

INSTRUCTION MANUAL MCO-20AIC CO2 Incubator



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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.
-  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.














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 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.
 -  **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 pose a hazard.
 -  **Use a power supply outlet with ground (earth)** to prevent electric shock. If the power supply outlet is not grounded, 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 CO₂ gas. Elevated level of CO₂ gas can be hazardous to health and may lead to asphyxiation and risk of death.**
-  **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.
 -  **Never store volatile or flammable substances** in this unit. This may cause explosion or fire.
















PRECAUTIONS FOR SAFE OPERATION

WARNING

-  As with any equipment that uses CO₂ 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.
-  **Ventilate a room air occasionally when using CO₂ gas for control.** The gas density will increase in an enclosed small room and high level of gas density is harmful for human. In addition, avoid inhaling the chamber air directly when opening the door if CO₂ gas is used.
-  Si l'appareil est utilisé dans un endroit restreint, le niveau de la densité CO₂ 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 ouvrez la porte.
-  **Use this unit in safe area when treating the poison, harmful or radiate articles.** Improper use may cause bad effect on your health or environment.
-  **Never expose the eyes directly to the UV light** as the UV light is harmful.
-  **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.
-  **Never splash water directly onto the unit** as this may cause electric shock or short circuit.
-  **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 something 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 accomplished 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.
-  **Fix the shelves securely.** Incomplete installation may cause injury or damage.
-  **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 be resulted from the deterioration of insulation by spilled water.
-  **Do not climb onto the unit or do not put articles on the unit.** This may cause injury by tipping or damage to the unit.
-  **Never lean or press on the glass.** 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 drops out.
-  **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.
-  **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.
-  **Do not put the packing plastic bag within reach of children** as suffocation may result

CAUTIONS FOR USAGE

1. Install in proper environment

With an automatic calibrating function, the CO₂ sensor is calibrated according to an ambient air gas. Place the unit in proper environment.

2. 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. Keep the ambient temperature in adequate range.

3. Do not subject to direct air flow

Do not allow the air for air conditioning to hit the unit or door directly. Direct hit may cause condensation or contamination.

4. Always keep the chamber clean

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

5. 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 CO₂ concentration in the chamber.

6. 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. And close the doors gently. Rude closing may cause spillage of medium, incomplete closing, or damage of gasket. Before opening the inner door, check that the UV light is OFF.

7. Keep the inside panels dry

To protect the inside of the unit from contamination, the inside panels should always be kept dry. If water is spilled from a humidifying pan or if the door is kept open for a long period, condensation will form on the panels, allowing germs to breed. In such a case, wipe away the water with a dry sterile gauze. Particularly, if the medium is spilled, wipe it up immediately and sterilize the area.

8. Fill the humidifying pan with sterile distilled water

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

9. Humidifying pan and pan cover

The humidifying pan and pan cover prevent the UV light from releasing. Make sure to install them even if you do not need humidity. Install the pan cover properly since it affect the temperature distribution and humidity recovery in the chamber.

CAUTIONS FOR USAGE

10. Stored materials

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

11. Alarm

Always investigate the cause and fix the alarm condition immediately when the alarm is activated. Refer to page 20 for the alarm.

12. Never use CAL key

Never use CAL key during normal operation because the calibration mode is start by pressing this key. Wrong operation of this key will give an adverse effect on the basic performance of the unit. If you press this key accidentally, never press any keys on the control panel for 90 seconds, which returns the unit to the display mode automatically.

13. UV lamp

The UV lamp is OFF when the outer door is opened since it is related to the outer door switch. Check the UV lamp is ON with the inner door closed once a month by activating the outer door switch. If the lamp is not ON, the lamp needs to be replaced. Contact Sanyo sales representative or agent.

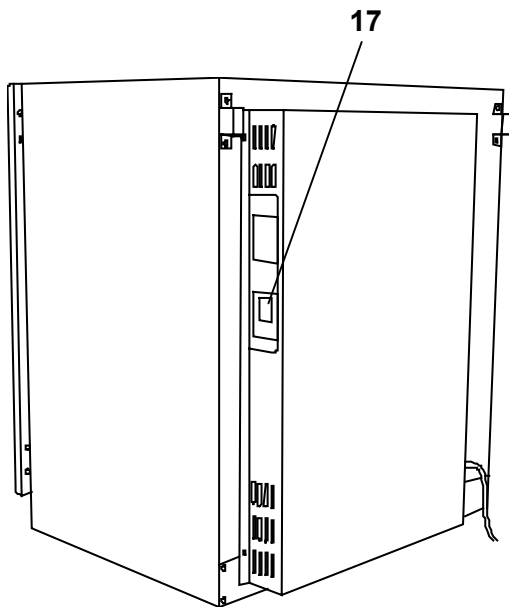
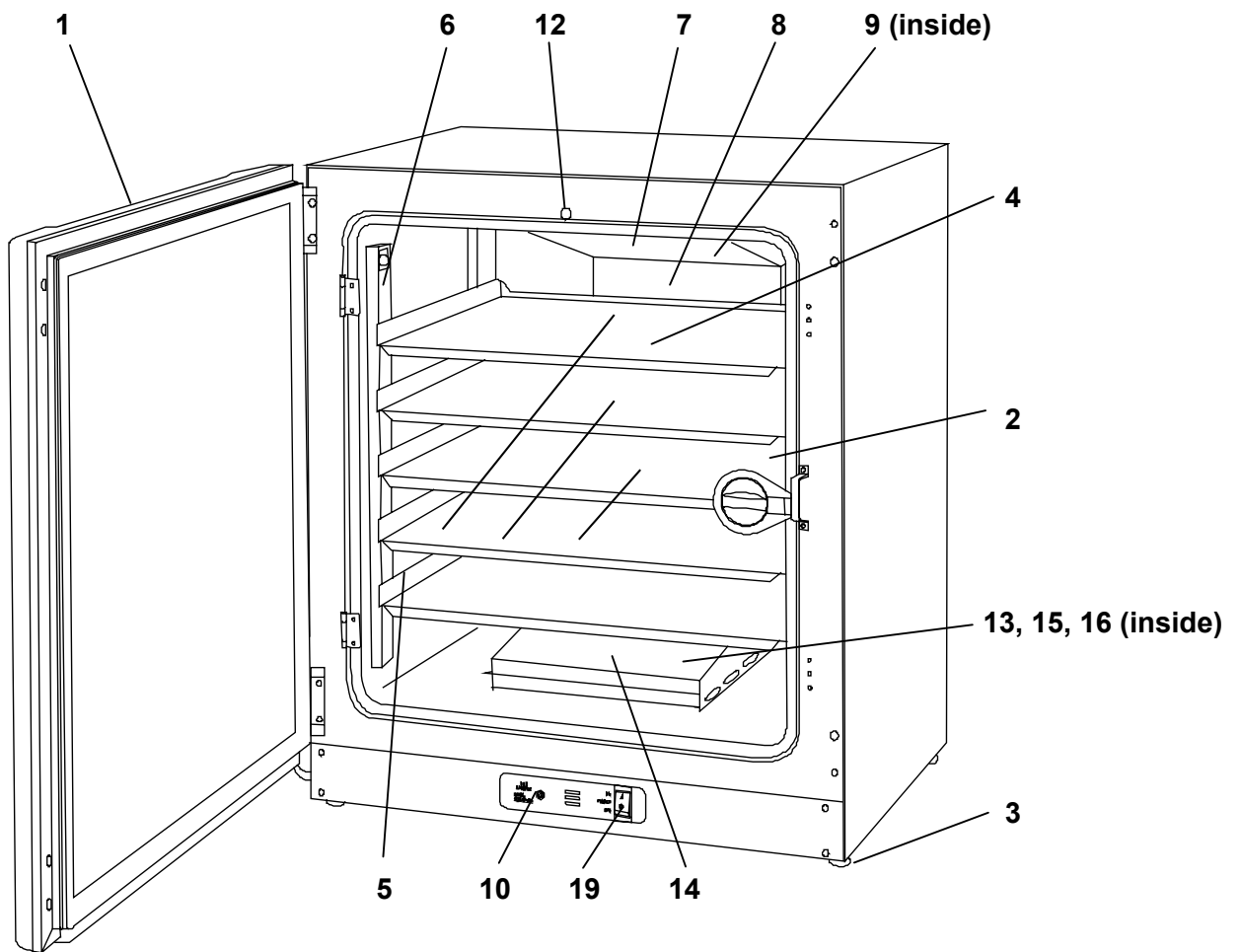
The UV lamp is located in the duct. Take care not to damage the lamp at the time of installation/removal of attachments or humidifying pan.

Note: The UV light is harmful for the eyes. Never turn on the UV lamp with the inner door opened.

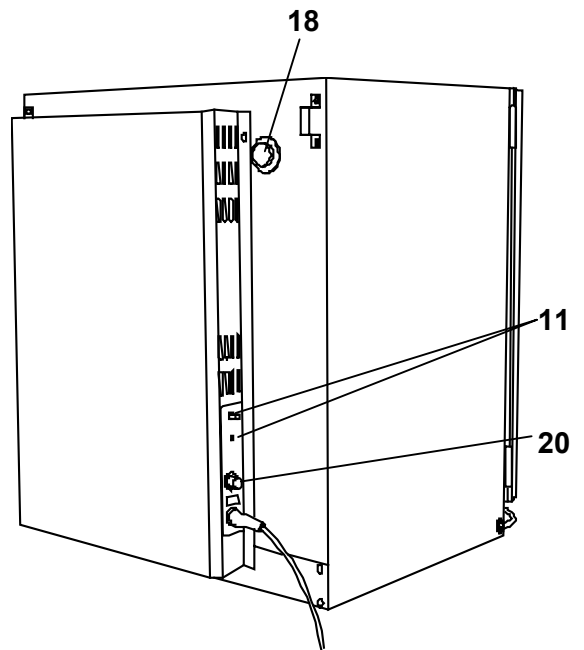
14. No use for long period

When the unit is not used for long period, dispose the water in the humidifying pan and remove the humidity in the chamber completely. Check that the chamber is enough dry before closing the doors.

INCUBATOR COMPONENTS



Rear right side



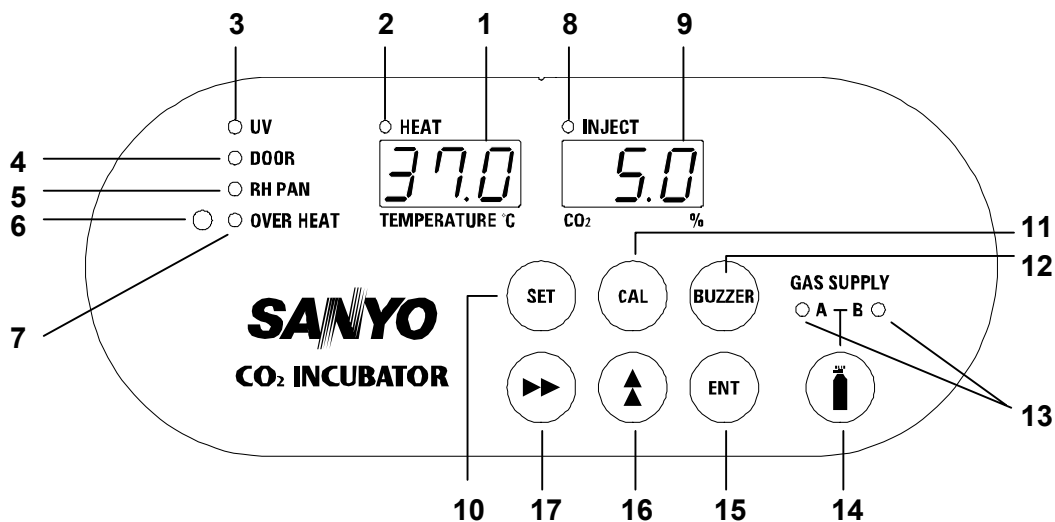
Rear left side

INCUBATOR COMPONENTS

- 1. Outer door:** Sticks to frame with magnetic packing. Door heater is installed in the door panel. The heater eliminates moisture on the inner door. The door opening is reversible. Contact Sanyo representative or agent to change the door hinge side.
- 2. Inner door:** Made of tempered glass. Avoid the excessive impact on the glass.
- 3. Leveling leg:** Used for leveling the unit.
- 4. Tray:** Can be pulled toward you.
- 5. Tray support:** Can be removed by lifting the front side and pulling toward you.
- 6. Side support:** Right and left side supports are removal for disinfection. See page 23 and 24.
- 7. Top duct:** Inlet of circulating air. Removable.
- 8. Depth duct:** Flow path for circulating air. Removable.
- 9. Fan (inside the depth duct):** Made from polypropylene resin. Can be disinfected by an autoclave.
- 10. Sample air outlet:** This also functions as an internal gas outlet, so do not cap it.
- 11. Connecting port for CO₂ gas pipe (back side):** When an optional component MCO-20GC is installed, both A and B are available. In the case of no MCO-20GC, only A is available. Refer to page 14 for gas cylinder connection. Ensure that the gas pressure is set at 0.03MPaG (0.3kgf/cm²G, 4.3psiG).
- 12. Door switch:** Detects the door opening/closing and stops the circulating fan and electromagnetic valve for CO₂ when door is open. And also turns off the UV lamp by door opening.
- 13. Humidifying pan:** Use the sterile distilled water to fill the pan. Install the pan properly so that it can be covered with the pan cover.
- 14. Humidifying pan cover:** Prevents the UV light from exposing to the chamber. When filling the pan, lift the front side and take out the pan. See page 23 for the details.
- 15. UV lamp:** A UV lamp that never generates ozone. Never look at the UV light directly. For the replacement, contact Sanyo representative or agent.
- 16. Water level sensor for humidifying pan:** Located at the depth of the chamber and detects the water level in the humidifying pan. Never add an excessive force on the sensor at the time of maintenance.
- 17. Remote alarm terminal:** Refer to page 21.
- 18. Access port:** When no use, cap with a rubber cap on both outside and inside.
- 19. Power switch:** Main switch of the unit. Also has a function as a over-current breaker (15A).
- 20. Glow lamp:** For UV lamp (model; FG-7P)

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.
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 about 1 liter.
6. **Upper limit regulator**: This regulator is used to set the upper limit temperature.
7. **Over heat lamp** (OVER HEAT): This lamp lights when the chamber temperature reaches the upper limit set value.
8. **CO₂ inject lamp** (INJECT): This lamp lights when CO₂ gas is being supplied.
9. **Digital CO₂ density indicator** (CO₂ %): Normally, this indicator shows the CO₂ concentration in the chamber. In the setting mode, it indicates the set value of the CO₂ concentration.
10. **Set key** (SET): Pressing this key to enter the setting mode, and the digits that can be set flash.
11. **Calibration key** (CAL): By pressing this key for about 5 seconds, the unit enters a function mode. Used for change the UV lamp ON period.
12. **Alarm buzzer stop key** (BUZZER): Press this key to silence the buzzer when the alarm operates and the buzzer sounds. The remote alarm also stops by this key. Press it once again to reactivate the buzzer.
13. **CO₂ gas supply line indicator** (A/B): The lamp of supply line currently used brightens provided that MCO-20GC is installed. This will flash when a gas cylinder is empty.
14. **CO₂ gas supply line switching key**: This key to select CO₂ gas supply line is available only when an automatic cylinder switcher MCO-20GC (option) is installed. When one CO₂ gas cylinder is empty, the CO₂ is supplied by the other cylinder automatically. But if necessary, by pressing this key, the supply line can be switched between A and B manually.
15. **Enter key** (ENT): Pressing this key memorizes the set value in the controller.
16. **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.
17. **Digit shift key** (▶▶): Pressing this key in the setting mode causes the changeable digit to shift.

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**

If the unit is used in a small confined room, the CO₂ density level in the air could rise and may be harmful to humans.

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

 **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 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 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 get the cultivation more efficiently, install the unit in a sterile room.

4. Use clean containers

The contamination is mainly caused by the containers such as Petri dishes or bottles stored in the chamber. 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 neutral detergent and rinse with clean water.

2. Adjust the leveling legs

Extend the leveling legs by rotating them counterclockwise to contact them to the floor. 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 UV lamp or water level sensor 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 attachment such as trays, humidifying pans, etc, from the chamber. Refer to page 23 and 24.
2. Clean the all attachments with neutral detergent and then wash out the detergent with distilled water.
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 with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.
5. Replace all attachments in the chamber.

Note:

Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

6. Fill the humidifying pan with the sterile distilled water.

BEFORE COMMENCING OPERATION

Connection of CO₂ 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 CO₂ gas. Elevated level of CO₂ gas can be hazardous to health and may lead to asphyxiation and risk of death.

Use a liquefied CO₂ gas cylinder, not a siphon (dip tube) type. The CO₂ gas should be 99.5% or more pure.

Install a pressure regulator on the cylinder. Use a regulator rated at 25MPa on the primary side and 0.2MPa on the secondary side. Use the following procedure to attach the incubator to the cylinder:

1. Using the gas supply pipe provided, connect the pressure regulator to the CO₂ inlet located at the rear left hand side of the CO₂ incubator.

2. Set the CO₂ pressure on the secondary side to 0.03MPaG (0.3kgf/cm²G, 4.3psiG). Excessive pressure may cause disconnection of internal pipes inside the CO₂ incubator which will result in leakage of CO₂ gas into the atmosphere. Elevated level of CO₂ gas can be hazardous to health and may lead to asphyxiation and risk of death.

3. Check that no gas is leaking at any point where the pipe connects with the CO₂ regulator or the CO₂ incubator.

Note:

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.

BEFORE COMMENCING OPERATION

Automatic switcher of CO₂ gas supply line

An automatic switcher of CO₂ gas supply line (MCO-20GC) is available as an optional component. This kit switches the gas supply line when one CO₂ gas cylinder is empty.

Note: The installation of MCO-20GC should be implemented by a qualified service personnel.

After attachment of MCO-20GC, do the following:

1. Connect a CO₂ gas pipe to port A and B respectively. A connecting port for CO₂ gas pipe is located on the left back of the unit. (See page 9).
2. Connect a CO₂ gas cylinder provided with a gas pressure regulator to each gas pipe. See page 14, for the connection of the gas cylinder.
3. Open the each valve of two gas cylinder.
4. Check that the CO₂ gas supply line indicator on the control panel is lit by pressing the switching key.
5. Select a CO₂ gas supply line (A or B).
6. When one cylinder is empty, the indicator is flashed, buzzer sounds, and "E01" and current chamber temperature are displayed alternately on the control panel while the gas supply line is switched to other one. To silence the buzzer, press the buzzer stop key (BUZZER).
7. Replace an empty CO₂ gas cylinder.

Note: Be careful to handle an empty CO₂ gas cylinder as some gas can be still left in the cylinder.

This kit MCO-20GC detects that no more CO₂ gas exists in a cylinder when the CO₂ density in the chamber is not increased after a few minutes of opening of CO₂ gas valve in the unit and switches the gas supply line. The switching of supply line can be caused by some other reasons; blocking or crush of gas tube, reduce of CO₂ gas pressure, or improper opening of CO₂ gas cylinder, in spite of gas quantity in the cylinder. Therefore, always check the gas quantity in the cylinder prior to disconnection.

OPERATING INSTRUCTIONS







Set of chamber temperature and CO₂ density

Table below shows the basic procedure for setting the chamber temperature and CO₂ 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 and CO₂ density is 5%.

Note: The unit is set at the factory so that the chamber temperature is 37°C and CO₂ control is 0%.

Allow at least 3 hours until the next setting after setting of desired chamber temperature and setting CO₂ density to 0%, at the time of first start-up or start-up after no use for long term.

Basic operation sequence (Example: Chamber temperature; 37°C, CO₂ 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 ►► key and ▲ key, set the figure to 37.0.	►►	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
4	Press ENT key.	ENT	Set temperature is memorized.  Left digit in CO ₂ density indicator is flashed. 
5	By pressing ►► key and ▲ key, set the figure to 05.0.	►►	When pressed, the changeable digit is shifted.
		▲	When pressed, the figure of settable digit increases.
6	Press ENT key.	ENT	Set CO ₂ density is memorized. 
7	Adjust upper alarm temperature set knob so that the alarm temp. is 1°C higher than chamber temp.		In CO ₂ density indicator, HI is displayed.  In temperature indicator, 38.0 is displayed. 
8	Press ENT key.	ENT	This is the end of set mode and the indicators display current temperature and CO ₂ density.

Note:

In each set mode, the indicator returns to the current temperature and CO₂ density display mode automatically when 90 seconds has passed without any key operation.

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

When the CO₂ density is set to 00.0, the control is OFF with regardless of chamber density.

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

OPERATING INSTRUCTIONS











UV lamp

A UV lamp is located inside the depth 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 inside the duct and the humidifying pan cover when all chamber components are installed properly.
- * During the 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, always install the humidifying pan cover. No use of the pan cover will affect the temperature distribution and humidify recovery.
- * Even if the unit is operating without humidifying, always install the humidifying pan and the humidifying pan cover.
- * The UV lamp is turned off when the outer door is opened during ON period.
- * When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed.
- * The expecting lamp life is about 3 years, provided that the setting is 5 minutes and the frequency of door operation is 10 times per a day. But Sanyo does not warrant 3 years lamp life.
- * The UV lamp is ON for predetermined period after the outer door is closed. The period is set in 5 minutes at the factory. Change the setting as necessary as shown in the table below.
- * Consult with a Sanyo representative or agent when a UV lamp is worn out.

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  key and  key, set the figure to F01		When pressed, the changeable digit is shifted.
			When pressed, the figure of settable digit increases.
3	Press ENT key.	ENT	The current setting is displayed in the CO ₂ density indicator. 
4	By pressing  key and  key, set the figure to 003.		When pressed, the changeable digit is shifted.
			When pressed, the figure of settable digit increases.
5	Press ENT key.	ENT	Set value is memorized and the display return to normal display mode.

Note:

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

The condensation will be occurred or temperature distribution is affected due to the heat by UV lamp when the setting of lamp operation is longer than 5 minutes or only outer door is operated frequently.



Note: On incubators with serial numbers greater than 203XXXXXX, the UV lamp is designed to come on once every 12 hours for a brief period if the glass door has not been opened. Otherwise, the factory default is to allow the UV light to come on for 5 minutes after a door opening to provide active contamination control.

OPERATING INSTRUCTIONS







Key lock function

This unit is provided with the key lock function. When the key lock is ON, change of temperature or CO₂ density setting through the key pad is not available.

Note: The key lock is set in OFF at the factory.

Display	Mode	Function
	Key lock is OFF	Enable to change of temperature setting
	Key lock is ON	Disable to change of temperature setting

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  key for 5 seconds.		LO is displayed in the temperature indicator. 
3	Press  key and scroll the figure to 1.		When pressed, the figure of settable digit increases. 
4	Press ENT key.	ENT	The key lock is set to ON. The current chamber temperature is displayed.

Note:

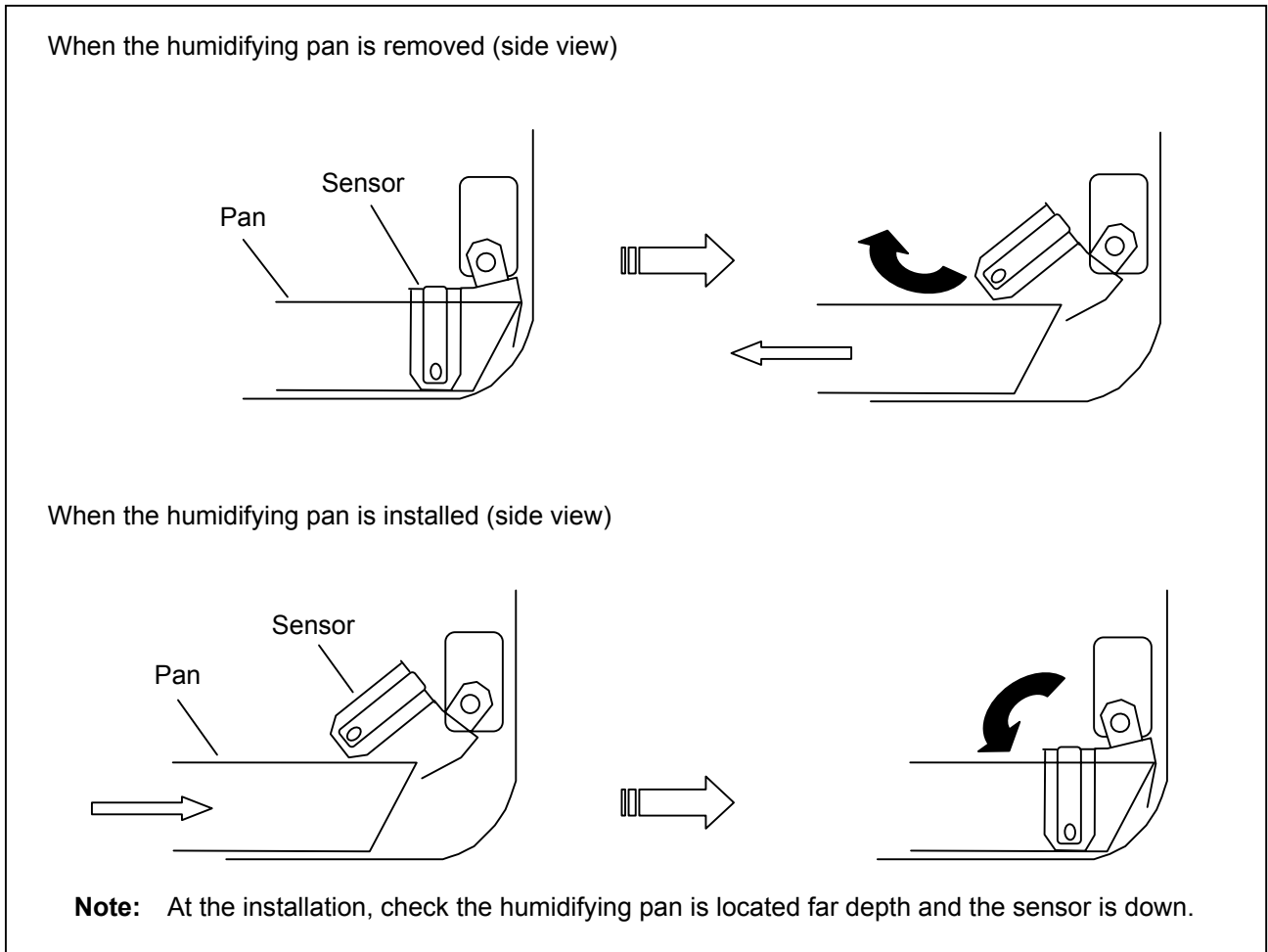
The key lock function is available to temperature and CO₂ density setting.

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

OPERATING INSTRUCTIONS

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.



Note:

- * Lift the sensor before installing the humidifying pan if the sensor is in lower position after maintenance.
- * 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. Also, the detection is executed after operation of the outer door. It takes a 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, E13, E14 and chamber temperature are displayed alternately.	Continuous tone	Heater OFF
Automatic set temperature alarm	If the chamber temperature deviates from the set temperature by $\pm 1^{\circ}\text{C}$ or more.	All digits on the temperature indicator flash.	Intermittent tone with 15 minutes delay.	----
Automatic set CO ₂ density alarm	If the chamber CO ₂ density deviates from the set value by $\pm 1\%$ or more.	All digits on the CO ₂ density indicator flash.	Intermittent tone with 15 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.
Automatic calibration function	Normally, the zero point of the CO ₂ sensor is calibrated every 4 hours (or very 10 minutes for the first hour after switch ON), using the atmosphere as the gas to be calibrated.	The decimal point (period) on the CO ₂ density indicator flashes.	----	----
CO ₂ gas cylinder empty	If the CO ₂ density does not increase when the gas valve is opened.	E01 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	----
Gas line switching	When the gas supply line is switched. (only when MCO-20GC is installed)	E01 is displayed alternately with the temperature on the temperature indicator. Gas supply line indicator flashes.	Intermittent tone	Gas supply line is altered.
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
	If the temperature sensor is short circuited.	E06 is displayed alternately with the temperature on the temperature indicator.		
Sensor box temperature sensor abnormality	If the sensor box temperature sensor is disconnected.	E07 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO ₂ valve close.
	If the sensor box temperature sensor is short circuited.	E08 is displayed alternately with the temperature on the temperature indicator.		
Ambient temperature sensor abnormality	If the ambient temperature sensor is disconnected.	E9 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	----
	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 close.
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	----
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	----
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	

Sensor box heater abnormality	If the sensor box heater goes open circuit, or the sensor box relay short circuit.	E15 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	----
Disconnection of sensor 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	----
Air pump (for sample air or auto-zero) failure	If the air pump (sampling or auto zero) does not operate, or if there is something wrong in the gas piping.	E17 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO ₂ valve close.
Low humidifying water	If the water in the pan is about 1 liter.	RH PAN lamp flashes.	----	----

* The remote alarm is silenced by pressing the buzzer stop key (BUZZER) as the remote alarm is operated in conjunction with the buzzer.

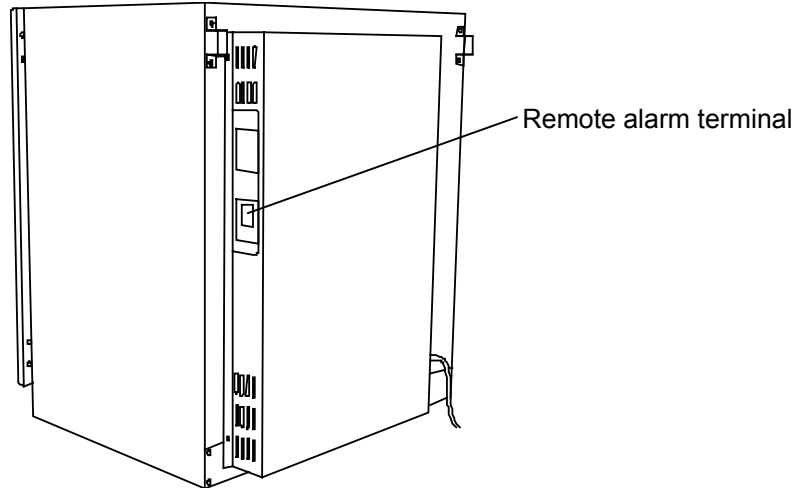
* The upper limit temperature alarm cannot be silenced with the BUZZER key.

* E01 is cleared automatically when the gas is connected correctly and the buzzer is silenced with the BUZZER key. If one of E05 to E17 (except for E12, E13, and E14) is displayed, consult with a Sanyo sales representative or agent.

ALARMS & SAFETY FUNCTIONS

Remote alarm terminal

The remote alarm terminal and remote recorder terminals are located at the rear right side.



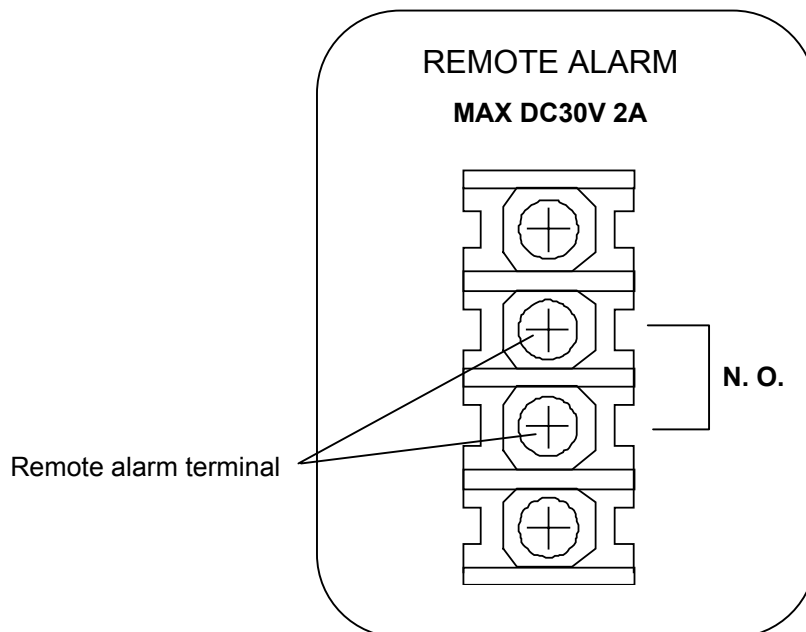
The remote alarm terminal is a contact output.

Normal : OPEN

Abnormal : CLOSE

Contact capacity : DC 30V, 2A, no voltage contact

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



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 the dry gloves to protect the hands at the time of maintenance. No gloves may cause cut of the finger by the edge or corner.

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 UV lamp or water level sensor 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 a humidifying pan from the chamber.
2. Remove top panel, side support (right and left side), tray supports, and a fan as shown in the figures on page 23 and 24.
3. Clean the all attachments with neutral detergent and then wash out the detergent with distilled water.
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 the sterile distilled water.

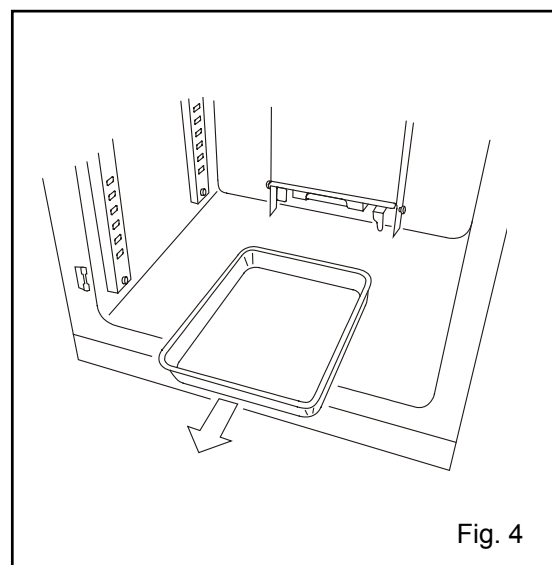
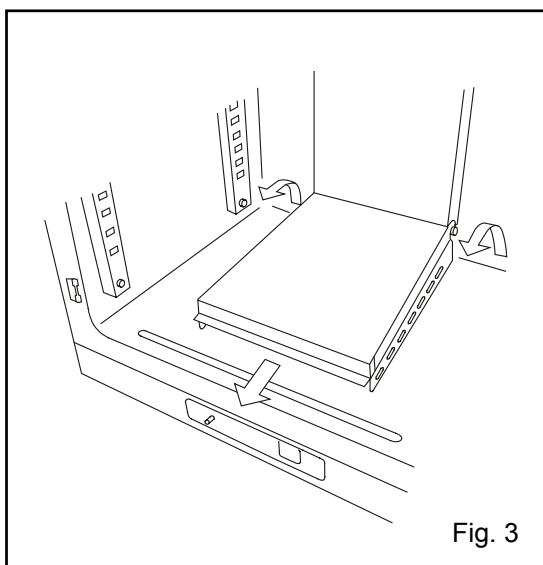
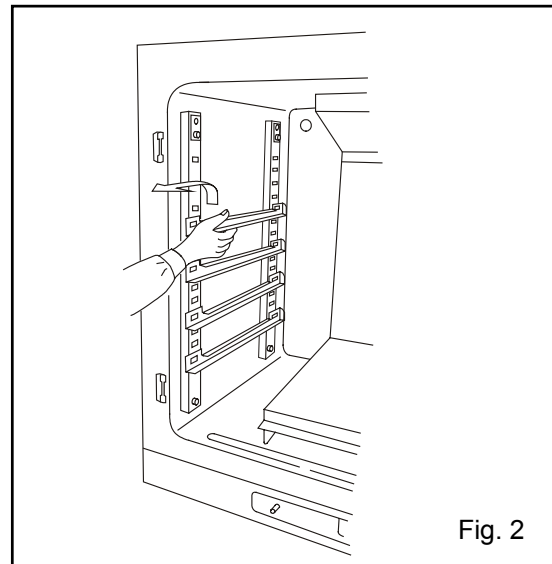
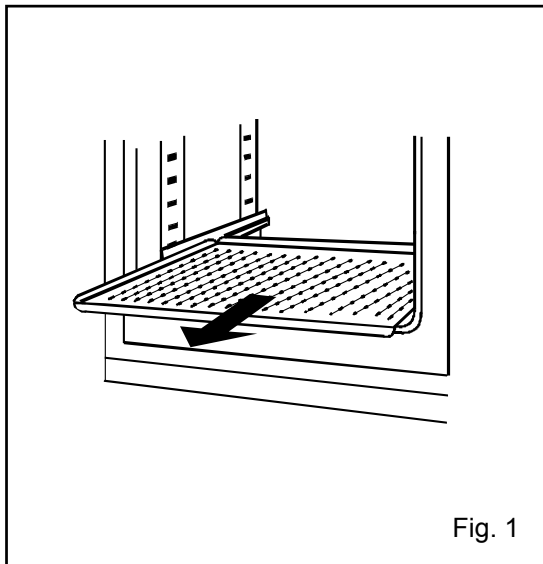
ROUTINE MAINTENANCE

Removal of attachments

Note:

Take care not to damage the UV lamp or water level sensor at the time of removal or replacement of attachments.

1. Close the tap of the gas cylinder and turn off the power.
2. Open the outer door. Remove 2 pins fixing the inner hinge and remove the inner door.
3. Pull out the all trays. See Fig. 1
4. Remove all tray supports on the right and left side by lifting up the front side. See Fig. 2.
5. By lifting up the humidifying pan cover to take off from the hook, remove the cover as shown in Fig. 3.
6. Take out the humidifying pan. See Fig. 4



ROUTINE MAINTENANCE

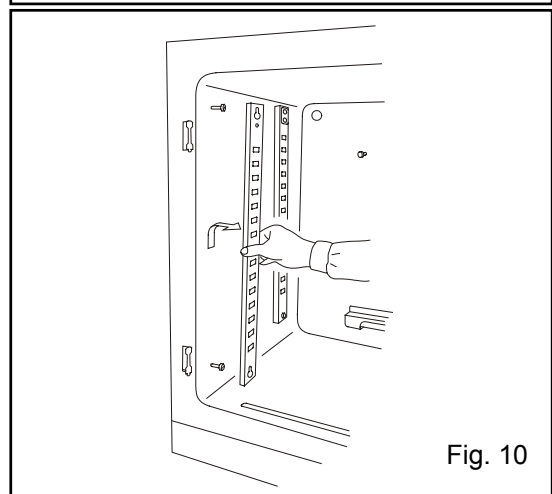
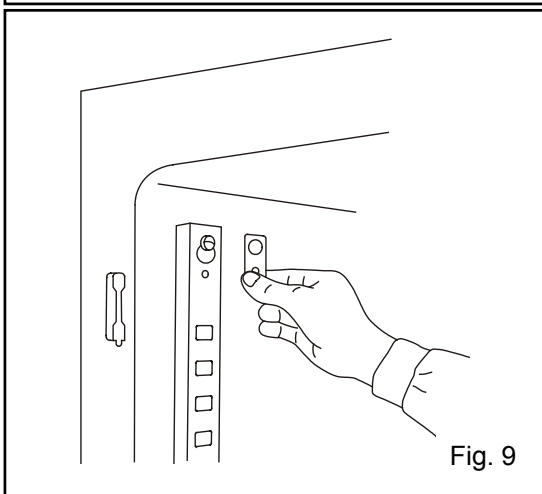
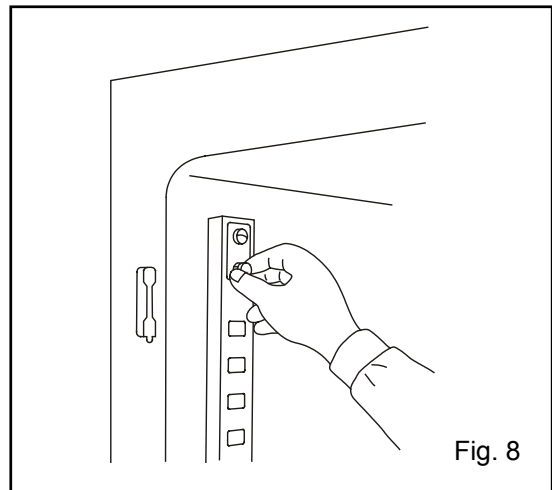
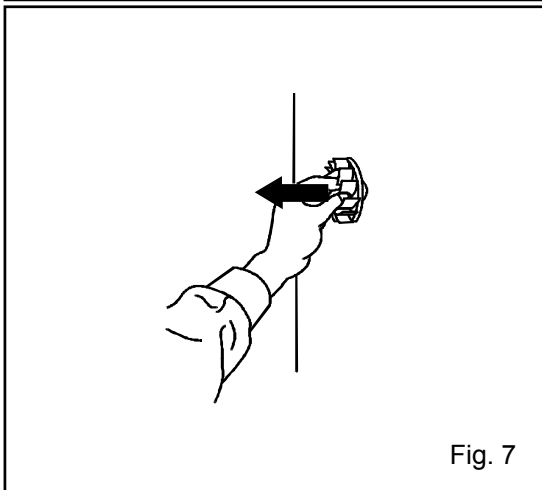
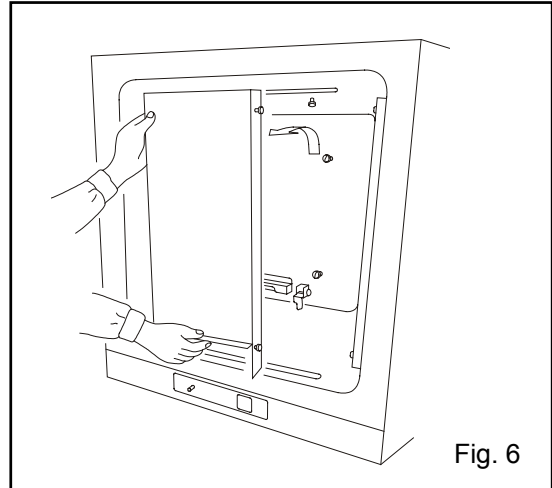
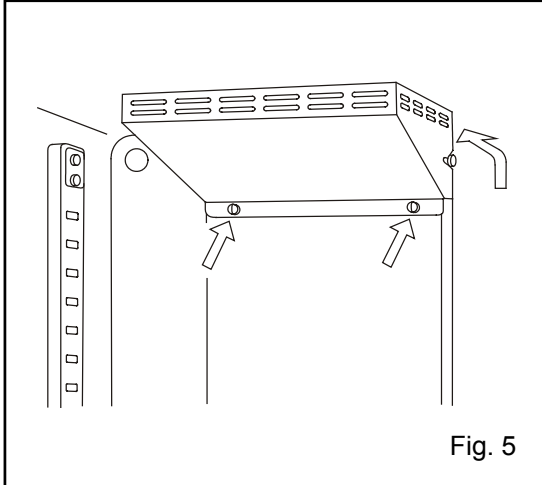
7. After removing 2 screws fixing the top duct, take out the top duct by removing pin. See Fig. 5.

8. To removing the back duct, lift it up as shown in Fig. 6.

9. To removing the circulating fan, pull out the spring and then pull the fan. See Fig. 7.

10. Loosen and remove the screw fixing the clamp and remove the clamp. See Fig. 8 and Fig. 9.

11. By lifting the side support, take it off from the hooks. See Fig. 10.



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

Note:

Always insert the fan on the motor shaft surely. Improper insertion may cause poor performance.

ROUTINE MAINTENANCE

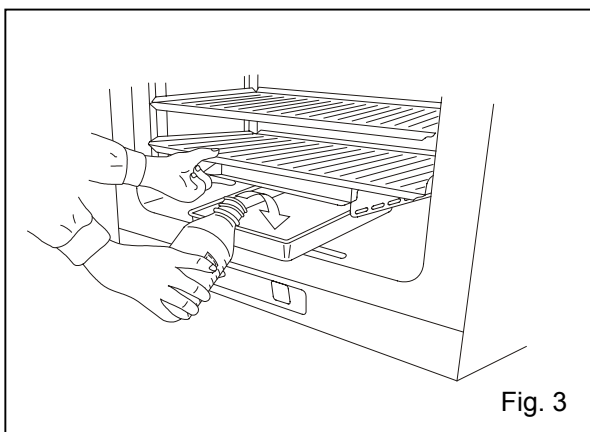
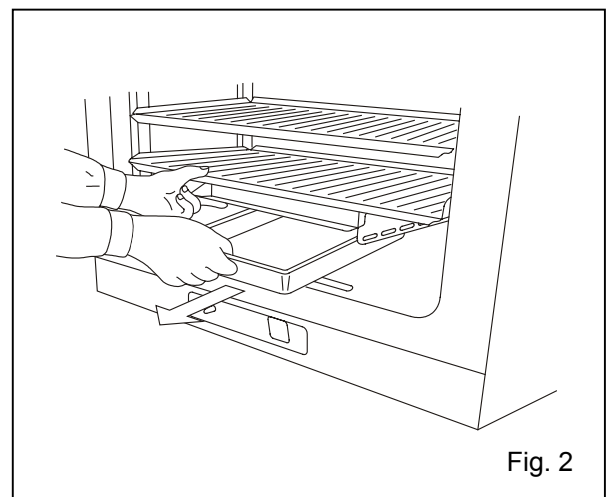
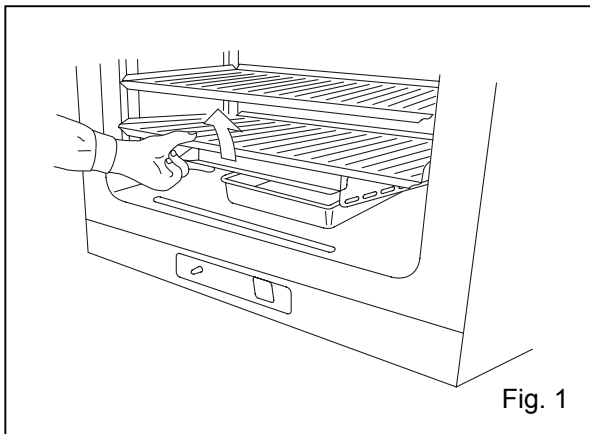
Filling the humidifying pan

Replace the water in the humidifying pan when the water level lamp lights. To fill the humidifying pan, do the following:

1. Lift the front side of the humidifying pan cover as shown in Fig. 1.
2. Pull out the humidifying pan toward you. See Fig. 2.
3. Dispose the water in the pan and wash it with neutral 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.
5. Place the pan under the pan cover and pour the sterile distilled water (about 5 liter) into it. See Fig. 3. Make sure that the water is pre-heated at 37°C.
6. Push in the pan to the far depth and cover the pan with the cover.
7. Check that the water level lamp on the control panel is black.

Note:

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



CALIBRATION

Temperature calibration

1. Press the CAL key for about 5 seconds.
2. The third digit of the temperature indicator flashes, and the CO₂ 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 CO₂ 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 $\pm 1.0^{\circ}\text{C}$ 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.

CO₂ calibration

Span setting

Span setting should be done under stable condition of temperature, humidity, and CO₂ density.

1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO₂ density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO₂ density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO₂ 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 setting of CO₂ density is 2% or more.

[Example]

For an internal CO₂ 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 CO₂ density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO₂ density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO₂ density (4.5%) with the ►► key and ▲ key, then press the ENT key.
6. The unit automatically reverts to the display mode.

TROUBLE SHOOTING

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

The unit does not operate at all

1. Is the unit plugged correctly into a power outlet?
2. Is the circuit breaker of power source active?
3. Has the power failure occurred?

The key operation is disable

1. Is the key lock function set in OFF?

If the alarm function operates

If the alarm function and the buzzer operates, check the cause using the following procedure.

[At the beginning of operation]

1. Is the chamber temperature equal to the set value?
2. Is the chamber CO₂ density equal to the set value?
 - a. Is the secondary pressure of the pressure regulator equal to the set value (0.03MpaG, 0.3kgf/cm²G, 4.3psiG)?
 - b. Is the tube connected securely between the pressure regulator and the unit?

[During operation]

1. Is the upper limit alarm temperature set at least 1°C higher than the set chamber temperature?
2. Was the set temperature value changed, or the door left open for a long period? Was a low temperature load placed inside the unit? In this case, if the unit is left as it is, the alarm will eventually clear itself.
3. Has the gas tube slipped off?
4. Was the set value of the gas density changed?
5. Is the gas cylinder empty? Check the primary pressure of the CO₂ cylinder once a week.

If the chamber temperature is not equal to the set temperature

1. Is the temperature in the vicinity too high? The ambient temperature must always be at least 5°C less than the set temperature.
2. Was the outer door closed while the inner door was left open?

If the gas density does not coincide with the set value

1. Is the secondary pressure set to 0.03MPaG (0.3kgf/cm²G, 4.3psiG)?
2. Is the gas tube clogged?

If the chamber humidity does not rise

1. Is the humidifying pan filled with sterile distilled water? (Always use the sterile distilled water.)
2. Is the humidifying pan cover installed properly?

If the CO₂ consumption is too much

1. Is the door opened frequently?
2. Is there any gas leakage at the connection or pin hole on the tube? It is recommended to replace the tube once a year.
3. Is the gasket of inner door completely sealed?
4. Is the access port at the upper left corner opened?

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

1. Is the environment around the unit normal? Is the source of the contaminated gas nearby?
2. Is the unit installed in an enclosed space?

If it takes much time to recover the gas density

1. 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 seems that the dust on the HEPA filter prevents the gas flow. Consult the

ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe at least under the following conditions:

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 $\pm 10\%$ 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 accomplished by appropriate personnel. Always remove doors to prevent accidents such as suffocation.

STACKED MODULE

This unit can be stacked by using the enclosed stack 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.

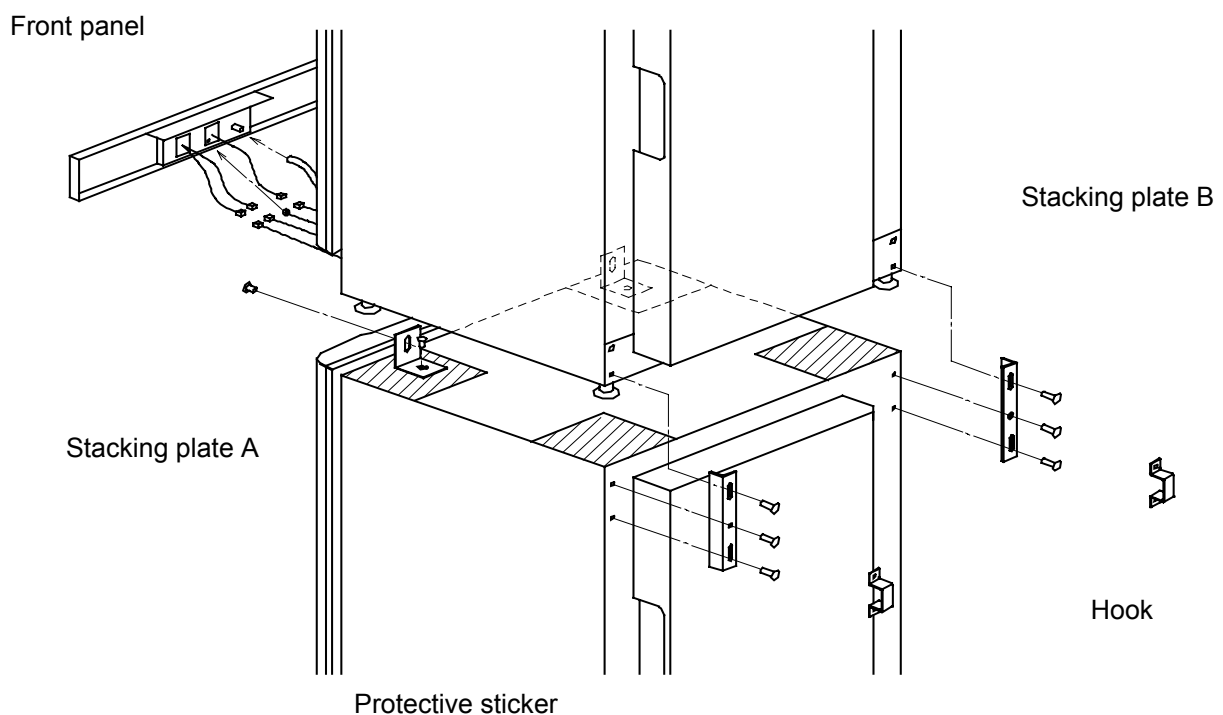
⚠️ WARNING

Select a level and sturdy floor having enough strength for installation of stacked module.

Never stack 3 or more units.

Take care not fall 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. Check that the lower unit is level.
3. Adhere the protective sticker at each corner on the top of the lower unit to avoid the scratch or damage.
4. Fix the stacking plate A at 2 locations on the top front of the lower unit by using the enclosed screws.
5. Remove the front panel on the upper unit by unscrewing 4 fixing screws and then disconnect the wires and gas tube.
6. Stack the unit so that the 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.
7. Secure the upper unit with 2 screws provided and the stacking plate A.
8. Remove 2 hooks on the back side of the lower unit by unscrewing 4 fixing screws.
9. Remove 2 screws on the bottom right and left on the back side of the upper unit.
10. Fix the stacking plate B on the back of the lower and upper unit with 6 screws removed in step 7 and 8.
11. Replace the front panel on the upper unit after connecting the wires and gas tube.
12. Fix the stacked unit to the wall with 2 hooks on the back of the upper unit and rope or chain.



SPECIFICATIONS

Name	CO ₂ Incubator
Model	MCO-20AIC
External dimensions	W770 x D708 x H900 (mm)
Internal dimensions	W620 x D523x H665 (mm)
Effective capacity	195 L
Exterior	Polyester finish baked on zinc galvanized steel
Interior	Stainless steel containing copper
Outer door	PMMA/PVC
Inner door	Tempered glass
Tray	5 trays made of stainless steel containing copper W580 x D450 x H12 (mm), Maximum load; 5 kg/tray
Access port	Inner diameter; 30 mm, On the back side
Insulation	Rigid polyurethane foamed-in place (CFC-FREE)
Heating system	DHA system (heater jacket + air jacket system)
Heater	395 W
Humidifying system	Natural evaporation with humidifying pan
Temperature controller	PID control
Temperature display	Digital display
CO ₂ controller	ON-OFF control system
CO ₂ density display	Digital display
Air circulation	Stir up of breeze
Air filter	0.3 μm, Efficiency; 99.97%
UV lamp	4 W, Ozoneless type
Water level sensor	Optical type
Alarm	Temperature alarm, CO ₂ density alarm, Upper limit temperature alarm, Door alarm
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A
CO ₂ connecting inlet	4 to 6 mm diameter tube
CO ₂ gas pressure	0.03MPaG (0.3kgf/cm ² G, 4.3psiG)
Accessories	5 trays, 5 sets of tray support, 1 gas tube, 1 humidifying pan, 1 set of stack kit, 2 tube bands
Weight	106 kg
Optional component	CO ₂ pressure regulator (MCO-100L), Roller base (MCO-20RB) Automatic gas switcher (MCO-20GC) Stainless tray (MCO-58ST) including 2 tray supports

Note: Design or specifications will be changed without notice.

PERFORMANCE

Usable environment condition	Temperature; +5°C to 35°C, Humidity; equal or less than 80% R.H.	
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)	
Chamber humidity	95 ± 5% R.H.	
Maximum power consumption	380 W	
Total maximum current	110 to 120 V	220 to 240 V
	3.7 A	1.9 A
Maximum heat emission	1370 kJ/h	
Noise level	30 dB (A scale)	

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. Refrigerator contents : Yes No
Risk of infection: Yes No
Risk of toxicity: Yes No
Risk from radioactive sources:

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

Notes :

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

3. Instructions for safe repair/maintenance of the unit Yes No
a) The unit is safe to work on Yes No
b) There is some danger (see below)

Procedure to be adhered to in order to reduce safety risk indicated in b) below.

Date :

Signature :

Address, Division :

Telephone :

Product name :
CO₂ incubator

Model :
MCO-20AIC

Serial number :

Date of Installation :

Please decontaminate the unit yourself before calling the service engineer.



SANYO Electric Co., Ltd.
Refrigeration Products Division
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Ora-Gun, Gunma 370-0596 Japan
Printed in Japan

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