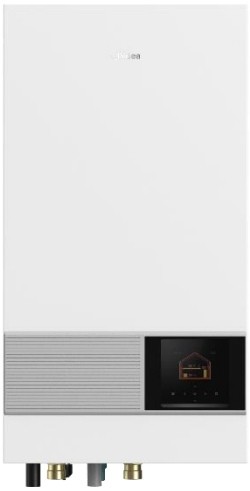
Midea Building Technologies Division

Service Manual

M thermal Arctic Split Series

12-16kW





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Part 1

General Information

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1 Unit Capacities

1.1 Outdoor Unit Capacities

Table 1-1.1: Capacity range

Capacity	12kW	14kW	16kW
Model[1] (MHA-* D2MN8-B2)	V12W	V14W	V16W
Notes: The full model names can be obtained by substituting the asterisk in the model name format given in the left-hand column of the table above with the shortened model names given in the table. For example, the model name for the 16kW model is MHA-V16WD2MN8-B2.			

1.2 Hydronic Box Model

Table 1-1.2: Model

Model	HB-A160CMDM30GN8-B2
Compatible ODU model	MHA- V12(14,16)WD2MN8-B2

2 External Appearance

2.1 Outdoor Unit Appearance

Table 1-2.1: Outdoor Unit appearance

MHA- V12WD2MN8-B2 / MHA- V14WD2MN8-B2 / MHA- V16WD2MN8-B2


2.2 Hydronic Box Appearance

Table 1-2.2: Hydronic box appearance

HB-A160CMDM30GN8-B2


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Part 2

Component Layout and Refrigerant Circuits

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1 Layout of Functional Components

1.1 Outdoor Unit Layout

MHA-V12WD2MN8-B2 / MHA-V14WD2MN8-B2 / MHA-V16WD2MN8-B2

Figure 2-1.1: MHA-V12(14,16)WD2MN8-B2 top view

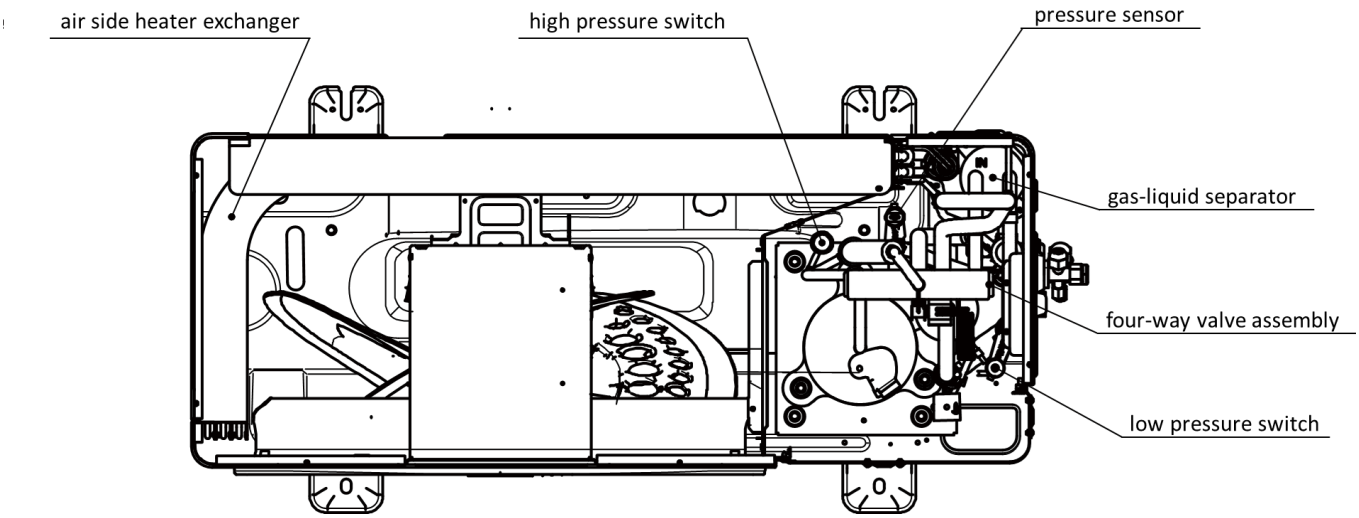
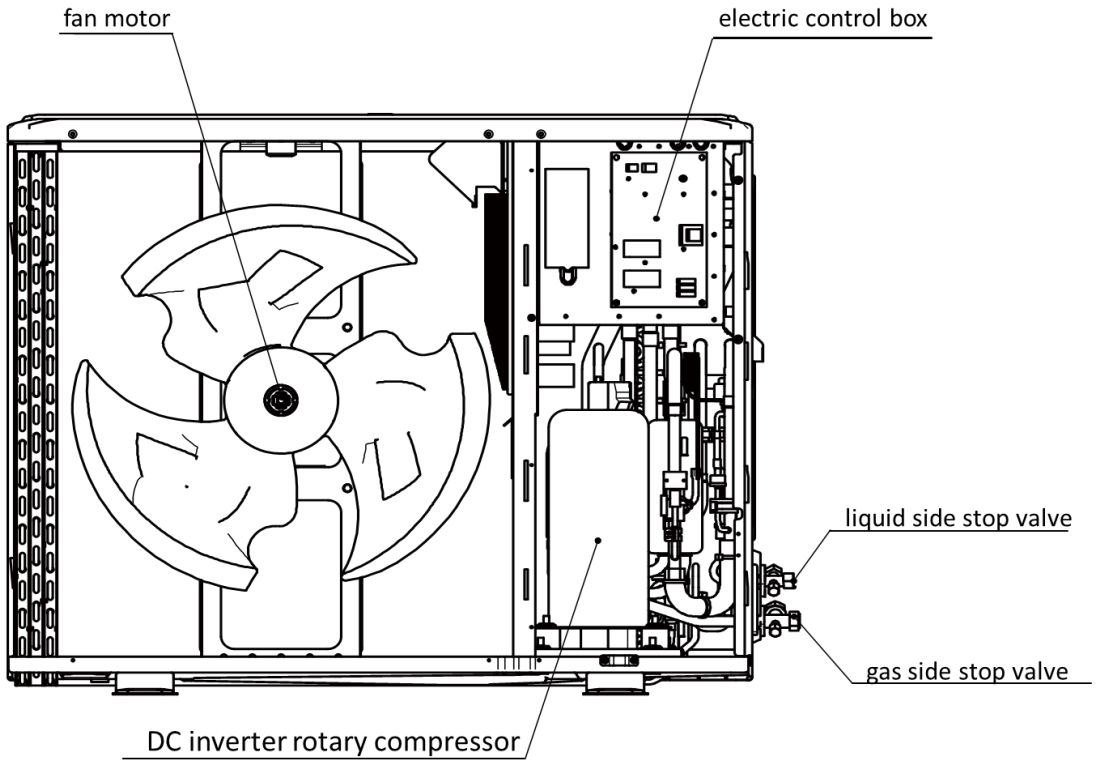


Figure 2-1.2: MHA-V12(14,16)WD2MN8-B2 front view

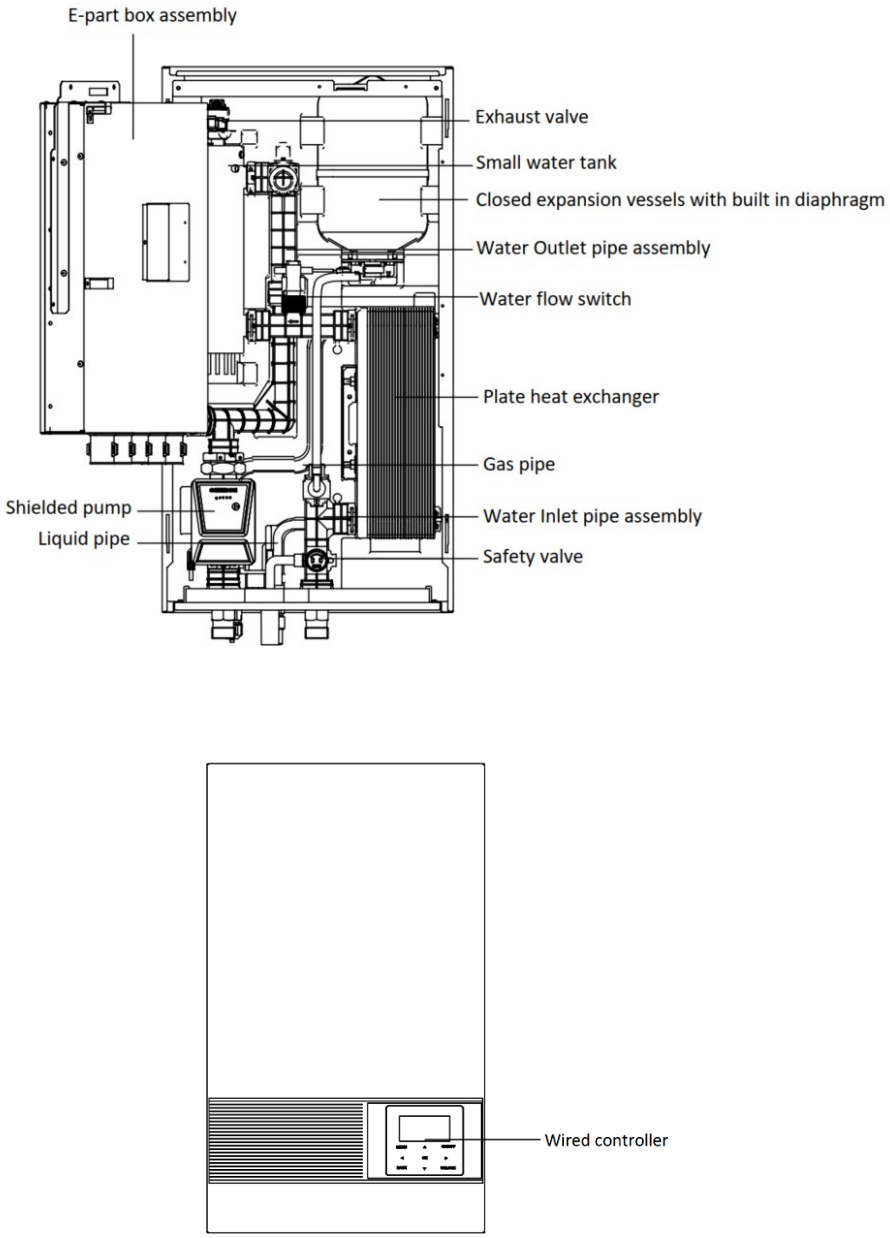


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1.2 Hydronic Box Layout

HB-A160CMDM30GN8-B2

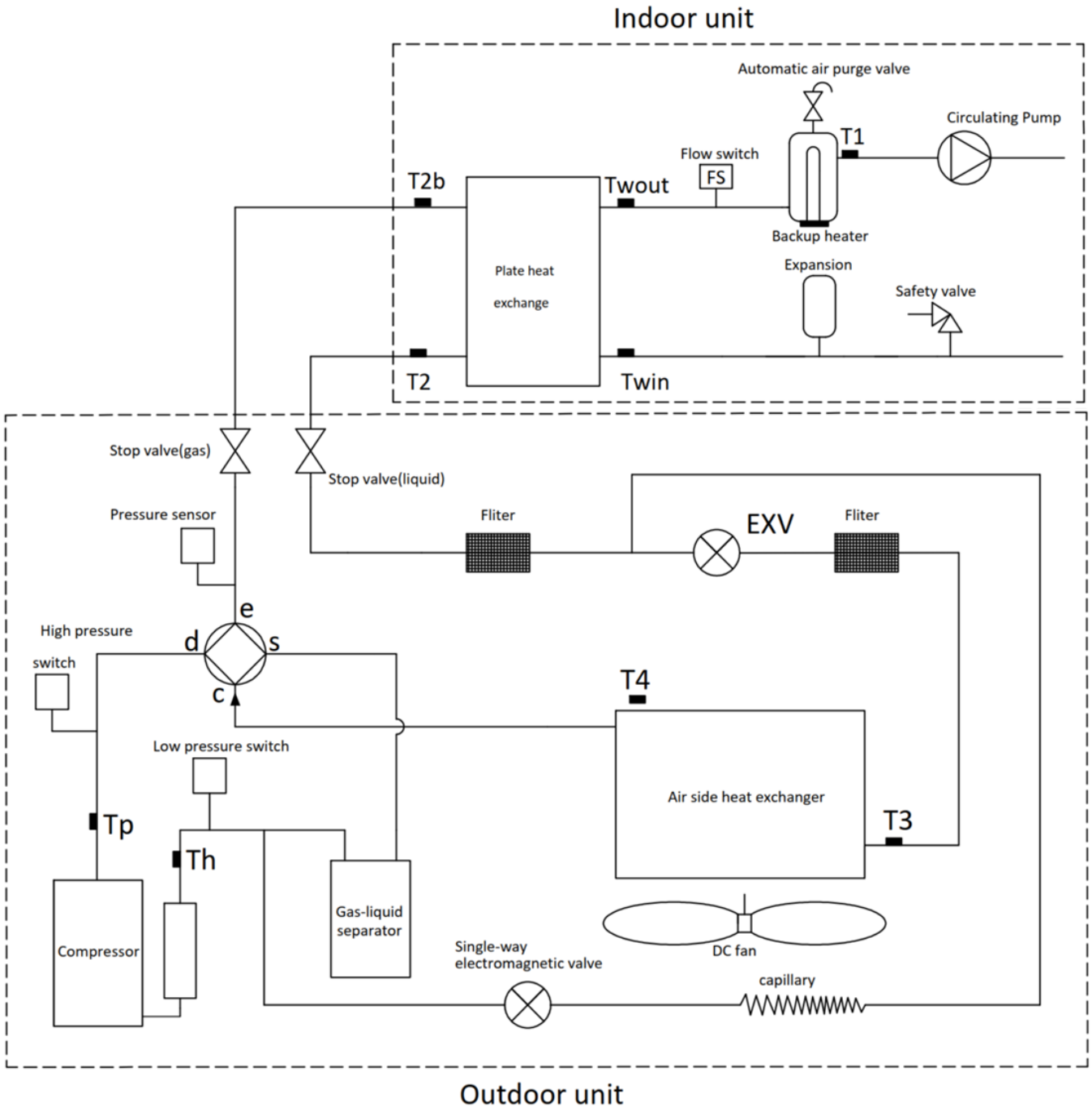
Figure 2-1.2: HB-A160CMDM30GN8-B2 front view



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2 Piping Diagram

Figure 2-1: Outdoor unit and indoor unit piping diagram

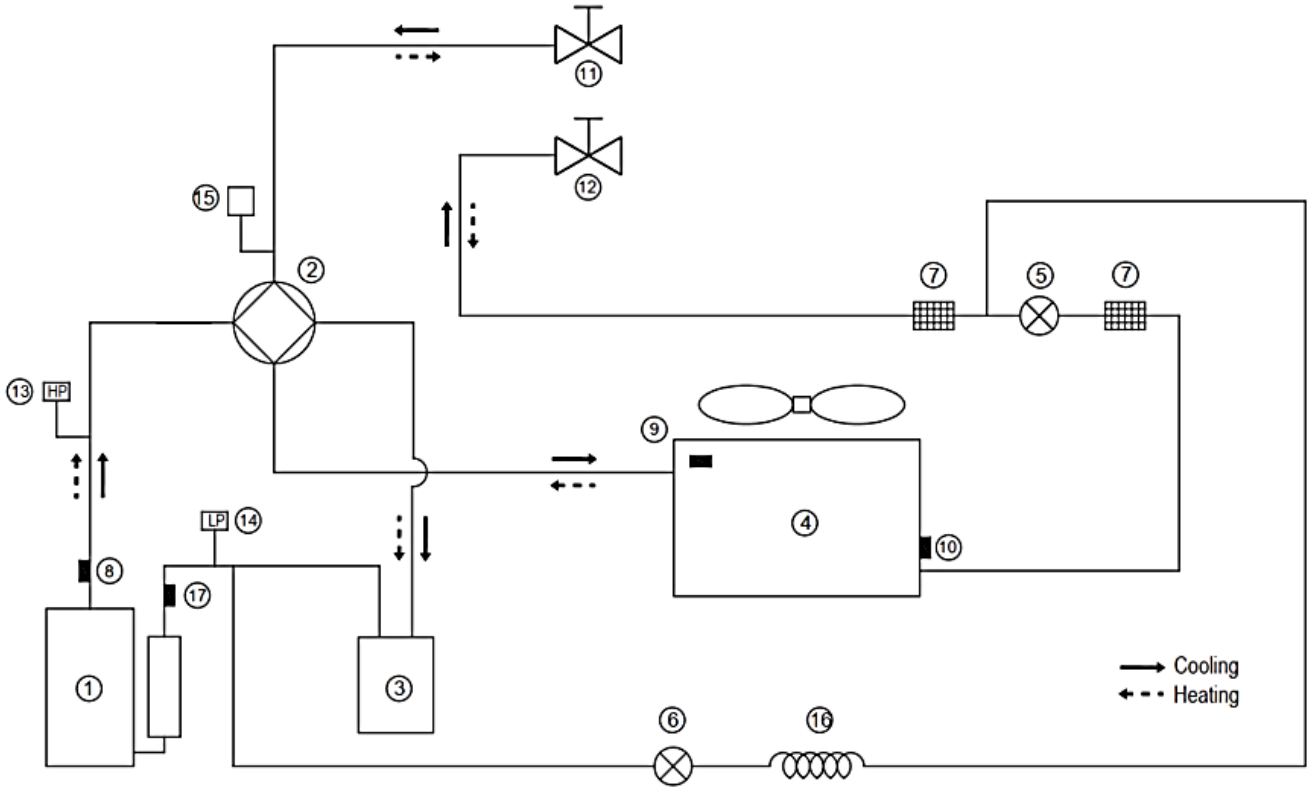


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3 Refrigerant Cycle

3.1 Outdoor Unit

Figure 3-3.1: Outdoor unit refrigerant cycle piping diagram



Legend			
1	Compressor	10	Evaporation sensor in heating (Condenser sensor in cooling)
2	4-Way valve	11	Stop valve (gas)
3	Gas-liquid separator	12	Stop valve (liquid)
4	Air side heat exchanger	13	High pressure switch
5	Electronic expansion valve	14	Low pressure switch
6	Single-way electromagnetic valve	15	Pressure sensor
7	Filter	16	Capillary
8	Discharge temperature sensor	17	Suction temperature sensor
9	Outdoor temperature sensor		

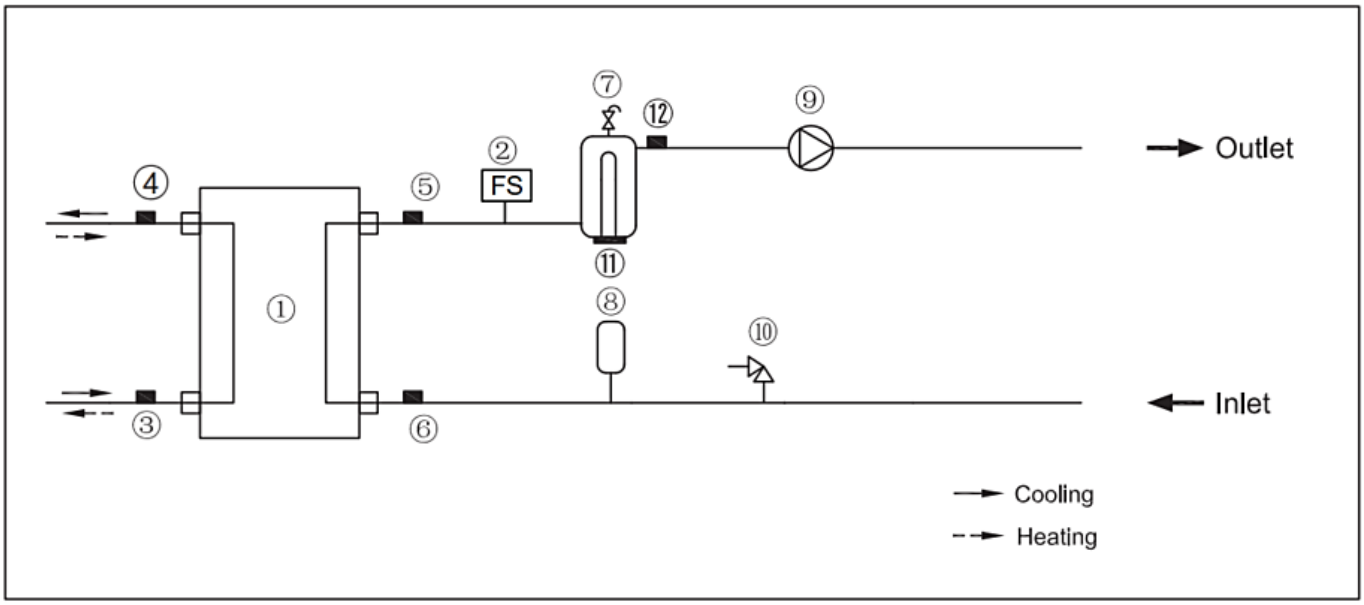
Key components:

1. **Electronic expansion valve (EXV):**
   Controls refrigerant flow and reduces refrigerant pressure.
2. **4-way valve:**
   Controls refrigerant flow direction. Closed in cooling mode and open in heating mode. When closed, the air side heat exchanger functions as a condenser and water side heat exchanger functions as an evaporator; when open, the air side heat exchanger functions as an evaporator and water side heat exchanger function as a condenser.
3. **High and low pressure switches:**
   Regulate refrigerant system pressure. When refrigerant system pressure rises above the upper limit or falls below the lower limit, the high or low pressure switches turn off, stopping the compressor.

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3.2 Hydronic box

Figure 3-3.2: Hydronic box refrigerant cycle piping diagram



Legend			
1	Water side heat exchanger (Plate Heat Exchange)	7	Automatic air purge valve
2	Flow switch	8	Expansion vessel
3	Refrigerant liquid line temperature sensor	9	Circulating pump
4	Refrigerant gas line temperature sensor	10	Manometer
5	Water outlet temperature sensor	11	Pressure relief valve
6	Water inlet temperature sensor	12	Total outlet temperature sensor

Key components:

1. **Automatic air purge valve:**
   Automatically removes air from the water circuit.
2. **Expansion vessel:**
   Balances water system pressure. (Expansion vessel volume: 8L.)
3. **Flow switch:**
   Detects water flow rate to protect compressor and water pump in the event of insufficient water flow.
4. **Manometer:**
   Provides water circuit pressure readout.
5. **Circulating pump:**
   Circulates water in the water circuit.

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Part 3

Control

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1 Stop Operation

The stop operation occurs for one of the following reasons:

1. Abnormal shutdown: in order to protect the compressors, if an abnormal state occurs the system makes a stop with thermo off operation and an error code is displayed on the outdoor unit PCB digital displays and on the user interface.
2. The system stops when the set temperature has been reached.

2 Standby Control

2.1 Crankcase Heater Control

The crankcase heater is used to prevent refrigerant from mixing with compressor oil when the compressors are stopped. The crankcase heater is controlled according to outdoor ambient temperature and the compressor on/off state. When the outdoor ambient temperature is above 41°F(5°C) or the compressor is running, the crankcase heater is off; when the outdoor ambient temperature is at or below 41°F(5°C) and either the compressor has been stopped for more than 3 hours or the unit has just been powered-on (either manually or when the power has returned following a power outage), the crankcase heater turns on.

2.2 Water Pump Control

When the outdoor unit is in standby, the internal and external circulator pumps run continuously.

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3 Startup Control

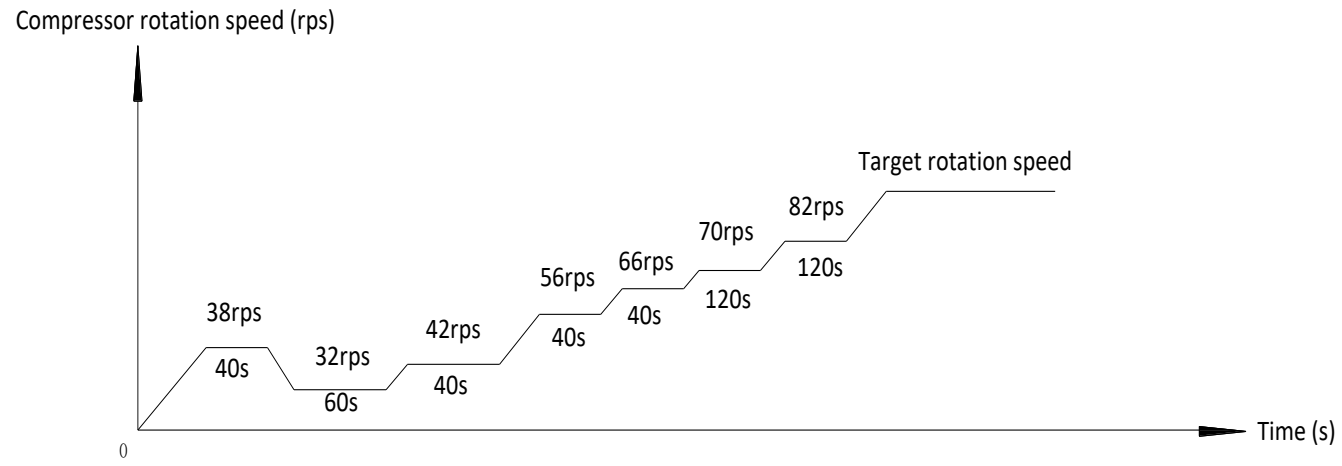
3.1 Compressor Startup Delay Control

In initial startup control and in restart control (except in oil return operation and defrosting operation), compressor startup is delayed such that a minimum of the set re-start delay time has elapsed since the compressor stopped, in order to prevent frequent compressor on/off and to equalize the pressure within the refrigerant system. The compressor re-start delays for cooling and heating modes are set on the user interface.

3.2 Compressor Startup Program

In initial startup control and in re-start control, compressor startup is controlled according to outdoor ambient temperature. Compressor startup follows one of two startup programs until the target rotation speed is reached. Refer to Figure 3-3.2-1, Figure 3-3.2-2.

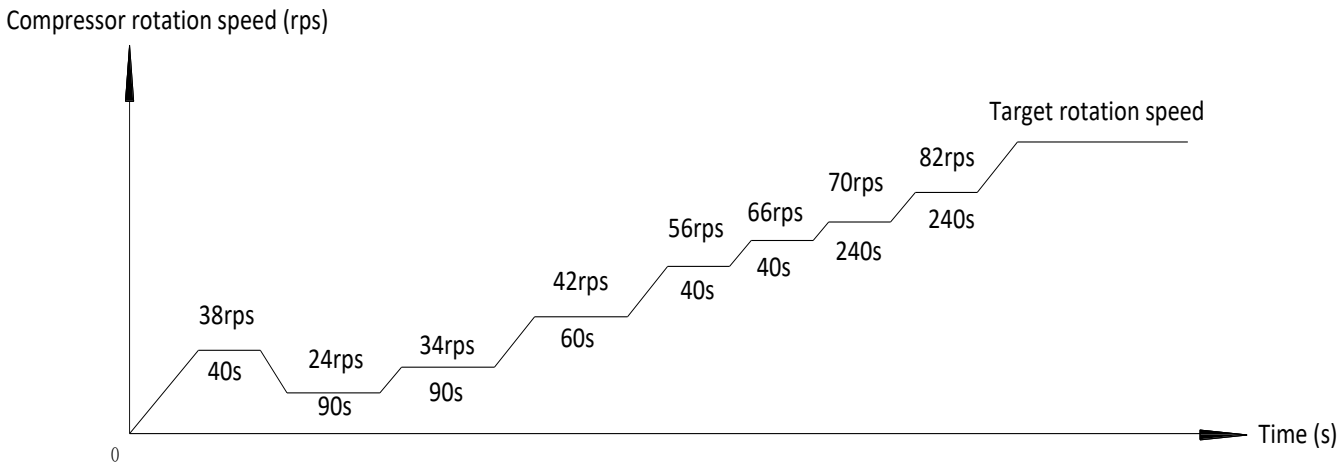
Figure 3-3.2-1: MHA- V12(14,16)WD2MN8-B2 compressor startup program[1] when ambient temperature is above 37.4°F(3°C)



Notes:

1. Once the first, 40-second stage of the program is complete, the program proceeds to the subsequent stages in a step-by-step fashion and exits when the target rotation speed has been reached.

Figure 3-3.2-2: MHA- V12(14,16)WD2MN8-B2 compressor startup program[1] when ambient temperature is at or below 37.4°F(3°C)



Notes:

1. Once the first, 40-second stage of the program is complete, the program proceeds to the subsequent stages in a step-by-step fashion and exits when the target rotation speed has been reached.

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3.3 Startup Control for Heating and Domestic Hot Water Operation

Table 3-3.3: Component control during startup in heating and domestic hot water modes

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Compressor startup program selected according to ambient temperature[1]
DC fan motor	FAN	●	Fan run at maximum speed[2]
Electronic expansion valve	EXV	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to outdoor ambient temperature, discharge temperature, suction superheat
Four-way valve	4-WAY	●	On

Notes:
1. Refer to Part 3, 3.2 “Compressor Startup Program”.
2. Refer to Table 3-4.6 in Part 3, 4.6 “Outdoor Fan Control”.

3.4 Startup Control for Cooling Operation

Table 3-3.4: Component control during startup in cooling mode

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Compressor startup program selected according to ambient temperature[1]
DC fan motor	FAN	●	Fan run at maximum speed[2]
Electronic expansion valve	EXV	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to outdoor ambient temperature, discharge temperature, suction superheat
Four-way valve	4-WAY	●	Off

Notes:
1. Refer to Part 3, 3.2 “Compressor Startup Program”.
2. Refer to Table 3-4.6 in Part 3, 4.6 “Outdoor Fan Control”.

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4 Normal Operation Control

4.1 Component Control during Normal Operation

Table 3-4.1-1: Component control during heating and domestic hot water operations

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement from hydronic system
DC fan motor	FAN	•	Controlled according to outdoor heat exchanger pipe temperature
Electronic expansion valve	EXV	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature, suction superheat and compressor speed
Four-way valve	4-WAY	•	On

Table 3-4.1-2: Component control during cooling operation

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement from hydronic system
DC fan motor	FAN	•	Controlled according to outdoor heat exchanger pipe temperature
Electronic expansion valve	EXV	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature, suction superheat and compressor speed
Four-way valve	4-WAY	•	Off

4.2 Compressor Output Control

The compressor rotation speed is controlled according to the load requirement. Before compressor startup, the M thermal Split outdoor unit determines the compressor target speed according to outdoor ambient temperature, leaving water set temperature and actual leaving water temperature and then runs the appropriate compressor startup program. Refer to Part 3, 3.2 “Compressor Startup Program”. Once the startup program is complete, the compressor runs at the target rotation speed.

4.3 Compressor Step Control

The running speed of six-pole compressors in rotations per second (rps) is one third of the frequency (in Hz) of the electrical input to the compressor motor. The frequency of the electrical input to the compressor motors can be altered at a rate of 1Hz per second.

4.4 Four-way Valve Control

The four-way valve is used to change the direction of refrigerant flow through the water side heat exchanger in order to switch between cooling and heating/DHW operations. Refer to Part 2, 3 “Refrigerant Flow Diagrams”. During heating and DHW operations, the four-way valve is on; during cooling and defrosting operations, the four-way valve is off.

4.5 Electronic Expansion Valve Control

The position of the electronic expansion valve (EXV) is controlled in steps from 0 (fully closed) to 480 (fully open).

- At power-on:
  - The EXV first closes fully, then moves to the standby position. After a few seconds the EXV moves to an initial running position, which is determined according to operating mode and outdoor ambient temperature. After a further a few minutes, the EXV is controlled according to suction superheat and discharge temperature. Once a further a few minutes have elapsed, the EXV is then controlled according to suction superheat, discharge temperature and compressor speed.
- When the outdoor unit is in standby:
  - The EXV is at standby position.
- When the outdoor unit stops:
  - The EXV first closes fully, then moves to the standby position.

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4.6 Outdoor Fan Control

The speed of the outdoor unit fan is adjusted in steps, as shown in Table 3-4.6.

Table 3-4.6: Component control during cooling operation

Fan speed index	Fan speed (rpm)	
	12-14kW	16kW
W1	200	200
W2	250	250
W3	300	300
W4	350	350
W5	400	400
W6	450	450
W7	500	500
W8	550	550
W9	580	600
W10	610	650
W11	630	700
W12	650	730

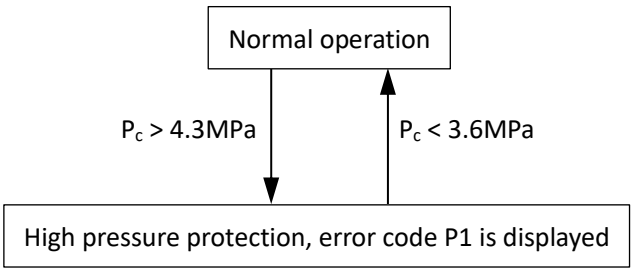
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5 Protection Control

5.1 High Pressure Protection Control

This control protects the refrigerant system from abnormally high pressure and protects the compressor from transient spikes in pressure.

Figure 3-5.1: High pressure protection control



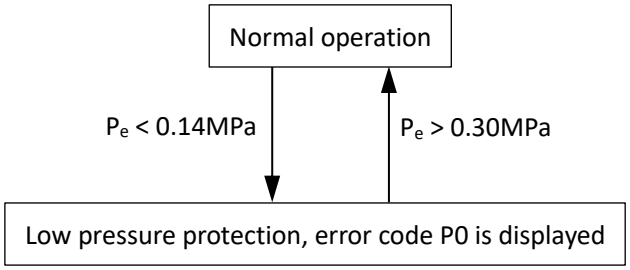
Notes:
1. P_c: Discharge pressure

When the discharge pressure rises above 4.3MPa the system displays P1 protection and the unit stops running. When the discharge pressure drops below 3.6MPa, the compressor enters re-start control.

5.2 Low Pressure Protection Control

This control protects the refrigerant system from abnormally low pressure and protects the compressor from transient drops in pressure.

Figure 3-5.2: Low pressure protection control



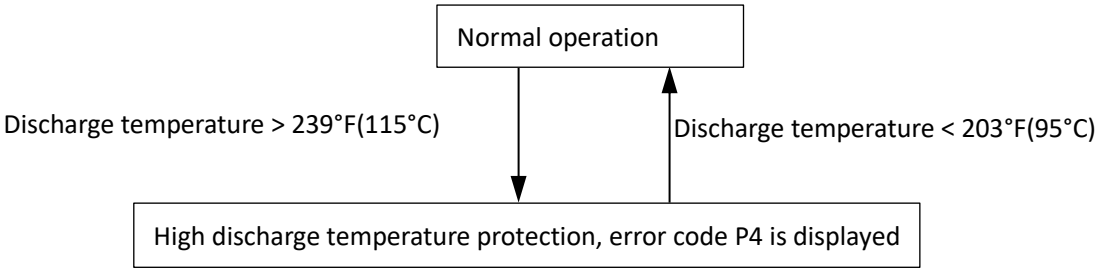
Notes:
1. P_e: Suction pressure

When the suction pressure drops below 0.14MPa the system displays P0 protection and the unit stops running. When the suction pressure rises above 0.3MPa, the compressor enters re-start control.

5.3 Discharge Temperature Protection Control

This control protects the compressor from abnormally high temperatures and transient spikes in temperature.

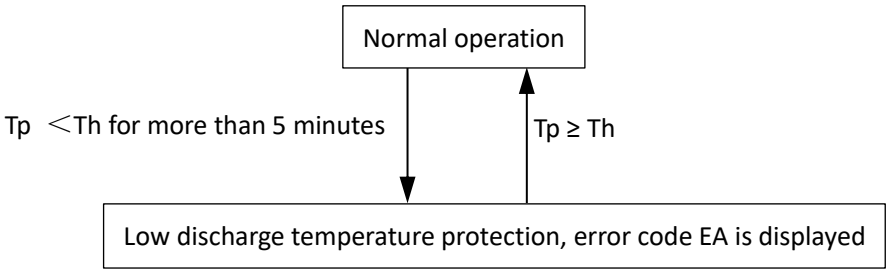
Figure 3-5.3-1: High discharge temperature protection control



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When the discharge temperature rises above 239°F(115°C) the system displays P4 protection and the unit stops running. When the discharge temperature drops below 203°F(95°C), the compressor enters re-start control.

Figure 3-5.4-2: Low discharge temperature protection control



When the discharge temperature is lower than suction temperature for more than 5 minutes, the system displays EA protection and the unit stops running. When the discharge temperature is higher than suction temperature, the compressor enters re-start control.

5.4 Compressor Current Protection Control

This control protects the compressor from abnormally high currents.

Figure 3-5.4: Compressor current protection control

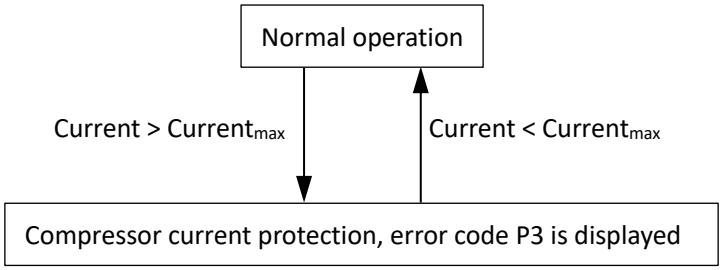


Table 3-5.4: Current limitation for compressors

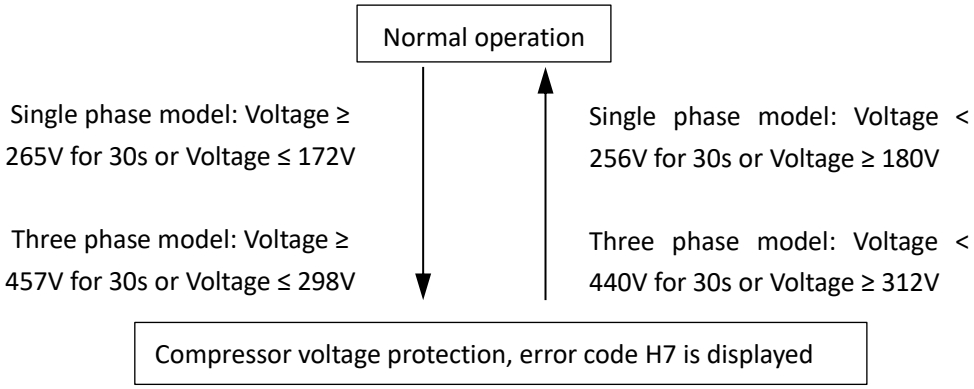
Model name	MHA-V12(14,16)WD2MN8-B2
Current$_{max}$	30A

When the compressor current rises above Current$_{max}$ the system displays P3 protection and the unit stops running. When the compressor current drops below Current$_{max}$, the compressor enters re-start control.

5.5 Voltage Protection Control

This control protects the M thermal Split from abnormally high or abnormally low voltages.

Figure 3-5.5: Compressor voltage protection control



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For single phase models, when the phase voltage of AC power supply is at or above 265V for more than 30 seconds, the system displays H7 protection and the unit stops running. When the phase voltage drops below 265V for more than 30 seconds, the refrigerant system restarts once the compressor re-start delay has elapsed. When the phase voltage is below 172V, the system displays H7 protection and the unit stops running. When the AC voltage rises to more than 180V, the refrigerant system restarts once the compressor re-start delay has elapsed.

For three phase models, when the phase voltage of AC power supply is at or above 457V for more than 30 seconds, the system displays H7 protection and the unit stops running. When the phase voltage drops below 440V for more than 30 seconds, the refrigerant system restarts once the compressor re-start delay has elapsed. When the phase voltage is below 298V, the system displays H7 protection and the unit stops running. When the AC voltage rises to more than 312V, the refrigerant system restarts once the compressor re-start delay has elapsed.

5.6 DC Fan Motor Protection Control

This control protects the DC fan motors from strong winds and abnormal power supply. DC fan motor protection occurs when any one of the following the following three sets of conditions are met:

- Outdoor ambient temperature is at or above 39.2°F(4°C) and actual fan speed differs from target fan speed by 200rpm or more for more than 3 minutes.
- Outdoor ambient temperature is below 39.2°F(4°C) and actual fan speed differs from target fan speed by 300rpm or more for more than 3 minutes.
- Actual fan speed is less than 150rpm for more than 90 seconds.

When DC fan motor protection control occurs the system displays the H6 error code and the unit stops running. After 3 minutes, the unit restarts automatically. When H6 protection occurs 10 times in 120 minutes, the HH error is displayed. When an HH error occurs, a manual system restart is required before the system can resume operation.

5.7 Water Side Heat Exchanger Anti-freeze Protection Control

This control protects the water side heat exchanger from ice formation.

In cooling mode, if inlet water temperature or leaving water temperature or auxiliary heat source leaving water temperature is below 39.2°F(4°C), heat pump stops and water pump keeps running for 30min. If water temperature is still below 39.2°F(4°C), heat pump turns to heating mode.

In heating/DHW standby mode, if ambient temperature is below 37.4°F(3°C) and inlet water temperature or leaving water temperature or auxiliary heat source leaving water temperature is below 41°F(5°C), heat pump stops and water pump keeps running for 30min. If ambient temperature is still below 37.4°F(43°C) and water temperature is still below 41°F(5°C), heat pump turns to heating mode.

In heating/DHW standby mode, if leaving water temperature is below 35.6°F(2°C), heat pump stops and water pump keeps running for 30min. If water temperature is still below 35.6°F(2°C) heat pump turns to heating mode to protect from anti-freezing.

When water side heat exchanger anti-freeze protection occurs the system displays error code Pb and the unit stops running.

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6 Special Control

6.1 Oil Return Operation

In order to prevent the compressor from running out of oil, the oil return operation is conducted to recover oil that has flowed out of the compressor and into the refrigerant piping.

The oil return operation starts when the following condition occurs:

- When the compressor cumulative operating time reaches 6 hours.

The oil return operation ceases when any one of the following three conditions occurs:

- Oil return operation duration reaches 5 minutes.
- Compressor stops.

Tables 3-6.1-1 show component control during oil return operation in cooling mode.

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Runs at oil return operation rotation speed
DC fan motor	FAN	●	Controlled according to cooling mode
Electronic expansion valve	EXV	●	304 (steps)
Four-way valve	4-WAY	●	Off

Tables 3-6.1-2 show component control during oil return operation in heating and DHW modes.

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Runs at oil return operation rotation speed
DC fan motor	FAN	●	Controlled according to heating mode
Electronic expansion valve	EXV	●	304 (steps)
Four-way valve	4-WAY	●	On

6.2 Defrosting Operation

In order to recover heating capacity, the defrosting operation is conducted when the outdoor unit air side heat exchanger is performing as a condenser. The defrosting operation is controlled according to outdoor ambient temperature, air side heat exchanger refrigerant outlet temperature and the compressor running time.

Table 3-6.2: Component control during defrosting operation

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Runs at defrosting operation rotation speed
DC fan motor	FAN	●	Off
Electronic expansion valve	EXV	●	480 (steps)
Four-way valve	4-WAY	●	Off

6.3 Force Cooling Operation

The force cooling operation helps the refrigerant recovering before removal the water side heat exchanger.

The force cool mode can be ended by pushing the button on the outdoor refrigerant system main PCB named “FORCE” for 5s or this mode will be ended automatic if the system has operated force cool mode for more than 30 minutes.

Table 3-6.3: Component control during force cool operation

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	●	Runs at force cooling operation rotation speed
DC fan motor	FAN	●	Runs at force cooling operation speed
Electronic expansion valve	EXV	●	304 (steps)
Four-way valve	4-WAY	●	Off

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6.4 Fast DHW Operation

Fast DHW operation is used to quickly meet a requirement for domestic hot water when DHW priority has been set on the user interface.

Domestic hot water demand priority can be ended by changing the switch on controller from "on" to "off".

Table 3-6.4: Component control during fast DHW operation

Component	Wiring diagram label	12-16kW	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement
DC fan motor	FAN	•	Controlled according to outdoor heat exchanger pipe temperature
Electronic expansion valve	EXV	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge superheat
Four-way valve	ST	•	On
Tank electric heater	TBH	•	On

6.5 Two zones control[1]

Two zones control function is used to control temperature of each zone separately, thus different type radiator will operate at its optimal temperature and water pump cycle time will be reduced to save energy.

- Cooling mode

In two zones control for cooling mode, when the setting temperature of a certain zones is reached, the zone and water pump of this zone will turn off.

- Heating mode

In two zones control for heating mode, the on/off control of zone and water pump is same with cooling mode, but in addition, the mixing valve (3-way valve SV3) control function will be activated to adjust the water temperature of the low temperature zone by control the opening time and closing time of the valve. The mixing valve will only turn on when two zones control for heating is activated. On other conditions, the mixing valve will keep off. When the valve initially turns on, the opening time and closing time is same and then the time is controlled according to the difference between water pipe temperature and setting water temperature of the controlling zone.

- Hydraulic adapter PCB (Optional)

With the help of hydraulic adapter PCB, totally 8 thermostats can be used at the same time for maximum 8 rooms to control heat pump.

Note:

1. M thermal units just have the controlling function, while the mixing valve, water pump of each zone need to be field supplied and connect to M thermal unit.

6.6 Smart grid control

Unit adjusts the operation according to different electrical signals to realize energy saving.

Free electric energy signal: DHW mode turn on, the setting temperature will be changed to 158°F(70°C) automatically, and the TBH operate as below: T5<149°F(65°C), the TBH is on. T5≥ 158°F(70°C), the TBH is off. The unit operates in cooling/heating mode as the normal logic.

Common electric energy signal: unit operates according to users' need.

Expensive electric energy signal: only available for cooling or heating mode and user can set the maximum operating time.

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6.7 Balance tank temperature control

Balance tank temperature sensor is used to control on/off of heat pump.

Once the heat pump stops, internal pump stops to save energy and then balance tank provides hot water for space heating. In addition, balance tank temperature control can meet both space heating and domestic hot water needs at the same time. Balance tank can store energy to provide hot water whilst heat pump runs heat mode/cooling, which can reduce the host selection and the initial investment.

6.8 USB data transfer

- Convenient program upgrade

No need to carry any other heavy equipment but only USB can realize program upgrade of indoor unit and outdoor unit.

- Parameter setting transmission between wired controllers

Installer can quickly copy the setting from one controller to another via USB, which save the time of on-site installation.

6.9 Dry contract M1M2 control

M1M2 can be set in the wired controller for heat pump on/off control, TBH control, AHS control.

- For heat pump on/off control

  When dry contract closes for 1s, heat pump stops. When dry contract opens for 5s, heat pump on/off according to wired controller or room thermostat setting.

- For TBH control

  TBH is only controlled by M1M2. If dry contract closes, T5<149°F(65°C) then TBH opens until water tank temperature reaches 158°F(70°C).

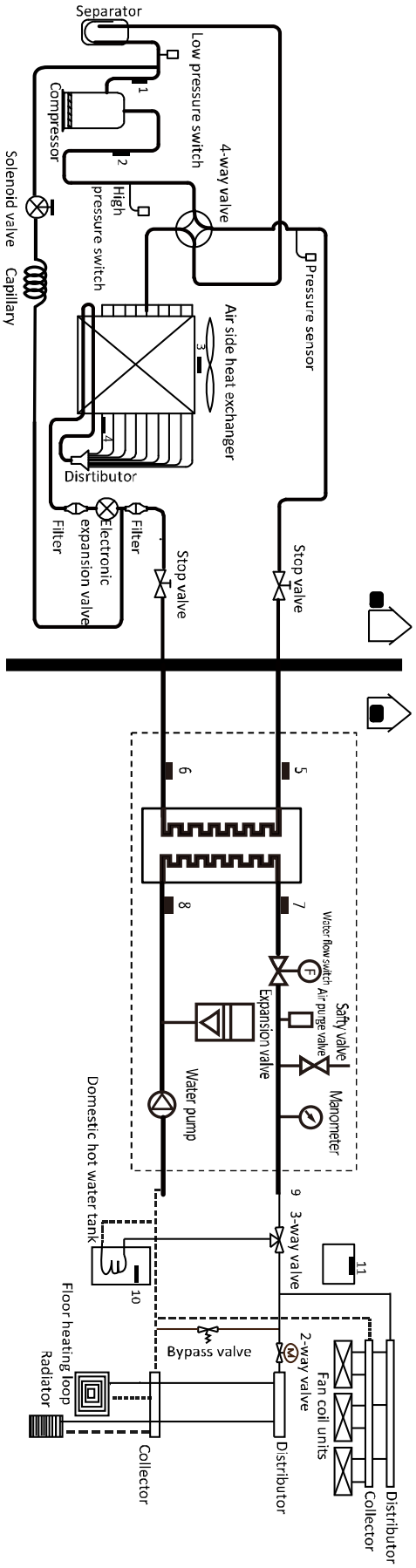
- For AHS control

  In heating mode, AHS on/off is only controlled by M1M2. In DHW mode, M1M2 control does not affect AHS on/off.

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7 Role of Temperature Sensors in Control Functions

Figure 3-7.1: Location of the temperature sensors on M thermal Split systems



Notes:

1. The names and functions of the temperature sensors labelled 1 to 11 in this figure are detailed in Table 3-7.1.

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Table 3-7.1: Names of the temperature sensors

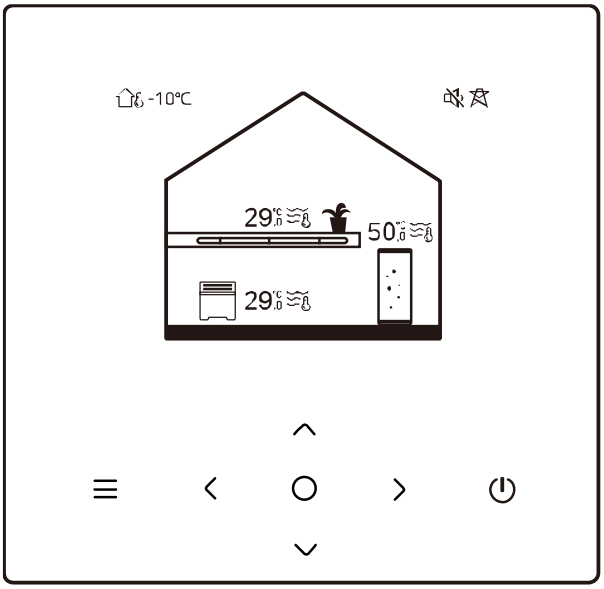
Number	Sensor name	Sensor code
1	Suction pipe temperature sensor	Th
2	Discharge pipe temperature sensor	Tp
3	Outdoor ambient temperature sensor	T4
4	Air side heat exchanger refrigerant outlet temperature sensor	T3
5	Water side heat exchanger refrigerant outlet (gas pipe) temperature sensor	T2B
6	Water side heat exchanger refrigerant outlet (liquid pipe) temperature sensor	T2
7	Water side heat exchanger water outlet temperature sensor	Tw_out
8	Water side heat exchanger water inlet temperature sensor	Tw_in
9	Final water outlet temperature sensor	T1
10	Domestic hot water tank temperature sensor	T5
11	Room temperature sensor (built in wired controller)	Ta

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8 User Interface Field Settings

8.1 Introduction

During installation, the parameters setting should be configured by the installer to suit the installation configuration, climate conditions and end-user preferences. The relevant settings are accessible and programmable through the FOR **SERVICEMAN** menu on the user interface. The user interface menus and settings can be navigated using the touch-sensitive keys.



Icon	Name	Function
≡	Menu	Press to access the menu page (from the home page) Return to the previous page (from a page other than the home page)
	Return	Hold for 2 seconds to return to the main page.
○	Confirm	Confirm a selection Save settings Access the next page
⏻	ON/OFF	Turn on/off zone 1/zone 2/DHW Press and hold for 3 seconds to turn on/off zone 1 / zone 2 / DHW
‹ ^ › v	Navigation	Press to navigate the cursor to adjust settings (holding it for 1 second can start quick adjustment)

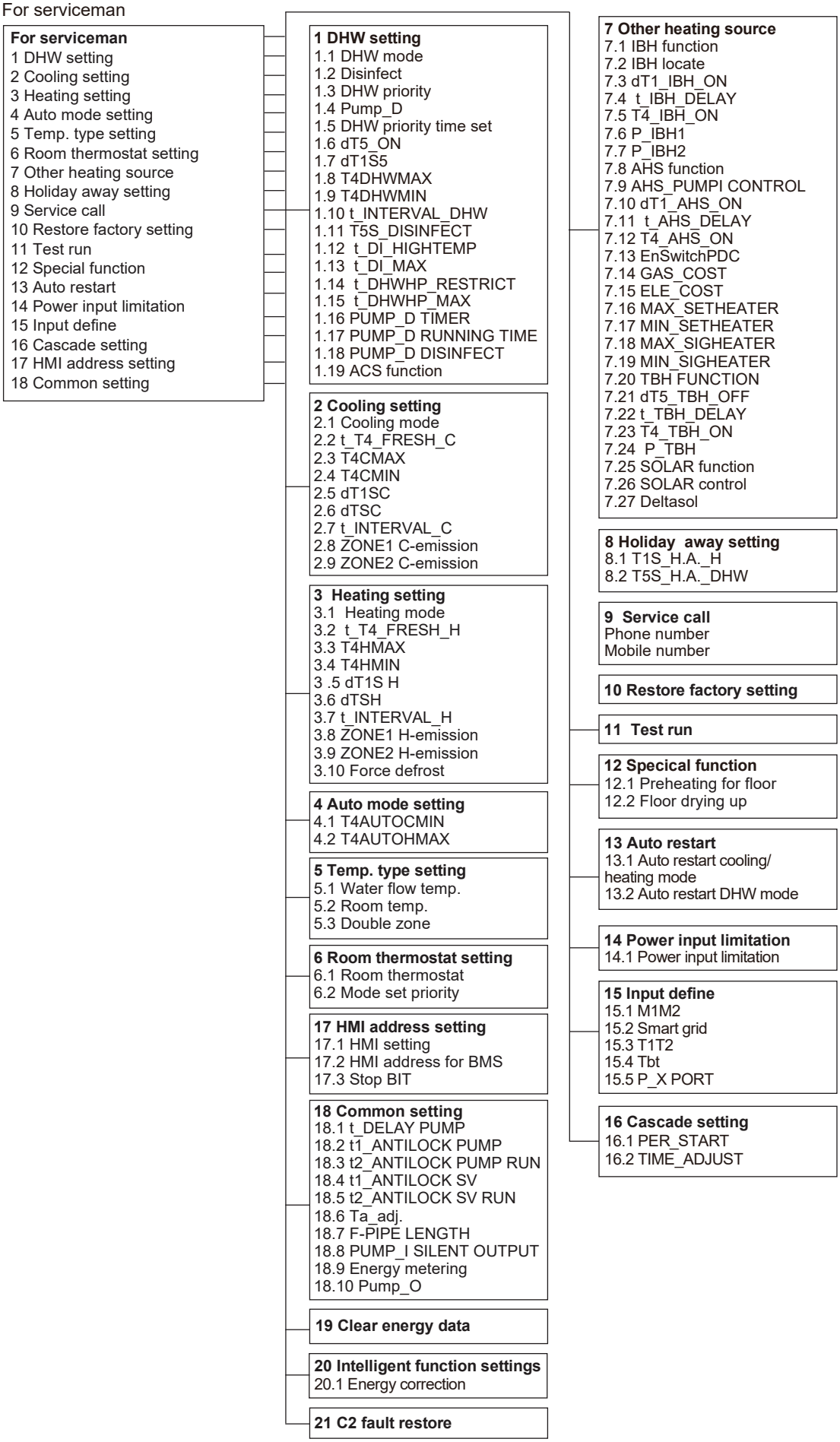
Combinations of buttons：

Press ≡ and › simultaneously for 3 seconds to enter the **FOR SERVICEMAN** menu.

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8.2 Menu Structure

For serviceman



There are some items that are invisible if the function is disabled or unavailable.

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8.3 FOR SERVICEMAN Menu

For serviceman allows installers to input the system configuration and set the system parameters.

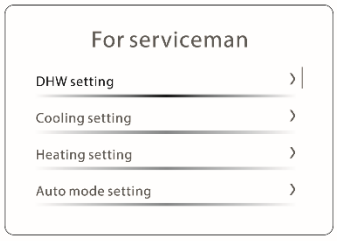
Press ≡ and › simultaneously for 3 seconds to enter the authorization page.

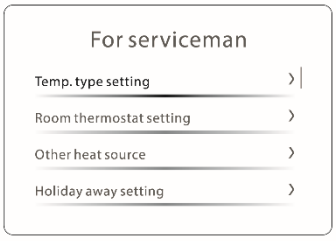


Press ‹ › to navigate cursor and press ◇ to adjust the numerical values. The password is 234. Press ○ to enter **For serviceman** menu.

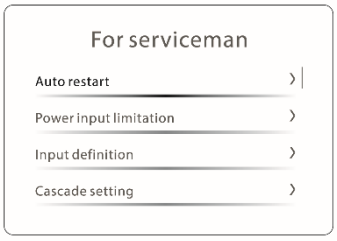


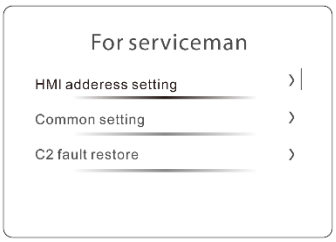
Then the following pages will be displayed:





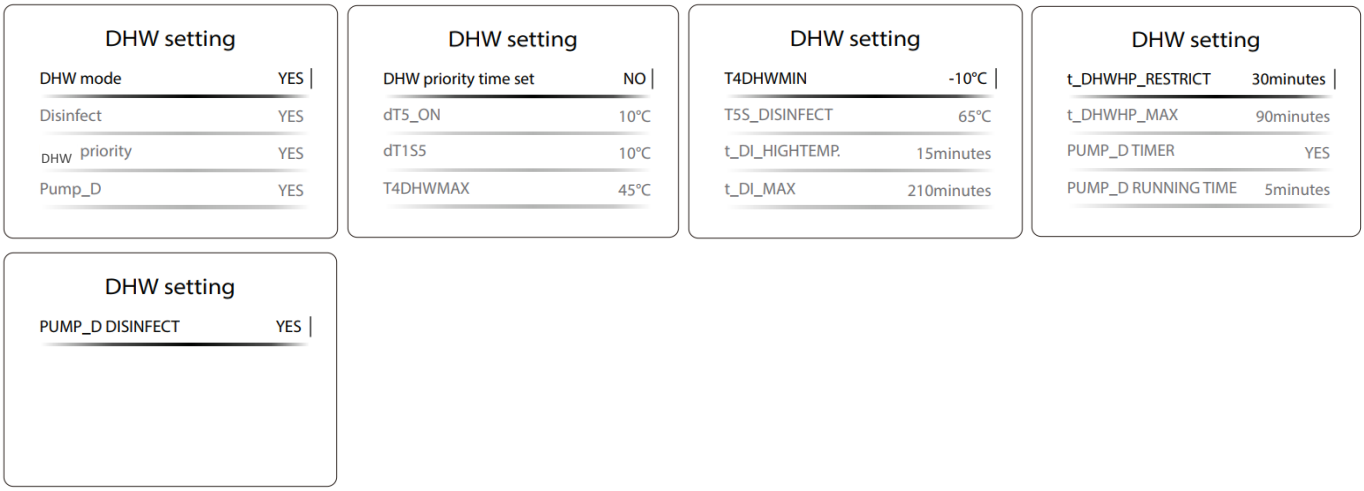






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8.3.1 DHW heating setting



8.3.1.1 DHW mode

DHW mode defines whether hot water demand is needed.

Setting	Description
YES	Enable DHW mode if DHW tank is installed.
NO	Disable DHW mode if DHW tank is not installed. In this case, no need to define other settings in **DHW setting,** all other settings in DHW setting will be invisible.

8.3.1.2 Disinfect, T5S_DISINFECT, t_DI_HIGHTEMP, t_DI_MAX

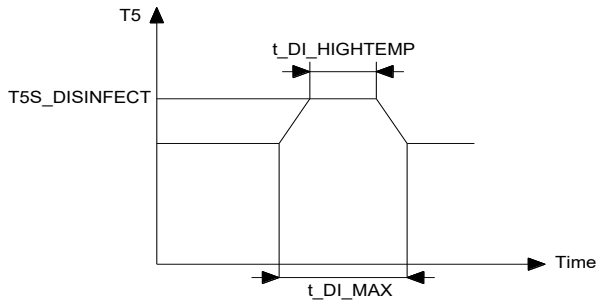
Disinfect defines whether disinfection function is activated.

Setting	Description
YES	Enable DHW tank disinfection function.
NO	Disable DHW tank disinfection function.

T5S_DISINFECT defines the target water temperature of water tank for disinfection function.

t_DI_HIGHTEMP defines Period that disinfection water target temperature maintains.

t_DI_MAX defines duration of disinfection mode.



Abbreviations:

T5: DHW tank water temperature

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8.3.1.3 DHW priority, DHW priority time set, t_DHWHP_RESTRICT, t_DHWHP_MAX

DHW priority defines whether domestic hot water or space heating/cooling takes priority.

Setting	Description
YES	When DHW demand and space heating/cooling demand both exist, heat pump will heat the water according to the setting of **DHW priority time set, t_DHWHP_RESTRICT, t_DHWHP_MAX**
NO	When DHW demand and space heating/cooling demand both exist, heat pump will heat the water after space heating/cooling demand is satisfied.

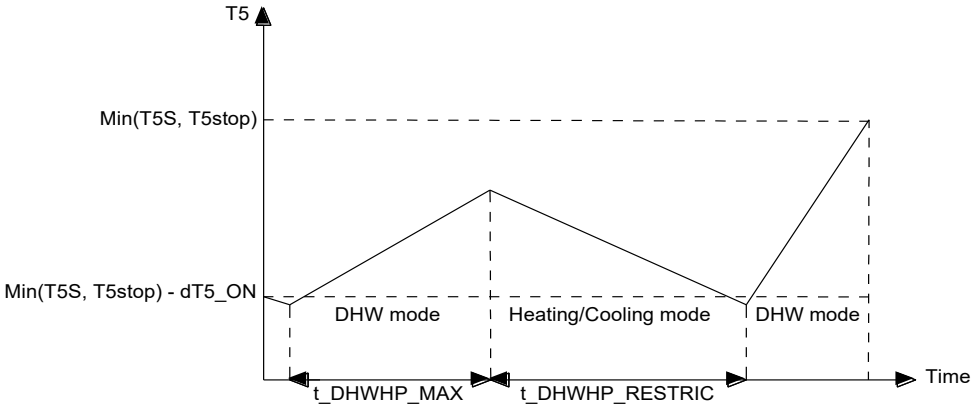
DHW priority time set defines whether **t_DHWHP_RESTRICT** (the_operation time of heating/cooling mode) is to be considered before switching to DHW mode and whether **t_DHWHP_MAX** (the operation time of DHW mode) is to be considered before switching to heating/cooling mode.

Setting	Description
YES	Enable the setting of **t_DHWHP_RESTRICT, t_DHWHP_MAX**
NO	Disable the setting of **t_DHWHP_RESTRICT, t_DHWHP_MAX**

t_DHWHP_RESTRICT defines the period that heat pump runs in space heating/cooling mode before switching to DHW mode if DHW requirement exists.

t_DHWHP_MAX defines the period that heat pump runs in DHW mode before switching to space heating/cooling mode if space heating/cooling requirement exists.

Diagram below illustrates the effects of **t_DHWHP_MAX** and **t_DHWHP_RESTRICT** when **DHW PRIORITY** and **DHW priority time set** are enabled.



Abbreviations:
T5: DHW tank water temperature
T5S: DHW tank set temperature
T5stop: Leaving water temperature operating limit of DHW mode

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DHW PRIORITY	DHW PRIORITY TIME SET	t_DHWHP _RESTRICT	t_DHWHP _MAX	Heating/Cooling turns to DHW	DHW turns to Heating/Cooling
YES	YES	A min	B min	&& DHW mode ON && T5<MIN(T5S, T5STOP)-dT5_ON && Heating/Cooling mode operates for A mins	|| DHW mode OFF || T5≥MIN(T5S, T5STOP) || DHW mode operates for B mins && Heating/Cooling mode ON
YES	NO	-	-	&& DHW mode ON && T5<MIN (T5S, T5STOP)-dT5_ON	|| DHW mode OFF || T5≥MIN(T5S, T5STOP) && Heating/Cooling mode ON
NO	-	-	-	&& DHW mode ON && T5<MIN(T5S, T5STOP)-1 &&Heating/Cooling mode OFF	Heating/Cooling mode ON

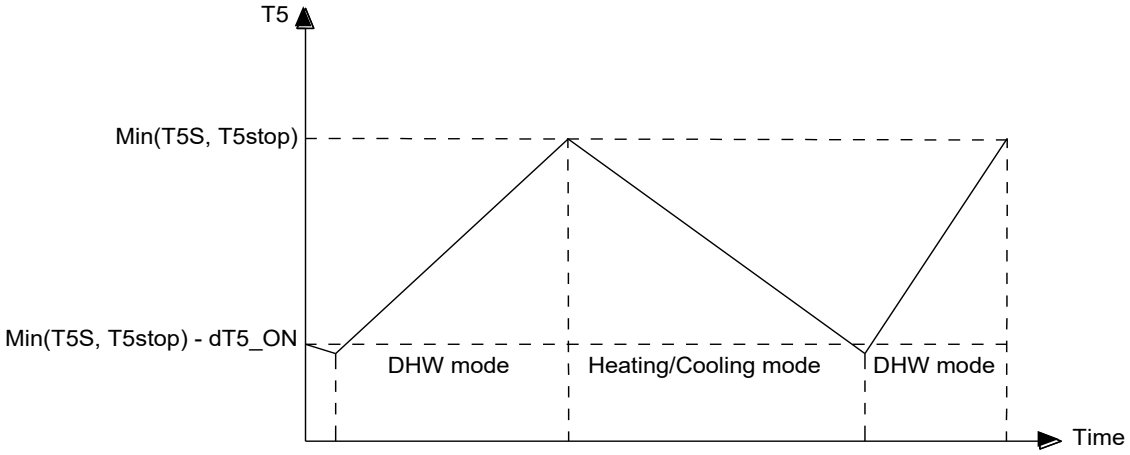
Note：

The content following "&&" and "II" in the table are judgment conditions.

The conditions following "&&" represent "AND logic," meaning that both conditions need to be met simultaneously.

The conditions following "II" represent "OR logic," meaning that only one of the conditions needs to be met.

Diagram below illustrates the effects when **DHW priority time set** is disabled.



Abbreviations:

T5: DHW tank water temperature

T5S: DHW tank set temperature

T5stop: Leaving water temperature operating limit of DHW mode

8.3.1.4 Pump_D, PUMP_D TIMER, PUMP_D RUNNING TIME, PUMP_D DISINFECT

DHW pump **(Pump_D)** is installed to circulate the water in the DHW pipe network.

Setting	Description
YES	Installation with DHW pump.
NO	Installation without DHW pump.

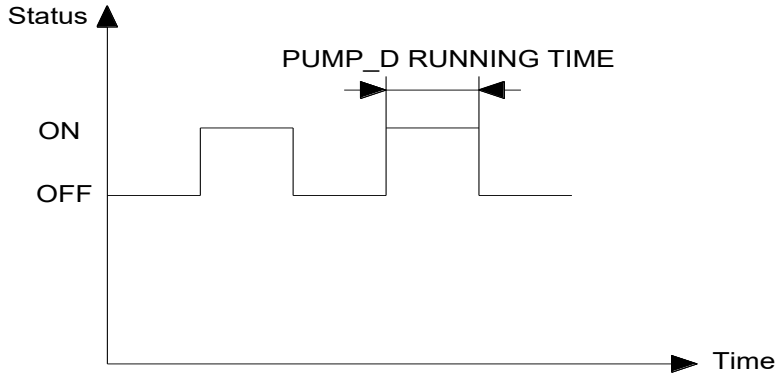
PUMP_D TIMER defines whether DHW pump operation schedule which is defined in the user menu is activated.

Setting	Description
YES	Enable DHW pump run in timer.
NO	Disable DHW pump run in timer.

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PUMP_D RUNNING TIME defines the period that DHW pump operates for each timer

Diagram below illustrates the effects of **PUMP_D RUNNING TIME** when **Pump_D** is installed and **PUMP_D TIMER** is enable.



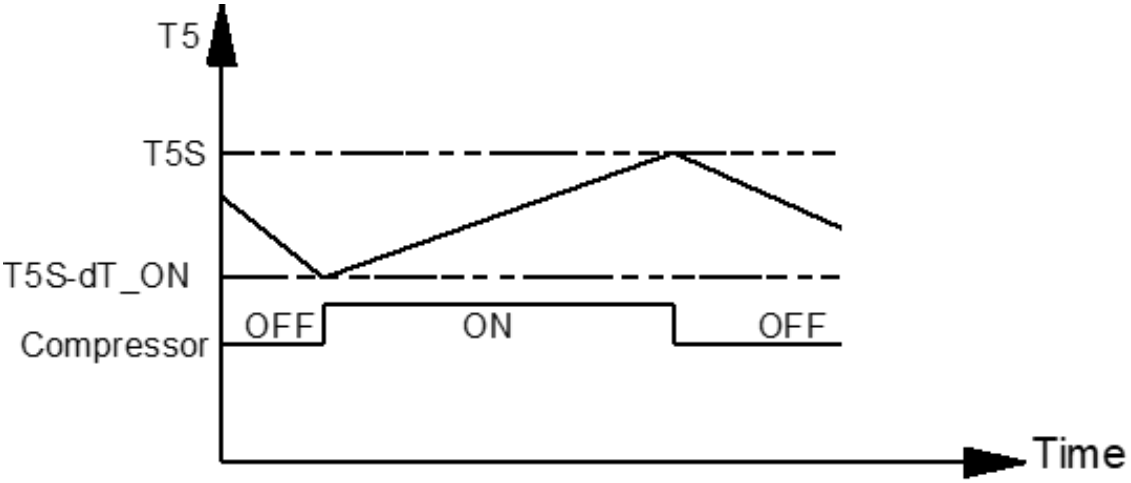
PUMP_D DISINFECT defines whether DHW pump operation is activated in disinfection mode.

Setting	Description
YES	When heat pump is in disinfection mode and T5S_DISINFECT - T5≤2, DHW pump operates **PUMP_D RUNNING TIME**+5 minutes T5S_DISINFECT: DHW tank disinfection set temperature T5S: DHW tank set temperature
NO	Disable the DHW pump operates when heat pump is in disinfection mode

8.3.1.5 dT5_ON

dT5_ON defines water temperature hysteresis of activating heat pump.

When T5S - T5 ≥ dT5_ON and heat pump is within operating ambient temperature range, heat pump provides hot water to the DHW tank.



Abbreviations:
T5: DHW tank water temperature
T5S: DHW set temperature

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8.3.1.6 dT1S5

Leaving water set temperature(T1S) for DHW mode is calculated by formula: T1S = T5 + △dT1S5 + dT1S5

T1S: Leaving water set temperature

T5: DHW tank water temperature

△dT1S5: Temperature modification value related to DHW tank water temperature(T5)

T5	T5<30°C	30°C≤T5<43°C	43°C≤T5
△dT1S5	**6**	**4**	**0**

dT1S5: Temperature difference between leaving water set temperature and tank water temperature modification value.

8.3.1.7 T4DHWMAX, T4DHWMIN

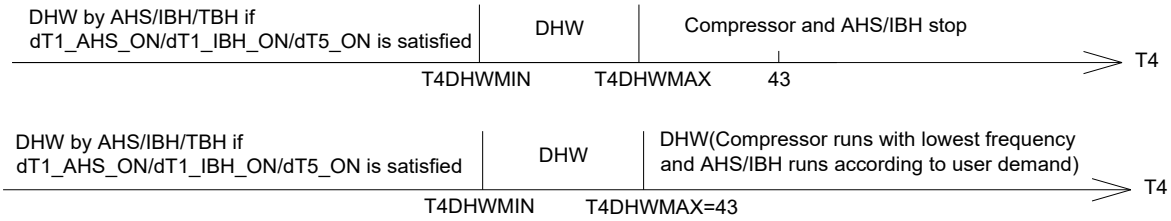
T4DHWMAX defines the ambient temperature above which heat pump and AHS/IBH may have different actions.

When T4DHWMAX≤T4 and T4DHWMAX<43, both compressor and AHS/IBH stop running.

When T4HMAX≤T4 and T4DHWMAX=43, compressor runs with lowest frequency and AHS/IBH runs according to user demand.

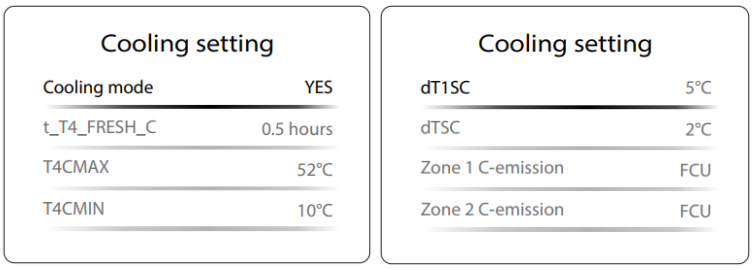
T4DHWMIN defines the ambient temperature below which heat pump stops, while AHS/IBH/TBH can run if dT1_AHS_ON/dT1_IBH_ON/dT5_ON is satisfied.

Diagram below illustrates the effects of **T4DHWMAX** and **T4DHWMIN.**



Abbreviations:
HP: Heat pump
TBH: DHW tank immersion heater
AHS: Auxiliary heating source
IBH: Electric heater

8.3.2 Cooling setting



8.3.2.1 Cooling mode

Cooling mode defines whether space cooling demand is needed.

Setting	Description
YES	Enable cooling mode if space cooling terminals are installed.
NO	Disable cooling mode if space cooling terminals are not installed. In this case, no need to define other settings in **Cooling mode**.

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8.3.2.2 t_T4_FRESH_C

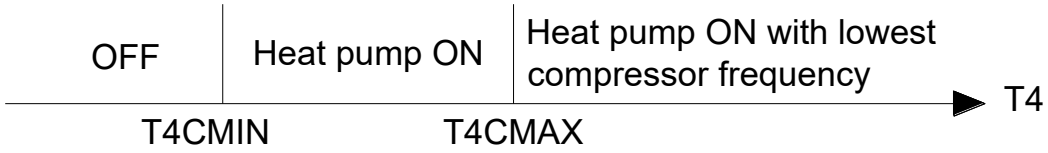
t_T4_FRESH_C defines the refresh cycle of detecting ambient temperature for climate curve.

8.3.2.3 T4CMAX, T4CMIN

T4CMAX defines ambient temperature above which heat pump operates with lowest compressor frequency.

T4CMIN defines ambient temperature below which heat pump not operates.

Diagram below illustrates the effects of **T4CMAX** and **T4CMIN.**



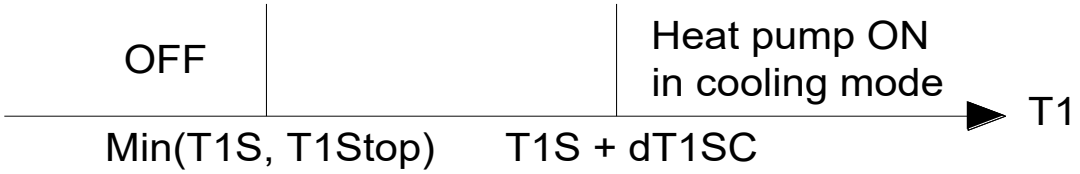
Abreviations:

T4: Outdoor ambient temperature

8.3.2.4 dT1SC

dT1SC defines water temperature hysteresis of activating heat pump.

When T1 – T1S ≥ dT1SC and heat pump is within operating ambient temperature range, heat pump provides chilled water to space cooling terminals.



Abreviations:

T1: Leaving water temperature

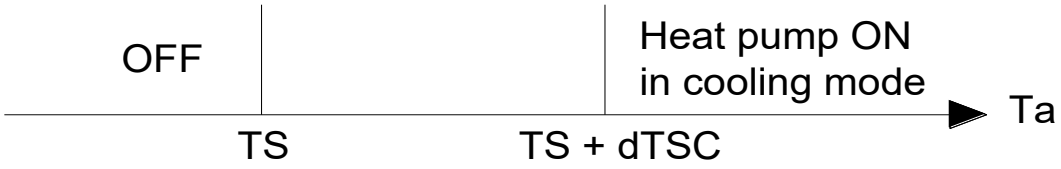
T1S: Leaving water set temperature

T1Stop: Leaving water temperature operating limit of cooling mode

8.3.2.5 dTSC

dTSC define room temperature hysteresis of activating heat pump. **dTSC** is only applicable if **1** is selected for **Room temp.** in the **1.5.3 Temp. type setting**.

When Ta – TS ≥ dTSC and heat pump is within operating ambient temperature range, heat pump provides chilled water to space cooling terminals.



Abreviations:

Ta: Actual room temperature

TS: Room setting temperature

8.3.2.6 Zone 1 C-emission, Zone 2 C-emission

Zone 1 C-emission defines the terminal type of zone 1.

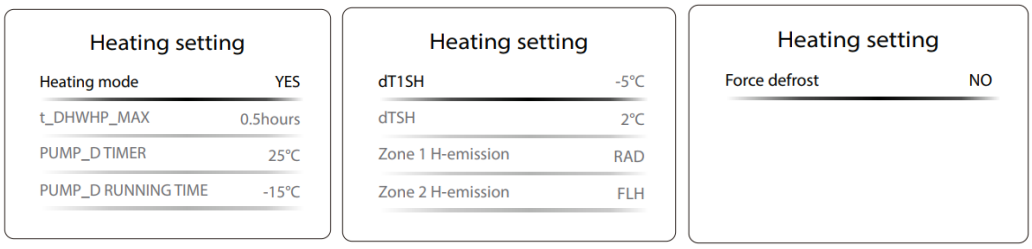
Setting	Description
FCU	Fan coil unit
FLH	Floor heating loop
RAD	Radiator

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Zone 2 C-emission defines the terminal type of zone 2.

Setting	Description
FCU	Fan coil unit
FLH	Floor heating loop
RAD	Radiator

8.3.3 Heating setting



8.3.3.1 Heating mode

Heating mode defines whether space heating demand is needed.

Setting	Description
YES	Enable heating mode if space heating terminals are installed.
NO	Disable heating mode if space heating terminals are not installed. In this case, no need to define other settings in **Heating mode,** all other settings in Heating mode will be invisible.

8.3.3.2 t_T4_FRESH_H

t_T4_FRESH_H defines the refresh time of heating mode climate temperature curve.

8.3.3.3 T4HMAX, T4HMIN

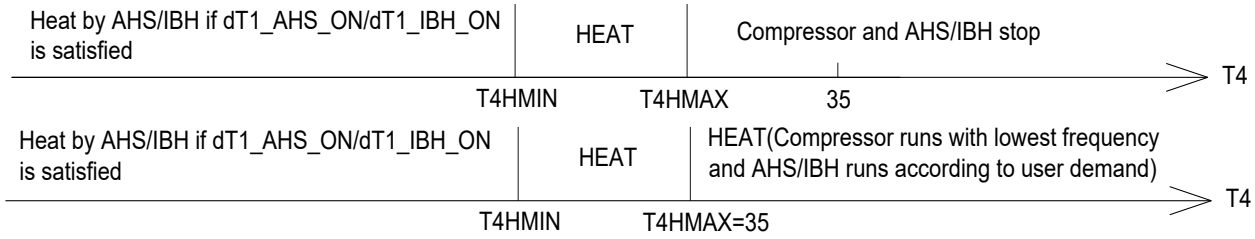
T4HMAX defines the ambient temperature above which heat pump and AHS/IBH may have different actions.

When T4HMAX≤T4 and T4HMAX<35, both compressor and AHS/IBH stop running.

When T4HMAX≤T4 and T4HMAX=35, compressor runs at lowest frequency and AHS/IBH runs according to user demand.

T4HMIN defines the ambient temperature below which heat pump stops, while AHS/IBH can run if dH1_AHS_ON/dT1_IBH_ON is satisfied.

Diagram below illustrates the effects of **T4HMAX** and **T4HMIN.**



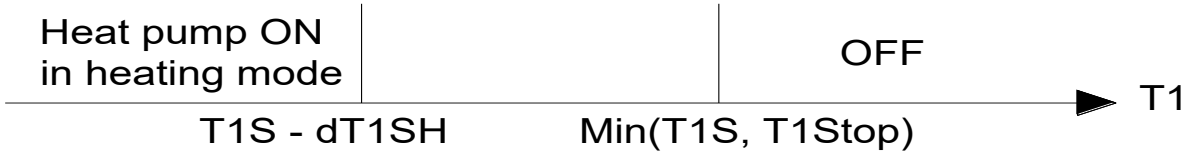
Abreviations:
T4: Outdoor ambient temperature
AHS: Additional heating source
IBH: Internal backup heater

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8.3.3.4 dT1SH

dT1SH defines water temperature hysteresis of activating heat pump.

When T1≤T1S - dT1SH and heat pump is within operating ambient temperature range, heat pump provides hot water to the space heating terminals.



Abreviations:
T1: Leaving water temperature
T1S: Leaving water set temperature
T1Stop: Leaving water temperature operating limit of cooling mode

8.3.3.5 dTSH

dTSH defines room temperature hysteresis of activating heat pump. **dTSH** is only applicable if **1** is selected for **Room temp.** in the **Temp. type setting**.

When TS – Ta ≥ dTSH and heat pump is within operating ambient temperature range, heat pump provides hot water to the space heating terminals



Abreviations:
Ta: Actual room temperature
TS: Room setting temperature

8.3.3.6 Zone 1 H-emission, Zone 2 H-emission

Zone 1 H-emission defines the terminal type of zone 1.

Setting	Description
FCU	Fan coil unit
FLH	Floor heating loop
RAD	Radiator

Zone 2 H-emission defines the terminal type of zone 2.

Setting	Description
FCU	Fan coil unit
FLH	Floor heating loop
RAD	Radiator

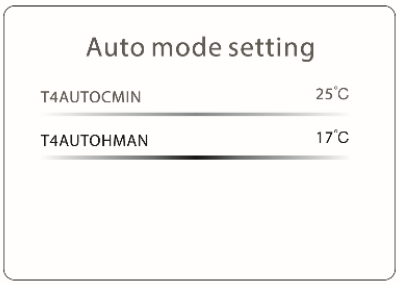
8.3.3.7 Force defrost

Force defrost enable heat pump enters defrost mode by manual operation when heat pump runs for 10min and air side heat exchanger outlet temperature T3<0°C (32°F) lasts for more than 6min.

Setting	Description
YES	Disable **Force defrost** function
NO	Enable **Force defrost** function

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8.3.4 Auto mode setting

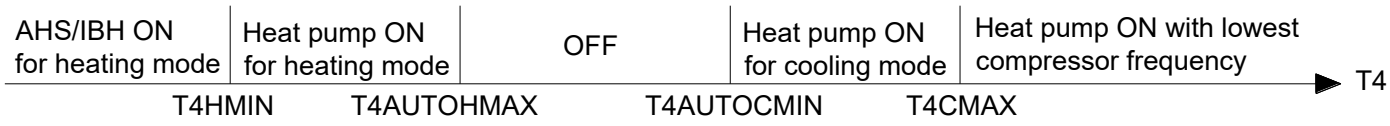


8.3.4.1 T4AUTOCMIN, T4AUTOHMAX

T4AUTOCMIN defines the ambient temperature below which the heat pump will not provide chilled water for space cooling in auto mode.

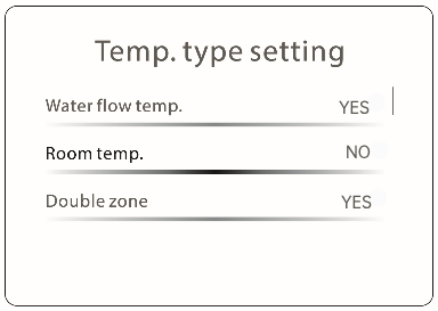
T4AUTOHMAX defines the ambient temperature above which the heat pump will not provide hot water for space heating in auto mode.

Diagram below illustrates the effects of **T4AUTOCMIN**, **T4AUTOHMAX, T4CMAX and T4HMIN.**

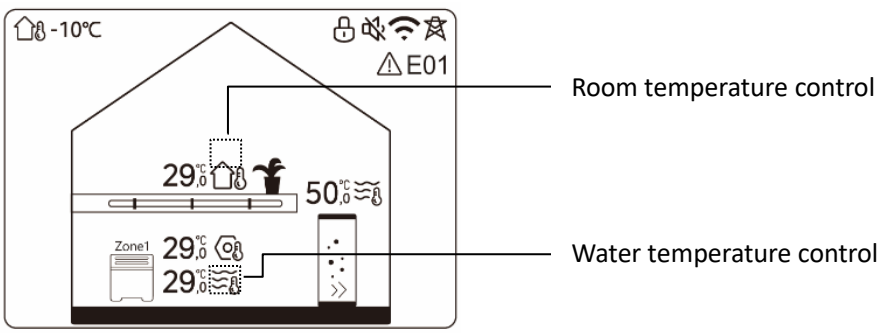


Abreviations:
AHS: Additional heating source
IBH: Backup electric heater
T4CMAX: The ambient temperature above which heat pump operates with lowest compressor frequency.
T4HMIN: The ambient temperature below which the heat pump will not operate in heating mode.

8.3.5 Temp. type setting



The TEMP. TYPE SETTING is used for selecting whether the water flow temperature or room temperature is used to control the ON/OFF of the heat pump. In this case, **8.3.6 Room thermostat setting** should be defined as 0.



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8.3.5.1 Water flow temp.

Water flow temp. defines whether heat pump is controlled by leaving water temperature.

Setting	Description
YES	Heat pump is controlled by leaving water temperature.
NO	Heat pump is not controlled by leaving water temperature.

8.3.5.2 Room temp.

Room temp. defines whether heat pump is controlled by room temperature detected by the temperature sensor inside the wired controller.

Setting	Description
YES	Heat pump is controlled by room temperature no matter what is the setting of **8.3.5.1 Water flow temp.** In this case, the target water flow temperature will be calculated from climate curves.
NO	Heat pump is not controlled by room temperature.

8.3.5.3 Double zone

Double zone defines the number of zones.

Setting	Description
YES	Double zones control
NO	Single zone control

Figure below illustrates the effects of different combinations in **Temp. type setting.**

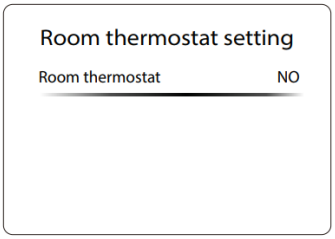
For single zone control

WATER FLOW TEMP.	ROOM TEMP.	DOUBLE ZONE	Zones control
YES	NO	NO	Zone 1: Water temperature control
NO	YES	NO	Zone 1: Room temperature control

For double zone control

WATER FLOW TEMP.	ROOM TEMP.	DOUBLE ZONE	Zones control
YES	YES	YES	Zone 1: Water temperature control
			Zone 2: Room temperature control
YES	NO	YES	Zone 1: Water temperature control
			Zone 2: Water temperature control

8.3.6 Room thermostat setting

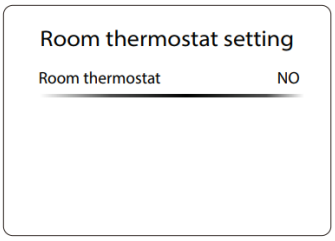


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Room thermostat can be as an alternative solution to control heat pump.

Setting	Description	Wired controller is used to
NO	• NON • Without room thermostats	• Control heat pump ON/OFF • Define water temperature • Define mode (heating/cooling/auto mode)
MODE SET	• MODE SET • Room thermostat provides separate heating/cooling switch signal to control heat pump ON/OFF • One zone control • All timers are invalid except DHW timers.	• Define water temperature
ONE ZONE	• ONE ZONE • Room thermostat provides switch signal to control heat pump ON/OFF • One zone control • All timers are invalid except DHW timers.	• Define water temperature • Define mode (heating/cooling mode)
DOUBLE ZONE	• DOUBLE ZONE • Room thermostat provides switch signal to control heat pump ON/OFF • Double zones control • All timers are invalid except DHW timers.	• Define water temperature • Define mode (Only for heating mode)

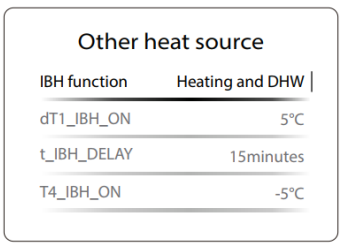
If **Room thermostat setting** is defined as MODE SET, the interface appears:

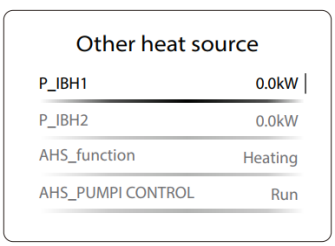


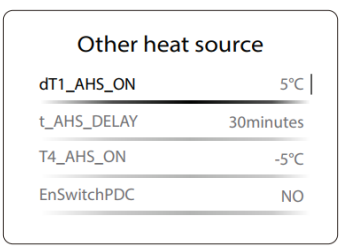
Mode set priority defines whether cooling mode or heating mode takes priority.

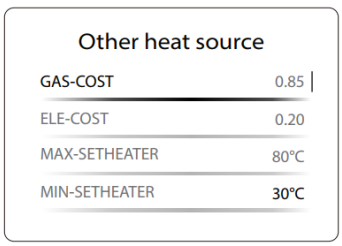
Setting	Description
Heating	When heating and cooling switch signal are closed simultaneously, heat pump runs in heating mode.
Cooling	When heating and cooling switch signal are closed simultaneously, heat pump runs in cooling mode.

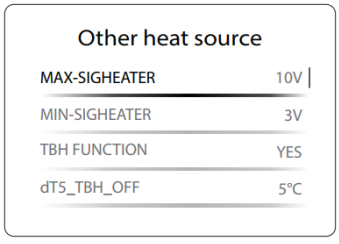
8.3.7 Other Heat Source Menu

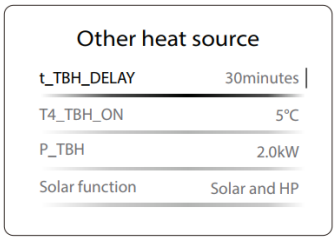


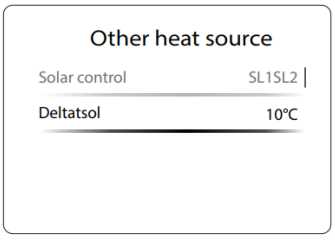












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8.3.7.1 IBH FUNCTION, IBH LOCATE, dT1_IBH_ON, t_IBH_DELAY, T4_IBH_ON, P_IBH1, P_IBH2

IBH FUNCTION defines backup heater function.

Setting	Description
YES	IBH is used for heating mode and DHW mode
NO	IBH is used for heating mode

dT1_IBH_ON defines water temperature hysteresis of activating electric heater. When T1S - T1 ≥ dT1_IBH_ON the backup electric heater is on.

T1S: Heat pump leaving water set temperature

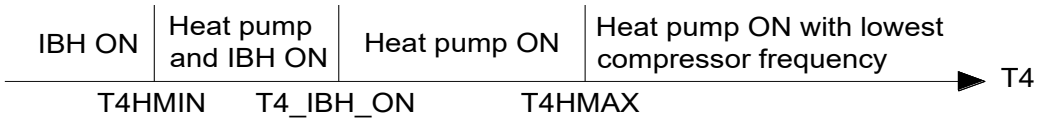
T1: Heat pump leaving water temperature

t_IBH_DELAY defines the delayed start-up time of electric heater. Electric heater will turn on **t_IBH_DELAY** minutes later after compressor starts.

T4_IBH_ON defines the ambient temperature below which the backup electric heater is on.

Note: Only when dT1_IBH_ON, t_IBH_DELAY and T4_IBH_ON are met at the same time then electric heater turns on.

Diagram below illustrates the effects of **T4_IBH_ON, T4HMIN** and **T4HMAX.**



Abreviations:
T4: Outdoor ambient temperature
IBH: Electric heater
T4HMIN: The ambient temperature below which the heat pump will not operate in heating mode.
T4HMAX: The ambient temperature above which the heat pump will operate heating mode with lowest compressor frequency.

P_IBH1 defines heating capacity of IBH1, which is used for energy consumption statistics.

P_IBH2 defines heating capacity of IBH2, which is used for energy consumption statistics.

8.3.7.2 AHS FUNCTION, AHS_PUMP_I CONTROL, dT1_AHS_ON, t_AHS_DELAY, T4_AHS_ON

AHS FUNCTION defines auxiliary heating source function.

Setting	Description
NO	Without Auxiliary heating source
Heating	Auxiliary heating source is used for heating mode
Heating and DHW	Auxiliary heating source is used for heating mode and DHW mode

AHS_PUMP_I CONTROL select the Pump_I operating status when only auxiliary heating source runs.

Setting	Description
RUN	Pump_I runs when auxiliary heating source runs only.
Not run	Pump_I does not run when auxiliary heating source runs only. In this case, please confirm there is an additional pump running for auxiliary heating source.

dT1_AHS_ON defines water temperature hysteresis of activating auxiliary heating source. When T1S - T1 ≥ dT1_AHS_ON the additional heating source is on.

T1S: Heat pump leaving water set temperature

T1: Heat pump leaving water temperature

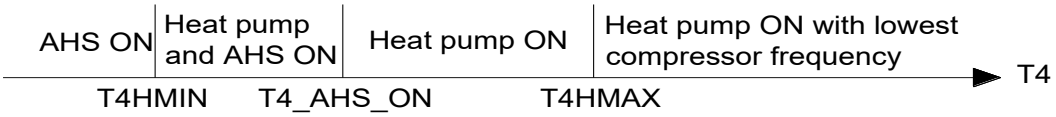
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t_AHS_DELAY defines the delayed start-up time of auxiliary heating source. Auxiliary heating source will turn on **t_AHS_DELAY** minutes later after compressor starts.

T4_AHS_ON defines the ambient temperature below which the auxiliary heating source is on.

Note: Only when dT1_AHS_ON, t_AHS_DELAY and T4_AHS_ON are met at the same time then auxiliary heating source turns on.

Diagram below illustrates the effects of **T4_AHS_ON, T4HMIN** and **T4HMAX.**



Abreviations:
T4: Outdoor ambient temperature
AHS: Auxiliary heating source
T4HMIN: The ambient temperature below which the heat pump will not operate in heating mode.
T4HMAX: The ambient temperature above which the heat pump will operate heating mode with lowest compressor frequency.

8.3.7.3 EnSWITCHPDC, GAS_COST, ELE_COST

EnSWITCHPDC defines whether heat pump and additional heating source switch automatically based on economic performance and system high efficiency.

Setting	Description
NO	Disable EnSWITCHPDC function, **T4_AHS_ON** need to be defined manually. Additional heating source may work with heat pump depends on the water temperature and heat pump status.
YES	Enable EnSWITCHPDC function, **T4_AHS_ON** is calculated according to price of gas and electricity and the efficiency of boiler and heat pump. Only Additional heating source works at ambient temperature of T4_AHS_ON because of the economic performance and system high efficiency.

GAS_COST defines gas price

ELE_COST defines electricity price

8.3.7.4 MAX_SETHEATER, MIN_SETHEATER, MAX_SIGHEATER, MIN_SIGHEATER

When “AHS1” port and “AHS2” port of main control PCB are connected with auxiliary heating source “ON/OFF” signal, auxiliary heating source leaving water temperature automatically change as voltage changes.

MAX_SETHEATER sets the maximum water temperature of auxiliary heating source.

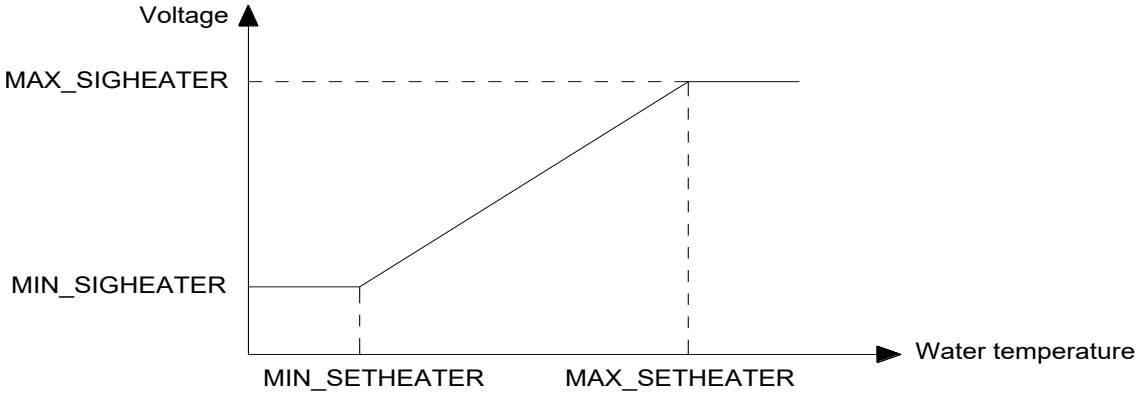
MIN_SETHEATER sets the minimum water temperature of auxiliary heating source.

MAX_SIGHEATER sets the voltage corresponding to the maximum water set temperature of auxiliary heating source.

MIN_SIGHEATER sets the voltage corresponding to the minimum water set temperature of auxiliary heating source.

Diagram below illustrates the effects of **MAX_SETHEATER, MIN_SETHEATER, MAX_SIGHEATER** and **MIN_SIGHEATER.**

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8.3.7.5 TBH FUNCTION, dT5_TBH_OFF, t_TBH_DELAY, T4_TBH_ON, P_TBH

TBH FUNCTION defines whether tank booster heater function is activated.

Setting	Description
YES	Disable tank booster heater function
NO	Enable tank booster heater function

dT5_TBH_OFF defines water temperature hysteresis of inactivating tank booster heater when heat pump malfunctions.

When T5 > Min(T5S+dT5_TBH_OFF, 70°C), the tank booster heater is off.

T5S: Domestic hot water tank set temperature

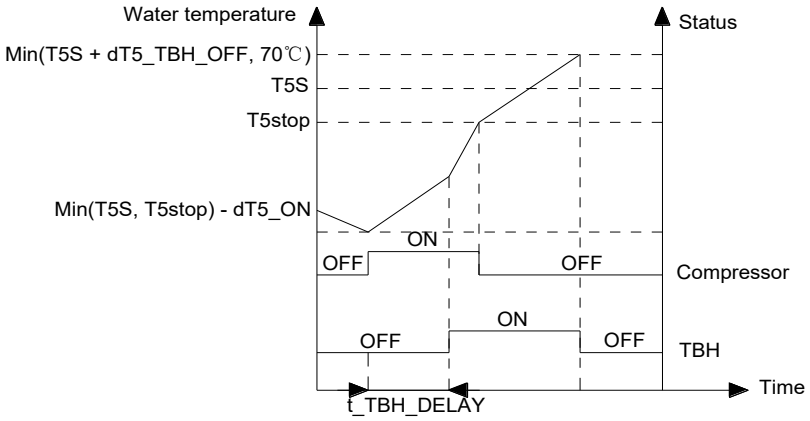
t_TBH_DELAY defines the delayed start-up time of tank booster heater. Tank booster heater will turn on **t_TBH_DELAY** minutes later after compressor starts.

T4_TBH_ON defines the ambient temperature below which the tank booster heater is on.

Note: Only when t_TBH_DELAY, T4_TBH_ON are met at the same time then tank booster heater turns on.

P_TBH defines the power input of tank booster heater.

Diagram below illustrates the operation of heat pump and tank booster heater of DHW mode.



Abbreviations:
T5S: DHW set temperature
T5stop: DHW mode leaving water temperature operating limit
TBH: Immersion heater

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8.3.7.6 Solar function, Solar control, Deltasol

Solar function defines whether the heating system is equipped with solar thermal panel.

Setting	Description
NO	Without solar thermal panel.
Solar and HP	With only solar thermal panel.
Only solar	With solar thermal panel and heat pump.

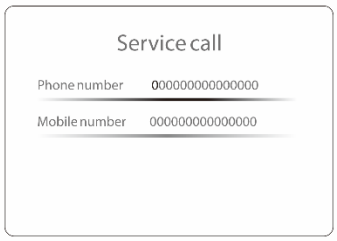
Solar control defines the control type of solar pump

Setting	Description
Tsolar	Solar pump(Pump_S) is controlled by solar temperature sensor
SL1SL2	Solar pump(Pump_S) is controlled by SL1SL2 signal

Deltasol defines temperature hysteresis of activating solar pump(Pump_s).

When Tsolar > T5 + **Deltasol**, T5 < 79°C(174.2°F) and DHW mode is ON, then solar pump activates.

8.3.8 Service call



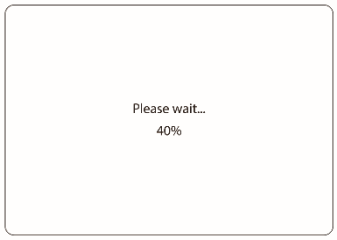
Phone number and **Mobile number** define after-sales service contact numbers. Press ‹ › to navigate cursor and press ^ ˇ to adjust the numerical values. The maximum length of the phone numbers is 13 digits.

8.3.9 Restore factory settings



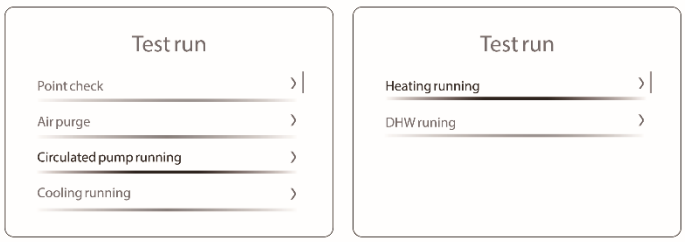
Restore factory settings is used to restore all the parameters (including energy metering data and WLAN setting) set in the user interface to factory defaults.

On selecting YES, the process of restoring all settings to factory defaults begins and progress is displayed as a percentage.



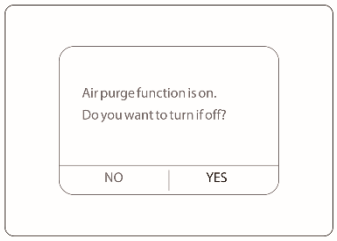
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8.3.10 Test run

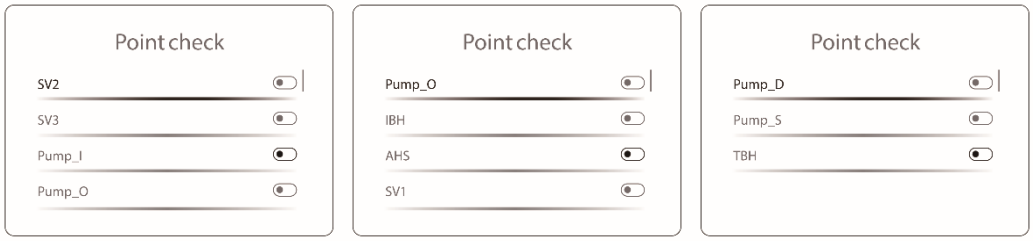


Test run is used to do the point check and check that air purge function, circulation pump, cooling mode, heating mode and DHW mode are all operating correctly. If any error code is displayed during the test run operation, the cause should be investigated.

During test run, all buttons except ○ are invalid. If you want to turn off the test run, please press ○. For example, when the unit is in air purge mode, after you press ○, the following page will be displayed:

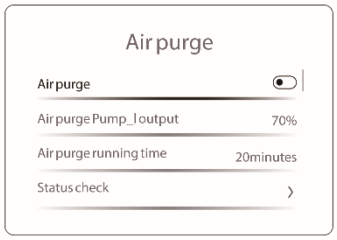


8.3.10.1Point check



The **POINT CHECK** menu is used to check the operation of individual components. Use ∧ ∨ to scroll to the components you want to check and press ○ to toggle the on/off state of the component. If a valve does not turn on/off or a pump/heater does not operate when their on/off state is toggled, please check the connection between component and main PCB and make sure components' status is normal.

8.3.10.2Air purge



Once installation is complete, it is important to run the air purge function to remove any air which may be present in the water piping and which could cause malfunctions during operation. Before running **Air purge** mode, make sure that the air purge valve is open. Pump_I will run according to the output and running time that has been set.

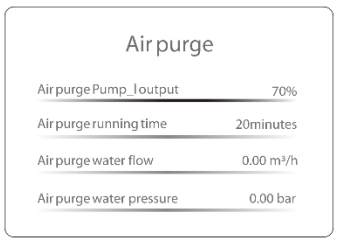
Air purge defines whether the function is activated.

Air purge Pump_I output defines the Pump_I output capacity.

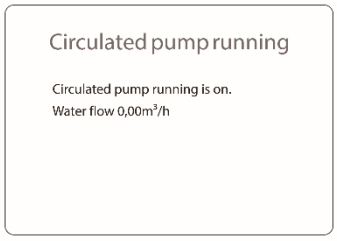
Air purge running time defines the period that Pump_I operates during the air purge process.

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Status check allows installers to check the real-time operation parameters of air purge operation.



8.3.10.3 Circulated pump running



Circulated pump running operation is used to check the operation of the circulation pump.

When circulation pump running is turned on, all running components will stop.

Circulated pump running operation is used to check the operation of the circulation pump.

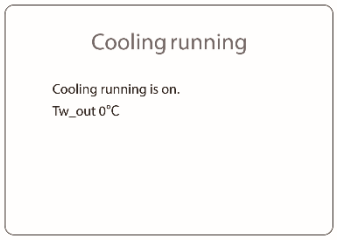
When circulation pump running is turned on, all running components will stop.

When the unit received signal that indicates Circulated pump running =ON:

- SV1 will be on after 30 secs;
- Pump_I will be on after 60 secs.
- Pump_I will be off after 240 secs.
- SV1 will be off and the SV2 will be on after 270 secs.
- Pump_I & pump_O will be on after after 30 secs

If E8 occurs during these processes, the unit will stop Circulated pump running mode immediately

8.3.10.4 Cooling running

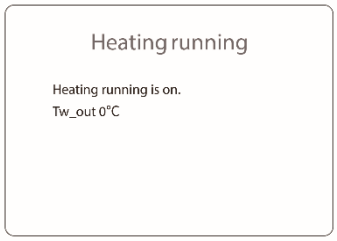


The **Cooing running** operation is used to check the operation of the system in space cooling mode.

During the **Cooing running** operation, the leaving water set temperature is 7°C(44.6°F). The current actual leaving water temperature is displayed on the user interface. The unit operates until the leaving water temperature drops to the set temperature or the next command is received.

8.3.10.5 Heating running

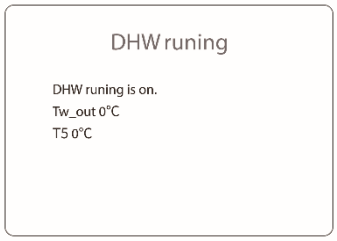
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The **Heating running** operation is used to check the operation of the system in space heating mode.

During **Heating running** test running, the default target outlet water temperature is 35°C(95°F). The IBH (backup heater) will turn on after the compressor runs for 10 min. After the IBH runs for 3 minutes, the IBH will turn off. Heat pump will operate until the water temperature increase to a certain value or the next command is received.

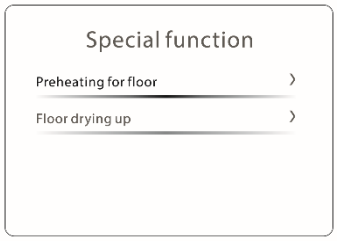
8.3.10.6 DHW running



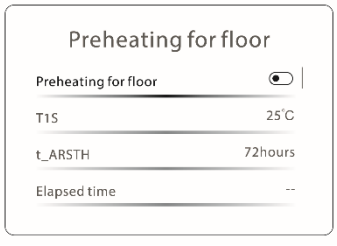
The **DHW running** operation is used to check the operation of the system in DHW mode.

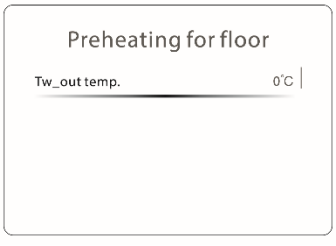
During **DHW running** test running, the default target temperature of the domestic water is 55°C(131°F). The TBH(tank boost heater) will turn on after the compressor runs for 10min. The TBH will turn off 3 minutes later. Heat pump will operate until the water temperature increase to a certain value or the next command is received.

8.3.11 Special Function



8.3.11.1 Preheating for floor





Preheating for floor function provides mild heat to the underfloor water piping for the first time during seasonal heating, diminish the risk of damage to the floor and piping system.

Setting	Description
NO	Disable preheating for floor function
YES	Enable preheating for floor function

T1S defines heat pump leaving water temperature in preheating.

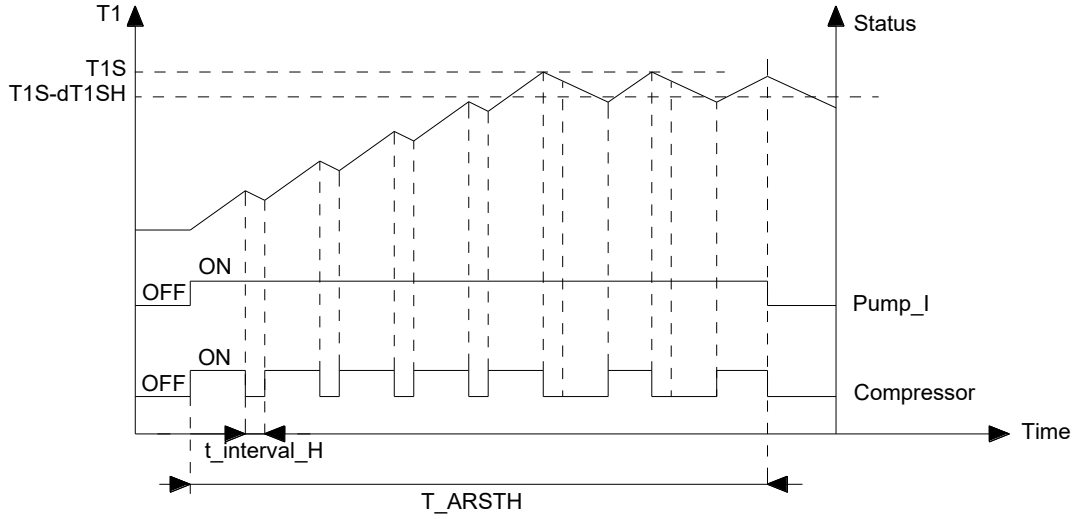
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T_ARSTH defines running time for first preheating of the floor

Elapsed time is the period that **Preheating for floor function** had run.

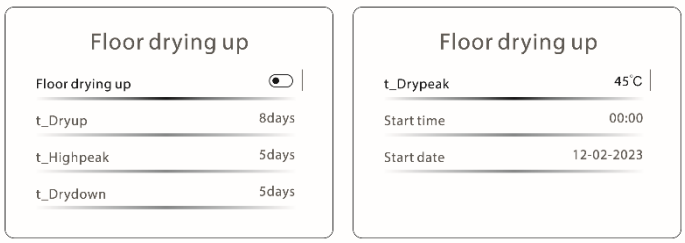
Tw_out temp. is the current leaving water temperature

Diagram below illustrates the operation of **Preheating for floor** function.



Abbreviations:
T1: Leaving water temperature
dT1SH: Water temperature hysteresis of activating heat pump.
t_interval_H: The delayed start-up time of compressor in heating mode.

8.3.11.2 Floor drying up

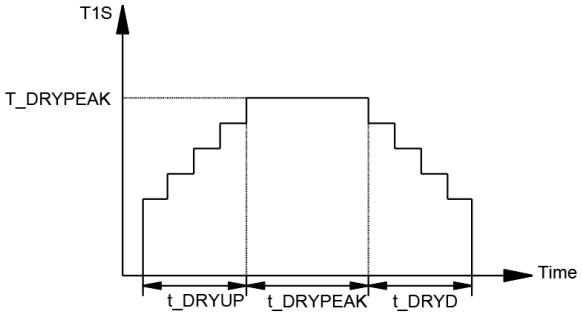


For newly-installed under-floor heating systems, floor drying up is necessary to remove moisture from the floor slab and subfloor to prevent warping or rupture of the floor. Heat pump provides mild heat to the concrete or other structural material around the underfloor water piping in a certain period of time, accelerate the process of getting rid of moisture. During floor drying up operation, the temperature of the floor would be increased gradually. In the event of a heat pump malfunction, floor drying up mode will continue if a backup electric heater and/or auxiliary heating source is available and configured to support space heating mode.

There are three phases to the floor drying up operation:

- Phase 1: gradual temperature increase to the peak temperature
- Phase 2: maintain peak temperature
- Phase 3: gradual temperature decrease from the peak temperature

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Floor drying up

Setting	Description
NO	Disable floor draying up function
YES	Enable floor draying up function

t_Dryup defines the duration of Phase 1.

t_Highpeak defines the duration of Phase 2.

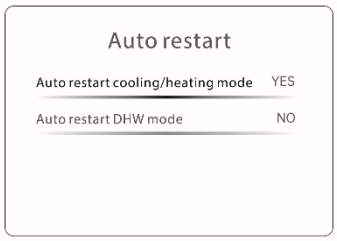
t_Drydown defines the duration of Phase 3.

t_Drypeak defines the heat pump leaving water temperature of Phase 2.

Start time defines the floor drying up operation start time.

Start date defines the floor drying up operation start date.

8.3.12 Auto restart



Auto restart sets whether or not the unit re-applies the mode and unit status settings when the power returns following a power failure.

If **8.3.6 Room thermostat setting** is defined as not 0, **Auto restart function** will not be applicable.

Auto restart cooling/heating mode

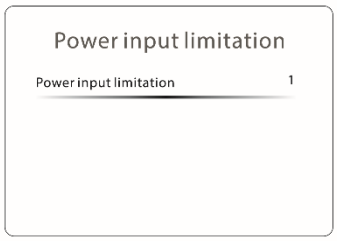
Setting	Description
NO	Disable auto restart cooling/heating mode
YES	Enable auto restart cooling/heating mode

Auto restart DHW mode

Setting	Description
NO	Disable auto restart DHW mode
YES	Enable auto restart DHW mode

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8.3.13 Power input limitation

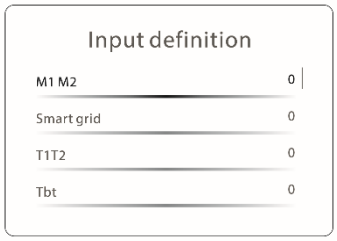


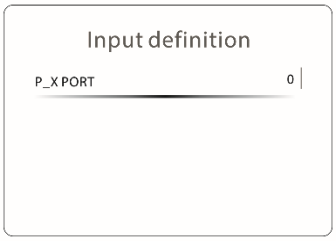
Power input limitation makes the machine suitable for a variety of current supplies. There are 8 configurations for user to choose according to the maximum allowable access current. If the unit will operate at larger current input, 1 should be selected. If the unit will operate at a lower current input, 2-8 should be selected and the power input and capacity will decrease.

Power limitation function

Setting	Model
	12~16kW
1	27A
2	25A
3	23A
4	21A
5	19A
6	17A
7	15A
8	13A

8.3.14 Input definition





INPUT DEFINE defines sensors and functions to fulfill with installation.

M1 M2 defines the function of M1M2 port

Setting	Description
Remote ON/OFF	Remote ON/OFF control of heat pump
TBH ON/OFF	Remote ON/OFF control of tank booster heater
AHS ON/OFF	Remote ON/OFF control of auxiliary heating source

Smart grid defines whether SMART GRID control signal is connected to hydronic PCB.

Setting	Description
NO	Disable Smart grid function
YES	Enable Smart grid function

T1T2 defines control options of Port T1T2

Setting	Description
NO	Installation with M-kit
RT/Ta_PCB	Installation without M-kit

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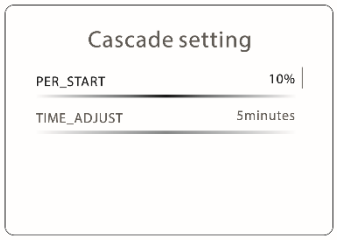
Tbt defines whether balance tank temperature sensors are installed in the balance tank.

Setting	Description
NO	Installation with balance tank temperature sensor (Tbt)
YES	Installation without balance tank temperature sensor (Tbt)

P_X PORT can be defined as defrosting signal or alarm signal according to customers' demand.

Setting	Description
Defrost	Defrosting signal
Alarm	Alarm signal

8.3.15 Cascade setting

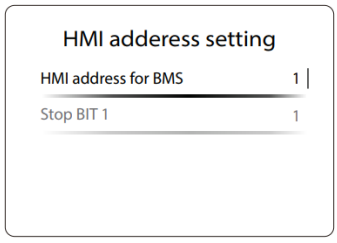


PER_START sets the start-up percentage of multiple units for the first time start-up after power on. For example:

Total units	PER_START	Starting units
6	50%	3
6	30%	2

TIME_ADJUST sets the judgment period of adding and subtracting units

8.3.16 HMI address setting

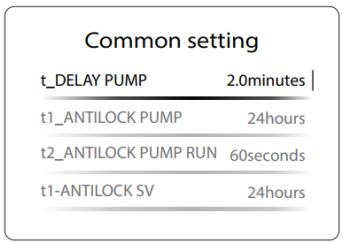


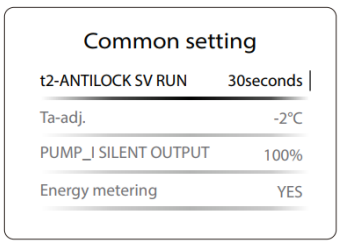
HMI ADDRESS FOR BMS sets the HMI address code for BMS.(only valid for master controller)

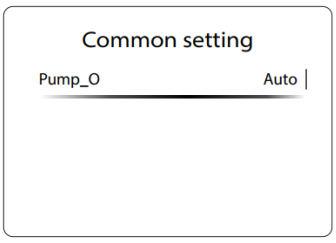
STOP BIT set upper computer stop bit(1: STOP BIT1; 2:STOP BIT2)

Setting	Description
1	Stop bit 1
2	Stop bit 2

8.3.17 Common setting







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8.3.17.1 t_DELAY PUMP

t_DELAY PUMP defines the delayed stop time of Pump_I. Pump_I will stop **t_DELAY PUMP** minutes later after compressor stops base on system temperature equalization consideration.

8.3.17.2 t1_ANTILOCK PUMP, t2_ANTILOCK PUMP RUN, t1_ANTILOCK SV, t2_ANTILOCK SV RUN

Antilock operation prevent components from sticking to result in system fail.

t1_ANTILOCK PUMP defines the interval time that Pump_I, Pump_O and Pump_C runs in order to antilock

t2_ANTILOCK PUMP RUN defines the running time for Pump_I, Pump_O and Pump_C antilock operation

t1_ANTILOCK SV defines the interval time that SV1, SV2 and SV3 valve works in order to antilock

t2_ANTILOCK SV RUN defines the running time for SV1, SV2 and SV3 valve antilock operation

8.3.17.3 Ta-adj

Ta-adj is an correction value for room temperature sensor(Ta) which is inside the wired controller. The display room temperature value is equal to Ta + **Ta-adj.**

8.3.17.4 PUMP_I_SLIENT OUTPUT

PUMP_I_SLIENT OUTPUT can decrease water pump maximum output in order to decrease the noise of heat pump.

8.3.17.5 Energy metering

Energy metering allows user to check energy data of day, week, month and year.

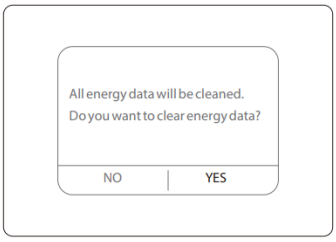
Setting	Description
NO	Disable energy metering function
YES	Enable energy metering function

8.3.17.6 Pump_O

Pump_O defines Zone 1 pump(**Pump_O**) control type.

Setting	Description
ON	Pump_O keeps running
Auto	Pump_O operation is controlled by heat pump

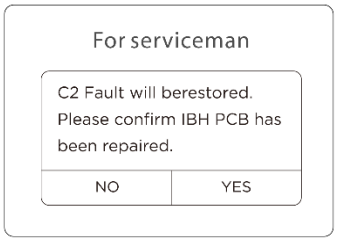
8.3.18 Clear energy data



Once selecting YES, all energy metering data is clear.

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8.3.19 C2 fault restore



For the unit with IBH(internal backup heater), when C2 error occurs, please follow C2 troubleshooting guide of Part4 Diagnosis and Troubleshooting. If necessary, select YES to restore C2 code.

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8.4 Operation parameter

Operation parameter is for reviewing the operation parameters. The interface below is for reference and different units' state correspond to different parameter values.

Operation for entering **Operation parameter**:

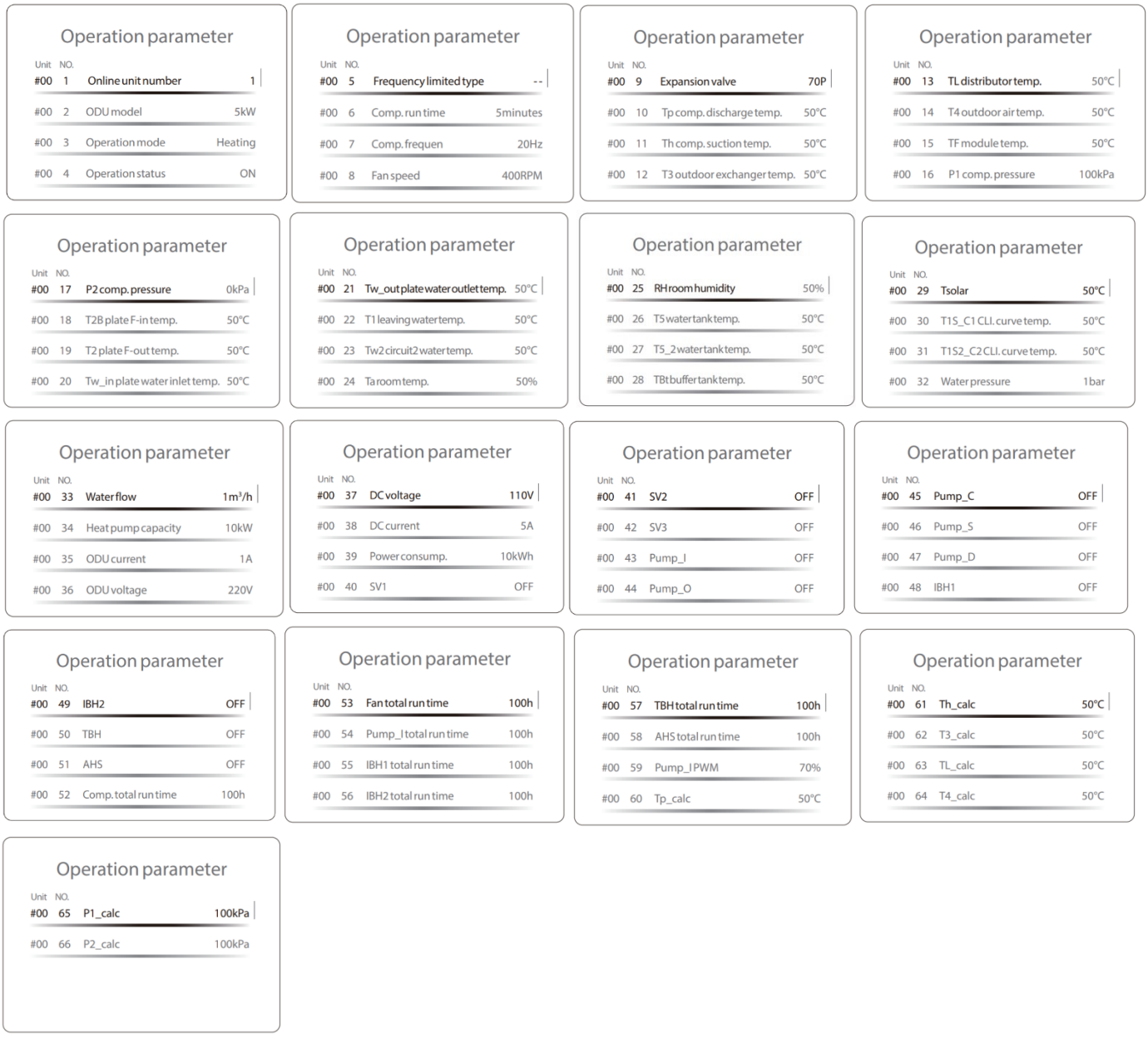
Step 1: Home page

Step 2: Press "≡"

Step 3: Select "Unit status"

Step 4: Select "Operation parameter"

Step 5: Press ○



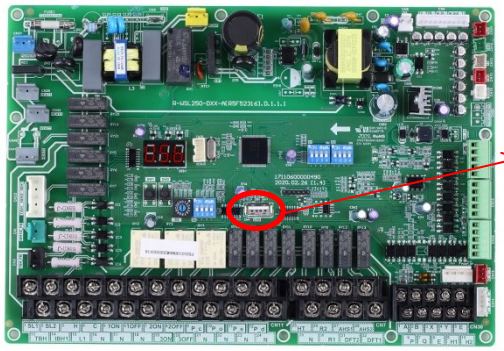
Part of operation parameter may be disabled or unavailable and will not appear on the menu.

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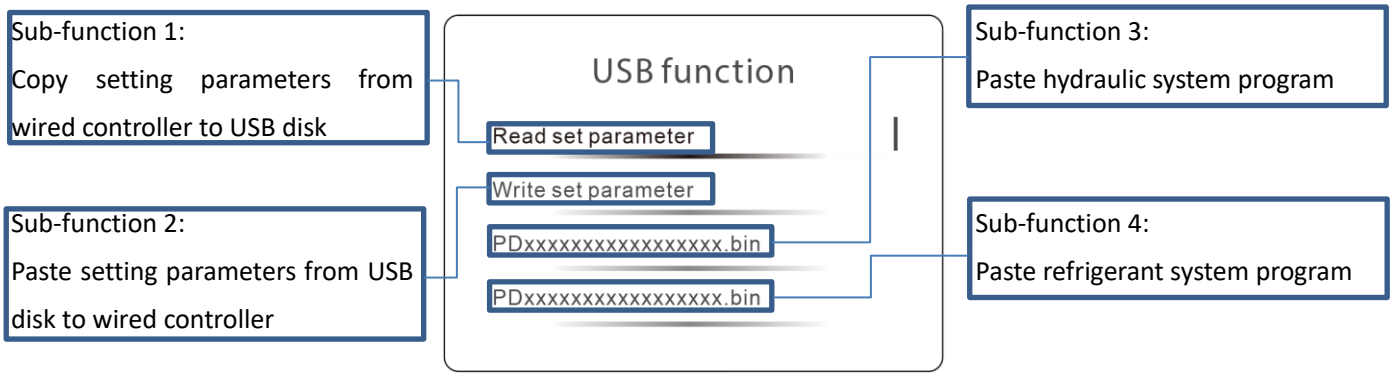
9 USB Function Field Settings

USB function helps you to transmit parameters and program easily. When USB disk connect to USB port of main control PCB, the USB function interface appears automatically on the wired controller.

Main control PCB

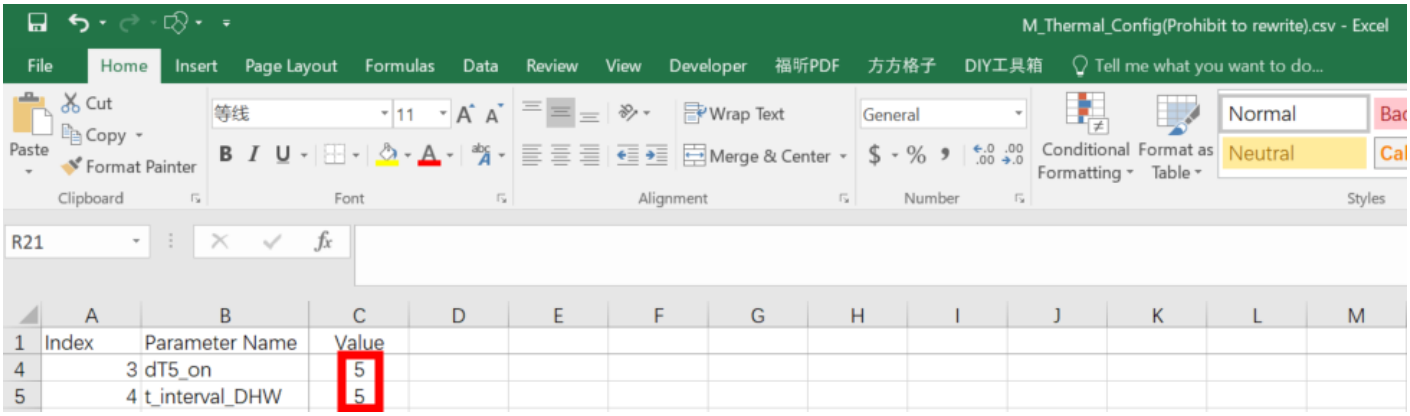


USB function interface



Sub-function 1:

Once the process finishes successfully, the parameter file “M_Thermal_Config(Prohibit to rewrite).csv” will be generated in the USB disk. If you want to change the parameter on computer, please remember only change the value of column C(red frame below) is allowed and do not change any other content or the file name.



Sub-function 2:

Please make sure there is only one parameter file in the USB disk before using this function.

Sub-function 3:

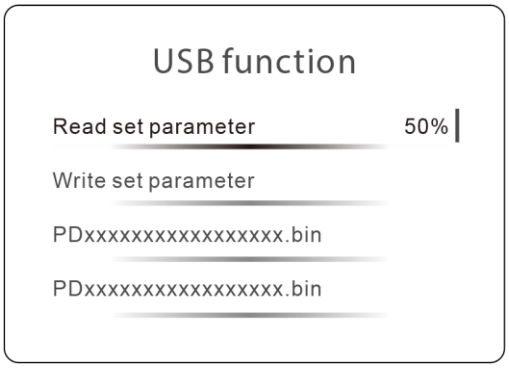
Please make sure there is only one applicable hydraulic system program in the USB disk before using this function.

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Sub-function 4:

Please make sure there is only one applicable refrigerant system program in the USB disk before using this function.

Press ^ v to choose the item and press ○ to confirm your choice, then the rate of process appears like below:



During the process, all the buttons are invalid.

When the process finishes, pop-up window with “Success” cue word appears briefly and unit stops. Please remove the USB disk and restart the unit.

When the process fails, pop-up window with “Fail” cue word appears briefly. The system program remains unchanged.

If the stalled process happens, please remove the USB disk and try to insert the USB disk according to operation above.

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Part 4

Diagnosis and Troubleshooting

1 Electric Control Box Layout 56

2 PCBs 57

3 Wiring Diagrams 64

4 Error Code Table 66

5 Troubleshooting 68

6 Discharge / Suction pressure and temperature range 117

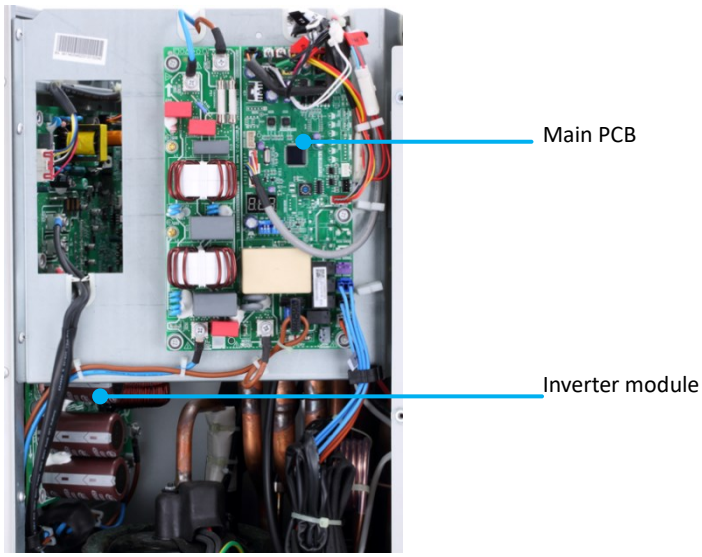
7 Appendix to Part 4 118

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1 Electric Control Box Layout

1.1 Outdoor Unit Electric Control Box Layout

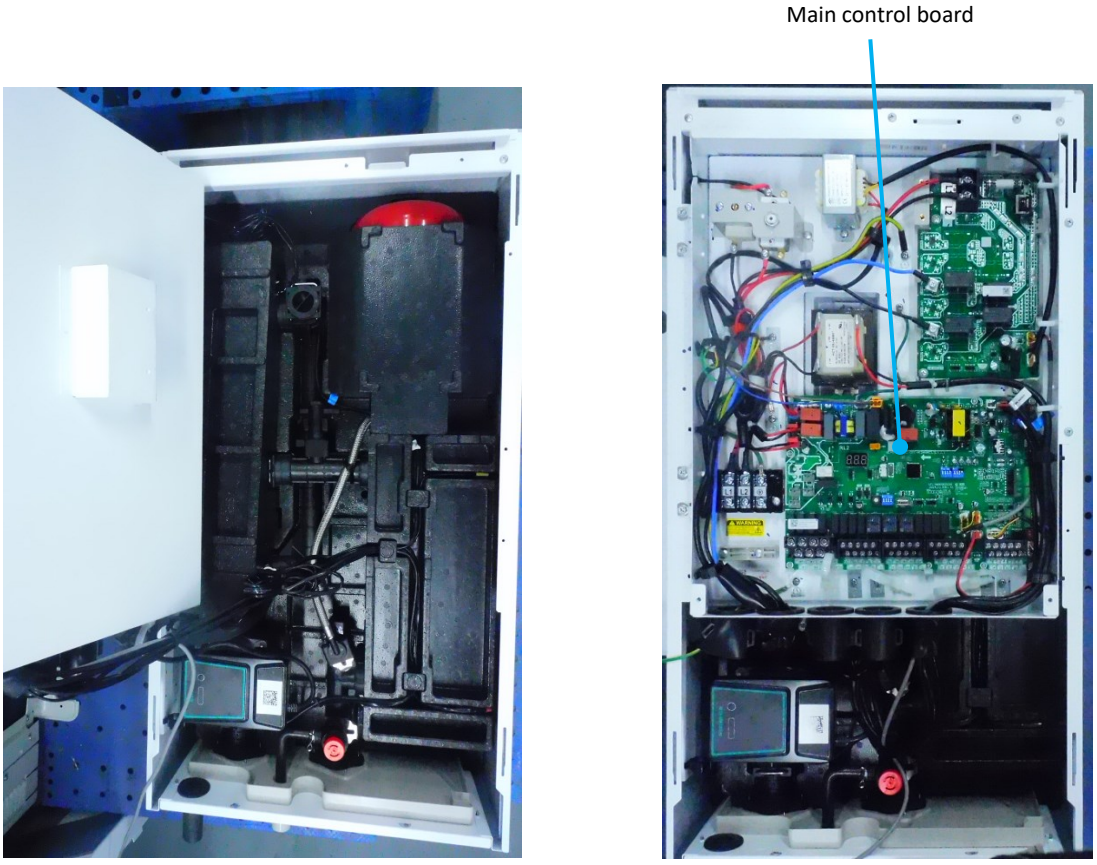
Figure 4-1.1: MHA-V12(14,16)WD2MN8-B2 electric control box



1.2 Hydronic Box Electric Control Box Layout

Figure 4-1.2: Hydronic Box Electric Control Box-HB-A160CMDM30GN8-B2

With 3kW electric heating



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2 PCBs

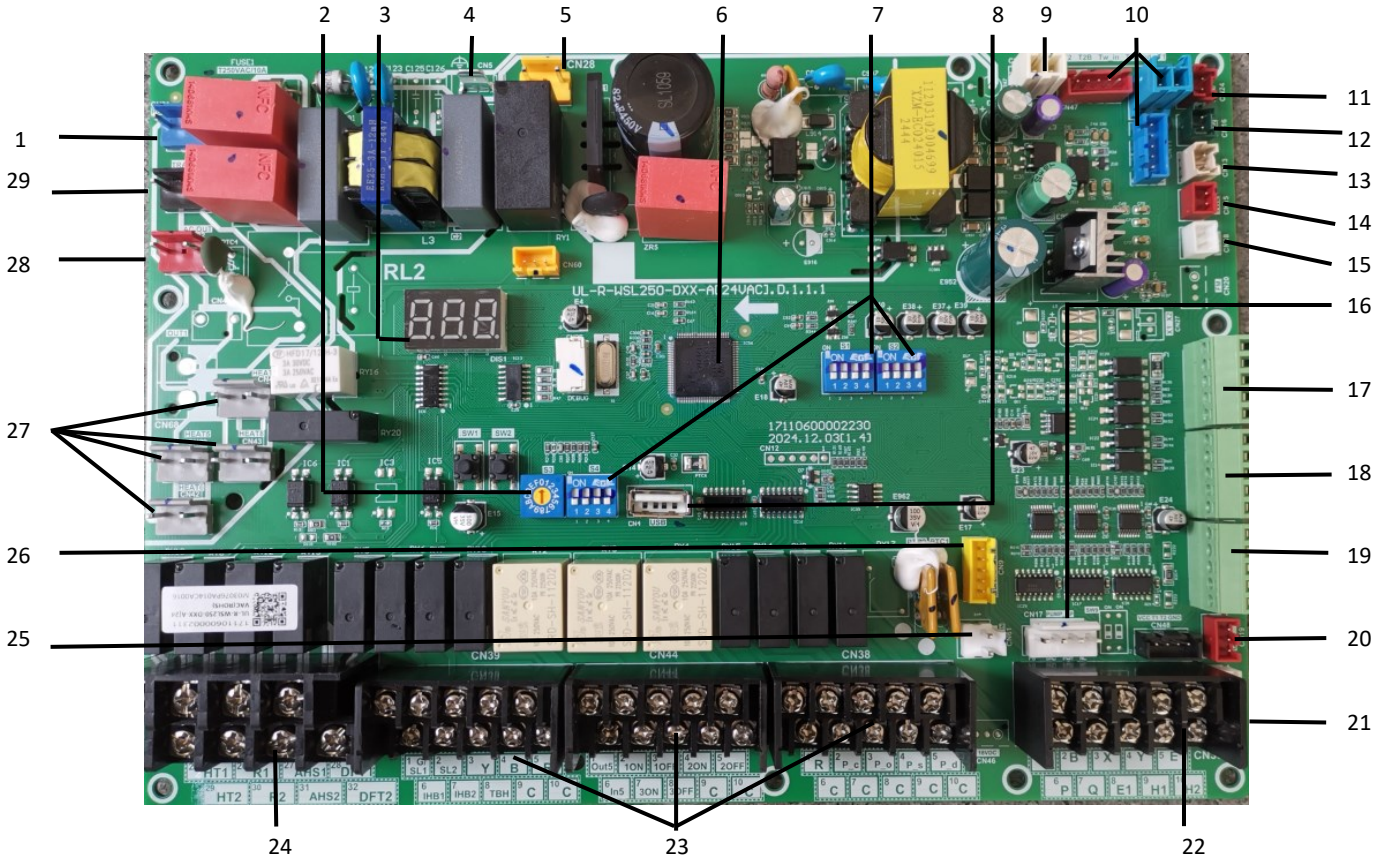
2.1 Outdoor Unit PCB

There are one type of main PCB for the 12kW to 16kW models. In addition to the main PCB, all models have an inverter module.

The locations of each PCB in the outdoor unit electric control box are shown in Figures 4-1.1 Part 4, 1.1 “Outdoor Unit Electric Control Box Layout”. The locations of each PCB in the hydronic box electric control box are shown in Figures 4-1.2 in Part 4, 1.2 “Hydronic Box Electric Control Box Layout”.

2.2 Main PCB for Hydronic System

Figure 4-2.2: Hydronic box main PCB



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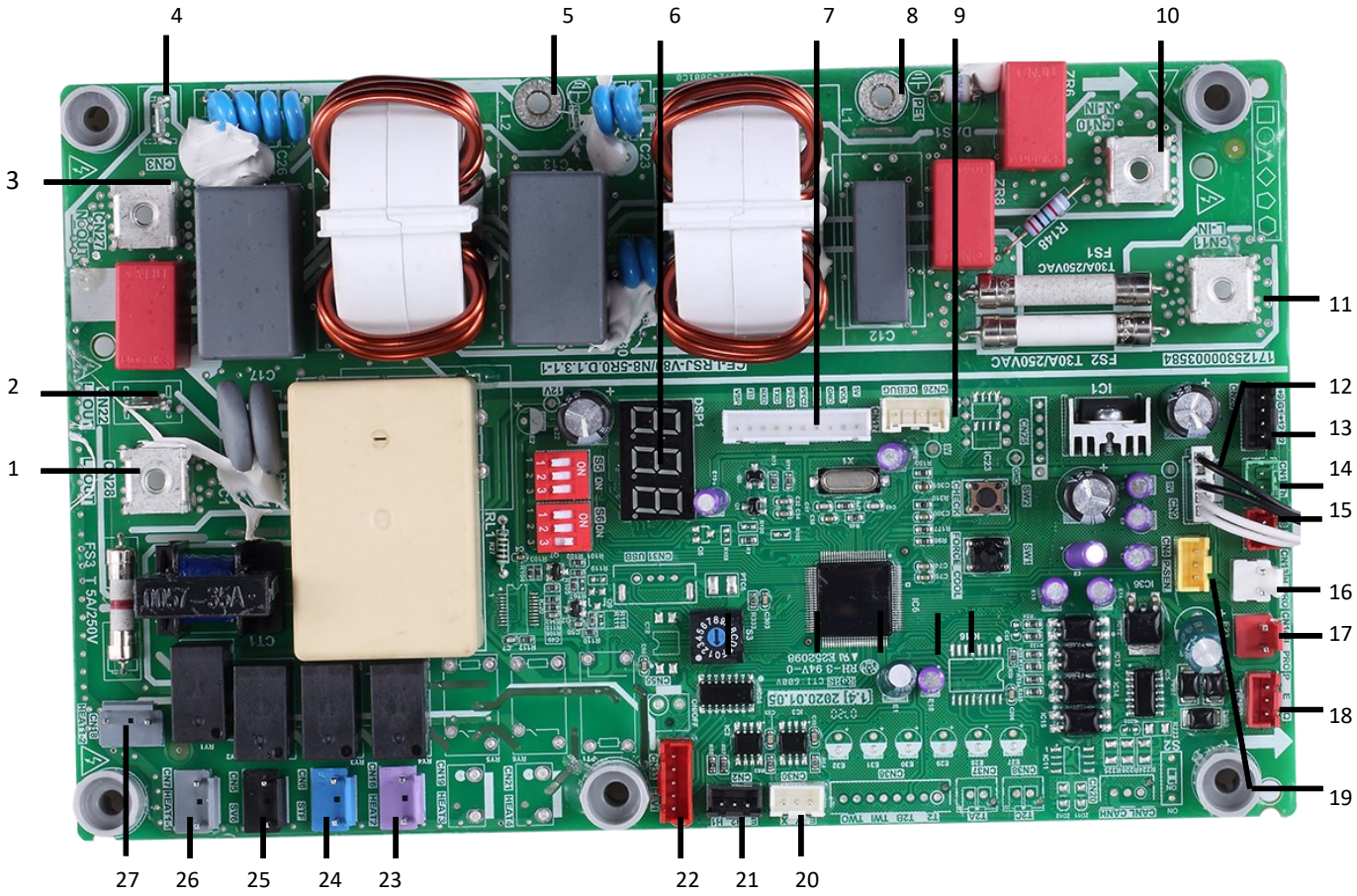
Table 4-2.2: Hydronic box main PCB

Label in Figure 4-2.2	Code	Content
1	CN21	Port for power supply
2	S3	Rotary dip switch
3	DIS1	Digital display
4	CN5	Port for ground
5	CN28	Port for pump power input
6	CN25	Port for IC programming
7	S1,S2,S4	Dip switch
8	CN4	Port for USB programming
9	CN8	Port for Flow switch
10	CN6	Port for temp. sensors (T2, T2B, TW_out, TW_in, T1,)
11	CN24	Port for temp. sensor (Tbt1, The balanced water tank of up temp. sensor)
12	CN16	Port for temp. sensor (Tbt2, The balanced water tank of up temp. sensor)
13	CN13	Port for temp. sensor (T5, domestic hot water tank temp. sensor)
14	CN15	Port for temp. sensor (Tw2, The outlet water for zone 2 temp. sensor)
15	CN18	Port for temp. sensor (Tsolar, Solar panel temp. sensor)
16	CN17	Port for variable speed pump communication
17	CN31	Control port for room thermostat (heating mode) (HT)/Control port for room thermostat (cooling mode) (CL)/Power port for room thermostat (COM)
18	CN35	Port for smart grid (grid signal, photovoltaic signal)
19	CN36	Port for remote switch, temperature board
20	CN19	Communicate port between indoor unit and outdoor unit
21	CN14	Port for communication with the wired controller
22	CN30	Communicate port between indoor unit and outdoor unit, port for communication with the wired controller, internal machine parallel
23	CN38/39/44	Control port for tank booster heater, internal backup heater 1, input port for solar energy, Port for room thermostat, SV1(3-way valve), SV2(3-way valve), SV3(3-way valve), zone 2 pump, outside circulation pump, solar energy pump, DHW pipe pump,
24	CN7	Port for antifreeze E-heating tape(external), additional heat source, compressor run/defrost run
25	CN61	Port for trans
26	CN9	Port for board
27	CN29/41/42/43	Port for anti-freeze electric heating tape
28	CN32	Port for backup heater
29	CN40	Port for trans

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2.3 Main PCBs for Refrigerant System, Inverter Module

Figure 4-2.3-1 MHA-V12(14,16)WD2MN8-B2 outdoor unit main PCB for refrigerant system



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Table 4-2.3-1: MHA-V12(14,16)WD2MN8-B2 outdoor unit main PCB for refrigerant system

Label in Figure 4-2.3-1	Code	Content
1	CN28	Output port L to main PCB for refrigerant system
2	CN22	Reserved
3	CN27	Output port N to main PCB for refrigerant system
4	CN3	Reserved
5	PE2	Port for ground wire
6	DSP1	Digital display
7	CN17	Port for communication with main PCB for refrigerant system
8	PE1	Port for ground wire
9	CN26	Reserved
10	CN10	Input port for neutral wire
11	CN11	Input port for live wire
12	CN9	Port for outdoor ambient temp. sensor and condenser temp. sensor
13	CN24	Input port for +12V/9V
14	CN1	Port for suction temp. sensor
15	CN8	Port for discharge temp. sensor
16	CN13	Port for high pressure switch
17	CN14	Port for low pressure switch
18	CN29	Port for communication with hydro-box control board
19	CN4	Port for pressure sensor
20	CN30	Port for communication(reserved)
21	CN2	Port for communication(reserved)
22	CN33	Port for electrical expansion value
23	CN16	Port for chassis electrical heating tape(Optional)
24	CN6	Port for 4-way value
25	CN5	Port for SV6 value
26	CN7	Port for compressor electric heating tape 1
27	CN18	Port for compressor electric heating tape 2

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Figure 4-2.3-2: MHA-V12(14,16)WD2MN8-B2 outdoor unit inverter module

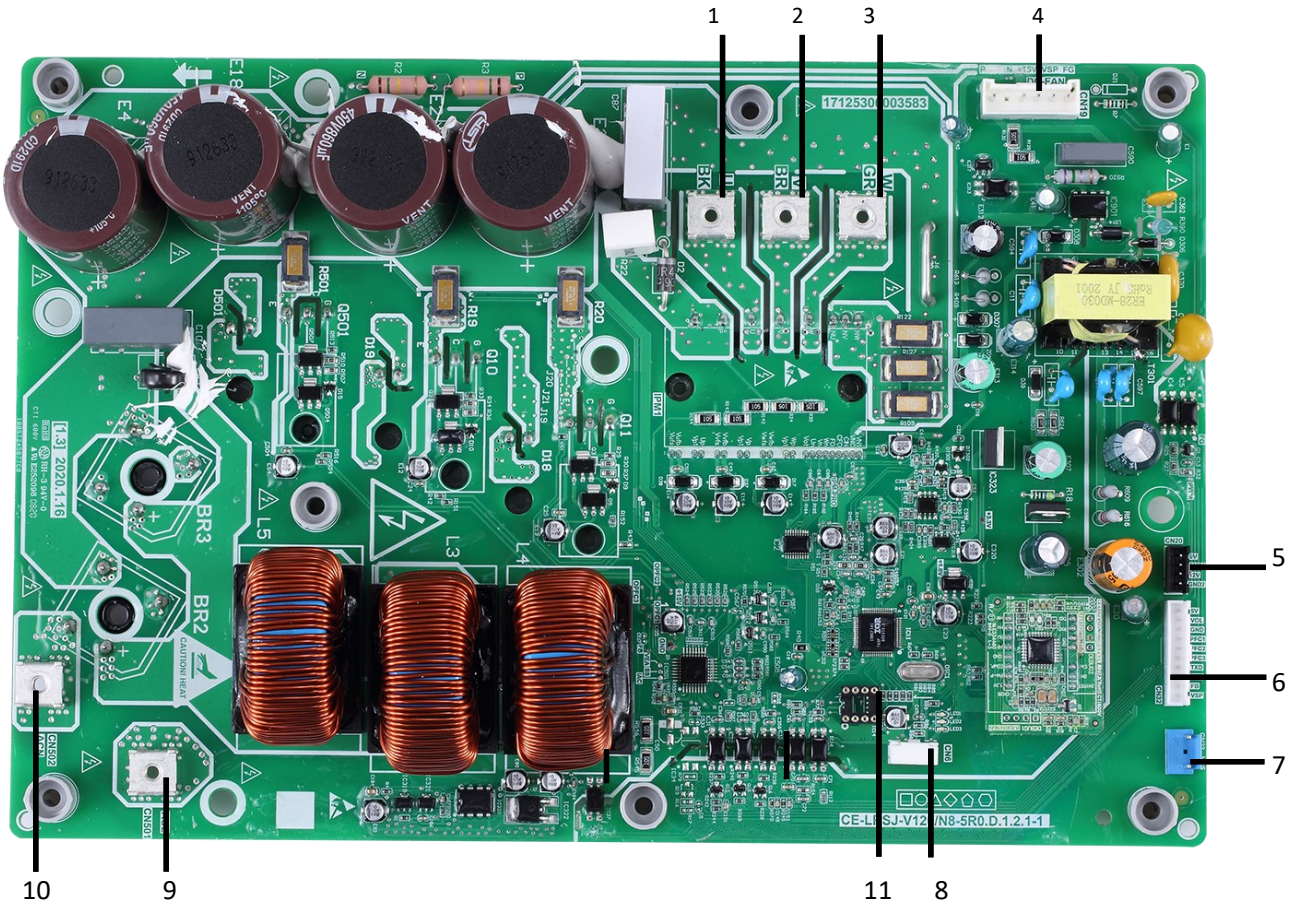


Table 4-2.3-2: MHA-V12(14,16)WD2MN8-B2 outdoor unit inverter module

Label in Figure 4-2.3-2	Code	Content
1	U	Compressor connection port U
2	V	Compressor connection port V
3	W	Compressor connection port W
4	CN19	Port for fan
5	CN20	Output port for +12V/9V
6	CN32	Port for communication with main PCB for filter board
7	CN23	Port for high pressure switch
8	CN6	Reserved
9	CN501	Input port L for rectifier bridge
10	CN502	Input port N for rectifier bridge
11	IC14	EEPROM

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2.4 Digital Display Output

Table 4-2.4: Digital display output in different operating states

M thermal Split system state	Parameters displayed on outdoor unit main PCB DSP1	Parameters displayed on hydronic box main PCB DSP1	
On standby	0	0	
Normal operation	Running speed of the compressor in rotations per second	Leaving water temperature (°F)	
Error or protection	Error or protection code	Error or protection code	

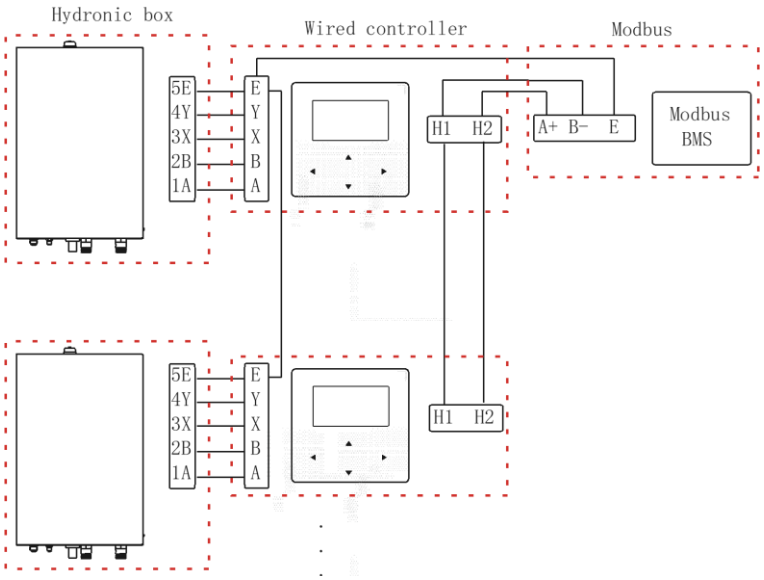
2.5 DIP switch setting and Modbus function

The rotating coded switch S3(0-F) on the main control board of hydraulic module is used for setting the Modbus address. By default the units have this coded switch positioned=0, but this corresponds to the Modbus address 16, while the others positions corresponds the number, e.g. pos=2 is address 2, pos=5 is address 5.

Figure 4-2.5-1: Rotating switch

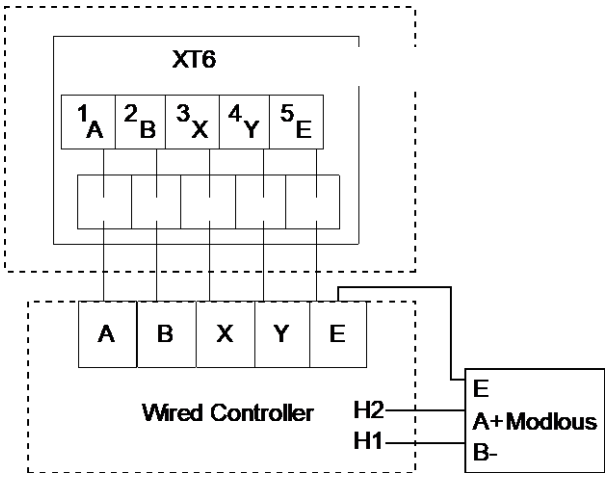


Figure 4-2.5-2: Connection



Note: Wired controller is integrated in the hydronic box.

Figure 4-2.5-3: Wiring

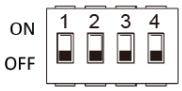
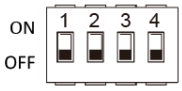
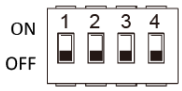


Input Voltage	24VAC
Min. Wiring size	18AWG

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DIP switches S1, S2, and S4 are located on the indoor unit main control board.

Switch		ON=1	OFF=0	Factory defaults
S1 	1/2	0/0= Integrated electric heater 0/1= External electric heater		Refer to electrically controlled wiring diagram
	3/4	0/0=No IBH 0/1=With IBH (One-step control) 1/0=With IBH (Two-step control) 1/1=With IBH (Three-step control)		
S2 	1	Reserved		Refer to electrically controlled wiring diagram
	2	Reserved		
	3/4	0/0=variable speed pump 1 0/1=Fixed speed pump 1/0=Reserved 1/1=variable speed pump 2		
S4 	1	master=Clear all slave address codes slave=Clear self-address codes	keep current address code	Refer to electrically controlled wiring diagram
	2	with refrigerant sensor(customized)	without refrigerant sensor	
	3	External MH-KIT	No external MH-KIT	
	4	Reserved		

The rotating coded switch S3(0-F) on the outdoor unit main PCB for refrigerant system Keep factory Settings.

2.6 Point check button

Point check button SW1 and SW2 are located on outdoor unit main PCB for refrigerant system.

Point check button is for the use of research and development personnel, and should not be touched under normal circumstances.

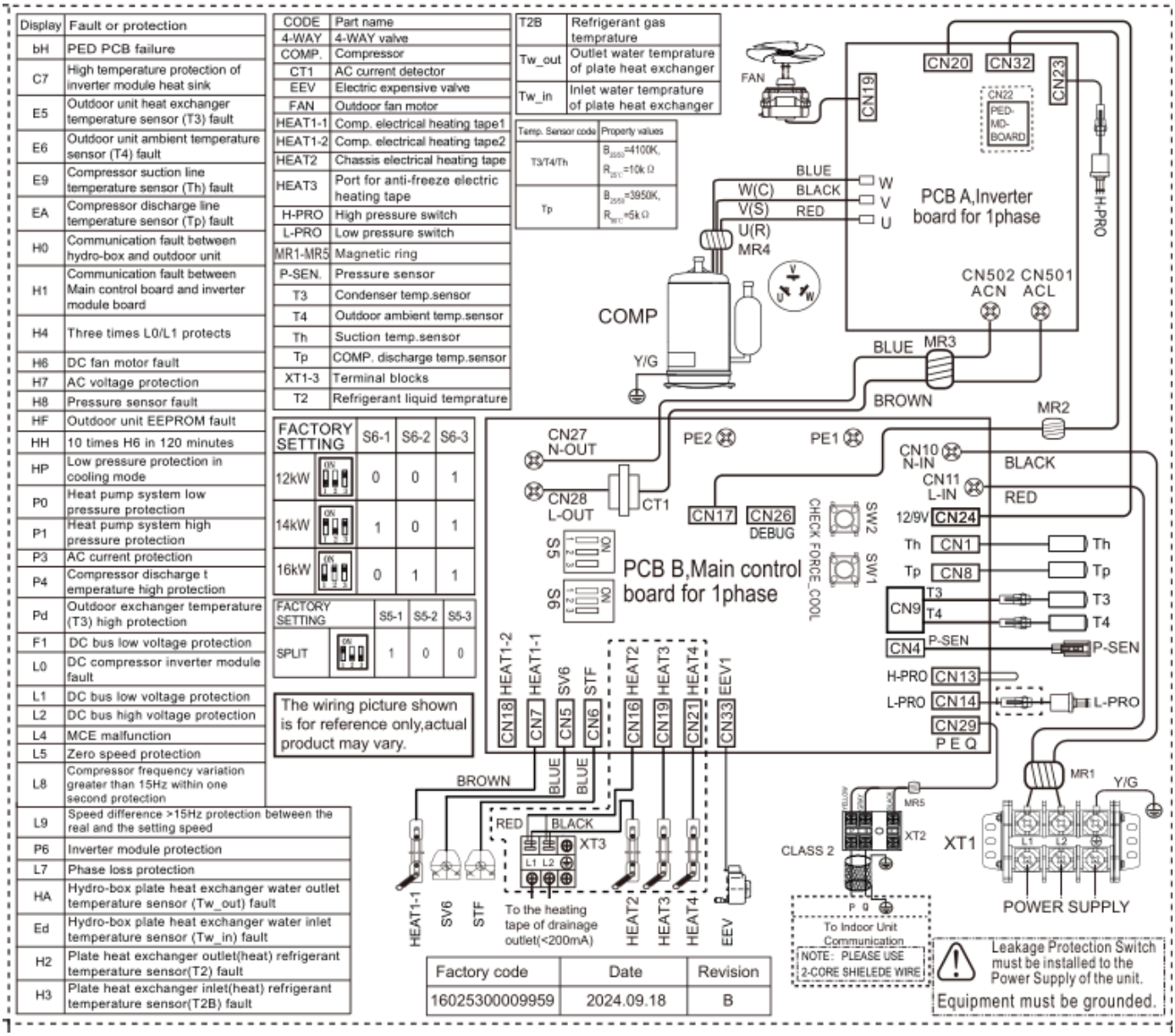
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3 Wiring Diagrams

3.1Outdoor Unit

MHA-V12(14,16)WD2MN8-B2

Figure 4-3.1: MHA-V12(14,16)WD2MN8-B2 wiring diagram

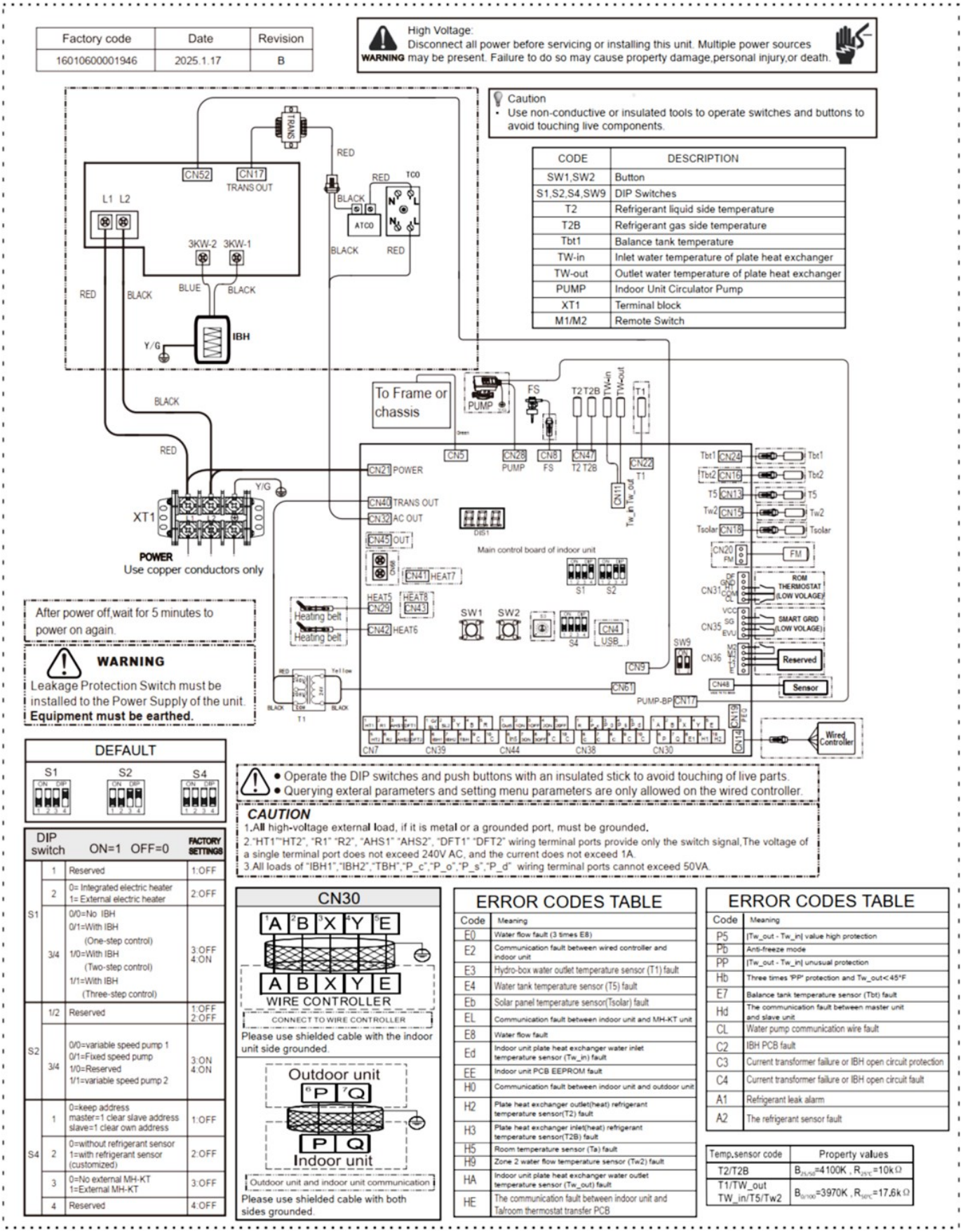


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3.2Hydronic Box

HB-A160CMDM30GN8-B2

Figure 4-3.2 HB-A160CMDM30GN8-B2 wiring diagram



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4 Error Code Table

Table 4-4.1: Error code table

Error code	Serial Number[1]	Content[2]	Remarks
C7	65	High temperature protection of inverter module heat sink	
E0	1	Water flow fault (3 times E8)	
E1	2	Phase sequence error	Only applies to 3-phase models
E2	3	Communication fault between wired controller and indoor unit	
E3	4	Hydro-box water outlet temperature sensor fault	Sensor T1
E4	5	Water tank temperature sensor fault	Sensor T5
E5	6	Outdoor unit heat exchanger temperature sensor fault	Sensor T3
E6	7	Outdoor unit ambient temperature sensor fault	Sensor T4
E7	8	Hydraulic separator temperature sensor fault	Sensor Tbt
E8	9	Water flow fault	
E9	10	Compressor suction line temperature sensor fault	Sensor Th
EA	11	Compressor discharge line temperature sensor fault	Sensor Tp
Eb	12	Solar panel temperature sensor fault	Sensor Tsolar
Ec	13	Balance tank nether temperature sensor error	Sensor Tbt2
Ed	14	Hydro-box plate heat exchanger water inlet temperature sensor fault	Sensor Tw_in
EE	15	Hydronic-box PCB EEPROM fault	
F1	116	DC bus low voltage protection	
H0	39	Communication fault between hydro-box and outdoor unit	
H1	40	Communication fault between Main control board and inverter module board	
H2	41	Plate heat exchanger outlet(heat) refrigerant temperature sensor fault	Sensor T2
H3	42	Plate heat exchanger inlet (heat) refrigerant temperature sensor fault	Sensor T2B
H4	43	Three times L0/L1 protects	
H5	44	Room temperature sensor fault	Sensor Ta
H6	45	DC fan motor fault	
H7	46	AC voltage protection	
H8	47	Pressure sensor fault	
H9	48	Zone 2 water flow temperature sensor fault	Sensor Tw2
HA	49	Hydro-box plate heat exchanger water outlet temperature sensor fault	Sensor Tw_out
Hb	50	Three times 'PP' protection and Tw_out<45°F(7°C)	
Hd	52	Communication fault between master unit and slave unit (in cascade)	
HE	53	The communication fault between indoor unit and Ta/room thermostat transfer PCB	
HF	54	Invert module EEPROM error	
HH	55	DC fan fault (H6 appears 10 times in 120min)	
HP	57	Low pressure protection in cooling mode	
P0	20	Heat pump system low pressure protection	

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P1	21	Heat pump system high pressure protection	
P3	23	AC current protection	
P4	24	Compressor discharge temperature high protection	
P5	25	High temperature difference between water side heat exchanger water inlet and water outlet temperatures protection	
P6	26	Inverter module protection	
L0	-	DC compressor inverter module fault	
L1	-	DC bus low voltage protection	
L2	-	DC bus high voltage protection	
L4	-	MCE malfunction	
L5	-	Zero speed protection	
L7	-	Phase loss protection	
L8	-	Compressor frequency variation greater than 15 Hz within one second protection	
L9	-	Speed difference > 15 Hz protection between the real and the setting speed	
Pb	31	Anti-freeze mode	
Pd	33	High temperature protection of refrigerant outlet temperature of condenser in cooling mode	
PP	38	Water side heat exchanger inlet temperature is higher than outlet temperature in heating mode or DHW mode	
bH	112	PED PCB failure	
CL	-	Water pump communication wire fault	
EL	-	Communication fault between hydraulic module and MH-kit	
C2	-	IBH electric heating small board relay sticking fault	
C3	-	Current transformer failure or IBH open circuit fault	
C4	-	When the counter detects that the number of C3 faults is ≥3, a C4 fault is reported	

Notes:

1. When the error code appears, the error code corresponding to the serial number can be obtained through the H1H2 port by using the host computer to query the wired controller register.
2. Sensor names in this service manual referring to refrigerant flow is named according refrigerant flow during cooling operation refer to Part 2, 3 “Refrigerant Flow Diagrams”.
3. In winter, if the unit has E0 and Hb failure and the unit is not repaired in time, the water pump and pipeline system may be damaged by freezing, so E0 and Hb failure must be repaired in time.

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5 Troubleshooting

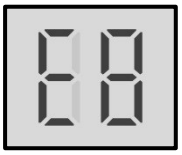
5.1 Warning

- All electrical work must be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation (all national, local and other laws, standards, codes, rules, regulations and other legislation that apply in a given situation).
- Power-off the outdoor units before connecting or disconnecting any connections or wiring, otherwise electric shock (which can cause physical injury or death) may occur or damage to components may occur.

5.2 E0, E8 Troubleshooting

5.2.1 Digital display output





5.2.2 Description

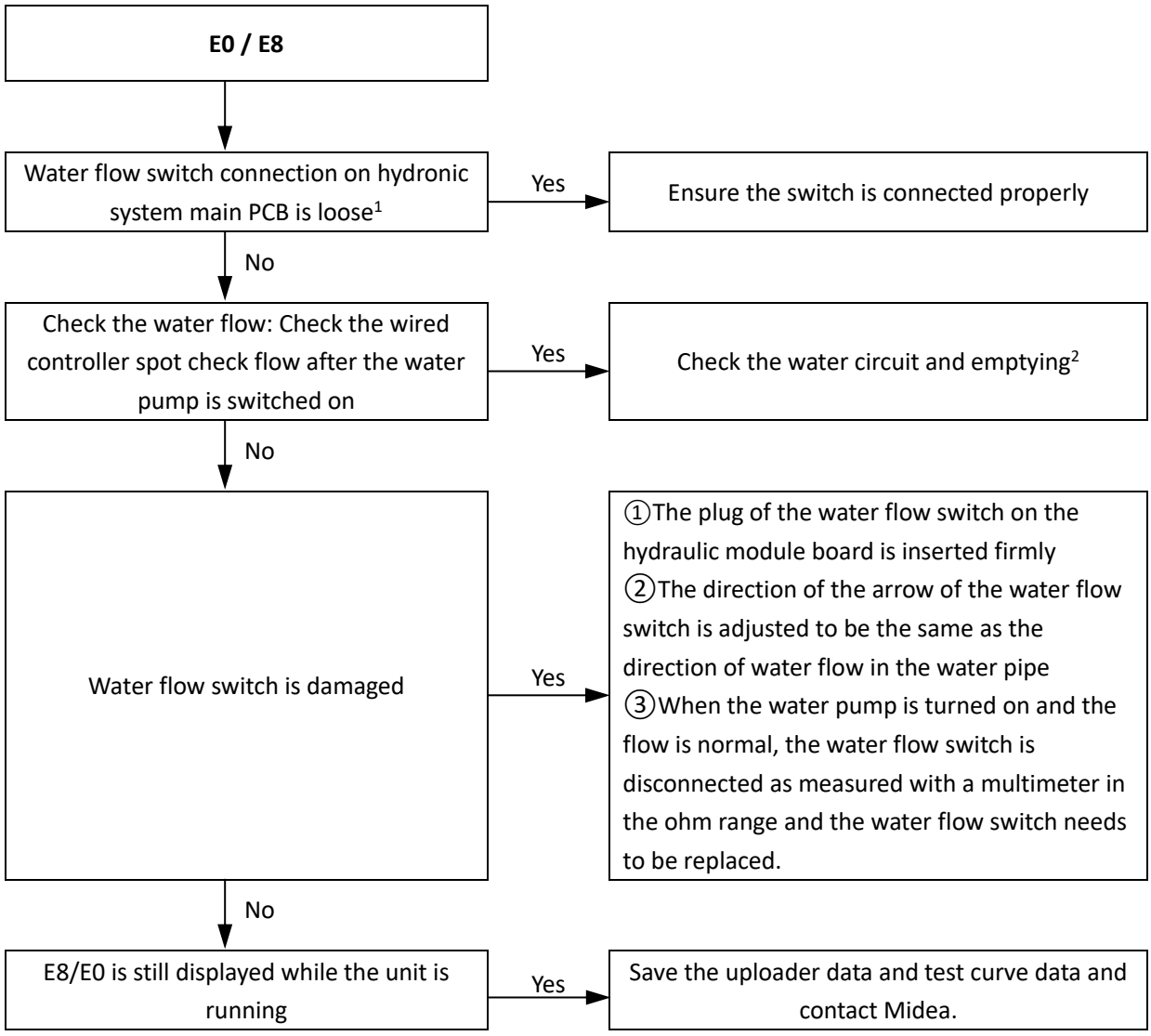
- Water flow failure.
- E0 indicates E8 has displayed 3 times. When an E0 error occurs, a manual system restart is required before the system can resume operation.
- M thermal Mono stops running.
- Error code is displayed on hydronic system main control board for refrigerant system and user interface.

5.2.3 Possible causes

- The wire circuit is short connected or open.
- Water flow rate is too low.
- Water flow switch damaged.
- Water circuit is abnormal or not emptied.

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5.2.4 Procedure



Notes:

1. Water flow switch connection is port CN8 on the main PCB for hydronic system (labeled 5 in Figure 4-2.2 in Part 4, 2.2 “Main PCB for Hydronic System”).
2. Methods of Checking the water circuit and emptying: ①Whether the unit connected the water circuit ball valve open; ②Whether the unit inlet and outlet pipes are reversed; ④Whether the unit water circuit replenishment and emptying is completed, if necessary, the unit can be emptied quickly and manually from the pressure relief valve, requiring system water pressure ≥ 1.5 bar; ⑤Whether the pump wires is connected, whether the water pump indicator lights up after the water pump icon is lit on the wired controller

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5.3 E1 Troubleshooting

5.3.1 Digital display output



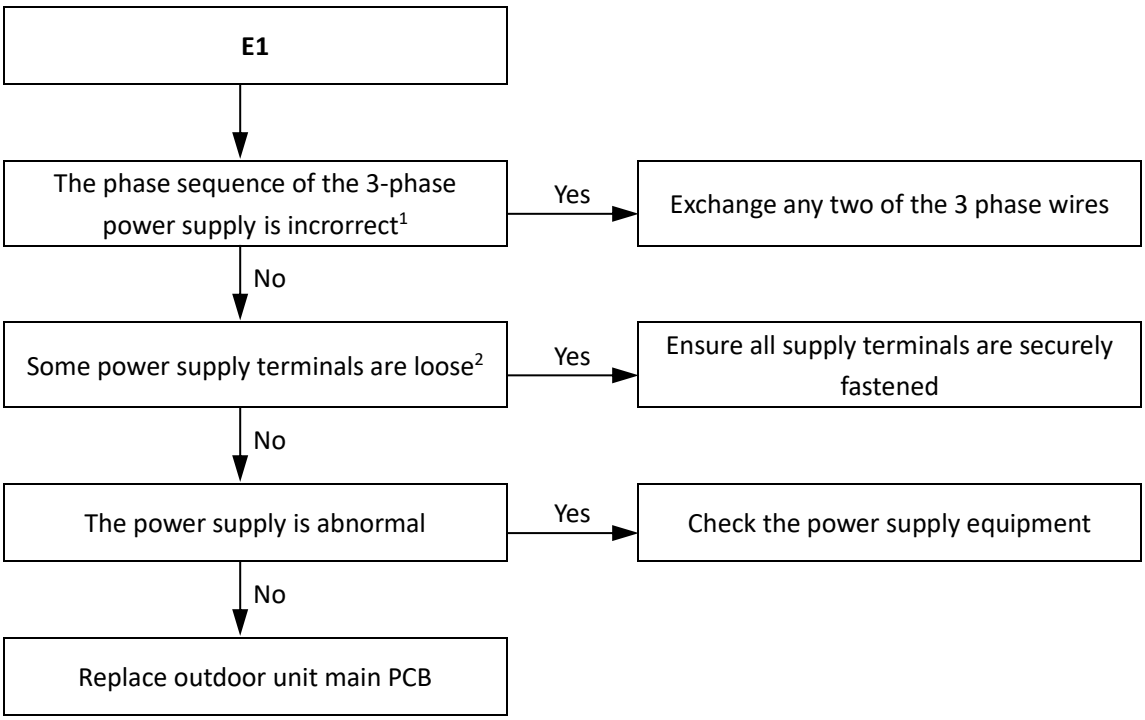
5.3.2 Description

- Phase sequence error.
- Only applies to 3-phase models.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.3.3 Possible causes

- Power supply phases not connected in correct sequence.
- Power supply terminals loose.
- Power supply abnormal.
- Main PCB damaged.

5.3.4 Procedure



Notes:

1. The A, B, C terminals of 3-phase power supply should match compressor phase sequence requirements. If the phase sequence is inverted, the compressor will operate inversely. If the wiring connection of each outdoor unit is in A, B, C phase sequence, and multiple units are connected, the current difference between C phase and A, B phases will be very large as the power supply load of each outdoor unit will be on C phase. This can easily lead to tripped circuits and terminal wiring burnout. Therefore if multiple units are to be used, the phase sequence should be staggered, so that the current is distributed among the three phases equally.
2. Loose power supply terminals can cause the compressors to operate abnormally and compressor current to be very large.

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5.4 E2 Troubleshooting

5.4.1 Digital display output



5.4.2 Description

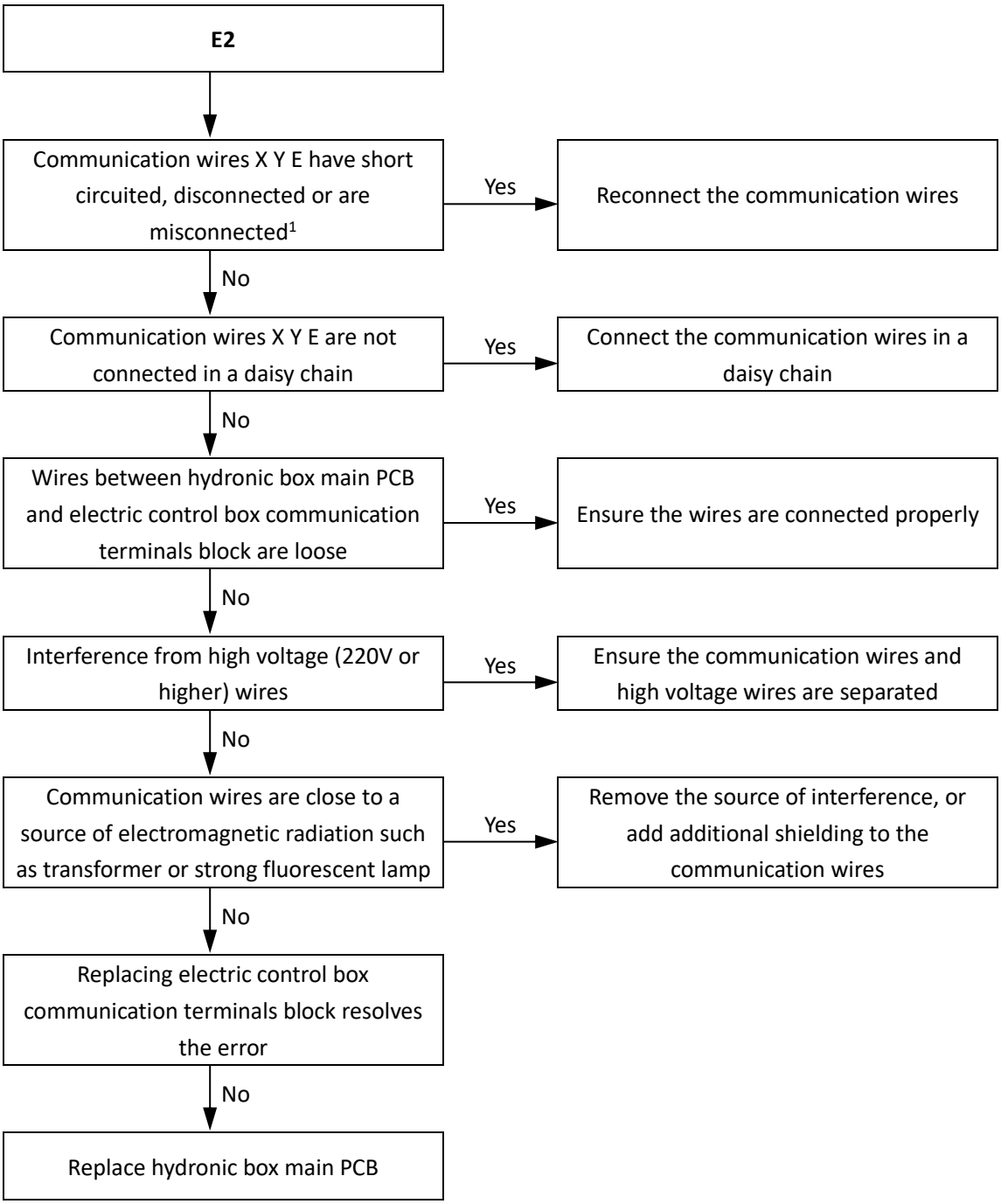
- Communication error between hydronic box and user interface.
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.4.3 Possible causes

- Communication wires between hydronic box and user interface not connected properly.
- Communication wiring X Y E terminals misconnected.
- Loosened wiring within electric control box.
- Interference from high voltage wires or other sources of electromagnetic radiation.
- Damaged main PCB or electric control box communication terminals block.

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5.4.4 Procedure



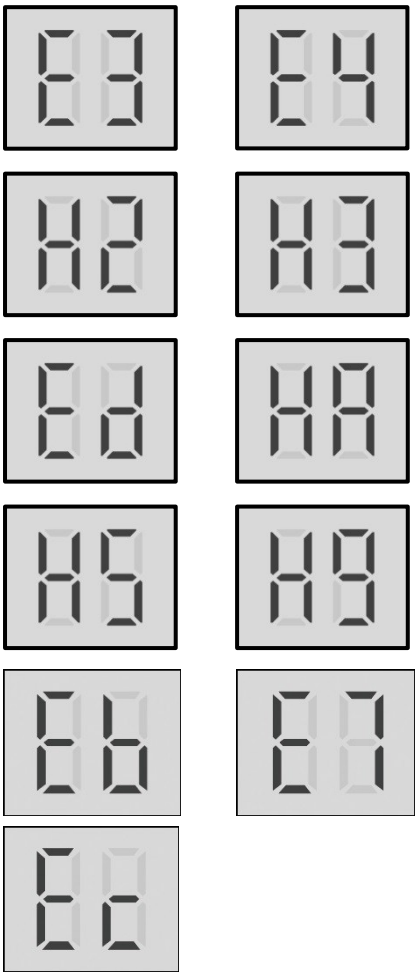
Notes:

1. Measure the resistance among X, Y and E. The normal resistance between P and Q is 120Ω, between P and E is infinite, between Y and E is infinite. Communication wiring has polarity. Ensure that the X wire is connected to X terminals and the Y wire is connected to Y terminals.

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5.5 E3, E4, H2, H3, Ed, HA, H5, H9, Eb, E7, Ec Troubleshooting

5.5.1 Digital display output



5.5.2 Description

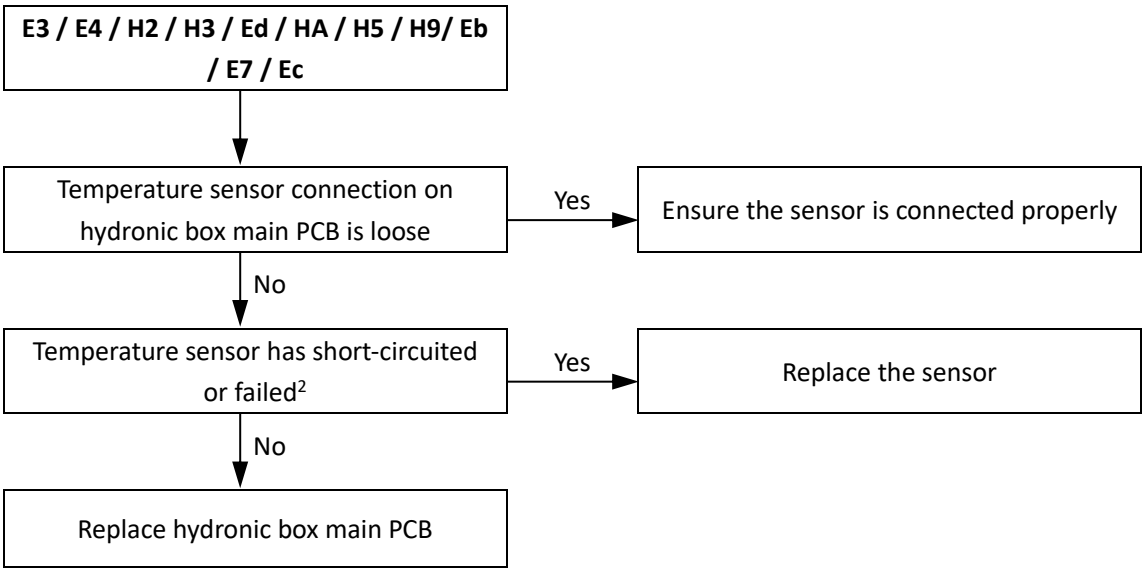
- E3 indicates final outlet water temperature sensor error
- E4 indicates a domestic hot water tank temperature sensor error.
- H2 indicates a water side heat exchanger refrigerant outlet (liquid pipe) temperature sensor error.
- H3 indicates a water side heat exchanger refrigerant inlet (gas pipe) temperature sensor error.
- Ed indicates a water side heat exchanger water inlet temperature sensor error.
- HA indicates a water side heat exchanger water outlet temperature sensor error.
- H5 indicates a room temperature sensor error.
- H9 indicates a circuit 2 water outlet temperature sensor error.
- Eb indicates solar panel temperature sensor error
- E7 indicates balance tank upper temperature sensor error
- Ec indicates balance tank nether temperature sensor error
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.5.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Damaged hydronic box main PCB.

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5.5.4 Procedure



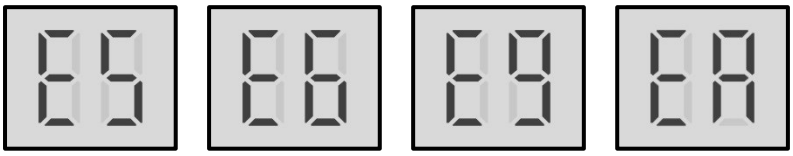
Notes:

1. Final water outlet temperature sensor, water side heat exchanger refrigerant inlet (liquid pipe) temperature sensor, water side heat exchanger refrigerant outlet (gas pipe) temperature sensor, water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled 10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Domestic hot water tank temperature sensor connection is port CN13 on the hydronic box main PCB (labeled 13 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Circuit 2 water outlet temperature sensor connection is port CN15 on the hydronic box main PCB (labeled 14 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Room temperature sensor connection is port CN11 on the hydronic box main PCB (labeled 24 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Solar panel temperature sensor connection is port CN18 on the hydronic box main PCB (labeled 15 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Balance tank upper temperature sensor connection is port CN24 on the hydronic box main PCB (labeled 11 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System") Balance tank nether temperature sensor connection is port CN16 on the hydronic box main PCB (labeled 12 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System")
2. 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. Refer to Table 7.1-1 or 7.1-2 or 7.1-3 in Part 7, 7.1 "Temperature Sensor Resistance Characteristics".

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5.6 E5, E6, E9, EA Troubleshooting

5.6.1 Digital display output



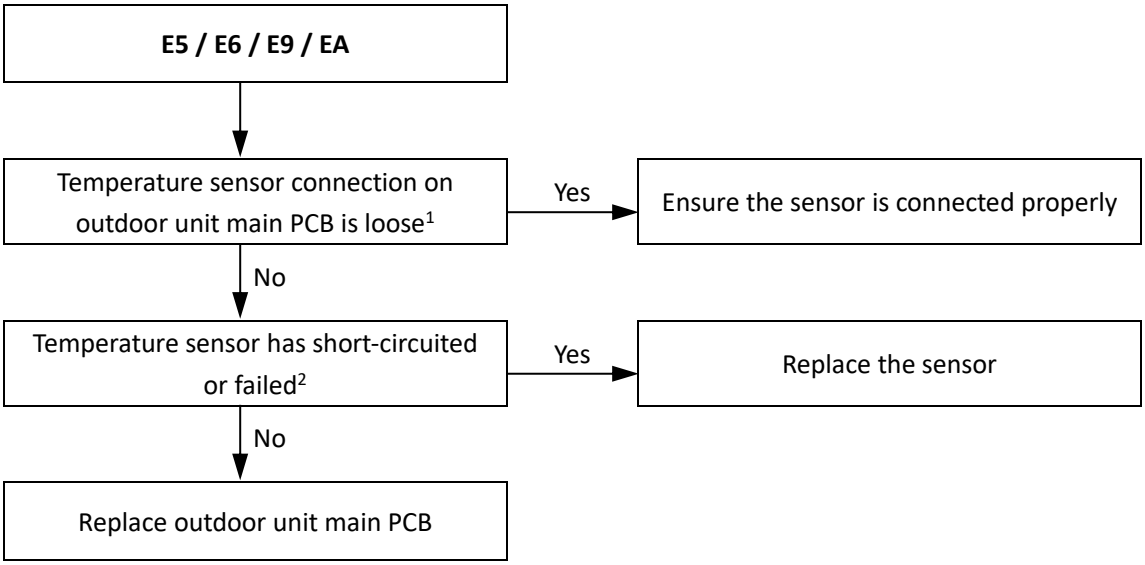
5.6.2 Description

- E5 indicates an air side heat exchanger refrigerant outlet temperature sensor error.
- E6 indicates an outdoor ambient temperature sensor error.
- E9 indicates a suction pipe temperature sensor error.
- EA indicates a discharge temperature sensor error.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.6.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Damaged outdoor unit main PCB.

5.6.4 Procedure



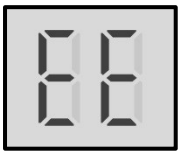
Notes:

1. Air side heat exchanger refrigerant outlet temperature sensor and outdoor ambient temperature sensor connections are port CN9 on the MHA-V12(14,16)W/D2MN8-B2 outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.3-1 in Part 4, 2.3 “Main PCBs for Refrigerant System, Inverter Module”). Discharge pipe temperature sensor connection are port CN8 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.3-1 in Part 4, 2.3 “Main PCBs for Refrigerant System, Inverter Module”). Suction pipe temperature sensor connection are port CN1 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 14 in Figure 4-2.3-1 in Part 4, 2.3 “Main PCBs for Refrigerant System, Inverter Module”).
2. 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. Refer to Table 7.1-1 and Table 7.1-2 in Part 7, 7.1 “Temperature Sensor Resistance Characteristics”.

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5.7 EE Troubleshooting

5.7.1 Digital display output



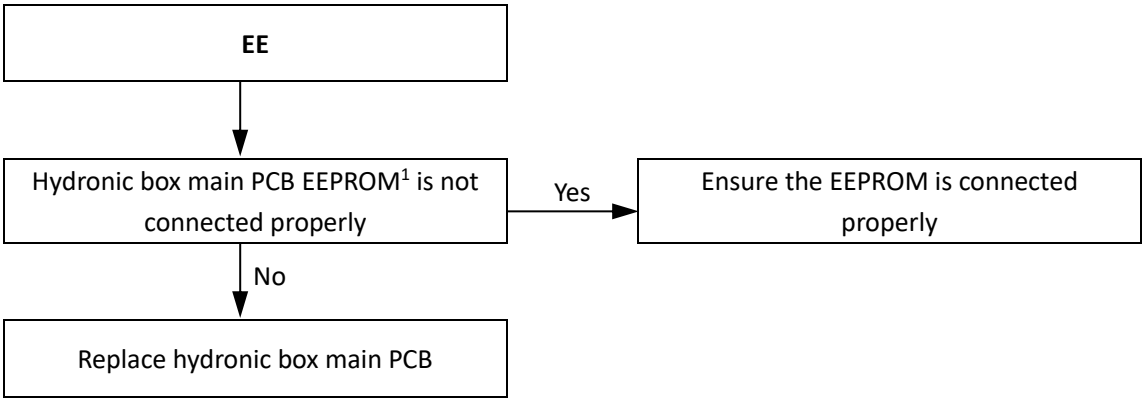
5.7.2 Description

- Hydronic box main PCB EEPROM error.
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.7.3 Possible causes

- Hydronic box main PCB EEPROM is not connected properly.
- Hydronic box main PCB damaged.

5.7.4 Procedure



Notes:

1. Hydronic box main PCB EEPROM is designated IC39 on the main PCB for hydronic box.

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5.8 F1 Troubleshooting

5.8.1 Digital display output



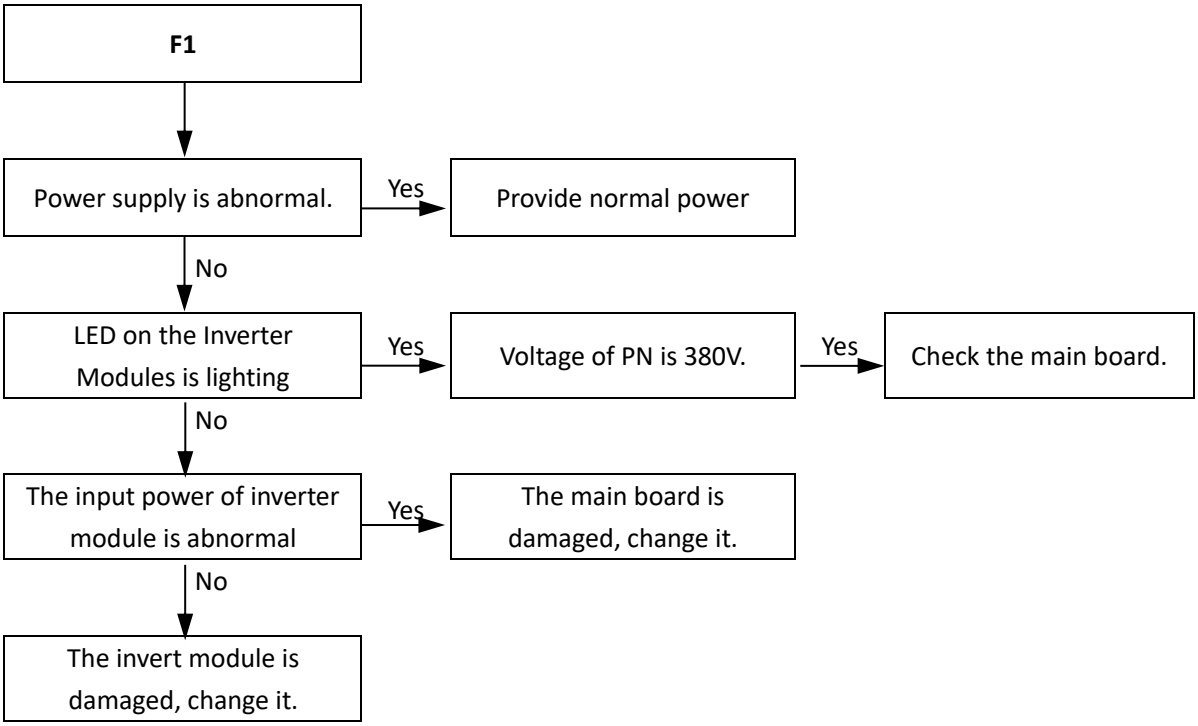
5.8.2 Description

- Low DC generatrix voltage.
- M thermal Split stops running.
- Error code is displayed on hydronic system main PCB and user interface.

5.8.3 Possible causes

- The DC generatrix voltage is too low.

5.8.4 Procedure



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5.9 HF Troubleshooting

5.9.1 Digital display output



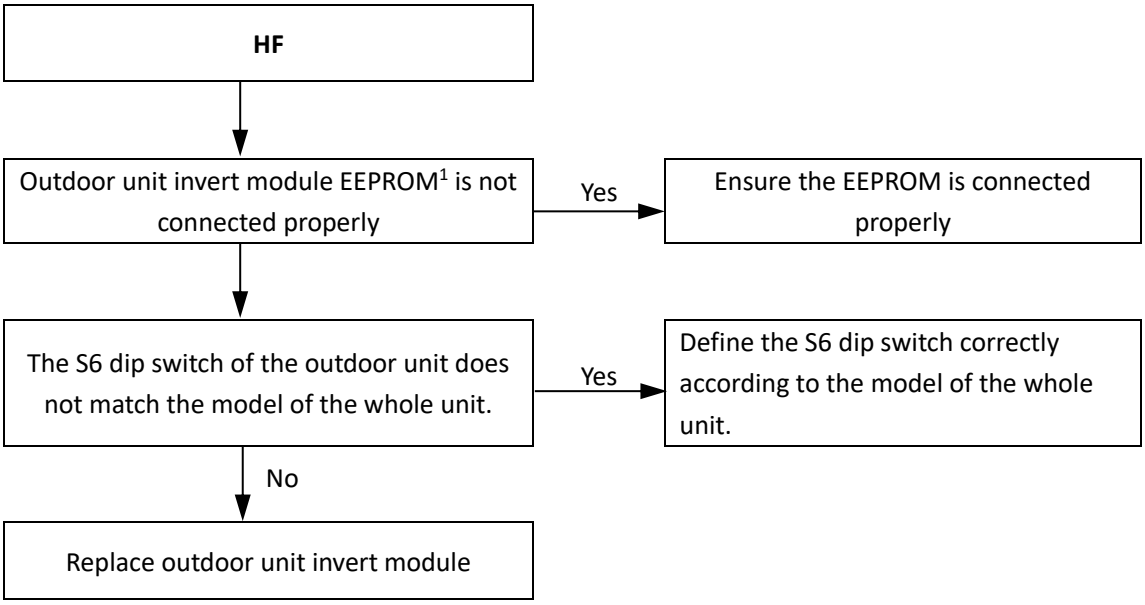
5.9.2 Description

- Outdoor unit inverter module EEPROM error.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.9.3 Possible causes

- Outdoor unit invert module EEPROM is not connected properly.
- Outdoor unit invert module EEPROM damaged.

5.9.4 Procedure



Notes:

1. Outdoor unit invert module EEPROM is designated IC14 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit invert module (labeled 11 in Figure 4-2.3-2 in Part4, 2.3 "Main PCBs for Refrigerant System, Inverter Module").

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5.10 H0 Troubleshooting

5.10.1 Digital display output



5.10.2 Description

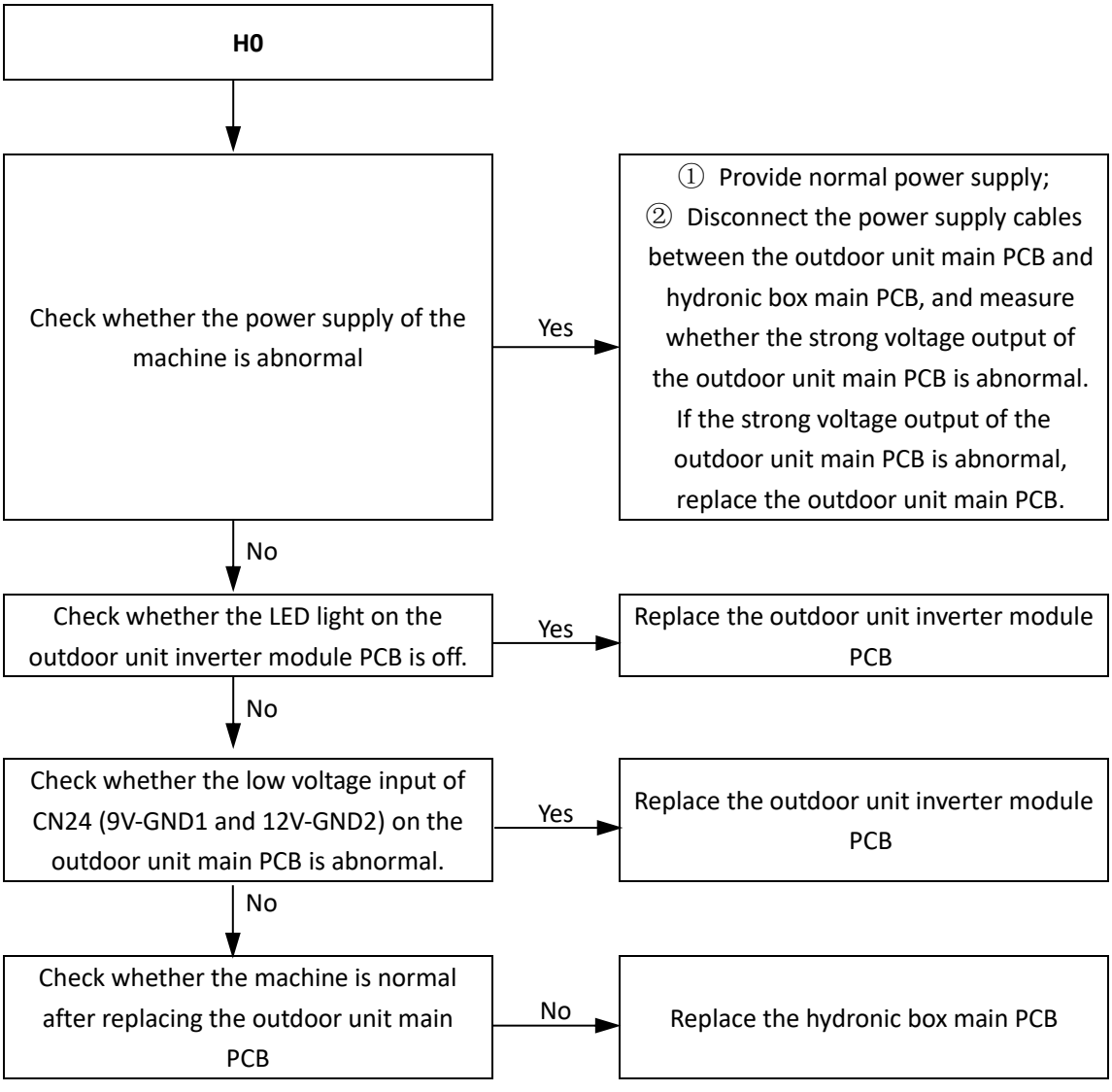
- Communication error between outdoor unit and hydronic box.
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB, outdoor unit main PCB and user interface.

5.10.3 Possible causes

- Power supply abnormal.
- Transformer malfunction.
- Interference from a source of electromagnetic radiation.
- Outdoor unit main PCB or hydronic box main PCB damaged.

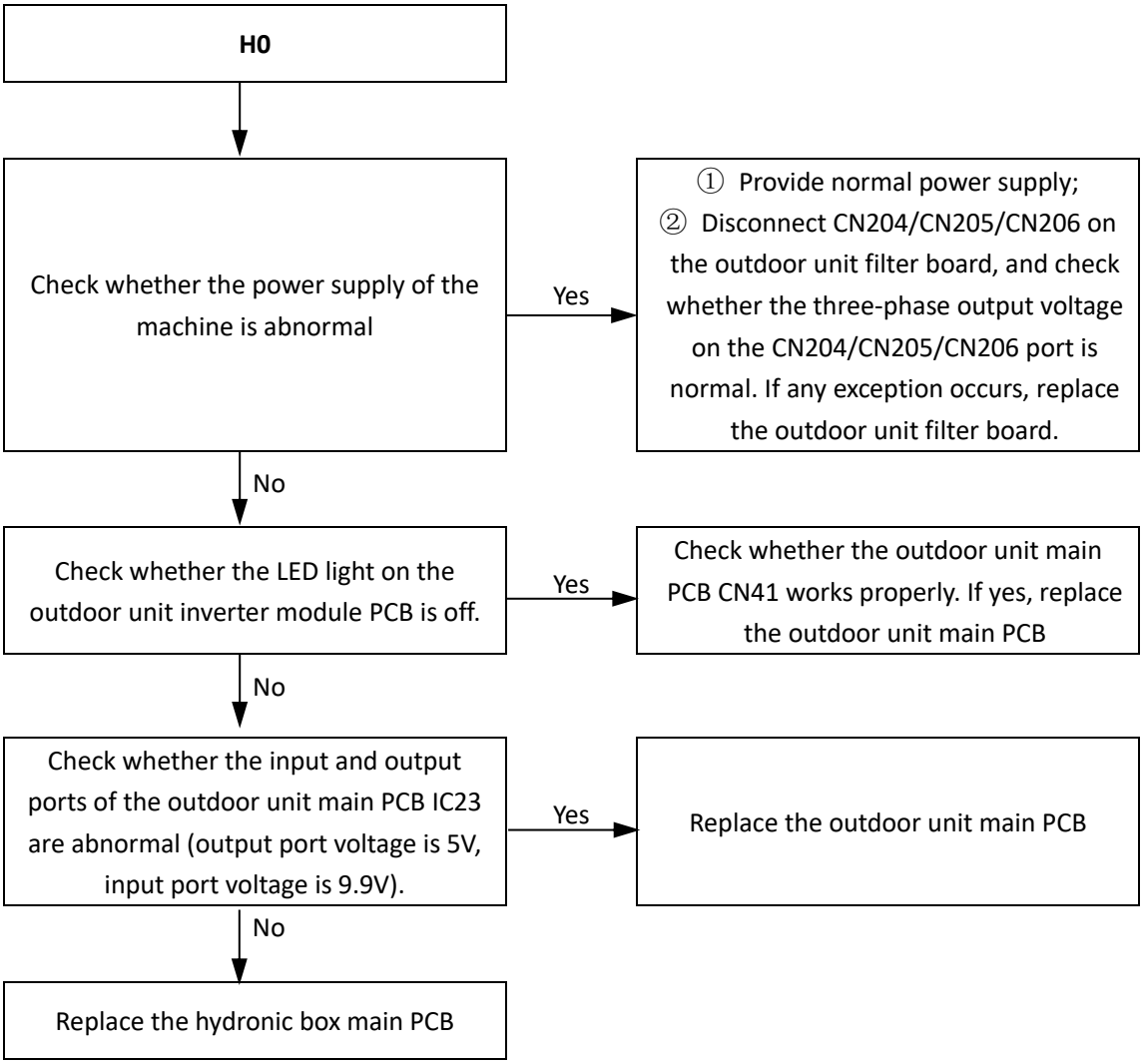
5.10.4 Procedure

One-phase model



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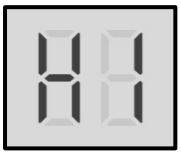
Three-phase model



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5.11 H1 Troubleshooting

5.11.1 Digital display output



5.11.2 Description

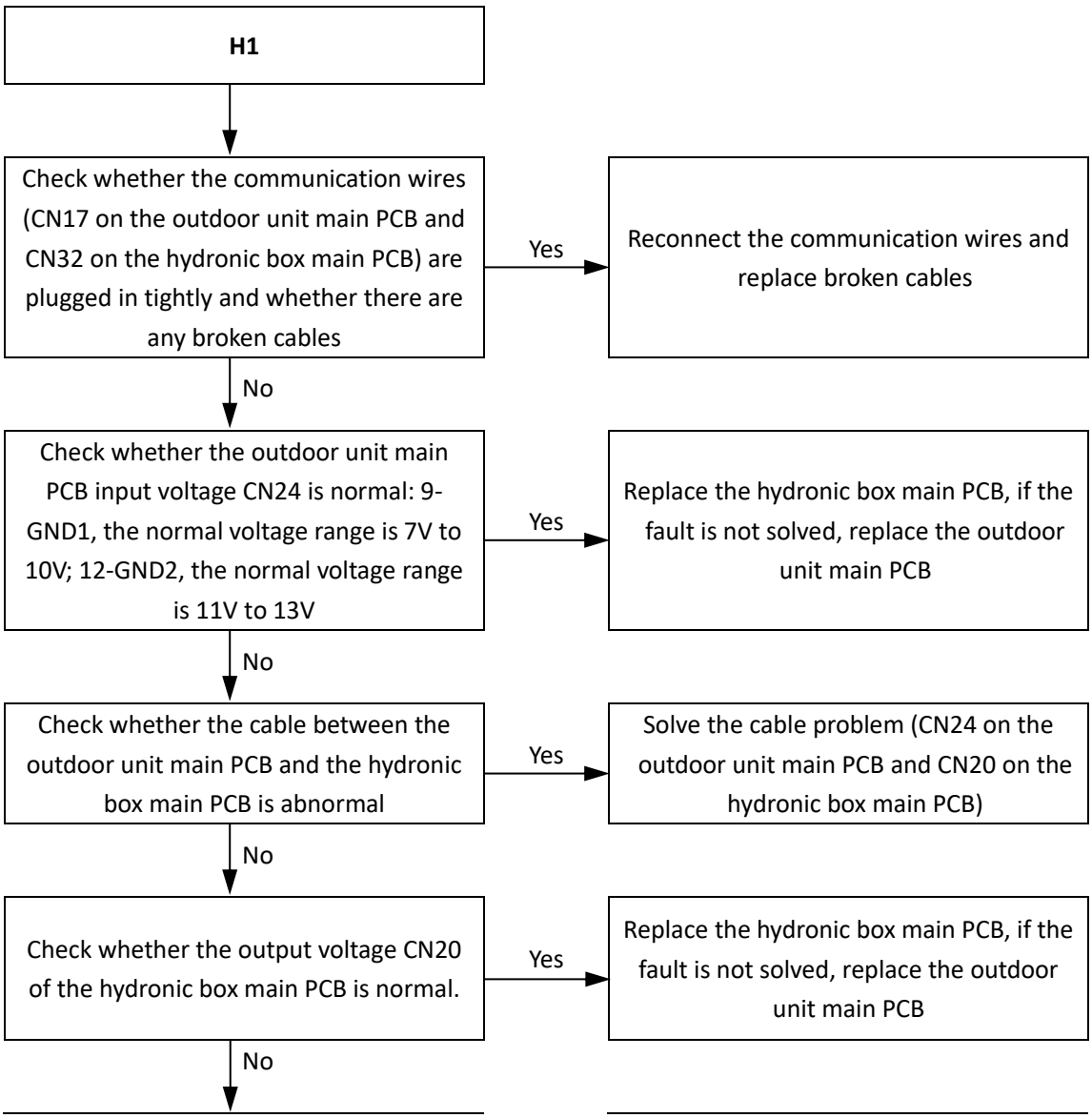
- Communication error between outdoor unit main control board and inverter module.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.11.3 Possible causes

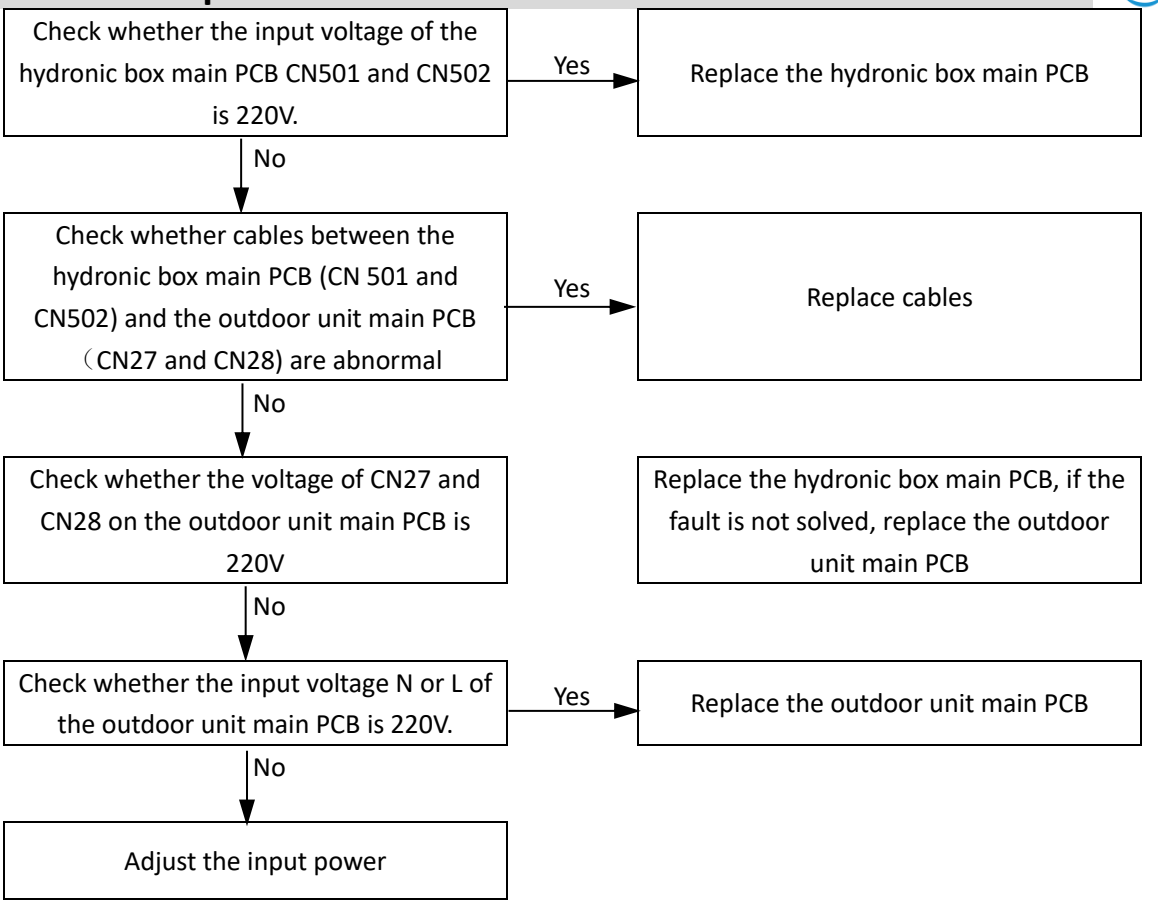
- Power supply abnormal.
- Interference from a source of electromagnetic radiation.
- Outdoor unit main PCB or inverter driven module damaged.

5.11.4 Procedure

One-phase model



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Notes:

1. A multimeter measure weak current in DC voltage mode and strong current in AC voltage mode.

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5.12 H6, HH Troubleshooting

5.12.1 Digital display output



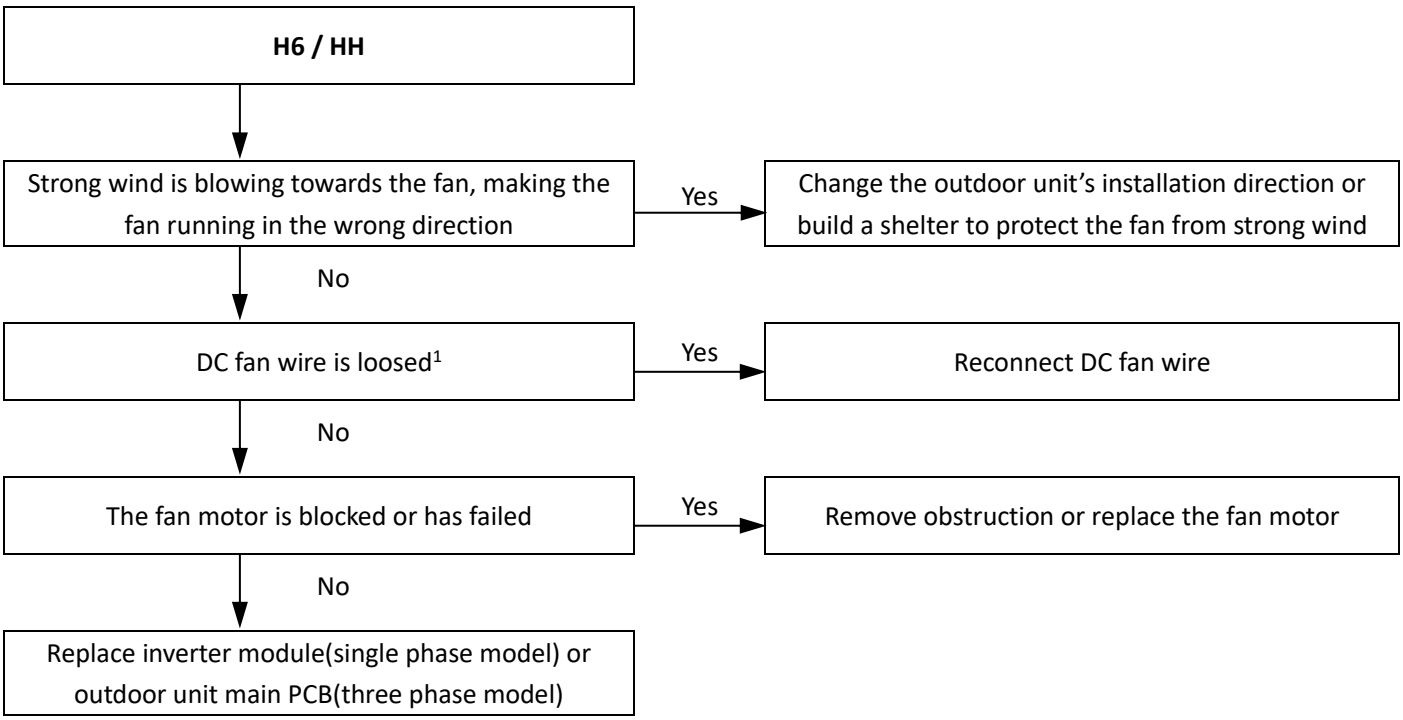

5.12.2 Description

- H6 indicates a DC fan error.
- HH indicates that H6 protection has occurred 10 times in 2 hours. When HH error occurs, a manual system restart is required before the system can resume operation. The cause of HH error should be addressed promptly in order to avoid system damage.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.12.3 Possible causes

- DC fan wire is loosed.
- High wind speed.
- Fan motor blocked or has failed.
- Invert module damaged.
- Main PCB is damaged.

5.12.4 Procedure



Notes:

1. Refer to Figures 4-1.1 Part 1, 1.1 "Outdoor Unit Electric Control Box Layout" and to the M thermal Split Engineering Data Book, Part 3 "Wiring Diagrams".
2. Measure the voltage between the DC fan motor power supply's white and black wires. The normal voltage is 15V when the unit is in standby. If the voltage is significantly different from 15V, the IPM module on the inverter module is damaged. DC fan connection are port CN19 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit inverter module PCB (labeled 4 in Figure 4-2.3-2 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").

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5.13 H7 Troubleshooting

5.13.1 Digital display output



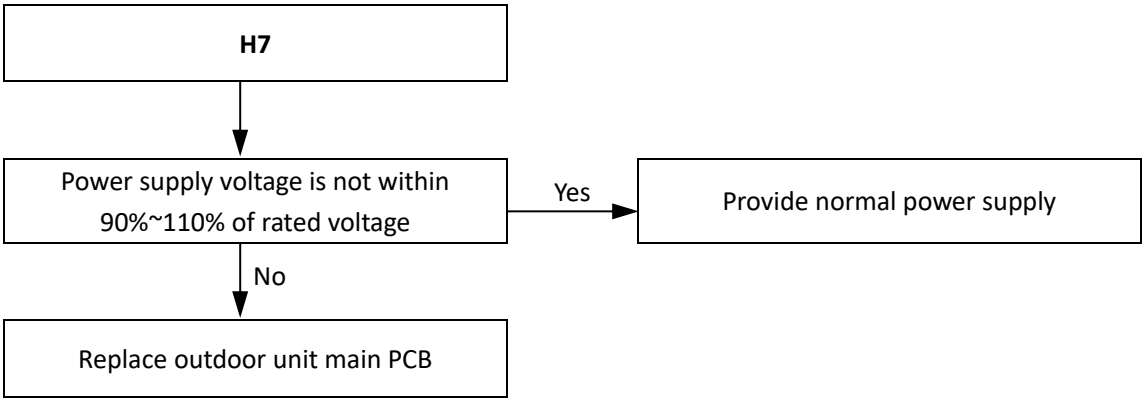
5.13.2 Description

- Abnormal main circuit voltage.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.13.3 Possible causes

- Power supply voltage not within 90%~110% of rated voltage.
- Outdoor unit main PCB is damaged.

5.13.4 Procedure



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5.14 H8 Troubleshooting

5.14.1 Digital display output



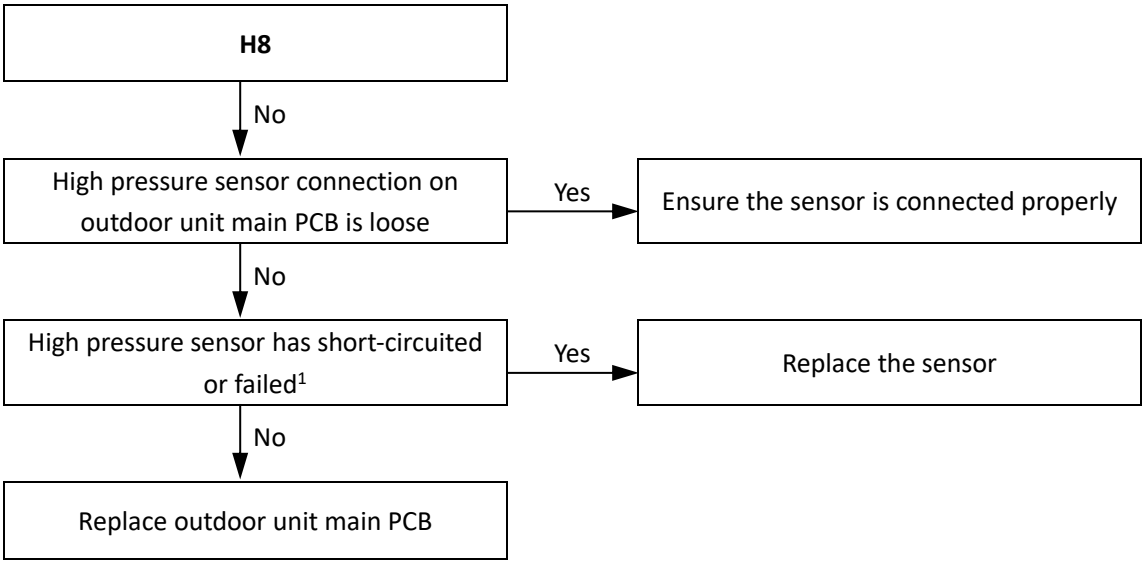
5.14.2 Description

- Pressure sensor error.
- M thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.14.3 Possible causes

- Pressure sensor not connected properly or has malfunctioned.
- Outdoor unit main PCB is damaged.

5.14.4 Procedure



Notes:

1. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed. The pressure sensor connection are port CN4 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 19 in Figure 4-2.3-1 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").

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5.15 P0, HP Troubleshooting

5.15.1 Digital display output




5.15.2 Description

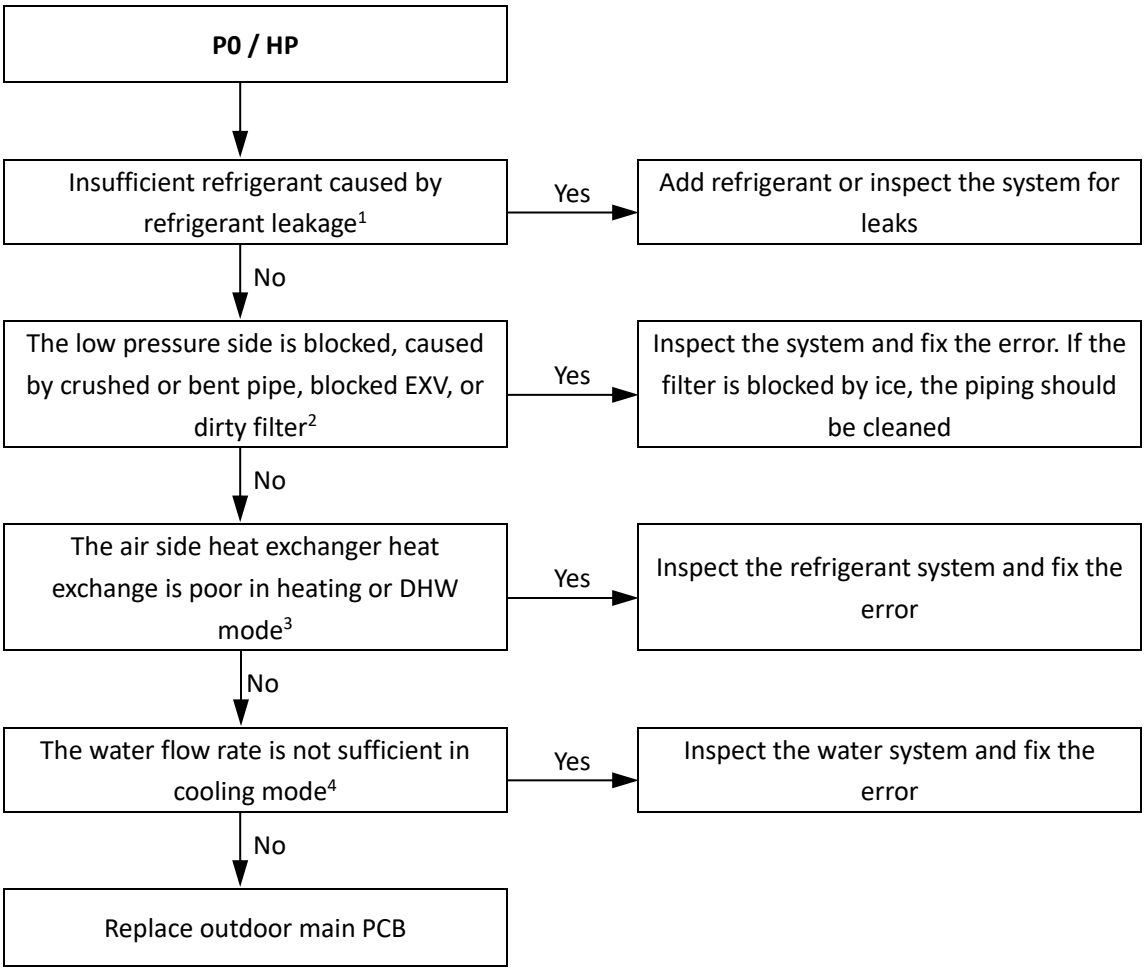
- P0 indicates suction pipe low pressure protection. When the suction pressure falls below 0.14MPa, the system displays P0 protection and M thermal Split stops running. When the pressure rises above 0.3MPa, P0 is removed and normal operation resumes.
- HP indicates Pe<0.6Mpa occurred 3 times in an hour.
- Error code is displayed on outdoor unit main PCB and user interface.

5.15.3 Possible causes

- Low pressure switch not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in heating mode or DHW mode.
- Insufficient water flow in cooling mode.
- Outdoor unit main PCB damaged.

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5.15.4 Procedure



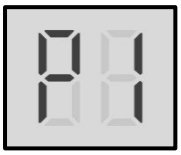
Notes:

1. To check for insufficient refrigerant:
   An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system.
2. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters.
3. Check air side heat exchanger, fan and air outlets for dirt/blockages.
4. Check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

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5.16 P1 Troubleshooting

5.16.1 Digital display output



5.16.2 Description

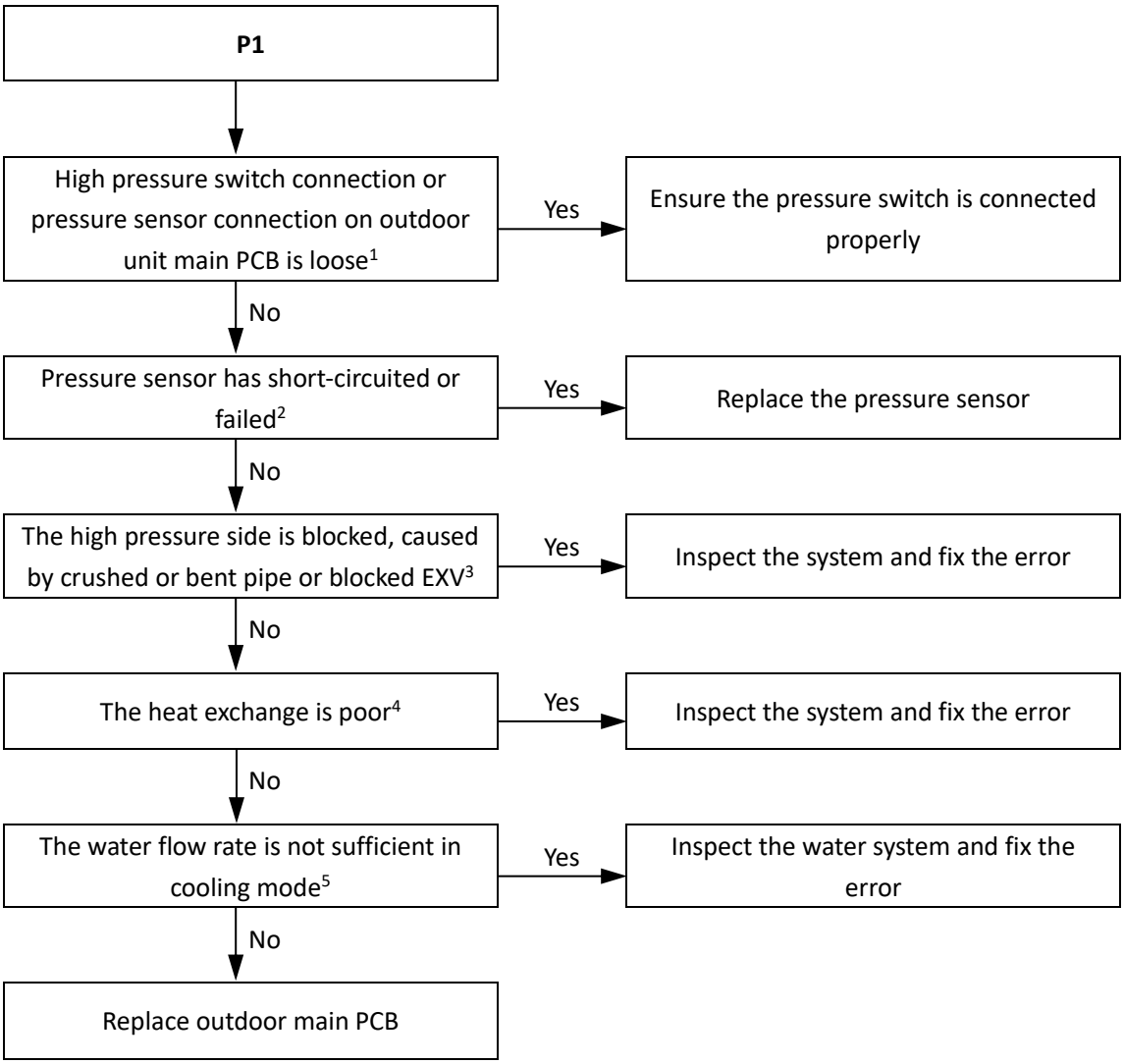
- Discharge pipe high pressure protection. When the discharge pressure rises above 4.3MPa, the system displays P1 protection and M thermal Split stops running. When the discharge pressure falls below 3.6MPa, P1 is removed and normal operation resumes.
- Error code is displayed on outdoor unit main PCB and user interface.

5.16.3 Possible causes

- Pressure sensor/switch not connected properly or has malfunctioned.
- Excess refrigerant.
- System contains air or nitrogen.
- High pressure side blockage.
- Poor condenser heat exchange.
- Outdoor unit main PCB damaged.

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5.16.4 Procedure



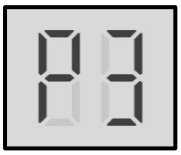
Notes:

1. High pressure switch connection is port CN13 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.3-1 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").
2. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
3. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal.
4. In heating mode check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages. In cooling mode check air side heat exchanger, fan(s) and air outlets for dirt/blockages.
5. Check water pressure on the manometer. If the water pressure is not > 1 bar, water flow is insufficient. Refer to Figure 1-1.2 in Part 1, 1.2 “Hydronic Box Layout”.

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5.17 P3 Troubleshooting

5.17.1 Digital display output



5.17.2 Description

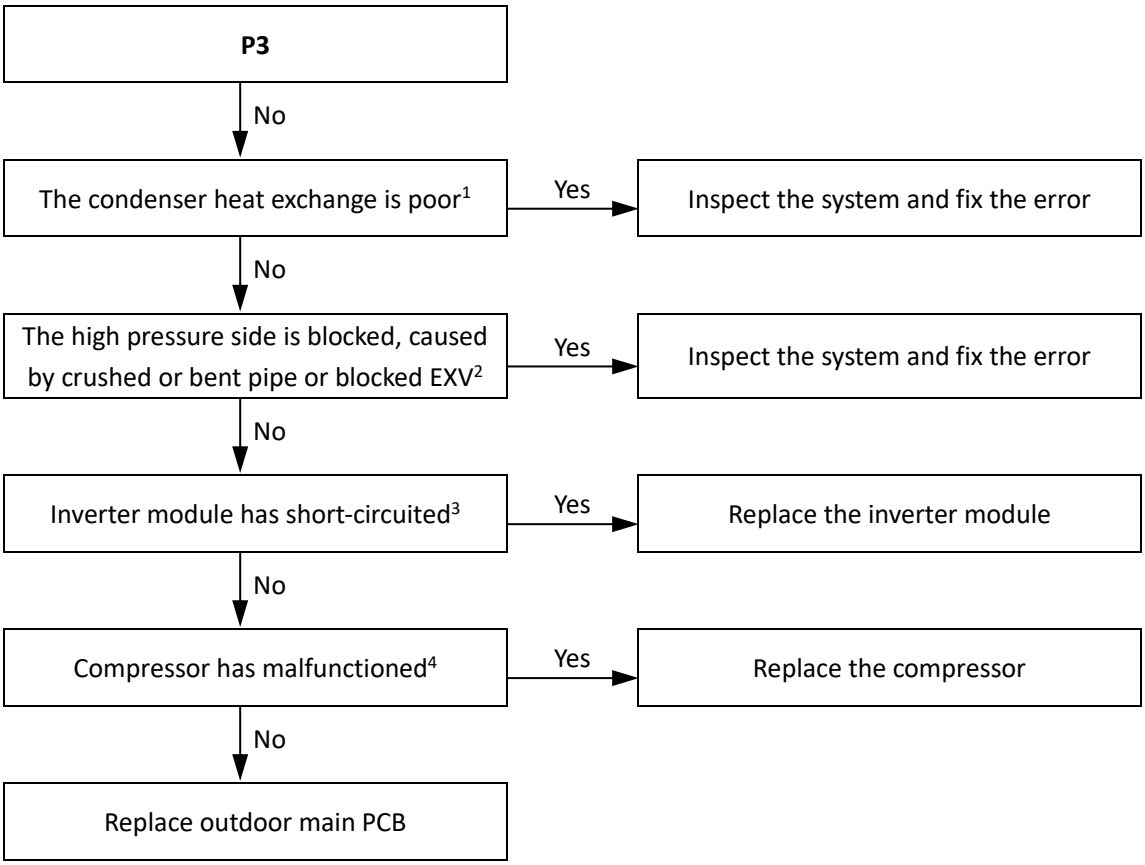
- Compressor current protection.
- When the compressor current rises above the protection value (4/6kW models 18A, 8/10kW model 19A, 12/14/16kW single phase model 30A, 12/14/16kW three phase model 14A,), the system displays P3 protection and M thermal Split stops running. When the current returns to the normal range, P3 is removed and normal operation resumes.
- Error code is displayed on refrigerant system main PCB and user interface.

5.17.3 Possible causes

- Poor condenser heat exchange.
- High pressure side blockage.
- Inverter module damaged.
- Compressor damaged.
- Outdoor unit main PCB damaged.

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5.17.4 Procedure



Notes:

1. In heating mode check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages. In cooling mode check air side heat exchanger, fan and air outlets for dirt/blockages.
2. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal.
3. Set a multi-meter to buzzer mode and test any two terminals of P N and U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited.
4. The normal resistances of the inverter compressor are 0.7-1.5Ω among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.

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5.18 P4 Troubleshooting

5.18.1 Digital display output



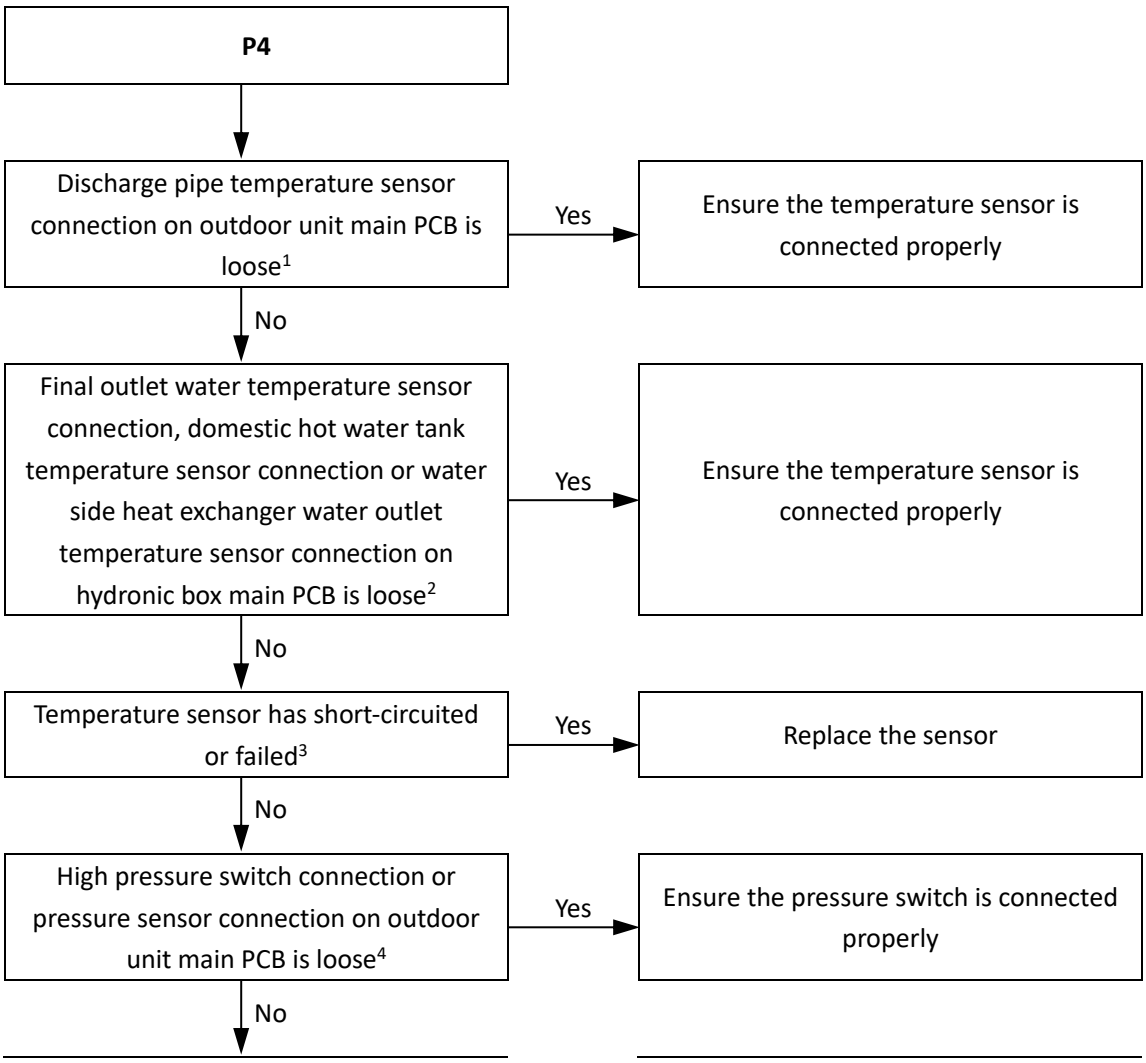
5.18.2 Description

- Discharge temperature protection.
- When the compressor the discharge temperature rises above 239°F(115°C), the system displays P4 protection and M thermal Split stops running. When the discharge temperature falls below 203°F (95°C), P4 is removed and normal operation resumes.
- Error code is displayed on refrigerant system main PCB and user interface.

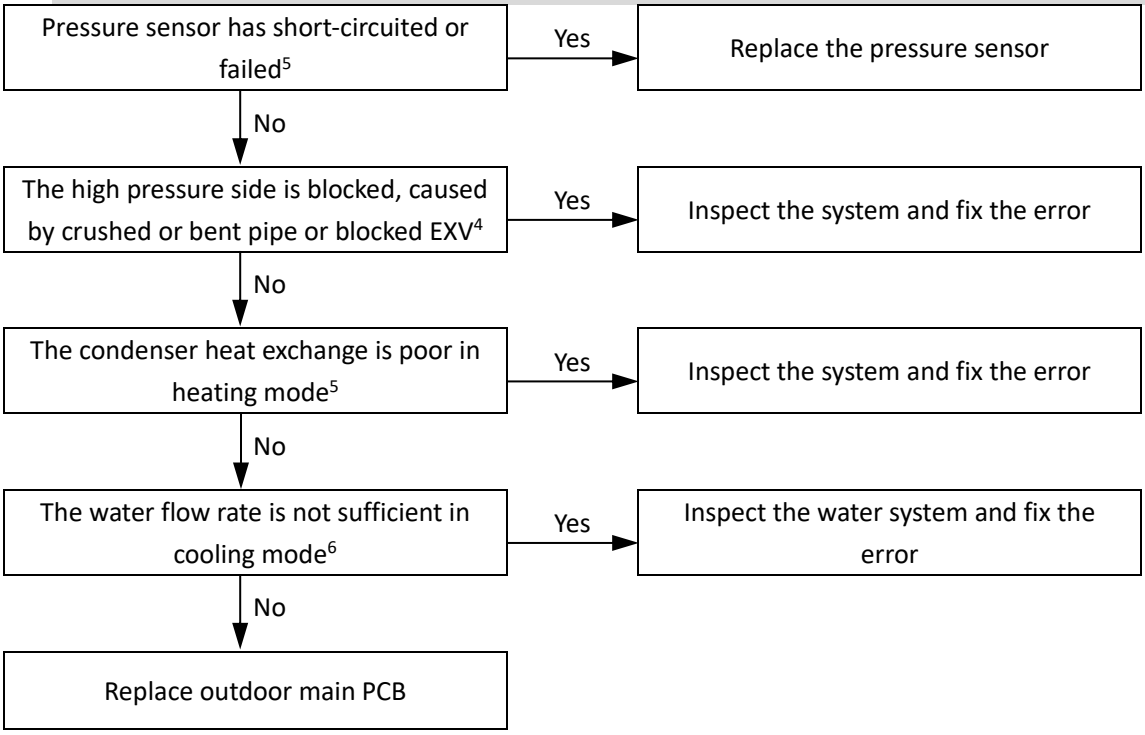
5.18.3 Possible causes

- Temperature sensor error
- High pressure side blockage.
- Poor condenser heat exchange.
- Outdoor unit main PCB damaged.

5.18.4 Procedure



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Notes:

1. Discharge pipe temperature sensor connection is port CN8 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.3-1 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").
2. Final outlet water temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled 10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System"). Domestic hot water tank temperature sensor connection is port CN13 on hydronic box main PCB (labeled 13 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System").
3. 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. Refer to Part 2, 1 "Layout of Functional Components" and to Table 7-7.1 or 7-7.2 in Part 7, 7.1 "Temperature Sensor Resistance Characteristics".
4. High pressure switch connection is port CN13 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.3-1 in Part 4,2. 3 "Main PCB for Refrigerant System, Inverter Module").
5. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
6. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal.
7. Check air side heat exchanger, fan and air outlets for dirt/blockages.
8. Check the water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

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5.19 P5 Troubleshooting

5.19.1 Digital display output



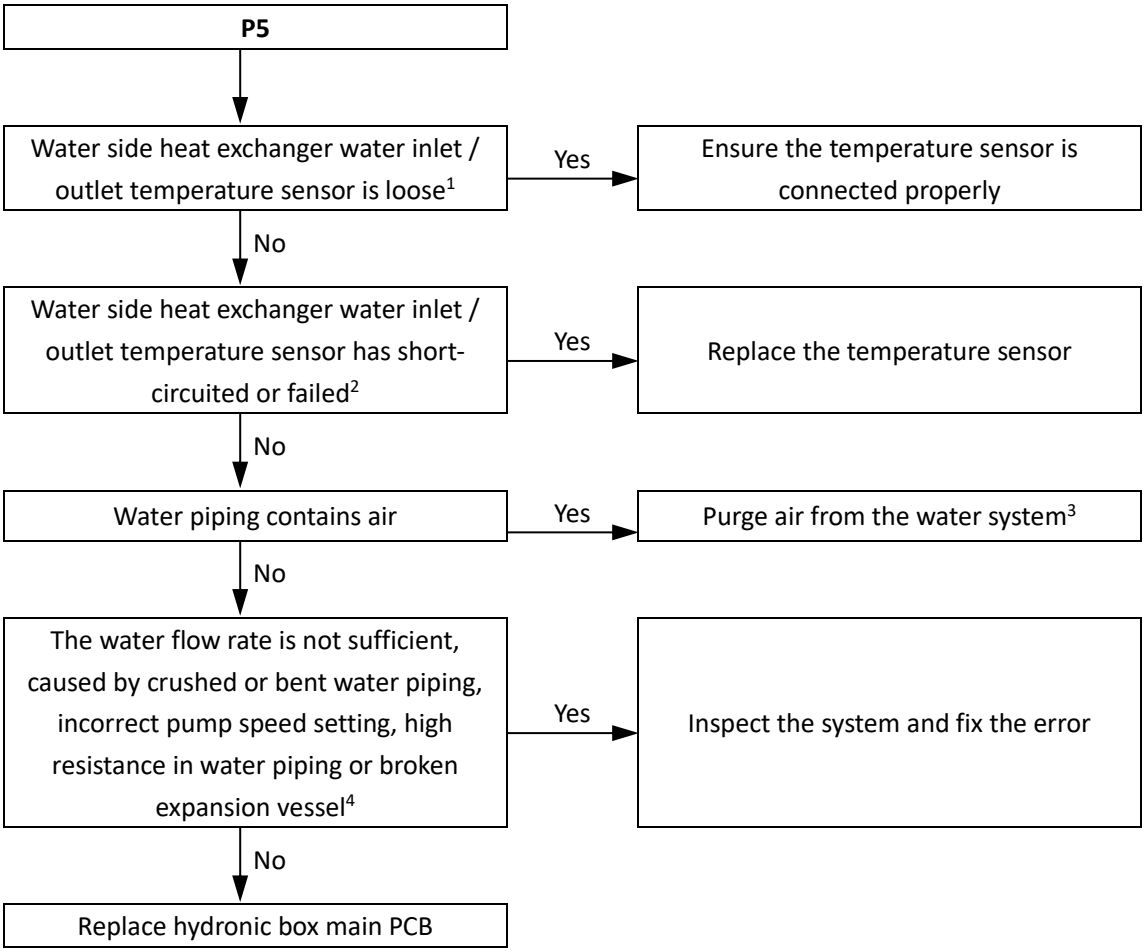
5.19.2 Description

- High temperature difference between water side heat exchanger water inlet and water outlet temperatures protection.
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.19.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Water piping contains air.
- Insufficient water flow.
- Hydronic box main PCB damaged.

5.19.4 Procedure



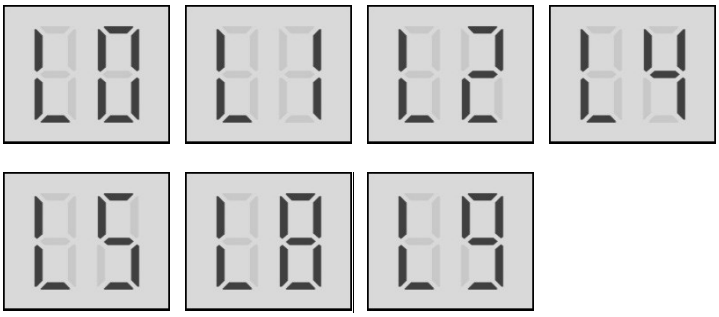
Notes:

1. Water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System").
2. 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. Refer to Part 2, 1.2 "Hydronic Box Layout" and to Table 7-7.3 in Part 7, 7.1 "Temperature Sensor Resistance Characteristics".
3. Refer to the M thermal Split Engineering Data Book.
4. Check water pressure on the manometer. If the water pressure is not > 1 bar, water flow is insufficient. Refer to Part 2, 1.2 "Hydronic Box Layout".

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5.20 Inverter module Troubleshooting for single-phase models

5.20.1 Digital display output



5.20.2 Description

- Inverter module protection.
- M thermal Split stops running.
- Specific error code L0, L1, L2, L4, L5, L8, L9 is displayed on the user interface and the main control board of refrigerant system.

5.20.3 Possible causes

- Inverter module protection.
- DC bus low or high voltage protection.
- MCE error(DC bus low or high voltage protection or software over current protection)
- Zero speed protection.
- Excessive compressor frequency variation.
- Actual compressor frequency differs from target frequency.
- High pressure protection.
- PED board self checking fail.

5.20.4 Specific error codes for inverter module protection

Table 4-5.20.4-1: Specific error codes

Specific error code	Content
L0	Inverter module protection
L1	DC bus low voltage protection
L2	DC bus high voltage protection
L4	MCE error(DC bus low or high voltage protection or software over current protection)
L5	Zero speed protection
L8	Compressor frequency variation greater than 15Hz within 1 second protection
L9	Actual compressor frequency differs from target frequency by more than 15Hz protection

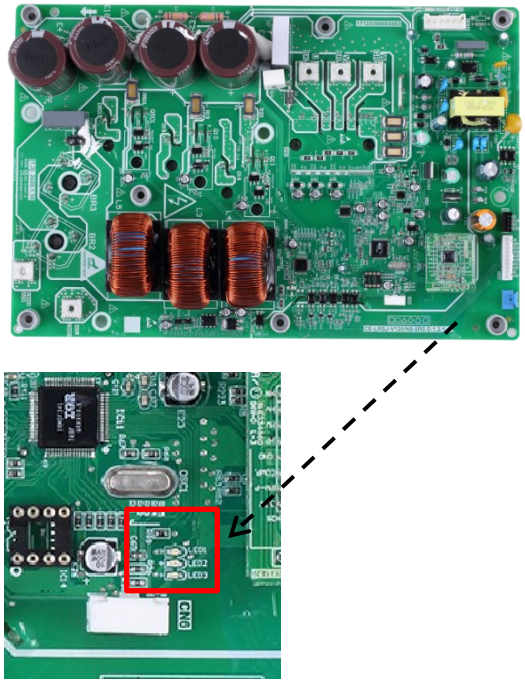
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The specific error codes can also be obtained from the LED indicators on the inverter module.

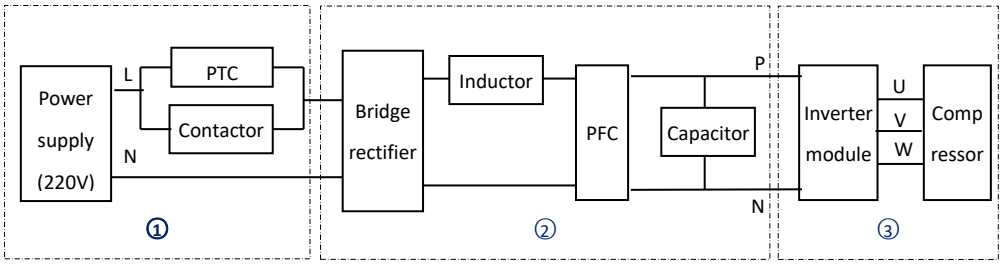
Table 4-5.20.4-2: Errors indicated on LED, single-phase 12~16kW

LED1 flashing pattern (GREEN) LED2 is always on (RED)	Corresponding error
Flashes 3 times and stops for 1 second, then repeats	P1 - High pressure protection
Flashes 5 times and stops for 1 second, then repeats	bH – PED board checking fail
Flashes 8 times and stops for 1 second, then repeats	L0 - Inverter module protection
Flashes 9 times and stops for 1 second, then repeats	L1 - DC bus low voltage protection
Flashes 10 times and stops for 1 second, then repeats	L2 - DC bus high voltage protection
Flashes 12 times and stops for 1 second, then repeats	L4 - MCE error
Flashes 13 times and stops for 1 second, then repeats	L5 - Zero speed protection
Flashes 16 times and stops for 1 second, then repeats	L8 - Compressor frequency variation greater than 15Hz within one second protection
Flashes 17 times and stops for 1 second, then repeats	L9 - Actual compressor frequency differs from target frequency by more than 15Hz protection

Figur:4-5.20.4: Inverter Module(12-16KW): LED1/LED2/LED3



5.20.5 Principle of DC inverter



①Contactor is open, the current across the PTC to charge capacitor. After 5 seconds, the contactor closed.

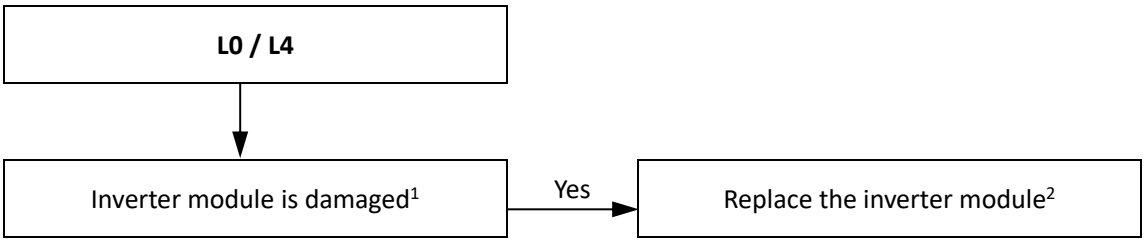
②220-240V AC power supply change to DC power supply after bridge rectifier.

③The capacitor output steady power supply for inverter module P N terminals. In standby the voltage between P and N terminal on inverter module is 1.4 time of AC power supply. When the fan motor is running, the voltage is 377V DC.

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5.20.6 L0/L4 troubleshooting

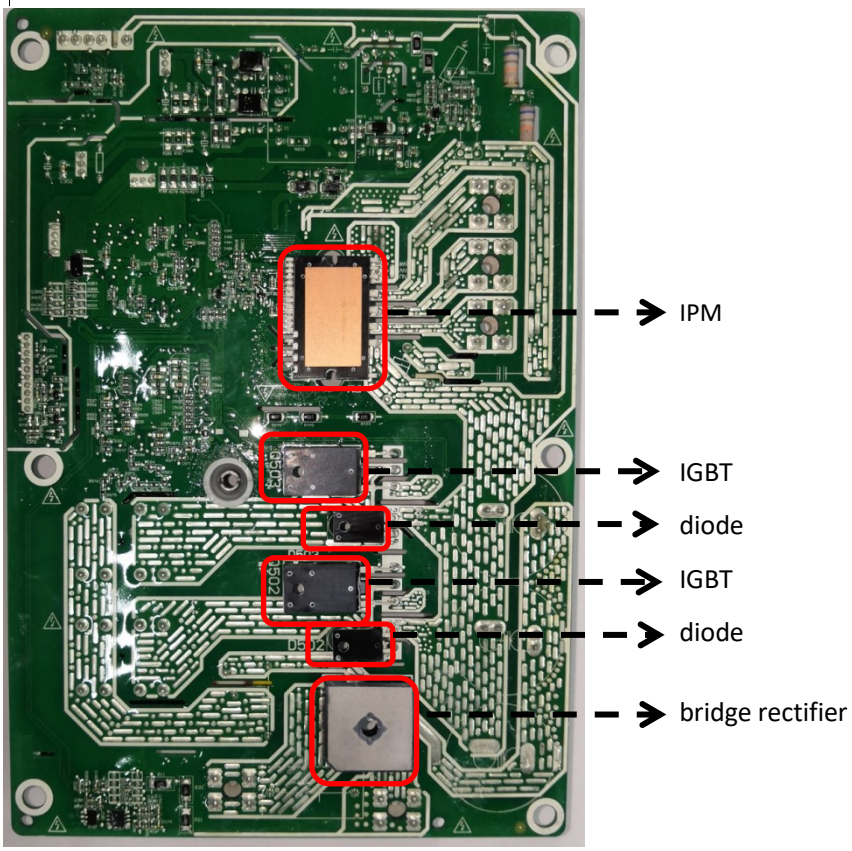
Situation 1: L0 or L4 error appears immediately after the outdoor unit is powered-on



Notes:

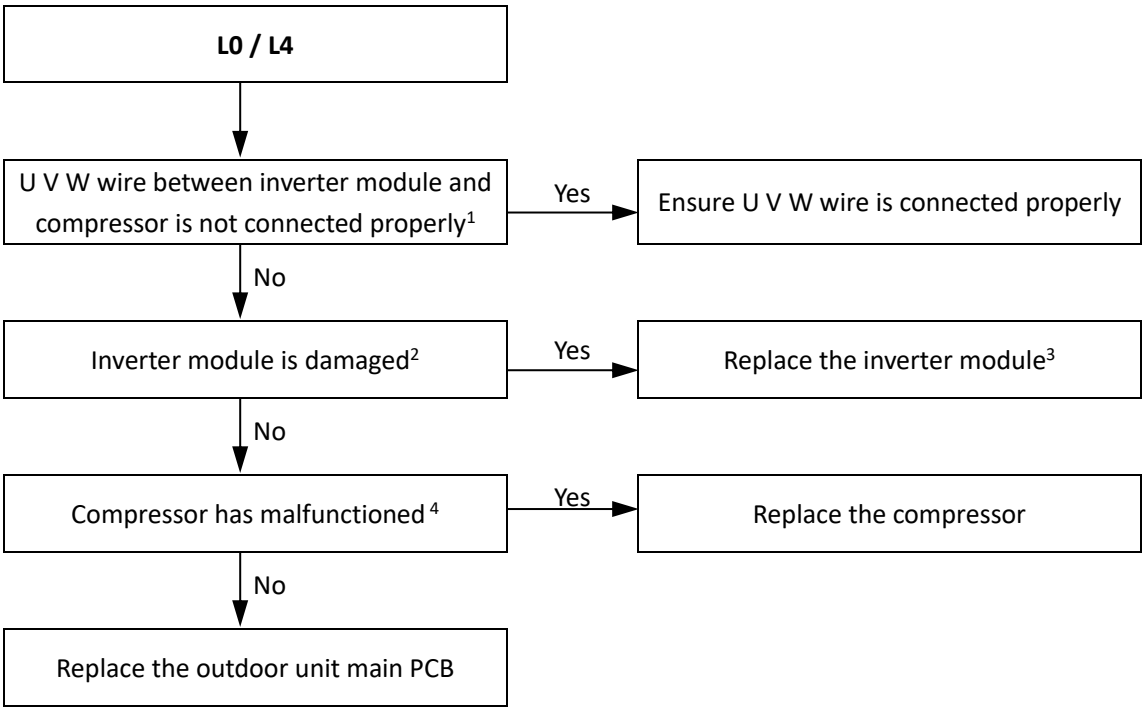
1. Measure the resistance between each of U, V and W and each of P and N on the inverter module. All the resistances should be infinite. If any of them are not infinite, the inverter module is damaged and should be replaced. Refer to Figure 4-2.3-2 in Part 4, 2.3-2 “Main PCBs for Refrigerant System, Inverter Module”.
2. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module, IGBT, diode, bridge rectifier (on the reverse side of the inverter module).

Figure 4-5.20.6: Replacing an inverter module



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Situation 2: L0 or L4 error appears immediately after the compressor starts up

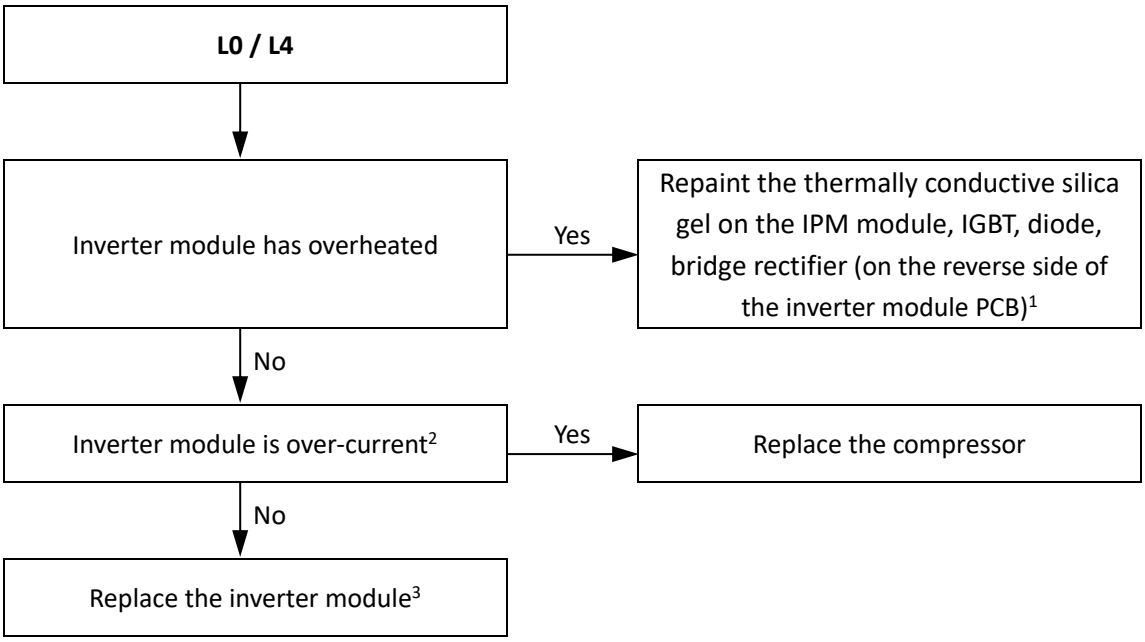


Notes:

1. Connect the U V W wire from the inverter module to the correct compressor terminals, as indicated by the labels on the compressor.
2. Measure the resistance between each of U, V and W and each of P and N on the inverter module. All the resistances should be infinite. If any of them are not infinite, the inverter module is damaged and should be replaced. Refer to Figure 4-2.3-2 in Part 4, 2.3-2 “Main PCBs for Refrigerant System, Inverter Module”.
3. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module, IGBT, diode bridge rectifier (on the reverse side of the inverter module PCB).
4. The normal resistances of the inverter compressor are 0.7-1.5Ω among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.

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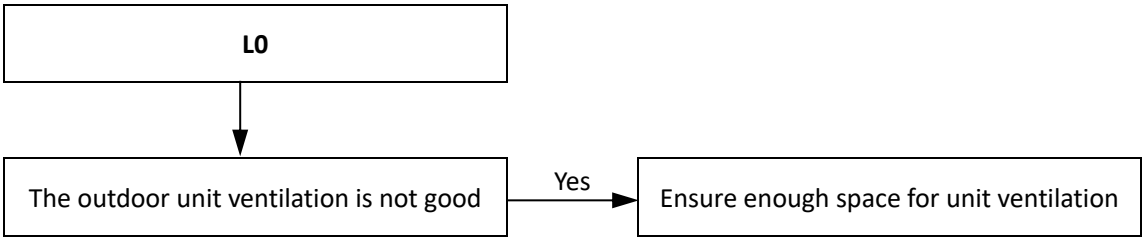
Situation 3: L0 or L4 error appears after the compressor has been running for a period of time and the compressor speed is over 60rps



Notes:

1. Use clip-on ammeter to measure the compressor current, if the current is normal indicates the inverter module is failed, if the current is abnormal indicates the compressor is failed.
2. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the PFC and IPM modules (on the reverse side of the inverter module PCB).

Situation 4: L0 error appears occasionally/irregularly



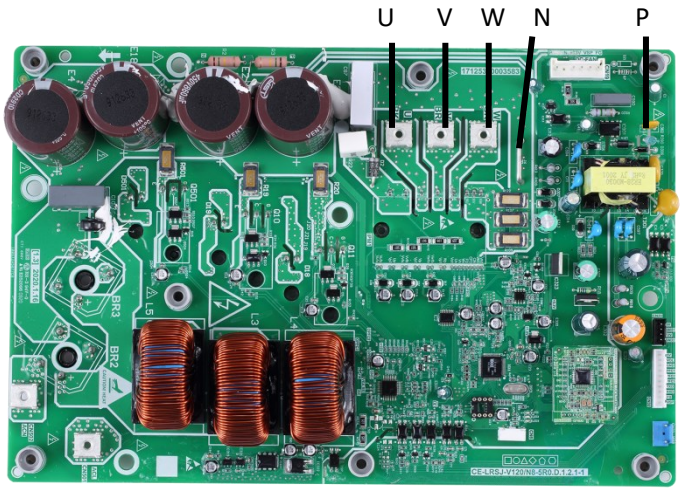
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5.20.7 L1/L2 troubleshooting

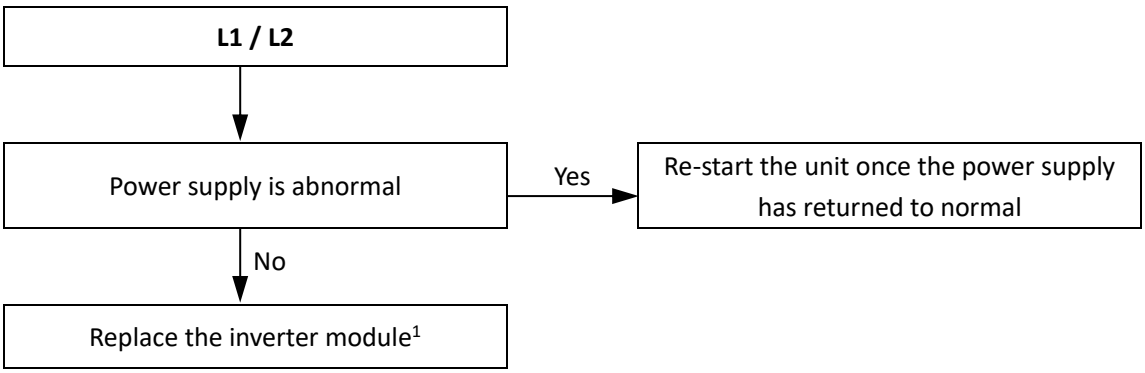
The normal DC voltage between terminals P and N on inverter module is 1.4 time of AC power supply in standby , the DC voltage is 377V when the fan motor is running. If the voltage is lower than 160V, the unit displays L1. If the voltage is higher than 500V, the unit display L2.

Figure 4-5.20.7: Inverter module terminals

Inverter module terminals (12-16KW)



Situation 1: L1 or L2 error appears immediately after the outdoor unit is powered-on

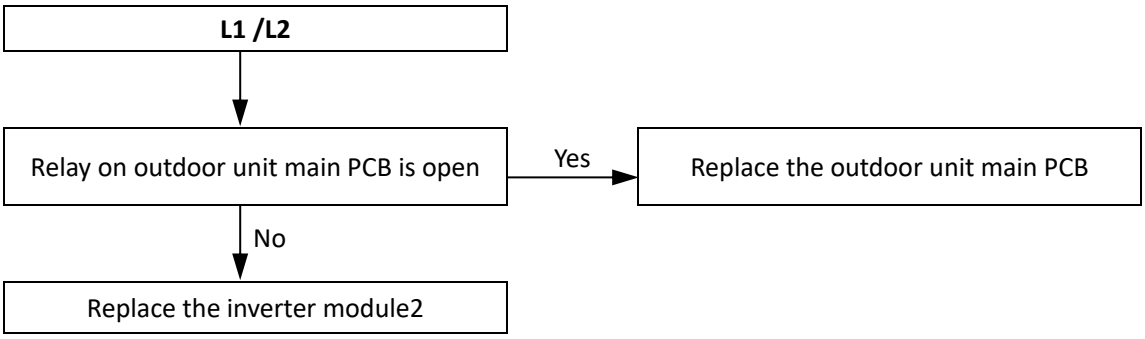


Notes:

1. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module, IGBT, diode, bridge rectifier (on the reverse side of the inverter module PCB).

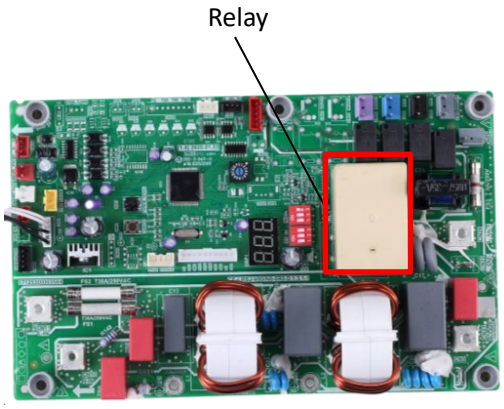
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Situation 2: L1 or L2 error appears after the compressor has been running for a period of time and the compressor speed is over 20rps

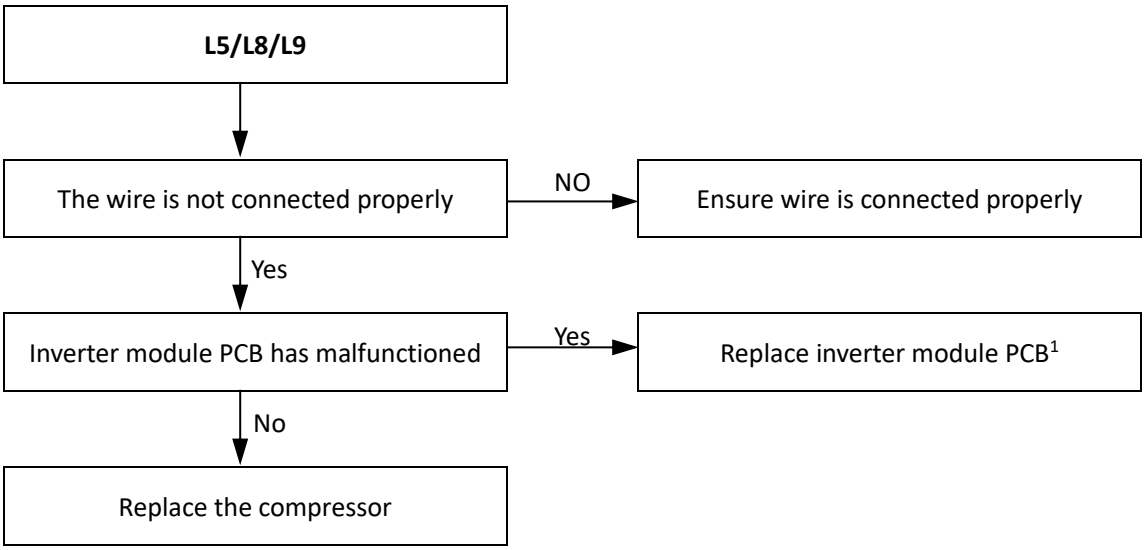


Notes:
1. If the fan motor is running and the DC voltage between terminals P and N on inverter module declined, Relay on the main control board of outdoor unit is open.
2. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on IPM module (on the reverse side of the inverter module PCB).

Figure 4-6.4: Relay location of main PCB for refrigerant system
Single phase 12/14/16kW unit



5.20.8 L5/L8/L9 troubleshooting

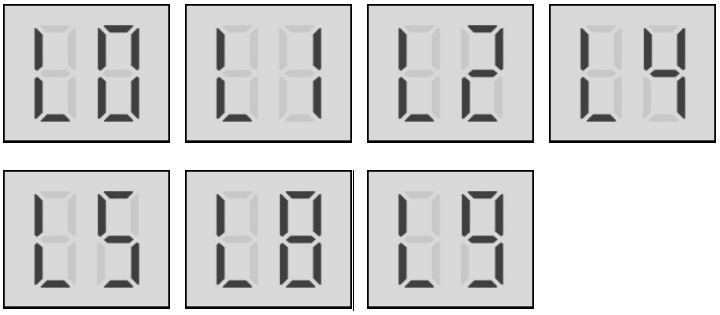


Note:
1. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on IPM module (on the reverse side of the inverter module PCB).

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5.21 Inverter module Troubleshooting for three-phase models

5.21.1 Digital display output



5.21.2 Description

- Inverter module protection or high pressure protection.
- M thermal Mono stops running.
- Specific error code L0, L1, L2, L4, L5, L8 , L9 is displayed on the user interface and the refrigerant system main PCB.

5.21.3 Possible causes

- Inverter module protection.
- DC bus low or high voltage protection.
- MCE error(DC bus low or high voltage protection or software over current protection)
- Zero speed protection.
- Excessive compressor frequency variation.
- Actual compressor frequency differs from target frequency.
- High pressure protection.
- Contactor stuck or 908 self checking fail.

5.21.4 Specific error codes for inverter module protection

Table 4-6.4: Specific error codes

Specific error code	Content
L0	Inverter module protection
L1	DC bus low voltage protection
L2	DC bus high voltage protection
L4	MCE error(DC bus low or high voltage protection or software over current protection)
L5	Zero speed protection
L8	Compressor frequency variation greater than 15Hz within one second protection
L9	Actual compressor frequency differs from target frequency by more than 15Hz protection

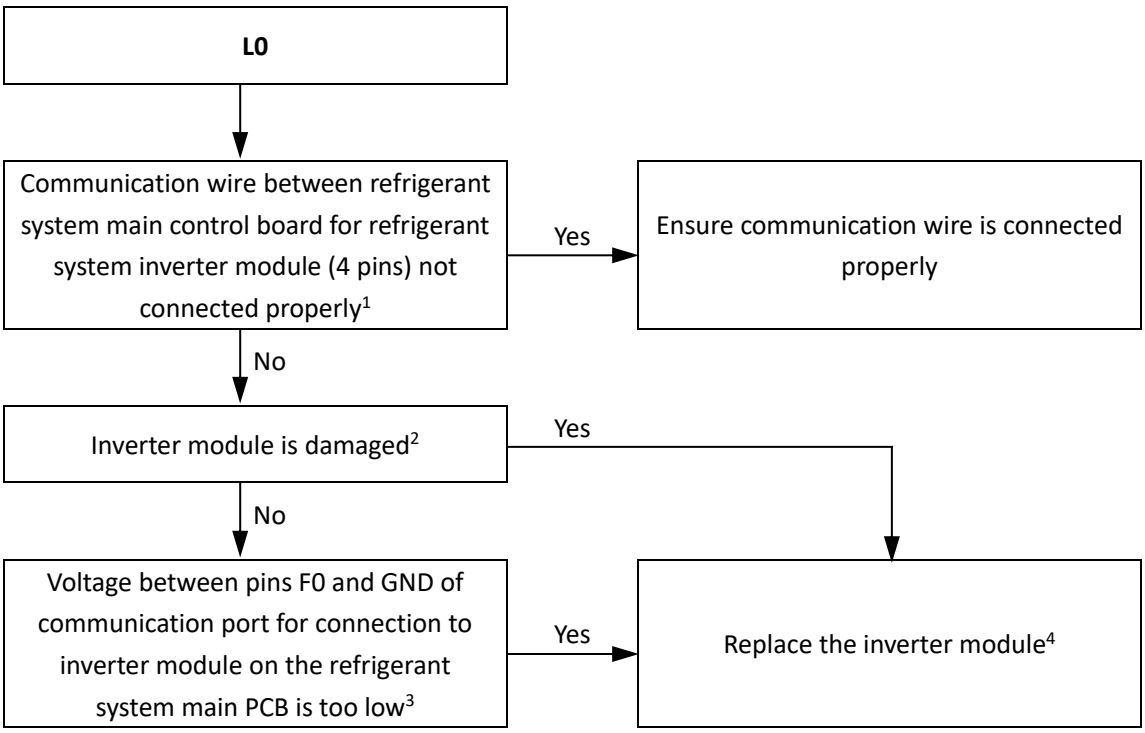
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The specific error codes can also be obtained from the LED indicators LED1/LED2 on the inverter module.

Table 4-6.5: Errors indicated on LED for three-phase 12~16kW unit

LED1/2 flashing pattern	Corresponding error
Flashes 8 times and stops for 1 second, then repeats	L0 - Inverter module protection
Flashes 9 times and stops for 1 second, then repeats	L1 - DC bus low voltage protection
Flashes 10 times and stops for 1 second, then repeats	L2 - DC bus high voltage protection
Flashes 12 times and stops for 1 second, then repeats	L4 - MCE error(DC bus low or high voltage protection or software over current protection)
Flashes 13 times and stops for 1 second, then repeats	L5 - Zero speed protection
Flashes 17 times and stops for 1 second, then repeats	L8 - Compressor frequency variation greater than 15Hz within one second protection L9 - Actual compressor frequency differs from target frequency by more than 15Hz protection
Flashes 3 times and stops for 1 second, then repeats	bH - Contactor stuck or 908 self checking fail
Flashes 5 times and stops for 1 second, then repeats	P1 - High pressure protection

Situation 1: L0 error appears immediately after the outdoor unit is powered-on

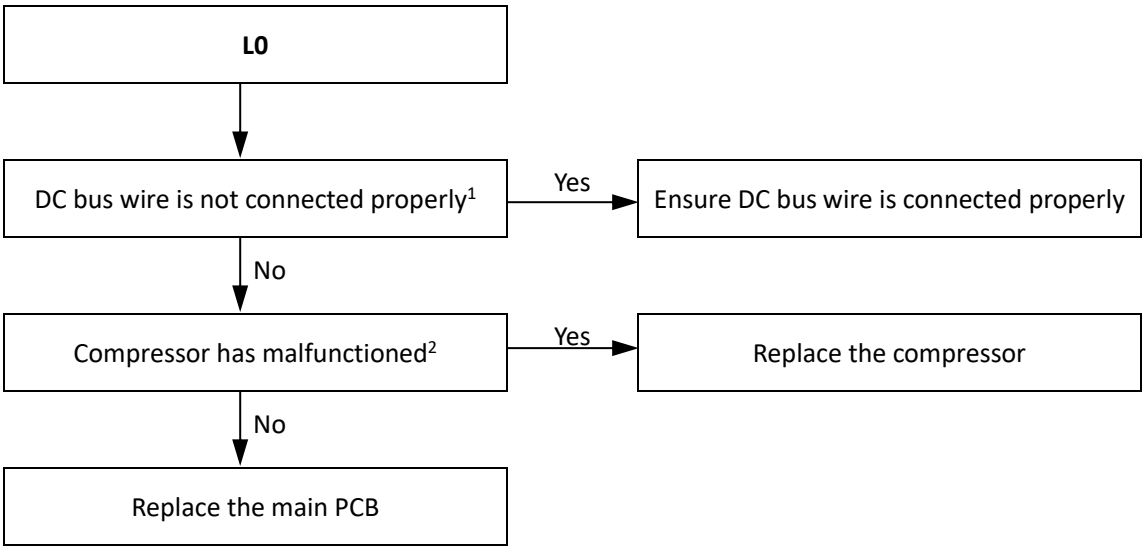


Notes:

1. For MHA-V12(14,16)W/D2RN8-B2, the communication port between refrigerant system main control board for refrigerant system inverter module is port CN36 on refrigerant system main control board for refrigerant system port CN8 on inverter module.
2. Measure the resistance between each of U, V and W and each of P and N on the inverter module. All the resistances should be infinite. If any of them are not infinite, the inverter module is damaged and should be replaced.
3. The normal voltage between F0 and GND is 5V. Refer to Figure 4-6.6.
4. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module (on the reverse side of the inverter module PCB). Refer to Figure 4-6.2.

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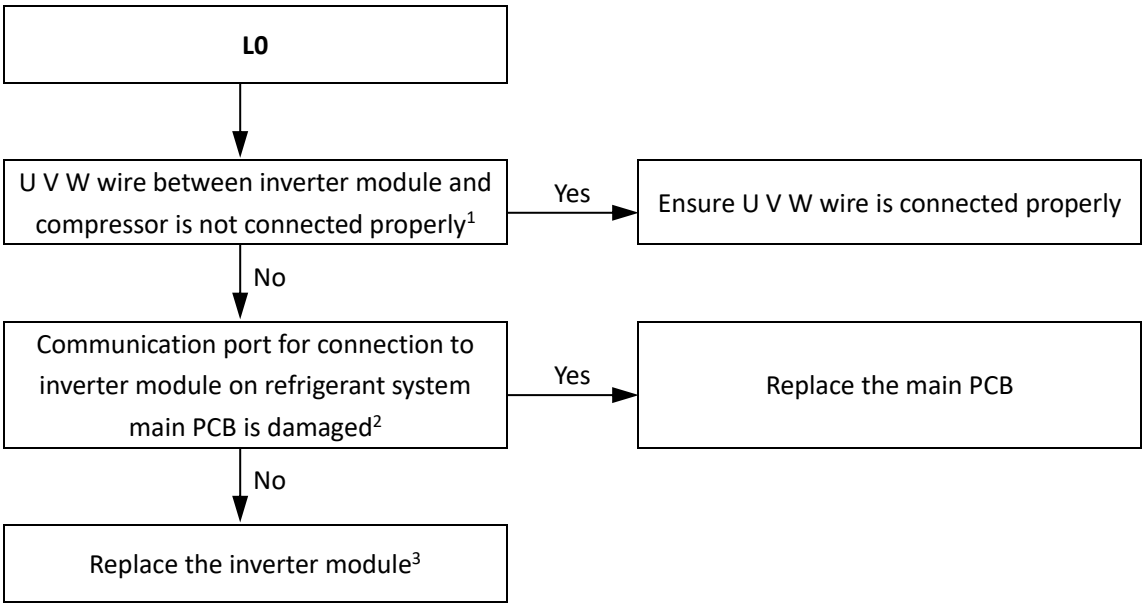
Situation 2: L0 error appears immediately after the compressor starts up



Notes:

1. The DC bus wire should run from the N terminal on the inverter module, through the current sensor (in the direction indicated by the arrow on the current sensor), and end at the N terminal of capacitor. Refer to Figure 4-6.7.

Situation 3: L0 error appears within 2 seconds of compressor start-up

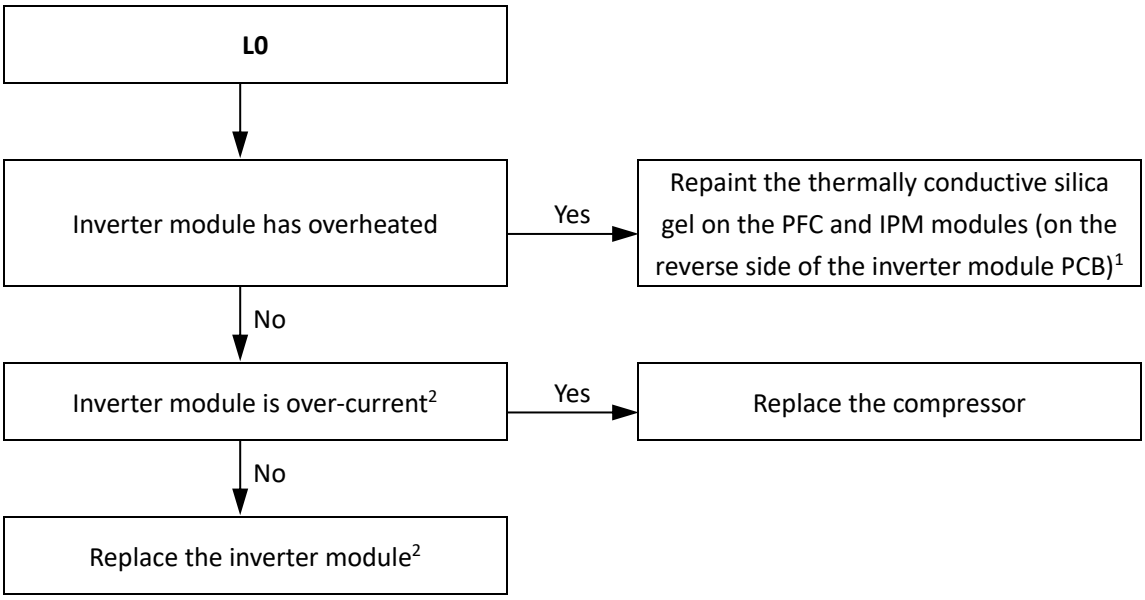


Notes:

1. Connect the U V W wire from the inverter module to the correct compressor terminals, as indicated by the labels on the compressor.
2. Measure the voltage between each of W-, W+, V-, V+, U-, U+ and GND when the unit is in standby. The normal voltage should be 2.5V-4V and the six voltages should be same, otherwise the communication terminal has failed. Refer to Figure4-6.8.

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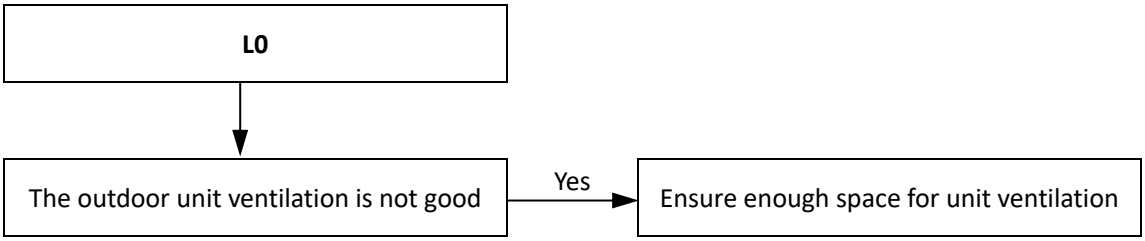
Condition 4: L0 error appears after the compressor has been running for a period of time and the compressor speed is over 60rps



Notes:

1. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module (on the reverse side of the inverter module PCB).
2. Use clip-on ammeter to measure the compressor current, if the current is normal indicates the inverter module is failed, if the current is abnormal indicates the compressor has failed.

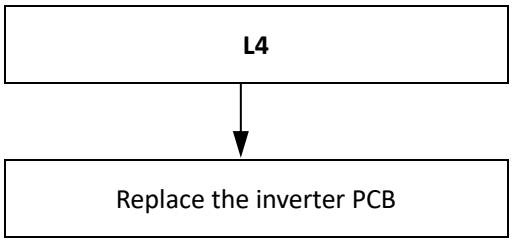
Situation 5: L0 error appears occasionally/irregularly



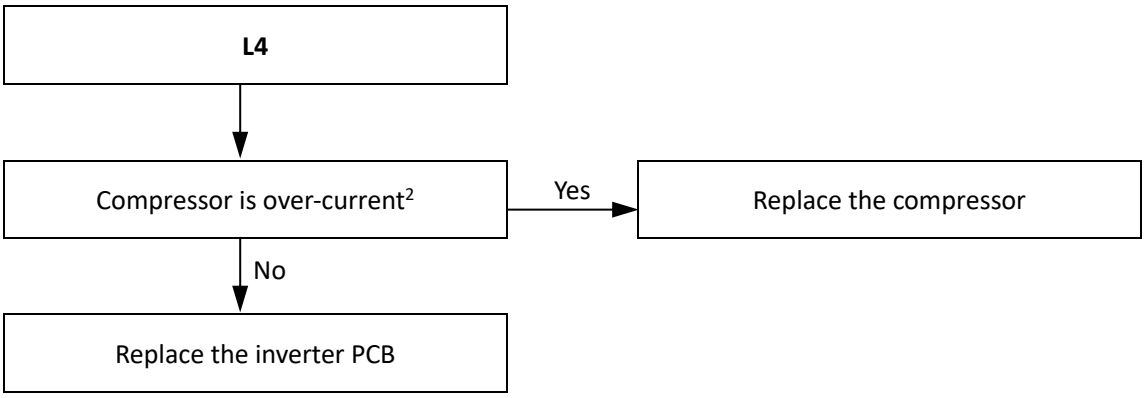
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5.21.5 L4 troubleshooting(the same as L1/L2)

Situation 1: L4 error appears immediately after the outdoor unit is powered-on



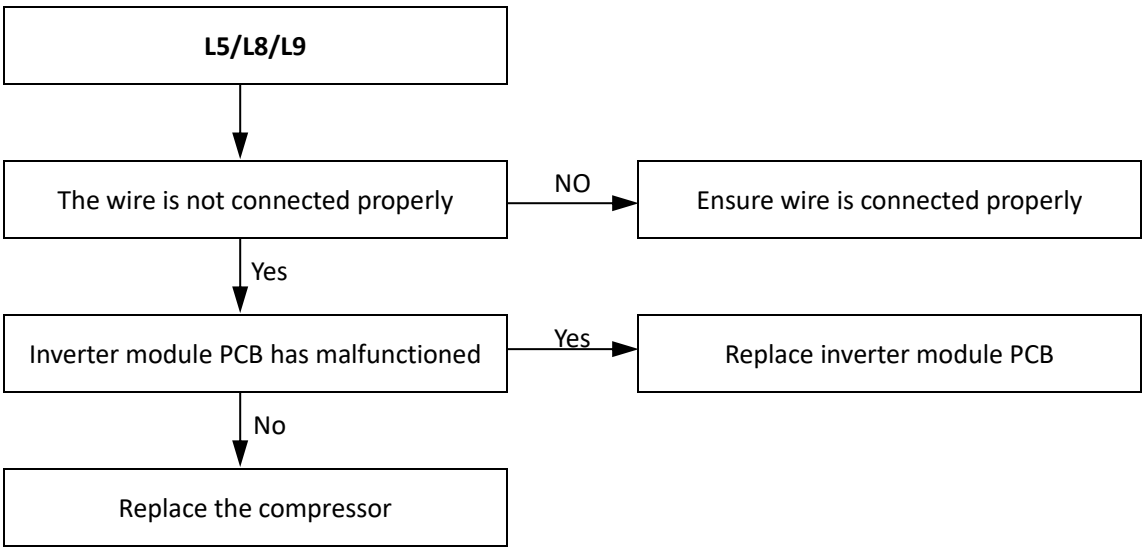
Condition 2: L4 error appears after the compressor has been running for a period of time and the compressor speed is over 60rps



Notes:

1. Re-start the unit, use clip-on ammeter to measure the compressor current, if the current is normal indicates the compressor is failed, if the current is abnormal indicates the inverter PCB is failed..

5.21.6 L5/L8/L9 troubleshooting



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5.22 Pd Troubleshooting

5.22.1 Digital display output



5.22.2 Description

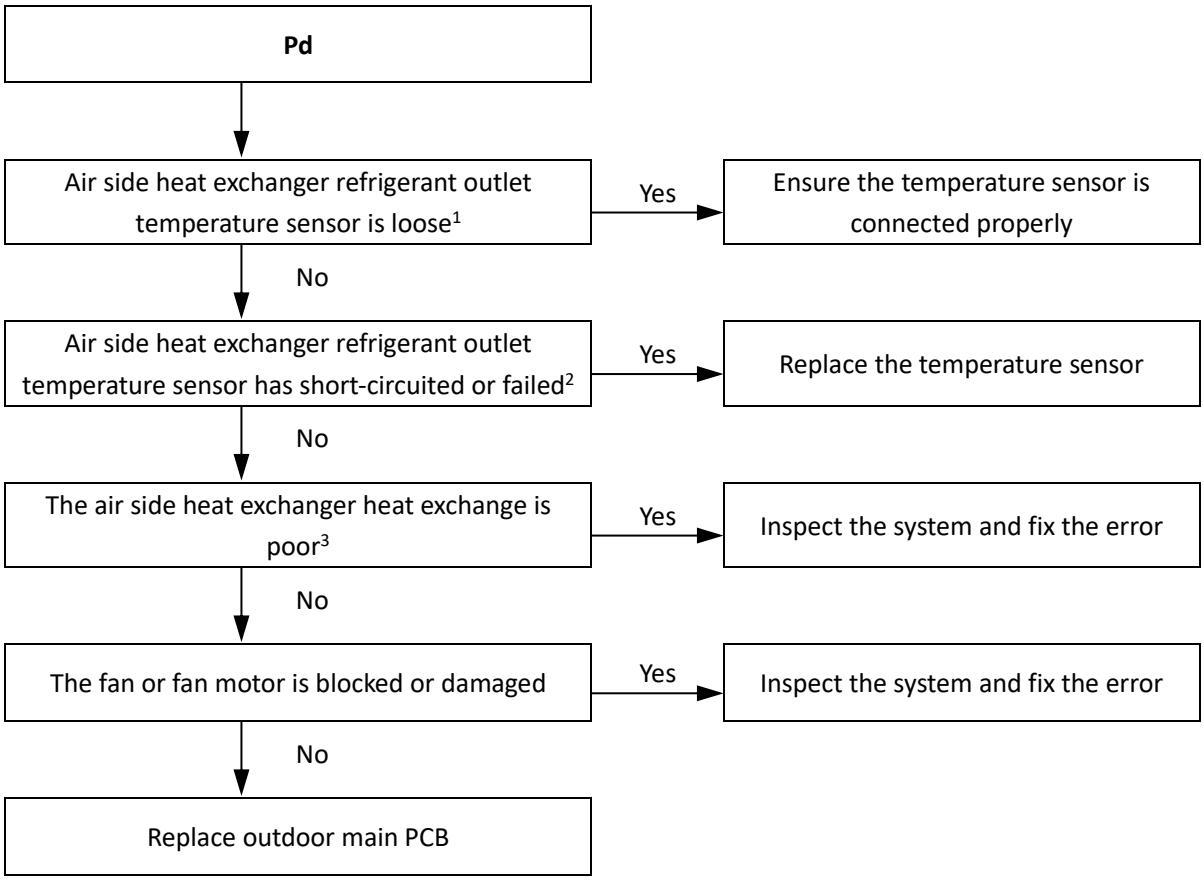
- High temperature protection of air side heat exchanger refrigerant outlet in cooling mode. When the air side heat exchanger refrigerant outlet temperature is higher than 141.8°F(61°C) for more than 3 seconds, the system displays Pd protection and M-Thermal Split stops running. When the air side heat exchanger refrigerant outlet temperature returns drops below 131°F(55°C), Pd is removed and normal operation resumes.
- M-Thermal Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

5.22.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Poor condenser heat exchange.
- Fan motor damaged.
- Hydronic box main PCB damaged.

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5.22.4 Procedure



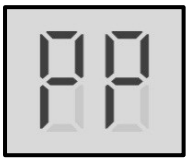
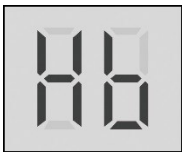
Notes:

1. Air side heat exchanger refrigerant outlet temperature sensor and outdoor ambient temperature sensor connection port CN9 on the MHA-V12(14,16)WD2MN8-B2 outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.3-1 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module")
2. 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. Refer to Part 2, 1.1 "Outdoor Unit Layout" and to Table 4-7.1 in Part 4, 7.1 "Temperature Sensor Resistance Characteristics".
3. Check air side heat exchanger, fan and air outlets for dirt/blockages.
4. High pressure switch connection is port CN13 on the control panel.

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5.23 PP Troubleshooting

5.23.1 Digital display output

5.23.2 Description

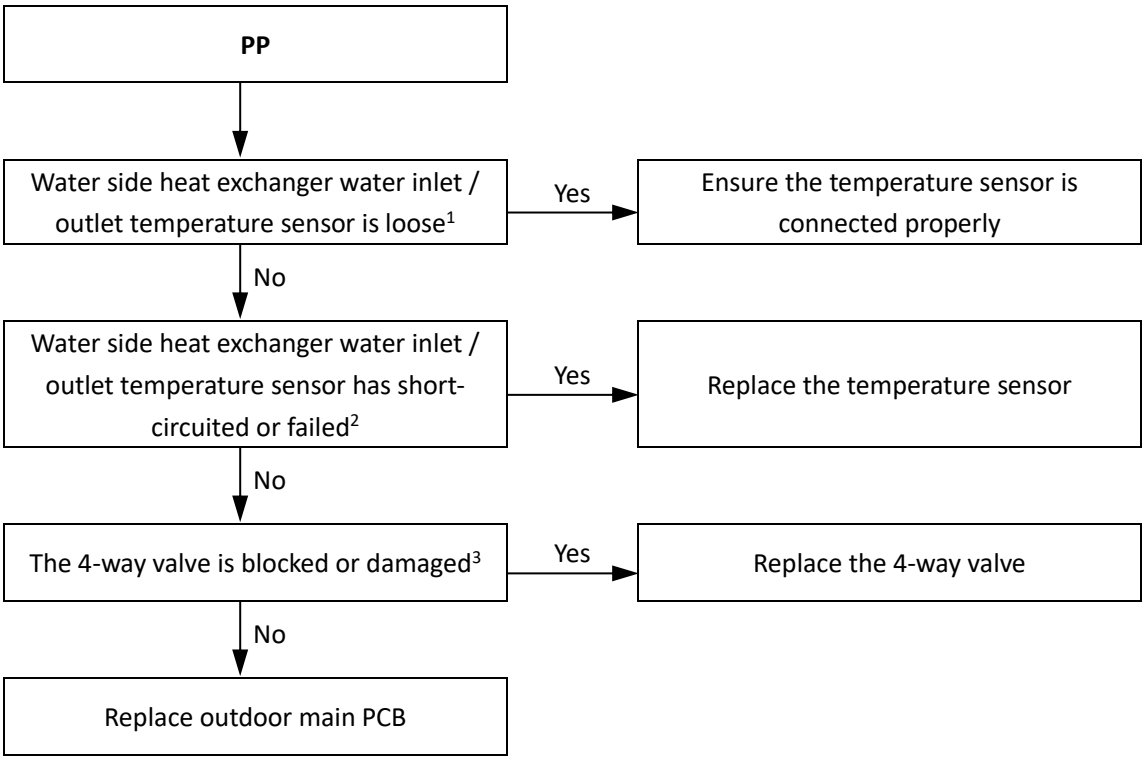
- Water side heat exchanger inlet temperature is higher than outlet temperature in heating mode.
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.
- Hb indicates PP has displayed 3 times.

5.23.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- 4-way valve is blocked or damaged.
- Hydronic box main PCB damaged.

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5.23.4 Procedure



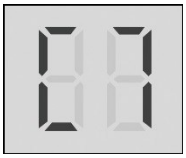
Notes:

1. Water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled 10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System").
2. 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. Refer to Part 2, 1.2 "Hydronic Box Layout" and to Table 4-7.3 in Part 4, 7.1 "Temperature Sensor Resistance Characteristics".
3. Restart the unit in cooling mode to change the refrigerant flow direction. If the unit does not operate normally, the 4-way valve is blocked or damaged.

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5.24 C7 Troubleshooting

5.24.1 Digital display output



5.24.2 Description

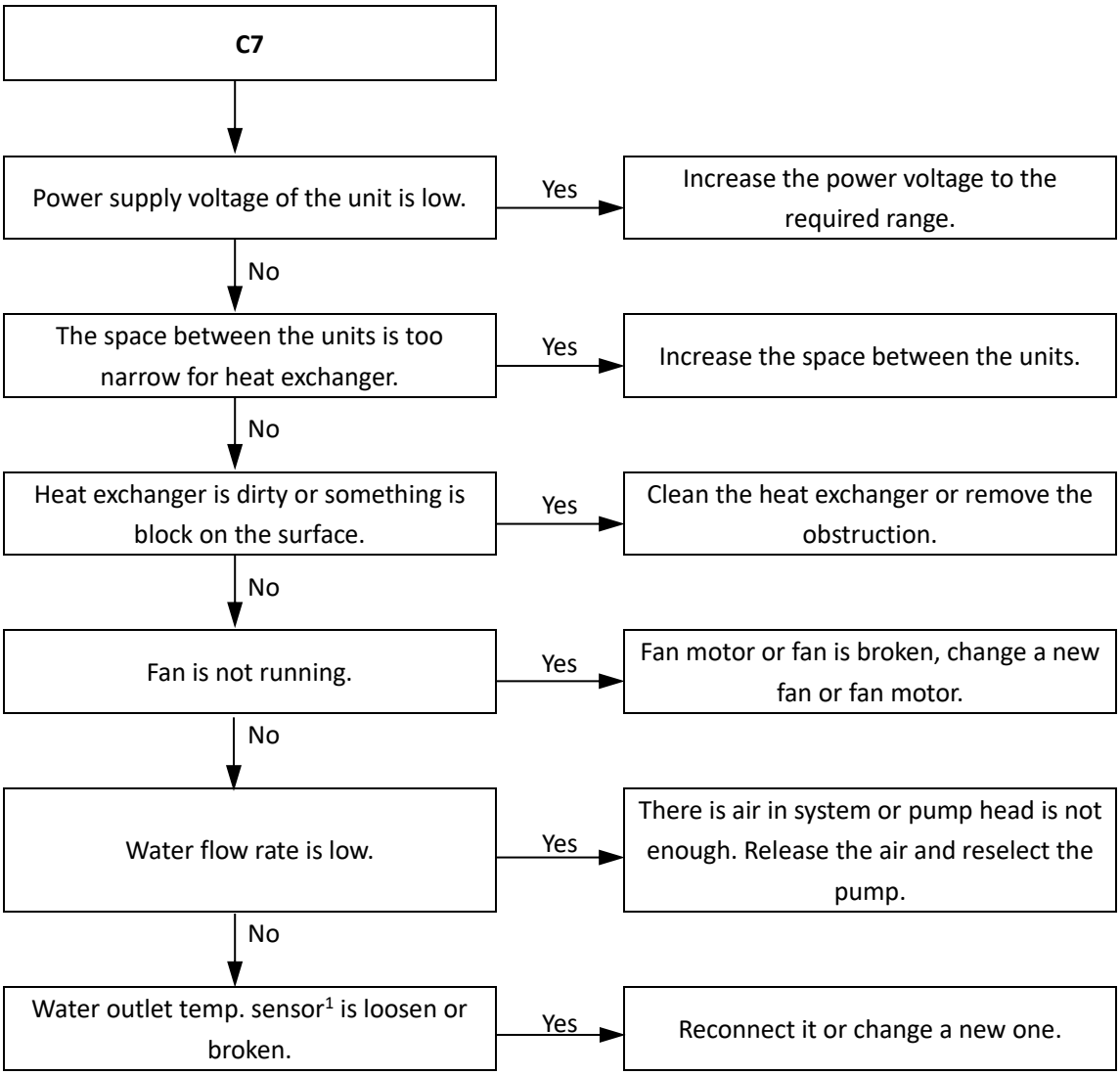
- Transducer module temperature too high protection
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.24.3 Possible causes

- Power supply voltage of the unit is low.
- The space between the units is too narrow for heat exchanger.
- Heat exchanger is dirty or something is block on the surface.
- Fan is not running.
- Water flow rate is low.
- Water outlet temp. sensor is loosen or broken.

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5.24.4 Procedure



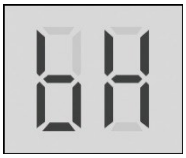
Notes:

1. Water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled 10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System").
2. 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. Refer to Part 2, 1.2 "Hydronic Box Layout" and to Table 4-7.3 in Part 4, 7.1 "Temperature Sensor Resistance Characteristics".

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5.25 bH Troubleshooting

5.25.1 Digital display output



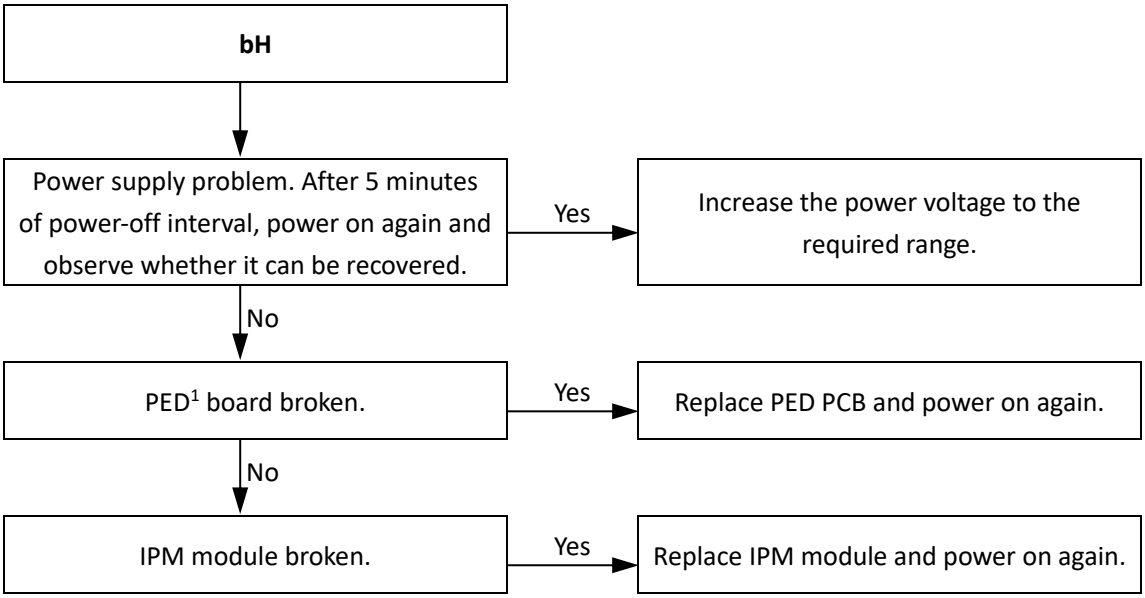
5.25.2 Description

- PED PCB failure
- M thermal Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

5.25.3 Possible causes

- Power supply problem.
- PED board broken.
- IPM module broken.

5.25.4 Procedure



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5.26 Pb Troubleshooting

5.26.1 Digital display output



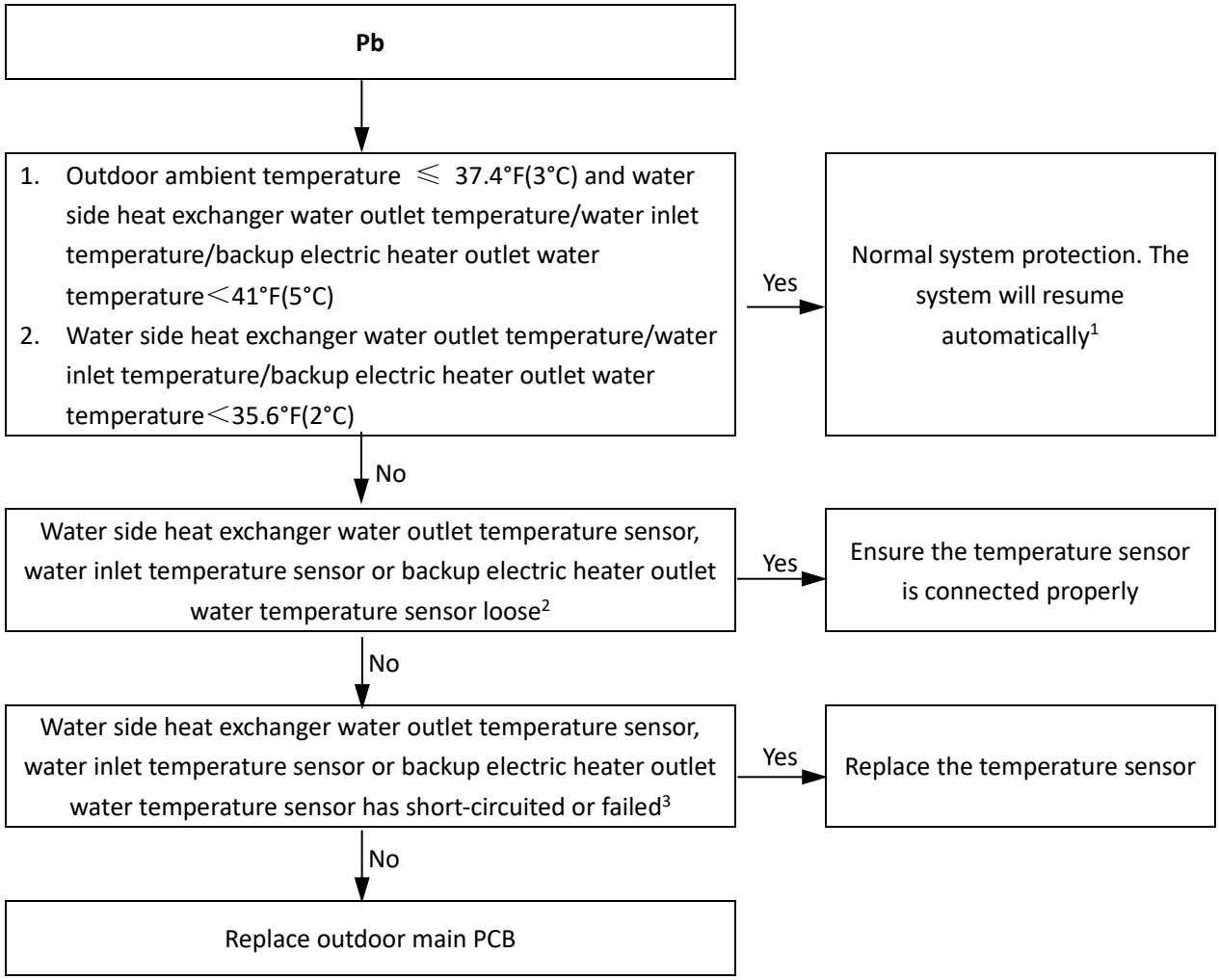
5.26.2 Description

- Water side heat exchanger anti-freeze protection.
- M-Thermal Split stops running.
- Error code is displayed on hydronic box main PCB and **ANTI.FREEZE** icon is displayed on user interface.

5.26.3 Possible causes

- Normal system protection.
- Temperature sensor not connected properly or has malfunctioned.
- Hydronic box main PCB damaged.

5.26.4 Procedure



Notes:

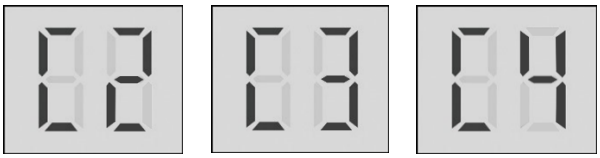
1. Refer to Part 3, 5.7 “Water Side Heat Exchanger Anti-freeze Protection Control”.
2. Final outlet water temperature sensor, water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN6 on the hydronic box main PCB (labeled 10 in Figure 4-2.2 in Part4, 2.2 "Main PCB for Hydronic System").
3. 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. Refer to Part 2, 1.2 “Hydronic Box Layout” and to Table 4-7.3 in Part 4, 7.1 “Temperature Sensor Resistance Characteristics”.

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5.27 C2/C3/C4 Troubleshooting

5.27.1 Digital display output

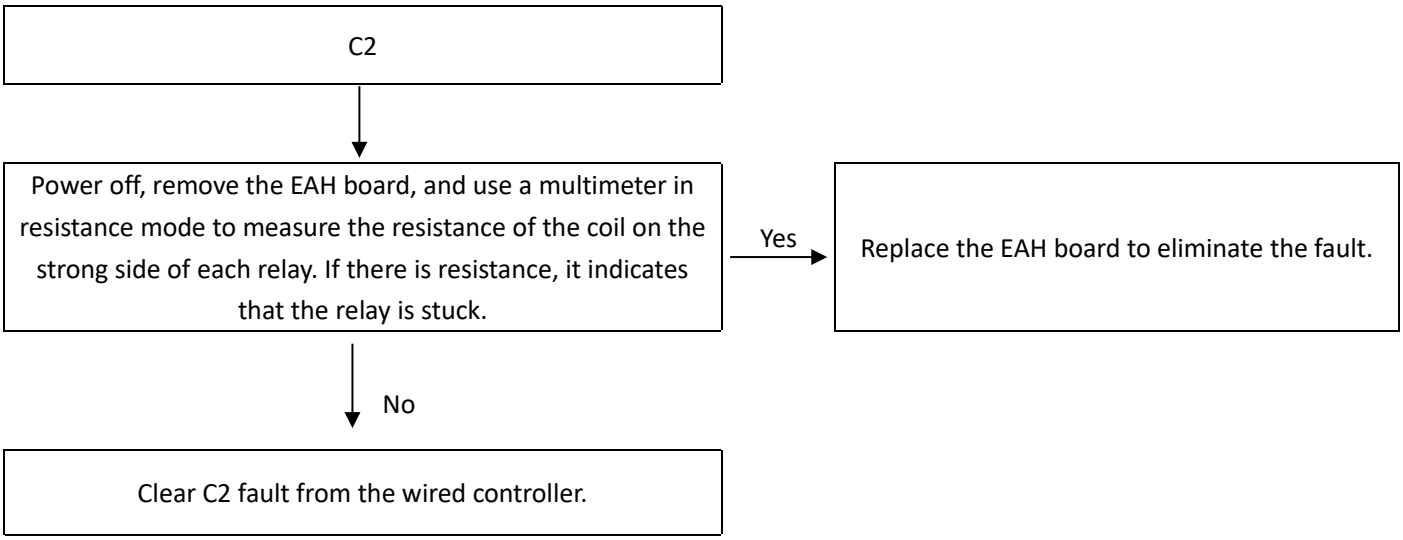
When the unit is set to built-in IBH, detect faults C2/C3/C4



5.27.2 Description

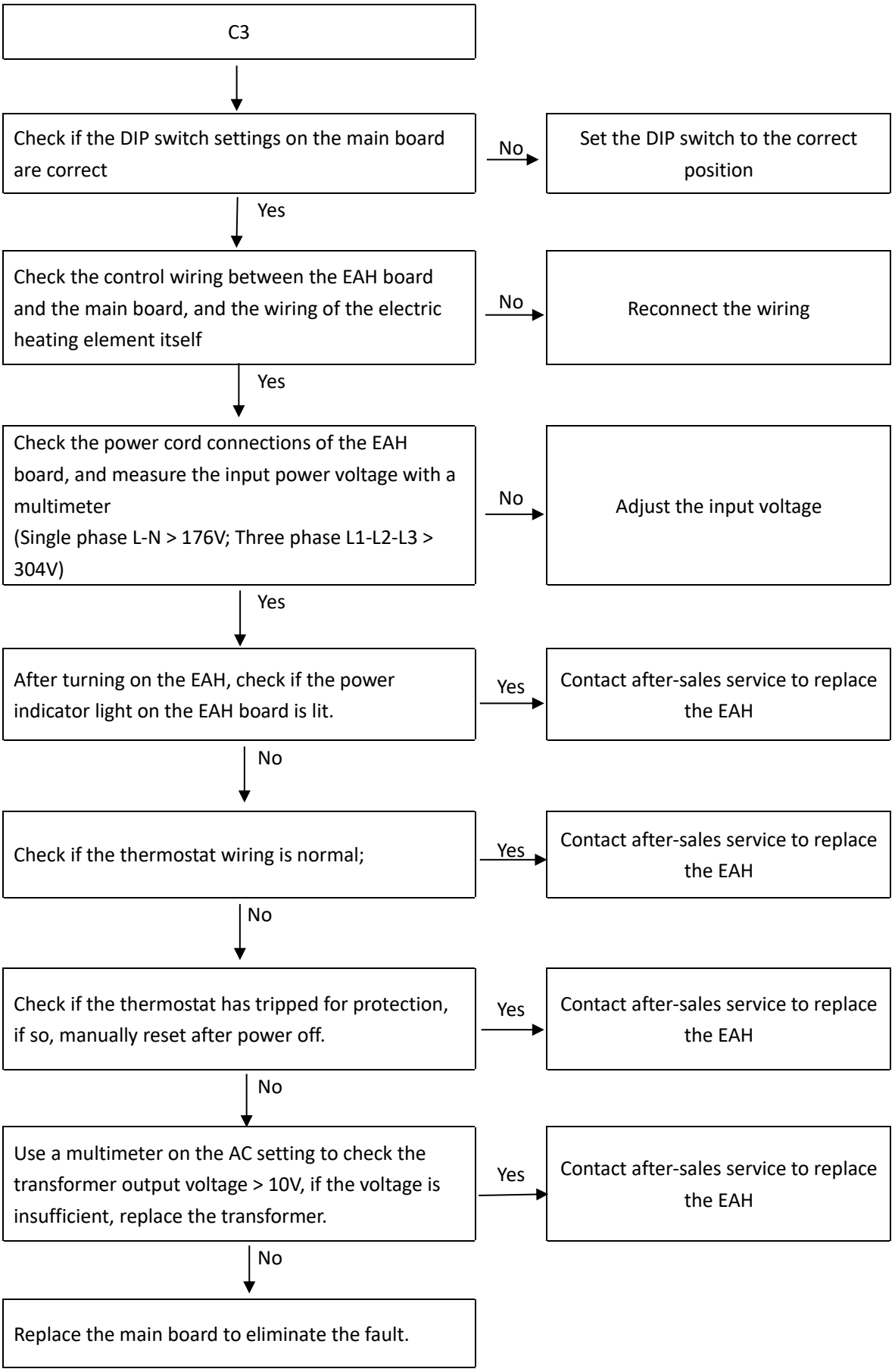
- C2: IBH electric heating small board relay sticking fault
- C3: Current transformer failure or IBH open circuit fault
- C4: When the counter detects that the number of C3 faults is ⩾3, a C4 fault is reported

5.27.3 Procedure-C2



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5.27.4 Procedure-C3/C4



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6 Discharge / Suction pressure and temperature range

The following parameter ranges are used to roughly determine whether the system is running properly:

Discharge temperature(Tp) for heating/DHW mode	
T4＜14°F(-10°C)	Twout+15＜Tp＜Tw_out+50
14°F(-10°C)≤T4＜50°F(10°C)	Twout+10＜Tp＜Tw_out+45
50°F(10°C)≤T4＜77°F(25°C)	Twout+10＜Tp＜Tw_out+40
T4≥77°F(25°C)	Twout+10＜Tp＜Tw_out+35
Note: T4 means ambient temperature Tw_out means leaving water temperature.	

Discharge pressure(P1) for heating/DHW mode										
Tw_out	°F(°C)	77(25)	86(30)	95(35)	104(40)	113(45)	122(50)	131(55)	140(60)	149(65)
P1	kPa	1750±150	2000±150	2270±150	2560±150	2890±150	3250±150	3630±150	3900±150	4200±150
Note: P1 is absolute pressure.										

Discharge temperature (Tp) for cooling mode				
Tp	Fx＜44Hz	44Hz≤Fx＜62Hz	62Hz≤Fx＜72Hz	Fx≥72Hz
T4＜77°F(25°C)	52±10	56±10	58±10	62±10
77°F(25°C)≤T4＜86°F (30°C)	56±10	62±10	68±10	74±10
86°F (30°C)≤T4＜95°F (35°C)	65±10	70±10	75±10	80±10
95°F (35°C)≤T4＜104°F (40°C)	70±10	75±10	80±10	85±10
104°F (40°C)≤T4＜114.8°F (46°C)	75±10	80±10	85±10	90±10
T4≥114.8°F (46°C)	78±10	80±10	85±10	90±10
Note: Fx means compressor operating frequency.				

Suction pressure(P1) for cooling mode								
Tw_out	°F(°C)	41~44.6 (5~7)	46.4~50 (8~10)	51.8~55.4 (11~13)	57.2~60.8 (14~16)	62.6~66.2 (17~19)	68~71.6 (20~22)	73.4~77 (23~25)
P1	kPa	880±100	955±100	1050±100	1150±100	1250±100	1360±100	1500±100
Note: P1 is absolute pressure.								

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7 Appendix to Part 4

7.1 Temperature Sensor Resistance Characteristics

Table 7.1-1: Outdoor ambient temperature sensor, water side heat exchanger refrigerant inlet / outlet (liquid / gas pipe) temperature sensor, air side heat exchanger refrigerant out temperature sensor and suction pipe temperature sensor resistance characteristics

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-25	144.266	15	16.079	55	2.841	95	0.708
-24	135.601	16	15.313	56	2.734	96	0.686
-23	127.507	17	14.588	57	2.632	97	0.666
-22	119.941	18	13.902	58	2.534	98	0.646
-21	112.867	19	13.251	59	2.44	99	0.627
-20	106.732	20	12.635	60	2.35	100	0.609
-19	100.552	21	12.05	61	2.264	101	0.591
-18	94.769	22	11.496	62	2.181	102	0.574
-17	89.353	23	10.971	63	2.102	103	0.558
-16	84.278	24	10.473	64	2.026	104	0.542
-15	79.521	25	10	65	1.953	105	0.527
-14	75.059	26	9.551	66	1.883		
-13	70.873	27	9.125	67	1.816		
-12	66.943	28	8.721	68	1.752		
-11	63.252	29	8.337	69	1.69		
-10	59.784	30	7.972	70	1.631		
-9	56.524	31	7.625	71	1.574		
-8	53.458	32	7.296	72	1.519		
-7	50.575	33	6.982	73	1.466		
-6	47.862	34	6.684	74	1.416		
-5	45.308	35	6.401	75	1.367		
-4	42.903	36	6.131	76	1.321		
-3	40.638	37	5.874	77	1.276		
-2	38.504	38	5.63	78	1.233		
-1	36.492	39	5.397	79	1.191		
0	34.596	40	5.175	80	1.151		
1	32.807	41	4.964	81	1.113		
2	31.12	42	4.763	82	1.076		
3	29.528	43	4.571	83	1.041		
4	28.026	44	4.387	84	1.007		
5	26.608	45	4.213	85	0.974		
6	25.268	46	4.046	86	0.942		
7	24.003	47	3.887	87	0.912		
8	22.808	48	3.735	88	0.883		
9	21.678	49	3.59	89	0.855		
10	20.61	50	3.451	90	0.828		
11	19.601	51	3.318	91	0.802		
12	18.646	52	3.191	92	0.777		
13	17.743	53	3.069	93	0.753		
14	16.888	54	2.952	94	0.73		

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Table 7.1-2: Compressor discharge pipe temperature sensor resistance characteristics

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-20	542.7	**20**	68.66	**60**	13.59	**100**	3.702
-19	511.9	**21**	65.62	**61**	13.11	**101**	3.595
-18	483.0	**22**	62.73	**62**	12.65	**102**	3.492
-17	455.9	**23**	59.98	**63**	12.21	**103**	3.392
-16	430.5	**24**	57.37	**64**	11.79	**104**	3.296
-15	406.7	**25**	54.89	**65**	11.38	**105**	3.203
-14	384.3	**26**	52.53	**66**	10.99	**106**	3.113
-13	363.3	**27**	50.28	**67**	10.61	**107**	3.025
-12	343.6	**28**	48.14	**68**	10.25	**108**	2.941
-11	325.1	**29**	46.11	**69**	9.902	**109**	2.860
-10	307.7	**30**	44.17	**70**	9.569	**110**	2.781
-9	291.3	**31**	42.33	**71**	9.248	**111**	2.704
-8	275.9	**32**	40.57	**72**	8.940	**112**	2.630
-7	261.4	**33**	38.89	**73**	8.643	**113**	2.559
-6	247.8	**34**	37.30	**74**	8.358	**114**	2.489
-5	234.9	**35**	35.78	**75**	8.084	**115**	2.422
-4	222.8	**36**	34.32	**76**	7.820	**116**	2.357
-3	211.4	**37**	32.94	**77**	7.566	**117**	2.294
-2	200.7	**38**	31.62	**78**	7.321	**118**	2.233
-1	190.5	**39**	30.36	**79**	7.086	**119**	2.174
0	180.9	**40**	29.15	**80**	6.859	**120**	2.117
1	171.9	**41**	28.00	**81**	6.641	**121**	2.061
2	163.3	**42**	26.90	**82**	6.430	**122**	2.007
3	155.2	**43**	25.86	**83**	6.228	**123**	1.955
4	147.6	**44**	24.85	**84**	6.033	**124**	1.905
5	140.4	**45**	23.89	**85**	5.844	**125**	1.856
6	133.5	**46**	22.89	**86**	5.663	**126**	1.808
7	127.1	**47**	22.10	**87**	5.488	**127**	1.762
8	121.0	**48**	21.26	**88**	5.320	**128**	1.717
9	115.2	**49**	20.46	**89**	5.157	**129**	1.674
10	109.8	**50**	19.69	**90**	5.000	**130**	1.632
11	104.6	**51**	18.96	**91**	4.849		
12	99.69	**52**	18.26	**92**	4.703		
13	95.05	**53**	17.58	**93**	4.562		
14	90.66	**54**	16.94	**94**	4.426		
15	86.49	**55**	16.32	**95**	4.294		
16	82.54	**56**	15.73	**96**	4.167		
17	78.79	**57**	15.16	**97**	4.045		
18	75.24	**58**	14.62	**98**	3.927		
19	71.86	**59**	14.09	**99**	3.812		

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Table 7.1-3: Water side *heat exchanger water inlet / outlet temperature sensor, final outlet water temperature sensor and DHW temperature sensor resistance characteristics*

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-30	867.29	10	98.227	50	17.600	90	4.4381
-29	815.80	11	93.634	51	16.943	91	4.3022
-28	767.68	12	89.278	52	16.315	92	4.1711
-27	722.68	13	85.146	53	15.713	93	4.0446
-26	680.54	14	81.225	54	15.136	94	3.9225
-25	641.07	15	77.504	55	14.583	95	3.8046
-24	604.08	16	73.972	56	14.054	96	3.6908
-23	569.39	17	70.619	57	13.546	97	3.5810
-22	536.85	18	67.434	58	13.059	98	3.4748
-21	506.33	19	64.409	59	12.592	99	3.3724
-20	477.69	20	61.535	60	12.144	100	3.2734
-19	450.81	21	58.804	61	11.715	101	3.1777
-18	425.59	22	56.209	62	11.302	102	3.0853
-17	401.91	23	53.742	63	10.906	103	2.9960
-16	379.69	24	51.396	64	10.526	104	2.9096
-15	358.83	25	49.165	65	10.161	105	2.8262
-14	339.24	26	47.043	66	9.8105		
-13	320.85	27	45.025	67	9.4736		
-12	303.56	28	43.104	68	9.1498		
-11	287.33	29	41.276	69	8.8387		
-10	272.06	30	39.535	70	8.5396		
-9	257.71	31	37.878	71	8.2520		
-8	244.21	32	36.299	72	7.9755		
-7	231.51	33	34.796	73	7.7094		
-6	219.55	34	33.363	74	7.4536		
-5	208.28	35	31.977	75	7.2073		
-4	197.67	36	30.695	76	6.9704		
-3	187.66	37	29.453	77	6.7423		
-2	178.22	38	28.269	78	6.5228		
-1	168.31	39	27.139	79	6.3114		
0	160.90	40	26.061	80	6.1078		
1	152.96	41	25.031	81	5.9117		
2	145.45	42	24.048	82	5.7228		
3	138.35	43	23.109	83	5.5409		
4	131.64	44	22.212	84	5.3655		
5	125.28	45	21.355	85	5.1965		
6	119.27	46	20.536	86	5.0336		
7	113.58	47	19.752	87	4.8765		
8	108.18	48	19.003	88	4.7251		
9	103.07	49	18.286	89	4.5790		

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