbol indicates items that are strictly prohibited.

A detailed message is shown adjacent to the symbol with specific actions not to perform.

This symbol indicates items that should be always performed.

A detailed message with instructions is shown adjacent to the symbol.

Safety Precautions

WARNING

⃠ Do not use the unit in an area where there is flammable or explosive gas.

℅ Never use the unit in an area where there is flammable or explosive gas.

The unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result.

❗ Always ground the unit.

℅ Always ground the unit on the power equipment side in order to avoid electrical shock due to a power surge.

❗ If a problem occurs, you should:

℅ If smoke or strange odor should come out of the unit for some reason, **turn off** the power key right away, then **turn off** the earth leakage breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result.

Never perform repair work yourself, since it is dangerous and not recommended.

⃠ Do not use the power cord if it is bundled or tangled.

℅ Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

⃠ Do not process, bend, wring, or stretch the power cord forcibly.

℅ Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.

⃠ Do not put the power cord under the desk, chair, etc.,

℅ Do not put the power cord under the desk, chair, etc., or through an object. Fire or electrical shock may be caused.

⃠ Do not run the power cord next to heating equipment such as a heater.

℅ Do not run the power cord next to heating equipment such as a heater. The cover of the cord may melt and fire or electrical shock may result.

WARNING

⃠ Substances that can not be used.

℅ Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in the unit. Explosion or fire may occur.

⃠ Do not disassemble or modify the unit.

℅ Do not reconfigure the unit. Fire or electrical shock may be caused.

⃠ Do not touch the door during or immediately after operation.

℅ Do not touch the door during or immediately after operation. Severe burning injury may be caused due to the high temperature.

CAUTION

❗ During a thunder storm . . .

℅ During a thunderstorm, **turn off** the power key immediately, then **turn off** the earth leakage breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

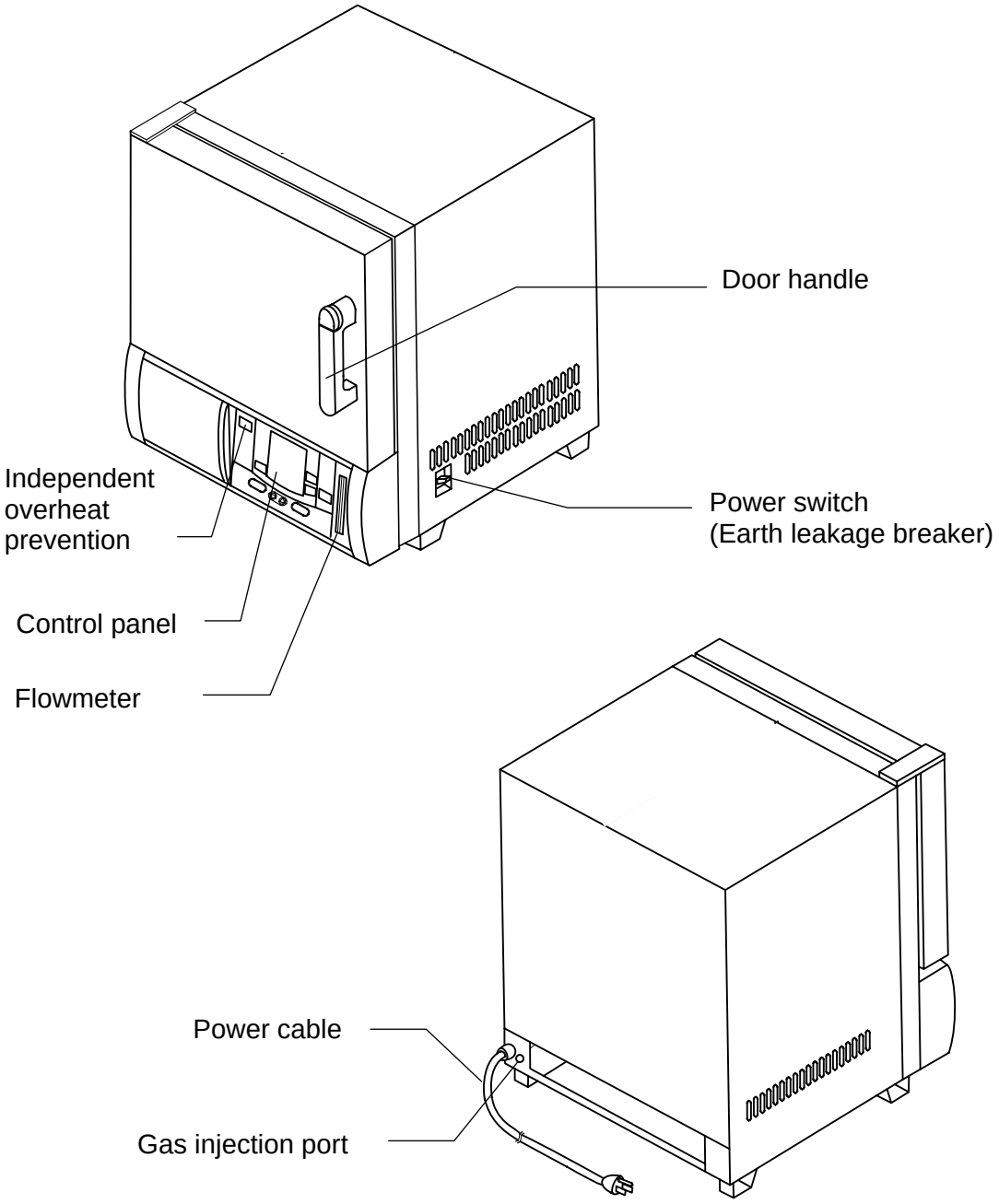
❗ Periodic check of the safety component.

℅ The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically. (See chapter of INDEPENDENT OVERHEAT PREVENTION on page 25.)

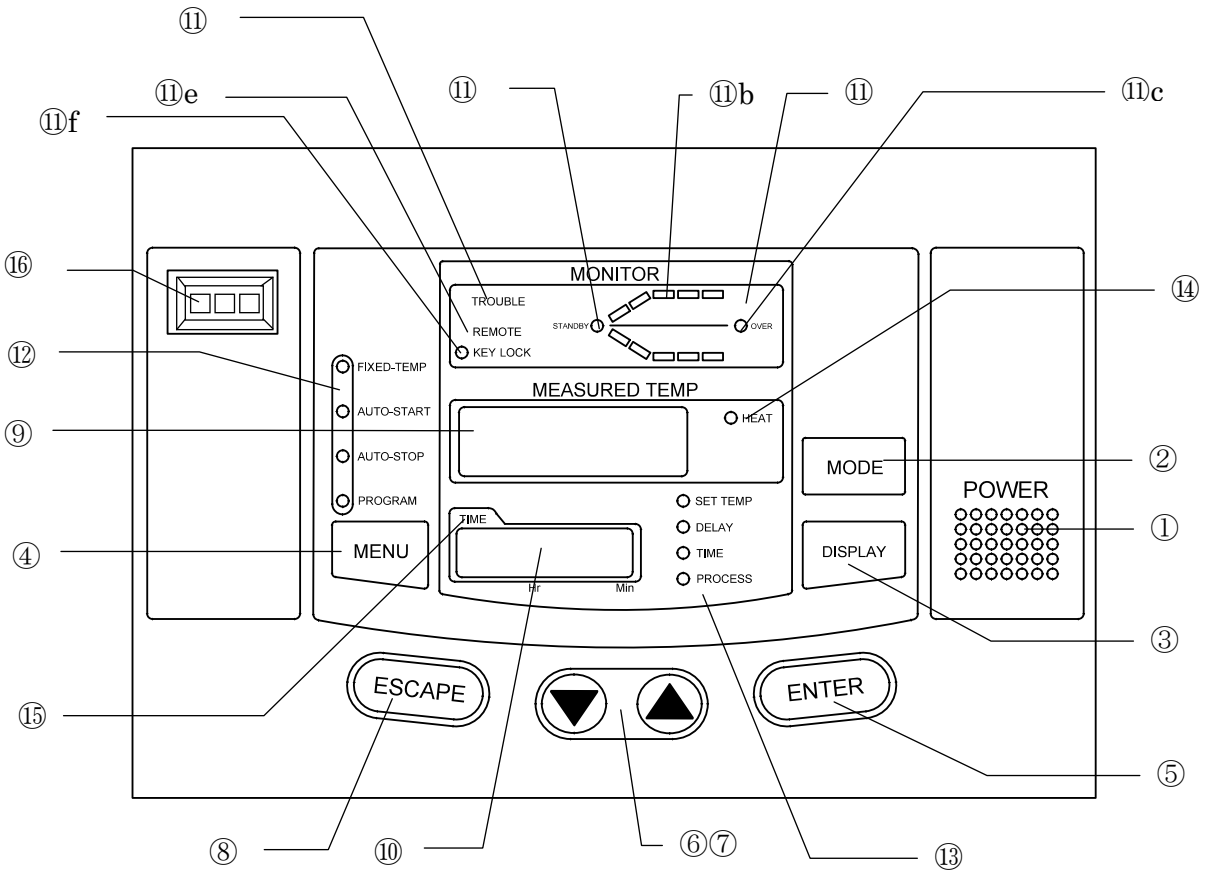
Notes to Users

Identification of Parts

Main unit



Control Panel



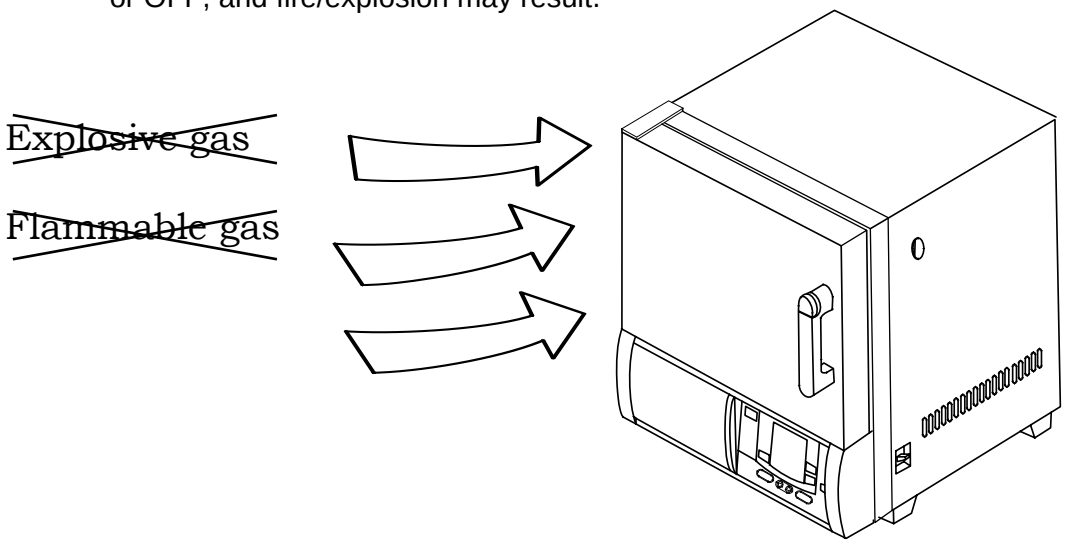
(1) **POWER** key:	Key to change over the controller from the standby mode to the operation mode or from the operation mode to the standby mode.
(2) **MODE** key:	Key to select a function from program input, edit, delete modes, hour/time setting, change-over mode, and other functions.
(3) **DISPLAY** key:	Key to change-over the display content of the sub display (10). Display content is changed over to set temperature, remaining time, hour, execution segment No.
(4) **MENU** key:	Key to select the operation mode. Each mode of fixed temperature, auto-start, auto-stop and program operation can be selected.
(5) **ENTER** key:	Key to determine the input value of set value (temperature, time, hour, etc.), selection mode, execution segment No. etc.
(6)/(7)™®(**UP/DOWN**) key:	Key to change set value (temperature, time, hour, etc.) and to choose a selection from various parameters on the function menu.
(8) **ESCAPE** key:	Key to cancel the latest entry and recover the status that was valid prior to the making the latest selection.
(9) Main Display:	It displays temperature measurements, set values (temperature, time, hour, etc.), program information, error information, etc.
(10)Sub Display:	It displays set temperature, remaining time, current hour and execution segment No. etc.
(11)Operation monitor:	It indicates an operation mode.
a) (11) **STANDBY** lamp:	It flashes to indicate that the instrument is in the preoperational standby mode.
b) (11) Temperature pattern lamp:	It illuminates to indicate the heat treatment process pattern executed by the controller with flashing light indicating the point currently in execution.
c) (11) **OVER** lamp:	It flashes to indicate the end of auto-stop or program operation.
d) (11) **TROUBLE** indicator lamp:	It blinks when an error is detected and displays the corresponding code for that particular problem.

e) (11)**REMOTE** operation indicator lamp:	It illuminates when the instrument is put into remote operation (optional) and displays the word "**REMOTE**."
f) (11)**KEY LOCK** indicator lamp:	It illuminates to indicate that the operation panel key lock function is in operation.
(12)Operation menu indicator lamp:	It illuminates to indicate the active operation mode in the operation menu.
(13)Sub display menu indicator lamp:	It illuminates to indicate the item (set temperature, remaining time, hour or execution segment) shown in the sub display.
(14)**HEAT ON** indicator lamp	It illuminates when the heater is on.
(15)**TIME** indicator lamp:	It illuminates when the operation starting time of the auto-start and the operation completion time of the auto-stop is set in the hour setting mode.
(16)Independent Temperature Overheating Prevention Device:	Setting the instrument to the operational temperature of the independent over rising prevention.

Installation

Do not use the unit in an area where there is flammable or explosive gas.

Never use the unit in an area where there is flammable or explosive gas. The unit is not explosion-proof. An arc may be generated when the power switch is turned ON or OFF, and fire/explosion may result.



Always ground the unit.

- Connect the grounding cable to your ground conductor or ground terminal.

- Do not forget to ground the Oven, to protect you and the unit from electrical shock in case of power surge.
- Do not connect the grounding wire to a gas pipe, or by means of a lightning rod or telephone line. A fire or electrical shock will occur.

NOTE: The oven has not a plug connected because of the 200V specification.

Choose a correct power distribution board.

- Choose a correct power distribution switchboard or receptacle that meets the oven's rated electric capacity.
  Electric capacity AC 200 V, single phase 16A
- Do not connect the oven to an outlet that differs from the above specifications because a fire or electrical shock will occur.

Supply connections for the oven

- Request the supply connection for the 200V specifications from a licensed electrician.
- Failure to have this operation complete by certified personnel will cause a fire or electrical shock during Oven operation.

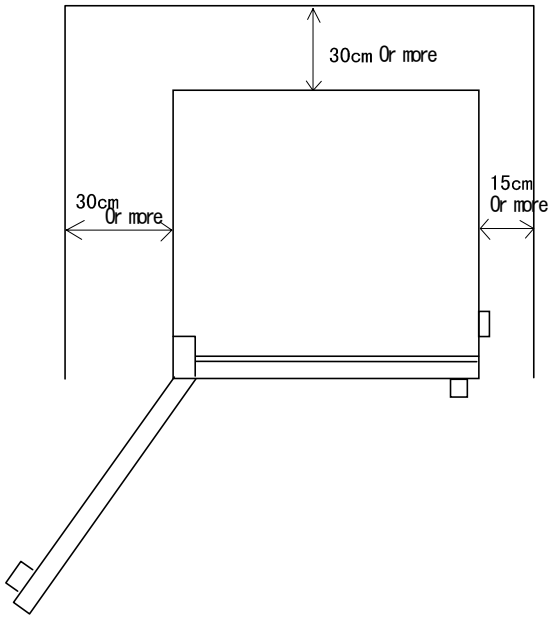
Install the Oven on a level area.

- Do not installation the oven on a non level surface. This will cause hazards to the operator and create problems during actual operation.

Choose a proper place for installation.

- Do not install the oven in a place where:
  - ♦ Flammable gas or corrosive gas is generated.
  - ♦ Ambient temperature exceeds 35°C.
  - ♦ Ambient temperature fluctuates violently.
  - ♦ There is direct sunlight.
  - ♦ There is excessive humidity and dust.
  - ♦ There are constant vibrations.

- Keep the following clearance around the oven.



After installed, you should:

- It may cause injure to a person if this oven falls down or moves by the earthquake and the impact, etc..
- To prevent, take measures that the unit cannot fall down.
- Secure the unit by putting the stoppers on the casters.

Handling of power code.

- Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.
- Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.
- Do not put the power cord under the desk, chair, etc., or through an object. Fire or electrical shock may be caused.
- Do not run the power cord next to heating equipment such as a heater. The cover of the cord may melt and fire or electrical shock may result.

- When the power cord is damaged (exposure of the core wires, disconnection, etc.), turn off the power key right immediately, then turn off the earth leakage breaker and the main power. Contact customer service for a replacement immediately. If this procedure is not followed, fire or electrical shock may be caused.

Caution in setting shelves

- Do not use any shelves but the attached ones.
  If it is used in this manner, the oven cannot occasionally regulate temperatures properly.
- Put the attached shelves on the shelf brackets fitted to the chamber when you use the oven.

Inert gas injection

- Adjust the pressure valve that the pressure will be within 0.2 to 0.5 kg/cm^{2}G prior to injecting a nitrogen gas.
- Secure the tube with a clamp when injecting a gas.
- Readjust the pressure valve within 0.2 to 0.5 kg/cm^{2}G while injecting a gas.
- Do not inject any gas other than a nitrogen gas.

Precautions in handling

Warning

Substances that can be used

- Never use explosive substances (shown on page 34), flammable substances (shown on page 34) and substances that include explosive or flammable ingredients in the unit. Explosion or fire may occur.

Do not put the foreign substances in the oven.

Do not put a foreign substances such as metals or flammable substances in the opening of the unit (ventilation hole and exhaust port, etc.). If this procedure is not followed, fire, electrical shock or burn may result.

If the foreign substances enter the unit, turn off the earth leakage breaker immediately and contact a service technician for inspection. If this procedure is not followed, fire, electrical shock or burn may result.

Caution in taking out samples

During and immediately after operation, the internal surfaces of the chamber and the door are extremely “HOT." To prevent injury, take out the samples when the chamber has cooled down or wear gloves while the chamber is still hot.

When you open the door during working at the high temperature.

Do not touch the internal surfaces of the chamber and the door when you will open the door, because they are extremely hot.

To open the door while the chamber is still hot may cause the malfunction of a fire detector if it is installed near the oven.

Do not touch heated parts.

Do not touch the door during or immediately after operation. Severe burning injury may be caused due to the high temperature.

Do not climb on the oven

Do not climb on top of the oven because it will fall down and break.
Failure to observe this caution may cause injury to a person.

Do not put anything on the oven

Do not put anything on top of the oven because they will fall and result in injury to a person.

⚠ Caution

Caution about the temperature range.

Use the oven in the range of 40°C to 210°C.

When you use the oven for the first time

During the initial operation, the oven may occasionally generate an odor especially when high temperatures are reached. This odor is normal and does not signal a problem with the oven. The adhesive on the insulation melting causes the nature of the odor.

About the temperature in the chamber

Temperature display indicates the sensor temperature installed in the unit, however it does not always correspond to the temperature of the sample when the sample volume is very large or when the temperature is on the increase.

Caution about a drenched sample

- When using a very wet sample, try to drain it as much as possible before putting it in chamber.

Caution about a powdery sample and the loading of samples

There are times when a powder sample is scattered by the sudden decompression operation or purge operation. When performing decompression or purge, open the valve very slowly.

It occasionally takes a long time before the chamber reaches the target temperature if the camber is congested with samples or a sample with the large specific heat is in it. In such cases, reduce samples. Moreover, note that the temperature display occasionally unsettle when you process an exothermic sample.

Distribute samples

- Each shelf can carry a uniform load of 15 kg (33 lb.). When you place samples on a shelf, distribute them evenly over the shelf area.
- If a shelf is congested with samples, the oven occasionally cannot regulate temperatures properly. To ensure the oven's temperature accuracy, there should be open space of at least 30% on each shelf.

Never use corrosive samples

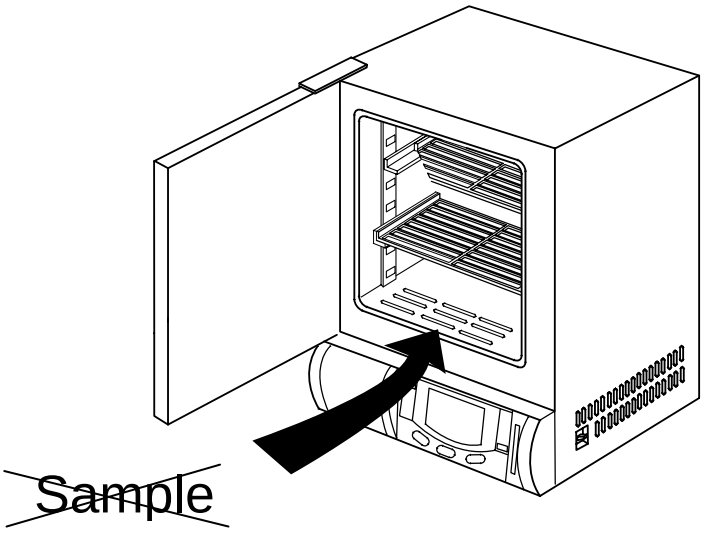
Most parts are made of stainless steel (SUS304). However, strong acid occasionally corrodes even stainless steel. Besides this, the silicone rubber packing is also vulnerable to acid, alkali, oil and halogens' solvents

Ventilate a room when using an inert gas

Application in a well-ventilated area is recommended.

Do not place any samples on the bottom of the chamber

- Do not place any samples on the bottom of the chamber to heat, because it affects the temperature control of the oven.



- Always put the samples on the attached shelves. Place sample so that it does not touch the interior wall of the chamber.
- Set the shelves on the shelf brackets that will accommodate the size of the sample.

During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the earth leakage breaker and main power. If this procedure is not followed, fire or electrical shock may be caused.

In case of power failure

Once the power supply has been cut off due to power failure, and then the power supply is restored, the oven will resume running.

When you open and shut the door

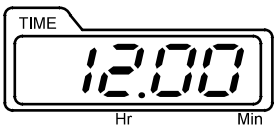
Do not put your hand either face near the door when you open and shut the door. Failure to observe this caution may result in injury because the door hits your hand or face.

Operating Procedure

When prepared completely, proceed as follows:

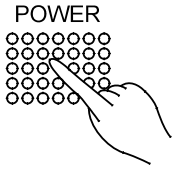
1. Turning on of power supply

- Turn on the earth leakage breaker.



- The present time is shown on the sub display.

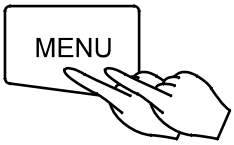
- Push the POWER key in the operation panel.



- When once the power is on, this oven becomes a standby state. Under such a condition, every operation mode can be selected by pushing the MENU key.

2. Selection of operation menu

- Press the MENU key several times to select desired operating method.



- It allows you to enter each parameter into a flashing menu.

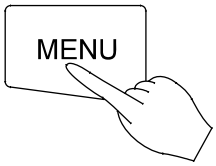
3. Explanation of operation menu

Fixed Temperature	**:** It is an operation method to bring the oven to the desired temperature and keep it steady.
Auto stop	**:** It is an operation method to stop a fixed temperature operation when reached the set time or hours.
Auto start	**:** It is an operation method to start the fixed temperature operation when reached the set time or hours.
Program	**:** It is an operation method that can start or stop an operation either when reached the set time or hours. Moreover, it can change the temperature when reached the desired time and repeat to do that.

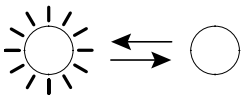
FIXED TEMPERATURE OPERATION INSTRUCTIONS

Selection of operation menu

- Push the MENU key and select the fixed temperature operation.



Push the MENU key.

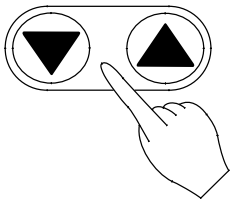


The lamp of the FIXED TEMP blinks.

- The temperature set last time is blinking and enters the state that a set temperature can be input in a sub-display.

Input of set temperature

- Push the ENTER key after making a sub-display display an arbitrary set temperature pushing ▲▼ keys.



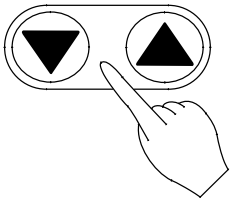
Press either the ▲key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.

Press the ENTER key.

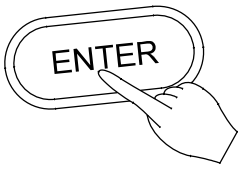
- The oven will start to run the fixed temperature operation to the renewed temperature.

Changing the set temperature when fixed temp operation is in progress

- Push either the ▲ key or the ▼ key to display the desired temperature on the main display and push the ENTER key.



Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



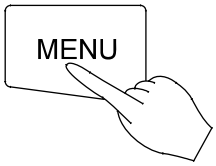
Push the ENTER key.

- The oven will start to run the fixed temperature operation to the renewed temperature.

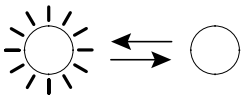
AUTO START OPERATION INSTRUCTIONS

Selection of operation menu

- Select AUTO START mode by pushing the MENU key.



Push the MENU key.



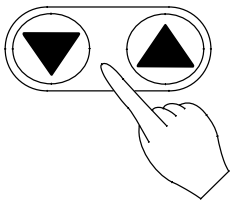
The operation menu lamp of an AUTO START blinks.

- tEMP will appear on the sub display and the desired temperature can be input.

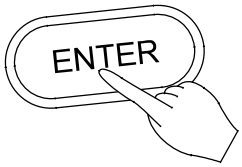
Sub display

Inputting the set temperature

- Press either the ▲ key or the ▼ key to display the desired temperature on the main display and push the ENTER key.

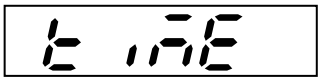


Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



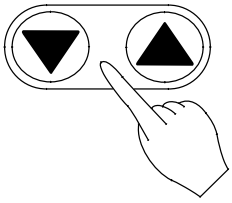
Press The ENTER key.

- tIME will appear on the sub display and the operation start time can be input.

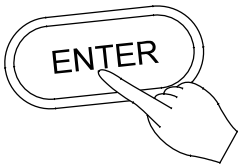


Inputting the desired set time

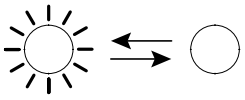
- Press either the ▲ key or the ▼ key to blink start time (or the hour) on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
Then, the desired start time (or hour) will appear on the main display.



Press the ENTER key.

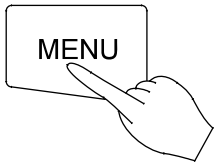


- The STANDBY lamp of the operation monitor blinks.
- The operation will be in standby condition.
- After reaching the set time (or hour), the oven will start to run the auto start operation to the renewed temperature.

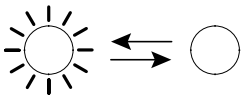
Auto Stop Operation Method

Selection of operation menu

- Press the MENU key and select the auto stop operation.



Press the MENU key.



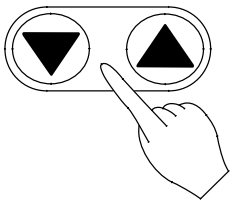
The menu lamp of an AUTO STOP blinks.

- tEMP will appear on the sub display and the desired temperature can be input.

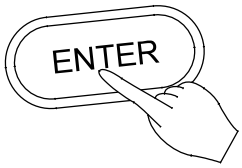
Sub display

Inputting the set temperature

- Push either the ▲ key or the ▼ key to blink the desired temperature on the main display and push the ENTER key.



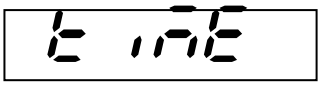
Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



Push the ENTER key.
The main display will light up to indicate the set temperature you have chosen.

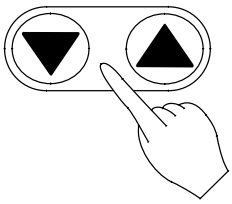
After about 1 second

- tIME will appear on the sub display and the operation stop time can be input.

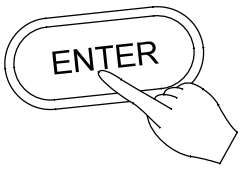


Inputting the desired set time

- Push either the ▲ key or the ▼ key to blink your desired time (or hours) for operation stop on the main display, and press the ENTER key.

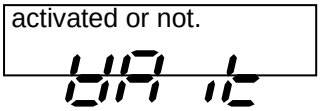


Press either the ▲ key or the ▼ key several times.
Then, the desired stop time (or hour) will appear on the main display.



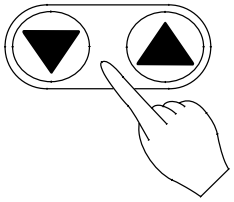
Push the ENTER key.

- WAIt will appear on the sub display and you can chose the wait function to be activated or not.

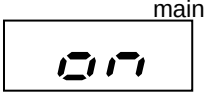


Selection of wait function

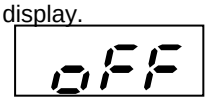
- Press either the ▲ key or the ▼ key to indicate the wait function (ON or OFF) on the main display. Then press ENTER key.



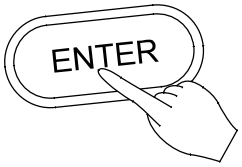
Press either the ▲ key or the ▼ key several times.
Either ON or OFF will appear on the main display.



(activate)



(inactive)



Press the ENTER key.

- This operation activates the auto stop operation.

Working conditions of timer

- **Auto Stop timer activates when:**

1. The wait function is on.

It starts when the set temperature has reached the target value.

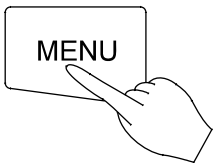
2. The waiting function is off or the time setting represents hours.

It starts right after the auto stop operation is started.

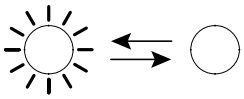
Programmed Operation Method

Selection of operation menu

- Press the MENU key and select the programmed operation.

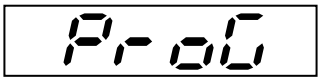


Press the MENU key.



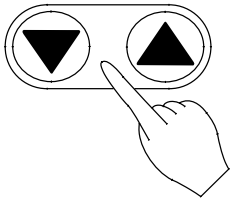
The operation menu lamp of the PROGRAM blinks.

- PrOG will appear on the sub display and the execution program number can be input.

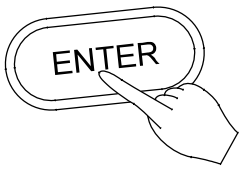


Input of execution program number

- Press either the ▲ key or the ▼ key to indicate an desired program number on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
The program number will appear on the main display.
NOTE: If no programs have been set, ———— is blinking.
See the Operating Instructions for Programmable Controller to set a new program.

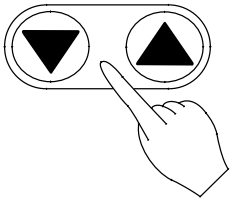


Push the ENTER key.

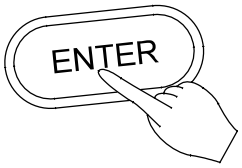
- tiME will appear on the sub display and the operation start time can be input.

Input of time

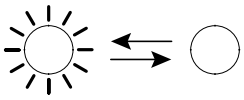
- Press either the ▲ key or the ▼ key to blink your desired operation start time (or hour) on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
The desired set time will appear on the main display.



Push the ENTER key.



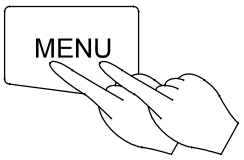
- The standby lamp on the operation monitor blinks. (Operation is in STANDBY MODE)
- The operation will start after the set time is up.

SWITCHING FROM ONE OPERATION TO ANOTHER

This instrument can switch to a different operation mode without stopping the current program no matter what mode it is in, fixed temperature operation, auto-start/stop operation, and program operation.

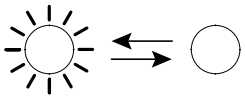
Selection of operation menu

- Press the MENU key several times until the desired operation menu lamp flashes on the Operation Menu.
- Since the current operation has not stopped, the operation menu lamp is also lit.
- On the Operation monitor -- the temperature pattern indicator lamp blinks with the current segment being executed.



Press MENU key several times.

- This status allows you to enter each parameter into blinking or lighting operation menu.



The lamp blinks or lights.

When the fixed temperature operation is selected

- The main display shows the current internal temperature.
- The sub-display flashes the temperature set by the previous fixed temperature operation.

When auto-start operation is selected

- The main display flashes the temperature set by the previous auto-start operation.
- The sub-display shows tEMP (Temp.)

When auto-stop operation is selected

- The main display flashes the temperature set by the previous auto-stop operation.
- The sub-display shows tEMP (Temp.)

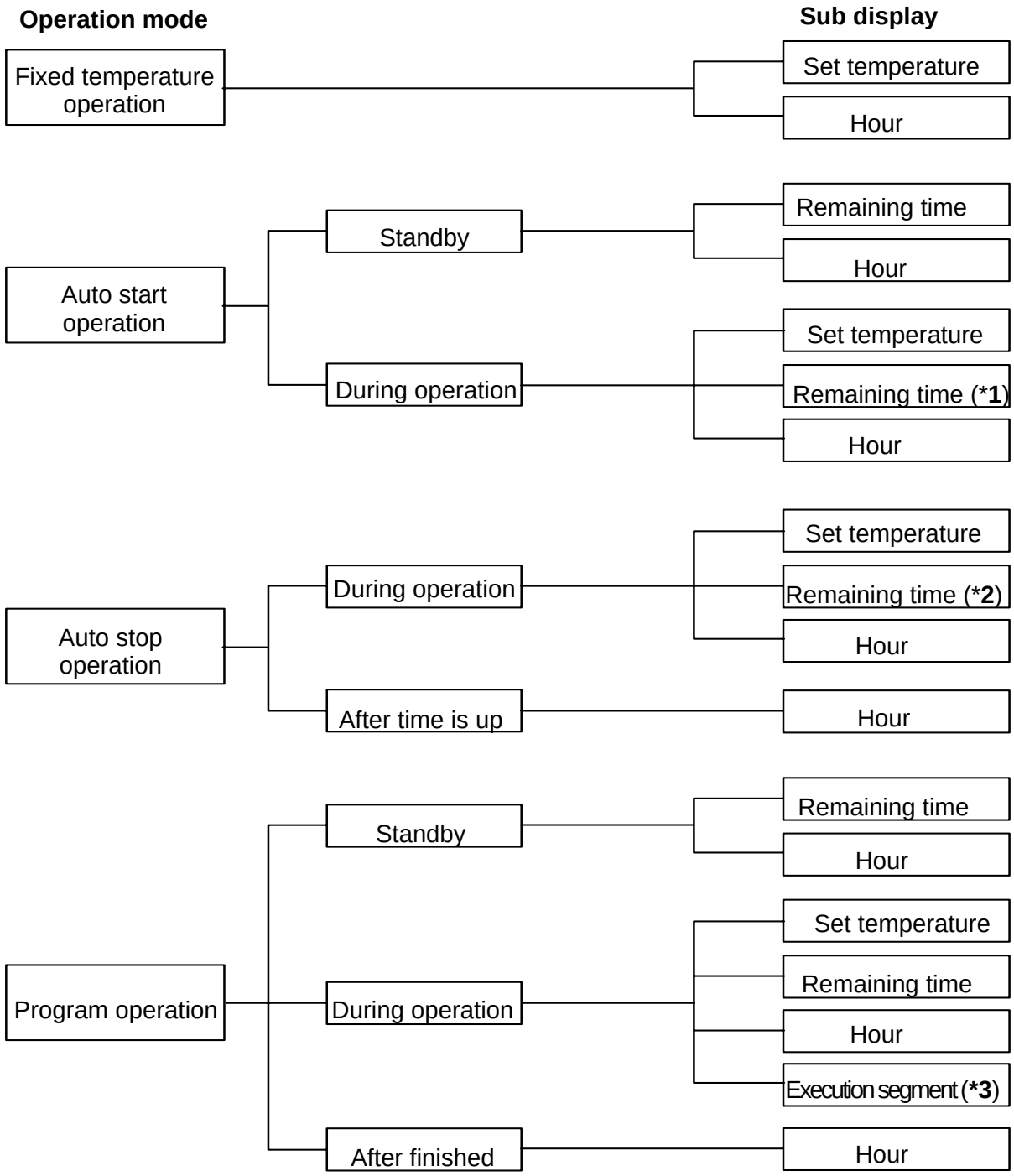
When program operation is selected

- The main display flashes the previously set program number.
- The sub-display shows Pro0 (Program)

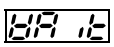
- Now operate according to the operation method you have chosen, see that section of this instruction manual.

Method of using DISPLAY key

The display content of the sub display can be changed over by turns when pushed the DISPLAY key.



***1:** HOLD is displayed.

***2:** When the wait function is set to on,  is displayed in the waiting status.

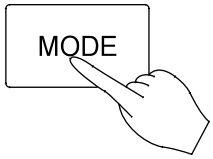
***3: T**he DISPLAY key will enable to show the rest of the repeat count while the repeat operation.

How to use the MODE

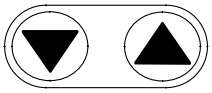
Content of function menu

This controller has the other functions shown bellow.

- Press the MODE key and display your desired function on the main display by pushing either the ® key or the ™ key. Each function will appear by turns whenever pushing the ®™ keys.



Press the mode key.



Select with the ▲ key or the ▼ key.

Main display	Function	
PrOG	Inputting and editing programs	To input and edit the program.
dELP	Deleting the Program.	To delete existing programs that are no longer necessary. Confirmation of the program contents should be performed prior to deleting and in accordance with Programmed Operation Method.
t .nE	Switching time setting mode.	To input either an hour or a period of time during time setting process in the various operation modes -- auto-start/stop, and program operation. It is set to the time (a period of time) setting mode when the product was shipped from the factory.
LOCK	Setting and releasing the key lock.	To set or release the key lock function. This function is for protecting wrong key actions during the operation or while being in the standby state. Once set to ON, the key lock will disable you from doing the **POWER**, **MENU**, **ENTER**, and **DELETE** key action. If the key lock function is set, the **KEY LOCK** lamp on the operation monitor is lit.
bEEP	Alarm buzzer ON/OFF function.	To select whether you want to activate the alarm buzzer or not when an error occurs.
AccN	Accumulating time display function	To display the total duration that the **POWER** key is on, within the range of 0 to 49999 hours.
HOLd	Hold function	To hold the operation that is currently running. This function will get active only when you run the oven in auto-start/stop or program operation mode (includes the standby state). In addition, it will work when the setting of the operation start time for auto-start and program operation as well as the operation end time for auto-stop are set in the form of “Time” and not in the form of “Hour.”
CLOC	Date and current hour setting function.	To set the date and hour.
CAL	Calibration offset function	To conform the display temperature to the measurement temperature of a voluntary point in the chamber at a voluntary temperature. Details are described on page 22

Calibration Offset Function

Outline of Function

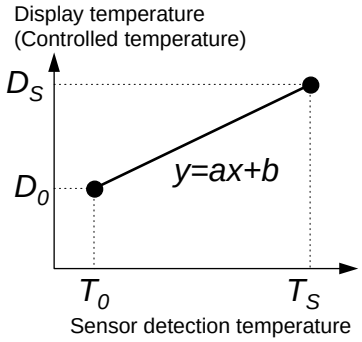


Fig. 1

In the controller, the relationship between the temperature T detected by the sensor and the display temperature of the operation panel D is expressed by the equation of the line which passes the two points (T_0, D_0) and (T_S, D_S) shown in Fig. 1.

Here, T_0 is the sensor detecting temperature when the chamber central temperature becomes the zero adjusting temperature (normally room temperature is adopted) D_0 at the time of no load, T_S is the sensor detecting temperature when the chamber central temperature becomes the span adjustment temperature (normally working maximum temperature is adopted) D_S at the time of no load in the same way.

As it is clear from the facts above, conforming of the chamber central temperature and the display temperature is guaranteed only when there is no load and at two points shown above. In other words, it is possible for a temperature measured at a point in the chamber does not conform to the display temperature of the operation panel at a voluntary temperature without load.

This is the function to move the line which passes above two points to the Y axis direction in parallel (increase or decrease y intercept of the line). The parallel movement amount including a sign is defined as the calibration offset. This function can conform the display temperature of the operation panel to the measurement temperature of a voluntary point in the chamber at a voluntary temperature.

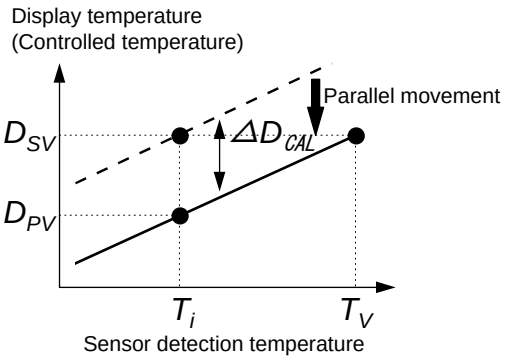


Fig. 2

In Fig. 2, D_{SV} is a display temperature of the operation panel under the condition that the temperature in the chamber is constant for a set temperature. It is natural to say that this value is equal to the target set temperature. D_{PV} is a measurement temperature of a voluntary point in the chamber under this condition. The difference between D_{PV} and D_{SV} including the sign is defined as the calibration offset. Therefore offset is shown as below.

$$\Delta D_{CAL} = D_{PV} - D_{SV} \qquad \textbf{Equation 1}$$

In Fig. 2, ΔD_{CAL} becomes the negative value since the target set temperature D_{SV} is larger than the actually measured temperature D_{PV}. In order to conform the display temperature to the actually measured temperature, let the controller to recognize that the temperature in the chamber differs from the target set temperature by ΔD_{CAL}.

NOTE: Setting Tolerance of Calibration Offset

- The calibration offset can be set within ±5% of the maximum working temperature of the oven. (Therefore, the setting tolerance of the calibration offset is ±19°C.)
- Initial off set value has been set to 0°C when shipping.

Setting The Calibration Offset Function

This function can be activated when the controller is in the condition of accepting the MODE key.

EX. Bring the oven to the target set temperature 100°C and allow it to reach the steady state. After then, measure the temperature at a point in the chamber. If it shows 97°C when the main display shows 100°C, you can conform your measuring value to the one on the display by using the calibration offset function.

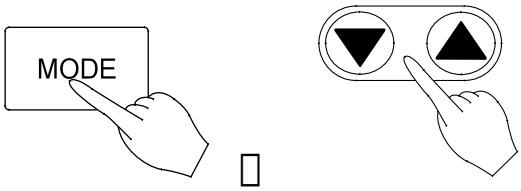
Calibration offset ΔD_{CAL} is obtained from the Equation **1** (page22) as shown below.

$$\Delta D_{CAL} = 97℃ - 100℃ = -3℃$$

Procedures to set the calibration offset ΔD_{CAL} to the controller are shown as below.

Setting and changing the calibration offset value

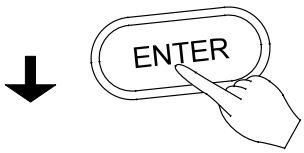
- Push the MODE key, and then push the ® key or the ™ key several times to display cAL on the main display.



Push the ® key or the ™ key several times

- The sub display shows the calibration offset value that has been set the last time.

NOTE: When the unit is shipped from the factory, the sub-display shows 0 as the calibration offset value.

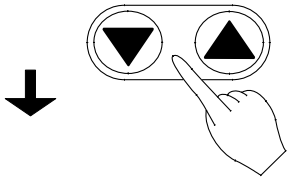


Push the ENTER key.

- The main display flashes the preset calibration offset value.

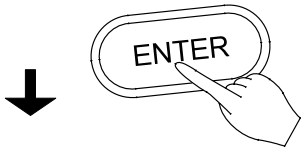
⇒ In this state, the set value of the calibration offset can be changed.

- The sub display shows cAL.



Push the ® key or the ™ key several times

- Push either the ™ key or the ® key to change the value on the main display to your desired value (calibration offset value to be set newly).



When the changing is completed, push the ENTER key.

- The changed value is entered and both the main and the sub displays return to the display mode just before pushing MODE key. The controller starts the temperature controlling operation in order to make the difference zero, since the difference is generated between the target set temperature and the temperature in the chamber by the changing of the calibration offset value.

Safety Devices and Error Codes

Purposes and Operations of Safety Device and Counter-measures

This instrument incorporates an automatic diagnosis function built in the controller and safety devices independent of the controller. The purposes and operations of the safety devices and countermeasures are shown in the **Table** below. When an abnormal condition occurs, an error code is displayed in the main display. Immediate action should be taken according to the specific counter-measures.

Safety Device	Display	Cause & Counter-measures
1. Earth leakage breaker	No Display	• Power circuit interrupted • Erases all displays ⇒ Report to our service office and check the cause of the problem.
2. Sensor malfunction detector	**TROUBLE** lamp flashes. Er.01 flashes.	• Break in temperature sensor circuit. ⇒ Report to our service office.
3. Triac circuit detector	**TROUBLE** lamp flashes Er.02 flashes.	• Short circuit in triac. ⇒ Report to our service office.
4. Disconnected heater circuit detector	**TROUBLE** lamp flashes Er.03 flashes.	• Heater circuit is disconnected. ⇒ Report to our service office.
5. Independent overheating prevention	**TROUBLE** lamp flashes Er.07 flashes.	• Incorrect setting of the independent overheating prevention. ⇒ Set correctly. • Heating of sample ⇒ Reduce the amount of the sample. • Malfunction of the independent overheating prevention circuit. ⇒ Report to our service office.
6. Main relay malfunction detector	**TROUBLE** lamp flashes Er. 10 flashes.	• A malfunction of the main relay. ⇒ Report to our service office.
7. POST function*	**TROUBLE** lamp flashes Er08, Er 14, Er 15 flashes.	• Contact Yamato Sciectific's Technical Service Department.
8. Automatic overheating preventive function	No Display	• Heating of samples ⇒ Reduce amount of samples
9. Key lock	Key lock display lamp lights up	• This function prevents the disruption of operation due to incorrect operation. Leave it on during operation. (See section in this manual for setting and resetting methods on page 21).
10. Memory backup circuit	No Display	
11. Door switch	door flashes	• It is not the fault. ⇒ When opened the door, door will flash on the sub display and the heater circuit will be cut off and the fan will stop for safety. Once closed the door, door will go out and the heater circuit and the fan will resume working.

- **POST** (**P**ower **O**n **S**elf **T**est) function checks the microprocessor, memory surrounding LSI, surrounding circuit of the controller every time "**POWER**" key is turned **ON**. This is the function for checking that the controller won't have a fatal fault before starting the operation.

INDEPENDENT OVERHEAT PREVENTION

There are two safety devices in this unit: the auto-overheating preventive function of the controller (automatic recovery) and the independent overheating prevention (manual recovery). Circuits and sensors that are independent from the controller configure them. These safety devices for the temperature overheating prevention protect the instrument in a fail-safe method.

Setting the Temperature Range and Function

Setting Temperature:	0 to 399°C
Input Method:	Three integer digital switch. Turn the drum of each column and set the desired value. The first integer can only be from 0 to 3 for the hundred columns.
Function:	Heater output is cut off when the measured temperature gets higher than the set temperature of the independent overheating prevention. The function is active when the earth leakage breaker is ON. When the independent overheating prevention is activated, is flashing on the main display with the **TROUBLE** lamp flashes. When the independent overheat prevention is active while the heater is in the temperature rising process, etc., and flash alternately on the display.

Activation/Setting Method

1. Set the independent overheating prevention 15°C higher than the set temperature of the main unit.

2. When setting the proper value to protect the sample, be sure it is well above room temperature, and set it at least 15°C higher than the maximum temperature set value of the temperature pattern of the program.

3. When the independent overheating prevention is activated improperly by changing the setting of the independent overheating prevention lower than the internal temperature or by continuing operation when the setting on the unit is too low, turn off the earth leakage breaker to reset the unit and perform the setting again. If it is activated by another reason, see chapter of Safety Devices and Error Codes on page 24.

Precautions

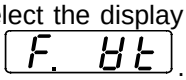
1. Only 0 to 3 can be set for the column of hundreds of the digital switch by the stop mechanism; however, if forced to change it to a value higher than 3, it will damage the unit.

2. Set temperature can change by touching the setter when cleaning. Always confirm that the set temperature is correct after cleaning or before operation.

Behavior after Power Restoration

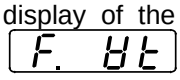
In case of power failure during operation, the controller resumes the following operations after the power restoration.

In case of power failure during the program operation

The controller automatically resumes the program operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows  .

The timer built-in the controller does not count as running time for a period of power failure.

In case of power failure during the Auto-Stop operation

The controller automatically resumes the Auto-Stop operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature after the power restoration, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows  . (Forced Wait)

In case that the operation stop time is set in a period of time, the timer built in the controller does not count as running time for a period of power failure. On the contrary, in case that the operation stop time is set in hours, the timer built in the controller counts as running time for a period of power failure.

When the operation stop time reaches during power failure, the controller stops running just after the power restoration.

In case of power failure while the controller is in standby condition

In case that the operation start time is set in a period of time, the timer built in the controller does not count as standby time for a period of power failure. On the contrary, in case that the operation start time is set in hours, the timer built in the controller counts as standby time for a period of power failure.

When the operation start time reaches during power failure, the controller starts running just after the power restoration.

In case of power failure during the fixed temperature operation and a soak period of the Auto-Start operation

The controller resumes running toward to the preset temperature after the power restoration.

Maintenance and Inspection

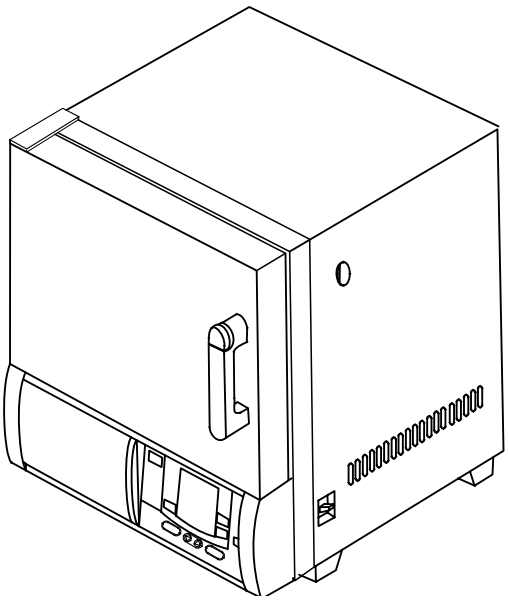
Warning

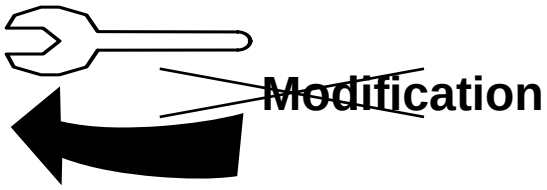
Do not disassemble and modify the oven.

- Do not disassemble the oven. There are parts in the unit with high voltage; therefore, if the unit is disassembled, electric shock and injury may result.

Ask the Yamato Scientific office for inspection, adjustment, and repair of the inside of the unit.

- Unauthorized modification will be hazardous and cause problems in the operation of the Oven.





Caution

Maintenance Precautions

- Before starting inspection or maintenance, disconnect the power plug from the receptacle.
- Conduct inspection and maintenance only after the oven has cooled down.
- When you remove dirt or stains from the unit's resin parts and the control panel, use a soft wet cloth. Do not use benzene, thinner, cleanser or a hard brush; it will cause deformation, qualitative deterioration and/or discoloring of the components.

Periodic inspection of the safety component.

- The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically.(See chapter of Maintenance Procedure on page 28)

If you have any questions, contact our sales representative in your vicinity or our service office.

Maintenance Procedure

Operation Check of Independent Temperature Overheating Prevention Device

- After executing the fixed temperature operation at the set temperature 0°C, set the operation temperature of the Independent Temperature Overheating Prevention Device to 0°C.
- Under normal circumstances, the heater circuit is cut off in a few seconds and the **TROUBLE** lamp and E-07 flashes at the same time, and the alarm buzzer sounds if the alarm buzzer function is ON.
- After confirming, turn off the earth leakage breaker once, and then return the setting of the Independent Temperature Overheating Prevention Device to the proper value. Turn the earth leakage breaker back ON.

Always perform inspection before a long continuous operation or an unattended operation.

Long Storage and Disposal

When you do not use the oven for a long period of time.

Disconnect the power cable from the power switchboard.

When you dispose of the oven.

Do not leave it where children can access. Remove the knob and hinges of the door to disable the door locking system.

After service and WARRANTY

If a Service Call is required:

If a Service Call is required

- If a problem occurs with the Mechanical Inert Oven, record the error code on the display and stop the operation immediately, turn off the power switch, and disconnect the power plug from the receptacle. Contact our sales or service representative.
- Check the warranty card or the name plate of your Mechanical Inert Oven and give us the information below.
  - Model of your oven;
  - Serial product number of your oven;
  - Date of purchase; and
  - Problem with your oven (as detailed as possible).

Warranty Card (attached to your Oven)

- Please fill out completely and return the bottom portion of the warranty card when the unit is received. The completed top portion is your Registration Card that should be retained for your records.
- Warranty period is one (1) year after the date of your purchase. During this warranty period, we will offer free repair service on the basis of the conditions provided on the warranty card.
- If you need repair service after expiration of the warranty period, contact our sales or service representative in your vicinity or service office for advice.

Minimum Inventory Period of Repair Parts

Repair parts will be available for at least 5 years after termination of our production of Mechanical Inert Oven. Repair parts mean the parts that are necessary to maintain the performance of the ovens.

TROUBLESHOOTING

Problem	Cause/Solution
No display of current hour in the sub-display at the activation of the earth leakage breaker.	• Check if the power cable is firmly connected to a receptacle. • Check for power failure.
Temperature fluctuates during the operation	• Does ambient temperature fluctuate violently? • Are there too many samples in the chamber? • Are the samples too moist?
It takes too much time for temperature to rise.	• Are there too many samples in the chamber?

SPECIFICATIONS

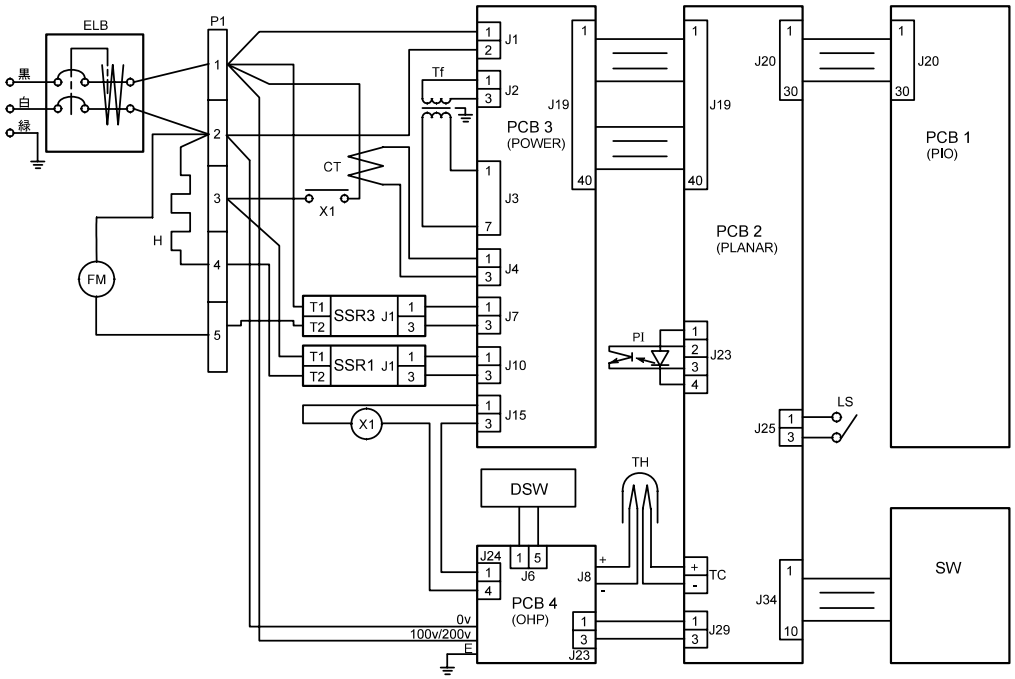
Model	DN410I
Method	Forced Ventilation
Performance:	
Operating Temperature	４０ ～ ３６０℃
Temperature Stability*[1]	±０．２℃（@３６０℃）
Temperature Uniformity	±３．０℃（@３６０℃）
Time To Reach Max. Temp.*[1]	Approx. 60 min.
Displacement Time	Approximately 70 min (Ambient temperature, Oxygen concentration in the chamber reaches 2%)
Structure:	
Exterior	Cold rolled steel plate with baked-on melamine resin finish
Interior Chamber	Stainless steel (SUS304)
Insulating Material	Glass wool and Ceramic fiber
Heater Nominal Capacity	3.0kW
Fan	Sirocco fan, Output:10W×2
Flowmeter	Maximum flow rate; 30 mℓ/min
Gas Injection Port	Outside diameter 8 mm (rear face)
Controller:	
Temperature Control Method	PID control by microprocessor
Temperature Setting Method	Digital setting method by ®™ keys (resolution: 1°C)
Temperature Indicating Method	Digital display by green LED (resolution: 1°C)
Other Indication	Temperature pattern LED indication that shows operation indication
Timer	1 min. to 99 hrs. 59 min. or 100 hrs to 999 hrs (Timer resolution: 1 min. or 1 hr.)
Operation Function	Fixed temperature operation Auto-start/Auto-stop operation Program operation (16 segments, repeat, etc.)
Additional Function	Calendar timer function (actual hr. timer within 24 hrs.) Integrating time function (Integrated hr. up to 49999 hrs. can be measured.) Time indication (The present time is indicated.) Calibration offset function
Heater Circuit Control	Triac zero cross system
Sensor	K thermocouple (double sensor)
Safety Device	Earth leakage breaker with the over current protector Self-diagnostic function (sensor abnormality, heater disconnection and Triac short circuit detection; automatic temperature over-rise prevention) Key lock function Independent Temperature Overheat Prevention device (Digital switch input system, setting temperature range: 0 to 399°C)
Internal Dimensions (WxDxH)*[2]	470 mm × 450 mm × 450 mm
External Dimensions (WxDxH)*[2]	640mm × 695mm × 930mm
Capacity	95 ℓ
Weight	Approx. 80 kg
Power Requirements	AC 200 V, 50/60Hz, 16A single phase
Accessories:	
Shelf / Shelf Brackets	2 sets
Instruction Manual	For exclusive use of this oven and the controller: each one

NOTES: *1. The values written on the chart were measured with no sample and both exhaust ports closed in ambient temperature of 20°C.

*2. Displacing was performed with a flow rate of 20 ml per minute.

*2. Both of internal and external dimensions do not include the one of protruding parts.

WIRING DIAGRAM



Symbol	Part Name	Symbol	Part Name
CT1	Current Transformer	PCB3	Power board
ELB	Earth leakage breaker	PCB4	Independent overheat prevention
FM1	Fan motor	PI1,2	Photo-interrupter
H	Heater	SSR1,2,3	Solid-state relay
LS	Door switch	SW	Membrane keypad
P1,2	Terminal block	Tf	Transformer
PCB1	PIO board	TH	Thermocouple
PCB2	PLANAR board	X1	Relay

REPLACEMENT PARTS TABLE

Symbol	Part Name	Code No.	Specifications
CT	Current Transformer	2-17-001-0002	CTL-6-S-400
ELB	Earth leakage breaker	**2-06-005-0012**	**BJS30-3**
FM	Fan motor	2-14-000-0003	REK42M-4CCW, AC200V
H	Heater	**DN63H-30320**	**AC200V 1500W**
P	Power code	2-13-001-0010	T3 - 3d
P1,2	Terminal block	2-07-023-0002	M011-0FX 4P
PCB1	PIO board	1-24-000-0024	
PCB2	PLANAR board	1-24-000-0059	
PCB3	Power board	1-24-000-0025	Type 1
PCB4	Independent overheat prevention	1-27-001-0002	QKB-0
PI1,2	Photo-interrupter	1-21-001-0002	TLP802
SSR1,2,3	Solid-state relay	LT00028423	SSR-01
SW	Membrane keypad	1-01-320-0008	Type 4H
Tf1	Transformer	2-18-000-0023	AC200V
TH	Thermocouple	1-16-001-0042	K thermocouple (double sensor)
X1	Relay	2-05-000-0010	HE1a-DC12V

Reference

HAZARDOUS MATERIAL

Explosives	Explosives Substances	1. Nitroglycol, Nitroglycerin, Nitrocellulose, and other explosive nitric esters.
		2. Trinitrobenzens, Trinitrotoluene, Picric acid, and other explosive nitro compounds.
		3. Peracetic acid, Methyl ethyl ketone peroxide, Benzoyl peroxide, and other organic peroxides.
Flammables	Combustible Substances	Metallic lithium, Metallic potassium, Metallic sodium, Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid, Calcium carbide, Lime phosphate, Magnesium powder, Aluminum powder, and other ignitable metal powders and sodium dithionite (hydrosulfite).
	Oxidants	1. Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorates.
		2. Potassium perchlorate, Sodium perchlorate, Ammonia perchlorate, and other perchlorates.
		3. Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxides.
		4. Potassium nitrate, Sodium nitrate, Ammonia nitrate, and other nitrates.
		5. Sodium chlorite and other chlorites.
		6. Calcium hypochlorite and other hypochlorites.
	Ignitable Substances	Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and flammable substances with a flash point below minus 30ºC.
		Normal hexane, Ethylene oxide, Acetone, Benzene, Methyl ethyl ketone, and flammable substances with a flash point between minus 30ºC and 0°C.
		• Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and inflammable substance with a flash point between 0ºC and 30ºC.
		• Kerosene, Light oil, Turpentine oil, Isoamyl alcohol, Acetic acid, and flammable substances with a flash point between 30ºC and 65ºC
	Combustible Gases	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane, and other gases that are flammable under 1 atmospheric pressure at 15ºC.

(Quoted from “Addendum Table1 of Code of Work Safety and Hygiene Standard”)

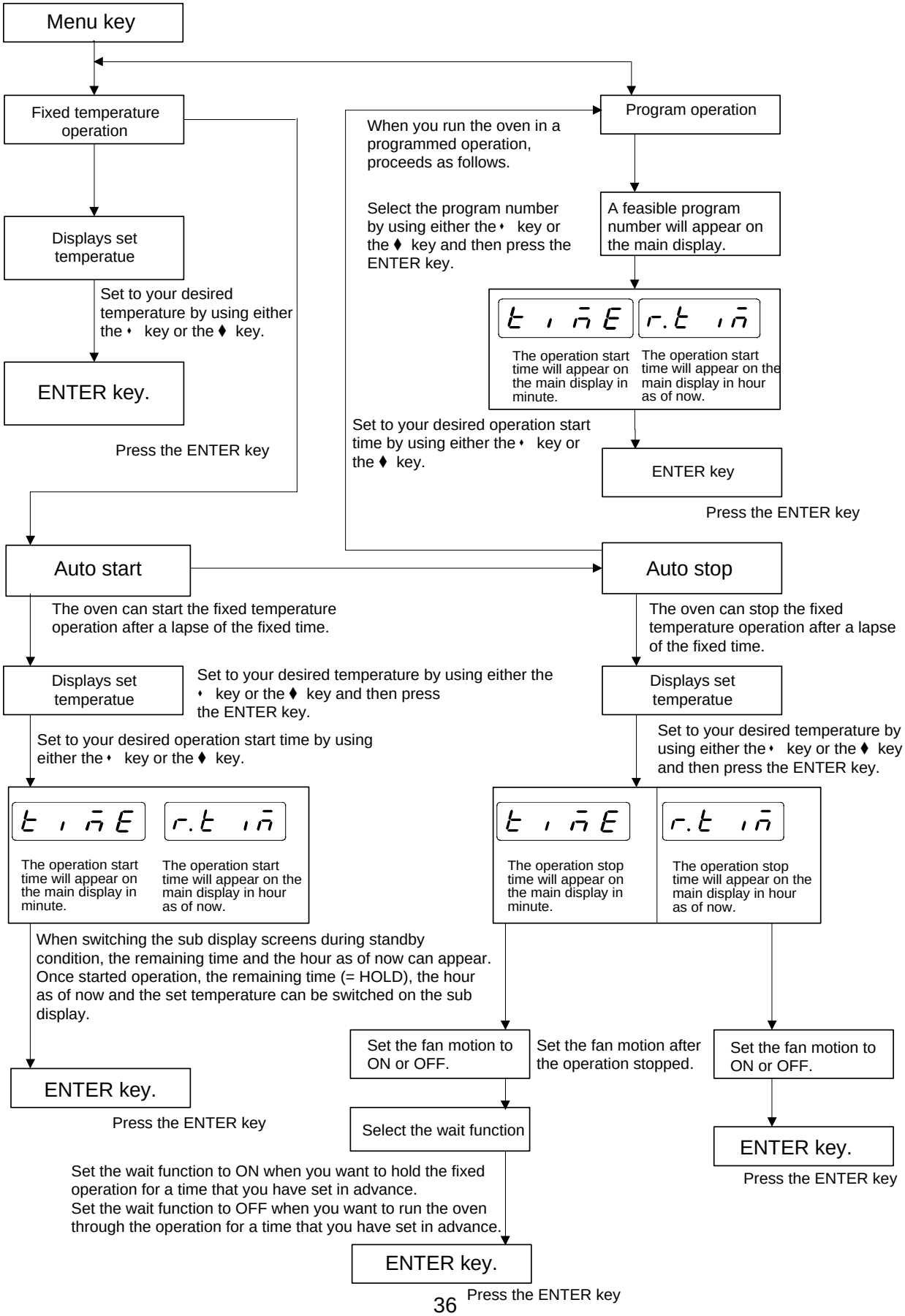
List of Symbols in the display

The oven has the controller with the 4-digit LED display. The meaning of symbols in the display is as follows:

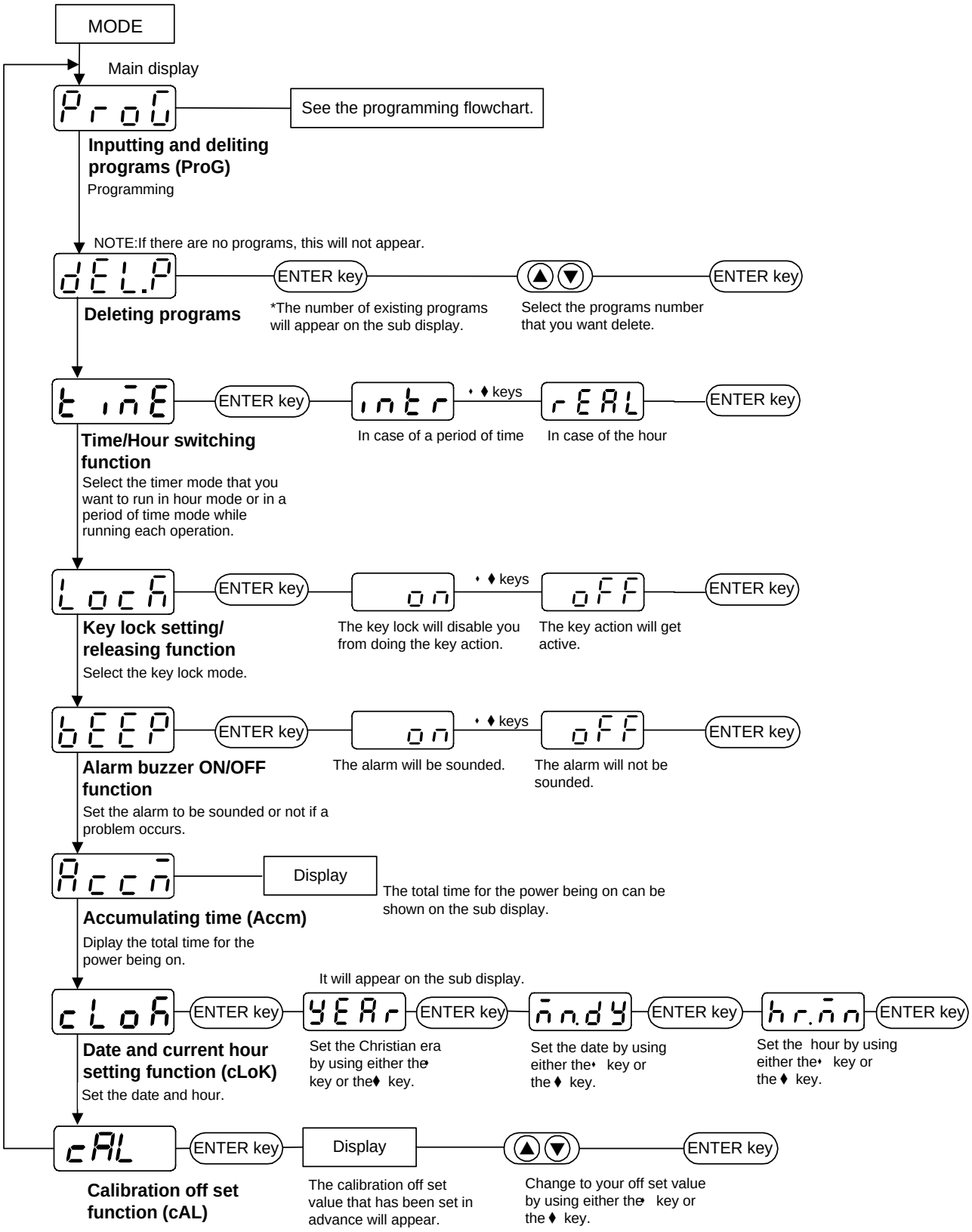
Capital	Symbol	Meaning of Abbreviation	Meaning of Symbol in the display
A	Accn	accumulation	Integrated time
B	bEEP	beep	Alarm sound setting mode
C	cAL	Calibration	Calibration offset setting mode
D	dEL.P	delete program	Deleting a program
	d iSP	display	Sub display switching mode
E	End	end	Setting mode for program end
	Er. #	error #	Error code #
F	F. Wt	f. wt (Forced wait)	Forced wait state after the power restoration
H	HoLd	hold	Hold function mode
	hr.mn	hr. mn (hour. minute)	Setting of time (hour, minute)
L	LocK	lock	Panel locking mode
M	mn.dY	mn. dy (month. day)	Setting of the date (month and day)
O	oFF	off	Make a function inactive
	on	on	Make a function active
P	Pr. #	program #	Program number
	ProG	program	Program mode
	Pr.SG	program, segment	Ongoing program and ongoing segment
R	r.cnt	repeat count	Repeat frequency setting mode
	rEAL	real (real time)	The hour
	rEP	repeat	Repeat command mode
	rESt	rest time #	Rest for remaining time
	rL. #	ramp level	Ramp level of Segment # (Desired set temperature)
	r.Str	repeat start	Repeat start segment setting mode
	rt. #	ramp time #	Ramp time of Segment # (Time required to reach the ramp level)
	r.t in	r. tim (real time)	the hour
S	SG. #	segment #	Segment number
	St. #	soak time	Soak time of Segment # (Holding time of the ramp level)
	StEP	step	Not in Ramp Operation
T	tEmP	temp	Temperature mode
	t imE	time	Time mode
W	WAit	wait	Wait function (Keep the operation until the desired temperature is achieved)
	Wt. #	wait #	Wait function of Segment #
Y	YEAr	year	the Christian era

Flowchart of Operational Procedures

Run “MENU”

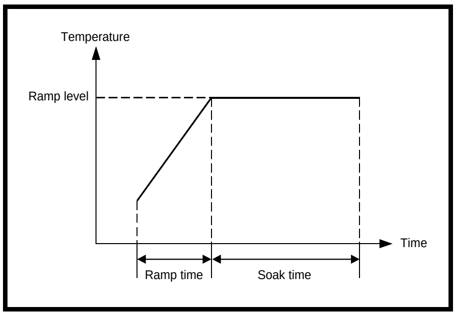


Program “MODE”



Flowchart for programming

Segment configuration
: Segments are made up of the following items, and must be input in this order.



Item	Description
Ramp time (rt.)	Rising time
Ramp level (rL.)	Target temperature
Soak time (St.)	Time held at ramp level
Wait function (Ht.)	Selects whether to give priority to soak time (OFF), or to hold process time at ramp level (ON).

Display / Key	Description
MODE key — Press; ▲▼ Key	
ProG — ENTER key; ▲▼ Key	Call up the program mode.
Pr. 1 — ENTER key; ▲▼ Key	Call up the program number that you want to input or edit.
SG. 1 — ENTER key; ▲▼ Key	When you want to rewrite programs, call up your desired segment number on the main display. Note that this will appear in case of editing.
rt. 1 — ENTER key; ▲▼ Key	Input Ramp time. Note: When you run this unit with full power, input StEP.
rL. 1 — ENTER key; ▲▼ Key	Input Ramp level.
St. 1 — ENTER key; ▲▼ Key	Input Soak time. Note: If there is no soak time (changing immediately to next temperature), input 0. To hold, select HoLd
Ht. 1 — ENTER key; ▲▼ Key	Select wait function.
SG. 2 — ENTER key; ▲▼ Key	The next segment will appear. Note: To repeat, press either the ® key or the ™ key to display rEP, and select it with the ENTER key. Input the segment number that you want to repeat, and then do the repeat count. * Input all the settings in the same way.
rt. 2 — ENTER key; ▲▼ Key	When finished inputting all items, select End for the ramp time, and press the ENTER key.
Settings finished	

MECHANICAL INERT OVEN

Model: DN610I

Version 2

Yamato Scientific Co., LTD.

Congratulations on your selection of Yamato Scientific's Mechanical Inert Oven!
Please read these operating instructions, user notes and the warranty card thoroughly before the initial operation of your Mechanical Inert oven. This will ensure proper operating procedures and extended life for the unit. Please keep the operating instructions together with the warranty card for easy access whenever you need them.

Attention: Read the warnings in the operating instructions carefully to familiarize yourself with the initial operation of your Mechanical Inert oven.

Depending on the extent and nature of danger, the warnings given in these operating instructions are classified into the following two categories by symbol.

To protect operators from accident --
Negligence of this warning may result in a serious accident.

To protect the Mechanical Inert Oven from damage --
Negligence of this warning may result in damage to the Mechanical Inert Oven. This warning also gives you tips on performance that are useful in its operation and maintenance or indicates the common mistakes that operators often make.

TABLE OF CONTENTS

Explanation of picture display

MEANING OF ILLUSTRATED SYMBOLS

Illustrated Symbols Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below.

Be sure that you understand the warnings and cautions in this manual before operating the unit.

⚠ Warning	If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.
⚠ Caution	If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

Meaning of Symbols

This symbol indicates items that urge the warning (including the caution).

A detailed warning message is shown adjacent to the symbol.

This symbol indicates items that are strictly prohibited.

A detailed message is shown adjacent to the symbol with specific actions not to perform.

This symbol indicates items that should be always performed.

A detailed message with instructions is shown adjacent to the symbol.

Safety Precautions

WARNING

⃠ Do not use the unit in an area where there is flammable or explosive gas.

℅ Never use the unit in an area where there is flammable or explosive gas.

The unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result.

❗ Always ground the unit.

℅ Always ground the unit on the power equipment side in order to avoid electrical shock due to a power surge.

❗ If a problem occurs, you should:

℅ If smoke or strange odor should come out of the unit for some reason, **turn off** the power key right away, then **turn off** the earth leakage breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result.

Never perform repair work yourself, since it is dangerous and not recommended.

⃠ Do not use the power cord if it is bundled or tangled.

℅ Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

⃠ Do not process, bend, wring, or stretch the power cord forcibly.

℅ Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.

⃠ Do not put the power cord under the desk, chair, etc.,

℅ Do not put the power cord under the desk, chair, etc., or through an object. Fire or electrical shock may be caused.

⃠ Do not run the power cord next to heating equipment such as a heater.

℅ Do not run the power cord next to heating equipment such as a heater. The cover of the cord may melt and fire or electrical shock may result.

WARNING

⃠ Substances that can not be used.

℅ Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in the unit. Explosion or fire may occur.

⃠ Do not disassemble or modify the unit.

℅ Do not reconfigure the unit. Fire or electrical shock may be caused.

⃠ Do not touch the door during or immediately after operation.

℅ Do not touch the door during or immediately after operation. Severe burning injury may be caused due to the high temperature.

CAUTION

❗ During a thunder storm . . .

℅ During a thunderstorm, **turn off** the power key immediately, then **turn off** the earth leakage breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

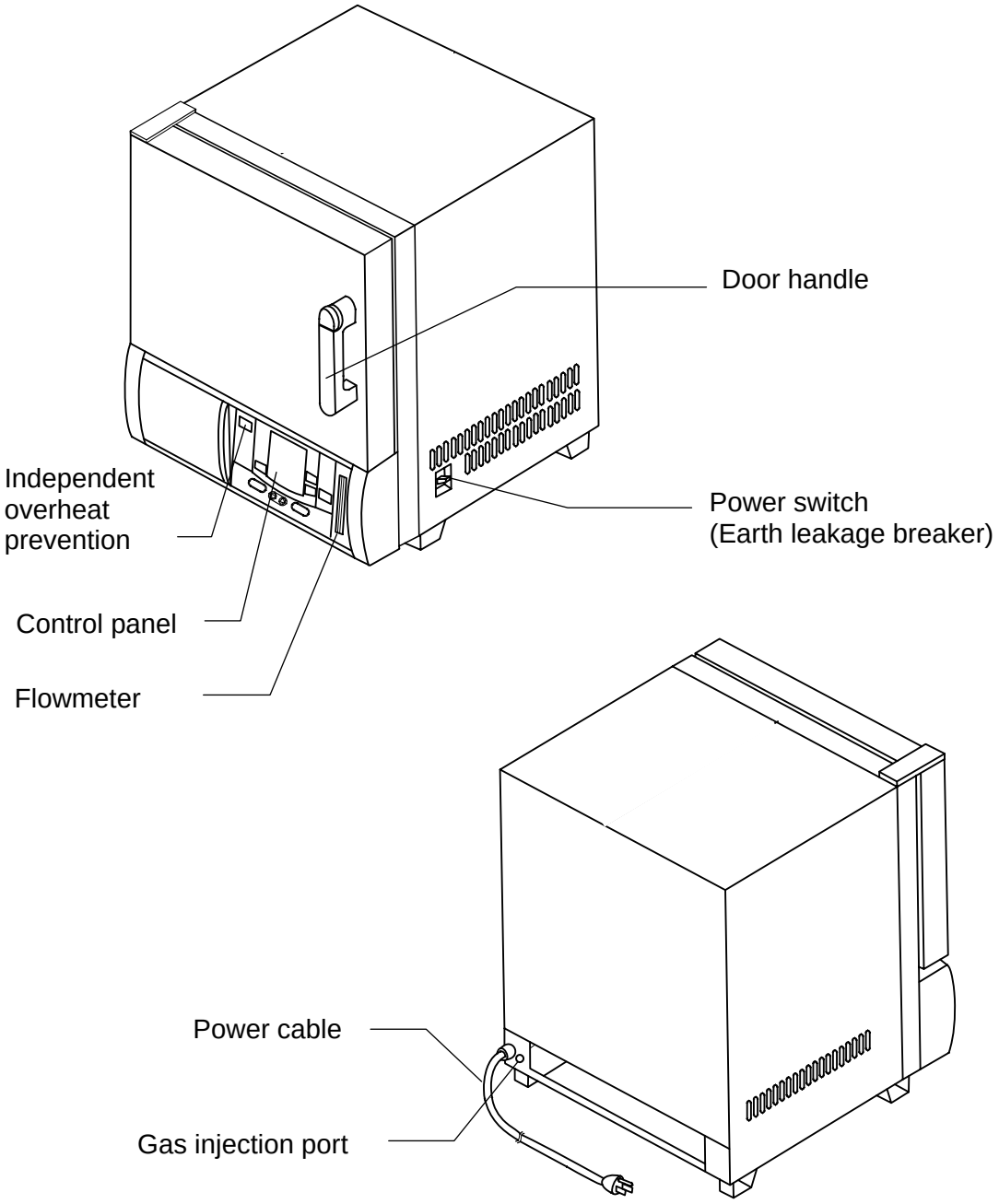
❗ Periodic check of the safety component.

℅ The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically. (See chapter of INDEPENDENT OVERHEAT PREVENTION on page 25.)

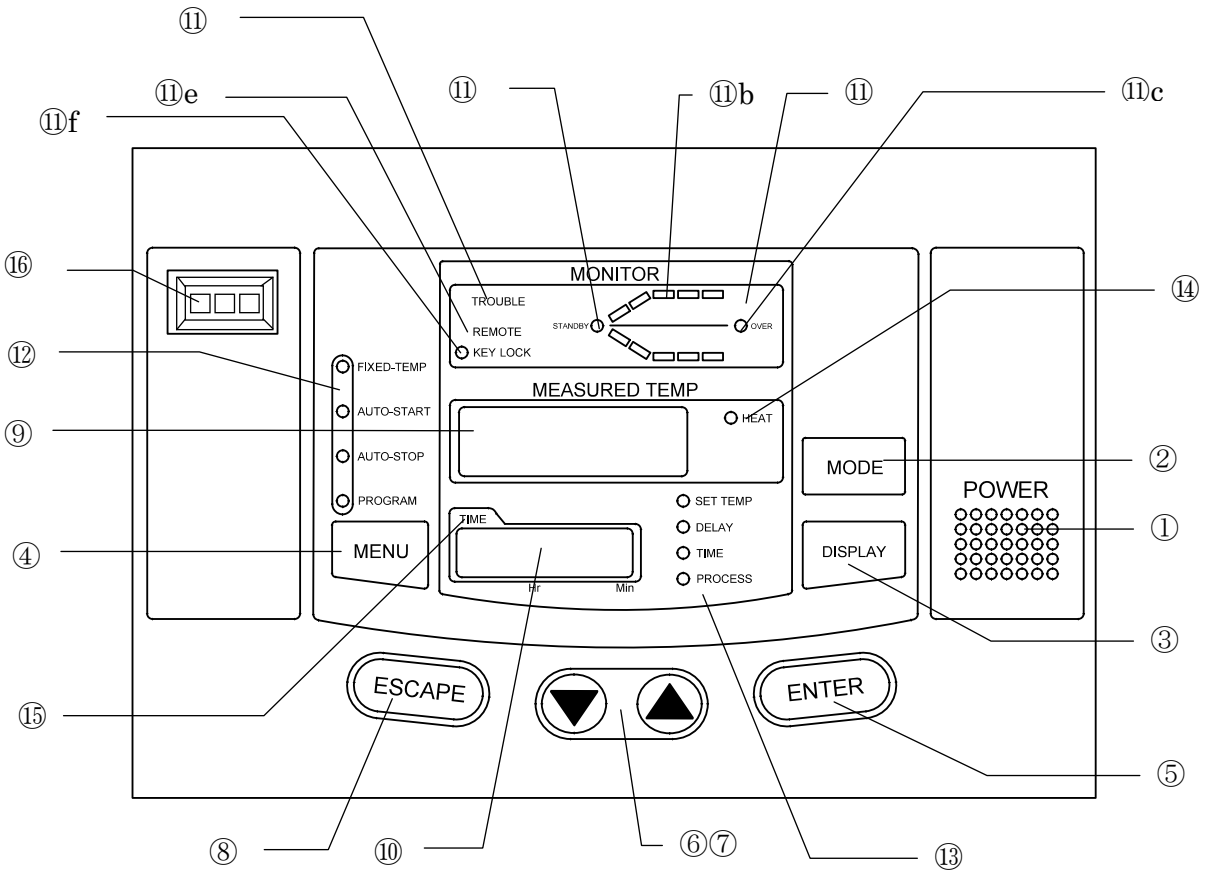
Notes to Users

Identification of Parts

Main unit



Control Panel



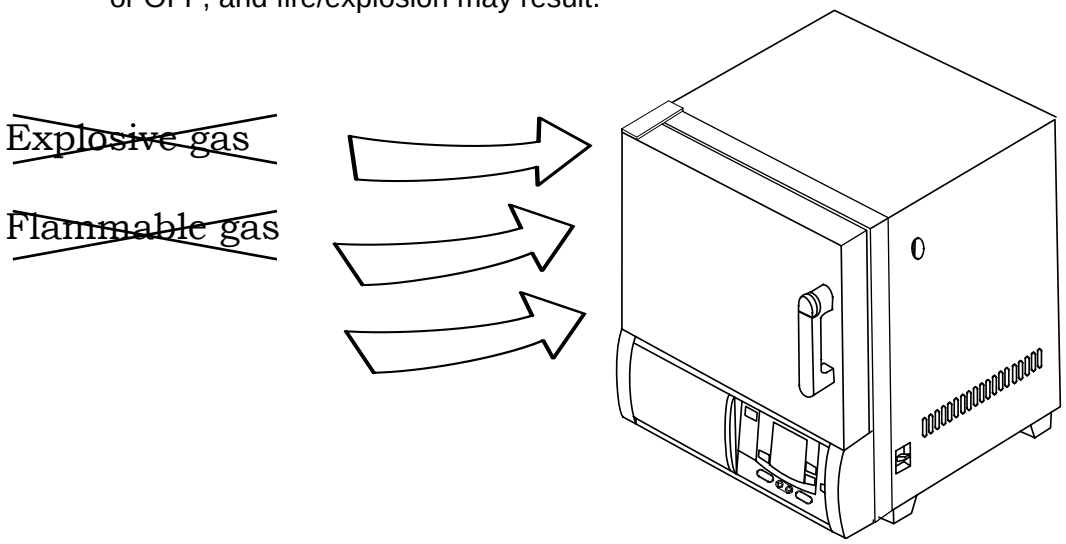
(1) **POWER** key:	Key to change over the controller from the standby mode to the operation mode or from the operation mode to the standby mode.
(2) **MODE** key:	Key to select a function from program input, edit, delete modes, hour/time setting, change-over mode, and other functions.
(3) **DISPLAY** key:	Key to change-over the display content of the sub display (10). Display content is changed over to set temperature, remaining time, hour, execution segment No.
(4) **MENU** key:	Key to select the operation mode. Each mode of fixed temperature, auto-start, auto-stop and program operation can be selected.
(5) **ENTER** key:	Key to determine the input value of set value (temperature, time, hour, etc.), selection mode, execution segment No. etc.
(6)/(7)™®(**UP/DOWN**) key:	Key to change set value (temperature, time, hour, etc.) and to choose a selection from various parameters on the function menu.
(8) **ESCAPE** key:	Key to cancel the latest entry and recover the status that was valid prior to the making the latest selection.
(9) Main Display:	It displays temperature measurements, set values (temperature, time, hour, etc.), program information, error information, etc.
(10)Sub Display:	It displays set temperature, remaining time, current hour and execution segment No. etc.
(11)Operation monitor:	It indicates an operation mode.
a) (11) **STANDBY** lamp:	It flashes to indicate that the instrument is in the preoperational standby mode.
b) (11) Temperature pattern lamp:	It illuminates to indicate the heat treatment process pattern executed by the controller with flashing light indicating the point currently in execution.
c) (11) **OVER** lamp:	It flashes to indicate the end of auto-stop or program operation.
d) (11) **TROUBLE** indicator lamp:	It blinks when an error is detected and displays the corresponding code for that particular problem.

e) (11)**REMOTE** operation indicator lamp:	It illuminates when the instrument is put into remote operation (optional) and displays the word "**REMOTE**."
f) (11)**KEY LOCK** indicator lamp:	It illuminates to indicate that the operation panel key lock function is in operation.
(12)Operation menu indicator lamp:	It illuminates to indicate the active operation mode in the operation menu.
(13)Sub display menu indicator lamp:	It illuminates to indicate the item (set temperature, remaining time, hour or execution segment) shown in the sub display.
(14)**HEAT ON** indicator lamp	It illuminates when the heater is on.
(15)**TIME** indicator lamp:	It illuminates when the operation starting time of the auto-start and the operation completion time of the auto-stop is set in the hour setting mode.
(16)Independent Temperature Overheating Prevention Device:	Setting the instrument to the operational temperature of the independent over rising prevention.

Installation

Do not use the unit in an area where there is flammable or explosive gas.

Never use the unit in an area where there is flammable or explosive gas. The unit is not explosion-proof. An arc may be generated when the power switch is turned ON or OFF, and fire/explosion may result.



Always ground the unit.

- Connect the grounding cable to your ground conductor or ground terminal.

- Do not forget to ground the Oven, to protect you and the unit from electrical shock in case of power surge.
- Do not connect the grounding wire to a gas pipe, or by means of a lightning rod or telephone line. A fire or electrical shock will occur.

NOTE: The oven has not a plug connected because of the 200V specification.

Choose a correct power distribution board.

- Choose a correct power distribution switchboard or receptacle that meets the oven's rated electric capacity.
  Electric capacity AC 200 V, single phase 21A
- Do not connect the oven to an outlet that differs from the above specifications because a fire or electrical shock will occur.

Supply connections for the oven

- Request the supply connection for the 200V specifications from a licensed electrician.
- Failure to have this operation complete by certified personnel will cause a fire or electrical shock during Oven operation.

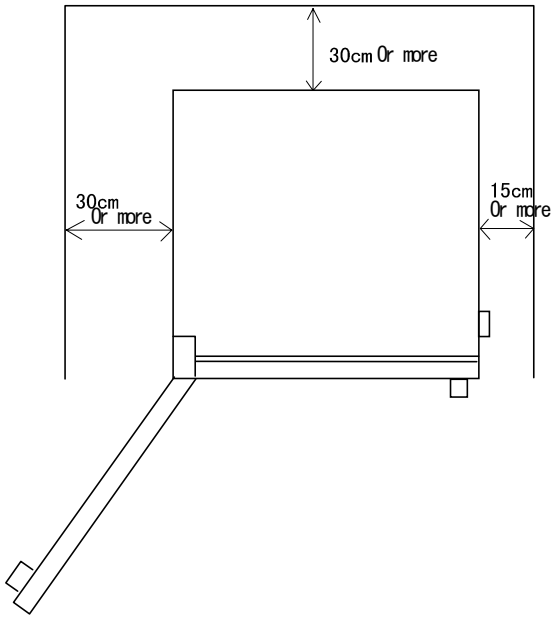
Install the Oven on a level area.

- Do not installation the oven on a non level surface. This will cause hazards to the operator and create problems during actual operation.

Choose a proper place for installation.

- Do not install the oven in a place where:
  - ♦ Flammable gas or corrosive gas is generated.
  - ♦ Ambient temperature exceeds 35°C.
  - ♦ Ambient temperature fluctuates violently.
  - ♦ There is direct sunlight.
  - ♦ There is excessive humidity and dust.
  - ♦ There are constant vibrations.

- Keep the following clearance around the oven.



After installed, you should:

- It may cause injure to a person if this oven falls down or moves by the earthquake and the impact, etc..
- To prevent, take measures that the unit cannot fall down.
- Secure the unit by putting the stoppers on the casters.

Handling of power code.

- Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.
- Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.
- Do not put the power cord under the desk, chair, etc., or through an object. Fire or electrical shock may be caused.
- Do not run the power cord next to heating equipment such as a heater. The cover of the cord may melt and fire or electrical shock may result.

- When the power cord is damaged (exposure of the core wires, disconnection, etc.), turn off the power key right immediately, then turn off the earth leakage breaker and the main power. Contact customer service for a replacement immediately. If this procedure is not followed, fire or electrical shock may be caused.

Caution in setting shelves

- Do not use any shelves but the attached ones.
  If it is used in this manner, the oven cannot occasionally regulate temperatures properly.
- Put the attached shelves on the shelf brackets fitted to the chamber when you use the oven.

Inert gas injection

- Adjust the pressure valve that the pressure will be within 0.2 to 0.5 kg/cm^{2}G prior to injecting a nitrogen gas.
- Secure the tube with a clamp when injecting a gas.
- Readjust the pressure valve within 0.2 to 0.5 kg/cm^{2}G while injecting a gas.
- Do not inject any gas other than a nitrogen gas.

Precautions in handling

Warning

Substances that can be used

- Never use explosive substances (shown on page 34), flammable substances (shown on page 34) and substances that include explosive or flammable ingredients in the unit. Explosion or fire may occur.

Do not put the foreign substances in the oven.

Do not put a foreign substances such as metals or flammable substances in the opening of the unit (ventilation hole and exhaust port, etc.). If this procedure is not followed, fire, electrical shock or burn may result.

If the foreign substances enter the unit, turn off the earth leakage breaker immediately and contact a service technician for inspection. If this procedure is not followed, fire, electrical shock or burn may result.

Caution in taking out samples

During and immediately after operation, the internal surfaces of the chamber and the door are extremely “HOT." To prevent injury, take out the samples when the chamber has cooled down or wear gloves while the chamber is still hot.

When you open the door during working at the high temperature.

Do not touch the internal surfaces of the chamber and the door when you will open the door, because they are extremely hot.

To open the door while the chamber is still hot may cause the malfunction of a fire detector if it is installed near the oven.

Do not touch heated parts.

Do not touch the door during or immediately after operation. Severe burning injury may be caused due to the high temperature.

Do not climb on the oven

Do not climb on top of the oven because it will fall down and break.
Failure to observe this caution may cause injury to a person.

Do not put anything on the oven

Do not put anything on top of the oven because they will fall and result in injury to a person.

⚠ Caution

Caution about the temperature range.

Use the oven in the range of 40°C to 210°C.

When you use the oven for the first time

During the initial operation, the oven may occasionally generate an odor especially when high temperatures are reached. This odor is normal and does not signal a problem with the oven. The adhesive on the insulation melting causes the nature of the odor.

About the temperature in the chamber

Temperature display indicates the sensor temperature installed in the unit, however it does not always correspond to the temperature of the sample when the sample volume is very large or when the temperature is on the increase.

Caution about a drenched sample

- When using a very wet sample, try to drain it as much as possible before putting it in chamber.

Caution about a powdery sample and the loading of samples

There are times when a powder sample is scattered by the sudden decompression operation or purge operation. When performing decompression or purge, open the valve very slowly.

It occasionally takes a long time before the chamber reaches the target temperature if the camber is congested with samples or a sample with the large specific heat is in it. In such cases, reduce samples. Moreover, note that the temperature display occasionally unsettle when you process an exothermic sample.

Distribute samples

- Each shelf can carry a uniform load of 15 kg (33 lb.). When you place samples on a shelf, distribute them evenly over the shelf area.
- If a shelf is congested with samples, the oven occasionally cannot regulate temperatures properly. To ensure the oven's temperature accuracy, there should be open space of at least 30% on each shelf.

Never use corrosive samples

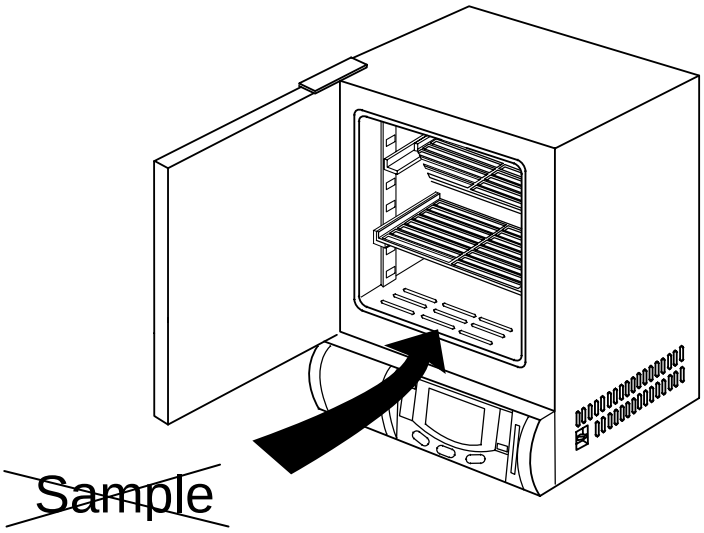
Most parts are made of stainless steel (SUS304). However, strong acid occasionally corrodes even stainless steel. Besides this, the silicone rubber packing is also vulnerable to acid, alkali, oil and halogens' solvents

Ventilate a room when using an inert gas

Application in a well-ventilated area is recommended.

Do not place any samples on the bottom of the chamber

- Do not place any samples on the bottom of the chamber to heat, because it affects the temperature control of the oven.



- Always put the samples on the attached shelves. Place sample so that it does not touch the interior wall of the chamber.
- Set the shelves on the shelf brackets that will accommodate the size of the sample.

During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the earth leakage breaker and main power. If this procedure is not followed, fire or electrical shock may be caused.

In case of power failure

Once the power supply has been cut off due to power failure, and then the power supply is restored, the oven will resume running.

When you open and shut the door

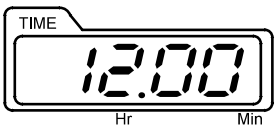
Do not put your hand either face near the door when you open and shut the door. Failure to observe this caution may result in injury because the door hits your hand or face.

Operating Procedure

When prepared completely, proceed as follows:

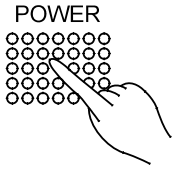
1. Turning on of power supply

- Turn on the earth leakage breaker.



- The present time is shown on the sub display.

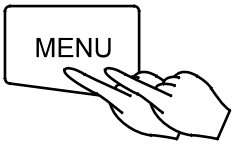
- Push the POWER key in the operation panel.



- When once the power is on, this oven becomes a standby state. Under such a condition, every operation mode can be selected by pushing the MENU key.

2. Selection of operation menu

- Press the MENU key several times to select desired operating method.



- It allows you to enter each parameter into a flashing menu.

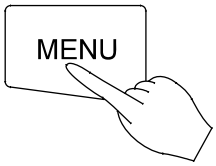
3. Explanation of operation menu

Fixed Temperature	**:** It is an operation method to bring the oven to the desired temperature and keep it steady.
Auto stop	**:** It is an operation method to stop a fixed temperature operation when reached the set time or hours.
Auto start	**:** It is an operation method to start the fixed temperature operation when reached the set time or hours.
Program	**:** It is an operation method that can start or stop an operation either when reached the set time or hours. Moreover, it can change the temperature when reached the desired time and repeat to do that.

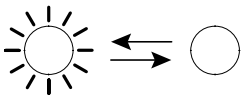
FIXED TEMPERATURE OPERATION INSTRUCTIONS

Selection of operation menu

- Push the MENU key and select the fixed temperature operation.



Push the MENU key.

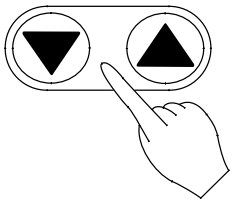


The lamp of the FIXED TEMP blinks.

- The temperature set last time is blinking and enters the state that a set temperature can be input in a sub-display.

Input of set temperature

- Push the ENTER key after making a sub-display display an arbitrary set temperature pushing ▲▼ keys.



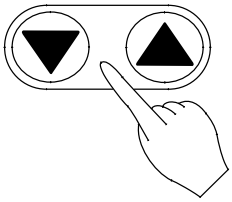
Press either the ▲key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.

Press the ENTER key.

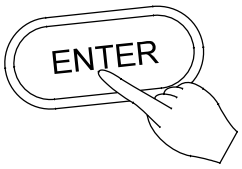
- The oven will start to run the fixed temperature operation to the renewed temperature.

Changing the set temperature when fixed temp operation is in progress

- Push either the ▲ key or the ▼ key to display the desired temperature on the main display and push the ENTER key.



Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



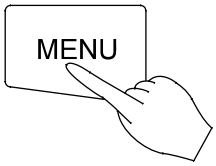
Push the ENTER key.

- The oven will start to run the fixed temperature operation to the renewed temperature.

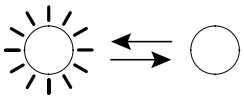
AUTO START OPERATION INSTRUCTIONS

Selection of operation menu

- Select AUTO START mode by pushing the MENU key.



Push the MENU key.



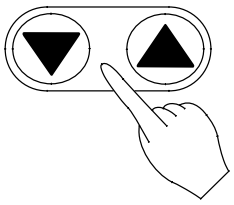
The operation menu lamp of an AUTO START blinks.

- tEMP will appear on the sub display and the desired temperature can be input.

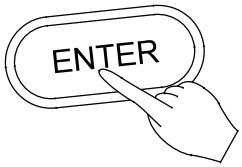
Sub display

Inputting the set temperature

- Press either the ▲ key or the ▼ key to display the desired temperature on the main display and push the ENTER key.

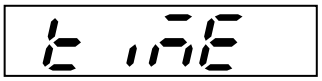


Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



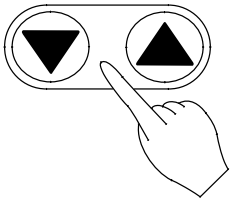
Press The ENTER key.

- tIME will appear on the sub display and the operation start time can be input.

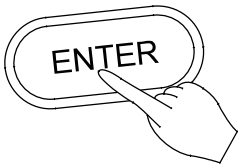


Inputting the desired set time

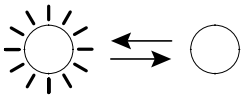
- Press either the ▲ key or the ▼ key to blink start time (or the hour) on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
Then, the desired start time (or hour) will appear on the main display.



Press the ENTER key.

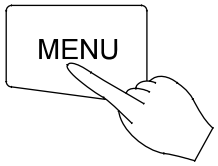


- The STANDBY lamp of the operation monitor blinks.
- The operation will be in standby condition.
- After reaching the set time (or hour), the oven will start to run the auto start operation to the renewed temperature.

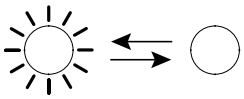
Auto Stop Operation Method

Selection of operation menu

- Press the MENU key and select the auto stop operation.



Press the MENU key.



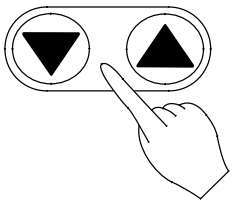
The menu lamp of an AUTO STOP blinks.

- tEMP will appear on the sub display and the desired temperature can be input.

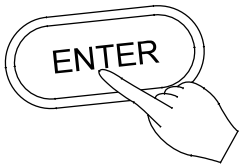
Sub display

Inputting the set temperature

- Push either the ▲ key or the ▼ key to blink the desired temperature on the main display and push the ENTER key.



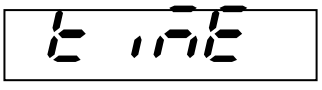
Press either the ▲ key or the ▼ key several times.
Then, the desired set temperature will appear on the main display.



Push the ENTER key.
The main display will light up to indicate the set temperature you have chosen.

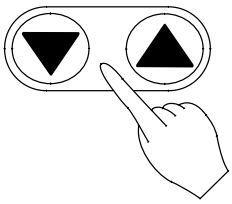
After about 1 second

- tIME will appear on the sub display and the operation stop time can be input.

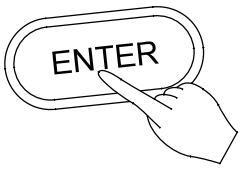


Inputting the desired set time

- Push either the ▲ key or the ▼ key to blink your desired time (or hours) for operation stop on the main display, and press the ENTER key.

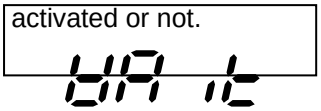


Press either the ▲ key or the ▼ key several times.
Then, the desired stop time (or hour) will appear on the main display.



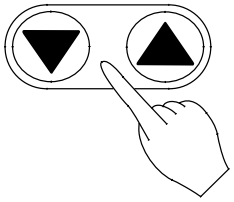
Push the ENTER key.

- WAIt will appear on the sub display and you can chose the wait function to be activated or not.

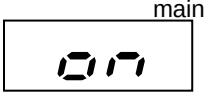


Selection of wait function

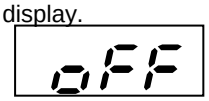
- Press either the ▲ key or the ▼ key to indicate the wait function (ON or OFF) on the main display. Then press ENTER key.



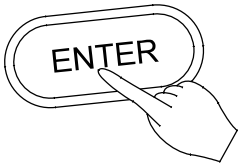
Press either the ▲ key or the ▼ key several times.
Either ON or OFF will appear on the main display.



(activate)



(inactive)



Press the ENTER key.

- This operation activates the auto stop operation.

Working conditions of timer

- **Auto Stop timer activates when:**

1. The wait function is on.

It starts when the set temperature has reached the target value.

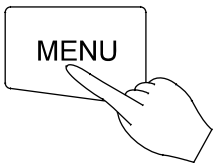
2. The waiting function is off or the time setting represents hours.

It starts right after the auto stop operation is started.

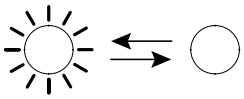
Programmed Operation Method

Selection of operation menu

- Press the MENU key and select the programmed operation.

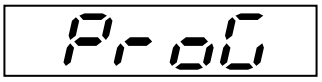


Press the MENU key.



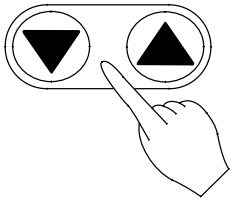
The operation menu lamp of the PROGRAM blinks.

- PrOG will appear on the sub display and the execution program number can be input.

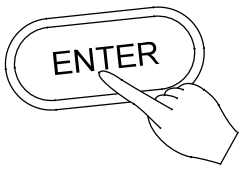


Input of execution program number

- Press either the ▲ key or the ▼ key to indicate an desired program number on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
The program number will appear on the main display.
NOTE: If no programs have been set, ———— is blinking.
See the Operating Instructions for Programmable Controller to set a new program.

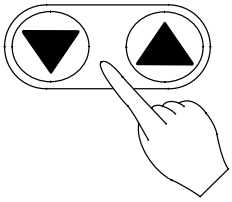


Push the ENTER key.

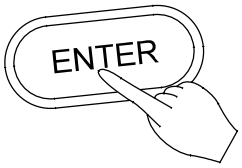
- tiME will appear on the sub display and the operation start time can be input.

Input of time

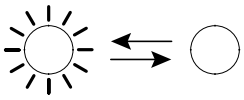
- Press either the ▲ key or the ▼ key to blink your desired operation start time (or hour) on the main display, and press the ENTER key.



Press either the ▲ key or the ▼ key several times.
The desired set time will appear on the main display.



Push the ENTER key.



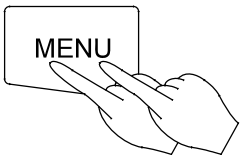
- The standby lamp on the operation monitor blinks. (Operation is in STANDBY MODE)
- The operation will start after the set time is up.

SWITCHING FROM ONE OPERATION TO ANOTHER

This instrument can switch to a different operation mode without stopping the current program no matter what mode it is in, fixed temperature operation, auto-start/stop operation, and program operation.

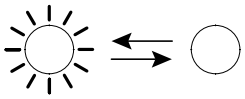
Selection of operation menu

- Press the MENU key several times until the desired operation menu lamp flashes on the Operation Menu.
- Since the current operation has not stopped, the operation menu lamp is also lit.
- On the Operation monitor -- the temperature pattern indicator lamp blinks with the current segment being executed.



Press MENU key several times.

- This status allows you to enter each parameter into blinking or lighting operation menu.



The lamp blinks or lights.

When the fixed temperature operation is selected

- The main display shows the current internal temperature.
- The sub-display flashes the temperature set by the previous fixed temperature operation.

When auto-start operation is selected

- The main display flashes the temperature set by the previous auto-start operation.
- The sub-display shows tEMP (Temp.)

When auto-stop operation is selected

- The main display flashes the temperature set by the previous auto-stop operation.
- The sub-display shows tEMP (Temp.)

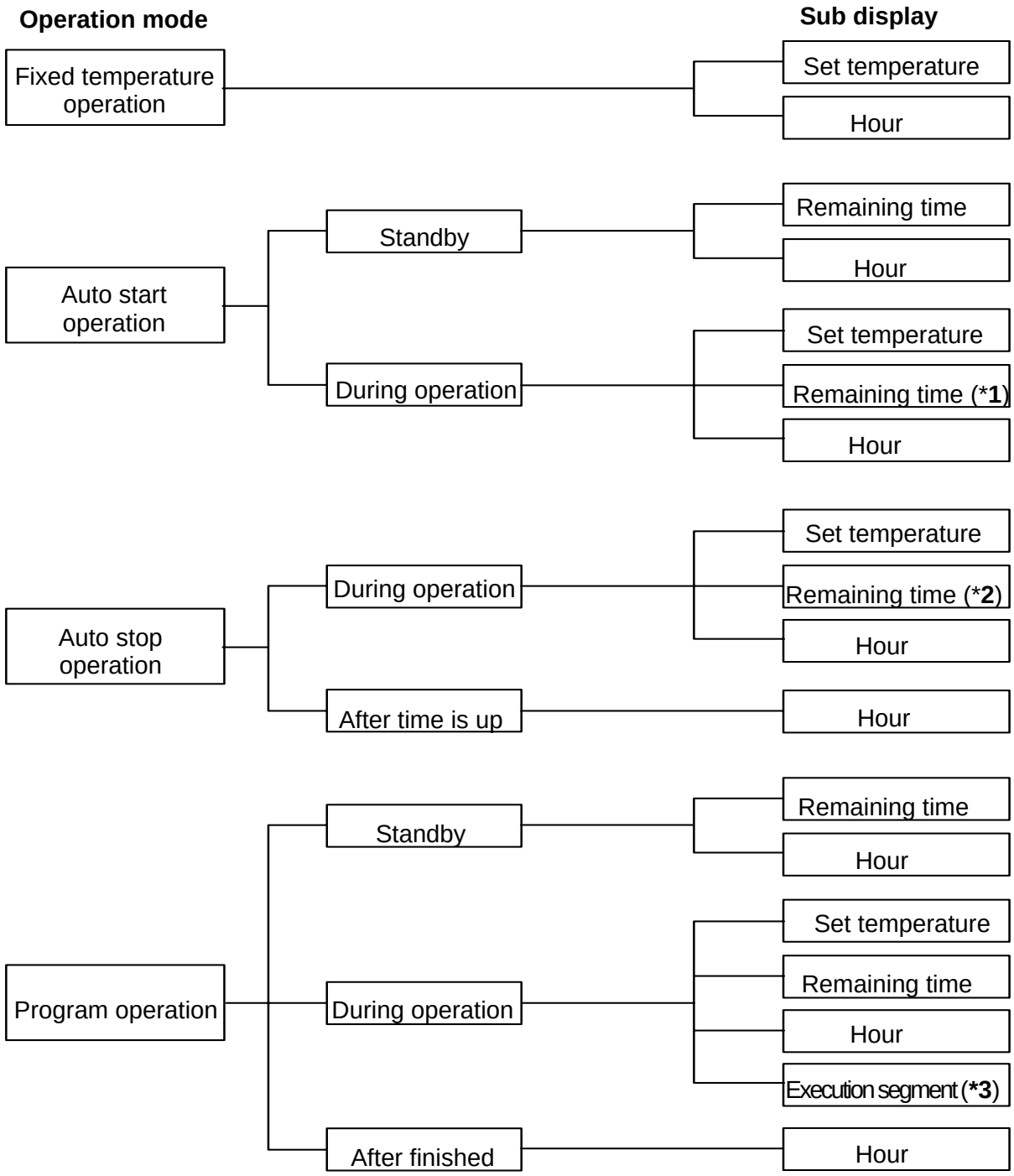
When program operation is selected

- The main display flashes the previously set program number.
- The sub-display shows Pro0 (Program)

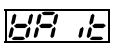
- Now operate according to the operation method you have chosen, see that section of this instruction manual.

Method of using DISPLAY key

The display content of the sub display can be changed over by turns when pushed the DISPLAY key.



***1:** HOLD is displayed.

***2:** When the wait function is set to on,  is displayed in the waiting status.

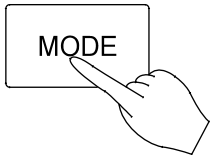
***3: T**he DISPLAY key will enable to show the rest of the repeat count while the repeat operation.

How to use the MODE

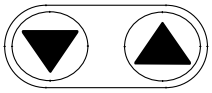
Content of function menu

This controller has the other functions shown bellow.

- Press the MODE key and display your desired function on the main display by pushing either the ® key or the ™ key. Each function will appear by turns whenever pushing the ®™ keys.



Press the mode key.



Select with the ▲ key or the ▼ key.

Main display	Function	
PrOG	Inputting and editing programs	To input and edit the program.
dELP	Deleting the Program.	To delete existing programs that are no longer necessary. Confirmation of the program contents should be performed prior to deleting and in accordance with Programmed Operation Method.
t .nE	Switching time setting mode.	To input either an hour or a period of time during time setting process in the various operation modes -- auto-start/stop, and program operation. It is set to the time (a period of time) setting mode when the product was shipped from the factory.
LOCK	Setting and releasing the key lock.	To set or release the key lock function. This function is for protecting wrong key actions during the operation or while being in the standby state. Once set to ON, the key lock will disable you from doing the **POWER**, **MENU**, **ENTER**, and **DELETE** key action. If the key lock function is set, the **KEY LOCK** lamp on the operation monitor is lit.
bEEP	Alarm buzzer ON/OFF function.	To select whether you want to activate the alarm buzzer or not when an error occurs.
AccN	Accumulating time display function	To display the total duration that the **POWER** key is on, within the range of 0 to 49999 hours.
HOLd	Hold function	To hold the operation that is currently running. This function will get active only when you run the oven in auto-start/stop or program operation mode (includes the standby state). In addition, it will work when the setting of the operation start time for auto-start and program operation as well as the operation end time for auto-stop are set in the form of “Time” and not in the form of “Hour.”
CLOC	Date and current hour setting function.	To set the date and hour.
CAL	Calibration offset function	To conform the display temperature to the measurement temperature of a voluntary point in the chamber at a voluntary temperature. Details are described on page 22

Calibration Offset Function

Outline of Function

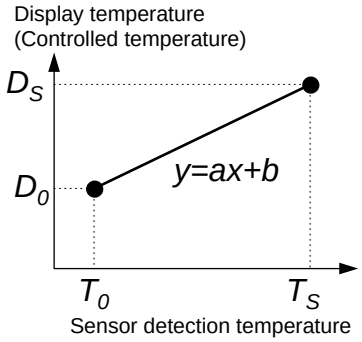


Fig. 1

In the controller, the relationship between the temperature T detected by the sensor and the display temperature of the operation panel D is expressed by the equation of the line which passes the two points (T_0, D_0) and (T_S, D_S) shown in Fig. 1.

Here, T_0 is the sensor detecting temperature when the chamber central temperature becomes the zero adjusting temperature (normally room temperature is adopted) D_0 at the time of no load, T_S is the sensor detecting temperature when the chamber central temperature becomes the span adjustment temperature (normally working maximum temperature is adopted) D_S at the time of no load in the same way.

As it is clear from the facts above, conforming of the chamber central temperature and the display temperature is guaranteed only when there is no load and at two points shown above. In other words, it is possible for a temperature measured at a point in the chamber does not conform to the display temperature of the operation panel at a voluntary temperature without load.

This is the function to move the line which passes above two points to the Y axis direction in parallel (increase or decrease y intercept of the line). The parallel movement amount including a sign is defined as the calibration offset. This function can conform the display temperature of the operation panel to the measurement temperature of a voluntary point in the chamber at a voluntary temperature.

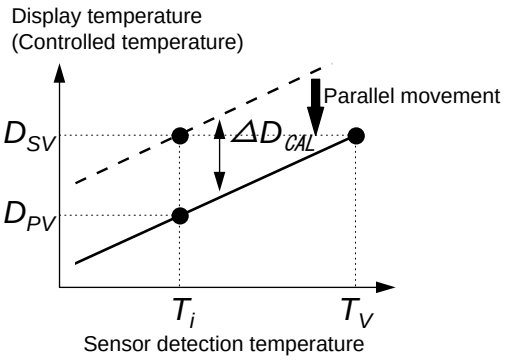


Fig. 2

In Fig. 2, D_{SV} is a display temperature of the operation panel under the condition that the temperature in the chamber is constant for a set temperature. It is natural to say that this value is equal to the target set temperature. D_{PV} is a measurement temperature of a voluntary point in the chamber under this condition. The difference between D_{PV} and D_{SV} including the sign is defined as the calibration offset. Therefore offset is shown as below.

$$\Delta D_{CAL} = D_{PV} - D_{SV} \qquad \textbf{Equation 1}$$

In Fig. 2, ΔD_{CAL} becomes the negative value since the target set temperature D_{SV} is larger than the actually measured temperature D_{PV}. In order to conform the display temperature to the actually measured temperature, let the controller to recognize that the temperature in the chamber differs from the target set temperature by ΔD_{CAL}.

NOTE: Setting Tolerance of Calibration Offset

- The calibration offset can be set within ±5% of the maximum working temperature of the oven. (Therefore, the setting tolerance of the calibration offset is ±19°C.)
- Initial off set value has been set to 0°C when shipping.

Setting The Calibration Offset Function

This function can be activated when the controller is in the condition of accepting the MODE key.

EX. Bring the oven to the target set temperature 100°C and allow it to reach the steady state. After then, measure the temperature at a point in the chamber. If it shows 97°C when the main display shows 100°C, you can conform your measuring value to the one on the display by using the calibration offset function.

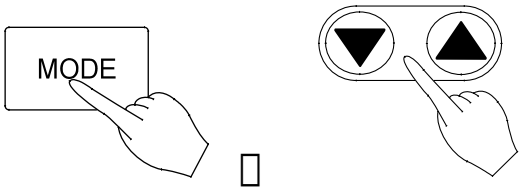
Calibration offset ΔD_{CAL} is obtained from the Equation **1** (page22) as shown below.

$$\Delta D_{CAL} = 97℃ - 100℃ = -3℃$$

Procedures to set the calibration offset ΔD_{CAL} to the controller are shown as below.

Setting and changing the calibration offset value

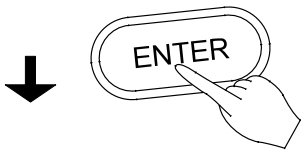
- Push the MODE key, and then push the ® key or the ™ key several times to display cAL on the main display.



Push the ® key or the ™ key several times

- The sub display shows the calibration offset value that has been set the last time.

NOTE: When the unit is shipped from the factory, the sub-display shows 0 as the calibration offset value.

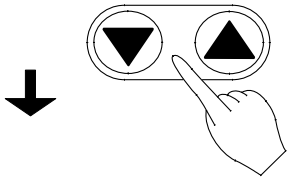


Push the ENTER key.

- The main display flashes the preset calibration offset value.

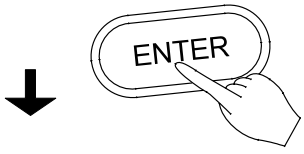
⇒ In this state, the set value of the calibration offset can be changed.

- The sub display shows cAL.



Push the ® key or the ™ key several times

- Push either the ™ key or the ® key to change the value on the main display to your desired value (calibration offset value to be set newly).



When the changing is completed, push the ENTER key.

- The changed value is entered and both the main and the sub displays return to the display mode just before pushing MODE key. The controller starts the temperature controlling operation in order to make the difference zero, since the difference is generated between the target set temperature and the temperature in the chamber by the changing of the calibration offset value.

Safety Devices and Error Codes

Purposes and Operations of Safety Device and Counter-measures

This instrument incorporates an automatic diagnosis function built in the controller and safety devices independent of the controller. The purposes and operations of the safety devices and countermeasures are shown in the **Table** below. When an abnormal condition occurs, an error code is displayed in the main display. Immediate action should be taken according to the specific counter-measures.

Safety Device	Display	Cause & Counter-measures
1. Earth leakage breaker	No Display	• Power circuit interrupted • Erases all displays ⇒ Report to our service office and check the cause of the problem.
2. Sensor malfunction detector	**TROUBLE** lamp flashes. Er.01 flashes.	• Break in temperature sensor circuit. ⇒ Report to our service office.
3. Triac circuit detector	**TROUBLE** lamp flashes Er.02 flashes.	• Short circuit in triac. ⇒ Report to our service office.
4. Disconnected heater circuit detector	**TROUBLE** lamp flashes Er.03 flashes.	• Heater circuit is disconnected. ⇒ Report to our service office.
5. Independent overheating prevention	**TROUBLE** lamp flashes Er.07 flashes.	• Incorrect setting of the independent overheating prevention. ⇒ Set correctly. • Heating of sample ⇒ Reduce the amount of the sample. • Malfunction of the independent overheating prevention circuit. ⇒ Report to our service office.
6. Main relay malfunction detector	**TROUBLE** lamp flashes Er. 10 flashes.	• A malfunction of the main relay. ⇒ Report to our service office.
7. POST function*	**TROUBLE** lamp flashes Er08, Er 14, Er 15 flashes.	• Contact Yamato Sciectific's Technical Service Department.
8. Automatic overheating preventive function	No Display	• Heating of samples ⇒ Reduce amount of samples
9. Key lock	Key lock display lamp lights up	• This function prevents the disruption of operation due to incorrect operation. Leave it on during operation. (See section in this manual for setting and resetting methods on page 21).
10. Memory backup circuit	No Display	
11. Door switch	door flashes	• It is not the fault. ⇒ When opened the door, door will flash on the sub display and the heater circuit will be cut off and the fan will stop for safety. Once closed the door, door will go out and the heater circuit and the fan will resume working.

- **POST** (**P**ower **O**n **S**elf **T**est) function checks the microprocessor, memory surrounding LSI, surrounding circuit of the controller every time "**POWER**" key is turned **ON**. This is the function for checking that the controller won't have a fatal fault before starting the operation.

INDEPENDENT OVERHEAT PREVENTION

There are two safety devices in this unit: the auto-overheating preventive function of the controller (automatic recovery) and the independent overheating prevention (manual recovery). Circuits and sensors that are independent from the controller configure them. These safety devices for the temperature overheating prevention protect the instrument in a fail-safe method.

Setting the Temperature Range and Function

Setting Temperature:	0 to 399°C
Input Method:	Three integer digital switch. Turn the drum of each column and set the desired value. The first integer can only be from 0 to 3 for the hundred columns.
Function:	Heater output is cut off when the measured temperature gets higher than the set temperature of the independent overheating prevention. The function is active when the earth leakage breaker is ON. When the independent overheating prevention is activated, is flashing on the main display with the **TROUBLE** lamp flashes. When the independent overheat prevention is active while the heater is in the temperature rising process, etc., and flash alternately on the display.

Activation/Setting Method

1. Set the independent overheating prevention 15°C higher than the set temperature of the main unit.

2. When setting the proper value to protect the sample, be sure it is well above room temperature, and set it at least 15°C higher than the maximum temperature set value of the temperature pattern of the program.

3. When the independent overheating prevention is activated improperly by changing the setting of the independent overheating prevention lower than the internal temperature or by continuing operation when the setting on the unit is too low, turn off the earth leakage breaker to reset the unit and perform the setting again. If it is activated by another reason, see chapter of Safety Devices and Error Codes on page 24.

Precautions

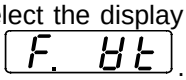
1. Only 0 to 3 can be set for the column of hundreds of the digital switch by the stop mechanism; however, if forced to change it to a value higher than 3, it will damage the unit.

2. Set temperature can change by touching the setter when cleaning. Always confirm that the set temperature is correct after cleaning or before operation.

Behavior after Power Restoration

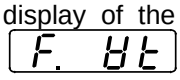
In case of power failure during operation, the controller resumes the following operations after the power restoration.

In case of power failure during the program operation

The controller automatically resumes the program operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows  .

The timer built-in the controller does not count as running time for a period of power failure.

In case of power failure during the Auto-Stop operation

The controller automatically resumes the Auto-Stop operation where it left at the power shutdown. In case that the temperature inside the chamber is outside the specified temperature range based on the setpoint temperature after the power restoration, the controller goes to the FORECED WAIT STATE until the temperature inside the chamber comes back to the specified temperature range. When you select the display of the remaining time by pushing the Display key in this condition, the sub display shows  . (Forced Wait)

In case that the operation stop time is set in a period of time, the timer built in the controller does not count as running time for a period of power failure. On the contrary, in case that the operation stop time is set in hours, the timer built in the controller counts as running time for a period of power failure.

When the operation stop time reaches during power failure, the controller stops running just after the power restoration.

In case of power failure while the controller is in standby condition

In case that the operation start time is set in a period of time, the timer built in the controller does not count as standby time for a period of power failure. On the contrary, in case that the operation start time is set in hours, the timer built in the controller counts as standby time for a period of power failure.

When the operation start time reaches during power failure, the controller starts running just after the power restoration.

In case of power failure during the fixed temperature operation and a soak period of the Auto-Start operation

The controller resumes running toward to the preset temperature after the power restoration.

Maintenance and Inspection

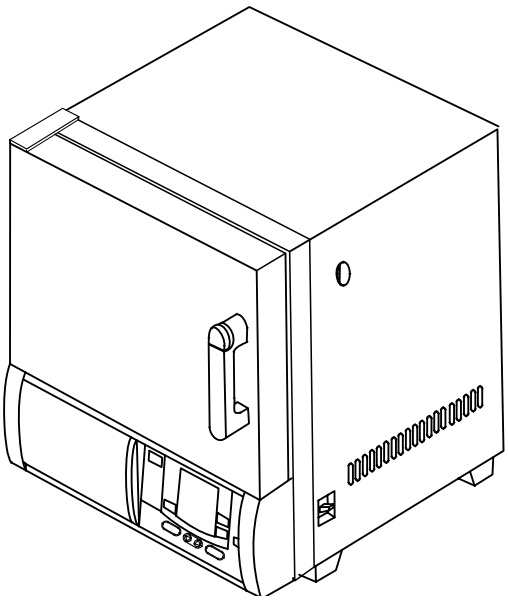
Warning

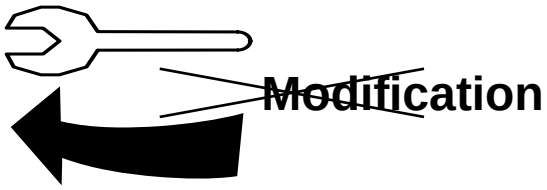
Do not disassemble and modify the oven.

- Do not disassemble the oven. There are parts in the unit with high voltage; therefore, if the unit is disassembled, electric shock and injury may result.

Ask the Yamato Scientific office for inspection, adjustment, and repair of the inside of the unit.

- Unauthorized modification will be hazardous and cause problems in the operation of the Oven.





Caution

Maintenance Precautions

- Before starting inspection or maintenance, disconnect the power plug from the receptacle.
- Conduct inspection and maintenance only after the oven has cooled down.
- When you remove dirt or stains from the unit's resin parts and the control panel, use a soft wet cloth. Do not use benzene, thinner, cleanser or a hard brush; it will cause deformation, qualitative deterioration and/or discoloring of the components.

Periodic inspection of the safety component.

- The independent temperature over-rise prevention device is important safety component. Be sure to inspect it periodically.(See chapter of Maintenance Procedure on page 28)

If you have any questions, contact our sales representative in your vicinity or our service office.

Maintenance Procedure

Operation Check of Independent Temperature Overheating Prevention Device

- After executing the fixed temperature operation at the set temperature 0°C, set the operation temperature of the Independent Temperature Overheating Prevention Device to 0°C.
- Under normal circumstances, the heater circuit is cut off in a few seconds and the **TROUBLE** lamp and E-07 flashes at the same time, and the alarm buzzer sounds if the alarm buzzer function is ON.
- After confirming, turn off the earth leakage breaker once, and then return the setting of the Independent Temperature Overheating Prevention Device to the proper value. Turn the earth leakage breaker back ON.

Always perform inspection before a long continuous operation or an unattended operation.

Long Storage and Disposal

When you do not use the oven for a long period of time.

Disconnect the power cable from the power switchboard.

When you dispose of the oven.

Do not leave it where children can access. Remove the knob and hinges of the door to disable the door locking system.

After service and WARRANTY

If a Service Call is required:

If a Service Call is required

- If a problem occurs with the Mechanical Inert Oven, record the error code on the display and stop the operation immediately, turn off the power switch, and disconnect the power plug from the receptacle. Contact our sales or service representative.
- Check the warranty card or the name plate of your Mechanical Inert Oven and give us the information below.
  - Model of your oven;
  - Serial product number of your oven;
  - Date of purchase; and
  - Problem with your oven (as detailed as possible).

Warranty Card (attached to your Oven)

- Please fill out completely and return the bottom portion of the warranty card when the unit is received. The completed top portion is your Registration Card that should be retained for your records.
- Warranty period is one (1) year after the date of your purchase. During this warranty period, we will offer free repair service on the basis of the conditions provided on the warranty card.
- If you need repair service after expiration of the warranty period, contact our sales or service representative in your vicinity or service office for advice.

Minimum Inventory Period of Repair Parts

Repair parts will be available for at least 5 years after termination of our production of Mechanical Inert Oven. Repair parts mean the parts that are necessary to maintain the performance of the ovens.

TROUBLESHOOTING

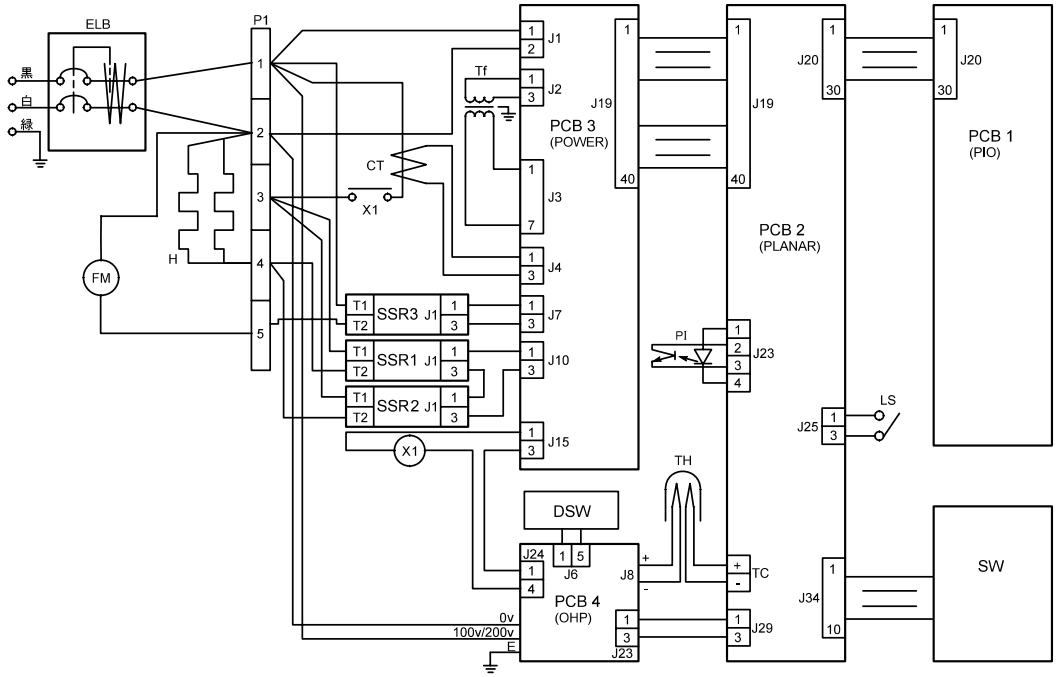
Problem	Cause/Solution
No display of current hour in the sub-display at the activation of the earth leakage breaker.	• Check if the power cable is firmly connected to a receptacle. • Check for power failure.
Temperature fluctuates during the operation	• Does ambient temperature fluctuate violently? • Are there too many samples in the chamber? • Are the samples too moist?
It takes too much time for temperature to rise.	• Are there too many samples in the chamber?

SPECIFICATIONS

Model	DN610I
Method	Forced Ventilation
Performance:	
Operating Temperature	４０ ～ ３６０℃
Temperature Stability*[1]	±０．２℃（@３６０℃）
Temperature Uniformity	±３．０℃（@３６０℃）
Time To Reach Max. Temp.*[1]	Approx. 60 min.
Displacement Time	Approximately 70 min (Ambient temperature, Oxygen concentration in the chamber reaches 2%)
Structure:	
Exterior	Cold rolled steel plate with baked-on melamine resin finish
Interior Chamber	Stainless steel (SUS304)
Insulating Material	Glass wool and Ceramic fiber
Heater Nominal Capacity	4.0kW
Fan	Sirocco fan, Output:10W×2
Flowmeter	Maximum flow rate; 30 mℓ/min
Gas Injection Port	Outside diameter 8 mm (rear face)
Controller:	
Temperature Control Method	PID control by microprocessor
Temperature Setting Method	Digital setting method by ®™ keys (resolution: 1°C)
Temperature Indicating Method	Digital display by green LED (resolution: 1°C)
Other Indication	Temperature pattern LED indication that shows operation indication
Timer	1 min. to 99 hrs. 59 min. or 100 hrs to 999 hrs (Timer resolution: 1 min. or 1 hr.)
Operation Function	Fixed temperature operation Auto-start/Auto-stop operation Program operation (16 segments, repeat, etc.)
Additional Function	Calendar timer function (actual hr. timer within 24 hrs.) Integrating time function (Integrated hr. up to 49999 hrs. can be measured.) Time indication (The present time is indicated.) Calibration offset function
Heater Circuit Control	Triac zero cross system
Sensor	K thermocouple (double sensor)
Safety Device	Earth leakage breaker with the over current protector Self-diagnostic function (sensor abnormality, heater disconnection and Triac short circuit detection; automatic temperature over-rise prevention) Key lock function Independent Temperature Overheat Prevention device (Digital switch input system, setting temperature range: 0 to 399°C)
Internal Dimensions (Wxdxh)*[2]	620 mm × 600 mm × 600 mm
External Dimensions (Wxdxh)*[2]	790mm × 845mm × 1080mm
Capacity	223 **l**
Weight	Approx. 120 kg
Power Requirements	AC 200 V, 50/60Hz, 21A single phase
Accessories:	
Shelf / Shelf Brackets	2 sets
Instruction Manual	For exclusive use of this oven and the controller: each one

NOTES: *1. The values written on the chart were measured with no sample and both exhaust ports closed in ambient temperature of 20°C.
*2. Displacing was performed with a flow rate of 20 ml per minute.
*2. Both of internal and external dimensions do not include the one of protruding parts.

WIRING DIAGRAM



Symbol	Part Name	Symbol	Part Name
CT1	Current Transformer	PCB3	Power board
ELB	Earth leakage breaker	PCB4	Independent overheat prevention
FM1	Fan motor	PI1,2	Photo-interrupter
H	Heater	SSR1,2,3	Solid-state relay
LS	Door switch	SW	Membrane keypad
P1,2	Terminal block	Tf	Transformer
PCB1	PIO board	TH	Thermocouple
PCB2	PLANAR board	X1	Relay

REPLACEMENT PARTS TABLE

Symbol	Part Name	Code No.	Specifications
CT	Current Transformer	2-17-001-0002	CTL-6-S-400
ELB	Earth leakage breaker	**2-06-005-0012**	**BJS30-3(AC200V)**
FM	Fan motor	2-14-000-0003	REK42M-4CCW, AC200V
H	Heater	**DN63H-30320**	**AC200V 2000W**
P	Power code	2-13-001-0010	T3 - 3d
P1,2	Terminal block	2-07-023-0002	M011-0FX 4P
PCB1	PIO board	1-24-000-0024	
PCB2	PLANAR board	1-24-000-0059	
PCB3	Power board	1-24-000-0025	Type 1
PCB4	Independent overheat prevention	1-27-001-0002	QKB-0
PI1,2	Photo-interrupter	1-21-001-0002	TLP802
SSR1	Solid-state relay	LT00028427	SSR-01A
SSR2	Solid-state relay	LT00028425	SSR-01B
SSR3	Solid-state relay	LT00028423	SSR-01
SW	Membrane keypad	1-01-320-0008	Type 4H
Tf1	Transformer	2-18-000-0023	AC200V
TH	Thermocouple	1-16-001-0042	K thermocouple (double sensor)
X1	Relay	2-05-000-0010	HE1a-DC12V
	Flowmeter	5-01-001-0013	RK-1200-12-B-1/4-N_2-30-0.5-0

Reference

HAZARDOUS MATERIAL

Explosives	Explosives Substances	1. Nitroglycol, Nitroglycerin, Nitrocellulose, and other explosive nitric esters.
		2. Trinitrobenzens, Trinitrotoluene, Picric acid, and other explosive nitro compounds.
		3. Peracetic acid, Methyl ethyl ketone peroxide, Benzoyl peroxide, and other organic peroxides.
Flammables	Combustible Substances	Metallic lithium, Metallic potassium, Metallic sodium, Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid, Calcium carbide, Lime phosphate, Magnesium powder, Aluminum powder, and other ignitable metal powders and sodium dithionite (hydrosulfite).
	Oxidants	1. Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorates.
		2. Potassium perchlorate, Sodium perchlorate, Ammonia perchlorate, and other perchlorates.
		3. Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxides.
		4. Potassium nitrate, Sodium nitrate, Ammonia nitrate, and other nitrates.
		5. Sodium chlorite and other chlorites.
		6. Calcium hypochlorite and other hypochlorites.
	Ignitable Substances	Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and flammable substances with a flash point below minus 30ºC.
		Normal hexane, Ethylene oxide, Acetone, Benzene, Methyl ethyl ketone, and flammable substances with a flash point between minus 30ºC and 0°C.
		• Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and inflammable substance with a flash point between 0ºC and 30ºC.
		• Kerosene, Light oil, Turpentine oil, Isoamyl alcohol, Acetic acid, and flammable substances with a flash point between 30ºC and 65ºC
	Combustible Gases	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane, and other gases that are flammable under 1 atmospheric pressure at 15ºC.

(Quoted from “Addendum Table1 of Code of Work Safety and Hygiene Standard”)

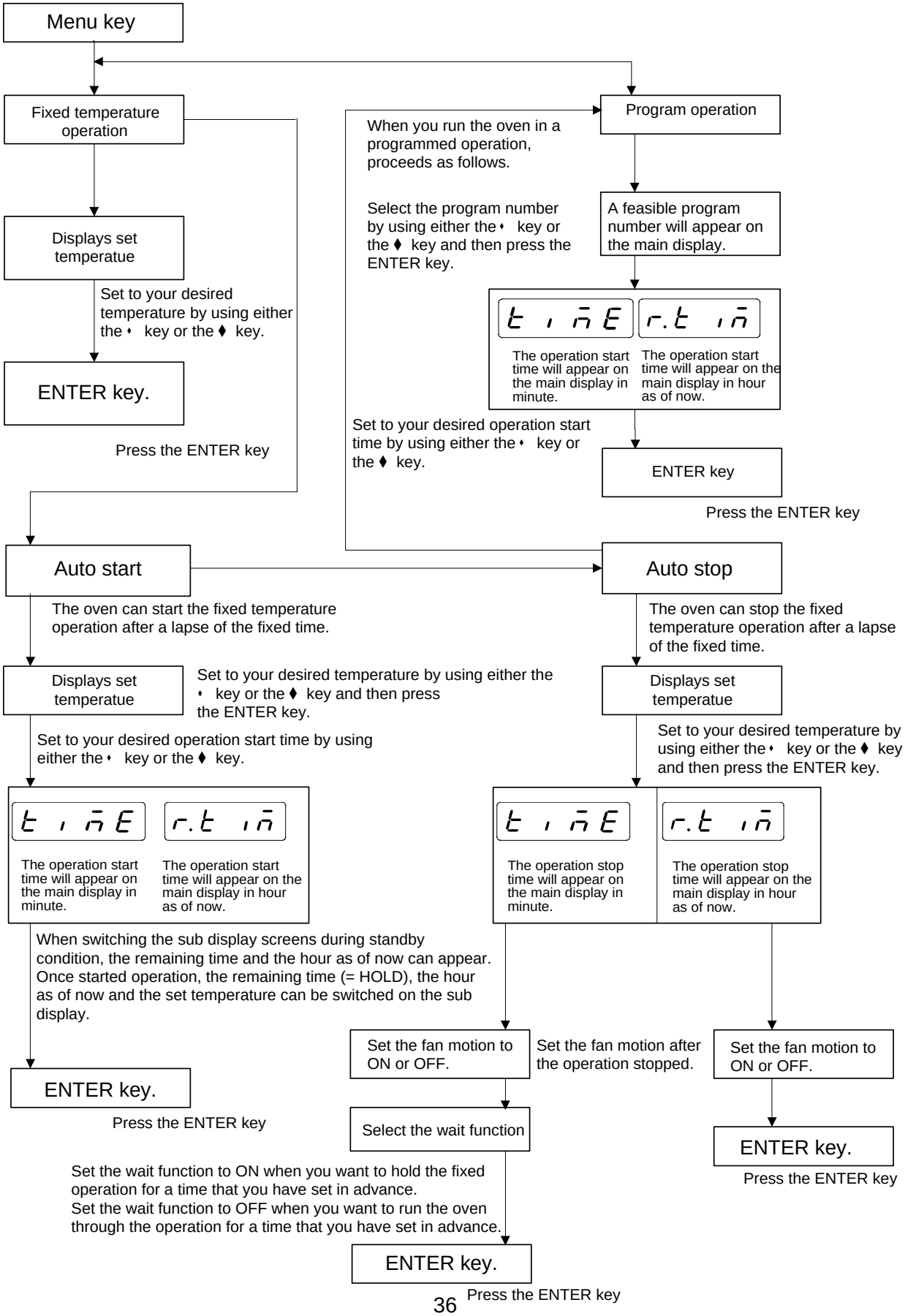
List of Symbols in the display

The oven has the controller with the 4-digit LED display. The meaning of symbols in the display is as follows:

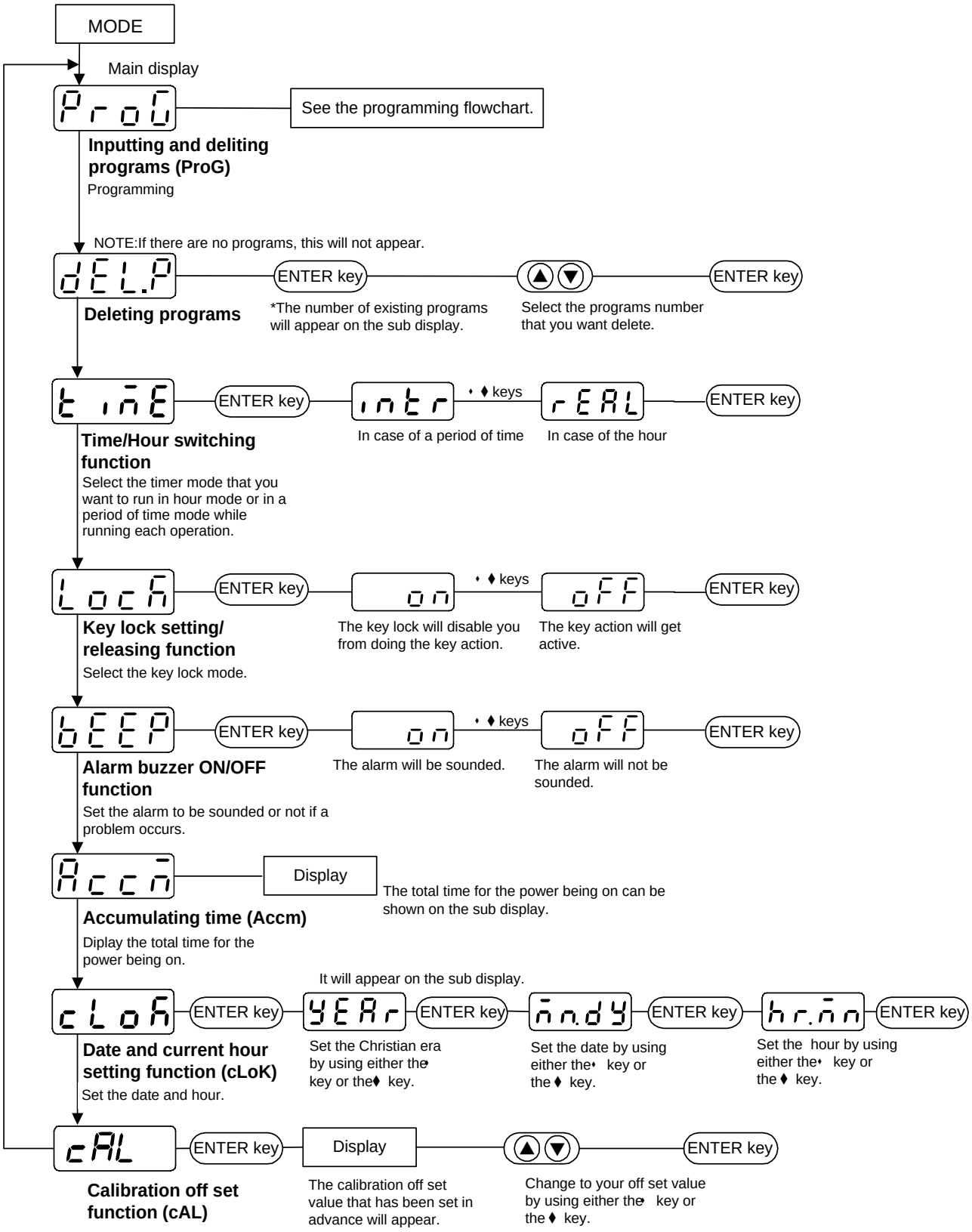
Capital	Symbol	Meaning of Abbreviation	Meaning of Symbol in the display
A	Accn	accumulation	Integrated time
B	bEEP	beep	Alarm sound setting mode
C	cAL	Calibration	Calibration offset setting mode
D	dEL.P	delete program	Deleting a program
	d iSP	display	Sub display switching mode
E	End	end	Setting mode for program end
	Er. #	error #	Error code #
F	F. Wt	f. wt (Forced wait)	Forced wait state after the power restoration
H	HoLd	hold	Hold function mode
	hr.mn	hr. mn (hour. minute)	Setting of time (hour, minute)
L	LocK	lock	Panel locking mode
M	mn.dY	mn. dy (month. day)	Setting of the date (month and day)
O	oFF	off	Make a function inactive
	on	on	Make a function active
P	Pr. #	program #	Program number
	ProG	program	Program mode
	Pr.SG	program, segment	Ongoing program and ongoing segment
R	r.cnt	repeat count	Repeat frequency setting mode
	rEAL	real (real time)	The hour
	rEP	repeat	Repeat command mode
	rESt	rest time #	Rest for remaining time
	rL. #	ramp level	Ramp level of Segment # (Desired set temperature)
	r.Str	repeat start	Repeat start segment setting mode
	rt. #	ramp time #	Ramp time of Segment # (Time required to reach the ramp level)
	r.t in	r. tim (real time)	the hour
S	SG. #	segment #	Segment number
	St. #	soak time	Soak time of Segment # (Holding time of the ramp level)
	StEP	step	Not in Ramp Operation
T	tEmP	temp	Temperature mode
	t imE	time	Time mode
W	WAit	wait	Wait function (Keep the operation until the desired temperature is achieved)
	Wt. #	wait #	Wait function of Segment #
Y	YEAr	year	the Christian era

Flowchart of Operational Procedures

Run “MENU”

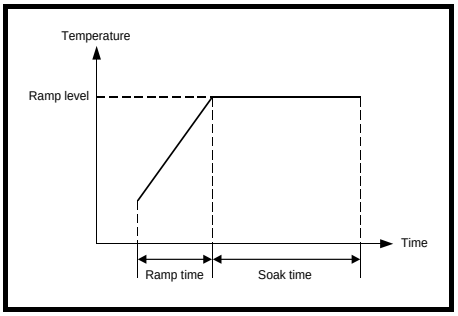


Program “MODE”



Flowchart for programming

Segment configuration
: Segments are made up of the following items, and must be input in this order.



Ramp time rt.	Rising time
Ramp level rL.	Target temperature
Soak time St.	Time held at ramp level
Wait function Wt.	Selects whether to give priority to soak time (OFF), or to hold process time at ramp level (ON).

Call up the program mode.

Call up the program number that you want to input or edit.

When you want to rewrite programs, call up your desired segment number on the main display.

Note that this will appear in case of editing.

Input Ramp time.
Note: When you run this unit with full power, input StEP.

Input Ramp level.

Input Soak time.

Note: If there is no soak time (changing immediately to next temperature), input 0. To hold, select HoLd

Select wait function.

The next segment will appear.

Note: To repeat, press either the ® key or the ™ key to display rEP, and select it with the ENTER key. Input the segment number that you want to repeat, and then do the repeat count.

* Input all the settings in the same way.

When finished inputting all items, select End for the ramp time, and press the ENTER key.