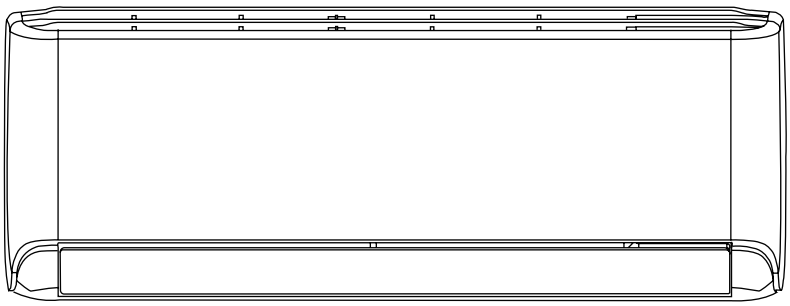
SERVICE MANUAL

EX R32 3D INVERTER CONTROL



INDOOR UNIT
EX-12RE1N-I

OUTDOOR UNIT
EXH-12RE1N-O

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Introduction

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1. Safety Precautions

To prevent personal injury, or property or unit damage, adhere to all precautionary measures and instructions outlined in this manual. Before servicing a unit, refer to this service manual and its relevant sections.

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

WARNING indicates a potentially hazardous situation which if not avoided could result in serious personal injury, or death.

CAUTION indicates a potentially hazardous situation which if not avoided could result in minor or moderate personal injury, or unit damage.

1. In case of Accidents or Emergency

WARNING

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

CAUTION

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

2. Pre-Installation and Installation

WARNING

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

CAUTION

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

3. Operation and Maintenance

WARNING

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

CAUTION

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

2. Information servicing(For flammable materials)

1. Checks to the area

- Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.

2. Work procedure

- Works shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed. Technical personnel in charge of operation, supervision, maintenance of air-conditioning systems shall be adequately instructed and competent with respect to their tasks. Works shall be undertaken with appropriate tools only (In case of uncertainty, please consult the manufacturer of the tools for use with flammable refrigerants)

3. General work area

- All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. work in confined spaces shall be avoided. The area around the work space shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.

4. Checking for presence of refrigerant

- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with flammable refrigerants, i.e. no sparking, adequately sealed or intrinsically safe.

5. Presence of fire extinguisher

- If any hot work is to be conducted on the refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.

6. No ignition sources

- No person carrying out work in relation to a refrigeration system which involves exposing any pipe work that contains or has contained flammable refrigerant shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which flammable refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. NO SMOKING signs shall be displayed.

7. Ventilated area

- Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

8. Checks to the refrigeration equipment

- Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed. If in doubt consult the manufacturer's technical department for assistance. The following checks shall be applied to installations using flammable refrigerants:
  - the charge size is in accordance with the room size within which the refrigerant containing parts are installed;
  - the ventilation machinery and outlets are operating adequately and are not obstructed;
  - if an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant; marking to the equipment continues to be visible and legible.
  - markings and signs that are illegible shall be corrected;
  - refrigeration pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

9. Checks to electrical devices

- Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, and adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- that capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking
- that there no live electrical components and wiring are exposed while charging, recovering or purging the system;
- that there is continuity of earth bonding.

10. Repairs to sealed components

- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment

being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.

- Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
  - Ensure that apparatus is mounted securely.
  - Ensure that seals or sealing materials have not degraded such that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

NOTE: The use of silicon sealant may inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.

11. Repair to intrinsically safe components

- Do not apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use. Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
- Replace components only with parts specified by the manufacturer. Other parts may result in the ignition of refrigerant in the atmosphere from a leak.

12. Cabling

- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

13. Detection of flammable refrigerants

- Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

14. Leak detection methods

- The following leak detection methods are deemed acceptable for systems containing flammable refrigerants. Electronic leak detectors shall be used to detect flammable refrigerants, but the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed and the appropriate percentage of gas (25 % maximum) is confirmed. Leak detection fluids are suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.
  - If a leak is suspected, all naked flames shall be removed or extinguished.
  - If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak. Oxygen free nitrogen (OFN) shall then be purged through the system both before and during the brazing process.

15. Removal and evacuation

- When breaking into the refrigerant circuit to make repairs or for any other purpose, conventional procedures shall be used. However, it is important that best practice is followed since flammability is a consideration.
- The following procedure shall be adhered to:
  - remove refrigerant;
  - purge the circuit with inert gas;
  - evacuate;
  - purge again with inert gas;
  - open the circuit by cutting or brazing.
- The refrigerant charge shall be recovered into the correct recovery cylinders. The system shall be flushed with OFN to render the unit safe. This process may need to be repeated several times. Compressed air or oxygen shall not be used for this task. Flushing shall be achieved by breaking the vacuum in the system with OFN and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final OFN charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe-work are to take place.
- Ensure that the outlet for the vacuum pump is not close to any ignition sources and there is ventilation available.

16. Charging procedures

- In addition to conventional charging procedures, the following requirements shall be followed:
  - Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
  - Cylinders shall be kept upright.
  - Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
  - Label the system when charging is complete (if not already).
  - Extreme care shall be taken not to overfill the refrigeration system.
  - Prior to recharging the system it shall be pressure tested with OFN. The system shall be leak tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

17. Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken.

In case analysis is required prior to re-use of reclaimed refrigerant. It is essential that electrical power is available before the task is commenced.

- Become familiar with the equipment and its operation.
- Isolate system electrically.
- Before attempting the procedure ensure that:
  - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - all personal protective equipment is available and being used correctly;
  - the recovery process is supervised at all times by a competent person;
  - recovery equipment and cylinders conform to the appropriate standards.
- Pump down refrigerant system, if possible.
- If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
- Make sure that cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with manufacturer's instructions.
- Do not overfill cylinders. (No more than 80 % volume liquid charge).
- Do not exceed the maximum working pressure of the cylinder, even temporarily.
- When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

18. Labelling

- Equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

19. Recovery

- When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.
- When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct numbers of cylinders for holding the total system charge are available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
- The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of flammable refrigerants. In addition, a set of calibrated weighing scales shall be available and in good working order.
- Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.
- The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant Waste Transfer Note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.
- If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable

refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.

20. Venting of HC Refrigerant (R290)

Venting may be carried out as an alternative to recovering the refrigerant. Because HC refrigerants have no ODP and negligible GWP, under certain circumstances it may be considered acceptable to vent the refrigerant. However, if this is to be considered, it should be done in accordance with the relevant national rules or regulations, if they permit.

In particular, before venting a system, it would be necessary to:

- Ensure that legislation relating to waste material has been considered
- Ensure that environmental legislation has been considered
- Ensure that legislation addressing safety of hazardous substances is satisfied
- Venting is only carried out with systems that contain a small quantity of refrigerant, typically less than 500 g.
- Venting to inside a building is not permissible under any circumstances
- Venting must not be to a public area, or where people are unaware of the procedure taking place
- The hose must be of sufficient length and diameter such that it will extend to at least 3 m beyond the outside of the building
- The venting should only take place on the certainty that the refrigerant will not get blown back into any adjacent buildings, and that it will not migrate to a location below ground level
- The hose is made of material that is compatible for use with HC refrigerants and oil
- A device is used to raise the hose discharge at least 1 m above ground level and so that the discharge is pointed in an upwards direction (to assist with dilution)
- The end of the hose can now discharge and disperse the flammable fumes into the ambient air.
- There should not be any restriction or sharp bends within the vent-line which will hinder the ease of flow.
- There must be no sources of ignition near the hose discharge
- The hose should be regularly checked to ensure that there are no holes or kinks in it, that could lead to leakage or blocking of the passage of flow

When carrying out the venting, the flow of refrigerant should be metered using manifold gauges to a low flow rate, so as to ensure the refrigerant is well diluted. Once the refrigerant has ceased flowing, if possible, the system should be flushed out with OFN; if not, then the system should be pressurised with OFN and the venting procedure carried out two or more times, to ensure that there is minimal HC refrigerant remaining inside the system.

21. Transportation, marking and storage for units

1. Transport of equipment containing flammable refrigerants

Compliance with the transport regulations

2. Marking of equipment using signs

Compliance with local regulations

3. Disposal of equipment using flammable refrigerants

Compliance with national regulations

4. Storage of equipment/appliances

The storage of the appliance should be in accordance with the applicable regulations or instructions, whichever is more stringent.

5. Storage of packed (unsold) equipment

Storage package protection should be constructed such that mechanical damage to the equipment inside the package will not cause a leak of the refrigerant charge.

The maximum number of pieces of equipment permitted to be stored together will be determined by local regulations.

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1. Electrical Characteristics

Model	Outdoor Unit			Power Supply			IFM		Compressor		OFM		
	Phase	Hz	Voltage	MCA	MOP	MFA	W	FLA	MSC	RLA	Qty	W	FLA
EX-12RE1N-I	1	50	220-240 Min:198 Max:264	10.22	17.77	15	20	0.11	/	7.55	1	79	0.67

Notes:

MCA: Minimum Circuit Amperes (A)

MOP: Maximum rating over current protective device

MFA: Maximum Fuse Amperes (A)

MSC: Maximum Starting Current

RLA: Rated Load Amperes (A)

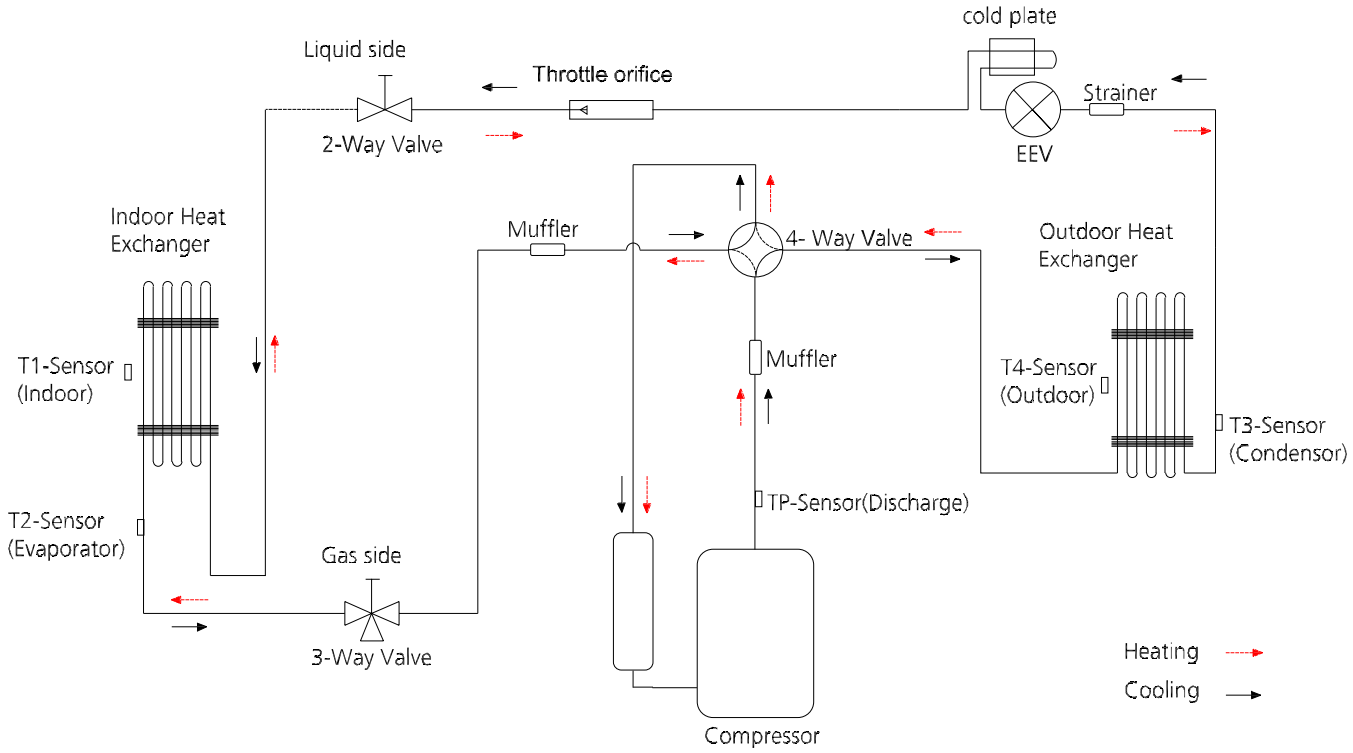
IFM: Indoor Fan Motor

OFM: Outdoor Fan Motor

FLA: Full Load Amperes (A)

2. Refrigerant Cycle Diagrams

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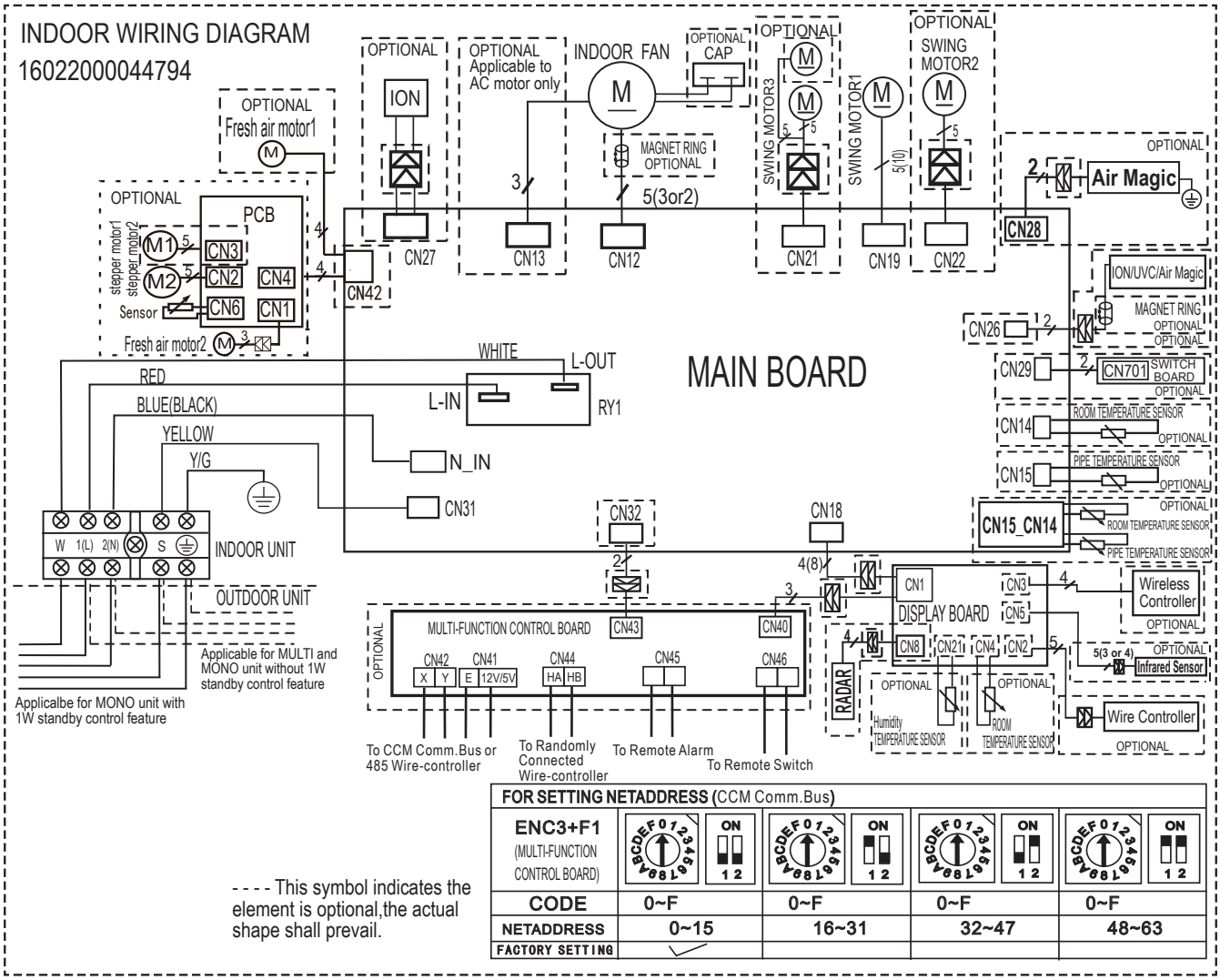


3. Electrical Wiring Diagrams

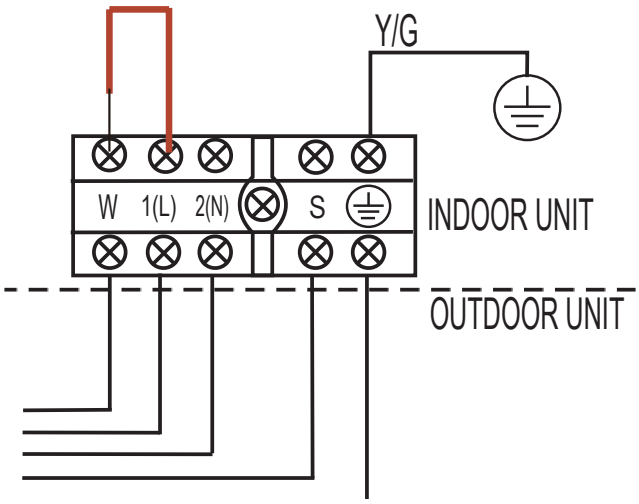
3.1 Indoor unit

Abbreviation	Paraphrase
Y/G	Yellow-Green Conductor
ION	Positive and Negative Ion Generator
CAP	Capacitor
PLASMA	Electronic Dust Collector
L	LIVE
N	NEUTRAL

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Wiring Information – 4 Core Interconnecting



For instances where a 4 core interconnecting is to be used we can bypass the 1W standby relay and power the condenser directly from the mains supply.

This reverts the system back to 5W standy power usage, the same as all other manufacturers.

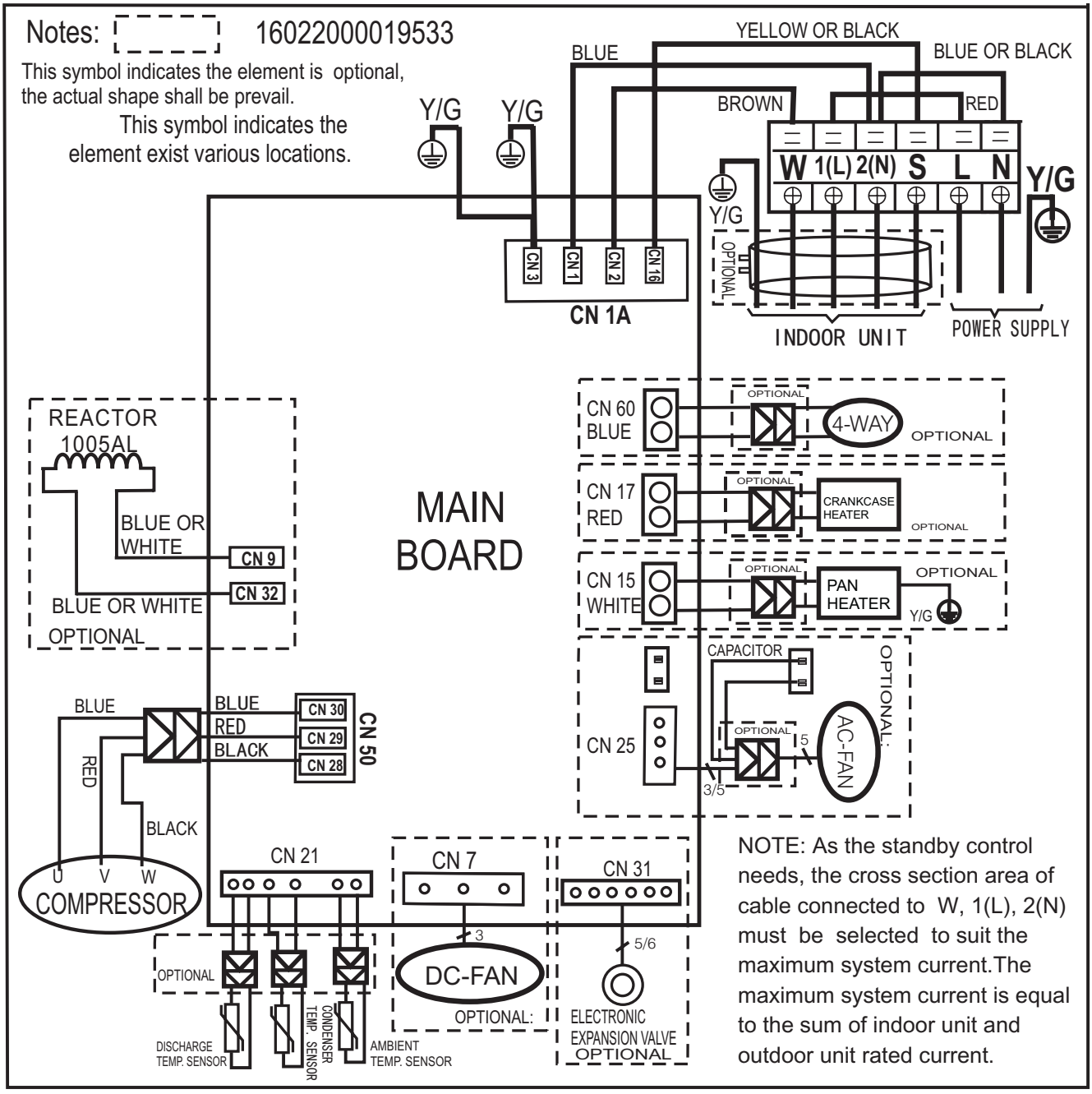
To achieve this, when the unit is powered down, we need to move the brown spade connection from the W terminal and replace it onto the spare connection on the 1(L) terminal.

You then wire with a 4 core cable and miss W at both units.

3.2 Outdoor Unit

Abbreviation	Paraphrase
4-WAY	Gas Valve Assembly/4-WAY VALVE
AC-FAN	Alternating Current FAN
DC-FAN	Direct Current FAN
COMP	Compressor

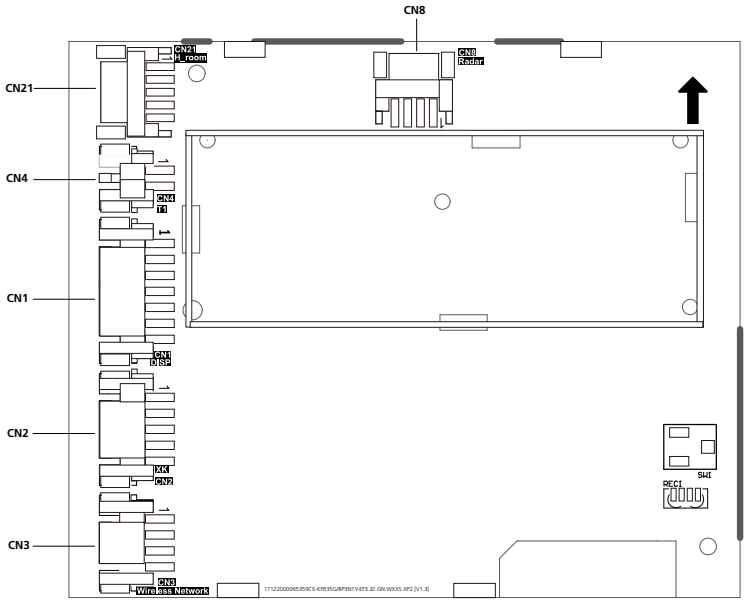
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4. Printed Circuit Board Diagram

4.1 Display board

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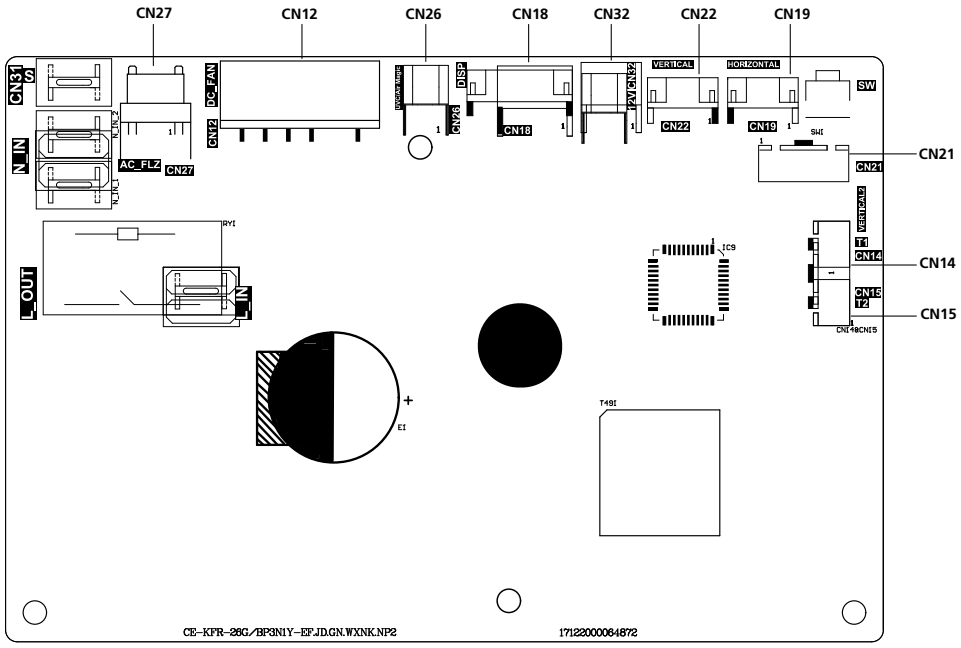


Port	Description	Parameter
CN8	Power for RADAR	5V/DC
CN21	Power output and communication for room humidity sensor	5V/DC
CN4	Power output and communication for room temperature sensor	5V/DC
CN1	Power input and communication with main PCB	5V/DC
CN2	Power output and communication for wired controller KJR-12B	5V/DC
CN3	Power for WIFI adapter	5V/DC

Note: This section is for reference only. Please take practicality as standard.

4.2 Indoor Unit

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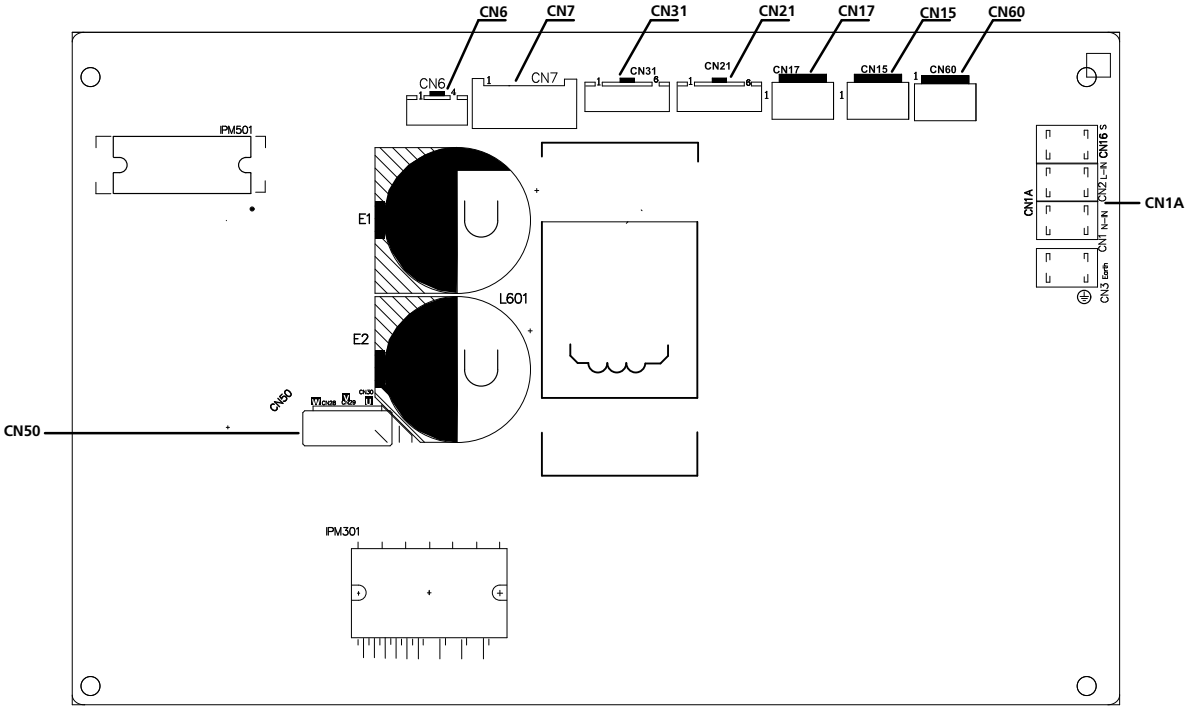


Port	Description	Parameter
CN27	Power output for Plasma/Ionizer	230V/AC
CN12	Power output for DC Fan	
CN26	Power output for UV light/Ionizer	12V/DC
CN18	Power output and communication for display board	5V/DC
CN32	Port for 12V output	12V/DC
CN22	Power output for swing motor of vertical louver	12V/DC
CN19	Power output for swing motor of louver	12V/DC
CN21	Power output for swing motor of vertical louver	12V/DC
CN14	Power output for room temperature sensor T1 and evaporator temperature sensor T2	5V/DC
CN15		

Note: This pictures are only for reference, actual appearance may vary.

4.3 Outdoor Unit

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Port		Description	Parameter
CN50		Port for compressor	0-310V/AC
CN6		Port for test board	5V/DC
CN7		Power output for DC fan	0-310V/AC
CN31		Power output for electric expansion valve	12V/DC
CN21		Power output for condenser (T3), ambient (T4) and discharge (Tp) temperature sensors	5V/DC
CN17		Power output for compressor heater	240V/AC
CN15		Power output for chassis heater	240V/AC
CN60		Power output for 4-way valve	240V/AC
CN1A	CN16	Port for communication cable S	
	CN2	Port for live wire	240V/AC
	CN1	Port for neutral wire	
	CN3	Port for earth wire	

Note: This pictures are only for reference, actual appearance may vary.

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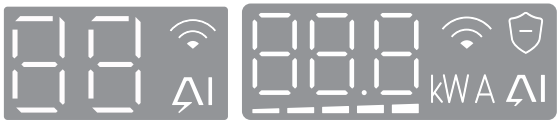
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1. Function General

1.1 Display Function

Unit display functions



Display Code	Function
	• Displays temperature, operation feature and error codes. • For some units, when GEAR function is activated, the display window will display and flash the target power value(kW), current value(A) or gear levels (Lx)for 15 seconds. The gear levels displays as: L1 gear(–), L2 gear(– –), L3 gear(– – –), L4 gear(– – – –), L5 gear(– – – – –).
	When Fresh feature is turned on(some units).
	When ECOMASTER feature is turned on.
ECO	When ECO+ feature is turned on.
	When Wireless Control feature is activated. (some units)
 (for 3s when)	• Timer ON is set. (if the unit is OFF,  remains on when TIMER ON is set). • Fresh, UV lamp, Swing, Turbo , Breeze away or Silent feature is turned on.
 (for 3s when)	• Timer OFF is set. • Fresh, UV lamp, Swing, Turbo , Breeze away or Silent feature is turned off.
	When defrosting(cooling & heating units).
	When active clean function is turned on.
	When 8°C(46°F) heating mode is turned on(for cooling & heating units).

1.2 Safety Features

Compressor three-minute delay at restart

Compressor functions are delayed for up to ten seconds upon the first startup of the unit, and are delayed for up to three minutes upon subsequent unit restarts.

Automatic shutoff based on discharge temperature

If the compressor discharge temperature exceeds a certain level for a period of time, the compressor ceases operation.

Automatic shutoff based on fan speed

If the indoor fan speed registers below 200RPM or over 2100RPM for an extended period of time, the unit ceases operation and the corresponding error code is displayed on the indoor unit.

Inverter module protection

The inverter module has an automatic shutoff mechanism based on the unit's current, voltage, and temperature. If automatic shutoff is initiated, the corresponding error code is displayed on the indoor unit and the unit ceases operation.

Indoor fan delayed operation

- When the unit starts, the louver is automatically activated and the indoor fan will operate after a period of setting time or the louver is in place.
- If the unit is in heating mode, the indoor fan is regulated by the anti-cold wind function.

Sensor redundancy and automatic shutoff

- If one temperature sensor malfunctions, the air conditioner continues operation and displays the corresponding error code, allowing for emergency use.
- When more than one temperature sensor is malfunctioning, the air conditioner ceases operation.

1.3 Basic Functions

1.3.1 Abbreviation

Unit element abbreviations

Abbreviation	Element
T1	Indoor room temperature
T2	Coil temperature of evaporator
T3	Coil temperature of condenser
T4	Outdoor ambient temperature
Tsc	Adjusted setting temperature
TP	Compressor discharge temperature
CDIFTEMP	Cooling shutdown temperature
HDIFTEMP2	Heating shutdown temperature

TCDI1	Enter defrost temperature
TCDE1	Exit defrost temperature1
TCDE2	Exit defrost temperature2 (maintain for a period of time)
TIMING_ DEFROST_TIME	Enter defrost time

In this manual, such as CDIFTEMP, HDIFTEMP2, TCDE1, TCDE2, TIMING_DEFROST_TIME...etc., they are well-setting parameter of EEPROM.

1.3.2 Fan Mode

When fan mode is activated:

- The outdoor fan and compressor cease operation.
- Temperature control is disabled and indoor room temperature is displayed.
- The indoor fan speed can be set to 1%~100%, or auto.
- The louver operations are identical to those in cooling mode.
- Auto fan: In fan-only mode, AC operates the same as auto fan in cooling mode with the temperature set at 24°C(75°F).(Tsc =24°C(75°F))

1.4 Cooling Mode

1.4.1 Compressor Control

Reach the configured temperature:

1) When the compressor runs continuously for within 120 minutes.
   - If the following conditions are satisfied, the compressor ceases operation.
     - Calculated frequency(fb) is less than minimum limit frequency(FminC).
     - Compressor runs at FminC more than 10 minutes
     - T1 is lower than or equal to (Tsc-CDIFTEMP-0.5°C(32.9°F))

Note: CDIFTEMP is EEPROM setting parameter. It is 2°C(35.6°F) usually.

2) When the compressor runs continuously for more than 120 minutes.
   - If the following conditions are satisfied, the compressor ceases operation.
     - Calculated frequency(fb) is less than minimum limit frequency(FminC).
     - Compressor runs at FminC more than 10 minutes.
     - T1 is lower than or equal to (Tsc-CDIFTEMP).

Note: CDIFTEMP is EEPROM setting parameter. It is 2°C(4°F) usually.

3) If one of the following conditions is satisfied, not judge protective time.
   - Compressor running frequency(fr) is more than test frequency(TestFre).
   - Compressor running frequency is equal to test frequency, T4 is more than 15°C(59°F) or T4 fault.
   - Change setting temperature.
   - Turn on/off turbo or sleep function.
   - Various frequency limit shutdown occurs.

1.4.2 Indoor Fan Control

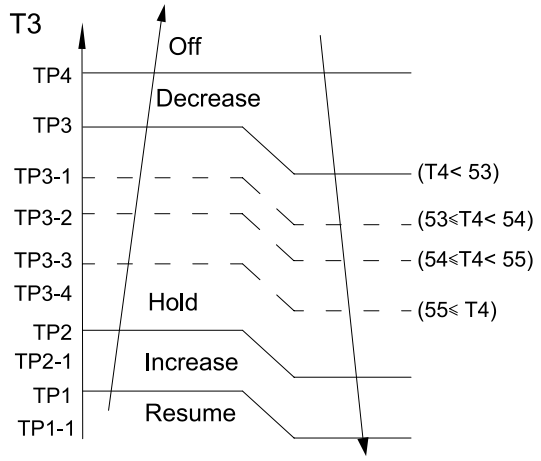
1) In cooling mode, the indoor fan operates continuously. The fan speed can be set to 1%-100%, or auto.

2) Auto fan
   - Descent curve
     - When T1-Tsc is lower than 3.5°C(6°F), fan speed reduces to 80%;
     - When T1-Tsc is lower than 1°C(2°F), fan speed reduces to 60%;
     - When T1-Tsc is lower than 0.5°C(1°F), fan speed reduces to 40%;
     - When T1-Tsc is lower than 0°C(0°F), fan speed reduces to 20%;
     - When T1-Tsc is lower than -0.5°C(-1°F), fan speed reduces to 1%.
   - Rise curve
     - When T1-Tsc is higher than or equal to 0°C(0°F), fan speed increases to 20%;
     - When T1-Tsc is higher than or equal to 0.5°C(0.9°F), fan speed increases to 40%;
     - When T1-Tsc is higher than or equal to 1°C(2°F), fan speed increases to 60%;
     - When T1-Tsc is higher than or equal to 1.5°C(3°F), fan speed increases to 80%;
     - When T1-Tsc is higher than or equal to 4°C(7°F), fan speed increases to 100%.

1.4.3 Outdoor Fan Control

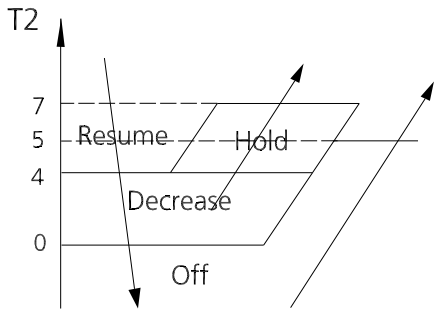
- The outdoor unit will be run at different fan speed according to T4 and compressor running frequency..
- For different outdoor units, the fan speeds are different.

1.4.4 Condenser Temperature Protection



When the condenser temperature exceeds a configured value, the compressor ceases operation.

1.4.5 Evaporator Temperature Protection



- Off: Compressor stops.
- Decrease: Decrease the running frequency to the lower level per 1 minute.
- Hold: Keep the current frequency.
- Resume: No limitation for frequency.

1.5 Heating Mode(For Heat Pump Units)

1.5.1 Compressor Control

1) Reach the configured temperature

- If the following conditions are satisfied, the compressor ceases operation.
  - Calculated frequency(fb) is less than minimum limit frequency(FminH).
  - Compressor runs at FminH more than 10 minutes.
  - T1 is higher than or equal to Tsc+ HDIFTEMP2.

Note: HDIFTEMP2 is EEPROM setting parameter. It is 2°C(4°F) usually.

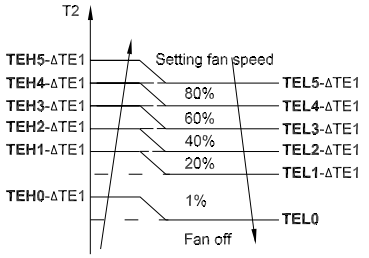
- If one of the following conditions is satisfied, not judge protective time.
  - Compressor running frequency(fr) is more than test frequency(TestFre).
  - When compressor running frequency is equal to test frequency, T4 is more than 15°C(59°F) or T4 fault.
  - Change setting temperature.
  - Turn on/off turbo or sleep function..

2) When the current is higher than the predefined safe value, surge protection is activated, causing the compressor to cease operations.

1.5.2 Indoor Fan Control

1) In heating mode, the indoor fan operates continuously. The fan speed can be set to 1%-100%, or mute.And the anti-cold wind function has the priority.

- Anti-cold air function
  - The indoor fan is controlled by the indoor temperature T1 and indoor unit coil temperature T2.



T1 ≥ 19°C(66°F)	ΔTE1=0
15°C(59°F)≤T1<19°C(66°F)	ΔTE1=19°C-T1 (66°F-T1)
T1<15°C(59°F)	ΔTE1=4°C(7.2°F)

2) Auto fan

- Rise curve
  - When T1-Tsc is higher than -1.5°C(-3°F), fan speed reduces to 80%;
  - When T1-Tsc is higher than 0°C(0°F), fan speed reduces to 60%;
  - When T1-Tsc is higher than 0.5°C(1°F), fan speed reduces to 40%;
  - When T1-Tsc is higher than 1°C(2°F), fan speed reduces to 20%.
- Descent curve
  - When T1-Tsc is lower than or equal to 0.5°C(1°F), fan speed increases to 40%;
  - When T1-Tsc is lower than or equal to 0°C(0°F), fan speed increases to 60%;
  - When T1-Tsc is lower than or equal to -1.5°C(-3°F), fan speed increases to 80%;
  - When T1-Tsc is lower than or equal to -3°C(5°F), fan speed increases to 100%.

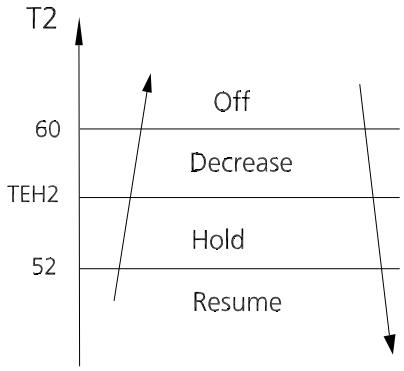
1.5.3 3.5.3 Outdoor Fan Control

- The outdoor unit will be run at different fan speed according to T4 and compressor running frequency.
- For different outdoor units, the fan speeds are different.

1.5.4 Defrosting mode

- The unit enters defrosting mode according to changes in the temperature value of T3, T4 as well as the compressor running time.
- In defrosting mode, the compressor continues to run, the indoor and outdoor motor will cease operation, the defrost light of the indoor unit will turn on, and the "dF" symbol is displayed.
- If any one of the following conditions is satisfied, defrosting ends and the machine switches to normal heating mode:
  - T3 rises above TCDE1°C.
  - T3 maintained above TCDE2°C for 80 seconds.
  - Unit runs for 15 minutes consecutively in defrosting mode.
- If T4 is lower than or equal to -22°C(-8°F) and compressor running time is more than TIMING_ DEFROST_TIME, if any one of the following conditions is satisfied, defrosting ends and the machine switches to normal heating mode:
  - Unit runs for 10 minutes consecutively in defrosting mode.
  - T3 rises above 10°C(50°F).

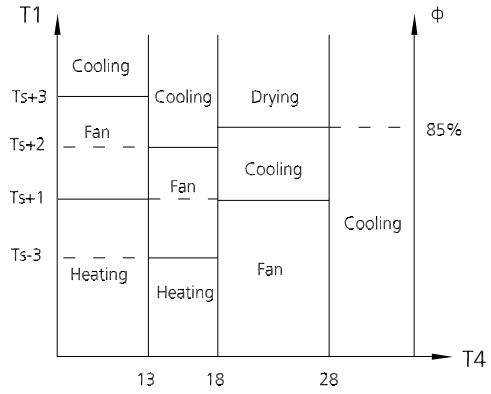
1.5.5 Evaporator Temperature Protection



- Off: Compressor stops.
- Decrease: Decrease the running frequency to the lower level per 20 seconds.
- Hold: Keep the current frequency.
- Resume: No limitation for frequency.

1.6 Auto Mode

- This mode can be selected with the remote controller and the setting temperature can be changed between 16°C~30°C.
- In auto mode, the machine selects cooling, heating, auto-drying or fan-only mode on the basis of T1,Ts, T4 and relative humidity.



- If the setting temperature is modified, the machine selects a new running function.

1.7 Drying Mode

- In drying mode, AC operates the same as auto fan in cooling mode.
- All protections are activated and operate the same as they do that in cooling mode.
- Low Room Temperature Protection

If the room temperature is lower than 10°C, the compressor ceases operations and does not resume until room temperature exceeds 12°C.

1.8 Forced Operation Function

- Forced cooling mode:

The compressor and outdoor fan continue to run(fixed at rated frequency), and the indoor fan runs at rated speed. After running for 30 minutes, the AC will switch to auto mode with a preset temperature of 24°C.

- Forced auto mode:

Forced auto mode operates the same as normal auto mode with a preset temperature of 24°C.

- The unit exits forced operation when it receives the following signals:
  - Switch on
  - Switch off
  - Timer on
  - Timer off
  - Sleep mode
  - Follow me

- Changes in:
  - mode
  - fan speed
  - setting temperature
- Forced defrosting mode:
  - Press AUTO/COOL button continuously for 5s under forced cooling mode to enter this mode.
  - Indoor fan will stop, defrosting lamp will light on.
  - Quit this mode and turn off the unit when:
    - quit normal defrosting
    - turn off by RC
    - Press AUTO/COOL button continuously for 5s again

1.9 Timer Function

- Timing range is 24 hours.
- Timer on. The machine will turn on automatically when reaching the setting time.
- Timer off. The machine will turn off automatically when reaching the setting time.
- Timer on/off. The machine will turn on automatically when reaching the setting "on" time, and then turn off automatically when reaching the setting "off" time.
- Timer off/on. The machine will turn off automatically when reaching the setting "off" time, and then turn on automatically when reaching the setting "on" time.
- The timer function will not change the AC current operation mode. Suppose AC is off now, it will not start up firstly after setting the "timer off" function. And when reaching the setting time, the timer LED will be off and the AC running mode has not been changed.
- The setting time is relative time.
- The AC will quit the timer function when it has malfunction

1.10 Sleep Function

- The SLEEP function is used to decrease energy use while you sleep.
- When the sleep function is activated, the air conditioner will intelligently adjust temperature, fan speed to provide a more comfortable sleeping environment. You can freely set the fan speed and airflow angle when in sleep operation. The sleep function will automatically exit after running for 9 hours.

Note:

- The sleep function is not available in Fan and Dry mode.
- For some models with wireless control feature, the sleep operation time and sleep light can be adjusted through the app.

1.11 Auto-Restart Function

- The indoor unit has an auto-restart module that allows the unit to restart automatically. The module automatically stores the current settings and, in the case of a sudden power failure, will restore those setting automatically within 3 minutes after power returns.
- If there is a power failure while the unit is running, the compressor starts 3 minutes after the unit restarts. If the unit was already off before the power failure, the unit stands by.

1.12 Active Clean Function

- The Active Clean Technology washes away dust when it adheres to the heat exchanger by automatically freezing and then rapidly thawing the frost. A "pi-pi" sound will be heard.
- The Active clean operation is used to produce more condensed water to improve the cleaning effect, and the cold air will blow out. After cleaning, the internal wind wheel then keeps operating with hot air to blow-dry the evaporator, thus keeping the inside clean.
- When this function is turned on, the indoor unit display window appears "CL", after 20 to 45 minutes, the unit will turn off automatically and cancel Active Clean function.

1.13 Follow Me

- The FOLLOW ME function enables the remote control to measure the temperature at its current location and send this signal to the air conditioner in 3 minute intervals.
- When using AUTO, COOL or HEAT modes, measuring ambient temperature from the remote control(instead of from the indoor unit itself) will enable the air conditioner to optimize the temperature around you and ensure maximum comfort.

1.14 8°C Heating(For Heat Pump Units)

In heating mode, the temperature can be set to as low as 8°C, preventing the indoor area from freezing if unoccupied during severe cold weather.

1.15 Silence

Press "Silence" or keep pressing Fan button for more than

2 seconds on the remote control to enable the SILENCE function. While this function is active, the indoor unit will run at faint breeze(1% fan speed), which reduces noise to the lowest possible level.

1.16 ECOMASTER Function

Under cooling/heating mode, the fan speed will change to Auto, the set temperature will remain unchanged which brings more comfortable feelings and power-saving, and reduces temperature fluctuations..

1.17 Breeze Away Function(some units)

- Press the Breeze Away button on the remote control to activate the avoiding direct air blowing on the body.
- Under Breeze Away operation, the system will adjust the louver angles and fan speed automatically. You can also choose the fan speed by remote controller.
- This feature is only available under Cool, Dry or Fan mode.

1.18 Coolflash Function

Cool Flash technology can very rapidly cool an entire room. This is achieved by producing a large air volume and high flow of air.

1.19 Heatflash Function(For Heat Pump Units)

Similarly, a fast and strong flow of heated air can warm up an entire room in a short time.

1.20 Wireless Control (some units)

- Wireless control allows you to control your air conditioner using your mobile phone and a Wireless connection.
- For the USB device access, replacement, maintenance operations must be carried out by professional staff

1.21 OTA Update Function (some units)

- The OTA function uses the communication link of "server → WiFi module → display → main control → outdoor" to transmit the display software, IDU EEPROM, and ODU EEPROM via the network to the display, main control, and outdoor unit.
- Achieve the update without disassembling the unit.
- After receiving the update command, the air conditioner stops running and displays "C0" during the update process.

NOTE: "C0" is not an error code, when the unit diplays this code, please do not power off until it complete the update process.

2. Basic Control

2.1 Compressor Control

2.1.1 Compressor Start-up Process

- When the compressor transitions from off to on, it must operate at the five platform frequencies (PLAT_FREQ1, PLAT_FREQ2, PLAT_FREQ3, PLAT_FREQ4, PLAT_FREQ5) for the corresponding durations (PLAT_TIME1, PLAT_TIME2, PLAT_TIME3, PLAT_TIME4, PLAT_TIME5). The frequency values and operating durations for these five platforms are determined by the parameter values in the parameter table.

2.1.2 High-frequency direct start of the compressor

- Based on conditions such as coil temperature of condenser(T3), outdoor ambient temperature(T4), and supply voltage, the compressor can directly start at the target frequency (skipping the normal start-up process of the five platform periods).

1) If the outdoor calculated target frequency ≥ the upper limit frequency for high-frequency start, the compressor starts at the upper limit frequency and maintains operation at the current frequency for the platform time corresponding to the high-frequency start.

2) If the outdoor limited target frequency < the upper limit frequency for high-frequency start, the compressor starts at the target frequency and maintains operation at the current frequency for the platform time corresponding to the high-frequency start.

2.2 Electronic Expansion Valve Control

2.2.1 Basic Structure

- Valve Body: The channel that controls the flow of refrigerant.
- Stepper Motor: Drives the movement of the valve needle to adjust the valve opening.
- Valve Needle: Adjusts the valve opening through the drive of the stepper motor.
- Controller: Receives system signals and controls the actions of the stepper motor.

2.2.2 Working Principle

- The electronic expansion valve precisely controls the refrigerant flow by driving the valve needle's movement through a stepper motor to adjust the valve opening. The working process is as follows:

A. Signal Reception:

- Sensors in the system detect parameters such as the superheat at the evaporator outlet and the condensing pressure.

- The sensors transmit the detected signals to the controller of the electronic expansion valve.

B. Signal Processing:

- The controller calculates the required valve opening based on the received signals.
- The controller sends instructions to the stepper motor.

C. Stepper Motor Drive:

- The stepper motor drives the valve needle to move up and down according to the controller's instructions.
- The movement of the valve needle changes the valve opening, thereby adjusting the refrigerant flow.

D. Flow Adjustment:

- Changes in refrigerant flow stabilize system parameters such as superheat and pressure.
- The controller continuously monitors system parameters and dynamically adjusts the valve opening to ensure optimal system operation.

3. Special Control

3.1 Startup Control

3.1.1 Outdoor Power Relay Control

1) The outdoor power relay closes after the outdoor unit is powered on and the switch power supply operates normally.

2) After powering on, if the DC bus voltage exceeds the relay protection voltage for approximately 2 seconds, the main relay closes.

3) If the DC bus voltage remains below the relay cutoff voltage for more than 0.8 seconds, and the main relay is already closed, the fan, four-way valve, electric heating belt, compressor, and other loads will stop operating first. If the voltage continues to remain below the relay cutoff voltage for more than 1.8 seconds, the main relay will disconnect.

4) If the DC bus voltage remains below the relay cutoff voltage for more than 0.8 seconds, and the fan, four-way valve, electric heating belt, compressor, and other loads have stopped operating, but the voltage then rises above the relay cutoff voltage, the loads such as the fan cannot be restarted within 10 seconds after the voltage returns to normal. They can only be allowed to restart after 10 seconds to prevent frequent relay engagement caused by voltage fluctuations.

3.2 Oil Return Operation

To prevent compressor oil depletion, initiate the cooling oil return operation to recover the oil flowing out of the compressor.

3.2.1 Cooling Oil Return Start Conditions

When the compressor operates continuously below OilInFreq (the frequency threshold for entering the oil return function) for OilInTime (the time threshold for entering the oil return function) and no other frequency limits or protection functions are triggered, the system enters the oil return function.

3.2.2 Cooling Oil Return Operation

The compressor operates at OilFreq (the set frequency for oil return) for 90 seconds. Upon exiting the oil return function, the compressor resumes operation at the frequency required by the indoor and outdoor functions.

3.3 Stopping Operation

Shutdown Process

If a protection function is triggered that requires the compressor to stop, it will immediately shut down at the current operating frequency.

The compressor will shut down directly in the following situations:

1) Indoor fan stall fault.

2) Outdoor compressor-related faults, outdoor DC fan faults, communication faults between the outdoor main control and drive, and communication faults between indoor and outdoor units.

3) Outdoor condenser, exhaust, current, and voltage protection conditions are met for shutdown.

4. Protection Control

4.1 Discharge Pipe Protection Control

Exhaust pipe protection control is used to safeguard the internal temperature of the compressor and prevent faults in the exhaust pipe temperature sensor or temporary rises or drops in exhaust temperature.

The following conditions will trigger exhaust temperature sensor protection:

1) The temperature value of the exhaust temperature sensor is too high.

2) During compressor operation, the exhaust temperature sensor remains too low for 1 minute continuously.

When the exhaust pipe temperature protection control is triggered, the compressor shuts down, and fault code EC54 is displayed.

4.2 IPM Module Protection

IPM module protection refers to the mechanism triggered

when the system detects abnormal operation or excessive temperature in the IPM (Intelligent Power Module) to prevent equipment damage or hazards.

The following conditions will trigger IPM module protection:

1) The system detects overcurrent in the IPM or IGBT.

2) IPM module overheating, IPM module power undervoltage, or other internal protections within the IPM.

When IPM module protection is triggered, the compressor shuts down, and fault code PC00 is displayed.

4.3 Compressor Phase Loss Protection

Compressor phase loss protection refers to the mechanism triggered when the system detects phase loss in the compressor power supply (i.e., one or more phases of the three-phase power supply are missing) to prevent compressor damage due to phase loss operation.

When the system detects compressor phase loss, the compressor shuts down, and fault code PC43 is displayed. If the compressor returns to normal within 30 seconds, the fault will be cleared.

4.4 EEPROM Parameter Error Protection

EEPROM parameter error protection refers to the mechanism triggered when the chip fails to read EEPROM parameters or detects parameter verification errors after powering on. This protection prevents the system from operating with incorrect parameters, which could lead to equipment damage.

When EEPROM parameter error protection is triggered, the compressor shuts down, the outdoor unit stops operating, and fault code EC51 is displayed. The fault will be cleared after the system is powered on again and the EEPROM parameters are correctly read.

5. Controller Functions

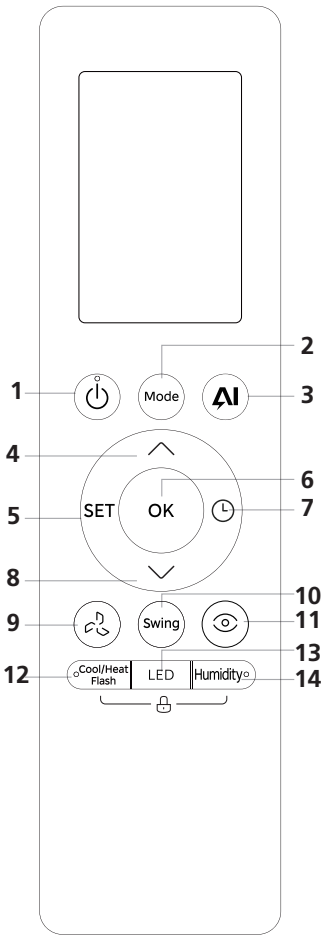
5.1 Infrared Wireless Remote Controller

5.1.1 RG10E27(2HS)/BGEF (Standard)

Remote Controller Specifications

Model	RG10E27(2HS)/BGEF
Rated Voltage	3.0V (Dry batteries R03/LR03×2)
Reaching Distance	8m
Environment Temperature Range	-5°C~60°C(23°F~140°F)

Buttons and Functions

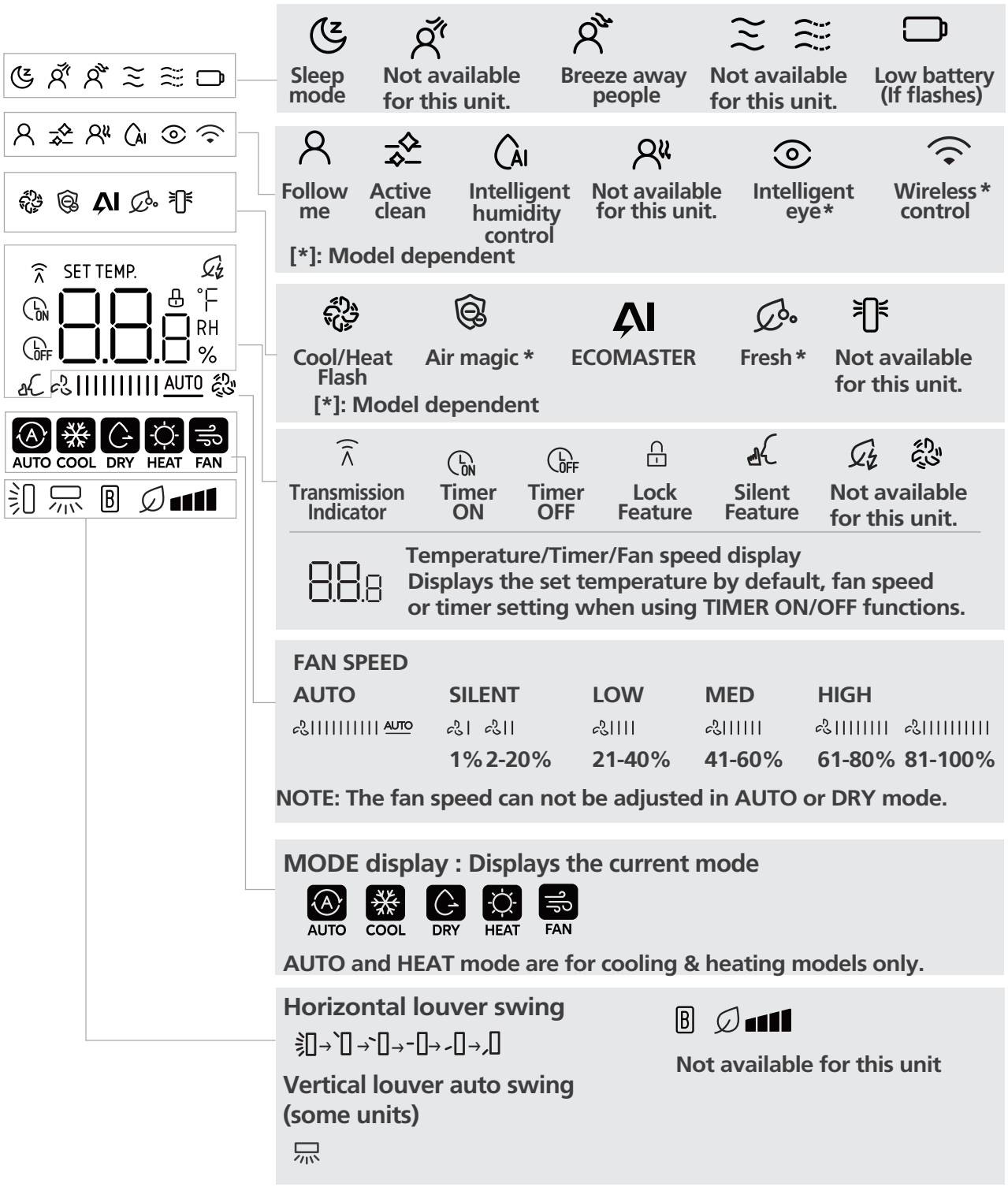


Model:
RG10E27(2HS)/BGEF

	Description
1	**ON/OFF: Turn the unit on or off.**
2	**Mode: Auto > Cool > Dry > Heat > Fan Note: Auto and Heat mode are not available for the cooling only appliance.**
3	**ECOMASTER: Starts and stops the energy saving operation.**
4	**Temp Up: Increases temperature in 0.5°C (1°F) increments. Max. temperature is 30°C (86°F). Note: Press ^ & v buttons at the same time for 3 seconds will alternate the temperature display between the °C & °F.**
5	**SET: Air magic >*Follow Me > Active clean > Intelligent humidity control > AP mode >*Sleep > Breeze away [*]: Model dependent**
6	**OK: Used to confirm the selected functions.**
7	**Timer: Set timer to turn unit on or off.**
8	**Temp Down: Decreases temperature in 0.5°C (1°F) increments. Min. temperature is 16°C (60°F).**
9	**Fan Speed: AU > 20% >40% > 60% > 80% > 100%. Press the TEMP ^ or v button to increase/ decrease the fan speed in 1% increments.**
10	**Swing: Starts and stops the horizontal louver movement. Hold down for 2 seconds to initiate vertical louver auto swing feature (some units).**
11	**Intelligent Eye: Used to detect the people activities in the room to save energy.**
12	**Cool/Heat Flash: Reduce (cool mode) or raise (heat mode) temperature in a short time.**
13	**LED: Turns LED display & air conditioner buzzer on and off.**
14	**Humidity: Adjust the room humidity during Dry operation in a range of 35%~85%. Press this button to increase the humidity in 5% increments. Note: After setting, the humidity settings will display on the screen**
15	**Lock: Long press both Cool/Heat Flash and Humidity buttons simultaneously for 5 seconds to lock the keyboard. Press together these two buttons again for 2 seconds to unlock the keyboard.**

Remote LCD Screen Indicators

Information are displayed when the remote controller is power up.



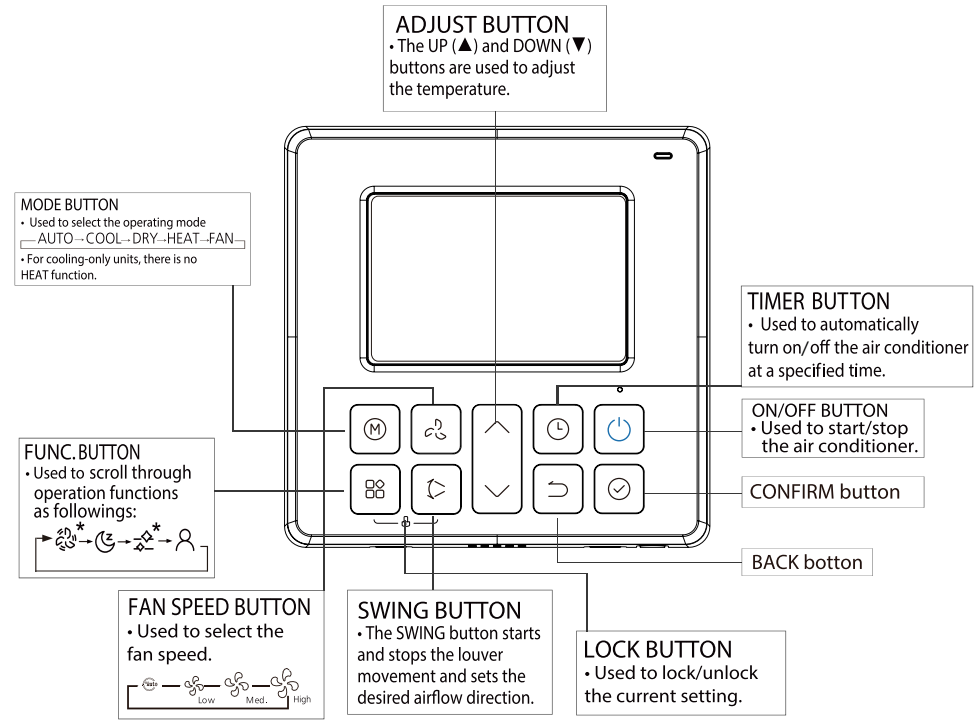
Note:

All indicators shown in the figure are for the purpose of clear presentation. But during the actual operation, only the relative function signs are shown on the display window.

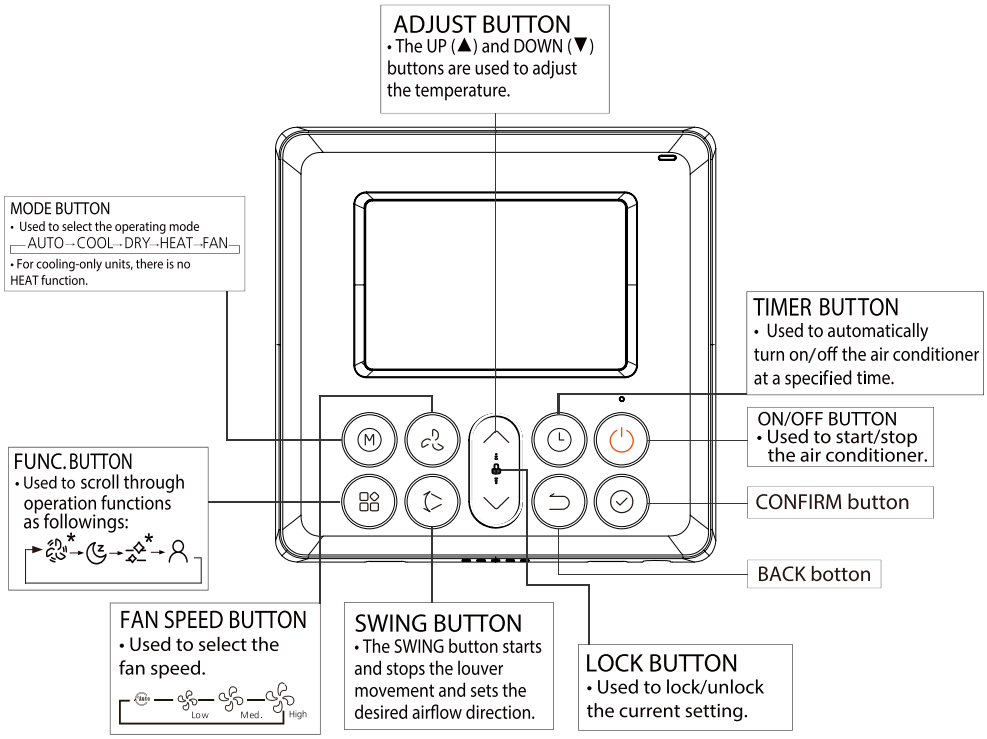
5.2 LCD Wired Remote Controller(Optional)

5.2.1 LCD Wired Remote Controller KJR-120L/F-E/KJR-120K/F-E

i) Buttons and Functions

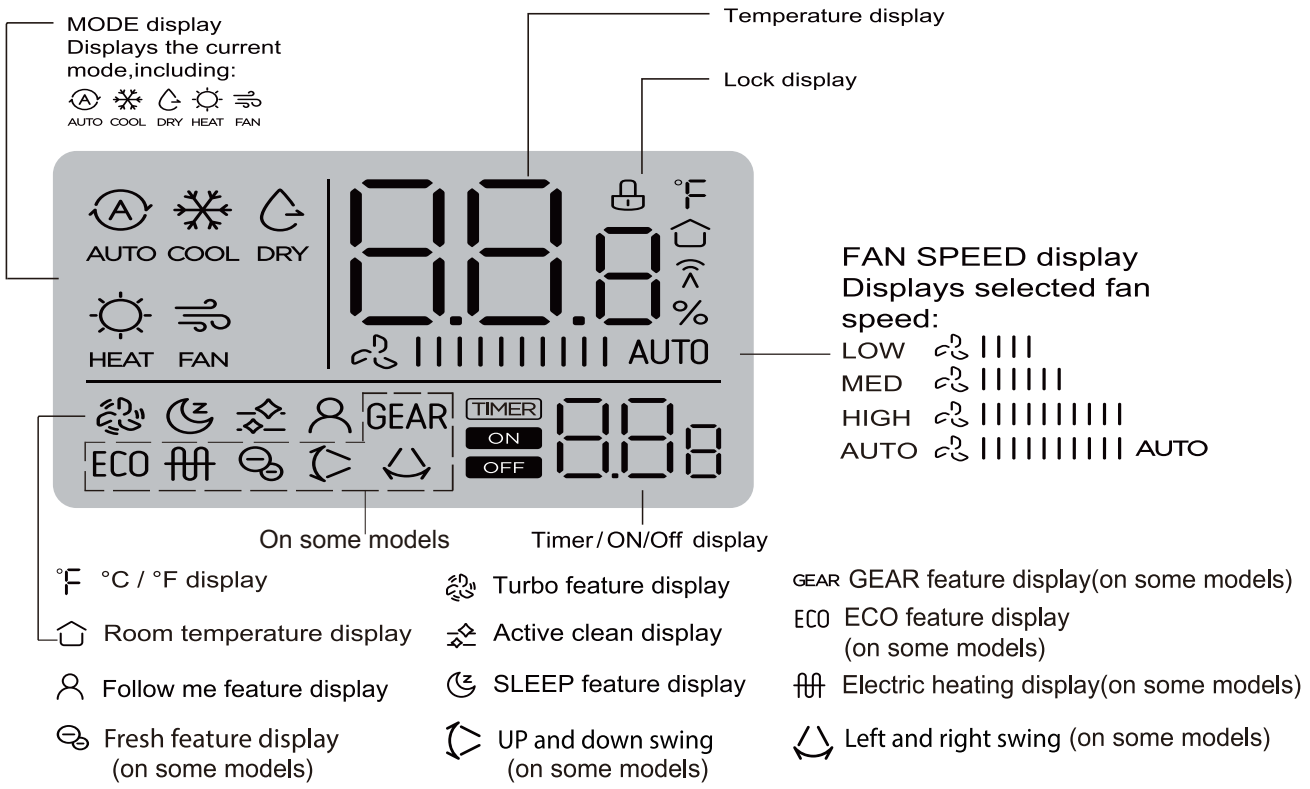


KJR-120L/F-E



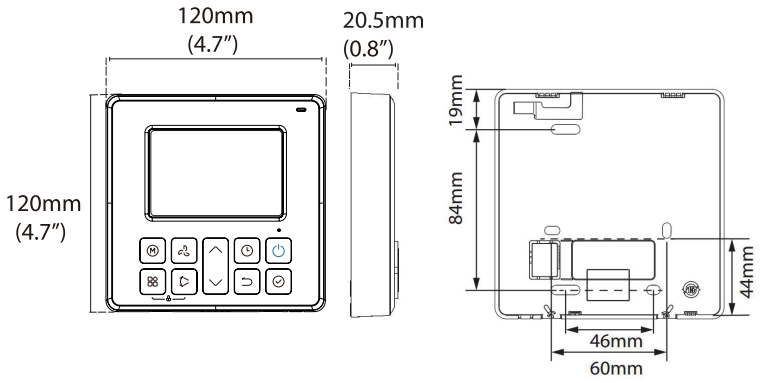
KJR-120K/F-E

ii) LCD Screen



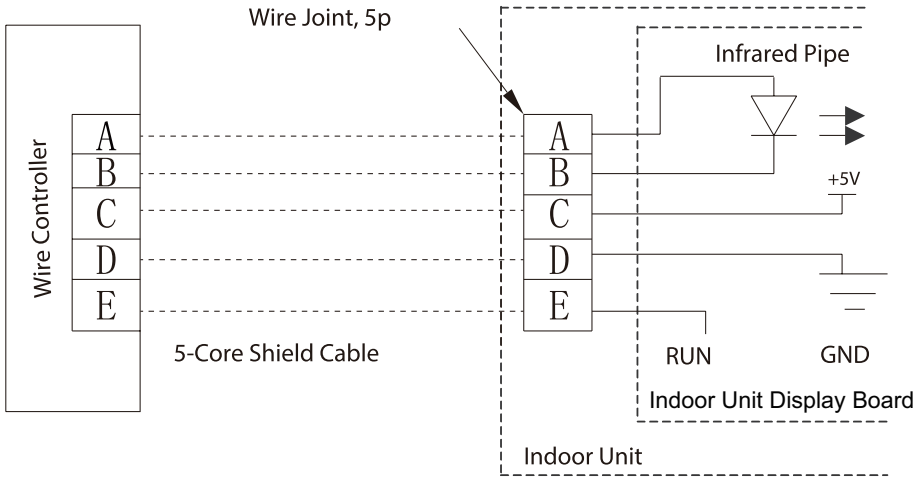
iii) Installation

- Dimensions



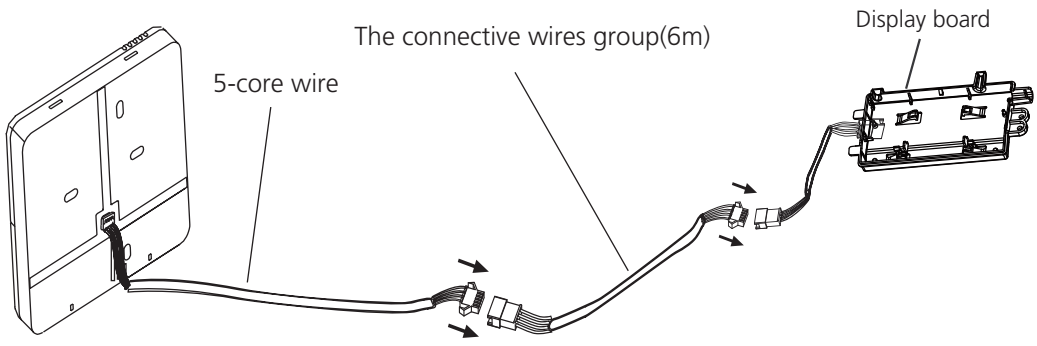
- Wiring diagram

  Refer to the following diagram to wire the wall-mounted remote control to the indoor unit.



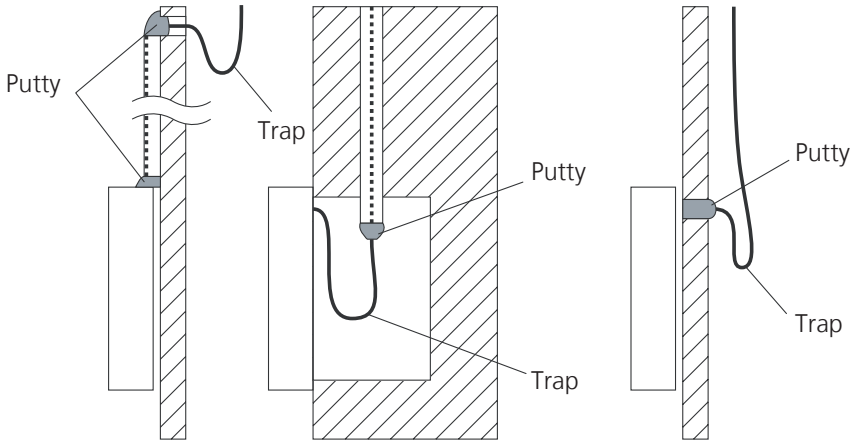
- Installation Diagram

  Connect the wire from the display panel of the indoor unit to a connecting cable. Then connect the other side of the connecting cable to the remote control.



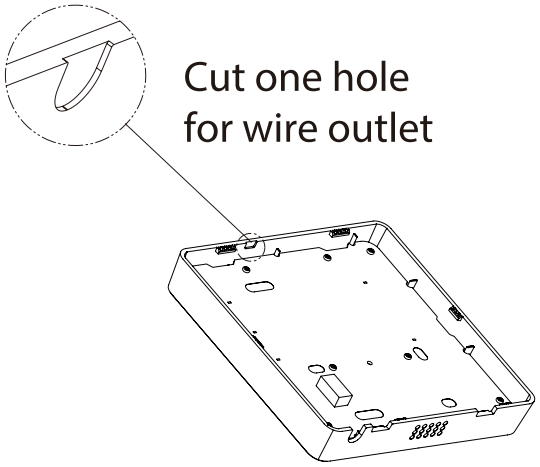
Note: Be sure to reserve a length of the connecting wire for periodic maintenance.

If there is a connection lug at the end of shielded wire, the connection lug should be properly grounded.

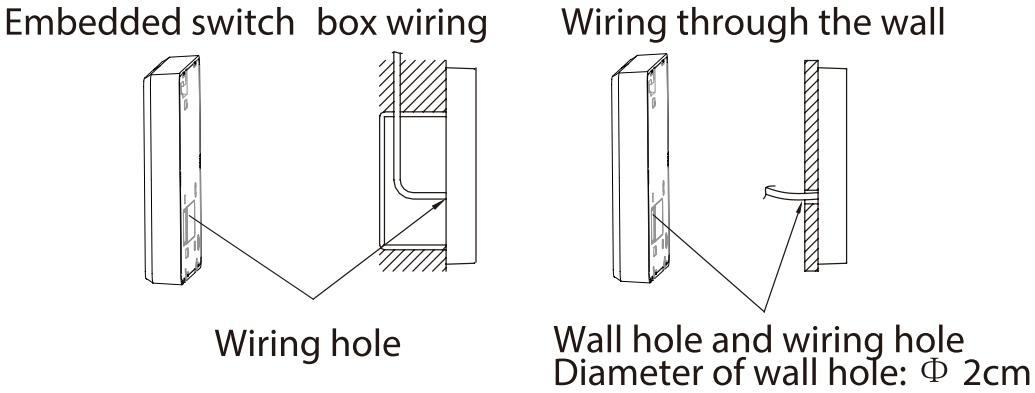


Note: DO NOT allow water to enter the remote control. Use the trap and putty to seal the wires.

- For exposed mounting, cut holes on four of the sides according to the picture below.

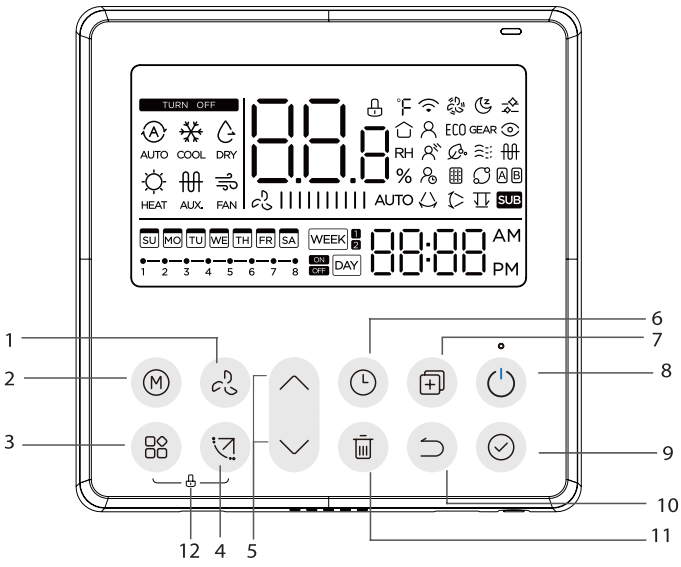


- For shielded wiring, please refer to the picture below.

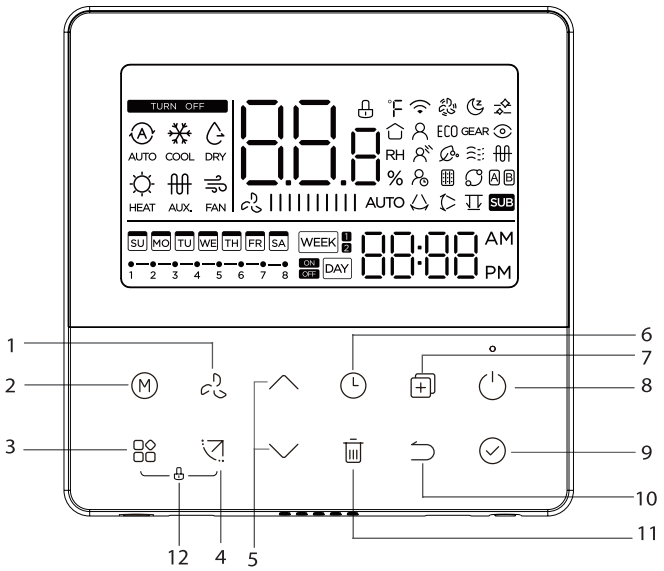


5.2.2 LCD Wired Remote Controller KJR-120N(X6W)/BGEF/KJR-120M(X6W)/BGEF

i) Buttons and Functions



KJR-120N(X6W)/BGEF



KJR-120M(X6W)/BGEF

1. FAN SPEED button

Used to select the fan speed.

2 MODE button

Used to select the operation mode: Auto / Cooling / Drying / Heating / Fan;

3. FUNC. button

Press the FUNC. button to scroll through operation functions.

To active turbo mode under COOL/HEAT mode(on some models).

4. Swing Button

Press to adjust the Up-down airfow direction and start the auto swing function.

5. Adjust button

To set temperature, time and timer.

6. TIMER button

To set timer on and timer off time of one day.

7. COPY button

To copy timer setting of one day to another in weekly schedule setting.

To active the follow me function while in normal operation.

8. POWER button

Turn on of turn off the unit.

9. CONFIRM button

To confirm an setting or call up the superior menu.

10. BACK button

Back to previous operation or superior menu

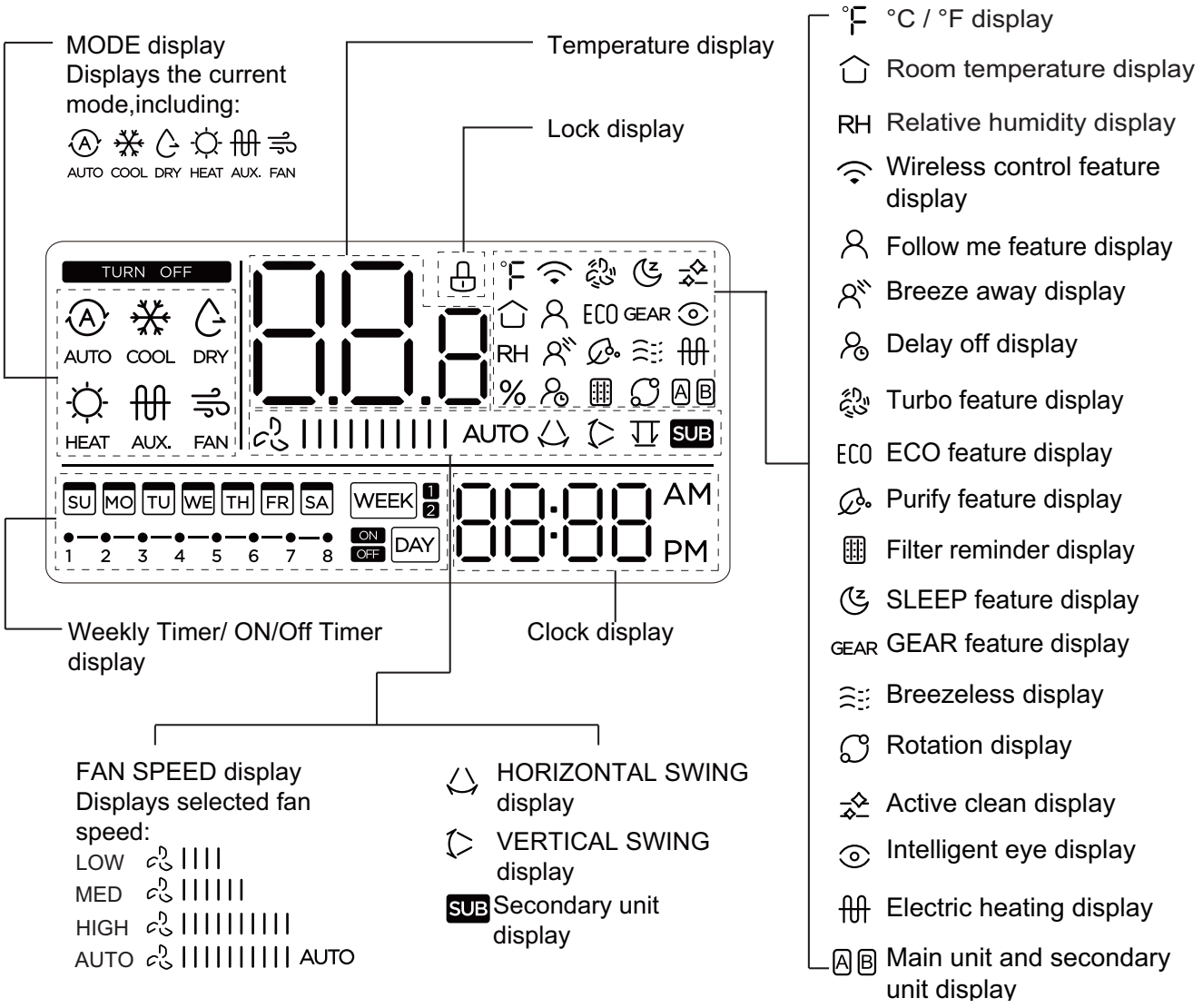
11.DELAY/DAY OFF button

To set 1 to 2 hours delay off for each day or a whole day off in a weekly timer schedule

12. CHILD LOCK button

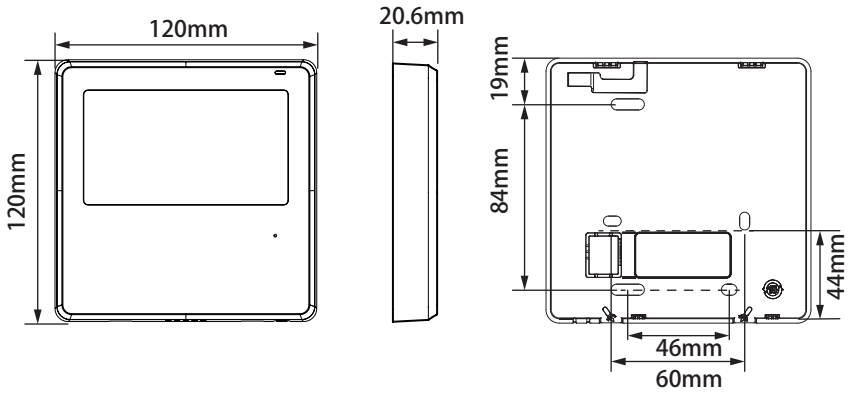
To activate the child lock function.

ii) LCD Screen



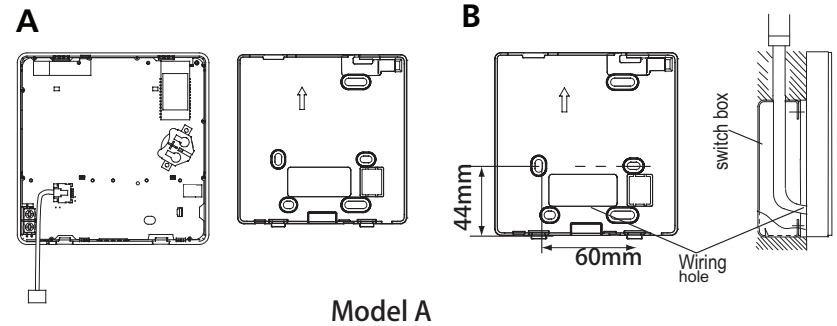
iii) Installation

- Dimensions

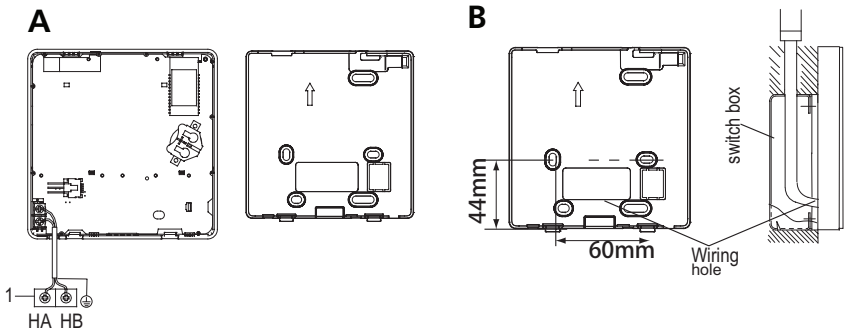


3) Connection

- Wire with the indoor unit:



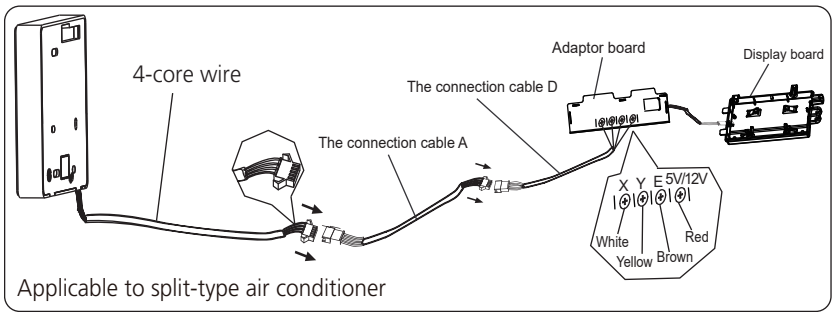
Model A



Model B

Model A

Connect the wire from the display panel of the indoor unit to a connecting cable. Then connect the other side of the connecting cable to the remote control.



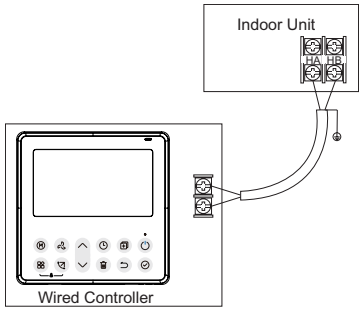
Model B

1 indoor unit

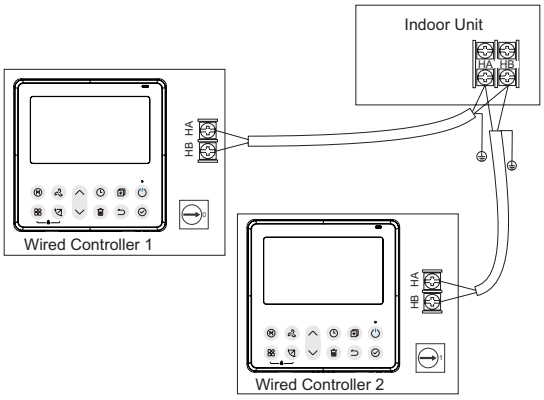
Notch the part for the wiring to pass through with nippers, etc.

Connect the terminals on the wired controller (HA ,HB), and the terminals of the indoor unit (HA ,HB). (HA and HB do not have polarity.)

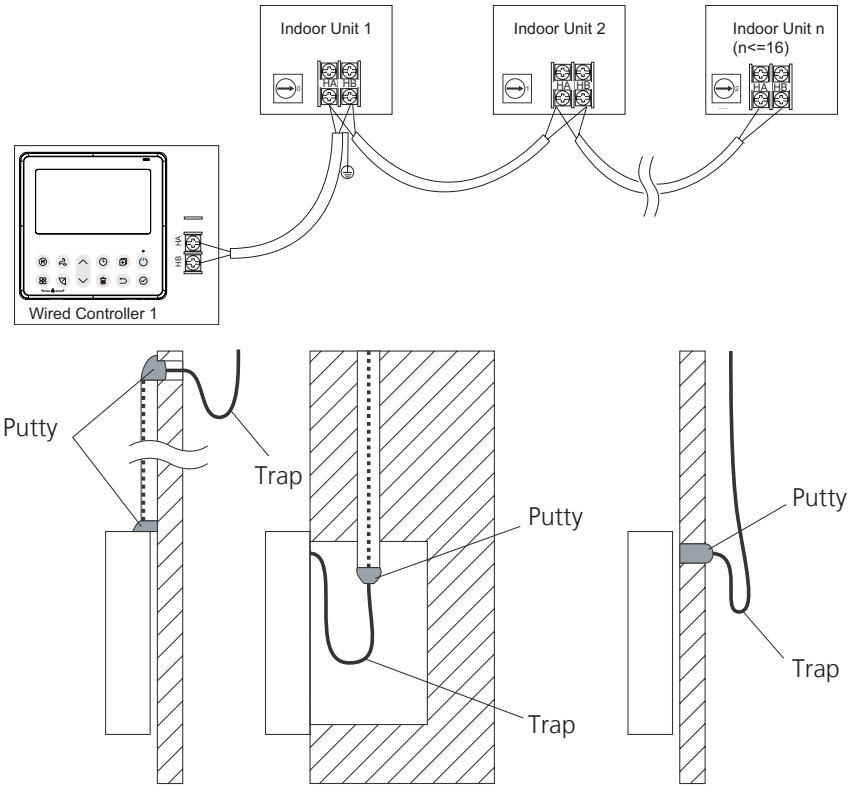
For some units, the wired controller connects to the unit HA and HB ports through the HA and HB ports. There is no polarity between HA and HB.



The main/secondary wired controller can be used to enable two wired controllers to control one unit, and the wired controllers connect to the unit HA and HB ports through the HA and HB port on the controller. There is no polarity between HA and HB.



For some units, one wired controller can support multiple units (a maximum of 16 units). In this case, the wired controller and unit need to be connected to the HA and HB ports at the same time. In group control, there will be no error displayed on the wired controller.


Indoor Unit 1
Indoor Unit 2
Indoor Unit n
(n<=16)
Wired Controller 1
Putty
Trap
Putty
Trap
Putty
Trap

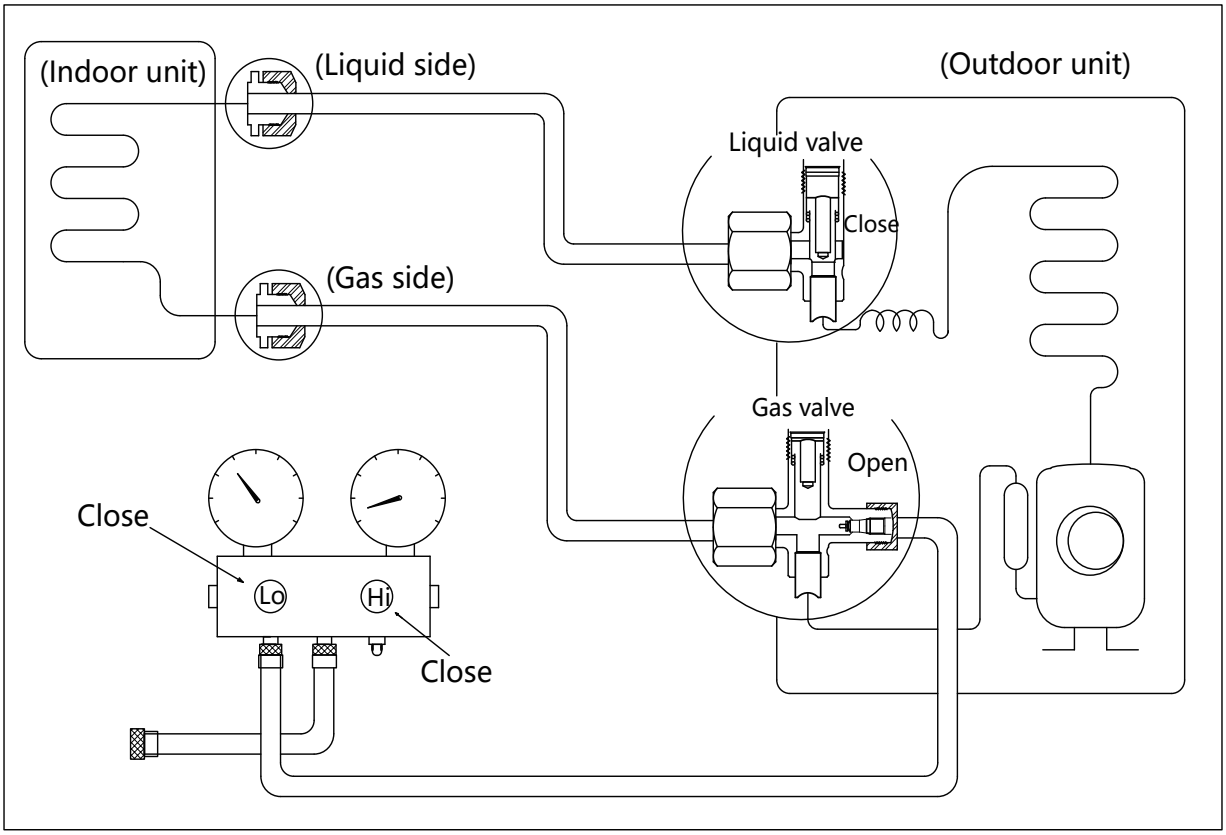
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1. Indoor Unit

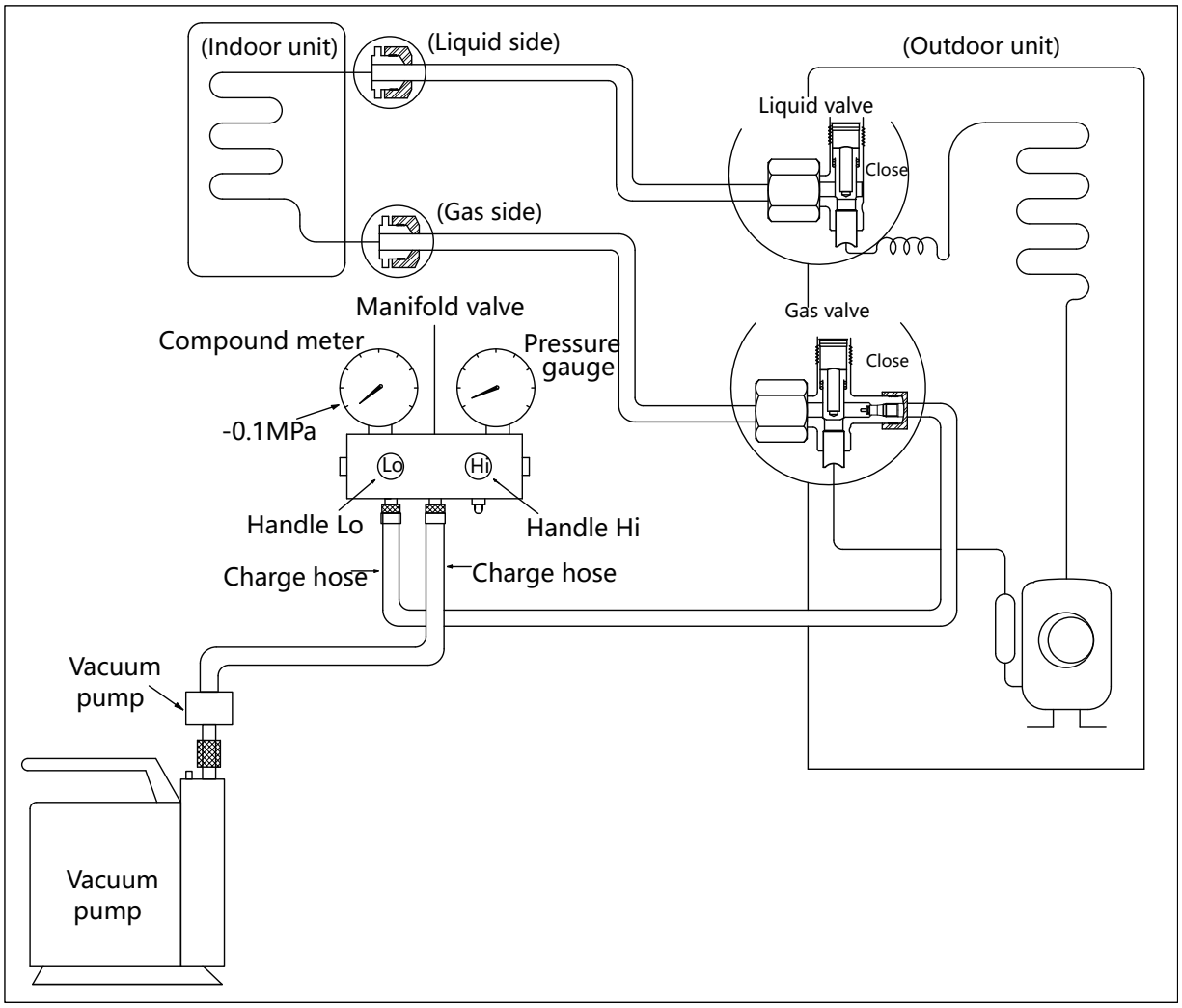
Collecting the refrigerant into the outdoor unit



Procedure:

1. Confirm that the liquid and gas way valves are opened.
2. Connect the charge hose with the push pin of Handle Lo to the gas way valve's gas service port.
3. Open the Handle Lo manifold valve to purge air from the charge hose for 5 seconds and then close it quickly.
4. Close the liquid way valve.
5. Operate the air conditioner in cooling mode. Cease operations when the gauge reaches 0.1 MPa (14.5 Psi).
6. Close the gas way valve so that the gauge rests between 0.3 MPa (43.5 Psi) and 0.5 MPa (72.5 Psi).
7. Disconnect the charge set and mount the caps of service port and liquid and gas way valves.
8. Use a torque wrench to tighten the caps to a torque of 18 N.m.
9. Check for gas leakage.

Air purging with vacuum pump

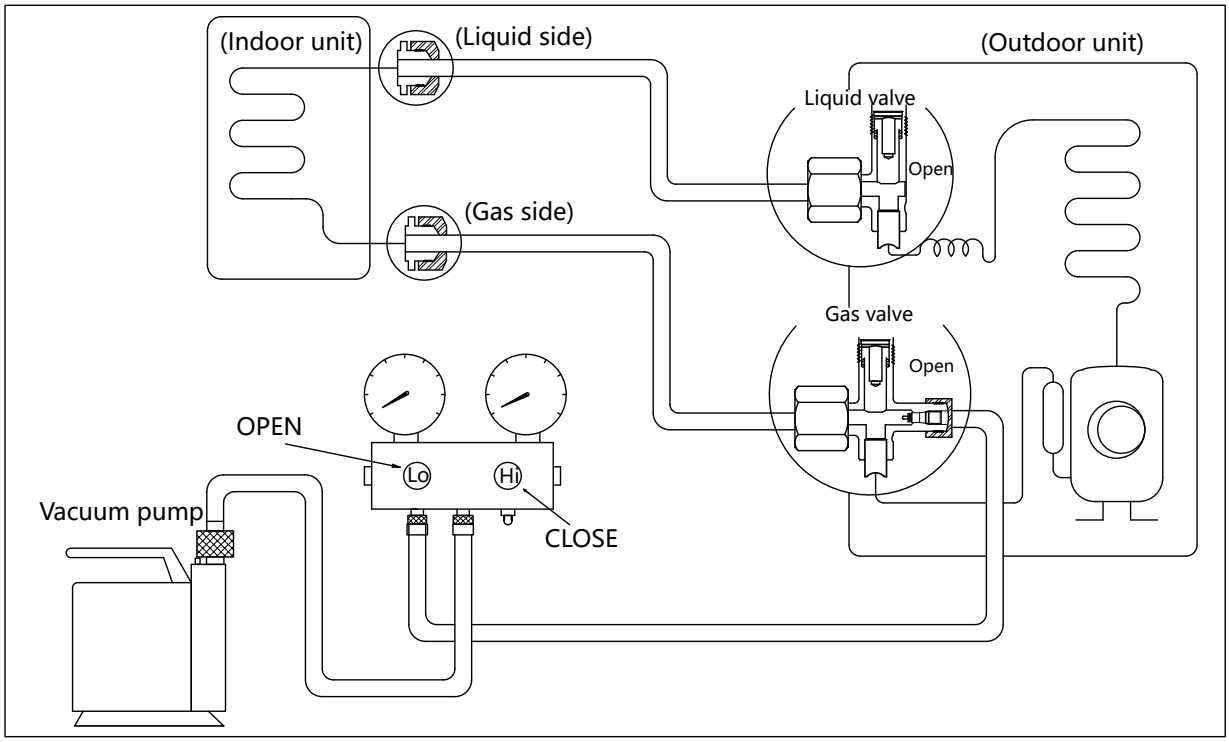


Procedure:

1. Tighten the flare nuts of the indoor and outdoor units, and confirm that both the liquid and gas way valves are closed.
2. Connect the charge hose with the push pin of Handle Lo to the gas service port of the gas way valve.
3. Connect another charge hose to the vacuum pump.
4. Fully open the Handle Lo manifold valve.
5. Using the vacuum pump, evacuate the system for 30 minutes.
   a. Check whether the compound meter indicates -0.1 MPa (14.5 Psi).
      - If the meter does not indicate -0.1 MPa (14.5 Psi) after 30 minutes, continue evacuating for an additional 20 minutes.
      - If the pressure does not achieve -0.1 MPa (14.5 Psi) after 50 minutes, check for leakage.
      - If the pressure successfully reaches -0.1 MPa (14.5 Psi), fully close the Handle Lo valve, then cease vacuum pump operations.
   b. Wait for 5 minutes then check whether the gauge needle moves after turning off the vacuum pump. If the gauge needle moves backward, check wether there is gas leakage.
6. Loosen the flare nut of the gas way valve for 6 or 7 seconds and then tighten the flare nut again.
   a. Confirm the pressure display in the pressure indicator is slightly higher than the atmospheric pressure.
   b. Remove the charge hose from the gas way valve.
7. Fully open the liquid and gas way valves and tighten the cap of the liquid and gas way valves.

2. Outdoor Unit

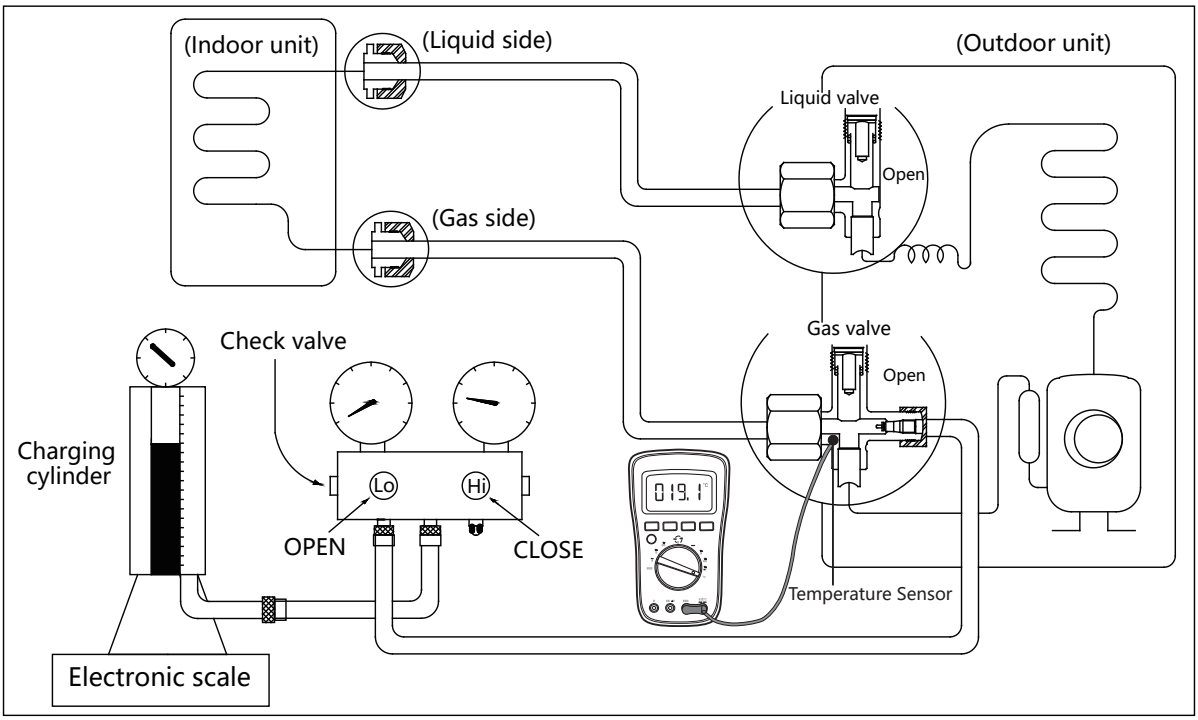
Evacuation for the whole system



Procedure:

1. Confirm that the liquid and gas way valves are opened.
2. Connect the vacuum pump to the gas way valve's service port.
3. Evacuate the system for approximately one hour. Confirm that the compound meter indicates -0.1 MPa (14.5Psi).
4. Close the valve (Low side) on the charge set and turn off the vacuum pump.
5. Wait for 5 minutes then check whether the gauge needle moves after turning off the vacuum pump. If the gauge needle moves backward, check whether there is gas leakage.
6. Disconnect the charge hose from the vacuum pump.
7. Mount the caps of service port and liquid and gas way valves.
8. Use a torque wrench to tighten the caps to a torque of 18 N.m.

Refrigerant charging



Procedure:

1. Close both liquid and gas way valves.
2. Slightly connect the Handle Lo charge hose to the gas way service port.
3. Connect the charge hose to the valve at the bottom of the cylinder.
4. If the refrigerant is R410A/R32, invert the cylinder to ensure a complete liquid charge.
5. Open the valve at the bottom of the cylinder for 5 seconds to purge the air in the charge hose, then fully tighten the charge hose with push pin Handle Lo to the service port of gas way valve..
6. Place the charging cylinder onto an electronic scale and record the starting weight.
7. Fully open the Handle Lo manifold valve, liquid and gas way valves.
8. Operate the air conditioner in cooling mode to charge the system with liquid refrigerant.
9. When the electronic scale displays the correct weight (refer to the gauge and the pressure of the low side to confirm, the value of pressure refers to chapter Appendix), turn off the air conditioner, then disconnect the charge hose from the gas way service port immediately..
10. Mount the caps of service port and liquid and gas way valves.
11. Use a torque wrench to tighten the caps to a torque of 18 N.m.
12. Check for gas leakage.

Note: 1. Mechanical connectors used indoors shall comply with local regulations.

2. When mechanical connectors are reused indoors, sealing parts shall be renewed. When flared joints are reused indoors, the flare part shall be re-fabricated.

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1. Safety Caution

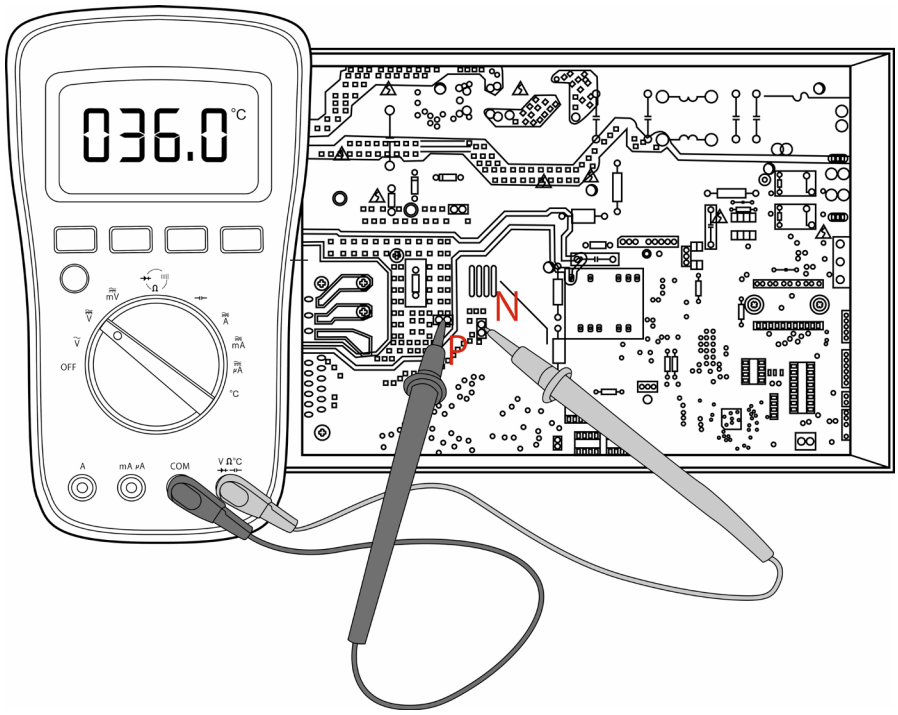
WARNING

Be sure to turn off all power supplies or disconnect all wires to avoid electric shock.
While checking indoor/outdoor PCB, please equip oneself with antistatic gloves or wrist strap to avoid damage to the board.

WARNING

Electricity remains in capacitors even when the power supply is off.
Ensure the capacitors are fully discharged before troubleshooting.

Test the voltage between P and N on back of the main PCB with multimeter. If the voltage is lower than 36V, the capacitors are fully discharged. For models that cannot be measured, wait 5 minutes after the power supply is off to ensure that the capacitors are fully discharged.



Note: This picture is for reference only. Actual appearance may vary.

2. General Troubleshooting

2.1 Error Display (Indoor Unit)

When the indoor unit encounters a recognized error, the operation lamp will flash in a corresponding series, the timer lamp may turn on or begin flashing, and an error code will be displayed. These error codes are described in the following table:

Display	Information	Solution
dF	Defrost	Normal Display, not error code
CL	Active clean	
FP	Heating in room temperature under 8°C	
FC	Forced cooling	
AP	AP mode of WIFI connection	
CP	Remote switched off	
EH00	IDU EEPROM malfunction	page 58
EH0R	IDU EEPROM parameter error	page 58
EL01	IDU & ODU communication error	page 60
EH02	Zero-crossing signal detection error(for some units)	page 62
EH03	IDU fan speed out of control	page 63
EC51	ODU EEPROM parameter error	page 59
EC52	ODU coil temp. sensor (T3) error	page 68
EC53	ODU ambient temp. sensor (T4) error	page 68
EC54	COMP. discharge temp. sensor (TP) error	page 68
EC56	IDU coil outlet temp. sensor (T2B) error(Multi-zone)	page 68
EH60	IDU room temp. sensor (T1) error	page 67
EH61	IDU coil temp. sensor (T2) error	page 67
EC07	ODU fan speed out of control	page 65
EH0b	IDU main control board and display board communication error(for some units)	page 70
EL0C	System lacks refrigerant	page 69
PC00	ODU IPM module protection	page 71
PC01	ODU voltage protection	page 73
PC02	Compressor top (or IPM) temp. protection	page 74
PC04	Inverter compressor drive error	page 71
PC03	Pressure protection(low or high pressure)(for some units)	page 75
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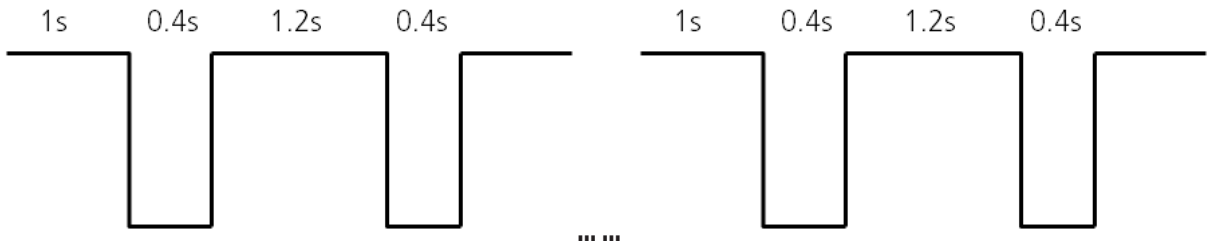
For other errors:

The display board may show a garbled code or a code undefined by the service manual. Ensure that this code is not a temperature reading.

Troubleshooting:

Test the unit using the remote control. If the unit does not respond to the remote, the indoor PCB requires replacement. If the unit responds, the display board requires replacement.

LED flash frequency:



3. Engineering Mode Entry and Setting Methods

3.1 Information Inquiry

In order to enter to the engineering mode, and check the data of the system (data checking mode), Please make the following steps:

- Make sure that the AC is on the standby status, or working normally in a non-locked conditions.
- Press "Power" + "Fan" buttons together for 7s until the remote controller screen shows "0", and also "Auto, Cool, Dry, Heat, Battery " icons will be displayed at the same time.
- Press "Up" or "Down" button to choose different channel number that you want to check (from 0-30) on the remote controller, and then the display will show the parameter value

Channel	Code	Meaning	Remark
0		Error code	Refer to next list of error code Empty means no error
1	T1	Room temperature	Actual data, °C
2	T2	Indoor coil temperature	Actual data,°C
3	T3	Outdoor coil temperature	Actual data, °C
4	T4	Ambient temperature	Actual data, °C
5	TP	Discharge temperature	Actual data,°C
6	FT	Targeted frequency	Actual data
7	Fr	Actual frequency	Actual data
8	dL	Running current	3.2A=3
9	Uo	AC voltage	220V=22*
10	Sn	Reserved	
11	nA	Reserved	
12	Pr	Outdoor fan speed	Actual data/8
13	Lr	EXV opening steps	Actual data/8
14	Ir	Indoor fan speed	Actual data/8
15	Hu	Humidity (if a sensor there)	Actual data, %
16	TT	Set temperature including compensation	Actual data, °C
17	DT	Reserved	
18	tF	Reserved	
19	nA	Reserved	
20	oT	Target Frequency calculated by indoor	Without limitation
21~30	nA	Reserved	

Please note that:

1-The Channel number indicates a certain parameter value (Check the below table).

2-The indoor unit display will show the code for 2s, and then the parameter value.

3-In the engineering mode, the other keys or operations are invalid except for the following buttons "Power", "Up", "Down" and "Ok".

4-In order to exit from the engineering mode, press "Power" + "Fan" buttons together for 2s to quit Checking and back to the home screen.

5-The engineering mode will be exited if there is no valid input data for 60s.

Error code of engineer mode

Display	Error Information
nR	No fault or protection
EH00	IDU EEPROM malfunction
EH0R	IDU EEPROM parameter error
EL01	IDU & ODU communication error
EH6R	Communication error between indoor unit and indoor external fan module
EH30	Parameters error of indoor external fan
EH35	Phase failure of indoor external fan
EH36	Indoor external fan current sampling bias fault
EH37	Indoor external fan zero speed failure
EH38	Indoor external fan stall failure
EH39	Out of step failure of indoor external fan
EH3R	Low voltage protection of indoor external fan DC bus
EH3b	Indoor external fan DC bus voltage is too high fault
EH3E	Indoor external fan overcurrent fault
EH3F	Indoor external fan module protection/hardware overcurrent protection
EH03	IDU fan speed out of control
EC51	ODU EEPROM parameter error
EC52	ODU coil temp. sensor (T3) error
EC53	ODU ambient temp. sensor (T4) error
EC54	COMP. discharge temp. sensor (TP) error
EC55	ODU IPM module temp.sensor(TH) error
EC0d	Outdoor unit malfunction
EH60	IDU room temp. sensor (T1) error
EH61	Evaporator coil temperature sensor T2 is in open circuit or short circuit
EC71	Outdoor external fan overcurrent fault
EC75	Outdoor external fan module protection/hardware overcurrent protection
EC72	Outdoor external fan phase failure
EC74	Outdoor external fan current sampling bias fault
EC73	Zero speed failure of outdoor unit DC fan
EC07	ODU fan speed out of control(
EL0C	System lacks refrigerant
PC00	ODU IPM module protection
PC10	ODU AC voltage too low protection
PC11	ODU DC bus voltage too high protection
PC12	ODU DC bus voltage too low protection
PC02	Compressor top (or IPM) temp. protection

PC40	Communication failure between outdoor unit main control chip and driver chip
PC41	Compressor current sampling circuit failure
PC42	Compressor starting failure
PC43	Compressor lost phrase protection
PC44	Compressor zero speed protection
PC45	Voltage drop
PC46	Compressor speed out of control
PC49	Compressor over current error
PC06	Compressor Discharge pipe high temp. protection
PC08	ODU Current protection
PH09	Anti-cold air in heating mode
PC0F	PFC failure
PC30	System overpressure protection
PC31	System pressure is too low protection
PC03	Pressure protection(low or high pressure)
PC0L	Outdoor low temp. protection
PH90	Evaporator high temp. protection
PH91	Evaporator low temp. protection
PC0R	Condenser high temp. protection
PH0C	Indoor unit humidity sensor malfunction
LH00	Evaporator temp. freq. limited(L0)
LH30	Indoor external fan current freq. limited
LH31	Indoor external fan voltage freq. limited
LC01	Condenser coil temp. (T3) freq. limited
LC02	ODU exhaust temp. (TP) freq. limited
LC05	Voltage freq. limited
LC03	Current freq. limited
LC06	IPM module temp. freq. limited
LC30	High pressure freq. limited
LC31	Low pressure freq. limited
LH07	Remote control frequency limitation in effect
----	IDUs mode conflict(Multi-zone)

3.2 Advanced Function Setting

In order to enter to the engineering mode, and check the advanced function settings, Please make the following steps:

If you want to check the current functions set value (Presetting Page):

1- Firstly, you need to disconnect the power supply from the unit, and wait for 1 minute.

2- Then connect the power supply again to the unit (the unit should be under the standby state).

3- Press "Power" + "Fan" buttons together for 7s until the remote controller screen shows "0", and also "Auto, Cool, Dry, Heat, Battery " icons will be displayed at the same time.

4- Press "Up" or "Down" button to choose different channel number that you want to check (from 0-30) on the remote controller.

5- Then Press "Power" button for 2s until the remote controller screen shows "Ch" .

6- Press "OK" button to query the current function set value while the remote controller shows "Ch", and the function set value will be shown on the indoor unit display.

If you want to change the current functions set value:

1- Firstly, you need to disconnect the power supply from the unit, and wait for 1 minute.

2- Then connect the power supply again to the unit (the unit should be under the standby state).

3- Press "Power" + "Fan" buttons together for 7s until the remote controller screen shows "0", and also "Auto, Cool, Dry, Heat, Battery " icons will be displayed at the same time.

4- Press "Up" or "Down" button to choose different channel number that you want to change (from 0-30) on the remote controller.

5- Then Press "Power" button for 2s until the remote controller screen shows "Ch".

6- Press "Up" or "Down" button to choose the desired set value from the screen of the remote control.

7- Then Press "OK" to send the new set value to the indoor unit, and the indoor unit will display "CS", which means that the new set value is uploaded successfully.

8- Finally, disconnect the power supply again from the unit, and wait for 10 minutes, then connect it again.

Please note that:

1- The Channel number indicates a certain function, and each number will be showed on the indoor unit screen indicates the current function set value (Check the below table).

2- In the engineering mode, the other keys or operations are invalid except for the following buttons "Power", "Up", "Down" , and "Ok".

3- In order to set a new set value successfully, you need to finish the steps (from 2 to 7) within 1 minute only.

4- The engineering mode will be exited if there is no valid input data for 60s.

5- In order to exit from the engineering mode, Pleas follow the following steps:

- Press "Power" button for 2s press until the remote controller screen shows "0".
- Then Press "Power" + "Fan" buttons together for 2s to quit the engineering mode and back to the home screen.

Channel	Function	Parameter Value Meaning	Remark
0	/	Nothing to set	
1	Auto-restart function	0 – Inactive 1 – Active	
2	Fan control when Ts reached	1- Fan stop 2 - Fan runs at lowest RPM 3 - Fan runs at setting RPM 4 - Fan stops for 4 mins and runs for 1min 5 - Fan stops for 8 mins and runs for 1min 6 - Fan stops for 16 mins and runs for 1min 7 - Fan stops for 24 mins and runs for 1min 8 - Fan stops for 48 mins and runs for 1min 9 - Fan stops for 15 mins and runs for 2.5min 10 - Fan stops for 30 mins and runs for 2.5min 11 - Fan stops for 60 mins and runs for 2.5min 12 - Fan runs at setting RPM, but stop if choose Automatic speed 13 - Fan runs at the lowest speed, but stop if choose Automatic speed	
3	Mode lock	CH–Cooling and heating (all modes) HH–Heating only (Heating + Fan only) CC–Cooling only (Cooling + Drying + Fan only) nU–Cooling and heating without Auto	Remote controller will change as well.
4	Lowest setting temperature	16-24	Remote controller will change as well.
5	Highest setting temperature	25-30	Remote controller will change as well.
6	Mode priority selection for multi units	H – Heating first C – Cooling first	
7	/	Nothing to set	
8	/	Nothing to set	
9	/	Nothing to set	
10	/	Nothing to set	
11	Min. frequency limitation in cooling mode	10, 11, 12, …, 49, 50, -- (Cancel)	
12	Min. frequency limitation in heating mode	10, 11, 12, …, 49, 50, -- (Cancel)	

13	Max frequency selection in T4 limitation of Zone6	20, 21, 22, …, 149, 150, -- (Cancel)	
14	/	Nothing to set	
15	Frequency selection of outdoor forced-operation	10, 11, 12, …, 249, 250, -- (Cancel)	
16	One button reset	rS – Reset	
17	nA	Nothing to set	
18	nA	Nothing to set	
19	Max. frequency selection in cooling mode	40, 41, 42, …, 83, 84, -- (Cancel)	
20	Max. frequency selection in heating mode	40, 41, 42, …, 83, 84, -- (Cancel)	Without limitation
21	Cooling temperature compensation	-3.0, -2.5, -2.0, …, 3.0, 3.5, -- (Cancel)	
22	Heating temperature compensation	-6.5, -6.0, -5.5, …, 0.5, 1.0, 1.5, …, 7.0, 7.5, -- (Cancel)	
23	Max. fan speed selection in cooling	-41, -40, -39, …, 19, 20, -- (Cancel)	
24	Min. fan speed selection in cooling	-41, -40, -39, …, 19, 20, -- (Cancel)	
25	Max. fan selection in heating	-41, -40, -39, …, 19, 20, -- (Cancel)	
26	Min. fan speed selection in heating	-41, -40, -39, …, 19, 20, -- (Cancel)	
27	Reserved	Nothing to set	
28	Anti-cold air Stop Fan Temperature	16~28	
29	Reserved	Nothing to set	
30	Reserved	Nothing to set	

4. Error Diagnosis and Troubleshooting Without Error Code

WARNING

Be sure to turn off unit before any maintenance to prevent damage or injury.

4.1 Remote maintenance

SUGGESTION: When troubles occur, please check the following points with customers before field maintenance.

1.Remote Maintenance	Electrical Circuit										Refrigerant Circuit							Others				
Possible causes of trouble	Power failure	The main power tripped	Loose connections	Shorted or broken wires	Safety device opens	Faulty transformer	Low voltage	The remote control is powered off	Broken the remote control	Fan mode	Dirty air filte	Dirty condenser fins	Dirty evaporator coil	The setting temperature is higher/lower than the room's(cooling/heating)	The ambient temperature is too high/low when the mode is cooling/heating	Frosting and defrosting frequently	High pressure of system	Heavy load condition	Loosen hold down bolts and / or screws	Bad airproof	The outlet of the outdoor unit was blocked	Shipping plates remain attached
Unit will not start	☆	☆	☆	☆	☆	☆																
the power switch is on but fans will not start			☆	☆	☆																	
the tempreture on the playboard cannot be setted								☆	☆													
Unit is on but the wind is not cold(hot)				☆	☆					☆				☆	☆							
Unit runs, but shortly stops							☆							☆	☆		☆					
the unit startup and stop frequently							☆								☆	☆					☆	
Unit runs continuously but insufficient cooling(heating)											☆	☆	☆		☆			☆		☆	☆	
cool can not change to heat																	☆					
Unit is noisy																			☆			☆
Test method / remedy	Test voltage	Close the power switch	Inspect connections - tighten	Test circuits with tester	Test continuity of safety device	Change the transformer	Test voltage	Replace the battery of the remote control	Replace the remote control	Adjust to cool mode	Clean or replace	Clean	Clean coil	Adjust the setting temperature	Turn on the AC later	Turn on the AC later	Turn on the AC later	Check heat load	Tighten bolts or screws	Close all the windows and doors	Remove the obstacles	Remove them

4.2 Field maintenance

2.Field Maintenance	Electrical Circuit														Refrigerant Circuit																Others				
Possible causes of trouble	Power failure	Blown fuse or varistor	Loose connections	Shorted or broken wires	Safety device opens	Faulty thermostat / room temperature sensor	Wrong setting place of temperature sensor	Faulty transformer	Faulty magnetic contactor for compressor	Faulty magnetic contactor for fan	Low voltage	Faulty stepping motor	Shorted or grounded compressor	Shorted or grounded fan motor	Compressor stuck	Shortage of refrigerant	Restricted liquid line	Dirty air filter	Dirty evaporator coil	Insufficient air through evaporator coil	Overcharge of refrigerant	Dirty or partially blocked condenser	Air or noncodensable gas in refrigerant cycle	Short cycling of condensing air	High temperature condensing medium	Insufficient condensing medium	Broken compressor internal parts	Inefficient compressor	Expansion valve obstructed	Expansion valve or capillary tube closed completely	Leaking power element on expansion valve	Poor installation of feeler bulb	Heavy load condition	Loosen hold down bolts and / or screws	Shipping plates remain attached	Poor choices of capacity	Contact of piping with other piping or external plate
Unit will not start	☆	☆	☆	☆	☆			☆																											
Compressor will not start but fans run				☆		☆			☆				☆		☆																				
Compressor and condenser (outdoor) fan will not start				☆		☆			☆																										
Evaporator (indoor) fan will not start				☆						☆				☆																					
Condenser (Outdoor) fan will not start				☆		☆				☆				☆																					
Unit runs, but shortly stops									☆		☆					☆	☆				☆	☆								☆	☆				
Compressor short-cycles due to overload									☆		☆					☆					☆	☆													
High discharge pressure																					☆	☆	☆	☆	☆	☆									
Low discharge pressure																☆												☆							
High suction pressure																					☆							☆				☆	☆		
Low suction pressure																☆	☆	☆	☆	☆									☆	☆	☆				
Unit runs continuously but insufficient cooling																☆	☆	☆	☆	☆		☆	☆	☆				☆				☆		☆	
Too cool						☆	☆																												
Compressor is noisy																					☆						☆						☆	☆	
horizontal louver can not revolve			☆	☆								☆																							
Test method / remedy	Test voltage	Inspect fuse type & size	Inspect connections - tighten	Test circuits with tester	Test continuity of safety device	Test continuity of thermostat / sensor & wiring	Place the temperature sensor at the central of the air inlet grille	Check control circuit with tester	Test coninuity of coil & contacts	Test coninuity of coil & contacts	Test voltage	Replace the stepping motor	Check resistance with meger tester	Check resistance with meger tester	Replace the compressor	Leak test	Replace restricted part	Clean or replace	Clean coil	Check fan	Change charged refrigerant volume	Clean condenser or remove obstacle	Purge, evacuate and recharge	Remove obstruction to air folow	Remove obstruction in air or water flow	Remove obstruction in air or water flow	Replace compressor	Test compressor efficiency	Replace valve	Replace valve	Replace valve	Fix feeler bulb	Check heat load	Tighten bolts or screws	Remove them	Choose AC of lager capacity or add the number of AC	Rectify piping so as not to contact each other or with external plate

5. Quick Maintenance by Error Code

If you do not have the time to test which specific parts are faulty, you can directly change the required parts according the error code.

You can find the parts to replace by error code in the following table.

Part requiring replacement	Error Code								
	EH00/ EH0R	EL01	EH02	EH03	EH60	EH61	EH0b	EL0C	EC56
Indoor PCB	✓	✓	✓	✓	✓	✓	✓	✓	x
Outdoor PCB	x	✓	x	x	x	x	x	x	✓
Display board	x	x	x	x	x	x	✓	x	x
Indoor fan motor	x	x	x	✓	x	x	x	x	x
T1 sensor	x	x	x	x	✓	x	x	x	x
T2 Sensor	x	x	x	x	x	✓	x	✓	x
T2B Sensor	x	x	x	x	x	x	x	x	✓
Refrigerant sensor	x	x	x	x	x	x	x	x	x
Reactor	x	✓	x	x	x	x	x	x	x
Compressor	x	x	x	x	x	x	x	x	x
Additional refrigerant	x	x	x	x	x	x	x	✓	x

Part requiring replacement	EC53	EC52	EC54	EC51	EC07	PC00	PC01	PC02	PC03	PC04
Outdoor PCB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Indoor fan motor	x	x	x	x	x	x	x	x	x	x
Outdoor fan motor	x	x	x	x	✓	✓	x	✓	x	✓
T3 Sensor	x	✓	x	x	x	x	x	x	x	x
T4 Sensor	✓	x	x	x	x	x	x	x	x	x
TP Sensor	x	x	✓	x	x	x	x	x	x	x
Reactor	x	x	x	x	x	x	✓	x	x	x
Compressor	x	x	x	x	x	✓	x	x	x	✓
IPM module board	x	x	x	x	x	✓	✓	✓	x	✓
High pressure protector	x	x	x	x	x	x	x	✓	x	x
Low pressure protector	x	x	x	x	x	x	x	x	✓	x
Additional refrigerant	x	x	x	x	x	x	x	x	✓	x

6. Troubleshooting by Error Code

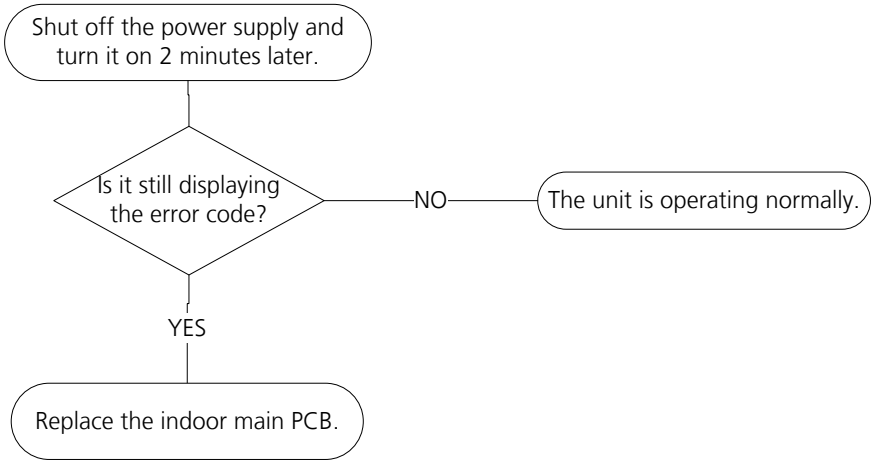
6.1 EH00/ EH0A(IDU EEPROM malfunction or IDU EEPROM parameter error) diagnosis and solution

Description: Indoor PCB main chip does not receive feedback from EEPROM chip.

Recommended parts to prepare:

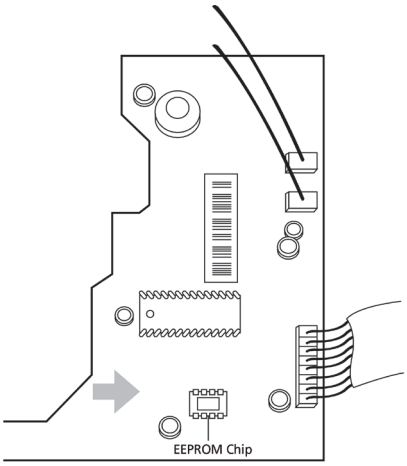
- Indoor PCB

Troubleshooting and repair:



Remarks:
EEPROM: A read-only memory whose contents can be erased and reprogrammed using a pulsed voltage.

The location of the EEPROM chip on the indoor PCB is shown in the following image:



Note: This pictures are only for reference, actual appearance may vary.

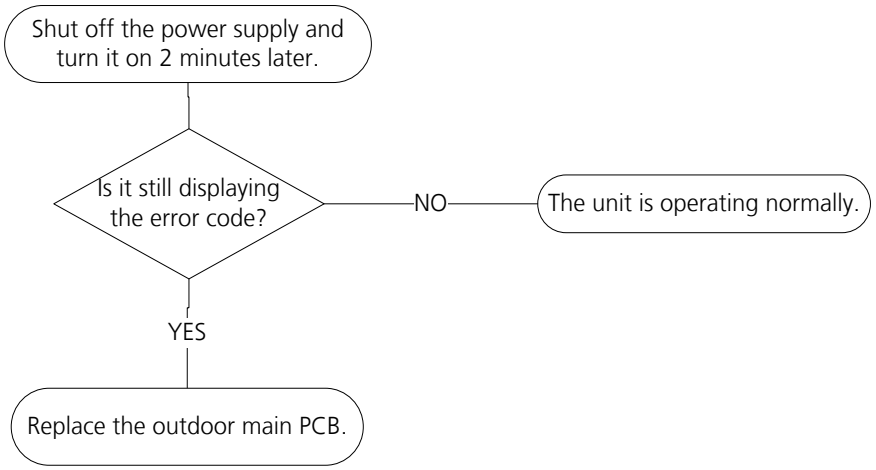
6.2 EC51(ODU EEPROM parameter error) diagnosis and solution

Description: Outdoor PCB main chip does not receive feedback from EEPROM chip.

Recommended parts to prepare:

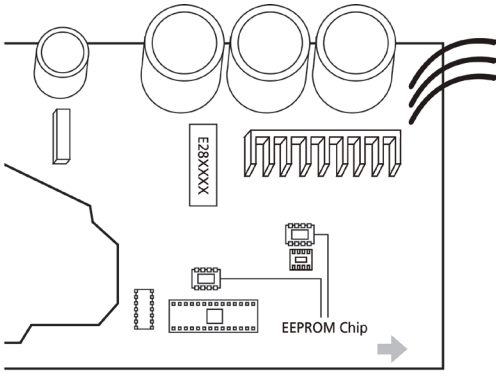
- Outdoor PCB

Troubleshooting and repair:



Remarks:
EEPROM: A read-only memory whose contents can be erased and reprogrammed using a pulsed voltage.

The location of the EEPROM chip on the outdoor PCB is shown in the following image:



This pictures are only for reference, actual appearance may vary.

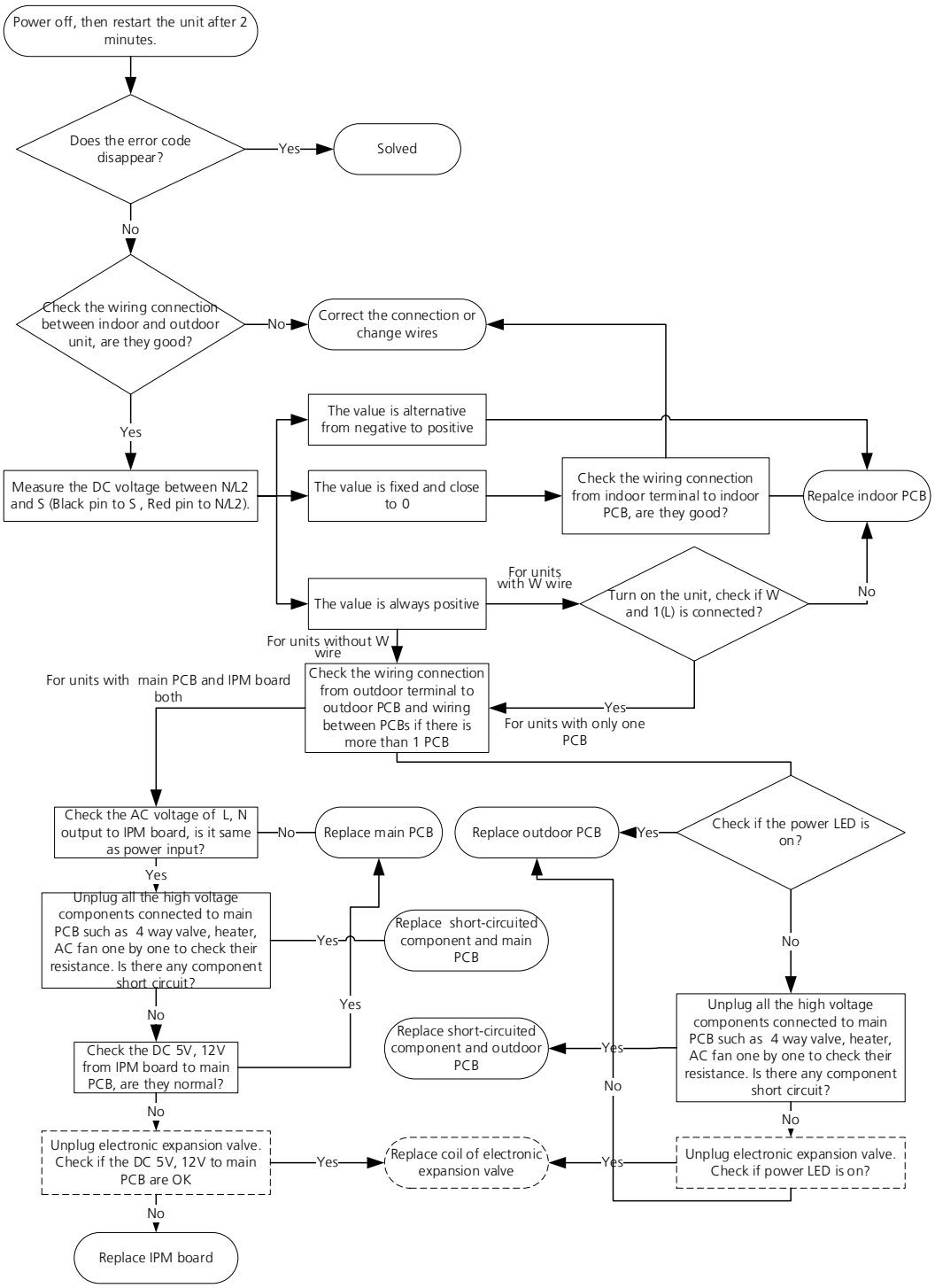
6.3 EL01(IDU & ODU communication error) diagnosis and solution

Description: Indoor unit can not communicate with outdoor unit

Recommended parts to prepare:

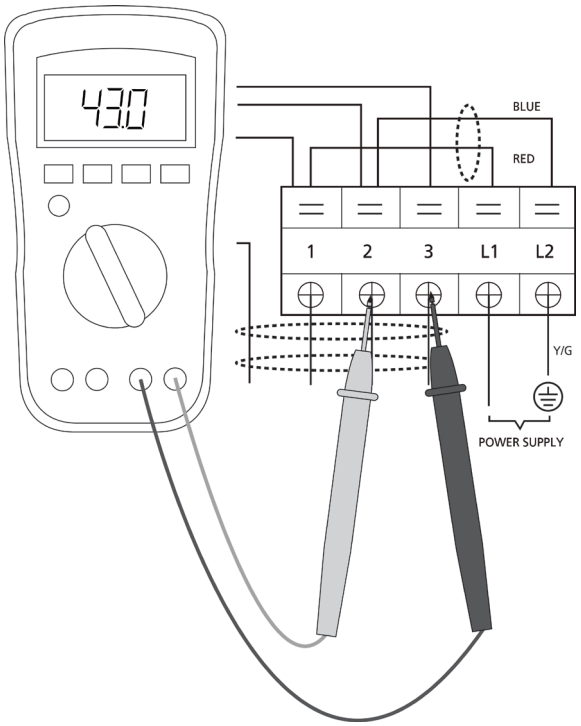
- Indoor PCB
- Outdoor PCB
- Short-circuited component

Troubleshooting and repair:



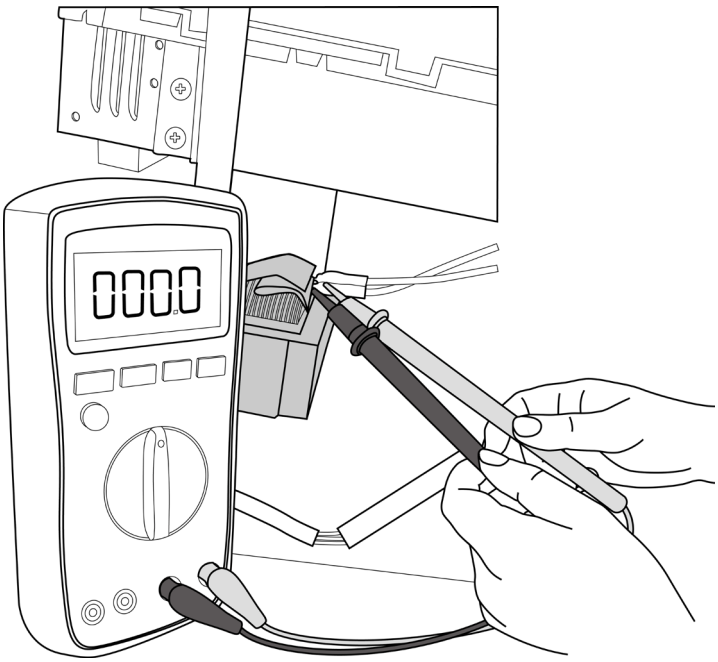
Remarks:

- Use a multimeter to test the DC voltage between 2 port(or S or L2 port) and 3 port(or N or S port) of outdoor unit. The red pin of multimeter connects with 2 port(or S or L2 port) while the black pin is for 3 port(or N or S port) .
- When AC is normal running, the voltage will move alternately between -25V to 25V.
- If the outdoor unit has malfunction, the voltage will move alternately with positive value.
- While if the indoor unit has malfunction, the voltage will be a certain value.



S and N or L2 and S or 2 and 3

- Use a multimeter to test the resistance of the reactor which does not connect with capacitor.
- The normal value should be around zero ohm. Otherwise, the reactor must have malfunction.



Note: The picture and the value are only for reference, actual condition and specific value may vary.

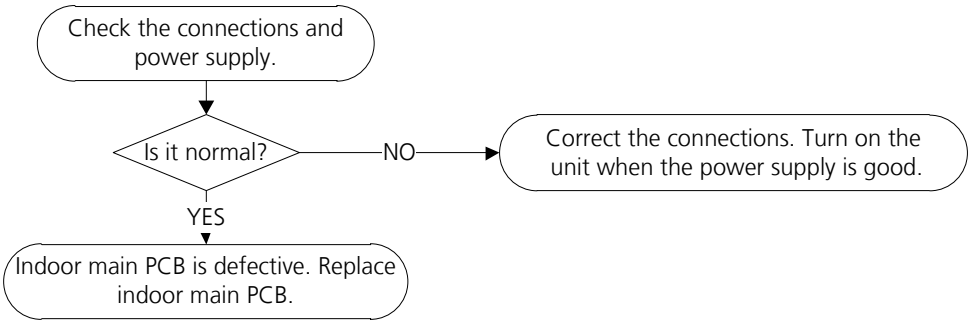
6.4 EH02(Zero crossing detection error) diagnosis and solution

Description: When PCB does not receive zero crossing signal feedback for 4 minutes or the zero crossing signal time interval is abnormal.

Recommended parts to prepare:

- Connection wires
- Indoor main PCB

Troubleshooting and repair:



Note: Zero crossing detection error is only valid for the unit with AC fan motor, for other models, this error is invalid.

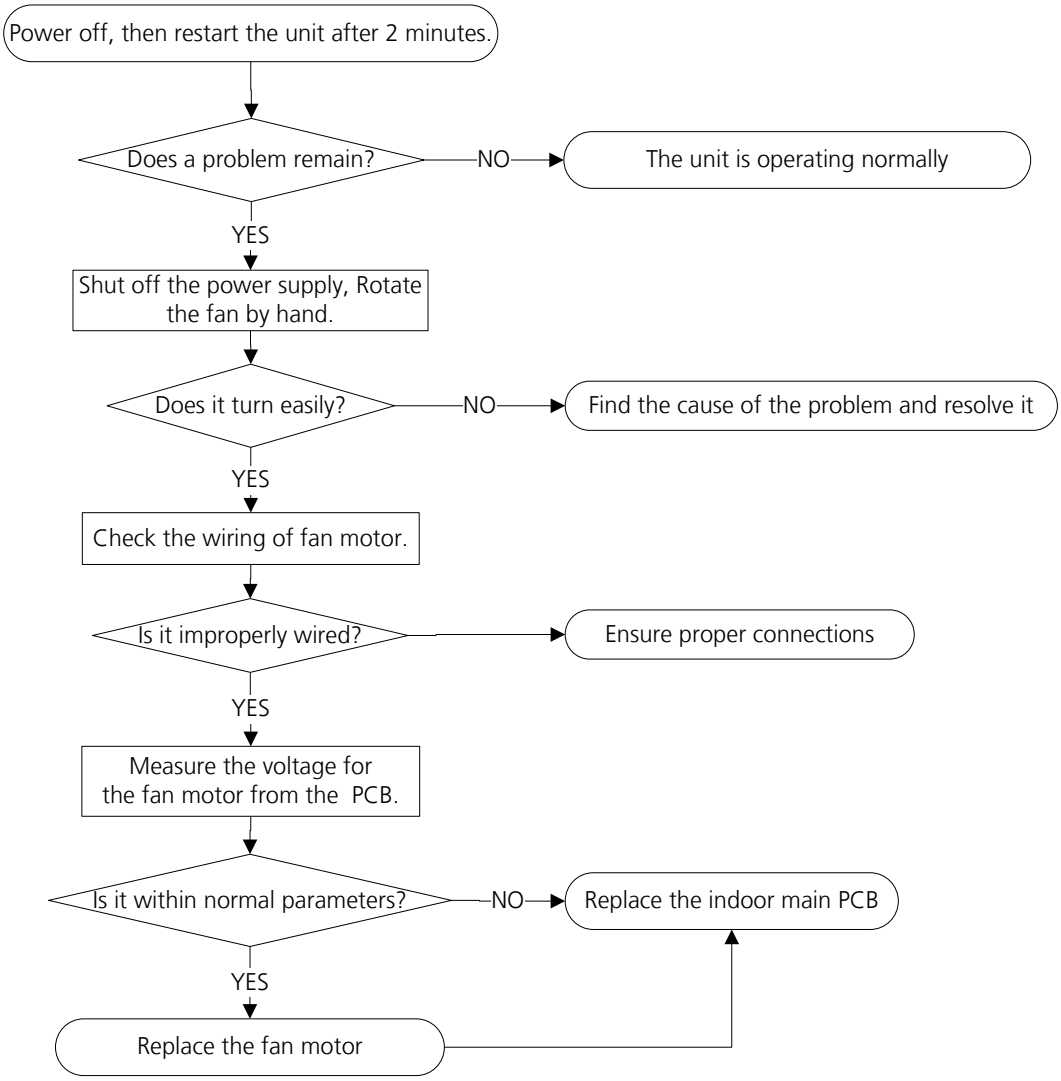
6.5 EH03(IDU fan speed out of control) diagnosis and solution

Description: When indoor fan speed keeps too low or too high for a certain time, the LED displays the failure code and the AC turns off.

Recommended parts to prepare:

- Connection wires
- Fan assembly
- Fan motor
- Indoor main PCB

Troubleshooting and repair:



Index:

1. Indoor DC Fan Motor(control chip is in fan motor)

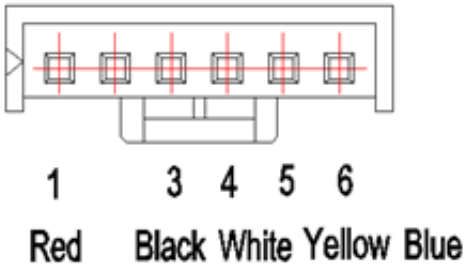
Power on and when the unit is in standby, measure the voltage of pin1-pin3, pin4-pin3 in fan motor connector. If the value of the voltage is not in the range showing in below table, the PCB must has problems and need to be replaced.

- DC motor voltage input and output (voltage: 220-240V~):

No.	Color	Signal	Voltage
1	Red	Vs/Vm	192V~380V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	14-17.5V
5	Yellow	Vsp	0~5.6V
6	Blue	FG	14-17.5V

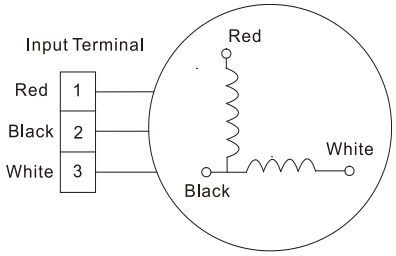
- DC motor voltage input and output (voltage: 115V~):

No.	Color	Signal	Voltage
1	Red	Vs/Vm	140V~190V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	14-17.5V
5	Yellow	Vsp	0~5.6V
6	Blue	FG	14-17.5V



2. Indoor AC Motor

1) Power on and set the unit running in fan mode at high fan speed. After running for 15 seconds, measure the voltage of pin1 and pin2. If the value of the voltage is less than 100V(208~240V power supply) or 50V (115V power supply), the PCB must has problems and need to be replaced.



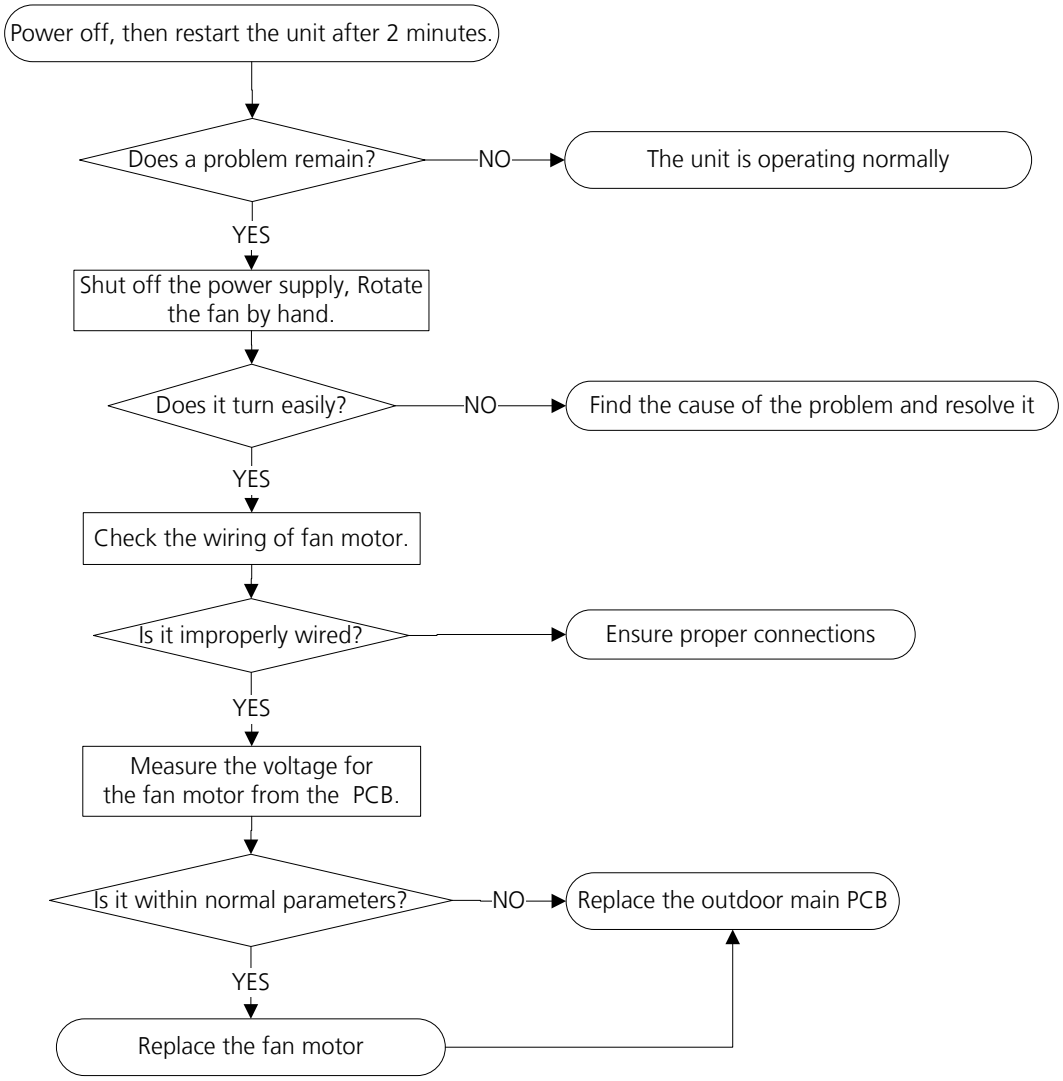
6.6 EC07(ODU fan speed out of control) diagnosis and solution

Description: When outdoor fan speed keeps too low or too high for a certain time, the LED displays the failure code and the AC turns off.

Recommended parts to prepare:

- Connection wires
- Fan assembly
- Fan motor
- Outdoor main PCB

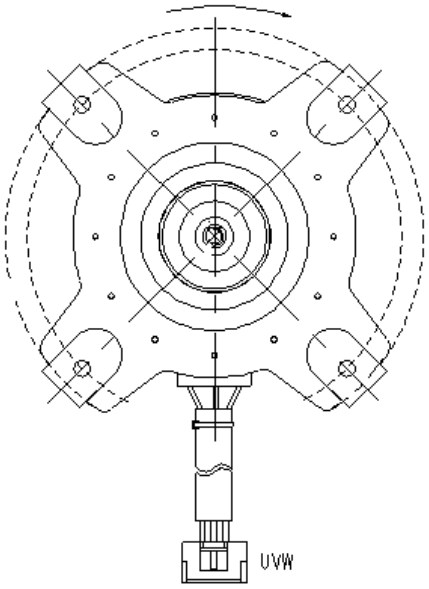
Troubleshooting and repair:



Index:

1. Outdoor DC Fan Motor (control chip is in outdoor PCB)

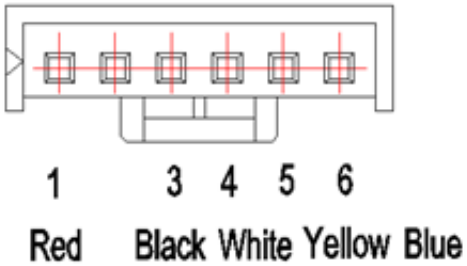
Release the UVW connector. Measure the resistance of U-V, U-W, V-W. If the resistance is not equal to each other, the fan motor must has problems and need to be replaced. otherwise the PCB must has problems and need to be replaced.



2. DC Fan Motor(control chip is in fan motor, single fan)

Power on and when the unit is in standby, measure the voltage of pin1-pin3, pin4-pin3 in fan motor connector. If the value of the voltage is not in the range showing in below table, the PCB must has problems and need to be replaced.

No.	Color	Signal	Voltage
1	Red	Vs/Vm	192V~380V
2	---	---	---
3	Black	GND	0V
4	White	Vcc	13.5-16.5V
5	Yellow	Vsp	0~6.5V
6	Blue	FG	13.5-16.5V



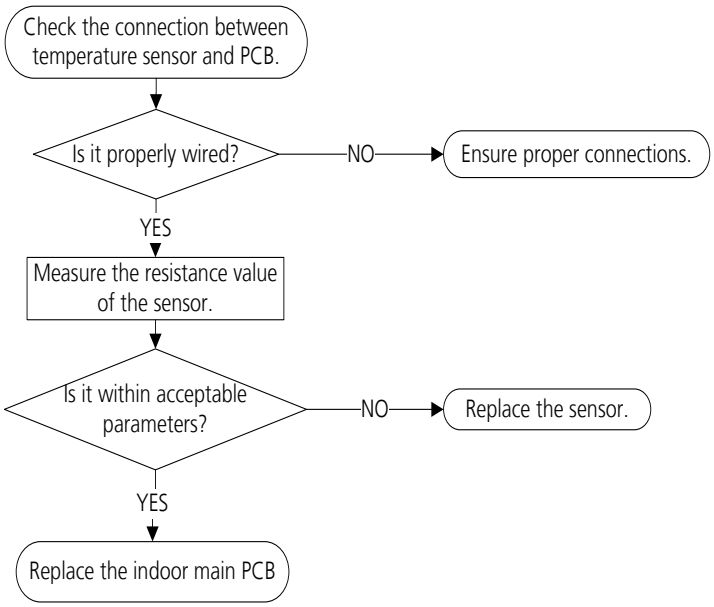
6.7 EH60/EH61(Open circuit or short circuit of indoor temperature sensor(T1, T2)) diagnosis and solution

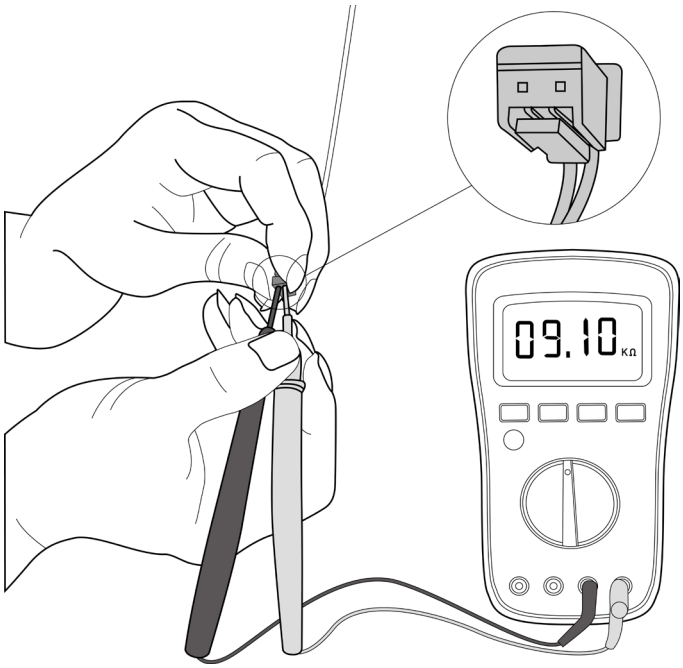
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED displays the failure code.

Recommended parts to prepare:

- Connection wires
- Sensors
- Indoor main PCB

Troubleshooting and repair:





Note: This picture and the value are only for reference, actual appearance and value may vary.

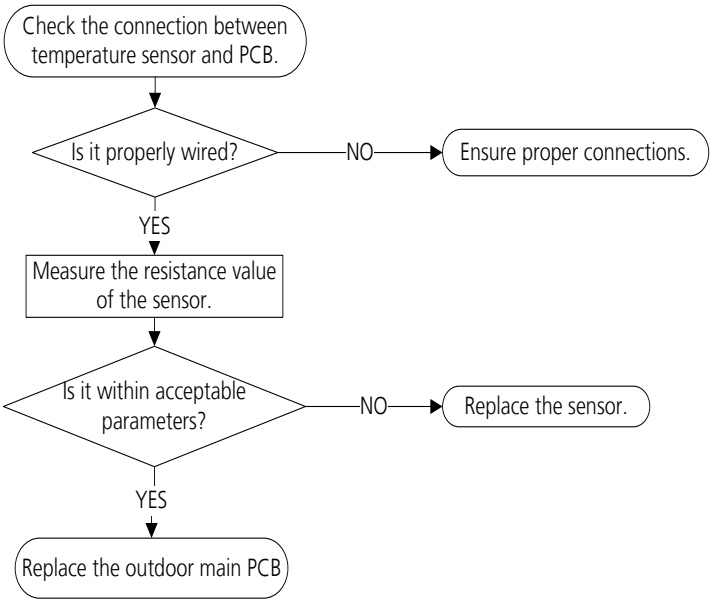
6.8 EC52/EC53/EC54/EC56(Open circuit or short circuit of outdoor temperature sensor(T3, T4, TP, T2B)) diagnosis and solution

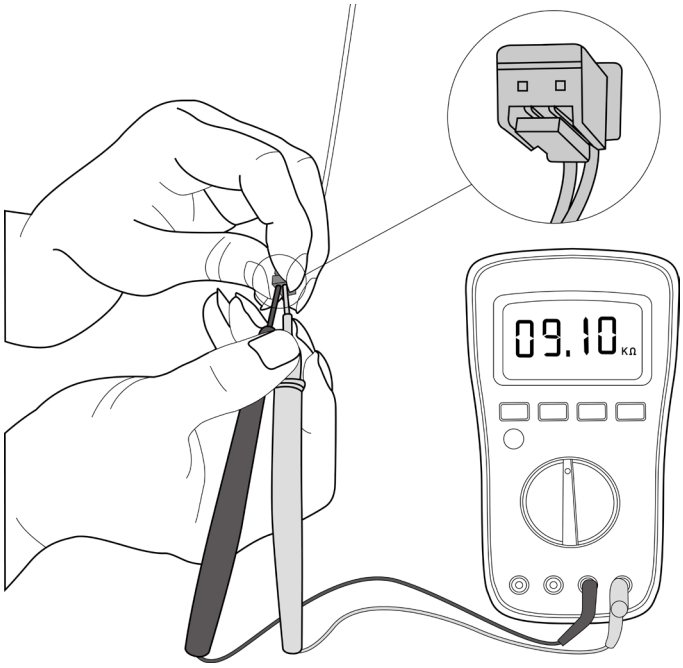
Description: If the sampling voltage is lower than 0.06V or higher than 4.94V, the LED displays the failure code.

Recommended parts to prepare:

- Connection wires
- Sensors
- Outdoor main PCB

Troubleshooting and repair:





For certain models, outdoor unit uses combination sensor, T3,T4 and TP are the same of sensor. This picture and the value are only for reference, actual appearance and value may vary.

6.9 EL0C(System lacks refrigerant) diagnosis and solution

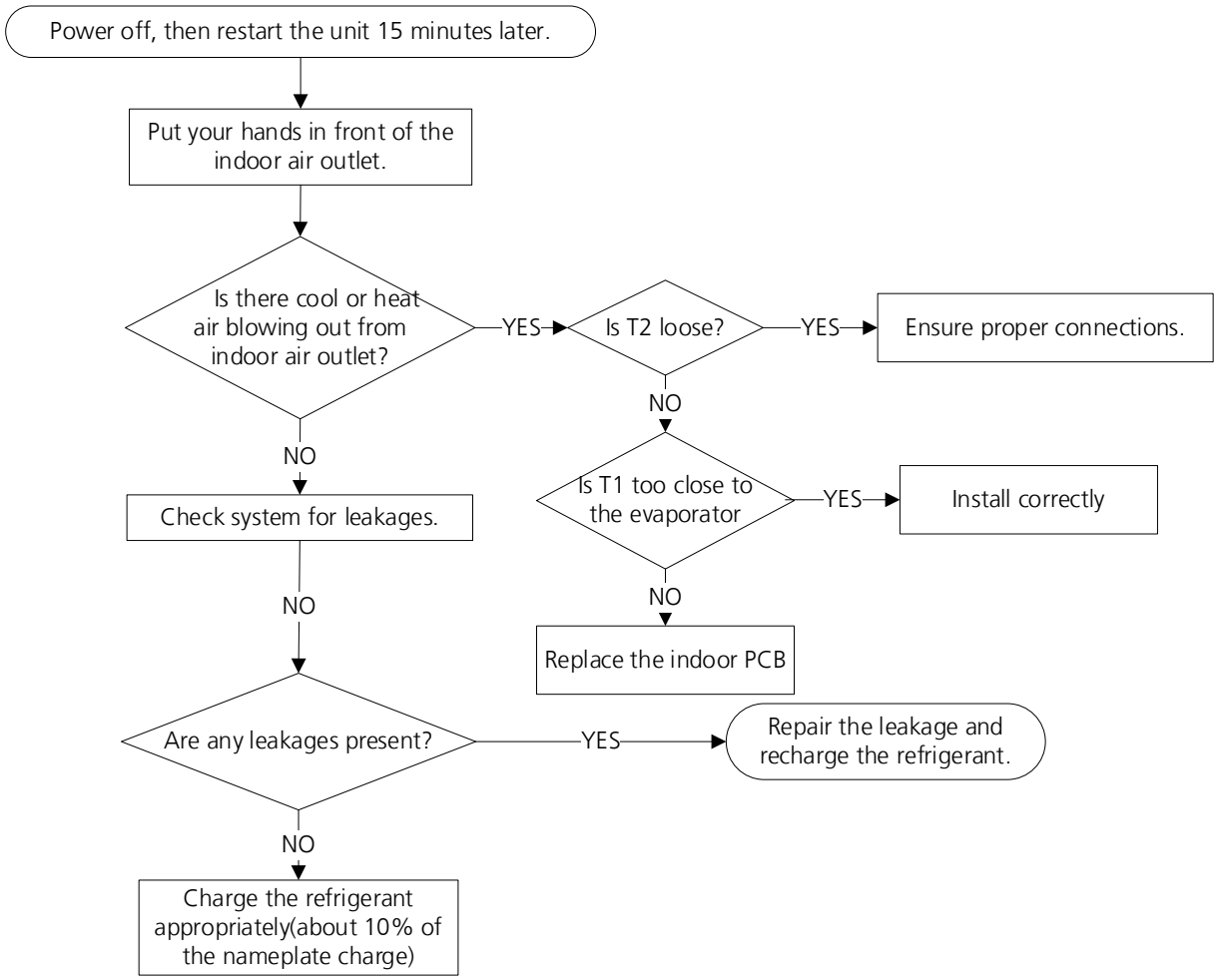
Description:

Judging the abnormality of the refrigeration system according to the number of compressor stops and the changes in operating parameters caused by excessive exhaust temperature.

Recommended parts to prepare:

- Indoor PCB
- Additional refrigerant

Troubleshooting and repair:



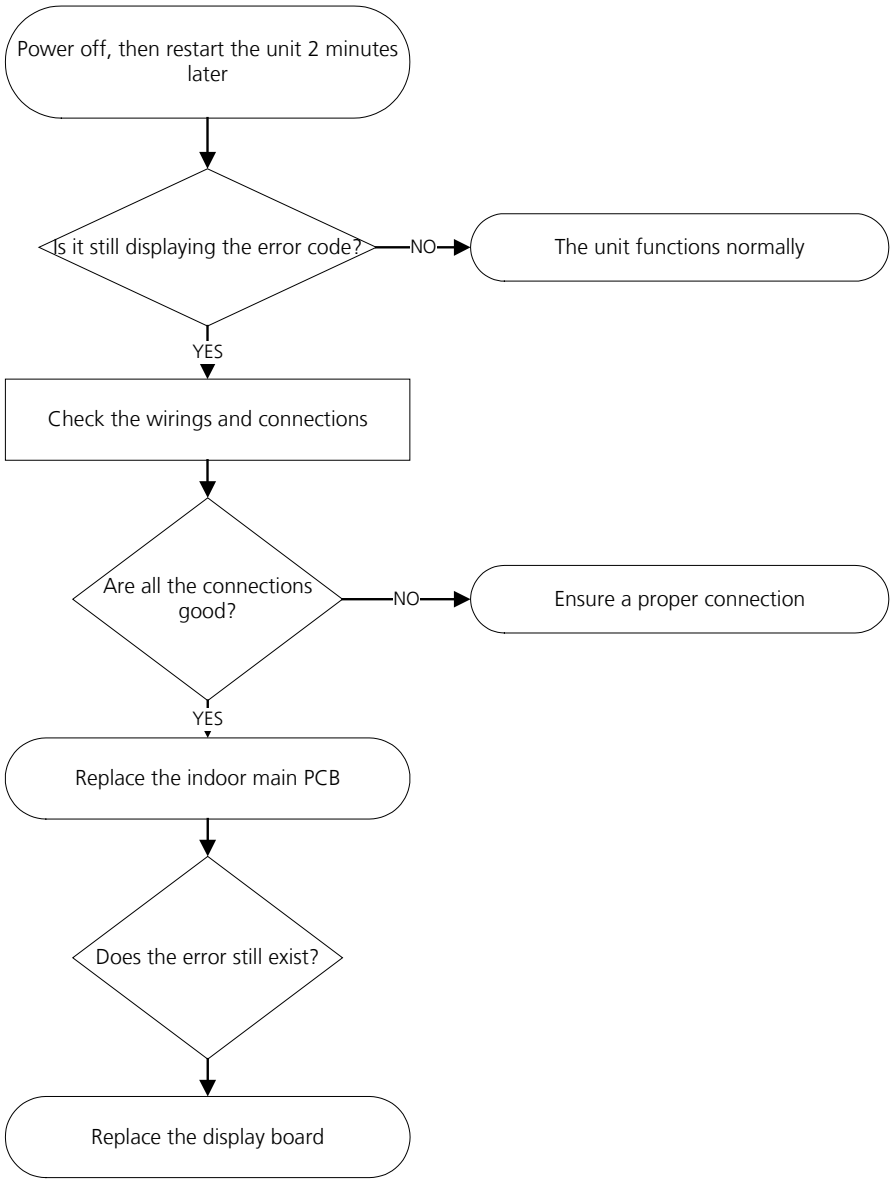
6.10 EH0b(IDU main control board and display board communication error) diagnosis and solution

Description: Indoor PCB does not receive feedback from the display board.

Recommended parts to prepare:

- Communication wire
- Indoor PCB
- Display board

Troubleshooting and repair:



6.11 PC00(ODU IPM module protection)/PC04(Inverter compressor drive error) Diagnosis and Solution

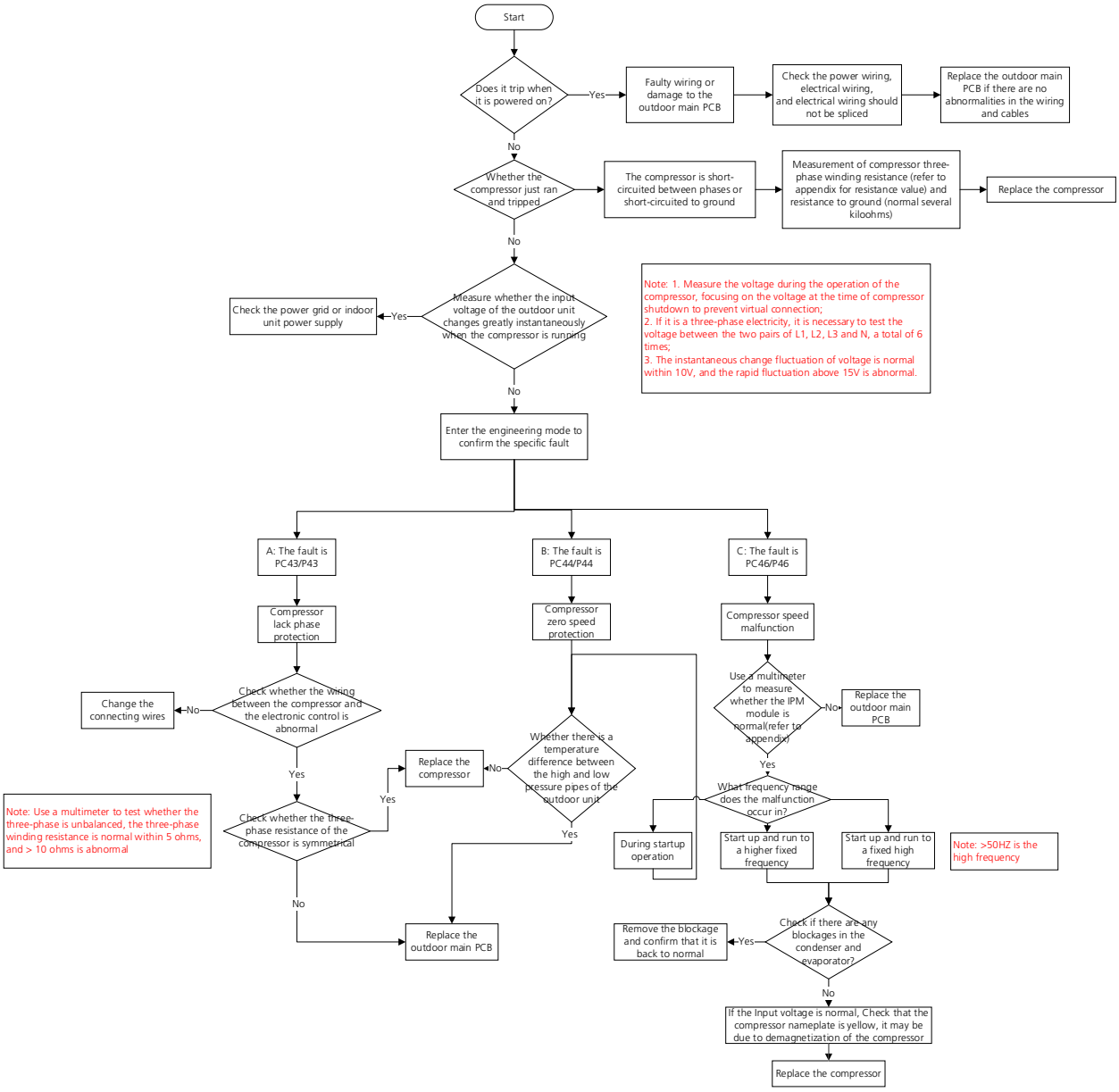
Description**:** When the voltage signal the IPM sends to the compressor drive chip is abnormal, the display LED shows "PC00" and the AC turn off.

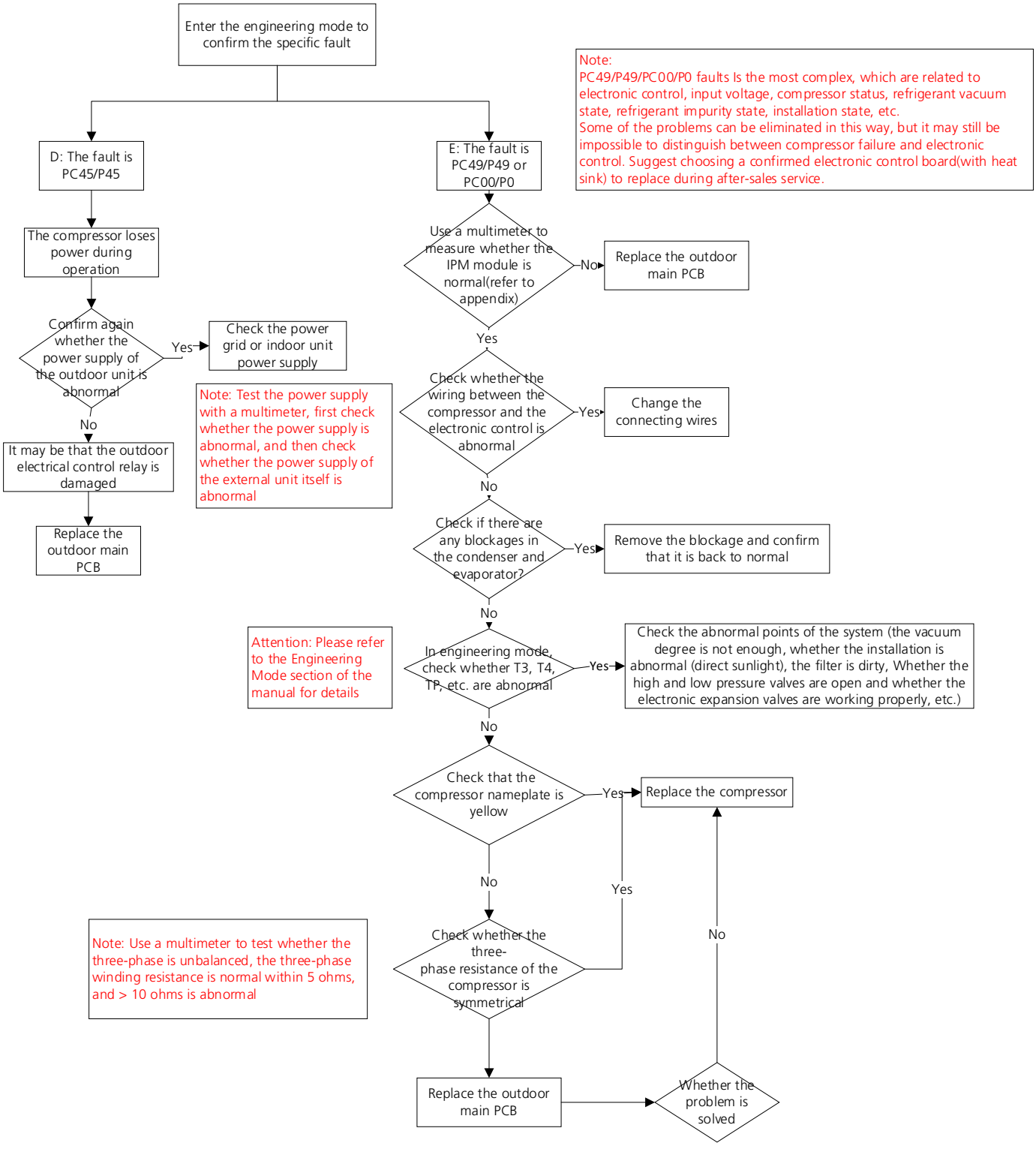
Or an abnormal inverter compressor drive is detected by a special detection circuit, including communication signal detection, voltage detection, compressor rotation speed signal detection and so on.

Recommended parts to prepare:

- Connection wires
- IPM module board
- Outdoor fan assembly
- Compressor
- Outdoor PCB

Troubleshooting and repair:




Enter the engineering mode to confirm the specific fault
D: The fault is PC45/P45
E: The fault is PC49/P49 or PC00/P0
Note:
PC49/P49/PC00/P0 faults Is the most complex, which are related to electronic control, input voltage, compressor status, refrigerant vacuum state, refrigerant impurity state, installation state, etc.
Some of the problems can be eliminated in this way, but it may still be impossible to distinguish between compressor failure and electronic control. Suggest choosing a confirmed electronic control board(with heat sink) to replace during after-sales service.
The compressor loses power during operation
Confirm again whether the power supply of the outdoor unit is abnormal
Yes
Check the power grid or indoor unit power supply
Note: Test the power supply with a multimeter, first check whether the power supply is abnormal, and then check whether the power supply of the external unit itself is abnormal
No
It may be that the outdoor electrical control relay is damaged
Replace the outdoor main PCB
Use a multimeter to measure whether the IPM module is normal(refer to appendix)
No
Replace the outdoor main PCB
Yes
Check whether the wiring between the compressor and the electronic control is abnormal
Yes
Change the connecting wires
No
Check if there are any blockages in the condenser and evaporator?
Yes
Remove the blockage and confirm that it is back to normal
No
Attention: Please refer to the Engineering Mode section of the manual for details
In engineering mode, check whether T3, T4, TP, etc. are abnormal
Yes
Check the abnormal points of the system (the vacuum degree is not enough, whether the installation is abnormal (direct sunlight), the filter is dirty, Whether the high and low pressure valves are open and whether the electronic expansion valves are working properly, etc.)
No
Check that the compressor nameplate is yellow
Yes
Replace the compressor
No
Yes
Note: Use a multimeter to test whether the three-phase is unbalanced, the three-phase winding resistance is normal within 5 ohms, and > 10 ohms is abnormal
Check whether the three-phase resistance of the compressor is symmetrical
No
Replace the outdoor main PCB
Whether the problem is solved

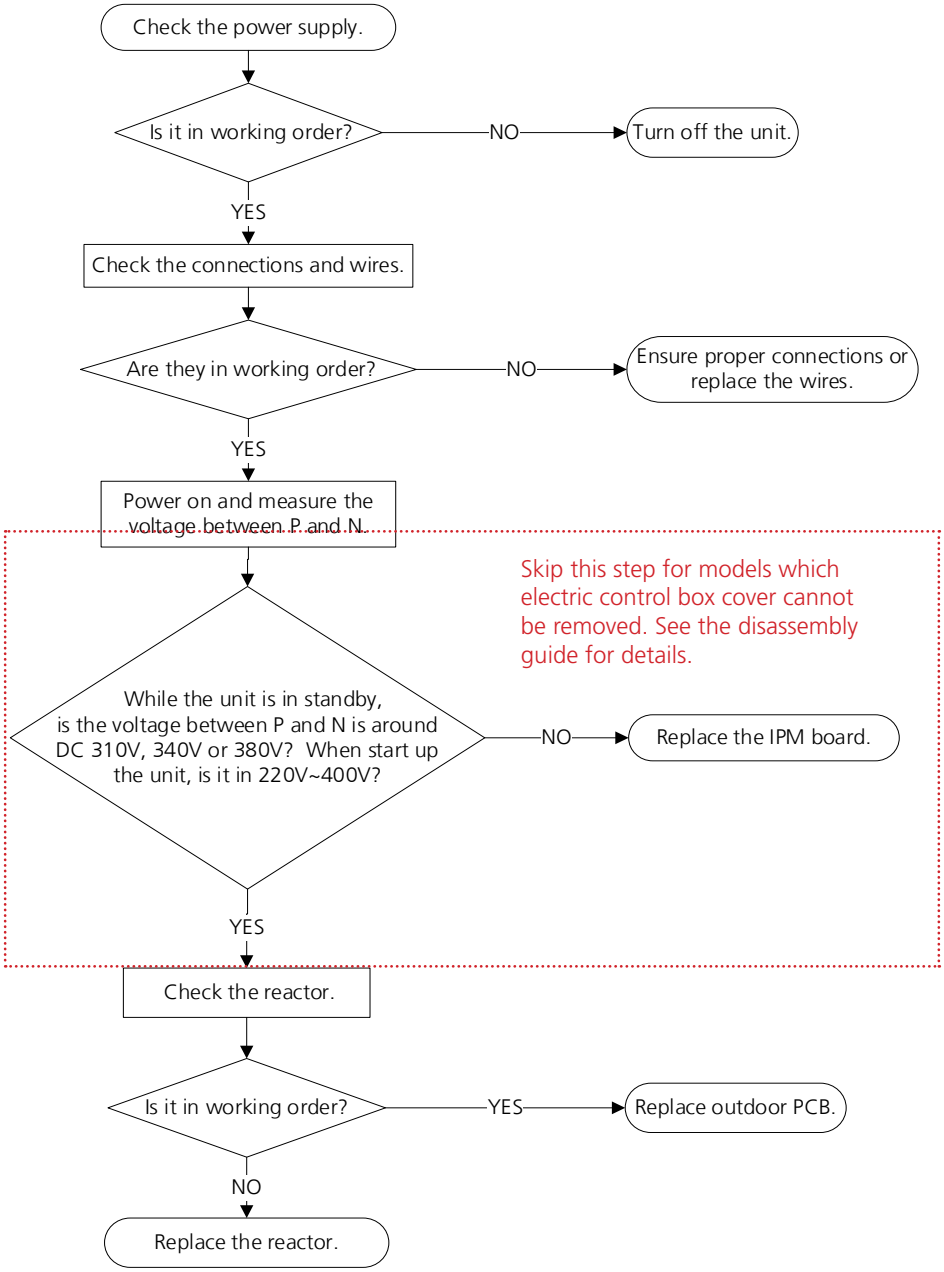
6.12 PC01(ODU voltage protection) diagnosis and solution

Description**:** Abnormal increases or decreases in voltage are detected by checking the specified voltage detection circuit.

Recommended parts to prepare:

- Power supply wires
- IPM module board
- PCB
- Reactor

Troubleshooting and repair:



6.13 PC02(Compressor top (or IPM) temp. protection) diagnosis and solution

Description**:** For some models with overload protection, If the sampling voltage is not 5V, the LED will display the failure.

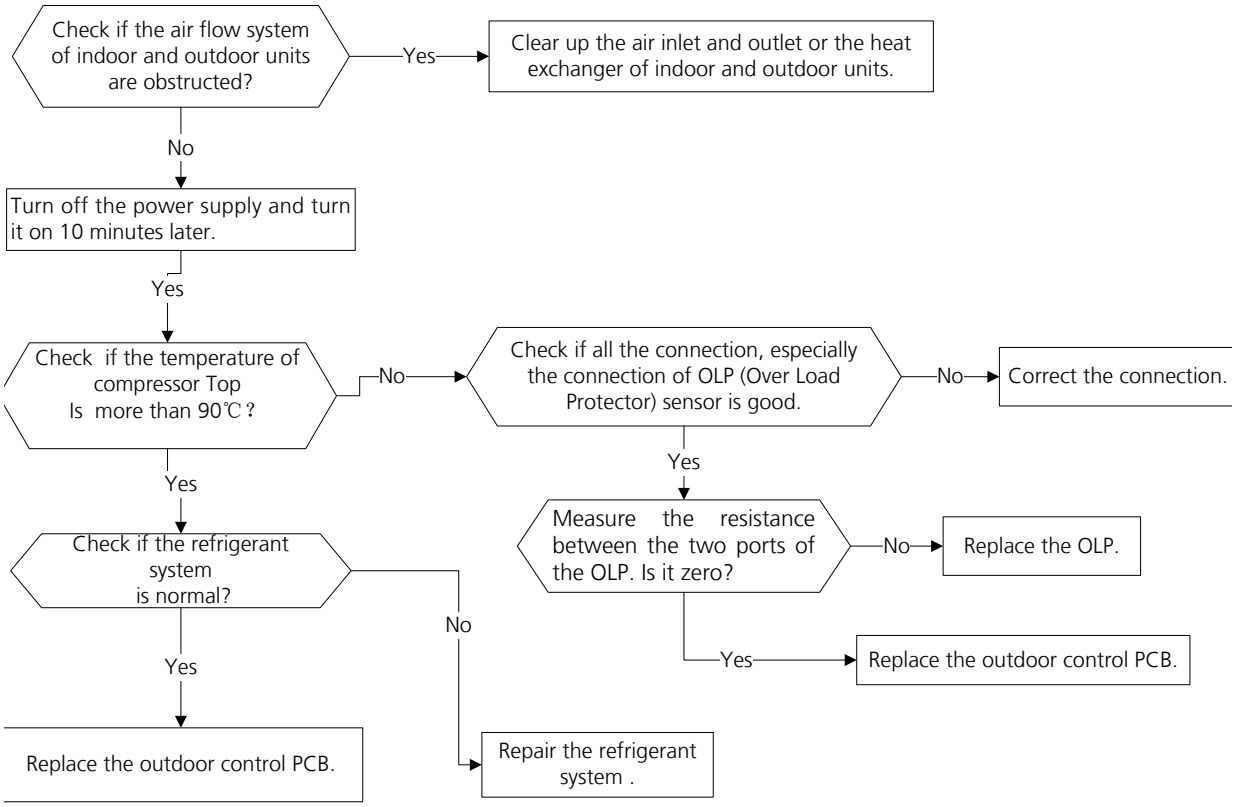
If the temperature of IPM module is higher than a certain value, the LED displays the failure code.

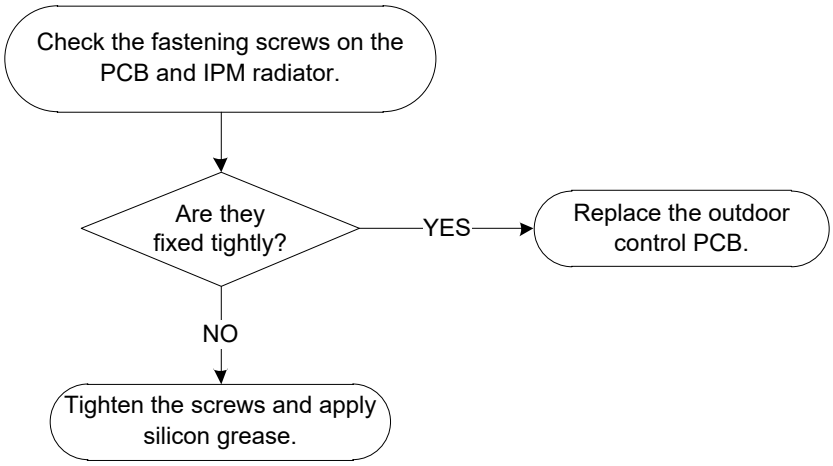
Models without overload protector should be diagnosed according to the second flowchart.

Recommended parts to prepare:

- Connection wires
- Overload protection
- Outdoor PCB

Troubleshooting and repair:





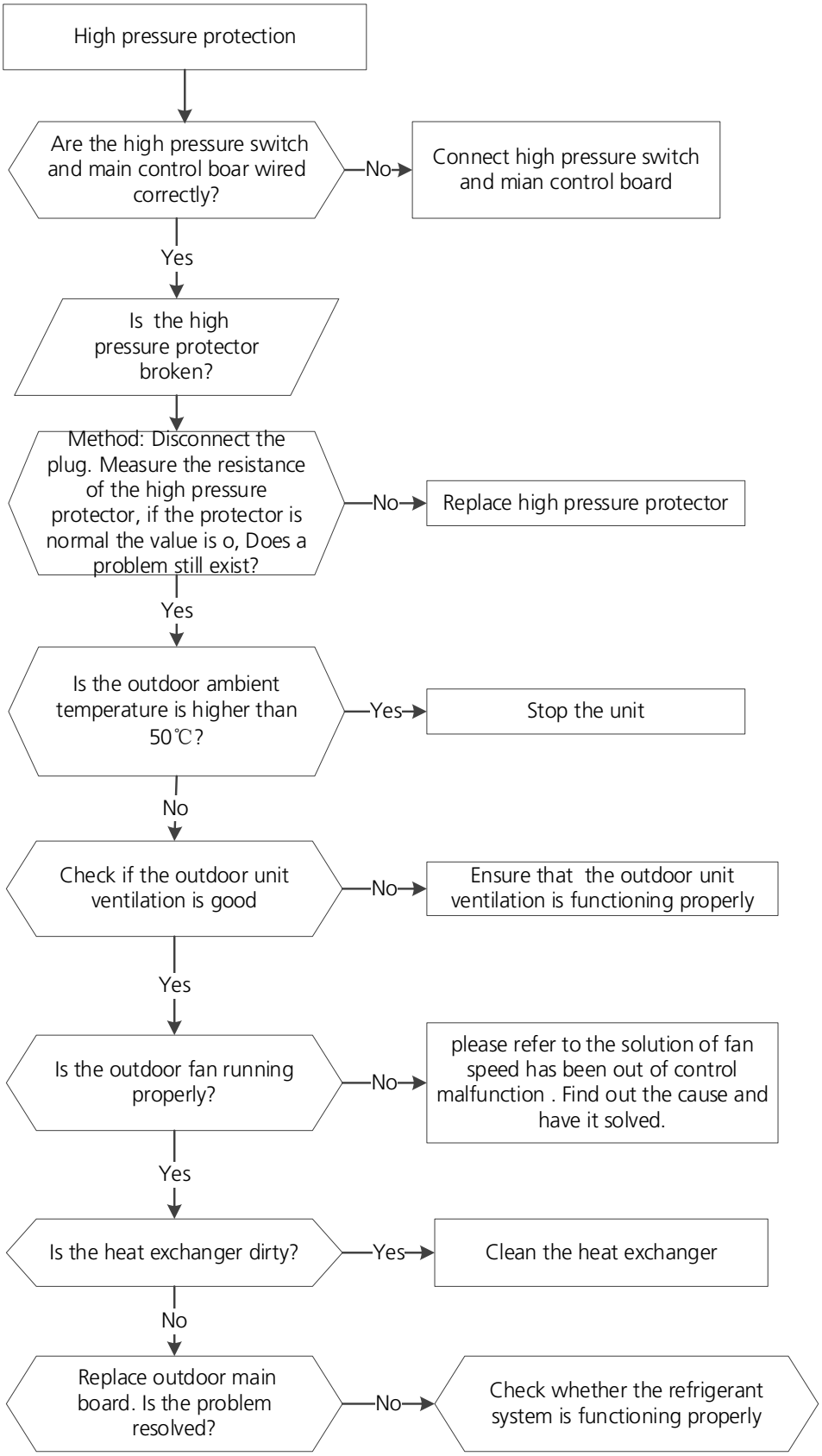
6.14 PC03(Pressure protection(low or high pressure) diagnosis and solution

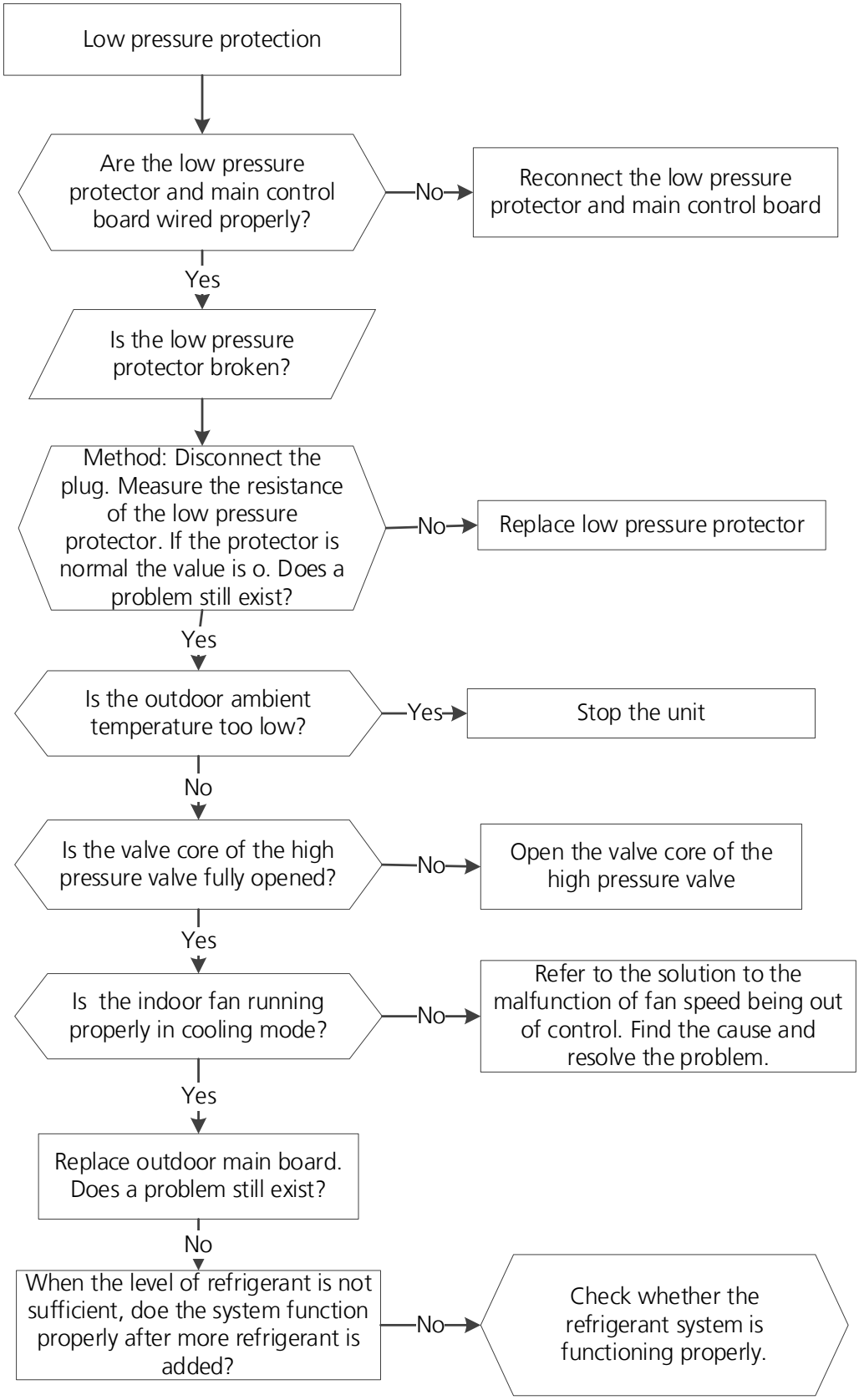
Description**:** Outdoor pressure switch cut off the system because high pressure is higher than 4.4 MPa or outdoor pressure switch cut off the system because low pressure is lower than 0.13 MPa, the LED displays the failure code.

Recommended parts to prepare:

- Connection wires
- Outdoor PCB
- Refrigerant
- Pressure switch
- Outdoor fan

Troubleshooting and repair:


High pressure protection
Are the high pressure switch and main control boar wired correctly?
No
Connect high pressure switch and mian control board
Yes
Is the high pressure protector broken?
Method: Disconnect the plug. Measure the resistance of the high pressure protector, if the protector is normal the value is o, Does a problem still exist?
No
Replace high pressure protector
Yes
Is the outdoor ambient temperature is higher than 50℃?
Yes
Stop the unit
No
Check if the outdoor unit ventilation is good
No
Ensure that the outdoor unit ventilation is functioning properly
Yes
Is the outdoor fan running properly?
No
please refer to the solution of fan speed has been out of control malfunction . Find out the cause and have it solved.
Yes
Is the heat exchanger dirty?
Yes
Clean the heat exchanger
No
Replace outdoor main board. Is the problem resolved?
No
Check whether the refrigerant system is functioning properly


Low pressure protection
Are the low pressure protector and main control board wired properly?
No
Reconnect the low pressure protector and main control board
Yes
Is the low pressure protector broken?
Method: Disconnect the plug. Measure the resistance of the low pressure protector. If the protector is normal the value is o. Does a problem still exist?
No
Replace low pressure protector
Yes
Is the outdoor ambient temperature too low?
Yes
Stop the unit
No
Is the valve core of the high pressure valve fully opened?
No
Open the valve core of the high pressure valve
Yes
Is the indoor fan running properly in cooling mode?
No
Refer to the solution to the malfunction of fan speed being out of control. Find the cause and resolve the problem.
Yes
Replace outdoor main board. Does a problem still exist?
No
When the level of refrigerant is not sufficient, doe the system function properly after more refrigerant is added?
No
Check whether the refrigerant system is functioning properly.

6.15 IDUs mode conflict (match with multi outdoor unit)

Description**:** The indoor units cannot work cooling mode and heating at same time. Heating mode has a priority.

- Suppose Indoor unit A working in cooling mode or fan mode, and indoor unit B is set to heating mode, then A will change to off and B will work in heating mode.
- Suppose Indoor unit A working in heating mode, and indoor unit B is set to cooling mode or fan mode, then B will change to stand by and A will be no change.

	Cooling mode	Heating Mode	Fan	Off
Cooling mode	No	Yes	No	No
Heating Mode	Yes	No	Yes	No
Fan	No	Yes	No	No
Off	No	No	No	No

Note:

No: No mode conflict

Yes: Mode conflict

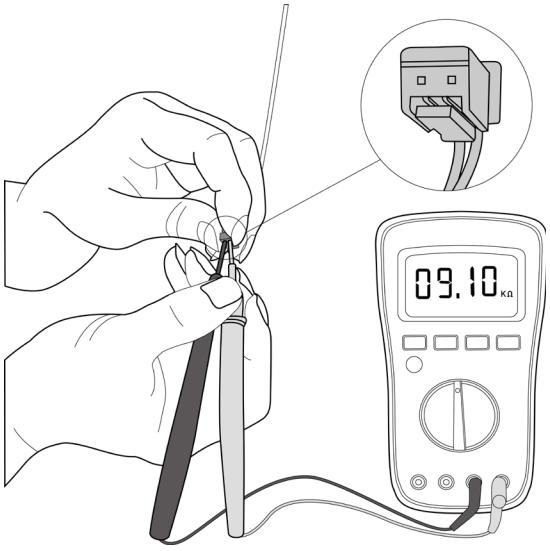
7. Check Procedures

7.1 Temperature Sensor Check

WARNING

Be sure to turn off all power supplies or disconnect all wires to avoid electric shock.
Operate after compressor and coil have returned to normal temperature in case of injury.

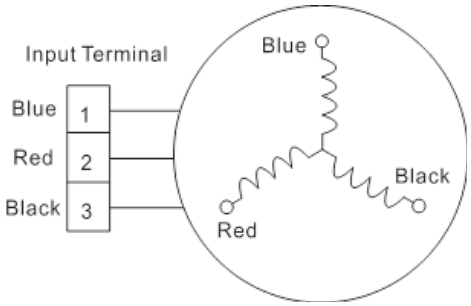
1. Disconnect the temperature sensor from PCB (Refer to Chapter 5&6. Indoor&Outdoor Unit Disassembly).
2. Measure the resistance value of the sensor using a multi-meter.
3. Check corresponding temperature sensor resistance value table (Refer to Chapter 8. Appendix).



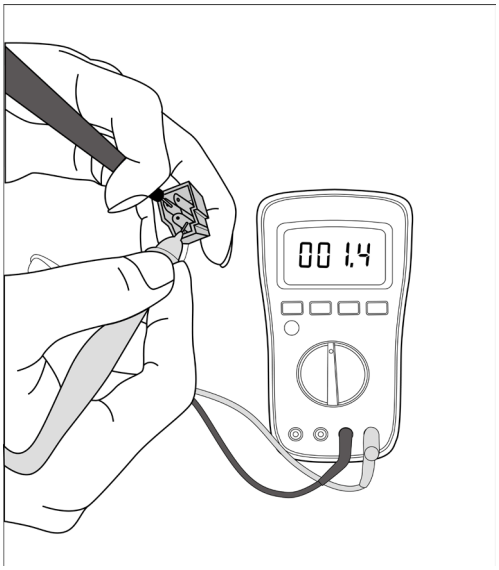
Note: The picture and the value are only for reference, actual condition and specific value may vary.

7.2 Compressor Check

1. Disconnect the compressor power cord from outdoor PCB (Refer to Chapter 6. Outdoor Unit Disassembly)).
2. Measure the resistance value of each winding using a multi-meter.
3. Check the resistance value of each winding in the following table.



Resistance Value	KTM140D79UFZA3
Blue-Red	1.88± 5%Ω (at 20°C/68°F)
Blue-Black	
Red-Black	



Note: The picture and the value are only for reference, actual condition and specific value may vary.

7.3 IPM Continuity Check

WARNING

Electricity remains in capacitors even when the power supply is off.
Ensure the capacitors are fully discharged before troubleshooting.

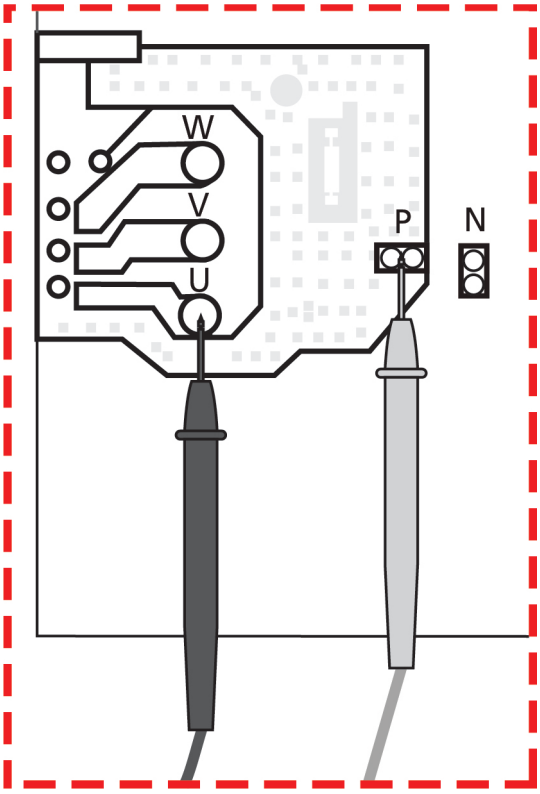
1. Turn off outdoor unit and disconnect power supply.
2. Discharge electrolytic capacitors and ensure all energy-storage unit has been discharged.
3. Disassemble outdoor PCB or disassemble IPM board.
4. Measure the resistance value between P and U(V, W, N); U(V, W) and N.

Digital tester		Resistance value	Digital tester		Resistance value
(+)Red	(-)Black		(+)Red	(-)Black	
P	N	∞ (Several MΩ)	U	N	∞ (Several MΩ)
	U		V		
	V		W		
	W		-		

Or test the conductivity of IPM with diode mode.

Needle-type Tester		Normal Value	Needle-type Tester		Normal Value
Red	Black		Red	Black	
P	U	Open-circuit	N	U	0.3-0.5V
	V			V	
	W			W	

Needle-type Tester		Normal Value	Needle-type Tester		Normal Value
Black	Red		Black	Red	
P	U	0.3-0.5V	N	U	Open-circuit
	V			V	
	W			W	



Note: The picture and the value are only for reference, actual condition and specific value may vary.

7.4 Normal voltage of P and N

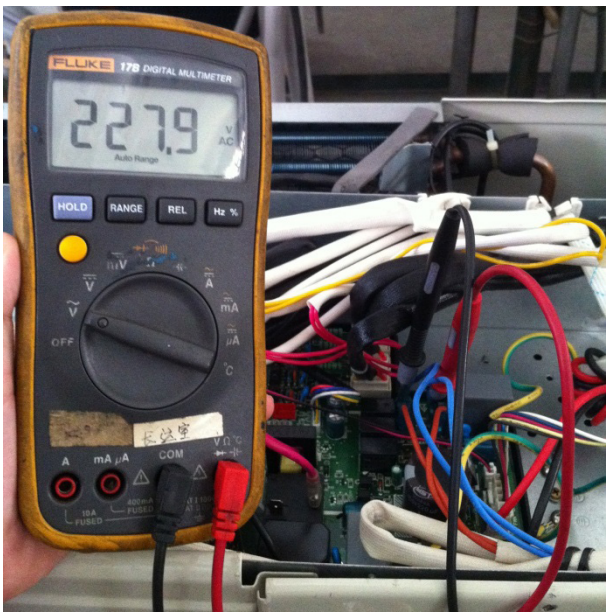
208-240V(1-phase,3-phase)	380-415V(3-phase)
In standby	
around 310VDC	around 530VDC
In operation	
>310VDC	>450VDC

7.5 4-way Valve Check(Heat pump units)

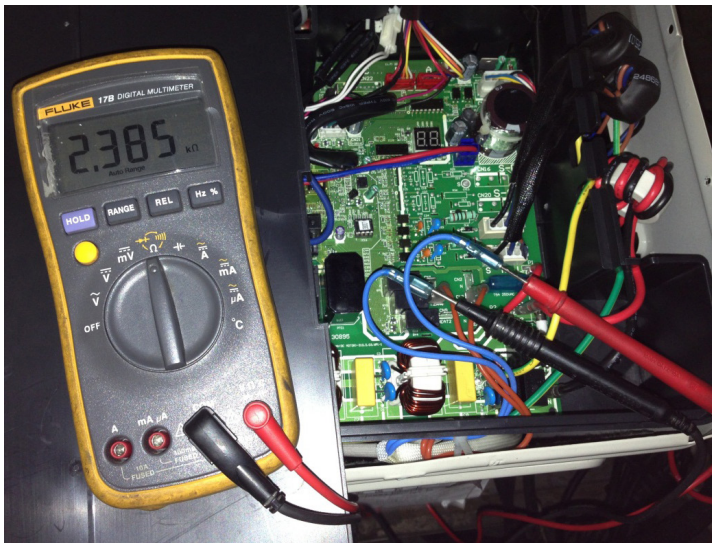
1. Power on, use a digital tester to measure the voltage, when the unit operates in cooling, it is 0V. When the unit operates in heating, it is about 230VAC.

If the value of the voltage is not in the range, the PCB must have problems and need to be replaced.





2 Turn off the power, use a digital tester to measure the resistance. The value should be 1.8~2.5 KΩ.

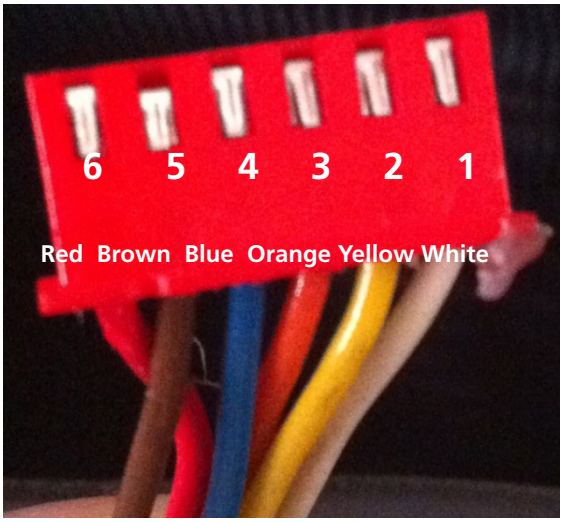


7.6 EEV Check(for some models)

WARNING

Electricity remains in capacitors even when the power supply is off.
Ensure the capacitors are fully discharged before troubleshooting.

1. Disconnect the connector from outdoor PCB.
2. Measure the resistance value of each winding using a multi-meter.
3. Check the resistance value of each winding in the following table.



Color of lead winding	Normal Value
Red- Blue	About 50Ω
Red - Yellow	
Brown-Orange	
Brown-White	

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ii). Temperature Sensor Resistance Value Table for TP(for some units) (°C --K) 87

iii). Pressure On Service Port 88

i). Temperature Sensor Resistance Value Table for T1,T2,T3 and T4 (°C – K)

°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
-20	-4	115.266	20	68	12.6431	60	140	2.35774	100	212	0.62973
-19	-2	108.146	21	70	12.0561	61	142	2.27249	101	214	0.61148
-18	0	101.517	22	72	11.5	62	144	2.19073	102	216	0.59386
-17	1	96.3423	23	73	10.9731	63	145	2.11241	103	217	0.57683
-16	3	89.5865	24	75	10.4736	64	147	2.03732	104	219	0.56038
-15	5	84.219	25	77	10	65	149	1.96532	105	221	0.54448
-14	7	79.311	26	79	9.55074	66	151	1.89627	106	223	0.52912
-13	9	74.536	27	81	9.12445	67	153	1.83003	107	225	0.51426
-12	10	70.1698	28	82	8.71983	68	154	1.76647	108	226	0.49989
-11	12	66.0898	29	84	8.33566	69	156	1.70547	109	228	0.486
-10	14	62.2756	30	86	7.97078	70	158	1.64691	110	230	0.47256
-9	16	58.7079	31	88	7.62411	71	160	1.59068	111	232	0.45957
-8	18	56.3694	32	90	7.29464	72	162	1.53668	112	234	0.44699
-7	19	52.2438	33	91	6.98142	73	163	1.48481	113	235	0.43482
-6	21	49.3161	34	93	6.68355	74	165	1.43498	114	237	0.42304
-5	23	46.5725	35	95	6.40021	75	167	1.38703	115	239	0.41164
-4	25	44	36	97	6.13059	76	169	1.34105	116	241	0.4006
-3	27	41.5878	37	99	5.87359	77	171	1.29078	117	243	0.38991
-2	28	39.8239	38	100	5.62961	78	172	1.25423	118	244	0.37956
-1	30	37.1988	39	102	5.39689	79	174	1.2133	119	246	0.36954
0	32	35.2024	40	104	5.17519	80	176	1.17393	120	248	0.35982
1	34	33.3269	41	106	4.96392	81	178	1.13604	121	250	0.35042
2	36	31.5635	42	108	4.76253	82	180	1.09958	122	252	0.3413
3	37	29.9058	43	109	4.5705	83	181	1.06448	123	253	0.33246
4	39	28.3459	44	111	4.38736	84	183	1.03069	124	255	0.3239
5	41	26.8778	45	113	4.21263	85	185	0.99815	125	257	0.31559
6	43	25.4954	46	115	4.04589	86	187	0.96681	126	259	0.30754
7	45	24.1932	47	117	3.88673	87	189	0.93662	127	261	0.29974
8	46	22.5662	48	118	3.73476	88	190	0.90753	128	262	0.29216
9	48	21.8094	49	120	3.58962	89	192	0.8795	129	264	0.28482
10	50	20.7184	50	122	3.45097	90	194	0.85248	130	266	0.2777
11	52	19.6891	51	124	3.31847	91	196	0.82643	131	268	0.27078
12	54	18.7177	52	126	3.19183	92	198	0.80132	132	270	0.26408
13	55	17.8005	53	127	3.07075	93	199	0.77709	133	271	0.25757
14	57	16.9341	54	129	2.95896	94	201	0.75373	134	273	0.25125
15	59	16.1156	55	131	2.84421	95	203	0.73119	135	275	0.24512
16	61	15.3418	56	133	2.73823	96	205	0.70944	136	277	0.23916
17	63	14.6181	57	135	2.63682	97	207	0.68844	137	279	0.23338
18	64	13.918	58	136	2.53973	98	208	0.66818	138	280	0.22776
19	66	13.2631	59	138	2.44677	99	210	0.64862	139	282	0.22231

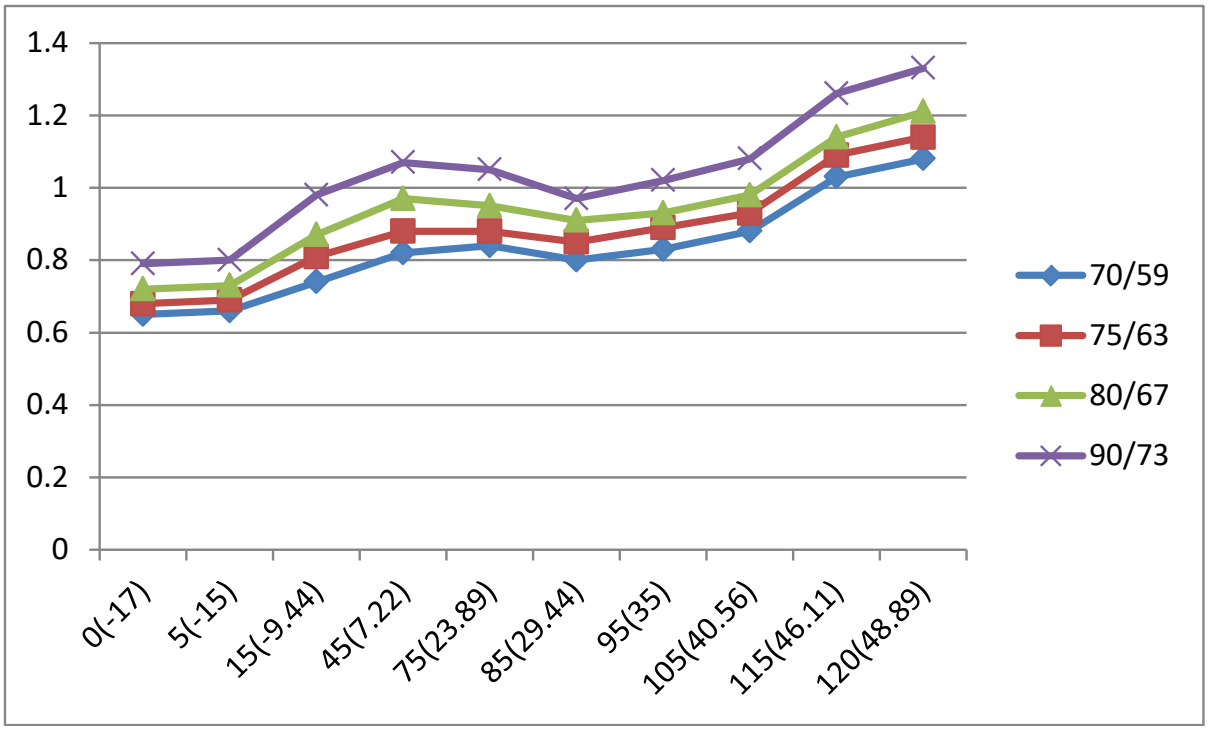
ii). Temperature Sensor Resistance Value Table for TP(for some units) (°C --K)

°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm	°C	°F	K Ohm
-20	-4	542.7	20	68	68.66	60	140	13.59	100	212	3.702
-19	-2	511.9	21	70	65.62	61	142	13.11	101	214	3.595
-18	0	483	22	72	62.73	62	144	12.65	102	216	3.492
-17	1	455.9	23	73	59.98	63	145	12.21	103	217	3.392
-16	3	430.5	24	75	57.37	64	147	11.79	104	219	3.296
-15	5	406.7	25	77	54.89	65	149	11.38	105	221	3.203
-14	7	384.3	26	79	52.53	66	151	10.99	106	223	3.113
-13	9	363.3	27	81	50.28	67	153	10.61	107	225	3.025
-12	10	343.6	28	82	48.14	68	154	10.25	108	226	2.941
-11	12	325.1	29	84	46.11	69	156	9.902	109	228	2.86
-10	14	307.7	30	86	44.17	70	158	9.569	110	230	2.781
-9	16	291.3	31	88	42.33	71	160	9.248	111	232	2.704
-8	18	275.9	32	90	40.57	72	162	8.94	112	234	2.63
-7	19	261.4	33	91	38.89	73	163	8.643	113	235	2.559
-6	21	247.8	34	93	37.3	74	165	8.358	114	237	2.489
-5	23	234.9	35	95	35.78	75	167	8.084	115	239	2.422
-4	25	222.8	36	97	34.32	76	169	7.82	116	241	2.357
-3	27	211.4	37	99	32.94	77	171	7.566	117	243	2.294
-2	28	200.7	38	100	31.62	78	172	7.321	118	244	2.233
-1	30	190.5	39	102	30.36	79	174	7.086	119	246	2.174
0	32	180.9	40	104	29.15	80	176	6.859	120	248	2.117
1	34	171.9	41	106	28	81	178	6.641	121	250	2.061
2	36	163.3	42	108	26.9	82	180	6.43	122	252	2.007
3	37	155.2	43	109	25.86	83	181	6.228	123	253	1.955
4	39	147.6	44	111	24.85	84	183	6.033	124	255	1.905
5	41	140.4	45	113	23.89	85	185	5.844	125	257	1.856
6	43	133.5	46	115	22.89	86	187	5.663	126	259	1.808
7	45	127.1	47	117	22.1	87	189	5.488	127	261	1.762
8	46	121	48	118	21.26	88	190	5.32	128	262	1.717
9	48	115.2	49	120	20.46	89	192	5.157	129	264	1.674
10	50	109.8	50	122	19.69	90	194	5	130	266	1.632
11	52	104.6	51	124	18.96	91	196	4.849			
12	54	99.69	52	126	18.26	92	198	4.703			
13	55	95.05	53	127	17.58	93	199	4.562			
14	57	90.66	54	129	16.94	94	201	4.426			
15	59	86.49	55	131	16.32	95	203	4.294			
16	61	82.54	56	133	15.73	96	205	4.167			
17	63	78.79	57	135	15.16	97	207	4.045			
18	64	75.24	58	136	14.62	98	208	3.927			
19	66	71.86	59	138	14.09	99	210	3.812			

iii). Pressure On Service Port

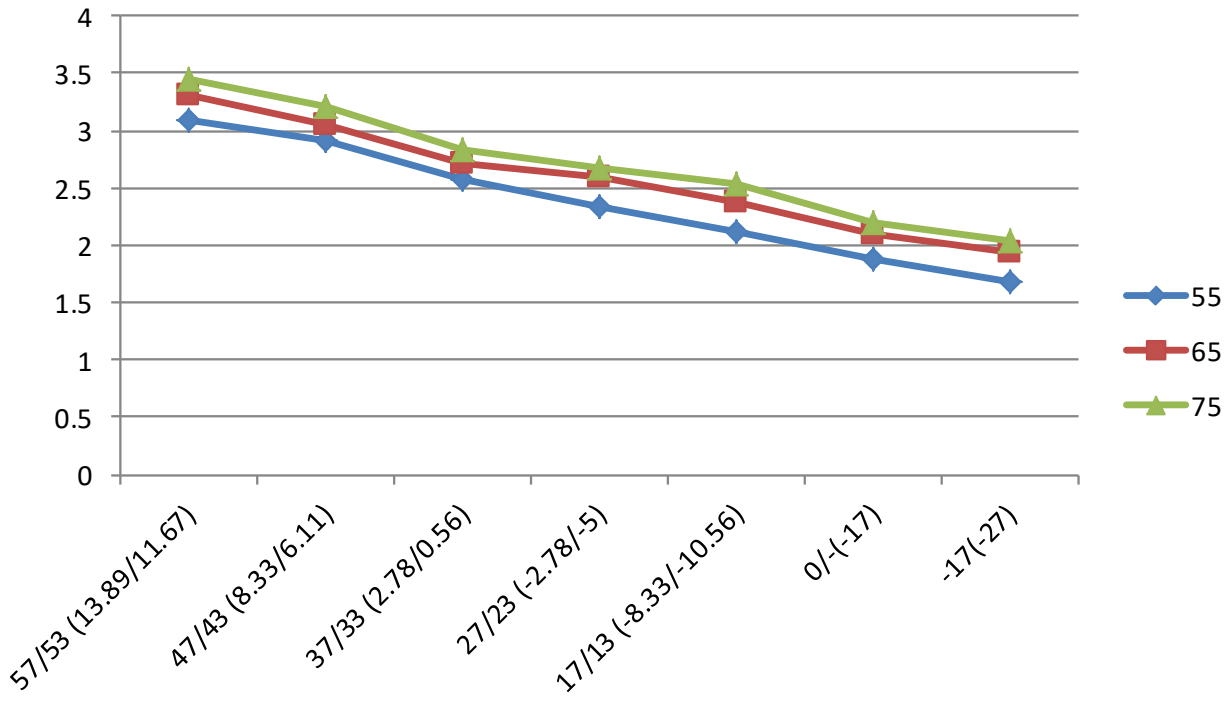
Cooling chart**(R32)**:

°F(°C)	ODU(DB) / IDU(DB/WB)	0(-17)	5(-15)	15 (-9.44)	45 (7.22)	75 (23.89)	85 (29.44)	95 (35)	105 (40.56)	115 (46.11)	120 (48.89)
BAR	70/59 (21.11/15)	6.5	6.6	7.4	8.2	8.4	8.0	8.3	8.8	10.3	10.8
	75/63 (23.89/17.22)	6.8	6.9	8.1	8.8	8.8	8.5	8.9	9.3	10.9	11.4
	80/67 (26.67/19.44)	7.2	7.3	8.7	9.7	9.5	9.1	9.3	9.8	11.4	12.1
	90/73 (32.22/22.78)	7.9	8.0	9.8	10.7	10.5	9.7	10.2	10.8	12.6	13.3
PSI	70/59 (21.11/15)	95	96	108	118	121	115	119	128	150	157
	75/63 (23.89/17.22)	99	101	117	128	126	122	129	135	158	165
	80/67 (26.67/19.44)	105	106	125	141	138	132	135	143	165	176
	90/73 (32.22/22.78)	114	115	142	155	152	141	148	157	184	193
MPa	70/59 (21.11/15)	0.65	0.66	0.74	0.82	0.84	0.80	0.83	0.88	1.03	1.08
	75/63 (23.89/17.22)	0.68	0.69	0.81	0.88	0.88	0.85	0.89	0.93	1.09	1.14
	80/67 (26.67/19.44)	0.72	0.73	0.87	0.97	0.95	0.91	0.93	0.98	1.14	1.21
	90/73 (32.22/22.78)	0.79	0.80	0.98	1.07	1.05	0.97	1.02	1.08	1.26	1.33



Heating chart**(R32)**:

°F(°C)	QDU(DB/WB) / IDU(DB)	57/53 (13.89/11.67)	47/43 (8.33/6.11)	37/33 (2.78/0.56)	27/23 (-2.78/-5)	17/13 (-8.33/-10.56)	0/-2 (-17/-19)	-17/-18 (-27/-28)
BAR	55(12.78)	30.9	29.1	25.8	23.3	21.2	18.9	16.8
	65(18.33)	33.2	30.6	27.1	25.9	23.8	20.9	19.4
	75(23.89)	34.5	32.1	28.4	26.8	25.4	21.9	20.4
PSI	55(12.78)	448	421	374	337	308	273	244
	65(18.33)	480	444	394	375	346	303	282
	75(23.89)	499	466	411	389	369	318	296
MPa	55(12.78)	3.09	2.91	2.58	2.33	2.12	1.89	1.68
	65(18.33)	3.32	3.06	2.71	2.59	2.38	2.09	1.94
	75(23.89)	3.45	3.21	2.84	2.68	2.54	2.19	2.04



System Pressure Table-R32

Pressure			Temperature		Pressure			Temperature	
Kpa	bar	PSI	°C	°F	Kpa	bar	PSI	°C	°F
100	1	14.5	-51.909	-61.436	1850	18.5	268.25	28.425	83.165
150	1.5	21.75	-43.635	-46.543	1900	19	275.5	29.447	85.005
200	2	29	-37.323	-35.181	1950	19.5	282.75	30.448	86.806
250	2.5	36.25	-32.15	-25.87	2000	20	290	31.431	88.576
300	3	43.5	-27.731	-17.916	2050	20.5	297.25	32.395	90.311
350	3.5	50.75	-23.85	-10.93	2100	21	304.5	33.341	92.014
400	4	58	-20.378	-4.680	2150	21.5	311.75	34.271	93.688
450	4.5	65.25	-17.225	0.995	2200	22	319	35.184	95.331
500	5	72.5	-14.331	6.204	2250	22.5	326.25	36.082	96.948
550	5.5	79.75	-11.65	11.03	2300	23	333.5	36.965	98.537
600	6	87	-9.150	15.529	2350	23.5	340.75	37.834	100.101
650	6.5	94.25	-6.805	19.752	2400	24	348	38.688	101.638
700	7	101.5	-4.593	23.734	2450	24.5	355.25	39.529	103.152
750	7.5	108.75	-2.498	27.505	2500	25	362.5	40.358	104.644
800	8	116	-0.506	31.089	2550	25.5	369.75	41.173	106.111
850	8.5	123.25	1.393	34.507	2600	26	377	41.977	107.559
900	9	130.5	3.209	37.777	2650	26.5	384.25	42.769	108.984
950	9.5	137.75	4.951	40.911	2700	27	391.5	43.55	110.39
1000	10	145	6.624	43.923	2750	27.5	398.75	44.32	111.776
1050	10.5	152.25	8.235	46.823	2800	28	406	45.079	113.142
1100	11	159.5	9.790	49.621	2850	28.5	413.25	45.828	114.490
1150	11.5	166.75	11.291	52.324	2900	29	420.5	46.567	115.821
1200	12	174	12.745	54.941	2950	29.5	427.75	47.296	117.133
1250	12.5	181.25	14.153	57.475	3000	30	435	48.015	118.427
1300	13	188.5	15.52	59.936	3050	30.5	442.25	48.726	119.707
1350	13.5	195.75	16.847	62.325	3100	31	449.5	49.428	120.970
1400	14	203	18.138	64.648	3150	31.5	456.75	50.121	122.218
1450	14.5	210.25	19.395	66.911	3200	32	464	50.806	123.451
1500	15	217.5	20.619	69.114	3250	32.5	471.25	51.482	124.668
1550	15.5	224.75	21.813	71.263	3300	33	478.5	52.15	125.87
1600	16	232	22.978	73.360	3350	33.5	485.75	52.811	127.060
1650	16.5	239.25	24.116	75.409	3400	34	493	53.464	128.235
1700	17	246.5	25.229	77.412	3450	34.5	500.25	54.11	129.398
1750	17.5	253.75	26.317	79.371	3500	35	507.5	54.748	130.546
1800	18	261	27.382	81.288					