AIR-TO-WATER HEAT PUMP
SERVICE MANUAL
(General)

CAUTION

Before Servicing the unit, read the safety precautions in General SVC manual.
Only for authorized service personnel.

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Safety Precautions

	Read the precautions in this manual carefully before operating the unit.		Indicates that this appliance uses a flammable refrigerant. If the refrigerant is leaked and exposure to an external ignition source, there is a risk of fire.
	This symbol indicates that the Operation Manual should be read carefully.		This symbol indicates that a service personnel should be handling this equipment with reference to the Installation Manual.

To prevent injury to the user or other people and property damage, the following instructions must be followed.

■ Incorrect operation due to ignoring instruction will cause harm or damage. The seriousness is classified by the following indications.

DANGER	Indicates a hazardous situation that, if not avoided, WILL RESULT IN DEATH OR SERIOUS INJURY.
WARNING	Indicates a hazardous situation that, if not avoided, COULD RESULT IN DEATH OR SERIOUS INJURY.
CAUTION	Indicates a hazardous situation that, if not avoided, COULD RESULT IN MINOR OR MODERATE INJURY.

- Signal words, symbols, and definitions taken from American National Standards Institute (ANSI) Z535.6. See https://www.ansi.org/ for more information.

■ Meanings of symbols used in this manual are as shown below.

	**This symbol indicates an action that should not be performed.**
	**Be sure to follow the instruction.**
	**Dangerous Voltage**

1.1 Safety Precautions in Repair

WARNING	
Ensure the electrical power is off before servicing. Internal components and circuit boards are at main potential when the equipment is connected to the power cables. This voltage is extremely dangerous and may cause death or severe injury if come in contact with it.	
Do not touch the discharging refrigerant gas during the repair work. The refrigerant gas can cause frostbite, serious injury, or death.	
Release the refrigerant gas completely at a well-ventilated place first. Otherwise, when the pipe is disconnected, refrigerant gas or refrigerating machine oil discharges and it can cause injury.	
When removing the front panel or cabinet, execute short-circuit and discharge between high voltage capacitor terminals. If discharge is not executed, an electric shock is caused by high voltage which can result in a death or injury.	
When repairing the equipment in a humid or wet place, you must ground the unit in accordance with local, state, and NEC codes to avoid electrical shocks.	

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Properly sized circuit breaker must be used. Use this product on a dedicated circuit. Otherwise there is a risk of fire or electric shock.	
Install the panel and the cover of control box securely. Otherwise there is risk of fire or electric shock due to dust, water etc.	
Do not touch, operate, or repair the product with wet hands as there is risk of electric shock or fire.	
Use a vacuum pump or Inert (nitrogen) gas when doing leakage test or air purge. Do not compress air or Oxygen and Do not use Flammable gases. Otherwise, it may cause fire or explosion. - There is the risk of death, injury, fire or explosion.	
Do not turn on the breaker or power under condition that front panel, cabinet, top cover, control box cover are removed or opened. Otherwise, it may cause fire, electric shock, explosion or death.	
The product shall be stored so as to prevent mechanical damage from occurring	
Any person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerants safely in accordance with an industry recognised assessment specification. Servicing shall only be performed as recommended by the equipment manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.	
Keep any required ventilation openings clear of obstruction	
• Refrigerant tubing shall be protected or enclosed to avoid damage.	
• The installation of pipe-work shall be kept to a minimum • When flared joints are reused indoors, the flare part shall be re-fabricated. • When mechanical connectors are reused indoors, sealing parts shall be renewed.	
• Product is all-in-one and require no additional refrigerant charge. If you need to recharge the refrigerant, please contact a licensed professional.	

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• Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer. • Do not pierce or burn. • Be aware that refrigerants may not contain an odour. • Ducts connected to an appliance shall not contain an ignition source. • Two or more people must lift and transport the product. Avoid personal injury. • Periodic (more than once/year) cleaning of the dust or salt particles stuck on the heat exchanger by using water. • Dismantling the unit, treatment of the refrigerant oil and eventual parts must be done in accordance with local and national standards. • The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.)	
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 minimised. For repair to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.	
Work procedure Work 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.	
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.	
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. non-sparking, adequately sealed or intrinsically safe.	
Presence of fire extinguisher If any hot work is to be conducted on the refrigerating 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.	

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No ignition sources No person carrying out work in relation to a refrigerating 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.	
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.	
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. The following checks shall be applied to installations using flammable refrigerants: - The actual refrigerant charge 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.	
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, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.	

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Initial safety checks shall include - Capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking. - No live electrical components and wiring are exposed While charging, recovering or purging the system. - Continuity of earth bonding	
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	
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 **NOTE** The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.	
Cabling 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 ageing or continual vibration from sources such as compressors or fans.	
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.	

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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 also 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.

NOTE

Examples of leak detection fluids are
- bubble method
- fluorescent method agents

If a leak is suspected, all naked flames shall be removed/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. Removal of refrigerant shall be according to removal and evacuation procedure.

Removal and evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants 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 (optional for A2L);
• evacuate (optional for A2L);
• purge with inert gas (optional for A2L);
• open the circuit by cutting or brazing

The refrigerant charge shall be recovered into the correct recovery cylinders. For appliances containing flammable refrigerants other than A2L refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process may need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, other than A2L refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen 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 oxygen-free nitrogen 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 potential ignition sources and that ventilation is available.

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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 minimise the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instruction.
- 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 the appropriate purging gas. 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.

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.

a) Become familiar with the equipment and its operation.
b) Isolate system electrically.
c) 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.
d) Pump down refrigerant system, if possible.
e) If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
f) Make sure that cylinder is situated on the scales before recovery takes place.
g) Start the recovery machine and operate in accordance with manufacturer's instructions.
h) Do not overfill cylinders. (No more than 80 % volume liquid charge).
i) Do not exceed the maximum working pressure of the cylinder, even temporarily.
j) 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.
k) Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

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.

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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 number 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.	
WARNING - The non-fixed appiance shall be stored in an area where the room size corresponds to the room area as specified for operation	
the non-fixed appliance shall be stored in a room without continuously operating open flames (for example an operating gas appliance) or other potential ignition sources (for example an operating electric heater, hot surfaces)	
The appliance shall be stored so as to prevent mechanical damage from occurring	
Compliance with national gas regulations shall be observed	
The installation of pipe-work shall be kept to a minimum	
A brazed, welded, or mechanical connection shall be made before opening the valves to permit refrigerant to flow between the refrigerating system parts. A vacuum valve shall be provided to evacuate the interconnecting pipe and/or any uncharged refrigerating system part.	

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Any person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerants safely in accordance with an industry recognised assessment specification.	
Servicing shall only be performed as recommended by the equipment manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.	
When mechanical connectors are reused indoors, sealing parts shall be renewed. When flared joints are reused indoors, the flare part shall be re-fabricated.	
Mechanical connections (mechanical connectors or flared joints) shall be accessible for maintenance purposes.	
Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer. Do not pierce or burn. Be aware that refrigerants may not contain an odour.	
Periodic(more than once/year) cleaning of the dust or salt particles stuck on the heat exchangers by using water.	
Dismantling the unit, treatment of the refrigerant oil and eventual parts should be done in accordance with local and national standards.	
Checks to the refrigerating 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 actual refrigerant charge 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 – refrigerating 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.	

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Qualification of workers The manual shall contain specific information about the required qualification of the working personnel for maintenance, service and repair operations. Every working procedure that affects safety means shall only be carried out by competent persons according to Annex HH. Examples for such working procedures are: • breaking into the refrigerating circuit; • opening of sealed components; • opening of ventilated enclosures.	

⚠ CAUTION	
Be sure to earth the air conditioner with an earthing conductor connected to the earthing terminal.	
Conduct repair works after checking that the refrigerating cycle section has cooled down sufficiently. Otherwise, working on the unit, the hot refrigerating cycle section can cause burns.	
Do not tilt the unit when removing panels. Otherwise, the water inside the unit can spill and wet floor.	
The appliance shall be disconnected from its power source during service and when replacing parts.	
The noe hose-sets supplied with the appliance are to be used and that old hose-sets should not be reused.	
If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.	
The instructions for service to be done by specialized personnel, mandated by the manufacturer or the authorized representative may be supplied in only one Community language which the specialized personnel understand.	
Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.	
Servicing shall be performed only as recommended by the manufacturer.	

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1.2 Inspections after Repair

⚠ WARNING	
Check to see if the terminal block is not dirty or loose. If terminal block is dust or loose it can cause an electrical shock or fire.	
Do not use a joined power cable or extension cable, or share the same power outlet with other electrical appliances. otherwise, it can cause an electrical shock, excessive heat generation or fire.	
Do not insert hands or other objects through the air inlet or outlet while the product is operating. There are sharp and moving parts that could cause personal injury.	
Do not block the inlet or outlet of air flow. It may cause product failure	

⚠ CAUTION	
Check to see if the parts are mounted correctly and wires are connected. Improper installation and connections can cause an electric shock or an injury.	
Check the installation platform or frame has corroded. Corroded installation platform or frame can cause the unit to fall, resulting in injury.	
Be sure to check the earth wire is correctly connected.	
After the work has finished, be sure to do an insulation test to check the resistanceis 2[Mohm] or more between the charge section and the non-charge metal section(Earth position). If the resistance value is low, a disaster such as a leak or electric shock can be caused.	
Check the drainage of the indoor unit after the repair. If drainage is faulty the water to enter the room and wet floor.	
Flexible pipe elements shall be protected against mechanical damage, excessive stress by torsion, or other forces. They should be checked for mechanical damage annually.	
Protection devices, piping and fittings shall be protected as far as possible against adverse environmental effects, for example, the danger of water collecting and freezing in relief pipes or the accumulation of dirt and debris.	
Precautions shall be taken to avoid excessive vibration or pulsation to refrigerating piping.	

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Steel pipes and components shall be protected against corrosion with a rustproof coating before applying any insulation.	
Piping material, pipe routing, and installation shall include protection from physical damage in operation and service, and be in compliance with national and local codes and standards, such as ASHRAE 15, IAPMO Uniform Mechanical Code, ICC International Mechanical Code, or CSA B52. All field joints shall be accessible for inspection prior to being covered or enclosed.	
• Piping in refrigerating systems shall be so designed and installed to minimize the likelihood hydraulic shock damaging the system.	

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Part 1
General Information

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1. Model Information

With advanced inverter technology, AWHP is suitable for applications like under floor heating, under floor cooling, and hot water generation. By Interfacing to various accessories user can customize the range of the application.

In this chapter, general information of AWHP is presented to identify the installation procedure. Before beginning installation, read this chapter carefully and find helpful information on installation.

Factory Model Name

Model	No.									
	1	2	3	4	5	6	7	8	9	10
Monobloc	Z	H	B	W	0	5	5	G	A	0

No.	Signification
1, 2	Air-to-Water-Heat Pump for R32
3	Classification - B : Monobloc
4	Model Type - W : Inverter Heat Pump
5, 6, 7	Heating Capacity - E.g) 55 kBtu/h → '55'
8	Electrical ratings - G : 220~240/50,60/1
9	Function - A : General heating heat pump
10	Series Number

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Buyer Model Name

Model	No								
	1	2	3	4	5	6	7	8	9
Monobloc	K	P	H	T	C	5	5	1	M

No.	Signification
1	Refrigerant - K: R32
2	Component - P : Packaged (Monobloc, HPWH)
3	Product Category - H: Heating (AWHP, HPWH)
4	Product Type - T : Monobloc Water
5	Product Grade - C : Standard Efficiency
6, 7	Nominal Capacity - E.g) 55 kBtu/h → 55
8	Generation
8	Features - M : Mid Temp. Water

- Additional Information : Series number refers to the barcode on the product.
- Max. allowable pressure : High side 4.32 MPa (626.6 PSI) / Low side 2.4 MPa (348.1 PSI)

[Operating condition]

- Maximum operating temperature of water : Heating 65 °C (149 °F) / Cooling 27 °C (80.6 °F)
- Minimum operating temperature of water : Heating 15 °C (59 °F) / Cooling 5 °C (41 °F)
- Maximum inlet water pressure : 0.3 MPa(43.5 PSI)
- Minimum inlet water pressure : 0.03 MPa(4.4 PSI)

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Model name and related information

Model information				Capacity (kW/Btu/h)		Power Source (Unit)
Chassis	Phase (Ø)	Factory Model Name	Buyer Model Name	Heating	Cooling	
UN60A	1	ZHBW041GA0	KPHTC411M	12 / 41 000	12 / 41 000	220-240 V~ 60 Hz
		ZHBW048GA0	KPHTC481M	14 / 48 000	14 / 48 000	
		ZHBW055GA0	KPHTC551M	16 / 55 000	16 / 55 000	

1 : Tested
(water temperature 30 °C (86 °F) → 35 °C (95 °F) at outdoor ambient temperature 7 °C (44.6 °F) / 6 °C (42.8 °F))

2 : Tested
(water temperature 23 °C (73.4 °F) → 18 °C (64.4 °F) at outdoor ambient temperature 35 °C (95 °F) / 24 °C (75.2 °F))

* All appliances were tested at atmospheric pressure.

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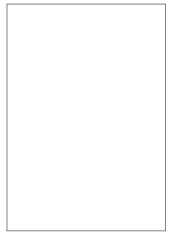
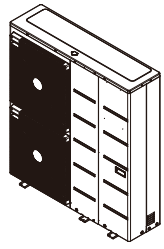
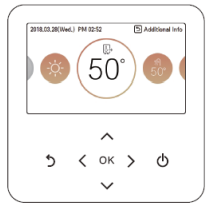
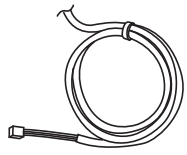
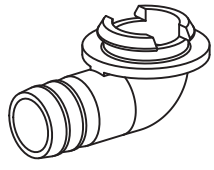
2. External Apprearance

Item	Image
Installation Manual	
Outdoor Unit UN60A Chassis	
Remote Controller	
Remote Controller Cable (Default length : 10m(3.3 ft)	
Damper (x 6)	
Drain Cap (x 6)	

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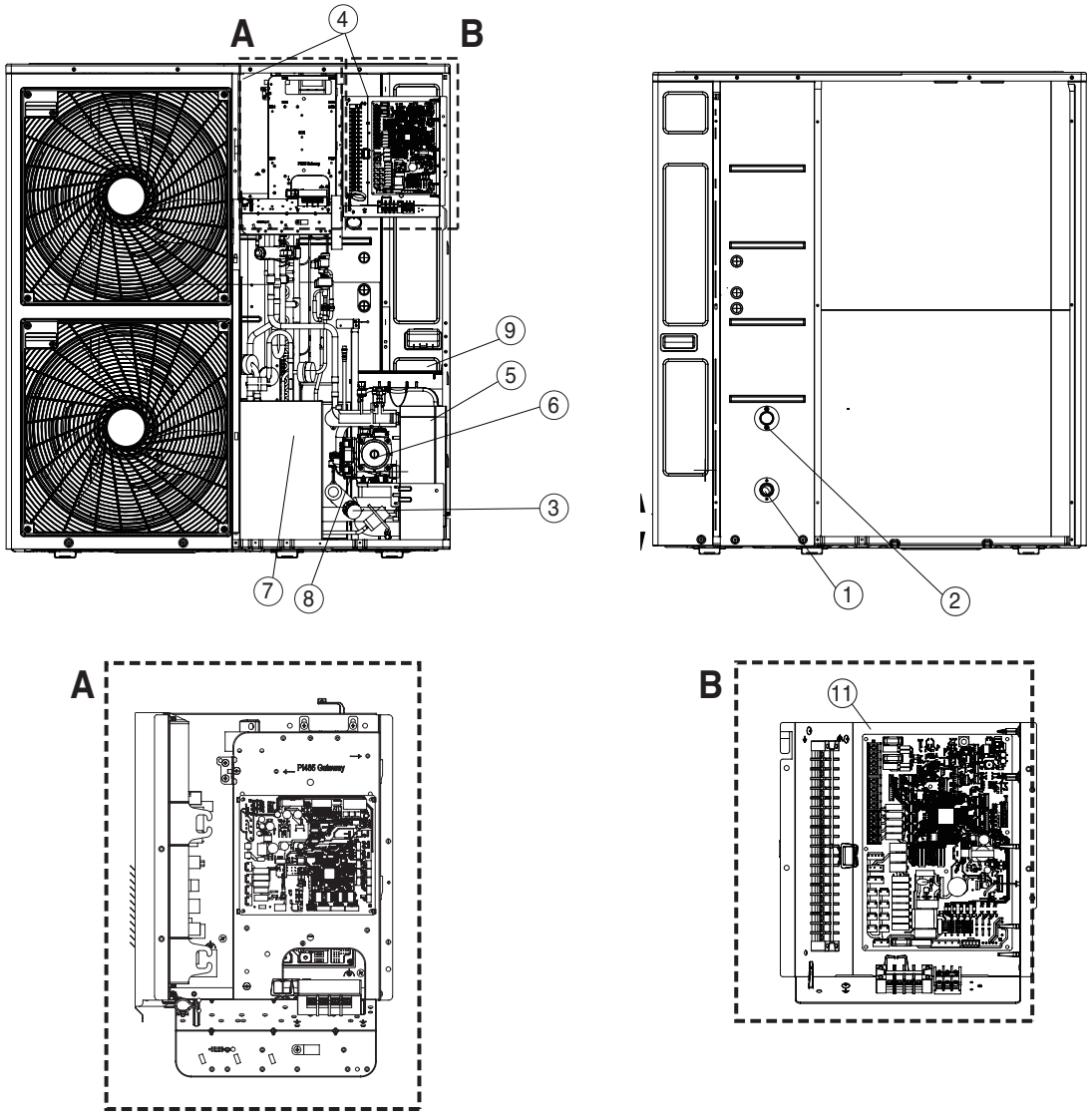
Cycle compartment

UN60A (12(41 000), 14(48 000), 16(55 000) kW(Btu/h))



* The shape may differ depending on the model. Refer to “Exploded View” in SVC Manual.

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Description

No	Name	Remarks
1	Entering water pipe	PT 25.4mm(Female type)
2	Leaving water pipe	PT 25.4mm(Female type)
3	Strainer	Filtering and stacking particles inside circulating water
4	Control box	PCB and terminal blocks
5	Plate heat exchanger	Heat exchange between refrigerant and water
6	Water pump	Circulating the water
7	Shield Bracket	Reducing Noise
8	Safety valve	Open at water pressure 3 bar (43.5 PSI)
9	Expansion vassel	Protecting components from water pressure
10	Main PCB assembly (A)	This PCB controls the cycle parts of the unit
11	Main PCB assembly (B)	This PCB controls the functioning of the unit

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Part 2
Features & Controls

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1. List of Function

Basic functions of Unit

Water Side

Category	Functions	ZHBW055GA0 [KPHTC551M] ZHBW048GA0 [KPHTC481M] ZHBW041GA0 [KPHTC411M]
Installation	Backup heater (3rd party Install kit)	O
Reliability	Self diagnosis	O
Convenience	Auto Restart	O
	Child lock	O
	Sleep mode	O
	Timer (on/off)	O
	Timer (weekly)	O
	Two thermistor control	X
Network function	Network solution(LGAP)	O
	Modbus connectivity (without gateway)	O
Air to Water Heat Pump Functions	Anti-condensation on floor (cooling)	O
	Digital output for external pump	O
	Current flow rate monitoring	O
	Thermostat interface (230V AC)	O
	Thermostat interface (24V AC)	X
	Solar thermal system	O
	DHW(Domestic Hot Water) tank installation kit	O
	PHEX anti-freezing control	O
	Water pump anti-stuck function	O
	Seasonal auto mode (heating and cooling)	O
	Low noise operation	O
	Anti-overheating of water pipe	O
	Emergency operation	O
	Weather dependent operation with thermostat	O
	Scheduler (DHW Tank Heater)	O
	Timer (Domestic Hot Water Tank Heater)	O
	Quick Domestic Hot Water Tank Heating	O
	Screed Drying Mode	O
	Sump Heater	X
	Base Pan Heater	O
	Integrated Dry Contact (CN-EXT)	O
	Water flow control	O
	Water pressure monitoring	O
	Digital inputs for energy saving (SG Ready)	O
	Communication with LG ESS by Modbus	O
	Energy Monitoring	O
	DHW Recirculation	O

Notes
1. O : Applied, X : Not applied

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Refrigerant Side

Category	Functions	ZHBW055GA0 [KPHTC551M] ZHBW048GA0 [KPHTC481M] ZHBW041GA0 [KPHTC411M]
Reliability	Defrost / Deicing	O
	High pressure switch	O
	Low pressure switch	X
	Phase protection	X
	Restart delay (3-minutes)	O
	Self diagnosis	O
	Soft start	X
Convenience	Test function	X
	Low Noise Operation	O
	Wiring Error Check	X
	Peak Control	O
	Mode Lock	O
	Forced Cooling Operation (Outdoor Unit)	X
	Base Pan Heater	O
	SLC(Smart Load Control)	X
Network function	Network solution(LGAP)	O

Notes

1. O : Applied, X : Not applied
2. * : Some advanced functions controlled by individual controller cannot be operated.

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■ Accessory Compatibility List

Category		Product	Remark	ZHBW055GA0 [KPHTC551M] ZHBW048GA0 [KPHTC481M] ZHBW041GA0 [KPHTC411M]
Wired Remote Controller	Standard	PREMTW101	New standard (White)	O
Dry Contact	Simple Contact	PDRYCB000	Simple Dry Contact	O
	Communication Type	PDRYCB400	2 Points Dry Contact (For Setback)	X
		PDRYCB320	For 3rd party Thermostat	O
		PDRYCB500	Dry Contact for Modbus	X
Gateway	IDU PI485	PHNFP14A0	Without case	X
		PSNFP14A0	With case	X
	ODU PI485	PMNFP14A1	PI 485 Gateway	O
	BACnet	PQNFB17C0	ACP BACnet	O
	Lonworks	PLNWKB000	ACP Lonworks	O
	Modbus	PMBUSB00A	-	O
Accessory Kit for AWHP	DHW sensor	PHRSTA0	included in DHW Tank kit	O
	Solar thermal kit	PHLLA	-	X
	2nd Circuit or E/Heater Thermistor	PRSTAT5K10	-	O
Central Controller	AC EZ	PQCSZ250S0	AC EZ	X
	AC Ez Touch	PACEZA000	AC Ez Touch	O
	AC Smart	PACS4B000	AC Smart IV	X
		PACS5A000	AC Smart 5	O
	ACP	PACP4B000	ACP IV	X
		PACP5A000	ACP 5	O
	AC Manager **	PACM4B000	AC Manager IV	X
		PACM5A000	AC Manager 5	O
ETC	Remote temperature sensor	PQRSTA0	-	O
	Group control wire	PZCWRCG3	0.25 m(0.8 ft)	X
	2-Remo Control Wire	PZCWRC2	0.25 m(0.8 ft)	O
	Extension wire	PZCWRC1	10 m(32.8 ft)	O
	Wi-Fi controller *	PWFMDD200	USB Cable : 0.6 m Extension cable : 0.5 m	O
	Meter Interface***	PENKTH000	Interface between IDU and Meter	O
	2 Zone Valve Controller	PZNVVB200	-	X
	PDI	PPWRDB000	PDI Standard	O
		PQNUD1S40	PDI Premium	O
	ACS IO Module	PEXPMB000	-	X

Note
1. O: Possible, X: Impossible, - : Not applicable
2. * : Some advanced functions controlled by individual controller cannot be operated.
3. ** : ACP or AC Smart is needed.
4. *** : Meter interface cannot be connected at the same time with 3rd-party controller.
5. For Solar thermal system, PT-1000 sensor needs to be supplied locally.
6. If you need more detail, please refer to the manual of product.
(http://partner.lge.com > Select Your Region : Home> Doc.Library> Product > Control(BECON))

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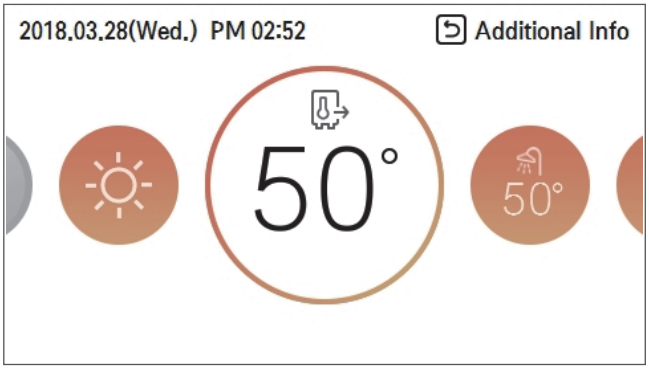
2. Feature & Controls

1. Summarized Features

1.1 Emergency Control



Easy checking of system failure

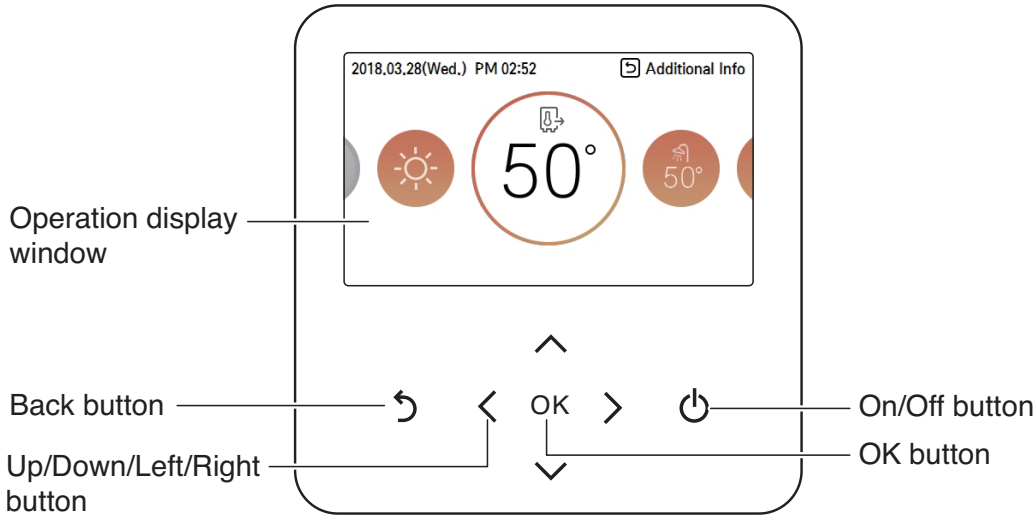
- Slight / Heavy trouble

Emergency operating

- Heavy trouble
- Back up heater ON
- Secure at least heating before A/S

1.2 Remote controller

• Controller Configuration



Operation display window	Operation and Settings status display
Back button	When you move to the previous stage from the menu's setting stage
Up/down/left/right button	When you change the menu's setting value
OK button	When you save the menu's setting value
On/Off button	When you turn ON/OFF the air conditioner

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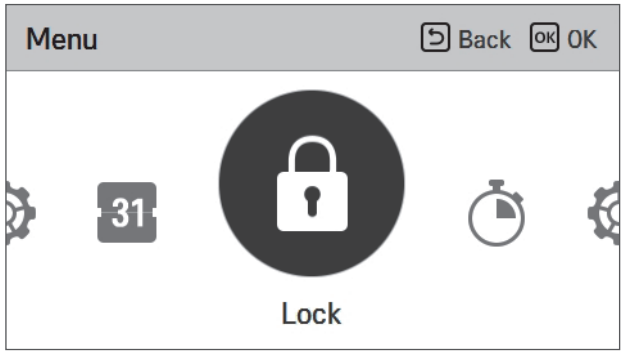
2. Special Function

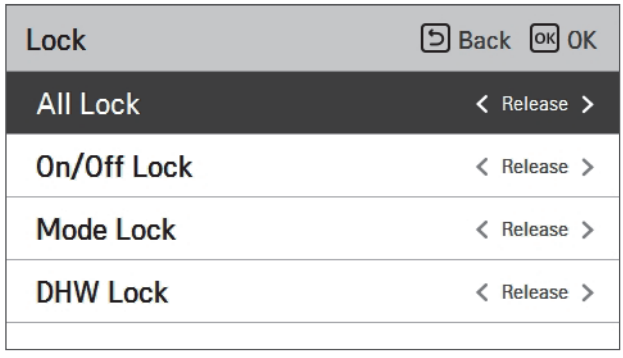
Lock setting – All, On/Off, Mode, DHW Lock

- It is the function to lock the button operation of the remote controller so that children or other persons cannot use it without permission.
- It is the function to limit the desired temperature range that can be set in the wired remote controller.

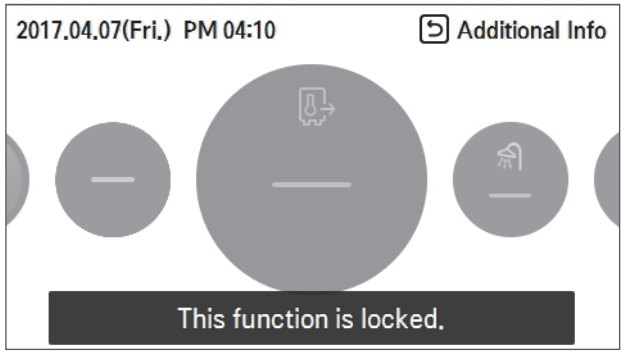
1 In the menu screen, press [<, > (left/right)] button to select “lock setting” category, and press [OK] button to move to the lock setting list screen.



2 In the lock setting list, if you press [∧ , ∨ (up/down)] button, you can turn on/off the corresponding lock function.



3



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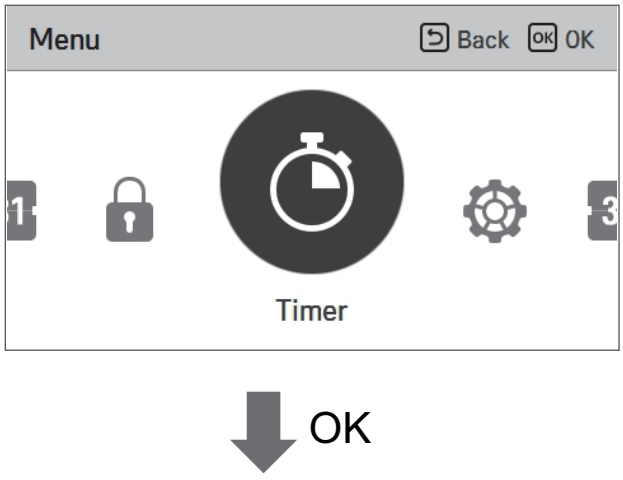
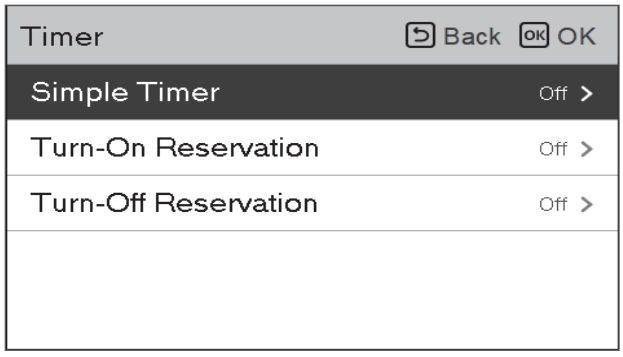
Timer entrance and setting method

- In the menu screen, press [<,>(left/right)] button to select the timer category, and press [OK] button to move to the timer setting list screen.
- In the timer setting list screen, press [∧, ∨(up/down)] button to select the timer to set, and press [OK] button to move to the detail screen.
- After setting the value, when you press [OK] button, the timer is activated.
- After setting the value, if you press [Back] button, the changed value will not be applied.





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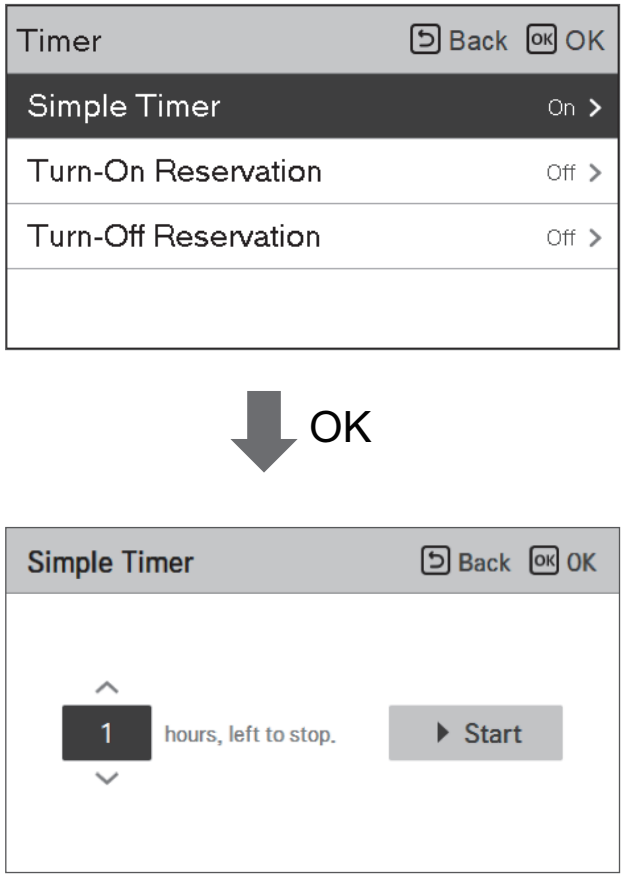
Simple Timer

You can easily set the timer in the range of 1~7 hours in the units of 1 hour.



NOTICE

If the product operation is On, the easy timer turns off the operation after the corresponding time.
If the product operation is Off, the easy timer turns on the operation after the corresponding time.
If the easy timer operation is turned On/Off before the timer operation, the set timer will be cleared.

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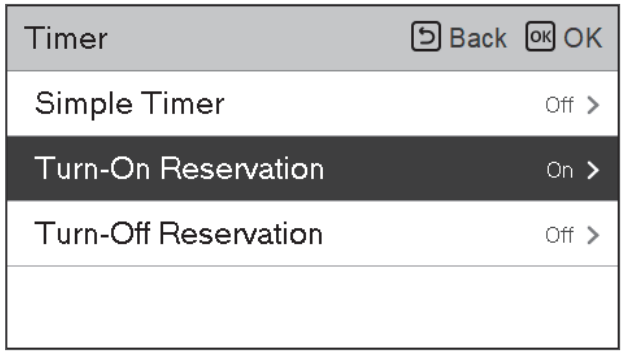
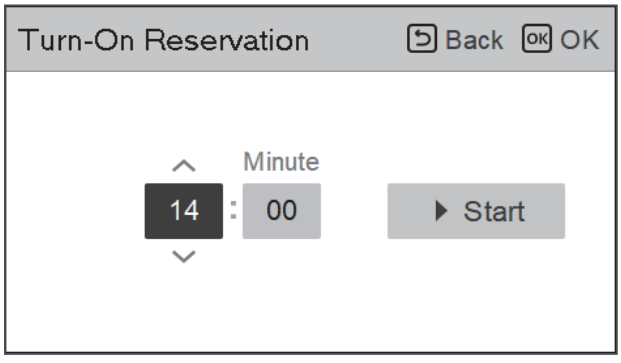
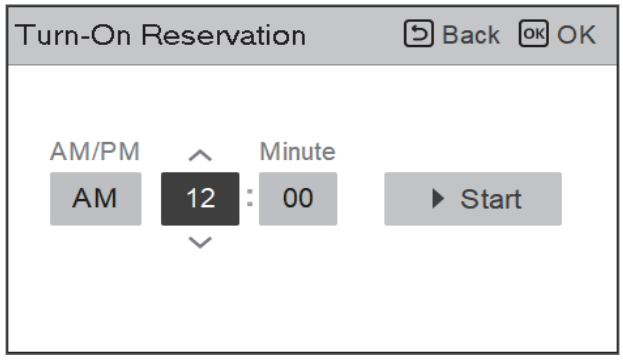
Turn-On Reservation

The product is automatically turned On at the set timer time.



It provides 2 Time formats, 12Hours(AM/PM) or 24Hours reference.





NOTICE

Even if the Turn-on Reseravation operation is turned On/Off after the setting and before the timer operation, the set timer is not cleared.

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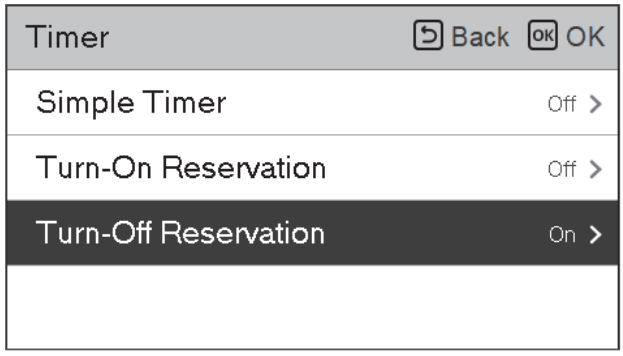
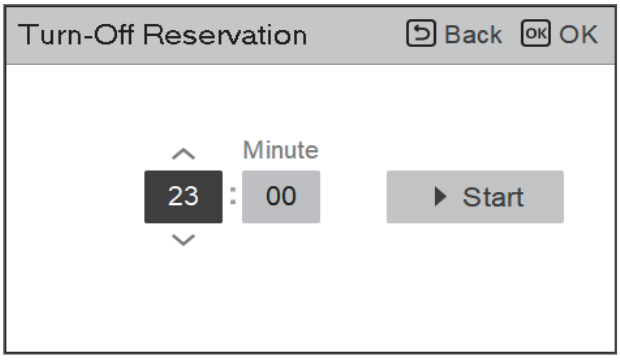
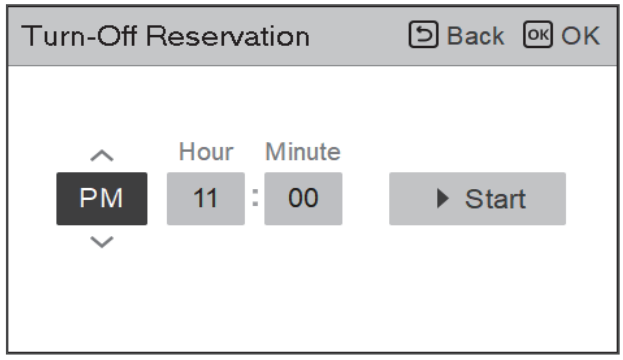
Turn-Off Reservation

The product is automatically turned Off at the set timer time.



It provides 2 Time formats, 12Hours(AM/PM) or 24Hours reference.





NOTICE

Even if the Turn-off Reservation operation is turned On/Off after the setting and before the timer operation, the set timer is not cleared.

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Schedule Setting

Daily Schedule

It is the function that can check the status of the timer (schedule) saved in the remote controller.

- In the schedule list, select the daily schedule status category, and press [OK] button to move to the detail daily schedule status screen.
- You can use the remote controller's [<, > (left/right)] button to check the timer information of other dates.
- You can use the remote controller's [∧ , ∨ (up/down)] button to check the corresponding date's other timer information.
- Select the timer information, and press [OK] button to move to the corresponding timer's edit screen.

Schedules & Edit

It is the function that can check the status of the timer (schedule) saved in the remote controller.

- In the schedule list, select the daily schedule status category, and press [OK] button to move to the daily schedule status detail screen.
- You can use the remote controller's [<, > (left/right)] button to check other date's timer information.
- You can edit the saved schedule's timer information.
  - Select the schedule to edit using [∧ , ∨ (up/down)] button, and press [OK] button to move to the edit screen.
- Select the timer information, and press [OK] button to move to the corresponding timer's edit screen.

Schedules & Edit – Add schedule

Description of each stage in Add schedule

In 'Stage 1', it sets the period to perform the timer.

In 'Stage 2', it sets the day of week to perform the timer.

- You can select 'Everyday / Weekend / Weekdays / Individual selection'.
  In 'Stage 3', it sets the start time for the timer.
  In 'Stage 4', it sets the timer operation information.
- If 'Stop' is selected, you cannot set the mode / temperature / fan speed.
  When stages 1~4 are completed, along with the message of 'schedule is added', it moves to View and edit schedule screen.

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Exception day

It is the function to automatically stop the operation on the set timer day.

- In the schedule list, select the exception day category, and press [OK] button to move to the Exception day designation detail screen.
- In the exception day, you can check, and add/change/delete the exception day information saved in the remote controller.
  - To add an exception day, in the Exception day registration detail screen, designate year/month/day, and press [OK] button to save the Exception day.
  - Select the Exception day to edit using [∧ , ∨ (up/down)] button, and press [OK] button to move to the edit screen.
  - In the exception day edit screen, you can check, delete/change the corresponding exception day's setting contents.
  - When you change the exception day information, you need to save it after the change.

DHW Tank Heating & DHW Tank Heater Operation

This function is schedule programming about DHW tank heating and DHW tank heater operation.

Two schedule programming for DHW tank heating and another Two schedule programming for DHW tank heater operation are possible. Scheduled programming will be operated everyday.

Low noise mode operation

If necessary, enable or disable of silent mode can be programmed according to user's specific time.

Screed drying

- If necessary, enable or disable of screed drying can be programmed according to user's setting.
- While the screed drying mode is operating, "Dry" is displayed.

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3. System Set-up

As AWHP is designed to satisfy various installation environment, it is important to set up system correctly. If not configured correctly, improper operation or degrade of performance can be expected.

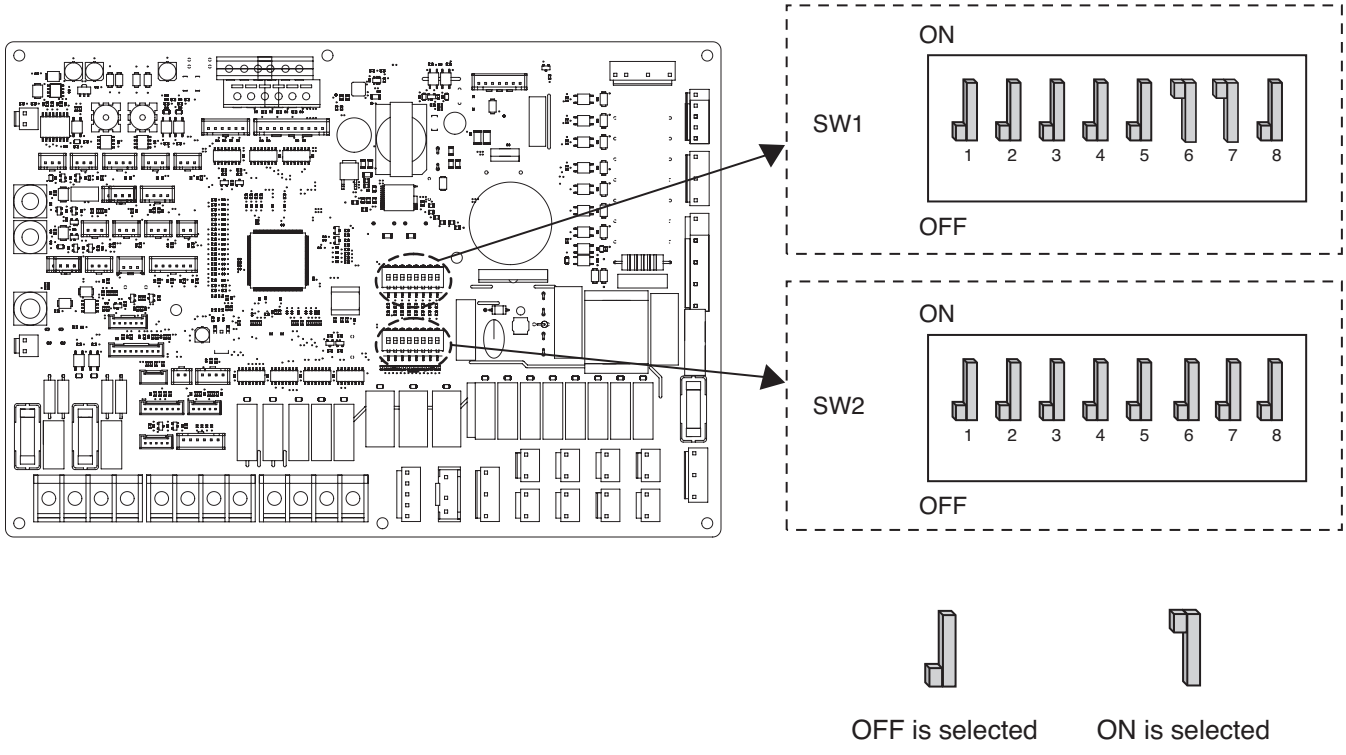
3.1 DIP Switch Setting

⚠CAUTION

Turn off electric power supply before setting DIP switch

• Whenever adjusting DIP switch, turn off electric power supply to avoid electric shock.

General Information



OFF is selected ON is selected

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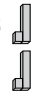
DIP switch information

• If you set DIP switch when power is on, the changed setting will not be applied immediately.
The changed setting will be enabled only when Power is reset or by pressing Reset button.

Option Switch 2

Description	Setting		Default
Accessory installation information	 2 3	Heat pump is installed (Heating(Cooling) circuit only)	 2 3
	 2 3	Heat pump + DHW tank is installed	
	 2 3	Heat pump + DHW tank + Solar thermal system is installed	
Cycle	 4	Heating Only	 4
	 4	Heating & Cooling	
Room Air Sensor	 5	Room Air Sensor is not installed	 5
	 5	Room Air Sensor is installed	
Selecting electric heater capacity	 6 7	Electric heater is not used	 6 7
	 6 7	Half capacity is used only	
	 6 7	Full capacity is used	
Thermostat installation information	 8	Thermostat is NOT installed	 8
	 8	Thermostat is installed	

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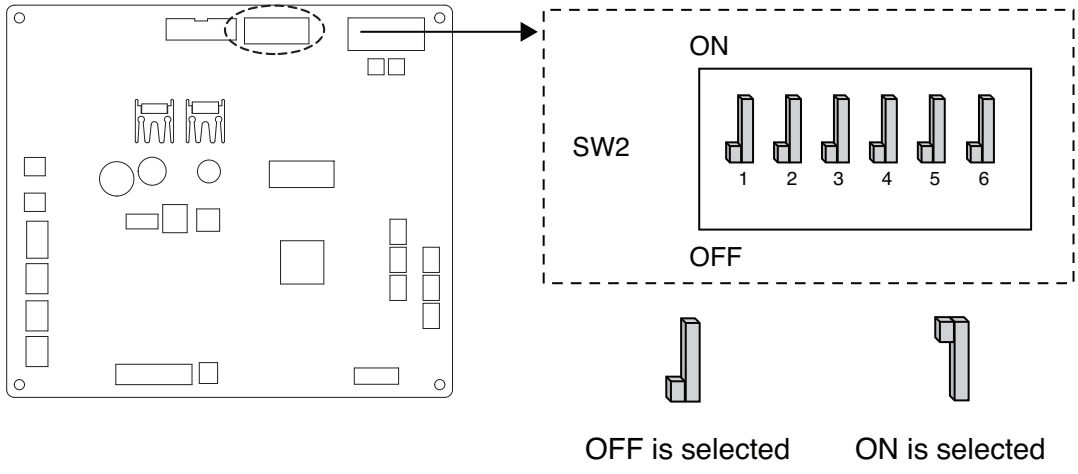
Option Switch 1

Description	Setting		Default
MODBUS Communication Type	1	As Master (LG extension modules)	1
	1	As Slave (3rd party controller)	
MODBUS Function	2	Unified Open Protocol	2
Antifreeze Agent	8	Antifreeze agent is not used	8
	8	Antifreeze agent is used *	

❊ Possibility to allow colder water temperature by setting.
Bridge at CN_ANTI_SW must be dis-connected to enable setting.

UN60A (12(41 000), 14(48 000), 16(55 000) kW(Btu/h))



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DIP Switch Information
(Option Switch 1)

Description	Setting		Default
Low Noise Mode	2 	Normal Low Noise Mode	2 
	2 	Limited Low Noise Mode	
Peak Control	3  4 	Max Mode	3  4 
	3  4 	Peak Control Step 1 - To limit maximum current (Power saving)	
	3  4 	Peak Control Step 2 - To limit maximum current (Power saving)	

❉ Only DIP Switch no. 2 and no.3 has a function. Others have no function.
❉ When setting the limited low noise mode, Mode can be exited to secure capacity after operating for a certain time.

Note

❉ Input current value can be limited by DIP Switch operation.

Model Name			Peak Control Mode Running Current (A)	
Chassis	Phase (Ø)	Capacity (kW(Btu/h))	1 Step	2 Step
UN60A	1	12 (41 000)	23	20
		14 (48 000)	24	21
		16 (55 000)	25	22

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NOTICE

Emergency operation

• **Definition of terms**

- **Trouble :** a problem which can stop system operation, and can be resumed temporally under limited operation without certificated professional's assist.
- **Error :** problem which can stop system operation, and can be resumed only after certificated professional's check.
- **Emergency mode :** temporary heating operation while system met trouble.

• **Objective of introducing 'trouble'**

- Not like airconditioning unit, Air-to-Water heat pump is generally operating in whole winter season without any system stopping.
- If system found some problem, which is not critical to system operating for yielding heating energy, the system can temporarily continue in emergency mode operation with end user's decision.

• **Classified trouble**

- Trouble is classified two levels according to the seriousness of the problem : Slight Trouble and heavy trouble
- **Slight trouble :** Sensor trouble.
- **Heavy trouble :** Compressor cycle trouble.
- **Option trouble :** a problem is found for option operation such as water tank heating. In this trouble, the troubled option is assumed as if it is not installed at the system.

• **When the AWHP has any trouble,**

(1) If there is not a function to judge possibility of operation : Once an trouble occurs mainly in outdoor unit, AWHP stops. On the other hand, Remocon allows the product to activate On/ Off operation.(On : emergency operation)
   - Slight / Heavy trouble : Heating Operable only
   - Critical trouble : Full stop
   - Treatment priority : Critical>Heavy>Slight

(2) If there is a function to judge possibility of operation : Depending on the status of slight / heavy / critical trouble, pop-up phrase is guided separately on display.
   - Slight trouble : Heating/Cooling Operable
   - Heavy trouble : Heating Operable only
   - Critical trouble : Service center request

   AWHP operates when user pressed OK button on pop-up window.

• **Duplicated trouble : Option trouble with slight or heavy trouble**

If option trouble is occurred with slight (or heavy) trouble at the same time, the system puts higher priority to slight (or heavy) trouble and operates as if slight (or heavy) trouble is occurred.
Therefore, sometimes DHW heating can be impossible in emergency operation mode. When DHW is not warming up while emergency operation, please check whether the DHW sensor and related wiring are connected well or not.

• **Emergency operation is not automatically restarted after main electricity power is reset.**

In normal condition, the unit operating information is restored and automatically restarted after main electricity power is reset.
But in emergency operation, automatic re-start is prohibited to protect the unit.
Therefore, user must restart the unit after power reset when emergency operation has been running.

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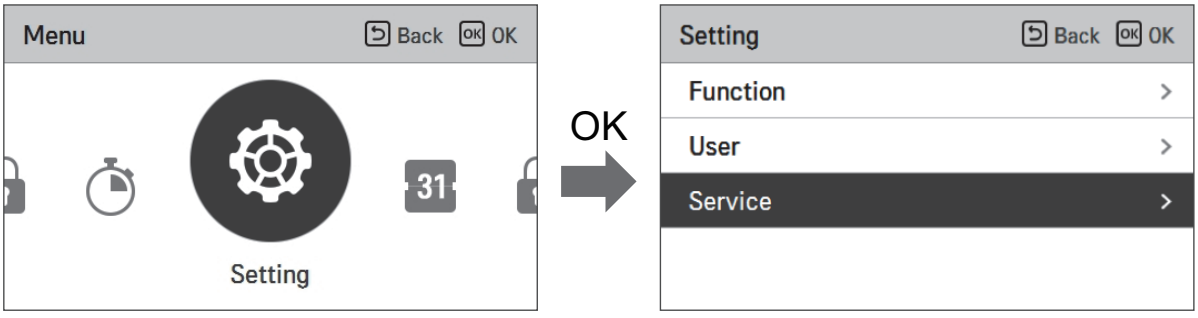
3.2 Service setting

How to enter service setting

To enter the menu displayed at the bottom, you need to enter the service setting menu as follows.

- In the menu screen, press [<,>(left/right)] button to select the setting category, and press [OK] button to move to the setting list.
- In the setting list, select the service setting category, and press [OK] button to move to the service setting list.



Service setting

- You can set the product service functions.
- Some functions may not be displayed/operated in some product types.

Menu	Description
Service contact	Check and input the service center phone number that you can call when there is service issue.
Model information	view the Indoor / outdoor product group and capacity information
RMC Version Information	Check the remote controller model name and software version.
Open Source License	View the remote controller's open source license.

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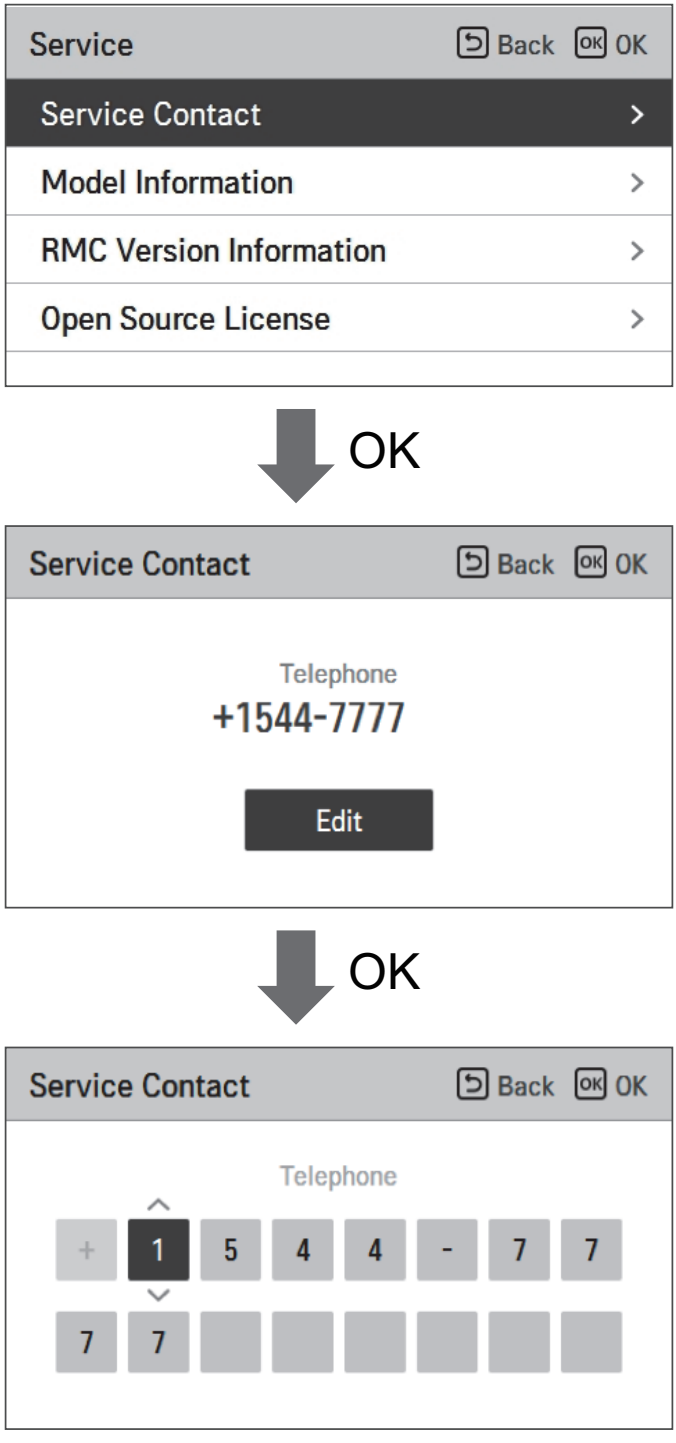
Service Contact

Check and input the service center phone number that you can call when there is service issue.

- In the service setting list, select the service contact point and press [OK] button to move to the detail screen.
- While “edit” button is selected, press [OK] button to move to the edit screen, change it, and press [OK] button to change the service contact point.



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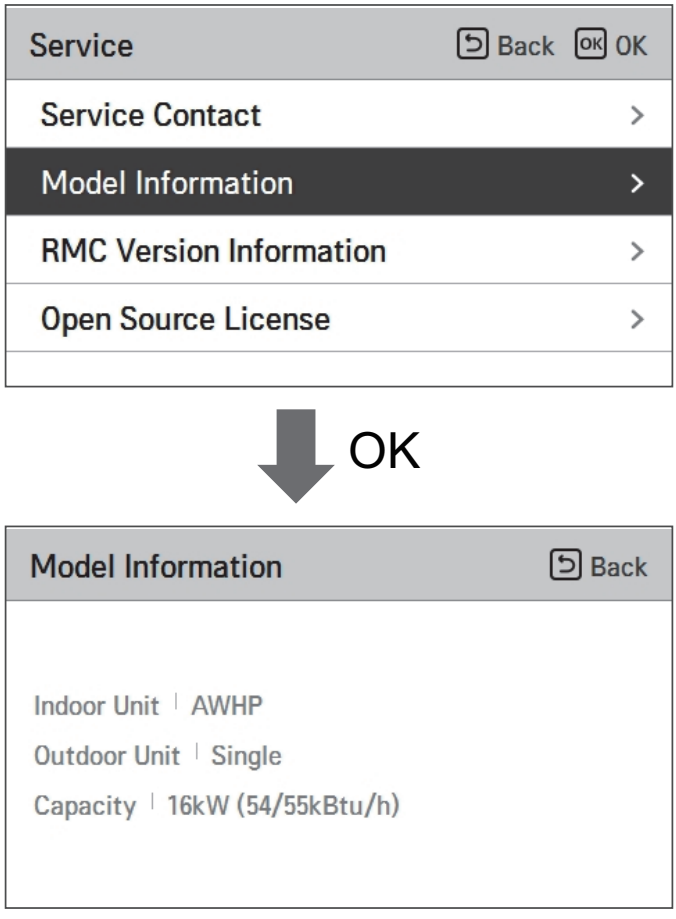
Model Information

Check the indoor/outdoor product group and capacity information to which the remote controller is connected.

• In the service setting list, select the indoor/outdoor model information category, and press [OK] button to move to the detail screen.

• Indoor unit capacity

- 1kWh = 1kBtu * 0.29307
  kWh is the result calculated based on Btu, There may be a small difference between calculated and actual capacity.
  Ex) If the indoor unit capacity is 18kBtu, it is displayed as 5kWh.



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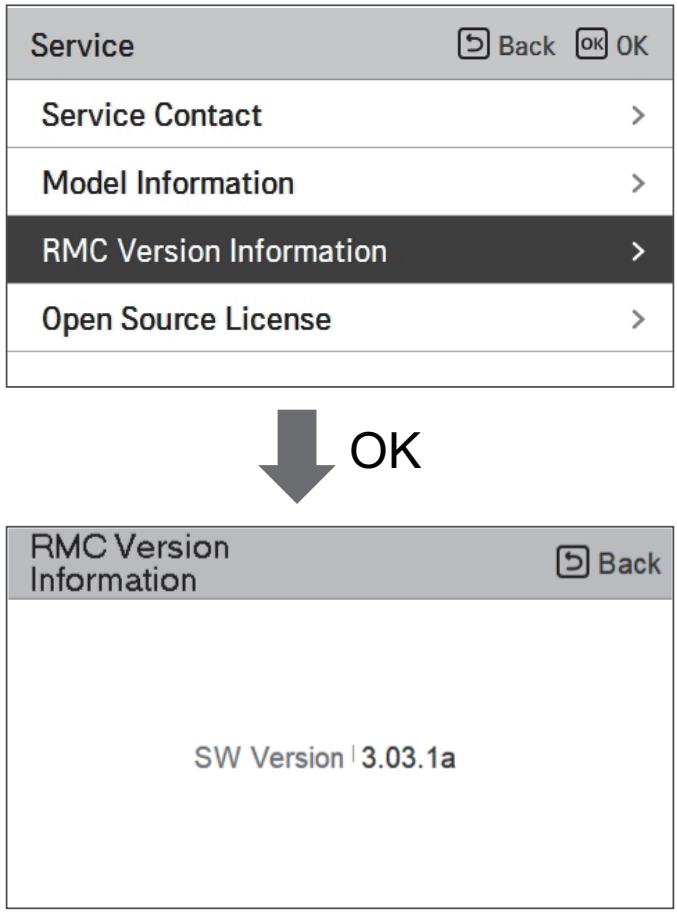
RMC Version Information

View the remote controller software version.

• In the service setting list, select the RMC version information and press [OK] button to move to the detail screen



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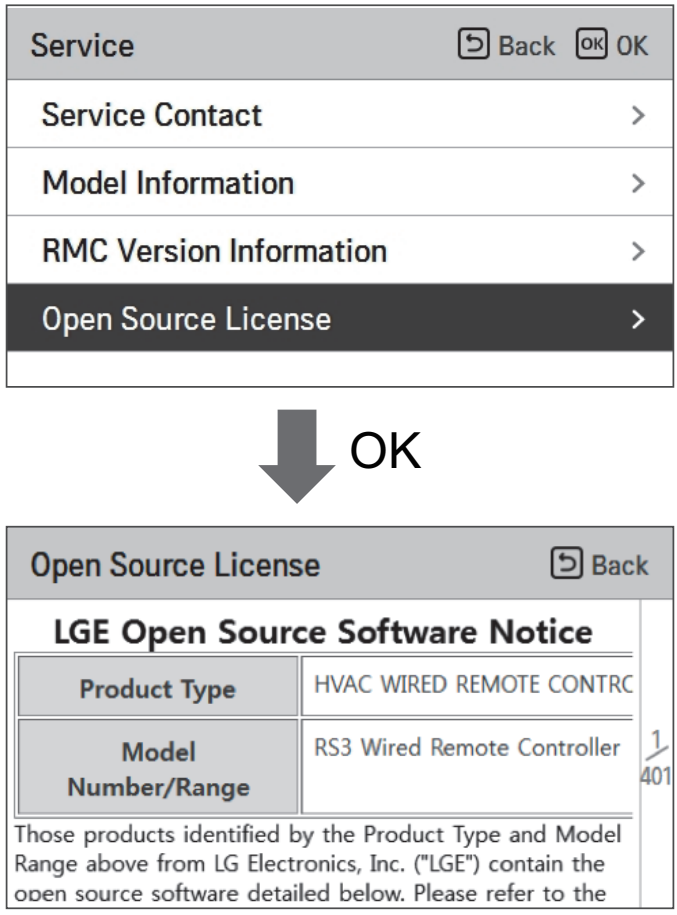
Open Source License

View the remote controller's open source license.

- In the service setting list, select the open source license category, and press [OK] button to move to the detail screen.



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3.3 Installer setting

How to enter installer setting mode

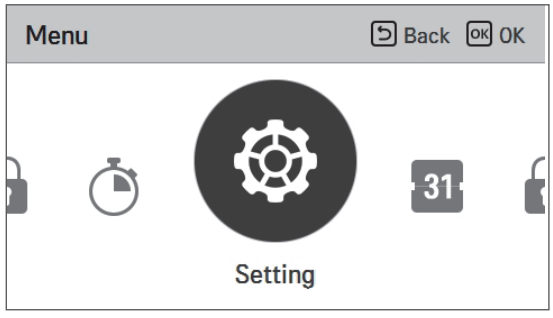
⚠CAUTION

Installer setting mode is to set the detail function of the remote controller.
If the installer setting mode is not set correctly, it could cause problems to the unit, user injury or property damage. This must be set by an certificated installer, and any installation or change that is carried out by a non-certificated person should be responsible for the results. In this case, free service cannot be provided.

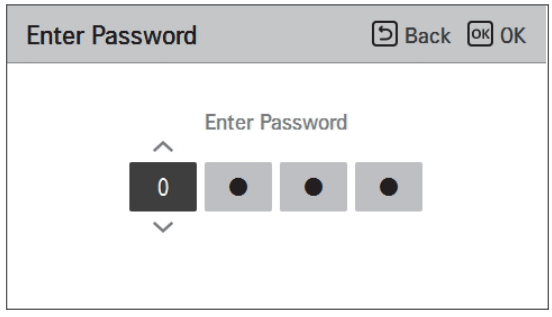
❉ Installer setting password
Main screen → menu → setting → service → RMC version information → SW Version
Example) SW version : 1.00.1 a
In the above case, the password is 1001.

❉ Remote controler should be hanged botton of control box in service

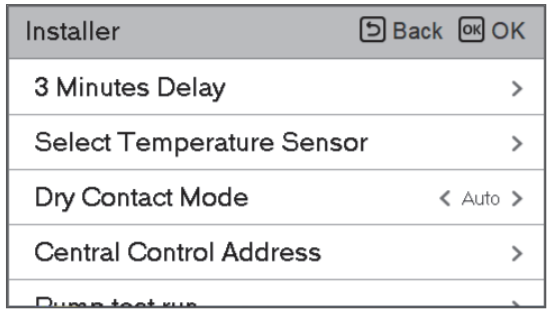
1 In the menu screen, press [< ,>(left/right)] button to select the setting category, and press [∧ (up)] button for 3 seconds to enter the password input screen for the installer setting.



2 Input the password and press [OK] button to move to the installer setting list.



3



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Installer setting

• You can set the product user functions.
• Some functions may not be displayed/operated in some product types.

Segmentation	Functions	Description
Configuration	Select Temperature Sensor	Selection for setting temperature as air temperature or leaving water temperature or air + leaving water temperature
	Use Heating Tank Heater	Set up to control booster heater
	Mixing Circuit	This function is to use mixing circuit function. Set enable/disable mixing circuit function and valve closing time and hysteresis.
	Use External Pump	Set up to control an external water pump
	RMC master/slave	Function to use 2 remote control environment
	LG AWHP Configuration	Function to save the environment settings of the product for use in LG AWHP Configuration through SD Card.
General settings	Forced operation	Water pump off After 20 consecutive hours, disable / enable the logic that drives the water pump by itself
	Pump Prerun/Overrun	Set to reach the optimum flow rate by circulating the heating water with the water pump before heat exchange. After the operation stop, additional water pump is activated to circulate the heating water.
	Water Flow Control	Set water pump to control the water flow
	Energy Monitoring	Set up to use energy monitoring fuction of unit
	Password Reset	It is the function to initialize (0000) the password when you forgot the password set in the remote controller.
Room Heating	Heating temp. setting	At the water control in heating mode, the control reference water temperature position setting
	Air heating set temp.	Adjusting range of 'Setting Air Temperature' in heating mode
	Water heating set temp.	Adjusting range of 'Setting Heating Flow Temperature' in heating mode
	Hysteresis Heating Water	Heating Water Outlet Temperature Hysteresis range setting
	Hysteresis Room Air (Heating)	Heating air temperature Hysteresis range setting
	Pump setting in heating	Set water pump on/off interval option during thermo off condition in heating mode
	Heater on temperature	Setting outdoor air temperature where half capacity of backup heater starts operation.
	Screed drying	This function controls floor heating to a specific temperature for a certain period of time to cure floor cement

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Segmentation	Functions	Description
Room Cooling	Cooling temp. setting	At the water control in cooling mode, the control reference water temperature position setting
	Air cooling set temp.	Adjusting range of 'Setting Air Temperature' in cooling mode
	Water cooling set temp.	Adjusting range of 'Setting Leaving Water Temperature' in cooling mode
	Water supply off temp. during cooling	Determine the leaving water temperature which blocks the flow into underfloor coil in cooling mode. This function is used for preventing condensation on the floor in cooling mode
	Hysteresis Cooling Water	Cooling Water Outlet Temperature Hysteresis range setting
	Hysteresis Room Air (Cooling)	Cooling air temperature Hysteresis range setting
	Pump setting in cooling	Set water pump on/off interval option during thermo off condition in cooling mode
Auto mode	Seasonal auto temp	Set the operating temperature in Seasonal Auto mode
Domestic hot water	DHW set temp.	Setting DHW set temperature
	Over-heating schedule setting	Setting start/maintain time for Over-heating
	Over-heating Time setting	Setting Over-heating temperature
	Tank setting 1	Setting minimum and maximum temperature using heat pump cycle for DHW heating
	Tank setting 2	Setting temperature hysteresis and heating priority (DHW heating or floor heating)
	Heater priority	Determine usage of backup heater and booster heater
	DHW time setting	Determine follow time duration : operation time of domestic hot water tank heating, stop time of domestic hot water tank heating, and delay time of DHW tank heater operating
	Recirculation time	Whether to use the recirculation function and set the water pump on/off interval option
Solar thermal	Solar Thermal System	Function to set operation reference value in Solar Thermal System.
Service	Pump test run	Water pump test run
	Frost Protection Temp.	This function is to apply an offset to the freezing temperature of the freeze protection logic when using antifreeze mode

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Segmentation	Functions	Description
Connectivity	Dry Contact Mode	Dry contact function is the function that can be used only when the dry contact devices is separately purchased and installed.
	Central Control Address	When connecting the central control, set the central control address of the unit.
	CN_CC	It is the function to set whether to install (use) Dry Contact. (It is not a function for Dry Contact installation, but it is a function to set the usage of the unit's CN_CC port.)
	CN_EXT	Function to set external input and output control according to DI / DO set by customer using dry contact port of indoor unit. Determine the use of the contact port (CN_EXT) mounted on the indoor unit PCB
	3rd Party Boiler	Configuration to control 3rd party boiler
	Meter Interface	When installing the meter interface to measure energy / calorie in the product, set unit spec for each port
	Energy state	Select whether to use or not use the SG Mode function of the product, set the operation option value in SG1 step.
	Thermostat control type	Setting Thermostat control type
	Modbus Address	It is function to set the address of the Modbus device that is externally linked to the product. Modbus address setting function is available from indoor unit.
Info	Pump operation time	Display water pump's operation time
	IDU operation time	Display Indoor Unit's operation time
	Current Flow Rate	Function to check the current flow rate.
	Data logging	Display error and operation history of connected unit

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Common setting

• **3 Minutes Delay**
Factory use only.

• **Select temperature sensor**
In case an installer set the water in this menu, it is possible to select whether a leaving water temperature or entering water temperature in the heating temperature menu.

• **Dry Contact Mode**
This function allows the dry contact operate under auto run mode or manual mode with remote controller.

Temperature range setting

• **Air cooling set temp.**
Determine cooling setting temperature range when air temperature is selected as setting temperature.

NOTICE

It is possible to control the unit based on room air temperature by using either remote air temperature sensor or wired remote controller (RS3).
- Remote room air sensor is an accessory (PQRSTA0) and sold separately.
- DIP switch setting should be set properly in order to control the unit based on room air temperature.

• **Water cooling set temp**
Determine cooling setting temperature range when water temperature is selected as setting temperature.

NOTICE

Water condensation on the floor
- While cooling operation, it is very important to keep leaving water temperature higher than 16 °C (60.8 °F). Otherwise, dew condensation can be occurred on the floor.
- If floor is in humid environment, do not set leaving water temperature below 18 °C (64.4 °F).

NOTICE

Water condensation on the radiator
- While cooling operation, cold water may not flow to the radiator. If cold water enters to the radiator, dew generation on the surface of the radiator can be occurred.

• **Air heating set temp.**
Determine heating setting temperature range when air temperature is selected as setting temperature.

CAUTION

It is possible to control the unit based on room air temperature by using either remote air temperature sensor or wired remote controller (RS3).
- Remote room air sensor is an accessory (PQRSTA0) and sold separately.
- DIP switch setting should be set properly in order to control the unit based on room air temperature.

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• **Water heating set temp**

Determine cooling setting temperature range when water temperature is selected as setting temperature.

• **DHW set temp.**

Determine heating setting temperature range of water tank leaving water.

NOTICE

Only available when DHW tank feature is installed.

- DHW tank and DHW tank kit should be installed.
- DIP switch No. 2 and 3 should be set properly.

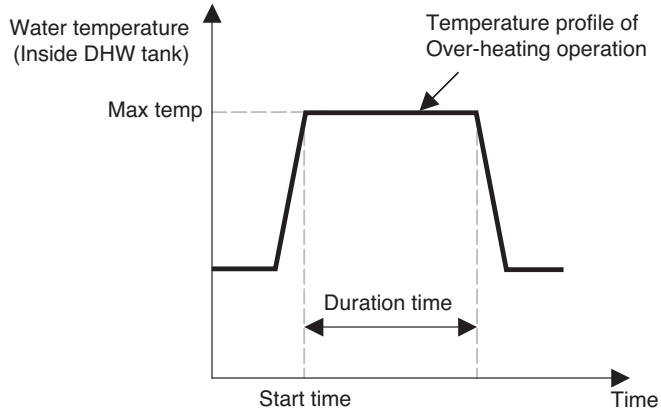
• **Screed drying mode**

After installing water pipes for under floor heating, user can select screed drying mode for curing the cement.

• **Over-heating schedule setting and Over-heating Time setting**

This is a function that raises the temperature of the tank by Over-Heating at a specific time.

- Over-Heating active : Selecting enable or disable of Over-Heating operation.
- Start date : Determining the date when the Over-Heating mode is running.
- Start time : Determining the time when the Over-Heating mode is running.
- Max temp. : Target temperature of Over-Heating mode.
- Duration time : Duration of Over-Heating mode.



NOTICE

Value of tank Over-heating setting

- If Over-Heating active is set as ' Not use', that is 'disable Over-Heating mode', Start date and Start time is not used.
- When Over-heating active is set as 'Use', that is 'enable Over-heating mode', Start date is displayed at the position of Over-heating active and Start time is displayed at the position of Start date.

NOTICE

DHW heating should be enable.

- If DHW heating is disable, the Over-heating mode will not be operated although Over-heating active is set as 'Use'.
- To use Over-heating mode, DHW heating should be enable. (by button input or scheduler programming)

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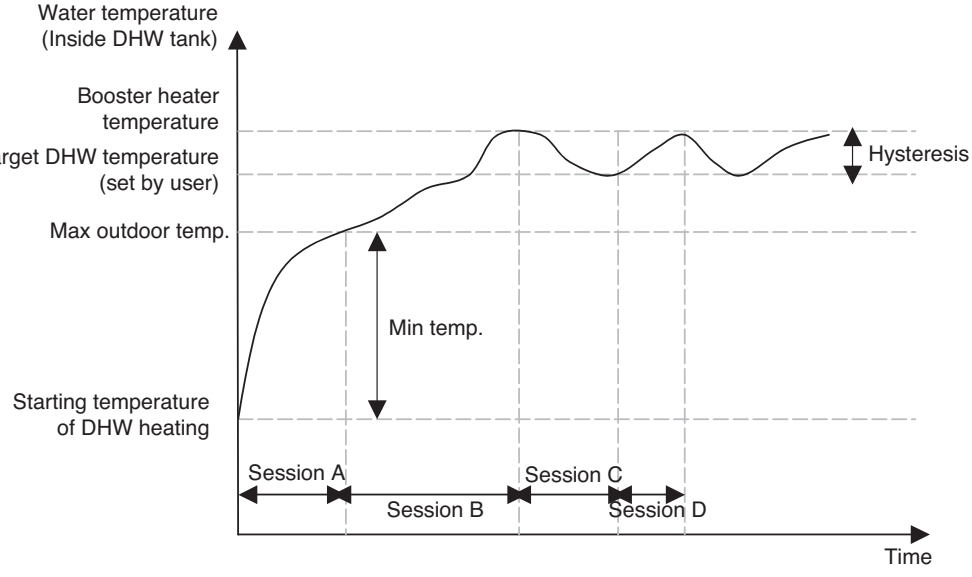
• **Tank setting 1, 2**

Descriptions for each parameters are as following.

- Min temp. : temperature gap from Max outdoor temp.
- Max outdoor temp. : maximum temperature generated by AWHP compressor cycle.
- Example : If Min temp. is set as 5°C(9°F) and Max outdoor temp. is set as 48°C(118°F), then Session A (see the graph) will be started when the water tank temperature is below 43 °C(109.4°F)…. If temperature is above 48 °C(118°F)…, then Session B will be started.

- Hysteresis :Temperature gap from target DHW temperature. This value is required to prevent frequent On and Off of water tank heater. In the normal DHW operation, the value is set as '0' and Hysteresis is valid when heater delay time is active.
- Example : If user's target temperature is set as 70 °C (158 °F) and Hysteresis is set as 3 °C (5.4 °F), then the booster heater will be turned off when the water temperature is above 73 °C (163.4 °F). The booster heater will be turned on when the water temperature is below 70 °C (158 °F).
- Heating priority : Determining heating demand priority between DHW tank heating and under floor heating.
- Example : If Heating priority is set as 'DHW', that means heating priority is on DHW heating, DHW is heated by AWHP compressor cycle and booster heater. In this case the under floor can not be heated while DHW heating. On the other hand, if the Heating priority is set as 'Floor heating', that means heating priority is on under floor heating, DHW tank is ONLY heated by booster heater. In this case the under floor heating is not stopped while DHW is heated.



Session A : Heating by AWHP compressor cycle and booster heater
Session B : Heating by booster heater
Session C : No heating (Booster heater is Off)
Session D : Heating by booster heater

NOTICE

DHW heating does not operate when it is disabled.

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Temperature control parameter setting and etc

• **Heater on temperature**

Using Half capacity of back up heater: when DIP Switch No. 6 and 7 is set as 'OFF-ON' :

- Example : If Heater on temperature is set as -1 °C (-1.8 °F) and DIP switch No 6. and 7 is set as 'OFF-ON', then half capacity of back up heaterwill start operation when outdoor air temperature is below -1 °C (-1.8 °F) and current leaving water temperature or room air temperature is much belower than target leaving water temperature or target room air temperature.

Using Full capacity of back up heater: when DIP Switch No. 6 and 7 is set as 'OFF-OFF' :

- Example : If Heater on temperature is set as '-1 °C (-1.8 °F)' and DIP switch No 6. and 7 is set as 'OFF-OFF', then full capacity of back up heaterwill start operation when outdoor air temperature is below -1 °C (-1.8 °F) and current leaving water temperature or room air temperature is much belower than target leaving water temperature or target room air temperature.

• **Water supply off temp. during cooling**

Determine the leaving water temperature which blocks the flow into underfloor coil in cooling mode. This function is used for preventing condensation on the floor in cooling mode.

- Stop temp. : heat pump cycle cut off temperature. Stop temp. is valid when FCU is not installed.
- FCU : determines if FCU is installed or not.
- Example : If FCU is set as 'Use', Stop temp. setting is disabled. and However, if actually FCU is NOT installed in the water loop, the unit operates continuously in cooling mode until water temperature meets desired temperature. In this case, a condensed water may form on the floor caused by cold water in the underfloor coil.
- Example : If Stop temp. is set as '20' and FCU is set as 'Not use' and actually FCU is installed in the water loop, then the Stop temp. is used and the unit stops operation in cooling mode when the leaving water temperature is below 20 °C. As a result, the unit may not offer enough cooling since the cold water with desired temperature doesn't flow into the FCU.

NOTICE

FCU Installation

- If FCU is used, related 2way valve should be installed and connected to the Main PCB assembly 1.
- If FCU is set as 'Use' whereas FCU or 2way valve is NOT installed, the unit can do abnormal operation.

• **TH on/off Variable, Heating Air**

It is a function to adjust the heating air temperature Thermal On / Off temperature according to the field environment in order to offer optimized heating operation.

• **TH on/off Variable, Heating Water**

It is a function to adjust the heating water temperature Thermal On / Off temperature according to the field environment in order to offer optimized heating operation.

• **TH on/off Variable, cooling air setting**

It is a function to adjust the cooling air temperature Thermal On / Off temperature according to the field environment in order to offer optimized heating operation.

• **TH on/off Variable, cooling water setting**

It is a function to adjust the cooling water temperature Thermal On / Off temperature according to the field environment in order to offer optimized heating operation.

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- **Pump setting in heating**
  Installer setting function to set water pump on/off interval option during thermo off condition in heating mode

- **Pump setting. In cooling**
  Installer setting function to set water pump on/off interval option during thermo off condition in heating mode

- **Forced operation**
  Water pump off After 20 consecutive hours, disable / enable the logic that drives the water pump by itself

- **CN_CC setting**
  It is the function to set the usage of the indoor unit's CN_CC port.

- **Pump capacity**
  It is a function to enable installer to control pump PWM of BLDC pump application model.

- **Energy state**
  This function is to control the product according to the energy state. When the charged state of ESS is transmitted, it changes the target temperature of heating, cooling and DHW by setting value according to energy state

- **Seasonal auto temp**
  It is the function to set the operation reference value in Seasonal Auto mode.
  - Setting range: Celsius
  - This function is to check the operation and error history.
  * If heating mode is selected, heating & cooling or cooling can not be selected.
  - Depending on the air / outflow control selection value, the water / air related setting value is displayed on the screen

- **Data logging**
  It is the function to set the operation reference value in Seasonal Auto mode.

- **Password initialization**
  It is the function to initialize (0000) when you forgot the password set in the remote controller.
  When you press "initialization" button, a popup screen appears, and when you press "check" button, password initialization starts, and the user password is changed to 0000.

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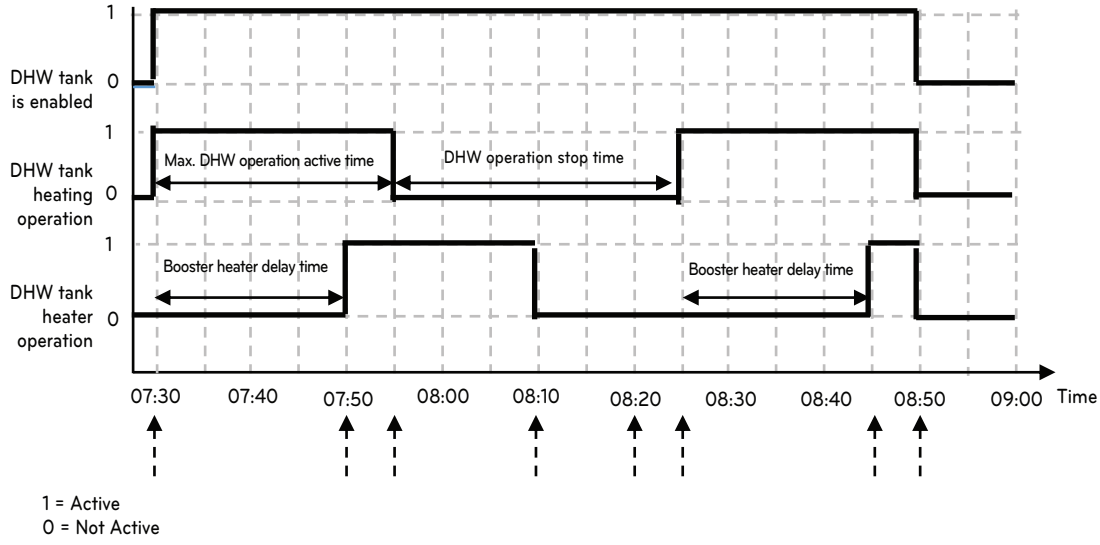
• **Heater priority**

- Heater priority : Determine the usage of back up heater and booster heater.
- Example : If Heater priority is set as 'Main+Boost heater ON', then back up heater and booster heater are on and off according to control logic. If Heater priority is set as 'Boost heater only ON', then back up heater is never turned on and only booster heater is on and off according to control logic.

• **DHW time setting**

Determine following time duration : operation time of DHW tank heating, stop time of DHW tank heating, and delay time of DHW tank heater operating.

- Active time : This time duration defines how long time DHW tank heating can be continued.
- Stop time : This time duration defines how long time DHW tank heating can be stopped. It is also regarded as time gap between DHW tank heating cycle.
- Boost heater delay time : This time duration defines how long time DHW tank heater will not be turned on in DHW heating operation.
- Example of timing chart :



Time	Description
7:30	The user activates the DHW function in the remote controller (DHW operation starts by the heat pump cycle as the Thermo on condition is reached)
7:50	The booster heater is activated after the booster heater delay time(20 min)
7:55	The active time(25min) of DHW operation by the heat pump cycle ends and the heat pump cycle is forced to be stopped (The booster heater is continues to operate because the target temperature is not reached)
8:10	The booster heater operation ends as the target temperature is reached
8:20	DHW operation is not activated by the stop time(30 min) even though the water temperature is dropped and DHW operation condition is reached.
8:25	When the active time condition is reached, DHW operation starts again by the heat pump cycle
8:45	The booster heater is activated after the booster heater delay time(20 min)
8:50	The user deactivates the DHW function by turning it off in the remote controller

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- **Modbus Address**
  It is function to set the address of the Modbus device that is externally linked to the product.

- **CN_EXT**
  It is a function to control external input and output according to DI type set by customer using CN-EXT Port.

- **Add Zone**
  Function to set whether or not to use a installed 2nd circuit function using mixing kit.

- **Use External Pump**
  This function can be set to control the external water pump.

- **3rd Party Boiler**
  This function is to configure the 3rd party boiler to be controlled.

- **Meter interface**
  It is the function that can check the status of energy and power on screen. It collects and calculates power or calorie data to create data for energy monitoring and energy warning alarm pop-ups.

- **Pump Prerun/Overrun**
  Pump Prerun operates to ensure sufficient flow before the compressor is operated. This is a function that allows heat exchange to work smoothly.

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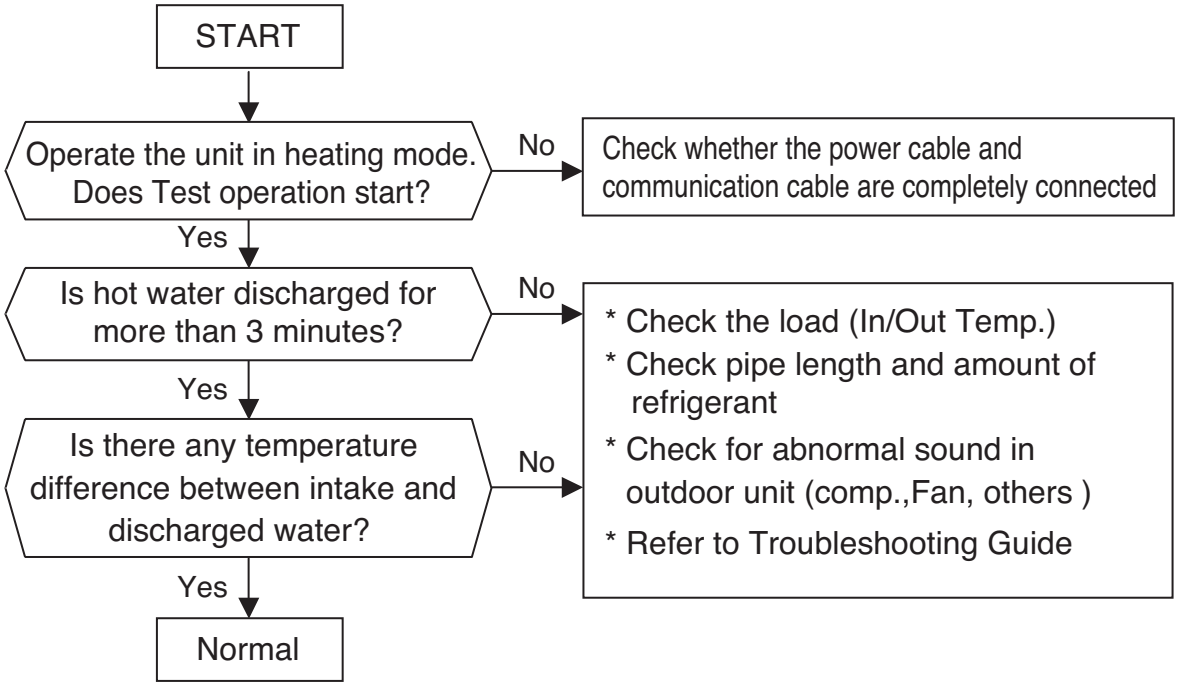
3. Test Run

1. Check before Test Run

1	Check to see whether there is any refrigerant leakage, and check whether the power or transmission cable is connected properly.
2	Confirm that 500 V megger shows 2.0 MΩ or more between power supply terminal block and ground. Do not operate in the case of 2.0 MΩ or less. **NOTE**: Never carry out mega ohm check over terminal control board. Otherwise the control board may break. Immediately after mounting the unit or after leaving it turned off for an extended length of time, the resistance of the insulation between the power supply terminal board and the ground may decrease to approx. 2.0 MΩ as a result of refrigerant accumulation in the internal compressor. If the insulation resistance is less than 2.0 MΩ, turn on the main power supply.

2. Test Run Flow chart



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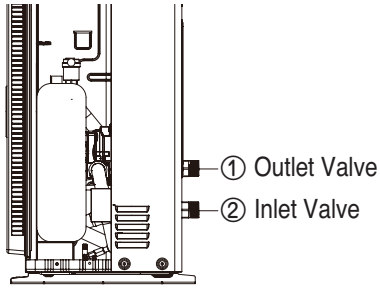
4. How to drain remaining water in the product

⚠CAUTION

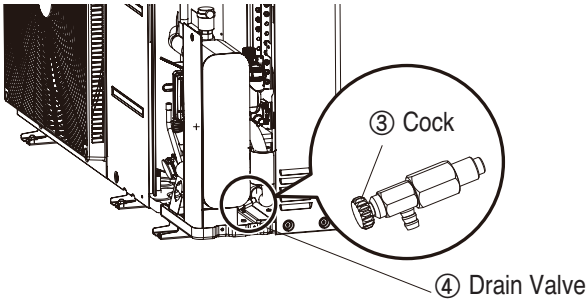
If the product is not used for a long period of time with remaining water, there is a risk of freezing in winter.

Step1



Step1. To drain most of the water out of the product, remove the water pipes from the inlet/outlet valve(①,②). After draining, reconnect them.

Step2



Step2. To drain the rest of the water out of the product, open the cock(③) of the drain valve(④) counterclockwise. After draining, lock it in the opposite direction to the end.

- To use the product again, you have to refill water in it. Refer to ‘Water Charging’ of ‘Installaion’ part in installation manual.

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Part 3
Basic Control

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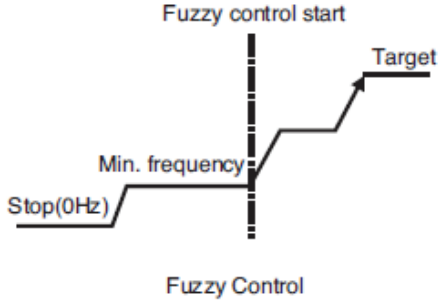
1. Normal operation

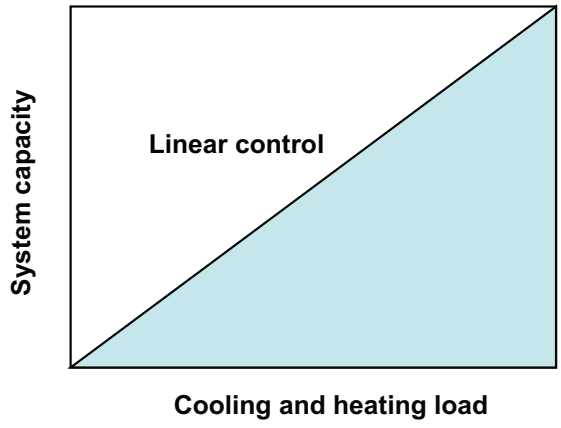
Basic principle is to control the rpm of the motor by changing the working frequency of the compressor.
Three phase voltage is supplied to the motor and the time for which the voltage will supplied is controlled by IPM (intelligent power module).
Switching speed of IPM defines the variable frequency input to the motor.

Actuator	Cooling operation	Heating operation	Stop state
Compressor	Fuzzy control	Fuzzy control	Stop
Fan	Fuzzy control	Fuzzy control	Stop
EEV	Super heating fuzzy control	Discharge Temp. Control	Min. Pulse

2. Compressor control

Fuzzy control : Maintain evaporating temperature (Te) to be constant on cooling mode and constant condensing temperature (Tc) on heating mode by fuzzy control to ensure the stable system performance.





Inverter linear control as cooling and heating load increasing

3. EEV(Electronic Expansion Valve) control

EEV operates with fuzzy control rules to keep The degree of superheat (2~3 °C (3.6~5.4 °F)) or the target temperature of discharge pipe.

* Cooling mode

The degree of superheat = Tsuction – Tevaporator

Tsuction : temperature at suction pipe sensor(°C(°F))

Tevaporator : evaporation temperature (°C(°F))

* Heating mode

the target temperature of discharge pipe = T condenser + α

T condenser : condenser temperature (°C (°F))

Tevaporator : evaporation temperature (°C (°F))

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Part 4
Replacement

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1. Replacement Procedure for Compressor

1. Remove the sound shields covering the faulty Compressor.
   ① Remove the sound proof covering the top of compressor.
   ② Remove two screws.
   ③ Remove the front sound shield.
   ④ Remove the screw.
   ⑤ Remove the rear sound shield.

2. Disconnect the power.

3. Disconnect the brazing sections of suction pipe and discharge pipe by using brazing torch after the refrigerant has been pumped out or collected completely.

4. Remove three nuts at cushion rubber section to take out the faulty compressor outside the unit.

5. Install the new compressor in the unit. (Be sure to insert the cushion rubbers before tightening the fixing nut of compressor.)

6. Remove the rubber caps put on the suction and discharge pipe of the new compressor to release the sealing nitrogen gas.

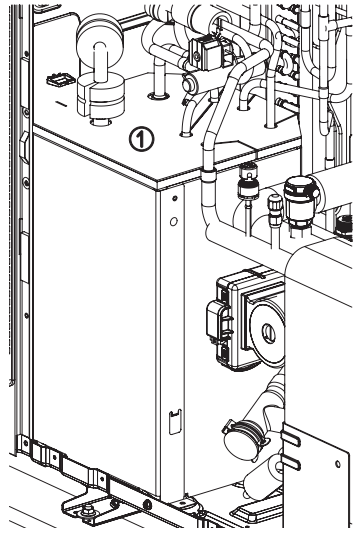
7. Braze the suction and discharge pipe with brazing torch to the compressor.

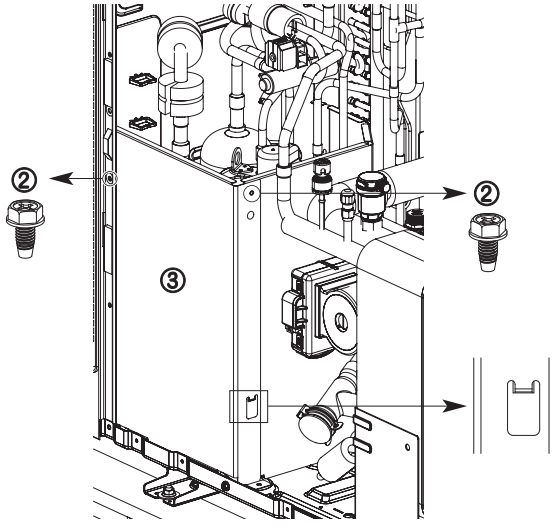
8. Conduct air tight test to check the piping system is free from leakage.

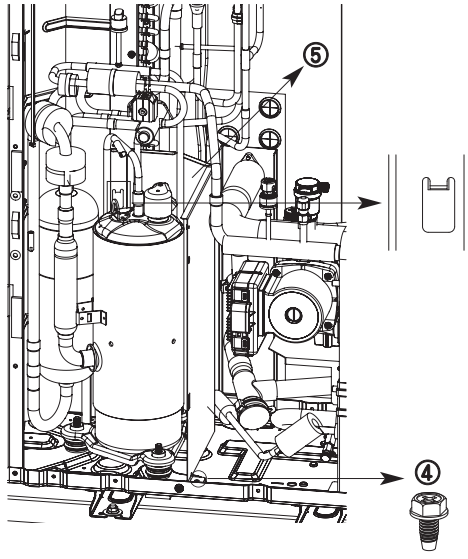
9. Connect power cable to the terminal board of compressor and cover the compressor with the sound shields.

10. Conduct vacuum.

11. After completion of vacuum, open the service valves. If recovery unit is used, charge refrigerant.







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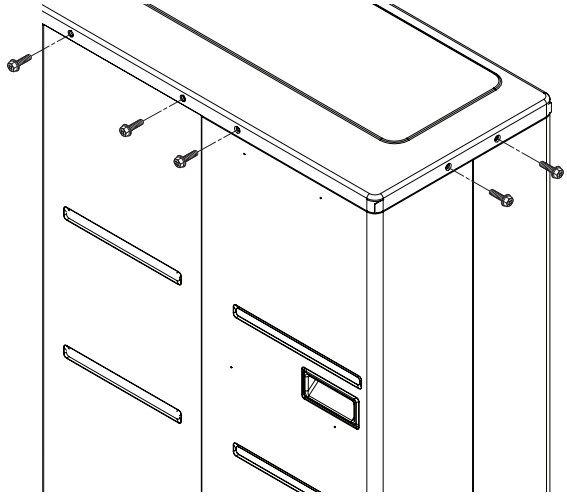
2. Caution for Assembling Outdoor Panels after Test Run

When assemble the unit panels after replacement, make sure that screws of top panel are assembled as shown figure below.
If screws are not assembled, it allows rain come into control box causing malfunction of unit.



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Part 5
Trouble Shooting

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Trouble Shooting

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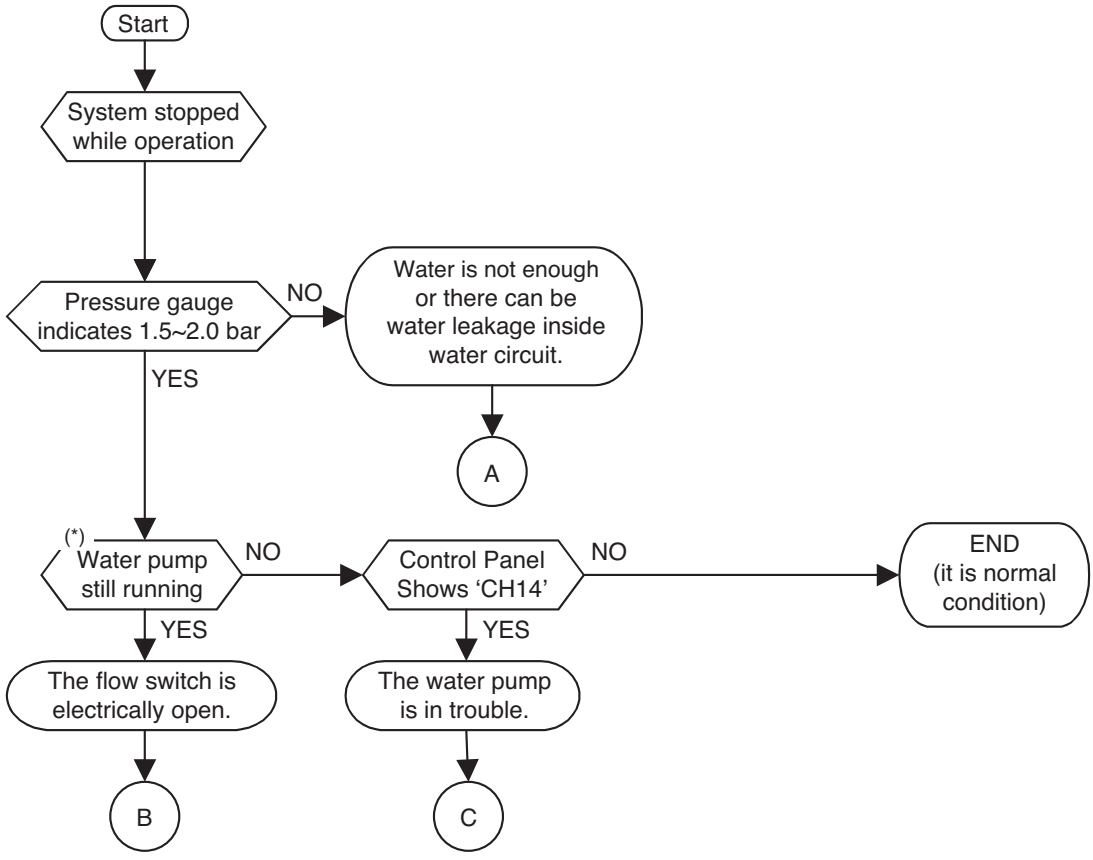
1. Checking Key Components of Unit

1.1 Flow Sensor



* : How to identify? - Touch the terminal box (black plastic box at the water pump) of water pump and feel if the water pump is vibrating. If no vibration, the water pump is not operating. Also, you can see 'Water Pump Operating' at control panel.

A
- Check if water inside water circuit is fully charged. Pressure gauge at the unit should indicate 1.5~2.0 bar(21.8 ~ 29.0 PSI).
- Also, as the hand of the pressure gauge is not react so fast according to water charging, check the pressure gauge again.
- Otherwise, there can be water leakage inside water circuit. Examine if water circuit is completely sealed.

B
- Although water is well flowing, the flow switch can not detect water flow. It is due to electrically open of flow switch or the contact of flow switch is mechanically broken.
- Contact official After Service Center and replace the flow switch.

C
- Read 'Checking Key Components of Unit – Water Pump' carefully to get more detail information.
- Contact official After Service Center and replace the water pump.
- Also, check the water quality if there are particles that can yield locking at the shaft of the water pump.
- Check the air vent. If there is air in the unit, it can display "CH14". Please remove the air by using the air vent.

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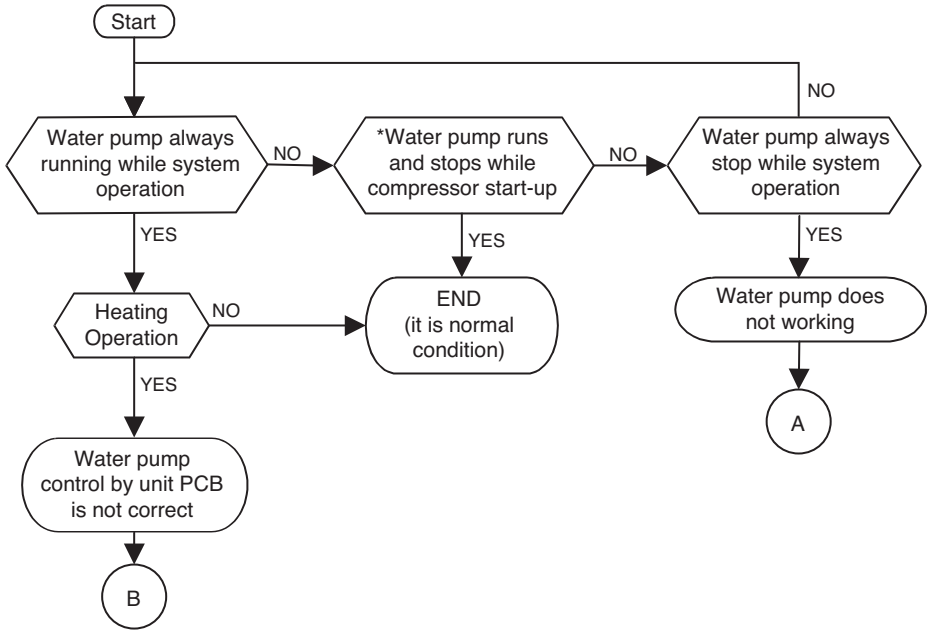
1.2 Water Pump



* : It is normal condition that water pump runs or stops during system operation (including compressor start-up) due to specific control logic.

- Water pump does not operate because of mechanical malfunction of water pump or wrong wiring at the water pump.

A

- To correct mechanical defects, contact a licensed professional.
- To correct wrong wiring, check if wires 'CN_MOTOR1' connector on the unit PCB and water pump terminal box (black plastic box at the water pump) are connected firmly. Also, check wires are electrically connected by measuring resistance of each wires (if electrically connected exactly, resistance should be 0 ohm).

- Unit PCB can not make control signal or wrong wiring at the water pump.

B

- To correct unit PCB's making control signal, first check the signal level. Use electric voltage meter and measure voltage at 'CN_MOTOR1' connector on the unit PCB. If measured value is not 220-240 V~ while 'Water Pump Operating' is displayed at control panel, the unit PCB is in trouble. In this case, contact official After Service Center and replace the unit PCB.
- To correct wrong wiring, please refer Ⓐ.

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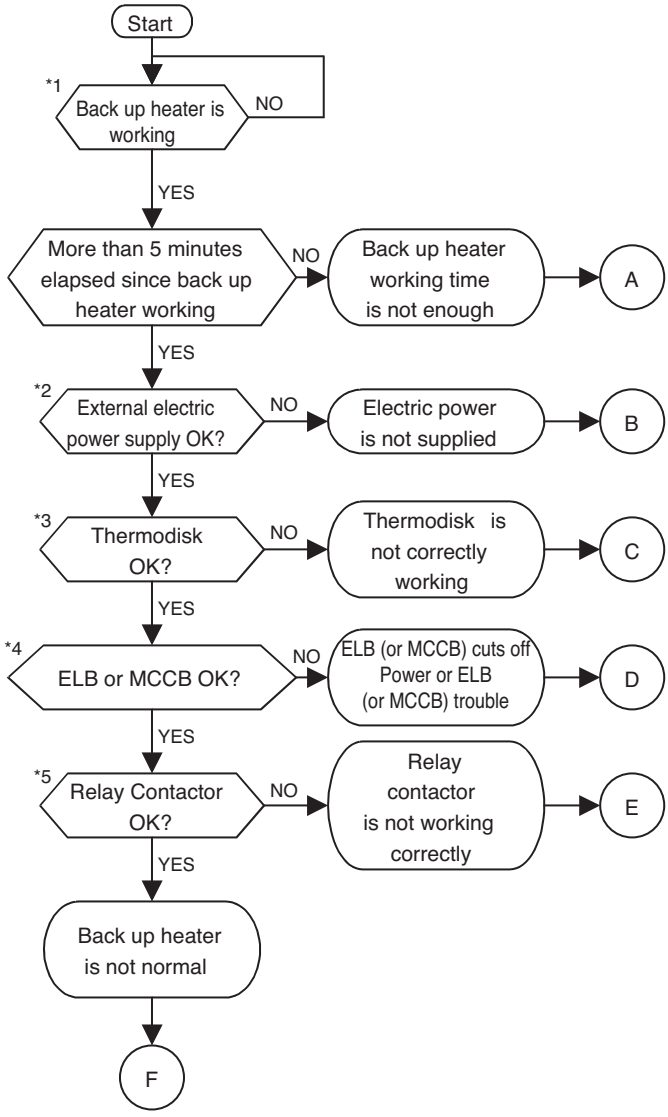
1.3 Back up heater



*1 : When back up heater is working, 'back up heater Operating' is displayed at control panel

*2 : For single-phase model : Measure electric voltage at port 3 (Live) and port 4 (Neutral) of Terminal Block 3 with voltage meter. The measured value should be 220-240 V~ . To identify the location of Terminal Block 3, please refer circuit diagram of unit at 'Installation Manual' or backside of front cover of the unit.

*2 : For three-phase model : Measure electric voltage at two port of 3 (R), 4 (S), and 5 (T) of Terminal Block 3 with voltage meter. The measured value should be 220-240 V~ or 380-415 V~ . To identify the location of Terminal Block 3, please refer circuit diagram of unit at 'Installation Manual' or backside of front cover of the unit.

*3 : For single-phase model : Find cover of thermodisk which is located beside air vent. Air vent is on the top of the back up heater tank. Uncover the cover by unscrewing bolts. Find two copper leads located both left and right side of the thermodisk core. Check resistance of both leads. The measured resistance should be 0 ohm. After then, check if voltage is transmitted to the thermodisk correctly. Measure electric voltage between one of the lead (Live) of the thermodisk and port 3 (Neutral) of ELB (A). The measured value should be 220-240 V~ .

*3 : For three-phase model : Find cover of thermodisk which is located side of back up heater tank.Uncover the cover by unscrewing bolts. Find two copper leads located both left and right side of two thermodisk core. Check resistance of both leads of each thermodisks. The measured resistance should be 0 ohm.

While uncovering the cover of the thermodisk, be careful for electric shock.

*4 : For single-phase model : Resistance between port 1 and port 2 should be 0 ohm. Also, port 3 and port 4 should be 0 ohm, too. Finally, measure electric voltage at port 2 (Live) and port 4 (Neutral) with voltage meter. The measured value should be 220-240 V~ .

*4 : For three-phase model : Resistance between port 1-to-port 2, port 3-to-port 4, and port 5-to-port 6 of MCCB (A) should be 0 ohm. Port number and location of MCCB (A) can be found circuit diagram of the unit(back side of front cover).

*5 : For single-phase model : At Relay Contactor (A), measure electric voltage at port 2 (Live) and port 6 (Neutral) with voltage meter. The measured value should be 220-240 V~ . Also, at Relay Contactor (B), measure electric voltage at port 2 (Live) and port 6 (Neutral) with voltage meter. The measured value should be 220-240 V~ .

*5 : For three-phase model : At Magnet Contact (C) or Magnet Contact (B), resistance between port L1-to-port T1, port L2-to-port T2, and port L3-to-port T3 should be 0 ohm.

A
- Wait for 5 minutes to heat water inside back up heater tank. If capacity of back up heater is 6kW, at least 2 centigrade will be increased.

B
- For single-phase model : Check if external electricity power supply is breakout. If not, check wiring between external electricity power supply and port 3 and port 4 of Terminal Block 3. You can identify the location of Terminal Block 3 at the circuit diagram of unit.
- For three-phase model : Check if external electricity power supply is breakout. If not, check wiring between external electricity power supply and port 3, port 4, and port 5 of Terminal Block 3. You can identify the location of Terminal Block 3 at the circuit diagram of unit.

C
- Thermodisk is mechanically malfunction. In this case, contact a licensed professional.
- Check the insulation resistance of back up heater.

D
- If the insulation resistance has improper, remove the cause of the problem and then reset the ELB (or MCCB).
- Replace the ELB (or MCCB) when the insulation resistance is suitable.

E
- Relay contactor is mechanically malfunction. In this case, contact a licensed professional and replace the relay contactor.

F
- Heating coil of back up heater can be damaged or wiring inside the back up heater is problem. Before replacing the back up heater, in this case, contact a licensed professional and do the diagnosis about back up heater and related parts including the capacity of external electric power source. If the reason of malfunction is clearly proved as the faulty back up heater itself, then replace it with new one.

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1.4 Remote Controller

To solve various troubles while using control panel, please read following FAQ (Frequently Asked Questions).
For your convenience, all questions are classified according to topics.

No	Topic	Question	Answer
1	Power button does not bright	System installation is finished. Also, all wirings including power connection is all right. But when the power button in front of the control panel is pushed, it does not bright.	• There can be a problem in wiring between PCB and control panel. Open control box and find 'CN_REMO' connector at the PCB. If the connector is empty or nothing is connected, please connect it with end of wire which is from control panel then restart the system. • Check if external controller is connected like thermostat. If thermostat is connected to the system and it is configured exactly, you can see 'Thermostat' text at the display of the control panel. It is normal condition that power button of control panel does not work when thermostat is installed.
2	Some texts are displayed automatically	Although nobody touched control panel, sometimes it displays specific texts and the system operates automatically.	• It is normal condition. Basically, two features can be operated without user's decision – one is system protective operation, the other is 'background water tank heating operation', which is heating inside the water tank while space heating is not used or the system is not working. System protective operation is, as letter says, for the purpose of securing the system from worse condition. Anti-freezing operation, for example, is one of the protective operation. It is essential to start protective operation to prevent potential malfunction and to keep possible accidents. On the other hand, background water tank heating operation is not protective operation but to supply warm water to end-user. The background water tank heating operation is only started when the water tank temperature is under the specific temperature.
3	Water tank heating or related features are not permitted	Setting water tank temperature is not permitted although the water tank is installed.	Following two conditions should be satisfied. • Check if 'Water tank enable/disable' is correctly displayed or not. To use water tank, end-user must push On/Off button focused on hot. • Also, check if DIP switch setting is correct or not. To identify the DIP switch setting, open the control box inside the unit. Unless 2nd and 3rd pin of DIP switch setting is OFF-ON or ON-OFF, the water tank heating will not be configured.

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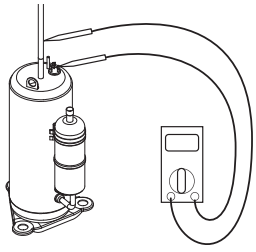
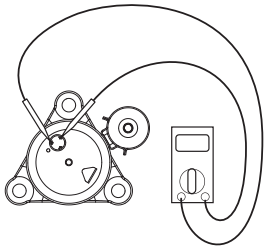
1.5 Compressor

Check and ensure in following order when error related with the compressor or error related with power occurs during operation:

No.	Checking Item	Symptom	Countermeasure
1	Is how long power on during operation?	1) Power on for 12 hours or more	• Go to No.2.
		2) Power on for 12 hours or less	• Go to No.2 after applying power for designated time (12 hours).
2	Does failure appears again when starting operation?	1) The compressor stops andsame error appears again.	• Check IPM may fail.
	Method to measure insulation resistance  Method to measure coil resistance 	2) If output voltage of the inverter is stable.	• Check coil resistor and insulation resistor. If normal, restart the unit. If same symptom occurs, replace the compressor. • Insulation resistor: 2 MΩ or more • Coil resistor: Please refer to Page 68
		3) If output voltage of the inverter is unstable or it is 0 V. (When incapable of using a digital tester)	• Check the IPM. If the IPM is normal, replace the inverter board. • Check coil resistor and insulation resistor.

[Cautions when measuring voltage and current of inverter power circuit]

Measuring values may be different depending on measuring tools and measuring circuits since voltage, current in the power supply or output side of the inverter has no same waveform.
Especially, output voltage changes when output voltage of the inverter has a pattern of pulse wave.
In addition, measuring values appear largely different depending on measuring tools.

Note

1) If using a portable tester when checking the output voltage of the inverter is constant (when comparing relative voltage between lines), always use an analog tester. Especially exercise particular caution if the output frequency of the inverter is low, when using a movable tester, where change of measured voltage values is large between other lines, when virtually same values appear actually or where there is danger to determine that failure of the inverter occurred.
2) You can use rectification voltmeter (⊣▶⊢) if using commercial frequency tester when measuring output values of the inverter (when measuring absolute values). Accurate measuring values cannot be obtained with a general portaable tester (For analog and digital mode).

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1.6 Fan Motor

Checking Item	Symptom	Countermeasure
(1) The fan motor does not operate. Does failure appears again when starting operation? (2) Vibration of the fan motor is large.	1) When power supply is abnormal	• Modify connection status in front of or at the rear of the breaker, or if the power terminal console is at frosting condition.
		• Modify the power supply voltage is beyond specified scope.
	2) For wrong wiring	• For following wiring. 1. Check connection status. 2. Check contact of the connector. 3. Check that parts are firmly secured by tightening screws. 4. Check connection of polarity. 5. Check short circuit and grounding.
	3) For failure of motor	• Measure winding resistance of the motor coils.
	4) For failure of circuit board	Replace the circuit board in following procedures if problems occur again when powering on and if there are no matters equivalent to items as specified in above 1) through 4). (Carefully check both connector and grounding wires when replacing the circuit board.) 1. Replace only fan control boards. If starting is done, it means that the fan control board has malfunction. 2. Replace both the fan control board and the main board. If starting is done, it means that the main board has malfunction. 3. If problems continue to occur even after countermeasure of No.1 and No.2, it means that both boards have malfunction.

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2. Self-Diagnosis Feature

2.1 Concept of 'Classified Trouble'

• Definition of terms

- Trouble : a problem which can stop system operation, and can be resumed temporarily under limited operation without certificated professional's assist.
- Error : a problem which can stop system operation, and can be resumed ONLY after certificated professional's check.
- Emergency mode : temporary heating operation while system met Trouble

• Objective of introducing 'Trouble'

- Not like airconditioning product, Air-to-Water heat pump is generally operating in whole winter season without any system stopping.
- If system found some problem, which is not critical to system operating for yielding heating energy, the system can temporarily continue operating in emergency mode with enduser's decision.

• Classified trouble

- Trouble is classified two levels according to the seriousness of the problem : Slight trouble and heavy trouble
- Slight trouble : In most case, this trouble is concerned with sensor problems. The outdoor unit is operating under emergency mode operation condition which is configured by DIP switch No. 4 of the Main PCB Assembly 1.
- Heavy trouble : As the outdoor unit has problem, the emergency mode operation is performed by back up heater
- Option trouble : a problem is found for option operation such as water tank heating. In this trouble, the troubled option is assumed as if it is not installed at the system.

• Emergency operation is not automatically restarted after main electricity power is reset.

- In normal condition, the product operating information is restored and automatically restarted after main electricity power is reset.
- But in emergency operation, automatic re-start is prohibited to protect the product.
- Therefore, user must restart the product after power reset when emergency operation has been running.

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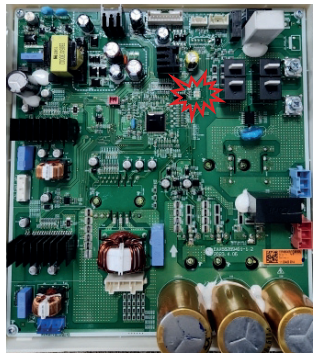
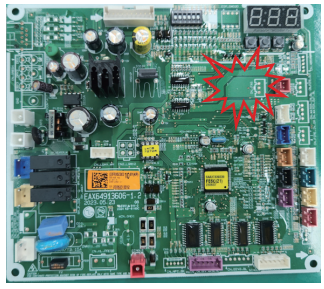
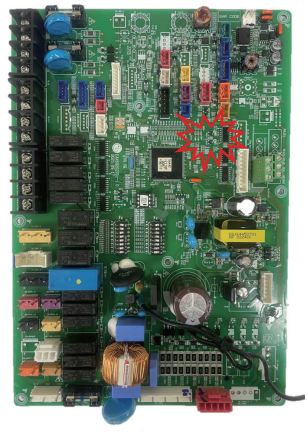
2.2 Error Indicator

- Red LED means error no. 10's digit, and green LED means 1's digit, and when red and green simultaneously blink, it means 100's unit.

  Ex) Inverter compressor IPM defect Error : error number 21

Error Code	Description	LED 1 (Red)	LED 2 (Green)
21	Inverter compressor IPM defect	2times ◑	1time ◑

Chassis	**Outdoor PCB**			**Indoor Main PCB (Hydro)**
	Phase(Ø)	Inverter PCB	Main PCB (Cycle)	
UN60A	1			

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2.3 Error Code List

Indoor PCB assembly

Error Code	Description	Main Reasons
01 *	Problem in Remote Room Air sensor	Remote air temperature sensor of MainPCB(indoor) is open or short.
02 **	Problem in Refrigerant (Inlet side) sensor	Refrigerant inlet pipe temperature sensor of indoor unit is open or short.
03 ****	Communication error between indoor unit and wired remote controller	Communication between wired remote controller and indoor unit is not possible.
05 **	Communication error between Main PCB(Indoor) and Main PCB(Outdoor Cycle)	There is no communication between the Main PCB(Indoor) and the Main PCB(Outdoor cycle).
06 **	Problem in Refrigerant pipe sensor (Outlet side)	Refrigerant outlet pipe temperature sensor of indoor unit is open or short.
08 ***	Problem in Water Tank sensor	Domestic hot water tank temperature sensor of indoor unit is open or short.
09 ****	PCB Program (EEPROM) Fault	The optional EEPROM is loosely inserted in or disconnected from the Main PCB(Indoor)
13 ***	Problem in Solar-thermal sensor	Solar pipe temperature sensor of indoor unit is open or short.
14 ****	Problem in Flow rate	Low flow detection during pump operation
15 ****	Overheating of water pipe	The temperature of the water pipe has exceeded a certain temperature.
16 ****	Problems in sensors An error	An error code 17,18,19 error has occurred at the same time.
17 *	Problem in Water-inlet sensor	Water inlet pipe temperature sensor of indoor unit is open or short.
18 *	Problem in Water-outlet sensor	Water outlet pipe temperature sensor of indoor unit is open or short.
19 *	Problem in Elec/Heater Water-outlet sensor	Electric backup heater outlet temperature sensor of indoor unit is open or short.
20 ****	Electric heater overheated	Fuse of electric heater is blown due to overheat.
231 *	Problem in Water Pressure Sensor	Water Pressure Sensor of indoor unit is damaged.
232 ****	Problem in Flow Sensor	Flow Sensor of indoor unit is damaged.

- **Notice of error code**
  - Slight Trouble(S-Trouble) : *
    A trouble is occurred with temperature sensor of indoor unit. (sensing fail)
    Emergency operation(heating) is possible with heat pump and electric heater.
  - Heavy Trouble(H-Trouble) : **
    A trouble is occurred with cycle and system can not be operated
    Emergency operation(heating) is possible with electric heater ONLY.
  - Other Trouble(O-Trouble) : ***
    A trouble is occurred with optional function. (e.g. DHW tank sensor, Solar thermal sensor)
    Emergency operation(heating) is possible with heat pump and electric heater.
    In case of CH13, Heat pump operation does not stop.
  - Error : ****
    A serious fail was found and system can not be used before repair it.

⚠CAUTION

Precaution in service or check

Even after stopping the operation of product, it takes some time to discharge the remaining electricity of the electrolytic capacitor that was charged early. Before conducting a checking or repairing job, pull out the plug out of the outlet and make sure that the lamp on the control board outdoor unit is off.

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Outdoor PCB assembly

Error Code	Description	Main Reasons
21**	DC Peak(IPM Fault)	Comp is stopped to prevent the power module from being damaged by detecting the Fault Out signal of the power element.
22**	CT Current Error	Overcurrent flows to the outdoor unit that measures the outdoor unit current.
23**	DC Link Overvoltage / Undervoltage	This is when the Comp is running when the DC Link is low or high.
24**	High Pressure Error (Activation of Pressure Switch)	This is the case when the discharge pressure of the outdoor unit compressor is excessively increased.
26**	No Position Error	No Position Error occurs when the initial startup of Comp does not work normally.
27**	PFC overcurrent	This is the case of overcurrent or CT overcurrent inside PFC.Over current is passed through PFC module.
29**	Comp Over Current	Input current for Inverter Compressor exceeds the limit.
32**	D-Pipe Temp. High	Temperature of discharge pipe is abnormally high.
35**	Low Pressure Error	Evaporating pressure is excessively low.
41**	Inv. D-Pipe Temp sensor Error(Open/Short)	Discharge pipe temperature sensor of outdoor unit is open or short.
43**	High Pressure Sensor(Open/Short)	Comp cannot be controlled due to high pressure sensor error
44**	Outdoor air Temperature sensor Error(Open/Short)	Outdoor air temperature sensor is open or short.
45**	Condenser Middle Pipe Temperature Error(Open/Short)	Cond. Middle pipe temperature sensor is open or short.
46**	Compressor Suction Pipe Temperature Error(Open/Short)	Suction pipe temperature sensor is open or short.
48**	Condenser Out Pipe Temperature Error(Open/Short)	Condenser Out Pipe thermistor isn't inserted or is inserted incorrectly
52****	Inv PCB(Outdoor) -Main PCB(Outdoor Cycle) Communication Error	Communication between Inv PCB(Outdoor) -Main PCB(Outdoor Cycle) is not available
53**	Main PCB(Indoor) - Main PCB(Outdoor) Communication Error	It is failed to receive the signal from IDU.
54*	Open and Reverse Phase Error	Wiring fault is occurred. – reverse phase (only 3-phase model)
60**	Outdoor EEPROM error	EEPROM is loose or missing, or it is burnt out.
61**	High Pressure Error	Condensation pressure is too high.
62**	Heatsink Error(High)	Temperature of heatsink or element is abnormally high.
65***	Problem in Heatsink Temperature sensor	This occurs when the temperature cannot be sensed above the heat sink sensor or the PSCM or PFCM internal sensor.
67***	Fan Lock Error	Outdoor BLDC Fan lock
114**	Injection In TH Error (Open/Short)	Vapor injection inlet pipe temperature sensor of outdoor unit is open or short.
115**	Injection Out TH Error (Open/Short)	Vapor injection outlet pipe temperature sensor of outdoor unit is open or short.

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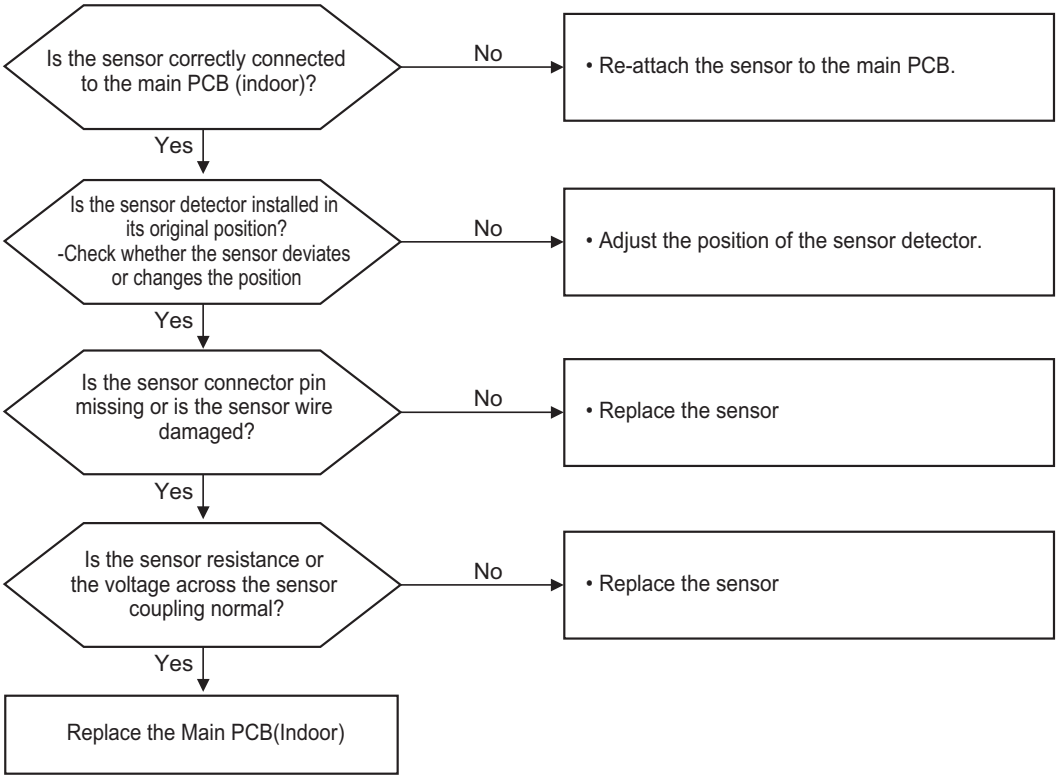
3. Trouble shooting Guide

Error Code	Title	Description	Cause of error
CH01	Problem in remote air sensor	Indoor unit sensor open / short	1. Sensor mismatch on the Main PCB(Indoor) 2. Main PCB(Indoor) malfunction 3. Sensor failure (Reason of major malfunction) 4. Temperature sensor maximum reached
CH02	Problem in refrigerant inlet(liquid) side sensor		
CH06	Problem in refrigerant outlet(gas) side sensor		
CH08	Problem in water tank sensor		
CH13	Problem in solar pipe sensor		
CH17	Problem in Water-inlet sensor		
CH18	Problem in Water-outlet sensor		
CH19	Problem in electric backup heater outlet sensor		

Check Flow Chart



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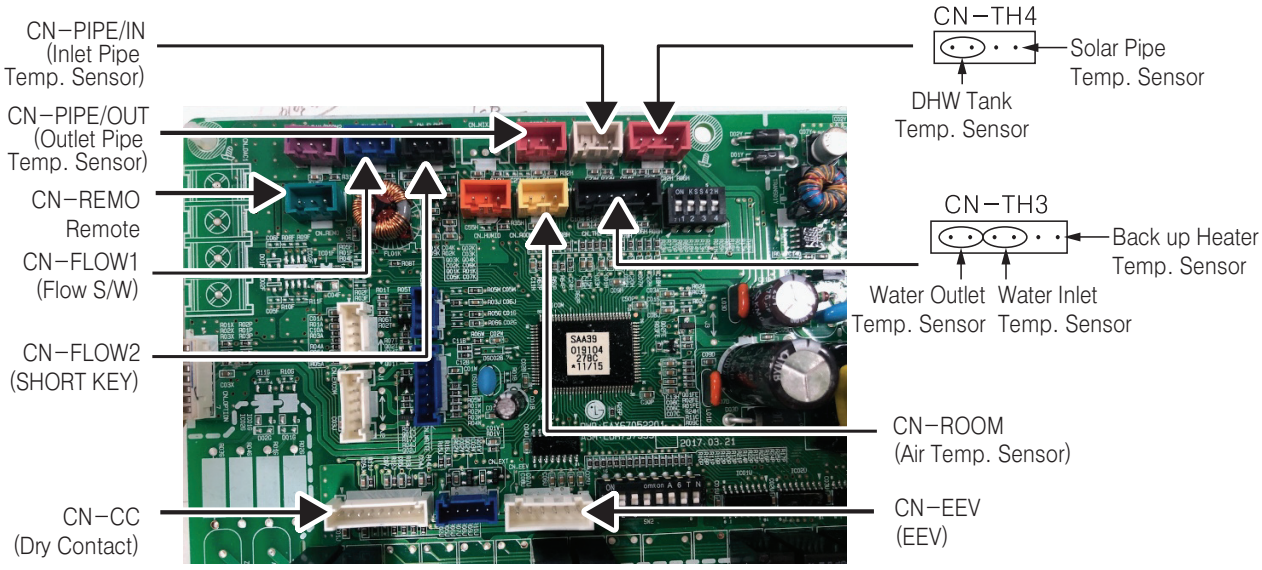
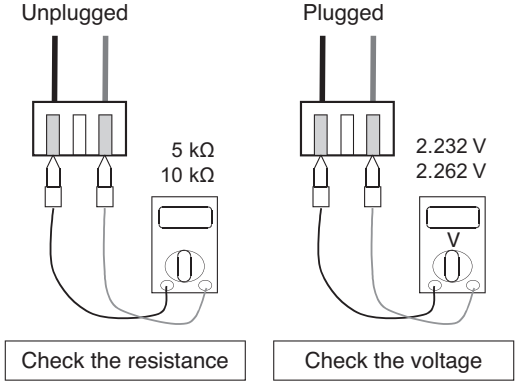


Error code	PCB mark	Housing color / pin
CH 01	CN_ROOM	Yellow / 3
CH 02	CN_PIPE_IN	White / 3
CH 06	CN_PIPE_OUT	Red / 3
CH 08	CH_TH4	Red / 4
CH 13	CH_TH4	Red / 4
CH 17	CN_TH3	Black / 6
CH 18	CN_TH3	Black / 6
CH 19	CN_TH3	Black / 6



* The sensor resistance value and the voltage value at both ends may vary depending on the ambient temperature, and the value has a deviation of ± 5 %.
* There may be some errors depending on the measurement equipment.

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PCB mark	Indoor Temp. (°C(°F))	Resistance(kΩ)	Voltage(V)
CN_ROOM (Yellow / 3pin)	-10 °C (14 °F)	60 kΩ	4.1 V
	-5 °C (23 °F)	44 kΩ	3.9 V
	0 °C (32 °F)	33 kΩ	3.6 V
	5 °C (41 °F)	25 kΩ	3.4 V
	10 °C (50 °F)	20 kΩ	3.1 V
	15 °C (59 °F)	15 kΩ	2.8 V
	20 °C (68 °F)	12 kΩ	2.5 V
	25 °C (77 °F)	10 kΩ	2.2 V
	30 °C (86 °F)	8 kΩ	1.9 V
	35 °C (95 °F)	6 kΩ	1.6 V
	40 °C (104 °F)	5 kΩ	1.5 V
	45 °C (113 °F)	4 kΩ	1.3 V

PCB mark	Indoor Temp. (°C(°F))	Resistance(kΩ)	Voltage(V)
CN_PIPE_IN(White/3Pin) CN_PIPE_OUT(Red/3Pin) CN_TH4(Red/4Pin) CN_TH3(Black/6Pin)	-10 °C (14 °F)	29 kΩ	4.1 V
	-5 °C (23 °F)	22 kΩ	3.9 V
	0 °C (32 °F)	17 kΩ	3.6 V
	5 °C (41 °F)	13 kΩ	3.3 V
	10 °C (50 °F)	10 kΩ	3 V
	15 °C (59 °F)	8 kΩ	2.8 V
	20 °C (68 °F)	6 kΩ	2.5 V
	25 °C (77 °F)	5 kΩ	2.2 V
	30 °C (86 °F)	4 kΩ	1.9 V
	35 °C (95 °F)	3.2 kΩ	1.7 V
	40 °C (104 °F)	2.6 kΩ	1.5 V
	45 °C (113 °F)	2.1 kΩ	1.2 V
	50 °C (122 °F)	1.7 kΩ	1 V
	55 °C (131 °F)	1.4 kΩ	0.9 V
	60 °C (140 °F)	1.2 kΩ	0.8 V
	65 °C (149 °F)	1 kΩ	0.7 V

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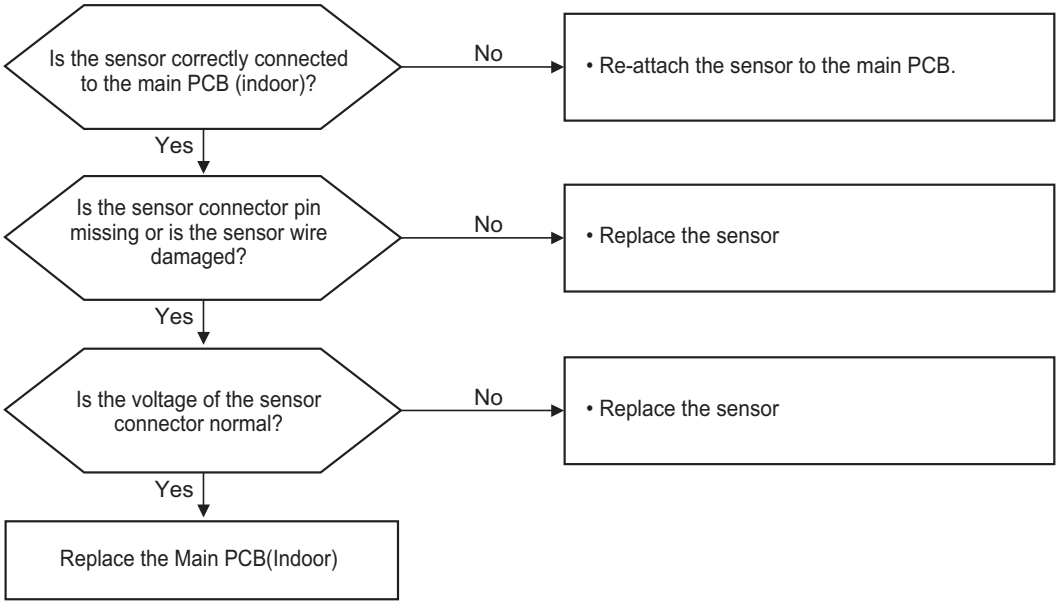
Error Code	Title	Description	Cause of error
CH231	Problem in Water Pressure sensor	Indoor unit water pressure sensor failure	1. Senor mismatch on the main PCB of Indoor unit. 2. The main PCB of Indoor unit malfunction. 3. Sensor failure (Reason of major malfunction))
CH232	Problem in Water Flow sensor	Indoor unit water flow sensor failure	

Check Flow Chart



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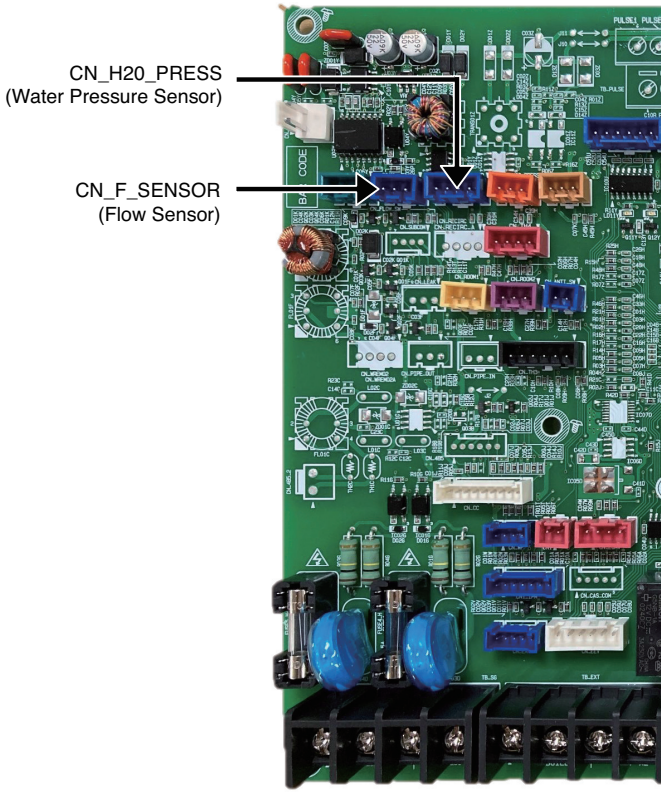
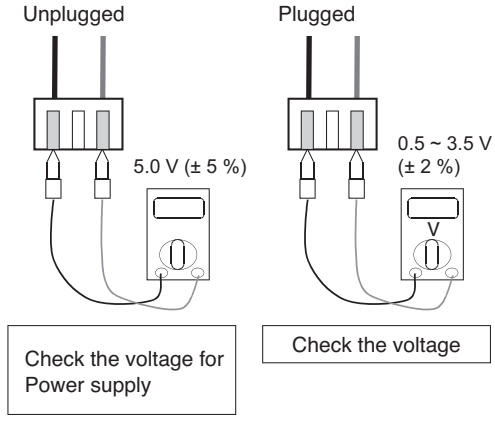


Indoor Unit PCB

Error code	PCB mark	Housing color / pin
CH 231	CN_H20_PRESS	Orange / 3
CH 232	CN_F_SENSOR	Blue / 4



* The sensor voltage value at Pin 2 & Pin3 may vary depending on the reference voltage input, and the value has a deviation of ±2%.
* There may be some earrors depending on the measurement equipment.

PCB Remark	Pressure (bar (PSI))	Voltage(V)
CN_H20_Press (Orange / 3)	0.2 (2.9)	0.53
	0.4 (5.8)	0.56
	0.6 (8.7)	0.59
	0.8 (11.6)	0.62
	1.0 (14.5)	0.65
	1.2 (17.4)	0.68
	1.4 (20.3)	0.71
	1.6 (23.2)	0.74
	1.8 (26.1)	0.77
	2.0 (29.0)	0.80
	2.2 (31.9)	0.83
	2.4 (34.8)	0.86
	2.6 (37.7)	0.89
	2.8 (40.6)	0.92
	3.0 (43.5)	0.95

PCB Remark	Pressure (bar (PSI))	Voltage(V)
CN_F_SENSOR (Blue / 4)	5.0 (72.5)	0.50
	10.0 (145.0)	0.70
	15.0 (217.6)	0.90
	20.0 (290.1)	1.10
	25.0 (362.6)	1.30
	30.0 (435.1)	1.50
	35.0 (507.6)	1.70
	40.0 (580.2)	1.90
	45.0 (652.7)	2.10
	50.0 (725.2)	2.30
	55.0 (797.7)	2.50
	60.0 (870.2)	2.70
	65.0 (942.7)	2.90
	70.0 (1 015.2)	3.10
	75.0 (1 087.8)	3.30
	80.0 (1 160.3)	3.50

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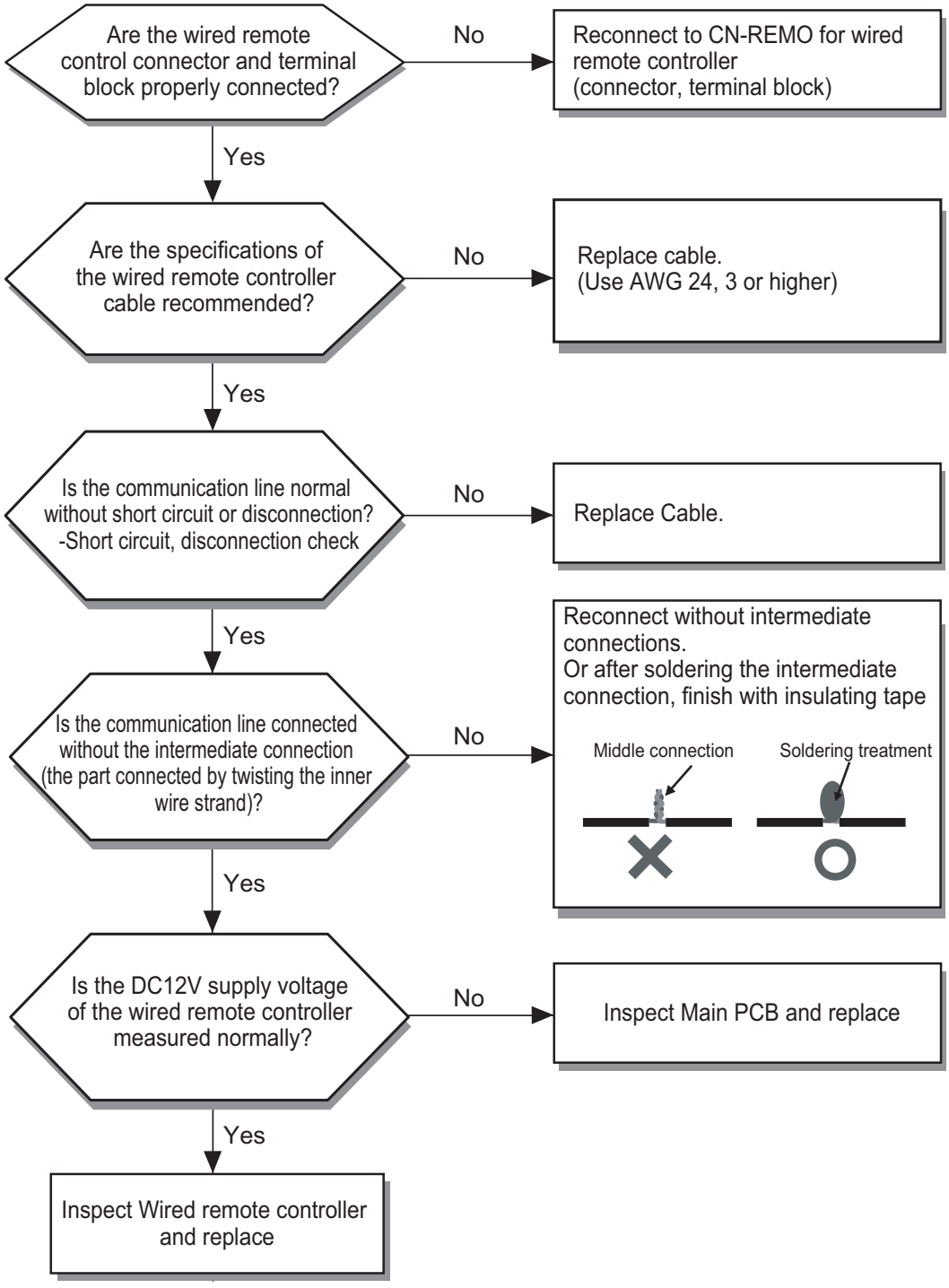
Display code	Title	Description	Cause of error
CH03	Bad communication between remote controller and indoor unit	No communication between Main PCB(Indoor) and wired remote controller.	1. Incorrect cable connection and burnout 2. Noise interference 3. Wired remote controller burnout 4. Main PCB burnout

Check Flow Chart



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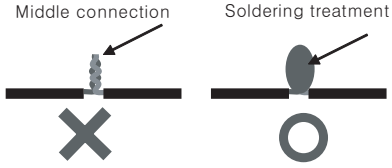
⚠WARNING

Before checking the PCB or various indoor / outdoor energizing parts, check the power supply after 3 minutes.
When measuring while the power is on, check the measurement mode of the tester and pay attention to the short circuit and other parts.

1. Check if the remote control terminal block is properly connected.
2. Check if there is an intermediate connection (combined by twisting the inner wire strand).
   If there is a connection, solder it and finish it with tape.

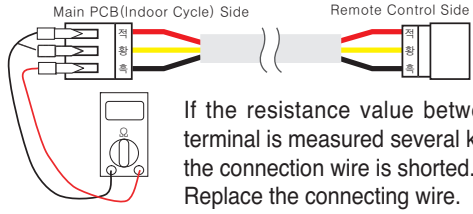


3. Check if the communication line is shorted or disconnected.
4. Measure the Main PCB(Indoor) CN-REMO voltage.
   1) When DC 12 V is measured, the Main PCB(Indoor) isnormal, check the wired remote control.
   2) If the voltage is not measured, replace the Main PCB(Indoor).
5. There is noise near the wired remote control or around the communication line.
   Check the product or wires that may be generated.

Inspection method

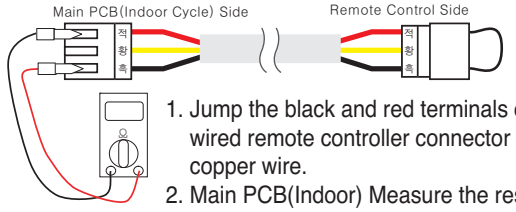
1. First, check the indoor main PCB and wired remote control.
2. Disconnect the “CN-REMO” connector of the indoor PCB.
3. Disconnect the "CN-REMO" connector of the wired remote control.
4. Set the range of the tester to Ω.
5. Please check as below.

How to check the short circuit

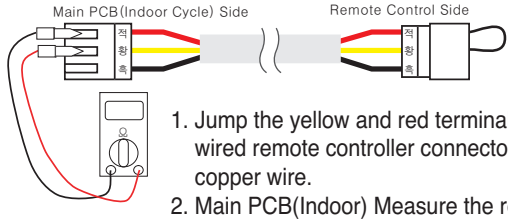


If the resistance value between each terminal is measured several kΩ, the connection wire is shorted.
Replace the connecting wire.

How to check for disconnection



1. Jump the black and red terminals of the wired remote controller connector to the copper wire.
2. Main PCB(Indoor) Measure the resistance value of black and red.
   If the resistance value is several Ω or less, it is normal. If it points to infinity, it is disconnected.



1. Jump the yellow and red terminals of the wired remote controller connector to the copper wire.
2. Main PCB(Indoor) Measure the resistance values of yellow and red.
   If the resistance value is several Ω or less, it is normal. If it points to infinity, it is disconnected.

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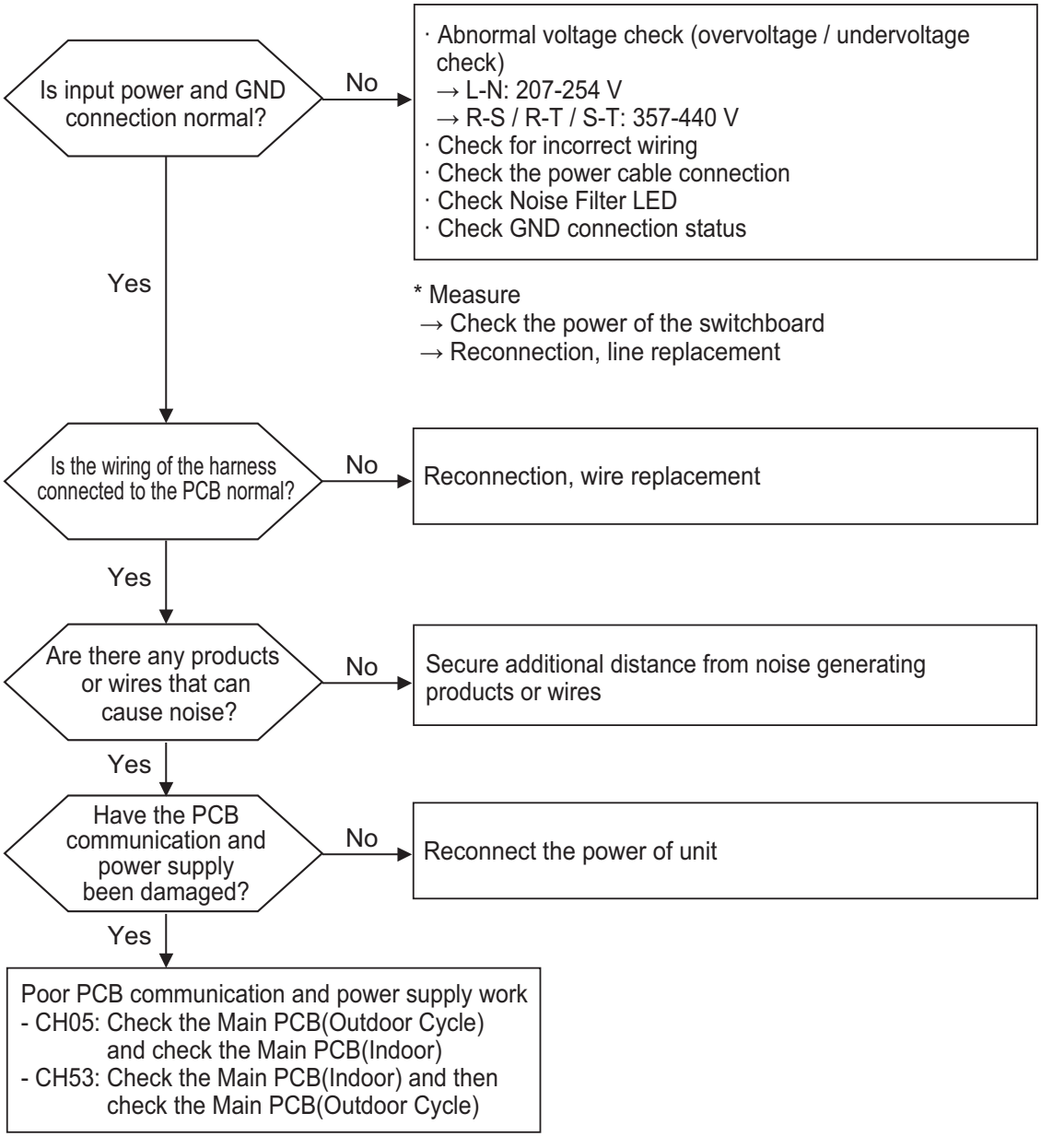
Display code	Title	Description	Cause of error
CH05 CH53	Bad communication between outdoor unit and indoor unit	Communication between Main PCB(Indoor) and Main PCB (Outdoor cycle) is less than 3 minutes	1. Check the input voltage 2. Check the input power line connection 3. Main PCB (Outdoor Cycle) and Main PCB (Indoor) connection line short circuit, check for burnout 4. Check the main GND connection status 5. Check for ambient noise interference 6. Check whether Main PCB (Outdoor Cycle) and Main PCB (Indoor) are powered 7. Check the PCB burnout

Check Flow Chart



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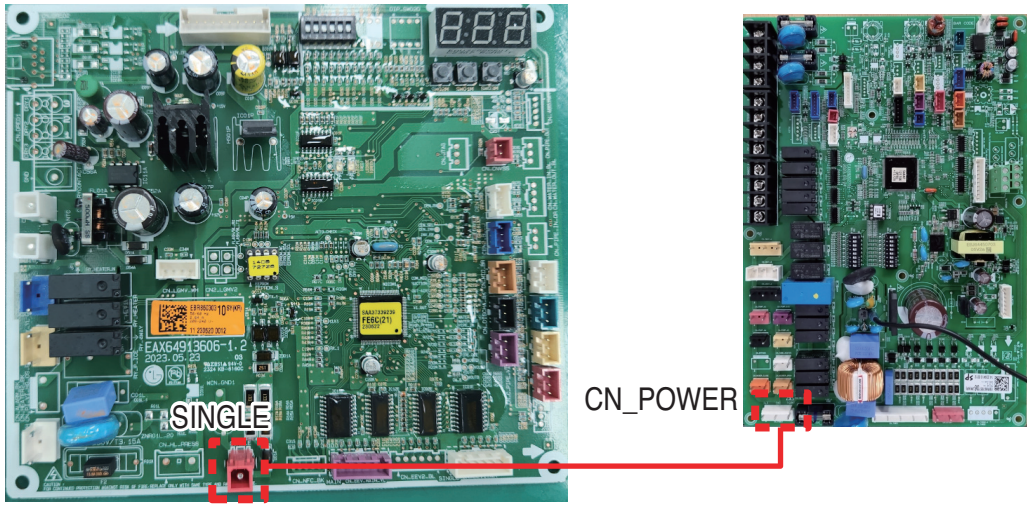
▶ 12(41 000), 14(48 000), 16(55 000) kW(Btu/h)
: Check the connection state of the PCB connection harness



Main PCB(Outdoor Cycle)

Main PCB(Indoor)

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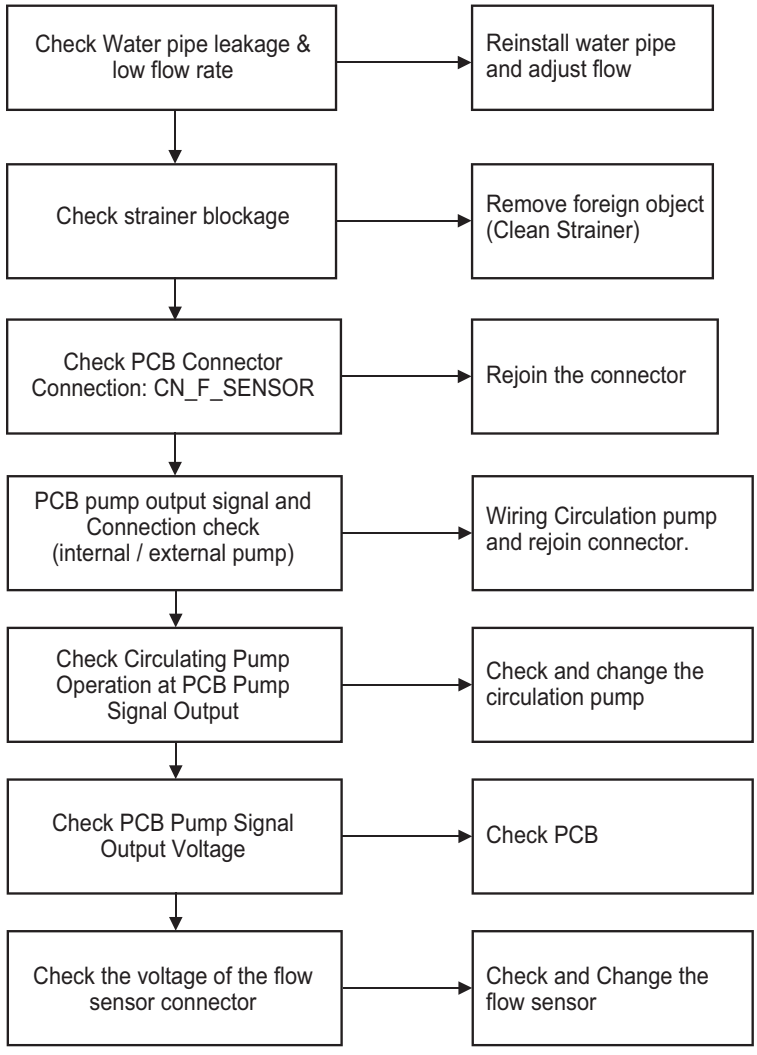
Display code	Title	Description	Cause of error
CH14	Problem in Flow rate	Low flow detection during pump operation	1. Low flow rate due to water leakage 2. Strainer / water pipe clogging 3. Poor setting of external pump installation 4. Circulation pump malfunction 5. Flow detection sensor disconnection or short circuit

Check Flow Chart



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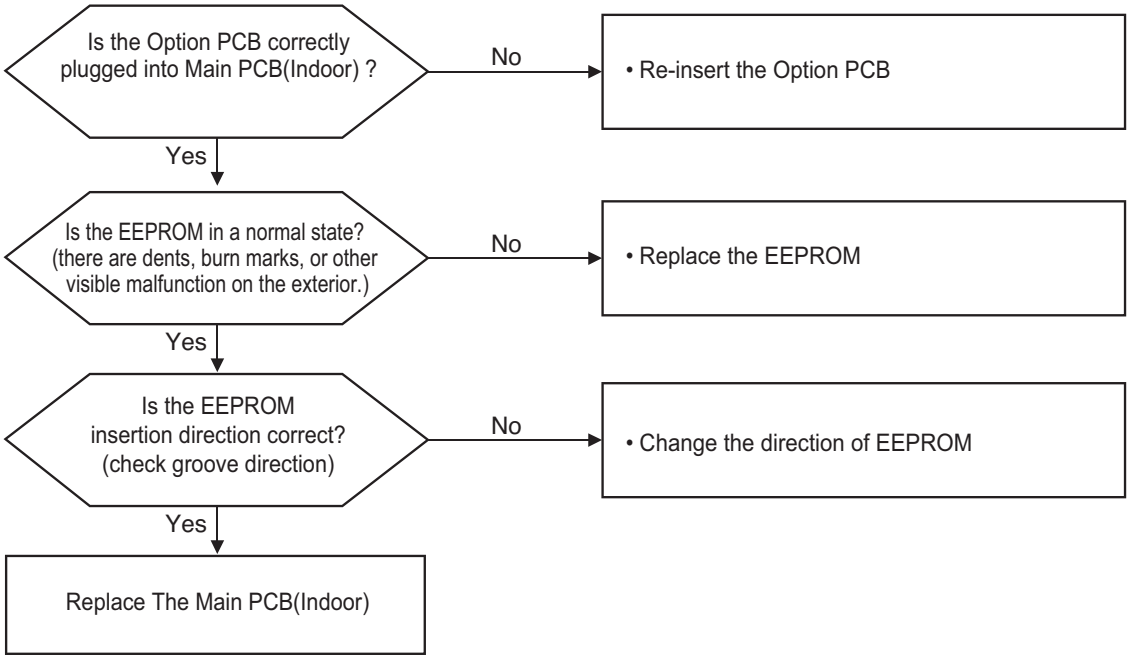
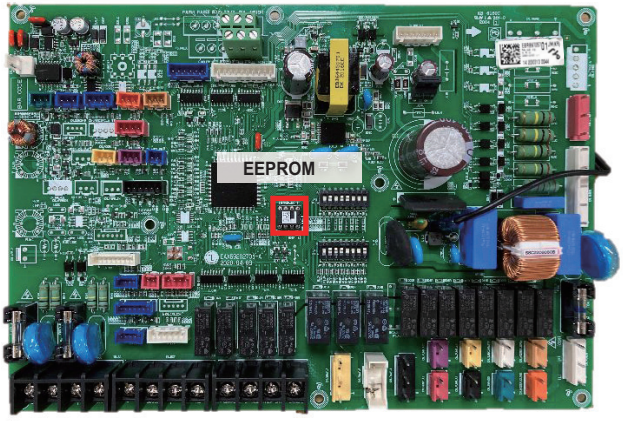
Display code	Title	Description	Cause of error
CH09	PCB Program (EEPROM) Fault	A malfunction occurred in the optional EEPROM connected to the Main PCB(Indoor).	1. Optional EEPROM is loosely inserted or removed 2. Optional EEPROM burnout

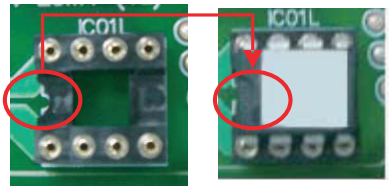
Check Flow Chart

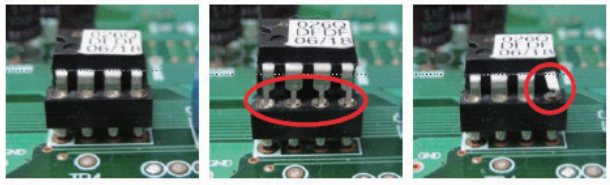


Check Point

1. Check the EEPROM Direction
2. If the EEPROM value & the Program value are not matched, the Code is Displayed
3. After Checking the connection and Insertion, replace the PCB or Option PCB







OK NG NG

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1. Check for water pipe leakage and low flow rate

1) Check for water leakage and valve lock.

❊ Check for water pipe leakage

- Check for leakage of water pipes and accessory parts inside the product
- Check whether water pipes and accessory parts of the facility are leaking (connections, buffer tanks, etc.)

① In case of leakage
- Reconnect the leaking part or replace or reinforce damaged parts.
- Re-operate after rechecking leaks and performing air extracting.

② When there is no leak
- Check whether the valve in the water pipe is locked (open the valve when it is confirmed)
- Check if the strainer is clogged.
- Open the water pipe line and the air vent inside the product, or perform air extracting inside the pump.
  *. When you open the air vent inside the pump, be sure to close it.
- If there is no problem, check whether the flow rate is low.

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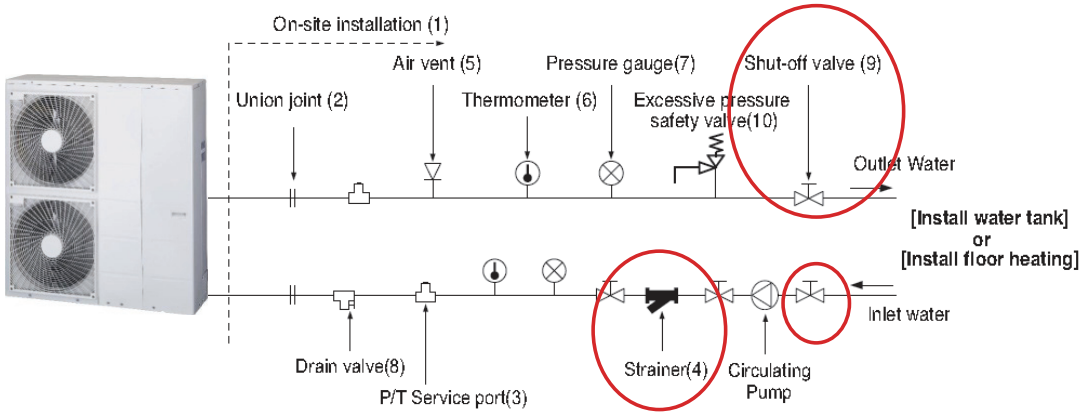
2. Check for clogging of strainer and temporary cleaning of plate type

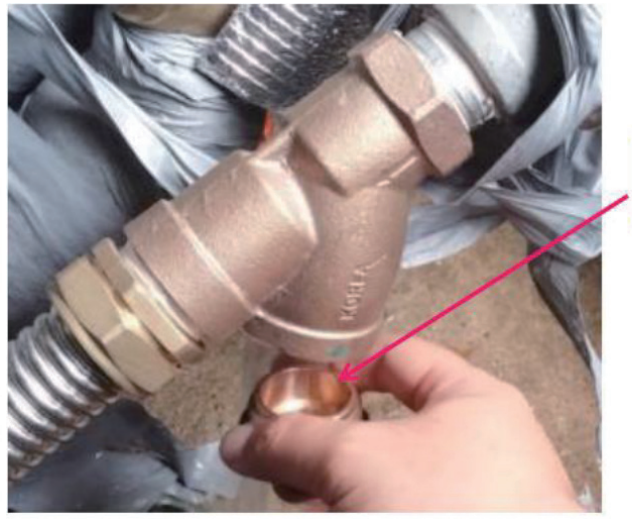
1) External strainer cleaning method



① Close the Shut-off valve(9) at the front and rear of the strainer.

② Use a monkey wrench to separate the lower part of the strainer.
③ After separation, check foreign substances and wash them with running water.
④ After washing, reassemble the separated part.
⑤ Open the Shut-Off valve(9) again.

Wash with running water when checking for foreign substances as shown in the picture.



After washing is complete, tighten in a clean state.

❊ Strainer may not be the corresponding type.

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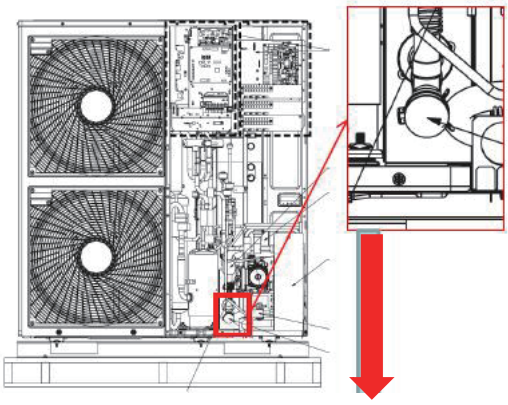
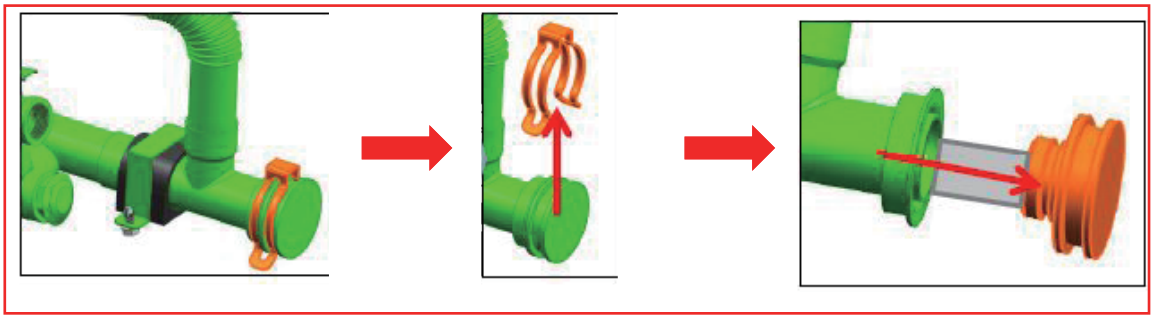
2) How to clean the inner strainer

① Close the inlet/outlet Shut-Off valve.
② Open the front panel of the product.
③ Remove the strainer fixing clip at the bottom as shown in the picture.
④ Pull the strainer to separate it and wash it.
⑤ Open the Shut-Off valve after separation and tightening in reverse order.





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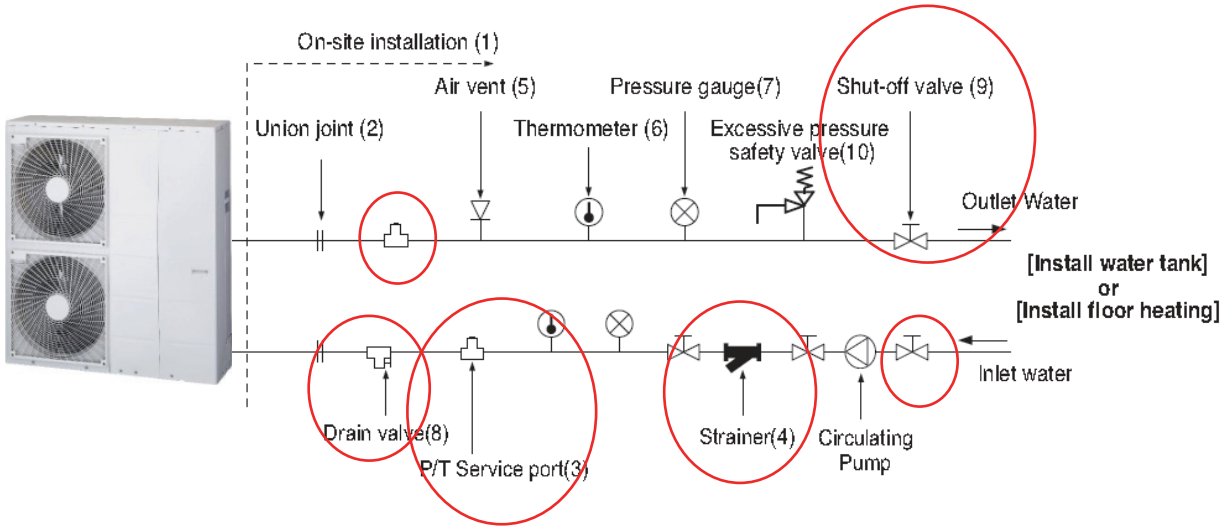
3) PHEX temporary cleaning method



※ Check the operating conditions when checking the circulation pump output and operating status.

① Close the Shut-Off valve (9) at the front and rear of the strainer.
(Check the product to be OFF by stopping operation.)

② Open the P/T service port (3) and drain valve (8) in the water outlet on the product side. (Incoming service port remains closed)

③ Use the faucet hose to continue supplying water to the water outlet service port so that water flows out to the drain valve.
※ If there is no P/T service port (3), supply water using the pressure gauge port at the outlet.

④ Supply water until transparent water comes out

⑤ Close the water outlet service port and drain valve.

⑥ Open the Shut-Off valve (9) again.
* Even if you temporarily clean the PHEX, please clean it as there are many foreign substances attached to the PHEX.

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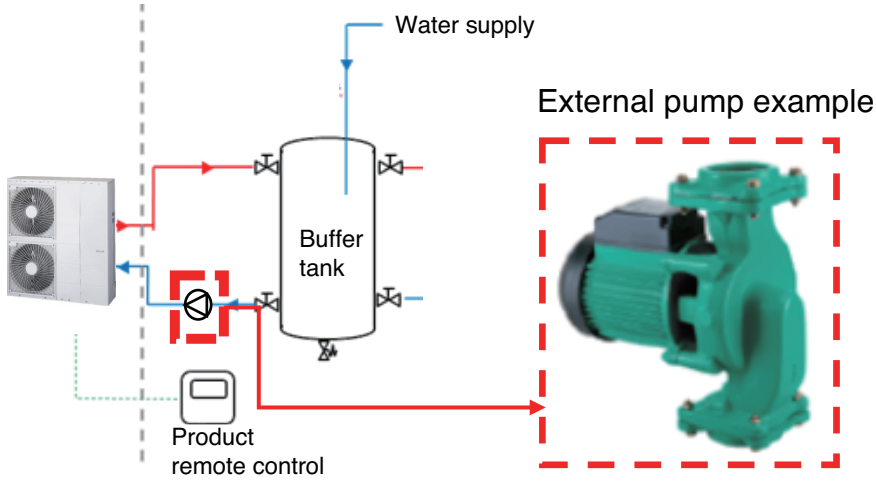
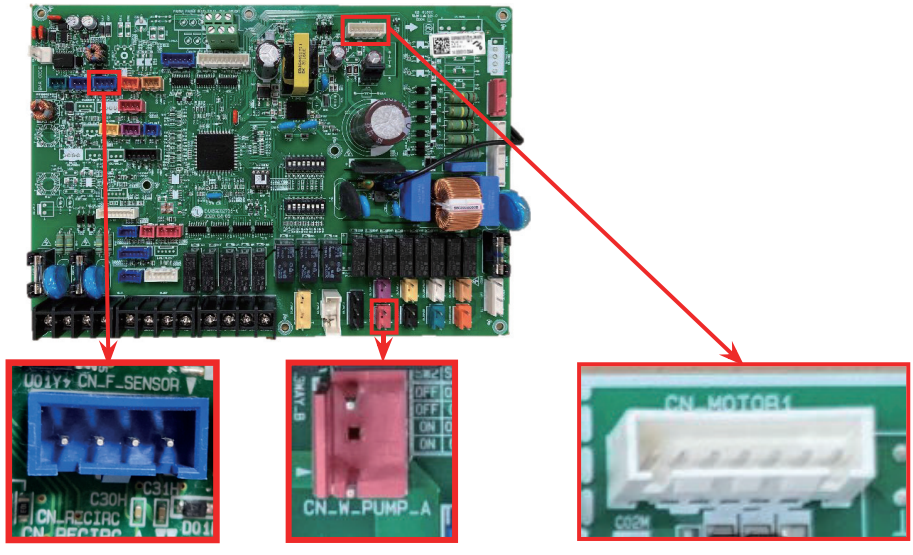
4. (Case 1) Insperction items when extemal pump is not used (Used the product pump)

1) Check installation of external pump (product ↔ buffer tank)



2) If the PCB connector is missing or less inserted → Reinsert the connector.



CN_FLOW1 CN_W_PUMP_A CN_MOTOR1

* Please proceed by referring to the inspection guide in the next chapter.

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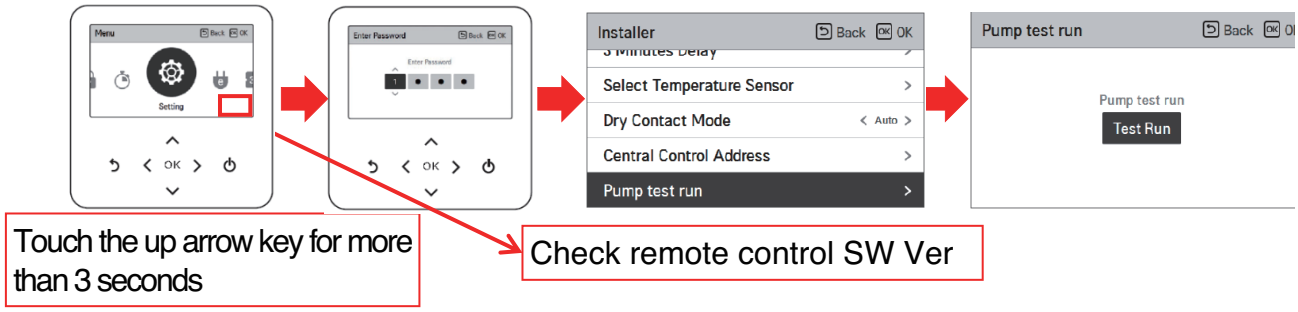
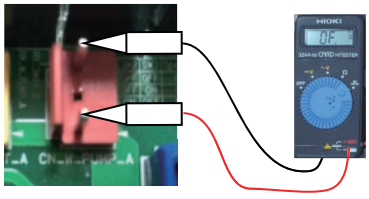
(Continued on how to check Case 1)

3) Check the product circulation pump output power.
① After removing the harness connected to CN_MOTOR1, check.
② Enter the pump test run mode.
→ Settings> Touch the UP arrow key for more than 3 seconds
> Enter password (remote control SW Ver)
> Click OK button in Pump Test Run mode



③ Check the following connector voltage using a tester
within 1 minute after entering the pump test run mode.



<CN__W_PUMP_A>

* Check with AC voltage measurement mode.
* AC190~240V output when pump is operating (OK)

- If there is no AC 190~240V output, replace the PCB.
※ When replacing the PCB for the relevant reason,
be sure to attach a picture of the inspection (to prevent misservice).
- AC 190~240V is measured, but if the pump does not work, check the pump.
(If vibration is felt by hand, it is judged as normal pump operation)

④ How to check the pump
- Remove the pump and check whether it is clogged or damaged by foreign substances.

⑤ After the breaker is turned off, refasten CN_MOTOR1 and check the ② and ③ processes again.
- If CH14 occurs, check the flow sensor.

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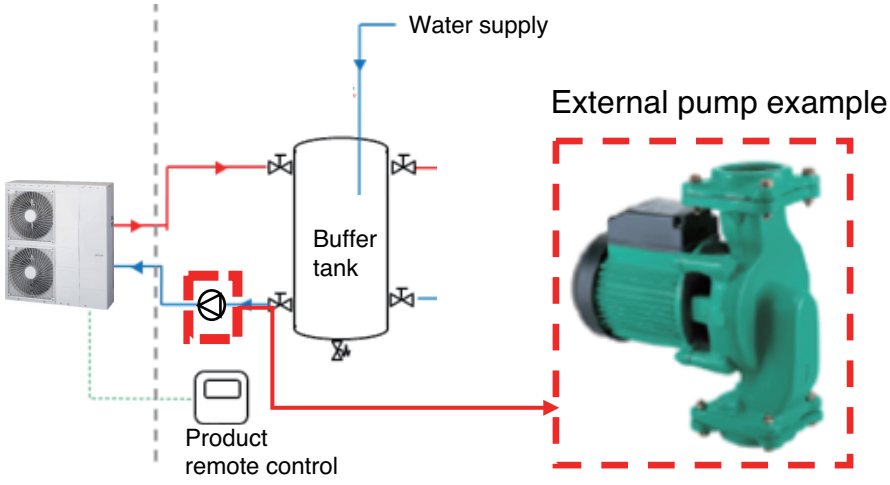
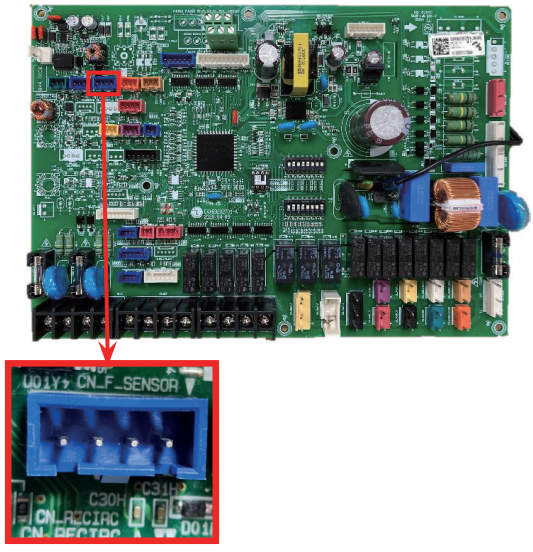
4. (Case 2) Inspection items when using an external pump (product not linked)

*. When using the product pump and the external pump at the same time,
check Case 1 as well.

1) Check whether an external pump (product ↔ buffer tank) is installed
- Check the external pump power connection and power output status.



2) If the PCB connector is missing or less inserted → Reinsert the connector.



3) Check whether the external pump (product ↔ buffer tank) is operating normally
- Check the external pump power connection and power output status.
(If the external pump is abnormal, contact the installation shop.)

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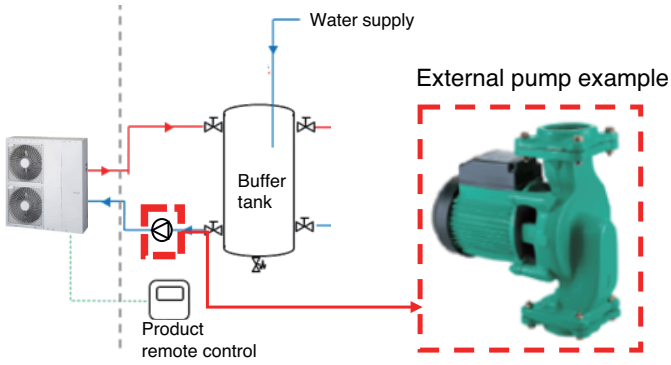
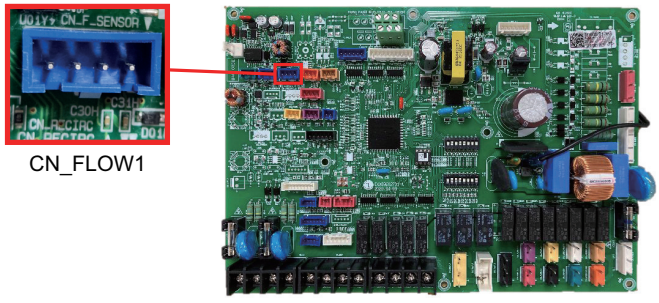
4. (Case 3) Inspection items when using an external pump (product linkage)

*. When using the product pump and the external pump at the same time, check Case 1 as well.

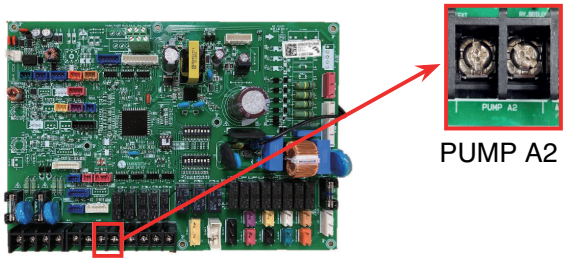
1) Install an external pump (product ↔ buffer tank) and check whether the product is interlocked



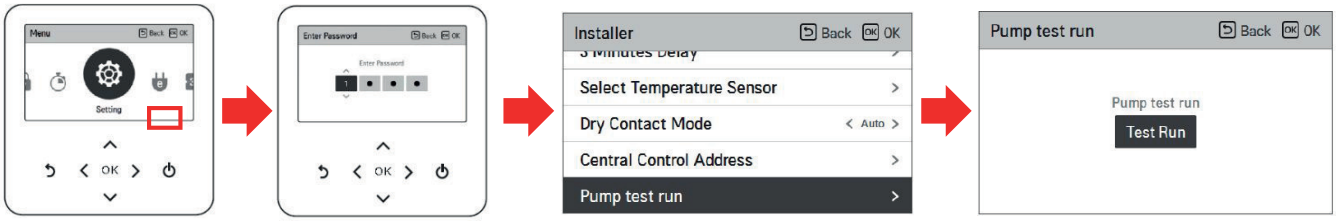
2) If the PCB connector is missing or less inserted → Reinsert the connector.



3) Check the connection and contact of the pump contact line outside the PCB



① Enter the installer setting> pump test run mode.



② Check whether or not TB_EXT_PUMP is contacted within 1 minute.
→ How to check: Use contact check ( ) to check as follows.
- Contact is open: No Sound (PCB NG) → PCB inspection required
- Contact is closed: Sound is heard (PCB OK) → Pump needs to be checked

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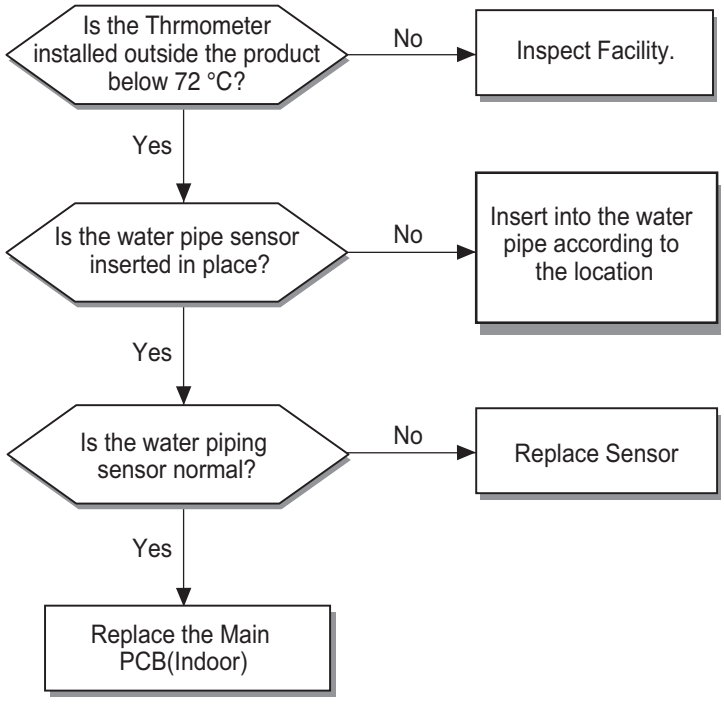
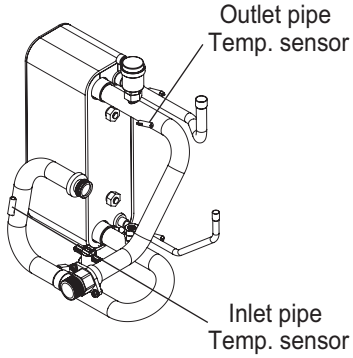
Display Code	Title	Description	Cause of Error
CH15	Water pipe strange overheat	When the temperature of the water pipe exceeds 72 °C (161.6 °F)	1. When hot water is introduced 2. Bad sensor 3. Main PCB (Indoor Cycle) malfunction.

Check Flow Chart

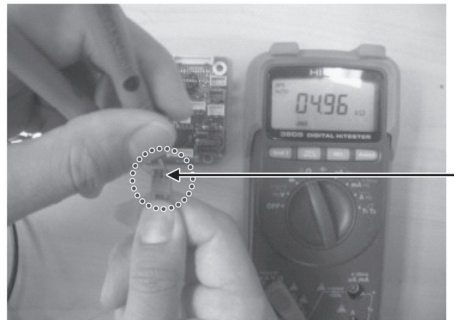


Water Pipe Temperature Sensor Location



The temperature sensor is normal when the resistance value changes according to the temperature and the next resistance value is displayed based on the current temperature (± 5% error)

Air temp. sensor
10 °C (50 °F) = 20.7 kΩ : 25 °C (77 °F) = 10 kΩ : 50 °C (122 °F) = 3.4kΩ
Piping temp. sensor
10 °C (50 °F) = 10 kΩ : 25 °C (77 °F) = 5 kΩ : 50 °C (122 °F) = 1.8kΩ



Measure Indoor unit outlet piping temperature sensor resistance

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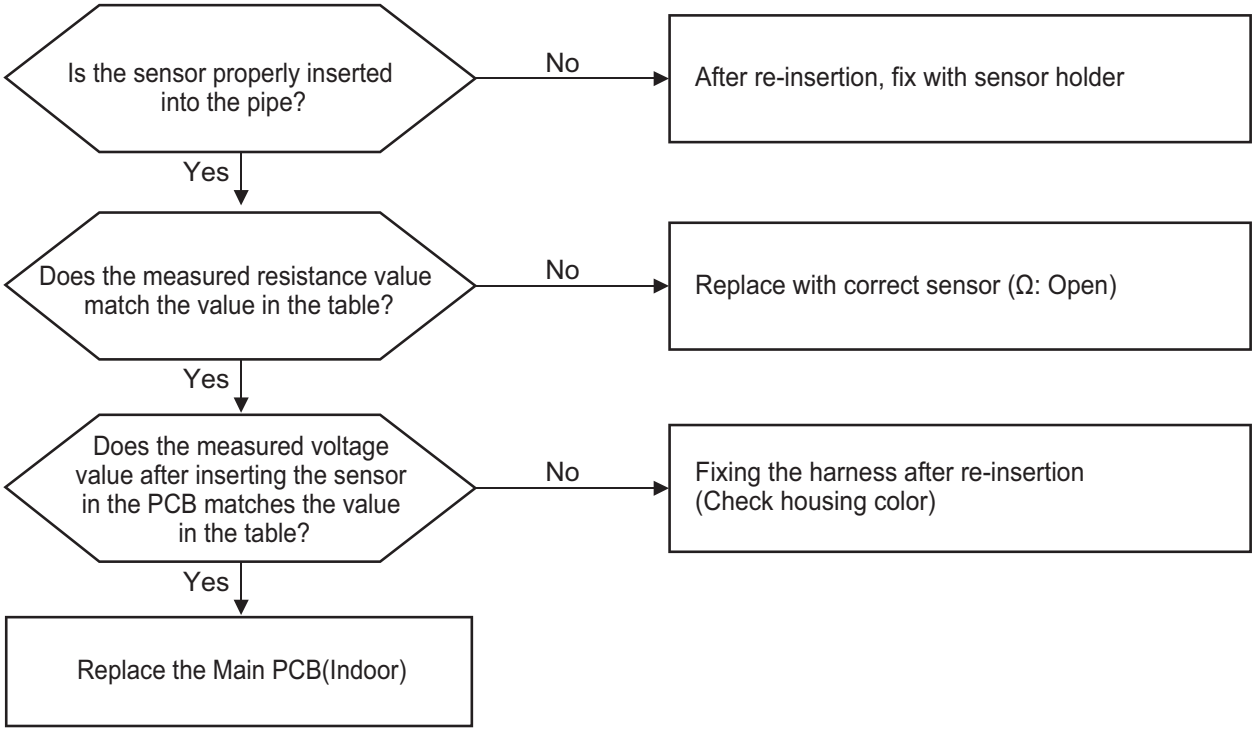
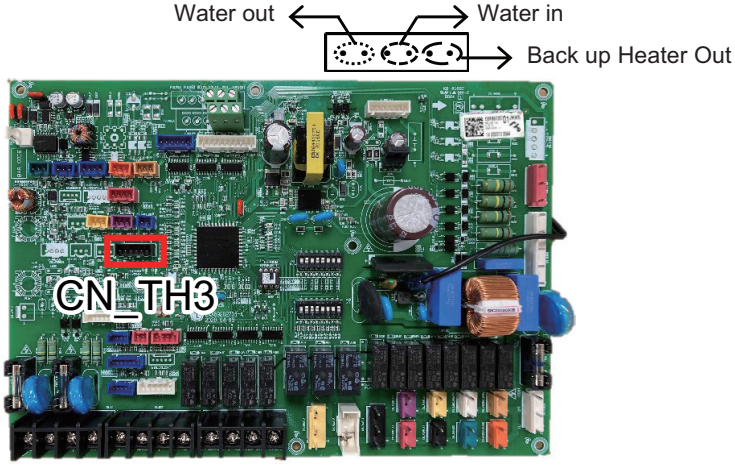
Display code	Title	Description	Cause of Error
CH16	Problems in sensors	Heater water temperature sensor error Temperature sensor error Water temperature sensor error At the same time, malfunction occur.	1. Inlet / Outlet / Heater out temp. sensor Error 2. Improperly connected sensor.

Check Flow Chart





	Voltage (at 25 °C(77°F))
Water Out	2.232
Water In	2.232

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PCB Mark	Indoor Temp. (°C(°F))	Resistance(kΩ)	Voltage(V)
CN_TH3(Black / 6PIN)	-10 °C (14 °F)	29 kΩ	4.1 V
	-5 °C (23 °F)	22 kΩ	3.9 V
	0 °C (32 °F)	17 kΩ	3.6 V
	5 °C (41 °F)	13 kΩ	3.3 V
	10 °C (50 °F)	10 kΩ	3 V
	15 °C (59 °F)	8 kΩ	2.8 V
	20 °C (68 °F)	6 kΩ	2.5 V
	25 °C (77 °F)	5 kΩ	2.2 V
	30 °C (86 °F)	4 kΩ	1.9 V
	35 °C (95 °F)	3.2 kΩ	1.7 V
	40 °C (104 °F)	2.6 kΩ	1.5 V
	45 °C (113 °F)	2.1 kΩ	1.2 V
	50 °C (122 °F)	1.7 kΩ	1 V
	55 °C (131 °F)	1.4 kΩ	0.9 V
	60 °C (140 °F)	1.2 kΩ	0.8 V
	65 °C (149 °F)	1 kΩ	0.7 V

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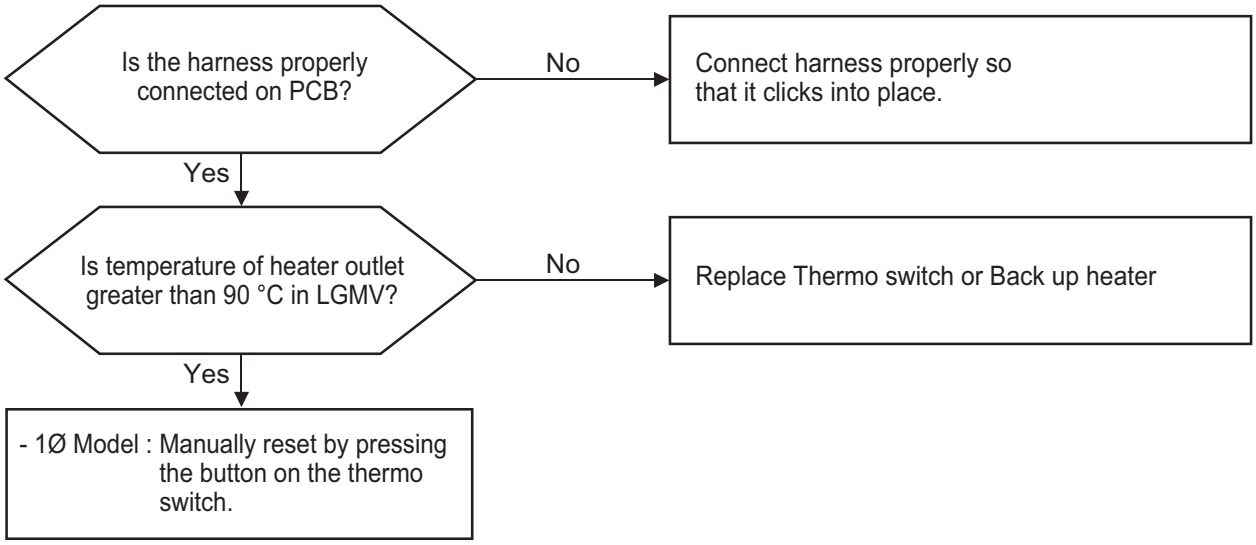
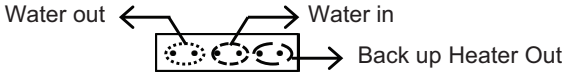
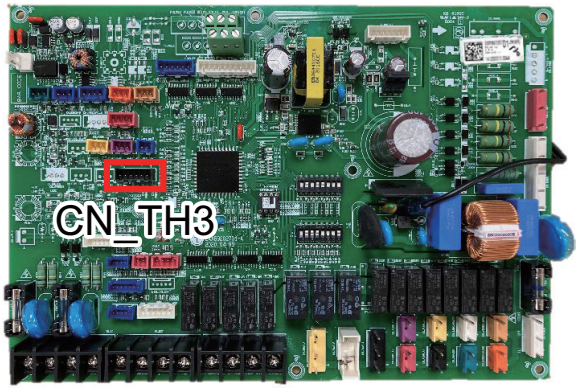
Error Code	Title	Description	Cause of Error
CH20	Back up heater strange overheat	The heater output water temperature is over specific temperature.	1. Wiring is wrong or imperfect. 2. Fuse of back up heater is blown due to overheat.

Check Flow Chart







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Display code	Title	Description	Cause of error
CH21	DC PEAK (IPM Fault)	IPM of inverter drive is abnormal or Inverter comp. is self-malfunction.	1. Compressor clogged 2. Compressor internal break / short 3. Overload operation-Outdoor fan restraint, shielding, clogging 4. H / Sink and C / Box contact due to malfunction inverter connection 5. IGBTM burnout, PCB work bad 6. Inv PCB(Outdoor) reassembly
CH26	DC Comp Position Error, LOCKING Detection	Initial start-up failure due to inverter compressor and cycle failure	1. Overload operation (EEV restriction / excessive refrigerant) 2. Inverter compressor burnout (insulation breakdown / motor burnout) 3. Bad connection of inverter compressor 4. Outdoor unit Outdoor unit Inverter PCB burnout (CT)
CH29	Inverter compressor over current	When the inverter compressor input current limit is exceeded	1. Overload operation (Plugging blocked / shielded / EEV failure / excessive refrigerant) 2. Compressor burnout (insulation breakdown / motor burnout) 3. Input voltage low voltage 4. Inv PCB (Outdoor) burnout

⚠WARNING

Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

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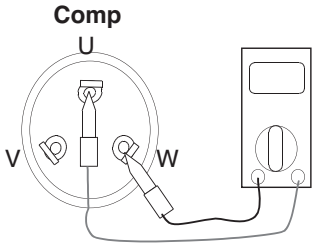
■ Method for manual entry using LGMV (PC or Mobile)

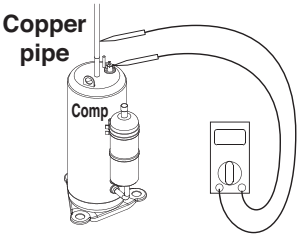
1. Turn off power
2. Check connection status, such as power, PCBA input/output, and Comp lines
   (If the connection is poor, it will make mistake "PCBA NG")
3. Check winding resistance and insulating resistance of compressor.
   (If there is a problem with the insulation of the compressor, it will make mistake “PCBA NG”)

Winding resistance check



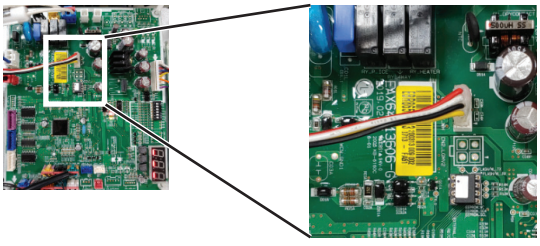
Model		RJB036MAA
Windings Restistance (at 25 °C (77 °F))	U-V	0.529 ± 7% Ω
	V-W	0.529 ± 7% Ω
	W-U	0.529 ± 7% Ω

Insulating resistance check



Terminal	Insulation Resistance
U-panel	≥ 10 MΩ
V-panel	≥ 10 MΩ
U-panel	≥ 10 MΩ

4. Turn on Power
5. Remote Controller Off (Stop mode)
6. Connect LGMV



7. Wait 30seconds.
8. Check compressor and fan off

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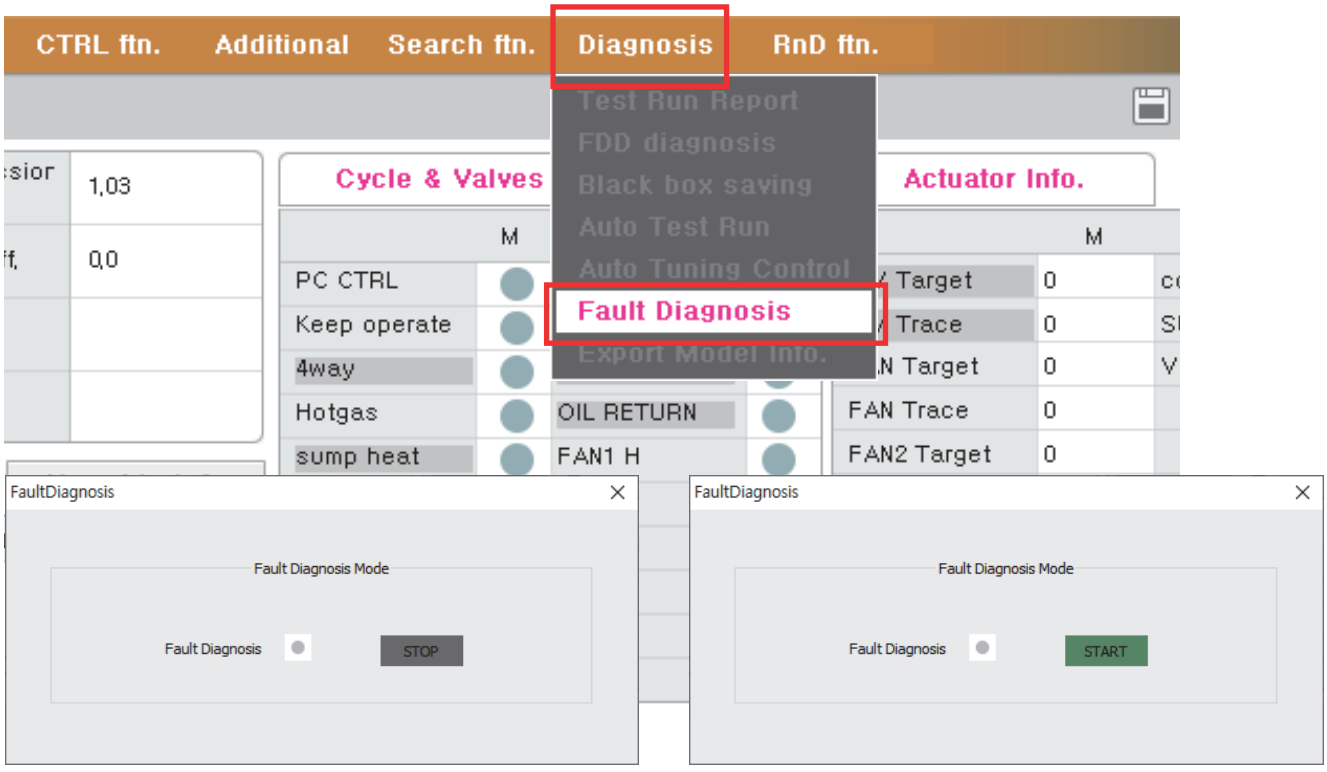
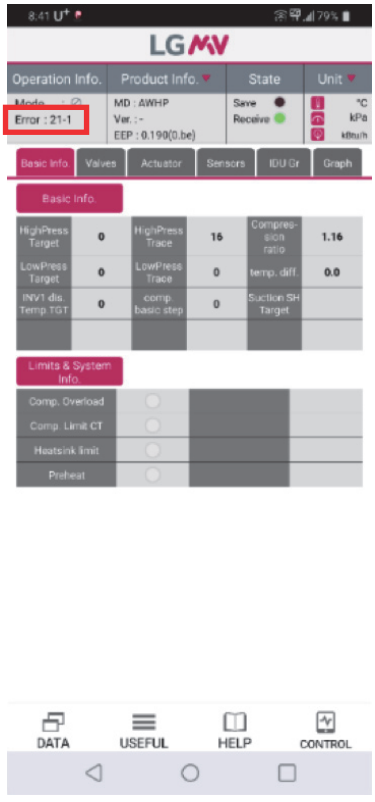
9. Perform diagnostic function

PC LGMV



Mobile LGMV



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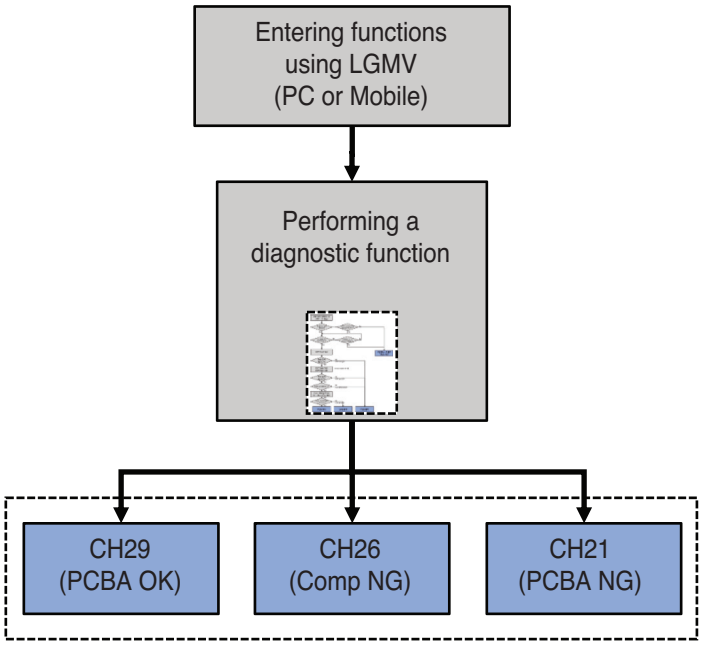
◆ Manual performing of fault diagnostic function

Manual Control Sequence

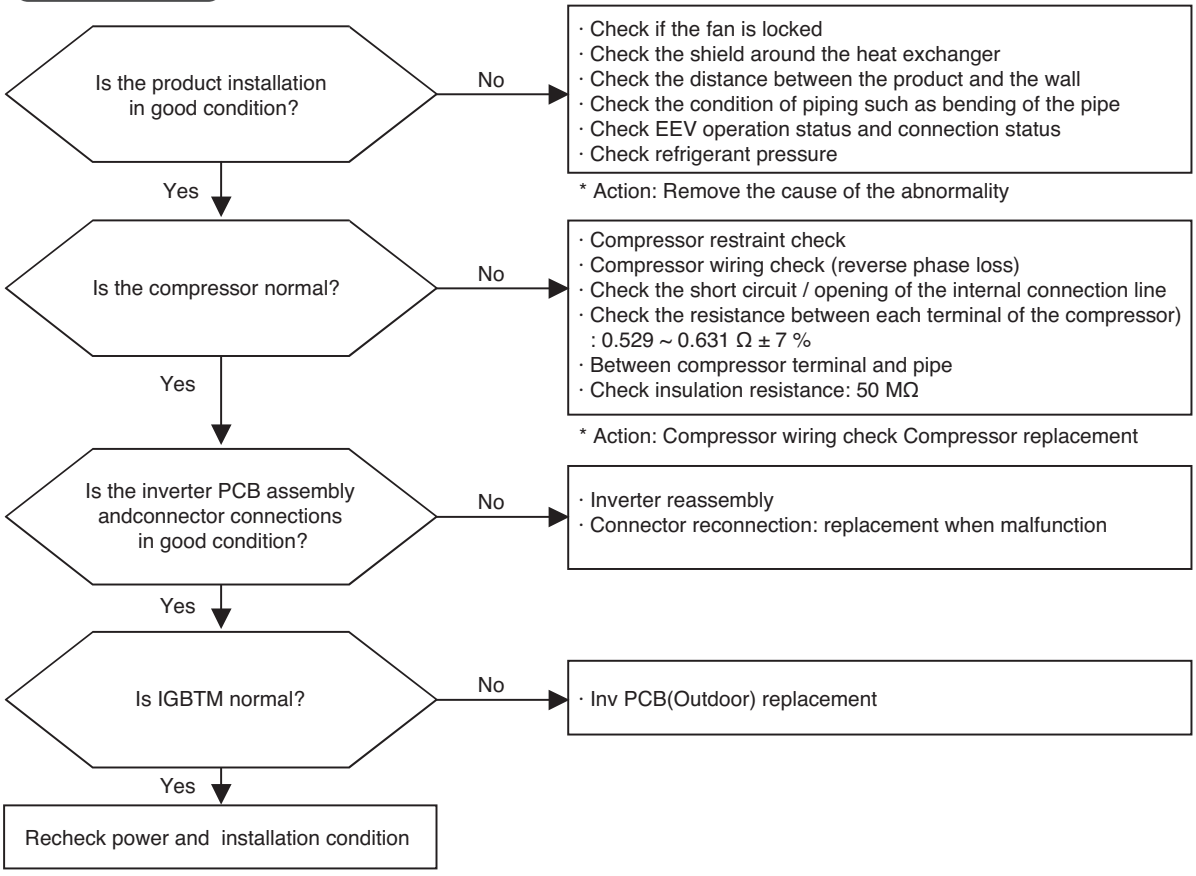


※ Maintaining error output based on fault finding results

NOTE

If an error does not occur after five minutes have elapsed after the fault finding function has been entered, the function has failed to enter. In this case, the SW Version information (the date of production of the product) or whether the Heatsink temperature has exceeded 60 °C (140 °F) should be checked.

Check Flow Chart



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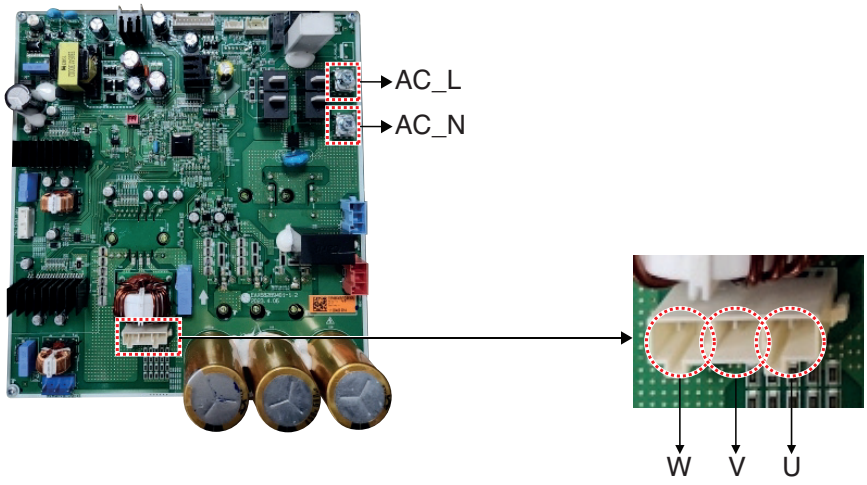
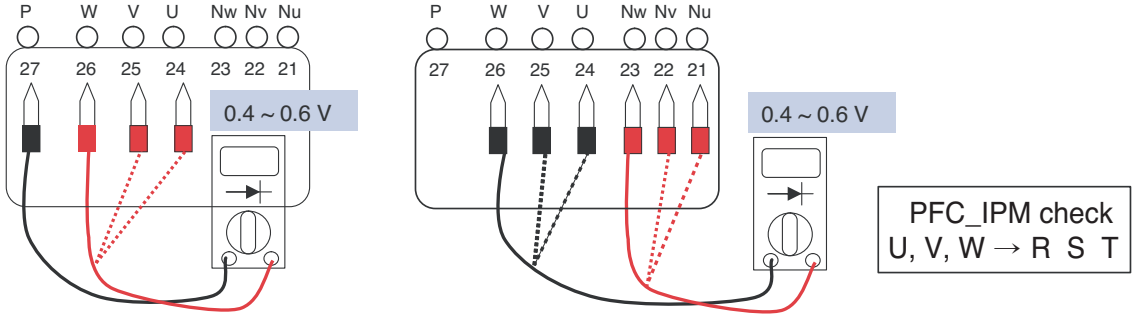
▶ UN60A (1Ø : 12(41 000), 14(48 000), 16(55 000) kW(Btu/h))



1. Wait PCB(Inverter) DC voltage is discharged after main power off.
2. Pull out AC(L), AC(N) connectors and U,V,W COMP Connector.
3. Set multi tester to resistance mode.
4. If the value between P and N terminal of IPM is short(0 Ω) or open(hundreds MΩ), PCB needs to be replaced.(IPM daaged)
5. Set the multi tester to diode mode.
6. In case measured value is different from the table, PCB(Inverter) needs to be replaced.(PCB damaged).



Model Name		Resistance(Ω) at 20 °C (68 °F)	
Phase	Capacity (kW(Btu/h)		
1Ø	12, 14, 16 kW (41 000, 48 000, 55 000 Btu/h)	U-V	0.438 Ω (at 25 °C (77 °F))
		V-W	0.438 Ω (at 25 °C (77 °F))
		W-U	0.438 Ω (at 25 °C (77 °F))

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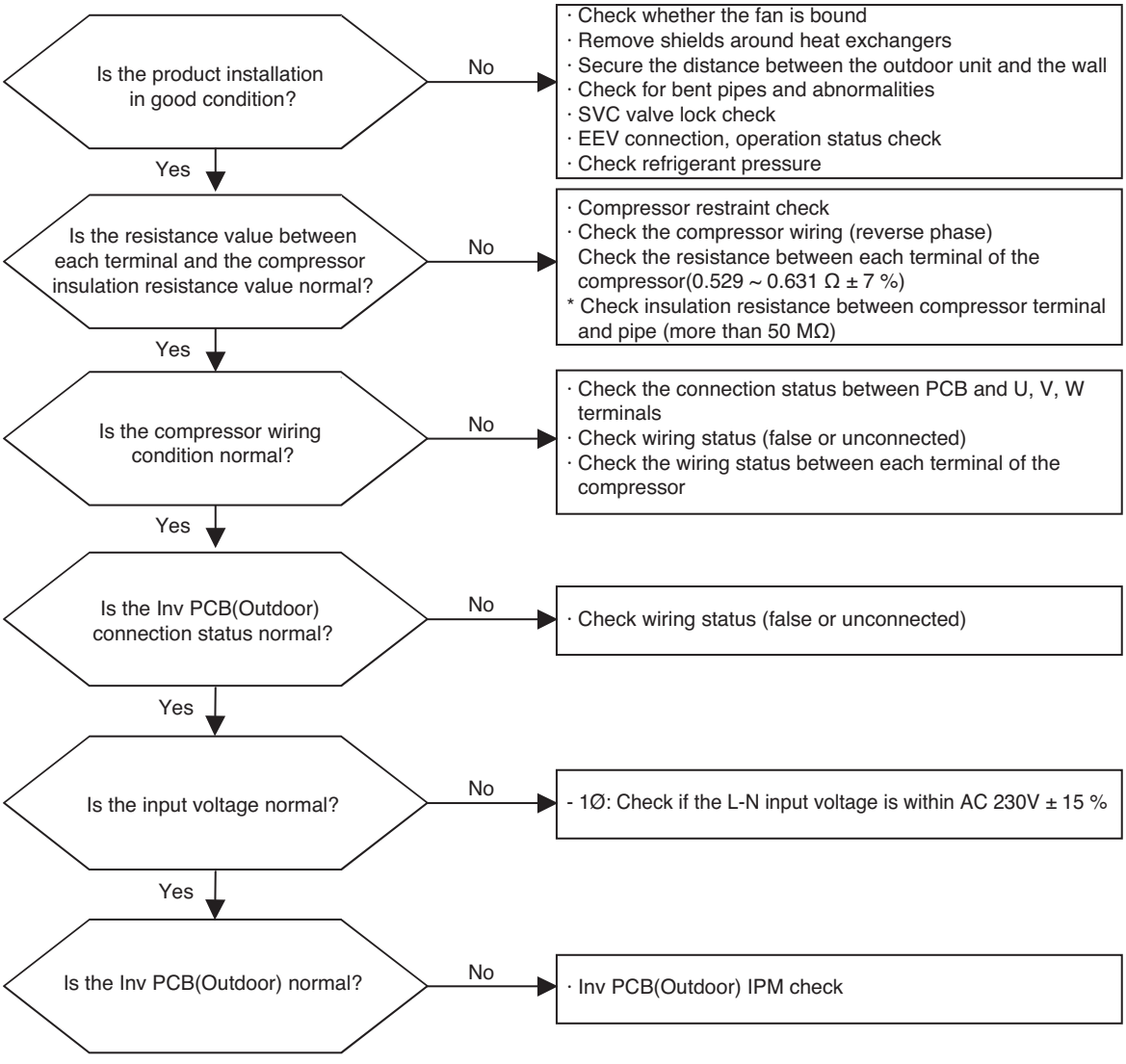
Display code	Title	Cause of error	Check point & Normal condition
CH22	Max. C/T	Power input of Inv PCB(Outdoor) is exceeded.	1. Check the input voltage 2. Check the structure of outdoor fan restraint / shielding / euro 3. Check R phase input current during operation 4. EEV Assembly Status Scholar 5. Check PCB current sensing components

⚠WARNING

Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

Check Flow Chart



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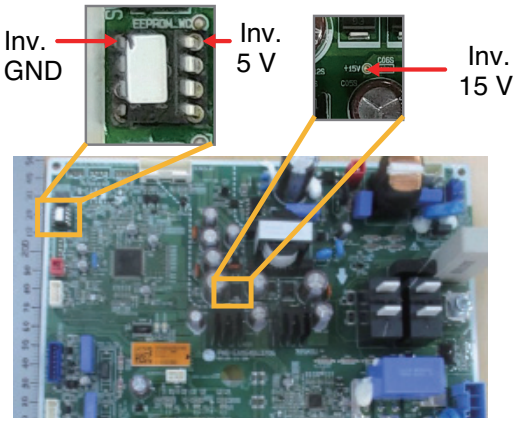
▶ UN60A(1Ø : 12(41 000), 14(48 000), 16(55 000) kW(Btu/h))

Check DC voltage when power is applied
Normal 15 V : 15 V ± 10% V
Normal 5 V : 5 V ± 10% V



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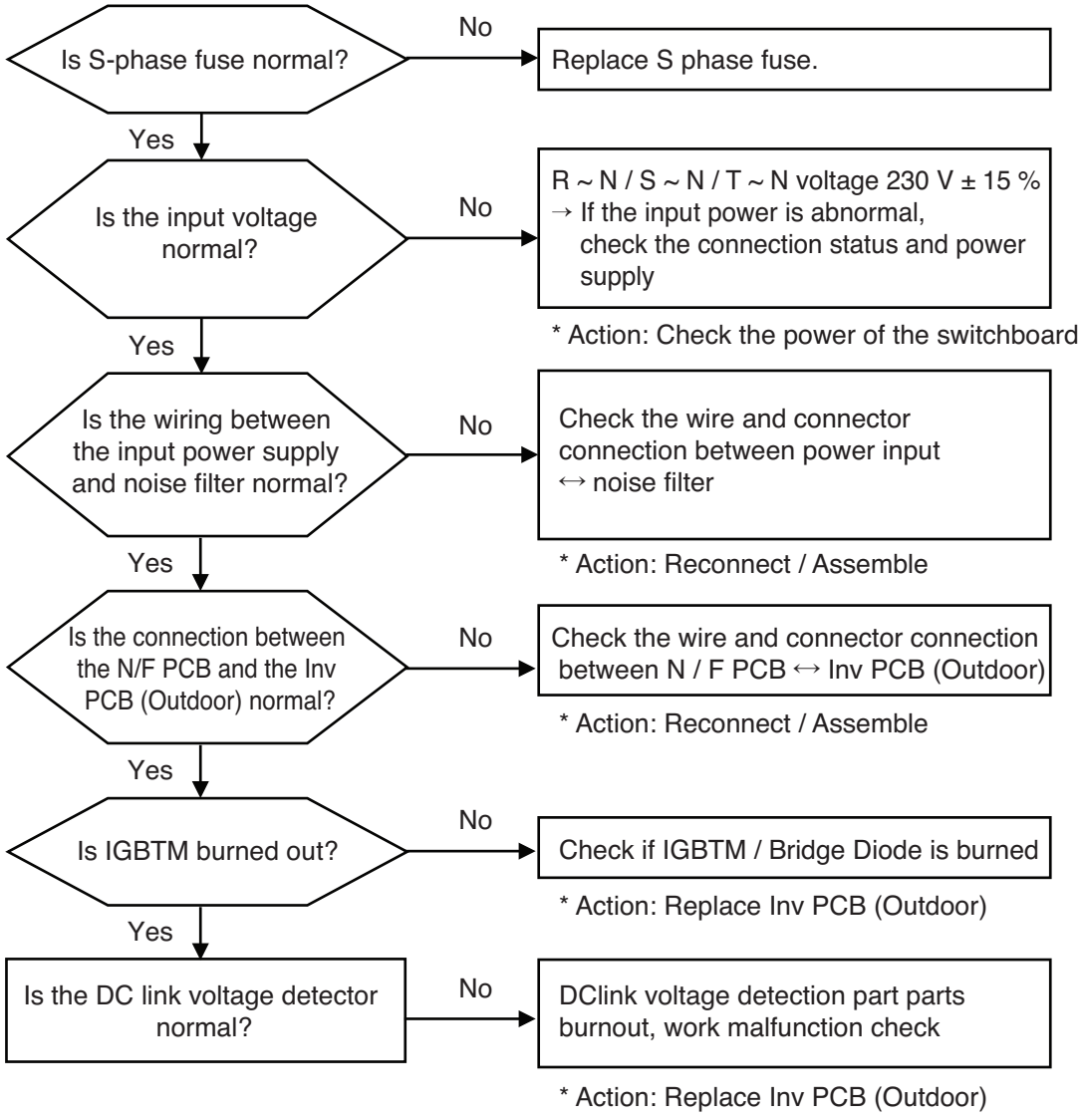
Display code	Title	Description	Cause of error
CH23	DC Link Low Volt	1. Inv PCB(Outdoor) DC voltage not charging 2. Inv PCB(Outdoor) DC Link voltage exceeds the limit	1.Incorrect wiring of DC Link terminal / Poor terminal contact (loose) 2.Condenser burnout 3.Inv PCB(Outdoor) burnout (DC Link voltage detection part) 4.Input voltage abnormality (R, S, T, N) 5.Bad power connection (N phase missing)

⚠WARNING

Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

Check Flow Chart



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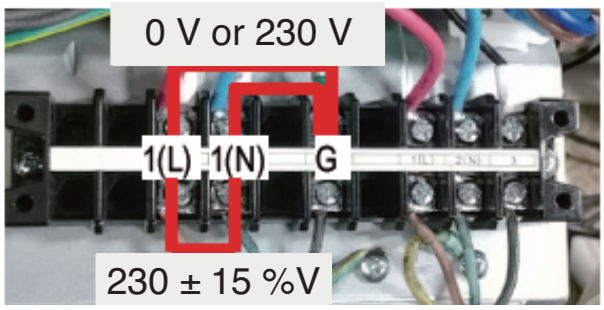
▶ Check L/N/G connection status (1Ø)



1. Check the L / N / G cable status and wiring status.
2. Check the outdoor unit input voltage
   L-N: 230 ± 15 % V / L-G, N-G: 0 V or 230 V

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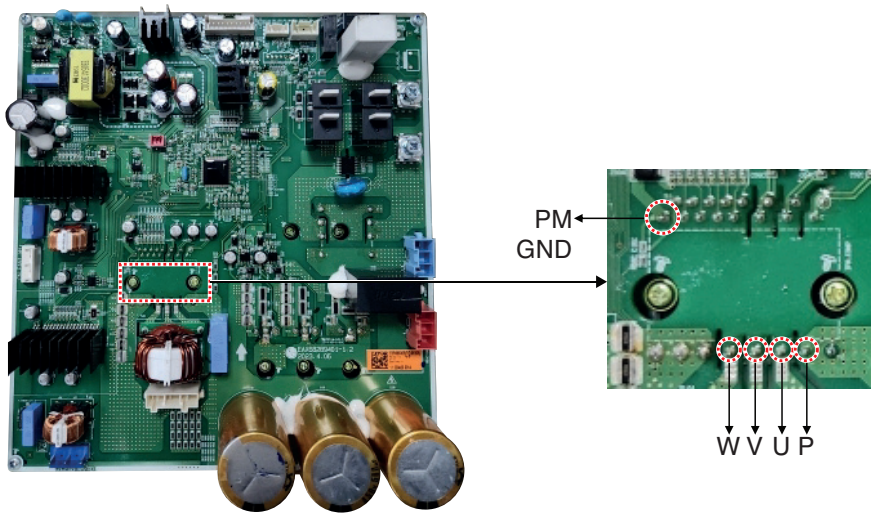
How to check the Inverter PCB IPM

▶ UN60A(1Ø : 12(41 000), 14(48 000), 16(55 000) kW(Btu/h))



Check Point	Multimeter			Measures	
	Mode	Black	Red	Normal	Abnormal
IPM	⊣◀	P	U	0.35 V ~ 0.7 V	Etc.
			V		
			W		
		U	IPM GND		
		V			
		W			

1. Remove PCB connector after power off (PCBA only measurement)
2. Multimeter diode measurement mode setting (⊣◀)
3. P ~ U / P ~ V / P ~ W measurement
4. U ~ GND / V ~ GND / W ~ GND measurement
5. If the IPM measurement value is significantly different from the normal value, IPM abnormal judgment

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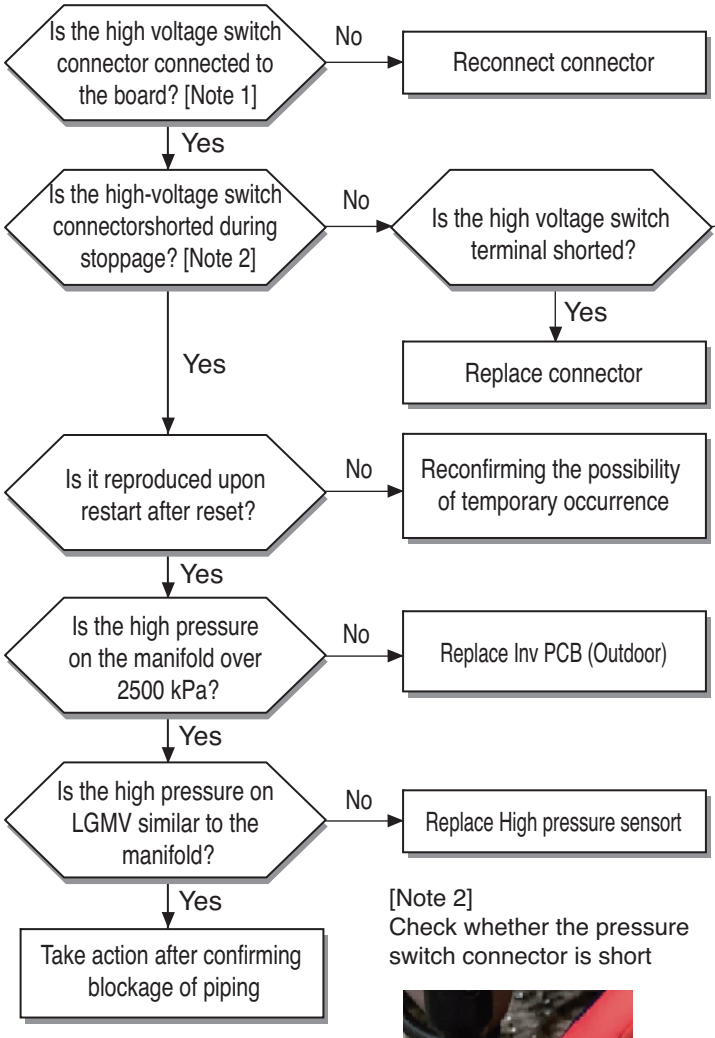
Display code	Title	Description	Cause of error
CH24	High Pressure Error	Compressor stop by operating high pressure switch	1. High pressure switch failure 2. Fan failure of outdoor unit 3. Compressor check valve clogged 4. Deformation due to breakage of refrigerant pipe 5. Refrigerant overcharge 6. Poor outdoor EEV 7. Shielding (Indoor filter clogged during heating) 8. Bad outdoor unit board

Check Flow Chart



[Note 1]
Check high volatage switch connection on the board.
► UN60A(12(41 000), 14(48 000), 16(55 000) kW(Btu/h))
<Inverter PCB>

[Note 2]
Check whether the pressure switch connector is short

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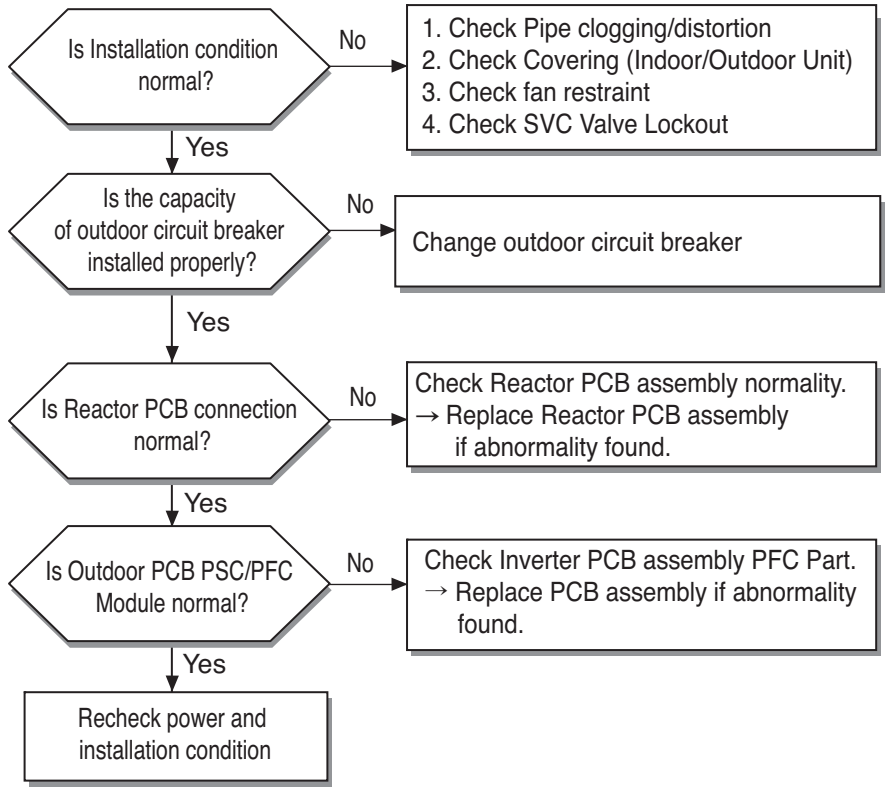
Display code	Title	Description	Cause of error
CH27	PSC / PFC Fault Error	Transfer of signals with detection of the flow of over-current in PSC / PFC	1. Overload Operation (Outdoor Fan Restraint / Blocking / Blocking) 2. Reactor PCB incorrect wiring 3. PCB Internal Components (PFC Module) Burnout

Check Flow Chart



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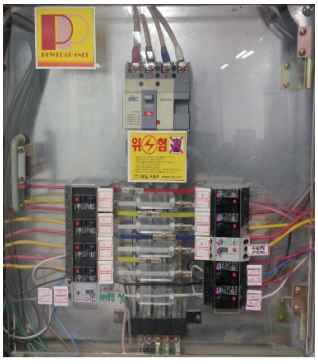
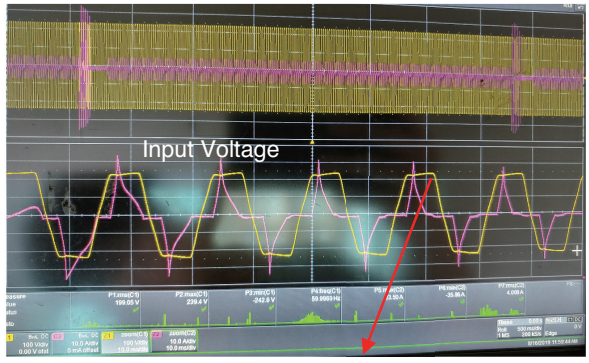
▶ Distribution Box Inspection

CH23 or CH27 may occur due to input voltage distortion.

1. When using 220V voltage in 3-phase power supply,
   check whether the voltage between lines is balanced. (Check R-N, S-N, T-N voltage during product operation)
2. Check if another product with a large load is connected to the same power supply.





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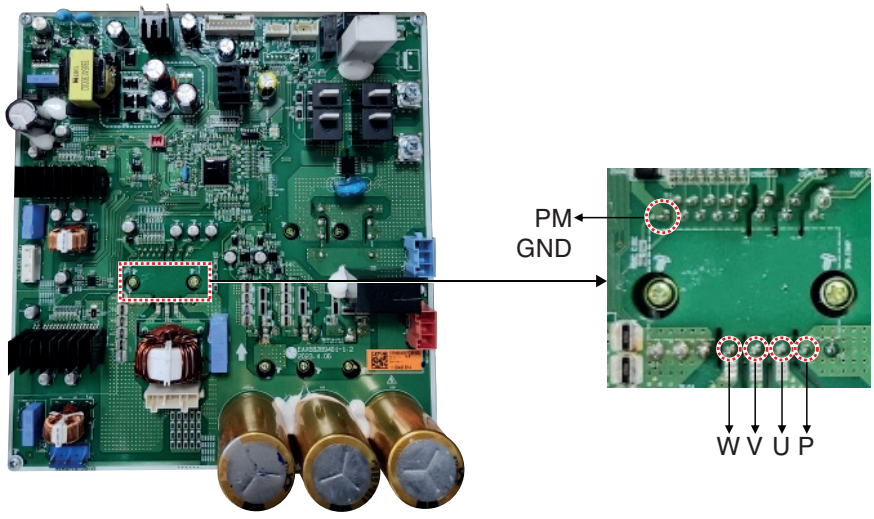
▶ UN60A(1Ø : 12(41 000), 14(48 000), 16(55 000) kW(Btu/h))



Check Point	Multimeter			Measures	
	Mode	Black	Red	Normal	Abnormal
IPM	⊣◀	P	U	0.35 V ~ 0.7 V	Etc.
			V		
			W		
		U	IPM GND		
		V			
		W			

1. Remove PCB connector after power off (PCBA only measurement)
2. Multimeter diode measurement mode setting (⊣◀)
3. P ~ U / P ~ V / P ~ W measurement
4. U ~ GND / V ~ GND / W ~ GND measurement
5. If the IPM measurement value is significantly different from the normal value, IPM abnormal judgment

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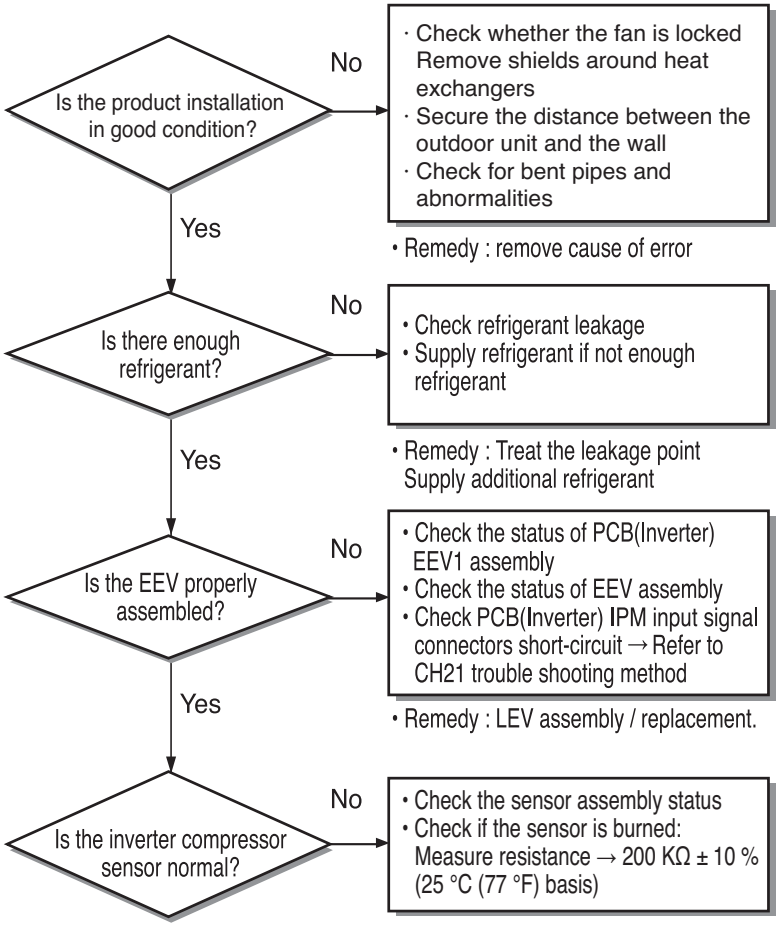
Display code	Title	Description	Cause of error
CH32	High temperature in Discharge pipe of the inverter compressor	Comp Off function when the discharge temperature is sensed and rises above a certain temperature	1. Overload operation 2. (Outdoor fan restraint, shielding, clogging) 3. Refrigerant leakage (shortage) 4. Inverter compressor discharge sensor malfunction 5. EEV connector missing / EEV assembly

⚠WARNING

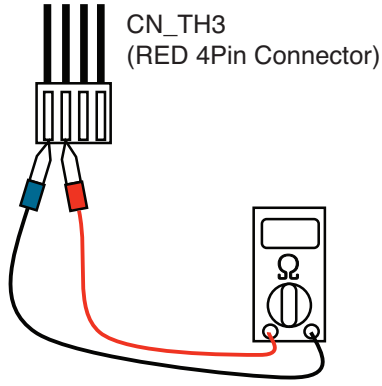
Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

Check Flow Chart



• Inspecting Inverter Compressor Discharge Sensor

1. Set Multi-tester as resistance measurement mode.
2. Measure the resistance between inverter discharge sensor connector pins.
3. Measure resistance value of 200 KΩ ± 10 %, 25 °C (77°F) basis
4. Check if the sensor insulation is damaged.
   → measure the resistance between sensor connector pin and unit assembly pipe. (1 MΩ or more)



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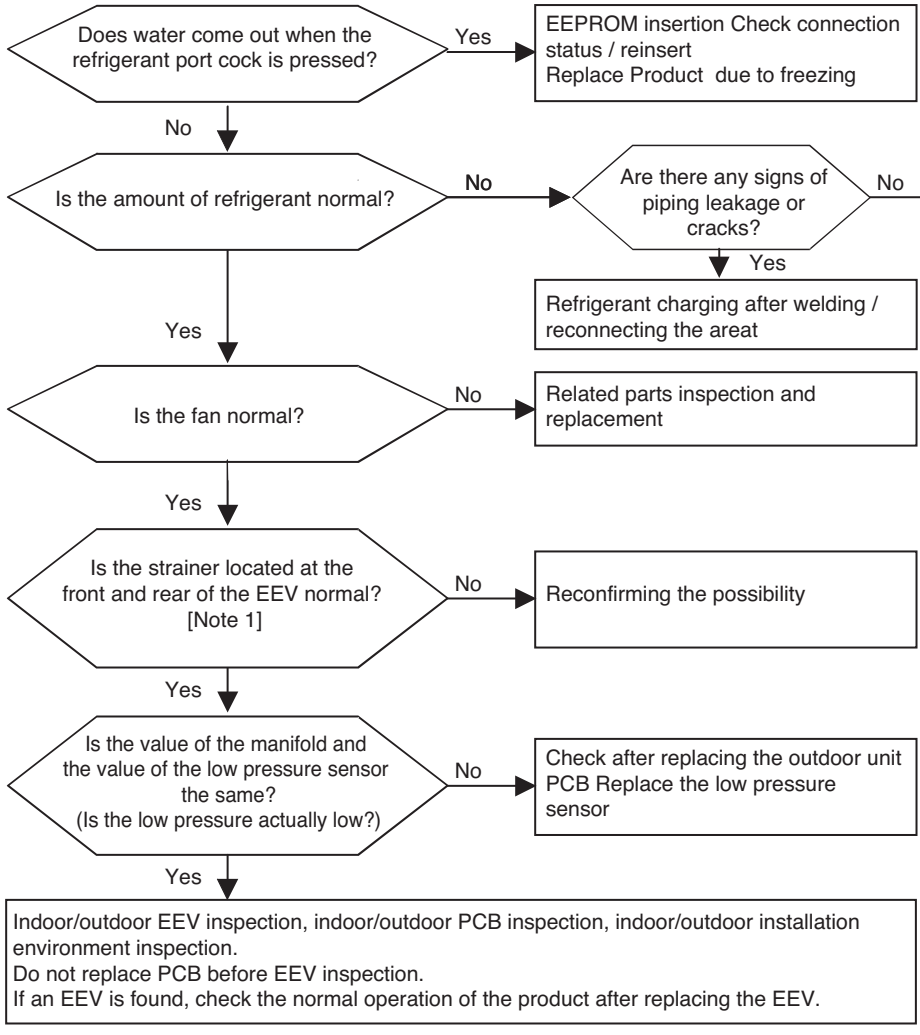
Display code	Title	Description	Cause of error
CH35	Low Pressure Error	Evaporating pressure is excessively low.	1. Pressure sensor Error 2. Outdoor fan Error 3. Shortage of refrigerant or leakage 4. Pipe damage and deformation 5. EEV Errpr 6. Heat exchanger shield (Clogging of indoor filter during cooling operation / Blockage of the outdoor unit heat exchanger during heating operation) 7. Outdoor PCB malfunction 8. Indoor piping temperature sensor failure

⚠ WARNING

Before checking the power supply of PCB or various outdoor units, check the power supply after 3 minutes. Caution When measuring while the power is on, check the measurement mode of the tester, and pay attention to the short circuit and other parts.

Check Flow Chart



[Note 1]
When the temperature difference between the front and rear of the strainer is severe, the freezing condition is visually confirmed, or if the temperature difference is confirmed, the strainer clogging condition should be suspected.

[Note 2]
Suspected when there is no freezing at the front end of the strainer and not freezing, and sudden freezing occurs.

[Note 3]
If replacement is necessary after checking the EEV, check the normal operation after replacing the EEV alone.

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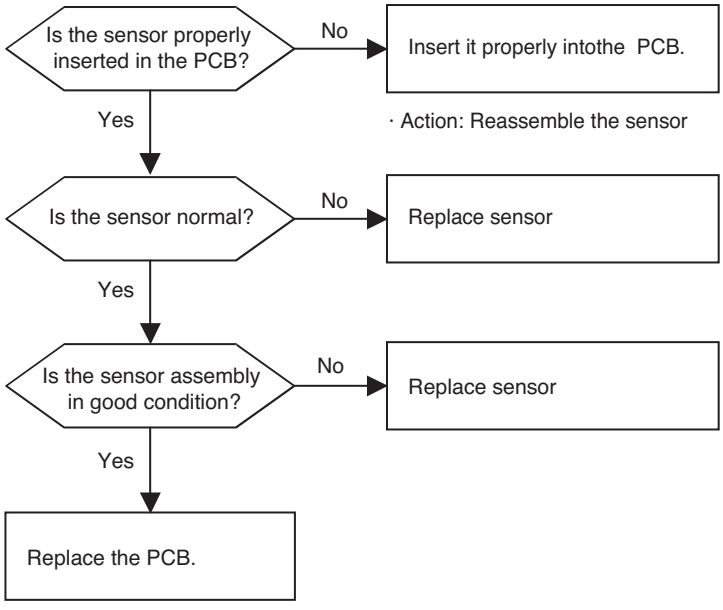
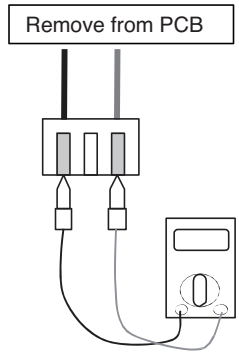
Display code	Title	Description	Cause of error
CH41	D-pipe sensor (Inverter)	Open / short of outdoor unit sensor	1. Check the sensor stewed condition 2. Check for sensor burnout
CH44	Air sensor		
CH45	Condenser Mid pipe sensor		
CH46	Suction Pipe sensor		
CH48	Const-D-Pipe Sensor Error		
CH65	Heatsink Temp. sensor		
CH114	Injection In Sensor Error		
CH115	Injection Out Sensor Error		

⚠WARNING

Before checking the power supply of PCB or various outdoor units, check the power supply after 3 minutes. When measuring while the power is on, check the measurement mode of the tester and pay attention to the short circuit and other parts.

Check Flow Chart





Temp	Air sensor	Pipe sensor	D-pipe sensor
	Resistance value	Resistance value	Resistance value
10 °C(50 °F)	20.7 kΩ	10 kΩ	362 kΩ
25 °C(77 °F)	10 kΩ	5 kΩ	200 kΩ
50 °C(122 °F)	3.4 kΩ	1.8 kΩ	82 kΩ

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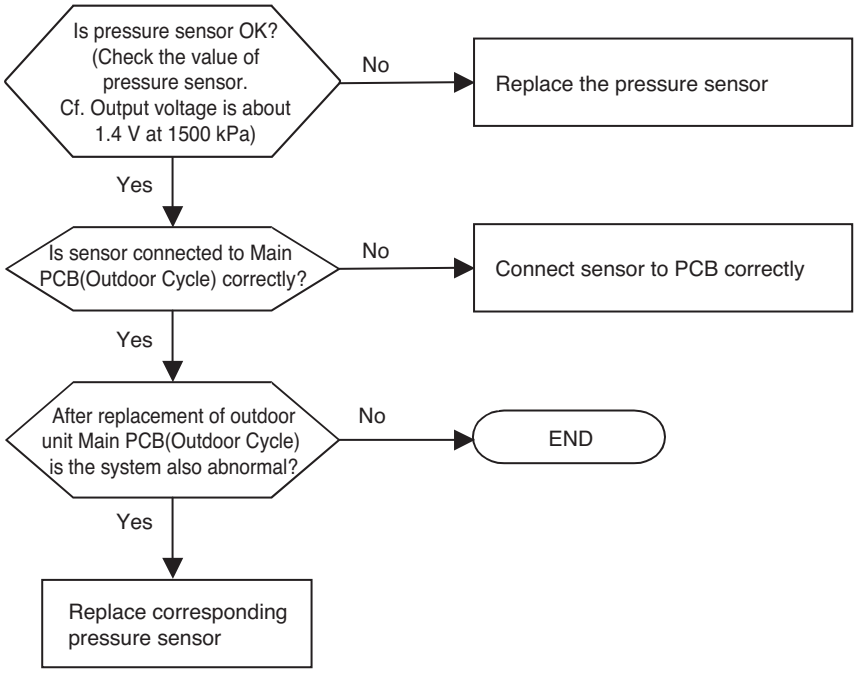
Display code	Title	Description	Cause of error
CH43	Sensor error of high pressure	Abnormal value of sensor (Open/Short)	1. Bad connection of connector Main PCB(Outdoor) 2. Bad connection high pressure connector 3. Malfunction of high pressure connector (Open/Short) 4. Malfunction of connector Main PCB(Outdoor)(Open/Short) 5. Malfunction of Main PCB(Outdoor)

Check Flow Chart



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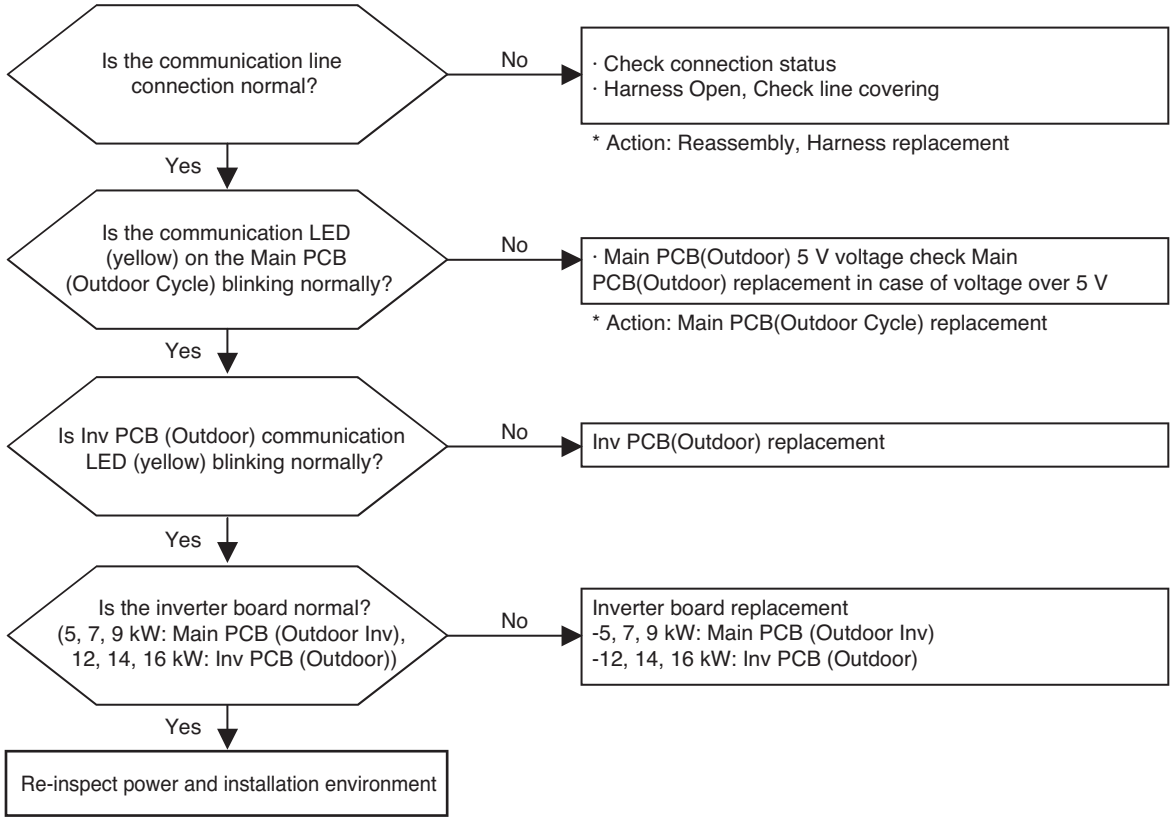
Display code	Title	Description	Cause of error
CH52	Communication Error Inv PCB(Outdoor) ↔ Main PCB(Outdoor Cycle)	It is failed to receive wired Inv PCB(Outdoor) signal in Main PCB(Outdoor Cycle).	1. Communication line connection failure 2. Harness of communication line failure 3. Standby power control unit burnout

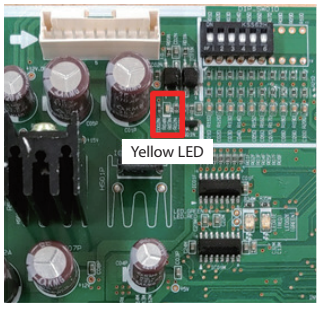
⚠ WARNING

Before checking the power supply of PCB or various outdoor units, check the power supply after 3 minutes. When measuring while the power is on, check the measurement mode of the tester and pay attention to the short circuit and other parts.

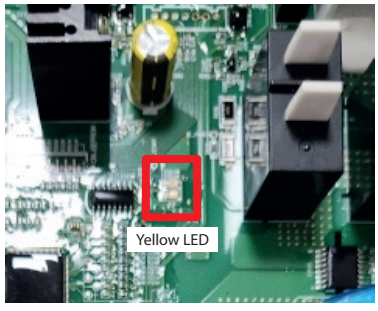
Check Flow Chart



How to check communication LED

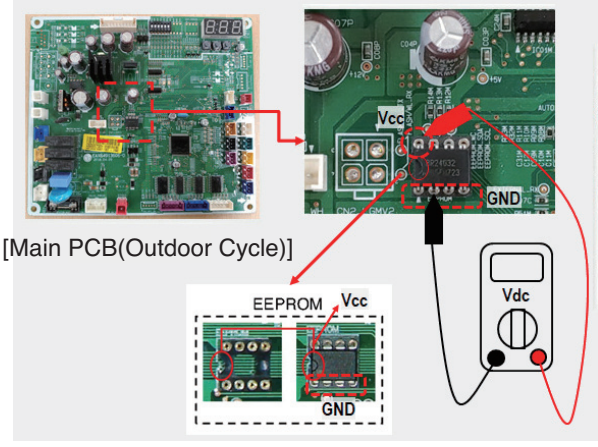


[Main PCB(Outdoor Cycle)]



[Inv PCB(Outdoor)]

Main PCB EEPROM voltage measurement method



[Main PCB(Outdoor Cycle)]

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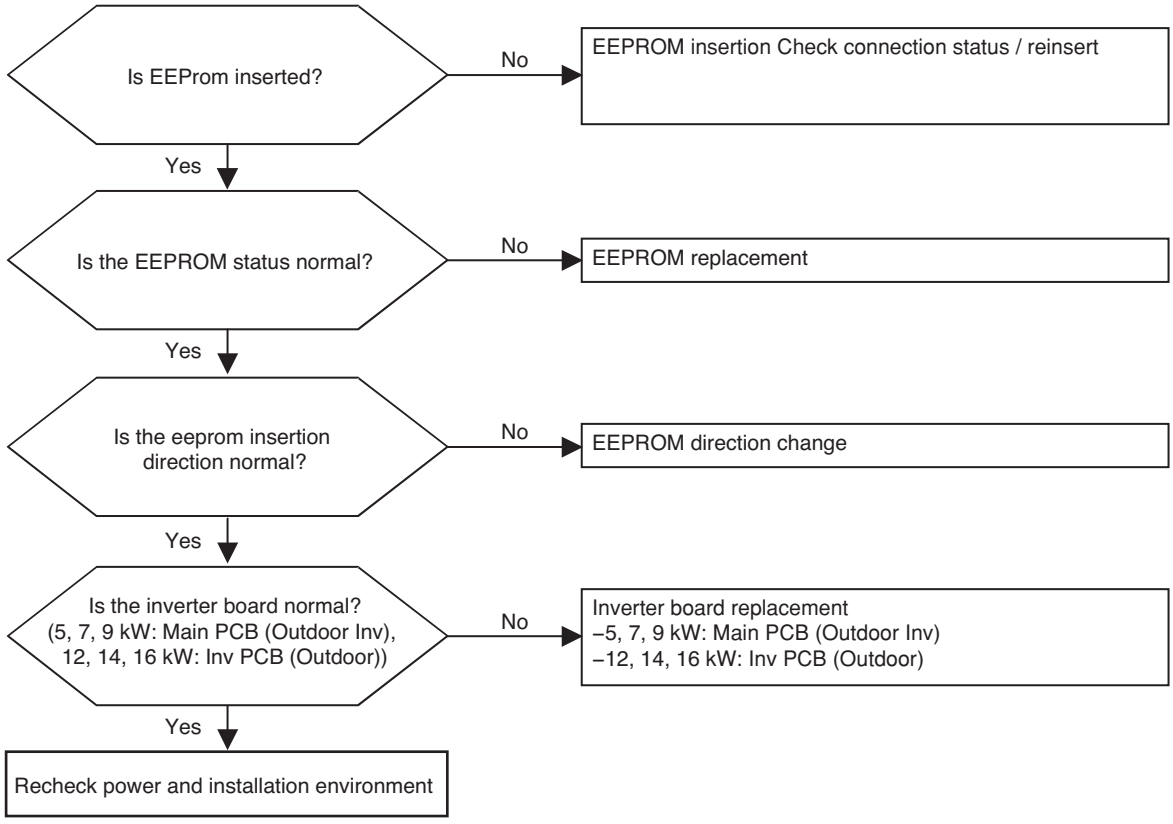
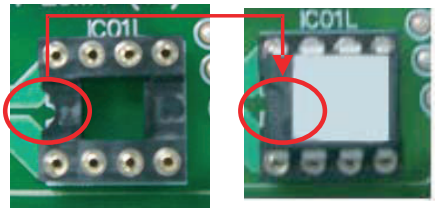
Display code	Title	Description	Cause of error
CH60	Outdoor EEPROM Error	EEPROM access error and Check SUM error	1. Bad EEPROM contact / wrong insertion 2. EEPROM version is different 3. Outdoor unit PCB failure

■ Error Diagnosis and Countermeasure Flow Chart



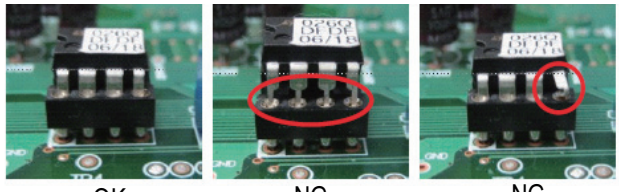
■ How to check the EEPROM error

EEPROM correct insertion direction



Insert the socket hole and EEPROM hole in the same direction.

Note: Turn off the power and replace the EEPROM.



OK NG NG

	1 ODU board (Inverter PCB)	2 ODU board (Main + Inverter PCB)
Main PCB	-	CH60 is displayed only on Main PCB(Outdoor Cycle) (7-segment)
Inverter PCB	CH60	CH60 is displayed only on Inv PCB(Outdoor) (blinking LED)

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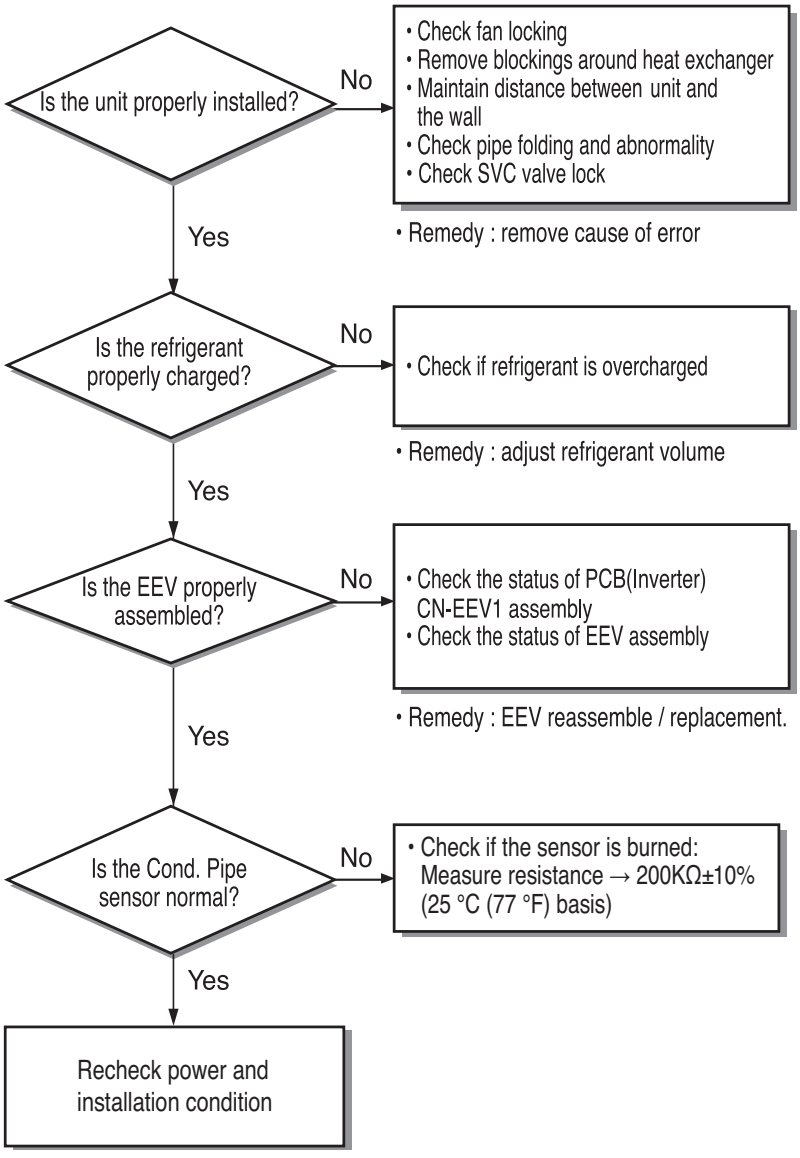
Error code	Title	Description	Cause of error
CH61	High temperature in Cond. Pipe	Temperature in Cond. Pipe is too high.	1. Overload operation (Outdoor fan constraint, screened, blocked) 2. Unit heat exchanger contaminated 3. EEV connector displaced / poor EEV assembly 4. Poor Cond. Pipe sensor assembly / burned

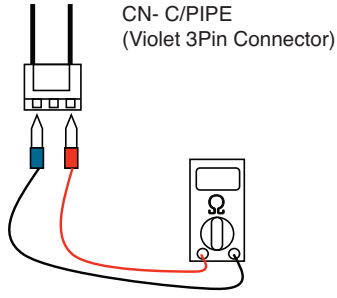
⚠WARNING

Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.



• Inspecting Cond. Pipe Sensor

1. Set Multi-tester as resistance measurement mode.
2. Measure the resistance between rated speed Comp Discharge sensor connector pins.
3. Measure resistance value of 200KΩ±10%, 25°C(77°F) basis
4. Check if the sensor insulation is damaged. → Measure the resistance between sensor connector pin and unit assembly pipe. (1 MΩ or more)



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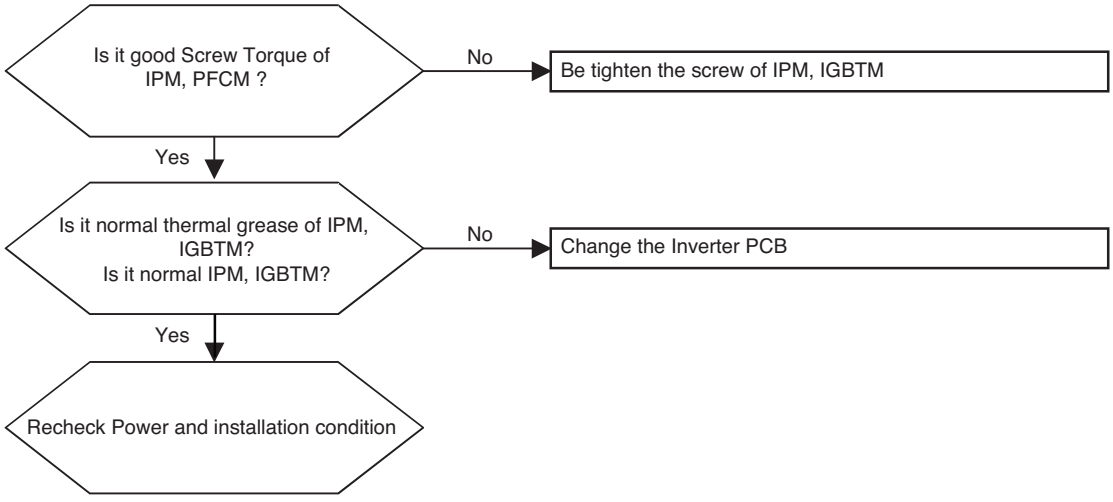
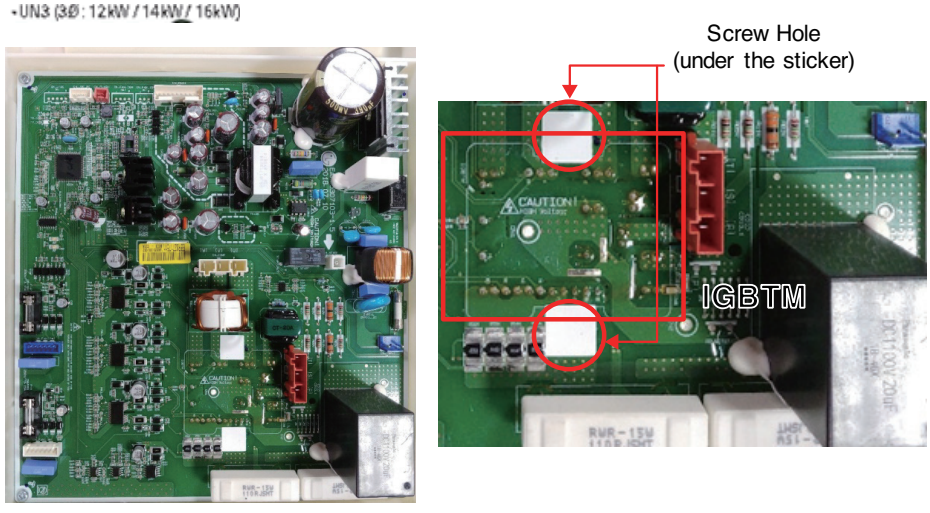
Error code	Title	Description	Cause of error
CH62	Heat sink Temp, High error	The heat sink detection Temp is over 85°C.	1. Inverter board power module connection status is bad. 2. The fan motor of the outdoor unit operates abnormally. 3. The inverter board of the outdoor unit is malfunction.

■ Error Diagnosis and Countermeasure Flow Chart



Check Point

- Check connection condition of IPM/IGBTM and Heatsink



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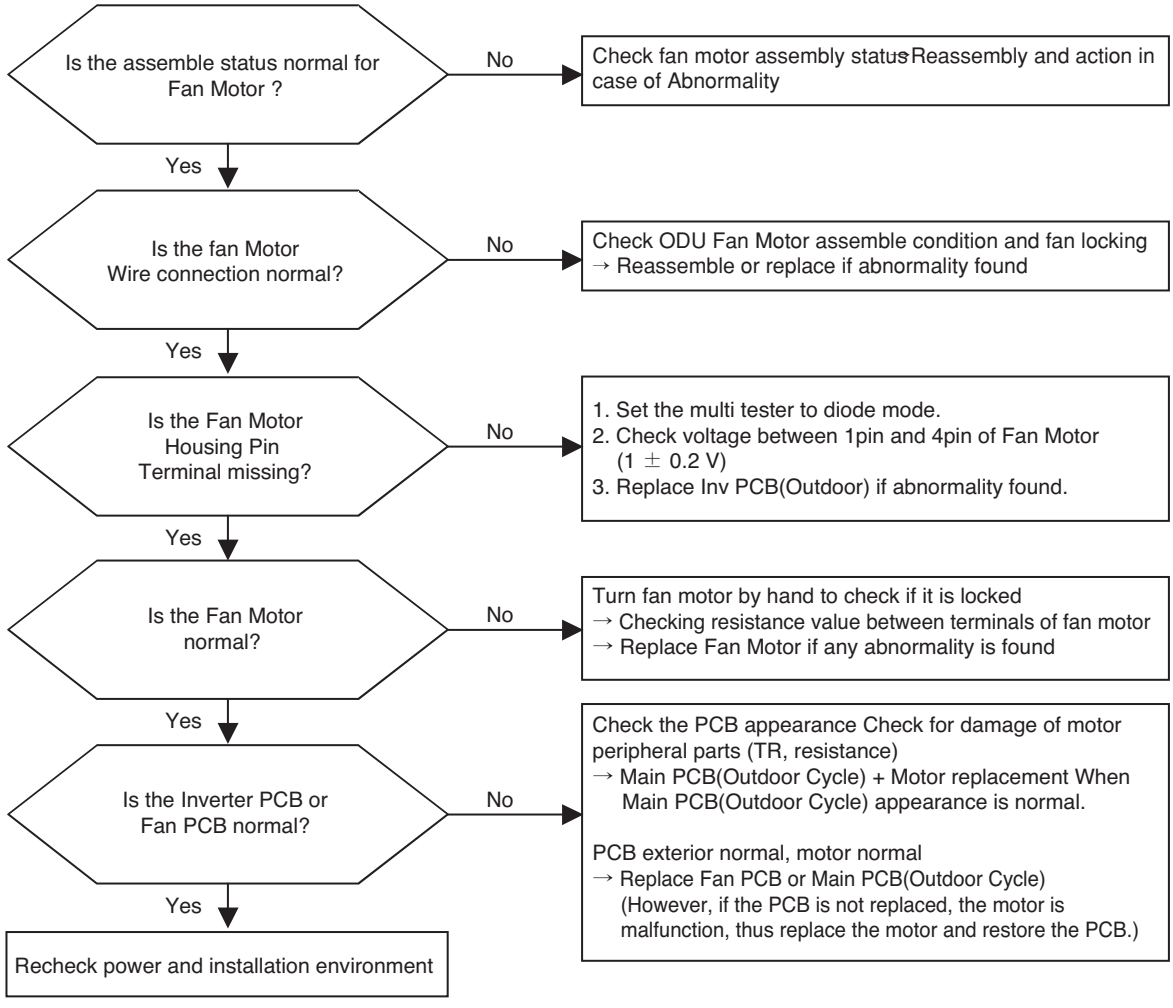
Error code	Title	Description	Cause of error
CH67	Outdoor Fan lock	Fan RPM is 10RPM or less for 5 seconds when ODU fan starts or 40 RPM or less after fan starting.	1. Bad Motor / Poor assembly. 2. Misconnection Fan Motor connector. 3. Rotation in reverse direction after speed command. 4. Bad Fan Board 5. Fan lock by Heavy snow

■ Error Diagnosis and Countermeasure Flow Chart

※ If the fan motor is not running in the beginning, must rotate the fan by using hand.
(Rotating fan by hand → must be replaced due to malfunction of the fan motor)



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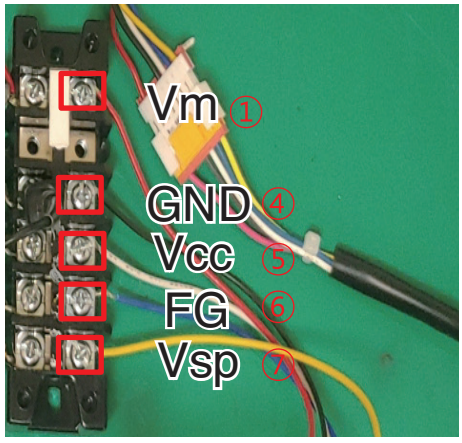
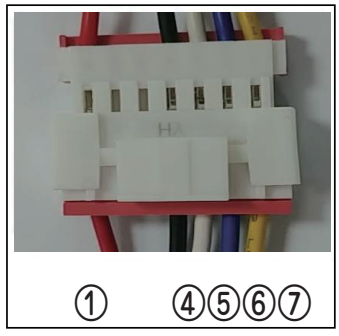
■ How to measure resistance between terminals

How to use the tester

- Black(-) : ④ Connect
- Red: (+) : ①,⑤,⑥,⑦ Each





- When measuring resistance value, black No. 4 pin is always measured as (-) because the value is different according to +-direction.

Measure	Tester	
	+(Red)	-(Black)
Vm	①	④
Vcc	⑤	④
FG	⑥	④
Vsp	⑦	④

Capacity (kW(Btu/h)	P/No.	U-V [Ω]	U-W [Ω]	V-W [Ω]
12, 14, 16 (41 000, 48 000, 55 000)	EAU62543703	43.1±5%		
	EAU62543704	43.1±5%		

* 25 °C (77 °F) standard

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