



Operating Instructions

CO₂ Incubator

MCO-230AICUVHL
MCO-230AICUVL



MCO-230AICUVHL

Please read the operating instructions carefully before using this product and save the operating instructions for future use.

See page 90 for all model number.

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INTRODUCTION

- Read the operating instructions carefully before using the Product and follow the instructions for safety operation.
- PHC Corporation disavows any responsibility for safety if the Product is used for other than the intended use or used with any procedures other than those given in the operating instructions.
- Keep the operating instructions in a suitable place so that it can be referred to as necessary.
- The contents of the operating instructions are subject to change without notice for improvement of performance or functions.
- Contact our sales representative or agent if any page of the operating instructions is lost or the page order is incorrect.
- Contact our sales representative or agent if any point in the operating instructions is unclear or if there are any inaccuracies.
- No part of the operating instructions may be reproduced in any form without the expressed written permission of PHC Corporation.

IMPORTANT NOTICE

PHC Corporation guarantees this product under certain warranty conditions. However, please note that PHC Corporation shall not be responsible for any loss or damage to the contents of the product.

<Intended Use>

This equipment is designed for cell and tissue culture for laboratory use. Not for clinical diagnosis or treatment of humans or animals.

PRECAUTIONS FOR SAFE OPERATION

It is imperative that the user comply with the operating instructions as they contain 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.

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.

USA Only (Model with a lamp): This product has a lamp that contains mercury. Disposal may be regulated in your community due to environmental considerations.

Contains mercury / Contenu avec mercure

For more information on safe handling procedures, the measures to be taken in case of accidental breakage, and safe disposal options visit:

ec.gc.ca/mercure-mercury/.

Dispose of or recycle in accordance with applicable laws.

Pour plus de renseignements sur les procédures de manutention sécuritaire, les mesures à prendre en cas de bris accidentel et les options d'élimination sécuritaire visitez:

ec.gc.ca/mercure-mercury/.

Mettez au rebut ou recyclez conformément aux lois applicables.

For the State of California, USA Only:

This product contains a CR Coin Cell Lithium Battery which contains Perchlorate Material – special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate.

PRECAUTIONS FOR SAFE OPERATION

WARNING

-  **Do not use the unit outdoors.** Current leakage or electric shock may result if the unit is exposed to rainwater.
-  **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 and take an adequate precaution to prevent the unit from turning over.** 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.
-  **Always ground (earth) the unit 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.
-  **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.
-  **Never store volatile or flammable substances** in this unit if the container cannot be sealed. These may cause explosion or fire.
-  **Do not insert metal objects such as a pin or a wire into any vent, gap, or any outlet on the unit.** This may cause electric shock or injury by accidental contact with moving parts.
-  **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.
-  **Turn off the power switch (if provided) and disconnect the power supply to the unit prior to any repair or maintenance** of the unit in order to prevent electric shock or injury.
-  **Do not touch any electrical parts (such as power supply plug) or operate switches with a wet hand.** This may cause electric shock.

WARNING

-  **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 put containers with liquid on the unit** as this may cause electric shock or short circuit when the liquid is spilled.
-  **Never bind, process, or step on the power supply cord, or never damage or break the power supply plug.** A broken power supply cord or plug may cause fire or electric shock.
-  **Do not use the power supply cord if its power supply plug is loose.** Such power supply cord may cause fire or electric shock.
-  **Never disassemble, repair, or modify the unit yourself.** Any such work carried out by an unauthorized person may result in fire, or electric shock 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.
-  **When removing the power supply 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.
-  **Do not use the supplied power cord for other electrical equipment.** Such power supply cord may cause fire or electric shock.
-  **Disconnect the power supply plug** before moving the unit. Take care not to damage the power supply cord. A damaged cord may cause electric shock or fire.
-  **Disconnect the power supply plug when the unit is not used for long periods.** Keeping the connection may cause electric shock, current leakage, or fire due to the deterioration of insulation.
-  **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.
-  **Do not put the packing plastic bag within reach of children** as suffocation may result.
-  **Use the reagent specified by our company for H₂O₂ decontamination.** Using a different H₂O₂ solution may result in explosion or damage to the incubator.
-  **When performing H₂O₂ decontamination, securely close the internal and external doors.** Failure to do so may be harmful to health due to leakage of H₂O₂ gas.
-  **During H₂O₂ decontamination, plug the access hole with the silicon cap that is provided.** Failure to do so may be harmful to health due to leakage of H₂O₂ gas.

PRECAUTIONS FOR SAFE OPERATION

WARNING

-  **Always use the removable power supply cord that is provided.** Other power supply cord may cause electric shock or fire.
-  **Do not position this unit and the other unit so that it is difficult to operate the disconnection of the power supply plug.** Failure to disconnect the power supply plug may cause fire if there is something wrong with the unit.

CAUTION

-  This unit must be plugged into a dedicated circuit protected by branch circuit breaker.
-  Use a dedicated power source as indicated on the rating label attached to the unit. A multiple-tap may cause fire resulting from abnormal heating.
-  **Never store corrosive substances such as acid or alkali** in this unit if the container cannot be sealed. These may cause corrosion of inner components or electric parts.
-  **Check the setting when starting up of operation after power failure or turning off of power switch.** The stored items may be damaged due to the change of setting.
-  **Be careful not to tip over the unit** during movement to prevent damage or injury.
-  **Prepare a safety check sheet** (copy the last page) when you request any repair or maintenance for the safety of service personnel.
-  **Wear rubber gloves when handling the H₂O₂ reagent.** Direct contact with the H₂O₂ reagent may result in inflammation of the skin.
-  H₂O₂ decontamination can be performed only for the chamber and chamber attachments with standard specifications, and not for any other objects.
-  **Perform H₂O₂ decontamination with the chamber attachments arranged as specified by our company.** Arranging them in a different way may result in insufficient decontamination.
-  After H₂O₂ decontamination has been completed, **wear rubber gloves and use a non-woven cloth to wipe off the residual H₂O₂ fluid from the bottom of the chamber, any objects that were decontaminated, and the bottoms of ducts.**
-  **Do not damage the glass or give it a shock.** The Inner door in the CO₂ Incubator are tempered glass, but they can be broken or cause injury if they are used incorrectly.

SYMBOLS ON INCUBATOR

The following symbols are attached to the incubator.

	This symbol indicates possibility of an electric shock. High-voltage electrical components are placed under the covers. Only a qualified engineer or service personnel should be allowed to open these covers.
	This symbol indicates an ultraviolet light (UV) caution.
	This symbol indicates that caution is required. Refer to product documentation for details.
	This symbol indicates a hot surface.
	This symbol indicates an earth.
	This symbol means "ON" for a power switch.
	This symbol means "OFF" for a power switch.

SAFETY ENVIRONMENTAL CONDITIONS

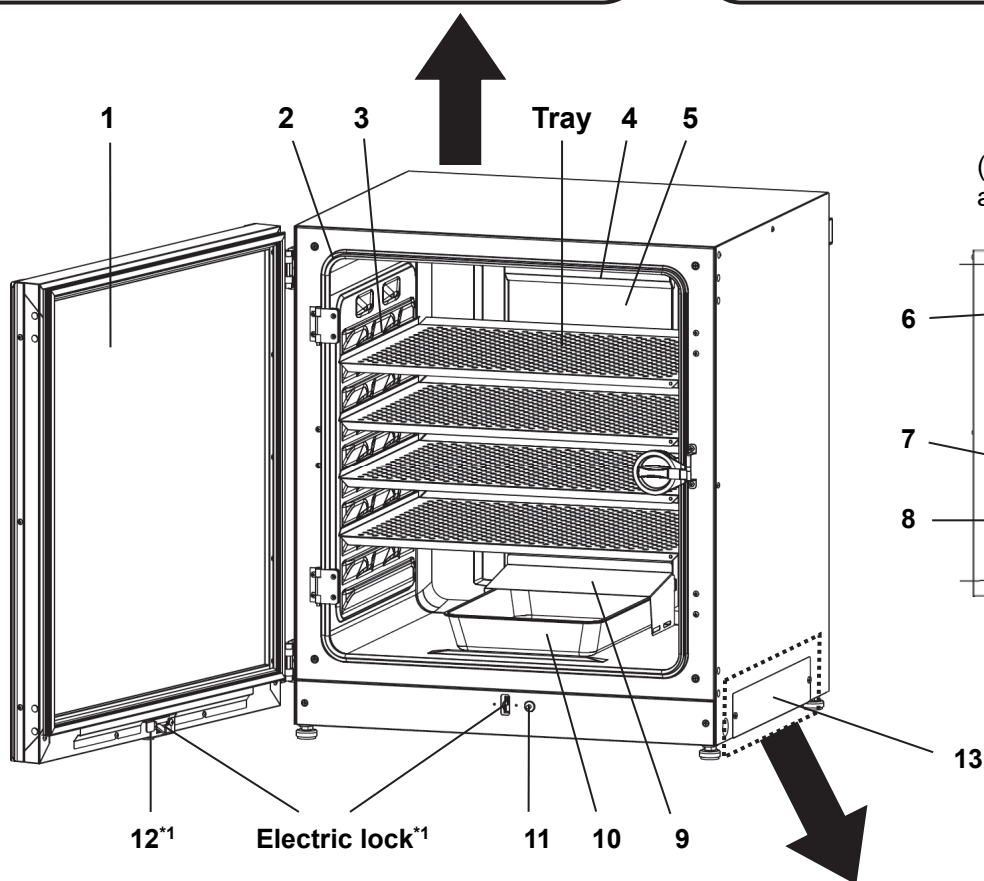
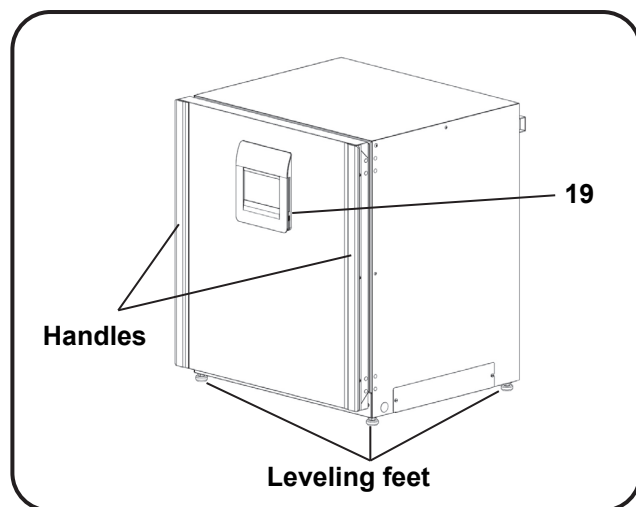
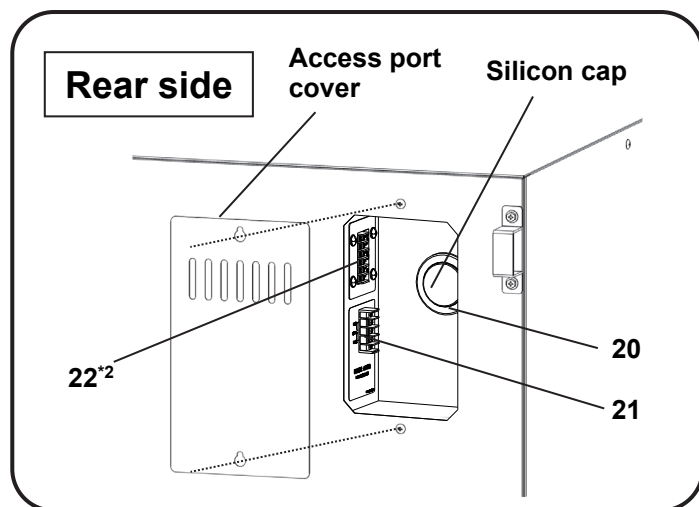
This equipment is designed to be safe at least under the following conditions (based on the IEC 61010-1):

- Indoor use;
- Altitude up to 2,000 m;
- Temperature 5°C to 40°C
- Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C;
- Mains supply voltage fluctuations up to $\pm 10\%$ of the nominal voltage;
- Transient overvoltages up to the levels of OVERVOLTAGE CATEGORY II;
- Temporary OVERVOLTAGES occurring on the mains supply;
- Applicable pollution degree of the intended environment (POLLUTION DEGREE 2 in most cases);

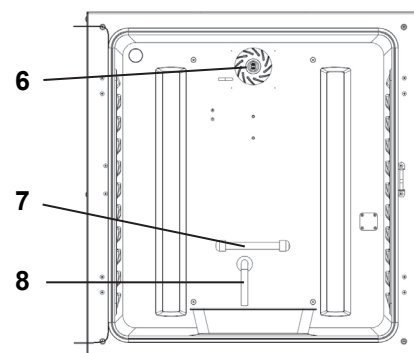
* Above conditions do not indicate the performance of this product. For the performance of this product, refer to "PERFORMANCE" on page 90.

INCUBATOR COMPONENTS

Unit



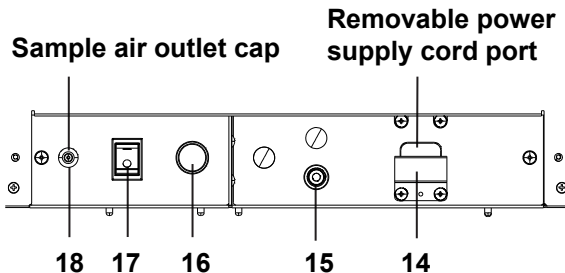
(When some inner attachments are removed)



*1: Available for MCO-230AICUVHL, or MCO-230AICUVL with the optional electric lock MCO-170EL installed.

*2: Available for MCO-230AICUVHL, or MCO-230AICUVL with the optional interface board MCO-420MA installed.

Lower right side (When 13 is removed)



-
- 1. Outer door:** The outer door is held to the frame with the magnetic seal. The door heater is installed in the door panel. The door opening is reversible. Contact our sales representative or agent to change the door hinge from left to right or vice versa.
 - 2. Inner door:** The inner door is made of tempered glass. However, do not subject the glass to excessive impacts.
 - 3. Tray catches:** Insert tray to fit the concave portion on chamber.
 - 4. Fan cover:** The fan cover serves as the inlet for circulating air. It is removable.
 - 5. Duct:** The duct for the path for circulating air. It is removable.
 - 6. Fan (inside the duct):** The fan is made from polypropylene resin. It can be disinfected in an autoclave.
 - 7. UV lamp:** This UV lamp does not generate ozone. Never look directly at the UV light. Refer to pages 59~63 for using. For replacement, contact our sales representative or agent.
 - 8. Humidity control bar:** Reduces condensation in the unit caused by the external environment and frequent door openings.
 - 9. Humidifying pan cover:** Prevents the UV light from leaking. Always use it. Using without it may have a bad influence on the chamber temperature distribution and humidity recovery.
 - 10. Humidifying pan:** Fill the humidifying pan with sterile distilled water or pure water and set the humidifying pan with the inner side flush against the back. Install the humidifying pan in a longitudinal direction as its shorter side is placed in the back.
 - 11. Door switch:** Detects the door opening/closing and stops the fan and electromagnetic valve for CO₂ when the door is open. The UV lamp*¹ is also deactivated by the door opening.
 - 12. Key hole*¹:** Hole for the accessory key to unlock the outer door while locked by the electric lock.
 - 13. Switch cover:** Prevent the accident of gas tube disconnected by the unexpected touch or power off.
 - 14. Power supply cord cover plate:** This plate is to prevent the removable power supply cord being come off.
 - 15. Connecting port A for CO₂ gas pipe:** Refer to pages 22~23 for gas cylinder connection. Ensure that the gas pressure is set at 0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G)).
Note: When the optional MCO-21GCP gas auto changer is installed, both ports A and B are available. Refer to page 77 for gas auto changer.
 - 16. Glow starter:** The glow is started for the UV lamp.
 - 17. Power switch:** The power switch of this incubator (ON-"I", OFF-"O"). It also functions as an overcurrent breaker.
 - 18. Sample air outlet:** The sample air outlet also functions as an internal gas outlet. Normally, cover this outlet with the sample air outlet cap.
 - 19. USB port:** Insert a USB flash drive to export operations and alarms log. Refer to pages 44~55.
Note: USB flash drives with capacity of 32 GB or less that employ the FAT16/FAT32 file system are supported. USB flash drives that require passwords cannot be used. Do not insert devices other than USB flash drives into the USB port.
 - 20. Access port:** Place the silicon caps on both outside and inside of the port when the port is not being used.
 - 21. Remote alarm terminals:** These terminals inform the alarm to remote location by connecting to external alarm unit. Refer to page 12.
 - 22. Interface board*²:** Used to obtain chamber temperature and CO₂ density data as current output. Refer to page 13.

INCUBATOR COMPONENTS

Remote alarm terminal

The alarm of this product can be informed at a remote location from this product by connecting the external alarm unit to the remote alarm terminals. For the type and behavior of remote alarm output, refer to pages 82~84.

The terminals of the remote alarm are installed at the rear upper right of the unit (see the right figure). The alarm is outputted from these terminals. Contact capacity is DC 30 V, 2 A.

When Buzzer key is pressed, the behavior of the remote alarm is showed in Table.1.

Note:

- In the door alarm, the remote alarm does not work. Refer to pages 82 and 83.
- It is recommended to use standard signal and interface cables with a maximum length of 30 meters.

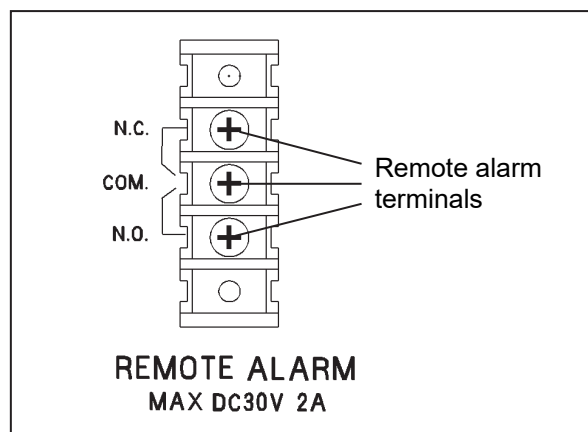


Table 1. The behavior of the remote alarm when pressing the Buzzer key

Remote Alarm setting (Refer to pages 41~43)	Connecting terminal	Normal condition	Abnormal condition (Including in the cases of power outage and of where the power supply plug is pulled out.)	
			When pressing the buzzer key	
ON: Non-interlock with Buzzer key	COM.-N.C.	Close	Open	Open (Maintain in abnormality)*
	COM.-N.O.	Open	Close	Close (Maintain in abnormality)*
OFF: Interlock with Buzzer key	COM.-N.C.	Close	Open	Close (Return to normal)
	COM.-N.O.	Open	Close	Open (Return to normal)

*In case of Err01 (CO₂ gas cylinder empty), Err11, 12 (CO₂ sensor error), the condition returns to normal.

Interface board

The interface board is used to obtain chamber temperature and CO₂ density data as current output. Each control element is as follows.

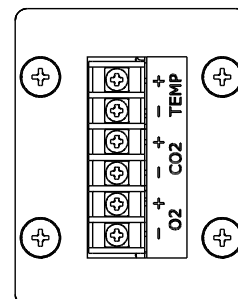
(Accuracy: ±3.0%)

	Range	Output
Temperature	25°C to 50°C	4 mA to 12 mA (0.32 mA/°C)
CO ₂ density	0% to 20%	4 mA to 20 mA (0.8 mA/%)

(Example)

Output of temperature 37°C: $(37^{\circ}\text{C} - 25^{\circ}\text{C}) \times 0.32 \text{ mA/}^{\circ}\text{C} + 4 \text{ mA} = 7.84 \text{ mA}$

Output of CO₂ density 5%: $5\% \times 0.8 \text{ mA/\%} + 4 \text{ mA} = 8 \text{ mA}$



O₂ terminals are unavailable.

Input / output characteristic

Temp [°C]	Analog Output [mA]	CO ₂ [%]	Analog Output [mA]
25.0	4.0	0	4.0
27.5	4.8	2	5.6
30.0	5.6	4	7.2
32.5	6.4	6	8.8
35.0	7.2	8	10.4
37.5	8.0	10	12.0
40.0	8.8	12	13.6
42.5	9.6	14	15.2
45.0	10.4	16	16.8
47.5	11.2	18	18.4
50.0	12.0	20	20.0

Notes:

- When connecting a recorder to the interface board terminals, turn off the power switch and unplug the incubator. Otherwise, it may cause an electric shock.
- Use shielded wire for connection. A maximum length of 30 meters of the cable is recommended.
- Electric current flows from the plus terminal to the minus terminal of each channel on the terminal block. When connecting a recorder, make sure that the polarity is correct.
- When connecting to the voltage terminal of the recorder, connect a commercially available shunt resistor (high precision) to the voltage terminal of the recorder.

The formula for converting voltage reading to electric current value:

Electric current (mA) = voltage reading (V) / shunt resistor value (Ω) x 1000

- We recommend performing calibration every year. For calibration, contact our sales representative or agent.

INCUBATOR COMPONENTS

LCD touch panel



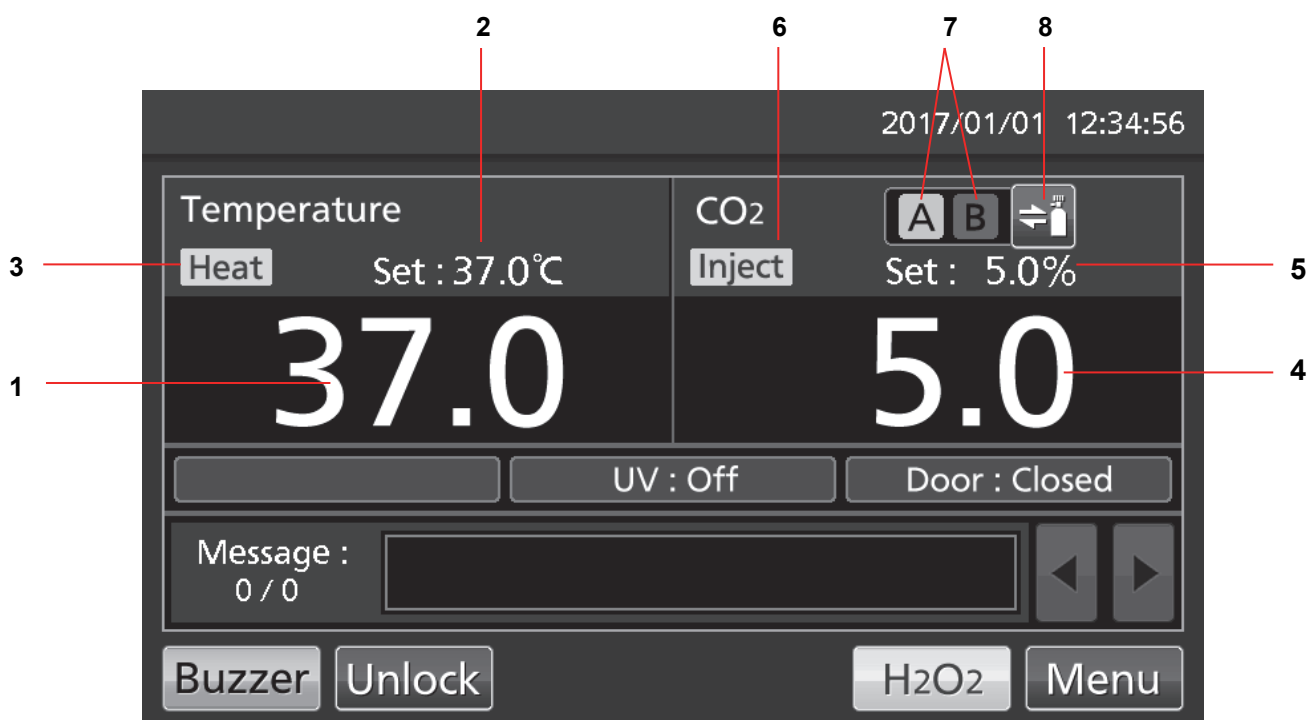
When sterilizing and cleaning the control panel, follow the precautions below.

(1) Do not spray liquid on the control panel directly.

(2) When sterilizing and cleaning, wipe the surface using a piece of gauze moistened with a proper amount of disinfectant (the amount that cannot form droplets).

The following display (called the Top screen) will appear when the power switch is turned ON.

Note: It takes approximately 20 seconds until Top screen is displayed. During warming-up, "Status: Gas sensor initializing" is displayed in the Message display field (13), and "--.-" is displayed in the Present CO₂ density display field (4).



1. Present temperature display field

The current chamber temperature is displayed.

2. Set temperature value display field

The set value of chamber temperature is displayed. Default setting: 37°C.

3. Heating indicator

This lamp lights when the heater is energized.

4. Present CO₂ density display field

The current chamber CO₂ density is displayed. Nothing is displayed when CO₂ density is set 0%.

5. Set CO₂ density value display field

The set value of the chamber CO₂ density is displayed. Default setting: 0%.

6. CO₂ gas injection indicator

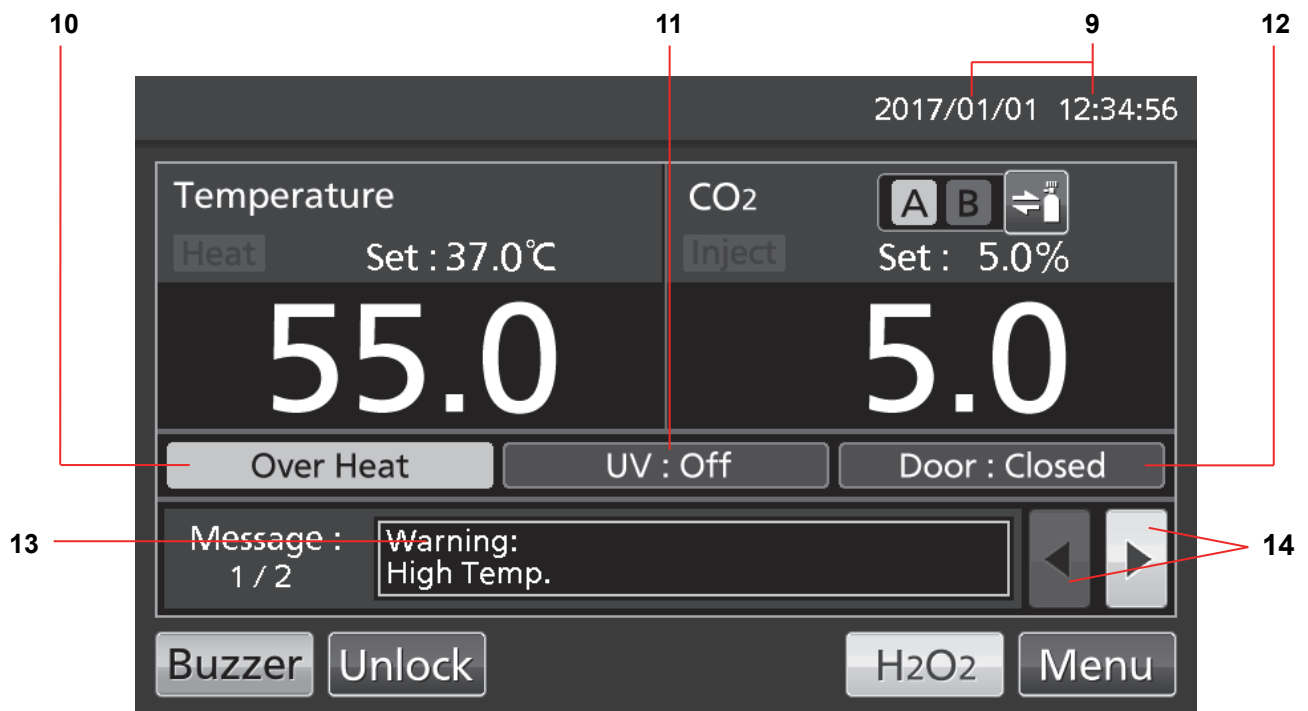
This lamp lights when CO₂ gas is being injected.

7. CO₂ gas supply line indicator A and B^{*1}

Current supplying CO₂ gas supply line (connecting port for CO₂ gas pipe) is displayed. The connecting port A/B for gas pipe that is currently supplying CO₂ is displayed in reverse video and blinks.

8. CO₂ gas supply line select key^{*1}

This is a key to select CO₂ gas supply line A or B (Connecting port A or B for CO₂ gas pipe). When an optional gas auto changer MCO-21GCP is installed, CO₂ gas supply line A/B changes over automatically when CO₂ gas cylinder is empty. Changeover is also workable by pressing this key.



9. Present date/time display field

Normally, this indicator shows date and time. The date and time is simply set when the incubator is shipped from the factory. Refer to page 56 for details.

10. Over heat display

High limit temperature alarm is activated: "Over Heat" is displayed alternately in normal characters and reverse video.

11. UV lamp condition display

UV lamp ON: "UV : On" is displayed.
UV lamp OFF: "UV : Off" is displayed.

12. Outer door (opening/closing) display

Open: "Door : Open" is displayed alternately in normal characters and reverse video.
Close: "Door : Closed" is displayed.
Locked: "Door : Locked" is displayed.*2

13. Message display field

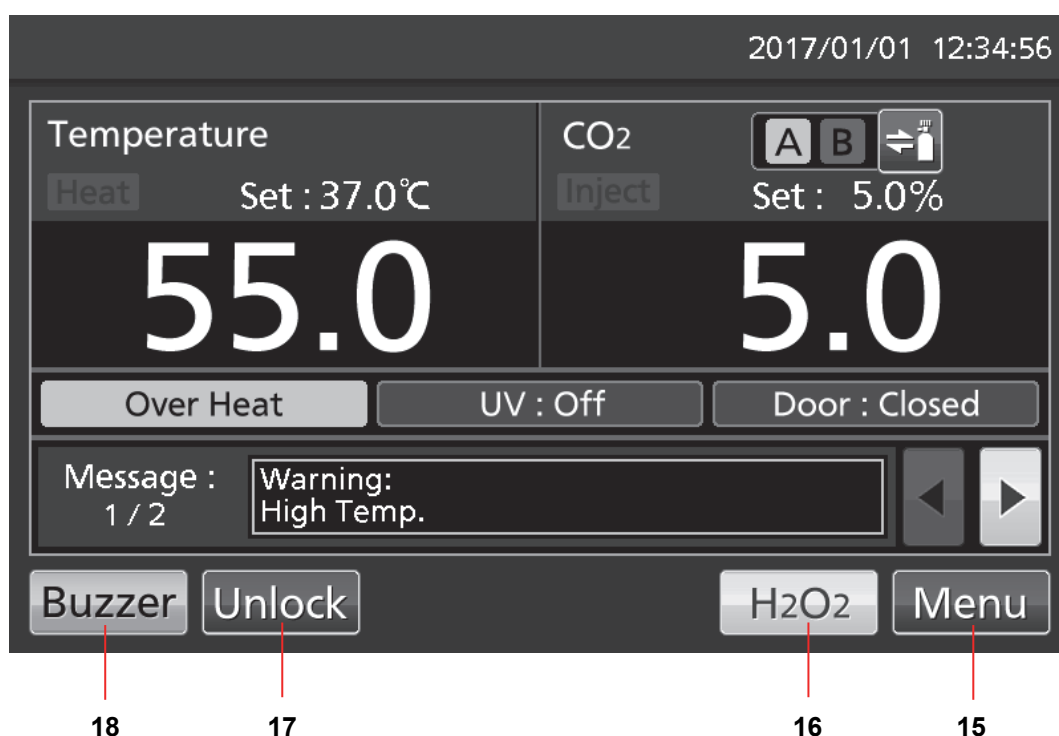
Alarms, errors, or messages are displayed when fault occurs. Refer to pages 82~84.

Note: When there are a number of alarms/errors, the display shows the message. For example, if 2 alarms/errors occur in total, the display shows "1/2".

14. Message select key

When there are a number of alarm/errors, the message on the screen is changeable.

INCUBATOR COMPONENTS



15. Menu key

Press this key to display the Menu screen. It is possible to set various setting on the Menu screen. Refer to page 32.

16. H₂O₂ key^{*3}

This key is to run H₂O₂ decontamination. Refer to pages 64 ~ 69.

17. Unlock key^{*2}

Press this key is to unlock the outer door when it is auto-locked by electric lock. Refer to page 74. When the auto lock function is OFF, this key is not displayed.

18. Buzzer key

Press this key to silence the buzzer. However, when the ring back is ON, the buzzer will sound again when the ring back passed, and the alarm state still continues. Refer to pages 42~43 and 82~84.

Note: It is not possible to silence the buzzer for the high limit temperature alarm.

*1: These keys become available only when the optional gas auto changer MCO-21GCP is installed. They are not displayed when the MCO-21GCP is not installed.

*2: Auto lock function by electric lock is available for MCO-230AICUVHL, or MCO-230AICUVL with the optional electric lock MCO-170EL installed. Otherwise, "Door : Locked" or Unlock key are not displayed.

*3: The H₂O₂ decontamination function is available for MCO-230AICUVHL, or MCO-230AICUVL with the optional H₂O₂ generator MCO-HP, H₂O₂ decon board MCO-170HB, and electric lock MCO-170EL installed. Otherwise, the H₂O₂ key is not displayed on the LCD touch panel.

INSTALLATION

Installation site

For correct operation of the incubator, install it in a location with the following conditions.

WARNING

When using CO₂ gas for control, **make sure that there is an adequate ventilation**. Using CO₂ gas in a small room without adequate ventilation may cause gas poisoning or oxygen deprivation. In addition, when opening the incubator doors, do not directly inhale the air in the chamber.

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.

● **Normal air environment**

Install the incubator in an environment with normal air.

● **Do not expose to direct sunlight**

Do not install the incubator in a location where it will be exposed to direct sunlight. If the incubator is operated in direct sunlight, performance will be adversely affected.

● **Separate from heat sources**

Do not install the incubator near significant heat sources, such as heaters, boilers, ovens, or autoclaves. Heat will adversely affect the performance of the incubator.

● **Ambient temperature at least 5°C lower than set temperature**

The control temperature of the incubator is at least 5°C higher than the ambient temperature. For example, if the chamber is controlled at 37°C, the ambient temperature must be 32°C or less. Do not allow the ambient temperature to become too high.

● **Strong and level floor**

Select a site with a strong and level floor. If the floor is uneven or the installation is not level, the incubator will be unstable, and this may cause accident or injury. To avoid vibration and noise, always make sure that the installation is stable. An unstable surface may result in vibration or noise.

WARNING

Install the incubator at a location that can support the weight. If the floor is not strong enough or if the installation is insufficient, the incubator may fall over and cause injury.

Always make sure that the floor is strong, even, and level, and that the incubator will not tip over.

An insufficient installation may result in injury due to water leakage or the incubator falling over.

● **Separate from vibration products**

Do not install the incubator near vibration products. Vibration may cause culture failure.

INSTALLATION

- **Low humidity**

Select a site with a relative humidity of 80% R.H. or lower. Using the incubator in high humidity may result in current leakage or electric shock.

WARNING

Do not use the incubator outdoors. If the incubator is exposed to rain water, it may result in current leakage or electric shock.

Never install the incubator in a moist location, such as near a sink or water line, or where it is likely to be exposed to water. In addition, **do not install it near water or steam pipes.** Moisture can cause the insulation to deteriorate, which may result in current leakage or electric shock.

- **No inflammable or corrosive gas**

Never install the incubator in a location where it will be exposed to inflammable or corrosive gas. Doing so may result in explosion or fire. In addition, insulation may deteriorate due to corrosion of protective casing, resulting in current leakage or electric shock.

- **No falling objects**

Do not install the incubator in a location where there is the possibility of objects falling from above. Doing so may result in damage or accident.

Installation

1. Remove the packing tape and clean up.

Remove all the tapes that are securing the doors and the inner attachments. Open the doors for ventilation. If the outer panels are dirty, wet a cloth with a diluted neutral detergent and wipe them. (Undiluted detergent can damage the plastic components. For the dilution, refer to the instruction of the detergent.) Wipe off the residual detergent with a wet cloth and then wipe off any moisture.

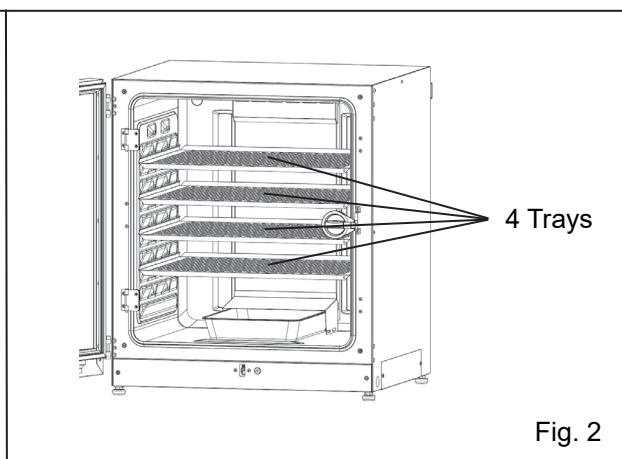
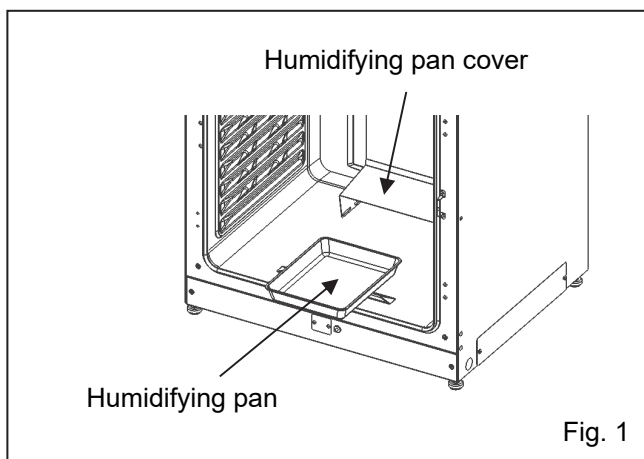
Note: Remove the cable tie banding the power supply cord. Prolonged banding may cause the corrosion of the cord coating.

WARNING

Do not leave the plastic wrapping bags within reach of children. If the bag is placed over a child's head, it can block the mouth and nose and cause suffocation.

2. Set the humidifying pan and humidifying pan cover (Fig. 1).

3. Set 4 trays (Fig. 2).

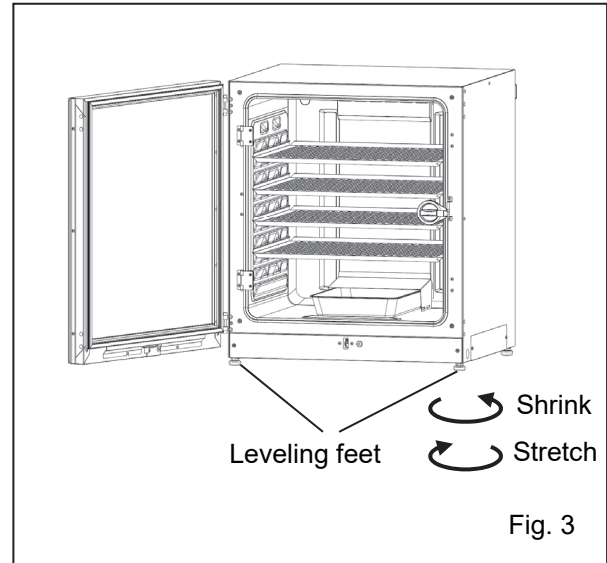


INSTALLATION

4. Adjust the leveling feet.

Adjust the leveling feet by turning them counterclockwise to level the incubator (Fig. 3).

Note: Incubating on a leaning tray may have a bad influence on the cultivation.



5. Ground the incubator.

Ground the incubator during installation to prevent electric shock in case the insulation is not sufficient. If there is no ground wire at the location, consult with qualified service personnel.

● When a ground must be installed

If a grounded 3-pole outlet is not available, then a ground must be installed. Consult with qualified service personnel.

⚠ WARNING

To prevent electric shock, **always ground the incubator**. If grounding is not possible, then have a ground installed by qualified personnel. If the incubator is not grounded, it may result in electric shock.

Never connect the ground wire to a gas pipe, water pipe, lightning rod, or telephone ground wire. Doing so may cause electric shock.

● Installing a ground fault circuit breaker

If using the incubator in the location with moisture or humidity cannot be avoided, then it is recommended that a ground fault circuit breaker be installed in the power supply circuit (i.e., the power supply at the incubator). Have the circuit breaker installed by qualified service personnel.

⚠ CAUTION

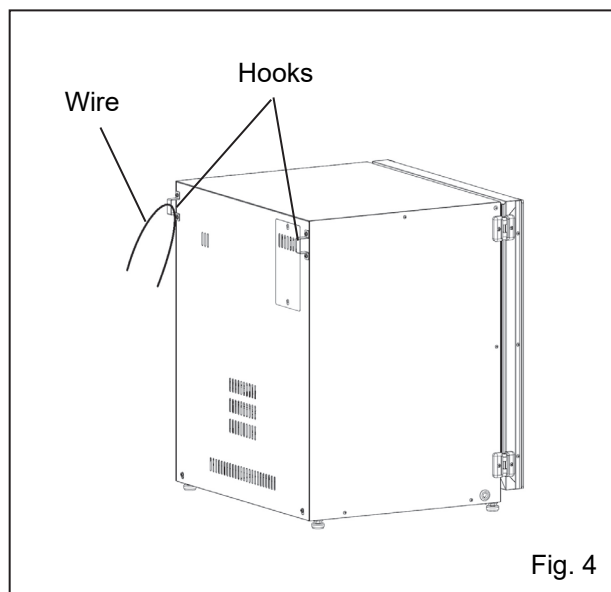
Do not climb on the incubator or place objects on top of it. Doing so may damage it or cause it to fall over, resulting in injury.

- **In case of double stack**

For stacking the incubators surely, refer to the procedure included with the optional double stacking bracket MCO-170PS or the stacking plate MCO-230SB.

Note: When stacking incubators, fix two hooks on the rear of the upper incubator to the wall by wire or chain, to prevent falling over (Fig. 4).

Note: When stacking the incubators with our CO₂ incubator or O₂/CO₂ incubator other than this product, use the stacking plate MCO-230SB. Refer to table 9 and 10 on page 89.



- **When the incubator is not in use**

Empty the water from the humidifying pan and remove moisture from the chamber. Make sure that the chamber is completely dry before closing the doors. Failure to do so may result in damage.

- **Before moving the incubator**

Before moving the incubator, empty the water from the humidifying pan, disconnect the power supply plug from the outlet, and make sure that the cord will not be damaged. Failure to do so may result in electric shock or fire.

INSTALLATION

Connecting CO₂ gas cylinder

⚠ WARNING

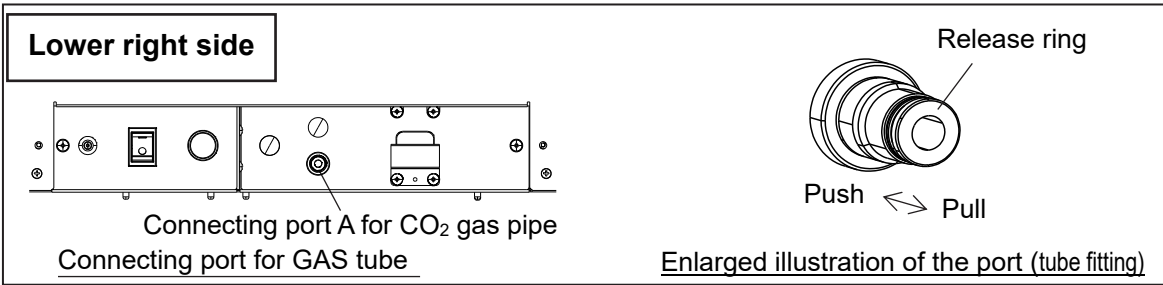
When connecting a gas cylinder to the incubator, **confirm the gas type. Confirm that the connections are secure and that no gas will leak. Be sure to use the specified pressure.** Using an incorrect gas or pressure may result in explosion or fire, or in gas poisoning or oxygen deprivation due to gas leak.
Install the incubator in a location with adequate ventilation. If adequate ventilation cannot be provided, then install an alarm system using CO₂ and O₂ densitometers.

1. Get a CO₂ gas cylinder ready and install an optional gas regulator MCO-010R.

Note:

- Use a liquefied CO₂ gas cylinder (at least 99.5% pure). The siphon (dip tube) type cannot be used.
- When MCO-010R is not available, install a gas regulator rated at 25 MPa(G) (250 kgf/cm²(G), 3600 psi(G)) for the primary side, and 0.25 MPa(G) (2.5 kgf/cm²(G), 36 psi(G)) for the secondary side.

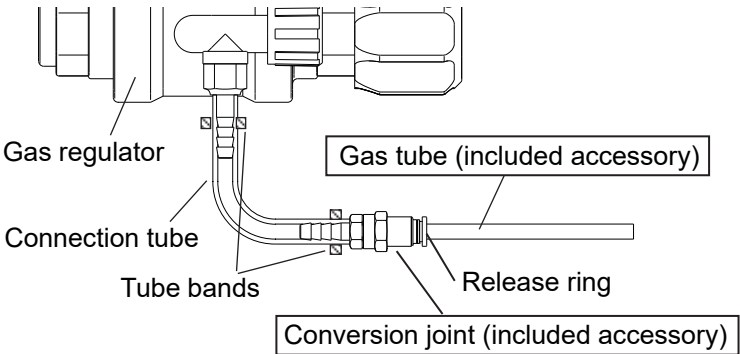
2. Connect the connecting port A for the CO₂ gas pipe and the gas regulator for the CO₂ gas cylinder using the included gas tube. When CO₂ gas auto-changer MCO-21GCP (optional) is installed, refer to page 77 for the connection.



Notes:

- This product employs a tube fitting. Refer to the following steps to attach and remove the tube.
 - (1) Attaching the tube
Insert the tube all the way to the end so that the tube is secured by the inner locking hook and sealed with elastic sleeve around it.
* In order to make sure that the tube is securely attached, pull the tube after connection. If the tube comes off, pull the release ring, and then reconnect the tube and check if it does not become detached.
 - (2) Removing the tube
Disconnect the tube while pressing on the release ring to remove the tube.

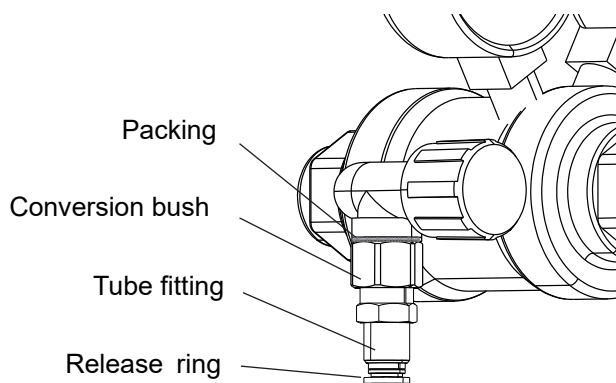
- Connecting to the gas regulator (MCO-010R)
<When connecting to the joint for the gas regulator tube>
 - (1) Attach the conversion joint that came with the incubator unit to the gas tube.
 - (2) Connect between the joints using the connection tube, and then secure the connection with the tube bands.



Preparation of parts (Reference)	Connection tube: φ6 inner diameter/Tygon tube Tube bands
-------------------------------------	---

<When using the tube fitting>

- (1) Remove the hose joint from the gas regulator.
 - (2) Attach the conversion bush using the packing or seal tape and then, attach the tube fitting.
 - (3) Connect the gas regulator and the incubator using the gas tube that came with the incubator unit.
- Note: Wind the seal tape around the thread part only. Make sure that the seal tape does not stick out of the thread.



Preparation of parts (Reference)	Tube fitting: female straight, adaptive tube OD6mm, Rc1/8 Conversion bush: bush A M12x1, R1/8 Packing: 6A (ID13mm x OD18mm) or seal tape
-------------------------------------	--

Note:

• If the CO₂ gas is supplied to multiple CO₂ incubators from a single gas cylinder, a CO₂ solid will be formed in the gas regulator. Then, the gas regulator safety valve will actuate, and there may be an explosive sound.

3. After connecting the gas tube, make sure that no gas is leaking (ex. by using a gas leak detection spray).

4. Set the CO₂ gas on the secondary side to 0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G)) for gas injection. Recommended pressure: 0.03 MPa(G) (0.3 kgf/cm²(G), 4.4 psi(G)).

Note: Do not set the pressure on the secondary side too high. As the pressure increases, the CO₂ gas density control range will increase. Excessive pressure may cause gas supply lines inside the incubator to come loose, which may result in gas poisoning or oxygen deprivation due to gas leak. If gas lines come loose, the incubator must be repaired.

5. When there is no CO₂ gas left and the CO₂ gas empty alarm is activated, replace the empty gas cylinder to a new one.

Note: When an optional gas auto changer MCO-21GCP is installed, it switches the empty CO₂ gas supply line to the other automatically. Refer to pages 78~79.

Note: The gas lines connected to the incubator will degrade over time. If any deterioration or abnormalities are found during inspection, replace the lines immediately.

BEFORE COMMENCING OPERATION

Initial cleaning method

Before using the incubator for the first time, always thoroughly clean the chamber, inner attachments, and humidifying pan (accessory) to remove dirt (tape residue, oil, etc.). Cleaning the chamber and humidifying pan is essential to ensure the utmost performance of the incubator. Use the following steps to properly clean the incubator.

1. Remove the inner attachments, referring to “Removing inner attachments” on pages 25~26.
2. Put on rubber gloves, and then disinfect the surface of the rubber gloves with ethanol for disinfection.
3. Thoroughly wipe clean the inner walls of the chamber, the inner attachments, the temperature sensor, the humidity control bar, and the UV lamp using gauze moistened with a proper amount*¹ of ethanol for disinfection (Fig. 1). Make sure to take particular care in cleaning corners and joints of the product.
4. Thoroughly wipe clean the inner door, inner door packing, and handles using gauze moistened with a proper amount*¹ of ethanol for disinfection.
5. Thoroughly wipe clean the removed inner attachments using gauze moistened with a proper amount*¹ of ethanol for disinfection, and then reinstall the inner attachments correctly and securely, referring to “Installing inner attachments” on page 27.
6. Thoroughly wipe clean the surface of the humidifying pan (accessory) using gauze moistened with a proper amount*¹ of ethanol for disinfection.

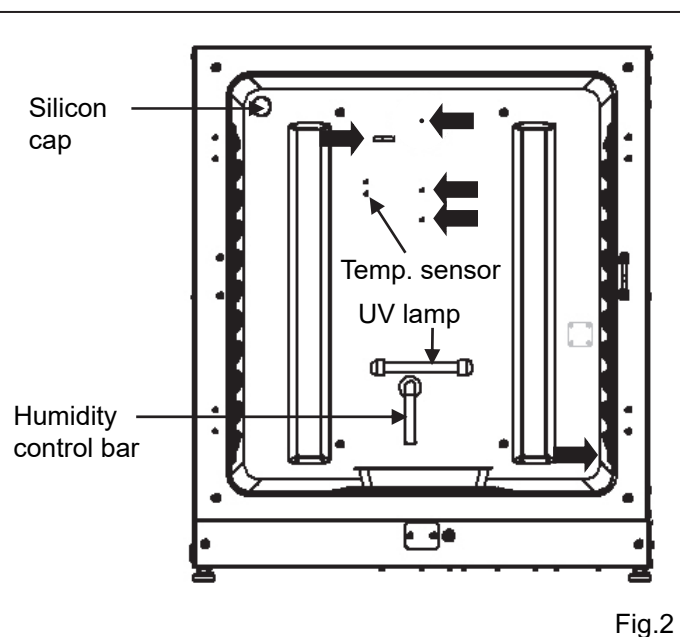
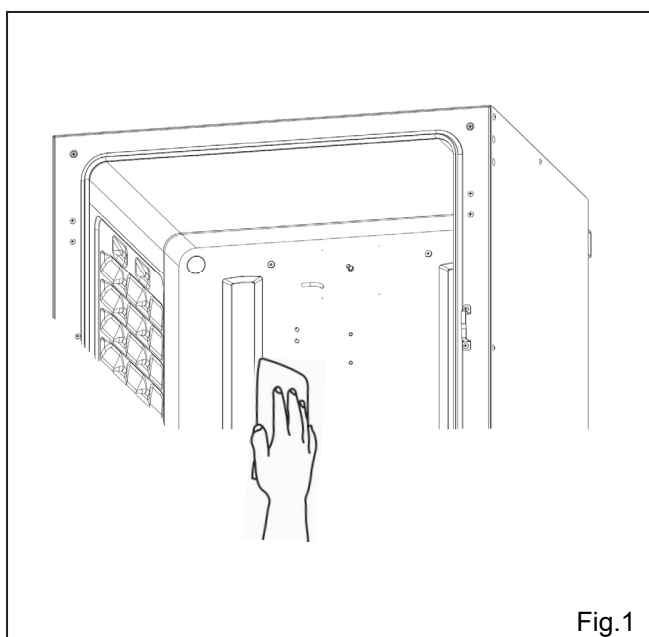
*¹ The amount that cannot form droplets on the surface.

Note: The most effective procedure to prevent contamination is to clean each part with a cloth or sponge moistened with a neutral cleaning solvent diluted to 5% or less, and then wipe down each part using gauze moistened with distilled water or pure water. You can also use autoclave sterilization (121°C for 20 minutes) for the silicon caps of the measurement ports (2 pcs) and the fan.

CAUTION

Do not use detergents or antiseptic solutions with acid, alkali, or chlorine. Doing so may cause discoloration, corrosion, or rusting.

Be careful to keep the diluted detergent or water out of the temperature sensor, the CO₂ gas injection port, the inner sample air access port, the fan motor shaft bearing, and the inner sample air outlet (Fig.2 ◀). Also, do not wash the temperature sensor, the UV lamp and the humidity control bar using detergent. Doing so may cause failure. (Fig. 2)



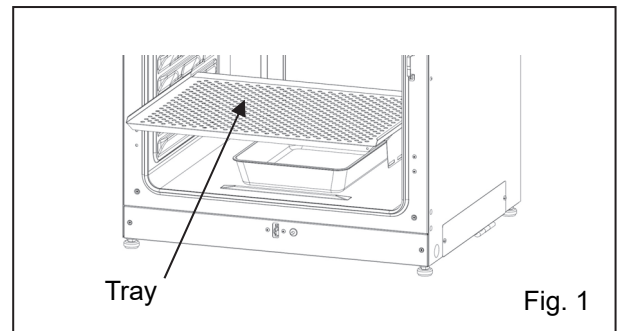
Removing inner attachments

CAUTION

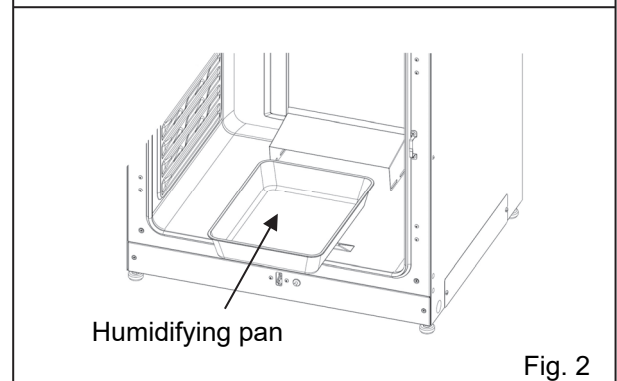
Wear rubber gloves when performing maintenance on the chamber. Failure to wear gloves may result in cuts or abrasions from sharp edges or corners.

Be careful not to damage the UV lamp in the duct.

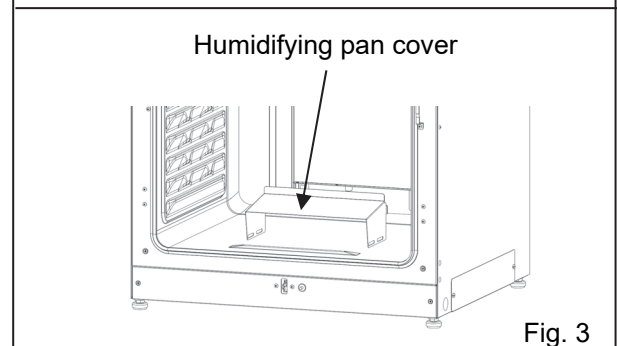
1. Turn OFF the power to the incubator.
2. Open the outer and inner doors and pull out all the trays (Fig. 1).



3. Pull out the humidifying pan (Fig. 2).



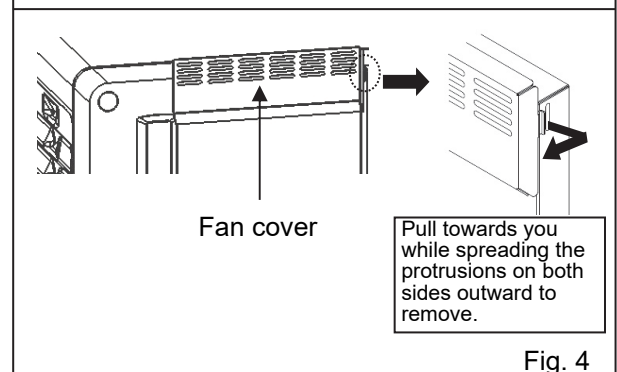
4. Pull out the humidifying pan cover (Fig. 3).



5. Pull out the fan cover (Fig. 4).

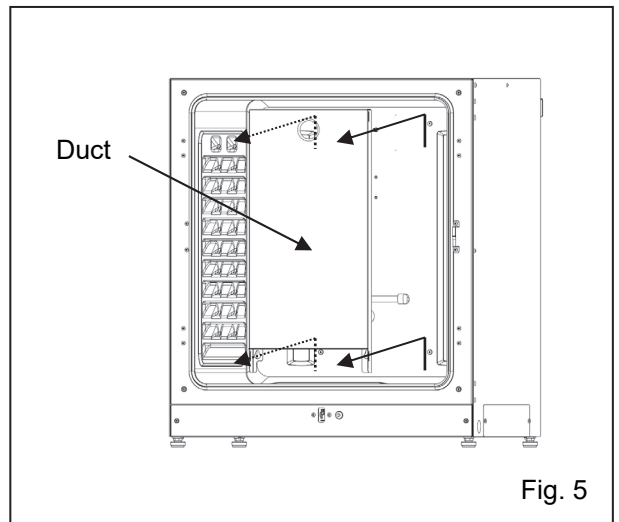
Note:

The fan cover is designed so that the protrusions on both sides catch in the elongated holes of the duct to prevent it from easily falling off after being attached to the duct. When removing the fan cover, pull it towards you while spreading the protrusions on both sides outward, and then remove it.

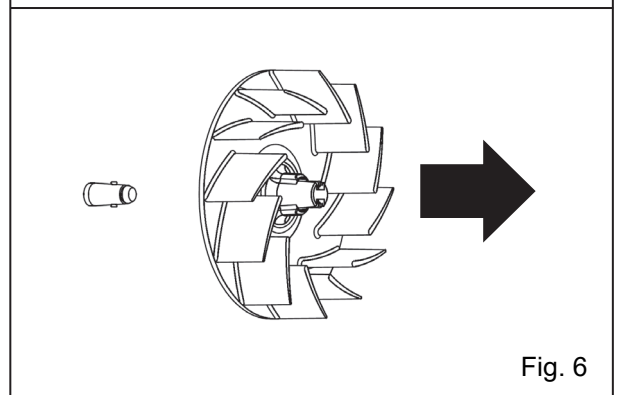


BEFORE COMMENCING OPERATION

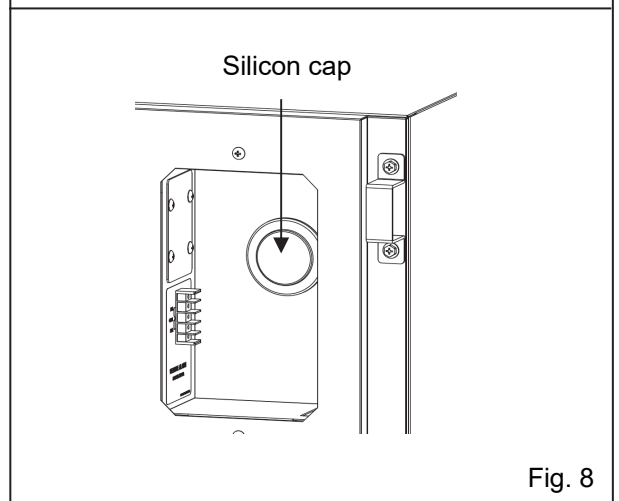
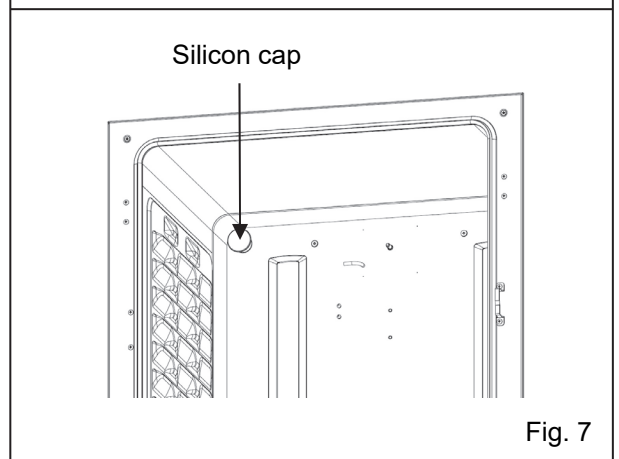
6. Lift the duct and remove it from the pins on the rear side (Fig. 5).



7. Pull out the fan (Fig. 6).



8. Remove the silicon caps of each access port from interior (Fig. 7) and exterior (Fig. 8).



Installing inner attachments

To re-install all the attachments, perform the procedure in reverse order from step 8 on page 26.

Note: When installing the fan, insert it to the motor shaft securely. Lightly turn and pull the fan manually to make sure that it does not touch the rear panel and is installed securely (Fig. 1).

CAUTION

If the fan is not inserted deep enough, the intended velocity performance cannot be achieved, and it may cause culture failure or insufficient decontamination.

Note: To install the duct, confirm 4 pins are securely installed in the 4 holes of the duct. (Fig. 2)

CAUTION

If the duct is fixed insecurely, the intended velocity performance cannot be achieved, which may cause culture failure or insufficient decontamination.

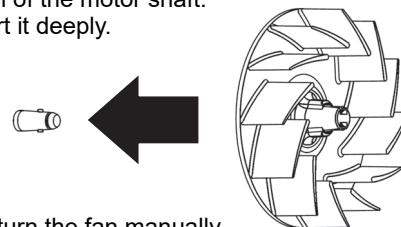
Note: When installing the fan cover, align the protrusions of the fan cover with the long holes in the duct and push until they click into place (Fig. 3). The same applies for the humidifying pan cover. Make sure that there is no space between the bottom of the fan cover and the duct after installing it. If the fan cover is incorrectly installed, it may adversely affect the temperature distribution in the chamber.

CAUTION

If the fan cover is fixed insecurely, the intended velocity performance cannot be achieved, which may cause culture failure.

Note: Set the tray with only the front edge bent down (Fig. 4).

1. Position the center hole of the fan with the projection of the motor shaft. And insert it deeply.



2. Lightly turn the fan manually to make sure that it does not touch the rear panel.
3. Lightly pull the fan manually to make sure that it is installed.

Fig. 1

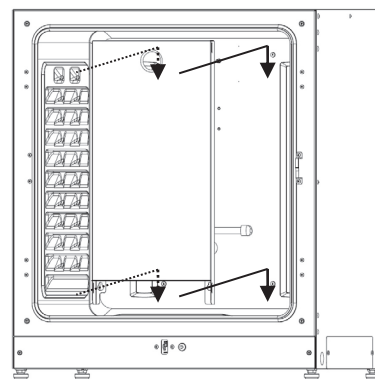
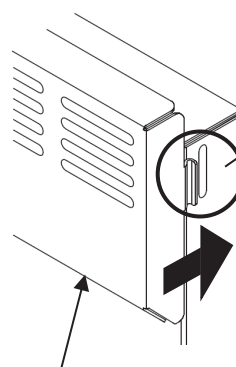


Fig. 2

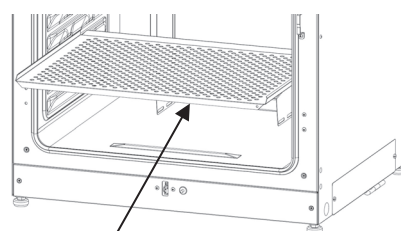


1. Fit the protrusions into the holes.

2. Check that protrusions on both sides are securely fitted.

3. Make sure that there is no space between the bottom of the fan cover and the duct.

Fig. 3



Bent down

Fig. 4

BEFORE COMMENCING OPERATION

Filling humidifying pan

Use the following procedure to fill the humidifying pan with sterile distilled water or pure water (do not use ultrapure water), or to replace the water in the humidifying pan.

1. Pull out the humidifying pan toward you. (Fig. 1)
2. Dispose of the remaining water in the humidifying pan and clean the humidifying pan with a diluted detergent. Then rinse it thoroughly with distilled water or pure water and wipe it with ethanol for disinfection.
3. Wipe all moisture from the bottom of the chamber.
4. Return the humidifying pan to the chamber and pour sterile distilled water or pure water (approx. 1.5 L, preheated to 37°C). (Fig. 2)

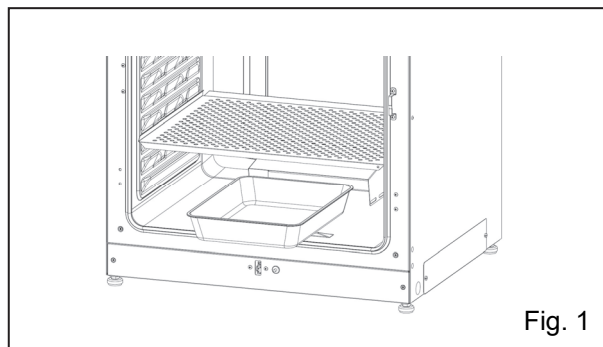


Fig. 1

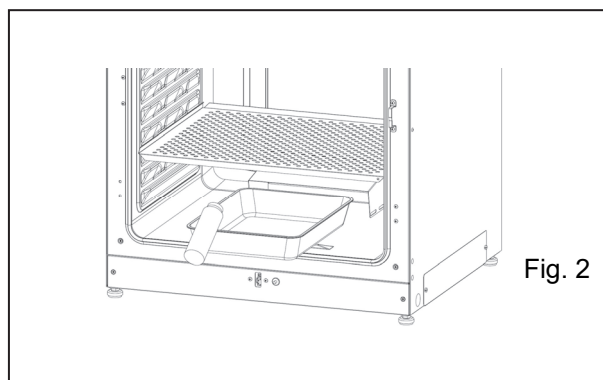


Fig. 2

Note:

- Operation with no water for humidifying may increase the chamber temperature than the set temperature temporarily.
- Preheat the water to 37°C to be poured into the humidifying pan. Adding low-temperature water will lower the temperature and humidity in the chamber.
- Install the humidifying pan in a longitudinal direction as its shorter side is placed in the back.
- Refill the humidifying pan with water early when the volume of water is decreased.
- Mixing any reagent in the water for humidifying may have a bad influence on the cultivation. Especially when using the UV lamp, do not use any reagent. Because the UV light may deteriorate the reagent mixed with the water for humidifying.
- After cleaning, please change the water of the humidifying pan. There is a possibility that it cannot be controlled correctly due to the influence of ethanol for disinfection.

5. Set the humidifying pan with the inner side flush against the back and close the inner door and the outer door.

Note: Set the humidifying pan with the inner side flush against the back. The humidity control bar in the duct keeps at low temperatures and inner moisture is recondensed. Slide the humidifying pan down right under the humidity control bar, otherwise the recondensed water drops will directly fall to the chamber bottom and will pool in the chamber bottom.

When the pooled water evaporates, it may leave a white mark on the chamber bottom. This is not a malfunction. Wipe it off with a piece of gauze or unwoven cloth moistened with ethanol for disinfection. When the mark cannot be removed, scrub the mark off with using a cream cleanser.

FOR BETTER CULTIVATION

Precautions for cultures

- **Leave space between culture containers.**

Always leave space for ventilation between culture containers (Petri dishes, flasks, etc.). Inadequate spacing may result in uneven temperature distribution and CO₂ gas density.

- **Do not place harmful materials in the chamber.**

Never place samples that release acidic, alkali, or corrosive gas in the chamber. Doing so may cause damage resulting from discoloration or corrosion.

- **Close the inner door.**

Always close the inner door before closing the outer door. Failure to close the inner door will adversely affect performance even if the outer door is closed.

- **Open and close the doors gently.**

Always open and close the doors gently. Closing the doors forcefully may cause spillage of the culture medium, incomplete closing, or damage to the gasket. Before opening the inner door, check through the glass to confirm that the UV lamp is OFF.

- **Be careful when closing the outer door.**

Use the handle when closing the outer door. Holding the door in other places may cause injury by getting fingers caught in the door. Do not lean on the outer door. Doing so may result in injury from the outer door coming loose or the incubator falling over, or it may cause current leakage or electric shock.

- **Be careful of the inside of the outer door.**

The inside of the outer door may become hot.

- **Avoid using excessive force on the inner door.**

Do not put your hand on the glass, poke it with sharp objects, or apply strong force. Doing so may result in injury from breaking the glass.

- **Check the cause of any alarm buzzer.**

If an alarm buzzer sounds while the incubator is in use, immediately check the cause of the alarm. For details on what may cause an alarm buzzer to sound, refer to pages 82~84.

FOR BETTER CULTIVATION

Preventing contamination

To prevent contamination of the chamber, select a suitable installation site.

- **Avoid locations with high temperatures or humidity.**

Avoid locations with high temperatures or humidity, because of a greater presence of microorganisms in the air.

- **Avoid locations with passers-by or drafts.**

Avoid locations near doors, air conditioners, fans, etc., where passers-by or drafts can facilitate the entry of microorganisms into the chamber.

- **If possible, use a cleanroom.**

To achieve a better culture, it is recommended that a cleanroom be used if one is available.

- **Use clean containers.**

The greatest cause of contamination is dirty containers for cultures. Be careful not to get containers or trays dirty when taking them in and out.

- **Keep the chamber clean.**

Wipe off any fingerprints. If water spills from the humidifying pan, or if the doors are left open for a long time, condensation may form on the inside of the doors. If that occurs, wipe off the condensation with a dry sterile gauze. In particular, clean and disinfect the chamber if the culture medium is spilled. For details, refer to “ROUTINE MAINTENANCE” on page 81.

- **Use sterile distilled water or pure water (do not use ultrapure water) to fill the humidifying pan and change it once a week.**

Use sterile distilled water or pure water that has been purified through methods such as deionization or desalination for the humidifying pan and replace it once a week.

Note that if ultrapure water is used or if the humidifying water is not replaced for more than a week, red rust-like particles may appear in the humidifying pan. If these red rust-like particles appear, promptly discard the water, thoroughly clean and rinse the tray, and then refill it with fresh sterile distilled water or pure water.

- **Keep the incubator out of direct airflows from air conditioners or fans.**

Cool airflow from an air conditioner may cause condensation and lead to possible contamination.

CORRECT OPERATION

Use the following procedure to start trial operation or actual operation of the incubator.

1. Install the incubator correctly, referring to “INSTALLATION” on pages 17~23.
2. Remove the packing materials from the chamber and inner attachments. Clean and disinfect the chamber and all the inner attachments, referring to “ROUTINE MAINTENANCE” on page 81.
3. Add approximately 1.5 L of sterile distilled water or pure water (not ultrapure water) to the humidifying pan (refer to page 28).
4. Connect the included removable power supply cord to the port on the lower right side.
5. Connect the removable power supply cord to the outlet.
6. Turn ON the power switch on the lower right side of the incubator.
7. Set the frequency of a power supply on the LCD touch panel (refer to pages 60~61).

WARNING

Always use the removable power supply cord that is provided. Other power supply cord may cause electric shock or fire.

- **The provided removable power supply cord is only for this product.**

Never use it for any other products.

- **When the incubator is not in use**

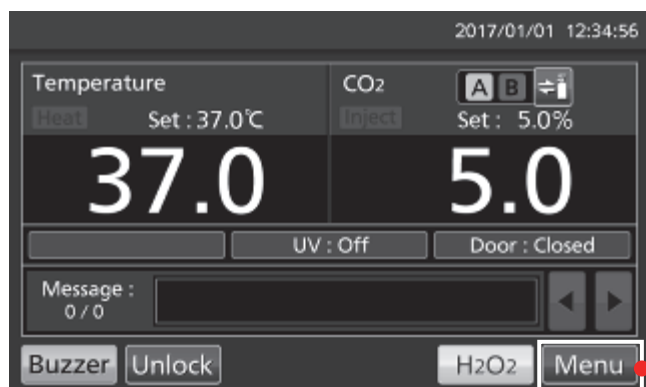
Empty the water out of the humidifying pan and remove moisture from the chamber. Make sure that the chamber is completely dry before closing the doors. Failure to do so may result in damage.

- **Before moving the incubator**

Before moving the incubator, empty the water out of the humidifying pan, disconnect the power supply plug from the outlet, and make sure that the cord will not be damaged. Failure to do so may result in electric shock or fire.

BASIC OPERATION ON LCD TOUCH PANEL

•Operation from Menu key



■Menu screen

Page

◆Set	→	■Stand-by Setting screen	(Setting)	Temp., CO ₂ density, high limit temp. alarm	35~36
◆Log	→	■Log screen			
		◆Chart	→	■Chart screen	
			◆Actual Temp.	(Display)	Chamber temp. log graph (can be exported) 45~47
			◆Actual CO ₂ Level	(Display)	CO ₂ density log graph (can be exported) 45~47
			◆Door Opening	(Display)	Outer door opening log graph (can be exported) 45~47
		◆Data Export	→	■Export screen	
			◆Actual Temp.	(Export)	Chamber temperature log 48~50
			◆Actual CO ₂ Level	(Export)	CO ₂ density log 48~50
			◆Door Opening	(Export)	Outer door opening log 48~50
		◆Setting	(Setting)	Log interval, Unique ID	44~45
		◆Alarm	(Display)	Alarm log (can be exported)	51~52
		◆Alarm Export	(Export)	Alarm log	53~55
◆Lock	→	■Lock screen			
		◆Auto-Lock	→	■Auto-Lock screen*1	(Setting) Auto-lock ON/OFF, User-ID ON/OFF 72~76
		◆KeyLock	→	■Key Lock screen	(Setting) Key lock ON/OFF, password 37~40
		◆Auto-Lock User	→	■Auto-Lock User screen	(Setting) User-ID, password 70~72
◆Tools#1	→	■Tools#1 screen			
		◆Temp./ Gas Calibration		Do not press this key (see next page).	
		◆Alarm Setting #1	(Setting)	Temp. alarm, CO ₂ density alarm, alarm delay	41
		◆Alarm Setting #2	(Setting)	Door alarm delay, ring back, remote alarm	41~43
		◆UV Setting	(Setting)	UV timer, power supply frequency	60~61
		◆STD Gas Setting	(Operate)	Lighting UV lamp for 24 hours	62~63
		◆STD Gas Calibration		Do not press this key (this function is unavailable).	
				Do not press this key (this function is unavailable).	
◆Tools#2	→	■Tools#2 screen			
		◆Date & Time	(Setting)	Date, time	56
		◆Brightness/Sleep	(Setting)	Brightness, sleep ON/OFF etc.	57~58
		◆DAQ Setting		Do not press this key (this function is unavailable).	

*1: The auto lock function is available when using MCO-230AICUVHL, or MCO-230AICUVL with the optional electric lock MCO-170EL installed.

Note: Service key is not available. (Qualified engineer only)

Note: On the Tools #1 screen, if the Temp/Gas Calibration key is pressed by mistake, the Temp/Gas Calibration screen is displayed.

When this screen is displayed, press Back key to return to the Tools #1 screen, or press Top key to return to the Top screen.

When these settings on this screen are changed, inaccurate temperature or CO₂ density may be displayed.

Temp/Gas Calibration		↑ Top	← Back
Temp Span	0.0	PV 37.0	Volt 0.5
CO ₂ Zero	0.1	0.1	4.00 500
CO ₂ Span		0.1	4.00 500
CO ₂ Ref		4.00	385
CO ₂ Gas		4.00	246

•Operation from other than Menu key

◆CO₂ gas supply line select key: (Operate) Manual changeover between CO₂ gas supply line A and B (Page 80)

2017/01/01 12:34:56

Temperature: Heat Set: 37.0°C

CO₂: Inject Set: 5.0%

37.0 5.0

UV: Off Door: Closed

Message: 0/0

Buzzer Unlock H₂O₂ Menu

◆Message select key: (Operate) Changing some messages

◆H₂O₂ key*²: (Operate) H₂O₂ decontamination (Pages 64~69)

◆Unlock key*³: (Operate) Unlock the outer door. (Pages 70~74)

◆Buzzer key: (Operate) Silencing the buzzer (Alarm is not canceled except for some alarms; page 83)

*2: This key becomes available for MCO-230AICUVHL, or MCO-230AICUVL with the optional H₂O₂ generator MCO-HP, H₂O₂ decon board MCO-170HB, and electric lock MCO-170EL installed.

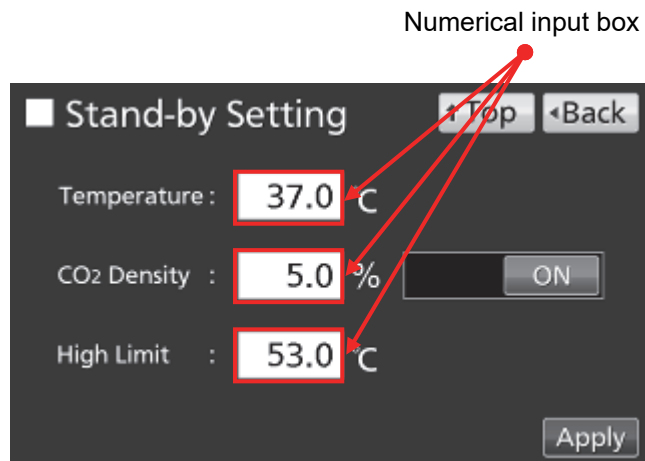
*3: This key becomes available when the auto lock function is set to "ON" for MCO-230AICUVHL, or MCO-230AICUVL with the optional electric lock MCO-170EL installed.

BASIC PARAMETERS

Numerical input to input window

On each screen in the LCD touch panel, it may be necessary to input numerical values on the numerical input box.

1. By pressing numerical input box, input window is displayed.



2. Press Numerical key or Up/Down key to input numerical value and press OK key.

- Key description

- Numerical key (0~9):

Input numerical values.

- Up/Down key (▲/▼):

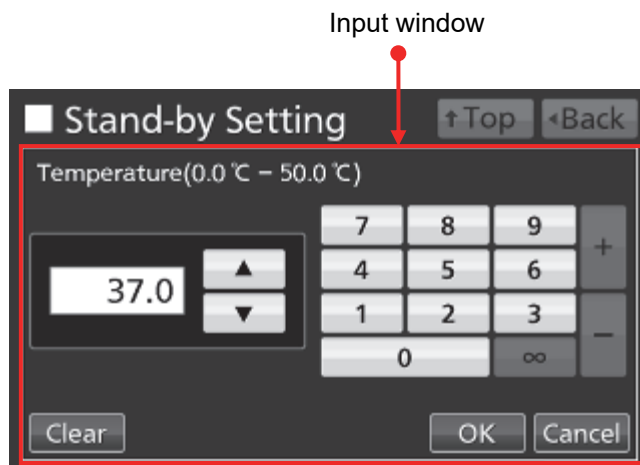
Increases or decreases the numerical value displayed in the numerical input box.

- Clear key:

Deletes the numerical value displayed on the numerical input box.

- Cancel key:

Stops inputting on the numerical input box and closes the input window.



Note: While the input window is open, it is not possible to operate Top key and Back key.

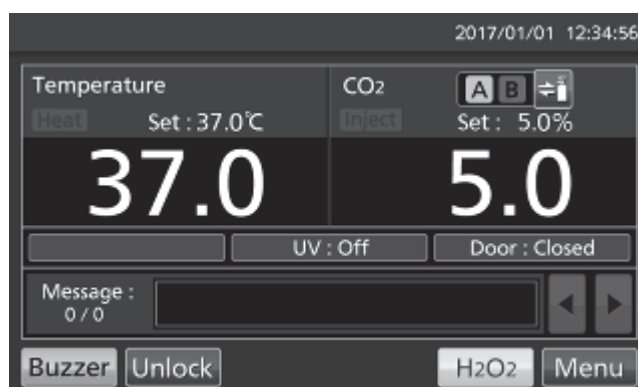
Note: Up/Down key may not be displayed.



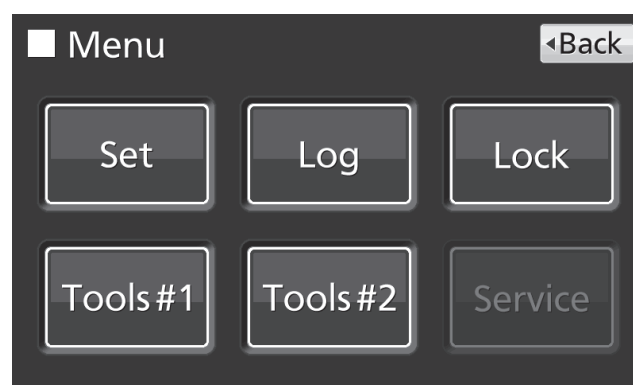
Setting temperature, CO₂ density and high limit temperature alarm

Set the chamber temperature, the CO₂ density, and the temperature of the high limit temperature alarm for normal operation according to the following procedure. The incubator automatically starts operation using these settings after power-on.

1. Press Menu key to display the Menu screen.



2. Press Set key to display the Stand-by Setting screen.



BASIC PARAMETERS

3. Input each parameter. Press Apply key to save the input value. The display returns to the Menu screen.

The screenshot shows a 'Stand-by Setting' screen with a dark background. At the top right are two buttons: '↑Top' and '◀Back'. The screen displays three settings: 'Temperature : 37.0 °C', 'CO2 Density : 5.0 %' with an 'ON' button to its right, and 'High Limit : 53.0 °C'. At the bottom right is an 'Apply' button.

- Each parameter setting

- Temperature: Set value of chamber temperature.

Settable range: 0.0°C ~50.0°C, factory setting: 37.0°C.

- CO₂ Density: Set value of chamber CO₂ density. By holding CO₂ Density slide key and sliding it to the right, CO₂ density control turns to ON. Settable range: 0.0%~20.0%, factory setting: 0.0% (OFF).

- High Limit: The high limit temperature alarm is different from the Automatic set temperature alarm (page 41), and it is independent temperature alarm. In case the chamber temperature exceeds the temperature of the high limit temperature alarm, this alarm is activated.

Settable range: 20.0°C ~53.0°C, factory setting: 53.0°C.

Refer to pages 82~84 for detail of each alarm.

Note:

- When changing the set temperature from less than 45.0°C to 45.0°C or higher, the incubator readjusts the CO₂ sensor. During readjusting, "Status: Gas sensor initializing" is displayed in the Message display field, and "--.-" is displayed in the Present CO₂ density display field. After 15 minutes in the shortest, the incubator returns to the normal operation.

- When operating the incubator for the first time or after not using it for an extended period of time, operate it for at least about 4 hours until the chamber temperature and the CO₂ sensor are stable after setting the chamber temperature to the desired temperature and setting the CO₂ density to 0%. Then change the setting to the desired CO₂ density.

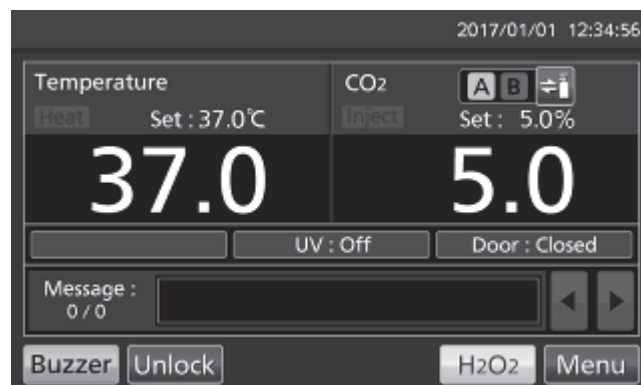
- Set the temperature of the high limit temperature alarm after the chamber temperature is stable at the set value.

- Set the high limit temperature alarm to at least 1°C higher than the chamber set temperature.

4. On the Menu screen, press Back key to return to the Top screen.

Setting key lock

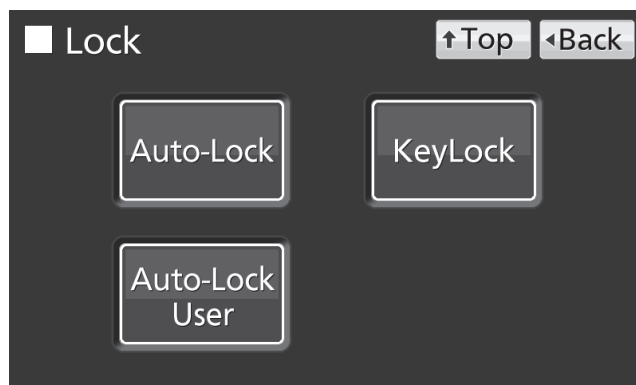
1. Press Menu key to display the Menu screen.



2. Press Lock key to display the Lock screen.

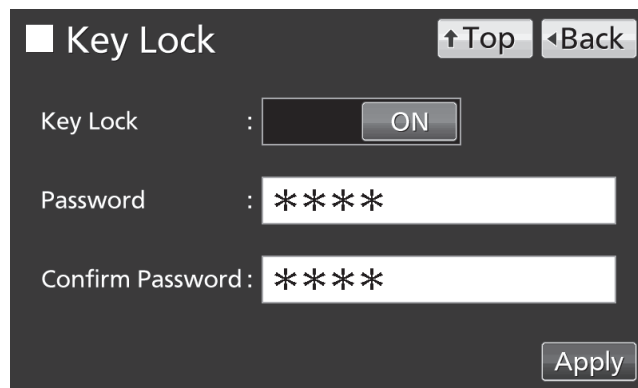


3. Press KeyLock key to display the Key Lock screen.



BASIC PARAMETERS

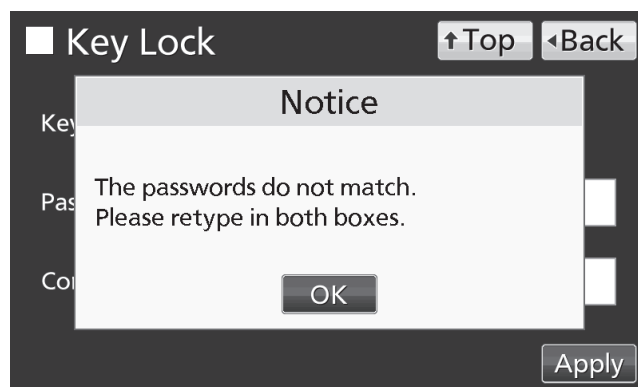
4. On the Key Lock screen, it is possible to set each setting of key lock. Press Apply key to change key lock ON and to save the password. The display returns to the Lock screen.



- Each setting of key lock

- Key Lock: By holding Key Lock slide key and sliding it to the right, Key Lock turns to ON.
- Password: The number (Max. 6-digit) inputted here are registered the release password of Key Lock.
- Confirm Password:

To prevent erroneous input, input the same password as Password input box. When inputting different password, the Notice dialog box is displayed. Press OK key and input the correct password.



Note: To prevent abuse of the release password of Keylock, manage properly by limited administrators.

5. On the Lock screen, press Top key to return to the Top screen.

●Operation for Keylock-ON

· When pressing any key except the CO₂ gas supply line select key, Buzzer key and Unlock key, Password input box is displayed, and input of the release password of Key Lock is required.

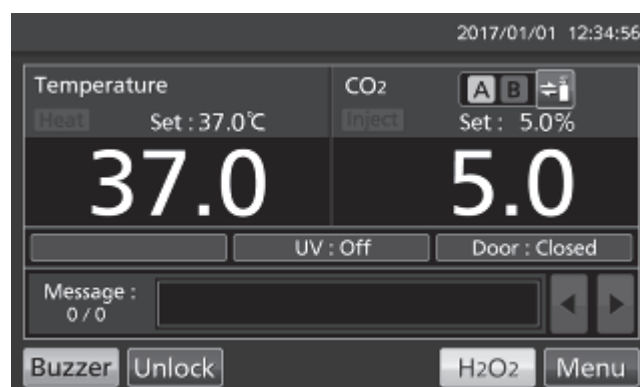


· When the inputted password is incorrect, the Notice dialog box is displayed. Press OK key, and then input the correct password.



Removing key lock

1. By pressing Menu key, the Password input window is displayed.



2. On Password input box, input the set release password of Key Lock, and press OK key to display the Menu screen.

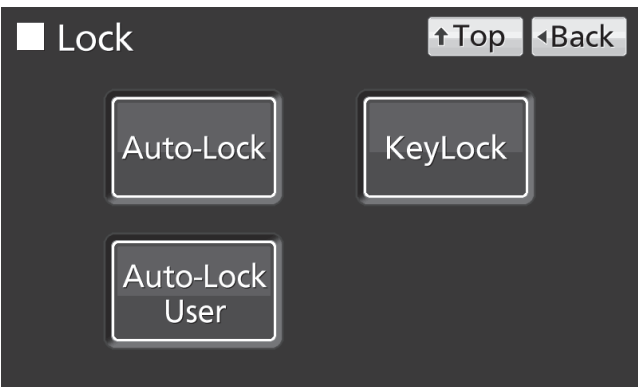


BASIC PARAMETERS

3. Press Lock key to display the Lock screen.

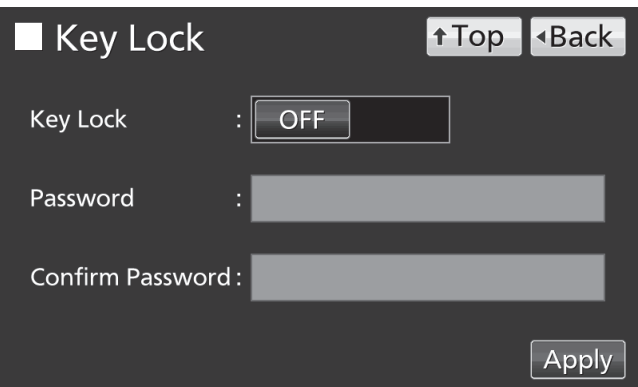


4. Press KeyLock key to display the Key Lock screen.



5. On the Key Lock screen, by holding Key Lock slide key and sliding to the left, change to OFF. Press Apply key to turn the key lock OFF. The display returns to the Lock screen.

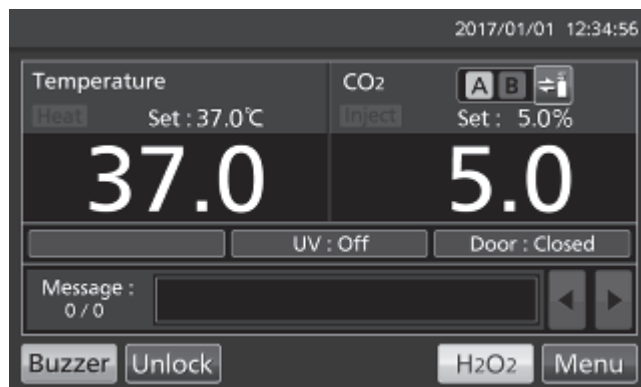
Note: The release password of key Lock is deleted.



6. On the Lock screen, press Top key to return to the Top screen.

ALARM PARAMETERS

1. Press Menu key to display the Menu screen.



2. Press Tools #1 key to display the Tools #1 screen.



3. On the Tools #1 screen,

- Press Alarm Setting #1 key to display the Alarm Setting #1 screen, it is possible to set automatic set temperature alarm, automatic set CO₂ density alarm and alarm delay of each alarm (go to procedure 4).

- Press Alarm Setting #2 key to display the Alarm Setting #2 screen, it is possible to set door alarm delay, ring back and remote alarm (go to procedure 5).

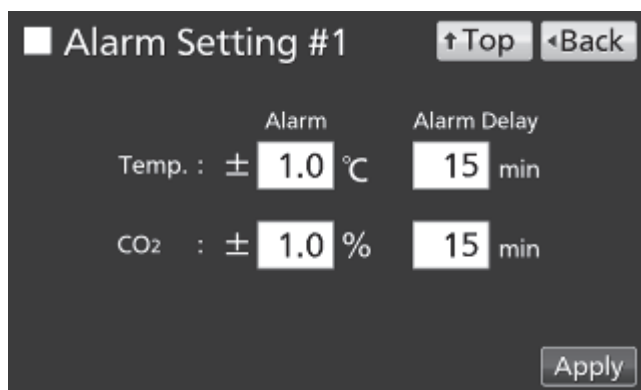


4. On the Alarm Setting #1 screen, input each parameter. Press Apply key to save the input value. The display returns to the Tools #1 screen.

- Each parameter setting

- Temp. Alarm:

When the chamber temperature exceeds the scope, the set temperature $\pm$ the set value of Automatic set temperature alarm, the alarm is activated. Settable range: $\pm 1.0^{\circ}\text{C}$ $\sim$ $\pm 5.0^{\circ}\text{C}$, factory setting: $\pm 1.0^{\circ}\text{C}$.



ALARM PARAMETERS

· Automatic set temperature alarm delay (Temp. Alarm Delay):

The function is that when the incubator is in the alarm state of automatic set temperature, the alarm buzzer will sound after the automatic set temperature alarm delay set time passed.

Settable range: 0 minute~15 minutes, factory setting: 15 minutes.

Note: When the incubator is recovered from the alarm state of automatic set temperature within the automatic set temperature alarm delay time, the buzzer doesn't sound after the elapse of the automatic set temperature alarm delay.

· CO₂ Alarm:

When the chamber CO₂ density exceeds the scope, the set CO₂ density $\pm$ the set value of Automatic set CO₂ density alarm, the alarm is activated. Settable range: $\pm 0.5\%$ ~ $\pm 5.0\%$, factory setting: $\pm 1.0\%$.

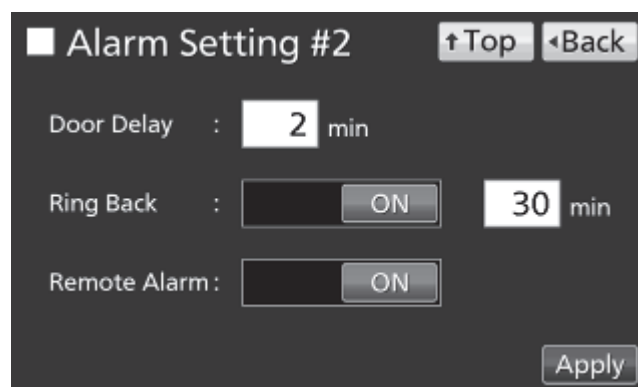
· Automatic set CO₂ density alarm delay (CO₂ Alarm Delay):

The function is that when the incubator is in the alarm state of automatic set CO₂ density, the alarm buzzer will sound after the automatic set CO₂ density alarm delay set time passed.

Settable range: 0 minute~15 minutes, factory setting: 15 minutes.

Note: When the incubator is recovered from the alarm state of automatic set CO₂ density within the automatic set CO₂ density alarm delay time, the buzzer doesn't sound after the elapse of the automatic set CO₂ density alarm delay.

5. On the Alarm Setting #2 screen, it is possible to set each alarm. Press Apply key to save the input value and setup. The display returns to the Tools #1 screen.



● Each setting

· Door Delay:

The function is that when the incubator is in the alarm state of door, the alarm buzzer will sound after the alarm delay set time passed. Settable range: 1 minute~30 minutes, factory setting: 2 minutes.

Note: When the incubator is recovered from the alarm state within the door alarm delay time, the buzzer doesn't sound after the elapse of the door alarm delay.

· Ring Back:

The function is that the alarm buzzer sounds again when the alarm state still continues after the alarm delay set time passed even though the alarm buzzer was stopped by pressing Buzzer key. By holding and sliding Ring Back slide key to the right, the Ring Back is turned to ON. Settable range: 1 minute~99 minutes, factory setting: 30 minutes.

Note: At Err01 (CO₂ gas cylinder empty), Err11•12 (CO₂ sensor error), Err18 (UV lamp failure) and Door alarm, the alarm is not re-activated because the alarm itself is deactivated by pressing Buzzer key (refer to pages 80~83).

· Remote Alarm:

The function is that the remote alarm is continued even though the buzzer is stopped by pressing Buzzer key. By holding and sliding Remote Alarm slide key to the right, the Remote Alarm is turned to ON (not in conjunction with Buzzer key). Factory setting: ON.

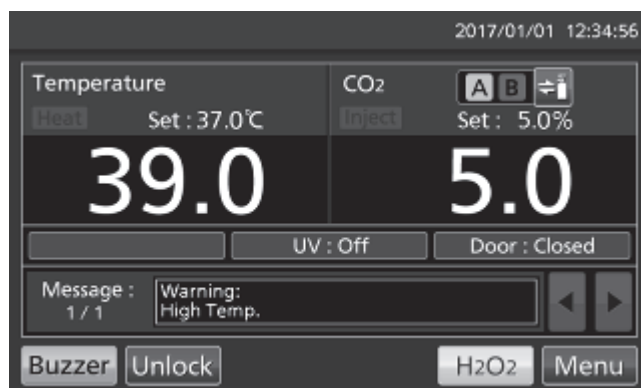
6. (From procedure 4 and 5) Press Top key to return to the Top screen.

- At the alarm state

· While the incubator's alarm is being activated and the buzzer is being sounding, the buzzer is silenced by pressing Buzzer key. For the behavior at the time of pressing Buzzer key and the re-activation of alarm, under each setting condition, refer to Table 5-7 on page 83.

Resolve the cause of the alarm in reference to pages 82~84 because the alarm itself is not deactivated by pressing Buzzer key except for some alarms.

Note: The buzzer for the high limit temperature alarm cannot be silenced.

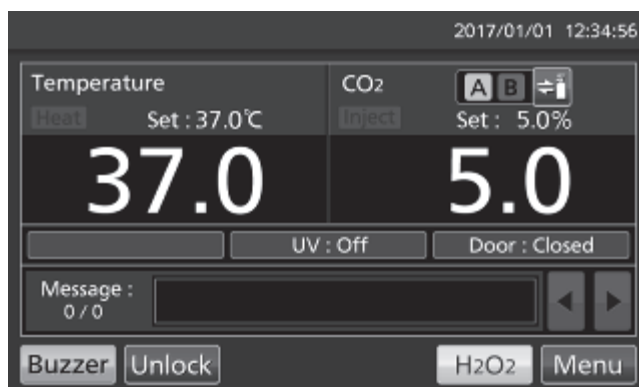


OPERATION/ALARM LOG

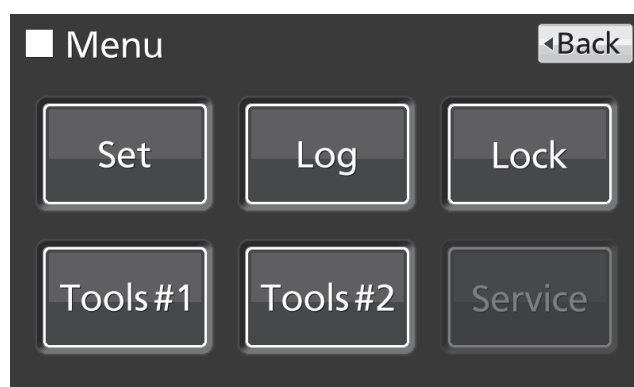
Setting log interval

The incubator is equipped with a function of saving operation log data (chamber temperature, CO₂ density and open/close state of outer door). Use the following procedure to set the log interval (interval of acquiring the operation log).

1. Press Menu key to display the Menu screen.



2. Press Log key to display the Log screen.



3. Press Setting key to display the Setting screen.



4. On the Setting screen, input Log Interval. Press Apply key to save the input value. The display returns to the Log screen.

Settable range: 2 minutes~30 minutes.

Factory setting: 6 minutes.

Note: It is possible to register 8-digit alphanumeric characters as the Unique ID. Refer to page 50.

The image shows a 'Setting' screen with a dark background. At the top left is a small square icon, followed by the title 'Setting'. At the top right are two buttons: '↑Top' and '◀Back'. Below the title, there are two input fields. The first is labeled 'Log Interval:' and contains the number '6' followed by 'min'. The second is labeled 'Unique ID :' and is an empty rectangular box. At the bottom right is an 'Apply' button.

Note: Relation between log interval and the estimated amount of data that can be saved

Log interval=2 minutes: Approx. 46 days

Log interval=6 minutes: Approx. 135 days

Log interval=30 minutes: Approx. 664 days

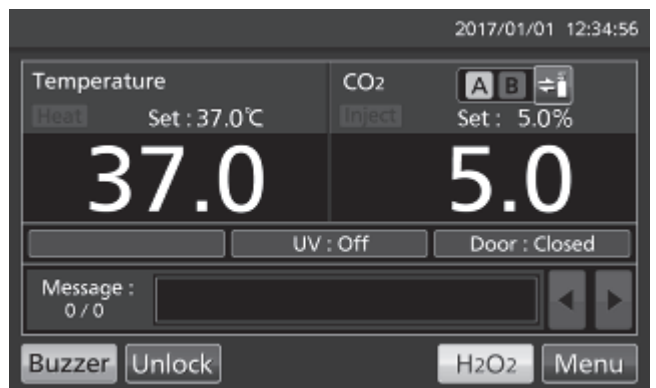
When saving data more than the above, and the data is overwritten, and the old data is deleted.

5. Press Top key to return to the Top screen.

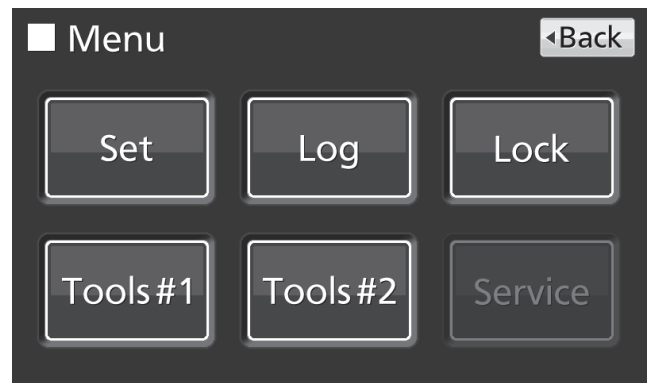
Displaying operation log

Operation log saved in the incubator can be displayed graphically on the LCD touch panel.

1. Press Menu key to display the Menu screen.

The image shows the main incubator display screen. At the top right is the date and time '2017/01/01 12:34:56'. Below this, there are two main sections: 'Temperature' and 'CO2'. The 'Temperature' section has a 'Heat' indicator and 'Set : 37.0°C', with a large '37.0' in the center. The 'CO2' section has an 'Inject' indicator, 'Set : 5.0%', and a large '5.0' in the center. Below these are three buttons: 'UV : Off' and 'Door : Closed'. At the bottom, there is a 'Message : 0 / 0' field with navigation arrows, and a row of buttons: 'Buzzer', 'Unlock', 'H2O2', and 'Menu'.

2. Press Log key to display the Log screen.

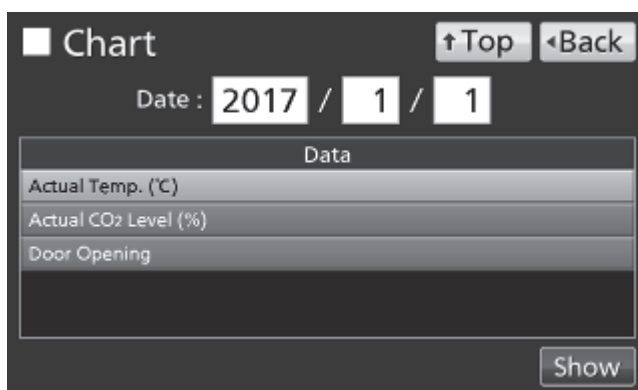
The image shows a 'Menu' screen with a dark background. At the top left is a small square icon, followed by the title 'Menu'. At the top right is a '◀Back' button. Below the title, there are six buttons arranged in two rows of three. The first row contains 'Set', 'Log', and 'Lock'. The second row contains 'Tools#1', 'Tools#2', and 'Service'.

OPERATION/ALARM LOG

3. Press Chart key to display the Chart screen.



4. On the Chart screen, input the date (year / month / day) of the operation log you want to display graphically.



5. On the Chart screen, by pressing Show key after pressing the item you want to display graphically, the graph of each operation log is displayed.

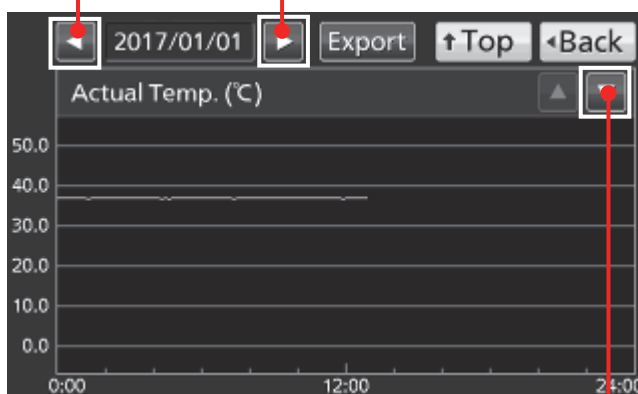
- Actual Temp.:
Chamber temperature log graph
(Go to procedure 6)
- Actual CO₂ Level:
CO₂ density log graph
(Go to procedure 7)
- Door Opening:
Open/close state of outer door log graph
(Go to procedure 8)



6. Actual Temp. log graph is displayed.

- Press Back key to return to the Chart screen.
- Press Top key to return to the Top screen.

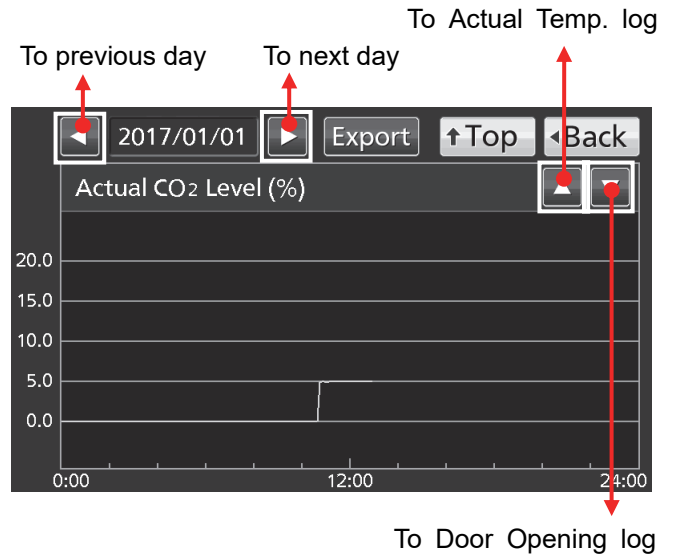
To previous day To next day



To Actual CO₂ Level log

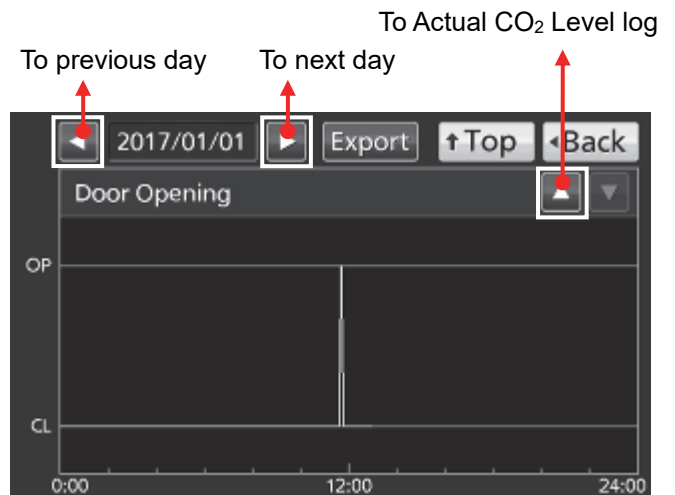
7. Actual CO₂ Level log graph is displayed.

- Press Back key to return to the Chart screen.
- Press Top key to return to the Top screen.



8. Door Opening log graph is displayed.

- Press Back key to return to the Chart screen.
- Press Top key to return to the Top screen.



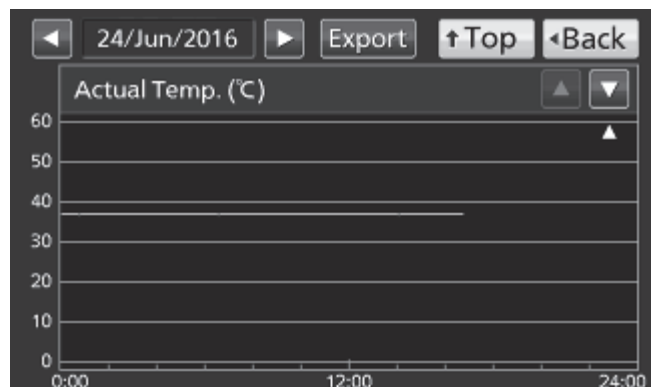
Note: The error of about 1 minute may be observed during a month. Refer to page 56 for the procedure of setting time.

● On each log graph screen of procedure 6, 7 or 8, operation log data can be exported in CSV format to a USB flash drive inserted into the USB port.

9. Insert a USB flash drive into the USB port.

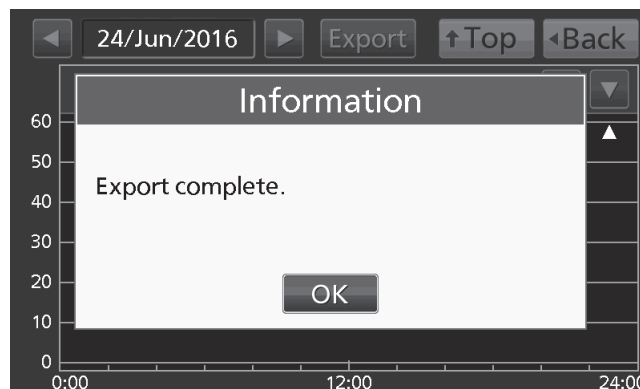
Note: USB flash drives with capacity of 32 GB or less that employ the FAT16/FAT32 file system are supported. USB flash drives that require passwords cannot be used. Do not insert devices other than USB flash drives into the USB port.

10. Press the Export key.



OPERATION/ALARM LOG

11. When the export is complete, Information dialog box is displayed. Press the OK key. Refer to page 50 for the details about abnormal export or exported file name.



12. Press the Top key to return to the Top screen.

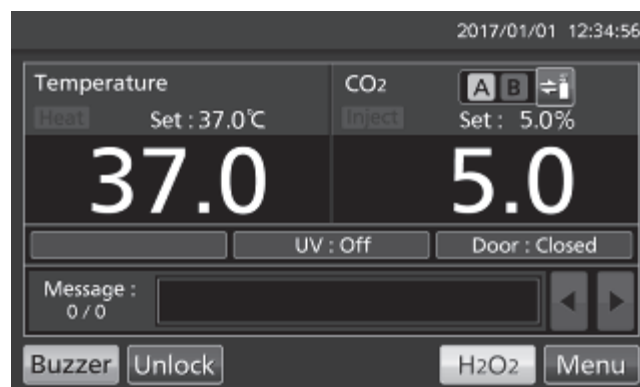
Exporting operation log

Operation log data saved in the incubator can be exported in CSV format to a USB flash drive inserted into the USB port.

1. Insert a USB flash drive into the USB port.

Note: USB flash drives with capacity of 32 GB or less that employ the FAT16/FAT32 file system are supported. USB flash drives that require passwords cannot be used. Do not insert devices other than USB flash drives into the USB port.

2. Press Menu key to display the Menu screen.



3. Press Log key to display the Log screen.



4. Press Data Export key to display the Export screen.



5. On the Export screen, select the time period you want to export.

- To export the saved operation log data over the entire period, press All radio button.
- To export the operation log data of a specified date, press 1 Day radio button and input the date (year / month / day) of the operation log data you want to export.



Note: The error of about 1 minute may be observed during a month. Refer to page 56 for the procedure of setting time.

6. On the Export screen, select the type of operation log data you want to export.

- To export all types of operation log data, press All Ch key.
- To export only operation log data you want to export, select operation log data you want to export, and then press Selected Ch key.
- Actual Temp.: Chamber temperature log data
- Actual CO₂ Level: CO₂ density log data
- Door Opening: Open/close state of outer door log data*



* When both of the Auto-lock function and the User-ID mode are ON (refer to page 70~73), inputted User-IDs for unlocking the outer door are also exported.

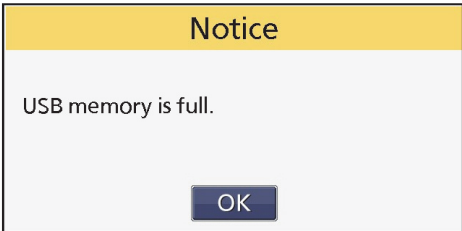
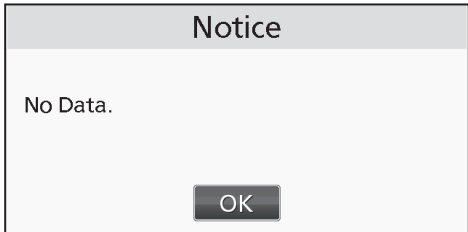
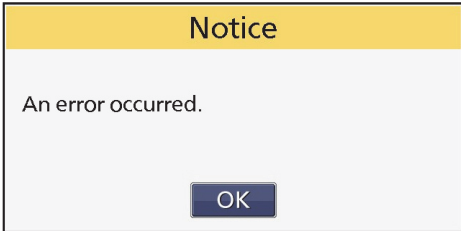
7. When the export is complete, Information dialog box is displayed. Press OK key.

Note: Even after the export of operation log data is complete, operation log data saved in the incubator are not deleted.



OPERATION/ALARM LOG

Note: When an export error occurs, any of the following notices will appear.

•USB flash drive is not inserted into the USB port. •USB flash drive is not inserted properly. Solution: Press the OK key, and then insert a USB flash drive properly into the USB port. 	•There is not enough free space in the USB flash drive. •The USB flash drive is not formatted in FAT16 or FAT32 format. Solution: Press the OK key, and then check the capacity and format type of the USB flash drive. 
•The specified log data does not exist. Solution: Press the OK key and specify the data again. 	• The export operation was unsuccessful. Solution: Press the OK key and specify the data again. 

8. Remove the USB flash drive from the USB port.

Note:

· The log folder is created in the USB flash drive, and the exported file is saved in it in CSV format. The exported file name is in date (8 digits) - type of data format.

(e.g.) When exporting all types of data using All (from Oct. 1st, 2017 to Jan. 1st, 2018):

20171001-20180101_AllCh.csv

20171001-20180101_Door.csv

(e.g.) When exporting Actual Temp. using 1 Day (Jan. 1st, 2018):

20180101_Temp.csv

· On the beginning of the exported file, "MCO-230AIC" is written. However, when the Unique ID is registered (refer to page 45), "MCO-230AIC" and Unique ID (8-digit) are written.

(e.g.) When "RoomA001" is set as the Unique ID of MCO-230AICUVL:

MCO-230AIC, RoomA001

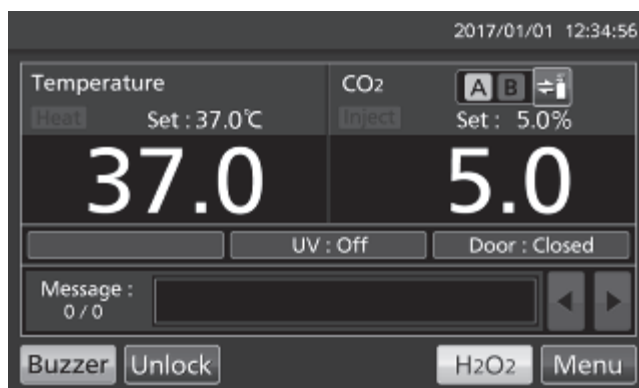
9. Press Top key to return to the Top screen.

Displaying alarm log

The incubator is equipped with a function of saving alarm log data (Max. 256 logs). Alarm log saved in the incubator can be displayed on the LCD touch panel.

Note: When saving alarm logs more than 256, the oldest alarm log is deleted, and then overwritten.

1. Press Menu key to display the Menu screen.



2. Press Log key to display the Log screen.



3. Press Alarm key to display the Alarm screen.

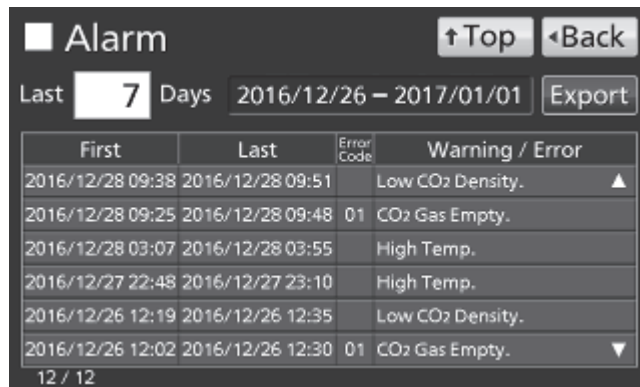


OPERATION/ALARM LOG

4. On the Alarm screen, the newest 7 days' alarm logs (containing that day) are displayed.

Note: When the number of applicable alarm log is 7 or more, by pressing the top (▲) or the bottom (▼) log, the log table currently displayed scrolls and hidden alarm logs can be seen.

- Press Back key to return to the Log screen.
- Press Top key to return to the Top screen.



The screenshot shows the 'Alarm' screen with a title bar containing 'Alarm', 'Top', and 'Back' buttons. Below the title bar, there is a 'Last' input box set to '7' Days, a date range '2016/12/26 - 2017/01/01', and an 'Export' button. The main area contains a table with columns: 'First', 'Last', 'Error Code', and 'Warning / Error'. The table lists 7 alarm events. The bottom status bar shows '12 / 12'.

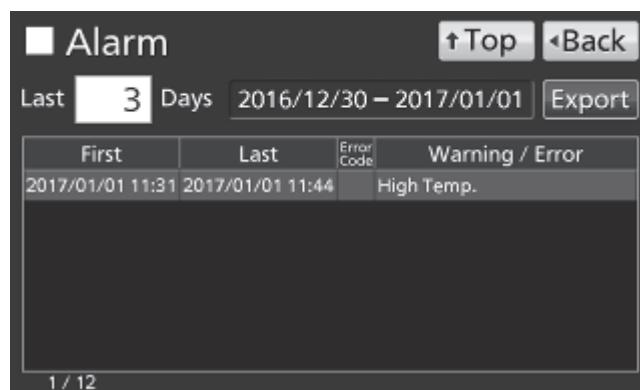
First	Last	Error Code	Warning / Error
2016/12/28 09:38	2016/12/28 09:51		Low CO ₂ Density. ▲
2016/12/28 09:25	2016/12/28 09:48	01	CO ₂ Gas Empty.
2016/12/28 03:07	2016/12/28 03:55		High Temp.
2016/12/27 22:48	2016/12/27 23:10		High Temp.
2016/12/26 12:19	2016/12/26 12:35		Low CO ₂ Density.
2016/12/26 12:02	2016/12/26 12:30	01	CO ₂ Gas Empty. ▼

5. On the Alarm screen, by inputting days into the Last XX Days input box, alarm logs for specified days (containing that day) are displayed.

Settable range: 1 day~45 days.

Note: The error of about 1 minute may be observed within a month. Refer to page 56 for the procedure of setting time.

- Press Back key to return to the Log screen.
- Press Top key to return to the Top screen.



The screenshot shows the 'Alarm' screen with the 'Last' input box set to '3' Days. The date range is '2016/12/30 - 2017/01/01'. The table shows 1 alarm event. The bottom status bar shows '1 / 12'.

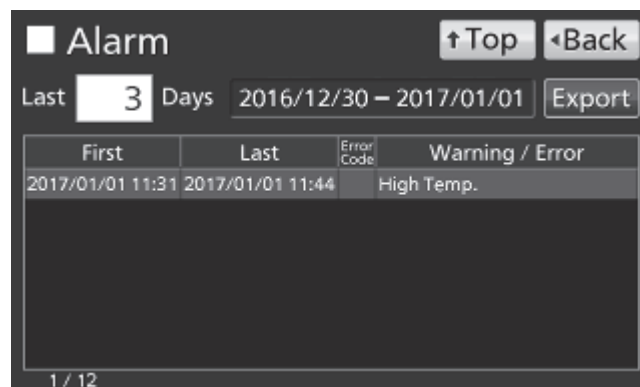
First	Last	Error Code	Warning / Error
2017/01/01 11:31	2017/01/01 11:44		High Temp.

●On the Alarm screen of procedure 4 or 5, alarm log data can be exported in CSV format to a USB flash drive inserted into the USB port.

6. Insert a USB flash drive into the USB port.

Note: USB flash drives with capacity of 32 GB or less that employ the FAT16/FAT32 file system are supported. USB flash drives that require passwords cannot be used. Do not insert devices other than USB flash drives into the USB port.

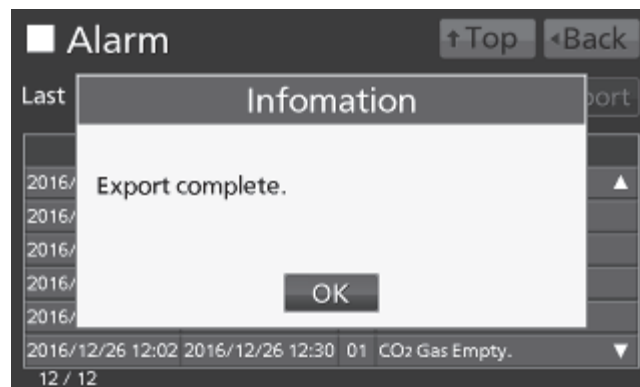
7. Press Export key.



This screenshot is identical to the previous one, showing the 'Alarm' screen with 'Last' set to '3' Days and one alarm event displayed. The bottom status bar shows '1 / 12'.

8. When the export is complete, Information dialog box is displayed. Press OK key. Refer to page 54 for the details about abnormal export or exported file name.

9. Press Top key to return to the Top screen.



The screenshot shows the 'Alarm' screen with an 'Information' dialog box overlaid. The dialog box contains the text 'Export complete.' and an 'OK' button. The background table shows the same alarm event as before. The bottom status bar shows '12 / 12'.

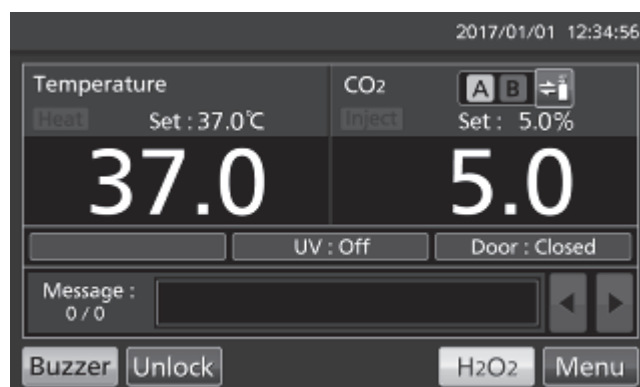
Exporting alarm log

It is possible to export saved alarm log data to a USB flash drive inserted in the USB port by CSV format.

1. Insert a USB flash drive in the USB port.

Note: USB flash drives with capacity of 32 GB or less that employ the FAT16/FAT32 file system are supported. USB flash drives that require passwords cannot be used. Do not insert devices other than USB flash drives into the USB port.

2. Press Menu key to display the Menu screen.



3. Press Log key to display the Log screen.



4. Press Alarm Export key to display Alarm Export screen.



OPERATION/ALARM LOG

5. On the Alarm Export screen, select the period to export.

· To export the saved alarm log data over the entire period, press All radio button.

· To export the alarm log data for the specified days (The newest period containing that day), press Last XX Days radio button and input days.

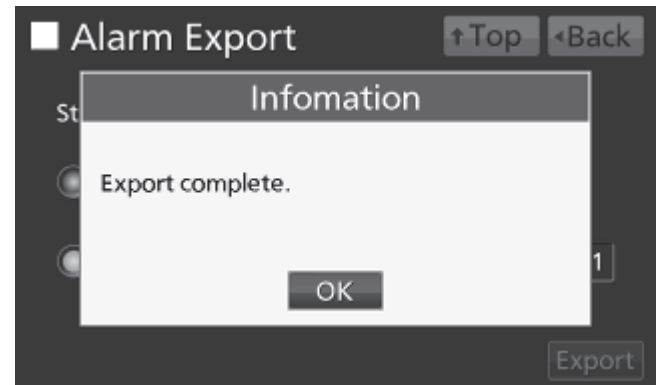
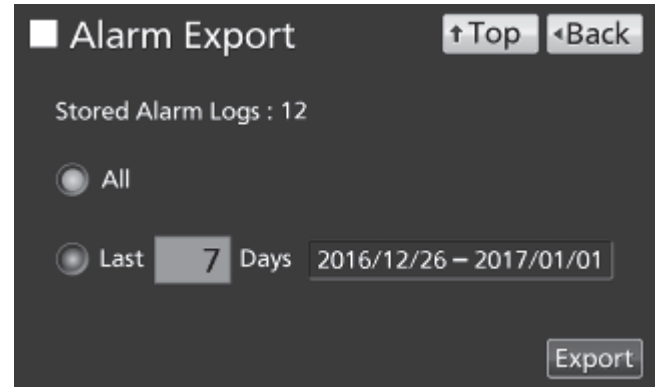
Settable range: 1 day~45 days.

Note: The error of about 1 minute may be observed within a month. Refer to page 56 for the procedure of setting time.

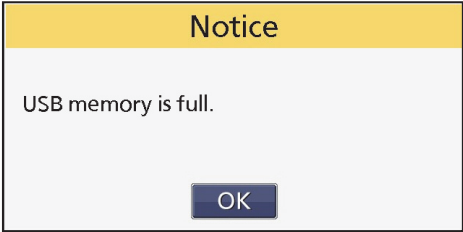
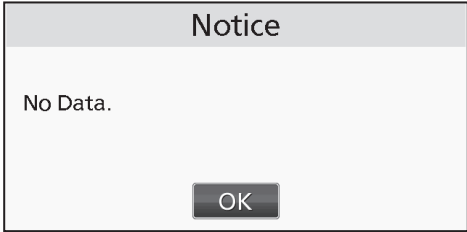
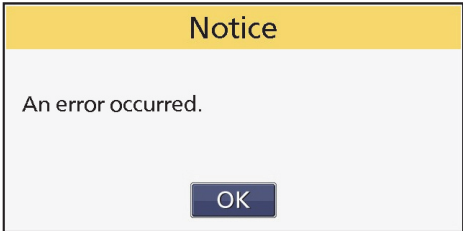
6. Press Export key.

7. Even after completion the export of alarm log data, Information dialog box is displayed. Press OK key.

Note: After completing the export of alarm log data, alarm log data saved at CO₂ incubator is not deleted.



Note: When an export error occurs, any of the following notices will appear.

•USB flash drive is not inserted into the USB port. •USB flash drive is not inserted properly. Solution: Press the OK key, and then insert a USB flash drive properly into the USB port.  A dialog box with a grey header labeled 'Notice'. The main text area is white and contains the message 'USB memory is disconnected.'. At the bottom center is a grey button labeled 'OK'.	•There is not enough free space in the USB flash drive. •The USB flash drive is not formatted in FAT16 or FAT32 format. Solution: Press the OK key, and then check the capacity and format type of the USB flash drive.  A dialog box with a yellow header labeled 'Notice'. The main text area is white and contains the message 'USB memory is full.'. At the bottom center is a grey button labeled 'OK'.
•The specified log data does not exist. Solution: Press the OK key and specify the data again.  A dialog box with a grey header labeled 'Notice'. The main text area is white and contains the message 'No Data.'. At the bottom center is a grey button labeled 'OK'.	• The export operation was unsuccessful. Solution: Press the OK key and specify the data again.  A dialog box with a yellow header labeled 'Notice'. The main text area is white and contains the message 'An error occurred.'. At the bottom center is a grey button labeled 'OK'.

8. Remove the USB flash drive from the USB port.

Note: A log folder is created in the USB flash drive, and an exported data file is saved in the log folder by CSV format.

Exported file name; The first date during exported period (8 digits) + the last date (8 digits) + AlarmLog

Example) When exporting alarm log data for 7 days on January 7, 2018;

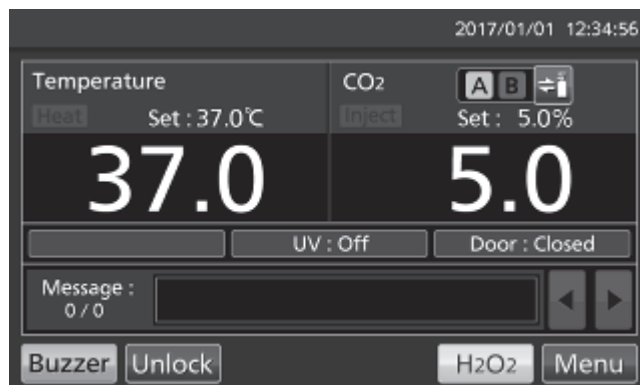
20180101-20180107_AlarmLog.csv

9. Press Top key to return to the Top screen.

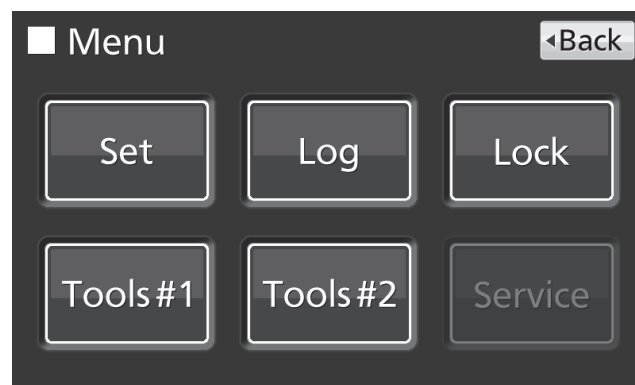
OTHER PARAMETERS

Setting date and time

1. Press Menu key to display the Menu screen.



2. Press Tools #2 key to display the Tools #2 screen.



3. Press Date & Time key to display the Date & Time screen.



4. On the Date & Time screen, input the present date and time. Press Apply key to save the input value. The display returns to the Tools #2 screen.

Note:

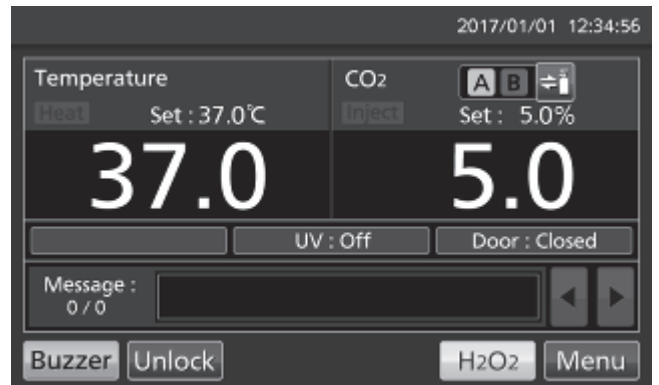
- 24-hour clock.
- It is recommended to set the time periodically since the error of about 1 minute may be observed during a month.

5. Press Top key to return to the Top screen.

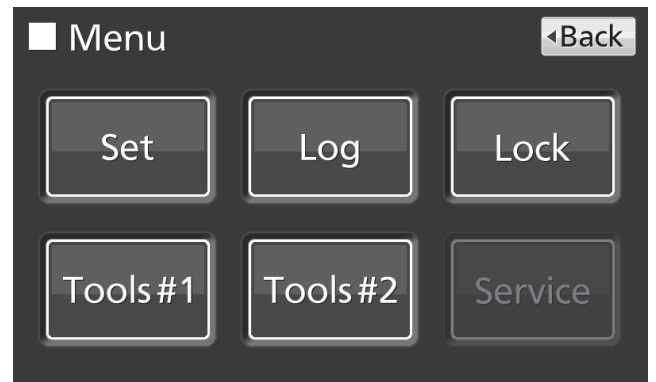


Setting brightness and sleep

1. Press Menu key to display the Menu screen.



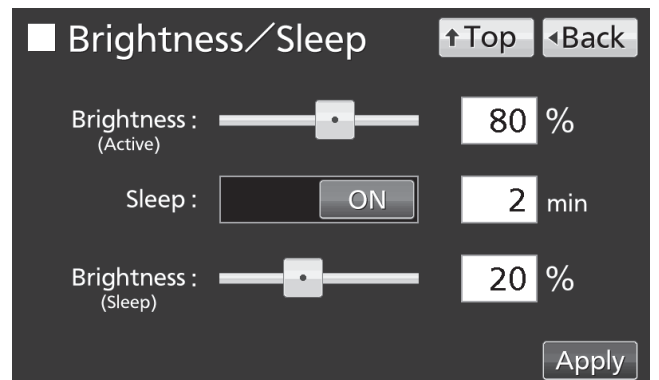
2. Press Tools #2 key to display the Tools #2 screen.



3. Press Brightness/Sleep key to display the Brightness/Sleep screen.



4. On the Brightness/Sleep screen, each setting of brightness and sleep is available. Press Apply key to save the input value and setup. The display returns to the Tools #2 screen.



OTHER PARAMETERS

- Each setting

- Brightness(Active):

Brightness of LCD touch panel of the usual state. Adjust Brightness(Active) slide bar or input set value into the Brightness(Active) input box. Settable range: 50~100, factory setting: 80.

- Sleep:

The function is that the brightness of LCD touch panel is lowered to save electricity, when there is no key operation during set time.

By holding the Sleep slide key and sliding it right, the Sleep function is turned to ON. Input the set value of time to change the Sleep state. Settable range: 1 minute~5 minutes, factory setting: 2 minutes.

Note: It is not possible to operate any key in the Sleep state. By touching the LCD touch panel, the Sleep state is released, and the LCD touch panel returns to the usual state. Under this condition, key operations are available.

- Brightness(Sleep):

Brightness of LCD touch panel of the Sleep state. Adjust Brightness(Sleep) slide bar or input set value into the Brightness(Sleep) input box. Settable range: 0~50, factory setting: 20.

5. Press Top key to return to the Top screen.

UV LAMP PARAMETERS

After closing the outer door, UV lamp lights for the preset period*, to disinfect the water in the humidifying pan, and the air circulating in the chamber.

Using UV lamp

1. Correctly install all of the inner attachments and place the cultivation samples on the trays.

Note:

- The duct, humidifying pan, and humidifying pan cover prevent UV light from escaping. Always use them even when not humidifying.
- Never turn the UV lamp ON when the duct and humidifying pan cover are removed.
- Always use the humidifying pan cover even when using the incubator without turning ON the UV lamp. Using without humidifying pan cover may have a bad influence on the chamber temperature distribution and humidity recovery.

2. When closing the outer door, the UV lamp lights for the preset period*.

Note:

- If the outer door is opened while the UV lamp is lit, the lamp will turn OFF. Then, when the door is closed, the lamp will light for the preset period*.
- If only the outer door is repeatedly opened and closed, it may have a bad influence on the condensation in the chamber and chamber temperature distribution because the UV lamp generates heat for a long time. It may also shorten the service life of the UV lamp.
- The preset period* can be changed when necessary as shown in the pages 60~61.
- To check whether the UV lamp is lit, open the outer door and then press the door switch with the inner door close. Visible blue light can be confirmed from the front of the humidifying pan cover.

Note: UV light is harmful to the eyes, so do not light the UV lamp when the inner door is open.



WARNING

Do not look directly at UV light. UV light is harmful to the eyes.

3. If the outer door is not opened for at least 12 consecutive hours, the UV lamp lights for the preset period* every 12 hours.

Note: Outer door opening resets the 12-hours-count.

* The set period in UV Timer setting + the period extended by the UV Timer Ext. Refer to page 61.

- The recommended replacement time for the UV lamp (i.e., when the UV output ratio drops to 60% to 70% of its initial value) is when the accumulated ON time reaches 5,000 hours. When the accumulated ON time reaches approximately 5,000 hours, "Warning: UV Bulb Life" is displayed in the message display field. It is recommended that the UV lamp be quickly replaced at this point. Contact our sales representative or agent for information on replacing the UV lamp.

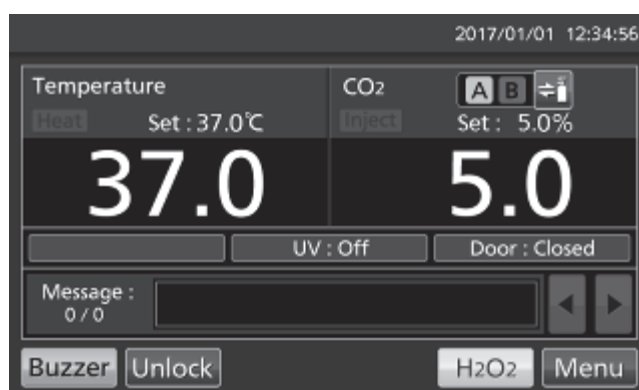
UV LAMP PARAMETERS

- If the UV lamp burns out, “Err18: UV Lamp Abnormal” is displayed in the message display field. If this occurs, replace the UV lamp. When replacing the UV lamp, replace the glow starter at the same time. Contact our sales representative or agent for information on replacing the UV lamp.
- If the UV lamp burns out (“Err18: UV Lamp Abnormal” is displayed in the message display field), it is not possible to perform H₂O₂ decontamination. Replace the UV lamp and the glow starter.

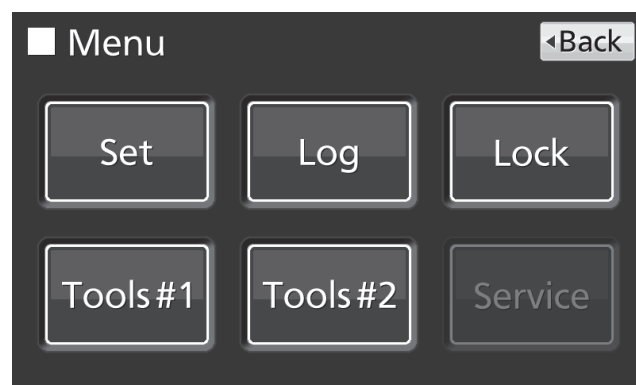
Setting UV lamp ON period

Use the following procedure to change the setting of the UV lamp ON period.

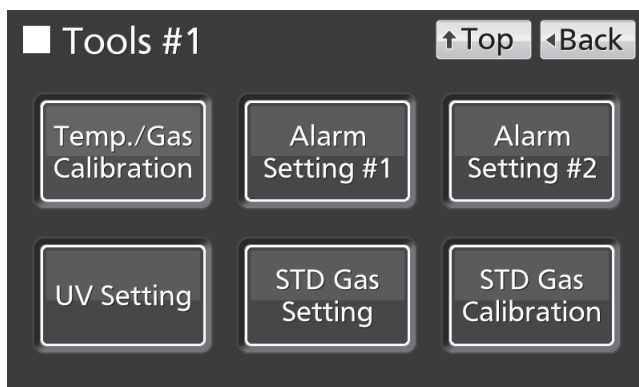
1. Press Menu key to display the Menu screen.



2. Press Tools #1 key to display the Tools #1 screen.



3. Press UV Setting key to display the UV Setting screen.



4. On the UV Setting screen, each setting of UV is available. Press Apply key to save the input value and setup. The display returns to the Tools #1 screen.

■ UV Setting

UV Timer : 10 min

UV Life : 10 %

UV Timer Ext. : 0 %

UV 24h Mode : OFF

Frequency : 50Hz 60Hz

Apply

●Each setting

· UV Timer:

Set value of period to light UV lamp after closing the outer door.

Settable range: 0 minute~30 minutes, factory setting: 10 minutes.

Note:

· It is recommended to set the UV Timer for 10 minutes. The setting for less than 10 minutes may result in insufficient disinfection.

· When the UV timer is set for 0, the UV lamp does not light.

· UV Life:

The total time which UV lamp has turned on is displayed as the percentage to 5,000 hours which are recommendation time to replace. (It is impossible to set).

· UV Timer Ext.:

The more total time which UV lamp has turned on increases, the more UV ray output declines. In order to cover a decline of the UV ray output, the lighting time of UV lamp is automatically extended with an increase of total lighting time of UV lamp. (The set value of UV Timer is not changed).

Extension rate: 0%~40% (It is impossible to set), factory setting: 0%.

Example) UV Timer: 10 minutes, UV Timer Ext.: 40% → UV lamp lights for 14 minutes.

· Frequency:

Frequency of a power supply which this product is connected to. Press Frequency radio button of 50 Hz or 60 Hz.

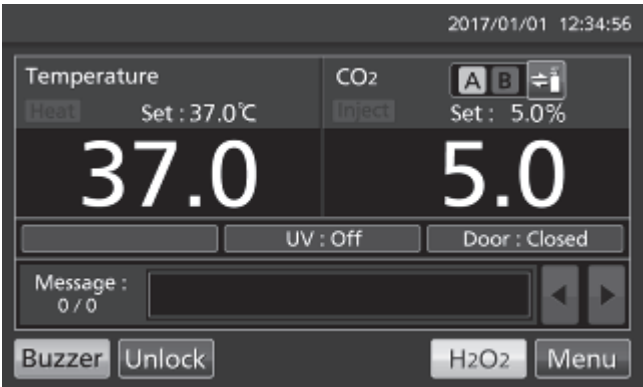
5. Press Top key to return to the Top screen.

UV LAMP PARAMETERS

Lighting UV lamp for 24 hours

If the chamber has been contaminated by dirt or by spilling the medium, use the following procedure to decontaminate the chamber by lighting the UV lamp for 24 hours.

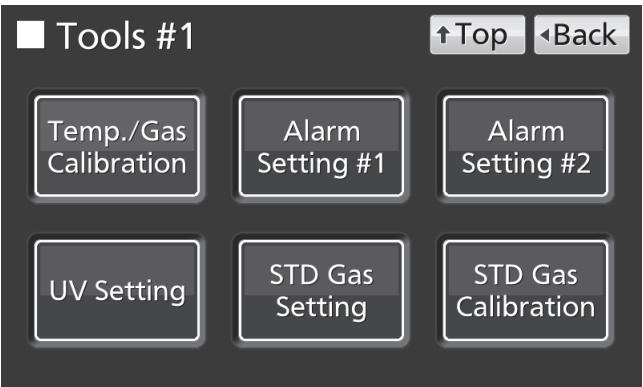
- 1. Remove all attachments from the chamber, including the trays, the fan cover, the duct, the fan, the humidifying pan, and the humidifying pan cover. Clean all the attachments in an autoclave or with ethanol for disinfection.
- 2. Clean and wipe off inside the chamber with ethanol for disinfection.
- 3. Set the CO₂ density to 0%. Refer to pages 35~36.
- 4. Press Menu key to display the Menu screen.



- 5. Press Tools #1 key to display the Tools #1 screen.



- 6. Press UV Setting key to display the UV Setting screen.



7. On the UV Setting screen, by holding the UV 24h Mode slide key and sliding it right, the UV 24h Mode is turned to ON. Press Apply key to start the UV 24-hour mode. The display returns to the Tools #1 screen.

■ UV Setting

UV Timer : 10 min

UV Life : 10 %

UV Timer Ext. : 0 %

UV 24h Mode : ON

Frequency : 50Hz 60Hz

Apply

8. The UV lamp lights continuously for 24 hours. "UV : ON" is displayed on the UV lamp condition display when UV lamp is lighting.

Note:

- The UV 24-hour mode may cause the automatic set temperature alarm because of a rising chamber temperature.
- After procedure 8, by opening the outer door when UV lamp is lighting, UV lamp is turned OFF and UV 24-hour mode is canceled by opening the outer door. Redo from procedure 4 to start the UV 24-hour mode again.

9. Press Top key to return to the Top screen.

10. 24 hours after, UV lamp turns OFF automatically. Install all attachments removed in the procedure 1.

H₂O₂ DECONTAMINATION

You can perform H₂O₂ decontamination when the chamber is contaminated or when cleaning the chamber prior to starting culture.

To perform H₂O₂ decontamination, one of the following conditions must be satisfied:

- The H₂O₂ generator MCO-HP is installed in the MCO-230AICUVHL.
- All of the H₂O₂ generator MCO-HP, H₂O₂ decon board MCO-170HB, and electric lock MCO-170EL are installed on the model MCO-230AICUVL.

Note:

The door is locked by the electric lock during decontamination. However, if the accessory key has been inserted into the key hole and left in unlocked position, the door cannot be locked. When performing decontamination, be sure to take the key out of the key hole and store and manage the key in a safe place.

WARNING

Use the reagent specified by our company for H₂O₂ decontamination. Using a different H₂O₂ solution may cause explosion or damage to the incubator, or insufficient decontamination.

Do not use chemicals other than the H₂O₂ reagent, such as ethanol for disinfection. Doing so may result in damage to the H₂O₂ vapor generator.

WARNING

When performing H₂O₂ decontamination, **make sure that the outer and inner doors are securely closed.** During H₂O₂ decontamination, plug the access hole with the silicon caps that are provided. Failure to do so may be harmful to health due to leakage of H₂O₂ gas.

CAUTION

H₂O₂ decontamination can be performed only for the chamber and inner attachments with standard specifications, and not for any other objects.

CAUTION

Perform H₂O₂ decontamination with the inner attachments arranged as specified by our company. Arranging them in a different way may result in insufficient decontamination.

CAUTION

Wear rubber gloves when handling the H₂O₂ reagent. Direct contact with the H₂O₂ reagent may result in inflammation of the skin.

CAUTION

After H₂O₂ decontamination has been completed, residual H₂O₂ solution will remain on the bottom of the chamber, the H₂O₂ vapor generator, and the bottom of the duct. **Wearing protective glasses and rubber gloves, wipe it off with a non-woven cloth.** Failure to do so may result in a deficient culture.

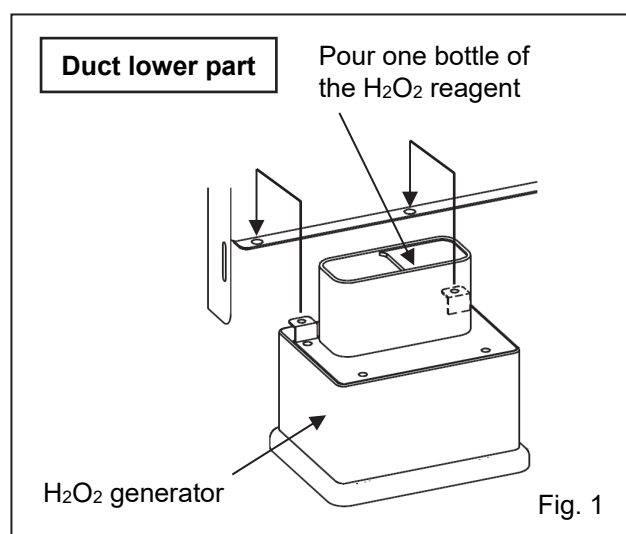
H₂O₂ decontamination

1. Take out all the trays, the fan cover, the duct, the humidifying pan cover, and the humidifying pan from the chamber.
2. Dispose of the water in the humidifying pan, and wipe inner attachments removed from the chamber, with a gauze containing ethanol for disinfection.
3. Wipe the inside walls of the chamber with a gauze containing ethanol for disinfection.
4. Attach the duct and the fan cover.

5. Pour one bottle of the H₂O₂ reagent MCO-H2O2 into the H₂O₂ generator MCO-HP (Fig. 1).

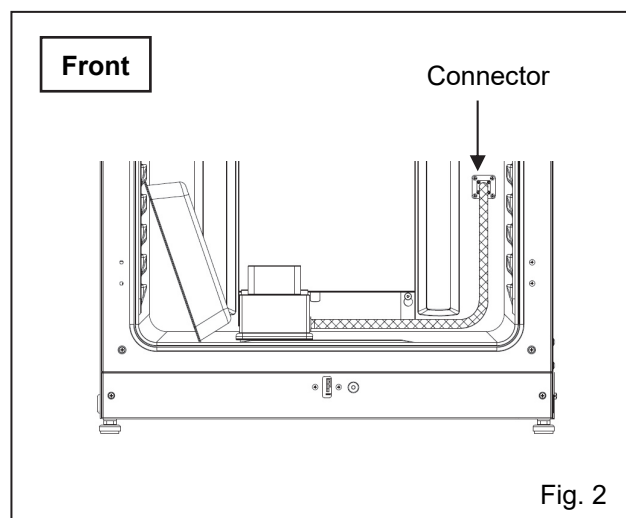
6. Set the two pins on the H₂O₂ generator in the 2 holes on the lower left side of the duct (Fig. 1).

Note: Make sure that the H₂O₂ generator is securely attached. Uncertain attachment may result in insufficient decontamination.



7. Remove a connector cap from connector on bottom right of the far side of the chamber. Connect the H₂O₂ generator and connector by a cable that is provided (Fig. 2).

Note: Be sure to keep the connector cap.



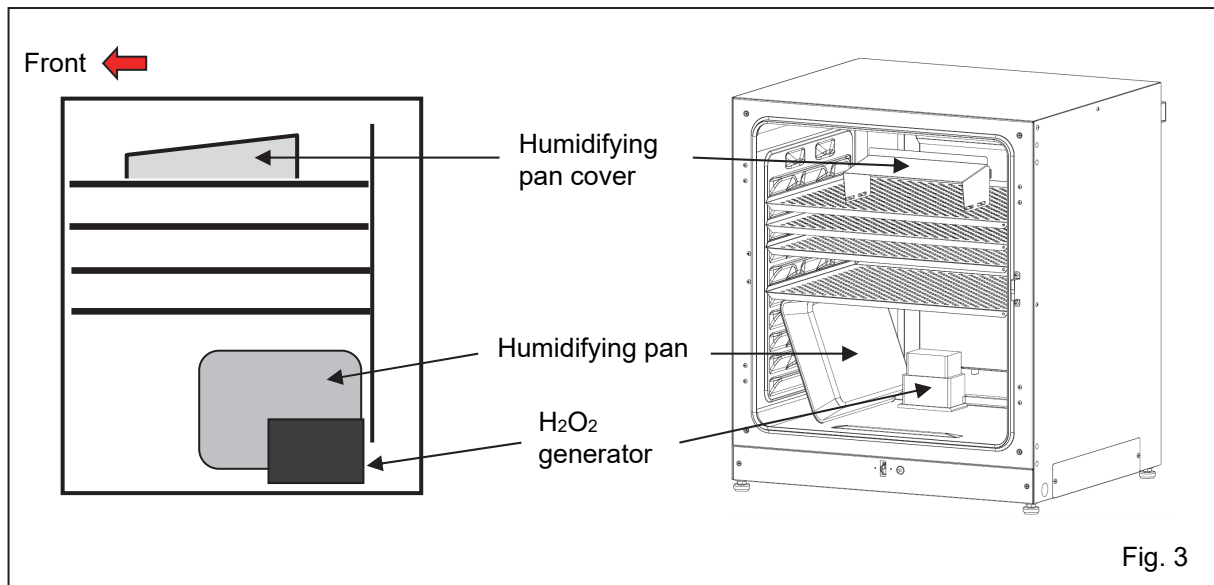
8. Insert 4 trays in the 2nd, the 3rd, the 4th, and the 6th tray catches from the top of the chamber side.

Note: The trays included as accessory are designed to be appropriate for decontamination. If half tray (MCO-35ST, optional) or trays for previous models are used, decontamination may not be sufficiently effective.

H₂O₂ DECONTAMINATION

9. Set the humidifying pan cover, the humidifying pan removed in the procedure 1 (Fig. 3).

Note: H₂O₂ decontamination can be performed only for the chamber and inner attachments with standard specifications, not for any other objects.

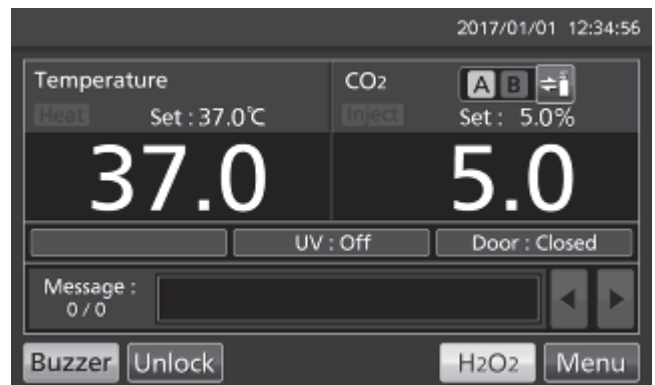


10. Make sure that the duct, the fan and the H₂O₂ generator are securely attached (refer to Fig. 1 to 3 on page 87). After that, close the inner door and the outer door.

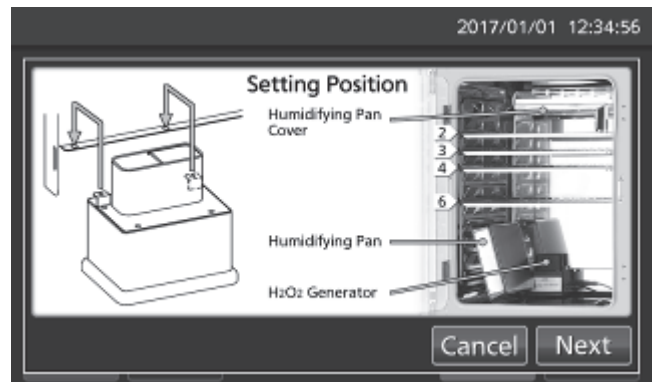
11. Press H₂O₂ key for 3 seconds to open Setting Position window.

Note:

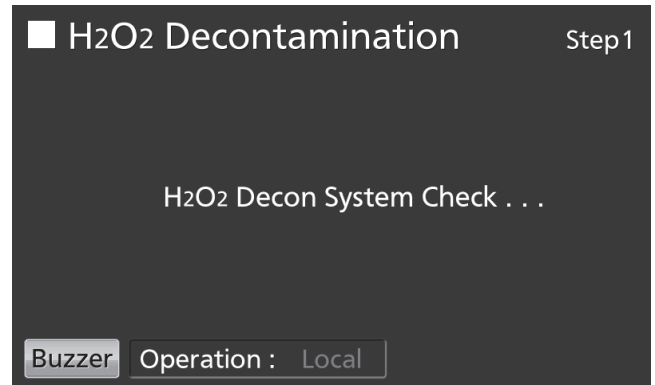
- When the model does not have H₂O₂ decontamination function, H₂O₂ key is not displayed on the Top screen.
- When key lock is ON, Password input window is opened and input of the release password of Key Lock is required. Refer to page 39.



12. Finally make sure that the inner attachments and the H₂O₂ generator are attached correctly. After the confirmation, press Next key to display the H₂O₂ Decontamination screen.



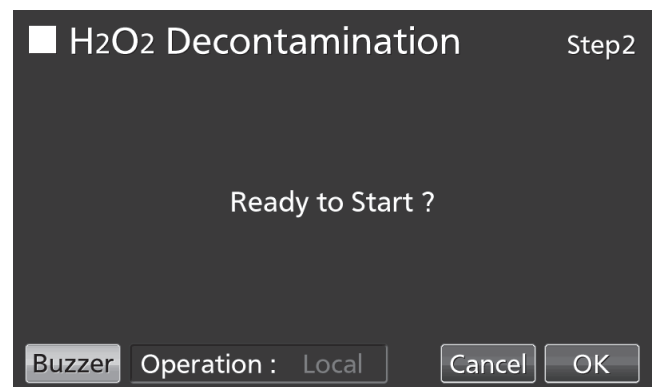
13. On the H₂O₂ Decontamination Step1 screen, the system check starts automatically. If the system is normal, the display leads the H₂O₂ Decontamination Step2 screen. When the system is abnormal, refer to Table 8 on page 84.



14. On the H₂O₂ Decontamination Step2 screen, press OK key to display the H₂O₂ Decontamination Step3 screen and H₂O₂ decontamination is started. H₂O₂ decontamination is performed automatically from Step3 to Step8 (procedure 15).

Note:

- The outer door is locked with electric lock for safety until completion of H₂O₂ decontamination.
- Buzzer sounds when H₂O₂ decontamination is completed (About 100 minutes later).



⚠ CAUTION

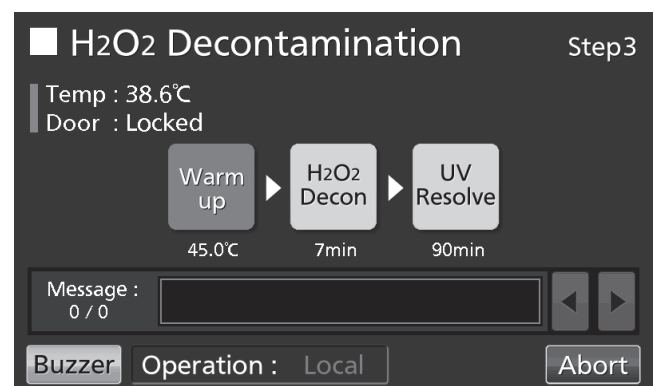
The electric lock will remain locked if power supply is cut off during H₂O₂ decontamination. After recovery of the power supply, the H₂O₂ gas resolution process will start execution and finish automatically. Execute the decontamination again because the decontamination has not fully completed.

⚠ WARNING

Do not unlock the outer door using the accessory key during H₂O₂ decontamination or during H₂O₂ gas resolve by UV. Doing so may cause harm to health from H₂O₂ gas leakage.

•Step3 is the process to warm the chamber temperature to 45°C.

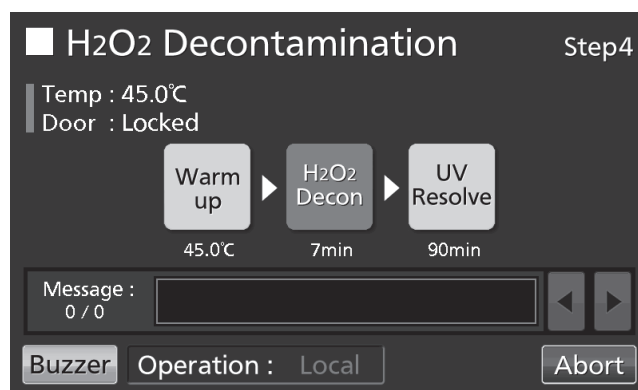
Note: By pressing Abort key, H₂O₂ decontamination is stopped in the middle of decontamination and go to Step8 (The End of H₂O₂ decontamination).



H₂O₂ DECONTAMINATION

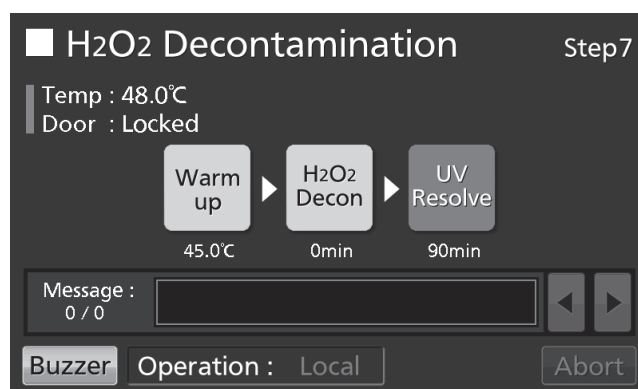
●Step4 is the process to decontaminate in the chamber by generating H₂O₂ vapor from H₂O₂ generator.

Note: By pressing Abort key, H₂O₂ decontamination is stopped in the middle of decontamination and go to Step7 (The process to resolve H₂O₂ vapor by UV lamp). It is not possible to skip Step7.



●Step7 is the process to resolve H₂O₂ vapor by UV lamp.

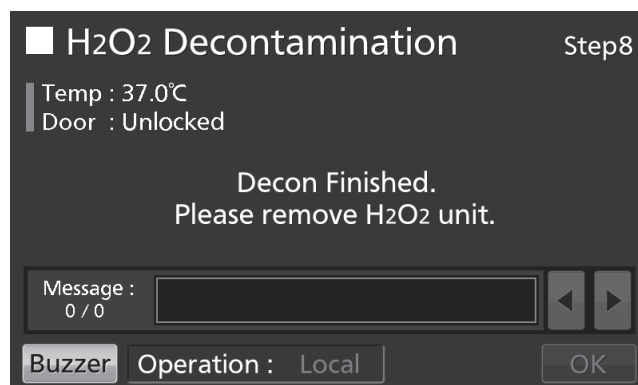
Note: Step5 and Step6 do not exist.



15. When the H₂O₂ decontamination is completed, the H₂O₂ Decontamination Step8 screen is displayed.

Open the outer and inner doors. Disconnect connector of the chamber, cable and H₂O₂ generator, and remove H₂O₂ generator and cable from the chamber.

Note: When doing the above work, put on protection glasses and rubber gloves.



16. On the H₂O₂ Decontamination Step8 screen, press OK key to return to the Top screen.

Note: When H₂O₂ generator is connected with connector of the chamber by cable, OK key is not workable.



17. Dilute the remaining H₂O₂ reagent in the H₂O₂ generator with a large volume of water and dispose of it. Rinse and wash the H₂O₂ generator with distilled water or pure water. Then keep the H₂O₂ generator in a clean environment outside of the chamber.

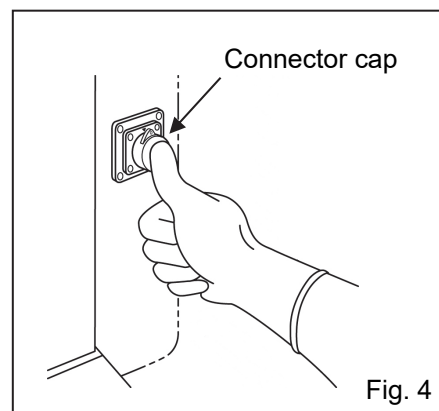
Note: Do not wash either the inside or outside of the H₂O₂ generator with ethanol for disinfection.

18. After H_2O_2 decontamination, surplus H_2O_2 liquid will remain at the bottom of the chamber and in the bottom part of the H_2O_2 generator duct. This solution contains H_2O_2 at a low density, so put on protective glasses and rubber gloves and wipe it up with a non-woven cloth.

19. Ventilate the chamber sufficiently and place all the attachments back into the chamber.

Note: After H_2O_2 decontamination, cover the connector on the chamber side with the connector cap deeply. (Fig. 4)

Caution: Wait at least one hour before starting the cultivation until the culture environment is stable.



Precautions when handling H_2O_2 reagent

Observe the following precautions when handling optional H_2O_2 reagent MCO-H2O2.

- Handling precautions

- Wear protective equipment, such as protective glasses and rubber gloves.
- Do not use fire in the area where the reagent is being handled.
- Do not leave any reagent in the container after it has been used or while it is being used.
- Do not place inflammable or combustible materials near the area where the reagent is handled.

- Precautions for storage

- Store in a cool, dark place.
- Always close the container cover securely to prevent impurities from becoming mixed in the reagent.
- Check the container to make sure that there is no damage, corrosion, or cracking.
- Store the container with the inlet facing upwards, and make sure that the container will not tip or be knocked over.

- Precautions for disposal

- Dispose according to the rule in your country.

ELECTRIC LOCK

The auto lock is a function to lock the outer door automatically when a specified time has passed after the door was closed. The auto lock function is available when using MCO-230AICUVHL, or MCO-230AICUVL with the optional electric lock MCO-170EL installed.

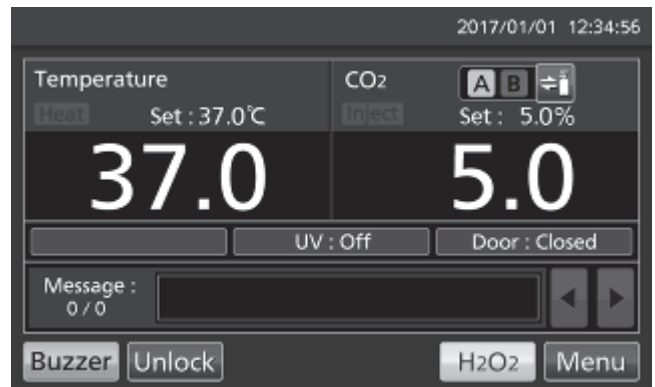
The modes of unlocking the outer door are as follows.

- Quick mode: Press the Unlock key.
- User-ID mode: Press the Unlock key, and then enter the User-ID and the password for releasing the lock.

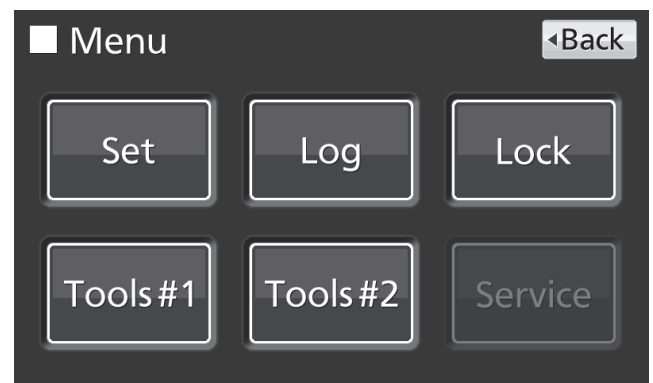
Setting User-ID

Before turning the User-ID mode to ON, use the following procedure to register a User-ID and a release password of Auto-Lock.

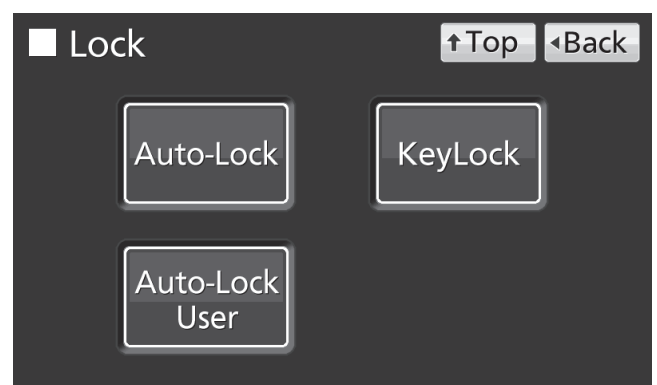
1. Press Menu key to display the Menu screen.



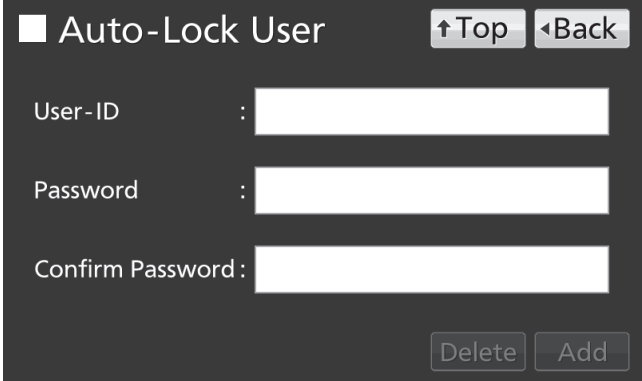
2. Press Lock key to display the Lock screen.



3. Press Auto-Lock User key to display the Auto-Lock User screen.



4. On the Auto-Lock User screen, it is possible to register a User-ID and its password. Press Apply key to save the User-ID and its password.



● Each setting of Auto-Lock

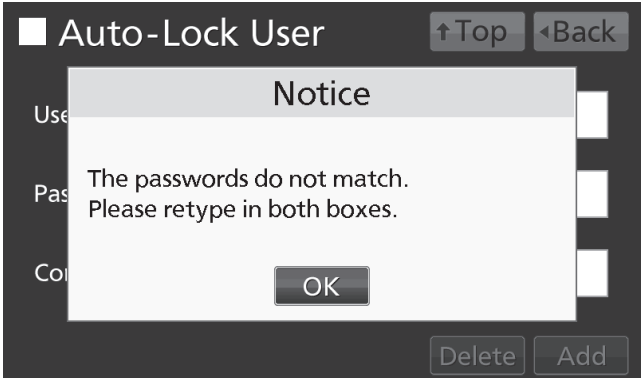
· User-ID: The alphanumeric characters (Max. 8 digits) inputted here are registered as a new User-ID.

· Password: The number (Max. 6 digits) inputted here is registered as a new release password of Auto-Lock of the User-ID.

Note: It is possible to register only a User-ID without registration of a release password of Auto-Lock.

· Confirm Password:

To prevent erroneous input, type the same password as you entered in the Password input box. If a wrong password is entered, the Notice dialog box is displayed. Press the OK key and type the correct password.



Note:

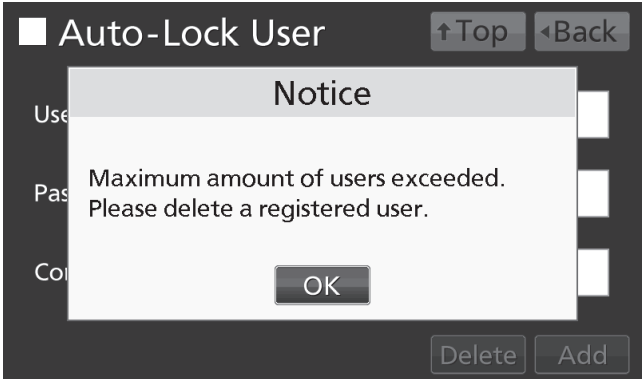
· A release password of Auto-Lock is for unlocking the outer door. It is different from the release password of Key Lock (refer to pages 37~39).

· It is possible to input up to 8-digit alphanumeric characters as a User-ID.

· It is possible to input up to 6-digit number as a release password of Auto-lock.

· It is possible to register up to 99 User-IDs (and its passwords). When registering the 100th User-ID, notice dialog box is displayed. Press OK key, and then delete a disused User-ID in reference to page 72.

· To prevent abuse of User-IDs and release passwords of Auto-Lock, manage them properly by limited administrators.



ELECTRIC LOCK

- Changing a registered User-ID's password

Input the registered User-ID into User-ID input box and input its new password into Password input box and Confirm Password box. Press Add key to re-write the new password.

- Deleting a registered User-ID

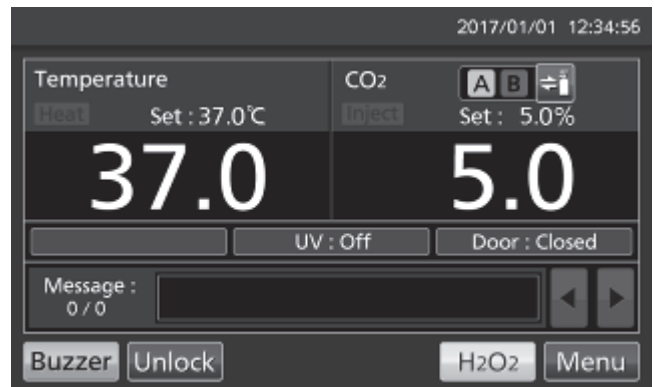
Input the registered User-ID into User-ID input box and input its registered password into Password input box. Press Delete key to delete the registered User-ID (and its password).

Note: When all registered User-IDs are deleted, the User-ID mode is turned OFF (refer to page 73).

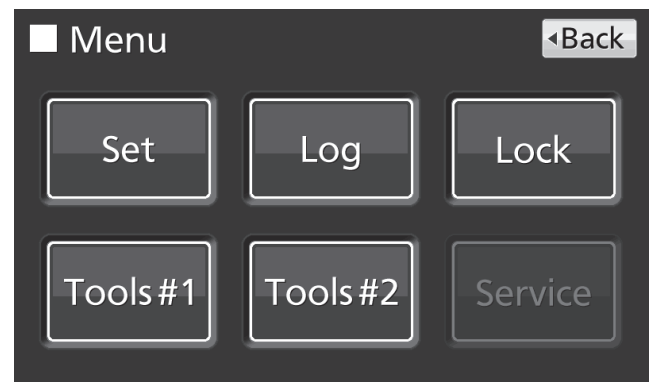
5. On the Menu screen, press Back key to return to the Top screen.

Setting auto lock

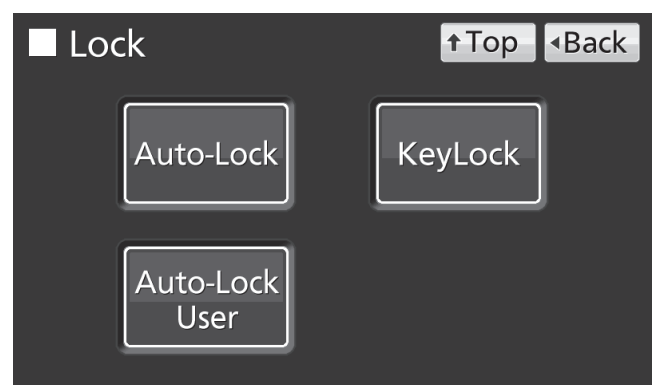
1. Press Menu key to display the Menu screen.



2. Press Lock key to display the Lock screen.



3. Press Auto-Lock key to display the Auto-Lock screen.



4. On the Auto-Lock screen, each setting of auto lock is available. Press Apply key to turn the auto lock ON and save the set value. The display returns to the Lock screen.



•Each setting of auto lock

· Auto-Lock:

Auto lock function is that the outer door is locked automatically when the setting time passed after the door closed. By holding the Auto-lock slide key and sliding it right, the Auto-lock is turned to ON. Settable range: 1 minute~60 minutes, Factory setting: 1 minute.

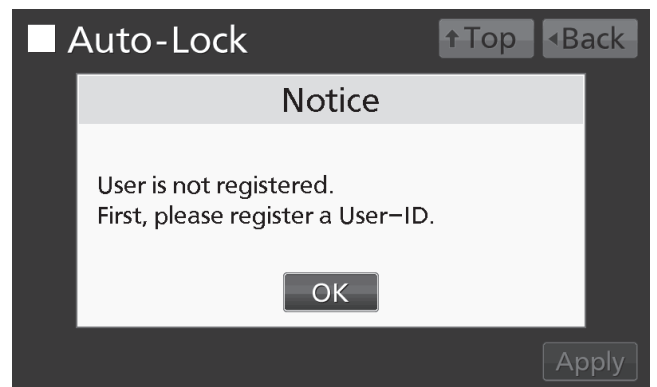
· User-ID:

Choose the mode of unlocking the outer door between the quick mode or the User-ID mode. By holding the User-ID slide key and sliding it right, the User-ID mode is turned to ON. Factory setting: OFF (quick mode).

Note:

- When no User-ID is registered, notice dialog box is displayed. Press OK key, and then register a User-ID and its password in reference to pages 70~72.
- In the User-ID mode, User-ID which is inputted to unlock the outer door is saved as a part of log data that shows the open/close state of the outer door (refer to pages 48~49).
- Even if the User-ID mode is turned OFF, registered User-IDs are not deleted.
- When all the registered User-IDs are deleted, the User-ID mode is turned OFF (refer to page 72).

5. Press Top key to return to the Top screen.

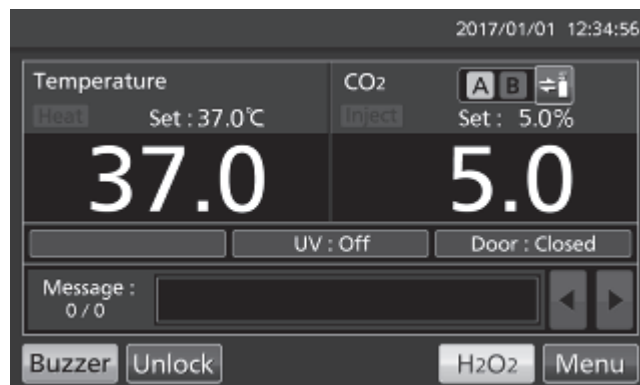


ELECTRIC LOCK

Unlocking the outer door

- In the quick mode

Press the Unlock key on the Top screen.



- In the User-ID mode

Pressing the Unlock key on the Top screen displays the User-ID input window. Enter the User-ID and password for releasing the lock.

Note: The User-ID entered here is saved as a part of log data that shows the open/close state of the outer door (refer to pages 48~49).



· When the inputted User-ID or its password is incorrect, the Notice dialog box is displayed. Press OK key, and then input the correct User-ID or its password.



Note: When the unlocked outer door is closed and the specified amount of time has elapsed, the outer door is automatically locked again.

Unlocking the outer door during a power failure or malfunction

Keys for unlocking the outer door in the event of a power failure or electric lock malfunction are included with the product (when using MCO-230AICUVHL) or included with the optional electric lock MCO-170EL (when using MCO-230AICUVL). Usually, these keys should be kept in a safe place and managed carefully. It is recommended that you make a note of the symbol and the serial number of the key in case the key is lost.

In the event of a power failure, the outer door will be electrically locked. To unlock the door in this situation, use the key included with optional accessory. To lock the outer door again, turn the key in the direction of the lock while the outer door is open, and then close the outer door.

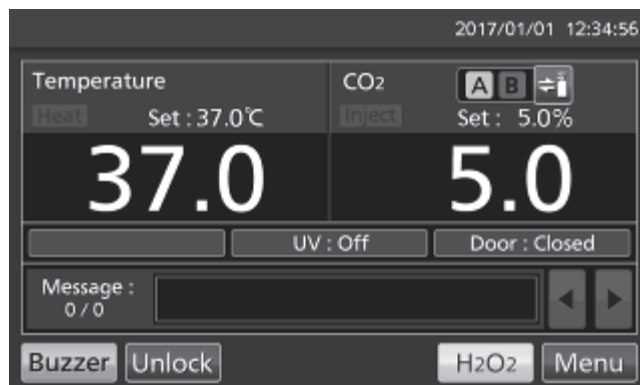
Note: Turning the key while the outer door is closed cannot lock the door. Attempting to turn the key while the outer door is closed may damage the electric lock system. Turn the key while the door is open, and then close it.

ELECTRIC LOCK

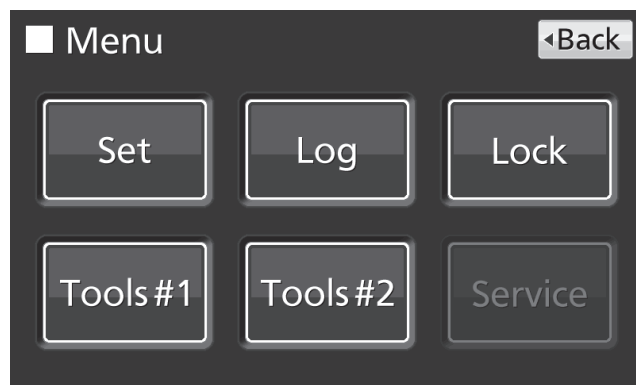
Cancelling the auto lock setting

Note: Do not turn off the Auto-Lock setting when the outer door is locked by the electric lock function. Doing so makes the Unlock key disappear from the top screen and makes the user unable to unlock the door using the touch panel. In that case, use the key included with the optional accessory to unlock the door.

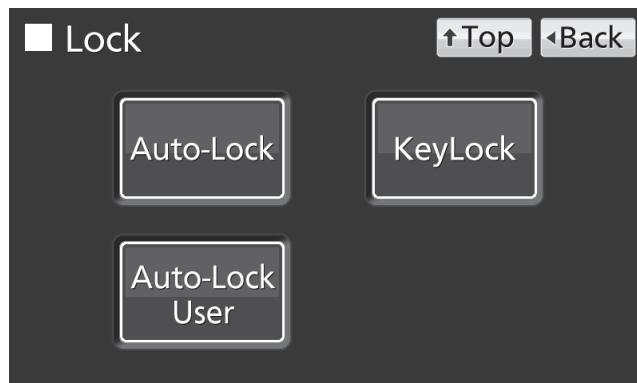
1. Press Menu key to display the Menu screen.



2. Press Lock key to display the Lock screen.



3. Press Auto-Lock key to display the Auto-Lock screen.



4. On the Auto-Lock screen, by holding the Auto-lock slide key and sliding it left, the Auto-lock is turned to OFF. Press Apply key to change Auto-lock OFF, and the display returns to the Lock screen.



5. Press Top key to return to the Top screen.

GAS AUTO CHANGER (OPTION)

When an optional gas auto changer MCO-21GCP is installed, there are two connecting ports for CO₂ gas pipe, A and B. By connecting two CO₂ gas cylinders, this kit switches the CO₂ gas supply line when one of the CO₂ gas cylinders becomes empty.

Connecting CO₂ gas cylinder

1. Get two CO₂ gas cylinder ready (CO₂ gas cylinder A and B) and install an optional gas regulator MCO-010R in both of CO₂ gas cylinders.

Note:

- Use a liquefied CO₂ gas cylinder (at least 99.5% pure). The siphon (dip tube) type cannot be used.
- When MCO-010R is not available, install a gas regulator rated at 25 MPa(G) (250 kgf/cm²(G), 3600 psi(G)) for the primary side, and 0.25 MPa(G) (2.5 kgf/cm²(G), 36 psi(G)) for the secondary side.

2. Using a gas tube that is provided, connect the connecting port A for CO₂ gas pipe and the gas regulator of the CO₂ gas cylinder A.

3. Using a gas tube that is provided, connect the connecting port B for CO₂ gas pipe and the gas regulator of the CO₂ gas cylinder B.

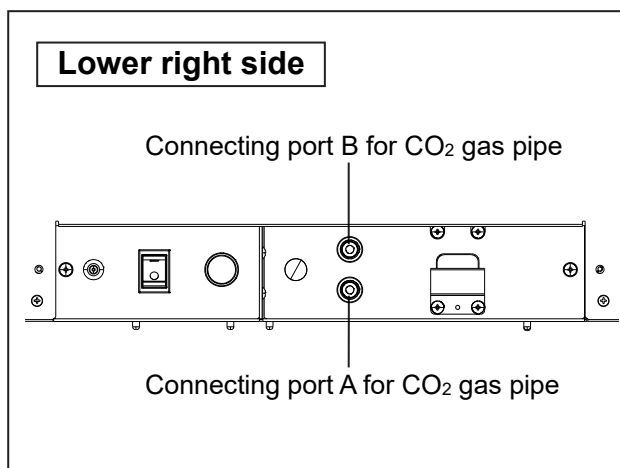
Note:

- For connecting and removing the tube and for connecting to the gas regulator MCO-010R, refer to pages 22~23.
- If the CO₂ gas is supplied to multiple CO₂ incubators from a single gas cylinder, a CO₂ solid will be formed in the gas regulator. The gas regulator safety valve will operate, and it may make an explosive sound.

4. After connecting the gas tube, make sure that no gas is leaking (ex. by using a gas leak detection spray).

5. Both CO₂ gas cylinder A and B, set the CO₂ gas on the secondary side to 0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G)) for gas injection.

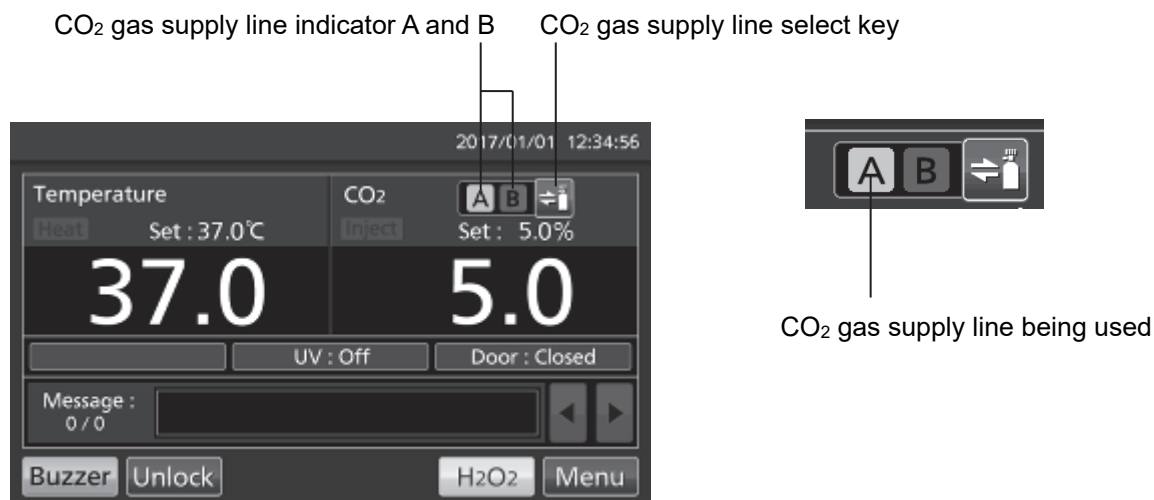
Note: As the pressure increases, the CO₂ gas density control range will increase. Excessive pressure may cause gas supply lines inside the incubator to come loose, which may result in gas poisoning or oxygen deprivation due to the escaping of gas. If gas lines come loose, the incubator must be repaired.



GAS AUTO CHANGER (OPTION)

Automatic CO₂ gas supply line changeover

When an optional gas auto changer MCO-21GCP is installed, CO₂ gas supply line indicator A•B and CO₂ gas supply line select key are displayed in the Top screen. CO₂ gas supply line indicator A or B being used is lighted.



When the CO₂ density level remains unchanged, even though the CO₂ gas valve in the unit is opened, the unit regards the present connecting CO₂ gas cylinder as an empty. The CO₂ gas supply line is changed over automatically. These movements are displayed (Table. 2).

1. When CO₂ gas is remaining in CO₂ gas cylinder A, the unit operates with CO₂ gas supplied from CO₂ gas cylinder A (Situation 1 on table 2).
2. When CO₂ gas cylinder A is empty, the level of CO₂ density in the unit does not increase because CO₂ gas is not supplied into the unit even though CO₂ gas valve in the unit is open (Situation 2 on table 2).
3. When the Situation 2 continues for 2 to 3 minutes, CO₂ gas supply line is changed over automatically by regarding CO₂ gas cylinder as an empty. At this time, CO₂ gas empty alarm is activated, the buzzer sounds, and CO₂ gas supply indicator A is displayed in reverse video and blinks (Situation 3 on table 2).
4. CO₂ gas empty alarm is released by pressing Buzzer key. The reverse video is put the light off (Situation 4 on table 2).
5. Exchange the empty CO₂ gas cylinder A into a new one immediately after the Situation 4 (Situation 5 on table 2).
6. When CO₂ gas cylinder B is empty, it changes into CO₂ gas cylinder A.

Table 2. CO₂ gas supply line automatic changeover

(e.g.) When CO₂ gas cylinder A is empty, it changes over CO₂ gas cylinder B.

	Situation	CO ₂ gas			CO ₂ gas supply line indicator			Message display field
		Supply line	Cylinder A	Cylinder B		A	B	
1	CO ₂ gas is supplying from valve A.	A	Remaining	Remaining		Light on	Light off	
2	CO ₂ density in the chamber is not increased even if CO ₂ gas valve opens.	A	Empty	Remaining		Light on	Light off	
3	CO ₂ gas supply line is changed over B automatically.	B	Empty	Remaining		Reverse video and blink	Light on	Err01: CO ₂ Gas Empty (and buzzer)
4	Pressed Buzzer key.	B	Empty	Remaining		Light off	Light on	
5	Changed empty gas cylinder A into a new one.	B	Remaining	Remaining		Light off	Light on	

Note:

- When the Buzzer key is not pressed in the Situation 4 and the CO₂ gas cylinder B gets empty without the CO₂ gas cylinder A being replaced in the Situation 5, the operation of switch between CO₂ gas supply line A and B will be repeated. In this case, replace both CO₂ gas cylinders A and B and press the Buzzer key immediately.
- The changeover of CO₂ gas cylinder is judged by an increase of CO₂ density in the chamber. In case that the gas tube is clogged, the gas is leaking, the gas pressure is dropped down, or the level of valve open for CO₂ gas cylinder is not enough etc., the changeover of CO₂ gas cylinder may be done even though the CO₂ gas cylinder being used is not empty.

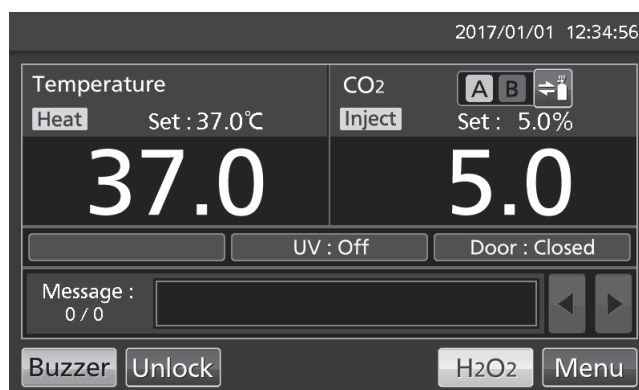
GAS AUTO CHANGER (OPTION)

Manual CO₂ gas supply line changeover

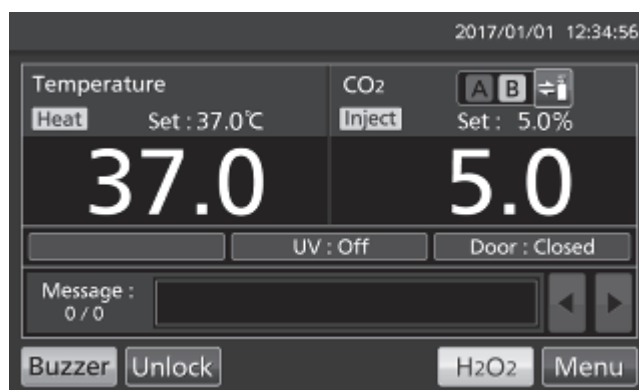
It is possible to change CO₂ gas supply line manually anytime.

Example) Change CO₂ gas supply line A to B.

1. Press CO₂ gas supply line select key for a few seconds.



2. CO₂ gas supply line A is changed to B.



Note: The behavior for the following case is shown in Table 3.

After the CO₂ gas supply line A is changed to B by CO₂ gas automatic changer function, the CO₂ gas supply line B is changed to A manually without pressing the Buzzer key.

Table 3. Manual change from cylinder B to empty cylinder A

	Situation	CO ₂ gas			CO ₂ gas supply line indicator			Message display field
		Supply line	Cylinder A	Cylinder B		A	B	
1	CO ₂ gas supply line A is changed to B automatically.	B	Empty	Remaining		Reverse video and blink	Light on	Err01: CO ₂ Gas Empty (and buzzer)
2	Without pressing the Buzzer key, long-pressed CO ₂ gas supply line select key	A	Empty	Remaining		Blink	Light off	Err01: CO ₂ Gas Empty (and buzzer)

ROUTINE MAINTENANCE

To use this unit in a clean condition, clean the chamber and all the inner attachments at least once a month.

1. Remove all the inner attachments by the procedures shown on pages 25~26.
 2. Clean the chamber and all the inner attachments by the procedures shown on page 24.
 3. Install all the inner attachments by the procedures shown on page 27.
- When there is excessive dirt, contact our sales representative or agent.

ALARMS, SAFETY, AND SELF-DIAGNOSIS

The incubator supports the following alarms, safety functions, and self-diagnostic functions. If an error from Err05 to Err18, or Err56 is activated, contact our sales representative or agent.

Table 4. Alarms, safety, and self-diagnosis for culture operations

Alarm or safety function	Conditions	Display	Buzzer	Remote alarm	Safety operation
High limit temperature alarm	The chamber temperature exceeds the high limit alarm temperature set value.	"Over Heat" is displayed alternately in normal characters and reverse video in the Over heat display.	Continuous tone	ON	Heater OFF.
Automatic set temperature alarm	The chamber temperature is out of the automatic set temperature alarm setting range ($\pm 1.0^{\circ}\text{C}$ to $\pm 5.0^{\circ}\text{C}$).	"Warning: High Temp" or "Warning: Low Temp" is displayed in the message display field.	Intermittent tone after set alarm delay time (0 min to 15 min) has elapsed	ON after set alarm delay time (0 min to 15 min) has elapsed	-----
Automatic set CO ₂ density alarm	The chamber CO ₂ density is out of the automatic set CO ₂ density alarm setting range ($\pm 0.5\%$ to $\pm 5.0\%$).	"Warning: High CO ₂ Density" or "Warning: Low CO ₂ Density" is displayed in the message display field.	Intermittent tone after set alarm delay time (0 min to 15 min) has elapsed	ON after set alarm delay time (0 min to 15 min) has elapsed	-----
Auto-return	On screens other than the Top screen, there is no key operation for approx. 90 s. (When the sleep function is ON) After sleep function is turned ON, there is no alarm/error and key operation for approx. 90 s.	(Return to the "Top screen".)	-----	-----	-----
Door alarm	The outer door is open.	"Door: Open" is displayed alternately in normal characters and reverse video in the outer door (opening/closing) display.	Intermittent tone after set alarm delay time (1 min to 30 min) has elapsed	-----	The CO ₂ valve is closed. The heater turns OFF after 1 min.
Door lock error	(When the electric lock is available) Outer door is opened when it is auto-locked by electric lock.	"Err20: Door Lock Failure" is displayed in the message display field.	Intermittent tone	ON	UV lamp OFF
CO ₂ gas cylinder empty	The CO ₂ density does not increase when the CO ₂ valve is opened.	"Err01: CO ₂ Gas Empty" is displayed in the message display field.	≡	≡	-----
Chamber temperature sensor error	The chamber temperature sensor is disconnected.	"Err05: Temp Sensor Open" is displayed in the message display field.	≡	≡	Heater OFF.
	The chamber temperature sensor is short-circuited.	"Err06: Temp Sensor Short" is displayed in the message display field.	≡	≡	Heater OFF.
Sensor box temperature sensor error	The sensor box temperature sensor is disconnected.	"Err07: CO ₂ Box Temp Sensor Open" is displayed in the message display field.	≡	≡	CO ₂ valve is closed.
	The sensor box temperature sensor is short-circuited.	"Err08: CO ₂ Box Temp Sensor Short" is displayed in the message display field.	≡	≡	CO ₂ valve is closed.
Ambient temperature sensor error	The ambient temperature sensor is disconnected.	"Err09: AT Sensor Open" is displayed in the message display field.	≡	≡	-----
	The ambient temperature sensor is short-circuited.	"Err10: AT Sensor Short" is displayed in the message display field.	≡	≡	-----
CO ₂ sensor error	The Vref or Vgas output voltage for the CO ₂ sensor is abnormal.	"Err11: CO ₂ Sensor Vref Abnormal" or "Err12: CO ₂ Sensor Vgas Abnormal" is displayed in the message display field.	≡	≡	CO ₂ valve is closed.
Main heater error	Main heater burnout occurs or the main heater SSR is short-circuited.	"Err13: Main Heater Abnormal" is displayed in the message display field.	≡	≡	-----
Bottom heater error	Bottom heater burnout occurs or the bottom heater SSR is short-circuited.	"Err14: Humidity Heater Abnormal" is displayed in the message display field.	≡	≡	-----
Door heater error	Door heater burnout occurs or the door heater SSR is short-circuited.	"Err15: Door Heater Abnormal" is displayed in the message display field.	≡	≡	-----
Sensor box heater error*1	a) High limit temperature alarm is activated. b) The sensor box heater burnout occurs or the sensor box heater SSR is short-circuited.	"Err16: CO ₂ Box Heater Abnormal" is displayed in the message display field.	≡	≡	-----
Heater SSR burnout*1	a) High limit temperature alarm is activated. b) Main, bottom, door, or sensor box heater SSR burnout occurs.	"Err17: Heater SSR Open" is displayed in the message display field.	≡	≡	-----

*1: After a while after the high limit temperature alarm is activated, Err16 (Sensor box heater error) and Err17 (Heater SSR burnout) are activated.

Alarm or safety function	Conditions	Display	Buzzer	Remote alarm	Safety operation
UV lamp failure	The UV lamp burns out.	"Err18: UV Lamp Abnormal" is displayed in the message display field.	Intermittent tone	ON	-----
New UV lamp replacement	The accumulated ON time reaches approx. 5,000 h.	"Warning: UV Bulb Life" is displayed in the message display field.	-----	-----	-----
Communication error *	When communication between LCD touch panel and control substrate is died out or unstable.	"Err56: Communication Failure" is displayed in the message display field.	Intermittent tone	-----	-----
Warming-up of gas control	After power switch is turned ON, under warming-up before temperature is stable and gas control is enabled.	"Status: Gas sensor initializing" is displayed in the message display field.	-----	-----	-----

※When a communication error occurs, you cannot operate the LCD touch panel.

●Table 5~7 show the behavior of the alarm (buzzer) and Ring Back function when pressing Buzzer key.

Table 5. In the cases of other than table 6 or table 7.

Remote Alarm setting	Ring Back setting	Buzzer from CO ₂ incubator		Remote Alarm	
		When pressing the Buzzer key	When the Ring Back set time passes	When pressing the Buzzer key	When the Ring Back set time passes
ON: Non-interlock with Buzzer key	ON	OFF (Alarm is not canceled)	ON	ON	ON (Under continuation)
	OFF		OFF		
OFF: Interlock with Buzzer key	ON		ON	OFF (Alarm is not canceled)	ON
	OFF		OFF		

Note: Resolve the cause of the alarm in reference to pages 82~84 because the alarm itself is not deactivated by pressing Buzzer key.

Table 6. In the cases of high limit temperature alarm or Err38 (The outer door opens during H₂O₂ decontamination; refer to next page).

Remote Alarm setting	Ring Back setting	Buzzer from CO ₂ incubator		Remote Alarm	
		When pressing the Buzzer key	When the Ring Back set time passes	When pressing the Buzzer key	When the Ring Back set time passes
ON: Non-interlock with Buzzer key	ON	ON	ON (Under continuation)	ON (Continue)	ON (Under continuation)
	OFF				
OFF: Interlock with Buzzer key	ON				
	OFF				

Note: Close the outer door when Err38 is activated.

Table 7. In the cases of Err01 (CO₂ gas cylinder empty), Err11, 12 (CO₂ sensor error), Err18 (UV lamp failure) or door alarm*2.

Remote Alarm setting	Ring Back setting	Buzzer from CO ₂ incubator		Remote Alarm setting	
		When pressing the Buzzer key	When the Ring Back set time passes	When pressing the Buzzer key	When the Ring Back set time passes
ON: Non-interlock with Buzzer key	ON	OFF (Alarm is canceled)	OFF (Alarm is already canceled)	OFF (Alarm is canceled*2)	OFF (Alarm is already canceled*2)
	OFF				
OFF: Interlock with Buzzer key	ON				
	OFF				

*2: In the door alarm, the remote alarm does not work.

Note: When Err01 is activated, connect the new CO₂ gas cylinder and press the Buzzer key to stop the buzzer. In addition, when the optional MCO-21GCP is installed and the gas supply is switched to the reserve gas cylinder, press the Buzzer key and replace the gas cylinder.

ALARMS, SAFETY, AND SELF-DIAGNOSIS

Table 8. Alarms and Safety functions for H₂O₂ decontamination

Alarm or safety function	Conditions	Display	Buzzer	Remote alarm	Safety operation
System check error at start of H ₂ O ₂ decontamination	The H ₂ O ₂ generator is not connected.	"Err31: H2O2 Unit Not Connected" is displayed in the message display field.	-----	-----	H ₂ O ₂ decontamination is cancelled.
	There is no H ₂ O ₂ solution or the H ₂ O ₂ level sensor has failed (or is disconnected).	"Err32: Low H2O2 Level" is displayed in the message display field.	-----	-----	H ₂ O ₂ decontamination is cancelled.
	The door is not closed.	"Err33: Outer Door Open" is displayed in the message display field.	-----	-----	H ₂ O ₂ decontamination is cancelled.
Failure during warming-up	Power was interrupted.	After power is restored, return to the "Top Display".	-----	-----	-----
	The outer door is open.	"Err38: Door Lock Failure" is displayed in the message display field.	Continuous tone (when the outer door is open.)	ON (when the outer door is open.)	H ₂ O ₂ decontamination is cancelled.
Failure during H ₂ O ₂ decontamination	The volume of H ₂ O ₂ generated is abnormal.	"Err34: H2O2 Volume" is displayed in the message display field.	Intermittent tone with 25 min delay	ON with 25 min delay	Moves to UV resolve.
	Power was interrupted during H ₂ O ₂ decontamination.	After power is restored, "Err35: Power Failure" is displayed in the message display field.	Intermittent tone	ON	- During power failure, outer door is locked by electric lock. - After power is restored, moves to UV resolve.
	The outer door is open.	"Err38: Door Lock Failure" is displayed in the message display field.	Continuous tone (when the outer door is open.)	ON (when the outer door is open.)	- H₂O₂ mist generation is cancelled. - Resolve time is extended.
Failure during H ₂ O ₂ gas resolve by UV.	The UV lamp failed during H ₂ O ₂ gas resolve by UV.	"Err36: UV Lamp Failure" is displayed in the message display field.	Intermittent tone	ON	Resolve time is extended.
	Power was interrupted during H ₂ O ₂ gas resolve by UV.	After power is restored, "Err37: Power Failure" is displayed in the message display field.	-----	-----	- During power failure, outer door is locked by electric lock. - After power is restored, UV resolve is repeated.
	The outer door is open.	"Err38: Door Lock Failure" is displayed in the message display field.	Continuous tone (when the outer door is open.)	ON (when the outer door is open.)	Resolve time is extended.

Note:

Keys for unlocking the outer door in the event of a power failure or electric lock malfunction are included with the product (when using MCO-230AICUVHL) or included with the optional electric lock MCO-170EL (when using MCO-230AICUVL). Usually, these keys should be kept in a safe place and managed carefully. It is recommended that you make a note of the symbol and the serial number of the key in case the key is lost.

⚠ WARNING

Do not unlock the outer door using the accessory key during H₂O₂ decontamination or during H₂O₂ gas resolve by UV. Doing so may cause harm to health from H₂O₂ gas leakage.

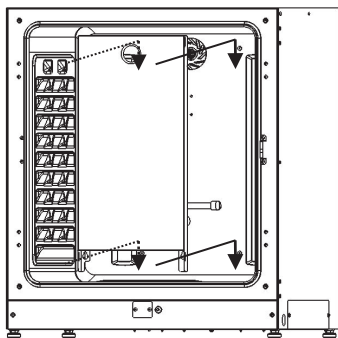
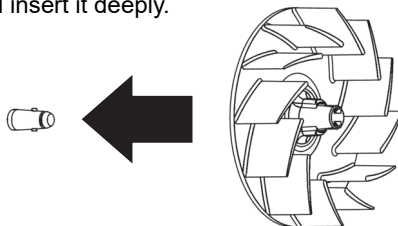
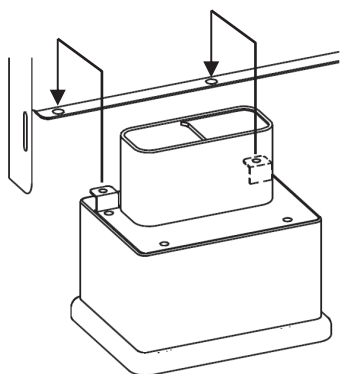
TROUBLESHOOTING

If the incubator does not seem to be working properly, check the following items before calling for service.

Symptom	Items to check and countermeasures
The incubator does not operate at all.	- Is the incubator plugged in? - Is there a power outage, or has a circuit breaker interrupted the power? - The removable power supply cord is connected to the port attached on the lower right side of the cabinet.
An alarm is activated.	[When starting operation] - Does the chamber temperature match the set value? - Does the CO₂ gas density in the chamber match the set value? (1) Is the secondary pressure for the gas regulator at the specified value of 0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G))? (2) Is the gas tube properly connected? [During operation] - Is the high limit alarm temperature set at least 1°C higher than the chamber set temperature? - Has the temperature setting been changed? Has the outer door been left open for a long time? Has a low-temperature object been placed in the chamber? If any of these is the case, the alarm will be automatically cleared if you wait. - Has the gas tube come loose, or is there a gas leak? - Has the CO₂ gas density setting been changed? - Is the gas cylinder empty? Check the primary pressure of the gas cylinder once a week. (When the primary pressure is 3.8 MPa(G) (38 kgf/cm²(G), 551 psi(G)) or lower, it is a sign that there is little gas remaining. Replace the cylinder soon.) - Is the incubator operating beside the appliance that generates the electromagnetic wave? • If the LCD touch panel cannot be operated, turn the power off and then turn on again.
The chamber temperature does not match the set value.	- Is the ambient temperature less than 5°C different from the set value for the chamber temperature? - Is the outer door closed with the inner door left open? - Is the incubator operating beside the appliance that generates the electromagnetic wave?
The chamber humidity does not rise.	Is there enough water in the humidifying pan? (Be sure to use sterile distilled water or pure water.)
The CO ₂ gas density does not match the set value.	- Is the secondary pressure for the gas regulator at the specified value of 0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G))? - Is the gas tube blocked? - Is the duct securely attached? Attach the duct properly to the 4 points hooks. (Fig. 1 on page 87) - Is the fan attached properly? Confirm if the fan is pushed all the way to the motor shaft. (Fig. 2 on page 87) - Is the incubator operating beside the appliance that generates the electromagnetic wave?
A large quantity of CO ₂ gas is being consumed.	- Are the outer and inner doors being frequently opened and closed? - Check whether gas is leaking from connectors due to deterioration of the gas tube, or whether there may be any pinhole leaks. The gas tube is a replaceable part, and it is recommended that it be replaced once a year. - Is the packing seal for the inner door defective? - Is the access hole open?

TROUBLESHOOTING

Symptom	Items to check and countermeasures
Normal cultures are not possible, and the CO ₂ gas density is suspect.	Is the ambient air environment around the incubator normal? Is there a source of polluted gas in the vicinity?
CO ₂ gas is not being injected.	- The CO₂ control method for the incubator is the ON-OFF method. CO₂ gas is intermittently injected as the gas density in the chamber approaches the set value. Injections may be stopped for periods of approximately 15 seconds, but that is not an error. - The gas is not injected until the temperature of the CO₂ sensor becomes stable enough approx. 1 hour, after turning ON the power switch or recovering from power failure.
The CO ₂ gas density is slow to recover.	- A dust filter is used for the incubator CO₂ gas piping. If gas density is slow to recover when the CO₂ gas pressure is normal, it is possible that the dust filter may be clogged. Contact our sales representative or agent. - Is there little gas remaining in the CO₂ gas cylinder? - Is the secondary pressure for the gas regulator at the specified value of 0.03 MPa(G) ~0.1 MPa(G) (0.3 kgf/cm²(G)~1 kgf/cm²(G), 4.4 psi(G)~14.5 psi(G))? - Is the gas tube blocked? - Is the duct securely attached? Attach the duct properly to the 4 points hooks. (Fig. 1 on page 87) - Is the fan attached properly? Confirm if the fan is pushed all the way to the motor shaft. (Fig. 2 on page 87)
UV lamp lights when the outer door is open.	Does something push the door switch?
The outer door will not open.	When using MCO-230AICUVHL, or MCO-230AICUVL with the optional MCO-170EL installed: - When the power switch is OFF, the electric lock is locked, and the outer door will not open. Either turn ON the power switch or use the accessory key to unlock the electric lock. - During decontamination the outer door is electrically locked and does not open.
Data cannot be exported to the USB flash drive.	- The USB flash drive is not inserted properly. - Data during the specified time period does not exist. - The USB flash drive is full. - The USB flash drive has not been formatted in FAT16 or FAT32 format. - The USB flash drive that requires password is used. - The USB flash drive with capacity of more than 32 GB is used.
H2O2 decontamination cannot be performed.	- Is the optional MCO-HP installed when using MCO-230AICUVHL? - Are the optional MCO-HP, MCO-170HB, and the MCO-170EL installed when using MCO-230AICUVL? - Are the optional MCO-HP, the optional MCO-170HB and the MCO-170EL installed? - Is the UV lamp burned out? If the UV lamp is burned out, H2O2 decontamination will not be possible. - Is the H₂O₂ generator cable properly connected? - Has the entire bottle of the H2O2 reagent been used?

Symptom	Items to check and countermeasures	
In H ₂ O ₂ decontamination cycle, "Err34: H ₂ O ₂ Volume" is activated.	• Is the duct securely attached? Attach the duct properly to the 4 points hooks. (Fig. 1) • Is the fan attached properly? Confirm if the fan is pushed all the way to the motor shaft. (Fig. 2) • Is the H₂O₂ generator securely installed? Set the 2 pins of the H₂O₂ generator in the 2 holes at the left bottom of the duct. (Fig. 3) • Is it the end-of-life of the H₂O₂ generator? If the total operating time exceeds 5,000 hours, replace the H₂O₂ generator.	
	1.Position the center hole of the fan with the projection of the motor shaft. And insert it deeply. 	
Fig. 1	Fig. 2	Fig. 3

Note: If the problem still has not been solved after trying the above checks and countermeasures, or for any problems not covered here, contact our sales representative or agent.

Keep an electric product which emits an electromagnetic wave away from this product. A noise from an electromagnetic wave may cause malfunction to this product.

DISPOSAL OF UNIT

When disposing of the CO₂ incubator, contact our sales representative or agent.

WARNING

The CO₂ incubator must be dismantled and disposed of by qualified personnel only. If the CO₂ incubator is left where outsiders enter, it may result unexpected accident (for example, children to become locked inside).

Before disposing the CO₂ incubator with biohazardous danger, decontaminate the CO₂ incubator to the extent possible by the user.



■ This label is a recycle mark complying with the Taiwanese battery regulation.

SPECIFICATIONS

Product name	CO ₂ Incubator MCO-230AICUVL	CO ₂ Incubator MCO-230AICUVHL
External dimensions	W770 mm x D730 mm x H905 mm (W30.3 in. x D28.7 in. x H35.6 in.)	
Internal dimensions	W643 mm x D523 mm x H700 mm (W25.3 in. x D20.6 in. x H27.6 in.)	
Interior volume	230 L (8.12 cu.ft.)	
Exterior	Painted steel (Rear cover has no paint)	
Interior	Stainless steel containing copper	
Outer door	Painted steel	
Inner door	Tempered glass	
Trays	4 trays made of stainless steel containing copper W620 mm x D450 mm x H12 mm (W24.4 in. x D17.7 in. x H0.47 in.) Maximum load: 7 kg (15 lbs.)/tray	
Access port	Inner diameter: 30 mm (1.18 in.), On the back side	
Insulation	Styrene AcryloNitrile copolymer	
Heating system	DHA system (heater jacket + air jacket system)	
Heater	345 W	
Humidifying system	Natural evaporation with humidifying pan	
Temperature controller	PID control system	
Temperature display	Digital display	
CO ₂ controller	PID control system	
CO ₂ density display	Digital display	
Air circulation	Fan assisted	
Gas line filter	0.01 µm, Efficiency: 99.99% or higher	
UV lamp	4 W x 1 (ozone-free emission)	
Alarms	Automatic set temperature alarm, Automatic set CO ₂ density alarm, High limit temperature alarm, CO ₂ gas, various sensor/heater alarms	
Remote alarm contacts	Allowable contact capacity: DC 30 V, 2 A *	
CO ₂ inlet connection	Soft Polyurethane tube can be connected (ID 4 mm, OD 6 mm (ID 0.157 in., OD 0.236 in.))	
CO ₂ inlet pressure	0.03 MPa(G)~0.1 MPa(G) (0.3 kgf/cm ² (G)~1 kgf/cm ² (G), 4.4 psi(G)~14.5 psi(G))	
Weight	90 kg (198 lbs.)	
Accessories	1 removable power supply cord, 1 power supply cord cover plate, 4 trays 1 gas tube, 1 humidifying pan, 1 conversion joint	
	2 keys to outer door	

* It is recommended to use standard signal and interface cables with a maximum length of 30 meters.

SPECIFICATIONS

Product name	CO ₂ Incubator MCO-230AICUVL	CO ₂ Incubator MCO-230AICUVHL
Optional accessories for H ₂ O ₂ decontamination	H ₂ O ₂ decon board (MCO-170HB)* ⁴ Electric lock (MCO-170EL):* ¹ * ⁴	
	H ₂ O ₂ generator (MCO-HP) H ₂ O ₂ reagent (MCO-H2O2)	
Optional accessories (Refer to Table 9 and Table 10)	Double stacking bracket (MCO-170PS) Stacking plate (MCO-230SB)	
Optional accessories	Gas regulator (MCO-010R) Gas auto changer (MCO-21GCP) Tray (MCO-230ST: same as that of standard accessory) Half tray (MCO-35ST) Roller base (MCO-230RB) Interface board (MTR-L03)* ² , * ³ ; For LAN Interface board (MTR-480)* ² , * ³ ; For RS-232C/RS-485	
	Interface board (MCO-420MA)* ⁴	

*1: Electric lock can also be used for the auto lock function.

*2: For purchase of the interface boards, contact our sales representative or agent.

When you use one of these interface boards for MCO-230AICUVHL, you cannot use the standard interface board for MCO-230AICUVHL (MCO-420MA).

*3: It is recommended to use standard signal and interface cables with a maximum length of 30 meters.

*4: These items come standard on MCO-230AICUVHL.

Note: Refer to the updated catalog when ordering an optional component.

Table 9. Required bracket/plate for each incubator combination of double stacking

Upper product	MCO-230AIC series	MCO-170AIC series MCO-170M series MCO-170AICD series	MCO-19AIC series MCO-19M series	MCO-18AC series
Lower product	MCO-230AIC series			
Bracket Plate	Double stacking bracket MCO-170PS	Stacking plate MCO-230SB		

Table 10. Required bracket/plate for each incubator combination of double stacking

Upper product	MCO-230AIC series			
Lower product	MCO-230AIC series	MCO-20AIC series		
Bracket Plate	Double stacking bracket MCO-170PS	Stacking plate MCO-230SB		

PERFORMANCE

Product name	CO ₂ Incubator MCO-230AICUVL	CO ₂ Incubator MCO-230AICUVHL
Model number	MCO-230AICUVL-PA	MCO-230AICUVHL-PA
Temperature control range	Ambient temperature plus 5°C to max. 50°C * (Ambient temperature: 5°C to 35°C)	
Temperature distribution	±0.25°C (ambient temperature: 23°C, setting: 37°C, CO ₂ : 5%, no load)	
Temperature variation	±0.1°C (ambient temperature: 23°C, setting: 37°C, CO ₂ : 5%, no load)	
CO ₂ setting range	0% to 20%	
CO ₂ variation	±0.15% (ambient temperature: 23°C, setting: 37°C, CO ₂ : 5%, no load)	
Chamber humidity	95% R.H.± 5% R.H.	
Environmental conditions	Ambient temperature: 5°C to 35°C, Humidity: 80% R.H. max. (The designed performance may not be obtained if the ambient temperature is 15°C or lower)	
Noise level	25 dB (A scale)	
Power consumption	Max. 430 W	
Heat emission	Max. 1,250 kJ/h	
Rated voltage, frequency	AC 110 V-120 V, 60 Hz	
Amperage	Max. 3.8 A	

*When set temperature is 37°C, ambient temperature must be 32°C or less. Regardless of ambient temperature, the maximum of temperature control range is always 50°C.

Note:

- Based on our measuring method.
- Default calibration conditions: 37°C, CO₂: 5%

When using under other conditions, we recommend calibration under the conditions of use.

- We recommend calibration every year.

SAFETY CHECK SHEET



CAUTION

Please copy and fill out this form before servicing.
Hand over this form to the service engineer for their
and your safety.

Safety check sheet

1. Stored material

Risk of infection: ☐Yes ☐No ☐Maybe
Risk of toxicity: ☐Yes ☐No ☐Maybe
Risk from radioactive sources: ☐Yes ☐No ☐Maybe

List all potentially hazardous materials that have been stored in this unit:

2. Contamination in the unit

a) Contamination ☐Yes ☐No ☐Maybe

Types of contamination (if any):

b) Decontaminated ☐Yes ☐No

Methods used for the decontamination work:

3. Status of the unit

a) The unit is now safe to work on ☐Yes ☐No

b) If the answer is "No,"

Details on the danger:

Measures we should take to reduce the danger:

Date:

Signature:

Address, Division:

Telephone:

Product name:
CO₂ incubator

Model No.
MCO-

Serial number:

Date of Installation:

Please decontaminate the unit yourself before calling the service engineer.

PHC Corporation

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