

ENGINEERING
TOMORROW

Danfoss

User Guide

Optyma™ iCO₂

OP-UPAC015COP04E



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1. Condensing unit control

1.1 Control

Following explanation refer to the overall control. Initial settings required at the test run are described on page 25, "5.1-Procedure and caution for commissioning".

(1) Control items

This Condensing unit (CDU) has the following control functions.

Category	Control name	Description
Start	Control at start	Bypasses the start step at the starting.
Ordinary operation control	Calculation frequency control	Changes the operation frequency of Condensing unit (CDU) based on the low pressure (LP).
	Fan control	Controls the gas cooler fan speed aiming to achieve the high pressure being determined by ambient temperature.
	Medium pressure control	Controls the aperture of medium pressure receiver inlet electronic expansion valve to make constant the medium pressure being determined by ambient temperature and setting evaporation temperature.
	Inching prevention control	Operation immediately after a stop is inhibited to reduce the numbers of starts and stops.
Auxiliary control	Subcooling degree suppression control	Controls the aperture of subcooling electronic expansion valve, when it exceeds the upper and lower limit values of subcooling degree.
Protective control ⁽¹⁾	High pressure protective control	Reduces the operation frequency when the high pressure (HP) is too higher.
	Overcurrent protective control	Reduces the operation frequency when the current value is too higher.
	Discharge temperature overheat prevention	It controls the liquid bypass electronic solenoid valve and reduces the operation frequency further, when the discharge temperature (Td) is too higher.
	Oil return control	Controls such that Condensing unit oil will return to the compressor.
Control valves	Electronic expansion valve for middle pressure receiver inlet	Controls the aperture of electronic expansion valve to make constant the medium pressure.
	Electronic expansion valve for liquid bypass	Lowers the discharge temperature by controlling the aperture of electronic solenoid valve, when the discharge temperature (Td) is too higher.
	Electronic expansion valve for subcooling coil	Controls the aperture of electronic expansion valve to maintain the subcooling coil superheat degree constantly.
At inverter error	Inverter error control	Control when the inverter PCB detects an error
Demand control	Frequency changing speed change/ stop control	Lowers the maximum speed of operation frequency.

Note: Protective control initiates an extraordinary operation in order to protect the product when it is expected that it may run out the allowable ranges for the refrigeration cycle devices and electro/electronic parts.

Once it reverts, as a result of control, to a state that it can operate within the allowable range, the control function is released and it returns to ordinary operation.

(2) Explanation of control

States of operation on the condensing unit can be observed on the segment and LED on the "condensing unit control PCB". Method of the segment display, display items, and control contents are as explained below.

(a) Display method

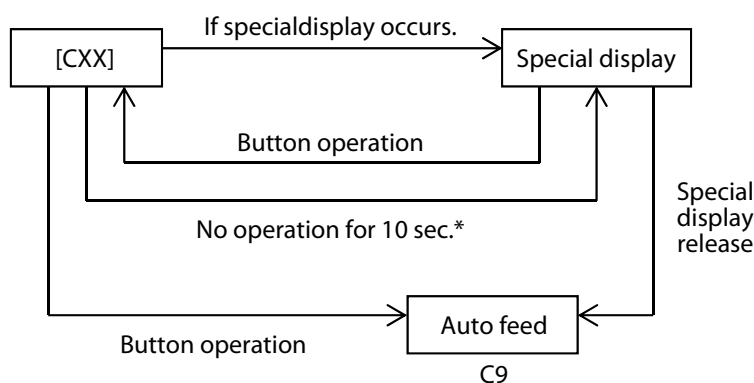
- Each item is displayed on the 7-segment display of 3-digit x 2 on the condensing unit PCB.
- To control the display, use SW7 to SW9 buttons.
SW9: Button to set the tens place of the code display.
SW8: Button to set the ones place of the code display.
SW7: Data delete/write button
- Select the code No. of each item by pressing SW9 for the tens place or SW8 for the ones place.
There are following 2 types for the identifying alphabet at the code display section.
"C": "C00" to "C99"
"P": "P00" to "P99"
- If SW9 (tens place) is pressed, it jumps to the leading code at each tens place. It passes over "C00" – "C99", and displays "P00".
- SW8 (ones place) displays in the order of 0 → 1 → 2 ... 9 → 0. It displays in the order of "P00" → "P01" → "P02" ... "P09" → "P00".
- Adjust at the code to change, hold down SW7 (Data write/delete) for 3 seconds continuously.
- Data at the data display section flickers at every 0.5 second. (Unless SW is pressed for 10 seconds in this state, the write mode terminates.)
- Press SW9 (tens place) and SW8 (ones place) to change data.
- If SW7 is pressed for 3 seconds or more continuously in the state of flicker, the date display section changes to the data lighting. By this operation, data of each item is saved in E2PROM, and the operation is controlled with this content henceforth.
- Contents which have been changed and saved are used for control even if the power supply is turned off and backed on again.

(b) Display priority

1. Display priority is as shown by the following table.

Priority	Display content	
High ↑ ↓ Low	Receiving of line check command	[QO]
	ROM version display	[WLMC], or other
	Error display	[Exx]
	Operation code display	[oPE-X]
	Compressor oil check operation display	[oil]
	Ordinary channel display	[Cxx][Pxx][xx]

2. If the state of the display at 1 is released, it changes to the auto display.
3. If SW8 or SW9 is pressed in the display at 1, it changes to display [C00].
4. However, if the switch is not pressed for 10 seconds, it displays by the priority of 1).
5. Display change : Special display shows other than CXX, PXX and FXX.



* If the special display is released in this period, [CXX] or [PXX] continues.

(c) Display item

1. Display of data and operation status

Order of display is "C00" → "C01" ... "C93" → "C00".

•Data

Table 1: Operation information

Code No.	Display contents	Display range	Min. unit	Setting for combination	Remarks
Error displa	[Exx]				
Caution display	[oPx][oPE-X]				
Special display	[QO][WLMC](ROM version display) [oil]				
Code No.	Data display contents	Data display range	Min. unit		Remarks
<Sensor value, actuator information>					
C00	CM1 operation frequency	0~255	1Hz		
C02	Tho-A outdoor air temp.	L,-25~85	1°C		
C03	Tho-G1 gas cooler inlet temp. 1	L,-30~150	1°C		
C04	Tho-G2 gas cooler outlet temp. 2	L,-40~100	1°C		
C05	Tho-M medium pressure receiver inlet temp.	L,-40~100	1°C		
C06	Tho-INJ1 gas injection temp.	L,-40~100	1°C		
C08	Tho-D1 discharge pipe temp. (CM1)	L,-30~150	1°C		
C10	Tho-C under-dome temp. (CM1)	L,-30~150	1°C		
C12	Tho-P1 power transistor temp. (CM1)	L,-20~120	1°C		
C14	Tho-SC subcooling coil temp.	L,-40~100	1°C		
C15	Tho-R liquid feed pipe temp.	L,-40~100	1°C		
C16	Tho-S suction pipe temp.	L,-40~100	1°C		
C18	CT1 (CM1) current	0~50	1A		
C20	EEVG medium pressure receiver inlet electronic expansion valve	0~470	1 pulse		
C21	EEV-LB1 liquid bypass electronic expansion valve	0~470	1 pulse		
C23	EEVSC subcooling coil expansion valve	0~470	1 pulse		
C24	FM01 actual speed	0~999 (*1)	1 (10 min ⁻¹)		
C25	FM02 actual speed	0~999 (*1)	1 (10 min ⁻¹)		
C26	PSH high pressure sensor	0~15	0.01 Mpa (0.1 Mpa for 10.0 or more)		
C27	PSL low pressure sensor	0~8.5	0.01 Mpa		
C28	PSM medium pressure sensor	0~8.5	0.01 Mpa		
C29	Inverter 2ry current 1	0~50	1A		
C31	Pressure switch	0, 1 (0: Open 1: Short)			100's place: 63H1, 2
					10's place: Spare
					1's place: Spare
C32	Level switch	0,1			100's place: OLS1-2 (*3)
					10's place: Spare
					1's place: Spare
C33	External input	0, 1 (0: Open 1: Short) (*2)			100's place: CNS1
					10's place: CNS2
					1's place: CNS3
C35	Relay output	0, 1 (0: Open 1: Short)			100's place: 52X1
					10's place: 52X2 (Spare)
					1's place: (Spare)

Code No.	Data display contents	Data display range	Min. unit		Remarks
C36	Relay output	0, 1 (0: Open 1: Short)			100's place: Crankcase heater 1
					10's place: Spare
					1's place: Spare
C37	Relay output	0, 1 (0: Open 1: Short)			100's place: Cooling fan
					10's place: Ventilation fan
					1's place: Spare
C38	Relay output	0, 1 (0: Open 1: Short)			100's place: SVHG1
					10's place: Spare
					1's place: SV-INJ1
C39	Relay output	0, 1 (0: Open 1: Short)			100's place: Spare
					10's place: Spare
					1's place: SV-OIL1-2
C40	Relay output/external output	0, 1 (0: Open 1: Short)			100's place: Spare
					10's place: Spare
					1's place: External output (CNZ1)
C41	External output	0, 1 (0: Open 1: Short)			100's place: External output (CNZ2)
					10's place: Operation output (CNH)
					1's place: Error output (CNY)

(*1) 7 segment display of C24, C25 indicates 10 min⁻¹/count.

(*2) When the pulse input is set, 0 and 1 are switched if it changes Open→Short.

(*3) 0: OLS OFF (No oil), 1: OLS ON (With oil)

<Unit information>					
C44	Compressor total operation time (CM1)	0~655 (*1)	1(100h)		
C46	Medium pressure saturation temp.	-50~30	0.1°C		In the unit of 1°C in the range beyond display (-10°C or under)
C47	Suction pressure saturation temp.	-50~30	0.1°C		In the unit of 1°C in the range beyond display (-10°C or under)
C48	Subcooling coil temp. sensor 1 saturation pressure	0~8.5	0.1 bar		
C49	Suction superheat degree 1	0~50	0.1deg		
C51	Subcooling coil superheat degree	0~50	0.1deg		
C52	Under-dome superheat degree 1	0~50	0.1deg		
C54	Compressor total operation time after previous maintenance (CM1)	0~655 (*1)	1(100h)		
C61	Demand rate display	0~100	1%		

(*1) 7 segment display of C44, C54 indicates 100 h/count.

<Control status>					
C66	Control status	0~127	1		Digital→Analog display
C67	Protective control status	0~127	1		Digital→Analog display
C68	Cause of compressor stop	0~127	1		
C73	Cause of compressor error detection 1	0~127	1		Displays No. of error detection, which occurred most frequently, out of error detections occurred after turning power on and starting operation. This is retained in EEPROM memory till the cause of compressor stop by first error occurs after turning power on.
C74	Cause of compressor error detection 2	0~127	1		Displays No. of error detection, which occurred at second place frequently, out of error detections occurred after turning power on and starting operation. This is retained in EEPROM memory till the cause of compressor stop by first error occurs after turning power on.
C75	Cause of compressor error detection 3	0~127	1		Displays No. of error detection, which occurred at third place frequently, out of error detections occurred after turning power on and starting operation. This is retained in EEPROM memory till the cause of compressor stop by first error occurs after turning power on.

Code No.	Data display contents	Data display range	Min. unit		Remarks
<Error counter information>					
C80	Counter/current cut (CM1)	0~255	1		
C84	Counter/compressor 1 start error	0~255	1		
C86	Counter/inverter 1 step-out error	0~255	1		
C95	Auto feed display 1				Feeds and displays C26, C28, C27.
<Others>					
C97	Program/sub version	000~991			
C98	Program/POL version	0.00~9.99	0.01		
C99	Auto feed display 2				

2. Alarm code display

•If following controls take place during operation, data corresponding to each control is displayed on 7-segment display

Table 2: 7 segment software input

Code No.	Data display contents	Data display range	Min. unit		Remarks
<User setting>					Setting of contents of functions described on catalogue
P02	Gas cooler fan snow control → (15-8)	0: (Default) 0, 1			0: External snow fan control invalid (Default) 1 or more: External snow fan control valid
P03	Gas cooler fan snow control ON time setting → (15-8)	30: (Default) 10, 30~, 60 0 [sec]	30		Changes 10, 30, 60, 90 ... 600.
P04	Demand rate change value (1st stage at multistage setting)	80: (Normally) 0, 40, 60, 80			
P05	External output (CNZ1) function assignment	2: (Default) 0 - 20	1		1: Demand input 2: Quiet mode input 3: (Spare) 4: Compulsory oil return control input 5: Gas cooler fan snow control input 9: Multistage demand input
P06	External output (CNZ2) function assignment	4: (Default) 0 - 20	1		
P07	External input (CNS2) function assignment				
P08	External input (CNS3) function assignment	4: (Default) 0 - 20	1		
P09	External input (CNG1) function assignment	5: (Default) 0 - 20	1		
P10	External input (CNG2) function assignment	9: (Default) 0 - 20	1		
P11	Quiet mode setting	0: (Default) 0 - 9	1		
P14	Multistage demand rate change value (2nd stage)	60: (Normally) 0, 40, 60, 80			
P15	Multistage demand rate change value (3rd stage)	40: (Normally) 0, 40, 60, 80			
P17	Operation permission/prohibition by external input	0: (Default) 0, 1			
P19	Compressor oil check operation Compressor speed	90: (Default) 30 - 100			
P20	Error inspection reset	0,1	-	0	0: Invalid Increases or decreases default value. Special to performance measurement mode.
<Service personal setting>					General setting adjusted by service personal at site
P58	Oil return time change value	5: (Default) 5 - 10	1 min.		
P60	Oil return frequency change value	70: (Default) 40 - 104 (rps)	1		
P61	EEVSC target superheat degree change value	20: (Default) 1 - 40 (0.5 - 20 deg)	1		
P62	EEV-LB target discharge pipe temp. change	0: (Default) -20 - 20 deg	1		

Code No.	Data display contents	Data display range	Min. unit		Remarks
P63	EEVSC target subcool degree change	8: (Default) 4 – 40 (2 – 20 deg)	1		
P64	Simultaneous oil return time ℓ1 by expansion valve control	10: (Default) [min]	1 min		Values change 1→2→3 ...→20.
P65	Distributed oi return time by expansion valve control ℓ2	3: (Default) [min]	1 min		Changes 1 → 5 at 1 min intervals.
P65	Suction superheat reduction protection control	1: (Default) 0,1	1		0: Inactive,1: Active
P83	Current safe correction value	0: (Default) -3~+6	0.5A		
P84	Oil return control type	1: Normal (Default)			0: Normal 1: Expansion valve oil return (Simultaneous) 2: Expansion valve oil return (Distributed)

Error code	Unit LED		2-screen 7 segment display	Inspection contents
	Green	Red		
E32	Continuous	Once	E32	Power supply open phase Power supply reverse phase (Export 3P, 4-wire type only)
E36	Continuous	Once	E36-1	Td error (Tho-D1)
E37	Continuous	Once	E37-1	Gas cooler sensor 1 broken wire (Tho-G1)
		Twice	E37-2	Gas cooler sensor 2 broken wire (Tho-G2)
		3-time	E37-3	Medium pressure receiver inlet temp. sensor broken wire (Tho-M)
		4-time	E37-4	Gas injection inlet temp. sensor broken wire (Tho-INJ1)
		6-time	E37-6	Subcooling coil sensor broken wire (Tho-SC)
		7-time	E37-7	Liquid feed pipe temp. sensor broken wire (Tho-R)
E38	Continuous	Once	E38	Outdoor temp. sensor broken wire (Tho-A)
E39	Continuous	Once	E39-1	Td sensor 1 broken wire (Tho-D1)
E40	Continuous	Once	E40	High pressure switch ON (63H1-1, 2)
E41	Continuous	Once	E41-1	Power transistor overheat (CM1) (5-time/1 h)
E42	Continuous	Once	E42-1	Current cut (CM1)
E43	Continuous	Once	E43-1	Liquid pack error (CM1)
E45	Continuous	Once	E45-1	Inverter-PCB transmission error (CM1)
E48	Continuous	Once	E48-1	FMO1 error
		Twice	E48-2	FMO2 error
E49	Continuous	Once	E49	Low pressure error (PSL ON)
E51	Continuous	Once	E51-1	Power transistor overheat (CM1) (15 min continuously)
E53	Continuous	Once	E53	Suction pipe temp. sensor broken wire (Tho-S)
E54	Continuous	Once	E54-1	Low pressure sensor broken wire (PSL)
				Low pressure sensor output error
		Twice	E54-2	High pressure sensor broken wire (PSH)
				High pressure sensor output error
E55	Continuous	Once	E55-1	Under-dome temp. sensor 1 broken wire (Tho-C1)
E56	Continuous	Once	E56-1	Power transistor temp. sensor 1 broken wire (Tho-P1)
E58	Continuous	Once	E58-1	Compressor step-out error (CM1)
E59	Continuous	Once	E59-1	Compressor start error (CM1)
E60	Continuous	Once	E60	Medium pressure sensor broken wire (PSM)
				Medium pressure sensor output error
E63	Continuous	Once	E63	External input error stop
E88	Continuous	Once	E88-1	Oil level error (CM1)
E89	Continuous	Once	E89	CPU-CPU communication error

(d) Control at start

Following control takes place when starting the condensing unit.

1. Turn ON the operation switch of Module controller.
2. As the low pressure (LP) picks up to the start condition ($LP > \text{Evaporation temperature setting value}$), the condensing unit starts 60 seconds later.
3. Opens the liquid injection solenoid valve synchronized with the start of compressor, and starts the discharge gas overheat degree control.
4. At the compressor start, it raises the frequency to 40 Hz once. After operating for 105 seconds, it changes to the calculation frequency control.

(e) Calculation frequency control**1. Suction gas pressure control**

The cooling capacity by load is controlled with the low pressure (LP). The low pressure (LP) varies depending on the compressor speed which changes depending on the operation frequency. In order to maintain a necessary cooling capacity, the low pressure (LP) value that corresponds to the cooling capacity is set so as to control the inverter output frequency such that the low pressure (LP) being detected by the low pressure sensor will become the set low pressure.

2. Operation stop by decreased low pressure (LP)

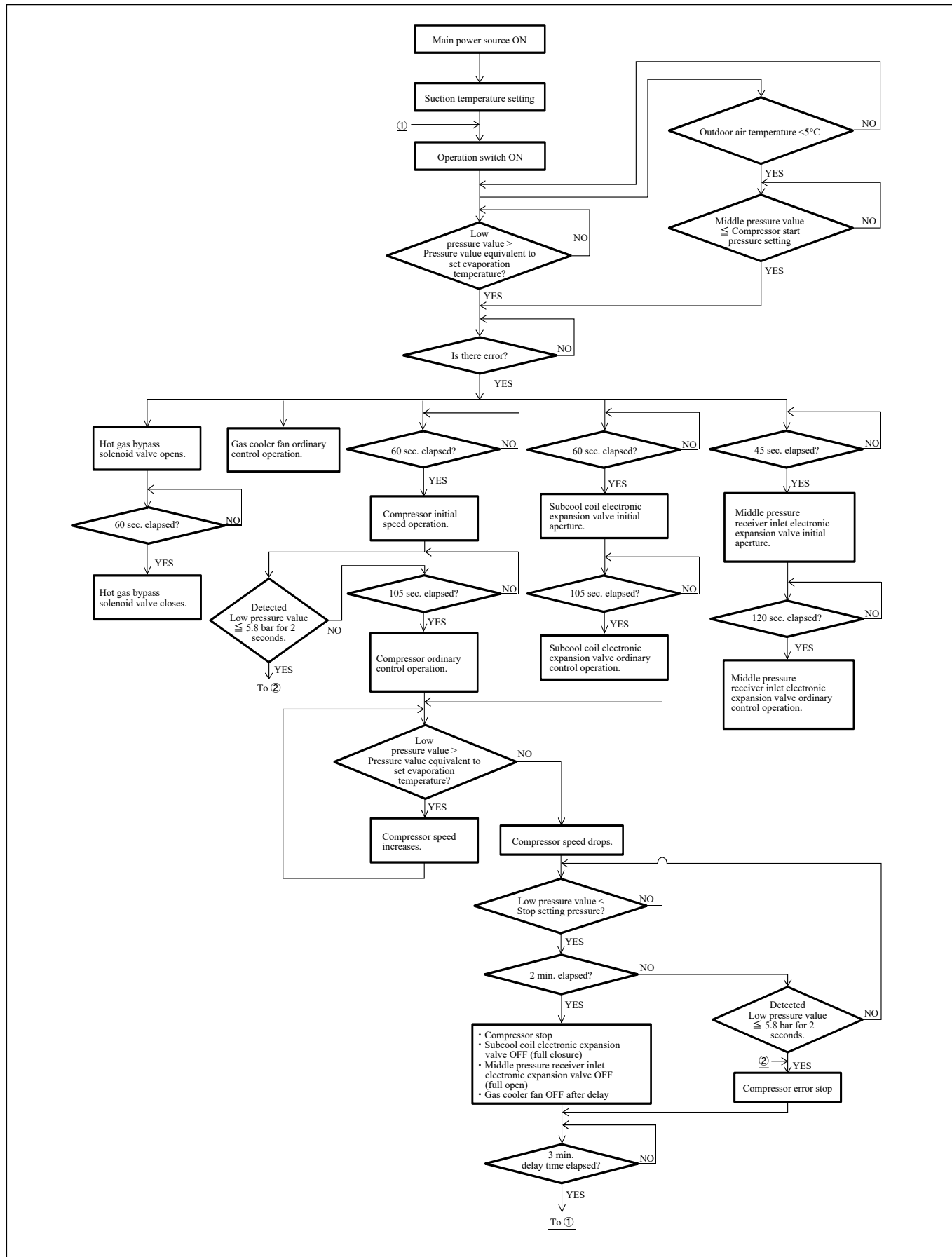
When the low pressure (LP) is lower than the preset stop pressure value (Low pressure cut value) ($LP \leq \text{Low pressure cut value}$) and the compressor frequency is 50 Hz or more, the hot gas bypass solenoid opens and, if it is lower than 50 Hz, the compressor stops after the state of $LP \leq \text{Low pressure cut value}$ has continued for 2 minutes or more.

After that, if the low pressure (LP) picks up to the operation restart pressure value, it restarts automatically.

3. Setting of pressure setting value

Pressure setting value is set to the central value between the lower value of pressure setting (PsD) and the upper value of pressure setting (PsU). When Module controller code "r28" is set to 1, PsD is the value set in module controller code r01 and PsU is the value set in module controller code r02. When Module controller code "r28" is set to 0, PsD is the value +1.0bar from value set with rotary SW of the condensing unit and PsU is the value -1.0bar from value set with rotary SW of the condensing unit.

4. Flow chart of respective operations
Flow chart of operations is shown below.



(f) High pressure overshoot prevention (Overload control)

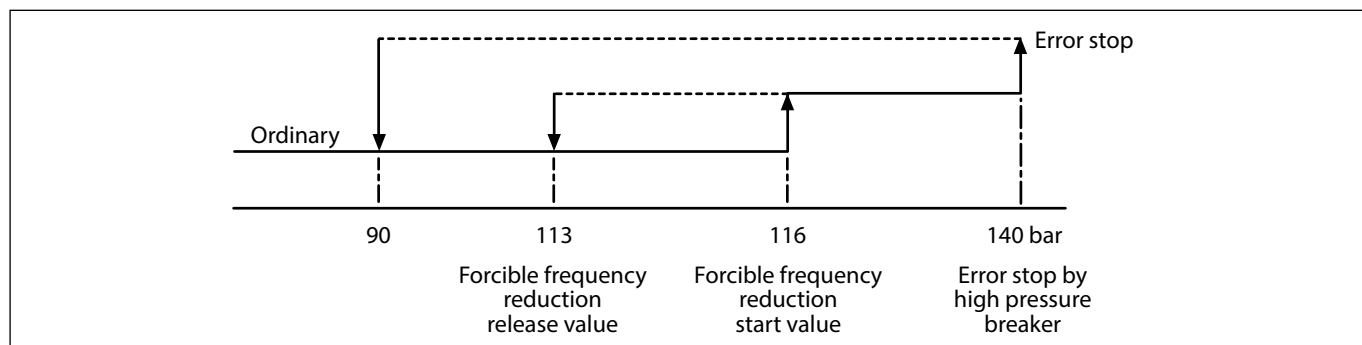
This control suppresses the high pressure (HP) from rising excessively. If the detected high pressure (HP) exceeds a preset value, the frequency output is controlled.

Restriction on the frequency output

Forcible frequency decrease ... Start value: 116 bar, release value: 113 bar

Stop by pressure overshoot

High pressure breaker Setting value: 140 bar
(Displays the alarm code "E40".)



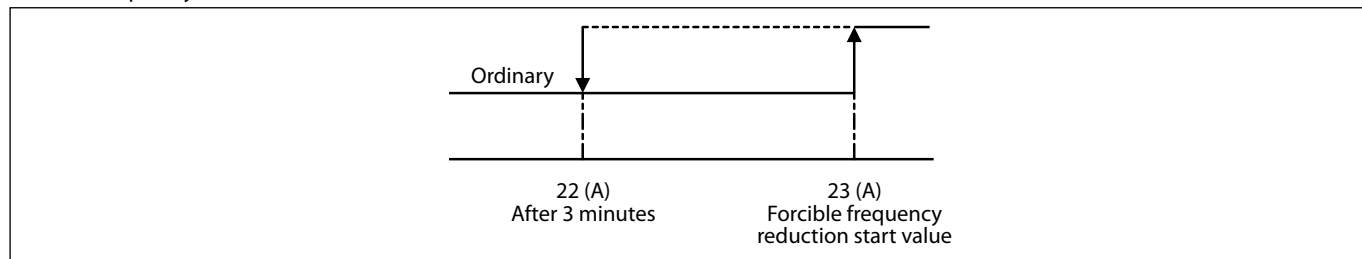
Lower limit of forcible frequency reduction: 40 rps

(g) Over-current prevention (Overload control)

This control suppresses the compressor operating current from rising excessively. If the detected secondary current of inverter becomes higher than the value preset as shown below, the frequency output is restricted by the control PCB of condensing unit.

Restriction of frequency output

Forcible frequency reduction ... Start value: 23 A, release value: 22 A



(h) Discharge temperature overheat prevention (Overload control)

1. When the temperature of gas discharged (Td) from each compressor becomes too higher, the aperture of liquid bypass electronic expansion valve is controlled in order to cool the state of high-stage suction gas and lower the highstage discharge gas temperature by bypassing 2-phase flow (liquid/gas) at the gas cooler outlet to the compressor medium pressure injection. If the discharge temperature exceeds 135°C, the compressor frequency decreases.
2. When the discharge gas temperature (Td) rises to 150°C even if this control is turned on, the Condensing unit is stopped with the retry stop.
If the retry stop repeats 5 times, however, the unit is stopped with the error stop. (Alarm code "E36" is displayed.)

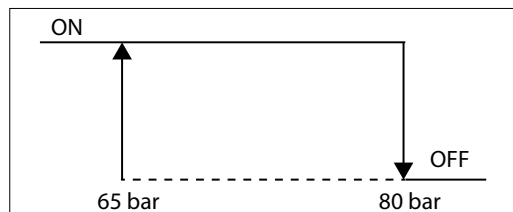
(i) Middle pressure overshoot prevention

1. Compressor

This control suppresses the middle pressure (MP) from rising excessively during compressor running.

If the detected middle pressure (MP) exceeds 80bar, stop the compressor. Control is end when 180 seconds pass after compressor stop and middle pressure (MP) below 65bar.

Compressor

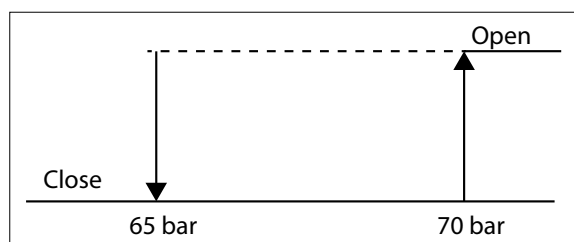


2. Standstill

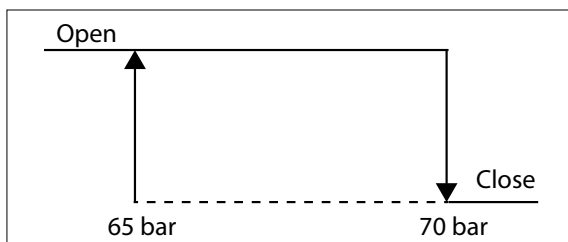
This control suppresses the middle pressure (MP) from rising excessively at standstill.

If the detected middle pressure (MP) exceeds 70bar, EEVSC is opened and EEVG is closed. Control is end when middle pressure (MP) below 65bar or 180 seconds pass after control start.

EEVSC



EEVG

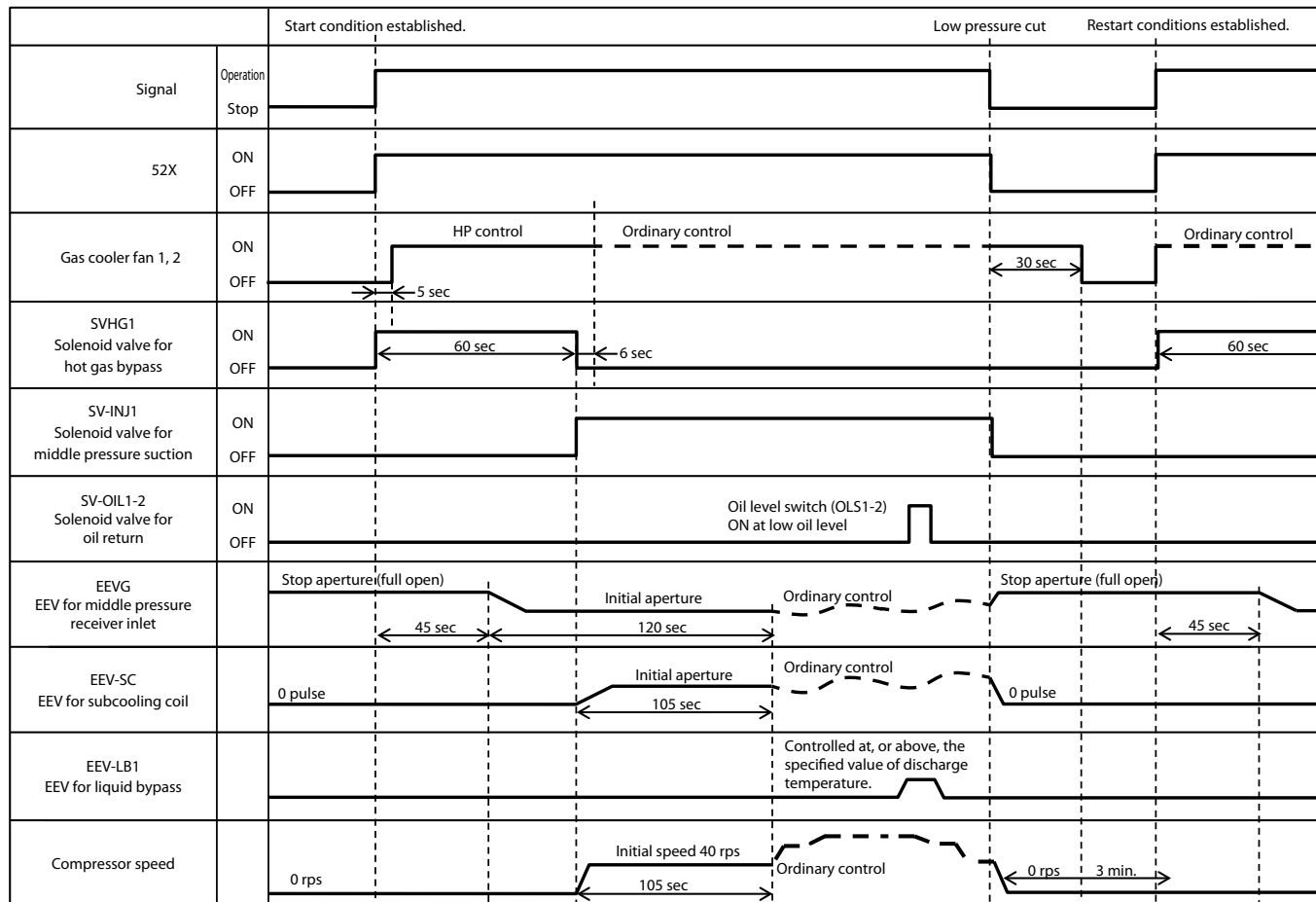


(j) Oil return operation control

In the event that total operation time at lower than the frequency in the following table (excluding the stop time) exceeds 2 hours at first power on or 3 hours at second or later oil return, and total oil loss exceeds the specified value, the following control is performed.

It operates with the compressor frequency fixed at the frequency as shown in the table above.

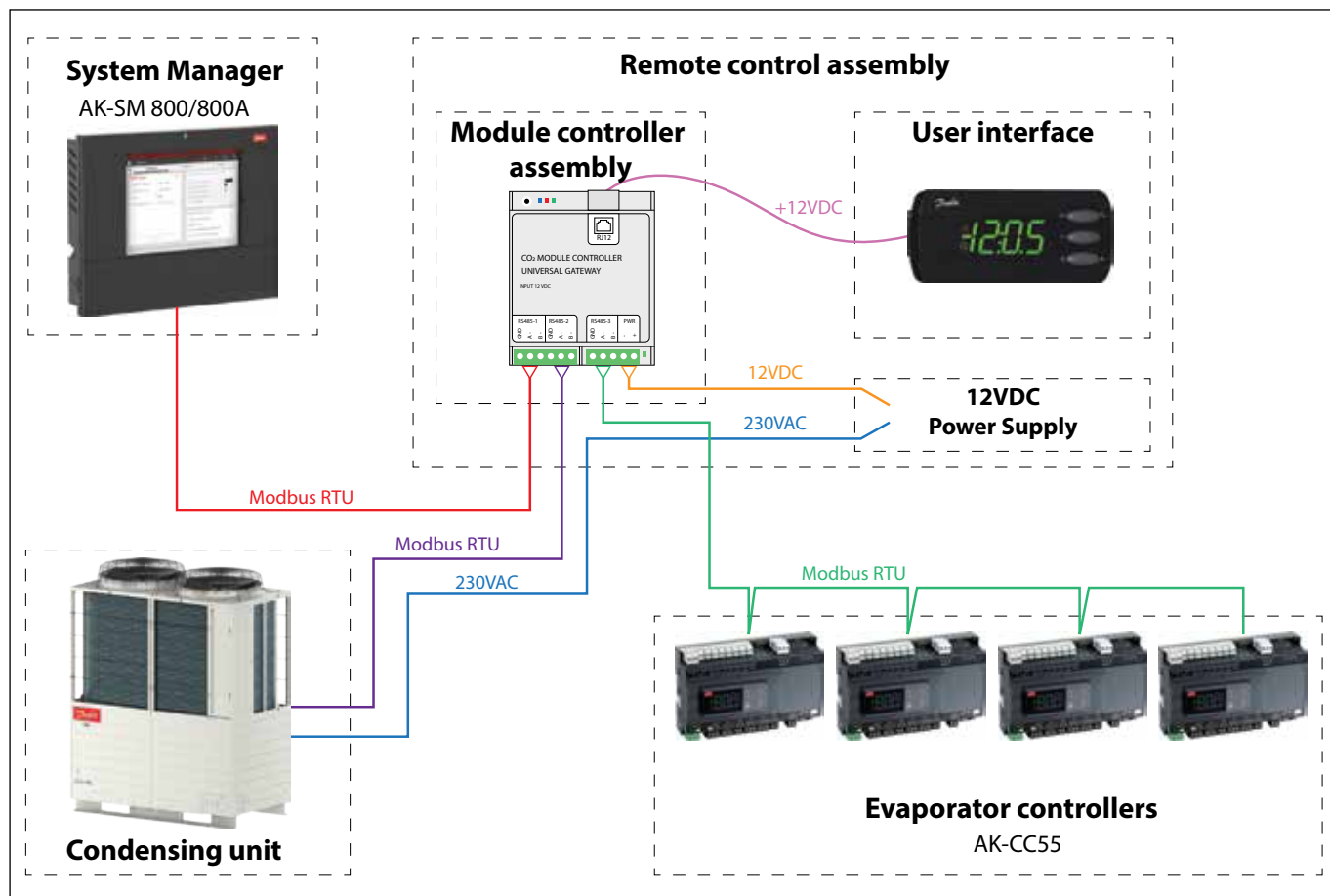
1.2. Time chart
During ordinary operation



2. Module controller

2.1 System Overview

Below is a topology over the system



Note:

No direct possible link between System Manager and unit controller, you need to connect to Module controller

Functions

- Control of connected condensing unit (CDU).
- Coordination of oil recovery.
- Communication with a Danfoss System Manager.

Condensing unit

The connected condensing unit is allowed to start when any of the evaporator controllers have a cooling demand.

Oil recovery

The controller coordinates oil recovery operation between the condensing unit and the evaporator controllers. During oil recovery the expansion valves are opened and the speed of the compressor is increased.

Data communication

The controller is delivered with three interfaces for Modbus communication, each with their own function:

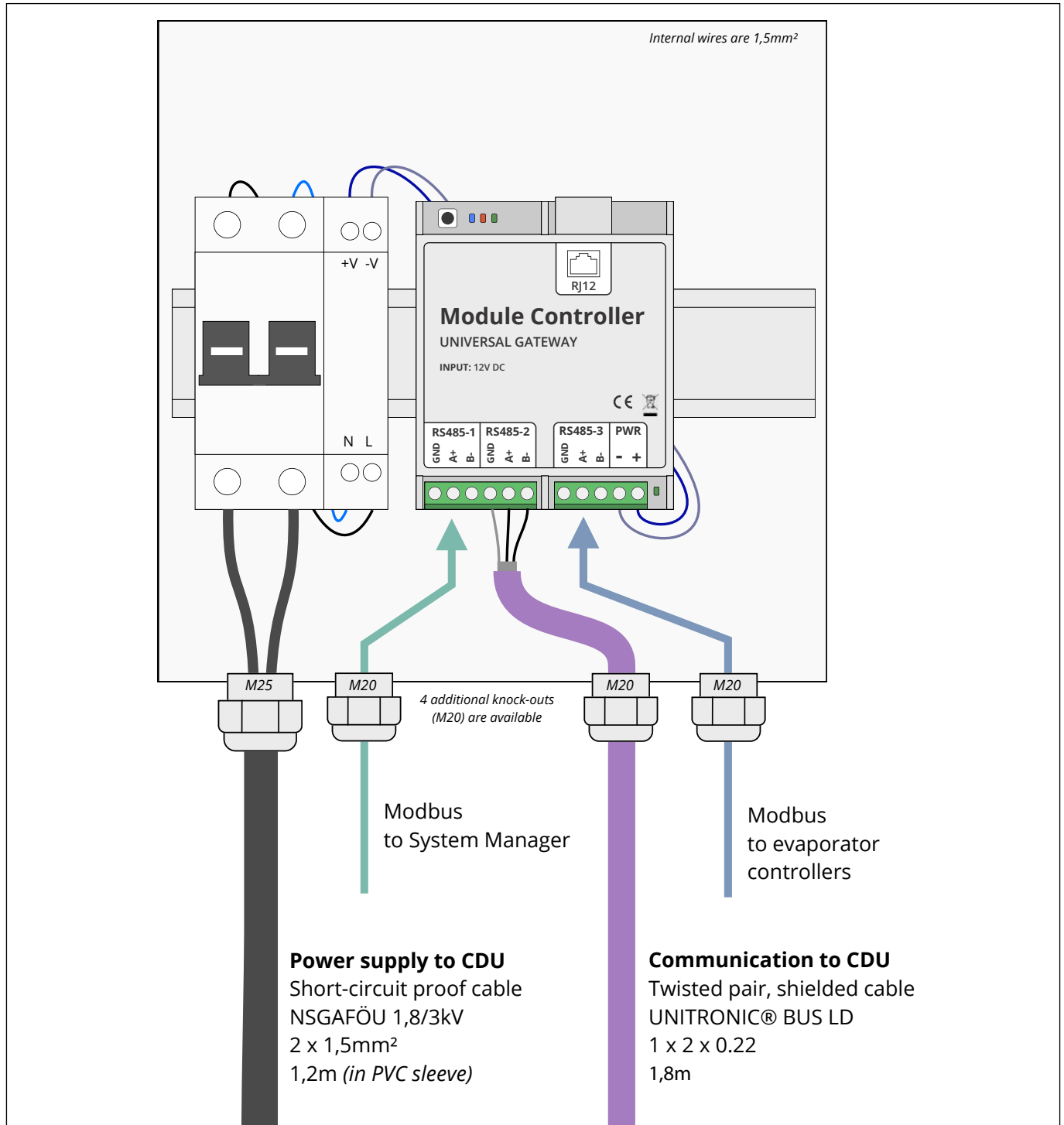
1. Communication with System Manager
This interface lets a Danfoss System Manager find both the connected condensing unit and all the connected evaporator controllers.
2. Communication with condensing unit
3. Communication with evaporator controllers

Important

All connections to the data communication must comply with the requirements for data communication cables. See literature: Design guide RC8AC Data communication between ADAP-KOOL® Refrigeration Controls.

2.2 Electric Installation

Below is an illustration of the external connections that can be made in the remote control assembly.



Power supply to CDU

230V AC 1,2m cable for this is included.

Connect Module controller power supply cable to L1 (left terminal) and N (right terminal) of the condensing unit control panel - power supply terminal block

Caution: If the cable needs to be replaced, it must either be short-circuit proof or it must be protected by a fuse on the other end.



RS485-1

Modbus interface for connection to the System Manager

RS485-2

Modbus interface for connection to the CDU.

1,8 m cable for this is included.

Connect this RS485-2 Modbus cable to terminal A and B of the condensing unit control panel - Modbus interface terminal block. Do not connect insulated shield to ground



RS485-3

Modbus interface for connection to the evaporator controllers

3x LED Function explanation

- Blue led is ON when the CDU is connected and polled operation is complete
 - Red led is flashing when there is a communication fault with an evaporator controller
 - Green led is flashing during communication with an evaporator controller
- The green LED next to the 12V power supply terminals indicates "Power OK".

Electric noise

Cables for data communication must be kept separate from other electric cables:

- Use separate cable trays
- Keep a distance between cables of at least 10 cm.

Mechanical Installation

1. Installation in the backside of the unit / backside of e-panel with provided rivets or screws (3 mounting holes provided)

Procedure:

- Remove CDU panel



- Mount the bracket with provided screws or rivets
- Fix the e-Box to the bracket (4 screws provided)
- Route and connect the provided Modbus and power supply cables to the CDU control panel
- Route and connect the evaporator controller Modbus cable to the Module controller
- Option: Route and connect the System Manager Modbus cable to the Module controller

2. Optional installation on the frontside (only for 10HP unit, just beside the CDU control panel, holes to be drilled)

Procedure:

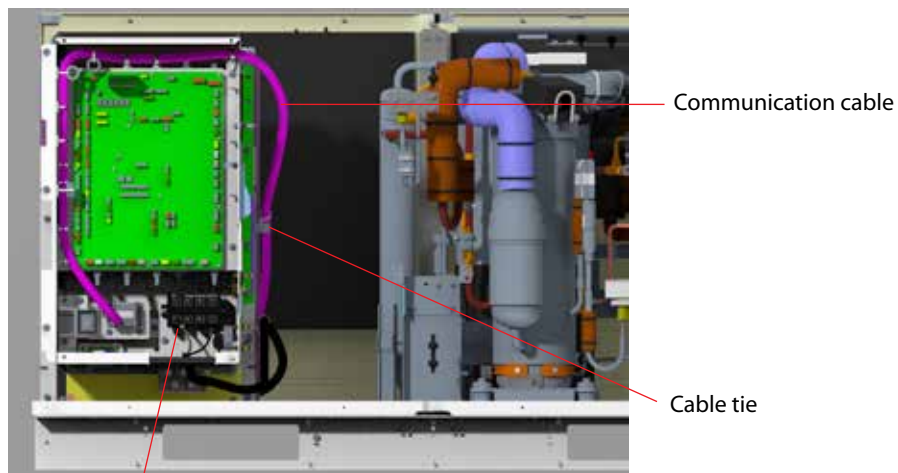
- Remove CDU panel



- Mount the bracket with provided screws or rivets
- Fix the e-Box to the bracket (4 screws provided)
- Route and connect the provided Modbus and power supply cables to the CDU control panel
- Route and connect the evaporator controller Modbus cable to the Module controller
- Option: Route and connect the System Manager Modbus cable to the Module controller

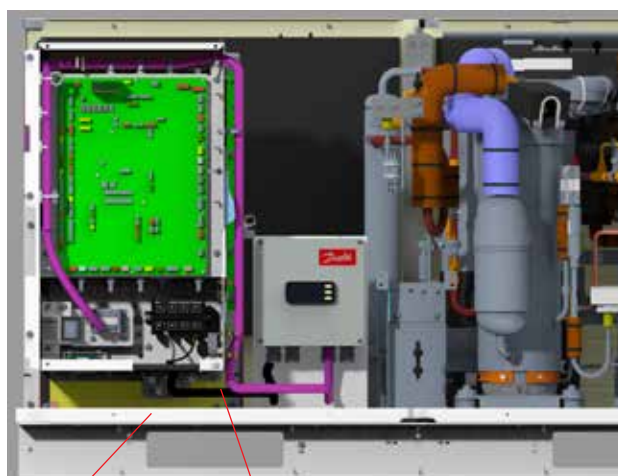
Module Controller wiring

Please wire the communication cable from the top of the control board to the left side. The cable comes along with the module controller.



Module controller wiring need to be connected to the L1 and N -Terminals

Please pass the power cable through the insulation at the bottom of the control box.



The communication cable and the power cable should not touch the baseplate

Power cable

Note:

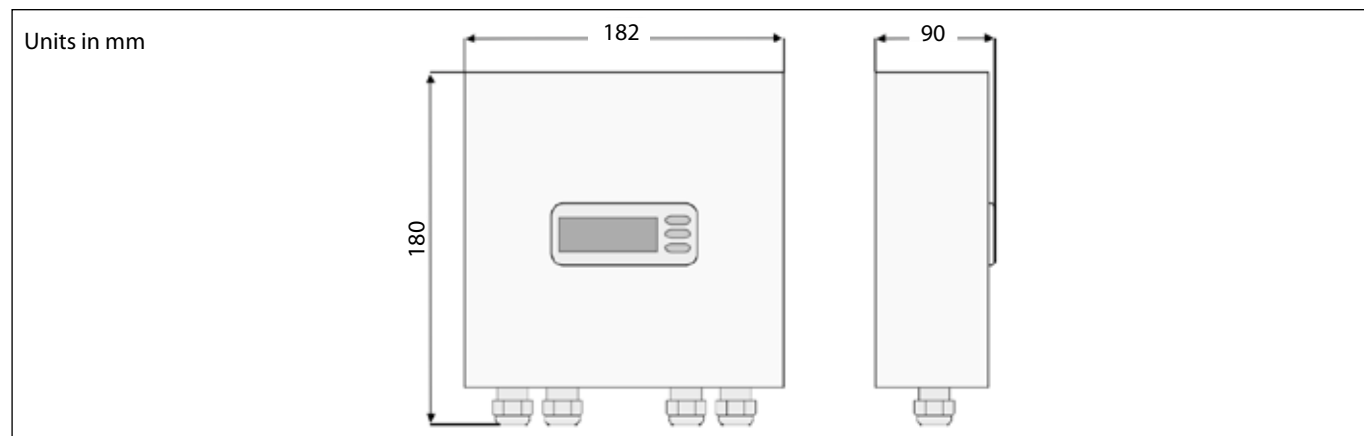
The cables should be fixed with the cable ties and should not touch the baseplate to avoid water ingress.

2.4 Technical data

Supply voltage	110-240 V AC, 5 VA, 50 / 60 Hz
Display	LED
Electrical connection	Power supply: Max.2.5 mm ² Communication: Max 1.5 mm ²
	-25 – 55 °C, During operations -40 – 70 °C, During transport
	20 - 80% RH, not condensed
	No shock influence
Protection	IP65
Mounting	Wall or with included bracket
Weight	TBD
Included in the package	1 x Remote control assembly 1 x Mounting bracket 4 x M4 screws 5 x Inox rivets 5 x Sheet metal screws
Approvals	EC Low Voltage Directive (2014/35/EU) - EN 60335-1 EMC (2014/30/EU) - EN 61000-6-2 and 6-3

2.5 Spare parts

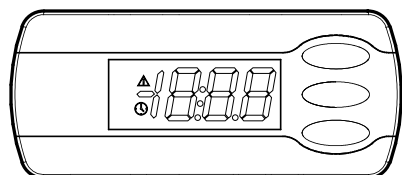
Parts Name	Parts No	Danfoss Requirements				Packing Style	Remarks
		Gross weight	Unit Dimension (mm)				
			Kg	Length	Width		
CO ₂ MODULE CONTROLLER UNIVERSAL GATEWAY							
MODULE CONTROLLER	118U5498	TBD	182	90	180	Carton box	



2.6 Dimensions


2.7 Operation

Display

The values will be shown with three digits.



-  Active alarm (red triangle)
-  Scan for Evap. controller is in progress (yellow clock)

When you want to change a setting, the upper and the lower button will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the middle buttons until value for the parameter is shown. When you have changed the value, save the new value by once more pushing the middle button. (If not operated for 10 seconds, the display will change back to showing the suction pressure in temperature).

Examples:

Set menu

1. Push the upper button until parameter code r01 is shown
2. Push the upper or the lower button and find that parameter you want to change
3. Push the middle button until the parameter value is shown
4. Push the upper or the lower button and select the new value
5. Push the middle button again to freeze the value.

See alarm code

A short press of the upper button

If there are several alarm codes they are found in a rolling stack.

Push the uppermost or lowermost button to scan the rolling stack.

Set point

1. Push upper button until display shows parameter menu code r01
2. Select and change par. r28 to 1, which defines the MMILDS UI as the reference set device
3. Select and change par. r01 to the required lower pressure setpoint target in bar(g)
4. Select and change par. r02 to the required upper pressure setpoint target in bar(g)

Remark: The arithmetic middle of r01 and r02 is the target suction pressure.

Get a good start

With the following procedure you can start regulation as soon as possible.

1. Connect the modbus communication to CDU.
2. Connect the modbus communication to evaporator controllers.
3. Configure the address in each evaporator controller.
4. Perform a network scan in the module controller (n01).
5. Verify that all evap. controllers have been found (lo01-lo08).
6. Open parameter r12 and start the regulation.
7. For connection to a Danfoss System Manager
 - Connect the modbus communication
 - Set the address with parameter o03
 - Perform a scan in the System Manager.

2.8 Survey of functions

Function	Parameter	Remark
Normal display		
The display shows the suction pressure in temperature.		
Regulation		
Min. Pressure The lower setpoint for suction pressure. See instructions for CDU.	r01	
Max. Pressure The upper setpoint for suction pressure. See instructions for CDU.	r02	
Demand Operation Limits the compressor speed of the CDU. See instructions for CDU.	r03	
Silent Mode Enable/disable silent mode. Operating noise is suppressed by limiting the speed of the outdoor fan and compressor.	r04	
Snow Protection Enable/disable snow protection functionality. To prevent snow from building up on the outdoor fan during winter shutdown, the outdoor fan is operated at regular intervals to blow off the snow.	r05	
Main Switch Start/stop the CDU	r12	
Reference source The CDU can either use a reference that is configured with rotary switches in the CDU, or it can use the reference as defined by parameter r01 and r02. This parameter configures which reference to use.	r28	
For Danfoss Only		
SH Guard ALC Cut-out limit for ALC control (oil recovery)	r20	
SH Start ALC Cut-in limit for ALC control (oil recovery)	r21	
Oil ALC setpoint LBP (AK-CC55 parameter P87,P86)	r22	
SH Close (AK-CC55 parameter ---)	r23	
SH Setpoint (AK-CC55 parameter n10, n09)	r24	
EEV force low OD after oil recovery (AK-CC55 AFidentForce = 1.0)	r25	
Oil ALC setpoint MBP (AK-CC55 parameter P87,P86)	r26	
Oil ALC setpoint HBP (AK-CC55 parameter P87,P86)	r27	
Miscellaneous		
If the controller is built into a network with data communication, it must have an address, and the system unit of the data communication must then know this address.		
The address is set between 0 and 240, depending on the system unit and the selected data communication.	o03	
Evaporator controller addressing		
Node 1 Address Address of the first evaporator controller Will only be shown if a controller has been found during scan.	lo01	
Node 2 Address See parameter lo01	lo02	
Node 3 Address See parameter lo01	lo03	
Node 4 Address See parameter lo01	lo04	
Node 5 Address See parameter lo01	lo05	

Function	Parameter	Remark
Node 6 Address See parameter lo01	lo06	
Node 7 Address See parameter lo01	lo07	
Node 8 Address See parameter lo01	lo08	
Node 9 Address See parameter lo01	lo09	
Node 10 Address See parameter lo01	lo10	
Node 11 Address See parameter lo01	lo11	
Node 12 Address See parameter lo01	lo12	
Node 13 Address See parameter lo01	lo13	
Node 14 Address See parameter lo01	lo14	
Node 15 Address See parameter lo01	lo15	
Node 16 Address See parameter lo01	lo16	
Scan Network Initiates a scan for evaporator controllers	n01	
Clear Network List Clears the list of evaporator controllers, may be used when one or several controllers are removed, proceed with a new network scan (n01) after this.	n02	
Service		
Read discharge pressure	u01	Pc
Read gascooler outlet temp.	U05	Sgc
Read receiver pressure	U08	Prec
Read receiver pressure	U09	Trec
Read discharge pressure in temperature	U22	Tc
Read suction pressure	U23	Po
Read suction pressure in temperature	U24	To
Read discharge temperature	U26	Sd
Read suction temperature	U27	Ss
Read controller software version	u99	

Operating status		(Measurement)
Push briefly (1s) the upper button. A status code will be shown on the display. The individual status codes have the following meanings:		Ctrl. state:
CDU not operational	S0	0
CDU operational	S1	1
<i>Other displays</i>		
Oil recovery	Oil	
No communication with CDU	---	

2.9 Fault message

In an error situation an alarm symbol will flash..

If you push the top button in this situation you can see the alarm report in the display.

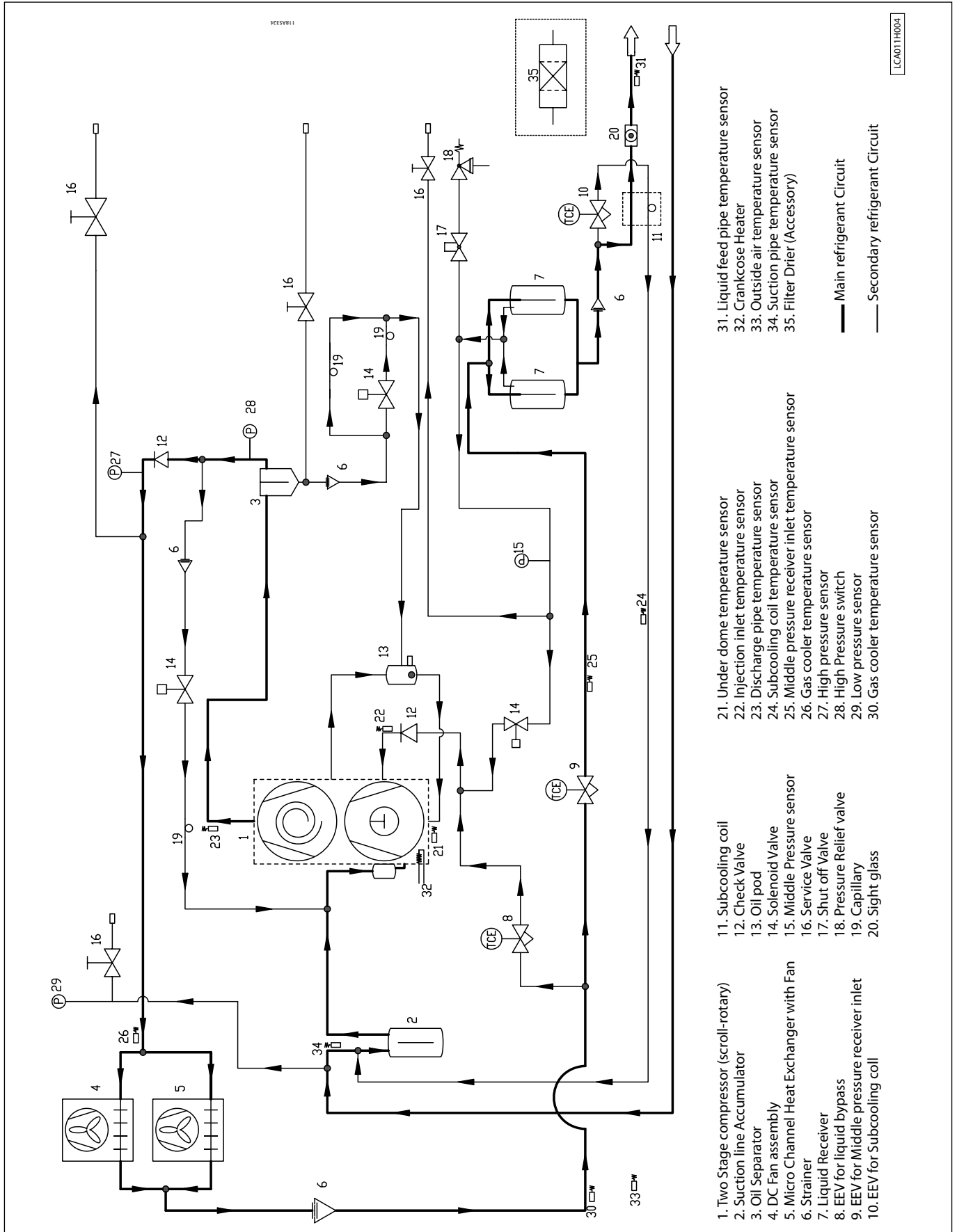
Here are the messages that may appear:

Code / Alarm text via data communication	Description	Action
E01 / CDU offline	Communication lost with CDU	Check CDU connection and configuration (SW1-2)
E02 / CDU communication error	Bad response from CDU	Check CDU configuration (SW3-4)
A17 / CDU alarm	An alarm has occurred in the CDU	See instructions for CDU
A01 / Evap. controller 1 offline	Communication lost with evap. controller 1	Check Evap. controller controller and connection
A02 / Evap. controller 2 offline	Communication lost with evap. controller 2	See A01
A03 / Evap. controller 3 offline	Communication lost with evap. controller 3	See A01
A04 / Evap. controller 4 offline	Communication lost with evap. controller 4	See A01
A05 / Evap. controller 5 offline	Communication lost with evap. controller 5	See A01
A06 / Evap. controller 6 offline	Communication lost with evap. controller 6	See A01
A07 / Evap. controller 7 offline	Communication lost with evap. controller 7	See A01
A08 / Evap. controller 8 offline	Communication lost with evap. controller 8	See A01
A09 / Evap. controller 9 offline	Communication lost with evap. controller 9	See A01
A10 / Evap. controller 10 offline	Communication lost with evap. controller 10	See A01
A11 / Evap. controller 11 offline	Communication lost with evap. controller 11	See A01
A12 / Evap. controller 12 offline	Communication lost with evap. controller 12	See A01
A13 / Evap. controller 13 offline	Communication lost with evap. controller 13	See A01
A14 / Evap. controller 14 offline	Communication lost with evap. controller 14	See A01
A15 / Evap. controller 15 offline	Communication lost with evap. controller 15	See A01
A16 / Evap. controller 16 offline	Communication lost with evap. controller 16	See A01

2.10 Menu survey

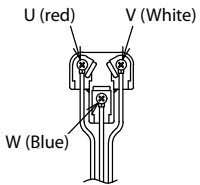
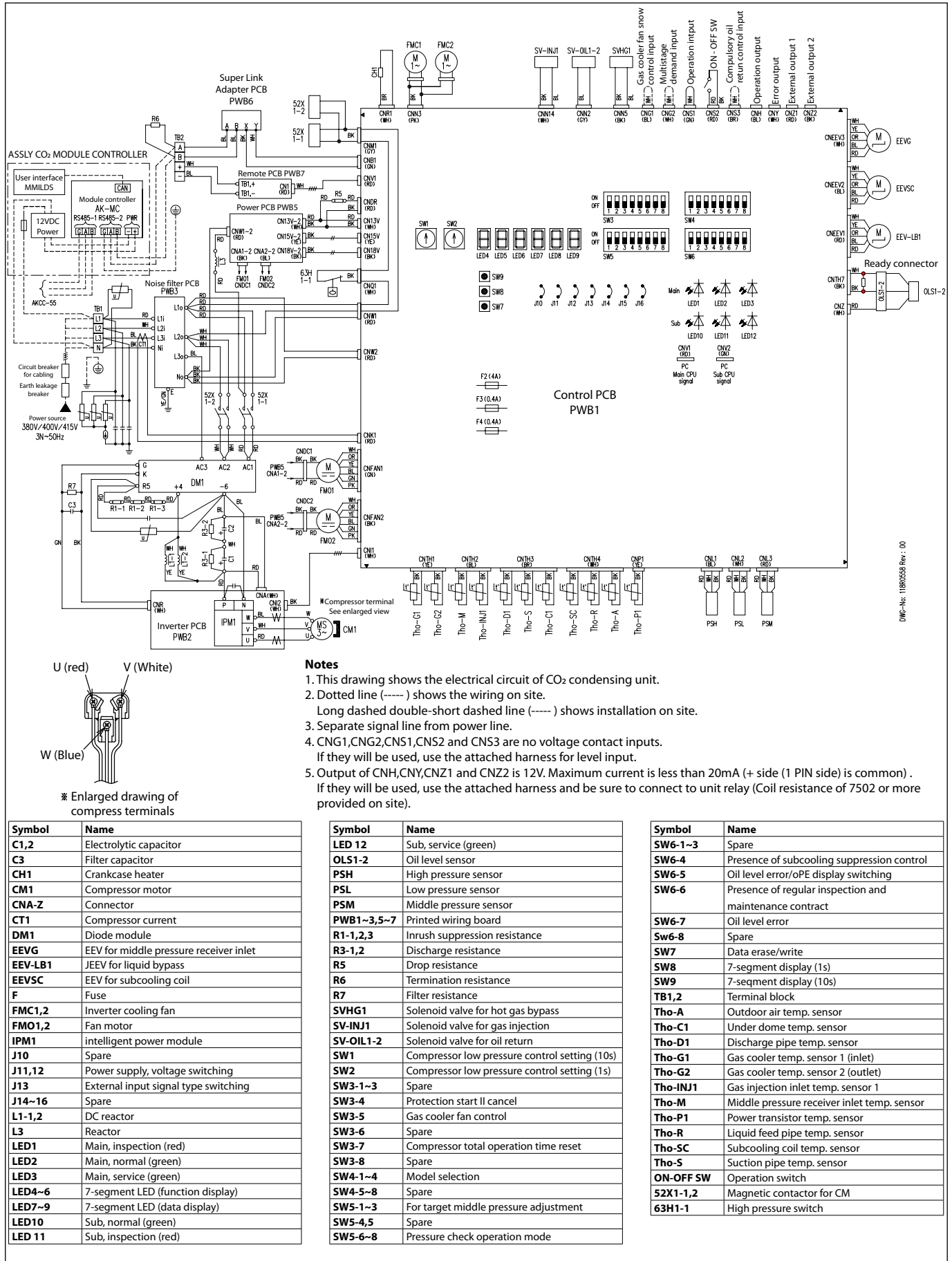
Function	Code	Min	Max	Factory	User-Setting
Regulation					
Min. Pressure	r01	0 bar	126 bar	CDU	
Max. Pressure	r02	0 bar	126 bar	CDU	
Demand Operation	r03	0	3	0	
Silent Mode	r04	0	4	0	
Snow Protection	r05	0 (OFF)	1 (ON)	0 (OFF)	
Main Switch Start/stop the CDU	r12	0 (OFF)	1 (ON)	0 (OFF)	
Reference source	r28	0	1	1	
For Danfoss Only					
SH Guard ALC	r20	1.0 K	10.0 K	2.0 K	
SH Start ALC	r21	2.0 K	15.0 K	4.0 K	
Oil ALC setpoint LBP	r22	-6.0 K	6.0 K	-2.0 K	
SH Close	r23	0.0 K	5.0 K	2.5 K	
SH Setpoint	r24	4.0 K	14.0 K	6.0 K	
EEV force low OD after oil recovery	r25	0 min	60 min	20 min	
Oil ALC setpoint MBP	r26	-6.0 K	6.0 K	0.0 K	
Oil ALC setpoint HBP	r27	-6.0 K	6.0 K	3.0 K	
Miscellaneous					
CDU Address	o03	0	240	0	
Evap. controller Addressing					
Node 1 Address	lo01	0	240	0	
Node 2 Address	lo02	0	240	0	
Node 3 Address	lo03	0	240	0	
Node 4 Address	lo04	0	240	0	
Node 5 Address	lo05	0	240	0	
Node 6 Address	lo06	0	240	0	
Node 7 Address	lo07	0	240	0	
Node 8 Address	lo08	0	240	0	
Node 9 Address	lo08	0	240	0	
Node 10 Address	lo10	0	240	0	
Node 11 Address	lo11	0	240	0	
Node 12 Address	lo12	0	240	0	
Node 13 Address	lo13	0	240	0	
Node 14 Address	lo14	0	240	0	
Node 15 Address	lo15	0	240	0	
Node 16 Address	lo16	0	240	0	
Scan Network Initiates a scan for evaporator controllers	n01	0 (OFF)	1 (ON)	0 (OFF)	
Clear Network List Clears the list of evaporator controllers, may be used when one or several controllers are removed, proceed with a new network scan (n01) after this.	n02	0 (OFF)	1 (ON)	0 (OFF)	
Service					
Read discharge pressure	u01		bar		
Read gascooler outlet temp.	U05		°C		
Read receiver pressure	U08		bar		
Read receiver pressure in temperature	U09		°C		
Read discharge pressure in temperature	U22		°C		
Read suction pressure	U23		bar		
Read suction pressure in temperature	U24		°C		
Read discharge temperature	U26		°C		
Read suction temperature	U27		°C		
Read controller software version	u99				

3. System diagram



- | | | |
|---|---|---|
| 1. Two Stage compressor (scroll-rotary) | 21. Under dome temperature sensor | 31. Liquid feed pipe temperature sensor |
| 2. Suction line Accumulator | 22. Injection inlet temperature sensor | 32. Crankcase Heater |
| 3. Oil Separator | 23. Discharge pipe temperature sensor | 33. Outside air temperature sensor |
| 4. DC Fan assembly | 24. Subcooling coil temperature sensor | 34. Suction pipe temperature sensor |
| 5. Micro Channel Heat Exchanger with Fan | 25. Middle pressure receiver inlet temperature sensor | 35. Filter Drier (Accessory) |
| 6. Strainer | 26. Gas cooler temperature sensor | |
| 7. Liquid Receiver | 27. High pressure sensor | |
| 8. EEV for liquid bypass | 28. High Pressure switch | — Main refrigerant Circuit |
| 9. EEV for Middle pressure receiver inlet | 29. Low pressure sensor | — Secondary refrigerant Circuit |
| 10. EEV for Subcooling coil | 30. Gas cooler temperature sensor | |

4. Wiring diagram



※ Enlarged drawing of compress terminals

Notes

1. This drawing shows the electrical circuit of CO₂ condensing unit.
2. Dotted line (----) shows the wiring on site.
Long dashed double-short dashed line (-----) shows installation on site.
3. Separate signal line from power line.
4. CNG1,CNG2,CNS1,CNS2 and CNS3 are no voltage contact inputs.
If they will be used, use the attached harness for level input.
5. Output of CNH,CNY,CNZ1 and CNZ2 is 12V. Maximum current is less than 20mA (+ side (1 PIN side) is common).
If they will be used, use the attached harness and be sure to connect to unit relay (Coil resistance of 7502 or more provided on site).

Symbol	Name
C1,2	Electrolytic capacitor
C3	Filter capacitor
CH1	Crankcase heater
CM1	Compressor motor
CNA-Z	Connector
CT1	Compressor current
DM1	Diode module
EEVG	EEV for middle pressure receiver inlet
EEV-LB1	JEEV for liquid bypass
EEVSC	EEV for subcooling coil
F	Fuse
FMC1,2	Inverter cooling fan
FMO1,2	Fan motor
IPM1	intelligent power module
J10	Spare
J11,12	Power supply, voltage switching
J13	External input signal type switching
J14~16	Spare
L1-1,2	DC reactor
L3	Reactor
LED1	Main, inspection (red)
LED2	Main, normal (green)
LED3	Main, service (green)
LED4~6	7-segment LED (function display)
LED7~9	7-segment LED (data display)
LED10	Sub, normal (green)
LED 11	Sub, inspection (red)

Symbol	Name
LED 12	Sub, service (green)
OLS1-2	Oil level sensor
PSH	High pressure sensor
PSL	Low pressure sensor
PSM	Middle pressure sensor
PWB1~3,5~7	Printed wiring board
R1-1,2,3	Inrush suppression resistance
R3-1,2	Discharge resistance
R5	Drop resistance
R6	Termination resistance
R7	Filter resistance
SVHG1	Solenoid valve for hot gas bypass
SV-INJ1	Solenoid valve for gas injection
SV-OIL1-2	Solenoid valve for oil return
SW1	Compressor low pressure control setting (10s)
SW2	Compressor low pressure control setting (1s)
SW3-1~3	Spare
SW3-4	Protection start II cancel
SW3-5	Gas cooler fan control
SW3-6	Spare
SW3-7	Compressor total operation time reset
SW3-8	Spare
SW4-1~4	Model selection
SW4-5~8	Spare
SW5-1~3	For target middle pressure adjustment
SW5-4,5	Spare
SW5-6~8	Pressure check operation mode

Symbol	Name
SW6-1~3	Spare
SW6-4	Presence of subcooling suppression control
SW6-5	Oil level error/oPE display switching
SW6-6	Presence of regular inspection and maintenance contract
SW6-7	Oil level error
Sw6-8	Spare
SW7	Data erase/write
SW8	7-segment display (1s)
SW9	7-segment display (10s)
TB1,2	Terminal block
Tho-A	Outdoor air temp. sensor
Tho-C1	Under dome temp. sensor
Tho-D1	Discharge pipe temp. sensor
Tho-G1	Gas cooler temp. sensor 1 (inlet)
Tho-G2	Gas cooler temp. sensor 2 (outlet)
Tho-INJ1	Gas injection inlet temp. sensor 1
Tho-M	Middle pressure receiver inlet temp. sensor
Tho-P1	Power transistor temp. sensor
Tho-R	Liquid feed pipe temp. sensor
Tho-SC	Subcooling coil temp. sensor
Tho-S	Suction pipe temp. sensor
ON-OFF SW	Operation switch
52X1,2	Magnetic contactor for CM
63H1-1	High pressure switch

5. Servicing

5.1 Procedure and caution for commissioning

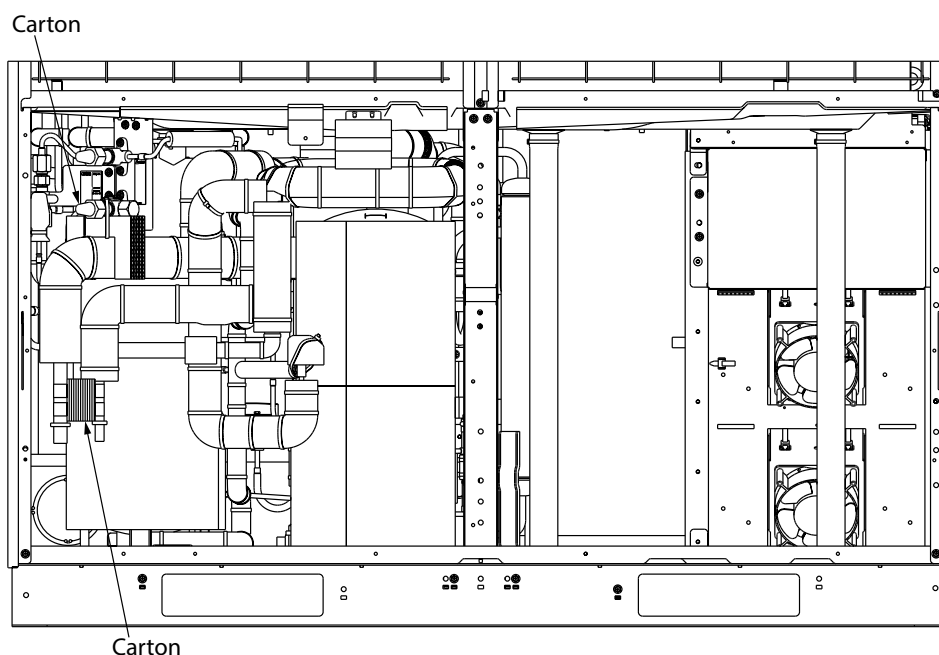
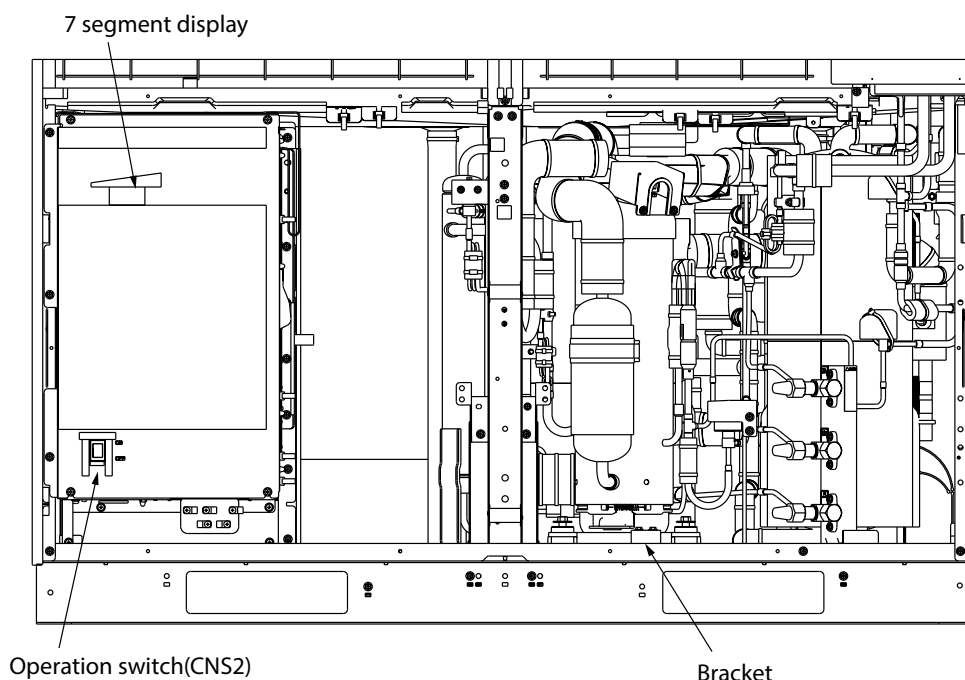
Electric work should be implemented by a contractor approved by the power company.



Install the earth leakage breaker. It is required to install the breaker to prevent electric shock or fire.
(Since the inverter is used on this unit, select a shock wave resistant type.)

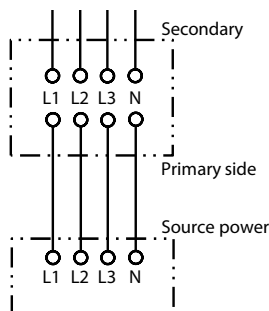
(1) Checking before turning on the power supply

1. Reconfirm that wires are connected correctly.
2. Check the power terminal board and installation face with a 500 V megger to see if it is 1 MΩ, or more.
3. Charge specified condensing unit oil and specified quantity of refrigerant after evacuation. (Refer Instruction manual to, 6.1. Charge of condensing unit oil, 6.2. Calculation of the charge quantity of condensing unit oil, 6.3. Replenishment of condensing unit oil after operation, 6.4. Refrigerant charge)
4. Confirm that the operation switch (CNS2) at the bottom of controller is turned OFF. Remove the carton and the bracket before operation.
5. Anti-vibration shipping washers are not used on the compressor. Since this product does not use anti-vibration shipping washers, it is not necessary to remove them before operation.
6. Turn on the source power supply 6 hours or more before starting the compressor to energize the crankcase without turning on the operation switch (CNS2).



(2) Prevention of reverse phase operation

Compressor of this equipment runs in one direction only. If it is run in reverse direction, the compressor may fail to operate properly. To prevent the reverse phase operation, the unit is equipped with the reverse phase prevention relay which checks whether the phase of power supply is positive or reverse and, if it is in the reverse phase, displays the error code "E32", inhibiting the compressor start. In such occasion, check that the primary (power supply side) phase and secondary phase are the same phase.



Note:
Turn power off before replacing the connection for prevention of electric shock.

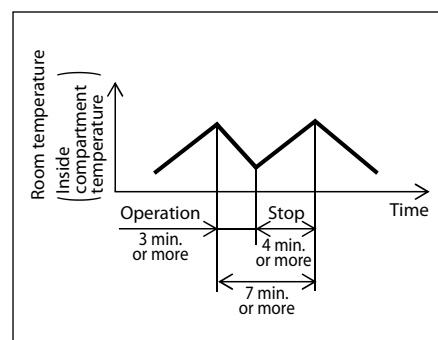
(3) Prevention of short cycle operation

Short cycle operations (frequent repetitions of start and stop) could cause a short supply of lubrication oil as a result of excessive oil rise at the time of starting. In addition, if a large start current flows repeatedly through the built-in motor, the motor may overheat, resulting in motor coil burnout.

To prevent the short cycle operation, it is necessary at the minimum to set such that the pattern as shown at right will be achieved. Major causes of short cycle operation are as follows

- Unbalanced load and condensing unit capacity
- Clogged suction strainer
- Improper setting of the operating pressure value

In addition to the above, where a unit cooler is used, the temperature sensor of inside compartment temperature regulator may be misplaced (the temperature sensor is blown directly by cold air from the unit cooler). Adjust the inlet suction superheating degree of condensing unit at 5 – 40 deg.



(4) Standard operational data

The figures in the table below are reference values; with change in outside ambient temperatures and/or evaporation temperatures, the operating conditions will be different from the table below.

Standard data - OP-UPAC015COP04E

	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Rated refrigeration value	32	-10	103	91.5/50.2/26.0	82.5	399	435	0
Rated freezing value	32	-40	102	83.7/29.5/9.0	125	181	86	313
	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Refrigeration overload	42	-10	102	110/58.5/25.8	104.3	399	395	0
Freezing overload	42	-40	100	105/36.5/9.1	130.7	180	80	311
	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Refrigeration low outside temperature	3.2	-10	102	84.9/48.7/26.3	87.9	400	334	0
Freezing low outside temperature	-5.4	-40	104	86.8/41.3/8.0	109	400	83	0

Standard data - OP-UPAC015COP04E for showcase

	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Rated refrigeration value	32	-30	103	96/37/14	123.9	180	130	200
Rated freezing value	32	-45	103	83/28/8	124.3	180	80	331

	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Refrigeration overload	43	-30	98	107/42/13	122.6	204	145	302
Freezing overload	43	-45	104	105/38/10	124.1	180	91	347

	Outside temperature (°C)	Evaporation temperature (°C)	Compressor Rotating rate (rps)	HP/MP/LP (bar g)	Td (°C)	EEVG (pulse)	EEVSC (pulse)	EEVLB (pulse)
Refrigeration low outside temperature	-5.6	-30	101	73/31/14	109.7	182	101	0
Freezing low outside temperature	-5.6	-45	103	74/25/8	123.6	180	73	101

(5) Setting the high pressure

High pressure cut value (CUT OUT)	140 bar ^{+0 bar} -10 bar
-----------------------------------	--------------------------------------

(6) Setting of operation control pressure (Setting evaporation temperature)

Setting value of the operation control pressure needs to be adjusted according to purposes. Special care is required particularly on the relation to the setting value of room temperature (inside compartment temperature) thermostat.

Room temperature (inside compartment temperature) is controlled by opening or closing the liquid solenoid valve with the room temperature (inside compartment temperature) thermostat. The condensing unit controls its capacity by detecting changes in the suction gas pressure (Ps) by opening or closing the liquid solenoid valve with the control PCB of condensing unit.

Evaporation temperature* can be set from the following two methods by changing the value of the code "r28" of Module controller.

*The evaporation temperature means the saturated temperature of suction pressure.

(a) When using the Module controller

When the CDU is turned on for the first time after shipping, the Module controller code "r28" is set to 1 as default value. Therefore, if the value of the code r28 is not changed, the target evaporation pressure is the value set in the Module controller. In this state, target evaporation pressure is set by changing the values of codes "r01" and "r02".

The target evaporation pressure is set to the central value between the lower value of the target evaporation pressure set in r01 and the upper value of the target evaporation pressure set in r02. The target evaporation pressure is sent to the CDU from the module controller.

e.g. When r01 is set to 30 and r02 is set to 32, the target evaporation pressure sent to the CDU is 31 bar.

Code r01 is a code for setting the target evaporation pressure lower value and is set between 0 and 126. The initial setting value of r01 is the value set in the rotary SW of the CDU. The default evaporation temperature value set in the rotary SW of the CDU is 0 °C. This value is about 34 bar when converted into the evaporation pressure. The code r01 is the lower set point of evaporation pressure, so the value of code r01 first shows "33". The lower set point of evaporation pressure can be set by changing the value of code r01. The value set in code r01 must be less than the value set in code r02.

Code r02 is a code for setting the target evaporation pressure upper value and is set between 0 and 126. Same as the code r01, the initial setting value of r02 is the value set in the rotary SW of the CDU and the default evaporation temperature value set in the rotary SW of the CDU is 0 °C. The code r02 is the upper set point of evaporation pressure, so the value of code r02 first shows "35". The upper set point of evaporation pressure can be set by changing the value of code r02. The value set in code r02 must be greater than the value set in code r01.

(b) When using the rotary SW of CDU

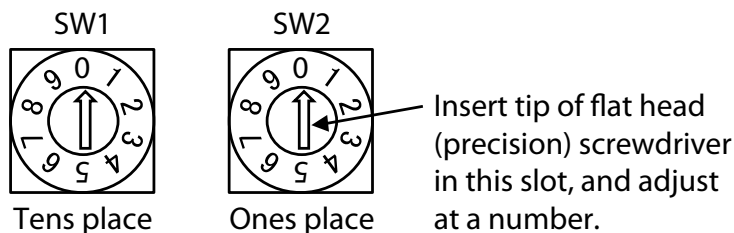
When using the rotary SW of the condensing unit to set the evaporation pressure, the CDU must be turned off and on again after changing the Module controller code "r28" from the default "1" to "0". When this operation is performed, the value set by the rotary SW of CDU becomes the target evaporation pressure. In this case, the target evaporation pressure setting in (a) is ignored.

Evaporation temperature corresponding to the evaporation pressure can be set from +5 to -45 in the unit of °C with the rotary switches (SW1, 2) on the control PWB of CDU. The suction pressure setting is depending on the evaporation temperature (set by rotary SW).

The setting can be changed during operation and the default value at the shipment is 0°C. ("SW1" = "0 or 7", "SW2" = "0".)

e.g. When setting the evaporation pressure to 26 bar (the evaporation temperature is -10 °C), open the CDU panel to access the control PWB and set "SW1" = "1" and "SW2" = "0". An image is shown below.

Following table also shows examples of setting for reference.



<Examples of other setting>

Evaporation temp. to set	SW1 (Tens place)	SW2 (Ones place)
5°C	7	5
-5°C	0	5
-10°C	1	0
-40°C	4	0

A guide for setting of pressure value is shown below.

<Example setting value>

Purpose	Inside compartment temp. range	Inside compartment std.setting (Thermo ON value)	Evaporation temp. (Setting value)	Pressure equivalent to evaporation temp.	Low pressure setting OFF value	Low pressure setting ON value	Error pressure
Fruit, vegetables	2~15°C	5~10°C	-10°C	25.5 bar	13.3 bar	30.5 bar	5.8 bar
Meat, fishes	-2~2°C	0°C	-17°C	20.6 bar	13.3 bar	25.6 bar	5.8 bar
Frozen foods	-20°C~-18°C	-18°C	-40°C	9.0 bar	6.0 bar	11.0 bar	5.8 bar

The low pressure setting (OFF value, ON value) and error pressure in the table above become as shown below depending on the evaporation temperature

Evaporation temperature (setting value)	Converted pressure (setting value)	Low pressure setting OFF value	Low pressure setting ON value	Error pressure
-5 ~ -19	38.7 bar ~ 19.3 bar	13.3 bar	Evaporation temperature Converted pressure (setting value) +5.0 bar	5.8 bar
-20 ~ -29	18.7 bar ~ 13.8 bar	9.0 bar	Evaporation temperature Converted pressure (setting value) +3.0 bar	
-30 ~ -45	13.3 bar ~ 7.3 bar	6.0 bar	Evaporation temperature Converted pressure (setting value) +2.0 bar	

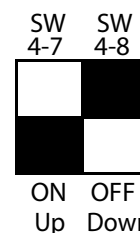
When the evaporation temperature (setting value) is 5°C - -19°C, the low pressure cut value can be adjusted with the dip switches SW4-7, 4-8. (Although 13.3 bar is equivalent to evaporation pressure at -30°C, the compressor can be stopped without lowering to -30°C by setting as shown in the table below.) SW4-7 and SW4-8 at the shipment is "SW4-7" = "OFF", "SW4-8" = "ON".

Shows the low pressure setting OFF value converted from evaporation temperature.

Low pressure control setting pressure (LPSP)	Low pressure setting OFF value
LPSP ≥ 18.7 bar	X bar
18.7 bar > LPSP ≥ 13.3 bar	9.0 bar
13.3 bar > LPSP	6.0 bar

SW 4-7	SW 4-8	Low pressure setting OFF value "X"	
OFF	OFF	13.3 bar	13.3 bar
ON	OFF	Pressure equivalent to "Evaporation temperature (setting value) -5°C"	25.47 bar
OFF	ON	Pressure equivalent to "Evaporation temperature (setting value) -10°C"	21.89 bar
ON	ON	Pressure equivalent to "Evaporation temperature (setting value) -15°C"	18.68 bar

Dip switch



(7) Operation start

1. Turn on the operation switch (CNS2) at the bottom of controller.
2. Turn ON the power supply of condensing unit.
3. Turn ON the operation switch of the module controller.
4. When Low pressure value \geq Reset pressure or Outdoor air temperature $< 5^{\circ}\text{C}$ and Medium pressure value \leq Reset pressure, the compressor starts. (Refer to page 10, 4 Flow chart of each movement.)

(8) Check of adequate refrigerant quantity

Calculate the refrigerant quantity according to Instruction manual page 17, 6.4. Refrigerant charge.

Charge the 90% of the calculated amount.

When you confirm that the following operating conditions 1, 2 are met, please add the refrigerant to the 100% of the calculated amount.

1. In the operation at 5 minutes or more after starting the compressor, the subcooling degree (*1) must be 0°C or under.

*1 Subcooling degree = Medium pressure saturation temperature "C46" – "Liquid feed pipe temperature "C15"

Calculated by 7 segment display C46: Medium pressure saturation temperature C15: Liquid feed pipe temperature

2. The aperture of EEVSC subcooling coil electronic expansion valve must be at the upper limit value.

Type	Upper limit value (pulse) of subcooling coil electronic expansion valve 7 segment display "C23"
OP-UPAC015COP04E	470

(9). Oil check verification

Charge condensing unit oil according to "Instruction manual page 13, 6.1. Charge of condensing unit oil".

Check if adequate quantity of oil is retained, by the following refrigerating oil check operations.

<Operation>

1. Change the setting of compressor speed at 90 rps using 7-segment display "P19". (For the detail of setting, see Explanation of control on instruction manual page 25.)
2. Operate all load units to be connected (show case and unit cooler).
3. Change the dipswitch SW4-6 OFF \rightarrow ON.
4. Operate the unit for 180 minutes in total with the compressor running at 90 rps. Elapsed operating time of compressor (90rps) is indicated at 7-segment display. (The compressor may stop during operation depending on the condition of load unit.)
5. Should the operation of total 180 minutes be counted up without detecting by the oil level sensor any oil shortage (detection of oil shortage for 30 seconds continuously), "7-segment display" changes to "0". In this case, it is complete the oil quantity check.
When "7-segment display" has shown "Lo1" in place of "0", the operation is stopped because an oil shortage has been detected. In this case, turn the dipswitch SW-6 to OFF and replenish the oil.
(Quantity of oil to be added at one time should be 500 cc as a guide.) After replenishing the oil, repeat from (1), 2 to check operation till "7-segment display" shows "0".

(10) Oil return operation

When the external input harness is inserted into the external input "CN3" of the control board while the compressor is in operation and the rotational speed is less than 70 rps, the oil return control is immediately executed.

In the maintenance PC of the condensing unit, the compressor rotation speed CM1, the suction superheat degree, the indoor unit expansion valve opening degree, and the oil return control status are selected, and whether the expansion valve opening degree is opened by the oil return or not, the oil return control is normally completed (10 minutes end or end in time due to low overheat), and the oil return control status is confirmed.

(11) Operation check of protective device

Confirm that, if a protective device trips, an alarm is released and the unit stops by the error stop.

Out of various protective devices for the condensing unit, confirm here, as a representative example, if the error stop occurs when the thermistor error is raised forcibly.

1. Disconnect CNTH1 connector (Gas cooler temperature Tho-G1, G2 thermistor).
2. Turn on the power supply. (It can be confirmed for 20 seconds only at 10 minutes after starting operation.)
3. Confirm that it stops approx. 5 seconds later. (Alarm code "E-37" is displayed.)
4. Reinsert the removed CNTH1 connector as it was.
5. Reset the alarm code as follows.
 - Pressing SW8, SW9, change the 7-segment display to "P20", and press SW7 for 3 seconds or more.
 - Change from "0" to "1" with SW8.

The alarm code is reset.

If the external input P08 (CNS3) is set at "3: Error reset", it can be reset also externally. Make sure, however, to check the error code and remove the cause of error, before resetting.
6. Confirm that the operation restarts. (Alarm code "E-37" extinguishes.)
7. Referring to instruction manual page 29, Alarm history display mode, clear the history of alarm code "E-37" which has been displayed and saved.
8. By the low pressure cut or turning "OFF" the breaker, end the operation confirmation (stop of condensing unit).

5.2 Installation and Commissioning check sheet
Installation checklist

Date: / /

		Criteria	Result	Comment
1. Details				
1.01	Name	-		
1.02	Company	-		
1.03	Type of Installation (e.g. refrigerated warehouse, supermarket and convenience store)	-		
1.04	Site Name	-		
1.05	Site Address	-		
1.06	Is this the first system design and installation using Danfoss Condensing unit?	-		
1.07	Have you designed the system and selected the equipment yourself?	-		
1.08	Do you require support with system design from Danfoss?	-		
1.09	What is the system application? (i. e. cold rooms, cabinets, LT or MT etc.)	-		
2. Installation				
2.01	Record Condensing unit Model & Serial number on the data plate?	Write the Condensing unit serial number in the result column.		
2.02	Record Condensing unit software version. (Refer the label of CPU on Control PWB)	-		
2.03	Is the Condensing unit suitable installed with fixing bolts and anti-vibration mounting blocks?	Follow the Instruction manual		
	Is the Condensing unit installed level?	Check with level gauge Yes/No		
	Is the Condensing unit installed on a suitable base?	Check foundation strength		
	Is the Condensing unit installed near any oil and/or hazardous gases? Eg Sulphide gas	Yes/No		
	Is the Condensing unit installed in an area, where there are combustible gases and/or flammable substances near the units?	Yes/No		
	Is the Condensing unit installed in a cold ambient region? Have any additional measures been taken? Eg. snow hoods, mounting stand	Check measure		
	Confirm sections "4- Cautions for Installation" and "2 – Handling and storage/Delivery", Were followed correctly?	Yes/No		
2.04	Is there sufficient space for for airflow around the surface area of gas cooler?	Be sure to follow the Instruction manual "4 Installation / Selection of installation place".		
2.05	Is there sufficient service space at the front and back of the condensing unit?	Be sure to follow the Instruction manual "4 Installation / Selection of installation place".		
2.06	Is the height difference between indoor unit and Condensing unit (CDU) within specification?	Indoor unit is higher than CDU; ≤5m Indoor unit is lower than CDU ; ≤22m Be sure to follow the Instruction manual "3 Installation precautions/Typical installation".		

		Criteria	Result	Comment
2.07	Is the piping length between indoor unit from Condensing unit within specification?	The distance between the farthest indoor unit and the condensing unit is 100 m or less. (Follow the Maximum refrigerant charge quantity at the same time shown in "5 Leak detection and 6 Vacuum dehydration")		
2.08	Location of Condensing unit(s). (pictures required)	-		
3. Electrical/Wiring				
3.01	Is earth leakage breaker (ELB) installed?	Fill in whether the ELB is present or not		
3.02	Is capacity of earth leakage breaker (ELB) appropriate?	Rated sensitivity current: 30mA (operation time < 0.1 sec) Rated current: 30A		
3.03	Are earth wires installed?	Fill in whether the earth wire is present or not		
3.04	Are terminal screws tightened with torque securely?	M4 1.0 – 1.3 / M5 2.0 – 2.5 M6 4.0 – 5.0 / M8 9.0 – 11.0 M10 18.0 – 23.0 (Unit: N.m)		
3.05	Insulation check between power terminal (400V circuit) and ground	> 1MΩ		
3.06	Is wiring capacity appropriate?	8mm ² ×4		
	Is the power supply breaker rating, selection of earth leakage breaker and wire sizing conform to the local national standards?	Yes/No		
3.07	Isn't there reverse phase, phase loss?	no reverse phase and no phase loss		
3.08	[L1-L2/L2-L3/L3-L1/L1-N/L2-N/L3-N = / / / / / V]	Fill in the voltage		
3.09	Is the power supply balanced?	less than 2%		
3.10	Is below dip switch setting of control board or interface board same as below? SW4-6 of control board (Oil check operation mode select): OFF SW5-7 of control board (Airtight test mode select): OFF SW3-4 of interface board (Connecting Module controller select): ON	Yes/No		
4. Design-Refrigeration components				
4.01	Required room/ cabinet temperature.	Fill in the required temperature		
4.02	Design SST (Dew point)	SST usage: -45°C ~ 5°C		
4.03	Is the ambient temperature within the operating range?	ambient temperature usage range: -20°C ~ 43°C		
4.04	What is the total load unit capacity. What is the minimum operated load unit capacity.	Write the total capacity of load units. Minimum operating capacity should be over the 50% of the capacity of the condensing unit.		
4.05	Provide cold room or cabinet sizes?	Write the approximate cold room or cabinet size.		
4.06	How many evaporators are connected to the Condensing unit? Is the maximum number of indoor connections within specification?	Condensing unit up to 8 units.		
4.07	Evaporator / cabinet details (i.e. LuVe or Searle etc.)	Write the information of the evaporator/ cabinet detail		
4.08	Is the piping flow speed, for each indoor Evaporator within the oil return specification?"	Write the minimum flow rate (m/s) "4-Installation / Selection of installation place"		
4.09	Provide photos of system configuration and set up of the refrigeration system?	-		

		Criteria	Result	Comment
4.10	Is Danfoss specified evaporator controller installed?	Danfoss Condensing unit specifies Danfoss AK-CC55 as the indoor unit controller. (Danfoss: 084B4083)		
4.11	Change the parameter code in AKCC-55 from the default to Danfoss setting.	Follow the Instruction manual (Danfoss: LCA012A026)		
4.12	Is external monitoring installed?	Write the information of the external monitoring.		
4.13	What is the provided valve type? (manufacturer & model)	Write the EEV model Danfoss Condensing unit specifies Danfoss AKV series as the expansion valve.		
5. Module Controller				
5.01	Is Danfoss specified module controller installed?	Write the model number and serial number of module controller.		
5.02	Is Danfoss specified or user interface (Danfoss: MMILDS) installed? Is remote controller set according to Instruction manual?	Follow the Instruction manual (Danfoss: LCA012A025, LCA012A027)		
5.03	Confirm the address No. of condensing unit and address NO. of AK-CC55 (indoor unit controller) on remote controller or user interface.	Write the address Follow the inWrite the address Follow the Instruction manual (Danfoss: LCA012A025, LCA012A026) stallation manual (LCA01A014,LCA012A015)		
6. Piping				
6.01	Write the piping configuration between the condensing unit and load unit (Refer 2.07)	The distance between the farthest load unit and the condensing unit is 100m or less. (Follow the Maximun refrigerant charge quantity at the same time shown in "5 Leak detection and 6 Vacuum dehydration")		
6.02	Pipe sizes. (liquid & gas)	Write the liquid and gas pipe size / Or piping diagram		
	Is there any trouble with piping connection, piping length and/or route of the pipework?	Follow the Instruction manual Provide a downward slope(1/200 or 1/250) at the sidewise run of suction pipe. Install the liquid solenoid valve just before the expansion valve. Yes/No		
	Is piping insulation work done correctly?	Follow the Instruction manual Avoid direct contact between suction and liquid pipes without insulation material. Yes/No		
6.03	Is the installation position of the evaporators above the Condensing unit? The tip of the reverse trap should be set higher than the level of the evaporator so that liquid refrigerant in the evaporator does not flow into the condensing unit after stopping.	Installation of the trap follows the "3 Installation precautions/Typical instillation"		
6.04	Is the height of the Condensing unit more than the indoor unit. Is the height difference within 22m? Oil trap should be installed every 5m to ensure correct oil return.	Installation of the trap follows the "3 Installation precautions/Typical instillation"		
6.05	Is this diameter in the vertical riser part of the Gas pipe limited to use Ø19.05 (t1.4)?	Installation of the trap follows the "3 Installation precautions/Typical instillation"		

		Criteria	Result	Comment
7. Replenishment refrigerating oil /Refrigerant charge				
7.01	When the system was on a vacuum, What was the vacuum pressure achieved?	-1.0 bar or less		
7.02	How much the additional oil amount did you calculate according to the Instruction manual? (cc)	Follow the oil amount shown in the Instruction manual. "5 Leak detection and 6 Vacuum dehydration / 6.1. Charge of condensing unit oil"		
7.03	Is the total oil charge less than maximum oil quantity?	Follow the oil amount shown in the Instruction manual. "5 Leak detection and 6 Vacuum dehydration / 6.1. Charge of condensing unit oil"		
7.04	How much the additional oil amount did you charge actually? (cc)	Follow the oil amount shown in the Instruction manual. "5 Leak detection and 6 Vacuum dehydration / 6.1. Charge of condensing unit oil"		
7.05	How much the refrigerant amount did you calculate ? (g) (Instruction/Instruction manual "Refrigerant charge")	Follow the refrigerant amount shown in the Instruction manual. "5 Leak detection and 6 Vacuum dehydration / 6.1. Charge of condensing unit oil"		
7.06	How much the refrigerant amount did you charge? (g) (The operation starts at 90% of the calculated amount of the refrigeration.)	Follow the refrigerant amount shown in the Instruction manual. "10 Procedure and caution for commissioning/ 10.7 Check of adequate refrigerant quantity".		
8. Test run (check the refrigerant amount)				
8.01	Record the "Operation data check sheet" each time you add the refrigerant.	Follow the refrigerant amount shown in the Instruction manual. "10 Procedure and caution for commissioning/ 10.7 Check of adequate refrigerant quantity".		
8.02	Have you recorded the refrigerant charge on the condensing unit label?	-		
8.03	Are there any deformation, scratches and/or dents on the unit surface?	Check unit surface	Yes/No	
8.04	Are there any error stop conditions?	Check the history of error stops	Yes/No	
8.05	Are the fan motor blades operating correctly?	Check stable rotation	Yes/No	
8.06	Is the discharge gas temperature with range? (Normal operation<125°C)	Max. 135°C		
8.07	Is there any short cycling of gas cooler exhaust air? Check temperature difference between actual outdoor air temperature and 7 segment display CO ₂ : Outdoor air temperature (Tho-A)	<5°C		
8.08	Are there any anomalous sound and/or vibration?	Audible and visual check	Yes/No	

Commissioning check sheet

Item 1. ~8. in the commissioning check sheet is the same as in the Design check sheet. This item (1.~8.) is omitted in this manual.

Date: / /

		Criteria	Result	Comment
9. Test run (Refrigerant oil check operation)				
9.01	Confirm oil check operation without "OIL-Lo" indication on 7 segment display	Follow the oil check operation shown in the Instruction manual. "11 Operation / 11.1 Oil check verification".		
9.02	Record the "Operation data check sheet" during oil check operation.	Follow the oil check operation shown in the Instruction manual. "11 Operation / 11.1 Oil check verification".		
10. Test run (Oil return operation)				
10.01	Did you execute the oil return control?	Check the setting related to oil return control of the module controller. SH Guard ALC_r20:2.0K SH Start ALC_r21:4.0K Oil ALC setpoint LBP_r22:-2.0K Oil ALC setpoint MBP_r26:0.0K Oil ALC setpoint HBP_r27:3.0K EEV force low OD after oil recovery_r25:1min		
10.02	Does the oil return control start when the external input "CNS3" is connected?	Yes/No		
10.03	Did you write down the "Operation data check sheet" during oil return control.	Did the EEV opening surely expand during oil return control? Did the oil return control status change?		
11. Operation check of alarm				
11.01	Disconnect the sensor to confirm if the alarm is working.	Follow the oil check operation shown in the Instruction manual. "11 Operation / 11.1 Oil check verification".		

5.3 Request for maintenance and inspection
(1) Maintenance and inspection

- The list shows contents of regular inspection and replacement guideline under general usage condition. The cycle of regular inspection is on an annual basis and it shows estimated cycle for component replacement and repair as the replacement guideline based on the result of the regular inspection. «Under the general usage condition» supposes 7 minutes of stop-start cycle and 5,000 running hours per year upon normal operational condition.
- Execute maintenance and inspection for load side (unit cooler and show-case) and module controller in accordance with criteria of load side and module controller. In case that adjustment, maintenance and inspection for load side and module controller are not adequate, there is significant harmful effect on condensing unit.
- Condensing unit shall be utilized as putting in the system via on-site construction works like installation, refrigerant pipe work and electric work and so on. Since lifetime for failure and operation significantly depends on degree of right and wrong on construction works, criteria of construction works described on Instruction manual must be followed.

Part		Inspection	Cycle (time/year)	Guide for replacement
Refrigerant circuit parts	Compressor	High/middle/low pressure, vibration, noise, insulation resistance, loose terminal	1	40,000 h
	Air-side heat exchanger (Gas cooler)	High/middle/low pressure, fouled fin, discharge temperature	1	8 years
	Solenoid valve	Operation, leak, clogging	1	7 years
	Electronic expansion valve	Operation	1	7 years
	Safety valve	Whether or not there is refrigerant leakage	1	5 years
	Strainer	Strainer out-/inlet temperature	1	8 years
	Capillary tube	Contact wear, vibration	1	8 years
	Piping	Contact wear, vibration	1	8 years

Part		Inspection	Cycle (time/year)	Guide for replacement
Electric circuit parts	Relay	Operation, contact/ insulation resistance	1	8 years
	Solenoid valve, electronic expansion valve coil	Insulation resistance	1	8 years
	Crankcase heater	Insulation resistance	1	20,000 h
	Fuse	Appearance	1	8 years
	PCB (Control, inverter)	Appearance	1	8 years
	High pressure breaker, pressure sensors	Contact resistance, capillary rubbing	1	8 years
	Terminal block	Looseness on terminal board	1	8 years
	Wiring, connector	Disconnection, looseness, deterioration, rubbing	1	8 years
	Dielectric capacitor	No liquid leak, deformation allowed	1	8 years
	Cooling fan	Insulation resistance, noise	1	8 years
	Electromagnetic switch (52C)	Contact resistance, operation	1	8 years
Blower	Propeller fan	Balance, crack	1	8 years
	Fan motor	Insulation resistance, noise, vibration	1	20,000 h

(2) When a protective device has tripped

- When the Condensing unit is stopped by a protective device, consult your dealer or contact desk of maker. Report (1) Product model, (2) Alarm code content and (3) Condition of failure, referring to page 37, "5.5 Operation data check sheet"
- Upon receipt of a report on the trip of protective device and resulting stop of Condensing unit, reconfirm whether it was operated within a proper operating range and did match the load capacity that of the Condensing unit. For major items, refer to the table on page 41.
- If the Condensing unit or parts of refrigerant circuit have failed, take care of following points in order to prevent recurrence of the failure.
- Diagnose the cause in detail to identify the location and cause of failure.
- When repairing a leak from welding on pipe, make sure to recollect the refrigerant, and weld by passing nitrogen gas.
- When replacing the compressor, restore original formation on the suction, discharge pipes of compressor and the liquid injection pipe. If the formation is changed, it could cause cracks on pipes owing to vibration. Take care not to mistake on the wire connection of compressor (R, S, T) to prevent reverse phase.
- When a part failed (including compressor), do not replace the while Condensing unit, but replace defective part only.
- When disposing the Condensing unit, make sure to collect the refrigerant beforehand. When the cause of failure is unknown, check the model of Condensing unit, production No. and condition of failure, and report them to specified service company.

Protective device activation value

Name	Symbol	Activation value
High pressure switch	63H	Activation value/release value = 140 ⁺⁰ / 90 bar
Current sensor (compressor)	CT	OP-UPAC015COP04E: 19A
Discharge pipe temperature sensor	Tho-D1	Activation value * 135C
Fuse (gas cooler motor)	CNDC1,2	4A

- If the load of loading equipment is too large or when the user has turned ON the Condensing unit with the power source to the loading equipment turned OFF, the Condensing unit may repeat start and stop. If such stops were repeated 120 times within 24 hours continuously, the 7-segment display indicates "oPE-11". Check the load condition. "oPE-11" can be cancelled with the error inspection reset.
- Method of error inspection reset
When any error occurred, rest it as follows.
 - Remove the cause of error.
 - Change the display on the 7-segment display to "P20" by pressing SW8 and SW9, and press SW7 for more than 3 seconds.
 - Change from "0" to "1" with SW8. The error will be reset.
 Make sure, however, to check the error code and remove the cause of error before resetting. If SW6-7 is turned to "ON", the warning "oPE-11" is not displayed.
- When total operation time of compressor has exceeded 30,000 hours since the last maintenance, the warning "oPE-3" is displayed to urge the user to request for maintenance. If this warning is displayed, you should prepare for maintenance.

External input connector name	Code No.	Data display range	Setting item
CNS3	P08	4: (Default) 0 – 20	0: External operation input
CNG1	P09	5: (Default) 0 – 20	1: Demand input
CNG2	P10	9: (Default) 0 – 20	2: Silent mode input
			4: Forced oil return input
			5: Gas cooler fan snow control input
			9: Multistage demand input

(3) Method to purge CO₂ refrigerant

- (a) Turn the power ON at the state that SW5-7 on the PCB of the refrigeration unit is switched ON. With this procedure, operation is prohibited and EEVG, EEVSC and EEVLB1, 2 become fully opened.
- (b) Turn the power OFF for safety.
- (c) Remove the cap of service valve and connect gauge manifold. (It will be sufficient if you turn the nut by 1/8 turn.)
- (d) Open the service valve little by little and purge the CO₂ refrigerant.

(Note) If purging CO₂ refrigerant instantly, a lot of refrigerant oil may be purged together with the CO₂ refrigerant like dry ice. Accordingly be sure to purge it little by little. And then, since CO₂ is 1.5 times as heavy as the air, do not purge it at a place such as manhole where CO₂ may stay.
- (e) After purging almost of all amount of refrigerant charged in the refrigeration unit, attach a gauge manifold and purge the residual refrigerant merged into the refrigerant oil by using evacuation pump.
- (f) After completion of purging work, switch OFF the SW5-7 on the PCB of the refrigeration unit.

(4) Relocation, disposal and servicing

- When the Condensing unit is relocated and reinstalled after moving to new address, or other, specialized techniques are required. Consult your dealer or specified contact desk of maker.
- When disposing the Condensing unit, although it is not necessary to collect the refrigerant, consult your dealer or specified contact desk of maker.

(5) When safety valve closed/seal broken during servicing (before Pressure Relief Valve)

- In the event of servicing / Replacement of pressure Relief Valve, the service personnel must break the Factory installed seal / tag to close the Shut off valve.
- When the shut off valve Seal/Tag opened after serving, service personnel must not apply the factory assembled seal/tag.
- Before completion of servicing the shut off valve must be included with fresh /new alternate seal/ tag to ensure the valve open position.



Alternate seal or tag



Factory assembly

Note:

*The Shut off valve position must be fully opened condition before and during operation.
The factory assembled seal / identification cannot be reused after the servicing.
Shut off Valve hole diameter is 2mm.*

5.4 Warranty conditions of Condensing unit
(1) Scope not warranted

1. Nonconformity in the selection of model or design of Condensing unit.

When we judge that the failure has resulted from a fact that the installation work is made without observing instructions or cautions given in the instruction manual, or the Condensing unit that has an excessively larger or smaller capacity is selected for the cooling load.

(Example: Mistake in selection of expansion valve, improper installation, omission of solenoid valve in liquid line, etc.)

2. Nonconformity in the selection of low pressure device.

- When the low pressure device doesn't satisfy the requirements described in Instruction manual, Page 9.

3. When any items other than the followings specified by us are used.

- Refrigerant R744
- Condensing unit oil "Diamond Freeze MA68"

4. Nonconformity in installation work

- Damage caused by improper handling during installation work
- When it is judged that foreign matters entered in the cycle during installation piping work.
- When it is judged that electric wires have been connected improperly during installation.
- When matters have not been improved although our supervisor warned improper practice during installation.
- Accident resulted from violating relevant laws or regulations.
- When it has been operated neglecting larger vibration or operating noise.
- When the failure was caused by weak foundation or fragile support frame.

5. Accident resulted from modification, incidental work or relocation at site, or overriding protective devices provided on our product.

6. Accident resulted from installing on vehicle, rail car, ship, or other mobile carrier.

7. Accident resulting from nonconformity in operating environment, maintenance and inspection.

- Accidents resulting from installation in the environment impregnated with corrosive gas such as oil (including machine oil), salt (coast area) and sulfide gas.
- Accident related to installation place (shortage of air blow volume, special environmental conditions like hydraulic pressure, chemicals, etc.)
- Accident caused by maladjustment (overheat degree of expansion valve, pressure switch setting at low pressure side).
- Accident by short-cycle operation (operation and stop of less than 3 minutes each).
- Improper maintenance (clogged gas cooler fins, overlooked inspection and cleaning of fouling, inspection and replacement of dirty Condensing unit oil and gas leak).
- Mistake in repair work (use of wrong parts, missing parts, improper installation).
- Accident caused by overcharge or shortage of refrigerant or Condensing unit oil (start failure, poor cooling of motor, improper lubrication).
- Accident owing to insufficient defrost operation.

- Accident resulting from abnormal voltage, abnormal electromagnetic radiation, or other external factor like trapped insect.
 - When it is judged that air or moisture has been inhaled in the cycle.
8. Accident resulting from running out ranges of evaporation temperature, outdoor temperature, or voltage as specified for this product.
9. Accident caused by external factors such as fire, earthquake, storm or flood, thunderbolt, abnormal weather, other natural disasters, soot, ash, acid rain, etc.
10. Any other accidents are not warranted at all, including installation or use contradicting common practices in the installation, operation, adjustment or maintenance of the Condensing unit. Also exempted from this warranty are consequential compensations for damage on cooled goods, or business interruption. It is recommended therefore to install an alarm system, or subscribe to a property insurance through our dealer in preparation for consequential accidents.



5.5 Operation data check sheet

(1) Condensing unit

Check the data of each code in the 7-segment display of the control PCB (PWB1).

7-segment have six digits, the three digits on the left shows code and the three digits on the right shows the data of the code.

Each code value increases by 1 for each press of SW7 of control PCB (PWB1) and by 10 for each press of SW8.

Code	Display	Unit	Criteria	data display by time				
				(:)	(:)	(:)	(:)	(:)
C00	Compressor operation frequency	rps	40~104					
C02	Outdoor air temp.	°C	-20~50					
C03	Gas cooler inlet temp.	°C	≤135					
C04	Gas cooler outlet temp.	°C	≤60					
C08	Discharge pipe temp.	°C	≤135					
C10	Under-dome temp.	°C	≤85					
C12	Power transistor temp.	°C	≤90					
C15	Liquid feed pipe temp.	°C	-					
C18	Current	A	≤19					
C20	Medium pressure receiver inlet expansion valve	Pulse	180~400					
C21	Liquid bypass electronic expansion valve	Pulse	10~470					
C23	Subcool coil expansion valve	Pulse	60~470					
C24	Fan 1 actual speed	rpm	0~1000					
C25	Fan 2 actual speed	rpm	0~1000					
C26	PSH high pressure sensor	Bar	65~140					
C27	PSL low pressure sensor	Bar	6~46					
C28	PSM medium pressure sensor	Bar	14~79					
C29	Inverter current 1	A	≤23					
C31	Pressure switch	 left end	1					
C32	Oil level switch	 left end	1 ^{*1}					
C46	Medium Pressure saturation temp	°C	-					
C50	Suction superheat degree	deg	≥5					
C51	Subcool coil superheat degree	deg	≥10 ^{*2}					
C52	Under-dome superheat degree 1	deg	≥10					
Subcool Calculated By C46-C15		deg	≥1					

*1 Check the data in either below case 1 or 2

1. When the compressor is stopped and there is no pressure difference between medium pressure and low pressure

2. Compressor is running

*2 Check the data during compressor running

(2) Load unit side

Connect a PC to the condensing unit and check the operation status of the load unit side unit using the mente-PC software.

Item with* 3 can also be possible to check from the each Evaporator Controller. See literature of User Guide Controller for appliance control AK-CC55.

Display		Unit	Criteria	data display by time				
				(:)	(:)	(:)	(:)	(:)
Cooler 1: Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler 1: Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler 1: superheat SV	*3 (u22)	deg	>5					
Cooler 1: superheat PV	*3 (u21)	deg	>5					
Cooler 1: expansion valve opening duty	*3 (u23)	%	0~100					
Cooler 1: information		-	-					
Cooler 1: Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler 1: defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler 1: fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler 2: Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler 2: Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler 2: superheat SV	*3 (u22)	deg	>5					
Cooler 2: superheat PV	*3 (u21)	deg	>5					
Cooler 2: expansion valve opening duty	*3 (u23)	%	0~100					
Cooler 2: information		-	-					
Cooler 2: Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler 2: defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler 2: fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler 3: Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler 3: Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler 3: superheat SV	*3 (u22)	deg	>5					
Cooler 3: superheat PV	*3 (u21)	deg	>5					
Cooler 3: expansion valve opening duty	*3 (u23)	%	0~100					
Cooler3: information		-	-					
Cooler 3: Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler 3: defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler 3: fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler 4: Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler 4: Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler 4: superheat SV	*3 (u22)	deg	>5					
Cooler 4: superheat PV	*3 (u21)	deg	>5					
Cooler 4: expansion valve opening duty	*3 (u23)	%	0~100					
Cooler 4: information		-	-					
Cooler 4: Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler 4: defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler 4: fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler 5: Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler5:Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler5:superheat SV	*3 (u22)	deg	>5					
Cooler5:superheat PV	*3 (u21)	deg	>5					
Cooler5:expansion valve opening duty	*3 (u23)	%	0~100					
Cooler5:information		-	-					
Cooler5:Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler5:defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler5:fan Operating	*3 (u59)	ON(1)/OFF(0)	-					

Display		Unit	Criteria	data display by time				
				(:)	(:)	(:)	(:)	(:)
Cooler6:Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler6:Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler6:superheat SV	*3 (u22)	deg	>5					
Cooler6:superheat PV	*3 (u21)	deg	>5					
Cooler6:expansion valve opening duty	*3 (u23)	%	0~100					
Cooler6:information		-	-					
Cooler6:Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler6:defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler6:fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler7:Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler7:Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler7:superheat SV	*3 (u22)	deg	>5					
Cooler7superheat PV	*3 (u21)	deg	>5					
Cooler7:expansion valve opening duty	*3 (u23)	%	0~100					
Cooler7:information		-	-					
Cooler7:Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler7:defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler7:fan Operating	*3 (u59)	ON(1)/OFF(0)	-					
Cooler8:Roomtemperature SV	*3 (r00)	°C	-45~30					
Cooler8:Roomtemperature PV	*3 (u36)	°C	-45~30					
Cooler8:superheat SV	*3 (u22)	deg	>5					
Cooler8:superheat PV	*3 (u21)	deg	>5					
Cooler8:expansion valve opening duty	*3 (u23)	%	0~100					
Cooler8:information		-	-					
Cooler8:Liquid feeding solenoid valve		ON(1)/OFF(0)	-					
Cooler8:defrost status	*3 (u60)	ON(1)/OFF(0)	-					
Cooler8:fan Operating	*3 (u59)	ON(1)/OFF(0)	-					

5.6 Regular inspection check sheet

This table shows points of regular inspection to use safely the refrigerating equipment which uses highly pressurized CO₂ refrigerant. Inspect the machine regularly and, if any anomaly is discovered, repair it immediately, particularly when corrosion generates widely over the surface of compressor, or vessels, and deteriorates their strength. Inspect the Optyma iCO₂ at installation after regular intervals. Record the inspection results on the regular inspection check sheet.

Installation ID	
Installation Date	
Remarks	

Method	Inspection item	Inspection at installation(1)	Inspection at installation(2)	Inspection at installation(3)
Visual inspection	Does abnormal vibration, noise occur?			
	Does oil spread around or inside?			
	Are there traces of running rusty water around or inside?			
	Is the drain pan discharge outlet clogged?			
	Is rust observed on the surface of compressor?			
	Is rust observed on the surface of vessels?			
	Are insulation materials deteriorated, broken?			
	•Piping (Aeroflex)			
	•Compressor (felt, Aeroflex)			
	•Accumulator (Aeroflex)			
	•Receiver (Aeroflex)			
	Is the heat exchanger damaged?			
	Is the heat exchanger corroded?			
	Does oil spreads on the heat exchanger?			
	Is piping in the machine corroded?			
	Is piping in the machine rubbed?			
	Does oil spread at pipe joints on the compressor?			
	Are compressor terminals deteriorating?			
	Is the compressor casing rusty, corroded?			
	Does oil spread at expansion valve joints?			
Are service ports capped?				
Does oil spread at service ports?				
Does oil spread at brazed sections?				
Is it frosting?				
Is the indicator hardware corroded?				
Are resin bands tightened properly?				
Are resin bands cracked?				
Operation inspection	Does abnormal noise or vibration (chatter) occur on the compressor or fan motor?			
	Does flash-gas generate at the liquid outlet?			
	Isn't refrigerant overcharged? (Does the high pressure error (7 segment display, E40) or liquid back from the medium pressure receiver (7 segment display, E43) occur?)			
	Is the oil level maintained above the lower limit during operation? (Check with 7 segment display, C32: Level switch.)			
	Does oil spread around or inside?			
	Is the movement control pressure suitable to the purpose of low pressure devices (load side)?			
	Is the cooling capacity of low pressure devices (load side) correct? (Turn off the thermostat.)			
	Is it normal the frequency of compressor start/stop? (10 times/h)			
	Is the suction gas superheating degree correct? (7 segment display, C49: Suction superheating degree 1, [Judgment guide] 1. It is not frosting at the compressor side from its suction inlet. 2. $5 \text{ deg} \leq \text{TsSH} \leq 40 \text{ deg}$			
Is the discharge gas temperature correct? (7 segment display C08: Discharge pipe temperature (CM1), [Judgment guide] Td 125°C or under				
Is the waste heat short-circuited? (7 segment display C02: Outdoor air temperature (Tho-A))				

5.7 Error code list
(1) Maintenance code (oPE code)

If conditions corresponding to each item are satisfied, the maintenance code (oPE code) is displayed on the 7-segment display. For details of display, refer to the following table.

7-segment display	Item	Remark
oPE-3	Total compressor operation time since last maintenance > 30,000 h	Synchronized with simplified remote monitor trigger timing
oPE-11	Number of the error detection stops within 60 min. after first stop [Low pressure error count (load side stop)] = 120 times	Synchronized with simplified remote monitor trigger timing
oPE-88	Compressor oil shortage detection	Oil level error is valid when SW6-5 and SW6-7 are OFF.

(2) Error code

If the unit is stopped fully by error, the code corresponding to error content is displayed on the 7-segment display. For details of display, refer to the following table.

7-segment display	Protective device symbol	Cause	Inspection	Measures / Countermeasures	
E32	Power source phase loss Power source reverse phase	Phase loss (incl. under-voltage)	Volt check at 3 phase	Security of correct connection, power source voltage	
		Power source reverse phase	See page 26“(2)...”Prevention of reverse phase operation” and change connection		
E36-1	Discharge pipe temperature error	Refrigerant gas shortage	Flash gas generation or no in sight glass	Additional refrigerant charge	
		Liquid bypass circuit failure	Defective electronic expansion valve	Replace	
E37-1	Gas cooler temperature sensor No.1 error	Gas cooler temperature sensor blown wire, short-circuit are detected	Defective gas cooler temperature sensor, connector disconnection or short-circuit	Replace	
E37-2	Gas cooler temperature sensor No.2 error				
E37-3	Middle pressure receiver inlet temperature sensor error	Middle pressure receiver inlet temperature sensor blown wire, short-circuit are detected	Defective middle pressure receiver inlet temperature sensor, connector disconnection or short-circuit	Replace	
E37-4	Injection inlet temperature sensor error	Injection inlet temperature sensor blown wire, short-circuit are detected	Defective injection inlet temperature sensor, connector disconnection or short-circuit	Replace	
E37-6	Subcooling coil temperature sensor error	Subcooling coil temperature sensor blown wire, short-circuit are detected	Defective subcooling coil temperature sensor, connector disconnection or short-circuit	Replace	
E37-7	Liquid feed pipe temperature sensor error	Liquid feed pipe temperature sensor blown wire, short-circuit are detected	Defective liquid feed pipe temperature sensor, connector disconnection or short-circuit	Replace	
E38	Outdoor air temperature sensor error	Outdoor air temperature sensor blown wire, short-circuit are detected	Defective outdoor air temperature sensor, connector disconnection or short-circuit	Replace	
E39-1	Discharge pipe temperature error	Discharge pipe temperature sensor blown wire, short-circuit are detected	Defective discharge pipe temperature sensor, connector disconnection or short-circuit	Replace	
E40	63H High pressure switch	Less air passing through gas cooler	Much dust on gas cooler	Wash, remove	
			Clogged gas cooler suction inlet, blow outlet	Remove	
			Low compressor speed	Fan speed control failure	Replace parts
			Under overload state	High gas cooler suction air temperature	Repair short-circuit
				High suction gas pressure (low pressure)	Adjust as specified
Clogged high pressure side refrigerant pipe	Defective oil separator outlet check valve	Remove			
E41-1	Power transistor overheat (5 times in 1 hour)	Overheat of power transistor	Defective power transistor temperature sensor, connector disconnection or short-circuit	Replace power transistor cooling fan or power transistor	
		Stops with power transistor temperature sensor blown wire, output error detection		Replace power transistor temperature sensor	
E42-1	Current cut	Detect the anomalous output current of inverter	Check the inverter output	Replace inverter or compressor	
			Compressor wiring, connector disconnection or short-circuit	Replace wiring or power transistor	

7-segment display	Protective device symbol	Cause	Inspection	Measures / Countermeasures
E43-1	Liquid return error	Defect the anomalous under-dome temperature	Check the specification of connected low pressure devices	Connect the adequate low pressure devices
			Under-dome temperature sensor, connector disconnection or short-circuit	Replace
E45-1	Inverter-PCB transmission error (CM1)	Loose, blown, wrong wiring between Condensing unit-control	Wiring conductivity check Loose connection check Wire connection No. check	Replace wiring
		Defective PCB (Condensing unit PCB)	PCB check	Replace PCB
E48-1	DC fan motor No.1 error	Low fan speed is detected	Defective DC fan motor, connector disconnection or short-circuit	Replace DC fan motor or PCB
E48-2	DC fan motor No.2 error			
E49	Low pressure error	Low pressure is detected	Leakage of refrigerant	Repair the leakage
			Defective low pressure sensor, connector disconnection or short-circuit	Replace low pressure sensor
E51-1	Power transistor overheat (continue for 15 min.)	Overheat of power transistor	Check the operation of the transistor cooling fan	Replace power transistor cooling fan or power transistor
		Stops with power transistor temperature sensor blown wire, output error detection	Defective power transistor temperature sensor, connector disconnection or short-circuit	Replace power transistor temperature sensor
E53	Suction pipe temperature sensor error	Suction pipe temperature sensor blown wire, short-circuit are detected	Suction pipe temperature sensor, connector disconnection or short-circuit	Replace
E54-1	Low pressure sensor error	Stops with low pressure sensor blown wire, output error detection	Defective low pressure sensor, connector disconnection or short-circuit	Replace
E54-2	High pressure sensor error	Stops with high pressure sensor blown wire, output error detection	Defective high pressure sensor, connector disconnection or short-circuit	Replace
E55-1	Under-dome temperature sensor error	Under-dome temperature sensor blown wire, short-circuit are detected	Under-dome temperature sensor, connector disconnection or short-circuit	Replace
E56-1	Power transistor temperature sensor error	Power transistor temperature sensor blown wire, short-circuit are detected	Power transistor temperature sensor, connector disconnection or short-circuit	Replace
E58-1	Rotor position detection error	Detection of the compressor rotor position	Check the inverter output	Replace inverter or compressor
			Compressor wiring, connector disconnection or short-circuit	Replace wiring or power transistor
E59-1	Compressor startup failure	Compressor fails to startup.	Check the inverter output	Replace inverter or compressor
			Compressor wiring, connector disconnection or short-circuit	Replace wiring or power transistor
E60	Middle pressure sensor error	Stops with middle pressure sensor blown wire, output error detection	Defective middle pressure sensor, connector disconnection or short-circuit	Replace
E63	Emergency stop	Stops with the external input	Check the connected devices	Replace wiring or repair the connecte devices
E88-1	Oil level sensor error	The oil level of compressor is not adequate	Check the quantity of oil with oil check operetion	Additional refrigerant oil charge
E89	Communication error between CPU of control PCB	Comunnication between CPU is detected	Check the wiring surround the CPU	Repair wiring or replace PCB

Method of error inspection reset

If any error occurred, reset it as follows.

1. Remove the cause of error.
2. Adjust the 7-segment display at "P20" with SW8, SW9, and press SW7 for more than 3 seconds.
3. Change from "0" to "1" with SW8.

The error will be reset.

Make sure, however, to check the error code and remove the cause of error before resetting.

* Error cannot be reset for 3 minutes after it occurred.

6. External signal output

Part of operating states can be output from the controller of condensing unit.

1. Alarm signal

If the condensing unit stops under abnormal condition, an alarm signal is released.

2. Compressor operation signal

Signals of compressor operation and stop can be extracted.

- Extract signals via a relay.

Where the power for the relay contacts is taken from a terminal box, connect the wires as shown by the electric wiring in the next section.

List of external output

Name		Purpose (Factory default)	Specifications	Point of caution	
External input	CNS1(Green)	no use	Non-voltage contact (DC12V)	Stops when open.	
	CNS2(Red)	ON-OFF SW		Valid when short-circuited.	
	CNS3(Brown)	Compulsory oil return control input		Valid when short-circuited.	Use connectors fixed with tapes on the outer wall of the control box.
	CNG1(Blue)	Gas cooler fan snow control input		Valid when short-circuited	
	CNG2(White)	Multistep demand input		Valid when short-circuited.	
External output	CNH(Blue)	Operation output	12 VDC output (10 mA)	-	
	CNY(White)	Error output		-	
	CNZ1, CNZ2 (Red) (Black)	Set with 7-segment (*)		(Molex: Provide 5557-2R, 5556T at site.)	

(*) 0: Operation output 1: Error output 2: Compressor ON output 3: Fan ON output 4: Oil return operation output 5: High pressure control output

6: Compressor operation time (Maintenance time) time-over output

For the default output, see page 6

3. Signal cable connection procedures for connecting module controller

•Signal cables use DC 5 V. Never connect wires for 400 V. It trips the protective fuse on the PCB.

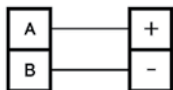
-Confirm that it is so arranged that 400 V power will not be applied to signal cables.

-Check the resistance of signal cable terminal board before turning power on . If the resistance is 100Ω, or less, a power cable may be connected to the signal cable terminal board.

•Communication method is based on RS485.

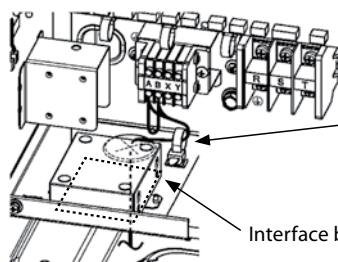
•Connect signal cable to A, B on the terminal board.

•Signal cables has the polarity. Connect them as shown below.



Rotary switch setting (SW1:0, SW2:1) on interface board is "01" from factory shipping. This is slave address number.

Set dip switch SW3-4 of interface board to ON.



Signal cable fixing band

-Fix the signal cable with care to protect the connection to the terminal board from external force.

-Give an adequate allowance to the signal cable before fixing.


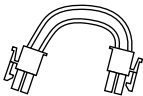



•Connect it to the terminal board using M3.5 crimp terminal as shown in the sketch below.



•Use an adequate screwdriver to tighten terminal screws. If it is tightened too much, it could destroy screws. For the tightening torque of screw, see the table below.

Tightening torque (N-m)		
M3.5	Power cable/signal cable terminal board	0.68 ~ 0.82

Accessories

Name	Q'ty	Location of use	
 Wiring	3	Connect these to CNG1, 2 or CNS3 on the outdoor unit PCB when external inputs are used.	These are fixed in the control box with tapes. When using the wiring, refer to the "External input harness Instruction manual", page 46.
 Wiring	2	When using external outputs, cut the harness at the center to produce a pair of connectors, and connect them to CNH, CNY, CNZ1 and CNZ2 on the outdoor unit PCB.	These are fixed in the control box with tapes. When using the wiring, refer to the "External input harness Instruction manual", page 47.
 Dryer	1	Install in liquid pipe. Dryer pipe diameter need to reduce with reducer to connect liquid pipe.	This is fixed to unit base plate with tapes.
 Reducer (for dryer)	2	Connect to dryer pipe.	These are fixed to unit base plate with tapes.
 Reducer (for service port)	3	Using for airtight test and vacuuming. Connect to service port.	"These are fixed to unit base plate with tapes. When using the reducer, refer to the page 12-13 of Instruction manual "Leak detection" and "Vacuum dehydration"

External Input Harness Installation Manual

The harnesses are used to control the operation of CO₂ refrigerating machine from external control panel (device).
 (The "a" contact relay needs to be provided at site.)

CAUTION

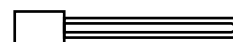
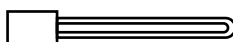
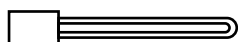
- Have the harnesses installed by your dealer or specialized contractor.
- Electrical work must be made using dedicated circuit by qualified electricians.
- Source power supply to the CO₂ refrigerating machine and external control panel must be turned off before starting work.
- Carefully read the installation manual of CO₂ refrigerating machine, and observe the precautions.

External input harness (attached to the outside of control box) ... 3 pcs.

Brown ... For compulsory oil return control input (CNS3)

Blue ... For gas cooler fan snow control input (CNG1)

White ... For multistage demand input (CNG2)



JST XAP-02V-1

* Harnesses for external operation input (CNS1) and demand input (CNS2) are fixed in the control box with tapes.

Installation procedure

1. Cut the harness, and attach a round terminal (provided at site) at the end, and connect to the relay.
 *External input is input in the non-voltage contact (open or short-circuited). The relay is not necessary if the non-voltage contact output of control panel can be used.
2. Connect the connector to the control PCB of CO₂ refrigerating machine.

External input	Default setting: Function	7-segment: Setting value
CNS3 (Brown)	4: Compulsory oil return control input	P08 : 0 ~ 20
CNG1 (Blue)	5: Gas cooler fan snow control input	P09 : 0 ~ 20
CNG2 (White)	9: Multistage demand input	P10 : 0 ~ 20

Specifications of external input

Default functions of external inputs are as shown at right.

*Inputs use non-voltage contacts.

Functions can be changed from the default settings using the 7-segment display as follows.

* Setting values on the 7-segment display correspond to respective functions as shown at right

[Procedure to change external input function]

1. Using SW8, SW9, change the 7-segment display to the display (PO0) of external input to be changed.
2. Hold down SW7 for 3 seconds to flicker the display, and change the setting value for function to be changed with SW8, SW9.
3. Hold down SW7 for 3 seconds to light the display.
 This is all for the change of external input functions.

Setting value	Function	Open	Short-circuit
0	External operation input	Stop	Valid
1	Demand input	Valid	Valid
2	Quiet mode input	Invalid	Valid
4	Compulsory oil return input	Ordinary	Valid
5	Gas cooler fan snow control input	Ordinary	Valid
9	Multistage demand input	Invalid	Valid

*1 Demand input: P04

*2 Demand rate setting for multistage demand input: 0%, 40%, 60%, 80% PF22: OFF → 000 → 040 → 060 → 080, P14, P15

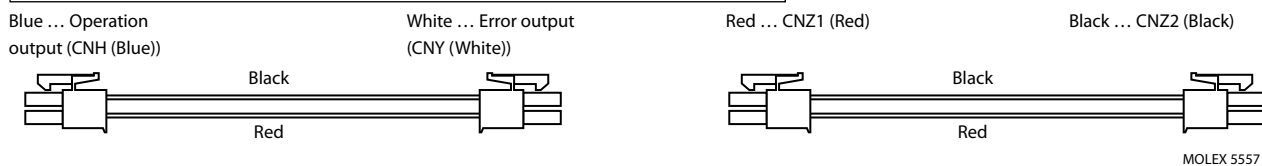
External Output Harness – Installation Manual

The harnesses take out operation and error signals from CO₂ refrigerating machine.
(The 4-point unit relay needs to be provided at site.)

CAUTION

- Have the harnesses installed by your dealer or specialized contractor.
- Electrical work must be made using dedicated circuit by qualified electricians.
- Source power supply to the CO₂ refrigerating machine and external control panel must be turned off before starting work.
- Be sure to use the harnesses via the unit relay. Otherwise it could cause electric shock, or fire.
- Carefully read the installation manual of CO₂ refrigerating machine, and observe the precautions.

External input harness (attached to the outside of control box) ... 3 pcs.



* Harness has connectors at both ends to prevent short-circuit by misconnection.

Installation procedure

1. Cut the harness at center to two pieces.
2. Attach a round terminal at end of each harness, and connect to the relay (provided at site)
3. Connect the connector to the CO₂ refrigerating machine control PCB.

Circuit diagram

* External output is "Plus common DC 12 V output". Coil resistance of contact relay must be 750Ω or higher.

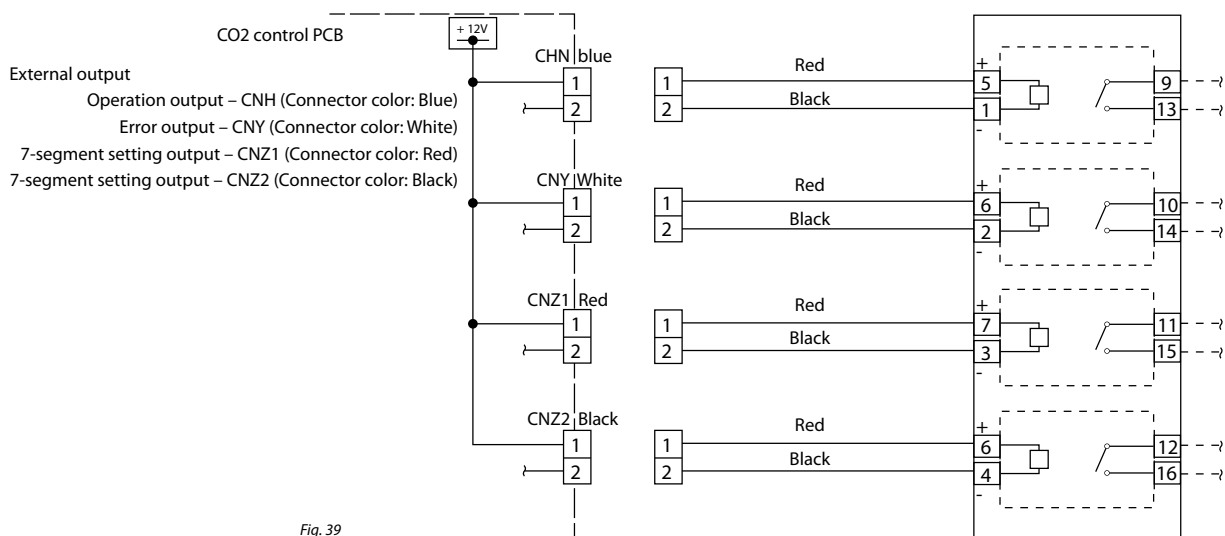


Fig. 39

<4-point relay (Provided at site)>
(Recommended) Omron G5D-F4E
Coil resistance 750Ω or more

<CNZ1, CNZ2 setting method>

External output Function assignment	Code No.	Default setting value
CNZ1	P05	0
CNZ2	P06	1

· P05, P06 setting value

Setting value	Function	Setting value	Function
0	Operation output	5	High pressure control output
1	Error output	6	Compressor operation time (Maintenance time) time-over output
2	Compressor ON output	7	Spare (Spare setting to be same as default setting.)
3	Fan ON output	8	Spare (Spare setting to be same as default setting.)
4	Oil return operation output	9	Spare (Spare setting to be same as default setting.)

7. Troubleshooting

Error code Remote control: – 7-segment display: E32	LED Condensing unit	Green Keep flashing	Red 1-time flash	Content <h2 style="text-align: center;">Open phase of power line</h2>
--	-------------------------------	-------------------------------	----------------------------	---

<p>1. Applicable model</p> <p>All models</p>	<p>5. Troubleshooting</p>	
<p>2. Error detection method</p> <p>Check the power source voltage of inlet side of control PCB. (Check only L3-phase)</p>	<p>Diagnosis</p> <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the primary side of power source voltage between phases OK?} B -- NO --> C[Ask the customer to make rectification.] B -- YES --> D[Reset the power source and restart] D --> E{Is E32 displayed?} E -- YES --> F[Replace control PCB.] E -- NO --> G[Check operation without any rectifications.] </pre>	<p>Countermeasure</p> <ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. (When asking the customer to make rectification, it is much easier to explain the <p>Ask the customer to make rectification.</p> <p>Check it under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Replace control PCB.</p> <p>Check operation without any rectifications.</p>
<p>3. Condition of error displayed</p> <p>If the power voltage between L3 and L1 phases or L3 and L2 phases becomes 0V.</p>		
<p>4. Presumable cause</p> <ul style="list-style-type: none"> • Power source voltage failure on primary side • Control PCB anomaly 		

Note:

Error code Remote control:– 7-segment display: E36-1	LED	Green	Red	Content	Discharge pipe temperature anomaly
	Condensing unit	Keep flashing	*1		

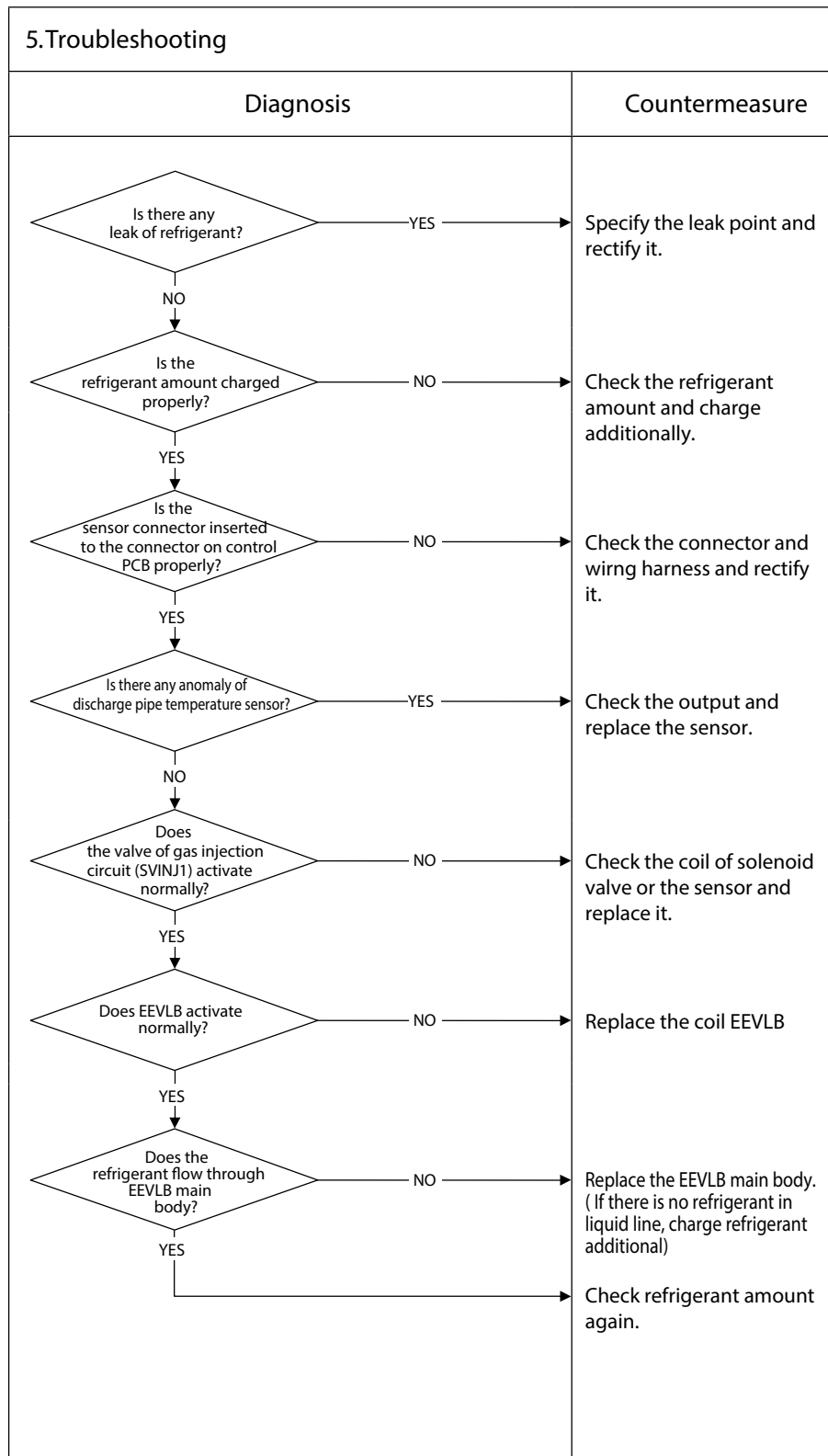
*1 E36-1: 1-time flash

1. Applicable model
All models

2. Error detection method
If discharge pipe temperature sensor detects anomalous high temperature

3. Condition of error displayed
If discharge pipe temperature sensor detects 150°C or higher for 2 seconds or compressor stops 5 times within 60 minutes

4. Presumable cause
<ul style="list-style-type: none"> • Discharge pipe temperature sensor anomaly • Control PCB anomaly • Leakage of refrigerant • Lack of air flow volume • Injection circuit malfunction • Excessive suction superheat due to malfunction of EEV operation.



Note:

Error code	LED	Green	Red	Content
Remote control:— *1 7-segment display: E37-1 to -7	Condensing unit	Keep flashing	*2	Gas cooler temperature sensor (Tho-G1, 2) anomaly Middle pressure receiver inlet temperature sensor (Tho-M) anomaly Gas injection inlet temperature sensor (Tho-INJ1) anomaly Subcooling coil temperature sensor (Tho-SC) anomaly Liquid feed pipe temperature sensor (Tho-R) anomaly

*1 E37-1, -2: Tho-G1, -G2, E37-3: Tho-M, E37-4: Tho-INJ1, E37-6: Tho-SC, E37-7: Tho-R

*2 According to the kinds of sensors, from 1 to 7-time flash or keep flashing

1. Applicable model
All models

2. Error detection method
Detection of the anomalously low temperature (resistance value) of gas cooler temperature sensors

3. Condition of error displayed
If the sensor detects anomalously low temperature for 20 seconds continuously after power ON.

4. Presumable cause
<ul style="list-style-type: none"> • Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly

5. Troubleshooting

Diagnosis	Countermeasure
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the Mente PC data of 30 minutes before stopping</div> <p style="text-align: center;">*3 Check several times to prove any poor connection</p> <p>[Temperature-resistance characteristics] Gas cooler temperature sensor (Tho-G2) Middle pressure receiver inlet temperature sensor (Tho-M) Gas injection inlet temperature sensor (Tho-INJ1) Subcooling coil temperature sensor (Tho-SC) Liquid feed pipe temperature sensor (Tho-R)</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> </div> <div style="text-align: center;"> </div> </div>	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. <p>Insert the connector securely</p> <p>Replace the temperature sensor.</p> <p>Replace the control PCB of condensing unit.</p>

Note:

Error code Remote control:– 7-segment display: E38	LED	Green	Red	Content Outdoor air temperature sensor (Tho-A) anomaly
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model
All models

2. Error detection method
Detection of anomalously low temperature (resistance) of outdoor air temperature sensor (Tho-A)

3. Condition of error displayed
If the sensor detects anomalously low temperature for 20 seconds continuously after power ON

4. Presumable cause
<ul style="list-style-type: none"> • Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly

5. Troubleshooting

Diagnosis	Countermeasure																
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the data 30 minutes before stopping into the Mente PC</div> <pre> graph TD Start[Save the data 30 minutes before stopping into the Mente PC] --> Q1{Is the connector of the anomalous sensor connected properly?} Q1 -- NO --> C1[Insert the connector securely.] Q1 -- YES --> Q2{Are the characteristics of sensor OK? *1} Q2 -- NO --> C2[Replace the temperature sensor (Tho-A).] Q2 -- YES --> C3[Replace the control PCB of condensing unit.] </pre> <p>*1 Check several times to prove any poor connection</p> <p>[Temperature-resistance characteristics]</p> <p>Outdoor</p> <table border="1"> <caption>Temperature-resistance characteristics (Outdoor)</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>3</td></tr> <tr><td>80</td><td>2</td></tr> <tr><td>100</td><td>1</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	3	80	2	100	1	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. <p>Insert the connector securely.</p> <p>Replace the temperature sensor (Tho-A).</p> <p>Replace the control PCB of condensing unit.</p>
Temperature (°C)	Resistance (kΩ)																
-20	50																
0	20																
20	10																
40	5																
60	3																
80	2																
100	1																

Note:

Error code Remote control:– 7-segment display: E39-1 *1	LED	Green	Red	Content Discharge pipe temperature sensor (Tho-D1) anomaly
	Condensing unit	Keep flashing	*2	

*1 E39-1: Tho-D1
 *2 E39-1: 1-time flash

1. Applicable model

All models

2. Error detection method

Detection of anomalously low temperature (resistance) of temperature sensor

3. Condition of error displayed

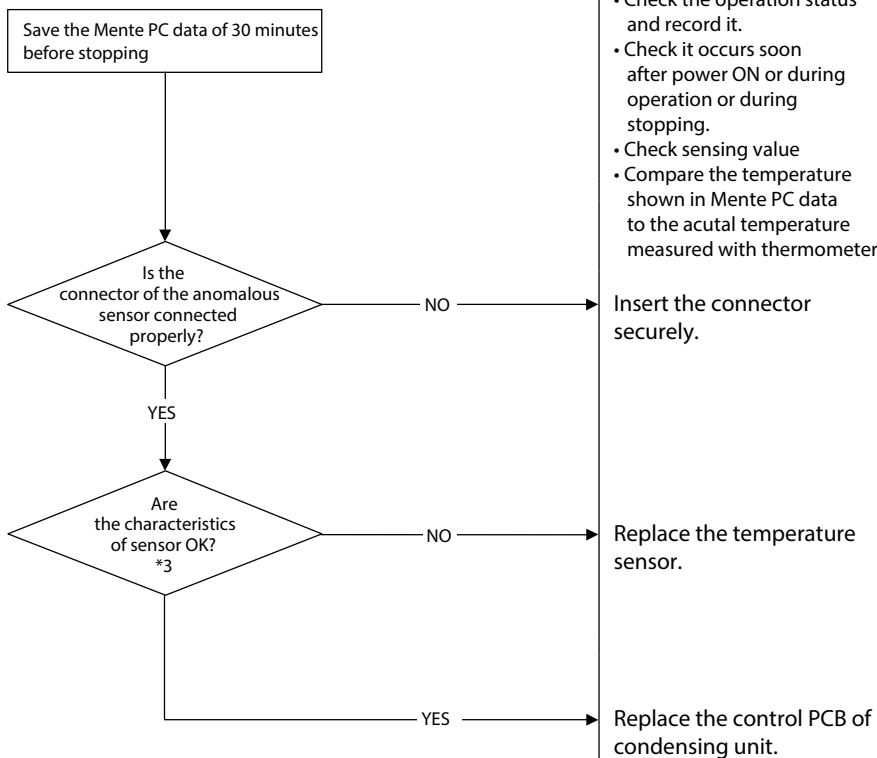
If the sensor detects anomalously low temperature for 20 seconds continuously after power ON.

4. Presumable cause

- Broken sensor harness or the internal wire of sensing section (Check the molded section as well.)
- Disconnection of sensor harness connection (connector)
- Control PCB anomaly

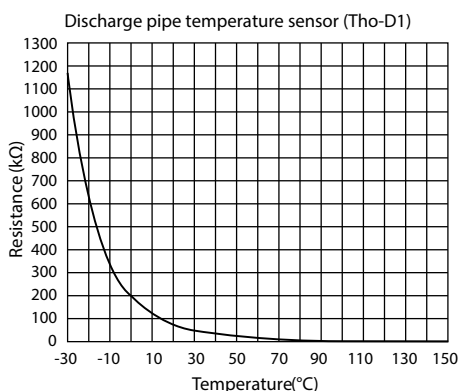
5. Troubleshooting

Diagnosis	Countermeasure
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*3 Check several times to prove any poor connection

[Temperature-resistance characteristics]



Note:

Error code Remote control:- 7-segment display: E40	LED	Green	Red	Content <h2 style="text-align: center;">High pressure anomaly (63H1-1 activated)</h2>
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model
All models

2. Error detection method
When high pressure switch 63H1-1 is activated

3. Condition of error displayed
<ul style="list-style-type: none"> • High pressure increases to 140 bar or higher. • 63H1-1 is activated 5 times within 60 minutes. • 63H1-1 is activated for 60 minutes continuously.

4. Presumable cause
<ul style="list-style-type: none"> • Short-circuit of air flow at gas cooler / Disturbance of air flow / Clogging filter / Fan motor anomaly • Control PCB anomaly • Disconnection of high pressure switch connector • Breakage of high pressure switch harness/Disconnection of connector • Closed service valves • High pressure sensor anomaly

5.Troubleshooting	
Diagnosis	Countermeasure
<pre> graph TD Start[Save the data 30 minutes before stopping into the Mente PC] --> D1{Is 63H1-1 activated at 140 bar or higher?} D1 -- NO --> D2{Is the fuse F2 blown?} D2 -- YES --> C1[Check the operation status and record it. Check the sensing value of high pressure when 63H1-1 is activated. Check the activated pressure of high pressure switch (63H1-1) with the sensing value of high pressure sensor. Check the cause of F2 blown. Check wiring mistake and short circuit of AC220V line.] D2 -- NO --> D3{Does the sensing value of high pressure sensor show 140 bar? (Is 63H1-1 normal?)} D3 -- YES --> D4{Is 63H1-1 normal? Are the connector and the wiring harness of 63H1-1 OK?} D3 -- NO --> D5{Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1-1 wire?} D5 -- YES --> C2[Connect the connector securely. Rectify the disconnection of 63H1-1 wire.] D5 -- NO --> D4 D4 -- YES --> C3[7-segment : Check C31] D4 -- NO --> C4[If it is a fault of connector or disconnection of wiring harness, rectify it. Since the wrong assembling of high pressure switch is suspected, check it as well] C3 --> D6{Does the unit stop, when the high pressure increases to 140 bar?} D6 -- NO --> C5[Replace control PCB] D6 -- YES --> D7{Does the refrigerant circuit get clogged?} D7 -- YES --> C6[Clear the clog.] D7 -- NO --> C7["[Check items] Gas cooler, Strainer, Clogging of gas cooler"] </pre>	<p>• Check the operation status and record it.</p> <p>• Check the sensing value of high pressure when 63H1-1 is activated.</p> <p>• Check the activated pressure of high pressure switch (63H1-1) with the sensing value of high pressure sensor.</p> <p>• Check the cause of F2 blown. Check wiring mistake and short circuit of AC220V line.</p> <p>After checking, replace fuse F2. High pressure sensor anomaly is suspected</p> <p>After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it.)</p> <p>Connect the connector securely. Rectify the disconnection of 63H1-1 wire.</p> <p>If it is a fault of connector or disconnection of wiring harness, rectify it. Since the wrong assembling of high pressure switch is suspected, check it as well</p> <p>Replace control PCB</p> <p>Clear the clog.</p> <p>[Check items] Gas cooler, Strainer, Clogging of gas cooler</p>

Note: If the same error does not reappear, continue to get data with Mente PC.

<div style="border: 1px solid black; padding: 2px; width: fit-content;">Error code</div> <p>Remote control:- *1 7-segment display: E41(E51) -1</p>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">LED</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Green</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Red</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Content</div> <p style="font-size: 1.2em; font-weight: bold;">Power transistor overheating (CM1)</p>
	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Condensing unit</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Keep flashing</div>	<div style="border: 1px solid black; padding: 2px; width: fit-content;">*2</div>	

*1 E41 (E51) -1: CM1
*2 E41 (E51) -1: 1-time flash

1. Applicable model

All models

2. Error detection method

When E41 is displayed on the 7-segment LED display

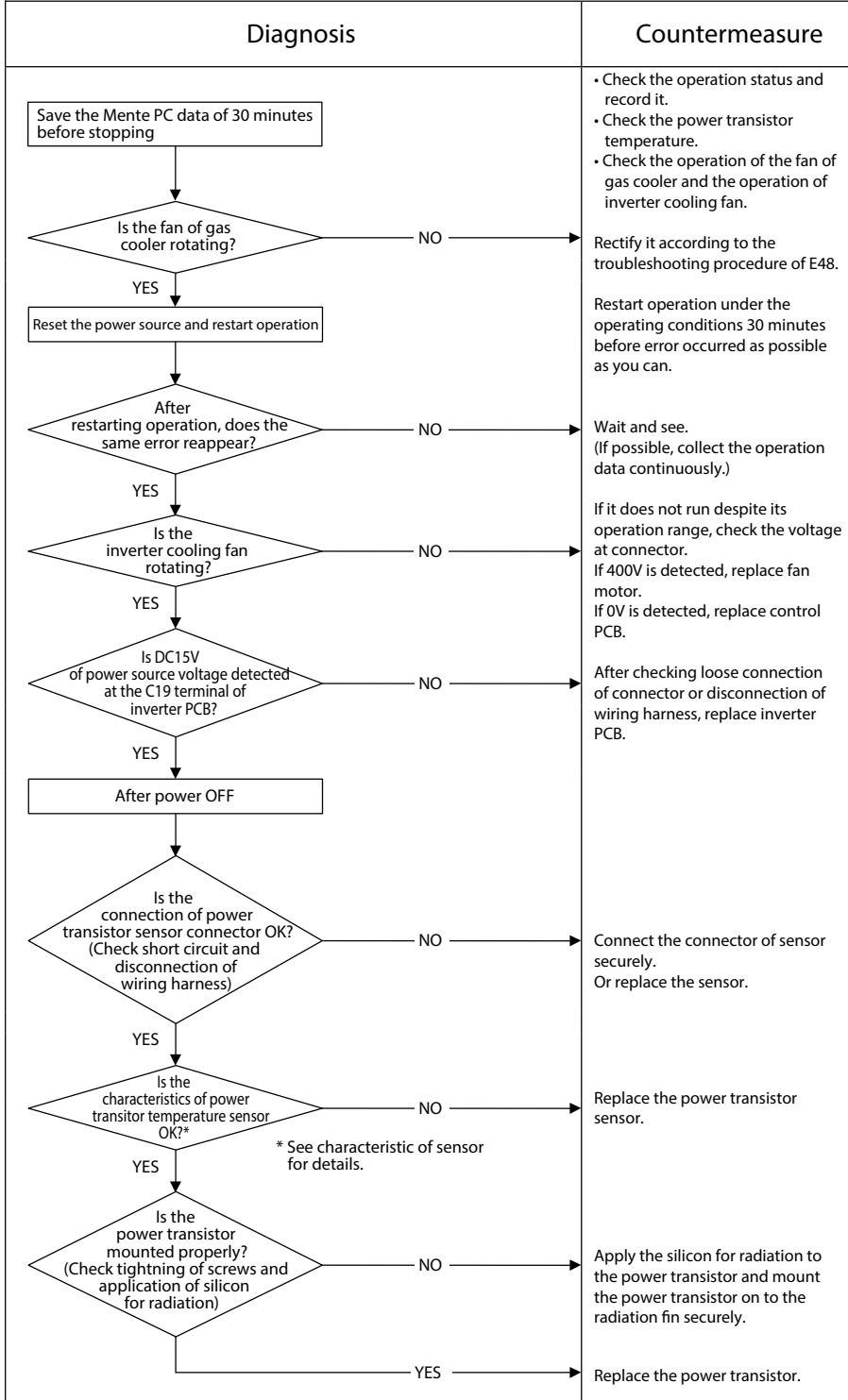
3. Condition of error displayed

Error signal from power transistor is detected 5 times within 60 minutes. (E41)
Or error signal from power transistor is detected for 15 minutes continuously (E51)

4. Presumable cause

- Power transistor anomaly
- Power transistor temperature sensor anomaly
- Anomalous power source to inverter PCB

5. Troubleshooting



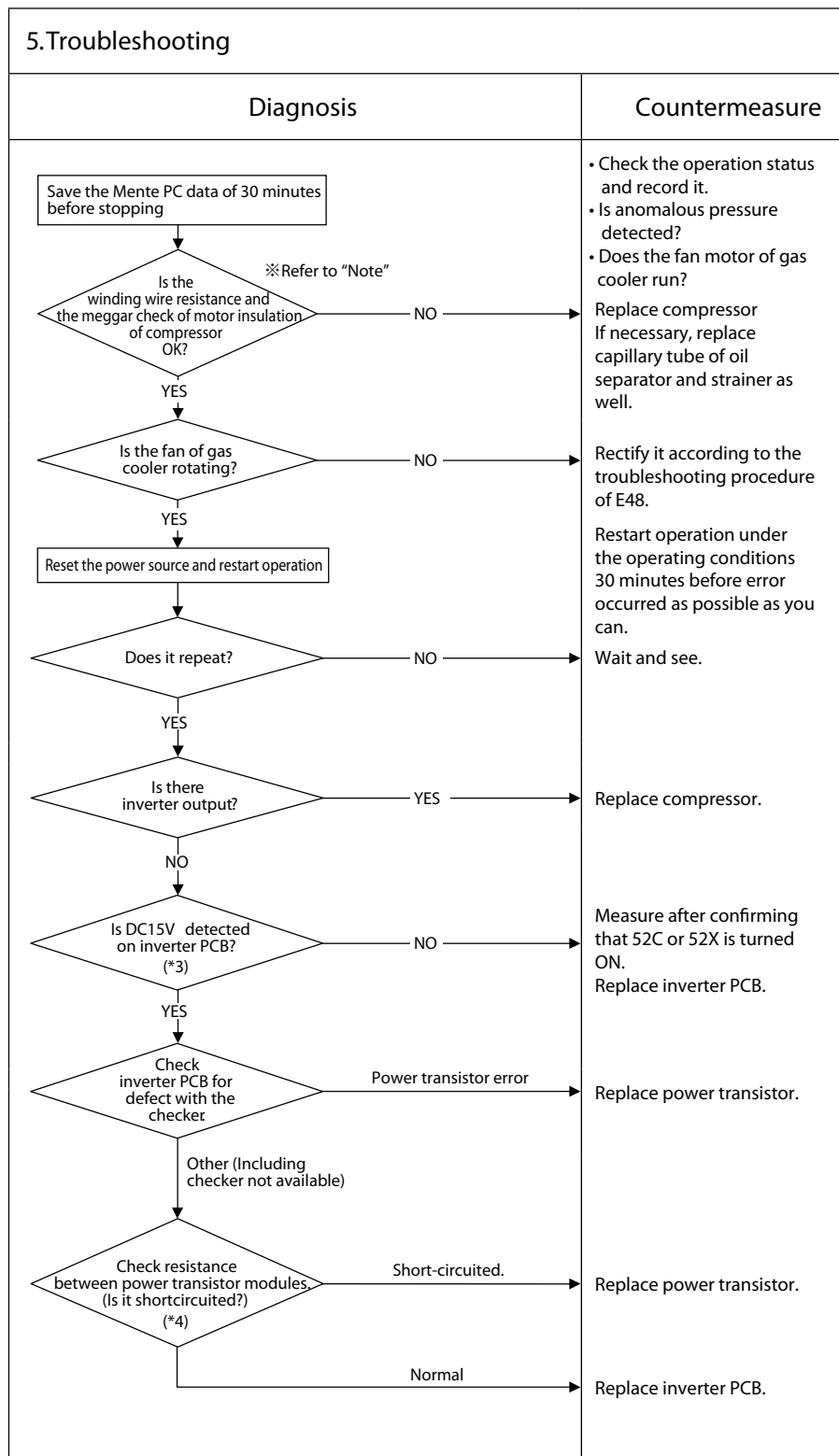
Note: Inverter cooling fan is operated under the condition mentioned at right.
If the same error does not reappear, continue to get data with Mente PC.

Power transistor temperature sensor

Error code	LED	Green	Red	Content
Remote control:— *1 7-segment display: E42-1	Condensing unit	Keep flashing	*2	Current cut (CM1)

*1 E42-1: CM1
*2 E42-1: 1-time flash

1. Applicable model
All models
2. Error detection method
Detect the anomalous output current of inverter with the sensor built in the power transistor
3. Condition of error displayed
If the error signal (47A or higher output current of inverter) is detected 4 times within 20 minutes.
4. Presumable cause
<ul style="list-style-type: none"> • Compressor anomaly • Leak of refrigerant • Power transistor anomaly • Anomalous power voltage to the inverter PCB • Fan motor anomaly



Note: *3 Measurement position: Between + and - of C19 or Between pins 5-8 of PC18, 19 and 20
*4 Measurement position: Check resistance between P-U, P-V, P-W, N-U, N-V, N-W, P-N. (Disconnect compressor wires before measurement).
If it fails to repeat, connect the Mente PC, and continue to collect data.

Error code Remote control:- 7-segment display: E45-1	LED	Green	Red	Content Communication error between inverter PCB and control PCB High pressure anomaly (63H1-1 activated)
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model All models	5. Troubleshooting	
2. Error detection method When E45 is displayed on the 7-segment LED display	Diagnosis	Countermeasure
3. Condition of error displayed When the communication between inverter PCB and control PCB is not established	<pre> graph TD Start[Save the data 30 minutes before stopping into the Mente PC] --> Q1{Is the LED 2 on the control PCB flashing?} Q1 -- NO --> C1[Replace control PCB.] Q1 -- YES --> Q2{Is the LED 1 on the inverter PCB flashing?} Q2 -- NO --> C2[Replace inverter PCB. Check the cause of F2 blown. Check wiring mistake and short circuit of AC220V line. After checking, replace fuse F2. Restart operation under the operating conditions of 30 minutes before error occurred as possible as you can.] Q2 -- YES --> Q3{Is the fuse F2 blown?} Q3 -- YES --> C2 Q3 -- NO --> R1[Reset the power source and restart] R1 --> Q4{Does E45 recur?} Q4 -- NO --> C3[Wait and see. (If possible, collect the operation data continuously.)] Q4 -- YES --> Q5{Does 63H1 activate at the pressure 140 bar or higher?} Q5 -- YES --> Q6{Does the high pressure sensor (PSH1) show 140 bar?} Q6 -- NO --> C4[High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it.)] Q6 -- YES --> Q7{Does the refrigerant circuit get clogged?} Q7 -- YES --> C5[Clear the clog.] Q7 -- NO --> Q8{Is there loose connection of 63H1-1 at the connector on the PCB or disconnection of 63H1-1 wire?} Q8 -- YES --> C6[Connect the connector securely. Rectify the disconnection of 63H1-1 wire.] Q8 -- NO --> End[Go to next page] </pre>	
4. Presumable cause <ul style="list-style-type: none"> • Disconnection of signal wiring harness • Control PCB anomaly • Inverter PCB anomaly • Anomaly of inrush current suppression resistance 	<p>• Check the operation status and record it.</p> <p>• Wait and see. (If possible, collect the operation data continuously.)</p> <p>• Do not use pressure gauge for measuring pressure while operating.</p> <p>• [Check items] Gas cooler, Strainer, Clogging of gas cooler.</p>	

Note: If the same error does not reappear, continue to get data with Mente PC.

Error code	LED	Green	Red	Content
Remote control:– 7-segment display: E45-1	Condensing unit	Keep flashing	1-time flash	Communication error between inverter PCB and control PCB High pressure anomaly (63H1-1 activated)

1. Applicable model

All models

2. Error detection method

When E45 is displayed on the 7-segment LED display

3. Condition of error displayed

When the communication between inverter PCB and control PCB is not established

4. Presumable cause

- Disconnection of signal wiring harness
- Control PCB anomaly
- Inverter PCB anomaly
- Anomaly of inrush current suppression resistance

5. Troubleshooting

Diagnosis	Countermeasure								
<p>From previous page</p> <p>(Check after Power OFF) Is the connection of wiring harness and connector between inverter PCB and control PCB OK?</p> <p>NO →</p> <p>YES →</p> <p>Is the inrush current suppression resistance normal?</p> <p>NO →</p> <p>YES →</p> <p>Is the connection of wiring harness between diode module and inverter PCB OK?</p> <p>NO →</p> <p>YES →</p> <p>Is the DIP switch setting of inverter PCB correct?*</p> <p>* See following for</p> <div style="border: 1px dashed black; padding: 5px; margin: 10px 0;"> <p>[Setting of DIP switch on inverter PCB]</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">JSW10-1 OFF</td> <td style="width: 50%;">JSW11-1 ON</td> </tr> <tr> <td>-2 OFF</td> <td>-2 OFF</td> </tr> <tr> <td>-3 OFF</td> <td>-3 ON</td> </tr> <tr> <td>-4 OFF</td> <td>-4 OFF</td> </tr> </table> </div> <p>NO →</p> <p>YES →</p>	JSW10-1 OFF	JSW11-1 ON	-2 OFF	-2 OFF	-3 OFF	-3 ON	-4 OFF	-4 OFF	<p>Check the disconnection of wiring harness and loose connection of connector. If there is a problem, collect it. Disconnect the wiring harness connected to resistance and check the resistance value between terminals of resistance.</p> <p>If the resistance is broken, replace it. If the resistance is broken, check the wiring harness between diode module and inverter PCB as well.</p> <p>Check the disconnection of wiring harness and loose connection of connector. If there is a problem, correct it.</p> <p>Correct the setting of DIP switch.</p> <p>Replace inverter PCB.</p>
JSW10-1 OFF	JSW11-1 ON								
-2 OFF	-2 OFF								
-3 OFF	-3 ON								
-4 OFF	-4 OFF								

Note:

Error code	LED	Green	Red	Content
Remote control:- 7-segment display:E48-1,2 *1	Condensing unit	Keep flashing	*1	DC fan motor anomaly (1/2)

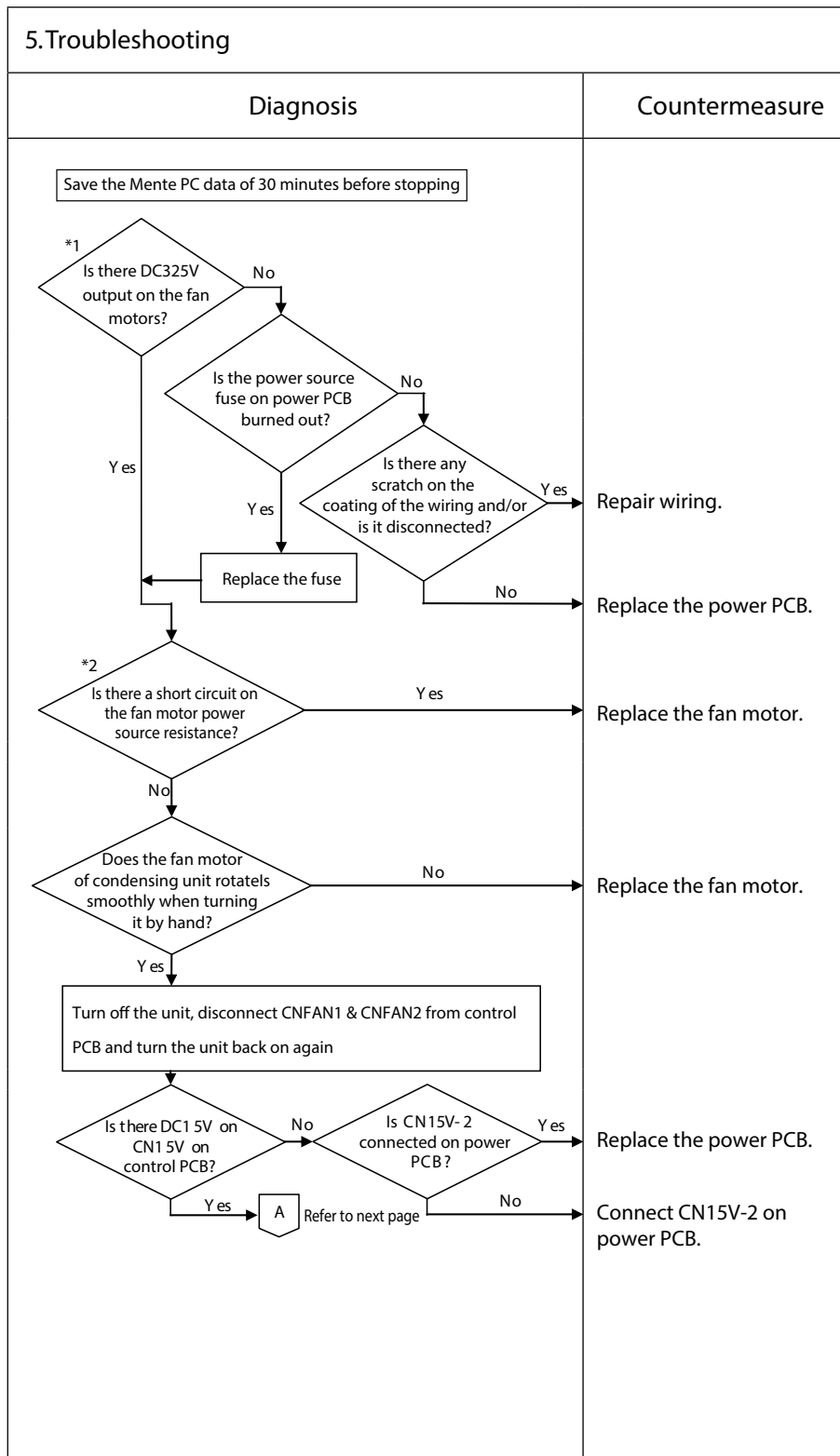
*1 E48-1:FMO1 / 1-time flash, E48-2:FMO2 / 2-time flash

1. Applicable model
All models

2. Error detection method
<ul style="list-style-type: none"> When fan speed command is 400min-1 or lower and over current status is detected 10 times continuously When actual fan speed is 100 min-1 or lower for 30 seconds

3. Condition of error displayed
<ul style="list-style-type: none"> When fan speed command is 400min-1 or lower and overcurrent status is detected 10 times continuously When actual fan speed is 100min-1 or lower for 30 seconds (Fan motor is locked.)

4. Presumable cause
<ul style="list-style-type: none"> Disconnection of wiring or loose connection of connector Fan motor anomaly Control PCB anomaly Power PCB anomaly



Notes: *1 Measurement item Connector of power source wiring for fan motors (RED - BLACK)
 *2 Refer to resistance on another table (Page 58)
 If the same error does not reappear, continue to get data with Mente PC.

Error code Remote control:- 7-segment display:E48-1,2 *1	LED Condensing unit	Green Keep flashing	Red *1	Content DC fan motor anomaly (2/2)
---	-------------------------------	-------------------------------	------------------	--

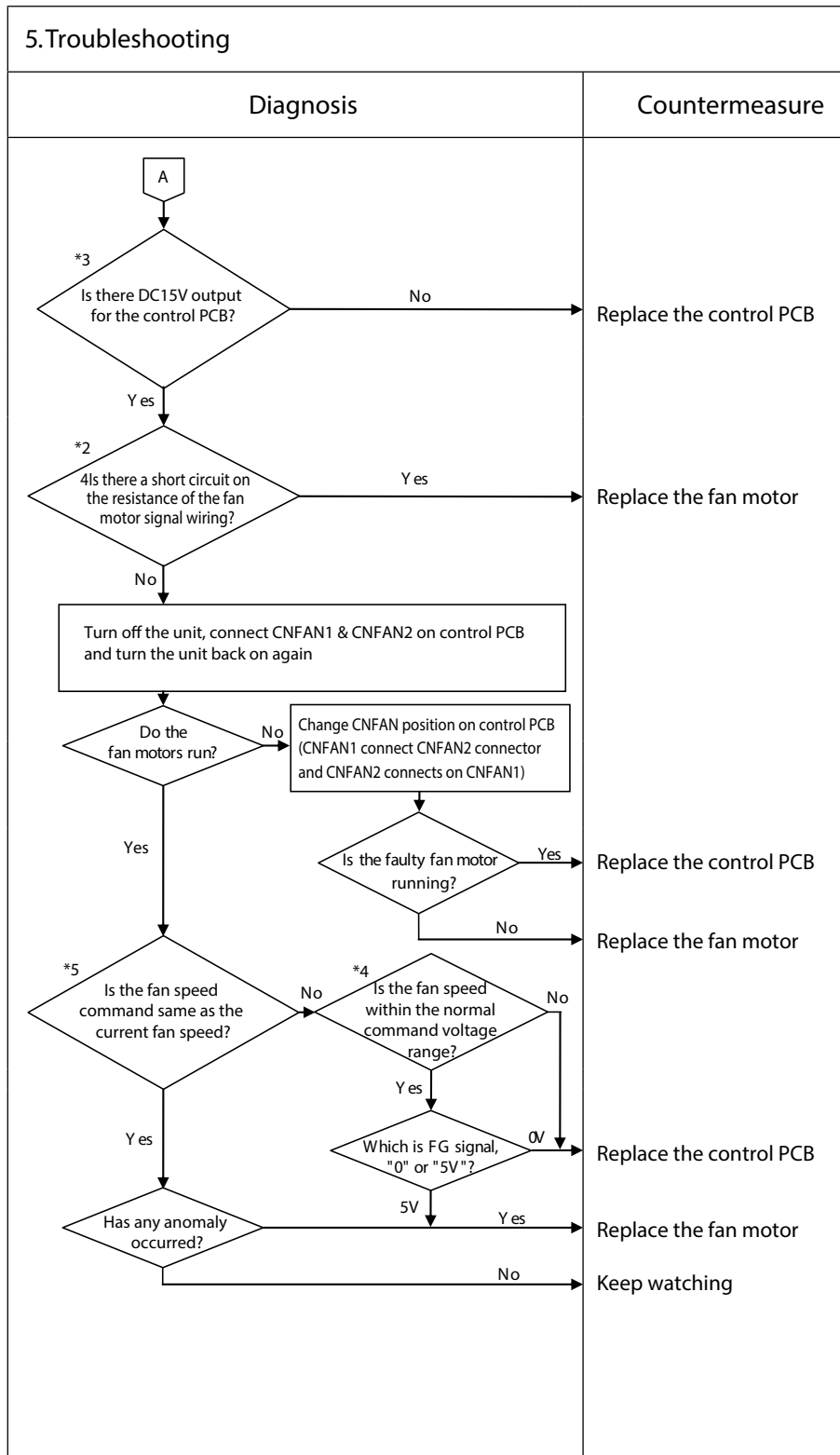
*1 E48-1:FMO1 / 1-time flash, E48-2:FMO2 / 2-time flash

1. Applicable model All models
--

2. Error detection method <ul style="list-style-type: none"> • When fan speed command is 400min⁻¹ or lower and over current status is detected 10 times continuously • When actual fan speed is 100 min⁻¹ or lower for 30 seconds

3. Condition of error displayed <ul style="list-style-type: none"> • When fan speed command is 400min⁻¹ or lower and overcurrent status is detected 10 times continuously • When actual fan speed is 100min⁻¹ or lower for 30 seconds (Fan motor is locked.)
--

4. Presumable cause <ul style="list-style-type: none"> • Disconnection of wiring or loose connection of connector • Fan motor anomaly • Control PCB anomaly • Power PCB anomaly



Notes: *2 Refer to resistance on another table (Page 58) *3 Measurement item Between 1-6 pin of CNFAN connector for control PCB
 *4 Speed command voltage 0 ~ 7.5[V] *5 Checking by Mente PC or 7-segment
 If the same error does not reappear, continue to get data with Mente PC.

				Part number for fan motor
Terminal	Signal	Measurement point		SSA512T101 or SSA512T155
Electric source	VM	Between 1 pin and 2 pin of power source terminal (GND)	Red-Black	1MΩ and over
Control	Vcc	Between 1 pin and 2 pin of power source terminal (GND)	White-Black	7.7kΩ ±20%
	REV	Between 2 pin and 2 pin of power source terminal (GND)	Orange-Black	1MΩ and over
	VSP	Between 3 pin and 2 pin of power source terminal (GND)	Yellow-Black	200k Ω ±10%
	FG	Between 4 pin and 2 pin of power source terminal (GND)	Blue-Black	1MΩ and over
	OVERC	Between 5 pin and 2 pin of power source terminal (GND)	Green-Black	1MΩ and over
	GND	Between 6 pin and 2 pin of power source terminal (GND)	Peach-Black	1MΩ and over

Note: Measurement value varies depending on measurement equipment used. This value is to inspect obvious anomaly e.g. short circuit etc. and then it's not the one to guarantee to judge right and wrong.

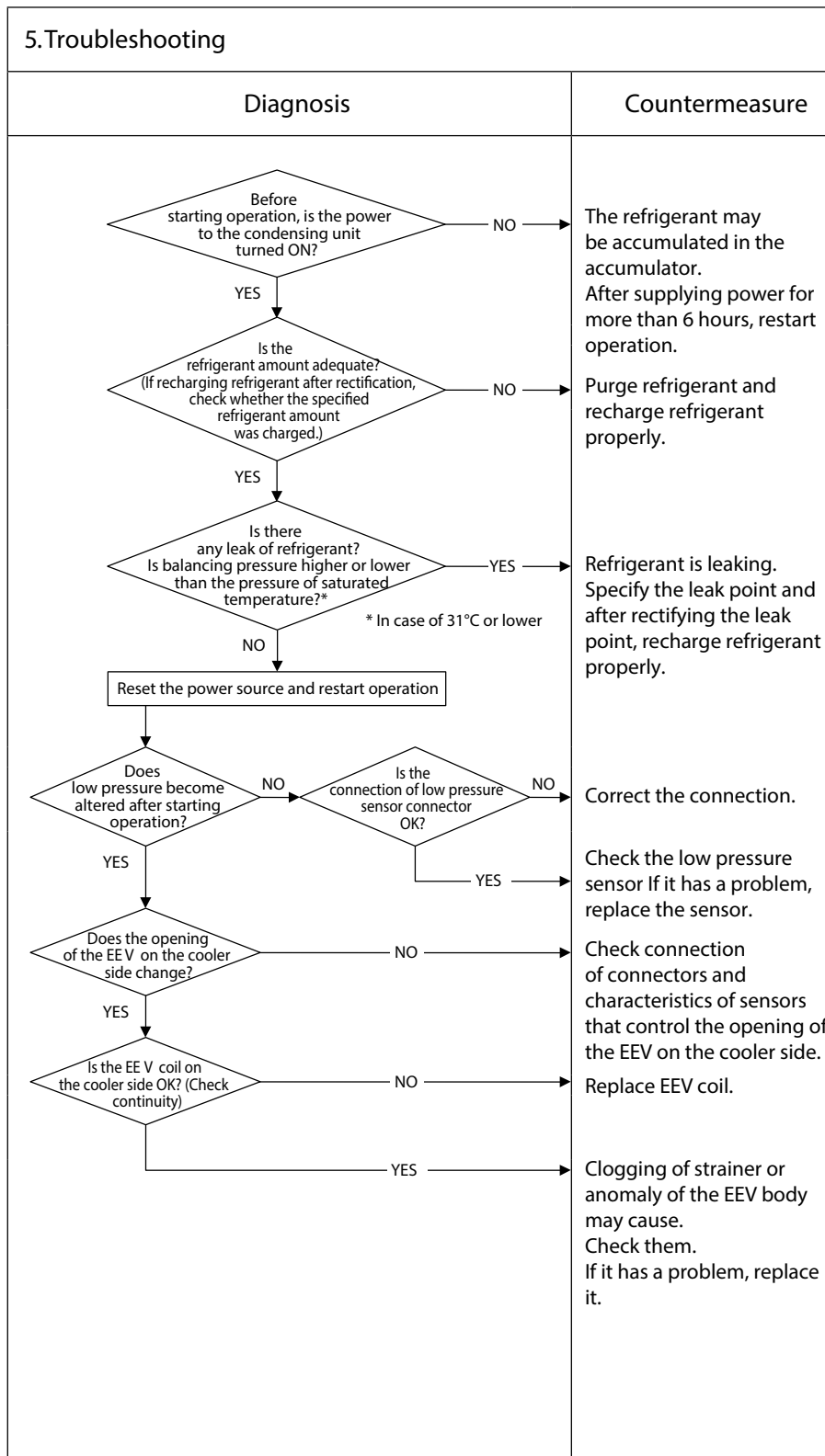
Error code Remote control:- 7-segment display: E49-1	LED	Green	Red	Content <h2 style="text-align: center;">Low pressure anomaly</h2>
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model
All models

2. Error detection method
Detection of anomalously low pressure • LP 5.8 bar is detected for 2 seconds continuously

3. Condition of error displayed
If error signal is detected 10 times within 60 minutes

4. Presumable cause
<ul style="list-style-type: none"> • Leak of refrigerant • EEV on the cooler side anomaly



Note:

Error code Remote control:- 7-segment display: E53-1	LED	Green	Red	Content Suction pipe temperature sensor (Tho-S) anomaly
	Condensing unit	Keep flashing	1 time flash	

1. Applicable model All models
--

2. Error detection method Detection of anomalously low temperature (resistance) of temperature sensor (Tho-S1)
--

3. Condition of error displayed If the sensor detects -50°C or lower temperature for 5 seconds continuously

4. Presumable cause <ul style="list-style-type: none"> • Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly

5. Troubleshooting

Diagnosis	Countermeasure																
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the Mente PC data of 30 minutes before stopping</div> <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace temperature sensor (Tho-S1).] D -- YES --> F[Replace the control PCB of condensing unit.] </pre> <p>*3 Check several times to prove any poor connection.</p> <p>[Temperature-resistance characteristics]</p> <p>Suction pipe temperature sensor (Tho-S)</p> <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	2	80	1	100	0.5	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. <p>Insert the connector securely.</p> <p>Replace temperature sensor (Tho-S1).</p> <p>Replace the control PCB of condensing unit.</p>
Temperature (°C)	Resistance (kΩ)																
-20	50																
0	20																
20	10																
40	5																
60	2																
80	1																
100	0.5																

Note:

Error code	LED	Green	Red	Content
Remote control:- *1 7-segment display: E54-1, 2	Condensing unit	Keep flashing	* 1	High pressure/Low pressure sensor anomaly (PSH/PSL)

* 1 E54-1/1 time flash: Low pressure sensor, E54-2/2 time flash: High pressure sensor

1. Applicable model

All models

2. Error detection method

Detection of anomalous pressure (resistance) of PSH/PSL

[High pressure 0 - 140 bar
Low pressure 0 - 100 bar]

3. Condition of error displayed

If the pressure sensor detects anomalous output voltage for 20 seconds continuously after turning power ON
Or if the pressure sensor detects anomalous output voltage for 5 seconds continuously within 2 minutes to 2 minutes and 20 seconds after the compressor ON

4. Presumable cause

- Broken sensor harness
- Disconnection of sensor harness connection (connector)
- Sensor anomaly
- Control PCB anomaly
- Bad installation condition
- Insufficient refrigerant amount

5. Troubleshooting

Diagnosis	Countermeasure
<p>Save the Mente PC data of 30 minutes before stopping</p> <p>Check the data of 30 minutes before stopping</p> <p>Does anomalous pressure occur?</p> <p>YES → Is the connection of connector of the anomalous sensor to the control PCB OK?</p> <p>NO → Insert the connector of sensor securely and restart operation.</p> <p>YES → Reset the power source and restart operation</p> <p>Is the pressure value indicated on Mente PC same as that measured with pressure gauge?*</p> <p>YES → Does the same error recur?</p> <p>NO → Temporary malfunction by noise. If noise source can be specified, take a measure.</p> <p>NO → Measure the output voltage of sensor</p> <p>Is the measured output voltage of sensor same as that shown in following characteristics?</p> <p>YES → Replace control PCB.</p> <p>NO → Replace sensor.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</p> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>[Output characteristics of high pressure sensor] (Up to 150 bar)</p> </div> <div style="text-align: center;"> <p>[Output characteristics of low pressure sensor] (Up to 100 bar)</p> </div> </div> <p>Pressure sensor output voltage : To measure between Black-White</p>	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value. <p>No anomaly in pressure sensor & its control. Suspect other causes which can cause pressure anomaly. (I.E, lack of CO₂ gas and etc...).</p>

Note:

Error code Remote control:- 7-segment display: E55-1	LED	Green	Red	Content Under-dome temperature sensor (Tho-C1) anomaly
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model All models
--

2. Error detection method Detection of anomalously low temperature (resistance) of temperature sensor. (Tho-C1)

3. Condition of error displayed If the sensor detects -50°C or lower temperature for 5 seconds continuously

4. Presumable cause <ul style="list-style-type: none"> • Broken sensor harness or the internal wire of sensing section(Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly

5. Troubleshooting

Diagnosis	Countermeasure																
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the Mente PC data of 30 minutes before stopping</div> <pre> graph TD Start[Save the Mente PC data of 30 minutes before stopping] --> Q1{Is the connector of the anomalous sensor connected properly?} Q1 -- NO --> C1[Insert the connector securely.] Q1 -- YES --> Q2{Are the characteristics of sensor OK? *1} Q2 -- NO --> C2[Replace under-dome temperature sensor (Tho-C1).] Q2 -- YES --> C3[Replace the control PCB of condensing unit.] </pre> <p style="text-align: center;">*1 Check several times to prove any poor connection.</p> <p style="text-align: center;">[Temperature-resistance characteristics] Under-dome temperature sensor (Tho-C1, 2)</p> <table border="1" style="margin-top: 10px;"> <caption>Approximate data from the Temperature-resistance characteristics graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>3</td></tr> <tr><td>80</td><td>2</td></tr> <tr><td>100</td><td>1.5</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	3	80	2	100	1.5	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely. <ul style="list-style-type: none"> • Replace under-dome temperature sensor (Tho-C1). • Replace the control PCB of condensing unit.
Temperature (°C)	Resistance (kΩ)																
-20	50																
0	20																
20	10																
40	5																
60	3																
80	2																
100	1.5																

Note:

Error code	LED	Green	Red	Content
Remote control:– 7-segment display: E56-1	Condensing unit	Keep flashing	1-time flash	Power transistor temperature sensor (Tho-P1) anomaly

1. Applicable model

All models

2. Error detection method

Detection of anomalously low temperature (resistance) of power transistor temperature sensor. (Tho-P1)

3. Condition of error displayed

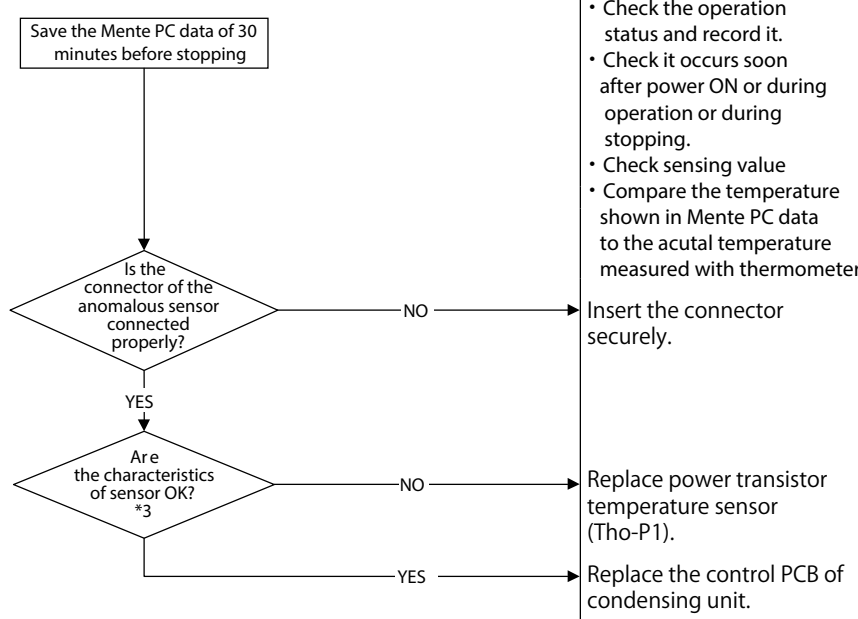
Under the condition of 0°C or higher of outdoor air temperature, if the sensor detects disconnection for 20 seconds continuously within 5 seconds after 10 minutes has elapsed since compressor ON, it makes the compressor stopped. After 3 minutes, compressor restarts automatically. And then if this error is detected 3 times within 40 minutes, it makes error stop.

4. Presumable cause

- Broken sensor harness or the internal wire of sensing section (Check the molded section as well.)
- Disconnection of sensor harness connection (connector)
- Control PCB anomaly

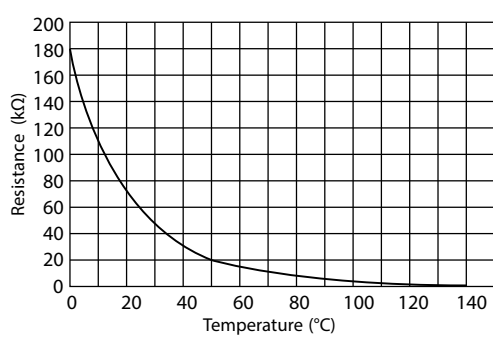
5. Troubleshooting

Diagnosis	Countermeasure
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*3 Check several times to prove any poor connection.

[Temperature-resistance characteristics]
Power transistor temperature sensor (Tho-P1)



Note:

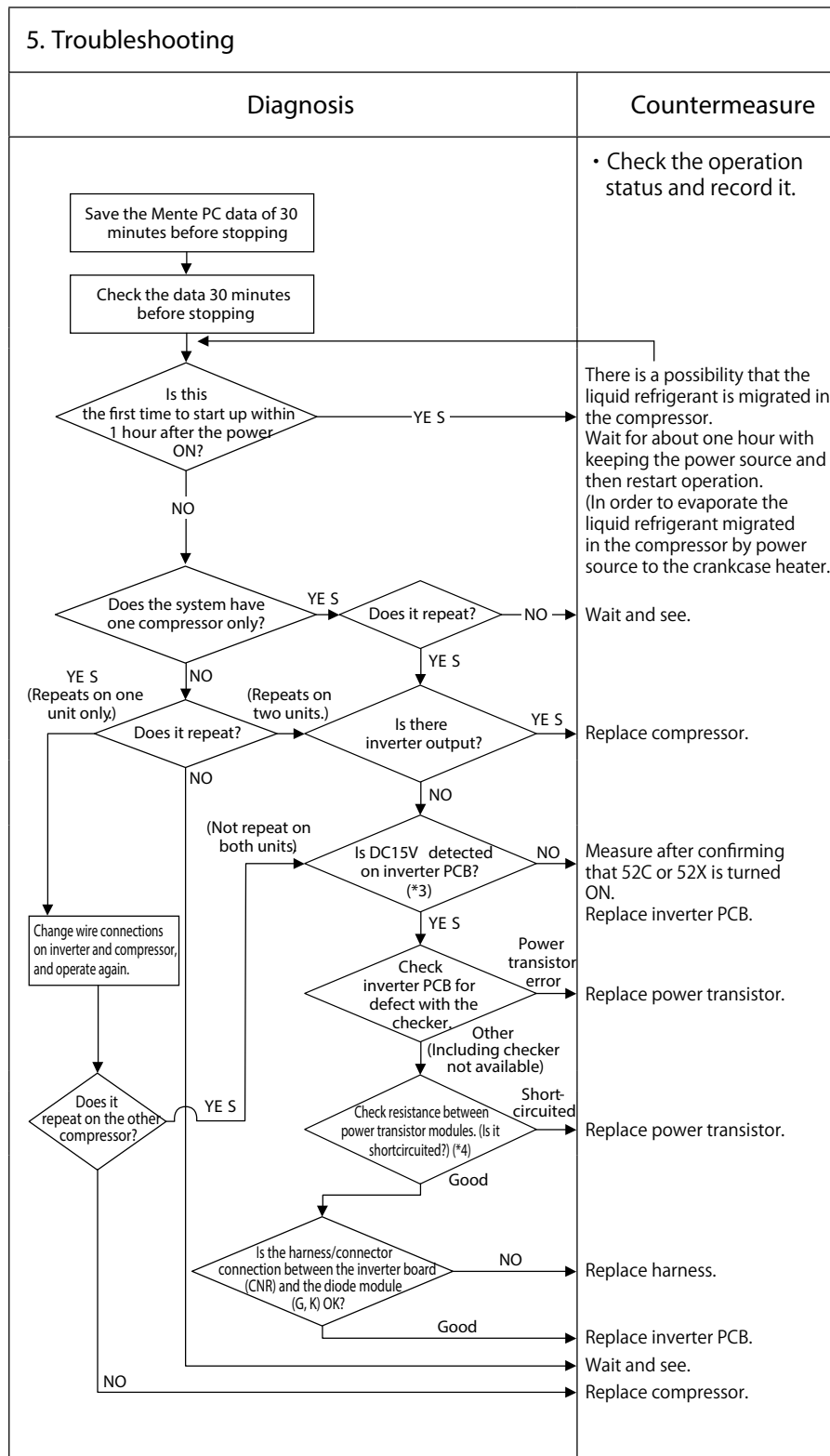
Error code	LED	Green	Red	Content
Remote control:- 7-segment display: E58-1	Condensing unit	Keep flashing	1-time flash	Compressor anomaly by loss of synchronism

1. Applicable model
All models

2. Error detection method
When E58-1 is displayed on the 7-segment LED display

3. Condition of error displayed
If this anomaly is established 4 times within 20 minutes

4. Presumable cause
<ul style="list-style-type: none"> • Insufficient communication hours before start operation. (Start operation without power source to the crankcase heater in advance) • Compressor anomaly • Harness anomaly



Note: *3 Measurement position: Between + and - of C19 or Between pins 5-8 of PC18, 19 and 20
 *4 Measurement position: Check resistance between P-U, P-V, P-W, N-U, N-V, N-W, P-N. (Disconnect compressor wires before measurement.). If it fails to repeat, connect the Mentec PC, and continue to collect data.

Error code Remote control:- 7-segment display: E59-1	LED	Green	Red	Content <h2 style="text-align: center;">Compressor startup failure</h2>
	Condensing unit	Keep flashing	1-time flash	

1. Applicable model

All models

2. Error detection method

When it fails to change over to the operation for rotor position detection of compressor motor

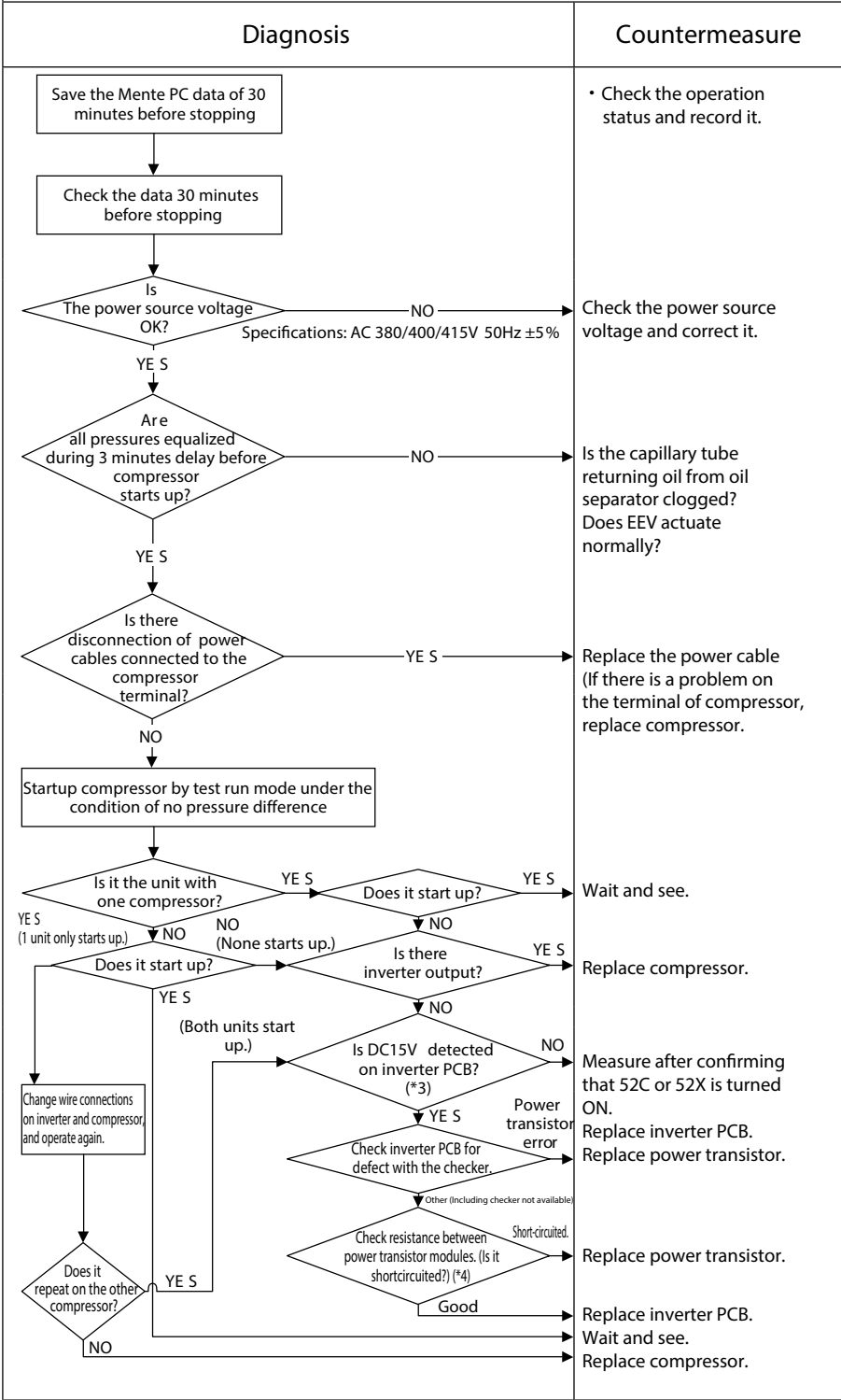
3. Condition of error displayed

If the compressor fails to startup 20 times (10 patterns×2 times) continuously.

4. Presumable cause

- Anomalous power source voltage
- Faulty component for refrigerant circuit
- Inverter PCB anomaly
- Disconnection of power cable and/or poor connection of connector
- Compressor anomaly (Motor or bearing)
- Power transistor anomaly

5. Troubleshooting



Note: *3 Measurement position: Between + and - of C19 or Between pins 5-8 of PC18, 19 and 20
 *4 Measurement position: Check resistance between P-U, P-V, P-W, N-U, N-V, N-W, P-N. (Disconnect compressor wires before measurement.). If it fails to repeat, connect the Mente PC, and continue to collect data.

Error code	LED	Green	Red	Content
Remote control:- 7-segment display: E60	Condensing unit	Keep flashing	1-time flash	Middle pressure sensor anomaly PSM

1. Applicable model

All models

2. Error detection method

Detection of anomalous pressure (resistance) of PSM
[Middle pressure 0 - 10MPa]

3. Condition of error displayed

If the pressure sensor detects anomalous output voltage for 5 seconds continuously within 2 minutes to 2 minutes and 20 seconds after the compressor ON

4. Presumable cause

- Broken sensor harness
- Disconnection of sensor harness connection (connector)
- Sensor anomaly
- Control PCB anomaly
- Bad installation condition
- Insufficient refrigerant amount

5. Troubleshooting

Diagnosis	Countermeasure
<p>Save the Mente PC data of 30 minutes before stopping</p> <p>Check the data of 30 minutes before stopping</p> <p>Does anomalous pressure occur?</p> <p>NO → Reset the power source and restart operation</p> <p>YES → Is the connection of connector of the anomalous sensor to the control PCB OK?</p> <p>NO → Insert the connector of sensor securely and restart operation.</p> <p>YES → Does the same error recur?</p> <p>NO → Temporary malfunction by noise. If noise source can be specified, take a measure.</p> <p>YES → No anomaly in pressure sensor & its control. Suspect other causes which can cause pressure anomaly. (I.E, lack of CO₂ gas and etc...).</p> <p>Measure the output voltage of sensor</p> <p>Is the measured output voltage of sensor same as that shown in following characteristics?</p> <p>NO → Replace sensor.</p> <p>YES → Replace control PCB.</p> <p><i>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</i></p> <p>[Output characteristics of middle pressure sensor] (Up to 100 bar)</p> <p>Pressure sensor output voltage : To measure between Black-White</p>	<ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value.

Note:

Error code Remote control:- 7-segment display: E63	LED	Green	Red	Content <h2 style="text-align: center;">Emergency stop</h2>
	Condensing unit	Keep flashing	1-time flash	

1.Applicable model
All models

2.Error detection method
When the contact signal is input to CNS3, CNG1 and CNG2 on the control PCB of condensing unit.

3.Condition of error displayed
Same as above

4.Presumable cause
<ul style="list-style-type: none"> • Occurrence of emergency stop factor

5.Troubleshooting	
Diagnosis	Countermeasure
<pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Dose the contact signal input to CNS3, CNG1 and CNG2 on the control PCB?} B -- NO --> C[Replace control PCB] B -- YES --> D[Check the cause for occurring emergency stop. (It is better to have the data of 30 minutes before stopping for checking.)] </pre>	

Note: The condensing unit detected the emergency stop signal sends the command to make [All stop].

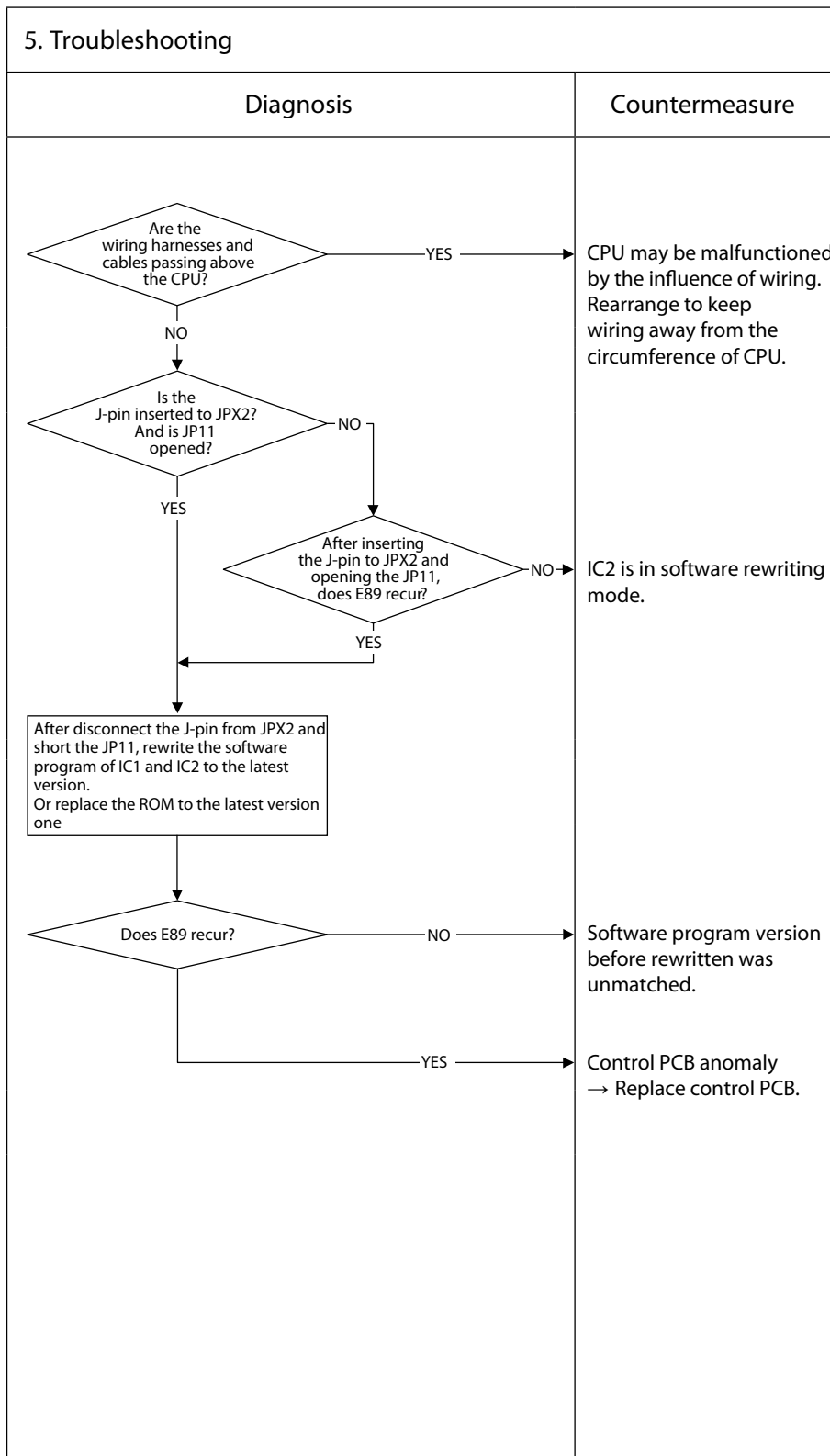
Error code Remote control:- 7-segment display: E89	LED	Green	Red	Content Communication error between CPU of control PCBs
	Condensing unit	Keep flashing	1-time flash	

1.Applicable model
All models

2.Error detection method
When the communication between CPUs is interrupted for a certain period of time

Condition of error displayed
If it occurs 4 times within 15 minutes

4.Presumable cause
<ul style="list-style-type: none"> • Noise • Mixing of software versions • Control PCB anomaly



Note:

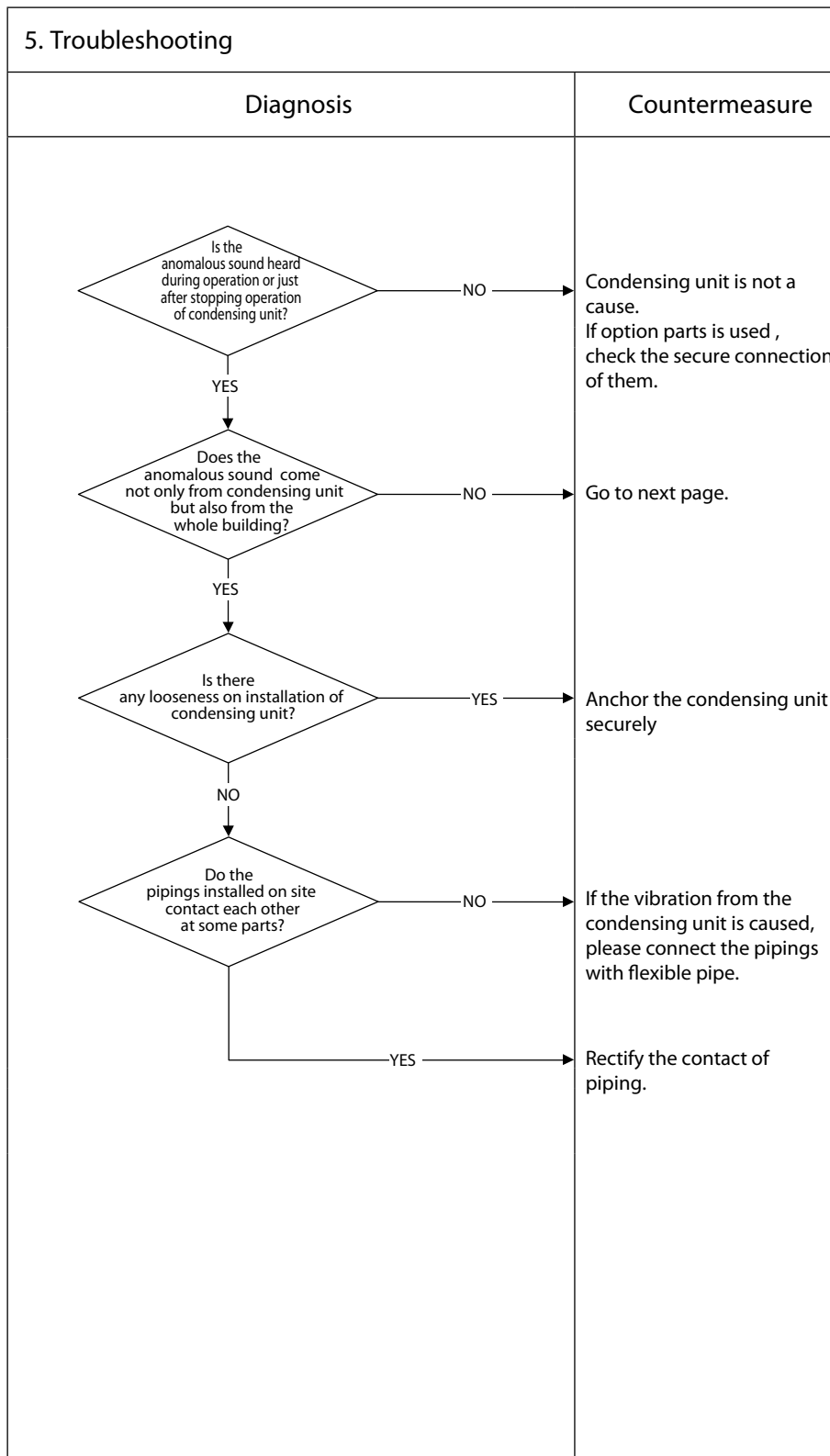
Error code Remote control: No display 7-segment display: No display	LED	Green	Red	Content Anomalous sound and vibration (1)
	Condensing unit	Stay OFF	Stay OFF	

1.Applicable model
All models

2.Error detection method

3. Condition of error displayed

4.Presumable cause



Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Condensing unit	Stay OFF	Stay OFF	Anomalous sound and vibration (2)

1.Applicable model	5. Troubleshooting		
All models	Diagnosis		Countermeasure
2.Error detection method			
3. Condition of error displayed			
4.Presumable cause			

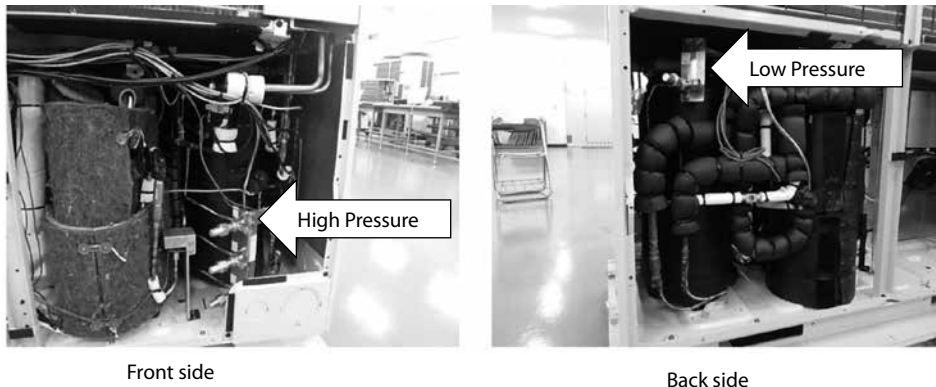
Note:

8. Disassemble and reassemble method

8.1 Compressor replacement procedure

(a) Purge CO₂ refrigerant

Discharge refrigerant through service valves for high and low pressure.

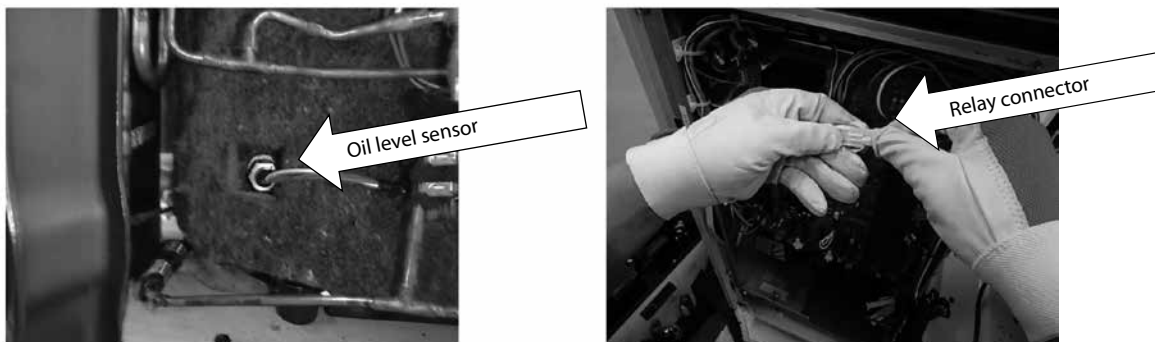


(b) Before dismounting compressor

1) Remove insulation jacket from the compressor

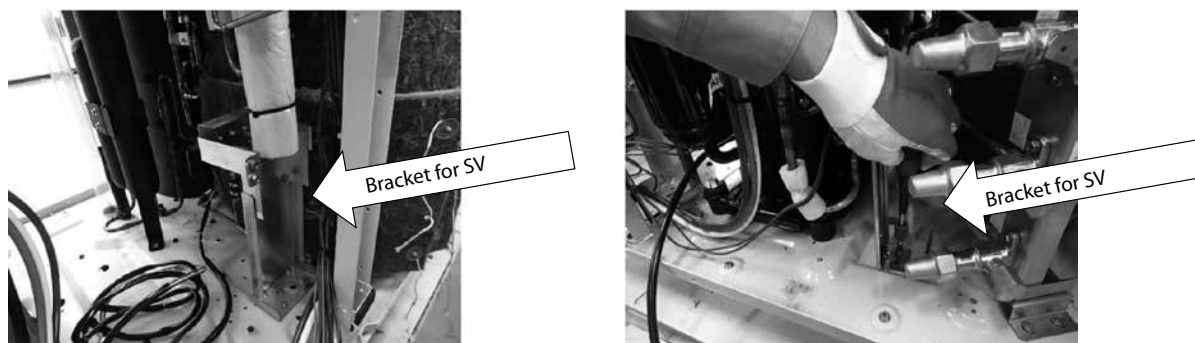
a) Disconnect harness of the oil level sensor from the connector.

As the harness for the oil level sensor passes through the insulation, disconnect the relay connector (OSL1-2) where connected with another connectors from the control PCB. (CNTH7, CNZ on control PCB)



b) Moving aside bracket for solenoid valve (SV)

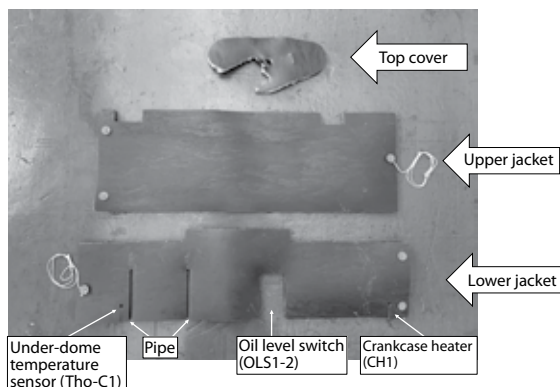
Remove the bracket for the SV from the compressor to keep the workspace.



2) Remove insulation jackets

Taking off / pulling out from the left-hand side with following orders;

Lower jacket → Upper jacket → Top cover



3) Remove temperature sensors (four places) and crankcase heater

1. Tho-S1(Suction pipe temperature sensor)



2. Tho-INJ1(Injection inlet temperature sensor)



3. Tho-C1(Under-dome temperature sensor)



4. Crankcase heater



5. Tho-D1(Discharge pipe temperature sensor)



4) Remove the power cables from the compressor

1. Remove the terminal cover



2. Use stubby screwdriver since the terminals are facing upward.

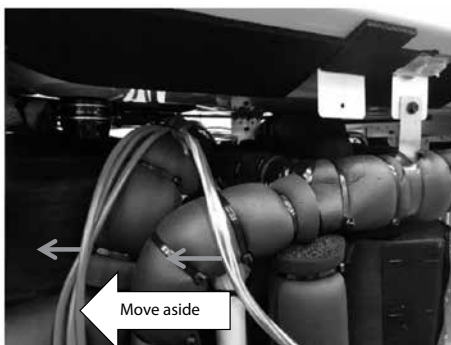


3. Remove the terminal block.



5) Keep off harnesses from the brazing area

Before starting brazing, remove EEV coil and sensors located backside to keep-off harnesses from the brazing area.



Remove EEV to keep the harnesses away.

(c) Dismounting compressor

1) Disconnect pipes by cutting

1. Suction pipe, Discharge pipe, Oil return pipe, Gas injection (Below picture shows the Suction pipe.)

Be careful: Oil may come out from the pipe inside.

Make sure if residual pressure is 0 bar.

In case anything goes wrong, sudden brazing is dangerous.

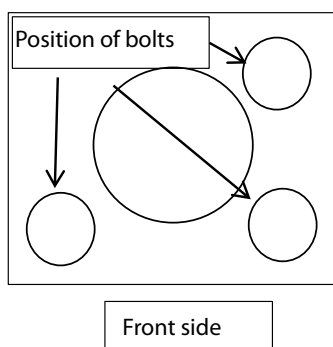
We recommend dismantling the compressor by cutting off the pipes because the pipes are thicker and longer inserted for the CO₂ refrigerant pipes.

For the compressor investigation, remain full pipes for the compressor side when cutting off.



2) Dismounting compressor

Dismounting installation bolts (three positions in total) and pulling out with inclining upper side of compressor to front side.



(d) Mounting the new compressor

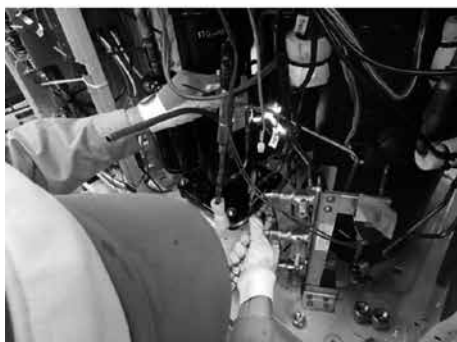
1) Mounting the new compressor

Braze pipes after tightening fixing bolts (three positions in total).

1. Gas injection pipe



2. Oil return pipe



3. Suction pipe



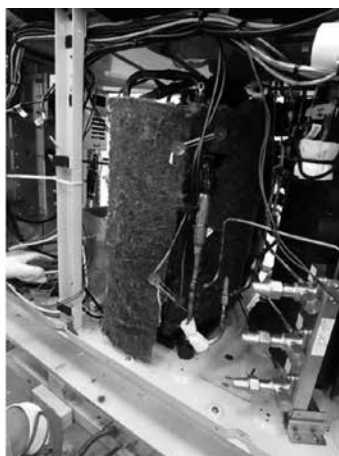
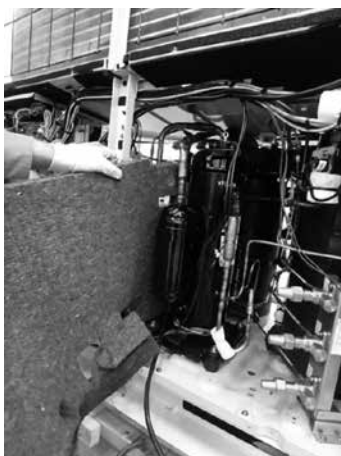
4. Discharge pipe



2) Mounting Tho-C1(Under-dome temperature sensor), sensors and crankcase heater

Preparation work before mounting insulation

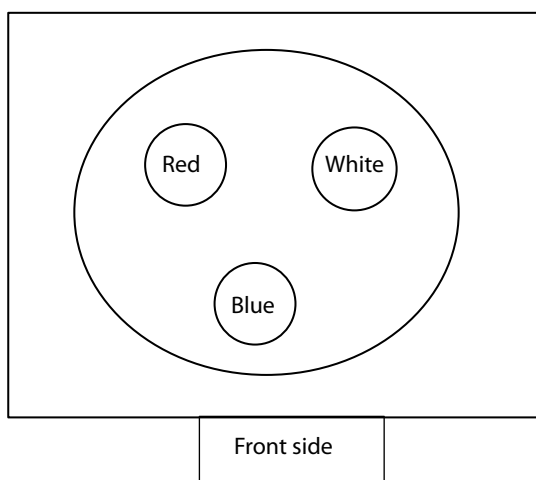
3) Mounting of insulation



4) Fitting discharge pipe and injection sensor etc., back to the original position

Sensor should be put in from the lower side.

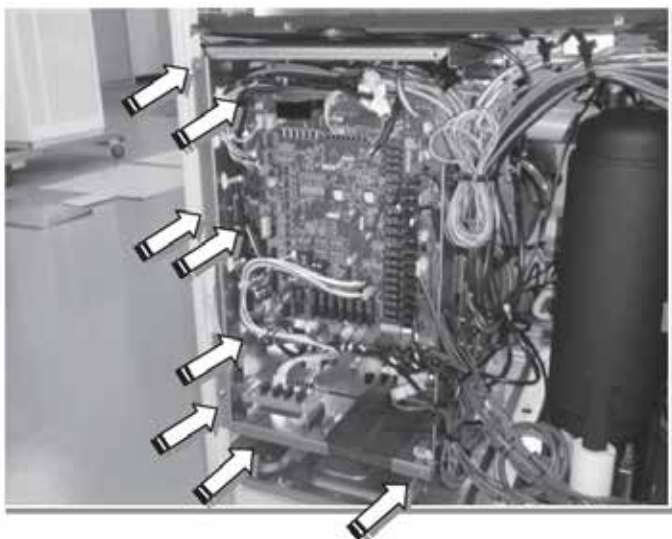
5) Mounting of wiring for compressor



8.2 Inverter PCB replacement procedure

(a) Replacement work of inverter PCB (on the third layer)

1) Loosen screws



The mounting board of the first layer (on the front) the second layer (on the back) can be removed like as opening door.

Loosen 8 screws (shown with white arrow)

Left side of control box : 3 screws

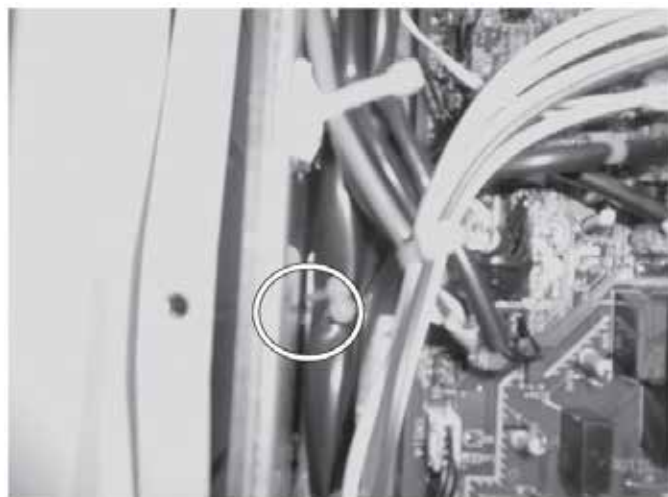
Inner left side of control box : 3 screws

Bottom side of control box : 2 screws

1. Inside of control box



There are 3 screws at inner left side of control box.



Be careful not to forget to loosen a center screw which is hidden by wiring.

2. At the bottom of control box

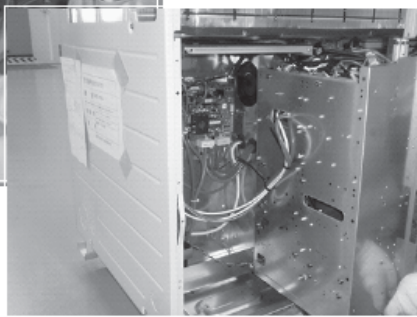


There are 2 screws at the bottom of the control box.

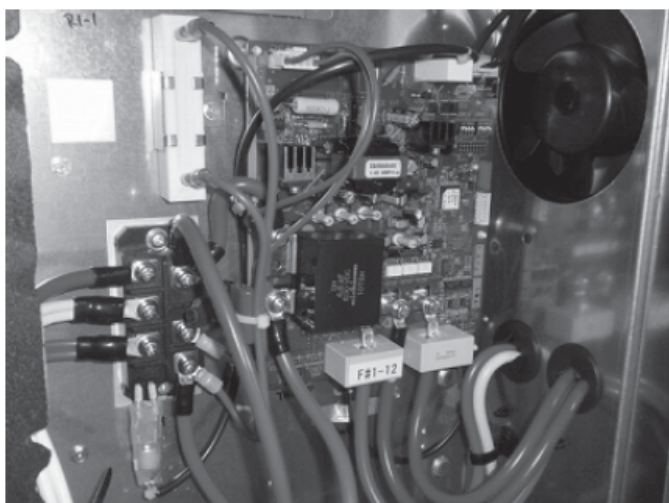
3. Open the mounting board of first and second layer



This mounting board supported at right edge as supporting point can be opened from left side.



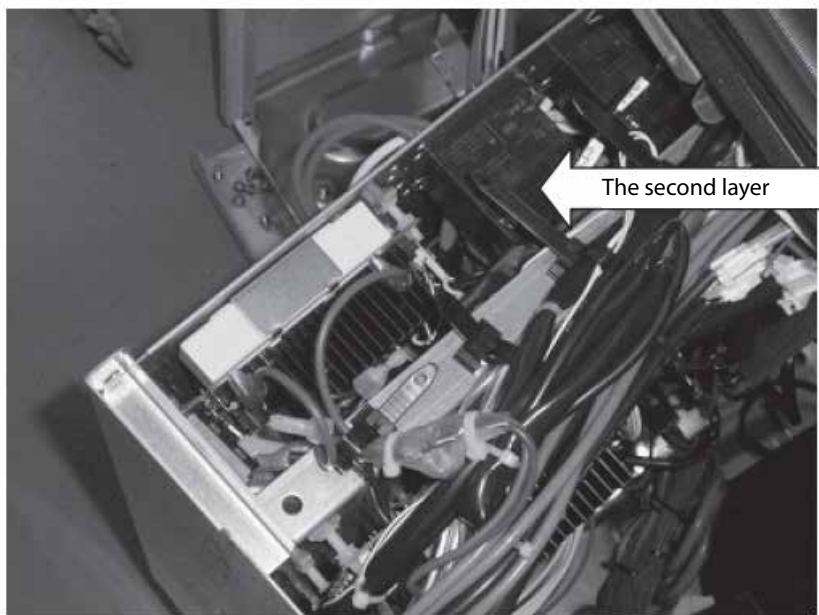
2) Inverter PCB



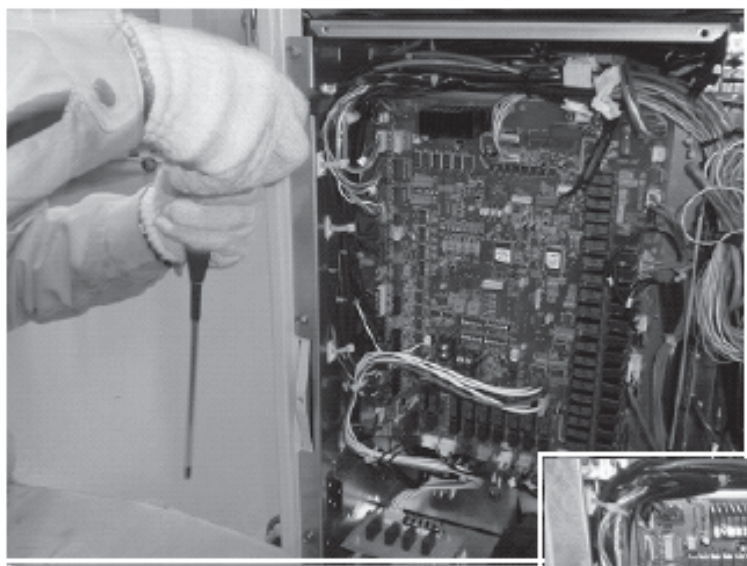
Following the process 1. to 3. enables easy access to the inverter PCB without disconnecting wires.

8.3 Replacement procedure of power PCB

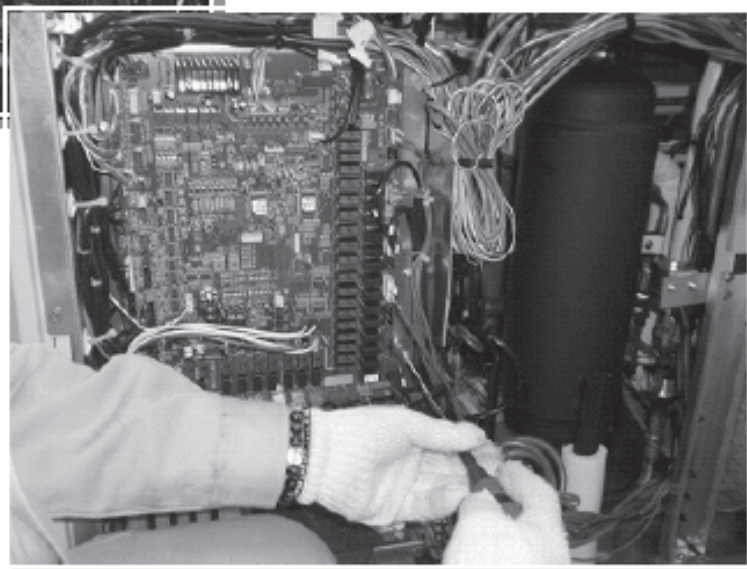
(a) Replacement work of power PCB (on the second layer)



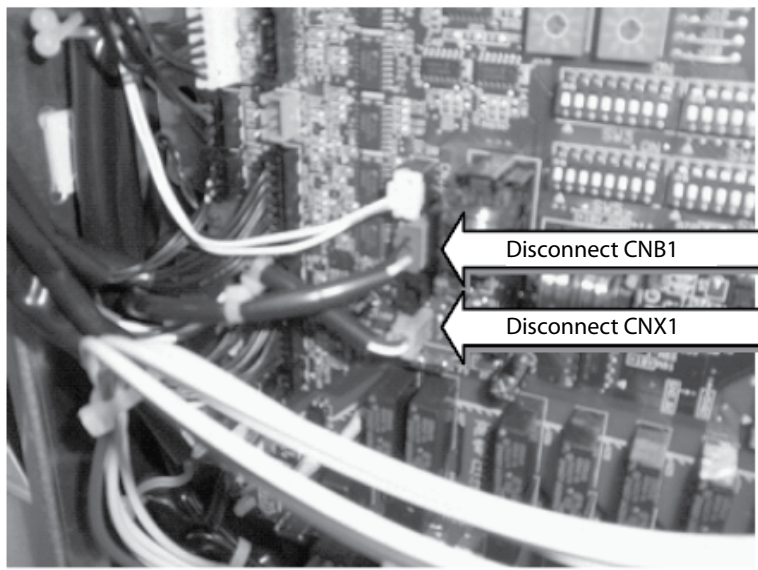
1. Loosen 4 screws



There are 4 screws at all corners of the first layer.

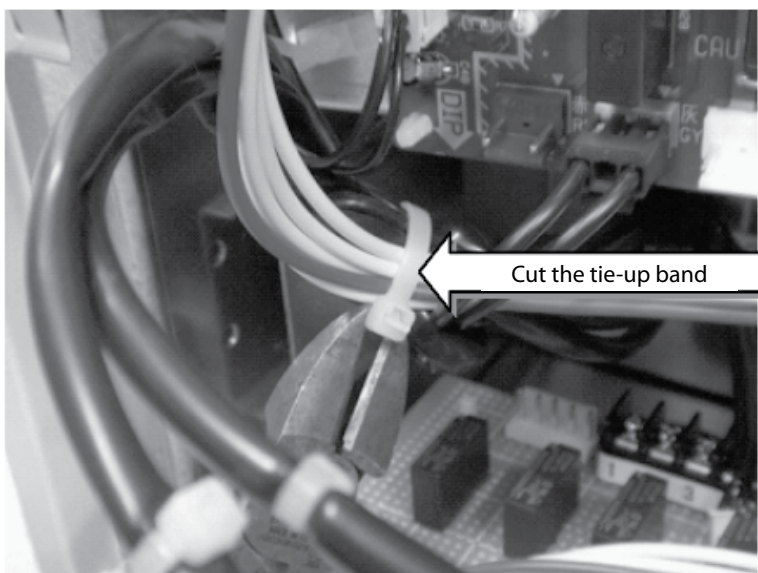


2. Disconnect the wires going to control PCB



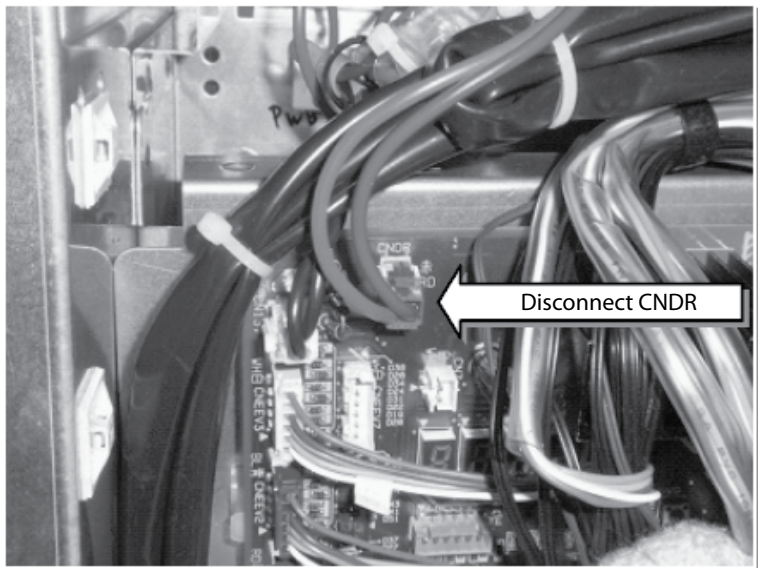
Disconnect CNB1 connector (Green) and CNX1 connector (Yellow) on the control PCB.

3. Cut the tie-up band



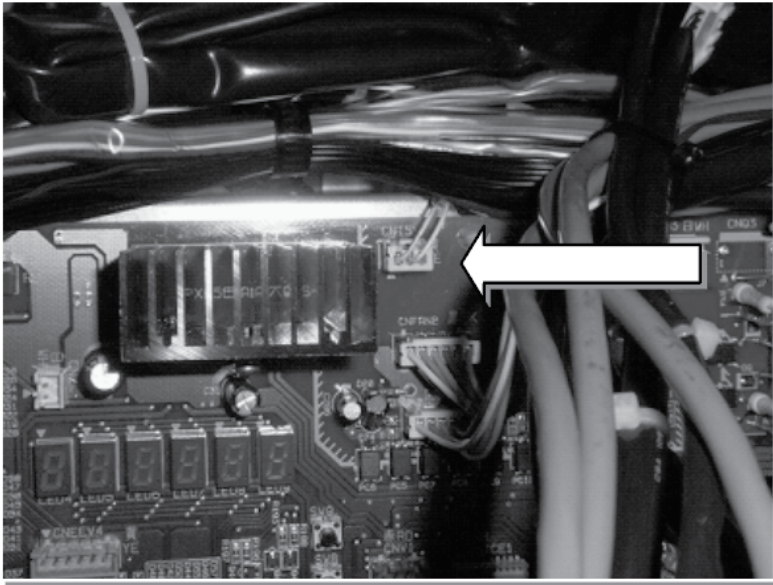
Cut the tie-up band

4. Disconnect the wire going to control PCB



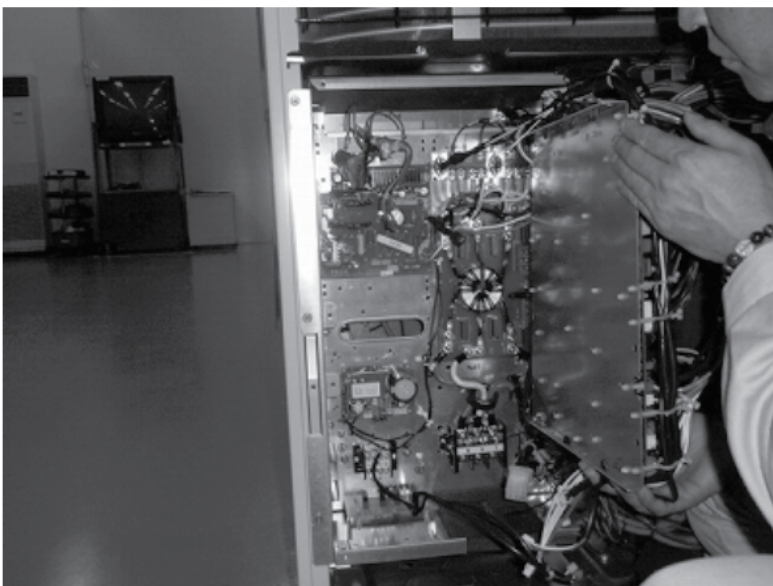
Disconnect CNDR connector (Red) at the upper left part of control PCB

6. Disconnect the wire going to control PCB



Disconnect CN13V connector (White), CN15V connector (Yellow) and CN18V connector (Black) at the upper center part of control PCB. (Check the detailed position of connector with the wiring diagram or control PCB drawing)

7. Remove the first layer



Following the process from 1. to 6. enables to remove the first layer and to access power PCB.

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