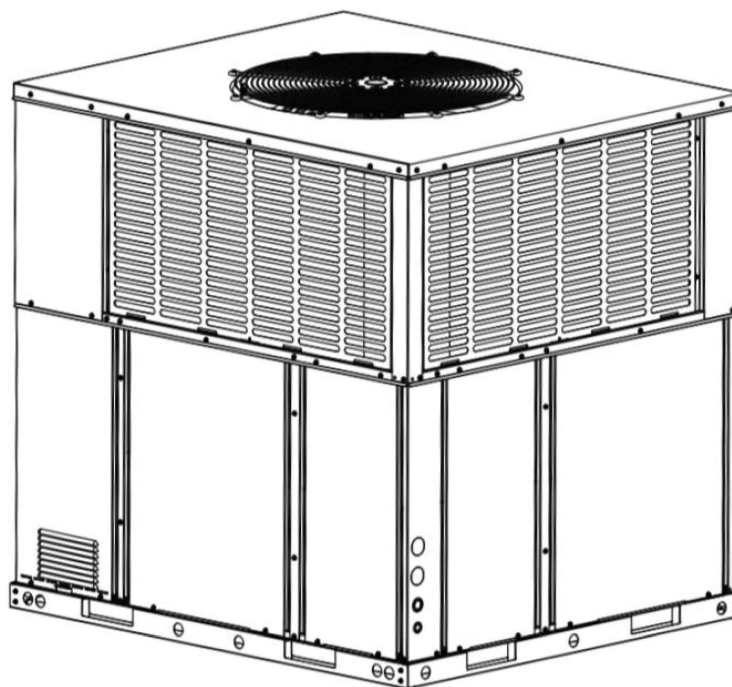




Service Manual

Outdoor Unit:

CSV24-32(29V) CSV36-32(29W)
CSV48-32(29X) CSV60-32(29Y)



RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION

ATTENTION INSTALLING PERSONNEL

Prior to installation, thoroughly familiarize yourself with this Installation Manual. Observe all safety warnings.

During installation or repair, caution is to be observed

It is your responsibility to install the product safely and to educate the customer on its safe use

Eair LLC

12201 N.W. 107th Avenue, Medley, FL 33178

www.comfortstarusa.com

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Part 1

General Information

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1 Product lineup

Model	Cooling Capacity (Btu/h)	Appearance
CSV32-24	24000	
CSV32-36	34600	
CSV32-48	48000	
CSV32-60	55000	

2 Specifications

Model		CSV24-32	CSV36-32	CSV48-32	CSV60-32
Power supply	V-Ph-Hz	208~230V/1PH/60HZ			
Cooling	Capacity(Btu/h)	24000	34600	48000	55000
	EER2(Btu/h/W)	9.90	8.20	9.30	8.60
	SEER2(Btu/h/W)	15.20	13.80	14.60	13.40
Heating	Capacity(Btu/h/W)	24000	36000	48000	57000
	HSPF2(Btu/h/W)	7.20	7.10	8.20	8.0
Compressor	RLA(A)	16.00	19.00	23.00	27.00
	LRA(A)	/	/	/	/
	Type	DC Inverter Rotary			
Condenser Fan Motor	Number of Motors	1	1	1	1
	R.P.M.	200~950R.P.M.	200~950R.P.M.	200~900R.P.M.	200~900R.P.M.
	Horsepower	1/3HP	1/3HP	1/3HP	1/3HP
	F.L. A/L.R. Amps(A)	2.1/-	2.1/-	2.1/-	2.1/-
Evaporator Fan Motor	Number of Motors	1	1	1	1
	R.P.M.	750R.P.M.	1030R.P.M.	1030R.P.M.	1080R.P.M.
	Horsepower	1/3HP	3/5HP	3/5HP	3/4HP
	CFM	760@0.50"	1060@0.50"	1400@0.50"	1600@0.50"
Refrigerant	Type	R32	R32	R32	R32
	Charging volume(oz)	63.5	63.5	100.5	100.5
Electrical Data	Minimum Circuit Ampacity(A)	23.88	29.33	34.33	39.70
	Max. Overcurrent Protection(A)	38.20	46.90	54.93	65.90
	Min. / Max. Volts(V)	173 / 269	173 / 269	173 / 269	173 / 269
Dimension and Weight	Unit (WxDxH)	50-45/64x35-3/64x46-27/32		51-9/16x44-13/16x51-7/16	
	Packing (WxDxH)	51-27/64x35-43/64x48-11/32		52-9/32x45-7/16x51-21/32	
	Net / Gross weight(lbs)	390/403	390/403	507/525	507/525

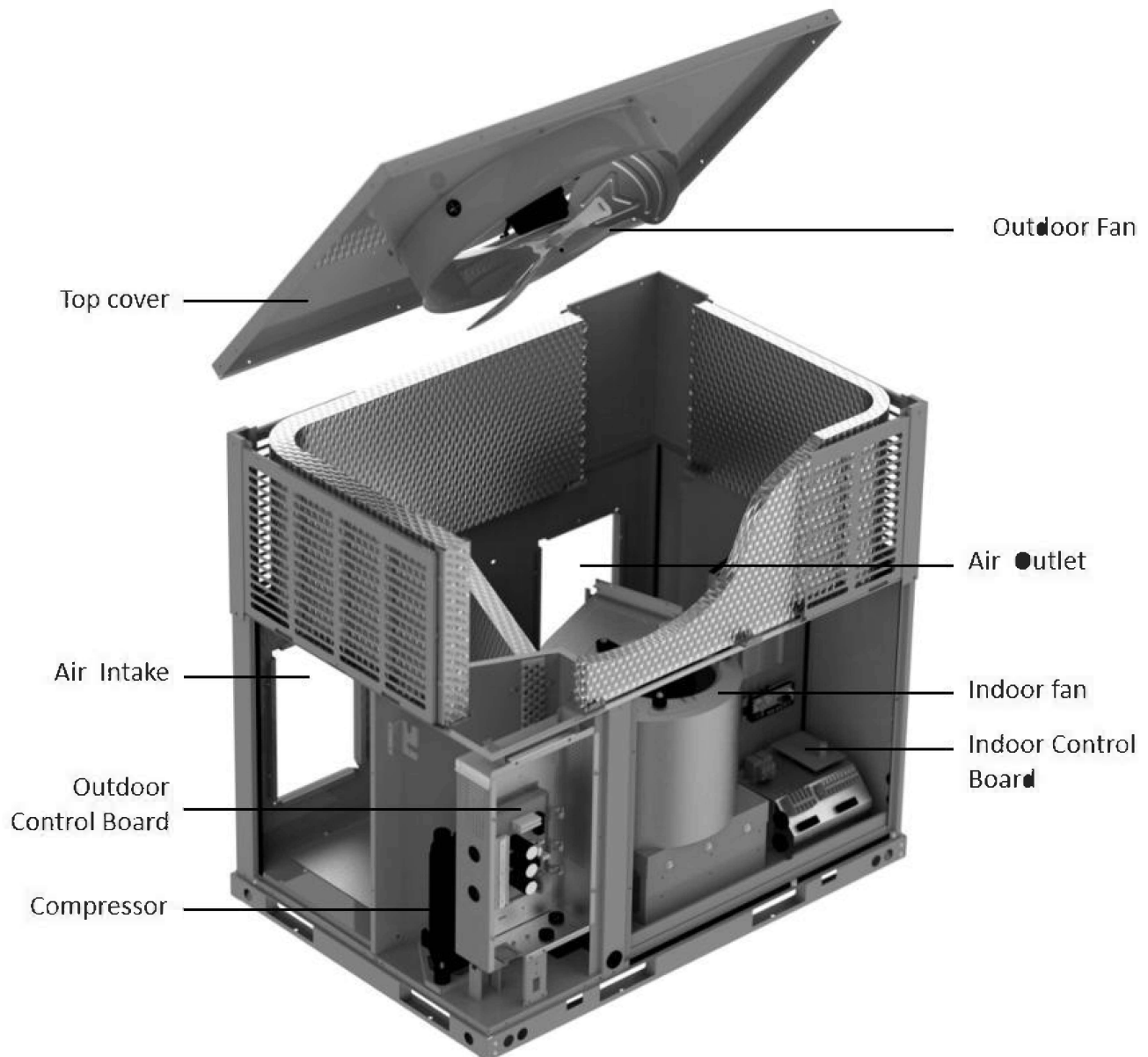
Part 2

Component Layout and Refrigerant Circuit

1 Layout Functional Components	5
1.1 Structure of the unit and main components	5
1.2 Refrigerant system and main components	6
2 Piping diagrams	8

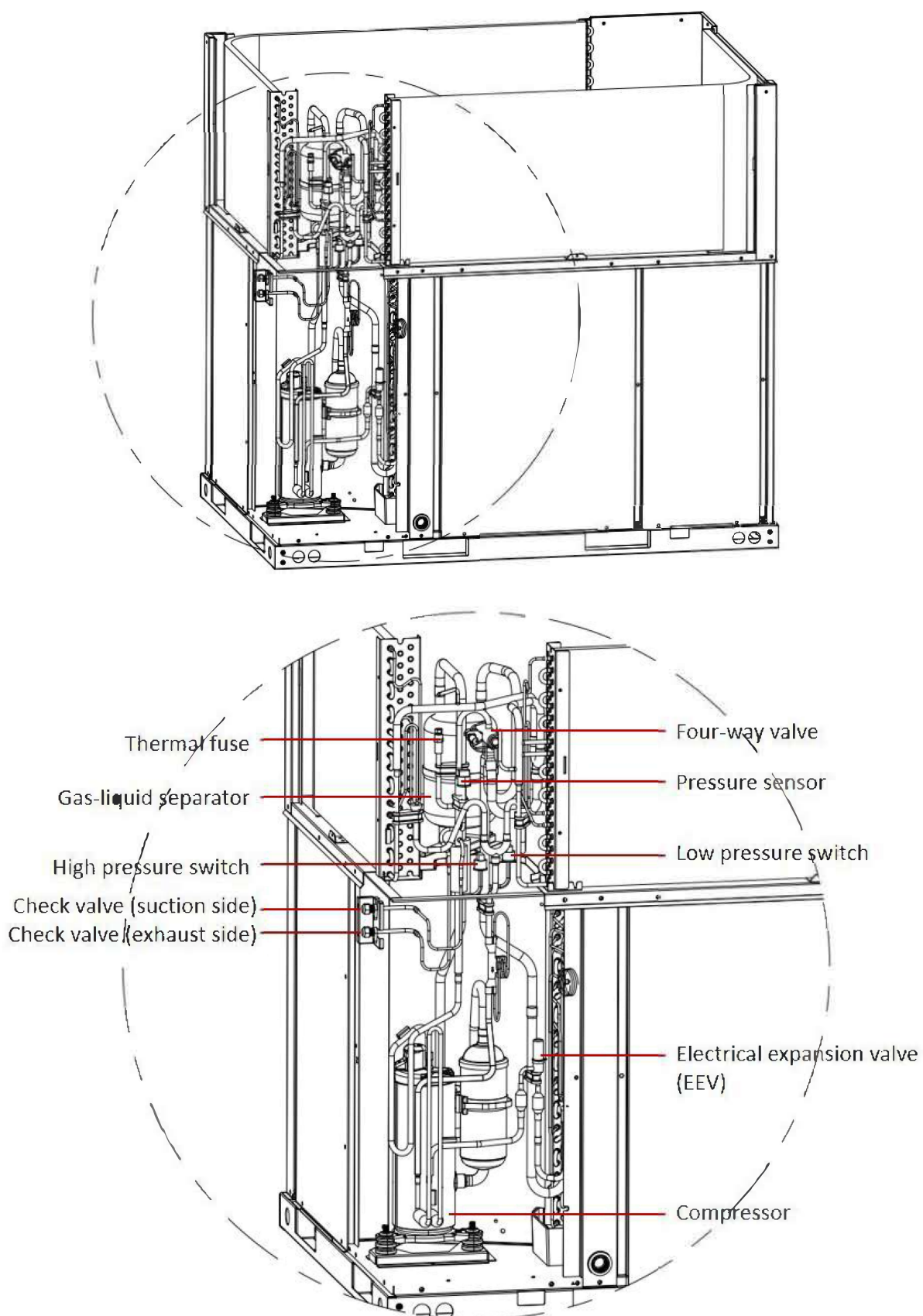
1 Layout Functional Components

1.1 Structure of the unit and main components

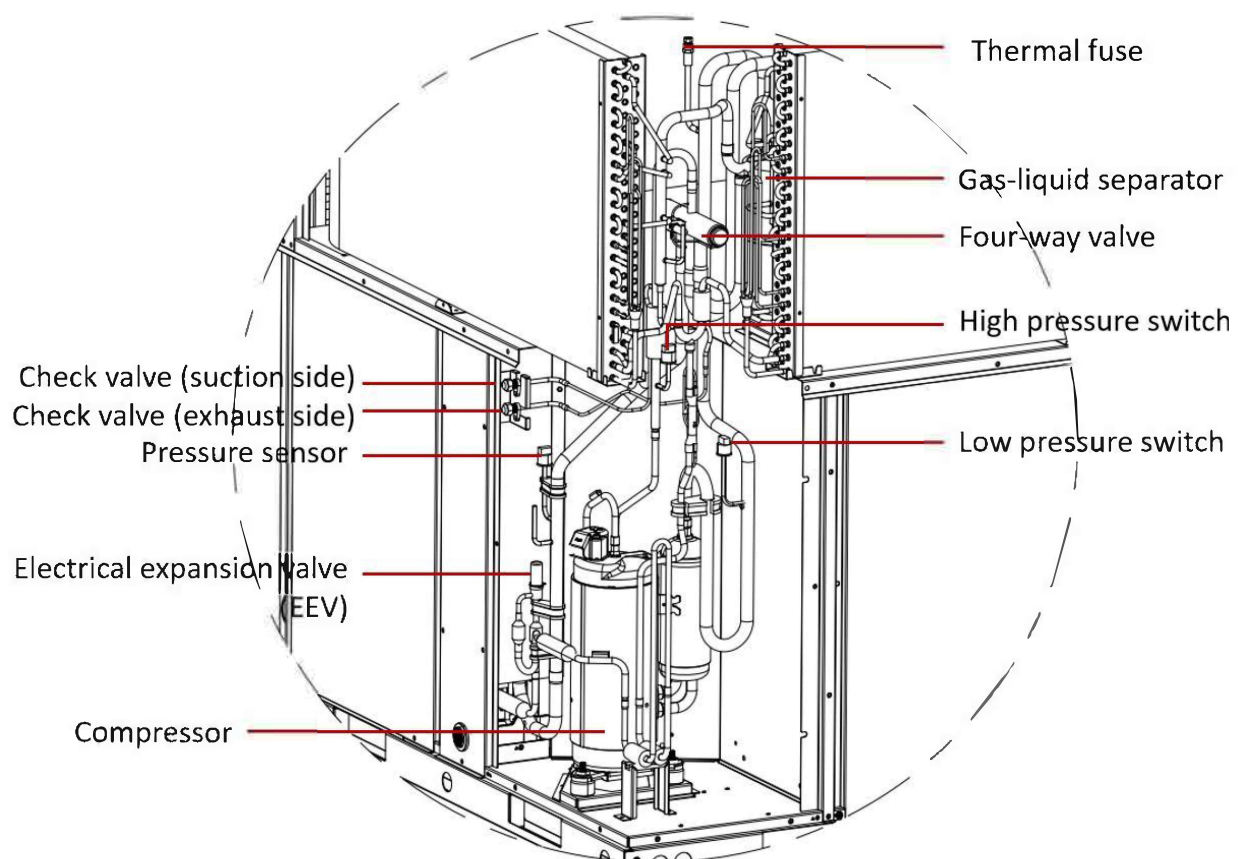
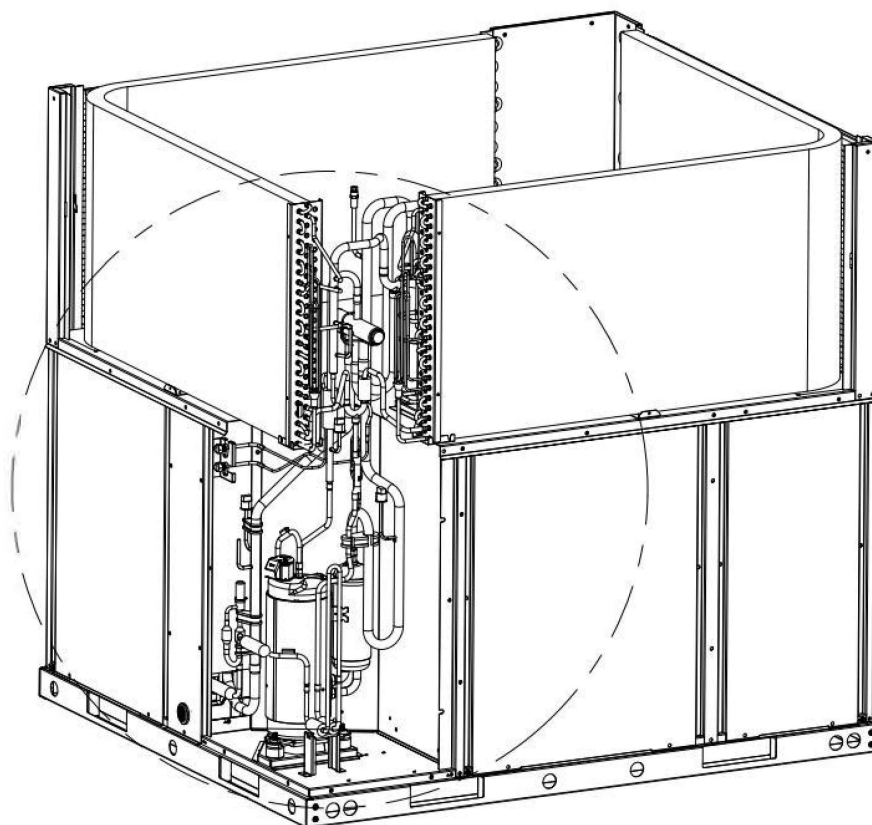


1.2 Refrigerant system and main components

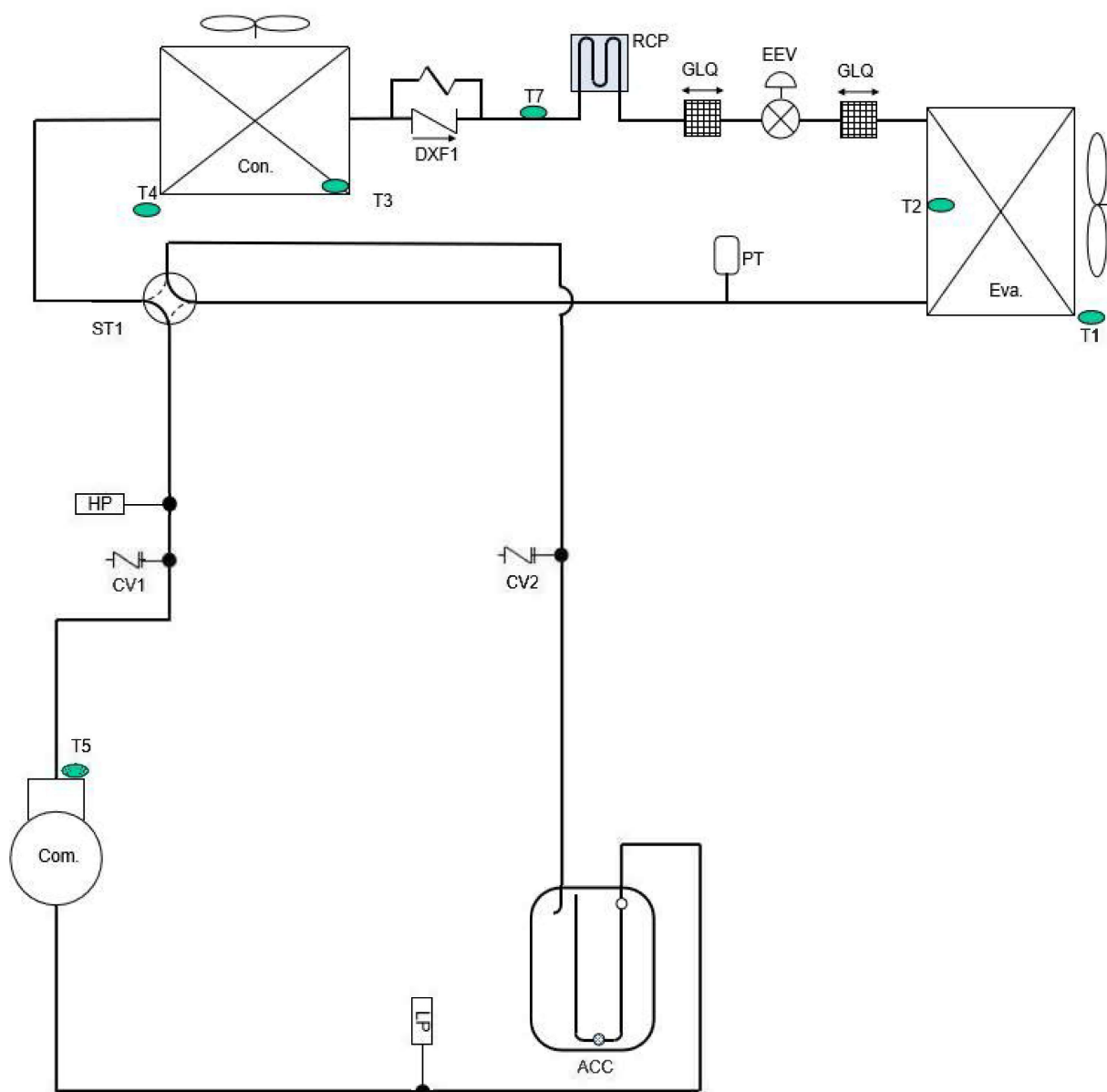
CSC32-24, CSV32-36



CSV32-48, CSV32-60



2 Piping diagrams



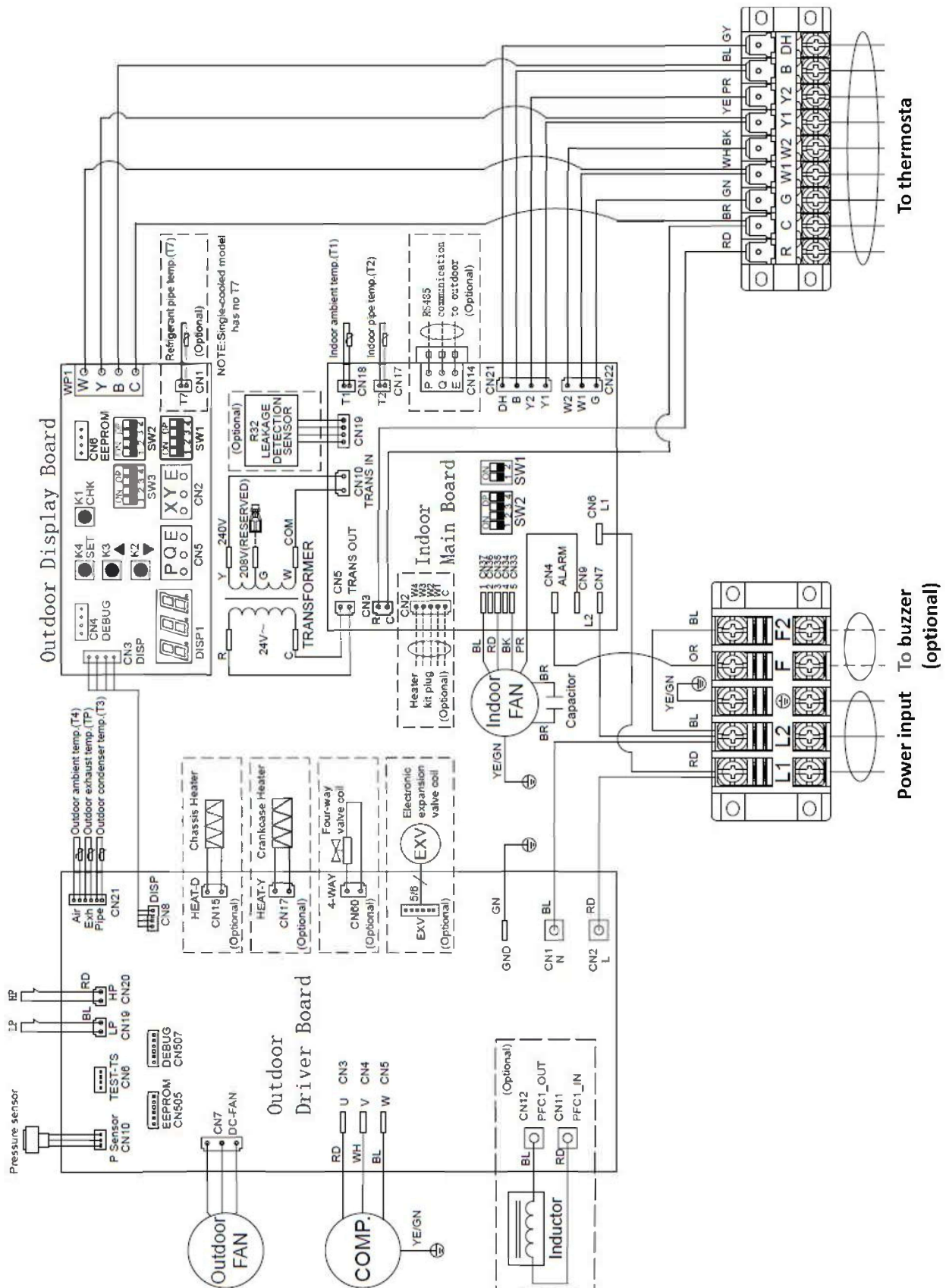
NO.	Component(Outdoor unit)	NO.	Component(Outdoor unit)
Com.	Compressor	T7	Refrigerant cooling pipe inlet temperature sensor
T5	Exhaust temperature sensor	RCP	Refrigerant cooling pipe
CV1	Check valve1	GLQ	Filter
HP	High pressure switch	EEV	Electrical expansion valve
PT	Pressure transducer	Eva.	Evaporator
ST1	Four-way valve	T1	Room temperature sensor
Con.	Condenser	T2	Indoor pipe temperature sensor
T3	Condenser coil temperature sensor	CV2	Check valve2
T4	Ambient temperature sensor	ACC	Gas-liquid separator
DXF1	One-way valve	LP	Low pressure switch

Part 3

Wiring Diagram

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1 Electric wiring diagram

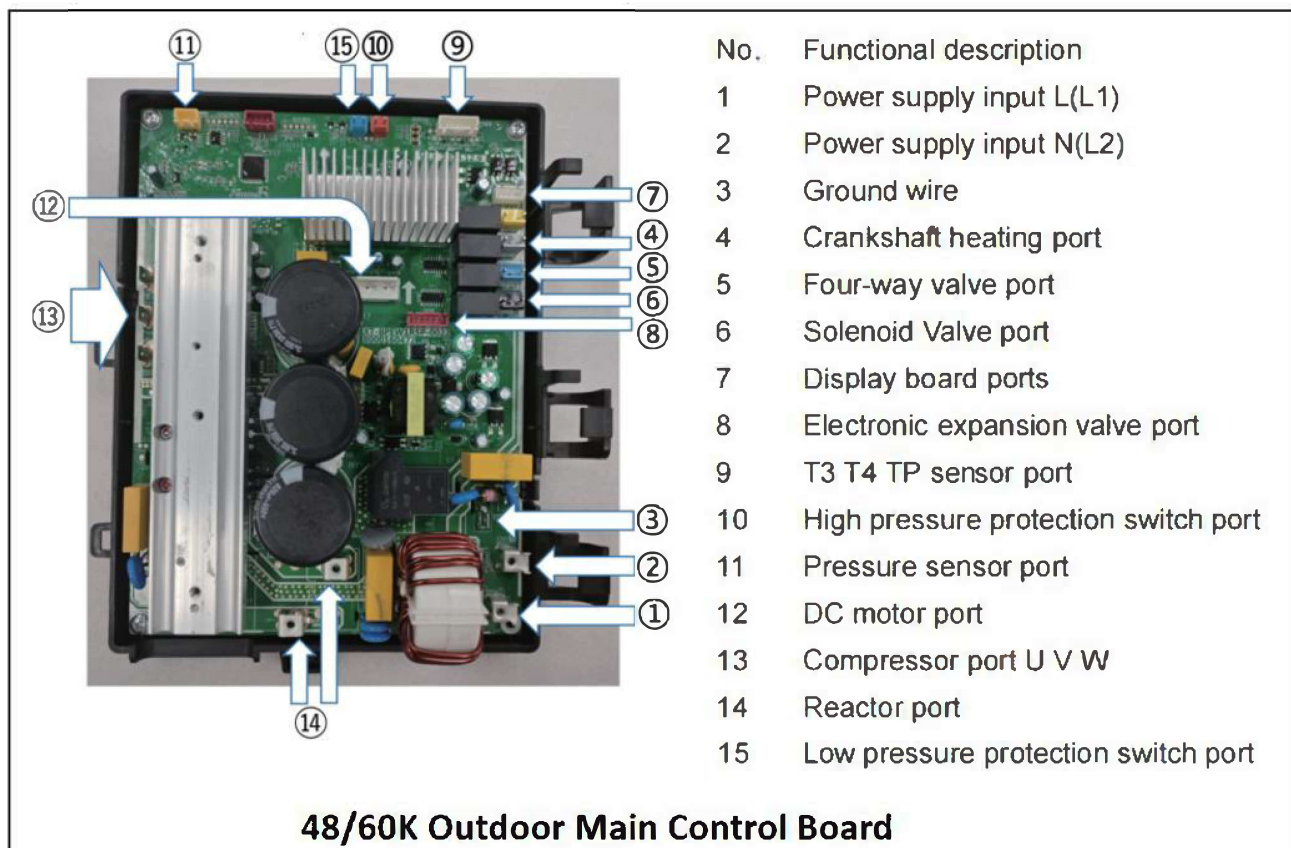
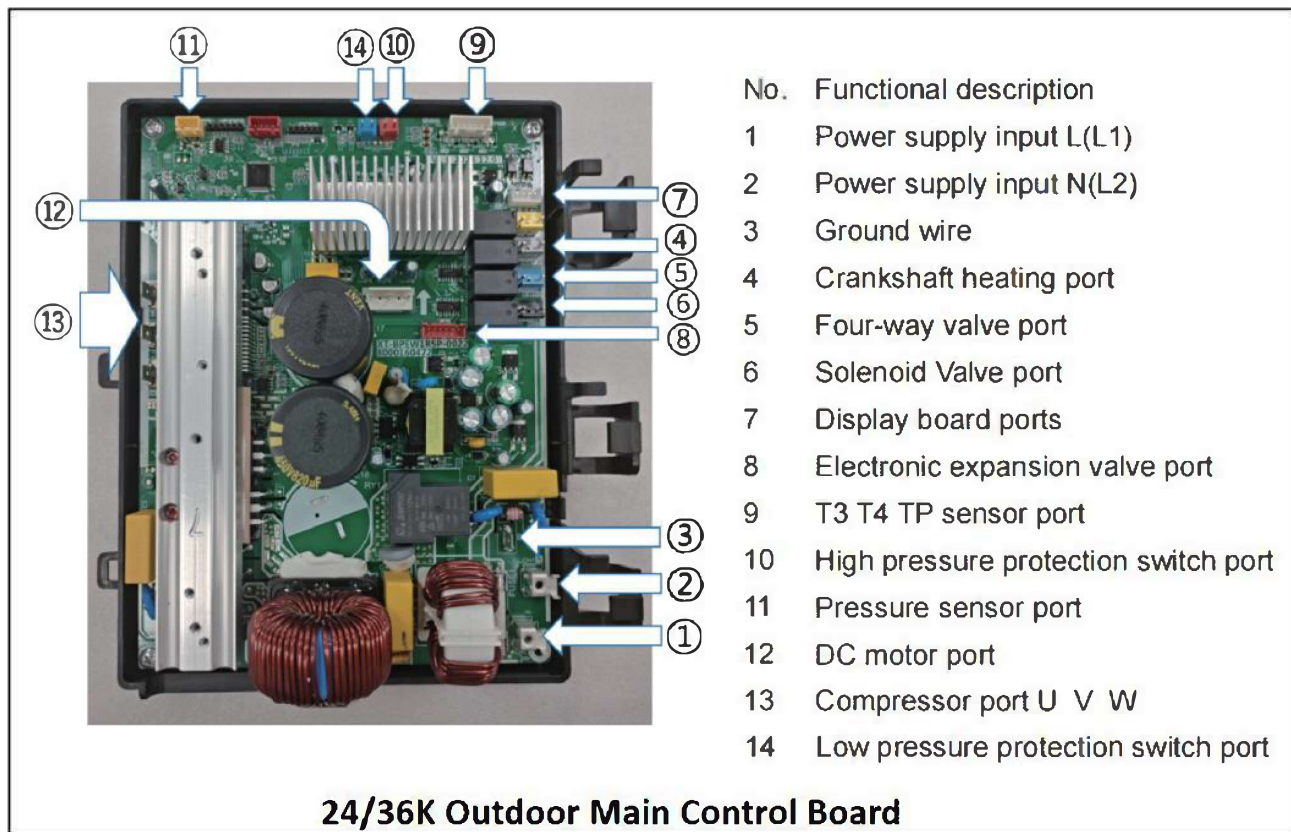


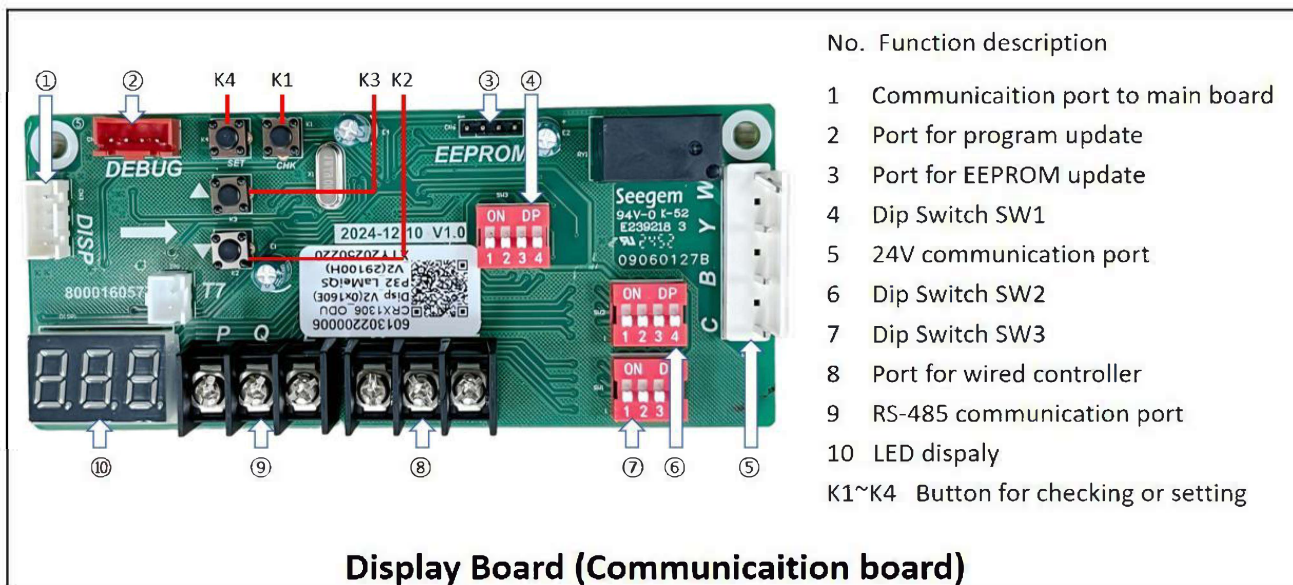
Definition of SW1~SW3

Wire Color Code	DIP switch status Indicate	Outdoor Display Board SW1 DIP switch selection	Outdoor Display Board SW2 DIP switch selection
RD RED OR ORANGE BL BLUE GN GREEN BR BROWN GY GRAY BK BLACK YE YELLOW WH WHITE PR PURPLE	ON ☐ OFF ☒ 1 This Indicate OFF (The DIP switch is dialed to the digital side)	SW1.1 OFF 24V Control ON RS485 Comm. Mode SW1.2 OFF °F for Fahrenheit ON °C for Celsius SW1.3 OFF Heating and cooling ON Single-cooled SW1.4 OFF Normal Cooling ON Accelerate Cooling	SW2.1 OFF Auto Defrosting ON Periodically Defrosting SW2.2 OFF Defrost interval 60 minutes ON Defrost interval 30 minutes SW2.3 OFF Normal Defrosting ON Accelerate Defrosting SW2.4 OFF Normal Thermostat ON O/B Thermostat

Outdoor Display Board SW3 DIP switch selection	Indoor Main Board SW1 DIP switch selection (Indoor FAN speed)	Indoor Main Board SW2 DIP switch selection
SW3.1 OFF Normal energy efficiency ON High energy efficiency (SE18)	SW1.1 SW1.2 High speed (Y1+Y2 OR W) Low speed (Y1 OR G)	SW2.1 OFF 24V Control ON RS485 Comm. Mode
SW3.2 OFF ON SW3.3 OFF ON Model 24K 36K 48K 60K	SW1.1 SW1.2 High speed (Y1+Y2 OR W) Low speed (Y1 OR G)	SW2.2 OFF Anti-Cold Air Delay ON Disable Anti-Cold Air Delay
SW3.4 OFF Normal Heating ON Accelerate Heating	SW1.1 SW1.2 High speed (Y1+Y2 OR W) Low speed (Y1 OR G)	SW2.3 OFF T1 from main board ON T1 from thermostat
	SW1.1 SW1.2 High speed (Y1+Y2 OR W) Low speed (Y1 OR G)	SW2.4 OFF Indoor AC FAN ON Indoor ECM FAN

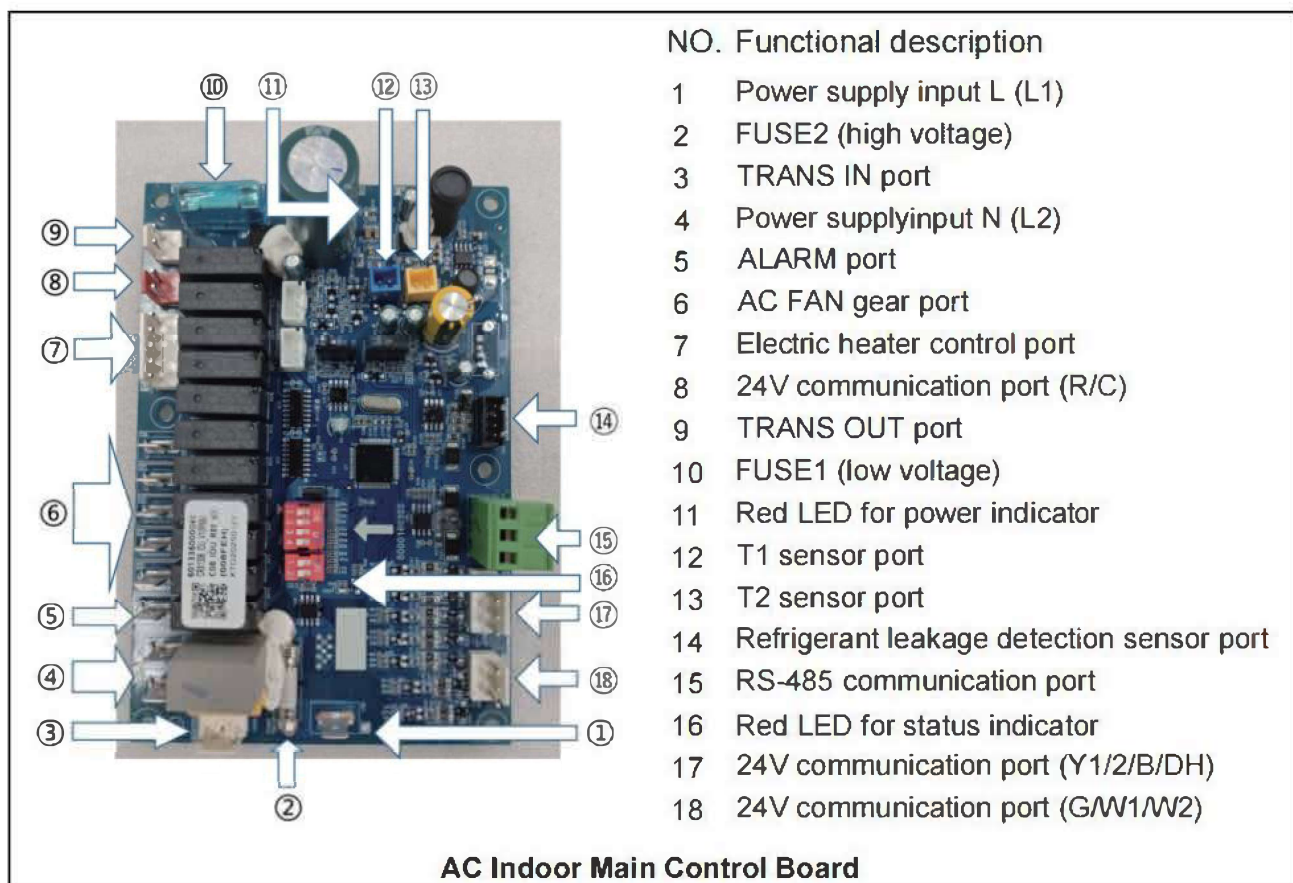
2 PCB





Definition and uses of the button

- K1: Press "K1" once to enter the outdoor unit parameter inspection.
- K2: Press "K2" to view the parameters in sequence.
- K3: Press "K3" to view the parameters in reverse order.
- K4: "SET" button used to enter forced cooling mode to recover the refrigerant.



3 Auxiliary electrical heater

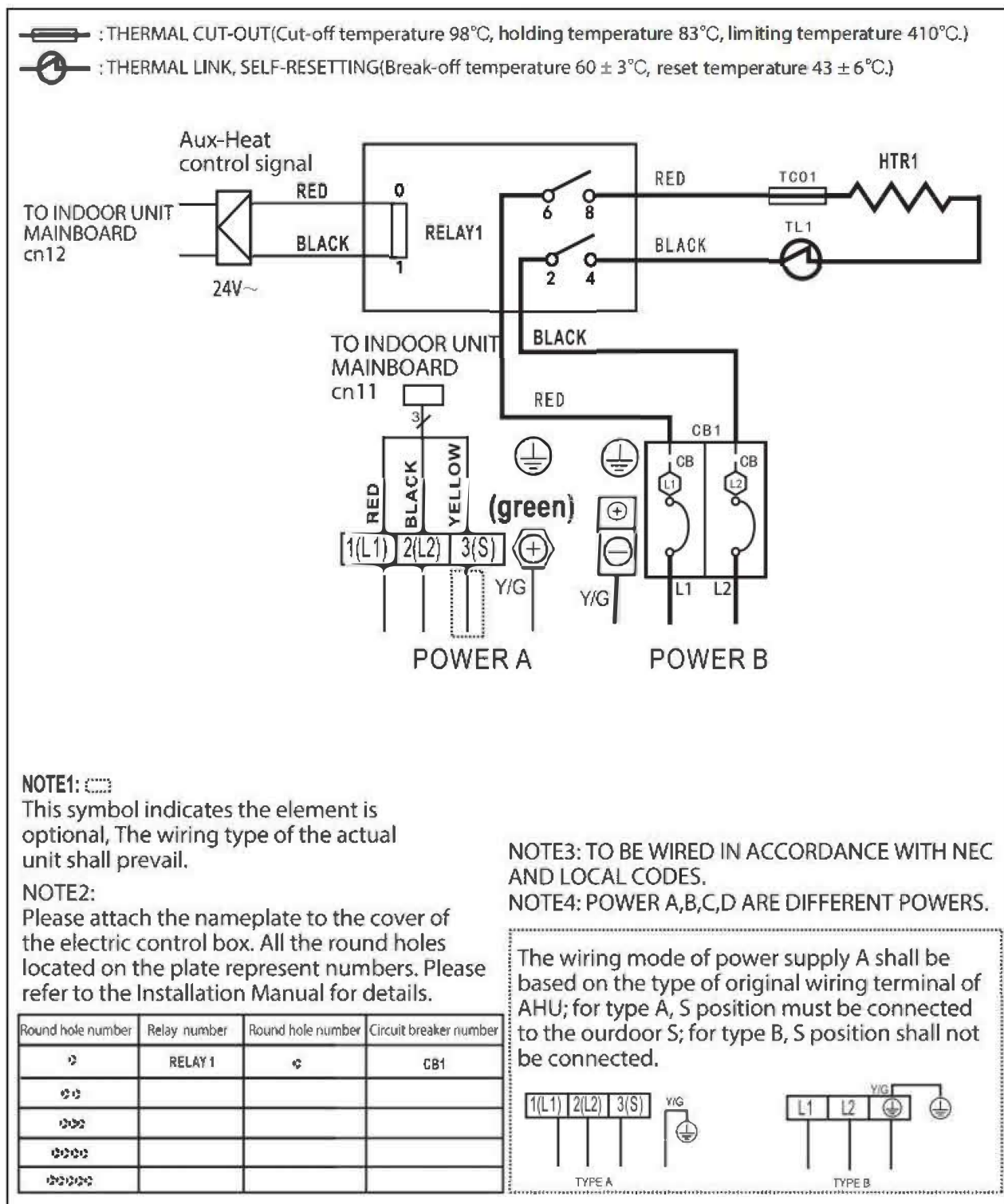
3.1 electrical data

Model	kW 208/240	Heater Kit FLA (A)	Minimum CKT AMPS (A)	Rating of overcurrent protective device or HACR breaker (A)
EHK-05	3.8/5	18.2/20.8	23/26	2
EHK-08	5.6/7.5	27.9/31.9	35/40	2
EHK-10	7.5/10	36.3/41.7	46/53	2
EHK-15	11.3/15	55.1/62.6	69/79	3
EHK-20	15/20	72.8/83.3	91/105	3

3.2 Wiring diagram

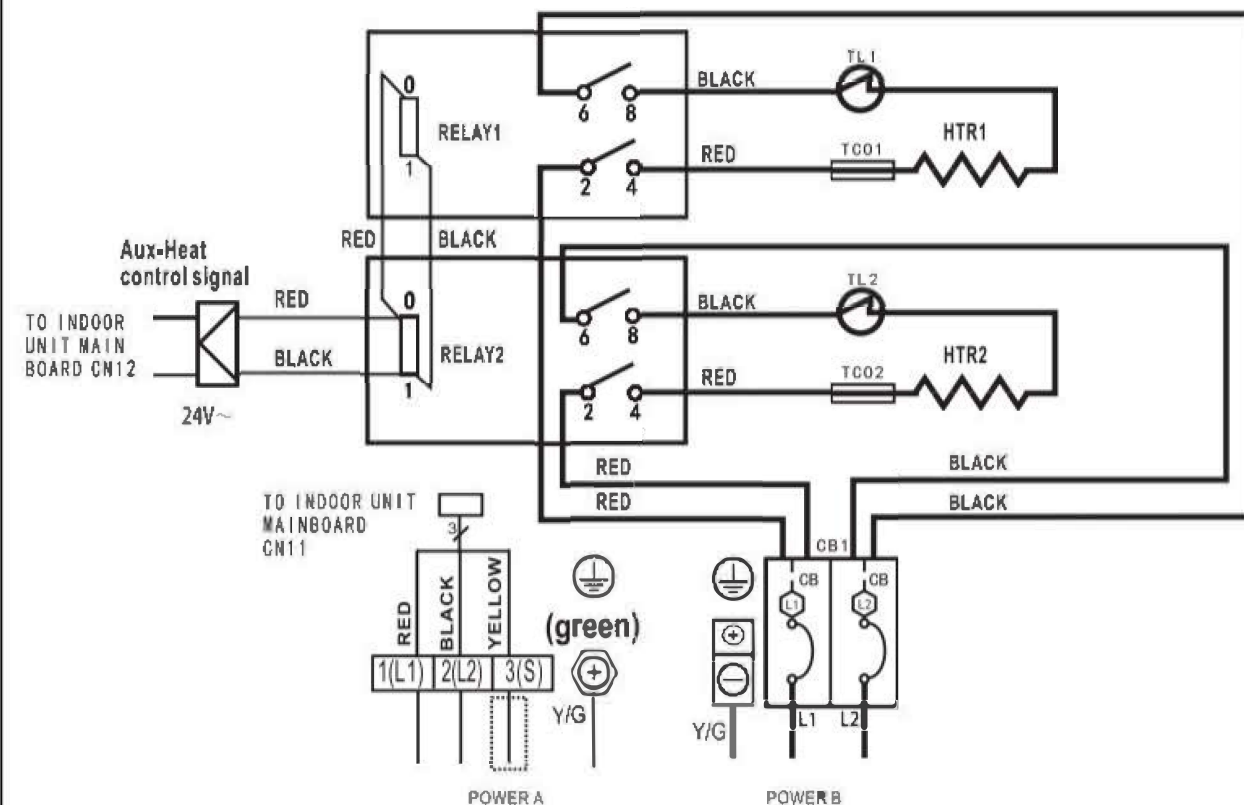
Specification	Number of circuit breakers	Number of relays	Number of power cord groups	Number of power cord grounding screws
5kW	1	1	2	2
8kW	1	2	2	2
10kW	1	2	2	2
15kW	2	4	3	3
20kW	2	4	3	3

5kW Heat Kit



8/10kW Heat Kit

-  : THERMAL CUT-OUT(Cut-off temperature 98°C, holding temperature 83°C, limiting temperature 410°C.)
-  : THERMAL LINK, SELF-RESETTING(Break-off temperature 60 ± 3°C, reset temperature 43 ± 6°C.)



NOTE1:

This symbol indicates the element is optional, The wiring type of the actual unit shall prevail.

NOTE2:

Please attach the nameplate to the cover of the electric control box. All the round holes located on the plate represent numbers. Please refer to the Installation Manual for details.

Round hole number	Relay number	Round hole number	Circuit breaker number
	RELAY1		CB1
	RELAY2		
			
			
			

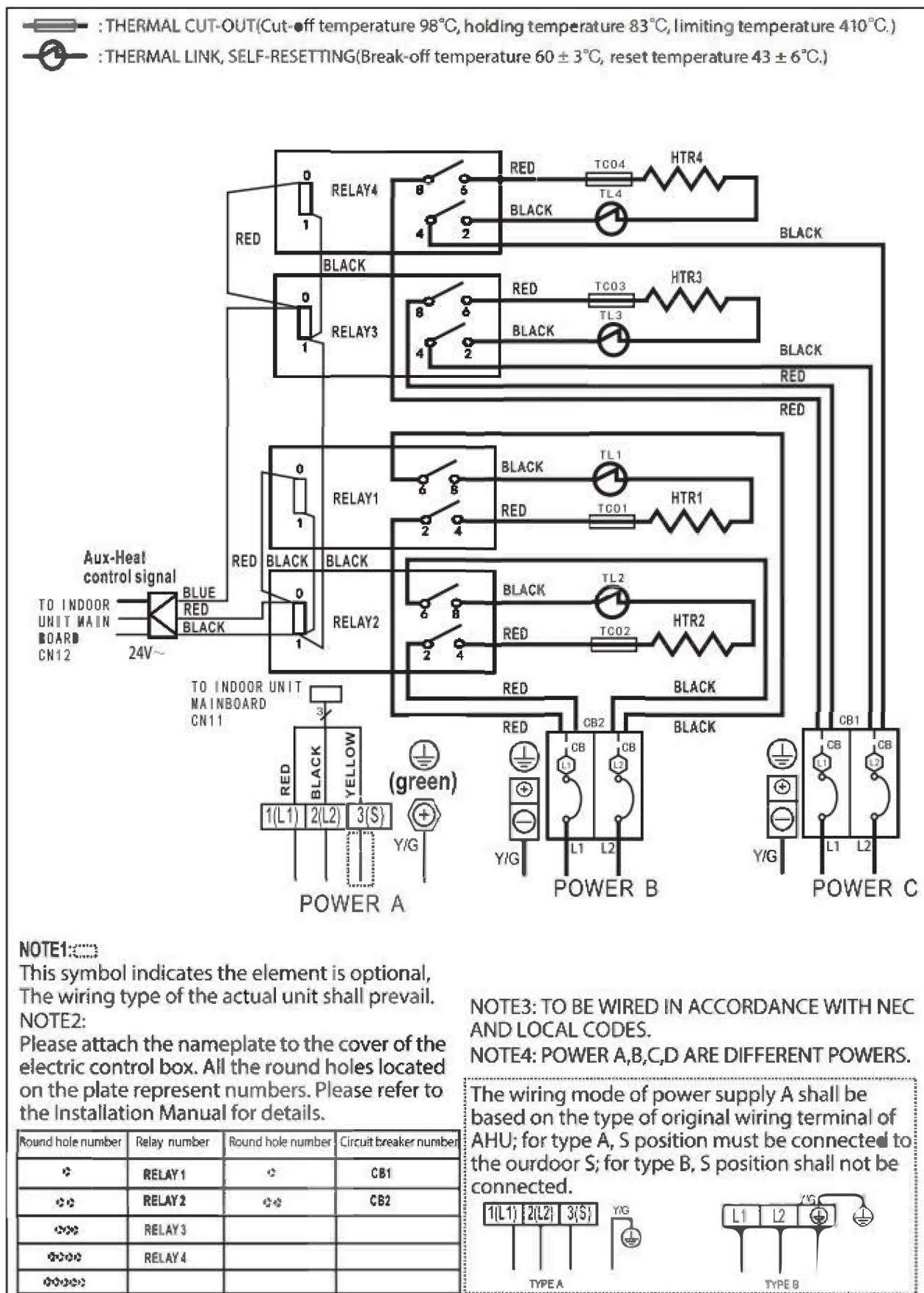
NOTE3: TO BE WIRED IN ACCORDANCE WITH NEC AND LOCAL CODES.

NOTE4: POWER A,B,C,D ARE DIFFERENT POWERS.

The wiring mode of power supply A shall be based on the type of original wiring terminal of AHU; for type A, S position must be connected to the outdoor S; for type B, S position shall not be connected.



15/20kW Heat Kit

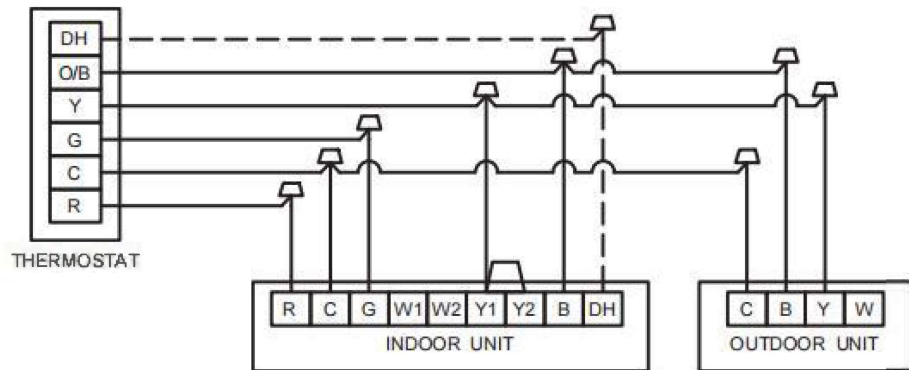


4 Low voltage wiring diagram

The following wiring diagram are suitable for the unit with 24V thermostat.

Wiring for 1H and 1C thermostat (heat pump system model)

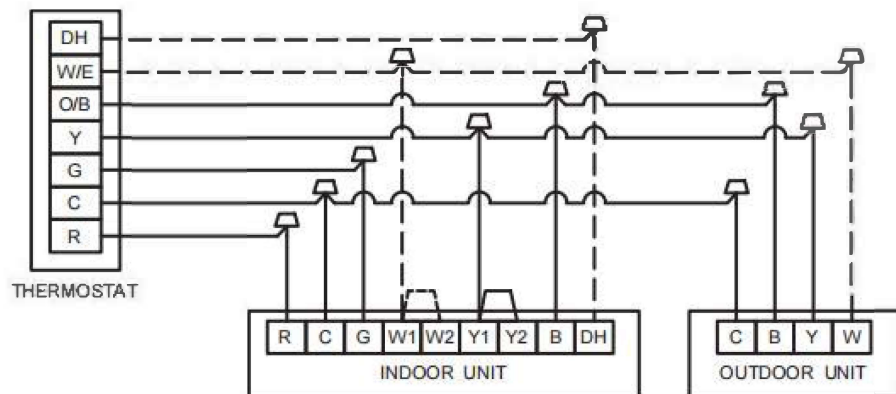
Note: Because Y1 and Y2 are jumped, the indoor fan will only run in high stage.



Wiring for 2H and 1C thermostat (heat pump system model)

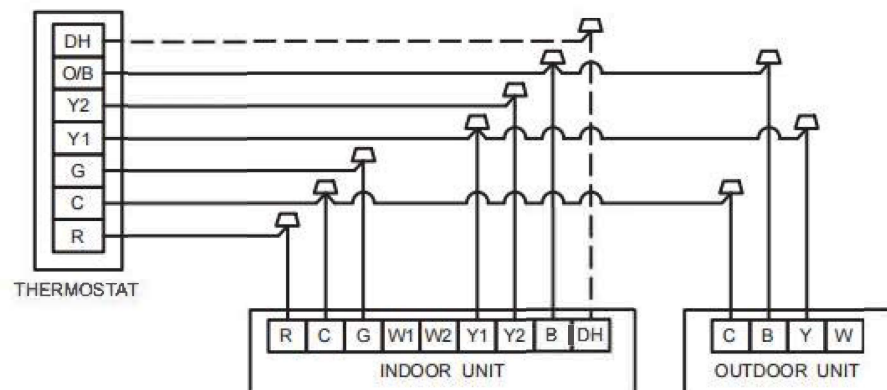
Note: Because Y1 and Y2 are jumped, the indoor fan will only run in high stage.

Note: Any time the electric heat elements are active, the indoor fan will run in high stage.

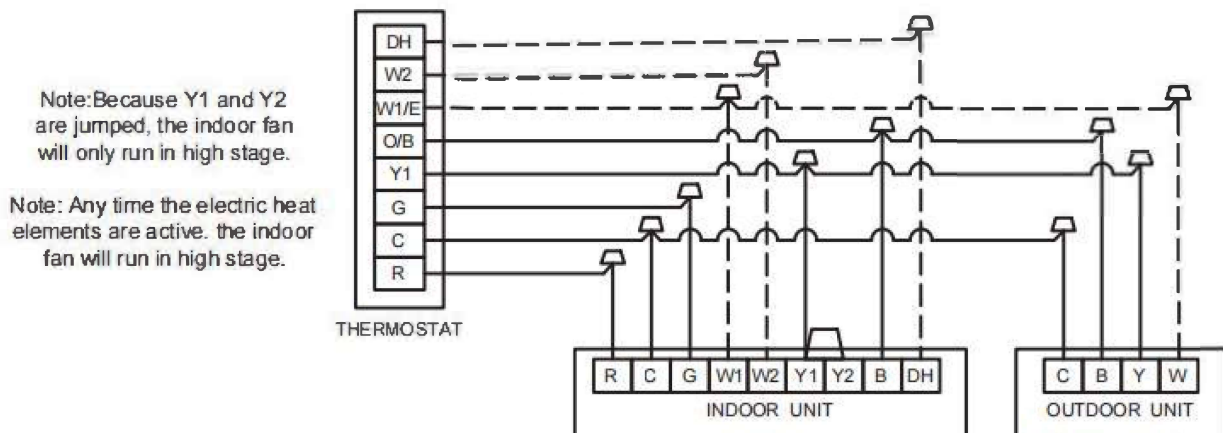


Wiring for 2H and 2C thermostat (heat pump system model)

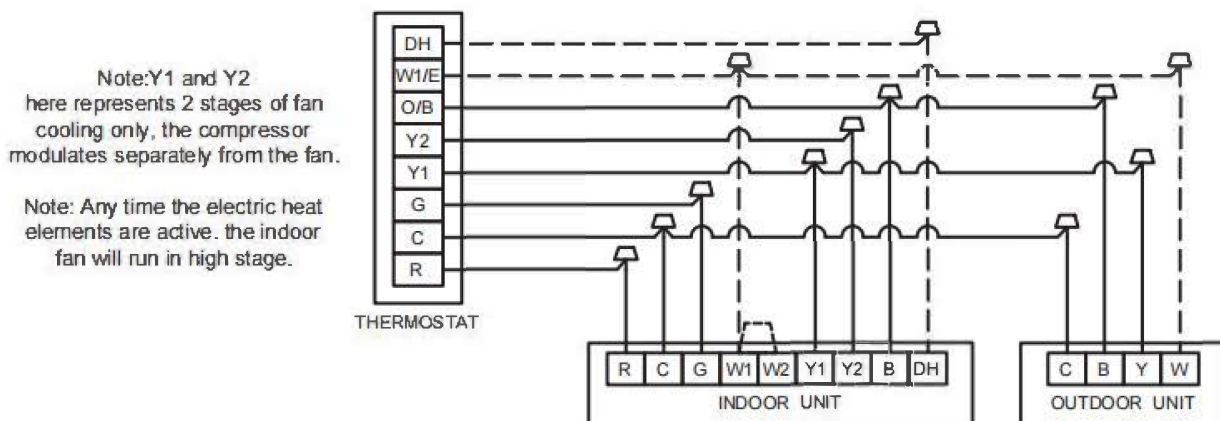
Note: Y1 and Y2 here represents 2 stages of fan cooling only, the compressor modulates separately from the fan.



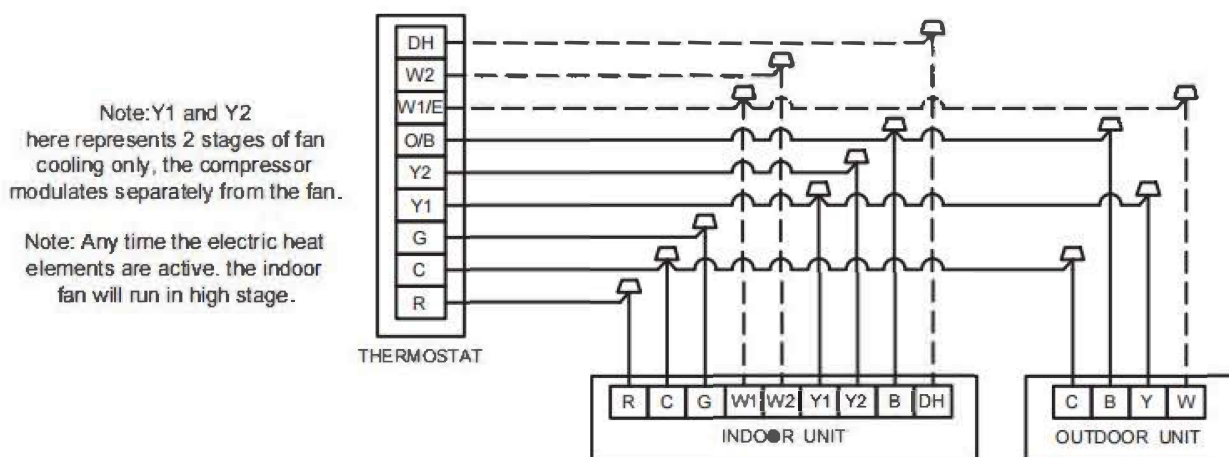
Wiring for 3H and 1C thermostat (heat pump system model)



Wiring for 3H and 2C thermostat (heat pump system model)



Wiring for 4H and 2C thermostat (heat pump system model)



Control Logic:**Indoor unit connector**

Connector	Purpose
R	24V Power Connection
C	Common
G	Fan Control
Y1	Low Cooling
Y2	High Cooling
B	Heating Reversing Valve
W1	Stage 1 Electric Heating
W2	Stage 2 Electric Heating
DH	Dehumidification

Outdoor unit connector

Connector	Purpose
C	Common
Y	Cooling
B	Heating Reversing Valve
W	Defrost control

Note:

- 1) DH wiring is optional and requires a thermostat with a humidistat. DH functions as Passive Dehumidification and will downstage the indoor fan to first stage. System will operate according to normal sequence of operations if DH wiring is absent.
- 2) Dashed lines in the above thermostat wiring diagrams refer to optional wiring (wiring for Passive Dehumidification Function and/OR Electric Heat). For thermostat wiring please refer to the Owner's Manual of the thermostat.
- 3) B wire must be used with heat pump system only, the reversing valve energizes in heating.

Part 4

Diagnosis and Troubleshooting

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1 Error code table

Error code	Error definition
E1	Communication error (Indoor side)
E2	T1- Room temperature sensor fault
E3	T2 -Indoor coil temperature sensor fault
E4	Refrigerant concentration sensor fault
E6	Refrigerant leakage protection
E8	Indoor fan motor current fault
E9	Wired controller communication fault
EE	EEPROM failure (indoor unit)
F0	Communication error(Outdoor side)
F4	T4 - Ambient temperature sensor fault
F5	T5 - Discharge temperature sensor fault
F6	T3 - Coil temperature sensor fault
F7	T7 - refrigerant cooling pipe inlet temperature sensor fault
F8	T7 temp sensor error in detecting condensate risks
F9	AC voltage is too high or too low protection
FA	EEPROM fault (on main PCB)
FB	EEPROM fault (on inverter module)
FC	IPM temperature sensor fault
FD	Pressure sensor fault
FE	T3/T5 temperature sensor loose protection
FF	High pressure switch fault for 20 minutes
H0	Inverter module and main PCB communication error
H1	P5 protection appears 3 times in 180 minutes can't be recovered until re-power on
H2	FF protection appears 3 times in 150 minutes can't be recovered until re-power on
H3	PD protection appears 3 times in 180 minutes can't be recovered until re-power on

H4	P8 protection appears 3 times in 120 minutes can't be recovered until re-power on
H5	P2 protection appears 3 times in 240 minutes can't be recovered until re-power on
H6	P4 protection appears 3 times in 100 minutes can't be recovered until re-power on
H7	PC protection appears 3 times in 200 minutes can't be recovered until re-power on
H8	FE protection appears 3 times in 120 minutes can't be recovered until re-power on
HC	F7 protection appears 3 times in 180 minutes can't be recovered until re-power on
HE	F8 protection appears 3 times in 60 minutes can't be recovered until re-power on
L0	DC bus low voltage protection
L1	DC bus high voltage protection
P1	High pressure switch fault for 4 seconds
P2	Low pressure protection
P3	Over current protection
P4	Discharge temperature protection
P5	T3 high temperature protection in cooling mode
P6	Compressor inverter module protection
P7	Indoor unit anti-freezing protection
P8	IPM high temperature protection
P9	Outdoor fan motor fault
PC	Overwet operation protection
PD	High pressure protection in heating mode
ATL	Ambient temperature out of bounds protection

Other codes

Code	Code Definition
D0	Oil return
Df	Defrost
DC	Force cooling
LA	Frequency limitation by voltage
LB	Frequency limitation or decline by high pressure
LC	Frequency limitation by condenser temp
LD	Frequency limitation by discharge temp
LE	Frequency limitation by IPM modular high temp
LF	Frequency limitation by current
PRH	Crankcase heater preheating, can not start

2 Troubleshooting

2.1 Safety Precautions

The following precautions here are quite important, so be sure to follow them carefully. Read these instructions carefully before installation. Keep this manual in a handy for future preference.

Failure to adhere to all precautionary measures listed in this section may result in personal injury, damage to the unit or to property, or in extreme cases, death.



WARNING

- Indicates a potentially hazardous situation which if not avoided, could result in death or serious injury.



CAUTION

- Indicates a potentially hazardous situation which if not avoided, may result in minor or moderate injury.
- It is also used to alert against unsafe practices.

2.1.1 In case of Accidents or Emergency



WARNING

- If a gas leak is suspected, immediately turn off the gas and ventilate the area if a gas leak is suspected before turning the unit on.
- If strange sounds or smoke is detected from the unit, turn the breaker off and disconnect the power supply cable.
- If the unit comes into contact with liquid, contact an authorized service center.
- If liquid from the batteries makes contact with skin or clothing, immediately rinse or wash the area well with clean water.
- Do not insert hands or other objects into the air inlet or outlet while the unit is plugged in.
- Do not operate the unit with wet hands.



CAUTION

- Clean and ventilate the unit at regular intervals when operating it near a stove or near similar devices.
- Do not use the unit during severe weather conditions. If possible, remove the product from the window before such occurrences.

2.1.2 Information servicing(For flammable materials)



WARNING

- Use this unit only on a dedicated circuit.
- Damage to the installation area could cause the unit to fall, potentially resulting in personal injury, property damage, or product failure.
- Only qualified personnel should disassemble, install, remove, or repair the unit.
- Only a qualified electrician should perform electrical work. For more information, contact your dealer, seller, or an authorized service center.



CAUTION

- While unpacking be careful of sharp edges around the unit as well as the edges of the fins on the condenser and evaporator.

2.1.3 Operation and Maintenance



WARNING

- Do not use defective or under-rated circuit breakers.
- Ensure the unit is properly grounded and that a dedicated circuit and breaker are installed.
- Do not modify or extend the power cable. Ensure the power cable is secure and not damaged during operation.
- Do not unplug the power supply plug during operation.
- Do not store or use flammable materials near the unit.
- Do not open the inlet grill of the unit during operation.
- Do not touch the electrostatic filter if the unit is equipped with one.
- Do not block the inlet or outlet of air flow to the unit.
- Do not use harsh detergents, solvents, or similar items to clean the unit. Use a soft cloth for cleaning.
- Do not touch the metal parts of the unit when removing the air filter as they are very sharp.
- Do not step on or place anything on the unit or outdoor units.
- Do not drink water drained from the unit.
- Avoid direct skin contact with water drained from the unit.

- Use a firm stool or step ladder according to manufacturer procedures when cleaning or maintaining the unit.

**CAUTION**

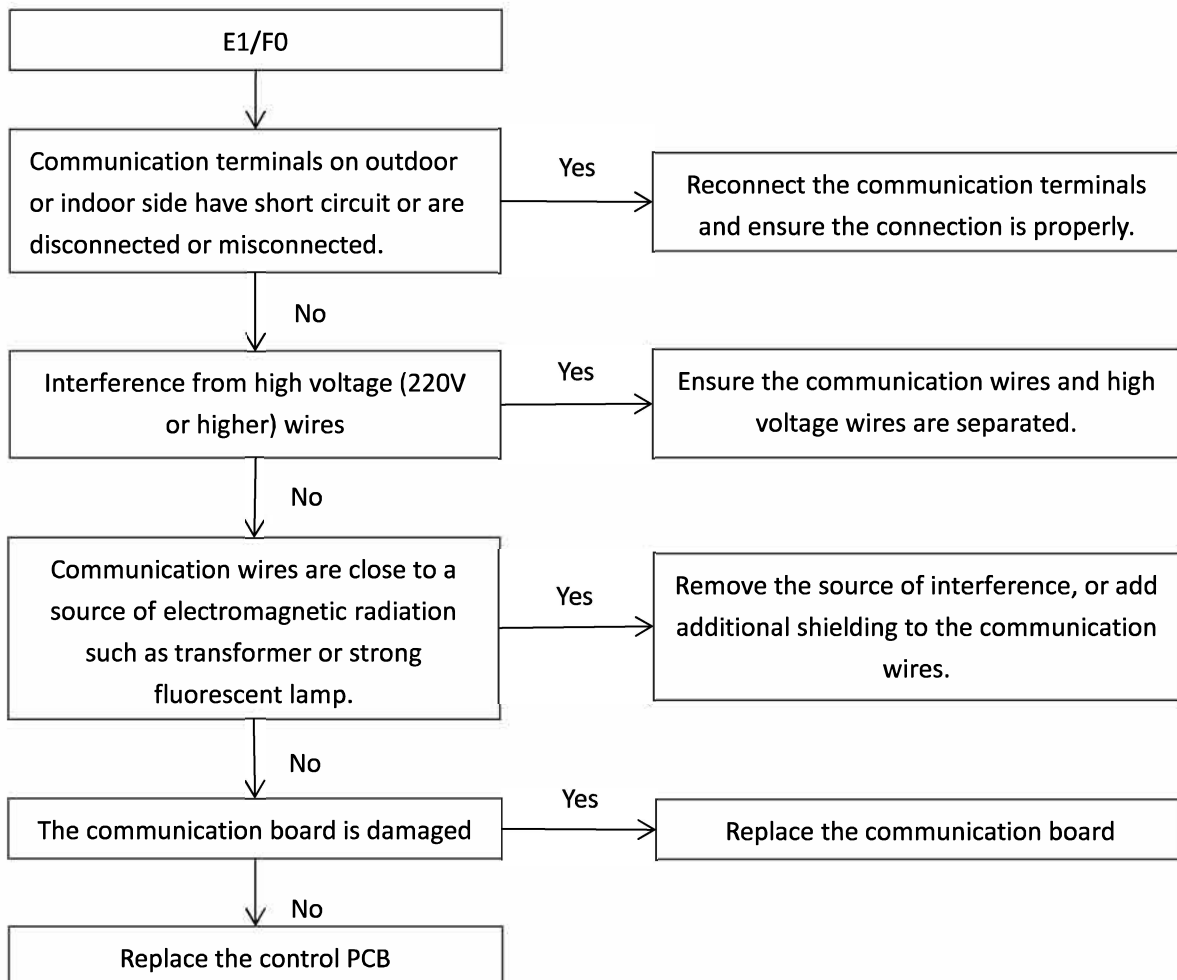
- Do not install or operate the unit for an extended period of time in areas of high humidity or in an environment directly exposing it to sea wind or salt spray.
- Do not install the unit on a defective or damaged installation stand, or in an unsecured location.
- Ensure the unit is installed at a level position
- Do not install the unit where noise or air discharge
- Created by the outdoor unit will negatively impact the environment or nearby residences.
- Do not expose skin directly to the air discharged by the unit for prolonged periods of time.
- Ensure the unit operates in areas waterOr other liquids.
- Ensure the drain hose is installed correctly to ensure proper water drainage.
- When lifting or transporting the unit, it is recommended that two or more people are used for this task.
- When the unit is not to be used for an extended time, disconnect the power supply or turn off the breaker.

2.2 ATL Troubleshooting

- ATL indicates ambient temperature out of bounds protection.
- The unit stops running and will not start operating until the ambient temperature returns to the allowable temperature range, error code is displayed on the communication board.
- The allowable ambient temperature range is 5~125°F (-15~52°C).

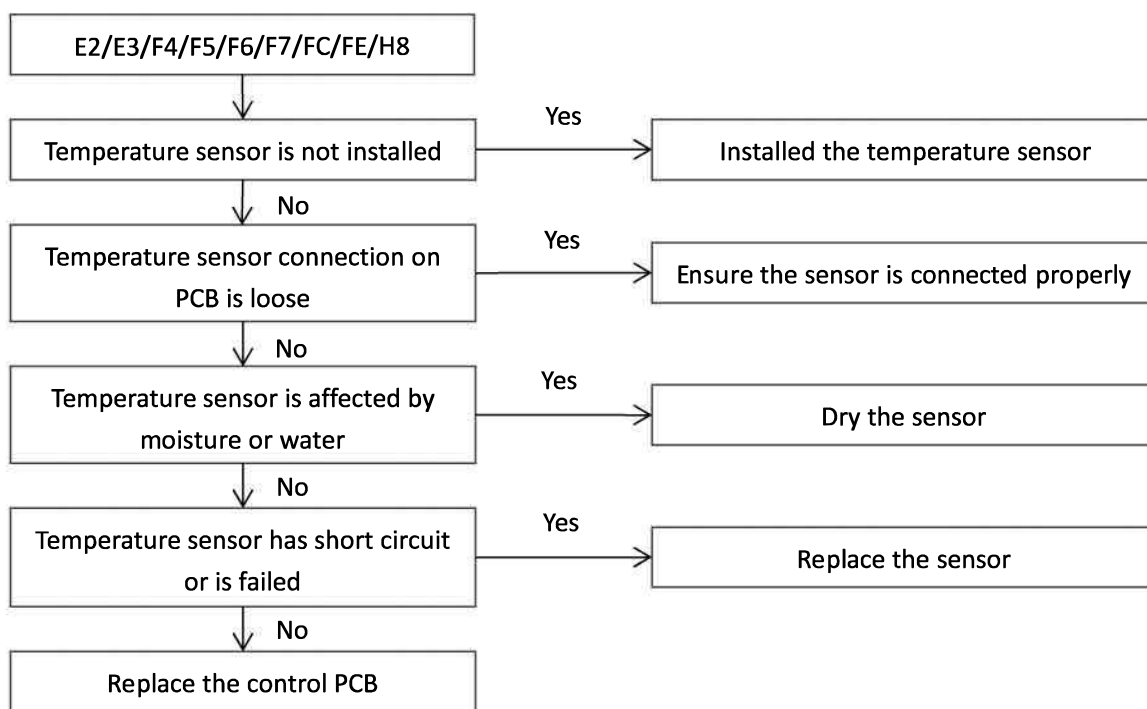
2.3 E1/F0 Troubleshooting

- E1 indicates RS485 communication error(indoor side).
- F0 indicates RS485 communication error(outdoor side).
- The unit stops running and error code is displayed on the communication board



2.4 E2/E3/F4/F5/F6/F7/FC/FE/H8 Troubleshooting

- E2 indicates indoor unit T1-roomtemperature sensor fault
- E3 indicates indoor unit T2-indoor coil temperature sensor fault
- F4 indicates T4-ambient temperature sensor fault
- F5 indicates T5-discharge temperature sensor fault
- F6 indicates T3-outdoor coil temperature sensor fault
- F7 indicates T7-refrigerant cooling pipe inlet temperature sensor fault
- FC indicates IPM temperature sensor fault
- FE indicates T3/TP temperature sensor loose protection
- H8 indicates FE protection appears 3 times in 120 minutes can't be recovered until re-power on.
- The unit stops running and error code is displayed on the communication board

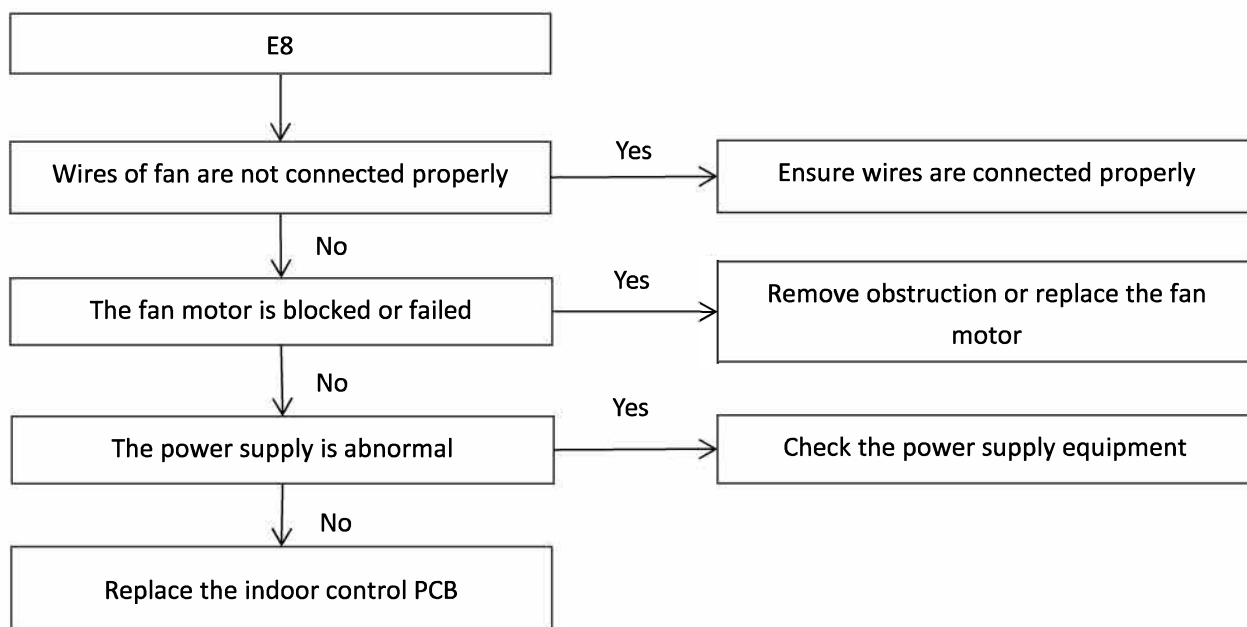


Note:

- 1) Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed.
- 2) E2/E3 is applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS-485.

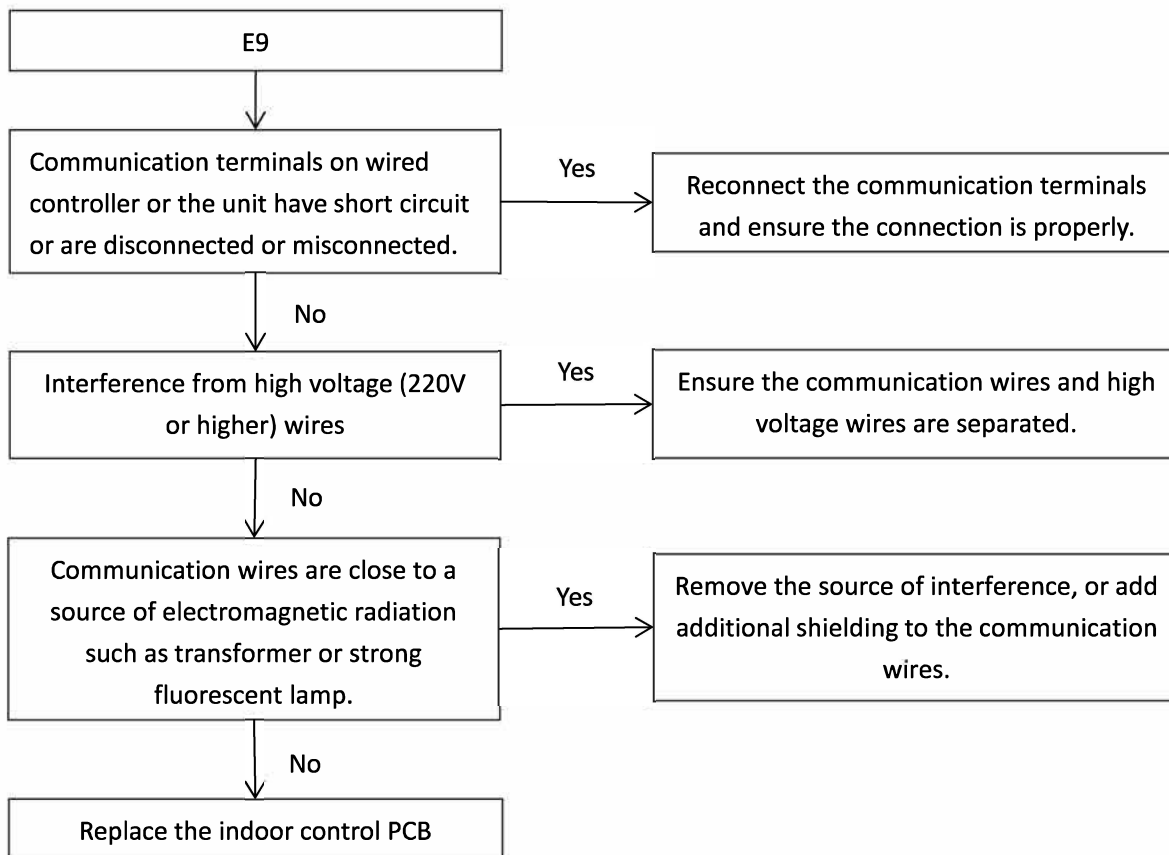
2.5 E8 Troubleshooting

- E8 indicates indoor fan motor current fault.
- The unit stops running and error code is displayed on the communication board



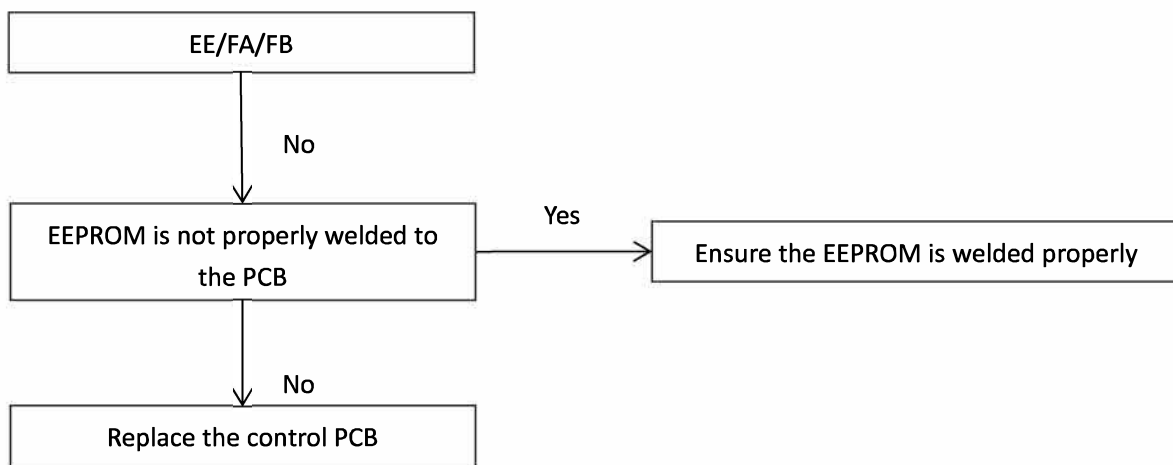
2.6 E9 Troubleshooting

- E9 indicates wired controller communication fault.
- The unit stops running and error code is displayed on the communication board



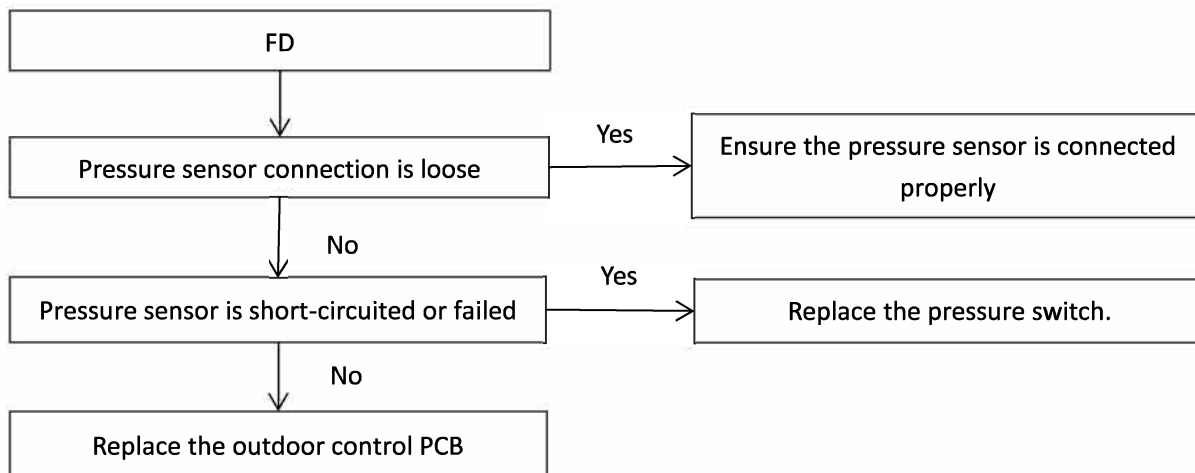
2.7 EE/FA/FB Troubleshooting

- EE indicates EEPROM fault (indoor unit)
- FA indicates EEPROM fault on the main PCB
- FB indicates EEPROM fault on the inverter module
- The unit stops running and error code is displayed on the communication board



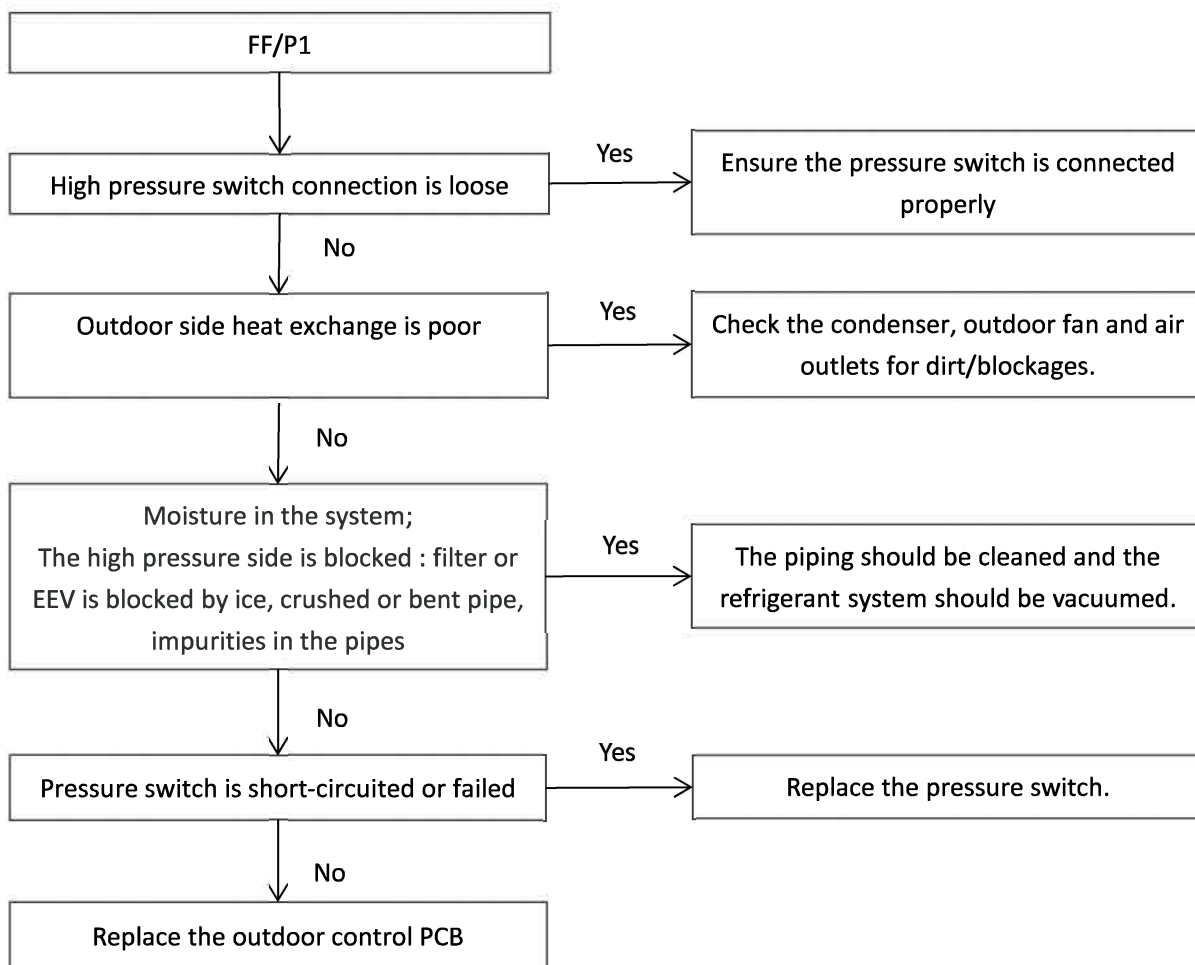
2.8 FD Troubleshooting

- FD indicates pressure sensor fault
- The unit stops running and error code is displayed on the communication board



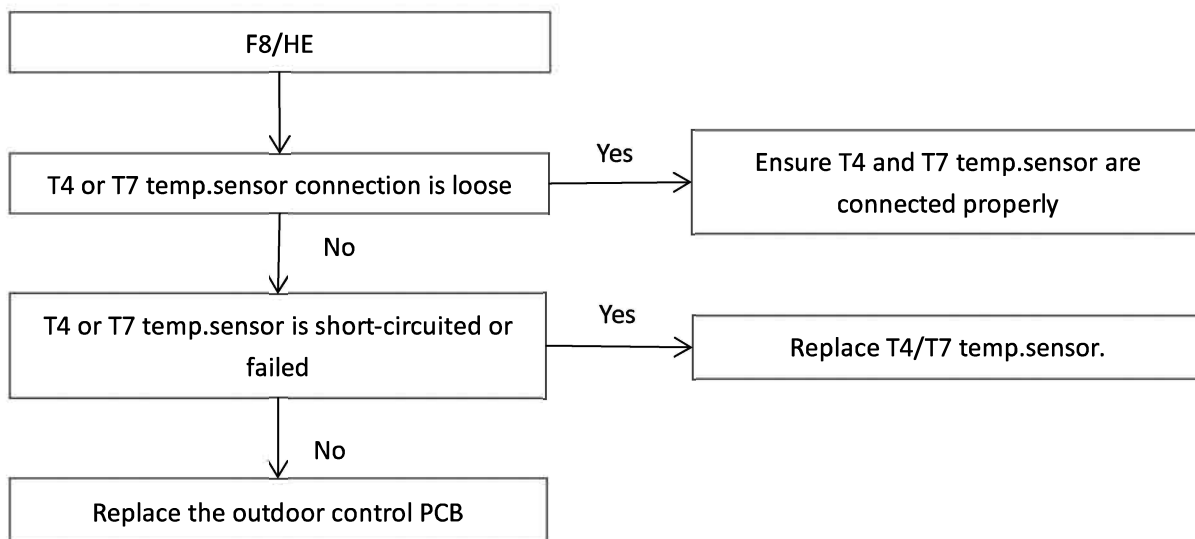
2.9 FF/P1/H2 Troubleshooting

- FF indicates high pressure switch fault for 20 minutes.
- P1 indicates high pressure switch fault for 4 seconds.
- H2 indicates FF protection appears 3 times in 150 minutes can't be recovered until re-power on.
- The unit stops running and error code is displayed on the communication board



2.10 F8/HE Troubleshooting

- FF indicates T7 temp sensor error in detecting condensate risks.
- HE indicates F8F protection appears 3 times in 60 minutes can't be recovered until re-power on.
- The unit stops running and error code is displayed on the communication board

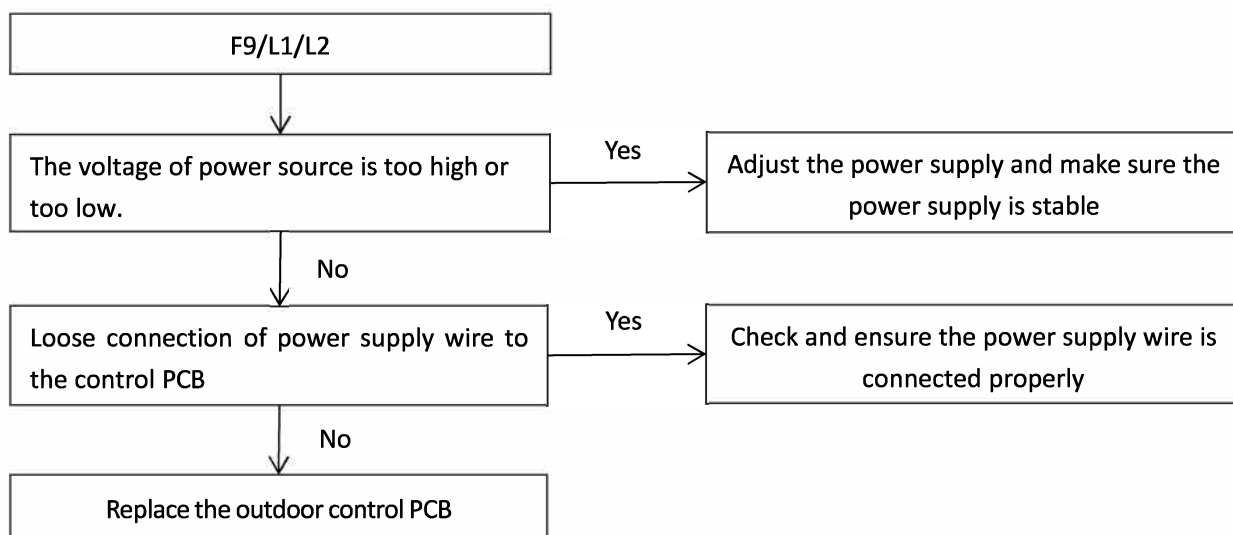


2.11 F9/L0/L1 Troubleshooting

- F9 indicates AC voltage is too high or too low protection
- L0 indicates DC bus low voltage protection
- L1 indicates DC bus high voltage protection

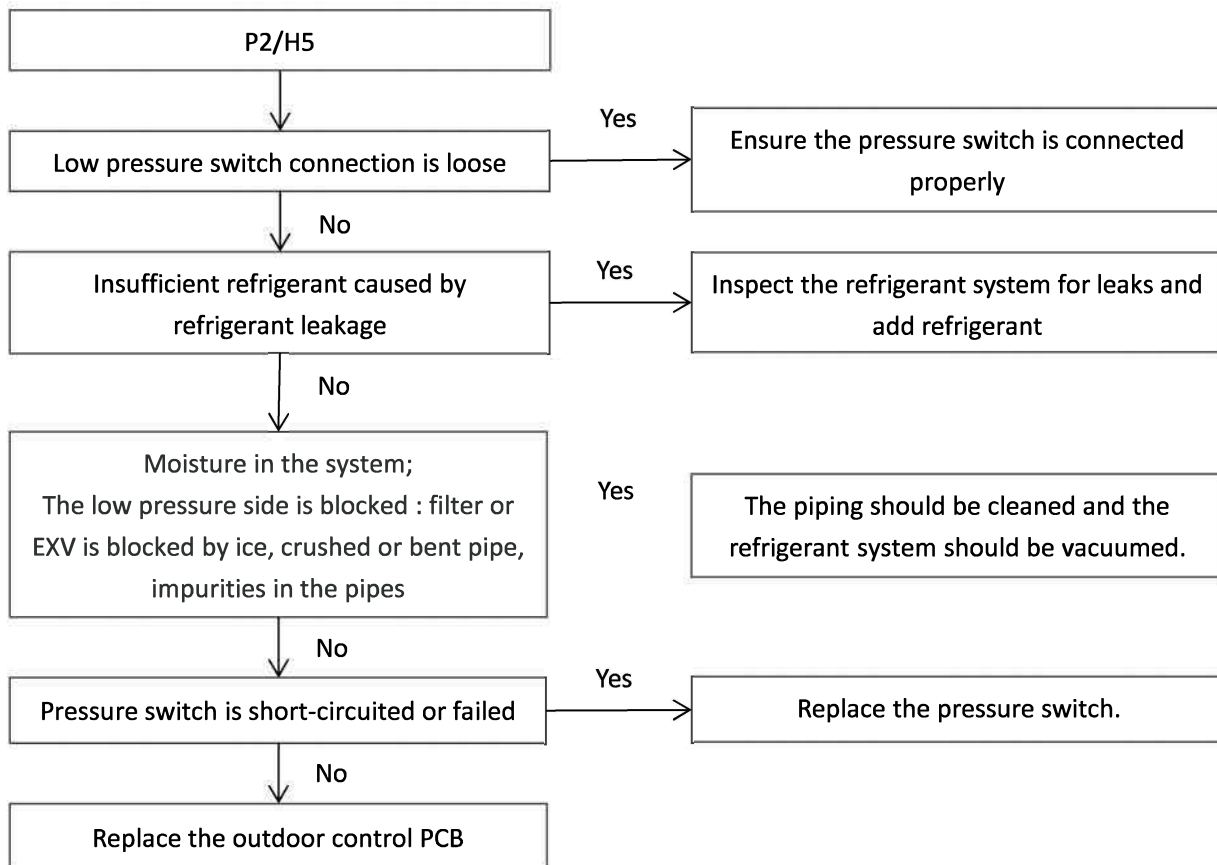
Allowable voltage range of power source	178~265V
Upper limit of DC generatrix voltage	430V
Lower limit of DC generatrix voltage	150V

- The unit stops running and error code is displayed on the communication board



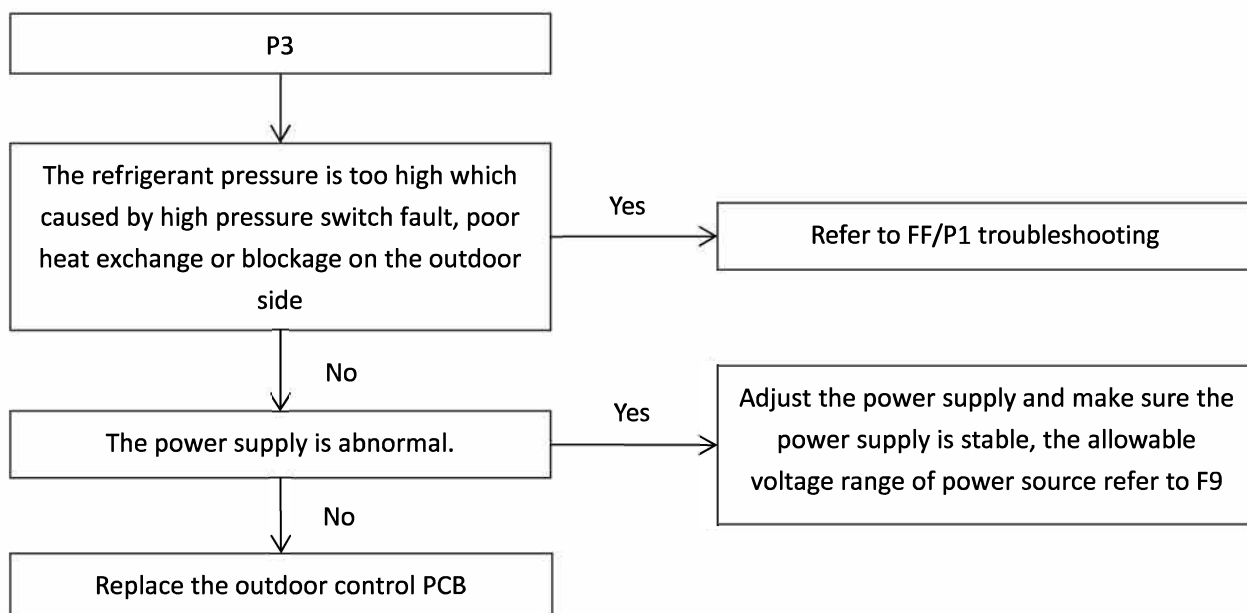
2.12 P2/H5 Troubleshooting

- P2 indicates low pressure protection .
- H5 indicates P2 protection appears 3 times in 240 minutes can't be recovered until re-power on.
- The unit stops running and error code is displayed on the communication board



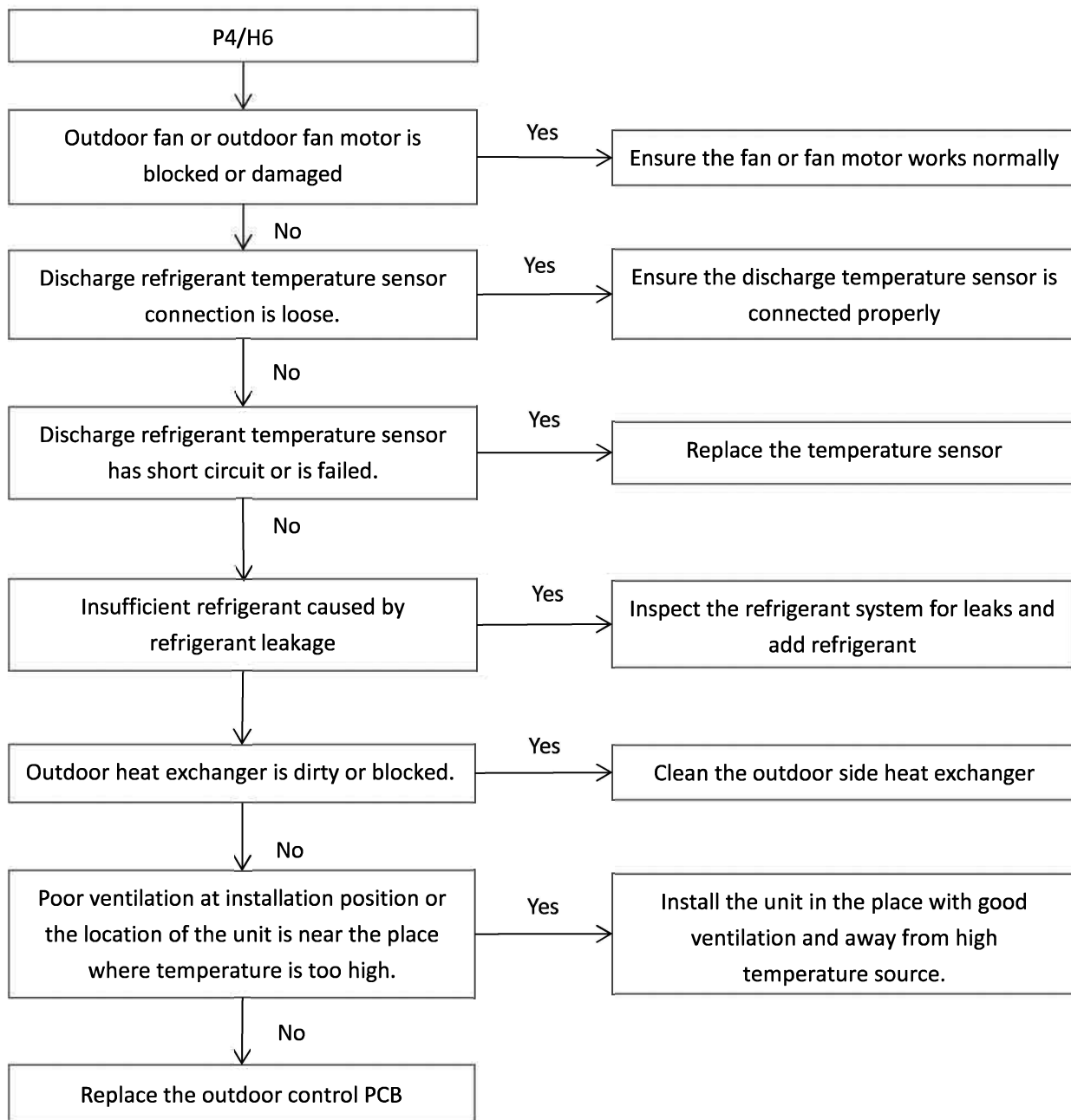
2.13 P3 Troubleshooting

- P3 indicates over current protection
- The unit stops running and error code is displayed on the communication board



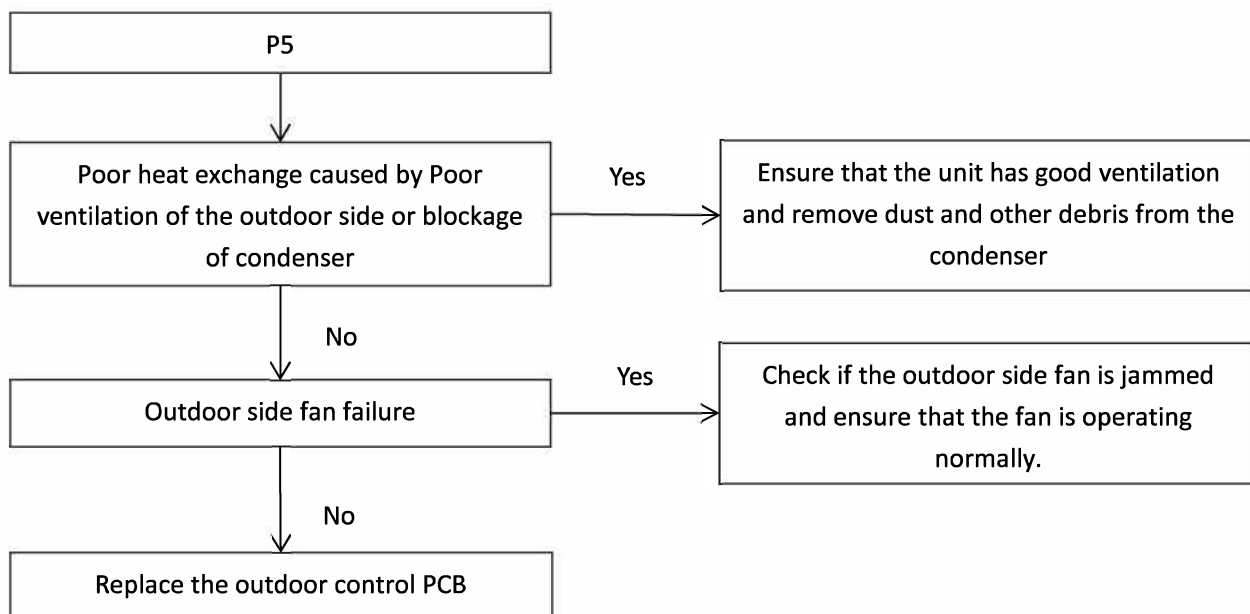
2.14 P4/H6 Troubleshooting

- P4 indicates discharge temperature protection
- H6 indicates P4 protection appears 3 times in 100 minutes can't be recovered until re-power on.
- The unit stops running and error code is displayed on the communication board.



2.15 P5 Troubleshooting

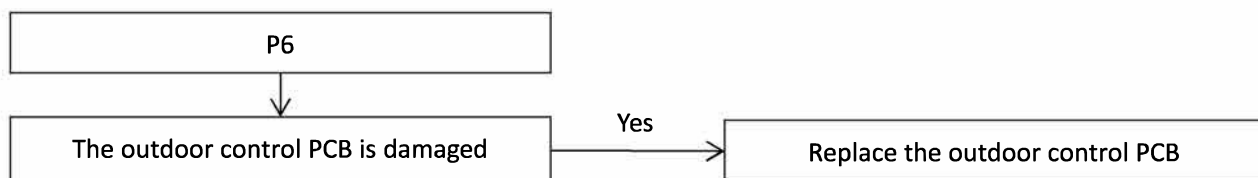
- P5 indicates T3 high temperature protection in cooling mode
- The unit stops running and error code is displayed on the communication board.



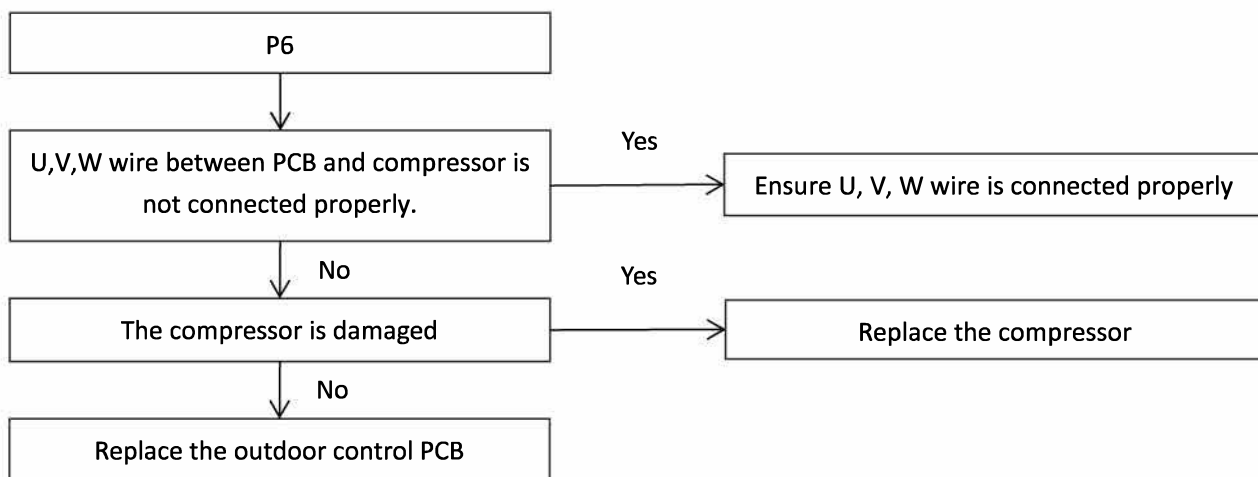
2.16 P6 Troubleshooting

- P6 indicates compressor inverter module protection.
- The unit stops running and error code is displayed on the communication board.

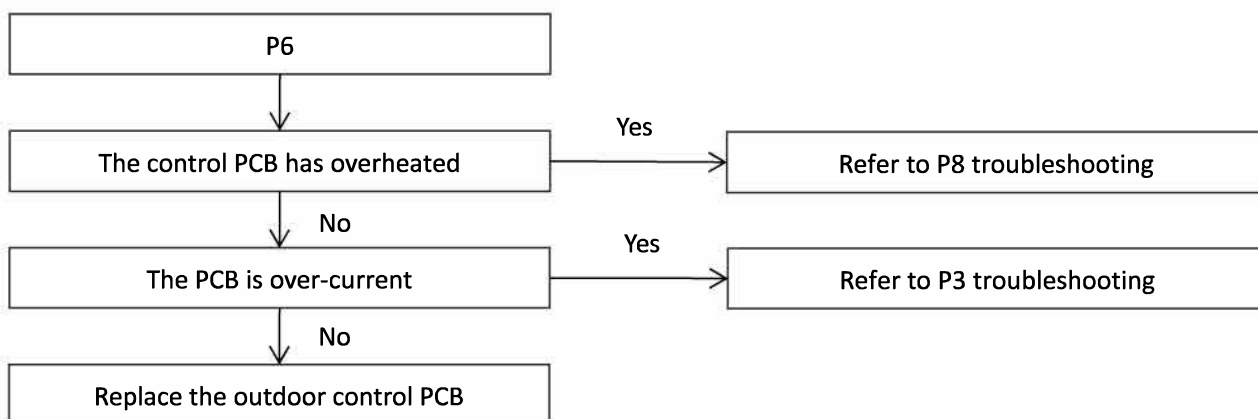
Situation1: P6 appears immediately when the outdoor unit is powered-on



Situation2: P6 appears immediately after the compressor starts up

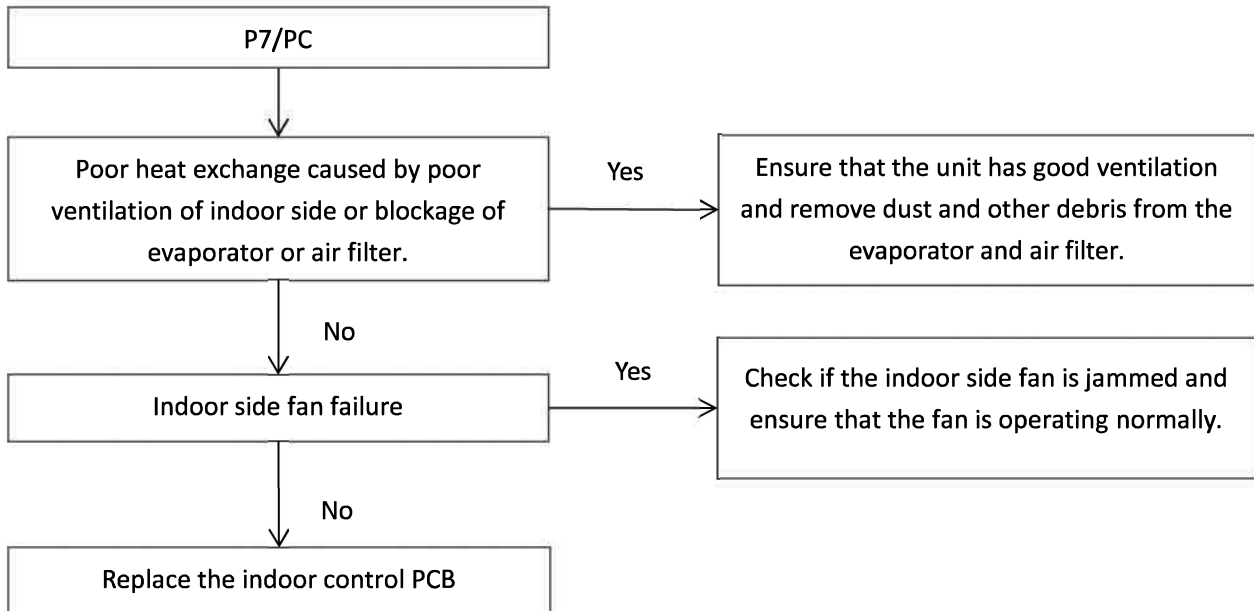


Situation3: P6 appears after the compressor has been running for a period of time.



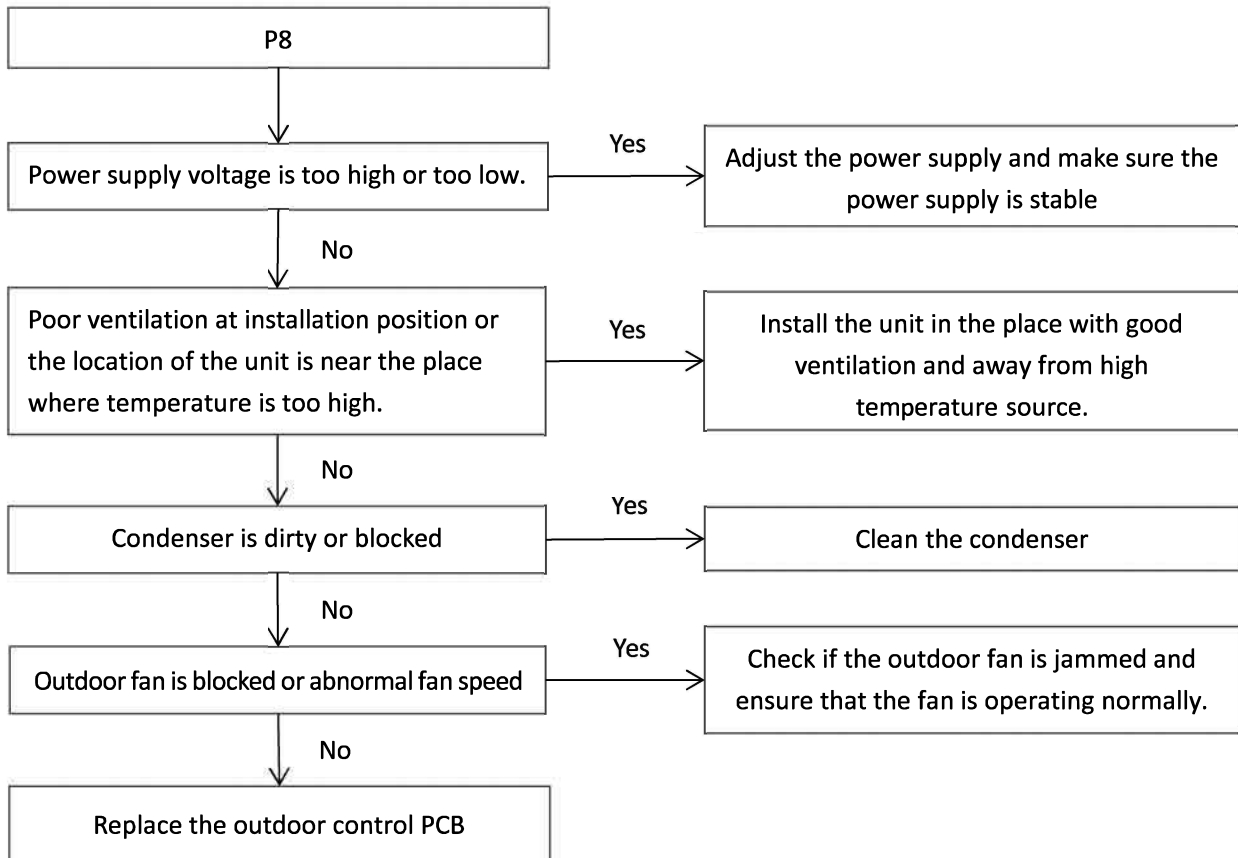
2.17 P7/PC Troubleshooting

- P7 indicates Indoor unit anti-freezing protection.
- PC indicates overwet operation protection.
- The unit stops running and error code is displayed on the communication board.



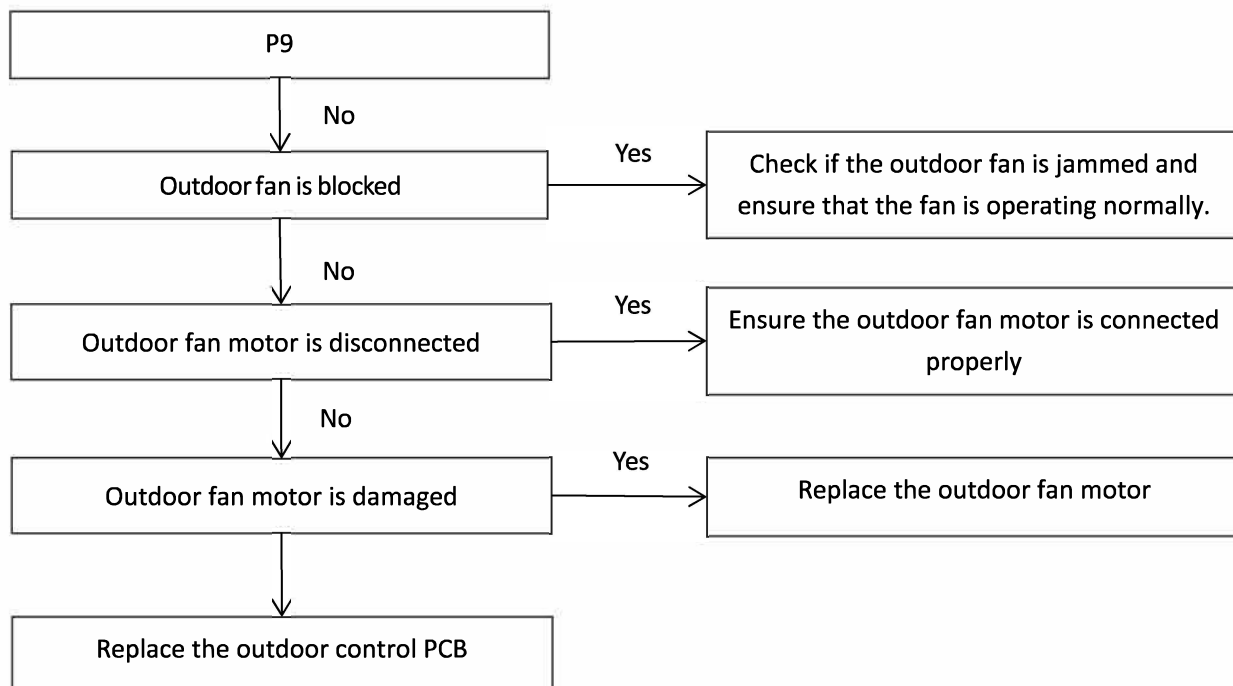
2.18 P8 Troubleshooting

- P8 indicates IPM high temperature protection.
- The unit stops running and error code is displayed on the communication board.



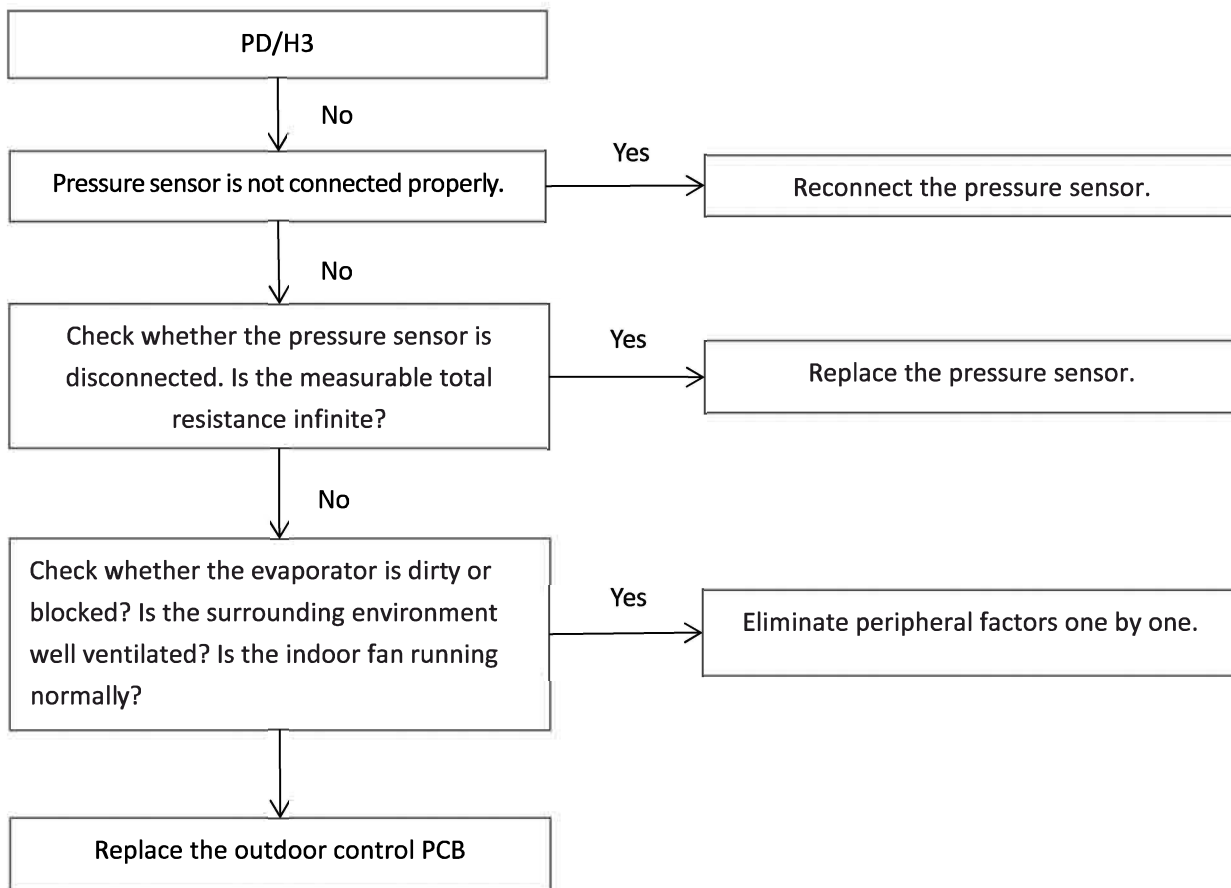
2.19 P9 Troubleshooting

- P9 indicates outdoor fan motor fault
- The unit stops running and error code is displayed on the communication board.



2.20 PD/H3 Troubleshooting

- PD indicates high pressure protection in heating mode
- H3 indicates PD protection appears 3 times in 180 minutes can't be recovered until re-power on
- The unit stops running and error code is displayed on the communication board.



2.21 H0 Troubleshooting

- H0 indicates Communication fault of master board and driver chip
- The unit stops running and error code is displayed on the communication board.

There is only one control PCB in the electric control box which integrates the functions of main control board and inverter module, maintenance personnel has to replace the PCB when H0 fault occurs.

3. Temperature Sensor Resistance Characteristics

Room temperature sensor(T1), condenser coil temperature sensor(T2), condenser coil temperature sensor(T3) and outdoor ambient temperature sensor(T4) resistance characteristics.

Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)
-30	65.02	62.77	60.59	11	8.92	8.78	8.65	52	1.94	1.90	1.86
-29	61.52	59.42	57.39	12	8.55	8.42	8.30	53	1.88	1.84	1.80
-28	58.24	56.28	54.39	13	8.20	8.08	7.96	54	1.82	1.78	1.74
-27	55.15	53.32	51.56	14	7.86	7.75	7.64	55	1.76	1.72	1.69
-26	52.24	50.54	48.89	15	7.55	7.44	7.34	56	1.70	1.67	1.63
-25	49.51	47.92	46.38	16	7.24	7.14	7.05	57	1.65	1.61	1.58
-24	46.94	45.46	44.02	17	6.95	6.86	6.77	58	1.60	1.56	1.53
-23	44.51	43.13	41.79	18	6.67	6.59	6.50	59	1.55	1.51	1.48
-22	42.23	40.94	39.69	19	6.41	6.33	6.25	60	1.50	1.46	1.43
-21	40.08	38.88	37.71	20	6.15	6.08	6.01	61	1.45	1.42	1.39
-20	38.05	36.93	35.84	21	5.91	5.85	5.78	62	1.41	1.37	1.34
-19	36.14	35.09	34.07	22	5.68	5.62	5.56	63	1.36	1.33	1.30
-18	34.34	33.36	32.40	23	5.46	5.40	5.35	64	1.32	1.29	1.26
-17	32.63	31.72	30.83	24	5.25	5.20	5.14	65	1.28	1.25	1.22
-16	31.03	30.17	29.34	25	5.05	5.00	4.95	66	1.24	1.21	1.18
-15	29.51	28.71	27.93	26	4.86	4.81	4.76	67	1.21	1.18	1.15
-14	28.07	27.33	26.60	27	4.68	4.63	4.58	68	1.17	1.14	1.11
-13	26.72	26.02	25.34	28	4.51	4.46	4.41	69	1.13	1.11	1.08
-12	25.44	24.78	24.15	29	4.34	4.29	4.24	70	1.10	1.07	1.05
-11	24.22	23.61	23.02	30	4.18	4.13	4.08	71	1.07	1.04	1.02
-10	23.08	22.51	21.95	31	4.03	3.98	3.93	72	1.04	1.01	0.98
-9	21.99	21.46	20.93	32	3.89	3.84	3.79	73	1.01	0.98	0.96
-8	20.96	20.46	19.97	33	3.75	3.70	3.65	74	0.98	0.95	0.93
-7	19.99	19.52	19.06	34	3.61	3.56	3.52	75	0.95	0.92	0.90
-6	19.06	18.63	18.20	35	3.48	3.44	3.39	76	0.92	0.90	0.87
-5	18.19	17.78	17.38	36	3.36	3.31	3.27	77	0.90	0.87	0.85
-4	17.36	16.98	16.61	37	3.24	3.20	3.15	78	0.87	0.85	0.82
-3	16.57	16.22	15.87	38	3.13	3.08	3.04	79	0.85	0.82	0.80
-2	15.83	15.49	15.17	39	3.02	2.97	2.93	80	0.82	0.80	0.78
-1	15.12	14.81	14.50	40	2.91	2.87	2.83	72	1.04	1.01	0.98
0	14.45	14.16	13.87	41	2.81	2.77	2.73	73	1.01	0.98	0.96
1	13.81	13.54	13.27	42	2.72	2.67	2.63	74	0.98	0.95	0.93
2	13.20	12.95	12.70	43	2.63	2.58	2.54	75	0.95	0.92	0.90
3	12.63	12.39	12.15	44	2.54	2.49	2.45	76	0.92	0.90	0.87
4	12.08	11.85	11.64	45	2.45	2.41	2.37	77	0.90	0.87	0.85
5	11.56	11.35	11.14	46	2.37	2.33	2.29	78	0.87	0.85	0.82
6	11.06	10.87	10.67	47	2.29	2.25	2.21	79	0.85	0.82	0.80
7	10.59	10.41	10.23	48	2.21	2.17	2.13	80	0.82	0.80	0.78
8	10.14	9.97	9.80	49	2.14	2.10	2.06	81	0.80	0.78	0.75
9	9.71	9.56	9.40	50	2.07	2.03	1.99	82	0.78	0.75	0.73
10	9.31	9.16	9.01	51	2.00	1.97	1.93	83	0.75	0.73	0.71

Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (°C)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)
84	0.73	0.71	0.69	107	0.40	0.39	0.37	130	0.23	0.22	0.21
85	0.71	0.69	0.67	108	0.39	0.38	0.36	131	0.23	0.22	0.21
86	0.69	0.67	0.65	109	0.38	0.37	0.35	132	0.22	0.21	0.20
87	0.68	0.66	0.64	110	0.37	0.36	0.34	133	0.22	0.21	0.20
88	0.66	0.64	0.62	111	0.36	0.35	0.34	134	0.21	0.20	0.19
89	0.64	0.62	0.60	112	0.35	0.34	0.33	135	0.21	0.20	0.19
90	0.62	0.60	0.58	113	0.34	0.33	0.32	136	0.20	0.19	0.19
91	0.61	0.59	0.57	114	0.34	0.32	0.31	137	0.20	0.19	0.18
92	0.59	0.57	0.55	115	0.33	0.32	0.30	138	0.19	0.19	0.18
93	0.57	0.56	0.54	116	0.32	0.31	0.30	139	0.19	0.18	0.17
94	0.56	0.54	0.52	117	0.31	0.30	0.29	140	0.19	0.18	0.17
95	0.54	0.53	0.51	118	0.31	0.29	0.28	141	0.18	0.17	0.17
96	0.53	0.51	0.50	119	0.30	0.29	0.28	142	0.18	0.17	0.16
97	0.52	0.50	0.48	120	0.29	0.28	0.27	143	0.17	0.17	0.16
98	0.50	0.49	0.47	121	0.28	0.27	0.26	144	0.17	0.16	0.16
99	0.49	0.47	0.46	122	0.28	0.27	0.26	145	0.17	0.16	0.15
100	0.48	0.46	0.45	123	0.27	0.26	0.25	146	0.16	0.16	0.15
101	0.47	0.45	0.43	124	0.27	0.25	0.24	147	0.16	0.15	0.15
102	0.45	0.44	0.42	125	0.26	0.25	0.24	148	0.16	0.15	0.14
103	0.44	0.43	0.41	126	0.25	0.24	0.23	149	0.15	0.15	0.14
104	0.43	0.42	0.40	127	0.25	0.24	0.23	150	0.15	0.14	0.14
105	0.42	0.41	0.39	128	0.24	0.23	0.22				
106	0.41	0.40	0.38	129	0.24	0.23	0.22				

Compressor exhaust temperature sensor (TP) resistance characteristics.

Temperature (℃)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (℃)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)	Temperature (℃)	Resistance Rmax(kΩ)	Resistance Rnor(kΩ)	Resistance Rmin(kΩ)
0	165.85	162.28	158.78	51	17.62	17.27	16.91	102	3.18	3.06	2.94
1	157.60	154.29	151.04	52	16.97	16.62	16.27	103	3.08	2.97	2.86
2	149.81	146.74	143.71	53	16.35	16.00	15.66	104	2.99	2.88	2.77
3	142.44	139.59	136.79	54	15.75	15.41	15.08	105	2.90	2.79	2.69
4	135.48	132.84	130.23	55	15.17	14.84	14.52	106	2.82	2.71	2.61
5	128.90	126.45	124.03	56	14.62	14.30	13.98	107	2.74	2.63	2.53
6	122.68	120.40	118.15	57	14.09	13.78	13.46	108	2.66	2.56	2.46
7	116.79	114.68	112.59	58	13.59	13.27	12.97	109	2.58	2.48	2.38
8	111.21	109.26	107.32	59	13.10	12.79	12.50	110	2.51	2.41	2.32
9	105.94	104.12	102.33	60	12.63	12.33	12.04	111	2.44	2.34	2.25
10	100.94	99.26	97.59	61	12.19	11.89	11.61	112	2.37	2.27	2.18
11	96.20	94.64	93.10	62	11.76	11.47	11.19	113	2.30	2.21	2.12
12	91.72	90.27	88.84	63	11.34	11.06	10.79	114	2.24	2.15	2.06
13	87.46	86.13	84.80	64	10.95	10.67	10.40	115	2.18	2.09	2.00
14	83.43	82.19	80.97	65	10.57	10.30	10.03	116	2.11	2.03	1.94
15	79.60	78.46	77.33	66	10.20	9.94	9.68	117	2.06	1.97	1.89
16	75.97	74.92	73.87	67	9.85	9.59	9.34	118	2.00	1.92	1.84
17	72.53	71.55	70.58	68	9.51	9.26	9.01	119	1.94	1.86	1.78
18	69.26	68.36	67.46	69	9.19	8.94	8.70	120	1.89	1.81	1.73
19	66.15	65.32	64.49	70	8.87	8.63	8.40	121	1.84	1.76	1.69
20	63.20	62.43	61.67	71	8.57	8.34	8.11	122	1.79	1.71	1.64
21	60.40	59.69	58.99	72	8.28	8.05	7.83	123	1.74	1.67	1.59
22	57.73	57.08	56.44	73	8.01	7.78	7.56	124	1.69	1.62	1.55
23	55.20	54.60	54.01	74	7.74	7.52	7.30	125	1.65	1.58	1.51
24	52.79	52.25	51.70	75	7.48	7.27	7.06	126	1.60	1.53	1.47
25	50.50	50.00	49.50	76	7.24	7.02	6.82	127	1.56	1.49	1.43
26	48.36	47.86	47.36	77	7.00	6.79	6.59	128	1.52	1.45	1.39
27	46.33	45.83	45.33	78	6.77	6.57	6.37	129	1.48	1.41	1.35
28	44.39	43.89	43.39	79	6.55	6.35	6.16	130	1.44	1.38	1.31
29	42.54	42.04	41.55	80	6.33	6.14	5.95	131	1.40	1.34	1.28
30	40.78	40.28	39.80	81	6.13	5.94	5.76	132	1.37	1.30	1.24
31	39.10	38.61	38.12	82	5.93	5.75	5.57	133	1.33	1.27	1.21
32	37.49	37.01	36.53	83	5.74	5.56	5.39	134	1.30	1.24	1.18
33	35.96	35.49	35.01	84	5.56	5.38	5.21	135	1.26	1.20	1.15
34	34.51	34.03	33.56	85	5.38	5.21	5.04	136	1.23	1.17	1.12
35	33.11	32.65	32.18	86	5.21	5.04	4.88	137	1.20	1.14	1.09
36	31.78	31.32	30.86	87	5.05	4.88	4.72	138	1.17	1.11	1.06
37	30.51	30.06	29.61	88	4.89	4.73	4.57	139	1.14	1.08	1.03
38	29.30	28.85	28.41	89	4.74	4.58	4.43	140	1.11	1.06	1.01
39	28.14	27.70	27.26	90	4.59	4.44	4.29	141	1.08	1.03	0.98
40	27.04	26.60	26.17	91	4.45	4.30	4.15	142	1.05	1.00	0.95
41	25.98	25.55	25.13	92	4.31	4.16	4.02	143	1.03	0.98	0.93
42	24.97	24.55	24.13	93	4.18	4.03	3.89	144	1.00	0.95	0.91
43	24.00	23.59	23.18	94	4.05	3.91	3.77	145	0.98	0.93	0.88
44	23.08	22.67	22.26	95	3.93	3.79	3.66	146	0.95	0.91	0.86
45	22.19	21.79	21.39	96	3.81	3.67	3.54	147	0.93	0.88	0.84
46	21.35	20.95	20.56	97	3.69	3.56	3.43	148	0.91	0.86	0.82
47	20.54	20.15	19.77	98	3.58	3.45	3.33	149	0.88	0.84	0.80
48	19.76	19.38	19.00	99	3.48	3.35	3.23	150	0.86	0.82	0.78
49	19.02	18.64	18.28	100	3.37	3.25	3.13				
50	18.31	17.94	17.58	101	3.27	3.15	3.03				

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