Service Manual

OPTIMUS PRO Split

CONTENTS

Part 1

General Information

1 Unit Capacities

1.1 Outdoor Unit Capacities

Table 1-1.1: Capacity range

Capacity	4kW	6kW	8kW	10kW	12kW	14kW	16kW
Model[1] (HOP**WODU)	V4W	V6W	V8W	V10W	V12W	V14W	V16W
Model[1] (HOP**WODU3)	/	/	/	/	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 10kW model is HOP10WODU.							

1.2 Hydronic Box Model

Table 1-1.2: Model

Model[1]	HOP60WIDU	HOP100WIDU(3)	HOP16WIDU3
Compatible OU model	HOP4(6)WODU	HOP8(10)WODU	HOP12(14,16)WODU HOP12(14,16)WIDU3

2 External Appearance

2.1 Outdoor Unit Appearance

Table 1-2.1: Outdoor unit appearance

HOP4(6)WODU	HOP8(10,12,14,16)WODU HOP12(14,16)WODU3
	

2.2 Hydronic Box Appearance

Table 1-2.2: Hydronic box appearance

HOP60WIDU HOP100WIDU(3) HOP160WIDU3


Part 2

Component Layout and Refrigerant Circuits

1 Layout of Functional Components

1.1 Outdoor Unit Layout

HOP4WODU / HOP6WODU

Figure 2-1.1: HOP4(6)WODU top view

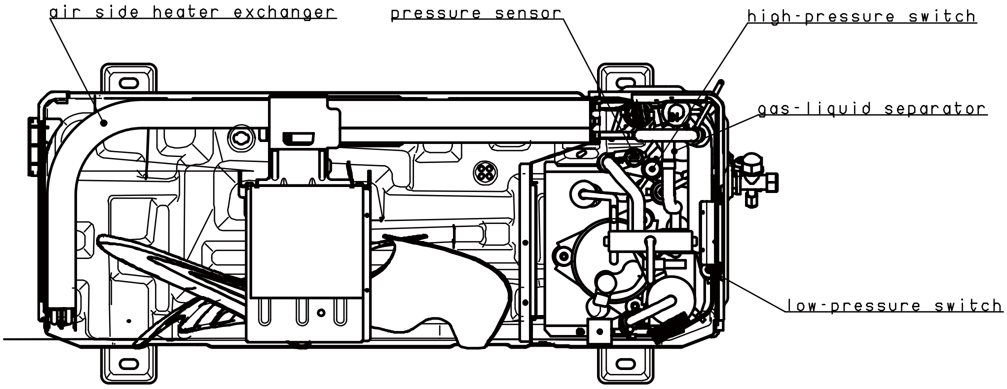
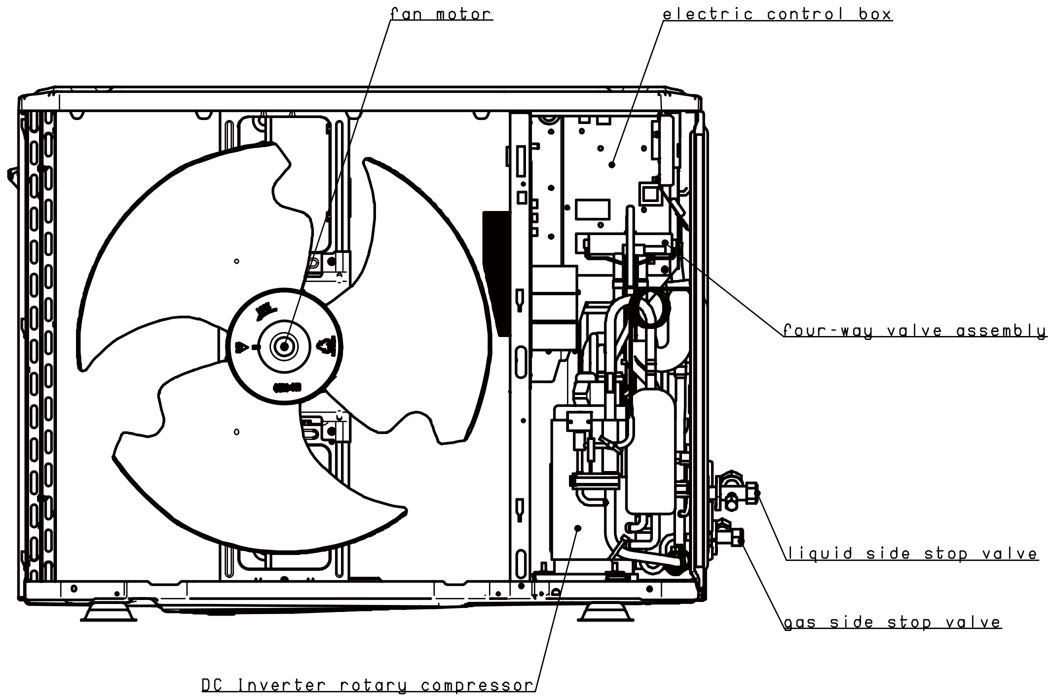


Figure 2-1.2: HOP4(6)WODU front view



HOP8WODU / HOP10WODU

Figure 2-1.3: HOP8(10)WODU top view

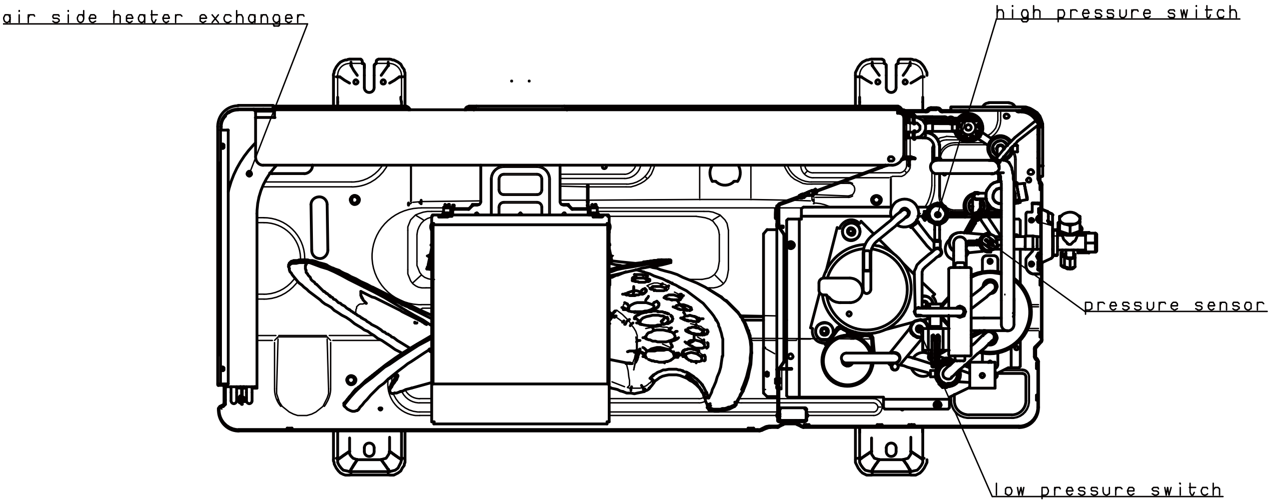
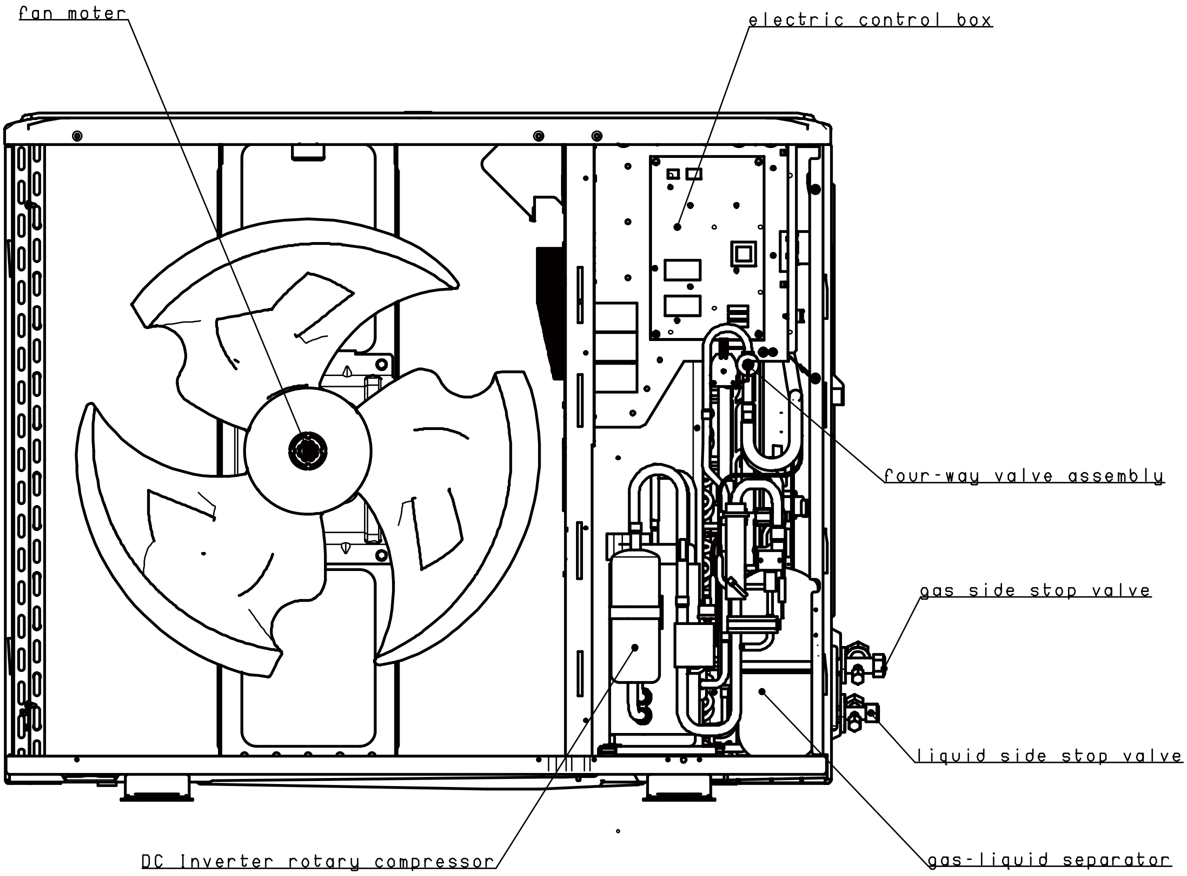


Figure 2-1.4: HOP8(10)WODU front view



HOP12WODU / HOP14WODU / HOP16WODU

Figure 2-1.5: HOP12(14,16)WODU top view

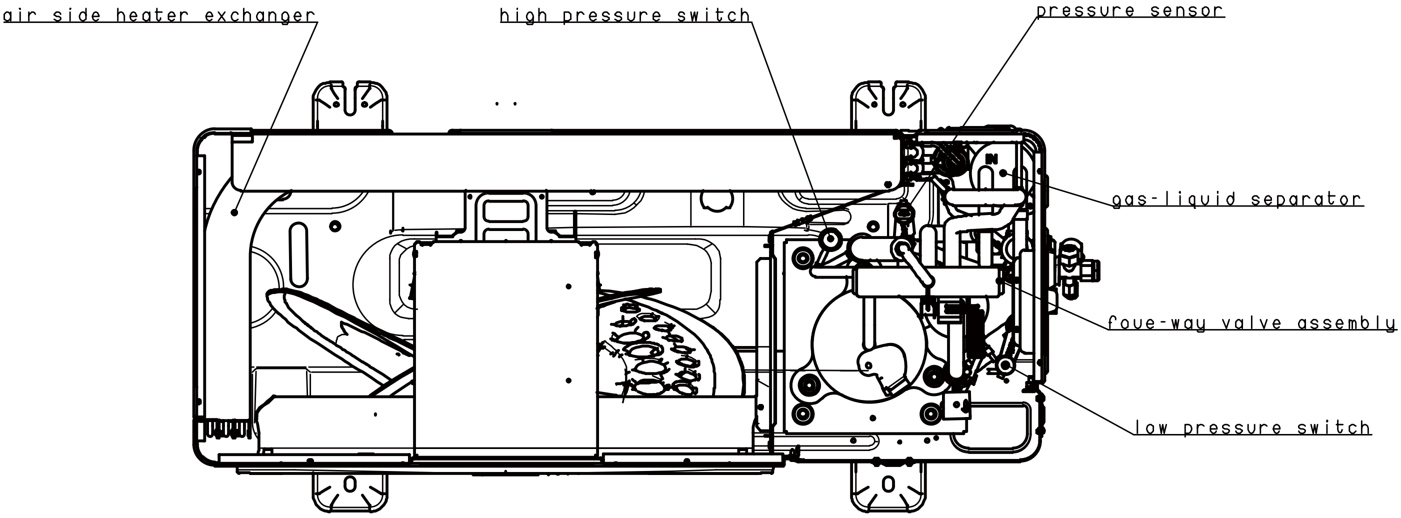
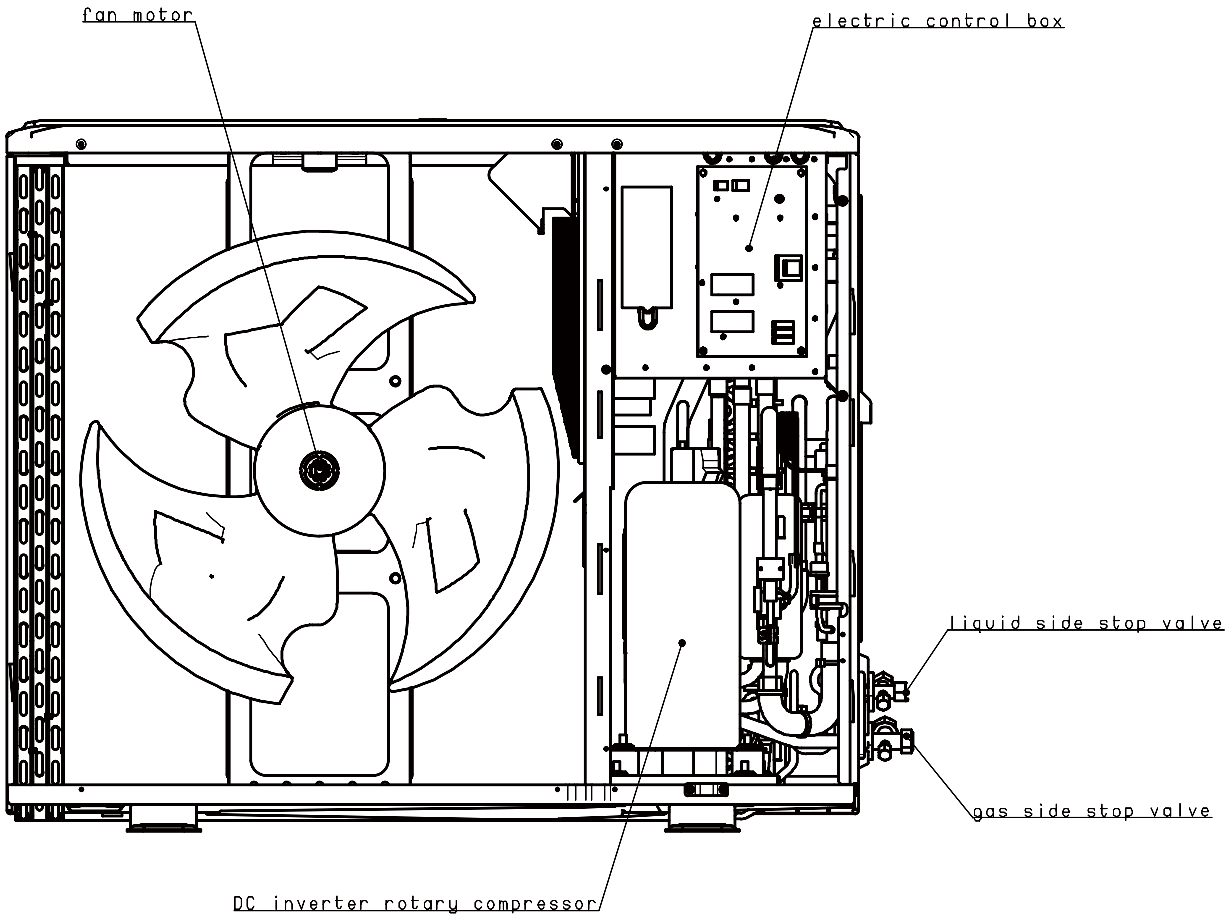


Figure 2-1.6: HOP12(14,16)WODU front view



HOP12WODU3 / HOP14WODU3 / HOP16WODU3

Figure 2-1.7: HOP12(14,16)WODU3 top view

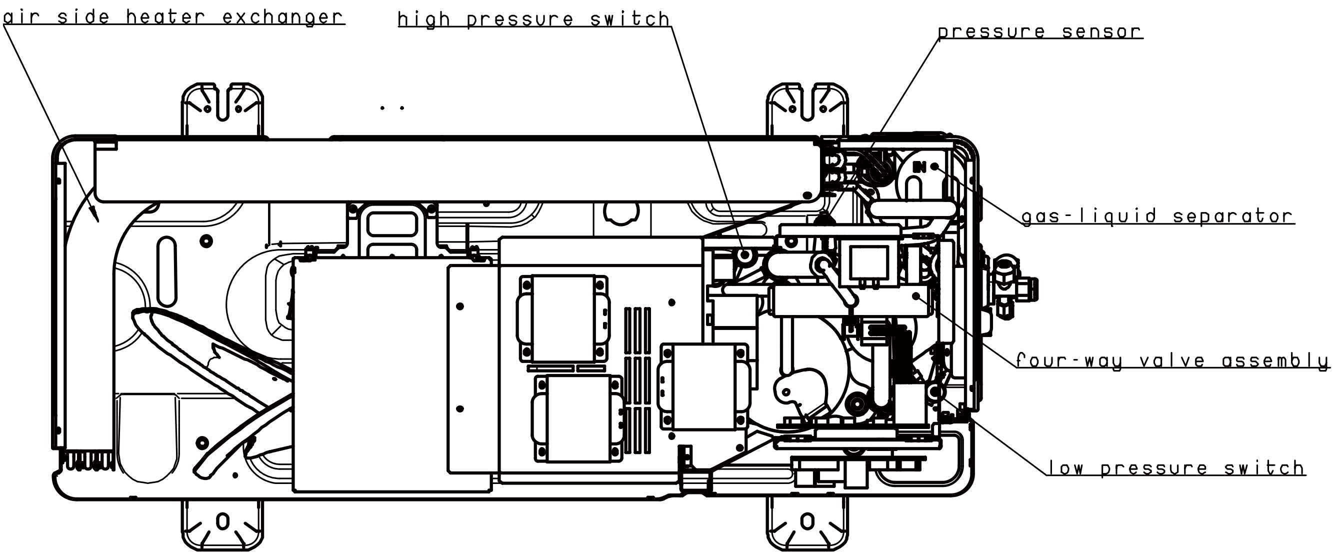
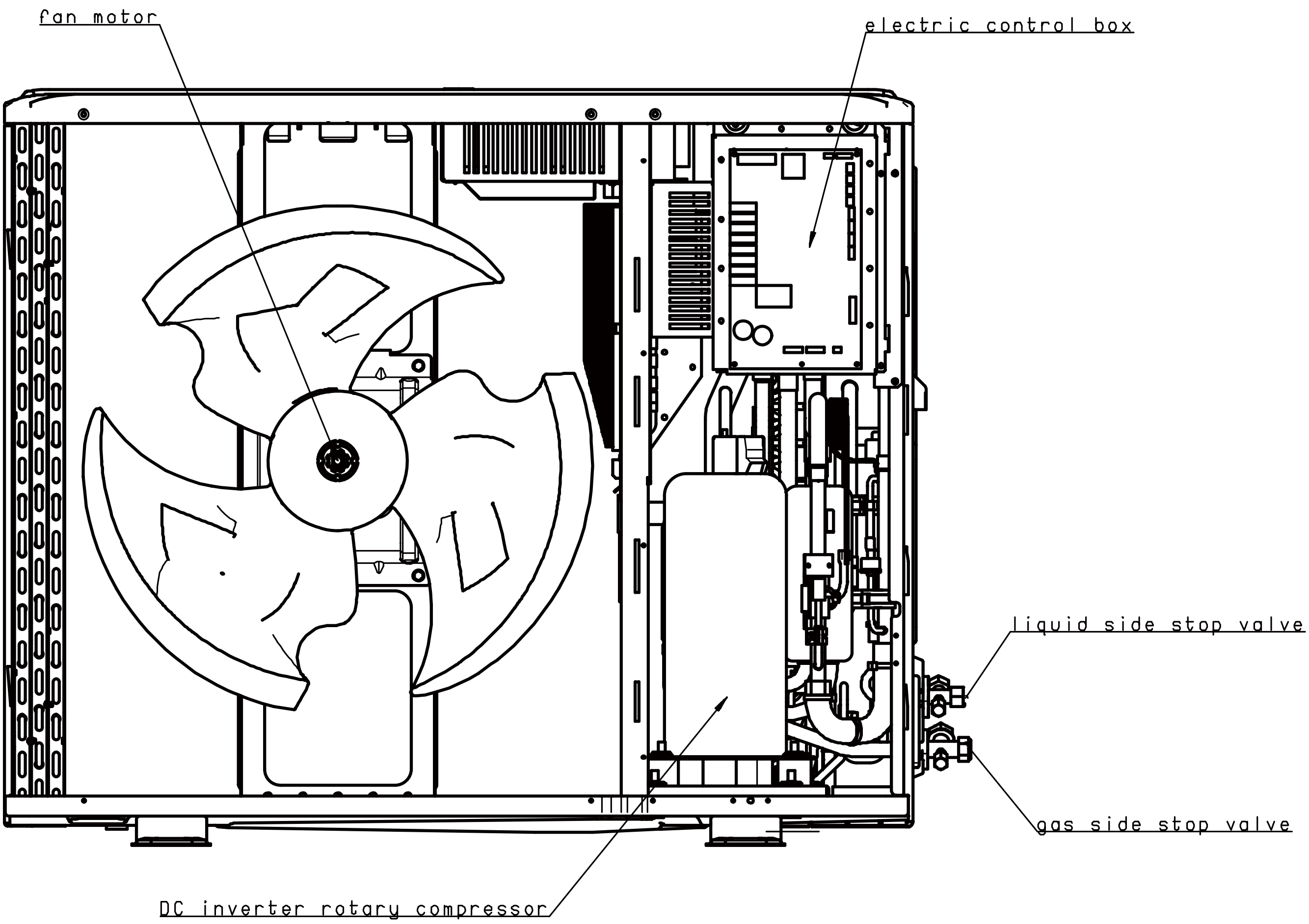
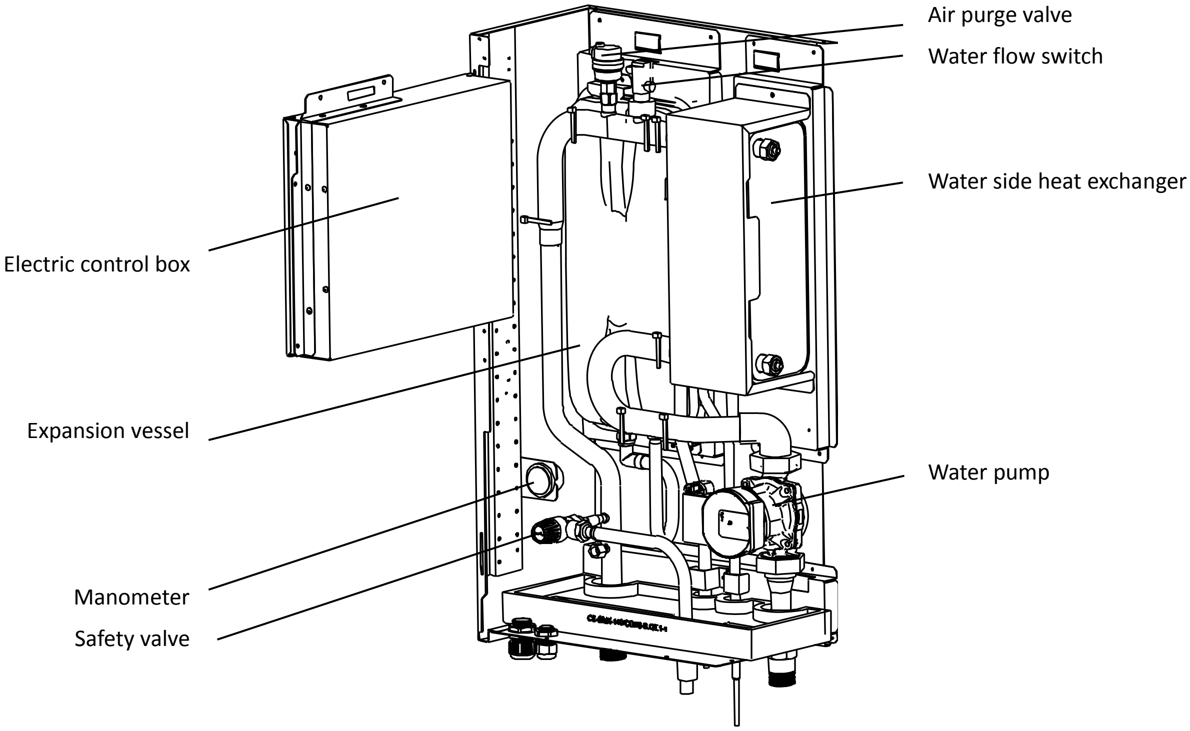


Figure 2-1.8: HOP12(14,16)WODU3 front view



1.2 Hydronic Box Layout

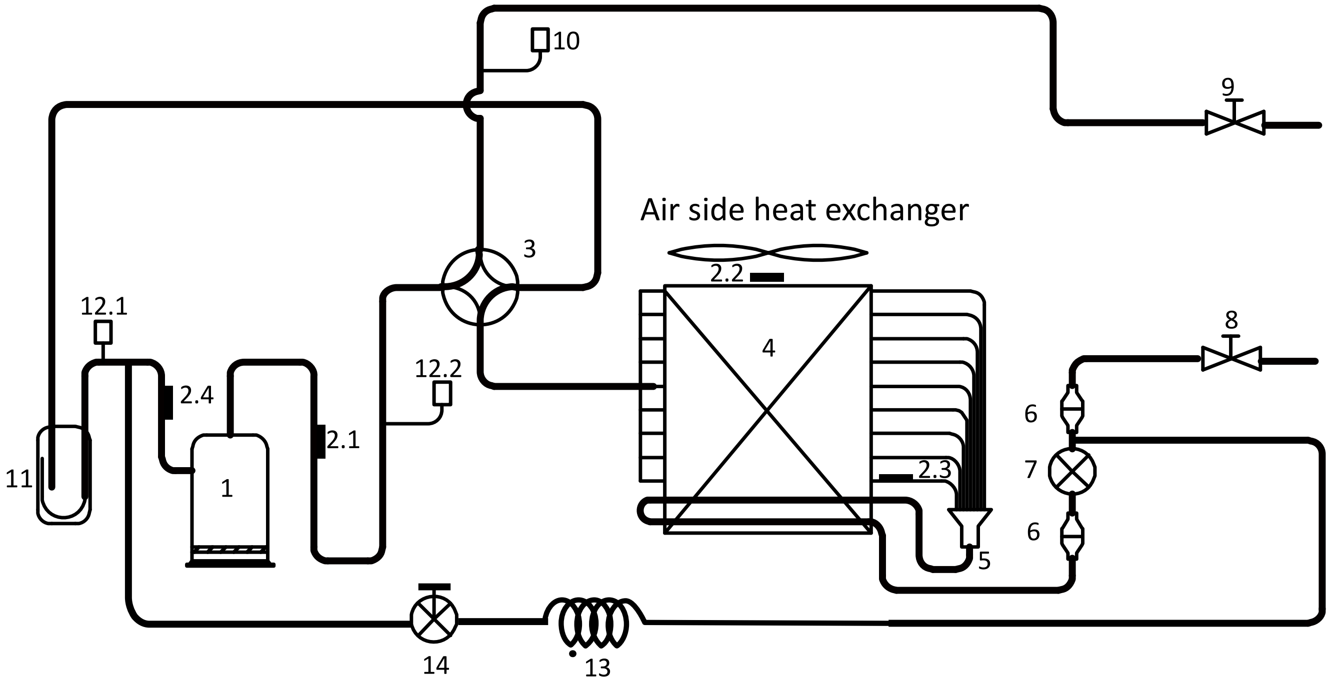
Figure 2-1.9: HOP60(100,160)WIDU(3) oblique view



2 Piping Diagrams

2.1 Outdoor Unit Piping

Figure 2-2.1: Outdoor unit piping diagram



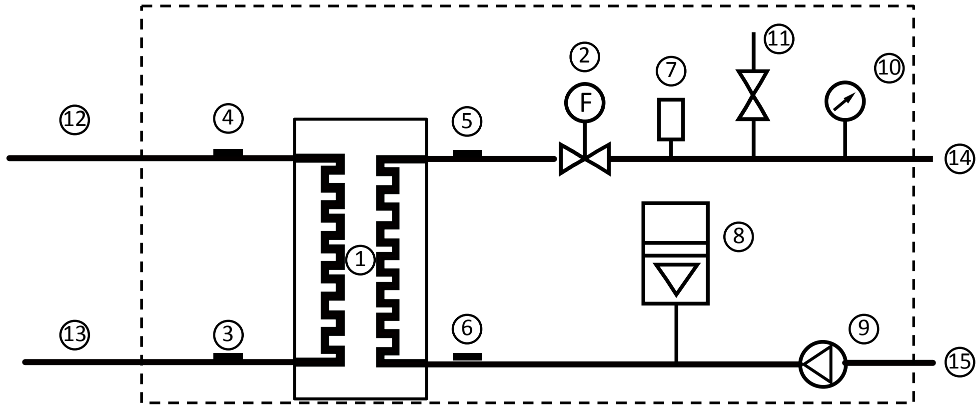
Legend			
1	Compressor	7	Electronic expansion valve
2.1	Discharge pipe temperature sensor	8	Stop valve (liquid side)
2.2	Outdoor ambient temperature sensor	9	Stop valve (gas side)
2.3	Air side heat exchanger refrigerant outlet temperature sensor	10	Pressure sensor
2.4	Suction pipe temperature sensor	11	Separator
3	4-way valve	12.1	Low pressure switch
4	Air side heat exchanger	12.2	High pressure switch
5	Distributor	13	Capillary
6	Filter	14	Solenoid valve

Key components:

1. **Electronic expansion valve (EXV):**
   Controls refrigerant flow and reduces refrigerant pressure.
2. **Four-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.
4. **Separator:**
   Separates liquid refrigerant from gas refrigerant to protect compressor from liquid hammering.

2.2 Hydronic box Piping

Figure 2-2.2: Hydronic box piping diagram



Legend			
1	Water side heat exchanger	9	Water pump
2	Water flow switch	10	Manometer
3	Refrigerant liquid line temperature sensor	11	Safety valve
4	Refrigerant gas line temperature sensor	12	Refrigerant gas side
5	Water outlet temperature sensor	13	Refrigerant liquid side
6	Water inlet temperature sensor	14	Water outlet
7	Air purge valve	15	Water inlet
8	Expansion vessel		

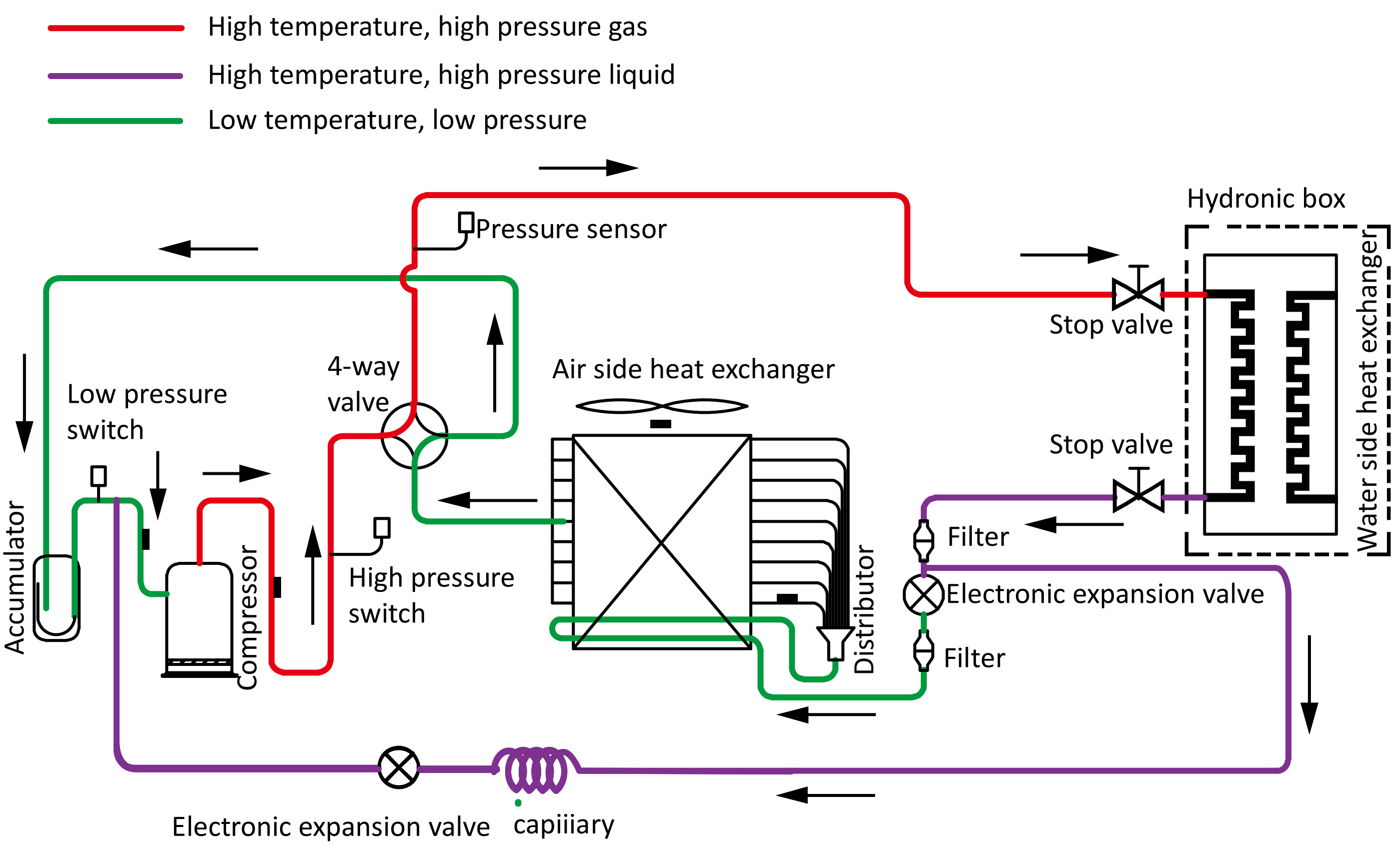
Key components:

1. **Air purge valve:**
   Automatically removes air from the water circuit.
2. **Safety valve:**
   Prevents excessive water pressure by opening at 43.5 psi (3 bar) and discharging water from the water circuit.
3. **Expansion vessel:**
   Balances water system pressure. (Expansion vessel volume: 8L.)
4. **Water flow switch:**
   Detects water flow rate to protect compressor and water pump in the event of insufficient water flow.
5. **Backup electric heater:**
   Provides additional heating capacity when the heating capacity of the heat pump is insufficient due to very low outdoor temperature. Also protects the external water piping from freezing.
6. **Manometer:**
   Provides water circuit pressure readout.
7. **Water pump:**
   Circulates water in the water circuit.

3 Refrigerant Flow Diagrams

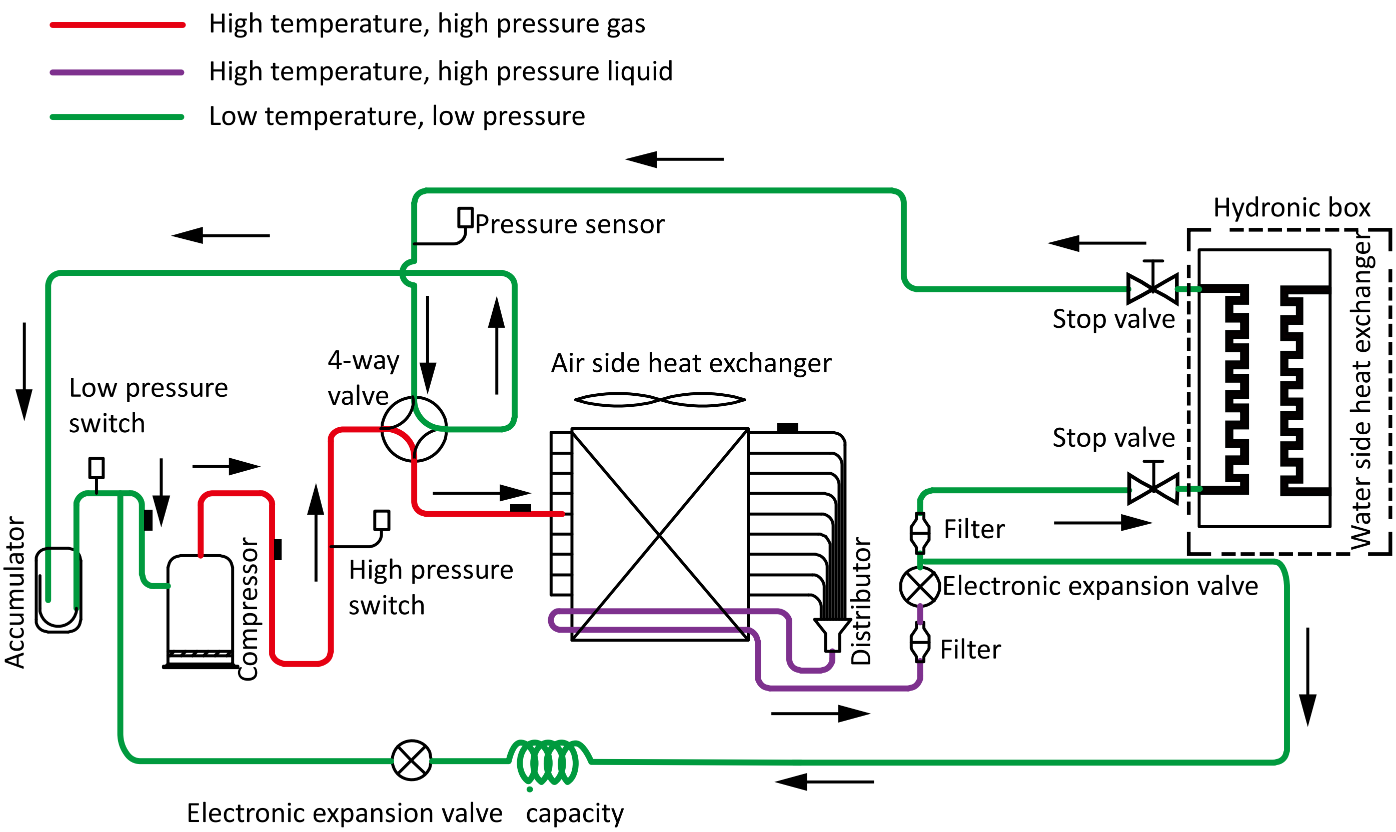
Heating and domestic hot water operation

Figure 2-3.1: Refrigerant flow during heating or domestic hot water operation



Cooling and defrosting operation

Figure 2-3.2: Refrigerant flow during cooling and defrosting operations



Part 2 - Component Layout and Refrigerant Circuits

Part 3

Control

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 8°C or the compressor is running, the crankcase heater is off; when the outdoor ambient temperature is at or below 8°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.

3 Startup Control

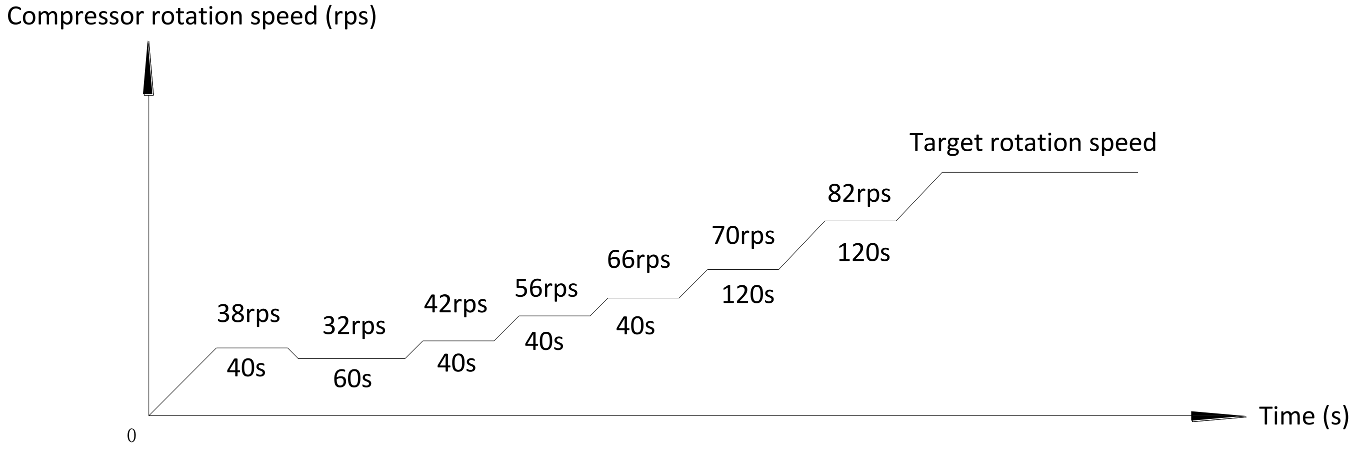
3.1 Compressor Startup Delay Control

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. Refer to the OPTIMUS PRO Split Engineering. Data Book Part 3, 8.5 "COOL MODE SETTING Menu" and Part 3, 8.6 "HEAT MODE SETTING Menu".

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 3-3.1, Figure 3-3.2.

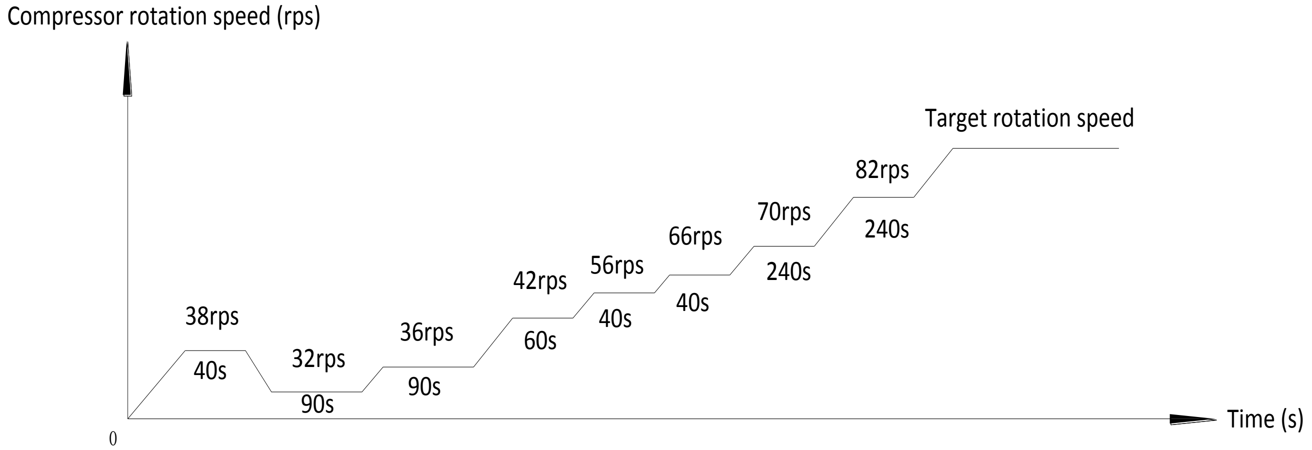
Figure 3-3.1: HOP4(6)WODU compressor startup program[1] when ambient temperature is above 3°C



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.

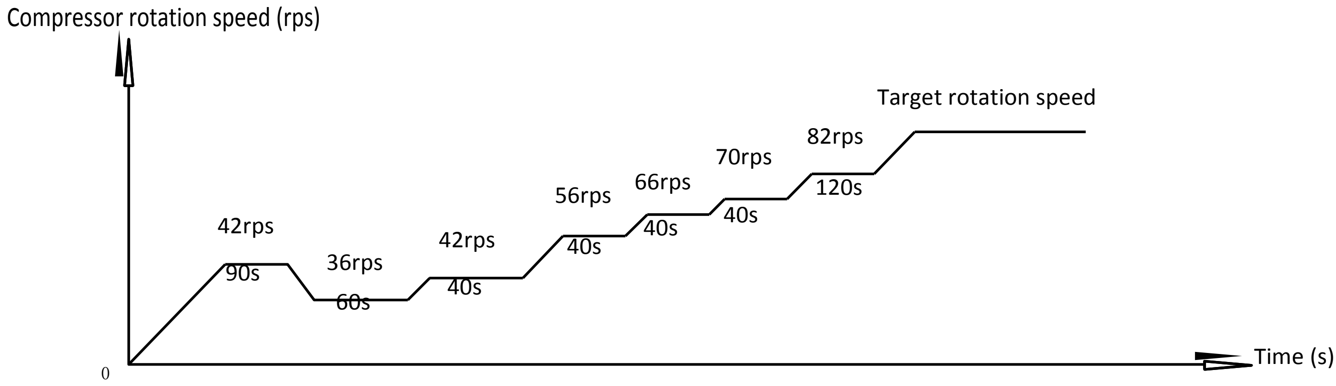
Figure 3-3.2: HOP4(6)WODU compressor startup program[1] when ambient temperature is at or below 3°C



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.

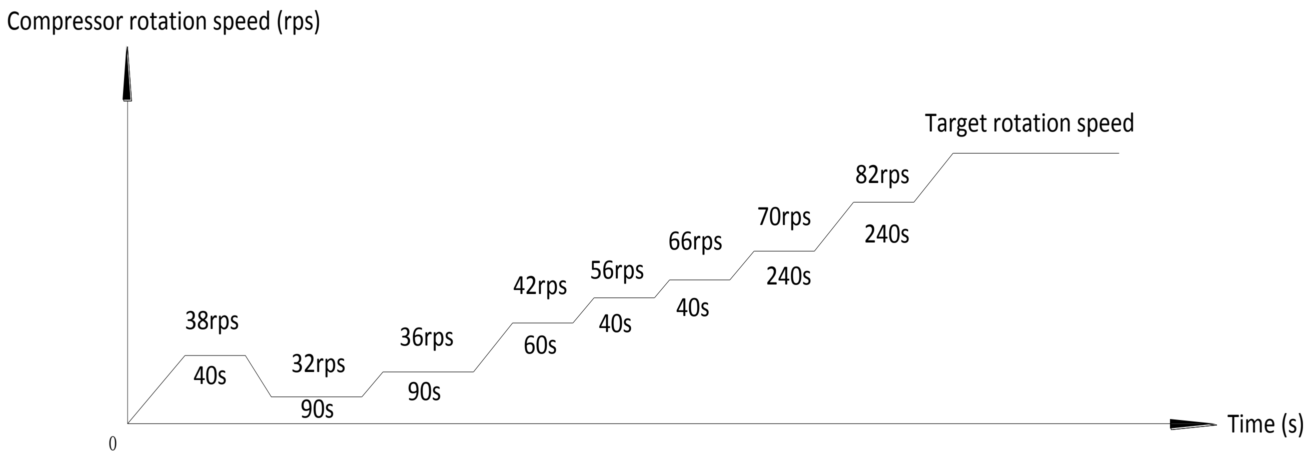
Figure 3-3.3: HOP8(10)WODU compressor startup program[1] when ambient temperature is above 11°C



Notes:

1. Once the first, 90-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.

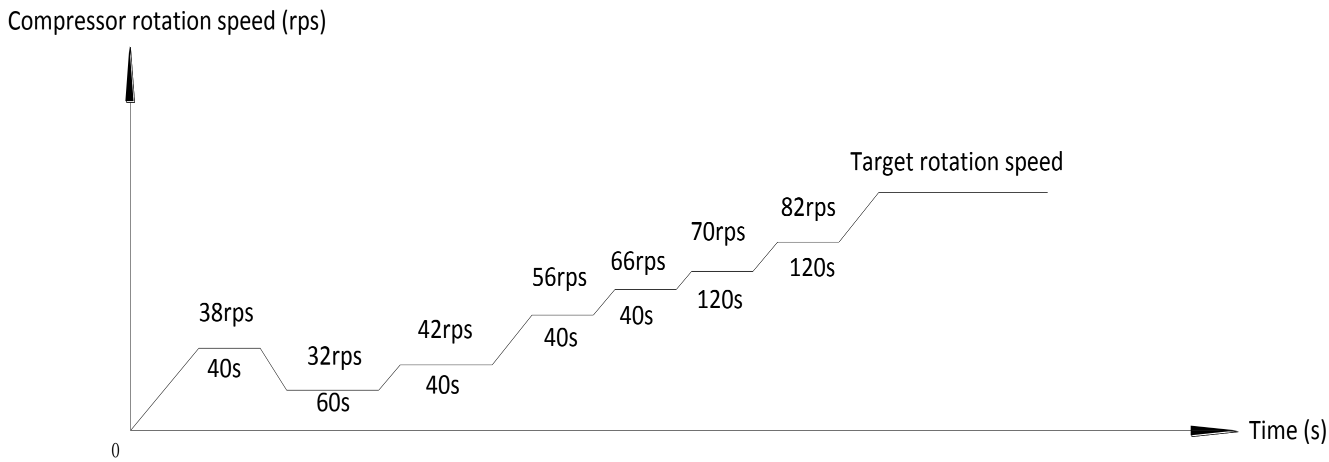
Figure 3-3.4: HOP8(10)WODU compressor startup program[1] when ambient temperature is at or below 11°C



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.

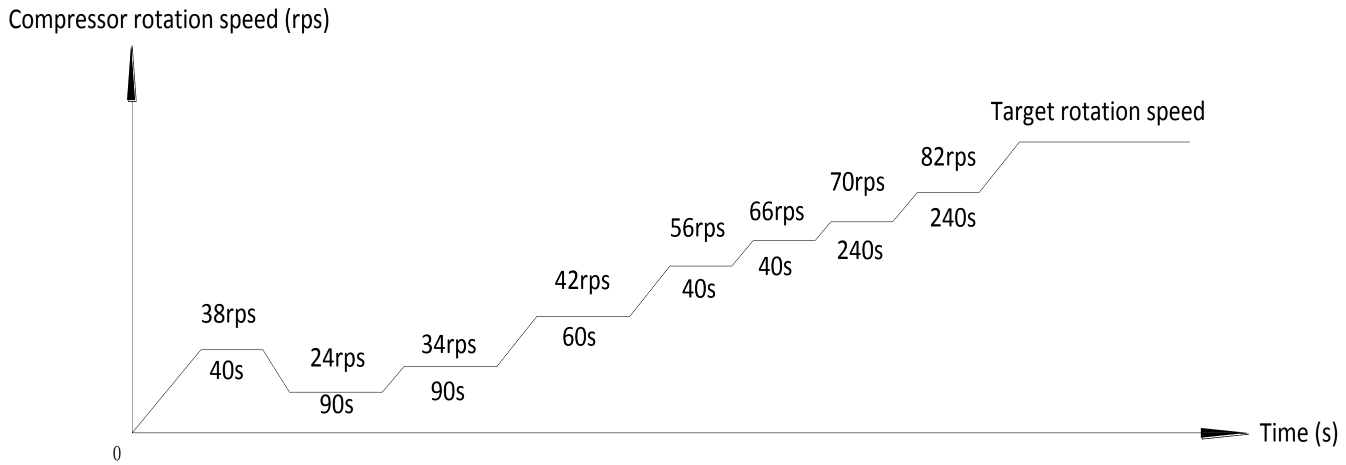
Figure 3-3.5: HOP12(14,16)WODU(3) compressor startup program[1] when ambient temperature is above 3°C



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 3-3.6: HOP12(14,16)WODU(3) compressor startup program[1] when ambient temperature is at or below 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.

3.3 Startup Control for Heating and Domestic Hot Water Operation

Table 3-3.1: Component control during startup in heating and domestic hot water modes

Component	Wiring diagram label	4-16kW	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 3-4.3 in Part 3, 4.6 “Outdoor Fan Control”.

3.4 Startup Control for Cooling Operation

Table 3-3.2: Component control during startup in cooling mode

Component	Wiring diagram label	4-16kW	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 3-4.3 in Part 3, 4.6 “Outdoor Fan Control”.

4 Normal Operation Control

4.1 Component Control during Normal Operation

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

Component	Wiring diagram label	4-16kW	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 3-4.2: Component control during cooling operation

Component	Wiring diagram label	4-16kW	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 OPTIMUS PRO 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.

4.6 Outdoor Fan Control

The speed of the outdoor unit fan is adjusted in steps, as shown in Table 3-4.1.

Table 3-4.3: Component control during cooling operation

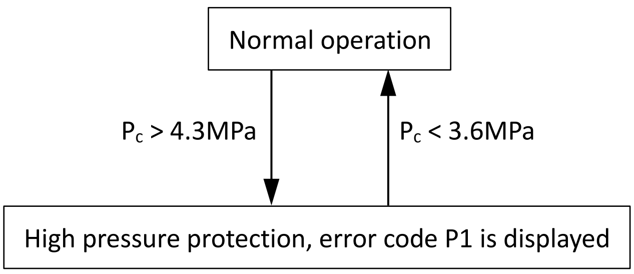
Fan speed index	Fan speed (rpm)		
	4/6/8/10kW	12/14kW	16kW
W1	200	200	200
W2	250	250	250
W3	300	300	300
W4	350	350	350
W5	400	400	400
W6	450	450	450
W7	500	500	500
W8	530	550	550
W9	550	580	600
W10	580	610	650
W11	600	630	700
W12	600	650	730

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:

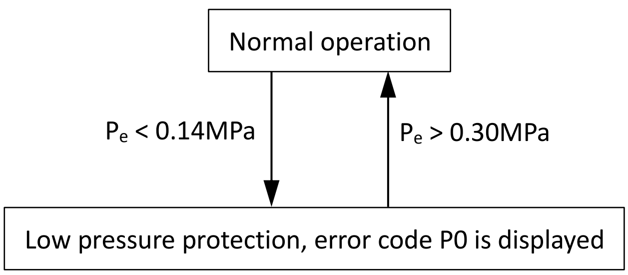
1. P_c: Discharge pressure

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:

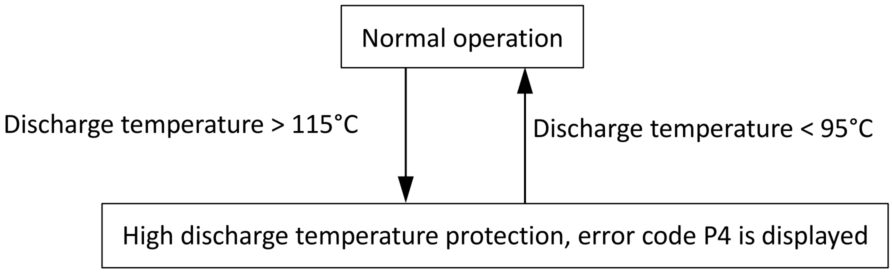
1. P_e: Suction pressure

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

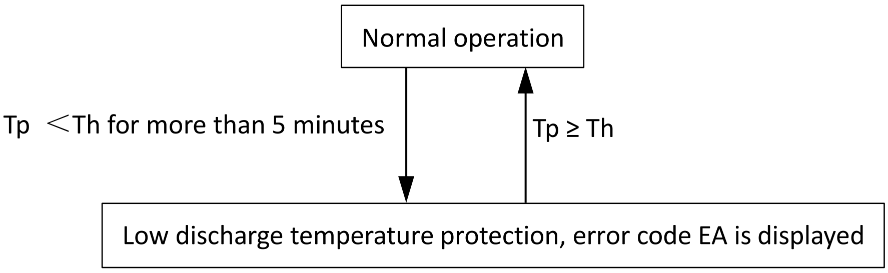
This control protects the compressor from abnormally high temperatures and transient spikes in temperature.

Figure 3-5.3: High discharge temperature protection control



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

Figure 3-5.4: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 3-5.5: Compressor current protection control

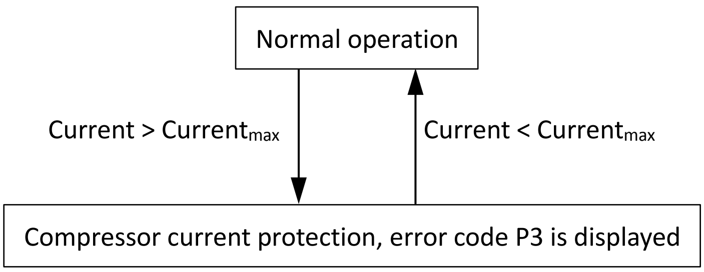


Table 3-5.1: Current limitation for compressors

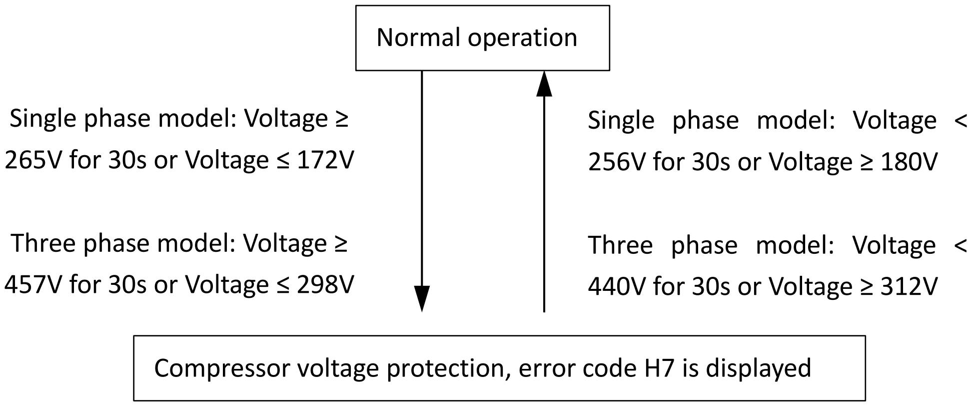
Model name	HOP4(6)WODU	HOP8(10)WODU	HOP12(14,16)WODU	HOP12(14,16)WODU3
$Current_{max}$	18A	19A	30A	14A

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 OPTIMUS PRO Split from abnormally high or abnormally low voltages.

Figure 3-5.6: Compressor voltage protection control



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 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 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 4°C, heat pump stops and water pump keeps running for 30min. If water temperature is still below 4°C, heat pump turns to heating mode.

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

In heating/DHW standby mode, if leaving water temperature is below 2°C, heat pump stops and water pump keeps running for 30min. If water temperature is still below 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.

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 show component control during oil return operation in cooling mode.

Component	Wiring diagram label	4-16kW	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 3-6.2 show component control during oil return operation in heating and DHW modes.

Component	Wiring diagram label	4-16kW	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 3-6.3: Component control during defrosting operation

Component	Wiring diagram label	4-16kW	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 3-6.4: Component control during force cool operation

Component	Wiring diagram label	4-16kW	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

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 3-6.5: Component control during fast DHW operation

Component	Wiring diagram label	4/6kW	8/10/12/14/16kW	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. *OPTIMUS PRO units just have the controlling function, while the mixing valve, water pump of each zone need to be field supplied and connect to OPTIMUS PRO 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 70℃ automatically, and the TBH operate as below:T5<69. the TBH is on, T5 ≥ 70, 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.

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 equipments 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

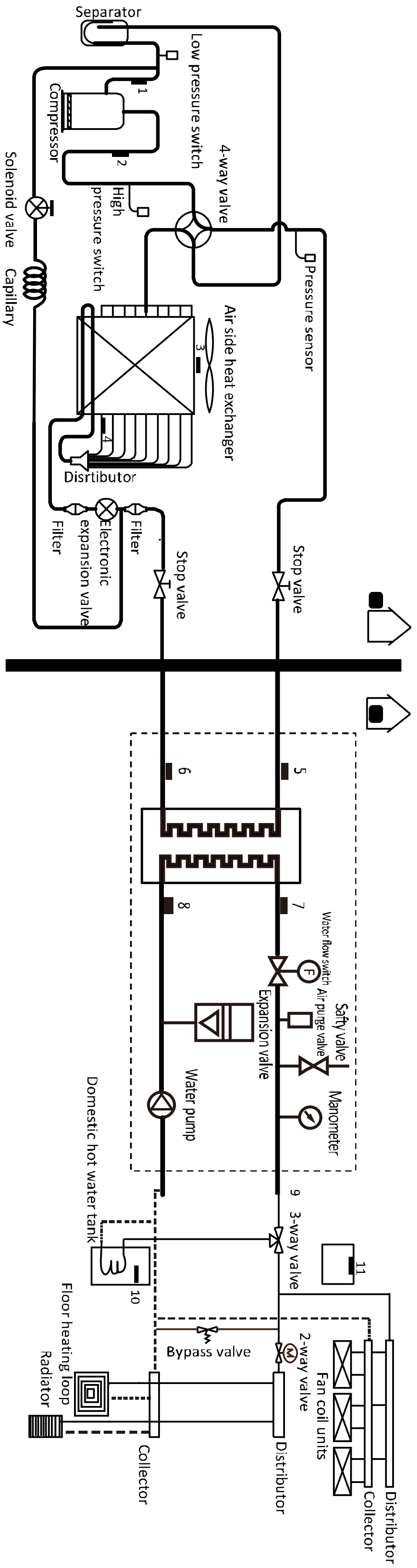
TBH is only controlled by M1M2. If dry contract closes, T5<65℃ then TBH opens until water tank temperature reaches 70℃.

- 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.

7 Role of Temperature Sensors in Control Functions

Figure 3-7.1: Location of the temperature sensors on OPTIMUS PRO 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.

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

Part 4

Diagnosis and Troubleshooting

1 Electric Control Box Layout

1.1 Outdoor Unit Electric Control Box Layout

Figure 4-1.1: HOP4(6)WODU electric control box

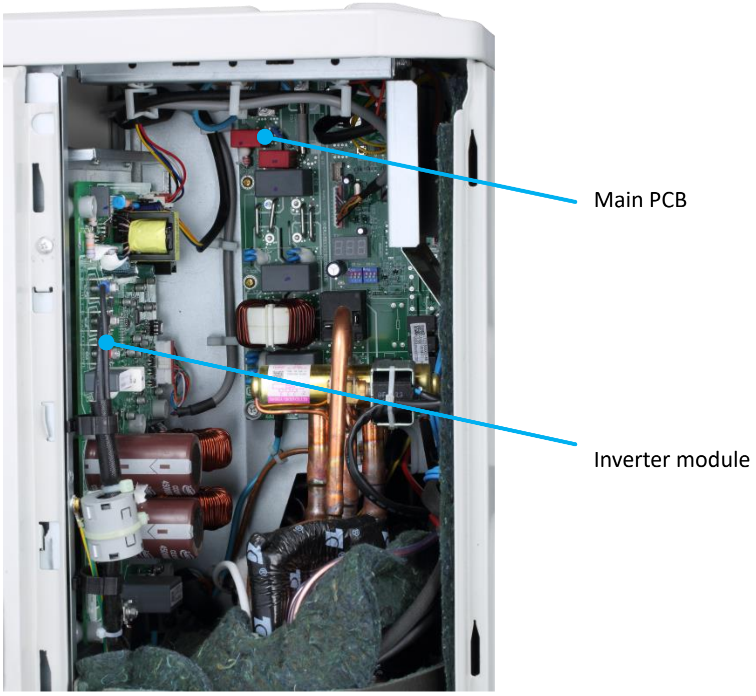


Figure 4-1.2: HOP8(10)WODU electric control box

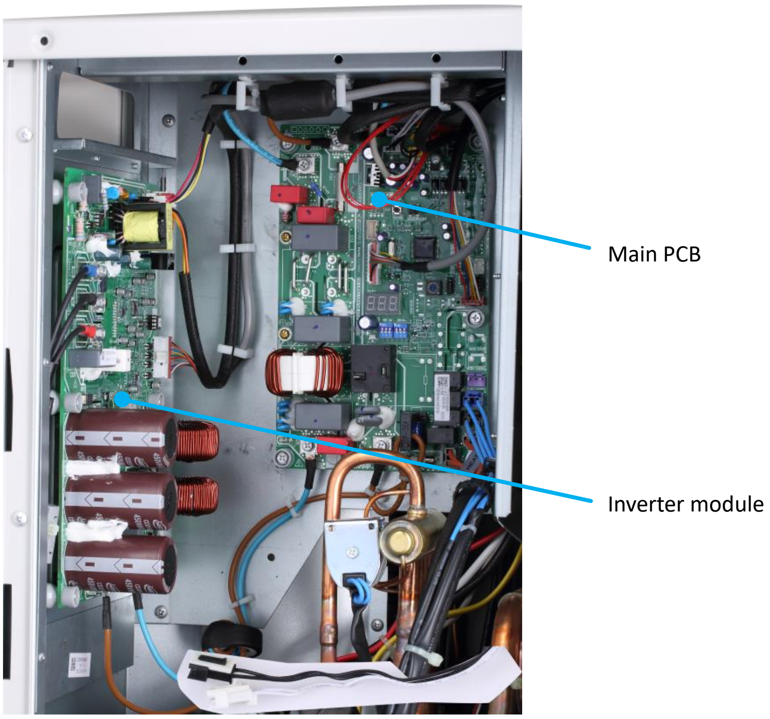


Figure 4-1.3: HOP12(14,16)WODU electric control box

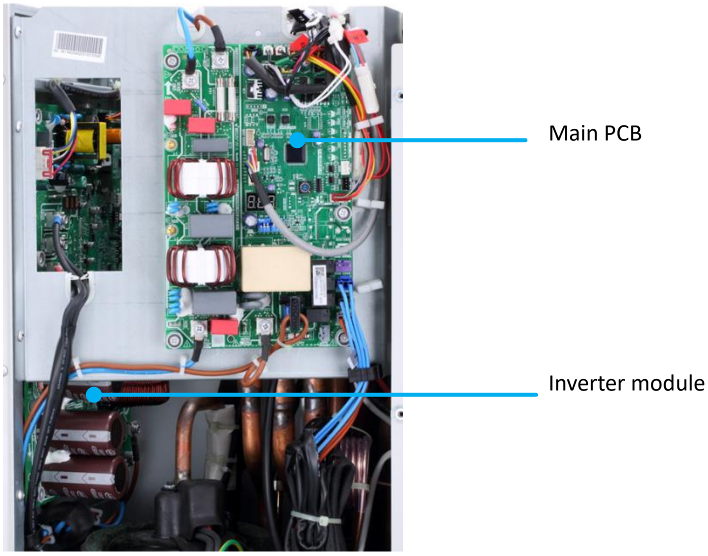
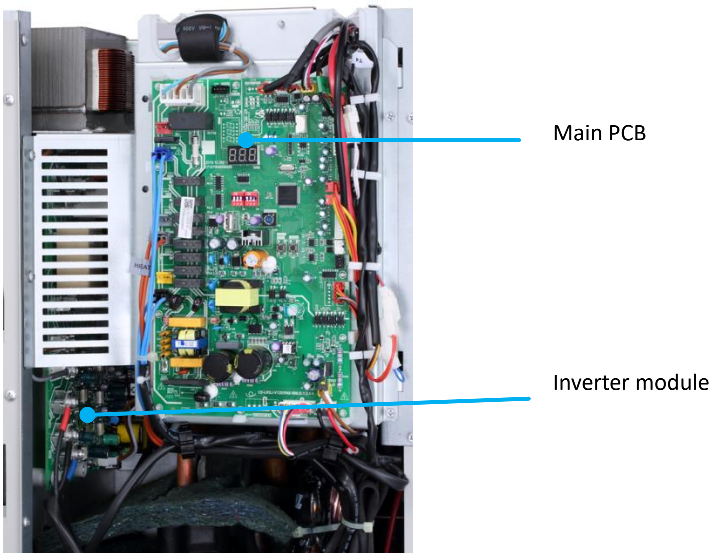
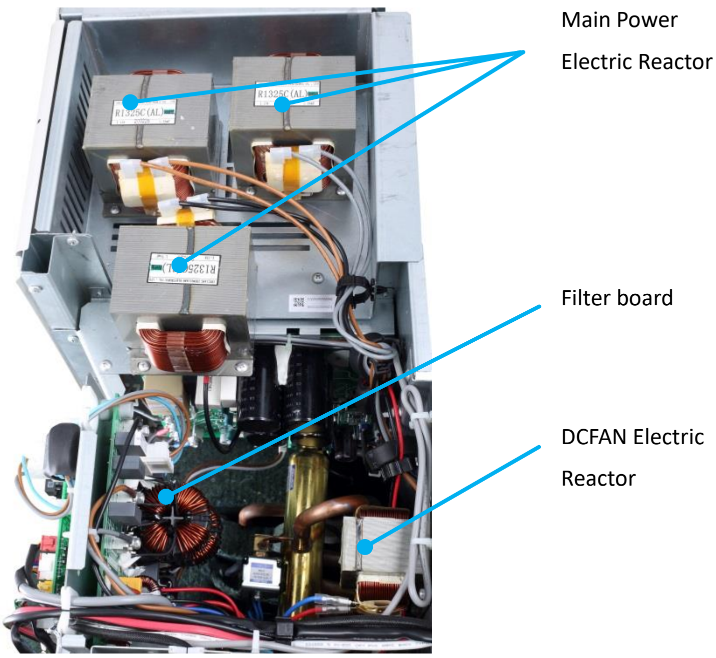


Figure 4-1.4: HOP12(14,16)WODU3 electric control box





1.2 Hydronic Box Electric Control Box Layout

Figure 4-1.5: HOP60(100)WIDU

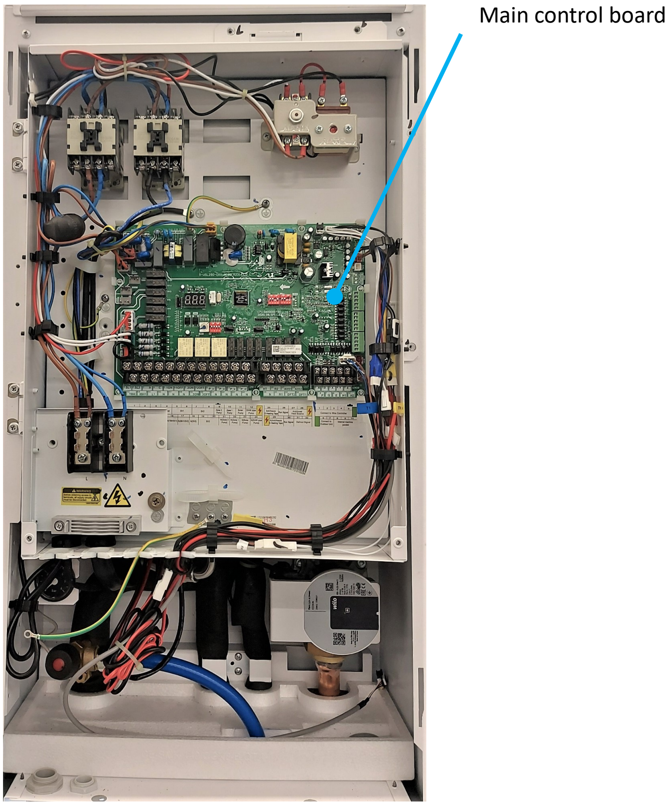
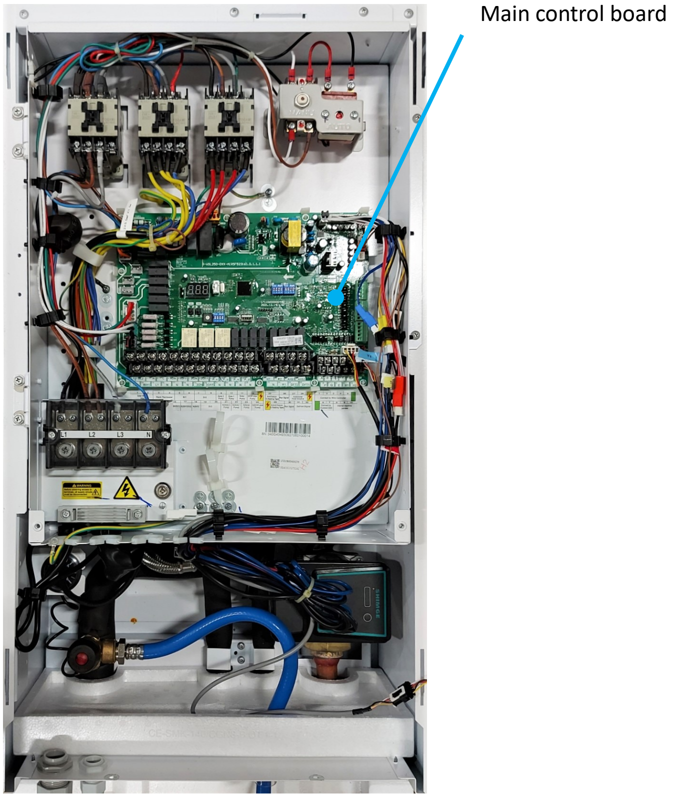


Figure 4-1.6: HOP100(160)WIDU3



2 PCBs

2.1 Outdoor Unit PCB

There are one type of main PCB for the 4kW to 10kW 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 to Figure 4-1.4 in 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 4-1.5 in Part 4, 1.2 “Hydronic Box Electric Control Box Layout”.

2.2 Main PCB for Hydronic System

Figure 4-2.1: HOP60(100,160)WIDU(3) hydronic box main PCB

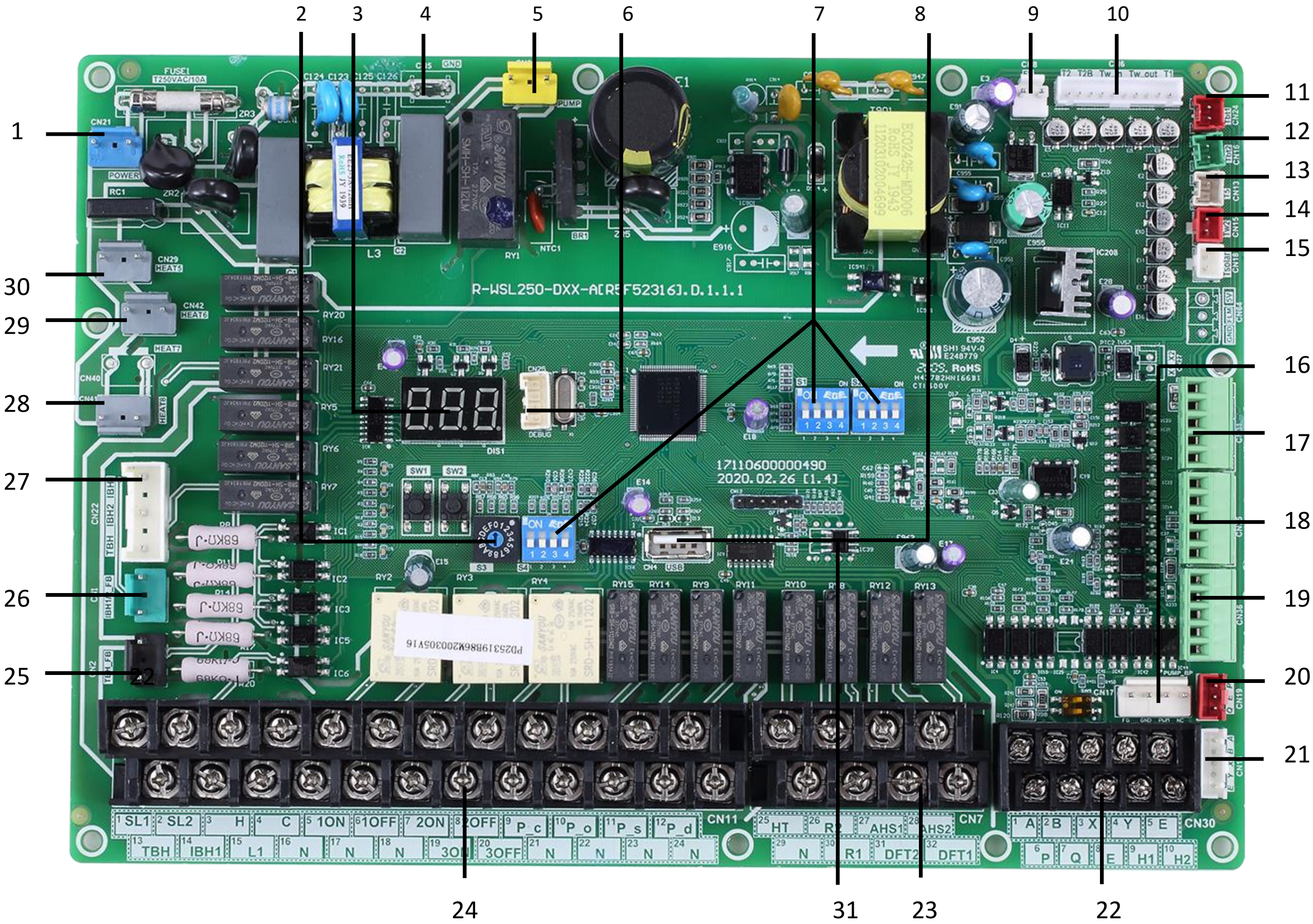


Table 4-2.1: HOP60(100,160)WIDU(3) hydronic box main PCB

Label in Figure 4-2.1	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 variable speed 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	CN7	Port for antifreeze E-heating tape(external), additional heat source, compressor run/defrost run
24	CN11	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,
25	CN2	Feedback port for external temp. switch(shorted in default)
26	CN1	Feedback port for temperature switch(shorted in default)
27	CN22	Control port for backup heater1/booster heater/Reserved
28	CN41	Port for anti-freeze electric heating tape
29	CN42	Port for anti-freeze electric heating tape
30	CN29	Port for anti-freeze electric heating tape
31	IC39	EEPROM

2.3 Main PCBs for Refrigerant System, Inverter Module

Figure 4-2.2: HOP4(6,8,10)WODU outdoor unit main PCB for refrigerant system

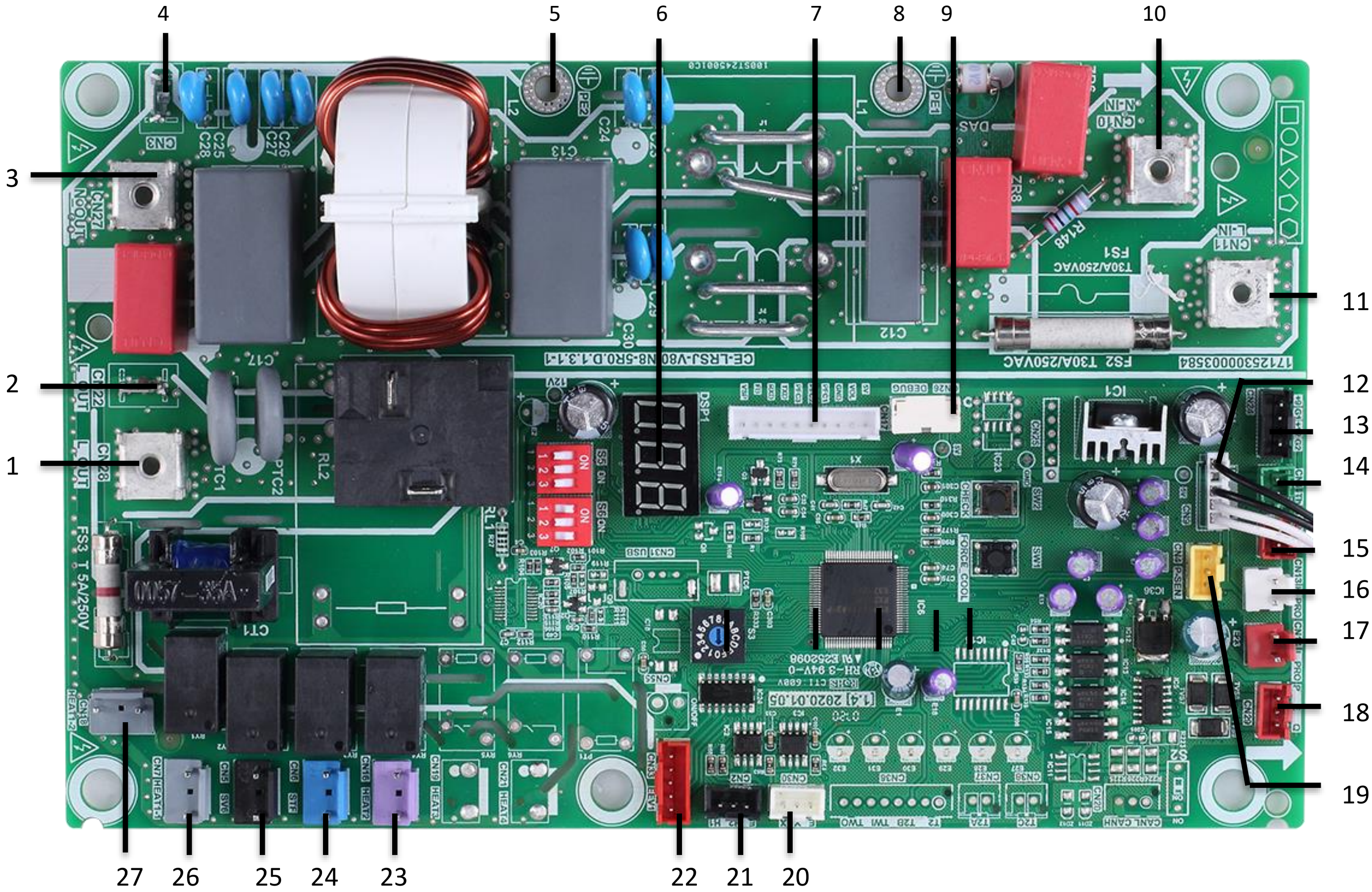


Table 4-2.2: HOP4(6,8,10)WODU outdoor unit main PCB for refrigerant system

Label in Figure 4-2.2	Code	Content
1	CN28	Ourput 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

Figure 4-2.3 HOP12(14,16)WODU outdoor unit main PCB for refrigerant system

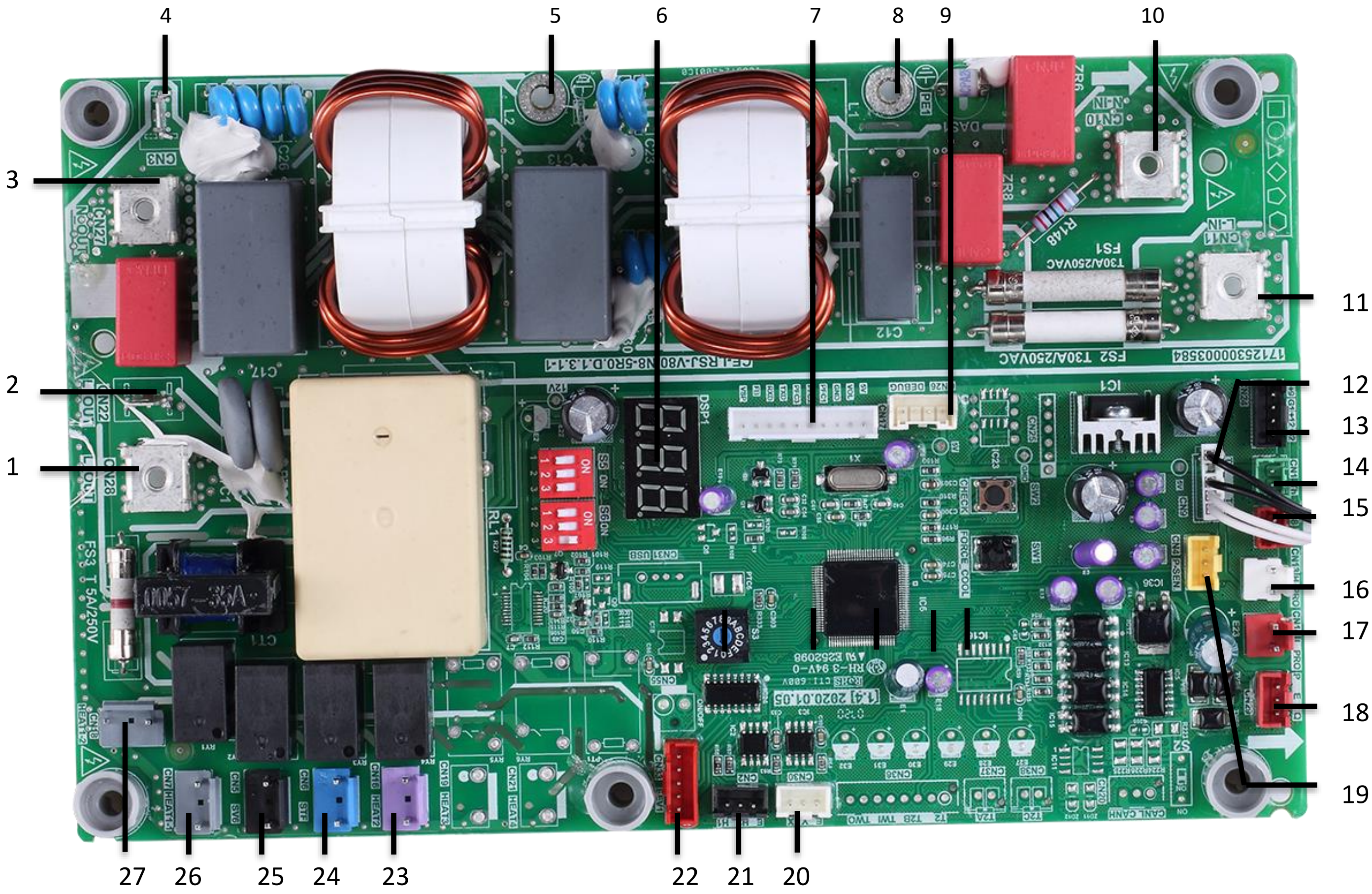


Table 4-2.3: HOP12(14,16)WODU outdoor unit main PCB for refrigerant system

Label in Figure 4-2.3	Code	Content
1	CN28	Ourput 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

Figure 4-2.4 HOP12(14,16)WODU3 outdoor unit main PCB for refrigerant system

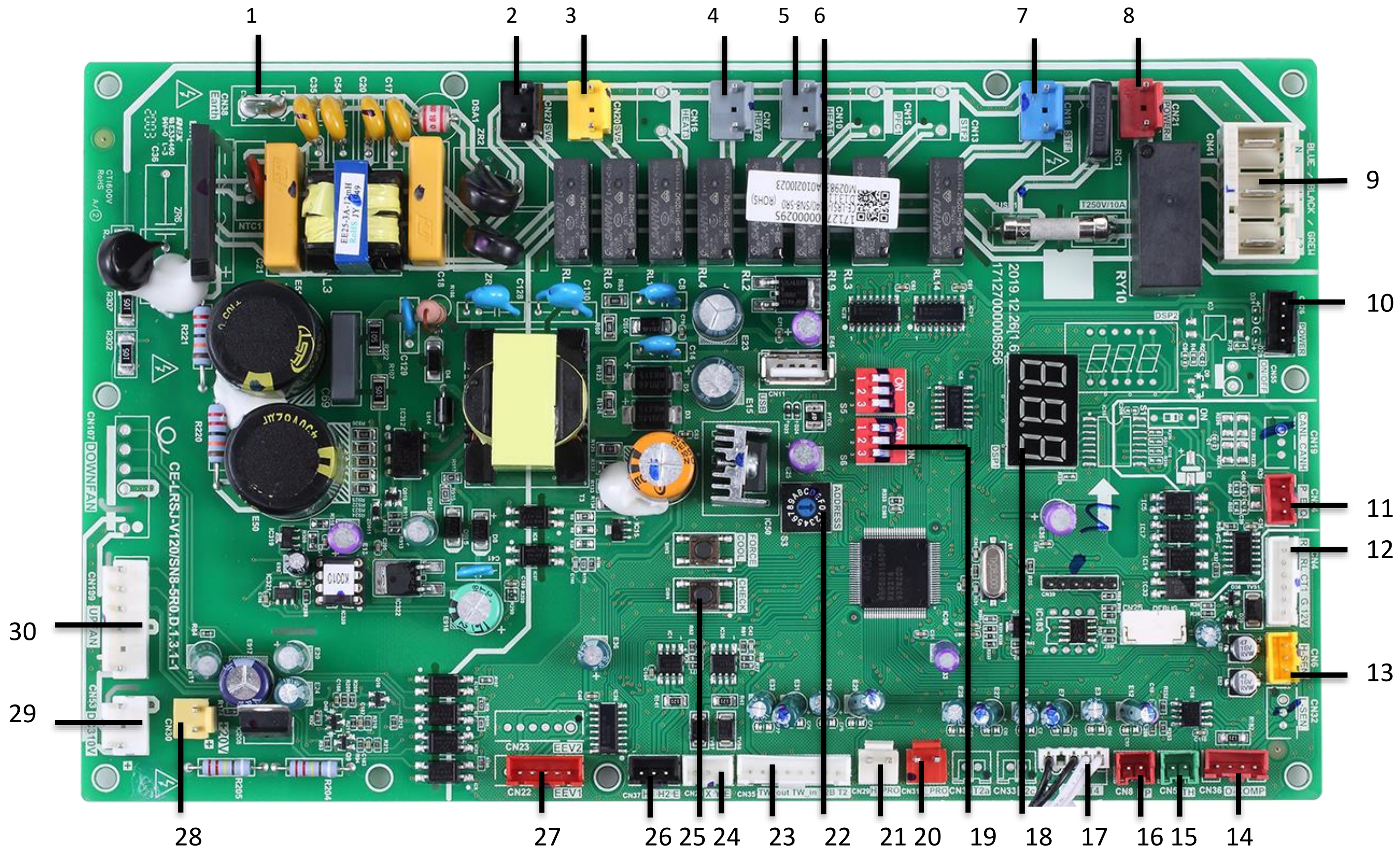
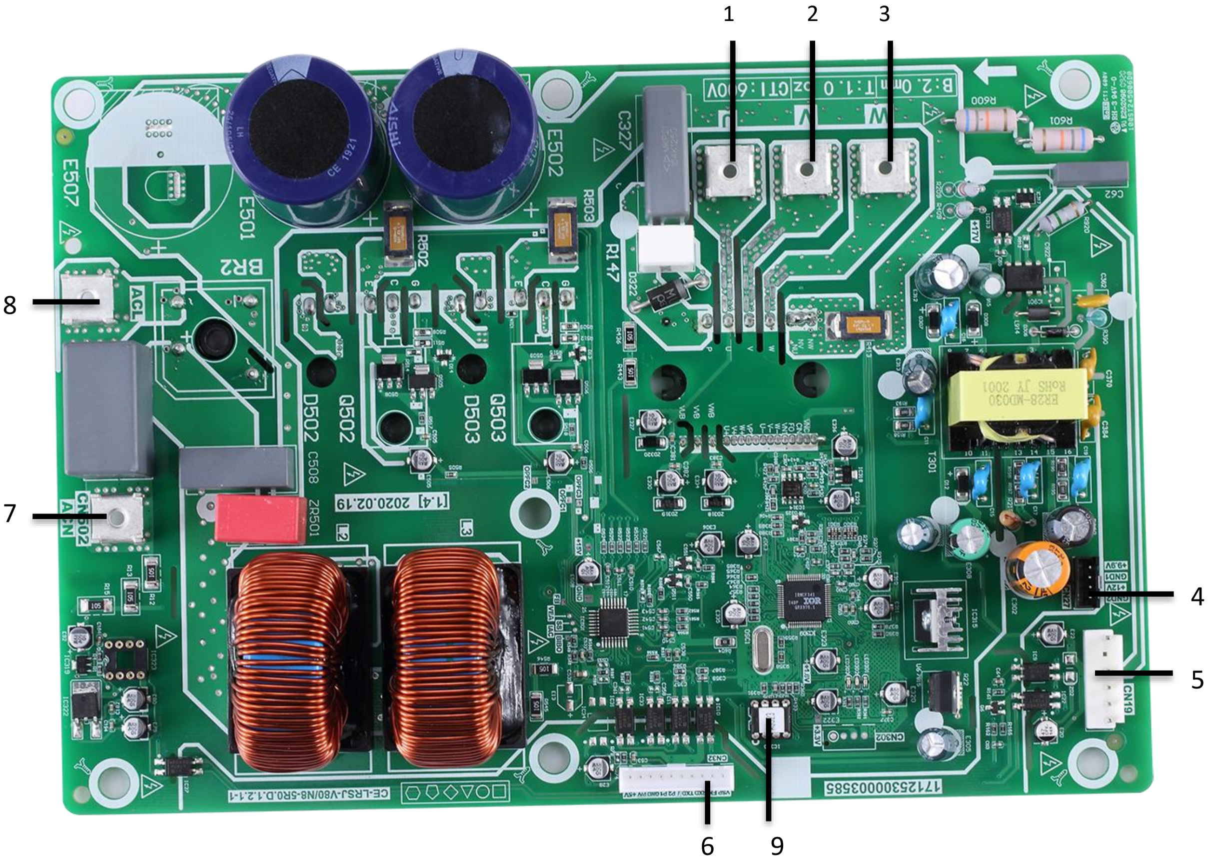


Table 4-2.4: HOP12(14,16)WODU3 outdoor unit main PCB for refrigerant system

Label in Figure 4-2.4	Code	Content
1	CN38	Port for GND
2	CN27	Port for 2-way valve 6
3	CN20	Port for 2-way valve 5
4	CN7	Port for eletric heating tape2
5	CN10	Port for eletric heating tape1
6	CN11	Reserved
7	CN18	Port for 4-way value
8	CN21	Reserved
9	CN41	Power supply port from main PCB for invert module board
10	CN26	Port for communication with Power Meter
11	CN24	Port for communication with hydro-box control board
12	CN4	Port for communication with main PCB for invert module board
13	CN6	Port for pressure sensor
14	CN36	Port for communication with main PCB for refrigerant system
15	CN5	Port for temp. sensor Th
16	CN8	Port for temp. sensor Tp
17	CN9	Port for outdoor ambient temp. sensor and condenser temp. sensor
18	DSP1	Digital display(DSP1)
19	S5,S6	DIP switch(S5,S6)
20	CN31	Port for low pressure switch(CN31)
21	CN29	Port for high pressure switch and quick check(CN29)
22	S3	Rotary dip switch(S3)
23	CN35	Port for temp. sensors(TW_out, TW_in, T1, T2,T2B)
24	CN28	Port for communication XYE
25	S3, S4	Key for fore cool & check
26	CN37	Port for communication H1H2E
27	CN22	Port for electrical expansion value
28	CN30	Port for fan 15VDC power supply
29	CN53	Port for fan 310VDC power supply
30	CN109	Port for fan

Figure 4-2.5 HOP4(6,8,10)WODU outdoor unit inverter module

For 4/6kW model



For 8/10kW model

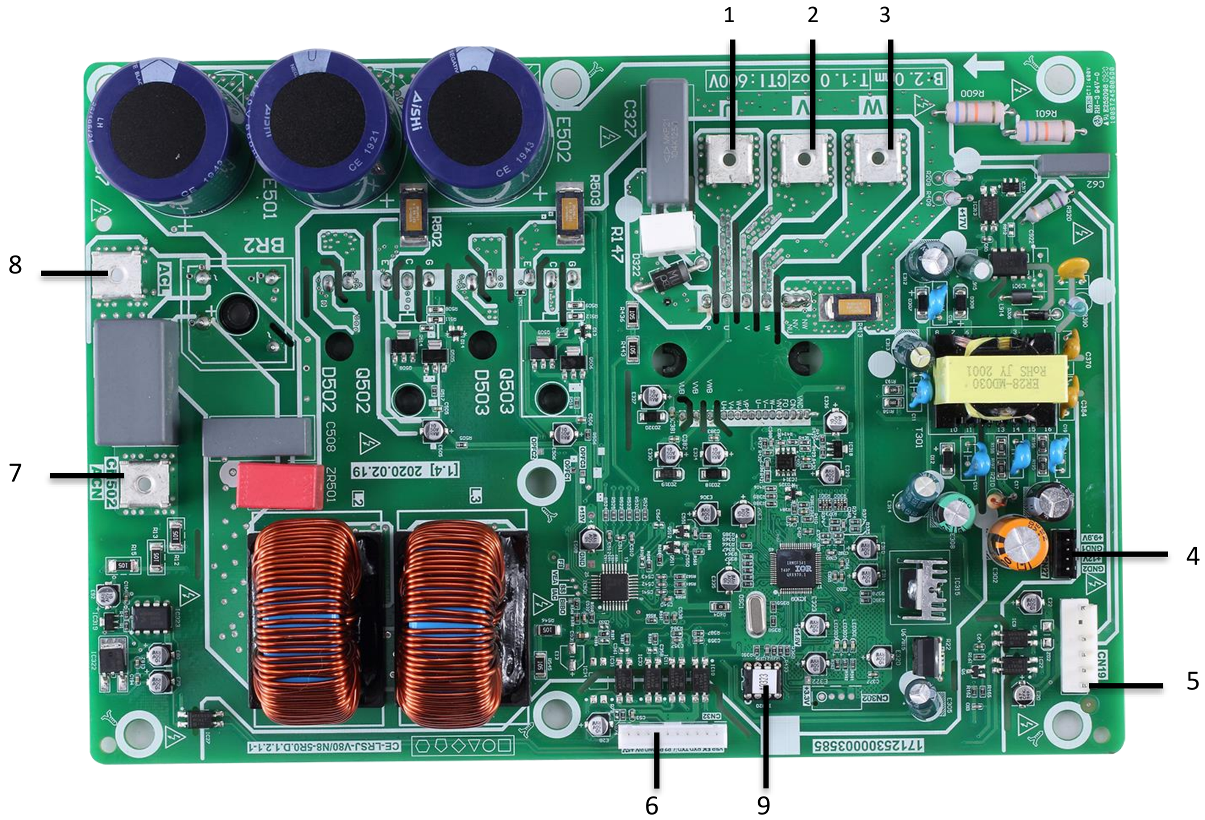


Table 4-2.5: HOP4(6,8,10)WODU outdoor unit inverter module

Label in Figure 4-2.5	Code	Content
1	U	Compressor connection port U
2	V	Compressor connection port V
3	W	Compressor connection port W
4	CN20	Output port for +12V/9V
5	CN19	Port for fan
6	CN32	Port for communication with main PCB for filter board
7	CN502	Input port N for rectifier bridge
8	CN501	Input port L for rectifier bridge
9	IC320	EEPROM

Figure 4-2.6: HOP12(14,16)WODU outdoor unit inverter module

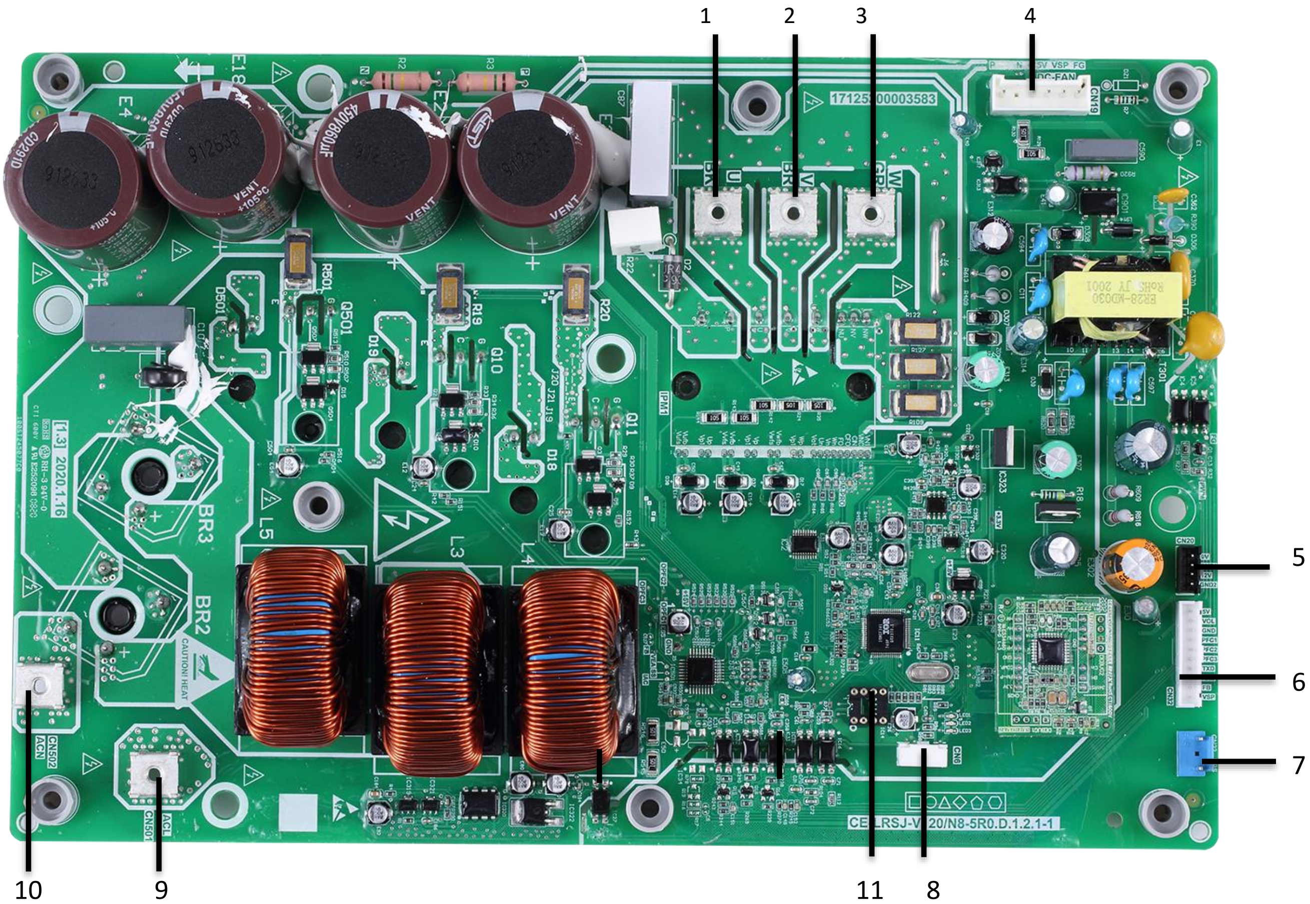


Table 4-2.6: HOP12(14,16)WODU outdoor unit inverter module

Label in Figure 4-2.6	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

Figure 4-2.7: HOP12(14,16)WODU3 outdoor unit inverter module

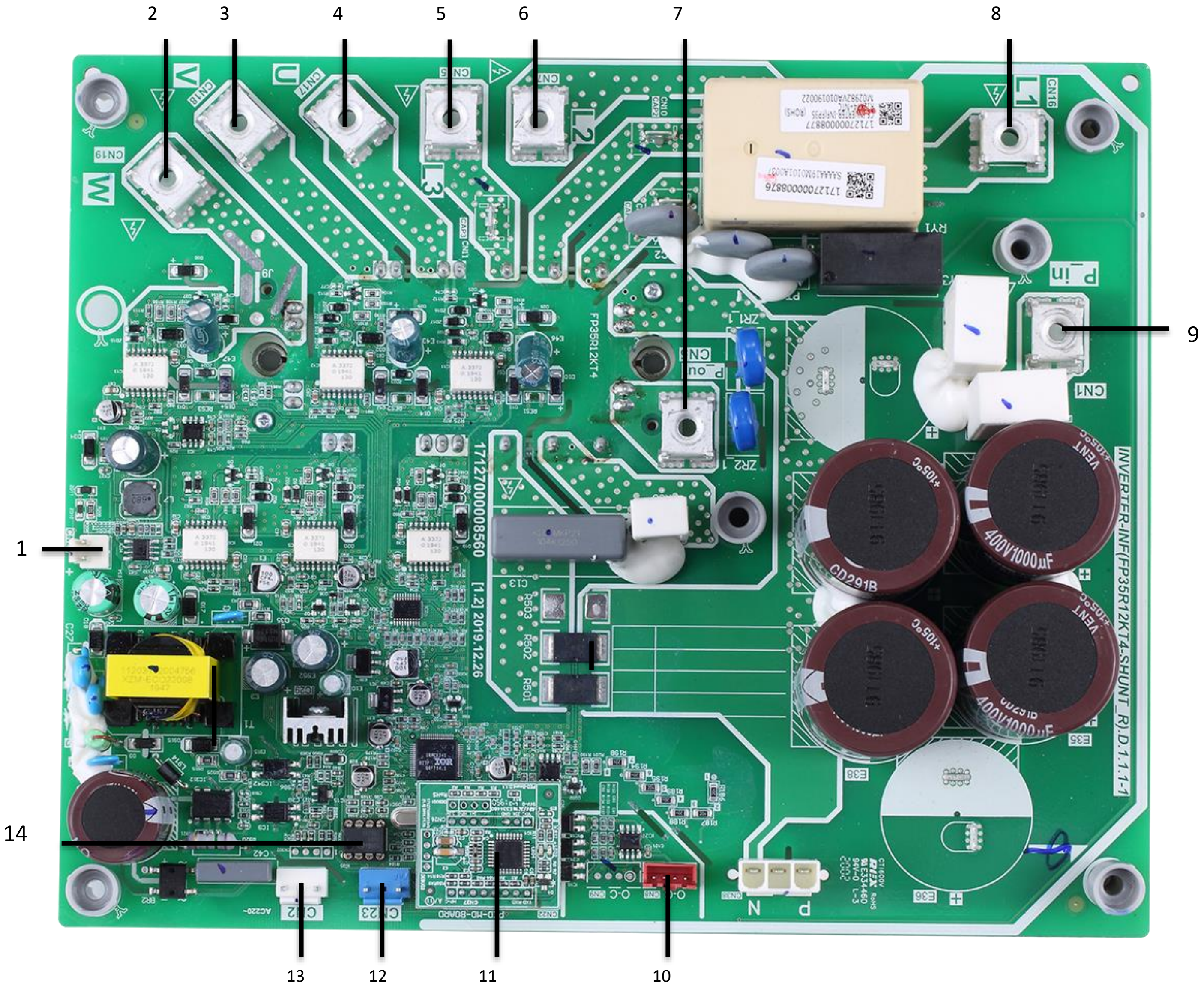


Table 4-2.7: HOP12(14,16)WODU3 outdoor unit inverter module

Label in Figure 4-2.7	Code	Content
1	CN20	Output port for +15V
2	CN19	Compressor connection port W
3	CN18	Compressor connection port V
4	CN17	Compressor connection port U
5	CN15	Power Input port L3
6	CN7	Power Input port L2
7	CN5	Input port P_out for IPM module
8	CN16	Power Input port L1
9	CN1	Input port P_in for IPM module
10	CN8	Port for communication with main PCB for filter board
11	CN22	PED board
12	CN23	Power for high pressure switch
13	CN2	Port for communication with PCB
14	IC25	EEPROM

Figure 4-2.8: HOP12(14,16)WODU3 outdoor unit filter board

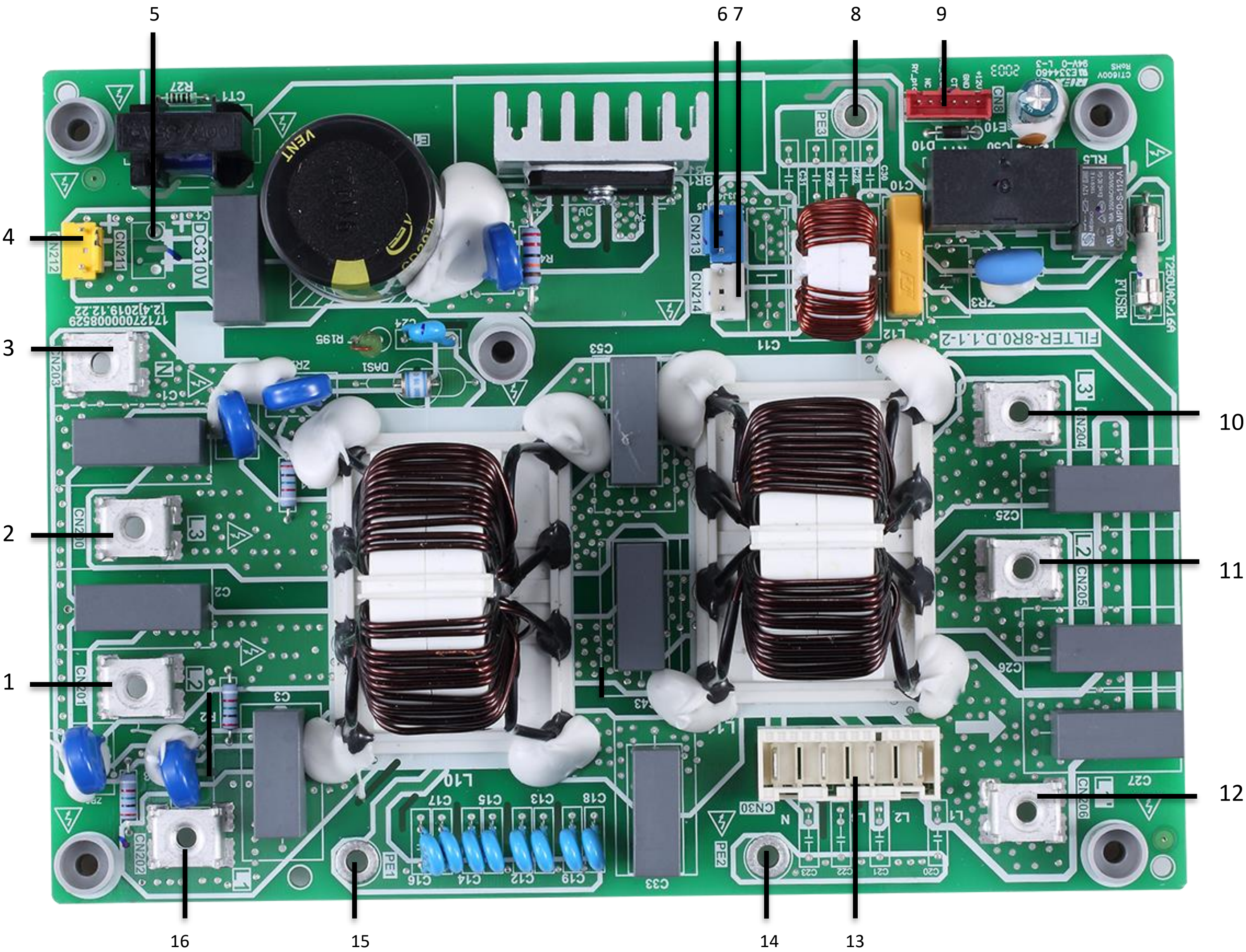


Table 4-2.8: HOP12(14,16)WODU3 outdoor unit filter board

Label in Figure 4-2.8	Code	Content
1	CN201	Power supply L2
2	CN200	Power supply L3
3	CN203	Power supply N
4	CN212	Power supply port of 310VDC
5	CN211	Reserved
6	CN213	Port for FAN Reactor
7	CN214	Power supply port for Inverter module
8	PE3	Ground wire
9	CN8	Port for communication with main PCB for filter board
10	L3’	Power filtering L3
11	L2’	Power filtering L2
12	L1’	Power filtering L1
13	CN30	Power supply port for main control board
14	PE2	Port for ground wire
15	PE1	Port for ground wire
16	L1	Power supply L1

2.4 Digital Display Output

Table 4-2.9: Digital display output in different operating states

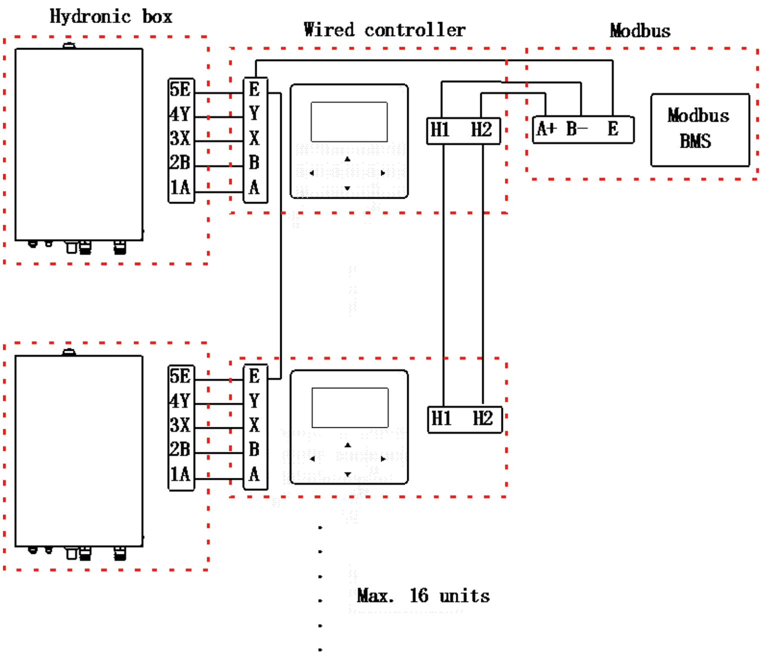
OPTIMUS PRO Split system state	Parameters displayed on outdoor unit main PCB DSP1	Parameters displayed on hydronic box main PCB DSP1	
On standby	0	0	
Normal operation	Running speed of the compressor in rotations per second	Leaving water temperature (°C)	
Error or protection	Error or protection code	Error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

2.5 DIP switch setting and Modbus function (Modbus function will be available in 2020-5-30)

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.

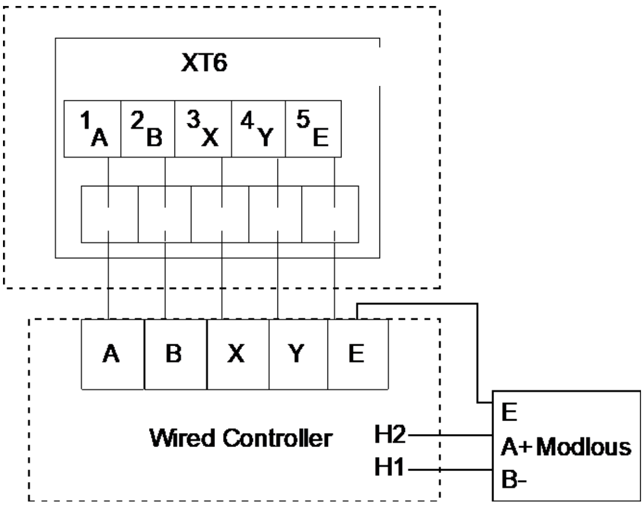
Figure 4-2.10: Rotating switch

Figure 4-2.11: Connection



Note: Wired controller is integrated in the hydronic box.

Figure 4-2.12: Wiring



Input Voltage(A/B)	13.5VAC
Wiring size	0.75mm²

3 Error Code Table

Table 4-3.1: Error code table

Error code	Serial Number[1]	Content[2]	Remarks
C7	65	High temperature protection of transducer module	
E0	1	Water flow failure(E8 appears for 3 times)	
E1	2	Phase sequence error	Only applies to 3-phase models
E2	3	Communication error between the main control board of hydraulic module and user interface	
E3	4	Final outlet water temperature sensor error	Sensor T1
E4	5	Domestic hot water tank temperature sensor error	Sensor T5
E5	6	Air side heat exchanger refrigerant outlet temperature sensor error	Sensor T3
E6	7	Outdoor ambient temperature sensor error	Sensor T4
E7	8	Balance tank upper temperature sensor error	Sensor Tbt1
E8	9	Water flow failure	
E9	10	Suction pipe temperature sensor error	Sensor Th
EA	11	Discharge pipe temperature sensor error	Sensor Tp
Eb	12	Solar panel temperature sensor error	Sensor Tsolar
Ec	13	Balance tank nether temperature sensor error	Sensor Tbt2
Ed	14	Water side heat exchanger water inlet temperature sensor error	Sensor Tw_in
EE	15	Hydronic box EEPROM error	
F1	116	DC generatrix voltage is too low	
H0	39	Communication error between outdoor unit main control chip and hydronic box main control chip	
H1	40	Communication error between outdoor unit main control chip and inverter driver chip	
H2	41	Water side heat exchanger refrigerant outlet (liquid pipe) temperature sensor error	Sensor T2
H3	42	Water side heat exchanger refrigerant inlet (gas pipe) temperature sensor error	Sensor T2B
H4	43	P6 appear 3 times in one hour	
H5	44	Room temperature sensor error	Sensor Ta
H6,	45	DC fan error	
H7	46	Abnormal main circuit voltage	
H8	47	Pressure sensor error	
H9	48	Circuit 2 water outlet temperature sensor error	Sensor Tw2
HA	49	Water side heat exchanger water outlet temperature sensor error	Sensor Tw_out
Hb	50	PP protection appears three times in a row and Twout<7℃	
HF	54	Invert module EEPROM error	
HH	55	DC fan error(H6 appears 10 times in 120min)	
HP	57	Low pressure protection for cooling mode	
P0	20	Low pressure switch protection	
P1	21	High pressure switch protection	
P3	23	Compressor current protection	
P4	24	Discharge temperature protection	

Table continued on next page …

Table 4-3.1: Error code table (continued)

P5	25	High temperature difference between water side heat exchanger water inlet and water outlet temperatures protection	
P6	26	Inverter module protection	
L0	-	Inverter module protection	
L1	-	DC bus low voltage protection	
L2	-	DC bus high voltage protection	
L4	-	MCE error	
L5	-	Zero speed protection	
L7	-	Phase sequence error	
L8	-	Compressor frequency variation greater than 15Hz within one second protection	
L9	-	Actual compressor frequency differs from target frequency by more than 15Hz protection	
Pb	31	Water side heat exchanger anti-freeze protection	
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 board error	

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”.

4 Troubleshooting

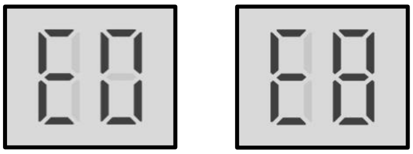
4.1 Warning

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.

4.2 E0, E8 Troubleshooting

4.2.1 Digital display output



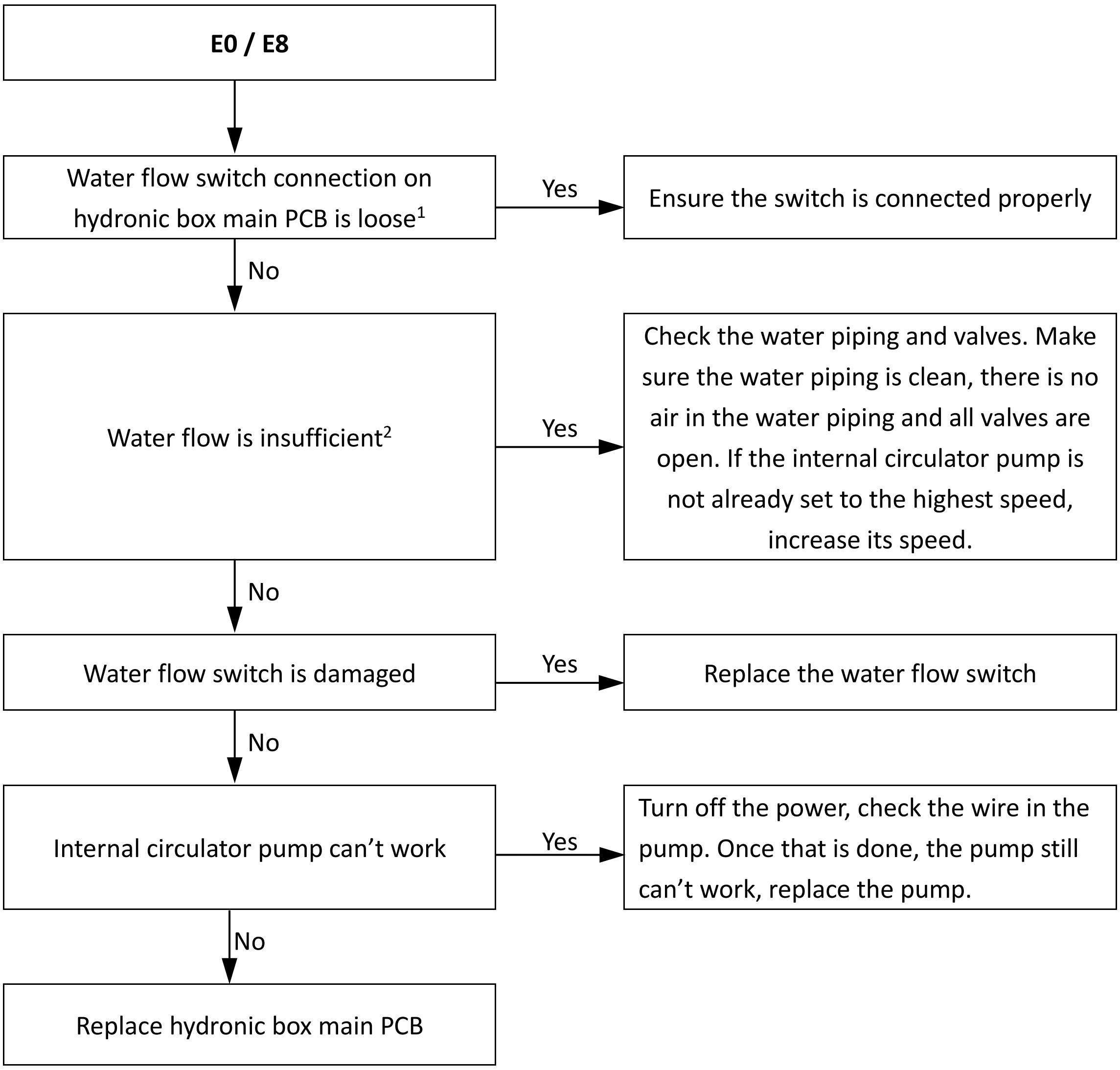
4.2.2 Description

- 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.
- OPTIMUS PRO Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

4.2.3 Possible causes

- The wire circuit is short connected or open.
- Water flow rate is too low.
- Water flow switch damaged.

4.2.4 Procedure



Notes:

1. Water flow switch connection is port CN8 on the main PCB for hydronic box (labeled 9 in Figure 4-2.1 in Part4, 2.2 "Main PCB for Hydronic System").
2. Check water pressure on the manometer. If the water pressure is not > 1 bar, water flow is insufficient. Refer to Figure 2-1.9 in Part 2, 1 "Hydronic Box Layout".

4.3 E1 Troubleshooting

4.3.1 Digital display output

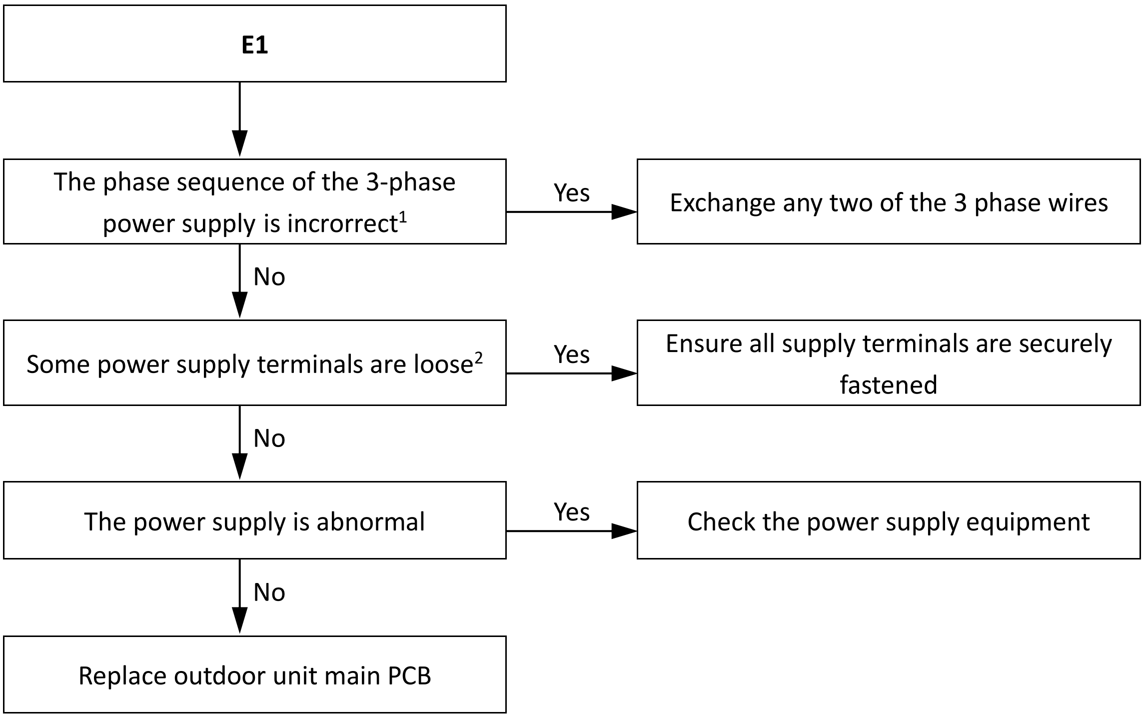
4.3.2 Description

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

4.3.3 Possible causes

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

4.3.4 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.

4.4 E2 Troubleshooting

4.4.1 Digital display output

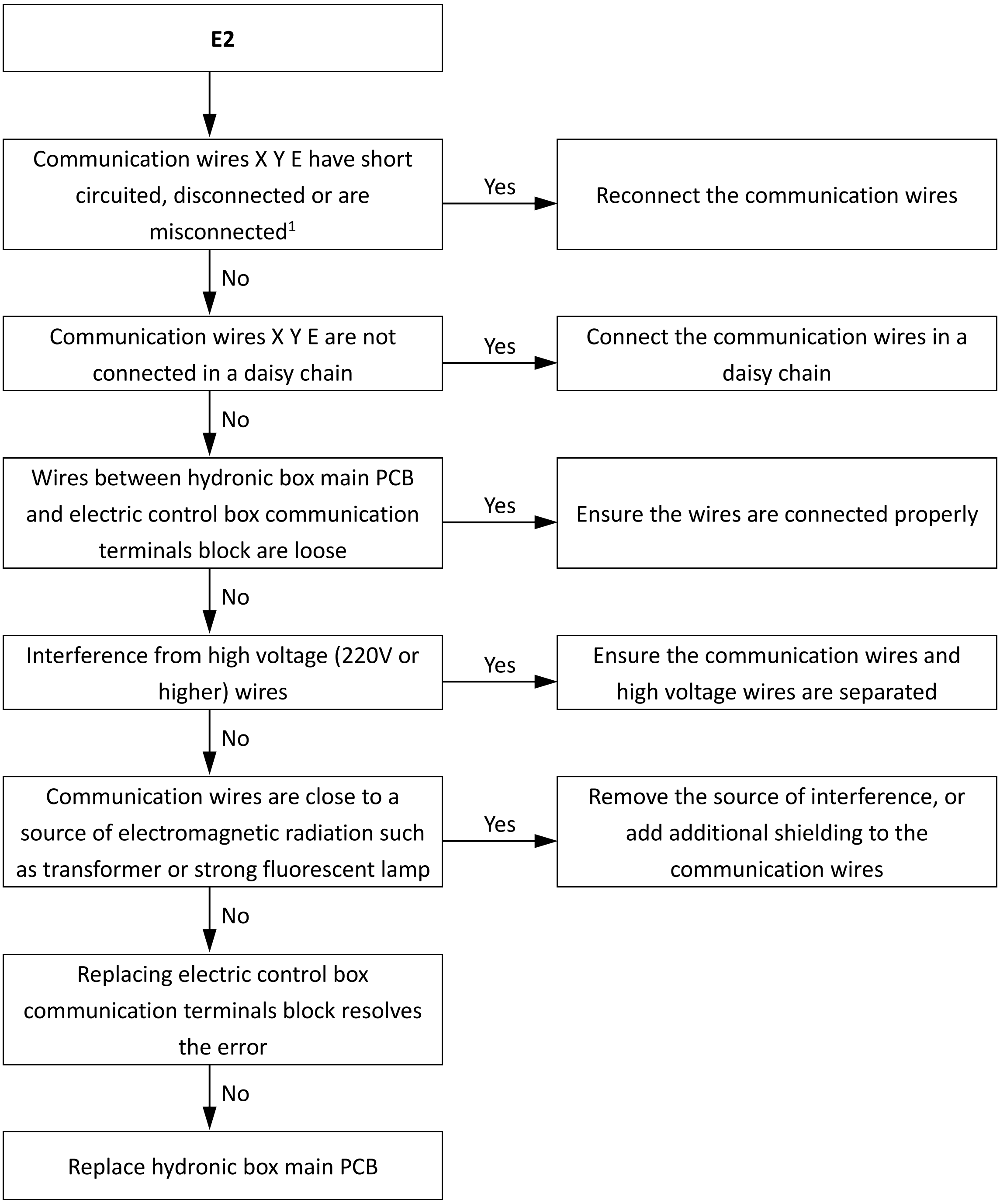
4.4.2 Description

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

4.4.3 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.

4.4.4 Procedure

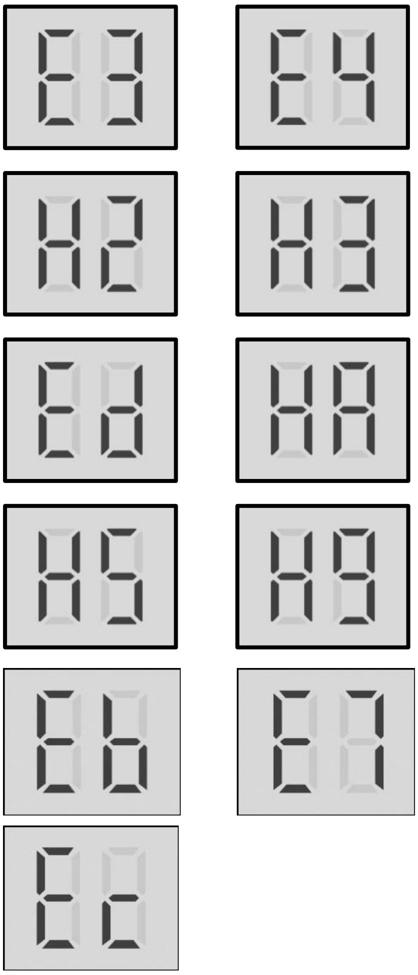


Notes:

1. Measure the resistance among X, Y and E. The normal resistance between X and Y is 120Ω, between X 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.

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

4.5.1 Digital display output



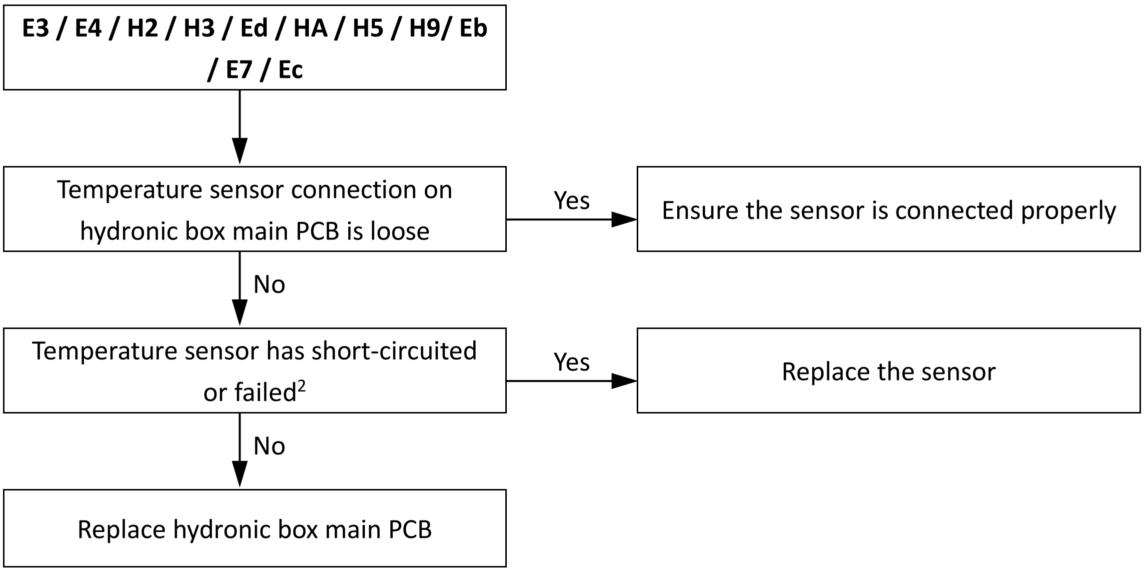
4.5.2 Description

- 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
- OPTIMUS PRO Split stops running.
- Error code is displayed on hydronic box main PCB and user interface.

4.5.3 Possible causes

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

4.5.4 Procedure

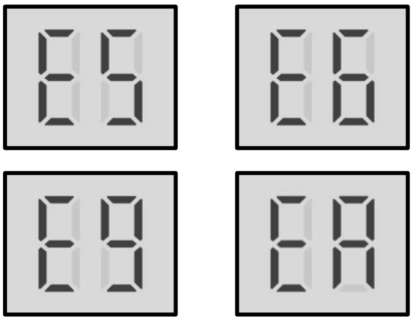


Notes:

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 4-2.1 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 4-2.1 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 4-2.1 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 4-2.1 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 4-2.1 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 4-2.1 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 4-2.1 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 4-5.1 or 4-5.3 in Part 4, 5.1 "Temperature Sensor Resistance Characteristics".

4.6 E5, E6, E9, EA Troubleshooting

4.6.1 Digital display output



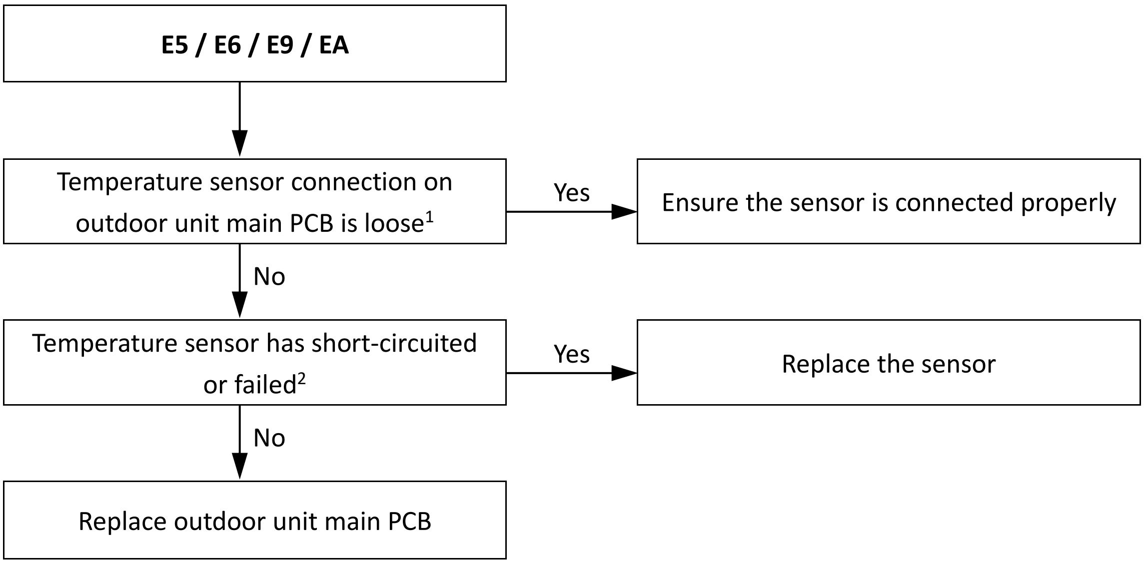
4.6.2 Description

- 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.
- OPTIMUS PRO Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

4.6.3 Possible causes

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

4.6.4 Procedure



Notes:

1. Air side heat exchanger refrigerant outlet temperature sensor and outdoor ambient temperature sensor connections are port CN9 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.2 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN9 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.3 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN9 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 17 in Figure 4-2.4 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"). Discharge pipe temperature sensor connection are port CN8 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.2 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN8 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.3 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN4 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.4 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"). Suction pipe temperature sensor connection are port CN1 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 14 in Figure 4-2.2 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN1 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 14 in Figure 4-2.3 in Part 4, 2.1 "Main PCBs for Refrigerant System, Inverter Module"), port CN8 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.4 in Part 4, 2.1 "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 4-5.1, and Table 4-5.2 in Part 4, 5.1 "Temperature Sensor Resistance Characteristics".

4.7 EE Troubleshooting

4.7.1 Digital display output

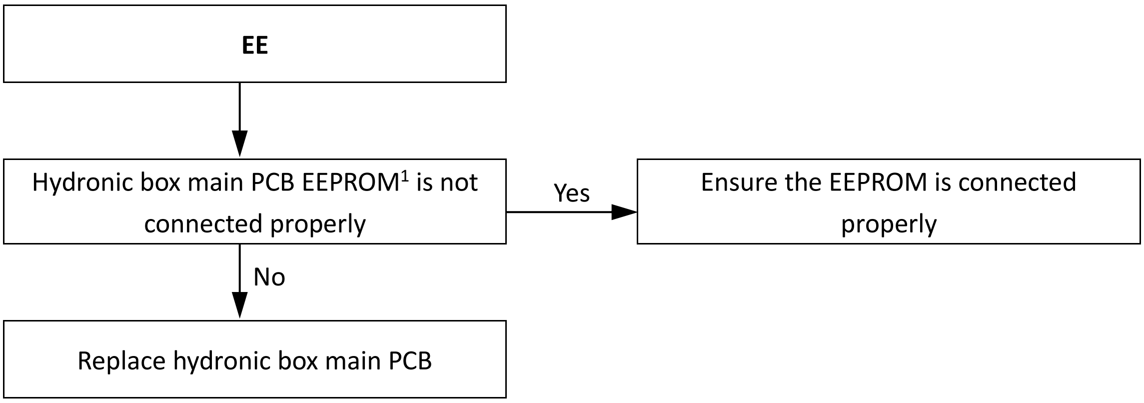
4.7.2 Description

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

4.7.3 Possible causes

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

4.7.4 Procedure



Notes:

1. Hydronic box main PCB EEPROM is designated IC39 on the main PCB for hydronic box (labeled 31 in Figure 4-2.1 in Part4, 2.2 "Main PCB for Hydronic System").

4.8 F1 Troubleshooting

4.8.1 Digital display output

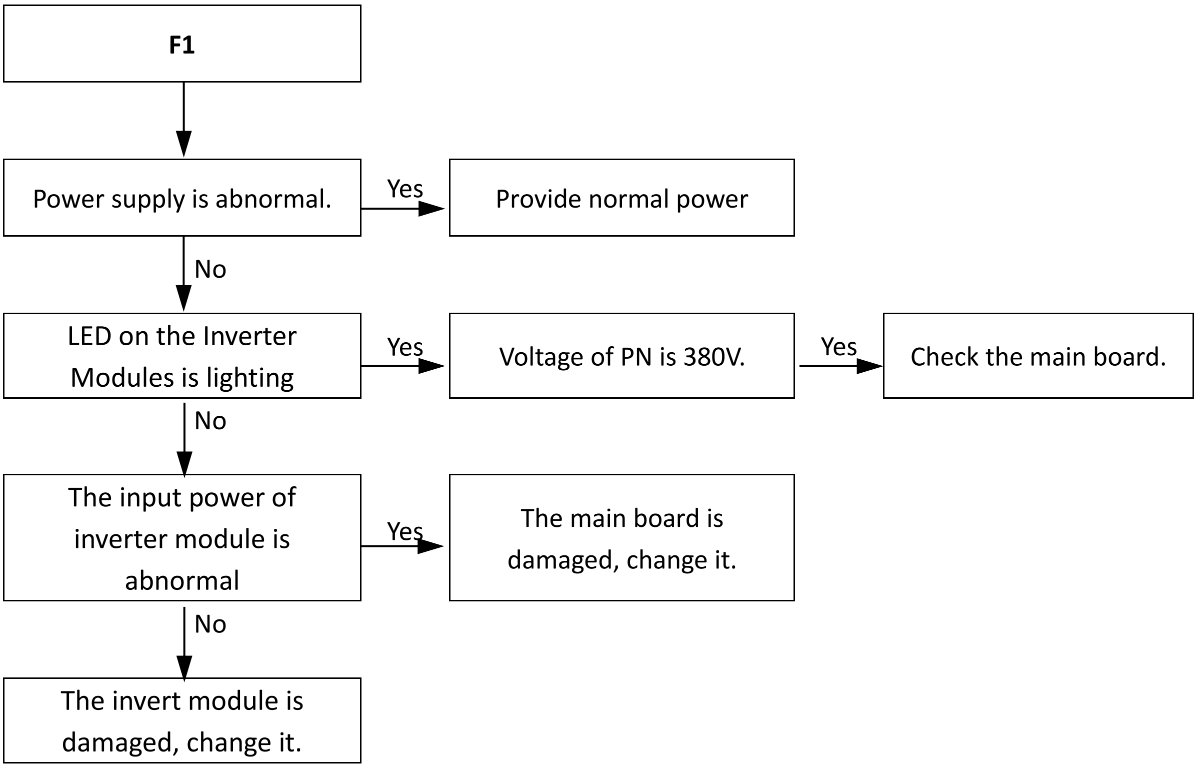
4.8.2 Description

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

4.8.3 Possible causes

- The DC generatrix voltage is too low.

4.8.4 Procedure



4.9 HF Troubleshooting

4.9.1 Digital display output

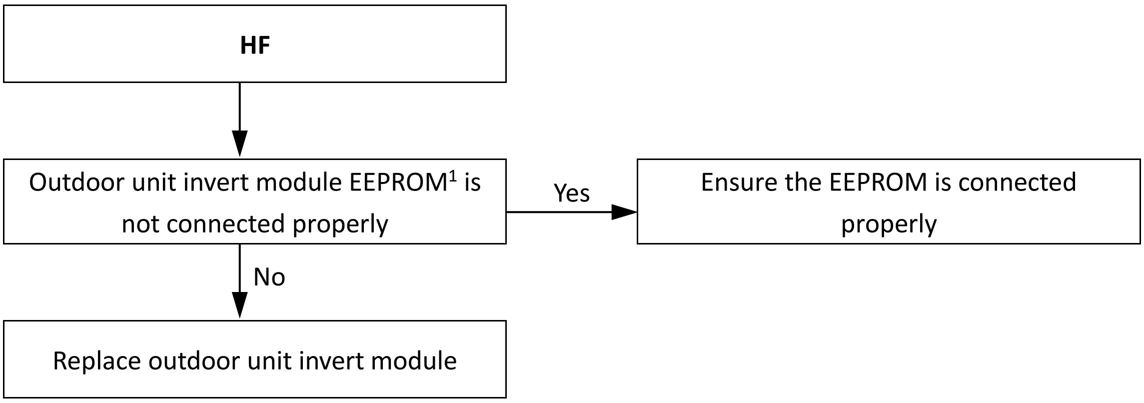
4.9.2 Description

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

4.9.3 Possible causes

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

4.9.4 Procedure



Notes:
1. Outdoor unit invert module EEPROM is designated IC320 on the HOP4(6,8,10)WODU outdoor unit invert module (labeled 9 in Figure 4-2.5 in Part4, 2.3 "Main PCBs for Refrigerant System, Inverter Module"), designated IC14 on the HOP12(14,16)WODU outdoor unit invert module (labeled 11 in Figure 4-2.6 in Part4, 2.3 "Main PCBs for Refrigerant System, Inverter Module"), designated IC25 on the HOP12(14,16)WODU3 outdoor unit invert module (labeled 14 in Figure 4-2.7 in Part4, 2.3 "Main PCBs for Refrigerant System, Inverter Module").

4.10 H0 Troubleshooting

4.10.1 Digital display output

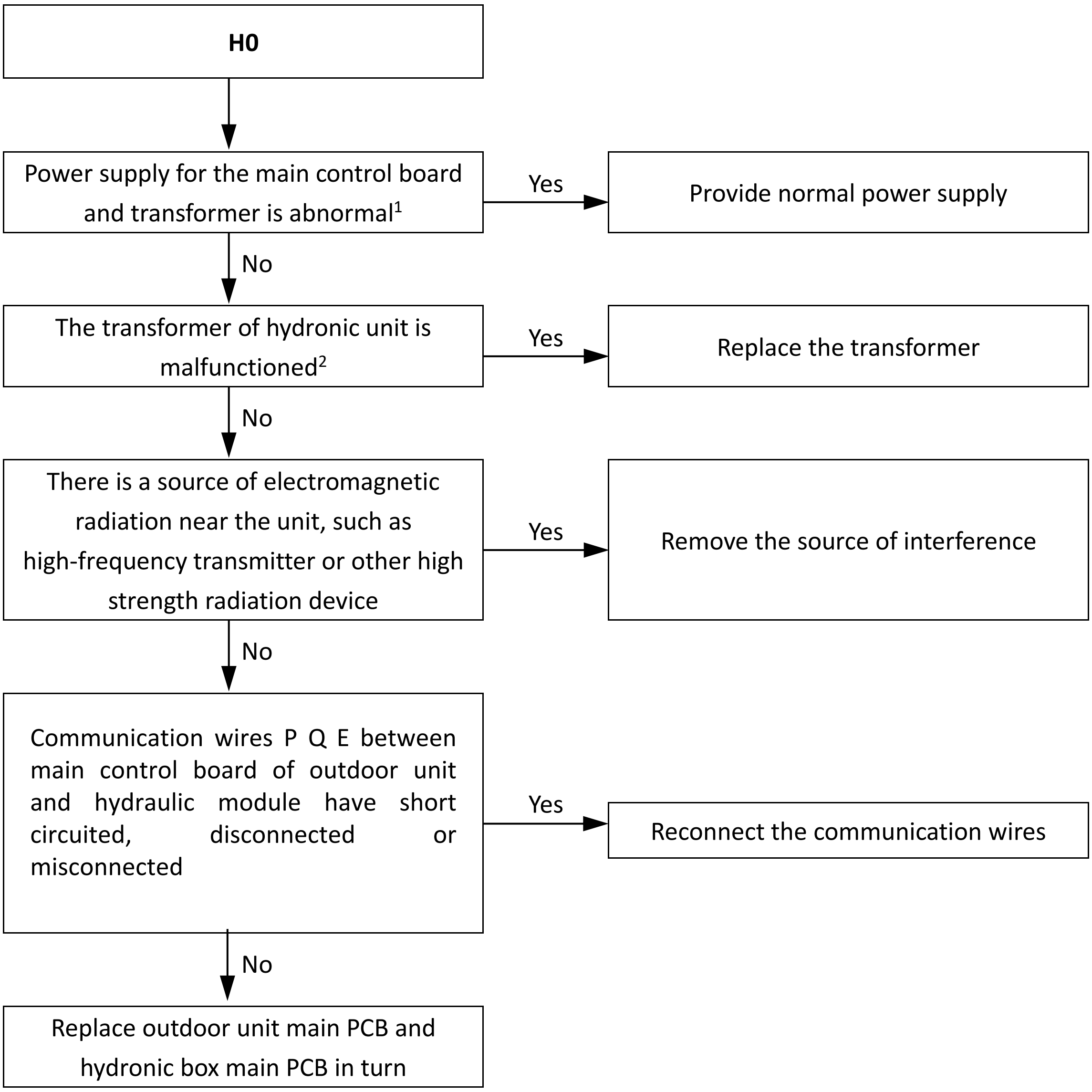
4.10.2 Description

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

4.10.3 Possible causes

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

4.10.4 Procedure



Notes:

1. Measure the voltages of transformer input port and out port. The input voltage of transformer is 220V AC, output voltage of transformer is 13.5V AC. If any voltages is abnormal, the power supply for the main control board of hydraulic module and transformer will be abnormal.
2. Measure the voltages of transformer output port ports. If the voltages are not normal, the transformer has malfunctioned.

4.11 H1 Troubleshooting

4.11.1 Digital display output

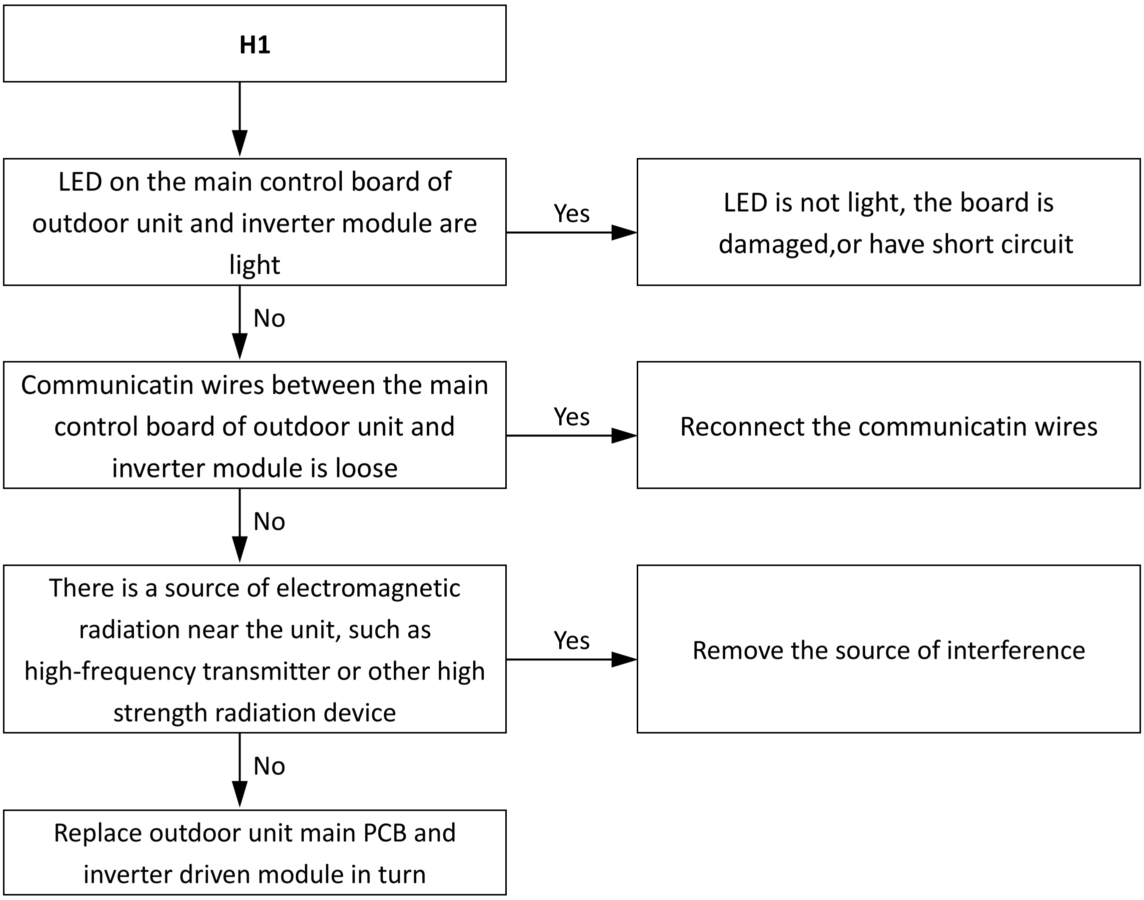
4.11.2 Description

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

4.11.3 Possible causes

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

4.11.4 Procedure



4.12 H6, HH Troubleshooting

4.12.1 Digital display output

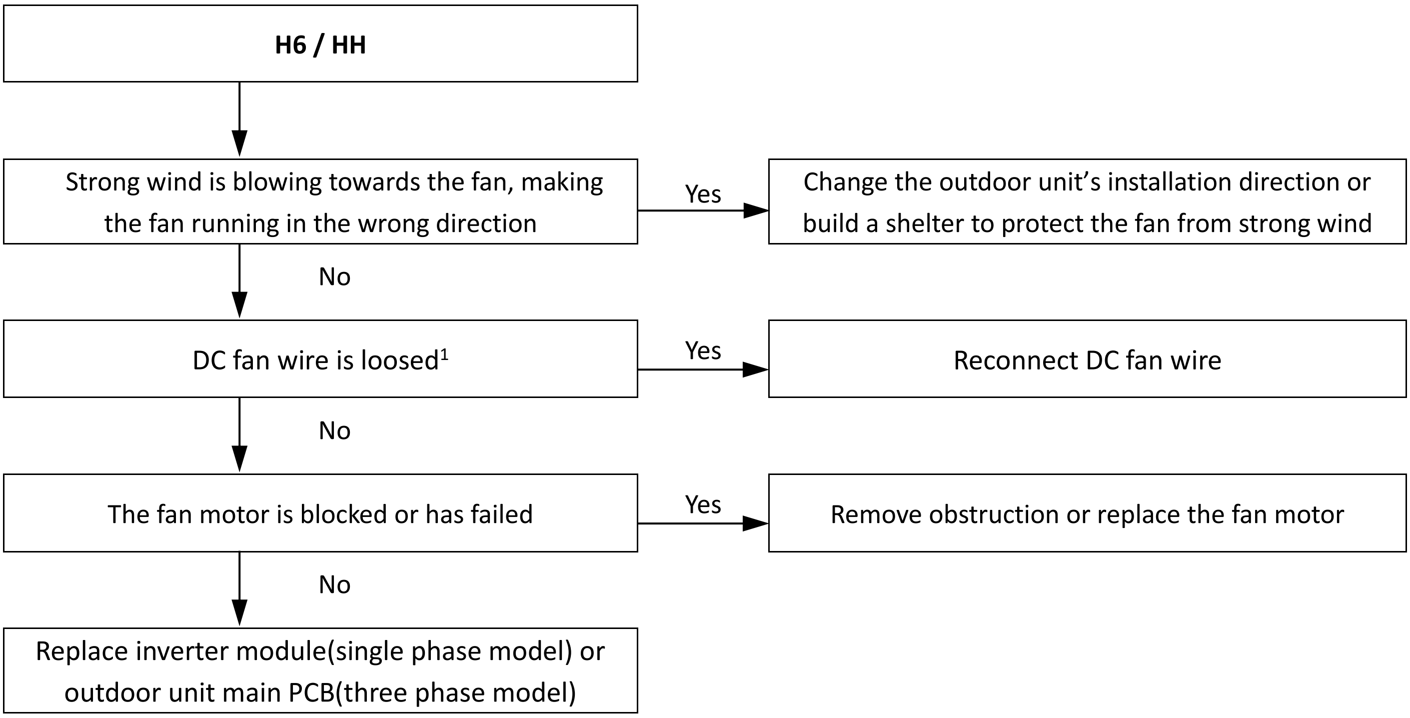
4.12.2 Description

- 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.
- OPTIMUS PRO Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

4.12.3 Possible causes

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

4.12.4 Procedure



Notes:

1. Refer to Figures 4-1.1 to 4-1.4 in Part 4, 1.1 "Outdoor Unit Electric Control Box Layout" and to the OPTIMUS PRO Split Engineering Data Book, Part 4 "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 HOPV4(6,8,10)WODU outdoor unit inverter module PCB (labeled 5 in Figure 4-2.5 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN19 on the HOP12(14,16)WODU outdoor unit inverter module PCB (labeled 4 in Figure 4-2.6 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN109 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 30 in Figure 4-2.4 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").

4.13 H7 Troubleshooting

4.13.1 Digital display output

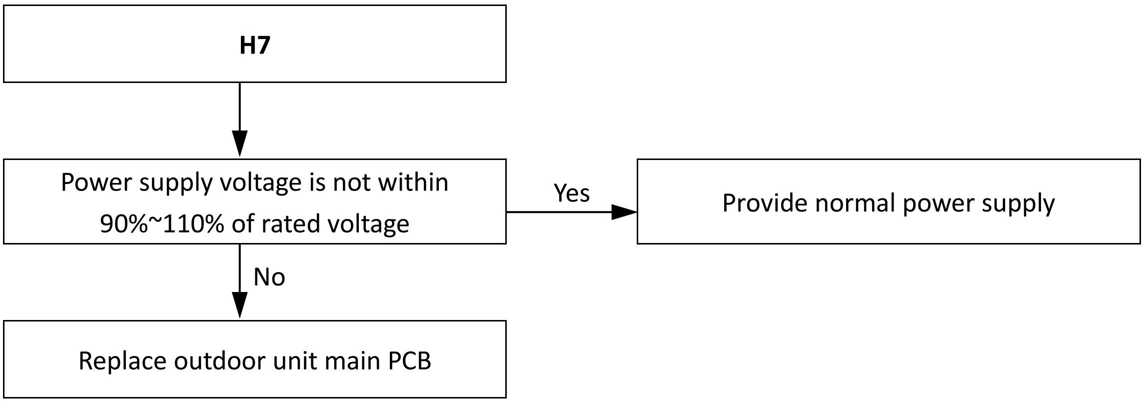
4.13.2 Description

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

4.13.3 Possible causes

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

4.13.4 Procedure



4.14 H8 Troubleshooting

4.14.1 Digital display output

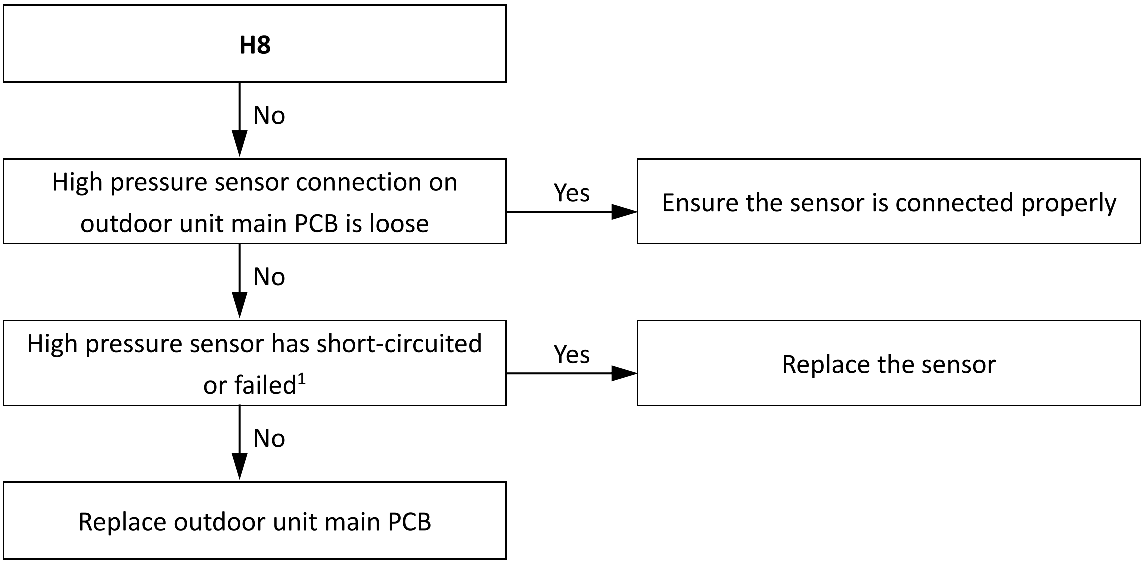
4.14.2 Description

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

4.14.3 Possible causes

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

4.14.4 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 HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 19 in Figure 4-2.2 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN4 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 19 in Figure 4-2.3 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN6 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 13 in Figure 4-2.4 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module").

4.15 P0, HP Troubleshooting

4.15.1 Digital display output

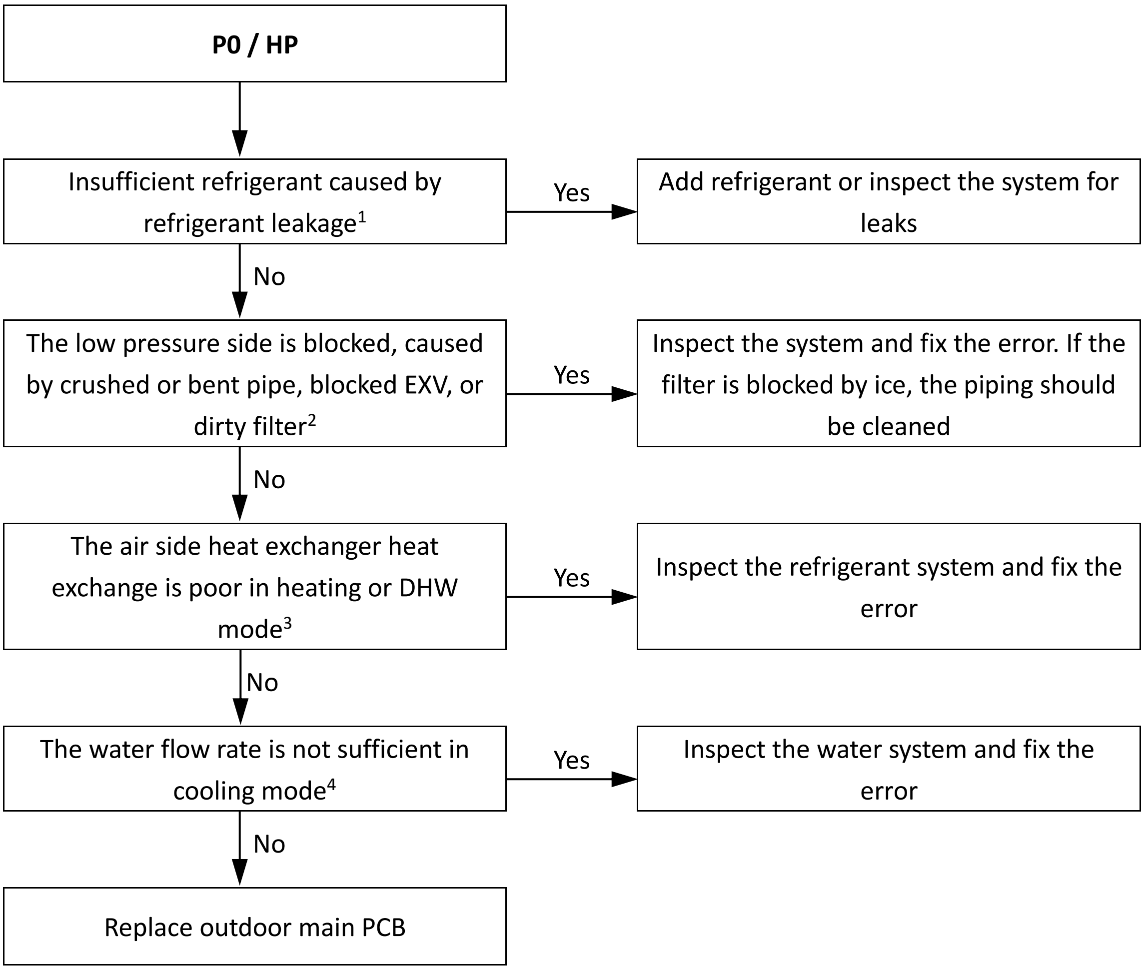
4.15.2 Description

- P0 indicates suction pipe low pressure protection. When the suction pressure falls below 0.14MPa, the system displays P0 protection and OPTIMUS PRO 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.

4.15.3 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.

4.15.4 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.

4.16 P1 Troubleshooting

4.16.1 Digital display output

4.16.2 Description

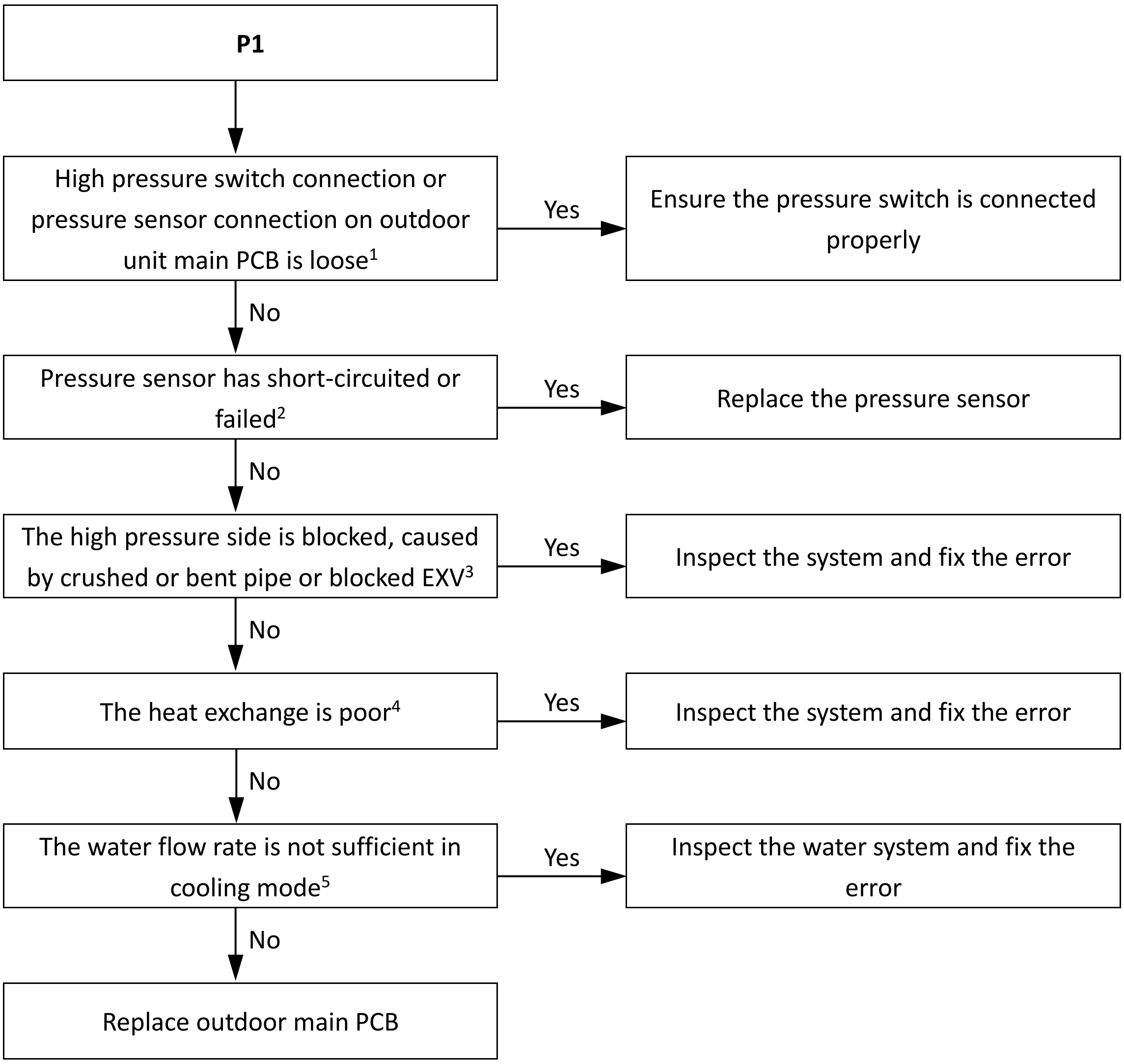
- Discharge pipe high pressure protection. When the discharge pressure rises above 4.3MPa, the system displays P1 protection and OPTIMUS PRO Split stops running. When the discharge pressure falls below 3.6MPa, P1 is removed and normal operation resumes.

- Error code is displayed on outdoor unit main PCB and user interface.

4.16.3 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.

4.16.4 Procedure



Notes:

1. High pressure switch connection is port CN13 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.2 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN13 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.3 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN31 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 20 in Figure 4-2.4 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 2-1.9 in Part 2, 1.2 “Hydronic Box Layout”.

4.17 P3 Troubleshooting

4.17.1 Digital display output

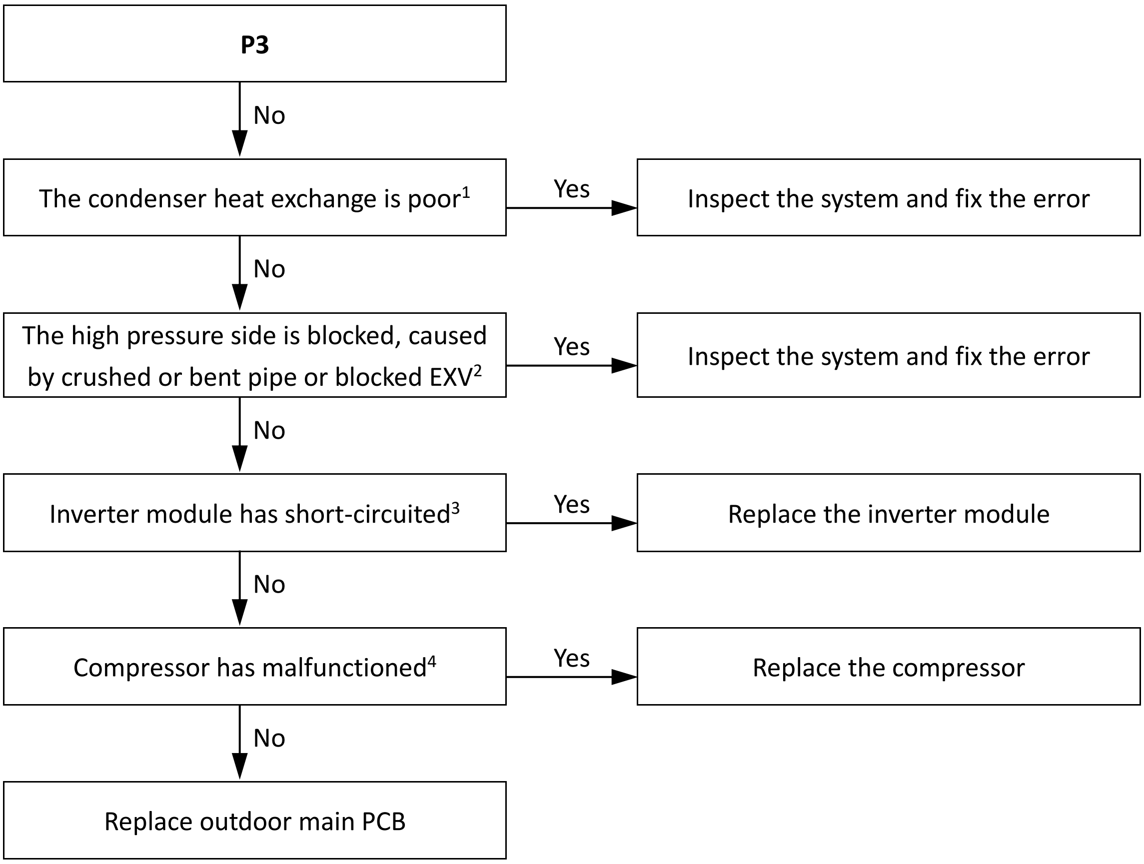
4.17.2 Description

- 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 OPTIMUS PRO 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.

4.17.3 Possible causes

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

4.17.4 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.

4.18 P4 Troubleshooting

4.18.1 Digital display output

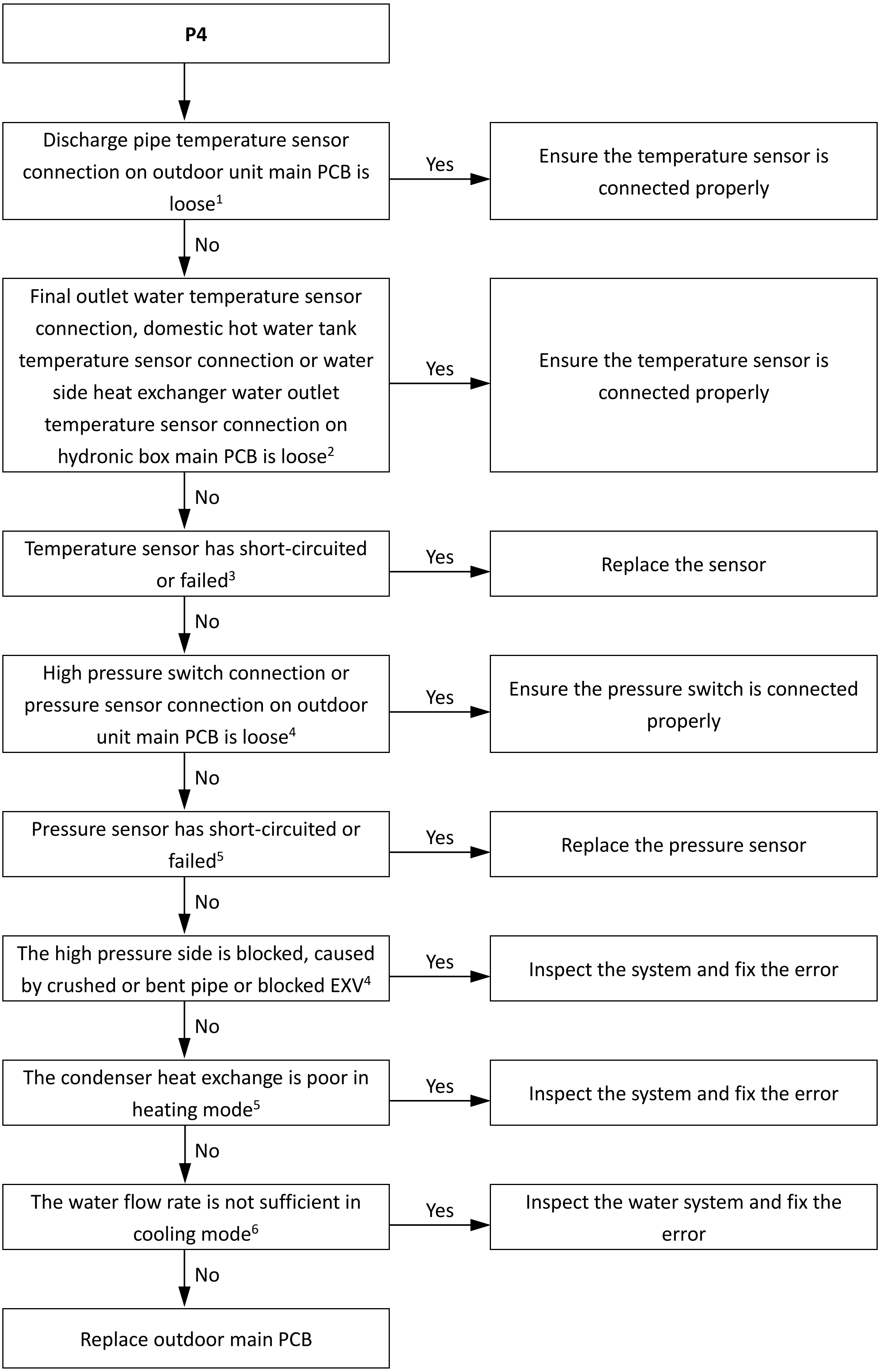
4.18.2 Description

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

4.18.3 Possible causes

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

4.18.4 Procedure



Notes:

1. Discharge pipe temperature sensor connection is port CN8 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.2 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN8 on the HOP12(14,16)WODU outdoor unit refrigerant

system main PCB (labeled 15 in Figure 4-2.3 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN4 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 15 in Figure 4-2.4 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 4-2.1 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 4-2.1 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 5-5.1 or 5-5.2 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".
4. High pressure switch connection is port CN13 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.2 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN13 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 16 in Figure 4-2.3 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN31 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 20 in Figure 4-2.4 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.

4.19 P5 Troubleshooting

4.19.1 Digital display output

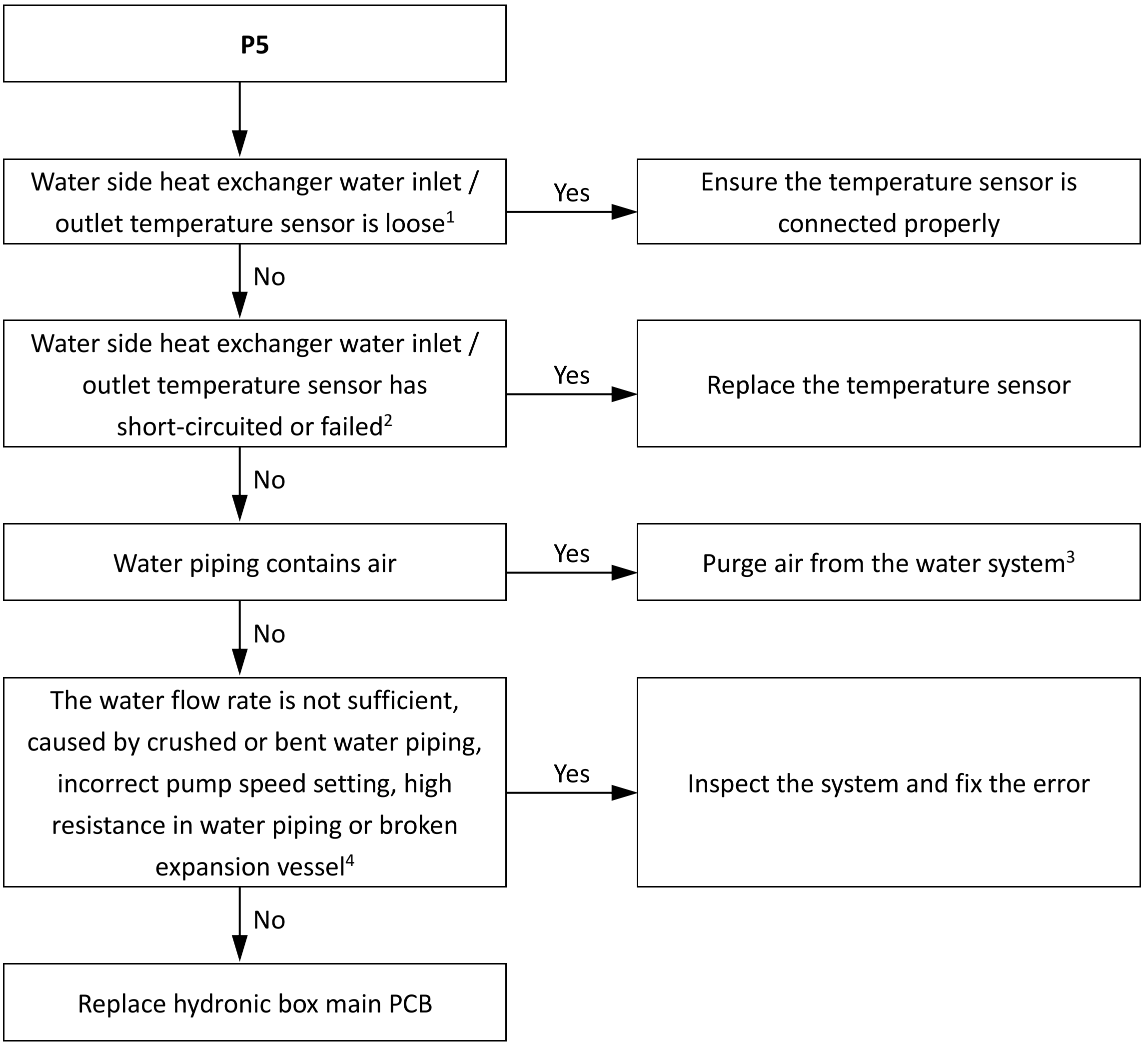
4.19.2 Description

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

4.19.3 Possible causes

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

4.19.4 Procedure

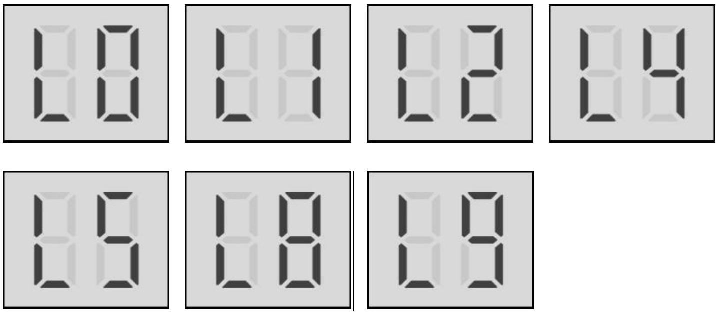


Notes:

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 4-2.1 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 5-5.3 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".
3. Refer to the OPTIMUS PRO Split Engineering Data Book, Part 5, 15 "SPECIAL FUNCTIONS".
4. Check water pressure on the manometer. If the water pressure is not > 1 bar, water flow is insufficient. Refer to Figures 2-1.7 and 2-1.8 in Part 2, 1.2 "Hydronic Box Layout".

4.20 Inverter module Troubleshooting for single-phase models

4.20.1 Digital display output



4.20.2 Description

- Inverter module protection.
- OPTIMUS PRO 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.

4.20.3 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.

4.20.4 Specific error codes for inverter module protection

Table 4-4.1: 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

OPTIMUS PRO Split

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

Table 4-4.2: Errors indicated on LED, single-phase 4~10kW

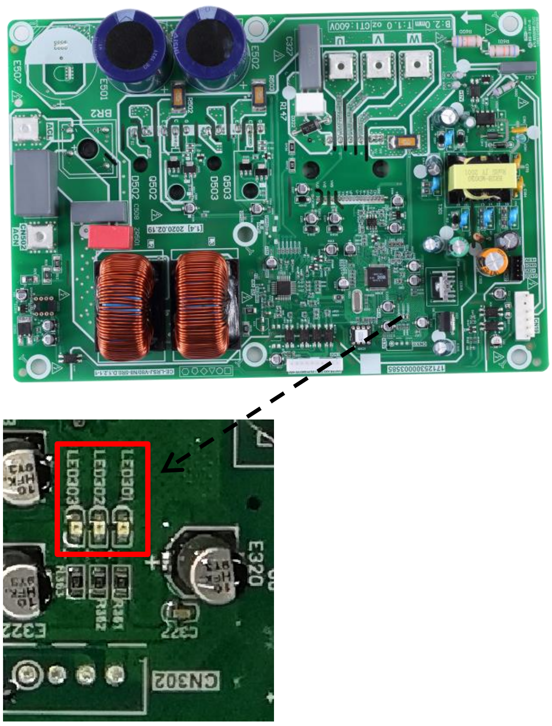
LED301 flashing pattern (GREEN) **LED302 is always on (RED)**	**Corresponding error**
Flashes 8 times and stops for 1 second, then repeats	L0 - Inverter module protection
Flashes 9 times and stops for 1 second, then repeats	L1 - DC bus low voltage protection
Flashes 10 times and stops for 1 second, then repeats	L2 - DC bus high voltage protection
Flashes 12 times and stops for 1 second, then repeats	L4 - MCE error
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

Table 4-4.3: Errors indicated on LED, single-phase 4~10kW

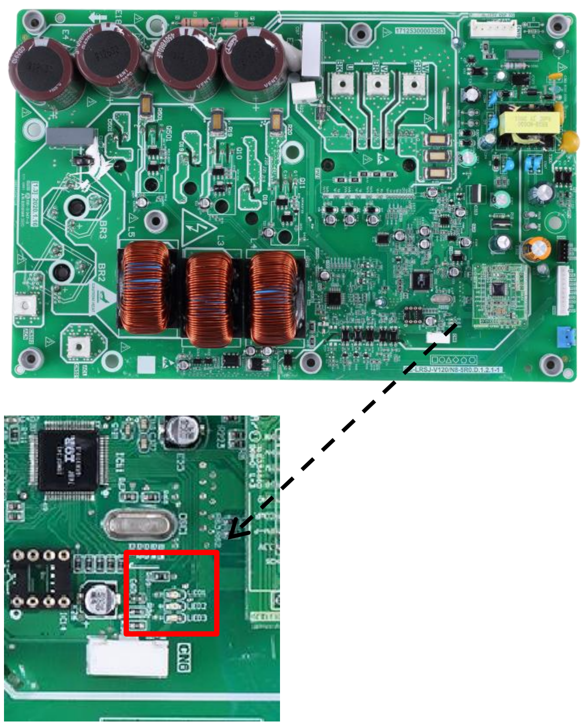
LED1 flashing pattern (GREEN) **LED2 is always on (RED)**	**Corresponding error**
Flashes 3 times and stops for 1 second, then repeats	P1 - High pressure protection
Flashes 5 times and stops for 1 second, then repeats	bH – PED board checking fail
Flashes 8 times and stops for 1 second, then repeats	L0 - 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

Figure 4-4.1: LED location of inverter module

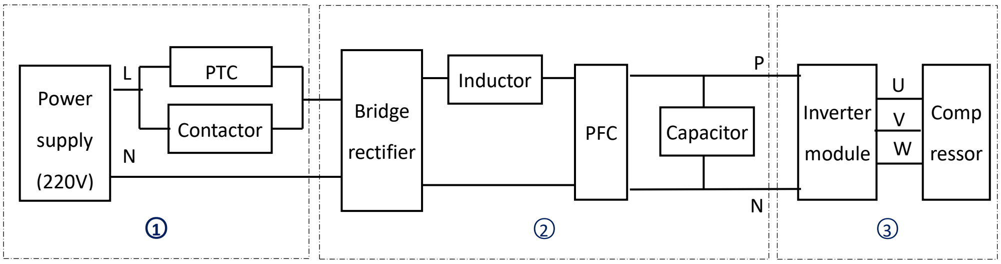
Inverter Module(4-10KW): LED301/302/303



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



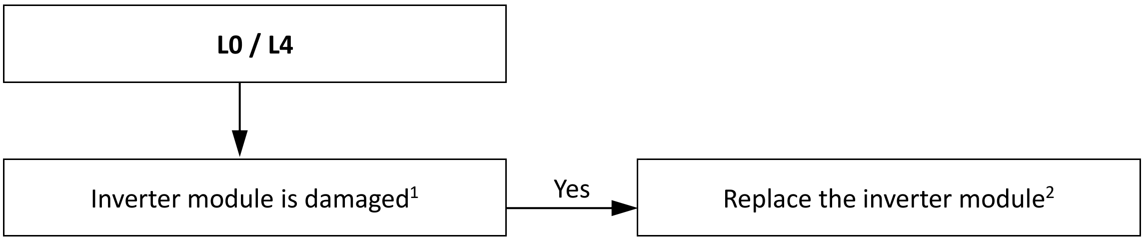
4.20.5 Principle of DC inverter



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.

4.20.6 L0/L4 troubleshooting

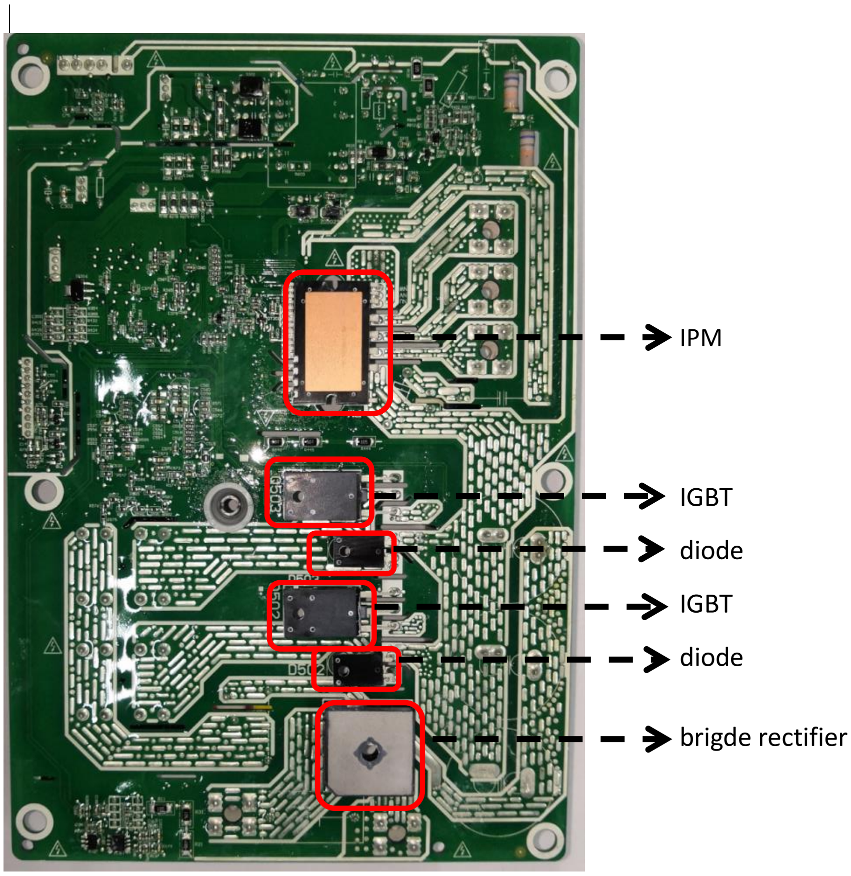
Situation 1: L0 or L4 error appears immediately after the outdoor unit is powered-on



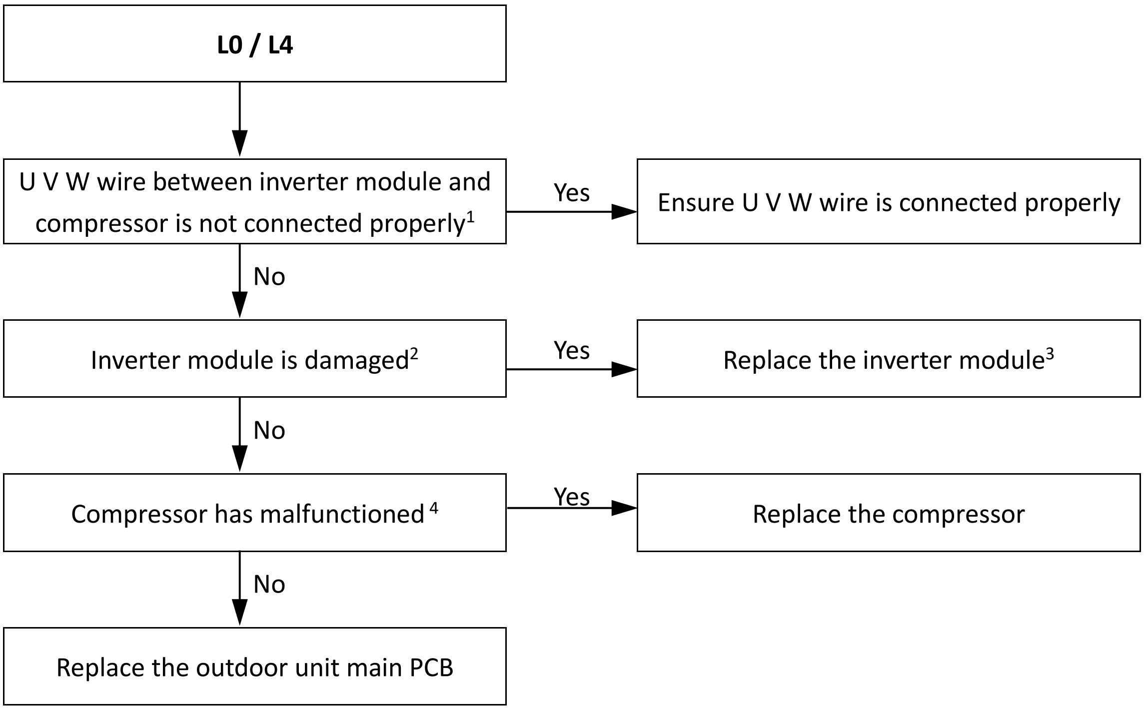
Notes:

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 4-2.5 to 4-2.7 in Part 4, 2.1 “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, brigde rectifier (on the reverse side of the inverter module). Refer to Figure 4-4.2.

Figure 4-4.2: Replacing an inverter module



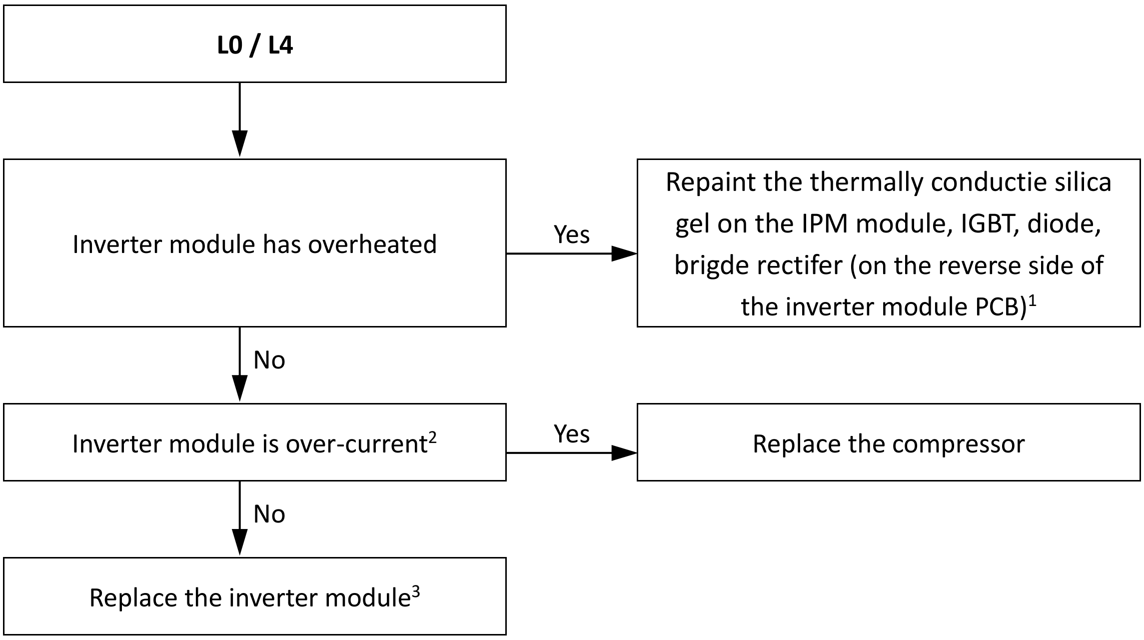
Situation 2: L0 or L4 error appears immediately after the compressor starts up



Notes:

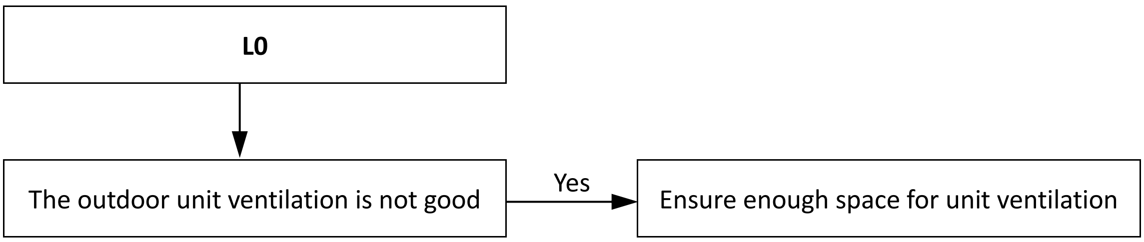
1. Connect the U V W wire from the inverter module to the correct compressor terminals, as indicated by the labels on the compressor.
2. Measure the resistance between each of U, V and W and each of P and N on the inverter module. All the resistances should be infinite. If any of them are not infinite, the inverter module is damaged and should be replaced. Refer to Figure 4-2.5 to 4-2.7 in Part 4, 2.1 “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 brigde rectifer (on the reverse side of the inverter module PCB). Refer to Figure 4-4.2.
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.

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. Refer to Figure 4-4.2.
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 is failed.
3. 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). Refer to Figure 4-4.2.

Situation 4: L0 error appears occasionally/irregularly

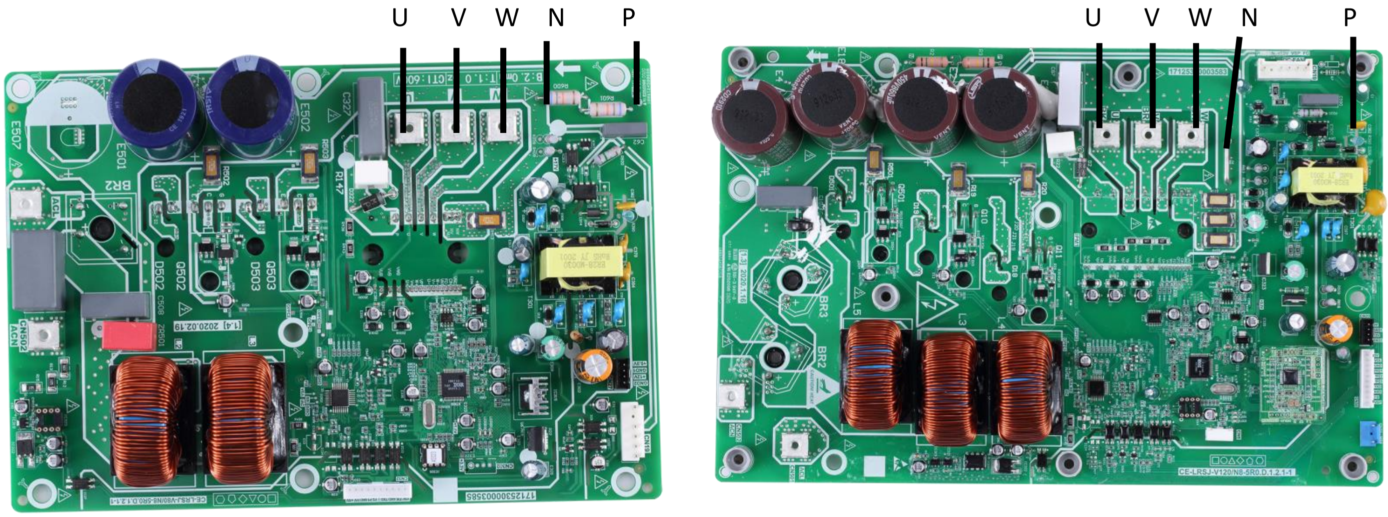


4.20.7 L1/L2 troubleshooting

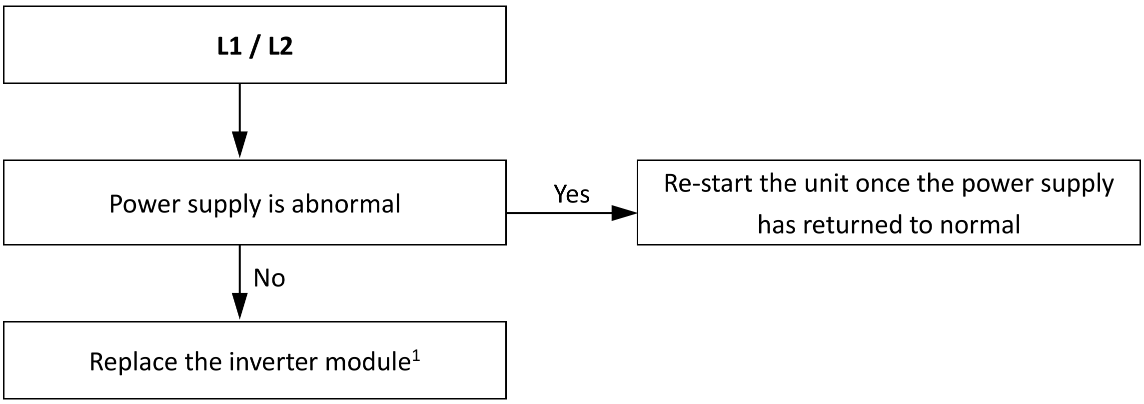
The normal DC voltage between terminals P and N on inverter module is 1.4 time of AC power supply in standby , the DC voltage is 377V when the fan motor is running. If the voltage is lower than 160V, the unit displays L1. If the voltage is higher than 500V, the unit display L2.

Figure 4-4.3: Inverter module terminals

Inverter module terminals (4-10KW) *Inverter module terminals (12-16KW)*



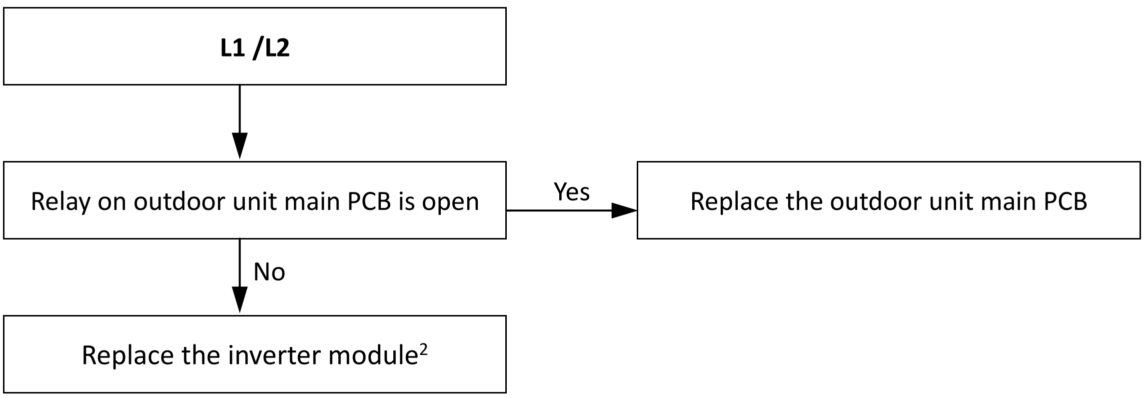
Situation 1: L1 or L2 error appears immediately after the outdoor unit is powered-on



Notes:

1. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on the IPM module, IGBT, diode, brigde rectifer (on the reverse side of the inverter module PCB). Refer to Figure 4-4.2.

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

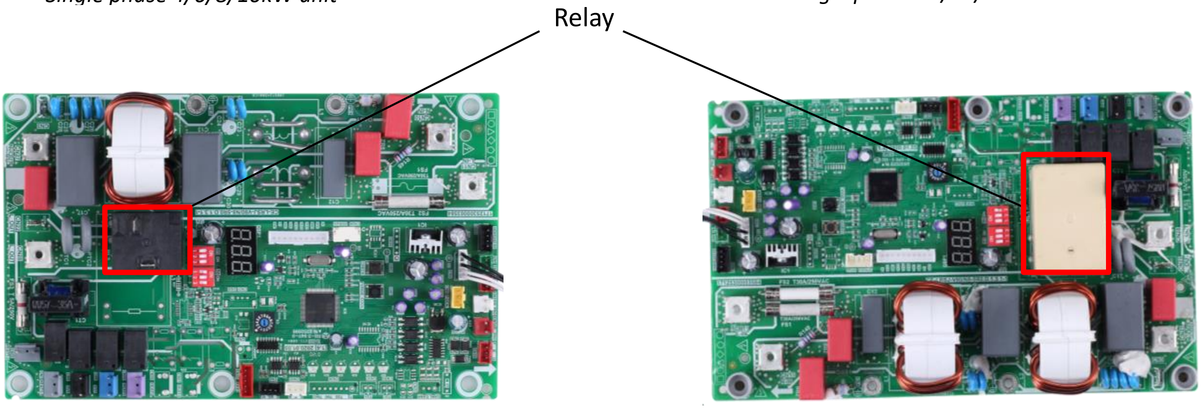


Notes:

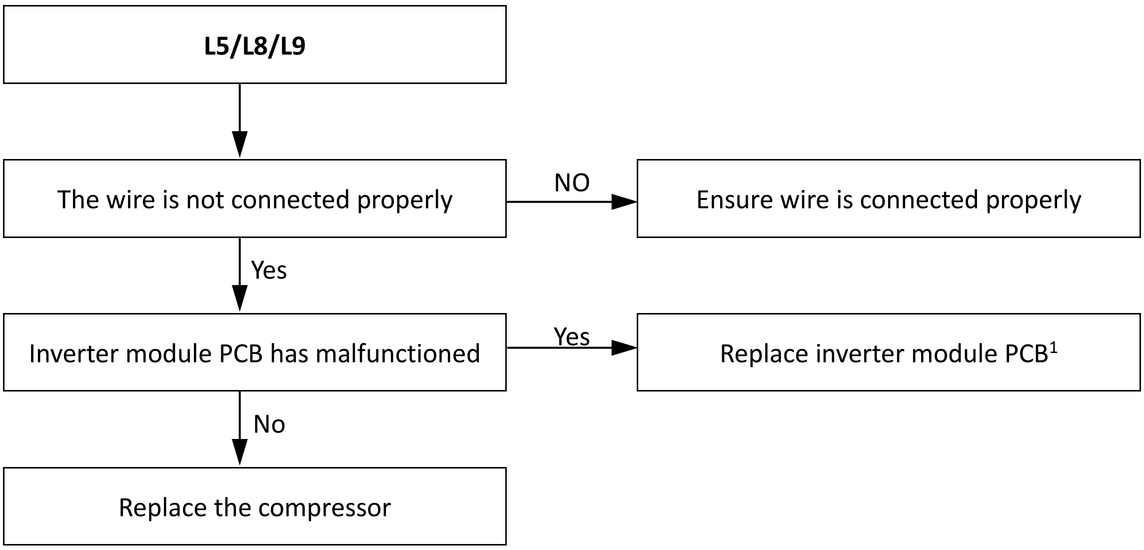
1. If the fan motor is running and the DC voltage between terminals P and N on inverter module declined, Relay on the main control board of outdoor unit is open.
2. When replacing an inverter module, a layer of thermally conductive silica gel should be painted on IPM module (on the reverse side of the inverter module PCB). Refer to Figure 4-4.2.

Figure 4-4.4: Relay location of main PCB for refrigerant system

Single phase 4/6/8/10kW unit *Single phase 12/14/16kW unit*



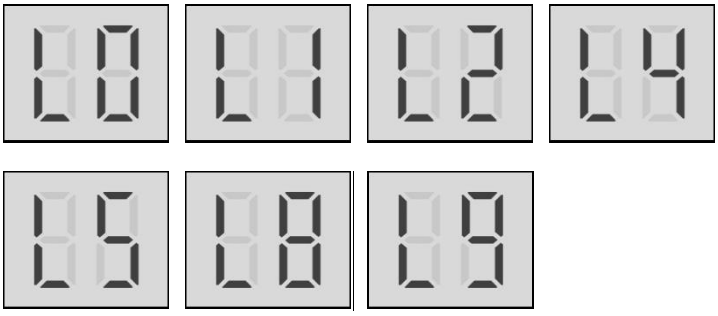
4.20.8 L5/L8/L9 troubleshooting



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). Refer to Figure 4-4.2.

4.21 Inverter module Troubleshooting for three-phase models

4.21.1 Digital display output



4.21.2 Description

- Inverter module protection or high pressure protection.
- OPTIMUS PRO 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.

4.21.3 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.

4.21.4 Specific error codes for inverter module protection

Table 4-4.4: Specific error codes

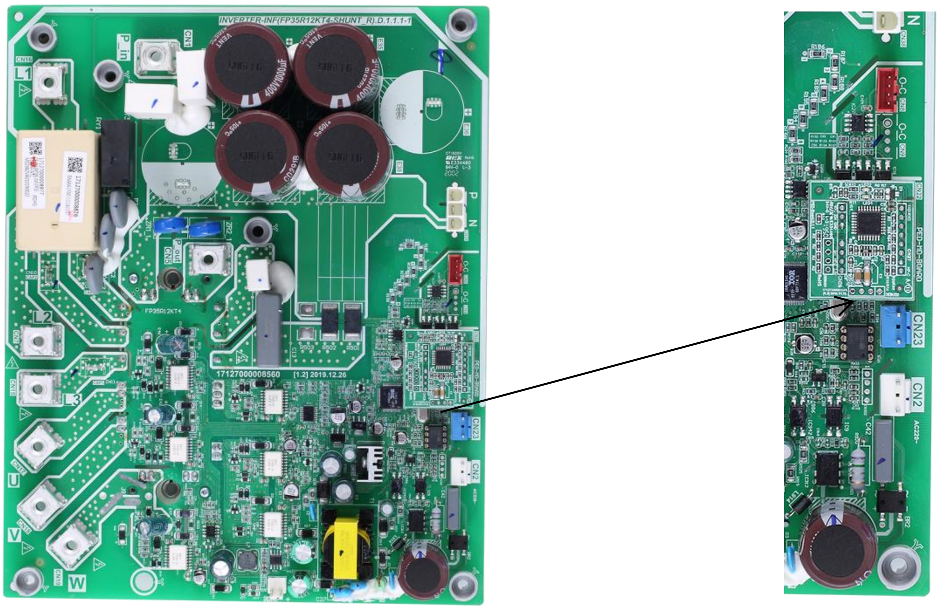
Specific error code	Content
L0	Inverter module protection
L1	DC bus low voltage protection
L2	DC bus high voltage protection
L4	MCE error(DC bus low or high voltage protection or software over current protection)
L5	Zero speed protection
L8	Compressor frequency variation greater than 15Hz within one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

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

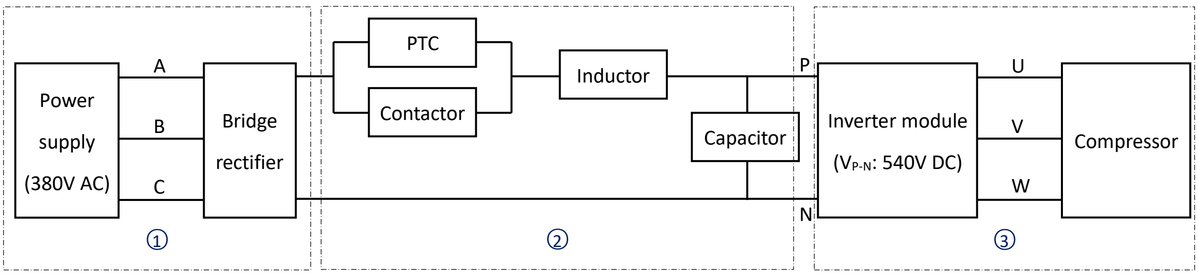
Table 4-4.5: Errors indicated on LED for three-phase 12~16kW unit

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

Figure 4-4.5: LED location of inveter module for three-phase 12~16kW unit



4.21.5 Principle of DC inverter



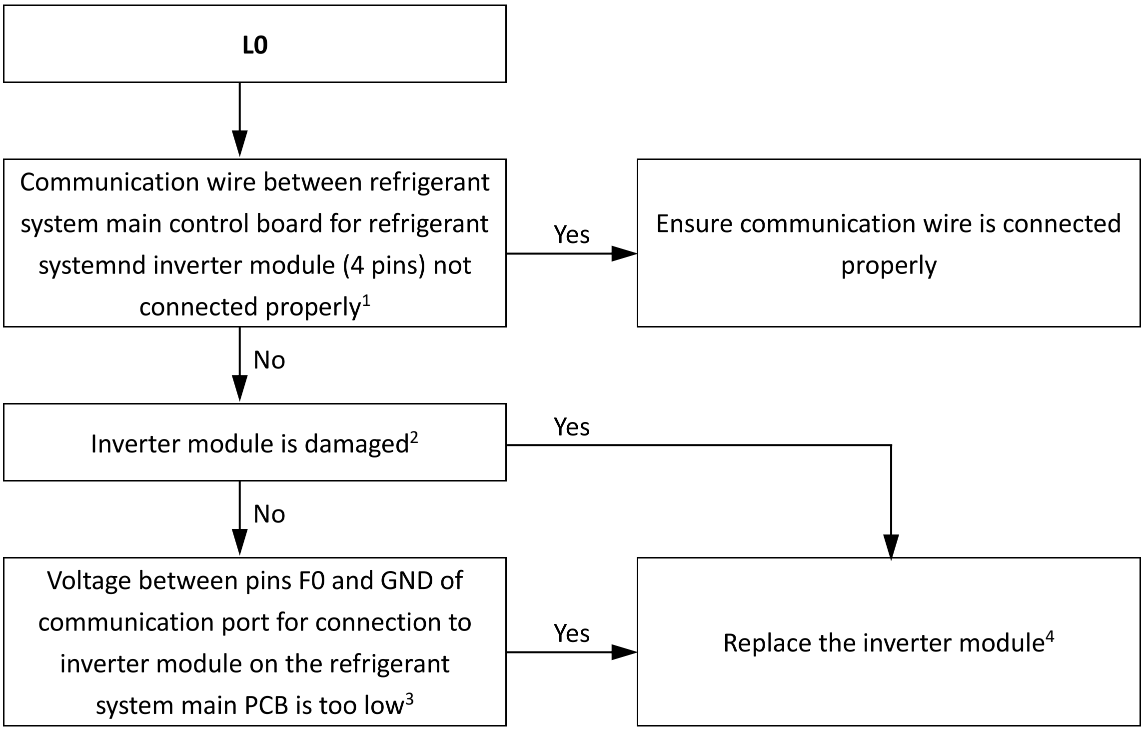
① 380-415V AC power supply change to DC power supply after bridge rectifier.

② Contactor is open the current across the PTC to charge capacitor, after 5 seconds the contactor closed.

③ The capacitor output steady 540V DC power supply for inverter module P N terminals.

4.21.6 L0 troubleshooting

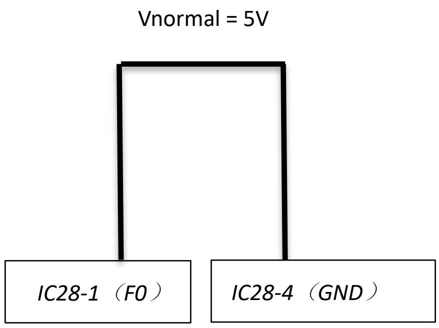
Situation 1: L0 error appears immediately after the outdoor unit is powered-on



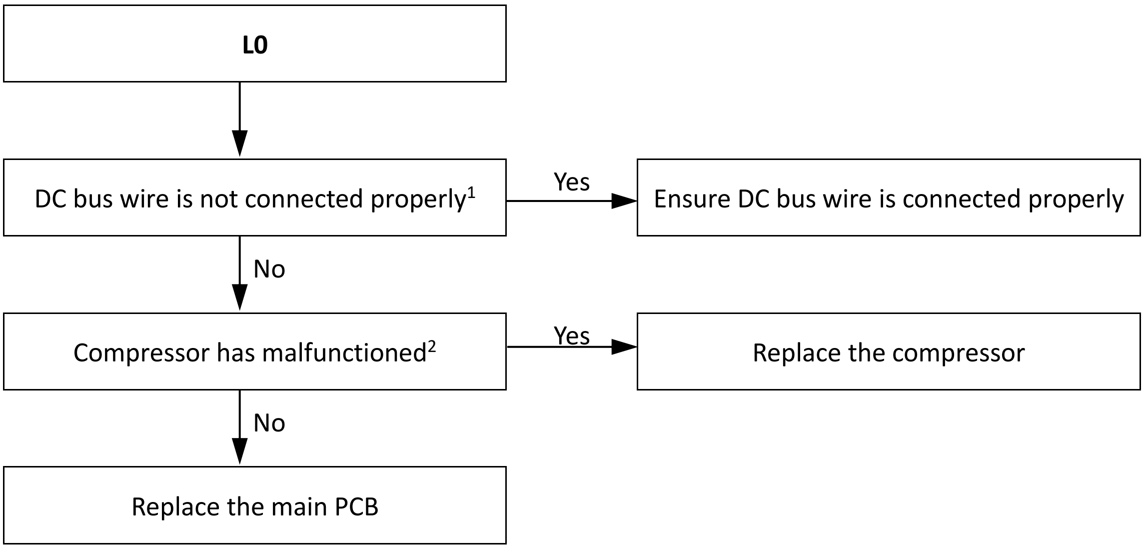
Notes:

1. For HOP12(14,16)WODU3, 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 4-4.6.
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 4-4.2.

Figure 4-4.6: F0 and GND voltage on IC28-1（F0）, IC28-4（GND）



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

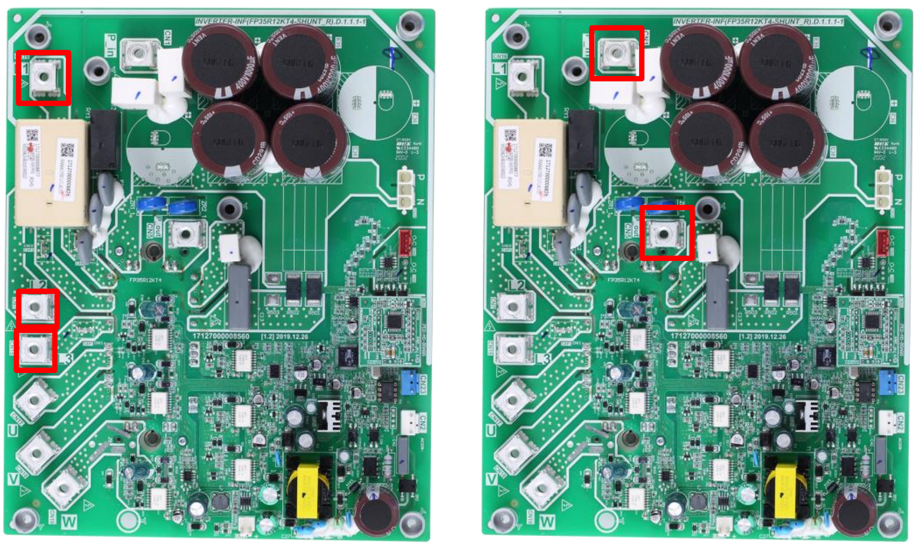


Notes:

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 4-4.7.

Figure 4-4.7: DC bus wire connection （L1L2L3,PIN- POUT）

L1，L2，L3 Pin，Pout



2. 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.

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

L0

↓

U V W wire between inverter module and compressor is not connected properly[1] — Yes → Ensure U V W wire is connected properly

↓ No

Communication port for connection to inverter module on refrigerant system main PCB is damaged[2] — Yes → Replace the main PCB

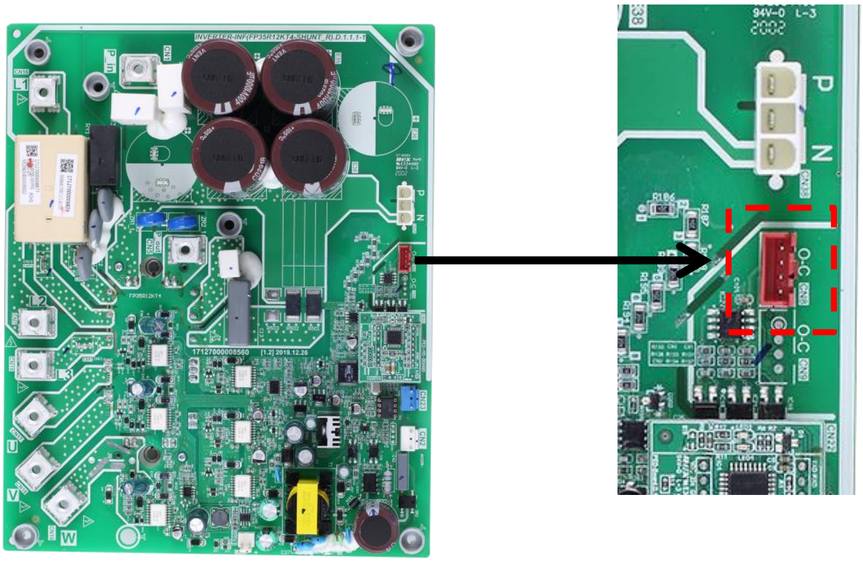
↓ No

Replace the inverter module[3]

Notes:

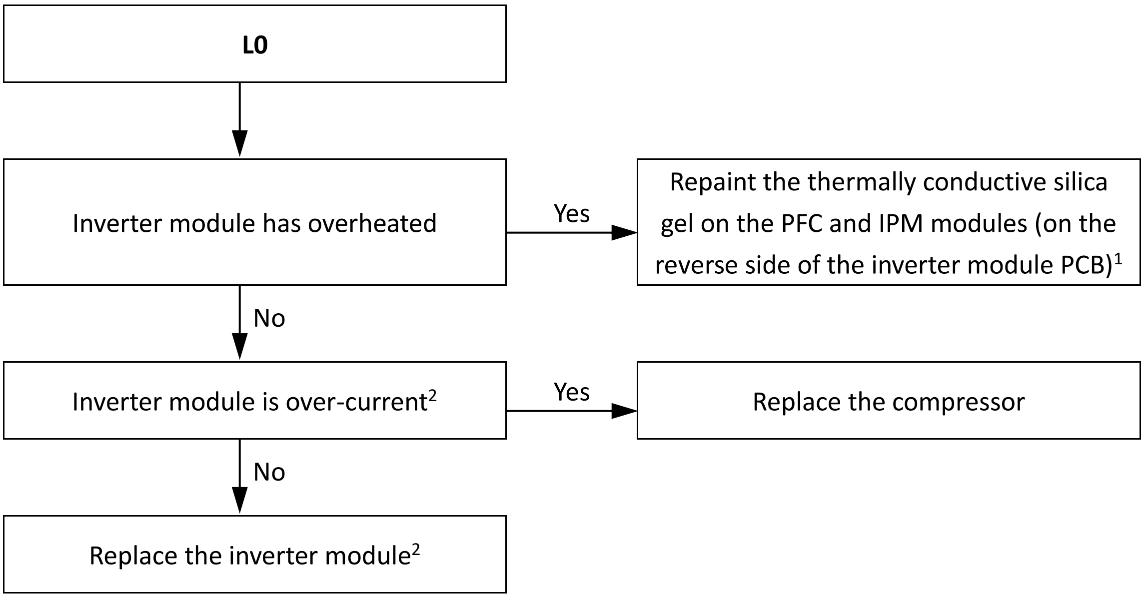
1. Connect the U V W wire from the inverter module to the correct compressor terminals, as indicated by the labels on the compressor.
2. Measure the voltage between each of W-, W+, V-, V+, U-, U+ and GND when the unit is in standby. The normal voltage should be 2.5V-4V and the six voltages should be same, otherwise the communication terminal has failed. Refer to Figure4-4.8.

Figure 4-4.8: Connection port for inverter module



3. 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 4-4.2.

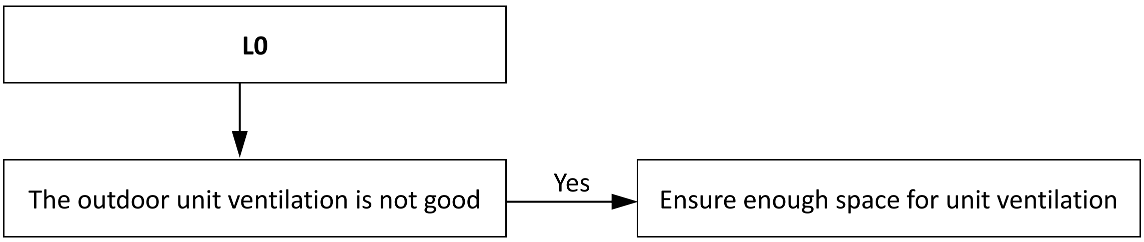
Condition 4: L0 error appears after the compressor has been running for a period of time and the compressor speed is over 60rps



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.

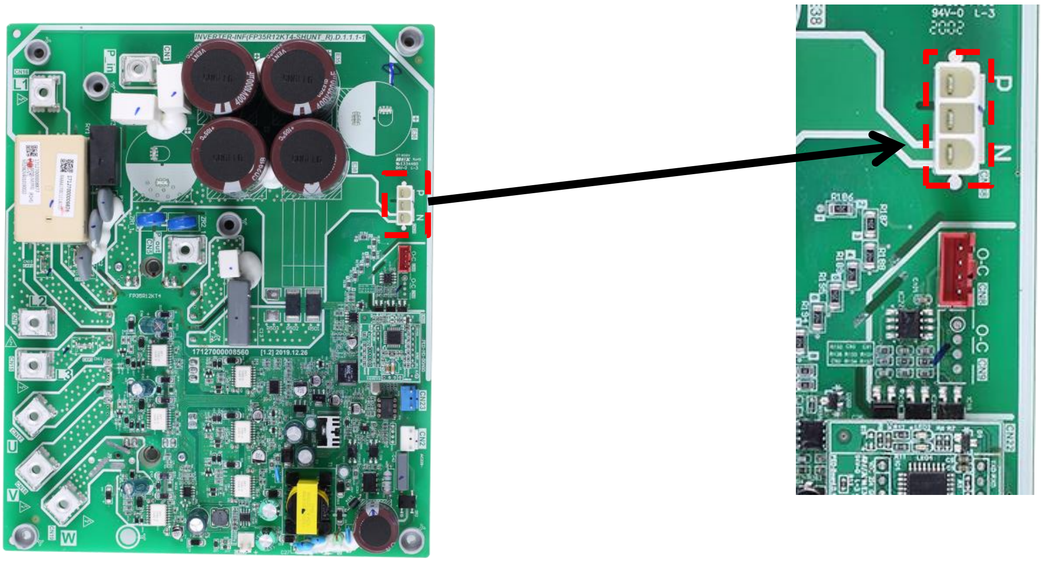
Situation 5: L0 error appears occasionally/irregularly



4.21.7 L1/L2 troubleshooting

The normal DC voltage between terminals P and N on inverter module is 540V. If the voltage is lower than 300V, the unit displays an L1 error; if the voltage is higher than 830V, the unit displays an L2 error. Refer to Figure4-4.9.

Figure 4-4.9: P, N terminals voltage



V_{normal} = 540V DC

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

L1 / L2

↓

P N +15V wire on refrigerant system main PCB is not connected properly[1] — Yes → Ensure P N +15V wire is connected properly

↓ No

Voltage between N and +15 is abnormal[2] — Yes → Check +15V circuit[3]

↓ No

DC voltage between terminal P and N is abnormal — Yes → Check power supply, three phase bridge rectifier[4]

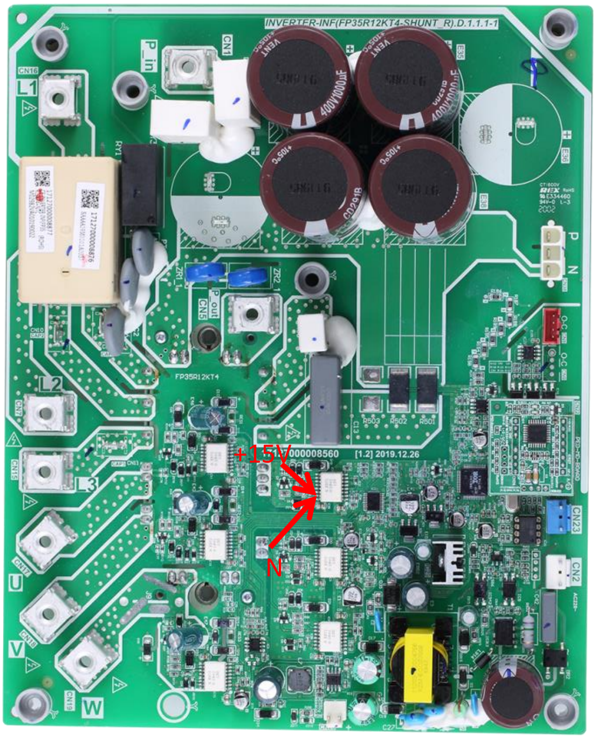
↓ No

Replace the main PCB

Notes:

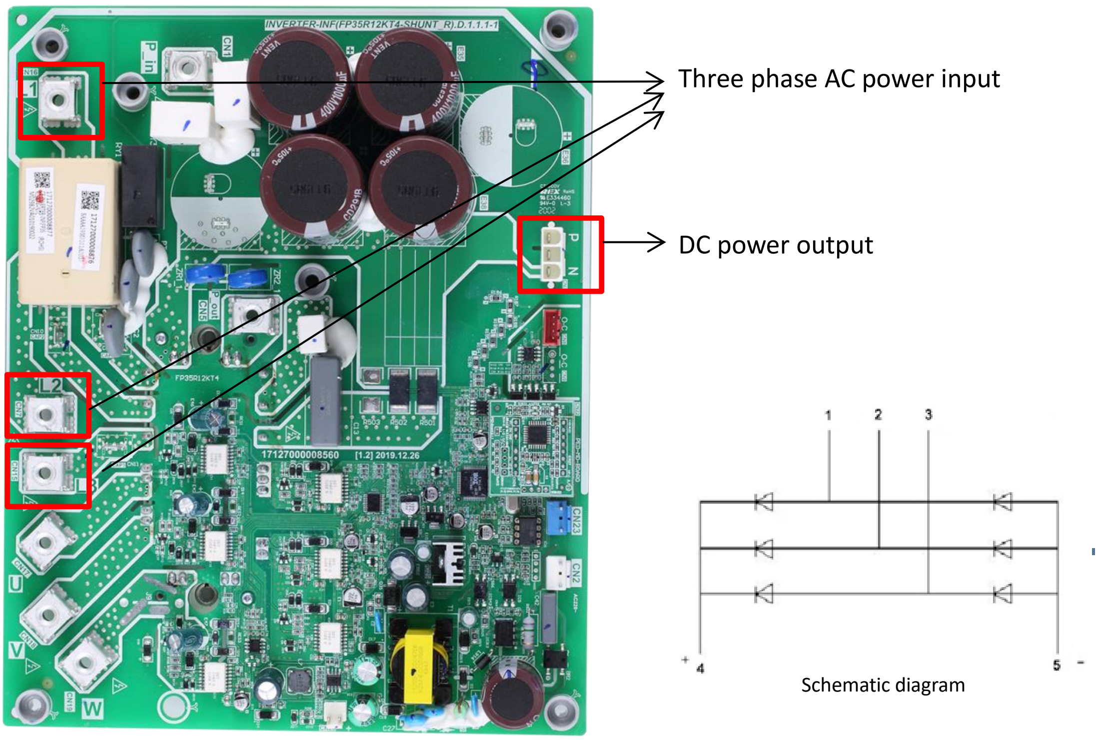
1. P N +15V terminal on refrigerant system main PCB. Refer to Figure4-4.9.
2. Voltage between N and +15. Refer to Figure4-4.10

Figure 4-4.10: P N +15V terminal-+15V（IC4/5/6PIN12）; N-（IC/4/5、6）PIN13



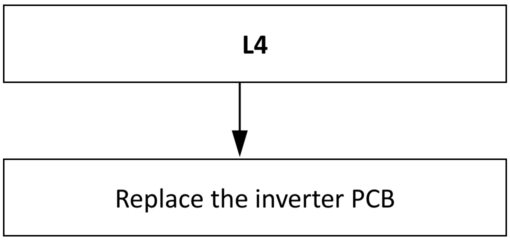
3. Check the +15V circuit according to corresponding wiring diagram. If IC4/5/6PIN12 on inverter module output voltage is not +15V means the inverter module is failed. If voltage output of inverter module is +15V means main PCB is failed.
4. Check the bridge rectifier using one of the following two methods (refer to Figure 4-4.11):
   - Method 1: measure the resistance between any two of the 5 bridge rectifier terminals. If any of the resistances is close to zero, the bridge rectifier has failed.
   - Method 2: dial a multimeter to the diode setting:
     - Put the red probe on the DC power output negative terminal (terminal 5) and put the black probe onto each of the AC power input terminals (terminals 1, 2 and 3) in turn. The voltage between terminal 5 and each of terminals 1, 2 and 3 should be around 0.378V. If the voltage is 0, the bridge rectifier has failed.
     - Put the red probe on the DC power output positive terminal (terminal 4), then put black probe onto each of the AC power input terminals (terminals 1, 2 and 3) in turn. The voltage between terminal 4 and each of terminals 1, 2 and 3 should be infinite. If the voltage is 0, the bridge rectifier has failed.
     -

Figure 4-4.11: Bridge rectifier

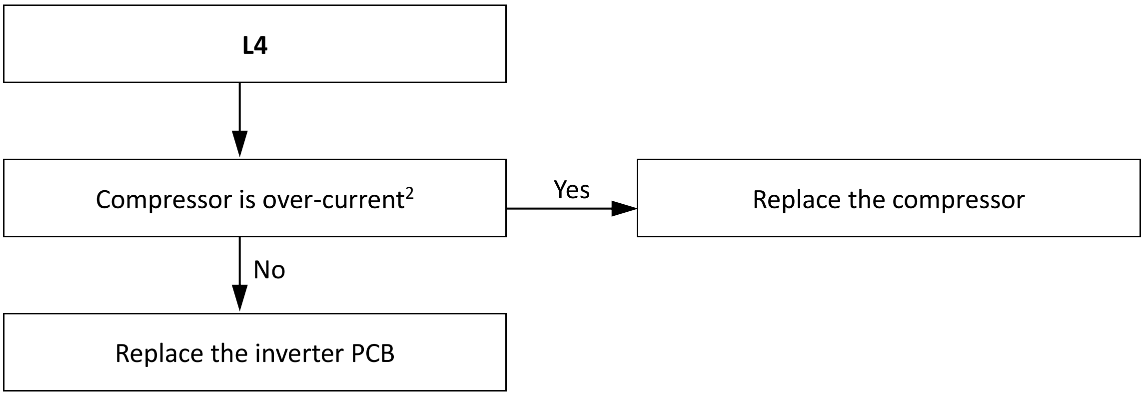


4.21.8 L4 troubleshooting(the same as L1/L2)

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



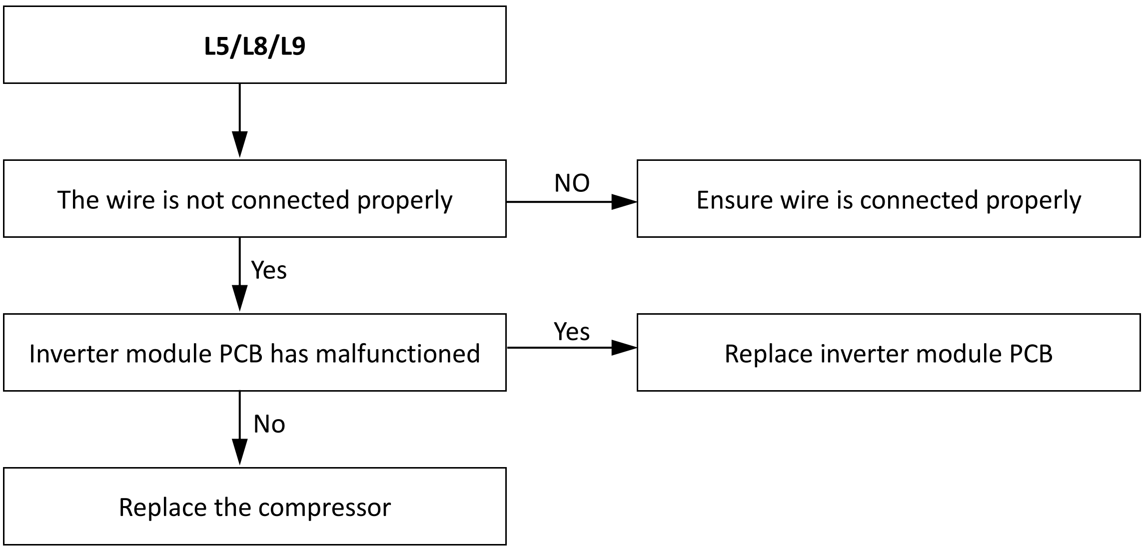
Condition 2: L4 error appears after the compressor has been running for a period of time and the compressor speed is over 60rps



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..

4.21.9 L5/L8/L9 troubleshooting



4.22 Pd Troubleshooting

4.22.1 Digital display output

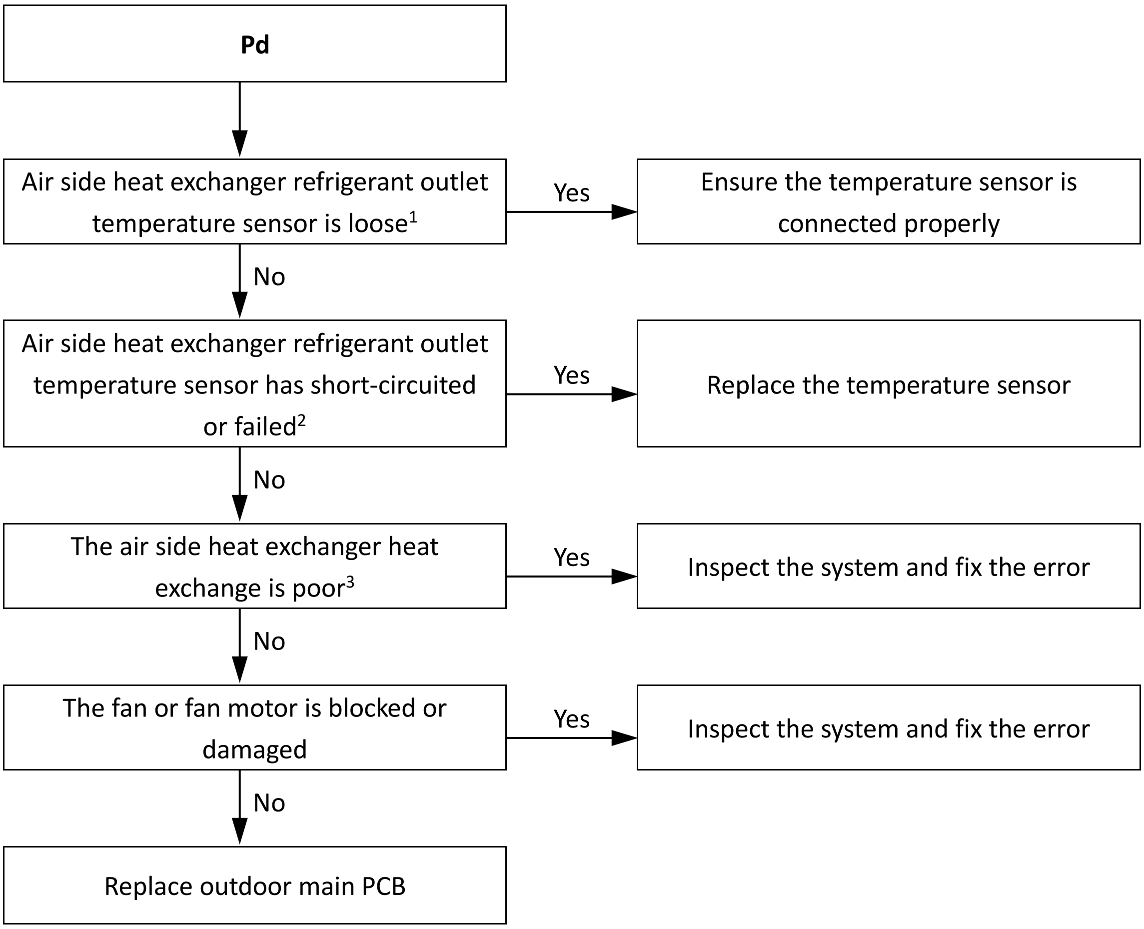
4.22.2 Description

- 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 61°C for more than 3 seconds, the system displays Pd protection and OPTIMUS PRO Split stops running. When the air side heat exchanger refrigerant outlet temperature returns drops below 55°C, Pd is removed and normal operation resumes.
- OPTIMUS PRO Split stops running.
- Error code is displayed on outdoor unit main PCB and user interface.

4.22.3 Possible causes

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

4.22.4 Procedure

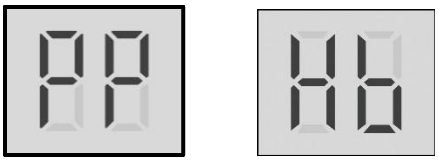


Notes:

1. Air side heat exchanger refrigerant outlet temperature sensor and outdoor ambient temperature sensor connection port are CN9 on the HOP4(6,8,10)WODU outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.2 in Part4, 2.3 "Main PCB for Refrigerant System, Inverter Module"). port CN9 on the HOP12(14,16)WODU outdoor unit refrigerant system main PCB (labeled 12 in Figure 4-2.3 in Part 4, 2. 3 "Main PCB for Refrigerant System, Inverter Module"), port CN9 on the HOP12(14,16)WODU3 outdoor unit refrigerant system main PCB (labeled 17 in Figure 4-2.4 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 4-5.1 in Part 4, 5.1 "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

4.23 PP Troubleshooting

4.23.1 Digital display output



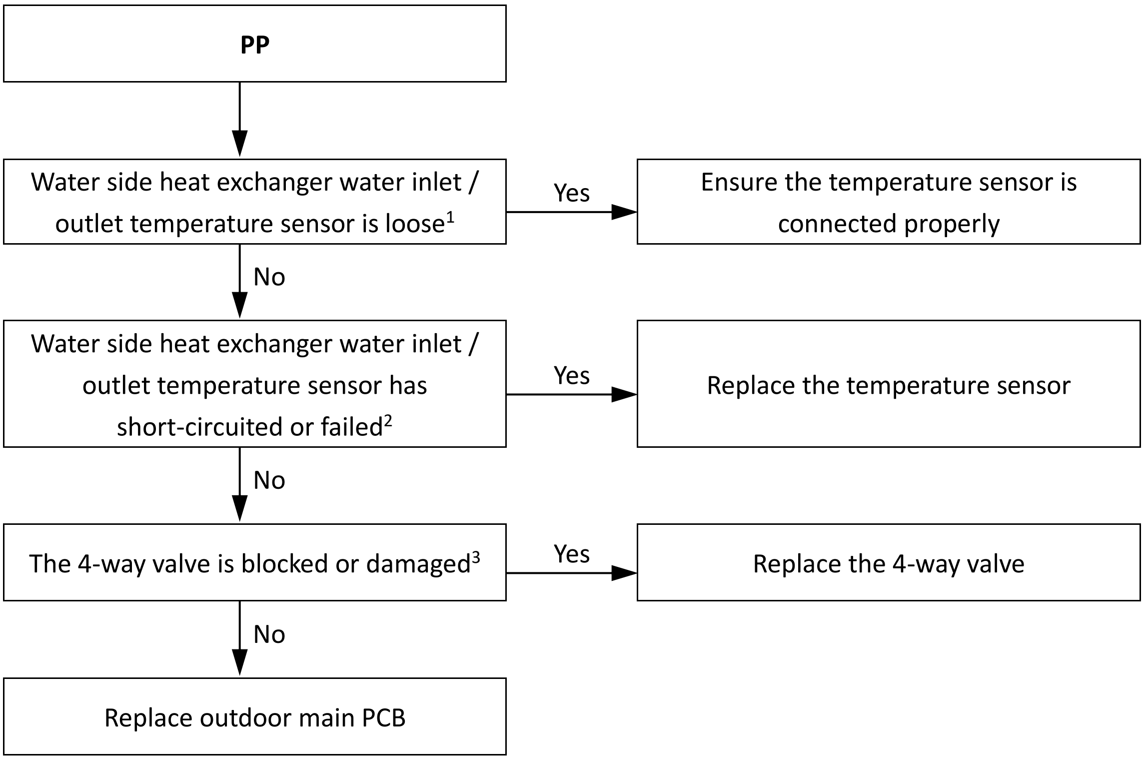
4.23.2 Description

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

4.23.3 Possible causes

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

4.23.4 Procedure

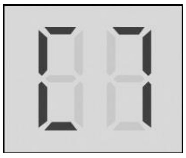


Notes:

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 4-2.1 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 4-5.3 in Part 4, 5.1 "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.

4.24 C7 Troubleshooting

4.24.1 Digital display output



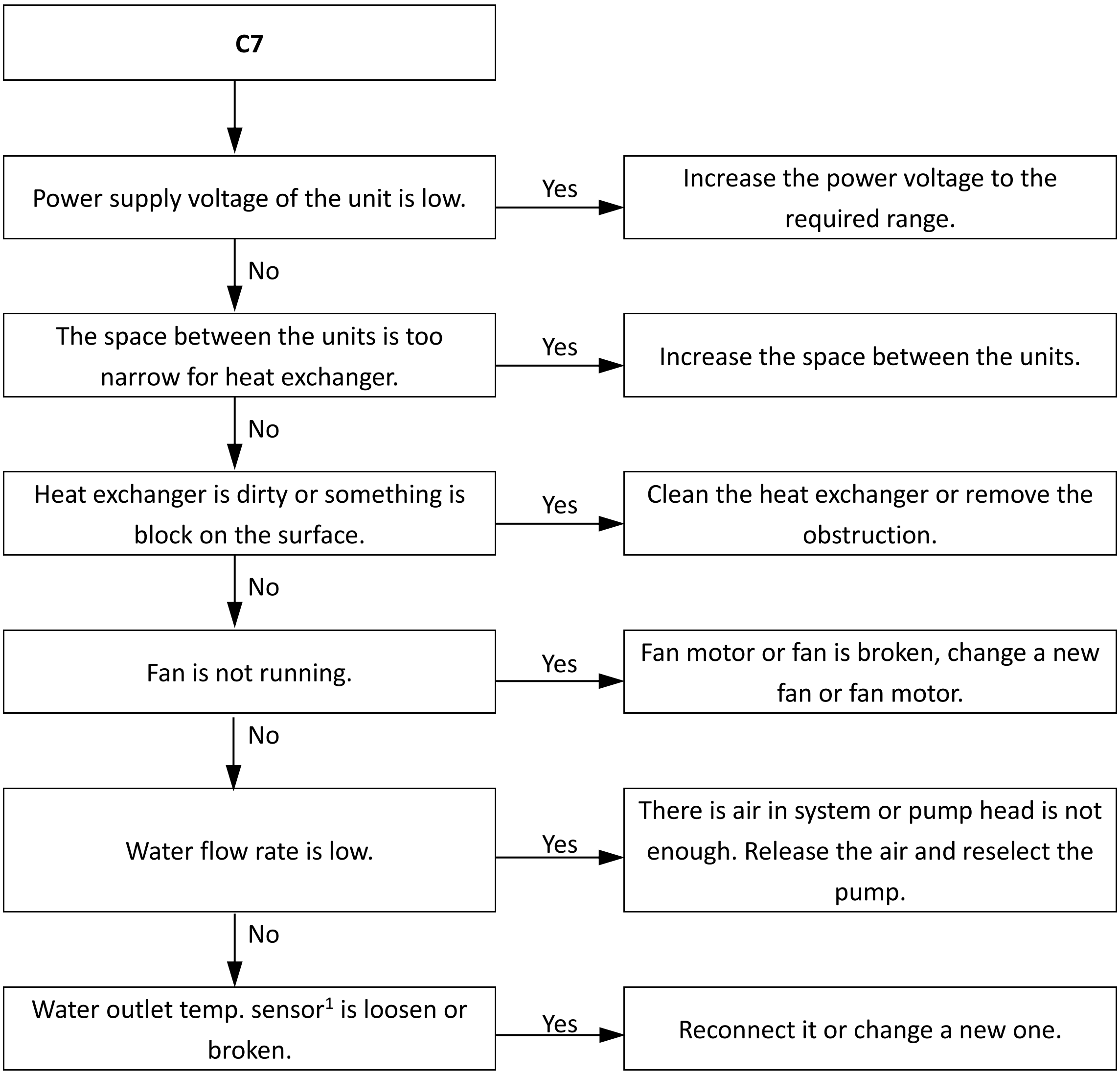
4.24.2 Description

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

4.24.3 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.

4.24.4 Procedure

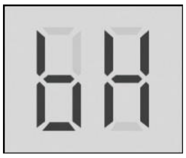


Notes:

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 4-2.1 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 4-5.3 in Part 4, 5.1 "Temperature Sensor Resistance Characteristics".

4.25 bH Troubleshooting

4.25.1 Digital display output



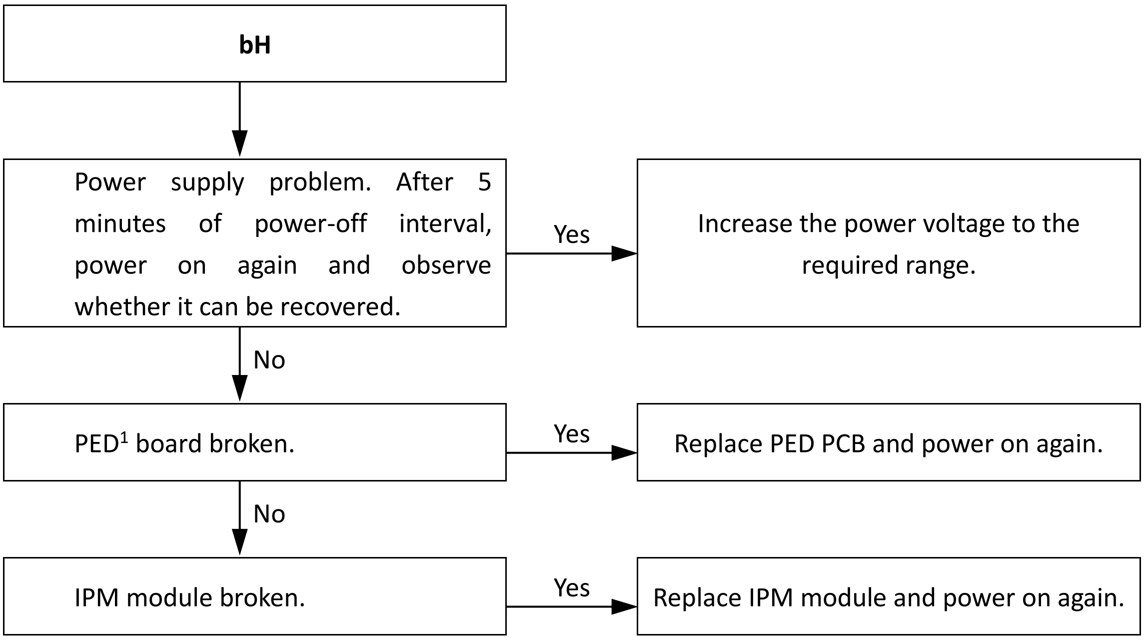
4.25.2 Description

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

4.25.3 Possible causes

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

4.25.4 Procedure



Notes:

1. PED is port CN22 on the hydronic box main PCB (labeled 11 in Figure 4-2.7: HOP12(14,16)WODU3 outdoor unit inverter module).

4.26 Pb Troubleshooting

4.26.1 Digital display output

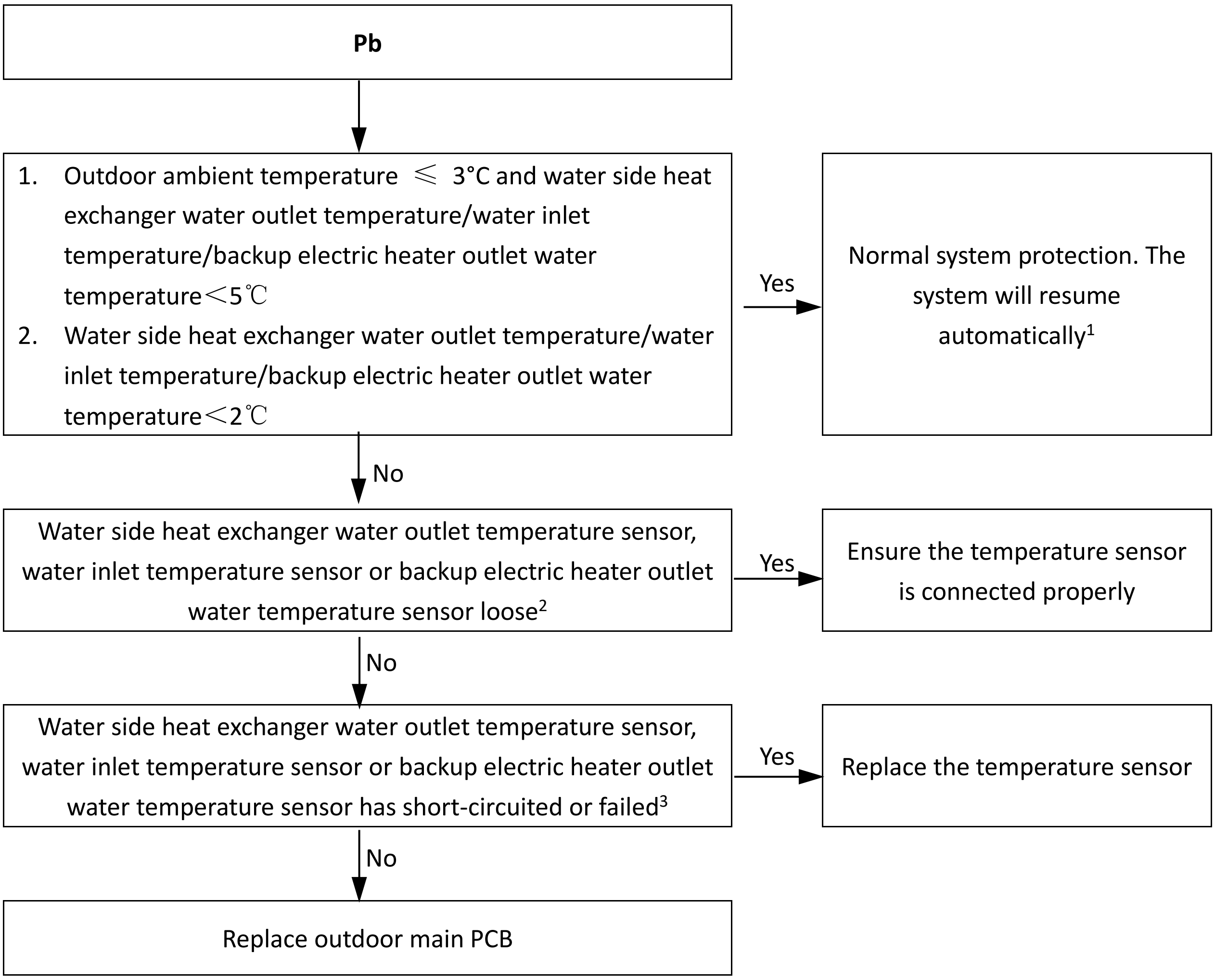
4.26.2 Description

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

4.26.3 Possible causes

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

4.26.4 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 4-2.1 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 4-5.3 in Part 4, 5.1 “Temperature Sensor Resistance Characteristics”.

5 Appendix to Part 4

5.1 Temperature Sensor Resistance Characteristics

Table 4-5.1: 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		

Table 4-5.2: 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		

Table 4-5.3: 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		

Ver. 2022-02V1