CONFIDENTIAL

THERMA V™

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.		This appliance is filled with flammable refrigerant (R32)
	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.

⚠WARNING	This symbol indicates the possibility of death or serious injury.
⚠CAUTION	This symbol indicates the possibility of injury or damage to properties only.

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

	**Be sure not to do.**
	**Be sure to follow the instruction.**
	**Dangerous Voltage**

1.1 Safety Precautions in Repair

⚠WARNING	
Be sure to disconnect all remote electric power supplies 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.	
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 the refrigerant gas leaks during work, execute ventilation. If the refrigerant gas touches to a fire, poisonous gas generates. A case of leakage of the refrigerant and the closed room full with gas is dangerous because a shortage of oxygen occurs. Be sure to execute ventilation.	
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 resulted in a death or injury.	
Be sure to provide the grounding when repairing the equipment in a humid or wet place, to avoid electrical shocks.	

Do not use a defective or underrated circuit breaker. Use the correctly rated breaker and fuse. 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 repaire the product with wet hands. Hoding the plug by hand when taking out. Otherwise 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 appliance 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.	

• 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 should be done in accordance with local and national standards.	
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. The area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.	
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 refrigeration equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO2 fire extinguisher adjacent to the charging area.	
• Pipe-work shall be protected from physical damage.	

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

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 **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.	
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	
Cabling Check 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.	

Leak detection methods

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

Removal and evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose - conventional procedures shall be used. However, it is important that best practice is followed since flammability is a consideration. The following procedure shall be adhered to:

- Remove refrigerant
- Purge the circuit with inert gas
- Evacuate
- Purge again with inert gas
- Open the circuit by cutting or brazing.

The refrigerant charge shall be recovered into the correct recovery cylinders. The system shall be “flushed” with OFN to render the unit safe. This process may need to be repeated several times. Compressed air or oxygen shall not be used for this task. Flushing shall be achieved by breaking the vacuum in the system with OFN and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final OFN charge is used, the system shall be vented down to atmospheric pressure to enable work to take place. This operation is absolutely vital if brazing operations on the pipe-work are to take place. Ensure that the outlet for the vacuum pump is not close to any ignition sources and there is ventilation available.

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 upright.
- Ensure that the refrigeration system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigeration system. Prior to recharging the system it shall be pressure tested with OFN. The system shall be leak tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

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.

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.	
The appliance shall be stored in a well-ventilated area where the room size corresponds to the room area as specified for operation	
The appliance shall be stored in a room without continuously operating open flames (for example an operating gas appliance) and ignition sources (for example an operating electric heater).	
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.	

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.	

⚠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.	
Do not use the welder in a well-ventilated place. Using the welder in an enclosed room can cause oxygen deficiency.	
Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.	

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 tset to check the resistance is 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 is caused at user's side.	
Check the drainage of the indoor unit after the repair. If drainage is faulty the water to enter the room and wet floor.	

Part 1
General Information

1. Model Information

With advanced inverter technology, THERMA V 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.

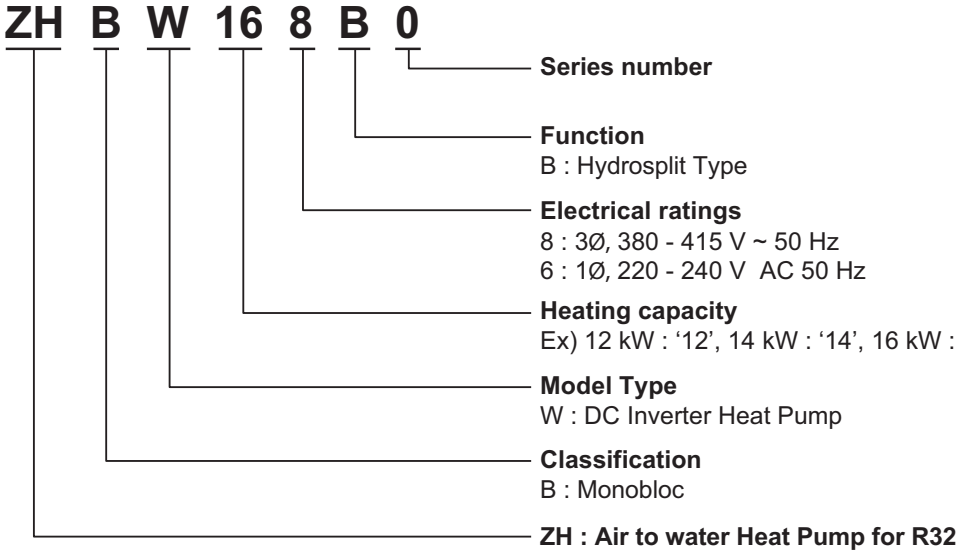
In this chapter, general information of THERMA V is presented to identify the installation procedure. Before beginning installation, read this chapter carefully and find helpful information on installation.

1. Model Information

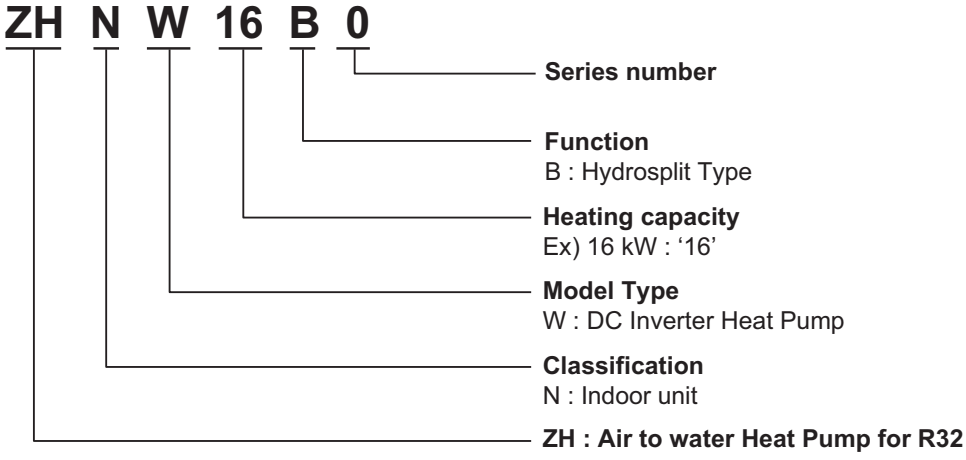
Model number nomenclature

Factory Model Name

Outdoor Unit



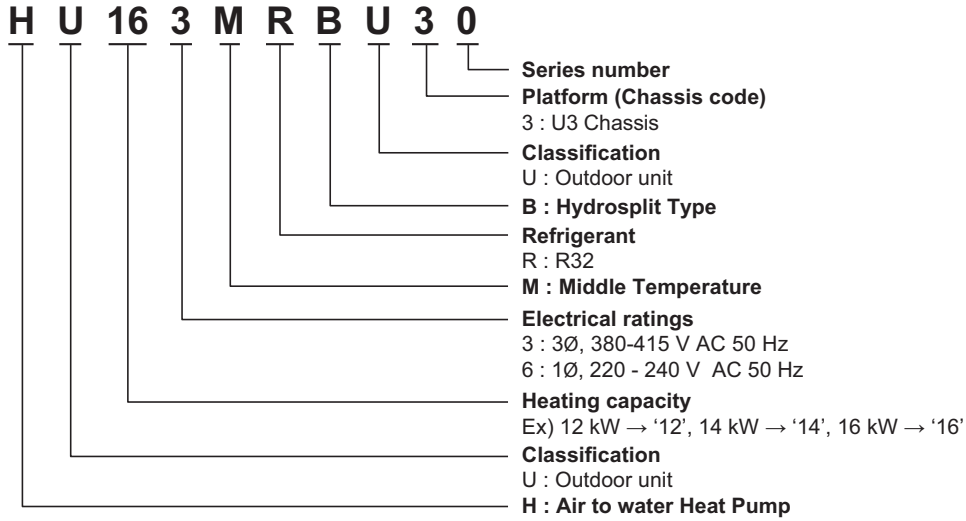
Indoor Unit



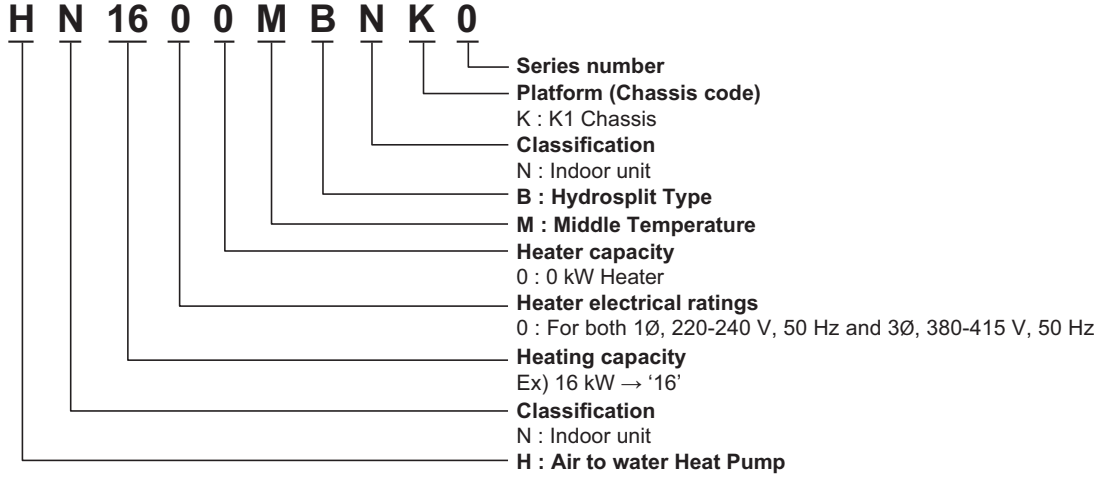
- Additional Information : Serial number is refer to the barcode on the product.
- Max allowable pressure High side / Low side : 4.32 MPa / 2.4 MPa
- Refrigerant : R32

Buyer Model Name

Outdoor Unit



Indoor Unit



- Additional Information : Serial number is refer to the barcode on the product.
- Max allowable pressure High side / Low side : 4.32 MPa / 2.4 MPa
- Refrigerant : R32

Model name and related information

Model Name		Capacity		Power Source (Unit)
Phase	Capacity	Heating(kW)*1	Cooling(kW)*2	
1Ø	12 kW	12	12	220~240 V~ 50 Hz
	14 kW	14	14	
	16 kW	16	16	
3Ø	12 kW	12	12	380-415 V~ 50 Hz
	14 kW	14	14	
	16 kW	16	16	

*1 : tested under EN 14511 Heating condition
(water out temperature 35°C at outdoor ambient temperature 7°C / 6°C)
*2 : tested under EN 14511 Cooling condition
(water out temperature 18°C at outdoor ambient temperature 35°C / 24°C)
※ All appliances were tested at atmospheric pressure (1atm).

2. Specification

Indoor

Indoor Unit					ZHNW16B0 [HN1600MB NK0]
Operation Range (Leaving Water Temp.)		Cooling	Min. ~ Max.	°C DB	5 ~ 27
		Heating	Min. ~ Max.	°C DB	15 ~ 65
		DHW	Min. ~ Max.	°C DB	15 ~ 80
Water Pump		Type		-	Canned type for hot water circulation
		Model		-	GRUNDFOS UPML 20-105 CHBL
		Motor Type		-	BLDC
		Steps of Pumping Performance		-	Variable capacity 10% to 100%
		Power input	Min. ~ Max.	W	3.5 ~ 140
Flow Sensor		Type		-	Vortex
		Model		-	SIKA VVX20
		Measuring Range		Min. ~ Max.	5 ~ 80
		Flow(Trigger point)		Min. ~ Max.	15
Water Pressure Sensor		Model		-	Sensata OFM(2HMP)
		Measuring Range	Min. ~ Max.	MPa(G)	0 ~ 2
Expansion Vessel		Volume	Max.	˜	8
		Water pressure	Max.	bar	3
			Pre-charged	bar	1
Relief Valve		Pressure Limit	Upper Limit	bar	3.0
Devices for Water Circuit				-	Relief valve / Flow sensor
				-	Drain hose
				-	Pressure sensor / Air vent valve
Piping Connections	Water Circuit	Inlet		mm(inch)	Male PT 25.4(1)
		Outlet		mm(inch)	Male PT 25.4(1)
Wiring Connections		Communication Cable (H07RN-F) (included Earth)		mm^2 × cores	0.75 x 4
Sound Power Level		Heating	Rated	dB(A)	44
Dimensions		Net	W × H × D	mm	490 × 850 × 315
		Shipping	W × H × D	mm	563 ×1082 × 375
Weight		Net		kg	30.3
		Shipping		kg	34.3

Note :

1. Due to our policy of innovation some specifications may be changed without notification.
2. Wiring cable size must comply with the applicable local and national codes. And “Electric characteristics” chapter should be considered for electrical work and design. Especially the power cable and circuit breaker should be selected in accordance with that.
3. Sound Level Values are measured at Noise Measuring chamber accordance with standard. Therefore, these values depend on the ambient conditions and values are normally higher in actual operation.
4. Performances are based on the following conditions :
   - Cooling : Inlet/Outlet Water Temp. 23°C/18°C, Outdoor Air Temp. 35°CDB / 24°CWB
   - Heating : Inlet/Outlet Water Temp. 30°C/35°C, Outdoor Air Temp. 7°CDB / 6°CWB
   - Interconnected Pipe Length is standard length and difference of Elevation (Outdoor ~ Indoor Unit) is Zero.
5. This product contains Fluorinated greenhouse gases.
6. Sound Performances are based on the following conditions.
   - Sound Power Level : Measured according to EN14825.
   - Sound Pressure Level : Calculated value according to distance of sound power.

Outdoor (1Ø)

Nominal Capacity and Nominal Input					ZHBW126B0 [HU121MRB U30]	ZHBW146B0 [HU141MRB U30]	ZHBW166B0 [HU161MRB U30]
-	-	Outdoor Temp. (°C) DB / WB	Leaving Water Temp. (°C)	-			
Capacity	Cooling	35 / 24	18	kW	12.00	14.00	16.00
			7	kW	12.00	14.00	16.00
	Heating	7 / 6	35	kW	12.00	14.00	16.00
			55	kW	11.00	11.50	12.00
		2 / 1	35	kW	11.00	12.00	13.80
Power Input	Cooling	35 / 24	18	kW	2.53	3.26	4.00
			7	kW	4.44	5.38	6.40
	Heating	7 / 6	35	kW	2.38	2.86	3.33
			55	kW	3.79	4.04	4.29
		2 / 1	35	kW	3.01	3.31	3.83
EER	Cooling	35 / 24	18	W/W	4.75	4.30	4.00
			7	W/W	2.70	2.60	2.50
COP	Heating	7 / 6	35	W/W	5.04	4.89	4.80
			55	W/W	2.90	2.85	2.80
		2 / 1	35	W/W	3.65	3.63	3.60
SCOP (Low temp. Average Climate)					4.60	4.57	4.55
SCOP (High temp. Average Climate)					3.50	3.47	3.45
Rated Water Flow Rate (at LWT 35 °C)				LPM	34.5	40.3	46.0

Electrical Specifications			ZHBW126B0 [HU121MRB U30]	ZHBW146B0 [HU141MRB U30]	ZHBW166B0 [HU161MRB U30]
Power Supply		V, Ø, Hz	220-240, 1, 50	220-240, 1, 50	220-240, 1, 50
Peak Control Running Current	Cooling	A	23.0	24.0	25.0
	Heating	A	23.0	24.0	25.0
Rated Running Current	Cooling	A	11.2	14.4	17.8
	Heating	A	10.6	12.7	14.8
Circuit Breaker		A	40.0	40.0	40.0
Wiring Connections	Power Supply Cable (included Earth, H07RN-F)	mm^2 × cores	6.0 x 3	6.0 x 3	6.0 x 3

Technical Specifications				ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
Sound Power Level	Heating	Max.	dB(A)	67	68	69
		Rated	dB(A)	61	62	63
		Silent	dB(A)	60	60	60
Dimensions	Net	W × H × D	mm	950 × 1,380 × 330	950 × 1,380 × 330	950 × 1,380 × 330
	Shipping	W × H × D	mm	1,140 × 1,462 × 461	1,140 × 1,462 × 461	1,140 × 1,462 × 461
Weight	Net		kg	91.7	91.7	91.7
	Shipping		kg	104.7	104.7	104.7

Outdoor Units				ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
Operation Range (Outdoor Temp.)	Cooling	Min. ~ Max.	°C DB	5 ~ 48	5 ~ 48	5 ~ 48
	Heating	Min. ~ Max.	°C DB	-25 ~ 35	-25 ~ 35	-25 ~ 35
Compressor	Type		-	Hermetic Sealed Scroll	Hermetic Sealed Scroll	Hermetic Sealed Scroll
	Model		Model × No.	RJB036MAA × 1	RJB036MAA × 1	RJB036MAA × 1
	Motor Type		-	BLDC	BLDC	BLDC
	Displacement		cm^3/Rev.	31.6	31.6	31.6
Refrigerant	Type		-	R32	R32	R32
	GWP (Global Warming Potential)		-	675.0	675.0	675.0
	Precharged Amount		g	2,100	2,100	2,100
	t-CO2 eq.		-	1.418	1.418	1.418
	Control		-	Electronic Expansion Valve	Electronic Expansion Valve	Electronic Expansion Valve
Refrigerant Oil	Type		-	FW68D	FW68D	FW68D
	Charged Volume		cc × No.	1,100	1,100	1,100
Heat Exchanger	Type		-	Fin & Tube	Fin & Tube	Fin & Tube
	Quantity		-	2	2	2
	Specification	Row	EA	32	32	32
		Column	EA	2	2	2
		FPI	EA	14	14	14
Plate Heat Exchanger	Type		-	Brazed Plate HEX	Brazed Plate HEX	Brazed Plate HEX
	Quantity		-	1	1	1
	Number of Plate		EA	76	76	76
Strainer	Mesh size		-	30 mesh	30 mesh	30 mesh
	Material		-	Stainless Steel	Stainless Steel	Stainless Steel
Fan	Type		-	Propeller	Propeller	Propeller
	Air Flow Rate	Rated	m^3/min × No.	76.3 × 2	76.3 × 2	76.3 × 2
Fan Motor	Type		-	BLDC	BLDC	BLDC
	Output		W × No.	124 × 2	124 × 2	124 × 2

Note :

1. Due to our policy of innovation some specifications may be changed without notification.
2. Wiring cable size must comply with the applicable local and national codes. And “Electric characteristics” chapter should be considered for electrical work and design. Especially the power cable and circuit breaker should be selected in accordance with that.
3. Sound Level Values are measured at Noise Measuring chamber accordance with standard. Therefore, these values depend on the ambient conditions and values are normally higher in actual operation.
4. Performances are based on the following conditions :
   - Cooling : Inlet/Outlet Water Temp. 23°C/18°C, Outdoor Air Temp. 35°CDB / 24°CWB
   - Heating : Inlet/Outlet Water Temp. 30°C/35°C, Outdoor Air Temp. 7°CDB / 6°CWB
   - Interconnected Pipe Length is standard length and difference of Elevation (Outdoor ~ Indoor Unit) is Zero.
5. This product contains Fluorinated greenhouse gases.
6. Sound Performances are based on the following conditions.
   - Sound Power Level : Measured according to EN14825.
   - Sound Pressure Level : Calculated value according to distance of sound power.

Outdoor (3Ø)

Nominal Capacity and Nominal Input					ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
-	-	Outdoor Temp. (°C) DB / WB	Leaving Water Temp. (°C)	-			
Capacity	Cooling	35 / 24	18	kW	12.00	14.00	16.00
			7	kW	12.00	14.00	16.00
	Heating	7 / 6	35	kW	12.00	14.00	16.00
			55	kW	11.00	11.50	12.00
		2 / 1	35	kW	11.00	12.00	13.80
Power Input	Cooling	35 / 24	18	kW	2.53	3.26	4.00
			7	kW	4.44	5.38	6.40
	Heating	7 / 6	35	kW	2.38	2.86	3.33
			55	kW	3.79	4.04	4.29
		2 / 1	35	kW	3.01	3.31	3.83
EER	Cooling	35 / 24	18	W/W	4.75	4.30	4.00
			7	W/W	2.70	2.60	2.50
COP	Heating	7 / 6	35	W/W	5.04	4.89	4.80
			55	W/W	2.90	2.85	2.80
		2 / 1	35	W/W	3.65	3.63	3.60
SCOP (Low temp. Average Climate)					4.60	4.57	4.55
SCOP (High temp. Average Climate)					3.50	3.47	3.45
Rated Water Flow Rate (at LWT 35 °C)				LPM	34.5	40.3	46.0

Electrical Specifications			ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
Power Supply		V, Ø, Hz	380-415, 3, 50	380-415, 3, 50	380-415, 3, 50
Peak Control Running Current	Cooling	A	8.0	9.0	10.0
	Heating	A	8.0	9.0	10.0
Rated Running Current	Cooling	A	3.7	4.8	5.9
	Heating	A	3.5	4.2	4.9
Circuit Breaker		A	16.0	16.0	16.0
Wiring Connections	Power Supply Cable (included Earth, H07RN-F)	mm^2 × cores	2.5 x 5	2.5 x 5	2.5 x 5

Technical Specifications				ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
Sound Power Level	Heating	Max.	dB(A)	67	68	69
		Rated	dB(A)	61	62	63
		Silent	dB(A)	60	60	60
Dimensions	Net	W × H × D	mm	950 × 1,380 × 330	950 × 1,380 × 330	950 × 1,380 × 330
	Shipping	W × H × D	mm	1,140 × 1,462 × 461	1,140 × 1,462 × 461	1,140 × 1,462 × 461
Weight	Net		kg	91.7	91.7	91.7
	Shipping		kg	104.7	104.7	104.7

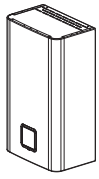
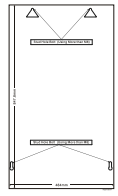
Outdoor Units				ZHBW128B0 [HU123MRB U30]	ZHBW148B0 [HU143MRB U30]	ZHBW168B0 [HU163MRB U30]
Operation Range (Outdoor Temp.)	Cooling	Min. ~ Max.	°C DB	5 ~ 48	5 ~ 48	5 ~ 48
	Heating	Min. ~ Max.	°C DB	-25 ~ 35	-25 ~ 35	-25 ~ 35
Compressor	Type		-	Hermetic Sealed Scroll	Hermetic Sealed Scroll	Hermetic Sealed Scroll
	Model		Model × No.	RJB036MAA × 1	RJB036MAA × 1	RJB036MAA × 1
	Motor Type		-	BLDC	BLDC	BLDC
	Displacement		cm^3/Rev.	31.6	31.6	31.6
Refrigerant	Type		-	R32	R32	R32
	GWP (Global Warming Potential)		-	675.0	675.0	675.0
	Precharged Amount		g	2,100	2,100	2,100
	t-CO2 eq.		-	1.418	1.418	1.418
	Control		-	Electronic Expansion Valve	Electronic Expansion Valve	Electronic Expansion Valve
Refrigerant Oil	Type		-	FW68D	FW68D	FW68D
	Charged Volume		cc × No.	1,100	1,100	1,100
Heat Exchanger	Type		-	Fin & Tube	Fin & Tube	Fin & Tube
	Quantity		-	2	2	2
	Specification	Row	EA	32	32	32
		Column	EA	2	2	2
		FPI	EA	14	14	14
Plate Heat Exchanger	Type		-	Brazed Plate HEX	Brazed Plate HEX	Brazed Plate HEX
	Quantity		-	1	1	1
	Number of Plate		EA	76	76	76
Strainer	Mesh size		-	30 mesh	30 mesh	30 mesh
	Material		-	Stainless Steel	Stainless Steel	Stainless Steel
Fan	Type		-	Propeller	Propeller	Propeller
	Air Flow Rate	Rated	m^3/min × No.	76.3 × 2	76.3 × 2	76.3 × 2
Fan Motor	Type		-	BLDC	BLDC	BLDC
	Output		W × No.	124 × 2	124 × 2	124 × 2

Note :

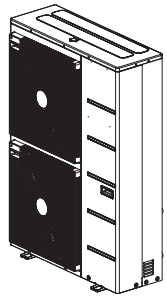
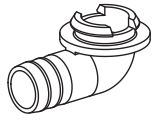
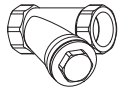
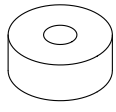
1. Due to our policy of innovation some specifications may be changed without notification.
2. Wiring cable size must comply with the applicable local and national codes. And “Electric characteristics” chapter should be considered for electrical work and design. Especially the power cable and circuit breaker should be selected in accordance with that.
3. Sound Level Values are measured at Noise Measuring chamber accordance with standard. Therefore, these values depend on the ambient conditions and values are normally higher in actual operation.
4. Performances are based on the following conditions :
   - Cooling : Inlet/Outlet Water Temp. 23°C/18°C, Outdoor Air Temp. 35°CDB / 24°CWB
   - Heating : Inlet/Outlet Water Temp. 30°C/35°C, Outdoor Air Temp. 7°CDB / 6°CWB
   - Interconnected Pipe Length is standard length and difference of Elevation (Outdoor ~ Indoor Unit) is Zero.
5. This product contains Fluorinated greenhouse gases.
6. Sound Performances are based on the following conditions.
   - Sound Power Level : Measured according to EN14825.
   - Sound Pressure Level : Calculated value according to distance of sound power.

2. External Apprearance

INDOOR UNIT BOX

Item	Image	Quantity	Item	Image	Quantity
Indoor unit		1	Installation Sheet		1

OUTDOOR UNIT BOX

Item	Image	Quantity
Outdoor Unit U3 Chassis		1
Drain Cap		4
Drain Nippl		1
Installation Manual		1
Owner's / Installation manual		1
Strainer		1
Damper		4

Part 2
Features & Controls

3. Functions

Basic functions of Unit

Note

1. O : Applied, X : Not applied
   Accessory model name : Installed at field, ordered and purchased separately by the corresponding model name, supplied with separate package.

Indoor Unit

Category	Functions	ZHNW16B0 [HN1600MB NK0]
Installation	Backup heater (Operation)	O (Accessory)
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 (Accessory)
Air to Water Heat Pump Functions	Anti-condensation on floor (cooling)	O
	Digital output for external pump	O
	Flow sensor	O
	Thermostat interface (230V AC)	O
	Thermostat interface (24V AC)	X
	DHW(Domestic Hot Water) tank kit	O (Accessory)
	Therma V solar kit	O (Accessory)
	PHEX anti-freezing control	O
	Water pump anti-stuck function	O
	Weather compensation for heating and cooling (Auto mode)	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
	Integrated Dry Contact (CN-EXT)	O
	Water flow control	O
	Water pressure sensor	O

Outdoor Unit

Category	Functions	ZHBW126B0 [HU121MRB U30], ZHBW146B0 [HU141MRB U30], ZHBW166B0 [HU161MRB U30]	ZHBW128B0 [HU123MRB U30], ZHBW148B0 [HU143MRB U30], ZHBW168B0 [HU163MRB U30]
Reliability	Defrost / Deicing	O	O
	High pressure switch	O	O
	Low pressure switch	X	X
	Phase protection	X	O
	Restart delay (3-minutes)	O	O
	Self diagnosis	O	O
	Soft start	O	O
Convenience	Test function	X	X
	Wiring Error Check	X	X
	Peak Control	O	O
	Mode Lock	O	O
	Low noise operation	O	O
	Forced Cooling Operation (Outdoor Unit)	X	X
	Base Pan Heater	O	O
Network function	Network solution(LGAP)	O (Accessory)	O (Accessory)

Accessory Compatibility List

Indoor unit

Category		Product	Remark	ZHNW16B0 [HN1600MB NK0]
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
		PDRYCB300	For 3rd party Thermostat	O
		PDRYCB500	Dry Contact for Modbus	X
ETC	Remote temperature sensor	PQRSTA0	-	O
	Group control wire	PZCWRCG3	0.25 m	X
	2-Remo Control Wire	PZCWRC2	0.25 m	O
	Extension wire	PZCWRC1	10 m	O
	Wi-Fi controller *	PWFMDD200	USB Cable : 0.6 m Extension cable : 0.5 m	O
	Meter Interface Module	PENKTH000	Interface between IDU and Meter	O
	2 Zone Valve Controller	PZNVVB200	-	O
	Cover plate	PDC-HK10	For K1 Chassis only	O
Accessory Kit for AWHP	DHW tanks (Single coil)	OSHW-200F	200 L	O
		OSHW-300F	300 L	O
		OSHW-500F	500 L	O
	DHW tanks (Double coil)	OSHW-300FD	300 L	O
	DHW tank kit	PHLTA	For Split	O
		PHLTB	For Monobloc	X
	DHW sensor	PHRSTA0	included in PHLTA kit	O
	Mixing Valve	OSHA-MV	3/4” DN20	O
		OSHA-MV1	1” DN20	O
	Backup heater	AHEH066B [HA061B E1]	220~240 V, 1Ø	O
		AHEH068B [HA063B E1]	380~415 V, 3Ø	O
	3way valve	OSHA-3V	-	O
	Solar thermal kit	PHLLA	-	O
	Thermistor for 2nd Circuit or E/Heater	PRSTAT5K10	-	O
	Drain pan	PHDPB	-	X
		PHDPC	-	O

Note :

1. O: Possible, X: Impossible, - : Not applicable
2. * : Some advanced functions controlled by individual controller cannot be operated.
3. ** : ACP, AC Smart, ACP BACnet or ACP Lonworks is needed.
4. If you need more detail, please refer to the manual of product. (http://partner.lge.com/global : Home> Doc.Library> Product > Control(BECON))
   *** Meter interface cannot be connected at the same time with 3rd-party controller.

Outdoor unit

Category		Product	Remark	ZHBW126B0 [HU121MRB U30], ZHBW128B0 [HU123MRB U30] ZHBW146B0 [HU141MRB U30], ZHBW148B0 [HU143MRB U30] ZHBW166B0 [HU161MRB U30], ZHBW168B0 [HU163MRB U30]
Central Controller	AC EZ	PQCSZ250S0	AC EZ	X
	AC Ez Touch	PACEZA000	AC Ez Touch	O
	AC Smart	PACS4B000	AC Smart IV	O
		PACS5A000	AC Smart 5	O
	ACP	PACP4B000	ACP IV	O
		PACP5A000	ACP 5	O
	AC Manager **	PACM4B000	AC Manager IV	O
		PACM5A000	AC Manager 5	O
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

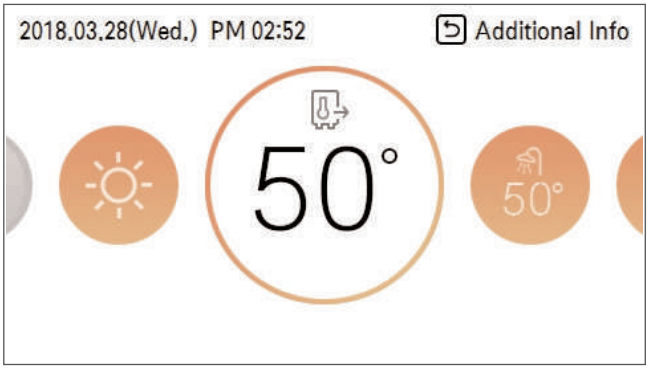
Note :

1. O: Possible, X: Impossible, - : Not applicable
2. * : Some advanced functions controlled by individual controller cannot be operated.
3. ** : ACP, AC Smart, ACP BACnet or ACP Lonworks is needed.
4. If you need more detail, please refer to the manual of product. (http://partner.lge.com/global : Home> Doc.Library> Product > Control(BECON)))

2. Feature & Controls

1. Summarized Features

1.1 Emergency Control



Easy checking of system failure

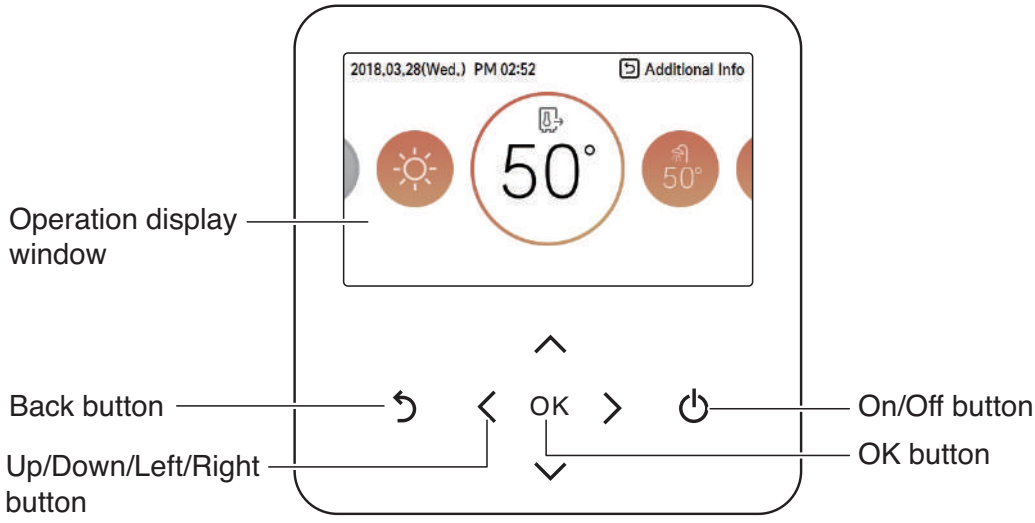
- Slight / Heavy trouble

Emergency operating

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

1.2 Remote controller

• Controller Configuration



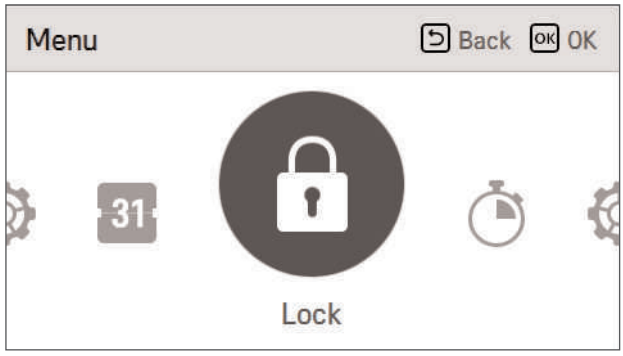
Operation display window	Operation and Settings status display
Back button	When you move to the previous stage from the menu's setting stage
Up/down/left/right button	When you change the menu's setting value
OK button	When you save the menu's setting value
On/Off button	When you turn ON/OFF the AWHP

2. Special Function

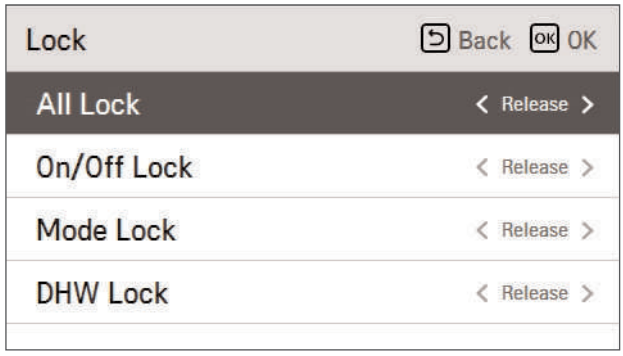
Lock setting – All, On/Off, Mode, DHW Lock

- 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.

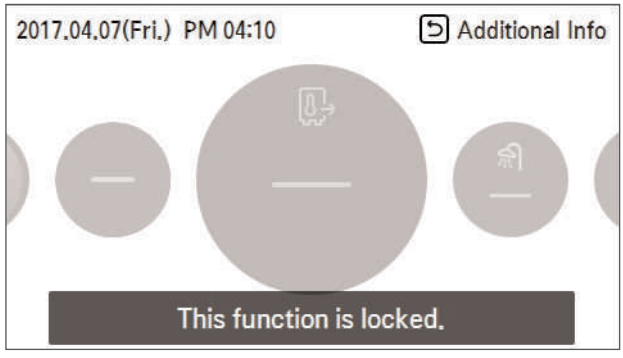
1 In the menu screen, press [<, > (left/right)] button to select “lock setting” category, and press [OK] button to move to the lock setting list screen.



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

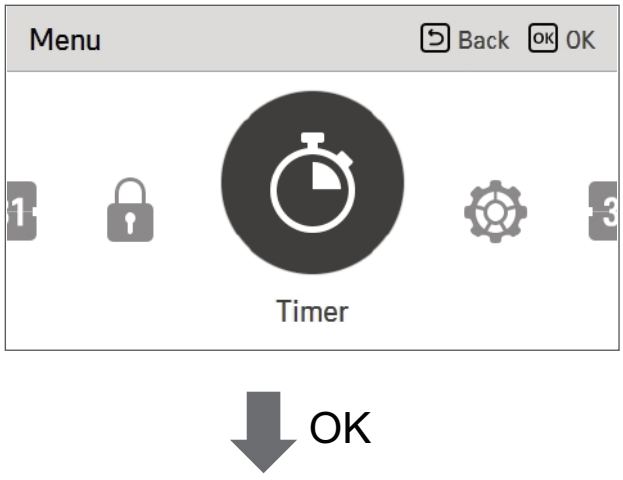


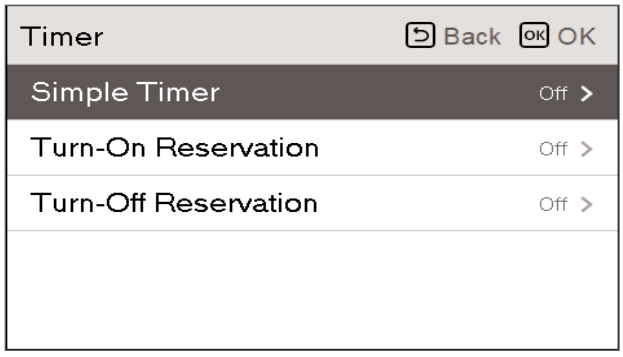
3



Timer entrance and setting method

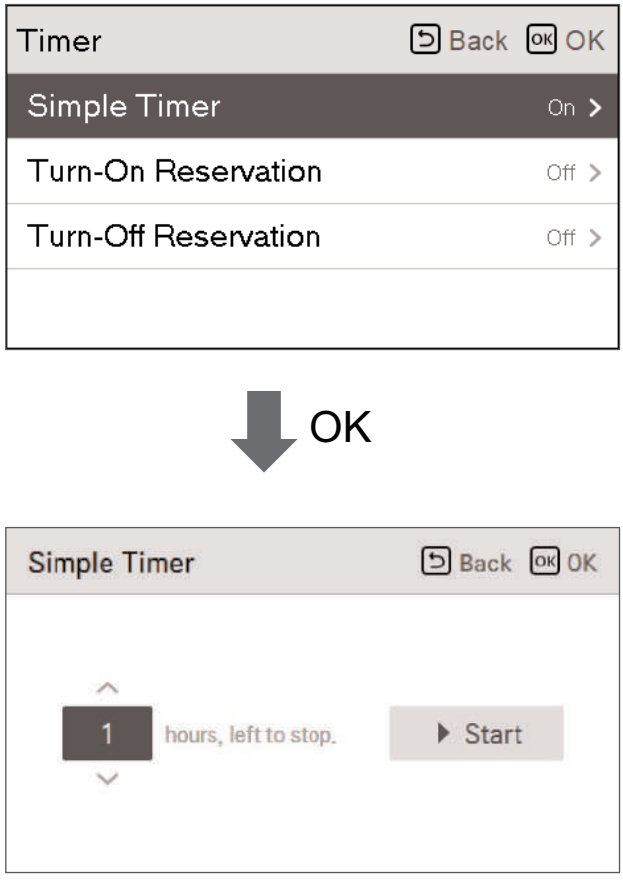
- In the menu screen, press [<,>(left/right)] button to select the timer category, and press [OK] button to move to the timer setting list screen.
- In the timer setting list screen, press [∧, ∨(up/down)] button to select the timer to set, and press [OK] button to move to the detail screen.
- After setting 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.





Simple Timer

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

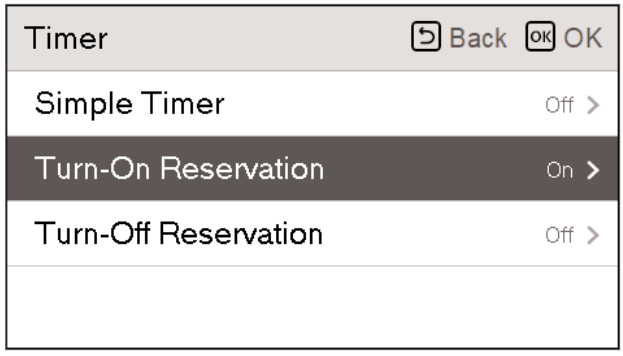


NOTICE

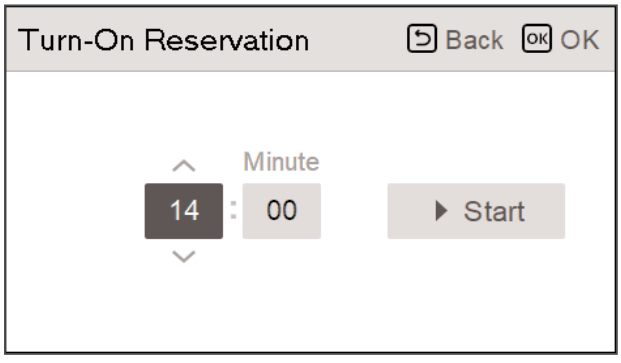
If the product operation is On, the easy timer turns off the operation after the corresponding time.
If the product operation is Off, the easy timer turns on the operation after the corresponding time.
If the easy timer operation is turned On/Off before the timer operation, the set timer will be cleared.

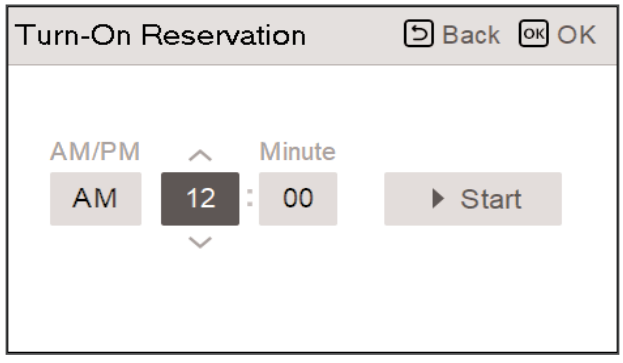
Turn-On Reservation

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



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



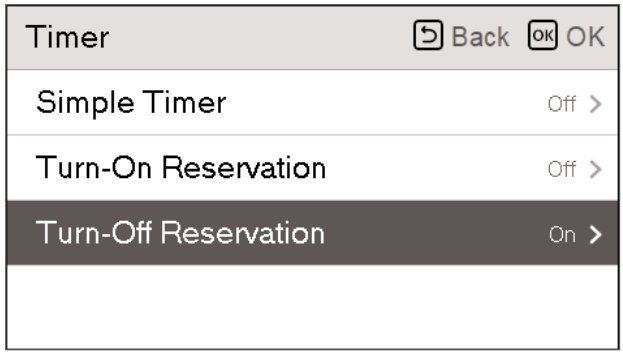


NOTICE

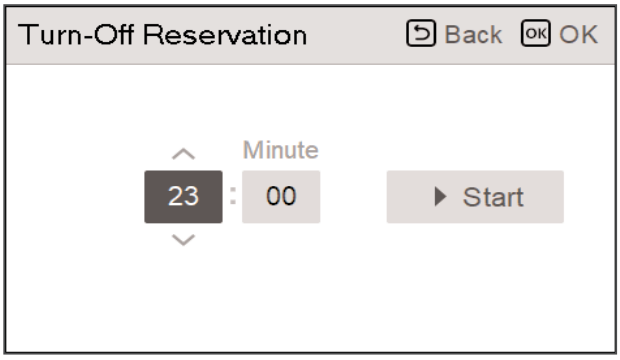
Even if the Turn-on Reseravation operation is turned On/Off after the setting and before the timer operation, the set timer is not cleared.

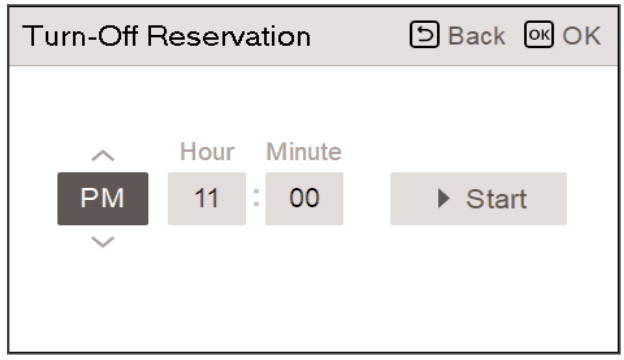
Turn-Off Reservation

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.

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.

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.

3. System Set-up

As THERMA V 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.

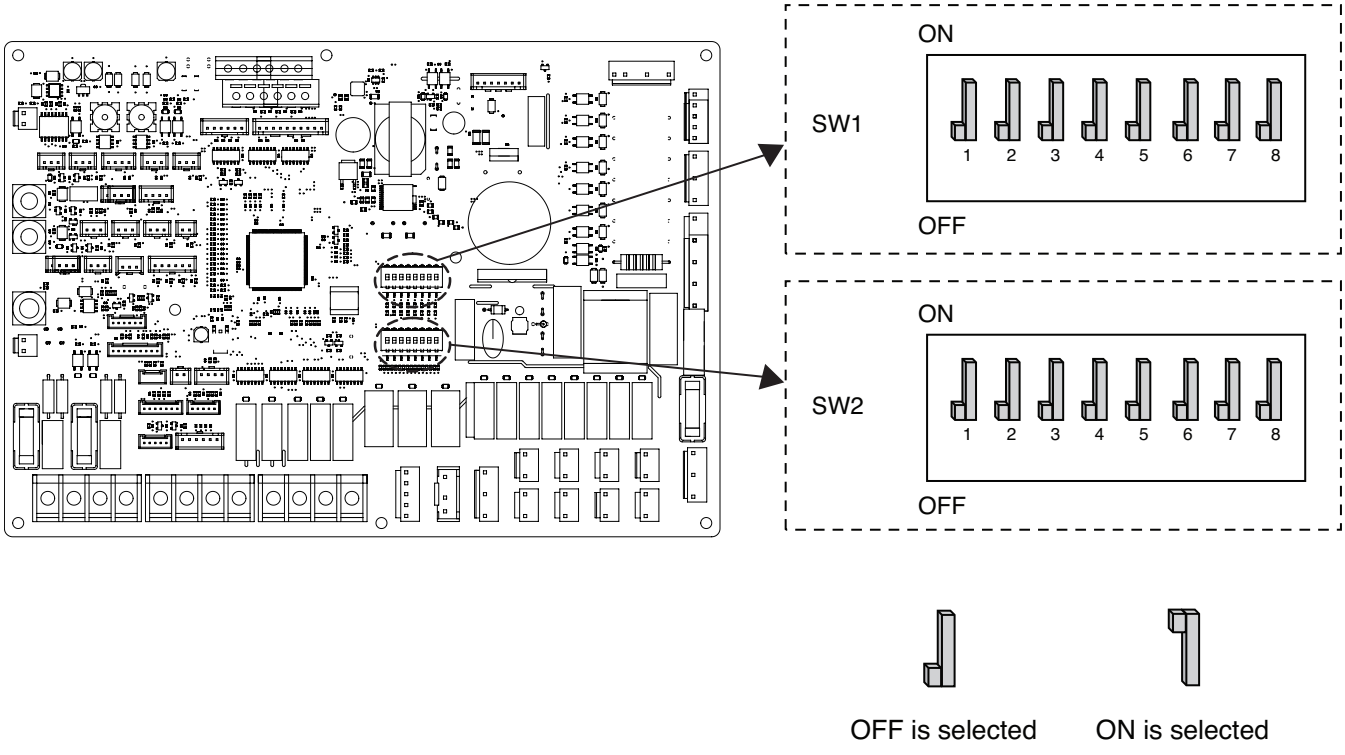
3.1 DIP Switch Setting

⚠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

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.

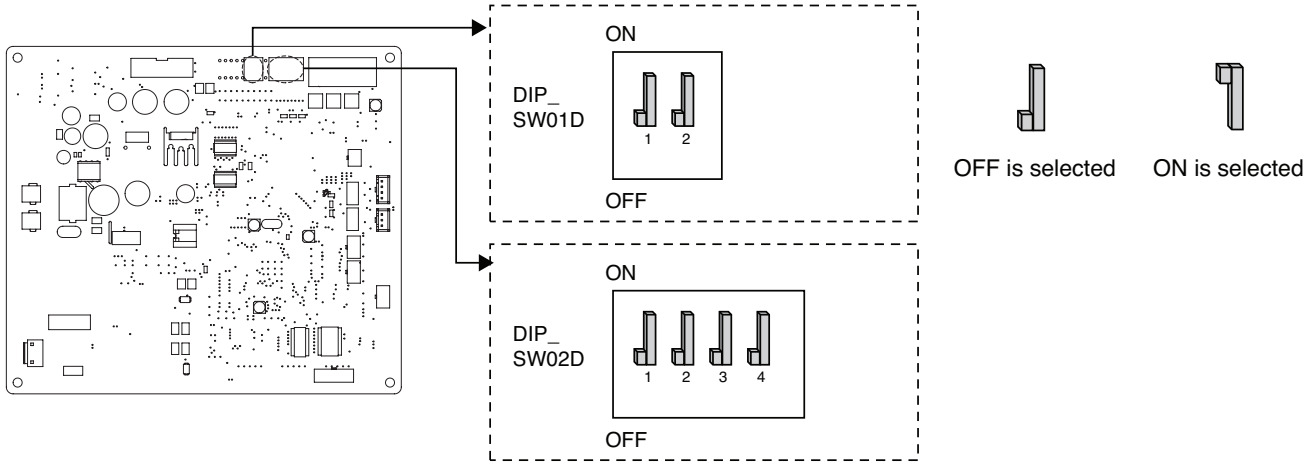
Option Switch 2

Description	Setting		Default
Role when central controller is equipped	 1	As Master	 1
	 1	As Slave	
Accessory installation information	 2 3	Unit + Outdoor unit is installed	 2  3
	 2 3	Unit + Outdoor unit + DHW tank is installed	
	 2 3	Unit + Outdoor unit + 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	Full capacity is used	
	 6 7	Electric heater is not used	
	 6 7	Electric heater is not used	
Thermostat installation information	 8	Thermostat is NOT installed	 8
	 8	Thermostat is installed	

Option Switch 1

Description	Setting		Default
MODBUS	1 	As Master	1 
	1 	As Slave	
MODBUS Function	2 	REGINE	2 
	2 	Unified Open Protocol	
ANTIFREEZE	8 	Antifreeze mode not use	8 
	8 	Antifreeze mode	

Outdoor PCB (12, 14, 16 kW)



DIP Switch Information

(Option Switch 1)

Description	Setting	Default
Low Noise Mode	2 Always Mode : Maintain Low noise mode for target temperature	2
	2 Partial Mode : Escape Low noise mode for target temperature	

(Option Switch 2)

Description	Setting	Default
Peak Control	1 2 Max Mode	1 2
	1 2 Peak Control Step 1: To limit maximum current (Power saving)	
	1 2 Peak Control Step 2: To limit maximum current (Power saving)	

❊ Only the switch in the table has a function. Others have no function.

❊ When setting the Partial 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.

Capacity	Mode	Max Mode Running Current(A)	Peak Control Mode Running Current(A)	
			Step 1	Step 2
1Ø 12,14,16 kW	Cooling	35	25	22
	Heating	35	25	22
3Ø 12,14,16 kW	Cooling	15	10	8
	Heating	15	10	8

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 error 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.

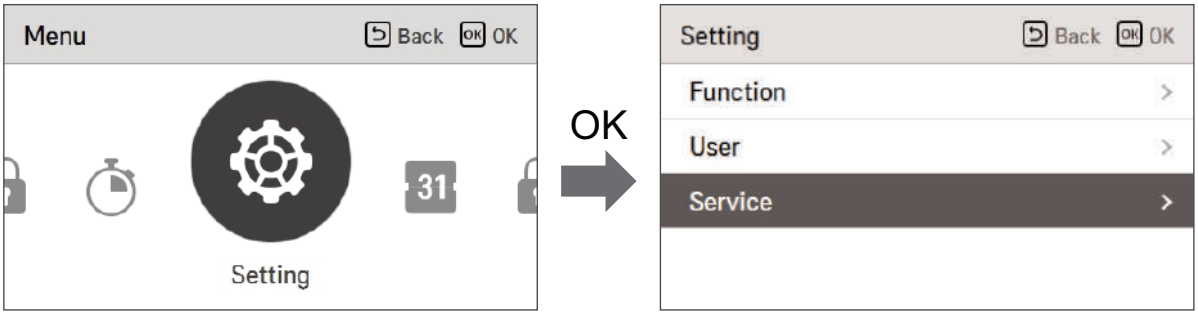
3.2 Service setting

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.

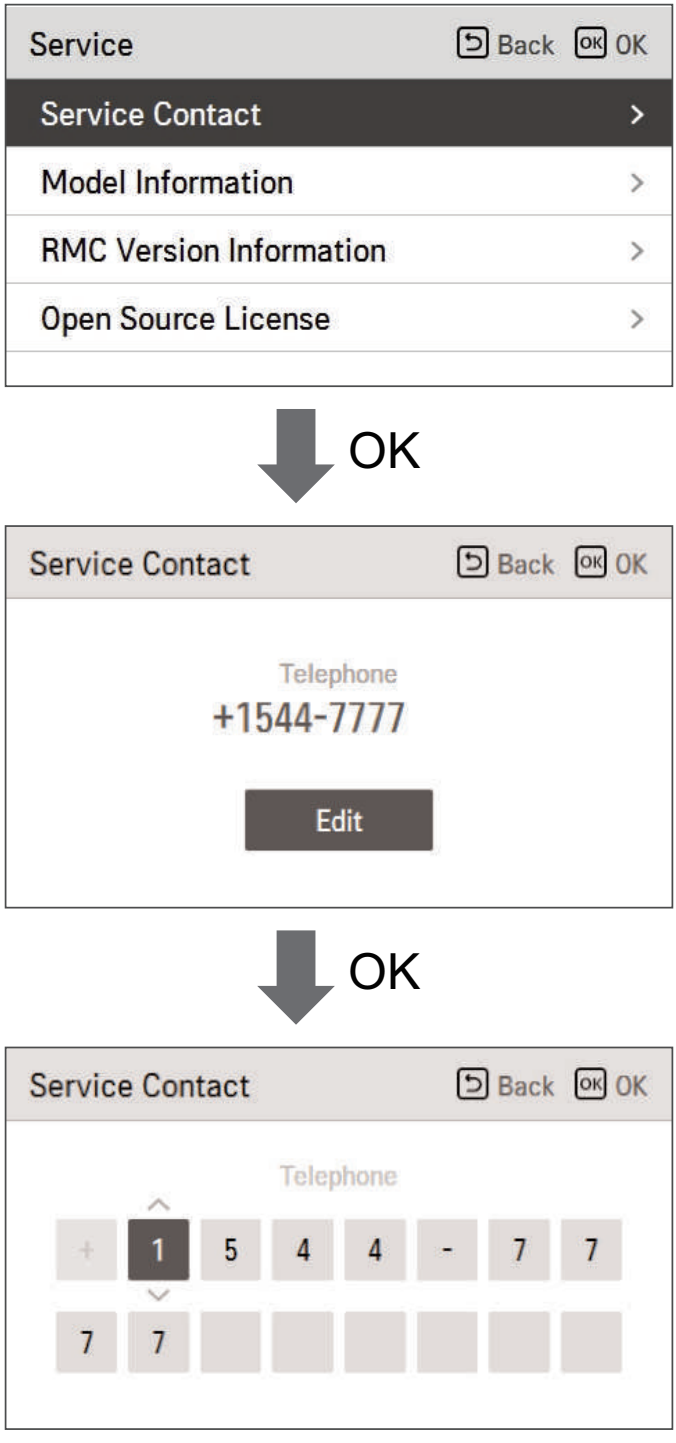
• Some functions may not be displayed/operated in some product types.

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.

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.



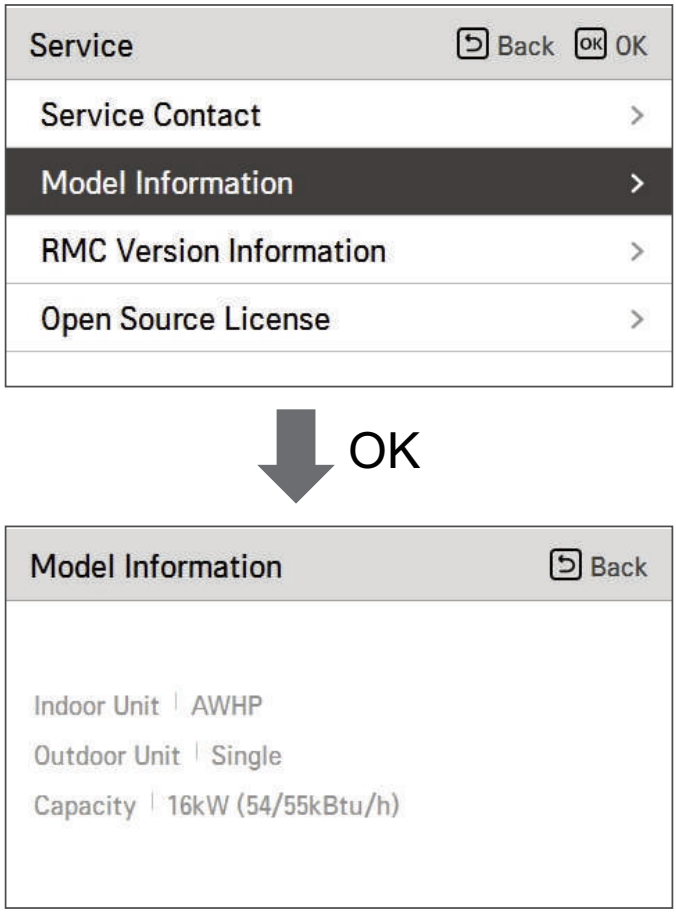
Model Information

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

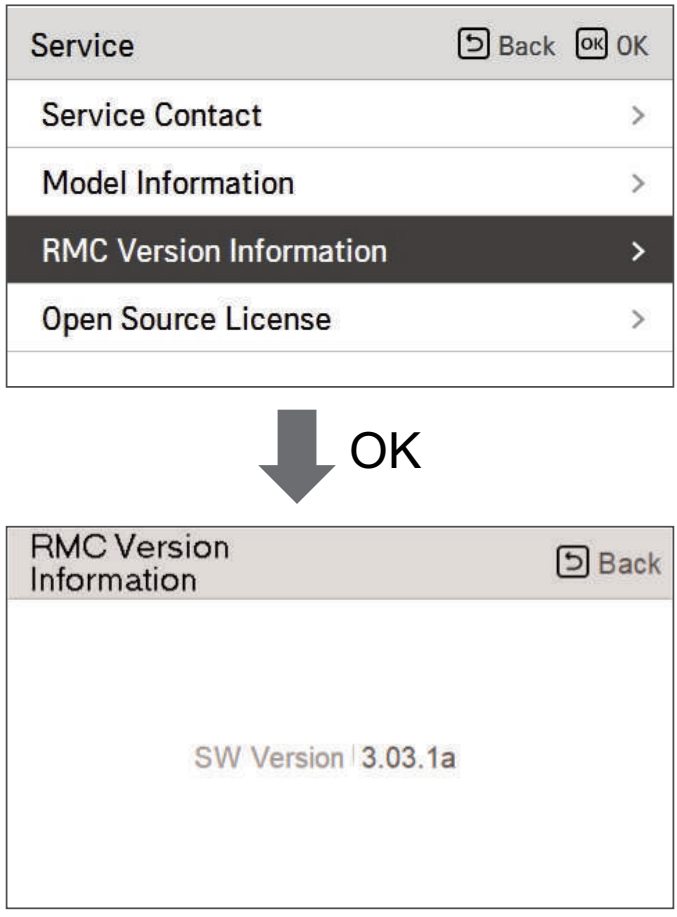
- 1kWh = 1kBtu * 0.29307
  kWh is the result calculated based on Btu, There may be a small difference between calculated and actual capacity.
  Ex) If the indoor unit capacity is 18kBtu, it is displayed as 5kWh.



RMC Version Information

View the remote controller software version.

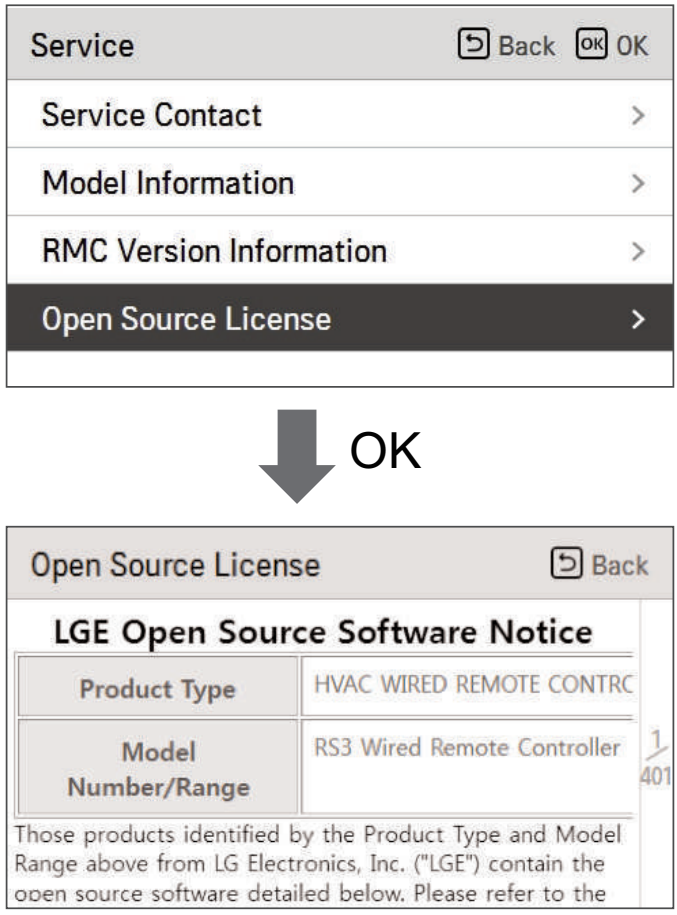
• In the service setting list, select the RMC version information and press [OK] button to move to the detail screen



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.



3.3 Installer setting

How to enter installer setting mode

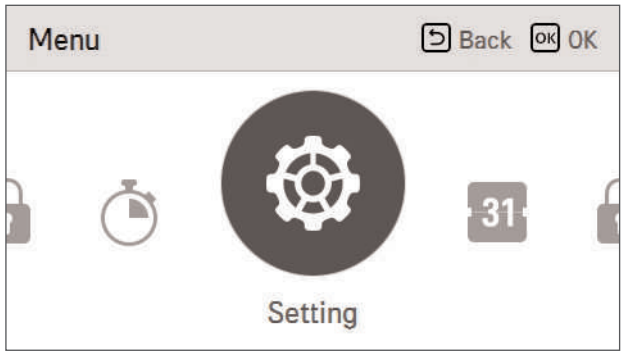
⚠CAUTION

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.

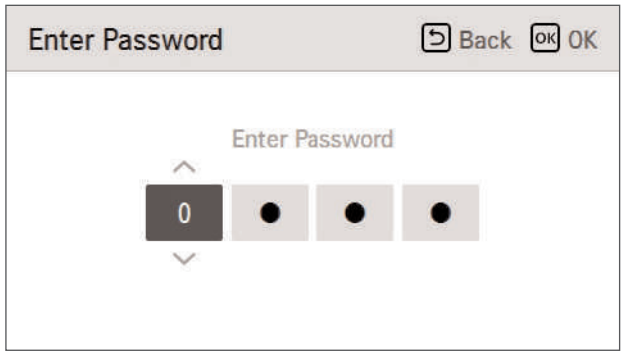
❊ Installer setting password
Main screen → menu → setting → service → RMC version information → SW Version
Example) SW version : 1.00.1 a
In the above case, the password is 1001.

❊ 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.



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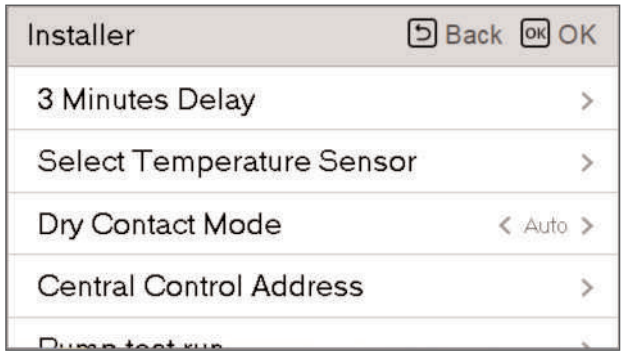


Installer setting

- **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 of leaving water temperature or air+leaving water temperature
	Use Heating Tank Heater	Set up to control an hot water tank heater
	Mixing Circuit	Install additional valve in product to control additional operation area
	Use External Pump	Set up to control an external water pump
	RMC master/slave	Function to use 2 remote control environment
	LG Therma V Configuration	Function to save the environment settings of the product for use in LG Therma V Configurator through SD Card.
General	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
	Pump frequency setting(RPM)	Function to change Water Pump RPM
	Pump Capacity	Function to change Water Pump Capacity
	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 leaving 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 delay option in heating mode
	Heater on temperature	Setting outdoor air temperature where half capacity of electric heater starts operation.
	Screed drying	Setting for using Step 1 or 2 capacity of electric
Room Cooling	Cooling temp. setting	At the leaving 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 leaving water temperature when the unit is turned off. 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 delay option in cooling mode

Segmentation	Functions	Description
Auto Mode	Seasonal auto temp	Set the operating temperature in Seasonal Auto mode
Domestic Hot Water	DHW set temp.	Setting DHW set temperature
	Tank disinfection setting 1	Setting start/maintain time for pasteurisation
	Tank disinfection setting 2	Setting pasteurisation temperature
	Tank setting 1	Setting start temperature for operation
	Tank setting 2	Setting maintain temperature for operation
	Heater priority	Determine electric heater and water heater on and off
	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
Solar Thermal System	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 prevents the product from freezing.
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	Set up to control the water pump options
	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.
Information	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 history of connected unit

Common setting

• **Select temperature sensor**

The unit can be operated according to air temperature or leaving water temperature. The selection for setting temperature as air temperature or leaving water temperature is determined.

Note : Air temperature as setting temperature is ONLY available when remote air sensor connection is enabled and Remote air sensor connection is set as 02.

• **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

Only available when remote air temperature sensor is connected.

- Accessory PQRSTA0 should be installed.
- Also, Remote air sensor connection should be set properly.

• **Water cooling set temp**

Determine cooling setting temperature range when leaving 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. Otherwise, dew condensation can be occurred on the floor.
- If floor is in humid environment, do not set leaving water temperature below 18 °C.

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

Only available when remote air temperature sensor is connected.

- Accessory PQRSTA0 should be installed.
- Also, Remote air sensor connection should be set properly.

• **Water heating set temp**

Determine heating setting temperature range when leaving 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.

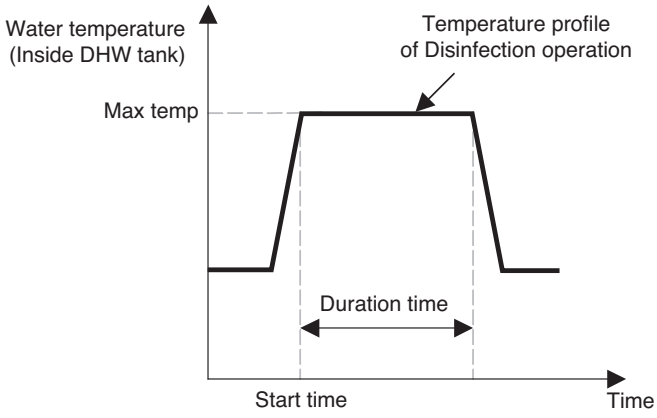
• **Screed drying mode**

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

• **Tank disinfection setting 1, 2**

Disinfection operation is special DHW tank operation mode to kill and to prevent growth of viruses inside the tank.

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



NOTICE

Vales of Tank disinfection setting

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

NOTICE

DHW heating should be enable.

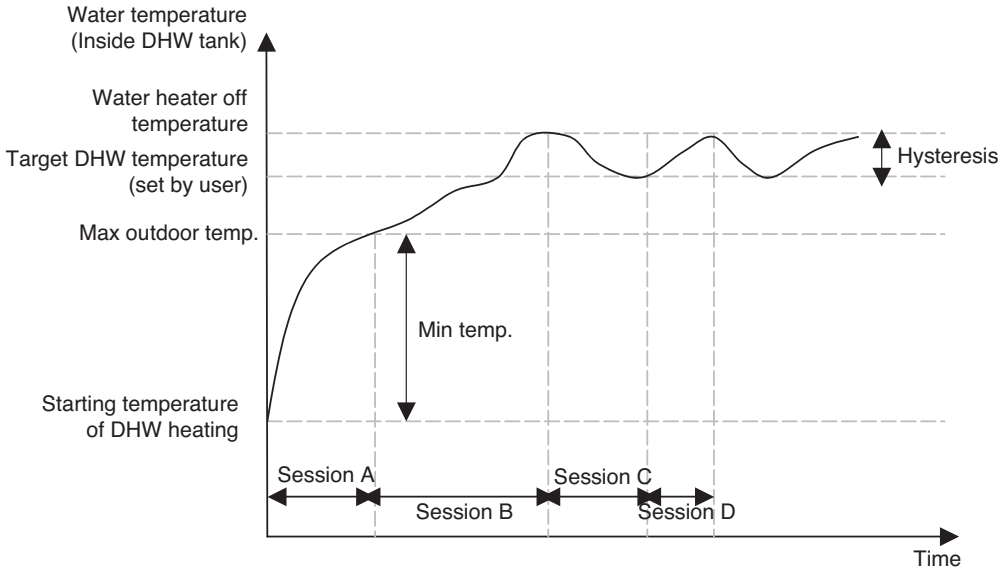
- If DHW heating is disable, the disinfection mode will not be operated although Disinfection active is set as 'Use'.
- To use disinfection mode, DHW heating should be enable. (by button input or scheduler programming)

• **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' and Max outdoor temp. is set as '48', then Session A (see the graph) will be started when the water tank temperature is below 45 °C…. If temperature is above 48 °C…, then Session B will be started.

- Hysteresis : temperature gap from target DHW temperature. This value is required to frequent On and Off of water tank heater.
- Heating priority : Determining heating demand priority between DHW tank heating and under floor heating.
- Example : If user's target temperature is set as '70' and Hysteresis is set as '3', then the water tank heater will be turned off when the water temperature is above 73 °C. The water tank heater will be turned on when the water temperature is below 70 °C.
- Example : If Heating priority is set as 'DHW', that means heating priority is on DHW heating, DHW is heated by AWHP compressor cycle and water 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 water heater. In this case the under floor heating is not stopped while DHW is heated.



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

NOTICE

DHW heating does not operate when it is disabled.

Temperature control parameter setting and etc

• **Heater on temperature**

Using Step 1 capacity of electric heater : when DIP switch No. 6 and 7 is set as 'OFF-ON' :

- Heater on temperature : outdoor air temperature where Step 1 capacity of electric heater starts operation.
- Not used.
- Example : If Heater on temperature is set as '-1' and DIP switch No 6. and 7 is set as 'OFF-ON', then Step 1 capacity of electric heater will start operation when outdoor air temperature is below -1 °C and current leaving water temperature or room air temperature is much belower than target leaving water temperature or target room air temperature.

- Heater on temperature
- Not used.
- Example : If Heater on temperature is set as '-1' and DIP switch No 6. and 7 is set as 'OFF-OFF', then step2 capacity of electric heater will start operation when outdoor air temperature is below -1 °C 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 leaving water temperature when the unit is turned off. This function is used fr preventing condensation on the floor in cooling mode.

- Stop temp. : cut-off temperature. Stop temp. is valid when FCU is installed.
- FCU : determines if FCU is installed or not.
- Example : If Stop temp. is set as '10' and FCU is 'Use' and actually FCU is NOT installed in the water loop, the unit stop operation in cooling mode when the leaving water temperature is below 10 °C.
- Example : If Stop temp. is set as '10' and FCU is 'Not use' and actually FCU is installed in the water loop, the Stop temp. is not used and the unit do NOT stop operation in cooling mode when the leaving water temperature is below 10 °C.

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 'Not use' but FCU or 2way valve is NOT installed, the unit can do abnormal operation.

• **Hysteresis Room Air(Heating)**

It is a function to adjust the heating air temperature Thermal On / Off temperature according to the field environment in preparation for heating or heating claim.

• **Hysteresis Heating Water**

It is a function to adjust the heating water temperature Thermal On / Off temperature according to the field environment in preparation for heating or heating claim

• **Hysteresis Room Air(Cooling)**

It is a function to adjust the cooling air temperature Thermal On / Off temperature according to the field environment in preparation for cooling or cooling claim.

• **Hysteresis Cooling Water**

It is a function to adjust the cooling water temperature Thermal On / Off temperature according to the field environment in preparation for cooling or cooling claim.

- **Pump setting in heating**
  Installer setting function to set water pump operation / delay time option in heating mode

- **Pump setting. In cooling**
  installer setting function to set water pump operation / delay time option in cooling 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**
  It is the function to enable / disable the SG Ready function and to set the reference value at SG2 step.

- **Seasonal auto temp**
  It is the function to set the operation reference value in Seasonal Auto mode.
  - Setting range: Celsius
  - Seasonal Auto Driving mode: Heating, Heating & Cooling, Air-conditioning
  * 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 (air conditioner / general, DX ventilator)**
  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.

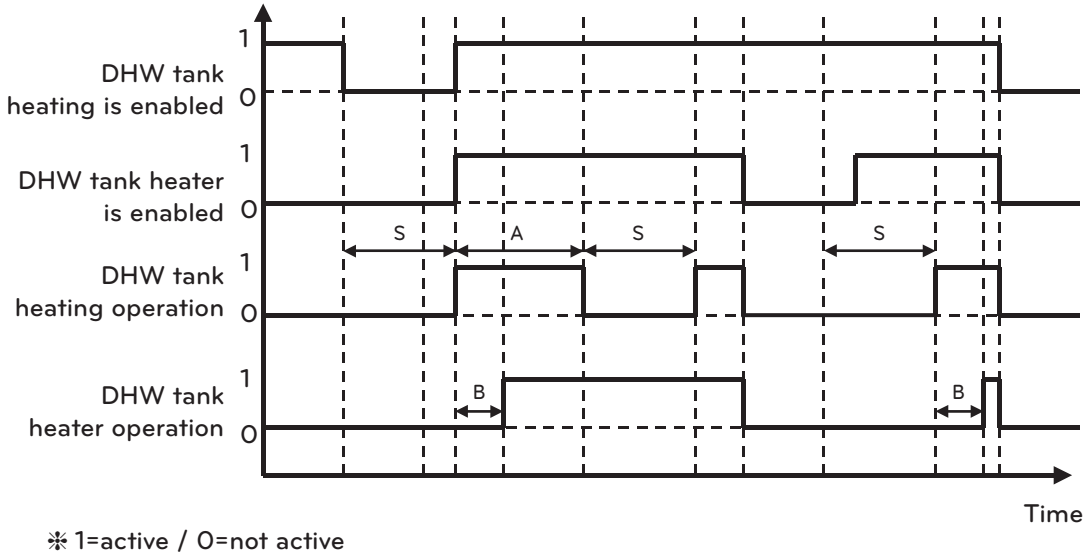
• **Heater priority**

- Heater priority : determine electric heater and sanitary tank heater on and off..
- Example : If Heater priority is set as 'Main+Boost heater ON', then electric heater and DHW tank heater are on and off according to control logic. If Heater priority is set as 'Boost heater only ON', then electric heater is never turned on and only water 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 :



❊ 1=active / 0=not active
❊ A = Active time
❊ S = Stop time
❊ B = Boost heater delay time

- **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.

- **Mixing Circuit**
  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.

- **Solar Thermal System**
  It is a function to set operation reference value in Solar Thermal System.

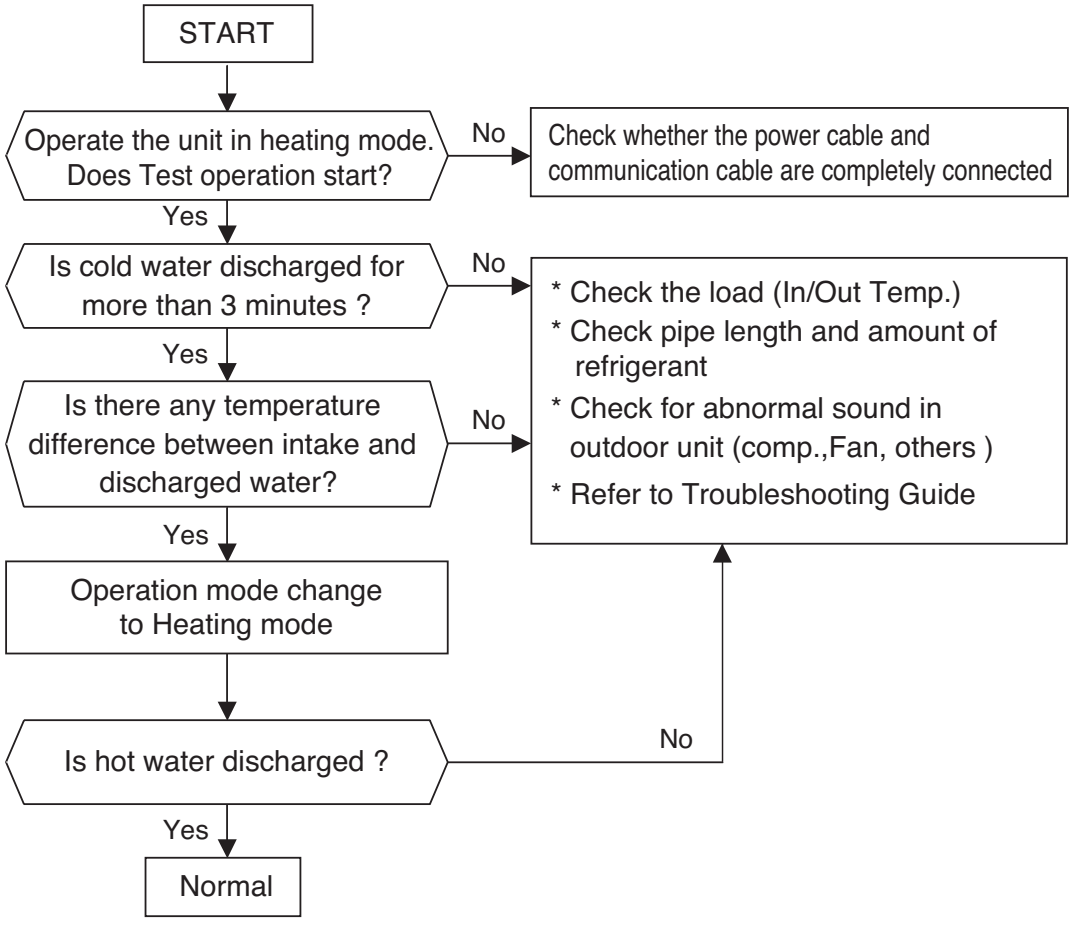
- **Current flow rate**
  It is a function to check the current flow rate.

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



Part 3
Basic Control

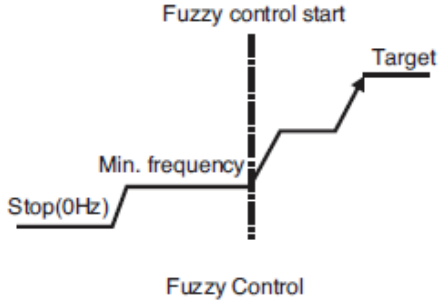
1. Normal operation

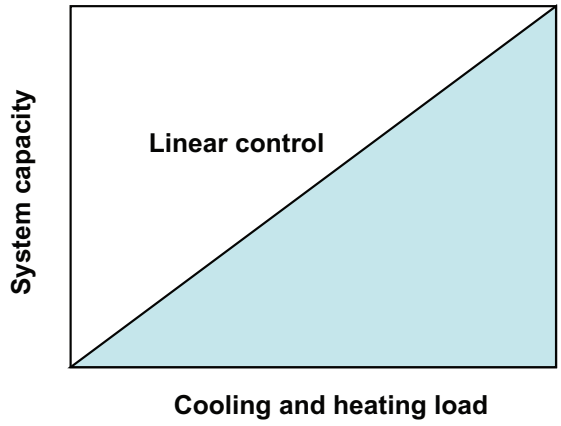
Basic principle is to control the rpm of the motor by changing the working frequency of the compressor.
Three phase voltage is supplied to the motor and the time for which the voltage will supplied is controlled by IPM (intelligent power module).
Switching speed of IPM defines the variable frequency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

* Cooling mode

The degree of superheat = Tsuction – Tevaporator

Tsuction : temperature at suction pipe sensor(°C)

Tevaporator : evaporation temperature (°C)

* Heating mode

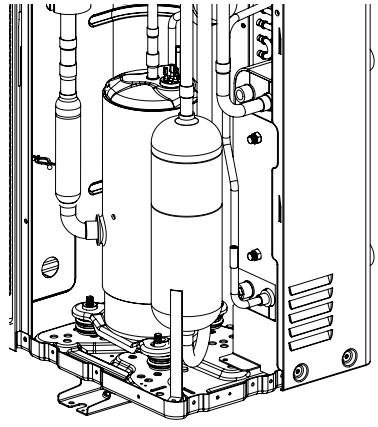
the target temperature of discharge pipe = T condenser + α

T condenser : condenser temperature (°C)

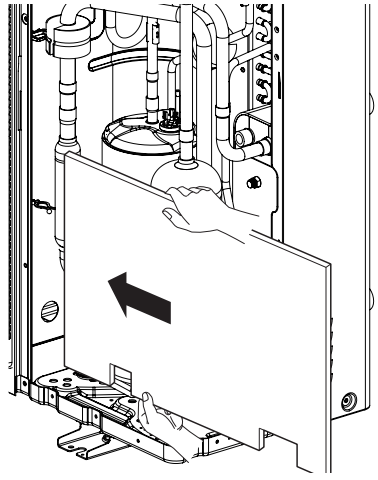
Part 4
Replacement

1. Replacement Procedure for Compressor

1. Remove the sound proof covering the faulty compressor, and disconnect the power
2. Disconnect the brazing sections of suction pipe and discharge pipe by using brazing torch after the refrigerant has been pumped out or collected completely.
3. Remove three nuts at cushion rubber section to take out the faulty compressor outside the unit. <Figure 1>
4. Install the new compressor in the unit. (Be sure to insert the cushion rubbers before tightening the fixing nut of compressor.)
5. Remove the rubber caps put on the suction and discharge pipe of the new compressor to release the sealing nitrogen gas.
6. Braze the suction and discharge pipe with brazing torch to the compressor.
7. Conduct air tight test to check the piping system is free from leakage.
8. Connect power cable to the terminal board of compressor and cover the compressor with sound proof. <Figure 2>
9. Conduct vacuum.
10. After completion of vacuum, open the service valves. If recovery unit is used, charge refrigerant.

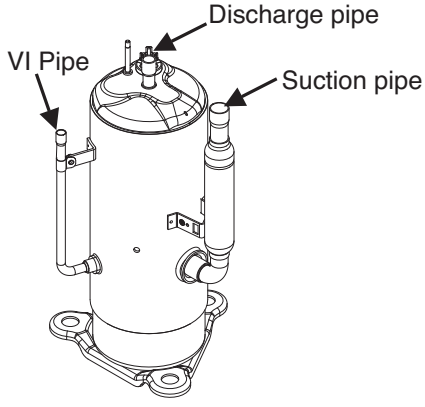


< Figure 1 >



When inserting the sound proof, be sure to insert counter-clockwise.

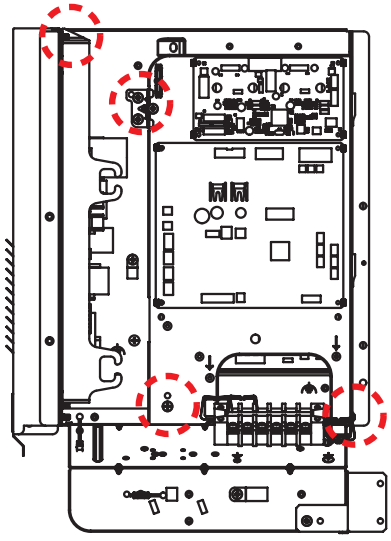
< Figure 2 >



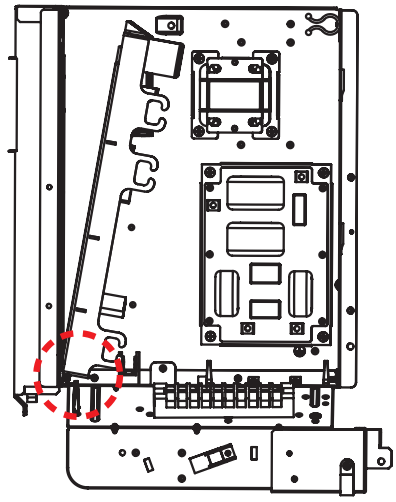
2. Replacement Procedure for INV PCB

1. Disassemble panel assembly by unscrewing screws. (Figure 1.)
2. Replace PCB assembly. (Figure 2.)
   When assemble PCB assembly with control case, make sure that PCB case is inserted surely in the slit of control case.
3. Assemble panel assembly and main PCB.

U3 (12, 14, 16 kW)



< Figure 1. >



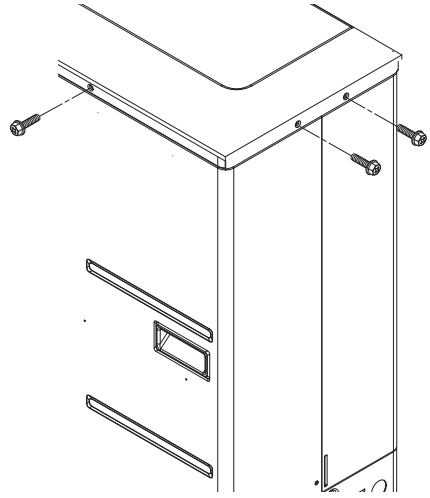
< Figure 2. >

CAUTION

Be sure that PCB assembly is firmly assembled with control case.
Confirm that there is no gap between PCB case and control case.
If any gap is present, it will cause product malfunction.

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 defect of unit.

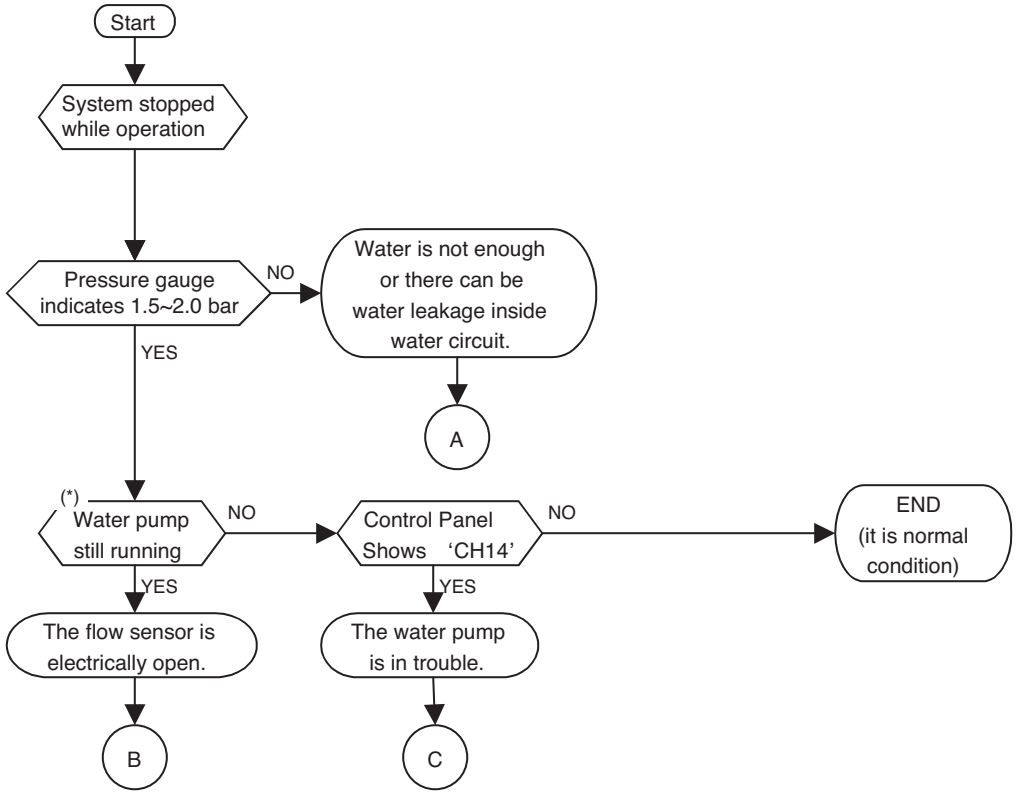


Part 5
Trouble Shooting

Trouble Shooting

1. Checking Key Components of Unit

1.1 Flow Sensor



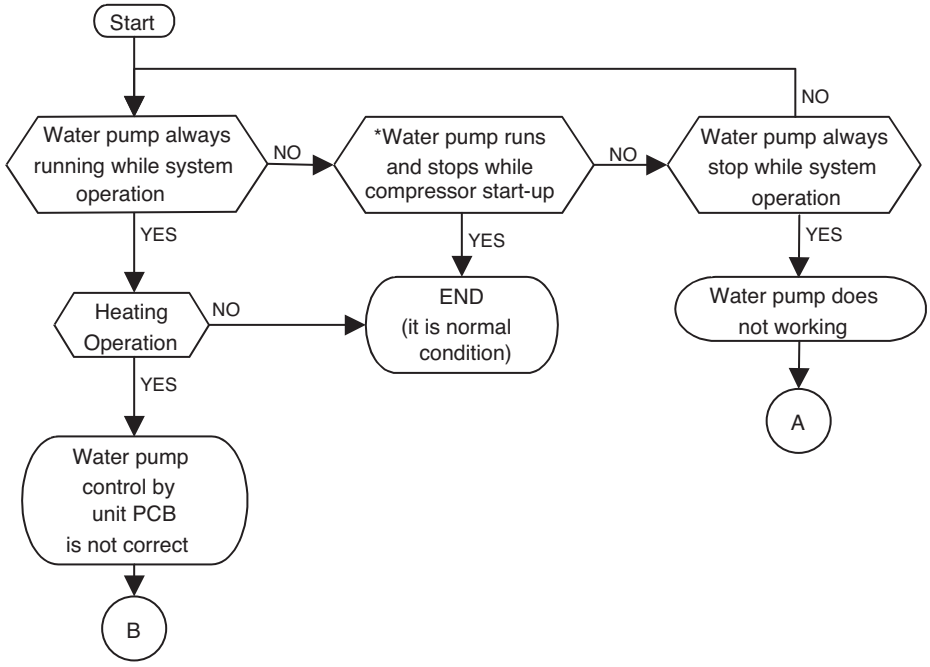
* : How to identify? - Touch the terminal box (black plastic box at the water pump) of water pump and feel if the water pump is vibrating. If no vibration, the water pump is not operating. Also, you can see 'Water Pump Operating' at control panel.

A
- Check if water inside water circuit is fully charged. Pressure gauge at the unit should indicate 1.5~2.0 bar.
- 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.

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.

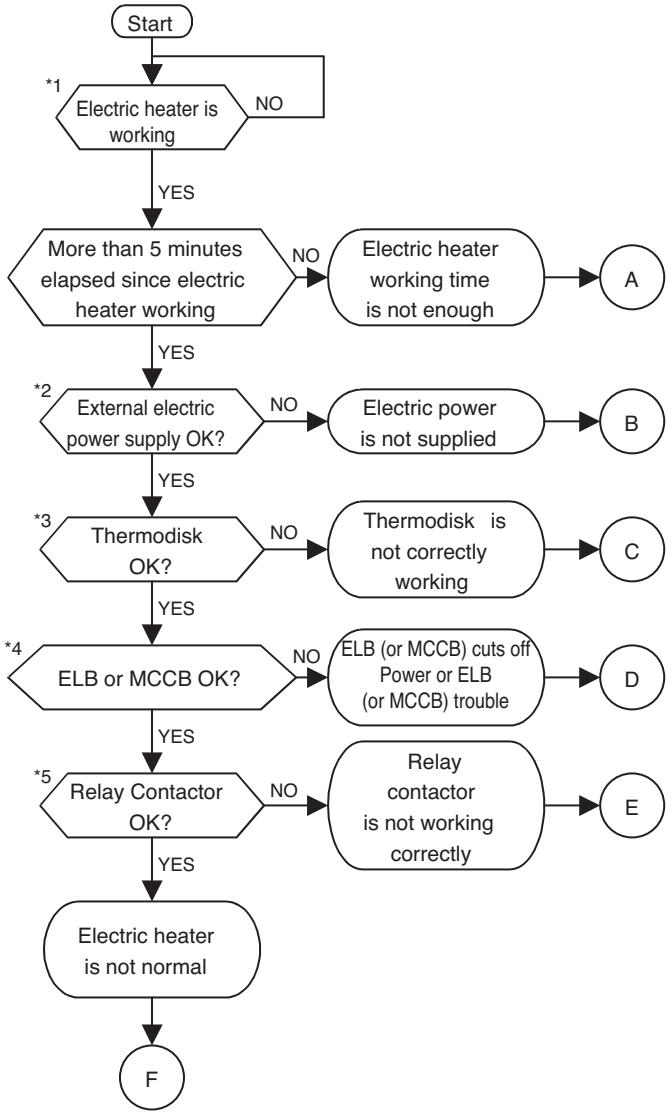
A

- Water pump does not because of mechanical defects of water pump or wrong wiring at the water pump.
- To correct mechanical defects, contact official After Service Center and replace the water pump.
- 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).

B

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

1.3 Electric Heater



*1 : When electric heater is working, 'Electric 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.

*3 : For single-phase model : Find cover of thermodisk which is located beside air vent. Air vent is on the top of the electric 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~ .

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~ .

*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~ .

A
- Wait for 5 minutes to heat water inside electric heater tank. If capacity of electric 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.

C
- Thermodisk is mechanically defected. In this case, contact official After Service Center and replace the thermodisk.
- Check the insulation resistance of Electric 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 is mechanically defected. In this case, contact official After Service Center and replace the relay contactor.

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

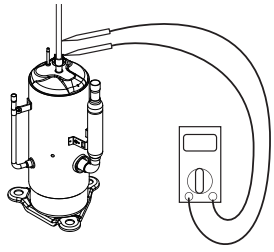
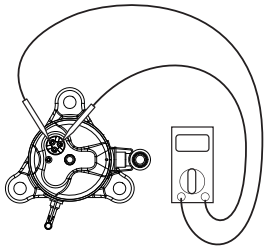
1.4 Remote Controller

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, someties 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 01(OFF-ON) or 10(ON-OFF), the water tank heating will not be configured.

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).

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 defect. 2. Replace both fan control board and the main board. If starting is done, it means that the main board has defect. 3. If problems continue to occur even after countermeasure of No.1 and No.2, it means that both boards has defect.

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.

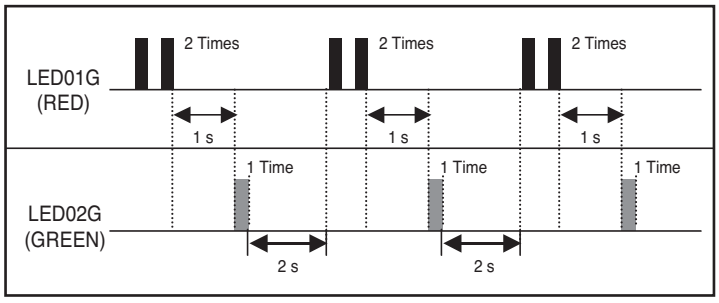
• **Classified trouble**

- 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 electric 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.

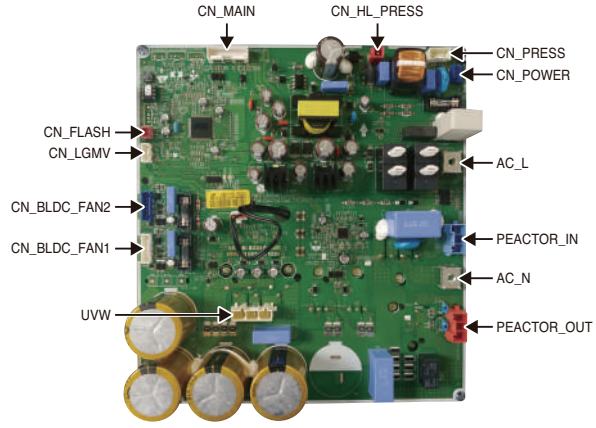
2.2 Error Indicator



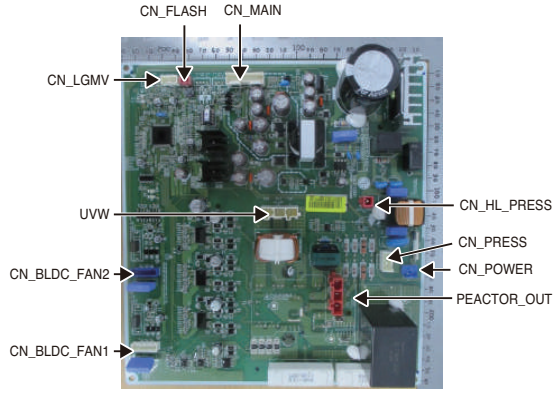
Iris Hellas
Technology Innovations
www.irishellas.com

12 / 14 / 16kW

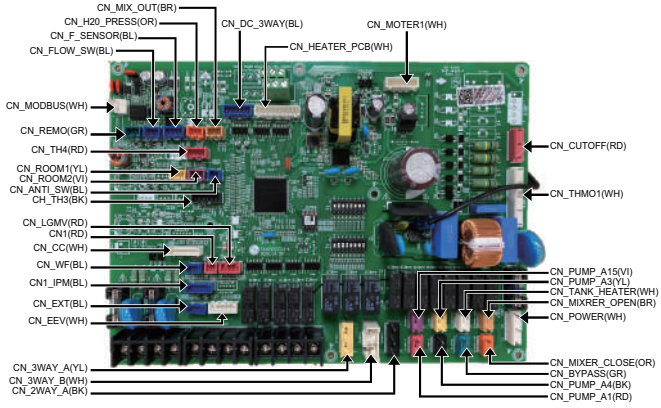
Inverter PCB(Outdoor) - 1Ø



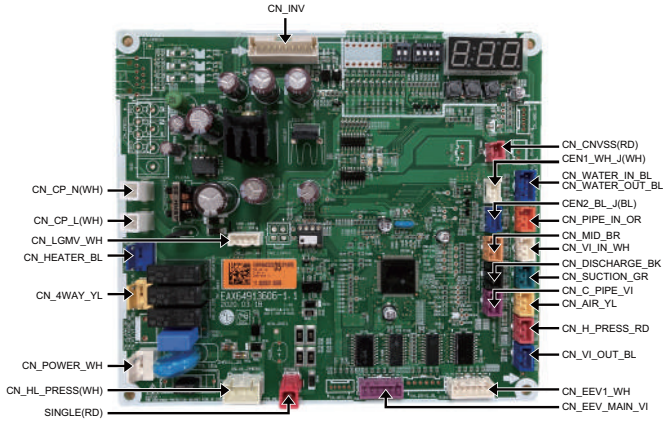
Inverter PCB(Outdoor) - 3Ø



Main PCB(Indoor)



Main PCB(Outdoor Cycle)



If abnormal voltage is supplied, the protection circuits will turn off the product in order to prevent the component damage. The product will automatically restart after 3 minutes.

2.3 Error Code List

Main PCB assembly(Indoor)

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 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.

Main PCB assembly(Outdoor)

- 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 ◑

U3 (1Ø : 12, 14, 16 kW)

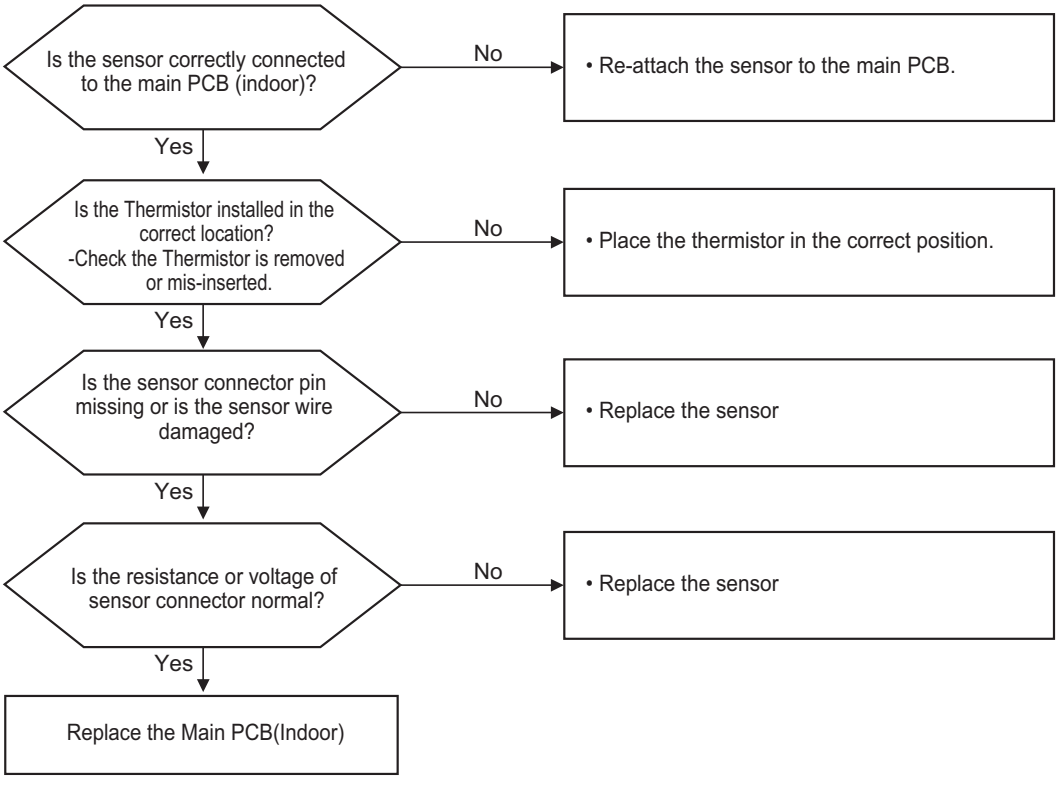
U3 (3Ø : 12, 14, 16 kW)

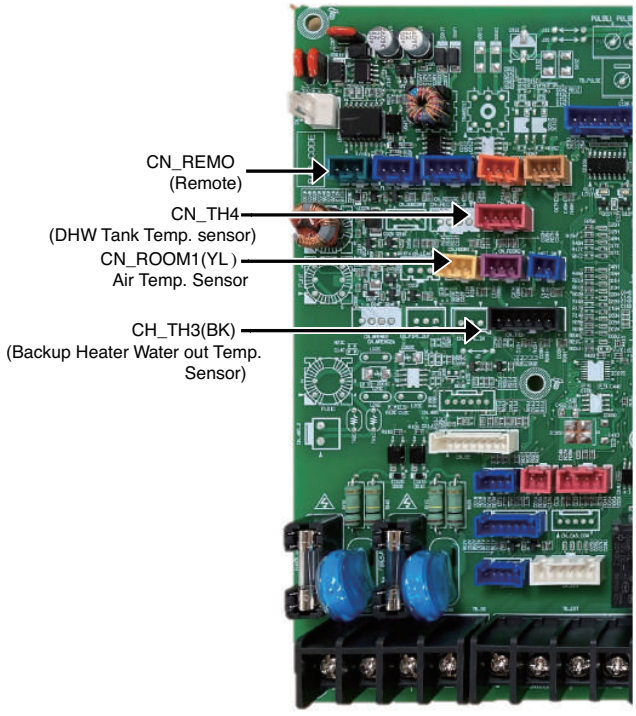
Error Code	Description	Main Reasons
21**	DC Peak(IPM Fault)	Comp is stopped to prevent the power module from being damaged by detecting the Fault Out signal of the power element.
22**	CT Current Error	Overcurrent flows to the outdoor unit that measures the outdoor unit current.
23**	DC Link Overvoltage / Undervoltage	This is when the Comp is running when the DC Link is low or high.
24**	High Pressure Error	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.
34**	High Pressure Error	Condensing pressure is excessively High.
35**	Low Pressure Error	Evaporating pressure is excessively low.
40**	Inv Comp CT Sensor Error	Comp control is not possible due to CT sensor error in Inv Driver
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)
57**	Main PCB(Indoor) → Inv PCB(Outdoor) Communication Error	Main PCB (Outdoor Cycle) → Inv PCB (Outdoor) communication is defective
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.

3. Trouble shooting Guide

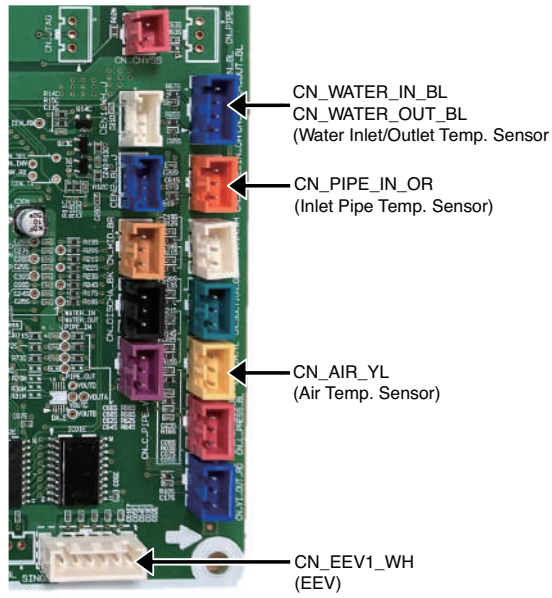
Error Code	Title	Description	Cause of error
CH01	Problem in remote air sensor	Indoor unit, Outdoor unit sensor open / short	1. Sensor mismatch on the Main PCB(Indoor, Outdoor) 2. Main PCB(Indoor, Outdoor) defect 3. Sensor failure (Reason of major defect) 4. Temperature sensor maximum reached
CH02	Problem in refrigerant inlet(liquid) side sensor		
CH08	Problem in water tank sensor		
CH13	Problem in solar pipe sensor		
CH16	Problem in Water-inlet sensor		
CH17	Problem in Water-outlet sensor		
CH18	Problem in electric backup heater outlet sensor		
CH19	Problem in electric backup heater outlet sensor		

Check Flow Chart



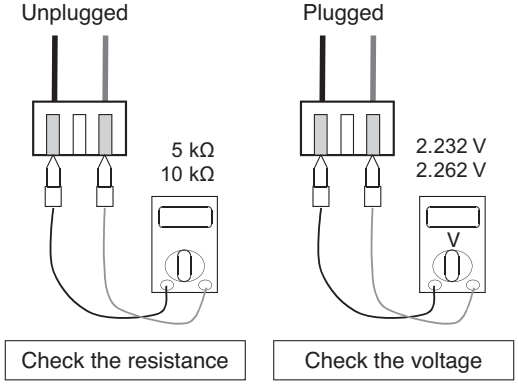


Indoor Unit PCB



Outdoor Unit PCB

Error code	PCB mark	Housing color / pin
CH 01	CN_ROOM	Yellow / 3
CH 02	CN_PIPE_IN	Orange / 3
CH 08	CH_TH4	Red / 4
CH 13	CH_TH4	Red / 4
CH 16, CH 17	CN_WATER_IN_BL CN_WATER_OUT_BL	Blue / 4
CH 18	CN_TH3	Black / 6
CH 19	CN_TH3	Black / 6



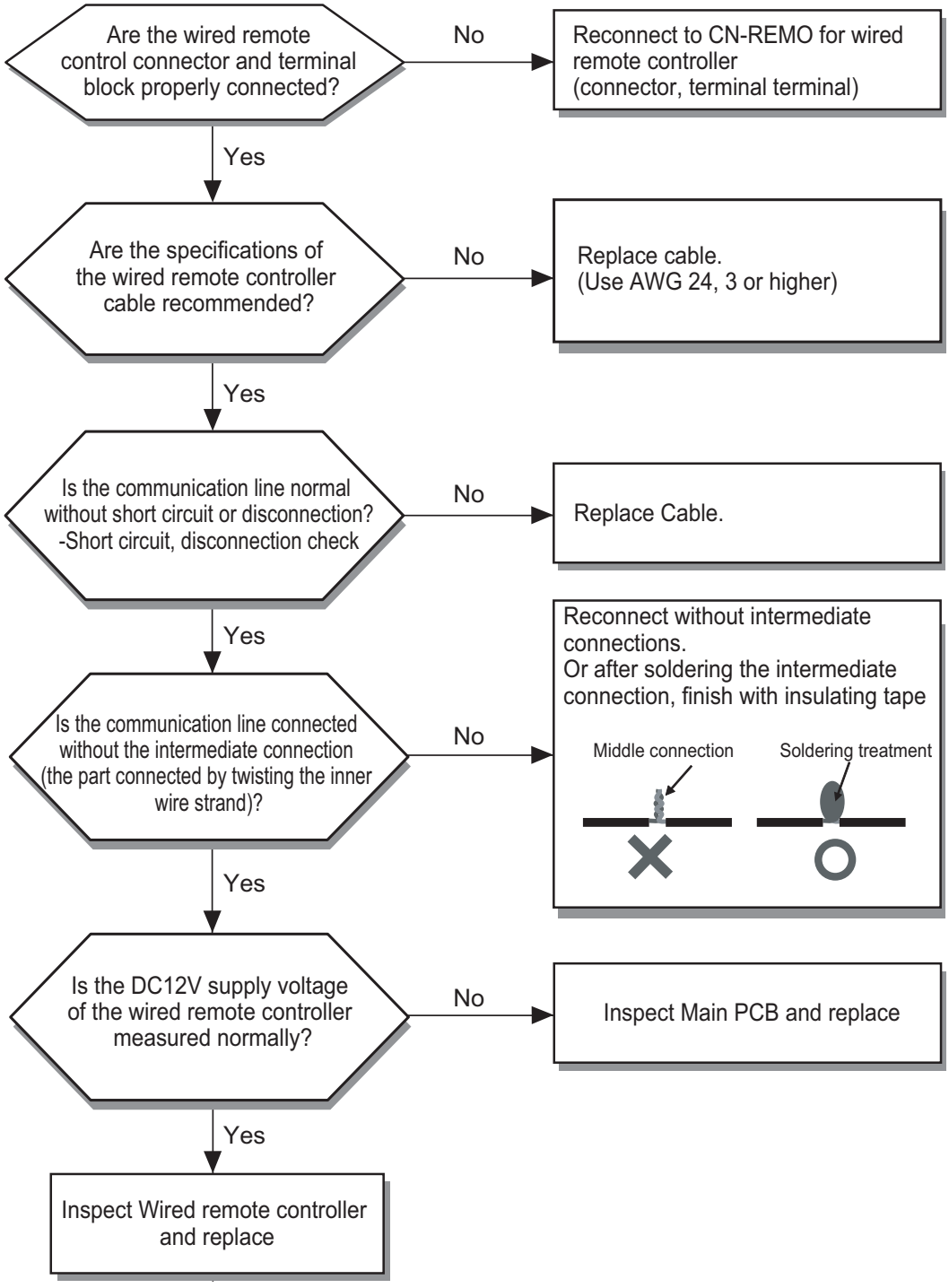
* The sensor resistance value and the voltage value at both ends may vary depending on the ambient temperature, and the value has a deviation of ± 5 %.
* There may be some errors depending on the measurement equipment.

PCB mark	Indoor Temp.(°C)	Resistance(kΩ)	Voltage(V)
CN_ROOM1 (Yellow / 3pin)	-10 °C	60 kΩ	4.1 V
	-5 °C	44 kΩ	3.9 V
	0 °C	33 kΩ	3.6 V
	5 °C	25 kΩ	3.4 V
	10 °C	0 kΩ	3.1 V
	15 °C	15 kΩ	2.8 V
	20 °C	12 kΩ	2.5 V
	25 °C	10 kΩ	2.2 V
	30 °C	8 kΩ	1.9 V
	35 °C	6 kΩ	1.6 V
	40 °C	5 kΩ	1.5 V
	45 °C	4 kΩ	1.3 V

PCB mark	Indoor Temp.(°C)	Resistance(kΩ)	Voltage(V)
CN_PIPE_IN(White/3Pin)) CN_TH4(Red/4Pin) CN_TH3(Black/6Pin)	-10 °C	29 kΩ	4.1 V
	-5 °C	22 kΩ	3.9 V
	0 °C	17 kΩ	3.6 V
	5 °C	13 kΩ	3.3 V
	10 °C	10 kΩ	3 V
	15 °C	8 kΩ	2.8 V
	20 °C	6 kΩ	2.5 V
	25 °C	5 kΩ	2.2 V
	30 °C	4 kΩ	1.9 V
	35 °C	3.2 kΩ	1.7 V
	40 °C	2.6 kΩ	1.5 V
	45 °C	2.1 kΩ	1.2 V
	50 °C	1.7 kΩ	1 V
	55 °C	1.4 kΩ	0.9 V
	60 °C	1.2 kΩ	0.8 V
	65 °C	1 kΩ	0.7 V

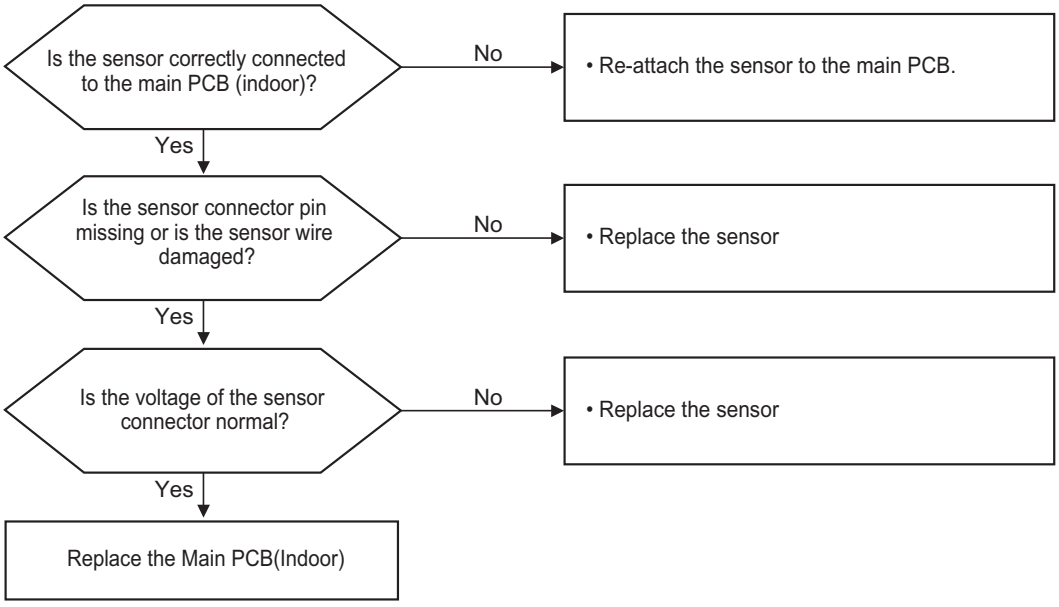
Display code	Title	Description	Cause of error
CH03	Bad communication between remote controller and indoor unit	No communication between Main PCB(Indoor) and wired remote controller.	1. Incorrect cable connection and burnout 2. Noise interference 3. Wired remote controller burnout 4. Main PCB burnout

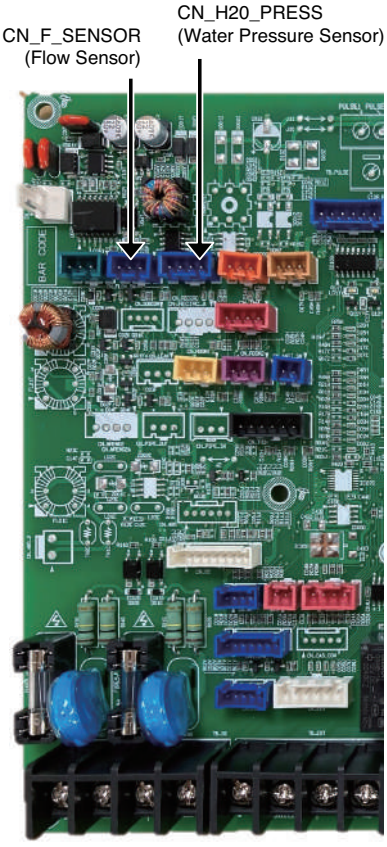
Check Flow Chart



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 defect 3. Sensor failure (Reason of major defect)
CH232	Problem in Water Flow sensor	Indoor unit water flow sensor failure	

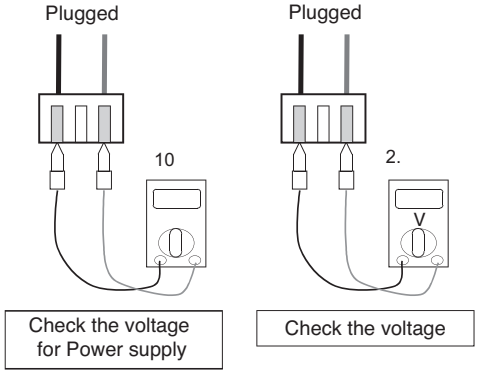
Check Flow Chart





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 errors depending on the measurement equipment.

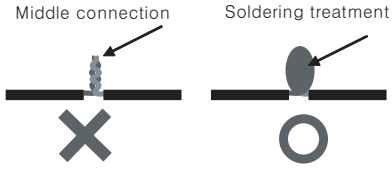
PCB Remark	Pressure (bar)	Voltage(V)
CN_H20_Press (Orange / 3)	0.2	0.53
	0.4	0.56
	0.6	0.59
	0.8	0.62
	1.0	0.65
	1.2	0.68
	1.4	0.71
	1.6	0.74
	1.8	0.77
	2.0	0.80
	2.2	0.83
	2.4	0.86
	2.6	0.89
	2.8	0.92
	3.0	0.95

PCB Remark	Flow(l/min)	Voltage(V)
CN_F_SENSOR (Blue / 4)	5.0	0.50
	10.0	0.70
	15.0	0.90
	20.0	1.10
	25.0	1.30
	30.0	1.50
	35.0	1.70
	40.0	1.90
	45.0	2.10
	50.0	2.30
	55.0	2.50
	60.0	2.70
	65.0	2.90
	70.0	3.10
	75.0	3.30
	80.0	3.50

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.

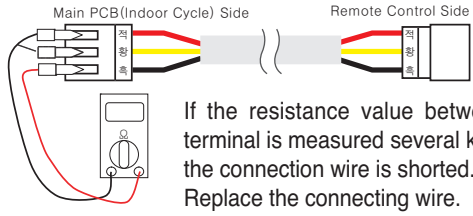


3. Check if the communication line is shorted or disconnected.
4. Measure the Main PCB(Indoor) CN-REMO voltage.
   1) When DC 12 V is measured, the Main PCB(Indoor) isnormal, check the wired remote control.
   2) If the voltage is not measured, replace the Main PCB(Indoor).
5. There is noise near the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

Inspection method

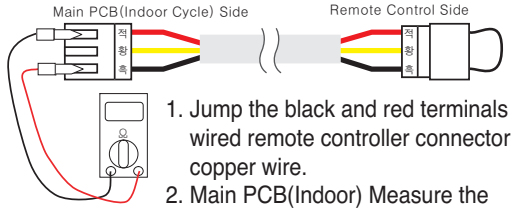
1. First, check the indoor main PCB and wired remote control.
2. Disconnect the “CN-REMO” connector of the indoor PCB.
3. Disconnect the "CN-REMO" connector of the wired remote control.
4. Set the range of the tester to Ω.
5. Please check as below.

How to check the short circuit

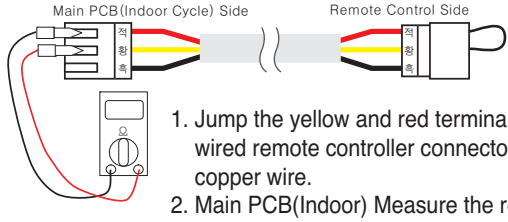


If the resistance value between each terminal is measured several kΩ, the connection wire is shorted.
Replace the connecting wire.

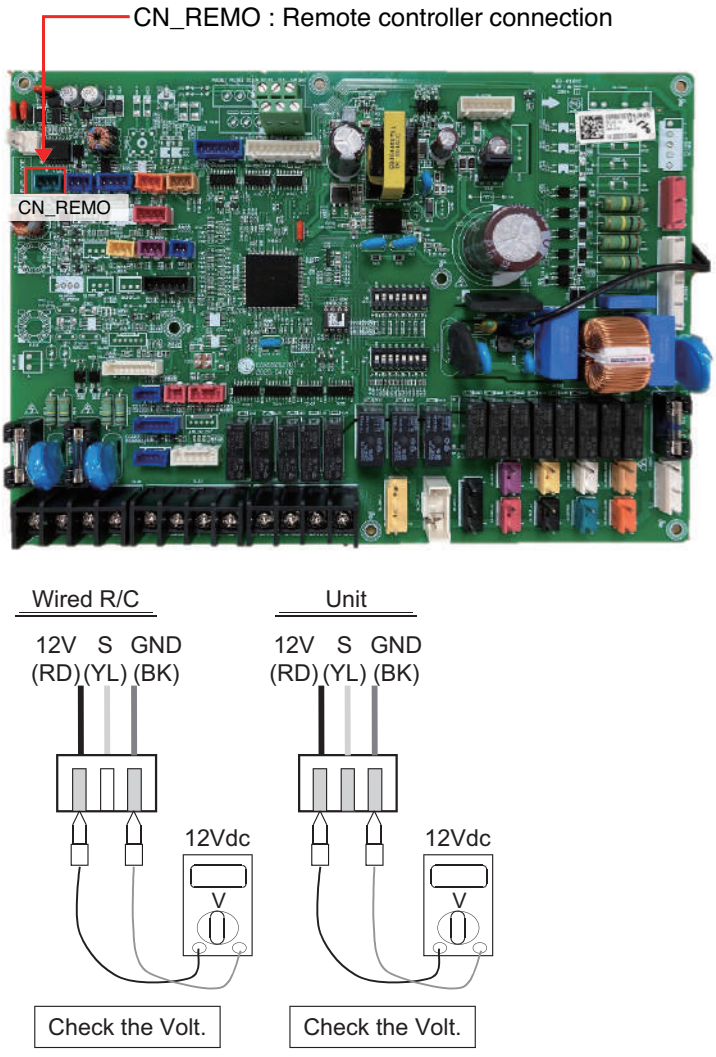
How to check for disconnection



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.

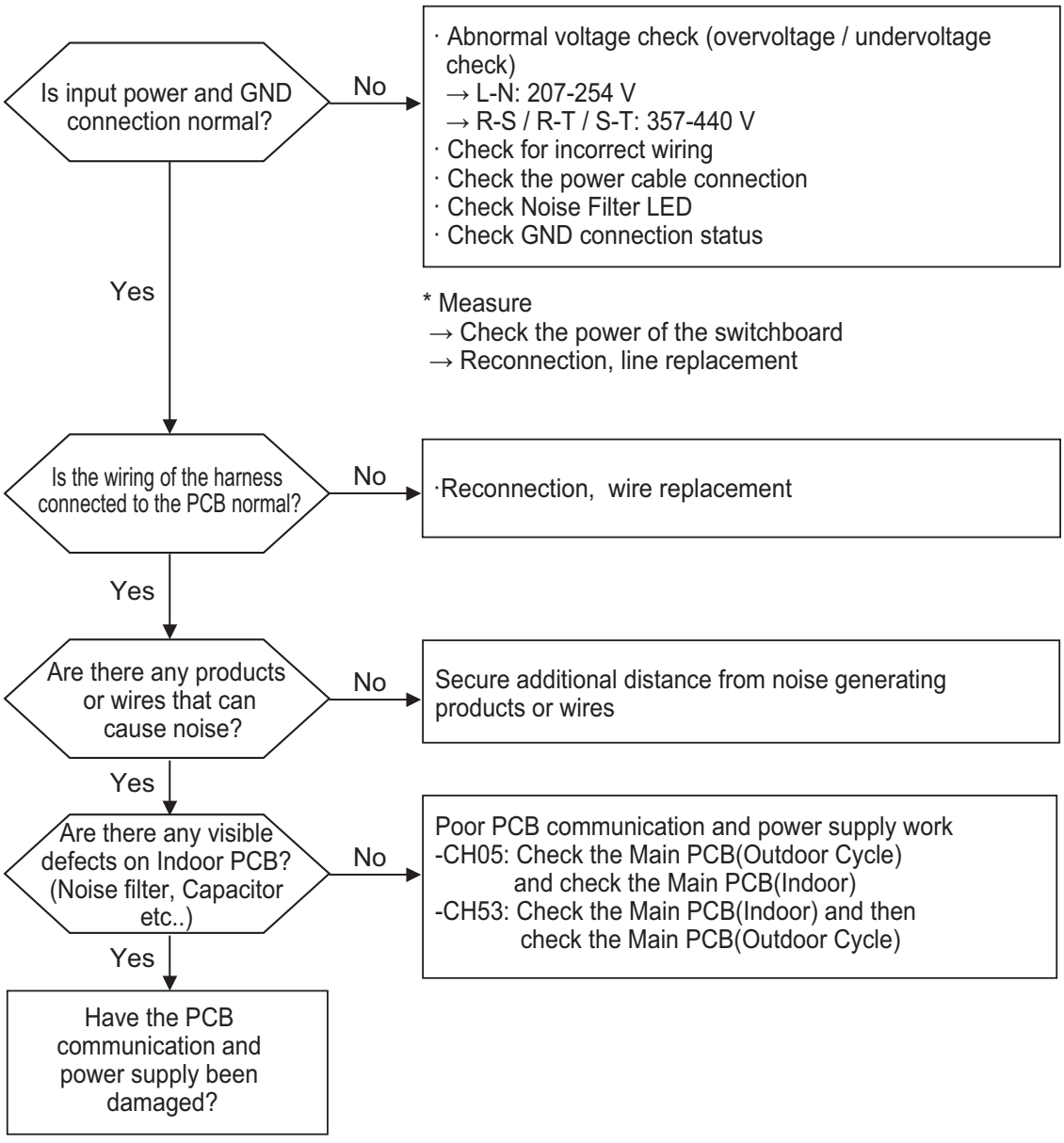


Check Point

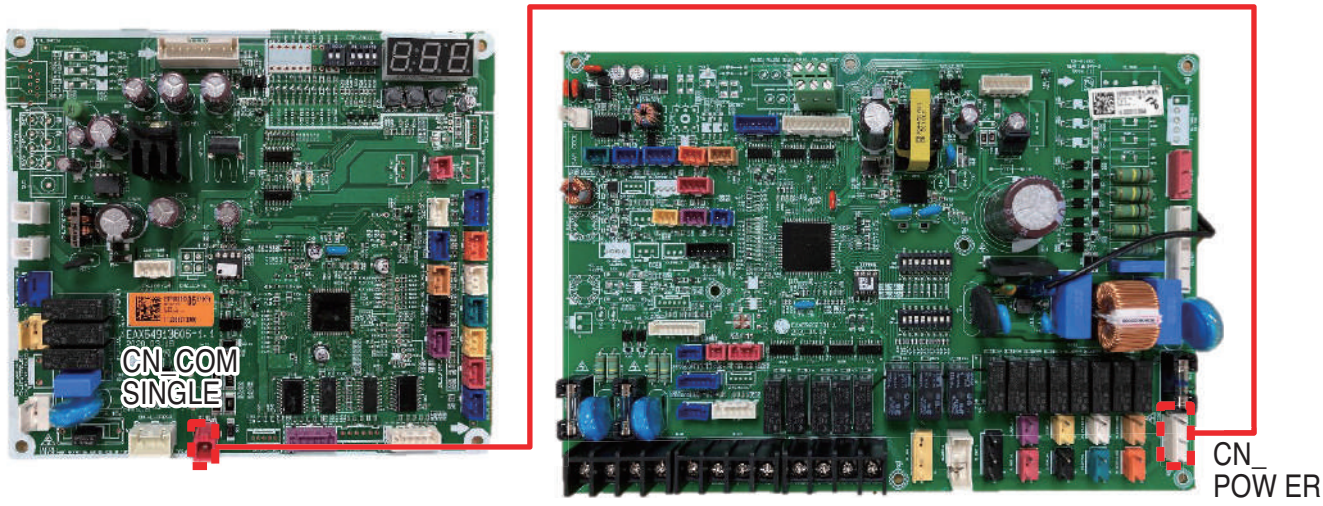
1. Check the wiring status. In case of Open/Short, it is reinserted.
2. Check the welding condition of the connector. If welding is defective, repair/replace the Main PCB (Indoor Cycle).
3. Measure whether the voltage of the Main PCB (Indoor Cycle) power supply is DC 12 V. If it is bad. Repair/replace Main PCB (Indoor Cycle).
4. Check the installation status of the wired remote control. If there is influence of ambient noise, it is separated from the electromagnetic wave generating equipment.

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



▶ 12 / 14 / 16 kW: Check the connection state of the PCB connection harness

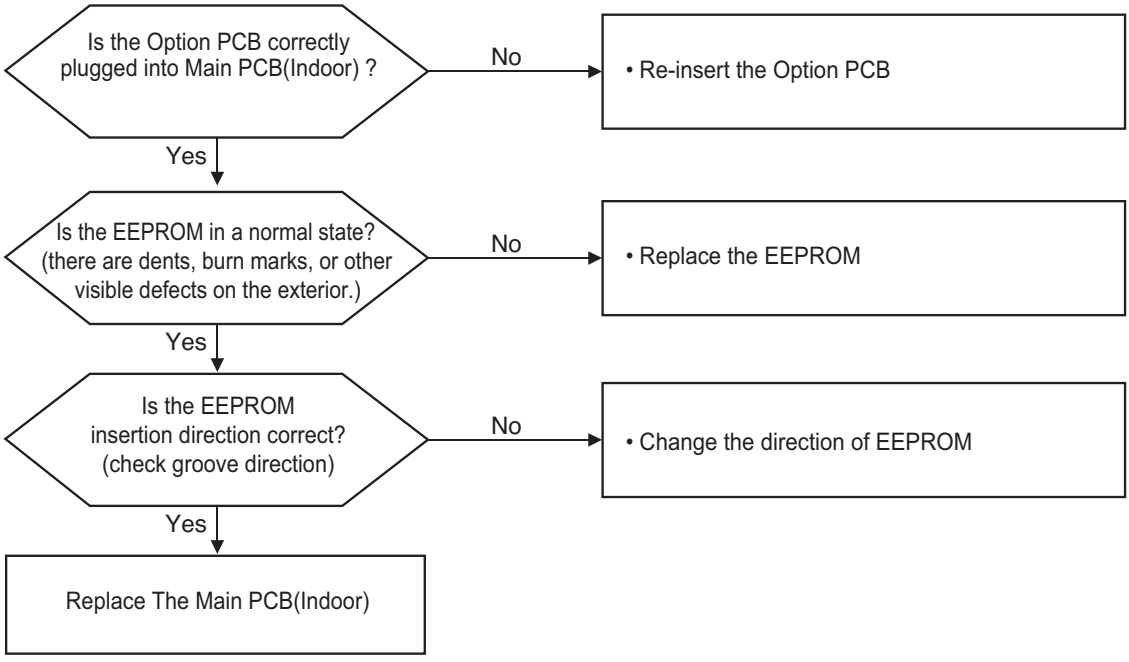


Main PCB(Outdoor Cycle)

Main PCB(Indoor)

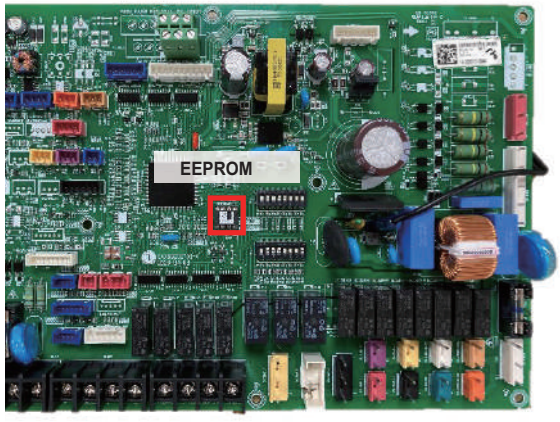
Display code	Title	Description	Cause of Error
CH09	PCB Program (EEPROM) Fault	A defect occurred in the optional EEPROM connected to the Main PCB(Indoor).	1. Optional EEPROM is loosely inserted or removed 2. Optional EEPROM burnout

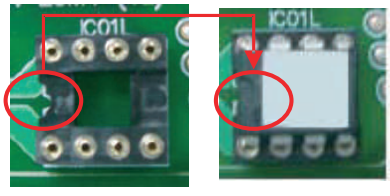
Check Flow Chart

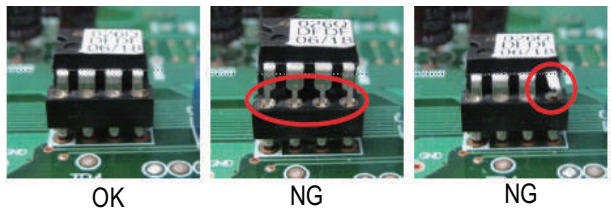


Check Point

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



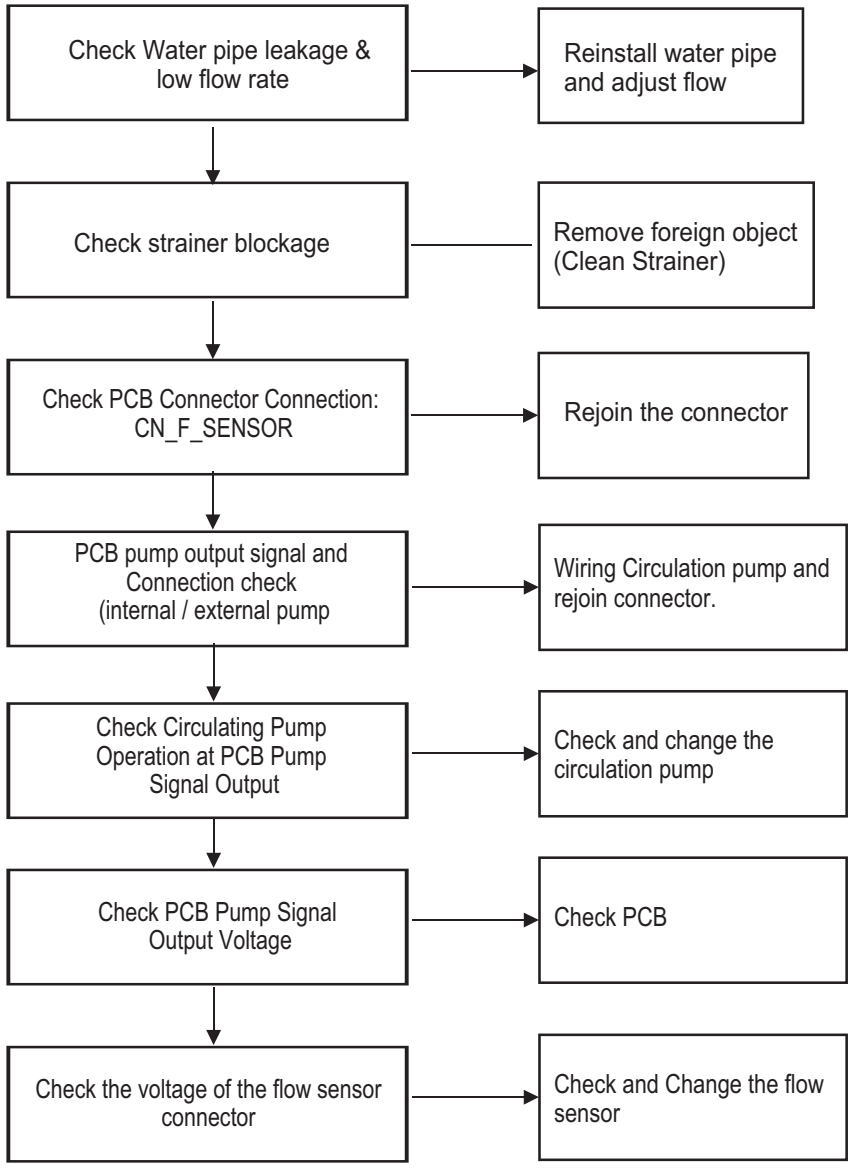




OK NG NG

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



1. Check for leaks (low flow rate).

❊ Low leakage may occur when water leaks into the water pipe system

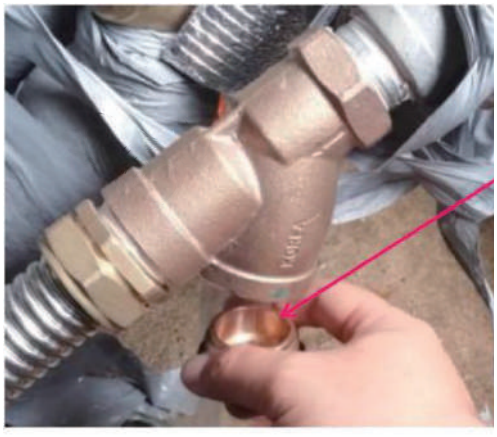
① Check for water leakage
- Check if water leaks inside the product and accessories
- Check if water is leaked from the water pipes and accessories (connections, heat storage tanks, etc.)

② When leakage occurs
- Reconnect leaking parts or replace damaged parts and reinforce
- Recheck the reinforced leak area and re-operate after bleeding air.

③ If there is no leak
- Check if the valve in the water pipe is locked (open the valve when it is confirmed)
- Check if there is any blockage by foreign substances in the water pipes such as struts.

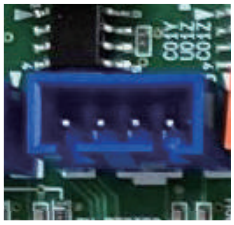
2. Check inside of the Strainer.

① Close the inlet / outlet connection valves.
② Separate the bottom of strainer with a spanner.
③ Clean the strainer with running water.
④ After assembling the strainer, open the valves.



3. Check the flow sensor connector

① If the CN_F_SENSOR connector is removed → reinsert the connector.



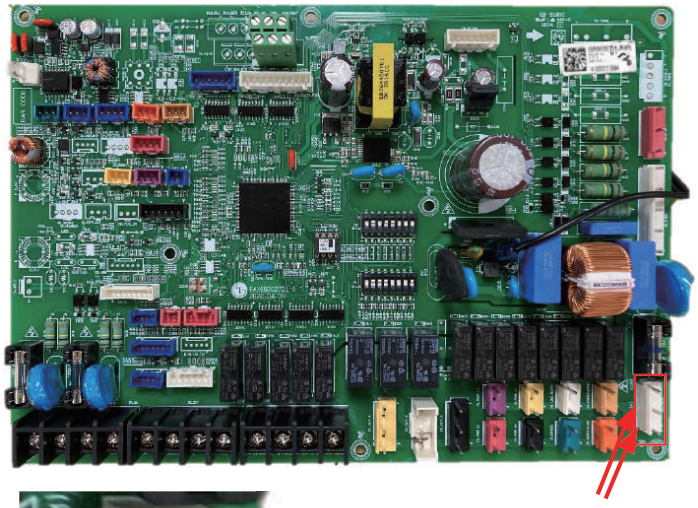
CN_F_SENSOR

② If there is cable interference around the flow sensor → Arrange the cable so that it does not interfere.
* Cable interference can cause false switch state detection.

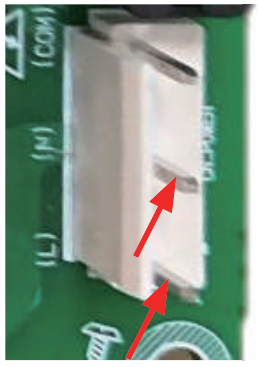
4. Check the PCB supply power.

① Check CN_POWER input voltage 220 V.

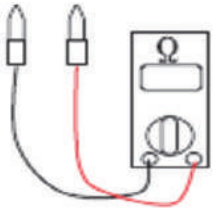
② If the input voltage is abnormal, check the breaker and power line.



CN_POWER

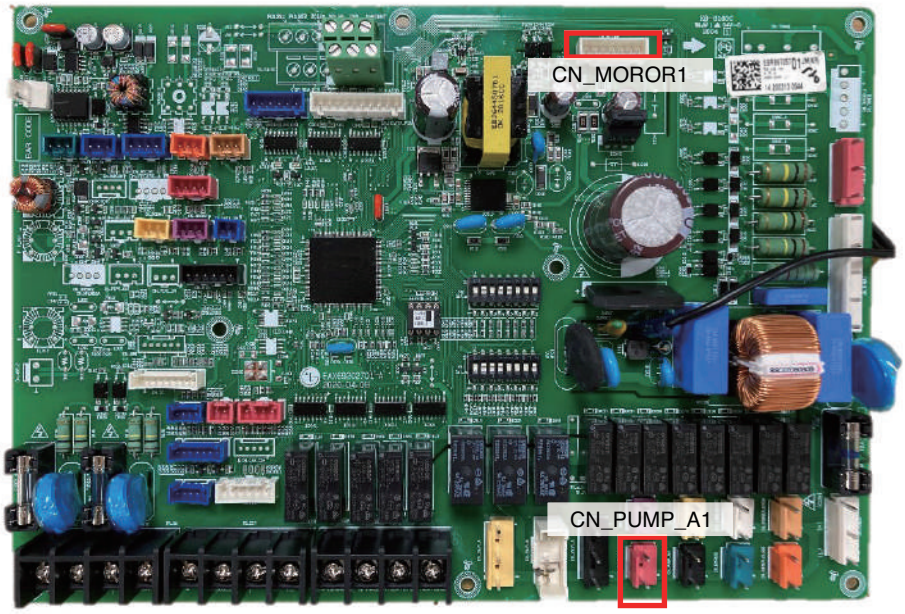


Check with the AC voltage measurement mode.(~V)



circuit tester

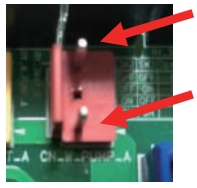
5. Check the circulation pump supply power and operation status.



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

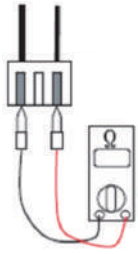
① Wired remote control operation ON

② Check that “Pump operating” is displayed on the wired remote



AC220 V output during pump operation

< CN_PUMP_A1 >



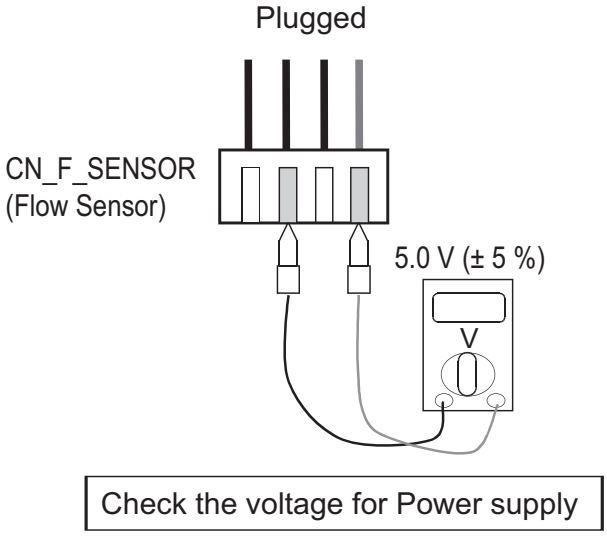
*Check the AC voltage measurement mode.

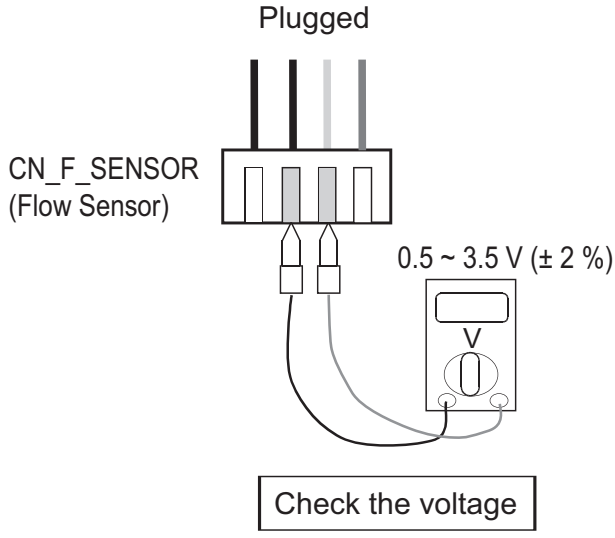
circuit tester

① If the AC 220 V is measured but the pump does not work, replace the pump.

② If there is no 220V output on the connector, replace the PCB.

6. Check the voltage of the flow sensor.





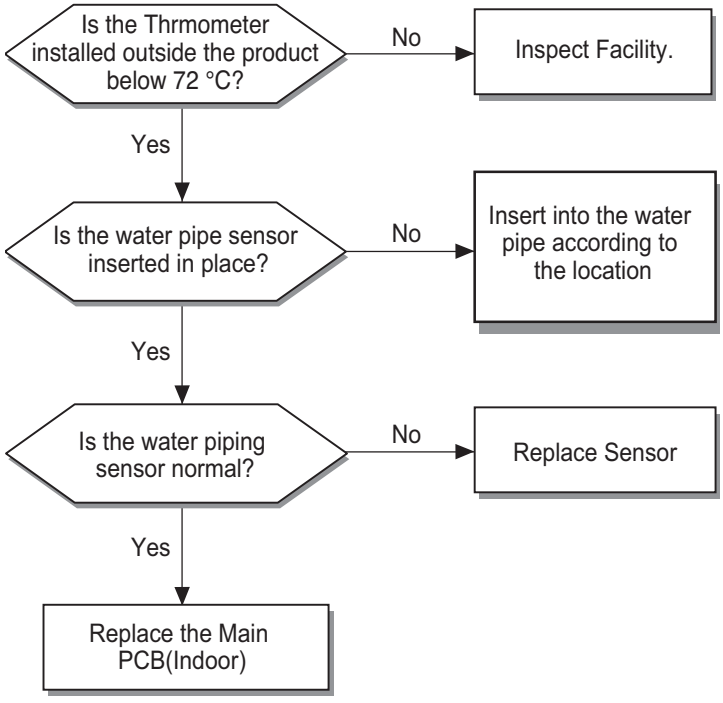
* The sensor voltage value at Pin 2 & Pin3 may vary depending on the reference voltage input, and the value has a deviation of ±2%.

* There may be some errors depending on the measurement equipment.

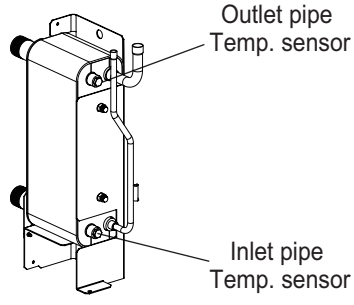
※ If there is no problem in the flow sensor, check the indoor unit PCB and replace the PCB.

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

Check Flow Chart

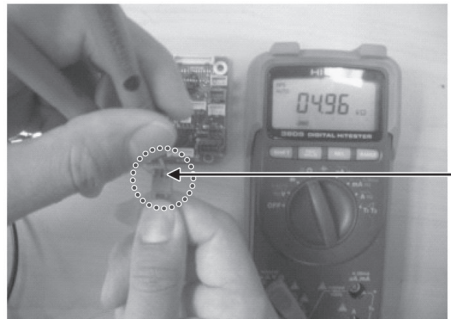


Water Pipe Temperature Sensor Location



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)

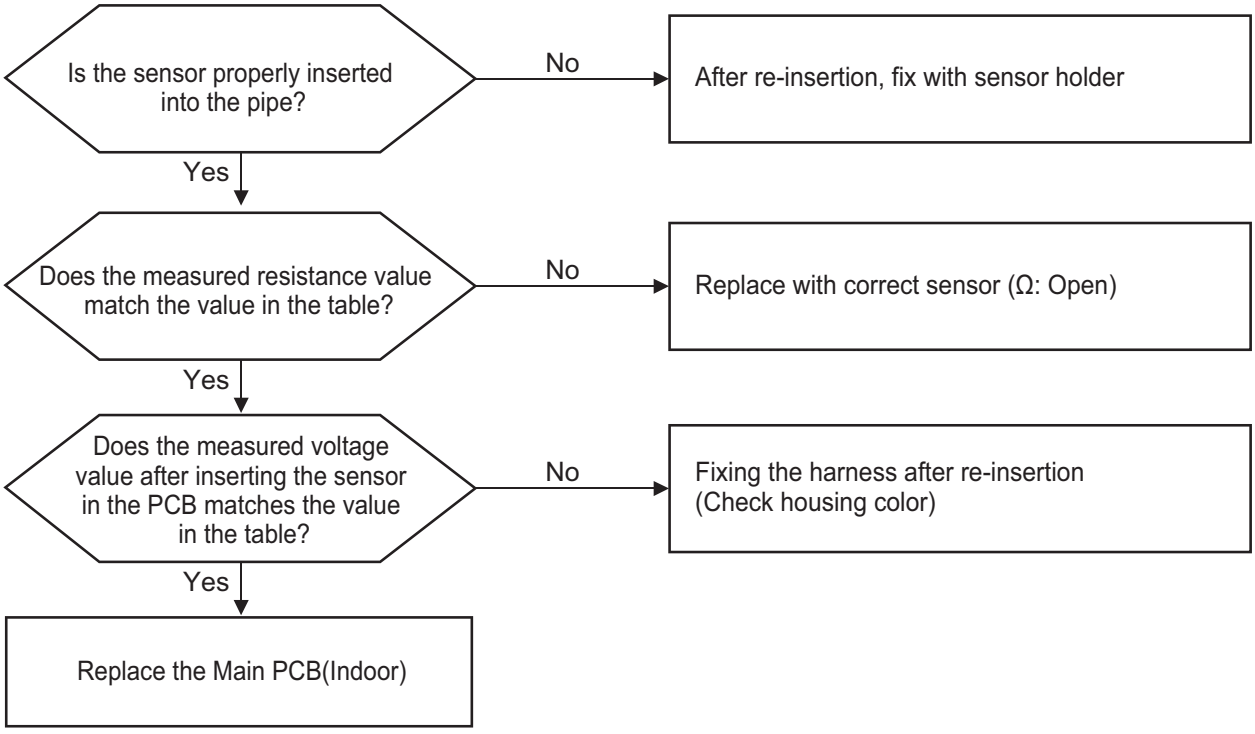
Air temp. sensor 10 ˚C = 20.7 kΩ : 25 ˚C = 10 kΩ : 50 ˚C = 3.4 kΩ
Piping temp. sensor 10 ˚C = 10 kΩ : 25 ˚C = 5 kΩ : 50 ˚C = 1.8 kΩ

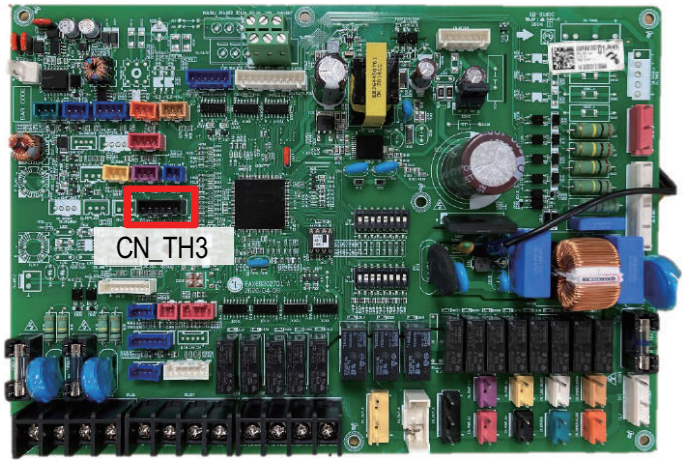


Measure Indoor unit outlet piping temperature sensor resistance

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, defects occur.	1. Heater out temp. sensor Error 2. Improperly connected sensor.

Check Flow Chart



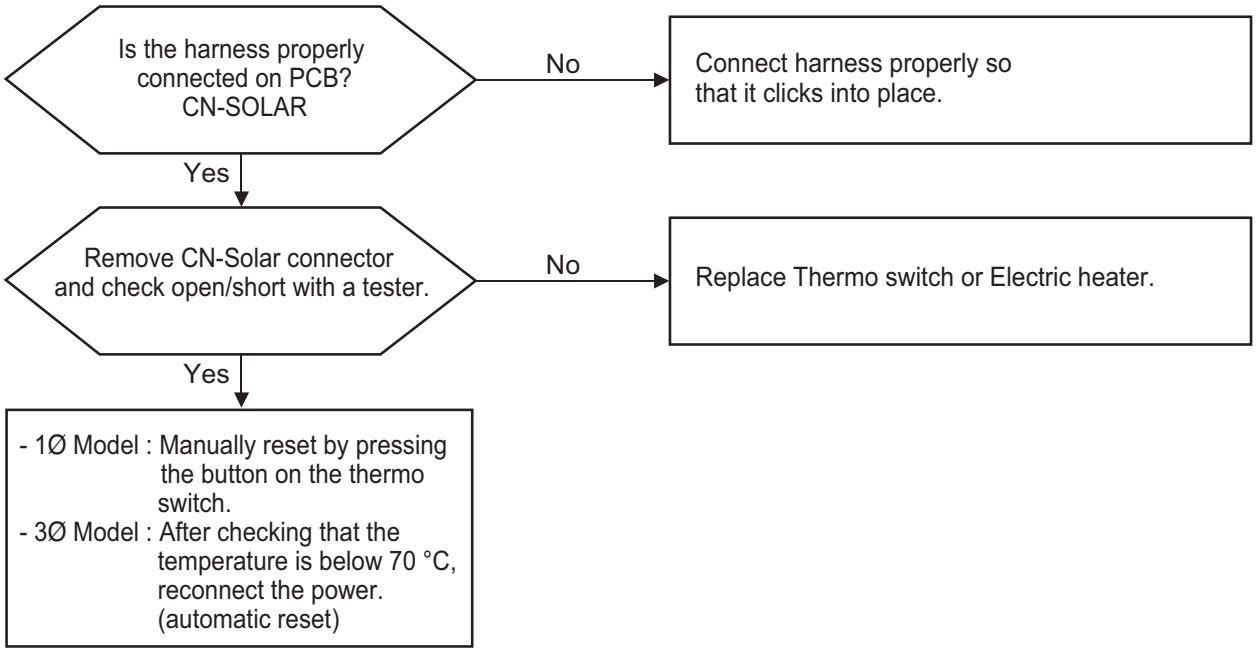


	Voltage (at 25 °C)
Water Out	2.232
Water In	2.232

PCB Mark	Indoor Temp.(°C)	Resistance(kΩ)	Voltage(V)
CN_TH3(Black / 6PIN)	-10 °C	29 kΩ	4.1 V
	-5 °C	22 kΩ	3.9 V
	0 °C	17 kΩ	3.6 V
	5 °C	13 kΩ	3.3 V
	10 °C	10 kΩ	3 V
	15 °C	8 kΩ	2.8 V
	20 °C	6 kΩ	2.5 V
	25 °C	5 kΩ	2.2 V
	30 °C	4 kΩ	1.9 V
	35 °C	3.2 kΩ	1.7 V
	40 °C	2.6 kΩ	1.5 V
	45 °C	2.1 kΩ	1.2 V
	50 °C	1.7 kΩ	1 V
	55 °C	1.4 kΩ	0.9 V
	60 °C	1.2 kΩ	0.8 V
	65 °C	1 kΩ	0.7 V

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

Check Flow Chart



Display code	Title	Description	Cause of error
CH21	DC PEAK (IPM Fault)	IPM of inverter drive is abnormal or Inverter comp. is self-defective.	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 defective 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

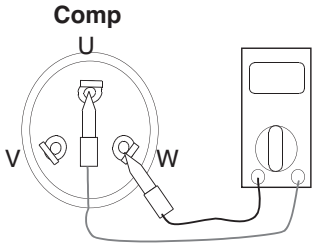
WARNING

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.

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

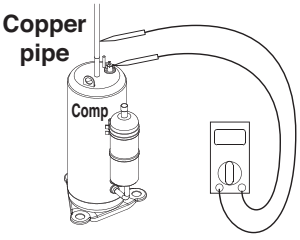
1. Turn off power
2. Check connection status, such as power, PCBA input/output, and Comp lines
   (If the connection is poor, it will make mistake "PCBA NG")
3. Check winding resistance and insulating resistance of compressor.
   (If there is a problem with the insulation of the compressor, it will make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

Winding resistance check



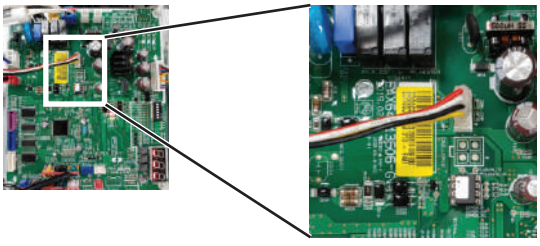
Model		RJB036MAA
Windings Restistance (at 25 °C)	U-V	0.529 ± 7% Ω
	V-W	0.529 ± 7% Ω
	W-U	0.529 ± 7% Ω

Insulating resistance check



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

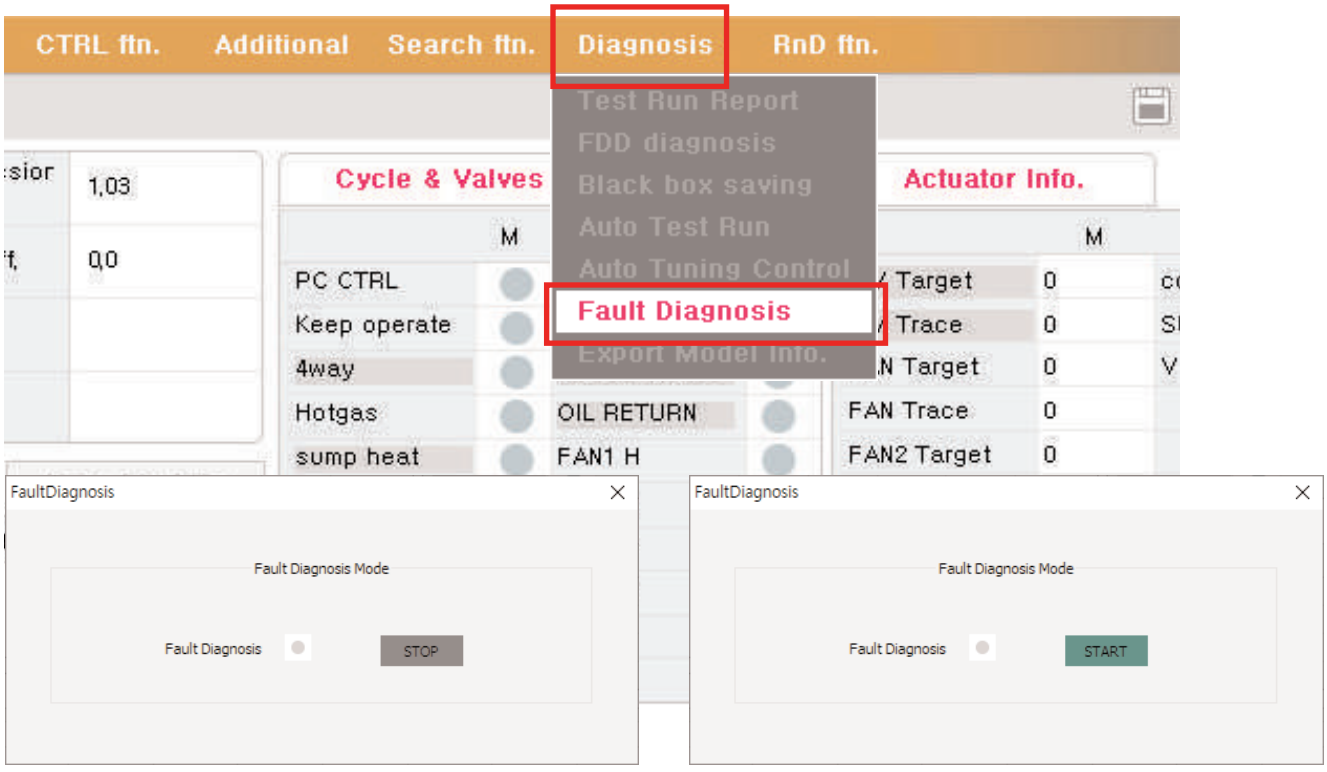
4. Turn on Power
5. Remote Controller Off (Stop mode)
6. Connect LGMV



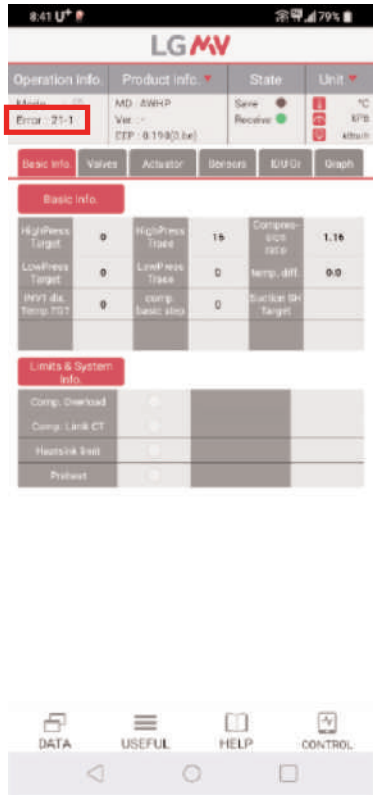
7. Wait 30seconds.
8. Check compressor and fan off

9. Perform diagnostic function

PC LGMV

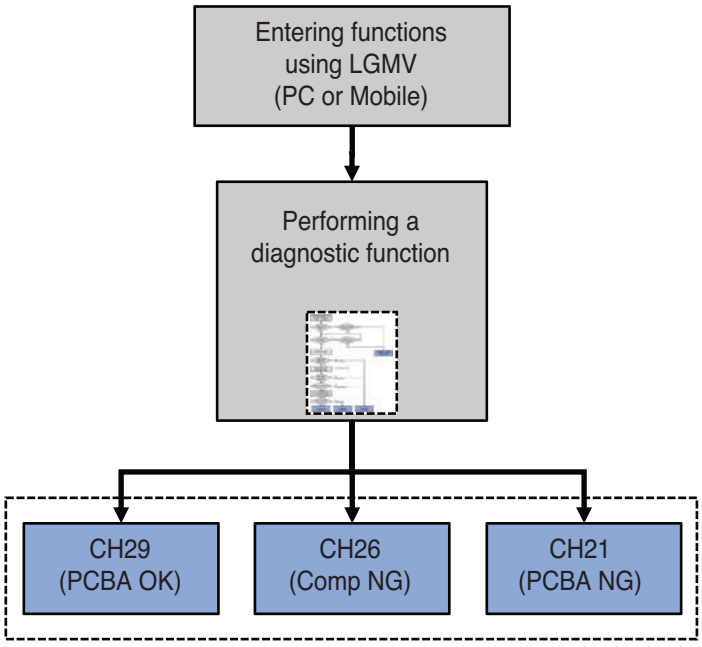


Mobile LGMV



◆ Manual performing of fault diagnostic function

Manual Control Sequence

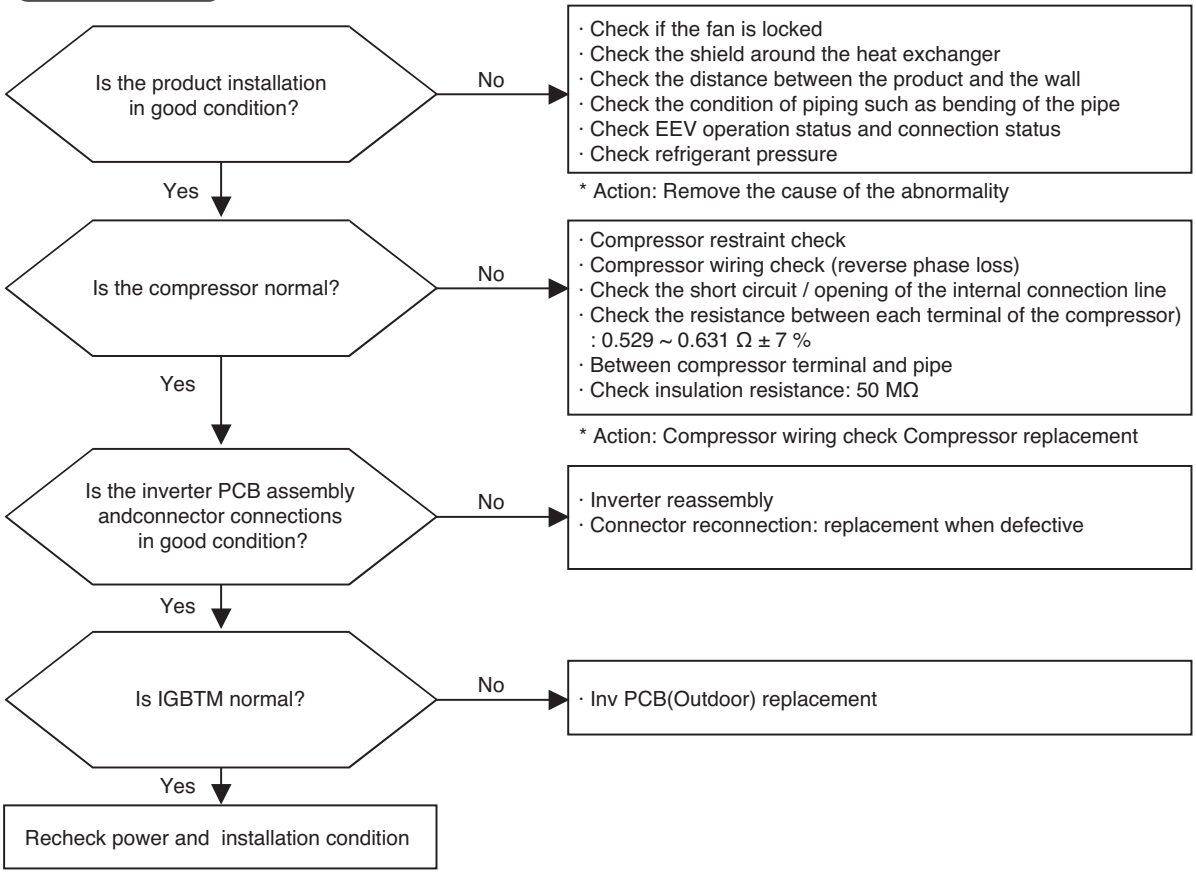


※ Maintaining error output based on fault finding results

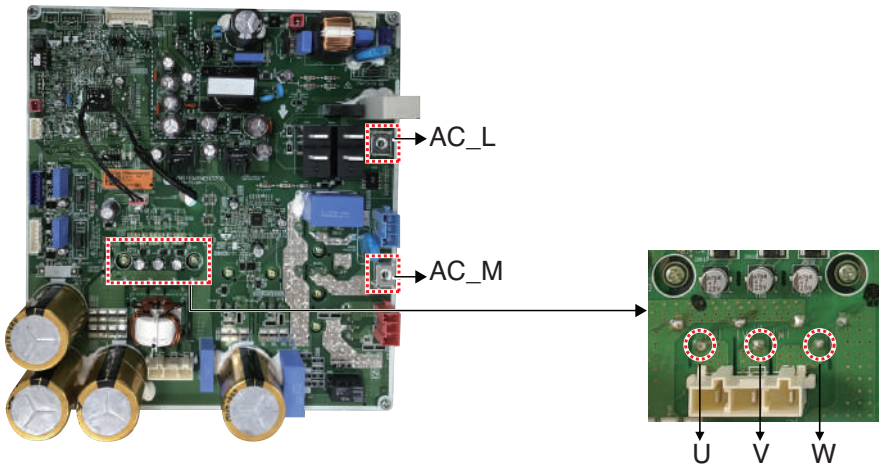
NOTE

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 should be checked.

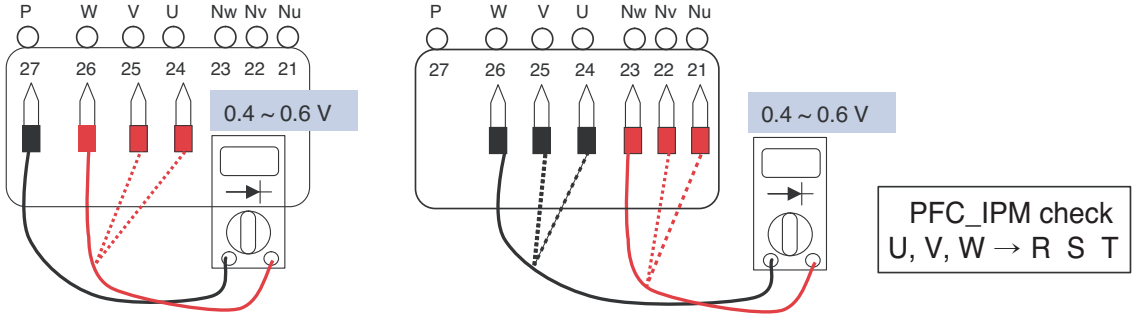
Check Flow Chart



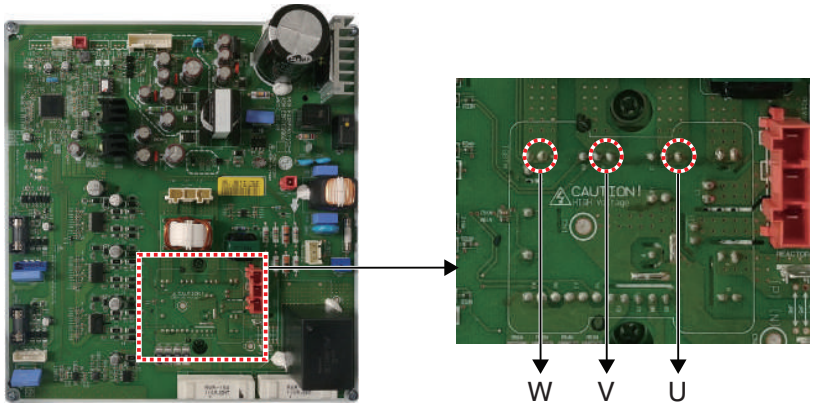
▶ U3 (1Ø : 12, 14, 16 kW)



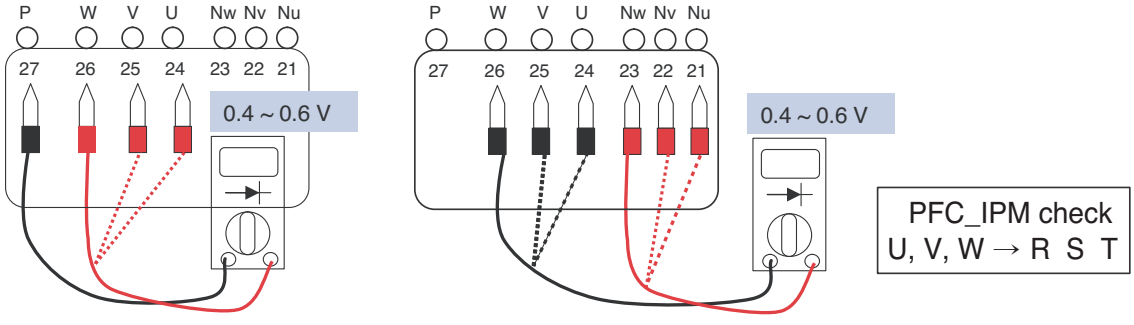
1. Wait PCB(Inverter) DC voltage is discharged after main power off.
2. Pull out AC(L), AC(N) connectors and U,V,W COMP Connector.
3. Set multi tester to resistance mode.
4. If the value between P and N terminal of IPM is short(0 Ω) or open(hundreds MΩ), PCB needs to be replaced.(IPM daaged)
5. Set the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



▶ U3 (3Ø : 12, 14, 16 kW)



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 damaged)
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).

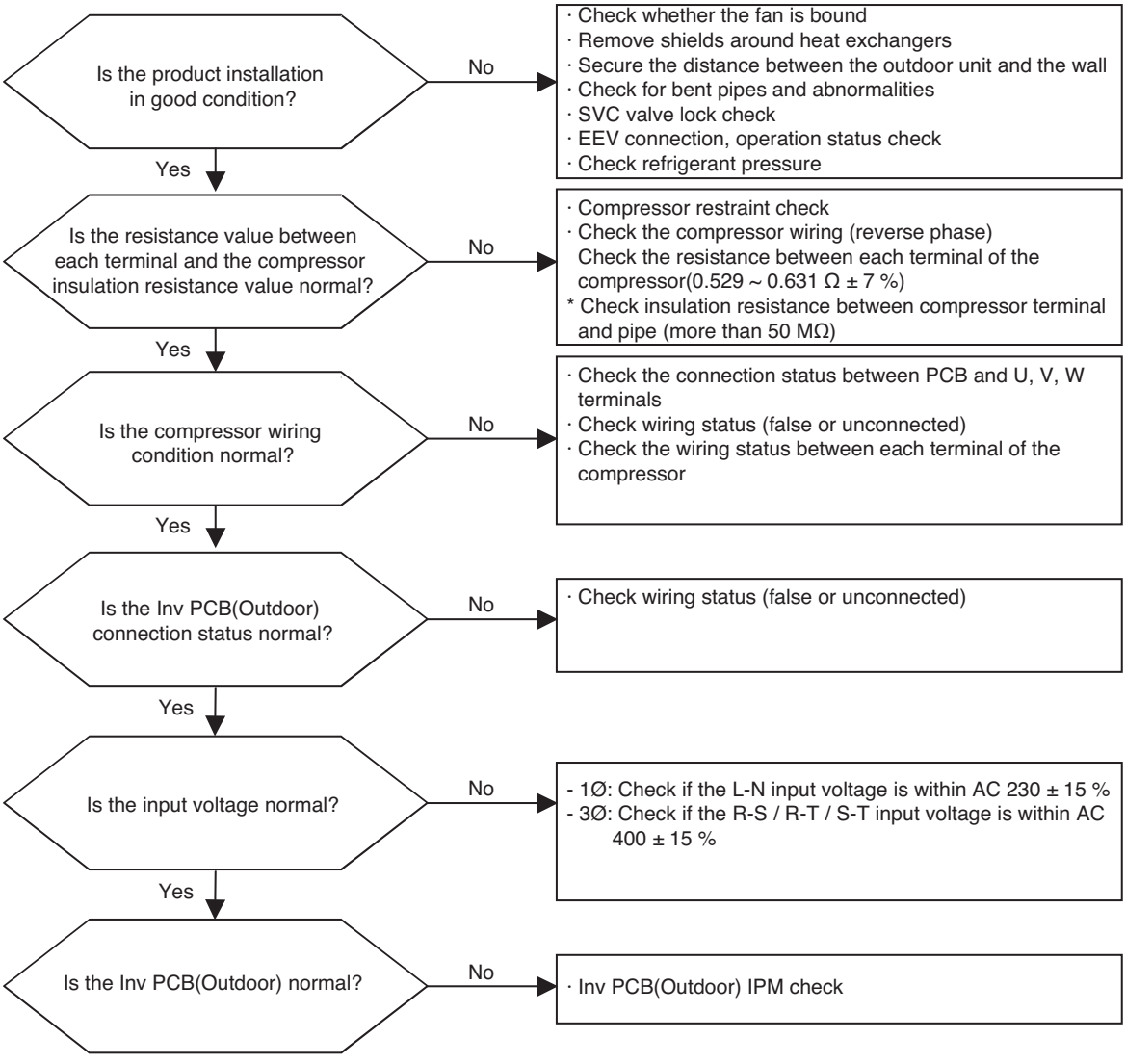


Display code	Title	Cause of error	Check point & Normal condition
CH22	Max. C/T	Power input of Inv PCB(Outdoor) is exceeded.	1. Check the input voltage 2. Check the structure of outdoor fan restraint / shielding / euro 3. Check R phase input current during operation 4. EEV Assembly Status Scholar 5. Check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

⚠ WARNING

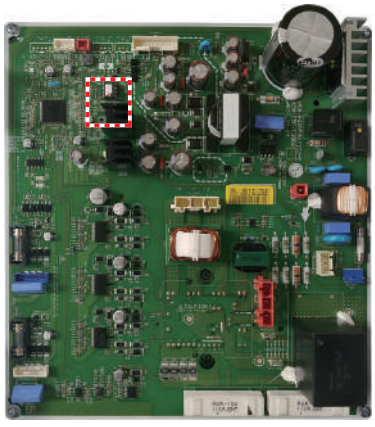
Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

Check Flow Chart

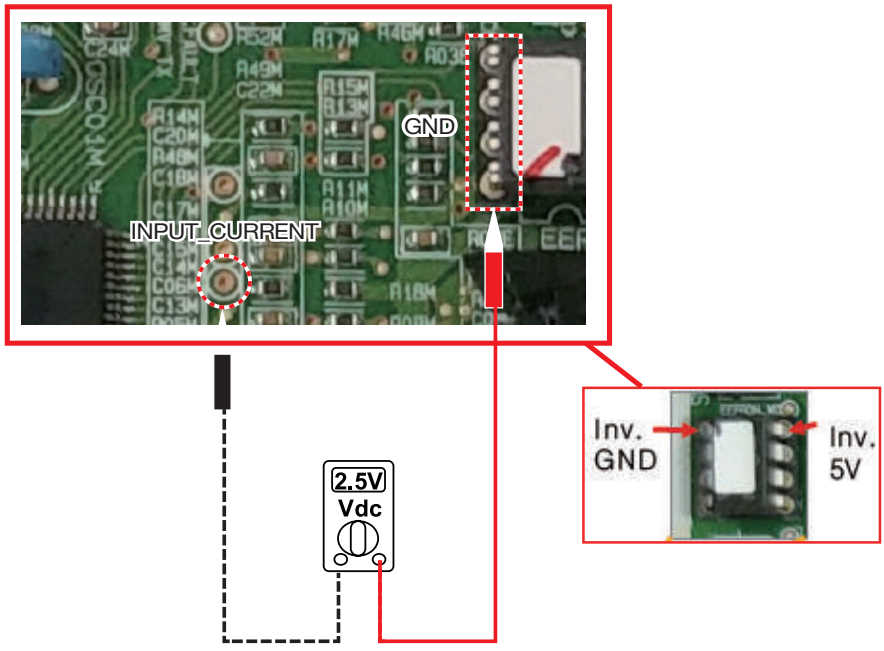


▶ U3 (3Ø : 12, 14, 16 kW)

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



<Inverter PCB>



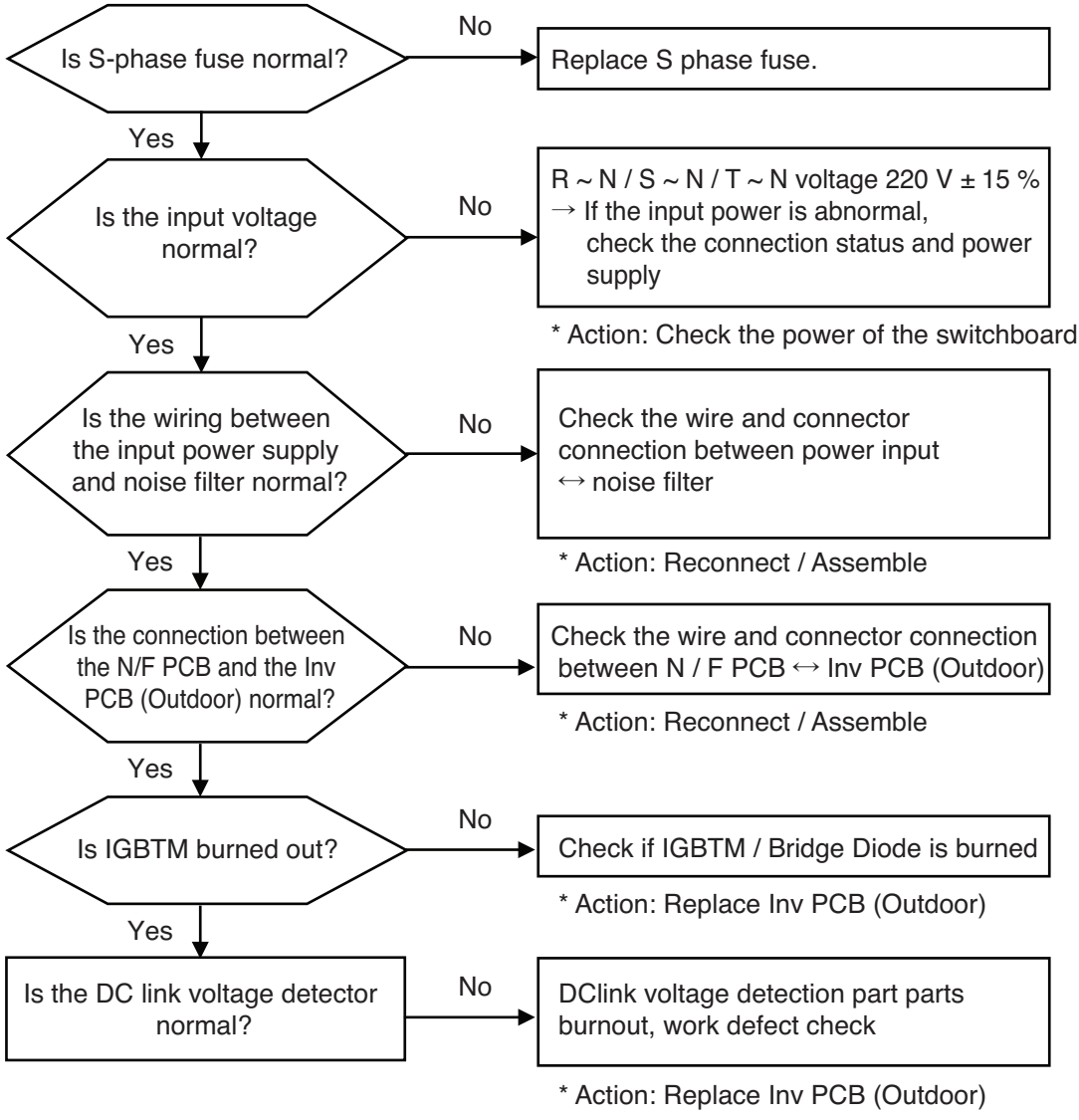
<CT Sensing Check Point >

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)

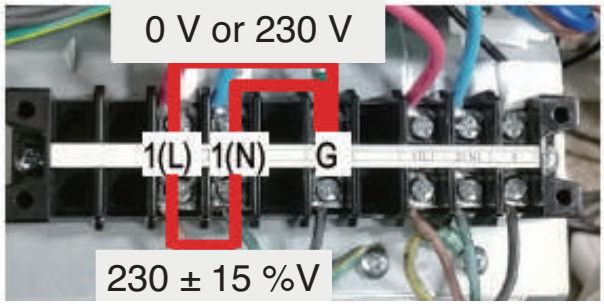
WARNING

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

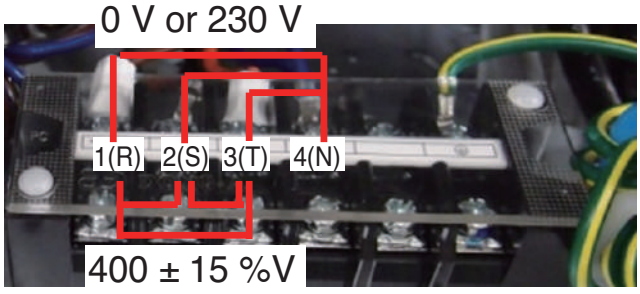


▶ Check L/N/G connection status (1Ø)



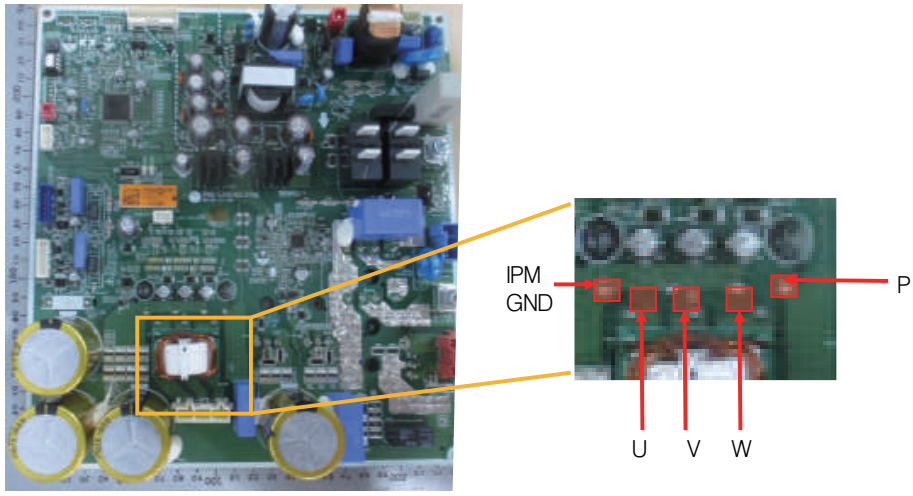
1. Check the L / N / G cable status and wiring status.
2. Check the outdoor unit input voltage
   L-N: 230 ± 15 % V / L-G, N-G: 0 V or 230 V

▶ Check R/S/T/N connection status (3Ø)



1. Check R / S / T / N cable status and wiring status.
2. Check the outdoor unit input voltage
   R-N, S-N, T-N: 230 ± 15 % V
   R-S, R-T, T-S: 400 ± 15 % V

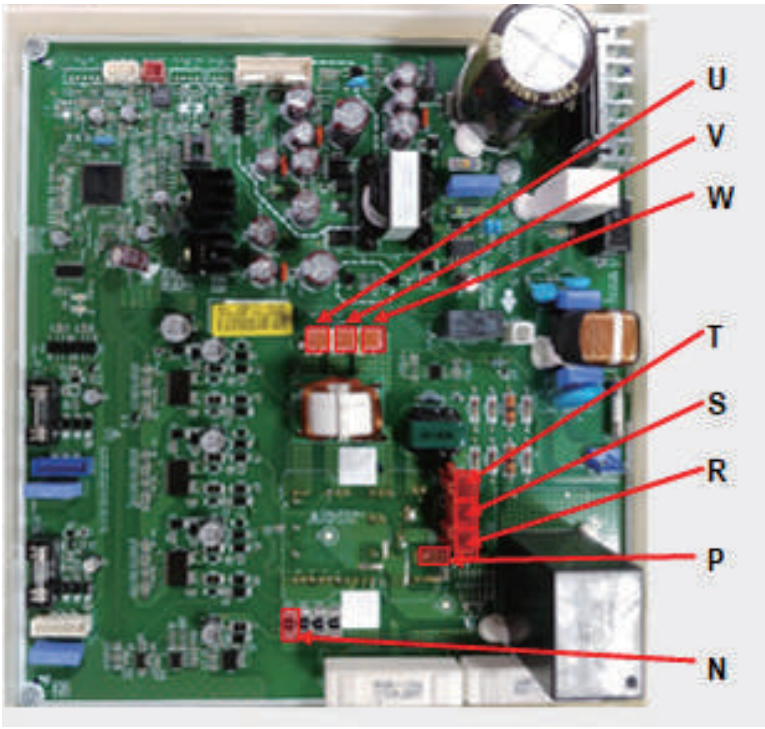
▶ U3(1Ø: 12, 14, 16 kW)



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

▶ U3(3Ø: 12, 14, 16 kW)

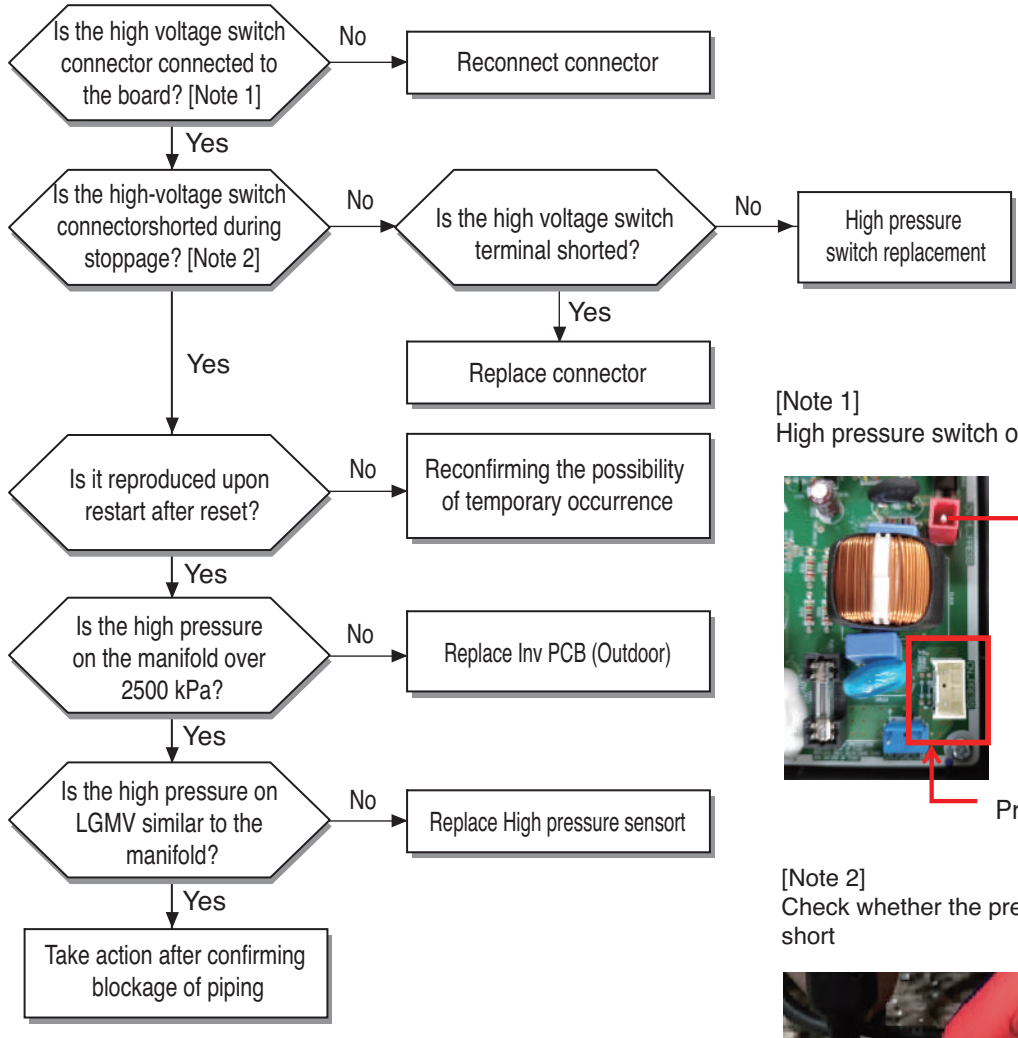


Check Point	Multimeter			Measures	
	Mode	Black	Red	Normal	Abnormal
IPM	→|–	P	U	0.3 V ~ 0.7 V	Etc.
			V		
			W		
		U	N		
		V			
		W			
		P	R		
			S		
			T		
		R	N		
		S			
		T			

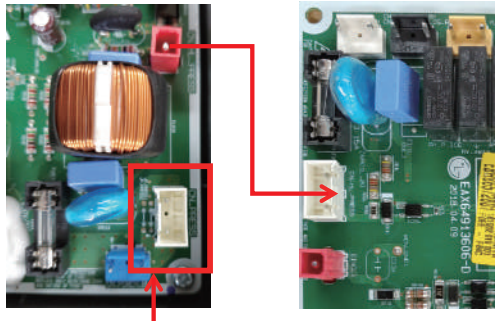
1. Remove PCB connector after power off (PCBA only measurement)
2. Multimeter diode measurement mode setting (→\|–)
3. P ~ U / P ~ V / P ~ W / P ~ R / P ~ S / P ~ T measurement (see photo)
4. U ~ N / V ~ N / W ~ N / R ~ N / S ~ N / T ~ N measurement (Refer to the picture)
5. If the measured value is significantly different from the normal value, IGBTM abnormal judgment

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]
High pressure switch on board Connector location

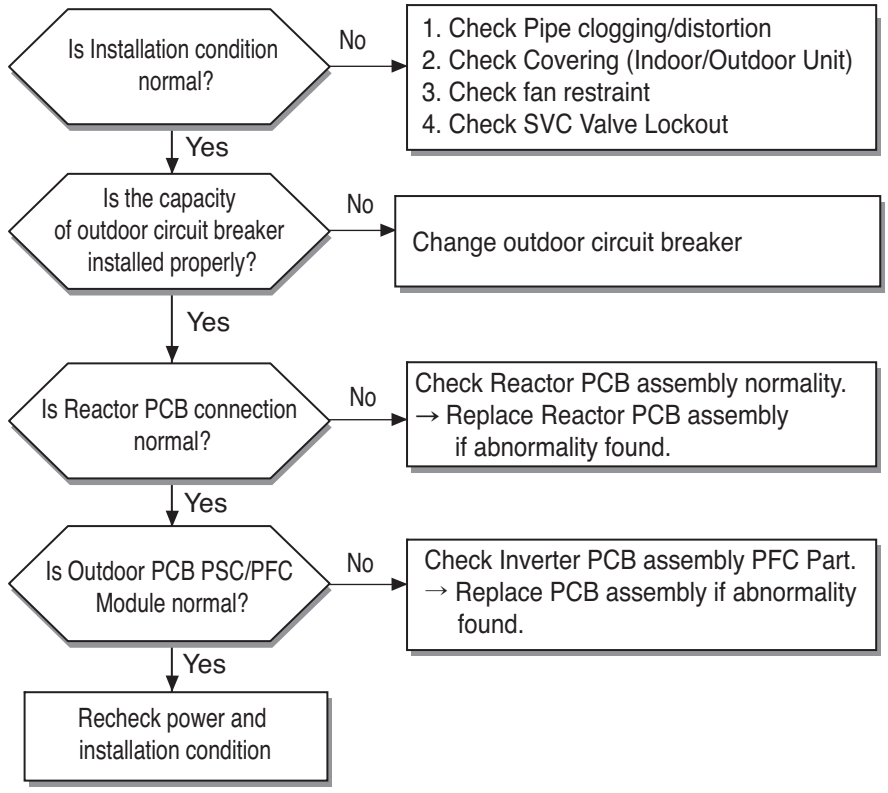


Product High pressure switch

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

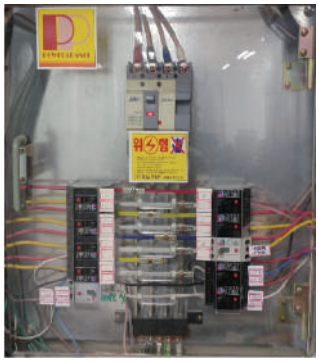
Display code	Title	Description	Cause of error
CH27	PSC / PFC Fault Error	Transfer of signals with detection of the flow of over-current in PSC / PFC	1. Overload Operation (Outdoor Fan Restraint / Blocking / Blocking) 2. Reactor PCB incorrect wiring 3. PCB Internal Components (PFC Module) Burnout

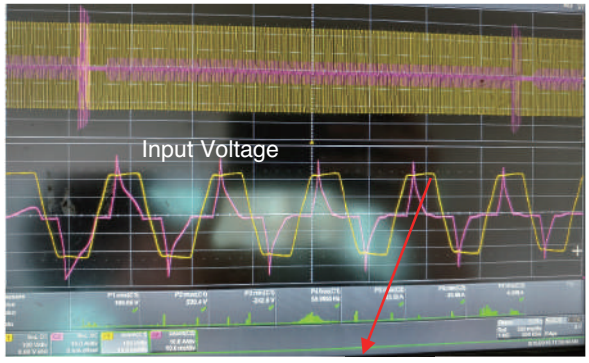
Check Flow Chart



▶ 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.

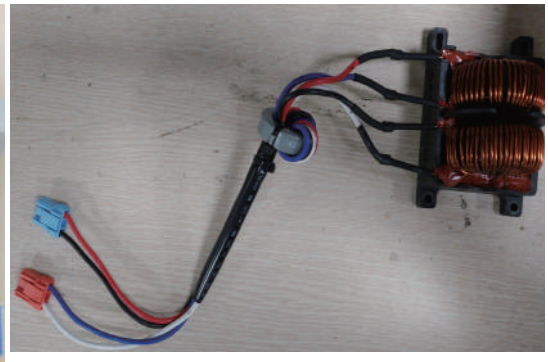




CH23 or CH27 occurs
when input voltage
distortion occurs

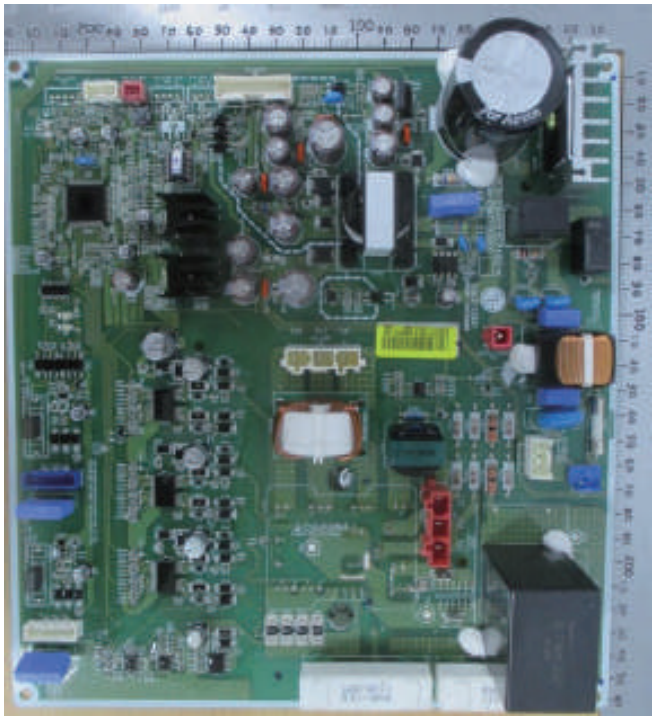
▶ U3(1Ø : 12, 14, 16 kW)

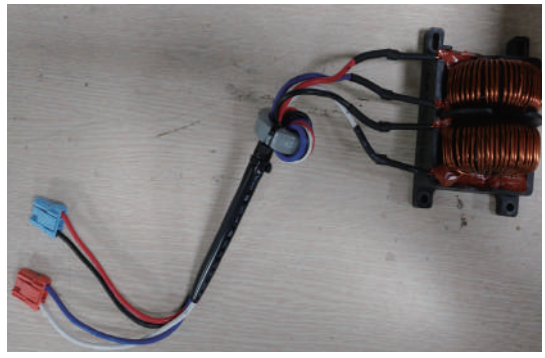
Check Reactor PCB assembly normality.
- Replace Reactor PCB assembly if abnormality found.



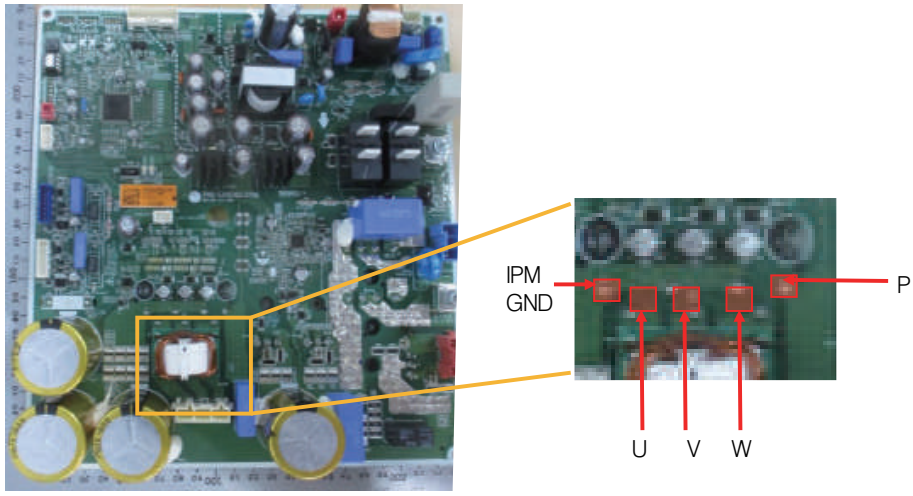
▶ U3(3Ø : 12, 14, 16 kW)

Check Reactor PCB assembly normality.
- Replace Reactor PCB assembly if abnormality found.





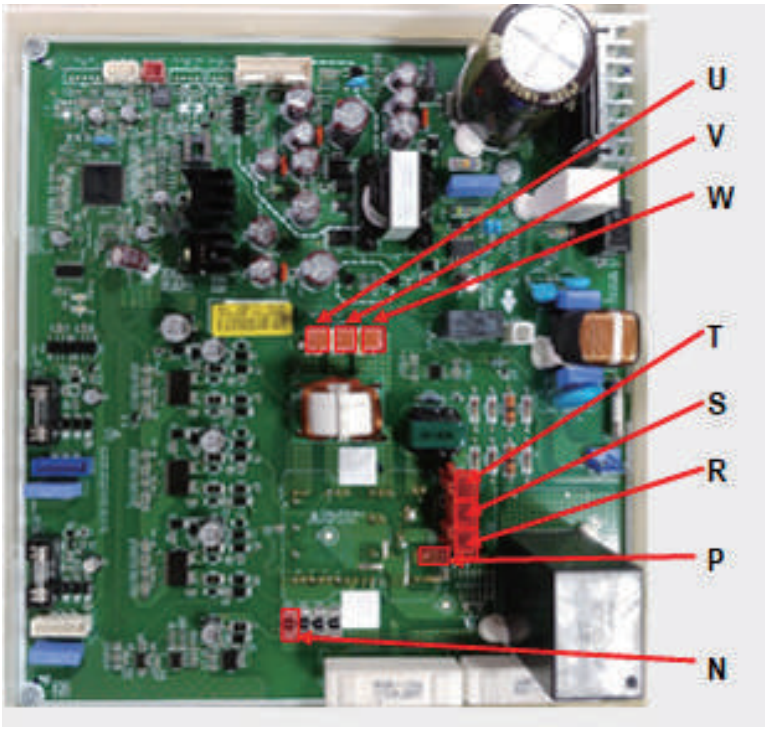
▶ U3(1Ø: 12, 14, 16 kW)



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

▶ U3(3Ø: 12, 14, 16 kW)



Check Point	Multimeter			Measures	
	Mode	Black	Red	Normal	Abnormal
IPM	→|–	P	U	0.3 V ~ 0.7 V	Etc.
			V		
			W		
		U	N		
		V			
		W			
		P	R		
			S		
			T		
		R	N		
		S			
		T			

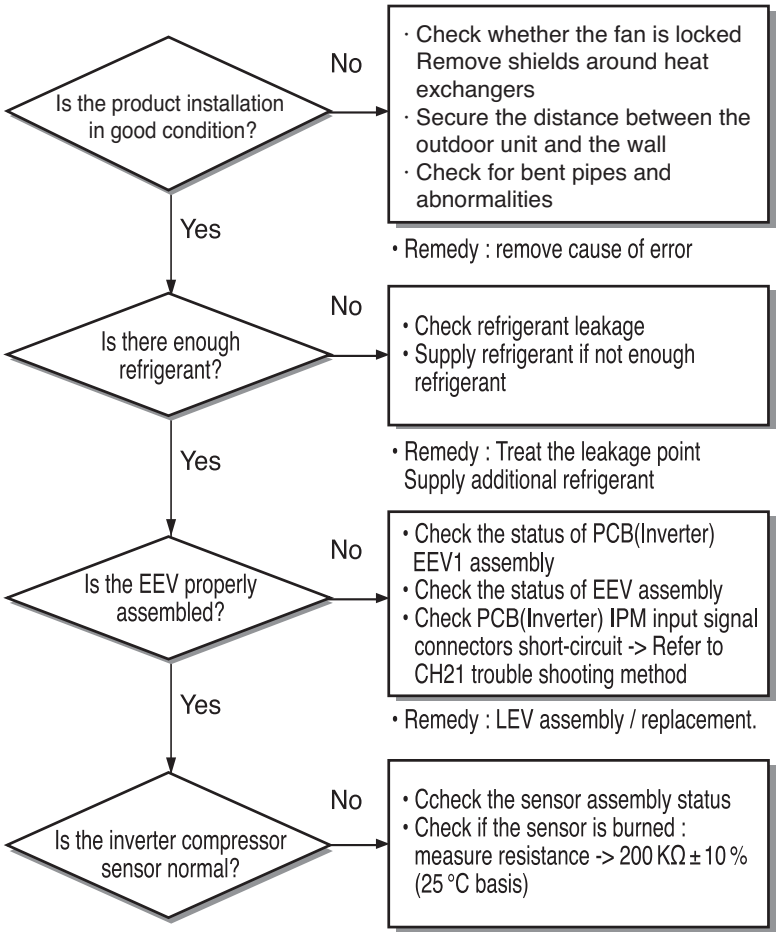
1. Remove PCB connector after power off (PCBA only measurement)
2. Multimeter diode measurement mode setting (→\|–)
3. P ~ U / P ~ V / P ~ W / P ~ R / P ~ S / P ~ T measurement (see photo)
4. U ~ N / V ~ N / W ~ N / R ~ N / S ~ N / T ~ N measurement (Refer to the picture)
5. If the measured value is significantly different from the normal value, IGBTM abnormal judgment

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 defective 5. EEV connector missing / EEV assembly

WARNING

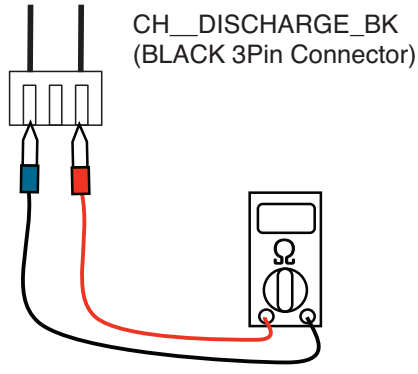
Before checking PCB(Inverter) or each outdoor electric parts, wait for 3 minutes after the power is off. When measuring at standby state of power supply, after checking the measurement mode of the meter, be careful of the short-circuits with other parts.

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 basis
4. Check if the sensor insulation is damaged.
   -> measure the resistance between sensor connector pin and unit assembly pipe. (1 MΩ or more)

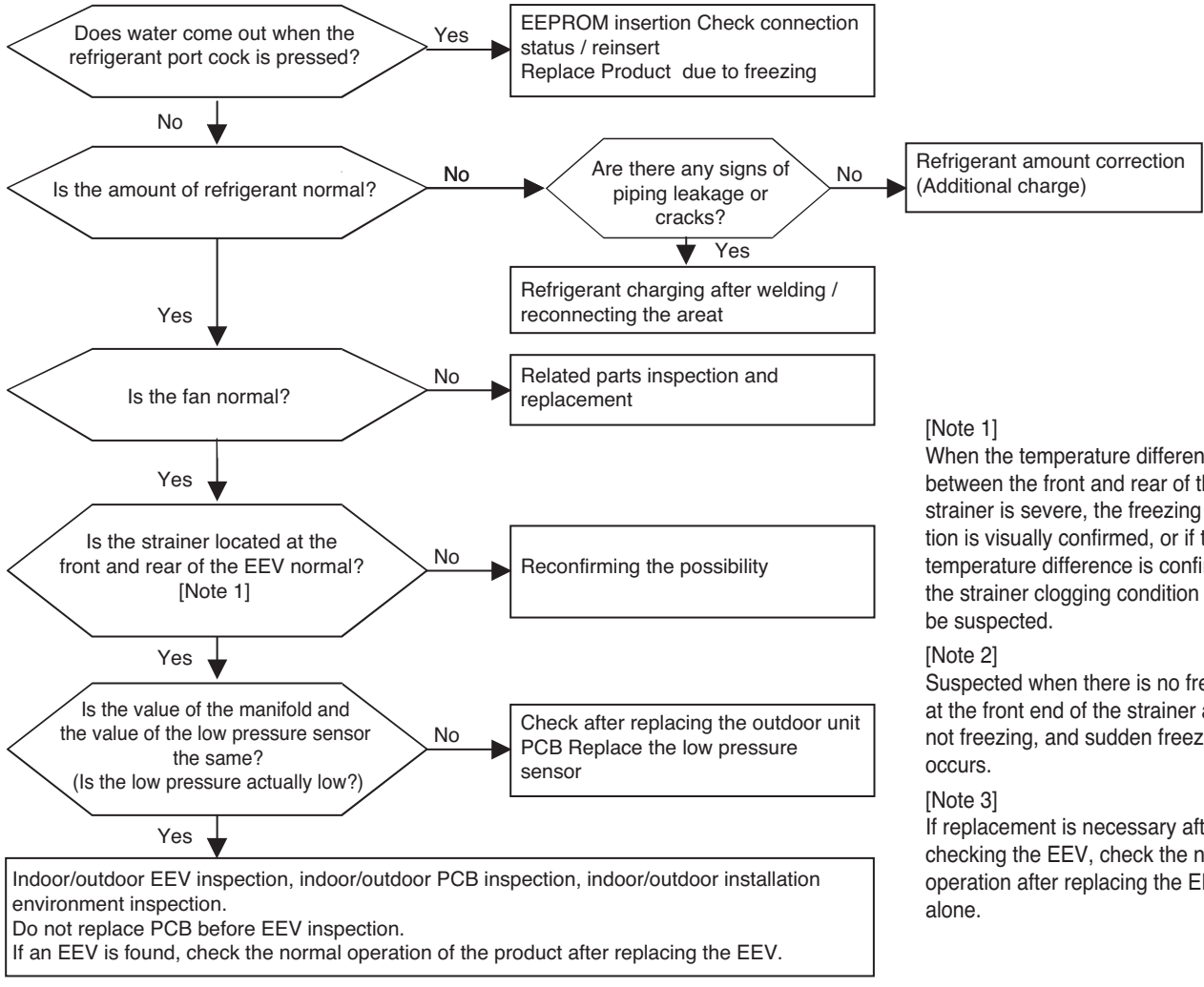


Display code	Title	Description	Cause of error
CH35	Low Pressure Error	Evaporating pressure is excessively low.	1. Pressure sensor Error 2. Outdoor fan Error 3. Shortage of refrigerant or leakage 4. Pipe damage and deformation 5. EEV Errpr 6. Heat exchanger shield (Clogging of indoor filter during cooling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

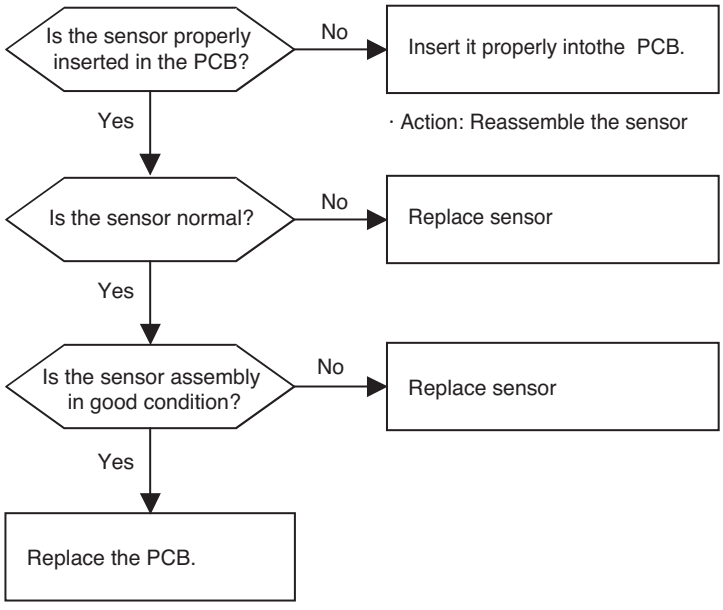
[Note 3]
If replacement is necessary after checking the EEV, check the normal operation after replacing the EEV alone.

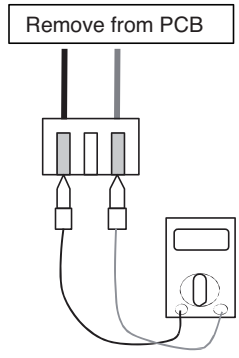
Display code	Title	Description	Cause of error
CH41	D-pipe sensor (Inverter)	Open / short of outdoor unit sensor	1. Check the sensor stewed condition 2. Check for sensor burnout
CH44	Air sensor		
CH45	Condenser Mid pipe sensor		
CH46	Suction Pipe sensor		
CH48	Const-D-Pipe Sensor Error		
CH65	Heatsink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

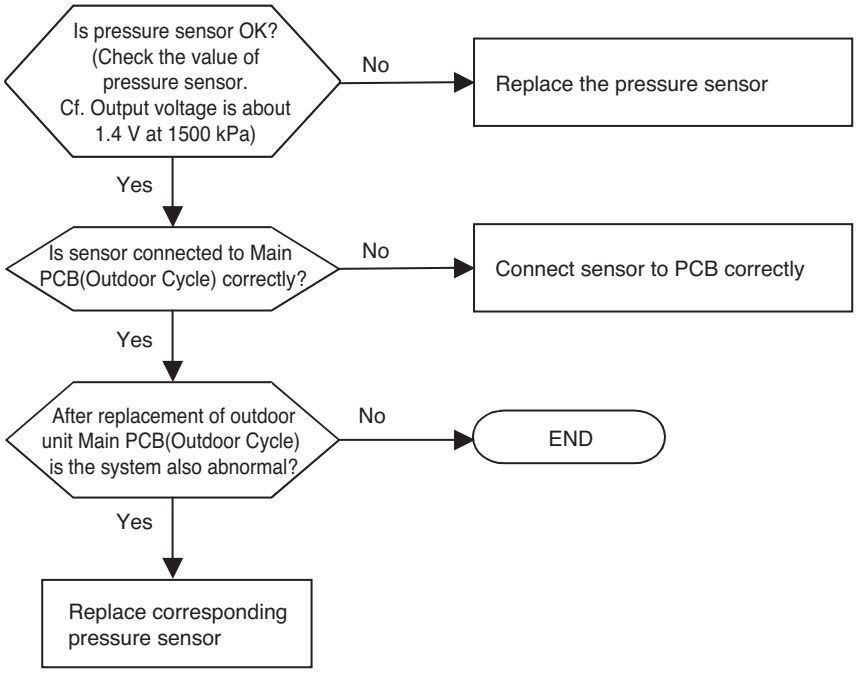




Temp	Air sensor	Pipe sensor	D-pipe sensor
	Resistance value	Resistance value	Resistance value
10 °C(50 °F)	20.7 kΩ	10 kΩ	362 kΩ
25 °C(77 °F)	10 kΩ	5 kΩ	200 kΩ
50 °C(122 °F)	3.4 kΩ	1.8 kΩ	82 kΩ

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. Defect of high pressure connector (Open/Short) 4. Defect of connector Main PCB(Outdoor) (Open/Short) 5. Defect of Main PCB(Outdoor)

Check Flow Chart

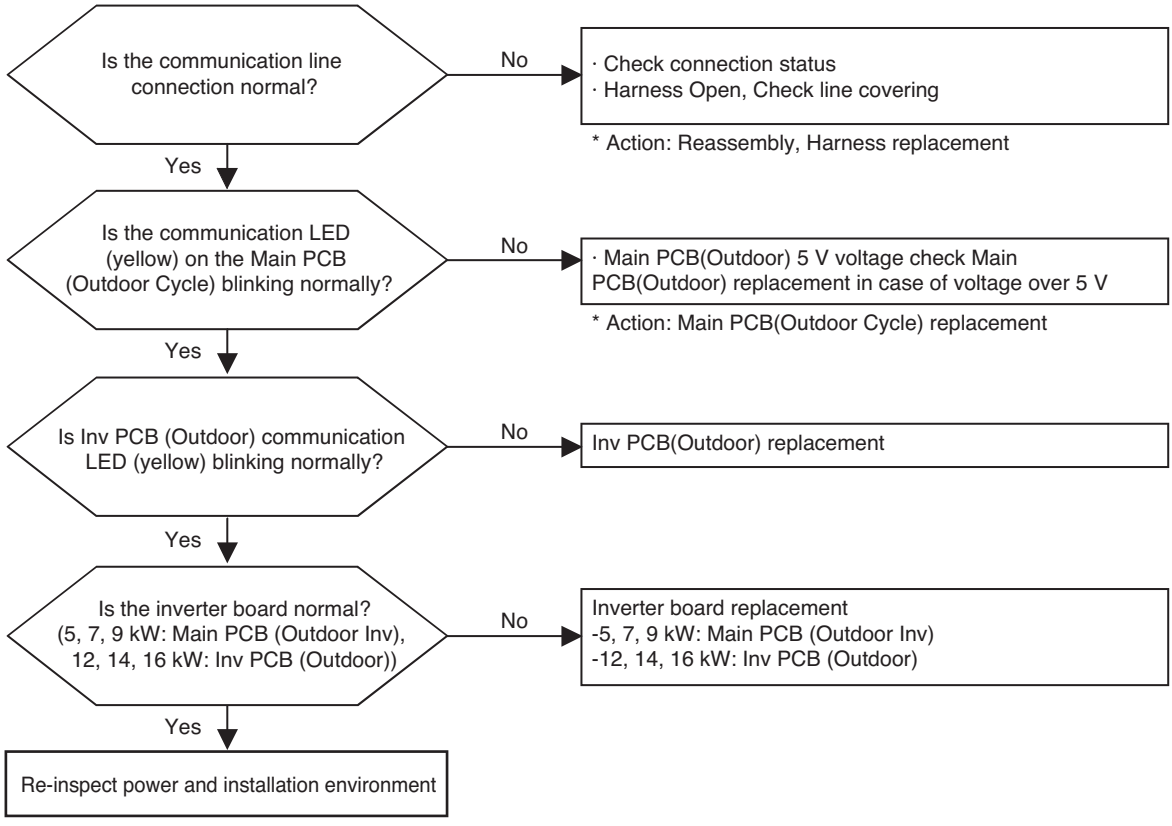


Display code	Title	Description	Cause of error
CH52	Communication Error Inv PCB(Outdoor) ↔ Main PCB(Outdoor Cycle)	It is failed to receive wired Inv PCB(Outdoor) signal in Main PCB(Outdoor Cycle).	1. Communication line connection failure 2. Harness of communication line failure 3. Standby power control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

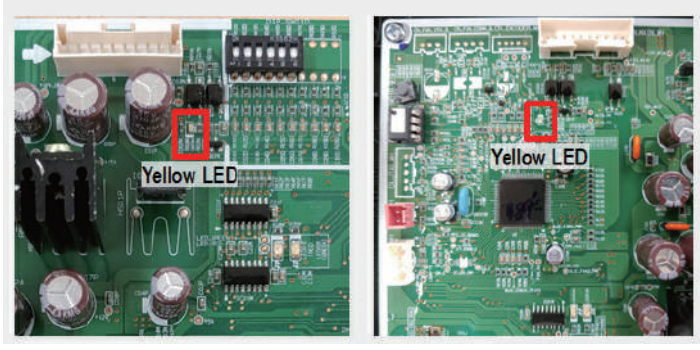
WARNING

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

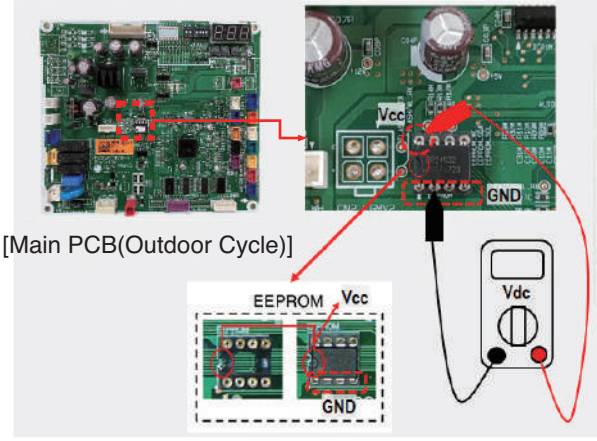


How to check communication LED



[Main PCB(Outdoor Cycle)] [Inv PCB(Outdoor)]

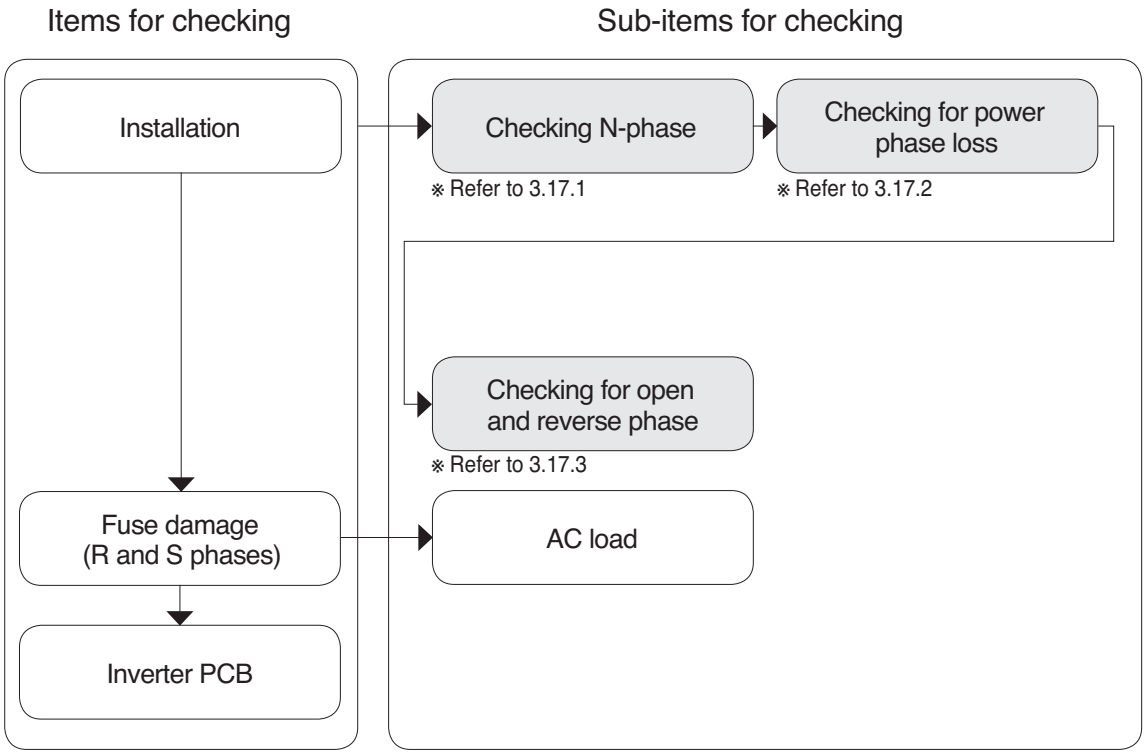
Main PCB EEPROM voltage measurement method



[Main PCB(Outdoor Cycle)]

Display code	Title	Description	Cause of error
CH54	RST Reverse Phase Detection Error	Wiring fault is occurred. – reverse phase (only 3-phase model)	Prevention of phase unbalance and prevention of reverse rotation of constant-rate compressor

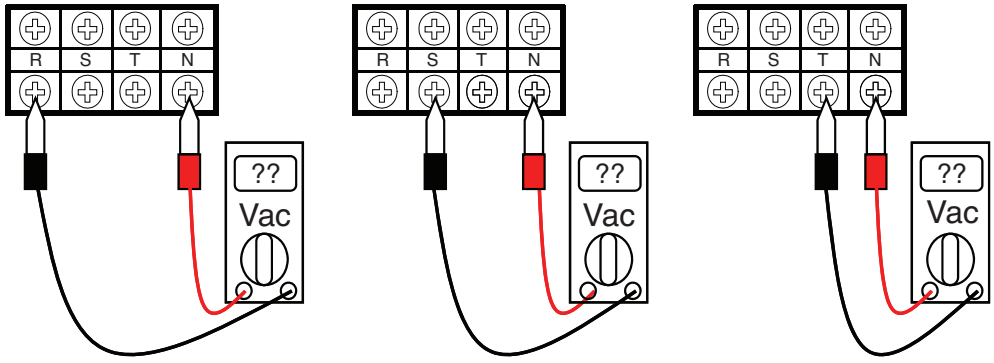
Check Flow Chart



▶ U3 (3Ø : 12, 14, 16 kW)

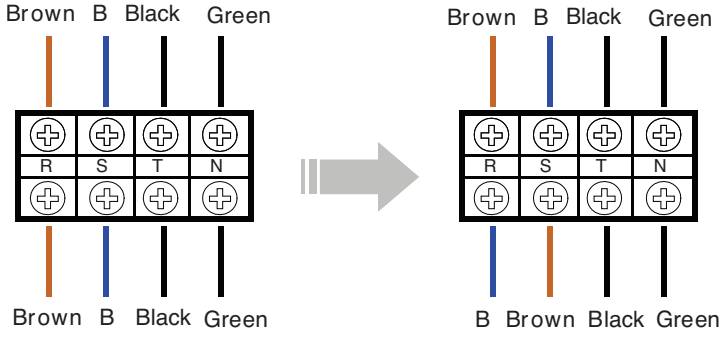
Judgment Method of R,S,T phase loss

- Set the tester in AC voltage measurement mode (The part having wave pattern)
- The part that does not generate voltage was upgraded.
- Power module requires checking.



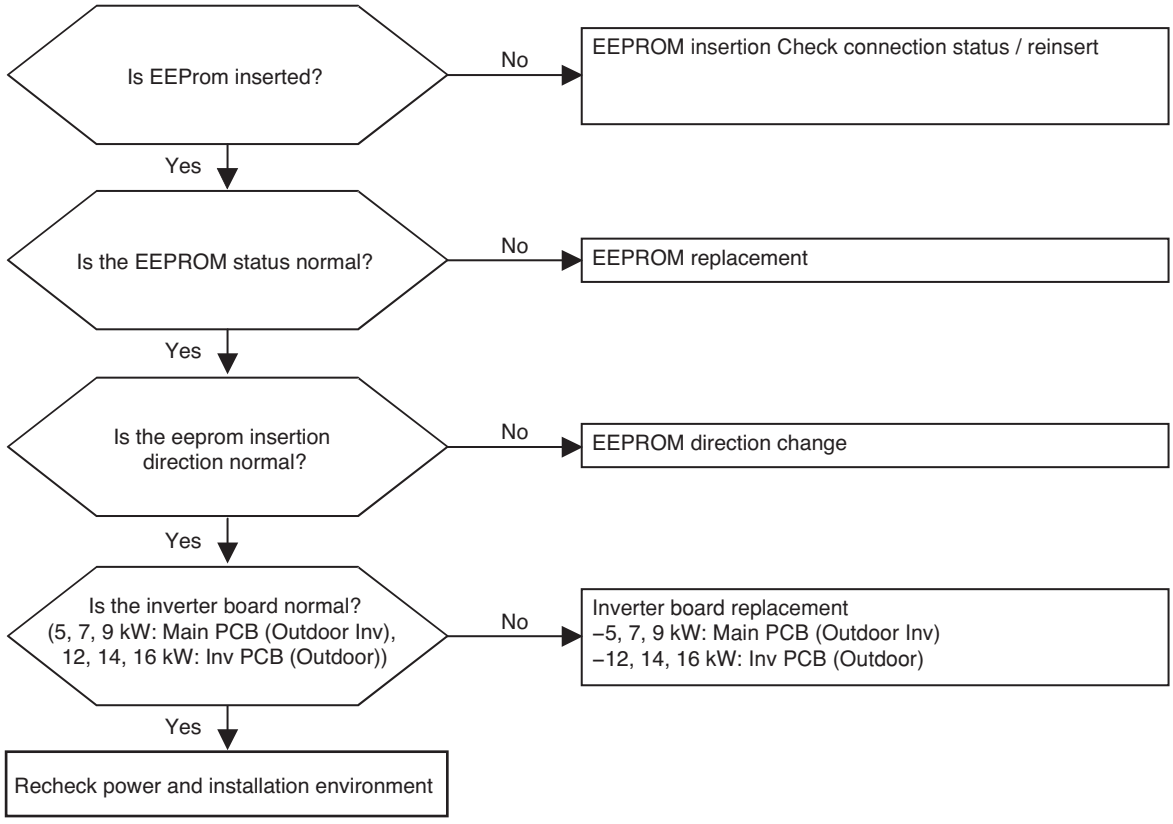
Judgment method of open and reverse phase of R,S,T

- Operation with replacement of R and S phases only



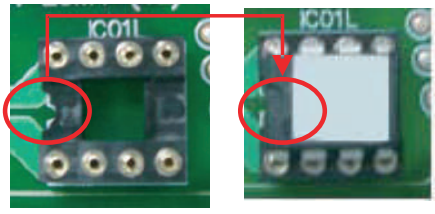
Display code	Title	Description	Cause of error
CH60	Outdoor EEPROM Error	EEPROM access error and Check SUM error	1. Bad EEPROM contact / wrong insertion 2. EEPROM version is different 3. Outdoor unit PCB failure

■ Error Diagnosis and Countermeasure Flow Chart



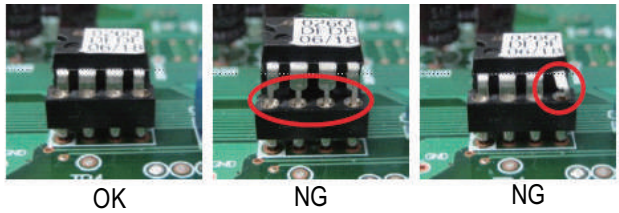
■ How to check the EEPROM error

EEPROM correct insertion direction



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

Note: Turn off the power and replace the EEPROM.



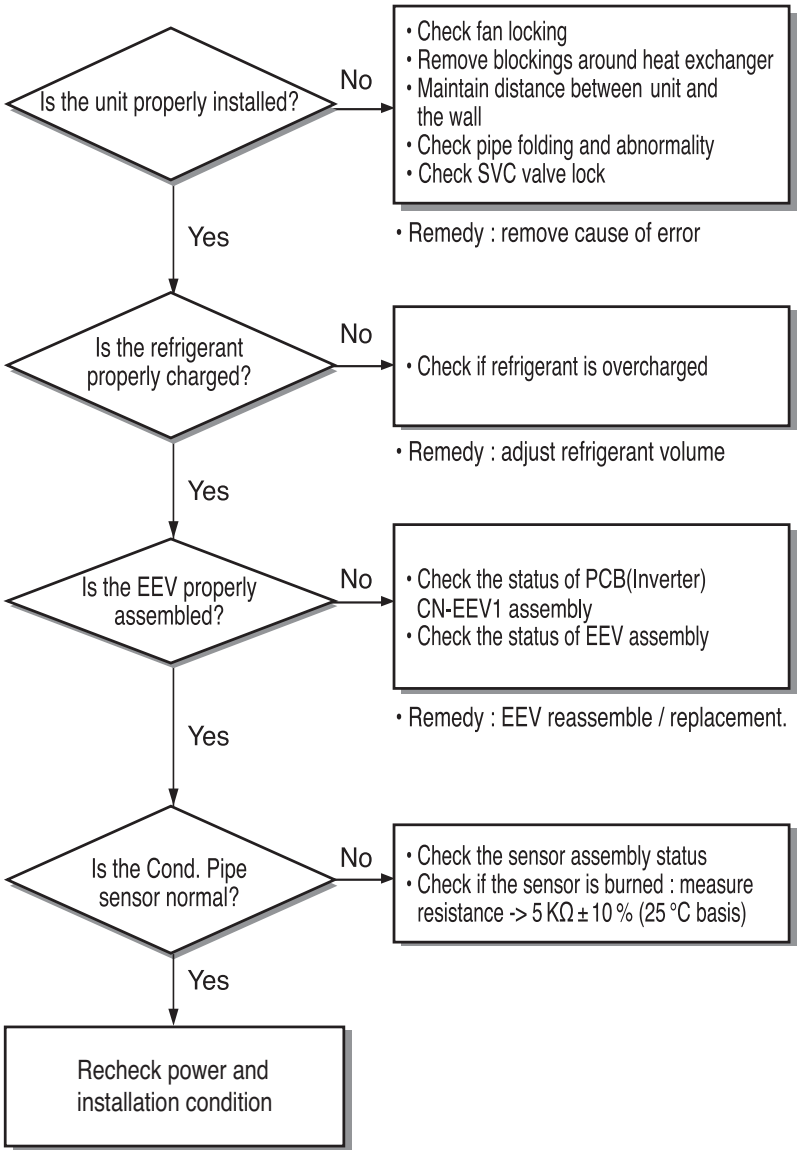
OK NG NG

	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)

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

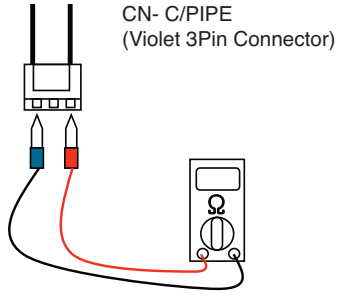
WARNING

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.



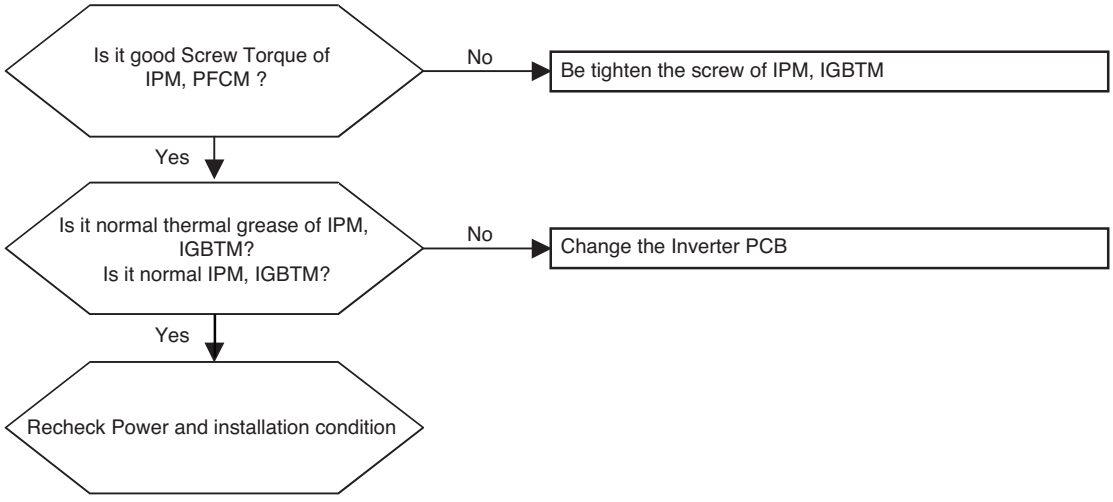
• Inspecting Cond. Pipe Sensor

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 5 kΩ ± 10 %, 25 °C basis
4. Check if the sensor insulation is damaged. -> measure the resistance between sensor connector pin and unit assembly pipe. (1 MΩ or more)



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 defective. 4. Overload operation.

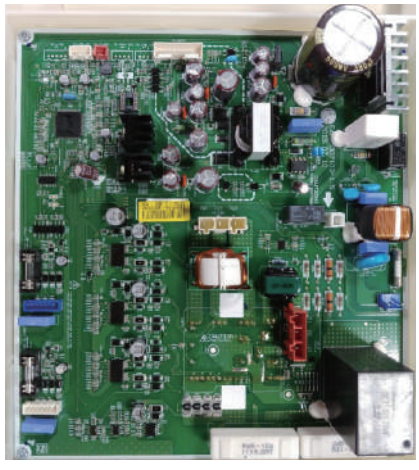
■ Error Diagnosis and Countermeasure Flow Chart

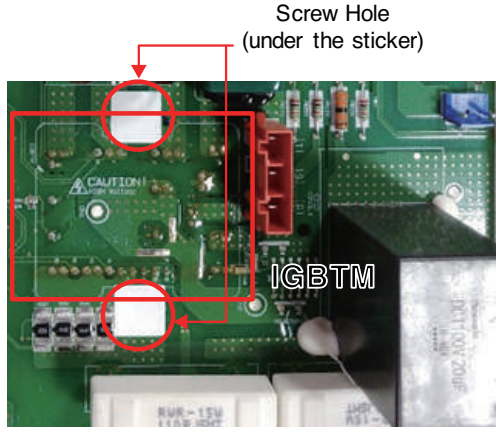


Check Point

- Check connection condition of IPM/IGBTM and Heatsink

-U3 (3Ø : 12, 14, 16 kW)

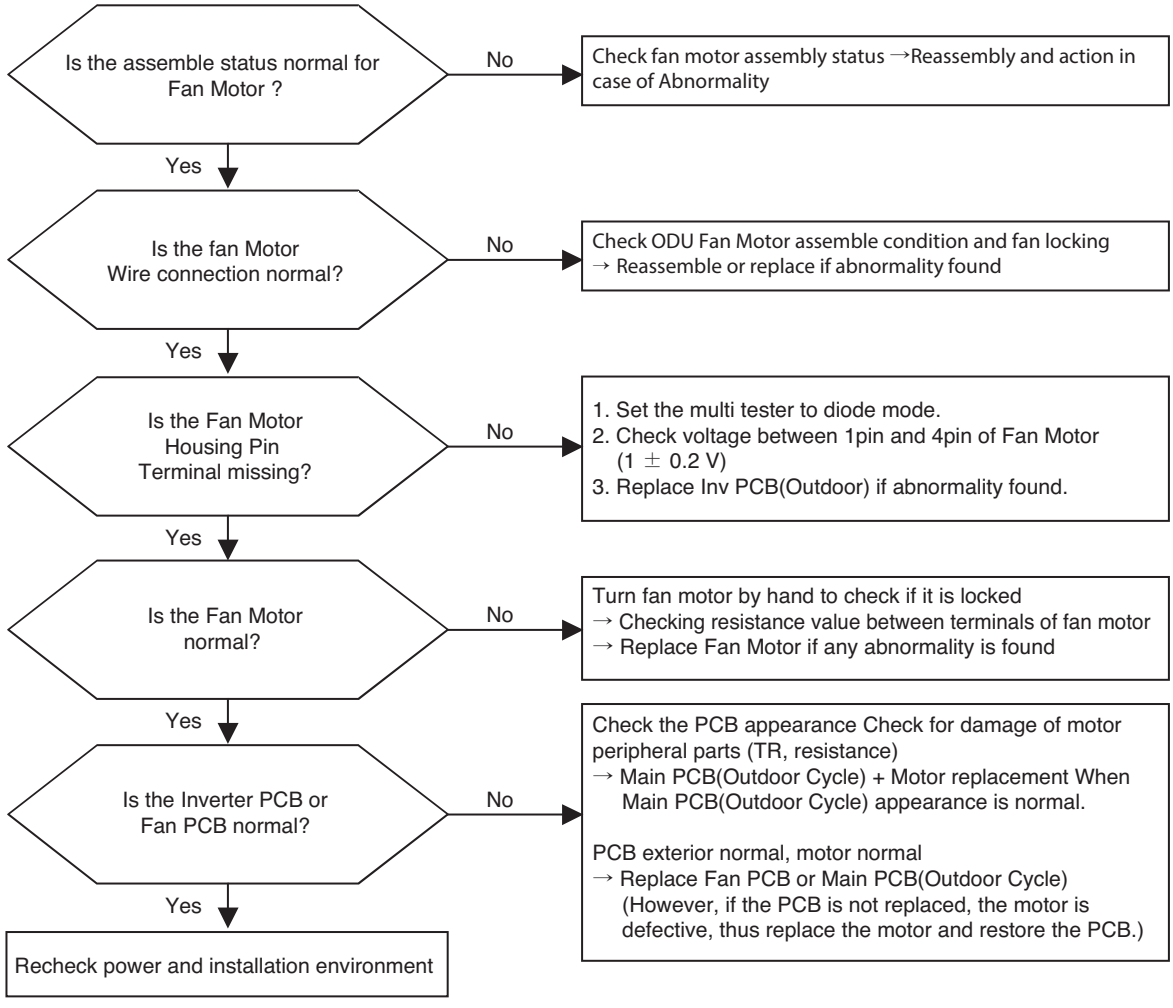




Error code	Title	Description	Cause of error
CH67	Outdoor Fan lock	Fan RPM is 10RPM or less for 5 seconds when ODU fan starts or 40 RPM or less after fan starting.	1. Bad Motor / Poor assembly. 2. Misconnection Fan Motor connector. 3. Rotation in reverse direction after speed command. 4. Bad Fan Board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

■ Error Diagnosis and Countermeasure Flow Chart

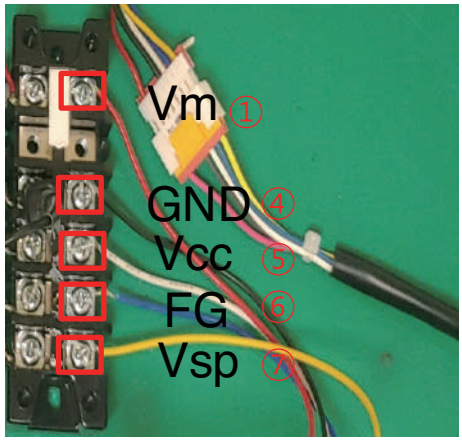
※ If the fan motor is not running in the beginning, must rotate the fan by using hand.
(Rotating fan by hand → must be replaced due to defect of the fan motor)

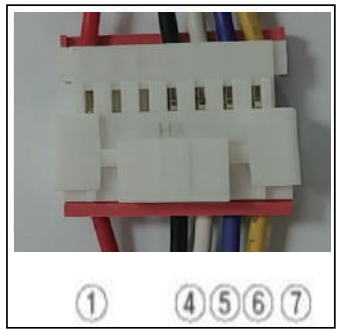


■ How to measure resistance between terminals

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)	P/No.	U-V [Ω]	U-W [Ω]	V-W [Ω]
5, 7 , 9	EAU62543703	43.1±5%		
12, 14, 16	EAU62543703	43.1±5%		
	EAU62543704	43.1±5%		

* 25°C standard

P/NO : MFL68682007