

SINCE 1889



# **Instruction Manual For Vacuum Drying Oven**

**Model  
ADP21  
ADP31**

Ver.3

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# Contents

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|  |           |
|--|-----------|
| ◆ <b>Cautions in Using with Safety</b> .....                 | <b>1</b>  |
| • Explanation.....   | 1         |
| ◆ <b>Cautions in Using with Safety</b> .....                 | <b>2</b>  |
| • Table of Illustrated Symbols .....                         | 2         |
| ◆ <b>Cautions in Using with Safety</b> .....                 | <b>3</b>  |
| • Fundamental Matters of “WARNING!” and “CAUTION!” .....     | 3         |
| ◆ <b>Before Using this unit</b> .....                        | <b>4</b>  |
| • Requirements for Installation.....                         | 4         |
| ◆ <b>Before Using this unit</b> .....                        | <b>5</b>  |
| • Requirements for Installation.....                         | 5         |
| ◆ <b>Before Using this unit</b> .....                        | <b>6</b>  |
| • Requirements for Installation.....                         | 6         |
| ◆ <b>Description and Function of Each Part</b> .....         | <b>7</b>  |
| • Main Unit .....  | 7         |
| ◆ <b>Description and Function of Each Part</b> .....         | <b>8</b>  |
| • Control Panel.....   | 8         |
| ◆ <b>Description and Function of Each Part</b> .....         | <b>9</b>  |
| • Characters of Thermo Controller .....                      | 9         |
| ◆ <b>Operation Method</b> .....                              | <b>10</b> |
| • Preparation for Operation.....                             | 10        |
| ◆ <b>Operation Method</b> .....                              | <b>11</b> |
| • Operation Mode and Function List .....                     | 11        |
| ◆ <b>Operation Method</b> .....                              | <b>11</b> |
| ◆ <b>Operation Method</b> .....                              | <b>13</b> |
| • Operation Mode, Function Setting Key, and Characters ..... | 13        |
| ◆ <b>Operation Method</b> .....                              | <b>14</b> |
| • Setting of Overheating Prevention Device .....             | 14        |
| ◆ <b>Operation Method</b> .....                              | <b>15</b> |
| • Fixed Temperature Operation.....                           | 15        |
| ◆ <b>Operation Method</b> .....                              | <b>16</b> |
| • Quick Auto Stop Operation.....                             | 16        |
| ◆ <b>Operation Method</b> .....                              | <b>17</b> |
| • Auto Stop Operation.....                                   | 17        |
| ◆ <b>Operation Method</b> .....                              | <b>18</b> |
| • Auto Stop Operation.....                                   | 18        |
| ◆ <b>Operation Method</b> .....                              | <b>19</b> |
| • Auto Start Operation.....                                  | 19        |

|   |           |
|---|-----------|
| ◆ <b>Operation Method</b> .....                                 | <b>20</b> |
| • Auto Start Operation.....                                     | 20        |
| ◆ <b>Operation Method</b> .....                                 | <b>21</b> |
| • Other Functions.....  | 21        |
| ◆ <b>Handling Precautions</b> .....                             | <b>22</b> |
| ◆ <b>Maintenance Method</b> .....                               | <b>23</b> |
| • Daily Inspection and Maintenance .....                        | 23        |
| ◆ <b>Long storage and disposal</b> .....                        | <b>24</b> |
| • When not using this unit for long term / When disposing ..... | 24        |
| ◆ <b>In the Event of Failure</b> ... ..                         | <b>25</b> |
| • Safety Device and Error Code.....                             | 25        |
| ◆ <b>In the Event of Failure</b> ... ..                         | <b>26</b> |
| ◆ <b>In the Event of Failure</b> ... ..                         | <b>26</b> |
| • Trouble Shooting .....  | 26        |
| ◆ <b>After Service and Warranty</b> .....                       | <b>27</b> |
| ◆ <b>Specification</b> .....                                    | <b>28</b> |
| ◆ <b>Wiring Diagram</b> .....                                   | <b>29</b> |
| ◆ <b>Replacement Parts Table</b> .....                          | <b>30</b> |
| ◆ <b>Reference</b> .....  | <b>31</b> |
| • List of Dangerous Substances .....                            | 31        |

## Explanation


### 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.

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 **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.

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#### 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.  
perform.



This symbol indicates items that should be always performed. A detailed message with instructions is shown adjacent to the symbol.

# Cautions in Using with Safety

## Table of Illustrated Symbols

### Warning



Warning,  
generally



Warning,  
high voltage



Warning,  
high temperature



Warning,  
drive train



Warning,  
explosive

### Caution



Caution,  
generally



Caution,  
electrical shock



Caution,  
scald



Caution,  
no road heating



Caution,  
not to drench



Caution,  
water only



Caution,  
deadly poison

### Prohibit



Prohibit,  
generally



Prohibit,  
inflammable



Prohibit,  
to disassemble



Prohibit,  
to touch

### Compulsion



Compulsion,  
generally



Compulsion,  
connect to the  
grounding  
terminal



Compulsion,  
install on a flat  
surface



Compulsion,  
disconnect the  
power plug



Compulsion,  
periodical  
inspection

## Cautions in Using with Safety

### Fundamental Matters of “WARNING!” and “CAUTION!”

#### **WARNING!**

##### **Do not use this unit in an area where there is flammable or explosive gas**

Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result. (Refer to page31 “List of Dangerous Substances”.)

##### **Always ground this unit**

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

##### **If a problem occurs**

If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit 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.

##### **Substances that can not be used**

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

##### **Do not disassemble or modify this unit**

Do not disassemble or modify this unit. Fire or electrical shock or failure may be caused.

##### **Do not touch high-temperature parts**

The inside of the body or the door may become hot during and just after operation. It may cause burns.

#### **CAUTION!**

##### **During a thunder storm**

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

## Requirements for Installation

### **WARNING!**

#### 1. Always ground this unit



- Connect the power plug to a receptacle with grounding connectors.



- Do not forget to ground this unit, to protect you and the unit from electrical shock in case of power surge. Choose a receptacle with grounding connectors as often as possible.
- 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.

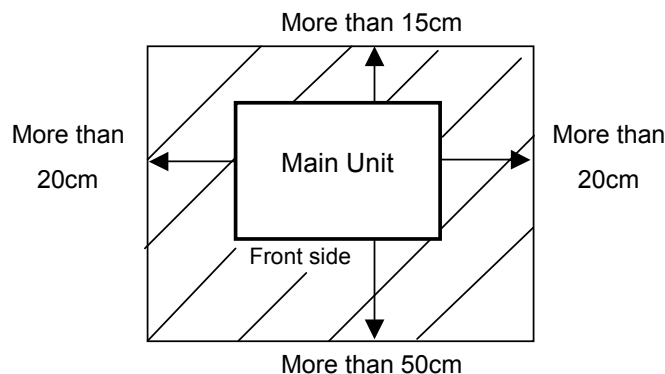
#### 2. Choose a proper place for installation



- Do not install this unit in a place where:
  - ◆ Rough or dirty surface.
  - ◆ 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 is a constant vibration.



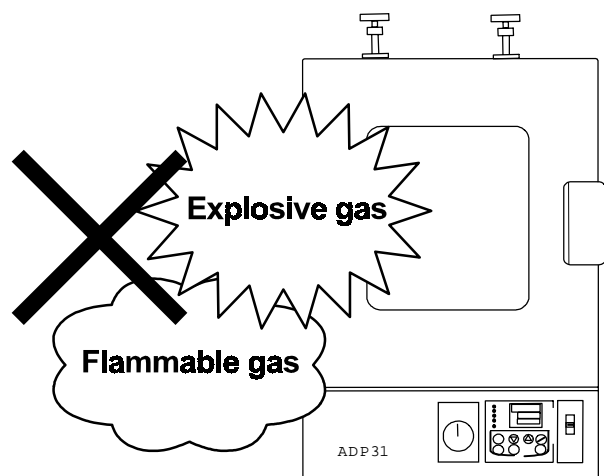
- Install this unit on a stable place with the space as shown below.



#### 3. Do not use this unit in an area where there is flammable or explosive gas



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

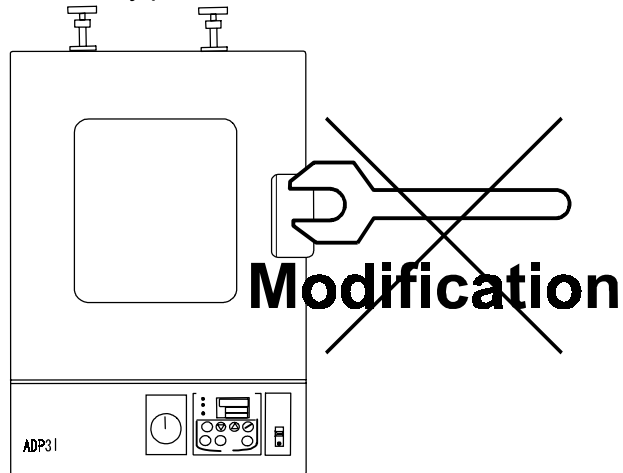


## Requirements for Installation

### 4. Do not modify



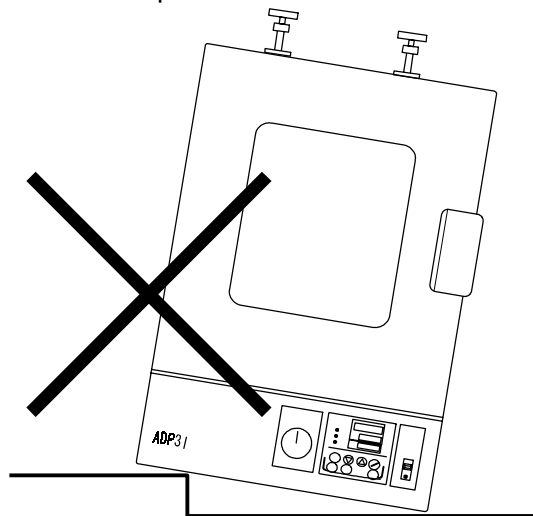
- Modification of this unit is strictly prohibited. This could cause a failure.



### 5. Installation on horizontal surface



- Set this unit to the flattest place. Setting this unit on rough or slope place could cause the vibration or noise, or cause the unexpectible trouble or malfunction.





## Requirements for Installation

### **CAUTION!**

#### 6. Choose a correct power distribution board or receptacle



- Choose a correct power distribution board or receptacle that meets the unit's rated electric capacity.

**Electric capacity:** ADP21: 115V AC, 6A  
ADP31: 115V AC, 10A

NOTE)

There could be the case that the unit does not run even after turning ON the power. Inspect whether the voltage of the main power is lowered than the specified value, or whether other device(s) uses the same power line of this unit. If the phenomena might be found, change the power line of this unit to the other power line.

#### 7. Handling of power code



- Do not entangle the power cord. This will cause overheating and possibly a fire.
- Do not bend or twist the power cord, or apply excessive tension to it. This may cause a fire and electrical shock.
- Do not lay the power cord under a desk or chair, and do not allow it to be pinched in order to prevent it from being damaged and to avoid a fire or electrical shock.
- Keep the power cord away from any heating equipment such as a room heater. The cord's insulation may melt and cause a fire or electrical shock.



- If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.
- Connect the power plug to the receptacle which is supplied appropriate power and voltage.

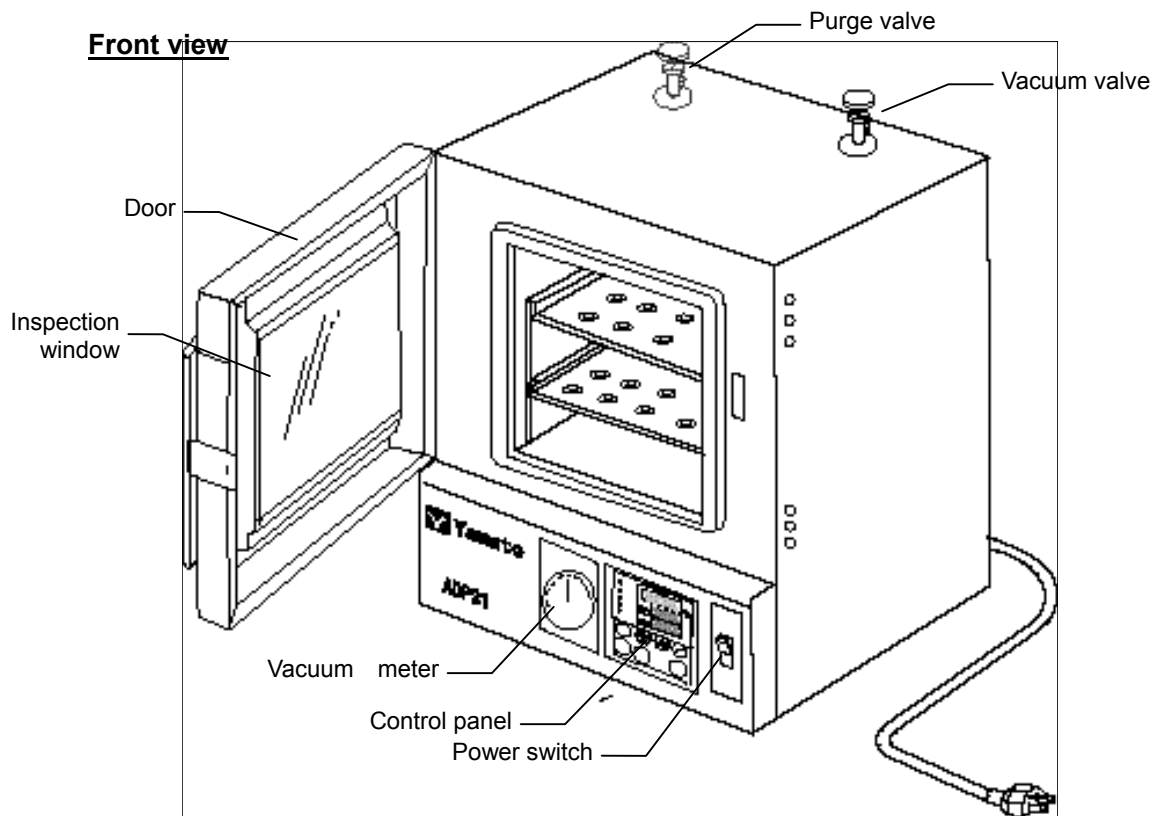
#### 8. Before/after installing



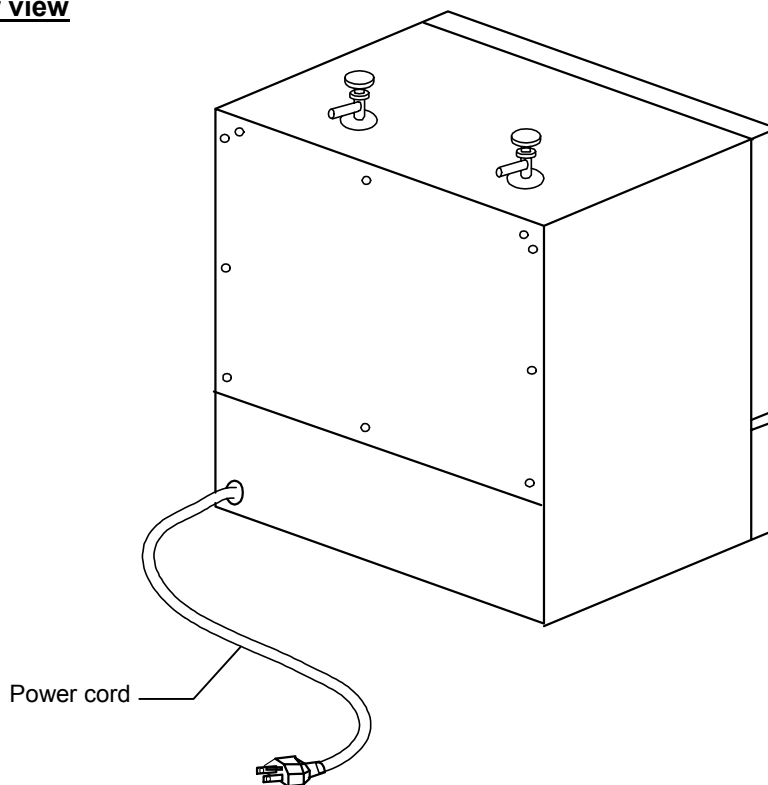
- It may cause injure to a person if this unit falls down or moves by the earthquake and the impact. etc..To prevent, take measures that the unit cannot fall down, and not install to busy place.
- Touching the unit may cause a burn during and just after the operation. To prevent, take measures that putting up a notice of operating etc..

# Description and Function of Each Part

## Main Unit

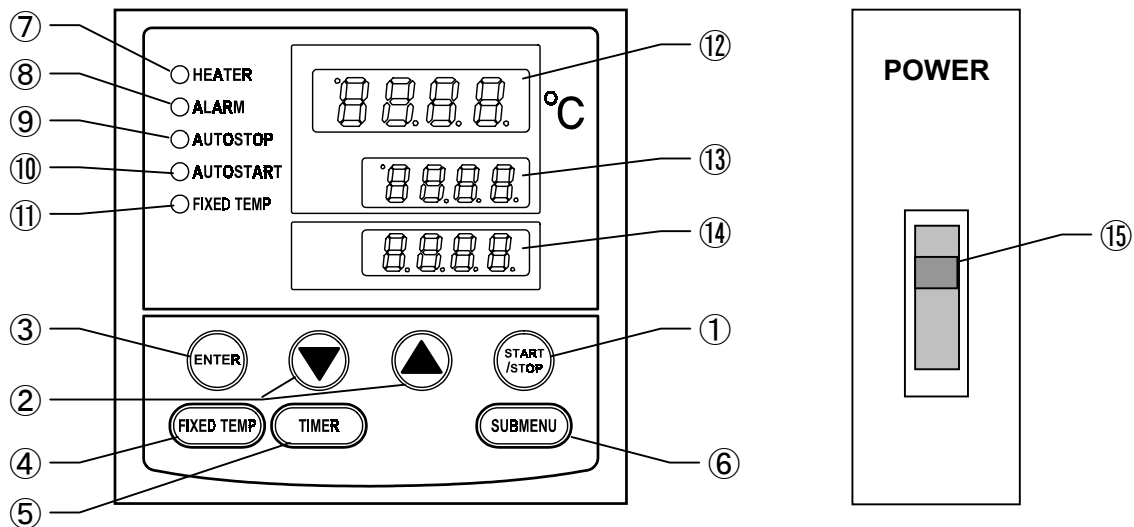


## Rear view



# Description and Function of Each Part

## Control Panel












|   |  |   |
|---|--|---|
| ① | START/STOP Key :                             | Starts/stops the operation.   |
| ② | ▲▼ Key :                                     | Uses for rising UP/lowering DOWN the setting value.   |
| ③ | ENTER Key :                                  | Settles the inputted value.   |
| ④ | FIXED TEMP Key :                             | Chooses the fixed temperature operation.  |
| ⑤ | TIMER Key :                                  | Chooses the timer operation (Quick Auto Stop/Auto Stop/Auto Start).   |
| ⑥ | SUBMENU Key :                                | Uses for setting the overheating prevention temperature, calibration offset temperature, and key lock function.                     |
| ⑦ | HEATER Lamp :                                | Lights while the heater works.  |
| ⑧ | ALARM Lamp :                                 | Lights up when an error occurs. (Buzzer sounds simultaneously.)   |
| ⑨ | AUTO STOP Lamp :                             | Blinks while setting quick auto stop timer or auto stop timer.<br>Lights while quick auto stop timer or auto stop timer is running. |
| ⑩ | AUTO START Lamp :                            | Blinks while setting auto start timer.<br>Lights while auto start timer is running.   |
| ⑪ | FIXED TEMP Lamp :                            | Blinks while setting fixed temperature operation.<br>Lights while fixed temperature operation is running.                           |
| ⑫ | Measurement Temperature Display :            | Displays the measured temperature, setting character, alarm information.  |
| ⑬ | Setting Temperature Display :                | Displays the setting temperature, setting value for timer mode, remaining time.   |
| ⑭ | Overheating Prevention Temperature Display : | Displays the setting temperature for overheating prevention device.   |
| ⑮ | Power Switch :                               | Turns ON/OFF the main power.  |

## Description and Function of Each Part

### Characters of Thermo Controller

The characters VS3 controller shows are as follows:

| Character   | Identifier  | Name                           | Purpose  |
|---|-------------|--------------------------------|--|
|    | <b>FiX</b>  | Fixed Temperature Setting Mode | Used for starting the fixed temperature operation.   |
|    | <b>Sv</b>   | Temperature Setting            | Used for setting the temperature.  |
|    | <b>AStP</b> | Timer Setting Mode Display     | Represents the setting of quick auto stop or auto stop operation.  |
|    | <b>AStr</b> | Timer Setting Mode Display     | Represents the setting of auto start operation.  |
|    | <b>tim</b>  | Time Setting                   | Used for setting the time.   |
|    | <b>End</b>  | Time Up                        | Displays when the timer operation is completed.  |
|   | <b>cAL</b>  | Calibration Offset Setting     | Used for inputting the calibration offset temperature. (Refer to Page 21 "Use calibration offset function".)                   |
|  | <b>oH</b>   | Overheating Prevention Setting | Used for setting temperature for overheating prevention device. (Refer to Page 14 "Setting of Overheating Prevention Device".) |
|  | <b>LoCK</b> | Key Lock                       | Locks the keys on control panel to protect from unnecessary operation. (Refer to Page 21 "Use lock function".)                 |

\* Also refer to Page 14 "Setting of Overheating Prevention Device".

## Preparation for Operation

**Set the shelf:** Use the shelf of attached accessory. Permissible load of the shelf is approximately 15kg. Do not put too much sample.

**Set sample:** Set samples with space between each of them. Make room more than 30% of the shelf in order to keep accuracy of temperature.

**Connect the power code:** Connect the power code to a proper receptacle securely.

### ***Read the following without fail before using the vacuum pump***



Use a vacuum pump with air volume displacement of approximately 50 liters/min.



The vacuum pump shall be connected to the main unit before starting operation.  
Check no vacuum air leakage exists before turning on the power of this unit.

**Make bath to vacuum state:** Close the purging valve to vacuum the bath. Turn on the power switch of vacuum pump after opening the vacuum valve.  
After the power switch of vacuum pump is turned on, the scale at the front of the unit gradually slants to the left until it reaches to approximately 100 Pa.  
Vacuuming time is around seven minutes for ADP21 and around ten minutes for ADP31 under an ambient temperature.

**Return bath to atmospheric pressure:** Close the vacuum valve and open the purge valve.



Turn off the power switch of the vacuum pump after returning the inlet side of pump to atmospheric pressure. If not, oil inside the pump may flow back to the bath.



When using powder-type sample, open the purging valve gradually to avoid powder flying.

## Operation Mode and Function List

All the operation mode of this unit is as follows;

| No. | Name                        | Description  | Page |
|-----|-----------------------------|--|------|
| 1.  | Fixed Temperature Operation | Pressing the FIXED TEMP key enters into the fixed temperature operation setting mode.<br>Pressing it again enters into the temperature setting mode.<br>The "▲▼" are used to set temperature.<br>Pressing the START/STOP key starts or stops operation.  | 15   |
| 2.  | Quick Auto Stop Operation   | This operation is used to specify the period up to automatic stop during operation.<br>The period up to operation stop can be set by pressing the TIMER key during fixed temperature operation.<br>The "▲▼" are used to set the time.<br>Pressing the START key starts the quick auto stop operation, activates the timer function and stops the operation automatically after specified period. | 16   |
| 3.  | Auto Stop Operation         | This operation is used to specify the automatic stop time in the fixed temperature operation.<br>Pressing the TIMER key displays "AS t p".<br>The setting temperature "SV" can be set by pressing the ENTER key.<br>The operation time "tim" can be set by pressing it again.<br>Pressing the START/STOP key starts the auto stop operation.   | 17   |
| 4.  | Auto Start Operation        | This operation is used to specify the period up to automatic start after power on.<br>Pressing the TIMER key displays "AS t r".<br>The setting temperature "SV" can be set by pressing the ENTER key.<br>The operation time "tim" can be set by pressing it again.<br>Pressing the START/STOP key starts the auto start operation.   | 19   |

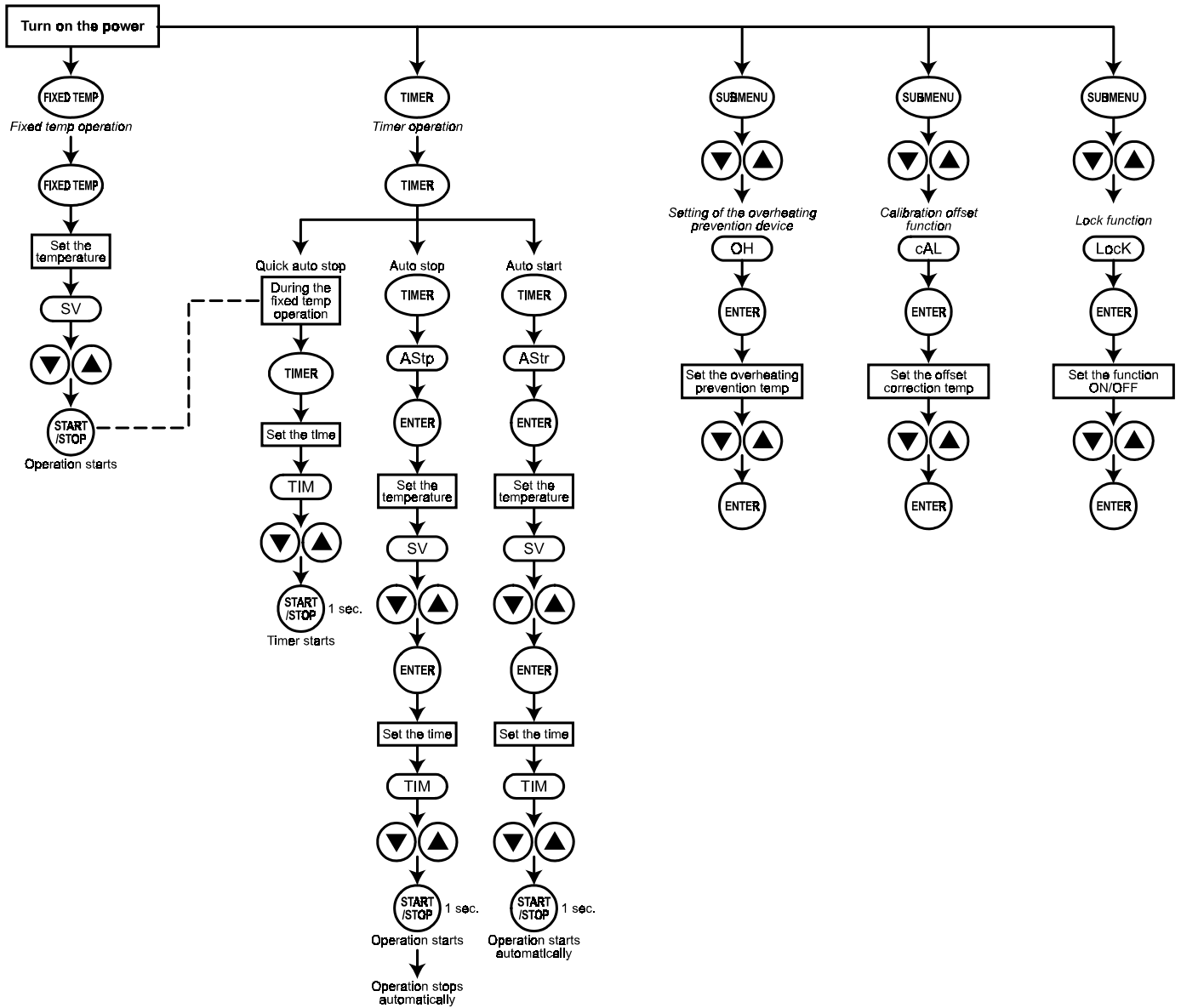
NOTE) This unit is impossible to be changed the mode during the operation. If the mode requires to be changed, stop the operation.

The operation function of this unit is as follows;

| No.                           | Name  |   | Description  | Page |
|-------------------------------|---|---|--|------|
| 1.                            | Overheating prevention function                         | Auto overheating prevention function  | This function is set to be automatically activated (auto reset) when the temperature exceeds the setting temperature by 12°C.  | 14   |
| Overheating prevention device |   | Though the device shares power source, display, and key input with the controller, it has independent temperature measurement circuit, CPU, sensor and output circuit. Overheating prevention temperature can be set using the operation panel. The unit stops operation when the device is activated. The unit starts operation again when the POWER switch is pressed again (manual reset). |  |      |
| 2.                            | Calibration offset function                             |   | This calibration offset function is for calibrating the difference occurred between the required in- furnace temperature and control temperature (sensor temperature) of the controller. This unit can be calibrated toward either plus side or minus side of the whole temperature range. | 21   |
| 3.                            | Overheating prevention temperature calibration function |   | The temperature of overheating prevention device is automatically corrected when the temperature of controller is collected.   | —    |
| 4.                            | Recovery at power failure                               |   | The unit starts operation with the same condition as just before power failure if it occurs during operation. Press the START/STOP key to start the unit again.  | —    |
| 5.                            | Setting value locking                                   |   | This function locks the established operation status. It can be set and cancelled with the SUBMENU key.  | 21   |

## Operation Mode, Function Setting Key, and Characters

The operation mode setting and function setting use the key operation and characters show in the following figure.





## Setting of Overheating Prevention Device

The unit has the overheating prevention device (manual reset) that consists of independent temperature measurement circuit, CPU, sensor and output circuit (it shares power source, display, and key input with the controller) in addition to the automatic overheating prevention function (auto reset) in the controller.

### Setting range/function

The unit has failsafe functions against overheating. One of them is built in the controller and previously set at factory shipment so to be automatically activated when the temperature exceeds the setting temperature of temperature controller by 12°C, where the heater repeats on and off.

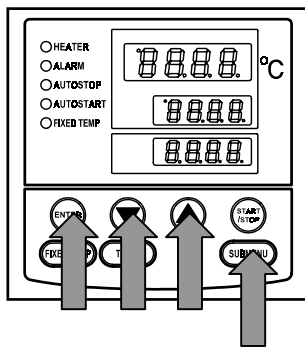
The other is united with the controller, which can be set by operating the keys on the controller.

The setting range of latter is from 0°C to 1300°C.

In case the temperature in furnace exceeds the setting temperature of controller to reach to that of overheating prevention device, the circuit is shut off and "Er19" is displayed with blinking on the screen of controller with buzzer sound.

If the device is once activated, "Er19" continues to be displayed until the power is newly turned on.

### Temperature setting procedure



#### 1. Turn on the power (turn on the breaker in front)

- The default value is displayed for about four seconds after turning on the power. The screen then displays the initial setting. The current temperature in furnace, operation mode character and setting temperature of overheating prevention device are displayed on respective screens.

#### 2. Set the temperature for overheating prevention

- Press the SUBMENU key.
- Press the "▼▲" several times to select the setting character of overheating prevention temperature "OH".
- Press the ENTER key. The current setting temperature is displayed with blinking on the setting temperature screen.

**Note:** To prevent improper operation, set the value 12°C or more over the setting temperature of controller.

- Select the value using the "▼▲" and then press the ENTER key. This completes the setting.

### Notes:



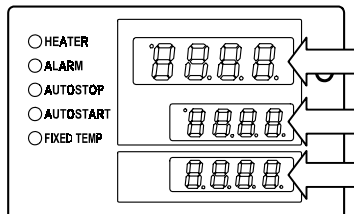
- The standard setting temperature of device is "the maximum setting temperature of unit plus 12°C" or "setting temperature plus 12°C".
- The setting range of overheating prevention device is from 0°C to 1300°C. Improper setting of temperature may cause inoperative of unit, malfunction of device, e.g. it is activated during increasing in temperature in furnace, or unexpected accidents such as fire disaster. To prevent such matters, set a proper value.
- The temperature is set at 252°C for the ADP21 and ADP31 at factory shipment.**
- In some case, the overheating prevention device is possible to be activated by mistake when its yield temperature is set to around room temperature.
- The purpose of overheating prevention device is to protect the unit from overheating. It does not intend to protect the samples, or to protect them from the accident caused by the use of explosive or inflammability.

## Fixed Temperature Operation

### Fixed temperature operation procedure

#### 1. Turn on the power (turn on the breaker in front)

- ❖ The default value is displayed for about four seconds after turning on the power. The screen then displays the initial setting. The current temperature in furnace, operation mode character and setting temperature of overheating prevention device are displayed on respective screens.



#### Measurement temperature screen:

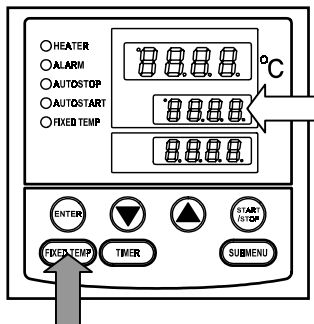
Displays the current temperature in furnace.

#### Setting temperature screen:

Displays the operation mode character. (Refer to Page 9)

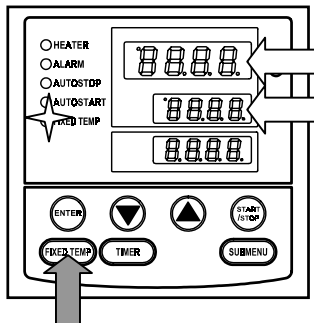
#### Overheating prevention screen:

Displays the setting temperature of overheating prevention device



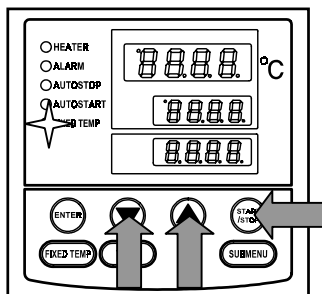
#### 2. Select the operation mode

- Press the FIXED TEMP key to display "FIX", which indicates the fixed temperature operation, on the center display screen.



#### 3. Set the temperature

- Press the FIXED TEMP key again.
- The setting temperature screen displays the character "SV" which indicates the temperature setting. Also it displays the current setting temperature with blinking. The FIXED TEMP lamp blinks, too.
- Set the temperature by pressing the "▼▲".



#### 4. Start operation

- Press the orange START/STOP key for about one second. The unit starts operation and the blinking FIXED TEMP lamp lights on.

#### 5. Stop operation

- Press the orange START/STOP key for about one second. The unit stops operation and the FIXED TEMP lamp lights off. The screen returns to the initial setting screen.

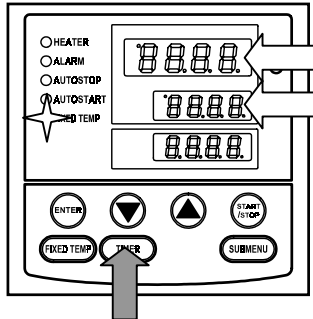
### To correct or check setting...

Press the FIXED TEMP key again to correct or check the setting.

Changing the setting temperature during operation is also possible by pressing the FIXED TEMP key.

## Quick Auto Stop Operation

### Quick auto stop operation procedure



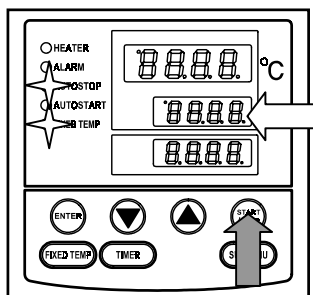
This operation is used to specify the period up to automatic stop, i.e., sets the auto stop timer during operation.

#### 1. Set the time up to stop during fixed temperature operation

- Check that the FIXED TEMP lamp lights on and that the unit is under operation.
- Press the TIMER key.
- The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.
- Select the time by pressing the "▼▲".

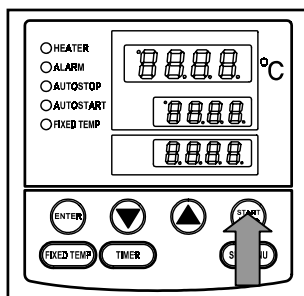
#### Timer function:

- The maximum setting time is "999 hours and 50 minutes".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲" can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.



#### 2. Start timer operation

- Press the START/STOP key for one second after deciding the time.
- Timer operation starts with the FIXED TEMP and AUTO STOP lamps lighting on.
- The timer is activated at the point when the START/STOP key is pressed.



#### 3. Stop/terminate timer operation

- The operation stops automatically at setting time.
- Buzzer continues to sound for about five seconds at operation stop.
- The setting temperature screen displays the character "End", which indicates termination of operation, with the FIXED TEMP and AUTO STOP lamps lighting on. Press the START/STOP key to terminate the timer operation mode. The screen returns to the initial setting screen.

### To correct or check setting...

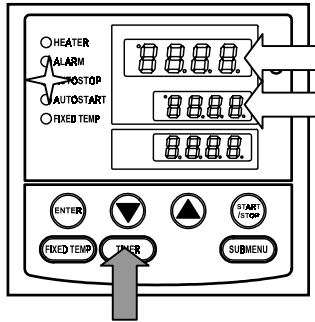
Changing the setting temperature during operation is possible by pressing the FIXED TEMP key. Press the ENTER key after changing the setting.

Changing the setting temperature during operation is available by pressing the FIXED TEMP key. Press the ENTER key after changing the setting.

Press the ▼ key to display the setting temperature, operation mode and residual time on the setting temperature screen.

## Auto Stop Operation

### Auto stop operation procedure



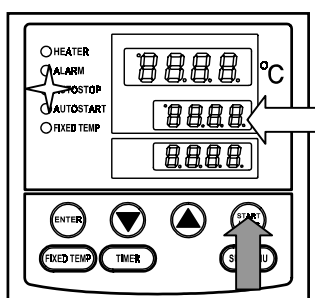
This operation is used to specify the automatic stop time in the fixed temperature operation.

#### 1. Set stop time

- ① Press the TIMER key on the initial screen.  
Press the TIMER key again. The setting temperature display screen displays the character "AstP", which indicates the auto stop operation, with blinking.
- ② Press the ENTER key.  
The measurement temperature screen displays the character "SV", which indicates the temperature setting. The setting temperature screen displays the current setting temperature with blinking. The AUTO STOP lamp blinks, too.
- ③ Set the temperature using the "▼▲".
- ④ Press the ENTER key again.  
The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.
- ⑤ Set the time using the "▼▲".

#### Timer function:

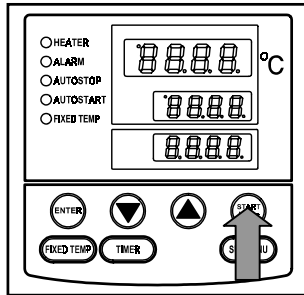
- The maximum setting time is "999 hours and 50 minutes".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲" can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.



#### 2. Start timer operation

- Press the START/STOP key for one second after deciding the time.
- Timer operation starts with the AUTO STOP lamp lighting on.
- The timer is activated at the point when the temperature in furnace (measurement temperature) reaches to the setting temperature.

## Auto Stop Operation



### 3. Stop/terminate timer operation

- The operation stops automatically at setting time.
- Buzzer continues to sound for about five seconds at operation stop.
- The setting temperature screen displays the character "End", which indicates termination of operation, with the FIXED TEMP and AUTO STOP lamps lighting on. Press the START/STOP key to terminate the timer operation mode. The screen returns to the initial setting screen.

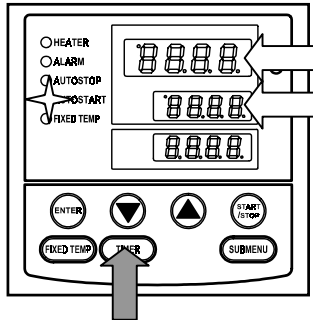
### To correct or check setting...

Changing the setting temperature or time during operation is possible by pressing the TIMER key. Use the "▼▲" to change the setting value. Press the ENTER key respectively after changing the setting.

Press the "▼" to display the setting temperature, operation mode and residual time on the setting temperature screen.

## Auto Start Operation

### Auto start operation procedure



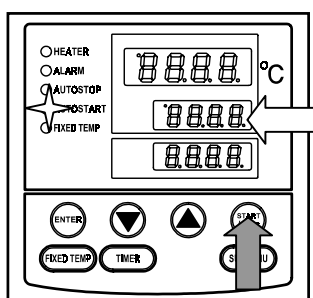
This operation is used to specify the period up to automatic start after power on.

#### 1. Set start time

- ① Press the TIMER key on the initial screen.  
Press the TIMER key again. The setting temperature display screen displays the character "Astr", which indicates the auto start operation, with blinking.
- ② Press the ENTER key.  
The measurement temperature screen displays the character "SV", which indicates the temperature setting. The setting temperature screen displays the current setting temperature with blinking. The AUTO START lamp blinks, too.
- ③ Set the temperature using the "▼▲".
- ④ Press the ENTER key again.  
The measurement temperature display screen displays the character "tim", which indicates the timer setting. The setting temperature display screen displays the current setting time with blinking.
- ⑤ Set the time using the "▼▲".

#### Timer function:

- The maximum setting time is "999 hours and 50 minutes".
- The time can be set in increments of a minute under 99 hours and 59 minutes.
- It can be set in increment of ten minutes over 100 hours.
- The "▼▲" can change the setting time quickly when it is pressed continuously. Press them discontinuously when fine adjustment is needed.

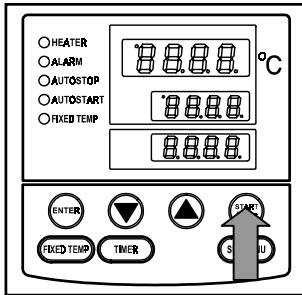


#### 2. Start timer operation

- Press the START/STOP key for one second after deciding the time.
- Timer operation starts with the AUTO START lamp lighting on.

## Auto Start Operation

---



### 3. Stop/terminate timer operation

- The operation starts automatically at setting time.
- Press the START/STOP key for one second to stop or terminate operation. The screen returns to the initial setting screen.

---

### To correct or check setting...

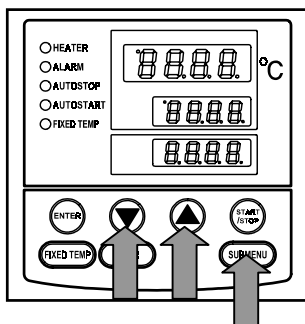
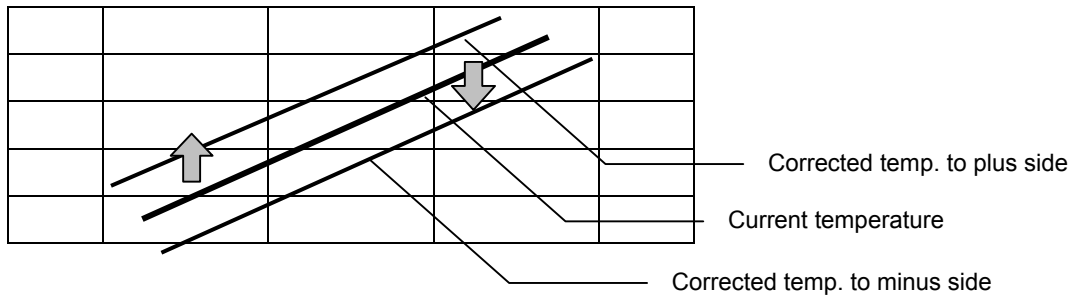
Changing the setting temperature or time during operation is possible by pressing the TIMER key. Use the "▼▲" to change the setting value. Press the ENTER key respectively after changing the setting. They are not changeable after the unit starts operation. In this case, stop the operation by pressing the START/STOP key, then set the value again.

Press the "▼" to display the setting temperature, operation mode and residual time on the setting temperature screen.

## Other Functions

### Use calibration offset function

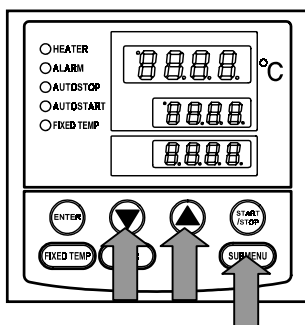
Calibration offset is a function which corrects the difference between the temperature in furnace and that of controller (sensor temperature) if arises. The function parallel corrects the difference either to the plus or minus side within the whole temperature range of unit. The function can be set or cancelled by the SUBMENU key.



- ① Start operation with the target setting temperature. Check the temperature in furnace (temperature of sample) with a thermograph after it is stabilized.
  - ② Check the difference between the setting temperature and that in furnace (temperature of sample).
  - ③ Press the SUBMENU key. Select the character "cAL", which indicates the calibration offset, using the "▲▼", and then press the ENTER key.
  - ④ Input the difference using the "▲▼" and then press the ENTER key. This completes the setting.
- ❖ The setting range of offset correction temperature is +99°C to plus side and -99°C to minus side respectively.  
When it is set to the minus side, the temperature on the measurement temperature display screen falls by the setting temperature, while the temperature on furnace rises.  
When it is set to the plus side, the temperature on the measurement temperature display screen rises by the setting temperature, while the temperature on furnace falls.
  - ❖ The unit has two-point correction function, which performs offset between low-temperature zone and high-temperature zone. Please consult our local branch office when carrying out validation of temperature controller.

### Use lock function

This function locks the operation status previously set. The function can be set or cancelled by the SUBMENU key.




- ① Press the SUBMENU key. Select the character "Lock", which indicates the lock of setting value, using the "▲▼", and then press the ENTER key.
  - ② The setting temperature screen displays "oFF". The setting value is locked when it is turned to "o n" using the "▲".
  - ③ Press the SUBMENU key again to cancel the lock. Select the character "Lock", which indicates the lock of setting value, using the "▲▼", and then press the ENTER key. Select "oFF" with the "▼" and then press the ENTER key to cancel the function.
- ❖ All keys other than the START/STOP and SUBMENU keys are lock when the lock function is on.




## **WARNING!**

### **If a problem occurs**


-  If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit 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.

### **Substances that cannot be used**


-  Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit. Explosion or fire may occur. (Refer to page31 “List of Dangerous Substances”.)

## **CAUTION!**


### **Do not step on this unit**

-  Do not step on this unit. It will cause injury if this unit fall down or break.


### **Do not put anything on this unit**

-  Do not put anything on this unit. It will cause injury if fall.


### **During a thunder storm**

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


### **Do not touch high-temperature parts**

-  Some parts of this unit may become hot during and just after operation. It may cause burns.

### **Sample loading**

-  Overload of samples may cause the malfunction of the temperature control. Do not use this unit with too much samples. Leave a certain space between samples.

### **Return after power failure**

-  When power is supplied after a power failure, the device automatically starts operation again with the same state as just before the power failure. It is danger that the device starts unattached operation after a power failure. We recommend for you to turn off the switch of this unit if a power failure occurs during operation.

## Daily Inspection and Maintenance

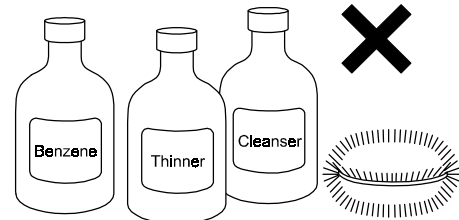
For the safety use of this unit, please perform the daily inspection and maintenance without fail. Using the city water to this unit might attach dirt. Do inspect and maintain this point while performing daily inspection and maintenance.

### **WARNING!**

- Disconnect the power cable from the power source when doing an inspection or maintenance unless needed.
- Perform the daily inspection and maintenance after returning the temperature of this unit to the normal one.
- Do not disassemble this unit.

### **CAUTION!**

- Use a well-drained soft cloth to wipe dirt on this unit. Do not use benzene, thinner or cleanser for wiping. Do not scrub this unit. Deformation, deterioration or color change may result in.



For any questions, contact Yamato Service Office.

## When not using this unit for long term / When disposing

### **CAUTION!**

#### When not using this unit for long term...

- Turn off the power and disconnect the power cord.

### **WARNING!**

#### When disposing...

- Keep out of reach of children.
- Remove the door and driving parts.
- Treat as large trash.

### **Environmental protection should be considered**

We request you to disassemble this unit as possible and recycle the reusable parts considering to the environmental protection. The feature components of this unit and materials used are listed below.

| Component Name           | Material   |
|--------------------------|--|
| <b>Exterior Parts</b>    |  |
| Outer covering           | Steel plate, Melamine and epoxy composite resin coating                        |
| Chamber                  | Stainless steel SUS304   |
| Inspection window        | Reinforced glass and polycarbonate resin                                       |
| Heat insulation material | Composites with glass fiber and others   |
| Piping                   | Copper pipe  |
| Intake/exhaust valve     | Brass  |
| Vacuum meter             | Composites with glass, brass and others  |
| <b>Electrical Parts</b>  |  |
| Switches, Relays         | Composites with resin, copper and others                                       |
| Control panel frame      | ABS resin  |
| Board                    | Composites with glass fiber and others   |
| Heater                   | Steel and mica heater  |
| Power cord               | Composites with synthetic rubber, copper, nickel and others                    |
| Wiring Material          | Composites with glass fiber, flame resistance vinyl, copper, nickel and others |
| Labels                   | Resin material   |
| Leg with rubber          | Synthetic rubber, Steel  |

## Safety Device and Error Code

This unit has an automatic diagnosis function built in the controller and safety devices independent of the controller. The table below shows the cause and the solution method when the safety device operates.

### Error Code:

When an abnormal condition occurs, an error code appears and the alarm lamp lights in the controller, the buzzer sounds simultaneously. Record the error code and turn off the power of device immediately.

| Safety Device                  | Notify                                     | Cause/Solution   |
|--------------------------------|--|--|
| Sensor trouble detection       | “ALARM” lamp lights on,<br>“Er.01” appears | <ul style="list-style-type: none"> <li>Temperature sensor is broken or disconnected.</li> <li>Make a call for service.</li> </ul>  |
| SSR short-circuit detection    | “ALARM” lamp lights on,<br>“Er.02” appears | <ul style="list-style-type: none"> <li>Triac is in short-circuit</li> <li>Make a call for service.</li> </ul>  |
| Heater disconnecting detection | “ALARM” lamp lights on,<br>“Er.03” appears | <ul style="list-style-type: none"> <li>Heater is disconnected.</li> <li>Make a call for service.</li> </ul>  |
| Memory error                   | “ALARM” lamp lights on,<br>“Er.15” appears | <ul style="list-style-type: none"> <li>Failure in internal memory.</li> <li>Make a call for service.</li> </ul>  |
| Internal communication error   | “ALARM” lamp lights on,<br>“Er.17” appears | <ul style="list-style-type: none"> <li>Failure in internal communication or temperature inputting circuit.</li> <li>Make a call for service.</li> </ul>  |
| Overheating                    | “ALARM” lamp lights on,<br>“Er.19” appears | <ul style="list-style-type: none"> <li>Overheating prevention device is in operation.</li> <li>Reset the power supply, and then adjust the setting temperature of the overheating protection device.</li> <li>If the state does not recover, make a call for service.</li> </ul> |
| Measurement temperature error  | “ALARM” lamp lights on,<br>“-----” appears | <ul style="list-style-type: none"> <li>Measurement value is out of display range.</li> <li>Make a call for service.</li> </ul>   |

## **Trouble Shooting**

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### **Before call us...**

| Condition   | Possible Causes  |
|---|--|
| The device does not start when turning on the power switch. | <ul style="list-style-type: none"><li>• Power plug is not connected to the receptacle correctly.</li><li>• Power failure.</li></ul>  |
| Temperature fluctuates during the operation.                | <ul style="list-style-type: none"><li>• Too much samples.</li><li>• Wind from air conditioner directly blows.</li><li>• The change of ambient temperature is remarkable.</li><li>• Samples are too moist.</li><li>• The power supply voltage is lower than the proper value.</li></ul> |

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**In the case if the error other than listed above occurred, turn off the power switch and primary power source immediately. Contact the shop of your purchase or Yamato Service Office.**

### In Case of Request for Repair

If the failure occurs, stop the operation, turn OFF the power switch, and unplug the power plug. Please contact the sales agency that this unit was purchased, or Yamato sales office.

#### < Check following items before contact >

- ◆ Model Name of Product
  - ◆ Production Number
  - ◆ Purchase Date
  - ◆ About Trouble (in detail as possible)
- } See the production plate attached to this unit.

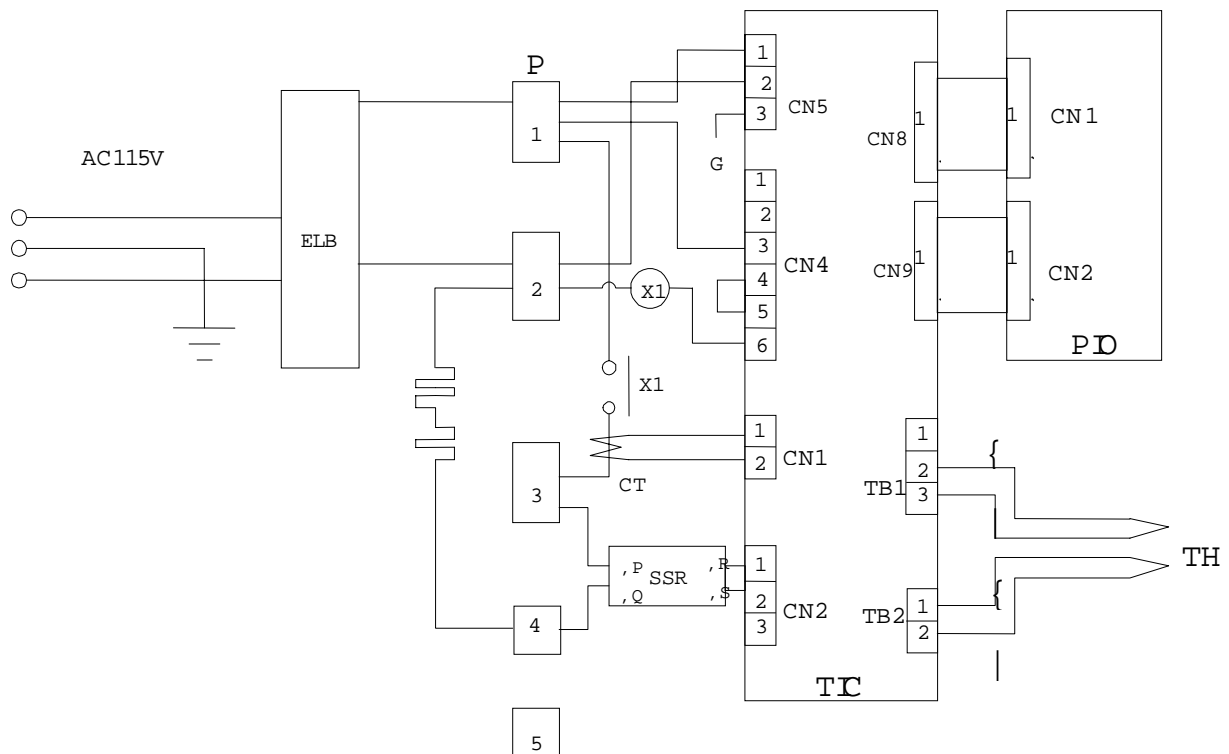
### Minimum Retention Period of Performance Parts for Repair

The minimum retention period of performance parts for repair of this unit is 5years after discontinuance of this unit.

The "performance part for repair" is the part that is required to maintain this unit.

# Specification

| Model         |  | ADP21  | ADP31                 |
|---------------|--|--|-----------------------|
| Standards     | Internal dimensions  | W200 × D250 × H200 mm  | W300 × D300 × H300 mm |
|               | External dimensions  | W360 × D411 × H535 mm  | W420 × D463 × H639 mm |
|               | Interior   | Stainless steel SUS304   |                       |
|               | Internal capacity  | 10L  | 27L                   |
|               | Permissible load of shelf  | Approx. 15kg/one shelf   |                       |
|               | Shelf material   | Aluminum   |                       |
|               | Number of shelf step   | 2  | 3                     |
|               | Pitch of shelf   | 63mm   | 71mm                  |
|               | Intake   | Outer diameter: 18mm   |                       |
| Performance   | Method   | Decompression, radiation heating   |                       |
|               | Operating temperature range  | Room Temperature+ 5 °C to 240°C  |                       |
|               | Operating vacuum degree range  | 101 to 0.1KPa  |                       |
|               | Temperature adjustment accuracy  | ± 1.5°C (at 240°C, no load)  |                       |
|               | Temperature distribution accuracy  | Within ±10°C (at 240°C, no load)   |                       |
|               | Time required to reach highest temperature                               | Approx. 70min.   | Approx. 100min.       |
| Function      | Thermo regulator   | PID control by microcomputer (VS3 controller)  |                       |
|               | Overheating prevention device  | ON/OFF control by microcomputer (VS3 controller)   |                       |
|               |  | Temperature control circuit shares the power source with overheating prevention circuit. Temperature measurement circuit, CPU, sensors, and output circuit are independent respectively. |                       |
|               | Sensor for temperature control   | K-thermocouple<br>(Double sensor for temperature control and overheating prevention)   |                       |
|               | Sensor for overheating prevention  |  |                       |
|               | Temperature setting system   | Digital setting (also for overheating prevention device)   |                       |
|               | Temperature display system   | Digital display  |                       |
|               | Heater   | Mica heater  |                       |
|               |  | 680W   | 1.05KW                |
|               | Heat insulation material   | Rock wool 100 mm   |                       |
|               | Inspection window  | Reinforced glass, 12mm thickness with polycarbonate resin protection plate   |                       |
| Vacuum meter  | Bourdon tube type, scale range 0 to 0.1 mPa                              |  |                       |
| Safety device | Over current earth leakage breaker, Dual overheating prevention function |  |                       |
| Operation     | Key input  | Display : 4digits 7segments 10mm LED (green)<br>Setting : 4digits 7segments 8mm LED (red)<br>Setting of overheating prevention : 4digits 7segments 8mm LED (red)                         |                       |
|               | Monitor lamp   | Heater lamp, Alarm lamp, Timer lamp. Fixed lamp.   |                       |
|               | Function key   | Select from Fixed/ Auto stop/Auto start/Sub menu   |                       |
|               | Vacuum control   | Bourdon tube display, manually control by vacuum valve and purge valve   |                       |
|               | Safety function  | Circuit breaker , Dual overheating prevention function, Error display  |                       |
| Power supply  | 115V AC, 50/60Hz, 6A   | 115V AC, 50/60Hz, 10A  |                       |
| Weight        | Approx. 30Kg   | Approx. 55Kg   |                       |
| Accessory     | Shelf (aluminum punching metal)  |  |                       |
|               | 2 pcs.   | 3pcs.  |                       |



| Symbol | Part name              | Symbol | Part name               |
|--------|------------------------|--------|-------------------------|
| H      | Heater                 | X1     | Main relay              |
| TIC    | Control board (planar) | SSR    | Solid state relay       |
| PIO    | Display circuit board  | TH     | K-thermocouple          |
| ELB    | Circuit breaker        | CT     | Overcurrent transformer |



## Replacement Parts Table

| Part Name                   | Code No.     | Specification  | Manufacturer      |
|-----------------------------|--------------|--|-------------------|
| ADP21 Upper Heater          | ADP-21-40100 | 115V 80W   | Yamato Scientific |
| ADP21 Side and Lower Heater | ADP-21-40110 | 115V 200W  | Yamato Scientific |
| ADP31 Upper Heater          | ADP-31-40070 | 115V 150W  | Yamato Scientific |
| ADP31 Side and Lower Heater | ADP3140080   | 115V 300W  | Yamato Scientific |
| Control board               | DX-301-00052 | VS-3 fixed value type (control board and display circuit board are replaced together.) | Yamato Scientific |
| Display circuit board       | DX-301-00051 |  | Yamato Scientific |
| Ribbon cable                | ADP-21-00008 | Length: 300mm  | Yamato Scientific |
| Circuit breaker             | ADP-21-00019 | FB323B-15 15A  | Fuji Electric     |
| Main relay                  | DX-301-00043 | AHE1254 120V   | Matsushita        |
| Solid state relay           | DX-301-00035 | TRS5225  | Toho Electronics  |
| Temperature sensor          | ADP-21-30048 | K-thermocouple   | Yamato Scientific |
| Vacuum/Purge valve          | ADP-21-00009 | DC-42B BS  | Fujikin           |
| Vacuum gauge                | ADP-21-10004 | GK25-A40   | Nagano Keiki      |
| Door gasket (ADP21)         | ADP-21-40080 | Silicon rubber   | Yamato Scientific |
| Door gasket (ADP31)         | ADP-31-40060 | Silicon rubber   | Yamato Scientific |
| Window glass (ADP21 and 31) | ADP2140260   | Hard glass   | Yamato Scientific |

## List of Dangerous Substances



Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit.

### EXPLOSIVE

|                   |  |
|-------------------|--|
| <b>EXPLOSIVE:</b> | Ethylene glycol dinitrate (nitro glycol), Glycerin trinitrate (nitroglycerine), Cellulose nitrate (nitrocellulose), and other explosive nitrate esters |
|                   | Trinitrobenzene, Trinitrotoluene, Trinitrophenol (picric acid), and other explosive nitro compounds  |
|                   | Acetyl hydroperoxide (peracetic acid), Methyl ethyl ketone peroxide, Benzyl peroxide, and other organic peroxides                                      |

### FLAMMABLE

|                            |   |
|----------------------------|---|
| <b>IGNITING:</b>           | Lithium (metal), Potassium (metal), Sodium (metal), Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid compounds, Calcium carbide, Lime phosphate, Magnesium (powder), Aluminum (powder), Powder of metals other than magnesium and aluminum, Sodium hydrosulfite |
| <b>OXIDIZING:</b>          | Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorate  |
|                            | Potassium perchlorate, Sodium perchlorate, Ammonium perchlorate, and other perchlorate  |
|                            | Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxide  |
|                            | Potassium nitrate, Sodium nitrate, Ammonium nitrate, and other nitrate  |
|                            | Sodium chlorite and other chlorites   |
|                            | Calcium hypochlorite and other hypochlorites  |
| <b>INFLAMMABLE LIQUID:</b> | Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and other flammable substances having a flash point of lower than -30°C  |
|                            | Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone, and other flammable substances having a flash point of -30°C or higher but lower than 0°C   |
|                            | Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and other flammable substances having a flash point of 0°C or higher but lower than 30°C  |
|                            | Kerosene, Light oil (gas oil), Oil of turpentine, Isopentyl alcohol (isoamyl alcohol), Acetic acid, and other flammable substances having a flash point of 30°C or higher but lower than 65°C   |
| <b>FLAMMABLE GAS:</b>      | Hydrogen, Acetylene, Ethylene, Methane, Propane, Butane, and other flammable substances which assume a gaseous state at 15°C and 1 atm  |

(Source: Appendix Table 1 of Article 6 of the Industrial Safety and Health Order in Japan)

## Responsibility

Please follow the instructions in this document when using this unit. Yamato Scientific America has no responsibility for the accidents or breakdown of device if it is used with a failure to comply.

Never conduct what this document forbids. Unexpected accidents or breakdown may result in.

## Note

- ◆ The contents of this document may be changed in future without notice.
- ◆ Any books with missing pages or disorderly binding may be replaced.

Instruction Manual for  
**Vacuum Drying Oven**  
**Model ADP21/31**  
Ver.3 May 12, 2004

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