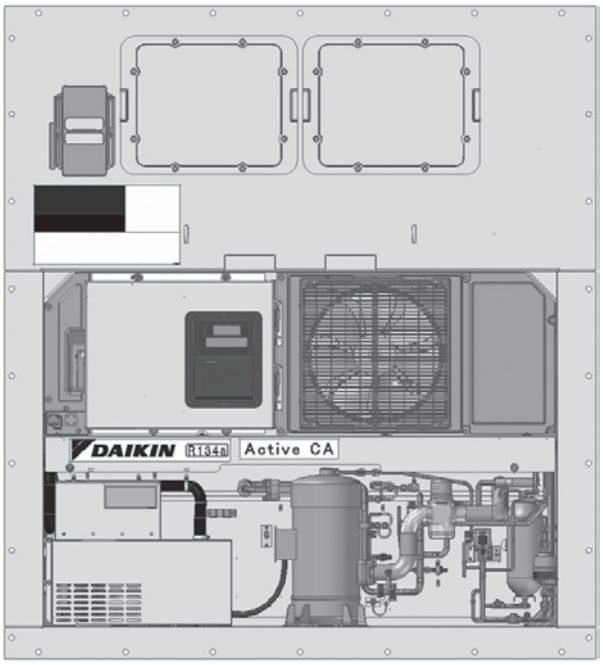
DAIKIN

# DAIKIN
# CA DEVICE FOR MARINE TYPE CONTAINER REFRIGERATION UNIT

## Service Manual




# DAIKIN Active CA
## LXCA04-6

**DAIKIN INDUSTRIES,LTD.**

TR 20-02

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**Remarks**
**At-a-Glance Handling Manual**

The contents of this service guide are current as of January 2020.
The contents may be changed without prior notice for purposes of improvement.

# "Handling Precautions"

☆ Before handling (operating/inspecting) this equipment, be sure to read "Handling Precautions" on the following pages carefully.

☆ The precaution symbols in the text are classified according to degrees of danger with regard to safety as shown in the table below.

| | |
|---|---|
| ⚠ **DANGER** | Failure to follow these instructions properly may result in imminent personal injury or loss of life. |
| ⚠ **WARNING** | Failure to follow these instructions properly may result in personal injury or loss of life. |
| ⚠ **CAUTION** | Failure to observe these instructions properly may result in property damage or personal injury, which may be serious depending on the circumstances. |

## Be sure to read this before operation and work.

This document lists the names of the parts that compose the CA device (LXCA4-6), how to turn on the power, how to change the settings, product functions, maintenance work, pre-transport inspections, and precautions for unloading cargo.

Refer to the following in addition to this manual.

| | | LXE10E | | LX10F |
|---|---|---|---|---|
| | | DECOS III h | DECOS III j | |
| Marine Container Refrigeration System Service Guide | Japanese | TR15-01 | TR17-12 | TR16-01 |
| | English | TR15-02 | TR17-13 | TR16-02 |
| | Spanish | - | TR17-14 | TR16-03 |
| | Chinese | TR15-06 | - | - |
| Parts List | Japanese/English | TR16-21 | TR17-28 | TR16-22 |
| PC Software Operation Guide | Japanese | TR08-04 | | |
| | English | TR08-05 | | |

## ⚠ DANGER Safety Precautions

**During CA operation, the inside of the container is in a state of low oxygen and high carbon dioxide, which is very dangerous.**
**Life cannot be sustained in a low oxygen or high carbon dioxide environment.**

The CA device adjusts the air composition as described in ① and ② below.

① Adjusts the oxygen volume in the container to 21% or less.

② Adjusts the carbon dioxide concentration to the atmospheric concentration (400 ppm) or higher by cargo respiration and filling with carbon dioxide gas.

Low oxygen and high carbon dioxide status cannot be identified visually or by smell. When entering the container equipped with CA device or opening the access panel, use a device that can properly detect oxygen and carbon dioxide, and confirm that the environment in the container is oxygen concentration: 21% and carbon dioxide concentration: 1% or less.

When entering the container or opening the access panel, be sure to operate according to the manual and warning labels.

## ⚠ DANGER Safety Precautions

<Effects of air composition concentration on the human body>

### Effects of hypoxia on the human body

| Oxygen concentration | Effects on the human body |
|---|---|
| 21% | Atmospheric concentration |
| 18% | Hard to breathe, requiring continuous ventilation |
| 16% | Increased respiration/heartbeat, headache, nausea, decreased concentration |
| 12% | Dizziness, nausea, muscle weakness, increased body temperature, falling due to loss of balance |
| 10% | Pallor, unconsciousness, bluish-purple skin and mucous membranes, vomiting |
| 8% | Syncope, coma, death in 7 to 8 minutes |
| 4% | Instantaneous fainting, respiratory arrest, convulsions, death in 1 minute |

### Effects of high dioxygenated carbon on the human body

| Carbon dioxide concentration | Effects on the human body |
|---|---|
| 400 ppm (0.04%) | Atmospheric concentration |
| 30,000 ppm (3%) | Difficulty breathing<br>Headache, nausea and mild narcosis<br>Decreased vision and increased blood pressure and heartbeat |
| 40,000 ppm (4%) | Severe headache |
| 50,000 ppm (5%) | Signs of toxicity appear after 30 minutes, causing headaches, dizziness, and sweating |
| 100,000 ppm (10%) | Syncope, coma, death in 1 minute |

## ⚠ DANGER Safety Precautions

### Preparations for entering containers equipped with CA device

1. Since the inside of the container may be adjusted to low oxygen and high carbon dioxide, ensure that **two or more people** work together when entering containers equipped with CA device.

2. The workers must first read and understand the "Safety Precautions" and the warning labels adhered to the container refrigeration system.

3. The workers should enter the container after ventilating and confirming the safety of the container using the specified operations and procedures.

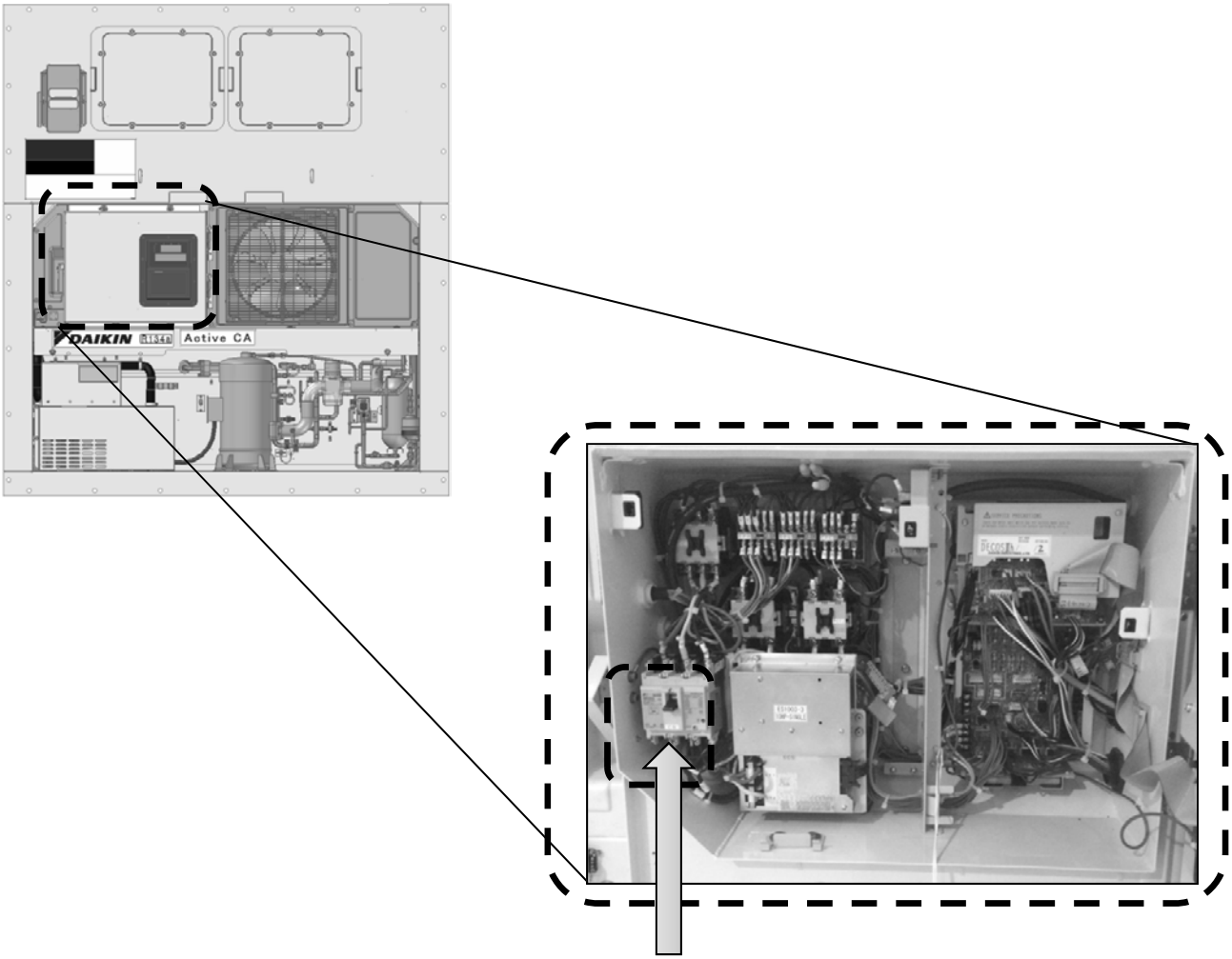
## ⚠ DANGER Inspection Precautions

**During inspection,**

- **Shut off the power supply on the equipment side and disconnect the power plug.**
- **Turn off the circuit breaker in the control box.**

- Even if the circuit breaker in the control box is turned OFF, power supply voltage is applied to the circuit breaker primary terminal, which may cause electric shock. Be careful not to touch it.
- Even if the fan is stopped, the condenser fan may start and stop automatically depending on the operating conditions, unless the circuit breaker is turned OFF. This is dangerous.
  Air cooling: The condenser fan starts and stops automatically due to high pressure control.

<For LXE10E>



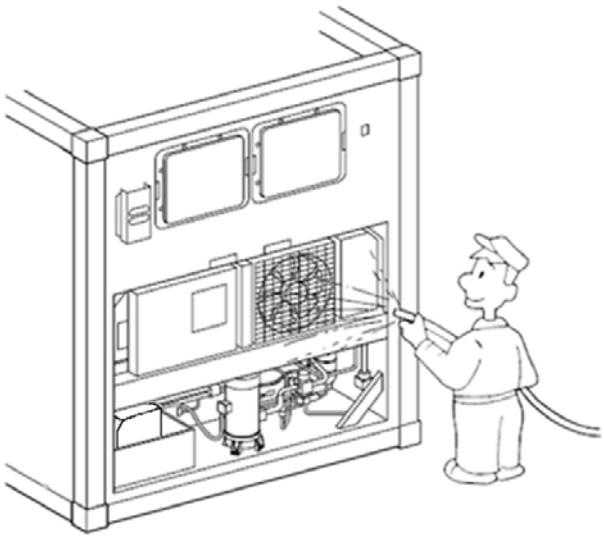
## ⚠ CAUTION Precautions before Operation

- When using a generator, make sure that the voltage from the generator is correct before operating the container refrigeration system. (Failure to do so may result in startup failure.)
- Close the control box door securely.
  (This is to prevent failure of electrical components due to an influx of water.)

## ⚠ CAUTION Precautions for Cleaning

During PTI (pre-trip inspection), be sure to clean the container refrigeration system with pure water.

1. Do not use a high pressure washer to clean the container refrigeration system.
2. Thoroughly clean the condenser, as a large amount of salt may be adhered.



## ⚠ CAUTION Precautions for Use

1. The inside evaporator's copper pipes, aluminum fins and the like may corrode due to cargo that generates corrosive gas, etc.
   Provide appropriate wrapping for the cargo.
   Typical corrosive gases include chlorine, ammonia, sulfuric acid, acetic acid and sulfur dioxide.

2. If corrosive gas contamination is present, such as when transporting fish, the $O_2$ sensor and $CO_2$ sensor may produce false detections, or the sensors may deteriorate.
   Typical corrosive gases include ammonia, sulfuric acid, sulfurous acid gas, hydrogen sulfide, ozone gas, hydrogen chloride and benzene.

# 1. Overview of Functions

- LXCA4-6 is a device that adjusts the oxygen concentration and carbon dioxide concentration in the container.
- Adjustment of oxygen concentration and carbon dioxide concentration
  Adjustment is done by combining the following three elements.

1. Low-concentration oxygen gas generated by suctioning the atmosphere with an air pump and adsorbing/desorbing nitrogen with the built-in adsorption cylinder is supplied to the container. (VPSA method(*))
2. Supplying atmosphere
3. Cargo respiration effect

(*) The VPSA method means Vacuum Pressure Swing Adsorption, in which adsorption is performed at atmospheric pressure and desorption is performed under vacuum, using two adsorption cylinders.

## 1.1 Operating Range

Use the container refrigeration system equipped with CA device within the operating range shown in the table below.
(Use outside this range may result in system failure or damage to the loaded cargo.)

| Item | Operating range |
|---|---|
| outdoor air temperature | -20˚C to +50˚C (-4°F to +122˚F) |
| Settable temperature | -5˚C to +20˚C (+23˚F to +68˚F) |
| Operating voltage | 50 Hz: 380/400/415 V, 60 Hz: 440/460 V<br>Voltage fluctuation range: ±10% |
| Vibration/impact | Horizontal: 5 G or less, Vertical: 2 G or less |

## 1.2 CA Device Product Specifications

| Item \ Model name | | | LXCA4-6 |
|---|---|---|---|
| Set concentration range | | $O_2$* | 1% to 21% |
| | | $CO_2$* | 1% to 17% |
| Sensor box | Sensor | $O_2$ sensor | Zirconia method |
| | | $CO_2$ sensor | NDIR (Non-Dispersive Infrared Gas Analyzer) |
| Air pump unit | Sensor | Temperature sensor | Thermistor |
| | | Pressure sensor | Semiconductor type |
| | Air pump motor | | Three-phase motor 160 W |
| | Adsorbent | | Zeolite |
| Air discharge valve (ADV) | | | Operation method: Open/close control |

*Remark: Set so that $O_2 + CO_2 \geq 8\%$.

## 1.3 Parts Configuration

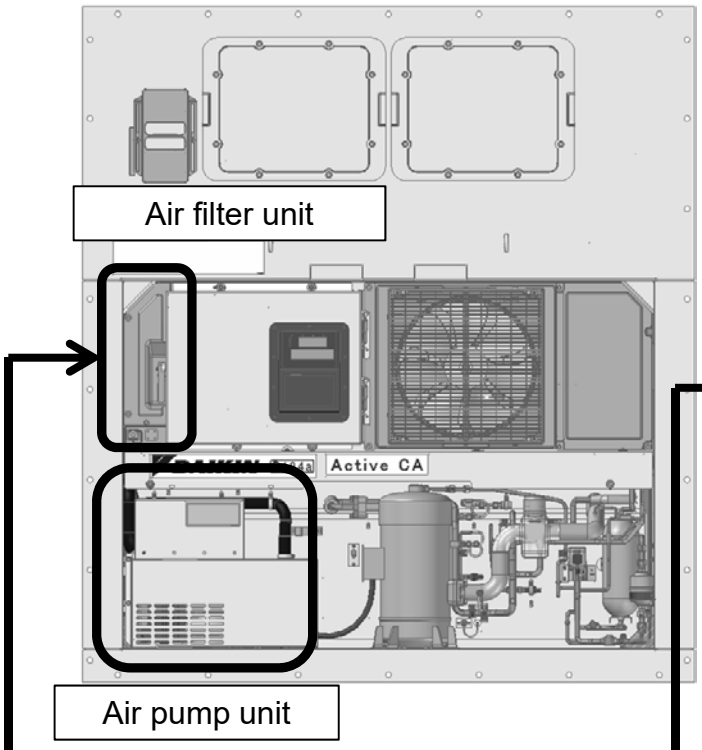
The parts configuration of the CA device is as follows.

◆ Outside
- Air pump unit
- Air filter unit

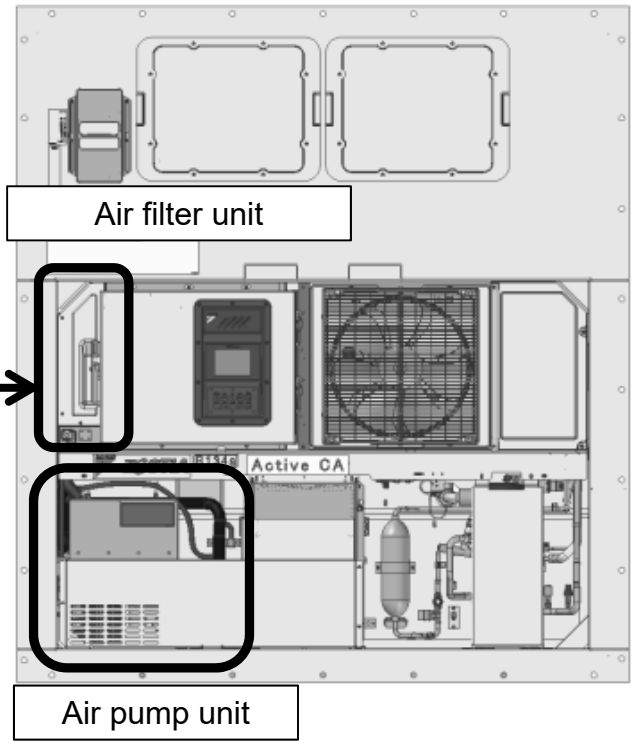
◆ Inside
- Sensor box
- Air discharge valve (ADV)

### 1.3.1 Parts Arrangement (Outside)

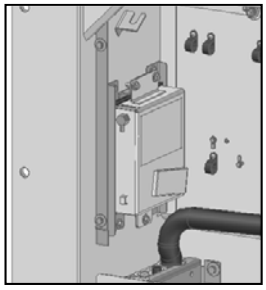
**LXE10E**



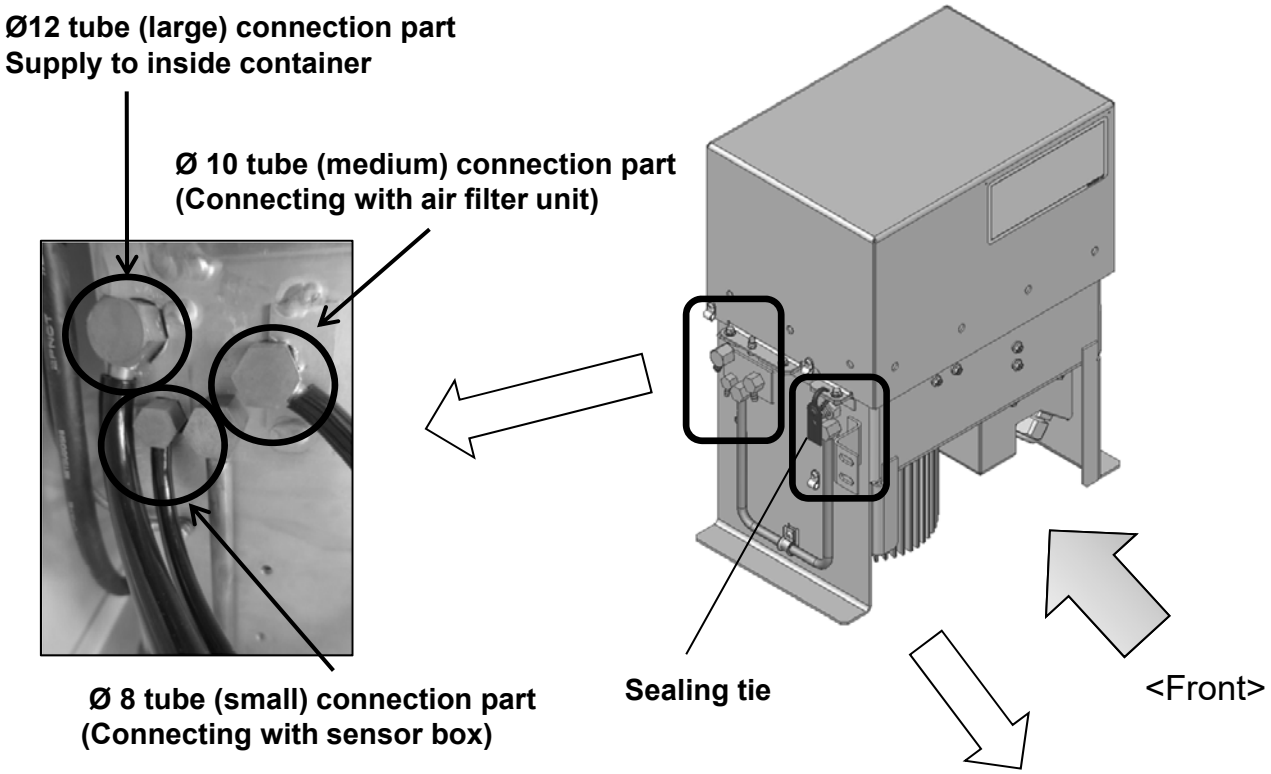

**LX10F**

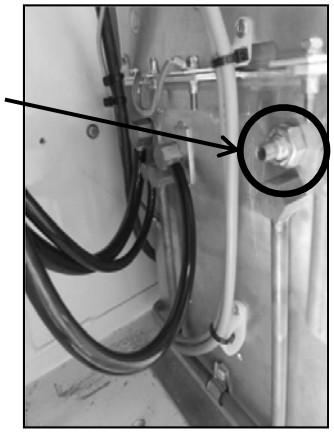


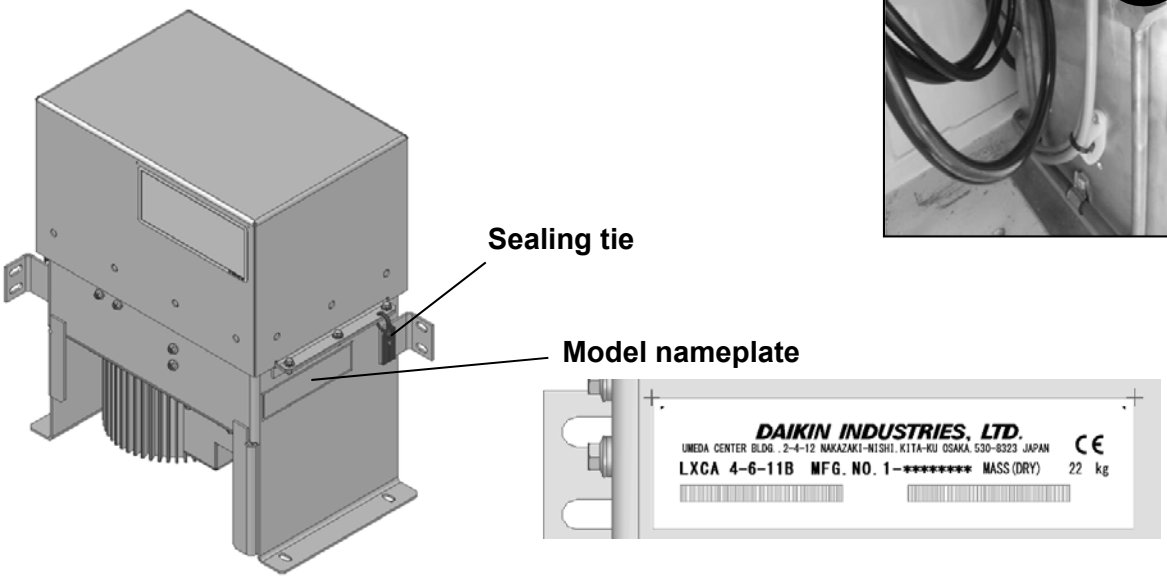

There is an air filter unit inside the cover.



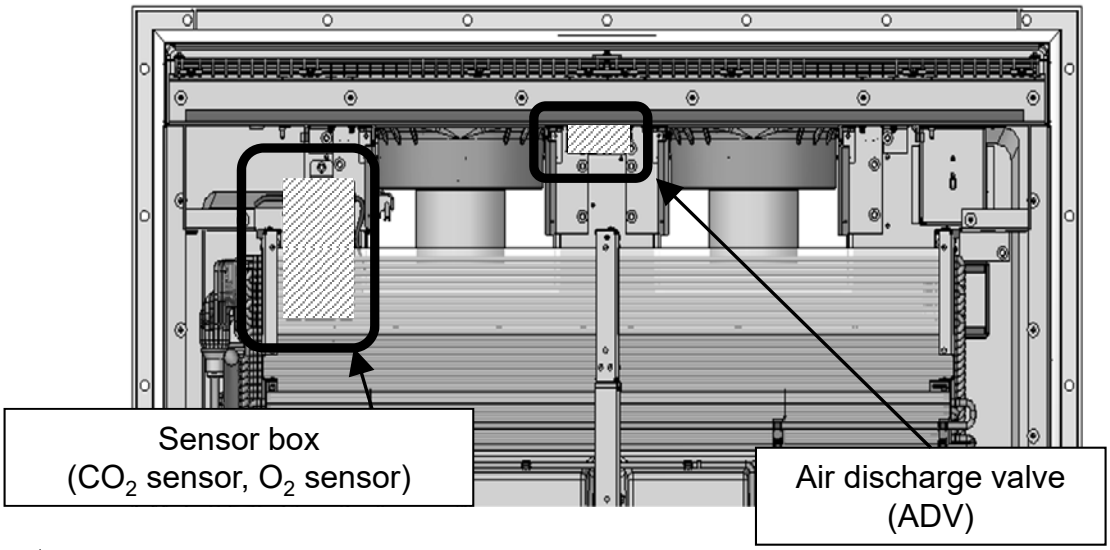
## ◆ Air pump unit



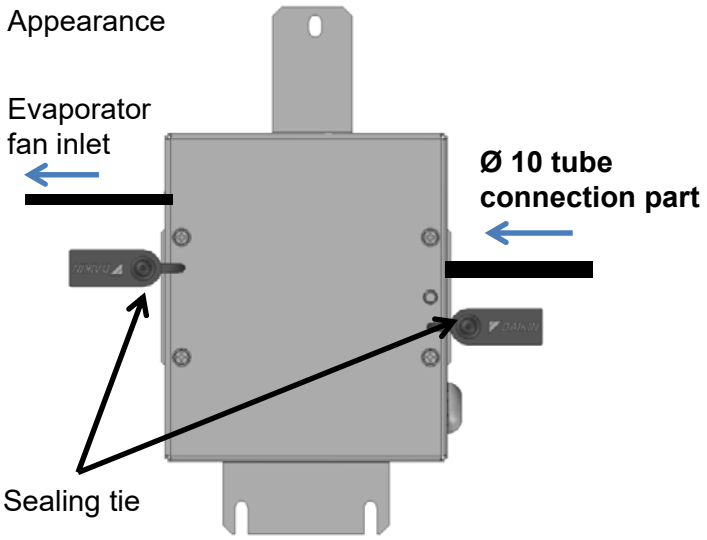



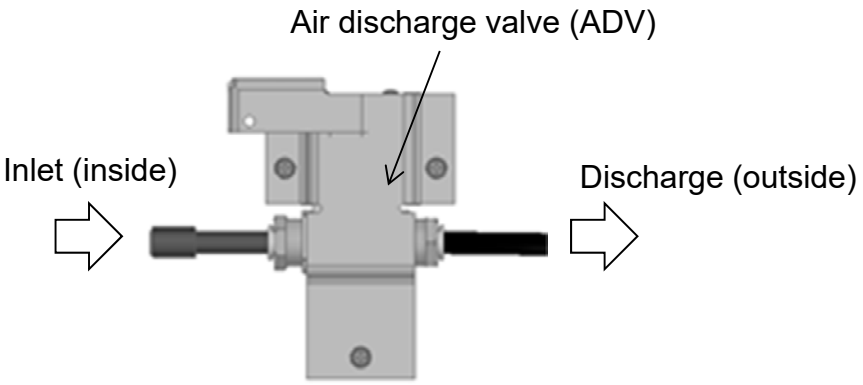
## 1.3.2 Parts Arrangement (Inside)




### ◆ Sensor box ( $CO_2$ sensor, $O_2$ sensor)

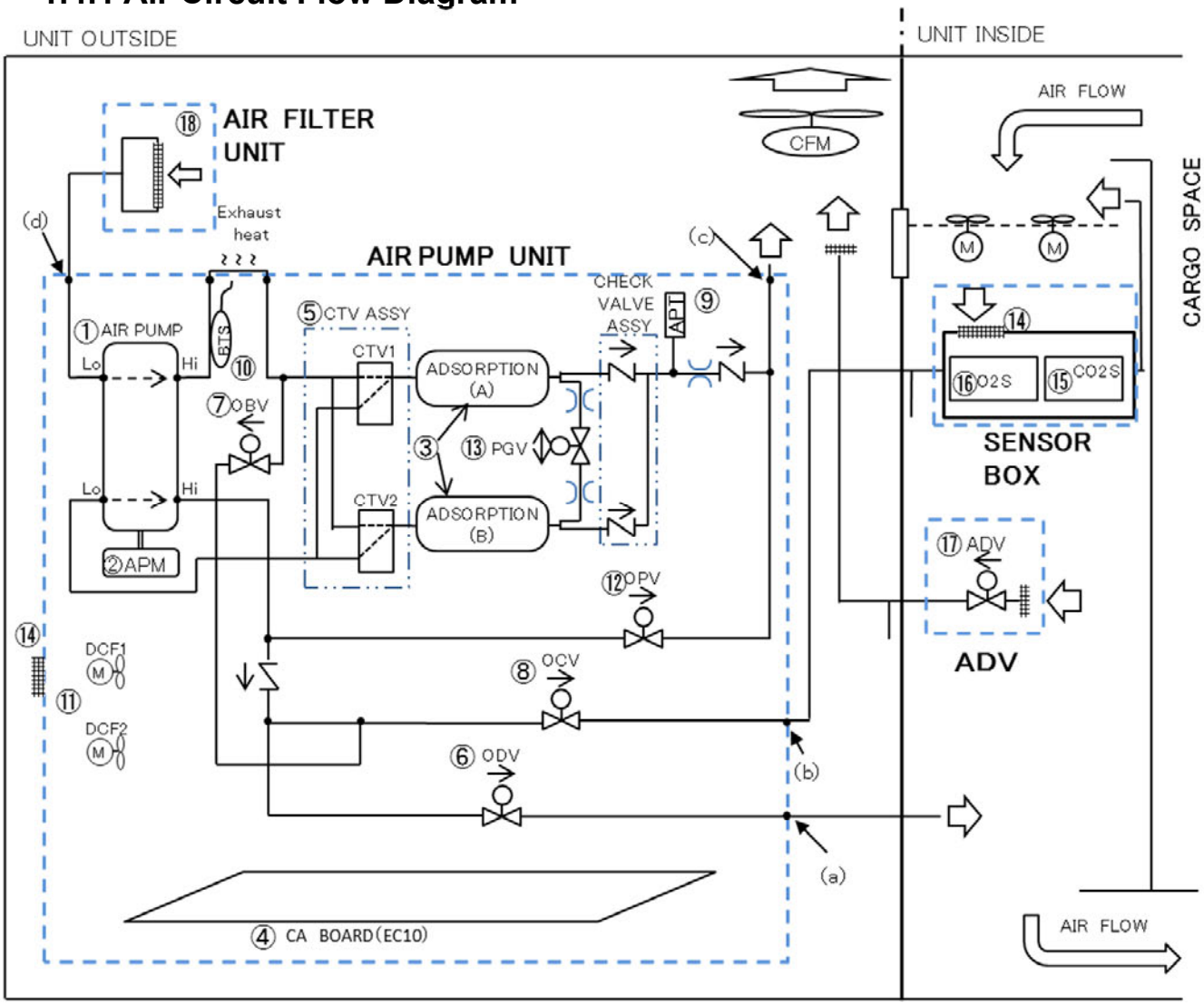



### ◆ Air discharge valve (ADV)



## 1.4 CA Device Parts Overview

### 1.4.1 Air Circuit Flow Diagram




| Class | Number | Code | Number | Code |
|---|---|---|---|---|
| Air pump Unit | ① | AIR PUMP | ⑦ | OBV |
| | ② | APM | ⑧ | OCV |
| | ③ | ADSORPTION (A) | ⑨ | APT |
| | | ADSORPTION (B) | ⑩ | BTS |
| | ④ | CA BOARD (EC10) | ⑪ | DCF1 DCF2 |
| | ⑤ | CTV1 | ⑫ | OPV |
| | | CTV2 | ⑬ | PGV |
| | ⑥ | ODV | ⑭ | Membrane filter |

| Class | Number | Code |
|---|---|---|
| Sensor box | ⑮ | CO2S |
| | ⑯ | O2S |
| Air discharge valve | ⑰ | ADV |
| Air filter Unit | ⑱ | AIR FILTER UNIT |

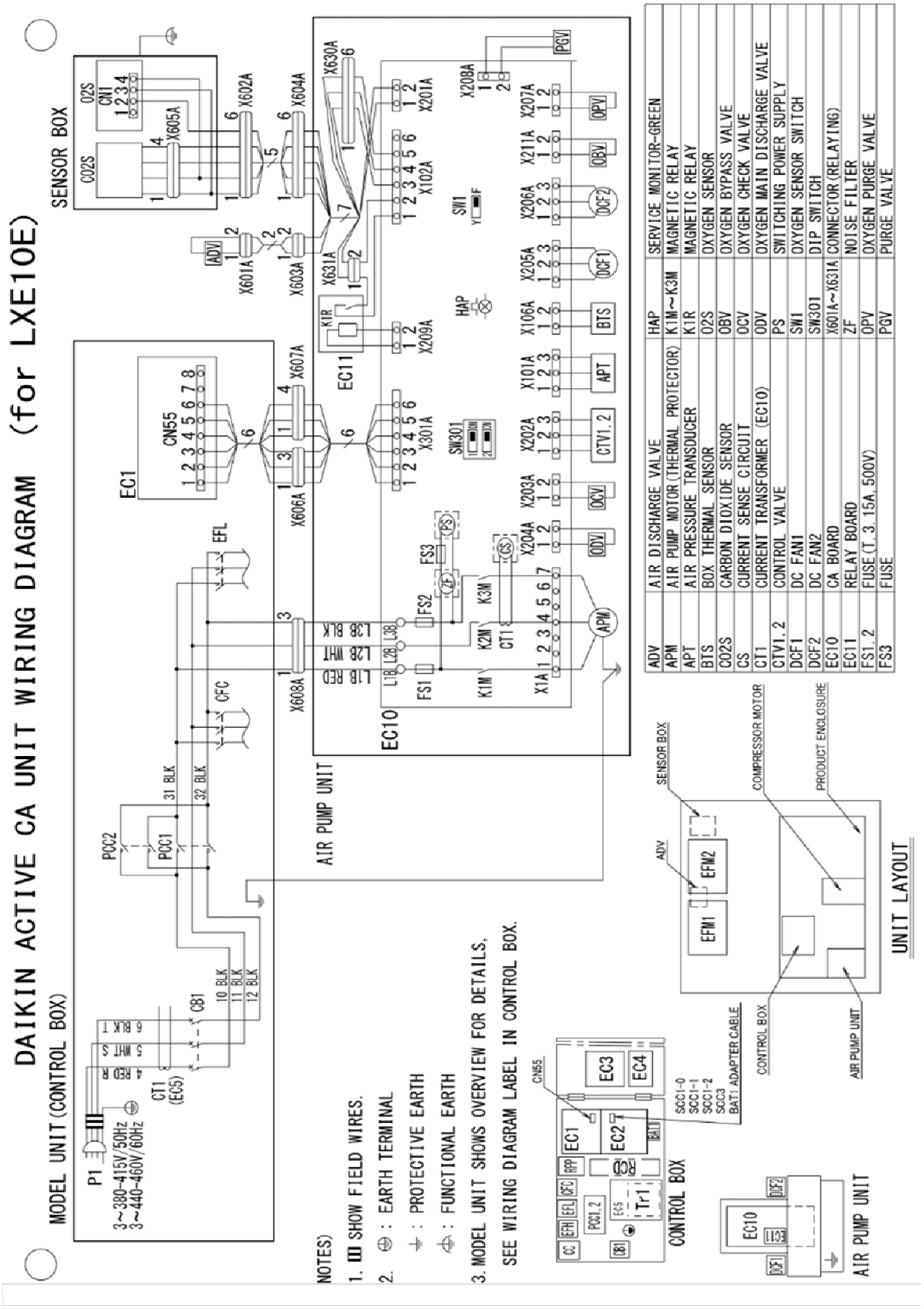
Orifice

## 1.4.2 Functions of Each Part

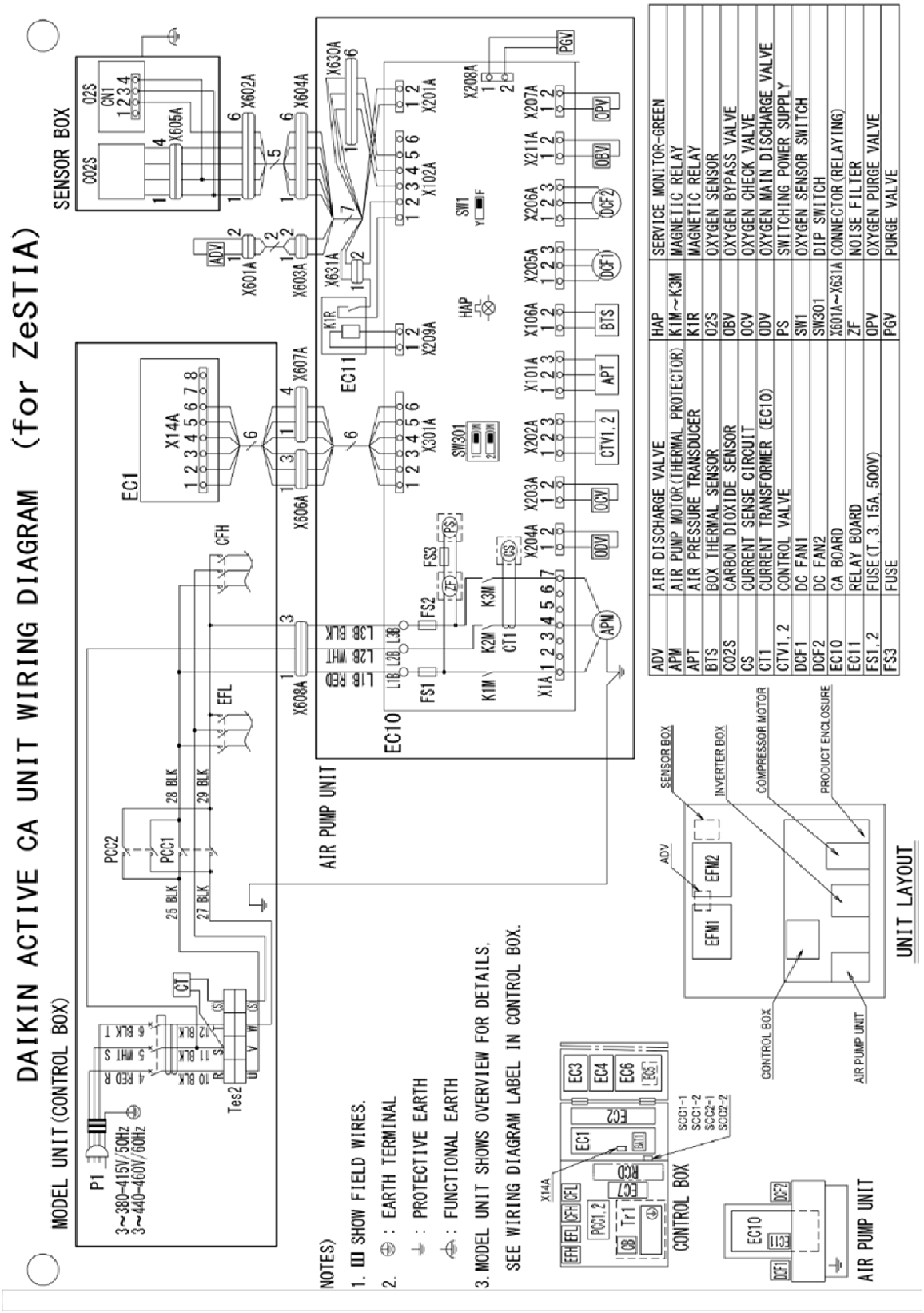
| Class | Number | Code | Name | Description |
|---|---|---|---|---|
| Air pump unit | ① | AIR PUMP | Air pump | Pump that supplies outside air into the container |
| | ② | APM | Air pump motor | Air pump drive motor |
| | ③ | ADSORPTION (T1) | Adsorption cylinder 1 | Adsorbs and desorbs atmospheric nitrogen |
| | | ADSORPTION (T2) | Adsorption cylinder 2 | |
| | ④ | EC10 | CA board | Controls CA device in linkage with the refrigerating machine CPU panel |
| | ⑤ | CTV1 | Control valve 1 | Solenoid valve that switches the air flow path between adsorption cylinder 1 and adsorption cylinder 2 |
| | | CTV2 | Control valve 2 | |
| | ⑥ | ODV | Oxygen main discharge valve | Solenoid valve that supplies low concentration $O_2$ gas into the container |
| | ⑦ | OBV | Oxygen bypass valve | Solenoid valve that supplies outside air into the container |
| | ⑧ | OCV | Oxygen check valve | Switching valve that supplies gas to the $O_2$ sensor (⑯ O2S) and $CO_2$ sensor (CO2S) |
| | ⑨ | APT | Air pressure transducer | Sensor that measures the high pressure side discharge pressure |
| | ⑩ | BTS | Box thermal sensor | Sensor that measures the interior temperature of the air pump unit |
| | ⑪ | DCF1<br>DCF2 | DC fan 1<br>DC fan 2 | Air cooling fan inside the air pump unit<br>ON when the CA device is in operation (with start/stop)<br>OFF when the CA device is stopped |
| | ⑫ | OPV | Oxygen purge valve | Switching valve that discharges $O_2$ gas from the adsorption cylinder out of the container |
| | ⑬ | PGV | Purge valve | Switching valve that purges $O_2$ gas from one absorption cylinder to the other |
| | ⑭ | Membrane filter | - | Filter for preventing foreign matter (seawater and drainage) from entering the system<br>• Air pump cooling part<br>• $O_2$ sensor part |
| Sensor box | ⑮ | CO2S | Carbon dioxide sensor | Sensor that measures carbon dioxide concentration in the container |
| | ⑯ | O2S | Oxygen sensor | Sensor that measures oxygen concentration in the container |
| Air discharge valve | ⑰ | ADV | Air discharge valve | Switching valve that discharges gas from the container interior to the outside |
| Air filter unit | ⑱ | Air filter unit | - | Filter for preventing foreign matter (seawater and drainage) from entering the system<br>• Air pump suction part |

## 1.4.3 CA Device Electric Circuits

### ◆ Electric circuit (LXE10E)



## ◆ CA device electric circuit (LX10F)




| | | | |
|---|---|---|---|
| ADV | AIR DISCHARGE VALVE | HAP | SERVICE MONITOR-GREEN |
| APM | AIR PUMP MOTOR (THERMAL PROTECTOR) | K1M~K3M | MAGNETIC RELAY |
| APT | AIR PRESSURE TRANSDUCER | K1R | MAGNETIC RELAY |
| BTS | BOX THERMAL SENSOR | O2S | OXYGEN SENSOR |
| CO2S | CARBON DIOXIDE SENSOR | OBV | OXYGEN BYPASS VALVE |
| CS | CURRENT SENSE CIRCUIT | OCV | OXYGEN CHECK VALVE |
| CT1 | CURRENT TRANSFORMER (EC10) | ODV | OXYGEN MAIN DISCHARGE VALVE |
| CTV1, 2 | CONTROL VALVE | PS | SWITCHING POWER SUPPLY |
| DGF1 | DC FAN1 | SW1 | OXYGEN SENSOR SWITCH |
| DGF2 | DC FAN2 | SW301 | DIP SWITCH |
| EC10 | CA BOARD | X601A~X631A | CONNECTOR (RELAYING) |
| EC11 | RELAY BOARD | ZF | NOISE FILTER |
| FS1, 2 | FUSE (T, 3.15A, 500V) | OPV | OXYGEN PURGE VALVE |
| FS3 | FUSE | PGV | PURGE VALVE |

## 1.4.4 Protective devise (CA device)

### ◆ Air pump unit

| Device name | Set value |
|---|---|
| Air pump built-in relief valve | 250 kPa ± 15% open |
| Air pump motor built-in protection thermostat | OFF: 145 ± 5℃ (293 ± 9°F)<br>ON: 95 ± 15℃ (203 ± 27°F) |

### ◆ Current protection fuse

| Part code | Model | Purpose |
|---|---|---|
| FS1 FS2 | 3.15 A 500 V | Main circuit protection<br>(R phase, T phase) |
| FS3 | 1.0 A 500 V | Control circuit protection |

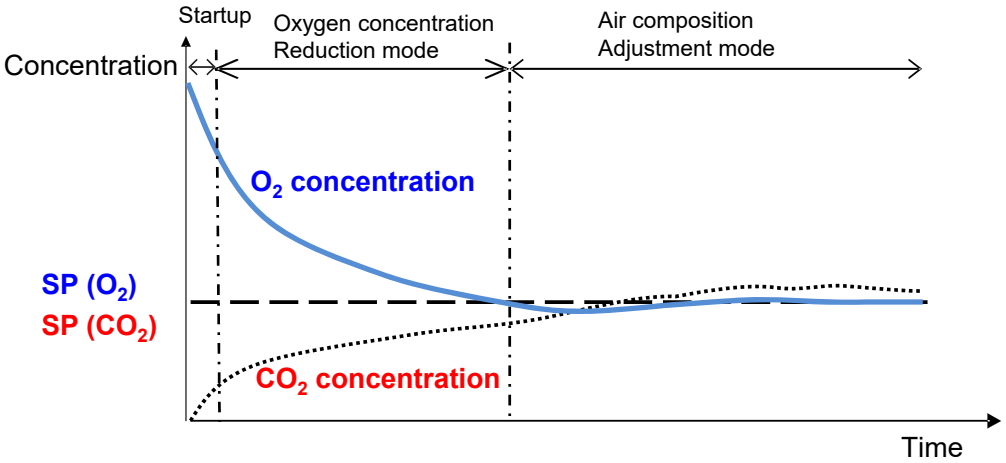
## 1.5 CA Control

### 1.5.1 CA Mode Operation (standard)

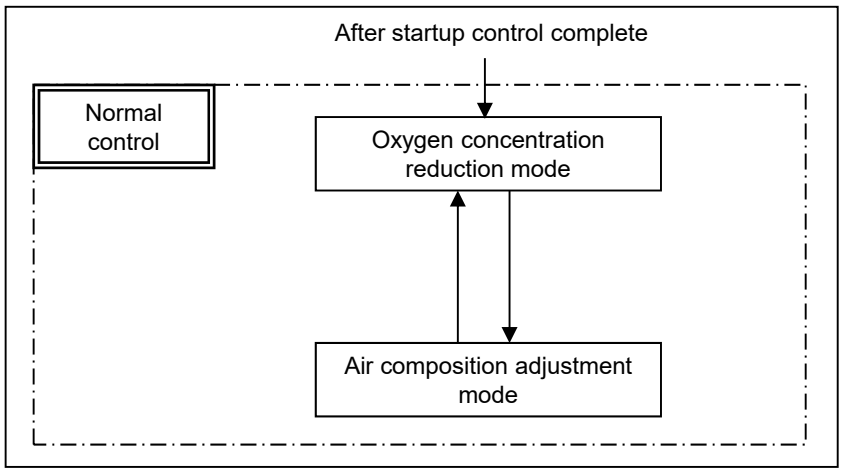
Controlling air composition by switching between oxygen concentration reduction mode and air composition adjustment mode.

1) Oxygen concentration reduction mode
   In this operation mode, the $O_2$ concentration is brought closer to the set concentration through low-concentration oxygen gas supply and cargo respiration.
   (After the CA device starts, it automatically transitions to "oxygen concentration reduction mode".)

2) Air composition adjustment mode
   In this operation mode, $O_2$ and $CO_2$ concentrations are adjusted by ventilation through low-concentration oxygen gas supply and outside air supply, as well as cargo respiration.
   (When the $O_2$ concentration reaches the set concentration, it automatically transitions to "air composition adjustment mode".)




■ Transitioning between oxygen concentration reduction mode and air composition adjustment mode




3) Carbon dioxide concentration reduction mode
   This operation mode prioritizes $CO_2$ concentration reduction over $O_2$ concentration adjustment during high $CO_2$ concentration.
   When the setting below is ON and the $CO_2$ concentration is high, the mode transitions to "Carbon dioxide concentration reduction mode."
   LXE10E: 2.2.7 [Optional Function Setting] <$CO_2$ emission control settings>
   LX10F: 3.2.4 [Configuration Setting] <$CO_2$ emission control settings>

## 1.5.2 CA Mode Operation (High $CO_2$ Concentration Transport)

Control for cargo requiring high $CO_2$ concentration.
It is possible to maintain the adjusted $CO_2$ concentration in the container before transportation.
It is set automatically when the set $CO_2$ concentration is 11% or higher.

1) Oxygen concentration reduction mode
   In this operation mode, the $O_2$ concentration is brought closer to the set concentration through low-concentration oxygen gas supply and cargo respiration.
   (After the CA device starts, it automatically transitions to "oxygen concentration reduction mode".)

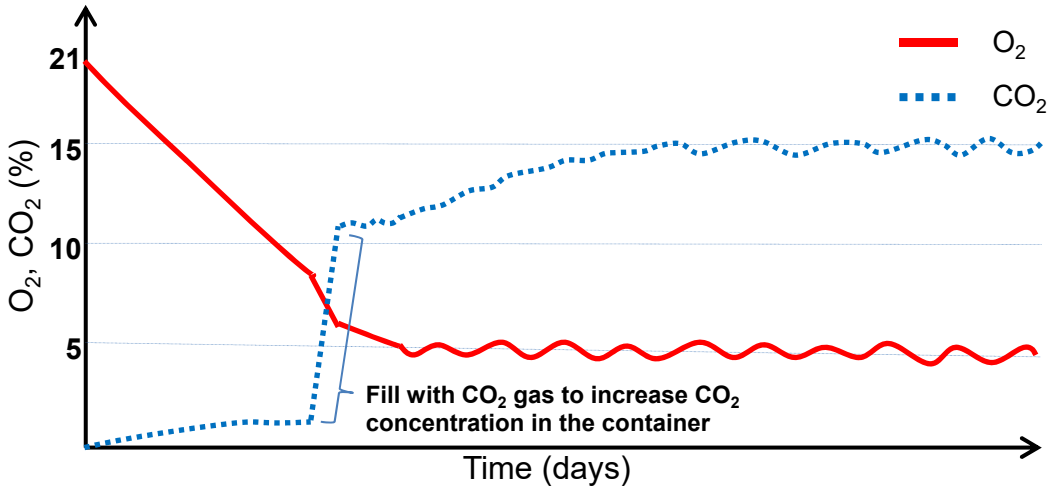
2) Air composition adjustment mode
   In this operation mode, $O_2$ and $CO_2$ concentrations are adjusted by ventilation through low-concentration oxygen gas supply and outside air supply, as well as cargo respiration.
   (When the $O_2$ concentration reaches the set concentration, it automatically transitions to "air composition adjustment mode".)

3) Carbon dioxide concentration reduction mode
   This operation mode prioritizes $CO_2$ concentration reduction over $O_2$ concentration adjustment when the set $CO_2$ concentration is exceeded.
   When the above conditions are met with the $CO_2$ emission control setting ON, the mode transitions to "Carbon dioxide concentration reduction mode."
   LXE10E: 2.2.7 [Optional Function Setting] <CA-AIR>
   LX10F: 3.2.4 [Configuration Setting] <CA Air Mode for $CO_2$>

● Operation method

1. Operate the CA device with the set $CO_2$ concentration at 11% or above.
2. When the $O_2$ concentration falls below the set $O_2$ concentration +3%, <u>manually</u> fill with $CO_2$ gas until the $CO_2$ concentration becomes 10% or more.
   (For details on how to fill with $CO_2$, see "6.5 Filling the Container with Gas ($N_2$, $CO_2$, etc.) ")
3. The mode automatically transitions to carbon dioxide concentration adjustment mode.

Example:
Set $O_2$ concentration: 5%
Set $CO_2$ concentration: 15%




**CAUTION**

● Mount curtains, as high airtightness is required.
● When $CO_2$ is injected with $O_2$ concentration of +3% or more, it may take time to lower the $O_2$ concentration.
● When the container is filled with $CO_2$ gas too vigorously, the $CO_2$ concentration in the container may not be detected correctly.
The filling time should be about 60 minutes. Fill over time until the $CO_2$ concentration in the container becomes 11% or more.

## 1.6 Combined Use of CA Device with Other Functions

✓ : Available
- : Unavailable
▲ : Available with conditions *1

| DECOS III h Software ver. "26xx" Ver.2677 or later | Dehumidification | G-set | USDA | Bulb mode | DTMSII | ASC mode | ACT mode |
|---|---|---|---|---|---|---|---|
| CA mode | ✓ | ✓ | - | - | - | - | - |
| C-EFL set | - | ✓ | - | - | - | - | - |

| DECOS III j Software ver. "27xx" Ver.2711 or later | Dehumidification | G-set | USDA | Bulb mode | DTMSII | ASC mode | ACT mode |
|---|---|---|---|---|---|---|---|
| CA mode | ✓ | ✓ | ✓ | - | - | ▲ | ▲ |
| C-EFL set | - | ✓ | - | - | - | - | - |

| DECOS Va Software ver. "30xx" Ver.3043 or later | Dehumidification | G-set | USDA | Bulb mode | Fan Speed Control | ASC mode | ACT mode |
|---|---|---|---|---|---|---|---|
| CA mode | ✓ | ✓ | ✓ | - | - | ▲ | ▲ |
| C-EFL set | - | ✓ | - | - | - | - | - |

Note 1) If the controller setting is DECOSIIIg or earlier, the CA device cannot be operated.
Note 2) When the valve mode is "ON", the CA menu will not be displayed and CA operation is not available.

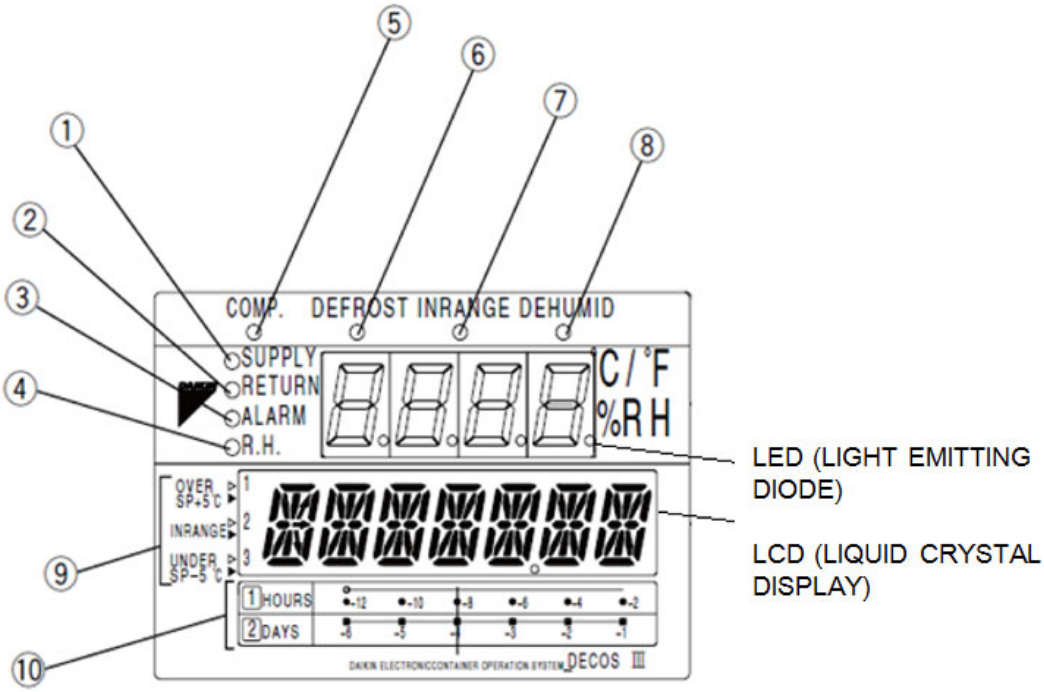
*1: Can be used at -5.0 ≤ SP ≤ +20.0˚C when CA mode = ON or DSP (Display)
• CA mode setting cannot be changed while ASC is running
• CA mode setting cannot be changed while ACT is running

# 2. Operation (LXE10E)

The CA device is operated via the operation panel of the container refrigeration system control box.

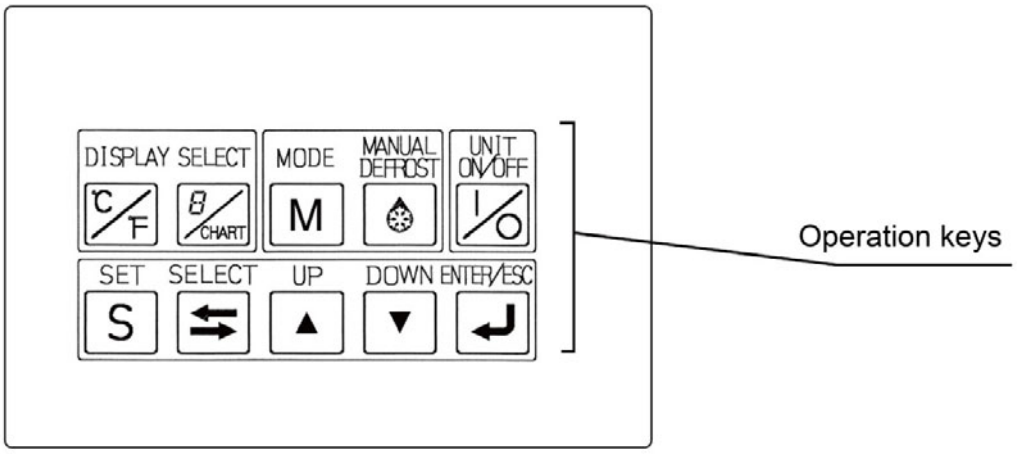
## 2.1 Basic Controller Operation

### ◆ Control panel names and functions




| No. | Name | Details |
|---|---|---|
| ① | SUPPLY LED | Lights up when outlet air temperature is displayed |
| ② | RETURN LED | Lights up when inlet air temperature is displayed |
| ③ | ALARM LED | Blinks when an alarm is generated |
| ④ | R.H.LED | Lights up when humidity is displayed |
| ⑤ | COMP.LED | Lights up when the compressor is running |
| ⑥ | DEFROST LED | Lights up during defrost operation |
| ⑦ | IN RANGE LED | Lights up when control temperature is in range. |
| ⑧ | DE-HUMID.LED | Lights up during dehumidification control (optional) |
| ⑨ | Temperature axis range | Used to display charts on the LCD screen |
| ⑩ | Time axis range | Used to display charts on the LCD screen |

## ◆ Names and functions of operation keys



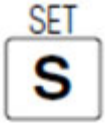
● UNIT ON/OFF key
Stops the operation of the unit.
The controller stores the unit ON/OFF status when the power is turned off.
If the power is turned OFF while the unit is on, the operation will start automatically even if the unit is not turned ON the next time the power is turned on.
If the power is turned off when the unit is turned OFF, operation will not start unless the unit is turned ON.

● UP key
Used to move among items to be displayed.

● DOWN key
Used to move among items to be displayed.

● ENTER/ESCAPE key
Used to determine the contents to be set or displayed.

● MODE key
Performs the following control.
① G-set setting (= power consumption reduction control)
② Automatic pump down
③ Dehumidification setting, CA mode setting

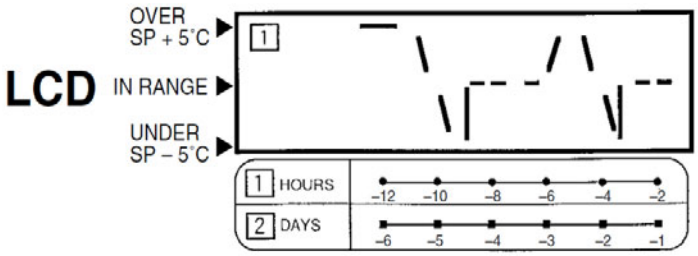



● SET key
Power ON: ① Transitions from current display mode to operation setting mode.
② Transitions between setting items in operation setting mode.
Power OFF: ① Transitions from power OFF mode to battery mode.

● SELECT key
Not used in basic operations.
Used when performing maintenance work.

## The following keys are not used for CA operation

● CHART key (display select key)
Display set temperature, etc., and press this key to display a simple graph of the recorded temperature data on the LCD screen. Pressing this key again returns to the set temperature.

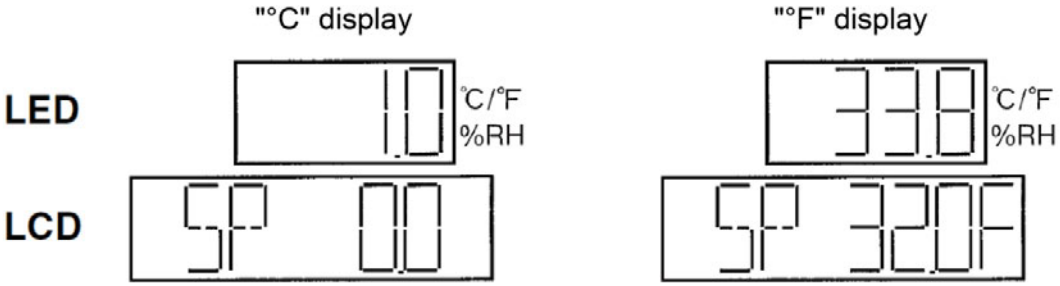


● Temperature unit switching key

① Displays the temperature data to be displayed as "°F" on the LED and LCD screen.

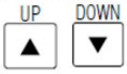
② is pressed to change the temperature data from "°C" to "°F" display for 1 minute.

* If other keys are pressed while "°F" is displayed, the screen will return to "°C" display.



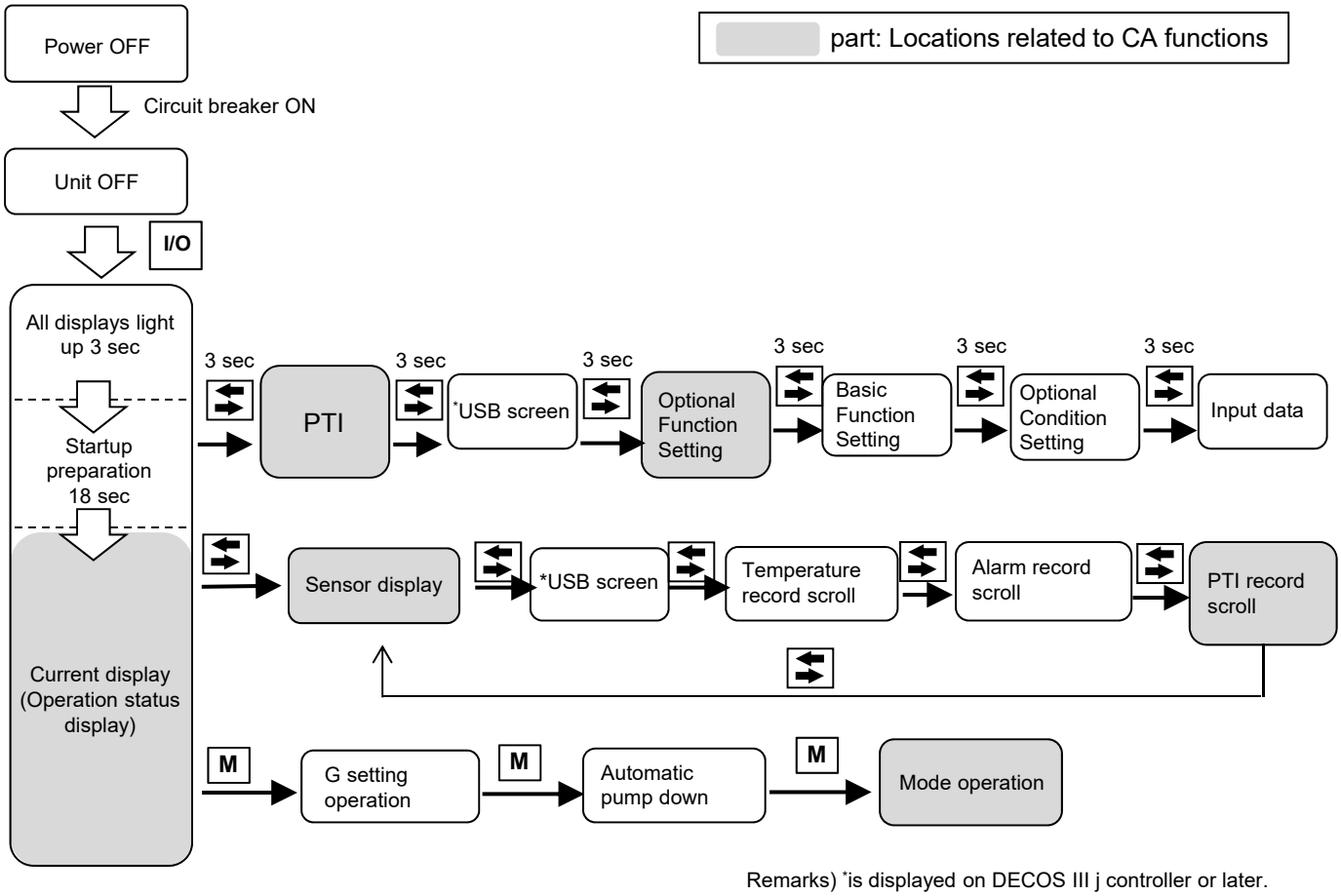
● MANUAL DEFROST key
Manual defrost operation method

① Press the manual defrost key.

②  Display "ON" on the LED screen and press the key.

(Performs defrost operation.)

## 2.2 Operation Process (LXE10E)
## 2.2.1 Operation/Setting Flowchart




Remarks) *is displayed on DECOS III j controller or later.

## 2.2.2 CA Operation/Setting Flowchart (LXE10E)

Current display (Operation status display) → **[Current Display Screen for CA Setting] Go to 2.2.3**

Mode operation → **[CA Mode Setting] Go to 2.2.4**

- Set the CA operation mode and $O_2$/$CO_2$.

Sensor display → **[$O_2$ $CO_2$ concentration display] Go to 2.2.5**

- Present values of $O_2$ and $CO_2$ sensors can be displayed.

PTI record scroll → **[CA TEST Date/Time Confirmation] Go to 2.2.6**

- Date and time of last successful CA TEST can be displayed.

PTI → **[CA TEST] Go to 2.3.1**

- Pre-trip inspection: Inspection of parts related to CA device.

→ **[CA Check] Go to 2.3.2**

- The following items can be implemented.
  - Air discharge valve (ADV) ON/OFF
  - Checking $O_2$/$CO_2$ sensors
  - Displaying CA unit operation time
  - Displaying air pump operation time
  - Displaying CA unit software version

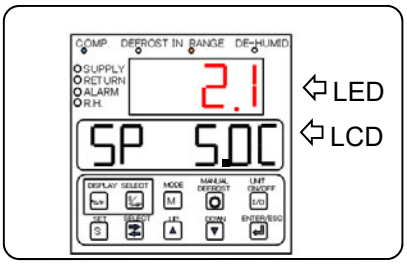
Optional Function Setting → **[Optional Function Setting] Go to 2.2.7**

- Sets presence/absence of CA device.
- Enables changing setting of days until CA mode is automatically turned OFF.
- Evaporator fan operation during CA operation can be selected.

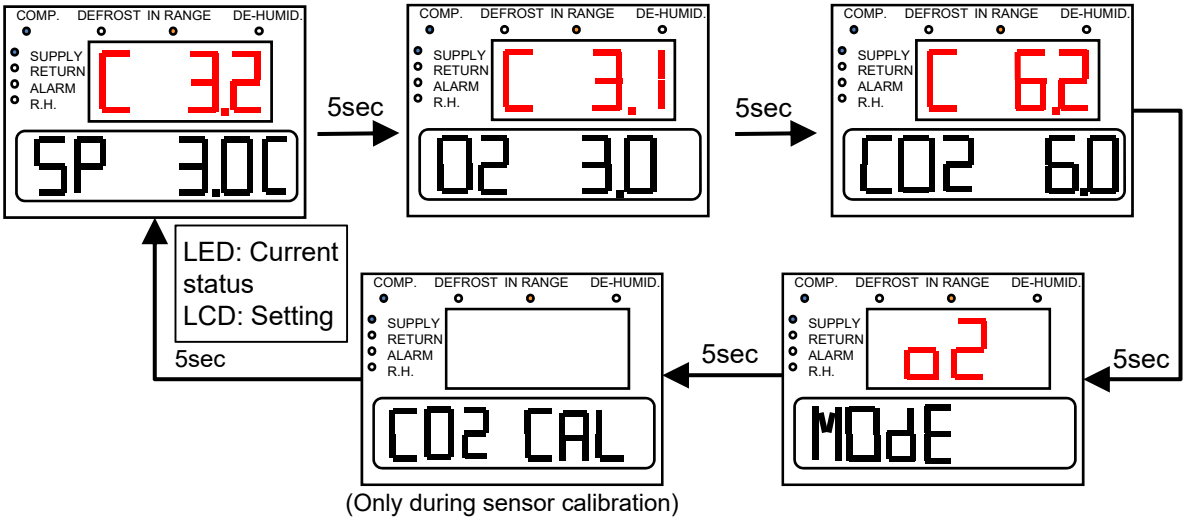
Remark: Check the contents of 2.2.7 before selection.

## 2.2.3 Current Display Screen for CA Setting (Operation Status Display)

When CA mode is set to "ON", "Set $O_2$ concentration" and "Current $O_2$ concentration", "Set $CO_2$ concentration" and "Current $CO_2$ concentration" and priority control sensor are displayed after the temperature display.
However, there will be no display outside the allowable conditions of CA operation.

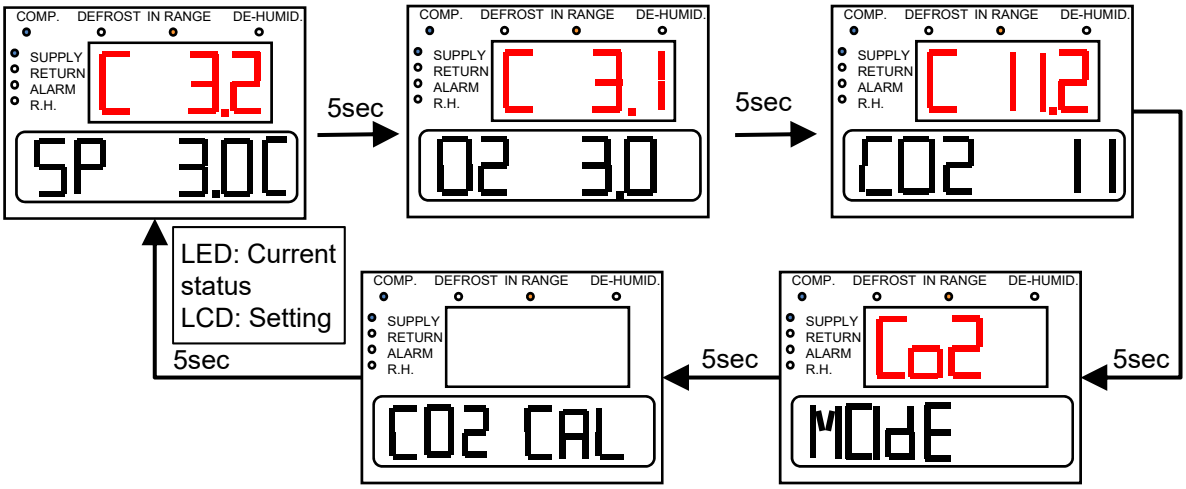



● **CA mode setting = ON (CA setting)**
**Standard**
The current screen switches automatically every 5 seconds, as shown below.




(Only during sensor calibration)

● **CA mode setting = ON (CA setting)**
**When transporting at high $CO_2$ concentration**
The current screen switches automatically every 5 seconds, as shown below.




(Only during sensor calibration)

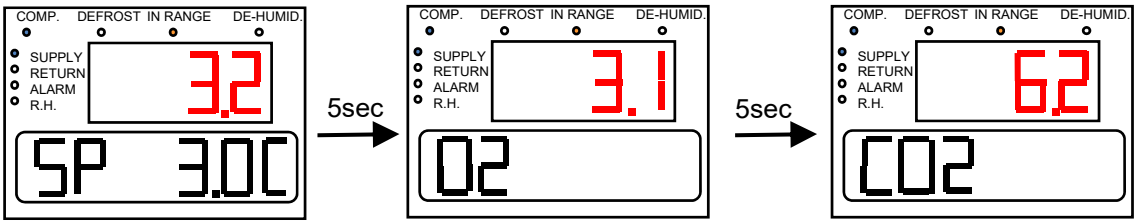
- When CA mode is "ON", "**C**" is displayed at the left end of the LED.
- When CA mode is "OFF", $O_2$/$CO_2$ and priority control sensor are not displayed.
- Even if CA mode is "ON", if the allowable conditions for the CA operation are not satisfied, $O_2$ and $CO_2$ will not be displayed.

## Current screen display when DSP is selected

When CA mode is set to "DSP", "current $O_2$ concentration" and "current $CO_2$ concentration" will be displayed.
The air concentration in the container can be checked without operating the CA device.

### ● CA mode setting = DSP selected

The current screen switches automatically every 5 seconds, as shown below.

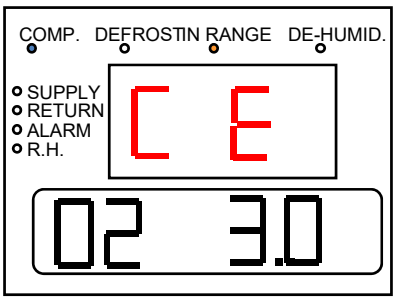



- In CA mode "DSP", the set values of "**C**" at the left end of LED and $O_2$, $CO_2$ are not displayed.

### ● Current screen during sensor abnormality

Automatic switching: If an $O_2$ or $CO_2$ sensor is abnormal, "E" is displayed on the LED.

Example: For $O_2$ sensor abnormality




"E" is displayed during sensor abnormality

Applicable sensor

## 2.2.4 CA Mode Setting

CA mode setting

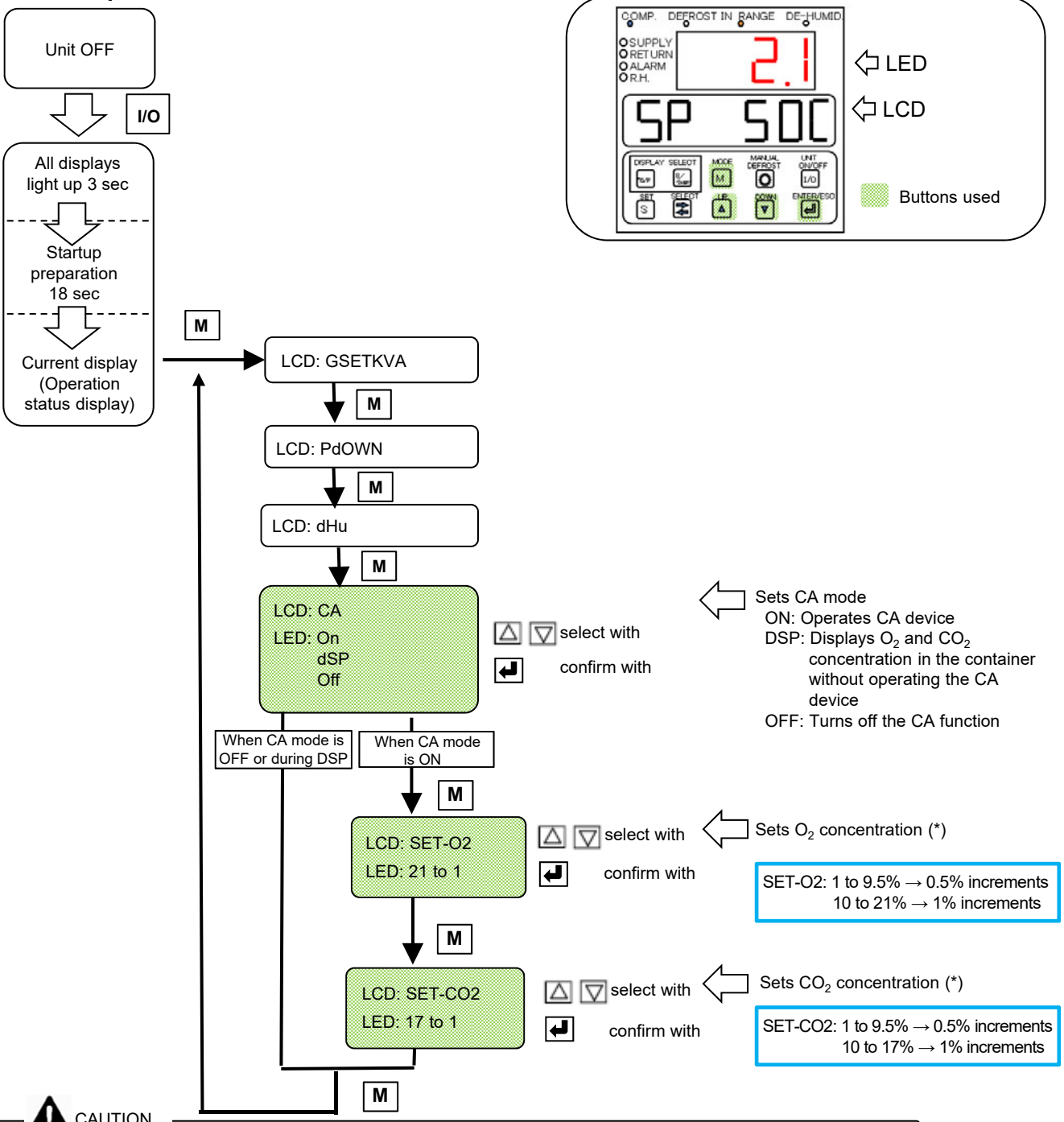
The following settings can be made for the CA function in CA mode setting.

CA mode setting ON: Sets $O_2$ and $CO_2$ concentration and operates the CA device

DSP: Displays $O_2$ and $CO_2$ concentration in the container without operating the CA device

OFF: Turns off the CA function

**<Selection procedure>**




CAUTION

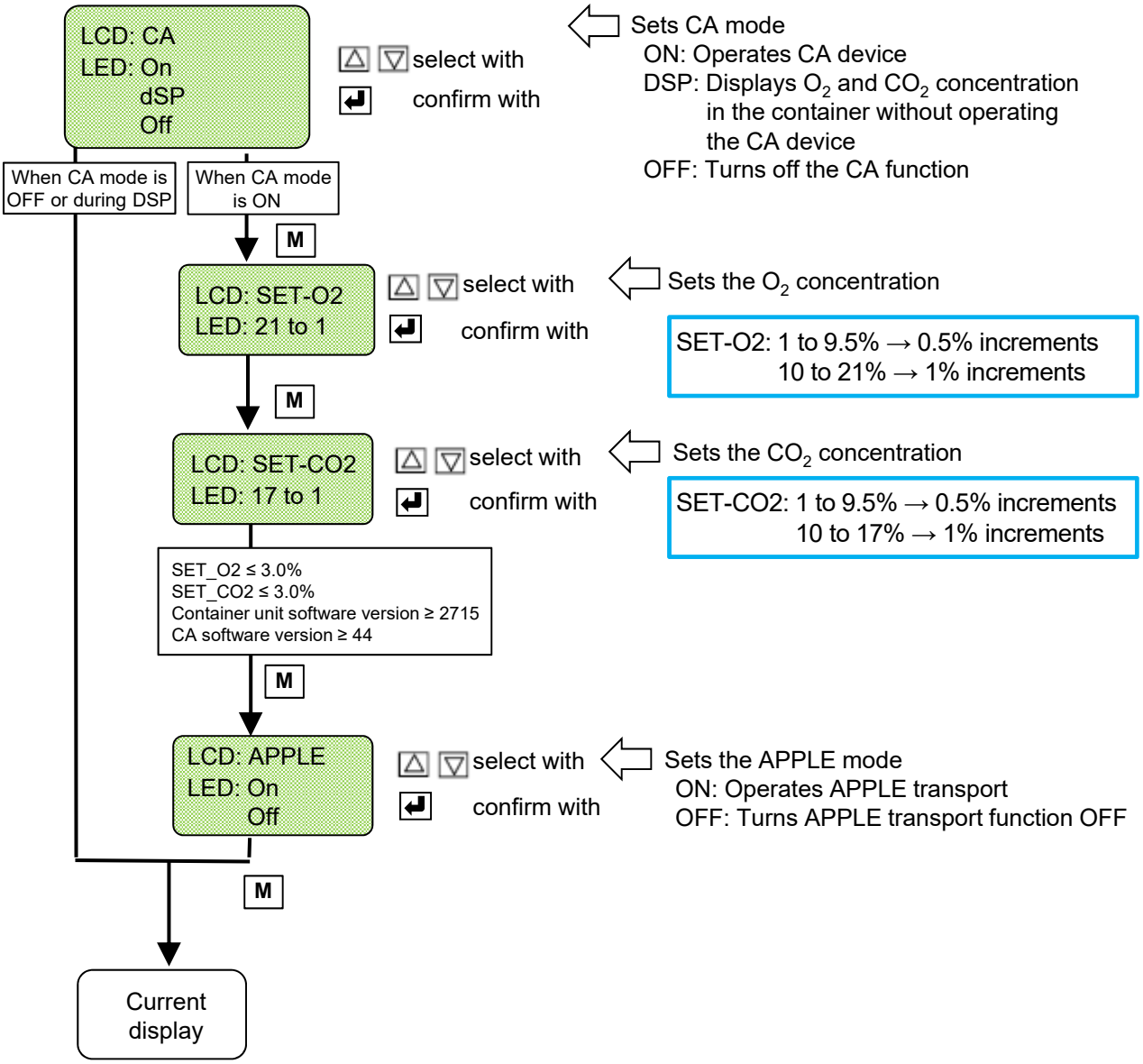
*Remark: Set so that $O_2 + CO_2 \geq 8\%$.

**<APPLE mode setting procedure>**

If the container unit software version and CA software version are Ver.2715 or later and Ver.44 or later, when SET-O2 ≤ 3.0% & SET-CO2 ≤ 3.0%, APPLE mode can be set with the following procedure.
If any of the above conditions are not met, it will automatically turn off.

**CAUTION**

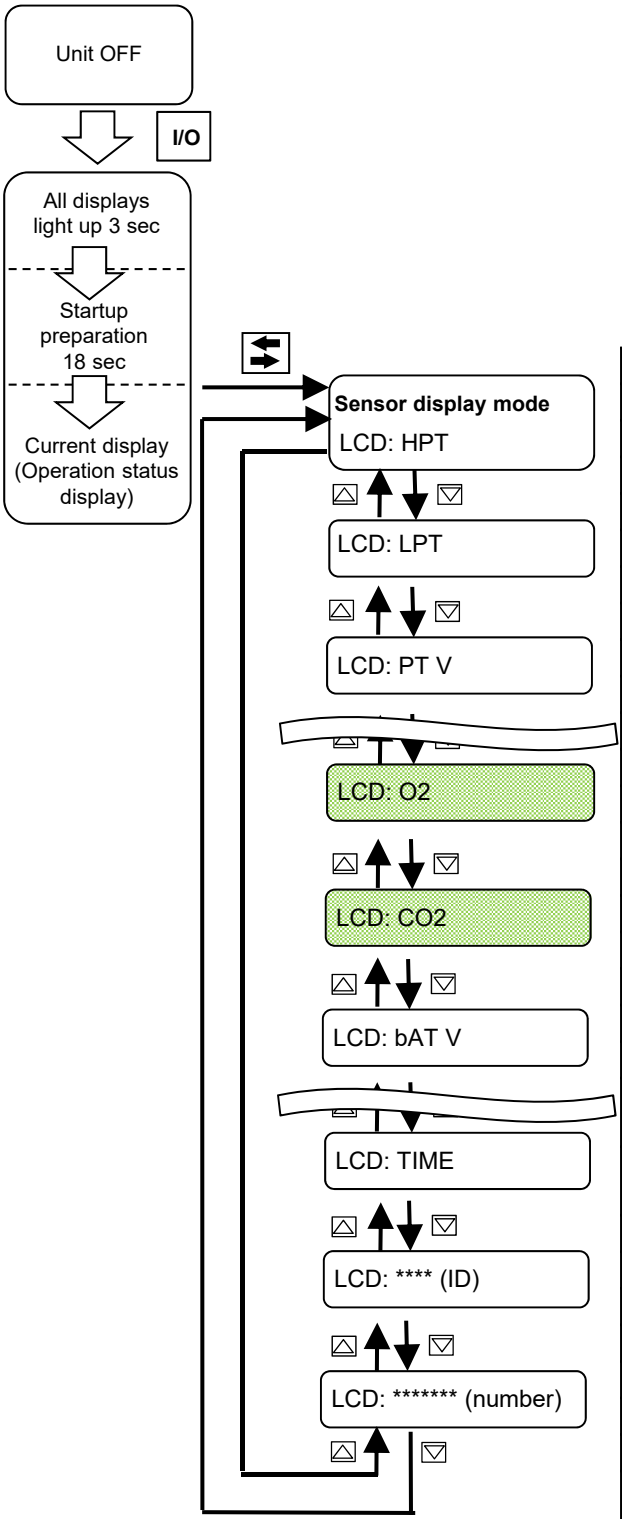
This setting is for transporting apples.
Do not turn this setting ON when transporting cargo other than apples.

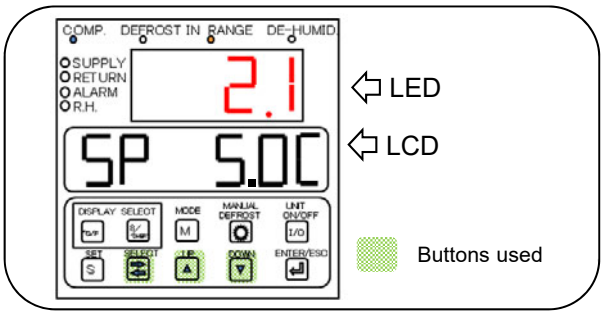


## 2.2.5 $O_2$/$CO_2$ Concentration Display

The $O_2$ and $CO_2$ concentration can be checked with the sensor display mode.

**<Selection procedure>**



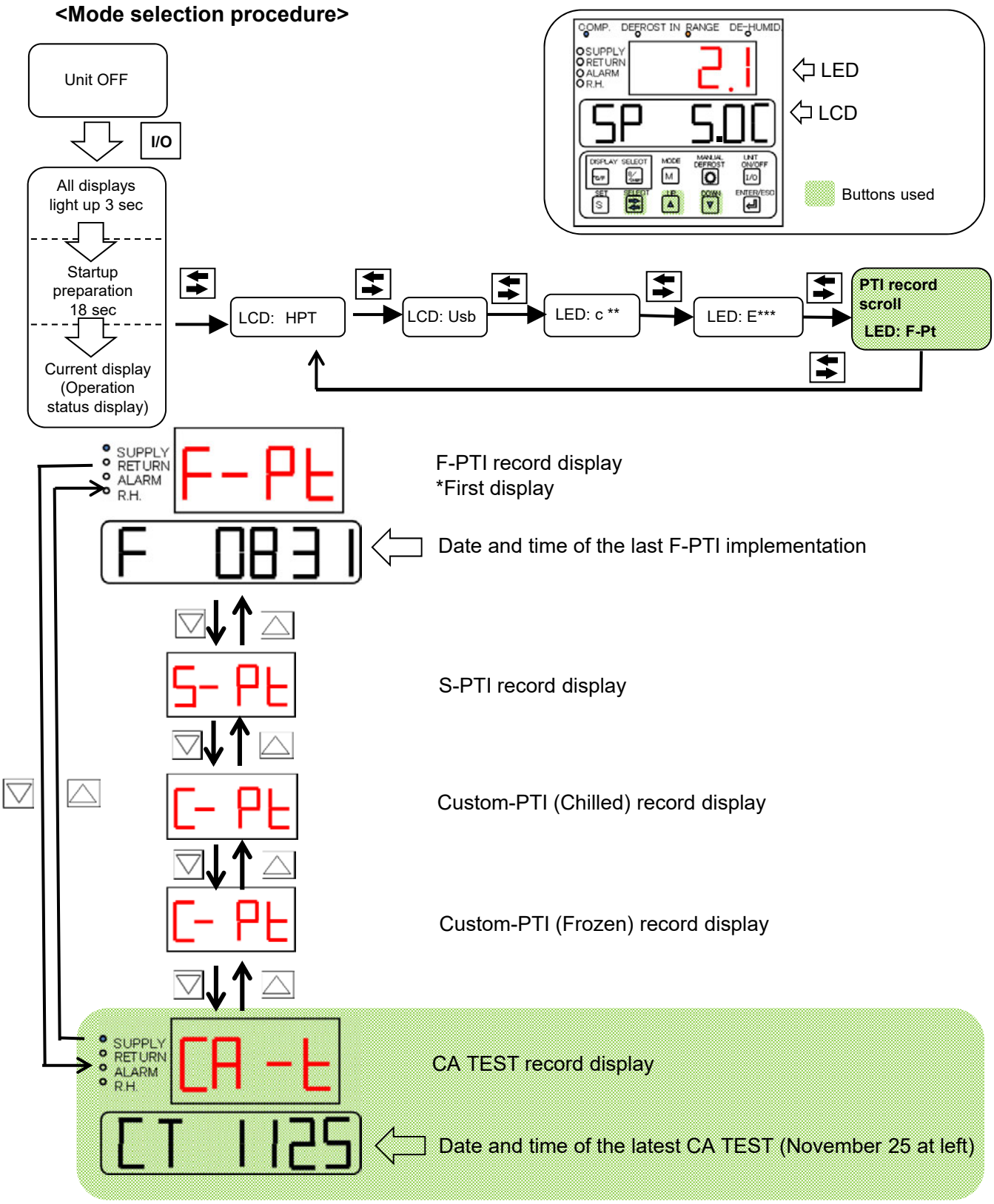




| No. | LCD display | Details |
|---|---|---|
| 0 | "FA" | Ventilation quantity value (optional) |
| 1 | "HPT" | High pressure sensor value |
| 2 | "LPT" | Low pressure sensor value |
| 3 | "PT V" | Voltage value |
| 4 | "CT A" | Total operating current value |
| 5 | "CT A" | Compressor operating current value |
| 6 | "Ab C" | Outside temperature |
| 7 | "EI C" | Evaporator inlet temperature |
| 8 | "EO C" | Evaporator outlet temperature |
| 9 | "dC C" | Discharge gas temperature |
| 10 | "SG C" | Inlet gas temperature |
| 11 | "SMV" | Control opening |
| 12 | "EV" | Control opening |
| 13 | "SS C" | discharge air temperature |
| 14 | "RS C" | Intake air temperature |
| 15 | "US C" | Core temperature (optional) |
| 16 | "US C" | Core temperature (optional) |
| 17 | "US C" | Core temperature (optional) |
| 18 | "CS C" | Core temperature (optional) |
| 19 | "dS C" | Discharge air temperature for data recorder |
| 20 | "dR C" | Intake air temperature for data recorder |
| 21 | "O2" | Current $O_2$ concentration |
| 22 | "CO2" | Current $CO_2$ concentration |
| 23 | "bAT V" | Residual voltage |
| 24 | "YEAR" | Year |
| 25 | "dAY/MON" | Month/day |
| 26 | "TIME" | Time |
| 27 | "*****" (ex.dilu) | ID |
| 28 | "*******" (ex.1234567) | ID number 7 digits |

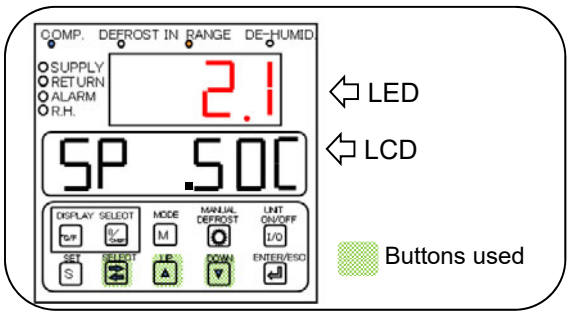
## 2.2.6 CA TEST Date/Time Confirmation

The past CA TEST implementation date and time can be checked in "PTI record scroll mode".

**<Mode selection procedure>**



## 2.2.7 Optional Function Setting




**1. CA unit setting <CA UNIT>**

Sets presence/absence of CA device.

1: With CA device

OFF: No CA device

**2. CA mode automatic OFF setting**

1) **<CA-OFF>**

This function automatically turns off the CA mode after the number of days set below has elapsed since the power was turned OFF.

ON: This setting only displays ON

↵ is pressed to move to the setting screen for the number of days **<dAYS>**

dAYS: Set from 5 to 999 days on the screen

2) **<AFT-PTI>**

Sets whether to turn off CA mode after PTI is complete.

RST: Changes CA mode setting to OFF after PTI is complete

NON: CA mode setting does not change after PTI complete

**3. $CO_2$ emission control setting <CA-AIR>**

Sets the threshold of $CO_2$ concentration for transitioning into and out of carbon dioxide concentration reduction mode. *

ON1: Transitions when CO2 > set CO2 + 3.0%

Separates when CO2 ≤ set CO2 + 2.0%

ON2: Transitions when CO2 > set CO2 + 2.0%

Separates when CO2 ≤ set CO2 + 1.0%

OFF: Does not transition to carbon dioxide concentration reduction mode

> * Setting ON1 is recommended.
> However, if the cargo has very high respiration volume, both $CO_2$ and $O_2$ levels may be high.
> To keep $O_2$ concentration low, select OFF and disable the mode.

**4. CA + Energy saving combination setting <CA + dTMS>**

Sets whether to apply energy saving control during CA operation.

OFF: Does not permit energy saving control during CA operation

ON: Permits energy saving control during CA operation

(*Even when ON is selected, energy saving control setting and CA mode setting do not turn ON.

Set CA mode and energy saving control to "CA = ON" and "dTMS = dFLt" respectively in mode operation.)

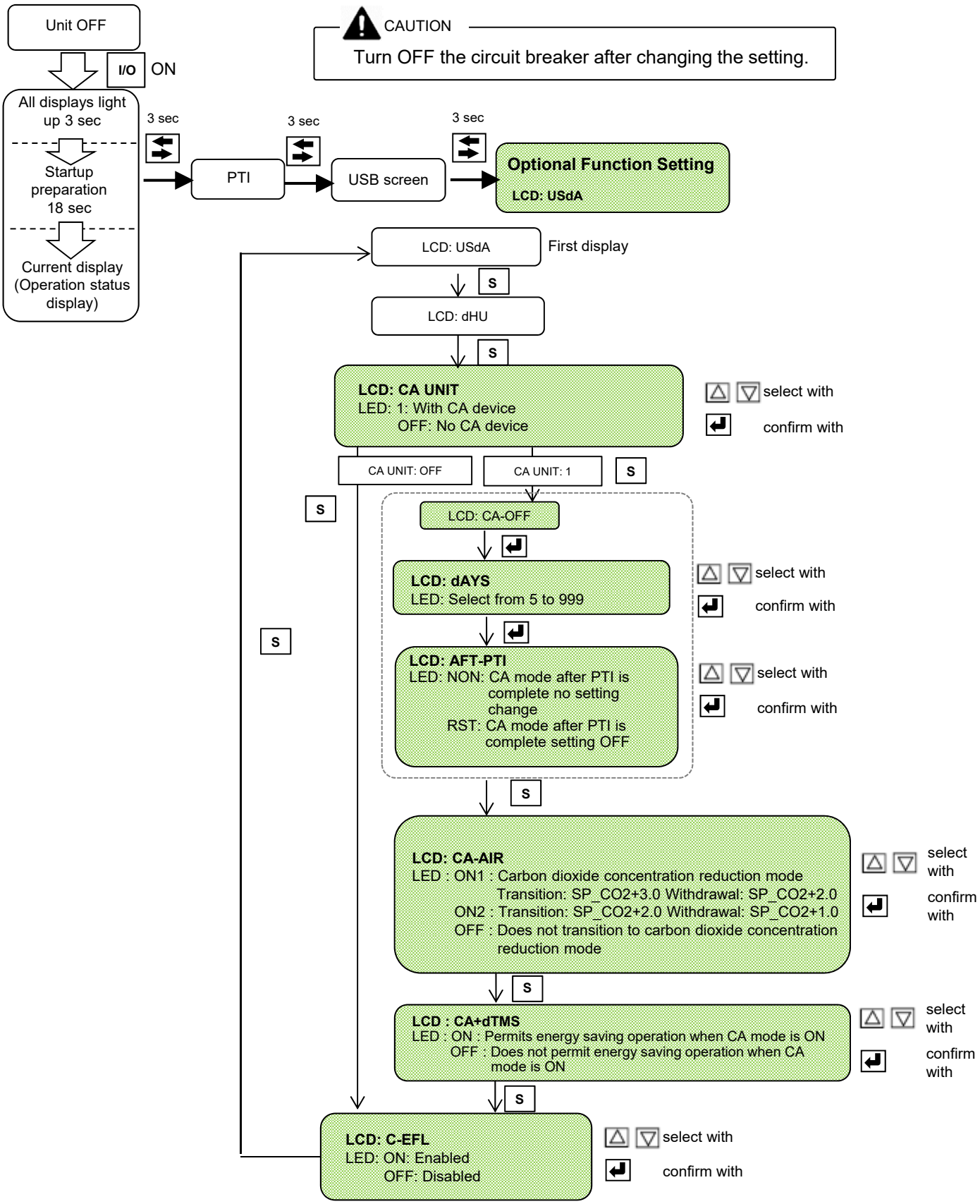
**5. Evaporator fan low setting <C-EFL>**

If the cargo respiratory volume is too low with a 20 ft container, turn the setting ON.

ON: The evaporator fan operates at low speed during CA unit operation

OFF: The evaporator fan operates normally

**<Selection procedure>**



## 2.3 Pre-Trip Inspection

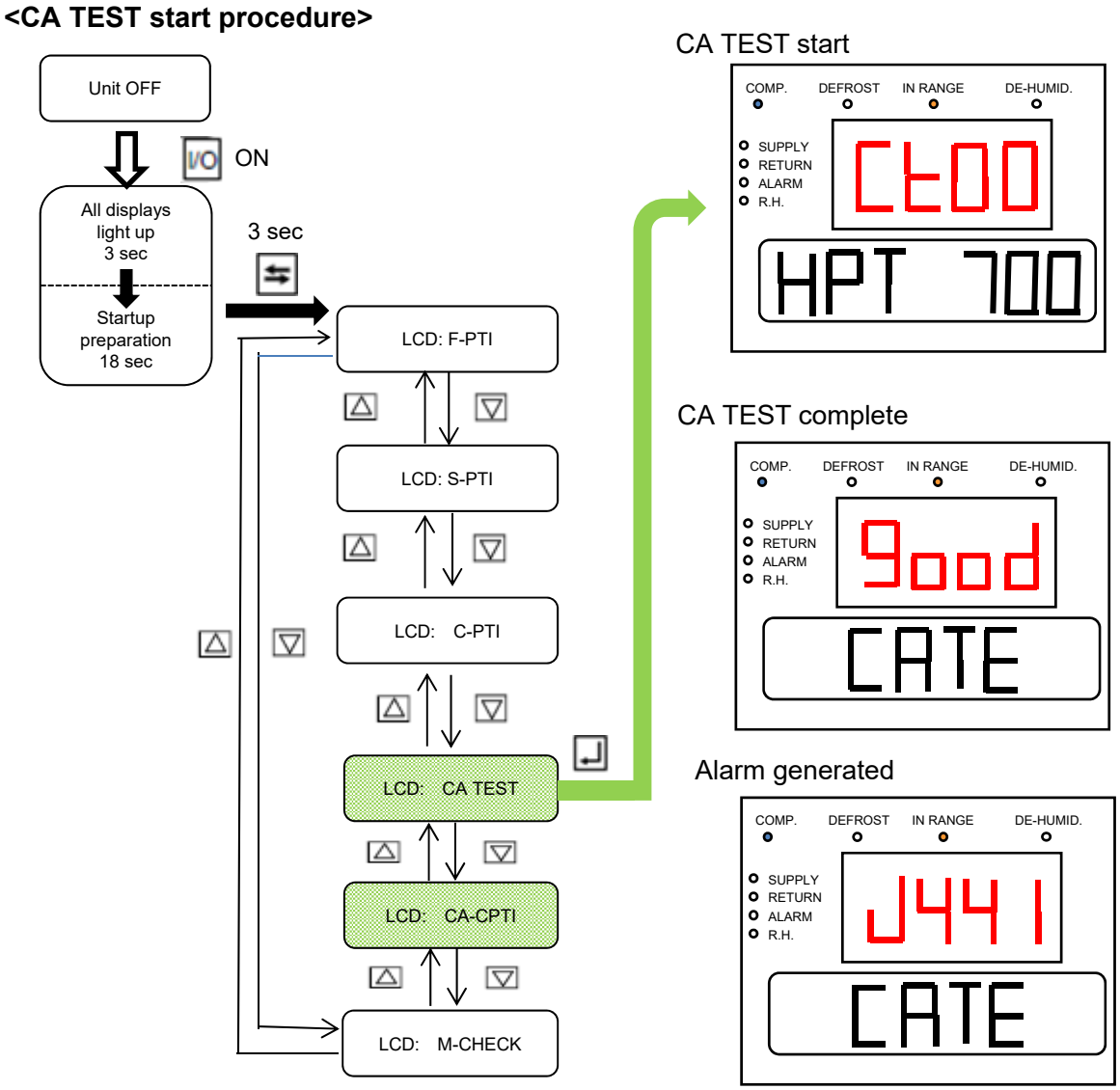
### 2.3.1 CA TEST

- CA TEST is implemented to find any abnormalities in CA device parts.
- If the CA unit is set to "1", "CA TEST" and "CA-CPTI" are added to the automatic PTI.
  Select "CA TEST" to implement the CA TEST.
  If "CA-CPTI" is selected, the CA TEST is implemented automatically after custom chilled PTI is performed.
  * If an error occurs in the custom chilled PTI, it ends at this point.

**Precautions when performing the CA TEST**

- CA TEST allowable internal temperature condition -5.0 ≤ inside temperature (RS) ≤ +30.0℃
  Keep the temperature inside the container (RS) between -5.0℃ and +30.0℃.
  Completes in about 40 minutes to 1 hour in normal conditions.
  If the above temperature conditions are not met, "J443" will occur and the CA TEST will complete.
  Adjust the inside temperature (RS) to -5.0℃ to +30.0℃ and perform the CA TEST again.
  Remark: The inside temperature may increase during the CA TEST. For high ambient air temperature, start the CA TEST after adjusting the inside temperature to under +30.0℃.

**<CA TEST start procedure>**



## CA TEST step numbers and contents

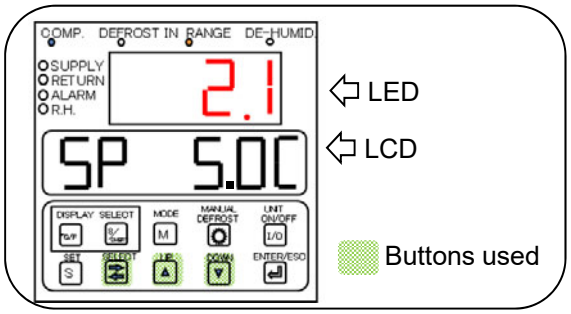
For details on CA TEST alarms, see "5.1 CA TEST (Pre-Trip Inspection) Alarm List and Checkpoints".

| step | Details |
|---|---|
| P00 | Basic data records (container number, date, time, compressor elapsed operation time, ambient temperature) |
| P02 | Sensor alarm check, PCC fusing check |
| P40 | Checking air pump interior temperature sensor and pressure sensor |
| P42 | Air pump unit internal cooling fan, current sensor, motor for air pump, air pump, $O_2$ gas bypass valve, control valve, purge valve, main valve, $O_2$ concentration measurement valve, $O_2$ gas purge valve check |
| P44 | $O_2$ sensor, $CO_2$ sensor check |
| P46 | $O_2$ concentration measurement valve, system capacity check |

* When the temperature inside the container (RS) is lower than -5.0℃ or higher than +30.0℃ between the start of the CA TEST and the start of P44, "J443" is generated and PTI is forcibly terminated.
Adjust the inside temperature (RS) to -5.0℃ to +30.0℃ and perform the CA TEST again.

## 2.3.2 CA Check

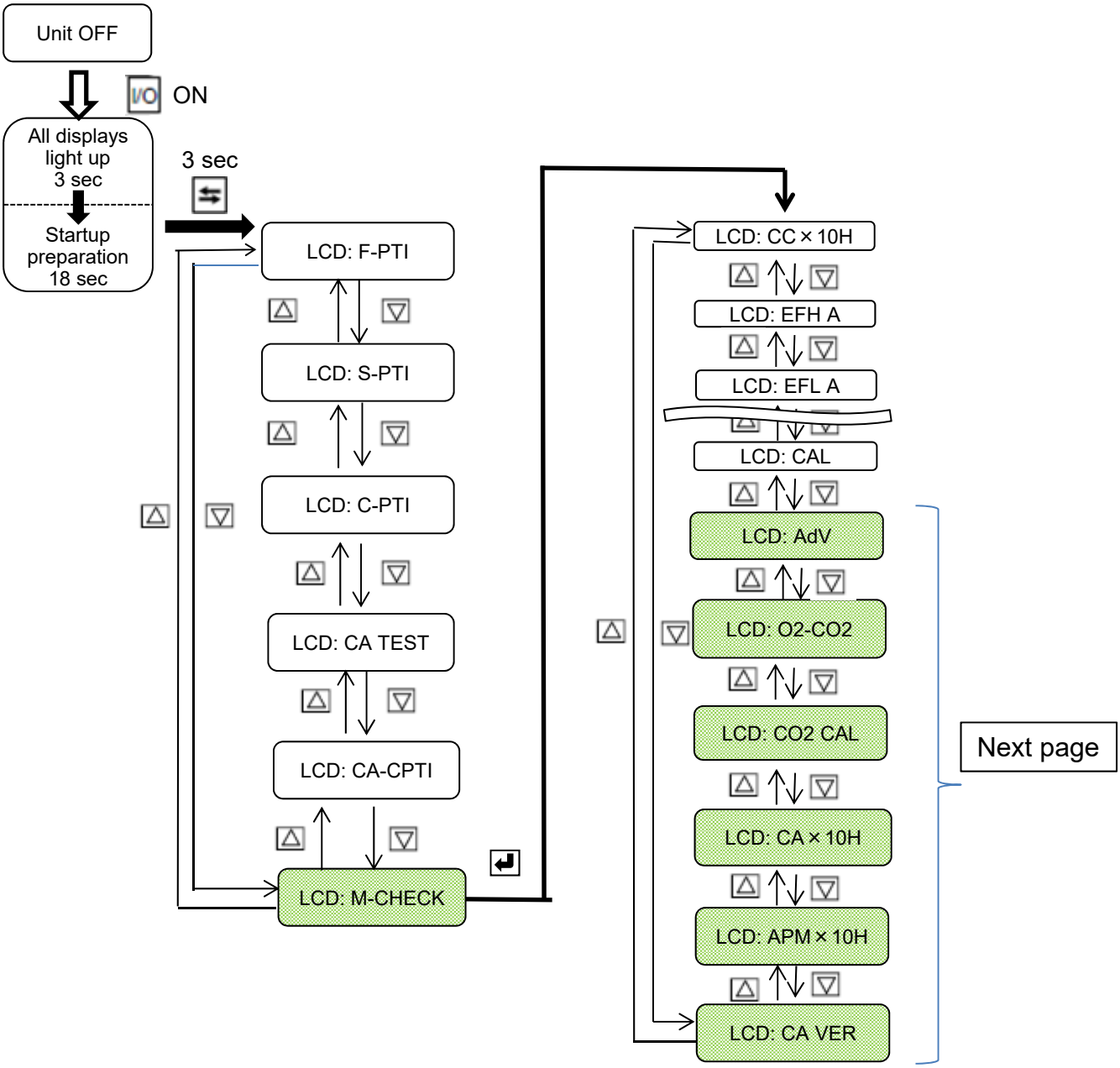
Items related to CA can be checked during M-CHECK.



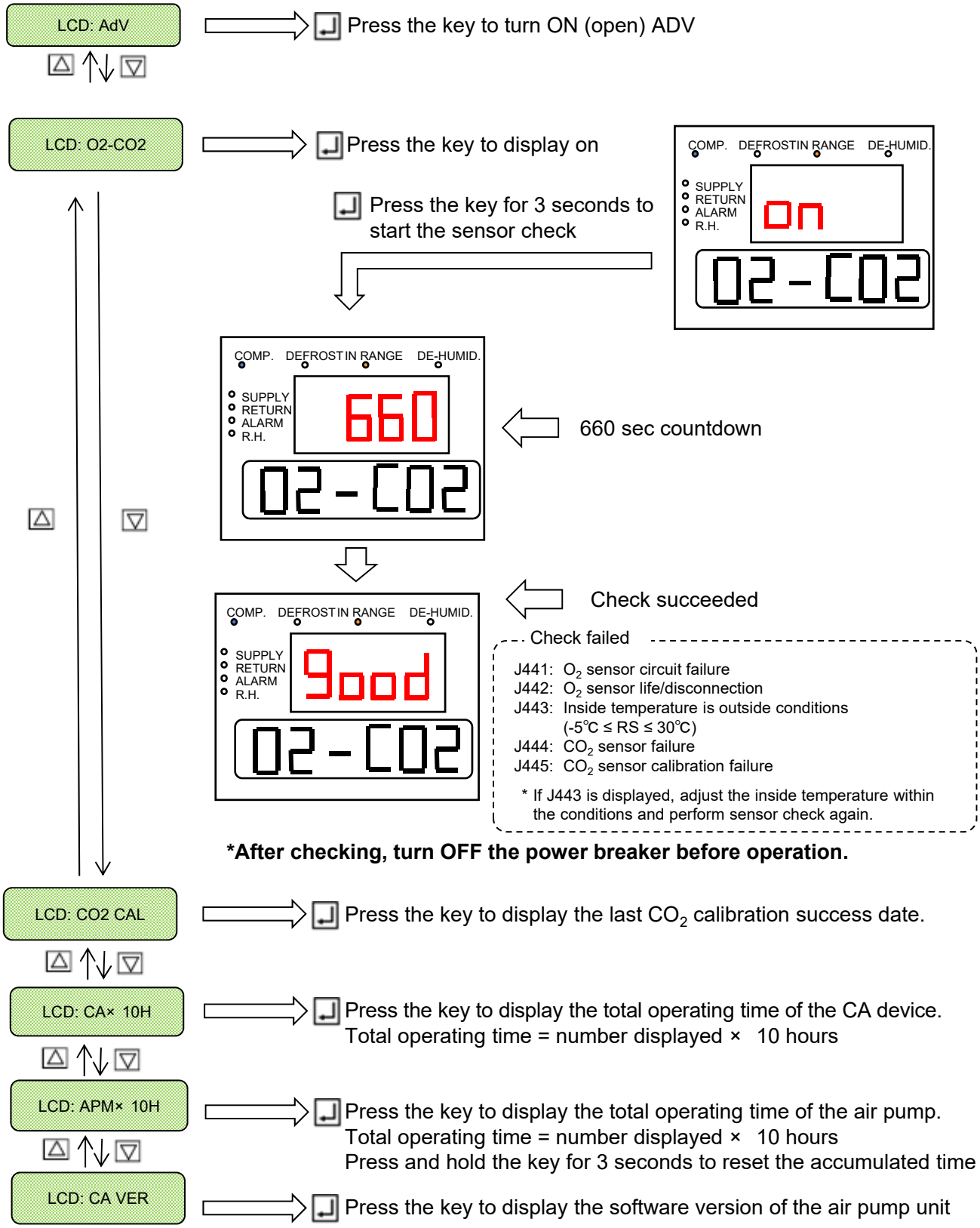

**<Item>**

| | |
|---|---|
| ADV: | Checks the opening and closing of the air discharge valve (ADV) |
| O2-CO2: | $O_2$ sensor / $CO_2$ sensor check (sensor calibration) |
| CA × 10H: | CA operation time check |
| AMP × 10H: | Air pump operation time check/reset |
| CA VER: | CA software version check |

**<Operation method>**



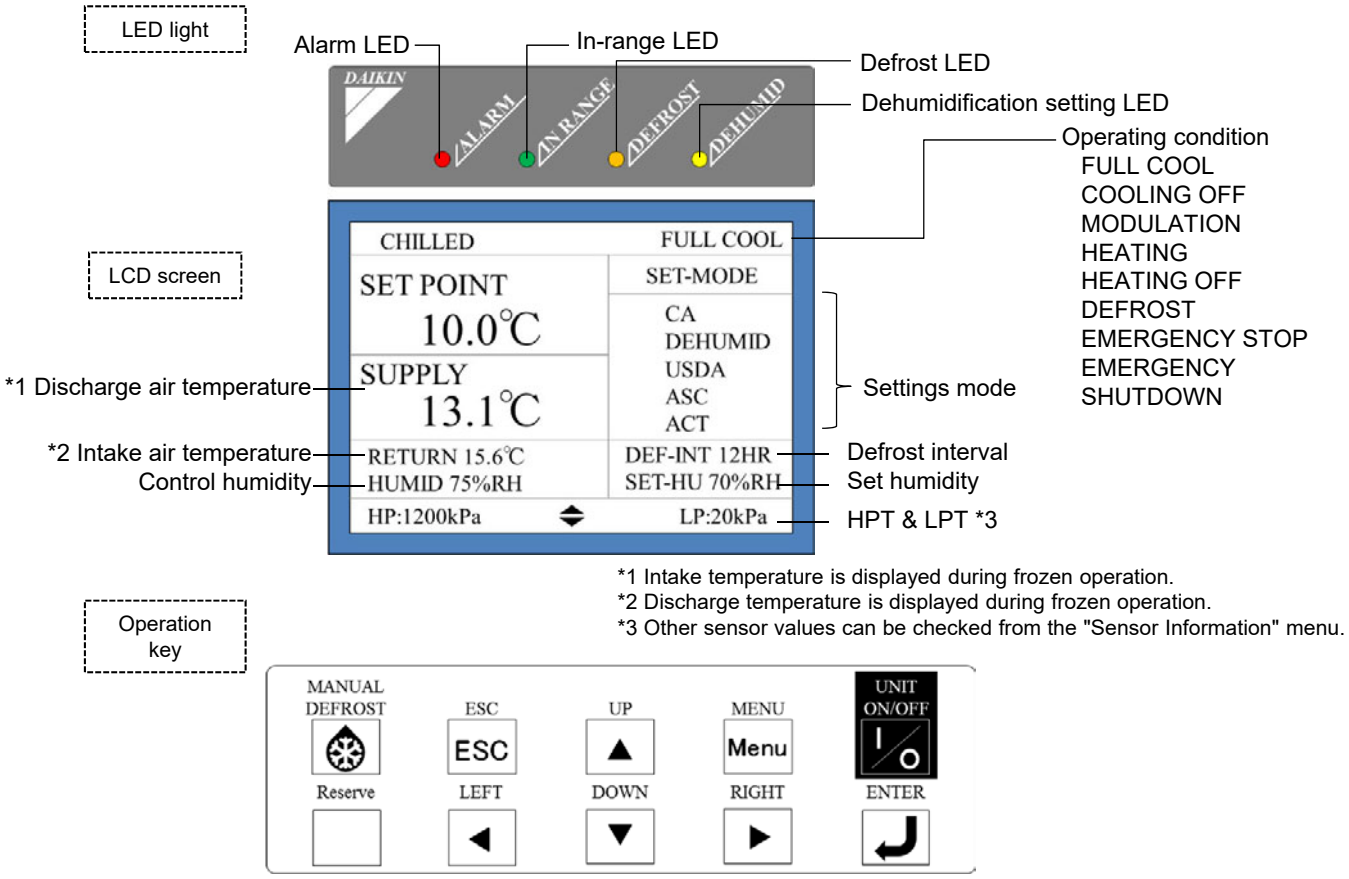
**<Operation method>**



# 3. Usage Method (LX10F)

## 3.1 Basic Controller Operation

### ◆ Control panel names and functions




*1 Intake temperature is displayed during frozen operation.
*2 Discharge temperature is displayed during frozen operation.
*3 Other sensor values can be checked from the "Sensor Information" menu.

◆ Alarm LED (red)
Blinks when the following occurs
- F alarm and E203, E303, E655, E807
- No recovery in a given time after E101, E103, E107 or E707 occurs
- Wait for 4 hours

◆ In-range LED (green)
Lights up when control temperature is in range.

◆ Defrost LED (orange)
Lights up during defrost control

◆ Dehumidification setting LED (yellow)
Lights up when dehumidification setting = ON

◆ Functions of operation keys

UNIT ON/OFF
Starts/stops the unit
If the power is turned off while the unit is ON, the operation will start automatically even if the unit is not turned on the next time the power is turned ON.

UP DOWN
- Moves up and down among items
- Selects settings

RIGHT LEFT
- Moves left and right among items
- Moves to next screen or previous screen

MENU
- Switches to battery mode when power is OFF
- Moves to initialize menu screen after unit is turned ON
- Moves to menu screen during operation

ENTER
- Determines settings

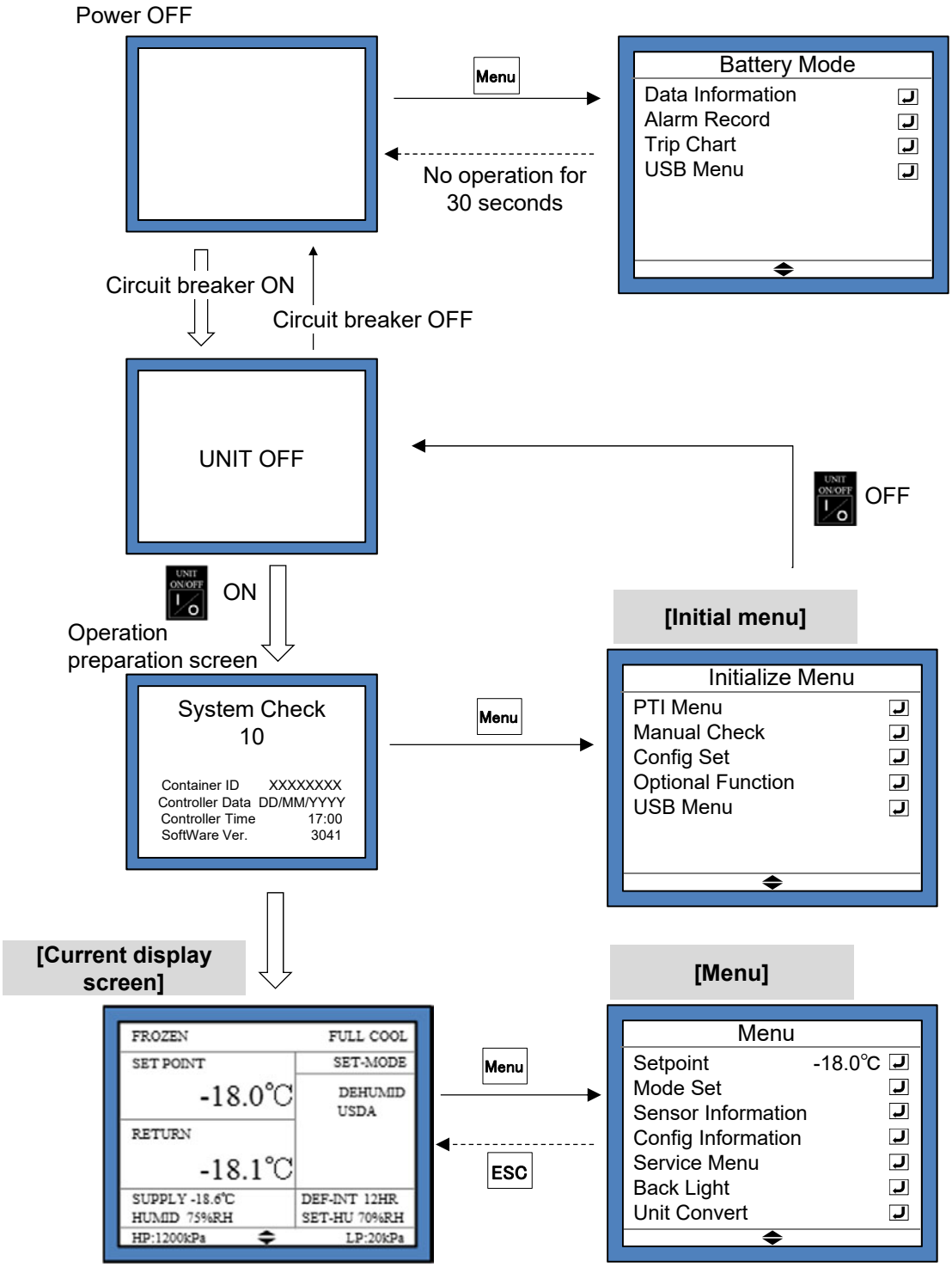
ESC
- Returns to the previous screen from the displayed contents

MANUAL DEFROST
- Manual defrost operation

## 3.2 Operation Process

### 3.2.1 Operation/Setting Flowchart (LX10F)

Each menu screen is displayed using the operation keys on the operation panel.

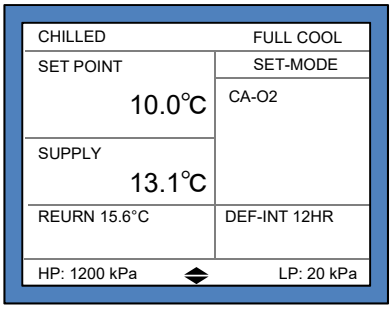


## 3.2.2 CA Operation/Setting Flowchart (LX10F)

When using the CA function on the LX10F, refer to the applicable items in the table below. Otherwise, refer to the Marine Container Refrigeration System Service Guide.

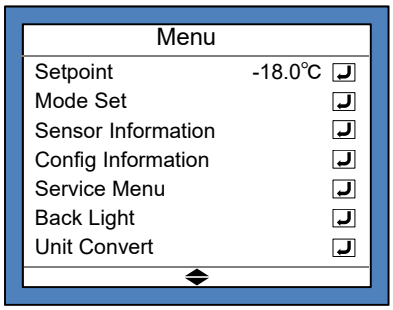
part: Locations related to CA functions

**[Current display screen]**




**[Current Display Screen for CA Setting] Go to 3.2.3**

**[Menu]**




**[CA Mode Setting] Go to 3.2.5**

- Set the CA operation mode and $O_2$/$CO_2$.

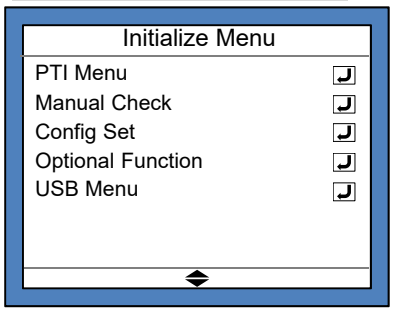
**[Sensor information] Go to 3.2.6**

- Present values of $O_2$ and $CO_2$ sensors can be viewed.

**[Configuration information] Go to 3.2.7**

- The contents of the selected initial setting can be viewed.

**[Initial menu]**




**[CA TEST] Go to 3.3.1**

- Pre-trip inspection: Inspection of parts related to CA device.

**[CA Check] Go to 3.3.2**

- The following items can be implemented.
  - Air discharge valve (ADV) ON/OFF
  - Checking $O_2$/$CO_2$ sensors
  - Displaying CA unit operation time
  - Displaying air pump operation time
  - Displaying CA unit software version

**[Configuration setting] Go to 3.2.4**

- Sets presence/absence of CA device.
- Enables changing setting of days until CA mode is automatically turned OFF.

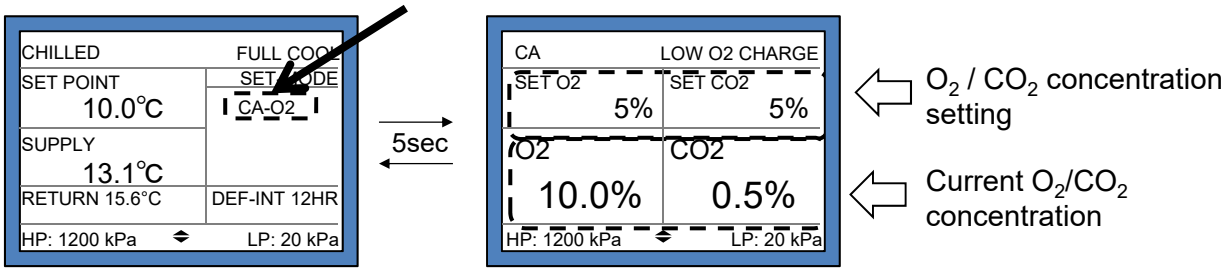
**[Optional Function Setting] Go to 3.2.8**

- Evaporator fan operation during CA operation can be selected.
  Remark: Refer to the precautions in 3.2.8.

### 3.2.3 Current Display Screen for CA Setting

When "ON" or "DISPLAY" is selected in CA mode setting, "Set $O_2$ concentration" and "Current $O_2$ concentration", "Set $CO_2$ concentration" and "Current $CO_2$ concentration" and priority control sensor are displayed.

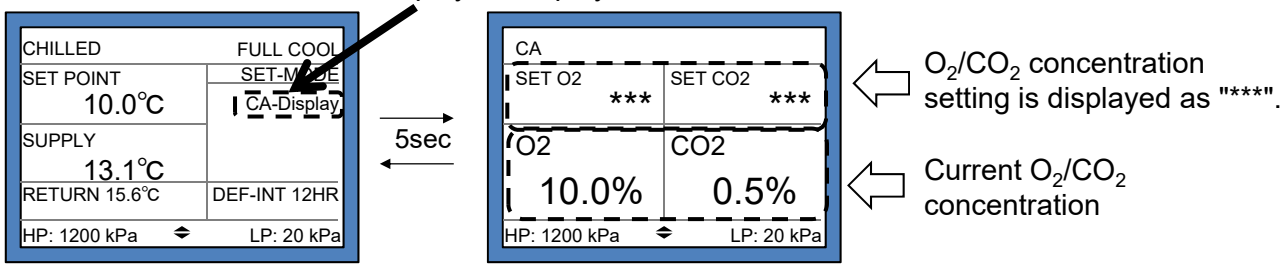
**<CA mode = ON>** "CA-O2" or "CA-CO2" is displayed.
With EF-L setting, "CA O2 (EF-L)" or "CA CO2 (EF-L)" is displayed.




*The screen switches every 5 seconds.

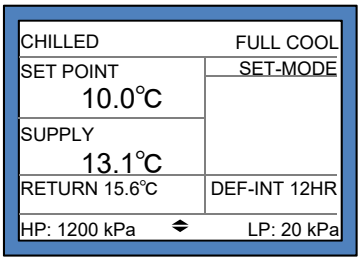
**<CA mode = Display>**

"CA-Display" is displayed.




*The screen switches every 5 seconds.

**<CA mode = OFF>**




- Refer to 3.2.5 for CA mode setting.

## 3.2.4 Configuration Setting

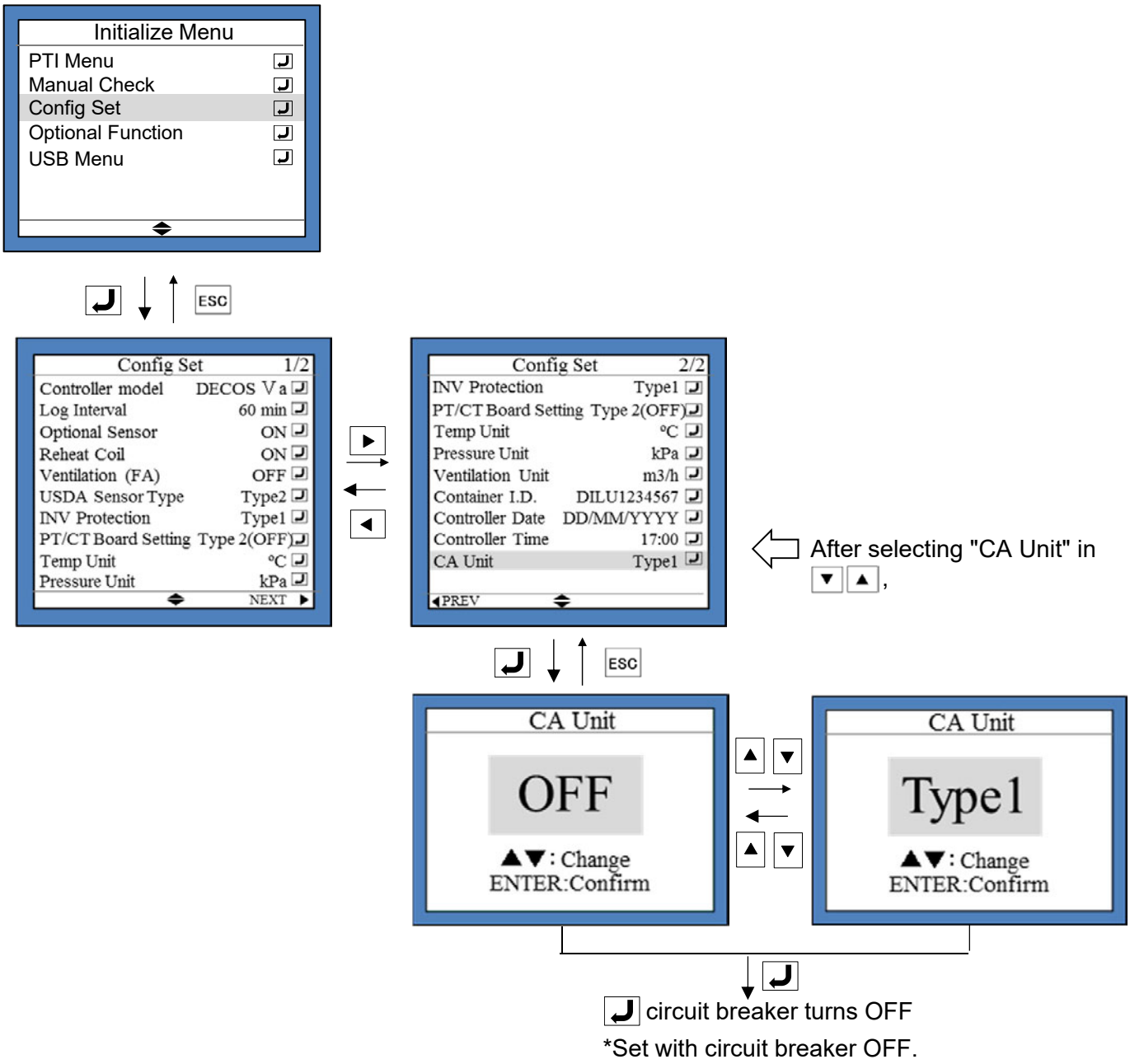
### 1. CA unit setting

Sets presence/absence of CA device.

Type1: With CA device

OFF: No CA device

## <CA unit setting procedure>

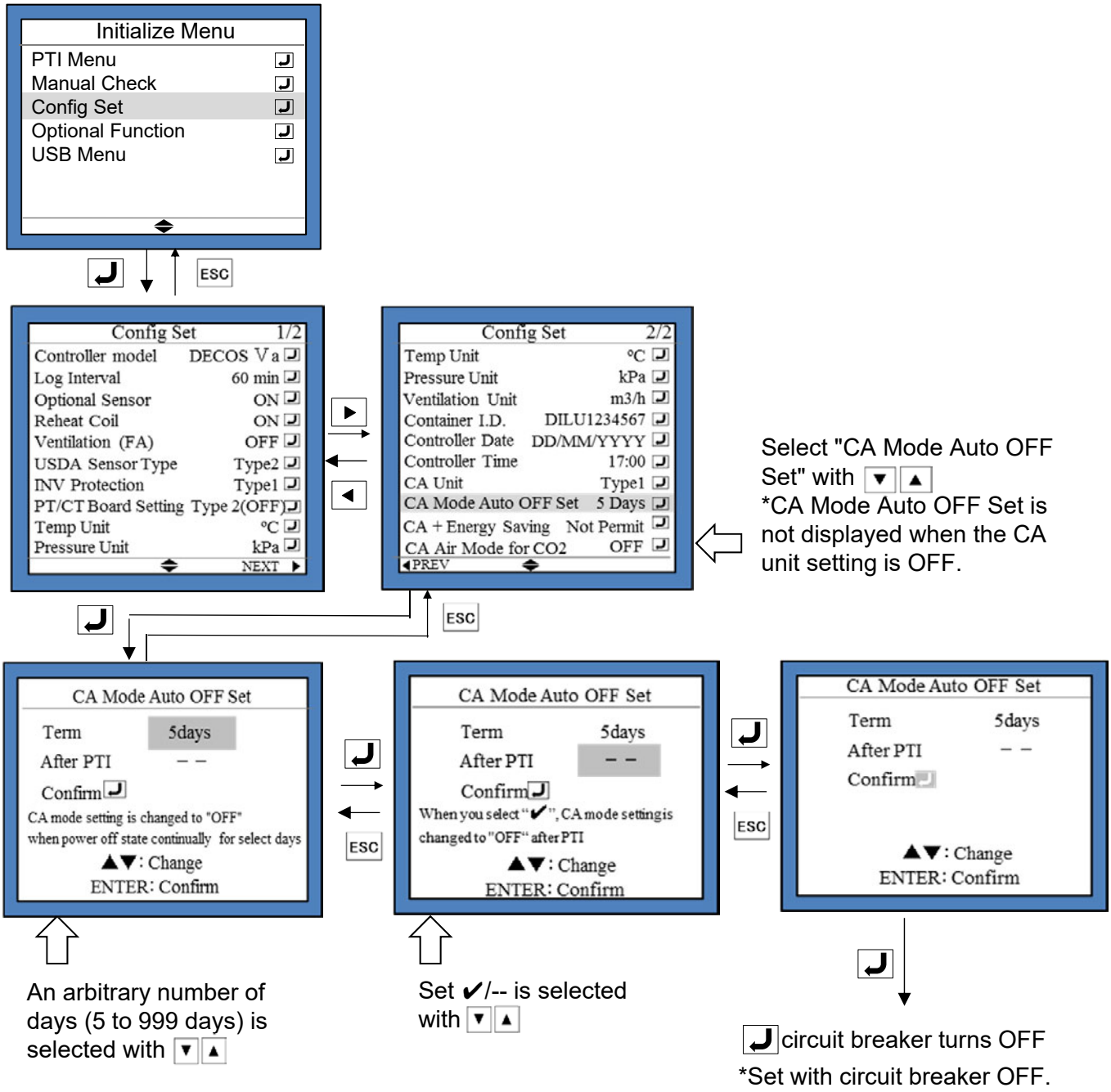


## 2. CA mode automatic OFF setting

1) Setting for number of days for CA mode automatic OFF
   This function automatically turns off the CA mode setting after the number of days set above has elapsed since the power was turned off.
   Sets number of days for CA mode automatic OFF from 5 to 999 days.

2) CA mode automatic OFF setting after PTI is complete
   Sets whether to turn off the CA mode after PTI completes.
   ✔ : Changes CA mode setting to OFF after PTI is complete
   -- : CA mode setting does not change after PTI is complete

### <CA mode automatic OFF setting procedure>



**3. CA + energy saving combination setting**

Sets whether to apply energy saving control during CA operation.

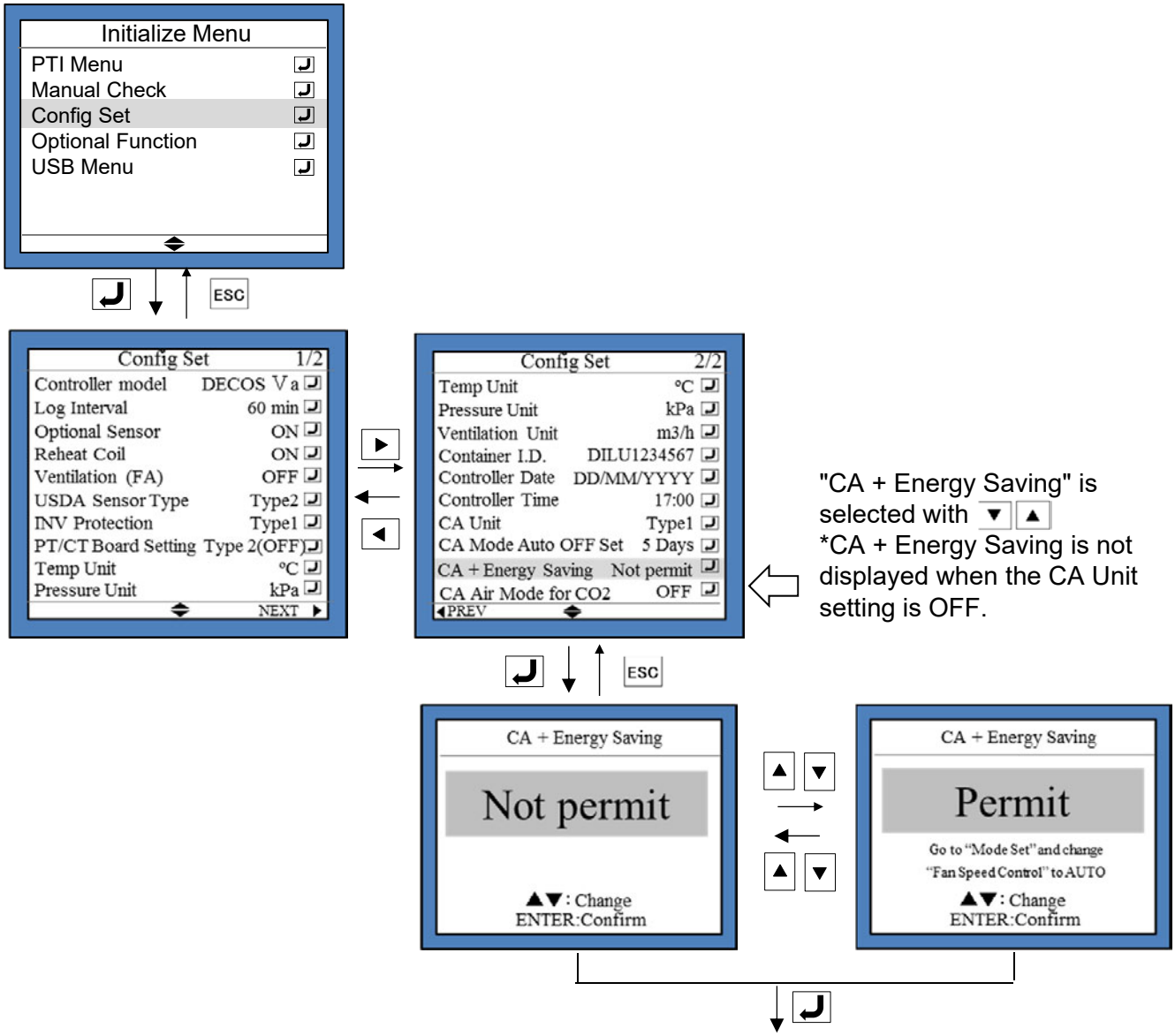
Not Permit : Does not permit energy saving control during CA operation

Permit : Permits energy saving control during CA operation

(*Even when Permit is selected, the energy saving control setting and CA mode setting do not turn ON.

On the Mode Set screen, set the CA mode setting and energy saving control setting to "CA Mode = ON" and "Fan Speed Control = AUTO" respectively. )

## <CA + energy saving combination setting procedure>




circuit breaker turns OFF

*Set with circuit breaker OFF.

## 4. $CO_2$ emission control setting

Sets the threshold of $CO_2$ concentration for transitioning into and out of carbon dioxide concentration reduction mode. *

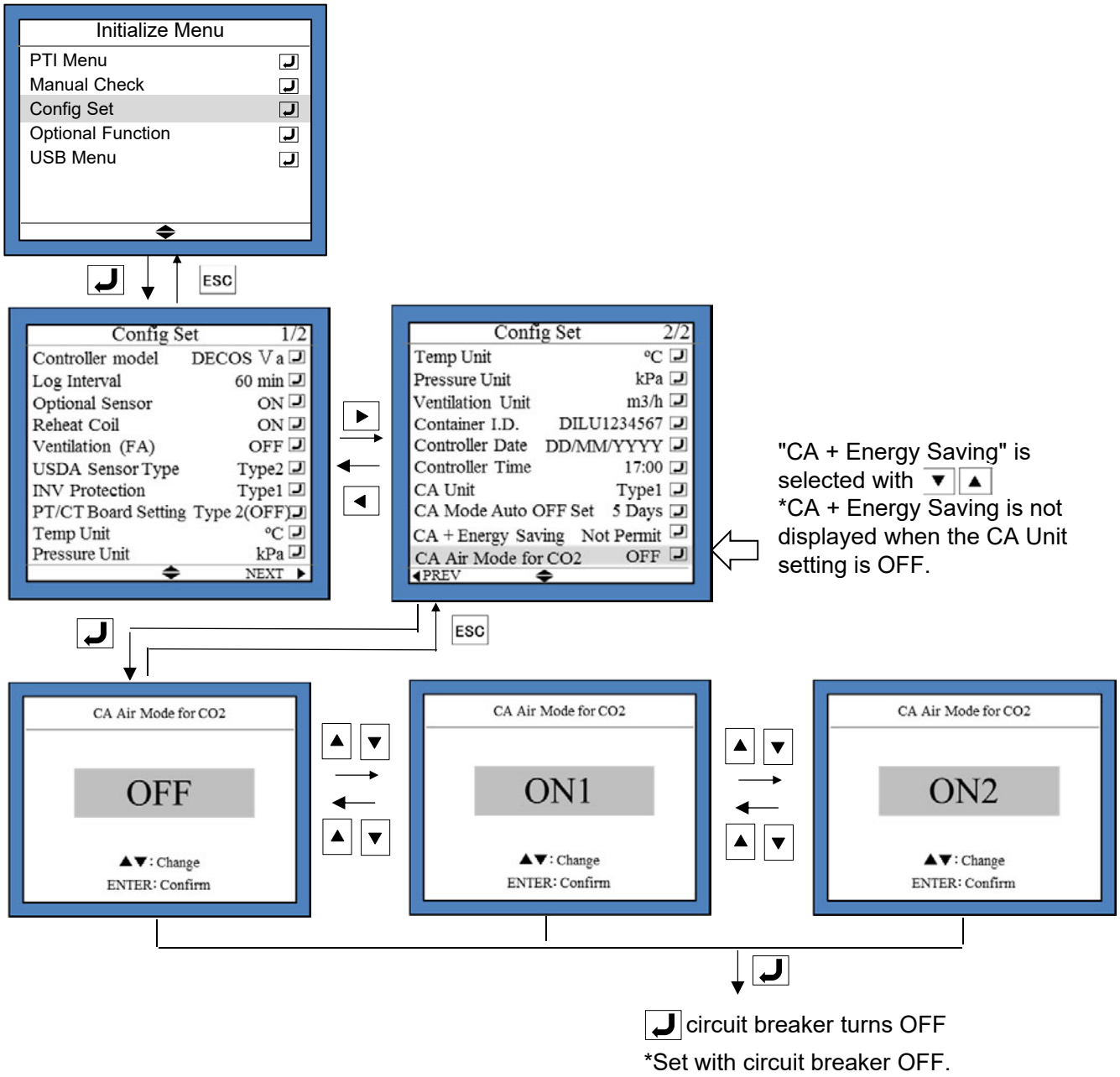
ON1: Transitions when CO2 > set CO2 + 3.0%
Separates when CO2 ≤ set CO2 + 2.0%

ON2: Transitions when CO2 > set CO2 + 2.0%
Separates when CO2 ≤ set CO2 + 1.0%

OFF: Does not transition to carbon dioxide concentration reduction mode

> * Setting ON1 is recommended.
> However, if the cargo has very high respiration volume, both $CO_2$ and $O_2$ levels may be high.
> To keep $O_2$ concentration low, select OFF and disable the mode.

### <$CO_2$ emission control setting procedure>



### 3.2.5 CA Mode Setting

The following settings can be made for the CA function on the mode setting screen.

CA mode ON : Sets $O_2$ and $CO_2$ concentration and operates the CA device

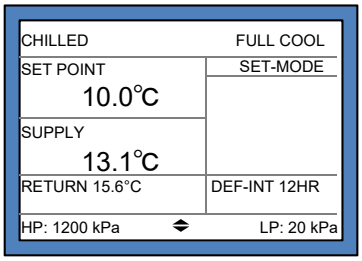
Display : Displays $O_2$ and $CO_2$ concentration in the container without operating the CA device

OFF : Turns CA function OFF

| CA mode | Refrigeration equipment | CA device | $O_2$ sensor display | $CO_2$ sensor display |
|---|---|---|---|---|
| ON | Operates | Operates | Displays | Displays |
| Display | Operates | Does not operate | Displays | Displays |
| OFF | Operates | Does not operate | Does not display | Does not display |

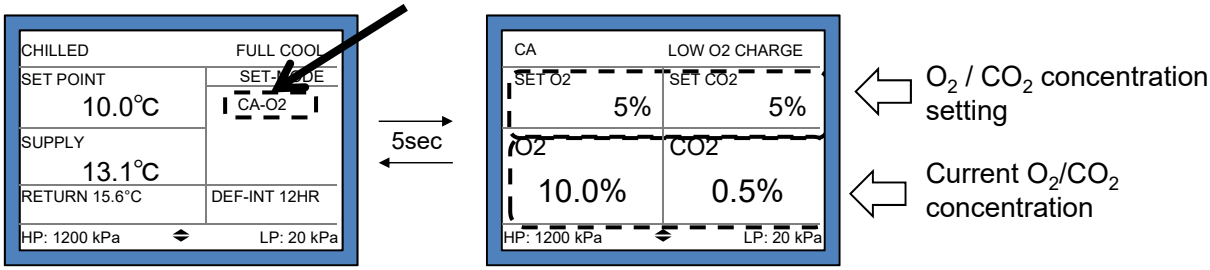
**Current display screen**

**<CA mode = OFF>**




The normal screen is displayed.

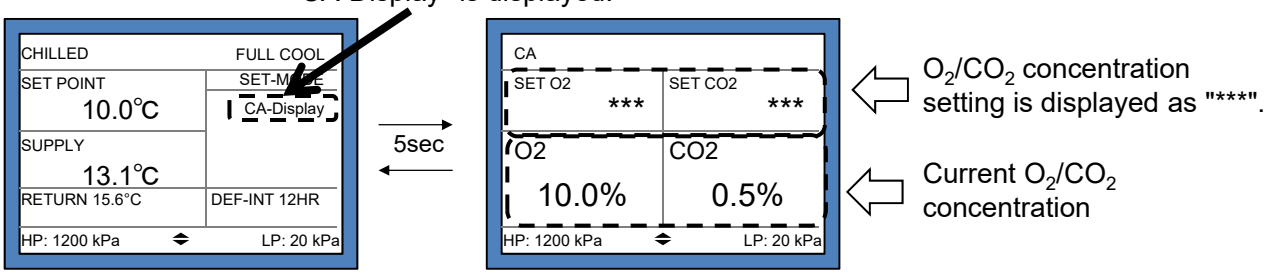
**<CA mode = ON>** "CA-O2" or "CA-CO2" is displayed.
With EF-L setting, "CA O2 (EF-L)" or "CA CO2 (EF-L)" is displayed.




*The screen switches every 5 seconds.

**<CA mode = Display>**

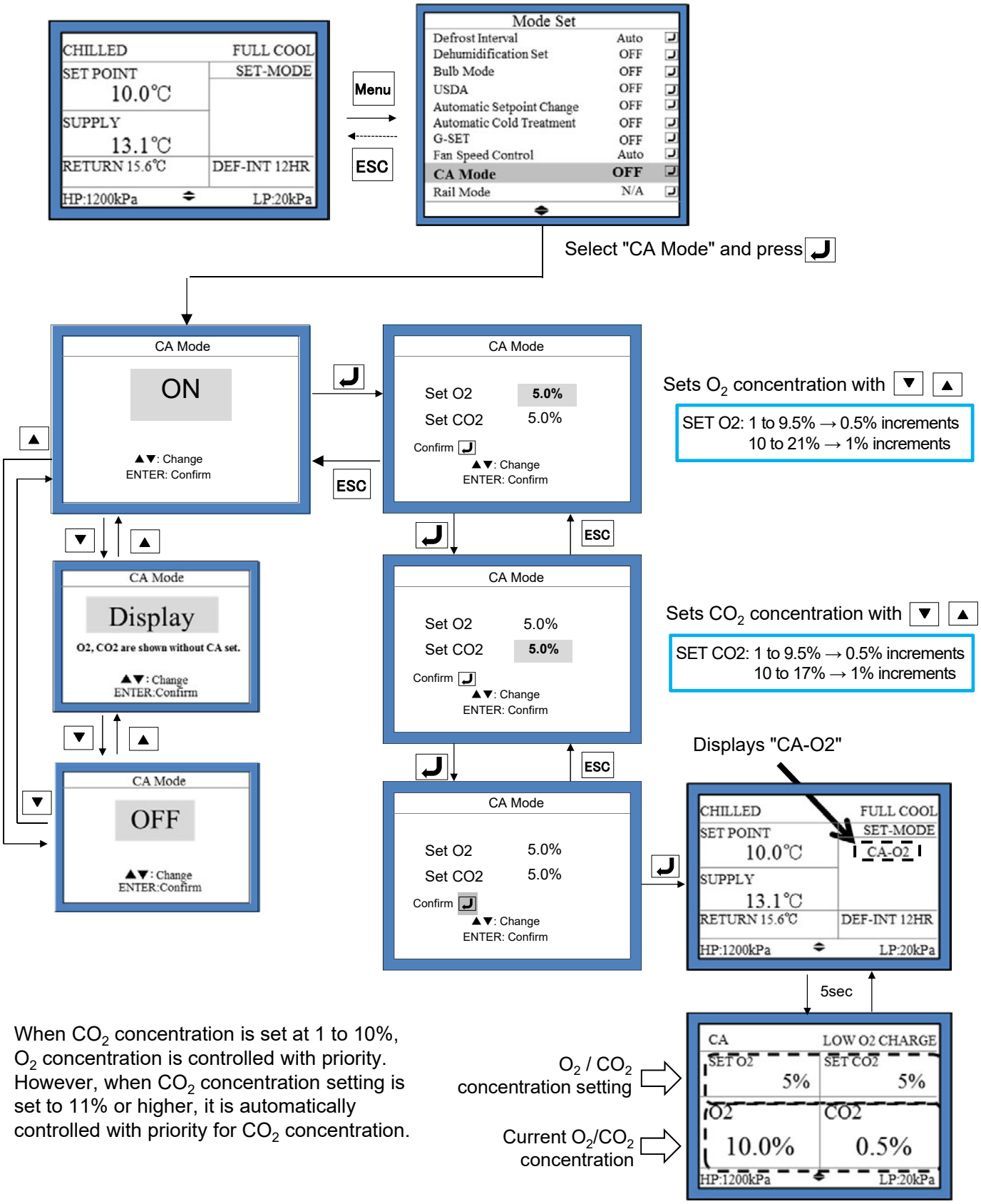
"CA-Display" is displayed.




*The screen switches every 5 seconds.

## <CA mode setting procedure>

### ◆ CA Mode = ON



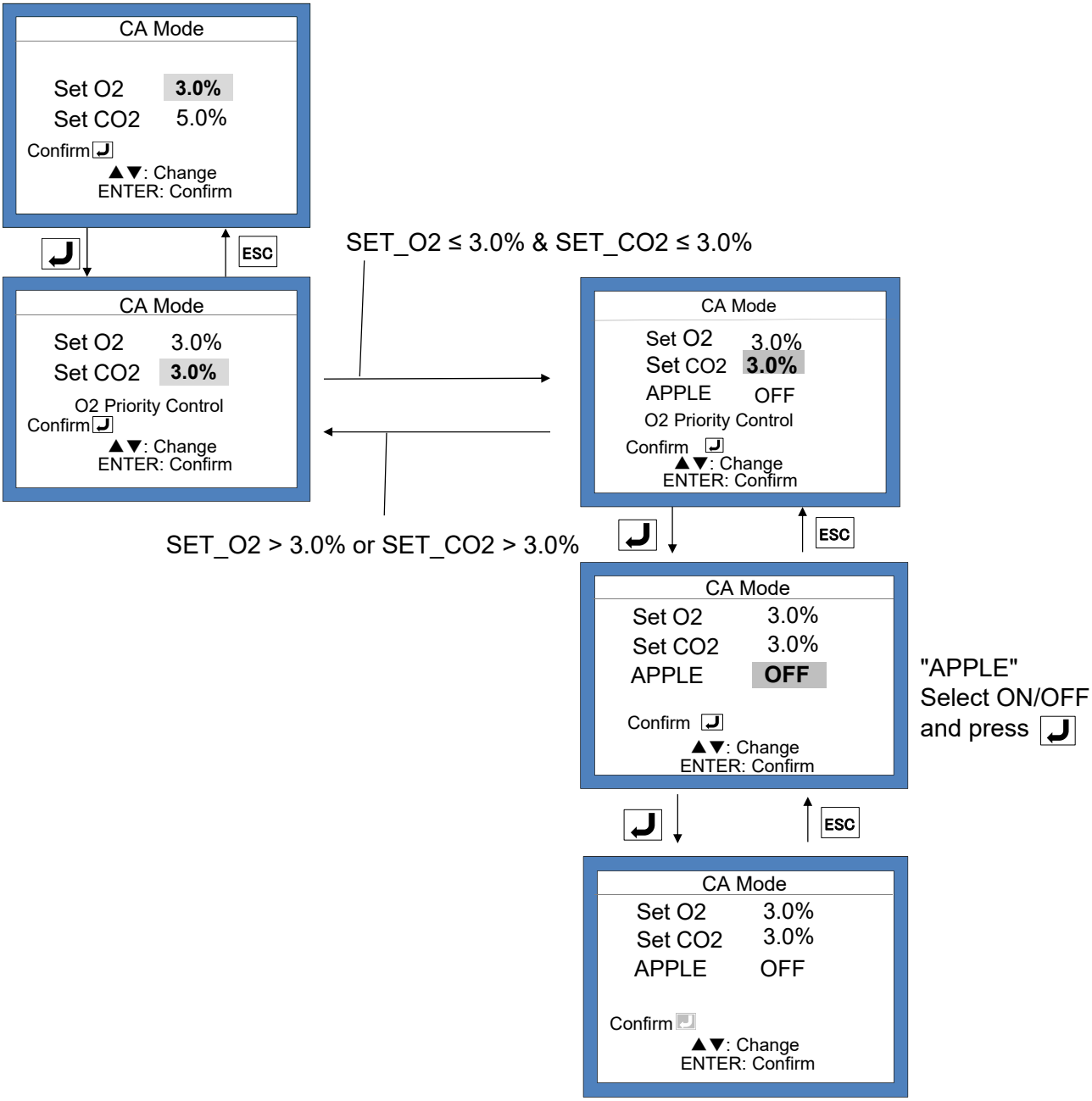

When $CO_2$ concentration is set at 1 to 10%, $O_2$ concentration is controlled with priority. However, when $CO_2$ concentration setting is set to 11% or higher, it is automatically controlled with priority for $CO_2$ concentration.

## <APPLE mode setting procedure>

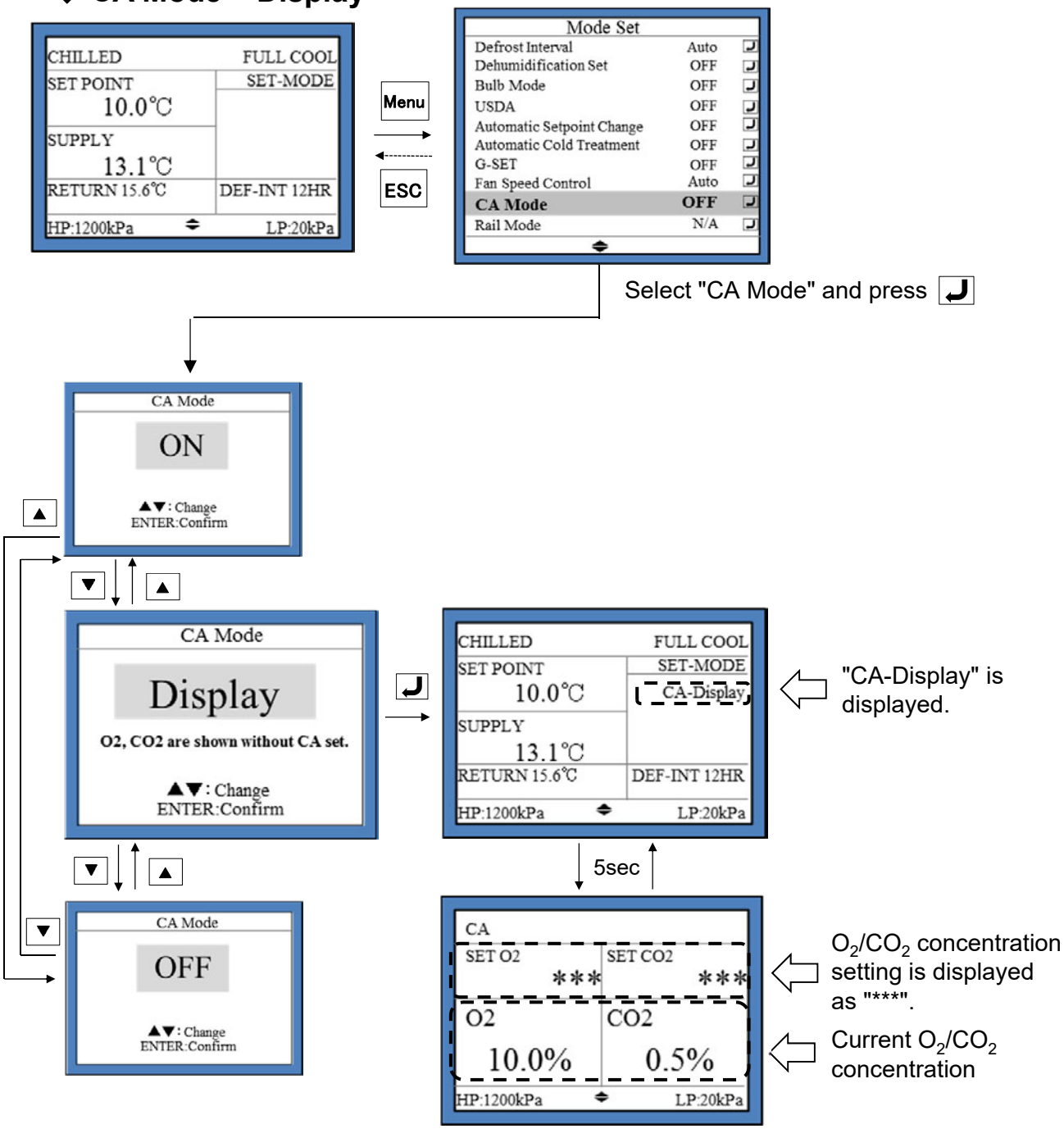
If the container unit software version and CA software version are Ver.3044 or later and Ver.44 or later, when SET_O2 ≤ 3.0% & SET_CO2 ≤ 3.0%, APPLE mode can be set with the following procedure.
If any of the above conditions are not met, it will automatically turn OFF.

**CAUTION**

This setting is for transporting apples.
Do not turn this setting ON when transporting cargo other than apples.

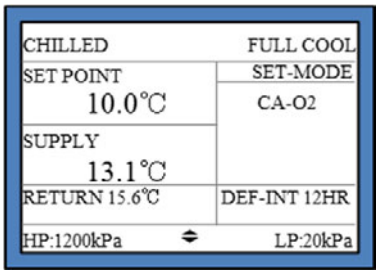


## ◆ CA Mode = Display



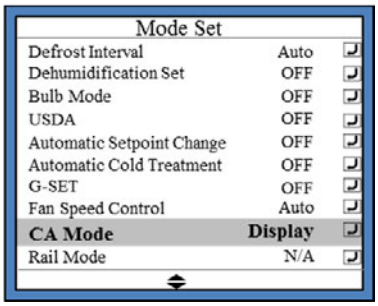
## ◆ CA Mode = OFF

CA = ON

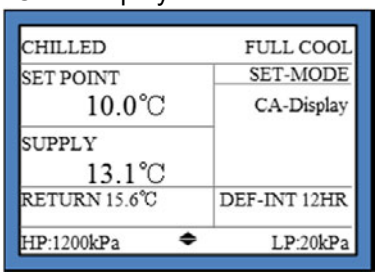



Menu →

← ESC

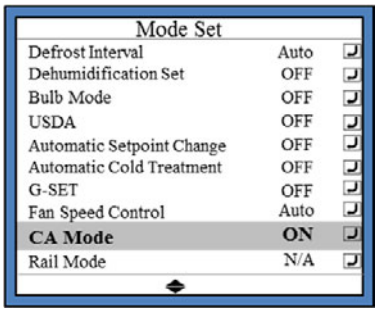



CA = Display

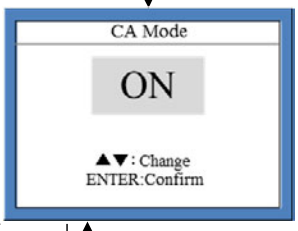



Menu →

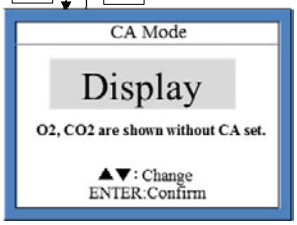
← ESC



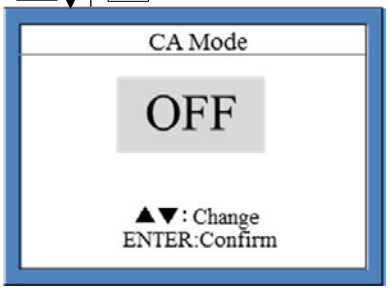

Select "CA Mode" and press ↵



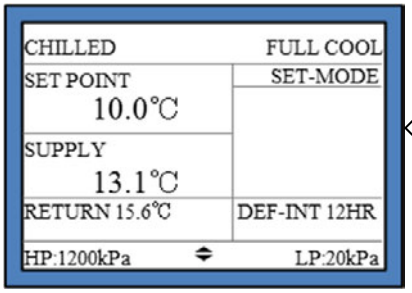

▲ ▼ ▲




▼ ▲



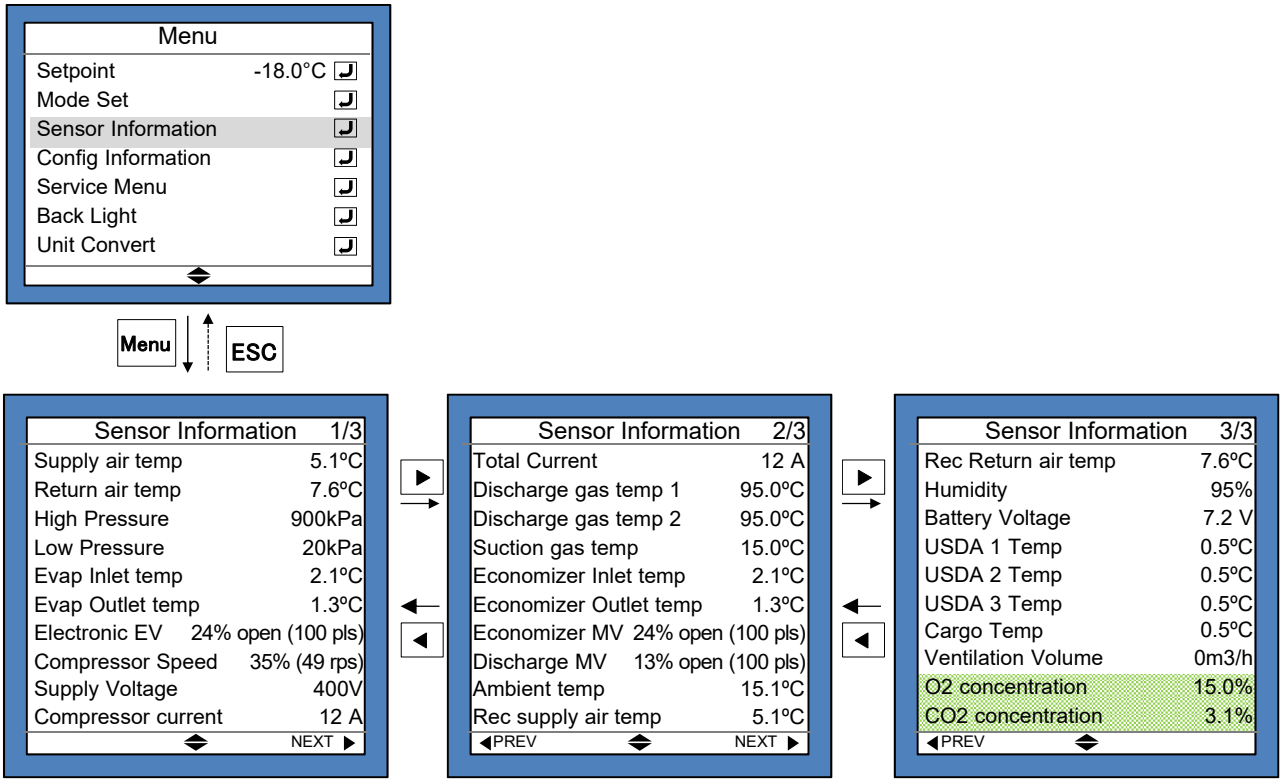

↵ →




⇦ CA or CA-Display is not displayed

## 3.2.6 Sensor Information

Displays the present values of $O_2$ and $CO_2$ sensors.

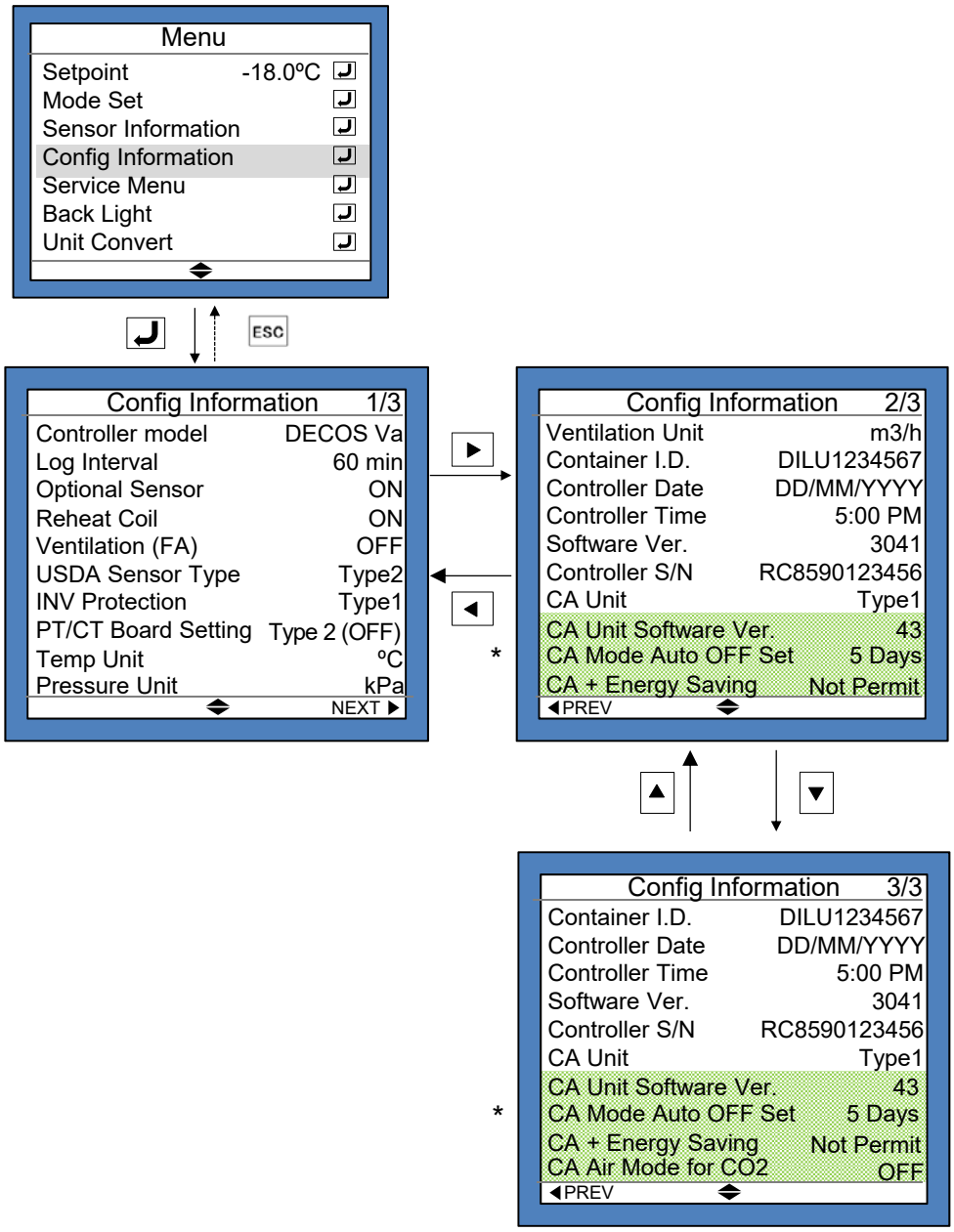



Displays the present values of $O_2$ and $CO_2$ concentration.

### 3.2.7 Configuration Information

Displays the contents set in Config Set.
The following CA function settings can be checked.

- CA unit software version
- CA mode automatic OFF setting
- CA + energy saving combination setting
- $CO_2$ emission control setting




*Displayed only when the CA unit setting is "Type1".

- To change the settings, go to Config Set from the Initialize Menu screen. (3.2.2, 3.2.4)

### 3.2.8 Optional Function Setting

The following items can be set for the CA function.

- Evaporator fan low setting (**EF-Low speed with CA Mode)** ON/OFF

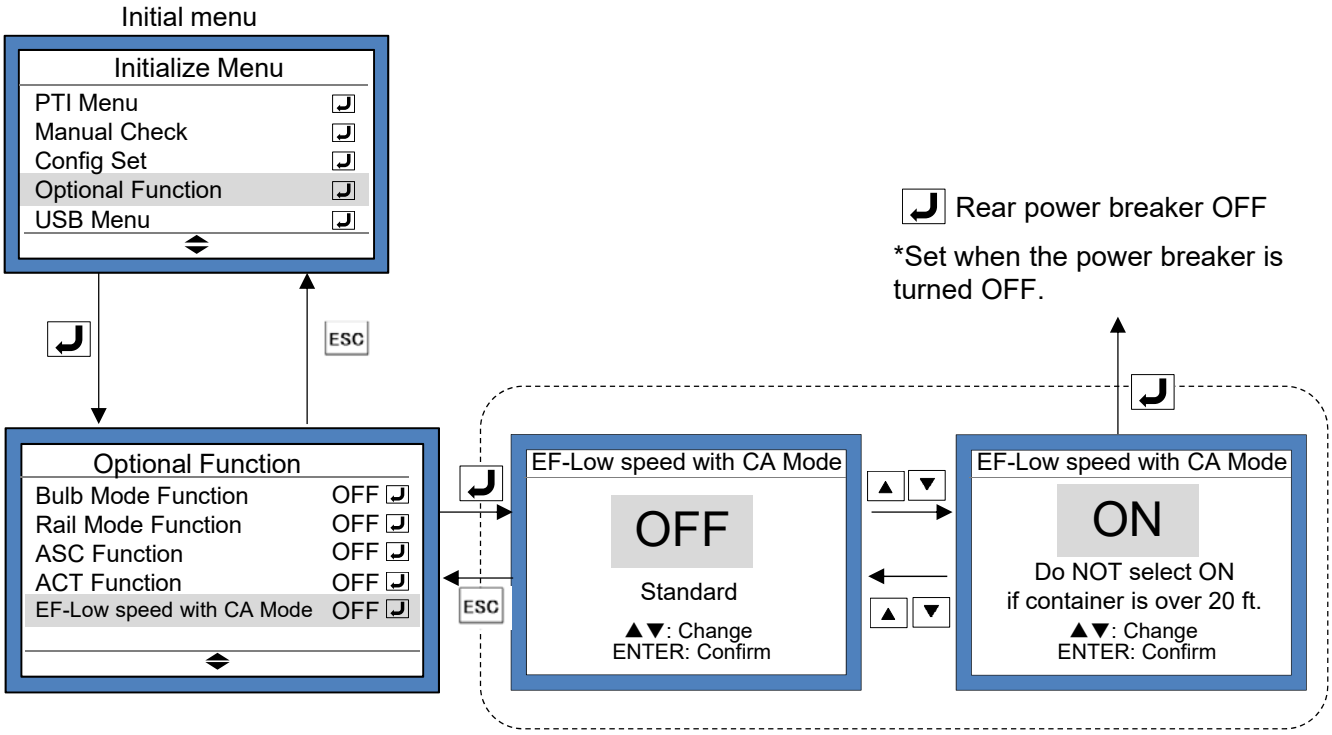
**Precautions for setting EF-Low speed with CA Mode**

1. If the cargo respiratory volume is too low with a 20 ft container, turn the setting ON.
   ON: The evaporator fan operates at low speed during CA unit operation
   OFF: The evaporator fan operates normally

2. When the CA mode setting is set to "OFF" or "Display".
   Even if the EF-Low speed with CA Mode setting is set to "ON", the evaporator fan operates at high speed or switches between high and low speed.

### <EF-Low speed with CA Mode = ON setting procedure>

1. Press the Menu key on the operation preparation screen, select "Optional Function" on the "Initialize Menu" screen and press the ↵ key to display the "Optional Function" screen.
2. Select "EF-Low speed with CA Mode" on the "Optional Function" screen and press the ↵ key.
3. Select "ON" on the "EF-Low speed with CA Mode" screen.

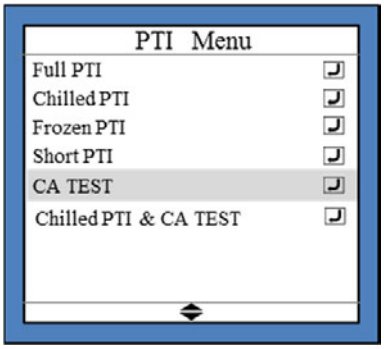


## 3.3 Pre-Trip Inspection

### 3.3.1 CA TEST

- CA TEST is implemented to find any abnormalities in CA device parts.
- When the CA unit setting is "Type1", "CA TEST" is added to the automatic PTI.
  When selected, the CA TEST is implemented.
- In "PTI Menu Function", "Chilled PTI & CA TEST" is added when "Chilled PTI & CA TEST" setting is ON & CA unit setting is "Type1".
  When selected, the CA TEST is implemented automatically after Chilled PTI is performed.

  * If an error occurs in Chilled PTI, it ends at this point.

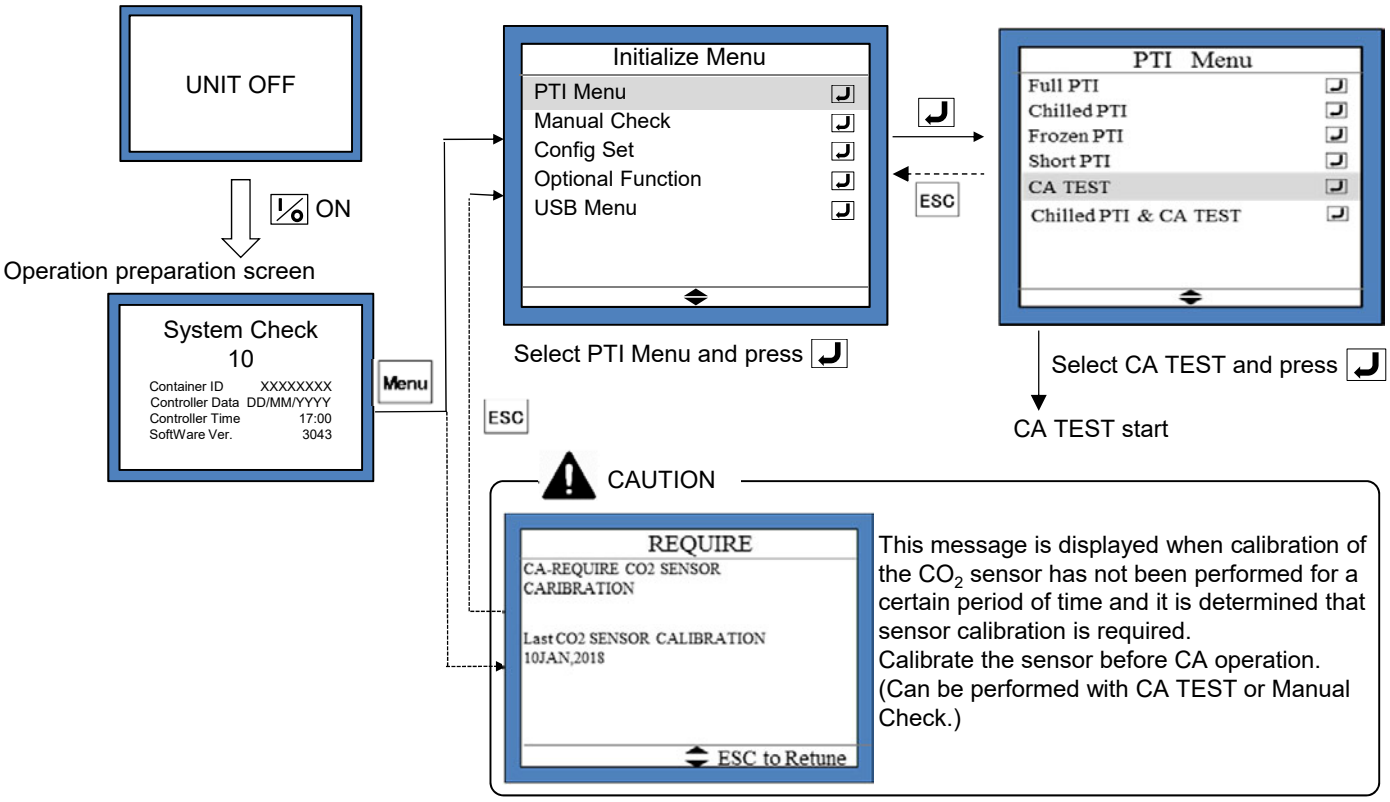



Displays "CA TEST" and "Chilled PTI & CA TEST"

**Precautions when performing CA TEST**

- CA TEST allowable internal temperature condition -5.0 ≤ inside temperature (RS) ≤ +30.0ºC
  Keep the temperature inside the container (RS) between -5.0ºC and +30.0ºC.
  Completes in about 40 minutes to 1 hour in normal conditions.
  If the above temperature conditions are not met, "T443" will occur and the CA TEST will complete.
  Adjust the inside temperature (RS) to -5.0ºC to +30.0ºC and perform the CA TEST again.

**<CA TEST start procedure>**



## ◆ CA TEST step numbers and contents

For details on CA TEST alarms, see "5.1 CA TEST (Pre-Trip Inspection) Alarm List and Checkpoints".

| step | Details |
|---|---|
| P00 | Basic data records (container number, date, time, compressor elapsed operation time, ambient temperature) |
| P02 | Sensor alarm check (RS, DRS) |
| P03 | PCC fusing check |
| P40 | Checking air pump interior temperature sensor and pressure sensor |
| P42 | Air pump unit internal cooling fan, current sensor, motor for air pump, air pump, $O_2$ gas bypass valve, control valve, purge valve, main valve, $O_2$ concentration measurement valve, $O_2$ gas purge valve check |
| P44 | $O_2$ sensor, $CO_2$ sensor check |
| P46 | $O_2$ concentration measurement valve, system capacity check |

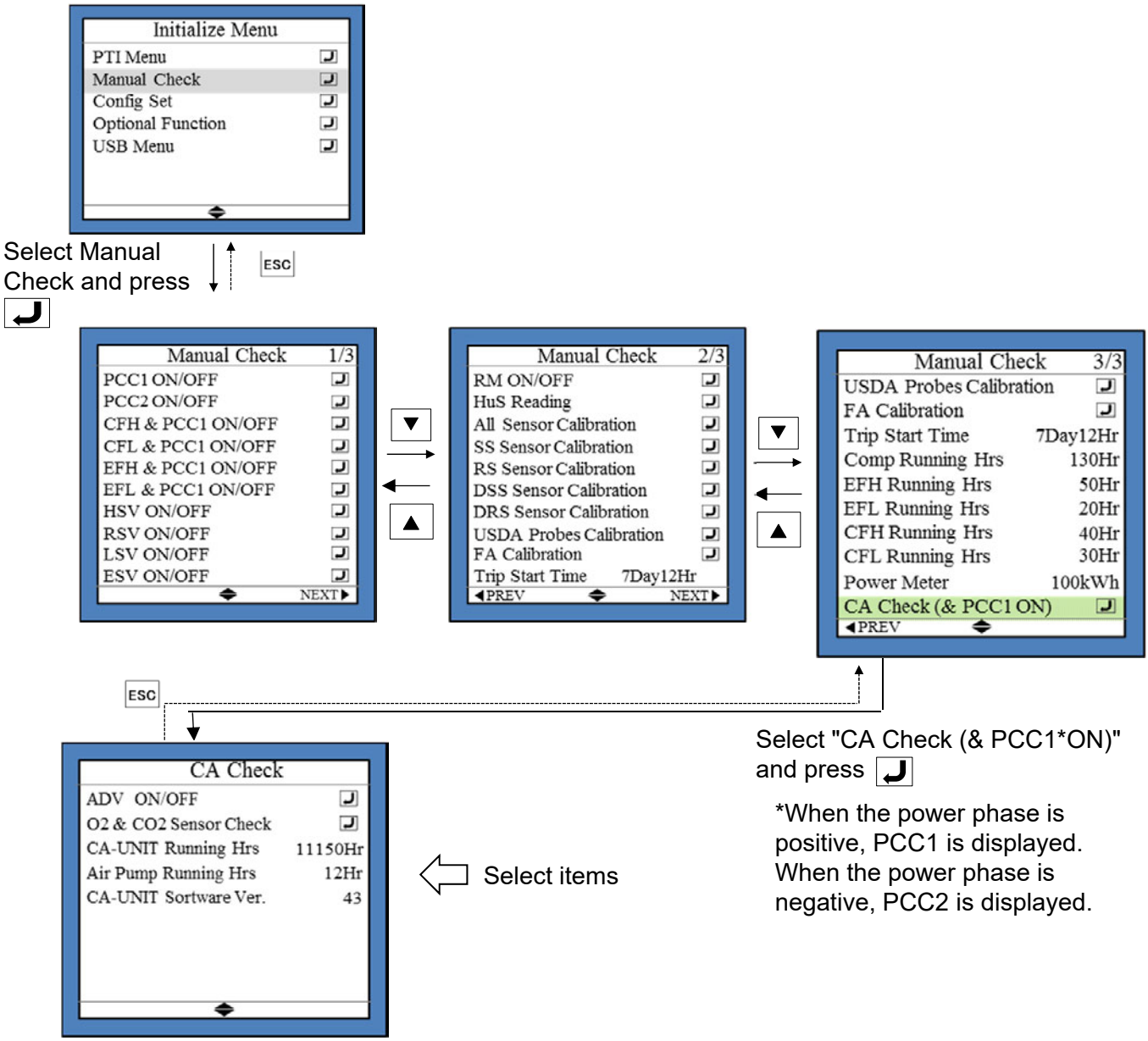
* When the temperature inside the chamber (RS) is lower than -5.0ºC or higher than +30.0ºC between the start of CA TEST and the start of P44, "T443" is generated and PTI is forcibly terminated.
Adjust the inside temperature (RS) to -5.0ºC to +30.0ºC and perform the CA TEST again.

### 3.3.2 CA Check

With CA Check, the following CA device items can be inspected.

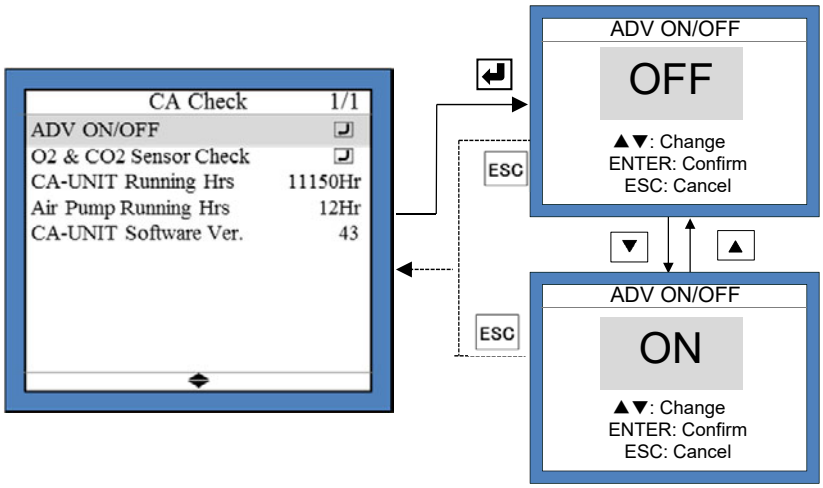
- Air discharge valve (ADV) ON/OFF operation
- $O_2$ & $CO_2$ sensor check
  Checks $O_2$ sensor and calibrates $CO_2$ sensor
- CA unit total operation time display
- Air pump operation time display / operation time clear operation
- CA unit software version display

**<Operation method>**



## <CA Check items>

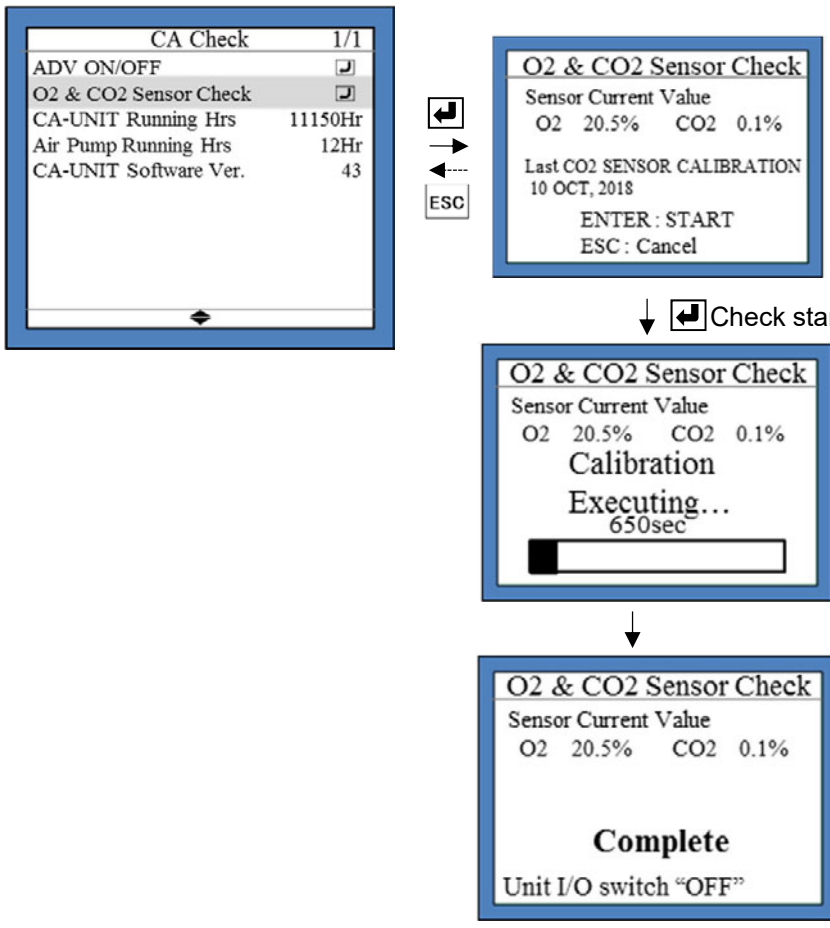
### ◆ ADV ON/OFF




Press the key to turn the air discharge valve (ADV) OFF.

Press the key to turn the air discharge valve (ADV) ON.

### ◆ O2 & CO2 Sensor Check




Displays current $O_2$/$CO_2$ concentration

Displays date of most recent calibration of $CO_2$ sensor

Check starts with

Displays remaining check time

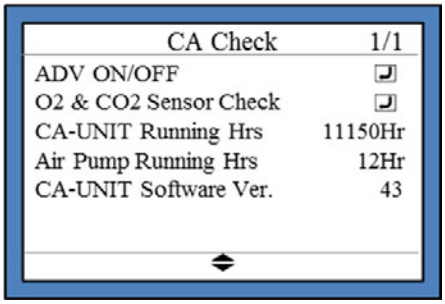
Check completed
At sensor abnormality, an alarm is displayed.

Check failed

T441: $O_2$ sensor circuit failure
T442: $O_2$ sensor life/disconnection
T443*: Inside temperature is outside conditions (-5ºC ≤ RS ≤ 30ºC)
T444: $CO_2$ sensor failure
T445: $CO_2$ sensor calibration failure

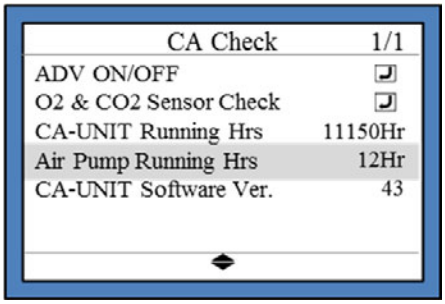
* If T443 is displayed, adjust the inside temperature within the conditions and perform sensor check again.

## ◆ CA Unit Running Hours



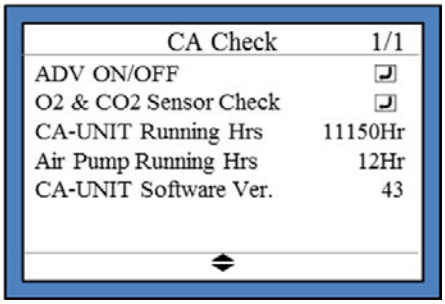

Displays total operating time of the CA unit.

## ◆ Air Pump Running Hours




Displays total operating time of the Air Pump.
↵ is pressed for more than 3 seconds to reset the accumulated time to 0.

## ◆ CA Unit Software Version




Displays the software version of the CA device.

# 4. Service and Maintenance

**⚠ DANGER Safety Precautions**

Low oxygen and high carbon dioxide status cannot be identified visually or by smell. When entering the container equipped with CA device or opening the access panel, use a device that can properly detect oxygen and carbon dioxide, and confirm that the environment in the container is oxygen concentration: 21% and carbon dioxide concentration: 1% or less.

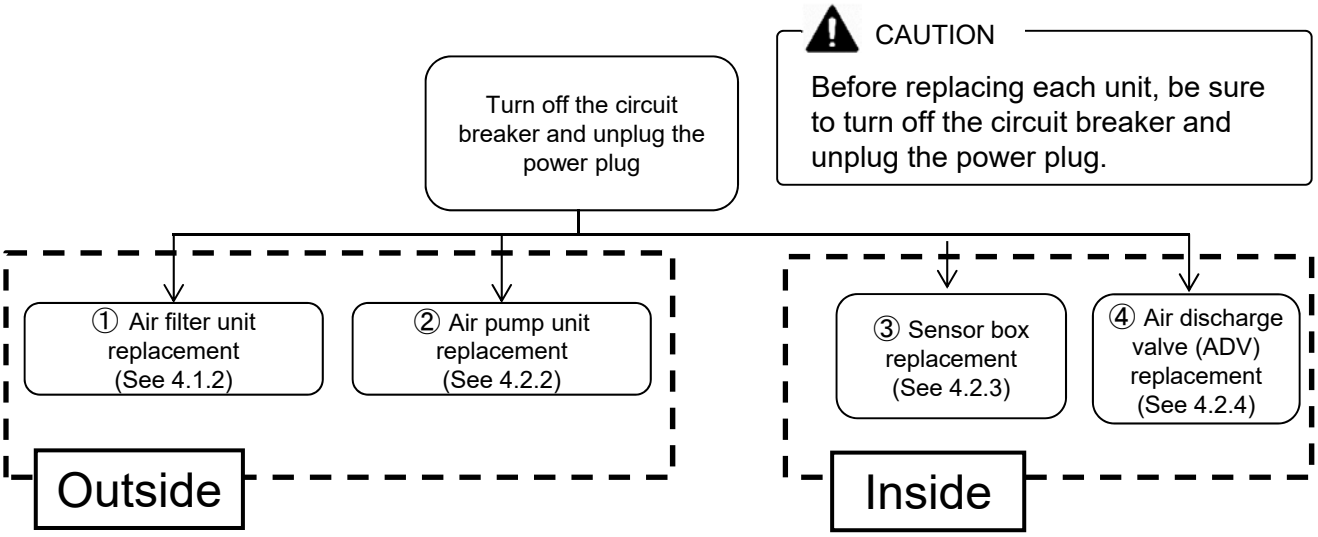
## 4.1 Maintenance Overview

There are two types of maintenance parts for CA device: inside and outside the container.

Outside container: Air pump unit, air filter unit
Inside container: Sensor box, air discharge valve (ADV)

### ◆ Maintenance parts replacement process

The following is the replacement process for maintenance.
Details of the maintenance procedure are described on the following pages.



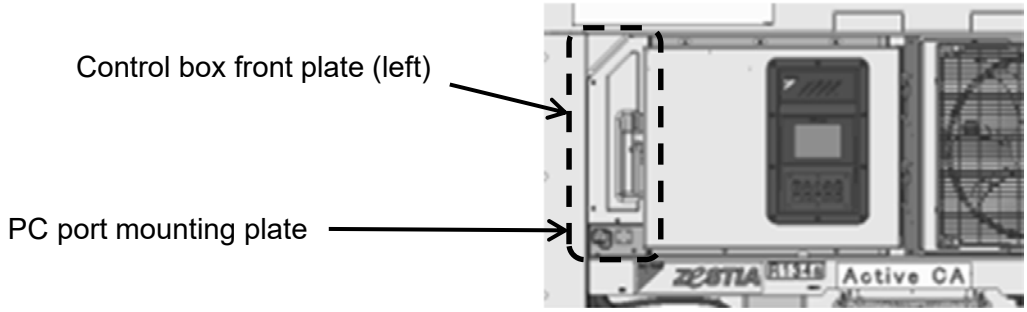

*The sensor box and air discharge valve (ADV) can also be replaced from outside the container. In that case, it is necessary to remove the access panel and evaporator fan motor.

**Estimated parts replacement time**
Filter: 2 years
Air pump unit: 10,500 hrs

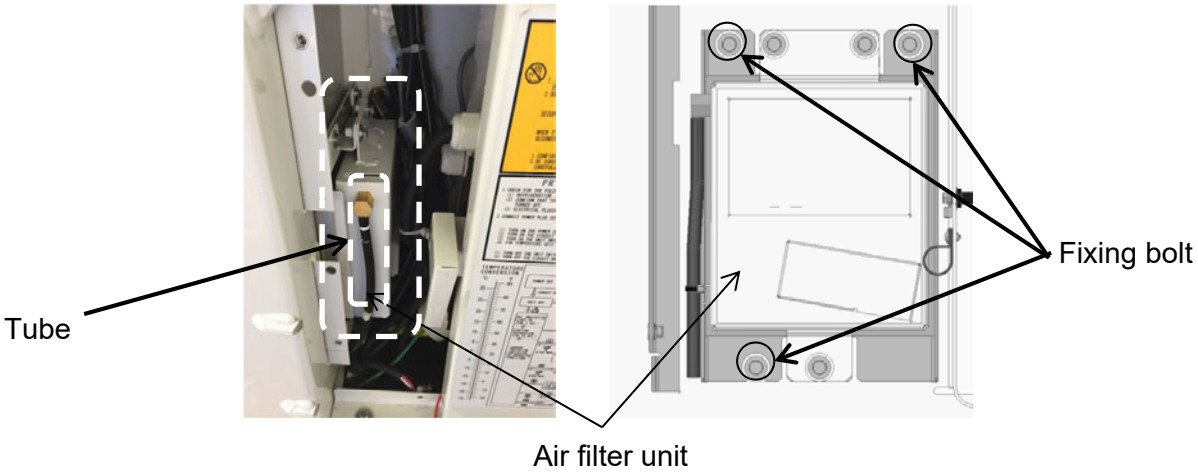
## 4.2 CA Device Maintenance

### 4.2.1 Air Filter Unit Replacement Procedure

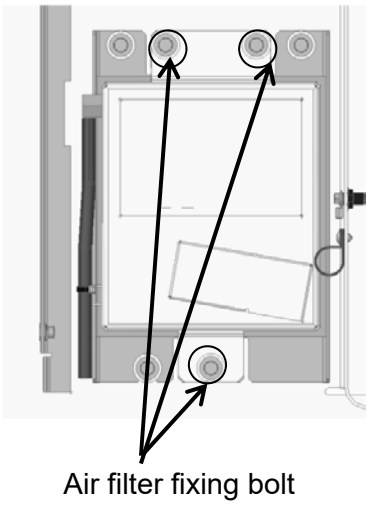
1) Remove the control box front plate (left) and PC port mounting plate.

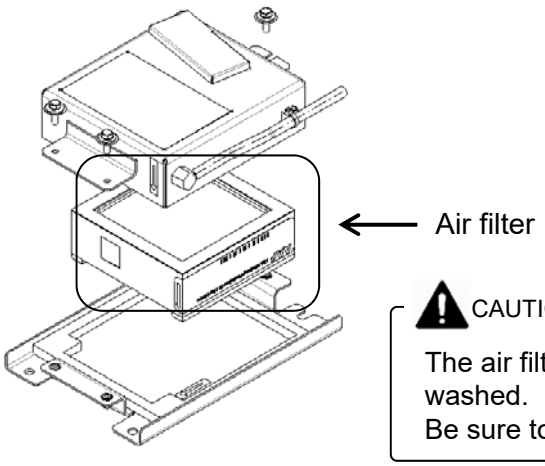



2) Remove the fixing bolts (3 pcs) and the air filter unit tube, and then remove the air filter unit from the casing.




3) Remove the air filter unit, remove the fixing bolts, and remove the air filter.



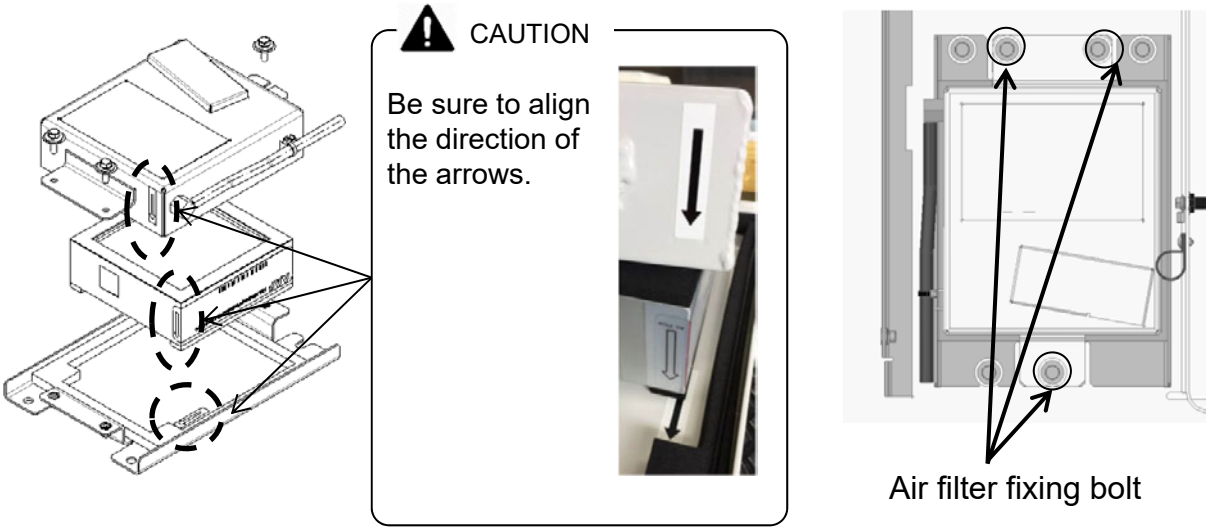




**CAUTION**

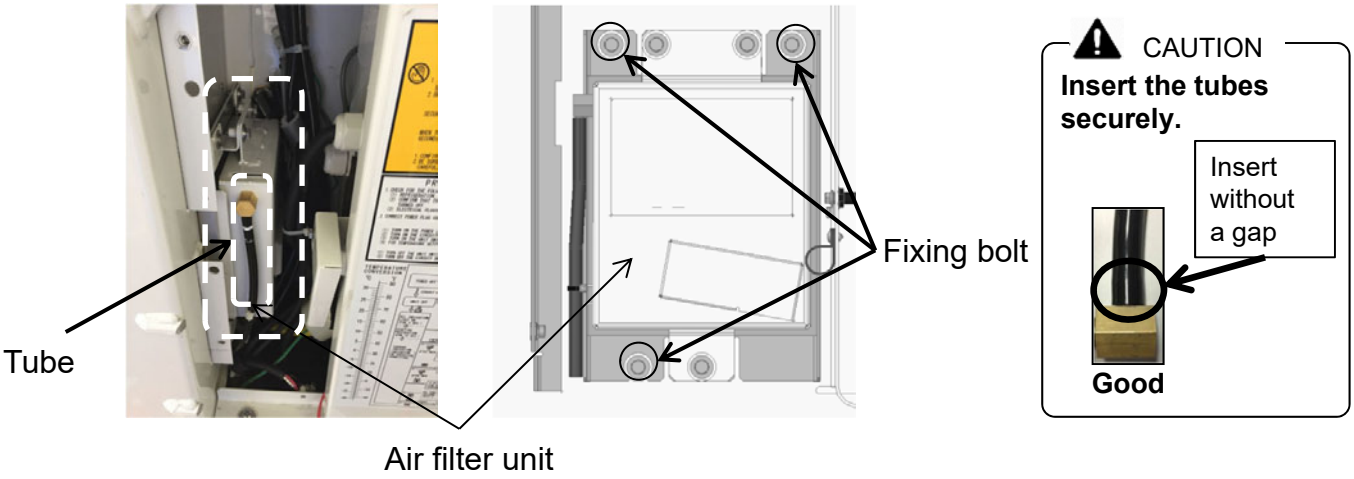
The air filter cannot be washed.
Be sure to replace it.

When replacing the air filter, write the date of replacement on the nameplate included with the main unit.

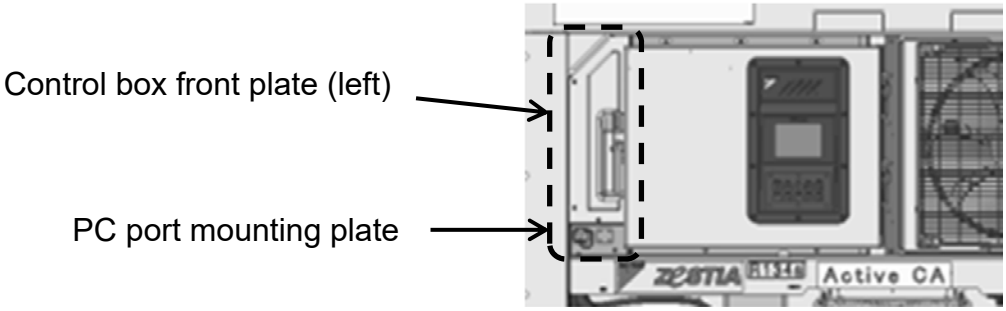
4) Replace the air filter.




5) Fix the air filter unit to the casing and mount the tube.

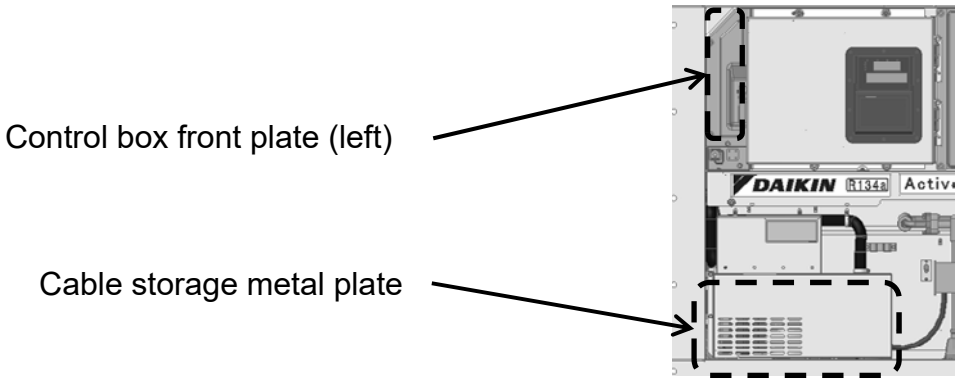



6) Mount the control box front plate (left) and PC board mounting plate.

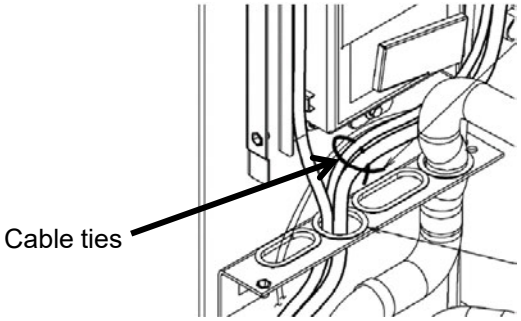


## 4.2.2 Air Pump Unit Replacement Procedure

1) Remove the control panel front plate (left) and the cable storage metal plate.



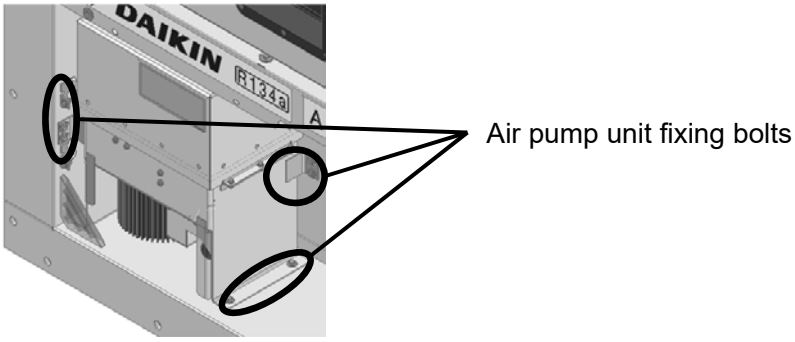

2) Remove the cable ties securing the CA harness.



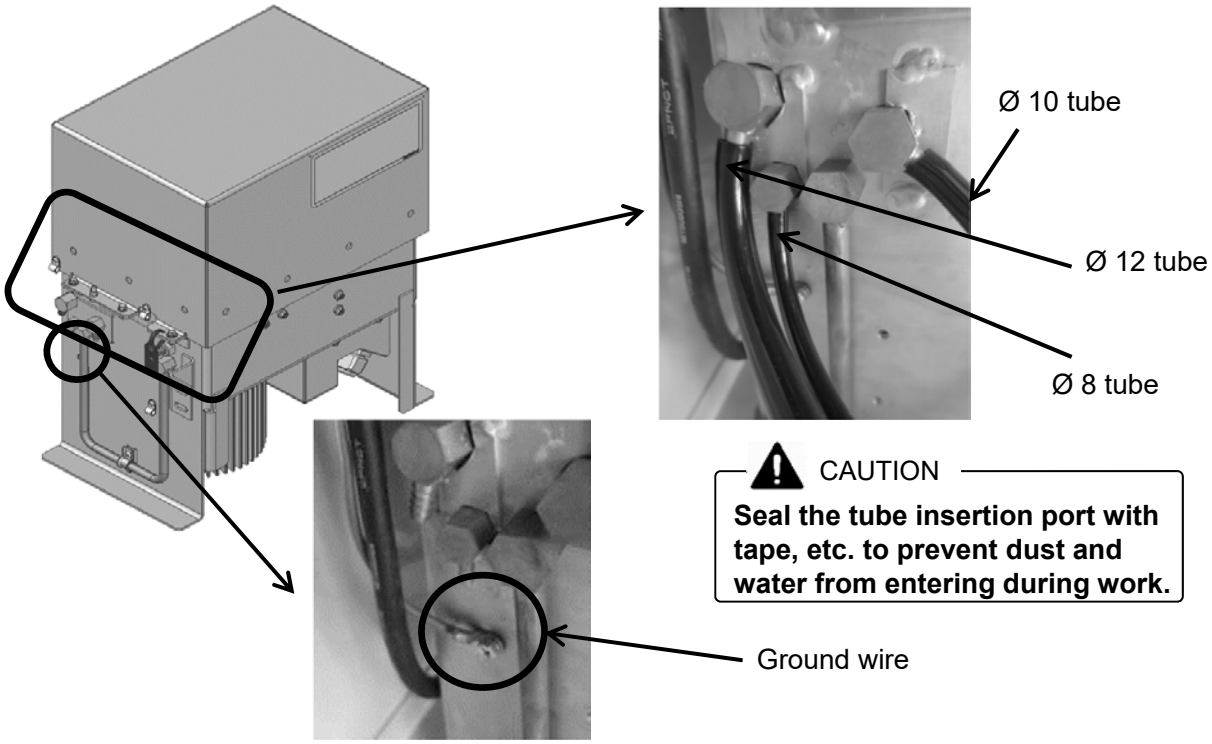

3) Remove the four relay connectors fixed next to the control box.

4) Remove the power relay connector from the control box.

5) Remove the fixing bolts of the air pump unit.



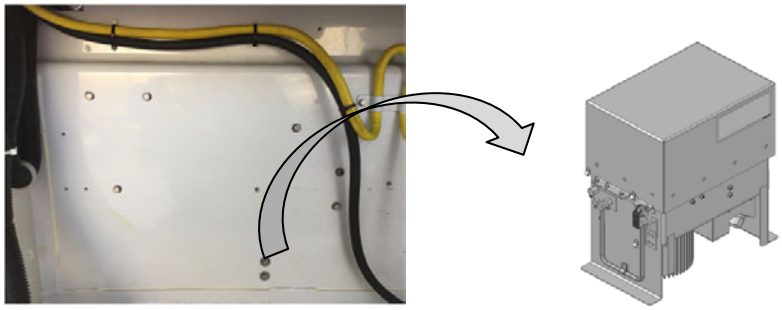

6) Slide the air pump unit, and remove the three tubes and the ground wire connected to the air pump unit.



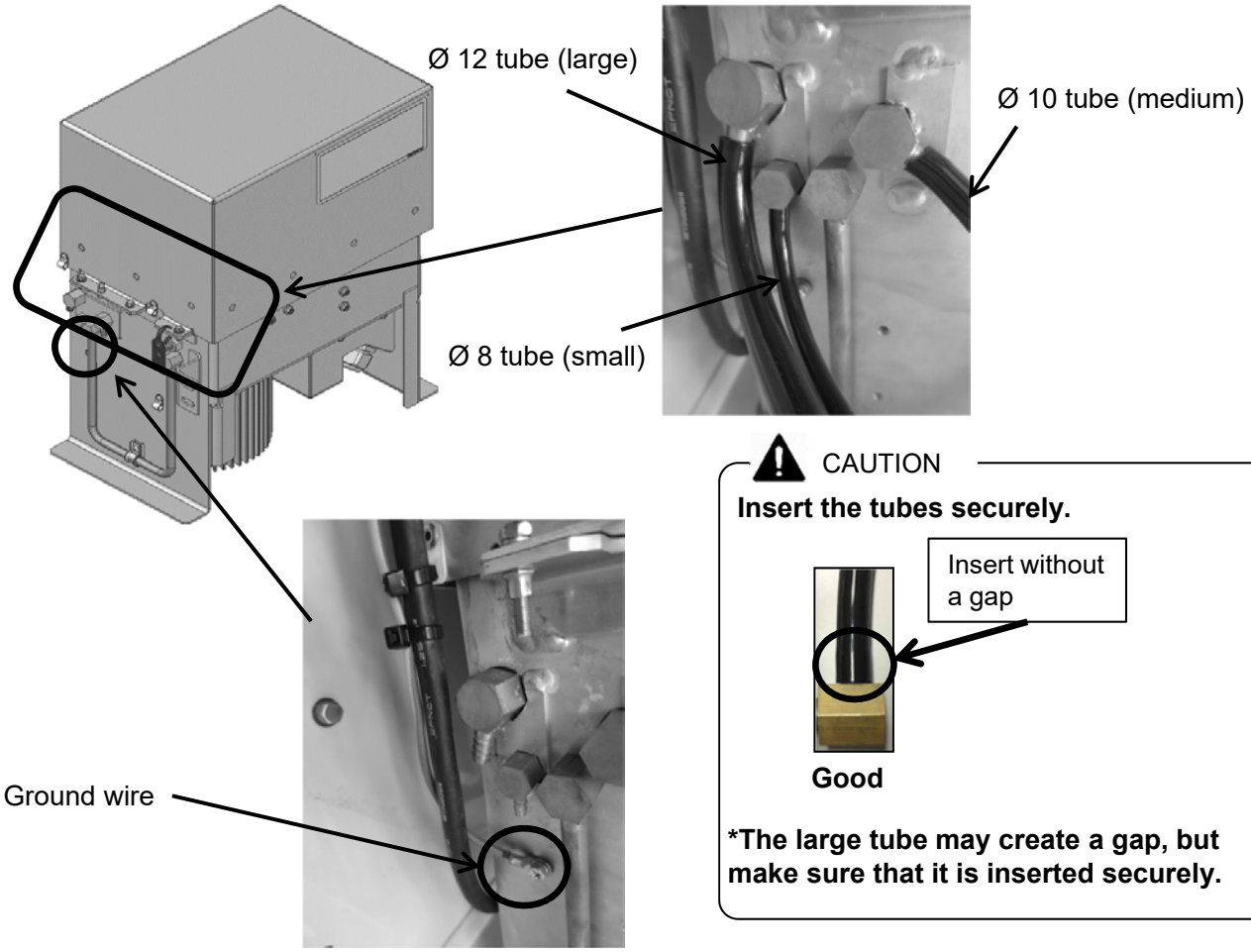

CAUTION

**Seal the tube insertion port with tape, etc. to prevent dust and water from entering during work.**

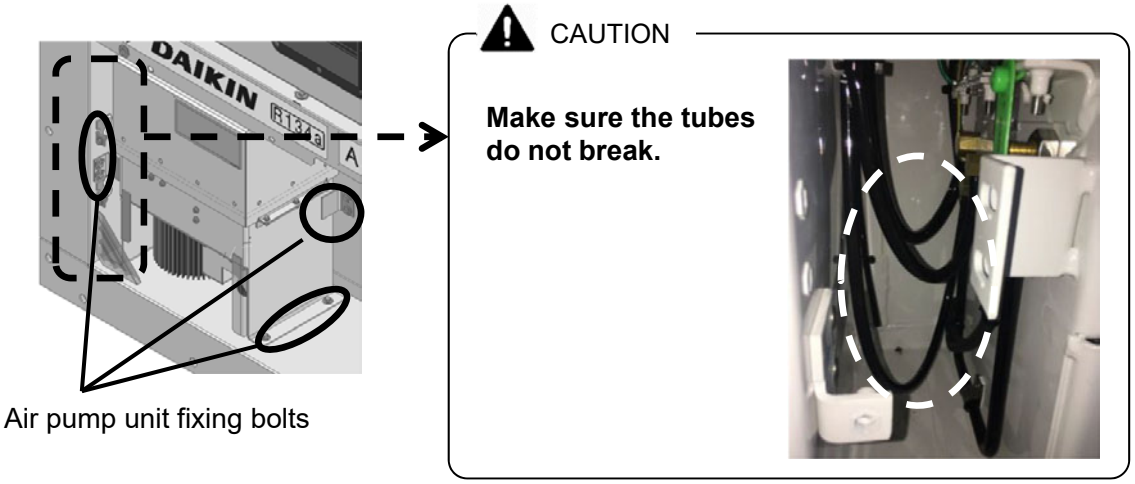
7) Remove the air pump unit.



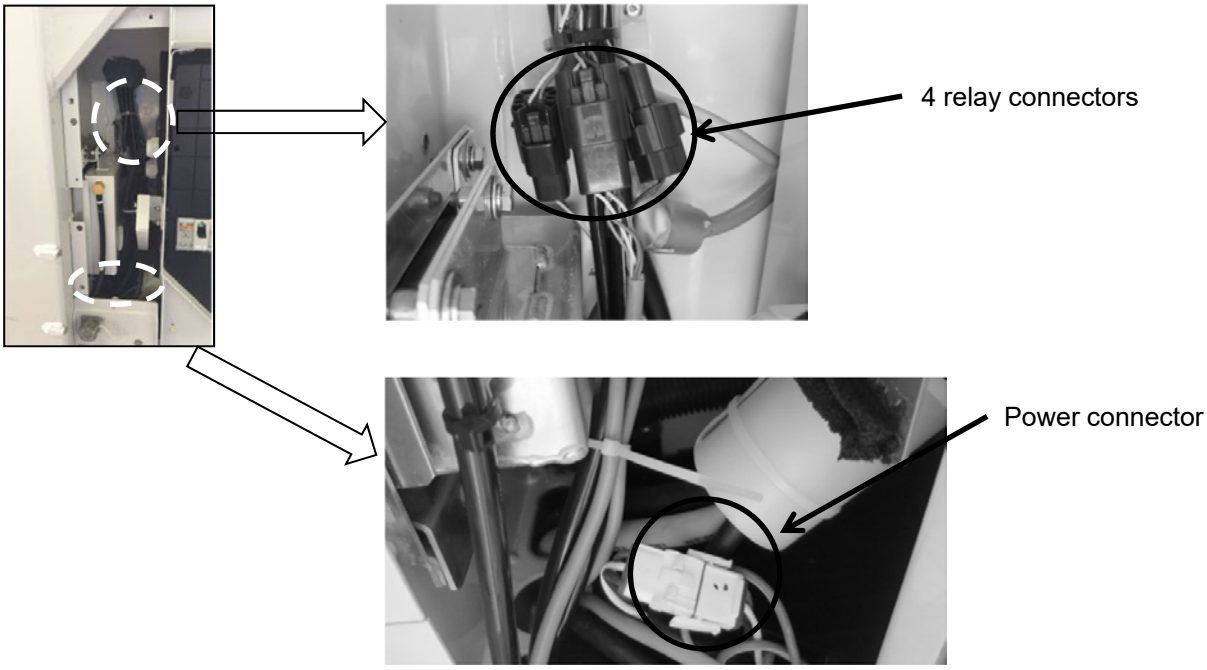
8) Place the air pump unit on the casing, and mount the three tubes and the ground wire to the air pump unit.




9) Push in the air pump unit and install with fixing bolts.

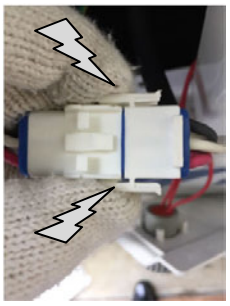


10) Mount four relay connectors and one power connector.

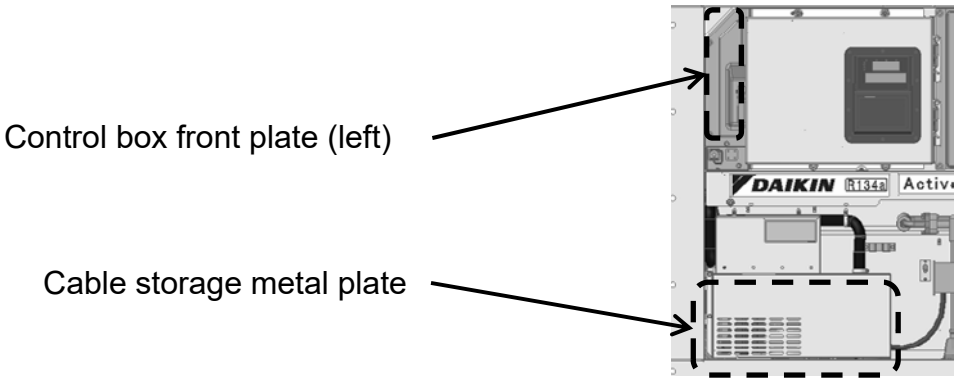



CAUTION

- **Connect the connectors securely.**
- **Check that the power connector is securely hooked on.**
- **Check that the waterproof rubber of the female connector is not disconnected before connecting.**



11) Mount the control panel front plate (left) and the cable storage metal plate.

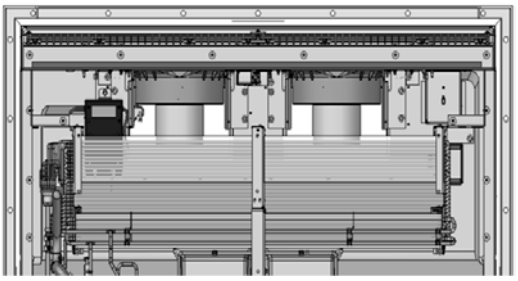


### 4.2.3 Sensor Box Replacement Procedure

The sensor box can be replaced both inside and outside the container.

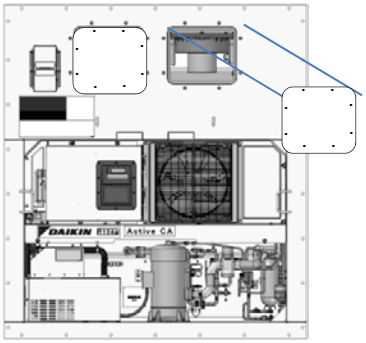
Preparation

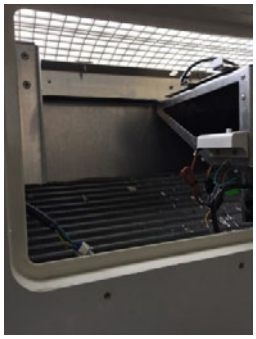
◆ Inside



Remove the back plate.

◆ Outside

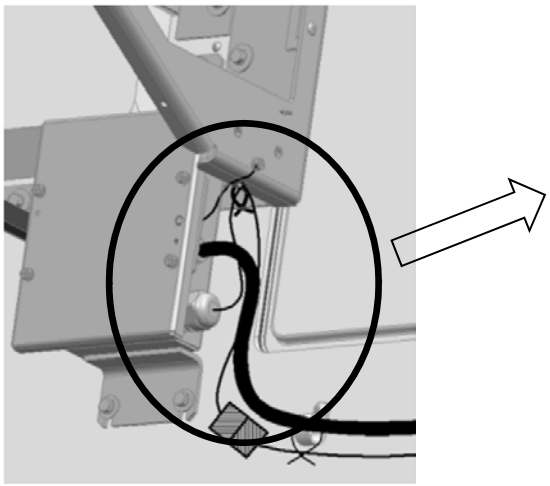


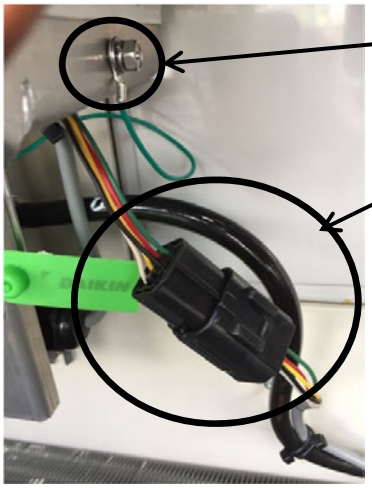


Remove the right access panel and evaporator fan.

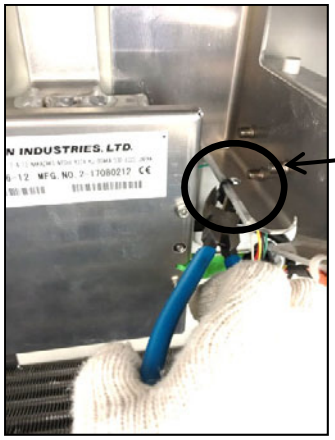
◆ Sensor box replacement

1) Disconnect the ground wire and connector.






2) Cut the cable ties.



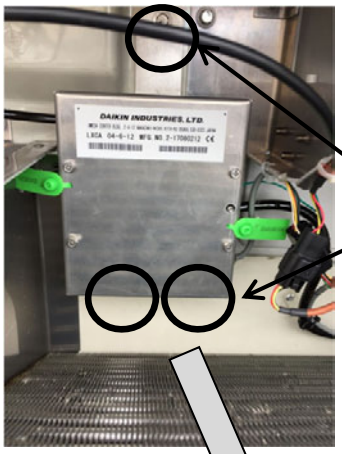
3) Remove the two tubes.

Tube x 2

CAUTION

If the tubes do not come off, cut the tubes at the base.
Be careful not to damage the tube connection at this time.

4) Remove three mounting bolts and remove the sensor box.

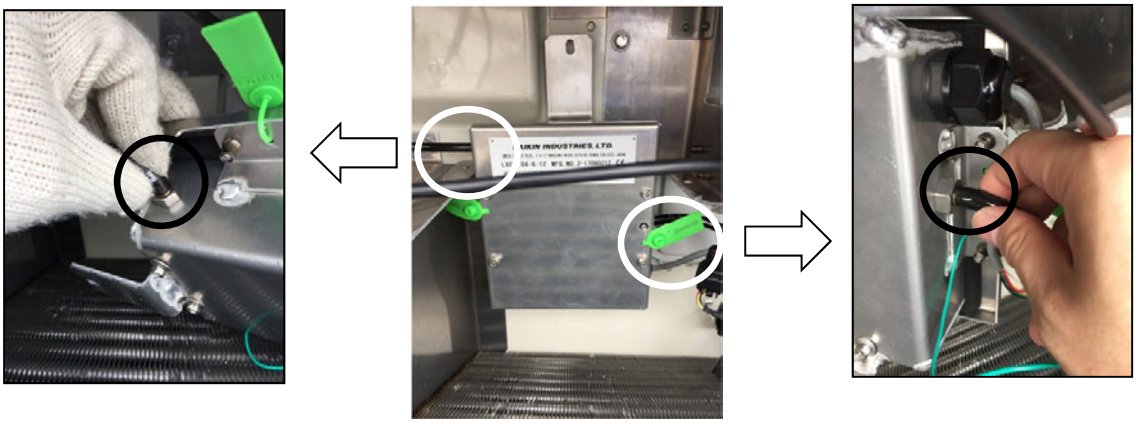


Bolt x 3

There is a notch at the bottom of the sensor.
The sensor box can be removed by loosening the bolts.

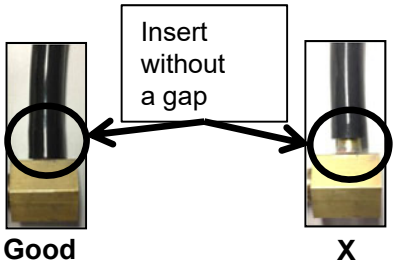
After removing the sensor box

5) Attach the two tubes.

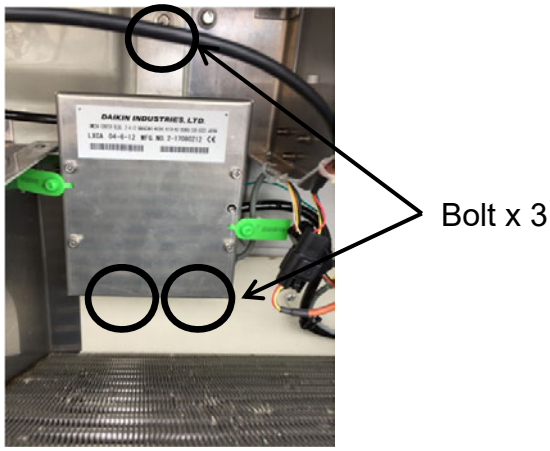


CAUTION

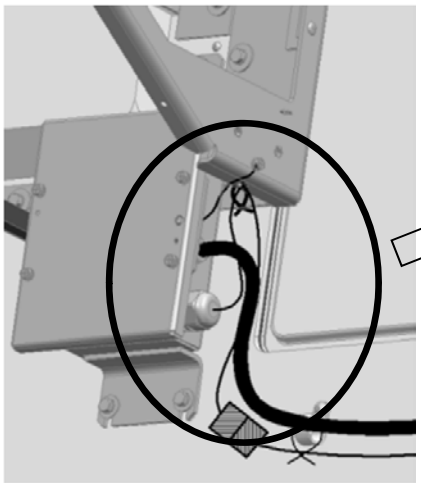
**Insert the tubes securely.**

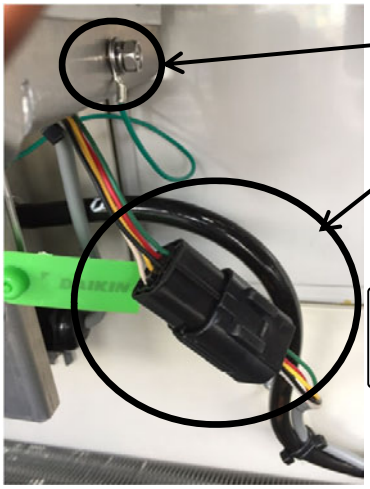



6) Secure the sensor box with mounting bolts.



7) Attach the connector and ground wire.

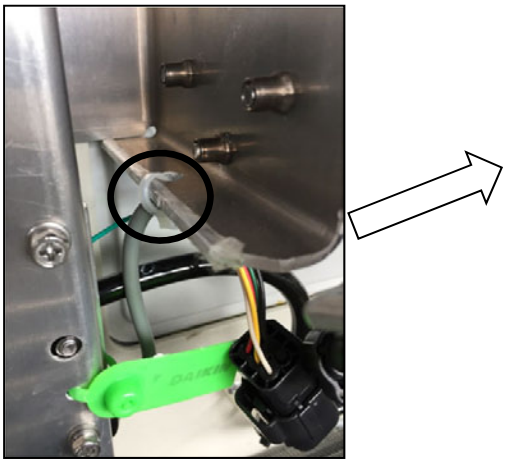


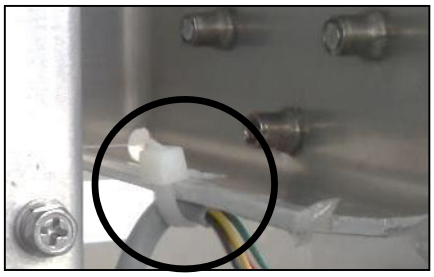



CAUTION

Mount securely.

8) Secure with cable ties





CAUTION

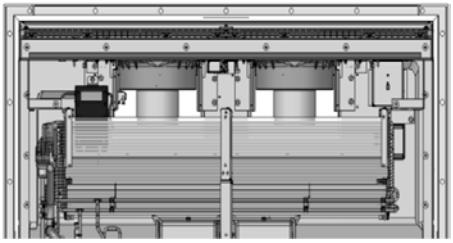
Secure with the sheath of the cable.

9) Complete

## 4.2.4 Air Discharge Valve (ADV) Replacement Procedure

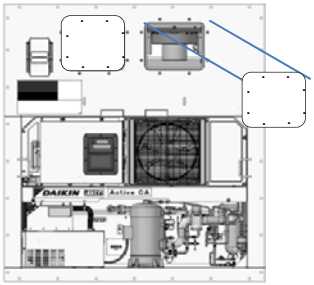
The air discharge valve (ADV) can be replaced both from inside and outside the container.

◆ Inside the container



Remove back plate

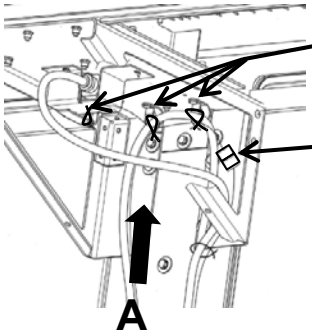
◆ Outside the container



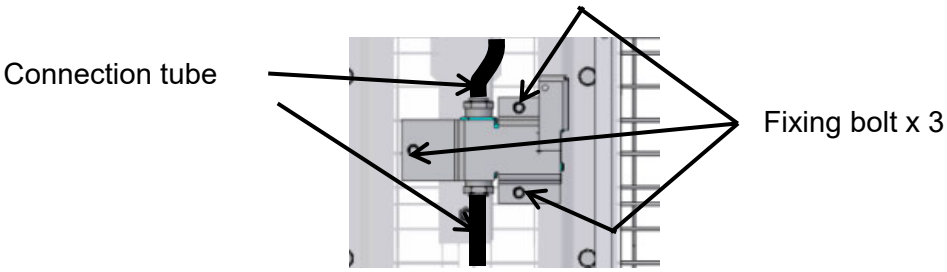
Remove right access panel and fan motor

◆ Air discharge valve (ADV) replacement

1) Cut the cable ties (3 places) that secure the harness of the air discharge valve.
2) Remove the waterproof connector.




3) Remove the tube connected to the air discharge valve fitting.
4) Remove the fixing bolts (3 pcs).




**Arrow A**

5) Replace the air discharge valve (ADV)

CAUTION
Mount securely

■ Mounting the replacement air discharge valve

① Mount the parts in the reverse order of the above.
Tighten the removed bolts with the specified torque (229 ±34 cN • m).
For the specified torque, see "9.1 Standard Tightening Torque for Bolts and Screws".

② Connect the removed tube to the tube connection.
Connect the tube down to the base.

③ Secure the harness with the cable ties so that it does not contact the evaporator fins.
(Insufficient fixation: Harness may wear and wire may break.)

# 5. Failure Diagnosis

## 5.1 CA TEST (Pre-Trip Inspection) Alarm List and Checkpoints

- In the following CA TEST alarm code list, ● will be J or T depending on the type of marine container refrigeration system.
- When an alarm is generated during the CA TEST,
  **① Replace the air filter unit and perform the CA TEST again.**
  **② If another alarm is generated, check each time for abnormalities.**
- **If an "F or E alarm" is generated during the CA TEST, take measures according to 5.2 CA-Related Alarm Codes.**

| Check number (LED display) | Check contents | | Alarm display | Error description | Parts for replacement | |
|---|---|---|---|---|---|---|
| | | | | | Air pump unit | Sensor box |
| P40 | Failure of temperature sensor (BTS) in the air pump | | E672 | Open, short | ✓ | |
| | Failure of pressure sensor (APT) | | E678 | Open, short | ✓ | |
| P42 | Operation of cooling fan in the air pump unit | DCF1 | E679 | The ON signal from DCF1 is not detected | ✓ | |
| | | DCF2 | E680 | The ON signal from DCF2 is not detected | ✓ | |
| | Failure of current sensor (CT1) | | ●421 | Pressure rises and no current is detected | ✓ | |
| | Operation of air pump | | ●422 | Pressure does not rise, and no current is detected | ✓ | |
| | Operation of air pump motor (AMP) | | ●423 | Pressure does not rise and locked current is detected | ✓ | |
| | Operation of $O_2$ concentration measurement valve (OCV) | | ●424 | $O_2$ concentration measurement valve (OCV) is open but $O_2$ concentration does not fluctuate | ✓ | |
| | Operation of $O_2$ gas purge valve (OPV) | | ●425 | $O_2$ gas valve (OPV) is open but $O_2$ concentration does not rise | ✓ | |
| | Operation of control valve | CTV1 | ●426 | Control valve (CTV1) is open but pressure does not change | ✓ | |
| | | CTV2 | ●427 | Control valve (CTV2) is open but pressure does not change | ✓ | |
| | Operation of main discharge valve (ODV) | | ●428 | Main discharge valve (ODV) is open but pressure does not change | ✓ | |
| | Operation of $O_2$ gas bypass valve (OBV) | | ●429 | $O_2$ gas bypass valve (OBV) is open but pressure does not change | ✓ | |
| | Operation of purge valve (PGV) | | ●42A | Purge valve (PGV) is open but pressure does not change | ✓ | |
| P44 | Failure of $O_2$ sensor circuit (CA control panel) | | ●441 | Output voltage exceeds the appropriate range | ✓ | |
| | $O_2$ sensor (O2S) life / failure | | ●442 | Output voltage exceeds the appropriate range | | ✓ |
| | Determination temperature range | | ●443 | Intake air temperature exceeds determination temperature range | *1 | |
| | Failure of $CO_2$ sensor (CO2S) | | ●444 | Output voltage exceeds the appropriate range | | ✓ |
| | Failure of $CO_2$ sensor (CO2S) calibration | | ●445 | Calibration failure (unable to save) | ✓ | |
| P46 | Operation of $O_2$ concentration measurement valve (OCV) | | ●461 | Decrease in $O_2$ concentration is below 5% | ✓ | |
| | System capacity | | ●462 | $O_2$ concentration does not decrease below 8% | ✓ | |

*1 Adjust the intake air temperature to -5 to + 30ºC and perform the CA TEST again.

## 5.2 Alarm Codes

When an alarm is generated, identify the cause of the failure and troubleshoot according to the table below.

*For information on container refrigeration system alarms, refer to the Marine Container Refrigeration System Service Guide.

◆ **F alarm: CA device stops.**

| Diagnosis | Page | Alarm | Error description | Action at abnormality |
|---|---|---|---|---|
| 001 | 5-3 | F643 | Air pump unit operating current is high | CA device stops |
| 002 | 5-3 | F644 | Air pump motor error (E644) occurs multiple times | |
| 003 | 5-3 | F679 | Cooling fan 1 (DCF1) error (E679) & cooling fan 2 (DCF2) error (E680) | |

◆ **E-alarm: After stopping CA device operation, the operation continues with automatic reset, backup operation or error display only.**

| Diagnosis | Page | Alarm | Error description | Action at abnormality |
|---|---|---|---|---|
| 004 | 5-4 | E643 | Air pump motor (APM) operation not possible | Automatic reset after operation stop |
| 005 | 5-4 | E644 | Air pump motor (APM) error | |
| 006 | 5-5 | E651 | $O_2$ sensor (O2S) error | back-up operation |
| 007 | 5-5 | E652 | $CO_2$ sensor (CO2S) error | |
| 008 | 5-6 | E653 | Abnormal drop in $O_2$ concentration | Abnormality display only |
| 009 | 5-6 | E654 | Abnormal rise in $CO_2$ concentration | |
| 010 | 5-7 | E655 | Communication error between refrigeration system CPU and CA control board | After operation stop, automatic reset on error cancel |
| 011 | 5-7 | E656 | Air pump motor relay contactor fusing | back-up operation |
| 012 | 5-8 | E661 | Air pump unit high temperature error | After operation stop, automatic reset on error cancel |
| 013 | 5-8 | E671 | Air pump unit high pressure side discharge pressure error | Abnormality display only |
| 014 | 5-9 | E672 | Air pump unit temperature sensor (BTS) error | |
| 015 | 5-9 | E675 | Abnormal drop in high pressure side discharge pressure of air pump unit | back-up operation |
| 016 | 5-10 | E677 | Current sensor (CT1) error | Abnormality display only |
| 017 | 5-10 | E678 | Pressure sensor (APT) error | |
| 018 | 5-10 | E679 | Air pump unit cooling fan 1 (DCF1) error | |
| 019 | 5-11 | E680 | Air pump unit cooling fan 2 (DCF2) error | |
| 020 | 5-11 | E688 | Air pump unit maintenance is required | |

| 001 | F643 |
|---|---|
| Alarm logic | Air pump motor operating current is abnormally high |
| Possible causes | • Air pump motor is locked<br>• Air pump unit interior power supply path short-circuit<br>• State of continued air pump motor overload |
| Troubleshooting | Step 1: Make sure that the operating voltage and frequency are within the operating range<br>Step 2: Replace the air pump unit |
| Controller action | • All CA functions suspended<br>• Backup : None<br>• Alarm : F643<br>• Alarm LED : Blinking * |

| 002 | F644 |
|---|---|
| Alarm logic | "E644 Air pump motor error" generated multiple times<br>(When air pump motor operating current is not detected) |
| Possible causes | • Disconnection in air pump motor |
| Troubleshooting | Step 1: Make sure that the operating voltage and frequency are within the operating range<br>Step 2: Replace the air pump unit |
| Controller action | • All CA functions suspended<br>• Backup : None<br>• Alarm : F644<br>• Alarm LED : Blinking * |

| 003 | F679 |
|---|---|
| Alarm logic | • Abnormal operation of air pump unit interior cooling fan 1 (DCF1) and fan 2 (DCF2) |
| Possible causes | • Air pump unit cooling fan 1 (DCF1) or fan 2 (DCF2) is locked<br>• Air pump unit cooling fan 1 (DCF1) or fan 2 (DCF2) is disconnected |
| Troubleshooting | • Replace the pump unit |
| Controller action | • All CA functions suspended<br>• Backup : None<br>• Alarm : F679<br>• Alarm LED : Blinking * |

* When the Alarm LED blinks, press and hold the ↵ key on the alarm display screen to stop the blinking.

| 004 | E643 |
|---|---|
| Alarm logic | Air pump motor operating current is abnormally high |
| Possible causes | • Air pump motor is locked in low temperature environments<br>• Power supply path short-circuit in pump unit |
| Troubleshooting | Step 1: Check that the ambient temperature is -20°C or higher<br>Step 2: Make sure that the supply voltage and frequency are within the operating range<br>Step 3: Replace the air pump unit |
| Controller action | • CA function suspended<br>Clears the alarm 2 hours after operation stops and automatically resets<br>• Backup : None<br>• Alarm : E643<br>• Alarm LED : OFF |

| 005 | E644 |
|---|---|
| Alarm logic | Air pump motor overload current is detected<br>Air pump motor operating current is not detected |
| Possible causes | • State of continued air pump motor overload<br>• Disconnection in air pump motor continues |
| Troubleshooting | Step 1: Make sure that the supply voltage and frequency are within the operating range<br>Step 2: Replace the air pump unit |
| Controller action | • CA function suspended<br>Clears the alarm 3 minutes after operation stops and automatically resets<br>• Backup : None<br>• Alarm : E644<br>• Alarm LED : OFF |

| 006 | E651 |
|---|---|
| Alarm logic | $O_2$ sensor error |
| Possible causes | • $O_2$ sensor is disconnected or short-circuited<br>• $O_2$ sensor failure<br>• CA control panel (CA BOARD) failure |
| Troubleshooting | Step 1: Check the continuity of the relay connector (sensor box) (see Measure D)<br>Step 2: Replace the O2 sensor<br>Step 3: Replace the air pump unit |
| Controller action | • Proceed to backup operation *<br>(When the sensor returns to normal, normal operation will return and the alarm will be canceled)<br>• Alarm : E651<br>• Alarm LED : OFF |

| 007 | E652 |
|---|---|
| Alarm logic | $CO_2$ sensor error<br>$CO_2$ sensor calibration failure |
| Possible causes | • $CO_2$ sensor is disconnected or short-circuited<br>• $CO_2$ sensor failure<br>• Auto calibration failure<br>• CA control panel (CA BOARD) failure |
| Troubleshooting | Step 1: Check the continuity of the relay connector (sensor box) (see Measure D)<br>Step 2: Replace the CO2 sensor<br>Step 3: Replace the air pump unit |
| Controller action | • Proceed to backup operation *<br>(When the sensor returns to normal, normal operation will return and the alarm will be canceled)<br>• Alarm : E652<br>• Alarm LED : OFF |

*If E651 and E652 are reported, check the connection of the relay connector (sensor box) and replace the air pump unit.
(The wire to the sensor box in the air pump unit may well be broken.)

| 008 | E653 |
|---|---|
| Alarm logic | $O_2$ concentration is abnormally low |
| Possible causes | ① Mechanical causes<br>• The tube connected to the air pump unit is disconnected.<br>• No gas is supplied from the air pump unit<br>② Other causes<br>• The cargo's respiration volume is high<br>• Operation stopped for a long time with cargo loaded |
| Troubleshooting | ①<br>Step 1: Check the tube connected to the air pump unit for disconnection and breakage<br>Step 2: Replace the air pump unit<br>②<br>Open the vent until the $O_2$ concentration reaches the set $O_2$ concentration or higher, and continue operation. |
| Controller action | • Continue normal operation<br>(When the $O_2$ concentration returns to the normal range, the alarm will be cleared.)<br>• Alarm : E653<br>• Alarm LED : OFF |

| 009 | E654 |
|---|---|
| Alarm logic | $CO_2$ concentration is abnormally high |
| Possible causes | ① Mechanical causes<br>• The tube connected to the air pump unit is disconnected.<br>• No gas is supplied from the air pump unit<br>② Other causes<br>• The cargo's respiration volume is high<br>• Operation stopped for a long time with cargo loaded |
| Troubleshooting | ①<br>Step 1: Check the tube connected to the air pump unit for disconnection.<br>Step 2: Replace the air pump unit<br>②<br>Open the vent until the $CO_2$ concentration reaches the set $CO_2$ concentration or lower, and continue operation. |
| Controller action | • Continue normal operation<br>(When the $CO_2$ concentration returns to the normal range, the alarm will be cleared.)<br>• Alarm : E654<br>• Alarm LED : OFF |

| 010 | E655 |
|---|---|
| Alarm logic | Communication error between refrigeration system CPU and CA control board (CA BOARD) |
| Possible causes | • Power is not supplied to the air pump unit<br>• Communication cable between refrigeration system CPU and CA control board (CA BOARD) is disconnected or short-circuited<br>• CA control board (CA BOARD) failure<br>• Electrical noise |
| Troubleshooting | Step 1: Restart with unit switch "OFF"<br>If normal operation is possible, the abnormality is temporary, so continue operating<br>Step 2: Check the communication cable between the relay connector and CPU board<br>Step 3: Replace the air pump unit |
| Controller action | • CA function suspended<br>After stopping for 3 minutes, the alarm is cleared and automatic reset is executed when communication is restored<br>• Backup: None<br>• Alarm : E655<br>• Alarm LED : Blinking * |

| 011 | E656 |
|---|---|
| Alarm logic | Air pump motor relay fusing error |
| Possible causes | Air pump motor miniature relay on CA control board (CA BOARD) is fused |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Proceed to backup operation *<br>• Alarm : E656<br>• Alarm LED : OFF |

* When the Alarm LED blinks, press and hold the ↵ key on the alarm display screen to stop the blinking.

| 012 | E661 |
|---|---|
| Alarm logic | Air pump unit interior temperature is abnormally high |
| Possible causes | • Power voltage rise<br>• Power frequency rise<br>• The following parts in the air pump unit are abnormal<br>  • Control valves (CTV1, CTV2)<br>  • $O_2$ gas bypass valve (OBV)<br>  • Main discharge valve (ODV)<br>  • Air pump unit interior cooling fans (DCF1, DCF2)<br>  • $O_2$ gas purge valve (OPV) |
| Troubleshooting | Step 1: Check the power supply (voltage/frequency)<br>Step 2: Replace the air pump unit |
| Controller action | • CA device suspended<br>When the temperature inside the air pump unit drops after stopping for 3 minutes, the alarm is cleared and automatic reset is executed<br>• Alarm : E661<br>• Alarm LED : OFF |

| 013 | E671 |
|---|---|
| Alarm logic | Air pump high pressure side discharge pressure rises abnormally |
| Possible causes | • Power voltage rise<br>• Power frequency rise<br>• The following parts in the air pump unit are abnormal<br>  • Air pump<br>  • Control valves (CTV1, CTV2)<br>  • $O_2$ gas bypass valve (OBV)<br>  • Clogged orifice |
| Troubleshooting | Step 1: Check the power supply (power/frequency)<br>Step 2: Replace the air pump unit |
| Controller action | • Continue normal operation<br>• Alarm : E671<br>• Alarm LED : OFF |

| 014 | E672 |
|---|---|
| Alarm logic | Air pump unit interior temperature sensor (BTS) error |
| Possible causes | Air pump unit interior temperature sensor (BTS) is disconnected or short-circuited |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Continue normal operation<br>• Alarm : E672<br>• Alarm LED : OFF |

| 015 | E675 |
|---|---|
| Alarm logic | Air pump high pressure side discharge pressure drops abnormally |
| Possible causes | • Low power supply voltage<br>• Low power frequency<br>• Clogged air filter<br>• The following parts in the air pump unit are abnormal<br>  • Control valves (CTV1, CTV2)<br>  • Leak in air circuit (air tube)<br>  • Clogging in air circuit upstream of pressure sensor<br>  • Air pump |
| Troubleshooting | Step 1: Check the power supply voltage<br>Step 2: Check the power frequency<br>Step 3: Replace the air filter<br>Step 4: Replace the air pump unit |
| Controller action | • Proceed to backup operation *<br>(After backup operation for 2 hours, the alarm is cleared and automatic reset is executed when the pressure returns to normal)<br>• Alarm : E675<br>• Alarm LED : OFF |

| 016 | E677 |
|---|---|
| Alarm logic | Current sensor (CT1) error |
| Possible causes | Current sensor (CT1) disconnection |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Continue normal operation<br>• Alarm : E677<br>• Alarm LED : OFF |

| 017 | E678 |
|---|---|
| Alarm logic | Pressure sensor (APT) error |
| Possible causes | • Pressure sensor (APT) disconnection<br>• Pressure sensor (APT) failure |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Continue normal operation<br>• Alarm : E678<br>• Alarm LED : OFF |

| 018 | E679 |
|---|---|
| Alarm logic | Air pump unit interior cooling fan 1 (DCF1) operation error |
| Possible causes | • Air pump unit cooling fan 1 (DCF1) is locked<br>• Air pump unit cooling fan 1 (DCF1) is disconnected |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Continue normal operation<br>• Alarm : E679<br>• Alarm LED : OFF |

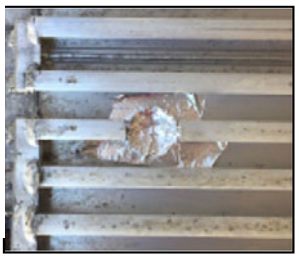
| 019 | E680 |
|---|---|
| Alarm logic | Air pump unit interior cooling fan 2 (DCF2) operation error |
| Possible causes | Air pump unit cooling fan 2 (DCF2) is locked<br>Air pump unit cooling fan 2 (DCF2) is disconnected |
| Troubleshooting | Air pump unit replacement |
| Controller action | • Continue normal operation<br>• Alarm : E680<br>• Alarm LED : OFF |

| 020 | E688 (Maintenance alarm) |
|---|---|
| Alarm logic | Total air pump operation time has exceeded 10,500 hours |
| Possible causes | Air pump has reached the maintenance limit |
| Troubleshooting | Step 1: Replace the air pump unit<br>Step 2: Reset the total pump operation time after replacing the pump |
| Controller action | • Continue normal operation<br>• Alarm : E688<br>• Alarm LED : OFF |

# 6. Pre-Transport Work

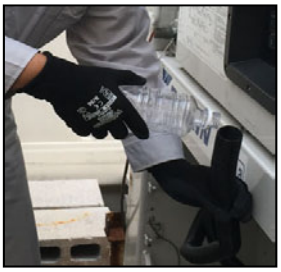
## 6.1 Checking Container Box

① Cover the bottom drain port in the container with aluminum tape, etc.



② Put a curtain on the back of the container box and close the door.

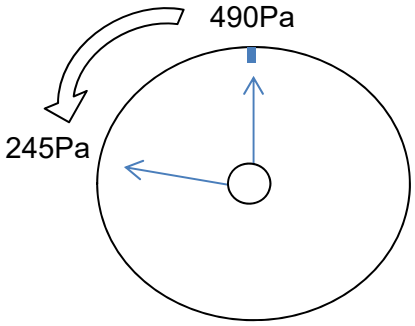
③ Pour water into the drain hose and seal it.



④ Remove the vent cover and attach the airtight test kit.

Airtight test kit

⑤ Connect an $N_2$ gas or air cylinder to the air tube of the airtight test kit.
⑥ Fill with connected gas and retain **50 to 51 mm$H_2O$ (490 to 500 Pa) for 10 minutes.**
⑦ After 10 minutes, close the filling gas valve and confirm that the **time from 50 mm$H_2O$ (490 Pa) to 25 mm$H_2O$ (245 Pa) is 105 seconds or more**.




105 seconds or more: Usable (OK)
105 seconds or less: Air leak (X)

⑧ After passing the airtight test, put back the vent lid.

## 6.2 Implementing CA TEST

See below for CA TEST settings.

LXE10E: 2.3.1 [CA TEST]

LX10F: 3.3.1 [CA TEST]

⚠ Precautions when performing CA TEST

- CA TEST allowable internal temperature condition -5.0 ≤ inside temperature (RS) ≤ +30.0 ºC

  Keep the temperature inside the container (RS) between -5.0ºC and +30.0ºC.
  Completes in about 40 minutes to 1 hour in normal conditions.
  If the above temperature conditions are not met, "T443" will occur and the CA TEST will complete.
  Adjust the inside temperature (RS) to -5.0ºC to +30.0ºC and perform the CA TEST again.

## 6.3 Installing Curtains

After loading the cargo, install a curtain at the rear of the container.

## 6.4 CA Mode "ON" and $O_2$ and $CO_2$ Concentration Settings

Make the following settings.

CA mode setting: ON

$O_2$ concentration setting: 1 to 21%

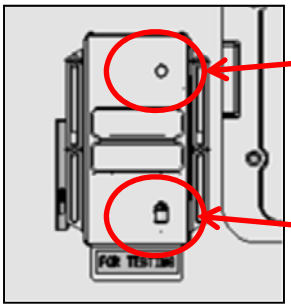
$CO_2$ concentration setting: 1 to 17%

⚠ CAUTION

*Remark: Set so that $O_2 + CO_2 \geq 8\%$.

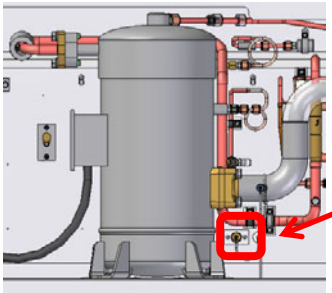
## 6.5 Filling Container with Gas ($N_2$, $CO_2$, etc.) (as needed)

① Mount the airtight test kit.
② Make preparations as follows.

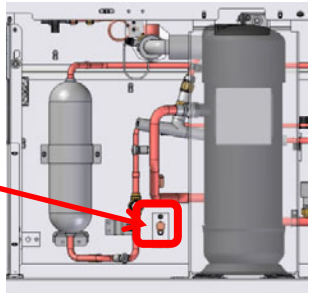



Charge port for filling gas
Connect the charge hose for filling gas.

Pressure measurement port
Connect a differential pressure gauge or block with tape.



Thermometer insertion port
Remove the cap to open.



**LXE10E** **LX10F**

③ Fill the gas to the target concentration while operating the refrigeration equipment.

④ Remove the airtight test kit and attach the vent cover.

### ⚠ CAUTION

- **Make sure to use a clean gas charging hose.**
  **Using a hose that has been contaminated with refrigerating oil or the like may cause contamination inside the container.**
- **The size of the charge port is 4/16 (screw size 7/16-20UNF).**

### ⚠ DANGER

**Low-concentration oxygen gas is emitted from gas outlets such as the thermometer insertion port.**
**Do not inhale the gas directly, as it is dangerous.**

# 7. Work during Cargo Unloading

CAUTION

**CA break requires 2 or more people for safety.**

## 7.1 With Power Supply Equipment

1. Fully open the vent (100%).
2. Set "DSP/Display mode" on the operation panel.
   LXE10E: 2.2.4 [CA mode setting]
   LX10F: 3.2.5 [CA mode setting]

   When "Display mode" is selected, the refrigeration system operates while the $O_2$ and $CO_2$ concentrations in the container are displayed with the air pump unit stopped.
   *The displayed $O_2$ and $CO_2$ concentrations are for reference only.

3. After operating the container refrigeration system, **allow at least 60 minutes to pass**, and confirm that the container is in atmospheric state before entering the container.

CAUTION

**When entering the container, make sure that the CA mode setting is "Display mode" or "OFF".**
When the CA mode setting is "ON", operating the refrigeration system may cause the CA device to operate, which is dangerous.

## 7.2 Without Power Supply Equipment

1. Turn off the circuit breaker.
   *This prevents the CA device from operating when the power is turned on.
2. Fully open the vent (100%).
3. Fully open the container door, tear the curtain and release the air inside the chamber.

CAUTION

**Low oxygen concentration or high carbon dioxide concentration gas may flow out directly due to a torn curtain, etc.**
**Be careful when opening the door.**

CAUTION

**When the inside air is released, low oxygen concentration or high carbon dioxide concentration gas will fill the surroundings of the container.**
**Be careful not to let anyone approach the open container, as it is dangerous.**

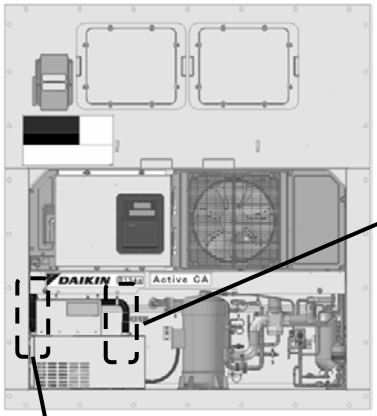
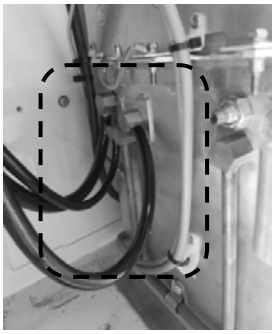
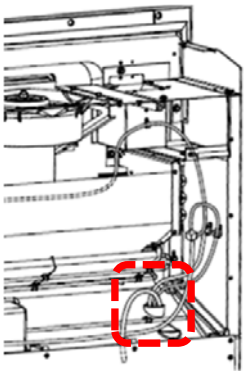
4. Check that the $O_2$ and $CO_2$ concentration around and inside the container have reached the safe level before entering the container.
   $O_2$ concentration: 21% $CO_2$ concentration: 0.1% or less (1000 ppm or less)

CAUTION

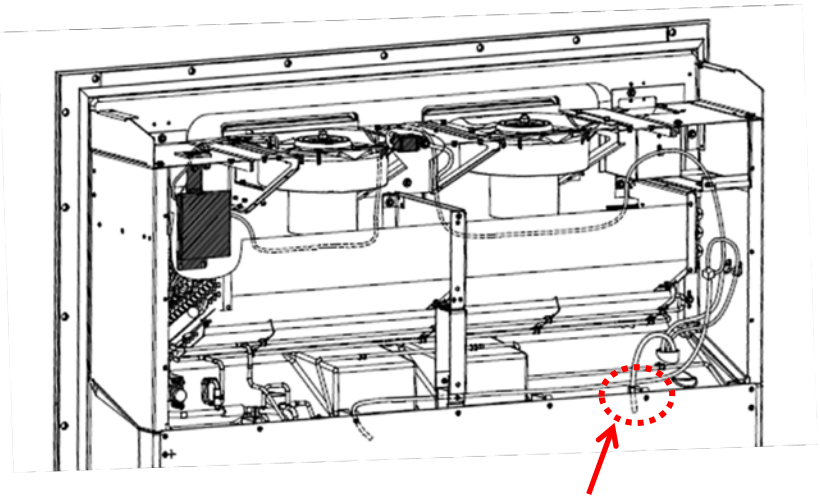
**Make sure that the CA mode setting is "OFF" when turning on the power.**
When the CA mode setting is "ON", operating the refrigeration system may cause the CA device to operate, which is dangerous.

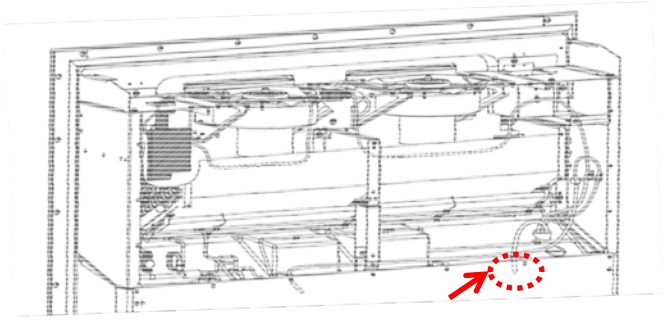
# 8. Failure Diagnosis/Measures Based on Phenomena

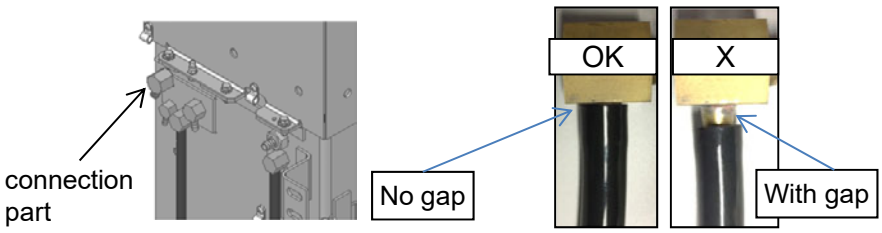
| Phenomenon | | | Measure | Reference Page |
|---|---|---|---|---|
| The airtight test does not work (Does not maintain standard pressure) | | | A | 8-2 |
| • CA does not operate even when the unit is turned ON (the air pump unit does not operate)<br>• CA TEST does not display | | | B | 8-3 |
| $O_2$ concentration does not decrease with respect to the set $O_2$ concentration | Pattern 1 | $O_2$ concentration does not change immediately after starting operation | C1 | 8-4 |
| | Pattern 2 | $O_2$ concentration stops dropping partway through.<br>Or the number of days to reach the set $O_2$ is too long. | C2 | 8-5 |
| $O_2$ concentration does not increase according to the set $O_2$ concentration | | | D | 8-6 |
| $CO_2$ concentration does not decrease according to the set $CO_2$ concentration | | | E | 8-8 |
| $CO_2$ concentration does not increase according to the set $CO_2$ concentration | | | F | 8-8 |

| | | |
|---|---|---|
| Measure A | Phenomenon | The airtight test does not work.<br>(Does not maintain standard pressure) |
| | Cause | Insufficient airtightness in the refrigeration equipment and container. |
| | Measure | Place the container to be tested for airtightness on a flat surface and check the following.<br>① One or more drain holes in the container left open.<br>② Drain hose U-trap left unsealed.<br>③ Air leak from the gap in the container.<br>• Container door gap (air curtain, gasket)<br>• Gap in the mounting bolts between the container and refrigeration system<br>• Vent left open or loosened vent cover screws<br>• Gap in access panel bolt<br>④ Air pump unit tube is disconnected.<br>⑤ Insufficient seal on through holes inside and outside the container.<br>Example: Air leak from refrigeration equipment.<br>  <br> <br>②Water seal check<br>  <br>④Tube connection check<br>  <br>⑤Through hole check |

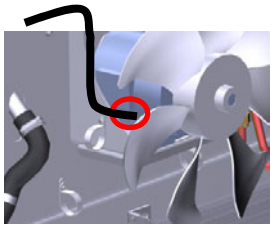
| | | | |
|---|---|---|---|
| Measure B | Phenomenon | CA does not operate even when unit is turned ON. (Air pump unit does not operate.) | CA TEST does not display. (①) |
| | Cause | ① | CA unit setting is "ON" (not "1" or "Type1".) |
| | | ② | $O_2$ and $CO_2$ settings are initial values.<br>If the $O_2$ and $CO_2$ settings are at initial values ($O_2$ = 21%, $CO_2$ = 1%), the CA device will not operate. |
| | Measure | ① | (1) Check whether the CA unit setting is as below.<br>LXE10E: "1"<br>LX10F: "Type1"<br><br>(2) Check that the CA mode setting is set to "ON".<br><br>*Even if the CA unit setting is changed from "OFF" to "1" or "Type1", the CA mode will be "OFF".<br>When using the CA device, set the CA mode setting to "ON". |
| | | ② | Set the $O_2$ concentration and $CO_2$ concentration. |

| | | | |
|---|---|---|---|
| Measure C1 | Phenomenon | $O_2$ concentration does not decrease with respect to the set $O_2$ concentration.<br><Pattern 1><br>$O_2$ concentration does not change immediately after starting operation. | |
| | Cause | ① | Depending on the operating environment, low $O_2$ gas is not supplied to the container at startup. |
| | | ② | Gas filled into the container is leaking. |
| | | ③ | The space between the air pump unit and outlet in the container is clogged. |
| | Measure | ① | Wait about 15 to 20 minutes until the startup is completed, and confirm that the $O_2$ concentration has dropped. |
| | | ② | Perform the airtight test again. (Check measure A.) |
| | | ③ | Check that the O2 concentration is 21% before entering the container, then check that gas is flowing out of the tube indicated by the numbered arrow.<br><br>If gas is not coming out of the container, check for loose tubing connections or broken tubing and repair as needed.<br>  |

| | | | |
|---|---|---|---|
| Measure C2 | Phenomenon | $O_2$ concentration does not decrease with respect to the set $O_2$ concentration.<br><Pattern 2><br>$O_2$ concentration stops dropping partway through.<br>Or the number of days to reach the set $O_2$ concentration is too long. | |
| | Cause | ① | Low cargo capacity. (Low respiration volume.) |
| | | ② | Poor container airtightness. |
| | | ③ | The gas flow from the air pump unit is low. |
| | | ④ | The space between the air pump unit and outlet in the container is clogged. |
| | | ⑤ | Decrease in the air pump unit performance. |
| | | ⑥ | (For 20 ft) Optional function setting is incorrect. |
| | Measure | ① | If the cargo capacity is low, the respiratory volume will be low and it may take some time to reach the set $O_2$ concentration. |
| | | ② | Perform the airtight test again. (Check measure A.) |
| | | ③ | Check that the air filter unit (pump inlet) is clean.<br>If more than two years have passed since the date indicated on the filter, perform replacement.<br>Check the total operating time of the air pump manually.<br>If the total operation time of the air pump exceeds 10,500 hours, replace the air pump unit.<br>Refer to the following for the manual check operation method.<br>• LXE10E: 2.3.2 "CA Check"<br>• LX10F: 3.3.2 "CA Check" |
| | | ④ | After confirming that the $O_2$ concentration is 21%, enter the container and check that gas is emitted from the tube indicated by the arrow below.<br>If gas is not coming out of the container, check for loose tubing connections or broken tubing and repair as needed.<br>  |
| | | ⑤ | If the CA TEST is implemented and failed, replace the air pump unit. |
| | | ⑥ | For 20 ft, the evaporator fan Low setting must be set to ON to limit the evaporator fan air volume. See the following for the setting method.<br>• LXE10E: 2.2.7 "Optional Function Setting"<br>• LX10F: 3.2.8 "Optional Function Setting" |

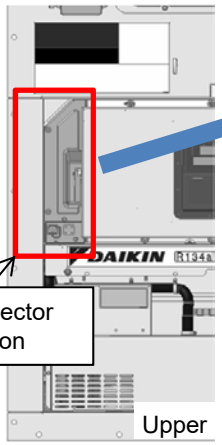
| | | | |
|---|---|---|---|
| Measure D | Phenomenon | $O_2$ concentration does not increase with respect to the set $O_2$ concentration. | |
| | Cause | ① | Gas is not supplied from the air pump unit. |
| | | ② | The air discharge valve (ADV) is not operating properly. |
| | Measure | ① | • Remove the tube and check that gas is flowing out of the connection on the left side of the air pump unit. If not, gas may have leaked in the air pump unit, so perform the CA TEST. If the CA TEST is implemented and failed, replace the air pump.<br><br>• After checking that gas is flowing, connect the tubing to prevent gas leakage from the connection.<br><br>  |
| | | ② | See the next page. |

| | | | |
|---|---|---|---|
| Measure D continued | Phenomenon | $O_2$ concentration does not increase with respect to the set $O_2$ concentration. | |
| | Cause | ③ | The air discharge valve (ADV) is not operating properly. |
| | Measure | ③ | (1) With the refrigeration unit stopped, check that the ADV outlet on the back of the outside fan is not blocked. |



(2) Remove the ADV, turn on the ADV with manual check, and blow on it to confirm that the ADV is open.
Refer to 4.2.4 "Air Discharge Valve (ADV) Replacement Procedure" for the ADV removal method.
Also, refer to the following for the manual check operation method.
- LXE10E: 2.3.2 "CA Check"
- LX10F: 3.3.2 "CA Check"

(3) If blowing on the ADV confirms that it is not open, the air pump unit control board may be faulty, so turn on the ADV by manual check, remove the connector (2-pin) next to the controller box, and measure the voltage (12 VDC) of the lower connector (2-pin) using a tester.



**Connector combinations**

<Measured location>

| | Harness color |
|---|---|
| + | Red |
| - | Green |

| | | | |
|---|---|---|---|
| Measure E | Phenomenon | $CO_2$ concentration does not decrease with respect to the set $CO_2$ concentration. | |
| | Cause | ① | Gas is not supplied from the CA device. |
| | | ② | The display does not change, due to $CO_2$ sensor failure. |
| | | ③ | ADV (installed inside the refrigerating machine) is not open. |
| | Measure | ① | Perform ① in Measure D. |
| | | ② | (1) Open the FA, set the CA mode setting to "Display mode", and confirm that the $CO_2$ concentration decreases.<br><br>(2) If the $CO_2$ concentration does not decrease, perform the CA TEST.<br>If the CA TEST is implemented and failed, take measures according to the alarm code instructions. |
| | | ③ | Perform ③ in Measure D. |

| | | | |
|---|---|---|---|
| Measure F | Phenomenon | $CO_2$ concentration does not increase with respect to the set $CO_2$ concentration. | |
| | Cause | ① | There is no cargo.<br>Low cargo capacity.<br>Low cargo respiration volume. |
| | | ② | Poor container box airtightness. |
| | | ③ | EFL setting is OFF. (For 20 ft box) |
| | Measure | ① | Check the type of cargo.<br>If the cargo load is low, or if the cargo has low respiration, the rise in $CO_2$ concentration may be slow. |
| | | ② | Perform the airtight test again. (Check measure A.) |
| | | ③ | Turn ON the EFL setting. See the following for the setting method.<br>• LXE10E: 2.2.7 "F Option Function Setting"<br>• LX10F: 3.2.8 "Optional Function Setting" |

# 9. Appendix

## 9.1 Standard Tightening Torque for Bolts and Screws

◆ Standard tightening torque of bolts

| | Bolt size | tightening torque | | |
|---|---|---|---|---|
| | | cN • m | Kgf • cm | lbf • ft |
| Stainless steel | M4 | 122 | 12.4 | 0.90 |
| | M5 | 229 | 23.3 | 1.69 |
| | M6 | 393 | 40.0 | 2.90 |
| | M8 | 938 | 95.6 | 6.92 |

Note) Allowable tightening torque range: ±15%

◆ Standard tightening torque of screws

| | Screw size | tightening torque | | |
|---|---|---|---|---|
| | | cN • m | Kgf • cm | Lbf • ft |
| Stainless steel | M3 | 540 | 5.50 | 0.39 |
| | M4 | 131 | 13.3 | 11.5 |
| | M5 | 265 | 27.0 | 1.95 |

Note) Allowable tightening torque range: ±10%

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