ComfortStar®

Service Manual

Outdoor Unit: **CSL18CD (31Q)**
CSL24CD (31R)
CSL36CD (30C)
CSL48CD (31S)
CSL60CD (30D)
CSL18CD-M (34P)
CSL24CD-M (34Q)
CSL36CD-M (34R)
CSL48CD-M (34S)
CSL60CD-M (34T)

⚠ 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

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Content

Part 1

General Information

1 Product lineup

Model	Capacity(Btu/h)	Appearance
CSL18CD **CSL18CD-M**	18000	
CSL24CD **CSL24CD-M**	24000	
CSL36CD **CSL36CD-M**	36000	
CSL48CD **CSL48CD-M**	48000	
CSL60CD **CSL60CD-M**	55000	

2 Specifications

OUTDOOR UNIT			CSL18CD	CSL24CD	CSL36CD	CSL48CD	CSL60CD
Power supply		V-Ph-Hz	208/230V,1Ph, 60Hz				
Cooling	Capacity	Btu/h	18000	24000	36000	48000	55000
	Input	W	2000	2600	3450	5450	6400
Heating	capacity	Btu/h	N/A	N/A	N/A	N/A	N/A
	Input	W	N/A	N/A	N/A	N/A	N/A
Outdoor Minimum Circuit Ampacity		A	9.0	12.5	19.0	28.0	34.0
Outdoor Max.Fuse		A	15	15	20	30	40
Outdoor Air Flow		CFM	1060	1350	2350	2800	3050
Outdoor Noise Level		dB(A)	54	54	56	60	60
Connection Wiring			485: AWG 25*3 Shielded, 24V: AWG 20				
Comunication Type			24V / 485	24V / 485	24V / 485	24V / 485	24V / 485
Throttle type			/	/	/	/	/
Outdoor Unit	Unpacking(W*H*D)(inch)	inch	34-1/16×21-29/64×12-51/64		36-7/32×28-5/32×14-49/64	37-63/64×31-57/64×15-3/4	
	Packing (W*H*D)(inch)	inch	37-13/32×24-7/32×15-5/32		40-23/64×30-33/64×18-45/64	42-1/8×34-41/64×20-43/64	
	Net/Gross weight (lbs)	lbs	53/58	61/65	79/87	122/131	122/131
Refrigeration	Type/Charge	oz	R32/20.10	R32/35.27	R32/33.51	R32/52.91	R32/52.91
	Outdoor Additional Charge	oz/ft	0.52	0.52	0.52	0.52	0.52
	N.A.Design Pressure	PSI	609/174	609/174	609/174	609/174	609/174
Refrigerant piping	Liquid /Vapor Valve Size	inch	(3/8) / (1/2)	(3/8) / (1/2)	(3/8) / (5/8)	(3/8) / (5/8)	(3/8) / (5/8)
	Max. refrigerant pipe length	ft	98	164	246.0	246.0	246.0
	Max.Height Difference	ft	66	82	98	98	98
Ambient temp.	Cooling	℉	5~131	5~131	5~131	5~131	5~131
	Heating	℉	N/A	N/A	N/A	N/A	N/A
SERVICE CODE			31Q	31R	30C	31S	30D

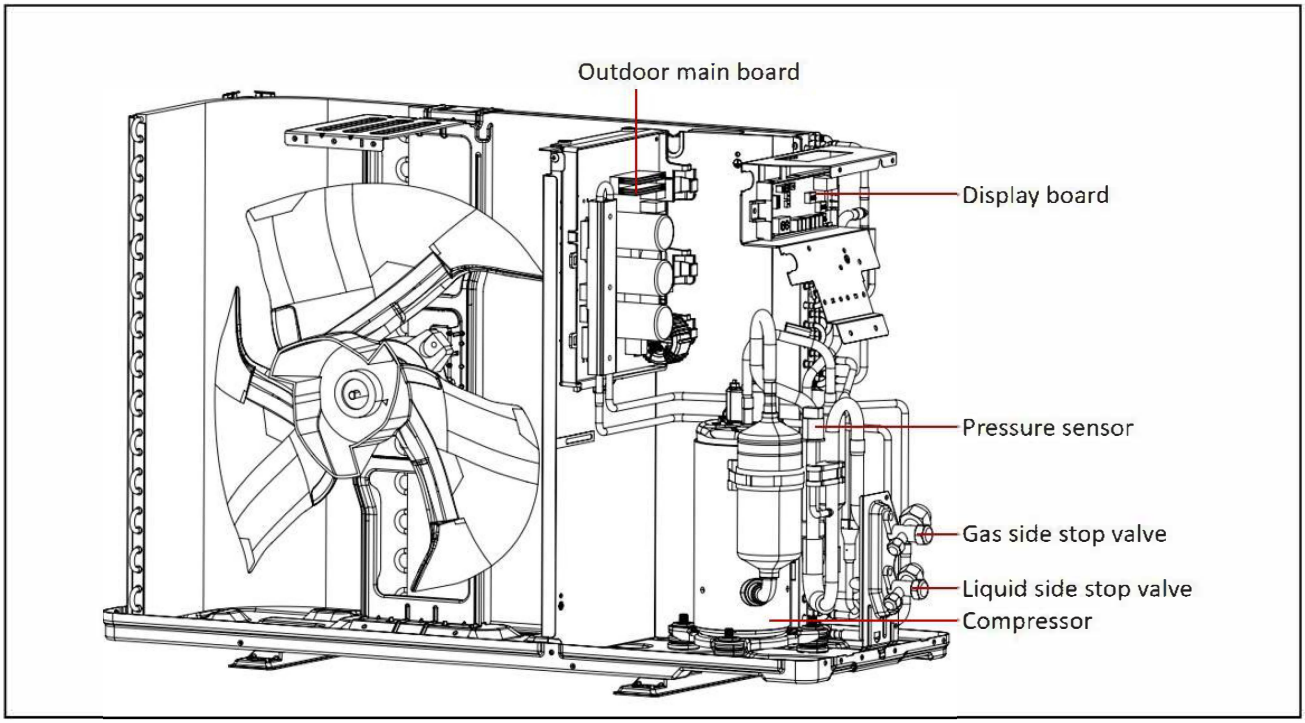
OUTDOOR UNIT			CSL18CD-M	CSL24CD-M	CSL36CD-M	CSL48CD-M	CSL60CD-M
Power supply		V-Ph-Hz	208/230V,1Ph, 60Hz				
Cooling	Capacity	Btu/h	18000	24000	36000	48000	55000
	Input	W	2000	2600	3450	5450	6400
Heating	capacity	Btu/h	N/A	N/A	N/A	N/A	N/A
	Input	W	N/A	N/A	N/A	N/A	N/A
Outdoor Minimum Circuit Ampacity		A	9.0	12.5	19.0	28.0	34.0
Outdoor Max.Fuse		A	15	15	20	30	40
Outdoor Air Flow		CFM	1060	1350	2350	2800	3050
Outdoor Noise Level		dB(A)	54	54	56	60	60
Connection Wiring			485: AWG 25*3 Shielded, 24V: AWG 20				
Comunication Type			24V / 485	24V / 485	24V / 485	24V / 485	24V / 485
Throttle type			/	/	/	/	/
Outdoor Unit	Unpacking(W*H*D)(inch)	inch	34-1/16×21-29/64×12-51/64		36-7/32×28-5/32×14-49/64	37-63/64×31-57/64×15-3/4	
	Packing (W*H*D)(inch)	inch	37-13/32×24-7/32×15-5/32		40-23/64×30-33/64×18-45/64	42-1/8×34-41/64×20-43/64	
	Net/Gross weight (lbs)	lbs	53/58	61/65	79/87	122/131	122/131
Refrigeration	Type/Charge		R410a/24.1	R410a/42.3	R410a/40.2	R410a/63.5	R410a/63.5
	Outdoor Additional Charge	oz/ft	0.62	0.62	0.62	0.62	0.62
	N.A.Design Pressure	PSI	609/174	609/174	609/174	609/174	609/174
Refrigerant piping	Liquid /Vapor Valve Size	inch	(3/8) / (1/2)	(3/8) / (1/2)	(3/8) / (5/8)	(3/8) / (5/8)	(3/8) / (5/8)
	Max. refrigerant pipe length	ft	98	164	246.0	246.0	246.0
	Max.Height Difference	ft	66	82	98	98	98
Ambient temp.	Cooling	℉	5~131	5~131	5~131	5~131	5~131
	Heating	℉	N/A	N/A	N/A	N/A	N/A
SERVICE CODE			34P	34Q	34R	34S	34T

Part 2

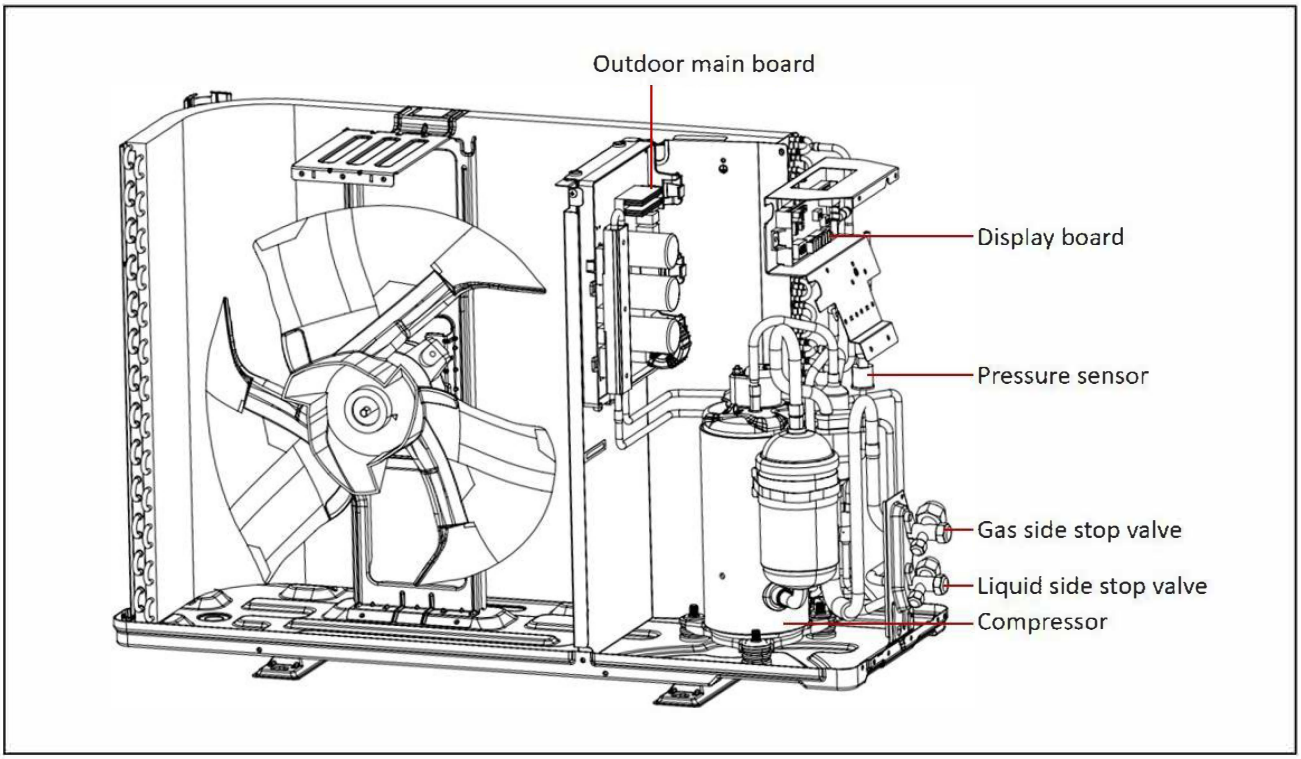
Component Layout and Refrigerant Circuit

1 Layout Functional Components

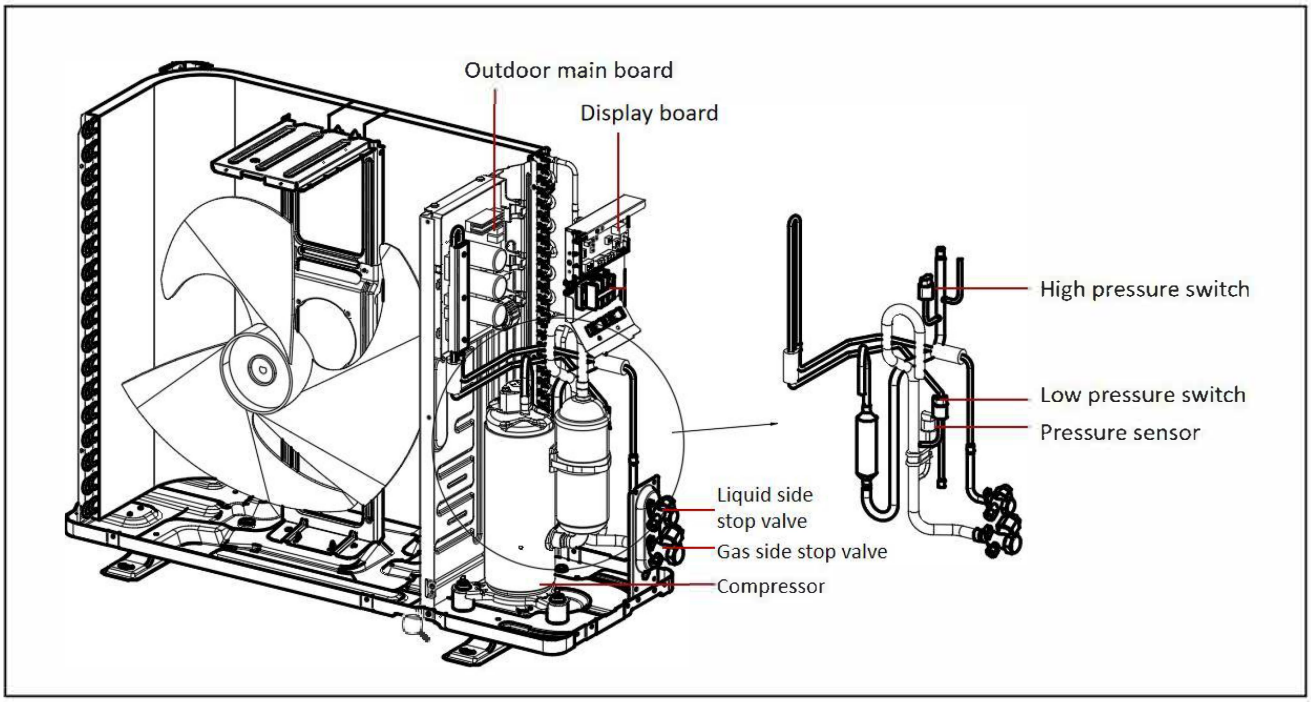
CSL18CD, CSL18CD-M



CSL24CD,CSL24CD-M

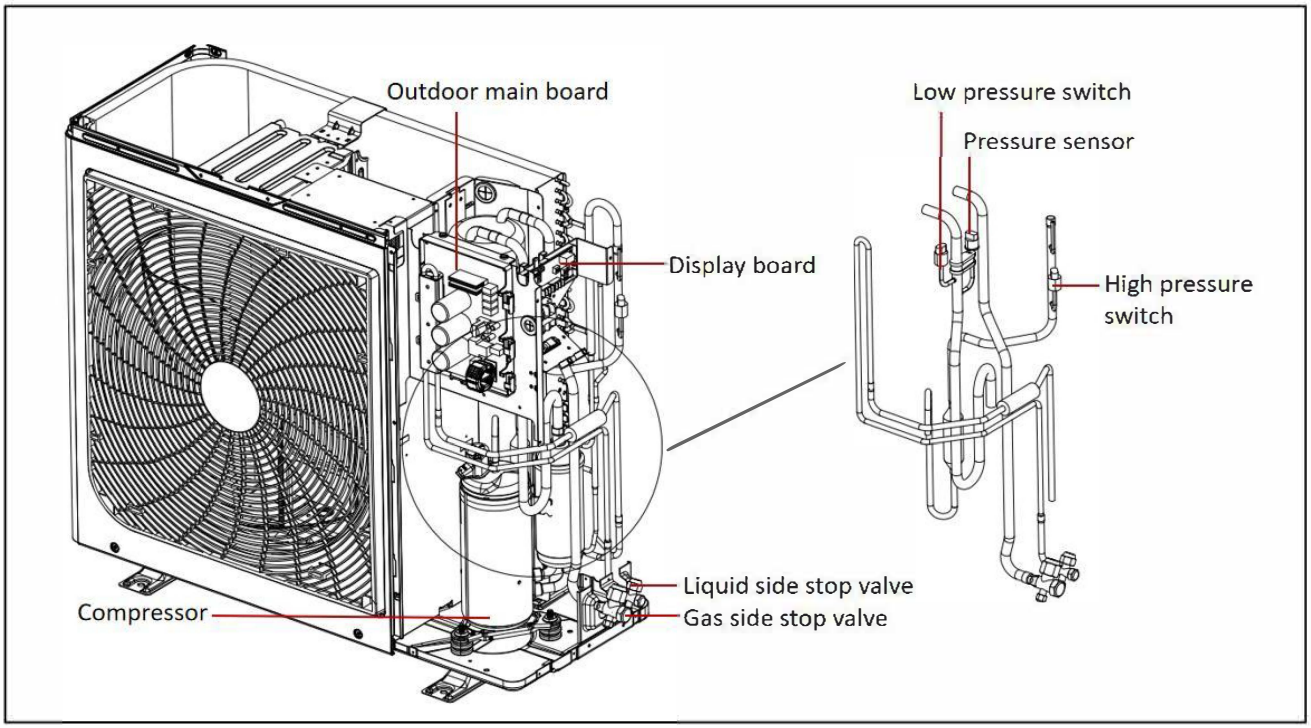


CSL36CD, CSL36CD-M

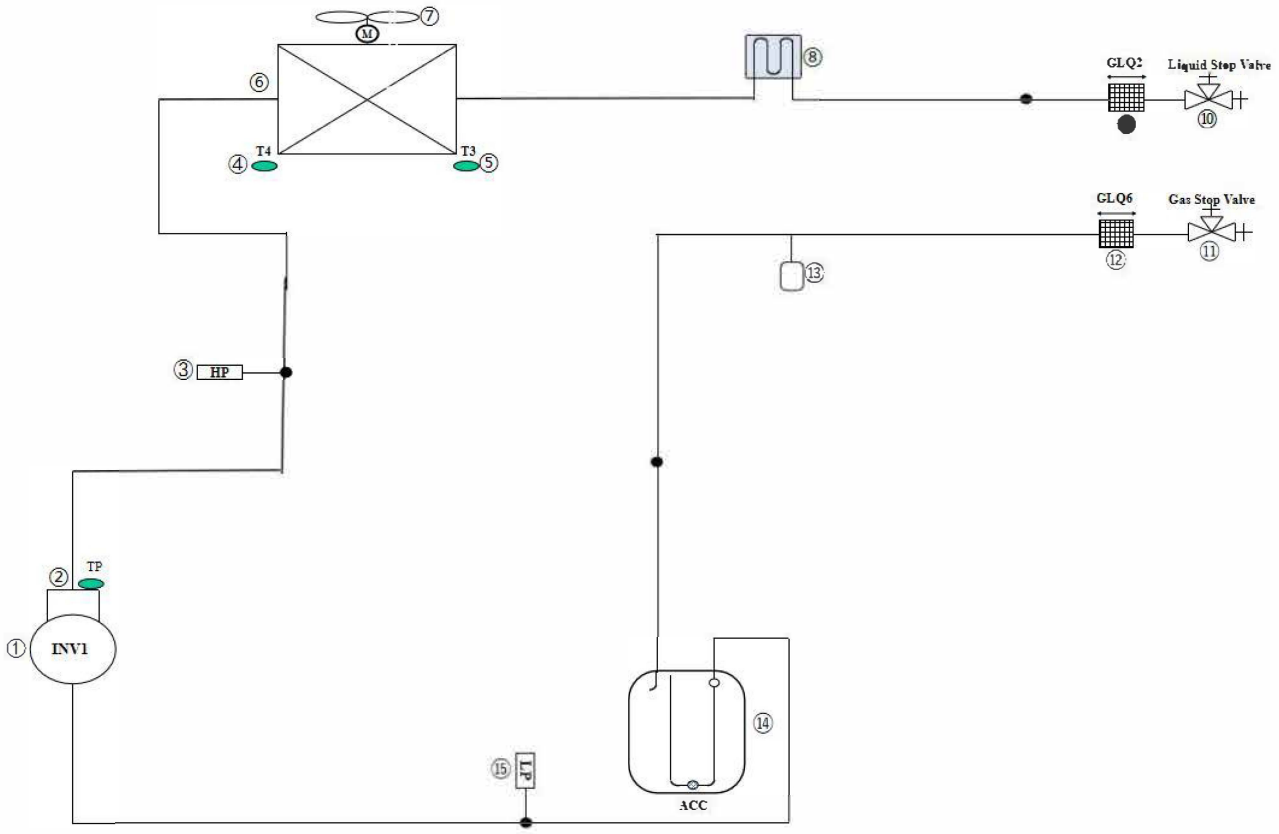


CSL48CD, CSL48CD-M

CSL60CD, CSL60CD-M



2 Piping diagrams

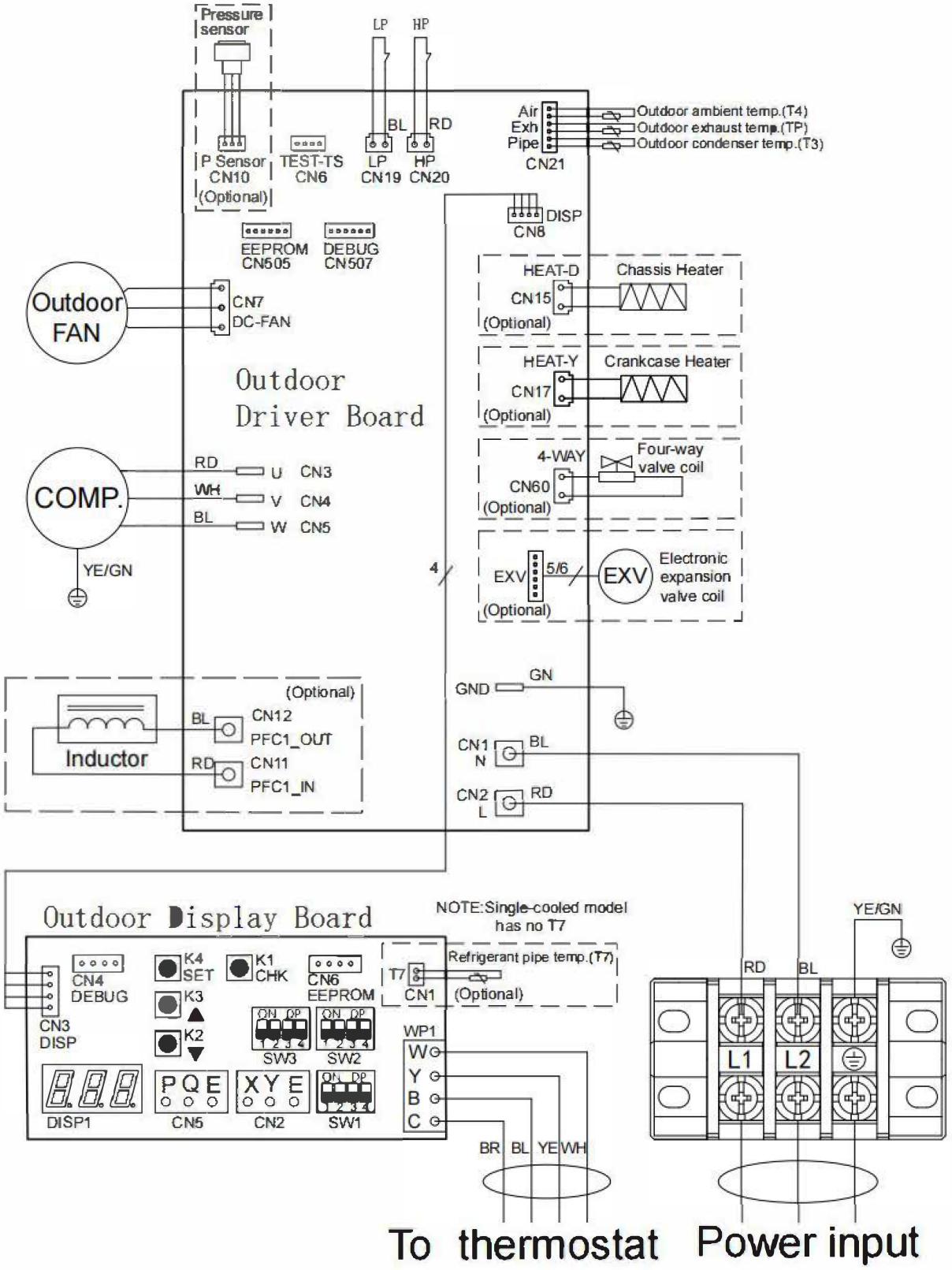


NO.	Component(Outdoor unit)	NO.	Component(Outdoor unit)
1	Compressor	9	Filter
2	Exhaust temperature sensor(TP)	10	Liquid Stop Valve
3	High pressure switch	11	Gas Stop Valve
4	Ambient temperature sensor(T4)	12	Filter
5	Condenser coil temperature sensor(3)	13	Pressure sensor
6	Condenser	14	Gas-liquid separator
7	Outdoor fan	15	Low pressure switch
8	Refrigerant cooling pipe	/	

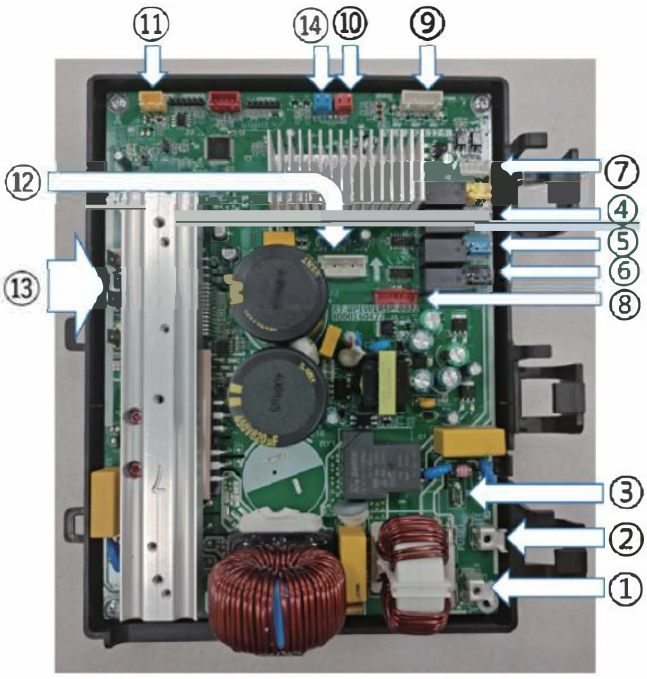
Part 3

Wiring Diagram

1 Electric wiring diagram

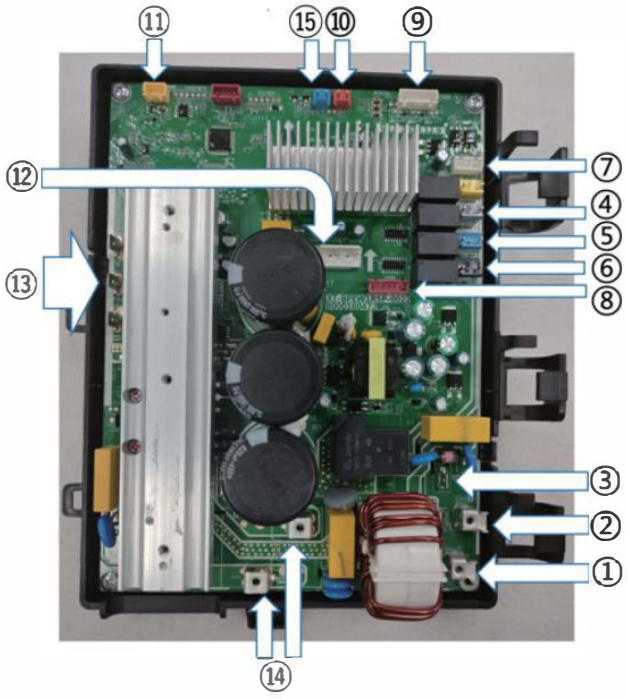


2 PCB



No.	Functional description
1	Power supply input L(L1)
2	Power supply input N(L2)
3	Ground wire
4	Crankshaft heating port
5	Four-way valve port
6	Solenoid Valve port
7	Display board ports
8	Electronic expansion valve port
9	T3 T4 TP sensor port
10	High pressure protection switch port
11	Pressure sensor port
12	DC motor port
13	Compressor port U V W
14	Low pressure protection switch port

18/24/36K Outdoor Main Control Board



No.	Functional description
1	Power supply input L(L1)
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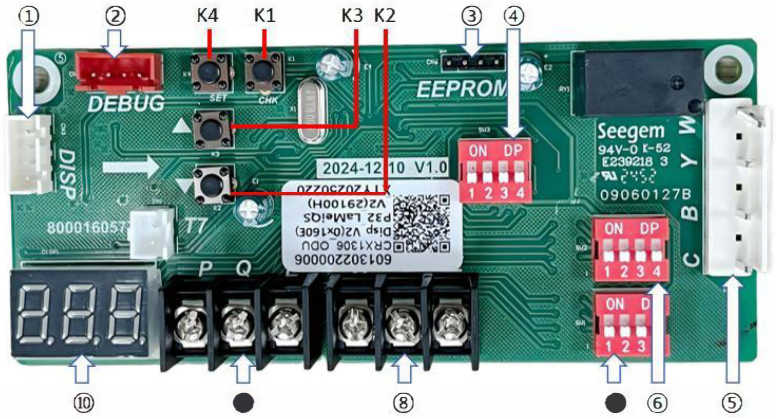
6	Solenoid Valve port
7	Display board ports
8	Electronic expansion valve port
9	T3 T4 TP sensor port
10	High pressure protection switch port
11	Pressure sensor port
12	DC motor port
13	Compressor port U V W
14	Reactor port
15	Low pressure protection switch port

48/60K Outdoor Main Control Board



No. Function description

1 Communicaition port to main board
2 Port for program update
3 Port for EEPROM update
4 Dip Switch SW1
5 24V communication port
6 Dip Switch SW2
7 Dip Switch SW3
8 Port for wired controller
9 RS-485 communication port
10 LED dispaly
K1~K4 Button for checking or setting

Display Board (Communicaition board)

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.

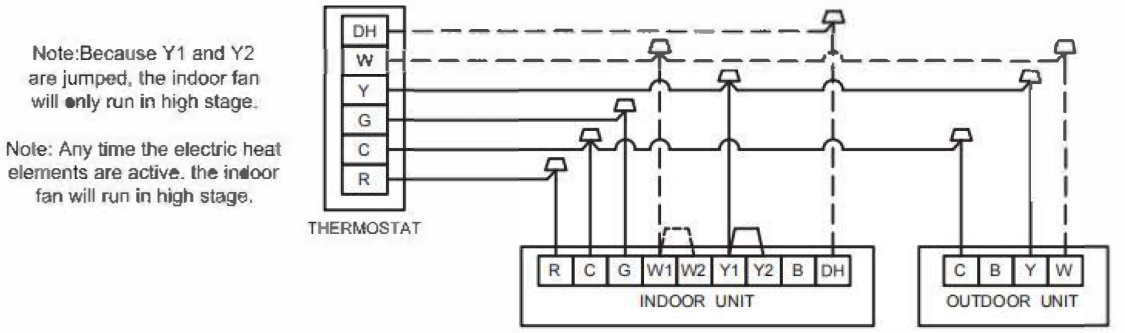
Definition of SW1~SW3

Outdoor Display Board SW1 DIP switch selection			Outdoor Display Board SW2 DIP switch selection			Outdoor Display Board SW3 DIP switch selection					
SW1.1	OFF	24V Control(Default)	SW2.1	OFF	Auto Defrosting(Default)	SW3.1	OFF	Normal energy efficiency			
	ON	RS485 Comm. Mode		ON	Periodically Defrosting		ON	High energy efficiency (SE18)			
SW1.2	OFF	°F for Fahrenheit(Default)	SW2.2	OFF	Defrost interval 60 minutes(Default)	SW3.2	OFF	SW3.3	OFF	Model	24K
	ON	°C for Celsius		ON	Defrost interval 30 minutes		OFF		ON		36K
SW1.3	OFF	Heating and cooling	SW2.3	OFF	Normal Defrosting(Default)		ON		OFF		48K
	ON	Single-cooled		ON	Accelerate Defrosting		ON		ON		60K
SW1.4	OFF	Normal Cooling(Default)	SW2.4	OFF	Normal Thermostat(Default)	SW3.4	OFF	Normal Heating(Default)			
	ON	Accelerate Cooling		ON	O/B Thermostat		ON	Accelerate Heating			

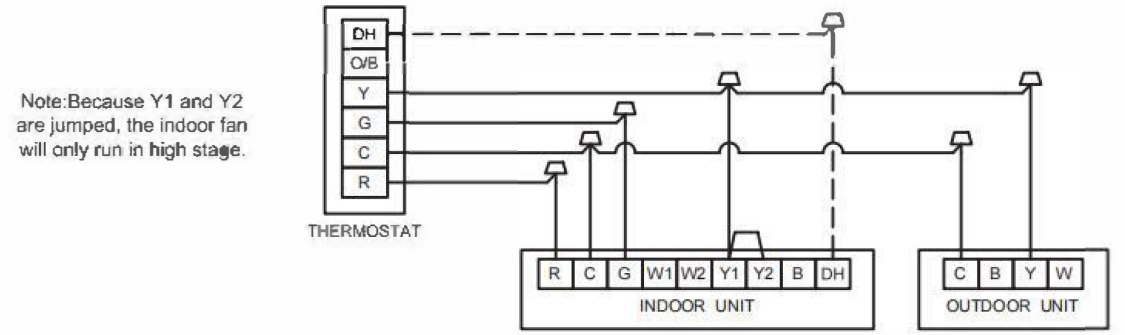
3 Low voltage wiring diagram

The following wiring diagram are suitable for the Indoor Unit and Outdoor Unit with 24V thermostat.

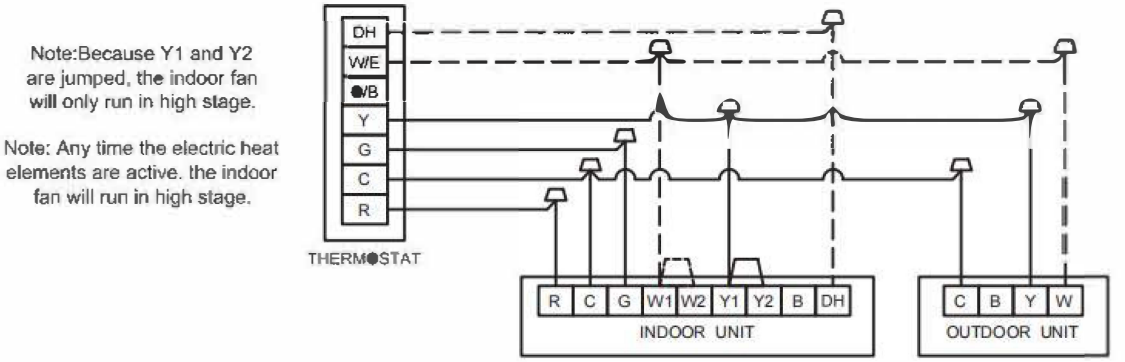
Wiring for 1H and 1C thermostat (no heat pump system model)



Wiring for 1H and 1C thermostat (no heat pump system model)

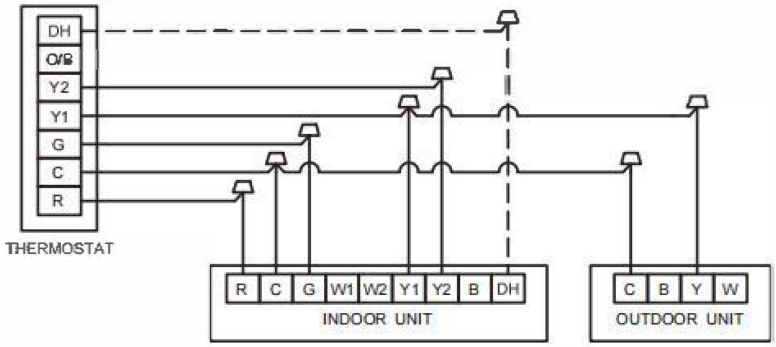


Wiring for 2H and 1C thermostat (no heat pump system model)



Wiring for 2H and 2C thermostat (no heat pump system model)

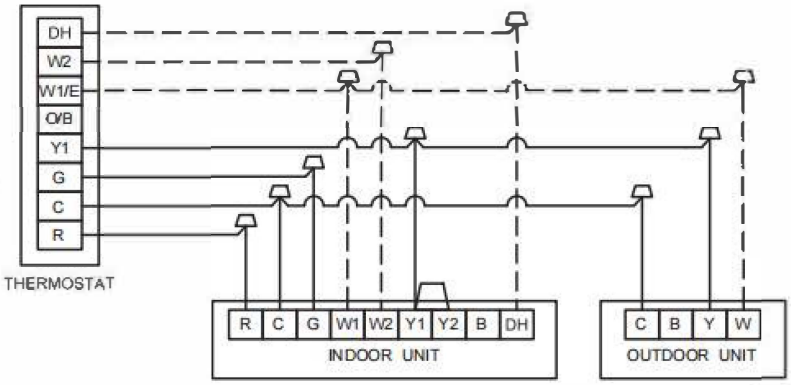
Note:Y1 and Y2 here represents 2 stages of fan cooling only, the compressor modulates separately from the fan.



Wiring for 3H and 1C thermostat (no heat pump system model)

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

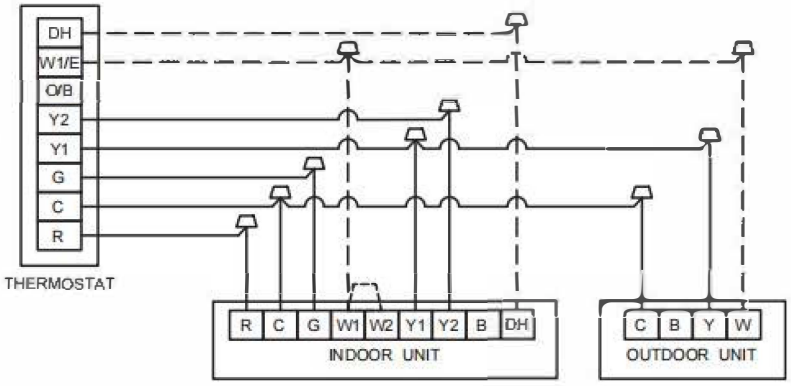
Note: Any time the electric heat elements are active. the indoor fan will run in high stage.



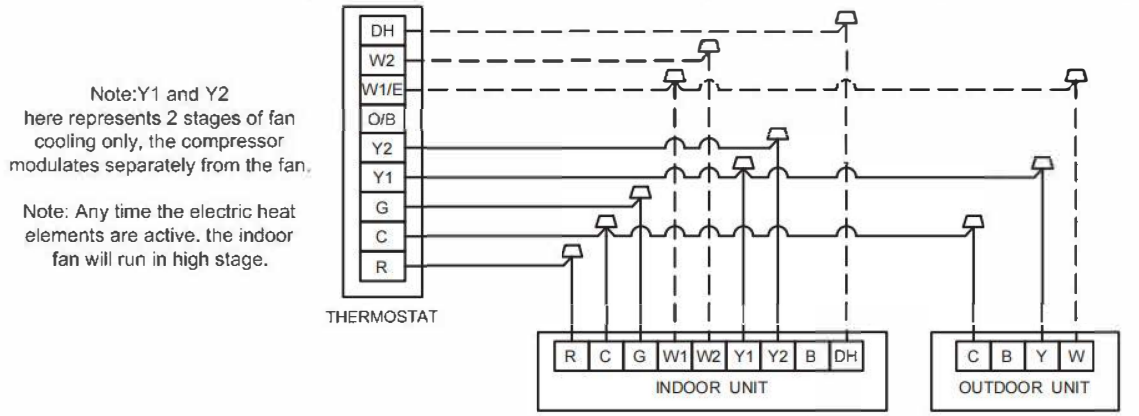
Wiring for 3H and 2C thermostat (no heat pump system model)

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

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



Wiring for 4H and 2C thermostat (no 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

1 Error code table

Error code	Error definition
FA	EEPROM fault (on main PCB)
FB	EEPROM fault (on inverter module)
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(not applicable for cooling only unit)
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(not applicable for cooling only unit)
HE	F8 protection appears 3 times in 60 minutes can't be recovered until re-power on (not applicable for cooling only unit)
H0	Inverter module and main PCB communication error
L0	DC bus low voltage protection
L1	DC bus high voltage protection
FF	High pressure switch fault for 20 minutes
P1	High pressure switch fault for 4 seconds
P2	Low pressure protection in cooling mode
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(Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
P8	IPM high temperature protection

P9	Fan motor inverter module protection
PC	Overwet operation protection(Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
PD	High pressure protection in heating mode(not applicable for cooling only unit)
F0	Outdoor unit and indoor unit communication error(From Outdoor unit)
F4	T4 - Ambient temperature sensor fault
F5	TP - Discharge temperature sensor fault
F6	T3 - Coil temperature sensor fault
F7	T7 temperature sensor fault (not applicable for cooling only unit)
F8	Condensation of the refrigerant pipe protection (not applicable for cooling only unit)
F9	AC voltage is too high or too low protection
FC	IPM temperature sensor fault
FD	Pressure sensor fault
FE	T3/TP temperature sensor loose protection
E1	Outdoor unit and indoor unit communication error (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E2	Indoor unit T1 temperature sensor fault (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E3	Indoor unit T2 temperature sensor fault (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E4	Refrigerant concentration sensor fault (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E6	Refrigerant leakage protection (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E8	Indoor fan motor current fault (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
E9	Wired controller communication fault (Applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485)
ATL	Ambient temperature out of bounds protection

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

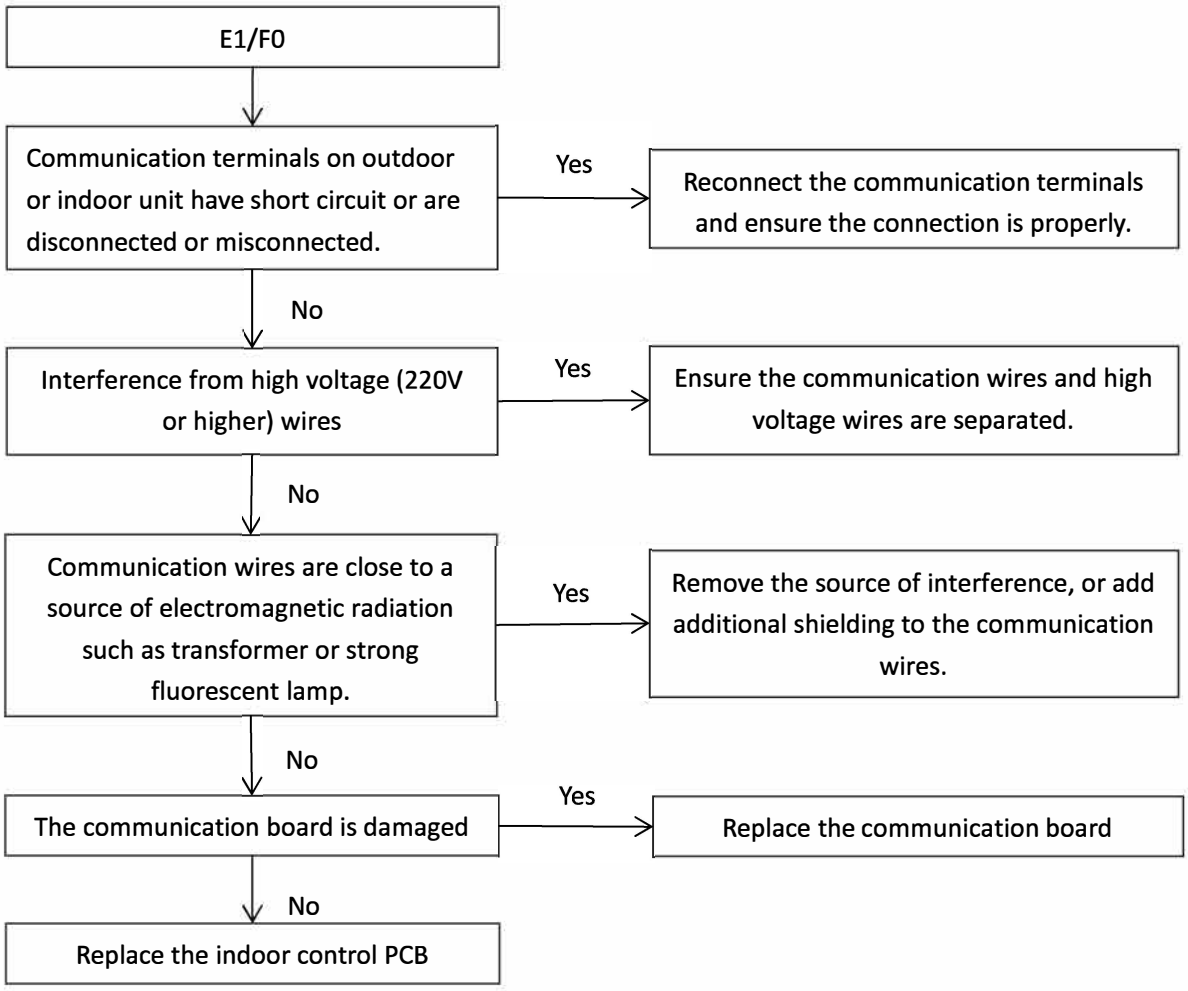
- Do not install or operate the unit for an extended period of time in areas of high humidity or in an environment directly exposing it to sea wind or salt spray.
- Do not install the unit on a defective or damaged installation stand, or in an unsecured location.
- Ensure the unit is installed at a level 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 water0r 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℉(-15~52℃).

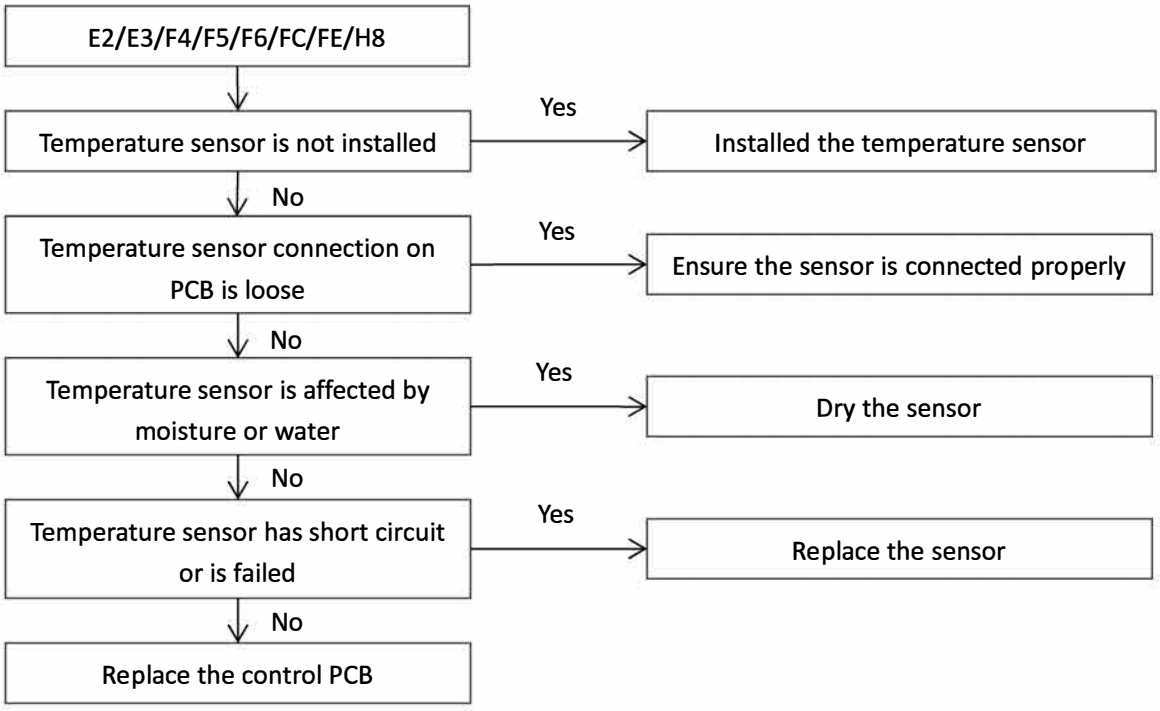
2.3 E1/F0 Troubleshooting

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



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

- E2 indicates indoor unit T1 temperature sensor fault
- E3 indicates indoor unit T2 temperature sensor fault
- F4 indicates ambient temperature sensor fault
- F5 indicates discharge temperature sensor fault
- F6 indicates coil 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



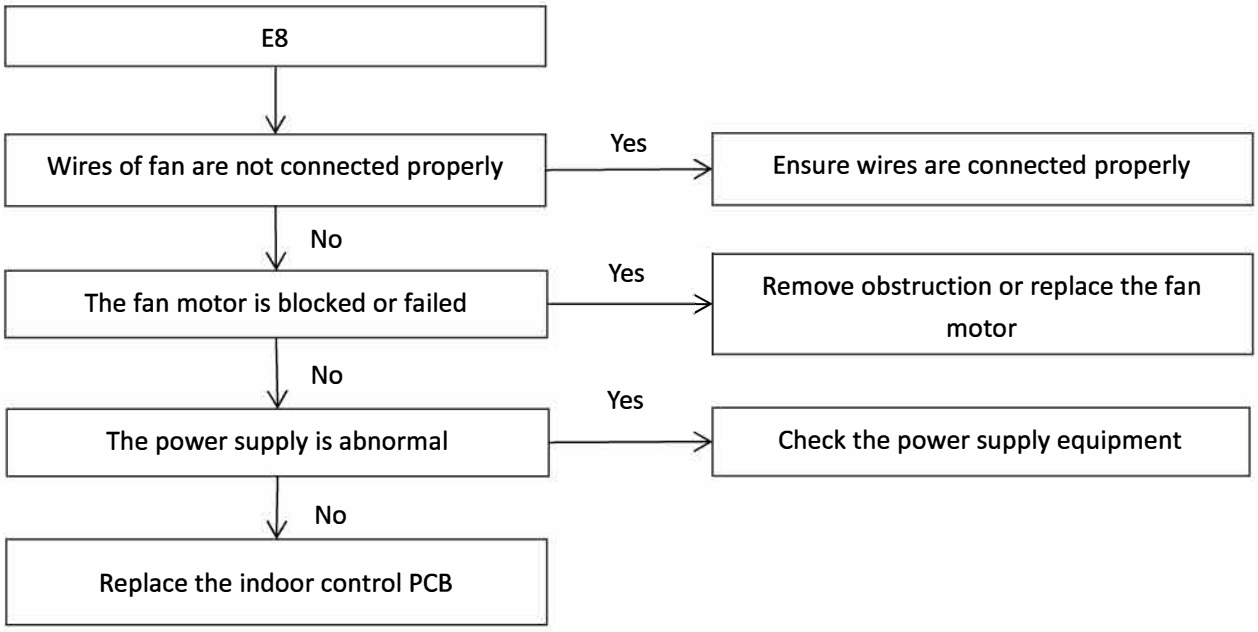
Note:

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.

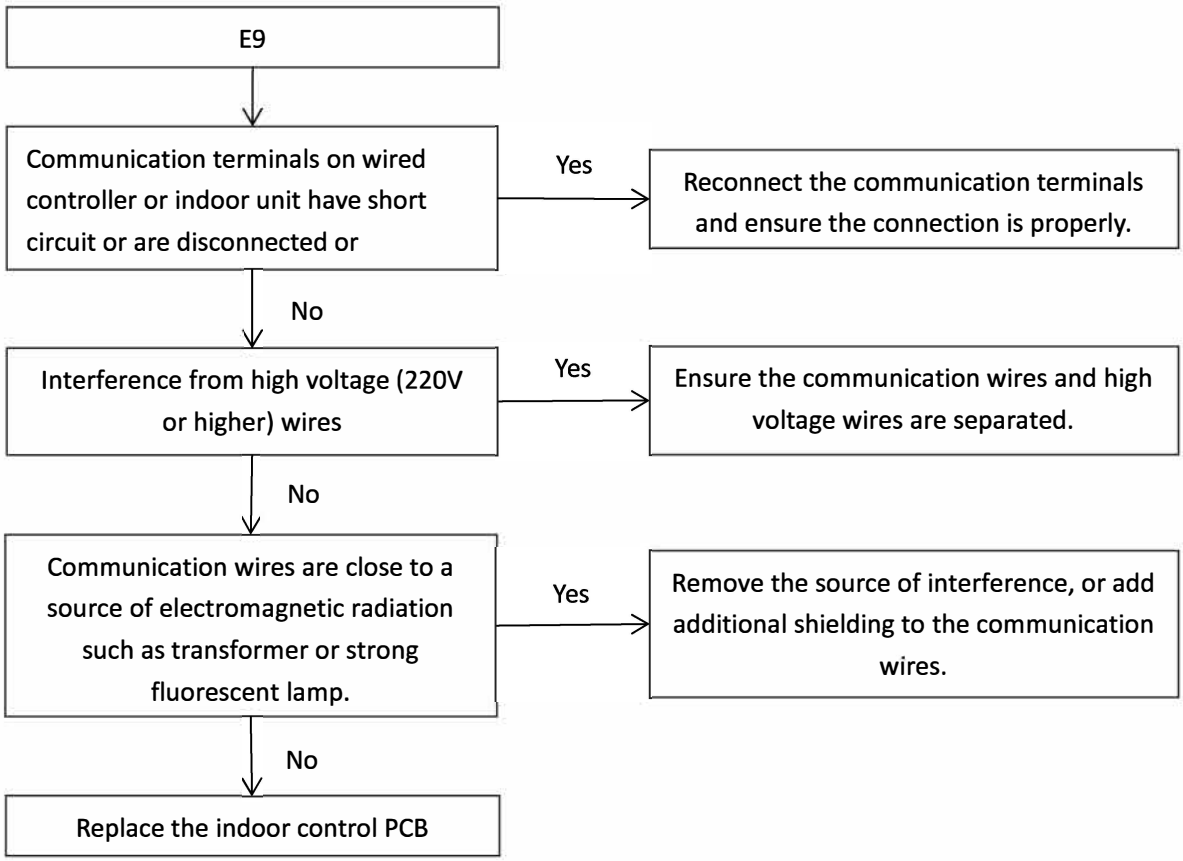
2.5 E8 Troubleshooting

- E8 indicates indoor fan motor current fault, E8 is applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS-485.
- The unit stops running and error code is displayed on the communication board



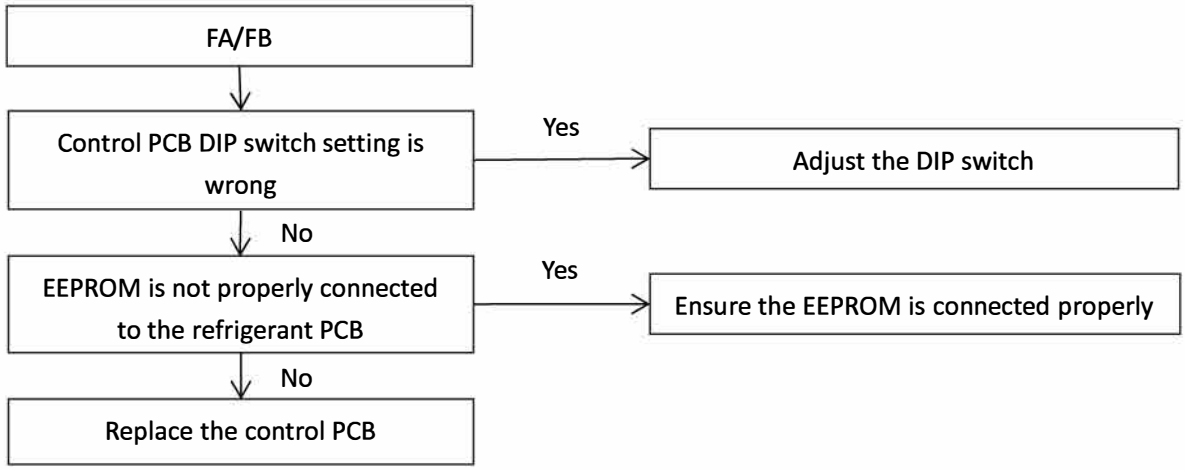
2.6 E9 Troubleshooting

- E9 indicates wired controller communication fault, E9 is applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485.
- The unit stops running and error code is displayed on the communication board



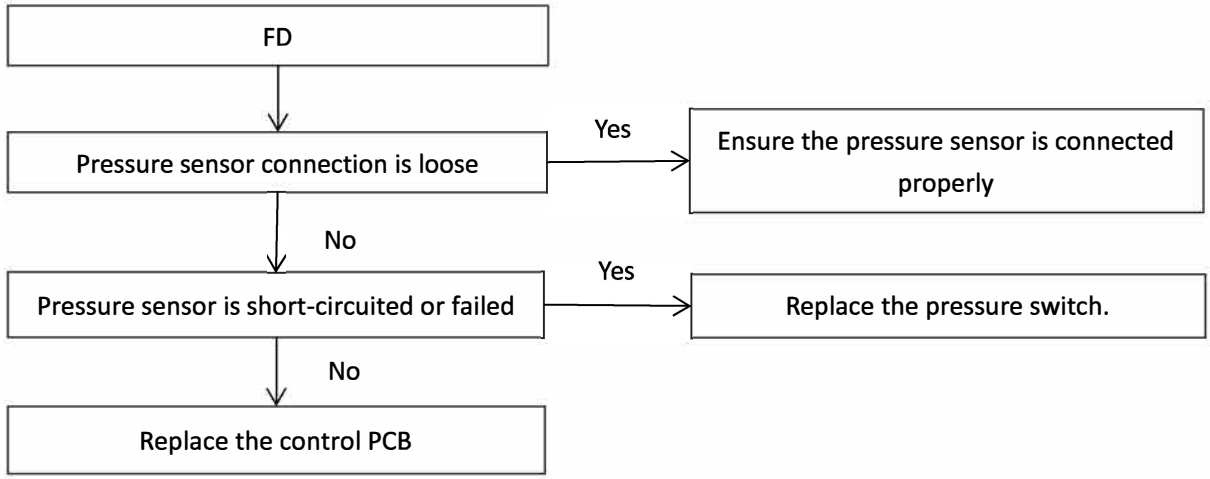
2.7 FA/FB Troubleshooting

- 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



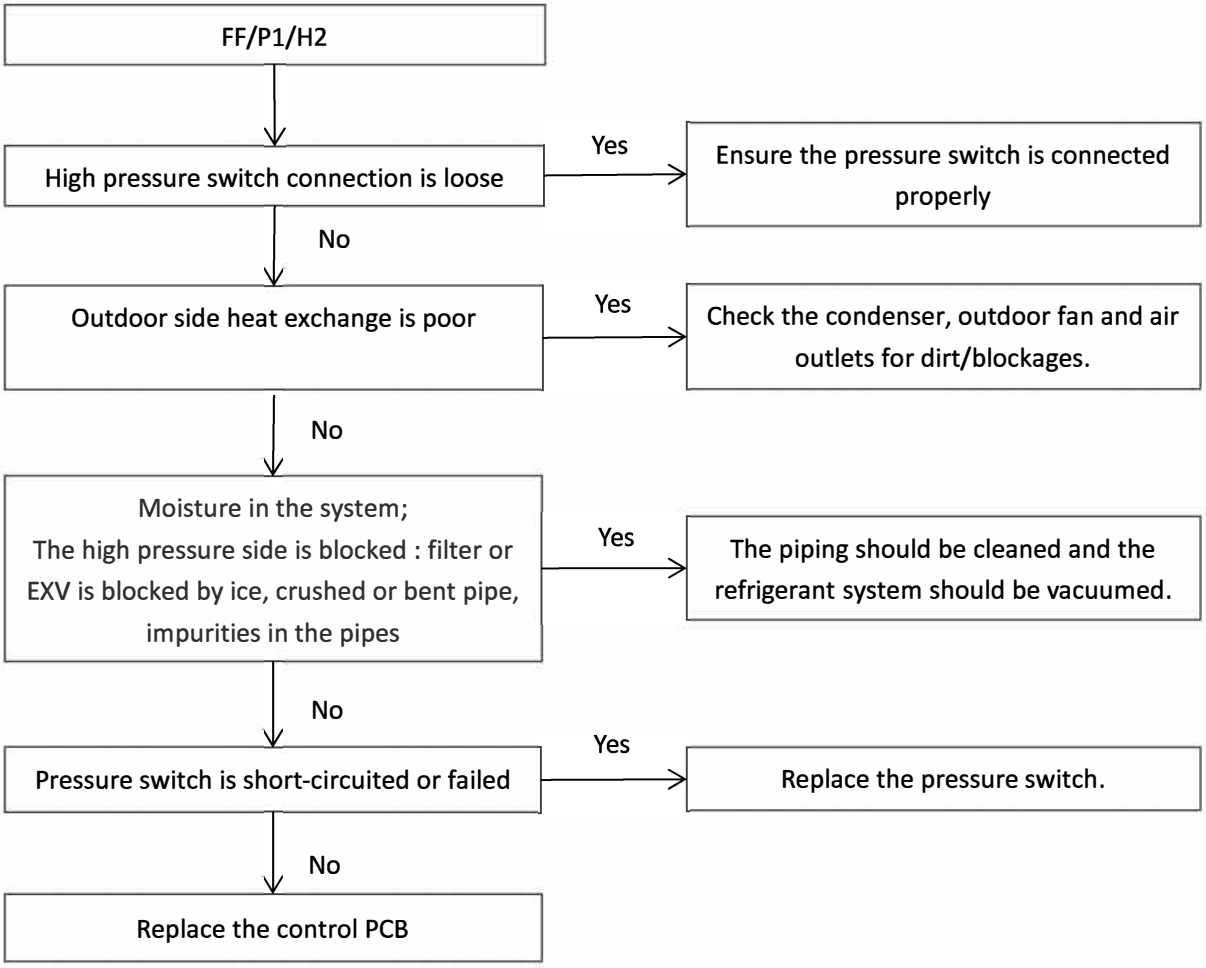
2.8 FD Troubleshooting

- 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

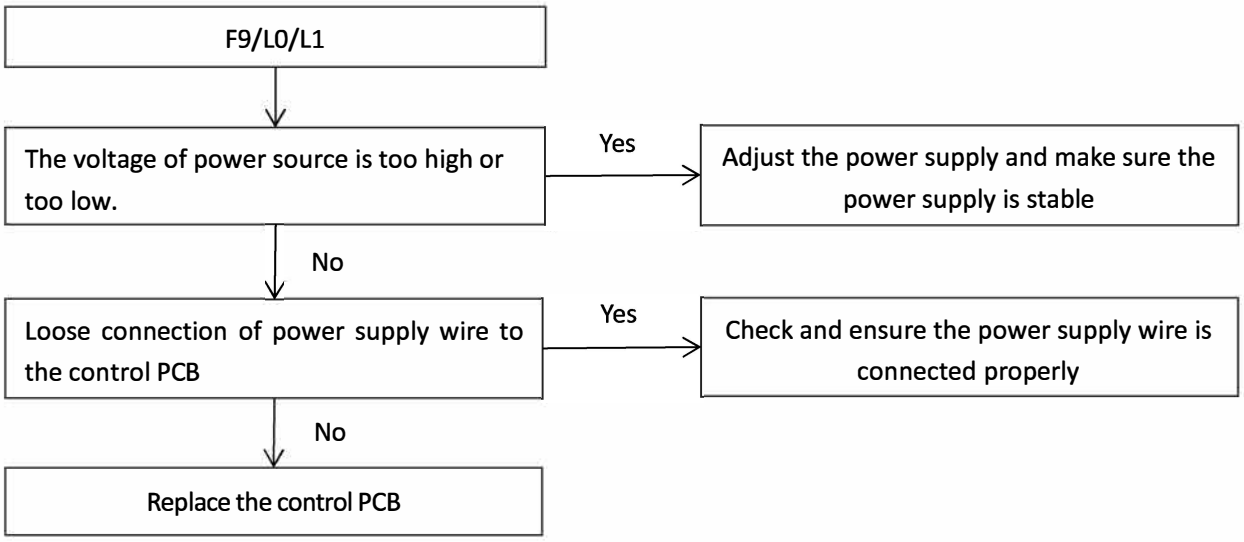


2.10 F9/L0/L1 Troubleshooting

- 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

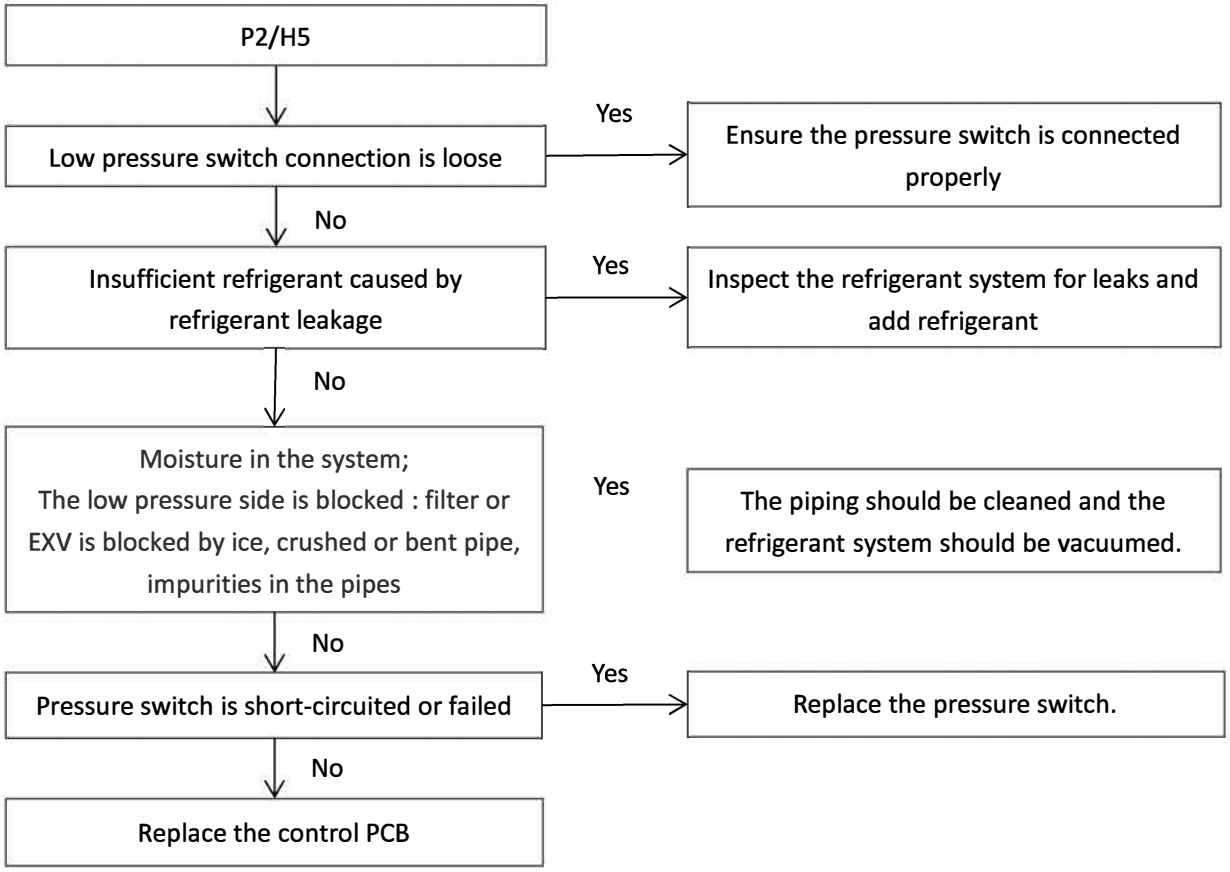
Allowable voltage range of power source	178~265V
Upper limit of DC generatrix voltage	430V
Lower limit of DC generatrix voltage	150V

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



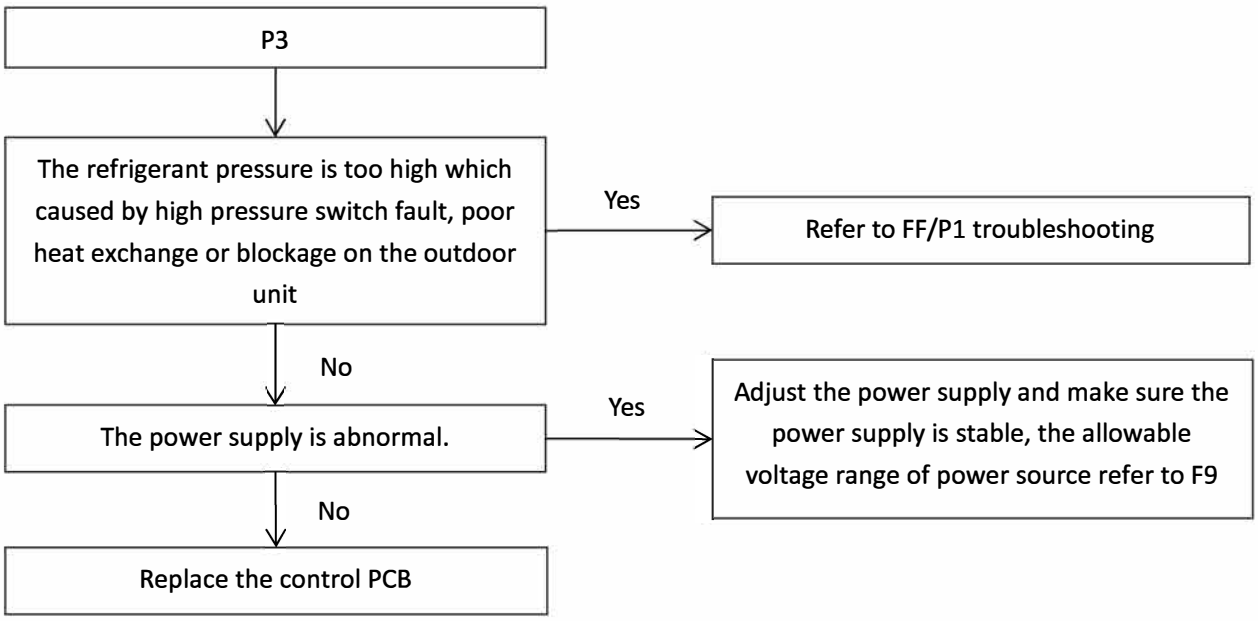
2.11 P2/H5 Troubleshooting

- P2 indicates low pressure protection in cooling mode.
- 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



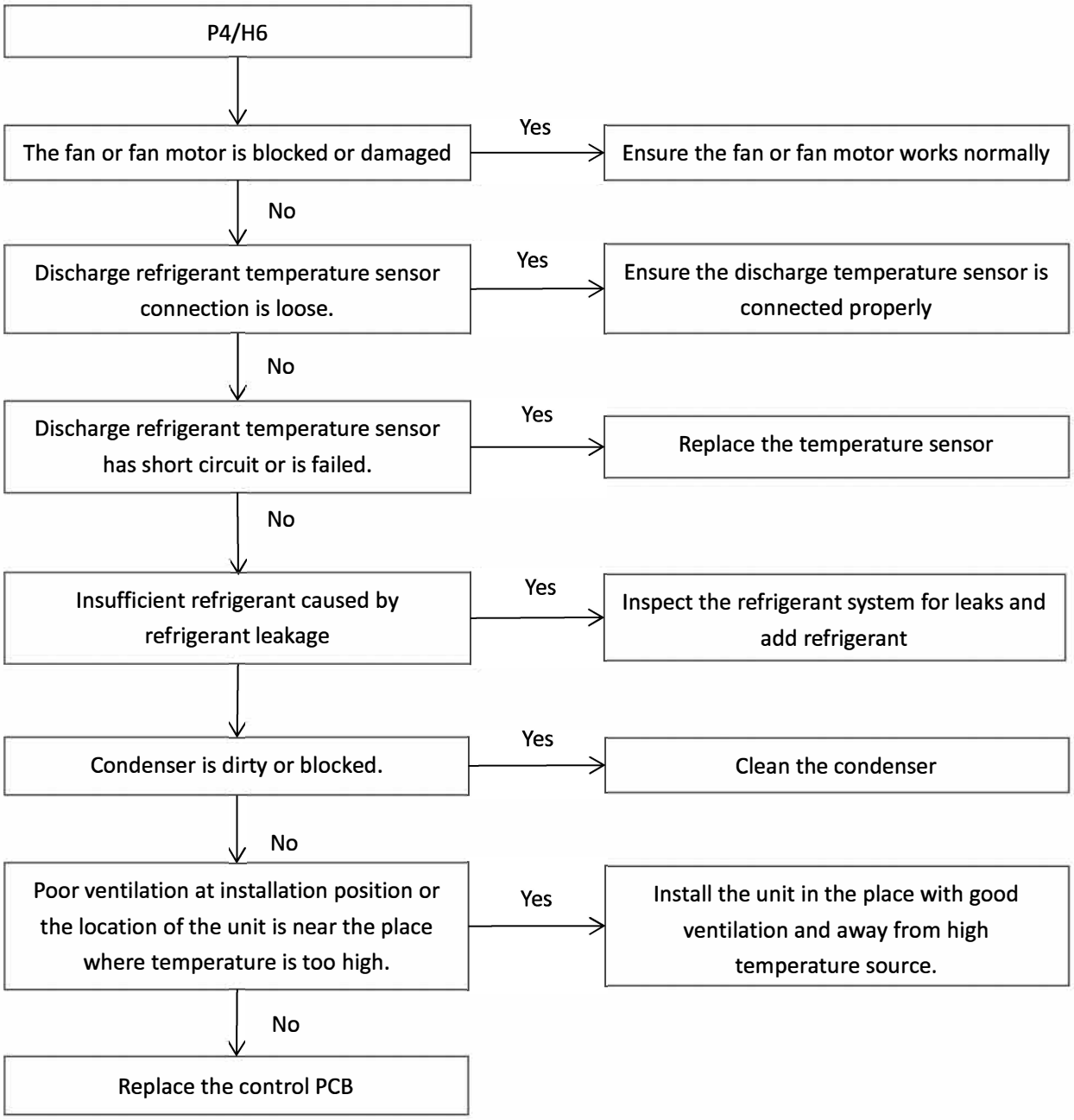
2.12 P3 Troubleshooting

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



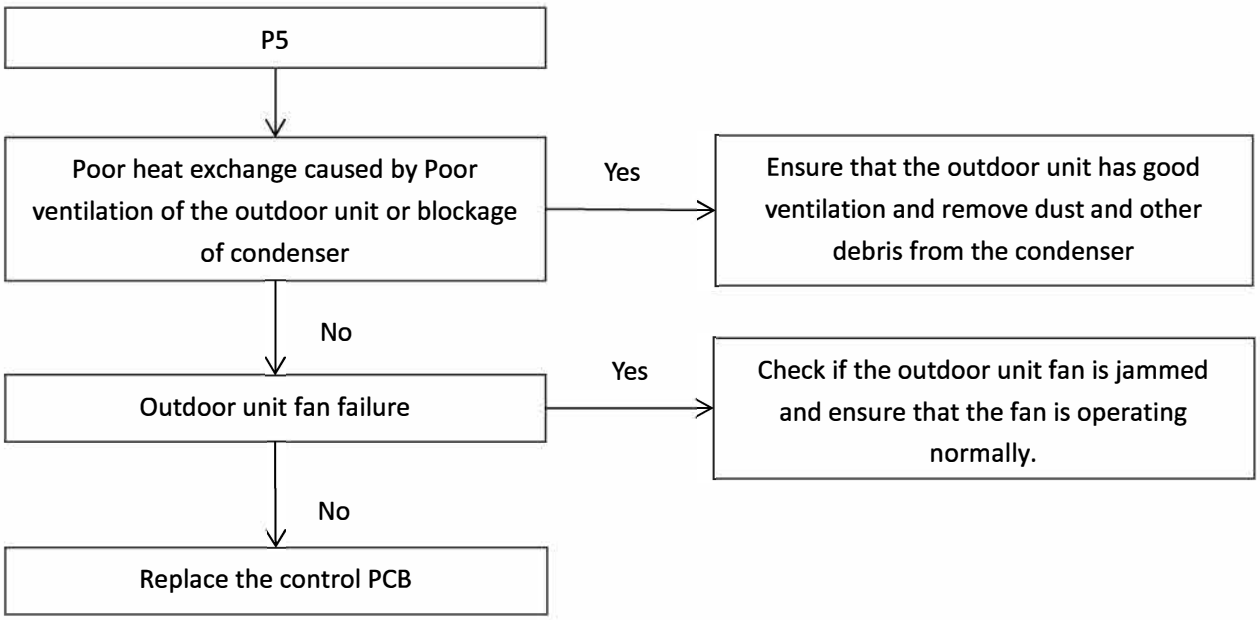
2.13 P4/H6 Troubleshooting

- 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.



2.14 P5 Troubleshooting

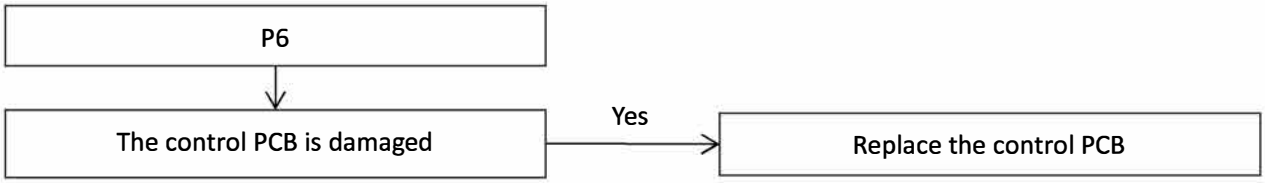
- P5 indicates T3 high temperature protection in cooling mode
- The unit stops running and error code is displayed on the communication board.



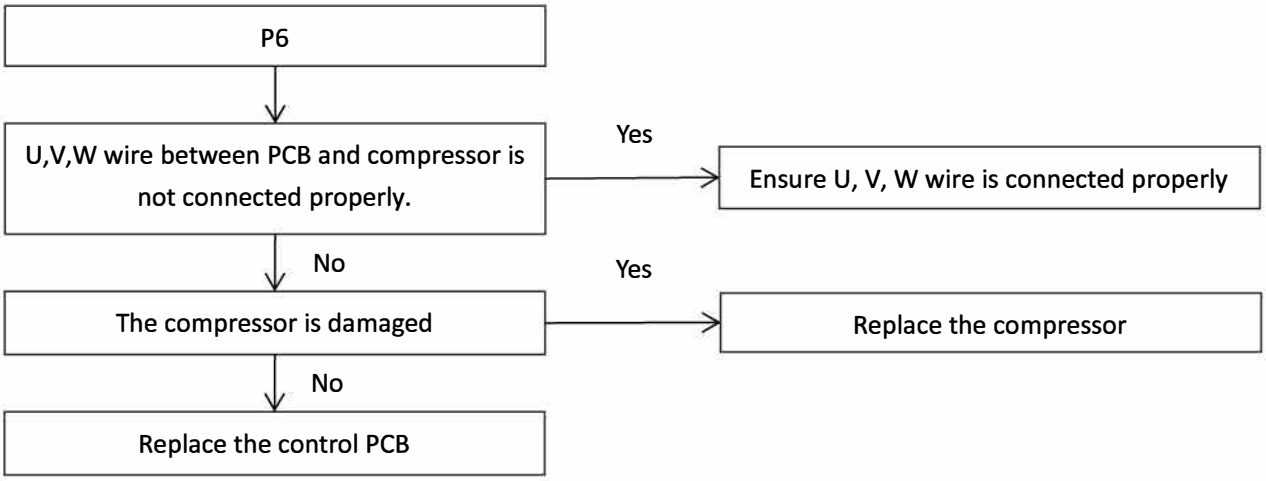
2.15 P6 Troubleshooting

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

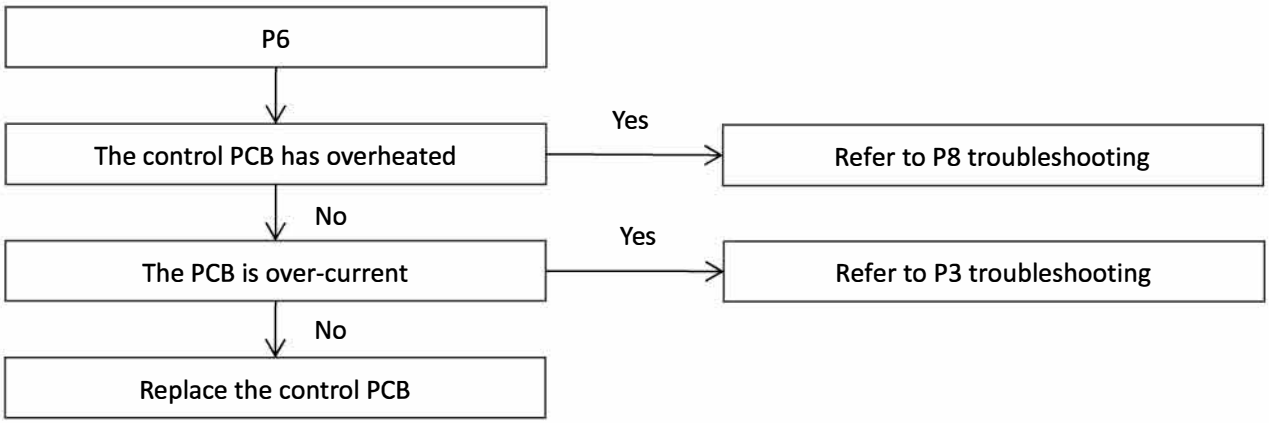
Situation1: P6 appears immediately when the outdoor unit is powered-on



Situation2: P6 appears immediately after the compressor starts up

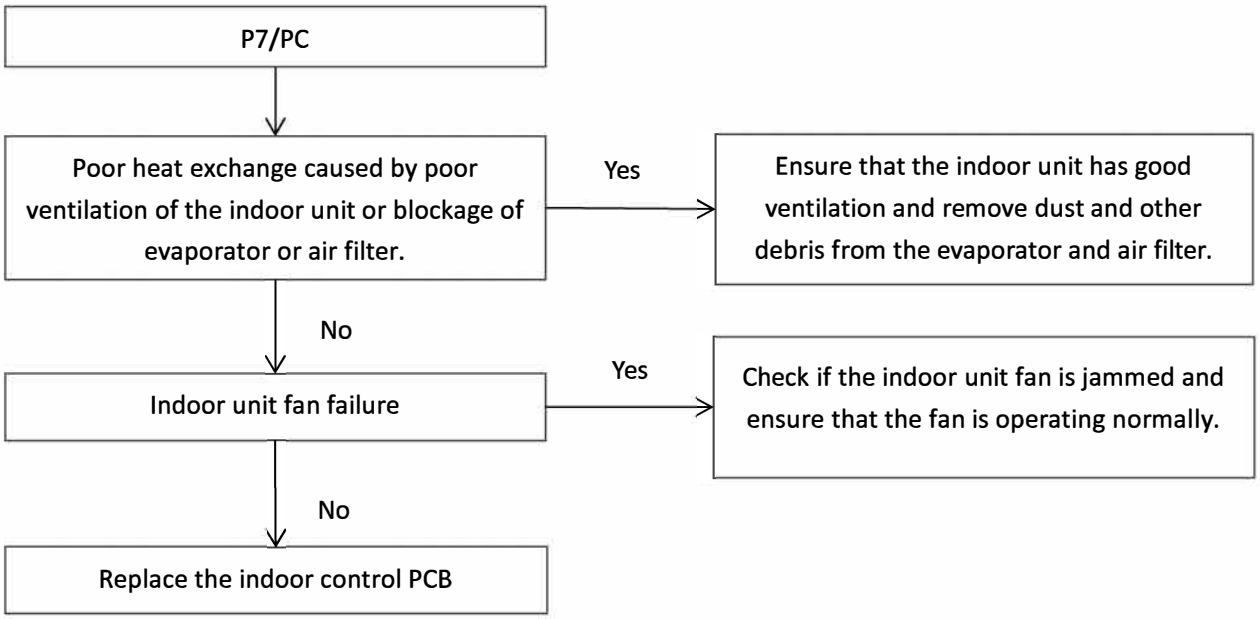


Situation3: P6 appears after the compressor has been running for a period of time.



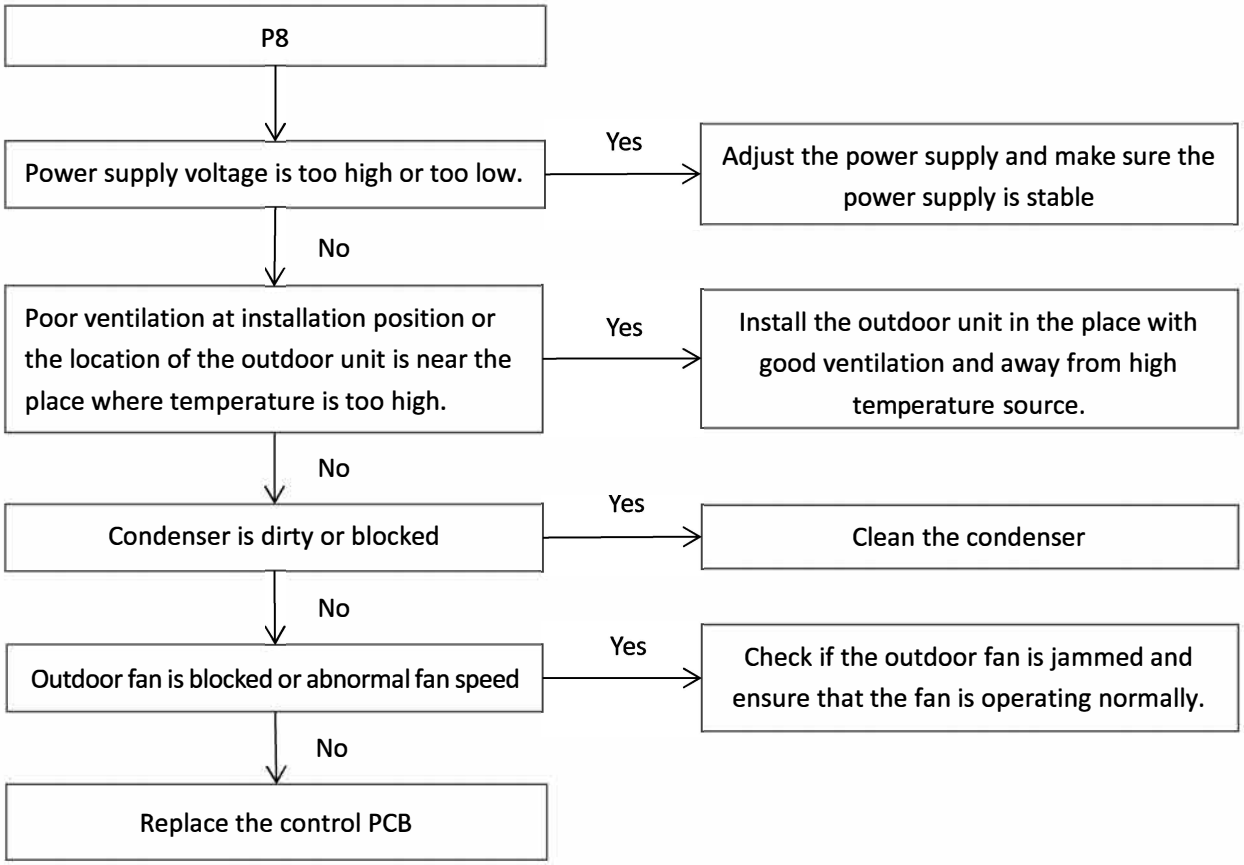
2.16 P7/PC Troubleshooting

- 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.
- P7/PC is applicable only when communication is established between the ComfortStar outdoor unit and the ComfortStar indoor unit via RS485.



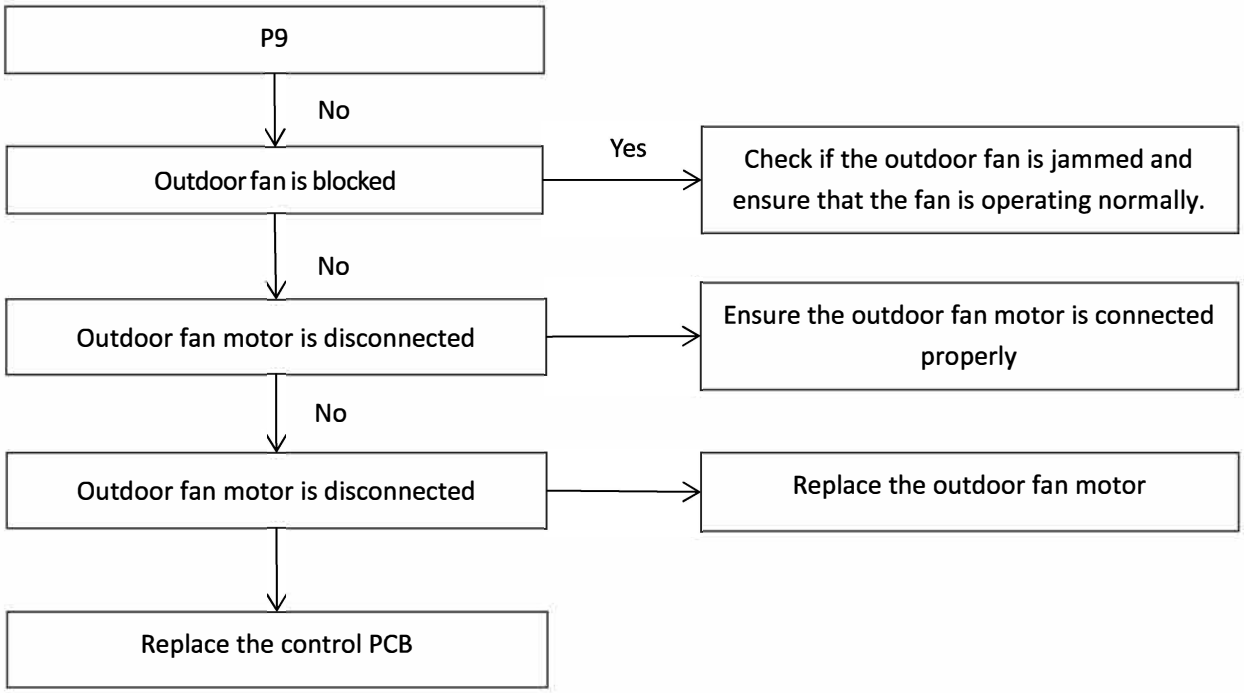
2.17 P8 Troubleshooting

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



2.18 P9 Troubleshooting

- P9 indicates fan motor inverter module protection
- The unit stops running and error code is displayed on the communication board.



2.19 H0 Troubleshooting

- H0 indicates Inverter module and main PCB communication error
- 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

Outdoor ambient temperature sensor(T4) and condenser coil temperature sensor(T3) resistance characteristics.

Temperature (℃)	Temperature (℉)	Resistance (kΩ)	Temperature (℃)	Temperature (℉)	Resistance (kΩ)
-25	-13	144.266	15	59	16.079
-24	-11	135.601	16	61	15.313
-23	-9	127.507	17	63	14.588
-22	-8	119.941	18	64	13.902
-21	-6	112.867	19	66	13.251
-20	-4	106.732	20	68	12.635
-19	-2	100.552	21	70	12.05
-18	0	94.769	22	72	11.496
-17	1	89.353	23	73	10.971
-16	3	84.278	24	75	10.473
-15	5	79.521	25	77	10
-14	7	75.059	26	79	9.551
-13	9	70.873	27	81	9.125
-12	10	66.943	28	82	8.721
-11	12	63.252	29	84	8.337
-10	14	59.784	30	86	7.972
-9	16	56.524	31	88	7.625
-8	18	53.458	32	90	7.296
-7	19	50.575	33	91	6.982
-6	21	47.862	34	93	6.684
-5	23	45.308	35	95	6.401
-4	25	42.903	36	97	6.131
-3	27	40.638	37	99	5.874
-2	28	38.504	38	100	5.63
-1	30	36.492	39	102	5.397
0	32	34.596	40	104	5.175
1	34	32.807	41	106	4.964
2	36	31.12	42	108	4.763
3	37	29.528	43	109	4.571
4	39	28.026	44	111	4.387
5	41	26.608	45	113	4.213
6	43	25.268	46	115	4.046
7	45	24.003	47	117	3.887
8	46	22.808	48	118	3.735
9	48	21.678	49	120	3.59
10	50	20.61	50	122	3.451
11	52	19.601	51	124	3.318
12	54	18.646	52	126	3.191
13	55	17.743	53	127	3.069
14	57	16.888	54	129	2.952

Temperature(℃)	Temperature(℉)	Resistance(kΩ)	Temperature(℃)	Temperature(℉)	Resistance(kΩ)
55	131	2.841	95	171	0.708
56	133	2.734	96	173	0.686
57	135	2.632	97	175	0.666
58	136	2.534	98	176	0.646
59	138	2.44	99	178	0.627
60	140	2.35	100	180	0.609
61	142	2.264	101	182	0.591
62	144	2.181	102	184	0.574
63	145	2.102	103	185	0.558
64	147	2.026	104	187	0.542
65	149	1.953	105	189	0.527
66	151	1.883			
67	153	1.816			
68	154	1.752			
69	156	1.69			
70	158	1.631			
71	160	1.574			
72	162	1.519			
73	163	1.466			
74	165	1.416			
75	167	1.367			
76	169	1.321			
77	171	1.276			
78	172	1.233			
79	174	1.191			
80	176	1.151			
81	178	1.113			
82	180	1.076			
83	181	1.041			
84	183	1.007			
85	185	0.974			
86	187	0.942			
87	189	0.912			
88	190	0.883			
89	192	0.855			
90	194	0.828			
91	196	0.802			
92	198	0.777			
93	199	0.753			
94	201	0.73			

Compressor exhaust temperature sensor (TP) resistance characteristics.

Temperature (℃)	Temperature (℉)	Resistance (kΩ)	Temperature (℃)	Temperature (℉)	Resistance (kΩ)
-20	-4	542.7	20	68	68.66
-19	-2	511.9	21	70	65.62
-18	0	483	22	72	62.73
-17	1	455.9	23	73	59.98
-16	3	430.5	24	75	57.37
-15	5	406.7	25	77	54.89
-14	7	384.3	26	79	52.53
-13	9	363.3	27	81	50.28
-12	10	343.6	28	82	48.14
-11	12	325.1	29	84	46.11
-10	14	307.7	30	86	44.17
-9	16	291.3	31	88	42.33
-8	18	275.9	32	90	40.57
-7	19	261.4	33	91	38.89
-6	21	247.8	34	93	37.3
-5	23	234.9	35	95	35.78
-4	25	222.8	36	97	34.32
-3	27	211.4	37	99	32.94
-2	28	200.7	38	100	31.62
-1	30	190.5	39	102	30.36
0	32	180.9	40	104	29.15
1	34	171.9	41	106	28
2	36	163.3	42	108	26.9
3	37	155.2	43	109	25.86
4	39	147.6	44	111	24.85
5	41	140.4	45	113	23.89
6	43	133.5	46	115	22.89
7	45	127.1	47	117	22.1
8	46	121	48	118	21.26
9	48	115.2	49	120	20.46
10	50	109.8	50	122	19.69
11	52	104.6	51	124	18.96
12	54	99.69	52	126	18.26
13	55	95.05	53	127	17.58
14	57	90.66	54	129	16.94
15	59	86.49	55	131	16.32
16	61	82.54	56	133	15.73
17	63	78.79	57	135	15.16
18	64	75.24	58	136	14.62
19	66	71.86	59	138	14.09

Temperature (℃)	Temperature (℉)	Resistance (kΩ)	Temperature (℃)	Temperature (℉)	Resistance (kΩ)
60	140	13.59	100	212	3.702
61	142	13.11	101	214	3.595
62	144	12.65	102	216	3.492
63	145	12.21	103	217	3.392
64	147	11.79	104	219	3.296
65	149	11.38	105	221	3.203
66	151	10.99	106	223	3.113
67	153	10.61	107	225	3.025
68	154	10.25	108	226	2.941
69	156	9.902	109	228	2.86
70	158	9.569	110	230	2.781
71	160	9.248	111	232	2.704
72	162	8.94	112	234	2.63
73	163	8.643	113	235	2.559
74	165	8.358	114	237	2.489
75	167	8.084	115	239	2.422
76	169	7.82	116	241	2.357
77	171	7.566	117	243	2.294
78	172	7.321	118	244	2.233
79	174	7.086	119	246	2.174
80	176	6.859	120	248	2.117
81	178	6.641	121	250	2.061
82	180	6.43	122	252	2.007
83	181	6.228	123	253	1.955
84	183	6.033	124	255	1.905
85	185	5.844	125	257	1.856
86	187	5.663	126	259	1.808
87	189	5.488	127	261	1.762
88	190	5.32	128	262	1.717
89	192	5.157	129	264	1.674
90	194	5	130	266	1.632
91	196	4.849			
92	198	4.703			
93	199	4.562			
94	201	4.426			
95	203	4.294			
96	205	4.167			
97	207	4.045			
98	208	3.927			
99	210	3.812			

ComfortStar®

The design and specifications are subject to change without prior notice for product improvement.Consult with the sales agency or manufacturer for details.

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