

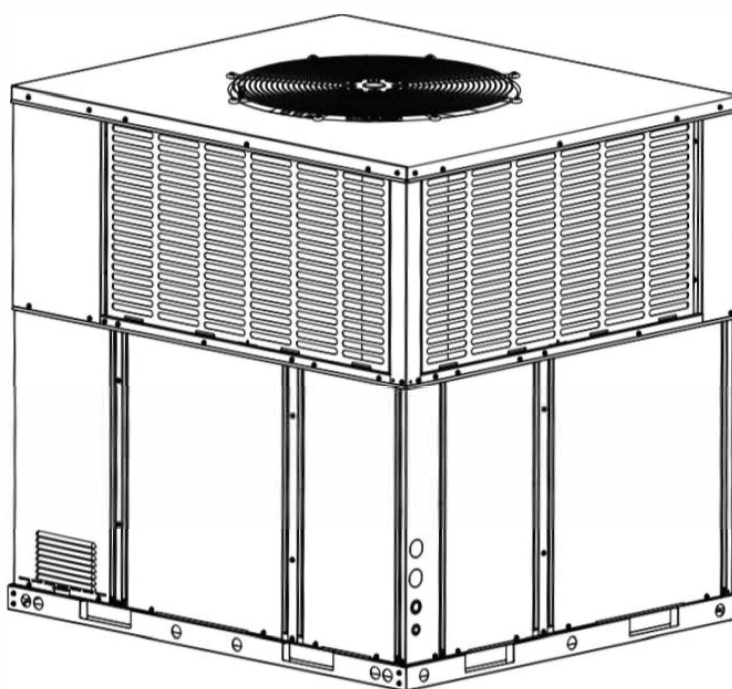
# ComfortStar®

Air Conditioning & Heating Products

## 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. 107<sup>th</sup> Avenue, Medley, FL 33178

[www.comfortstarusa.com](http://www.comfortstarusa.com)

# Content

|                                                             |    |
|-------------------------------------------------------------|----|
| <b>Part 1</b> General Information .....                     | 1  |
| <b>Part 2</b> Component Layout and Refrigerant Circuit..... | 4  |
| <b>Part 3</b> Wiring Diagram.....                           | 9  |
| <b>Part 4</b> Diagnosis and Troubleshooting.....            | 21 |

# Part 1

## General Information

|                        |   |
|------------------------|---|
| 1 Product lineup ..... | 2 |
| 2 Specifications ..... | 3 |

## 1 Product lineup

| Model    | Cooling Capacity<br>(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 (W×D×H)                   | 50-45/64×35-3/64×46-27/32  |               | 51-9/16×44-13/16×51-7/16 |               |
|                      | Packing (W×D×H)                | 51-27/64×35-43/64×48-11/32 |               | 52-9/32×45-7/16×51-21/32 |               |
|                      | Net / Gross weight(lbs)        | 390/403                    | 390/403       | 507/525                  | 507/525       |

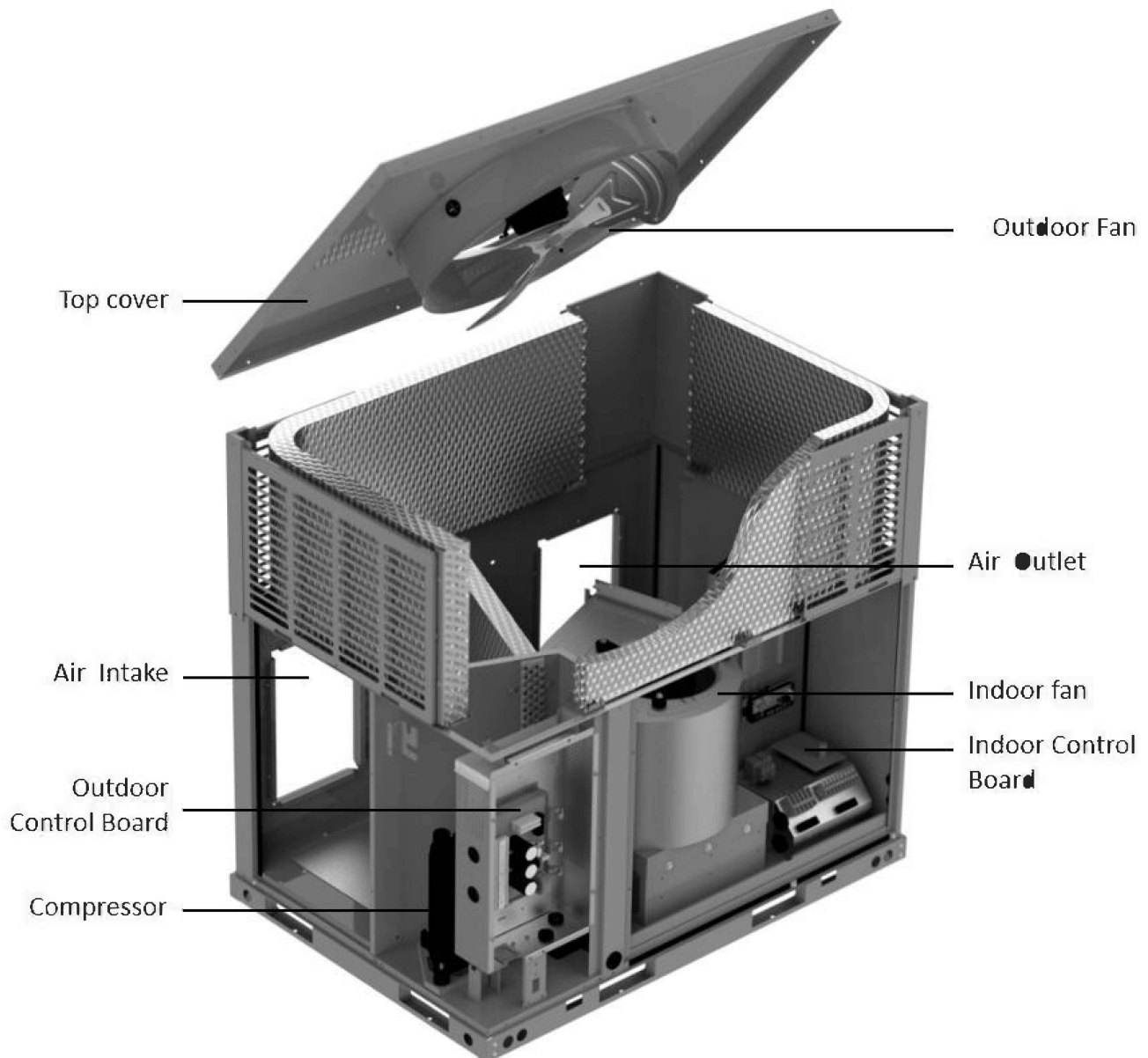
## Part 2

# 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 |

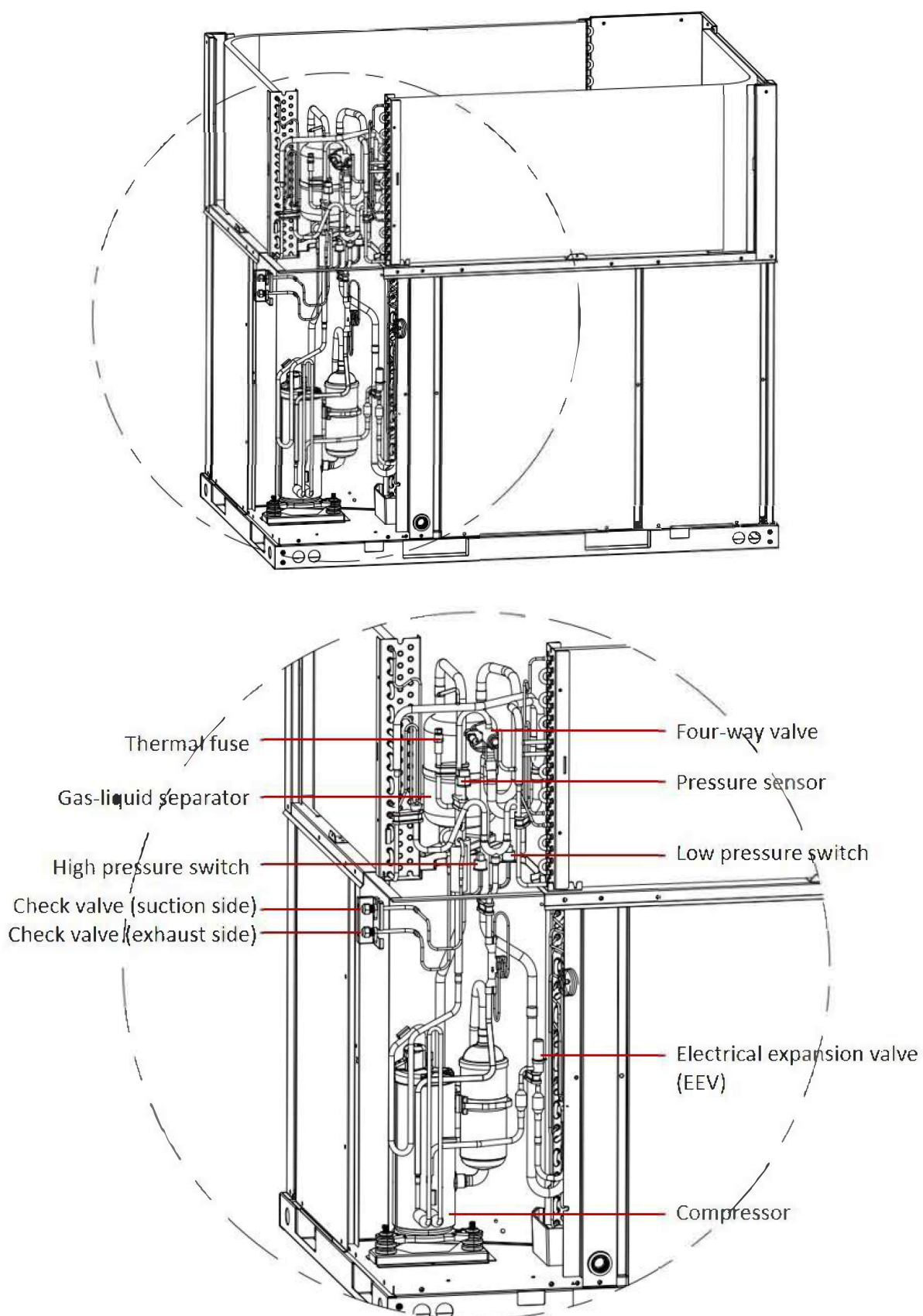
## 1 Layout Functional Components

### 1.1 Structure of the unit and main components

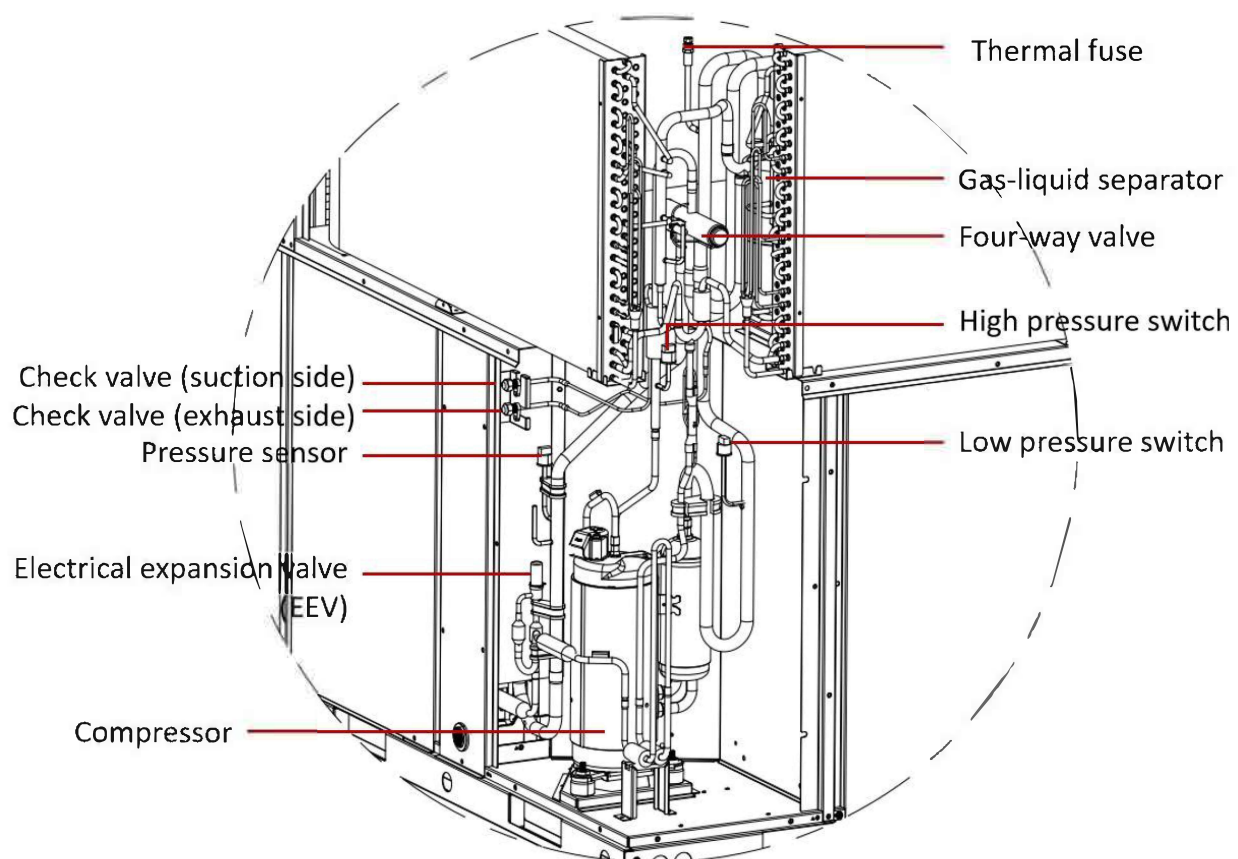
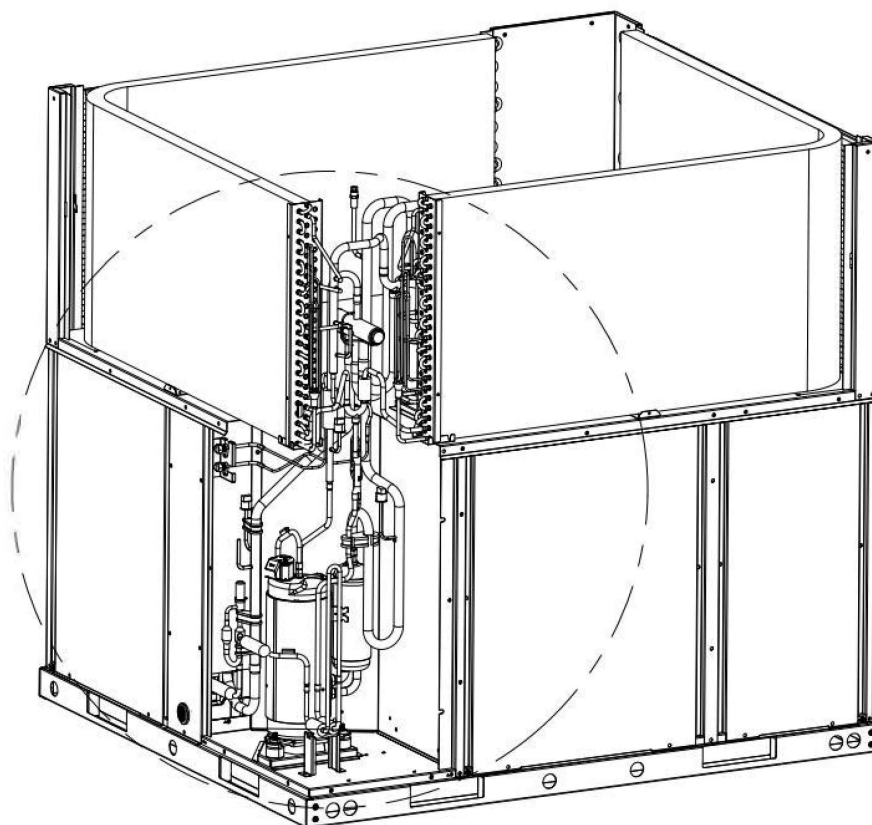


## 1.2 Refrigerant system and main components

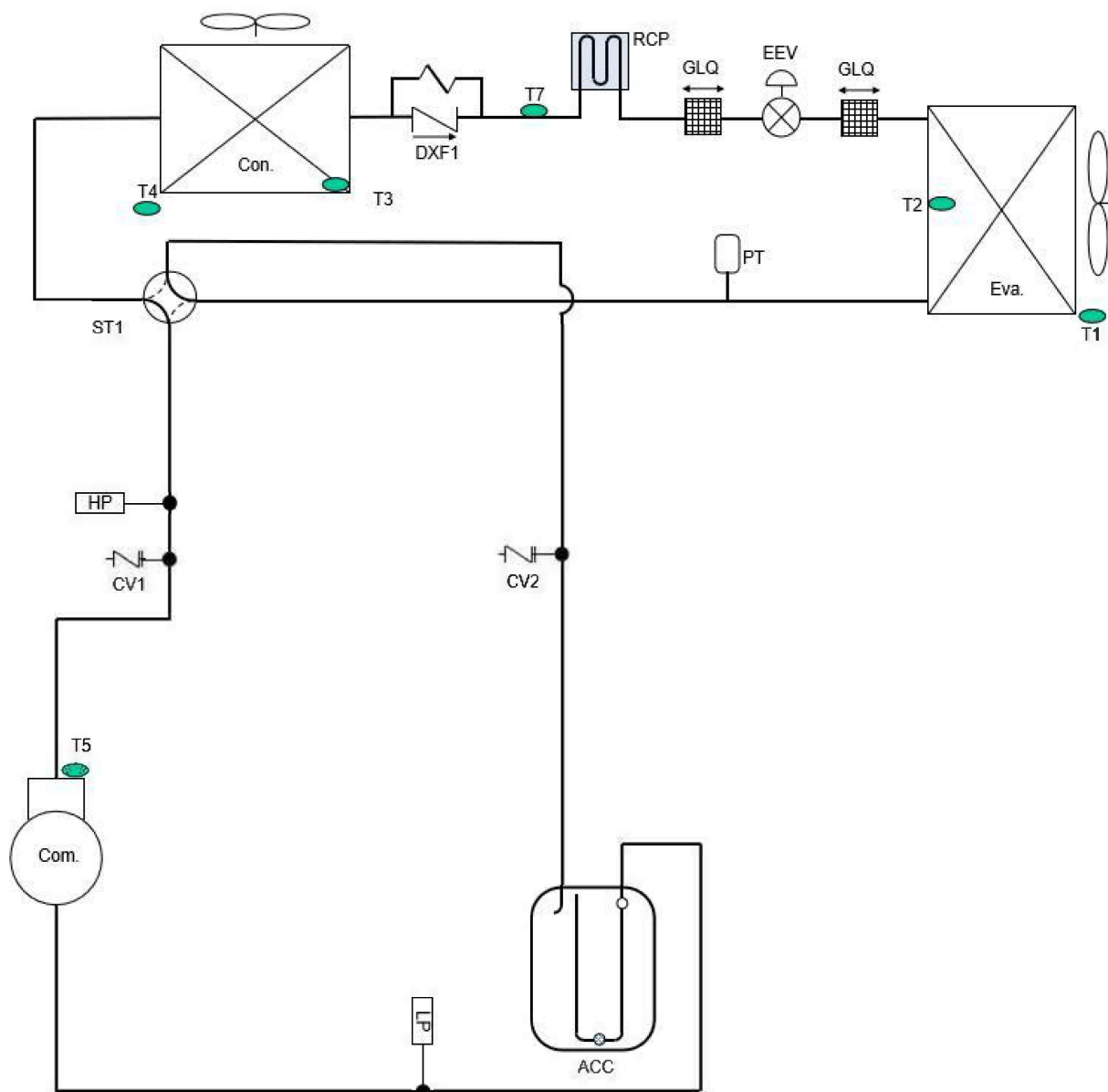
CSC32-24, CSV32-36



CSV32-48, CSV32-60



## 2 Piping diagrams



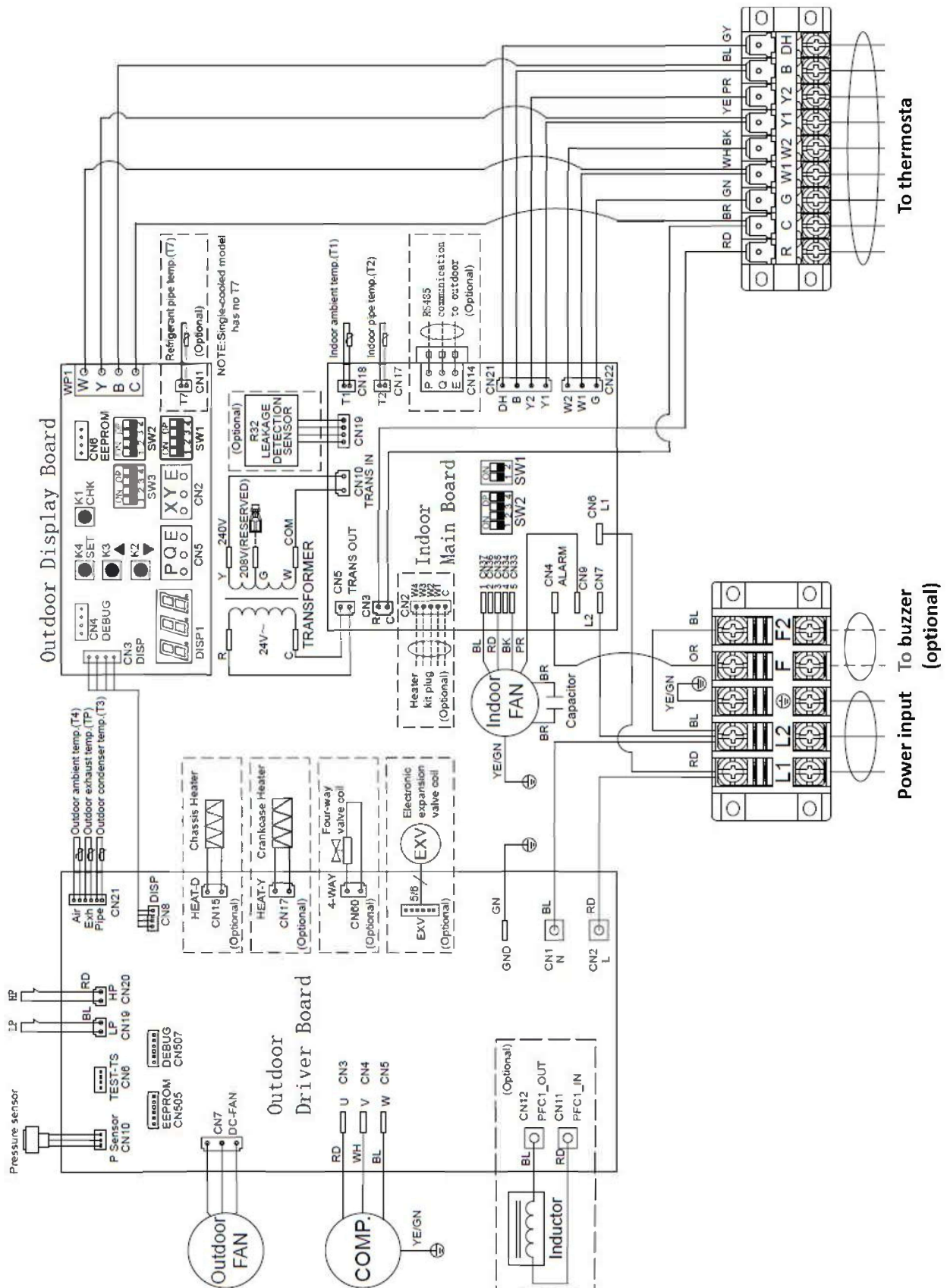
| NO.  | Component(Outdoor unit)           | NO.  | Component(Outdoor unit)                           |
|------|-----------------------------------|------|---------------------------------------------------|
| Com. | Compressor                        | T7   | Refrigerant cooling pipe inlet temperature 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

|                                     |    |
|-------------------------------------|----|
| 1 Electric wiring diagram .....     | 10 |
| 2 PCB .....                         | 12 |
| 3 Auxiliary electrical heater ..... | 14 |
| 3.1 electrical data .....           | 14 |
| 3.2 Wiring diagram .....            | 14 |
| 4 Low voltage wiring diagram .....  | 18 |

# 1 Electric wiring diagram

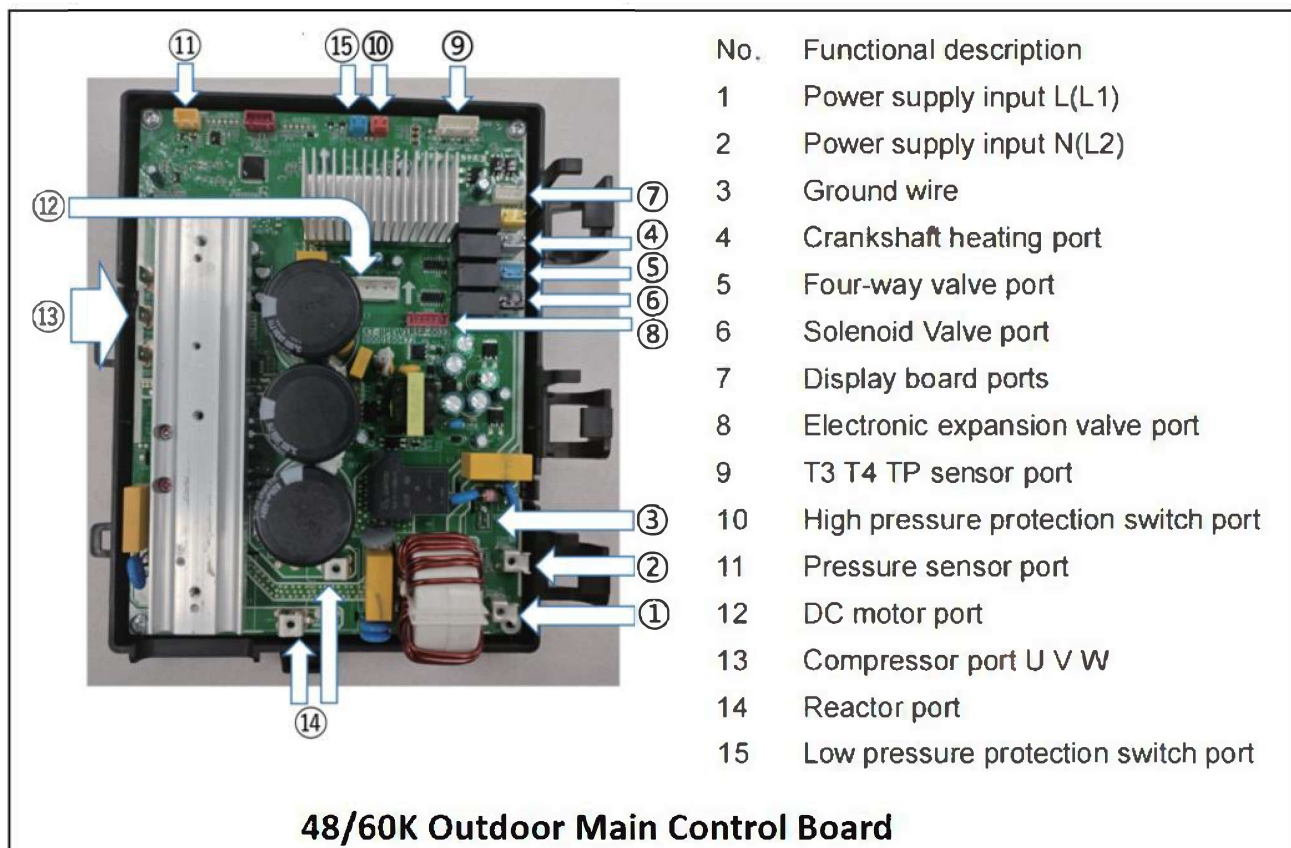
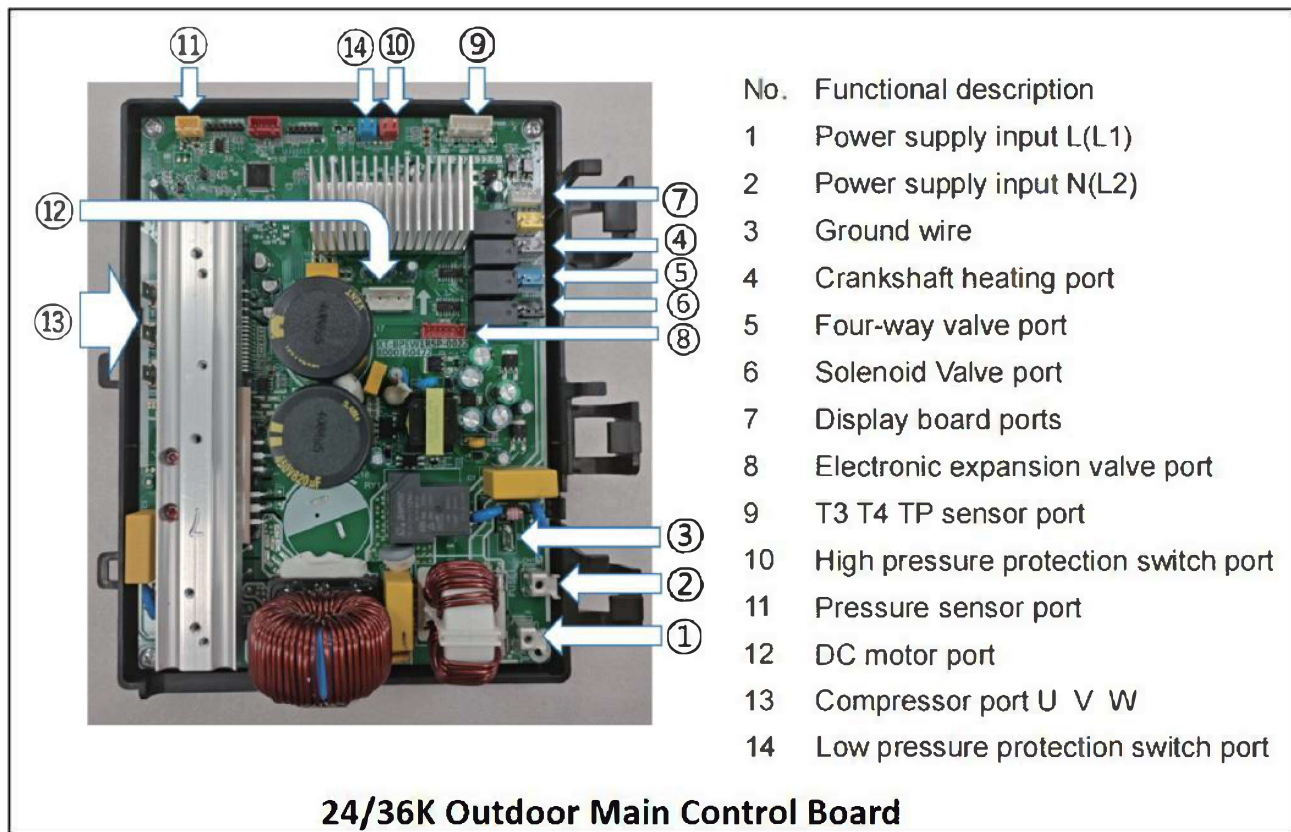


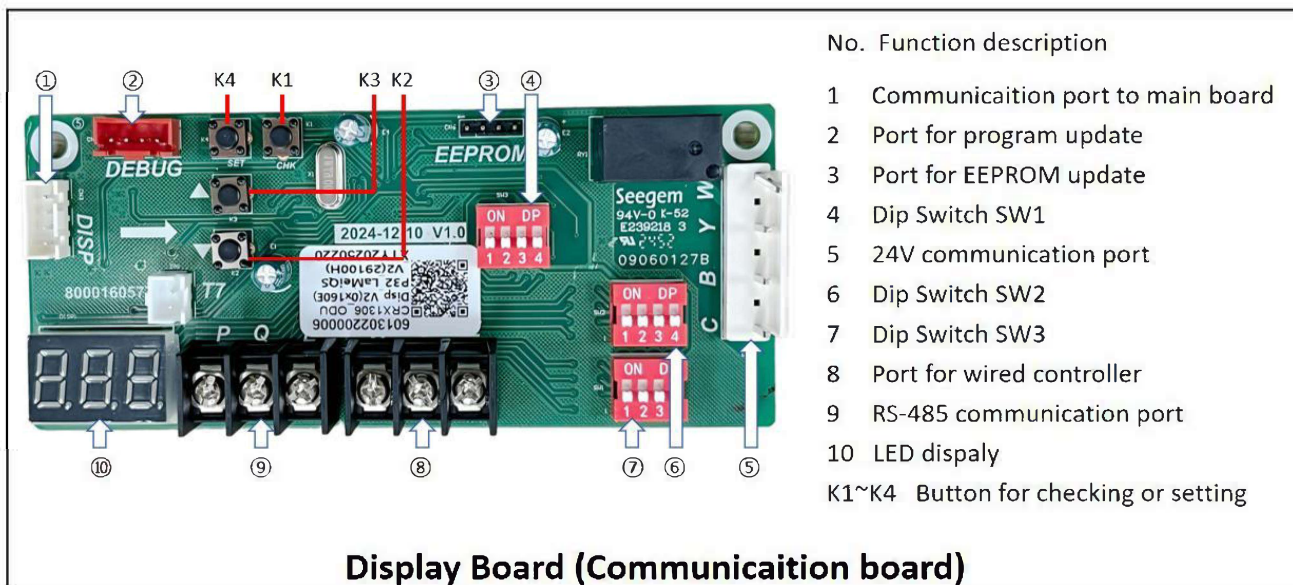
# Definition of SW1~SW3

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

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

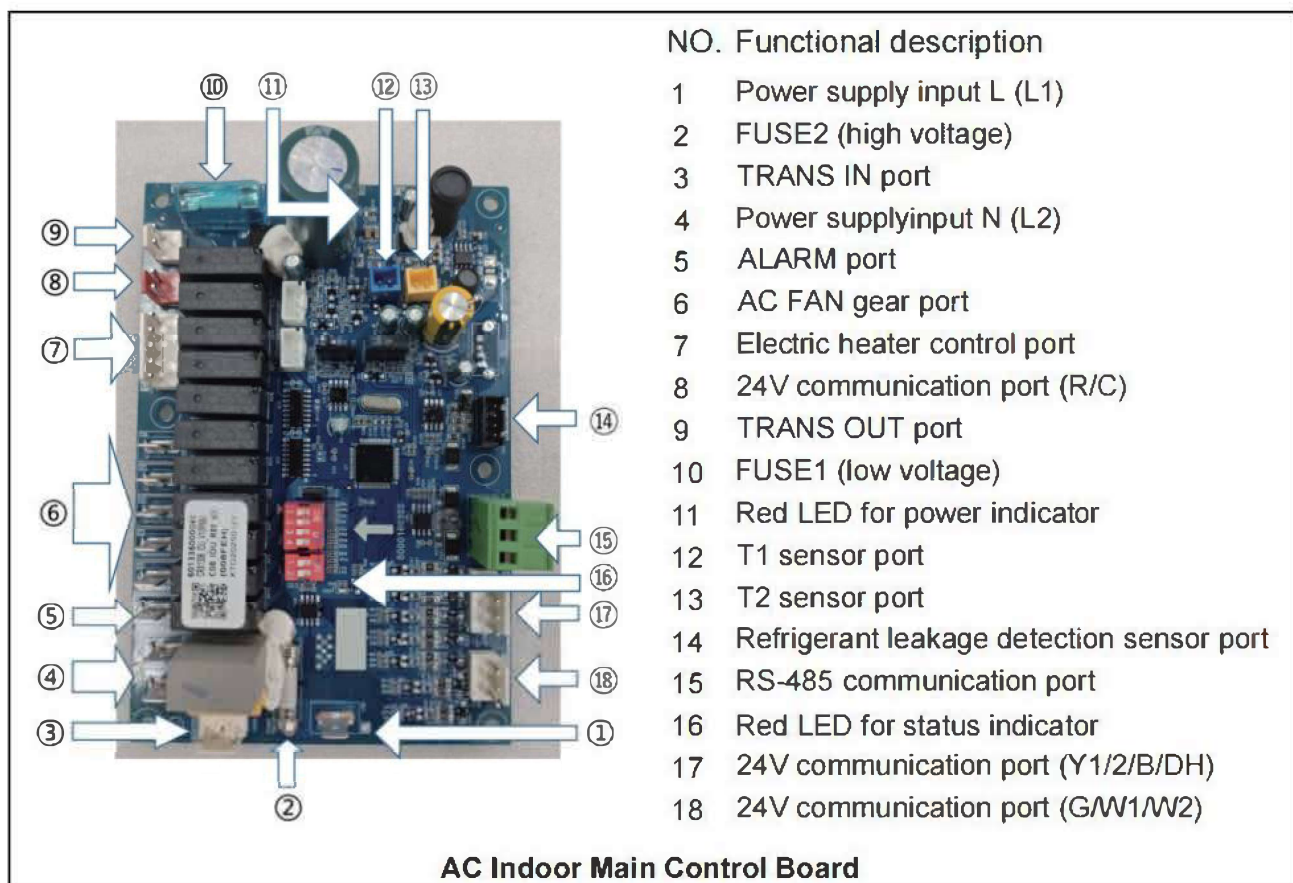
## 2 PCB





#### 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

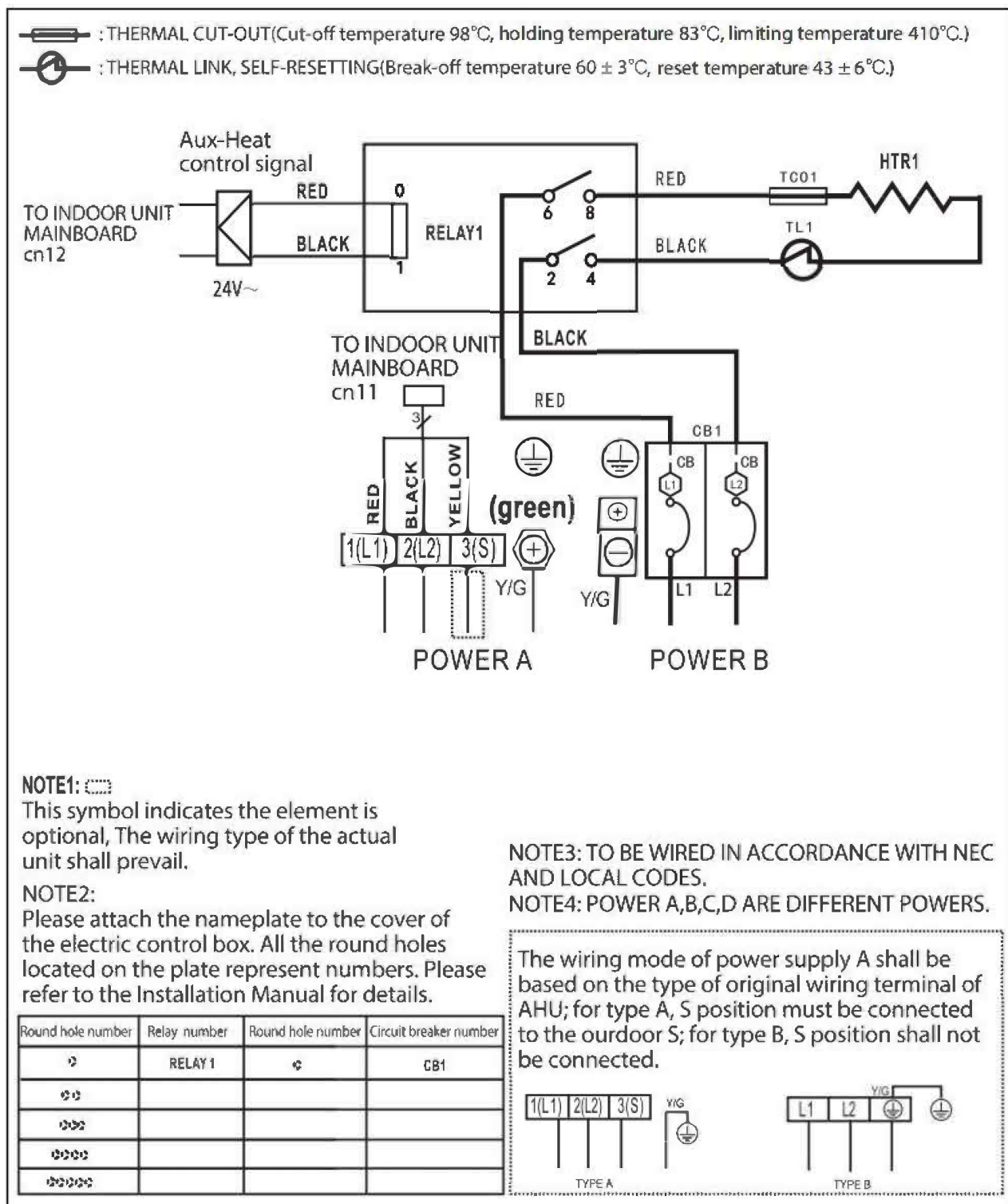
#### 3.1 electrical data

| Model  | kW<br>208/240 | Heater Kit<br>FLA (A) | Minimum CKT<br>AMPS (A) | Rating of overcurrent protective<br>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

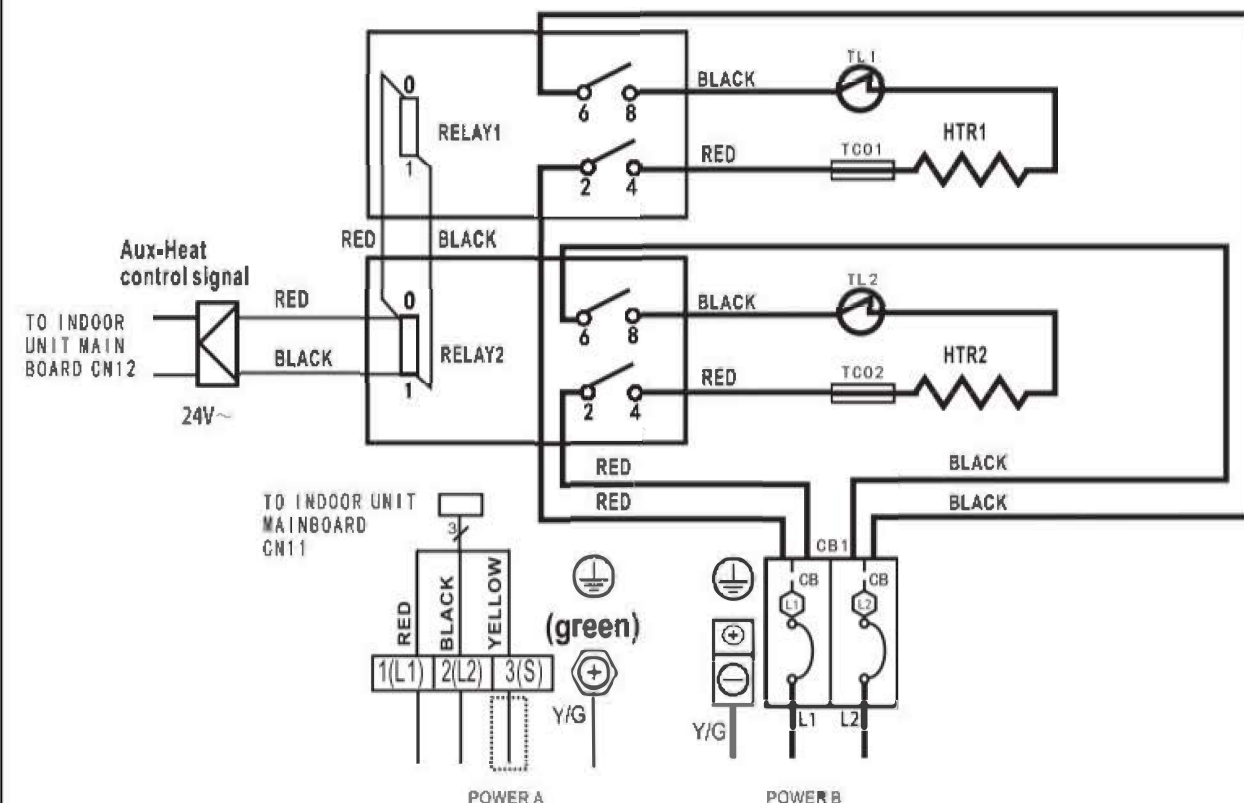
| Specification | Number of<br>circuit breakers | Number<br>of relays | Number of power<br>cord groups | Number of power cord<br>grounding screws |
|---------------|-------------------------------|---------------------|--------------------------------|------------------------------------------|
| 5kW           | 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       |                                                                                     |                        |
|  |              |                                                                                     |                        |
|  |              |                                                                                     |                        |
|  |              |                                                                                     |                        |

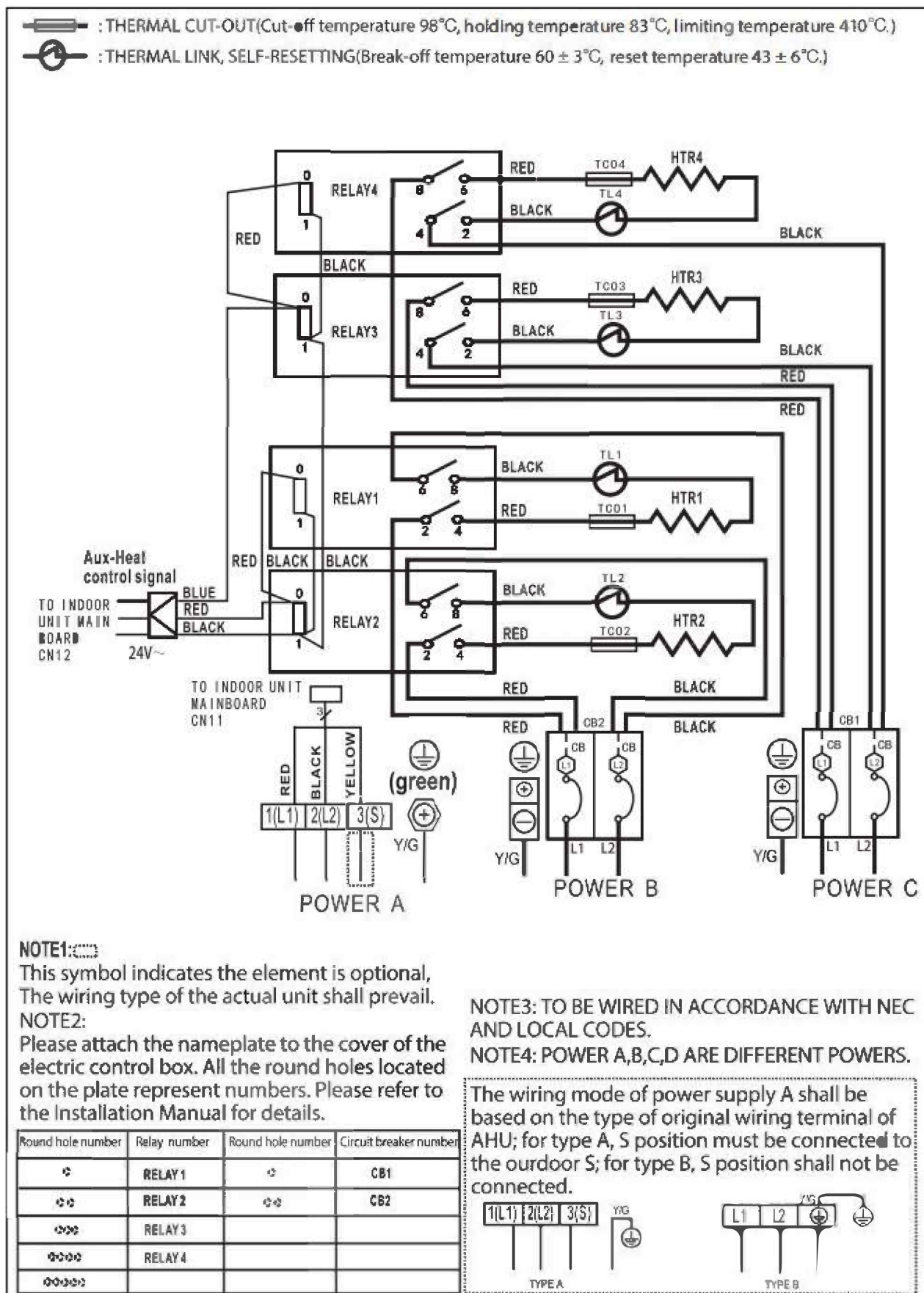
**NOTE3:** TO BE WIRED IN ACCORDANCE WITH NEC AND LOCAL CODES.

**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

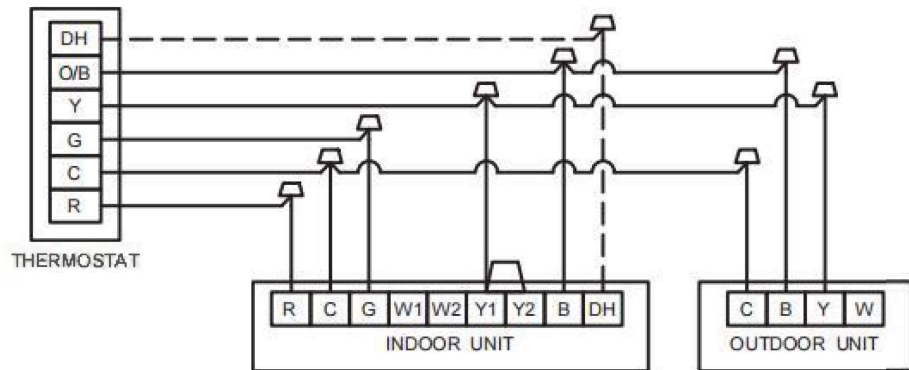


## 4 Low voltage wiring diagram

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

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

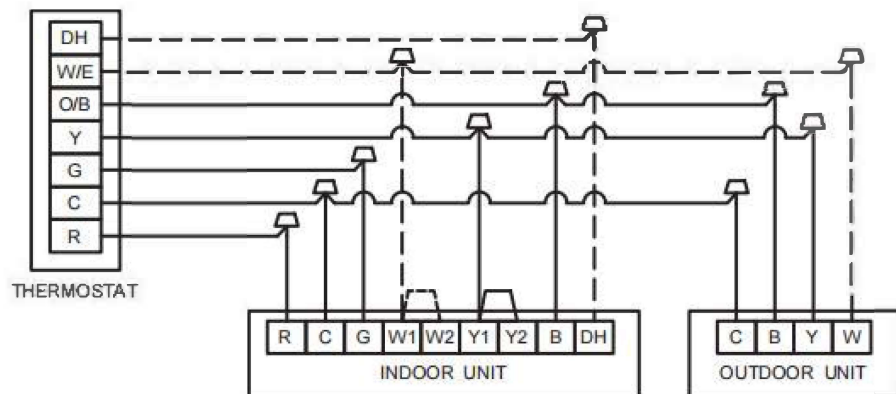
Note: Because Y1 and Y2 are jumped, the indoor fan will only run in high stage.



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

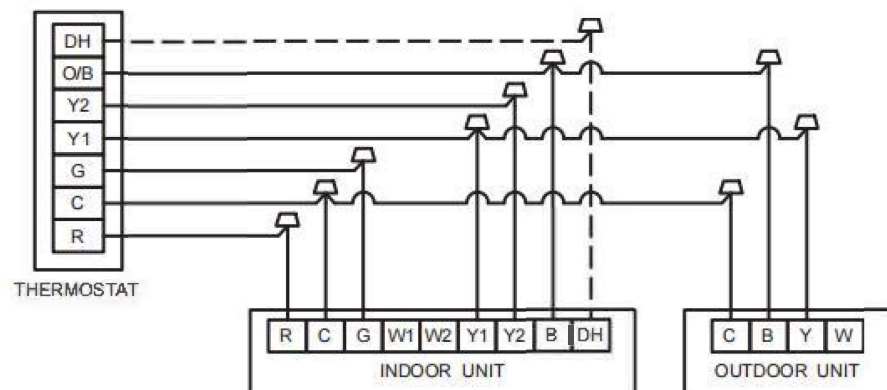
Note: Because Y1 and Y2 are jumped, the indoor fan will only run in high stage.

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

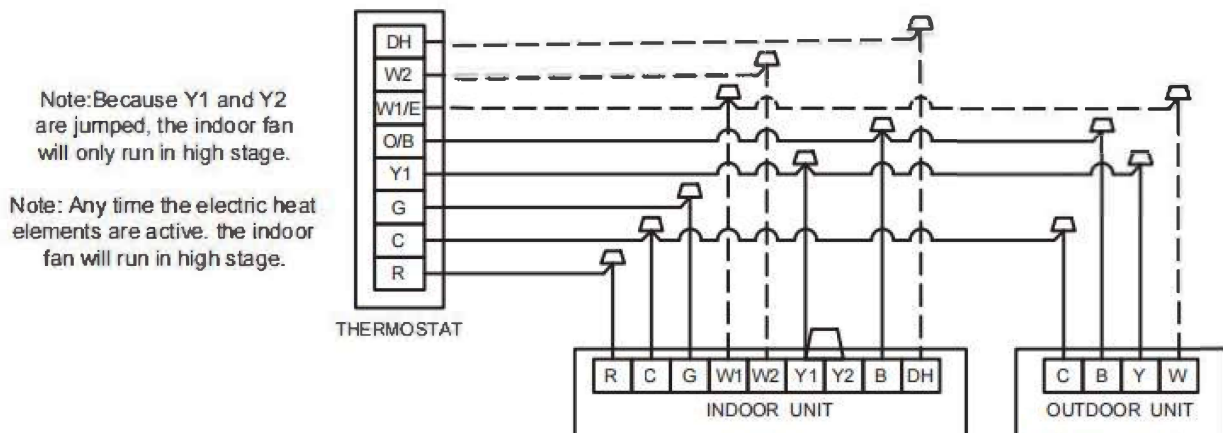


### Wiring for 2H and 2C thermostat (heat pump system model)

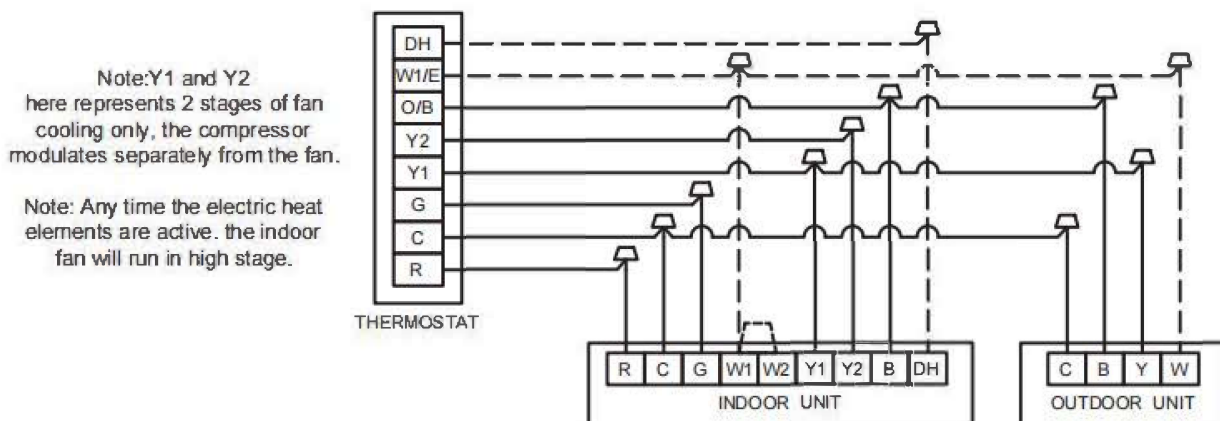
Note: Y1 and Y2 here represents 2 stages of fan cooling only, the compressor modulates separately from the fan.



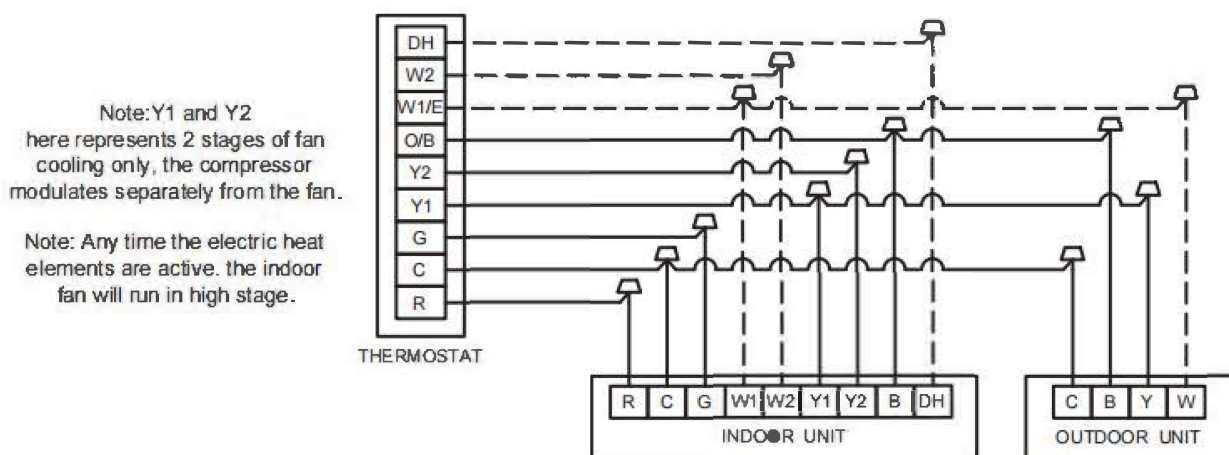
### Wiring for 3H and 1C thermostat (heat pump system model)



### 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

|                                                      |    |
|------------------------------------------------------|----|
| 1 Error code table .....                             | 23 |
| 2 Troubleshooting .....                              | 26 |
| 2.1 Safety Precautions .....                         | 26 |
| 2.2 ATL Troubleshooting .....                        | 29 |
| 2.3 E1/F0 Troubleshooting .....                      | 30 |
| 2.4 E2/E3/F4/F5/F6/F7/FC/FE/H8 Troubleshooting ..... | 31 |
| 2.5 E8 Troubleshooting .....                         | 32 |
| 2.6 E9 Troubleshooting .....                         | 33 |
| 2.7 EE/FA/FB Troubleshooting .....                   | 34 |
| 2.8 FD Troubleshooting .....                         | 35 |
| 2.9 FF/P1/H2 Troubleshooting .....                   | 36 |
| 2.10 F8/HE Troubleshooting .....                     | 37 |
| 2.11 F9/L0/L1 Troubleshooting .....                  | 38 |
| 2.12 P2/H5 Troubleshooting .....                     | 39 |
| 2.13 P3 Troubleshooting .....                        | 40 |
| 2.14 P4/H6 Troubleshooting .....                     | 41 |
| 2.15 P5 Troubleshooting .....                        | 42 |
| 2.16 P6 Troubleshooting .....                        | 43 |
| 2.17 P7/PC Troubleshooting .....                     | 44 |
| 2.18 P8 Troubleshooting .....                        | 45 |
| 2.19 P9 Troubleshooting .....                        | 46 |
| 2.20 PD/H3 Troubleshooting .....                     | 47 |
| 2.21 H0 Troubleshooting .....                        | 48 |

|                                                        |    |
|--------------------------------------------------------|----|
| 3. Temperature Sensor Resistance Characteristics ..... | 49 |
|--------------------------------------------------------|----|

## 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**

---

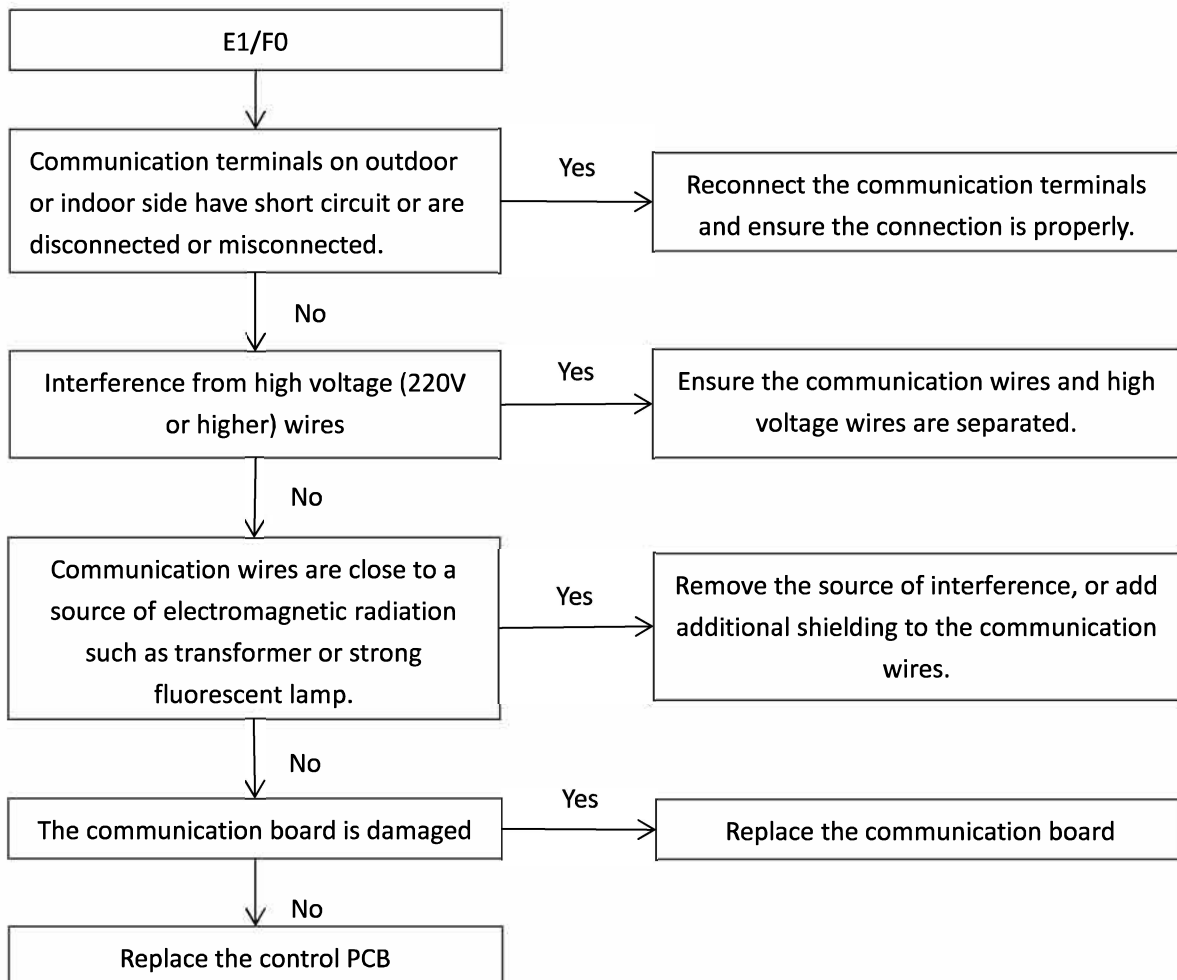
- Do not install or operate the unit for an extended period of time in areas of high humidity or in an environment directly exposing it to sea wind or salt spray.
- Do not install the unit on a defective or damaged installation stand, or in an unsecured location.
- Ensure the unit is installed at a level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

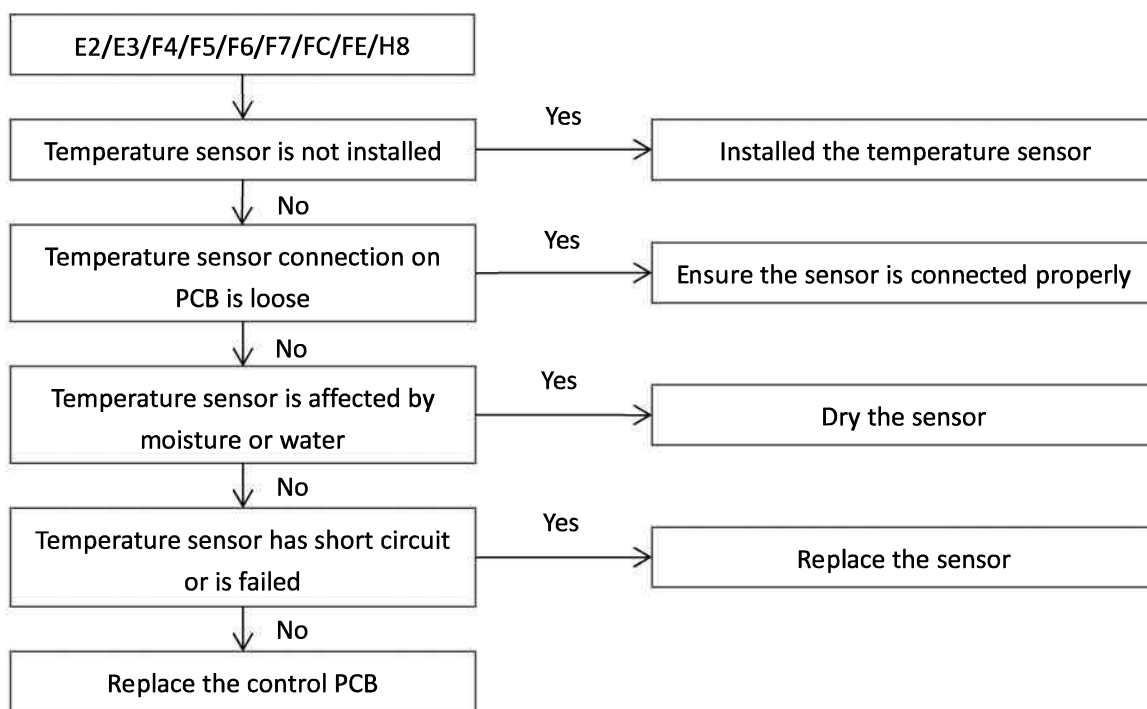
## 2.3 E1/F0 Troubleshooting

- 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

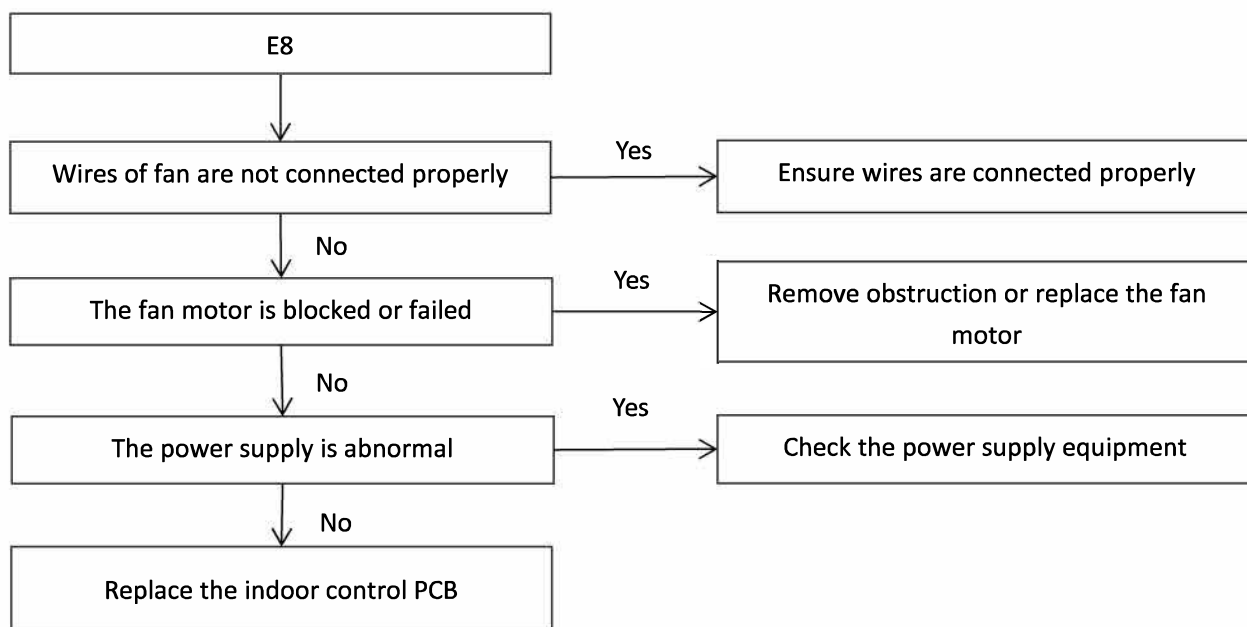


Note:

- 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.

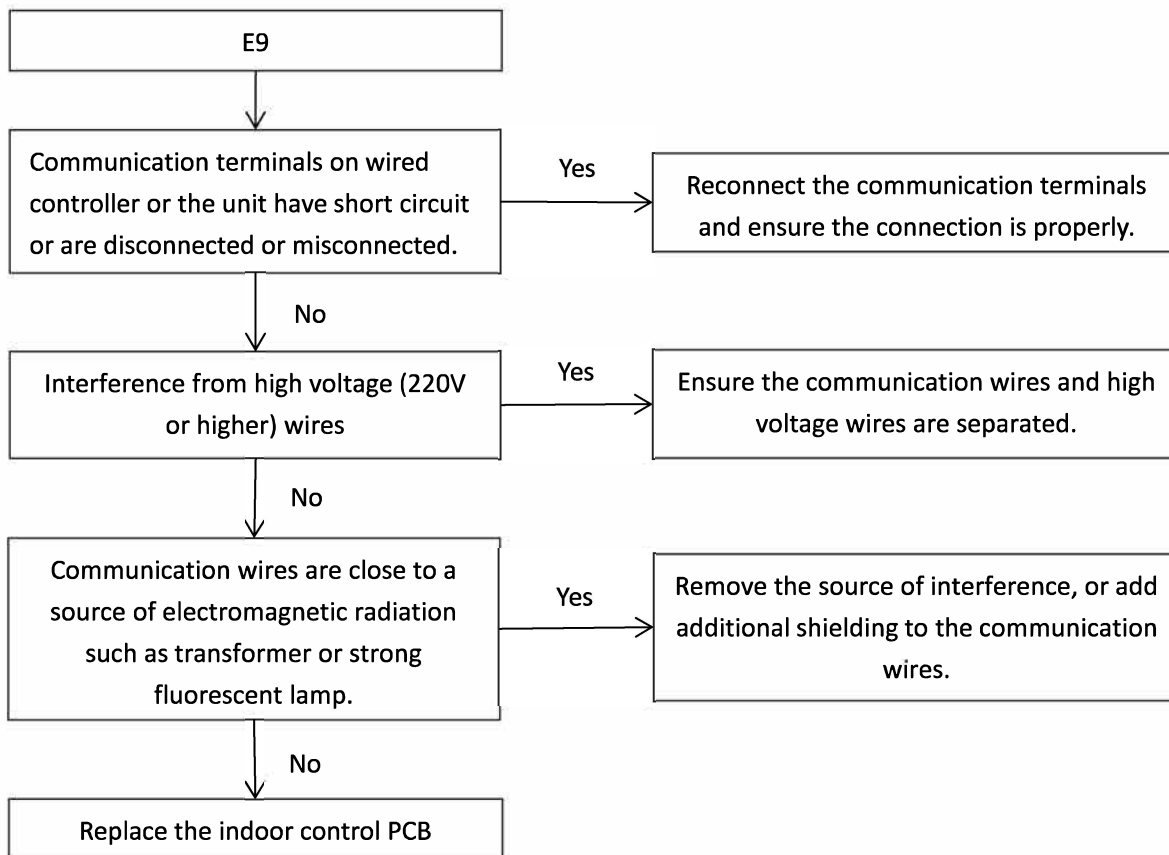
## 2.5 E8 Troubleshooting

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



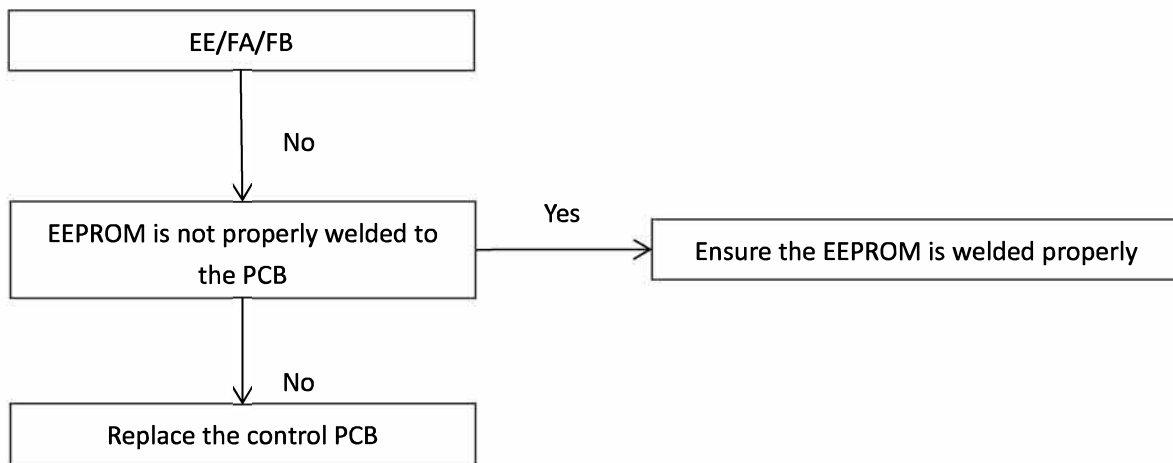
## 2.6 E9 Troubleshooting

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



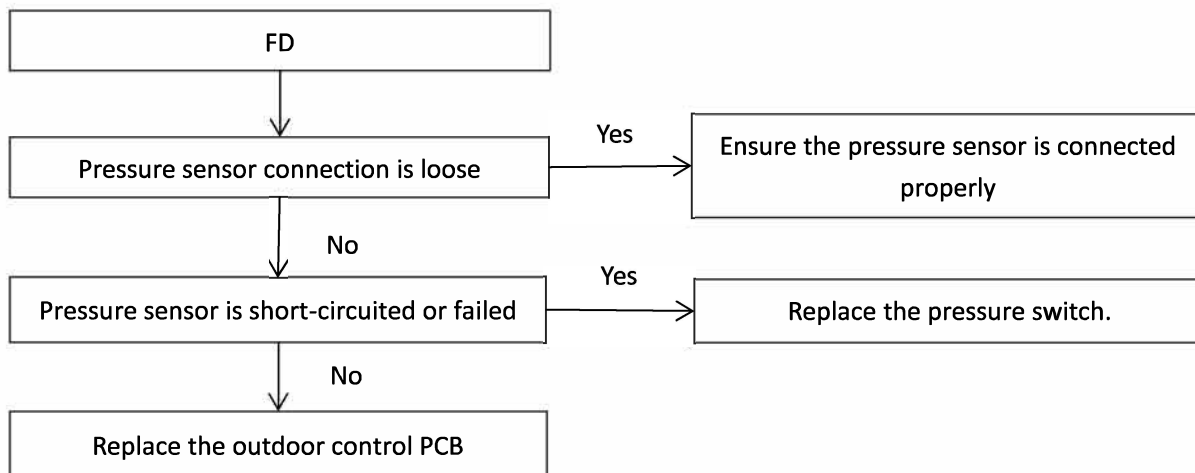
## 2.7 EE/FA/FB Troubleshooting

- 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



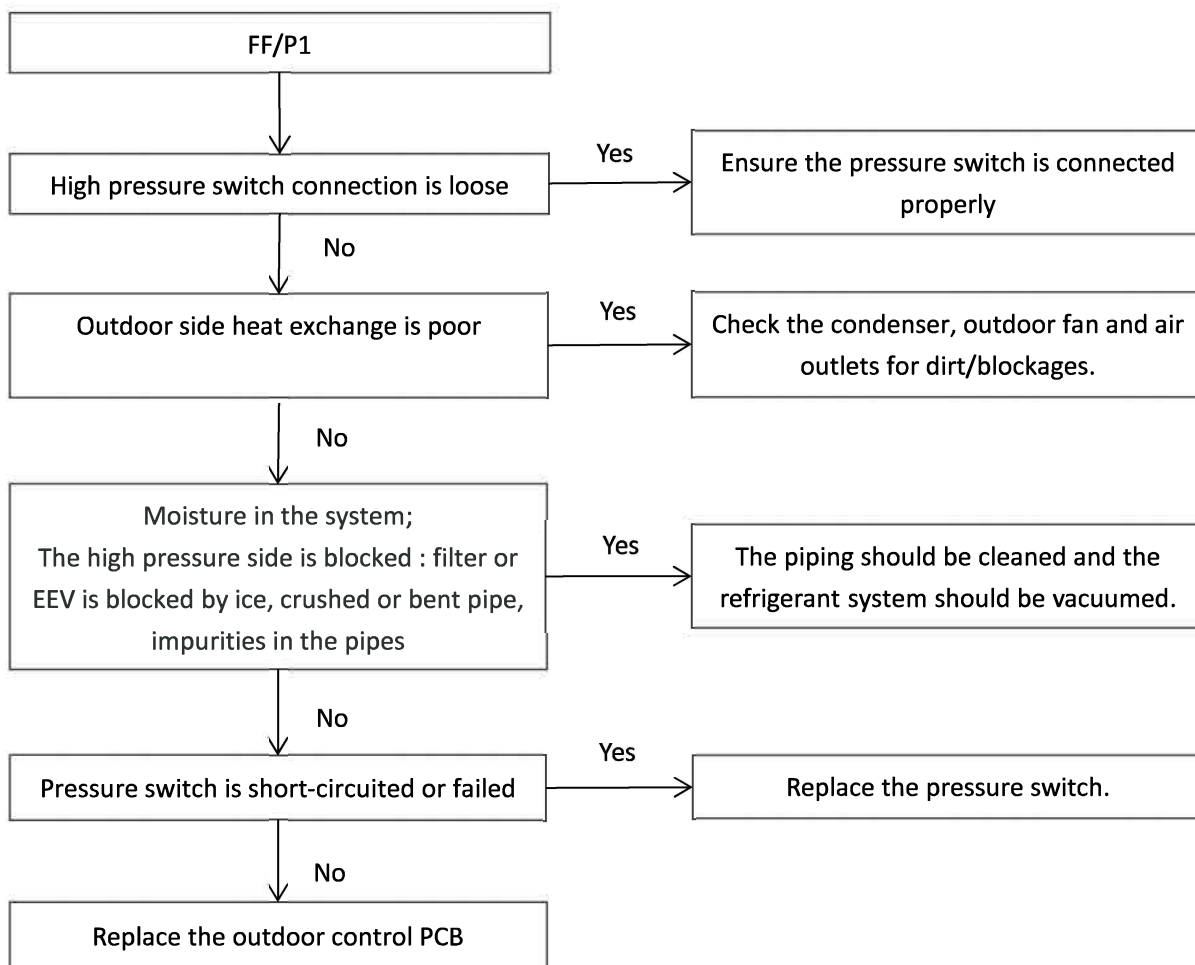
## 2.8 FD Troubleshooting

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



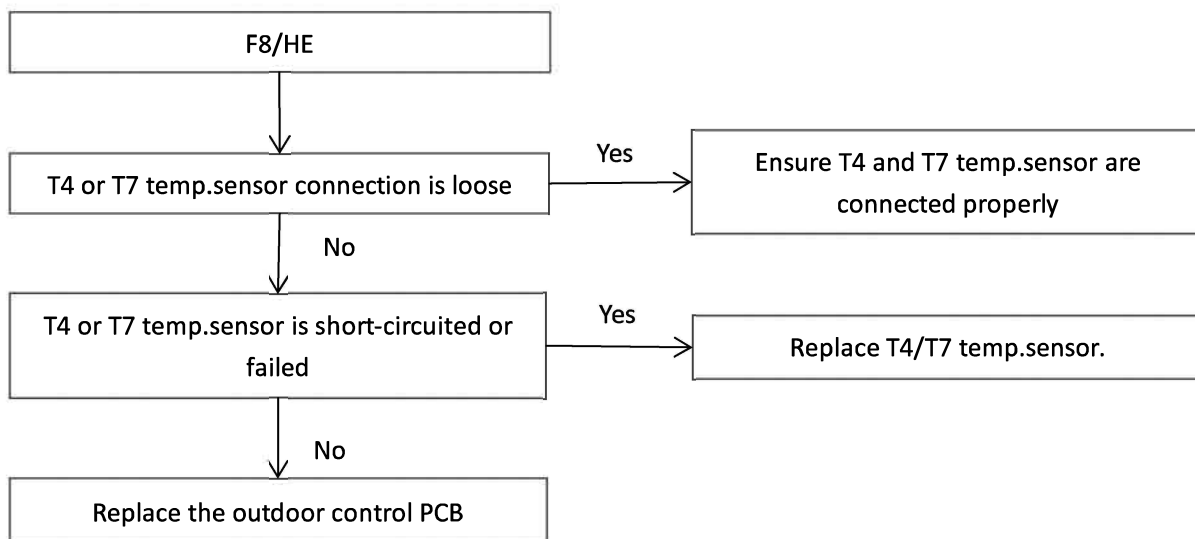
## 2.9 FF/P1/H2 Troubleshooting

- 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

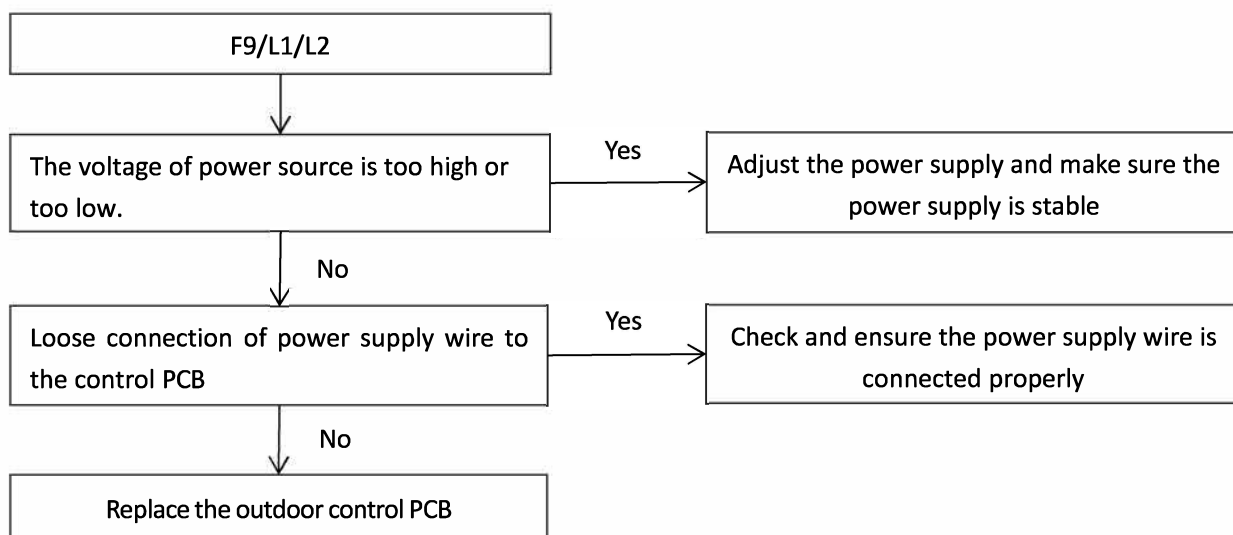


## 2.11 F9/L0/L1 Troubleshooting

- 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

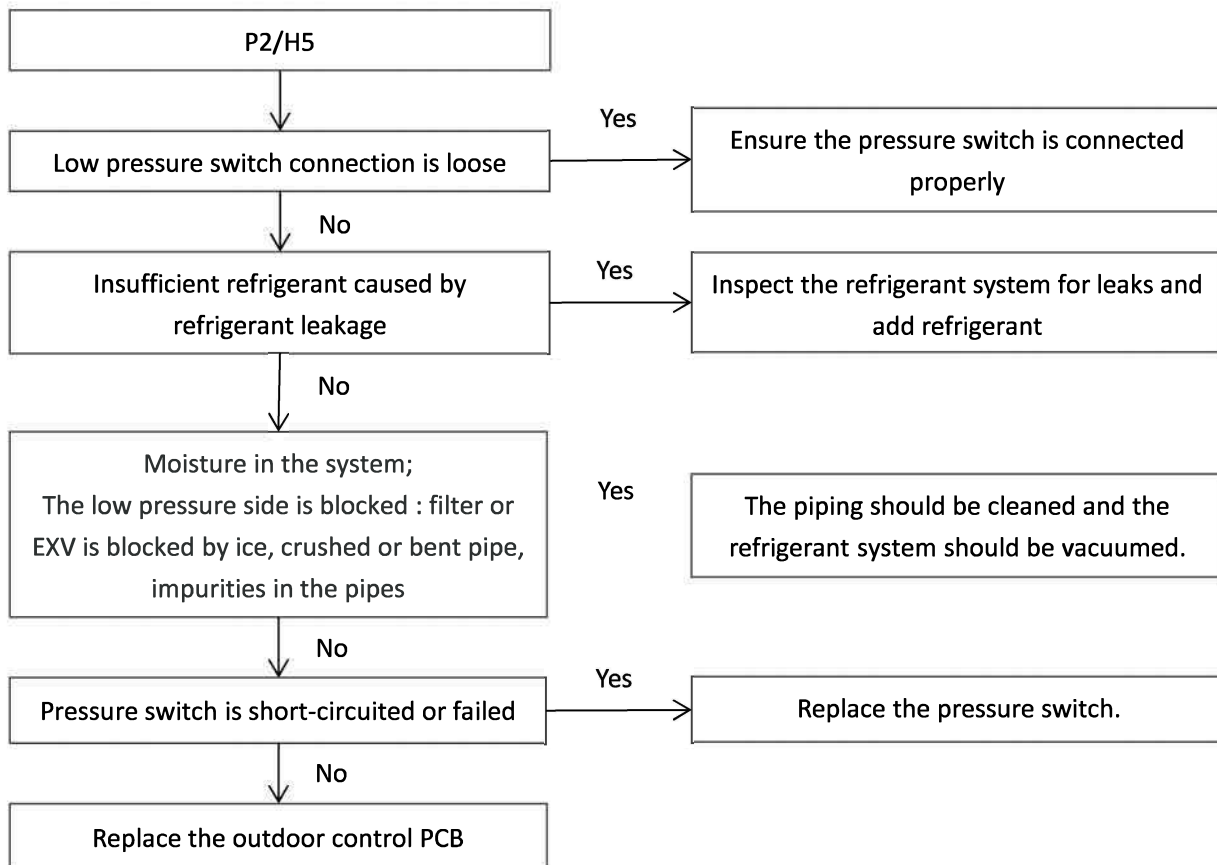
|                                                |          |
|------------------------------------------------|----------|
| <b>Allowable voltage range of power source</b> | 178~265V |
| <b>Upper limit of DC generatrix voltage</b>    | 430V     |
| <b>Lower limit of DC generatrix voltage</b>    | 150V     |

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



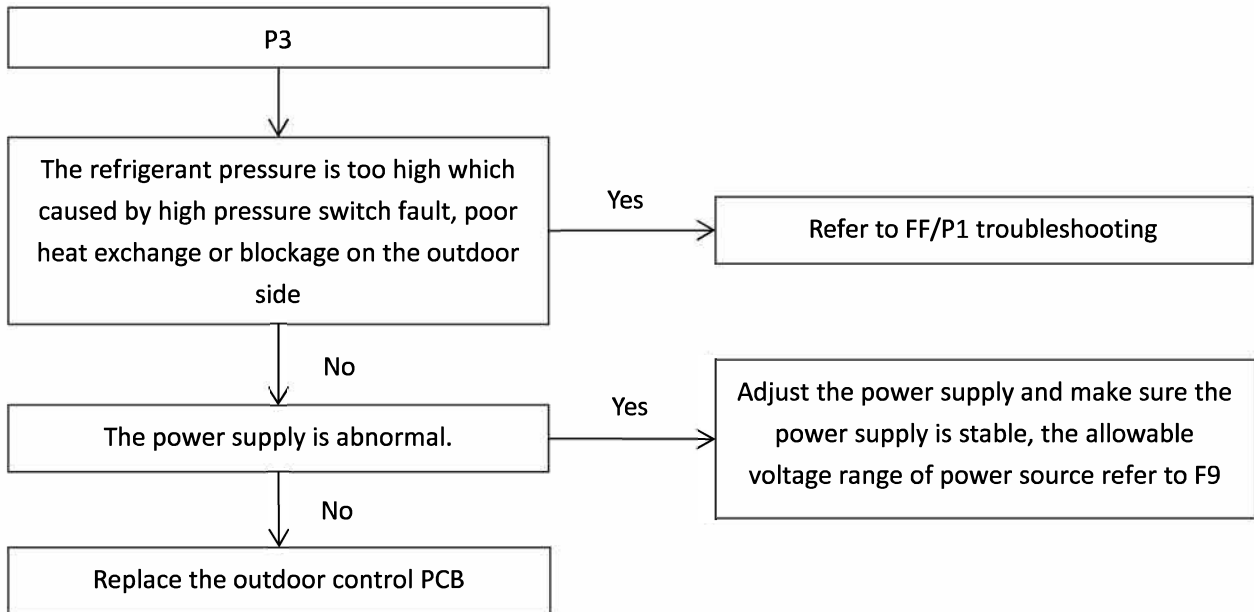
## 2.12 P2/H5 Troubleshooting

- 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



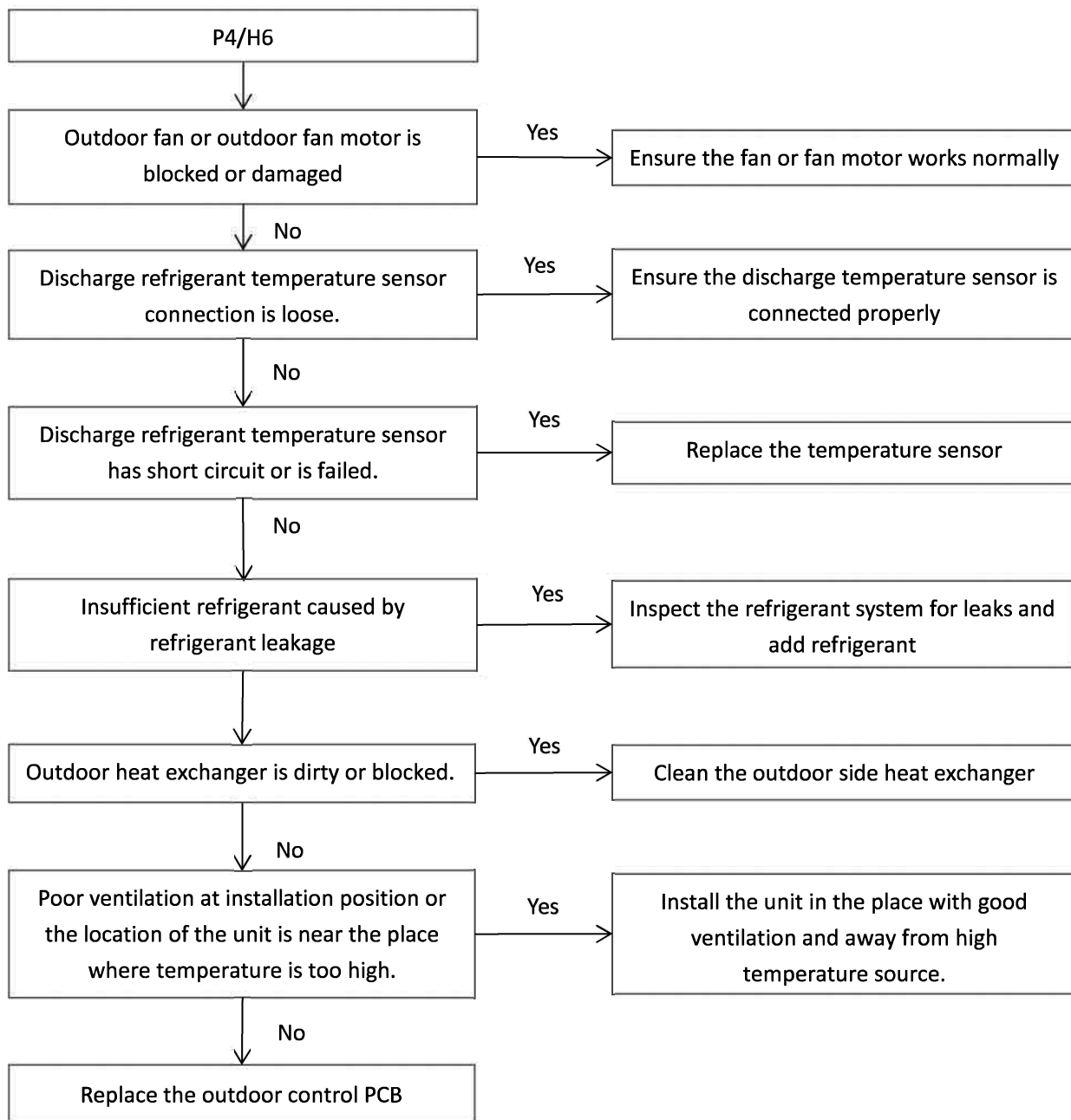
### 2.13 P3 Troubleshooting

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



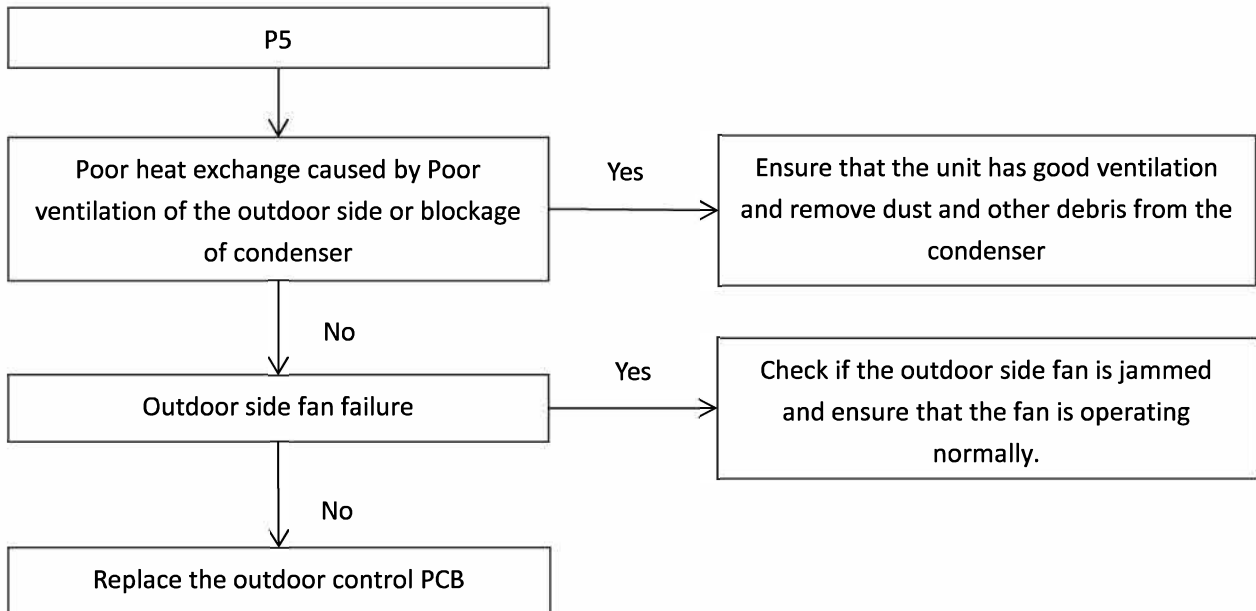
## 2.14 P4/H6 Troubleshooting

- 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

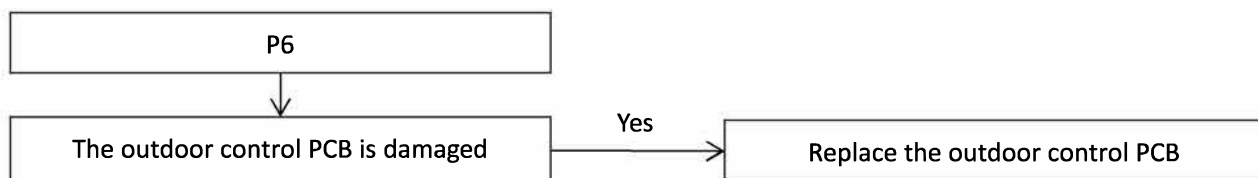
- P5 indicates T3 high temperature protection in cooling mode
- The unit stops running and error code is displayed on the communication board.



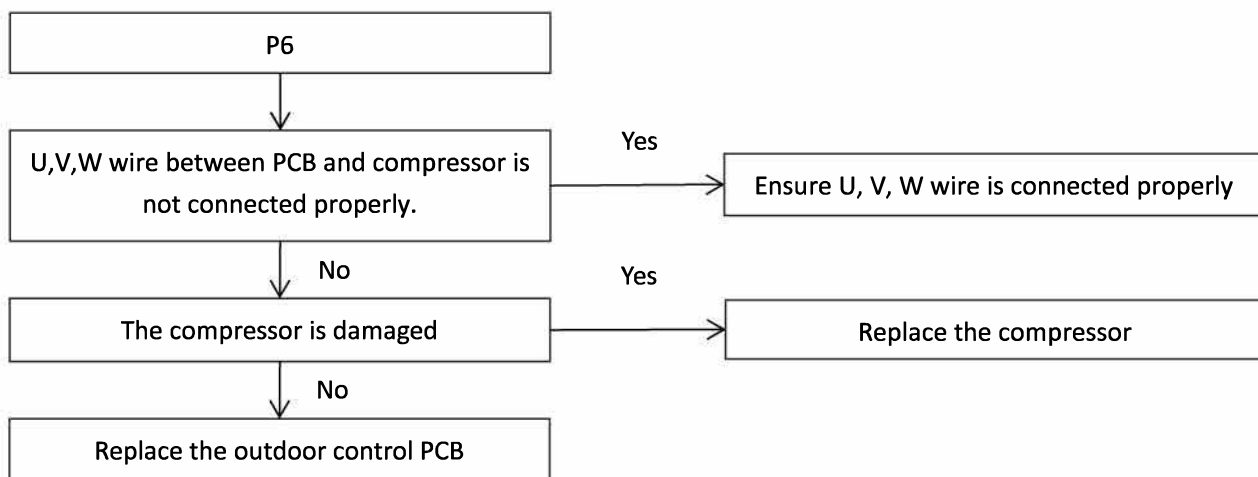
## 2.16 P6 Troubleshooting

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

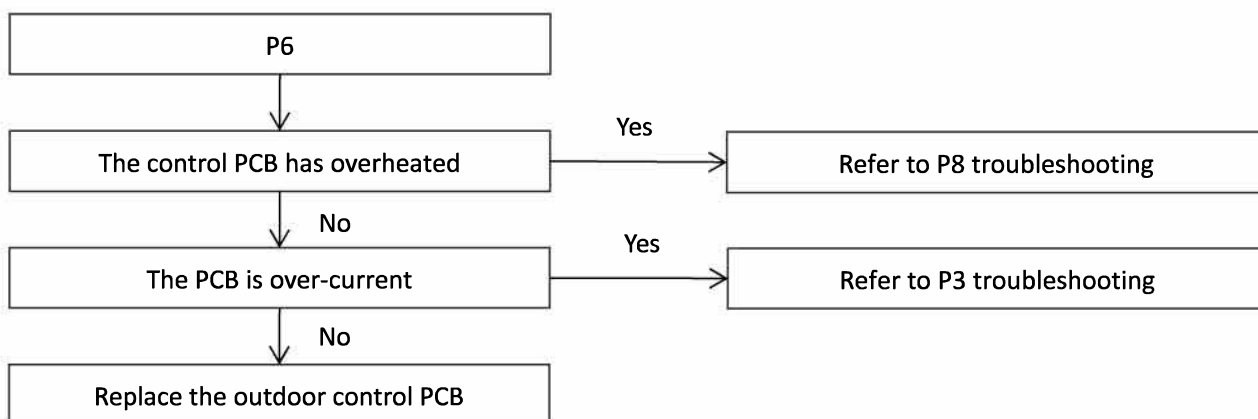
**Situation1:** P6 appears immediately when the outdoor unit is powered-on



**Situation2:** P6 appears immediately after the compressor starts up

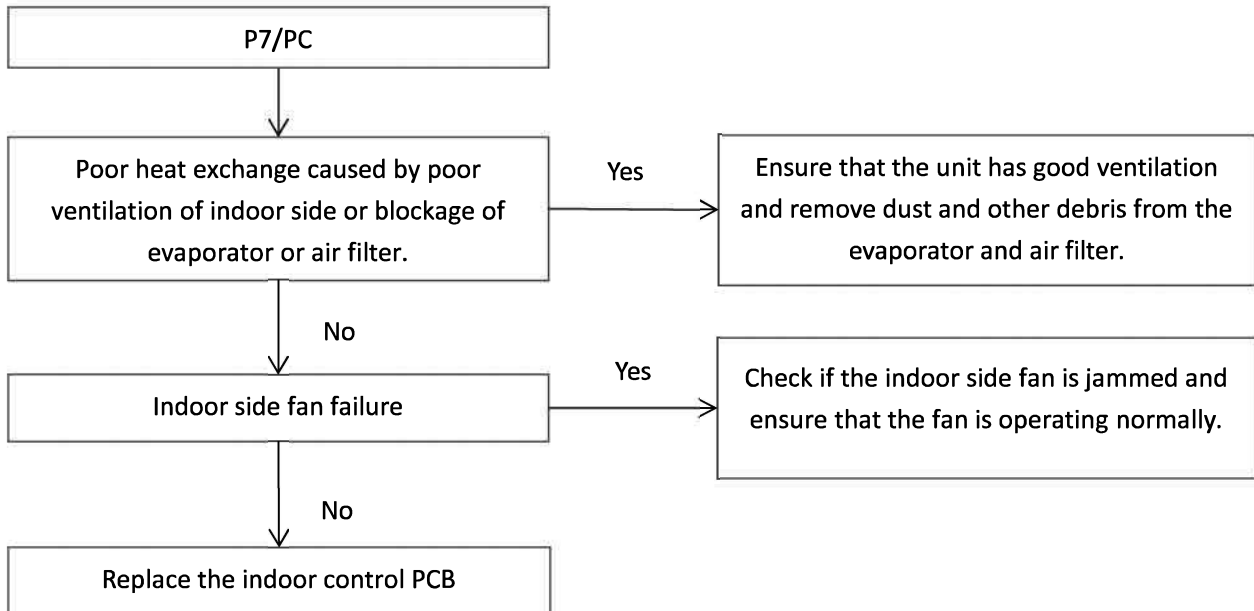


**Situation3:** P6 appears after the compressor has been running for a period of time.



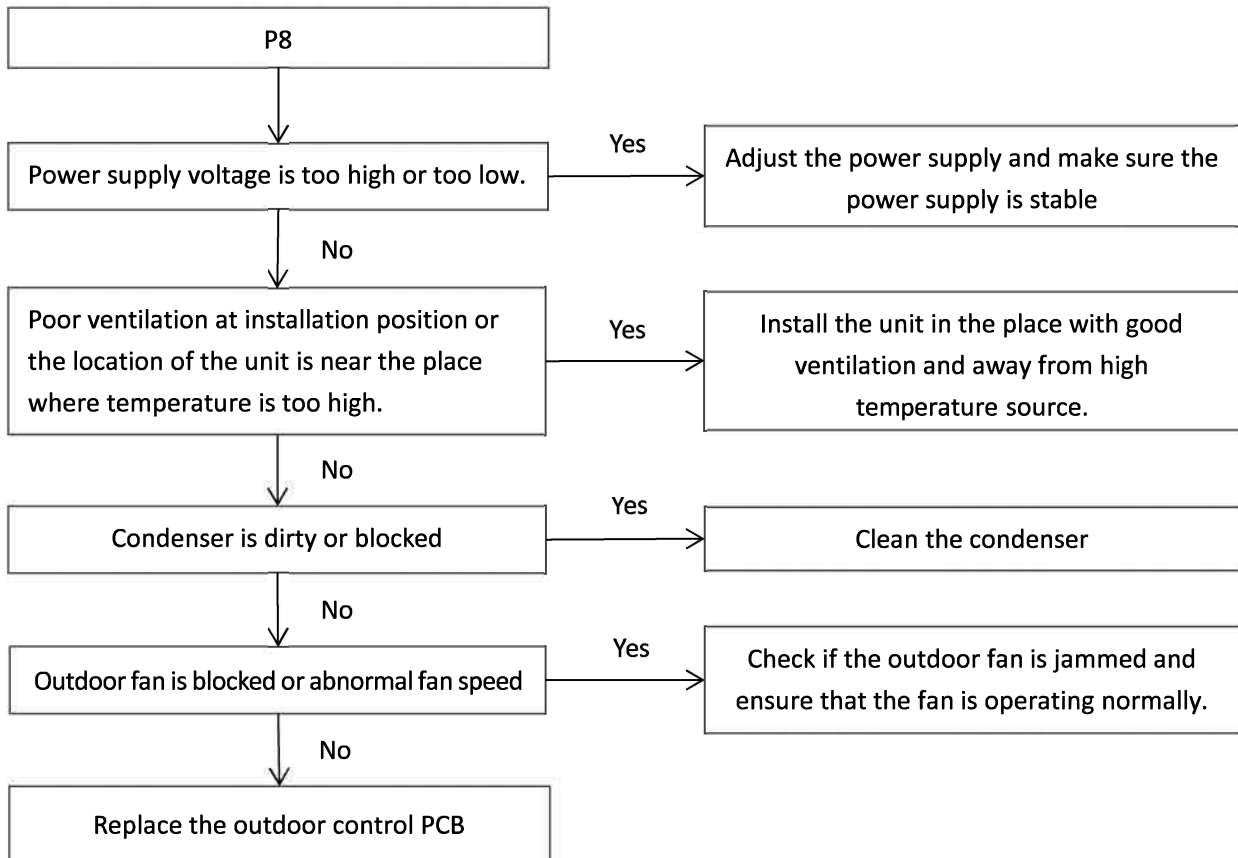
## 2.17 P7/PC Troubleshooting

- 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.



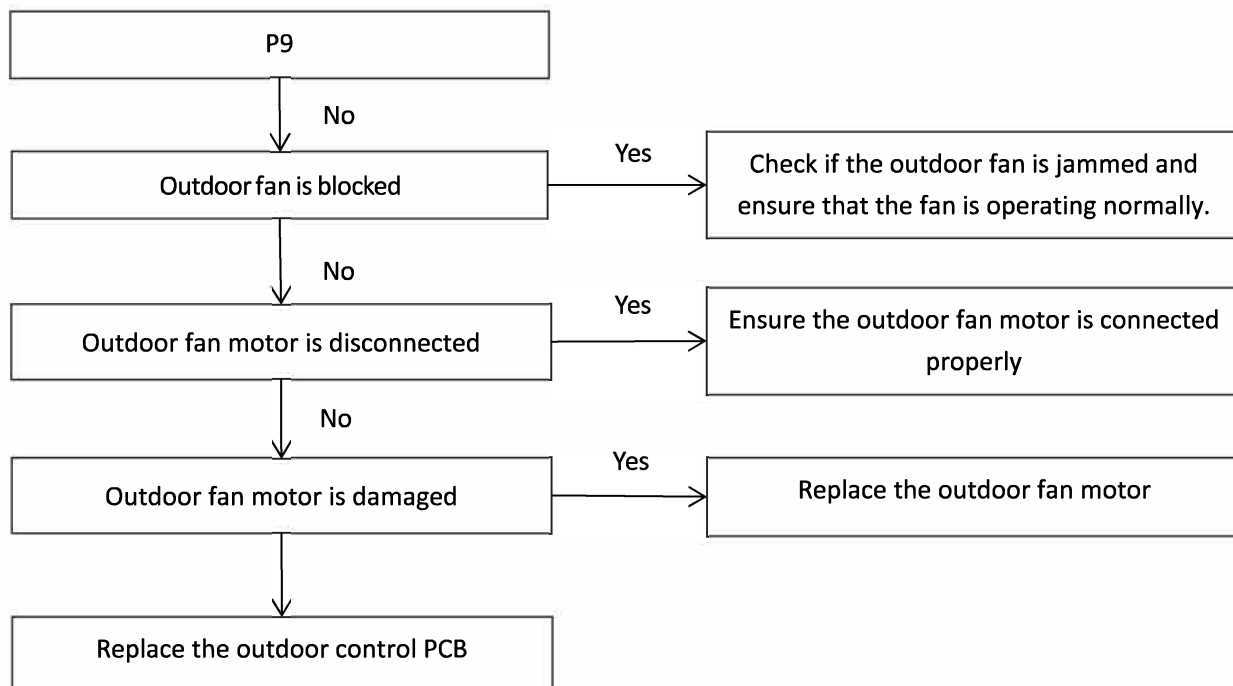
## 2.18 P8 Troubleshooting

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



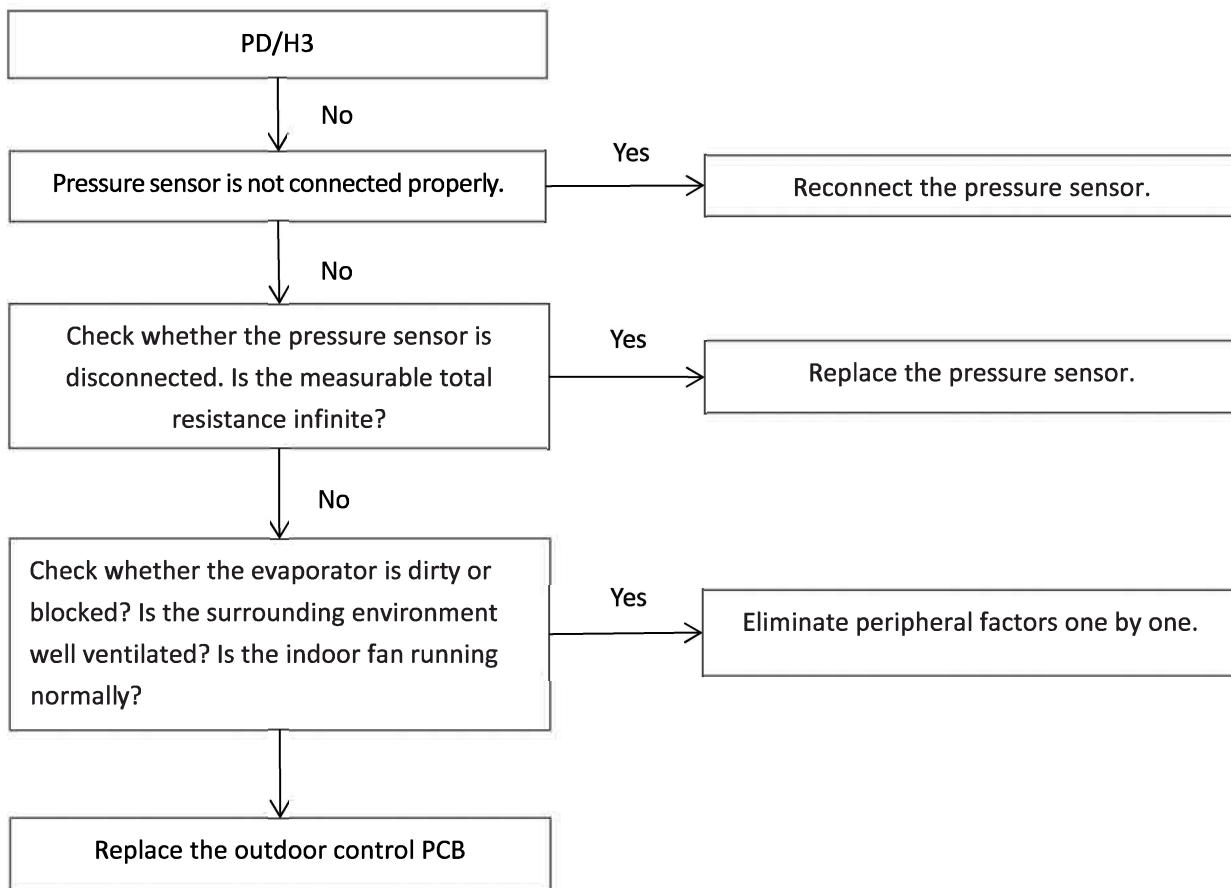
## 2.19 P9 Troubleshooting

- 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<br>(°C) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>Rmin(kΩ) | Temperature<br>(°C) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>Rmin(kΩ) | Temperature<br>(°C) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>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<br>(℃) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>Rmin(kΩ) | Temperature<br>(℃) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>Rmin(kΩ) | Temperature<br>(℃) | Resistance<br>Rmax(kΩ) | Resistance<br>Rnor(kΩ) | Resistance<br>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                   |                    |                        |                        |                        |

# ComfortStar®

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