



CO₂ Incubator

Model

IT400/600/820

Instruction Manual

- Second Edition -

- Thank you for purchasing "CO₂ Incubator, IT Series" of Yamato Scientific Co., Ltd.
- To use this unit properly, read this "Instruction Manual" thoroughly before using this unit. Keep this instruction manual around this unit for referring at anytime.



WARNING!:

Carefully read and thoroughly understand the important warning items described in this manual before using this unit.

Yamato Scientific Co. LTD.

This paper has been printed on recycled paper.

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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.



WARNING!

If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.



CAUTION!

If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

Meaning of Symbols



This symbol indicates items that urge the warning (including the caution). A detailed warning message is shown adjacent to the symbol.



This symbol indicates items that are strictly prohibited. A detailed message is shown adjacent to the symbol with specific actions not to perform.



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

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 page38 “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

Some parts of this unit 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.



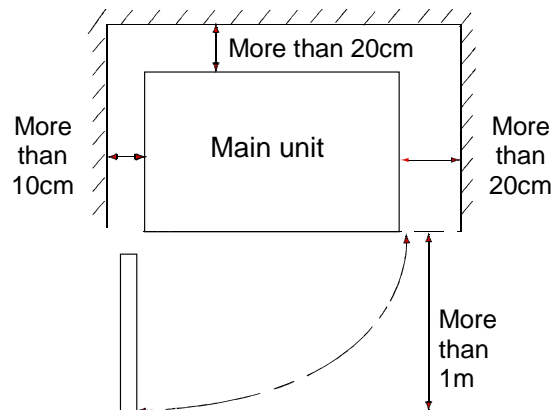
2. Choose a proper place for installation



- 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.



- Select the stable place, and keep wider space shown in the right figure for installing the unit. Then Adjust the four level adjusting screws at four corners of the unit for keeping the levelness of the unit. For IT400 and IT600 Models, attach the level adjusting screw to these models, and install them to the stable and level places. Besides, note that keep more space above the unit for maintenance space.



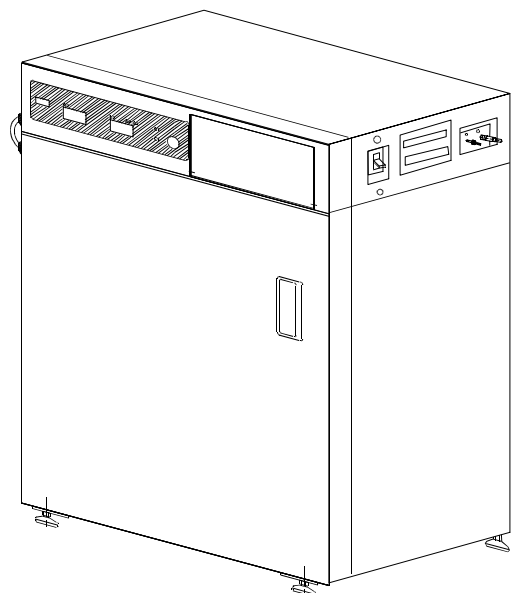
3. Do not use this unit in an area where there is flammable or explosive gas



- 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.
- To know about flammable or explosive gas refer to page38 "List of Dangerous Substances".



Flammable gas

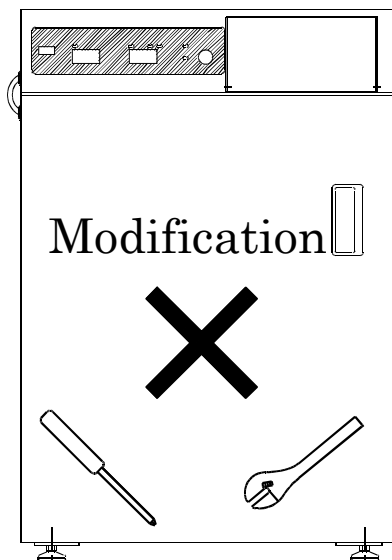


Requirements for Installation

4. Do not modify



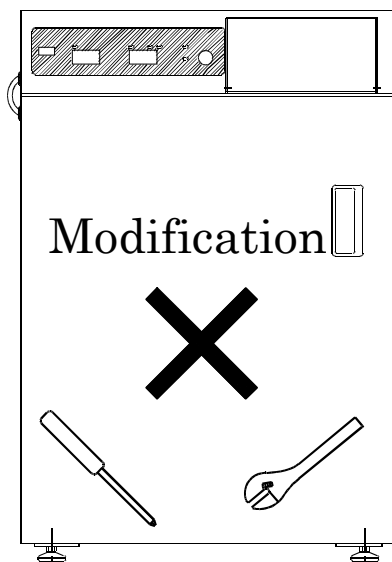
- Modification of this unit is strictly prohibited. This could cause a failure.



5. Installation on horizontal surface



- Set this unit to the flattest place. Setting this unit on rough or slope place could cause the unexpected 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: IT400: 100V AC, Single phase, 4A
IT600: 100V AC, Single phase, 5A
IT820: 100V AC, Single phase, 9A

7. Before/after installing



- It may cause injury 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.

8. Handling of power code



- Do not use other shelf than specified one. Failure to do so could cause the malfunction of the temperature control.



- Set the specific shelf plate(s) to the appropriate shelf pole, and use it (them).

9. Handling of power cord



- 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.

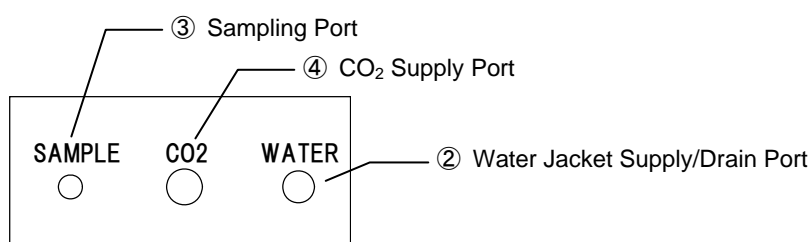
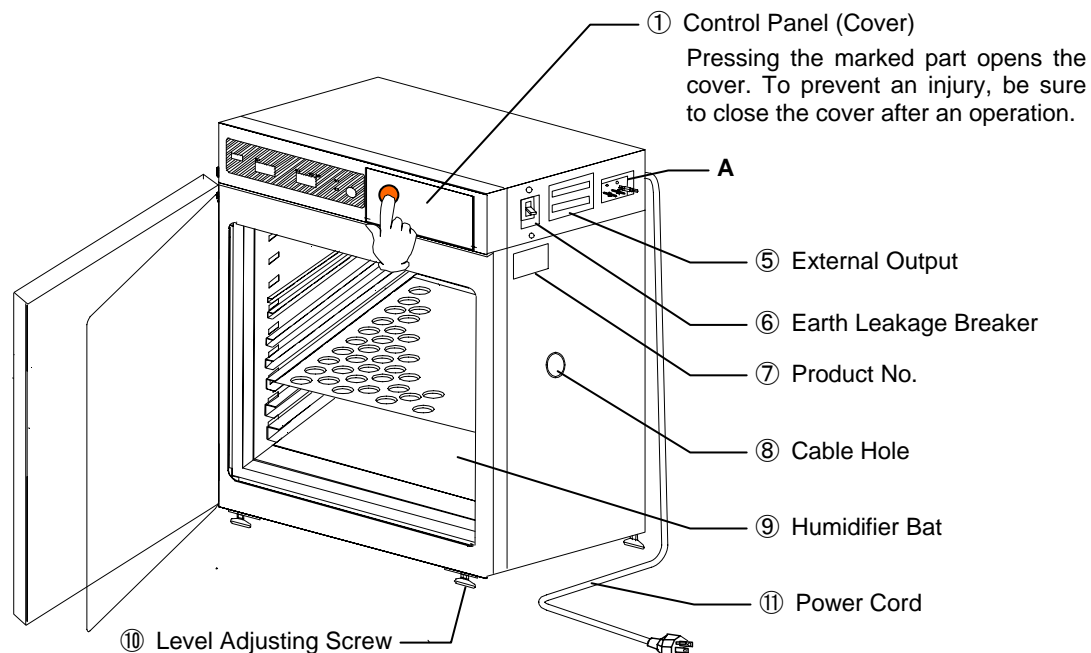


- If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.
- Connect the power plug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

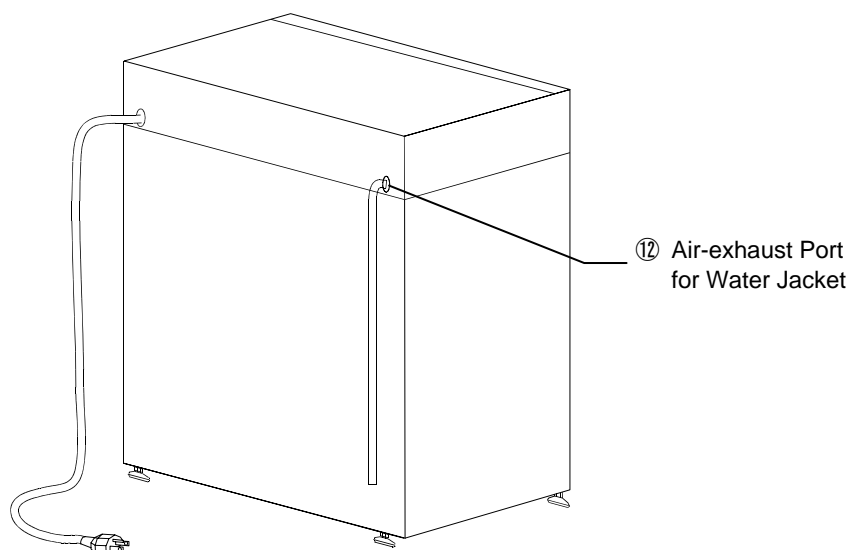
Description and Function of Each Part

Main Unit

IT400/600



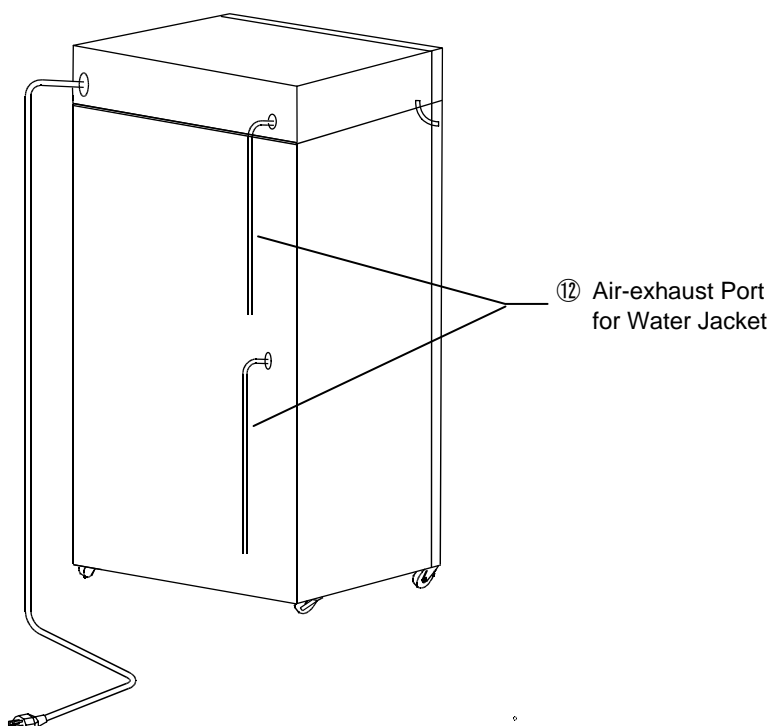
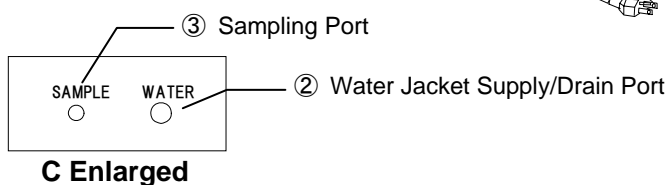
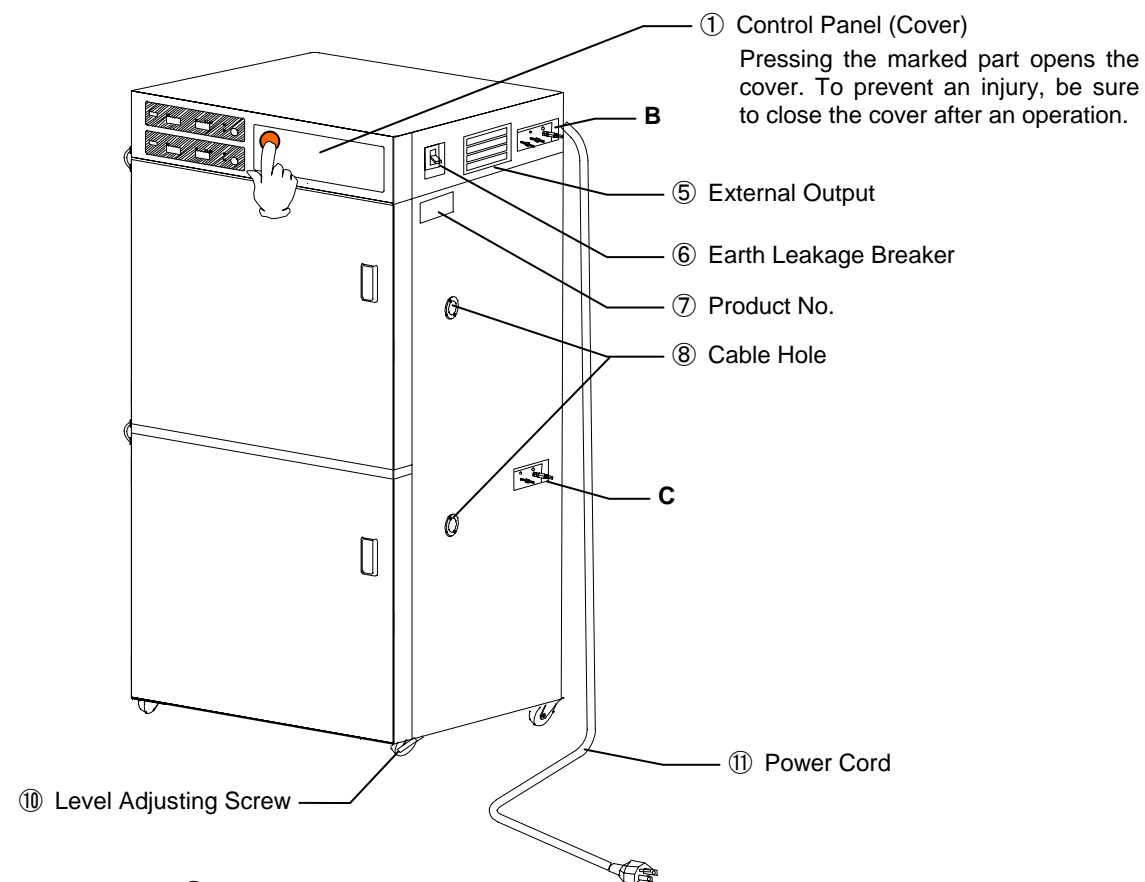
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Description and Function of Each Part

Main Unit

IT820



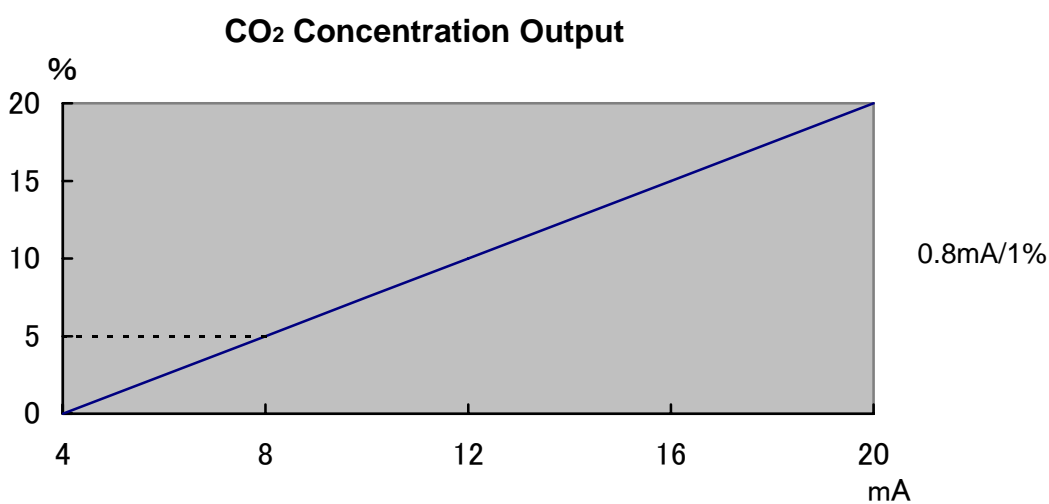
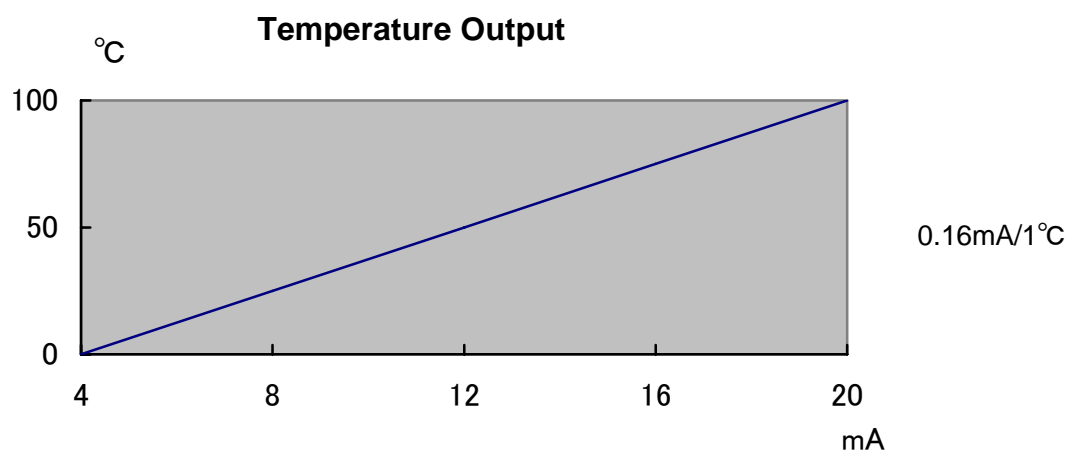
Description and Function of Each Part

Function of Main Part

No.	Part Name	Function															
①	Control Panel (Cover)	Pressing the marked part shown in the figure opens the cover. The control panel has two indicators displaying the temperature and CO ₂ concentration, and the operation key switch for setting, adjusting, and controlling. Also, do close the cover except when using then control panel for preventing from the miss operation.															
②	Water Jacket Supply/Drain Port	The connecting port for supplying to/draining from water jacket.															
③	Sampling Port	The connecting port to the CO ₂ analyzer for sampling CO ₂ concentration.															
④	CO ₂ Supply Port	Supply CO ₂ from the CO ₂ cylinder. Adjust the secondary pressure of the pressure adjuster at 0.02 to 0.3MPa with no gas supplied to the bath.															
⑤	External Output	<div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">OPTION</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">┌ALARM IN┐</td> <td style="text-align: center;">┌CO2┐</td> <td style="text-align: center;">┌TEMP┐</td> </tr> <tr> <td style="text-align: center;">C NO</td> <td style="text-align: center;">- +</td> <td style="text-align: center;">- +</td> </tr> </table> </div> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">OPTION</td> <td style="text-align: center;">┌RS485┐</td> <td style="text-align: center;">OPTION┐</td> </tr> <tr> <td style="text-align: center;">┌ALARMOUT┐</td> <td style="text-align: center;">TXD</td> <td style="text-align: center;">RXD</td> </tr> <tr> <td style="text-align: center;">NO NC C</td> <td style="text-align: center;">+ -</td> <td style="text-align: center;">- + FG</td> </tr> </table> </div> <p><u>Standard equipment:</u> output the in-bath temperature measurement value and CO₂ concentration value with 4~20mA direct current (0 to 100°C, 0 to 20%).</p> <p><u>Optional:</u></p> <ul style="list-style-type: none"> • Humidifier water level detecting I/O • External alarm output • Terminal for communication 	┌ALARM IN┐	┌CO2┐	┌TEMP┐	C NO	- +	- +	OPTION	┌RS485┐	OPTION┐	┌ALARMOUT┐	TXD	RXD	NO NC C	+ -	- + FG
┌ALARM IN┐	┌CO2┐	┌TEMP┐															
C NO	- +	- +															
OPTION	┌RS485┐	OPTION┐															
┌ALARMOUT┐	TXD	RXD															
NO NC C	+ -	- + FG															
⑥	Earth leakage breaker	This breaker performs for protecting human body and device from the electric leakage or over current of the device by stopping supplying the power. Not grounding this unit could not perform correctly. Press the red button before using this unit or at least one time per one month, and check that this earth leakage breaker performs correctly.															
⑦	Product No.	The product number for this unit.															
⑧	Cable Hole	This unit can be install and use each measurement instrument and monitors for temperature and humidity in the bath by wiring the cable through the cable hole.															
⑨	Humidifier Bat	This is the humidifier bat for keeping the humidity of the in-bath at least 95%. Supply the water up around the 3/4 level.															
⑩	Level Adjusting Screw	This is the screw for adjusting the levelness of the bath. Supply water to the humidifier bat mounted on the shelf plate, and adjust the levelness.															
⑪	Power Cord	This is the specific power cord for 100V AC. Connect this cord to the 3P plug with a grounding.															
⑫	Air-exhaust Port for Water Jacket	This is the air-exhaust port for supplying water to the water jacket. Never obstruct the port.															

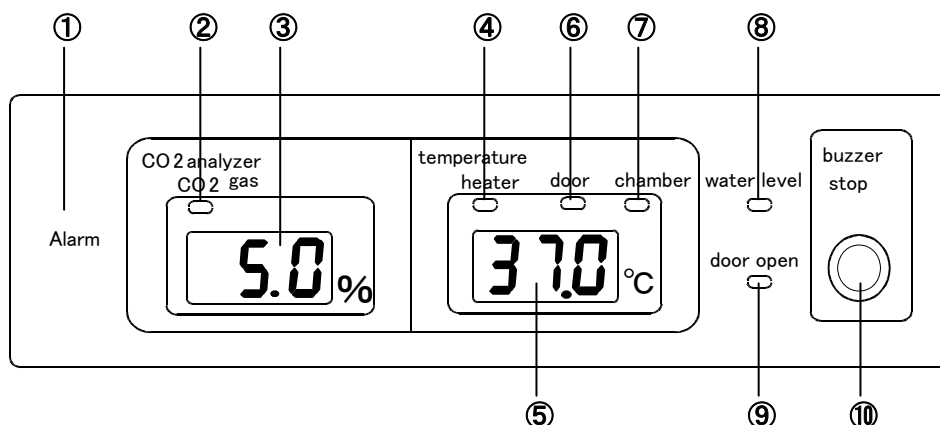
Description and Function of Each Part

External Output Line Chart



Description and Function of Each Part

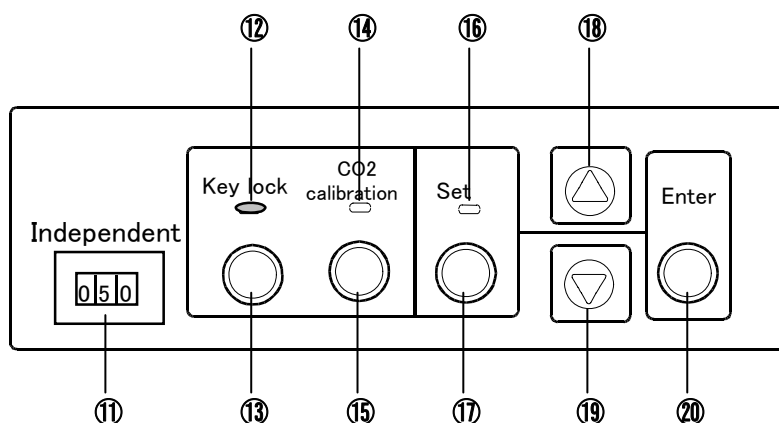
Control Panel



No.	Part Name	Function
①	Alarm Lamp	Blinks the lamp when any error is occurred.
②	CO ₂ supply Lamp	Lights on when the solenoid valve for supplying CO ₂ is opened.
③	Concentration Indicator	Displays the setting value and measurement value of CO ₂ concentration by switching with ⑩. Also, this indicator displays the Er number when any error is occurred to CO ₂ controller and CO ₂ concentration.
④	Heater Lamp	Lights on when the heater is activated.
⑤	Temperature Indicator	Displays the measurement value and setting value for in-bath and door by switching with ⑩. Also, this indicator displays the Er number when any error is occurred to humidity control system.
⑥	Setting Lamp for Door Temperature	Lights on when the setting value of the door temperature is displayed on ⑤.
⑦	Setting Lamp for In-bath Temperature	Lights on when the setting value of the in-bath temperature is displayed on ⑤.
⑧	Water Level Alarm Display Lamp	Lights on when the water level of the water jacket is lowered than the required level.
⑨	Door Opened Alarm Display Lamp	Lights on when the door is remained open.
⑩	Buzzer Stop Key	Key for stopping the alarm buzzer ringing on occurring error.

Description and Function of Each Part

Control Panel



No.	Part Name	Function
⑪	Temperature Setting Switch for Overheating Prevention Device	Uses for setting the activating temperature of the overheating prevention device.
⑫	Key Lock Display Lamp	Lights on with the key locked and blinks during setting.
⑬	Key Lock Key	Key for setting/releasing key lock
⑭	CO ₂ Calibration display Lamp	Blinks during performing CO ₂ calibration
⑮	CO ₂ Calibration Key	Key for adjusting the 0 point of CO ₂ concentration
⑯	Setting Status Display Lamp	Lights on in setting mode
⑰	Setting Key	Key for switching the display from "Temperature" or "Concentration" into "Setting Temperature".
⑱	Up key	Uses for rising up the setting value.
⑲	Down Key	Uses for lowering down the setting value.
⑳	Enter Key	Pressing this settles the setting value.

Preparation

1. Connecting of Power Cord and Turning ON the Earth Leakage Breaker

Connect, ground, and test the earth leakage breaker following the procedure shown below in the order. Apply 100VAC power source.

1. Check that the earth leakage breaker on the right side surface of the unit is turned OFF.
2. Prepare the 3P receptacle with 100VAC ground earth for the power plug. Plug the cord to the 3P receptacle. If there is no 3P receptacle with ground earth, ground the unit using the grounding adapter (optional accessory). Connect the power cord to the ground adapter, and plug the ground adapter to the receptacle.
3. Test the earth leakage breaker. Turn ON the earth leakage breaker on the right side surface of the device.
4. Press the red test button. When the earth leakage breaker is turned OFF, the test is in good status.
5. Even if the earth leakage breaker is not turned OFF after pressing the test button, check whether the main power is turned ON or not. If the earth leakage breaker is not turned OFF in spite of turning the power ON, contact to Yamato Scientific or dealer.
6. Perform the earth leakage breaker test once per one month. Besides, check the earth leakage breaker before performing the long term cultivating.

2. Sterilizing before Use

The inside surface of the bath and all parts are required the sterilizing before attaching to the inside of the bath. If particular dirt is not detected, sterilize the device with normal method shown below.

1. Moisten the sterilization water to the sterilization gauze, and wipe each part and inside surface of the bath.
2. Then, wipe each part with 70% ethanol liquid, or perform the atomize treatment.
3. Moisten the sterilization water to new sterilization gauze, and wipe each part and inside surface of the bath again.

Check whether the following parts are sterilized or not. When attaching the following part to the unit after sterilizing, do sterilize your hands.

Check Item	Check	Check Item	Check
Whole inside surface of the bath (side plate, floor, sealing)		Wing of fan	
Inner door (both sides)		Shelf	
Packing of inner door		Left and right of shelf pole	
Packing of outer door		Sealing duct	
Temperature Sensor		Humidifier bat	

Assembling Pole and Sealing Duct

3. Assembling Pole and Sealing Duct

Be sure to attach the pole and sealing duct securely following the photo show below.



Photo 1:
Attach the sirocco fan for the first time.



Photo 2:
Fix it with screws securely.



Photo 3:
Insert the right shelf pole.



Photo 4:
Then, insert the left shelf pole.



Photo 5



Photo 6:
Mount the sealing duct.



Photo 7:
Press both left and right shelf poles into the wall of the bath.



Photo 8



Photo 9:
Insert the humidifier bat.

Water Supply Method

4. Water Supply to Water Jacket

1. Prepare the distilled water to be supplied to the water jacket.

IT400: 28 liters

IT600: 38 liters

IT820: 38 liters × 2



Water Supply Port

2. Accumulate the distilled water into the polytank, and connect the prepared supply hose and supply pump, etc. to the water supply port.
3. Supply the half amount of the prepared distilled water to the water jacket.
4. Here, turn ON the earth leakage breaker. The water level indicator of the control panel lights on, alarm lamp and temperature indicator blink, and the alarm buzzer rings.
5. Supply the distilled water until this water level alarm indicator and water level alarm buzzer ring off.
6. Supply more 2 liters of the distilled water.

5. Water Supply to Humidifier Bat

Set the attached humidifier bat to the inside bottom of the bath, and pour the distilled water up to the 3/4 levels of the bath. Do not spilt any water onto the inside bottom surface of the bath during supplying water.

6. Levelness Adjustment

Keep the levelness of the water jacket and incubator, and adjust the levelness so as to keep the stable incubating environment.

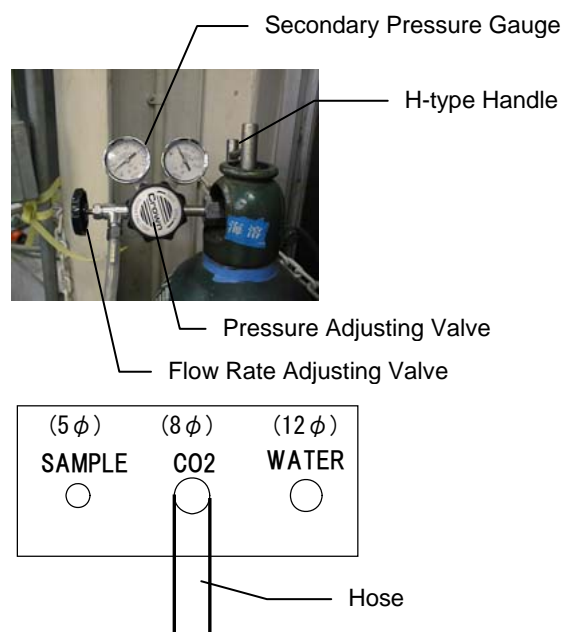
Set either level or attached humidifier bat onto the shelf plate in the incubator, and adjust the level adjusting screw. At this time, the point for the smooth minute adjustment is to adjust the length of the level adjusting screw at three points, two screws in front of the shelf plate and one screw at the right back of the plate.

1. Perform the minute adjustment after supplying water to the water jacket with the already sterilized shelf plate, shelf supporter, and duct be set to inside of the bath, and with the level put on the shelf plate.
2. Turning the level adjusting screw clockwise makes the height of the shelf higher and turning the level adjusting screw counterclockwise makes the height of the shelf lower. Adjust the height of the shelf plate using a spanner keeping the levelness.

Connection of CO₂ Supply Hose

7. Connection of CO₂ Supply Hose

1. Open/close the valve of the CO₂ cylinders (green color) immediately using the H-type handle, and remove the dust attached to the connecting part for regulator.
2. Check there is packing of the regulator at the connecting part of the CO₂ cylinder with its dust already removed, and attach the regulator securely using the spanner (monkey wrench). (Refer to the right photo.) The primary pressure of the non-used CO₂ cylinder is around 5.9+/-0.5MPa.
3. Connect the regulator and the CO₂ supply port of the main body with the attached black hose cut in appropriate length, and fix it with hose band securely. (Attach the hose band only to one end of the hose so as to remove the hose from the body in case of applying the error pressure from the gas cylinder.)
4. Check the connection part of the hose whether any gas is leaked from there following the procedure below in the order.
 - A) Turn the pressure adjusting valve up to leftmost for preventing from regulator breakage.
 - B) Open the valve by turning the flow rate adjusting valve up to leftmost.
 - C) Supply the gas with the valve of the cylinder opened half.
 - D) Pressurize gradually by turning the pressure adjusting valve to clockwise. When the secondary pressure is raised up around to 0.02 to 0.03MPa, check whether any gas is leaked from the connection part of the hose using soapsuds.
5. Apply the regulator with the secondary pressure specified its applicable range at 0 to 0.2MPa.



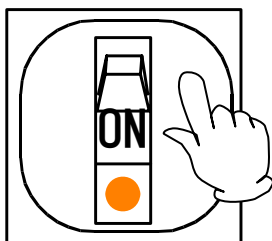
Procedure of Operation

The following 5 modes are prepared for the operation mode.

No.	Mode	Function
1	Measurement mode	Breaker turned ON status. Normal operation status.
2	Setting mode	Changing status for temperature and concentration.
3	O point adjusting mode	0 point adjusting status for CO ₂ concentration.
4	Key lock mode	Lock/unlock switching status for operation key.
5	Buzzer mode	Buzzer sound OFF status.

- The power of this unit is in turned OFF status at the initial use. When turning off the earth leakage breaker during the operation, or when the main power is shut down caused by the power failure, the device resets to the status before turning the main power off. This refers to "Immediate Reset Function".
- If the key operation is not performed more than 10 seconds, the device turns into measurement mode.
- If the continuous key operation is not performed more than 10 seconds by interrupting, the operation is canceled.

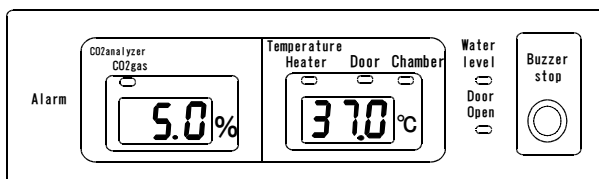
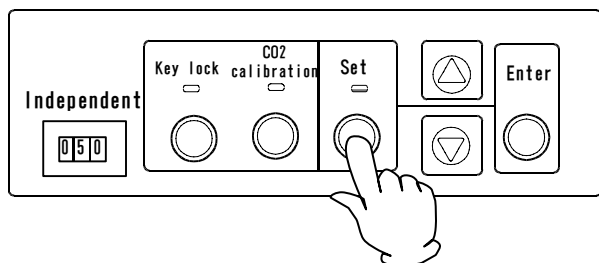
1. Operate



- Turn the earth leakage breaker ON.
- The device becomes into waiting status, and starts the current temperature measurement.
- The current in-bath temperature is displayed on the temperature indicator after 10 seconds.
- Then, the device becomes into operation status (measurement mode) after passing 1 minute, and the current in-bath temperature is displayed on the concentration indicator.
- Each lamp displays the current status.

2. Set

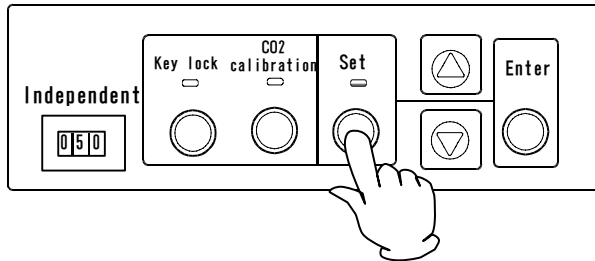
① Set the in-bath temperature.



- Press the "Set" key.
- The device becomes into setting mode for in-bath temperature.
- Both setting lamp and in-bath lamp are lit on, and the setting value is displayed on the temperature indicator.
- Display the required in-bath temperature on the temperature indicator by pressing either ▲ or ▼ key.
- Pressing "Enter" key fix the temperature, and the device becomes into door temperature setting mode.

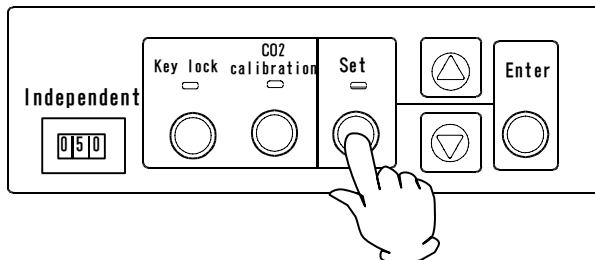
Procedure of Operation

② Set the door temperature.



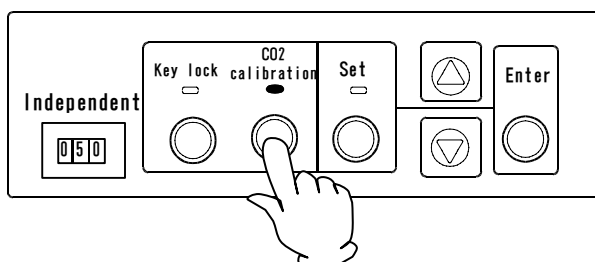
- Press the "Set" key.
- The device becomes into door temperature setting mode.
- Both setting lamp and set lamp are lit on, and the setting value is displayed on the temperature indicator.
- Display the required door temperature on the temperature indicator by pressing either ▲ or ▼ key.
- Pressing "Enter" key fix the temperature, and the device becomes into CO₂ concentration setting mode.

③ Set the CO₂ concentration.

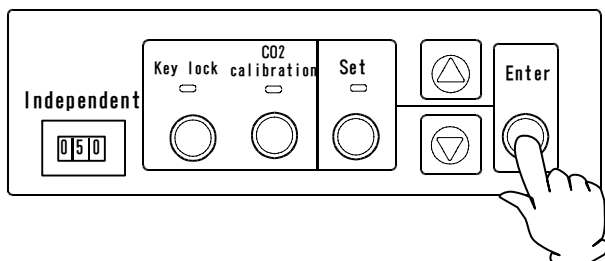


- Press the "Set" key.
- Display the required CO₂ concentration on the concentration indicator by pressing either ▲ or ▼ key.
- Pressing "Enter" key fix the CO₂ concentration, and the device becomes into measurement mode.

3. Perform 0 point adjustment for CO₂ concentration (for control substrate adjustment. Ask for Yamato Scientific Co., Ltd.)



- Leave the door open, and let the air to the inside of the bath.
- Keep pressing "Calibration" key more than 5 seconds.
- The calibration lamp lights on, and the concentration indicator blinks the "0.0" display.

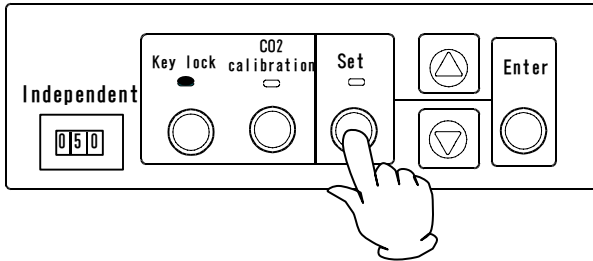


- Press "Enter" key.
- Both the calibration lamp and "0.0" displayed on the concentration indicator blink for 1 minute.
- After 1 minute, the calibration lamp turns off, and the measurement value "0.0" is lit on the concentration indicator.
- The device returns to the measurement mode.
- Close the door.

Procedure of Operation

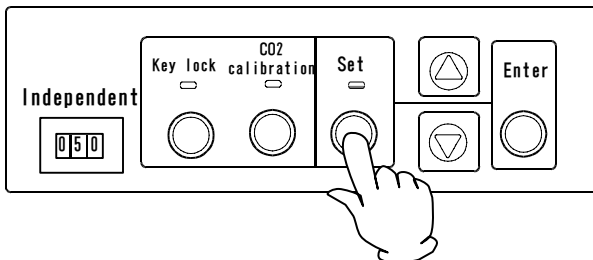
4. Set/release Key Lock

① Lock the key.



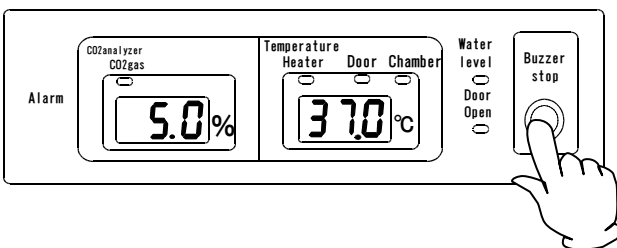
- Press the "Key Lock" key.
- The key lock lamp blinks.
- Pressing the "Enter" key locks the key, the key lock lamp lights on, and the device returns to measurement mode.

② Release the key lock.



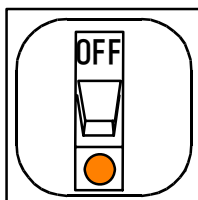
- Press the "Key Lock" key.
- The key lock lamp blinks.
- Pressing either ▲ or ▼ key releases the key lock, and the key lock lamp is turned off.
- The device returns to the measurement mode.

5. Stop the buzzer sound



- Press "Buzzer stop" key. Buzzer sound stops.

6. Stop the operation



- Turn the earth leakage breaker OFF. The device stops.

Independent overheating prevention device

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

Setting the Temperature Range and Function

Setting Temperature Range:	10 to 399°C
Input Method:	Three integer digital switch. Turn the dial of each column and set the desired value. The first integer as the left can only be from 0 to 3 for the hundred columns.
Function:	Heater output is cut off when the measured temperature gets higher than the set temperature of the independent overheating prevention device. The function is active when the earth leakage breaker is ON. When the independent overheating prevention device is activated, E07 blinks on the main indicator with the Alarm lamp blinks.

Activation/Setting Method


- Usually, set the temperature 10°C higher than the set temperature of the controller.
- When the independent overheating prevention device is activated improperly by the next reasons, changing the setting of the device lower than the internal temperature, or by continuing operation when the setting of the device is too low, turn off the earth leakage breaker to reset the main unit and perform the setting again. If it is activated by another reason, refer to the Page 27 “In the Event of Failure...”.
- For the independent overheating prevention device to start at the required temperature, first establish a stable operation at such a required temperature, and lower gradually the setting dial of the independent overheating prevention device, and then check if the operation is maintained with stable at the required temperature. (It takes approximately 5 seconds till the independent overheating prevention device is activated. It is possible that deference occur in the value between the in-bath temperature and the digital switch.)

Precautions


- Only 0 to 3 can be set for the column of hundreds of the digital switch by the stop mechanism; however, if forced to change it to a value higher than 3, it will damage the unit.
- Set temperature can change by touching the dial when cleaning. Always confirm that the set temperature is correct after cleaning or before operation.

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 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 page38 "List of Dangerous Substances".)

When opening the cover of the control panel...


-  Close the cover of the control panel immediately after operating this unit using the control panel. Leaving the cover opened could cause the injury by bumping to the face or body of the operator.

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.


Proper temperature range

-  Operate this unit under a temperature range of room temperature +5 to 50°C. Setting the temperature out of that could cause a trouble or malfunction.

Independent overheating prevention device

-  Always set the independent overheating prevention device for safety. Set its temperature 10°C higher than the set temperature of the control panel.

Treatment of sample

-  When large amount or large heat load of the sample requires to be treated, it takes longer time than usual. Check the appropriate amount as required, and set the sample. Also, when the heating sample (note that it is limited to deal only the sample with no explosion, ignition, and flammability) requires to be treated, the temperature is not stable. Be careful to this non-stable temperature.

Setting of sample



Since the withstand load of the attached shelf plate is about 5kg per one plate, do not set heavier sample than 5kg. When setting several sample, set them as dispersed as possible.

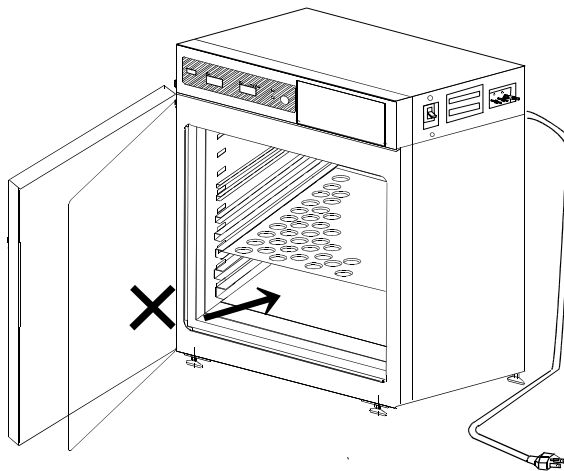


Too much sample setting could cause the improper control of the temperature and CO₂ concentration. For keeping the proper temperature and CO₂ concentration, keep more than 30% space against whole size of the shelf plate, and set the sample.

Do not put sample on the internal base



If sample is put directly on the base, device performance will be disturbed. Furthermore, internal temperature will abnormally rise and it will cause trouble. Never put sample on the base. Fix the shelf on the shelf pole then set sample on it.



Do not use corrosive sample



Stainless steel SUS304 is used for interior; however, it may be corroded by strong acid etc. And the packing made of vinyl chloride rubber and silicon rubber may be corroded by some kind of solvent, e.g. alkaline, oil, halogen etc. Do not use the sample includes those.

When you open and close the door



When you open and close the door, be careful not to be hit your hands or face. It may cause injury.

When using the cable hole...



When the sensor or probe for measurement is inserted to the cable hole, seal them so as not to have any space or gap between inner circumference of the cable hole and sensor or probe using the packing or sealing material. Having any space or gap could degrade the performance of the CO₂ concentration properties.

Water supply to water jacket



Apply the distilled water to the water jacket for protecting it from the breeding of the germs (bacteria). Besides, change the water of the water jacket once per half year.



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 shaking switch of this unit if a power failure occurs during operation.

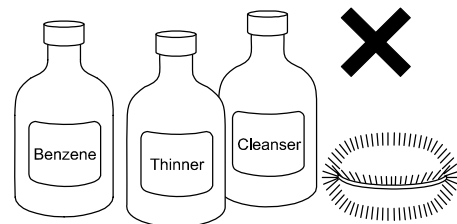
Daily Inspection and Maintenance

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.

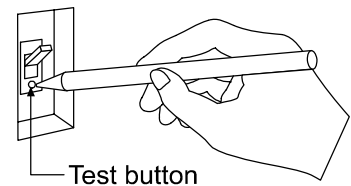
CAUTION!

- 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.



Monthly maintenance

- Check the earth leakage breaker function.
 1. Connect the power cord.
 2. Turn the breaker on.
 3. Push the red test switch by a ballpoint pen etc.
 4. If there is no problem, the earth leakage breaker will be turned off.



- Check the movement of overheating prevention device.

Perform the fixed temperature operation of device with certain preset temperature. Then set the operation temperature of overheating prevention device to the value approximately 5°C lower than the preset temperature of device.

In normal condition, the overheating prevention device shuts off the heating circuit in a few seconds, at the same time the alarm lamp lights on and the E07 is indicated accompanied with a warning buzzer.

❖ Be sure to check the movement of earth leakage breaker malfunction and overheating prevention device mentioned above before a long-term continuous operation or unmanned night operation.

For any questions, contact the dealer who you purchased this unit from, or the nearest sales division in our company.

Daily Inspection and Maintenance

For the daily maintenance to be performed by the user, this section described the following procedures, stopping operation, sterilization, water exchange, and periodical maintenance items. Read the following description before using this unit for realizing the more reliable incubating environment without fail.

1. Stopping Operation

Follow the procedure for stopping the operation of this unit. Particularly, dry the inside of the bath.

- A) Turn OFF the earth leakage breaker.
- B) Close the main valve of the CO₂ cylinder.
- C) Take the humidifier bat out of the bath, and clean/dry it.
- D) Leave this unit with its door opened for 24 hours for drying the inside of the bath.

2. Sterilization

Perform the sterilization after stopping the operation following the procedure "2. Sterilizing before Use" described in P.13. At this time, remove all components, shelf plate, shelf pole, sealing duct, etc. for sterilization.

Especially, when mold or dirt caused by the condensation is grown remarkably, wipe off it using the neutral detergent with enough. Then, wipe off the detergent with sterilized gauze, and sterilize the device.

3. Water Exchange of the Water Jacket

Drain the water from the water jacket at least once per half year, and pour new water into there again.

- A) Since the inner of the water supply port is the siphon form type, connect the hose to the water supply port, and suck out the water through the hose for easy draining from the water jacket.
- B) Supply water following the procedure "4. Water Supply to Water Jacket" described in P.15.

The following page describes the periodical inspection items to be performed during the operation. Follow the contents in this table and perform the maintenance and inspection without fail.

Item	Frequency	Reference Page
Water exchange of the water jacket	Once per 6 months	15
Water supply to the humidifier bat	Once per 1 to 2 weeks	15
Water exchange of the humidifier bat	Once per a month	15
Earth Leakage Breaker Inspection	Once per a month	23
Carbonated Gas Cylinder (30kg) Exchange	Once per 3 to 6 months (Exchange this cylinder immediately after the primary pressure of the CO ₂ pressure adjusting period decreases.)	16
CO ₂ concentration 0 point adjustment	Once per a year	Ask for Yamato Scientific.
Filter exchange for gas supplying	Once per 5 years (expendables)	
Air pump exchange	Once per 3 years (expendables)	
CO ₂ concentration span adjustment	Once per a year	
Temperature calibration	Once per a year	

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.







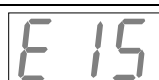





Environmental protection should be considered

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
Casing, Door	Iron, Bonderizing copper plate baked with melamine resin coating
Door packing	PVC
Inner bath	Stainless steel SUS304
Inner door	Glass
Packing (white, black)	Teflon, Silicon
Heat insulation material	Glass wool
Level switch	Polypropylene and others
Sensor	Stainless steel SUS304 and others
Motor	Iron, Aluminum, Copper wire and others
O-ring	Nitrile rubber
Sirocco fan	Polypropylene
Axis	Stainless steel SUS304, Brass C3604
Heater	Stainless steel SUS316 and others
Tube connector	Polypropylene
Hose (translucent)	PVC
Hose (milky-white)	Silicon
Board base	Aluminum
Production plates	PET resin film
Capillary	Copper, Brass
Bat	Stainless steel SUS304
Shelf	Aluminum
Shelf pole	Stainless steel SUS304

Error Display

When an error occurred, the alarm lamp blinks and the indicator shows an error code with buzzer sound.

Error Code		Failure	
E00		Communication Error	Communication system is troubled. Check the connection (optional).
E01		Temperature Sensor Error	Temperature sensor is broken or disconnected. Make a service call.
E02		Triac Short-circuit	Failure in Triac. Make a service call.
E03		Main Heater Disconnection	Heater is disconnected. Make a service call.
E07		Independent Overheating Prevention Device Activates	Overheating is occurred. Make a service call.
E14		RAM Error	Failure in controller. Make a service call.
E15		EEPROM Error	Failure in controller. Make a service call.
E20		Water Level Error	Water level of the water jacket is lowered. Supply water via the water jacket supply port.
E51		CO ₂ Sensor Error	Failure in CO ₂ sensor. Make a service call.
E60		Temperature Error	Current temperature is strayed out of the setting value. Make a service call.
E61		CO ₂ Concentration Error	Current concentration is strayed out of the setting value. The device will restore a state automatically.
E63		Humidifier Water Level Lowering	This error can be reset automatically by supplying water to the humidifier water level lowering (optional) bat.

Remedy

- When these error codes are displayed, record the error code, and turn off the breaker immediately after moving the sample to other device(s).
- When the error code "E14" is displayed, turn off the breaker at once, and turn on it again after passing 30 seconds. Even though "E14" is still displayed after turning on the breaker again, contact our service office.
- When occurred any error, the replacement of parts or inspection of the device is required. Contact our service office. Note that please let us know the error code occurred without fail. (Refer to P.28.)

Trouble Shooting

Condition	Cause	Remedy
The device does not operate when turning on the earth leakage breaker.	Failure in power supply.	Repair
	Failure of the breaker.	Replacement
Temperature does not rise.	Heater is disconnected.	Replacement
	Failure of temperature controller.	Replacement
Not match the setting temperature to the indication.	Not reach to stable status.	Wait until the device becomes into stable status.
	Higher door temperature than the setting temperature.	Lower the setting temperature.
	Failure of temperature controller.	Replacement
Not becomes stable in-bath temperature or high temperature.	Higher door temperature than the setting temperature	Lower the setting.
	Failure of temperature controller.	Replacement
Not raised the CO ₂ concentration at all.	Shorten the gas pressure of the CO ₂ cylinder.	Replacement of cylinder
	Failure of the solenoid valve.	Replacement
	Clogging of the filter.	Replacement
	Failure of the CO ₂ concentration adjusting device.	Replacement
Not match the CO ₂ concentration setting to the indicator.	Not reach to stable status.	Wait until the device becomes into stable status.
	Adjustment failure of the secondary pressure for CO ₂ cylinder.	Replacement
	Failure of the CO ₂ concentration adjusting device.	Replacement
	Failure of the air pump.	Replacement
	Clogging of the filter.	Replacement
	Failure of the dehumidifier.	Replacement
Too slow and unstable rising of the CO ₂ concentration.	Shorten the secondary pressure of the CO ₂ cylinder.	Adjustment
	Failure of the indoor packing.	Replacement
	Failure of cable hole cover.	Replacement
	Failure of the air pump.	Replacement
	Clogging of the filter.	Replacement
	Failure of the dehumidifier.	Replacement
	Failure of the CO ₂ concentration adjusting device.	Replacement
Not raised the humidity.	Shorten the humidifier water	Refill the distilled water.
	Not becomes the temperature into stable one.	Wait until the status becomes stable.
	Too many times of the door open/close.	Reduce the times of door opening/closing.
	Higher door temperature than the setting temperature	Lower the setting value.
	Failure of temperature controller.	Replacement
Condensed the glass door (inner side of the door)	Lower door temperature than the setting temperature.	Raise the setting value by 0.2°C, and observe the status.
	Failure of temperature controller.	Replacement
	Failure of the door heater	Replacement

Before call us...

Condition	Check the following.
The indicator does not light on when turning on the earth leakage breaker.	<ul style="list-style-type: none"> Power plug is not connected to the receptacle or power distribution board correctly. Power failure.
Temperature fluctuates during the operation.	<ul style="list-style-type: none"> Too much samples. The change of ambient temperature is remarkable.
Temperature does not reach the setting value.	<ul style="list-style-type: none"> Too much samples.

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 the Yamato Scientific's 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 7 years after discontinuance of this unit.

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

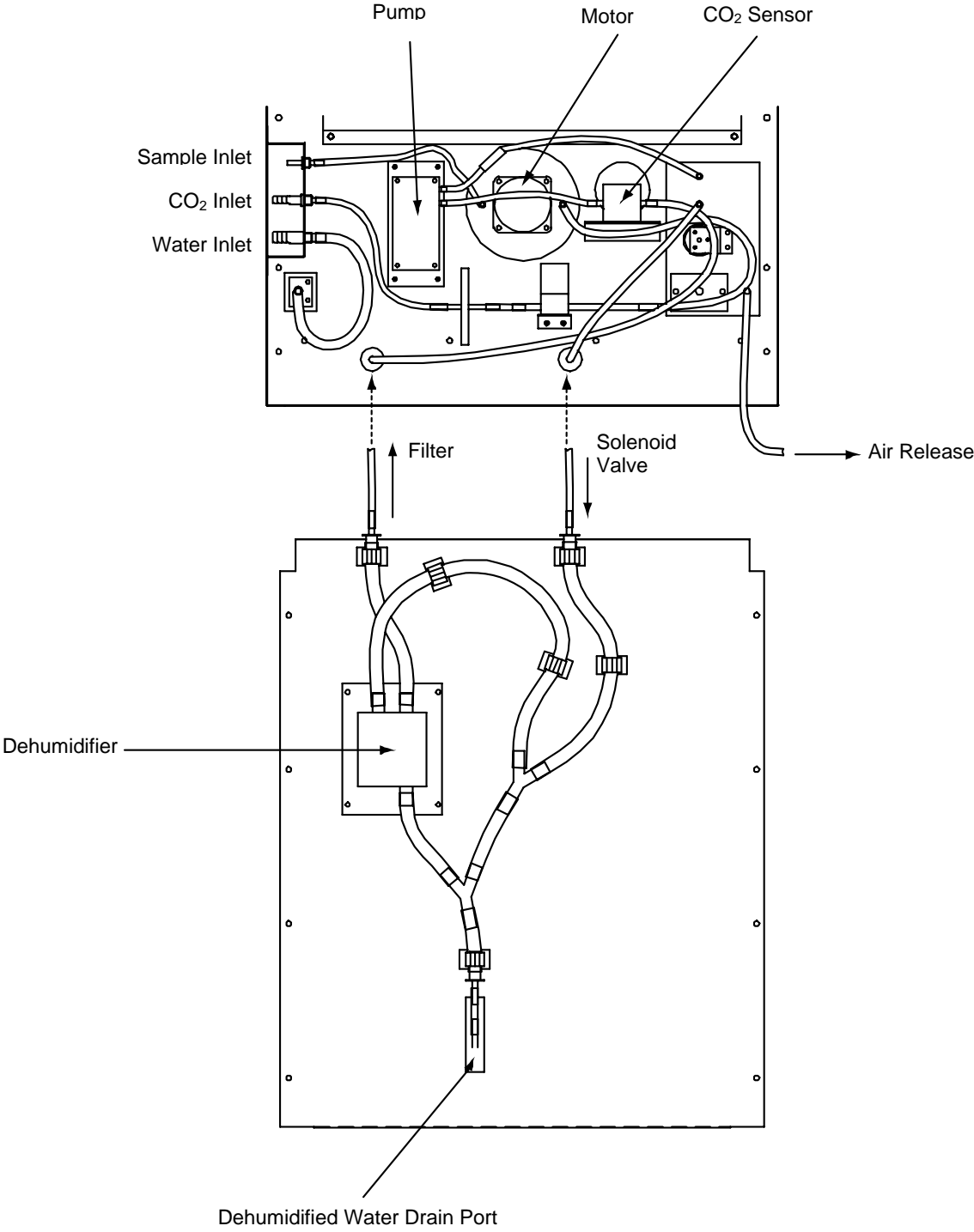
Model		IT400	IT600	IT820
Performance	Operating temperature range	Room temp. + 5 to 50°C		
	Operating humidity range	95%RH or more		
	CO ₂ concentration adjustment range	0.1 to 20.0%		
	Temperature adjustment accuracy (*1)	±0.1°C (at 37°C)		
	Temperature distribution accuracy (*1)	±0.2°C (at 37°C)		
	CO ₂ concentration adjustment accuracy	±0.1% (at 5%)		
Function/Configuration	Heating system	Water jacket (water bath)		
	Humidification system	Natural evaporation by supplying water of bat		
	CO ₂ concentration control	Detection control by CO ₂ sensor		
	Stir	Motor and sirocco fan		
	Temperature controller	PID control by IV CR2		
	CO ₂ controller	P control by IV CR2		
	Water bath/in-bath/door temperature sensor	Pt100Ω		
	Independent overheating prevention sensor	K-thermo couple		
	CO ₂ sensor	Infrared rays absorption		
	Temperature setting system	(In-bath and door), Digital setting, Setting range: 0.0 to 51.0		
	CO ₂ concentration setting system	Digital setting, Setting range: 0.1 to 21.0		
	Temperature display system	(In-bath and door), Digital display, Display range: 0.0 to 99.9		
	CO ₂ concentration display system	Digital display, Display range: 0.0 to 21.0		
	Water bath heater	140W × 2pcs	170W × 2pcs	170W × 2pcs × 2baths
	Door heater	40W	40W	40W × 2baths
	Stir fan	Condenser motor		Condenser motor × 2baths
	Air pump	Diaframe type		Diaframe type × 2baths
	Water level detection	Float switch		Float switch × 2baths
	Door switch	Micro switch		Micro switch × 2baths
	Dehumidify device	Peltier cell		Peltier cell × 2baths
	Cable hole	Diameter: 32mm		Diameter: 32mm, × 2baths
	Safety function	Self-diagnostic function (Sensor error, Heater disconnection, Triac short circuit, Auto overheating prevention), Key lock function, Door switch, Earth leakage breaker, Independent overheating prevention device		

*1: At Room temp: 23±5°C, Humidity: 65%RH±20%, No load

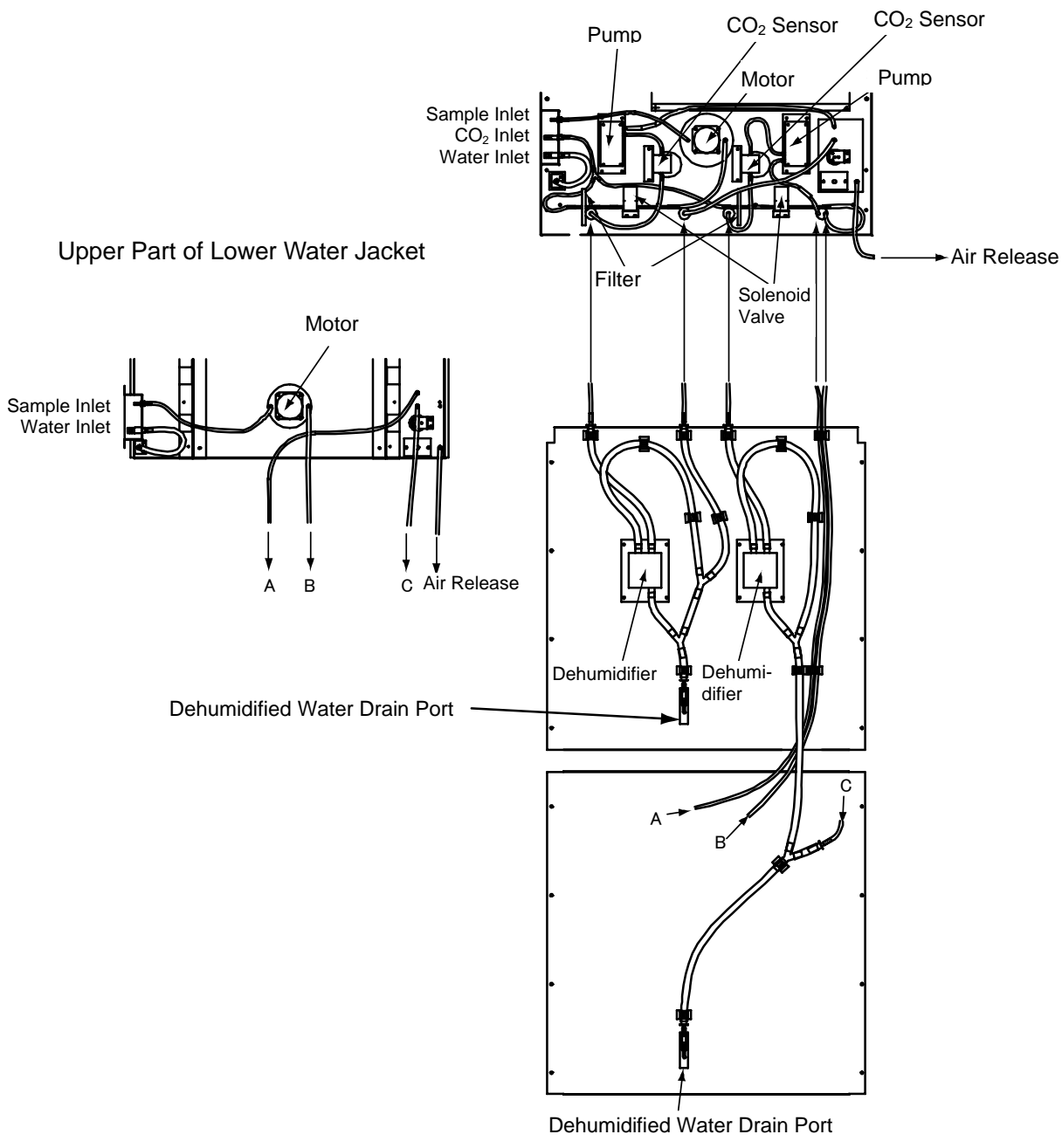
Model		IT400	IT600	IT820
Standard	Internal dimensions (*2) (W × D × H mm)	409 × 426 × 414	609 × 426 × 514	609 × 426 × 514 × 2baths
	External dimensions (*2) (W × D × H mm)	545 × 646 × 805	745 × 646 × 905	745 × 646 × 1811
	Internal capacity (liters)	72	133	133 × 2baths
	Permissible load of shelf	Approx. 5kg/one shelf		
	Number of shelf step	12	14	14 × 2baths
	Power supply (50/60Hz)	100V AC 4A	100V AC 5A	100V AC 9A
	Weight	Approx. 100kg	Approx. 115kg	Approx. 220kg
Standard accessories		Shelf (aluminum), Humidifier bat, Hose, Hose band, Shelf pole (for the right and left), Shelf fixer, Level adjusting screw (IT820: attached on main unit), Instruction manual		
Optional accessories		Metal fittings for piling install, Extra shelf, Frame, CO ₂ pressure adjuster, CO ₂ cylinder switcher, Small door inside of inner door, Water level detection for humidification water, External output		

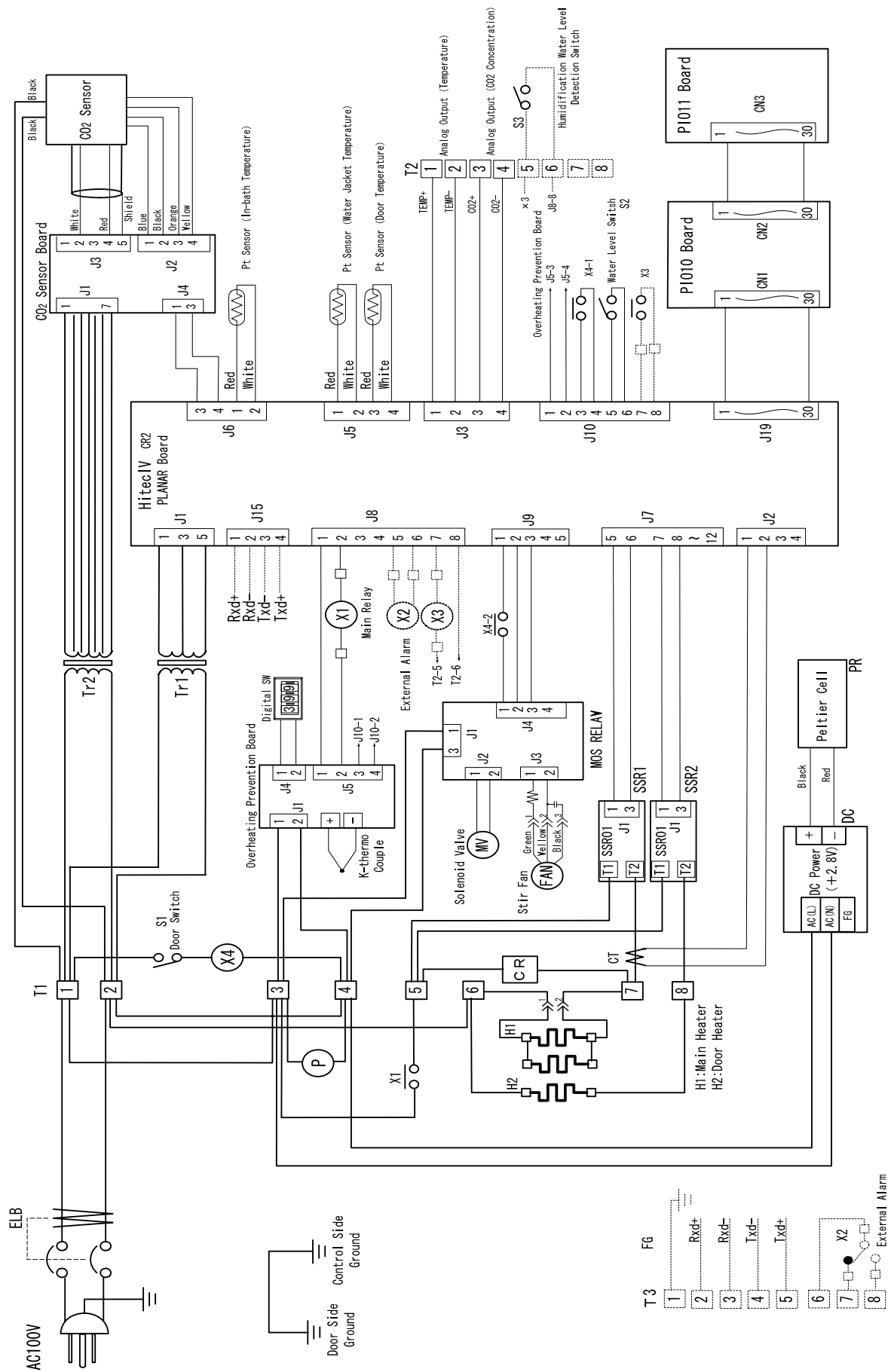
*2: The projection is not included

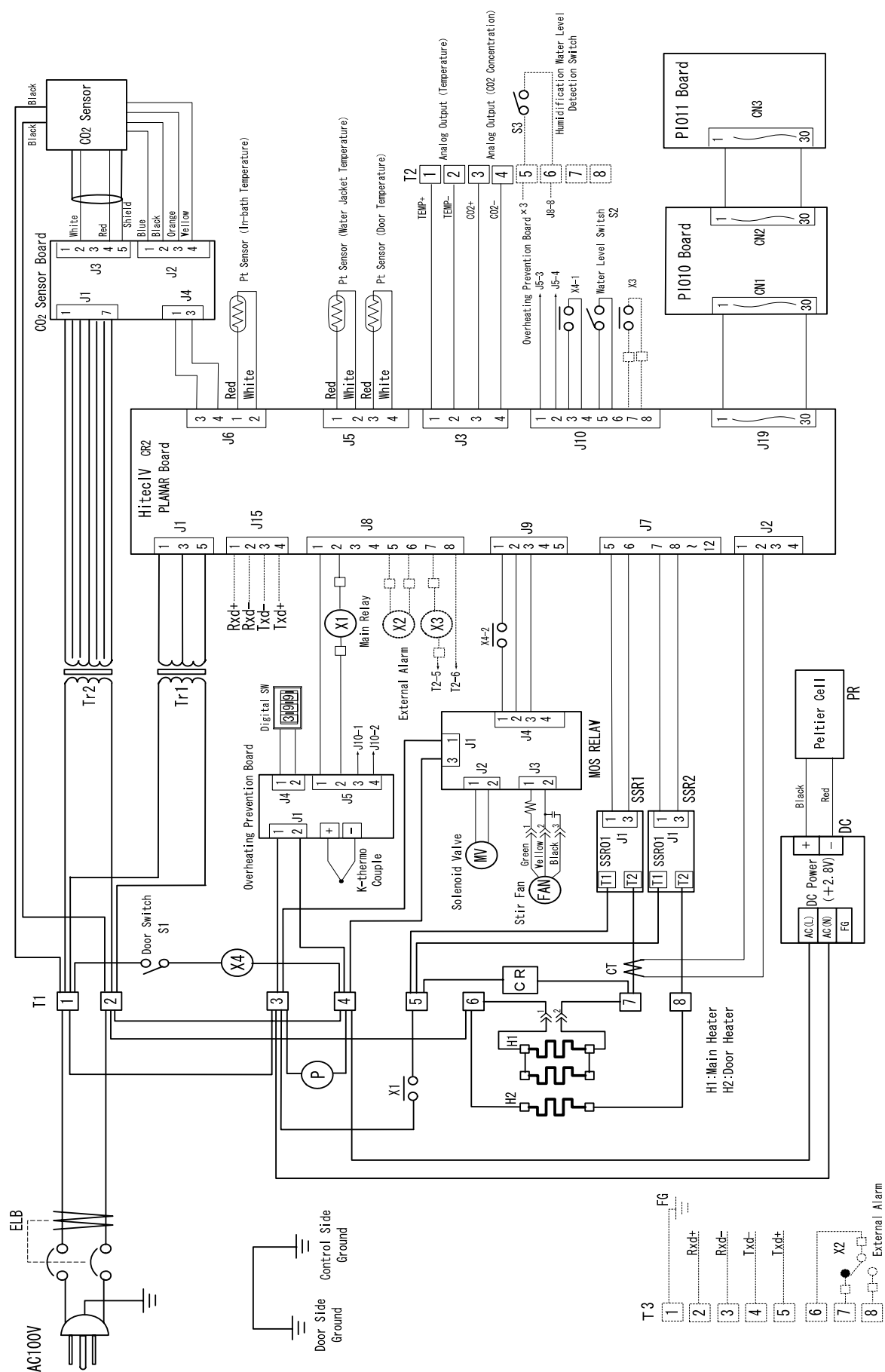
IT400/600



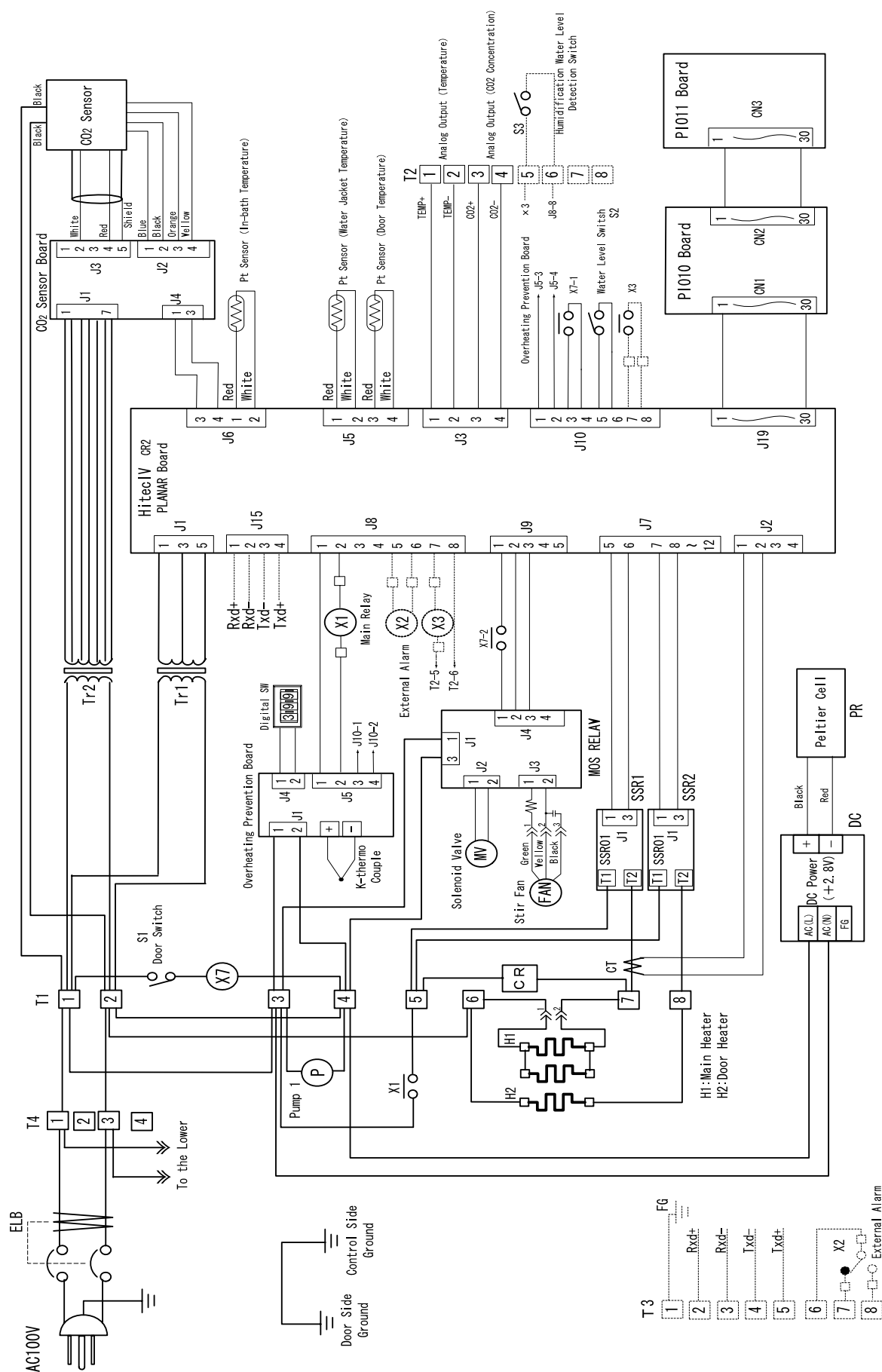
IT820



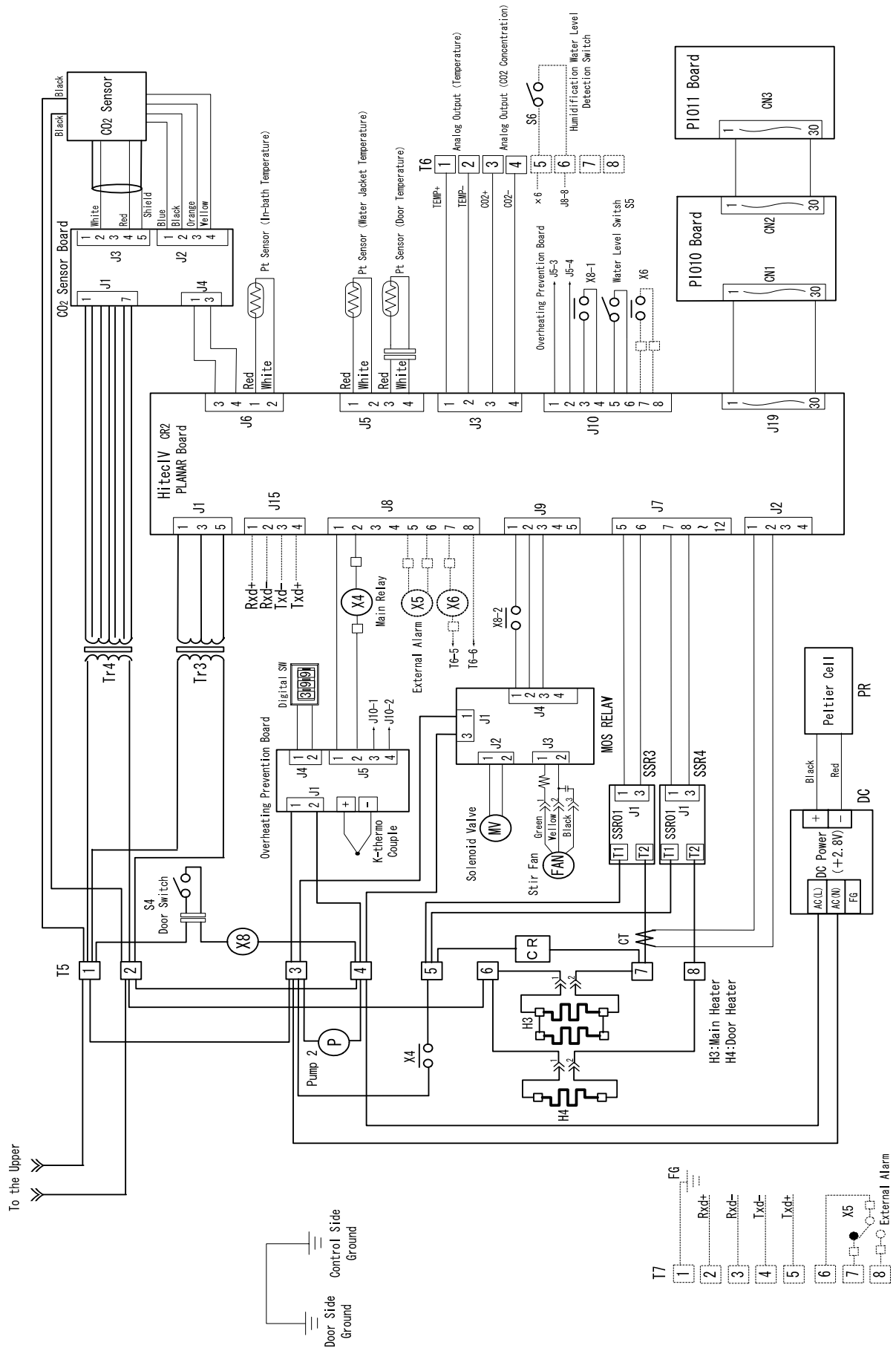




IT800 (upper)



IT800 (lower)



Replacement Parts Table

These replacement parts are common to IT400/600/820 except the main heater.

Symbol	Part Name	Code No.	Specification	Manufacturer
P	Air pump	2-15-006-0001	NS-S5	Yamato Scientific
DC	Switching power source	2-55-000-0004	HK10A-5	Nemick Lambda
FAN	Motor	2-14-002-0005	RM3	Yamato Scientific
H1	Heater (main) IT400	IT42-40631	100V 140W (IT433)	Yamato Scientific
H1	Heater (main) IT600/820	IT62-40291	100V 170W (IT623)	Yamato Scientific
H2	Heater (door)	IT43S-4029	100V 40W Cord heater	Yamato Scientific
X1	Main relay	2-05-000-0013	JalaF-TM-DC6V	Matsushita
S1	Limit switch (door)	2-02-001-0008	AGX106 (1 a)	Matsushita
MV	Solenoid valve	3-02-001-0023	VDW31-1G-2-01	SMC
S2	Level switch	2-04-002-0001	NV-112YA	Tokyo Seigyo
CO2	CO ₂ sensor	1-01-005-0003	ZFP unit	Yamato Scientific
Pt/k	Platinum sensor 1, 4	1-16-003-0041	Pt100Ω +K (in-bath/heating)	Yamato Scientific
Pt	Platinum sensor 2, 5	1-16-003-0042	Pt100Ω (for WJ)	Yamato Scientific
Pt	Platinum sensor 3	1-16-003-0043	Pt100Ω (door)	Yamato Scientific
PR	Thermo module	LT00035685	KSM-06127C-AAL	Komatsu Electronics
ELB	Breaker	2-06-005-0010	BJS15-3 15A	Matsushita
CR2	Control board	1-24-000-0066	CR2	Yamato Scientific
PIO10	Display board (left)	1-24-000-0098	PIO10	Yamato Scientific
PIO11	Display board (right)	1-24-000-0099	PIO11	Yamato Scientific
	CO ₂ adjustment board	1-24-000-0095		Yamato Scientific
	Overheat prevention board	1-24-000-0093		Yamato Scientific
CT	Current transformer	2-17-001-0002	CTL-6-S-400	URD
Tr1	Transformer A	2-18-000-0040	For IV CR2 100V	Yamato Scientific
Tr2	Transformer B	2-18-000-0045	For IV CR 100V	Yamato Scientific
MOS	MOS relay board	1-24-000-0042		Yamato Scientific
SSR	SSR board	LT00028423	SSR-01	Yamato Scientific
T2	Terminal block	LT00031669	W101A-8PC	World
T1	Terminal block (fasten)	LT00035675	MKH-250ABC-8P	Terminal
CR	CR2 absorber	2-30-002-0001	2S 1201 250V	Yamato Scientific
	Filter	9-02-001-0001	BRO-1	Pearl Bio Medical
	O-ring	7-34-001-6003	JIS B 2401 G105	Yamato Scientific
	Sirocco fan	4-35-003-0001	For (AO153) P325-9	Yamato Scientific

List of Dangerous Substances



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

EXPLOSIVE

EXPLOSIVE:	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 hidroperoxide (peracetic acid), Methyl ethyl ketone peroxide, Benzyl peroxide, and other organic peroxides

FLAMMABLE

IGNITING:	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
OXIDIZING:	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
INFLAMMABLE LIQUID:	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
FLAMMABLE GAS:	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 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

CO₂ Incubator

Model IT400/600/820

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