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Marine type

Container Refrigeration Unit

Service Manual

Maintenance and Repair

Model

LXE10D-A14

DAIKIN INDUSTRIES, LTD.

TR00-03

This manual describes the functions, maintenance and repair of the container refrigeration unit.

Please refer also to these manuals.

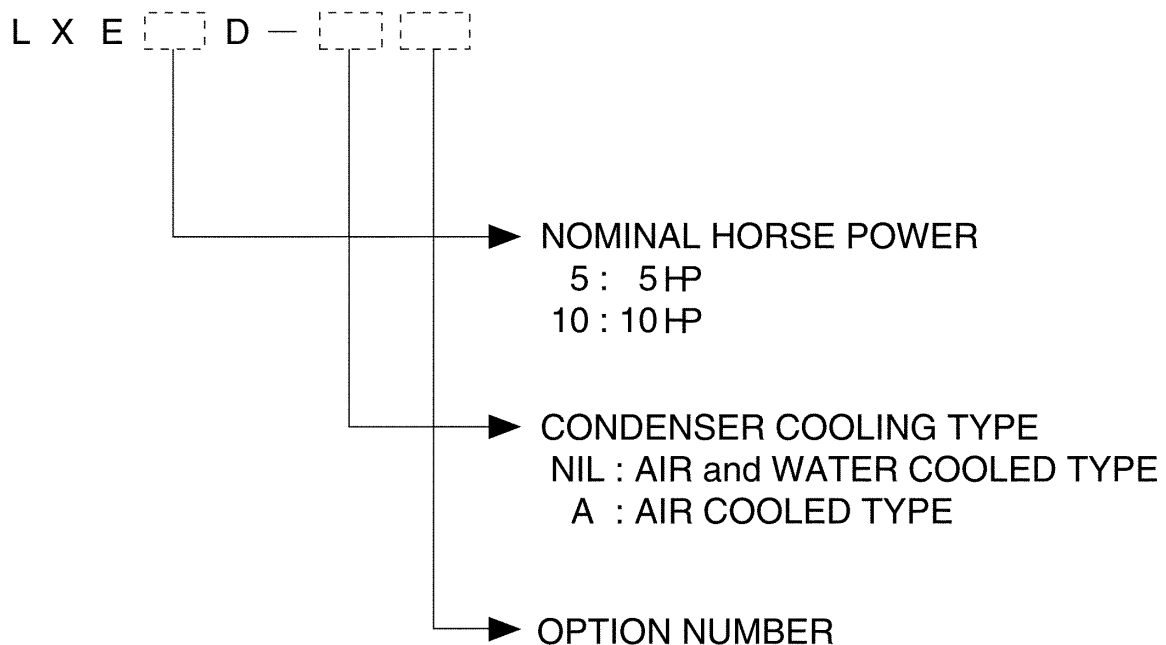
Service Manual (Operation)

Parts List

Operation Manual of Personal Computer Software

Compressor Dismantling and Assembly Manual

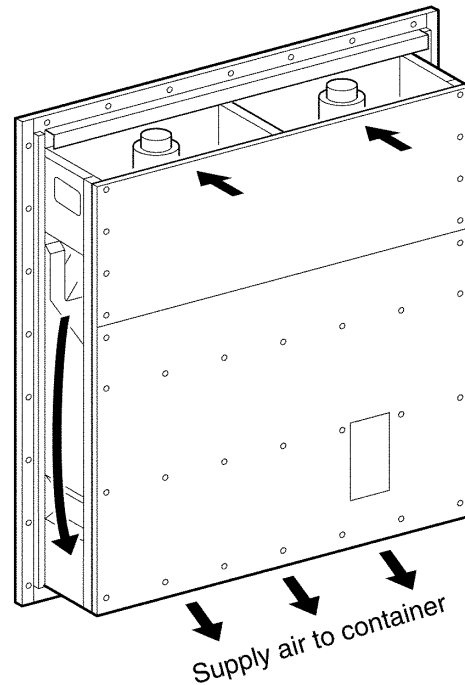
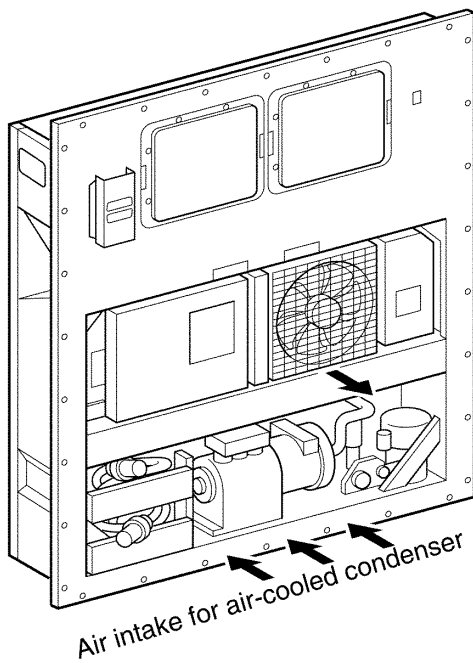
Denomination of Model Name



Note) "R" GIVEN AFTER OPTION NUMBER STANDS FOR "REVISION"
AND IT IS GIVEN FOR THE UNIT WHICH IS SPECIALLY
MODIFIED.

Covered Models

Name of models	LXE10D-A14
Major features	Dehumidifying function High gas-tightness matching machine Precision mechanical equipment transportation matching machine
Cooling system of condenser	Specifically used for air cooling system
Reheat coil	Provided
Wing bolt for control box cover	pcs.
Wing bolt for ventilator	5 pcs.



CAUTION

When the unit is for precision instrument transportation, or has a dehumidification function, it is necessary to change the initial setting of controller beforehand (See 2.4 Dehumidification operation).

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SAFETY PRECAUTIONS

Always observe the following points before operating or inspecting a unit.

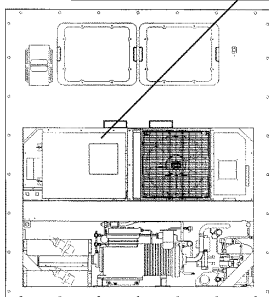
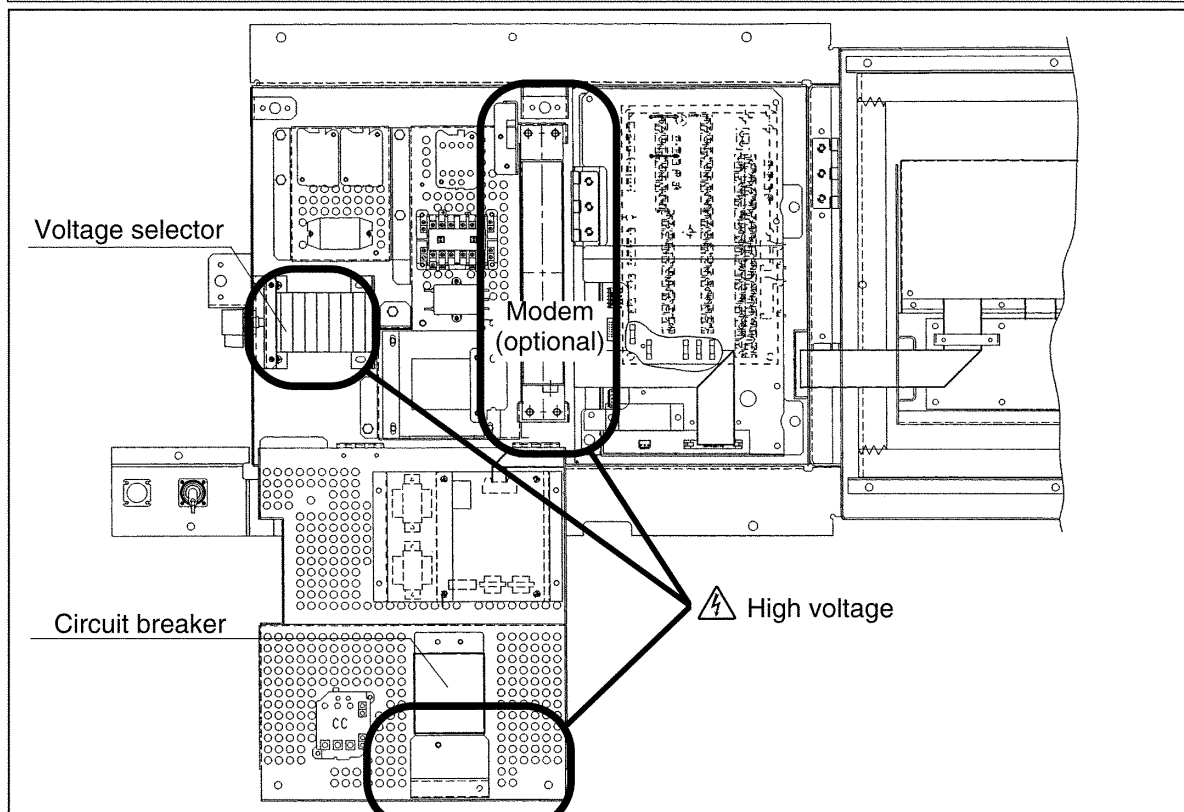
DANGER

Always turn off the main power supply of the facility before disconnecting the power plug.



Always turn off the main power supply of the facility before inspecting the inside of the control box.

* Because the high voltage remains at the voltage selector, the circuit breaker and the optionally provided modem even though the circuit breaker in the control box is turned off.



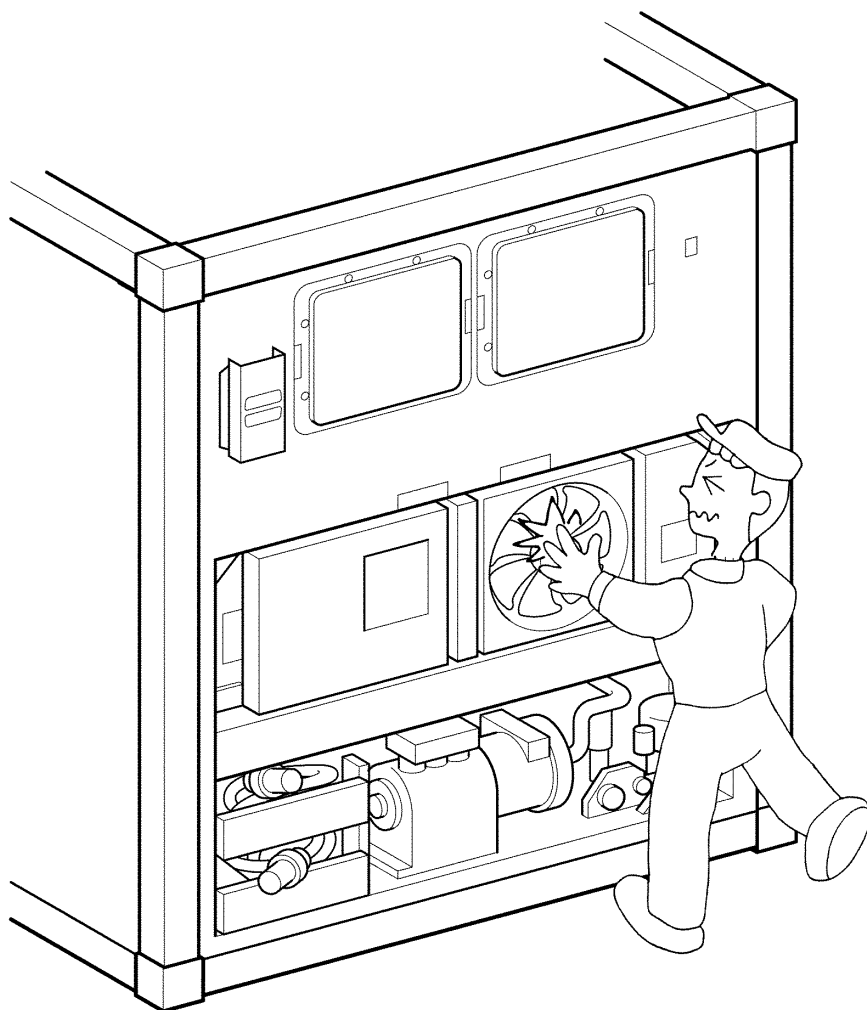
 **WARNING**

Do not touch the condenser fan during electricity being applied.

Before removing the condenser fan cover, turn off the circuit breaker and disconnect the power plug.



- At air-cooled operation : Condenser fan may start and stop automatically for the refrigerant high pressure control.

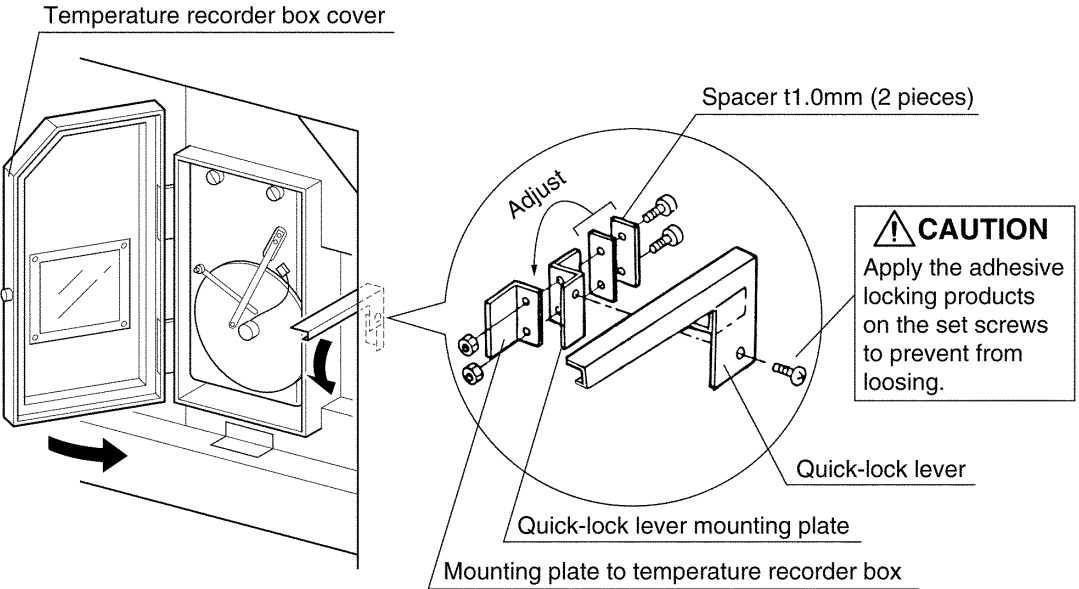


CAUTION

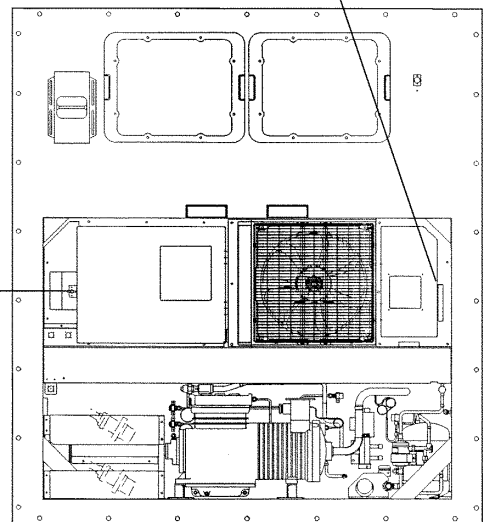
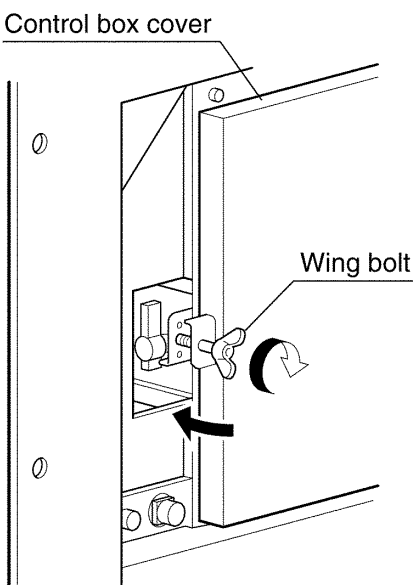
Before starting the unit, connect the power plug and run the generator.

Securely close the control box cover and the temperature recorder box cover (optional).

Otherwise, it will cause water ingress.

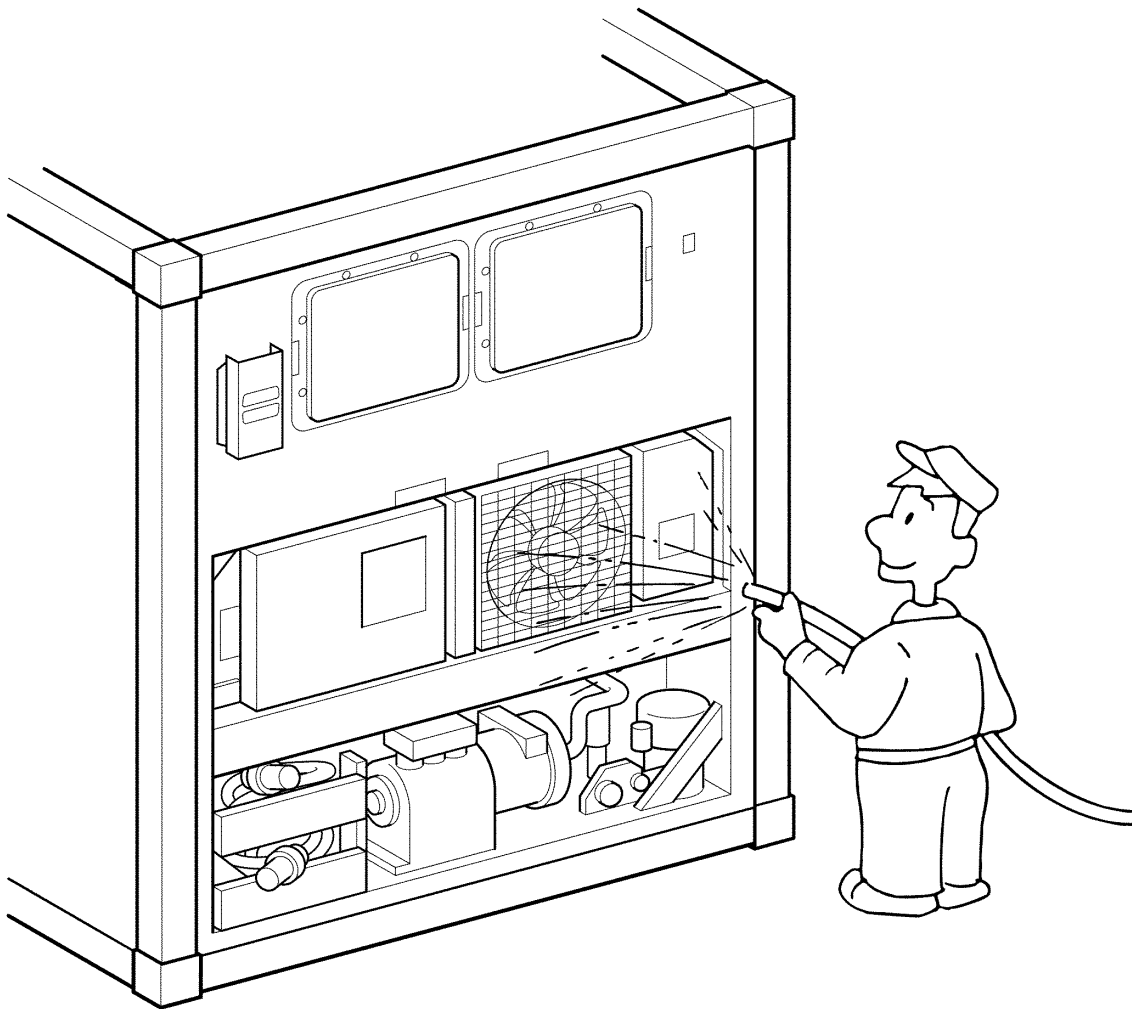


*** Quick-lock lever adjustment**
When the clearance between the cover and contact is large, adjust the quick-lock lever position.
→ Put the spacer between the quick-lock lever mounting plate and the mounting plate (temperature recorder box).



⚠ CAUTION

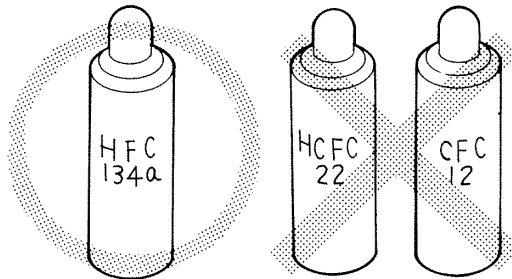
**Wash the refrigeration unit with fresh water before PTI.
Carefully flush the air-cooled condenser by fresh water since
much salt sticks to it.**



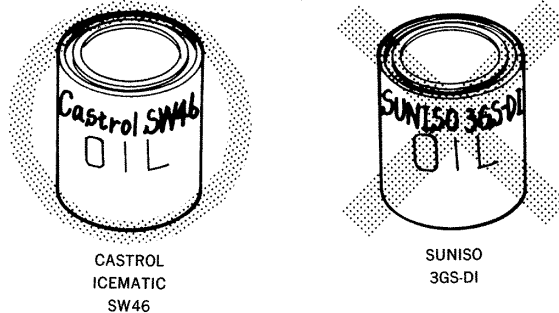
CAUTION

Refrigerant and refrigerating machine oil

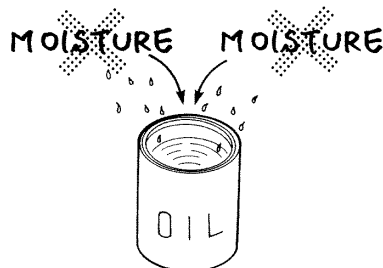
Charge only refrigerant HFC 134a to the unit.
Never attempt to use any other refrigerant (CFC12, HCFC22, etc) on the refrigeration unit.
If any other refrigerant not specified is charged, it may cause the troubles to the unit.



Use only Daikin specified oil (Castrol Icematic SW46) when replacing the refrigerating machine oil.
If any other refrigerating machine oil not specified is charged, it may cause the troubles to the unit.



Open the oil can, just before charging the oil, and use all the oil whose can is opened once.
Do not leave the opened can as it is for 5 hours or longer to avoid moisture ingress.
If any refrigerating machine oil which absorbs much moisture is used, it may cause the troubles to the unit.



Use only exclusive tools for HFC134a.(gauge manifold, charging cylinder, etc)
Do not use any tools for CFC12 or HCFC22.
Service ports with quick joints for exclusive use of HFC134a are provided in the refrigeration unit to avoid refrigerant and refrigerating machine oil of a different kind entering into the refrigeration circuit. (Refer to section 7.2)
The charging hose and service port are not interchangeable with those of previous model(s).

1. DATA OF REFRIGERATION UNIT

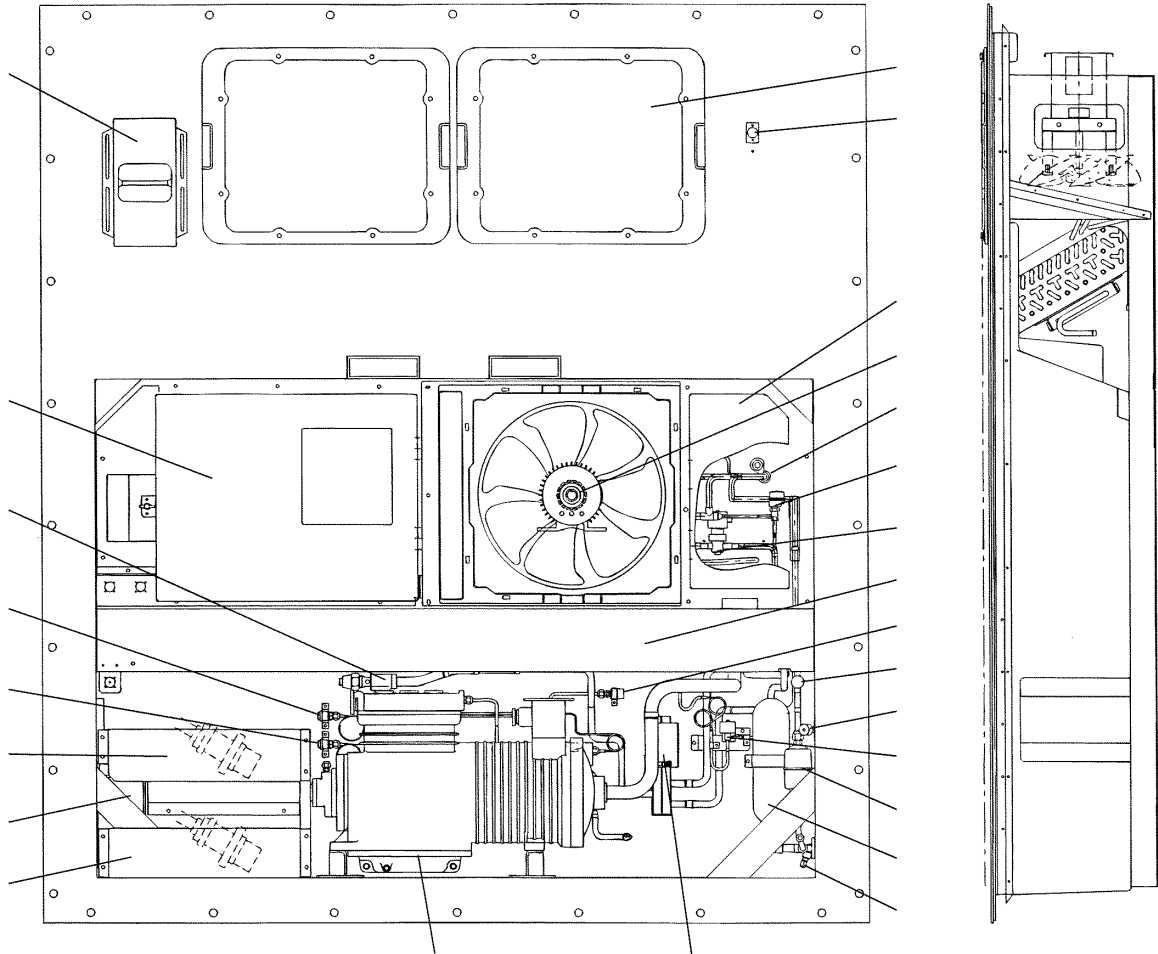
1.1 Main specifications

Item	Model	LXE10D-A14
Condenser cooling system		Air-cooled type
Controller		DECOS _{II} b
Power supply	AC 3-phase	50Hz : 380V/400V/415V 60Hz : 440V/460V
	Dual voltage	AC 3-phase 200V class 50Hz : 200V 60Hz : 200V/220V/230V 400V class 50Hz : 380V/400V/415V 60Hz : 440V/460V
Compressor		Semi-hermetic type (Output: 5.5kW)
Evaporator		Finned coil type
Air-cooled condenser		Finned coil type
Water-cooled condenser		No (Receiver)
Fan		Direct motor driven type propeller fan
Fan motor		Three-phase squirrel-cage induction motor
Defrosting	System	Hot-gas defrosting system
	Initiation	Dual timer or manual switch
	Termination	Evaporator outlet pipe temperature measured by a defrosting termination detecting thermostat.
Refrigerant flow control		Electronic expansion valve
Capacity control		Hot gas bypass control with modulating control valve
Protective safe devices		Circuit breaker, PT/CT board (for over current protection). compressor thermal protector, fan-motor thermal protector, high-pressure switch, fusible safety plug, fuse (10A) × 5
Refrigerant (charged amount)		HFC134a: 4.8 (kg)/10.6 (lbs)
Refrigeration oil (charged amount)		CASTROL ICEMATIC SW46: 3.6(ℓ)
Refrigeration unit weight		Approx. 630(kg)/1389(lbs) (Weight is different in accordance with refrigeration units.)

1.2 Names of components

1.2.1 Outside

●LXE10D-A14

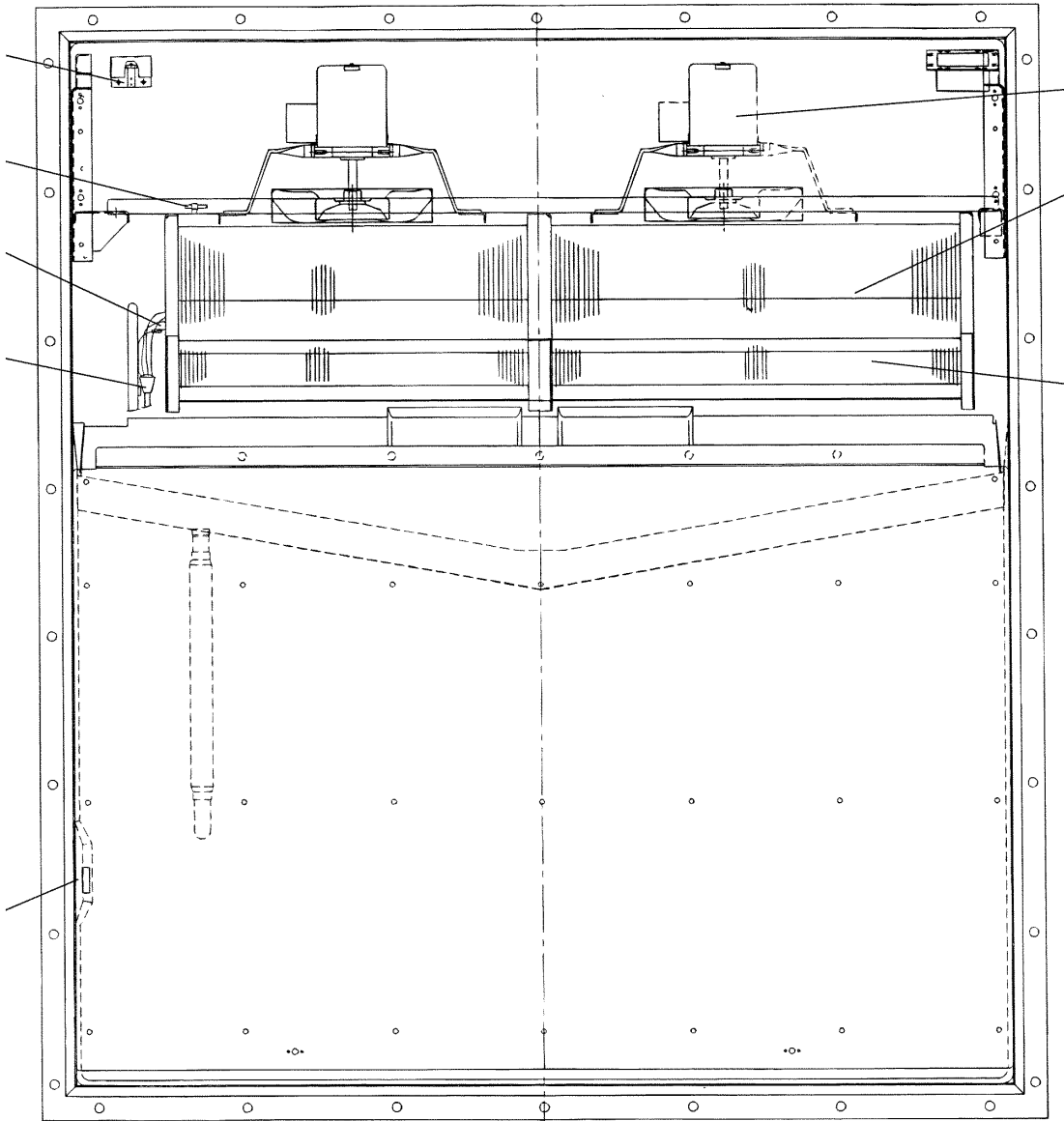


- Compressor
- Air-cooled condenser
- Receiver
- Outlet stop valve (receiver)
- Control box
- Condenser fan motor
- Dryer
- Access panel
- Storage space for power cable (200V class)
- Storage space for power cable (400V class)
- Ventilator
- Power transformer
- Thermometer check port/Gas sampling port

- Gas sampling port
- Liquid solenoid valve (LSV)
- Injection solenoid valve (ISV)
- Modulating control valve (MV)
- Electronic expansion valve (EV)
- High pressure switch (HPS)
- High pressure transducer (HPT)
- Low pressure transducer (LPT)
- Liquid/moisture indicator
- Discharge stop valve
- Hot-gas solenoid valve (HSV)
- Temperature recorder box

1.2.2 Inside

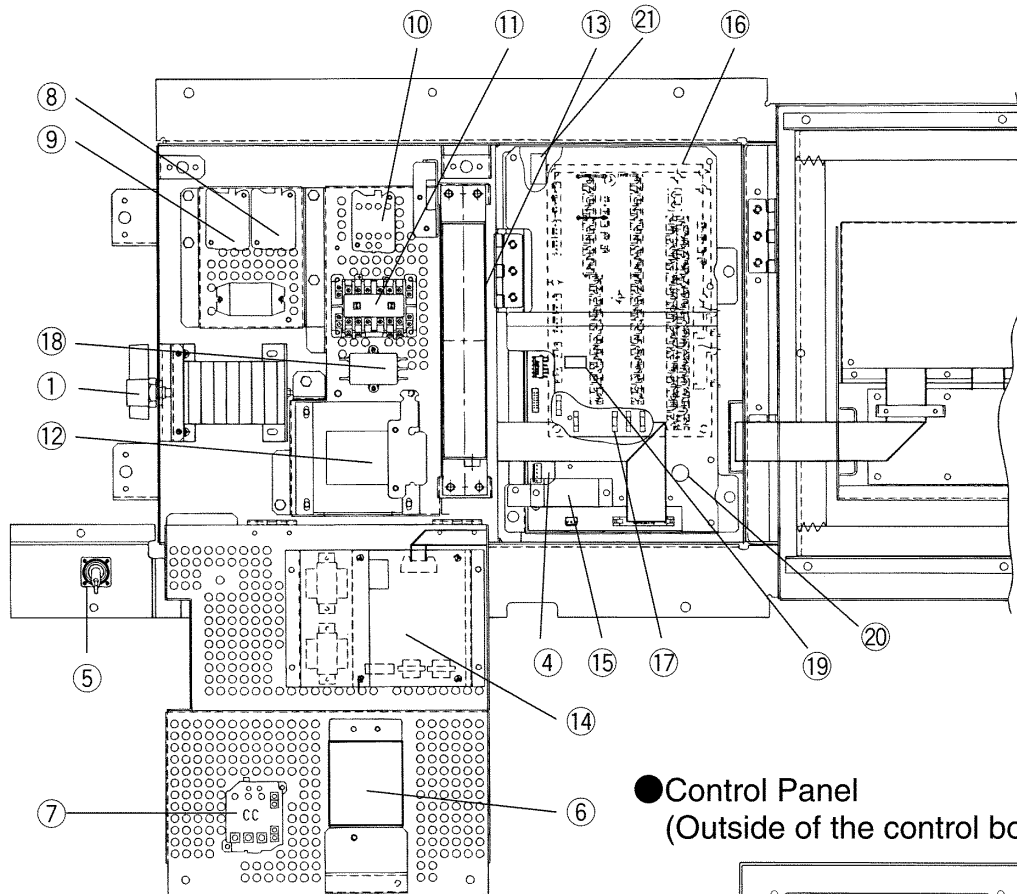
●LXE10D-A14



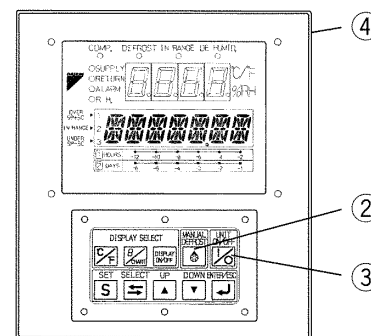
- Evaporator
- Evaporator fan motor
- Return air sensor and Record return air sensor (RS, RRS)
- Supply air sensor and Record Supply air sensor (SS, RSS)
- Evaporator outlet sensor
- Evaporator inlet sensor (EIS)
- Humidity sensor (HuS)
- Reheater

1.2.3 Control box

● Inside of the control box



● Control Panel
(Outside of the control box)

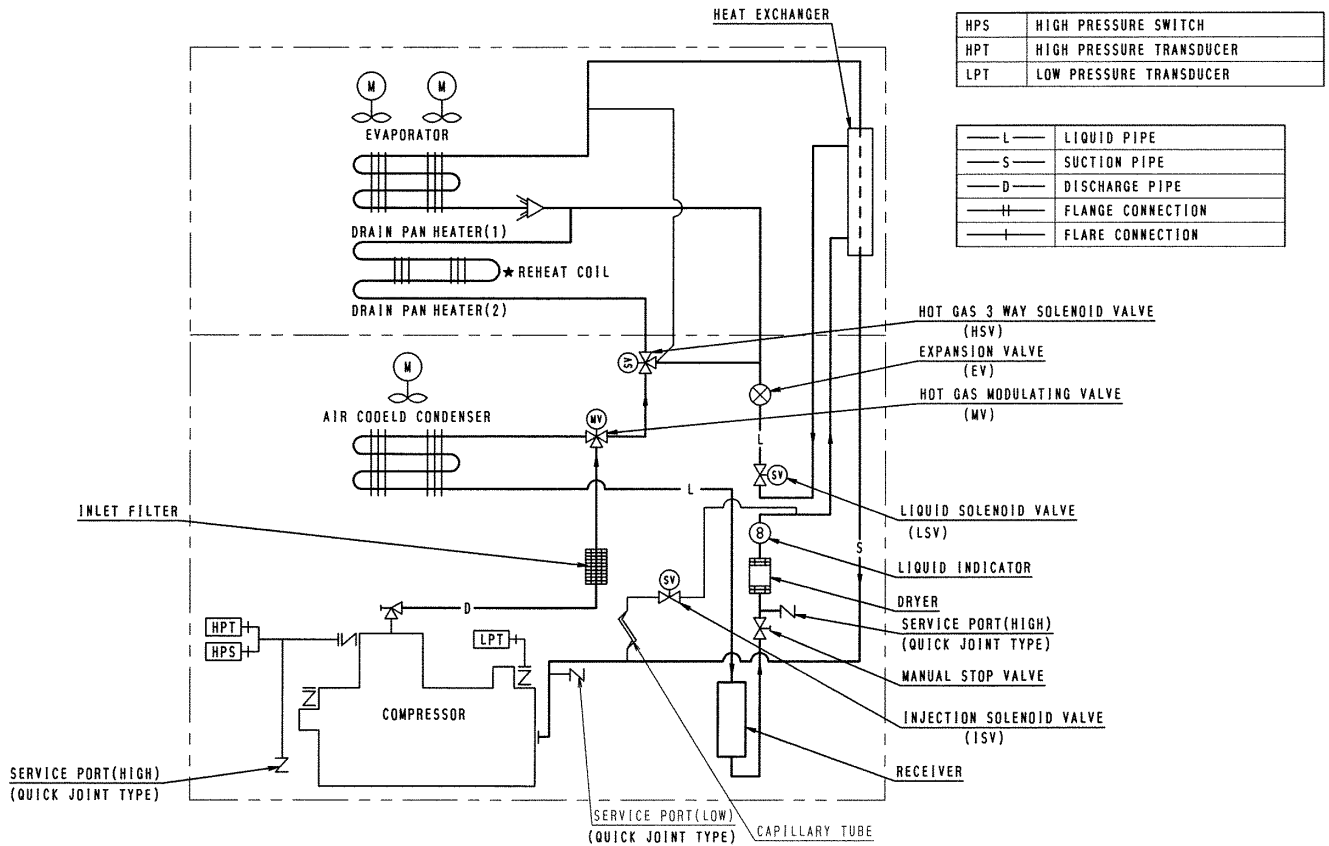


- ① Voltage selector (VS)
- ② MANUAL DEFROST key
- ③ UNIT ON/OFF key
- ④ Electronic controller
- ⑤ Remote monitoring receptacle (RM)
- ⑥ Circuit breaker (CB)
- ⑦ Magnetic contactor (CC), compressor
- ⑧ Magnetic contactor for low speed (EFL), evaporator fan
- ⑨ Magnetic contactor for high speed (EFH), evaporator fan
- ⑩ Magnetic contactor (CFC), condenser fan
- ⑪ Phase correction contactor (PCC1, 2)
- ⑫ Transformer (TrC), control circuit

- ⑬ Modem (RCD) (optional)
- ⑭ PT/CT board
- ⑮ Controller backup battery (BAT)
- ⑯ Terminal block board (TB1)
- ⑰ Fuse 10Ax5 (Fu)
- ⑱ Noise filter
- ⑲ Personal computer receptacle
- ⑳ Service monitor lamp (flashing when it is normal, and lit or extinguished when it is abnormal)
- ㉑ Spare fuse (kept in a holder)

1.3 Piping diagram

●LXE10D-A14



1.4 Schematic diagram

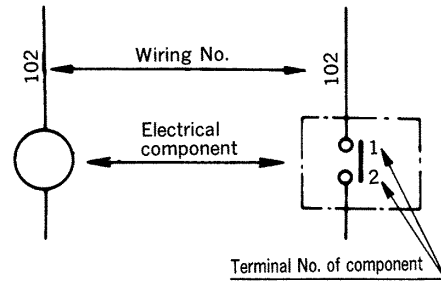
1.4.1 How to read schematic diagrams

(1) The marks and numbers in the schematic diagram have the meanings given right.

(2) Graphical Symbols for electrical chart

a. The schematic diagram indicates the unenergized or stationary state in which electricity does not flow in the circuit.

b. When a coil is energized (supplied with power), the associated contact changes its position.



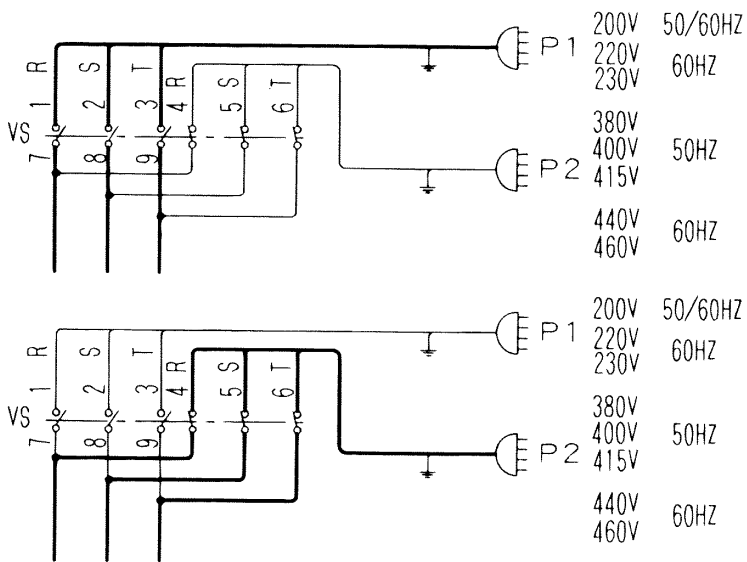
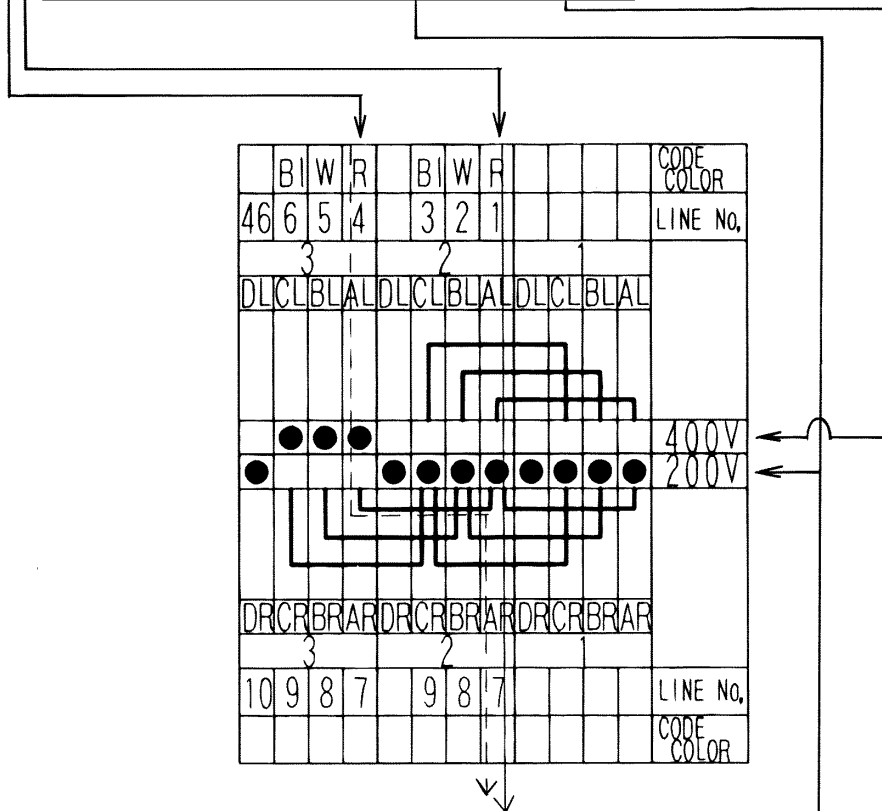
Name of component	Brief description	DAIKIN symbol	American symbol
Coil	Magnetic contactor		
	Solenoid valve		
	Modulating valve		
Contacts of contactor	N. O. : Normally open contact		
	N. C. : Normally closed contact		
Pressure switch	N. C. (Normal by Closed)		
Thermal switch			
Voltage selector	Close on 200V class		/
	Close on 400V class		

d. How to read the schematic diagram of the voltage selector.

In the chart "●" denotes that the contact is closed.

For example, the chart for the states between the terminal AL2 and AR2, and between AL3 and AR2 is as follows.

	Selector lever position	
	200V class	400V class
Between AL2 and AR2	Closed	Open
Between AL3 and AR2	Open	Closed

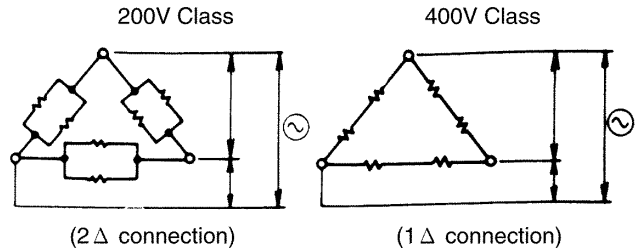


1.4.2 Voltage selection system (Change-over for 200V/400V class)

(1) Voltage selection system

Since the compressor motor is a dual voltage type and the fan motor is a transformer operated type, supply power is changed by the voltage selector lever with multi-contact cam switch which fits the wiring connections to the transformer for the control circuit and to each motor with its supply voltage. The internal wiring of the dual voltage compressor is as shown in the right.

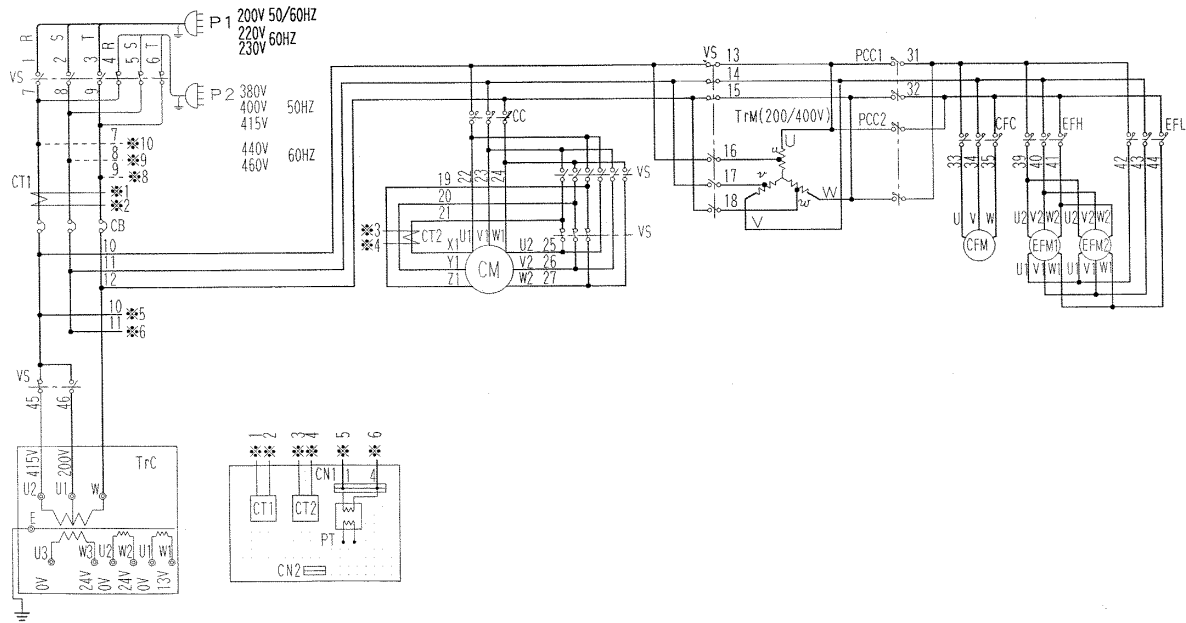
(Machine for 200V/400V dual power supply)



(2) Circuit formation

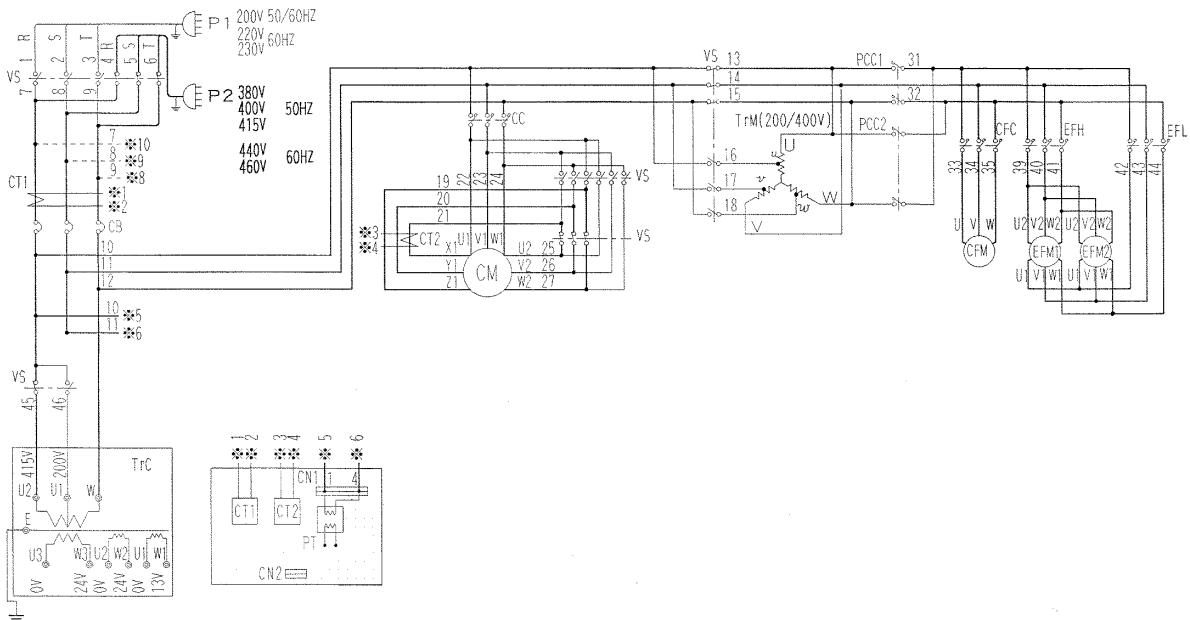
● 200V class (Set the voltage selector to "200V Class".)

The contacts (except SSW) shown by become closed in the sequence circuit.



● 400V class (Set the voltage selector to "400V Class".)

The contacts shown by become closed in the sequence circuit to formate the 400V class circuit.



(3) Phase selection

The reversible system is adopted to the compressor, and the positive-phase selection system is adopted to the fan motors.

Compressor

Since the oil pump is a reversible trochoid type, the specified oil pressure can be obtained regardless of the turning direction of the built-in motor.

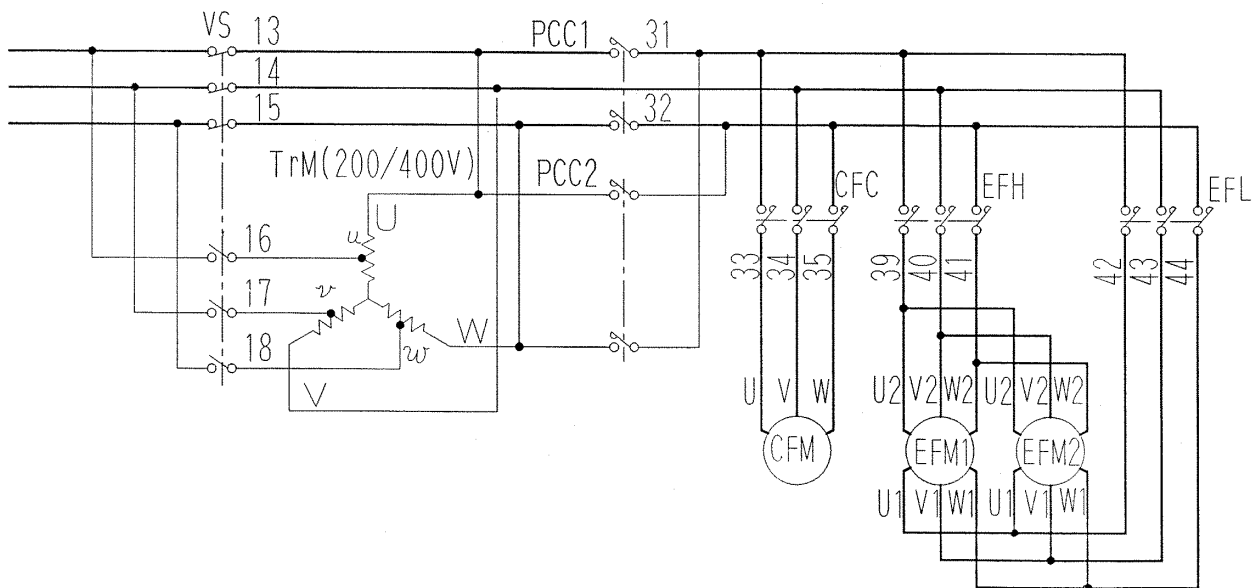
Fan motor

When the phases are reversed, R phase and T phase will be automatically interchanged by the controller according to the instruction of the phase sequence detecting function.

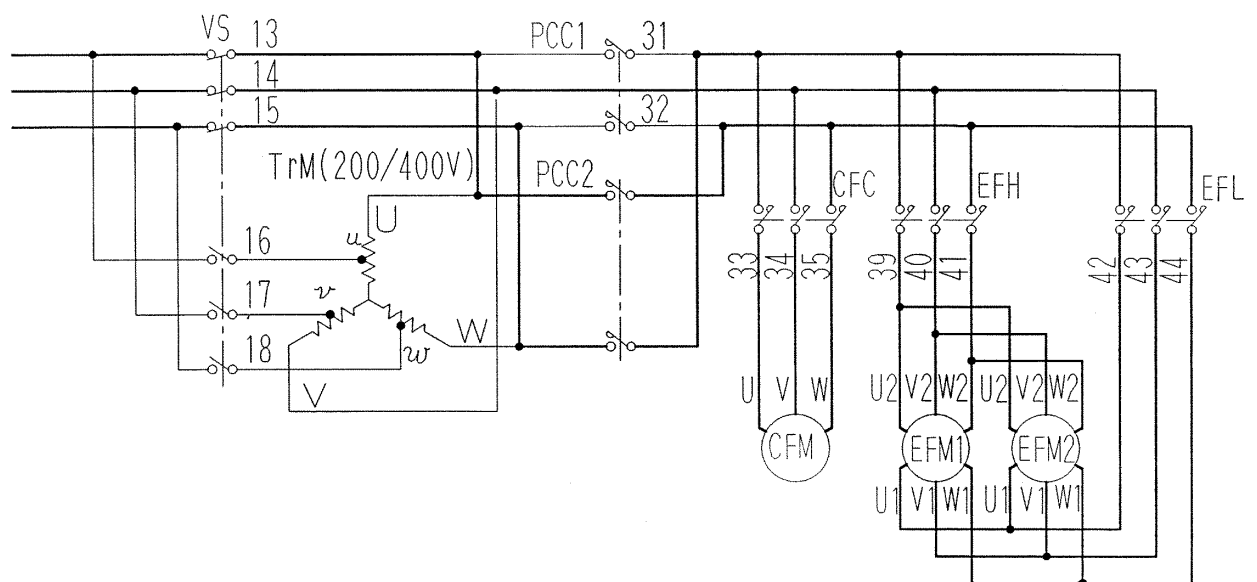
PT/CT board : Phase-sequence detecting function

PCC1, 2 : Phase correction contactor

● Positive phase



● Negative phase

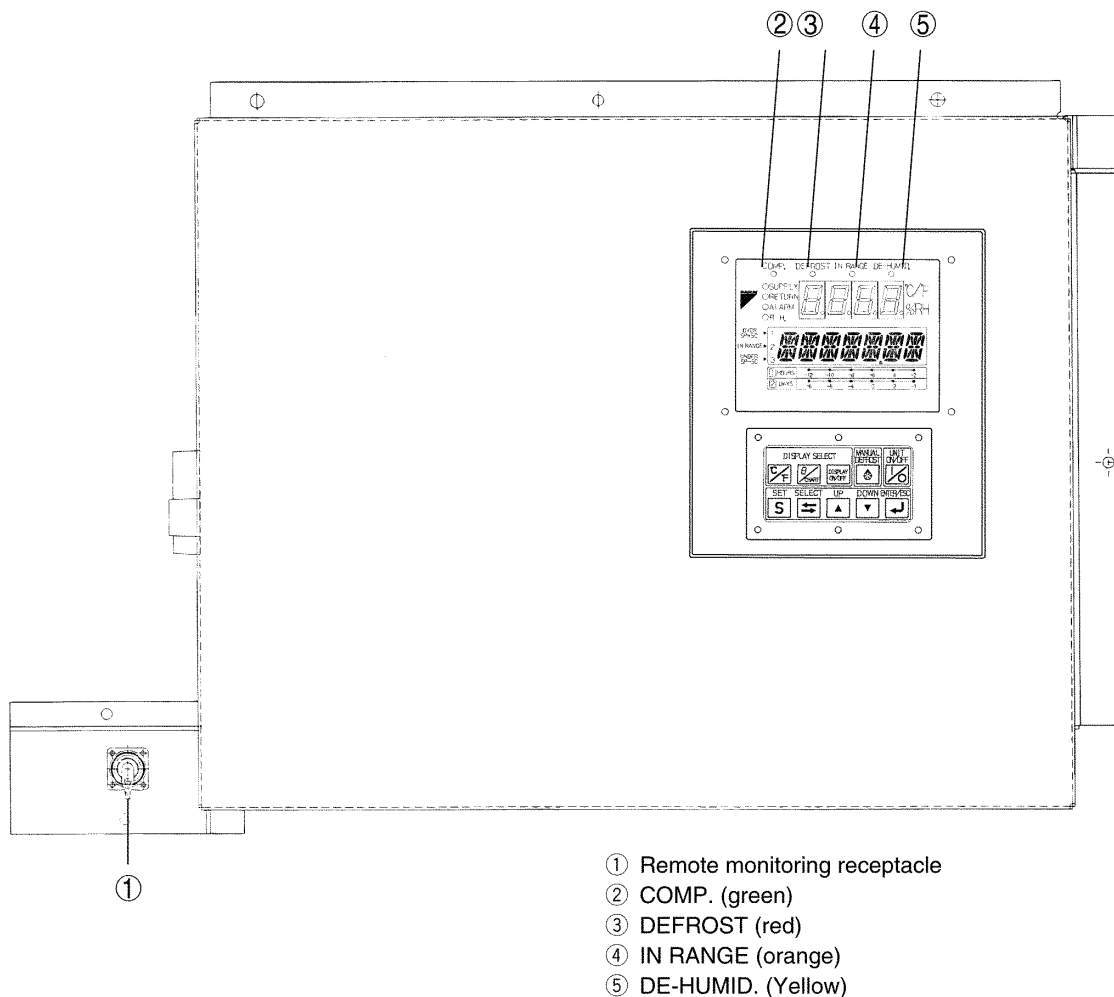


1.4.3 Pilot lamps and monitoring circuit

Four pilot lamps which indicate operating mode are mounted on the control panel in the control box.

Pilot lamp to be lit on	Color	Operating condition
COMP.	Green	The compressor is running.
DEFROST	Red	The unit is under defrosting operation.
IN RANGE	Orange	The inside temperature is within the range (within 2°C (3.6°F) of the set point temperature).
DE-HUMID.	Yellow	The controller is set to the dehumidification control operation.

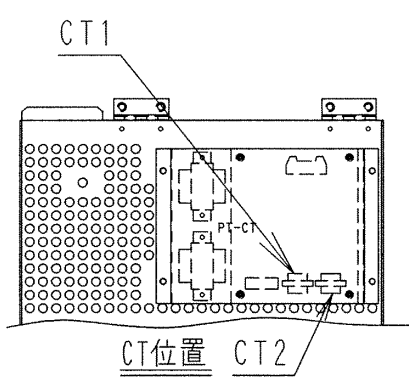
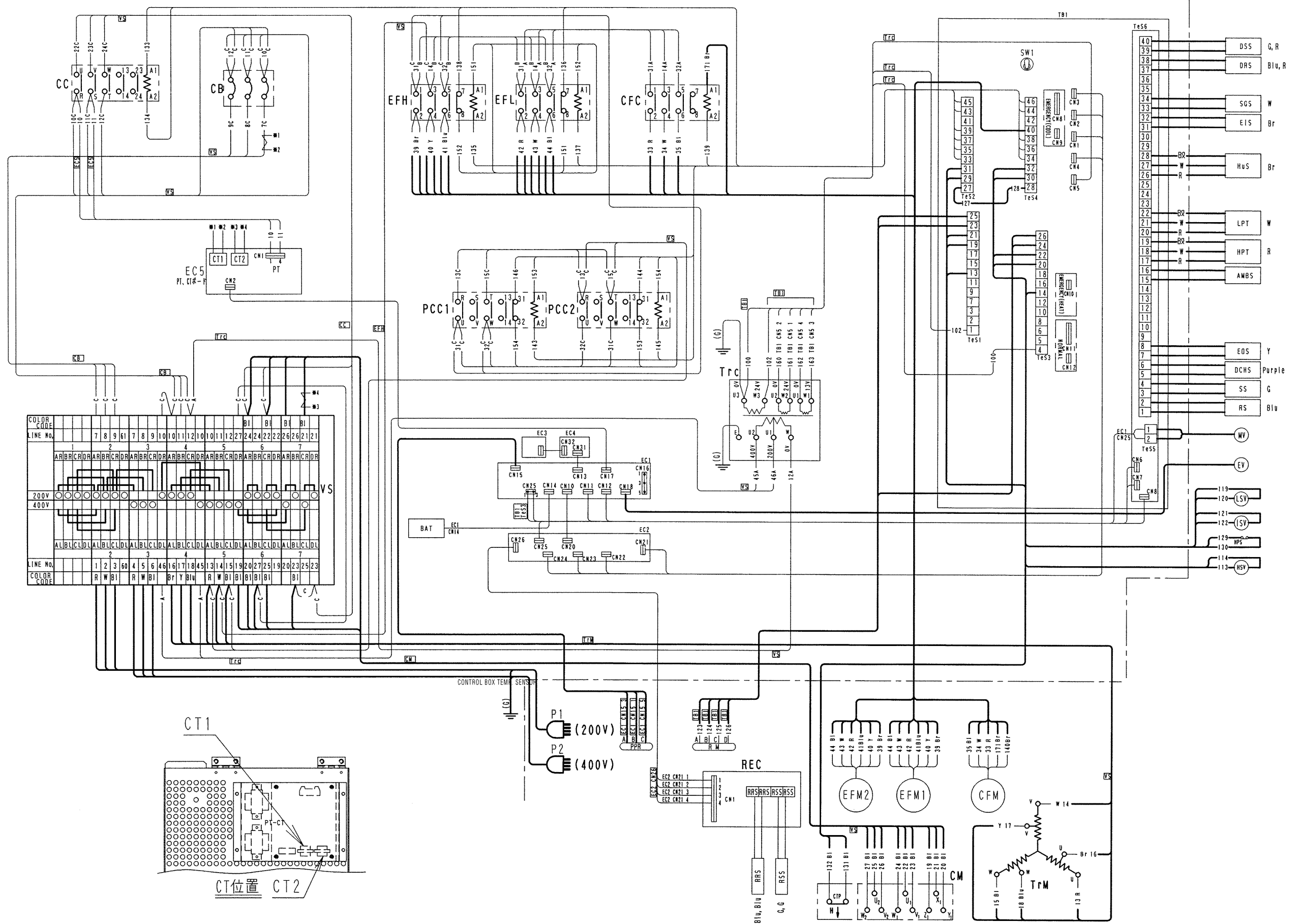
The remote monitoring receptacle for the pilot lamp is also equipped. The connections are shown below.



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1.4.5 Stereoscopic wiring diagram

●LXE10D-A

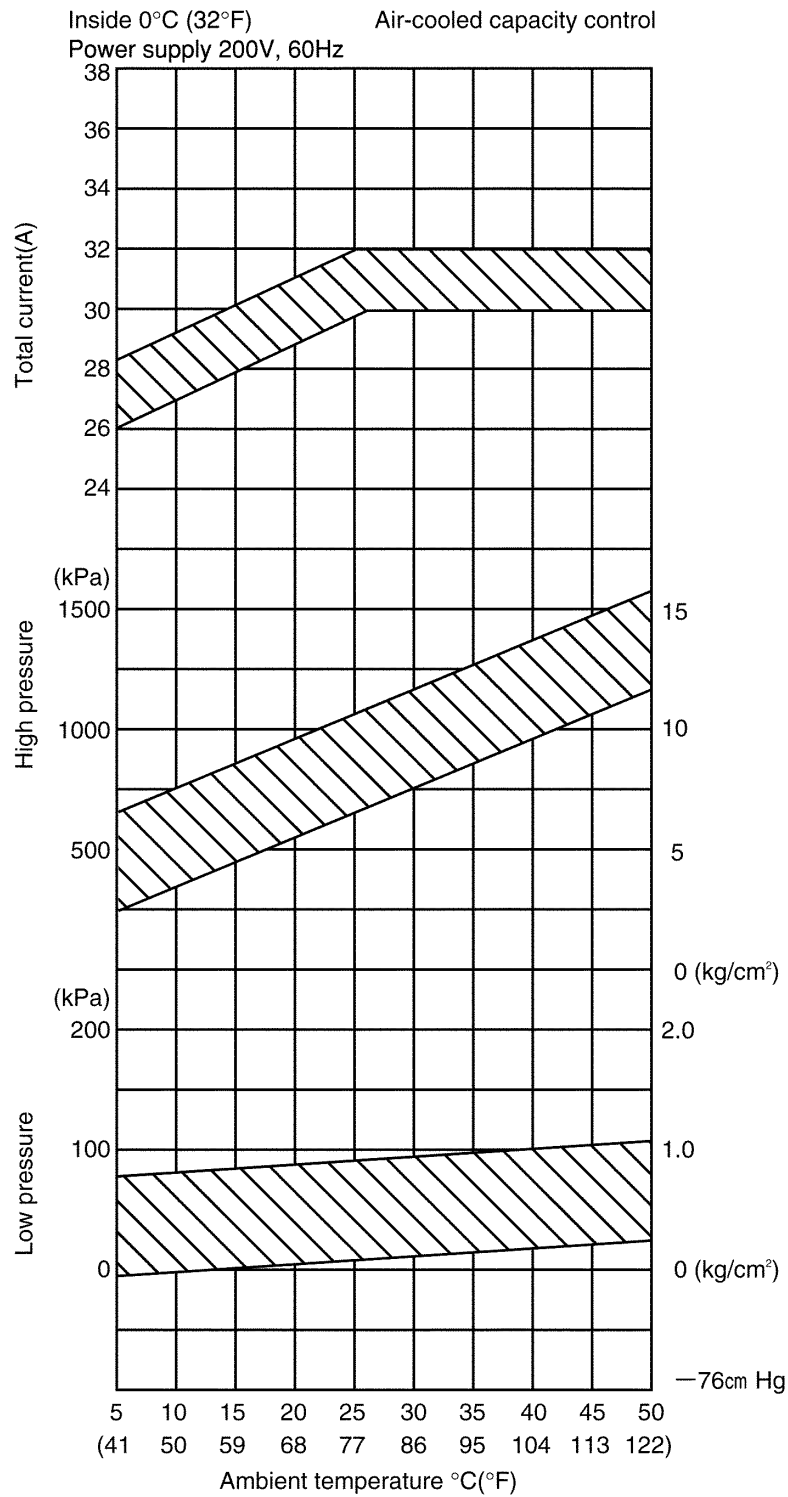


1.5 Set point of functional and protective devices

	Device name		Actuation	Set point	Detection method	Symbol	
Pressure switch	High-pressure switch		OFF ON	2059kPa (21kg/cm ²) 1569kPa (16kg/cm ²)	High-pressure switch	HPS	
	Model			DECOS b			
Electronic controller	Mode selection	Chilled mode	ON	+25.0°C ~ -2.9°C (+77.0°F ~ +26.8°F)	Set point temperature	EC	
		Partial frozen mode		-3.0°C ~ -10.0°C (+26.6°F ~ +14°F)			
		Frozen mode		-10.1°C ~ -30.0°C (+13.8°F ~ -22.0°F)			
	Delay timer	Fan	Change-over for H-L	ON	10 seconds		
			After defrosting		60 seconds		
		Compressor	At starting		3 seconds		
	Defrosting timer	Initiation	Short	ON	4 hours *1		
			Long		3, 6, 9, 12 and 24 hours		
		Back-up		OFF	90 minutes		
		In-range masking			90 minutes		
		Out-range guard		ON	30 minutes		
	Defrosting termination set point		OFF Reset		35°C (95°F) 20°C (68°F)	Evaporator outlet sensor	EOS
	High-pressure control (Condenser fan)		OFF ON		500kPa (4.1kg/cm ²) 800kPa (8.2kg/cm ²)	High-pressure transducer	HPT
	Compressor discharge temperature protection set point		Cutout Reset		130°C (266°F) 135°C during pull down operation After 3 minutes elapse	Discharge sensor	DCHS
	Injection solenoid valve		ON OFF		125°C (257°F) 115°C (239°F)	Discharge sensor	DCHS
Overcurrent protection		Cutout Reset		400V : 26.0A 200V/400V : 15.0A After 3 minutes elapse	CT/PT board	CT2	
Current control (during modulating control)		Control		50Hz 200V 31.5A 415V 16.1A 60Hz 220V 34.3A 440V 17.4A	CT/PT board	CTI	
High pressure control		Control		1900kPa (19.4kg/cm ²)	High-Pressure transducer	HPT	
Breaker	Circuit breaker (main circuit)		OFF	50A		CB	
	Fuse (controller)		OFF	10A		Fu	
Motor	Evaporator fan motor thermal protector		OFF	132°C (270°F)			
	Condenser fan motor thermal protector		OFF	135°C (275°F)			
	Compressor motor thermal protector		OFF	105°C (221°F)		CTP	

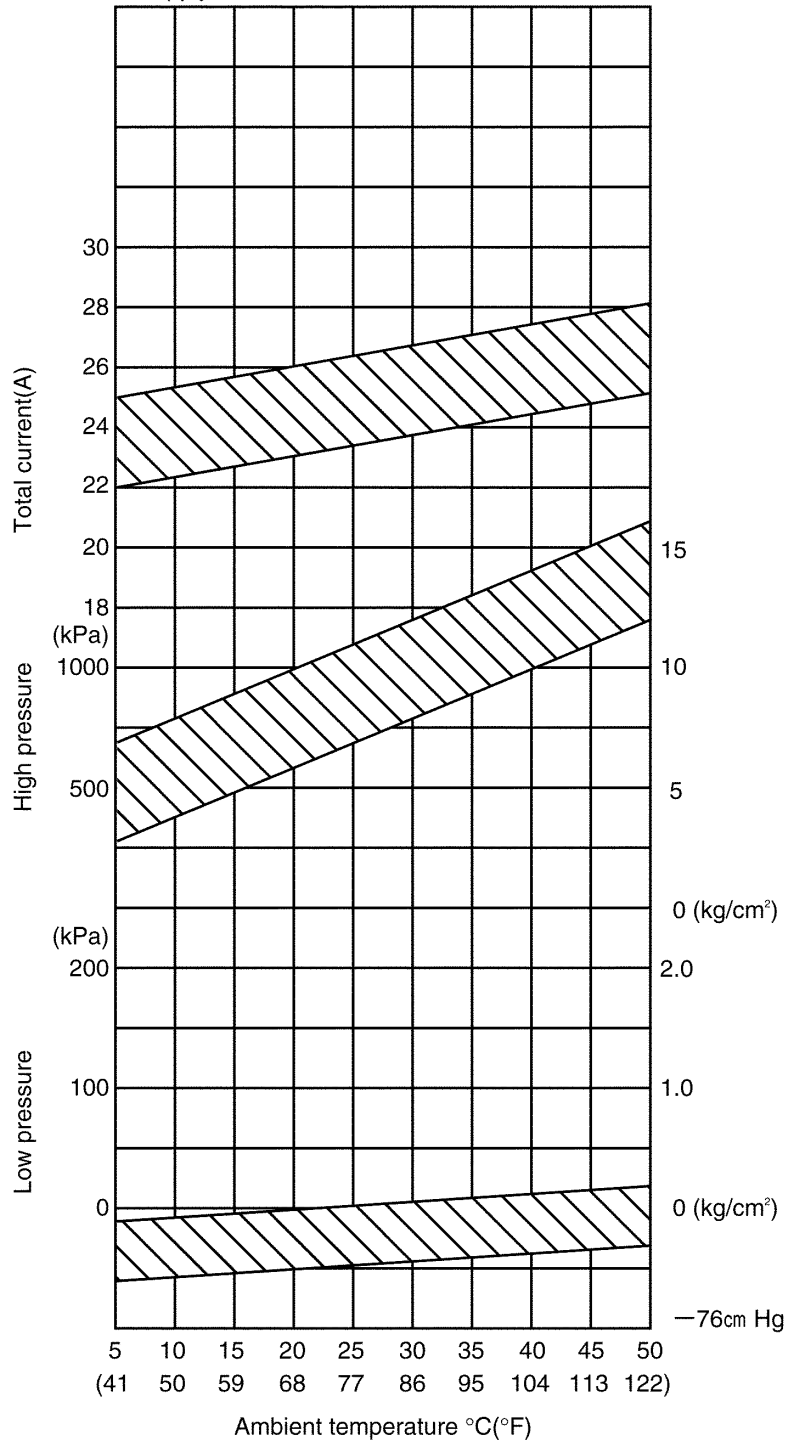
※1. 12 hours when the control temperature (RS temperature) is -20°C or below.

1.6 Operating pressure and running current



	Item	Unit	Amperage
1	Condenser fan motor running current	A	1.4 (AC400V)
2	Evaporator fan motor running current (2 motors)	A	High speed 3.2 (AC400V)
			Low speed 0.9 (AC400V)

Inside -18°C (-0.4°F) Air-cooled operation
 Power supply 200V, 60Hz



	Item	Unit	Amperage
1	Condenser fan motor running current	A	1.4 (AC400V)
2	Evaporator fan motor running current (2 motors)	A	High speed 3.2 (AC400V)
			Low speed 0.9 (AC400V)

2. OPERATION MODES AND CONTROL

There are two main kinds of the operation modes: the cargo cooling control mode and the unit inspection mode.

The cargo cooling control mode is explained in this section.

※For the unit inspection mode, refer to section 4.

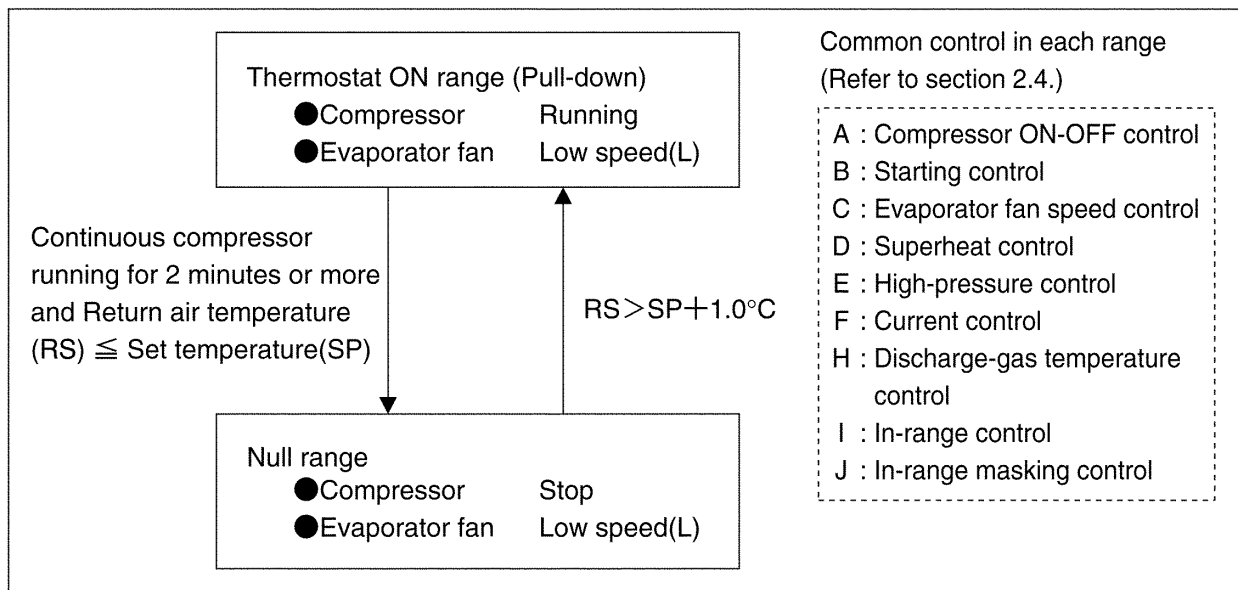
The relationship between the operation mode and set point temperature is as follows.

Operation mode	Set point temperature	Control sensor	Operation description
Frozen mode	-10.1~-30.0°C (+13.8~-22.0°F)	Return air sensor	Compressor ON/OFF control
Partial frozen mode	-3.0~-10.0°C (+26.6~+14.0°F)	Return air sensor	Hot-gas bypass control with modulating valve
Chilled mode	+25.0~-2.9°C (+77~+26.8°F)	Supply air sensor	Hot-gas bypass control with modulating valve
Defrosting mode		High pressure transducer	Hot-gas defrosting with refrigerant metering control
Dehumidification mode	+25.0~-2.9°C (+77~+26.8°F) Fixing set point temp.	Humidity sensor	Hot-gas 3 way Solenoid valve. ON/OFF control.

※For details, refer to section 2.1 to 2.4.

2.1 Frozen operation

● Control state transition and common control



● Operation of magnetic contactor and solenoid valve

Component name			Thermostat ON	Thermostat OFF	
Magnetic contactor	Compressor	CC	○	×	
	Evaporator fan. High speed	EFH	×	×	
	Evaporator fan. Low speed	EFL	○	○	
	Condenser fan	CF	△	×	
Solenoid valve	Liquid solenoid valve	LSV	○	×	
	Injection solenoid valve	ISV	△	×	
	Hot-gas 3-way solenoid valve	HSV	×	×	
Opening, modulating valve			MV	0%	0%
Electronic expansion valve			EV	300~2000 pulse	300~2000pulse

Note) ○ : Energized × : Deenergized △ : Depending on the control conditions

Frozen operation

(1) Set point temperature and control sensor

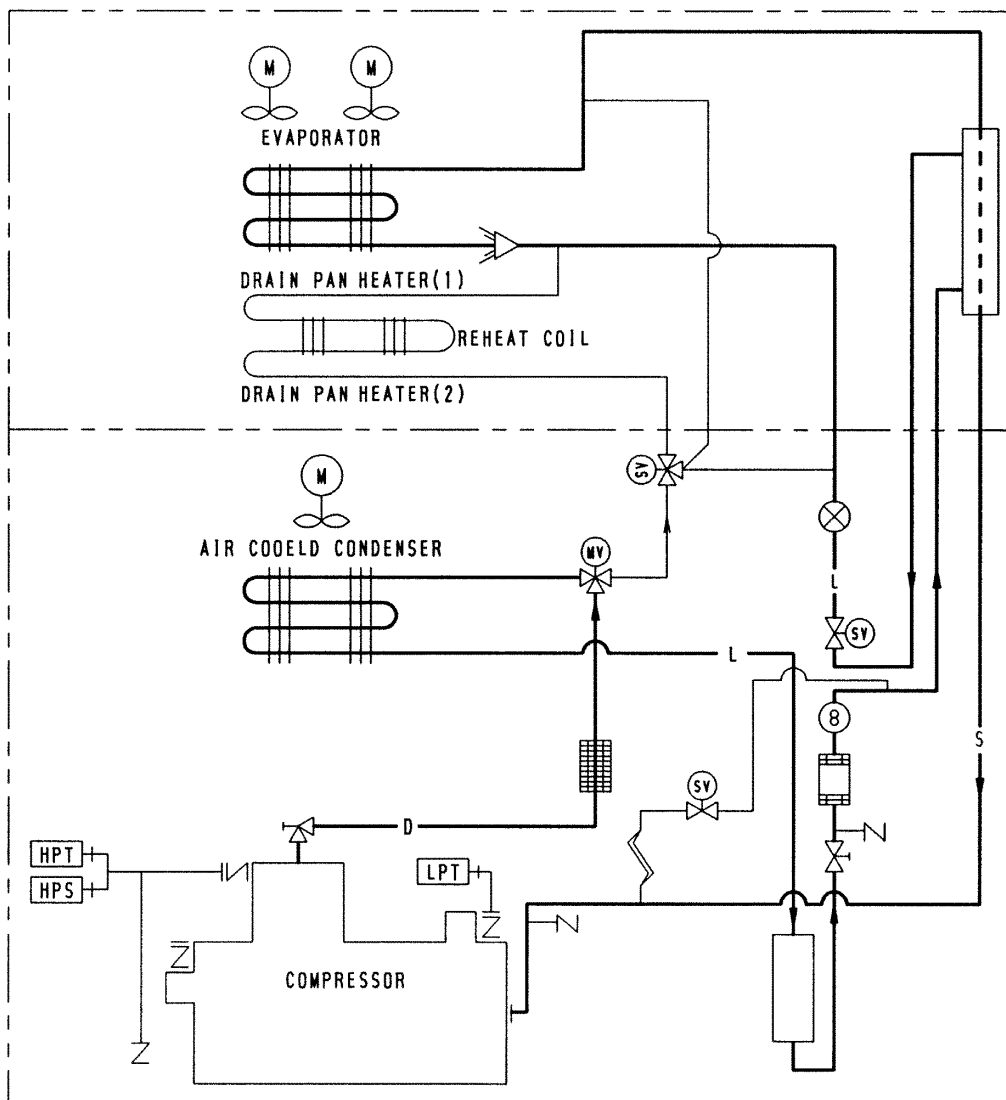
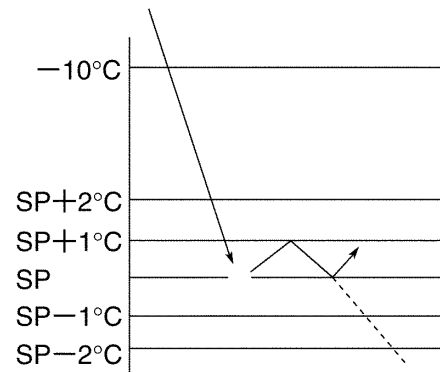
When the set point temperature (referred to as SP hereafter) is -10.1°C ($+13.8^{\circ}\text{F}$) or lower, the compressor is operated ON and OFF, in response to return air temperature.

(2) Control

When the control temperature reaches SP (point A), the compressor, condenser fan and liquid solenoid valve (LSV) are turned off.

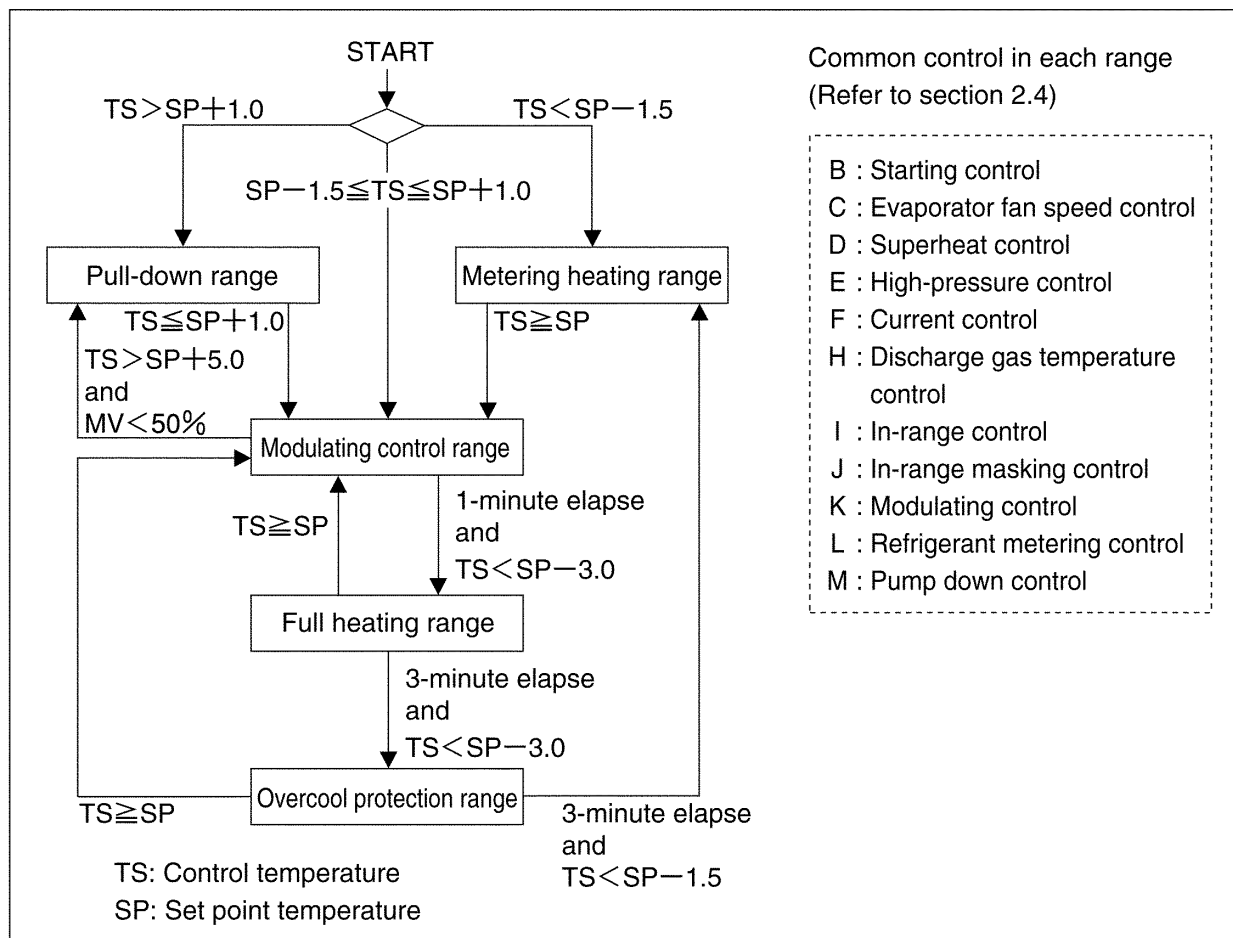
When the control temperature exceeds $\text{SP}+1.0^{\circ}\text{C}$, the compressor, liquid solenoid valve and condenser fan are turned on.

Here, the compressor runs for 2 minutes every time when it is turned on once. Even if the control temperature becomes below SP (point C) within 2 minutes after the compressor is turned on, the compressor, condenser fan and liquid solenoid valve are not turned off. (2 minutes compressor forced operation)



2.2 Chilled and partial frozen operation

● Control state transition and common control



● Operation of magnetic contactor and electronic solenoid valve

Component name			Pull-down	Modulating control	Full heating	Overcool protection	Metering heating
Magnetic contactor	Compressor		CC	○	○	○	○
	Evaporator fan	High speed	EFH	○	○	○	○
	Evaporator fan	Low speed	EFL	×	×	×	×
	Condenser fan		CF	△	△	△	△
Solenoid valve	Liquid solenoid valve		LSV	○	○	○	○
	Injection solenoid valve		ISV	△	△	×	△
	Hot-gas 3-way solenoid valve		HSV	×	×	×	○
Opening, modulating valve			MV	0%	0.1~99.9%	100%	0%
Electronic expansion valve			EV	400~2000 pulse	350~2000 pulse	500 pulse	500 pulse

Note) ○ : Energized × : Deenergized △ : Depending on the control conditions

Chilled and partial frozen operation

(1) Set point temperature and control sensor

Chilled operationWhen the set point temperature is -2.9°C ($+26.8^{\circ}\text{F}$) or higher, the modulating valve (MV) is controlled sensing the supply air temperature in order to adjust the hot gas flow rate.

Partial frozen operation ...When the set point temperature is -3.0°C to -10.0°C ($+26.6^{\circ}\text{F}$ to $+14.0^{\circ}\text{F}$), the modulating valve is controlled sensing the return air temperature in order to adjust the hot gas flow rate.

※The operation mode is automatically switched according to the set point of the electronic controller. Chilled and partial frozen operations are controlled in the same manner except the sensor for the temperature control.

(2) Description of control state

Pull-down range	Cooling operation is carried out to lower the inside temperature to the set temperature.
Modulating control range	The hot gas flow rate is adjusted by the modulating valve in order to keep the control temperature.
Full heating range	Rapid heating is carried out to prevent the inside temperature from over cooling.
Metering heating range	The refrigerant is metered for heating in order to reach to the control temperature.
Overcool protection range	The compressor is stopped but the evaporator fan is kept running.

(3) Control

In the pull-down range, the opening of the modulating valve (MV) is 0%.

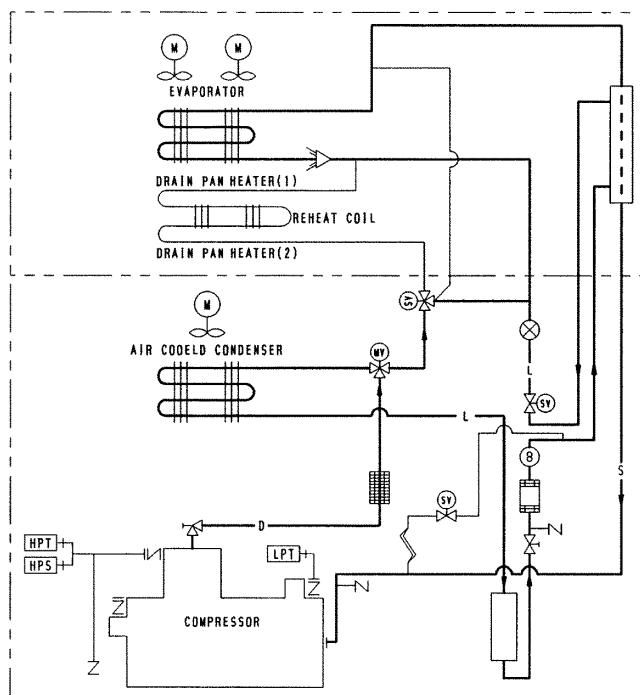
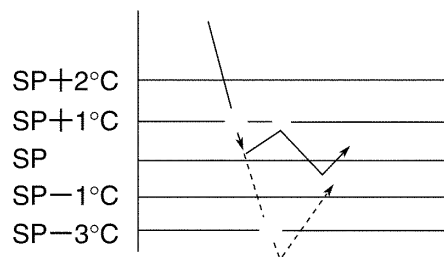
When the control temperature reaches the point A, the in-range lamp is turned on. At the same time, the modulating valve is opened to make the hot gas start flowing to the evaporator.

When the hot gas starts flowing, the temperature sometimes temporarily rises (point B) with the in-range lamp turned off.

After this operation is repeated several times, it will come into the stable state.

The hot gas flow rate will be gradually varied by the modulating valve in order to put the control temperature into the stable state.

Even after the stable state is achieved the ambient temperature varies. When the control temperature falls to $\text{SP}-3^{\circ}\text{C}$ (point C), the full heating is carried out.

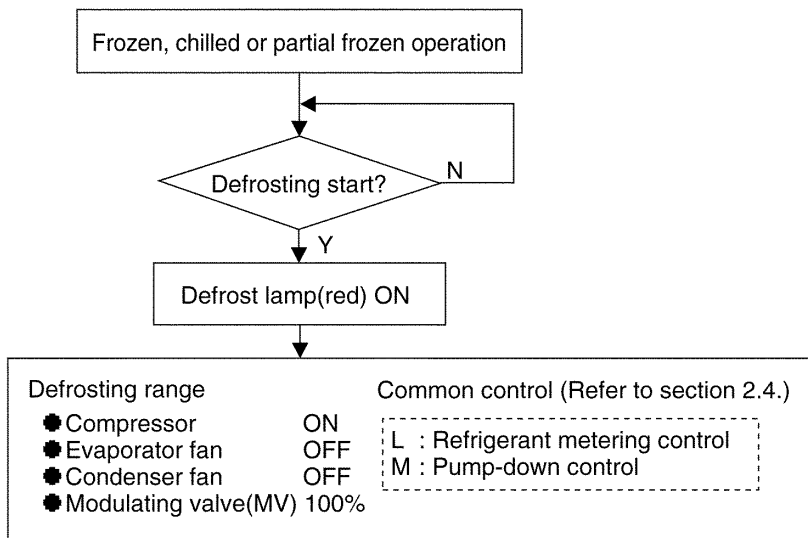
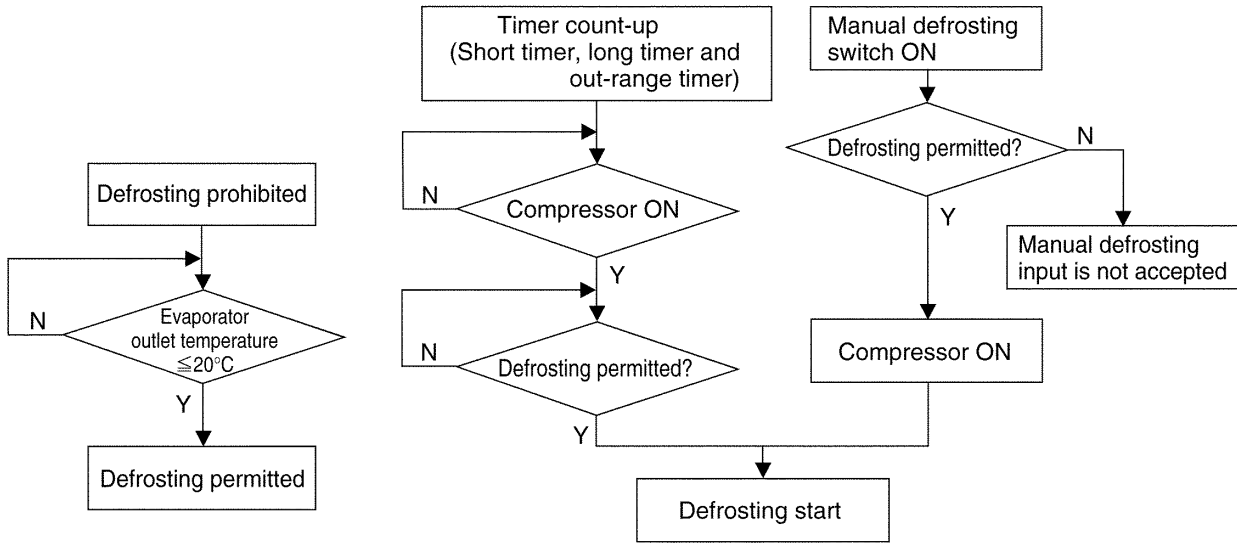


※The left figure shows the hot gas flowing state in the modulating control range.

In other range
Full heating range
...MV is 100% opened toward the evaporator.

Metering heating range
...Same as for defrosting

2.3 Defrosting operation



Operation of magnetic contactor and solenoid valve

Component name			Defrosting
Magnetic contactor	Compressor	CC	○
	Evaporator fan. High speed	EFH	×
	Evaporator fan. Low speed	EFL	×
Solenoid valve	Condenser fan	CF	△
	Liquid solenoid valve	LSV	×
	Injection solenoid valve	ISV	△
	Hot-gas 3-way solenoid valve	HSV	○
Opening, modulating valve			MV 100% or 47%
Electronic expansion valve			EV 500 pulse

Note) ○ : Energized × : Deenergized
 △ : Depending on the control conditions

Defrosting operation

(1) Defrosting system

The hot-gas defrost system is adopted in the units; i.e. the high temperature and high pressure refrigerant (hot gas) from the compressor is sent to the evaporator and drain pan for defrosting. Since the evaporator is heated directly by the hot refrigerant in the evaporator, defrosting can be performed effectively.

(2) DEFROSTING INTERVAL

LXE10D-A14 control the switch over of long timer and short timer so that they can be switched over according to the time elapsed from the start-up of the unit.

1) Starting of defrosting

	Within 72 hours from start-up of the unit	After 72 hours from start-up of the unit
Starting of defrosting	Defrosting is started by the signal from the timer set to a shorter time between the long timer (4 hours) and short timer.	Defrosting is started by the signal from the long timer.

2) Setting of defrosting interval (long timer)

Name of models	Dehumidification control Note: "dHu" setting	Setting of defrosting interval	Defrosting interval setting screen
LXE10D-A8	ON	Fixed (1)Setting for 75%RH When SP \geq 5.6°C: 6 hours When SP $<$ 5.6°C: 3.5 hours (2)Setting for 50%RH When SP \geq 5.6°C: 12 hours When SP $<$ 5.6°C: 3.5 hours	Not displayed
	OFF	Variable Can be selected from 3, 6, 9, 12, and 24 hours.	Displayed

Note: Refer to the "2.4 Dehumidification control setting."

3) Short timer when the set time is under -20°C

Name of models	Short timer
LXE10D-A14	12hr

Note, however, that the long timer set value should have priority when the long timer is set to a shorter level than the specified above.

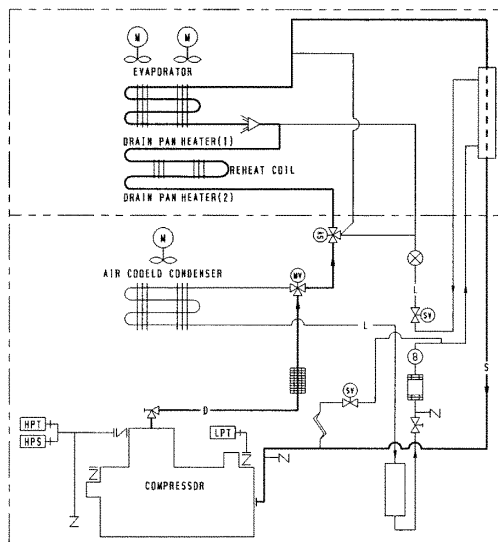
(3) Defrosting termination

Defrosting will be terminated when any one of the following three conditions is satisfied.

The evaporator outlet temperature becomes 35°C or higher.

90 minutes have elapsed.

Any one of protective devices is activated.

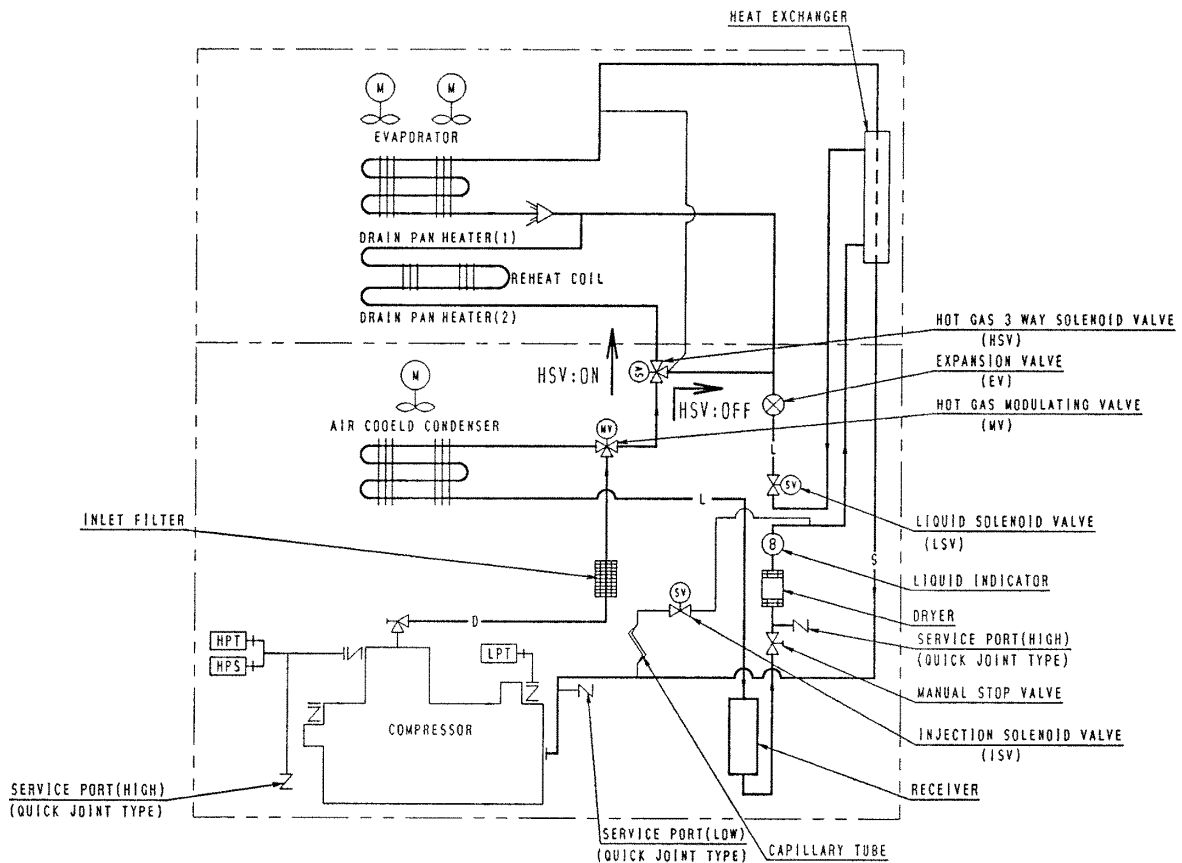


2.4 Dehumidification Operation

2.4.1 Dehumidification Control

LXE10D-A14 features the dehumidification function. The display panel on the controller allows switch over of dehumidification control setting. As for the setting valve, the cargo can choose 50% and 75%.

Dehumidification control setting	Dehumidification control
OFF	Not executed
ON	<ul style="list-style-type: none"> The opening degree of expansion valve is controlled so that the power consumption becomes 13.5 kW when the hot-gas 3-way solenoid valve is turned on under the "chilled" operation mode. The dehumidification control is turned on and off by turning on and off the hot-gas 3-way solenoid valve.



Dehumidification control

	Name of control	Description of control	Operation modes			
			Frozen	Chilled	Partially frozen	Defrost
O	Dehumidification ON/OFF control	The humidity in the refrigeration unit is controlled by turning on and off the hot-gas 3-way solenoid valve.		○*		

※ Only under the proportional control

O: Dehumidification ON/OFF control

- The dehumidification turning ON/OFF operation is controlled by turning on and off the hot-gas 3-way solenoid valve only under the proportional control of "chilled" operation mode.
- When the 3-way solenoid valve is turned on, hot gas flows in the reheat coil (reheat heater) and drain pan heater.

Then, when discharged air passing through the evaporator is fed through the reheat coil (reheat heater), the discharged air will be reheated, resulting in drop of its relative humidity and dehumidification of the refrigeration unit.

Conditions under which the hot-gas 3-way solenoid valve is turned on

- Humidity in the refrigeration unit > 75%RH and within the proportional control range

Conditions under which the hot-gas 3-way solenoid valve is turned on and then turned off

- Humidity in the refrigeration unit ≤ 60%RH
- Outside the proportional control range

Notes:

- If the relative humidity in the refrigeration unit is between 60% RH and 75% RH within the proportional control range, the hot-gas 3-way solenoid valve is turned on.
- Although the conditions under which the hot-gas 3-way solenoid valve is turned on are satisfied, the hot-gas 3-way solenoid valve is forcedly kept turned off for 3 minutes after the start-up of the unit, termination of defrosting, and measurement heating. Then, after 3 minutes has passed and the opening degree of proportional control valve (MV) has decreased to 75% or lower, the solenoid valve will be turned on.
- The opening degree of hot-gas 3-way solenoid valve (refrigerant circulation rate) is controlled so that the power consumption becomes 13.5 kW, resulting in the maximum dehumidification performances.

When set humidity is 50% (when transporting precision instrument), hot gas three-way solenoid valve is normally switched ON in modulating control area.


2.4.2 Dehumidification control setting

You can set whether the dehumidification control is to be executed or not by operating the display panel of controller (DECOSIIIb).

1) Description of setting

Whether the dehumidification control is to be executed or not is switched over according to the setting of dehumidification control parameter "dHu" under the optional function setting mode. Unit can operate with RH 50% setting or RH 75% settings depends on cargo.

In initial setting of electronic controller, when dehumidification setting "dHU" is selected "On" position, unit are controlled with 75% RH setting.

For change of RH setting from 75% to 50%, please press  Key for 3 sec. or more during 75% RH operation.

Dehumidification control		Dehumidification control "dHu" setting	DE-HUMID LED	7 segment LED (Left side)
If executing dehumidification control	RH 75% operation (for flower-bulb)	on	on	"A"
	RH 50% operation (for precision machinery ※)	on	on	"d"
If not executing dehumidification control		off	off	no

※Only for precision machinery (Ventilator CLOSE), Please do not select this setting for flower-bulb.



CAUTION

When the cargo does not need dehumidification control, be sure to set the dehumidification control parameter "dHu" to "off."

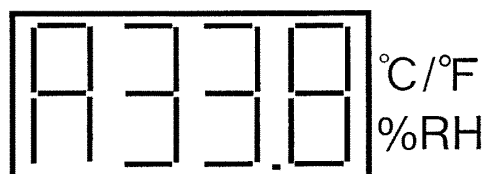


CAUTION

The reheat heater operation is not interlocked with the status of DE-HUMID LED.

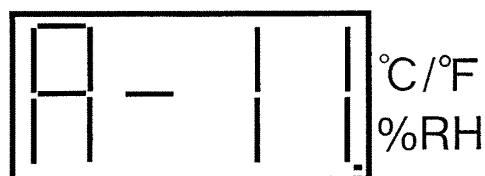
(Example of LED indication under dehumidification control)

Example: Sensor temperature: 33.8°C









However, when the sensor temperature is -10°C or lower or exceeds 100.0°C and its indication needs four digit places, the place of decimal point will be moved by one digit so that the temperature can be displayed. The fractions below the decimal point is rounded off in the indication.

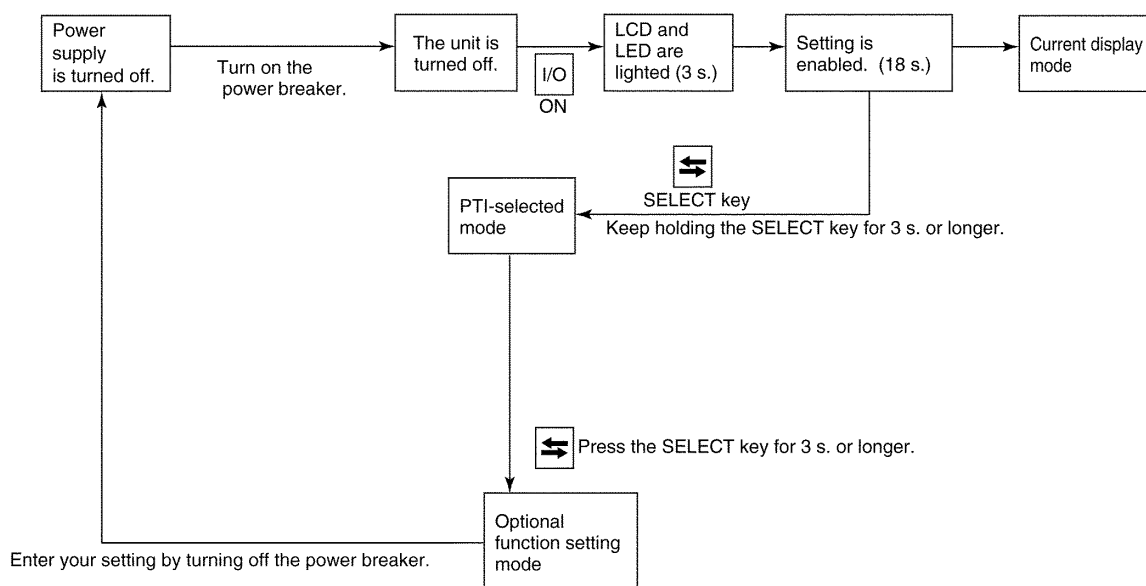
Example: Sensor temperature: -11.1°C



2) Panel operation

-1. Selection of dehumidification setting ("on" or "off")

- ① When the power is on, turn the unit switch off once.
- ② Turn the unit power on. Within 18 seconds after all LCD/LED's come on for 3 seconds, press and hold the  keys for 3 seconds.
- ③ The PTI selection mode is displayed on the LCD. press and hold the  keys for a minimum of 3 seconds and the mode changes to the optional function setting mode.
- ④ Press the  key once and display "dHu" on the LCD. (For details, refer to the optional function setting mode flow on the rear surface.)
- ⑤ Select "ON" or "OFF" with the  or  keys
- ⑥ Press the  key to enter your selection.
- ⑦ Turn the power breaker off. (Be sure to turn the power breaker off after changing the setting.)



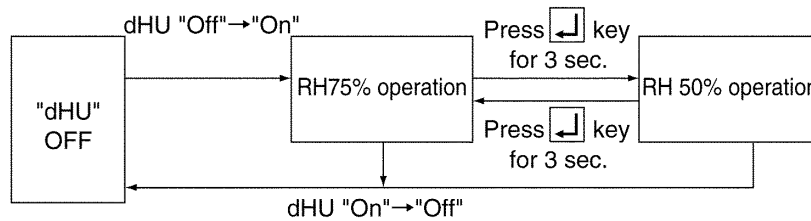
CAUTION

If you turn off only the unit switch after changing setting of a parameter without turning off the power breaker:

- **The controller cannot recognize the setting parameter change.**
Therefore, when you turn on the unit switch next, the previous setting will be automatically restored after the LCD and LED has lighted.
- **After changing setting of a parameter, be sure to turn off the power breaker.**

-2. Selection of RH 75% or RH 50% operation

When dehumidification setting (dHU) in initial setting of electronic controller is "On" position, RH settings is RH 75%. For change of RH setting from 75% to 50%, please press Enter key for 3 sec. or more during 75% RH operation.



- When you operate the unit under the "frozen" mode by mistake while the parameter for dehumidification control is set to "on":

Operation modes	DE-HUMID LED	7-segment LCD	Dehumidification control	Long timer
Partial frozen	Lighted	"A" is displayed.	Not to execute	<ul style="list-style-type: none"> • The setting screen of long timer is not displayed. • After the setting of parameter "dHu" is switched over from off to on, the timer (set to one of 3, 6, 9, 12, and 24 hours) starts and signals the unit to start defrosting after the set time passed.
Frozen	Lighted	"A" is displayed.	Not to execute	

2.5 Common control

The following are controlled in the operation modes. (For details, refer to the following pages.)

	Control name	Control content	Operation mode			
			Frozen	Chilled	Partial frozen	Defrost
A	Compressor ON-OFF control	The compressor is operated on and off to adjust the inside temperature.	○			
B	Starting control	At starting, the compressor may repeat the process of start and stop before its normal operation.	○	○	○	
C	Evaporator fan speed control	The evaporator fan is switched to the high or low speed according to the set point temperature.	○	○	○	
D	Superheat control	In order to keep the superheat of the evaporator optimal, the opening of the electronic expansion valve is controlled.	○			
E	High-pressure control	In order to keep the high pressure optimum, the opening of the electronic expansion valve is controlled.	○	○	○	
G	Discharge gas temperature control	In order to prevent the refrigerating machine oil from deterioration, the liquid injection solenoid valve control or electronic expansion valve control is carried out.	○	○★	○★	
H	In-range control	When the control temperature is within $SP \pm 2^{\circ}\text{C}$, the in-range lamp is turned on.	○	○	○	
I	In-range masking control	After defrosting initiation, the in-range lamp is kept on for 90 minutes.	○	○	○	○
J	Modulating control	The hot gas flow rate to the evaporator is proportionally controlled to keep the control temperature variation within $\pm 0.5^{\circ}\text{C}$.		○※	○※	
K	Refrigerant metering heating control	For optimum heating, the refrigerant flow rate is controlled.		○☆	○☆	○
L	Pump down control	The liquid refrigerant is pumped down into the water-cooled condenser (liquid receiver)		○	○	○

※ : Only in the modulating control range

☆ : Only in the metering heating range

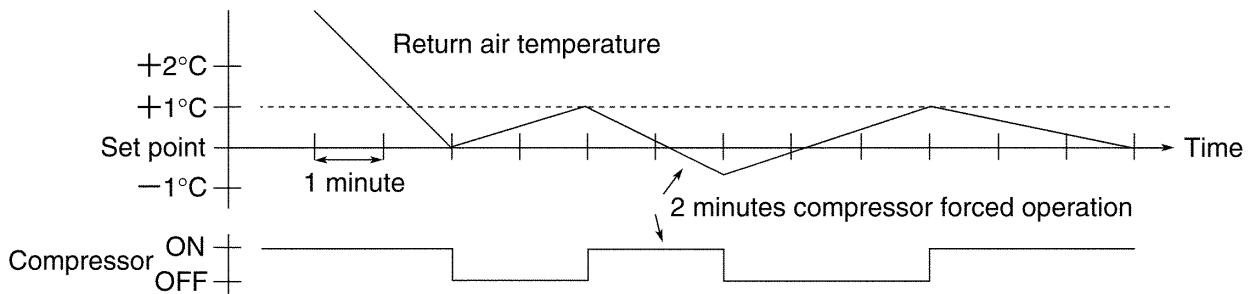
★ : Excluding the metering heating range

Common control

A: Compressor ON-OFF control

When the control temperature reaches the set point temperature or lower, the compressor is stopped. When the control temperature rises to the set point temperature +1.0°C afterward, the compressor runs again.

When the compressor starts running it is forcibly run for 2 minutes. (2 minutes compressor forced operation) in order to prevent the compressor from deterioration due to shortage of lubricant.



B: Starting control

When the high pressure rapidly rises at starting or when the starting current is overcurrent, the compressor automatically stops and starts to control high pressure and starting current.

When the unit restarts at -10 to 23°C ambient temperature after a long pause of its operation, the compressor repeats the process of stop and start for 4 times before its normal operation.

C: Evaporator fan speed control

The speed of the evaporator fan is switched in accordance with operation modes.

A delay time of 10 sec. is provided to switch the high speed to the low speed and vice versa.

Chilled mode : High speed

Partial frozen mode : High speed

Frozen mode : Low speed

D: Superheat control

The evaporator superheat is adjusted to be optimum by controlling the opening of the electronic expansion valve based on the evaporator inlet and outlet refrigerant temperature, and the compressor suction gas temperature.

E: High-pressure control

● By electronic expansion valve

When the ambient temperature is high during the air-cooled operation, the condensing pressure (high pressure) will increase, and the high pressure switch may be actuated.

In order to prevent this situation, the high pressure is controlled to be 1900kPa or lower by adjusting the opening of the electronic expansion valve.

● By condenser fan (Frozen mode and Pull down operation)

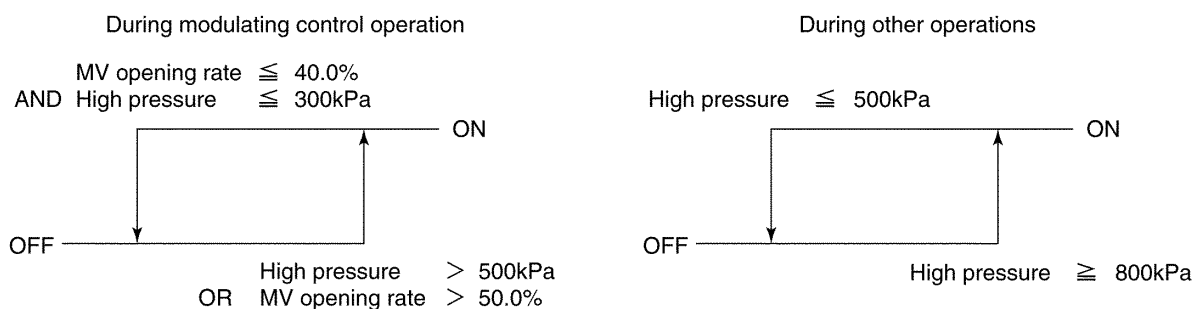
When the ambient temperature is low during the air-cooled operation, the condensing pressure (high pressure) will decrease. Then, the low pressure will decrease too.

In order to prevent this situation, when the high pressure becomes 500kPa or lower, the condenser fan stops to prevent the high pressure from excess dropping.

When the high pressure becomes 800kPa or higher afterward, the operation will be restarted.

● Condenser fan control (During the modulating control)

During the air-cooled operation, when the ambient temperature is low, the condensing pressure (high pressure) drops and then the evaporating temperature (low-pressure) drops. In order to prevent this, the condenser fan stops when the high pressure reaches 500kPa or lower. When the high pressure reaches 800kPa or higher, the condenser fan restarts. Here, during the modulating control operation, the condenser fan starts and stops in accordance with the opening rate of modulating valve (MV) and the high pressure. i.e. When the MV opening rate is 40.0% or lower and the high pressure is 300kPa or lower, the condenser fan stops, while when the MV opening rate exceeds 50.0% or the high pressure exceeds 500kPa, the condenser fan restarts.



G: Discharge gas temperature control

This refrigeration unit uses HFC134a as the refrigerant. In order to prevent the refrigerating machine oil used with the refrigerant from the high-temperature deterioration, the liquid refrigerant is injected to the suction pipe of the compressor.

The discharge gas temperature sensor detects the discharge gas temperature.

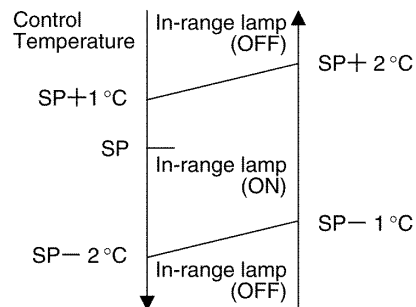
The refrigerant injection is processed by the opening of the injection solenoid valve or the electronic expansion valve in accordance with the discharge gas temperature.

RS > -5°C	Injection solenoid valve (Open)	Injection solenoid valve (Close)
	125°C	115°C
RS ≤ -5°C	Electronic expansion valve (Wider opening than ordinary setting)	Electronic expansion valve (Return to ordinary opening)
	120°C for 10 minutes or 125°C	115°C

RS = Return air temperature.

H: In-range control

In order to observe at a glance whether the refrigeration unit properly controls the inside temperature or not, the orange lamp on the display panel will light on when the control temperature is near the set point temperature (SP). At the same time, AC24V will be supplied to the monitoring output (D). (The monitoring output is used for observation in the bridge on the ship.)



I: In-range masking control

If the inside temperature is within the in-range when defrosting is started, the in-range lamp will be kept turned on for 90 minutes regardless of the following inside temperature. Since the control temperature temporarily rises during defrosting, it will prevent the misunderstanding that it is regarded as a trouble when the in-range lamp goes out.

J: Modulating control

In the chilled mode operation, the opening of the modulating valve is adjusted by proportionally controlling the supply air temperature for the set point temperature (SP) in order to control the amount of the hot gas bypass flowed to the evaporator.

Thus, the supply air temperature is controlled to be in the range of set point temperature $\pm 0.5^{\circ}\text{C}$. Here, the partial frozen operation has the same control method as the chilled operation except the different control sensor.

K: Refrigerant metering control

The amount of the refrigerant in the hotgas flow is controlled to keep the high pressure in the optimum range during the metering heating range or defrosting. When the high pressure is lower than kPa, the injection solenoid valve will be opened (called as refrigerant charge) till it is to be kPa or higher. When the high pressure exceeds , the modulating valve will be half opened (called as refrigerant release) till it is to be or lower.

Unit : kPa

	10HP	5HP
Refrigerant charge (start)	400	630
Refrigerant charge (stop)	500	700
# Refrigerant release (start)	1,300	1,300
Refrigerant release (stop)	1,200	1,200

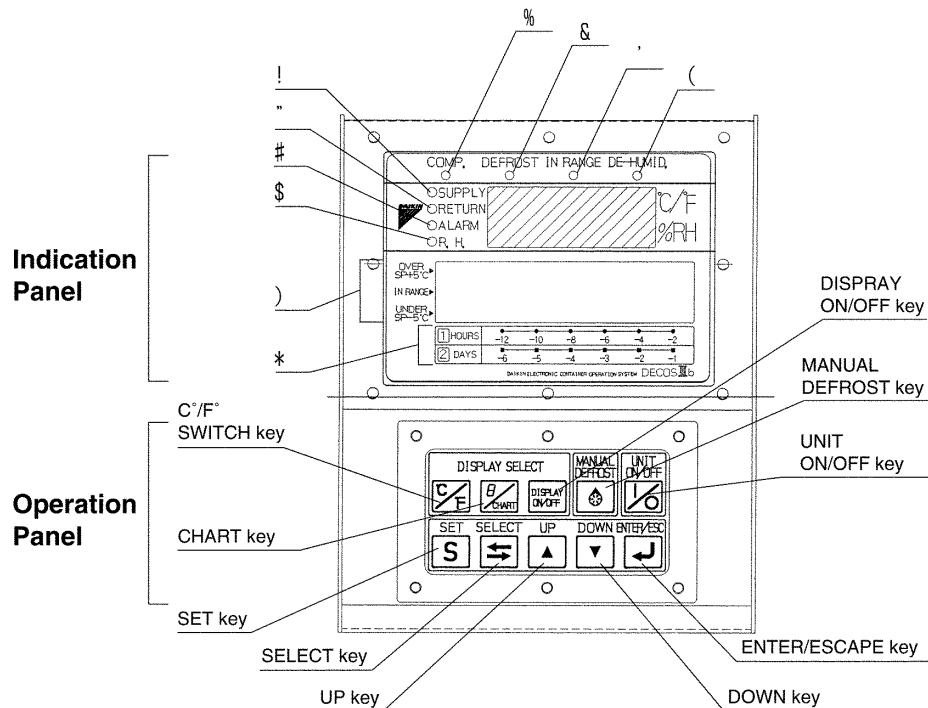
L: Pump down control

Before metering heating or defrost mode, the refrigerant in the refrigeration circuit is liquidized and pumped down in the water-cooled condenser (or receiver) by closing the liquid solenoid valve (LSV) and the modulating valve (MV). When the low pressure reaches -55kPa or lower, the pump down is terminated and it turns to the metering heating or defrost mode.

No.	Function division	Function	DECOS IIIb
5	Self-diagnosis and Automatic back-up	<ul style="list-style-type: none"> • Open-phase running • Overcurrent running • CPU and Peripheral device (electronic controller) 	<ul style="list-style-type: none"> ✓ ✓ ✓
6	Manual inspection	<ul style="list-style-type: none"> • Compressor running hour indication • Evaporator fan motor operation (high speed) • Evaporator fan motor operation (low speed) • Condenser fan motor operation • Battery replacement date reset • Compressor horsepower setting indication • Elapse time since trip start/item resetting • Evaporator run-hour indication • Condenser run-hour indication • Controller software version indication • [PC]---Header information set of data logger • [PC]---All sensor data indication • [PC]---Controller-internal relay output display/MV output (opening rate) indication/EV output (opening rate) indication • [PC]---Battery replacement date reset 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
7	Automatic PTI	<ul style="list-style-type: none"> • Automatic PTI (SHORT) = Operation check of components • Automatic PTI (FULL) 	<ul style="list-style-type: none"> ✓ ✓
8	Data logging	<ul style="list-style-type: none"> • Compressor total running hour • Evaporator fan motor total running hour • Condenser fan motor total running hour • Trip data • Alarm logging data • Automatic PTI data • Event data 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ ✓
9	Data retrieving (Data output)	<ul style="list-style-type: none"> • [PC]---Alarm data • [PC]---Trip data • [PC]---Automatic PTI data • [PC]---Event data 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓
10	Communication	<ul style="list-style-type: none"> • Remote monitoring • Remote control 	<ul style="list-style-type: none"> Optional Optional
11	Power buck-up	<p>* Even the power is off, the following works are possible.</p> <ul style="list-style-type: none"> • Setting : Temperature setting <li style="padding-left: 20px;">Defrosting interval setting <li style="padding-left: 20px;">[PC]---Container ID data setting • Battery back-up of the data logger record • Data retrieving and down loading 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓
12	Chart indication	<ul style="list-style-type: none"> • Temperature logging data indication in graphic chart 	<ul style="list-style-type: none"> ✓
13	Data input	<p>* The following works are possible using the control panel.</p> <ul style="list-style-type: none"> • Container ID (No.) setting • Controller time setting 	<ul style="list-style-type: none"> ✓ ✓

3.2 Control panel

Name and function of each component



- | | |
|---|---|
| <ul style="list-style-type: none"> ① SUPPLY LED (This is lit on while the LED display indicates "supply air temperature".) ② RETURN LED (This is lit on while the LED display indicates "return air temperature".) ③ ALARM LED (This is lit on and off when alarms happen.) ④ R.H. LED (This is lit on while the LED display indicates current "relative humidity".) ⑤ COMP. LED (This is lit on while the compressor is running.) | <ul style="list-style-type: none"> ⑥ DEFROST LED (This is lit on while the unit is under the defrosting operation.) ⑦ IN RANGE LED (This is lit on while the control temperature is in range.) ⑧ DE-HUMID. LED (This is lit on while the controller is under the dehumidification control operation.) ⑨ Temperature base (This is used for the graphic chart indicated on the LCD display.) ⑩ Time base (This is used for the graphic chart indicated on the LCD display.) |
|---|---|

Function of operation key



● Display ON/OFF key

Pressing this key alternately turns on and off the LED of controller.

The indication "dISPoFF" appears on the LCD while the LED is turned off.

If you set the unit ON/OFF key to the OFF position while the LED is turned on, the LED turning-off function will be reset.

Note: Under the chart display mode and scroll display mode, the display ON/OFF key is disabled.

- ※1 **CURRENT INDICATION MODE**.....Supply air temp. (SS), return air temp. (RS), defrosting interval, currently existing alarms, and set point temperature/humidity are indicated.
- ※2 **OPERATION SETTING MODE**.....Control temperature, defrosting interval, and control humidity (optional) can be set.
- ※3 **SENSOR INDICATION MODE**.....The following sensor values are indicated. High pressure (HPT), low pressure (LPT), total current (CT1), compressor current (CT2), voltage (PT1), ambient temperature (AMBS), evaporator inlet temperature (EIS), evaporator outlet temperature (EOS), discharge gas temperature (DCHS), suction gas temperature (SGS), modulating valve opening, electronic expansion valve opening, supply air temperature (SS) (during PTI only), return air temperature (RS) (During PTI only), Data recorder supply sensor (DSS) and data recorder return sensor (DRS).
- ※4 **PTI SELECTION MODE**.....Full PTI (F.PTI), Short PTI (S.PTI), manual check (M.CHECK) test modes can be selected.
- ※5 **OPTIONAL FUNCTION SETTING MODE**.....USDA sensor ON/OFF, dehumidification control ON/OFF, and cargo temperature sensor ON/OFF can be set.
- ※6 **BASIC FUNCTION SETTING MODE**.....Controller, logging interval, data recorder sensor ON/OFF, power input, horse power, panel (LED) lighting off function ON/OFF can be set.
- ※7 **OPTIONAL CONDITION SETTING MODE**.....D code, H code alarm indication, USDA sensor and conditions of alarms (H001, H002, H003, H004, H005, H006, d1--, d2--, d3--, d-1- and d-2-) can be set.
- ※8 **INPUT DATA MODE**.....Container I.D. (No.), and controller time can be input.
- ※9 **BATTERY MODE**.....This mode enables operation when power is not available.
- ※10 **CHART INDICATION MODE**.....Temperature record data can be indicated in graph on the LCD.
- ※11 **PANEL (LED) LIGHTING OFF MODE**.....Controller LED display panel can be turned the light off.
- ※12 **CONTROLLER SOFTWARE DOWNLOAD MODE**.....Data logged in a personal computer and a controller is exchangeable.

(NOTE) After setting was changed on ※5, ※6, ※7, and ※8 modes, be sure to turn OFF the power breaker for confirmation of the setting.

●For the operation procedures under each display mode, refer to the Service Guide, Services.





CAUTION



Since the humidity setting is fixed to 70% or 50% RH, the setting is not displayed under the operation setting mode and battery mode. Only the humidity in the refrigeration unit is displayed by the LED.

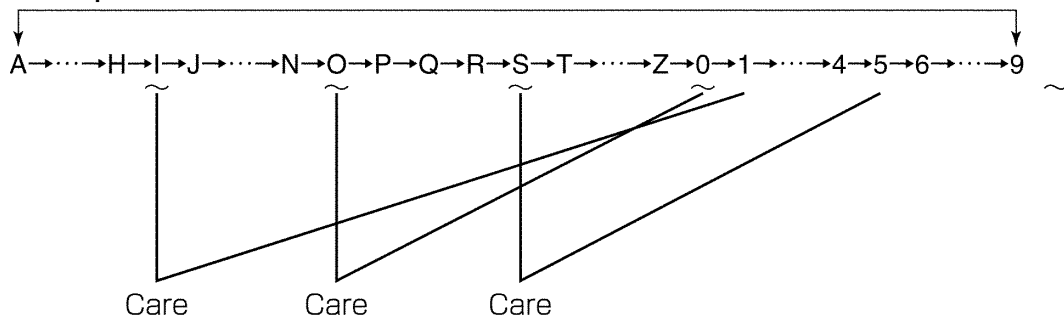
⚠ CAUTION

When inputting the container I.D. (No.) under the input data mode, take care not to enter any of the following pairs of an alphabet and a numeral.

- The alphabet "O" and numeral "0" are displayed in the same manner on the LCD screen. Do not input them inversely. 
- The alphabet "S" and numeral "5" are displayed in the same manner on the LCD screen. Do not input them inversely. 
- The alphabet "I" and numeral "1" are displayed in a similar manner on the LCD screen. Do not input them inversely.



To change the alphabet or numeral currently displayed, press the  or  key. The displayed character is changed in the following sequence.

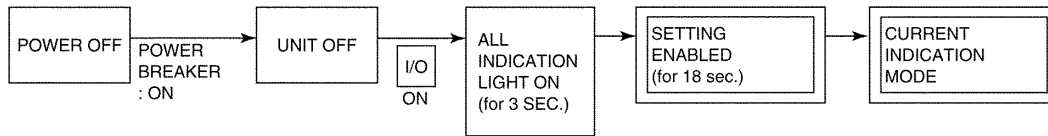


3.3.2 Mode operation procedure

1. CURRENT INDICATION MODE

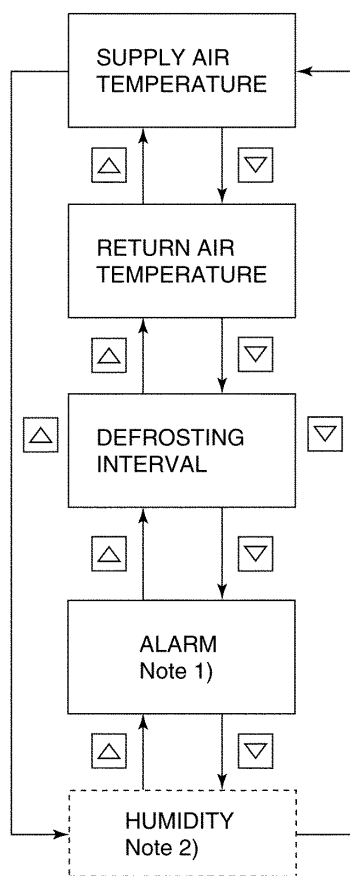
Supply air temperature (SS), Return air temperature (RS), Defrosting interval, Currently existing alarms, Set point humidity, and humidity are indicated.

<Mode selection procedure>



<Operation procedure>

Whenever the or key is pressed, the indication changes.



SUPPLY (red LED) : Light on
 LED : Supply air temperature is indicated.
 LCD : Set point temperature is indicated.

RETURN (red LED) : Light on
 LED : Return air temperature is indicated.
 LCD : Set point temperature is indicated.

In the CHILLED mode : SUPPLY (red LED) lights on.
 In the PARTIAL FROZEN, FROZEN modes :
 RETURN (red LED) lights on.
 LED : Supply air temperature in the Chilled mode, Return air temperature in the Partial frozen and Frozen modes are indicated.
 LCD : Current defrosting interval setting is indicated.

ALARM (red LED) : Light on
 LED : All the currently existing alarms are indicated in sequence.
 LCD : The total number of currently existing alarms is indicated.

R. H. (red LED) : Light on
 LED : The value of humidity sensor is indicated.
 LCD : Set point humidity is indicated.

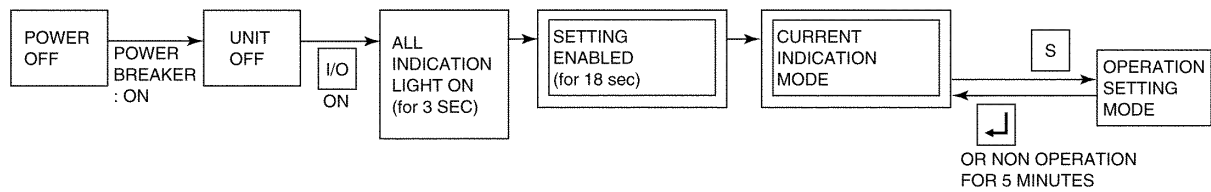
Note 1) ALARM indication steps to the next item after indicating all currently existing alarm in sequence. If there are no existing alarms, "Good" is displayed on the LED.

Note 2) The value of humidity sensor is indicated only when the "Dehumidification Control on/off Setting" is set to be "ON", according to the Optional Function Setting Operation.

2. OPERATION SETTING MODE

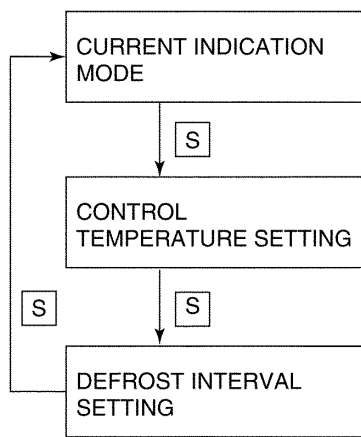
Control temperature, defrost interval, and control humidity are indicated.

<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.



LED : The current set point temperature is indicated.

LCD : "SET-SPC" or "SET-SPF" is indicated.

Change the set point temperature using the **△** or **▽** key. Press the **↵** key to determine the setting.

LED : The current defrost interval is indicated.

LCD : "SET-dEF" is indicated.

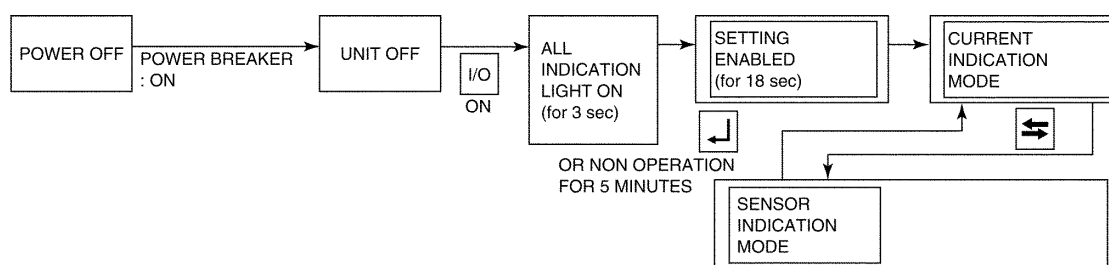
Select a defrost interval 24h, 12h, 9h, 6h or 3h using the **△** or **▽** key. Press the **↵** key to determine the setting.

3. SENSOR INDICATION MODE

The following sensor values, the modulating valve (MV) opening, and the electronic evaporating valve (EV) opening can be checked.

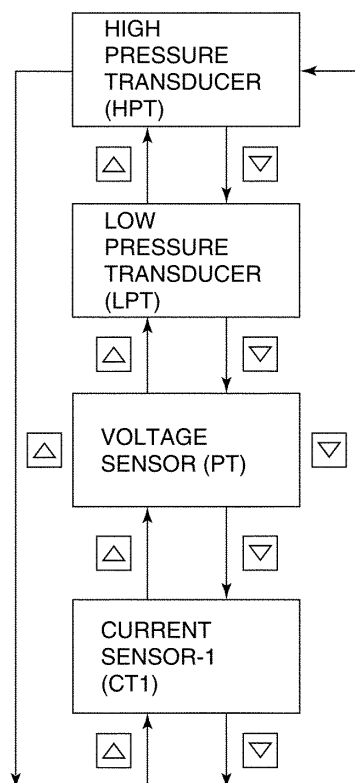
High pressure (HPT), Low pressure (LPT), Voltage (PT1), Total current (CT1), Compressor running current (CT2), Ambient temperature (AMBS), Evaporator inlet temperature (EIS), Evaporator outlet temperature (EOS), Discharge gas temperature (DCHS), Suction gas temperature (SGS), Modulating valve opening, Electronic expansion valve opening, Supply air temperature (SS) (during PTI only), Return air temperature (RS) (during PTI only), Supply air temperature of data recorder (dSS), Return air temperature of data recorder (dRS)

<Mode selection procedure>



<Operation procedure>

Whenever the or key is pressed, the indication changes.



LED : The control temperature is indicated.

LCD : The value of high pressure transducer is indicated.
The display indicates "HPT ".
(Unit is Kpa.)

LED : The control temperature is indicated.

LCD : The value of low pressure transducer is indicated.
The display indicates "LPT ".
(Unit is Kpa.)

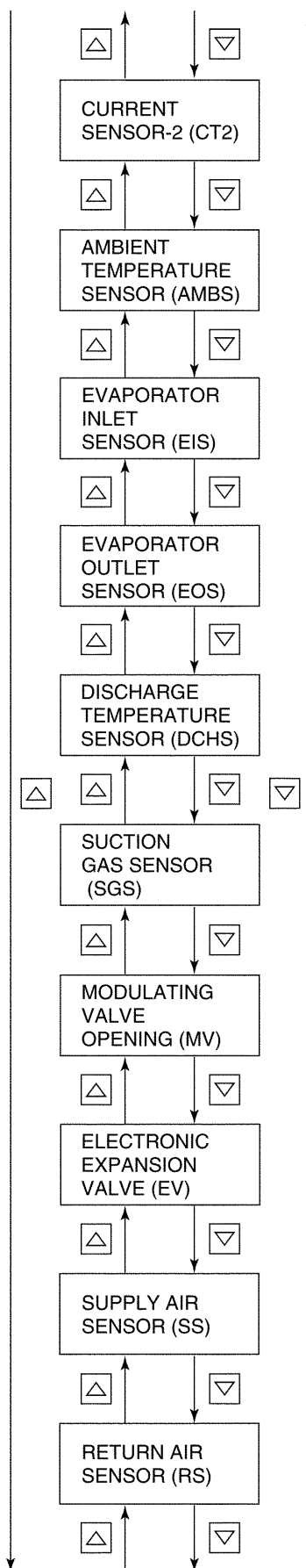
LED : The control temperature is indicated.

LCD : The value of voltage is indicated.
The display indicates "□ PT V".
(Unit is V.)

LED : The control temperature is indicated.

LCD : The value of total running current is indicated.
The display indicates "□ CT A".
(Unit is A.)

3. SENSOR INDICATION MODE continued



LED : The control temperature is indicated.
 LCD : The compressor running current is indicated.
 The display indicates "CT A".
 (Unit is A.)

LED : The control temperature is indicated.
 LCD : The ambient temperature is indicated.
 The display indicates "Ab C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The evaporator inlet temperature is indicated.
 The display indicates "EI C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The evaporator outlet temperature is indicated.
 The display indicates "EO C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The discharge gas temperature is indicated.
 The display indicates "dC C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The suction gas temperature is indicated.
 The display indicates "SG C".
 (Unit is °C or °F.)

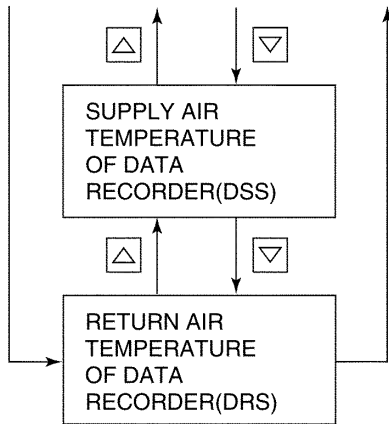
LED : The control temperature is indicated.
 LCD : The 3-way modulating valve opening is indicated.
 The display indicates "MV %".
 (Unit is % : 0%~100%)

LED : The control temperature is indicated.
 LCD : The electronic expansion valve opening is indicated.
 The display indicates "EV pulse".
 (Unit is Pulse. : 0pulse~2000pulse)

(During PTI only)
 LED : The PTI selection and the step No. are indicated.
 LCD : The supply air temperature is indicated.
 The display indicates "SS C".
 (Unit is °C or °F.)

(During PTI only)
 LED : The PTI selection and the step No. are indicated.
 LCD : The return air temperature is indicated.
 The display indicates "RS C".
 (Unit is °C or °F.)

3. SENSOR INDICATION MODE continued



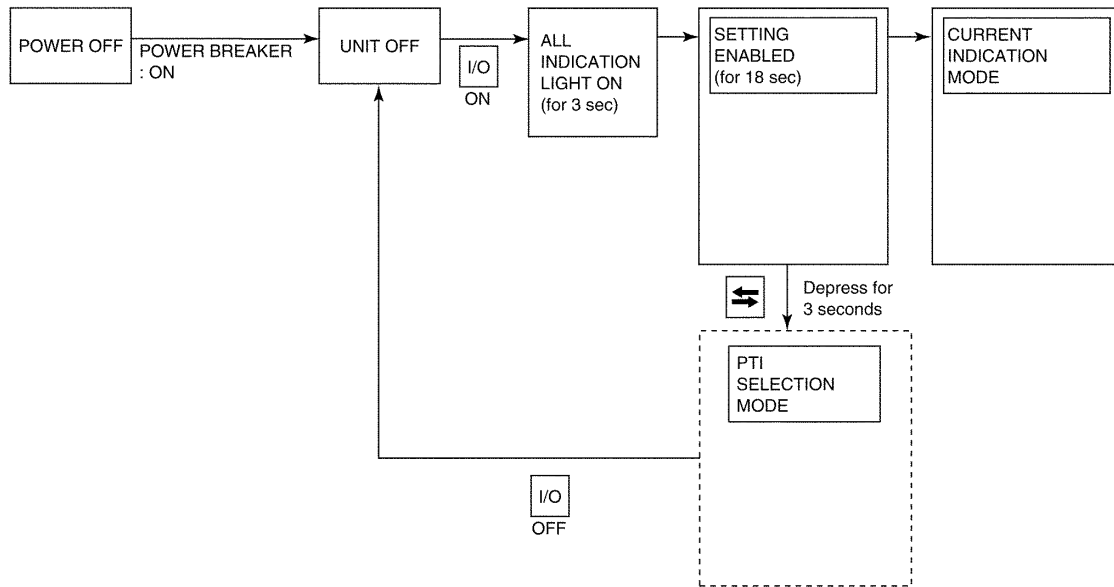
LED : The control temperature is indicated.
LCD : The supply air temperature of data recorder is indicated.
The display indicates "dS C".
(Unit is °C or °F.)

LED : The control temperature is indicated.
LCD : The return air temperature of data recorder is indicated.
The display indicates "dR C".
(Unit is °C or °F.)



4. PTI SELECTION MODE

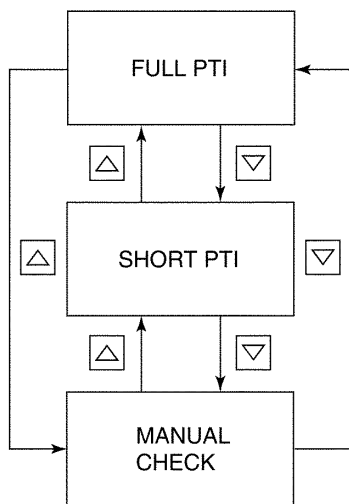
The FULL PTI (F. PTI), SHORT PTI (S. PTI), and MANUAL CHECK (M. CHECK) are selected.


<Mode selection procedure>





<Operation procedure>

Whenever the  or  key is pressed, the indication changes.



To start FULL PTI, press the  key while "F. PTI" is displayed on the LCD.

To start SHORT PTI, press the  key while "S. PTI" is displayed on the LCD.

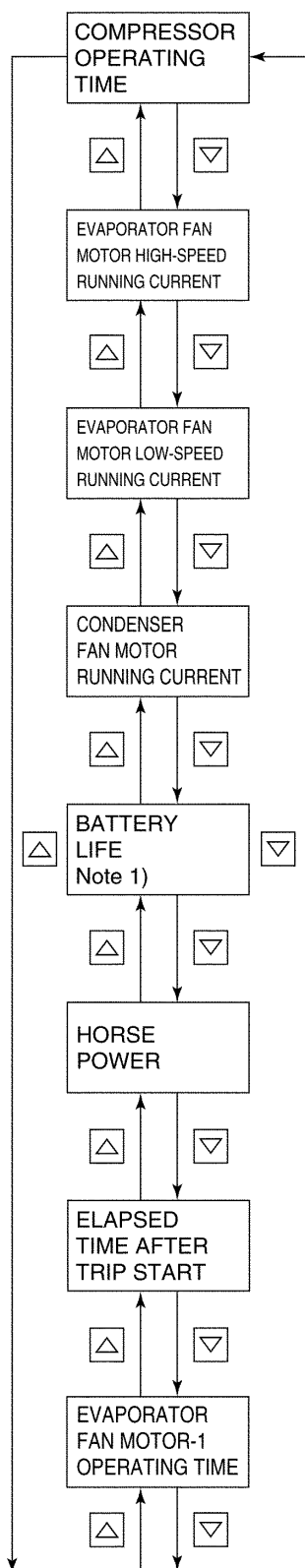
When the  key is pressed while "M-CHECK" is displayed on the LCD, the manual check selection mode is set.

- The detail of the manual check selection mode is described in the following pages.

4-1. MANUAL CHECK SELECTION MODE

The LED indicates the values of following items.

Compressor operating time, Evaporator fan motor high-speed running current, Evaporator fan motor low-speed running current, Condenser fan motor running current, Battery life, Horse power, Elapsed time after trip start, Evaporator fan motor running time, Condenser fan motor running time, and Controller software version



To indicate the compressor operating time:

Press the key while the LCD indicates "CCX10H".

The operating time is the value indicated on the LEDX10 hours.

To indicate the current value of evaporator fan motor high-speed operation :

Press the key while the LCD indicates "EFH A", then the LED indicates the current value. (Unit : Ampere)

To indicate the current value of evaporator fan motor low-speed operation:

Press the key while the LCD indicates "EFL A", then the LED indicates the current value. (Unit : Ampere)

To indicate the current value of condenser fan motor running current :

Press the key while the LCD indicates "CF A", then the LED indicates the current value. (Unit : Ampere)

To indicate lithium battery service life (year and month) :

Press the key while the LCD indicates "b-CH".

When the battery life limit is reached, "E801" appears.

While the LCD indicates "E801" after the battery replacement, depress the key switch for 3 seconds, then the next battery replacement data is indicated.

Note 1) This indication is used when the lithium battery is used.

To check compressor horse power setting :

Press the key while the LCD indicates "HP".

"5HP" or "10HP" on the LED is the compressor horse power setting on the controller.

To indicate the elapsed time after trip start:

Press the key while the LCD indicates "TS H", then the LED indicates the elapsed time. (Unit : Hours).

When the key is depressed for 3 seconds while the elapsed time is indicated, the TRIP START is set, and the elapsed time display is reset to "0" (hour).

To indicate the evaporator fan motor-1 operating time:

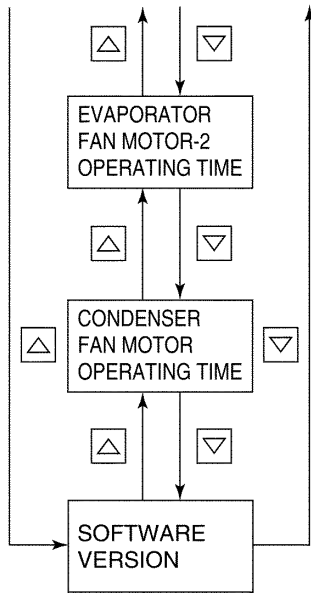
Press the key while the LCD indicates "EF1X10H".

The operating time is the value indicated on the LEDX10H hours.

When the key is depressed for 3 seconds while the evaporator fan motor-1 operation time is indicated, the evaporator fan motor-1 operation time is reset to "0" (hour)

("EF1" is the right hand side fan motor seeing from the inside of the container.)

4-1. MANUAL CHECK SELECTION MODE continued



To indicate the evaporator fan motor-2 operating time:
 Press key while the LCD indicates "EF2×10H".
 The operating time is the value indicated on the LED×10H hours.
 If the key is depressed for 3 seconds while the evaporator fan motor-2 operating time is indicated, the evaporator fan motor-2 operating time display is reset to "0" (hour).
 "EF2" is the left hand side fan motor seeing from the inside of the container.)

To indicate the condenser fan motor operating time:
 Press the key while LCD indicates "CF×10H".
 The operating time is the value indicated on the LED×10 hours.
 If the key is depressed for 3 seconds while the condenser fan motor operating time is indicated, the condenser fan motor operating time display is reset to "0" (hour).

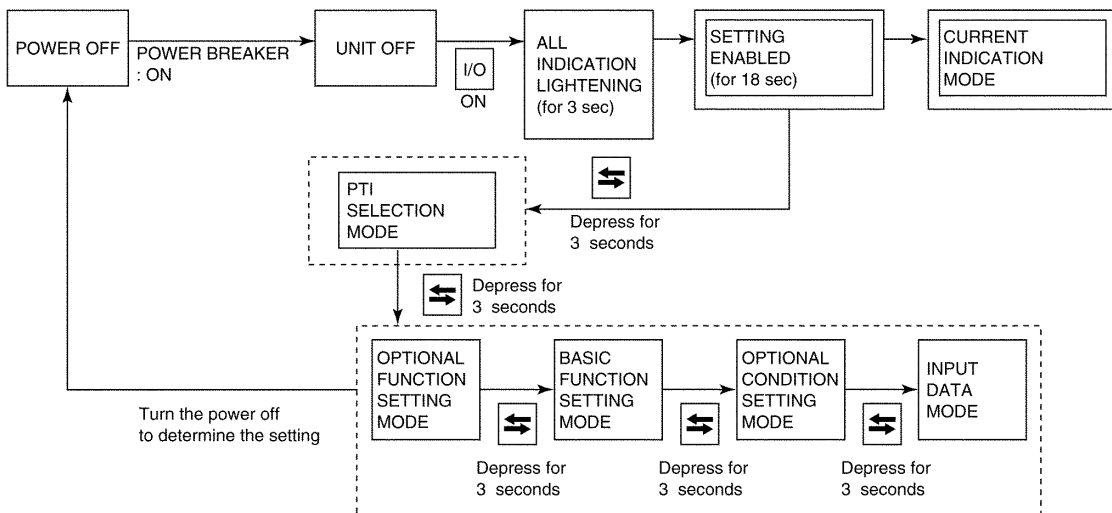
To indicate the software version:
 Press the key while the LCD indicates "SOFTVER".
 The value on the LED is the software version.

5. OPTIONAL FUNCTION SETTING MODE

The following items can be set:

USDA sensor on/off, dehumidification control on/off and cargo temperature sensor on/off.

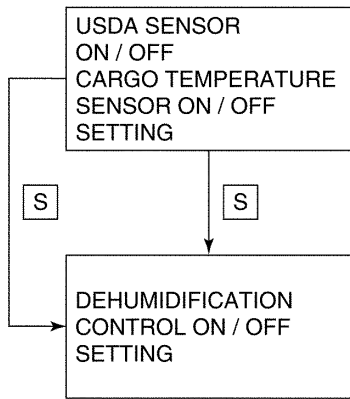
<Mode selection procedure>



<Operation procedure>

Whenever the **[S]** key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



To set the USDA ON/OFF:

Select "OFF" (not in use), "3" (3 USDA probes are in use), or "4" (4 USDA probes are in use) on the LED while the LCD indicates "USdA". Whenever the **[△]** or **[▽]** key is pressed, the indication changes. Press the **[↵]** key to determine the setting.

NOTE: When two USDA probes are connected, the setting will be set automatically to "3 (3 USDA probes are in use)".

To set the DEHUMIDIFICATION CONTROL ON/OFF:

Select "ON" (in use) or "OFF" (not in use) on the LED while the LCD indicates "dHU".

Whenever the **[△]** or **[▽]** key is pressed, the indication changes. Press the **[↵]** key to determine the setting.

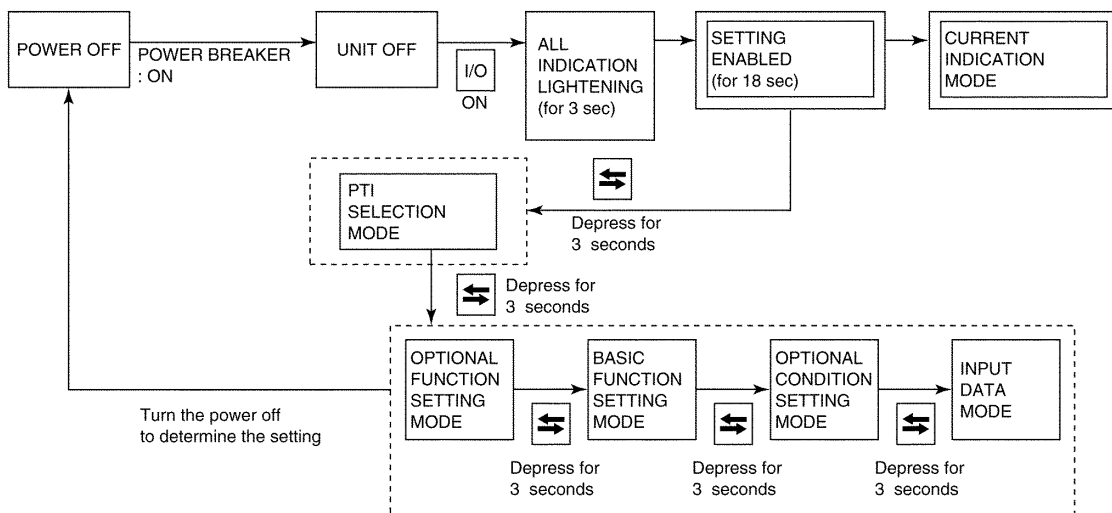
If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

6. BASIC FUNCTION SETTING MODE

The following items can be set:

Controller setting (DECOS-] a/DECOS-] b), logging interval, data recorder sensor on/off, input power, horse power, indication (LED) light on/off

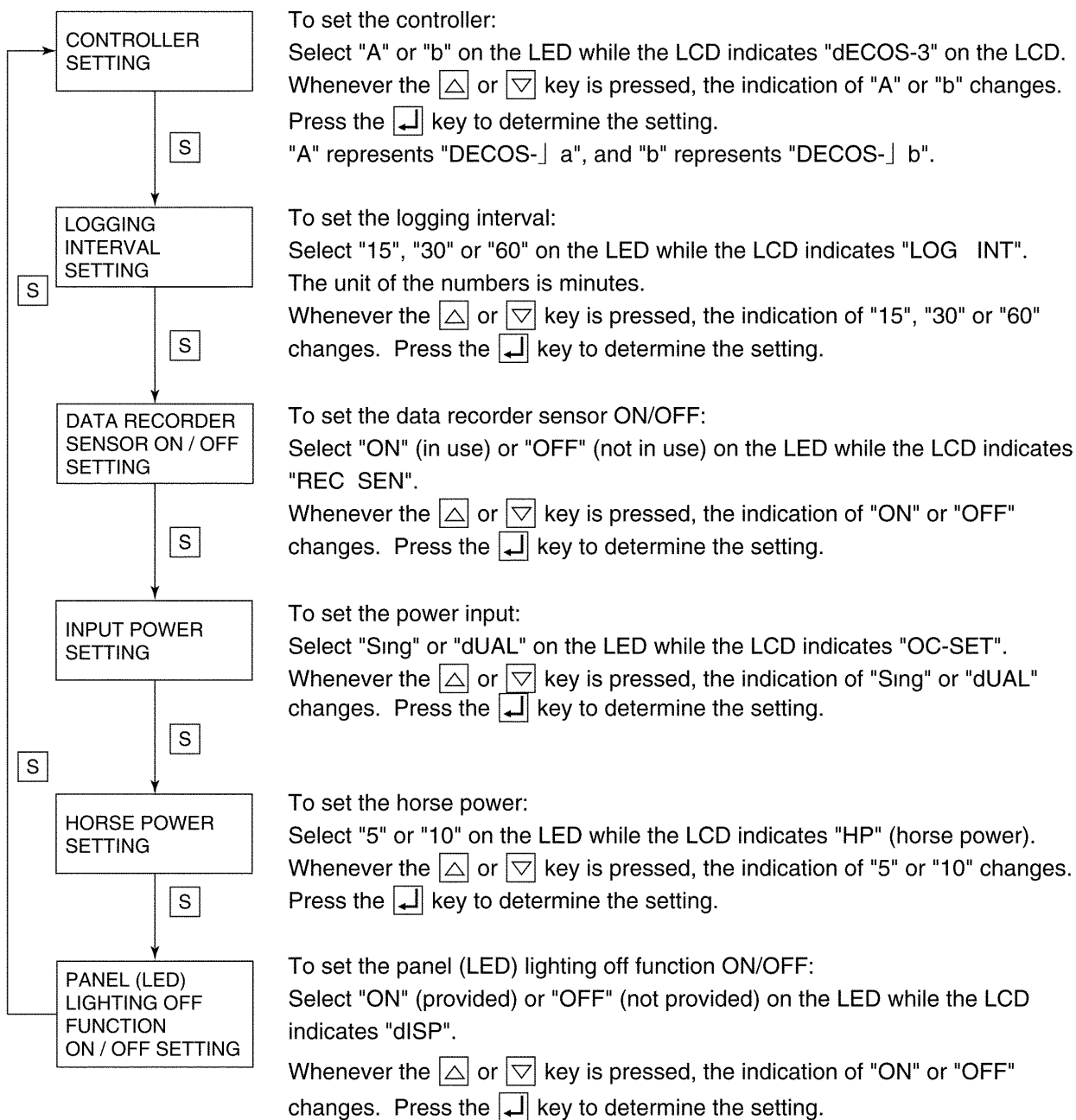
<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



Note : When the **DISPLAY ON/OFF** key is pressed while the panel (LED) lighting off function is ON, the LED panel is turned light off. However, even if the **DISPLAY ON/OFF** key is pressed while the panel (LED) lighting-off function is OFF, the LED panel is not lit on.

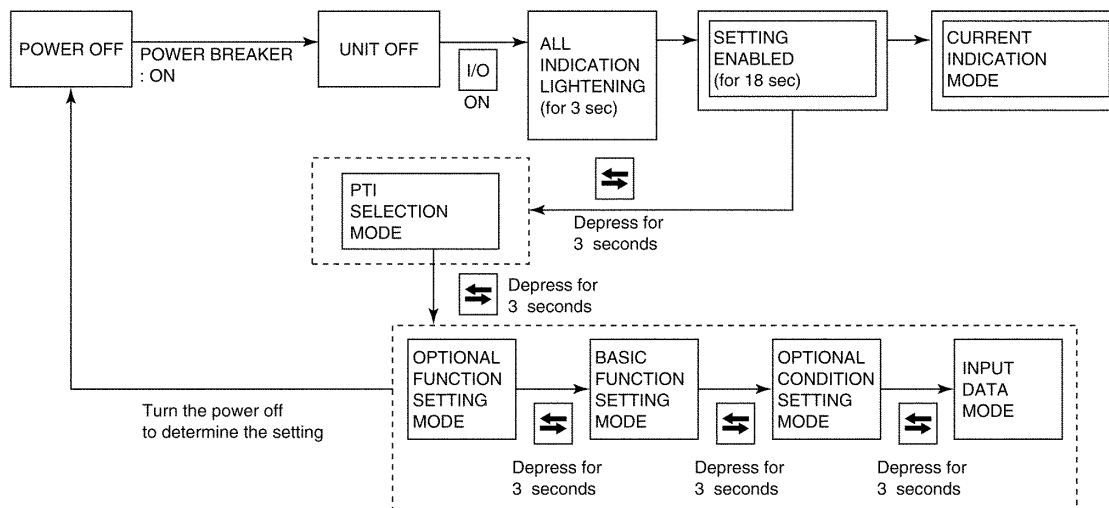
See the description of PANEL (LED) LIGHTING-OFF MODE for details. If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

7. OPTIONAL CONDITION SETTING MODE

D code / H code alarm indication, USDA sensor, H code and D code can be set.

The numerical values on the underline are set on the factory and can be changed according to the following procedures.

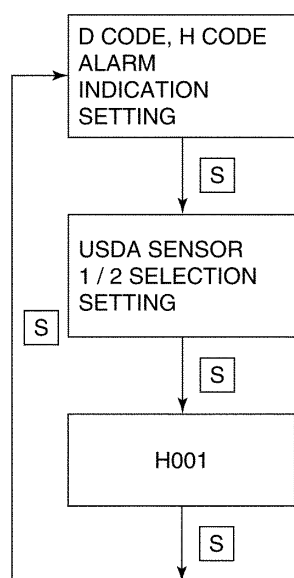
<Mode selection procedure>



<Operation procedure>

Whenever the **[S]** key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



To set D code and H code alarms indication:

Select "ON"(indication of D/H codes) or "OFF"(no indication of D/H codes) on the LED while the LCD indicates "CHARTLS".

Whenever the **[▲]** or **[▼]** key is pressed, the indication of "ON" or "OFF" changes. Press the **[↵]** key to determine the setting.

To set the USDA sensor selection:

Select "1" or "2" on the LED while the LCD indicates "USdA1/2".

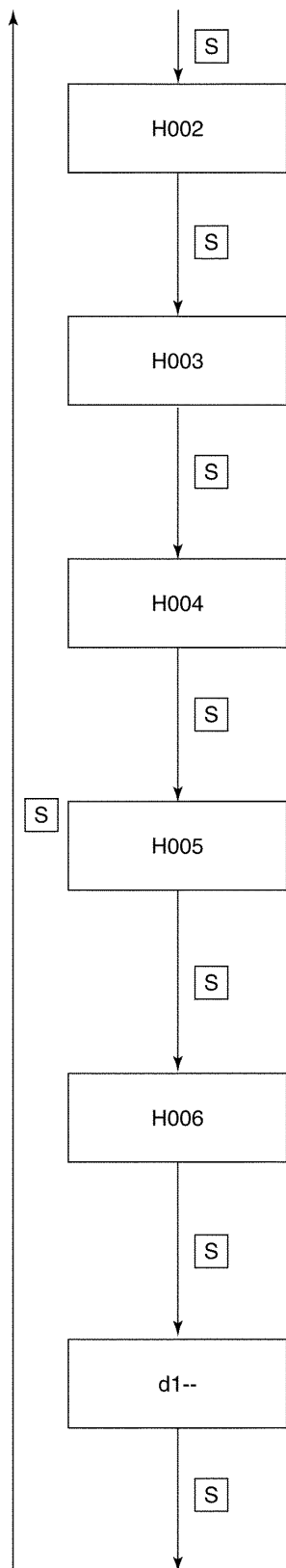
Whenever the **[▲]** or **[▼]** key is pressed, the indication of "1" or "2" changes. Press the **[↵]** key to determine the setting.

H001 alarm is displayed when the control temperature does not lower by 3°C or more during pull-down operation.

Select "1"°C, "2"°C, "3"°C, "4"°C, "5"°C or "10"°C on the LED while the LCD indicates "H001".

Whenever the **[▲]** or **[▼]** key is pressed, the indication of the selection from "1"°C to "10"°C changes. Press the **[↵]** key to determine the setting.

7. OPTIONAL CONDITION SETTING MODE continued



H002 alarm is displayed when the integrated time of Out-of-In-Range reaches 2 hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H002".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H003 alarm is displayed when the integrated time of state "below SP - 1°C" reaches 2 hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H003".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H004 alarm is displayed when the integrated time of state "below SP - 2°C" reaches one hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H004".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H005 alarm is displayed when the controlled temperature is Out-of-In-Range, and defrosting was performed successively three times while the controlled temperature does not return to In-Range.

Select "1"time, "2"times, "3"times, "4"times, "5"times or "10"times on the LED while the LCD indicates "H005".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1" time to "10" times changes. Press the \downarrow key to determine the setting.

H006 alarm is displayed when the integrated time of difference 2°C or more between control sensor data and record sensor data reaches one hour or more.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H006".

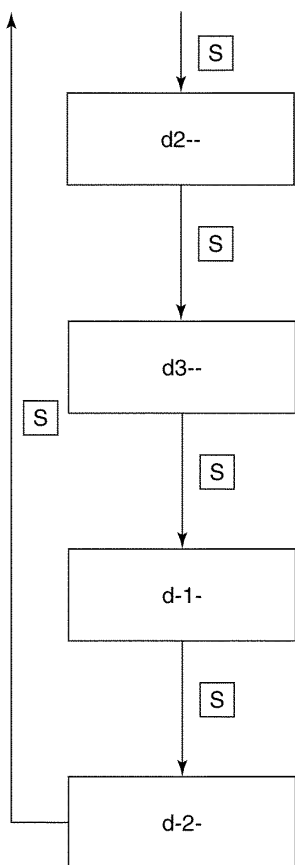
Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

d1-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP + 1°C " reaches one hour.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d1--".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

7. OPTIONAL CONDITION SETTING MODE continued



d2-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP +2°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d2--".

Whenever the Δ or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \square key to determine the setting.

d3-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP + 3°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d3--".

Whenever the Δ or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \square key to determine the setting.

d-1- message is displayed to indicate the total number of times of the state that the integrated time of state "below SP -1°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d-1-".

Whenever the Δ or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \square key to determine the setting.

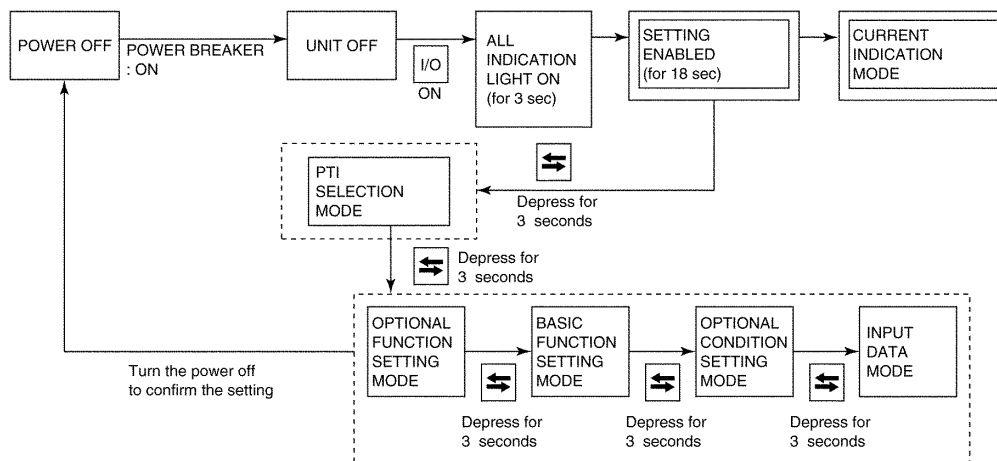
d-2- message is displayed to indicate the total number of times of the state that the integrated time of state "below SP -2°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d-2-".

Whenever the Δ or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \square key to determine the setting. If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

8.INPUT DATA MODE

The following items can be set.
Container I.D.(Number) and controller time

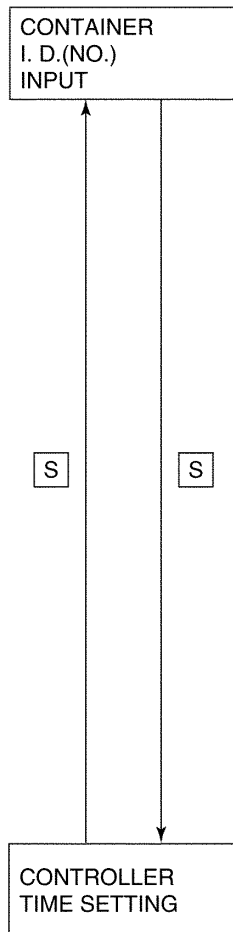
<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.

Turn OFF the power breaker to confirm the setting.



To input the container I.D.(No.) :

Press the **↵** key while the LCD indicates "SET I.d", then the LED indicates "i.d.-C" or "i.d.-n".

Change the indication of "i.d.-C"(Shipping company name in alphabet) and "i.d.-n"(numeric numbers) using the **△** or **▽** key.

To input the shipping company name :

Press the **↵** key while the LED indicates "i.d.-C", then the leftmost LCD panel box flashes. Select the alphabet to be input using the **△** or **▽** key, and press the **↵** key, then the next panel box flashes. Carry on the same procedure until the 4 alphabets are input, then press the **↵** key to confirm the input. Once confirmed, the input alphabets are lit on from flashing.

To input the numbers (numeral) :

Press the **↵** key while the LED indicates "i.d.-n", then the leftmost LCD panel box flashes. Select the number to be input using the **△** or **▽** key, and press the **↵** key, then the next panel box flashes.

Carry on the same procedure until the 7 numbers are input, then press the **↵** key to confirm the input.

Once confirmed, the input numbers are lit on from flashing.

To set the controller time :

Press the **↵** key while the LCD indicates "SET TIME", then the LCD indicates "YEAR" and the LED indicates the year currently set. Change the setting year using the **△** or **▽** key, then press the **↵** key to confirm the setting.

Then, the LCD indicates "MONTH" and the LED indicates the month currently set. Change the setting month using the **△** or **▽** key, then press the **↵** key to confirm the setting.

Set day, time and minute by the same procedure.

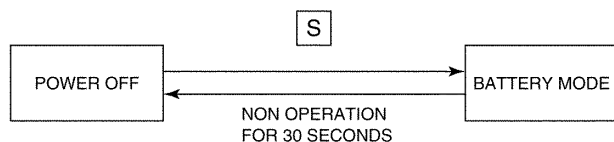
The LCD indicates "dAY", "HOuR" and "MINUTE" for the day, hour and minute setting respectively.

If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

9.BATTERY MODE

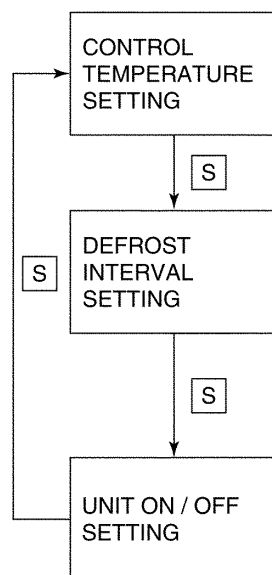
When commercial power is not available, Control temperature / Humidity and Defrosting interval, Unit ON/OFF can be controlled using the built -in wake-up battery.

<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.



LED : Light off

LCD : "SHU " is indicated.

Change the set point temperature using the **△** or **▽** key.

Press the **↵** key to determine the setting.

In case dehumidification control is set "OFF", this item is not displayed.

LED : Light off

LCD : "dEF H" is indicated.

Select a defrost interval 24h, 12h, 9h, 6h, or 3h using the **△** or **▽** key.

Press the **↵** key to determine the setting.

LED : Light off

LCD : "UNIT ON" or "UNIT OFF" is indicated.

Set the unit ON/OFF using the **△** or **▽** key.

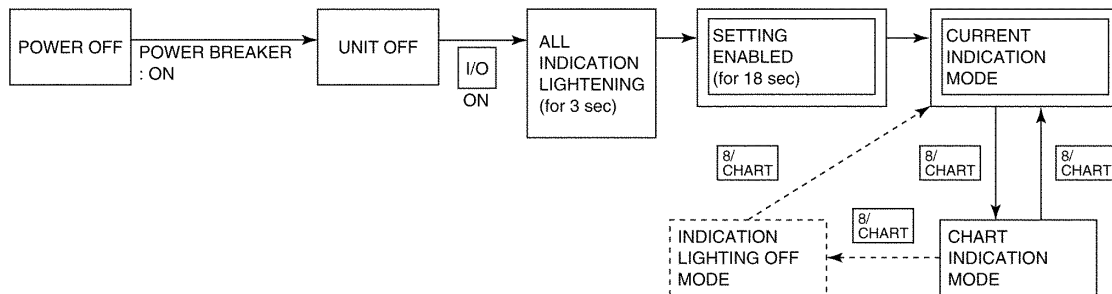
Press the **↵** key to determine the setting.

- When no key operation is performed for 30 seconds in the battery mode, the power is automatically turned off.

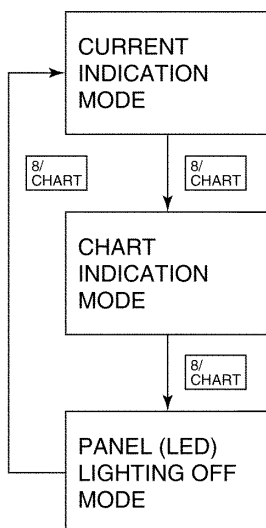
10.CHART INDICATION MODE


The temperature record data are indicated in graphic chart on the LCD.

<Mode selection procedure>



<Operation procedure>






To change to the chart indication mode, press the  key while the unit is in the current indication mode.

In the chart indication mode, the LCD indicates a graphic chart.

The axis of ordinates shows temperature base, the axis of abscissas shows time base.

The No. indicated on the left hand side of the time base is the same as the No. on the left hand side of the LCD, which indicates the graphic chart is of 12 hours log or 6 days log indication.

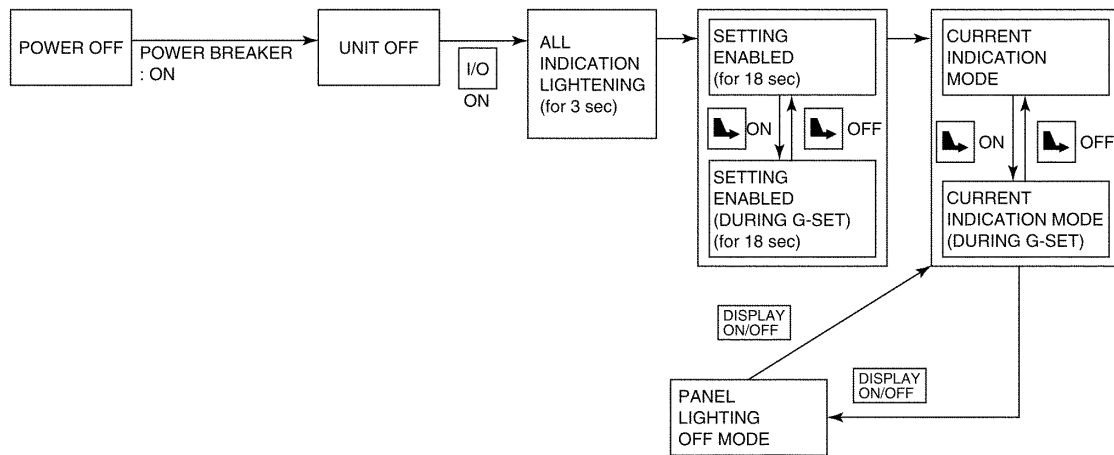
Select the base to be uses using the  or  key.

When the  key is pressed, the unit goes back to the current indication mode.

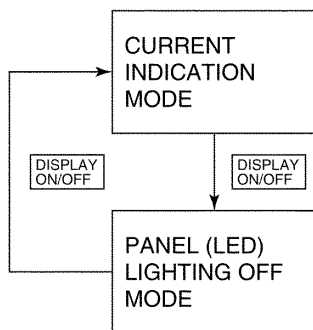
11. PANEL (LED) LIGHTING-OFF MODE

The controller LED display is turned light off in this mode.

<Mode selection procedure>



<Operation procedure>



To change to the chart indication mode, press the key while the unit is in the current indication mode.

While this mode is on, the controller LED display is turned light off, and the LCD indicates "dISPOFF".

To change to the current indication mode (to light on LED display), press the key.

NOTE : If the LED display is not turned off by pressing the key twice, set "ON" the "PANEL (LED) LIGHTING OFF FUNCTION ON/OFF SETTING" in section 8, the Basic Function Setting Operation Mode.

●For setting procedure, see section 8, the Basic Function Setting Operation Mode.

12. CONTROLLER SOFTWARE DOWNLOAD MODE

The data on a personal computer and a controller are interchanged in this mode.




For details, see the Operation Manual For Personal computer software.

Downloading is possible, even in "11. BATTERY MODE".

3.3.3. Other operations

Manual defrosting operation


Press the MANUAL DEFROST key

Select "ON" indicated on the LED by the  key or the  key, and press the  key to determine the setting, then the defrosting operation starts.

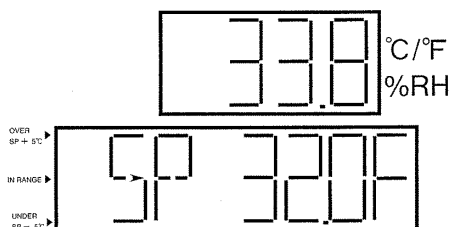
* Once defrosting operation starts, the operation mode is not changeable until the defrosting operation completes. If this key is pressed during the defrosting operation, it is ineffective.

°C/°F conversion operation

Indicate the temperature data required to be convert into "°F" on the LED or the LCD.

Press the  key, then the temperature data indicated in "°C" is converted into "°F" for one minute.

* If any other keys is pressed during the "°F" indication, the indication is switched to "°C".



3.4 Operation pattern and operation of each equipment

● Operation pattern

Output	Mode	Sensor		-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 SP 1 2 3 4 5 6 7 8 9 10 (°C)																
		Normal	Abnormal																	
Liquid solenoid valve (LSV), Compressor (CC)	Chilled	SS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C																
		RS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C																
	Partial frozen	RS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C																
		SS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C																
	Frozen	RS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C, OFF from 1°C to 2°C, ON from 2°C to 10°C																
		SS	/	OFF (dashed) until -1°C, ON from 1°C to 10°C, OFF from 1°C to 2°C, ON from 2°C to 10°C																
In-range lamp (IRS)	Chilled	SS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
		RS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
	Partial frozen	RS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
		SS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
	Frozen	RS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
		SS	/	OFF (dashed) until -1°C, ON from 1°C to 2°C, OFF from 2°C to 3°C, ON from 3°C to 4°C, OFF from 4°C to 10°C																
Modulating valve (MV) ※Fully closed during frozen mode	Chilled	SS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
		RS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
	Partial frozen	RS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
		SS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
	Frozen	RS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
		SS	/	Fully closed until -1°C, PID from 1°C to 2°C, Fully closed from 2°C to 3°C, Fully opened from 3°C to 4°C, PID from 4°C to 5°C, Fully closed from 5°C to 10°C																
Defrosting enable conditions	Chilled, Partial frozen, Frozen	EOS	/	Enable from -10°C to 20°C, Inhibit from 20°C to 10°C																
			Without back-up sensor	Fully enable from -10°C to 10°C																
Evaporator fan (EFH, L)	Frozen	/	/	Only EFL																
	Chilled Partial frozen	/	/	Only EFH																

Output	Mode	Sensor		-10 -9 -8 -7 -6 -5 -4 -3 -2 -1 SP 1 2 3 4 5 6 7 8 9 10 (°C)																
		Normal	Abnormal																	
Mode switching																				
Hot gas solenoid valve	Chilled (During dehumidification control)	Hus		OFF While the in range ramp is OFF 																
			Without back-up sensor	ON While the in range ramp is ON																

● Operation of each equipment

Name of component			Frozen mode setting temperature temperature —10.1°C or lower		Chilled mode setting temperature —2.9°C or higher Partial frozen mode setting temperature —3.0 to —10.0°C							Defrost
			Thermostat ON	Thermostat OFF	Pull-down	Modulating control	Full heat up	Overcool protection	Metering heating	Dehumidification control		
Magnetic contactor	Compressor	CC	○	×	○	○	○	○	×	○	○	○
	Condenser fan	CF	△	×	△	△	△	△	×	△	△	△
	Evaporator fan (High)	EFH	×	×	○	○	○	○	○	○	○	×
	Evaporator fan (Low)	EFL	○	○	×	×	×	×	×	×	×	×
Solenoid valve	Liquid solenoid valve	LSV	○	×	○	○	○	○	×	×	○	×
	Solenoid valve for injection	ISV	△	×	△	△	×	×	×	△	△	△
	Hot-gas 3-way solenoid valve	HSV	×	×	×	×	×	×	×	○	△	○
Modulating valve		MV	0%	0%	0%	0.1~99.9%	100%	0%	100% or 47%	0.1~99.9% or 47%	100% or 47%	
Electronic expansion valve		EV	300~2000 pulse	300~2000 pulse	500~2000 pulse	500~2000 pulse	500 pulse	500 pulse	500 pulse	500~2000 pulse	500 pulse	

○ : Energized × : De-energized △ : Depending on the control

3.5 Alarm display and back-up function

3.5.1 Alarm list

Alarm grouping	Alarm code	Alarm content	Action with alarm	
Permanent stop	F101	High-pressure switch cuts out within 30 seconds after operation start or protection device actuation.	Unit stops	
	F109	Low-pressure cutouts within 2 seconds after operation start.	Unit stops	
	F301	Temperature setting required	Unit stops	
	F401	Return/supply air sensor malfunction (at chilled mode)	Unit stops	
	F403	Return/supply air sensor malfunction (at partial frozen mode)	Unit stops	
	F603	Modulating valve does not fully open contrary to the designation	Unit stops	
	F701	Abnormal high voltage	Unit stops	
	F705	S phase is single phase.	Unit stops	
	F803	Any of the following alarm actuates 10 times E101, E103, E105, E107, E203, E707	Unit stops	
Display alone or restartable alarm	Protector activation	E101	High pressure switch cuts out.	Restart after 3-minute
		E103	Actuation of compressor thermal protector or electronic OC	Restart after 3-minute
		E105	Actuation of micro processor OC protector	Restart after 3-minute
		E107	High compressor discharge gas temperature exceeds over 130°C.	Restart after 3-minute
		E109	Low pressure switch cuts out (low pressure drops to -72kPa or lower for over 5 minutes.)	Restart after 3-minute
	Control error	E201	Long pump down time (pump-down is not finished within 120 seconds.)	Back-up operation
		E203	Overcool protection activates in the chilled or partial frozen mode. (Control temperature drops to the set point -3°C or lower for 2 minutes.)	Restart after 3-minute
		E207	Long defrosting. (Defrosting is not finished within 90 minutes.)	Only alarm display
	Printed-circuit board alarm	E303	Temperature setting required (SRAM failure/CPU board)	Only alarm display
		E305	Defrost timer setting required (SRAM failure/CPU board)	Only alarm display
		E307	Calendar setting required (SRAM failure/CPU board)	Only alarm display
		E311	Trip-start setting required (SRAM failure/CPU board)	Only alarm display
		E315	PT/CT board replace requirement (PT/CT board failure)	Restart after 3-minute
	Sensor alarm	E401	Supply air temperature sensor (SS) malfunction	Back-up operation
		E402	Data recorder supply air temperature sensor (DSS) malfunction	Only alarm display
		E403	Return air temperature sensor (RS) malfunction	Back-up operation
		E404	Data recorder return air temperature sensor (DRS) malfunction	Only alarm display
		E405	Discharge air temperature sensor (DCHS) malfunction	Only alarm display
		E406	Suction gas temperature sensor (SGS) malfunction	Back-up operation
		E407	Evaporator inlet temperature sensor (EIS) malfunction	Back-up operation
		E409	Evaporator outlet sensor (EOS) malfunction	Back-up operation
		E411	Ambient sensor (AMBS) malfunction	Only alarm display
		E413	Low-pressure transducer (LPT) malfunction	Back-up operation
		E415	High-pressure transducer (HPT) malfunction	Back-up operation
		E417	Voltage transducer (PT1) malfunction	Only alarm display
		E419	Voltage transducer (PT2) malfunction	Only alarm display
		E421	Current transducer (CT1) malfunction	Only alarm display
E423		Current transducer (CT2) malfunction	Restart after 3-minute	
Electrically functional part alarm	E425	Pulp temperature sensor (USDA1) malfunction	Only alarm display	
	E427	Pulp temperature sensor (USDA2) malfunction	Only alarm display	
	E429	Pulp temperature sensor (USDA3) malfunction	Only alarm display	
	E431	Humidity sensor (HuS) malfunction	Only alarm display	
	E603	Modulating valve malfunction (wiring cut or output malfunction)	Back-up operation	
	E607	Manual defrosting switch contact malfunction	Only alarm display	
	Power alarm	E707	Momentary power loss	Restart after 3-minute
Other alarms	E801	Backup battery replace requirement	Only alarm display	

3.5.2 Alarm code list during PTI (Pre-Trip Inspection)

The alarms during automatic PTI are concerned with PTI inspection items in addition to those during normal operation.

The alarms caused by automatic PTI are indicated in J ※ ※ ※, being discriminated from those during normal operation.

Though there are alarms which are not displayed on the controller panel, they can be checked referring to the PTI report.

Check No. (LED display)	Check content	Alarm indication (LED display)	Alarm content	S.PTI	F.PTI	Remarks
P00	Basic data	No indication	Basic-data vanishment	↑	↑	
P02	All sensor	Same as normal operation	Basic-data vanishment			
P04	Power	No indication	Basic-data vanishment			
P05	Starting	J051	Compressor malfunction			
P06	HPS	J061	Abnormal OFF point			
		J062	Not return (closed)			
		J063	Abnormal ON point			
		J064	High pressure does not rise.			
		J065	High pressure does not drop.			
P08	Pump-down	J081	Long pump-down			
P10	Liquid solenoid valve	J101	Valve leakage			
P12	RS, SS accuracy	J121	Sensor deterioration			
P14	HPT, LPT accuracy	J141	Sensor deterioration			
P16	Evaporator fan motor	J161	Evaporator fan motor malfunction			
			Judged with P28			
P26	Operation	No indication	Judged with P28			
P28	Evaporator fan reverse-turning direction	J281	Abnormal evaporator fan miswiring			
			Long pump-down			
P29	Electronic expansion valve	J291	Long pump-down			
P30	Injection solenoid valve	J301	Injection solenoid valve malfunction			
			Hot-gas 3-way solenoid valve malfunction			
P32	Hot-gas 3-way solenoid valve	J321	Hot-gas 3-way solenoid valve malfunction			
P50	Pull-down cooling capacity	J501	Out of ambient temperature conditions	↓	↓	
P50	0°C control	J502	Long pull-down time			
P60	0°C control	No indication				
P70	Pull-down cooling capacity	J701	Long pull-down time			
P80	-18°C control	No indication				
P90	Defrosting	J901	Out of starting conditions			
	Basic-data	J902	Long defrosting time			

3.5.3 Back-up function cope with sensor abnormality

C : Chilling, PF : Partial Frozen, F : Frozen, DF : Defrosting, Meter : Metering heating

Sensor malfunctions		Mode	Back-up content		
			Item	Control content	
Return air sensor	RS	PF	Normal control	Controlled at SS+2.0°C. When SS is failure, the controller shuts off all outputs.	
		F	Compressor running	Controlled at SS+5.0°C.	
			Evaporator fan speed change over	Fixed at the low-speed operation.	
			In-range lamp	Not lit.	
	C/DF	Continuous operation			
Supply air sensor	SS	C	Normal control	Controlled at RS-2.0°C. When RS is failure, the controller shuts off all output.	
		PF/F DF	Continuous operation		
Ambient temperature sensor	AMBS	All modes	Continuous operation		
Discharge gas temperature sensor	DCHS	All modes	Injection	Not executed.	
			Malfunction protection	Not executed.	
Evaporator outlet temperature sensor	EOS	C/PF, F	Refer to the "Back-up for sensor abnormality (EIS, EOS, EGS)" on the following page.		
		DF	Permission to start defrosting	Always asking permission	
			Defrosting termination	90 minutes timer count-up or when EIS reaches to 90°C or higher.	
High-pressure transducer	HPT	DF Meter	Refrigerant charge (Charge when injection solenoid valve open (ON).)	Charging is performed by the timer depending on the preceding defrosting time.	
			Refrigerant release (Release at 47% opening of modulating valve)	Not executed.	
Low-pressure transducer	LPT	DF	Defrosting termination	Termination by 90 minutes timer count up	
High-pressure switch	HPS	All modes	High pressure abnormal judgment	Unit stops at HPT>2300kPa. When HPT malfunctions, unit stops.	
Compressor motor thermal protector	CTP	All modes	Continuous operation		
Humidity sensor	HuS	C	Reheat heater (reheat coil)	ON	Within the proportional control range, the hot-gas 3-way solenoid valve is forcedly turned on.
				OFF	Outside the proportional control range, the hot-gas 3-way solenoid valve is forcedly turned off.
		PF,F, DF	Ordinary operation. However, the pump-down control is executed in the standard manner.		
Overheat preventing thermocouple	EHT	All modes	Operation continues.		

※Combinations of sensor alarms which cause operation stop

SS & RS

HPS & HPT

※2 When the dehumidification parameter "dHu" is set to "off", the normal control is executed. Therefore, the unit continues ordinary operation regardless whether any of the following equipment is normal or not.

●Back-up for sensor abnormality (EIS, EOS, SGS) at frozen mode (super heat control)

No.	Evaporator inlet sensor (EIS)	Evaporator outlet sensor (EOS)	Suction gas sensor (SGS)	Back-up operation
1	Normal	Normal	Normal	Super heat control
2	Normal	Normal	Abnormal	Super heat control
3	Normal	Abnormal	Normal	Liquid refrigerant back prevention to compressor by EIS and SGS
4	Normal	Abnormal	Abnormal	Expansion valve fixed opening rate control
5	Abnormal	Normal	Normal	Liquid refrigerant prevention to compressor by EOS and SGS
6	Abnormal	Normal	Abnormal	Expansion valve fixed opening rate control
7	Abnormal	Abnormal	Normal	Expansion valve fixed opening rate control
8	Abnormal	Abnormal	Abnormal	Fixed expansion valve opening rate control

3.6 Data logging

The data logging function is to store various data which occur during transportation.

There are seven kinds of logging data.

	Data name	Logging data
1	ID data	<ul style="list-style-type: none"> • Container No. • Departure port • Set point temperature • Set point ventilation • Set point humidity • Comment • Loading date • Load • Transit place • Final destination • Navigation No.
2	Trip data	<ul style="list-style-type: none"> • Operation mode • Supply air sensor (SS) • Return air sensor (RS) • Humidity inside the container • Data recorder sensor temperature (DSS/DRS) • Ambient temperature (AMBS) ※Changeable logging intervals are 15, 30 and 60 minutes. • Set point temperature • Set point humidity
3	Alarm	<ul style="list-style-type: none"> • Alarm output date/time • Alarm code
4	PTI data	<ul style="list-style-type: none"> • SHORT PTI • FULL PTI
5	Event	<ul style="list-style-type: none"> • Power switch ON/OFF • Battery ON • Temperature setting change • Manual Defrosting ON • Early stage setting value change • F. PTI start • Unit ON/OFF • Date/time • Defrosting Internal change • Manual checking start • S. PTI start

Logged data are retrieved with the aid of personal computer software.

Refer to the Operation Manual for Personal Computer Software for detail.

3.7 Battery

The electronic controller (DECOS III b) is designed so that set point temperature, defrosting interval and other data can be set using the built-in wake-up battery when commercial power is not available. (Refer to section 3.2.2, 9.)

3.7.1 Specifications of battery

Type : Alkaline battery

Model : 6LR61 or equivalent

3.7.2 Battery replacement date

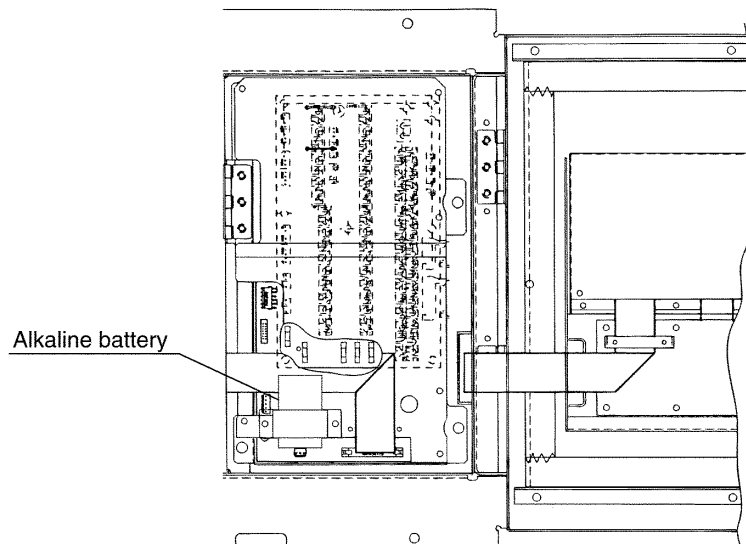
At normal transportation : Replace a battery when the temperature setting is not processed at the BATTERY MODE (Refer to section 3.3.2, 9. BATTERY MODE).

The life of battery is approximately one year.

※ Do not check the battery life of an alkaline battery by the controller function of the battery life indication in section 3.3.2, 4-1.

3.7.3 Battery replacement procedure

Replace the existing battery fixed at the center of bottom side in the control box with a new battery. Then, fix the battery with binding bands.

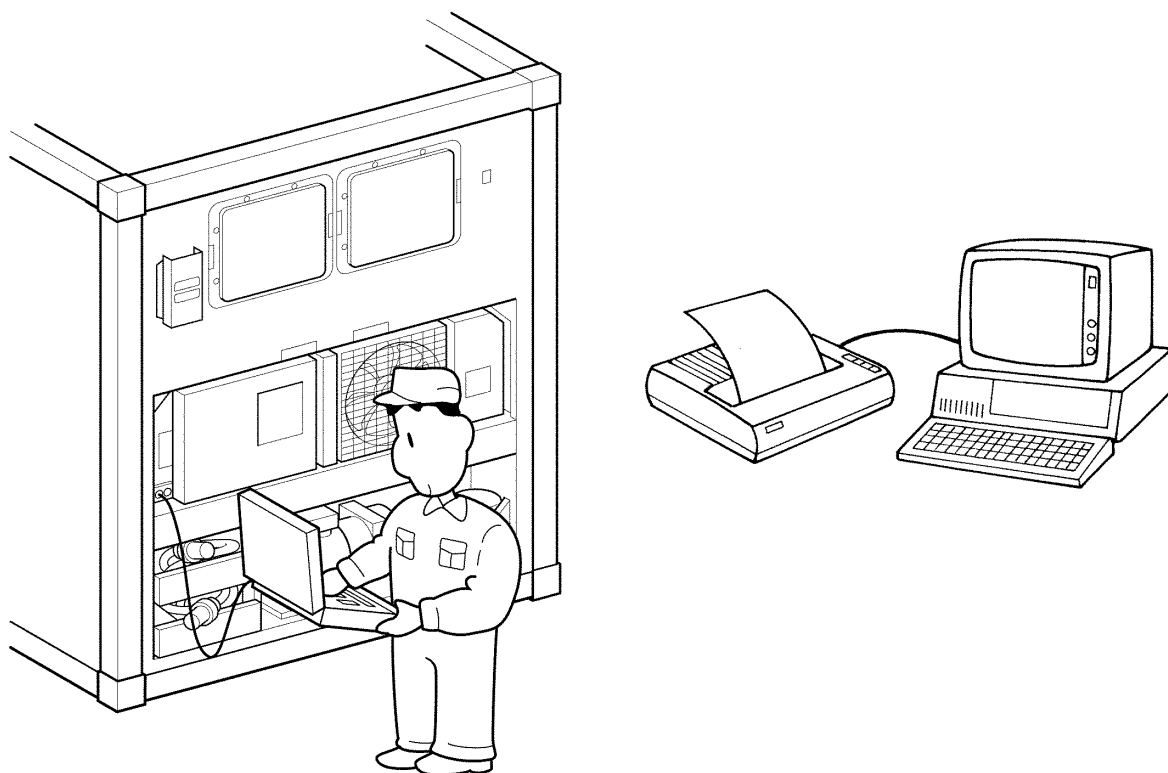


3.8 Information interchange with personal computer

The electronic controller DECOSIIIb has internally a memory function to record the set point temperature, inside temperature, operation mode, occurrence alarm and the report of automatic PTI during transportation in addition to the normal operation control.

Also users can retrieve the logging data saved in a personal computer by connecting the computer to the serial communication port (personal computer receptacle) provided on the controller front panel. The retrieved data are useful to produce the control temperature data graph and to prepare various kinds of reports for the effective analysis of troubles occurred during transportation.

Moreover, users can send the information such as the container No., cargo name, destination and other information from the personal computer to the controller for memorization.



● SOFTWARE CONFIGURATION

	MAIN MENU	SUB MENU	Explanation of function	Remarks	
FIELD JOB	LOGGER DATA DOWN LOAD	TRIP DATA	Data recorded in the logger is read from the controller into the personal computer (disk or hard disk). (This operation is called the down-load).	No information appears on the screen at this time.	
		USDA DATA			
		4-PULP SENSORS DATA			
		PTI DATA			
	CONTAINER I.D. /HEADER	ALL DATA AFTER TRIP-START			
		SET CONTAINER I.D. /HEADER -From DISK	The logger header(set point temperature, cargo name, destination and other memorandum information) is changed. * Data previously saved in the disk is transmitted to the controller.	Disk -> Controller	
		CHANGE CONTAINER I.D. -From Keyboard	The container No. (container ID) set in the controller is changed.	Input from keyboard	
		CHANGE CONTAINER HEADER -From Keyboard	The logger header is changed.	Input from keyboard	
	MAINTENANCE & REPAIR	CHANGE CALENDAR	The internal clock of controller is changed. * The controller clock is based on GMT (Greenwich MeanTime).	Conversion from personal computer built-in clock.	
		DISPLAY CURRENT OPERATING DATA	Controller sensor values, operation of internal relay and opening rates of MV and EV are displayed on the screen.	Record on disk is enabled.	
		DISPLAY CURRENT ALARM	Currently existing alarms are displayed.		
		DISPLAY ALARM LOG	Information of alarm recorded in the logger is displayed.	Record on disk is enabled.	
		DISPLAY TEMPERATURE CHART	Fluctuation of control temperature which has been recorded in the logger is displayed in a graphic chart.		
	USDA (3-PULP SENSORS) COLD -TREATMENT	REPLACE BATTERY	The back-up battery replacement day is set.	Setting can be also made on the control panel.	
CALIBRATION USDA SENSORS		The pulp sensor (USDA sensor) to be used for low temperature transportation is calibrated.	The ice bath is used.		
	DISPLAY TEMPERATURE CHART	Fluctuation of the pulp sensor (USDA sensor) temperature which has been recorded in the logger is displayed in a graphic chart. Summary report of trip data is indicated.			

	MAIN MENU	SUB MENU	Explanation of function	Remarks
FIELD JOB	4-PULP SENSORS COLD -TREATMENT	CALIBRATION 4-PULP SENSORS	The pulp sensor (USDA sensor) to be used for low temperature transportation is calibrated.	The ice bath is used.
		DISPLAY TEMPERATURE CHART	Fluctuation of the pulp sensor (USDA sensor) temperature which has been recorded in the logger is displayed in a graphic chart. Summary report of trip data is indicated.	
OFFICE JOB	MAKE REPORT	TRIP REPORT	Reports are made based on record data read from the logger.	
		USDA REPORT (4-PULP SENSOR REPORT)		
		PTI REPORT		
		ALARM REPORT		
		MONITOR REPORT		
		EVENT REPORT		
OFFICE JOB	MAKE CONTAINER I.D. /HEADER	SET CONTAINER I.D. /HEADER into DISK	Disk data to change LOGGER HEADER of controller is created.	
CONFIG SET		CHART MARK	Various conditions are set into software.	
		CRT MODEL		
		SET TIME ZONE		
		G.M.T-LOCAL TIME		
		SELECT JOB		
		TRIP REPORT		

3.9 Inspection procedure of the electronic controller

DECOS] b enables to make the personal computer indicate the internal data of the controller CPU (RAM data) on its display by connecting each other with a communication cable. This makes it possible to make easy inspection of the controller and diagnose the defective point of the controller.

(1) Inspection of sensors

The inspection is carried out by comparing with the sensor readings on the controller display and on the display of the personal computer. In case the sensor reading is abnormal, the sensor should be replaced to new one, but be sure to make checking for the sensor characteristics, internal wirings and its connectors before replacement. (Refer to Apendix for the sensor characteristics.)

(2) Inspection of the internal relays of the electronic controller

The inspection is carried out by checking the controller output (AC24V) utilizing the electric tester or test lamp according to the display of the personal computer. In case the controller output is abnormal, the power I/O board should be replaced to new one, but be sure to make checking for the internal wirings and its connectors before replacement.

(3) Inspection of the MV driver and its circuit

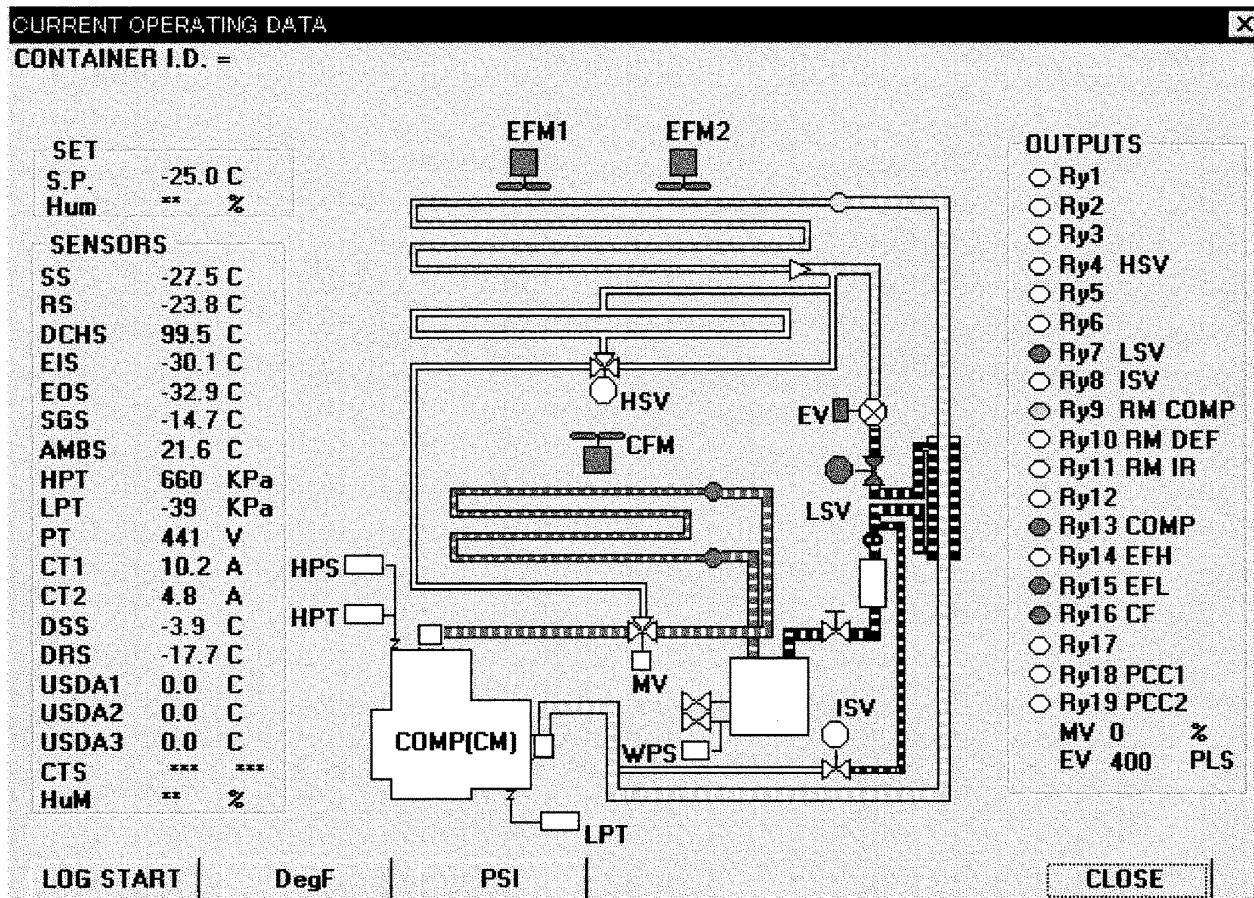
The inspection is carried out by checking of the controller output voltage according to the following table.

MV opening (%)	Output (DCV)
0	0.0
100	2.55V or more

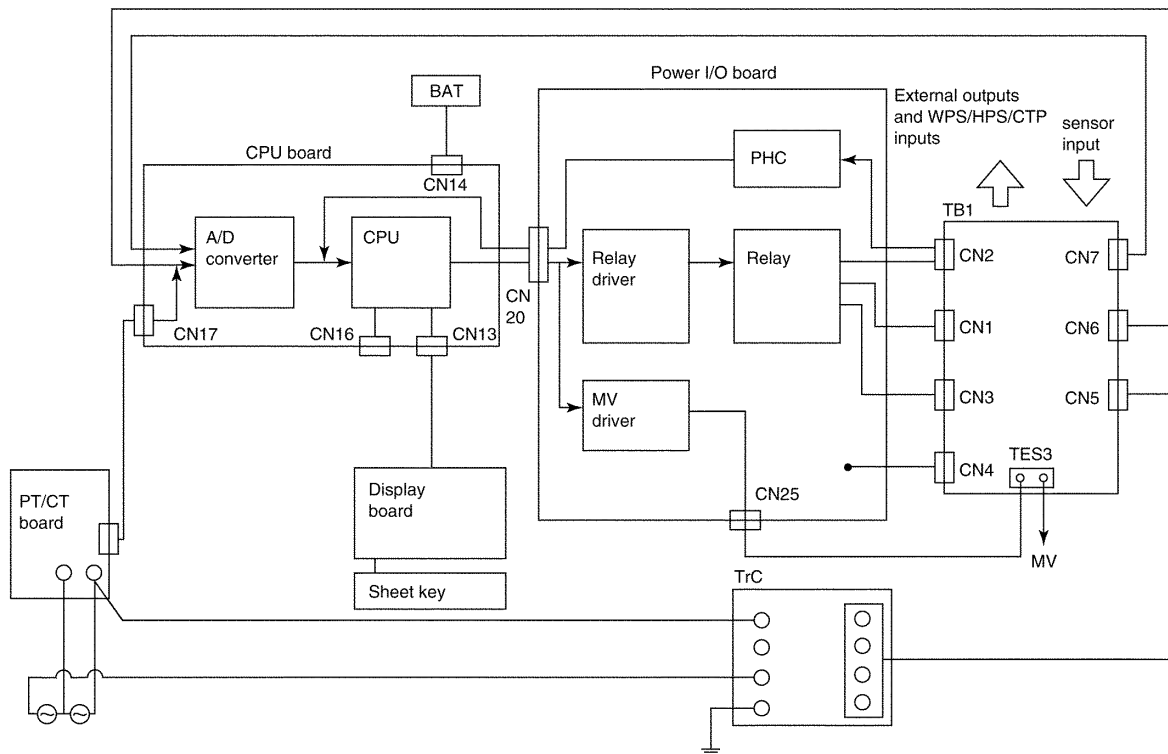
In case the controller output is abnormal, the power I/O board should be replaced to new one, but be sure to make checking for the harness and its connectors before replacement.

● The picture of the personal computer display

Menu selection: FIELD JOB — MAINTENANCE & REPAIR — DISPLAY CURRENT OPERATING DATA

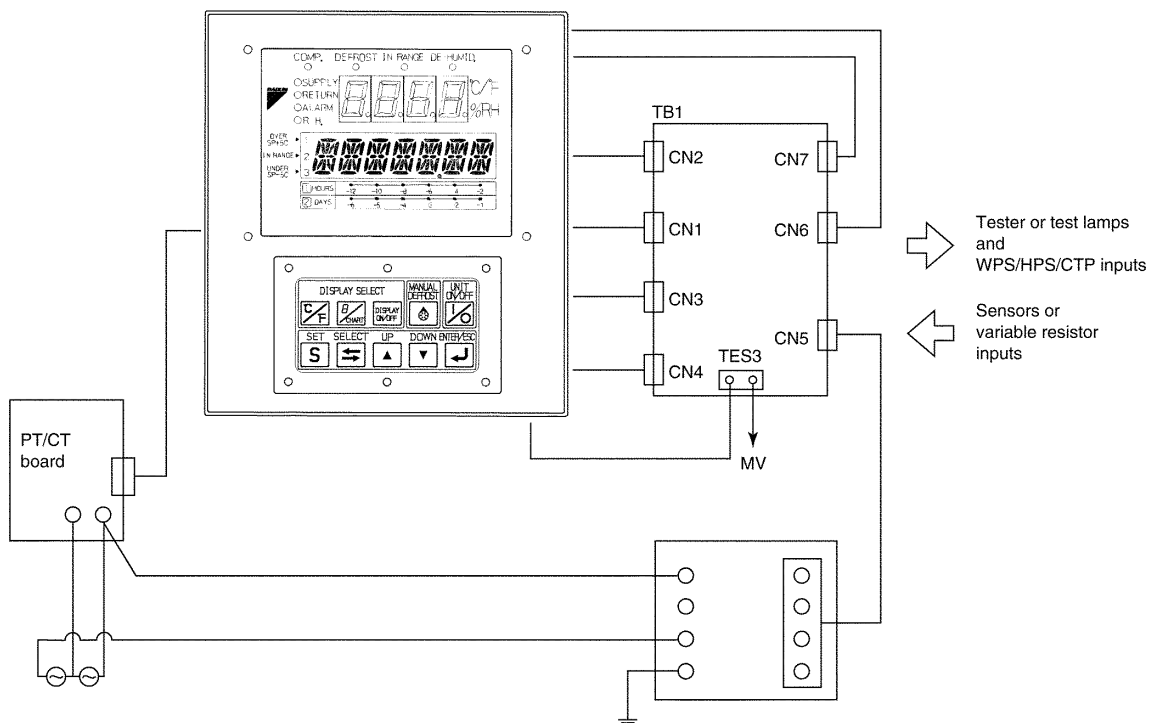


● Schematic wiring diagram of electronic controller



● Unit test of electronic controller

The controller is usually inspected with the controller unit installed in the refrigeration unit. When the controller unit is inspected with this unit removed from the refrigeration unit, the following relative components are required for the normal operation of controller.



3.10 Controller replacement and initialization

3.10.1 Controller replacement

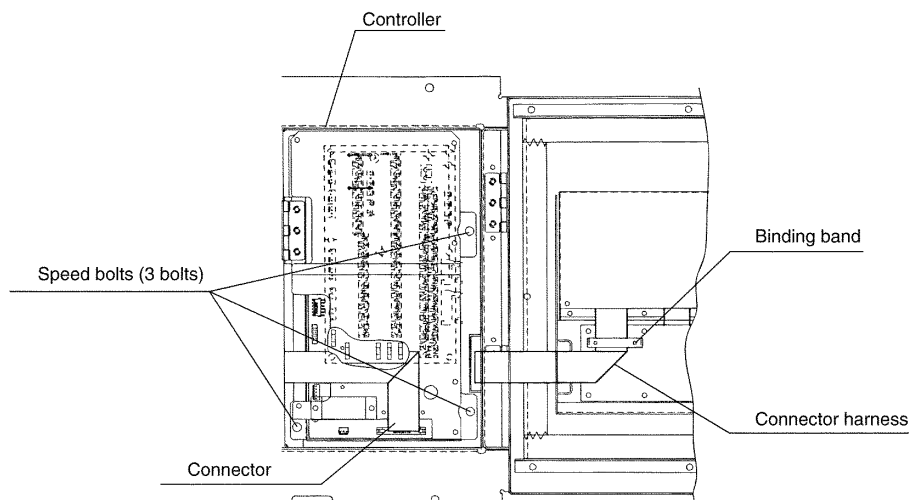
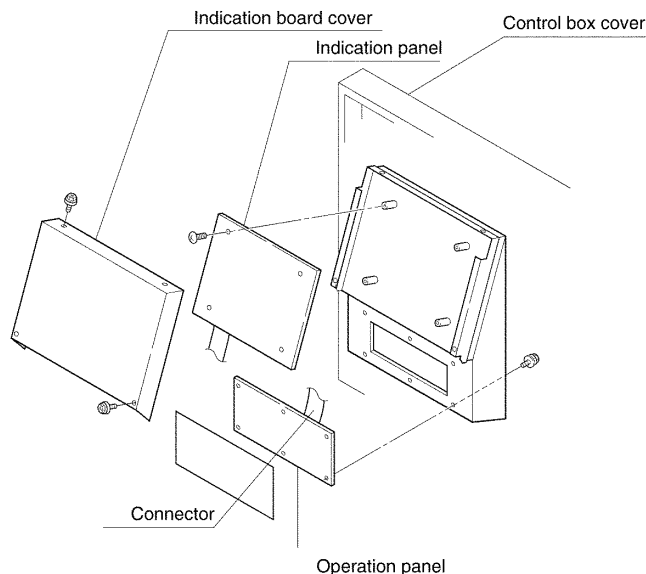
There are two different procedures for the controller replacement. Adopt the method of No.1 as much as possible.

1. To replace the controller with the LXE10D specific controller assembly
2. To replace the controller with the spare controller assembly which are interchangeable with DECOS] a

[How to replace the controller with the LXE10D specific controller assembly]

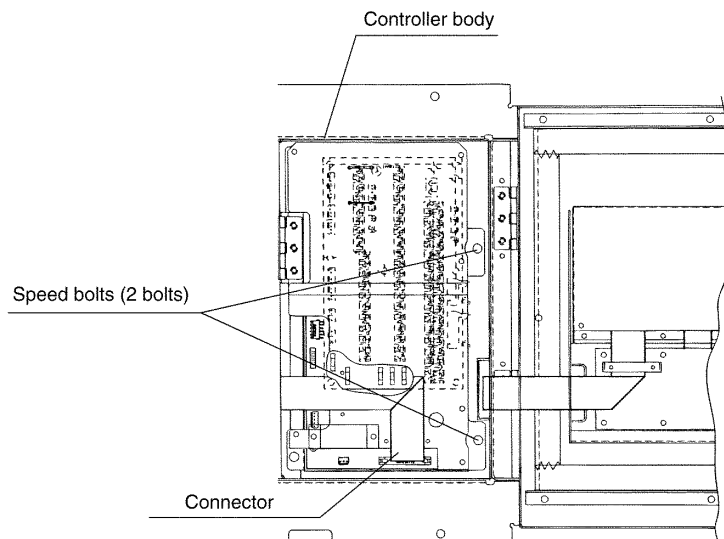
<How to replace indication and operation panel>

- (1) Remove the indication board cover .
- (2) Cut the binding band fixing the connector harness using a cutting nipper.
- (3) Remove 3 speed bolts from the controller body, and open the controller, then disconnect the connector .
- (4) Disconnect the connector , then remove the indication panel and the operation panel .
- (5) Connect the new indication panel and operation panel.
- (6) In the reverse procedure, restore the controller to the original state.



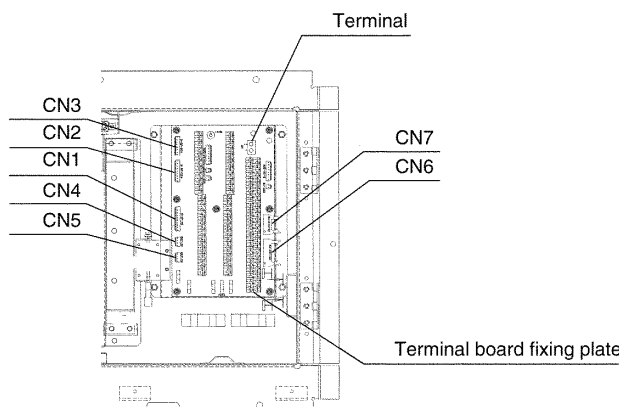
<How to replace controller>

- (1) Remove 2 speed bolts on the controller body, then remove the connector .



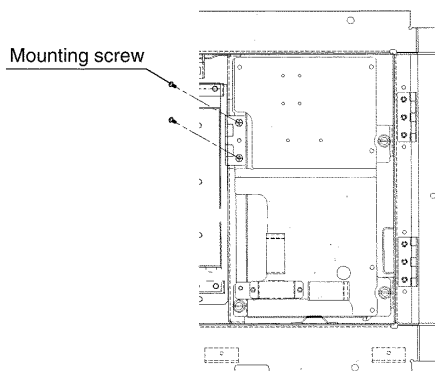
- (2) Open the controller body, then disconnect the connectors through on the terminal board .

- (3) Remove 2 terminals .



- (4) Remove 2 screws fixing the controller, and replace the controller with new one.

- (5) In the reverse procedure, bring the connector, the terminal speed bolts and the mounting screws into the original states.



CAUTION Make sure that the connector is firmly connected.



CAUTION

Observe the following items when installing the new controller.

3.10.2 Initial setting of controller

The controller needs to be initialized referring to the operation procedures of the following modes.

Refer to section, 3.3 :

5. Optional function setting mode
6. Basic function setting mode
7. Optional condition setting mode
8. Input data mode

※Since the spare part is not initially set, it can not be operated as it is. (The alarm will be displayed.)

4. PTI (Pre-Trip Inspection) AND PERIODIC INSPECTION

- The controller (DECOSIII b) has the automatic PTI function, which consists of three processes of SHORT PTI (referred to as S. PTI hereafter), FULL PTI (referred to as F. PTI hereafter) and MANUAL CHECK (referred to as M. CHECK hereafter).

Mode	Operation description
S. PTI	The components are inspected for abnormalities. Even if any abnormal components is found, a series of inspection is all executed.
F. PTI	S. PTI + unit cooling capacity are inspected. The cooling capacity check is executed only if any abnormal components is not found with S. PTI. If any abnormality is found during the cooling capacity inspection, F. PTI is interrupted.
M. CHECK	The electric devices at the continuous operation and the operation data are inspected.

※ Refer to section 3. 2 for details.

- The abnormalities which occur during automatic PTI will be displayed on the controller when automatic PTI is terminated.
 - Refer to section 4.2 for the alarm code checking procedure.
 - Refer to section 3.4 for the alarm code contents.
- When automatic PTI is terminated, the result of the PTI can be output as a report with the aid of personal computer. (Refer to the Operation Manual for Personal Computer Software.)

4.1 Inspection items

The periodic inspection and adjustment of components are recommended to ensure the successful operation.

The following table shows an example of the inspection plan.

No.	Inspection item	Inspection content	PTI	2nd year	4th year	8th year	
General structure	1	Inspection for physical damage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	2	Loose mounting bolts	1) Casing frame	<input type="radio"/>			
			2) Compressor	<input type="radio"/>			
			3) Condenser fan motor	<input type="radio"/>			
			4) Evaporator fan motor	<input type="radio"/>			
			5) Control box	<input type="radio"/>			
			6) Temperature recorder box	<input type="radio"/>			
			7) Access panel	<input type="radio"/>			
			8) Others		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	3	Conditions of panel, hinge and lock		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	4	Drain pan and drain hose cleaning	<input type="radio"/>				
	5	Control box inspection	1) Cover packing inspection and replacement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			2) Loose cable gland		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			3) Internal cleaning		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	6	Temperature recorder box inspection	1) Cover packing inspection and replacement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			2) Internal cleaning		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7	Sealing condition of casing frame through hole	1) Air leakage and clearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
8	Packing inspection and replacement	1) Fresh-air intake		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		2) Unit sealing packing				<input type="radio"/>	
9	Painted area recondition	1) Compressor		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		2) Water-cooled condenser /liquid receiver		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		3) Solenoid valve (coil cap)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		4) Casing frame			<input type="radio"/>	<input type="radio"/>	
10	Repainting	1) Compressor				<input type="radio"/>	
		2) Water-cooled condenser/ liquid receiver				<input type="radio"/>	
		3) Condenser fan motor				<input type="radio"/>	
		4) Condenser fan				<input type="radio"/>	
Refrigerant system	1	Gas leakage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	2	Refrigerant/ refrigerating machine oil	1) Inspection of moisture in the refrigerant, and refrigerant charged amount	<input type="radio"/>			
			2) Inspection of refrigerating machine oil amount	<input type="radio"/>			
			3) Replacement of refrigerant and refrigerating machine oil			<input type="radio"/>	<input type="radio"/>
3	Inspection of high pressure switch operational pressure		<input type="radio"/>				

	No.	Inspection item	Inspection content	PTI	2nd year	4th year	8th year	
Refrigerant system	4	Operation and leakage of solenoid valve	1) Liquid solenoid valve	<input type="radio"/>				
			2) Injection solenoid valve	<input type="radio"/>				
			3) Hot gas solenoid valve	<input type="radio"/>				
	5	Operation and leakage of modulating valve		<input type="radio"/>				
	6	Operation and leakage of electronic expansion valve		<input type="radio"/>				
	7	Compressor	1) Water ingress to compressor terminal			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
			2) Valve plate inspection/ replacement				<input type="radio"/>	<input type="radio"/>
			3) Oil filter cleaning				<input type="radio"/>	<input type="radio"/>
			4) Compressor disassembly and inspection					<input type="radio"/>
	8	Dryer replacement			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	9	Functional inspection and replacement of liquid moisture indicator		<input type="radio"/>			<input type="radio"/>	
	10	Check of cap gasket of service valve for missing		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	11	Conditions of fasteners on the refrigerant pipes and gauge pipes			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	12	Conditions of thermal insulation of refrigerant pipe			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	13	Evaporator coil cleaning (water-cleaning)			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
14	Condenser coil cleaning	1) Water-cleaning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
		2) Steam-cleaning (after pumping down the refrigerant)			<input type="radio"/>	<input type="radio"/>		
15	Water-cooled condenser inspection	1) Water-leakage inspection		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
		2) Operation of water pressure switch		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
Electrical System	1	Damage of power cable and plug		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	2	Inspection of conditions of internal wiring			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	3	Terminal looseness inspection and retightening	1) Voltage selector (cam switch)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			2) Magnetic contactor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			3) Electronic controller terminal block	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
			4) Terminal block	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
4	Conditions of monitoring receptacle cap		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
5	Conditions of personal computer receptacle cap		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
6	Fuse conditions	1) Bruned out or not	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		

No.	Inspection item	Inspection content	PTI	2nd year	4th year	8th year	
Electrical System	7	Magnetic contactor contact point inspection and replacement	1) Contact point inspection	○	○	○	
			2) Replace the contact of compressor contactor			○	○
			3) Replace the contact of evaporator fan motor				○
			4) Condenser fan motor contactor replacement				○
	8	Electric insulation check	1) Power cable and plug	○	○	○	○
			2) Compressor	○	○	○	○
			3) Condenser fan motor	○	○	○	○
			4) Evaporator fan motor	○	○	○	○
	9	Starting procedure inspection		○			
	10	Thermosensor	1) Installation conditions of sensor	○	○	○	○
			2) Inspection of sensor and sensor lead for damage		○	○	○
			3) Indication error inspection and replacement		○	○	○
	11	Humidity sensor	Indication of differentials compared with a calibrated humidity sensor	○			
			Replacement		○	○	○
	12	PT/CT (voltage and current) indication error inspection			○	○	○
	13	Pressure sensor indication error inspection and replacement			○	○	○
	14	Temperature recorder inspection	1) Calibration	○			
			2) Sensor error inspection and replacement		○	○	○
			3) Chart drive inspection	○			
4) Recording operation inspection			○				
5) Loose terminal				○	○	○	
6) Chart drive dry battery inspection, and replacement			○				
7) Check and replacement of pen lifting battery						○	
15	Electronic controller	1) Check and replacement of wake-up battery *	○				
		2) LCD panel replacement			○	○	
16	Evaporator fan motor	1) Speed switchover	○				
		2) Revolution direction	○				
		3) Motor replacement				○	
17	Condenser fan motor	1) Revolution direction	○				
		2) Motor replacement				○	
18	Evaporator fan	1) Deformation and damage inspection	○		○		
19	Condenser fan	1) Deformation and damage inspection	○	○	○	○	

	No.	Inspection item	Inspection content	PTI	2nd year	4th year	8th year
Others	1	Check for abnormal noise and vibration during operation		○			
	2	Temperature control conditions	1) 0°C operation	○			
			2) -18°C operation	○			
	3	Defrosting function		○			
4	Unit water-cleaning		○				

※The service life of wake-up battery is approx. one year (alkali battery).

4.2 Automatic PTI (Pre-Trip Inspection)

The automatic PTI function is provided so as to ensure the correct inspection and to shorten the inspection time.

The inspections of the following components mainly related to the unit operation are automated. (Refer to section 3.2 for detail.)

(1) Appearance inspection of unit

- Physical damage
- Casing insulation through hole area
- Drain hose (dust and clogging)
- Power cable and plug damage
- Conditions of refrigerant piping fasteners
- Conditions of each sensor installation
- Loose installing fasteners
 - Bolts and nutsCasing frame, compressor, fan motor control box and temperature recorder box
 - Cable glandsControl box
- Conditions of control box cover packing (water-proof) and temperature recorder box cover packing (water-proof)
- Magnetic contactor contact point for burning out.

(2) Inspection before operation

Gas leakage inspection

Power voltage inspection

(Automatic PTI range)

(3) Starting inspection and operation inspection of safety device and control equipment

- | | |
|-------------------|--|
| Starting | Inspection whether the starting procedure is proper or not
Inspection for abnormal noise and abnormal vibration
Oil level in the compressor
Moisture in the refrigerant.....This is reinspected at the end of PTI.
Revolution direction of fan motor |
| Safety device | HPSMeasurement of the actuating pressure by stopping the condenser fan motor. |
| Control equipment | Solenoid valve and MV.....Inspection of operation (open and close) and leakage
EFMSpeed switchover and revolution direction
Electronic expansionInspection of operation (open and close) and leakage |

(4) Operation in each mode

- | | | |
|-----------------|---------|---|
| Pull-down | → 0°C | Electronic temperature recorder calibration
Pull-down time, voltage and current
Return/supply air temperature differential, voltage and current
Pull-down time, evaporator fan motor speed switchover (Temperature differential and revolution direction)
ON-OFF, voltage and current |
| Chilled control | 0°C | |
| Pull-down | → -18°C | |
| Frozen control | -18°C | |

Defrosting

Defrosting time
Residual frost inspection

(5) PTI report printout

● Automatic PTI enable conditions

	Water-cooled operation	Air-cooled operation	
		Ambient temperature $\leq -10^{\circ}\text{C}$ or $> 43^{\circ}\text{C}$	Ambient temperature $> -10^{\circ}\text{C}$ and $\leq 43^{\circ}\text{C}$
S. PTI	×	○	
F. PTI	×	×	
M. CHECK	○	○	

※ During S. PTI at the ambient temperature of 43°C or higher, the compressor protective device may activate in accordance with the conditions of the inside temperature. This is not a malfunction of unit.

● Starting and ending operation of automatic PTI

(Refer to section 3.2)

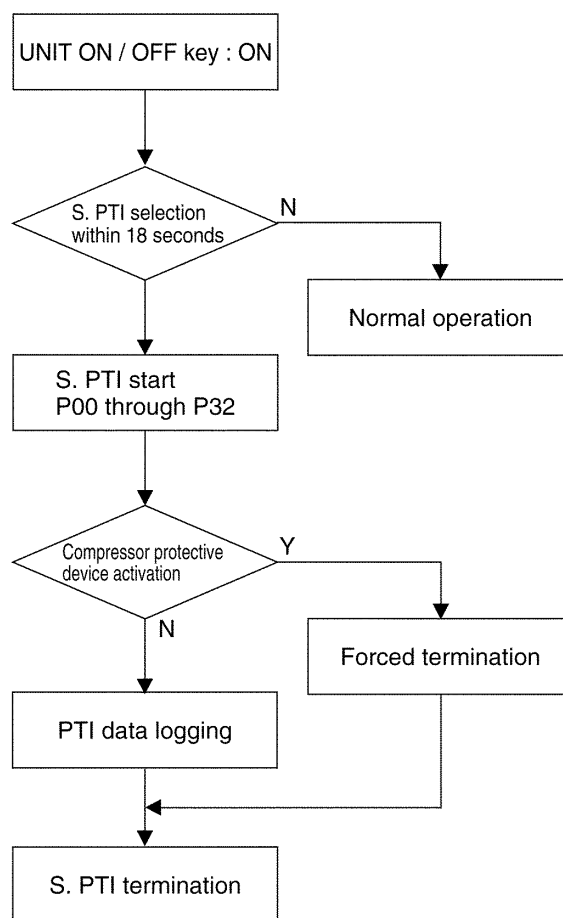
4.2.1 Short PTI (S. PTI)

Select S. PTI within 18 seconds after turning the UNIT ON/OFF key on, then Steps P00 through P32 will be carried out (displayed on LED). The items of sensor indication mode can be displayed by key operation.

● Step display and content

Step	Content
P00	Basic data record (container No., date, time, compressor integrated run-hour, ambient temperature)
P02	Alarm check on all sensors
P04	Power conditions (voltage and frequency) check
P05	Compressor start running check
P06	Actuating pressure check at OFF and ON of High pressure switch (HPS)
P08	Pump-down check
P10	Solenoid valve leakage check • Liquid solenoid valve (LSV) • Injection solenoid valve (ISV) • Modulating valve (MV)
P12	Supply and return air sensor (SS and RS) accuracy check
P14	Pressure sensor (HPT and LPT) accuracy check
P16	Evaporator fan high and low-speed operation check
P26	Standard pull-down operation
P28	Negative-phase operation check • Check visually for the rotating direction of condenser fan (S)
P29	Electronic expansion valve check
P30	Injection solenoid valve (ISV) opening or closing check
P32	Hot-gas 3-way solenoid valve (HSV) opening or closing check

● S. PTI flow chart operation



4.2.2 Full PTI (F. PTI)

Select F. PTI within 18 seconds after turning the UNIT ON/OFF key on, then steps P00 through P90 will be started.

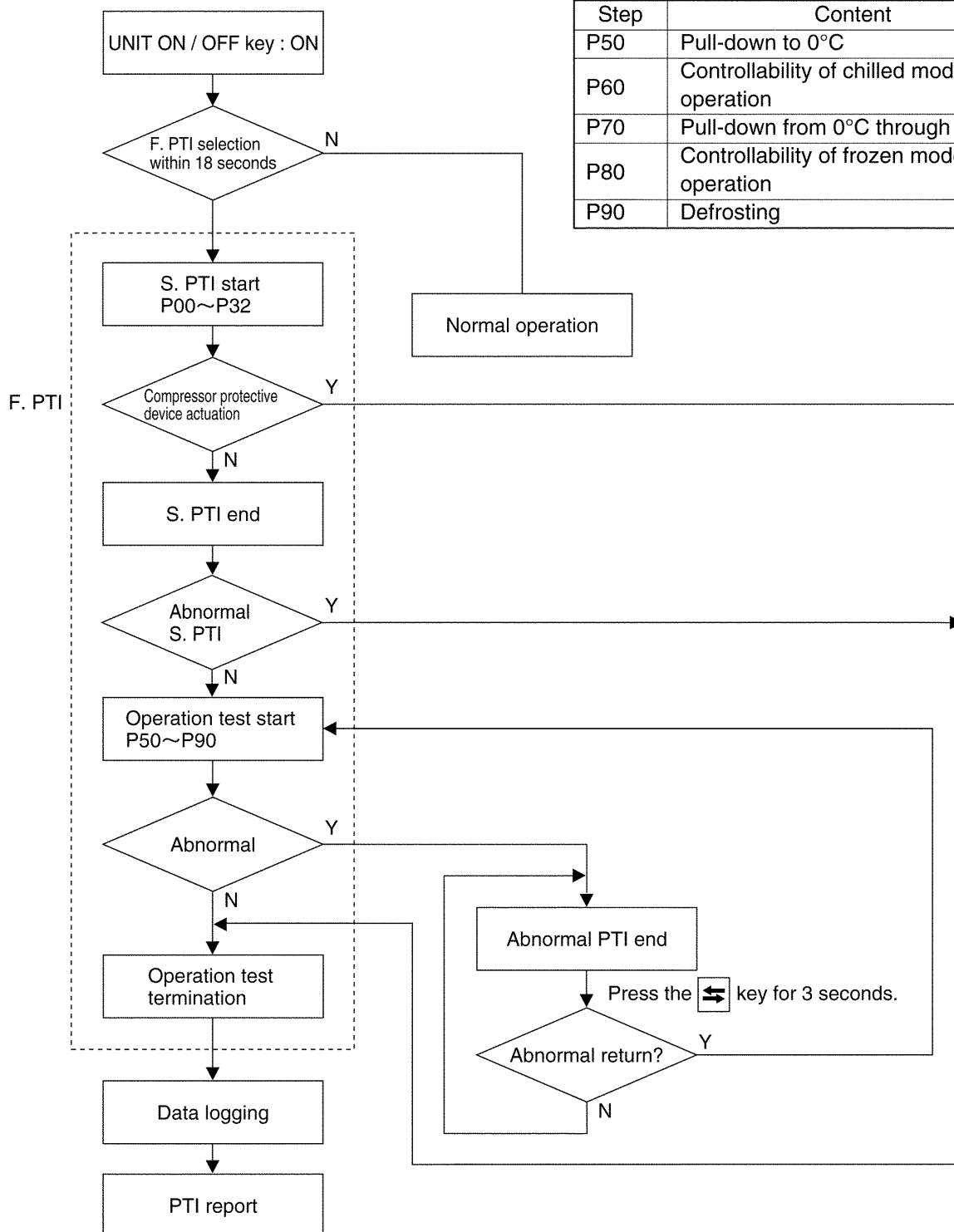
F. PTI consists of S. PTI and operation tests.

● F. PTI flow chart

● Step display and content

(Step P00~P32 are as same as S. PTI)

Step	Content
P50	Pull-down to 0°C
P60	Controllability of chilled mode operation
P70	Pull-down from 0°C through -18°C
P80	Controllability of frozen mode operation
P90	Defrosting



4.2.3 Alarm list during PTI (Pre-Trip Inspection)

The alarms during automatic PTI are concerned with PTI inspection items in addition to those during normal operation.

The alarms caused by automatic PTI are indicated in J※※※, being discriminated from those during normal operation.

Though there are alarms which are not displayed on the control panel, they can be checked referring to the PTI report.

Check No. (LED display)	Check content	Alarm indication (LED display)	Alarm content	S.PTI	F.PTI	Remarks
P00	Basic data	No indication	Basic-data vanishment	↑	↑	
P02	All sensor	Same as normal operation	Basic-data vanishment			
P04	Power	No indication	Basic-data vanishment			
P05	Starting	J051	Compressor malfunction			
P06	HPS	J061	Abnormal OFF point			
		J062	Not return (closed)			
		J063	Abnormal ON point			
		J064	High pressure does not rise.			
		J065	High pressure does not drop.			
P08	Pump-down	J081	Long pump-down			
P10	Liquid solenoid valve	J101	Valve leakage			
P12	RS, SS accuracy	J121	Sensor deterioration			
P14	HPT, LPT accuracy	J141	Sensor deterioration			
P16	Evaporator fan motor	J161	Evaporator fan motor malfunction			
P26	Operation	No indication	Judged with P28			
P28	Evaporator fan reverse-turning direction	J281	Abnormal evaporator fan miswiring			
P29	Electronic expansion valve	J291	Long pump-down			
P30	Injection solenoid valve	J301	Injection solenoid valve malfunction			
P32	Hot-gas 3-way solenoid valve	J321	Hot-gas 3-way solenoid valve malfunction			
P50	Pull-down cooling capacity	J501	Out of ambient temperature conditions	↓	↓	
P50	0°C control	J502	Long pull-down time			
P60	0°C control	No indication				
P70	Pull-down cooling capacity	J701	Long pull-down time			
P80	-18°C control	No indication				
P90	Defrosting	J901	Out of starting conditions			
	Basic-data	J902	Long defrosting time			

4.2.4 Manual check (M. CHECK)

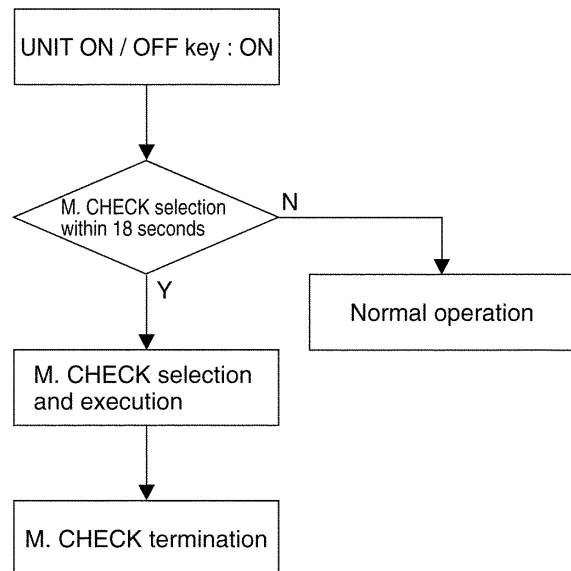
Select M. CHECK within 18 seconds after turning the UNIT ON/OFF key on, then M. CHECK will be executed.

Since the components are respectively operated differing from S. PTI and F. PTI, the steps can be respectively selected and executed. Here, any error code indication does not occur during execution. Turn the UNIT ON/OFF key OFF to terminate the M. CHECK.

●Item and content

Indication on the LCD	Content indicated on the LED
CC X10H	Compressor integrated run-hour
EFH A	Running current value of evaporator fan motor high-speed running
EFL A	Running current value of evaporator fan motor low-speed running
CF A	Running current value of condenser fan motor running
b-CH	Battery replacement date If the battery life limit is reached, "E801" is appears. ※1
HP	Compressor horse power setting (5HP or 10HP)
TS H	Elapsed time after trip start
EF1 X10H	Evaporator fan motor -1 run-hour
EF2 X10H	Evaporator fan motor -2 run-hour
CF X10H	Condenser fan motor run-hour
SOFTVER	Controller software version

●M. CHECK flow chart



※1 This indication is used only when the lithium battery is used. When the alkali battery is used, keep turning the alarm code "E801" on.

5. MAIN COMPONENTS AND MAINTENANCE

5.1 Components related with refrigeration circuit

5.1.1 Compressor

The compressor is of a semi-hermetic type with the built-in motor so that there are few places where refrigerant may leak. The reversible trochoid pump is adopted to produce the required oil pressure regardless of the rotating direction of the built-in motor.

(1) Removal

Remove the compressor by the following procedure.

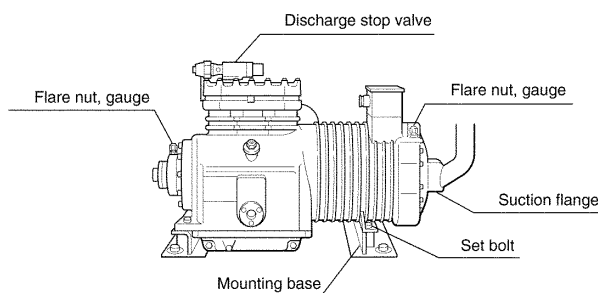
Remove discharge stop valve, suction flange, gauge piping flare nut (compressor side), and power cable.

Remove compressor set bolts (two for each of left and right leg). (Do not remove the bolts for the mounting base.)

Pull out the compressor to the front of the unit.

(2) Installation

For installation, reverse the above procedure. When tightening the bolts, refer to the standard tightening-torque table.




5.1.2 Air-cooled condenser and evaporator

This finned coil is compact and has even and high thermal conductivity due to the adoption of corrugated fins.

● Washing of air-cooled evaporator

Carefully flush the air-cooled condenser with fresh water after trip, although this type of condenser employs thick fins and electrodeposition coating for high corrosion resistance.

- For the maintenance of the air-cooled condenser, remove the fan cover, fan guide and temperature recorder box. For the maintenance of the evaporator, remove the rear panel of the evaporator.

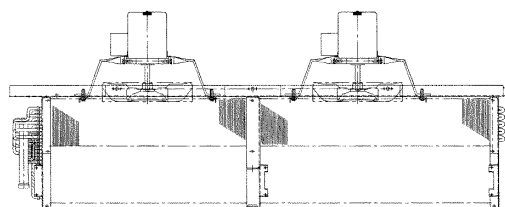


CAUTION

Seal the suction pipe opening with packing tape for prevention of moisture ingress because LXE10D and LXE10D-A are not provided with suction side stop valve.



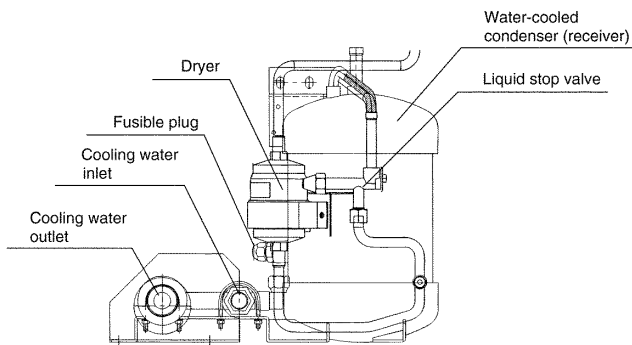
Air cooled condenser



Evaporator

5.1.3 Receiver (Air-cooled type)

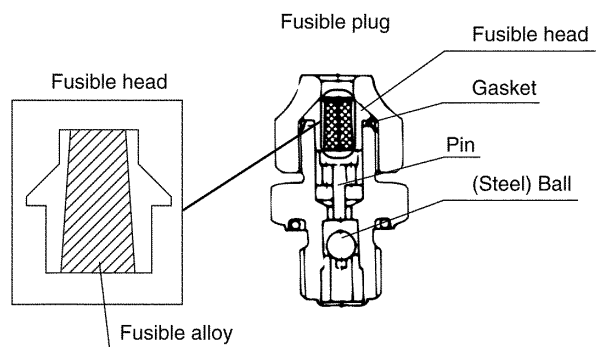
The water-cooled condenser is mounted on the air and water-cooled type, and the receiver is mounted on the air-cooled type. Since the condenser is of shell and coil type, the cooling water flows in the inner cooling tube and the refrigerant flows in the shell. The cooling tube having special fins are used to make it light and compact.



●Replacement of fusible safety plug

If pressure rises abnormally in the refrigeration circuit, the fusible plug actuates by itself. So, thoroughly check the possible causes if the fusible plug melts.

If the fusible plug actuates, the fusible alloy in the center of fusible head melts, from which the refrigerant jets out. When the flare nut is removed, the ball is apt to come out by pressure and clogs the passage of the refrigerant outlet, which prevents the refrigerant from jetting out and also the air from entering. Thus, refrigerant loss is extremely minimized.



For replacement, insert a new fusible alloy with gasket, and tighten the flare nut.

5.1.4 Dryer

The dryer automatically absorbs moisture in the refrigerant while it is circulated. It commonly works as a filter to remove dust in the refrigerant. Replace the dryer if it does not remove moisture or is clogged. When installing the new dryer, follow the directions given on the label and do not make any mistake about the direction of the dryer.

(1) Replacement

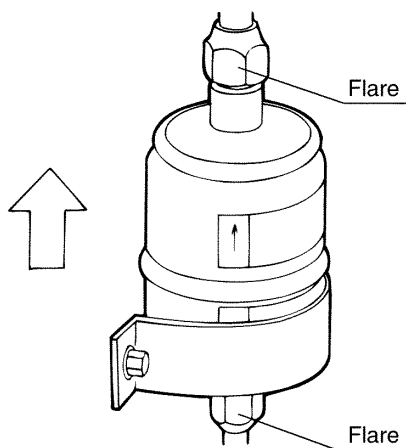
After pump-down operation, the suction pressure shall be slightly higher than the atmospheric pressure. (Refer to the section 7, Maintenance)

Then, loosen the flares at the both ends of the dryer, and replace the dryer quickly.

After reattaching the dryer, evacuate with keeping the liquid stop valve at the outlet of water cooled condenser (or receiver) closed.

After completing evacuation, fully open the stop valve, and be sure to inspect the dryer fitting for refrigerant leakage. Make sure that no gas leakage is found.

After replacement, confirm the moisture indicator shows green.



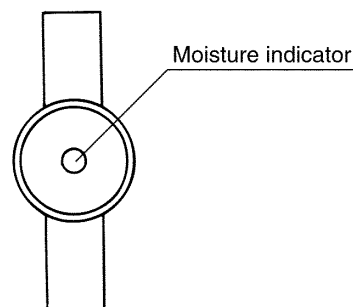
5.1.5 Moisture indicator

This indicator permits checking of flow of the refrigerant and moisture content in the refrigerant.

(1) Moisture ingress

The indicator indicates the moisture content by the color at the center of the window. Check this indicator during the unit is under operating.

Color	Judgment
Green	Dry
Yellow	Wet (moisture ingress)



- Note)
1. The indicator may appear yellow if it has been exposed to gaseous refrigerant for a long time.
 2. The indicator must be checked while the indicator is sealed by liquid refrigerant after operation of a few hours.
 3. The indication is influenced by the temperature of the liquid refrigerant. At the low temperature, a long time is required for the indicator to change.
 4. To shorten the indication changing time, raise up the temperature of the liquid refrigerant. (Block the air discharge grill of the condenser fan to increase the working pressure in order to raise up the temperature.)

(2) Flow of refrigerant

When the moisture indicator is sealed with the liquid, bubbles will disappear on the moisture indicator.

(3) Check

Operation	Indicator state
Starting	Bubbles appear but liquid refrigerant is sealed in 30 minutes to an hour after starting.
During operation	Bubbles may sometimes appear.

If bubbles continues violently appearing, the refrigerant may be short.

5.1.6 Electronic expansion valve

- Model Coil : EBM-MD 12DM-1
- Body : EDM-B402 DM-1

This unit adopts a relay connector for the lead wire of the electronic expansion valve coil.

(1) Replacement of coil

Disconnect the lead wire in the control box.

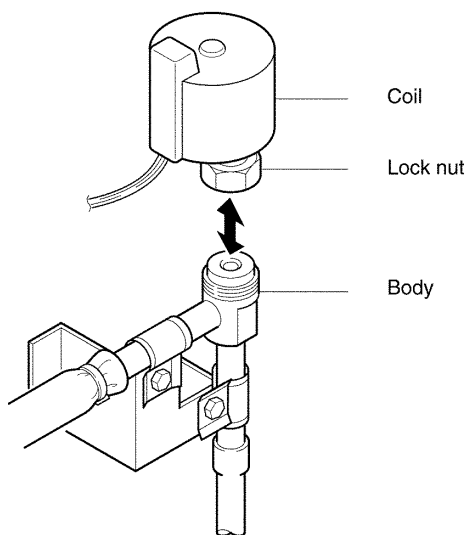
Cut the binding bands which fasten the lead wires using cutting nippers.

Loosen the lock nut, then remove the coil from the body.

Install a new coil. The tightening torque for installation is $6.9 \sim 16.7 \text{ N} \cdot \text{m}$ ($70 \sim 170 \text{ kgf} \cdot \text{cm}$).

Restore the binding bands and the lead wire into the original state.

After replacement, carry out refrigerant leakage checking, and make sure that any refrigerant does not leak.



(2) Replacement of body

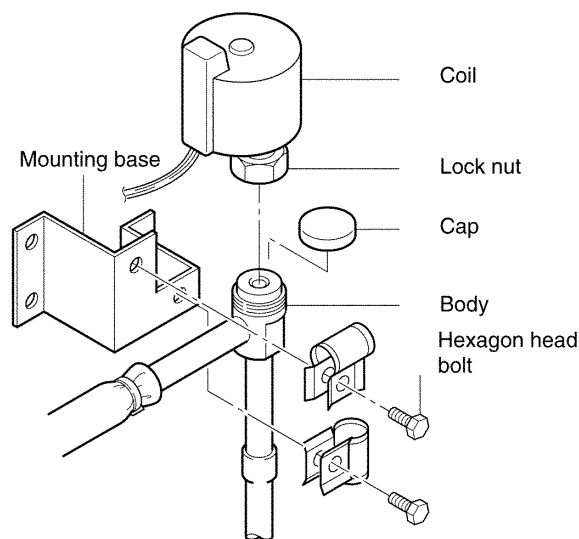
Loosen the lock nut, then remove the coil.

Remove the hexagon head bolts, and cut the pipe on the body, then remove remaining pipes from brazing parts.

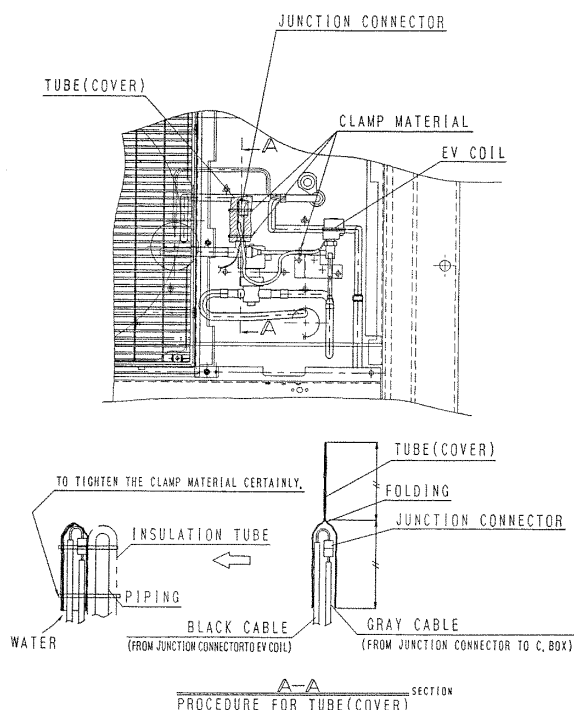
Connect a new body to the pipes and braze the joints while cooling the body below 120°C [248°F] with the cap on.

Fix the body to the mounting base.

Remove the cap, and mount the coil with the tightening torque is $6.9 \sim 16.7 \text{ N} \cdot \text{m}$ ($70 \sim 170 \text{ kgf} \cdot \text{cm}$).



Removing the relay connector facilitates replacement of the coil. Since the relay connector is not of the moistureproof specifications, treat the relay connector to make it moistureproof by the following procedures.



⚠ CAUTION

After replacing the coil, seal the lock nut that fastens the main unit and coil using the proper sealant.

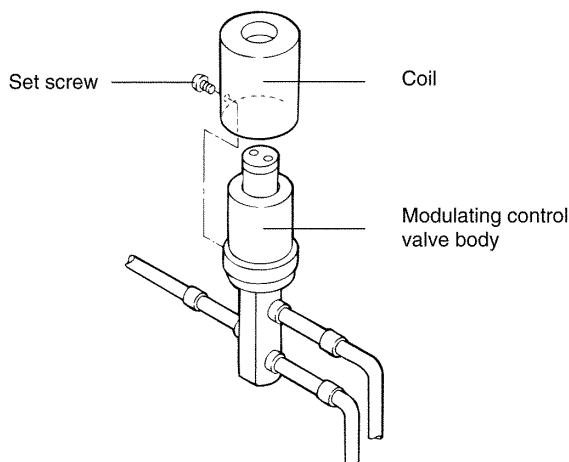
5.1.7 Modulating valve (MV)

●Model : DMR1101

The flow rate in two directions can be automatically adjusted from 0 to 100% by the magnetic valve. Modulating valve controls the hot gas by-pass operation, heating and defrosting during chilled and partial frozen operation.

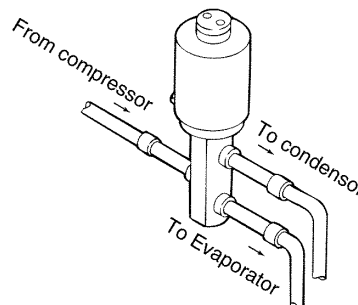
(1) Replacement of coil

Disconnect the MV lead wire from the inside of control box.
Remove the screw from the set side of the coil, and pull out the coil upward.
Install the new coil, tighten the set screw, then connect the lead wire at the controller.



(2) Replacement of MV body

Disconnect the MV lead wire from the inside of the control box.
Remove two binding bands which fasten the MV body.
Remove the MV body after cutting three pipes on the body, and remove remaining pipes from brazing parts.
For the installation of MV, first insert a pipe (inlet) at the left and next remaining two pipes (outlet), then braze the joints while cooling the lower valve body below 120°C [248°F] with wet cloth.
Return the binding band and lead wire into the original state.
After replacement, carry out refrigerant leakage checking, and make sure that any refrigerant does not leak.

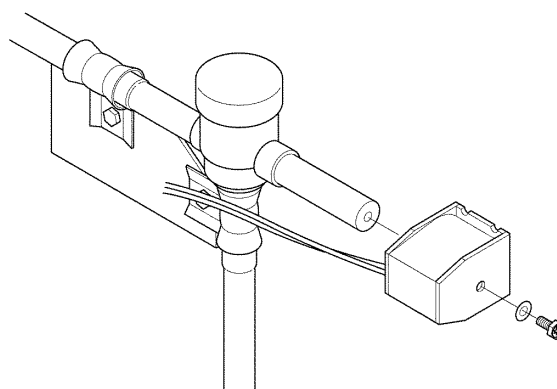


5.1.8 Liquid solenoid valve (LSV)

●Model : NEV803DXF

●Power supply : AC24V, 50/60Hz

The LSV is open or closed according to the signal of the controller. When it is closed, the refrigerant flow is stopped. (It is open when it is energized)



(1) Replacement

The internal structure of the solenoid valve is as shown below. (For checking and reassembly, refer to this illustration.)
When brazing the pipe, cool down the body with wet cloth. (It is not required to disassemble the valve, but remove the coil assembly from the body.)
In case of reassembly, tighten the four hexagon socket head cap screws with the torque of 2.9 N · m [30kg · cm] .

No.	Parts name
	Hexagon head bolt (M5)
	Spring lock washer (M5)
	Name plate
	Coil assembly
	Hexagon socket head cap screw
	Cover assembly
	Spring
	Piston
	Body
	Gasket (teflon)
	Sleeve
	Inner ring
	Piston ring

5.1.9 Injection solenoid valve (ISV)

●Model : NEV-202DXF

●Power supply : AC24V, 50/60Hz

The ISV is open or closed according to the signal of the controller. When it is closed, the refrigerant flow is stopped. (It is open when it is energized.)

(1) Replacement of coil

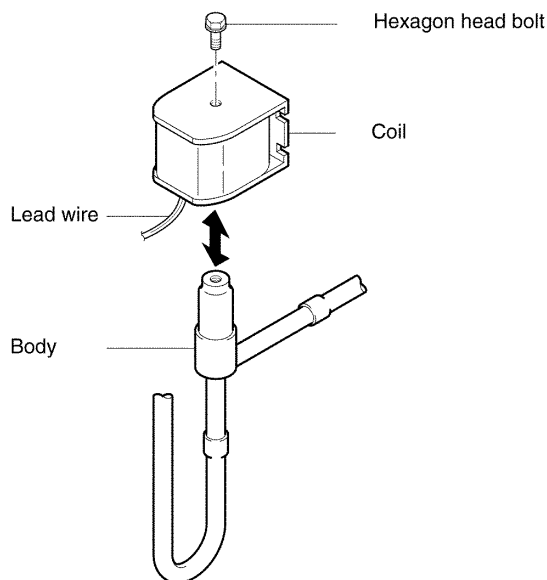
Disconnect the lead wire in the control box, and cut the binding bands fixing lead wires.

Loosen the hexagon head bolt on the top of the coil, and pull out the bolt upward.

Replace the coil, and restore the hexagon head bolts, binding bands and connector into the original states.

Tightening torque for coil is 2.9 N · m (30kg · cm).

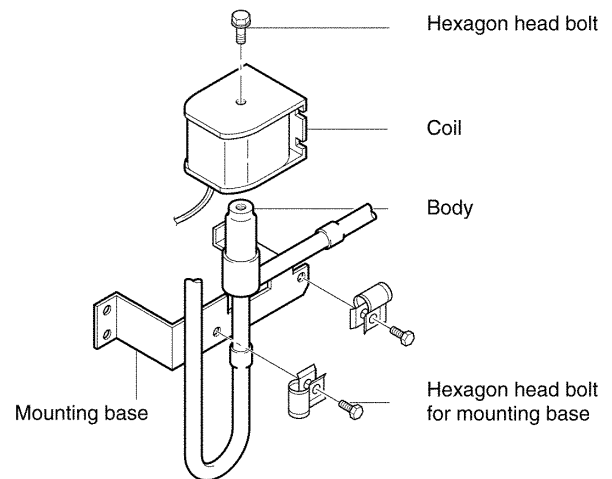
After replacement, carry out the refrigerant leakage checking, and make sure that any refrigerant does not leak.



(2) Replacement of ISV body

Loosen the hexagon head bolt on the top of the coil, and pull out the bolt upward. Remove the hexagon head bolt, cut two pipes on the body, then remove remaining pipes from brazing parts.

Connect a new body to the pipes, and braze the joint while cooling the body below 120°C [248°F] with wet cloth. Install the coil, and restore the hexagon head bolt for mounting base and connector into the original state.



5.1.10 Hot-gas 3-way solenoid valve (HSV)

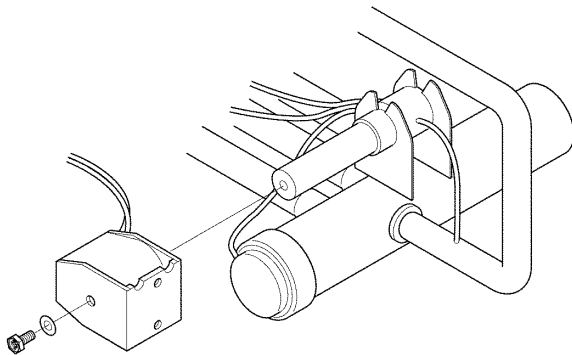
●Model : IHV804DXF

●Power supply : AC24V, 50/60Hz

The discharge gas directly flows to the evaporator in the defrosting and metering heating modes. The 3-way valve is provided to switch the discharge gas to the evaporator via the drain pan heater in the defrosting mode. Also, the dehumidification operation is controlled by the 3-way solenoid valve.

(1) Replacement of coil

No.	Component name
	M4 Hexagon head bolt
	M4 Spring washer
	Coil
	Washer
	Body
	M4 Round head screw
	Bracket

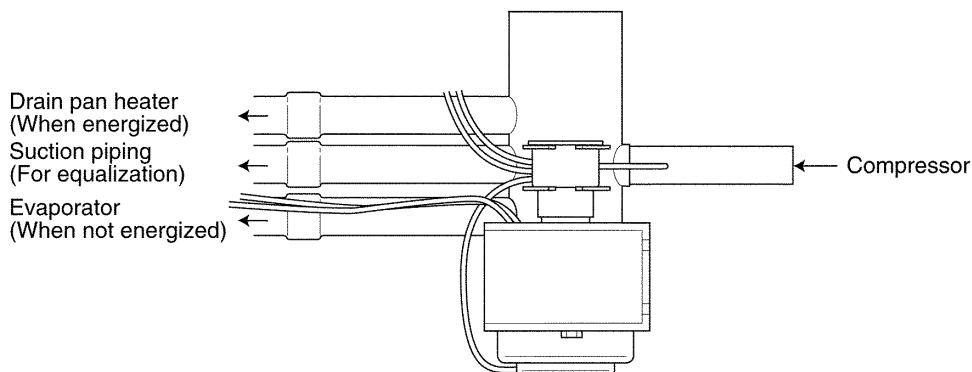
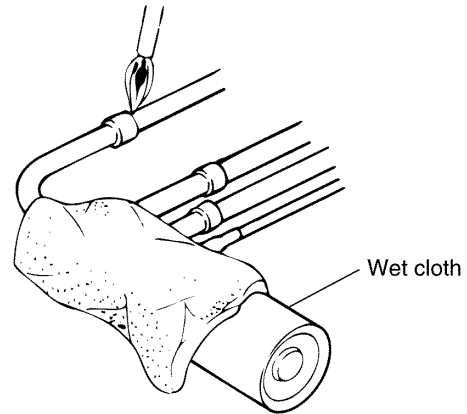


(2) Replacement of HSV body

●Piping connection

●Replacement

When brazing the valve body, remove the coil and cool the body below 120°C [248°F] with wet cloth.



5.1.11 High-pressure switch (HPS)

●Model 20PS780

●Set point : OFF 2059kPa (21.0kg/cm²)
ON 1569kPa (16.0kg/cm²)

When the refrigeration pressure of the unit abnormally rises, the compressor stops for safety. It will be actuated when the high pressure exceeds the set point due to the trouble of the condenser fan or the poor supply of the cooling water.

(1) Replacement

Disconnect the lead wire in the control box.

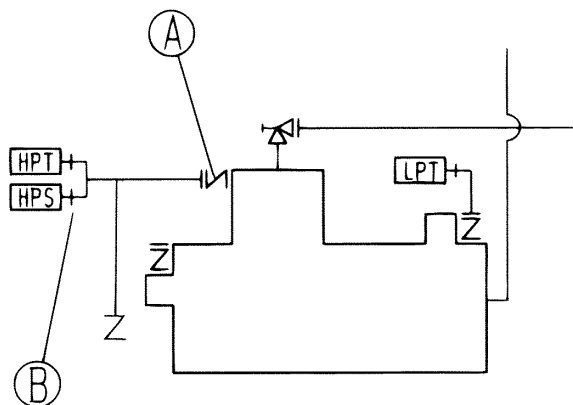
In order to prevent refrigerant from flowing out, disconnect the high-pressure gauge piping from the gauge joint (with check valve) on the compressor side.

Remove the flare nut and mounting screws of HPS on the casing at the right side of the compressor.

Replace the HPS. After tightening the flare nut, tighten the flare nut.

After tightening slightly loosen the flare nut, purge air, and retighten.

After replacement, carry out the refrigerant leakage checking, and make sure that any refrigerant does not leak.



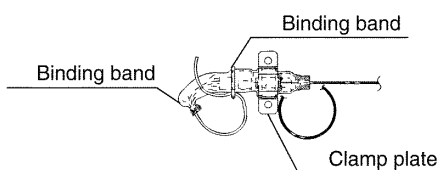
5.1.12 Low pressure transducer (LPT)

- Model : SPCL02
- Color indication : Low pressure transducer : Blue
Low pressure transducer cable : White

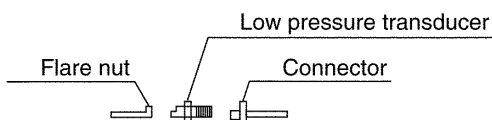
The LPT is located in the refrigerant circuit. The operating low pressure value is indicated in the controller indication panel.

(1) Replacement

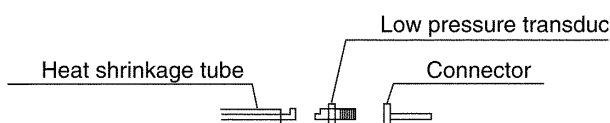
Remove two screws on the clamp plate fixing low pressure transducer, and cut the binding bands.



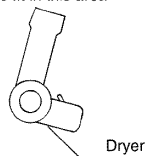
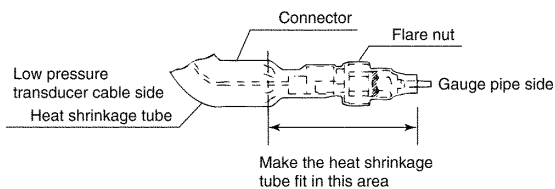
Remove the heat shrinkage tube, and disconnect the connector from the low pressure transducer, then disconnect the low pressure transducer from the flare nut.



Insert the pressure transducer cable through the heat shrinkage tube, and connect the cable to the low pressure transducer. If paint on the low pressure transducer is peeled off, apply clear lacquer.



Apply the heat shrinkage tube in the following position, then shrink it with hot air of a dryer.

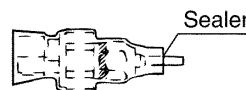


CAUTION

Do not expose the low pressure transducer to hot heat of a dryer for excess time.

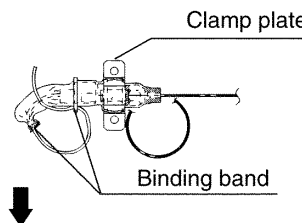
Otherwise, the transducer may be damaged.

Apply sealer in between the heat shrinkage tube and the flare nut. (Sealer : KE4898)



Fix the low pressure transducer with the clamp plate, and fix the cable with the binding band.

Fix the shrinkage tube end of the cable side downward for prevention of water ingress into the tube.



Fix the tube directing the end downward

5.1.13 High pressure transducer (HPT)

- Model : SPCH01
- Color indication : High pressure transducer : Red
High pressure transducer cable : Red

The HPT is located in the refrigerant circuit. The operating high pressure value is indicated in the controller indication panel.

(1) Replacement

The replacement procedure is the same as that for the low pressure sensor.

Make sure that the fixing position and the cable connection is correct.

5.2 Fan and fan motor

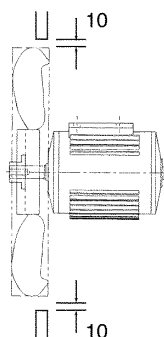
(1) Specifications

		Evaporator	Condenser
Fan	Model	Propeller fan	
	Size	440mm	300mm
Motor	Model	3-phase squirrel-cage induction motor	
	Output(60Hz) (Number of poles)	700/90W (2P/4P)	670W (4P)
	Bearing	Shielded ball bearing with rubber seal 6203WNC	Shielded ball bearing with rubber seal 620400NC-X

(2) Installation structure

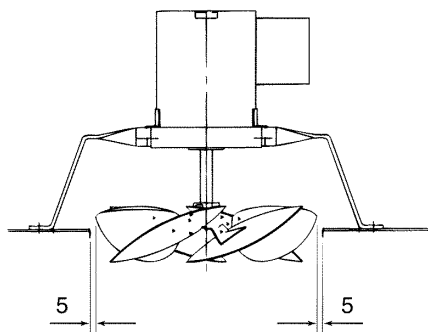
a. Condenser fan and fan motor

Condenser fan and fan motor



b. Evaporator fan and fan motor

Evaporator fan and fan motor



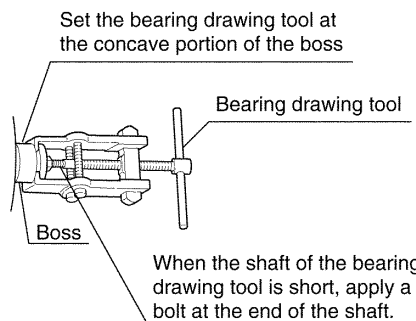
(3) Replacement

1) Condenser fan

Remove the fan grill and the fan guide, and loosen two hexagon set bolts on the boss of the fan, then pull out the fan forward.

※If the boss is stuck to the motor shaft, use the bearing drawing tool on the market.

●How to use bearing drawing tool on the market



2) Condenser fan motor

Remove the condenser fan.

Disconnect the fan motor cable from the magnetic contactor in the control box.

Remove the fan motor mounting bolts, and replace the motor.

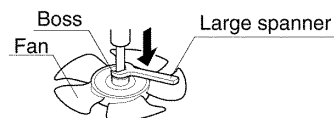
Install the fan motor and connect the cable.

After replacement, make sure that the fan is not in contact with the fan guide.

3) Evaporator fan

Loosen two set bolts on the boss portion of the fan, and pull out the fan downward.

※If the boss is stuck to the motor shaft, use a large spanner as shown below.



4) Evaporator fan motor

After removing the fan at Item 3), cut the motor cable at the terminal box.

Remove the motor mounting bolts. (Do not remove the motor mounting base.)

After removing the motor, connect the wiring with the cable by closed end connector.

Install the fan.

After replacement, make sure that the fan is not in contact with the fan guide. (For checking, rotate the fan by hand.)



CAUTION

Apply the locking products on the set bolts of the fan to prevent from loosening.

Otherwise, fan may drop from the motor.

5.3 PT and CT board (EC9756)

Two functions of the metering device and protector are integrated on this printed-circuit board. This board works as an interface between the main circuit (high voltage) and the controller.

(1) Function

Name	Content
Current measurement, (CT1, CT2)	AC 0 thru 50A (50/60Hz)
Voltage measurement, (PT1, PT2)	AC 150 thru 600V (50/60Hz)
Compressor overcurrent protection	Unit with 400V only : 26.0A Unit with 200V and 400V : 15.0A
Phase sequence detection	The phase sequence is detected by sending the voltage waveform to the controller.

(2) Replacing procedure

Disconnect the wire lead which passes through CT1 and CT2 at the voltage selector (cam switch).

※At this time, take care to prevent CT1 and CT2 from damaging.

Disconnect the connector (CN1) for the controller and the connector (CN2) for the main circuit.

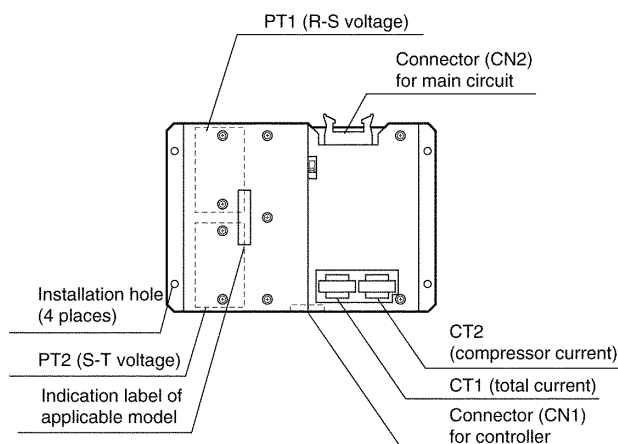
Remove four installing nuts.

After replacing the PT and CT board, connect the lead wires in reverse order of the above removal procedure.

After checking the wiring once, test-run the system to verify that no trouble is found.

CAUTION

Make sure to apply the PT and CT board for 400V exclusive use and that for 200V and 400V dual use correctly when replacing.



5.4 Humidity sensor

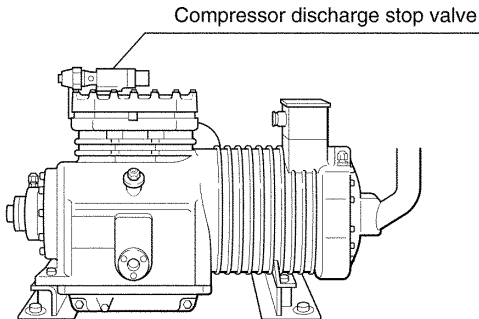
CAUTION

We recommend you to replace the humidity sensor every about three years.

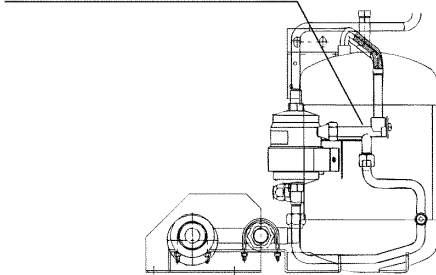
6. MAINTENANCE

6.1 How to handle stop valves

(1) Locations and kinds of stop valve

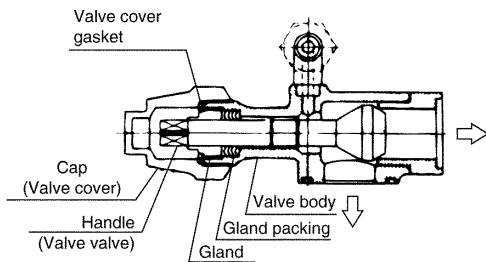


Stop valve of water-cooled condenser (or receiver)

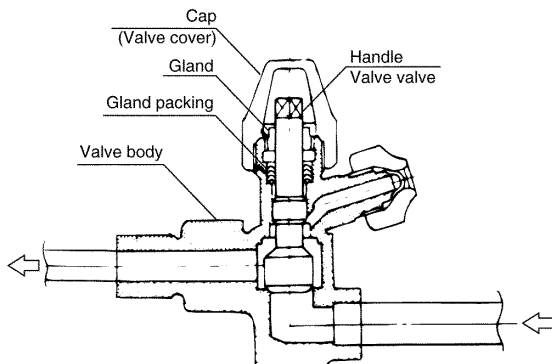


(2) Structure of stop valve

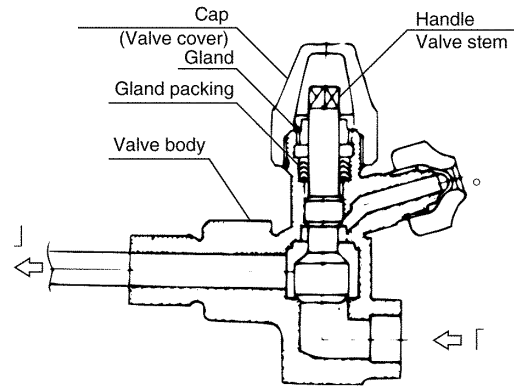
Compressor discharge stop valve (VSH22XBP)



Receiver outlet stop valve (VSH10CBP-4S-4SR)



(3) Stop valve handling method

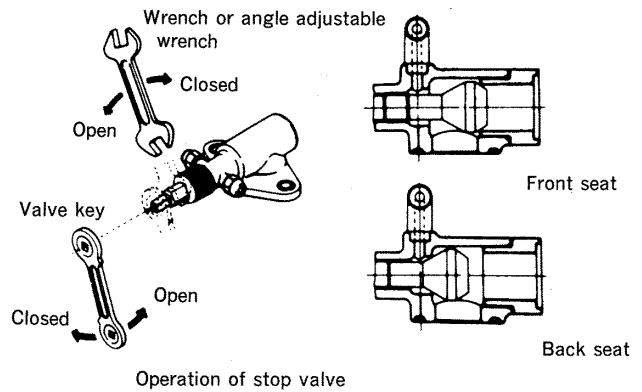


Remove the cap (valve cover). At this time, take care not to miss the gasket. Loosen the grand as far as no gas is leaked.

Turn the valve stem to the following position.

- Turn the handle to its full closing extent.
→The refrigerant passage routes from ◦ to] . (to front seat)
- Turn the handle to its full open.
→The refrigerant passage routes from [to] . (to back seat)
- Turn the handle to the neutral position.
→The refrigerant passage routes from ◦ through [to] .

After the completion of procedure above, make sure to tighten the gland, and place the valve cap. At this time, don't forget to attach the gasket.

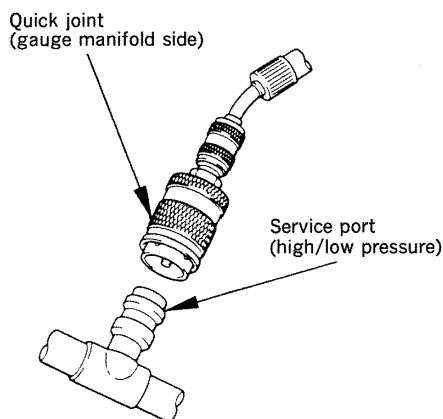


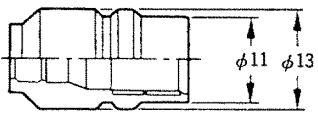
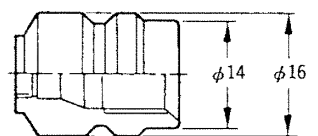
6.2 Installation and removal of gauge manifold

CAUTION

1. Use the pressure indicating function of the controller to refer the working pressure as possible instead of attaching the gauge manifold in order to prevent foreign particles or moisture from mixing into the refrigerant system.
2. Do not use any of the pressure gauge, gauge manifold, charge hose and charging cylinder which have been used for CFC12 in order to prevent refrigerant or refrigerating machine oil of a different kind from mixing. Use the exclusive tools for HFC 134a.

The service ports of quick joint type are provided to make improved handling.

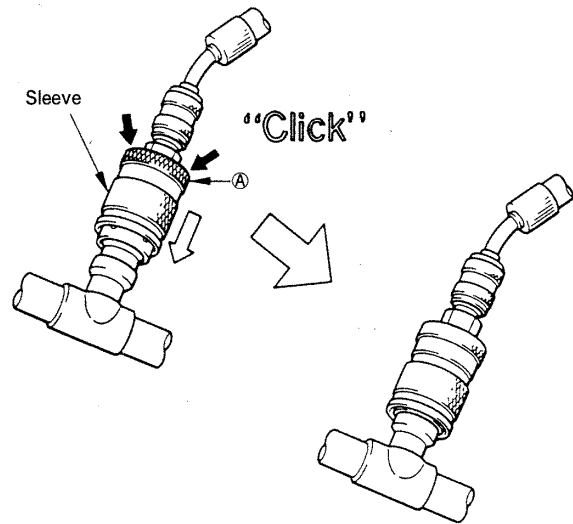


SAE quick joints HFC134a	
Low pressure	
High pressure	

Be sure to use the gauge manifold with the quick joints shown above.

(1) Attaching the gauge manifold

Put the quick joint to the service port and push it at until it clicks.

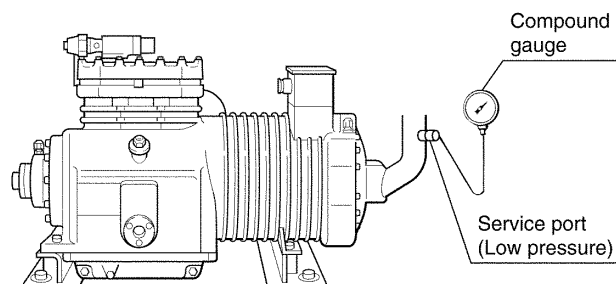


Caution


Be sure not to bend the refrigerant pipe when pushing the quick joint.

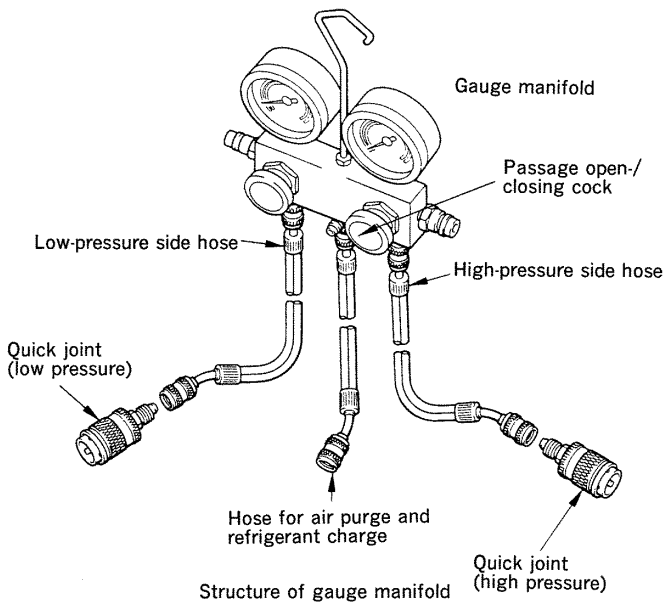
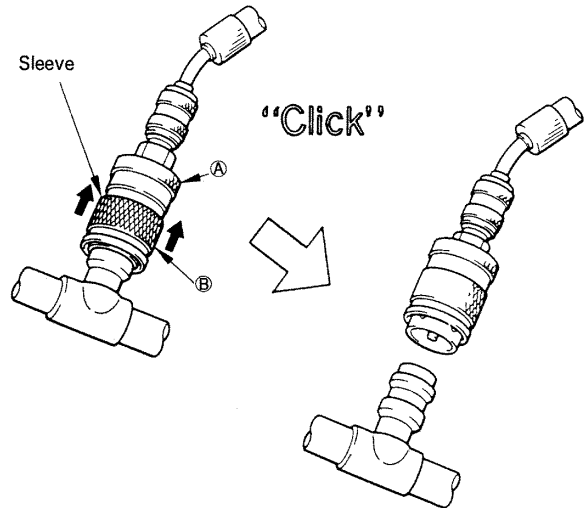
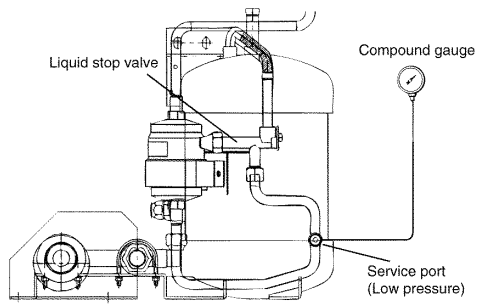
If the installation is failed due to movement of the sleeve, try it again after returning the sleeve at the original position.


The remaining pressure in the charge hose may cause the installation failure. In this case, try it again after removing the pressure in the hose.

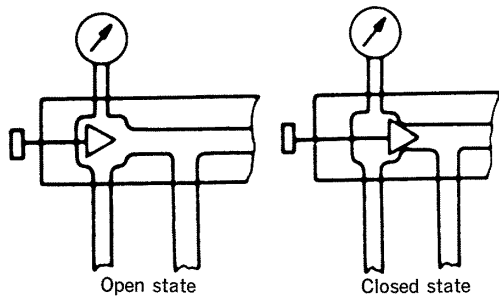


(2) Removal of pressure gauge and gauge manifold

Pushing the quick joint at , pull the sleeve upward and remove the quick joint from the service port.



 **CAUTION**
Be sure to attach the cap to the service port after the removal of the manifold.



Open and closed states of gauge manifold

6.3 Pump down

Pump down is the process that the refrigerant in the refrigerant circuit is liquidized and accumulated in the water-cooled condenser (or receiver). When the refrigerant circuit is repaired, this work is required to minimize the refrigerant leakage and to avoid the risk caused by the leakage or rising pressure.

Run the refrigeration unit in the cooling mode.

Close the liquid stop valve at the water-cooled condenser (or receiver) outlet.

Turn off the UNIT ON/OFF key when the low pressure reaches 10kPa (0.1 kg/cm²), and close the discharge stop valve of the compressor.

After a short while, open the compressor discharge valve and repeat the same procedure.

Repeat the same procedure a couple of times, and the refrigerant will be accumulated in the water-cooled condenser (or receiver).

6.4 Replacement and charge of refrigerant and refrigerating machine oil



CAUTION

Carry out the operation check after the replacement or charge of refrigerant or refrigerant machine oil, then replace a dryer.

(1) Purging non-condensable gas

If air or other non-condensable gas exists in the refrigerant circuit, it is accumulated in the water-cooled condenser (or receiver), which raises pressure in the water-cooled condenser (or receiver) abnormally high and reduces heat transferring ratio of the condenser surface. It is, therefore, very important to purge non-condensable gas.

If the discharge pressure is abnormally high (even though cooling water amount is increased in the water-cooled operation) and will not return to the normal pressure, inspect if air or other non-condensable gas exists by the following procedure.

● Stop the compressor, and close the water-cooled condenser (or receiver) outlet valve, then wait until leaving and entering cooling air (or water) of the air (water) - cooled condenser become equal. If there is any difference between saturated pressure corresponding to cooling air (water) and condensing pressure, non-condensable gas exists. In this case, purge non-condensable gas as stated below.

Accomplish pump down.

Condense the refrigerant as much as possible, and then discharge the gas from the service port of the compressor discharge side.

Reading the pressure gauge, discharge the non-condensable gas repeatedly until condensing pressure becomes saturated pressure.

(2) Refrigerant purging

There are two methods of refrigerant purging ; i.e. one is for accumulating the refrigerant purged in a cylinder and the other is accumulating the refrigerant by using a refrigerant recovery unit.

(a) Accumulate the refrigerant in a cylinder

Prepare an empty cylinder which has been dried and evacuated inside, and weigh it.

Connect the cylinder to the service port of the liquid line by the charging pipe with the cylinder cock closed, and then loosen the flare nut on the cylinder side a little to purge the air from the charging pipe.

Operate the refrigeration unit to pump down the refrigerant.

After the completion of pump down, open the service port at discharge stop valve of water cooled condenser (or receiver), then open the cock of the cylinder to accumulate the liquid refrigerant in it.

After the accumulation of the refrigerant, close the cock, and then remove the charging pipe.

Be certain that the refrigerant has been accumulated in the cylinder by weighing it.

As for the refrigerant remaining in the refrigeration circuit, release it to the atmosphere.

Note : Use the refrigerant recovery unit to accumulated refrigerant in the refrigeration unit, and be sure not to purge it to the atmosphere except emergency case.

(3) Vacuum-dehydrating, and refrigerant/refrigerating machine oil charging

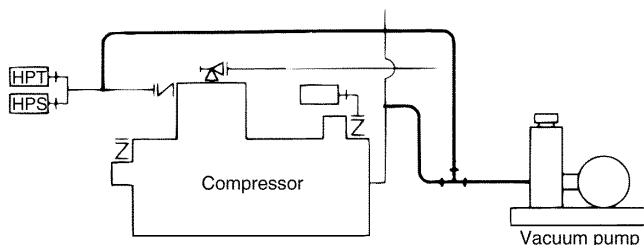
If all the refrigerant has leaked out and the air is intermixed in the refrigeration circuit, repair a cause of trouble and carry out vacuum-dehydrating. Then charge the specified amount of refrigerant. To replace the refrigerating machine oil, carry out the same procedure.

[Required tools]

1. Refrigerant cylinder (content of 20 kg) for HFC134a
2. Refrigerating machine oil (1 or 5 can) CASTROL ICEMATIC SW46
3. Gauge manifold with quick joints
4. Weighing scale (up to 50 kg)
5. Tools
6. Vacuum pump

(a) Charge of refrigerant alone without replacement of refrigerating machine oil

Connect the vacuum pump to the service ports of the compressor suction pipe and discharge pipe, and then vacuum up to 76cmHg. Disconnect the vacuum pump, holding the refrigeration circuit in the vacuum state setting the discharge stop valve to the back seat. Here, if air enters in the refrigerant circuit, vacuum up the circuit to 76cmHg for more than 2 hours. (Vacuum-dehydrating)



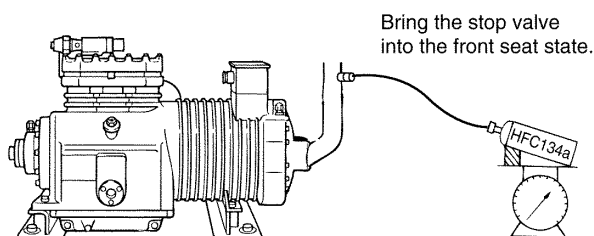
Place a refrigerant cylinder on the weighing scale, and record the weight of the cylinder.

Charge the specified amount of refrigerant

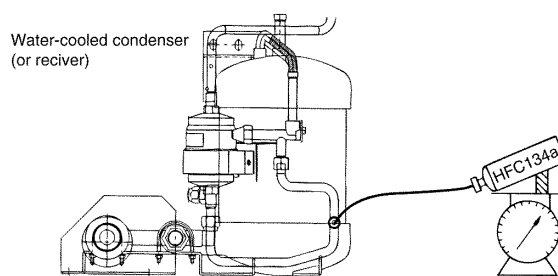
- In case of charging the liquid refrigerant

Charge the liquid refrigerant as shown in the figure (A) below. Make sure to prevent the liquid refrigerant accumulated in the water-cooled condenser (or receiver) from flowing to the low pressure side. If the refrigerant is hardly charged, charge the liquid refrigerant with the compressor running.

(A)



(B)



- In case of charging the gas refrigerant
Charge the gas refrigerant as shown in the figure (B) below. If the refrigerant is hardly charged, charge the gas refrigerant with the compressor running.

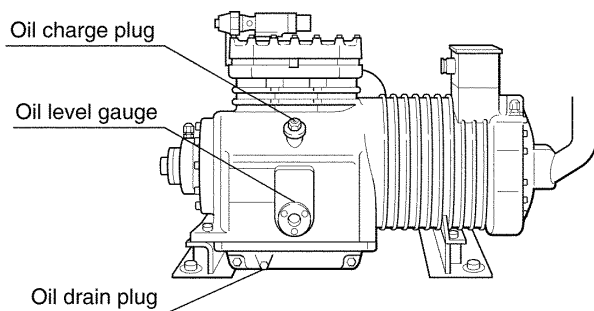
After completing the refrigerant charge, return the stop valve into the original state (back seat), then confirm that if the specified amount of the refrigerant has been charged by operating the unit.

(b) Charge of refrigerant and replacement of refrigerating machine oil

Refrigerating machine oil drainage procedure

Discharge all the gas to zero of the pressure in the refrigerant circuit.

Then, loosen the oil drain plug at the bottom of the compressor to extract all the oil. At this time, first remove the oil charge plug and then the oil drain plug to prevent the oil from spouting out.



Tighten up the oil drain plug.
Charge the specified amount of the oil from the compressor at the oil charge plug.
Accomplish the vacuum dehydrating and refrigerant charge stated in (a).

 **CAUTION**

- Stop the compressor before the refrigerating machine oil replacement.
- Remove the oil level gauge for cleaning when discarding the refrigerating machine oil.
- Charge the CASTROL ICEMATIC SW46 only as the refrigerating machine oil.
- Never attempt to mix other kinds of refrigerating machine oil.
- Do not use any oil whose can is left opened to the atmosphere for a long time as it may have contained moisture.

(c) Replacement of refrigerating machine oil only

- 1) Pump down the refrigeration unit. (For details, refer to section 7.3 "Pump down".)
- 2) After pump down, close the compressor discharge stop valve.
- 3) Release the remaining refrigerant in the compressor from the oil charge plug. (At this time, remain the refrigerant pressure a little, and the later draining work will be done faster.)
- 4) Loosen the oil drain plug at the bottom of the compressor, and discharge all the oil.
- 5) Remove the level gauge for cleaning after draining the refrigerating machine oil.
- 6) Close the oil drain plug.
- 7) Charge the specified amount of the refrigerating machine oil from the compressor at the oil charge plug.
- 8) Vacuum-dehydrate the inside of compressor at the oil charge plug.
- 9) Return the stop valve into the original state.
- 10) Charge the following specified refrigerating machine oil only.
Manufacture CASTROL
Type ICEMATIC SW46
- 11) Take sufficient care to handle the refrigerating machine oil. (To avoid moisture mixture, different-oil mixture.)



CAUTION

Take the following care to handle the can which contains the refrigerating machine oil.

1. Open the can just before charging the oil . Once the can is opened, use all the oil in the can at once.

Replace the air in the empty space which is produced by the used oil with the dry air or dry nitrogen gas. Pour the small amount of remaining oil into a small container (with label) which can be excellently sealed.

※Since the commercially available refrigerating machine oil is filled in the can in the dry state (approx. 50ppm as the moisture contents), take the following care to handle the can.

Since ICEMATIC SW46 is hygroscopic ester oil, moisture will be absorbed to approx. 1500ppm if it is exposed to the atmosphere.

2. As possible, select a dry day for the oil replacement.
3. Never leave the can opened for 5 hours or longer.
4. Be sure not to charge the refrigerating machine oil whose can is left open for along time since it may cause the refrigerating machine oil being exposed to the moisture.

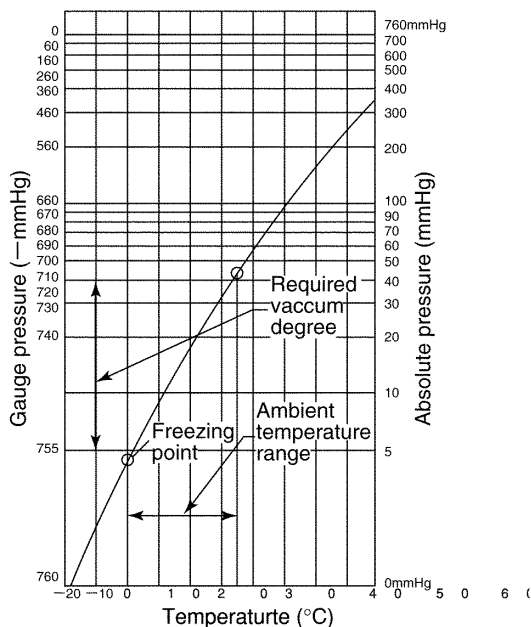
6.5 Vacuum dehydrating

After repairing the refrigerant system, vacuum-dehydrate the system before charging the refrigerant and refrigerating machine oil.

Vacuum-dehydrate is the process to make the circuit dry by purging the moisture (liquid) in the circuit to outside in state of vapor (gas) using the vacuum pump.

As the pressure is lower than normal atmosphere (760mmHg), the boiling point of water will rapidly drop. If the boiling point drops beyond the atmospheric temperature, water will be vaporized.

Example : If the atmospheric temperature is 7.2°C (45°F), vacuum-dehydrating will be impossible unless the vacuum degree is lower than -752mmHg. For vacuum-dehydrating, it is important to select and maintain the vacuum pump.



(1) Vacuum pump selection

Select a vacuum pump considering the following points.

Select the vacuum pump whose vacuum achievability is excellent.

(A pressure of -755mmHg or lower is required.)

The displacement must be relatively large (approx. 40 /min. or more).

Before vacuum-dehydrating operation work, be sure to use the vacuum gauge to confirm that the pump reaches the pressure of -755mmHg or lower.

Boiling point of water (°C)	Atmospheric pressure (mmHg)	Vacuum degree (mmHg)
40	55	-705
30	36	-724
26.7	25	-735
24.4	23	-737
22.2	20	-740
20.6	18	-742
17.8	15	-745
15.0	13	-747
11.7	10	-750
7.2	8	-752
0	5	-755

(Reference) Kinds of vacuum pumps and achievable vacuum

Type	Achievable vacuum displacement	Application	
		Vacuum dehydrating	Air exhaust
Oil rotary type (oil-necessary type)	-759.98mmHg 100 /min.	Applicable	Applicable
Oilless rotary type (oil-unnecessary type)	-750mmHg 50 /min.	Inapplicable	Inapplicable
	-759.98mmHg 40 /min.	Applicable	Applicable

Take care that this type is often used as the handy type.

On the pump of an oil rotary type, it is important to replace oil and check the achievability every 1 to 2 months.

(2) Vacuum-dehydrating method

There are two methods of vacuum-dehydrating of normal vacuum-dehydrating and special vacuum-dehydrating. In general, the normal vacuum-dehydrating is applied. If any moisture is ingressed in the circuit, apply the special vacuum-dehydrating method.

[Normal vacuum-dehydrating]

Vacuum dehydrating (first time)

Connect the gauge manifold to the service ports of the liquid line and the suction line. Run the vacuum pump for 2 hours or longer. (The achievable vacuum must be -755mmHg or lower.)

If a pressure of -755mmHg or lower can not be achieved even after evacuation of 2 hours, moisture or leakage may exist in the system. In this case, run the pump another hour or more. If a pressure of -755mmHg or lower can not be achieved even after evacuation of 3 hours or more, check for leakage.

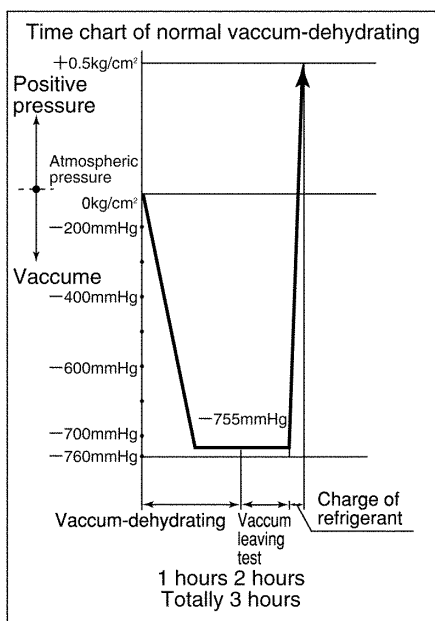
Note : Evacuate the system from the service ports of both liquid and suction lines.
Because the system is blocked on the way since the liquid solenoid valve is provided on the way of the system.

Vacuum holding test

Hold the system at a pressure of -755mmHg or lower for 1 hour or longer, and confirm that the reading does not rise on the vacuum gauge. If it rises, moisture or leakage may exist in the system. Here, take care not to leak air from the gauge manifold. If air may ingress, it is recommended to use the copper tube directly instead of gauge manifold.

Charge of refrigerant

After the vacuum-holding test, evacuate the circuit again for approx.10 minutes. Then, charge the specified amount of refrigerant through the service port of the liquid line using the charging cylinder. Fully open stop valves
Fully open the liquid stop valve and the suction stop valve.



[Special vacuum-dehydrating]

This method is that the vacuum breaking process with nitrogen gas is integrated one time or more on the way of the normal vacuum-dehydrating process.

Vacuum-dehydrating (first time)
..... 2 hours

Vacuum-breaking (first time)
Nitrogen gas is pressurized to 0.5kg/cm^2 . Since nitrogen gas breaks the vacuum, the effect of the vacuum-dehydrating is achieved. However, if there is much moisture, it can not be removed by this method. Therefore, do not make water ingress or produce water during the refrigerant piping work.

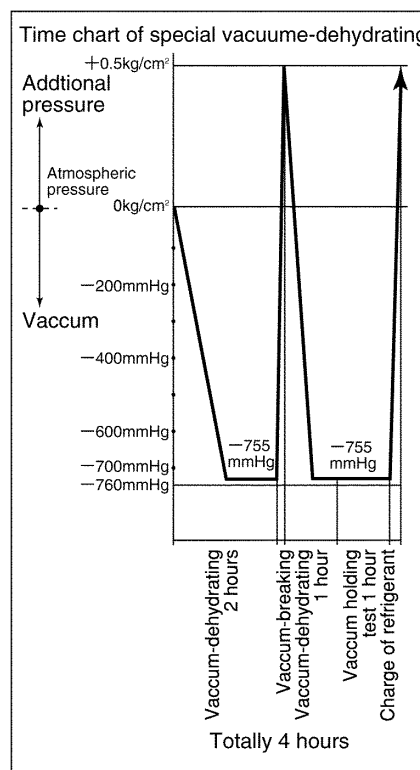
Vacuum-dehydrating (second time)
Run the vacuum pump one hour or longer. (The achievable vacuum must be -755mmHg or lower.)

If pressure of -755mmHg or lower can not be achieved even after evacuation of 2 hours, repeat Steps vacuum-breaking and vacuum-dehydrating.

Vacuum holding test
.....1hour
Same as normal vacuum-dehydrating

Charge of refrigerant

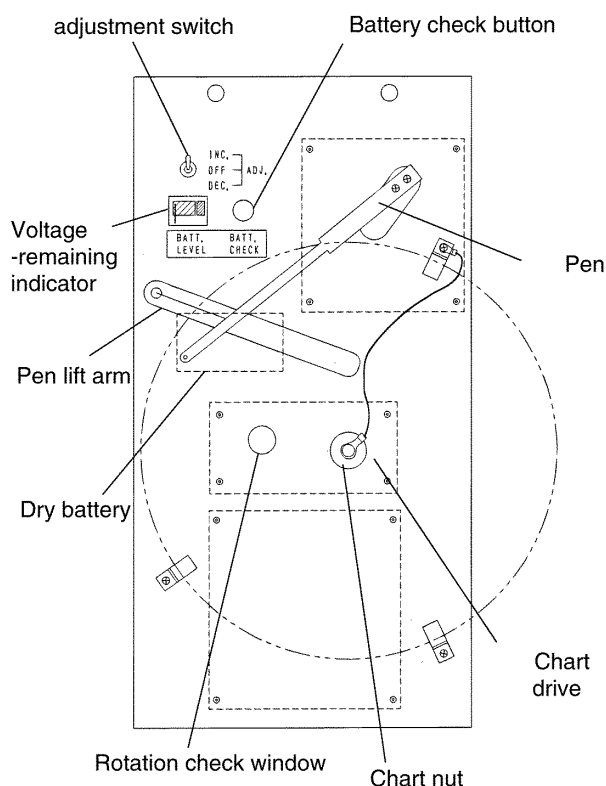
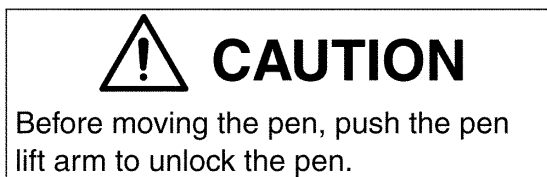
Note : Make sure to use nitrogen gas for vacuum-breaking. (If any oxygen gas is used, it may explode.)



$(1\text{mmHg}=0.0013\text{kg/cm}^2=0.133\text{Kpa})$

7. Electronic temperature recorder

This recorder automatically records the control temperature (either return air temperature or supply air temperature) with the chilled/partial frozen and frozen switching signals. The maintenance and inspection functions including the sensor failure detecting function and calibration function are integrated.



(1) Specifications

- Model : DER9601A
- Power supply: AC13V 50/60Hz
- Recording temperature range :
-30.0~+25.0°C
(-22~+77°F)
- Chart paper : Round type 8-inch pressure-sensitive paper
[PARTLOW PSD-217C (REV.A) or equivalent]
(31days/rev.)
- Chart driving battery :
JIS C8501SUM2 } Equivalent
IECR14 } (DC1.5V)
Battery life
Approx. 1 year (Check with the voltage-remaining indicator)
- Voltage-remaining indicator (optional)
 - Green zone : Operable
 - Silver zone : Usable for 7 days
 - Red zone : Battery replacement is necessary.
- Recording pen driving system :
Pulse motor drive
- Senser (Thermistor)

Model	Use
ST9503-4	For RSS : Recorder Supply air Sensor
ST9503-2	For RRS : Recorder Return air Sensor

Note : Recording Accuracy

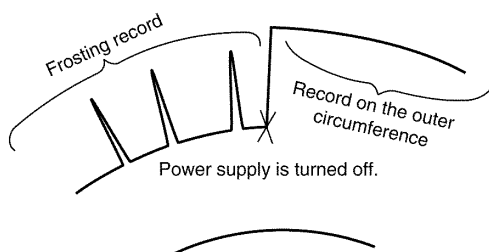
The accuracy of the recorder and the sensor are shown in the following table.

The calibration is applicable only on the recorder.

Recording temperature range	Accuracy °C		
	Recorder	Sensor	Total
25°C to 10°C	±1.0	±1.0	±2.0
10°C to -15°C	±0.5	±0.3	±0.8
-15°C to -29.9°C	±1.0	±1.0	±2.0

- Temperature record with power supply turned off

When the power supply is turned off, the pen will move to the outer circumference of recording sheet simultaneously.

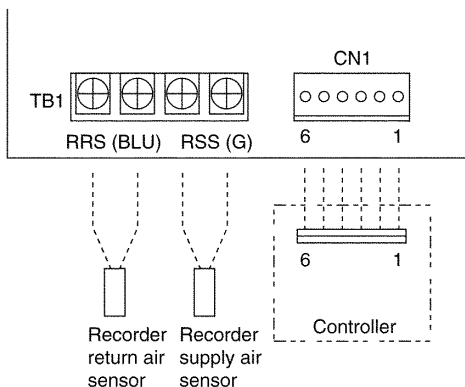


(2) Devices and schematic wiring diagram

1) Devices

Device	Location
Temperature recorder board	In the temperature recorder box
Recorder return air sensor (RSS)	Evaporator suction area
Recorder supply air sensor (RSS)	Evaporator discharge area

2) Schematic wiring diagram



(3) Checking (Calibration) of the indicated value on the recorder

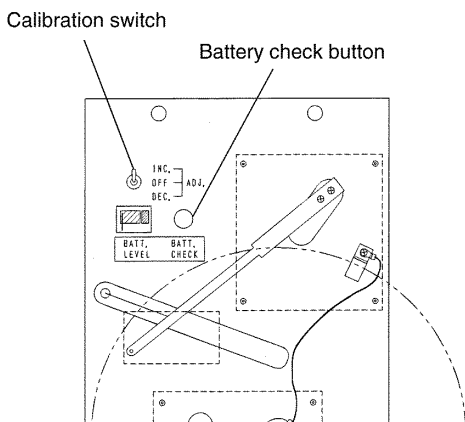
This recorder can be checked for its switching function for recording sensors and temperature indication functions regardless of inside temperature, and can be adjusted.

1) Switching function for recording sensors

The temperature recorder automatically switches the recording sensors according to the set point temperature set on the controller.

(RSS for frozen and partial frozen modes, RSS for chilled mode)

Set point temperature (°C)	Recording sensor
-30.0 to -3.0	Return air sensor
-2.9 to 25.0	Supply air sensor

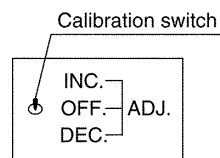


2) Pen adjusting function

Recording temperature is adjustable by changing the pen position using the calibration switch.

INC : To increase temperature figure

DEC : To decrease temperature figure

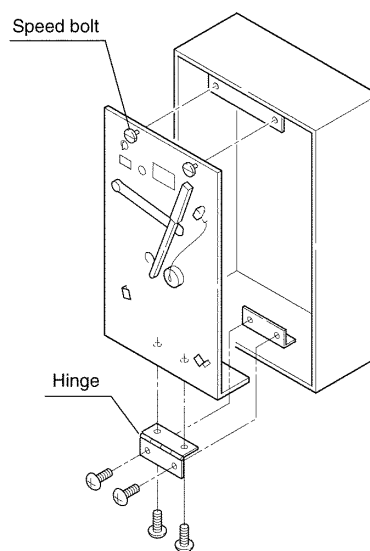


Notes :

1. The pen is adjusted to suit to the PSD-217C (REV.A) recording chart paper or its equivalent.
Do not use the recording charts other than ones mentioned above.
2. Do not change the position of pen during transportation.
3. When the power is supplied, the pen vibrates momentarily and will return to its original position due to the recording characteristics, but this is not a sign of trouble.

(4) Replacement of temperature recorder

- Turn off the circuit breaker.
- Remove the wiring connector and sensors from the back of the temperature recorder.
- Remove the hinges on the bottom and the speed bolts on the top.

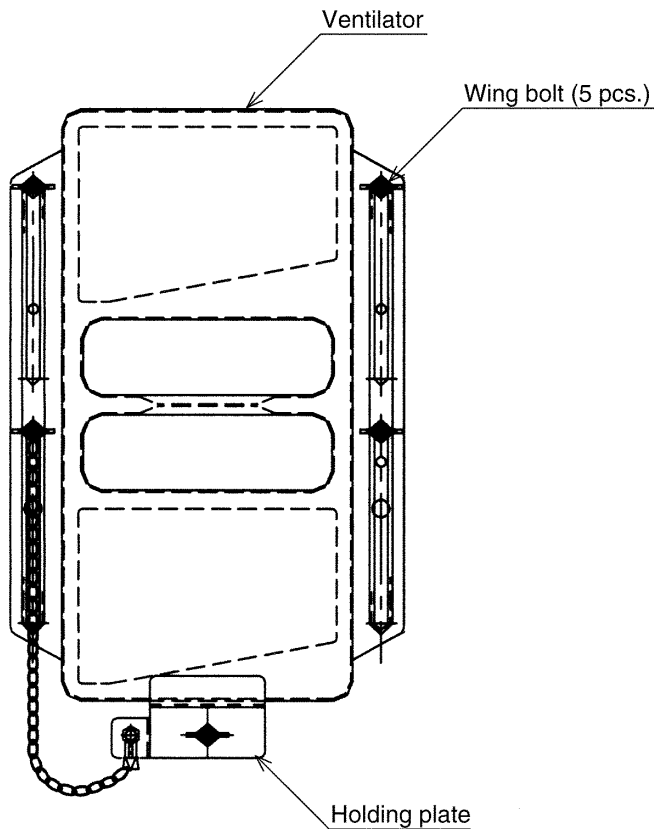


- Replace the temperature recorder board.
- After replacement, be sure to check the wiring.

8. VENTILATOR

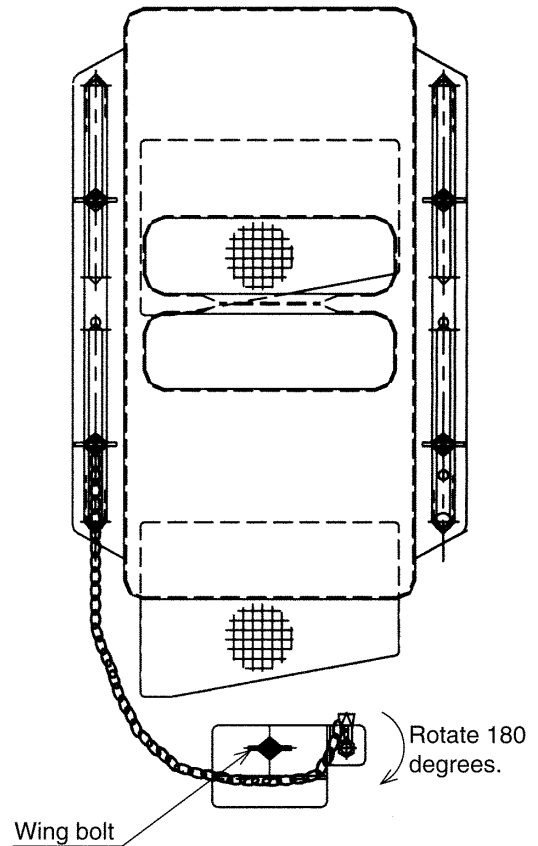
When opening/closing the ventilator, be careful of the following notes

- When fully closing the ventilator
 - ① Be sure to fix the bottom of the ventilator with the holding plate as shown in the figure below.
 - ② Securely tighten the wing bolts (5 pcs.).



When fully closing

- When opening the ventilator
 - ① Rotate the holding plate 180 degrees as shown in the figure above.
If the ventilator is opened without rotating the holding plate, the holding plate is cooled by cold air to form dewdrops.
 - ② Even when the holding plate is not used, be sure to fix the holding plate with a wing bolt.



When fully opening

<https://daikin-p.ru>

TROUBLESHOOTING

Coil resistance of each motor and solenoid valve (Normal valve)

- Compressor motor coil : 1,780 Ω (@75°C)
- Evaporator fan motor coil : 57.2 Ω
- Condenser fan motor coil : 19.4 Ω
- Liquid solenoid valve coil (LSV) }
• Hot gas solenoid valve coil (HSV) } : 15.2 \pm 1.1 Ω (common)
• Injection solenoid valve coil (ISV) }
- Electronic expansion valve coil (EV) : 150 Ω /PHASE
- Modulating control valve coil (MV) : 10.3 Ω

※These valve are at normal temperature exclude compressor.

1. Refrigeration system and electrical system

If the unit does not work properly, refer to the following table to find causes of trouble and provide appropriate measures.

State	Malfunction phenomenon	Abnormal point	Possible cause
Unit does not operate.	A. Neither evaporator fan, condenser fan nor compressor run	No trouble with unit	Power failure
			External power supply : OFF
			Disconnection of power plug
			Poor contact of power plug
		Circuit breaker	Circuit breaker : OFF
			Solenoid valve burned out or short circuit
			Contacting coil burned out or short circuit
			Short circuit of wiring
		UNIT ON/OFF Key Controller	Key : OFF or malfunction
		B. Evaporator fan rotates, but condenser fan and compressor do not rotate.	No trouble with unit
	Fuse (10A) burned out		
	Open phase (R or T)		
	Shut off due to happening of alarm		
	Inside temperature is lower than SP. (at frozen mode)		
	C. Condenser fan rotates, but evaporator fan and compressor do not rotate.	Actuation of electronic overcurrent protection device, PT/CT board	Overcurrent due to overload operation, etc
D. Compressor rotates, but evaporator fan and condenser fan do not rotate.	Transformer for fan motor	Wire breakage or open phase	
		Actuation of fan motor thermal protector	Fan locked by foreign material Not-closing of thermal protector contact point
E. Compressor buzzes, but it does not operate.		Open phase	
		Lock	
		Low supply voltage	
		Compressor fan motor burned out or short circuit	
Unit stops soon after operation.	A. Unit start but soon stops.	Actuation of high pressure sensor within 30 seconds after compressor starting	Discharge stop valve : closed
		Abnormal low pressure drop within 2 seconds after compressor starting	Liquid stop valve : closed
		Actuation of electronic overcurrent protection device, PT/CT board	Overcurrent due to overload operation, etc
		Actuation of compressor thermal protector	Overcurrent due to overload operation, etc
	B. Evaporator fan rotates, but condenser fan and compressor do not rotate.	No trouble with unit	During ON-OFF control operation in the frozen mode

State	Malfunction phenomenon	Abnormal place	Possible cause
┌ Unit stops soon after operation.	C. Condenser fan rotates, but evaporator fan and compressor do not rotate.	Actuation of high-pressure switch	Refrigerant overcharge
			Air ingress in the refrigerant system
			Insufficient air flow rate in the air cooled condenser
			○ Condenser finned coil clogged
			○ Air passage blocked by foreign material
			○ Broken blade of condenser fan
			○ Condenser fan motor rotation failure
			○ Actuation of condenser fan motor thermal protector
			○ Short circuit of condenser cooling air
			○ Wrong installation of condenser fan
		○ Reverse rotation of condenser fan	
		Insufficient cooling water flow rate	○ Water-cooled condenser clogged with scale
			Electronic overcurrent protection device, PT /CT board actuation
Abnormal low pressure drop	Electronic expansion valve clogged		
	Liquid stop valve : closed		
	Filter-dryer clogged		
Abnormal discharge gas temperature	Injection solenoid valve : closed		
	Injection capillary clogged		
	High pressure rises due to overload		
└ Inside temperature does not drop.	A. Suction pressure is high.	Poor compression of compressor	Damage on suction or discharge valve
			Abrasion of piston ring, damage on internal packing
		Modulating control valve	Valve clogged with contamination
		Electronic expansion valve	Electronic expansion valve malfunction
	B. Suction valve is excessively low.	Liquid solenoid valve (Not opened.)	Solenoid valve coil malfunction
			Shortage of refrigerant charge
		Dryer	Dryer clogged with contamination
		Liquid stop valve (Partially closed)	No attention to the valve
			Electronic expansion valve
		Valve clogged with contamination	
		Breakage of coil lead wire or disconnection of connector	
		Lead wire breakage or mis-mounting of heat exchanger inlet or outlet sensor	
		Electronic expansion valve body malfunction	
Evaporator		Abnormal frosting	
	Insufficient air flow rate in the evaporator		
	• Air passage blocked by foreign material		
	• Evaporator fan motor malfunction		
	• Evaporator fan damage or fall out		
	• Air short circuit of evaporator cooled air		
• Reverse rotation of evaporator fan motor			
C. Defrosting is not initiated.	MANUAL DEFROST Key	Continuity defective	
	Evaporator outlet sensor	Incorrect installation of sensor	

State	Malfunction phenomenon	Abnormal place	Possible cause			
Inside temperature does not drop.	C. Defrosting is not initiated.	Modulating control valve	Valve clogged with contamination Magnetic coil failure			
	D. Defrosting is operated frequently.	No trouble with the unit	Excessive amount of moisture in cargo			
		Injection solenoid valve	Leakage			
		Defrost timer	Short setting timer			
	E. Refrigeration unit is normal.	Container	High cargo temperature Poor thermal insulation or air leakage			
Inside temperature does not rise (in the heating mode).	A. Discharge pressure is low.	Poor compression of compressor	Damages on suction or discharge valve Worn-out of piston ring or damages on internal gasket			
		Modulating control valve	Hot gas leakage to condenser side			
		Injection solenoid valve	Valve clogged with contamination			
	B. Discharge pressure is high.	Evaporator fan	Damages on fan blade	Damages on fan blade Rotation failure of fan motor Actuation of fan motor thermal protector		
			Rotation failure of fan motor			
			Actuation of fan motor thermal protector			
Control is unstable.	A. Hunting	Modulating control valve	Valve clogged with contamination			
		Electronic expansion valve	Feeler bulb influenced by ambient temperature			
	B. Temperature continues dropping.	Modulating control valve	Valve clogged with contamination	Valve clogged with contamination Magnetic coil malfunction Wire breakage		
			Magnetic coil malfunction			
			Wire breakage			
	C. Temperature continues rising.	Modulating control valve	Valve clogged with contamination	Valve clogged with contamination		
		Electronic expansion valve	Valve clogged with contamination	Valve clogged with contamination		
		Evaporator	Insufficient evaporator air flow rate (Refer to ┘ —B— .)	Insufficient evaporator air flow rate (Refer to ┘ —B— .)		
		Dryer	Dryer clogged with contamination	Dryer clogged with contamination		
		Shortage of refrigerant charging amount	Refrigerant leakage	Refrigerant leakage		
Abnormal vibration or abnormal noise.	A. Abnormal noise is generated.	Compressor	Worn-out of fan motor bearing	Worn-out of fan motor bearing Damages on suction or discharge valve Loose-tightened bolt		
			Evaporator fan	Loose fan motor set bolt	Loose fan motor set bolt Deformation of fan motor set leg or loose-tightened bolt Crooked fan motor shaft Worn-out of fan motor bearing Deformation of fan guide Contact between fan and fan guide	
				Condenser fan	Loose-tightened fan motor set bolt	Loose-tightened fan motor set bolt Bending of fan motor shaft Worn-out of fan motor bearing Deformation of fan guide Deformation of condenser front panel
		Bending of fan motor shaft				
		Worn-out of fan motor bearing				
		B. Abnormal vibration generates.		Compressor	Loose-tightened set bolt	Loose-tightened set bolt
				Piping	Loose-tightened or missing of clamp bolt	Loose-tightened or missing of clamp bolt

2. Alarm codes on electronic controller

If any alarm occurs, search its cause and repair it referring to the following table.

Be sure to check the connectors in the electronic controller as the poor contact of them may cause the controller alarm codes.

Alarm code	Content	Possible cause			
F101	The high-pressure switch (HPS) actuates within 30 seconds after the compressor start or the protecton devices actuation at unit start -up.	The discharge stop valve is closed.			
		The wiring lead of the high-pressure switch is cut.			
		The high-pressure switch is defective.			
		The high-pressure switch contact is defective.			
		The condenser fan motor is defective.			
Printed-circuit board failure					
F109	The low pressure becomes —72kpa or lower within 2 seconds after compressor starts.	The liquid stop valve is closed.			
		The low pressure transducer (LPT) value is abnormal.	CPU board failure The low pressure transducer failure		
F111	High-pressure switch (HPS) does not actuate at set value.	High-pressure switch is disconnected.			
		High-pressure transducer is disconnected.			
F301	Temperature setting request	Set point temperature is not set.			
		Failure of SRAM (on CPU board)			
F401 F403	In the chilled or partial frozen mode, the supply air sensor (SS) or return air sensor (RS) is defective.	Short circuit or breakage of both sensor lead wires			
		Wrong wiring connection on both sensors			
F603	The modulating control valve does not fully open although it is set to be full-open.	Both sensors defective			
		CPU board malfunction			
F701	Abnormal power voltage Note 1	Electronic expansion valve coil is broken.			
		Electronic expansion valve body malfunction			
F705	S phase is open phase	The voltage selector is in poor contact.			
		The circuit breaker is in poor contact.			
		Power plug is in poor contact.			
		Power cable breakage			
		Open phase of power supply			
F803	Any following error codes are counted 5 times E101 · E103 · E105 · E107 E109 · E203 · E707	Refer to the possible cause of the left error code.			
E101	The high-pressure switch (HPS) actuates during operation.	Refrigerant is overcharged.			
		Wrong refrigerant is charged. (ie HCFC22)			
		Air ingressed in the refrigerant system			
		Insufficient air flow rate	Fins are clogged		
			Air passage is blocked by some foreign material.		
			Short circuit of condenser cooling air		
			Wrong installation of condenser fan		
			Condenser fan rotates reverse.		
			Condenser fan breakage		
		Condenser fan fell out.			
		Ambient temperature is abnormally high.			
		Condenser fan motor running is abnormal	Motor stops due to thermal protector actuation.	Clogged finned coil.	
				Air passage is blocked by some foreign material.	
			Motor does not run.	Wiring lead breakage	
		Water-cooled condenser capacity is decreased.	Shortage of cooling-water		
Cooling-water temperature rise					
Clogged with scale					
HPS malfunction					
Wiring lead breakage					
Poor connection with terminal block board					
Wrong wiring of high pressure switch					
CPU board malfunction					
I/O board malfunction					

Note1 : If S phase is open, F701 may occur. When F701 and F705 are displayed together, inspect the S phase for opening.

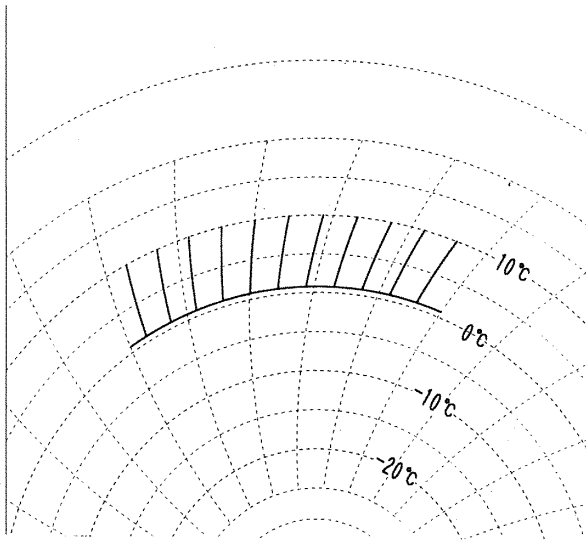
Alarm code	Content	Possible cause			
E103	Electronic overcurrent protector (electronic overcurrent protection device) actuates. Compressor thermal protector (CTP) actuates.	Compressor lock			
		CPU board malfunction			
		I/O board malfunction			
		PT/CT board malfunction			
		Shortage of refrigerant amount	Refrigerant leakage		
			Wiring lead breakage		
			Defective wiring		
			Coil burned out		
		Injection solenoid valve is not opened.	Coil fell out		
			Injection capillary is clogged.		
Compressor thermal protector (CTP) malfunction					
Compressor malfunction (Compressor lock)					
E105	Micro-computerized overcurrent protector (micro-computerized overcurrent protection device) actuates.	Compressor malfunction (Compressor lock)			
		Excessive refrigerant supply during defrosting and metering heating	Injection solenoid valve is not closed due to foreign materials.		
		The current sensor (CT2) value is abnormal.	CPU board malfunction Current sensor malfunction		
E107	Discharge gas temperature sensor (DCHS) becomes 130°C or higher during operation.	Injection solenoid valve operates improperly.	Valve is clogged with contamination		
			Wire lead breakage		
			Wrong wiring		
			Coil burned out		
		Injection capillary is clogged.	Coil fell out		
			High pressure is abnormally high.		
		Overcharge of refrigerant			
		Compressor valve breakage or internal gasket damage			
		Refrigerant shortage			
		Dryer is clogged			
		Excessive frost on the evaporator			
		Discharge gas temperature sensor value is abnormal.	CPU board malfunction		
			Sensor failure		
Evaporator outlet sensor failure during defrosting					
E109	Low pressure continues to be -72kpa or lower for 20 seconds.	Insufficient refrigerant flow	Shortage of refrigerant amount		
			Refrigerant leakage		
		Liquid solenoid valve is not opened.	Valve clogged with contamination		
			Wiring lead breakage		
			Wrong wiring		
			Coil burned out.		
		Electronic expansion valve dose not actuate. (Clogging)	Coil fell out		
			Valve clogged with moisture		
			Valve clogged with foreign material		
			Coi wiring lead breakage or connector disconnection		
			Heat exchanger inlet or outlet sensor wiring breakage or wrong installation		
		Electronic expansion valve malfunction			
		Dryer is clogged.			
		Liquid stop valve is closed			
		Excessive frost on evaporator	Evaporator fan insufficient air circulation	Air passage is blocked by foreign material.	
				Evaporator fan breakage	
				Air-short circuit around evaporator	
Reverse rotation of evaporator fan					
Evaporator fan fell out					
Evaporator fan motor does not run.	Wrong wiring				
	Fan motor thermal protector actuates.		Wiring lead breakage		
			Wrong wiring		
			Air passage is blocked by foreign material.		

Alarm code	Content	Possible cause			
E109	Low pressure continues to be -72kpa or lower for 20 seconds.	Excessive frost on evaporator	Air leaks on the access panel. Ventilator is open. (at frozen mode)		
		Low-pressure transducer (LPT) value is abnormal.	CPU board malfunction Sensor malfunction		
E201	Pull-down does not end within 120 seconds.	Liquid solenoid valve does not close.	Valve clogged with contamination		
			Lead wire breakage		
			Wrong wiring		
			Coil burned out		
			Coil fell out		
		Compressor valve lead breakage or internal gasket damage			
		Injection solenoid valve does not close.	Valve clogged with contamination		
			Lead wire breakage		
			Wrong wiring Coil burned out Coil fell out		
		Leakage of modulating valve	Valve clogged with contamination		
Low pressure sensor value is abnormal.	Printed-circuit board malfunction Pressure sensor malfunction				
E203	Overcool protection function actuate (control sensor \leq SP-3.0) in the chilled or partial frozen mode for 2 minutes or longer.	Modulating valve does not open fully.	Lead wire breakage		
			Wrong wiring		
			Coil burned out		
			Coil fell out		
			Valve clogged with contamination		
		Insufficient evaporator fan air flow rate	Air passage is blocked by foreign material. Evaporator fan damage Air short circuit around evaporator		
			Evaporator fan motor thermal protector activates.	Evaporator fan interferes with guide. Lead wire breakage Air passage is blocked by foreign material.	
		E207	Defrosting time is 90 minutes long.	Evaporator outlet sensor gets off from the evaporator outlet tube.	
				Insulation pipe cover of evaporator outlet sensor is improperly installed.	
				Evaporator outlet tube thermosensor is defective.	
Modulating valve does not open fully.	Lead wire breakage				
	Coil burned out				
	Valve clogged with contamination				
Injection solenoid valve does not open.	Lead wire breakage				
	Wrong wiring				
	Coil burned out				
	Coil fell out				
Valve clogged with contamination					
High-pressure transducer or low-pressure transducer malfunction.					
Evaporator outlet sensor value is abnormal.	Printed-circuit board malfunction Sensor malfunction				
E303	Humidity setting request	CPU board (SRAM) malfunction	Resetting		
E305	Defrosting interval setting request				
E307	Calendar setting request				
E311	Trip start setting request				
E401	Supply air temperature sensor (SS) malfunction	Open circuit			
		Short circuit			
		Wrong wiring			
		Sensor value is abnormal.	Printed-circuit board malfunction		
E402	Data recorder supply air temperature sensor (DSS) malfunction	Line breakage			
		Short circuit			
		Wrong wiring			
		Sensor value is abnormal.	Printed-circuit board malfunction		

Alarm code	Content	Possible cause
E403	Return air temperature sensor (RS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E404	Data recorder return air temperature sensor (DRS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E405	Discharge temperature sensor (DCHS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E406	Suction gas sensor (SGS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E407	Evaporator inlet sensor (EIS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E409	Evaporator outlet sensor (EOS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E411	Ambient sensor (AMBS) malfunction	Line breakage
		Short circuit
		Wrong wiring
		CPU board malfunction
E413	Low pressure transducer (LPT) malfunction	Lead line breakage
		Wrong wiring
		Defective main body
		CPU board malfunction
E415	High pressure transducer (HPT) malfunction	Lead line breakage
		Wrong wiring
		Defective of the high pressure sensor
		CPU board malfunction
E417	Voltage sensor (PT1) malfunction	Sensor malfunction
		CPU board malfunction
E419	Voltage sensor (PT2) malfunction	Sensor malfunction
		CPU board malfunction
E421	Current sensor (CT1) malfunction	Sensor malfunction
		CPU board malfunction
E423	Current sensor (CT2) malfunction	Sensor malfunction
		CPU board malfunction
E425 E427 E429	Pulp temperature sensor (USD1 to 3) malfunction	Wrong wiring in the relay terminal box
		Line breakage in the relay terminal box
		Short circuit in the junction terminal box
		Junction cable breakage
		Junction cable poor contact
		Wrong wiring in the control box
		Short circuit in the control box
		Pulp temperature sensor malfunction
		CPU board malfunction
E431	Humidity sensor (HuS) malfunction	Lead wire breakage
		Wrong wiring
		Humidity sensor malfunction
		CPU board malfunction
E603	Line breakage of modulating valve (MV) or drive circuit malfunction	Lead wire breakage
		Wrong wiring
		CPU board malfunction

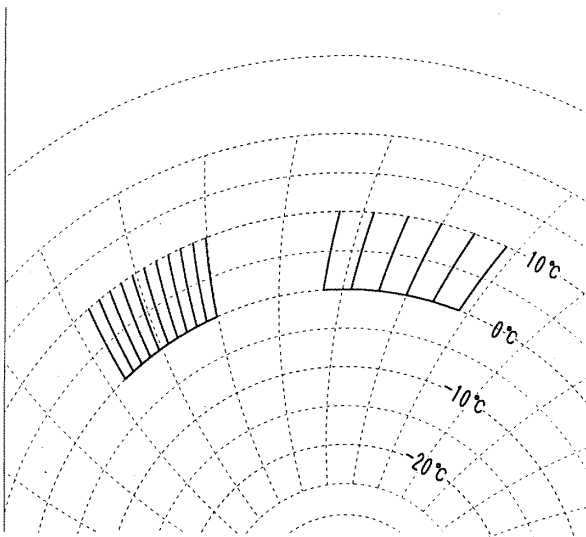
Alarm code	Content	Possible cause
E607	Abnormal contact point of manual defrost key	Switch malfunction
		Short circuit
		CPU board malfunction
E707	Momentally power loss	Commercial power supply stops for 40 to 300msec.
E801	Battery replacement request	Service life is exceeded.
E805	Dipswitch is improperly set (USDA sensor)	Sensor is connected but it is regarded as no-setting.
		CPU board malfunction
E807	Dipswitch is improperly set (Hu sensor).	Sensor is connected but it is regarded as no-setting.
		CPU board malfunction

3. Diagnosis based on the recording chart



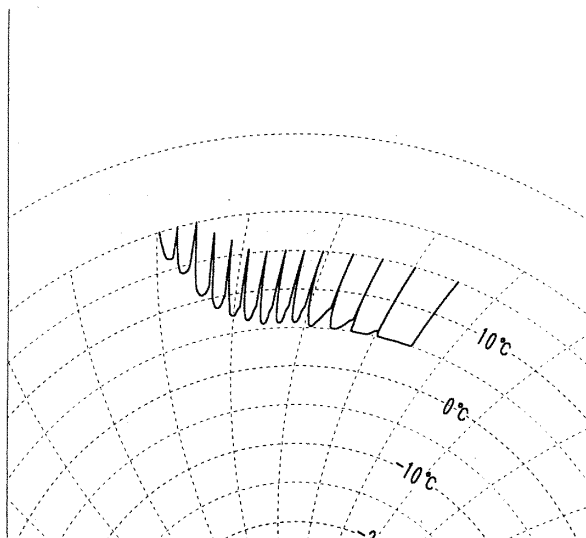
Set point temperature	0°C
Phenomenon read out from the recording chart	
Defrosting is periodically executed by the timer.	

Abnormal content and abnormal point	
Normal	



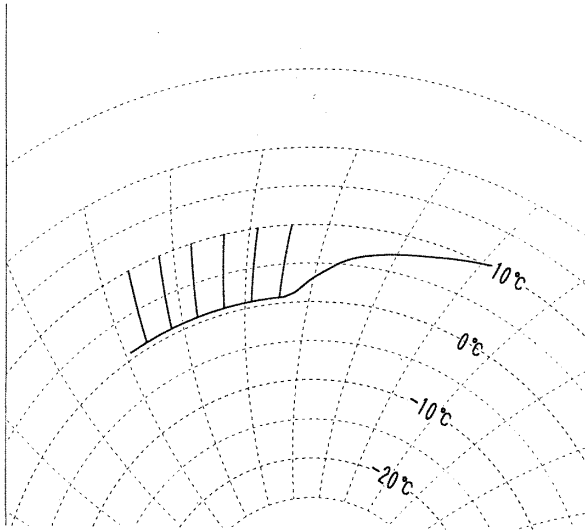
Set point temperature	0°C
Phenomenon read out from the recording chart	
The recording paper is not properly fed since the chart nut which retains the recording chart is loose.	
(Left side)	

Abnormal content and abnormal point	
Fasten the chart nut, then it will return to normal.	
(Right side)	



Set point temperature	5°C
Phenomenon read out from the recording chart	
When moisture in the cargo is excessive or when fresh air amount is excessive, the cooling capacity becomes insufficient during pull-down operation since frosting occurs excessively. Since the temperature rises before reaching the set point temperature, defrosting is repeated at outside of the in-range temperature.	

Abnormal content and abnormal point	
The operation is not abnormal. Until the amount of the frost on the evaporator is to be reduced, defrosting with the short timer is repeated. In 2 to 3 days, defrosting interval will return to normal.	



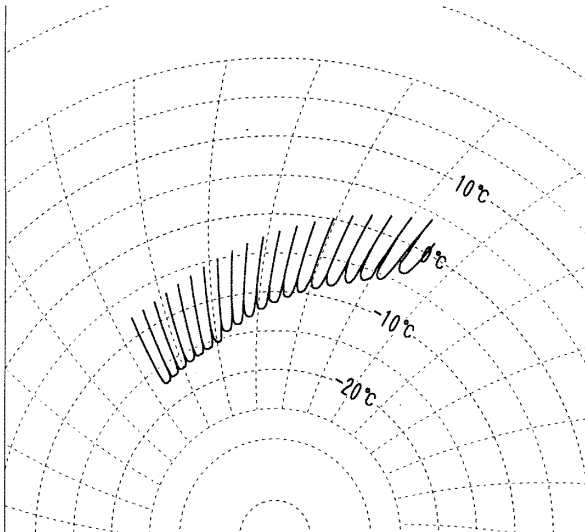
Set point temperature 0°C

Phenomenon read out from the recording chart

Though the temperature record is normal, the temperature rapidly rises.
Temperature has been recorded normally, but rised suddenly.

Abnormal content and abnormal point

Due to abnormality, the compressor stops or the fusible safety plug is molten.



Set point temperature -18°C

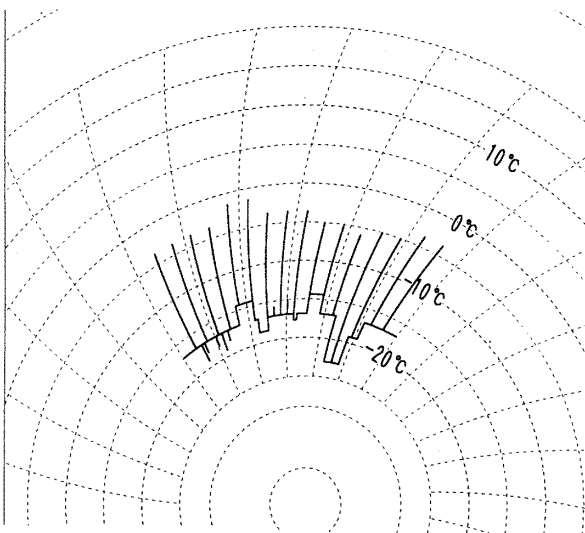
Phenomenon read out from the recording chart

Though defrosting is periodically executed, the inside temperature gradually rises.

Abnormal content and abnormal point

Due to the insufficient cooling capacity, the inside temperature rises.

- Refrigerant amount is short due to leakage.
- Compressor valve is broken.
- Hot gas bypasses due to leakage through the modulating control valve.
- Expansion valve or liquid solenoid valve are clogged.
- High pressure rises due to shortage of air blow rate of the condenser.



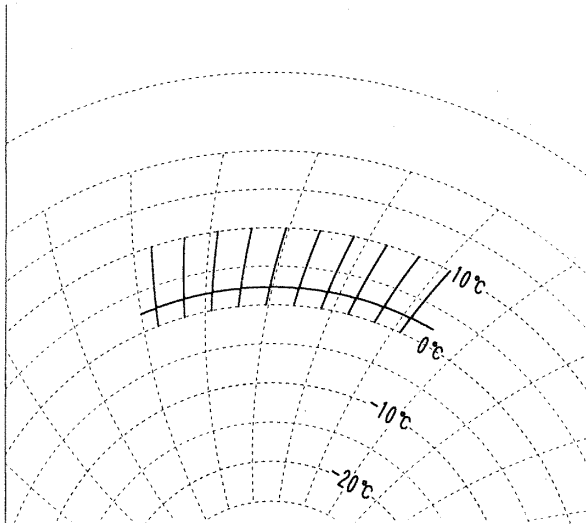
Set point temperature -18°C

Phenomenon read out from the recording chart

The recording temperature suddenly varies.

Abnormal content and abnormal point

The connector in the temperature recorder is in poor contact.

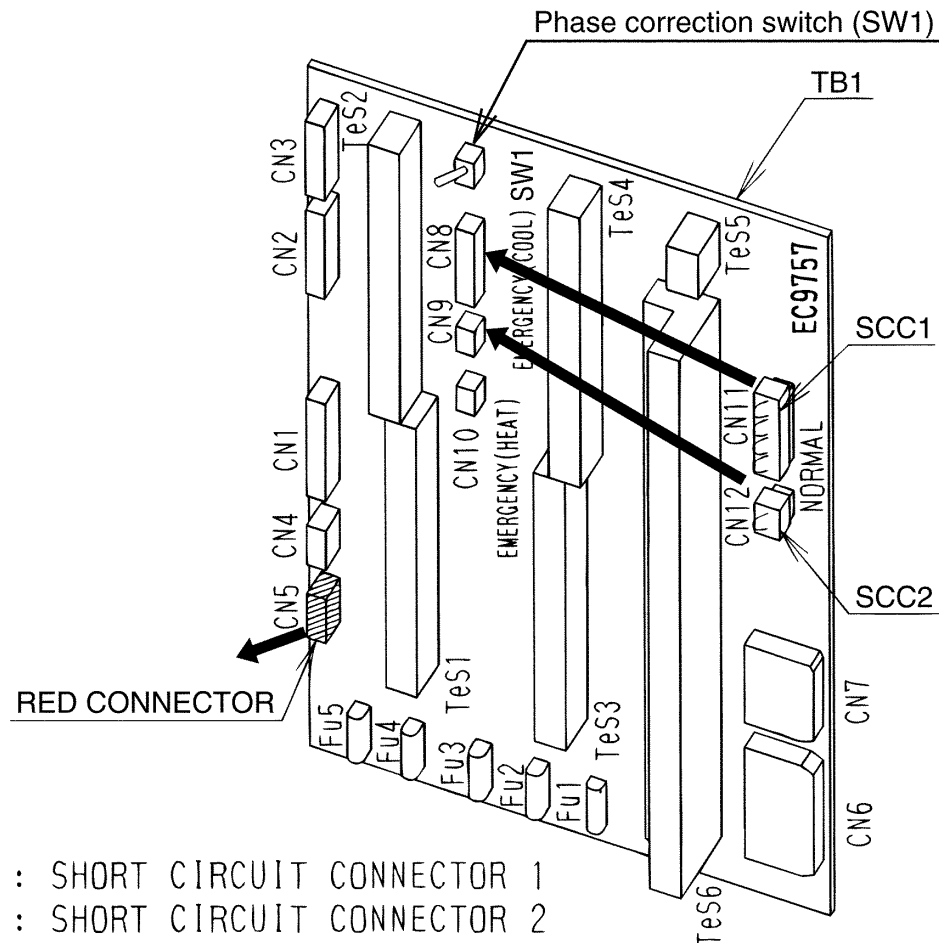


Set point temperature	0°C
Phenomenon read out from the recording chart After defrosting, the inside temperature temporarily drops.	
Abnormal content and abnormal point Since the liquid solenoid valve is not closed, pump-down operation before defrost starts is not performed, and cooling operation continues with the evaporator fan stopped. After 2 min. of forced defrosting termination signal, the normal operation starts but the evaporater is still cold.	

4. Emergency operation

4.1 Controller trouble

[Cooling operation]



(1) Procedure

1. Disconnect the power supply connector (Red connector).
2. Disconnect both 8 pin and 2 pin on the normal side, then connect them on the emergency position (Cool).
3. Open the electronic expansion valve manually.
Refer to section 4.3 for detail.

(2) Operating condition at emergency

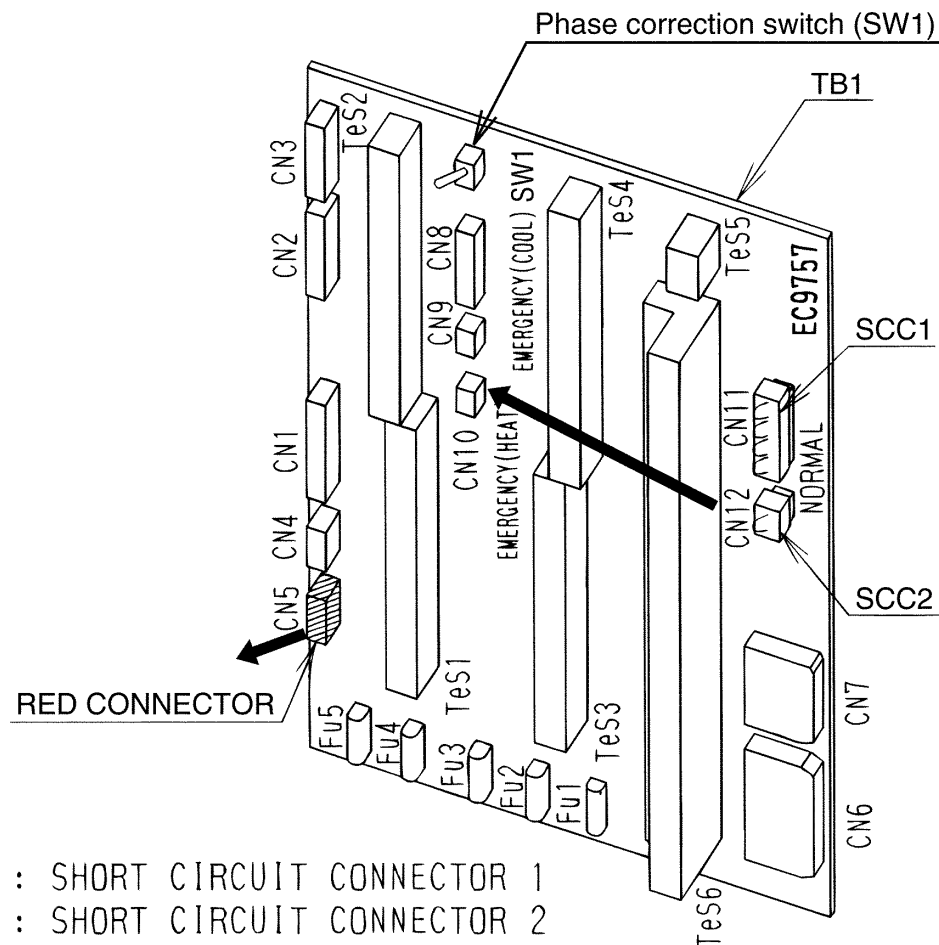
[Available functions of protection devices]

HPS (High pressure switch), CTP (Compressor thermal protection switch)

[Operation mode]

- Compressor runs. (Continuous operation)
- Evaporator fan runs at Low speed. (Continuous operation)
- Condenser fan runs. (Continuous operation)
- Opening rate of expansion valve is fixed with emergency coil cap.
- Fan direction can be changed with the phase correction switch.

[Heating operation]



(1) Procedure

1. Disconnect the power supply connector (Red connector).
2. Disconnect only 2 pin on the normal side, then connect it on the emergency position (Heat).
3. Open the electronic expansion valve manually.
Refer to section 4.3 for detail.

(2) Operating condition at emergency

[Operation mode]

- Evaporator fan runs at High speed. (Continuous operation)
- Compressor stops.
- Condenser fan stops.

4.2 Supply/return air temperature sensors trouble

When the unit is equipped with the data recorder sensors (optional), the following emergency operations are available.

When the DRS and the DSS are used for the emergency operation, DATA RECORDER SENSOR ON/OFF SETTING to be set OFF. (Refer to section 8, Basic function setting mode.)

RS : Return air temperature sensor

SS : Supply air temperature sensor

DRS : Data recorder return air temperature sensor

DSS : Data recorder supply air temperature sensor

RRS : Recorder return air temperature sensor

RSS : Recorder supply air temperature sensor

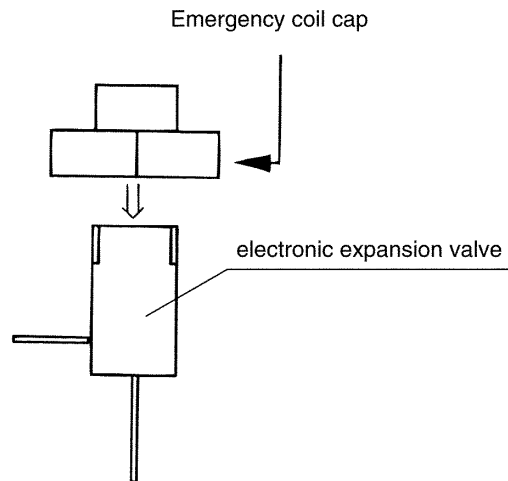
Error code	Abnormal point	Unit Back-up operation	Check content	Measure
E401	Supply air temperature sensor (SS) malfunction	Chilled mode : Back up operation terminals starts when RS to be -2°C Frozen mode : Only error code indication	Check connectors and crimp style for tightness.	Exchange the connection of SS and DSS.
E402	Data recorder supply air temperature sensor (DSS) malfunction	Only error code indication	Check connectors and crimp style terminals for tightness.	———
E403	Return air temperature sensor (RS) malfunction	Chilled mode : Only error code indication Frozen mode : Back-up operation starts when SS to be $+5^{\circ}\text{C}$	Check connectors and crimp style terminals for tightness.	Exchange the connection of RS and DRS.
E404	Data recorder return air temperature sensor (DRS) malfunction	Only error code indication	Check connectors and crimp style terminals for tightness.	———

4.3 Electronic expansion valve trouble

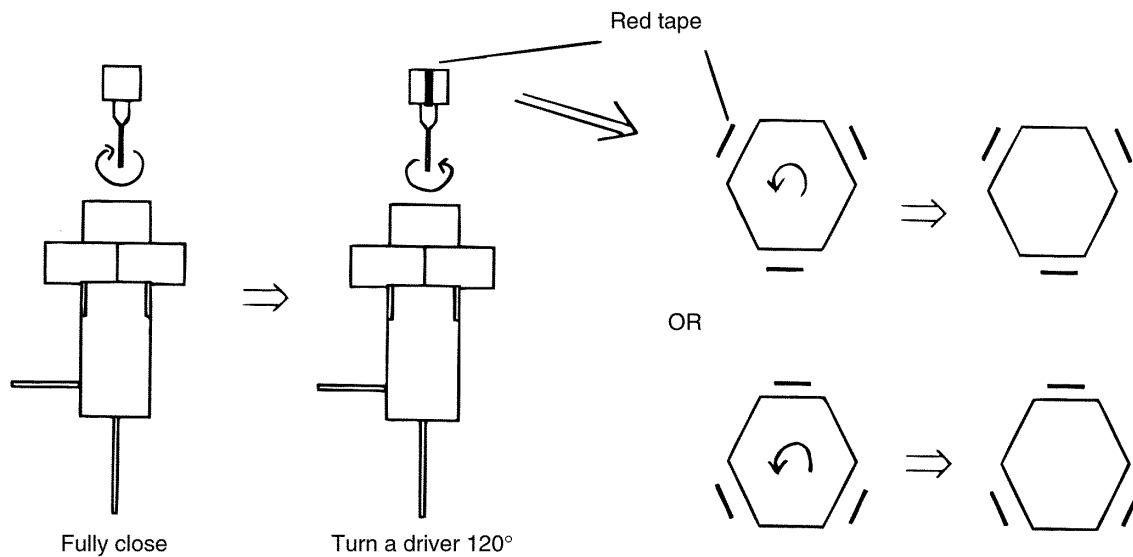
When the electric expansion valve is under malfunction, open the valve manually following the procedure below.

When the controller is also under malfunction, carry out the emergency operation for controller trouble as well (Refer to section 4.1.).

1. Set the emergency coil cap on the electronic expansion valve.



2. Fully close the expansion valve with the provided driver.
(tightening torque : approx. 1 kgf · cm : softly tighten the valve until the driver stops turning)
3. Then slightly open the expansion valve by turning a driver 120° counter clockwise.
120° turn --- from a red tape side to the next tape side or from a non-tape side to the next non-tape side.



4. Fix the screw with the provided adhesive.

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APPENDIX

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1. Standard tightening torques of bolts

	Bolt size	Main part	Tightening torque		
			N·m	kg·cm	lb·ft
Stainless steel	M4	Small parts	1.6	16	1.3
	M5	Solenoid valve	2.9	30	2.5
	M6	Access panel	4.9	50	4.3
	M8	Evaporator fan motor Flange connected dryer Control box	12.3	125	10
		Expansion valve	17.6	180	15
	M10	Evaporator fan motor mounting base Condenser fan motor Suction stop valve	25.0	255	21
M12		Compressor	42.6	435	36
Steel	M8 (10T)	Discharge stop valve	29.6	302	25
	M10 (10T)	Discharge stop valve	60.8	620	51

Note : Tolerance of tightening torque is within $\pm 10\%$.

2. HFC134a, temperature - vapor pressure characteristics table

Temperature °C	Vapor pressure		Temperature °C	Vapor pressure	
	kPa	kg/cm ² ·G		kPa	kg/cm ² ·G
-40.0	-49	-0.5015	20.0	470	4.7977
-39.0	-46	-0.4734	21.0	488	4.9795
-38.0	-44	-0.4440	22.0	507	5.1656
-37.0	-41	-0.4135	23.0	525	5.3560
-36.0	-37	-0.3817	24.0	544	5.5508
-35.0	-34	-0.3486	25.0	564	5.7500
-34.0	-31	-0.3141	26.0	584	5.9538
-33.0	-27	-0.2783	27.0	604	6.1621
-32.0	-24	-0.2410	28.0	625	6.3751
-31.0	-20	-0.2023	29.0	647	6.5929
-30.0	-16	-0.1621	30.0	668	6.8154
-29.0	-12	-0.1204	31.0	691	7.0428
-28.0	- 8	-0.0771	32.0	713	7.2751
-27.0	- 3	-0.0322	33.0	737	7.5124
-26.0	1	0.0144	34.0	760	7.7548
-25.0	6	0.0627	35.0	785	8.0023
-24.0	11	0.1128	36.0	810	8.2551
-23.0	16	0.1646	37.0	835	8.5131
-22.0	21	0.2183	38.0	861	8.7765
-21.0	27	0.2739	39.0	887	9.0453
-20.0	32	0.3314	40.0	914	9.3196
-19.0	38	0.3908	41.0	941	9.5994
-18.0	44	0.4523	42.0	969	9.8849
-17.0	51	0.5159	43.0	998	10.1762
-16.0	57	0.5816	44.0	1027	10.4732
-15.0	64	0.6494	45.0	1057	10.7761
-14.0	71	0.7195	46.0	1087	11.0850
-13.0	78	0.7918	47.0	1118	11.3999
-12.0	85	0.8664	48.0	1149	11.7209
-11.0	93	0.9434	49.0	1182	12.0481
-10.0	100	1.0229	50.0	1214	12.3815
- 9.0	108	1.1048	51.0	1248	12.7213
- 8.0	117	1.1892	52.0	1281	13.0676
- 7.0	125	1.2761	53.0	1316	13.4203
- 6.0	134	1.3657	54.0	1351	13.7797
- 5.0	143	1.4580	55.0	1387	14.1457
- 4.0	152	1.5530	56.0	1424	14.5185
- 3.0	162	1.6508	57.0	1461	14.8982
- 2.0	172	1.7514	58.0	1499	15.2848
- 1.0	182	1.8549	59.0	1538	15.6785
- 0.0	192	1.9613	60.0	1577	16.0793
1.0	203	2.0708	61.0	1617	16.4873
2.0	214	2.1833	62.0	1658	16.9027
3.0	225	2.2989	63.0	1699	17.3254
4.0	237	2.4177	64.0	1741	17.7557
5.0	249	2.5398	65.0	1784	18.1936
6.0	261	2.6651	66.0	1828	18.6391
7.0	274	2.7937	67.0	1872	19.0925
8.0	287	2.9258	68.0	1918	19.5539
9.0	300	3.0613	69.0	1964	20.0232
10.0	314	3.2004	70.0	2010	20.5007
11.0	328	3.3430	71.0	2058	20.9864
12.0	342	3.4892	72.0	2107	21.4805
13.0	357	3.6392	73.0	2156	21.9831
14.0	372	3.7929	74.0	2206	22.4943
15.0	387	3.9505	75.0	2257	23.0142
16.0	403	4.1119	76.0	2309	23.5430
17.0	419	4.2773	77.0	2362	24.0807
18.0	436	4.4467	78.0	2415	24.6276
19.0	453	4.6201	79.0	2470	25.1837
			80.0	2525	25.7492

Conversion rate: 1kgf/cm² · G=98.0665kPa

3. Temperature conversion table and temperature sensor (SS/RS/RSS/RRS/EOS/AMBS) characteristics table

Temperature (°C)	Temperature (°F)	Resistance (kΩ)	Temperature (°C)	Temperature (°F)	Resistance (kΩ)
+50	+122	0.985	+ 0	+32	6.860
+49	+120.2	1.018	- 1	+30.2	7.176
+48	+118.4	1.054	- 2	+28.4	7.508
+47	+116.6	1.090	- 3	+26.6	7.857
+46	+114.8	1.128	- 4	+24.8	8.226
+45	+113	1.167	- 5	+23	8.614
+44	+111.2	1.208	- 6	+21.2	9.023
+43	+109.4	1.251	- 7	+19.4	9.454
+42	+107.6	1.296	- 8	+17.6	9.909
+41	+105.8	1.342	- 9	+15.8	10.39
+40	+104	1.390	-10	+14	10.89
+39	+102.2	1.441	-11	+12.2	11.43
+38	+100.4	1.493	-12	+10.4	11.99
+37	+ 98.6	1.548	-13	+ 8.6	12.59
+36	+ 97	1.605	-14	+ 6.8	13.22
+35	+ 95	1.665	-15	+ 5	13.88
+34	+ 93.2	1.727	-16	+ 3.2	14.59
+33	+ 91.4	1.791	-17	+ 1.4	15.33
+32	+ 89.6	1.859	-18	- 0.4	16.12
+31	+ 87.8	1.929	-19	- 2.2	16.95
+30	+ 86	2.003	-20	- 4	17.83
+29	+ 84.2	2.080	-21	- 5.8	18.76
+28	+ 82.4	2.160	-22	- 7.6	19.75
+27	+ 80.6	2.244	-23	- 9.4	20.80
+26	+ 78.8	2.331	-24	-11.2	21.91
+25	+ 77	2.423	-25	-13	23.08
+24	+ 75.2	2.519	-26	-14.8	24.33
+23	+ 73.4	2.619	-27	-16.6	25.66
+22	+ 71.6	2.724	-28	-18.4	27.06
+21	+ 69.8	2.833	-29	-20.2	28.56
+20	+ 68	2.948	-30	-22	30.15
+19	+ 66.2	3.068	-31	-23.8	31.83
+18	+ 64.4	3.193	-32	-25.6	33.63
+17	+ 62.6	3.325	-33	-27.4	35.53
+16	+ 60.8	3.463	-34	-29.2	37.56
+15	+ 59	3.607	-35	-31.0	39.72
+14	+ 57.2	3.758	-36	-32.8	42.02
+13	+ 55.4	3.917	-37	-34.6	44.46
+12	+ 53.6	4.083	-38	-36.4	47.07
+11	+ 51.8	4.258	-39	-38.2	49.85
+10	+ 50	4.441	-40	-40	52.81
+ 9	+ 48.2	4.633			
+ 8	+ 46.4	4.834			
+ 7	+ 44.6	5.046			
+ 6	+ 42.8	5.268			
+ 5	+ 41	5.501			
+ 4	+ 39.2	5.747			
+ 3	+ 37.4	6.004			
+ 2	+ 35.6	6.275			
+ 1	+ 33.8	6.560			

4. Temperature conversion table and temperature sensor (DCHS) characteristics table

Temperature		Resistance	Temperature		Resistance
(°C)	(°F)	(kΩ)	(°C)	(°F)	(kΩ)
72	162	32.783	102	216	12.566
74	165	30.629	104	219	11.835
76	169	28.635	106	223	11.153
78	172	26.787	108	226	10.515
80	176	25.073	110	230	9.919
82	180	23.482	112	234	9.361
84	183	22.005	114	237	8.840
86	187	20.633	116	241	8.351
88	190	19.358	118	244	7.894
90	194	18.171	120	248	7.465
92	198	17.066	122	252	7.063
94	201	16.037	124	255	6.685
96	205	15.078	126	258	6.331
98	208	14.184	128	262	5.998
100	212	13.350	130	266	5.686

5. High pressure transducer characteristics table

Pressure (kPa·G)	Output (V)	Pressure (kPa·G)	Output (V)
0	0.50	1100	1.62
100	0.60	1200	1.72
200	0.70	1300	1.83
300	0.81	1400	1.93
400	0.91	1500	2.03
500	1.01	1600	2.13
600	1.11	1700	2.23
700	1.21	1800	2.34
800	1.32	1900	2.44
900	1.42	2000	2.54
1000	1.52	2100	2.64

6. Low pressure transducer characteristics table

Pressure (kPa·G)	Output (V)
-500	-1.03
-400	-0.72
-300	-0.42
-200	-0.11
-100	0.19
0	0.50
100	0.81
200	1.11
300	1.42
400	1.72
500	2.03
600	2.34
700	2.64
800	2.95
900	3.25
1000	3.56

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