

Service Manual

CO₂ Incubator MCO-18AIC



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Effective models

This service manual is effective following models.

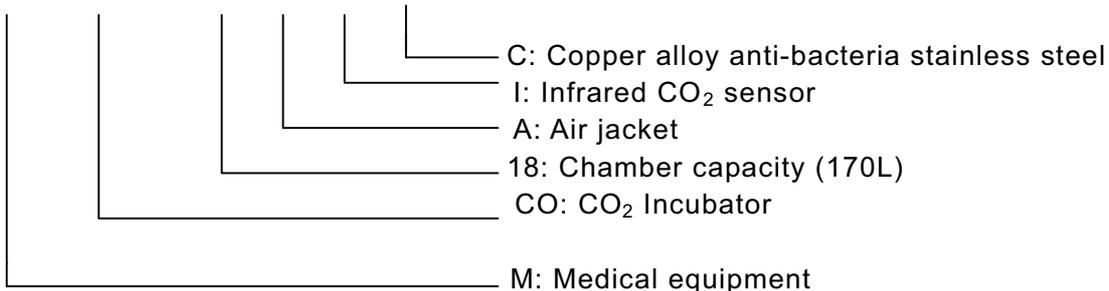
Model name	Model code	Voltage and Frequency	
MCO-18AIC	823 279 51	115V	60Hz
	823 279 52	220V	50Hz
	823 279 53	220V	60Hz
	823 279 54	230V	50Hz
	823 279 56	230V	50Hz

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%

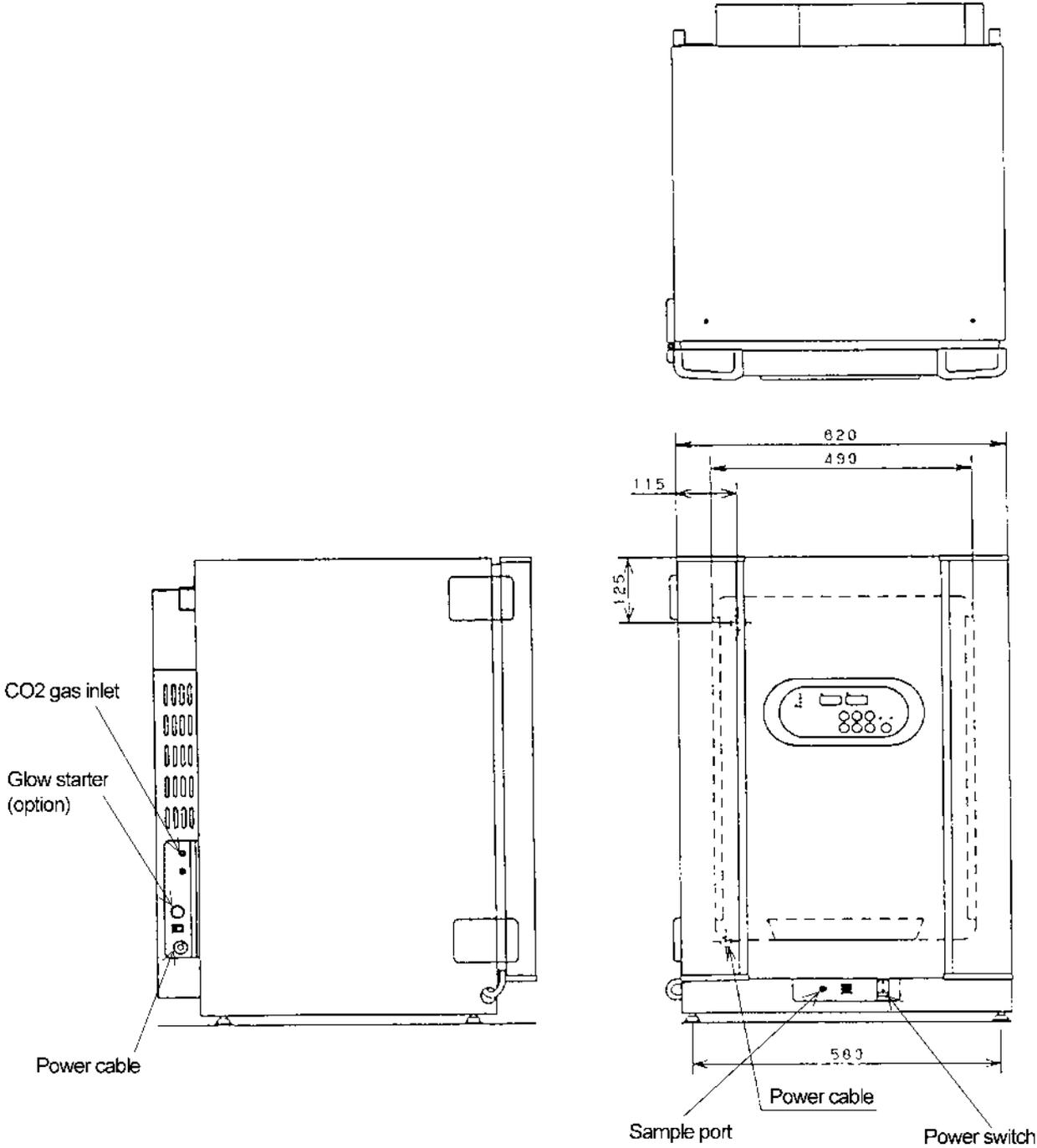
※ Based on the measuring method on validation service manual.

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

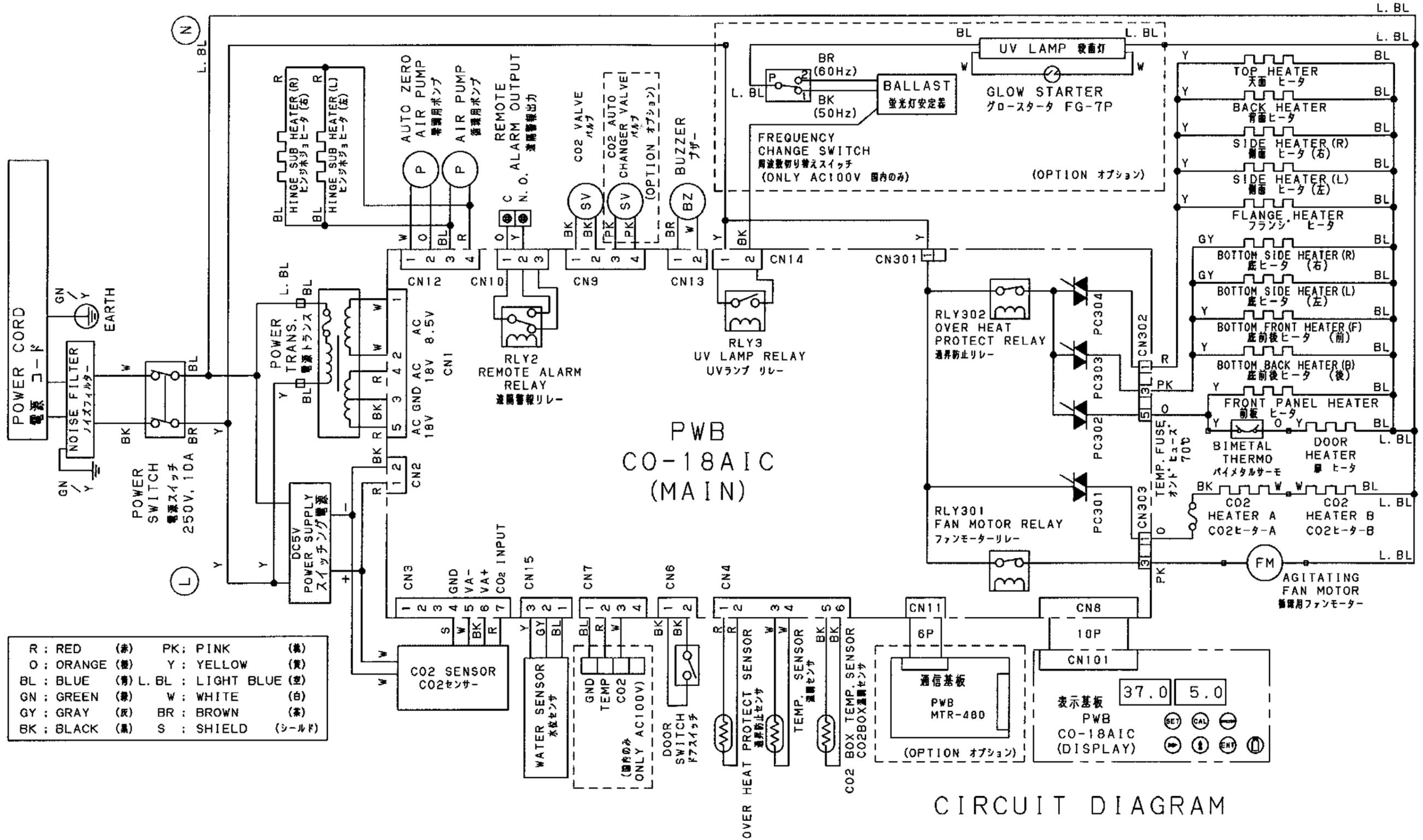
The difference between temperature sensed in temperature control sensor and temperature in internal 1/2H should be offset:

Offset value: +0.8°C

16. Example for displays

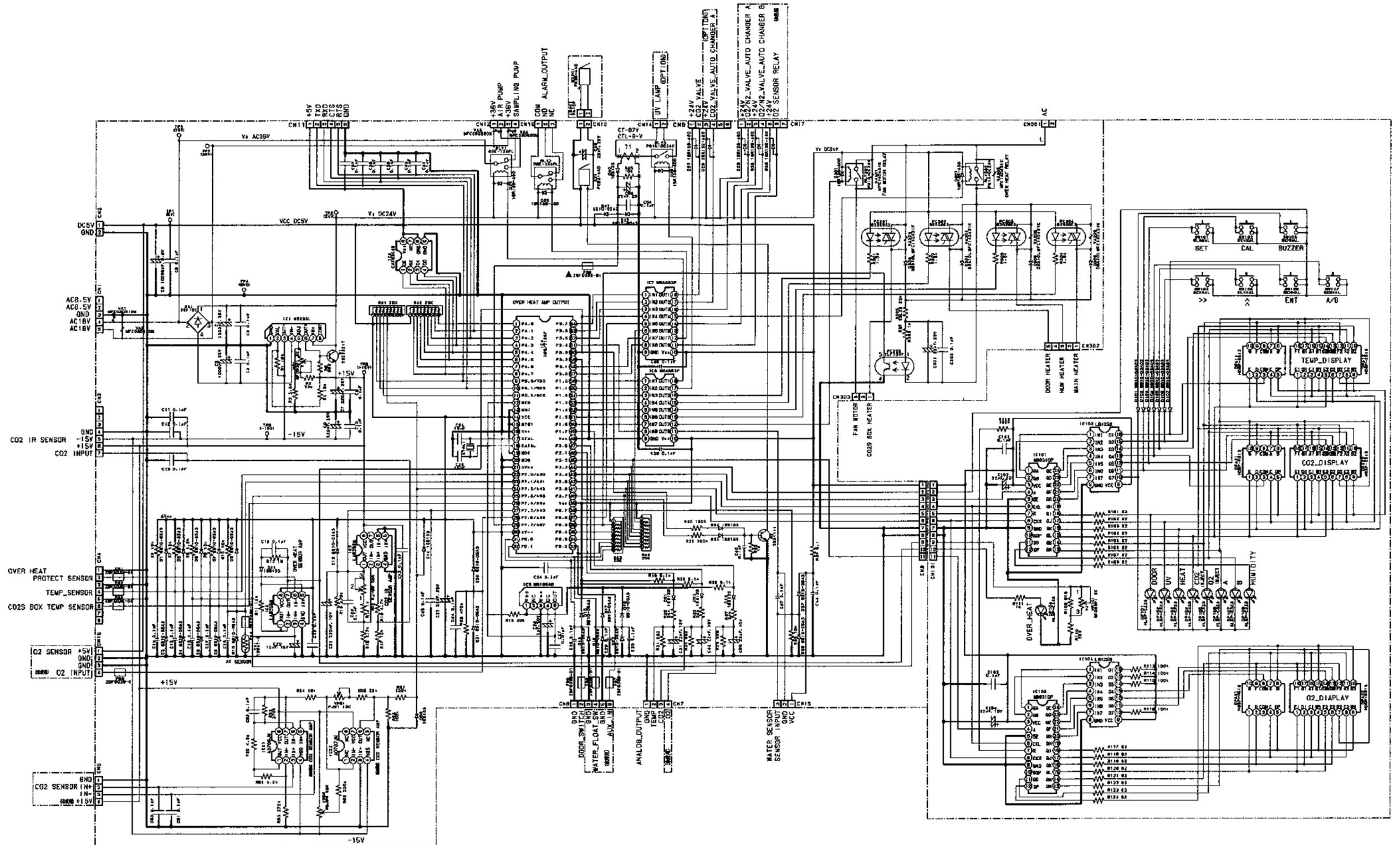
Current temperature +36.2°C		CO ₂ level +5.0%	
Set temperature +37.0°C		Auto Zero adjusting	
Function F03		Auto Zero adjustment value 5021	
(Service code input)		CO ₂ gas error E01	
Bottom heater ratio 004			
Lock Mode L0			

Wiring Diagram



CIRCUIT DIAGRAM

Circuit Diagram



Connection on PCB

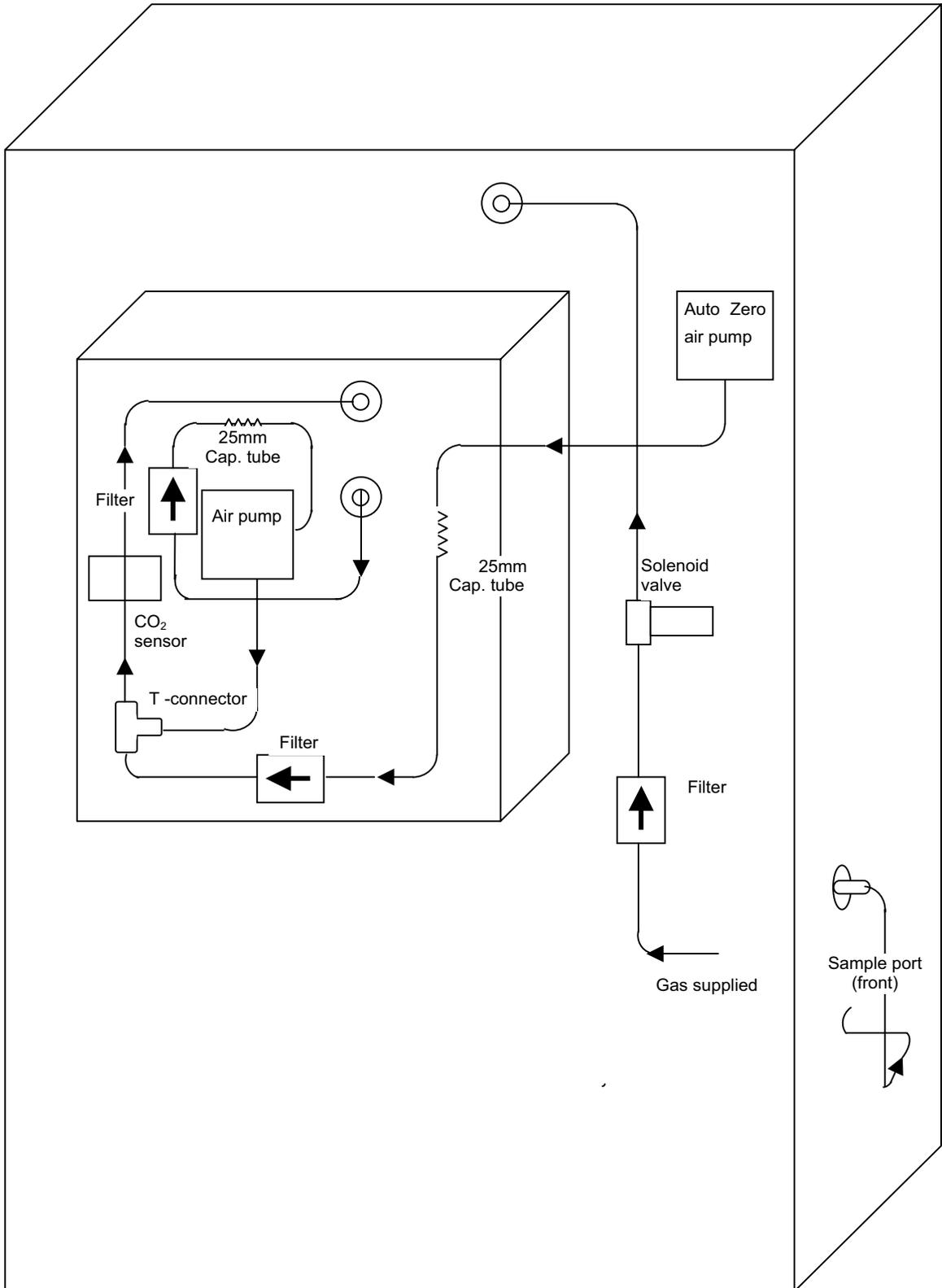
The following shows connections of connector (CN) on main PCB.

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.>

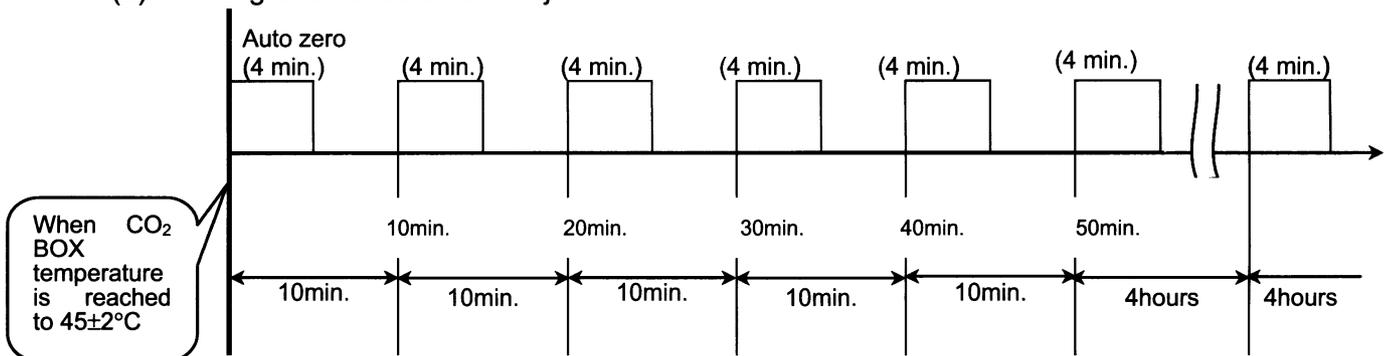
Auto zero adjustment

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.

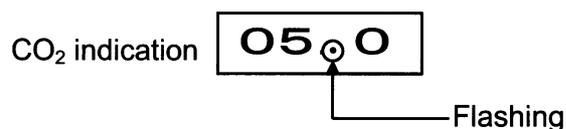
- Run the auto zero pump **for 2 minutes** to feed ambient air into CO₂ sensor. During this period, sampling air pump is off. CO₂ density in the atmosphere is almost 0% (0.03%~0.07%), adjust automatically that the measured CO₂ is 0%.
- Then do usual sampling **for 2 minutes**, compare CO₂ density of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

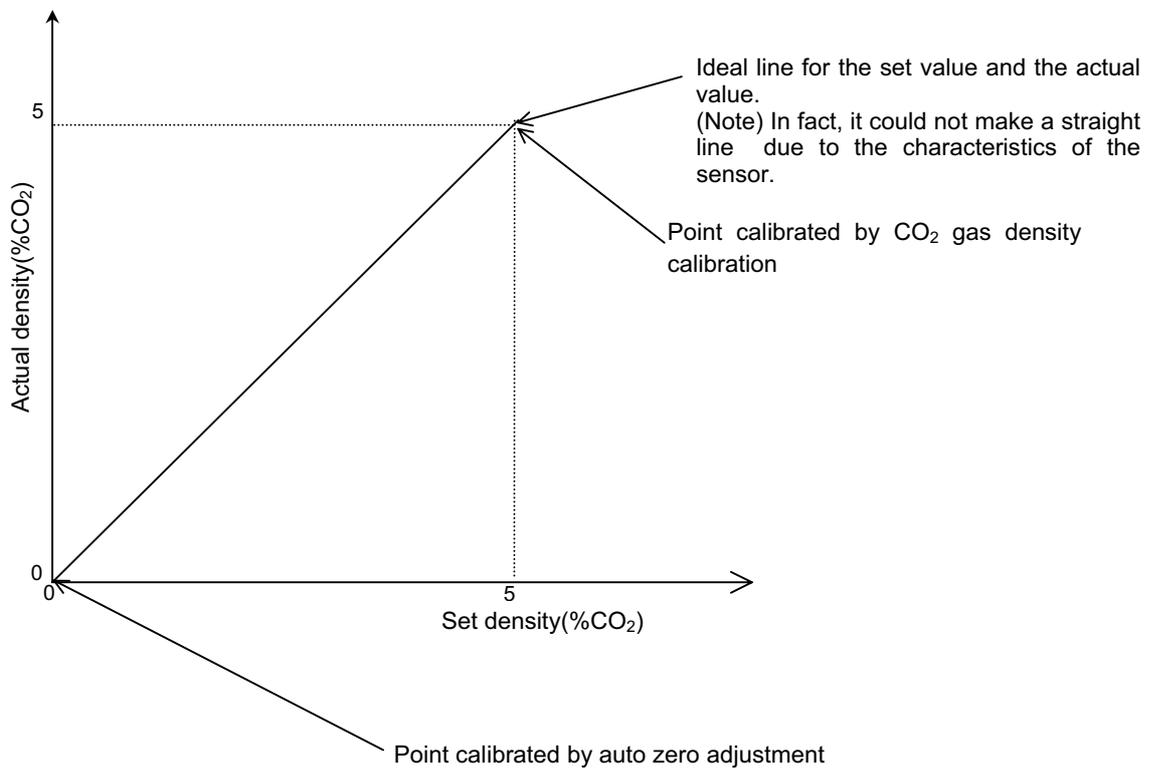
When either the CO₂ density SV or the display value is not match with the actual value, calibrate CO₂ gas density according with "CO₂ calibration" (Page 9) to input the actual value again.

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

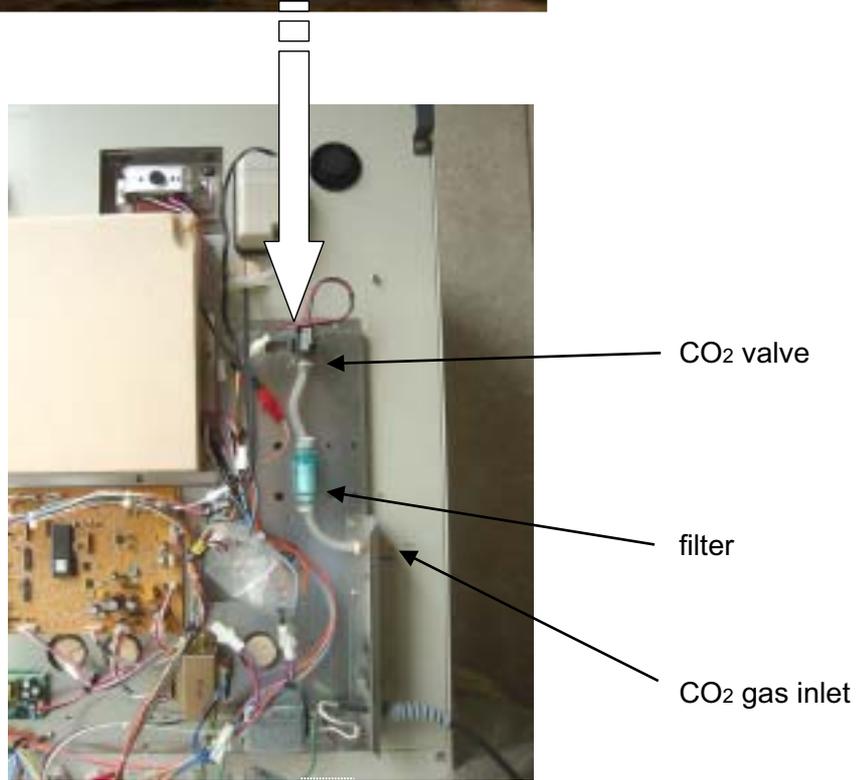
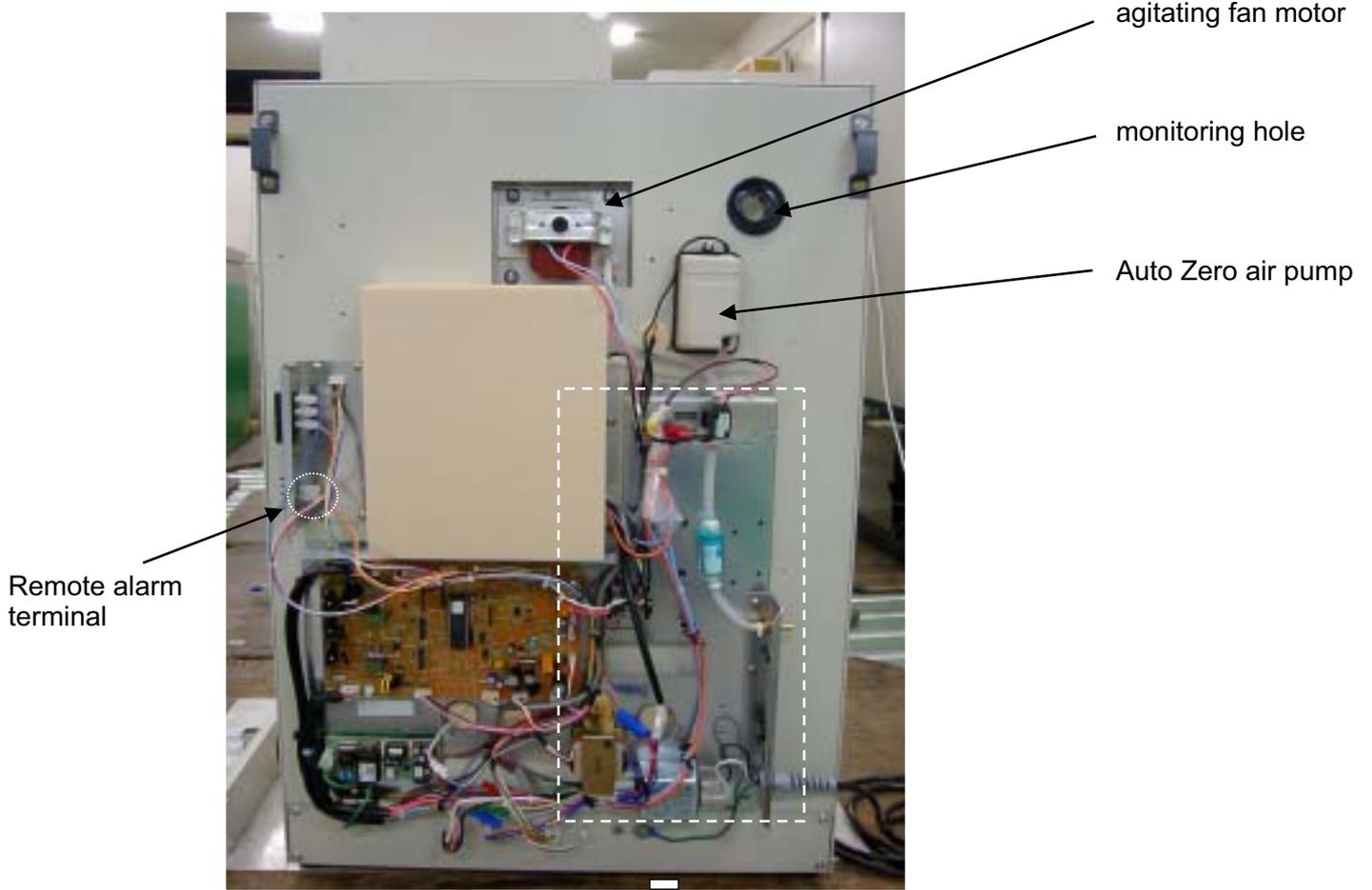
Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
0	27.28	17	13.57	34	7.19
1	26.13	18	13.06	35	6.94
2	25.03	19	12.56	36	6.70
3	23.99	20	12.09	37	6.47
4	22.99	21	11.63	38	6.25
5	22.05	22	11.20	39	6.03
6	21.15	23	10.78	40	5.83
7	20.29	24	10.38	41	5.63
8	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)

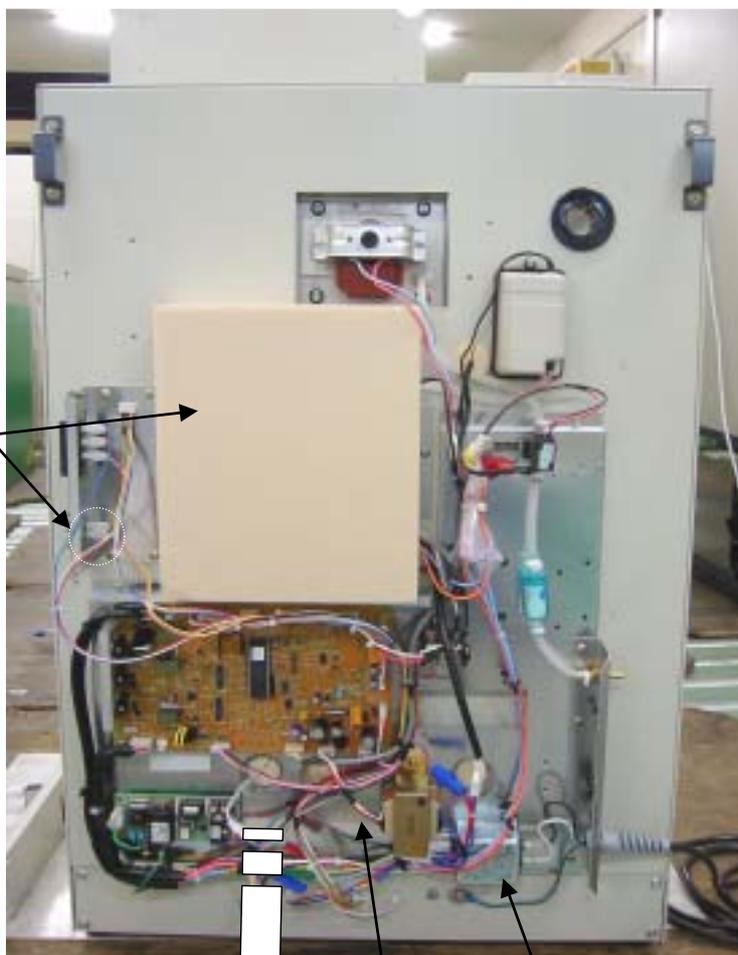
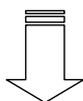
CO ₂ density (%)	R13 output voltage(V)	CO ₂ density (%)	R13 output voltage(V)	CO ₂ density (%)	R13 output voltage(V)
0.0	4.00	8.0	2.87	16.0	2.47
1.0	3.74	9.0	2.80	17.0	2.43
2.0	3.54	10.0	2.75	18.0	2.40
3.0	3.37	11.0	2.69	19.0	2.37
4.0	3.23	12.0	2.64	20.0	2.33
5.0	3.12	13.0	2.59		
6.0	3.02	14.0	2.55	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

Parts layout



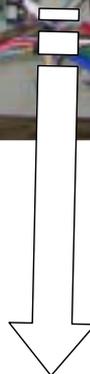
remote alarm terminal

sensor BOX



transformer
for PCB

noise filter



CO2 IR sensor power consumption resistance (R13)

sensor BOX temp. sensor
thermal fuse



sensor BOX heater

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



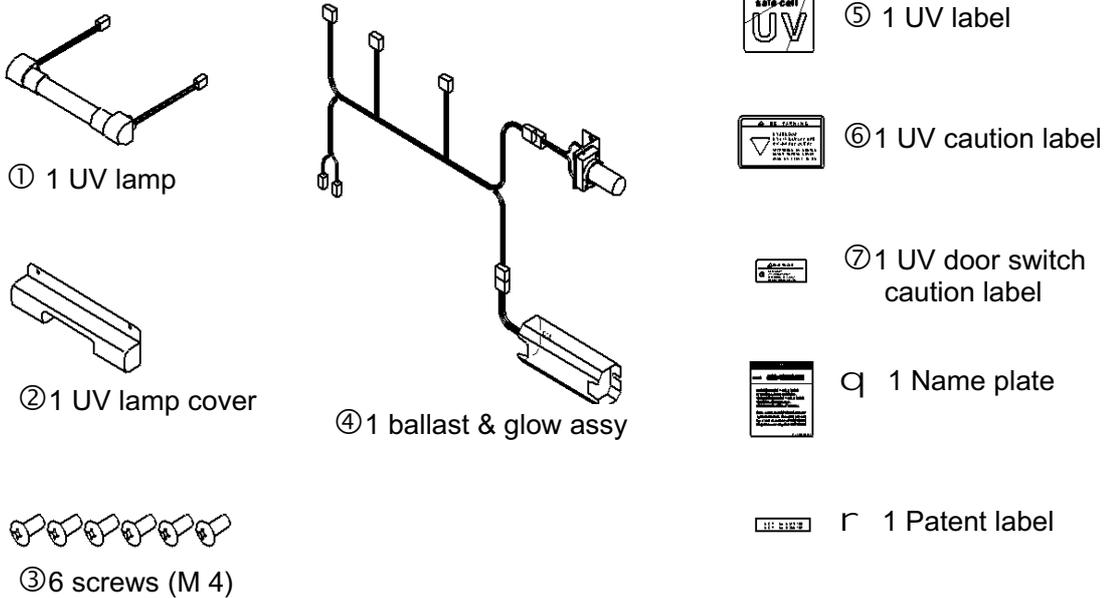
UV lamp connection port



Water level sensor

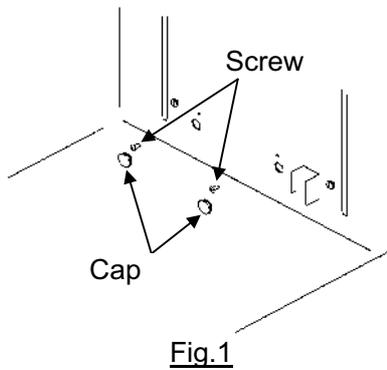
MCO-18UVS Installation Procedure

Kit of MCO-18UVS

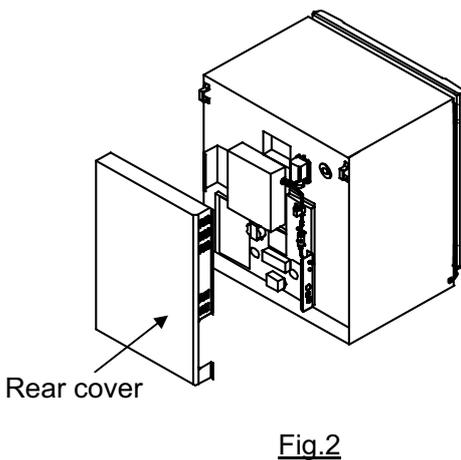


Procedure

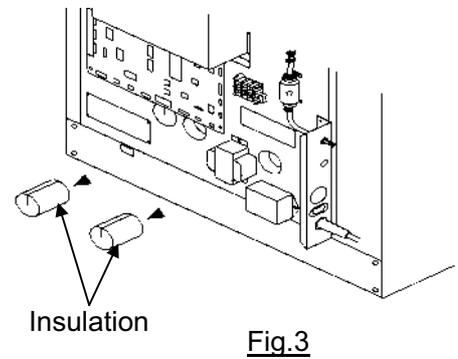
1. Unplug the unit and make sure that power is not supplied to the unit.
2. Remove the duct from inside the unit, then take off 2 caps and 2 screws shown in Fig. 1.



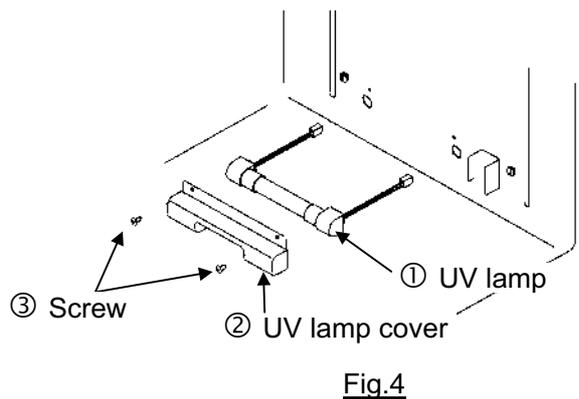
3. Take off the rear cover shown in Fig. 2.



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.



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

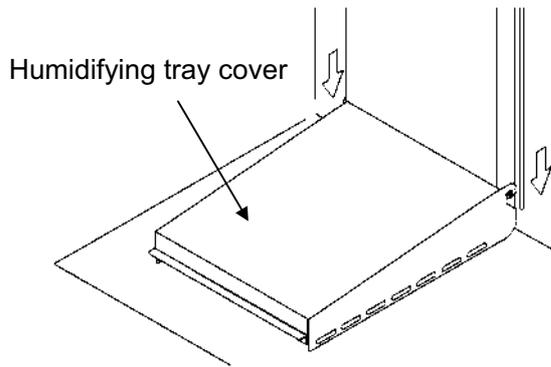


Fig.5

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.

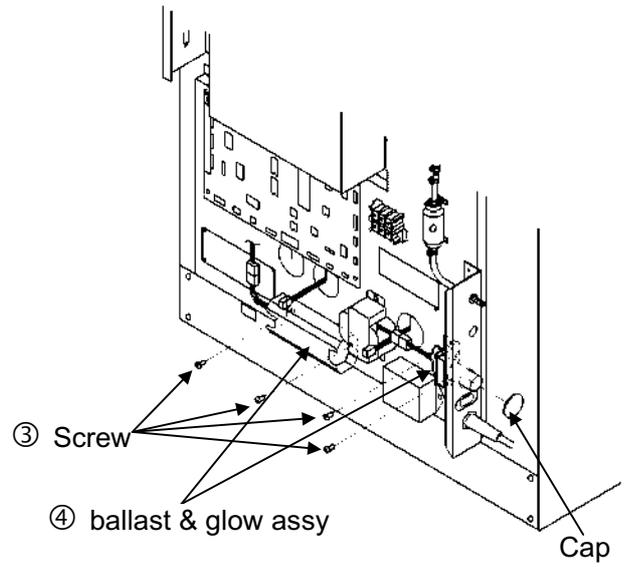


Fig.7

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

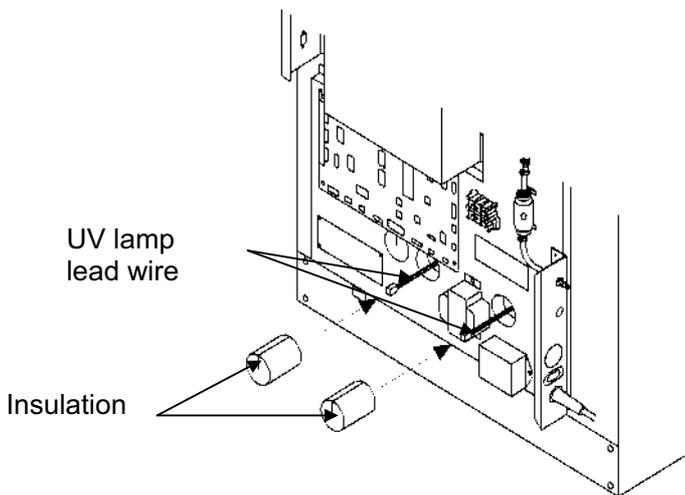


Fig.6

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

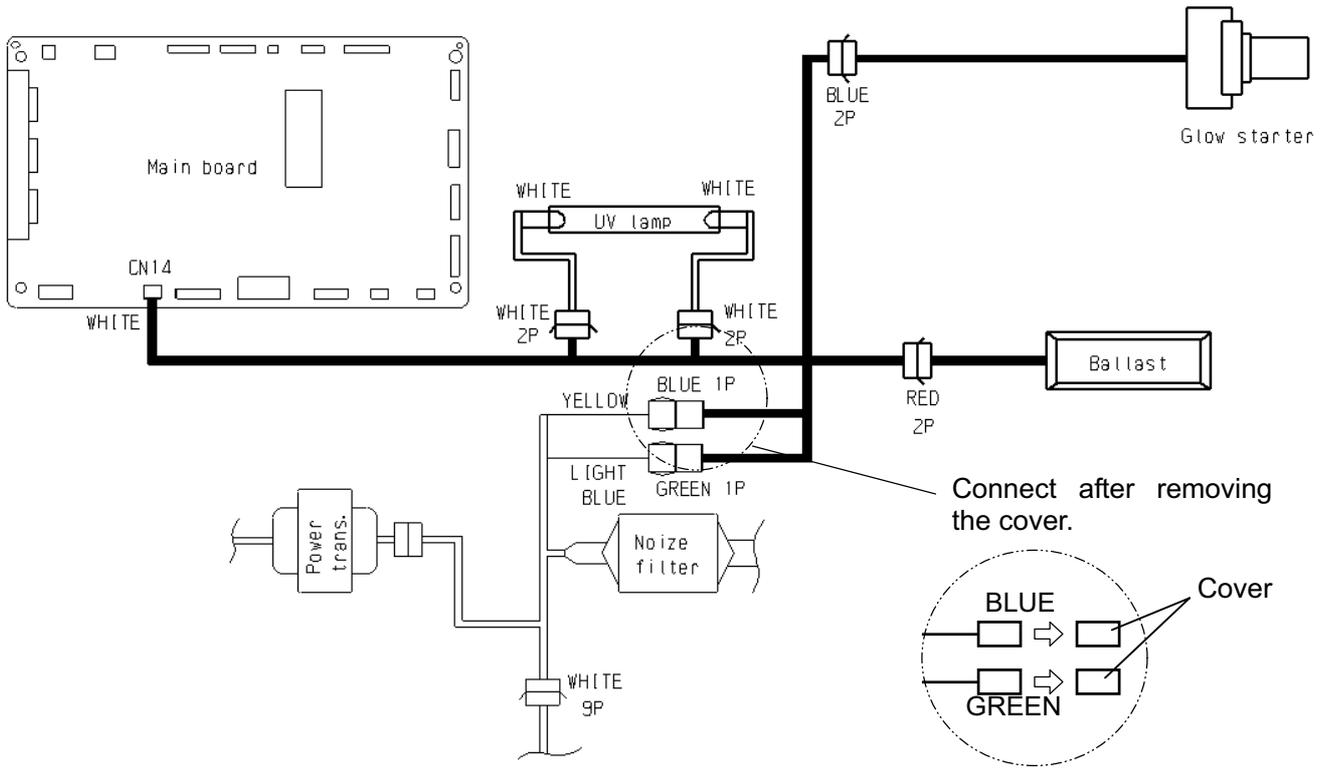


Fig.8

10. Attach the labels.

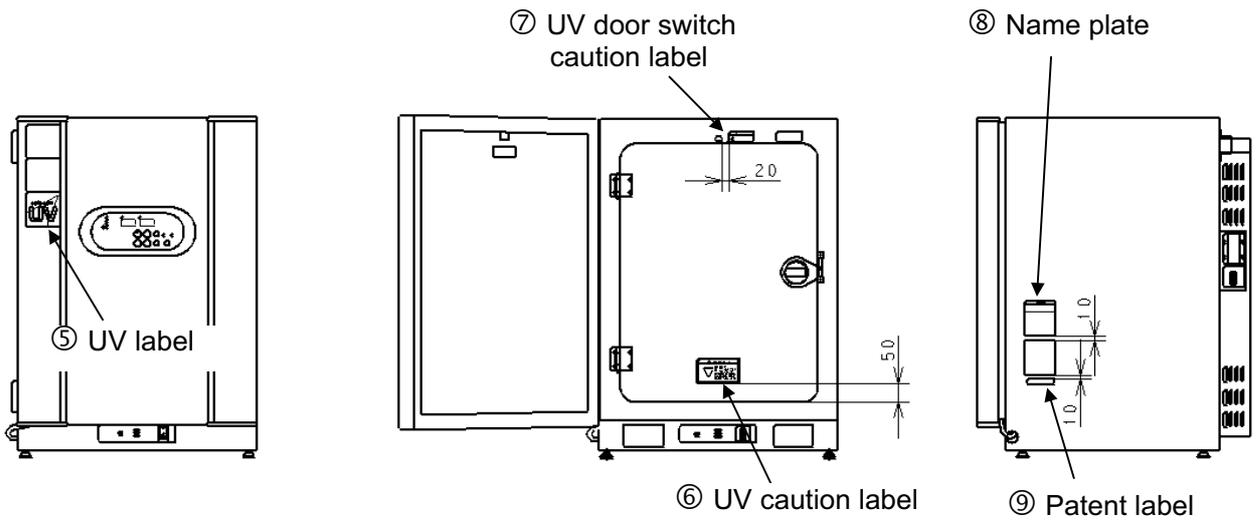


Fig.9

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.

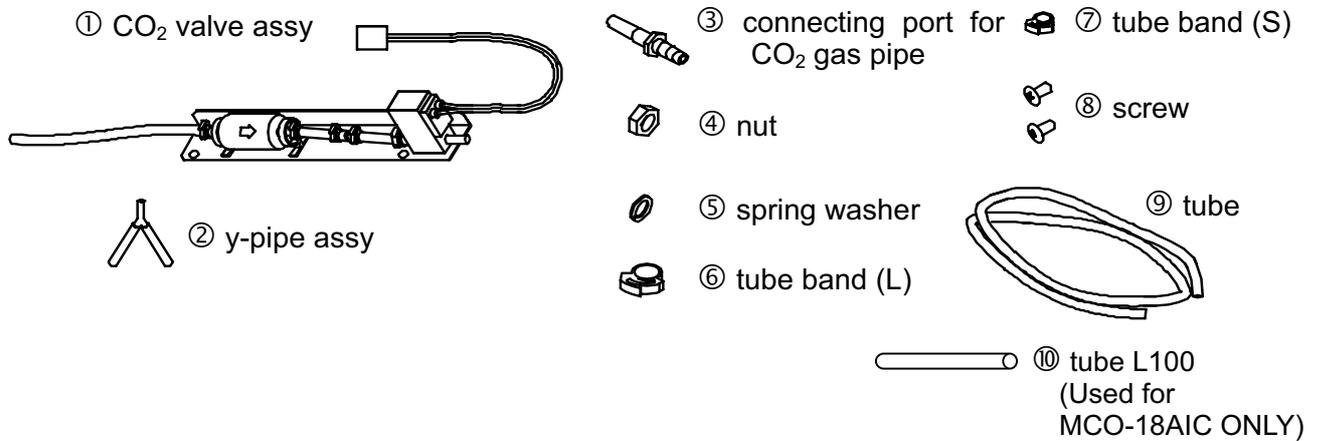
Check the UV lamp is turned on by the following procedure:

	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.

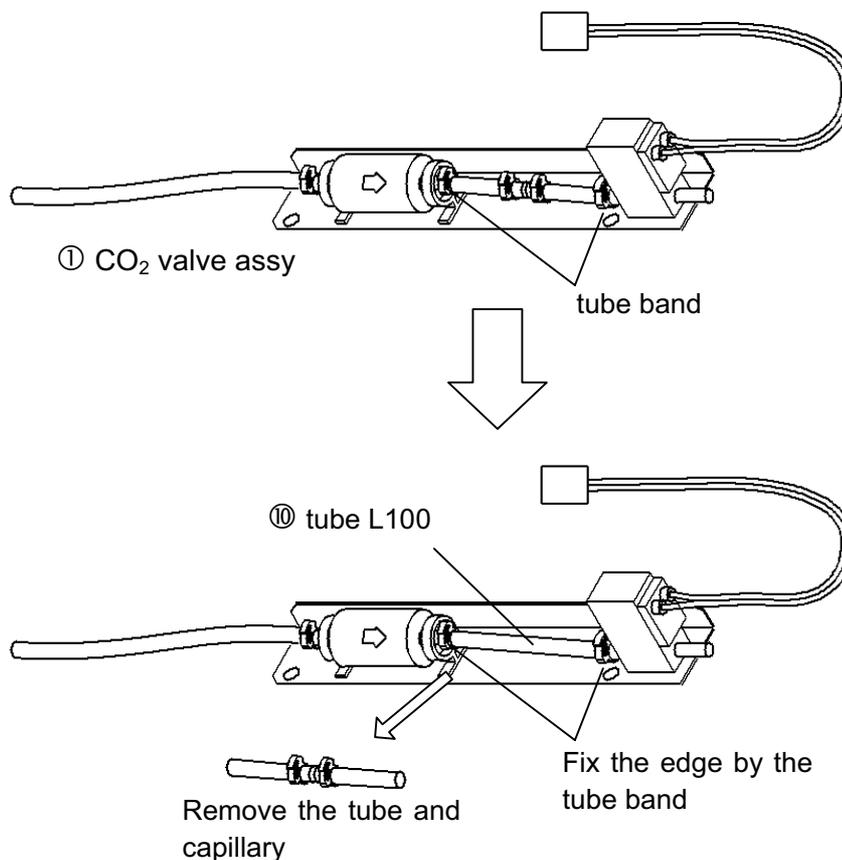
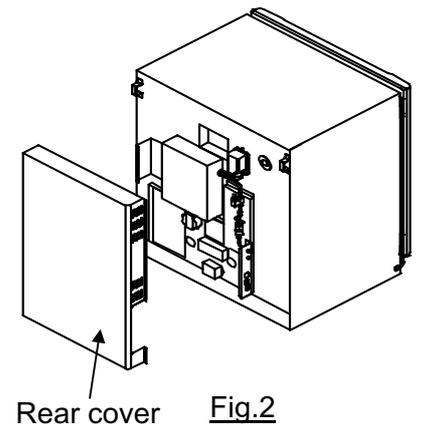


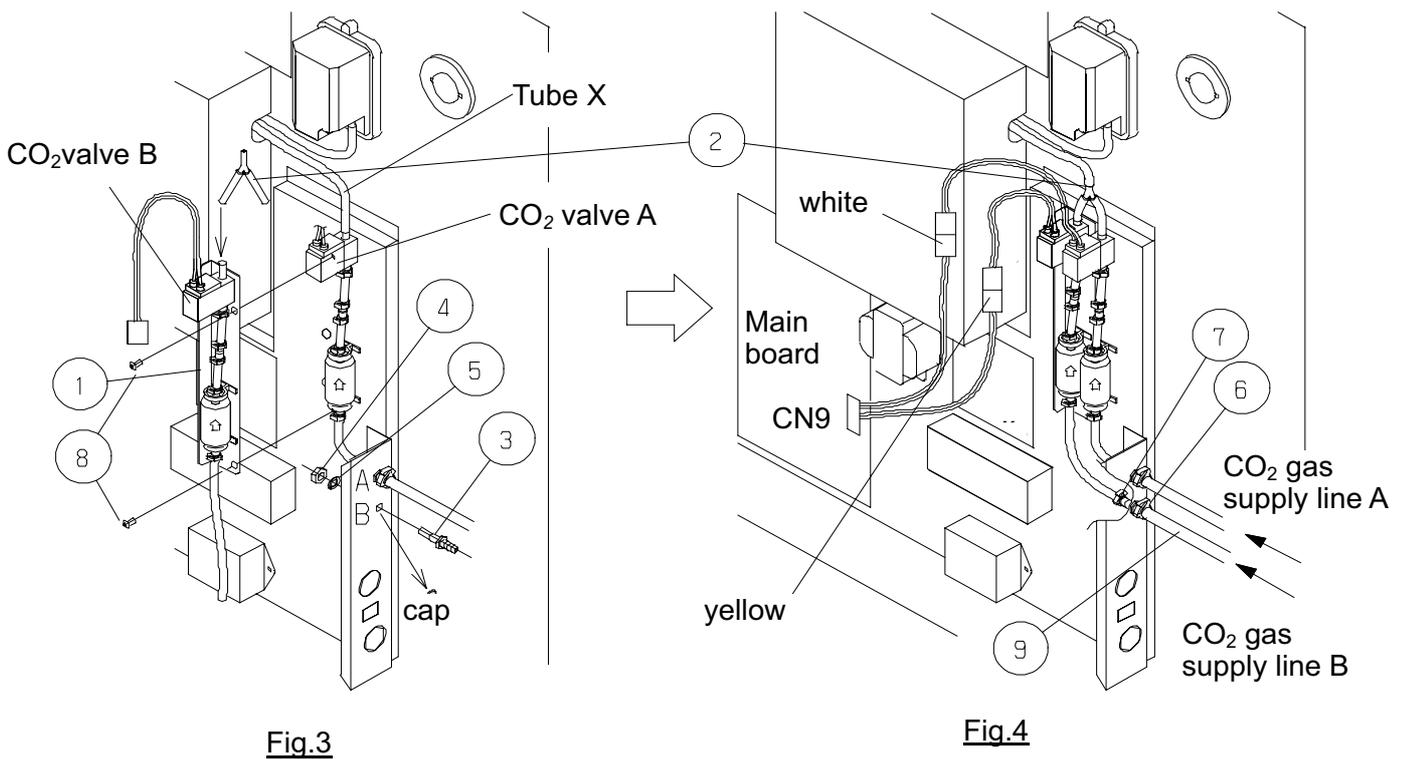
Fig.1

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.

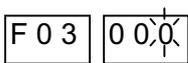
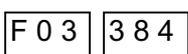
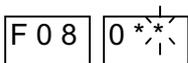


NOTE: Every tubes should be connected surely to prevent CO₂ leakage.



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.

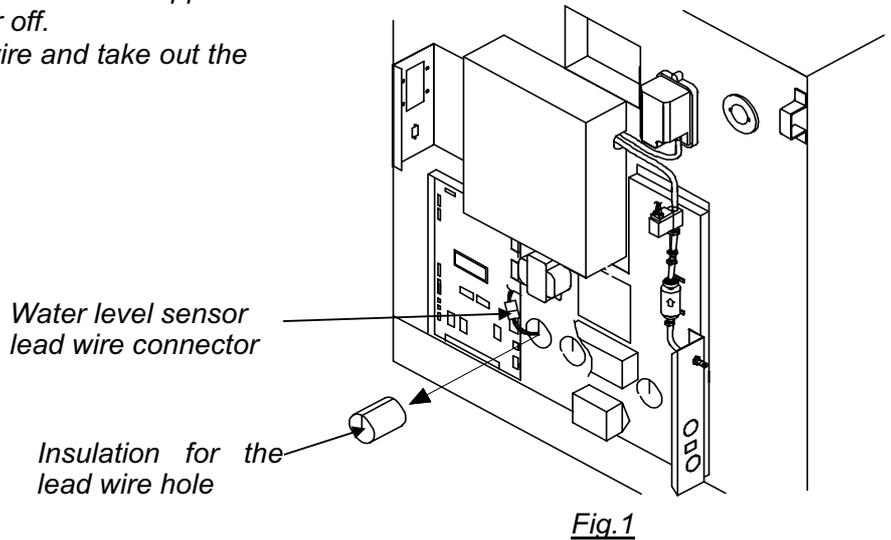
When the installation of MCO-21GC is completed, check the automatic gas switching operation according to the following to the following procedures.

	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.

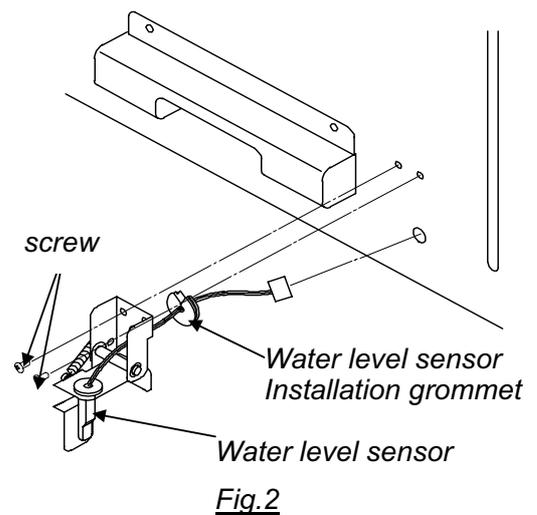
Refer to the MCO-20AIC/18AIC instruction manual for usage of MCO-21GC

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.

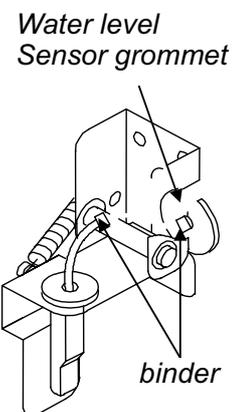


3. Take out the duct from inside.
 4. Unfasten the 2 screws to remove unit of water level sensor and installation grommets for water level sensor.
 5. replace water level sensor.
- Note** Be sure to set the water level sensor to the right direction.
6. Place back the water level sensor, Water sensor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



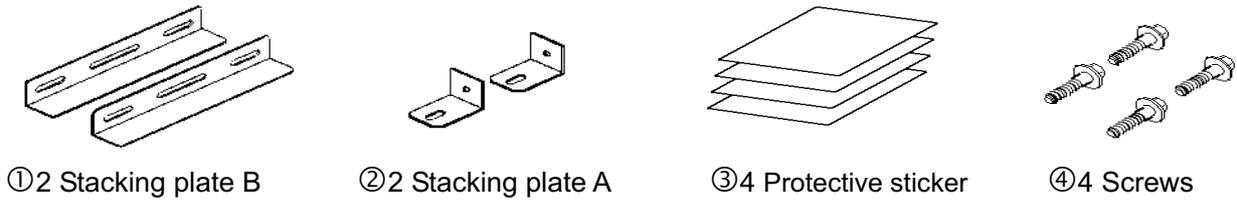
- Note** Be careful for the length of lead wire for water level sensor inside the unit Length is connect 2nd binder is located where it touches the water level sensor grommet.
(refer to Fig.3)

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.

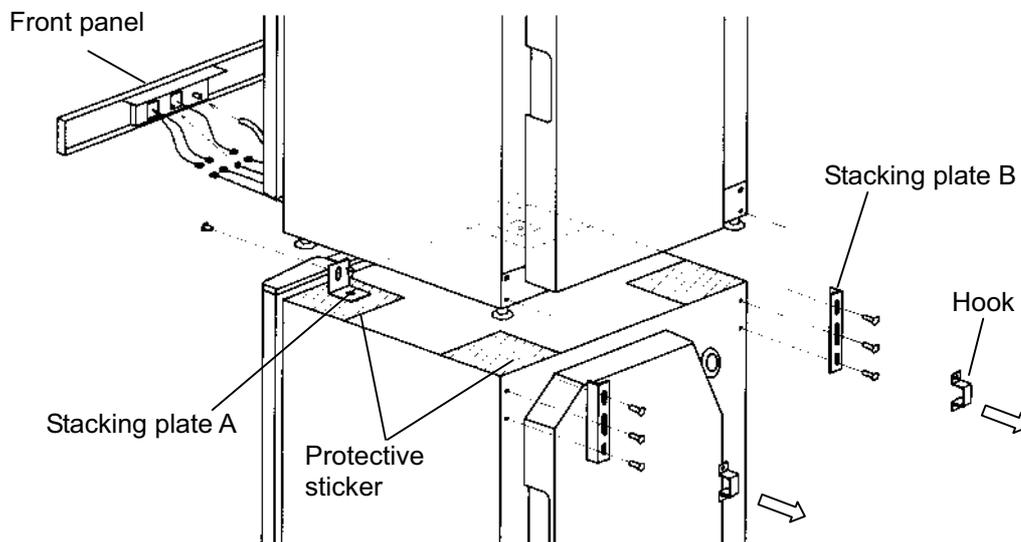


Fig.1

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

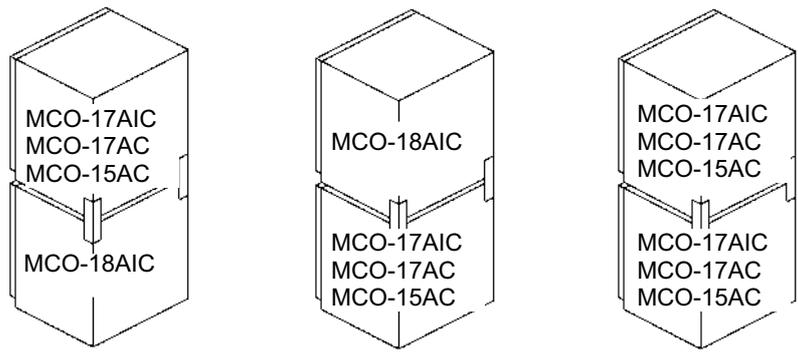


Fig.2

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.

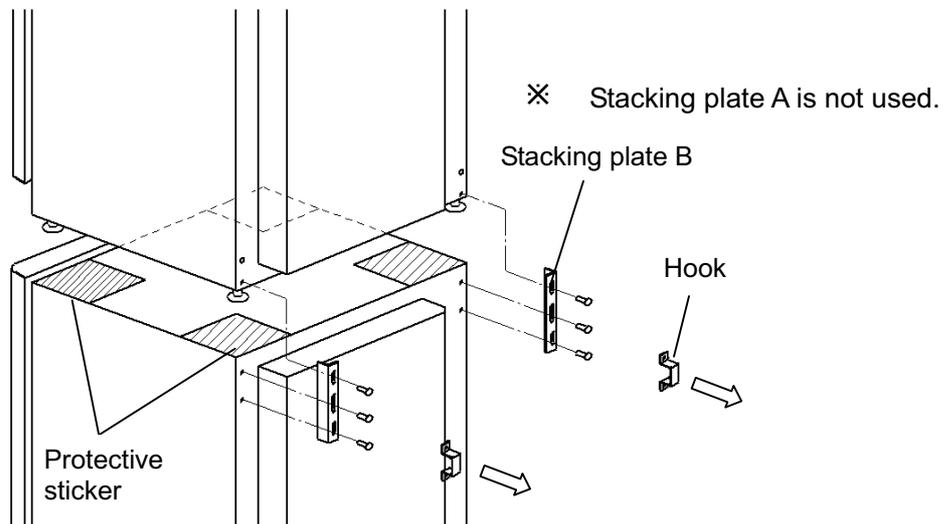


Fig.3

! 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.

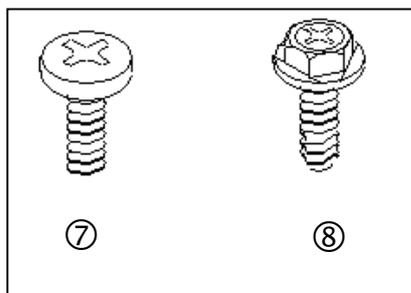
5. In case of stack MCO-18AIC

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

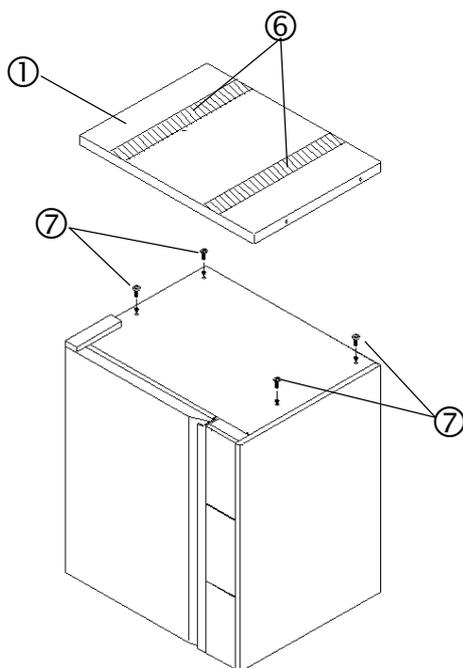


Fig.1

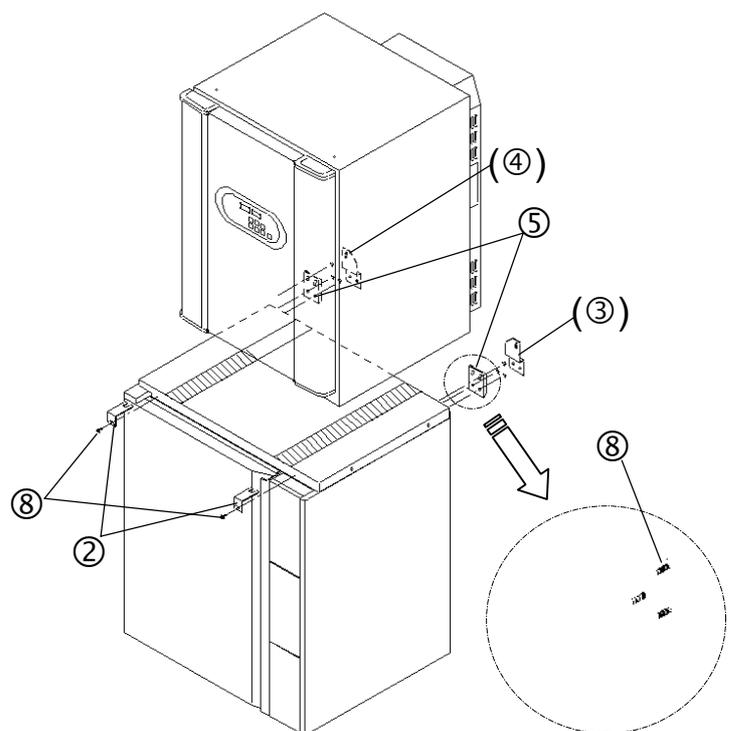


Fig.2

MCO-21SB Setting Procedure

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

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

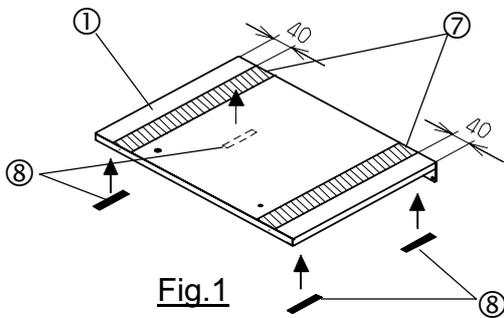
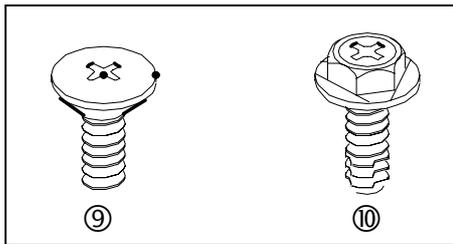


Fig.1

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

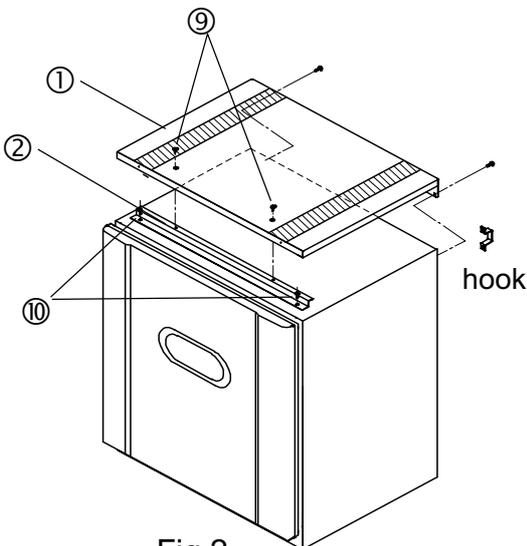


Fig.2

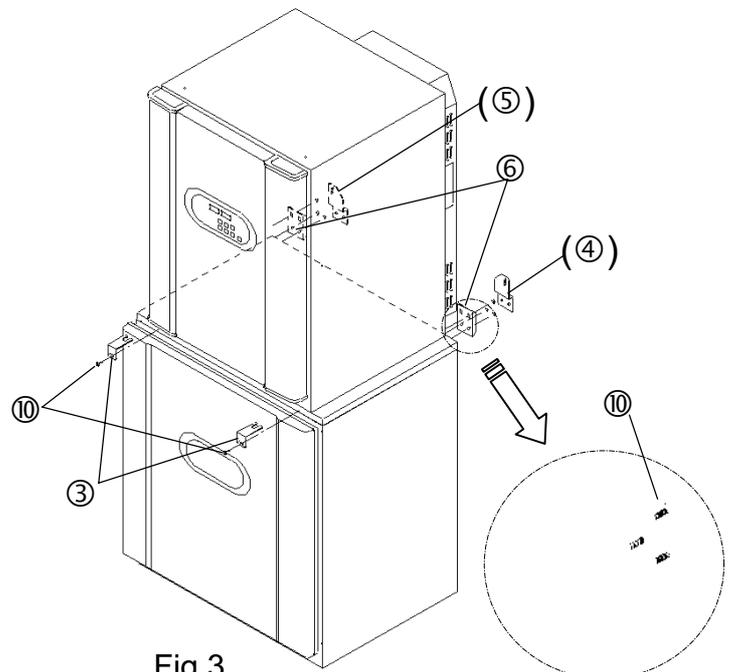


Fig.3