Inert Oven

DN411IE / 611IE

Instruction Manual

First Edition

- **Thank you for choosing DN-IE Series Inert Ovens by Yamato Scientific Co., Ltd.**
- **For proper equipment operation, please read this instruction manual thoroughly before use. Always keep equipment documentation safe and close at hand for convenient future reference.**

Warning: **Read instruction manual warnings and cautions carefully and completely before proceeding.**

Yamato Scientific America Inc.
Santa Clara, CA

Printed on recycled paper

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1. SAFETY PRECAUTIONS

Explanation of Symbols

A Word Regarding Symbols

Various symbols are provided throughout this text and on equipment to ensure safe operation. Failure to comprehend the operational hazards and risks associated with these symbols may lead to adverse results as explained below. Become thoroughly familiar with all symbols and their meanings by carefully reading the following text regarding symbols before proceeding.

Warning Signifies a situation which may result in serious injury or death (Note 1)

Caution Signifies a situation which may result in minor injury (Note 2) and/or property damage (Note 3)

(Note 1) Serious injury is defined as bodily wounds, electrocution, bone breaks/fractures or poisoning, which may cause debilitation requiring extended hospitalization and/or outpatient treatment.

(Note 2) Minor injury is defined as bodily wounds or electrocution, which will not require extended hospitalization or outpatient treatment.

(Note 3) Property damage is defined as damage to facilities, equipment, buildings or other property. （Note 1） Serious injury is defined as bodily wounds,

Symbol Meanings

Signifies warning or caution.
Specific explanation will follow symbol.

Signifies restriction.
Specific restrictions will follow symbol.

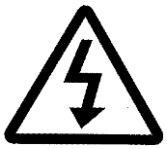
Signifies an action or actions which operator must undertake.
Specific instructions will follow symbol.

1. SAFETY PRECAUTIONS

Symbol Glossary

Warning

General Warning



Danger!: High Voltage

Danger!: Extremely Hot

Danger!: Moving Parts

Danger!: Blast Hazard

Caution

General Caution

Caution: Electrical Shock Hazard!

Caution: Burn Hazard!

Caution: Do Not Heat Without Water!

Caution: May Leak Water!

Caution: Water Only

Caution: Toxic Chemicals

Restriction

General Restriction

No Open Flame

Do Not Disassemble

Do Not Touch

Action

General Action Required

Connect Ground Wire

Level Installation Required

Disconnect Power

Inspect Regularly

1. SAFETY PRECAUTIONS

Warnings and Cautions

⚠ Warning

Never operate equipment near combustible gases/fumes.

Do not install or operate DN-I series unit near flammable or explosive gases/fumes. Unit is NOT fire or blast resistant. Negligent use could cause a fire/explosion.
See “List of Hazardous Substances” (P.50).

Always ground equipment.

Always ground this unit properly to avoid electric shock.

DO NOT operate equipment when abnormalities are detected.

If smoke or unusual odors begin emitting from unit, or if any other abnormalities are detected, terminate operation immediately, turn off main power switch (Earth Leakage Breaker - “ELB”) and disconnect power cable. Continued operation under such conditions may result in fire or electric shock.

DO NOT operate with bundled or tangled power cable.

Operating unit with the power cable bundled or otherwise tangled, may cause power cable to overheat and/or catch fire.

DO NOT damage power cable.

Damaging the power cable by forcibly bending, pulling or twisting may cause fire or electric shock to the operator.

DO NOT disassemble or modify equipment.

Attempting to dismantle or modify unit in any way, may cause malfunction, fire or electric shock.

DO NOT touch hot surfaces.

Some surfaces on this unit become extremely hot during operation. Exercise vigilance in order to avoid getting burned.

DO NOT insert multiple power cables into a single outlet.

Inserting multiple cords into a single outlet, using branch outlets or extension cords, may cause power cable to overheat and/or catch fire. Other issues may include a drop in voltage, which may affect performance, resulting in failure to control or maintain proper temperatures.

⚠ Caution

DO NOT operate equipment during thunderstorms.

In the event of a thunderstorm, terminate operation and turn off main power switch (ELB) immediately. A direct lightning strike may cause damage to equipment, or result in fire or electric shock.

2. PRE-OPERATION PROCEDURES

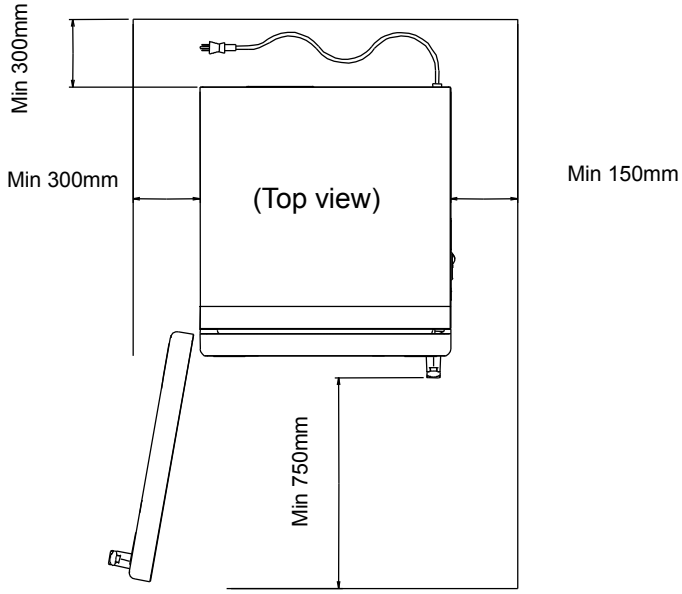
Installation Precautions & Procedures

1. Choose an appropriate installation site.

Do not install DN-IE series unit:

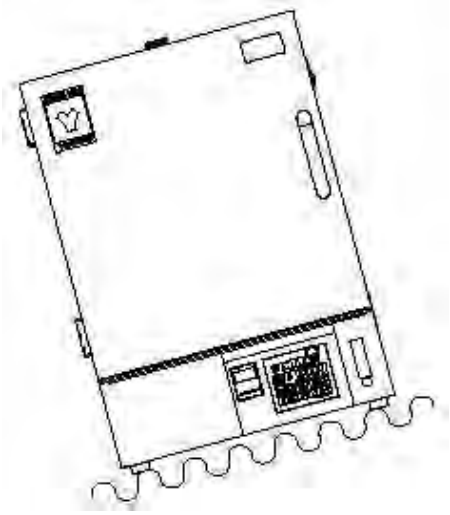
- where flammable or corrosive gases/fumes will be generated.
- where exterior temperature will exceed 35ºC, will fall below 5ºC or will fluctuate.
- in excessively humid or dusty locations.
- where there is constant vibration.
- where power supply is erratic.
- in direct sunlight or outdoors.

Install DN-IE series oven(s) in a location with sufficient space and ventilation as specified as below.



2. Install on a level surface.

Install unit on a level and even surface. Failure to do so may result in abnormal vibrations or noise, possibly causing complications and/or malfunction.



Approximate unit weight:
DN411IE:approx. 90 kg, DN611IE:approx. 130kg
Handle with care. Transportation and installation should always be done by two or more people.

2. PRE-OPERATION PROCEDURES

3. Install in a safe location.

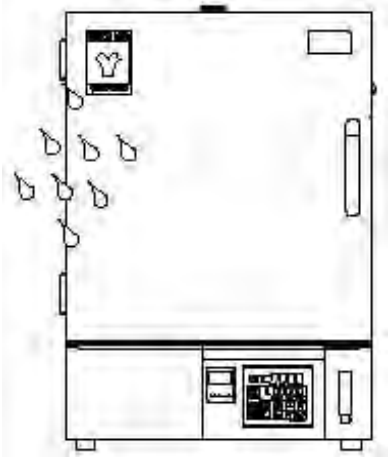
In the event of an earthquake or other unforeseen incident, equipment may unexpectedly shift or fall, causing injury. Taking preventative steps to install unit in a safe location, away from room access doors and out of other danger is strongly recommended.

4. Install in a well-ventilated area.

Install unit so that side panel heat vents (see “Unit Overview 1” on P.8 for location) are unobstructed and allowed to sufficiently diffuse heat. Failure to do so may result in excessive temperatures inside the unit control panel, causing possible degraded CPU board performance, malfunction or fire. See installation specifications above.

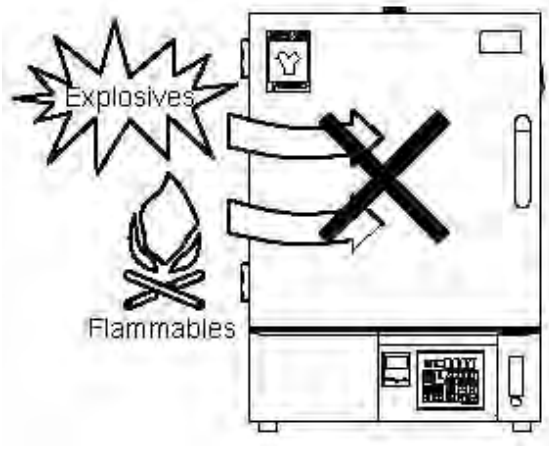
5. Install in a dry location.

Install unit where it will be free from liquid spray and other moisture. Failure to do so may result in control mechanisms becoming wet, causing malfunction, electrical shock and/or fire.



6. Install in a location free of flammables and explosives.

Never install near flammables or explosives. This unit is NOT fire or blast resistant. Simply switching the main power switch (ELB) “ON” or “OFF” can produce a spark, which could relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes. See “List of Hazardous Substances” (P.50).



2. PRE-OPERATION PROCEDURES

7. Connect to power supply.

Connect power cable to a suitable facility outlet or terminal, according to the following electrical requirements.

Electrical	DN411IE	AC220V Single phase 50/60Hz 16.5A
requirements:	DN611IE	AC220V Single phase 50/60Hz 23.0A

※ Check the line voltage on outlet or terminal to be used and properly evaluate whether to utilize a line being shared by other equipment. If the unit is not activated by turning on the main power switch (ELB), take an appropriate course of action, such as connecting the unit to a dedicated power source.

※Multiple power cables connected to a single outlet may cause unit input voltage to drop, resulting in degraded heating and temperature control performance.

8. Handle power cable with care.

Never operate unit with power cable bundled or tangled; and do not modifiy, bend, forcibly twist or pull on power cable. Doing so may cause fire and/or electrical shock.

Do not risk damage to power cable by positioning it under desks or chairs, or by pinching it between objects. Doing so may cause fire and/or electrical shock.

Do not place power cable near kerosene/electric heaters or other heat-generating devices. Doing so may cause power cable insulation to overheat, melt and/or catch fire, which may result in electric shock.

Turn off main power switch (ELB) immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Failure to do so may result in fire or electric shock.

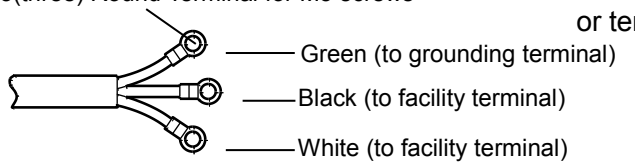
Contact a local dealer or Yamato sales office for information about replacing power cable if it is damaged.

Always connect power cable to appropriate facility outlet or terminal.

9. Ground wire MUST be connected properly.

- Grounding to Electrical Equipment Technical Standards, Section 19, class D (Grounding Resistance Max. 100Ω) is required in Japan where no grounding terminal is provided. Contact a local dealer, electrician, or Yamato Sales office for location-specific electrical requirements.
- Connect terminals securely to facility terminal or to an appropriate connector.

Plugs and connectors are not included with this unit. Ground unit properly to facility outlet or terminal as required.



Never connect ground wire to gas lines, water pipes, telephone grounding lines or lightening rods. Doing so may result in fire or electrical shock.

2. PRE-OPERATION PROCEDURES

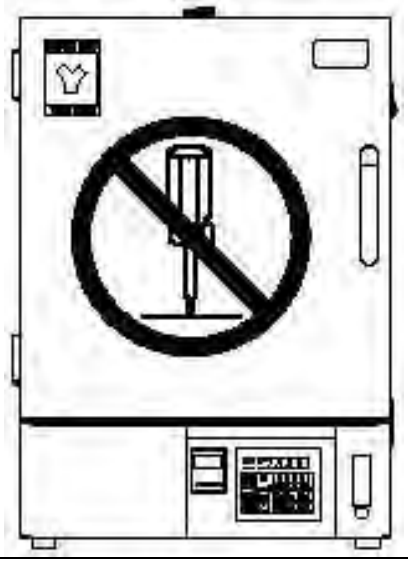
10. Observe wire color designation when connecting to facility terminal.

Confim that the facility main breaker is OFF before connecting the round terminals from the power cable. No power plugs or connectors of any kind are included with DN411IE/611IE. Where required, purchase an appropriate plug and properly connect using the round terminals.

Color	Facility
Black	Live side
White	Neutral side
Green	Ground

11. DO NOT disassemble or modify.

Attempting to disassemble or modifiy this unit in any way may result in malfunction, fire or electric shock.



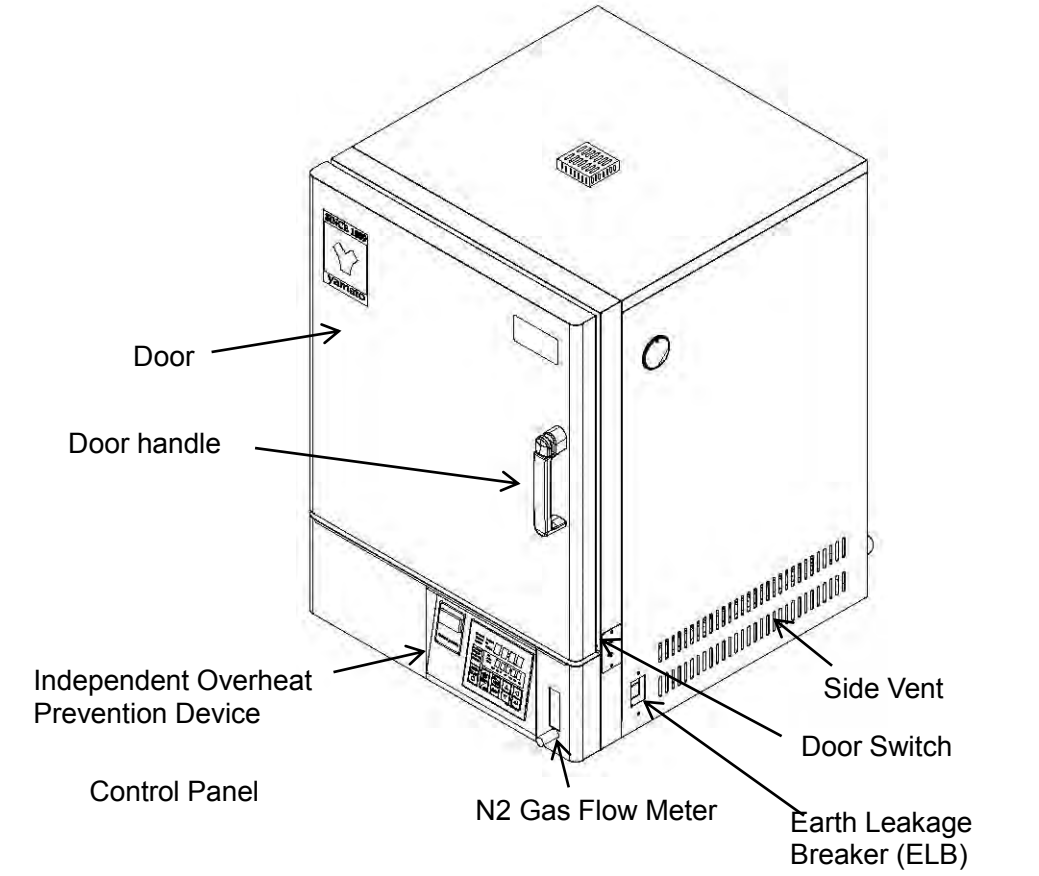
12. N2 gas injection

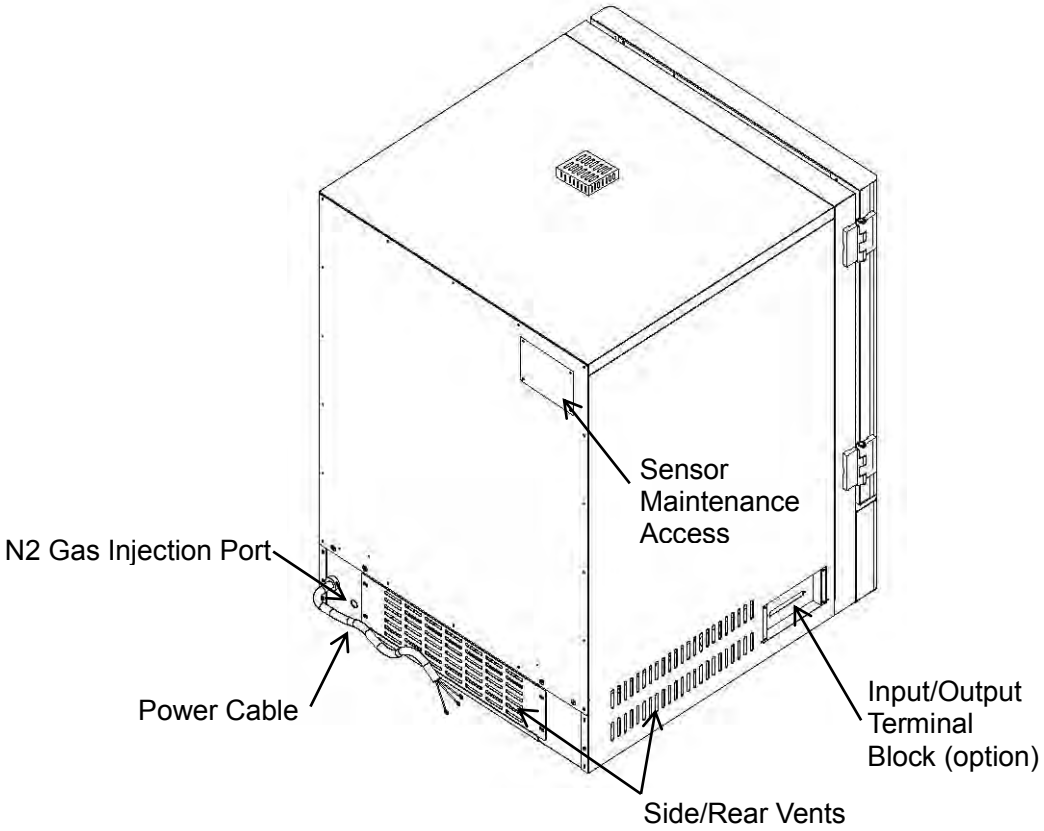
- Adjust secondary pressure for N2 gas injection to 0.02~0.05MPa using the pressure adjustment valve before connecting the injection hose (inner diameter 8mm). Secure with hose clamp.
- Slowly open the pressure adjustment valve along with the flow adjustment knob on the flow meter until the meter reads approximately 20L/min, then adjust pressure to 0.02~0.05MPa, once again, using the pressure adjustment valve.
- Read flow rate on meter by finding the indicator on the scale which aligns with center of the float.
- Flow meter installed on unit measures N2 gas flow rate only.
- Be sure room ventilation is adequate before opening N2 gas valve.

3. COMPONENT NAMES AND FUNCTIONS

Unit Overview

DN411IE/611IE

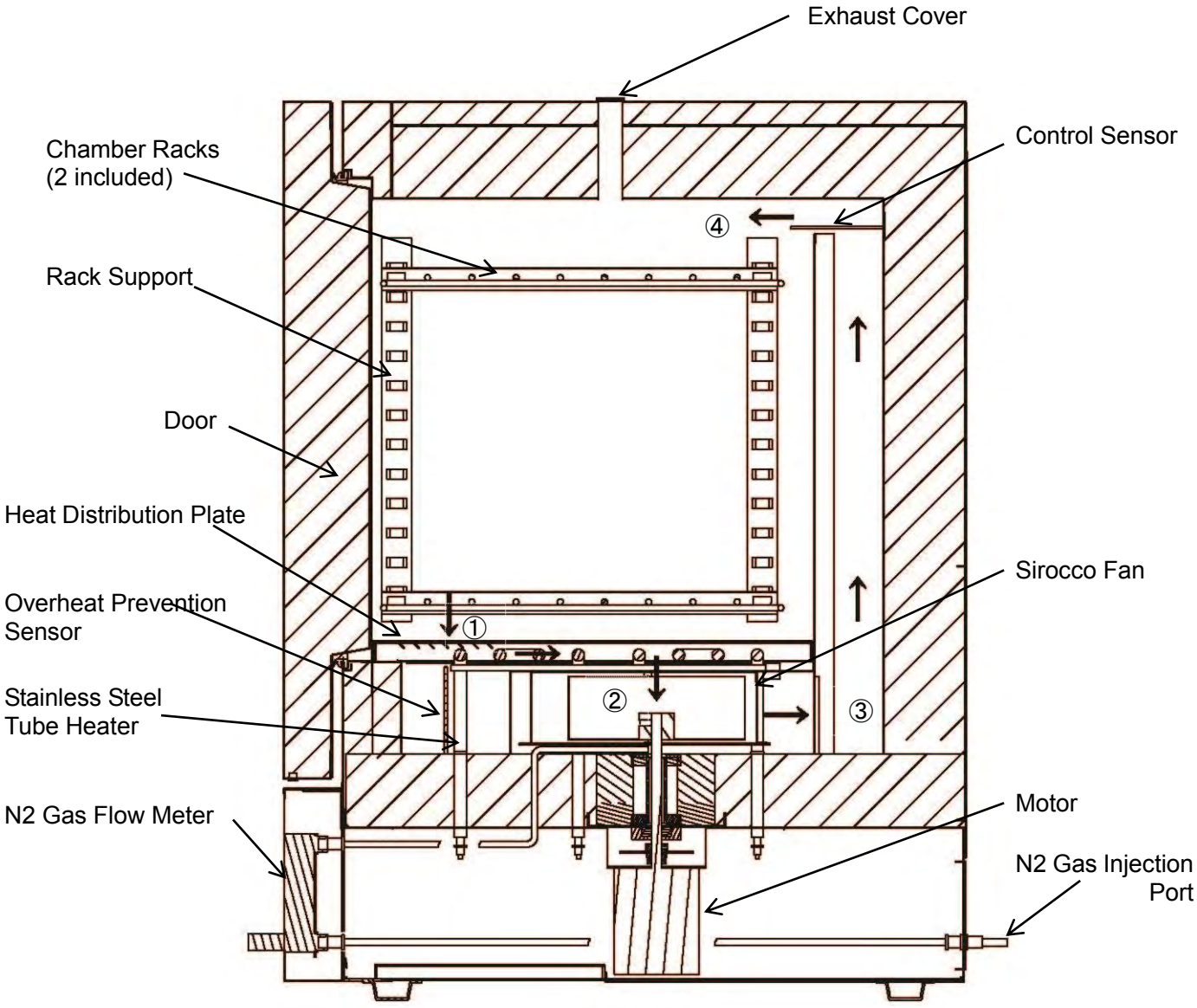




3. COMPONENT NAMES AND FUNCTIONS

Main Unit Structure & Function

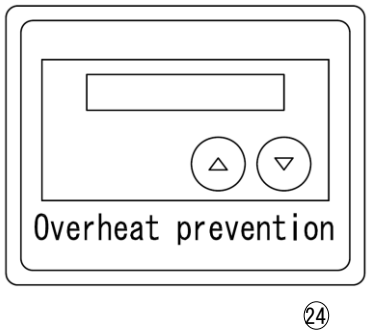
DN411IE/611IE



DN-IE series ovens employ a forced air circulation system by which air is drawn from the chamber, ① down through the heat distribution board with a Sirocco fan and heated, ② then sent upward through a duct in the rear wall of the unit ③ and back into the chamber from the top ④. A control sensor in the upper portion of the duct sends input signals to a temperature control device, which regulates heater intensity and maintains temperature stability inside unit.

3. COMPONENT NAMES AND FUNCTIONS

Control Panel



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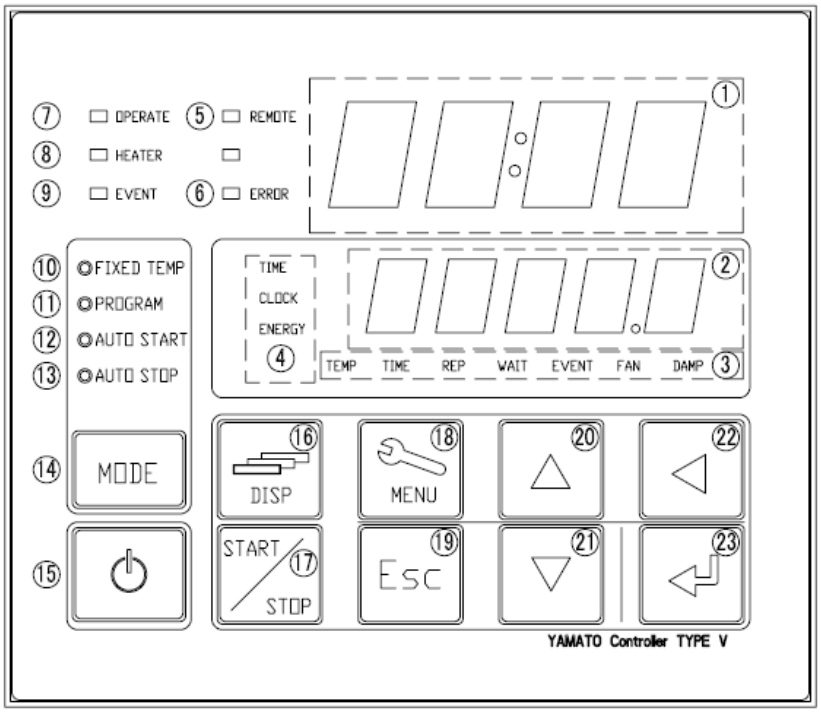


No	Name	Description
1	Upper Display	Readout for temperature reading (current chamber temp), error codes, etc.
2	Lower Display	Readout for temperature setting, clock, timer, etc.
3	Function Indicator Lamps	Illuminates (one or more) to show which function is currently running or active
4	Mode Indicator Lamps	Illuminates (only one) to show which mode is currently running.
5	REMOTE Indicator Lamp	Illuminates while remote comm (optional item) transmission is in progress.
6	ERROR Indicator Lamp	Illuminates when an error occurs.
7	OPERATE Indicator Lamp	Illuminates during operation. Flashes in operation standby mode.
8	HEATER Indicator Lamp	Illuminates when heaters are receiving power.
9	EVENT Indicator Lamp	Illuminates when event output (optional item) is transmitted.
10	FIXED TEMP Indicator Lamp	Illuminates during constant temperature operation.
11	PROGRAM Indicator Lamp	Illuminates during programmed operation. Flashes while entering program settings.
12	AUTO START Indicator Lamp	Illuminate during auto start operation.
13	AUTO STOP Indicator Lamp	Illuminates during auto stop operation.
14	MODE key	Press to switch between operation modes, ⑩~⑬ on control panel.
15	POWER key	Press and hold to switch between unit idle and unit standby.
16	DISP key	Press to switch between monitoring options in lower display.
17	START/STOP key	Press to start or stop an operation.
18	MENU key	Press to switch between setting options.
19	Esc key	Press to return to previous menu without finalizing settings.
20	▲(Up) key	Press to increase setting value.
21	▼(Down) key	Press to decrease setting value.
22	◄ key	Press to move cursor left.
23	ENTER key	Press to finalize setting items.
24	Independent Overheat Prevention Device	Set device to keep unit from exceeding a certain temperature.

4. OPERATION PROCEDURE

Prior Confirmation

(1) Power source and ground wire
Be sure to connect power cable to an appropriate power source and confirm that ground wire is connected.

(2) Main power switch (ELB)
Turn ELB ON.
Test ELB function once a month or before extended operation. See “Maintenance Procedures” (P.40) for details.
Check the lower display on the control panel when ELB is turned on and confirm it is showing current time.

(3) Independent Overheat Prevention Device (IOPD)
Be sure to set IOPD temperature 20ºC over the chamber temperature setting.
Test IOPD function before each instance of extended operation. See “Maintenance Procedures” (P.40) for details.

4. OPERATION PROCEDURE

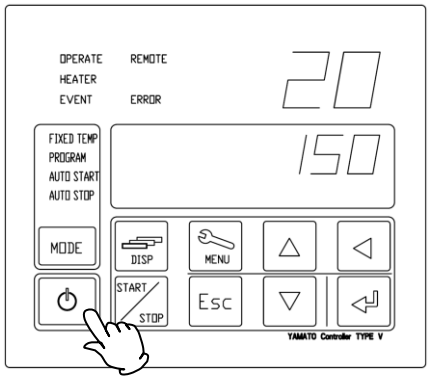
Date & Time Setting

The backup battery installed in DN-IE series units, is a wear item and has an estimated life of approximately 5 years. Replacing battery within the 5-year lifespan is recommended.

※ Contact a local dealer or Yamato sales office to request a replacement battery. If unit has program data in memory, make a data backup file before replacing backup battery. See “Data Backup” (P.32) in this section for details.

To set the current date & time,after replacing backup battery, follow the steps below.

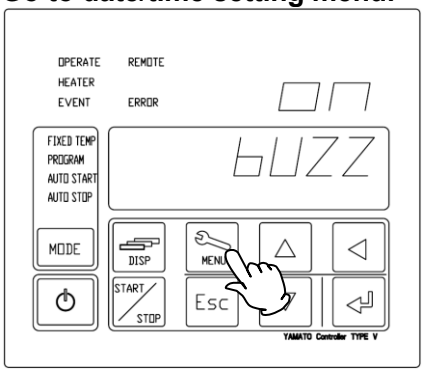
1 **Turn on power.**



Turn ON the main power switch (ELB), located on the right panel of the DN-IE series units.
Lower display on the control panel will show the time.
This indicates that the machine is in “idle”.

Press and hold ⏻ to display the standby screen.
Upper display shows current temperature in the chamber while lower display shows current temperature setting.
This indicates that the machine is in “standby”.

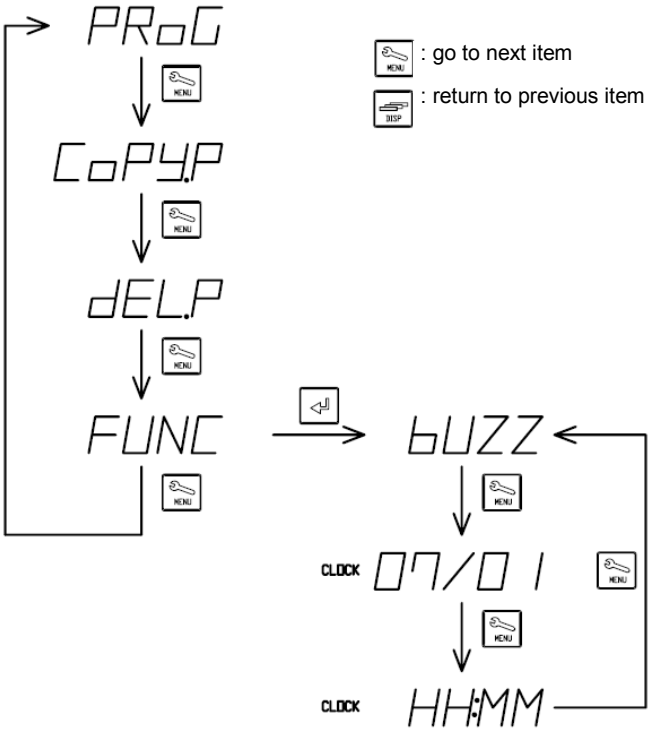
2 **Go to date/time setting menu.**



① Press MENU.

② Press MENU repeatedly until FUNC is shown in lower display. Press ↵. oFF and bUZZ show in upper and lower displays respectively.

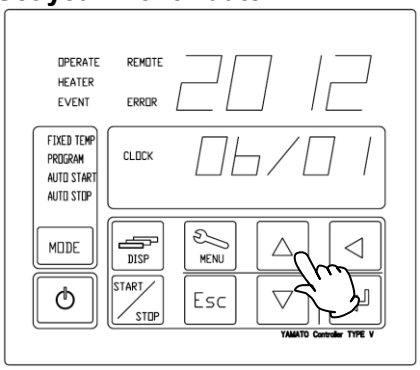
③ Press MENU. Year shows in upper display. Month/date shows in lower display. CLOCK indicator lamp flashes.



4. OPERATION PROCEDURE

Date & Time Setting

3 Set year/month/date.



Setting the year/month/date and clock.

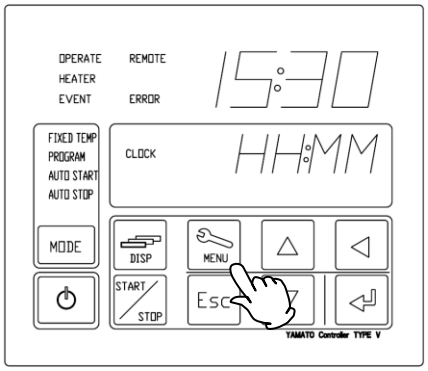
① Year and month/date are shown on upper and lower displays respectively.

② Press [↵]. Settable value begins flashing.

③ Set calendar year with [△] [▽] and [◁]. Press [↵].

④ Set month/date with [△] [▽] and [◁]. Press [↵].

4 Set clock.



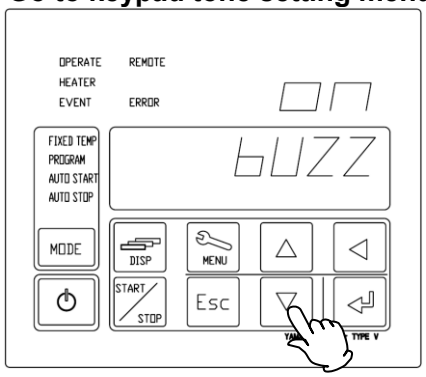
① Press [MENU].

② Press [↵]. Set clock time with [△] [▽] and [◁] (24-hour time system only). Press [↵].

③ Press [Esc] twice to return to initial screen, when time/date settings are completed.

Keypad Tone Function

1 Go to keypad tone setting menu.



① Press [MENU] repeatedly until FUNC is shown, then press [↵] to bring up bUZZ in lower display. Press [↵]. oFF begins flashing in upper display

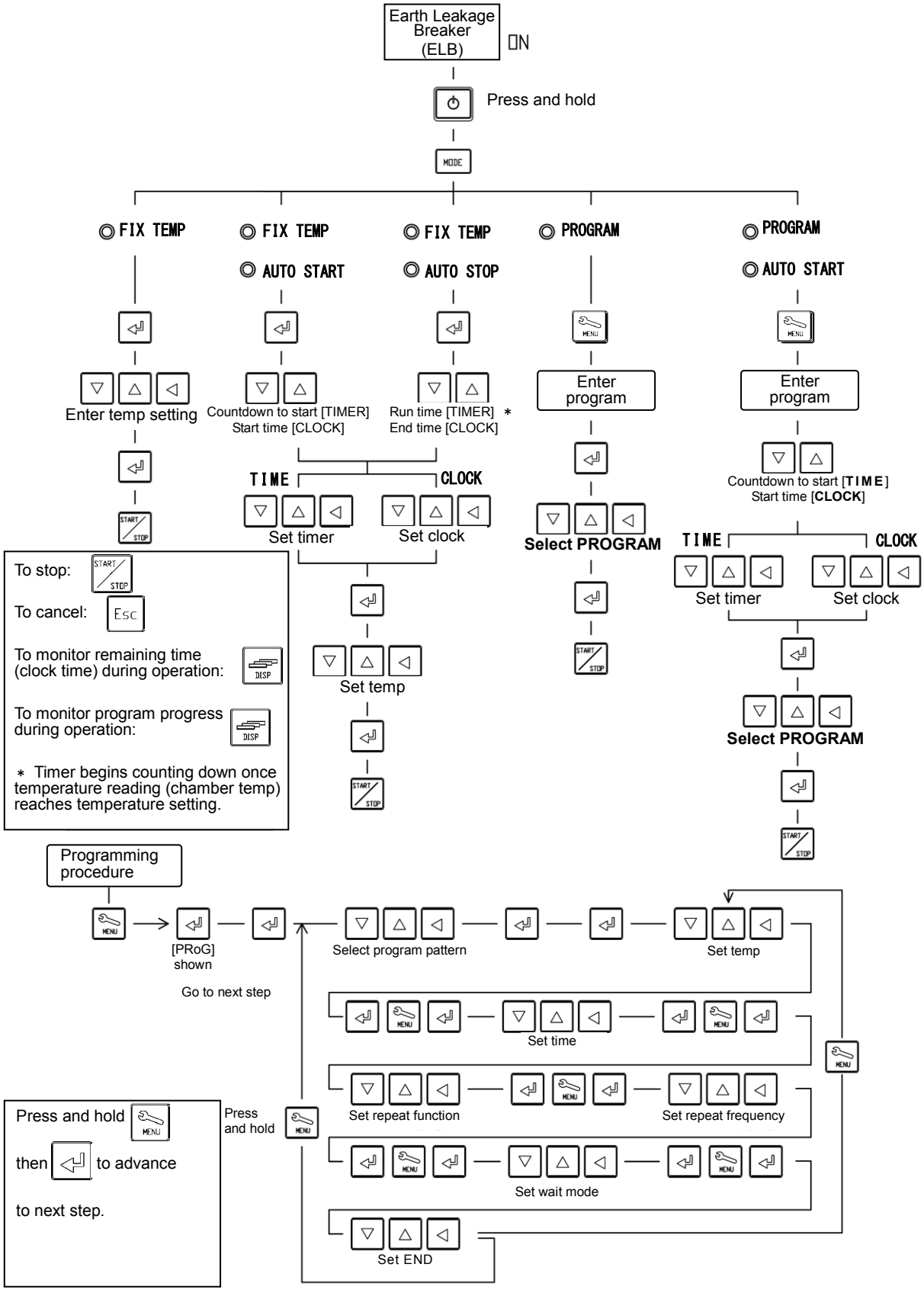
② Select one of three keypad tone modes using [△] [▽] and press [↵].

on: Activates tone for all keys. (factory default).
CLK: Activates tone for POWER and ENTER keys only.
oFF: Deactivates tone for all keys.

③ Press [Esc] twice to return to initial screen, when time/date settings are completed.

4. OPERATION PROCEDURE

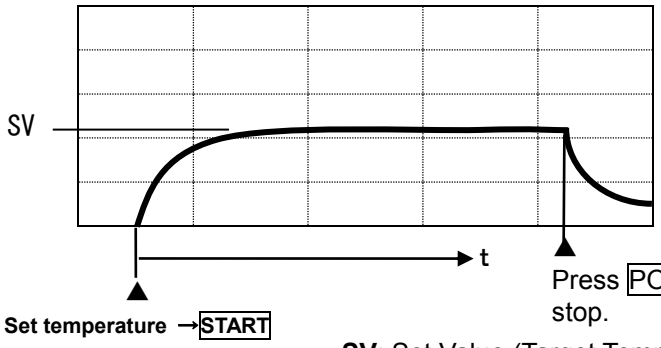
Mode & Function Flow



4. OPERATION PROCEDURE

Constant Temperature Operation

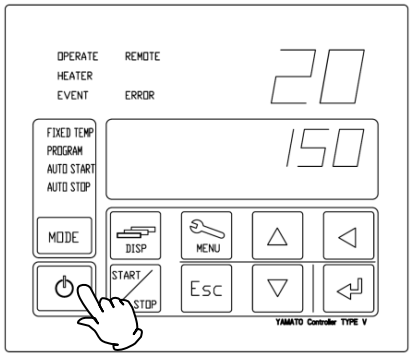
FIXED TEMP (constant temperature) mode runs DN-IE series unit at a constant selected temperature until START/STOP key is pressed, manually terminating operation.



SV: Set Value (Target Temperature), t : Time

Setting constant temperature mode.

1 Turn on power.

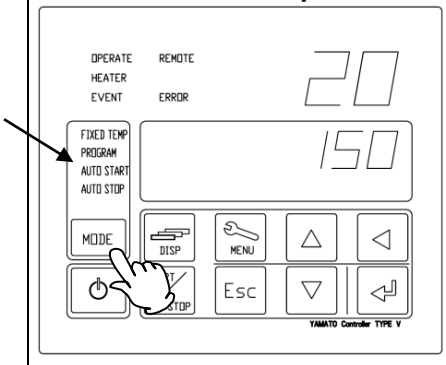


Turn on main power switch (ELB) (idle).

Press and hold ⏻ to turn on power. (standby)

Chamber temperature is shown in upper display, Temperature setting is shown in lower display.

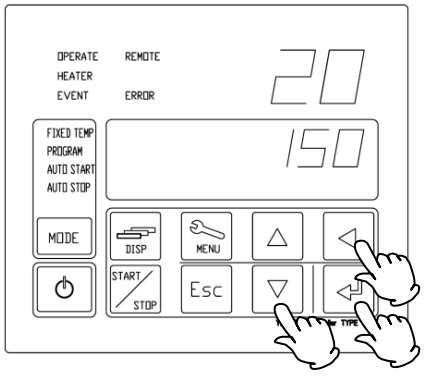
2 Select constant temperature mode.



Press MODE repeatedly until FIXED TEMP indicator lamp comes on.

※Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

3 Set temperature.



① Press ↵. Changeable digits flash in lower display.

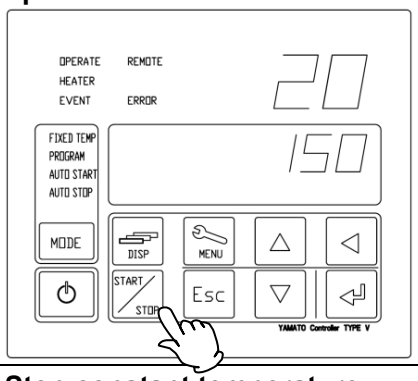
② Switch between digits using ◁ and change value using △ ▽.

Working temperature range:
0~370°C (Setting range: 15~360°C)

③ Press ↵ after temperature setting has been entered.

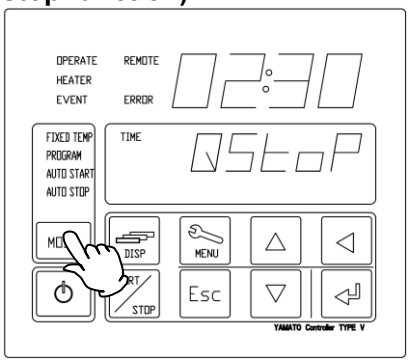
Press Esc once or twice to cancel setting.

4 **Start/stop constant temperature operation.**



① Press START/STOP key to start or stop constant temperature operation.

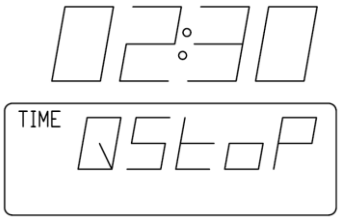
5 **Stop constant temperature operation using timer (quick auto stop function).**



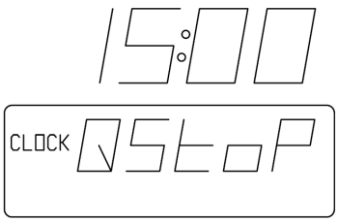
The quick auto stop function is used to automatically stop constant temperature operation at a certain time or after a certain time has passed. **(decided during operation).**

① Press MODE while constant temperature operation is in progress.
② QStoP shows in lower display. Start [TIME] lamp flashes.
③ Select TIME/CLOCK (timer or clock) with △ ▽ and press ↵.
④ Set TIME (setting range: 0~99hr：59min) or CLOCK (24-hour time system only) in upper display and press ↵.
⑤ "ENd" appears in lower display and opeation stops when timer reaches 0 or when clock reaches time setting.
⑥ Press START/STOP to clear "ENd".

Example 1. Timer:
Operation is automatically stopped, 2 hours and 30 minutes **after temperature setting is reached**.



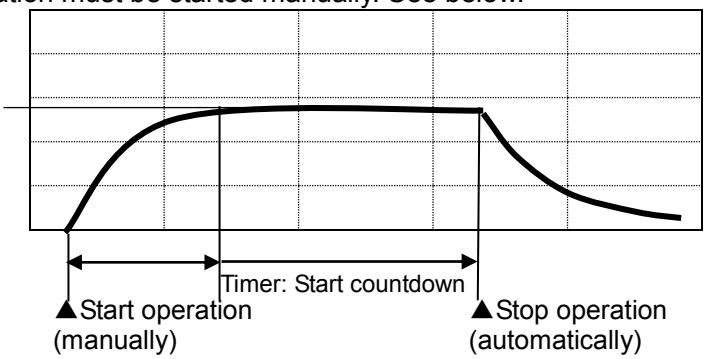
Example 2. Clock:
Operation is automatically stopped at 3:00PM **regardless of when temperature setting is reached.**



※Press DISP to monitor remaining time during operation, if necessary.

AUTO STOP (Automatic Stop) utilizes timer or clock to automatically stop an operation.

Operation must be started manually. See below.

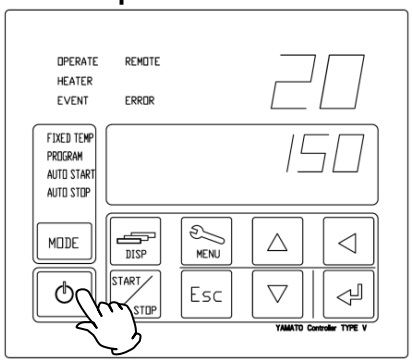


SV: Set Value (Temperature setting), t : Time

※See explanation regarding "wait mode" on page 26.

Seting automatic stop mode

1 Turn on power

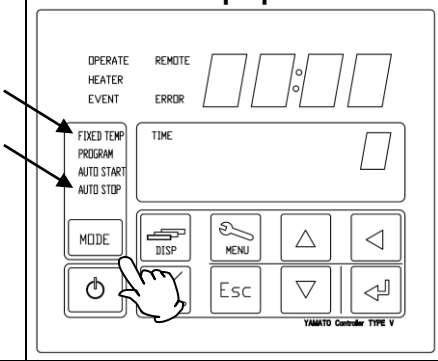


Turn on main power switch (ELB) (idle).

Press and hold ⏻ to turn on power (standby).

Chamber temperature is shown in upper display. Temperature setting is shown in lower display.

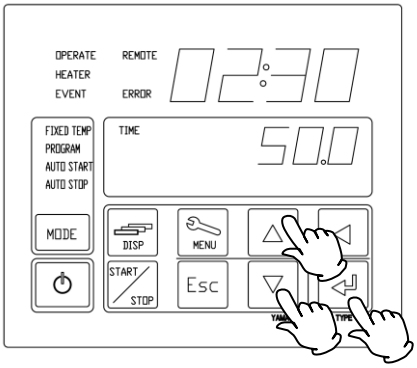
2 Select auto stop operation



Press MODE repeatedly until both the FIXED TEMP (constant temperature mode) and AUTO STOP (automatic stop mode) indicator lamps are illuminated.

※ Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

3 Set temperature and operation time.

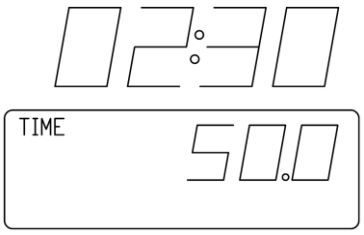


① Press ↵.
Select TIME/CLOCK using △ ▽ and press ↵.

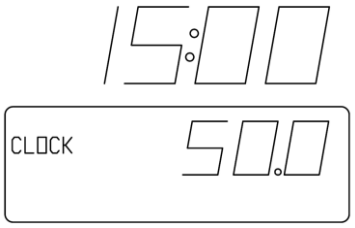
② Enter TIME (setting range: 0~99hr : 59min) or CLOCK (24-hour time system only) setting in upper display and press ↵.

③ Enter temperature in lower display and press ↵.

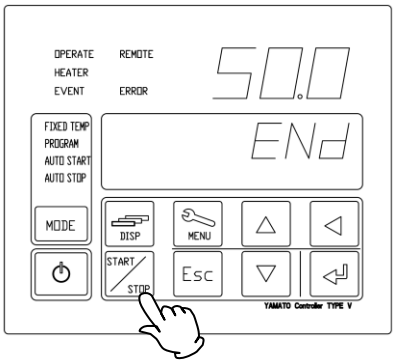
Example 1. Timer:
Operation is automatically stopped 2 hours and 30 minutes **after chamber temperature reaches 50°C temperature setting**.



Example 2. Clock:
Operation is automatically stopped at 3:00 p.m. **regardless of when target temperature is reached.**



4 **Start / stop operation**



① Press START/STOP to start or stop operation.

⑦ "ENd" appears in lower display and opeation stops when timer reaches 0 or when clock reaches time setting:

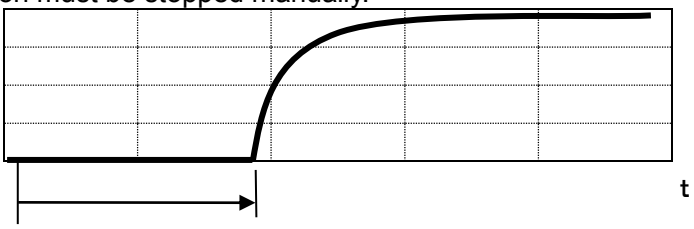
② Press START/STOP to clear "ENd".

※ Press DISP to monitor remaining time during operation, if necessary.

4. OPERATION PROCEDURE

Auto Start Operation

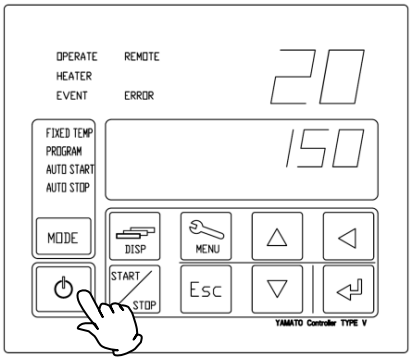
AUTO START (Automatic Start) mode utilizes timer or clock to automatically begin an operation. Operation must be stopped manually.



Timer countdown start Start operation (automatically)

Seting auto start mode

1 Turn on power

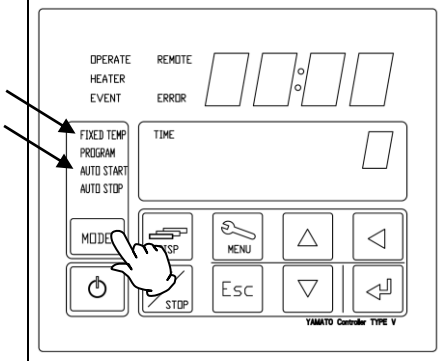


Turn on main power switch (ELB) (idle).

Press and hold ⏻ to turn on power (standby).

Chamber temperature is shown in upper display. Temperature setting is shown in lower display.

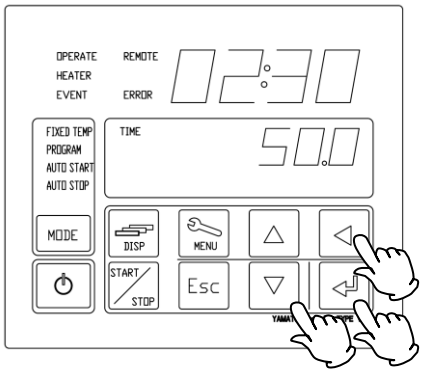
2 Select auto start mode



Press MODE repeadedly until both FIXED TEMP (constant temperature mode) AUTO START (automatic start mode) lamps illuminate.

※Factory default temperatures are shown in displays on first-time start-up. All subsequent start-ups will default to last temperature values entered.

3 Set temperature and time.

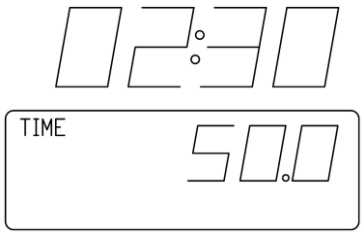


① Press ↵.
Select TIME/CLOCK using △ ▽ and press ↵.

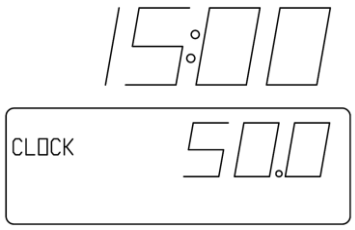
② Enter TIME (setting range: 0~99hr : 59min) or CLOCK settings (24-hour time system only) in upper display and press ↵.

③ Enter temperature in lower display and press ↵.

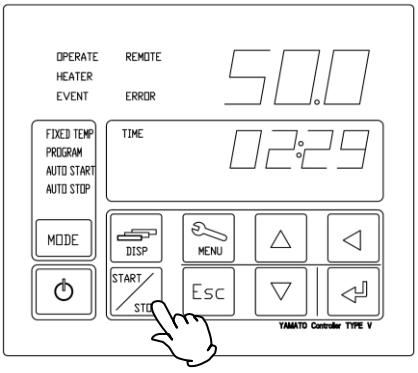
Example 1. Timer:
Operation will automatically begin 2 hours and 30 minutes, after the START/STOP key is pressed.



Example 2. Clock:
When START/STOP is pressed, operation is set to begin automatically at 3:00p.m.

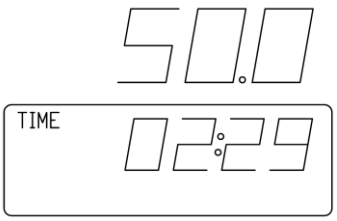


4 Start /stop operation



④ Press START/STOP to enter standby (wait) mode.

⑤ The OPERATE indicator lamp will begin flashing and timer countown or clock time will show in the lower display.



※ Temperature reading (chamber temp) will be shown in upper display. Timer countdown or clock will show in lower display, depending on which mode was selected to count down to start time.

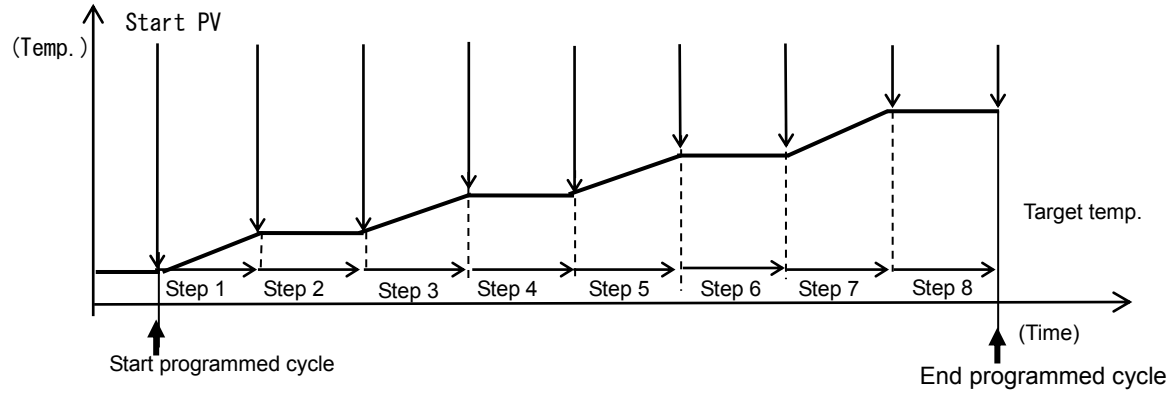
⑥ Press START/STOP to stop operation at any time.

※ Press DISP to monitor remaining time during operation, if desired.

4. OPERATION PROCEDURE

Programmed Operation

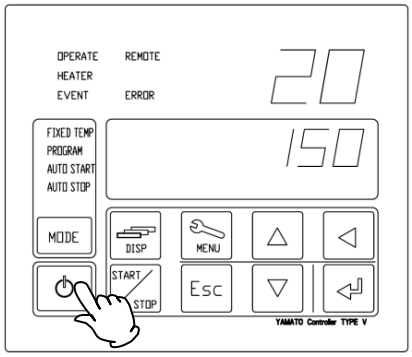
PROGRAM mode runs a combination of times and temperatures in a series of programmed steps as one operation. See below.



PV: Process Value

Entering programs

1 Turn on power



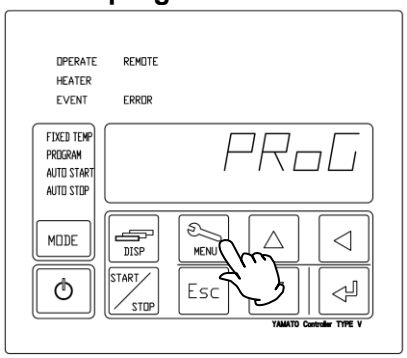
Turn on main power switch (ELB) (idle).

Press and hold ⏻ to turn on power (standby).

Chamber temperature is shown in upper display. Temperature setting is shown in lower display.

∗ Enter a target program prior to running first cycle.

2 Enter a program.



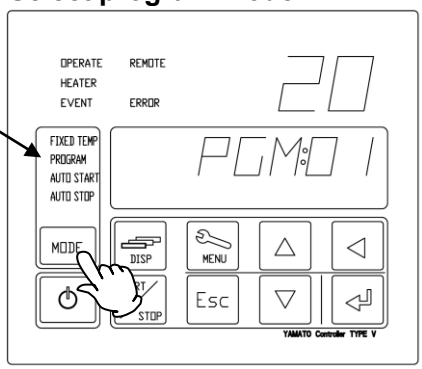
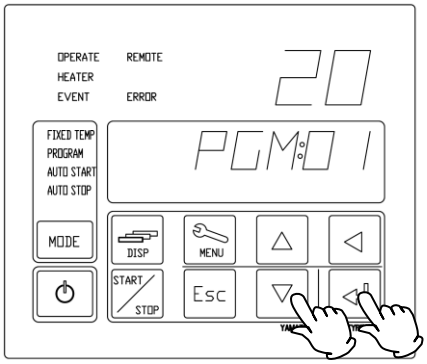
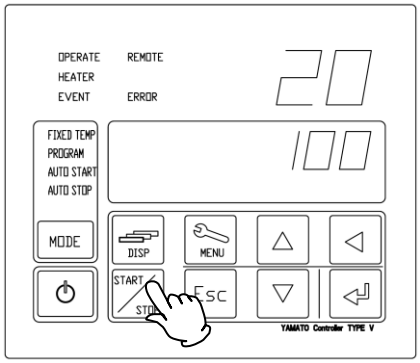
Program steps entered and program patterns saved may not exceed 99 in total.
Example:
Up to 11 program patterns with a maximum of 9 programmed steps each may be saved.

※Note when using “program repeat function”:
It is not possible to cut into and repeat process steps, in part (crossing) or in full (reduplication), from anywhere upstream in a program pattern, while programmed operation is in progress.

See "Programming Procedure" (P.23) for details on program entry.

4. OPERATION PROCEDURE

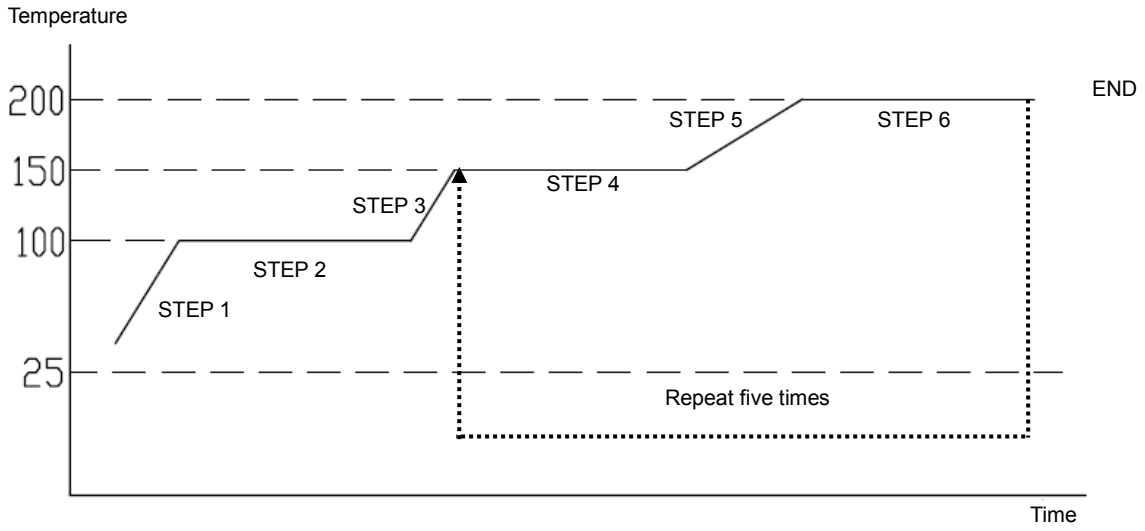
Programmed Operation

3	**Select program mode** 	Press [MODE] repeatedly (if necessary) until PROGRAM indicator lamp illuminates. "PGM:XX" will show in lower display (last program entered or last program used will always be the one shown in the display on start-up). ※Fixed temperature mode is the factory default setting and will be the mode selected on first-time startup. On all subsequent operations, the last mode run is shown on startup.
4	**Select program pattern number** 	Press [↵]. "01" flashes in the lower display. Select the desired program pattern number with [△] [▽] and press [↵].
5	**Start program mode** 	Press [START/STOP] to start programmed operation. ※If the "end" setting is left out on the final step of a program pattern, the entire program will not run. If newly entered programs fail to run, confirm that all settings have been entered correctly.

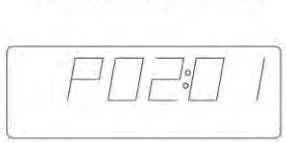
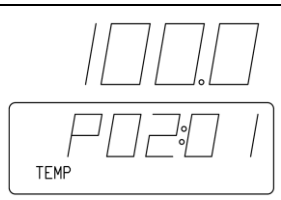
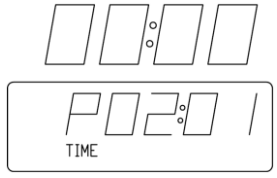
4. OPERATION PROCEDURE

Building & entering new programs.

Example 1: Program pattern below has 6 steps and contains a repeat cycle which repeats steps 4 to 6, five times and ends (STEP1,2,3→STEP 4, 5 and 6→repeat steps 4~6 five times→END).

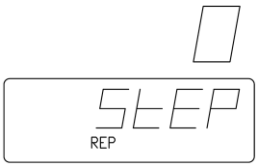
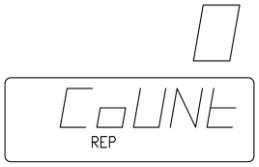
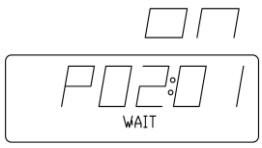
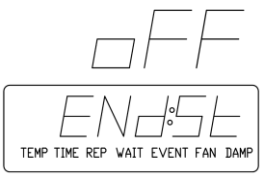
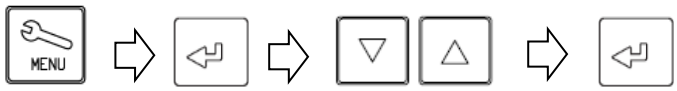


Program criteria:
STEP1：Set 100°C, 0 minute, wait ON
STEP2：Set 100°C, 2 hours, wait OFF
STEP3：Set 150°C, 0 minute, wait ON
STEP4：Set 150°C, 2 hours, wait ON
STEP5：Set 200°C, 1 hour, wait OFF
STEP6：Set 200°C, 2 hours, repeat beginning at step #4, repeat 5 times, wait ON, end ON

NO	Display	Input procedures (for Example 1 above)
1-1	Standby screen	
1-2		
Step1 1-3		Enter 02:01 (Pattern #02, step #01) 
1-4		Enter 100 (100°C) 
1-5		Enter 00:00 (00 hr 00 min) 

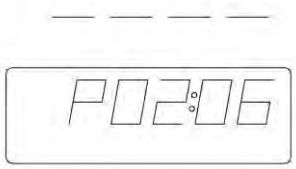
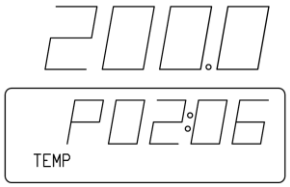
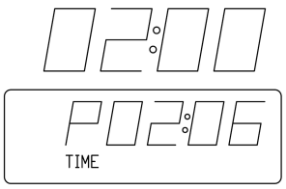
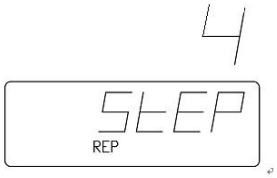
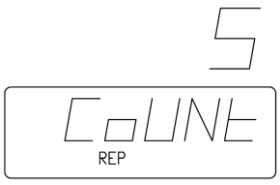
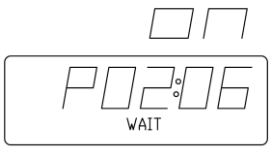
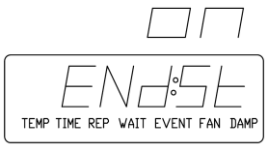
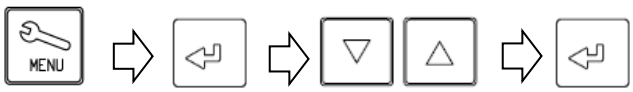
4. OPERATION PROCEDURE

Programming Procedure

1-6		Enter 0 (no repeat) 
1-7		Enter 0 (no repeat) 
1-8		Select “on” (to activate wait function) (Set time to when temperature reading (chamber temp) is within ±1℃ of temperature setting) 
1-9		Select “oFF” (Select "oFF" to program next step. Select "on" to program current step as “end step”) 
1-10	Programming for Step #1 complete. Now:	Press and hold  .
2-1		Enter 02:02 (Pattern #02, step #02) 
≀ **Step2** ≀ **Step3** ≀ **Step4** ≀ **Step5** ≀	Enter the parameters for steps #2 to #5 in the same manner as step #1. (repeat entry procedures 1-3~1-9)	※ Press  at any time while entering a program to show [RESt.P] in lower display and see the remaining available steps in upper display.

4. OPERATION PROCEDURE

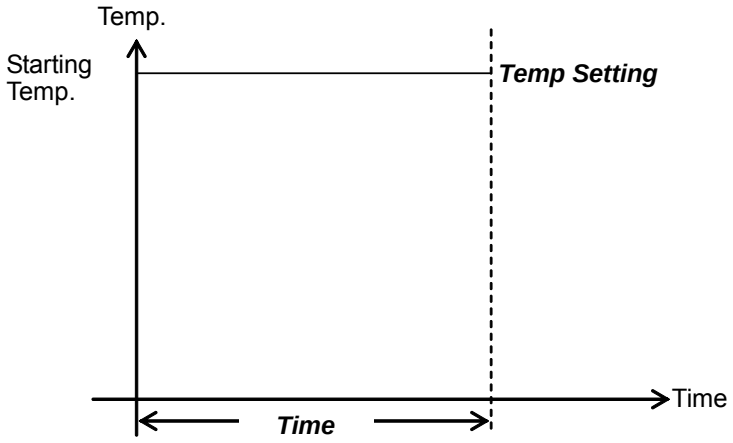
Programming Procedure

Step6 **6-1**		Enter 02:06 (Pattern #02, step #06) 
6-2		Enter 200 (200°C) 
6-3		Enter 02:00 (02 hr 00 min) 
6-4		Enter 4 (to repeat step #4 from the beginning) 
6-5		Enter 5 (to repeat five times) 
6-6		Select “on” (to activate wait function) (Set time to when temperature reading (chamber temp) is within ±1℃ of temperature setting) 
6-7		Select “oFF” (Select "oFF" to program next step. Select "on" to program current step as “end step”)  **※Last step in the program MUST include “END setting”.**

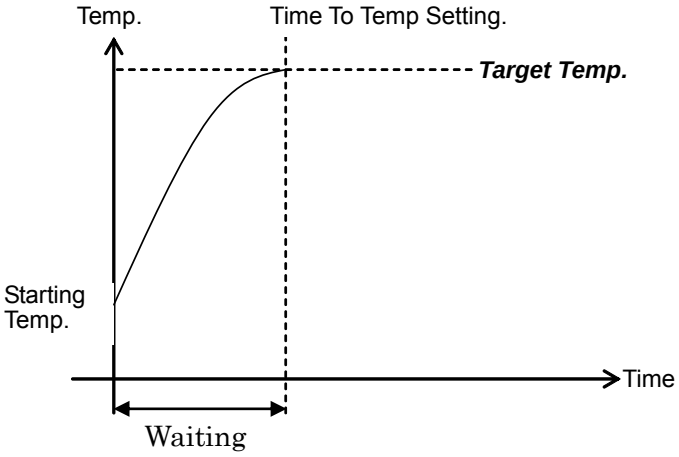
【Wait function explained】

If "starting temperature" and "temperature setting" are equal, chamber temperature is maintained until timer reaches 0 (zero),.

If chamber temperature drops more than 3°C below or goes more than 6°C beyond temperature setting, however, timer countdown stops and unit enters "wait mode" until chamber temperature returns to within -3°C or +6°C of temperature setting. Timer then begins counting down once again, from where it left off, until it reaches 0 (zero) and operation finishes.

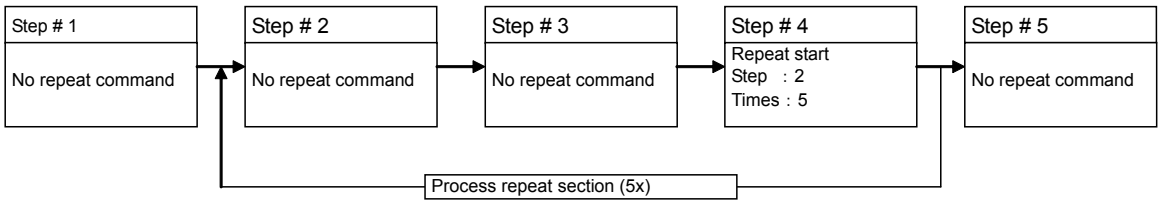


If timer setting is 0 (zero), temperature in chamber is raised to “temperature setting” on full power. If "wait" is set to "on" (program mode), “wait mode” will be activated until chamber temperature is within -3°C or +6°C of temperature setting.

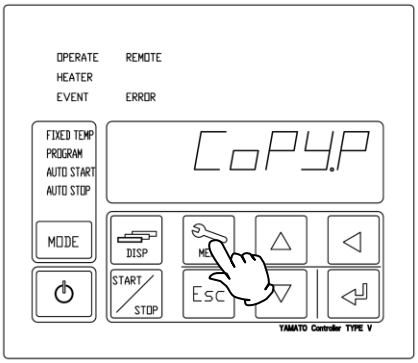


The following flowchart illustrates the repeat function concept.

Note that the first cycle of the repeated section is not counted in the repeating cycle.



Copy/delete program



・Copy program.

① Press [MENU] repeatedly until [CoPY.P] appears in lower display and press [↵].

② [SrC] shows in upper display. Use [▽] [△] to select program to copy in lower display and press [↵]. Program is copied.

③ [dESt] appears in upper display. Using [▽] [△], select a number which the copied program will be stored as and press [↵]. Program is duplicated with new designation.

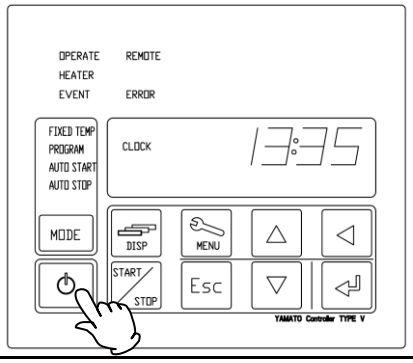
・Delete program.

① Press [MENU] repeatedly until [dEL.P] appears in lower display, then press [↵].

② [dEL] appears in upper display. Select a program number to delete using [▽] [△], then press and hold [↵].

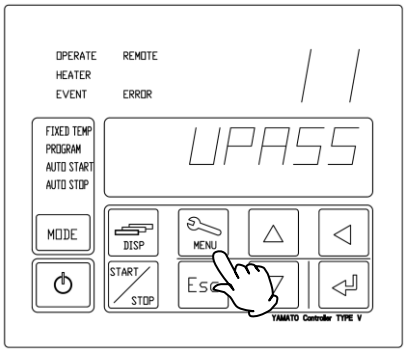
③ [dEL] flashes in upper display as warning that the program number shown is about to be deleted. Press [↵] again. Program is deleted.

1 Turn power OFF



Press and hold [⏻] to turn power OFF so that current time is showing in lower display (idle).

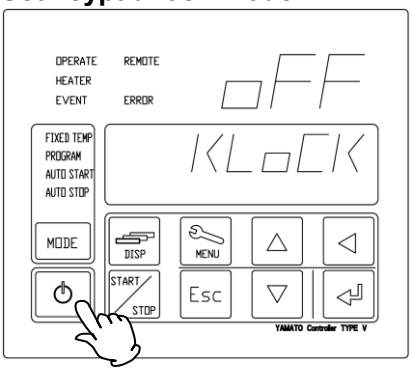
2 Enter password



① Press and hold [MENU].
[UPASS] appears in lower display. “00” shows in upper display with right digit flashing.

② Use [△] [▽] and [◁] to enter password “11” in upper display and press [↵] (password is locked to “11”).

3 Set keypad lock mode



① [KLoCK] is shown in lower display. Press [↵].

② Use [△] [▽] to select keypad lock mode and press [↵].

oFF : All keys enabled. (factory default)

on : All keys disabled except [⏻] key and START key.

FLoC : [MENU] key only is disabled.

ALoC : [MODE] key only is disabled.

③ Press and hold [⏻] to return to initial idle screen.

4. OPERATION PROCEDURE

Calibration Offset Function

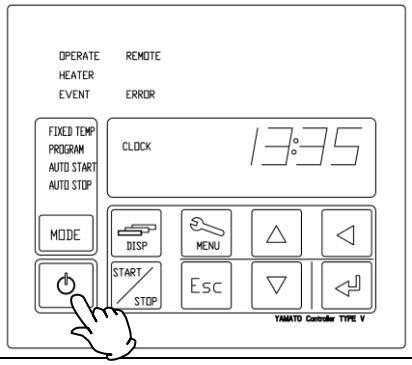
The calibration offset feature makes it possible to compensate for any difference between temperature reading on the control panel and actual chamber temperature (taken manually). This enables parallel compensation in either direction (+ or -) over the entire temperature setting range on all DN-IE series units.

Example

Actual chamber temperature is lower than the conrol panel temperature reading by 2°C:
Temperature reading can be calibrated by entering a calibration offset value of -2.0 to compensate against the actual temperature deficiency of 2°C.
If the initial temperature reading was 200°C, it will read 198°C after offset calibration, and be brought into agreement with the actual temperature.

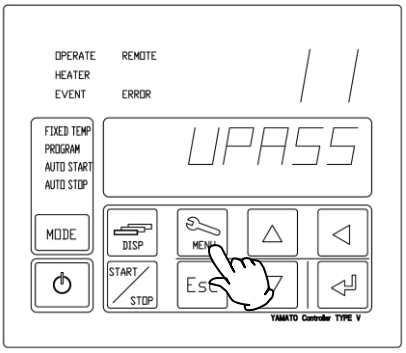
※**The -2°C calibration in the example above is applied over the entire temperature setting range (0~360°C). Note that offset values may change slightly depending on specimen arrangement in the chamber and/or temperature setting.**

1 Turn power OFF.



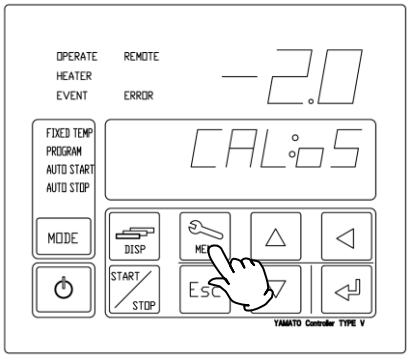
Press and hold [⏻] to turn power OFF so that current time is showing in lower display (idle).

2 Enter password.



① Press and hold [MENU].
[UPASS] appears in lower display. “00” shows in upper display with right digit flashing.
② Use [△] [▽] and [◁] to enter password “11” in upper display and press [↵] (password is locked to “11”).

3 Set calibration offset value.



① Press [MENU]. [CAL:oS] is shown in lower display and [0.0] in upper display. Press [↵]. Right-most digit flashes.
② Enter offset value using [△] [▽] and [◁] and press [↵].

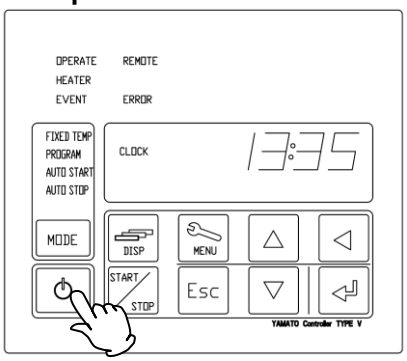
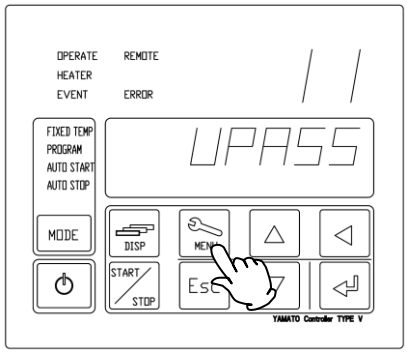
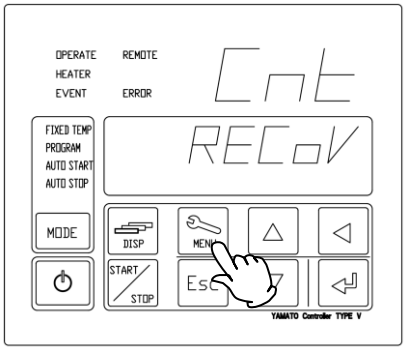
Example

Temperature reading is 200°C, while actual temperature (manually taken) is 198°C
⇒Offset input value: -2

③ Press and hold [⏻] to return to initial idle screen.

4. OPERATION PROCEDURE

Recovery Modes

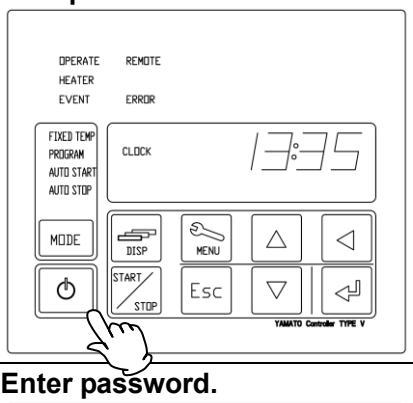
1	**Turn power OFF** 	Press and hold ⏻ to turn power OFF so that current time is showing in lower display (idle).
2	**Enter password** 	① Press and hold MENU. [UPASS] appears in lower display. “00” shows in upper display with right digit flashing. ② Use △ ▽ and ◁ to enter password “11” in upper display and press ↵ (password is locked to “11”).
3	**Set recovery mode** 	① Press MENU twice. [RECoV] is shown in lower display. Press ↵. ② Using △ ▽, select recovery mode and press ↵. Cnt: Operation will resume where it left off at power failure. (factory default) StoP: Operation will teminate and unit will be idle when power is restored. ③ Press and hold ⏻ to return to initial idle screen.

4. OPERATION PROCEDURE

CO2 Emissions & Power Consumption Settings

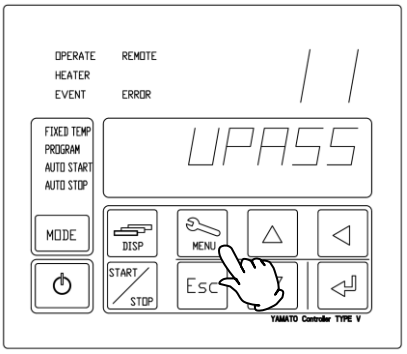
Setting CO2 conversion factor & resetting total CO2 emissions/power consumption.

1 Turn power OFF.



Press and hold [⏻] to turn power OFF so that current time is showing in lower display (idle).

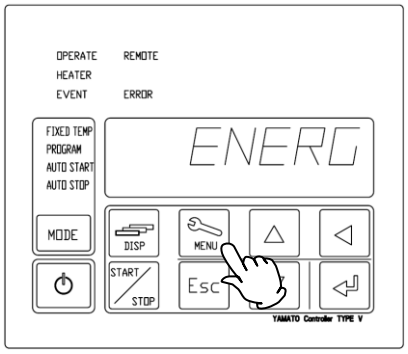
2 Enter password.



① Press and hold [MENU].
[UPASS] appears in lower display. “00” shows in upper display with right digit flashing

② Use [△] [▽] and [◁] to enter password “11” in upper display and press [↵] (password is locked to “11”).

3 Set/reset monitored items.



① Press [MENU] repeatedly to show [ENERG] in lower display, Press [↵].

② Press [MENU] to select an item in lower display :

“PoW:Rt” (“oFF” in upper display) :
Press [↵] to change “oFF” (constant) to → rUn (flashing) in lower display.
Press [↵] to reset accumulated power consumption.
Press [Esc] to return to [PoW:Rt] screen.

KG.K 0555 (denoting 0.555 - factory default value) :
Press [↵] to make value changeable (flashing).
Use [△] [▽] and [◁] to change conversion factor value.
Press [↵], then [Esc] to return to [KG.K] screen.

“Co2:Rt” (“oFF” in upper display) :
Press [↵] to change “oFF” (constant) to → “rUn” (flashing) in upper display.
Press [↵] to reset accumulated CO2 emissions.
Press [Esc] to return to [Co2:Rt] screen.

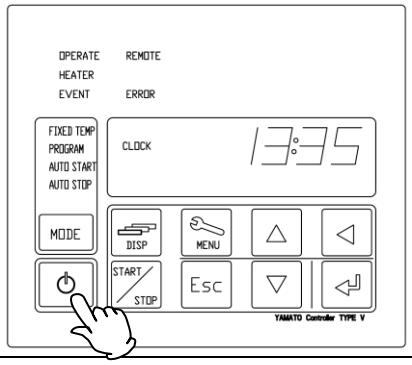
③ Press and hold [⏻] to return to initial idle screen.

4. OPERATION PROCEDURE

Data Backup & System Reset

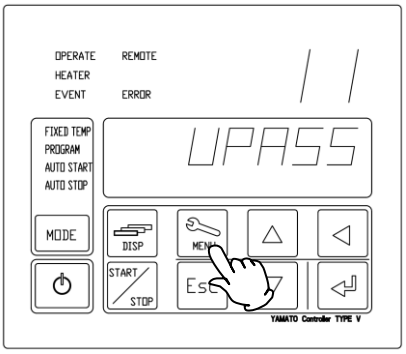
Back up, read out and reset controller for various setting information.

1 Turn power OFF.



Press and hold [⏻] to turn power OFF so that current time is showing in lower display (idle).

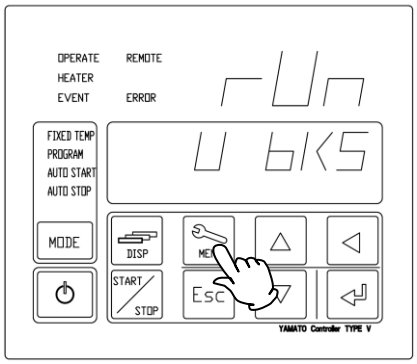
2 Enter password.



① Press and hold [MENU].
[UPASS] appears in lower display. “00” shows in upper display with right digit flashing.

② Use [△] [▽] and [◁] to enter password “11” in upper display and press [↵] (password is locked to “11”).

3 Save data/show saved data/reset.



① Press [MENU] repeatedly to toggle through the following items respectively in lower display:

U Bks: Backs up all setting information.
U bKR: Displays back up data.
INI.U: Resets all settings to factory default.

✳ Backup items include programs entered, temperature offset values and other data, such as keypad lock modes, calibration offsets, recovery modes, etc.

② Select one of the 3 modes desicribed above.
Press [↵]. [rUn] will be shown in upper display.
Press [↵].

※Current power consumption, accumulated hours of operation, etc. can be viewed by using the data monitoring feature on this unit.
Setting information shown in upper display cannot be modified.

1	**Values appear in upper display** ※Data can be viewed in standby mode or during operation. Press and hold the DISP key to view current power consumption (kW). Now press the DISP key repeatedly to scroll through and view the following items respectively: ↓Accumulated power consumption (tot:MW) ↓Accumulated power consumption (tot;kW) ↓Total CO2 Emission (Co2:t) ↓Total CO2 Emissin (Co2:KG) ↓Heater output (PId:MV) ↓Accumulated hours in power-on (PoW:tM) (0××××) Shows first (of 5) digit only. ↓Accumulated hours in power-on (PoW:tM) (×0000) Shows last four (of 5) digits only. ↓Accumulated operation run hours (RUN;tM) (0××××) Shows first (of 5) digit only. ↓Accumulated operation run hours (RUN:tM) (×0000) Shows last four (of 5) digits only. ↓Return to standby or mode screens.	∗ Current power consumption is power consumed from moment of activation and calculated in hourly increments. Accumulated power consumtion is updated hourly by using the sum total of current power consumption. ∗ CO2 emission (**CE**) is calculated using **CE**=(Conversion Coefficient)x(Power Consumption) Coefficient value will differ by local power supply company and must be confirmed and set accordingly in order to view accurate data. (Coefficient of -0.555 is set for TEPCO by default) ∗ Heater operation output is a parameter to control the output power ratio of heater's rated capacity in percentile units. Heater output will be controlled by a PID operation value between 100 and 0% until reaching objective temperature. ∗ Accumulated hours in power-on is the sum total of hours, aggregated between ELB ON and OFF. Maximum total for this value is 65,535 hours. Example First digit： 2 last four digits： 35 ⇒Accumulated hours in power-on: 20035 hours ∗ Accumulated operation run hours is the sum total of hours, aggregated between the start and end of operation runs. Maximum total for this value is 65,535 hours. Example Top digit： 0 Lower four digits： 135 ⇒Accumulated operation run hours: 0135 hours

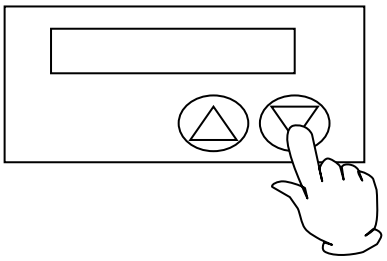
4. OPERATION PROCEDURE

Independent Overheat Prevention Device

DN-IE series units feature redundant safety devices: 1) The internal automatic overheat prevention (automatic reset) feature, and 2) the Independent Overheat Prevention Device (IOPD) with discrete power supply, circuit and sensor; completely independent of the CPU board.
The IOPD main relay functions to activate and cut power to the heater when chamber temperature goes too far beyond objective temperature.
These functions are enabled while the main power switch (ELB) is ON.

Set temperature on Independent Overheat Prevention Device(IOPD)

∗ Set temperature using ▼▲ on IOPD panel.



Operation may be terminated by Independent Overheat Prevention Device (IOPD) activation, when IOPD temperature setting and target temperature are less than 20°C apart.
IOPD temperature should be set at least 20°C higher than target temperature.

Note: main function of IOPD is to keep DN-IE unit from overheating, NOT to protect test samples from damage. Likewise, it is NOT intended for protection against accident or injury resulting from the negligent use of explosives and flammables.

IOPD factory default temperature setting: 400°C.
IOPD temperature setting range: 0°C~400°C.

To confirm whether IOPD functions as intended, set chamber temperature to any value within unit specification range and allow temperature to stabilize. Gradually lower IOPD temperature setting. If IOPD activates within 10°C of temperature setting, it is functioning normally.
Note: it normally takes 5 (five) seconds for IOPD to activate. Waiting 5 seconds each time temperature is lowered in the confirmation test above, is therefore recommended. When IOPD activates, error code Er07 shows in the display and operation will be terminated.
When changing the IOPD temperature setting, it takes a few seconds for the changes to finalize. For this reason, wait 5 seconds after entering the change before turning the power off.

5. HANDLING PRECAUTIONS

⚠ Warning

1. DO NOT process hazardous or harmful substances.

Never process explosive or flammable items. Fire or explosion causing serious injury or death may result. See “List of Hazardous Substances” (P.50) for more information on these items.

2. DO NOT operate equipment when abnormalities are detected.

If unit begins emitting smoke or abnormal odors for reasons unknown, turn off main power (ELB) immediately, disconnect power cable from power supply, and contact a local dealer or Yamato sales office for assistance. Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should be always be performed by a certified technician.

3. DO NOT insert foreign objects into openings.

- Never insert metal or combustible objects in unit openings, ventilation ports or exhaust ports. Fire or electric shock, causing serious burns, injury or death may result.
- In the event that a foreign object accidentally falls inside, turn off main power (ELB) immediately, disconnect power cable and contact a local dealer, or Yamato sales office for assistance. Continuing to operate unit without removing object may cause fire or electric shock resulting in serious injury or death.

⚠ Caution

1. DO NOT climb on equipment.

Do not attempt to climb onto unit or substitute it for a proper step ladder. Units are not designed to support bodily weight and damage may result. In addition, unit may become unstable and tip over or fall resulting in equipment damage, serious injury or death.

2. DO NOT place items on equipment.

Do not place any objects on unit. Doing so may cause unit to become unstable and tip over, resulting in possible equipment damage, injury or death.

3. DO NOT operate equipment during thunderstorms.

In the event of a thunderstorm, turn off main power switch (ELB), and disconnect power cable immediately. A direct lightning strike may cause equipment damage fire or electric shock, resulting in serious injury or death.

4. DO NOT leave chamber door open.

Do not leave DN-IE unit door open (i.e. to cool test samples in the chamber down, etc.) following an operation run. Heat from chamber may damage and/or deform control panel, causing CPU board malfunction or failure. Always remove processed test samples and close chamber door.

5. DO NOT process corrosive items.

Do not process items containing corrosive chemicals of any kind. Although chamber interior is manufactured of 304 stainless steel, damage may still occur from exposure to strong chemicals.

5. HANDLING PRECAUTIONS

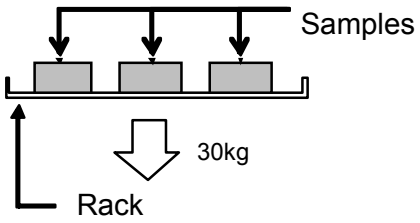
Caution

6. ALWAYS run equipment within specified temperature range.

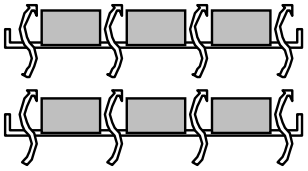
Operating temperature range is 15°C~360°C. Never attempt to operate unit outside of this range. Doing so may cause equipment malfunction or damage.

7. Arrange test samples appropriately.

Weight capacity for one chamber rack is approximately 30kg. Test sample load total for each rack should not exceed this specification.
Arrange test samples evenly on racks, leaving as much space between them as possible.



Do not place too many test samples on rack at once. Doing so may prevent proper temperature control in chamber. Test samples should be managed in the following way;
1. Install the supplied chamber racks, 2. Leave as much space between test samples as possible. 3. As a rule of thumb, leave 30% or more of the total space on each rack unoccupied.



Leave 30% of total rack space open.

8. DO NOT place items in bottom of chamber.

Operating unit with test samples placed directly on bottom surface of chamber may cause unit to perform poorly. Likewise, chamber temperature may become excessive, causing malfunction or damage. Always use the supplied chamber racks, supported on the standard supports, and avoid placing any items on bottom surface. Do not allow test samples to contact chamber walls.

9. Power outages.

In the event of a power loss during operation, one of the following will occur when power is restored, depending on what settings have been selected:

- Continued operation: if power recovery settings have been set to continue (factory default), the START/STOP key can be pressed and operation will pick up where it left off with the power failure.
- Stop operation: if recovery settings have been set to stop, operation will be terminated and unit will go into idle when power is restored.

See “Recovery Modes” (P.33) for details.

10. Confirm equipment stability.

If unit has not been stabilized, it may tip over or fall, causing injury or death, during an earthquake or other unforseen incident. Be sure to stabilize unit properly (adjustable leveling feet securely positioned, etc.) to ensure safe operation.

⚠ Caution

11. Chamber door seal.

Chamber door seals are manufactured from silicon rubber. Benzoic acid, oil, and other components, used during the silicone rubber manufacturing process, may be emitted during operation, spoiling incompatible test samples. If test samples, sensitive to silicone rubber by-products, are to be processed; specially formulated fluoro-rubber seals may be requested as an option.
Note that acids, alkaline, and halogenated solvents are corrosive to rubber.

【Caution】

Substances that are corrosive to the silicon or fluoro rubber used for chamber door seals are shown in Table 5.1.
Do not process test samples that contain any of the substances shown in this table.
For further assistance, contact a Yamato sales office or dealer.

Table 5.1 - Substances harmful to chamber door seal

Substance / Classification	Silicon Rubber	Fluoro-rubber
Hydrocarbons	Butane, Isooctane, Benzine, Toluene, Xylene, Styrene, Diphenyl, Pinene, Kerosene	Propane
Halogen, Haloid Hydrocarbon	Methyl Chloride, Methylene Chloride, Chloroform, Carbon Tetrachloride, Trichloroethylene, Phlorobenzene, Monochloronaphthalene, R-11、R-12、R-21、R-22、R-113、R-114、Bromine	R-21, R-22
Ketone, Aldehyde	Methyl Ethyl Ketone, Diisopropyl Ketone, Diclohexanon, Acetophenone	Acetone, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Diisopropyl Ketone, Diclohexanon, Acetophenone
Ester	Methyl Acetate, Ethyl Acetate, Propyl Acetate, Butyl Acetate, Amyl Acetate, Methyl Acetoacetate, Butyl Acrylate, Ethyl Methacrylate	Methyl Acetate, Ethyl Acetate, Propyl Acetate, Isopropyl Acetate, Butyl Acetate, Amyl Acetate, Ethyl Acetoacetate, Ethyl Acrylate, Butyl Acrylate, Ethyl Methacrylate
Ether	Diethyl Ether, Dibutyl Ether, Ethylene Oxide, Dioxane, Epichlorohydrin, Tetrahydrofuran	Diethyl Ether, Isopropyl Ether, Dibutyl Ether, Dibenzyl Ether, Ethylene Oxide、Dioxane, Epichlorohydrin, Furfural, Tetrahydrofuran
Alcohol	Amyl alcohol	
Multiple Alcohol Derivative		Cellosolve Acetate, Butyl Cellosolve, Triacetin
Fatty Acid, Phenol	Acetic Anhydride, Oleic Acid, Phenol Palmitate	Formic Acid、Acetic Anhydride, Hydroquinone

⚠ Caution

Table 5.1 - Substances harmful to chamber door seal (continued)

Substance / Classification	Silicon Rubber	Fluoro-rubber
Nitrogen Chemical Compounds	Nitromethane, Nitroethane, Nitropropane	Nitromethane, Nitroethane, Nitropropane, Ethylenediamine, Dimethylaniline, Ethanol amine, Hydrazine, Triethanol Amine, Dimethyl Formamide, Pyridine, Piperidine
Sulfur and phosphorus compounds	Hydrosulfuric	Hydrosulfuric, Tributyl Phosphate
Other Chemical Compounds	Nickel Acetate, Lead Acetate, Zinc Acetate, Tetraethyl Lead, Vegetable Oil, Silicon Oil	Calcium Acetate, Nickel Acetate, Lead Acetate, Zinc Acetate
Inorganic Solvent	Hydrochloric Acid, Nitric Acid, Sulfuric Acid, Hydrobromic Acid, Phosphoric Acid, Hypochlorous Acid, Chromic Acid, Perchloric Acid, Sodium Hydrate	Sodium Hydrate, Aqueous Ammonia

12. Temperature sensor.

The temperature sensor for this unit is installed on the inside wall of the chamber and used to control chamber temperature. The chamber temperature reading, as read by the sensor, may not always agree with the temperature of test specimens. Indeed, chamber and test sample temperatures may differ vastly just after opening or closing chamber door.

13. Inspect equipment regularly.

The main power switch (ELB) and Independent Overheat Prevention Device (IOPD) in particular, are key devices in maintining the safety of DN-IE series units, and must be inspected/maintained regularly.

See “Inspection & Maintenance” (P.40) for details.

14. Independent Overheat Prevention Device temperature limit must be set.

Activation temperature for the Independent Overheat Prevention Device (IOPD) must be set in order to protect unit from damage, if overheating occurs.
Note that temperature on the IOPD should be set to 20°C higher than objective temperature.

See “Independent Overheat Prevention Device” (P.34) for more on setting up this device and for other warnings.

15. Solvents and excess moisture in test samples.

Remove excess and unneeded moisture and water from test samples (i.e. thoroughly dry test sample container exterior, etc.) before processing.

16. Initial operation.

When operating unit for the first time, organic substances in the heat insulator may burn and produce smoke, which is normal and not a malfunction. An accompanying odor may also be present, but will subside with continued operation.

5. HANDLING PRECAUTIONS

⚠ Caution

17. Processing test samples/specimens

- ●Use caution when processing samples/specimens, which contain powder or small particles, so they are not disbursed by sudden movements or abrupt air pressure changes. Allowing flammable or metallic items to contact the heater assembly may cause a fire or shock hazard.
- ●Be advised that more time may be requred for chamber temperature to rise when processing a larger amount of samples/specimens or those with a higher heat load capacity. Do not process more samples than necessary. Also note that temperature reading may not be consistent when processing heat-generating specimens.

18. High temperature operation.

When running DN-IE series units at high temperature, exercise extreme caution so that hands and skin do not contact any hot surfaces. Always wear heat-resistant gloves when putting in and removing test samples

Also note that extended high temperature use may cause chamber door seal to adhere to window glass, preventing the door from being opened. Avoid more than 72 hours of continuous operation.

19. DO NOT apply paint thinner, alcohol or other solvents to equipment.

Never attempt to clean DN-IE series units with paint thinner, alcohol or solvents of any kind. Doing so may cause coating to peel, discoloration, superficial damage and deformity to some components.

Note: always turn off main power switch (ELB) prior to cleaning or maintenance.

20. Opening/closing chamber door

Exercise caution so that head and limbs are kept out of swing radius while chamber door is being opened or closed. Personal injury may otherwise result.

21. Modifications

Any malfunction resulting from unauthorized modifications or customizations to equipment will void the warranty and are not the responsibility of Yamato.

22. Use N2 gas only.

- For inert operation, use only N2 gas.
- Adjust secondary pressure to 0.02~0.05MPa before connecting hose to gas injection port.
- Be sure room ventilation is adequate before using N2 gas.

23. Read instruction manual thoroughly before operation.

Always read instruction manual(s) for all equipment, thoroughly, before beginning setup, installation or operation.

6. MAINTENANCE PROCEDURES

Warning

- Be sure that main power switch (ELB) is OFF before daily inspection and maintenance of DN-IE series units.
- Perform inspections and maintenance when inside of chamber is at room temperature.
- **Never attempt to disassemble unit.**

Caution

- Clean unit using soft damp cloth.
- Never use benzene, paint thinner, scouring powder, scrubbing brush or other abrasives and solvents to clean unit. Superficial damage and/or discoloration, as well as deformity to some components may result.

Inspect monthly.

- Inspect main power switch (ELB) ON and OFF function.
  - ・Prepare unit for inspection by connecting power cable to a facility outlet or terminal.
  - ・Confirm that main switch (ELB) is “OFF” then, turn main switch (ELB) back “ON”.
  - ・With the main switch “ON”, depress the test button on the main switch (ELB) using a ball-point pen or other fine-tipped object. If main switch (ELB) shuts off, it is functioning normally.

- Test Independent Overheat Prevention Device (IOPD).
  - ・Run unit in constant temperture mode and allow temperature to stabilize.
  - ・Set the activation temperature for the IOPD to approximately 5°C below chamber temperature.
  - ・If overheating prevention device is functioning normally, heater will shut off within few seconds and error code “Er07” will appear in the upper display. An alarm will also sound and ERROR lamp will illuminate.

∗ Main power switch (ELB) and overheat prevention device must be inspected, as prescribed above, prior to every instance of extended or overnight operation.

◆Contact a local dealer or Yamato sales office for further assistance.

7. EXTENDED STORAGE AND DISPOSAL

Extended Storage / Unit Disposal

⚠ Warning	⚠ Caution
If unit will be out of service for an extended period, turn off main power switch (ELB) and disconnect power cable from facility outlet or terminal.	**Unit disposal.** ●Remove door handle and hinges to prevent it from locking. ●Do not leave unit unattended, or in a place where children can have access. ●Dispose of this unit in accordance with local laws and regulations.

Disposal Considerations

Dispose of or recycle this unit in a responsible and environmentally friendly manner.
Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

Major components and materials, comprising DN-IE series units are listed in table below:

Component	Material
External Structure	Chrome free electrogalvanized carbon steel, sheet coated w/chemical-proof baked-on finish
Chamber	Stainless steel
Heat Insulator	Ceramic fiber + glass wool
Door seal	Silicon rubber
Window glass	Chemically reinforced glass
Switches and Relays	Resin composites, copper and other materials
Control Panel	Polycarbonate resin
Printed Circuit Boards	Fiber glass composites and other materials
Heater	Stainless steel tubing
Power Cable	Composites of synthesized rubber coating, copper, nickel and other compound materials
Wires	Composite of fiber glass, fire-retardant vinyl, copper, nickel and other materials
Stickers	Resin materials
Sensor (Pt&K TC Sensor)	Stainless steel and other material

8. TROUBLESHOOTING

Error Code Guide

All possible error codes are shown in Table 8.1 below.

On DN-IE series units, operation stops and a sounding alarm accompanies occurring errors. Error codes will appear in the upper display of control panel. Confirm code and see associated details in Table 8.1 below.

Turn off main power switch (ELB) immediately and block access to unit.

Table 8.1 Table of Error Code

Display code	Description	Possible causes and solutions
Er01	Sensor Failure	● Failure in temperature input circuit. ● Open circuit in temperature sensor line. ● Temperature out of specification range. Contact a local dealer or Yamato sales office.
Er02	SSR Short Circuit	● Electrical short in SSR circuit. ● Failure in current transformer (CT) sensor. Contact a local dealer or Yamato sales office.
Er03	Faulty Heater Line	● Heater line faulty or severed. ● Failure in current transformer (CT) sensor. ● Drop in supply voltage. Contact a local dealer or Yamato sales office.
Er07	Independent Overheat Prevention Device (IOPD) activated	● Independent Overheat Prevention Device (IOPD) activated. Turn ELB on again and check both chamber temperature and IOPD temperature setting. Contact a local dealer or Yamato sales office, if unit does not activate when ELB is switched back on.
Er 10	Main relay contact failure	Turn ELB back on and confirm: ● whether contact point on main relay is damaged. ● whether current transformer (CT) sensor(s) has failed. Contact a local dealer or Yamato sales office.
Er. 14	RAM Failure	Turn ELB back on and confirm whether there is a drop in backup battery capacity or whether backup battery is dead. Replace backup battery Contact a local dealer or Yamato sales office, if this error cannot be reset by turning ELB back on.
Er. 15	EEPROM Failure	Turn ELB back on and confirm whether there is a change in data code on EEPROM. Replace backup battery Contact a local dealer or Yamato sales office, if this error cannot be reset by turning ELB back on.

8. TROUBLESHOOTING

Troubleshooting Guide

Table 8.2 - Troubleshooting Guide

Symptom	Possible causes	Possible solutions
Unit does not turn on/operate when main power switch is turned “ON”.	・ No power ・ ELB failure ・ CPU board failure	・ Check connection to power supply and confirm power supply voltage. ・ Replace ELB. (※) ・ Replace CPU board. (※)
Nothing displayed in upper and lower displays when START/STOP key is pressed and held	・ Power supply failure (must be within ±10% voltage rating) ・ CPU board failure	・ Connect to adequate power supply ・ Replace CPU board (※)
Temperature in chamber does build.	・ IOPD and/or built–in self-diagnosis function has shut heater circuit down (error code displayed).	・ Refer to Table 8.1 in this chapter (※)
Temperature reading fluctuates during operation.	・ Heavily fluctuating ambient temperature ・ Power supply failure (must be within ±10% of voltage rating) ・ Temperature affected by test samples ・ CPU board failure ・ Temperature sensor failure	・ Re-evaluate installation site ・ Connect to adequate power supply ・ Reduce test sample load ・ Replace CPU board (※) ・ Replace temperature sensor (※)

※Contact a local dealer or Yamato sales office for further assistance.

If problem(s) persists, turn off power immediately, disconnect power cable from outlet or terminal and contact a local dealer or Yamato sales office for further assistance.

Recovering from a power outage.

Selecting whether or not to restore an interrupted operation process must be done prior to a power outage event, according to the following:

* **Resume operation after a power outage by selecting [Cnt] from the recovery function menu:**
  Restores unit to the status it was in just before power outage occurred.
  Resumes process from where it left off at power loss.
* **Terminate operation by selecting [StoP] from the recovery function menu:**
  Unit goes into idle when power is restored.
  Stops process when power outage occurs.

See P.30 for details.

9. SERVICE AND REPAIR

Requests for Repair

When a problem occurs, terminate operation immediately, turn off main power switch (ELB) and disconnect power cable.
Contact a local dealer or Yamato sales office for assistance.

The following information is required for all repairs.
- Model name
- Serial Number
- Date (year/month/day) of purchase
- Description of problem in as much detail as possible

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for DN411IE/611IE inert ovens. “Repair parts” is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

Specifications Table

Product Name		Inert Oven	
Model Name		DN411IE	DN611IE
System		Forced air convection	
Power supply		Single-phase 200V 16A	Single-phase 220V 19A
		50/60Hz、Allowable Input Voltage：Required Voltage±10%	
Performance ※1	Operating Temperature Range	Room temp. +15°C~360°C	
	Temperature control precision Temperature fluctuation	±0.2°C (at 360°C) JTM K05	
		±0.6°C (at 360°C) JIS C60068	
	Temperature distribution precision Temperature slope	±3°C (at 360°C) JTM K05	
		12°C (at 360°C) JIS C60068	20°C (at 360°C) JIS C60068
	Temperature rise time	Approx.60min.	
	Time required for N2 injection ※2	Approx. 30 minutes (at normal temperature, O2 density at the center in the container: 2%)	Approx. 70 minutes (at normal temperature, O2 density at the center in the container: 2%)
Composition	Exterior	Cold rolled steel plate with baked melamine resin coating	
	Chamber	Stainless steel plate	
	Insulation Material	Glass wool ＋ ceramic fiber	
	Door	Single swing (left side)	
	Heater	SUS tube heater:3.0kW	SUS tube heater:4.0kW
	Flow meter and gas inlet port	Maximum flow: 30L/min, hose fitting ⌀: 9mm	
Controllers	Temperature Control Method	PID control by microcomputer	
	Temperature setting method	Digital setting with ▲/▼ keys.	
	Temperature Display Method	Top Screen：Green 4-digit LED Digital Display (Resolution：1°C) Bottom Screen：Orange 5-digit LED Digital Display (Resolution：1°C)	
	Other displays	LED indicates temperature patterns for heating/stable/cooling	
	Timer	0 min~99 hrs 59 min (Resolution：1 minute or 1 hour)	
	Operation Functions	Fixed Temperature Operation/Quick Automatic Stop Operation Automatic Start Operation Automatic Stop Operation Program Operation (Repeatable Operation Function up to max 99 steps or 99 patterns)	
	Built-in Functions	Power on and Operation Time Integrating Function (up to 65,535 hours); Calendar Time (24 hours); Calibration Offset; Monitor Display of Integrated Power Consumption, Total CO2 Emission, and Heater operating Output; Power Recovery Mode; Save and Access of Operater's Setting Information;	
	Heater Control	Triac with Zero-cross Control	
	Sensor	K type Thermocouple (for temperature control and independent overheat preventive device)	

10. SPECIFICATIONS

Specifications (continued)

Safety Devices	Earth Leakage Breaker (ELB)	30A	
		Leak Current/Short Circuit/Over-current Protection, Rated Sensitivity Current 30mA	
	Independent Overheat Prevention Device (IOPD)	Set Temperature Range : : 0~400°C	
	CPU Board	Self-diagnostic Functions (Sensor Failure, SSR Short Circuit, Heater Line Disconnection, Main Relay Contact Damaged, Automatic Overheat Prevention), Key Lock Function	
	Door switch	Micro switch pin push button type	
Standard Measurements	Chamber Dimensions (W×D×H) ※2	470×450×450 ㎜	620×600×600 ㎜
	External Dimensions (W×D×H) ※2	640×695×915 ㎜	790×845×1065 ㎜
	Capacity	95ℓ	223ℓ
	Weight	Approx. 90 ㎏	Approx.130 ㎏
Acces-sories	Chamber racks and supports	Two racks/set	
	Instruction manual	One copy	
Remarks	※1 External temperature 5~35°C. Rated performance is based on power supplied at specification rating, 23°C ±5°C external temperature, 65%RH ±20% humidity, discharge port closed and no process load. ※2 N2 flow during injection approx. 20L/min. ※3 Dimensions do not include protruding components.		

11. ACCESSORIES

Optional Accessory Guide

Table 11.1 below shows a list of accessories, which provide a wide variety of options for DN-IE series vacuum drying ovens.

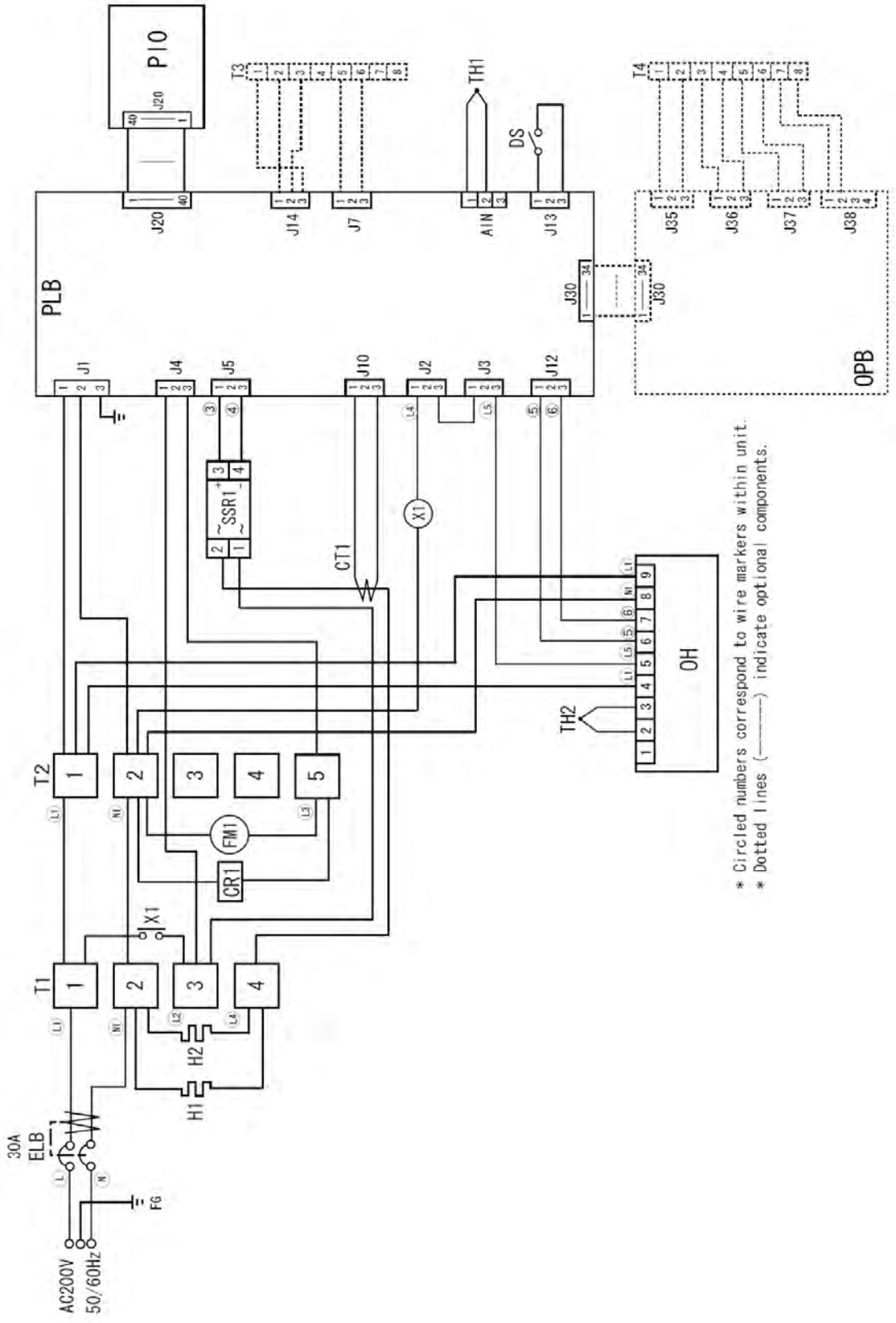
Table 11.1 List of Options

Option	Product Code No.	Model Name	Applicable model	Description
Stand	212477	OH41	DN411IE	For DN411IE/611IE
	212478	OH61	DN611IE	
Stainless steel wire chamber rack (1 rack, 2 supports included) (30kg max load per rack)	211063	ODQ10	DN411IE	Same as supplied racks.
	211064	ODQ20	DN611IE	
Stainless steel punched metal chamber rack (15kg max load per rack)	211098	ODQ30	DN411IE	Punched stainless steel rack.
	211099	ODQ40	DN611IE	
Remote Comm Terminal※1	212975	ODH16	All models	Allows DN-IE units to be monitored and controlled remotely.
Remote Comm Adaptor Kit ※1	211880	OIN90	All models	Allows DN-IE units to be interfaced to, monitored and controlled via PC. Software included.
Temperature output terminal ※1	212976	ODH18	All models	4 ~20 milli ampere analog signal output for external temperature sensors.
External alert output terminal ※1	212977	ODH22	All models	Allows alert signals to be output to an external device.
Timeup output terminal ※1	212978	ODH24	All models	Allows “end” signal for auto stop or programmed operations to be sent to an external device.
operation signal output terminal ※1	212979	ODH26	All models	Allows an “in progress” signal to be sent to an external device, during unit operation.
Event output terminal ※1	212980	ODH28	All models	Allows ON-OFF event output signals, such as standby, operating, end of operation, and program steps to be sent to an external device.

※1 These options must be ordered with unit and installed at the factory.

12. WIRING DIAGRAM

DN411IE/611IE Wiring Diagram



12. WIRING DIAGRAM

Wiring Diagram Glossary

Symbol	Component	Symbol	Component
ELB	Electric Leakage Breaker	PLB	CPU control board
T1	Terminal block	PIO	Display board
T2	Terminal block	OH	Independent overheat preventive device
SSR1	Heater control relay	TH1	Temperature sensor
H1	Heater	TH2	Temperature sensor
H2	Heater	CT1	Current sensor
X1	Main operation relay	DS	Door switch
FM1	Sirocco fan	CR1	CR absorber
Optional devices			
Symbol	Component	Symbol	Component
T3	Terminal block	OPB	Optional board
T4	Terminal block		

13. LIST OF HAZARDOUS SUBSTANCES

Never attempt to process explosives, flammables or any items which contain explosives or flammables.

Explosive Substance	①Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	②Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④Metallic Azide, including Sodium Azide, etc.
ExplosiveSsubstances	①Metal “Lithium” ②Metal “Potassium” ③Metal “Natrium” ④Yellow Phosphorus ⑤Phosphorus Sulfide ⑥Red Phosphorus⑦Phosphorus Sulfide ⑧Celluloids, Calcium Carbide (a.k.a, Carbide)⑨Lime Phosphide⑩Magnesium Powder ⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder ⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing Substances	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
Flammable Substances	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances having ignition point of 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a.amyl n-acetate) and other substances with ignition point between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyl Alcohol(a.k.a. Isoamyl Alcohol), Acetic Acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible Gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°C under air pressure.

Excerpt from Table 1, Hazardous Substances, in Cabinet Order from Occupational Safety and Health Law (substances related to Articles 1, 6, and 9)

14. SETUP CHECKLIST

* Setup DN-IE series units using the following procedure:

Model	Serial number	Installation Date	Installed by (company or personnel)	Installation approved by	Assessed by

No.	Item	Procedure	Section & Reference Page	Assessed by
Specifications				
1	Accessories	Verify inlcuded accessories against accessories column.	10. Specifications 45~46	
2	Installation	・Check site visually. Caution: check for hazards	2. Pre-operation Procedures 1. Choose Appropriate Site for Installation. 4	
		・Prepare installation space.		
		・Prepare for N2 gas injection	2. Pre-operation Procedures 7 12. N2 Gas Injection	
Equipment Operation				
1	Power Source Voltage	・Measure line voltage (facility power outlet or terminal) with voltmeter. ・Measure line voltage during operation. (Must meet required voltage rating) Caution: confirm facility power source rating meets unit requirements	2. Pre-operation Procedures 4~7 7. Connect power cable to outlet or terminal 6 9. Ground wire must be connected 6 10.Specifications 45~46 Power Supply (Required)	
2	Operation	・Start operation.	2. Pre-operation procedures 4~17 Installation Precautions 4. Operation procedure 11~34 Setting Time & Date ~ Service & Repair	
Orientation				
1	Operation	Explain function of each component as written in instruction manual.	4. Operation Procedure 11~34 Setting Time & Date 1. Safety Precautions ~ 1~50 14. List of Hazardous Substances	
2	Error codes	Explain error codes and reset procedures as written in instruction manual.	8. Error Codes ~ 42~51 15. Setup Checklist	
3	Maintenance and inspection	Explain function of each component as written in instruction manual.	6. Maintenance Procedures Inspection & Maintenance 40	
4	Setup checklist completion	・Fill in installation date and name of installing personnel or company on unit “OK and Service Sticker”. ・Explain how to contact technician.	9. Service & Repair 44	

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure on DN-IE series units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- **Instruction manual descriptions and specifications are subject to change without notice.**
- **Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

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Inert Oven
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