

Service Manual

CO₂ Incubator MCO-18AIC



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Effective models

This service manual is effective following models.

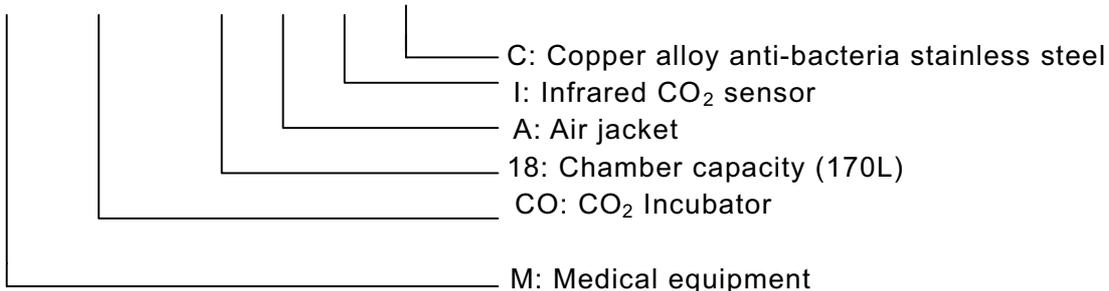
Model name	Model code	Voltage and Frequency	
MCO-18AIC	823 279 51	115V	60Hz
	823 279 52	220V	50Hz
	823 279 53	220V	60Hz
	823 279 54	230V	50Hz
	823 279 56	230V	50Hz

Features

1. PID control with micro-computer.
This unit has PID control (Proportional Integrate Differential) accurate controls internal temperature, as well as air sensor system monitoring internal temperature.
2. Infrared CO₂ sensor installed.
Infrared CO₂ sensor is not affected by humidity.
3. UV sterilization system (**Option**)
Water and the circulating chamber air in the humidifying pan are sterilized by UV lamp.
Optional setting of light mode is available.
4. Rounded Ball corners.
Inside chamber wall made by stainless steel and its corner made rounded type.
This made cleaning easier and de-contamination.
5. Reduce contamination.
Inside chamber material is made by anti-bacteria SUS.
Appearance and durability are almost same with ordinary SUS.
Anti-bacteria SUS has effect same as copper alloyed. (except for humidity pan)
6. Expandability (Module concept)
The control circuit is adopted commonly with MCO-20AIC.
7. Options
 - (1) Castor with adjustor (roller base: MCO-18RB)
 - (2) CO₂ gas tank switcher (assembled in unit: MCO-21GC)
 - (3) Extra stainless steel shelves (1 shelf + 1 shelf support basis :MCO-46ST)
 - (4) Stacking plate for double-piled (MCO-18PS)
 - (5) UV sterilization system (MCO-18UVS)

Note ; Model name

M CO - 18 A I C



Structural specification

Product name	CO ₂ incubator
Model	MCO-18AIC
Exterior dimension	(W) 620 x (D) 710 x (H) 900 mm
Interior dimension	(W) 490 x (D) 523 x (H) 665 mm
Interior volume	170 liter
Exterior	Zinc galvanized steel with baked on polyester paint
Interior	Copper alloyed stainless steel
Insulation material	Rigid polyurethane foam (NON-CFC)
Outer door	Zinc galvanized steel with baked on acrylic paint
Inner door	Tempered glass (reversible, thickness 5mm)
Shelves	4pcs. (450 x 450 x 12mm) Maximum 15pcs.available. Maximum load 7kg
Access port	φ30mm x 1, right hand on the rear panel.
Accessories	Shelf support x 4sets, Humidifying pan x 1, Tube x 1, Tube fixing x 2, Stacking plate x 1set
Net weight	93kg

Parts for Antibacterial stainless:

- Inner cabinet
- Shelves
- Shelf support
- Shelf support post
- Top duct
- Rear duct
- Humidifying pan cover

※The humidifying pan is not made of copper alloyed stainless steel.

Performance specification

Model	MCO-18AIC
Ambient temperature and humidity range	Temperature: 5°C~35°C Humidity: Less than 80%RH (In ambient temperature is lower than 15°C, original performance cannot be always obtained)
Temperature control range in the unit	Ambient temperature+5°C~+50°C (Settable range:0°C~50°C)
Temperature distribution in the unit	±0.25°C ※
Temperature variation in the unit	±0.1°C ※
Temperature recovery period	25 minutes or less (until the internal temperature is recovered to 36.5°C after door opened for 30 seconds)
CO ₂ level range	0~20%
CO ₂ level distribution range	±0.15%
CO ₂ level recovery period	10 minutes or less (until the CO ₂ level is recovered to 4.5% after door opened for 30 seconds.)
Internal humidity	95±5%RH
Internal humidity recovery period	30 minutes or less (until the internal humidity is recovered to 90%RH after door opened for 30 seconds.)
Supplied CO ₂ gas pressure	0.03MpaG (0.3kg/cm ² G) when the gas supplied
Power supply	Single phase, local voltage
Total power consumption	310W
Total current	110-120VAC: Maximum 2.8A 220-240VAC: Maximum 1.4A
Quantity of radiation	Maximum 1120kJ/h

Test condition:

Set point: 37°C
CO₂ set point: 5.0%
No load
Ambient temperature: 20°C
Ambient humidity: Approx.45%

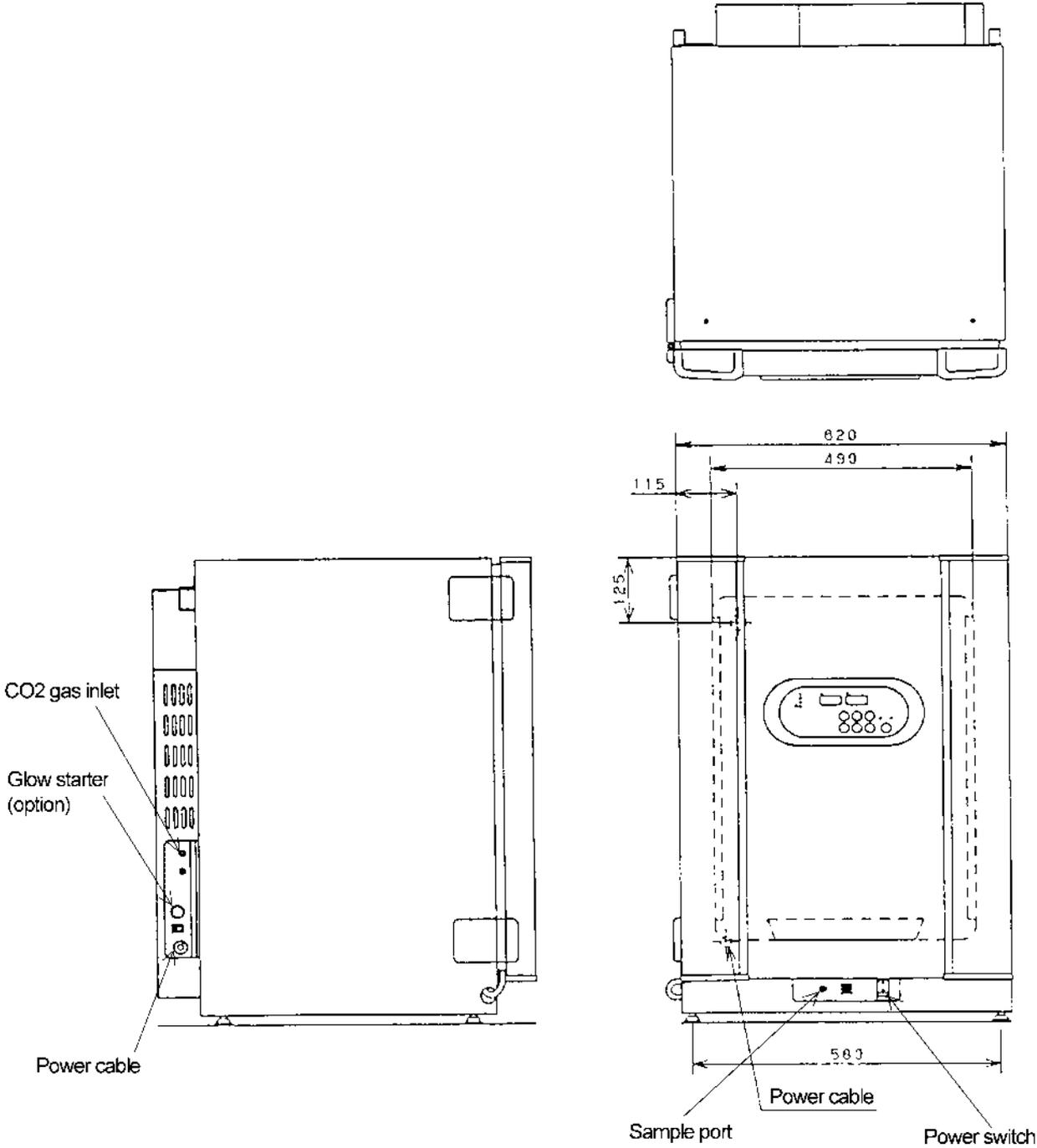
※ Based on the measuring method on validation service manual.

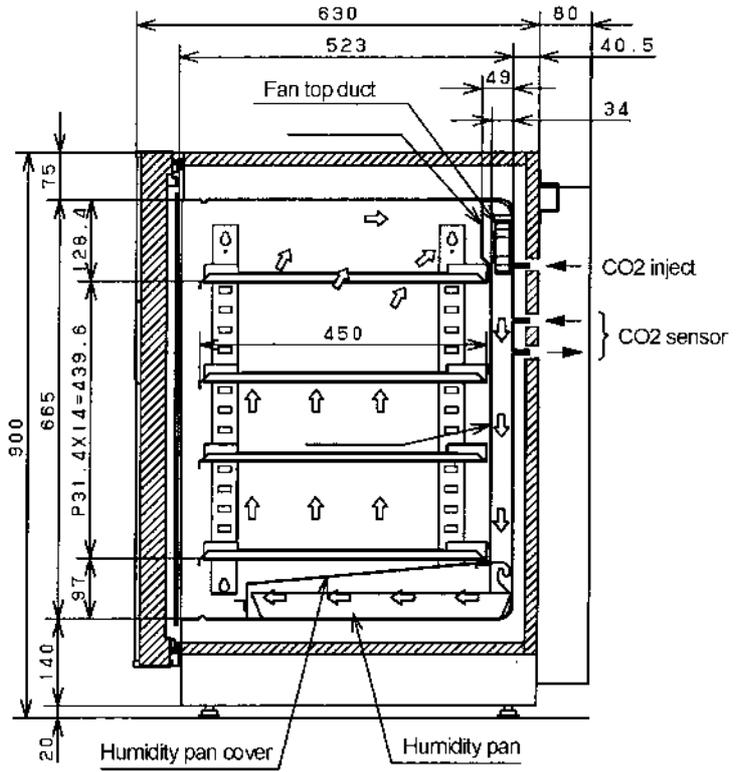
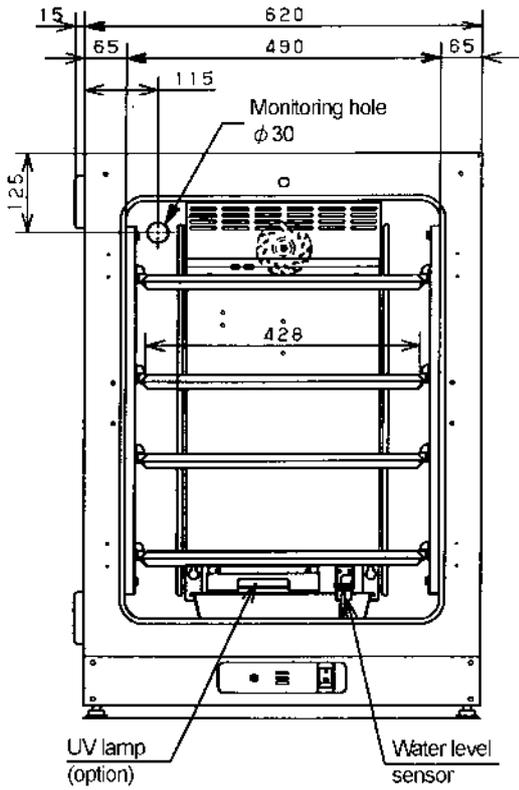
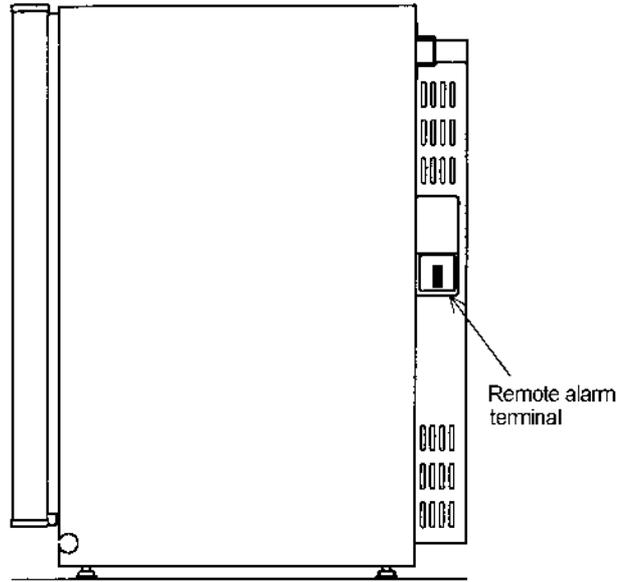
Control specification

Model	MCO-18AIC
Heating method	Direct Heat + Air jacket (DHA)
Temperature control system	Microprocessor PID Sensor: temperature sensor (103AT-1) Detect and control the inside temperature directly.
Temperature indication	Digital display (resolution: 0.1°C)
CO ₂ measuring system	Infrared CO ₂ sensor, PID control
CO ₂ level indication	Digital display (resolution: 0.1%)
Humidifying system	Natural vaporization by water in humidify pan. Humidify pan: W293 x D407 x H41mm
Inside air circulation	Breeze circulation
Alarm system	High/low temperature alarm, high/low CO ₂ level alarm Both display for temperature and CO ₂ are flashing, and buzzer sounds intermittently after 15 min. Independent alarm for overheat Door lamp
Door switch	When outer door is opened: Inside fan OFF, CO ₂ valve OFF, (UV lamp * OFF) and heater OFF (only when door is kept opening for 1 min. or more)
Remote alarm	When an alarm is triggered: Remote alarm ON (Alarm and buzzer are interlocked.) Contact output: rating of contact 30VDC, 2A
Self diagnosis function	Error code and internal temperature are displayed alternately. Buzzer and remote alarm contact ON
UV lamp control *	Automatic ON-OFF control (changeable with Function mode) 1. Interlocked with the door: UV lamp ON for 5 min. after every door closed. 2. OFF mode (UV lamp does not turn on)

* UV lamp is optionally provided.

Dimensions





Electrical parts

MCO-18AIC		AC110-120V, 60Hz	AC220v, 60Hz	AC220-240v, 50Hz
CO ₂ sensor	Type	IR sensor	IR sensor	IR sensor
	Code	MIR-1000CO2	MIR-1000CO2	MIR-1000CO2
Temp. sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ (25°C)	10KΩ (25°C)	10KΩ (25°C)
CO ₂ BOX temp. sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ (25°C)	10KΩ (25°C)	10KΩ (25°C)
Overheat protect sensor	Type	103AT-1	103AT-1	103AT-1
	Rating	10KΩ (25°C)	10KΩ (25°C)	10KΩ (25°C)
CO ₂ BOX thermal fuse	Type	SF70U	SF70U	SF70U
	Rating	250VAC, 7A, 70°Coff	250VAC, 7A, 70°Coff	250VAC, 7A, 70°Coff
Air pump	Type	MV-10B	MV-10B	MV-10B
	Rating	AC36V	AC36V	AC36V
Auto zero air pump	Type	AP-1500	AP-1500	AP-1500
	Rating	AC36V	AC36V	AC36V
Fan motor	Type	FL2-011YM	FL2-011Y5M	FL2-011Y5M
	Rating	110-120VAC	220-240V	220-240V
Transformer for PCB	Type	ATR-K23	ATR-HN235T	ATR-HN235T
	Primary	115V	230V	230V
	Secondary	8.5VAC ±18VAC	8.5VAC ±18VAC	8.5VAC ±18VAC
Top heater	Rating	115V 8W	230V 8W	230V 8W
		1653Ω	6613Ω	6613Ω
Back heater	Rating	115V 12W	230V 12W	230V 12W
		1102Ω	4408Ω	4408Ω
Side heater (right & left)	Rating	115V 30W	230V 30W	230V 30W
		441Ω	1763Ω	1763Ω
Flange heater	Rating	115V 31W	230V 31W	230V 31W
		426Ω	1706Ω	1706Ω
Bottom heater (front & back)	Rating	115V 10W	230V 10W	230V 10W
		1323Ω	5290Ω	5290Ω
Bottom side heater (Left & right)	Rating	115V 14W	230V 14W	230V 14W
		945Ω	3779Ω	3779Ω
Front panel heater	Rating	115V 37W	230V 37W	230V 37W
		357Ω	1430Ω	1430Ω
Door heater	Rating	115V 85W	230V 85W	230V 85W
		156Ω	622Ω	622Ω
CO ₂ heater A	Rating	71V 19.5W	141V 19.5W	141V 19.5W
		256Ω	1020Ω	1020Ω
CO ₂ heater B	Rating	45V 12.5W	89V 12.5W	89V 12.5W
		162Ω	634Ω	634Ω
Hinge sub heater (right & left)	Rating	36V 0.3W	36V 0.3W	36V 0.3W
		4410Ω	4410Ω	4410Ω
Bimetal thermo	Type	TH-2	TH-2	TH-2
	Rating	60°C CON, 70°C OFF	60°C CON, 70°C OFF	60°C CON, 70°C OFF
Solenoid valve	Type	FAB11-X1528	FAB11-X1528	FAB11-X1528
	Rating	DC24V	DC24V	DC24V
Noise filter	Type	ZHG2210-11S	ZHG2210-11S	ZHG2210-11S
	Rating	250VAC 10A	250VAC 10A	250VAC 10A
Power switch	Type	BAM215131	BAM215131	BAM215131
	Rating	250VAC 16A	250VAC 16A	250VAC 16A
Door switch	Type	SS160-A15	SS160-A15	SS160-A15
	Rating	28V 50mA	28V 50mA	28V 50mA
DC 5V power supply	Type	ZWS15-5/J	ZWS15-5/J	ZWS15-5/J
	Primary	5VDC 3A	5VDC 3A	5VDC 3A
	Secondary	85-264VAC	85-264VAC	85-264VAC
Water sensor	Type	OLS-1003S	OLS-1003S	OLS-1003S
	Rating	DC5V	DC5V	DC5V
UV lamp *	Type	GL4	GL4	GL4
	Rating	4W	4W	4W
Glow starter *	Type	FG-7P	FG-7P	FG-7P
Ballast *	Rating	115V, 60Hz	220V, 60Hz	230V, 50Hz

* Optionally provided for MCO-18AIC (UV).

Temperature calibration

Note) When key lock mode is ON, calibration mode is disabled.

- (1) Press **CAL** key for approx. 5 seconds.
- (2) The top (the 3rd) digit of temperature display is flashing, other digits will go off.
- (3) Set the present correct temperature with **▶▶** key and **▲** key. Press **ENT** key.
- (4) The display will automatically revert to the present temperature.

[Example] If the internal temperature display shows 37.0°C (the set value) and the actual measured value is 36.8,

- ① Press **CAL** key for approx. 5 seconds.
- ② The “3” (top digit) of temperature display is flashing, other digits will go off.
- ③ Set the displayed value at 36.8°C of the actual measured value with **▶▶** key and **▲** key, then press **ENT** key.
- ④ The display will automatically revert to the present temperature.

(Note)

sIn temperature calibration, it is important to accurately measure the internal temperature. Particularly, for the thermometer used, its grade of accuracy should be than 0.5 class. The measure should be carried out at the center of the chamber.

sThe temperature calibration range is between the set value $\pm 1.0^{\circ}\text{C}$. If the value over this range is input, an error tone will be emitted, the input data will be ignored, and the display will revert to the present temperature. Therefore, if you need to calibrate more than 1.0°C , you should repeat above procedure several times.

CO₂ Calibration

Note) When key lock mode is ON, calibration mode is disabled.

- (1) Press **CAL** key for approx. 5 seconds.
- (2) The top (the 3rd) digit of temperature display is flashing, other digits will go off.
- (3) Press **CAL** key again.
- (4) The top (the 3rd) digit of CO₂ density display is flashing, other digit will go off.
- (5) Set the present correct CO₂ density with **▶▶** key and **▲** key. Press **ENT** key.
- (6) The display will automatically revert to the present temperature.

[Example] If the internal CO₂ density display shows 5.0%(the set value), the actual measured value is 4.5,

- ① Press **CAL** key for approx. 5 seconds.
- ② The top digit of temperature display is flashing, and other digits will go off.
- ③ Press **CAL** key again.
- ④ The top digit of CO₂ density display is flashing, other digits will go off.
- ⑤ Set the displayed value at 4.5% of the actual measured value with **▶▶** key and **▲** key, then press **ENT** key.
- ⑥ The display will automatically revert to the present temperature.

(Note)

s In CO₂ calibration, if CO₂ density display is less than 2.0%, an error tone will be emitted and the input data will be ignored, and the display will revert to the present temperature.

s CO₂ calibration should be done after CO₂ density measuring was done at least three times after checked that there is no error of measurement.

s This unit has auto zero adjustment function. It is necessary to check that the room installed the unit is not filled with CO₂ gas.

If the unit is installed in smaller room, be sure to change the room air timely.

(Please request to your customers.)

s CO₂ calibration should be done in consideration of the difference for CO₂ density meter.

Control specification

1. Key and switch

- BZ** : When an alarm LED is flashing and the buzzer sounds,
Buzzer and remote alarm output \longrightarrow Force to turn off
When an alarm lamp flashing and the buzzer does not sound, buzzer remains OFF.
- SET** : Press once to enter the device into setting mode.
Press twice to enter the device into CO₂ level setting mode.
Press third times to enter the device into over-heat protection temperature check mode. Press four times to return the device to internal temperature (PV) display.
-  : In the setting mode, the device can be shifted the 2nd digit \longleftrightarrow the 1st digit \longleftrightarrow the 1st decimal place.
In PV display, keep the key pressing 5 seconds or more to enter the key lock mode.
-  : In the setting mode, the blinking digit counts up.
- CAL** : In PV display, keep the key pressing approximately 5 seconds to enter the device into the calibration mode, press again to enter the device into the CO₂ calibration mode. When the CO₂ setting value (SV) is 0%, the device goes into PV display instead of the CO₂ calibration mode.
In the temperature calibration mode, input FXX with  key and then press ENT key to enter the device into the function mode to obtain information of each mode.

Note) During CO₂ Auto Zero adjustment (the decimal point of indicator is flashing), the CO₂ calibration will not be performed with beeping the buzzer for a second continuously even if ENT key is pressed.

- ENT** : During setting mode, CAL mode and Function mode, press the key to store the value. The function is not valid for the unchangeable values.
- A / B** : The key is available only in optionally Auto-changer mode in F08.
In Auto-changer mode, press the key to switch the cylinder in use to another one. Lighting A or B indicates as the cylinder in current use. (If the Auto-changer mode is not installed, the cylinder switcher lamp does not activate)
When the cylinder in use is emptied, automatically switches to another one. At the time the lamp of cylinder emptied will blink, and the lamp of another one will illuminate.
(Ex: When the CO₂ cylinder in current used is emptied, the lamp cylinder A switches to blink, and then the lamp cylinder B will illuminate)

2. Temperature control

- Setting range : 0°C~+50°C
Display range : 0°C~+99.9°C
Setting method : Press the SET key. Change to the desired value with  key and  key, then press the ENT key. The value will be stored and then the device shifts to CO₂ setting mode.
- Out of the range: When a value is set out of the range and ENT key is pressed, buzzer sounds 1 second (continuously) and the previous value is still remained.
- Control : PID control
- Alarm : When the PV is SV \pm 1°C or higher, the display digit blinks.
After 15 minutes later, buzzer sounds and remote output turns ON.

3. CO₂ control

Setting range : 0%~20%

Display range : 0%~99.9%

Setting method : Press SET key twice.

Change to the desired value with  key and  key, then press ENT key to store the value. Then the device shifts to the Overheat protection temperature check mode.

Out of the range: When a value is set out of the range and ENT key is pressed, buzzer sounds 1 second (continuously) and the previous value is still remained.

Control : PID Control

Control OFF : When a value is set in 0.0%, CO₂ display will be disappeared to be the Control OFF.

Alarm : When the internal CO₂ level deviates SV±1% or higher, CO₂ display blinks. After the 15minutes later, buzzer sounds and remote alarm terminal turns ON.

4. Overheat protection temperature check mode

Setting range : 35°C~51°C

Setting method : Press SET key for three times to display the overheat protection temperature on PV display and “HI” on CO₂ display.
Press SET key again to return to PV display.

5. Alarm, safety mode and self diagnosis

In sensors malfunctions and CO₂ control malfunctions, an error code and PV is displayed alternately.

Note) The remote alarm is controlled in every a minute exceptionally in Auto Zero.

That's why the remote alarm control is delayed 4minutes (max) after an error is displayed.

<Error code>

E01: CO₂ cylinder is empty

E05: Temp. sensor is open circuit

E06: Temp. sensor is short circuit

E07: CO₂ box temp. sensor is open circuit

E08: CO₂ box temp. sensor is short circuit

E09: Ambient temperature sensor is open circuit

E10: Ambient temperature sensor is short circuit

E11: CO₂ sensor output voltage is abnormal

E12: Main heater is abnormal

E13: Bottom heater is abnormal

E14: Door heater is abnormal

E15: CO₂ sensor box heater is abnormal

E16: SSR for each heater is open circuit

E17: Sample pump and/or Auto zero pump malfunction

E18: UV lamp malfunction (a lamp blown out, a glow lamp unfitted, etc)

The description of error codes are follow:

E01 : CO₂ cylinder is empty

When the CO₂ level is not 0.2% or more in a minute even though the valve is opened, “E01” and “Internal temperature “ are displayed alternately, and buzzer sounds intermittently.

The definite action that CO₂ cylinder is empty, repeats twice, therefore it takes approximately 2minutes to display an error after the cylinder would be emptied.

- E05,E06 : Temp. sensor malfunction (open / short circuit)
 When the micro-computer detects an internal temperature as 0°C or lower, it is judged as “open circuit” displaying alternately “E05” with PV and sounding intermittent buzzer.
 When the micro-computer detects an internal temperature as +60°C or higher, it is judged as “short circuit” displaying alternately “E05” with PV and sounding intermittent buzzer.
- Note) In E05 and E06, displayed PV is different from product’s actual temperature)
- E07,E08 : CO₂ box temp. sensor malfunction (open / short circuit)
 See E05, E06 in details.
 (Note: In E07 and E08, CO₂ valve is closed)
- E09, E10: Ambient temperature sensor malfunction (open / short circuit)
 See E05, E06 in details.
- E11 : CO₂ sensor output voltage is abnormal
 When CO₂ sensor box temperature is stable and high or low temperature alarm is not occurred, it is judged as CO₂ sensor malfunction if CO₂ output voltage is lower than 1000mV or higher than 4800mV. “E11” and “internal temperature” are displayed alternately, and buzzer sounds intermittently.
 At the time, CO₂ valve is closed.
- E12 : Main heater is abnormal
 When high temperature alarm is activated, when the main heater is open circuit, and when the main heater SSR is short circuit, “E12” and an internal temperature are displayed alternately and buzzer sounds intermittently. An error is not displayed just after failed because the self-diagnosis for SSR and heater failure is done only in every 40min or in the power supplied.
(Above description is also applied for E13 - E16)
- E13 : Bottom heater is abnormal
 When the bottom heater is open circuit, or SSR is short circuit, “E13” and an internal temperature are displayed alternately, and buzzer sounds intermittently.
- E14 : Door heater is abnormal
 When the door heater is open circuit, or SSR is short circuit, “E14” and an internal temperature are displayed alternately, and buzzer sounds intermittently.
- E15 : CO₂ sensor box heater is abnormal
 When the CO₂ sensor box heater is open circuit, or SSR is short circuit, “E15” and internal temperature are displayed alternately, and buzzer sounds intermittently.
- E16 : SSR is open circuit
 When any SSR of main heater, bottom heater, door heater and CO₂ sensor box heater is open circuit, “E16” and an internal temperature are displayed alternately, and buzzer sounds intermittently.
- E17 : Sample pump and Auto zero pump malfunction
 In CO₂ SV is 3.5% or higher and the current level is 3.5% or higher, if the difference of voltage between “during Auto Zero “ and “before Auto Zero” is 150mV or lower, it judges as “Sample pump and Auto zero pump malfunction”. “E17” and an internal temperature are displayed alternately and buzzer sounds intermittently.
 At the same time CO₂ valve is closed.
 The judgement would be done in every Auto Zero adjusts, however, the judgement in the 1st interval in Auto Zero would be ignored.

E18 : UV lamp malfunction (UV lamp is optionally provided)
When the time to turn the UV lamp on (F01) is set, the microcomputer checks the output voltage in UV detect circuit, that is detected 30seconds after the door was opened → shut. If the detected voltage is 0.2V or lower, it is judged as UV lamp malfunction. "E18" and "internal temperature " are displayed alternately, at the time the buzzer sounds intermittently. Press BZ key to cancel the error.

High temperature alarm:

When the internal temperature is out of SV, OVERHEAT lamp illuminates displaying "PV" with "E12" (main heater malfunction) or "E16" (SSR for each heater is open circuit) alternately. The buzzer sounds intermittently. It is impossible to stop the buzzer sounding by BUZZER key.

At the time heaters (main heater, bottom heater and door heater) will be OFF.

Automatic temperature alarm

When the internal temperature is $\pm 1.0^{\circ}\text{C}$ out of SV, all digits in temperature display blink and intermittent buzzer sounds with 15minutes delay.

Automatic CO₂ level alarm

When the internal CO₂ level is 1.0% out of SV, all digits in CO₂ display blink and intermittent buzzer sounds with 15 minutes delay.

CO₂ Auto Zero adjustment calibration:

See details in "Auto Zero adjustment", Page 26.

6. Key lock function

Lock mode : In PV display, keep pressing  key (shift key) over 5 seconds to enter key lock mode, display will change to "L0".
Press  key to set 1 Key lock ON
Press  key to set 0 Key lock OFF
Press SET to memorize the set, then automatically returns to PV display.

Note)

In Key Lock ON, the device can enter into SET mode to check SV, however, the value cannot be changed. The device also cannot enter into Function mode.

7. Door alarm

Display : When the door is opened, DOOR lamp illuminates.
When the door is closed, DOOR lamp goes off.

Safety operation : When the door is opened, fan motor turns off, CO₂ valve shuts off, (UV lamp turns off if it is optionally fitted).
If the door left opened for 60seconds, the heater turns off.

8. Auto return

Function : In setting mode, Key Lock mode and Function mode, if any key is not operated for 90 seconds or more, the display automatically returns to PV without storing the value to be changed.

9. Calibration

Temperature calibration : In PV display, press CAL key for approx. 5seconds to enter the device into temperature calibration mode.
Input a proper value with  key and  key then press ENT key to store the value. Finally the device returns to PV display.

CO₂ calibration : In PV display, press CAL key for approx. 5seconds to enter the device into temperature calibration mode, then press CAL key again to enter the device into CO₂ calibration mode.
 Input a proper value with  key and  key then press ENT key to recognize and store a span calibrated value. Finally the device returns to PV display. (a span adjustment)
 If CO₂ level is lower than 0.9% or higher than 20% on the display, or if a value to calibrate is higher than 2.0%, the buzzer beeps to cancel the data input then automatically returns to PV display.
 During Auto Zero adjustment (the decimal point of the 2nd digit is blinking on CO₂ display), CO₂ calibration cannot be performed.

10. Function mode

- F00: Simply pass through.
- F01: Time length of UV lamp illuminating is changed. (initial: 000)
(UV lamp is optionally provided)
- F02: UV lamp 24hours sterilization mode set
(UV lamp is optionally provided)
- F03: Service code input (code: 384)
- F04: UV lamp life span check
(UV lamp is optionally provided)
- F05: Display the voltage in CO₂ sensor
- F06: Change the output ratio of bottom heater (initial:12)
- F07: Change the output ratio of door heater (initial: 4)
- F08: Auto changer, DEMO mode, Auto Zero mode set (initial : 000)
- F09: Display a temperature in CO₂ sensor box
- F10: Display a coefficient of adjustment value for CO₂ zero point
- F11: Display a coefficient of adjustment value for CO₂ span point
- F12: Display the temperature in ambient temperature sensor
- F13: Initialize non volatile memory
- F14: LEDs and drivers performance check
- F15: Display a value to adjust zero point in temperature (initial: 008)
- F21: Communication device address (ID) set (initial: 000)
- F22: Communication parameter set (initial: 000)
- F24: Interlock the remote alarm with buzzer (initial: 000)
- F25: Ring Back time set (initial: 030)
- F30: Display ROM version

Direction for use: In PV display, press CAL key for 5seconds or more to enter the device into temperature calibration mode. Input a desired function code with  key and  key then press ENT key.

F01: Time length of UV lamp illuminating is set. (initial: 0min, range:0~30min)

Note) UV lamp is optionally provided.

<Direction for use> Input "F01" on the temperature display then press ENT key to show a present SV on the CO₂ display. Input the desired value with  key and  key then press ENT key to store the value. Finally returns to PV.

If a value out of the range is input then ENT key is pressed, the buzzer beeps for a second continuously to keep the previous set.

<Action> After the door is opened and shut, UV lamp illuminates in appointed time then automatically goes off. There is approx. 3~5seconds delay to active the mode, due the device would check water level in the humidify pan just after the door shut. With UV lamp illuminating, the lamp goes off if the door is opened.

F02: UV lamp 24hours sterilization mode set

Note) UV lamp is optionally provided.

<Direction for use> Input "F02" on temperature display to show "000" on CO₂ display.
Input "001" with ▲ key and ►► key to enter the device into 24hours sterilization mode.

At the time press ENT key displaying with "001" to simply return to PV display.

<Action> When 24hours sterilization mode is set in F02, UV lamp starts illuminating and automatically goes off after 24hours has passed. In the middle of 24hours sterilization, if the door is opened, UV lamp goes off and 24 hours sterilization mode would be cancelled.

If 24hours sterilization mode is reset in the middle in F02, the mode would start operation from the beginning.

Note) UV indicator lamp should illuminate when UV lamp illuminates, so the indicator lamp illuminates if UV lamp is unfit.

F03: Note that those who knows service code (384) should use F04 or the following functions (except for F21, 22, 24, 25 and 30).

<Direction for use> Input the following code to use the following functions. (code: 384)
Input "F03" on temperature display then press ENT key to show "000" on CO₂ display. ("384" is appeared if service code has been already input)
Input service code "384" with ▲ key and ►► key, and press ENT key to return to PV display. Now F04 and the following functions are available.

If F03 or a following function code instead of the above code is input in F03, for example if "F05" is input then ENT key is pressed, the continuous buzzer beeps for a second to return to PV display. In this case input the above code to enter the device into "F04" or a following function.

Note) The above code is stored unless "000" is input in F03 or the mains is OFF.

F04: Display life span of UV lamp

Note) UV lamp is optionally provided.

<Direction for use> Input "F04" on temperature display and press ENT key to show UV lamp used time (a period to turn UV lamp on) by unit of %.

<Description> The microcomputer calculates UV lamp whole life span as 1000hours.
A period to turn UV lamp on is displayed in the unit of %.
For example, the period less than 5minutes is considered as 5minutes, the period of 6~30minutes is simply counted as they are.
In 24hours mode, simply 24hours is added just after "001" is input and ENT key is pressed in F02, ignored with the cancel for 24hours mode caused by the door is opened in the middle.
The added value is stored in the non-volatile memory in every 24hours.
Display the added value in F04 then display "000" on CO₂ display with ▲ key and ►► key and press ENT key to clear the value.
The display range is 0~260%. A value over than 260% is not added.
If the added period is over than 1000hours, UV indicator on the control panel flashes to inform "UV lamp run down". The "run down" is provided by the microcomputer's calculation, it does not mean "the actual time to be UV lamp run down".

UV lamp life span	UV indicator on the control panel	
	UV lamp ON	UV lamp OFF
1000hours or less	Illuminates	Goes off
1000hours or more	Illuminates	Flashes

- F05: Display the voltage in CO₂ sensor (A/D converter voltage in microcomputer on the main PCB)
- <Direction for use> Input "F05" on temperature display and press ENT key to show the voltage in CO₂ sensor on CO₂ display. Press ENT key to be Auto Zero forcibly performed within a minute. Since the 90seconds Auto Return is invalid in this mode, press ENT key to come to the end.
- F06: Adjust humidity level by changing the electricity output ratio in the bottom heater. (initial: 12, the range: 0~19)
- <Direction for use> Input "F06" on temperature display and press ENT key to show a current SV on CO₂ display.
Sum the value up to make humidify higher. Lessen the value to make humidify lower.
Press ENT key to store the value and automatically returns to PV display.
- F07: Prevent dew condensation by changing the electricity output ratio in the door heater. (initial: 4, the range: 0~9)
- <Direction for use> Input "F07" on temperature display and press ENT key to show a current SV on CO₂ display. If there is dew condensation on the door, sum the value on CO₂ display up and press ENT key to store the value and automatically returns to PV.
- F08: Auto Zero and Auto Changer ON/OFF set, Demonstration mode set (initial: 000)
- In **Auto Changer mode**, both of CO₂ cylinders are available when CO₂ is requested to supply. A lamp of cylinder in current used (either lamp-A or lamp-B) is illuminated to switch manually one to another with A/B key.
If the cylinder in current used is empty, automatically switches to another cylinder and the lamp of empty cylinder flashes.
In **Demonstration mode**, SV for both temperature and CO₂ are displayed, it seems to be under control. At the time the heater is not conducted and CO₂ valve is not opened. (Demonstration mode is used in exhibitions.)
- In **Auto Zero**, zero adjustment for CO₂ sensor is automatically performed based in ambient air. Auto Zero is performed per every 10minutes in 1 hour when the main power is supplied, after that it is performed per every 4hours.
- <Direction for use> **Auto Changer mode** setting (in the 3rd digit on CO₂ display)
Input "F08" on temperature display and press ENT key to show a current SV in the 3rd digit on CO₂ display. The value "0" is the normal mode (Auto Changer is inoperative), the value "1" is Auto Changer is operative.
Demonstration mode setting (in the 2nd digit on CO₂ display)
Input "F08" on temperature display and press ENT key to show a current SV in the 2nd digit on CO₂ display. The value "0" is the normal mode (Auto Zero is operative), the value "1" is Demonstration mode is operative.
Change the 2nd digit to a desired digit and press ENT key to return to PV display.
Auto Zero setting (in the 1st digit on CO₂ display)
Input "F08" on temperature display and press ENT key to show a current SV in the 1st digit on CO₂ display. The value "0" is the normal mode (Auto Zero is operative), the value "1" is Auto Zero is inoperative.
Change the 1st digit to a desired digit and press ENT key to return to PV display.

- F09: Display the temperature in CO₂ sensor box
 <Direction for use> Input "F09" on temperature display and press ENT key to show the temperature in CO₂ sensor box. If you press ENT key or leave for 90seconds, automatically returns to PV display.
 In SV is +45°C, CO₂ valve turns OFF when the temperature is out of SV±2.0°C.
 Once the temperature retrieves in SV±2.0°C, Auto Zero is forcibly executed since the apparatus falls into the condition that the main power is supplied. When CO₂ is not injected, the temperature in sensor box may be out of ±2.0°C, or it may be within 60minutes after the main power is supplied, or Auto Zero may be being executed.
- F10: Display a coefficient of adjustment value for CO₂ zero point (initial: 500)
 <Direction for use> Input "F10" on temperature display and press ENT key to display a coefficient of adjustment value for CO₂ zero point on CO₂ display. If you press ENT key or leave the device for 90seconds, automatically returns to PV display.
 <Description> The condition is that CO₂ sensor voltage should be adjusted in 4.0V when internal CO₂ level is 0%. Perform Auto Zero and ensure the sensor output voltage should be approx. 4.0V when ambient air is got properly by the pump. At that time the value should be approx. "500".
 If CO₂ in the ambient air is several %, the value would be lower than "500" since CO₂ sensor output voltage is lower than 4.0V.
 <Calculation> (CO₂ sensor output voltage during Auto Zero pump performs / 4.0V) x 5000
 Note) Only bigger three digits are displayed. e.g "5000" → displayed as "500"
- F11: Display a coefficient of adjustment value for CO₂ span point (initial: 500)
 <Direction for use> Input "F11" on temperature display and press ENT key to display an adjustment value for CO₂ zero point on CO₂ display. If you press ENT key or leave the device for 90seconds, automatically returns to PV display.
 <Description> The value is adjusted when CO₂ is calibrated. For example, calibrate CO₂ with SV 4.5% when the CO₂ level is displayed as 5.0%, however the actual level is 4.5%. At that time the value in F11 should be lower than "500", ex "460". If the value is abnormal, ex "999", the actual internal level can be 1.0%, however the CO₂ is displayed as 5.0%.
- F12: Display a temperature in ambient temperature sensor
 <Direction for use> Input "F12" on temperature display and press ENT key to display a temperature of ambient temperature sensor on CO₂ display. If you press ENT key or leave the device for 90seconds, automatically returns to PV display.
 Note) This temperature is not synchronized with actual ambient temperature since it is affected by waste heat in electrical parts. (indicated approx. 4°C higher than the actual temperature)
- F13: Initialize the non-volatile memory (initial: 000)
This function should be used only when data in the non-volatile memory cannot be restored owing to unexpected events (ex: noise). Do not use in normal condition.
 <Direction for use> Input "F13" on temperature display and press ENT key to display "000" on CO₂ display, then change the 1st digit to "1" and press ENT key to initialize all the data in non-volatile memory.

F25: Ring Back time set (initial: 030 (30min), the range: 0~60min)
 <Direction for use> Input "F25" on temperature display and press ENT key to set current Ring Back delay time. Change the 2nd digit to set delay time in the range of 0~60min.

Note) Ring Back time set, F25 = "000" means BZ would not comeback (in former spec)

F30: Display the ROM version
 <Direction for use> Input "F30" on temperature display and press ENT key to show current ROM version on CO₂ display.

11. Bottom heater control

In order to shorten the recovery time of humidity, conduct electricity to humidity heater as follows.

- In the ordinary, the maximum electricity conduct to bottom heater should be in the ratio of 80%.
- When the internal temperature is SV-0.4~-0.6deg, conduct 80% electricity to humidify heater for 10minutes (max). SV in F06 is applied except for above temperature.
- 80% electricity conduct should not be performed in the following cases:
 - 1) The period until an internal temperature reaches to SV-0.2deg after the power is supplied
 - 2) The period until an internal temperature reaches to SV-0.2deg after the door is left opened continuously for 60seconds or more.

12. Door heater control

Ordinarily, conduct electricity to door heater in the same ratio with main heater. SV in F07 is applied.

13. Remote alarm: remote alarm contact

In normal condition Open

In alarming condition Close

Note) The recovery time after BZ key is pressed and linkage between remote alarm and buzzer are depending on F24, F25 setting.

14. Storing in non-volatile memory

2 times comparison method: When the main power is supplied, a data storing in non-volatile memory is called for 2 times to compare. If the data 1st called coincides with the data of 2nd called, the data would be stored in RAM. Otherwise, the comparison would be repeated until the one coincides with another.

15. Temperature offset value

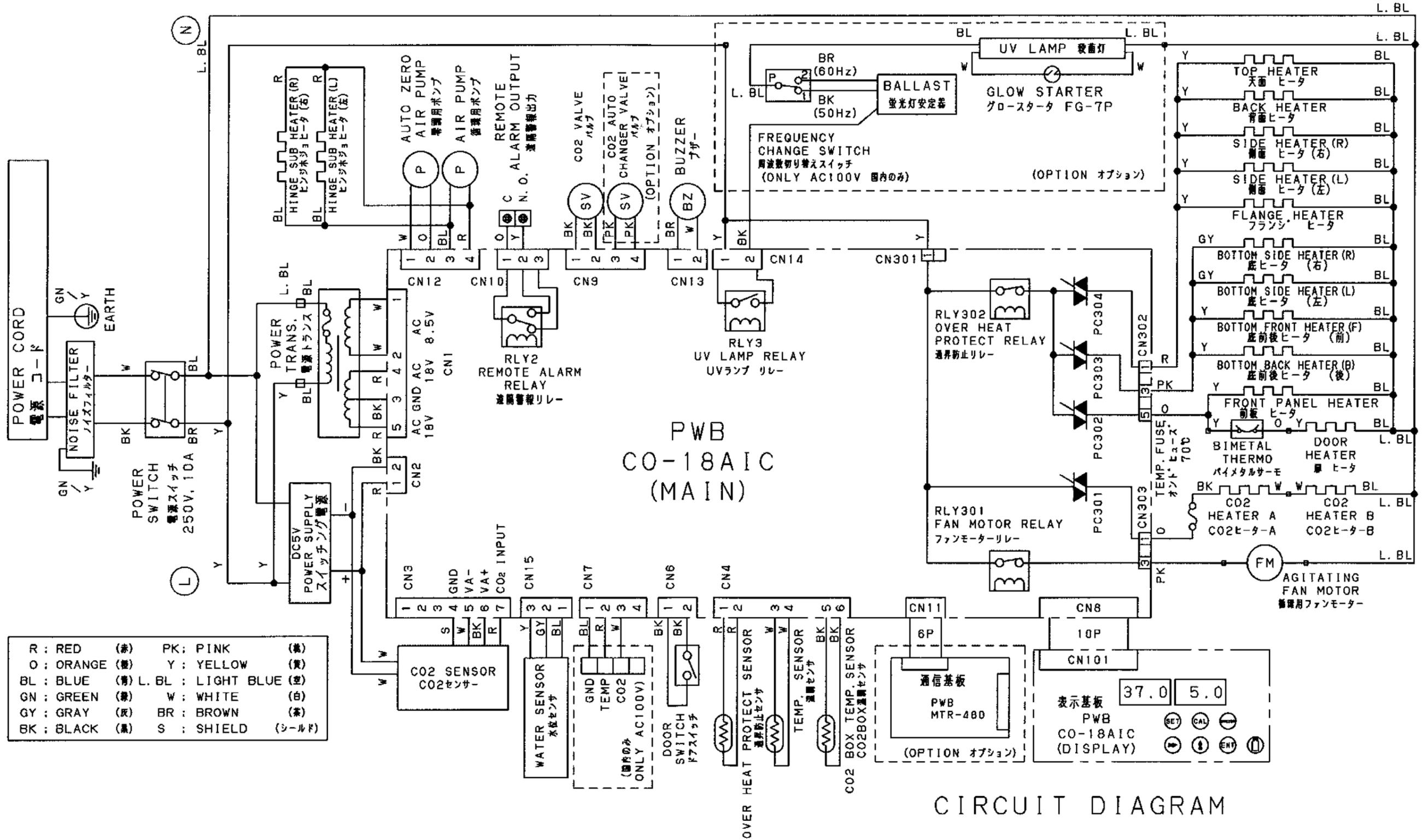
The difference between temperature sensed in temperature control sensor and temperature in internal 1/2H should be offset:

Offset value: +0.8°C

16. Example for displays

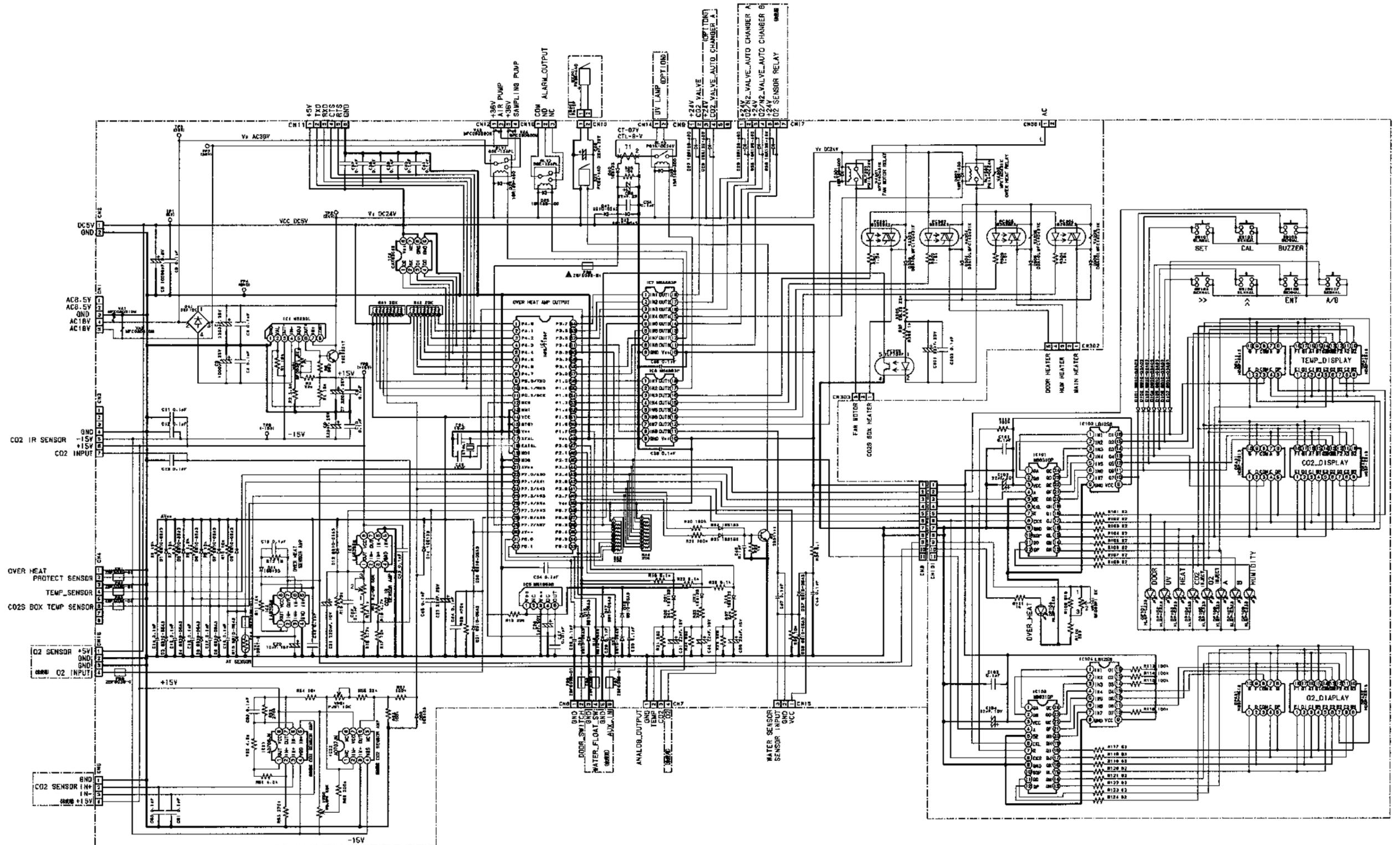
Current temperature +36.2°C		CO ₂ level +5.0%	
Set temperature +37.0°C		Auto Zero adjusting	
Function F03		Auto Zero adjustment value 5021	
(Service code input)		CO ₂ gas error E01	
Bottom heater ratio 004			
Lock Mode L 0			

Wiring Diagram



CIRCUIT DIAGRAM

Circuit Diagram



Connection on PCB

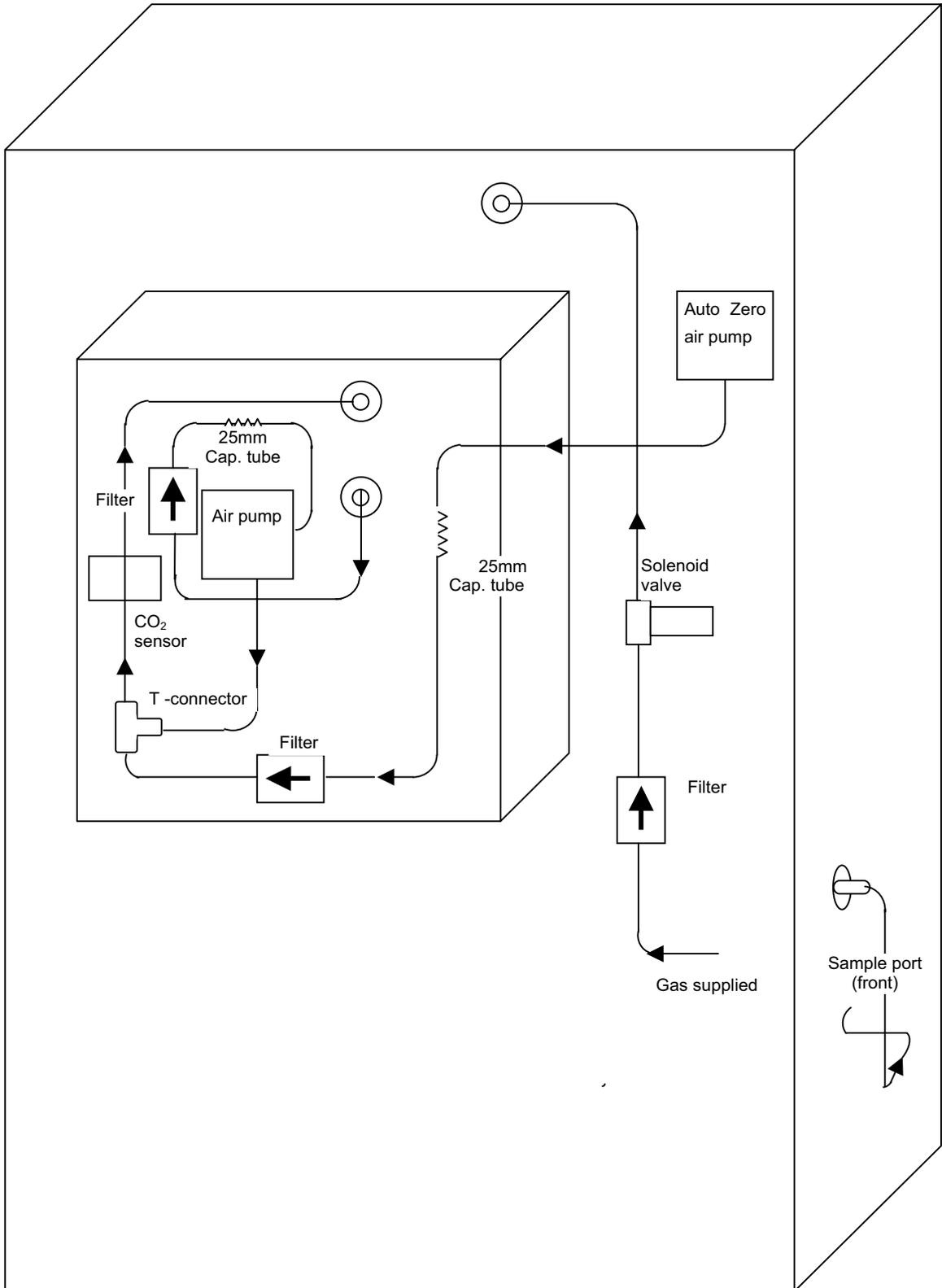
The following shows connections of connector (CN) on main PCB.

Connector	Connects to	Use
CN1	Power transformer Between #1-#2, AC8.5V #3 GND #4 and #5, AC18V	To supply the power to PCB. To supply the power AC36V for Auto zero air pump.
CN2	Power supply Between #1-#2(GND), DC5V	To supply the power to PCB.
CN3	CO ₂ sensor	Input from CO ₂ sensor.
CN4	#1-#2 Overheat protect sensor #3-#4 Temperature sensor #5-#6 CO ₂ box temp. sensor	To measure the temperature of each parts.
CN6	Door switch	To detect the door opening.
CN8	Switch, display PCB (CN101)	
CN9	#1-#2 CO ₂ valve #3-#4 CO ₂ auto changer valve (option)	To control CO ₂ valve ON and OFF.
CN10	Remote alarm output #1-#2 Open during normal operation	Output of remote alarm contact
CN11	Communication board (option)	
CN12	#1-#2 Auto zero air pump #3-#4 Air pump hinge sub heater	
CN13	Buzzer	For alarm
CN14	UV lamp relay (option)	
CN15	Water sensor	To check water level in humidify pan.
CN101	Display PCB (CN8)	

The following shows connections of connector (CN) on power PCB.

Connector	Connects to	Use
CN301	Main PCB	
CN302	#1: Heater for heat control (5pcs) #3: Bottom heater (4pcs) #5: Front panel heater, Door heater (2pcs)	To control heater
C303	#1: CO ₂ A, B heater #3: Agitating fan motor	To control the sensor BOX temperature. To control the pump for circulation.

CO₂ gas circuit



< Back view >

Prevention of contamination

In servicing for CO₂ incubator, it is important to prevent from contamination.

(1) More than 90% of contamination in CO₂ incubator is caused by mold. Mold is a kind of true fungi, it has high increasing power under high temperature and high humidity. Accordingly, it is easy for mold to increase inside CO₂ incubator. Those increased mold eat up culture (mainly animal cell), eventually precious test sample will be killed. Cell that is independent from ecosystem is also independent from immune system, it has no immunocompetence at all.

(2) Precautions for mold increasing

There are many cases that mold is increasing by eating fat on the fingers as a source of nutrient in CO₂ incubator.

Therefore,

- ① Be sure to wash and sterilize your hands prior to servicing. Use 70% ethanol.
- ② In installing, sterilize the inside wall and shelves after removing shelves, duct, humidifying pan and so on with 70% ethanol.

(3) In the case that mold is already increasing.

Sterilize the interior (walls) and shelves with 70% ethanol after removed all items from the chamber as same as (2)-② above.

And you should sterilize again after 24 hours once sterilized, when the root of spore is geminated, because it is too difficult to remove spore of mold. Repeat sterilization is effective.

NOTICE

In general, stainless steel is known that it is not easy (hard) to rust.

However depends on the conditions, rust might generate.

When you remove rust, we recommend the following agents.

Besides, the surface may become foggy.

Recommended agent:

1. Cream cleanser (Gif) (Nippon Leva)
2. Picasso #SUS300-W (Chemical YAMAMOTO)

<Picasso has greater capability of clean for rust than Gif.>

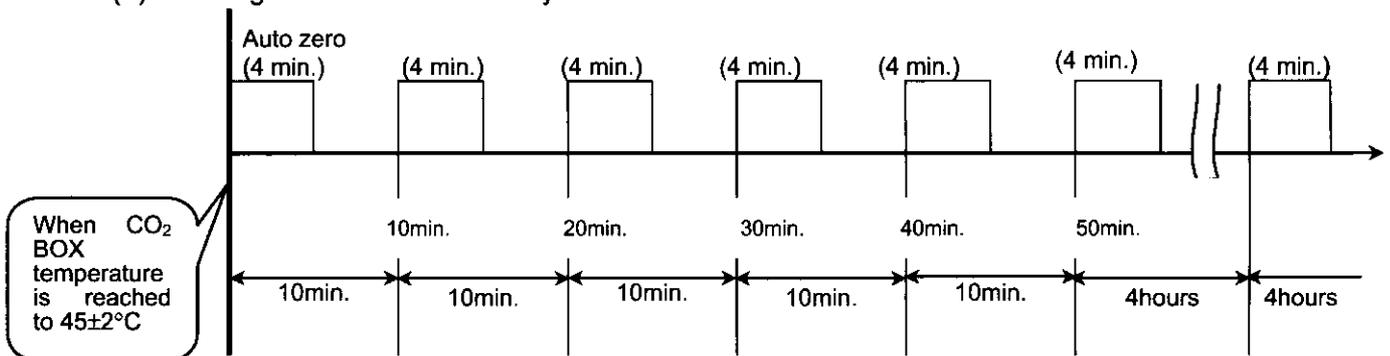
Auto zero adjustment

MCO-18AIC uses the infrared CO₂ sensor and it has to be adjusted CO₂ density and output voltage that they are changing as time goes by. In the first stage (when the power is supplied), auto zero adjustment is carried out every 10 minutes and repeats this cycle six times (total 1 hours), then auto zero adjustment will be carried out every 4 hours. (Refer to the timing chart below).

(1) Mechanism of auto zero adjustment.

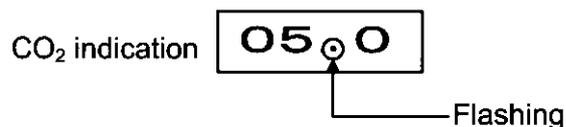
- Run the auto zero pump **for 2 minutes** to feed ambient air into CO₂ sensor. During this period, sampling air pump is off. CO₂ density in the atmosphere is almost 0% (0.03%~0.07%), adjust automatically that the measured CO₂ is 0%.
- Then do usual sampling **for 2 minutes**, compare CO₂ density of the ambient air with the inside of the chamber. At the time, only the sampling air pump is running.

(2) Timing chart of auto zero adjustment



(3) Indication during Auto Zero adjustment

The indication of CO₂ density is locked, and the decimal point of the indicator which is displayed just before Auto Zero performed, is flashing.
The CO₂ density SV is changeable.



(NOTE) If CO₂ density is set at 0%, CO₂ indication shows nothing, so the decimal point also cannot be seen.

(4) Auto zero adjusting method

Auto zero adjustment is carried out by adding a quarter of difference between each measurement so as not to change the density rapidly.

Ex.) 0.0% $\xrightarrow{4 \text{ hours}}$ 1.0% (CO₂ density) ... The added value is 0.25%.

(5) Auto zero adjustment OFF setting

Auto zero adjustment can be set OFF in F08. In case Auto Zero adjustment is not performed, you should observe CO₂ density that changing as time goes by.

CO₂ gas density calibration and Auto Zero adjustment

MCO-18AIC provides both the manual CO₂ gas density calibration and the automatic Auto Zero adjustment.

1. CO₂ gas density calibration

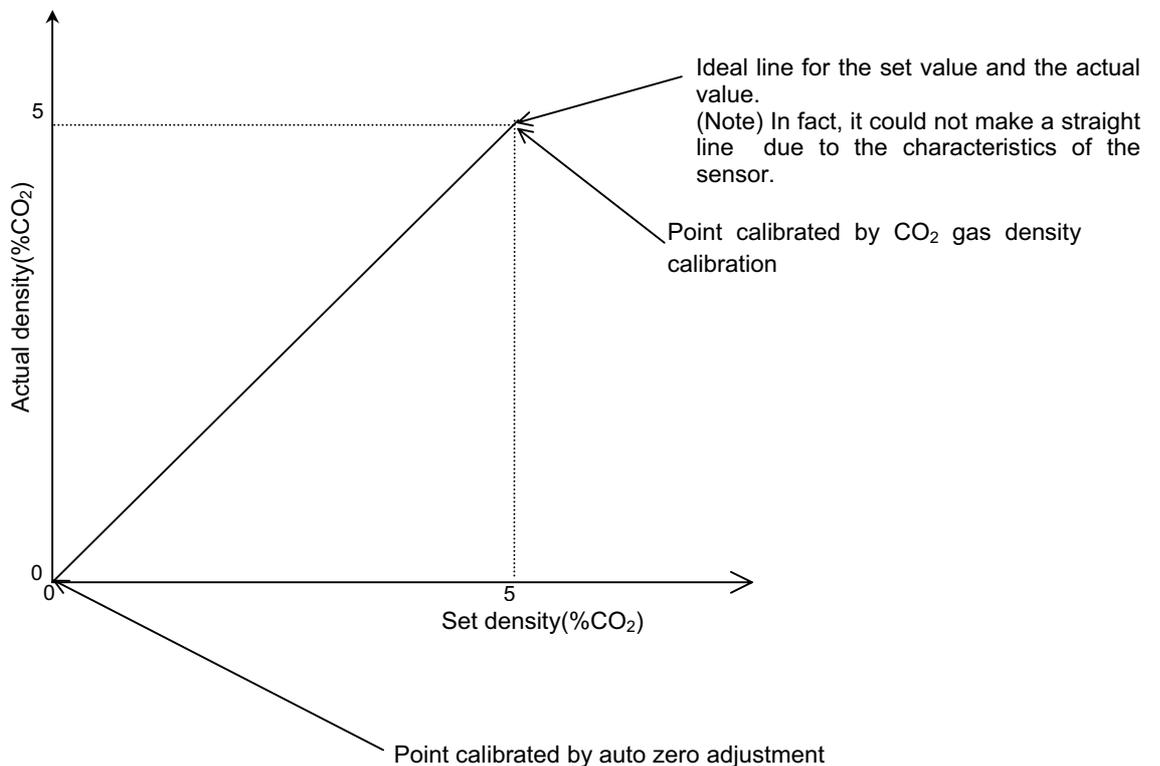
When either the CO₂ density SV or the display value is not match with the actual value, calibrate CO₂ gas density according with "CO₂ calibration" (Page 9) to input the actual value again.

2. Auto Zero adjustment

Refer to "Auto Zero adjustment"

3. The relation the CO₂ gas density calibration with the Auto Zero adjustment

The description is as follow.(Ex: CO₂ density = 5%)



Specifications of sensor

■ Temperature/Resistance for temperature sensor 103AT-1

The measure of internal temperature (internal temperature, overheat protection) and ambient temperature

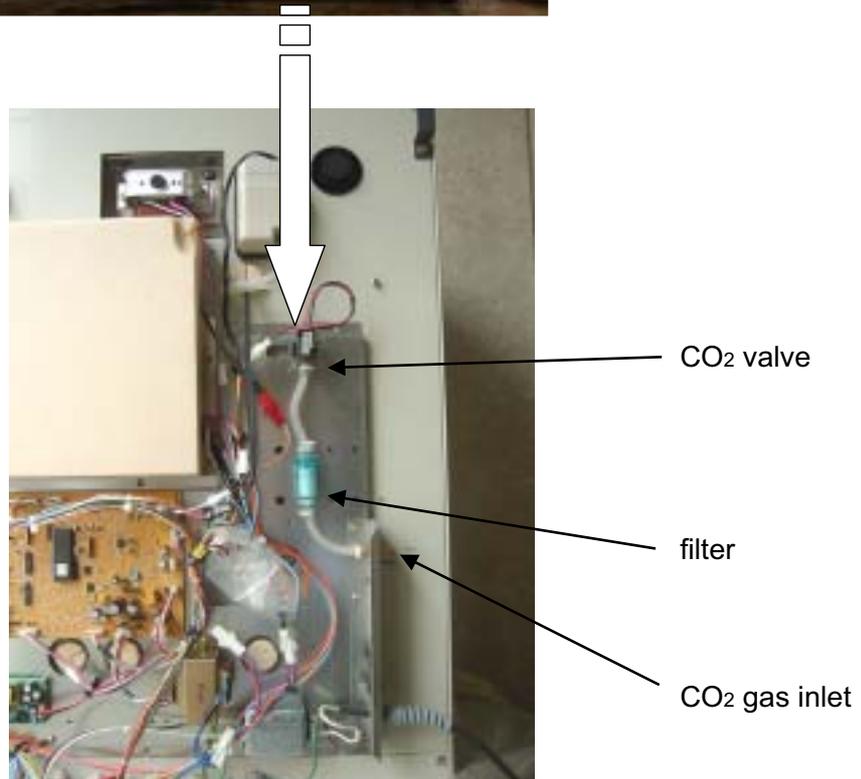
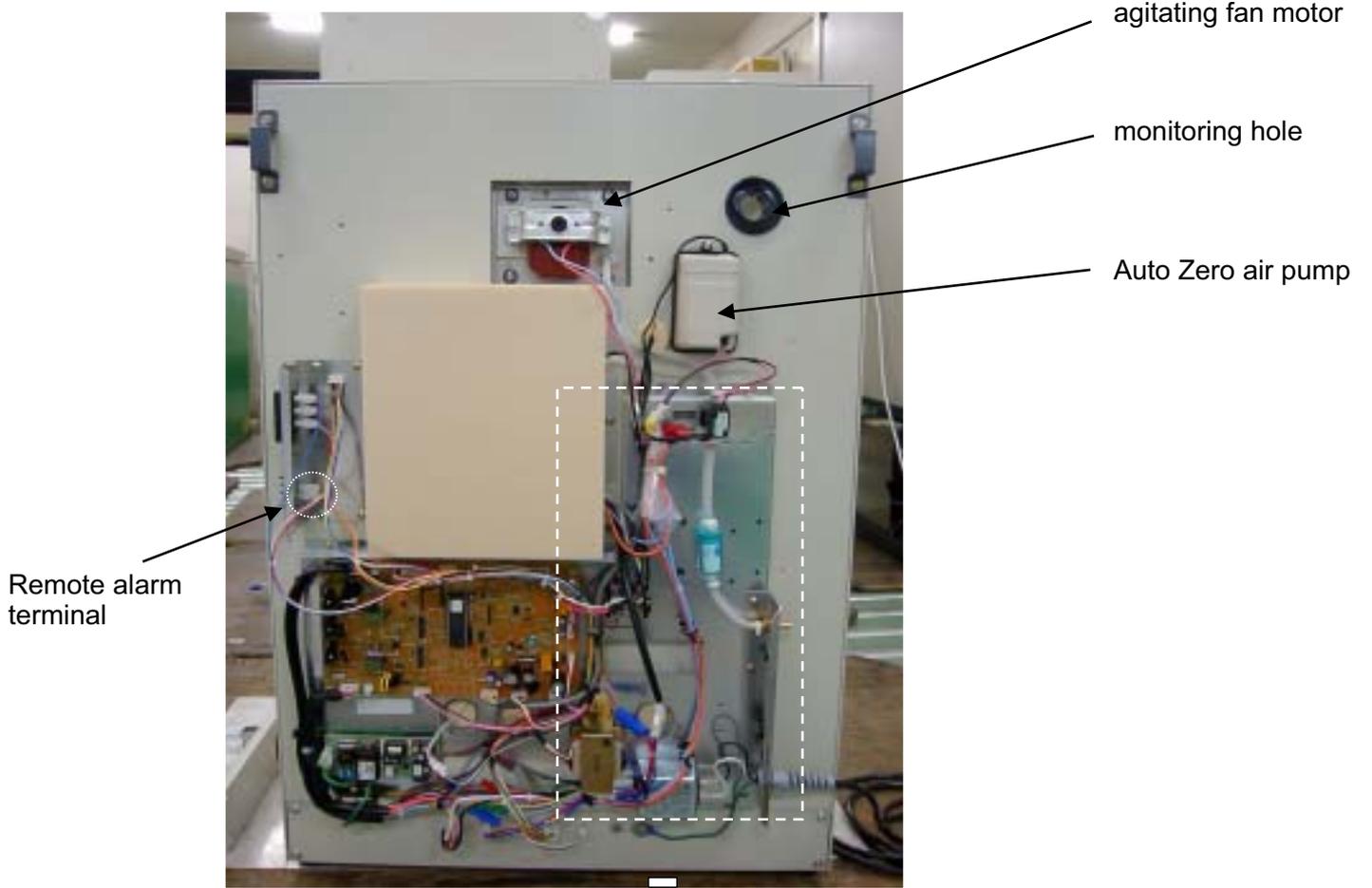
Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
0	27.28	17	13.57	34	7.19
1	26.13	18	13.06	35	6.94
2	25.03	19	12.56	36	6.70
3	23.99	20	12.09	37	6.47
4	22.99	21	11.63	38	6.25
5	22.05	22	11.20	39	6.03
6	21.15	23	10.78	40	5.83
7	20.29	24	10.38	41	5.63
8	19.48	25	10.00	42	5.44
9	18.70	26	9.63	43	5.26
10	17.96	27	9.28	44	5.08
11	17.24	28	8.94	45	4.91
12	16.55	29	8.62	46	4.75
13	15.90	30	8.31	47	4.59
14	15.28	31	8.02	48	4.44
15	14.68	32	7.73	49	4.30
16	14.12	33	7.46	50	4.16

Followings are reference voltage.
In actual use, it is no problem if the calibration could be done in reliable CO₂ density.

■ Specification for CO₂ density/output voltage in IR sensor (Output voltage = amplify value in main PCB)

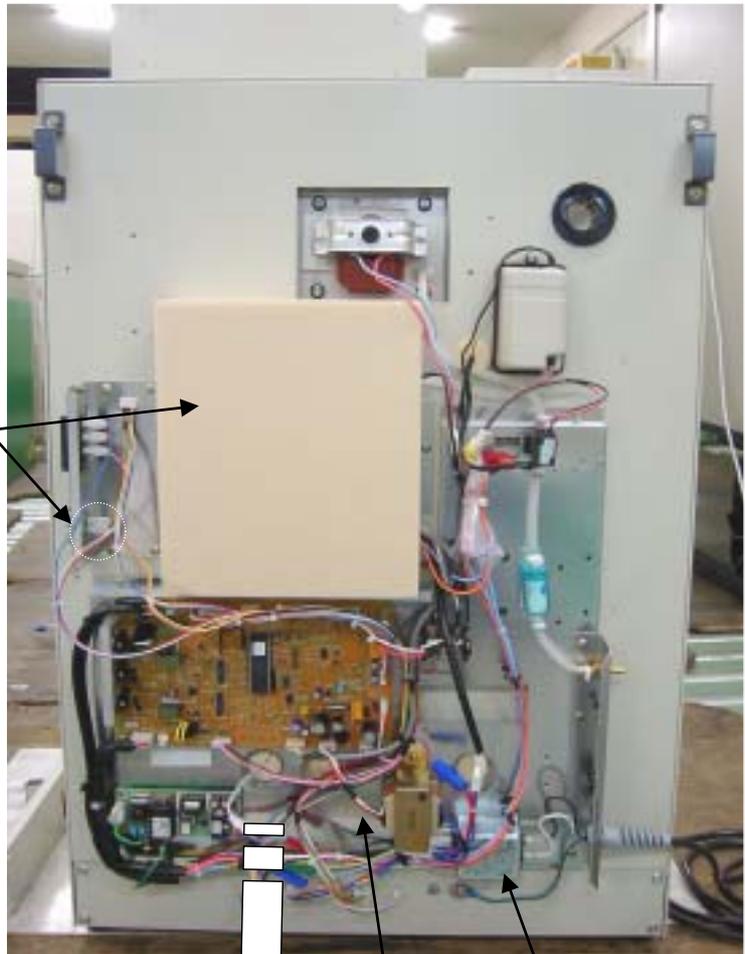
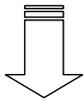
CO ₂ density (%)	R13 output voltage(V)	CO ₂ density (%)	R13 output voltage(V)	CO ₂ density (%)	R13 output voltage(V)
0.0	4.00	8.0	2.87	16.0	2.47
1.0	3.74	9.0	2.80	17.0	2.43
2.0	3.54	10.0	2.75	18.0	2.40
3.0	3.37	11.0	2.69	19.0	2.37
4.0	3.23	12.0	2.64	20.0	2.33
5.0	3.12	13.0	2.59		
6.0	3.02	14.0	2.55		
7.0	2.94	15.0	2.51		

Parts layout



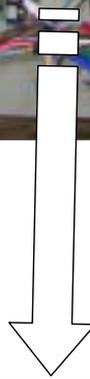
remote alarm terminal

sensor BOX



transformer for PCB

noise filter



sensor BOX temp. sensor
thermal fuse



sensor BOX heater



CO2 IR sensor power consumption resistance (R13)

CO₂ gas inject port

Overheat protect sensor

Temp. sensor

Inlet port of Sampling gas for CO₂ sensor

Return port of Sampling gas for CO₂ sensor



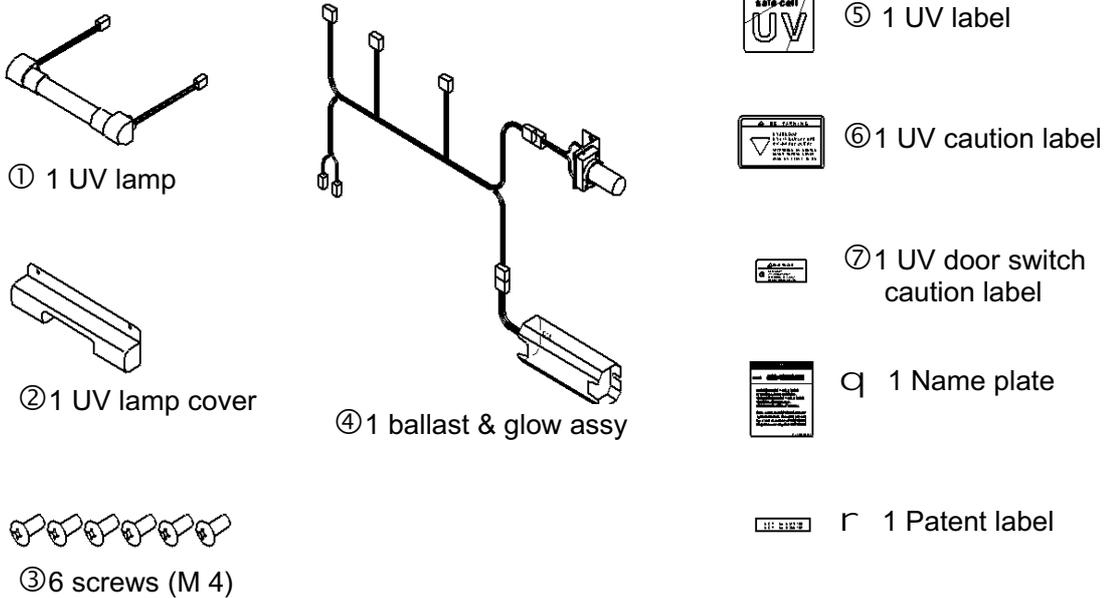
UV lamp connection port



Water level sensor

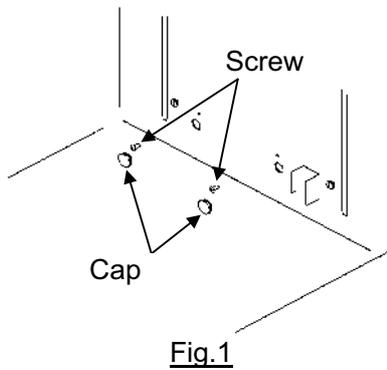
MCO-18UVS Installation Procedure

Kit of MCO-18UVS

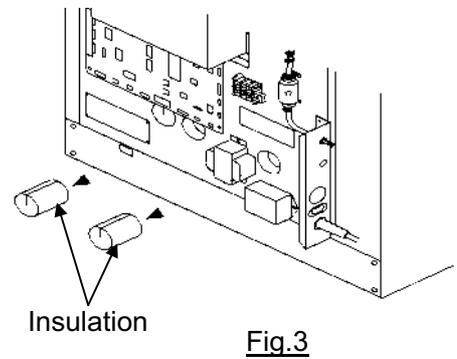


Procedure

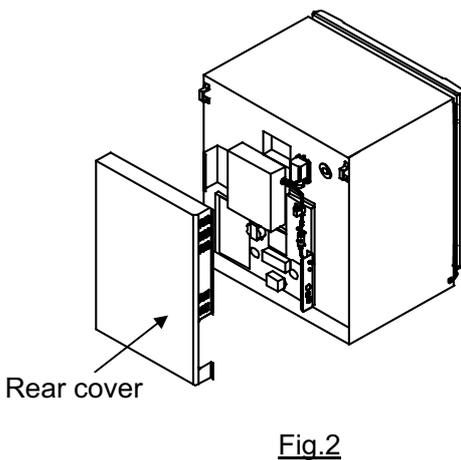
1. Unplug the unit and make sure that power is not supplied to the unit.
2. Remove the duct from inside the unit, then take off 2 caps and 2 screws shown in Fig. 1.



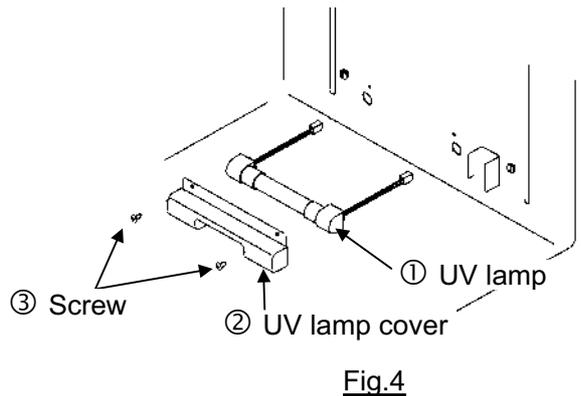
4. Take out two insulations for the UV lamp lead wire hole shown in Fig. 3. The insulation can be taken out easily by pushing it from inside of the chamber. Keep the insulation for the future use again.



3. Take off the rear cover shown in Fig. 2.



5. Set the UV lamp to the hole and make sure to be fitted properly. Fix the UV lamp cover with 2 screws enclosed in this kit.



6. Replace the duct. Place the humidifying tray, then cover the tray with the humidifying tray cover as shown in Fig. 5

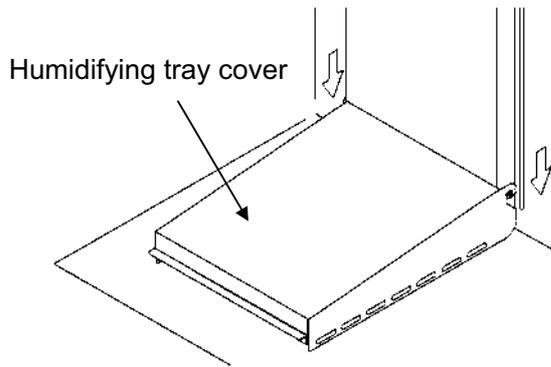


Fig.5

8. Remove a cap shown in Fig. 7.
By using 4 screws enclosed with this kit, fix the ballast/glow assy as shown in Fig. 7.

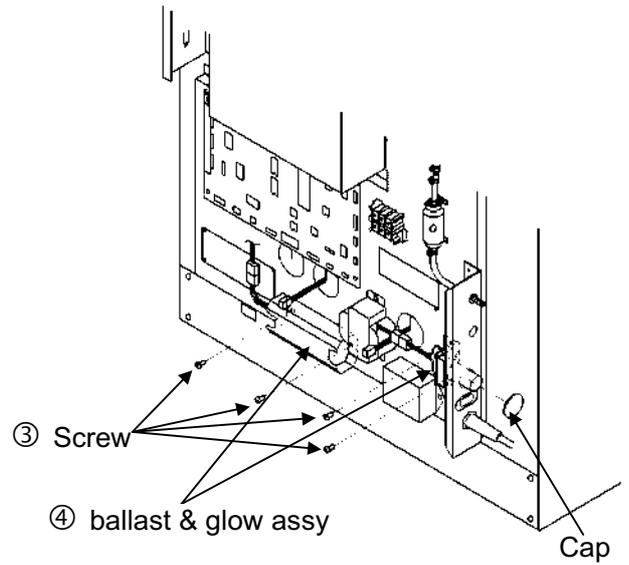


Fig.7

7. Replace the insulation into the UV lamp lead wire hole with the wire passed through the cut on the insulation. See Fig.6

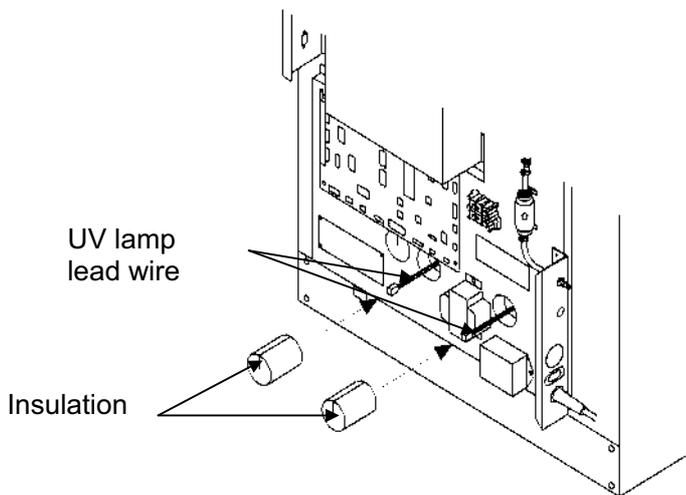


Fig.6

9. Connect each lead wire connector of ballast/glow assy, as shown in Fig. 8.

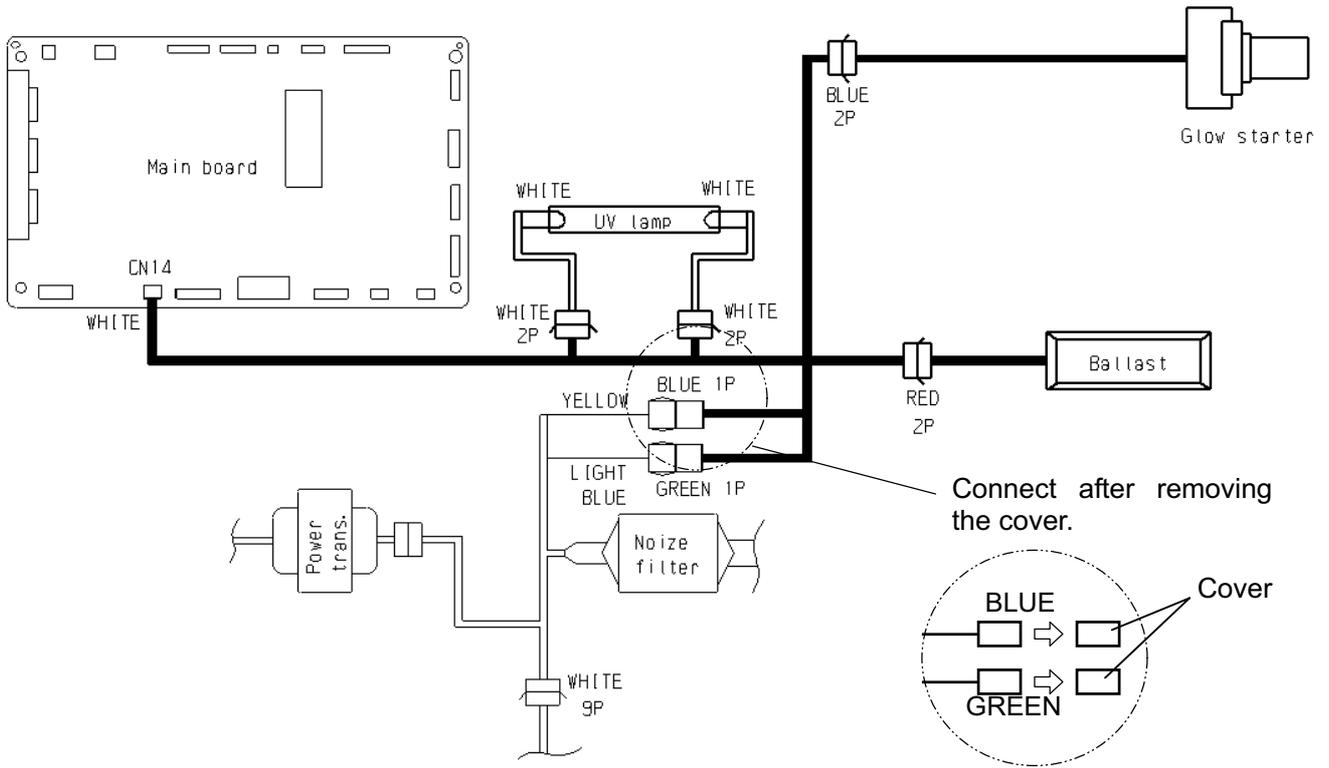


Fig.8

10. Attach the labels.

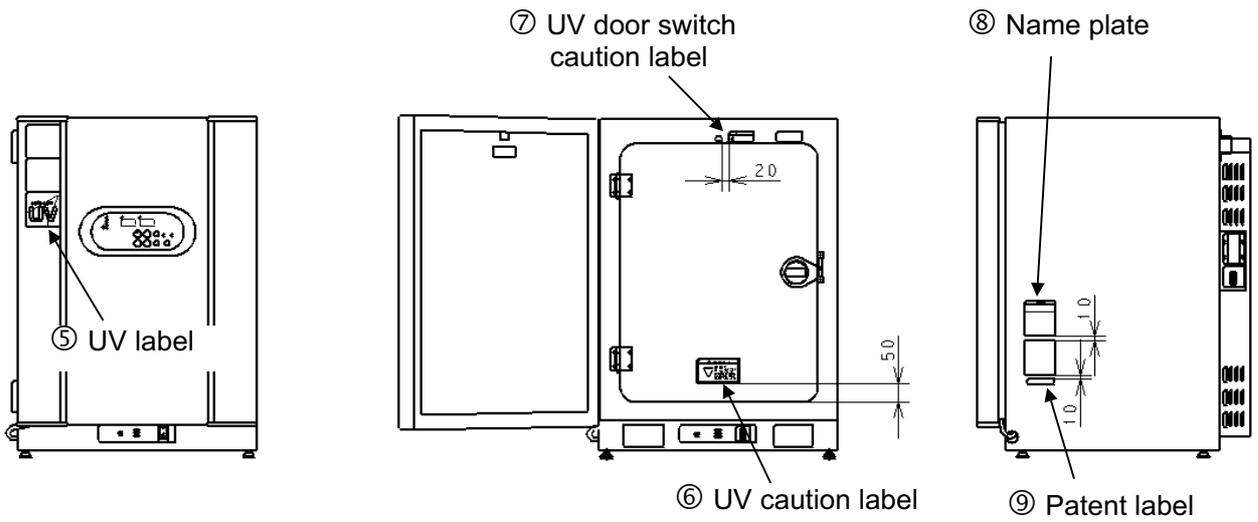


Fig.9

11. Set the UV lamp ON period through control panel

When using UV lamp option, it is needed to set the UV lamp ON period. Refer to the following procedure.

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	-	The current chamber temperature is displayed.
2	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
3	By pressing ▲ key and ►► key, set the figure to F01.	►► ▲	F 0 1 <input type="text"/>
4	Press ENT key.	ENT	In CO ₂ density indicator, "000" is displayed and the right digit is flashed. F 0 1 <input type="text"/> 0 0 0 <input type="text"/>
5	By pressing ▲ key and ►► key, set the figure to 005 (5 minutes of ON period).	►► ▲	F 0 1 <input type="text"/> 0 0 5 <input type="text"/>
6	Press ENT key.	ENT	The setting of UV lamp ON time is memorized and the current chamber temperature is displayed.

<<NOTE>>

- The UV lamp ON time is settable between 0 to 30 minutes. However, it is recommended to set 5 minutes in general.
- The UV lamp ON time is settable between 0 to 30 minutes (000 to 030). The UV lamp is not turned ON if the setting is 000.
- The UV lamp is turned off when the outer door is opened while the lamp is on. The lamp is turned on for pre-set duration after the outer door is closed.
- The condensation in the chamber can be caused and/or the chamber temperature distribution can be affected due to the heat from UV lamp when the setting of UV lamp ON time is longer than 5 minutes or the only the outer door is opened/closed repeatedly. In such case, the life of UV lamp is shortened.
- In the procedure 2 above, pressing CAL key for 5 seconds causes the calibration mode. In this mode, it is possible to calibrate the temperature and CO₂ density, and miss operation of the key may affect the basic performance of the unit. Take care of the key operation. Even if the key is operated wrongly, the unit returns to the current value display mode automatically when no key is operated for 90 seconds. In this case, the setting not entered by pressing ENT key is not effective.

12. Check that the UV lamp is turned on.

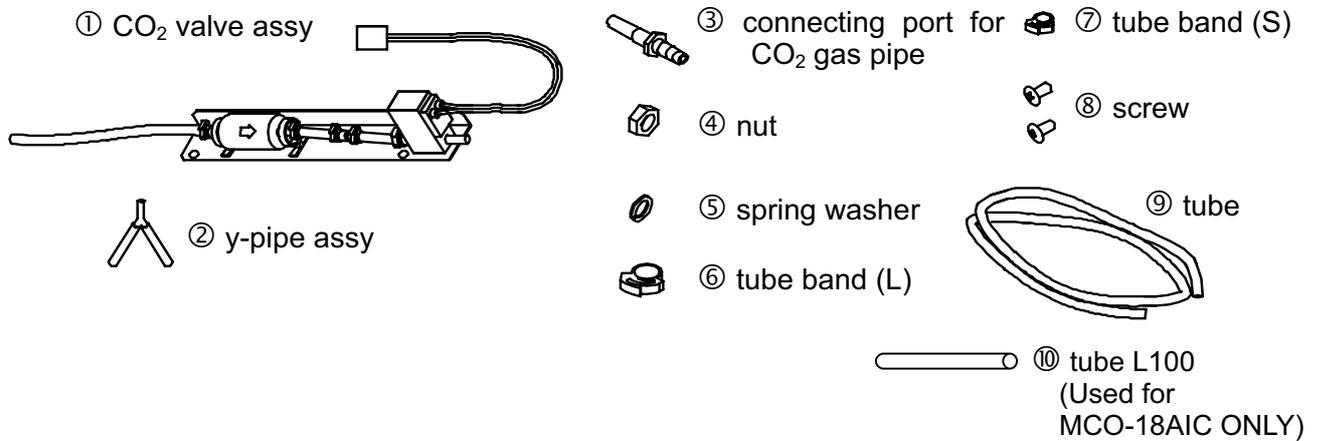
Check the UV lamp is turned on by the following procedure:

	Procedure
1	Open the outer door and push the door switch with the inner door is closed.
2	Check that the UV indicator on the control panel is on after a few seconds.
3	Check the visible blue light from the front side of the humidifying pan cover. (Check the light with the inner door closed. Never look at the UV light directly.)

Mounting Procedure of MCO-21GC

(Automatic CO₂ cylinder changer for MCO-20AIC/18AIC)

Parts list



Before mounting

This kit is applicable to both MCO-20AIC and MCO-18AIC.

Following procedure is necessary only when mounting to MCO-18AIC.

1. Remove the tube band on the CO₂ valve assy ①, and then remove the hose and capillary.
2. Attach the tube L100 ⑩ and fix the tube by the tube band removed in procedure 1.
Make sure the tube band is fixed firmly to prevent gas leakage.

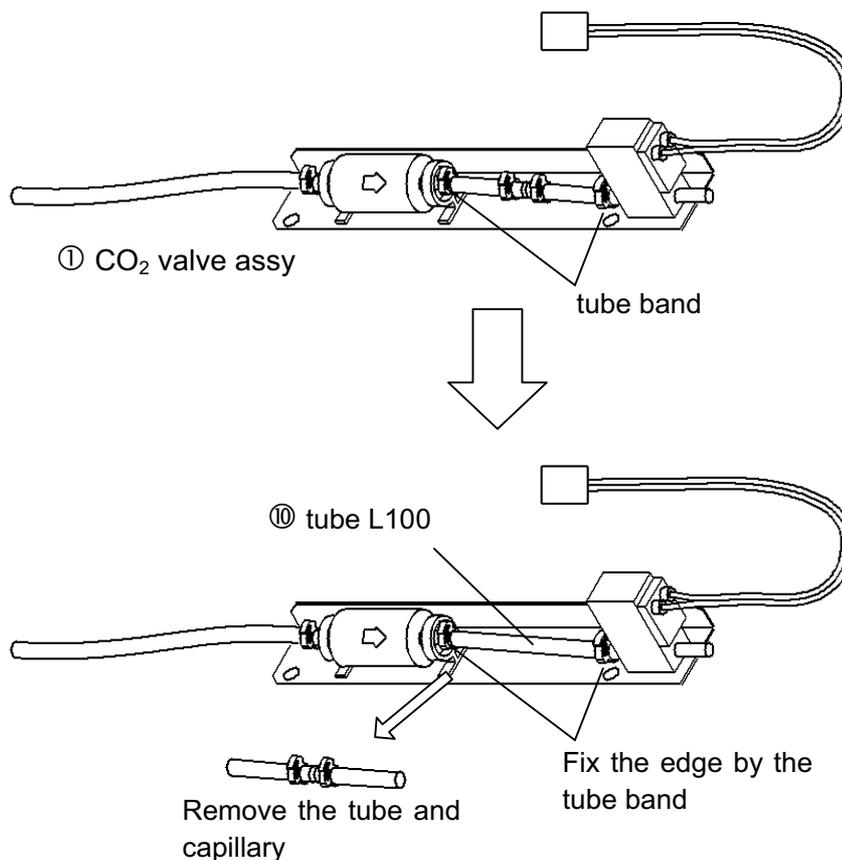


Fig.1

Mounting procedure

1. Disconnect the power cable and make sure that the unit is not supplied with the power.
2. Remove the rear cover by unscrewing the 6 fixing screws.
3. Fix ① by using the enclosed screws(⑧).
4. Remove cap and fix ③ with ④ and ⑤.
5. Connect the wiring harness of CO₂ valve B to wiring harness from CN9 on Main board.
6. Disconnect upper tube of CO₂ valve A.
Connect CO₂ valve A and CO₂ valve B and tube X by using ② as shown in Fig.4.
7. Connect bottom tube of ① to ③.
8. Connect ③ with CO₂ gas supply line B by using ⑨.
9. Fix tubes securely using ⑥ and ⑦ as shown in Fig.4.
10. Replace the rear cover.

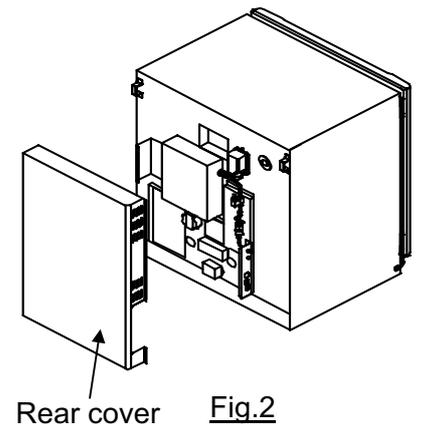


Fig.2

NOTE: Every tubes should be connected surely to prevent CO₂ leakage.

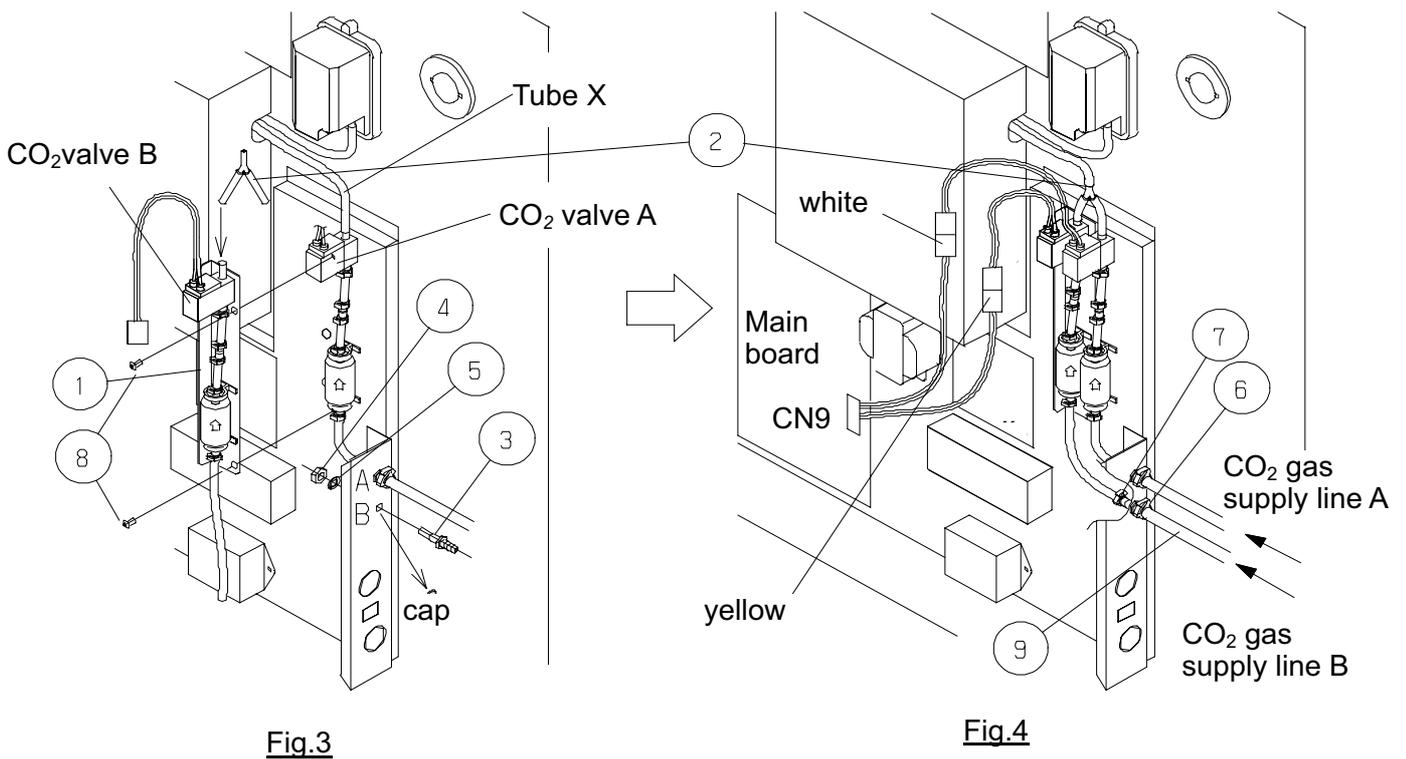
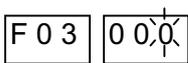
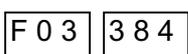
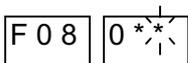
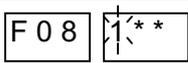


Fig.3

Fig.4

Setting procedure of Control panel.

When use MCO-21GC(the automatic CO₂ cylinder changer system), it is necessary to set the MCO-20AIC/18AIC automatic gas switching mode according to the following procedures.

	Description of operation	Key operated	Indication after operation
1	Turn the power switch ON.	-	The current chamber temperature is displayed.
2	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
3	By pressing ►► key and ▲ key, set the figure to F03.	►► ▲	
4	Press ENT key.	ENT	In CO ₂ density indicator, "000" is displayed and the right digit is flashed. 
5	By pressing ►► key and ▲ key, set the figure to 384	►► ▲	
6	Press ENT key.	ENT	The current chamber temperature is displayed.
7	Press CAL key for 5 seconds.	CAL	The left digit in the temperature indicator is flashed.
8	By pressing ►► key and ▲ key, set the figure to F08	►► ▲	
9	Press ENT key.	ENT	In CO ₂ density indicator, "0**" is displayed and the right digit is flashed. 
10	By pressing ►► key and ▲ key, set only the left digit figure to 1. <u>NOTE:Don't change center digit figure and right digit figure.</u>	►► ▲	 " * " means "0" or "1".
11	Press ENT key.	ENT	Setting of MCO-21GC is finished. The current chamber temperature is displayed. CO ₂ gas supply line indicator A is lighted.

Procedure for automatic gas switching operation check.

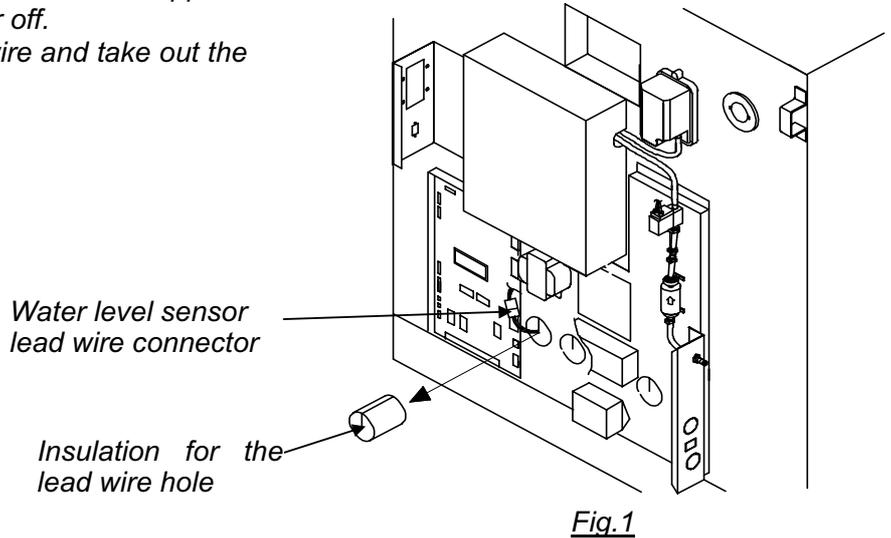
When the installation of MCO-21GC is completed, check the automatic gas switching operation according to the following to the following procedures.

	procedure
1	Stop the gas supply of cylinder A and use cylinder B only for CO ₂ gas supply.
2	Turn on the power switch of MCO-20AIC/18AIC and set 37decC and 0%. Turn on CO ₂ gas supply line indicator with CO ₂ gas supply line switching key.
3	Wait for 1 hour approx , until the machine can control the CO ₂ density. (It takes about 1 hour from turning on the power switch until CO ₂ control is enabled.)
4	Set CO ₂ density 5% and check the CO ₂ inject lamp turns on. NOTE: In case of low ambient temperature, it may take more than 1 hour until the machine can control CO ₂ density and the CO ₂ inject lamp turns on.
5	Check the E01(CO ₂ gas cylinder empty alarm) and buzzer turn on about 2-7minutes later from the CO ₂ inject lamp's turning on.
6	Check the CO ₂ gas density indicator reaches to the set value 5% and keep it stably. NOTE: CO ₂ density control is interrupted when automatic calibration of CO ₂ sensor is activated and the decimal point of CO ₂ density indicator blinks.
7	All the procedure are completed. Shut down the CO ₂ supply of cylinder A and cylinder B. Turn off "E01" display with the buzzer key and select cylinder A with CO ₂ gas supply line switching key. Turn off the main power switch.

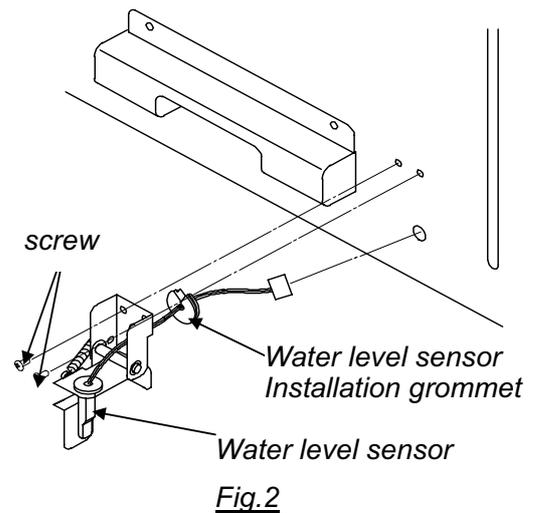
Refer to the MCO-20AIC/18AIC instruction manual for usage of MCO-21GC

HOW TO REPLACE WATER LEVEL SENSOR.

1. Unplug the unit and check that power is not supplied to the unit, then take the rear cover off.
2. Unfasten the connectors for lead wire and take out the insulation for the lead wire hole.

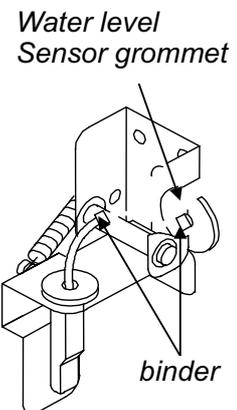


3. Take out the duct from inside.
 4. Unfasten the 2 screws to remove unit of water level sensor and installation grommets for water level sensor.
 5. replace water level sensor.
- Note** Be sure to set the water level sensor to the right direction.
6. Place back the water level sensor, Water sensor installation grommet as before.
 7. Place back the insulation material to the hole for the lead wire.



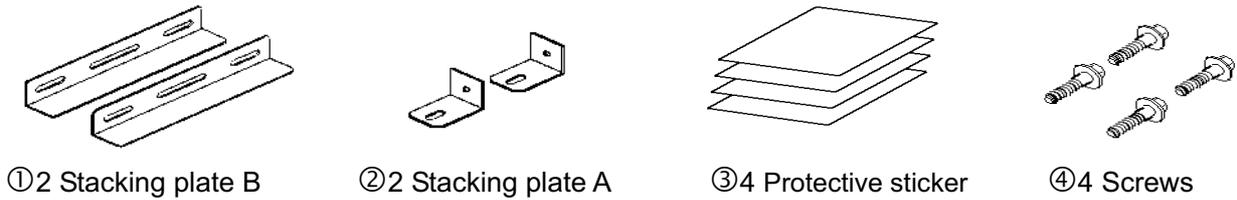
- Note** Be careful for the length of lead wire for water level sensor inside the unit Length is connect 2nd binder is located where it touches the water level sensor grommet.
(refer to Fig.3)

3. Put the rear cover in place



MCO-18PS Installation Procedure

Kit of MCO-18PS



Procedure

<When stacking 2 units of MCO-18AIC>

1. Turn off the power switch and disconnect a plug of each unit.
2. Check that the lower unit is level.
3. Apply the protective sticker enclosed in this kit at each corner on the top of the lower unit to avoid scratches or damage.
4. Fix the stacking plate A at 2 locations on the top front of the lower unit by using 2 screws enclosed in this kit.
5. Remove the front panel on the upper unit by unscrewing the 4 fixing screws and then disconnect the wires and gas tube.
6. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.
7. Secure the upper unit with the stacking plate A and 2 screws enclosed in this kit.
8. Remove 2 hooks on the rear side of the lower unit by unscrewing each 2 fixing screws.
9. Remove 1 screw on the bottom right and left on the rear side of the upper unit.
10. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 8 and 9.
11. Replace the front panel on the upper unit after connecting the wires and gas tube.
12. Fix the stacked unit to the wall with 2 hooks on the rear of the upper unit and rope or chain.

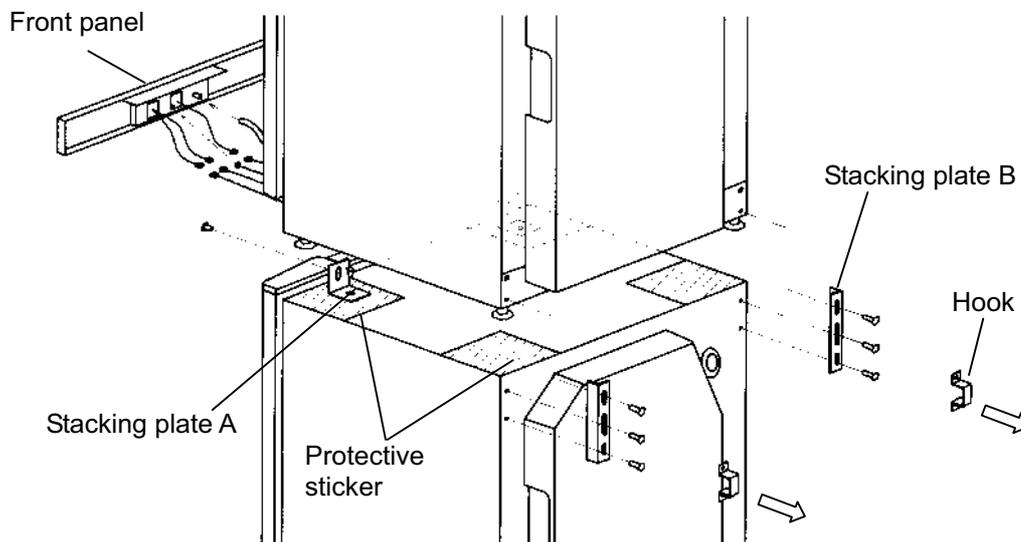


Fig.1

<When stacking of combination as shown in Fig.2.>

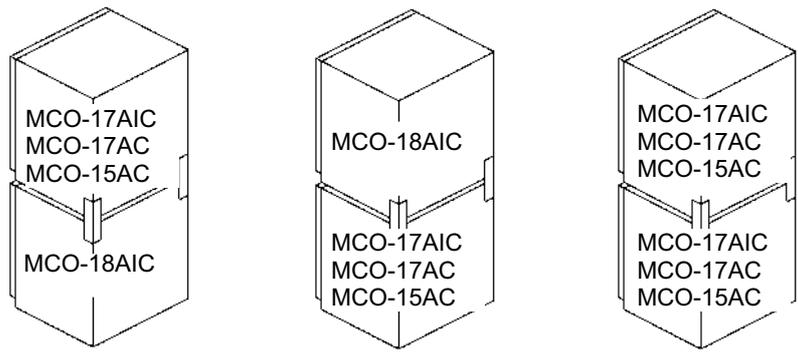


Fig.2

1. Turn off the power switch and disconnect a plug of each unit.
2. Check that the lower unit is level.
3. Apply the protective sticker enclosed in this kit at each corner on the top of the lower unit to avoid scratches or damage.
4. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.
5. Remove 2 hooks on the rear side of the lower unit by unscrewing each 2 fixing screws.
6. Remove 1 screw on the bottom right and left on the rear side of the upper unit.(only MCO-18AIC)
7. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 5 and enclosed in this kit.
8. Fix the stacked unit to the wall with 2 hooks on the rear of the upper unit and rope or chain.

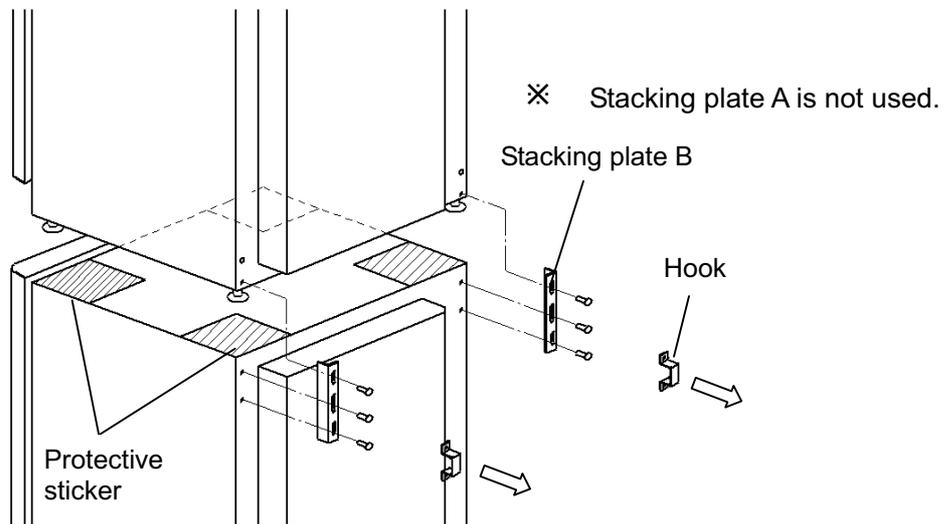


Fig.3

! WARNING

Select a level and sturdy floor having enough strength for installation of stacked module.
 Never stack 3 or more units.
 Take care not to drop or tip over the unit when stacking as this can cause injury or damage of the unit.

MCO-18SB Setting Procedure

(Stacking base for stacking MCO-18AIC/17AIC/17AC/15AC on MCO-175/175M)

1. Remove four clips on the top of lower unit.
2. Fasten four “⑦ Fixing screws A” tentatively from where the clips were remove.
3. Set the “① Stacking base” and fix with screws tentatively fastened.
4. Stick the “⑥ Protective sticker” on the “① Stacking base” as shown in Fig.1.

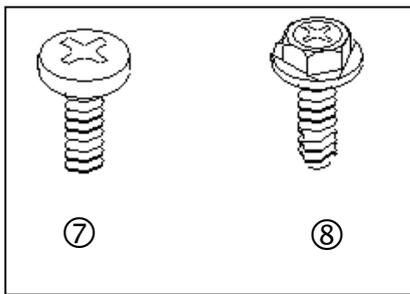
5. In case of stack MCO-18AIC

Put the upper unit on it. Fix the upper unit with “② Front fixing plate”, “⑤ Rear fixing plate”.
 (③ Rear fixing plate R and ④ Rear fixing plate L are not used.)

In case of stack MCO-17AIC/17AC/15AC

Put the upper unit on it. Fix the upper unit with “② Front fixing plate”, “③ Rear fixing plate R”, and
 “④ Rear fixing plate L”. (⑤ Rear fixing plate is not used.)

6. Check the both units are level.



NO.	Parts name	Q'ty
①	Stacking base	1
②	Front fixing plate	2
③	Rear fixing plate R (for 17AIC/17AC/15AC)	1
④	Rear fixing plate L (for 17AIC/17AC/15AC)	1
⑤	Rear fixing plate (for 18AIC)	2
⑥	Protective sticker	2
⑦	Fixing screw A	4
⑧	Fixing screw B	8

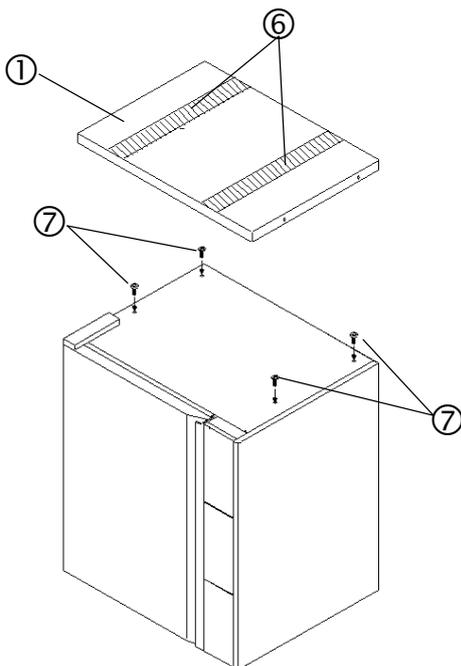


Fig.1

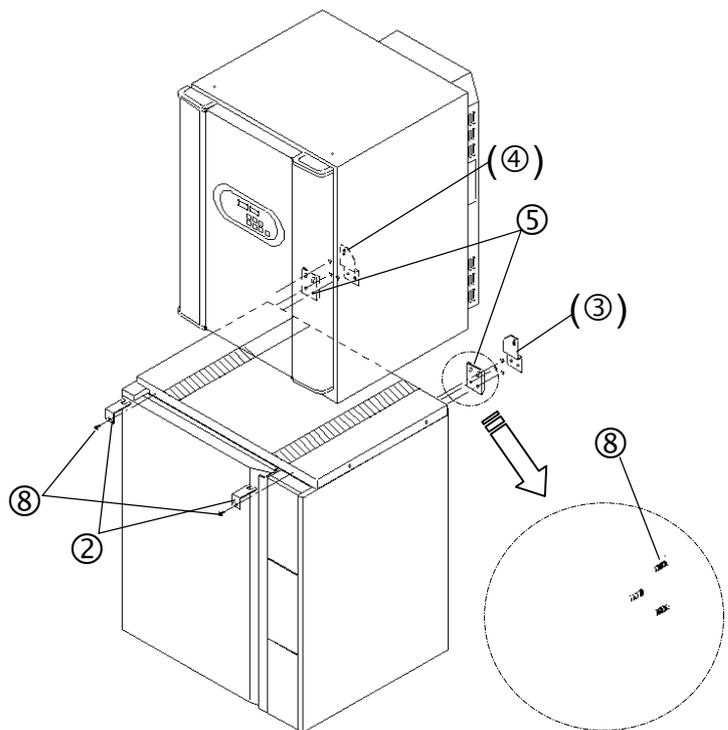


Fig.2

MCO-21SB Setting Procedure

(Stacking base for stacking MCO-18AIC/17AIC/17AC/15AC on MCO-20AIC)

- Stick the “⑧ Buffer rubber” at each corner on the bottom of “① Stacking base”.
Stick the “⑦ Protective sticker” on the “① Stacking base” as shown in Fig.1.
- Attach the “② Base mounting plate” onto the top of MCO-20AIC by using “⑩ Fixing screw B”.
- Remove 2 hooks on the rear side of MCO-20AIC.
- Fix the “① Stacking base” onto the top of MCO-20AIC by using “⑨ Fixing screw A” and 2 screws removed in step 3.
- In case of stack MCO-18AIC
Put the upper unit on it. Fix the upper unit with “③ Front fixing plate”, “⑥ Rear fixing plate”.
(④ Rear fixing plate R and ⑤ Rear fixing plate L are not used.)
In case of stack MCO-17AIC/17AC/15AC
Put the upper unit on it. Fix the upper unit with “③ Front fixing plate”, “④ Rear fixing plate R”, and
“⑤ Rear fixing plate L”. (⑥ Rear fixing plate is not used.)
- Check the both units are level.

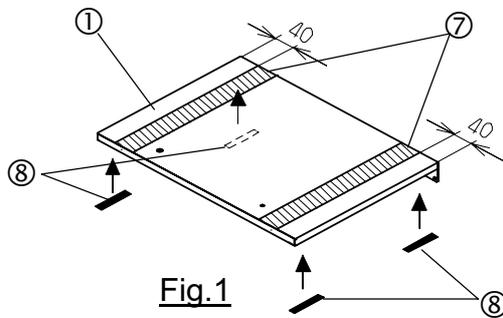
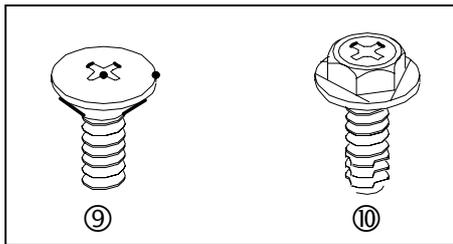


Fig.1

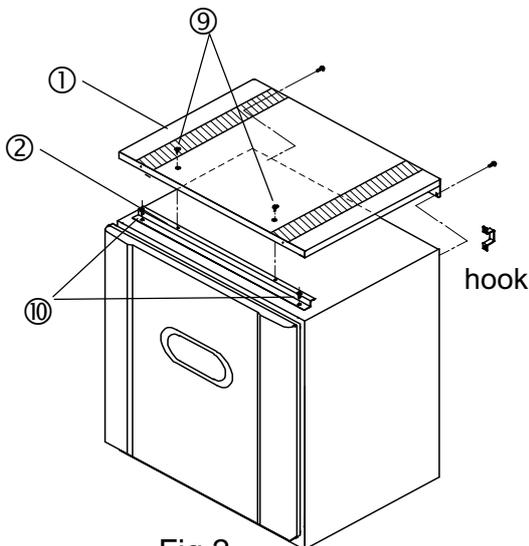


Fig.2

No.	Parts name	Q'ty
①	Stacking base	1
②	Base mounting plate	1
③	Front fixing plate	2
④	Rear fixing plate R (for 17AIC/17AC/15AC)	1
⑤	Rear fixing plate L (for 17AIC/17AC/15AC)	1
⑥	Rear fixing plate (for 18AIC)	2
⑦	Protective sticker	2
⑧	Buffer rubber	4
⑨	Fixing screw A	2
⑩	Fixing screw B	10

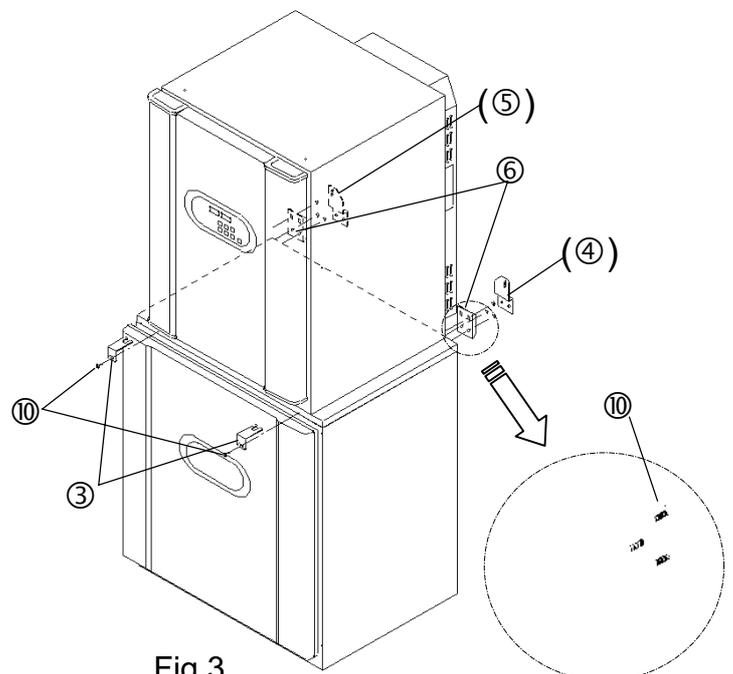


Fig.3

Instruction manual

- This section is extracted and printed from Instruction Manual.
- If you find out “Refer to page ●●” in them, this page means not page in service manual but page in the lower corner of each page in the extract from Instruction manual.
This page number is not corresponded with serial number in Service manual.

INSTRUCTION MANUAL

MCO-18AIC

CO₂ Incubator



Note:

1. No part of this manual may be reproduced in any form without the expressed written permission of SANYO.
2. The contents of this manual are subject to change without notice.
3. Please contact SANYO if any point in this manual is unclear or if there are any inaccuracies.

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PRECAUTIONS FOR SAFE OPERATION

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

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

Precautions are illustrated in the following way:

WARNING

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

CAUTION

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

Symbol shows;

-  this symbol means caution or warning.
-  this symbol means an action is prohibited.
-  this symbol means an instruction must be followed.

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

 < Label on the unit >
This mark is labeled on the cover in which the electrical components of high voltage are enclosed to prevent the electric shock.
The cover should be removed by a qualified engineer or a service personnel only.

PRECAUTIONS FOR SAFE OPERATION

WARNING

-  **Do not use the unit outdoors.** Current leakage or electric shock may result if the unit is exposed to rain water.
-  **Only qualified engineers or service personnel should install the unit.** The installation by unqualified personnel may cause electric shock or fire.
-  **Install the unit on a sturdy floor.** If the floor is not strong enough or the installation site is not adequate, this may result in injury from the unit falling or tipping over.
-  **Never install the unit in a humid place or a place where it is likely to be splashed by water.** Deterioration of the insulation may result which could cause current leakage or electric shock.
-  **Never splash water directly onto the unit** as this may cause electric shock or short circuit.
-  **Use a dedicated power source** as indicated on the rating label attached to the unit.
-  **Remove dust from the power supply plug** before inserting in a power source. A dusty plug or improper insertion may cause a hazard.
-  **Use a power supply outlet with ground (earth)** to prevent electric shock. If the power supply outlet is not grounded (earthed), it will be necessary to install a ground by qualified engineers.
-  **Never ground the unit through a gas pipe, water main, telephone line or lightning rod.** Such grounding may cause electric shock in the case of an incomplete circuit.
- Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO₂ gas. Elevated level of CO₂ gas can be hazardous to health and may lead to asphyxiation and risk of death.**
-  **Never store volatile or flammable substances** in this unit. This may cause explosion or fire.
- Ventilate a room air occasionally when using CO₂ gas for control.** The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO₂ gas is used.

 Si l'appareil est utilisé dans un endroit restreint, le niveau de la densité CO₂ de l'air peut s'élever et peut être nocif aux humains. Évitez d'aspirer l'air provenant de l'intérieur de l'appareil quand vous ouvrez la porte.
-  **Do not insert metal objects such as a pin or a wire into any vent, gap or any outlet** for inner air circulation. This may cause electric shock or injury by accidental contact with moving parts.

PRECAUTIONS FOR SAFE OPERATION

WARNING

- As with any equipment that uses 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. Keep proper gas pressure to avoid gas leak.
-  **Use this unit in a safe area if using poisonous, harmful or radioactive substances.** Improper use may be harmful to your health or the environment.
 -  **Disconnect the power supply to the unit prior to any repair or maintenance** in order to prevent electric shock or injury.
 -  **Never expose the eyes directly to UV light** as UV light can cause permanent damage to eyes. Never remove cover when UV light is ON (when an optional UV system kit MCO-18UVS is installed).
 -  **Hazardous UV light.** Do not press door switch.
 -  **Never disassemble, repair, or modify the unit yourself.** Any such work carried out by an unauthorized person may result in fire or injury due to a malfunction.
 -  **Disconnect the power supply plug if there is anything wrong with the unit.** Continued abnormal operation may cause electric shock or fire.
 -  If the unit is to be stored unused in an unsupervised area for an extended period, **ensure that children do not have access and that doors cannot be closed completely.**
 -  **The disposal of the unit should be undertaken by appropriate personnel.** Remove doors to prevent accidents such as suffocation.
 -  **Prepare a safety check sheet** when you request any repair or maintenance for the safety of service personnel.

PRECAUTIONS FOR SAFE OPERATION

CAUTION

-  **Select a level and sturdy floor for installation.** This precaution will prevent the unit from tipping. Improper installation may result in water spillage or injury from the unit tipping over.
-  **Connect the unit to a power source as indicated on the rating label attached to the unit.** Use of any other voltage or frequency other than that on the rating label may cause fire or electric shock.
-  **When removing the plug from the power supply outlet, grip the power supply plug, not the cord.** Pulling the cord may result in electric shock or fire by short circuit.
-  **Never damage or break the power supply plug or cord. Do not use the supply plug if its cord is loose.** This may cause fire or electric shock.
-  **Do not touch any electrical parts such as the power supply plug or any switches with a wet hand.** This may cause electric shock.
-  **Do not put a container with water or heavy articles on the unit.** It may cause injury if the articles fall. Current leakage or electric shock may result from deterioration of insulation by spilled water.
-  **Do not climb onto the unit and do not put articles on the unit.** This may cause injury by tipping or damage to the unit. When stacking the unit, follow the procedure shown on page 33.
-  **Always hold the handle when closing the door.** This will reduce the likelihood of a trapped finger.
-  **Do not damage the power supply cord.** Stepping on the cord, or processing, pulling, twisting, or binding of cord may cause fire or electric shock by damaged cord.
-  **Never lean or press on the glass or never hit the glass with sharp edge.** Intentional force may cause injury if the glass breaks.
-  **Do not lean on the door.** This may cause injury, current leakage, or electric shock if the unit tips over or door becomes detached.
-  **Always put on gloves at the time of maintenance.** The corners of fixtures may cause injury.
-  **Disconnect the power supply plug** before moving the unit. Take care not to damage the power cord. A damaged cord may cause electric shock or fire.
-  **Empty the humidifying pan completely before moving the unit.** Spilled or splashed water may cause current leakage or electric shock.

PRECAUTIONS FOR SAFE OPERATION

CAUTION

-  **Be careful not to tip over the unit** during movement to prevent damage or injury.
-  **Disconnect the power plug** when the unit is not used for long periods. The deteriorated insulation may cause electric shock, current leakage or fire.
-  **Do not put the packing plastic bag within reach of children** as suffocation may result
-  **Take care of the inside of the outer door.** It may get hot.

CAUTIONS FOR USAGE

1. Install on a sturdy and level floor

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

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

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

3. Ventilate a room air

Ventilate a room air occasionally when using CO₂ gas for control. The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO₂ gas is used.

4. Install in an appropriate environment

With an automatic calibration function, the CO₂ sensor is calibrated by utilizing air from the local environment. Place the unit in an environment which will reflect normal atmospheric conditions.

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

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

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

6. Always keep the chamber clean

The condensation may be caused on the inside of the door by spilled water from humidifying pan or opening of outer door for long period. Wipe off the condensation completely with a sterile dry gauze. Especially when the culture medium is spilled, clean and disinfect the chamber immediately. Refer to page 26 "Routine maintenance" for details.

7. Fill the humidifying pan with sterile distilled water

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

8. Always shut the inner door

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

9. Open/close the doors gently

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

CAUTIONS FOR USAGE

10. Use clean containers

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

11. Allow adequate space between the cultures

When storing cultures in the chamber, keep the Petri dishes or bottles containing the cultures sufficiently apart from each other to allow adequate air circulation. Inadequate space may result in uneven temperature distribution and CO₂ concentration in the chamber.

12. Stored materials

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

13. Alarm

Always investigate the cause and fix the alarm condition immediately when the alarm is activated. Refer to page 24 for alarm details.

14. Do not use CAL key

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

15. If not used for a long period

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

Labels on the unit

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

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

CAUTIONS FOR USAGE

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

1. Always use humidifying pan and pan cover

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

2. Notice of recommended replacement of UV lamp

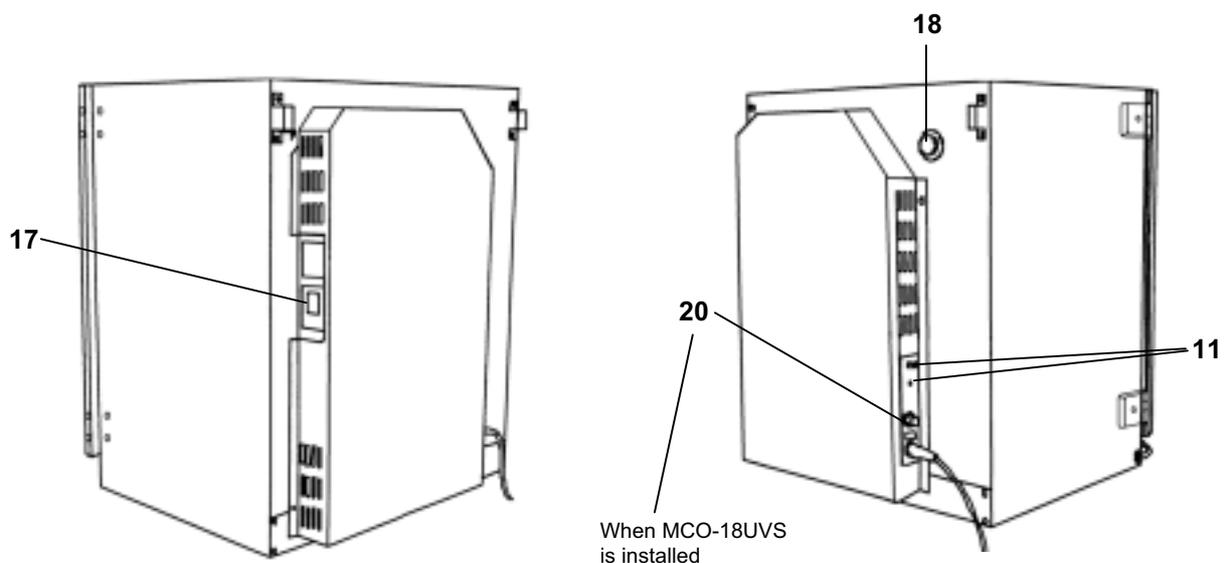
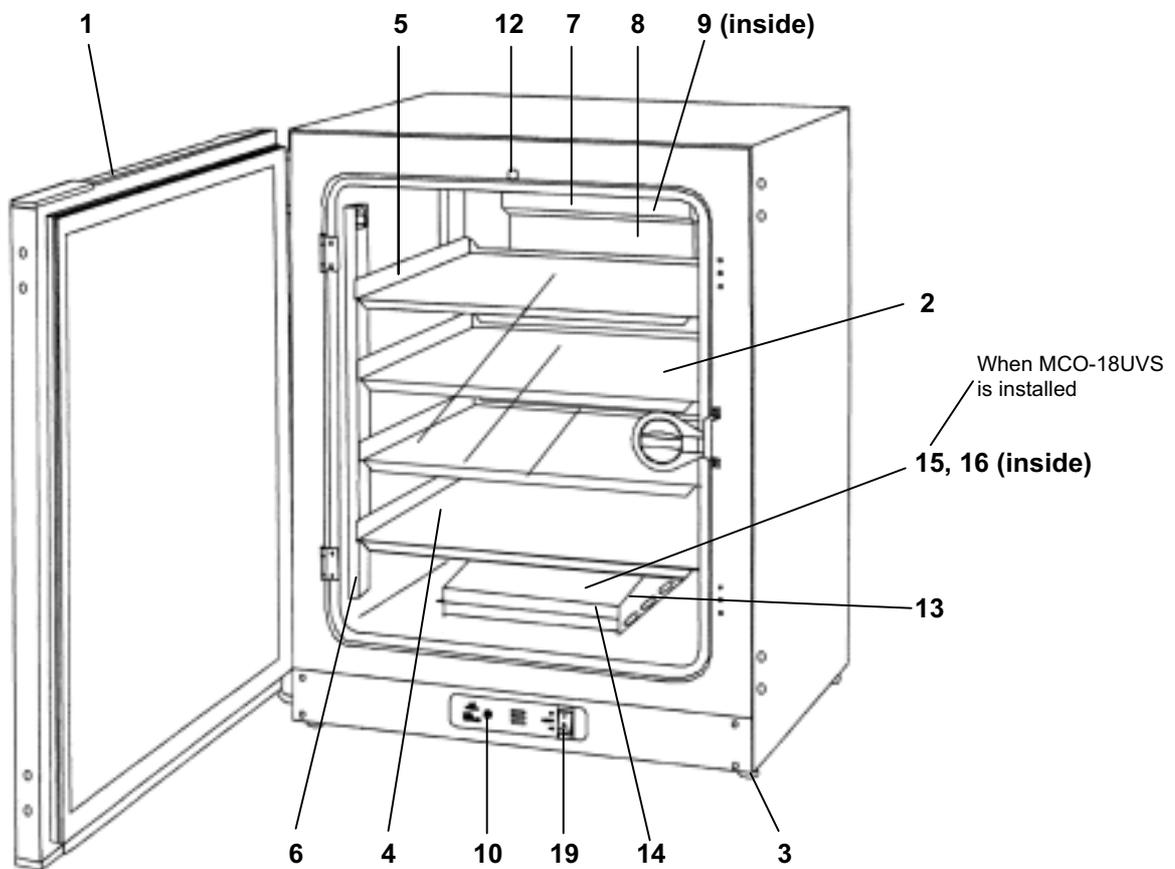
This unit is provided with a function to notify the recommendation of UV lamp replacement when the accumulated ON time of UV lamp is over about 1,000 hours. The blink of the UV indicator on the control panel recommends the replacement of UV lamp. For the replacement, contact Sanyo sales representative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

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

3. Location of UV lamp

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

INCUBATOR COMPONENTS

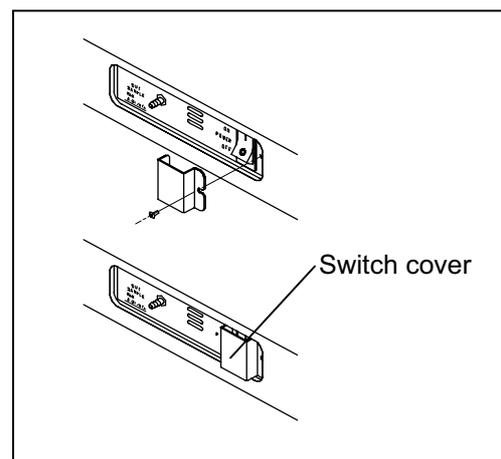


Rear right side

Rear left side

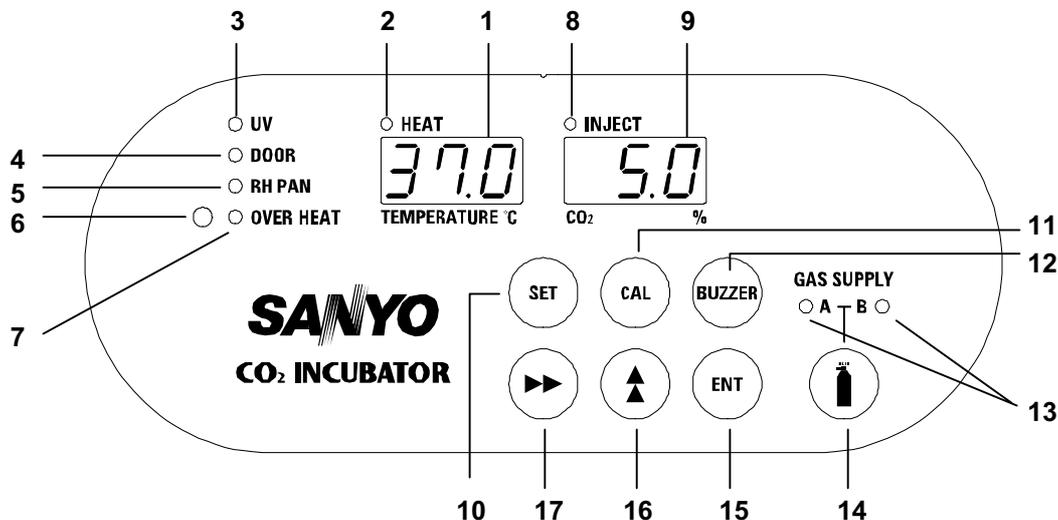
INCUBATOR COMPONENTS

- 1. Outer door:** Sticks to frame with magnetic seal. Door heater is installed in the door panel. The door opening is reversible. Contact Sanyo representative or agent to change the door hinge from left to right or vice versa.
- 2. Inner door:** Made of tempered glass, however avoid excessive impact on the glass.
- 3. Leveling foot:** Screw type for adjusting the height. Adjust the foot so that the unit can be level.
- 4. Tray:** Can be pulled toward you.
- 5. Tray support:** Can be removed by lifting the front side and pulling toward you.
- 6. Side support:** Right and left side supports can be removed for disinfection. See page 27 and 28.
- 7. Top duct:** Inlet of circulating air. Removable.
- 8. Rear duct:** Flow path for circulating air. Removable.
- 9. Fan (inside the rear duct):** Made from polypropylene resin. Can be disinfected by an autoclave.
- 10. Sample air outlet:** This also functions as an internal gas outlet, so do not cap it.
- 11. Connecting port for CO₂ gas pipe (rear side):** When an optional component MCO-21GC (gas cylinder changeover accessory) is installed, both A and B are available. If MCO-21GC is not used, only A is available. Refer to page 17 for gas cylinder connection. Ensure that the gas pressure is set at 0.03MPaG (0.3kgf/cm²G, 4.3psiG). Refer to page 18 for automatic cylinder changeover.
- 12. Door switch:** Detects the door opening/closing and stops the circulating fan and electromagnetic valve for CO₂ when door is open. UV lamp is also deactivated by door opening (When an optional UV system kit MCO-18UVS is installed).
- 13. Humidifying pan:** Use sterile distilled water to fill the pan. Install the pan properly so that it can be covered with the pan cover.
- 14. Humidifying pan cover:** Prevents UV light being exposed to the chamber. When filling the pan, lift the front side and take out the pan. See page 29 for details.
- 15. UV lamp** (When an optional UV system kit MCO-18UVS is installed):
Sanyo UV lamp does not generate ozone. Never look at the UV light directly. For replacement, contact Sanyo representative or agent.
- 16. Water level sensor for humidifying pan:** Detects the water level in the humidifying pan. See page 23 for details.
- 17. Remote alarm terminal:** Refer to page 13.
- 18. Access port:** When not in use, cap with the rubber cap on both outside and inside.
- 19. Power switch:** Main switch of the unit. Also functions as an over-current breaker. The switch is covered by a switch cover to prevent the accidental push. To turn on or off the switch, remove the switch cover by loosening the screw. See figure on the right.
- 20. Glow starter** (When an optional UV system kit MCO-18UVS is installed):
For UV lamp (model; FG-7P)



INCUBATOR COMPONENTS

Control panel and keypad

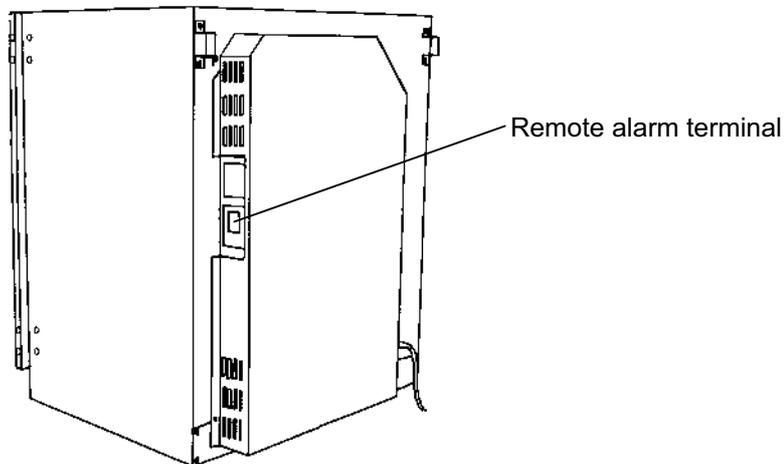


- 1. Digital temperature indicator (TEMPERATURE °C):** Normally, this indicator shows the chamber temperature. In the setting mode, it shows the set value of the chamber temperature. If the self diagnostic function detects any abnormality, an error code will be displayed.
- 2. Heater lamp (HEAT):** This lamp lights when the heater is energized.
- 3. UV indicator (UV):** This lamp lights when the UV lamp is ON. The blink of this indicator recommends the replacement of UV lamp. See page 20 for the details.
- 4. Door lamp (DOOR):** This lamp lights when the outer door is open.
- 5. Water level alarm lamp (RH PAN):** This lamp flashes when the water in the humidifying pan is less than approximately 1 liter.
- 6. Upper limit regulator:** This regulator is used to set the upper temperature limit.
- 7. Over heat lamp (OVER HEAT):** This lamp lights when the chamber temperature reaches the upper limit set value.
- 8. CO₂ inject lamp (INJECT):** This lamp lights when CO₂ gas is being injected.
- 9. Digital CO₂ density indicator (CO₂ %):** Normally, this indicator shows the CO₂ concentration in the chamber. In the setting mode, it indicates the set value of the CO₂ concentration.
- 10. Set key (SET):** Pressing this key to enter the setting mode, and the digits to be set will flash.
- 11. Calibration key (CAL):** By pressing this key for approximately 5 seconds, the unit enters calibration function mode. Also, used to change the UV lamp ON period. See page 30 and 21 for the details.
- 12. Alarm buzzer stop key (BUZZER):** Press this key to silence the buzzer when the alarm operates and the buzzer sounds.
- 13. CO₂ gas supply line indicator (A/B):** The lamp for the supply line currently in use lights up provided that MCO-21GC changeover accessory is installed.
- 14. CO₂ gas supply line switching key :** This key to select CO₂ gas supply line is available only when an automatic gas cylinder changeover MCO-21GC (option) is installed. When one CO₂ cylinder is empty, the CO₂ is supplied by the other cylinder automatically.
- 15. Enter key (ENT):** Pressing this key memorizes the set value in the controller.
- 16. Numerical value shift key (▲):** Pressing this key in the setting mode causes the numerical value to shift. In key lock mode, pressing this key makes key lock ON or OFF.
- 17. Digit shift key (▶▶):** Pressing this key in the setting mode causes the changeable digit to shift. Pressing this key more than 5 seconds enters key lock mode. See page 22 for the key lock.

INCUBATOR COMPONENTS

Remote alarm terminal

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



The remote alarm terminal is a contact output.

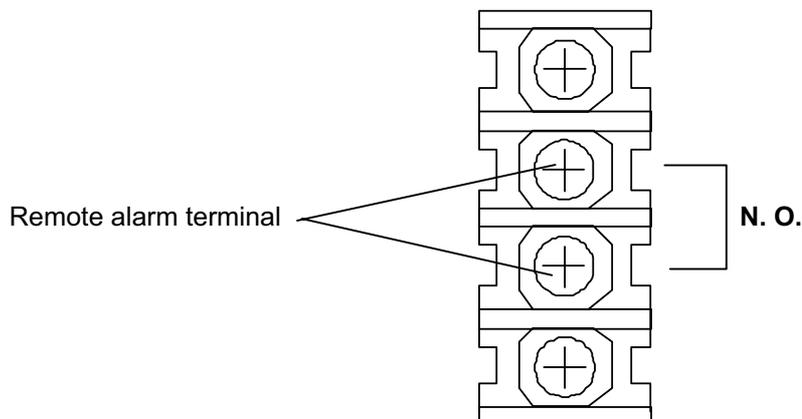
Normal : OPEN
Abnormal : CLOSE
Contact capacity : DC 30V, 2A

Note:

- When the power switch is OFF or the power failure condition, the contact output is CLOSE.
- The remote alarm cannot be silenced by pressing the alarm buzzer stop key (BUZZER) since the remote alarm is not conjunct with the BUZZER key

REMOTE ALARM

MAX DC30V 2A



INSTALLATION

Installation site

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

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

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

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

WARNING

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

Ventilate a room air occasionally when using CO₂ gas for control. The gas density will increase in an enclosed small room and high level of gas density can be hazardous to health. In addition, avoid inhaling the chamber air directly when opening the door if CO₂ gas is used.

3. A location away from heat generating sources

4. A location with a sturdy and level floor

WARNING

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

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

5. A location without flammable or corrosive gas

WARNING

Never install the unit in a flammable or volatile location. This may cause explosion or fire.

Never install the unit where acid or corrosive gases are present as current leakage or electric shock may result due to corrosion.

6. A location not prone to high humidity

WARNING

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

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

INSTALLATION

Prevent contamination

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

1. Avoid hot and humid location

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

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

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

3. Installation in a sterile room

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

4. Use clean containers

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

Installation

1. Remove the packaging materials and tapes

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

2. Adjust the leveling feet

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

3. Fix the unit

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

4. Ground (earth)

WARNING

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

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

BEFORE COMMENCING OPERATION

Sterilizing of chamber and attachments

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

Note:

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

Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause corrosion of metal surfaces.

1. Take out all attachment such as trays, humidifying pans, etc, from the chamber. Refer to page 27 and 28.
2. Clean all of the attachments with neutral detergent and then wash out the detergent with distilled water.
3. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.
4. Wipe the inside wall of the chamber with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.
5. Replace all attachments in the chamber.

Note:

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

6. Fill the humidifying pan with sterile distilled water.

BEFORE COMMENCING OPERATION

Connection of CO₂ gas cylinder

WARNING

Check the gas type and ensure that it is fit for the purpose. Make sure that all pipes are connected correctly and are not liable to become disconnected. Ensure that the gas pressure is set at the specified value. Improper connection of the gas pipe or use of incorrect gas pressure may result in leakage of CO₂ gas. **Elevated level of CO₂ gas can be hazardous to health and may lead to asphyxiation and risk of death.**

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

1. Install a pressure regulator (optional accessory MCO-100L) on the cylinder. Use a regulator rated at 25MPaG (250kgf/cm²G, 3600psiG) on the primary side and 0.2MPaG (2.0kgf/cm²G, 30psiG) on the secondary side.

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

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

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

Note:

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

BEFORE COMMENCING OPERATION

Automatic CO₂ cylinder changeover

An automatic CO₂ cylinder changeover system (MCO-21GC) is available as an optional accessory. This kit switches the gas supply line when one CO₂ gas cylinder is empty.

Note: The installation of MCO-21GC should be implemented by a qualified service personnel.

After attachment of MCO-21GC, do the following:

1. Connect a CO₂ gas pipe to port A and B respectively. A connecting port for CO₂ gas pipe is located on the left back of the unit. (See page 10 and 11.)
2. Connect a CO₂ gas cylinder provided with a gas pressure regulator to each gas pipe. See page 17, for the connection of the gas cylinder.
3. Open the valve of each gas cylinder.
4. Check that the CO₂ gas supply line indicator on the control panel is lit by pressing the switching key.
5. Select a CO₂ gas supply line (A or B).
6. When one cylinder is empty, the indicator is flashed, buzzer sounds (remote alarm is activated), and "E01" is displayed alternately on the control panel while the gas supply line is switched to other one. To silence the buzzer, press the BUZZER key.
7. Replace the empty CO₂ gas cylinder.

Note: Exercise caution when handling empty CO₂ gas cylinders as some gas can still be left in the cylinder.

This kit MCO-21GC detects that no more CO₂ gas exists in a cylinder when the CO₂ density in the chamber is not increased for a while after opening of CO₂ gas valve in the unit and switches the gas supply line. The switching of supply line can be caused by some other reasons; blocking or restricting of gas tube, reduction of CO₂ gas pressure, or improper opening of CO₂ gas cylinder, in spite of gas quantity in the cylinder. Therefore, always check the gas quantity in the cylinder prior to disconnection.

OPERATING INSTRUCTIONS

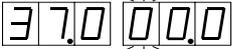
Set of chamber temperature and CO₂ density

Table below shows the basic procedure for setting the chamber temperature and CO₂ density. The upper limit alarm temperature setting is also shown in the table. Perform key operations in the sequence indicated in the table. The example in the table is based on the assumption that the desired temperature is 37°C and CO₂ density is 5%.

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

Allow at least 4 hours until the next setting after setting of desired chamber temperature and setting CO₂ density to 0%, at the time of first start-up or start-up after no use for long term.

Basic operation sequence (Example: Chamber temperature; 37°C, CO₂ density; 5%)

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

Note:

- In each set mode, if the change of the setting is not necessary, pressing SET key skips to next set mode.
- When the CO₂ density is set to 00.0, the control is OFF regardless of chamber density.
- The upper limit temperature set value will change when the regulator is turned even if the unit is not in set mode, because the alarm circuit is an independent circuit.
- In each set mode, the indicator returns to the current temperature and CO₂ density display mode automatically when 90 seconds has passed without any key operation.

OPERATING INSTRUCTIONS

UV lamp

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

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

Following shows precautions and instructions about the UV lamp.

- The UV light is exposed only to the inside of the duct and the humidifying pan cover when all chamber components are installed properly.
- During cultivation, ensure all components are located adequately and never turn on the UV light without the humidifying pan cover.
- Even if the unit is operating without turning on the UV lamp, the humidifying pan cover should be installed properly. An operation without pan cover will affect the temperature distribution and humidify recovery.
- Even if the unit is operated without humidifying, the humidifying pan and the pan cover should be installed properly.
- When checking the UV lamp operation, open the outer door and push the door switch with the inner door closed. The visible blue light can be checked under the humidifying pan cover. The UV light is harmful to eyes. Never turn on the UV light with the inner door or humidifying pan cover opened.
- The UV lamp is ON for a predetermined period after the outer door is closed. The period is factory set at 5 minutes. Change the setting as necessary as shown in the page 21.
- The UV lamp is ON for a predetermined period every 12 hours when the outer door is not opened more than 12 hours continuously. The predetermined period can be changed by following the procedure shown in page 21.
- The recommended timing of lamp replacement (the ratio of UV output is less than 70% of initial value) is when the accumulated ON time is over about 1,000 hours. The blink of the UV indicator when the UV lamp is OFF means the accumulated time has exceeded about 1,000 hours and recommends the replacement of the lamp. When replacing the UV lamp, contact Sanyo sales representative or agent.
- E18 is displayed on the temperature indicator when the UV lamp is burned out. In this case, replace the lamp immediately. At the time of replacement, also replace the glow starter (Type; FG-7P). For the replacement of UV lamp and glow starter, contact Sanyo sales representative or agent.

OPERATING INSTRUCTIONS

Change of setting for UV lamp ON period

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

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

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

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

- The available set range for the UV lamp is between 0 and 30 minutes (000 to 030). When set to 000, the UV lamp is not turned on.
- The UV lamp is turned off during ON period when the outer door is opened. After closing the outer door, the lamp turns on during predetermined period.
- Condensation will occur and/or temperature distribution may be affected due to the heat of the UV lamp when the setting of the lamp operation is longer than 5 minutes or if only the outer door is opened repeatedly.
- For the replacement of UV lamp, contact Sanyo sales representative or gent.

Pressing CAL key for about 5 seconds leads the calibration mode. In the calibration mode, the calibration of temperature and CO₂ density is possible. Wrong key operation affects the basic performance. Never touch any other keys on the control panel in the event of pressing CAL key accidentally. After about 90 seconds, the unit returns to chamber temperature display mode automatically.

OPERATING INSTRUCTIONS

Key lock function

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

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

Display	Mode	Function
	Key lock is OFF	Enable to change of temperature and CO ₂ setting
	Key lock is ON	Disable to change of temperature or CO ₂ setting

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

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

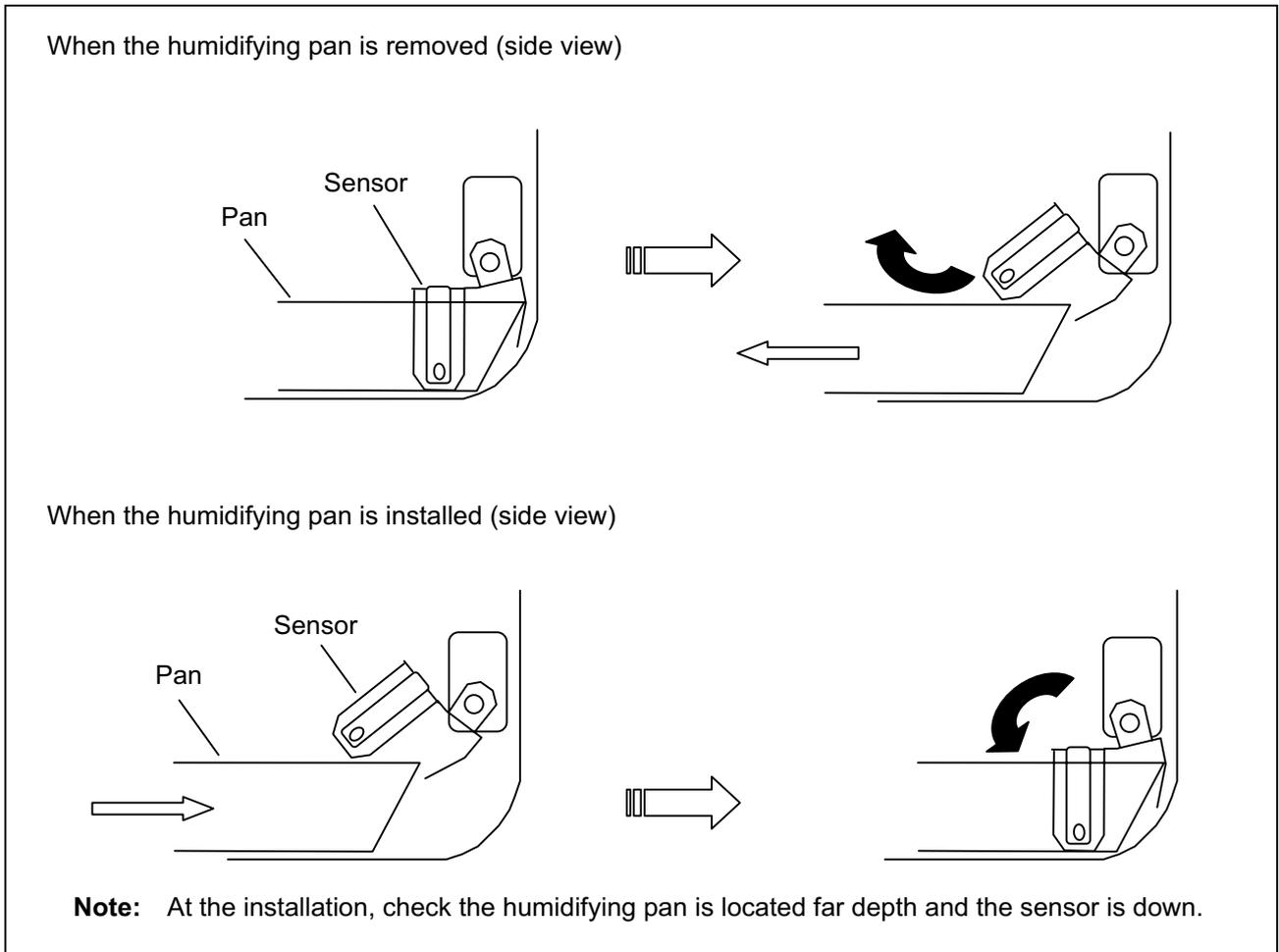
Note:

- The key lock function is available for temperature and CO₂ density setting.
- To cancel the key lock, set to L0 in the above procedure.

OPERATING INSTRUCTIONS

Water level sensor

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



Note:

- Lift the sensor before installing the humidifying pan if the sensor is in lower position after maintenance.
- At the time of installation of humidifying pan, check that the pan is set properly and sensor is down in the pan. The water level alarm lamp (RH PAN) blinks if the sensor is not down completely. In this case, set the pan again in adequate location.
- Use an alcohol for sterilization when cleaning the sensor, taking care not to stress the lead wire.
- The sensor detects the water level every 30 minutes. In addition, detection is executed after operation of the outer door. It takes several seconds to detect the water level. Therefore, the water level alarm lamp may flash a few times after the outer door is closed with the humidifying pan filled sufficiently.

ALARMS & SAFETY FUNCTIONS

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

Alarms and safety functions

Alarm & Safety	Situation	Indication	Buzzer	Safety operation
Upper limit temperature alarm	If the chamber temperature exceeds the upper limit alarm temperature set value.	Over heat lamp lights. E12 or E16 and chamber temperature are displayed alternately.	Continuous tone	Heater OFF Remote alarm
Automatic set temperature alarm	If the chamber temperature deviates from the set temperature by $\pm 1^{\circ}\text{C}$ or more.	All digits on the temperature indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Automatic set CO ₂ density alarm	If the chamber CO ₂ density deviates from the set value by $\pm 1\%$ or more.	All digits on the CO ₂ density indicator blink.	Intermittent tone with 15 minutes delay.	Remote alarm with 15 minutes delay
Auto-return	When there is no key pressing in each setting mode for 90 seconds.	Normal display mode.	----	The setting mode is canceled.
Key lock	When the key lock is "ON".	----	----	The setting is disabled.
Automatic calibration function	Normally, the zero point of the CO ₂ sensor is calibrated every 4 hours (or very 10 minutes for the first hour after switch ON), using the atmosphere as the gas to be calibrated.	The decimal point (period) on the CO ₂ density indicator blinks.	----	----
CO ₂ gas cylinder empty	If the CO ₂ density does not increase when the gas valve is opened.	E01 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Gas line changeover	When the gas supply line is switched. (only when MCO-21GC is installed)	E01 is displayed alternately with the temperature on the temperature indicator. Gas supply line indicator blinks.	Intermittent tone	Gas supply line is altered. Remote alarm
Chamber temperature sensor abnormality	If the temperature sensor is disconnected.	E05 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Heater OFF Remote alarm
	If the temperature sensor is short circuited.	E06 is displayed alternately with the temperature on the temperature indicator.		
Sensor box temperature sensor abnormality	If the sensor box temperature sensor is disconnected.	E07 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO ₂ valve close. Remote alarm
	If the sensor box temperature sensor is short circuited.	E08 is displayed alternately with the temperature on the temperature indicator.		
Ambient temperature sensor abnormality	If the ambient temperature sensor is disconnected.	E09 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
	If the ambient temperature sensor is short circuited.	E10 is displayed alternately with the temperature on the temperature indicator.		
CO ₂ sensor abnormality	If the output voltage of the CO ₂ sensor is abnormal.	E11 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO ₂ valve close. Remote alarm
Main heater abnormality	If the upper limit alarm temperature alarm operates, or if the main heater is open circuit, or the main heater relay short circuit.	E12 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Bottom heater abnormality	If the bottom heater goes open circuit, or the bottom heater relay short circuit.	E13 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Door heater abnormality	If the door heater goes open circuit, or the door heater relay short circuit.	E14 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm

Sensor box heater abnormality	If the sensor box heater goes open circuit, or the sensor box relay short circuit.	E15 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Disconnection of sensor for each heater	If the relay of main heater, bottom heater or sensor box heater goes open circuit.	E16 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Air pump (for sample air or auto-zero) failure	If the air pump (sampling or auto zero) does not operate, or if there is something wrong in the gas piping.	E17 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	CO ₂ valve close. Remote alarm
Low humidifying water	If the water in the pan is about 1 liter.	RH PAN lamp blinks.	----	----
UV lamp failure	[When MCO-18UVS is installed] When the UV lamp is burned out.	E18 is displayed alternately with the temperature on the temperature indicator.	Intermittent tone	Remote alarm
Recommendation of new UV lamp	[When MCO-18UVS is installed] The accumulated ON time is over about 1,000 hrs.	UV indicator blinks when UV lamp is OFF.	----	----

- The alarm can be canceled by pressing the BUZZER key, but the remote alarm cannot be silenced. And the upper limit temperature alarm cannot be silenced with the BUZZER key.
- E01 is cleared automatically when the gas is connected correctly and the buzzer is silenced with the BUZZER key. When MCO-21GC is installed, press BUZZER key to silence the alarm after changeover of gas supply line.
- If one of E05 to E17 (except for E12, E13, and E14) is displayed, consult with a Sanyo sales representative or agent.

SETTING OF ALARM RESUME TIME

The alarm buzzer is silenced by pressing BUZZER key on the control panel during alarm condition.

The buzzer will be activated again after certain suspension if the alarm condition is continued. The suspension time can be set by following the procedure shown in the table below.

The example in the table is based on the assumption that the desired duration is 20 minutes.

Note: The duration is set in 30 minutes at the factory.

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

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

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

ROUTINE MAINTENANCE

WARNING

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

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

CAUTION

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

Sterilizing of chamber and attachments

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

Note:

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

Do not clean the inside of the unit with a solution of disodium chlorate or other halogen-based solution because this may cause rust.

1. Take out all trays and the humidifying pan from the chamber.
2. Remove ducts, side support (right and left side), tray supports, and the fan as shown in the figures on page 27 and 28.
3. Clean all the attachments with neutral detergent and then rinse away the detergent with distilled water.
4. Wipe the attachments with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.
5. Wipe the inside wall of the with a gauze containing alcohol for sterilization and then wipe off with a dry gauze.

6. Replace all attachments in the chamber.

Note:

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

7. Fill the humidifying pan with sterile distilled water.

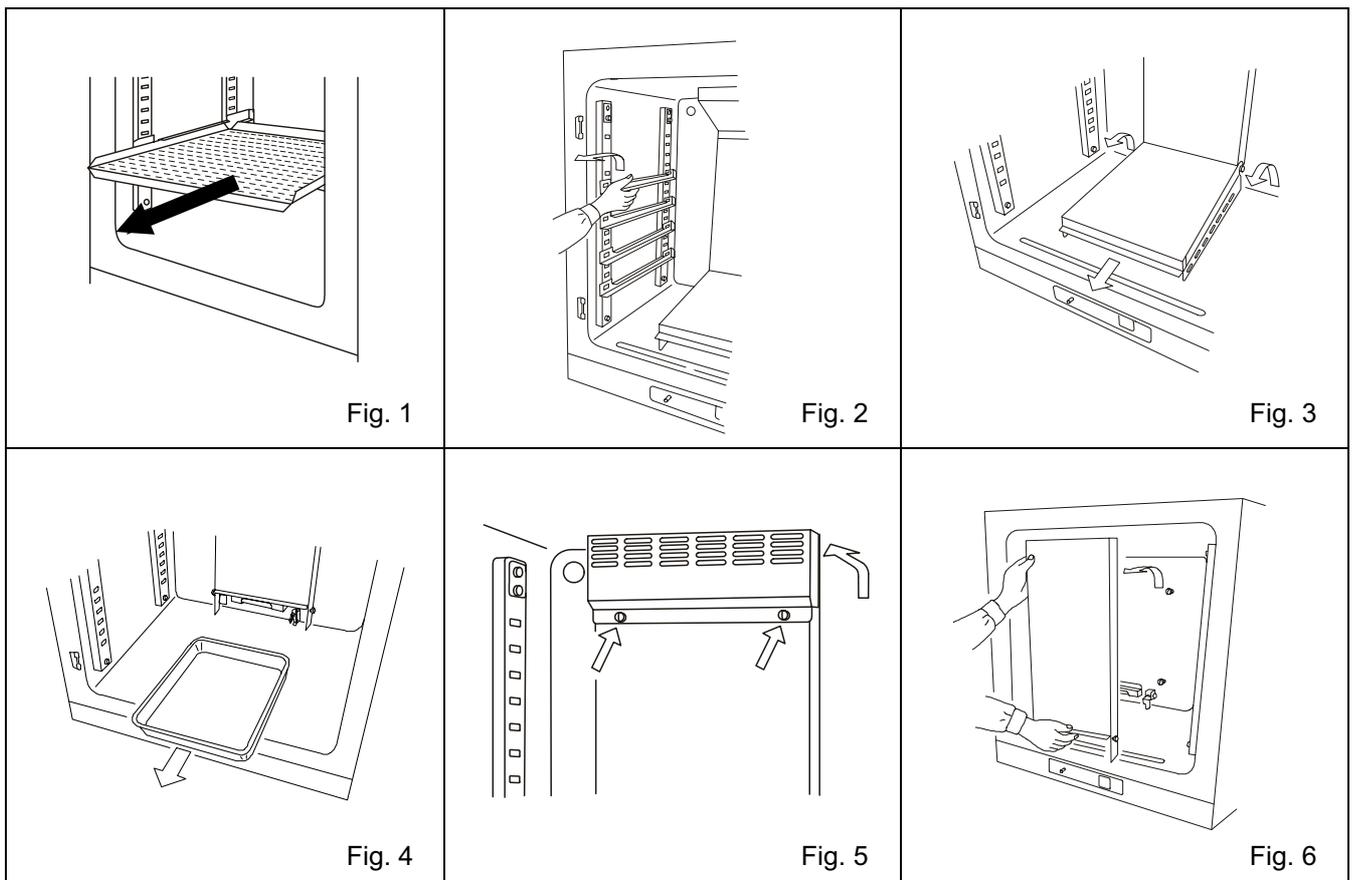
ROUTINE MAINTENANCE

Removal of attachments

Note:

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

1. Close the valve of the gas cylinder and turn off the power.
2. Open the outer door. Remove 2 pins fixing the inner hinge and remove the inner door.
3. Pull out the all trays. See Fig. 1
4. Remove all tray supports on the right and left side by lifting up the front side. See Fig. 2.
5. By lifting up the humidifying pan cover, unhook it at the rear and remove the cover as shown in Fig. 3.
6. Take out the humidifying pan. See Fig. 4
7. After removing 2 screws fixing the top duct, take out the top duct by removing pin. See Fig. 5.
8. To remove the rear duct, lift it up as shown in Fig. 6.

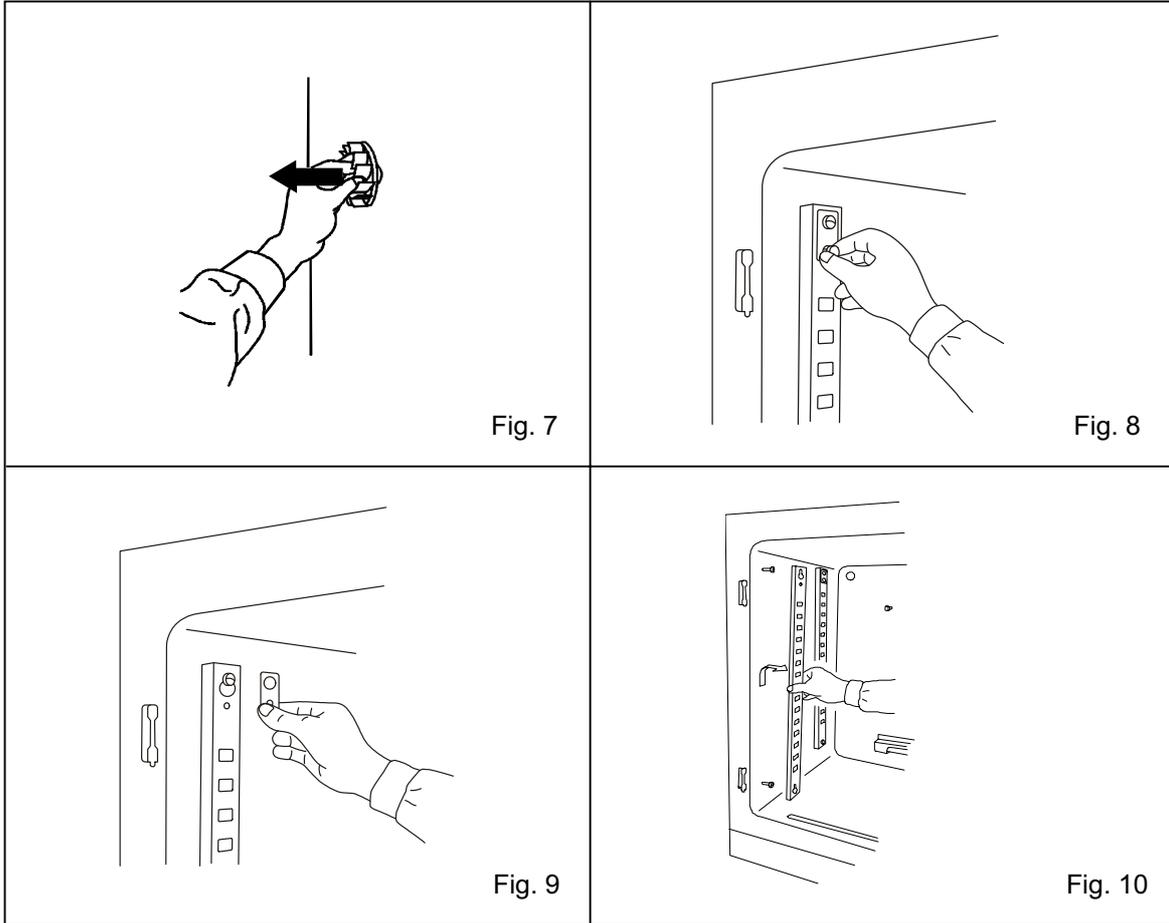


ROUTINE MAINTENANCE

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

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

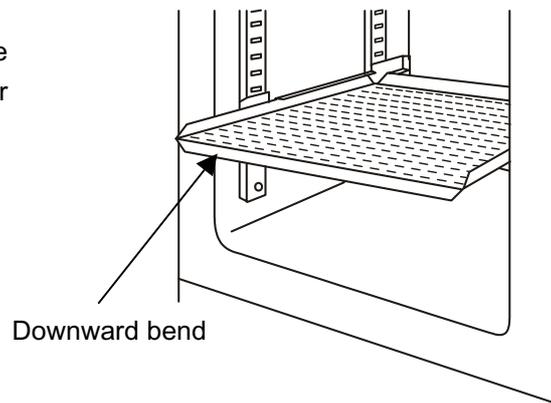
11. By lifting the side support, take it off from the hooks. See Fig. 10.



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

Note:

- Always insert the fan on the motor shaft surely. Check that the fan does not hit the rear panel by turning the fan manually. Improper insertion may cause poor performance.
- As shown in the figure, set the shelf with the edge bent downwardly positioned at the front. Improper setting cause tilted or unstable condition.



ROUTINE MAINTENANCE

Filling the humidifying pan

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

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

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

3. Dispose of the water in the pan and wash it with neutral detergent. Then rinse the pan with distilled water sufficiently. Finally, wipe the pan with a soft cloth and alcohol for disinfection.

4. Wipe off the bottom of the chamber completely.

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

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

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

Note:

- The sterile water filled in the humidifying pan should be pre-heated at 37°C. Cold water lowers the chamber temperature.
- Replace the water in the pan by the above procedure when the water level alarm lamp blinks.

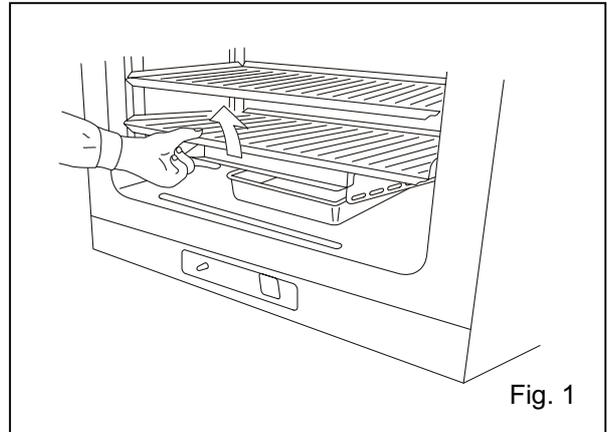


Fig. 1

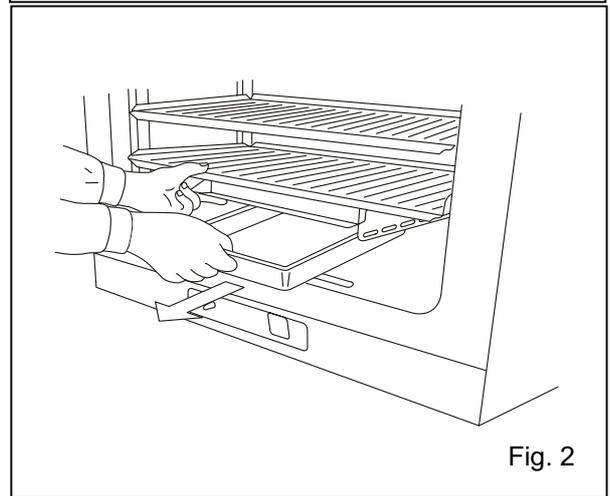


Fig. 2

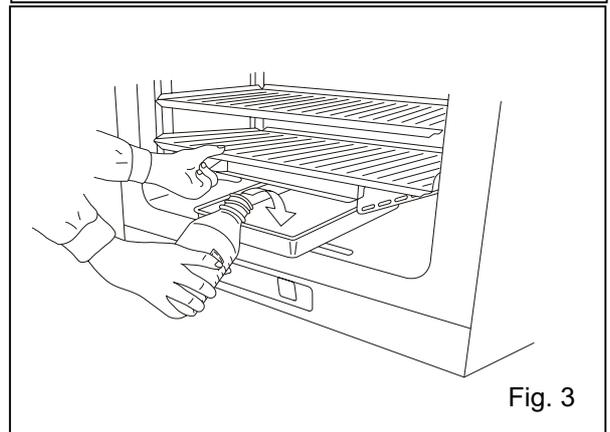


Fig. 3

CALIBRATION

Temperature calibration

1. Press the CAL key for approximately 5 seconds.
2. The third digit of the temperature indicator flashes, and the CO₂ density indicator goes out.
3. Set the present correct temperature with the ►► key and ▲ key, then press the ENT key.
4. The unit automatically reverts to the display mode.

[Example]

If the displayed chamber temperature is 37.0°C (set value) and the actual temperature is 36.8°C.

1. Press the CAL key for about 5 seconds.
2. The "3" on the temperature indicator flashes, and the CO₂ density indicator goes out.
3. Adjust the set value to the actual value of 36.8°C with the ►► key and ▲ key, then press ENT key.
4. The unit automatically reverts to the display mode.

Note:

It is important to accurately measure the temperature inside the unit when performing temperature calibration. Particularly, the temperature gauge used must have an accuracy of 0.5 Class or better. The temperature must be measured at several points.

The temperature setting must not change by more than $\pm 1.0^{\circ}\text{C}$ during calibration. If it exceeds this, an error tone is emitted, the input data is ignored, and the unit reverts to the display mode. Consequently, if it is necessary to change the temperature by more than 1.0°C , perform calibration in several stages over a period of time.

CO₂ calibration

Span setting

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

1. Press the CAL key for about 5 seconds.
2. The third digit on the temperature indicator flashes, and the CO₂ density indicator goes out.
3. Press the CAL key once again.
4. The third digit on the CO₂ density indicator flashes, and the temperature indicator goes out.
5. Set the present correct CO₂ density with the ►► key and ▲ key, then press the ENT key.
6. The unit automatically reverts to the display mode.

Note:

This calibration is available when the setting of CO₂ density is 2% or more.

[Example]

For an internal CO₂ density of 5.0% (setting) and a measured value of 4.5%.

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

TROUBLESHOOTING

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

The unit does not operate at all

- The unit is not plugged correctly into a power outlet.
- The circuit breaker at the power source is active or a power failure has occurred.

The key operation is disabled

- The key lock function is set in ON mode.

If the alarm function operates

[At the beginning of operation]

- The chamber temperature is not equal to the set value.
- The chamber CO₂ density is not equal to the set value.
 - a. The secondary pressure of the pressure regulator is not equal to the set value (0.03MPaG, 0.3kgf/cm²G, 4.3psiG).
 - b. The tube is not connected securely between the pressure regulator and the unit.

[During operation]

- The upper limit alarm temperature is not set at least 1°C higher than the set chamber temperature.
- The set temperature value was changed, or the door was left open for a long period. Or a low temperature load was placed inside the unit. In this case, if the unit is left as it is, the alarm will eventually clear itself.
- The gas tube has slipped off or the gas leaks.
- The set value of the gas density was changed.
- The gas cylinder is empty. Check the primary pressure of the CO₂ cylinder once a week. (The primary pressure of less than 3.8MPaG (38kgf/cm²G) means a little gas in the cylinder. Replace the cylinder soon.

If the chamber temperature is not equal to the set temperature

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

If the gas density does not coincide with the set value

- The secondary pressure is not set to 0.03MPaG (0.3kgf/cm²G, 4.3psiG).
- The gas tube is clogged or chinked.

If the chamber humidity does not rise

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

If the CO₂ consumption is too much

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

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

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

If it takes much time to recover the gas density

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

ENVIRONMENTAL CONDITIONS

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

1. Indoor use;
2. Altitude up to 2000 m;
3. Ambient temperature 5°C to 35°C
4. Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C;
5. Mains supply voltage fluctuations not to exceed $\pm 10\%$ of the nominal voltage;
6. Other supply voltage fluctuations as stated by the manufacturer;
7. Transient overvoltages according to Installation Categories (Overvoltage Categories) II; For mains supply the minimum and normal category is II;
8. Pollution degree 2 in accordance with IEC 664.

DISPOSAL OF UNIT

WARNING

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

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

STACKED MODULE

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

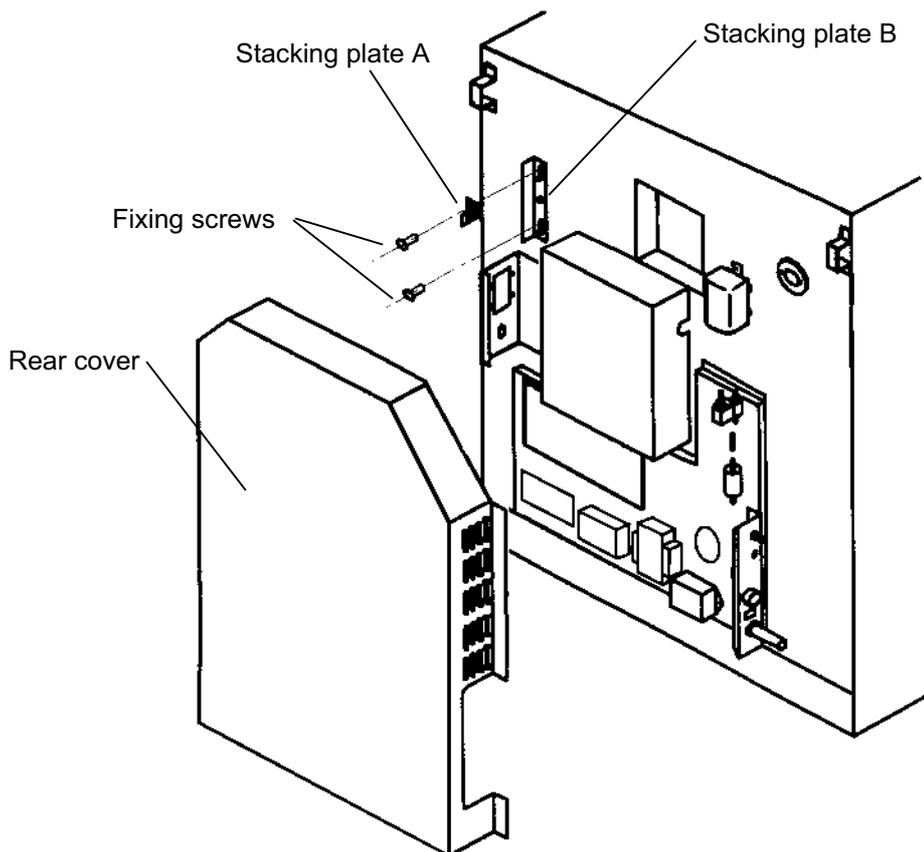
⚠ WARNING

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

Never stack 3 or more units.

Take care not to drop or tip over the unit when stacking as this can cause injury or damage of the unit.

1. Turn off the power switch and disconnect a plug of each unit.
2. The stacking plate A and B are attached on the back of each unit. To prepare the stacking plate A and B, remove the rear cover by unscrewing 6 screws on the rear cover. See the figure below.
3. Take out the stacking plate A and B by loosening 2 fixing screws on each unit.
4. Replace the rear cover and fix it with 6 screws.
5. Check that the lower unit is level.

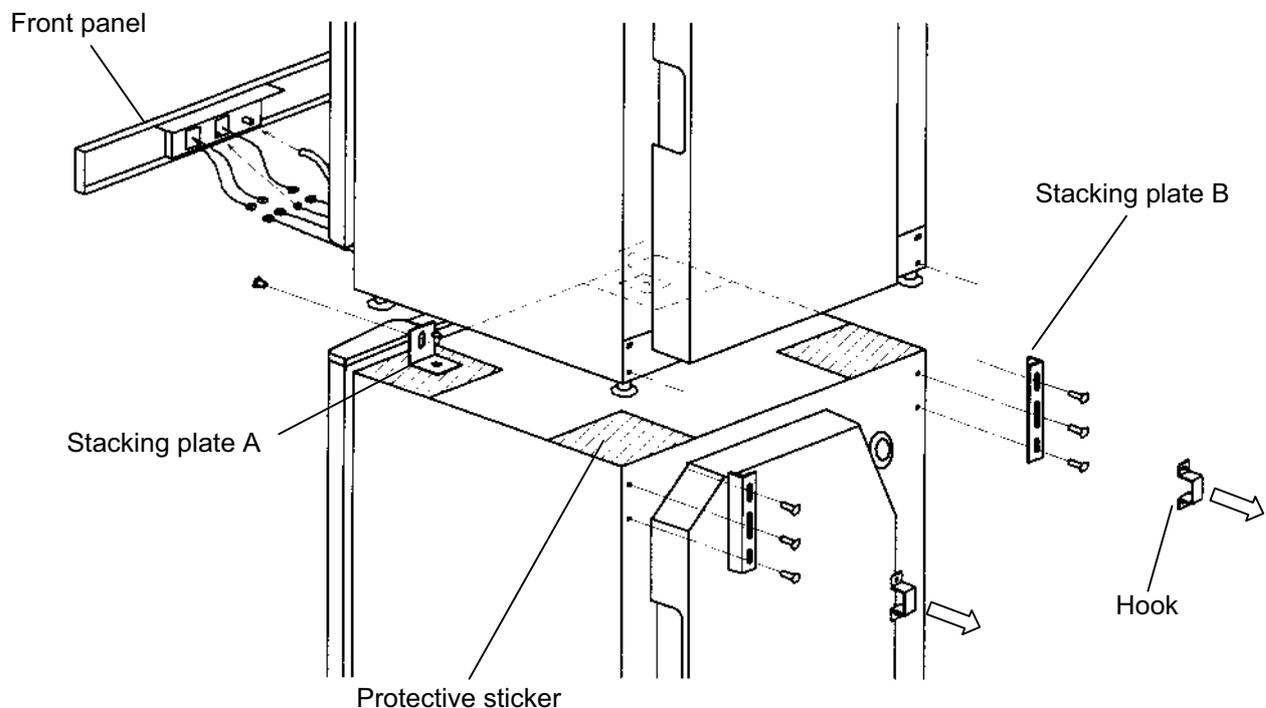


Note:

When stacking the unit, 2 stacking plates A and 2 stacking plates B are necessary. Each unit has 1 stacking plate A and 1 stacking plate B attached to the back. Remove stacking plate A and B from back of each unit.

STACKED MODULE

6. Apply the protective sticker enclosed with the unit at each corner on the top of the lower unit to avoid scratches or damage.
7. Fix the stacking plate A at 2 locations on the top front of the lower unit by using 2 screws removed in step 3.
8. Remove the front panel on the upper unit by unscrewing the 4 fixing screws and then disconnect the wires and gas tube.
9. Stack the unit so that both units can be aligned straight. Also check the upper unit is level. If it is not level, keep the unit even by adjusting the leveling legs.
10. Secure the upper unit with the stacking plate A and 2 screws removed in step 3.
11. Remove 2 hooks on the rear side of the lower unit by unscrewing each 2 fixing screws.
12. Remove 1 screw on the bottom right and left on the rear side of the upper unit.
13. Fix the stacking plate B at the right and left on the rear of the lower and upper unit with 3 screws removed in step 11 and 12.
14. Replace the front panel on the upper unit after connecting the wires and gas tube.
15. Fix the stacked unit to the wall with 2 hooks on the rear of the upper unit and rope or chain.



SPECIFICATIONS

Name	CO ₂ Incubator		
Model	MCO-18AIC		
External dimensions	W620 x D710 x H900 (mm)		
Internal dimensions	W490 x D523x H665 (mm)		
Interior volume	170 L		
Exterior	Polyester finish baked on zinc galvanized steel		
Interior	Stainless steel containing copper		
Outer door	Acrylic finish baked on zinc galvanized steel		
Inner door	Tempered glass		
Tray	4 trays made of stainless steel containing copper W450 x D450 x H12 (mm), Maximum load; 7 kg/tray		
Access port	Inner diameter; 30 mm, On the back side		
Insulation	Rigid polyurethane foamed-in place (CFC-FREE)		
Heating system	DHA system (heater jacket + air jacket system)		
Heater	314 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		
Air filter	0.3 μm, Efficiency; 99.97% or more		
Water level sensor	Optical type		
Alarm	High/Low temperature alarm, CO ₂ density alarm, Upper limit temperature alarm Door alarm, UV lamp failure alarm		
Remote alarm contact	Allowable contact capacity: DC 30 V, 2 A		
CO ₂ inlet connection	4 to 6 mm diameter tube		
CO ₂ inlet pressure	0.03MPaG (0.3kgf/cm ² G, 4.3psiG)		
Accessories	4 trays, 4 sets of tray support, 1 gas tube, 1 humidifying pan, Stacking plate A and B (fixed on rear of the unit), 4 protective stickers, 2 tube bands		
Weight	93 kg		
Optional accessory	CO ₂ cylinder regulator (MCO-100L) Automatic CO ₂ cylinder changeover system (MCO-21GC) Extra tray (MCO-46ST) including 2 tray supports, Half tray (MCO-25ST) UV system kit (MCO-18UVS), Roller base (MCO-18RB) UV lamp replacement kit (MCO-20UV)		
Maximum power consumption	310 W		
Total maximum current	110 to 120 V, 60 Hz	220 V, 60 Hz	220 to 240 V, 50 Hz
	2.8 A	1.4 A	1.4 A

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

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

PERFORMANCE

Temperature control range	Ambient temperature +5°C to 50°C (ambient temperature; 5°C to 35°C)
Temperature distribution	± 0.25°C* (ambient temperature; 25°C, setting; 37°C, 5%, no load)
Temperature variation	± 0.1°C (ambient temperature; 25°C, setting; 37°C, 5%, no load)
CO ₂ control range	0 to 20%
CO ₂ variation	± 0.15% (ambient temperature; 25°C, setting; 37°C, 5%, no load)
Chamber humidity	95 ± 5% R.H.
Maximum heat emission	1120 kJ/h
Usable environment condition	Temperature; 5°C to 35°C, Humidity; equal or less than 80% R.H. (The designed performance may not be obtained when the ambient temperature is equal or less than 15°C)

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

* It is based on our measuring method.

CAUTION

Please fill in this form before servicing.

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

Safety check sheet

1. Incubator contents :
- | | | |
|--------------------------------|------------------------------|-----------------------------|
| Risk of infection: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Risk of toxicity: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Risk from radioactive sources: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

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

Notes :

2. Contamination of the unit

- | | | |
|------------------|------------------------------|-----------------------------|
| Unit interior | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| No contamination | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Decontaminated | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Contaminated | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Others: | | |

3. Instructions for safe repair/maintenance of the unit

- | | | |
|-------------------------------------|------------------------------|-----------------------------|
| a) The unit is safe to work on | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b) There is some danger (see below) | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

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

Date :

Signature :

Address, Division :

Telephone :

Product name : CO ₂ incubator	Model : MCO-18AIC	Serial number :	Date of installation :
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Please decontaminate the unit yourself before calling the service engineer.

SANYO