SANYO

INSTRUCTION MANUAL

MCO-5M

Multi-gas Incubator

Note:

1. No part of this manual may be reproduced in any form without the expressed written permission of SANYO.

2. The contents of this manual are subject to change without notice.

3. Please contact SANYO if any point in this manual is unclear or if there are any inaccuracies.

CONTENT

PRECAUTIONS FOR SAFE OPERATION

It is imperative that the user complies with this manual as it contains important safety advice.

Items and procedures are described so that you can use this unit correctly and safely. If the precautions advised are followed, this will prevent possible injury to the user and any other person.

Precautions are illustrated in the following way:

⚠WARNING

Failure to observe WARNING signs could result in a hazard to personnel possibly resulting in serious injury or death.

⚠CAUTION

Failure to observe CAUTION signs could result in injury to personnel and damage to the unit and associated property.

Symbol shows;

△ this symbol means caution or warning.

⃠ this symbol means an action is prohibited.

● this symbol means an instruction must be followed.

Be sure to keep this manual in a place accessible to users of this unit.

< Label on the unit >

This mark is labeled on the cover in which the electrical components of high voltage are enclosed to prevent the electric shock.

The cover should be removed by a qualified engineer or a service personnel only.

⚠ WARNING

As with any equipment that uses CO_2 / O_2 / N_2 gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that you assess the work site to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices.

O_2 gas increases the susceptibility of substances to burn. Take care of the handling of flame in a room where the incubator is installed.

PRECAUTIONS FOR SAFE OPERATION

⚠WARNING

Do not use the unit outdoors. Current leakage or electric shock may result if the unit is exposed to rain water.

Only qualified engineers or service personnel should install the unit. The installation by unqualified personnel may cause electric shock or fire.

Install the unit on a sturdy floor. If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.

Never install the unit in a humid place or a place where it is likely to be splashed by water. Deterioration of the insulation may result which could cause current leakage or electric shock.

Never splash water directly onto the unit as this may cause electric shock or short circuit.

Use a dedicated power source as indicated on the rating label attached to the unit.

Remove dust from the power supply plug before inserting in a power source. A dusty plug or improper insertion may cause a hazard.

Use a power supply outlet with ground (earth) to prevent electric shock. If the power supply outlet is not grounded (earthed), it will be necessary to install a ground by qualified engineers.

Never ground the unit through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO_2 gas. <u>Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.</u>

Never store volatile or flammable substances in this unit. This may cause explosion or fire.

Ventilate a room air occasionally when using CO_2 gas for control. The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO_2 gas is used.
Si l'appareil est utilisé dans un evdroit restreint, le niveau de la densité CO_2 de l'air peut s'élever et peut être nocif aux humains. Évitez d'aspirer l'air provenant de l'intérieur de l'appareil quand vous ouverz la porte.

Do not insert metal objects such as a pin or a wire into any vent, gap or any outlet for inner air circulation. This may cause electric shock or injury by accidental contact with moving parts.

PRECAUTIONS FOR SAFE OPERATION

⚠WARNING

As with any equipment that uses CO_2 gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that you assess the work site to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices. Keep proper gas pressure to avoid gas leak.

Use this unit in a safe area if using poisonous, harmful or radioactive substances. Improper use may be harmful to your health or the environment.

Disconnect the power supply to the unit prior to any repair or maintenance in order to prevent electric shock or injury.

Never expose the eyes directly to UV light as UV light can cause permanent damage to eyes. Never remove cover when UV light is ON (when an optional UV system kit MCO-18UVS2 is installed).

Hazardous UV light. Do not press door switch.

Never disassemble, repair, or modify the unit yourself. Any such work carried out by an unauthorized person may result in fire or injury due to a malfunction.

Disconnect the power supply plug if there is anything wrong with the unit. Continued abnormal operation may cause electric shock or fire.

If the unit is to be stored unused in an unsupervised area for an extended period, **ensure that children do not have access and that doors cannot be closed completely.**

The disposal of the unit should be undertaken by appropriate personnel. Remove doors to prevent accidents such as suffocation.

Prepare a safety check sheet when you request any repair or maintenance for the safety of service personnel.

PRECAUTIONS FOR SAFE OPERATION

⚠CAUTION

Select a level and sturdy floor for installation. This precaution will prevent the unit from tipping. Improper installation may result in water spillage or injury from the unit tipping over.

Connect the unit to a power source as indicated on the rating label attached to the unit. Use of any other voltage or frequency other than that on the rating label may cause fire or electric shock.

When removing the plug from the power supply outlet, grip the power supply plug, not the cord. Pulling the cord may result in electric shock or fire by short circuit.

Never damage or break the power supply plug or cord. Do not use the supply plug if its cord is loose. This may cause fire or electric shock.

Do not touch any electrical parts such as the power supply plug or any switches with a wet hand. This may cause electric shock.

Do not put a container with water or heavy articles on the unit. It may cause injury if the articles fall. Current leakage or electric shock may result form deterioration of insulation by spilled water.

Do not climb onto the unit and do not put articles on the unit. This may cause injury by tipping or damage to the unit. When stacking the unit, follow the procedure shown on page 35.

Always hold the handle when closing the door. This will reduce the likelihood of a trapped finger.

Do not damage the power supply cord. Stepping on the cord, or processing, pulling, twisting, or binding of cord may cause fire or electric shock by damaged cord.

Never lean or press on the glass or never hit the glass with sharp edge. Intentional force may cause injury if the glass breaks.

Do not lean on the door. This may cause injury, current leakage, or electric shock if the unit tips over or door becomes detached.

Always put on gloves at the time of maintenance. The corners of fixtures may cause injury.

Disconnect the power supply plug before moving the unit. Take care not to damage the power cord. A damaged cord may cause electric shock or fire.

Empty the humidifying pan completely before moving the unit. Spilled or splashed water may cause current leakage or electric shock.

PRECAUTIONS FOR SAFE OPERATION

⚠CAUTION

Be careful not to tip over the unit during movement to prevent damage or injury.

Disconnect the power plug when the unit is not used for long periods. The deteriorated insulation may cause electric shock, current leakage or fire.

Do not put the packing plastic bag within reach of children as suffocation may result

Take care of the inside of the outer door. It may get hot.

Use the power supply cord enclosed with the unit. Use of an inferior power supply cord may cause electric shock or fire.

CAUTIONS FOR USAGE

1. Install on a sturdy and level floor

Install the unit on a sturdy and level floor and take precaution for preventing tipping over. Inadequate installation may result in water leakage or injury from the unit falling or tipping over.

2. Install in a place not subject to direct sunlight and far from heat sources

Never install the unit outdoor, near windows, or in direct sunlight. And install the unit far from heat sources such as exhausted heat from other equipment. The installation in improper location may result in insufficient performance.

3. Ventilate a room air

Ventilate a room air occasionally when using CO_2 gas for control. The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO_2 gas is used.

4. Setting of 5°C higher than the ambient temperature

The chamber temperature must be at least 5°C higher than the ambient temperature. For example, the chamber temperature is set to 37°C, the ambient temperature must be less than 32°C. Ensure the ambient temperature is within the desired range.

Also, do not place the unit in the direct air flow from an air conditioning system. Cool air from an air conditioning system may cause condensation and lead to possible contamination.

5. Always keep the chamber clean

The condensation may be caused on the inside of the door by spilled water form humidifying pan or opening of outer door for long period. Wipe off the condensation completely with a sterile dry gauze. Especially when the culture medium is spilled, clean and disinfect the chamber immediately. Refer to page 27 “Routine maintenance” for details.

6. Fill the humidifying pan with sterile distilled water

Always use sterile distilled water to fill the pan. The RH PAN lamp on the control panel flashes when the water level is low. Refill the sterile distilled water to the pan when the RH PAN lamp blinks. Note that when low temperature water is poured, the chamber temperature drops significantly. Clean the pan once a month.

7. Always shut the inner door

Shut the inner door completely, and then shut the outer door. If the inner door is not closed completely, even if the outer door is closed, the unit will fail to exhibit its maximum performance.

8. Open/close the doors gently

Ensure you close the doors gently. Robust closing may cause spillage of medium, incomplete closing, or damage of gasket. Also, before opening the inner door, check that the UV light is OFF (when an optional UV system kit MCO-18UVS2 is installed).

CAUTIONS FOR USAGE

9. Use clean containers

The Petri dishes or bottles for culturing may cause contamination in the chamber. Clean the containers before storing them in the chamber.

10. Allow adequate space between the cultures

When storing cultures in the chamber, keep the Petri dishes or bottles containing the cultures sufficiently apart from each other to allow adequate air circulation. Inadequate space may result in uneven temperature distribution and CO_2 concentration in the chamber.

11. Stored materials

Never place acid or alkaline materials or materials that release corrosive gas in the chamber. Such materials can cause failure resulting from discoloration or corrosion.

12. Alarm

Always investigate the cause and fix the alarm condition immediately when the alarm is activated. Refer to page 25 for alarm details.

13. Do not use CAL key

Do not use CAL key on the control panel in normal use. Pressing this key leads the calibration mode. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing CAL key accidentally. After about 90 seconds, the unit returns to chamber temperature display mode automatically.

14. If not used

When the unit is not used, dispose of the water in the humidifying pan and completely remove any moisture in the chamber completely. Check that the chamber is completely dry before closing the doors.

15.Thermal conductivity CO_2 sensor

It is not abnormal that the thermal conductivity CO_2 sensor displays CO_2 density higher than the actual density when the chamber humidity temporarily goes down. And take care of the level of humidifying water because the lack of water affects the CO_2 density.

CAUTIONS FOR USAGE

Labels on the unit

Some warning and/or caution labels are attached on the unit. Following shows the description of such labels.

	This label is on the cover in which the electrical components of high voltage are enclosed to prevent the electric shock. The cover should be removed by a qualified engineer or a service personnel only.
	This symbol means UV caution.
	This symbol means attention or refer to document.
	This symbol means hot surface.
	This symbol means earth.
I	This symbol means power switch “ON”.
O	This symbol means power switch “OFF”.

CAUTIONS FOR USAGE

The cautions below are applicable when an optional UV system kit MCO-18UVS2 is installed.

1. Always use humidifying pan and pan cover

The humidifying pan and pan cover prevent the UV light from escaping. Make sure they are installed even if you do not need humidity.

2. Notice of recommended replacement of UV lamp

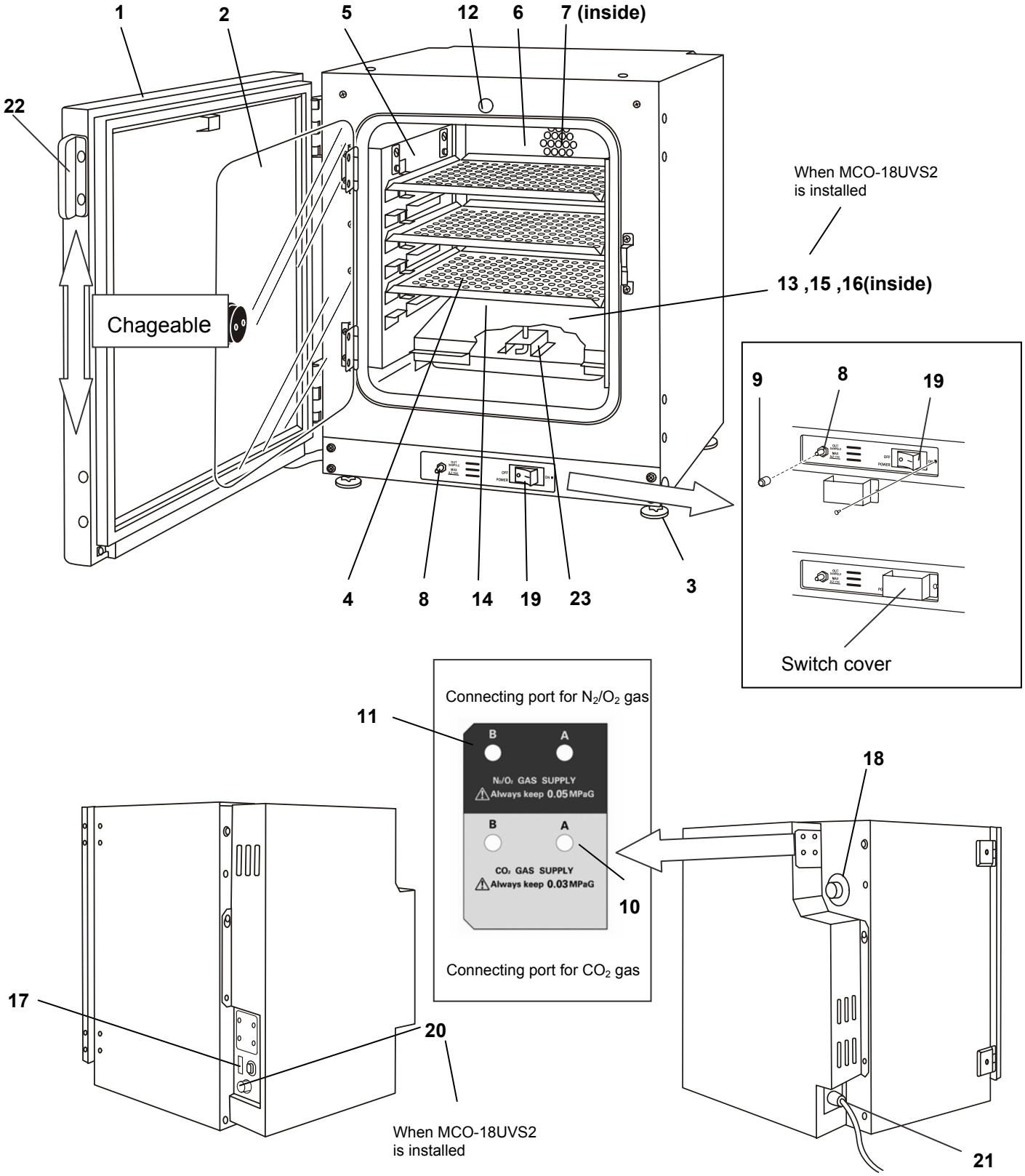
This unit is provided with a function to notify the recommendation of UV lamp replacement when the accumulated ON time of UV lamp is over about 1,000 hours. The blink of the UV indicator on the control panel recommends the replacement of UV lamp. For the replacement, contact Sanyo sales representative or agent.

E18 will be displayed on the temperature indicator when the UV lamp is burned out. Contact Sanyo sales representative or agent for the replacement.

3. Location of UV lamp

The UV lamp is located in the duct. Take care not to damage the lamp at the time of installation/removal of attachments or humidifying pan.

INCUBATOR COMPONENTS



INCUBATOR COMPONENTS

1. Outer door: Sticks to frame with magnetic seal. Door heater is installed in the door panel. The door opening is reversible. Contact Sanyo representative or agent to change the door hinge from left to right or vice versa.

2. Inner door: Made of tempered glass, however avoid excessive impact on the glass.

3. Leveling foot: Screw type for adjusting the height. Adjust the foot so that the unit can be level.

4. Tray: Can be pulled toward you.

5. Side support: Right and left side supports can be removed for disinfection. See page 33 and 34.

6. Rear duct: Flow path for circulating air. Removable.

7. Fan (inside the rear duct): Made from polypropylene resin. Can be sterilized by an autoclave.

8. Sample air outlet: This also functions as an internal gas outlet. Use only a supplied cap(9).

9. Sample air outlet cap: Always attach this cap except at the time of using of sample air outlet.

10. Connecting port for CO_2 gas pipe (rear side): When an optional component MCO-5GC (gas cylinder changeover accessory) is installed, both A and B are available. If MCO-5GC is not used, only A is available. Refer to page 21 for gas cylinder connection. Ensure that the gas pressure is set at 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG). Refer to page 25 for automatic cylinder changeover.

11. Connecting port (A/B) for N_2/O_2 gas pipe (rear side): Refer to page 19 for gas cylinder connection. Ensure that gas pressure is set at 0.05MPaG (0.5kgf/cm2G, 7.1psiG). Refer to page25 for automatic cylinder changeover.

12. Door switch: Detects the door opening/closing and stops the circulating fan and electromagnetic valve for CO_2 and N_2/O_2 when door is open. UV lamp is also deactivated by door opening (When an optional UV system kit MCO-18UVS2 is installed).

13. Humidifying pan: Use sterile distilled water to fill the pan.

14. Humidifying pan cover: Prevents UV light being exposed to the chamber. When filling the pan, lift the front side and take out the pan. See page 35 for details.

15. UV lamp (When an optional UV system kit MCO-18UVS2 is installed)**:**
Sanyo UV lamp does not generate ozone. Never look at the UV light directly. For replacement, contact Sanyo representative or agent.

16. Water level sensor for humidifying pan: Detects the water level in the humidifying pan. See page 28 for details.

17. Remote alarm terminal: Refer to page 15.

18. Access port: When not in use, cap with the rubber cap on both outside and inside.

19. Power switch: Main switch of the unit. Also functions as an over-current breaker. The switch is covered by a switch cover to prevent the accidental push. To turn on or off the switch, remove the switch cover by loosening the screw. See figure on the right.

20. Glow starter (When an optional UV system kit MCO-18UVS2 is installed)**:** For UV lamp (model; FG-7P)

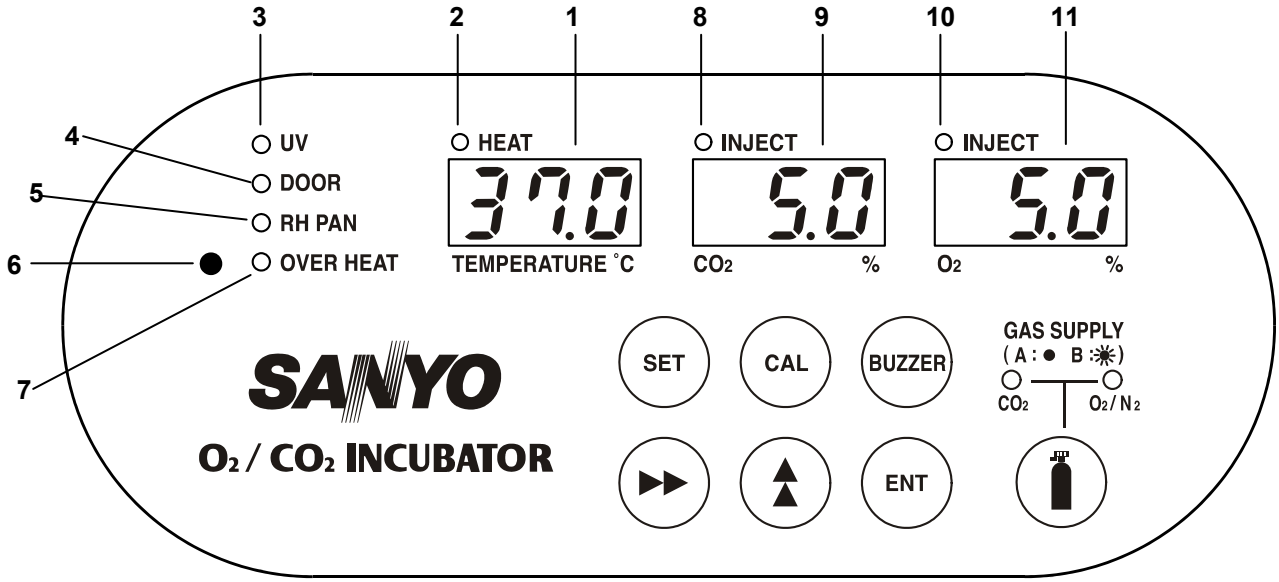
21. Removal Power supply cord

22. Handle: Outer door handle. When moving the handle from upper to a lower position remove it from original position first, then remove two cups and screws at the lower position and attach the handle there.

23. N_2 or O_2 gas injection nozzle

INCUBATOR COMPONENTS

Control panel and keypad



1. Digital temperature indicator (TEMPERATURE °C): Normally, this indicator shows the chamber temperature. In the setting mode, it shows the set value of the chamber temperature. If the self diagnostic function detects any abnormality, an error code will be displayed.

2. Heater lamp (HEAT): This lamp lights when the heater is energized.

3. UV indicator (UV): This lamp lights when the UV lamp is ON. The blink of this indicator recommends the replacement of UV lamp. See page 23 for the details.

4. Door lamp (DOOR): This lamp lights when the outer door is open.

5. Water level alarm lamp (RH PAN): This lamp flashes when the water in the humidifying pan is less than approximately 0.8 liter.

6. Upper limit regulator: This regulator is used to set the upper temperature limit.

7. Over heat lamp (OVER HEAT): This lamp lights when the chamber temperature reaches the upper limit set value.

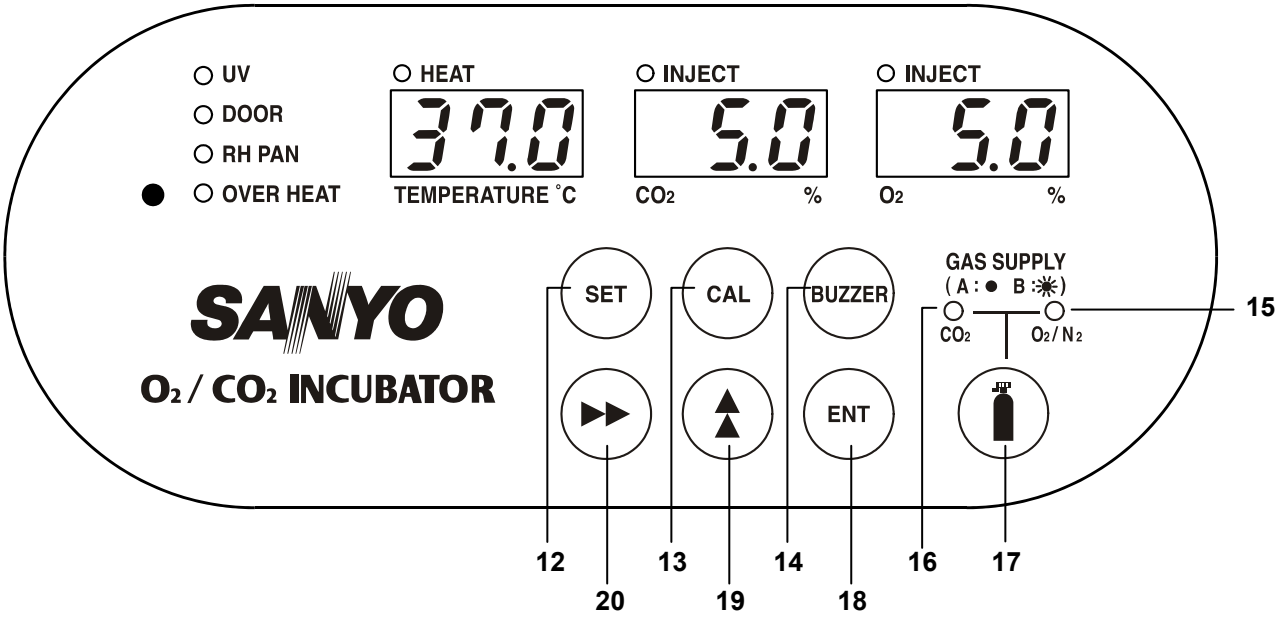
8. CO_2 inject lamp (INJECT): This lamp lights when CO_2 gas is being injected.

9. Digital CO_2 density indicator (CO_2 %): Normally, this indicator shows the CO_2 concentration in the chamber. In the setting mode, it indicates the set value of the CO_2 concentration. The empty gas supply line is displayed when CO_2 gas cylinder becomes empty (only when MCO-5GC is installed). See page 25 for details.

10. O_2 inject lamp (INJECT): This lamp lights when N_2 or O_2 gas is being injected.

11. Digital O_2 density indicator (O_2 %): Normally, this indicator shows the O_2 concentration in the chamber. In the setting mode, it indicates the set value of the CO_2 concentration. The empty gas supply line is displayed when N_2 or O_2 gas cylinder becomes empty (only when MCO-5GC is installed). See page 25 for details.

INCUBATOR COMPONENTS



12. Set key (SET): Pressing this key to enter the setting mode, and the digits to be set will flash.

13. Calibration key (CAL): By pressing this key for approximately 5 seconds, the unit enters calibration function mode. Also, used to change the UV lamp ON period. See page 36 and 24 for the details.

14. Alarm buzzer stop key (BUZZER): Press this key to silence the buzzer when the alarm operates and the buzzer sounds.

15. N_2/O_2 gas supply line indicator (A/B): The lamp for the supply line currently in use lights up. (Lamp ON; cylinder A, Lamp flash; cylinder B)

16. CO_2 gas supply line indicator (A/B): The lamp for the supply line currently in use lights up provided that MCO-5GC changeover accessory is installed. (Lamp ON; cylinder A, Lamp flash; cylinder B)

17. Gas supply line switching key (GAS SUPPLY): This is a key to select N_2 or O_2 gas supply. By pressing this key, the N_2 or O_2 gas supply line (A/B) is changed in O_2 density set mode. The supply line is changed automatically when N_2 or O_2 gas cylinder is empty. Similarly, by pressing this key in CO_2 density set mode, CO_2 gas supply line is changed automatically when an automatic gas cylinder changeover MCO-5GC (option) is installed. The supply line is changed automatically when CO_2 gas cylinder is empty.

18. Enter key (ENT): Pressing this key memorizes the set value in the controller.

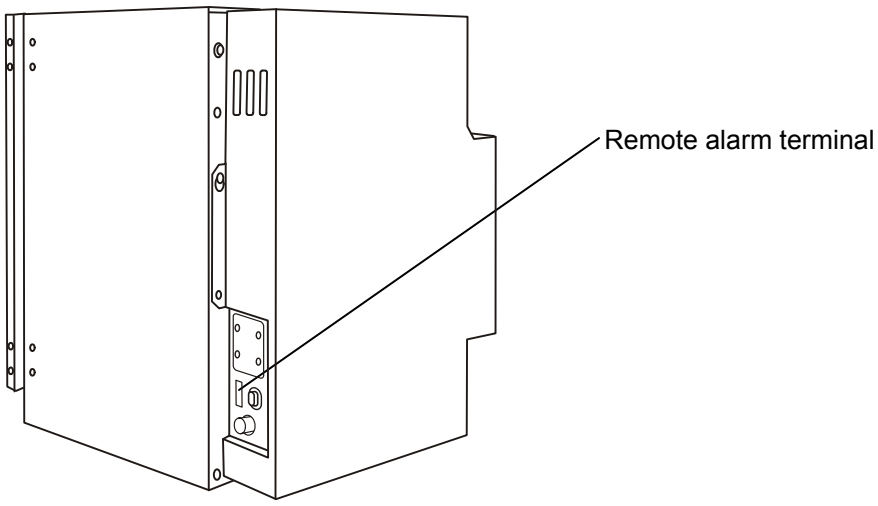
19. Numerical value shift key (▲): Pressing this key in the setting mode causes the numerical value to shift. In key lock mode, pressing this key makes key lock ON or OFF.

20. Digit shift key (▶▶): Pressing this key in the setting mode causes the changeable digit to shift. Pressing this key more than 5 seconds enters key lock mode. See page 27 for the key lock.

INCUBATOR COMPONENTS

Remote alarm terminal

The remote alarm terminal is located at the rear right side.



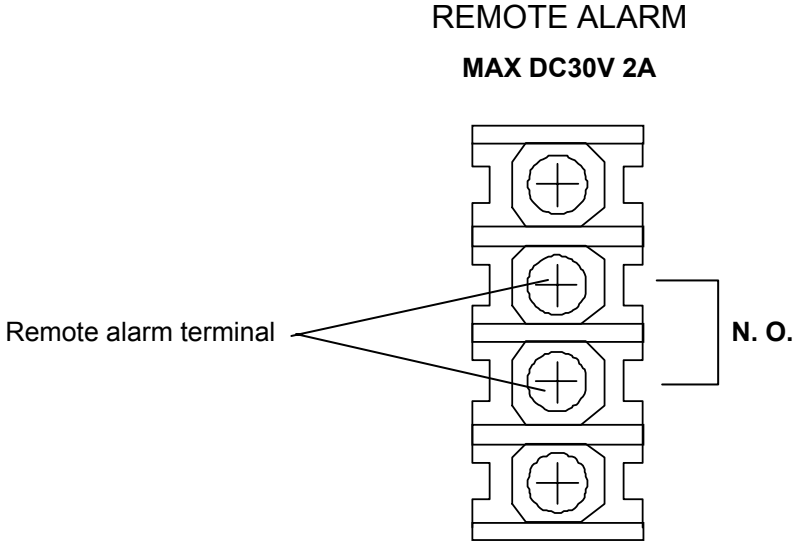
The remote alarm terminal is a contact output.

Normal	:	OPEN
Abnormal , blackout	:	CLOSE
Contact capacity	:	DC 30V, 2A

Note:

• When the power switch is OFF or the power failure condition, the contact output is CLOSE.

• The remote alarm cannot be silenced by pressing the alarm buzzer stop key (BUZZER) since the remote alarm is not conjunct with the BUZZER key. (The contact output is kept even though the remote alarm is silenced by pressing buzzer stop key (BUZZER).



INSTALLATION

Installation site

To operate this unit properly and to obtain maximum performance, install the unit in a location with the following conditions:

Note: The ambient temperature must be at least 5°C lower than the set temperature.

1. A location not subjected to direct sunlight or direct air flow from an air conditioner

2. A location with clean air and adequate ventilation (Small and sealed room is not recommended.)

⚠ WARNING

As with any equipment that uses $CO_2/O_2/N_2$ gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that you assess the work site to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices.
O_2 gas increases the susceptibility of substances to burn. Take care of the handling of flame in a room where the incubator is installed.

3. A location away from heat generating sources

4. A location with a sturdy and level floor

⚠ WARNING

Install the unit on a sturdy floor. If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.
Select a level and sturdy floor for installation. This precaution will prevent the unit from tipping. Improper installation may result in water spillage or injury from the unit tipping over.

5. A location without flammable or corrosive gas

⚠ WARNING

Never install the unit in a flammable or volatile location. This may cause explosion or fire.
Never install the unit where acid or corrosive gases are present as current leakage or electric shock may result due to corrosion.

6. A location not prone to high humidity (more than 80%)

⚠ WARNING

Do not use the unit outdoors. Current leakage or electric shock may result if the unit is exposed to rain water.
Never install the unit in a humid place or a place where it is likely to be splashed by water. Deterioration of the insulation may result which could cause current leakage or electric shock.

INSTALLATION

Prevent contamination

To prevent contamination of the chamber, select an appropriate location for installation as well as ensuring the complete disinfection of the chamber components.

1. Avoid hot and humid location

Avoid location with high temperature and/or humidity as the presence of bacteria in the air is greater than in the normal environment.

2. Avoid drafty location and location with many passers-by

Avoid locations near doors, air conditioners, fans, etc., where slight breezes can facilitate the entry of bacteria into the chamber.

3. Installation in a sterile room

To promote efficient cultivation, it may be best to install the unit in a sterile room.

4. Use clean containers

Contamination is often caused by containers such as Petri dishes or bottles stored in the chamber introducing contamination. Always keep the containers clean.

Installation

1. Remove the packaging materials and tapes

Remove all transportation packaging materials and tapes. Open the doors and ventilate the unit. If the outside panels are dirty, clean them with a diluted neutral dishwashing detergent. (Undiluted detergent can damage the plastic components. For the dilution, refer to the instruction of the detergent.) After the cleaning with the diluted detergent, always wipe it off with a wet cloth. Then wipe off the panels with a dry cloth.

2. Adjust the leveling feet

Extend the leveling feet by rotating them counterclockwise so they contact the floor or bench. Ensure the unit is level.

3. Fix the unit

Two fixtures are attached to the rear of the frame. Fix the frame to the wall with these hooks and rope or chain.

4. Ground (earth)

⚠WARNING

Use a power supply outlet with ground (earth) to prevent electric shock. If the power supply outlet is not grounded, it is necessary to install a ground by qualified engineers.

Never ground the unit through a gas pipe, water main, telephone line or lightning rod. Such grounding may cause electric shock in the case of an incomplete circuit.

BEFORE COMMENCING OPERATION

Sterilizing of chamber and attachments

Before first start-up of the unit, the chamber and internal attachments should be cleaned and sterilized as follows.

Note:
Take care not to damage the water level sensor or UV lamp (option) at the time of removal or replacement of attachments.
Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause corrosion of metal surfaces.

1. Take out all attachment such as trays, humidifying pans, etc, from the chamber. Refer to page 33 and 34.

2. Clean all of the attachments with a diluted neutral dishwashing detergent and then wash out the detergent with distilled water. (Undiluted detergent can damage the plastic components. For the dilution, refer to the instruction of the detergent.)

3. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

4. Wipe the inside wall of the chamber with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

5. Wipe the water level sensor with a gauze containing alcohol for sterilization and then wipe off with a dry gauze. Care should be taken not to stress the lead wire.

6. Replace all attachments in the chamber.
Note:
Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

7. Fill the humidifying pan with sterile distilled water.

BEFORE COMMENCING OPERATION

Connection of N_2 (or O_2) gas cylinder

⚠WARNING

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of gas. Elevated level of gas can be hazardous to health and may lead to asphyxiation and risk of death.

This incubator needs N_2 or O_2 gas depending on the setting of O_2 density. The selection is as follows:

When the setting of O_2 density is less than 18%: N_2 gas

When the setting of O_2 density is more than 22%: O_2 gas

O_2 density in the atmosphere is about 20%. For the control of O_2 density in the chamber, O_2 gas is diluted by N_2 gas when the setting of O_2 density is less than that of the atmosphere. On the contrary, O_2 gas is added when the setting of O_2 density is more than that of the atmosphere.

1. Install a pressure regulator (optional accessory MCO-100L) on N_2 or O_2 gas cylinder. Or use a regulator rated at 25MPaG (250kgf/cm^{2}G, 3600psiG) on the primary side and 0.2MPaG (2.0kgf/cm^{2}G, 30psiG) on the secondary side.

2. Using the gas supply tube provided, connect the pressure regulator to the N_2 or O_2 inlet (A/B) located at the rear left side of the incubator. Connect the main cylinder to the inlet A and connect the sub-cylinder to the inlet B so that the gas supply can be switched automatically when one gas cylinder is empty. Connect the same gas type to both inlet A and B. Never connect N_2 gas and O_2 gas at the same time to the inlet A and B respectively.

3. Set the N_2 or O_2 gas pressure on the secondary side to 0.05MPaG (0.5kgf/cm^{2}G, 7.1psiG) (at gas injection). The higher gas pressure makes control range of O_2 density wider. In addition, excessive pressure may cause disconnection of internal pipes inside the incubator, which will result in leakage of N_2 or O_2 gas into the atmosphere. **Elevated level of CO_2 gas or O_2 gas can be hazardous to health and may lead to asphyxiation and risk of death or fire by gas leakage.** The repair of the incubator will be necessary if the internal pipe is disconnected.

4. Check that no gas is leaking at any point where the pipe connects with the gas regulator or the incubator.

Note:

• Refer to “Procedure for replacement of gas cylinder” enclosed with the unit at the time of replacement.

• The incubator, including the gas supply pipes and services must be examined at frequent intervals to ensure they are safe. Ensure that items such as pipes are replaced if there is any sign of deterioration.

⚠ WARNING

O_2 gas increases the susceptibility of substances to burn. Take care of the handling of flame in a room where the incubator is installed.

BEFORE COMMENCING OPERATION

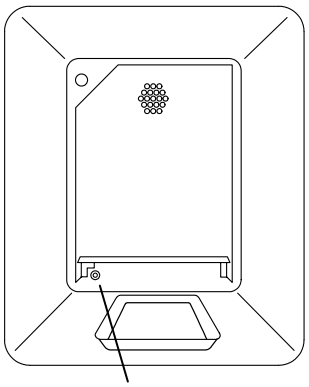
Connection of gas injection nozzle

In the case of control of O_2 density in the chamber, connect the gas injection nozzle to the gas injection port by using the connecting pipe enclosed (inner diameter; 5mm, outer diameter; 9mm, length; 300mm). This helps faster recovery of humidity after opening of the inner door.
Fill the humidifying pan with sterile distilled water so that the injection nozzle can be under the water level.

1. Inside of unit is arranged as shown in Fig.1 when humidifying pan cover removed. There is a gas injection port in the lower left-hand corner.

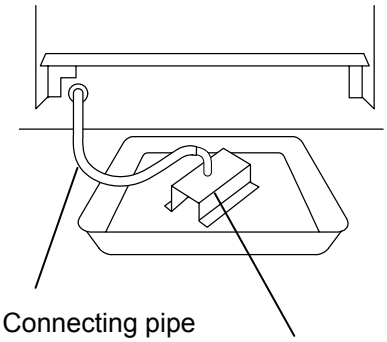
2. Connect gas injection nozzle to gas injection port using connecting pipe. (Fig.2)

3. Connecting gas injection nozzle is as shown in Fig.3.



Gas injection port

Fig.1



Connecting pipe

Gas injection nozzle

Fig.2

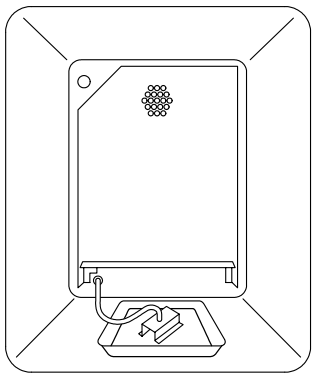


Fig.3

BEFORE COMMENCING OPERATION

Connection of CO_2 gas cylinder

⚠WARNING

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO_2 gas. Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices. Keep proper gas pressure to avoid gas leak.

The optional kit MCO-5GC is available for this incubator. MCO-5GC is an automatic gas supply changeover kit which switches the gas supply when one gas cylinder becomes empty.
The connection of CO_2 gas cylinder is different between with MCO-5GC and without MCO-5GC.

Use a liquefied CO_2 gas cylinder, not a siphon (dip tube) type. The CO_2 gas should be 99.5% or purer.

1. Install a pressure regulator (optional accessory MCO-100L) on the cylinder. Or use a regulator rated at 25MPaG (250kgf/cm^{2}G, 3600psiG) on the primary side and 0.2MPaG (2.0kgf/cm^{2}G, 30psiG) on the secondary side.

2. The connecting port for CO_2 gas is located at the rear left side of the incubator (see page 11). Use the port A only when MCO-5GC is not installed. With MCO-5GC installed, use the port A and B.

< When MCO-5GC is not installed >
Using the gas supply pipe provided, connect the pressure regulator to the CO_2 connecting port A located at the rear left hand side of the incubator.

< When MCO-5GC is installed >
Two gas cylinders having CO_2 gas regulator are necessary. Connect the main cylinder to the CO_2 connecting port A and connect the sub-cylinder to the port B.

3. Set the CO_2 pressure on the secondary side to 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG) (at gas injection). Excessive pressure may cause disconnection of internal pipes inside the incubator which will result in leakage of CO_2 gas into the atmosphere. **Elevated level of CO_2 gas can be hazardous to health and may lead to asphyxiation and risk of death.** The repair of the incubator will be necessary if the internal pipe is disconnected.

4. Check that no gas is leaking at any point where the pipe connects with the CO_2 regulator or the incubator.

Note:
• Refer to “Procedure for replacement of gas cylinder” enclosed with the unit at the time of replacement.
• The incubator, including the gas supply pipes and services must be examined at frequent intervals to ensure they are safe. Ensure that items such as pipes are replaced if there is any sign of deterioration.

OPERATING INSTRUCTIONS

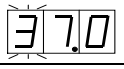
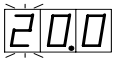
Operation of keys on the control panel

Table below shows the basic procedure for setting the chamber temperature, CO_2 and O_2 density. The upper limit alarm temperature setting is also shown in the table. Perform key operations in the sequence indicated in the table. The example in the table is based on the assumption that the desired temperature is 37°C, CO_2 density is 5% and O_2 density is 5%. Adjustment of the upper limit regulator should be executed after the chamber temperature reaches the stable condition.

(The unit is set at the factory so that the chamber temperature is 37°C, CO_2 control is 0% and O_2 density is 20%.)

Allow at least 4 hours until the next setting after setting of desired chamber temperature and setting CO_2 density to 0%, at the time of first start-up or start-up after no use for long period.

Basic operation (Example: Chamber temperature; 37°C, CO_2 density; 5% O_2 density; 5%)

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	----	The current chamber temperature is displayed in temperature indicator.
2	Press SET key.	SET	The left digit is flashed. 
3	By pressing digit shift key and numerical value shift key, set the figure to 37.0.		When pressed, the changeable digit is shifted.
			When pressed, the figure of settable digit changes.
4	Press ENT key.	ENT	Set temperature is memorized. Left digit in CO_2 density indicator is flashed. 
5	By pressing digit shift key and numerical value shift key, set the figure to 05.0.		When pressed, the changeable digit is shifted.
			When pressed, the figure of settable digit changes.
6	Press ENT key.	ENT	Set CO_2 density is memorized, and Left digit in O_2 density indicator is flashed. 
7	By pressing digit shift key and numerical value shift key, set the figure to 05.0.		When pressed, the changeable digit is shifted.
			When pressed, the figure of settable digit changes.
8	Press ENT key.	ENT	Set O_2 density is memorized.
9	(Executed after the chamber temperature reaches the stable condition) Adjust upper limit regulator so that the alarm temp. is 1°C higher than chamber temperature.		In CO_2 density indicator, HI is displayed. In temperature indicator, upper limit temp. is displayed. The upper limit temp. can be changed by turning upper limit regulator.
10	Press ENT key.	ENT	This is the end of set mode and the indicators display current temperature and density.

• In each set mode, if the change of the setting is not necessary, pressing SET key skips to next set mode.

• When the CO_2 density is set to 00.0% and O_2 density is set between 18.1 and 21.9%, the control is OFF regardless of the chamber atmosphere.

• The upper limit temperature set value will change when the regulator is turned even if the unit is not in set mode, because the alarm circuit is an independent circuit.

• In each set mode, the indicator returns to the current temperature and density display mode automatically when 90 seconds has passed without any key operation.

• The setting of CO_2 density is 70% in maximum when the setting of CO_2 density is higher than 10.1%. And, the setting of CO_2 density is 10% in maximum when the setting of O_2 density is 70.1%.

• Always ventilate the chamber when changing to CO_2 control only from O_2 control.

UV lamp

The clauses below are applicable when an optional UV system kit MCO-18UVS2 is installed.

A UV lamp is located inside the rear duct to sterilize the water in the humidifying pan and air circulating in the chamber.
Following shows precautions and instructions about the UV lamp.

• The UV light is exposed only to the inside of the duct and the humidifying pan cover when all chamber components are installed properly.

• During cultivation, ensure all components are located adequately and never turn on the UV light without the humidifying pan cover.

• Even if the unit is operating without turning on the UV lamp, the humidifying pan cover should be installed properly. An operation without pan cover will affect the temperature distribution and humidify recovery.

• When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed. The visible blue light can be checked under the humidifying pan cover. The UV light is harmful to eyes. Never turn on the UV light with the inner door or humidifying pan cover opened.

• The UV lamp is ON for a predetermined period after the outer door is closed, or every 12 hours when the outer door is not opened more than 12 hours continuously. The period of factory setting is 5 minutes. The period can be changed when necessary as shown in the page 22.

• The recommended timing of lamp replacement (the ratio of UV output is less than 70% of initial value) is when the accumulated ON time is over about 1,000 hours. The blink of the UV indicator when the UV lamp is OFF means the accumulated time has exceeded about 1,000 hours and recommends the replacement of the lamp. When replacing the UV lamp, contact Sanyo sales representative or agent.

• E18 is displayed on the temperature indicator when the UV lamp is burned out. In this case, replace the lamp immediately. At the time of replacement, also replace the glow starter (Type; FG-7P). For the replacement of UV lamp and glow starter, contact Sanyo sales representative or agent.

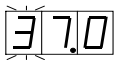
OPERATING INSTRUCTIONS

Change of setting for UV lamp ON period

The clauses below are applicable when an optional UV system kit MCO-18UVS2 is installed.

Follow the procedure below when changing the setting for UV lamp ON period.

Basic operation sequence (Example: change of UV lamp ON period from 5 minutes to 3 minutes)

	Description of operation	Key operated	Indication after operation
1	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed. 
2	By pressing digit shift key and numerical value shift key, set the figure to F01.	▶▶	When pressed, the changeable digit is shifted.
		▲▲	When pressed, the figure of settable digit changes.
3	Press ENT key.	ENT	The current setting is displayed in the CO_2 density indicator. 
4	By pressing digit shift key and numerical value shift key, set the figure to 003.	▶▶	When pressed, the changeable digit is shifted.
		▲▲	When pressed, the figure of settable digit changes.
5	Press ENT key.	ENT	Set value is memorized and the display return to normal display mode.

• The available set range for the UV lamp is between 0 and 30 minutes (000 to 030). When set to 000, the UV lamp is not turned on.

• The UV lamp is turned off during ON period when the outer door is opened. After closing the outer door, the lamp turns on during predetermined period.

• Condensation will occur and/or temperature distribution may be affected due to the heat of the UV lamp when the setting of the lamp operation is longer than 5 minutes or if only the outer door is opened repeatedly.

• For the replacement of UV lamp, contact Sanyo sales representative or agent.

Pressing CAL key for about 5 seconds leads the calibration mode. In the calibration mode, the calibration of temperature and CO_2 density is possible. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing CAL key accidentally. After about 90 seconds, the unit returns to chamber temperature display mode automatically.

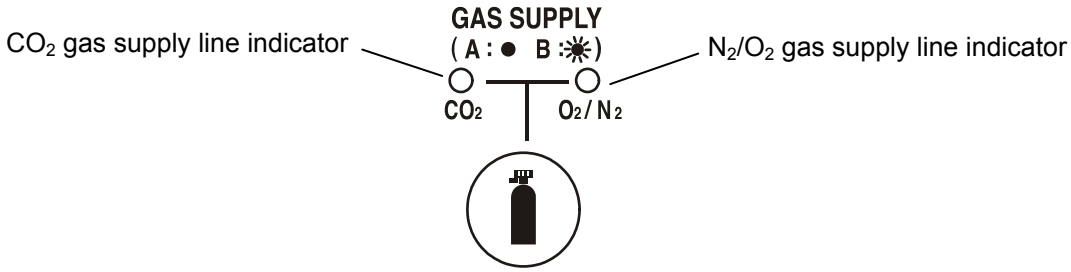
OPERATING INSTRUCTIONS

Automatic gas cylinder changeover

This incubator is provided with an automatic cylinder changeover system, which switches the gas (N_2 or O_2) cylinder when one gas cylinder becomes empty.
Also, an automatic CO_2 cylinder changeover system (MCO-5GC) is available as an optional accessory. This kit switches the gas supply line when one CO_2 gas cylinder becomes empty.
Note: The installation of MCO-5GC should be implemented by a qualified service personnel.

1. Indication of gas supply line currently used

	Lamp ON	Lamp blink with long interval
N_2/O_2 gas supply line indicator	Gas cylinder A	Gas cylinder B
CO_2 gas supply line indicator	Gas cylinder A (only when MCO-5GC installed)	Gas cylinder B (only when MCO-5GC installed)



2. The N_2/O_2 gas supply line switches when there is no change in O_2 density for a while even if gas valve is opened. Such status is regarded as the empty gas cylinder.
Similarly, CO_2 gas supply line switches when one gas cylinder is empty if MCO-5GC is installed.
The notice of change of gas supply line is as follows:

	Temperature indicator	CO_2 density indicator	O_2 density indicator
When N_2 or O_2 gas supply line is switches automatically	Current chamber temperature and E02 is displayed alternately.	Current CO_2 density is displayed.	Current O_2 density and empty cylinder is displayed alternately "A or b".
When CO_2 gas supply line is switches automatically (only when MCO-5GC is installed)	Current chamber temperature and E01 is displayed alternately.	Current CO_2 density and empty cylinder is displayed alternately "A or B".	Current O_2 density is displayed.

• By pressing BUZZER key, the alarm is canceled and the incubator returns to the normal operation.
• Replace the cylinder A when the gas supply line is switched from cylinder A to cylinder B. Care should be taken to the cylinder since a little gas may remain in the cylinder A.
• The supply line is switched to the cylinder A again when the cylinder B is empty.

Note:
The changeover of the gas supply line (N_2 or O_2 and CO_2) is determined based on the recovery of CO_2 and O_2density in the chamber. The changeover can be accomplished by some occasions (such as block or press of gas tube, reduction of gas pressure, or insufficient open of gas valve) even if the cylinder is not empty. Check the gas volume remained in the cylinder before replacement.

3. Following shows the procedure to changeover the gas supply line (N_2/O_2 gas cylinder and CO_2 gas cylinder) manually.

(Example: Change of CO_2 gas cylinder from B to A, Change of N_2 gas cylinder from A to B)

	Operation	Key operated	Indication after operation	Gas supply line indicator	
				CO_2	O_2/N_2
1	Press SET key.	SET	The left digit on the temperature indicator blinks.	☀	●
2	Press ENT key.	ENT	The left digit on the CO_2 density indicator blinks.	☀	●
3	Press gas supply line switching key once. (Pressing the key again selects CO_2 gas cylinder B)		The blinking CO_2 gas supply lamp changes to continuous ON and cylinder A is selected.	●	●
4	Press ENT key.	ENT	The setting of CO_2 gas cylinder is memorized, and the left digit on the O_2 density indicator blinks.	●	●
5	Press gas supply line switching key once. (Pressing the key again selects N_2 gas cylinder A)		The lamp ON of N_2/O_2 gas supply lamp changes to blinking and cylinder B is selected.	●	☀
6	Press ENT key.	ENT	The setting of N_2 gas cylinder is memorized. HI is displayed on the CO_2 density indicator and the setting of upper alarm temperature is displayed.	●	☀
7	Press ENT key.	ENT	This is the end of the setting mode. The current chamber temperature and densities are displayed.	●	☀

● : lamp ON ☀ : lamp blinks

Note:

The procedure 3 above should be skipped when MCO-5GC is not installed.

OPERATING INSTRUACTIONS

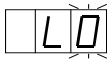
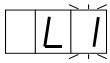
Key lock function

This unit is provided with a key lock function. When the key lock is ON, change of temperature, CO_2 or O_2 density setting through the key pad is not available.

Note: The key lock is set in OFF mode (L0) at the factory.

Display	Mode	Function
L0	Key lock is OFF	Enable to change of temperature and CO_2 setting
L1	Key lock is ON	Disable to change of temperature or CO_2setting

Procedure for key lock setting (change from key lock OFF to key lock ON)

	Description of operation	Key operated	Indication after operation
1		----	The current chamber temperature is displayed.
2	Press digit shift key for 5 seconds.	▶▶	L0 is displayed in the temperature indicator. 
3	Press numerical value shift key and scroll the figure to 1.	▲▲	When pressed, the figure of settable digit changes. 
4	Press ENT key.	ENT	The key lock is set to ON. The current chamber temperature is displayed.

Note:

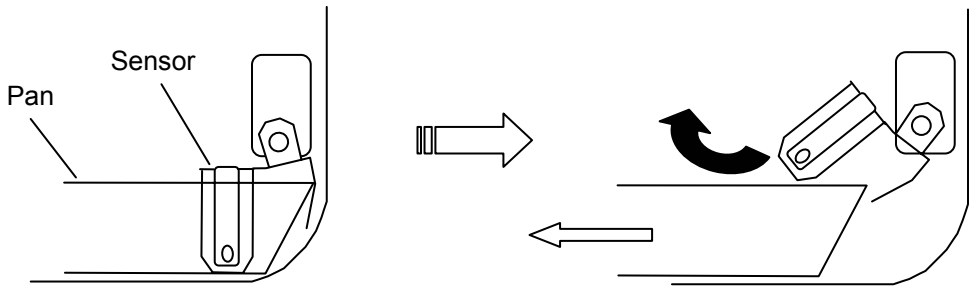
• The key lock function is available for temperature, CO_2 density and O_2 density setting.

• To cancel the key lock, set to L0 in the above procedure.

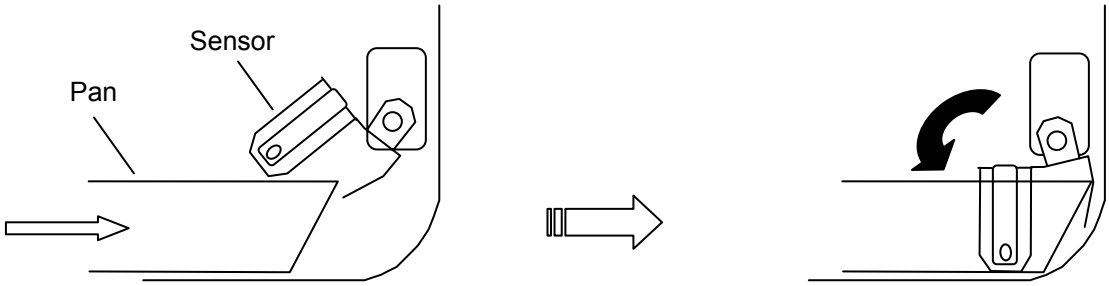
Water level sensor

This unit is provided with a water level sensor for the humidifying pan. The sensor is set in active position with respect to the installation of the humidifying pan. Take care not to damage the sensor at the time of removal or installation of the humidifying pan.

When the humidifying pan is removed (side view)



When the humidifying pan is installed (side view)



Note: At the installation, check the humidifying pan is located far depth and the sensor is down.

Note:

• Lift the sensor before installing the humidifying pan if the sensor is in lower position after maintenance.

• At the time of installation of humidifying pan, check that the pan is set properly and sensor is down in the pan. The water level alarm lamp (RH PAN) blinks if the sensor is not down completely. In this case, set the pan again in adequate location.

• Use an alcohol for sterilization when cleaning the sensor, taking care not to stress the lead wire.

• The sensor detects the water level every 30 minutes. In addition, detection is executed after operation of the outer door. It takes several seconds to detect the water level. Therefore, the water level alarm lamp may flash a few times after the outer door is closed with the humidifying pan filled sufficiently.

ALARMS & SAFETY FUNCTIONS

This unit has the alarms and safety functions shown in table below, and also self diagnostic functions.

Alarms and safety functions

Alarm & Safety	Situation	Indication	Buzzer	Safety operation
Upper limit temperature alarm	If the chamber temperature exceeds the upper limit alarm temperature set value.	Over heat lamp lights. E12 or E16 and chamber temperature are displayed alternately.	Continuous tone	Heater OFF Remote alarm
Automatic set temperature alarm	If the chamber temperature deviates from the set temperature by ±1°C or more.	All digits on the temperature indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Automatic set CO_2 density alarm	If the chamber CO_2 density deviates from the set value by ±1% or more.	All digits on the CO_2 density indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Automatic set O_2 density alarm	If the chamber O_2 density deviates from the set value by ±1% or more.	All digits on the O_2 density indicator blink.	Intermittent tone with 30 minutes delay.	Remote alarm with 30 minutes delay
Auto-return	When there is no key pressing in each setting mode for 90 seconds.	Normal display mode.	-----	The setting mode is canceled.
Key lock	When the key lock is “ON”.	-----	-----	The setting is disabled.
CO_2 gas cylinder empty	If the CO_2 density does not increase when the CO_2 gas valve is opened.	E01 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
N_2/O_2 gas cylinder empty	If the O_2 density does not change when the N_2/O_2 gas valve is opened.	E02 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm Automatic changeover of N_2/O_2 gas connection port.
CO_2 gas line changeover	When the gas supply line is switched. (only when MCO-5GC is installed)	E01 is displayed alternately with the temperature on the temperature indicator. The empty gas supply line is displayed on the CO_2 density indicator.	Intermittent tone	Gas supply line is altered. Remote alarm
O_2/N_2 gas line changeover	When the gas supply line is switched.	E02 is displayed alternately with the temperature on the temperature indicator. The empty gas supply line is displayed on the O_2 density indicator.	Intermittent tone	Gas supply line is altered. Remote alarm
Wrong CO_2 gas line connection	If the CO_2 gas is connected to wrong gas supply line.	E03 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm N_2/O_2 valve and CO_2 Valve are closed.
Wrong selection of gas between N_2 and O_2	If the N_2 gas or O_2 gas is selected wrongly.	E04 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm N_2/O_2 valve and CO_2 Valve are closed.
Chamber temperature sensor abnormality	If the temperature sensor is disconnected.	E05 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Heater OFF Remote alarm
	If the temperature sensor is short circuited.	E06 is displayed alternately with the temperature on the temperature indicator.		

ALARMS & SAFETY FUNCTIONS

Alarm & Safety	Situation	Indication	Buzzer	Safety operation
Ambient temperature sensor abnormality	If the ambient temperature sensor is disconnected.	E09 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
	If the ambient temperature sensor is short circuited.	E10 is displayed alternately with the temperature on the temperature indicator.		
CO_2 sensor abnormality	If the output voltage of the CO_2 sensor is abnormal.	E11 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO_2 valve closes. Remote alarm
O_2 sensor abnormality	If the output voltage of the O_2 sensor is abnormal.	E19 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	N_2/O_2 valve closes. Remote alarm
Main heater abnormality	If the upper limit alarm temperature alarm operates, or if the main heater is open circuit, or the main heater relay short circuit.	E12 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Bottom heater abnormality	If the bottom heater goes open circuit, or the bottom heater relay short circuit.	E13 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Door heater abnormality	If the door heater goes open circuit, or the door heater relay short circuit.	E14 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Disconnection of S.S.R for each heater	If the relay of main heater, bottom heater or sensor box heater goes open circuit.	E16 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Low humidifying water	If the water in the pan is about 0.8 liter.	RH PAN lamp blinks.	-----	-----
UV lamp failure	When the UV lamp is burned out.	E18 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Recommendation of new UV lamp	The accumulated ON time is over about 1,000 hrs.	UV indicator blinks when UV lamp is OFF.	-----	-----

• The alarm can be canceled by pressing the BUZZER key, but the remote alarm cannot be silenced. And the upper limit temperature alarm cannot be silenced with the BUZZER key.

• E01 or E02 is cleared automatically when the gas is connected correctly and the buzzer is silenced with the BUZZER key. Press BUZZER key to silence the alarm after changeover of gas supply line.

• If one of E05 to E17 is displayed, consult with a Sanyo sales representative or agent.

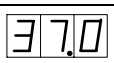
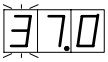
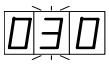
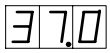
Operation after power failure

The set value is memorized by nonvolatile memory. Accordingly, the incubator resumes the operation with setting before power failure.

SETTING OF ALARM RESUME TIME

The alarm buzzer is silenced by pressing BUZZER key on the control panel during alarm condition.
The buzzer will be activated again after certain suspension if the alarm condition is continued. The suspension time can be set by following the procedure shown in the table below.
The example in the table is based on the assumption that the desired duration is 20 minutes.
Note: The duration is set in 30 minutes at the factory.

Table Changing procedure for alarm resume time (Ex: change from 30 minutes to 20 minutes)

	Description of operation	Key operated	Indication after operation
1		----	The current chamber temperature is displayed. 
2	Press CAL key for 5 seconds.	CAL	The left digit is flashed. 
3	Set the figure to F25 with the digit shift key and numerical value shift key.	▶▶	The settable digit is shifted.
		▲▲	When pressed, the figure of settable digit changes. 
4	Press ENT key.	ENT	The current setting is displayed. The middle digit is flashed. 
5	Set the figure to 020 with the numerical value shift key.	▲▲	When pressed, the figure of settable digit changes. 
6	Press ENT key.	ENT	The setting is memorized and the current chamber temperature is displayed. 

- The settable alarm resume time are 0, 10, 20, 30, 40, 50, or 60 minutes (The setting is 000, 010, 020, 030, 040, or 060 respectively). The buzzer would not reset if the reset time is set in 000.
- The set mode returns to the temperature display mode automatically when 90 seconds has passed without any key operation. In this case, any setting before pressing ENT key is not memorized.

ROUTINE MAINTENANCE

⚠WARNING

Always disconnect the power supply to the unit prior to any repair or maintenance of the unit in order to prevent electric shock or injury.

Ensure you do not inhale or consume medication or aerosols from around the unit at the time of maintenance. These may be harmful to your health.

⚠CAUTION

Always put on dry gloves to protect hands at the time of maintenance. Failure to use gloves may result in cuts or abrasions from any sharp edges or corners.

Sterilizing of chamber and attachments

When the chamber of the unit is contaminated, the chamber and internal attachments should be cleaned and sterilized as follows.

Note:
Take care not to damage the water level sensor or UV lamp(option) at the time of removal or replacement of attachments.
Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause rust.

1. Take out all trays and the humidifying pan from the chamber.

2. Remove ducts, side support (right and left side), and the fan as shown in the figures on page 33 and 34.

3. Clean all the attachments with a diluted neutral dishwashing detergent and then rinse away the detergent with distilled water. (Undiluted detergent can damage the plastic components. For the dilution, refer to the instruction of the detergent.)

4. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

5. Wipe the inside wall of the with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

6. Replace all attachments in the chamber.
Note:
Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

7. Fill the humidifying pan with sterile distilled water.

Removal of attachments

Note:
Take care not to damage the UV lamp (when an optional UV system kit MCO-18UVS2 is installed) or water level sensor at the time of removal or replacement of attachments.

1. Close the valve of the gas cylinder and turn off the power.

2. Open the outer and inner door.

3. Pull out the all trays. See Fig. 1

4. By lifting up the humidifying pan cover, unhook it at the rear and remove the cover as shown in Fig. 2.

5. Take out the humidifying pan. See Fig. 3

6. Loosen and remove the screw fixing the clamp and remove the clamp. See Fig. 4 and Fig. 5.

7. Remove all tray supports on the right and left side by lifting up the front side. See Fig. 6.

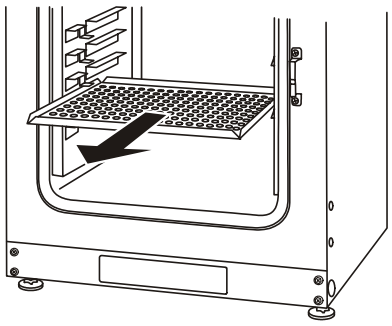


Fig. 1

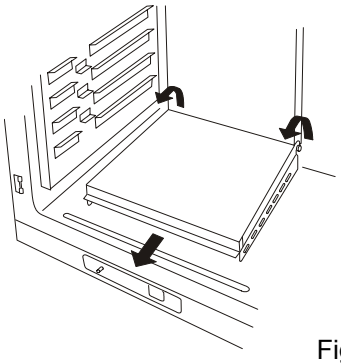


Fig. 2

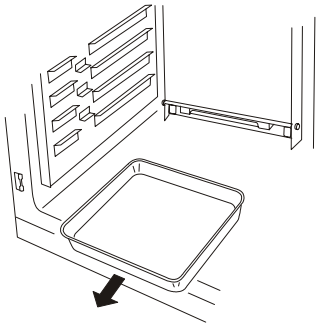


Fig. 3

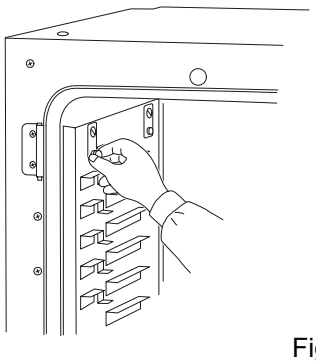


Fig. 4

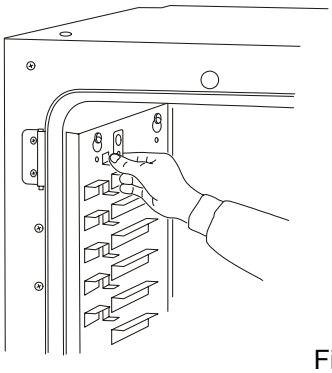


Fig. 5

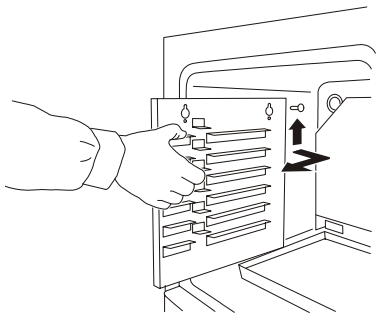


Fig. 6

8. To remove the rear duct, lift it up as shown in Fig. 7.

9. To removing the circulating fan, pull out the spring and then pull the fan. See Fig. 8.

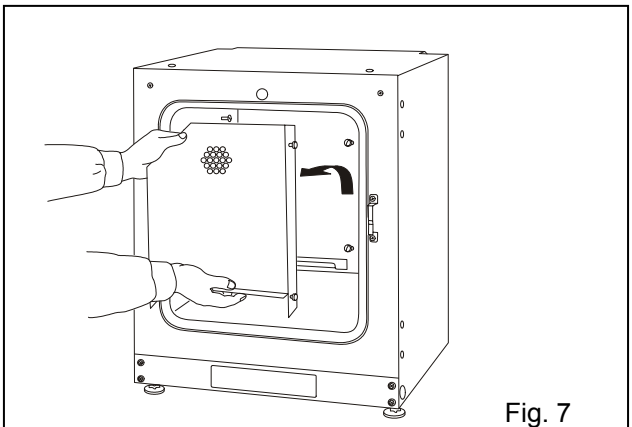


Fig. 7

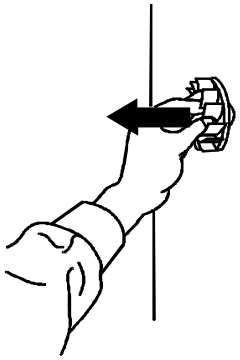


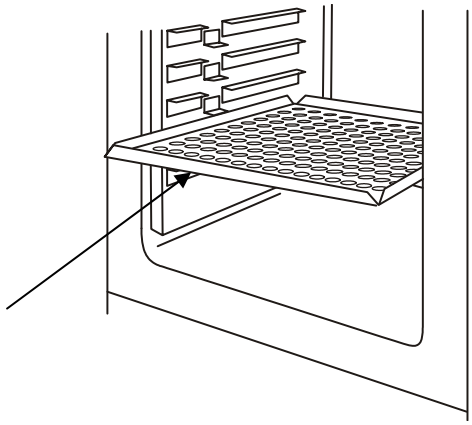
Fig. 8

10. Replace all attachments in the chamber with the reversed order mentioned above.

Note:

• Always insert the fan on the motor shaft surely. Check that the fan does not hit the rear panel by turning the fan manually. Improper insertion may cause poor performance.

• As shown in the figure, set the shelf with the edge bent upward. Improper setting may cause a tilted or unstable condition.



ROUTINE MAINTENANCE

Filling the humidifying pan

To fill the humidifying pan or to replace the water in the humidifying pan, do the following:

1. Lift the front side of the humidifying pan cover as shown in Fig. 1.

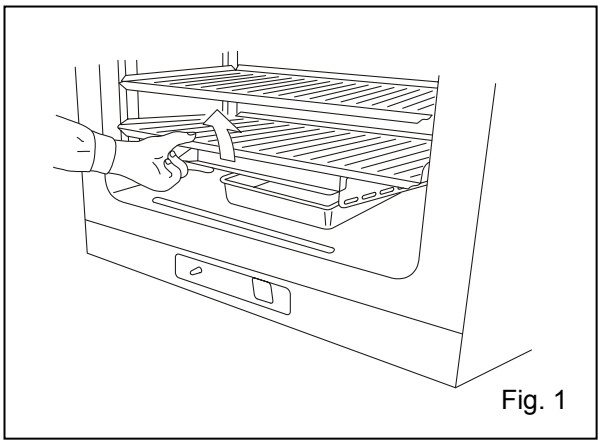


Fig. 1

2. Pull out the humidifying pan toward you. See Fig. 2.

3. Dispose of the water in the pan and wash it with a neutral dishwashing detergent. (Undiluted detergent can damage the plastic components. For the dilution, refer to the instruction of the detergent.) Then rinse the pan with distilled water sufficiently. Finally, wipe the pan with a soft cloth and alcohol for disinfection.

4. Wipe off the bottom of the chamber completely.

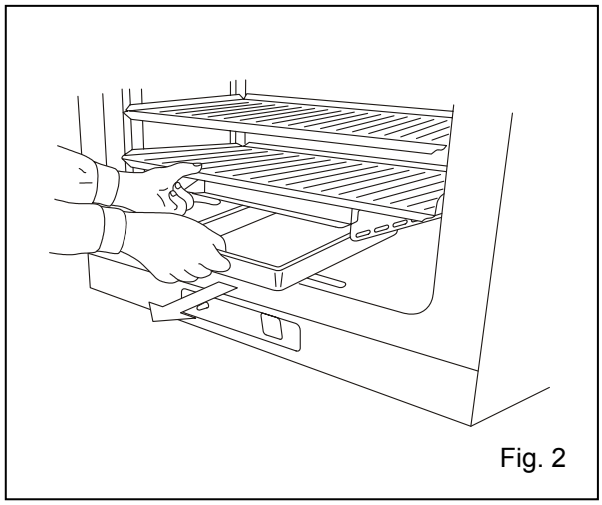


Fig. 2

5. Place the pan under the pan cover and pour the sterile distilled water (about 1.5 liters) into it. See Fig.3. Make sure that the water is pre-heated at 37°C.

6. Push the pan into its correct position and replace the cover over the pan. Close the inner and outer door.

7. Check that the water level alarm lamp on the control panel is off.

Note:

• The sterile water filled in the humidifying pan should be pre-heated at 37°C. Cold water lowers the chamber temperature.

• Replace the water in the pan by the above procedure when the water level alarm lamp blinks.

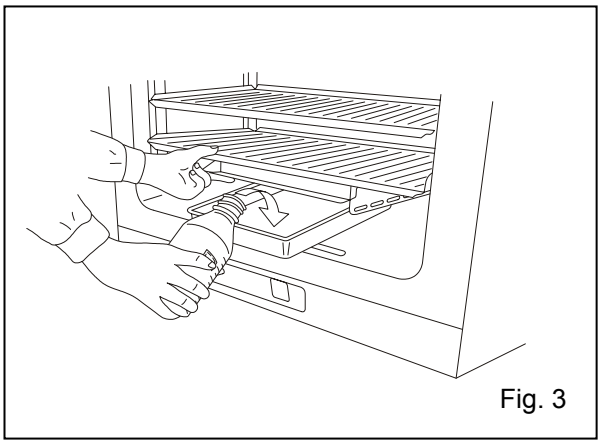


Fig. 3

CALIBRATION

Temperature calibration

1. Press the CAL key for approximately 5 seconds.
2. The third digit of the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Set the present correct temperature with the ▶▶ key and ▲ key, then press the ENT key.
4. The unit automatically reverts to the display mode.

[Example]
If the displayed chamber temperature is 37.0°C (set value) and the actual temperature is 36.8°C.
1. Press the CAL key for about 5 seconds.
2. The “3” on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Adjust the set value to the actual value of 36.8°C with the ▶▶ key and ▲ key, then press ENT key.
4. The unit automatically reverts to the display mode.

Note:
It is important to accurately measure the temperature inside the unit when performing temperature calibration. Particularly, the temperature gauge used must have an accuracy of 0.5 Class or better. The temperature must be measured at several points.
The temperature setting must not change by more than ±1.0°C during calibration. If it exceeds this, an error tone is emitted, the input data is ignored, and the unit reverts to the display mode. Consequently, if it is necessary to change the temperature by more than 1.0°C, perform calibration in several stages over a period of time.

CALIBRATION

CO_2 calibration

Carry out the O_2 calibration first when the calibrations both for CO_2 and O_2 are necessary.

[Zero setting]
Zero setting should be done when CO_2 and O_2/N_2 has not been injected yet and the stable condition (about 8 hours) of temperature/humidity inside the unit has been attained.

1. Press the CAL key for 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Set 00.0 with the ▶▶ key and ▲ key, then press the ENT key.
6. The unit automatically reverts to the display mode.

[Span setting]
Span setting should be done under stable condition of temperature, humidity, and CO_2 density.

1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO_2 density with the ▶▶ key and ▲ key, then press the ENT key.
6. The unit automatically reverts to the display mode.

Note:
This calibration is available when the present correct CO_2 density is 2% or more.

[Example]
For an internal CO_2 density of 5.0% (setting) and a measured value of 4.5%.

1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO_2 density (4.5%) with the ▶▶ key and ▲ key, then press the ENT key.
6. The unit automatically reverts to the display mode.

CALIBRATION

O_2 calibration

[Zero setting]

Zero setting should be done when CO_2 and O_2/N_2 has not been injected yet and the stable condition (about 8 hours) of temperature/humidity inside the unit has been attained.

1. Press the CAL key for 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO_2 density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO_2 density indicator flashes, and the temperature indicator goes out.
5. Press the CAL key once again.
6. The third digit of the O_2 indicator flashes, and the other indicators go out.
7. Set 20.0 with the ▶▶ key and ▲ key, then press the ENT key.
8. The unit automatically reverts to the display mode.

[Span setting]

Span setting should be done under stable condition of temperature, humidity, CO_2 and O_2 density.

1. Press the CAL key for about 5 seconds.
2. The third digit of the temperature indicator flashes, and the other indicators go out.
3. Press the CAL key once again.
4. The third digit of the CO_2 indicator flashes, and the other indicators go out.
5. Press the CAL key once again.
6. The third digit of the O_2 indicator flashes, and the other indicators go out.
7. Set the present correct O_2 density with the ▶▶ key and ▲ key, then press the ENT key.
8. The unit will automatically revert to the display mode.

[Example]

If the O_2 density is 5.0% and a measured value is 4.8%.

1. Set the indication to 4.8 using step 7, then press the ENT key.
2. The unit will automatically revert to the display mode.

Note:

・The calibration is applicable when the set value and present value are less than 15% or more than 25% O_2 density.
・The separate calibration is needed as the low density (less than 15%) and high density (more than 25%) has the span calibrating value respectively.
・Always carry out the CO_2 calibration after O_2 calibrating ([ZERO],[SPAN]).

TROUBLESHOOTING

If the unit malfunctions, check out the following before calling for service.

The unit does not operate at all

• The unit is not plugged correctly into a power outlet.
• The circuit breaker at the power source is active or a power failure has occurred.
• The power supply code is connected to the port attached on the rear of the cabinet.

The key operation is disabled

• The key lock function is set in ON mode.

If the alarm function operates

[At the beginning of operation]

• The chamber temperature is not equal to the set value.
• The chamber CO_2 density is not equal to the set value.
  a. The secondary pressure of the pressure regulator is not equal to the set value [for CO_2 gas; 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG), for N_2/O_2 gas; 0.05MPaG (0.5kgf/cm^{2}G, 7.1psiG)].
  b. The tube is not connected securely between the pressure regulator and the unit.

[During operation]

• The upper limit alarm temperature is not set at least 1°C higher than the set chamber temperature.
• The set temperature value was changed, or the door was left open for a long period. Or a low temperature load was placed inside the unit. In this case, if the unit is left as it is, the alarm will eventually clear itself.
• The gas tube has slipped off or the gas leaks.
• The set value of the gas density was changed.
• The gas cylinder is empty. Check the primary pressure of the CO_2 cylinder once a week. (The primary pressure of less than 3.8MPaG (38kgf/cm^{2}G) means a little gas in the cylinder. Replace the cylinder soon.

If the chamber temperature is not equal to the set temperature

• The ambient temperature must always be at least 5°C less than the set temperature.
• The outer door was closed while the inner door was left open.

If the gas density does not coincide with the set value

• The secondary pressure is not set to the specified value [for CO_2 gas; 0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG), for N_2/O_2 gas; 0.05MPaG (0.5kgf/cm^{2}G, 7.1psiG)].
• The gas tube is clogged or chinked.
• The humidifying pan is not filled with sterile distilled water. (Always use sterile distilled water.)

If the chamber humidity does not rise

• The humidifying pan is not filled with sterile distilled water. (Always use sterile distilled water.)

If the gas consumption is too much

• The door is opened frequently.
• There is any gas leakage at the connection or pin hole on the tube. It is recommended to replace the tube once a year.
• The gasket of the inner door is not completely sealed.
• The access port at the upper left corner is opened.

If normal cultivation cannot be done and chamber gas density is suspect

• The environment around the unit is not normal. The source of the contaminated gas is nearby.
• The unit is installed in an enclosed space.

If it takes much time to recover the gas density

• HEPA filter is provided in the gas piping. If it takes much time to recover the gas density even though the gas pressure is normal, it may be that dust on the HEPA filter prevents the gas flow. Consult the Sanyo dealer or agent.

ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe under the following conditions (based on the IEC 1010-1):

1. Indoor use;

2. Altitude up to 2000 m;

3. Ambient temperature 5°C to 35°C

4. Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C;

5. Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage;

6. Other supply voltage fluctuations as stated by the manufacturer;

7. Transient overvoltages according to Installation Categories (Overvoltage Categories) II; For mains supply the minimum and normal category is II;

8. Pollution degree 2 in accordance with IEC 664.

DISPOSAL OF UNIT

⚠WARNING

If the unit is to be stored unused in an unsupervised area for an extended period **ensure that children do not have access and doors cannot be closed completely.**

The disposal of the unit should be undertaken by appropriate personnel. Always remove doors to prevent accidents such as suffocation.

STACKED MODULE

This unit can be stacked by using the stacking kit. Following shows the procedure for stacking the unit. Consult with a Sanyo representative or agent prior to stacking procedure as such work involves dangers.

⚠WARNING

Select a level and sturdy floor having enough strength for installation of stacked module.
Never stack 4 or more units.
Take care not to drop or tip over the unit when stacking as this can cause injury or damage of the unit.

1. Turn off the power switch and disconnect a plug of each unit.

2. The stacking plate A and B are contained in accessories bag.

Note:

When stacking the unit, 2 stacking plates A and 2 stacking plates B are necessary.

3. Check that the lower unit is level.

4. Remove two caps at 2 locations on the top front of under unit, and apply the protective sticker enclosed with the unit at each corner on the top of the lower unit to avoid scratches or damage(Fig.A).

5. Fix the stacking plate A at 2 locations on the top front of the lower unit by using 2 screws contained in accessories bag.

6. Remove the front panel on the upper unit by unscrewing the 4 fixing screws and then disconnect the wires and gas tube.

7. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.

8. Secure the upper unit with the stacking plate A and 2 screws contained in accessories bag.

9. Remove 2 screws on the above right and left on the rear side of the lower unit.

10. Remove 1 screw on the bottom right and left on the rear side of the upper unit.

11. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 9 and 10.

12. Replace the front panel on the upper unit after connecting the wires and gas tube.

13. Repeat procedures from step 3. when stack more.

14. Fix the stacked unit to the wall with 2 stacking plate B on the rear of the top unit and rope or chain.

STACKED MODULE

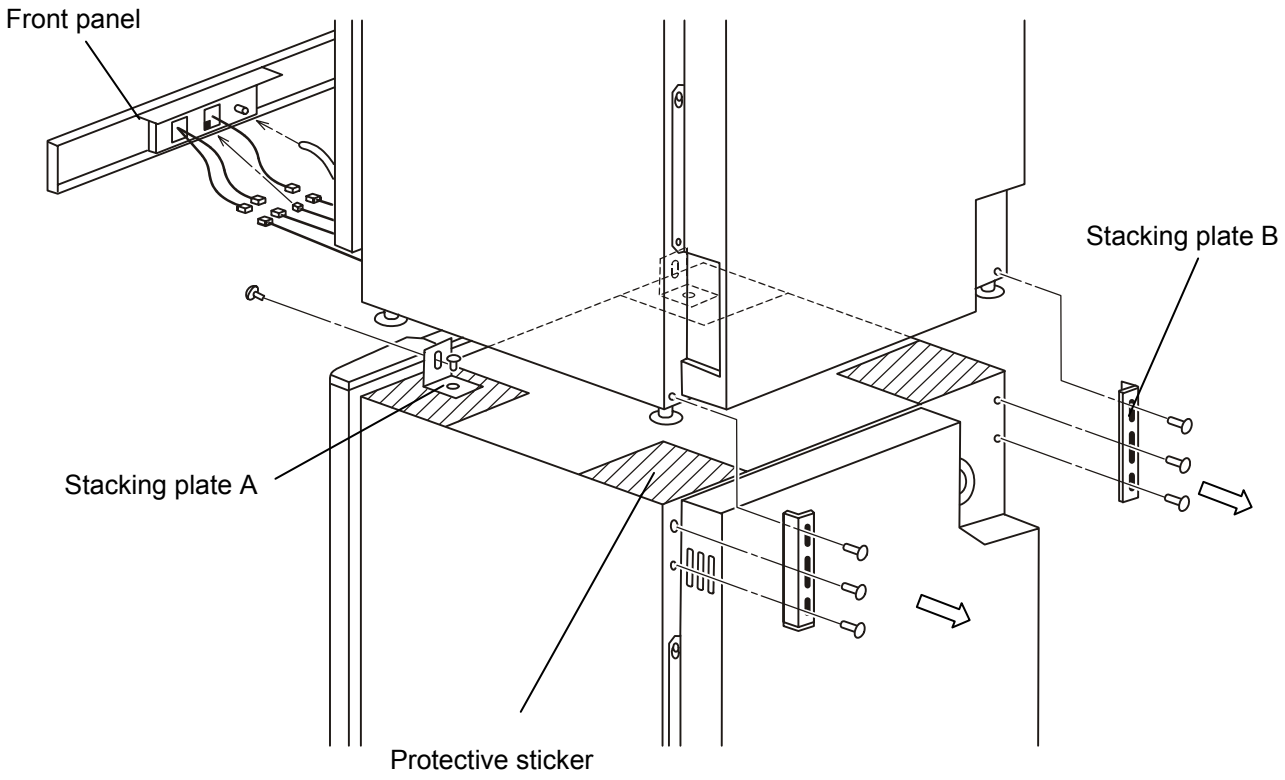


Fig.A ＜View from quarter rear side＞

SPECIFICATIONS

Name	Multi-gas Incubator		
Model	MCO-5M		
External dimensions	W480 x D548 x H575 (mm)		
Internal dimensions	W350 x D378 x H375 (mm)		
Interior volume	49 L		
Exterior	Acrylic finish baked on zinc galvanized steel		
Interior	Stainless steel containing copper (R corner structure)		
Outer door	Acrylic finish baked on zinc galvanized steel, Reversible support (selectable right or left-hand door)		
Inner door	Tempered glass		
Tray	Made of stainless steel containing copper (standard 3 trays , maximum 6 trays) W310 x D310 x H12 (mm), Maximum load; 4 kg/tray		
Access port	Inner diameter; 30 mm, On the back side		
Insulation	Rigid polyurethane foamed-in place (CFC-FREE)		
Heating system	Direct Heat & Air (DHA) jacket system		
Heater	180W		
Humidifying system	Natural evaporation with humidifying pan		
Temperature controller	PID control system		
Temperature display	Digital display		
CO_2 controller	PID control system/TC sensor(direct detection in chamber)		
CO_2 density display	Digital display		
O_2 controller	PID control system/Zirconia sensor(direct detection in chamber)		
O_2 density display	Digital display		
Air circulation	Fan assisted		
Air filter	0.3μm, Efficiency; 99.97% or more		
Water level sensor	Optical type		
Alarm	High/Low temperature alarm, CO_2 density alarm, O_2 density alarm Door alarm, Upper limit temperature alarm		
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A		
CO_2 inlet connection	4 to 6 mm diameter tube		
CO_2 inlet pressure	0.03MPaG (0.3kgf/cm^{2}G, 4.3psiG)		
O_2 inlet pressure	0.05MPaG (0.5kgf/cm^{2}G, 7.1psiG)		
Accessories	Power supply cord ,3 trays, 3 gas tube, 1 humidifying pan, Stacking plate A and B, 4 protective stickers, 6 tube bands 1 injection nozzle, 1injection nozzle tube		
Weight	50 kg		
Optional accessory	Self-contained CO_2 cylinder changeover system (MCO-5GC) Extra tray (MCO-30ST) , CO_2 cylinder regulator (MCO-100L) UV system kit (MCO-18UVS2), Roller base (MCO-5RB)		
Maximum power consumption	205 W		
Total maximum current	110 to 120 V, 60 Hz	220 V, 60 Hz	220 to 240 V, 50 Hz
	1.8 A	0.9 A	0.9 A

Note: Design or specifications will be subject to change without notice.

The ballast is not user replaceable part. Please contact a qualified service personnel.

PERFORMANCE

Temperature control range	Ambient temperature +5°C to 50°C (ambient temperature; 5°C to 35°C)
Temperature distribution	± 0.25°C* (ambient temperature; 25°C, setting; 37°C, 5%, no load)
Temperature variation	± 0.1°C (ambient temperature; 25°C, setting; 37°C, 5%, no load)
CO_2 control range	0 to 20%
CO_2 variation	± 0.15% (ambient temperature; 25°C, setting; 37°C, 5%, no load)
O_2 control range	1 to 18%, 22 to 80%
O_2 variation	± 0.2% (ambient temperature; 25°C, setting; 37°C, 5%, no load)
Chamber humidity	95 ± 5% R.H.
Maximum heat emission	740 kJ/h
Usable environment condition	Temperature; 5°C to 35°C, Humidity; equal or less than 80% R.H. (The designed performance may not be obtained when the ambient temperature is equal or less than 15°C)

Note: The unit with CE mark complies with EC directives 89/336/EEC, 93/68/EEC and 73/23/EEC.

* It is based on our measuring method.

⚠ CAUTION

Please fill in this form before servicing.

Hand over this form to the service engineer to keep for his and your safety.

Safety check sheet

1. Incubator contents : ☐Yes ☐No
   Risk of infection: ☐Yes ☐No
   Risk of toxicity: ☐Yes ☐No
   Risk from radioactive sources: ☐Yes ☐No

   (List all potentially hazardous materials that have been stored in this unit.)
   Notes :

2. Contamination of the unit
   Unit interior ☐Yes ☐No
   No contamination ☐Yes ☐No
   Decontaminated ☐Yes ☐No
   Contaminated ☐Yes ☐No
   Others:

3. Instructions for safe repair/maintenance of the unit
   a) The unit is safe to work on ☐Yes ☐No
   b) There is some danger (see below) ☐Yes ☐No
   Procedure to be adhered to in order to reduce safety risk indicated in b) below.

Date :
Signature :
Address, Division :
Telephone :

Product name :	Model :	Serial number :	Date of Installation :
Multi-gas incubator	MCO-5M		

Please decontaminate the unit yourself before calling the service engineer.