

AQUA



1U48NC1QRB

1U48NC1QAB

Service Manual

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1. Specification

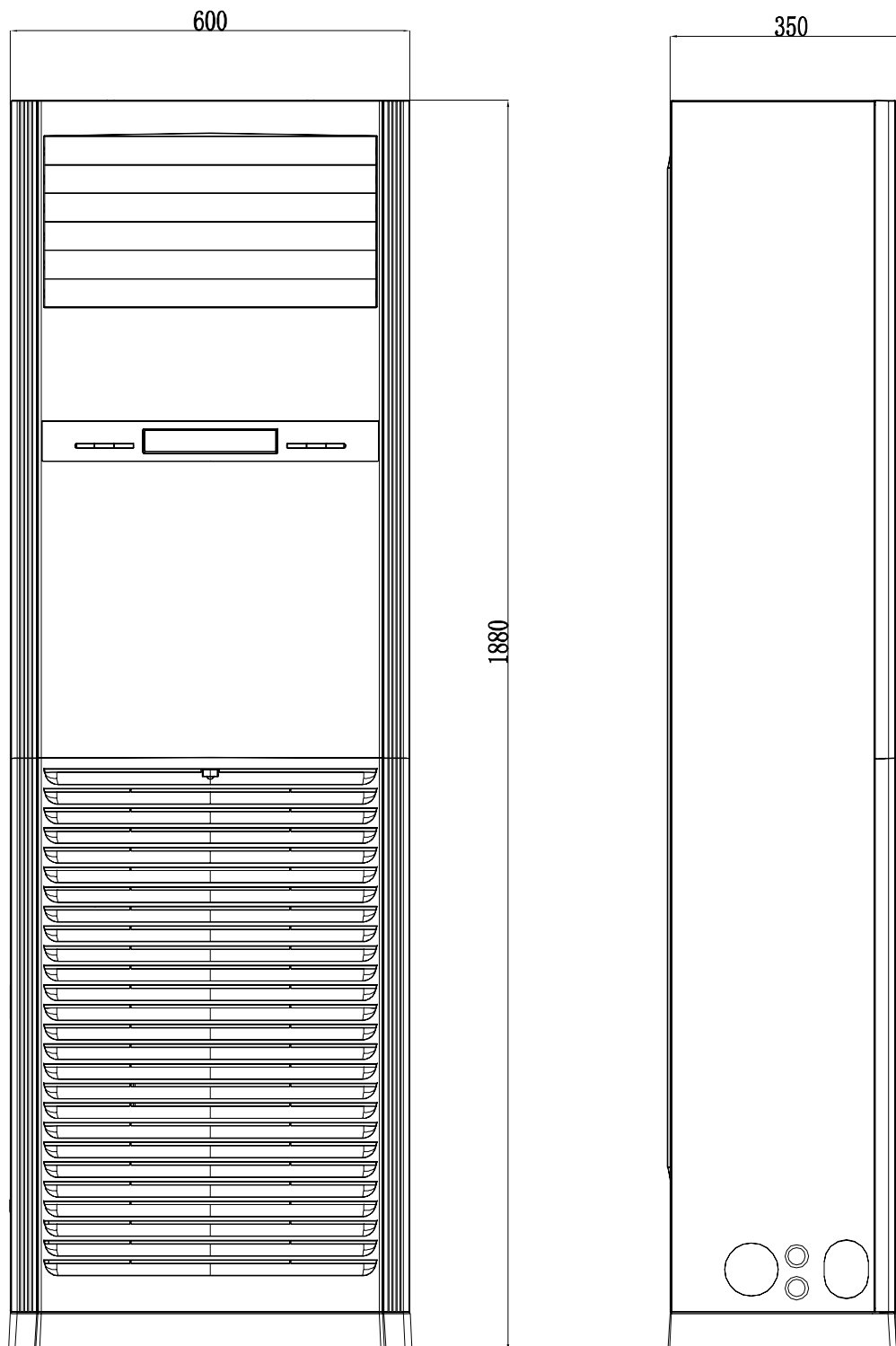
Factory Model		IDU	AP48KC1QRA 1U48NC1QAB	AP48KC1QRA 1U48NC1QRB
Power supply		V-ph-Hz	230-1-50	230-1-50
Cooling	Capacity	Btu/h	45731	47792
	Capacity	W	13400	14000
	EER	W/W	3.04	2.97
Indoor fan motor	Model		Y7S059B802	Y7S059B802
	Qty		1	1
	Input	W	110	110
	Capacitor	uF	8uf 450V	8uf 450V
	Speed(hi/mi/lo)	r/min	480/450/410/350	480/450/410/350
Indoor coil	a.Number of rows		2	2
	b.Tube pitch(a)x row pitch(b)	mm	21×18.186	21×18.186
	c.Fin spacing	mm	1.4	1.4
	d.Fin type (code)		Hydrophilic aluminium	Hydrophilic aluminium
	e.Tube outside dia. and type	mm	φ7 / Inner grooved	φ7 / Inner grooved
	f.Coil length x height x width	mm	924×480×36.372	924×480×36.372
	g.Number of circuits		11	11
Indoor air flow (Hi/Med/Lo)		m ³ /h	2050/1800/1700/1500	2050/1800/1700/1500
Sound level		dB(A)	53/48/45/42	53/48/45/42
Throttle type			In ODU	In ODU
Indoor unit	Dimension (W/D/H) (body)	mm	600×350×1850	600×350×1850
	Packing (W/D/H) (body)	mm	693/448/2035	693/448/2035
	Net/Gross weight(body)	kg	59/67	59/67
Design pressure		MPa	4.3/1.5	4.3/1.5
Drainage water pipe dia.		mm	37	37
Refrigerant piping	Liquid side/Gas side	mm	9.52/19.05	9.52/19.05
Controller			Remote control	Remote control
Operation temperature		°C	16 ~ 30	16 ~ 30
Room temperature	Cooling	°C	18 ~ 32	18 ~ 32
Qty'per 20' /40' /40'HQ			54/110/125	54/110/125

Factory Model		Cooling only	1U48NC1QRB	1U48NC1QAB
Power supply		V-ph-Hz	400-1-50	400-1-50
Power input		W	4700	4400
current		A	7.4	7.1
Max. input consumption		W	5900	5700
Max. input current		A	10	9.5
Compressor	Model		ATH307CDPC8DQ	LN48YRNCM
	Type		ROTARY	ROTARY
	Brand		Shanghai Highly	mitsubishi
	Capacity	W	8600	12092
	Input	W	2775	4038
	Rated current(RLA)	A	9.48	7.17
	Locked rotor Amp(LRA)	A	/	/
	Thermal protector position		INTERNAL	ON-OFF
	Capacitor	μF	/	/
	Refrigerant oil	ml	1050	750
Outdoor fan motor	Model		Y6S688B810	Y6S688B810
	Qty		1	1
	Input	W	85	85
	Capacitor	μF	5uf	5uf
	Speed	r/min	850/520	850/520
Outdoor coil	Number of rows		2	2
	Tube pitch(a)* row pitch(b)	mm	21×18.186	21×18.186
	Fin spacing	mm	1.45	1.45
	Fin type		Hydrophilic aluminium	Hydrophilic aluminium
	Tube outside dia.and type	mm	φ7 / Inner grooved	φ7 / Inner grooved
	Coil length * height * width	mm	940×714×36.37	940×714×36.37
	Number of circuits		7	7
Outdoor noise level (sound pressure)		dB(A)	61	61
Throttle type			EEV	Capillary
Outdoor unit	Dimension(W/D/H)	mm	965×950×370	965×950×370
	Packing(W/D/H)	mm	1050*485*1130	1050*485*1130
	Net/Gross weight	kg	78/90	81/92
Refrigerant type/Quantity	Type		R410A	R410A
	Charged volume	kg	2.7	2.5
Design pressure		MPa	4.3/1.5	4.3/1.5
Refrigerant piping	Liquid side/ Gas side	mm(inch)	9.52/19.05	9.52/19.05
	Max. pipe length	m	30	30
	Max. difference in level	m	20	20
Ambient temperature	Cooling	°C	18~60	18~53

2. Dimension

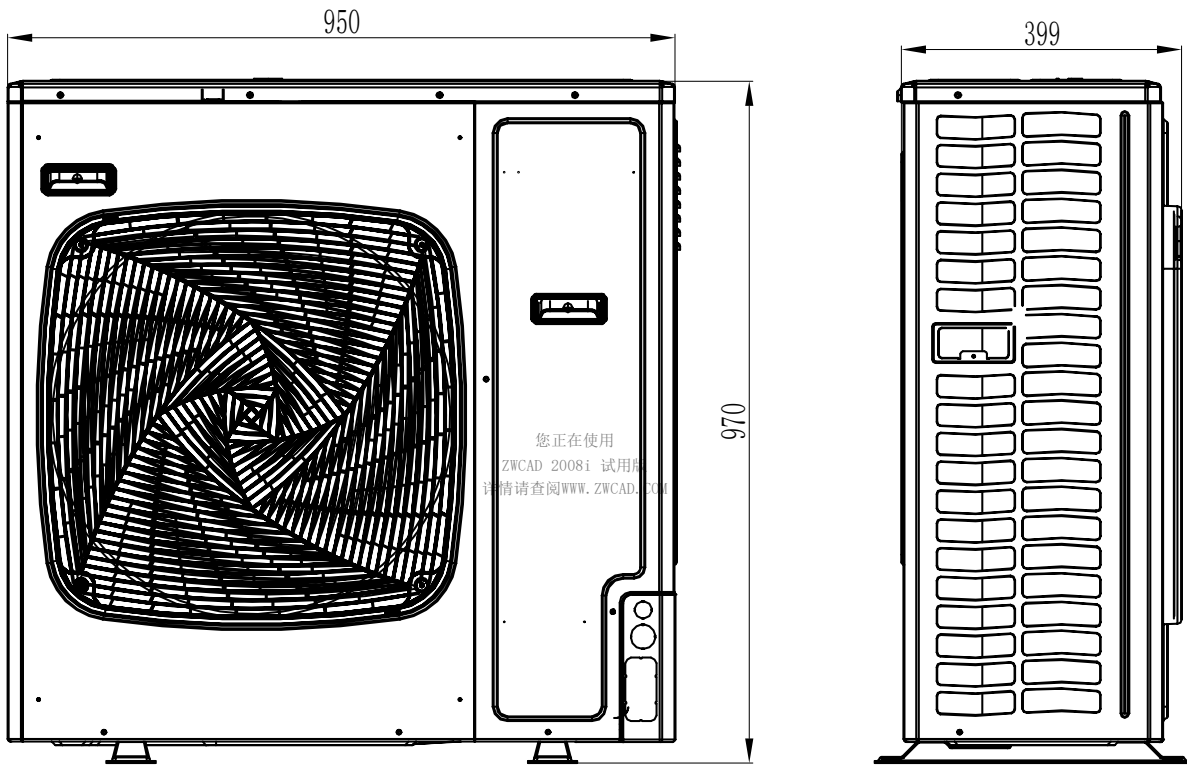
Indoor

AP48KC1QRA



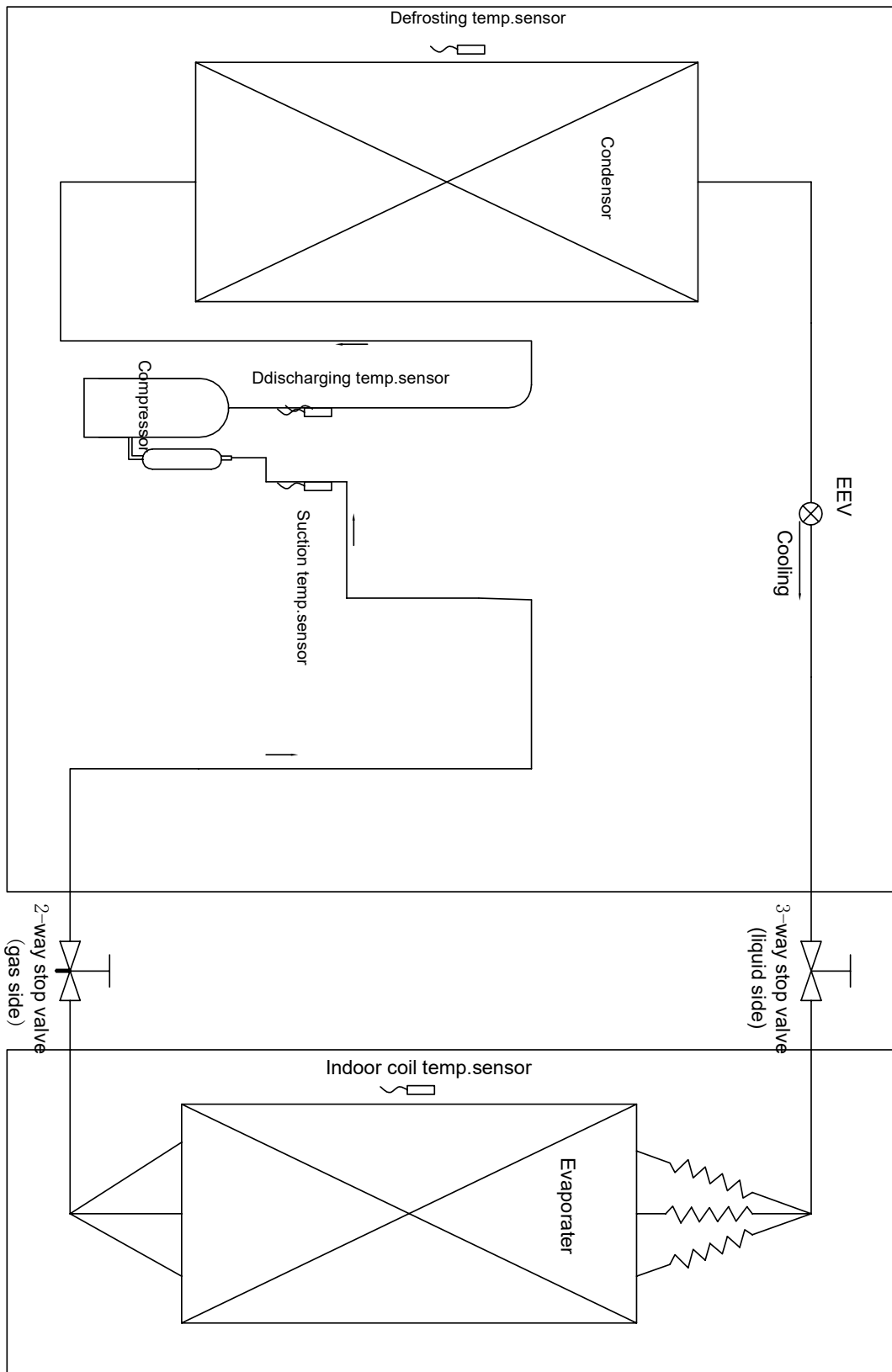
Outdoor

1U48NC1QAB 1U48NC1QRB

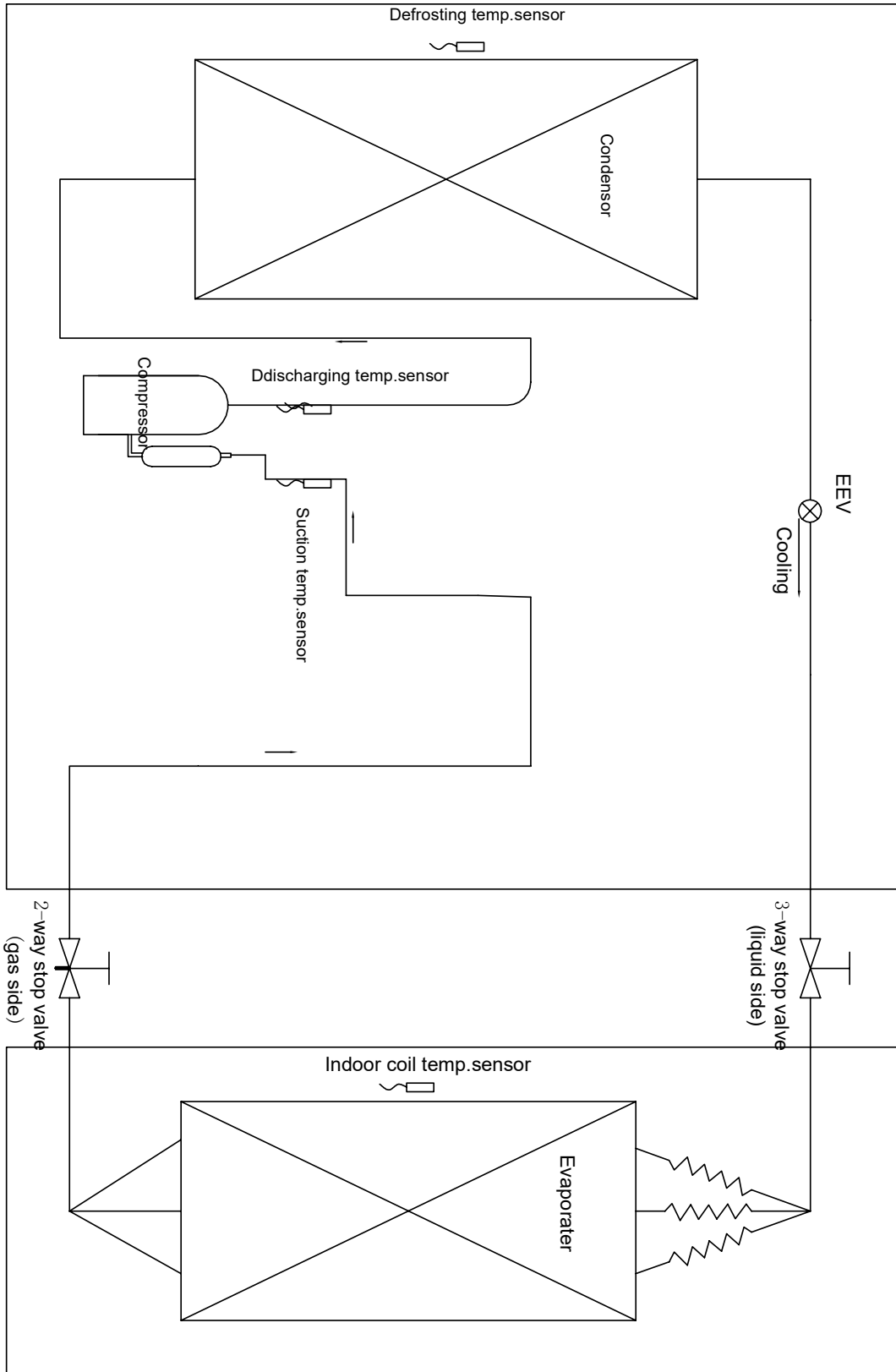


3. Piping diagram

1U48NC1QAB

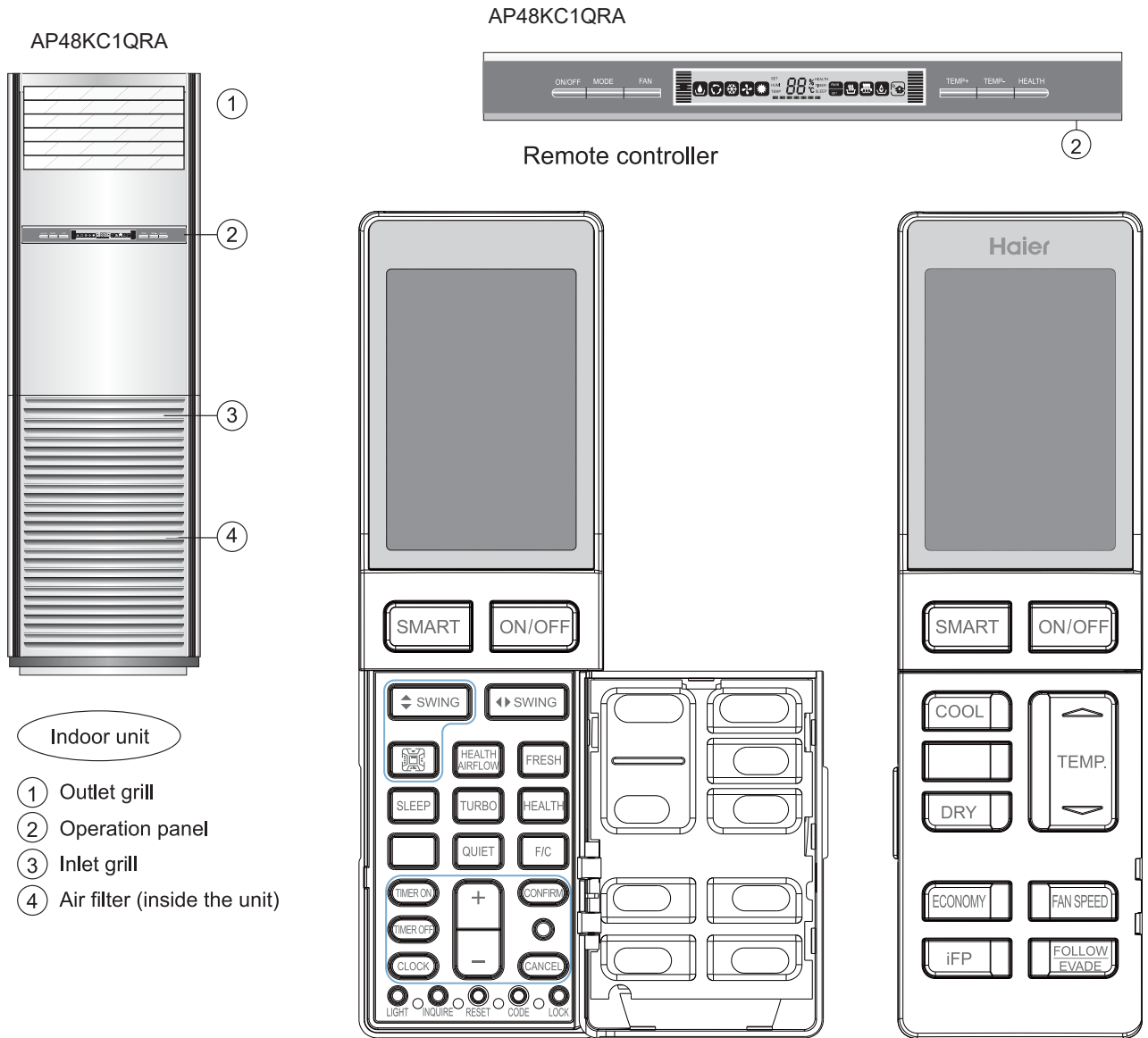


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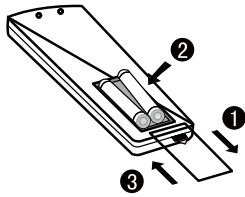


4. Installation

4.1 Cabinet installation



Loading of the battery



1. Remove the battery cover
2. Insert 2 AAA batteries as illustrated noting battery polarity
3. Reinstall the battery cover

Note:

The distance between the signal transmission head and the receiver hole should be within 7m without any obstacle as well.

When electronic-started type fluorescent lamp or change-over type fluorescent lamp or wireless telephone is installed in the room, the receiver is apt to be disturbed in receiving the signals, so the distance to the indoor unit should be shorter.

Full display or unclear display during operation indicates the batteries have been used up. Please change batteries.

If the remote controller can't run normally during operation, please remove the batteries and reload several minutes later.

Hint:

Remove the batteries in case won't be in use for a long period. If there is any display after taking-out, just press reset key.

Functional description:

1. Power-up and Show All: the LCD display shows all symbols in this function. 3s later, it just shows time and the initial time is AM 12:00. The initial time is adjustable and will be confirmed automatically 10s later.

2. ON/OFF Button: press the button for power on. The initial default mode is SMART, otherwise it will be the mode before power OFF. Press OFF button after power on.

3. SMART Button:

(1) SMART button is always valid during power ON/OFF;

(2) Press SMART button to execute power OFF in SMART mode;

(3) In OFF and other modes, press SMART button to enter initial default setting of SMART mode. LCD setting temperature is not showed;

(4) In SMART mode, press TEMP. +/- button to show the setting temperature.

4. COOL Button and DRY Button

(1) When the remote controller in ON, press COOL button and DRY button to execute COOL mode and DRY mode.

(2) For initial power-up, temperature and fan speed will be showed as follows when entering each mode, otherwise parameters set last time will be showed;

Mode	SMART	COOL	DRY	FAN
Initial TEMP.	24°C	24°C	24°C	Setting temperature is not showed.
Mode	SMART	COOL	DRY	FAN
Initial Fan Speed	AUTO	HI	AUTO	LOW

5. FAN Mode

(1) During power OFF, press "HEALTH" button or "FRESH" button to enter FAN mode with low fan speed. Meanwhile, the HEALTH or FRESH icon will be showed on the screen.



(2) Temperature is not showed in FAN mode.

(3) Auto fan speed is not available when switching fan speed in FAN mode.

6. FAN SPEED Button:

(1) In other modes except for Fan mode, LOW, MED, HI and AUTO fan speed is adjustable, switching sequence is as LOW-MED-HI-AUTO-LOW.



(2) After TURBO or QUIET is set. Press TURBO button to show **TURBO** on the screen with fan speed as , then press "FAN SPEED" button to exit; press QUIET button to show **QUIET** on the screen with fan speed as , then press "FAN SPEED" button to exit. To cancel TURBO and QUIET, press TURBO and QUIET buttons respectively, **TURBO** and **QUIET** icons will disappear and the fan speed will return to the last one.

(3) This button is invalid during power OFF.

7. TEMP. +/- Button:

- (1) This button is invalid in FAN mode;
- (2) Temperature adjustment range in SMART, HEAT, COOL and DRY mode: 16 ~30°C.
- (3) Press and hold "TEMP. +/- " button, the temperature changes once; long press the button, the temperature changes rapidly.

8. Four-side Embedment (Available for some models):



(1) Initial position of all modes for first power on::

	SMART	HEAT	COOL	DRY	FAN
Four-side Embedment	Show all	Show all	Show all	Show all	Show all
SWING Angle	Position 3	Position 5	Position 3	Position 3	Position 3

(2) After power on, press "Four-side Embedment" button for the first time and the recycle approach is as follows: four-side simultaneous control of Four-side Embedment → Four-side Embedment 1 → Four-side Embedment 2 → Four-side Embedment 3 → Four-side Embedment 4 → Four-side simultaneous control of Four-side Embedment.

(3) When pressing "Four-side Embedment" button to select air deflector, the selected air deflector flashes. Press "Up-and-down Angle" button to adjust angle of air deflector at the moment.

9. Up-and-down SWING Angle:



1: Position 1; 2: Position 2; 3: Position 3; 4: Position 4; 5: Position 5; 6: Position 6 (reserved)

Recycle approach: Position 1 → Position 2 → Position 3 → Position 4 → Position 5 → AUTO → Position 1

Free swing: 1 → 2 → 3 → 4 → 5 → 4 → 3 → 2 → 1 is showed circularly.


10. Right-and-left SWING Angle (Available for some models):

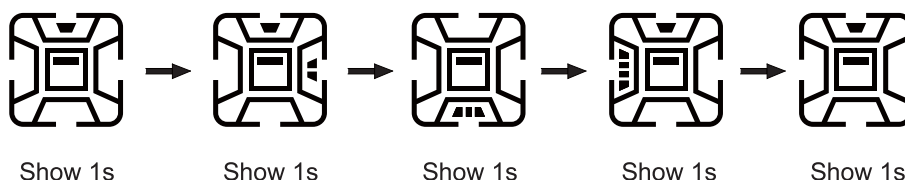
Recycle approach: 34 showed (Position 1) → 25 showed (Position 2) → 16 showed (Position 3) → 1 showed (Position 4) → 2 showed (Position 5) → 5 showed (Position 6) → 6 showed (Position 7) → Auto swing

Auto swing approach: 1 → 2 → 3 → 4 → 5 → 6 → 5 → 4 → 3 → 2 → 1 are showed circularly.



11. HEALTH AIRFLOW (Available for some models):



Press "HEALTH AIRFLOW" button to show  icon on LCD display. Each air deflector of swings on four sides alternates circularly to indicate that the swing rotates to exhaust air. Meanwhile, up-and-down SWING angle shows AUTO SWING. Press it again to cancel HEALTH AIRFLOW.




12. SLEEP:

- (1) Valid during power on.
- (2) The SLEEP time is fixed to 8 hours and is not adjustable.
- (3) It is invalid in FAN mode. When setting TIMER ON or TIMER ON to TIMER OFF after setting SLEEP function, once the timer setting is successful, the SLEEP function will be cancelled; after setting TIMER ON or TIMER ON to TIMER OFF, the SLEEP function cannot be set. SLEEP function can be set from TIMER OFF to TIMER ON, TIMER OFF and SLEEP function have priority in canceling the opposite side.







13. HEALTH:

- (1) During power-on or power-OFF, press "HEALTH" button to display icon  on LCD display, and press "HEALTH" button again to cancel.
- (2) During power-OFF, press "HEALTH" button to enter blowing-in mode, start low wind and HEALTH mode, display icon .
- (3) Switch among modes, and keep HEALTH function.
- (4) If HEALTH function is set, power OFF and then on to stay in HEALTH mode.




14. ECO:

- (1) Press ECO button and the display will show .
- (2) ECO is valid under all modes, it is memorized among switch of all modes.
- (3) ECO function power-on or power-OFF is memorized.


15. Turbo/Quiet:

- (1) Press button "Turbo", display icon  on remote LCD display, display icon  of fan speed; Press button "Quiet", display icon  on remote LCD display, display icon  of fan speed.
- (2) Turbo and QUIET functions can not exist at the same time, the latter will replace the former.
- (3) If Turbo function is set, press "SLEEP" button to exit turbo, which means that setting SLEEP function while canceling turbo function. At the same time, the icon  disappears and icon  is shown; if QUIET function is set at present, press button "SLEEP" while QUIET function is still kept.
- (4) This function is valid under the mode of COOL or HEAT.
- (5) Turbo/QUIET functions are not memorized among switch of all modes/the state of on or OFF.

16. IFP:

- (1) Press "IFP" button, display , IFP function is set, and press "IFP" button again to cancel.
- (2) Press "Follow/Evade" button, display  that expresses following; press it again, display  that expresses evading. Press it the third time to cancel.
- (3) If follow/evade functions are set, air-out angle will change with position of people, so after setting these functions, Four-side Embedment icons in all sides, up-and-down SWING and left-and-right SWING icons will disappear.
- (4) If air conditioner is in the state of HEALTH airflow, follow/evade functions are set, HEALTH airflow function is cancelled, Four-side Embedment, up-and-down SWING and left-and-right SWING icons will disappear.

17. FRESH (available for some models):

- (1) FRESH function is valid under the state of on or OFF. When air conditioner is OFF, press "FRESH" button, display icon  on LCD display to enter blowing-in mode and low speed. Press "FRESH" button again, this function is cancelled.
- (2) After FRESH function is set, on or OFF functions are kept.
- (3) After FRESH function is set, mode switch function is kept.

18. Timer:

(1) TIMER ON

- Press "TIMER ON" button, character "ON" is flashing, press "+/-" button to adjust, then press "OK" button to confirm, if "OK" button is not pressed within 10 s, TIMER ON function is cancelled.
- If time of TIMER ON is the same as that of clock at present, character "ON" is always flashing and can not be verified, it is necessary to readjust time.
- When the time of TIMER ON is end, the setting time and character "on" disappear.

(2) TIMER OFF

- Press "TIMER OFF" button, character "OFF" is flashing, press "+/-" button to adjust, then press "OK" to confirm, if "OK" is not pressed within 10 s, TIMER OFF function is cancelled.
- If time of TIMER ON is the same as that of clock at present, character "OFF" is always flashing and can not verified, it is necessary to readjust time.
- When the time of TIMER OFF is end, the setting time and character "OFF" disappear.

(3) TIMER ON/OFF

- After TIMER ON/OFF is set, remote will automatically judge sequential order of ON/OFF, arrow indicates that the one performed first points to the one performed second.
- After the time of clock performed first is end, corresponding characters of timer "ON/OFF" disappear.
- If time of TIMER ON is the same as that of TIMER OFF, and can not be verified, corresponding character of the latter of setting time is always flashing, it is necessary to readjust time and confirm again.
- If time of TIMER ON/OFF is the same as that of clock at present, and can not be verified, it is necessary to readjust time and confirm again.

(4) After setting timer, display the setting of timer first and then display time all the time, when timer is active, character "ON/OFF" is always displayed.

19. Button +/-:

- Press button "+/-", time will change in terms of 1 min as unit, pressing and holding the button will change quickly.

20. Clock:

● Press "Clock" button, "Morning" or "Afternoon" displayed at present are flashing to enter the state of clock adjustment, adjust clock and then press "OK" to confirm.

- It is valid under the state of ON/OFF.

21. LIGHT:

- No display on remote controller LCD, which is processed by indoor unit.

22. RESET:

- Perform one power on reset operation when RESET button is pressed.

23. LOCK:

- Press button Lock, display Lock symbol on LCD display, buttons on remote controller can not be used, press button Lock again to unlock.

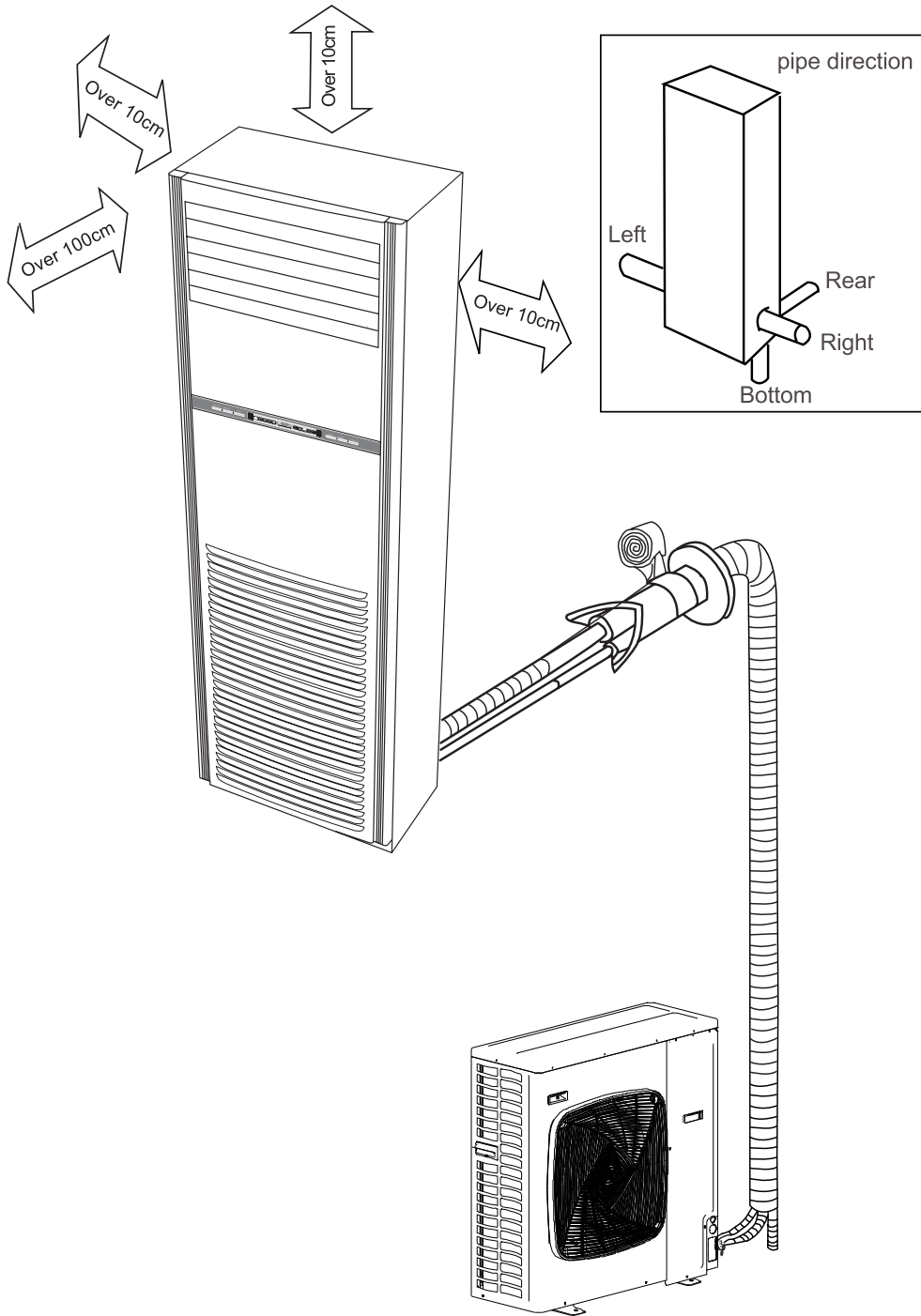
24. CODE:

- Function reserved.

25. INQUIRE

- Processing by Indoor unit

Installation figure please refers to AP48KC1QRA



Installation Procedure

Installation Preparation

Tools necessary

1. Screw driver
2. Hacksaw
3. 70mm dia. hole core drill
4. Spanner (dia. 22, 36mm)
5. Spanner (16, 18, 22, 36mm)
6. Pipe cutter
7. Flaring tool
8. Knife
9. Nipper
10. Gas leakage detector or soap water
11. Measuring tape
12. Reamer
13. Refrigerant oil

Installation accessories

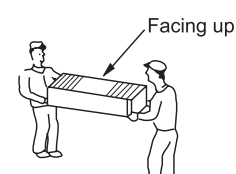
Following parts shall be field supplied

Part name
Adhesive tape
Pipe clip
Connecting hose
Insulation material
Putty
Drain hose

Before installation

- Try to bring the packed unit to the installation place.
- When it is inevitable to unpack the unit, be careful not to damage the unit. Wrap it with nylon etc.
- After unpacking, be sure to put it with the front side of the unit facing up.
- When delivering, don't hold plastic parts like inlet and outlet grill etc.

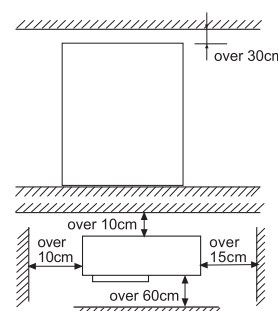
Delivery



Installation of outdoor unit

Selection of outdoor unit installation place

- Place strong enough to support the unit and will not cause vibration and noise.
- Place where discharged wind and noise doesn't cause a nuisance to the neighbors.
- Place where is less affected by rain or direct sunlight and is sufficiently ventilated, or to install a shield.
- Place with enough space for smooth air flow.



Fixing of the outdoor unit

- Fix outdoor unit using M10 bolt to concrete floor horizontally.
- If installed on the wall or on top of a roof, bracket should be fixed securely to resist earthquake or storms.
- Use rubber pad during installation against unit vibration.

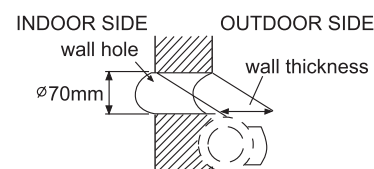
Selection of indoor unit installation place

- Place where it is easy to route drainage pipe and outdoor piping.
- Place away from heat source and with less direct sunlight.
- Place where cool and warm air could be delivered evenly to every corner of the room.
- Place near power supply socket. Leave enough space around the unit (refer to installation drawings).

Installation of indoor unit

1. Position of the wall hole

Wall hole should be decided according to installation place and piping direction. (refer to installation drawings)



(Cross section of wall hole)

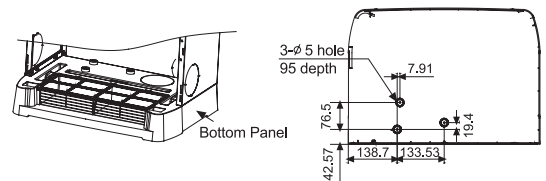
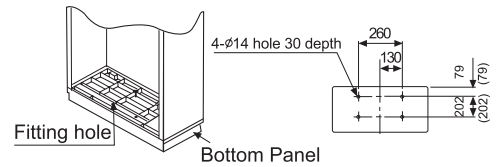
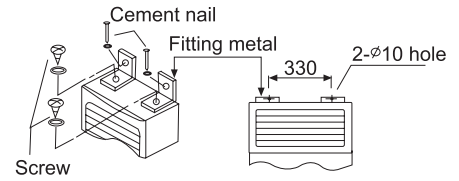
2. Making a wall hole

Drill a hole of 70mm dia. with a little slope towards outside.
Install piping hole cover and seal it with putty after installation.

3. Fixing of indoor unit

With the unit set up vertically, fix the fitting metal to the unit with screws, then fix the fitting metal to the wall with cement nail and washer, as shown right:

Moreover, if wanting to fix the unit more firmly, you should fix the bottom panel to the ground with concrete bolts, as shown right:



Connecting method

- Apply refrigerant oil at half union and flare nut.
- To bend a pipe, give the roundness as large as possible not to crash the pipe.
- When connecting pipe, hold the pipe centre to centre then screw nut on by hand, refer to Fig.
- Be careful not to let sundries, such as sands enter the pipe.

Pipe cutting and flaring

- Be sure to carry out deburring after pipe cutting with a pipe cutter.
- Insert flaring tool to make a flare.

Forced fastening without centering may damage the threads and cause a gas leakage.

	Pipe dia.	Dimension A	Fastening torque
Liquid pipe	∅ 9.52mm (3/8")	1.0 ~ 1.8(mm)	32.7-39.9N.m
Gas pipe	∅ 15.88mm(5/8")	1.0—1.8(mm)	61.8-74.5N.m
	∅ 19.05mm (3/4")	1.4 ~ 2.2(mm)	97.2-118.6N.m

Correct	Incorrect				
	Lean	Damaged flare	Crack	Partial	Too outside

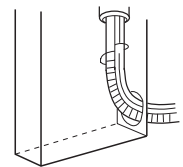
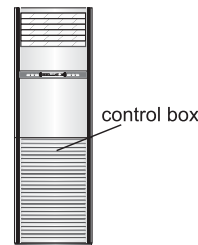
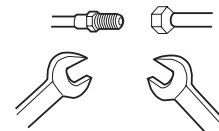
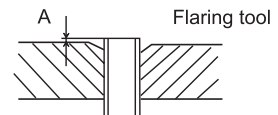
Piping connection of indoor unit

1. Arrangement of piping and drainage pipe

- After opening inlet grill, you will see a control box as shown in the Fig. Remove the cover before wiring work.

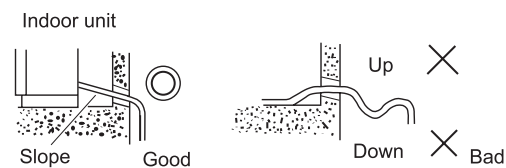
- Cut away, with a hammer or a saw, the lid for piping according to piping direction.

- According to the piping method, connect the piping on indoor unit with union of connecting pipe.
Arrange the piping as per the wall hole and bind drain hose, connecting electric cable and piping together with polyethylene tape.
Insert the bound piping, connecting electric cable and drain hose through wall hole to connect with outdoor unit.



2. Arrangement of drain hose

- Drain hose shall be placed in under place.
- There should be a slope when arrange drain hose. Avoid up and down waves in drain hose.
- If humidity is high, drain pipe(especially in room and indoor unit) must be covered with insulation material.



Piping connection of outdoor unit.

Connect the connecting pipe and inlet / outlet liquid pipe according to the piping method.

Vacuuminizing

Discharge the air out of the indoor unit and the refrigerant pipe by vacuumizing.

- (1) Fasten all the nuts of the indoor and outdoor pipes to make these parts out of leakage.
- (2) Under the condition of the complete close of the indoor and outdoor valve center (both liquid and gas side), dismantle the service valve cap. Vacuumizing through the charge mouth of the service valve.
- (3) After vacuumizing, fasten the service valve and dismantle the cap of the big and small stop valve, then loosen the stop valve center completely and fasten the big and small stop valve.

Note:

- Electrical wiring must be done by qualified person.
- The power supply connects from the outdoor unit.
- The connecting cable and power cable are self-provided.
- Use copper wire only.
- Air conditioner must use an exclusive line (over 30A)
- When installing air conditioner in a wet place, try to use a circuit breaker against current leakage.
- When installing in other places, use circuit breaker as far as possible.
- The breaker of the air conditioner should be all-pole switch; and the distance between its two contacts should be no less than 3 mm.
- Such means for disconnection must be incorporation in the fixed wiring

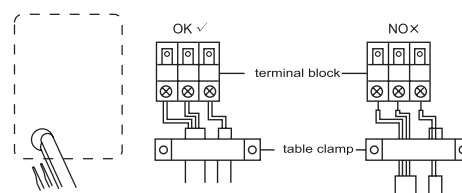
The [parameter of connection cable is H05RN-F 4G 2.5mm

The specification of power cable

For models1U48NC1QRB the power cable should be H07RN-F 5G 4.0mm

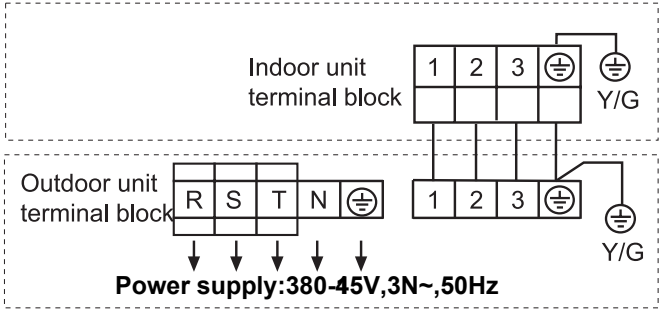
Wiring of indoor unit

- Insert the cable from outside the wall hole where piping already exist.
- Pull it out from front.
- Loosen terminal screws and insert cable end fully into terminal block, then tighten it.
- Pull the cable gently to make sure it is tight.
- Replace cover after wiring.



Wiring of outdoor unit

- Insert the cable from inside the wall hole where piping already exists.
- Pull it out from front.
- Loose terminal screw and insert cable end fully into terminal block, then tighten it.
- Pull the cable gently to make sure it is tight.
- Replace cover after wiring.



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Note:

When connecting indoor and outdoor wire, check the number on indoor and outdoor terminal blocks. Incorrect wiring may damage air conditioner's controller or cause operation failure.

4.2 Outdoor installation

EUROPEAN REGULATIONS CONFORMITY FOR THE MODELS

CE

All the products are in conformity with the following European provision:
 -Low voltage Directive
 -Electromagnetic Compatibility

ROHS

The products are fulfilled with the requirements in the directive 2011/65/EU of the European parliament and of council on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment(EU RoHS Directive)

WEEE

In accordance with the directive 2012/19/EU of the European parliament,herewith we inform the consumer about the disposal requirements of the electrical and electronic products.

DISPOSAL REQUIREMENTS:



Your air conditioning product is marked with this symbol.This means that electrical and electronic products shall not be mixed with unsorted household waste.Do not try to dismantle the system yourself:the dismantling of the air

conditioning system,treatment of the refrigerant,of oil and of other part must be done by a qualified installer in accordance with relevant local and national legislation.Air conditioners must be treated at a specialized treatment facility for reuse, recycling and recovery.By ensuring this product is disposed of correctly,you will help to prevent potential negative consequences for the environment and human health.Please contact the installer or local authority for more information. Battery must be removed from the remote controller and disposed of separately in accordance with relevant local and national legislation.

IMPORTANT INFORMATION REGARDING THE REFRIGERANT USED

Contains fluorinated greenhouse gases covered by the Kyoto Protocol _____ A

R410A

1= _____ kg B

2= _____ kg C

1+2= _____ kg D

F E

This product contains fluorinated greenhouse gases covered by the Kyoto Protocol.Do not vent into the atmosphere.

Refrigerant type:R410A

GWP:2088

GWP=global warming potential

Please fill in with indelible ink,

- 1 the factory refrigerant charge of the product
- 2 the additional refrigerant amount charged in the field and
- 1+2 the total refrigerant charge
- 3 $GWP \times \text{value} = 2088$
- $tCO_2 = (1+2) \times 3 / 1000$

on the refrigerant charge label supplied with the product.

The filled out label must be adhered in the proximity of the product charging port(e.g.onto the inside of the stop value cover).

A contains fluorinated greenhouse gases covered by the Kyoto Protocol

B factory refrigerant charge of the product:see unit name plate

C additional refrigerant amount charged in the field

D total refrigerant charge

E outdoor unit

F refrigerant cylinder and manifold for charging

⚠ WARNING

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.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

The appliances are not intended to be operated by means of an external timer or separate remote-control system.

Keep the appliance and its cord out of reach of children less than 8 years.

This appliance is intended to be used by expert or trained users in shops, in light industry and on farms, or for commercial use by lay persons.

Disconnect the appliance from its power source during maintenance service and when replacing parts.

1) Means for disconnection, such as circuit breaker, which can provide full disconnection in all poles, must be incorporated in the fixed wiring in accordance with the wiring rules.

It is necessary to allow disconnection of the appliance from the supply after installation. The disconnection may be achieved by incorporating a switch in the fixed wiring in accordance with the wiring rules.

The method of connection of the appliance to the electrical supply and interconnection of separate components, and the wiring diagram with a clear indication of the connections and wiring to external control devices and supply cord are detailed in below parts.

2) The appliance shall be installed in accordance with national wiring regulations. Wiring must be done by a qualified electrician. All the wiring must comply with the local electrical codes.

3) The cord of the H05RN-F type or the electrically equivalent type must be used for power connection and interconnection between outdoor unit and indoor unit. The size of the cord is detailed in below parts.


4) Details of type and rating of fuses, or rating of circuit breakers / ELB is detailed in below parts.


5) The information of dimensions of the space necessary for correct installation of the appliance including the minimum permissible distances to adjacent structures is detailed in below parts.


1. Definitions


1.1. Meaning of warnings and symbols


Warnings in this manual are classified according to their severity and probability of occurrence.

 **DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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


 **CAUTION**
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

 **NOTICE**
Indicates situations that may result in equipment or property-damage accidents only.

 **INFORMATION**
This symbol identifies useful tips or additional information.

Some types of danger are represented by special symbols:

 Electric current.

 Danger of burning and scalding.

1.2. Meaning of used terms

Installation manual:

Instruction manual specified for a certain product or application, explaining how to install, configure and maintain it.

Operation manual:

Instruction manual specified for a certain product or application, explaining how to operate it .

Maintenance instructions:

Instruction manual specified for a certain product or application, which explains (if relevant) how to install, configure, operate and/or maintain the product or application.

Dealer:

Sales distributor for products as per the subject of this manual.

Installer

Technical skilled person who is qualified to install products as per the subject of this manual.

User:

Person who is owner of the product and/or operates the product.

Service company:

Qualified company which can perform or coordinate the required service to the unit.

Applicable legislation:

All international, European, national and local directives, laws, regulations and/or codes which are relevant and applicable for a certain product or domain.

Accessories:

Equipment which is delivered with the unit and which needs to be installed according to instructions in the documentation.

Optional equipment:

Equipment which can optionally be combined to the products as per the subject of this manual.

Field supply:

Equipment which needs to be installed according to instructions in this manual, but which are not supplied

2. Safety considerations

The precautions here, all cover very important topics, so be sure to follow them carefully.

All activities described in this manual shall be carried out by an installer.

Be sure to wear adequate personal protection equipment (Protection gloves, safety glasses.....) when performing installation, maintenance or service to the unit.

If not sure of installation procedures or operation of the unit, always contact your local dealer for advice and information.


Improper installation or attachment of equipment or accessories could result in electric shock, short-circuit, leaks, fire or other damage to the equipment. Be sure only to use accessories, optional equipment and spare parts made by which are specially designed for use with the products as of subject in this manual and have them installed by an installer.

 **DANGER: ELECTRICAL SHOCK**

Switch off all power supply before removing the switch box service panel or before making any connections or touching electrical parts.

To avoid electric shock, be sure to disconnect the power supply 2 minute or more before servicing the electrical parts. Even after 2 minute, always measure the voltage at the terminals of main circuit capacitors or electrical parts. Even after 2 minute, always measure the voltage at the terminals of main circuit capacitors or electrical parts, and before touching, be sure that those voltages are 50V DC or less.

When service panels are removed, live parts can easily be touched by accident. Never leave the unit unattended during installation or servicing when the service panel is removed.

 **DANGER: DO NOT TOUCH PIPING AND INTERNAL PARTS**

Do not touch the refrigerant piping, water piping or internal parts during and immediately after operation. The piping and internal parts may be hot or cold depending on the working condition of the unit.


Your hand may suffer burns or frostbite if you touch the piping or internal parts. To avoid injury, give the piping and internal parts time to return to normal temperature or, if you must touch them, be sure to wear protective gloves.

Warning:

- Ask your dealer or qualified personnel to carry out installation work. Do not install the machine by yourself. Improper installation may result in water leakage, electric shocks or fire.
- Perform installation work in accordance with this installation manual. Improper installation may lead to water leakage, electric shocks or fire.
- The equipment is not intended for use in a potentially explosive atmosphere.
- For year round cooling applications with low indoor humidity conditions, such as Electronic Data Processing rooms, contact your dealer or see the engineering databook or the service manual.
- Consult your local dealer regarding what to do in case of refrigerant leakage. When the unit is to be installed in a small room, it is necessary to take proper measures so that the amount of any leaked refrigerant does not exceed the concentration limit in the event of a leakage.
- Otherwise, this may lead to an accident due to oxygen depletion. Be sure to use only the specified accessories and parts for installation work. Failure to use the specified parts may result in water leakage, electric shocks, fire, or the unit falling.
- Install the unit on a foundation that can withstand its weight. Insufficient strength may result in the fall of equipment and causing injury.
- Carry out the specified installation work in consideration of strong winds, typhoons, or earthquakes. Improper installation work may result in accidents due to fall of equipment.
- Make sure that all electrical work is carried out by qualified personnel according to the applicable legislation and this installation manual, using a separate circuit. Insufficient capacity of the power supply circuit or improper electrical capacity of the power supply circuit or improper electrical construction may lead to electric shocks or fire.

- Make sure that all wiring is secure, using the specified wires and ensuring that external forces do not act on the terminal connections or wires. Incomplete connection or fixing may cause a fire.
- When wiring between the indoor and outdoor units, and wiring the power supply, form the wires so that the frontside panel can be securely fastened. If the frontside panel is not in place, overheating of the terminals, electric shocks or a fire may be caused.
- If refrigerant gas leaks during installation work, ventilate the area immediately. Toxic gas may be produced if refrigerant gas comes into contact with fire.
- After completing the installation work, check to make sure that there is no leakage of refrigerant gas. Toxic gas may be produced if refrigerant gas leaks into the room and comes into contact with a source of fire, such as a fan heater, stove or cooker.
- When planning to relocate former installed units, you must first recover the refrigerant after the pump down operation.
- Never directly touch any accidental leaking refrigerant. This could result in severe wounds caused by frostbite. Be sure to install an earth leakage circuit breaker in accordance with applicable legislation. Failure to do so may cause electrical shock and fire.

Caution:

- Earth the unit. Earthing resistance should be according to applicable legislation. Do not connect the earth wire to gas or water pipes, lightning conductor or telephone earth wire. Incomplete earthing may cause electric shocks. 
- Gas pipe. Ignition or explosion may occur if the gas leaks. Water pipe. Hard vinyl tubes are not effective earths. Lightning conductor or telephone earth wire. Electric potential may rise abnormally if struck by a lightning bolt.
- Install drain piping according to this installation manual to ensure good drainage, and insulate the pipe to prevent condensation. Improper drain piping may cause water leakage, and make the furniture get wet.
- Install the indoor and outdoor units, power wire and connecting wire at least 1 meter away from televisions or radios to prevent image interference or noise. (Depending on the radio waves, a distance of 1 meter may not be sufficient to eliminate the noise.)
- Do not rinse the outdoor unit, This may cause electric shocks or fire.
- Do not install the unit in places such as the following:
 - Where there is mist of mineral oil, oil spray or vapour for example a kitchen. Plastic parts may deteriorate, and cause them to fall out or water to leak.
 - Where corrosive gas, such as sulphurous acid gas, is produced. Corrosion of copper pipes or soldered parts may cause the refrigerant to leak.

3. Before installation

3.1. Scope of this manual

This manual describes the procedures for handling, installing and connecting 1U24~1U66 units.

3.2. Precautions



CAUTION

Since maximum working pressure is 4.15 MPa or 41.5 bar, pipes of larger wall thickness may be required. Refer to paragraph "6.2. Selection of piping material" on page 12.



NOTICE: Insulation resistance of the compressor

If, after installation, refrigerant accumulates in the compressor, the insulation resistance can drop, but if it is at least $1M\Omega$, then the machine will not break down. Turn the power on and leave it on for six hours. Then, check if the insulation resistance of the compressor has risen or not. The compressor will heat up and evaporate any refrigerant in the compressor.

Check the following if the ground-fault circuit interrupter is triggered:

Make sure that the interrupter is compatible with high frequencies.
This unit has an inverter, so an interrupter capable of handling high frequencies is needed to prevent malfunction of the interrupter itself.

3.3. Precautions for R410A

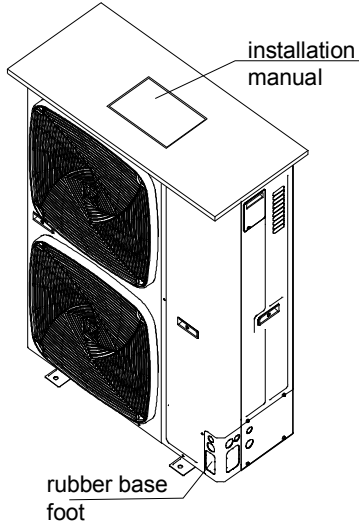
- The refrigerant requires strict cautions for keeping the system clean, dry and tight.
 - Clean and dry
 Foreign materials (including mineral oils or moisture) should be prevented from getting mixed into the system.
 - Tight
 Read "9.Precautions on refrigerant piping" on page 12 carefully and follow these procedures correctly.
- Since R410A is a mixed refrigerant, the required additional refrigerant must be charged in its liquid state.(If the refrigerant is in state of gas, its composition changes and the system will not work properly).
- The connected indoor units must be indoor units designed exclusively for R410A.

3.4. Installation

- For installation of the indoor unit(s), refer to the indoor unit installation manual.
- Illustrations show outdoor unit type. Other types also follow this installation manual.
- This outdoor unit requires the pipe branching kit(optional) when used as the outdoor unit for the simultaneous operation system. Refer to catalogues for details.
- Never operate the unit with a damaged or disconnected discharge thermistor and suction thermistor, burning of the compressor may occur.
- Be sure to confirm the model name and the serial no. of the outer(front) plates when attaching/detaching the plates to avoid mistakes.
- When closing the service panels, take care that the tightening torque does not exceed 4.1 N.M.
- In order to ensure the product effect and product life, it is recommended to install the voltage stabilizer in the area with unstable voltage

3.5. Accessories

Check if the following accessories are included with the unit. See the figure below for the location of the accessories.



- Do not climb, sit or stand on top of the unit.
- Be sure that sufficient precautions are taken, in accordance with applicable legislation, in case of refrigerant leakage.



NOTICE

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4. Selecting installation site

4.1. General



WARNING

- Be sure to provide for adequate measures in order to prevent that the outdoor unit be used as a shelter by small animals. Small animals making contact with electrical parts can cause malfunctions, smoke or fire. Please instruct the customer to keep the area around the unit clean.
- Select an installation site where the following conditions are satisfied and that meets with your customer's approval.
 - Places which are well-ventilated.
 - Places where the unit does not bother next-door neighbours.
 - Safe places which can withstand the unit's weight and vibration and where the unit can be installed level.
 - Places where there is no possibility of flammable gas or product leak.
 - The equipment is not intended for use in a potentially explosive atmosphere.
 - Places where servicing space can be well ensured.
 - Places where the indoor and outdoor units's piping and wiring lengths come within the allowable ranges.
 - Places where water leaking from the unit cannot cause damage to the location (e.g. in case of a blocked drain pipe)
 - Places where the rain can be avoided as much as possible.
 - Do not install the unit in places often used as work place. In case of construction works (d.g.grinding works) where a lot of dust is created, the unit must be covered.
 - Do not place any objects or equipment on top of the unit(top plate).

- When installing the unit in a place exposed to strong wind, pay special attention to the following. Strong winds of 5 m/sec or more blowing against the outdoor unit's air outlet causes short circuit (suction of discharge air), and this may have the following consequences:
 - Deterioration of the operational capacity.
 - Frequent frost acceleration in heating operation.
 - Disruption of operation due to rise of high pressure.
 - When a strong wind blows continuously on the face of the unit, the fan can start rotating very fast until it breaks.
 Refer to the figures for installation of this unit in a place where the wind direction can be foreseen.

- Repair a water drainage channel around the foundation, to drain waste water from around the unit.
- If the water drainage of the unit is not easy, please build up the unit on a foundation of concrete blocks, etc.(the height of the foundation should be maximum 150mm).
- If you install the unit on a frame, please install a waterproof plate(field suppu) within 150mm of the underside of the unit in order to prevent the invasion of water from the lower direction. When installing the unit in a place frequently exposed to snow, pay special attention to elevate the foundation as high as possible.
- Make sure that the unit is installed level.

4.2. General



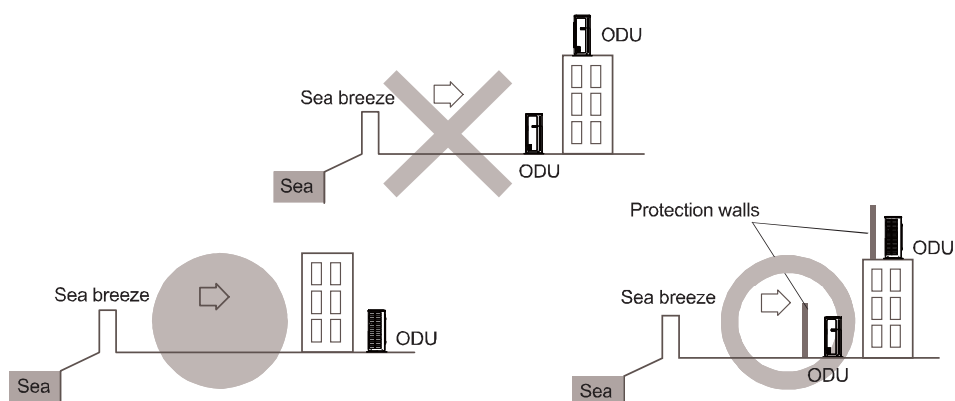
NOTICE

When operating the outdoor unit in a low outdoor ambient temperature, be sure to follow the instructions described below.

- To prevent exposure to wind, install the outdoor unit with its suction side facing the wall.
- Never install the outdoor unit at a site where the suction side may be exposed directly to wind.
- To prevent exposure to wind, install a baffle plate on the air discharge side of the outdoor unit. In heavy snowfall areas it is very important to select an installation site where the snow will not affect the unit and set the outlet side at a right angle to the direction of the wind.

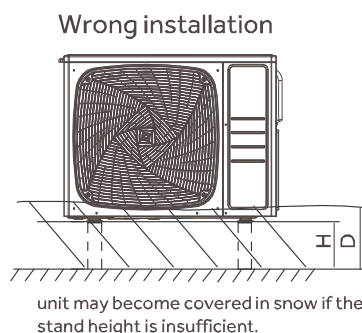
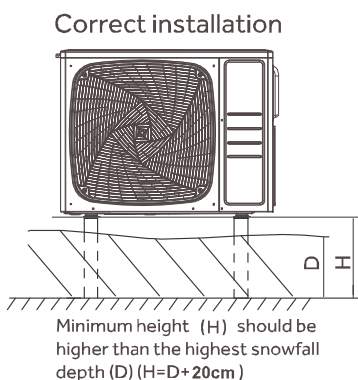
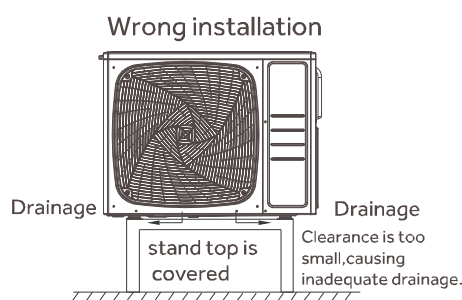
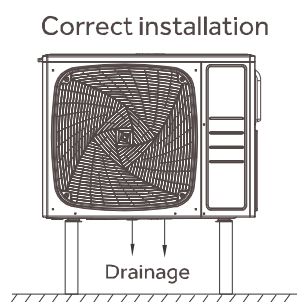
4.3. General

■ For seacoast applications, block the unit from direct exposure to sea breeze by installing the unit behind a structure (such as a building) or a protective wall that is 1.5 times higher than the unit, leaving 700 mm of space between the wall and unit for air circulation. Consult an installation expert about taking anti-corrosion measures, such as removing salinity on the heat exchanger and applying a rust inhibitor more frequently than once a year.



■ Set the unit on mounting brackets or pad. To avoid the adverse effects of snow, ice and defrosting issues, install the unit on heat pump risers to ensure a sufficient height from the ground. In all cases, refer to local code for correct riser height.

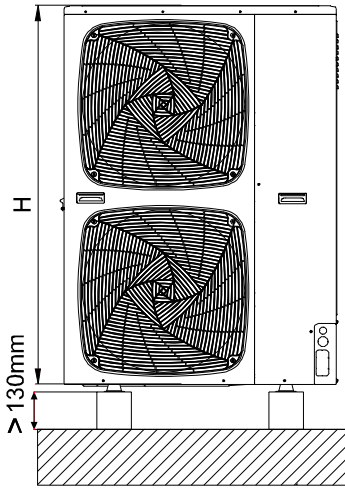
Make sure the outdoor unit is installed level and is stable.
Install snow protection hood as necessary.



5. Precautions on installation

NOTICE

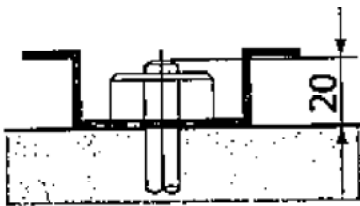
If drain holes of the outdoor unit are covered by a mounting base or by floor surface, raise the unit in order to provide a free space of more than 130mm under the outdoor unit.



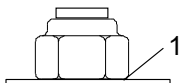
	1U48
A	600
B	405-410
C	450
D	367
W	947
H	960

5.1. Foundation work

- Check the strength and level of the installation ground so that the unit will not cause any operating vibration or noise after installation.
- In accordance with the foundation drawing in the figure, fix the unit securely by means of the foundation bolts. (Prepare four sets of M12 foundation bolts, nuts and washers each which are available on the market.)
- It is best to screw in the foundation bolts until their length are 20mm from the foundation surface.

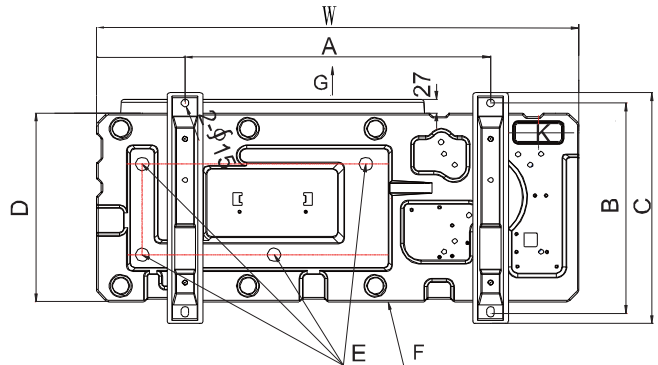


- Fix the outdoor unit to the foundation bolts using nuts with resin washers(1) as shown in the figure.



If the coating on the fastening area is stripped off, the nuts rust easily.

Dimensions (bottom view)(unit of measurement:mm)

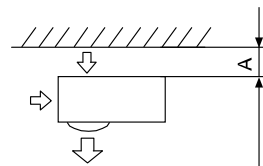


- A leg pitch1
- B leg pitch2
- C Front grill (air outlet side)
- D Drain hole
- E Bottom frame
- K Knock-out hole (for piping line)

5.2. Selection of installation location of outdoor

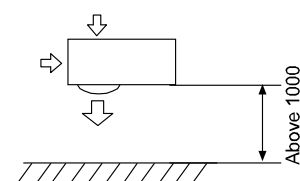
(1)Single-unit installation (unit: mm)

Back

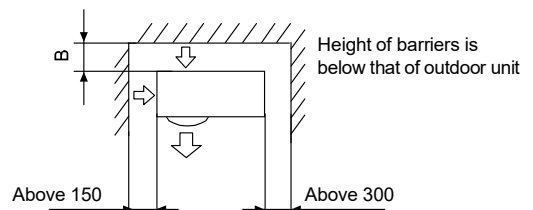


A	> 150
B	> 200
C	> 150
D	> 150
E	> 200
F	> 200
G	> 300
H	> 1500

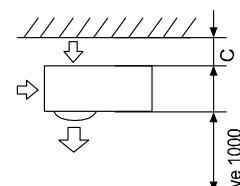
Front



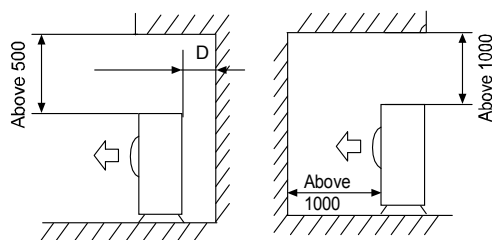
Back and side



Front and back

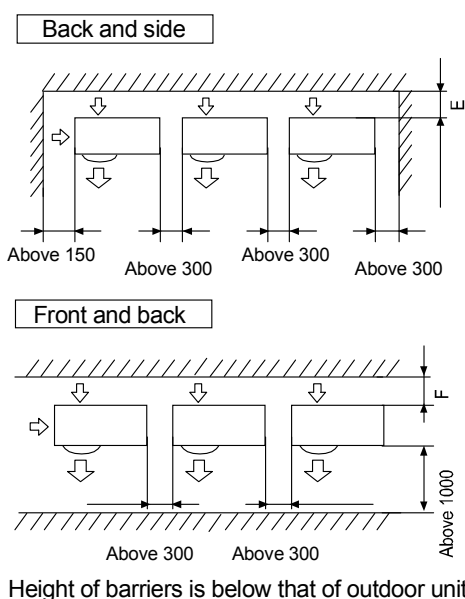


When barriers exist above the unit

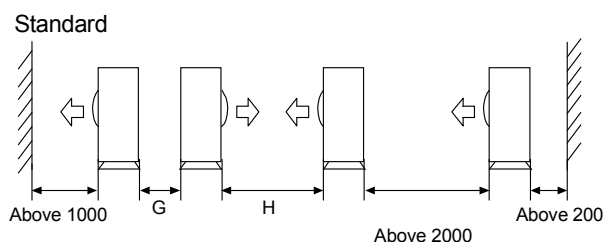


The top and two side surfaces must be exposed to open space, and barriers on at least one side of the front and back shall be lower than the outdoor unit.

(2) Multi-unit installation (unit: mm)



(3) Multi-unit installation in front and back (unit: mm)



The top and two side surfaces must be exposed to open space, and barriers on at least one side of the front and back shall be lower than the outdoor unit.

- The installation service spaces shown in the illustrations are based on an air intake temperature of 35 °C(DB) for COOL operation. In regions where the air intake temperature regularly exceeds 35°C(DB), or if the heat load of outdoor units is expected to regularly exceed the maximum operating capacity, reserve a larger space than that indicated at the air intake side of units.
- Regarding the required air outlet space, position the units with consideration to the space required for the onsite refrigerant piping work as well. Consult your dealer if the work conditions do not match those in the drawings.

5.3. Drain pipe disposal

- Make sure the drain works properly.
- In regions where buildups of snow can be expected, the accumulation and freezing of snow in the space between the heat exchanger and external plate may lower operating efficiency.
- After punching the knock-out hole, the application of repair-type paint on the surface around the edge sections is recommended to prevent rust.

6. Refrigerant pipe size and allowable pipe length

⚠ DANGER

- Piping an other pressure containing parts shall comply with the applicable legislation and shall be suitable for refrigerant. Use phosphoric acid deoxidised seamless copper for refrigerant.
- Installation shall be done by an installer, the choice of materials and installation shall comply with applicable legislation.

ⓘ INFORMATION

It is forbidden to discharge refrigerant into the atmosphere. Collect the refrigerant in accordance with the freon collection and destruction law.

ⓘ NOTICE

To persons in charge of piping work:
Be sure to open the stop valve after piping installing and vacuuming is complete. (Running the system with the valve closed may break the compressor.)

ⓘ NOTICE

Do not use flux when brazing the refrigerant piping. For brazing, use phosphor copper brazing filler metal (BCuP) which does not require a flux. (If a chlorine flux is used, the piping will corrode, and if the flux contains fluoride, it will cause the coolant oil to deteriorate, adversely affecting the coolant piping system.)

6.1. Necessary Tools and Materials

Prepare the following tools and materials necessary for installing and servicing the unit.
 Necessary tools for use with R410A(Adaptability of tools that are for use with R22 and R407C).

1. To be used exclusively with R410A (Not to be used if used with R22 or R407C)

Tools/Materials	Use	Notes
Gauge Manifold	Evacuating,refrigerant charging	5.09MPa on the High-pressure side.
Charging Hose	Evacuating, refrigerant charging	Hose diameter larger than the conccentional ones.
Refrigerant Recovery Equipment	Refrigerant recovery	
Refrigerant Cylinder	Refrigerant charging	Write down the refrigerant type. Pink in color at the top of the cylinder.
Refrigerant Cylinder Charging Port	Refrigerant charging	Hose diameter larger than the conventional ones.
Flare Nut	Connecting the unit to piping	Use Type-2 Flare nuts.

2. Tools and materials that may be used with R410A with some restrictions

Tools/Materials	Use	Notes
Gas leak detector	Detection of gas leaks	The ones for HFC type refrigerant may be used.
Vacuum Pump	Vacuum drying	May be used if a reverse flow check adaptor is attached.
Flare Tool	Flare machining of piping	Chages have been made in the flare machining dimension.Refer to the next page.
Refrigerant Recovery Equipment	Recovery of refrigerant	May be used if designed for use with R410A.

3. Tools and materials that are used with R22 or R407C that can also be used with R410A

Tools/Materials	Use	Notes
Vacuum Pump with a Check Valve	Vacuum drying	
Bender	Bending pipes	
Torque Wrench	Tightening flare nuts	Only $\phi 12.70$ (1/2") and $\phi 15.88$ (5/8") have a larger flare machining dimension.
Pipe Cutter	Cutting pipes	
Welder and Nitrogen Cylinder	Welding pipes	
Refrigerant Charging Meter	Refrigerant charging	
Vacuum Gauze	Checking vacuum degree	

4. Tool and materials that must not used with R410A

Tools/Materials	Use	Notes
Charging Cylinder	Refrigerant Charging	Must not be used with R410-type units.

Tools for R410A must be handled with special care, and keep moisture and dust from entering the cycle.

6.2. Piping Materials

Types of Copper Pipes (Reference)

Maximum Operation Pressure	Applicable Refrigerants
3.4MPa	R22, R407C
4.3MPa	R410A

- Use pipes that meet the local standards.

Piping Materials/Radial Thickness

Use pipes made of phosphorus deoxidized copper.

Since the operation pressure of the units that use R410A is higher than that of the units for use with R22, use pipes with at least the radial thickness specified in the chart below. (Pipes with a radial thickness of 0.7mm or less may not be used.)

Size(mm)	Size(inch)	Radial Thickness(mm)	Type
Φ 6.35	1/4"	0.8t	Type-O pipes
Φ 9.52	3/8"	0.8t	
Φ 12.7	1/2"	0.8t	
Φ 15.88	5/8"	1.0t	
Φ 19.05	3/4"	1.0t	Type-1/2H or Hpipes

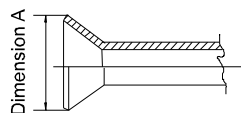
- Although it was possible to use type-O for pipes with a size of up to Φ 19.05(3/4") with conventional refrigerants, use type-1/2H pipes for units that use R410A. (Type-O pipes may be used if the pipe size is Φ19.05 and the radial thickness is 1.2t.)
- The table shows the standards in Japan. Using this table as a reference, choose pipes that meet the local standards.

Flare Machining (type-O and OL only)

The flare machining dimensions for units that use R410A is larger than those for units that use R22 in order to increase air tightness.

Flare Machining Dimension(mm)

External dimension of pipes	Size	Dimension A	
		R410A	R22
Φ6.35	1/4"	9.1	9.0
Φ9.52	3/8"	13.2	13.0
Φ12.7	1/2"	16.6	16.2
Φ15.88	5/8"	19.7	19.4
Φ19.05	3/4"	24.0	23.3



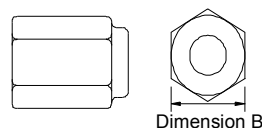
If a clutch type flare tool is used to machine flares on units that use R410A, make the protruding part of the pipe between 1.0 and 1.5mm. Copper pipe gauge for adjusting the length of pipe protrusion is useful.

Flare Nut

Type-2 flare nuts instead of type-1 nuts are used to increase the strength. The size of some of the flare nuts have also been changed.

Flare nut dimension(mm)

External dimension of pipes	Size	Dimension B	
		R410A(Type2)	R22(Type1)
Φ6.35	1/4"	17.0	17.0
Φ9.52	3/8"	22.0	22.0
Φ12.7	1/2"	26.0	24.0
Φ15.88	5/8"	29.0	27.0
Φ19.05	3/4"	36.0	36.0



- Using this table as a reference, choose pipes that meet the local standards.

For new installations, use the standard pipe sizes. When using existing pipes, size-up is allowed as mentioned in the table above. Additional restrictions towards allowable pipe lengths, as mentioned in the table 7.3 on page 13, must be taken into account. Not using the standard pipe size may result in capacity decrease. The installer must acknowledge this and judge this very carefully in function of the complete installation.

Existing or pre-installed piping can be used

Piping must comply with the criteria below.

- Piping diameter must comply with the limitations as indicated in paragraph "7.2. Refrigerant pipe size" .
- Piping length must be within limits of the allowable piping length as in paragraph "7.3. Allowable pipe length and height difference" .
- Piping must be designed for R410A. See paragraph "6.2. Selection of piping material" .

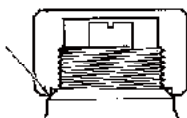
Piping can be reused without cleaning when:

- Total 1-way piping length: < 50m.
- No compressor breakdown has occurred in the history of the unit to be replaced.
- A correct pump down operation can be executed:
 - Operate the unit continuously for 30minutes in cooling mode.
 - Execute a pump down operation.
 - Remove the air conditioning units to be replaced.
- Check the contamination inside the existing piping. If you cannot meet all these requirements, the existing pipes must be cleaned or replaced after removing the air conditioning units to be replaced.

Prepare the flare connections for higher pressure. See paragraph 6.2

Instructions on handling the stem cap

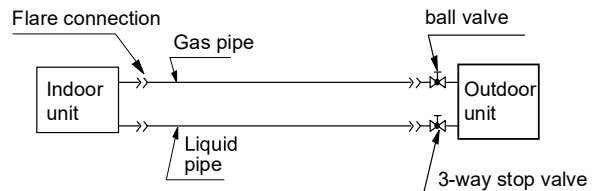
The stem cap is sealed where indicated by the arrow. Take care not to damage it. After handling the stop valve, make sure to tighten the stem cap securely. For the tightening torque, refer to the table below. Check for refrigerant leaks after tightening the stem cap.



- Always use a charge hose equipped with a valve depressor pin, since the service port is a Schrader type valve.
- After handling the service port, make sure to tighten the service port cap securely. For the tightening torque, refer to the table below.
- Check for refrigerant leaks after tightening the service port cap.

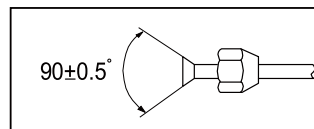
7. Refrigerant piping

7.1. Piping diagram for single split



7.2. Piping size for single split

Model	Pipe	Diameter of pipe	Connecting method
1U48NC1QRB 1U48NC1QAB	Liquid pipe	9.52mm	Flaring connection
	Gas pipe	19.05mm	



Install the removed flare nuts to the pipes to be connected, then flare the pipes.

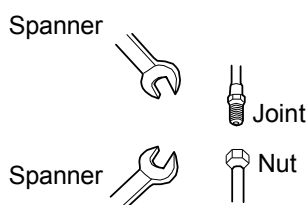
7.3. Limitations for one way piping length and vertical height difference for single split

Mode	1U48NC1QRB 1U48NC1QAB
One way piping length	Less than 30m
Vertical height difference (between indoor and outdoor)	Less than 10m

- Do not twist or crush piping.
- Be sure that no dust is mixed in piping.
- Bend piping with as wide angle as possible.
- Keep insulating both gas and liquid piping.
- Check flare-connected area for gas leakage.

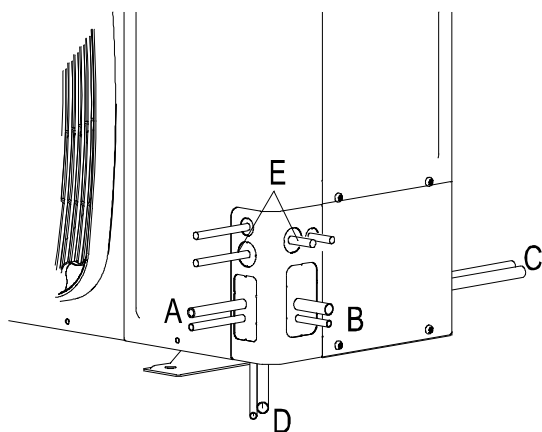
7.4. Piping connection method

- Apply refrigerant oil to the joint and the flange.
- To bend a pipe, give the roundness as possible not to crush the pipe.
- When connecting pipe, hold the pipe centre to centre and then screw nut on by hand, refer to Fig.
- Be careful not to let foreign matters, such as sands enter the pipe.



Pipe diameter	Fastening torque (N.m)
Liquid pipe ϕ 6.35mm	14.2-17.2
Liquid pipe ϕ 9.52mm	32.7-39.9
Gas pipe ϕ 12.7mm	49.5-60.3
Gas pipe ϕ 15.88mm	61.8-75.4
Gas pipe ϕ 19.05mm	97.2-118.6

- Field pipes can be installed in four directions (A, B, C, D, E).



- A: Forward
- B: Sideways
- C: Backward
- D: Downward
- E: Power supply cable, outdoor and indoor connection cable

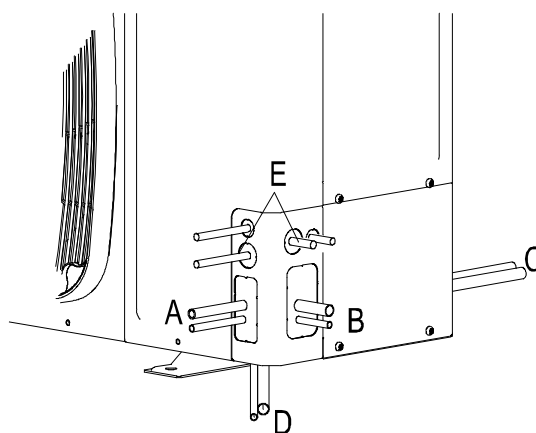
(Use a metal saw to cut out the slits.)

To install the connecting pipe to the unit in a downward direction, make a knock-out hole by penetrating the centre area around the knock-out hole using a ϕ 6mm drill (4x).

After knocking out the knock-out hole, it is recommended to apply repair paint to the edge and the surrounding end surfaces to prevent rusting.

When passing electrical wiring through the knock-out holes, remove any burrs from the knock-out holes and wrap the wiring with protective tape to prevent damage.

Plug the pipe through-holes with putty or insulating material (procured locally) to stop up all gaps, as shown in the figure.



1 Putty or insulating material (produced locally)

If there is any possibility that small animals enter the system through the knock-out holes, plug the holes with packing materials (field supplied).

Insects or small animals entering the outdoor unit may cause a short circuit in the electrical box.

Seal knock-out holes to avoid snow and humidity entering.

7.6. Preventing foreign objects from entering

- Be careful not to let the indoor and outdoor piping come into contact with the compressor terminal cover. If the liquid-side piping insulation might come into contact with it, adjust the height as shown in the figure below. Also, make sure the field piping does not touch the bolts or outer panels of the compressor.
- When the outdoor unit is installed above the indoor unit the following can occur: The condensed water on the stop valve can move to the indoor unit. To avoid this, please cover the stop valve with sealing material.

- If the temperature is higher than 30°C and the humidity is higher than RH 80%, then thickness of the sealing materials should be at least 20mm in order to avoid condensation on the surface of the sealing.
- Be sure to insulate the liquid and gas-side field piping.

NOTICE

Any exposed piping may cause condensation.

(The highest temperature that the gas-side piping can reach is around 120°C, so be sure to use insulating material which is very resistant.)

DANGER

No not touch piping and internal parts.

7.7. Cautions for necessity of a trap

To avoid the the risk of oil held inside the riser piping flowing back into the compressor when stopped and causing liquid compression phenomenon, or cases of deterioration of oil return, it will be necessary to provide a trap at each difference in height of 10m in the riser gas piping.

- A trap is not necessary when the outdoor unit is installed at higher position than the indoor unit.

8. Leak test and vacuum drying

When all piping work is complete and the outdoor unit is connected to the indoor unit, it is necessary to :

- check for any leakages in the refrigerant piping
- to perform vacuum drying to remove all moisture in the refrigerant piping.

If there is a possibility of moisture being present in the refrigerant piping (for example, rainwater may have entered the piping), first carry out the vacuum drying procedure below until all moisture has been removed.

8.1. General guidelines

- All piping inside the unit has been factory tested for leaks.
- Use a 2-stage vacuum pump with a non-return valve which can evacuate to a gauge pressure of -100.7kPa(5 Torr absolute, -755mm Hg).
- Connect the vacuum pump to both the service port of the gas stop valve and the liquid stop valve to increase efficiency.

NOTICE

- Do not purge the air with refrigerants. Use a vacuum pump to evacuate the installation. No additional refrigerant is provided for air purging. Make sure that the gas stop valve and liquid stop valve are firmly closed before performing the leak test or vacuum drying.

8.2. Leak test

The leak test must satisfy specification

- 1 Vacuum leak test
 - 1.1 Evacuate the system from the liquid and gas piping to -100.7 kPa(5 Torr).
 - 1.2 Once reached, turn off the vacuum pump and check that the pressure does not rise for at least 1 minute.
 - 1.3 Should the pressure rise, the system may either contain moisture (refer to the paragraph " Vacuum drying ") or have leaks.
- 2 Pressure leak test
 - 2.1 Break the vacuum by pressurizing with nitrogen gas to a minimum gauge pressure of 0.2 MPa (2 bar). Never set the gauge pressure higher than the maximum operation pressure of the unit, i.e. 4.0MPa (40bar).
 - 2.2 Test for leaks by applying a bubble test solution to all piping connections.

NOTICE

Make sure to use a recommended bubble test solution from your wholesaler.
Do not use soap water, which may cause cracking of flare nuts (soap water may contain salt, which absorbs moisture that will freeze when the piping gets cold). and/or lead to corrosion of flared joints (soap water may contain ammonia which causes a corrosive effect between the brass flare nut and the copper flare).

8.3. Vacuum drying

To remove all moisture from the system, proceed as follows:

- 1 Evacuate the system for at least 2 hours to a target vacuum of -100.7 kPa(=-1.007 bar).
- 2 Check that, with the vacuum pump turned off, the target vacuum is maintained for at least 1 hour.
- 3 Should you fail to reach the target vacuum within 2 hours or maintain the vacuum for 1 hour, the system may contain too much moisture.
- 4 In that case, break the vacuum by pressurizing with nitrogen gas to a gauge pressure of 0.05 MPa (0.5bar) and repeat steps 1 to 3 until all moisture has been removed.
- 5 The stop valves can now be opened, and/or additional refrigerant can be charged .

i INFORMATION

After opening the stop valve, it is possible that the pressure in the refrigerant piping does not rise. This might be caused by e.g. the closed state of the expansion valve in the outdoor unit circuit, but does not present any problem for correct operation of the unit.

9. Charging refrigerant

9.1. Important information regarding the refrigerant used

- This product contains fluorinated greenhouse gases covered by the Kyoto Protocol. Do not vent gases into the atmosphere.
- Evacuate Indoor Unit and interconnecting pipework to a vacuum pressure of 500 microns and hold for 15 minutes.
- The Outdoor unit is supplied with refrigerant HFC-410A (R410A) sufficient for 30m line length. Calculate additional refrigerant to suit your line length; refer supplied Specification Sheet.
- Open the service valve at the Outdoor unit to allow refrigerant to flow throughout the system.
- For long line lengths, oil (of the correct type) should be added to the refrigerant system at the rate shown in the Specification Data table. (see paragraph 9.5)
- Leak check all brazed and fitted joints.

9.2. Precautions and general guidelines

- When servicing the unit requires the refrigerant system to be opened, treatment and evacuation of refrigerant must be done in accordance with applicable legislation.
- Refrigerant can not be charged until field wiring has been completed.
Refrigerant may only be charged after performing the leak test and vacuum drying.

! CAUTION

When charging a system, care shall be taken that its maximum permissible charge is never exceeded, in view of the danger of liquid hammer.

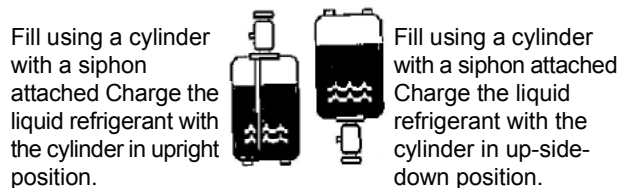
! WARNING

- Refrigerant cylinders shall be opened slowly.
- Always use protective gloves and protect your eyes when charging refrigerant.

! DANGER

- When the power is on, please close the front panel when leaving the unit unattended.
Charging with an unsuitable substance may cause explosions and accidents, so always ensure that the appropriate refrigerant (R410A) is charged.

- This unit requires additional charging of refrigerant according to the length of refrigerant piping connected at the site.
- Make sure to charge the refrigerant in liquid state to the liquid pipe. Since R410A is a mixed refrigerant, its composition changes if charged in its gaseous state and normal system operation would then no longer be assured.
- Before charging, check whether the refrigerant cylinder has a siphon attached or not and position the cylinder accordingly.



On this model it is not necessary to charge additionally if the piping length $\leq 30\text{m}$.

9.3. Complete recharging

! NOTICE

Before recharging, make sure to execute vacuum drying of the internal piping of the unit as well. To do so, use the internal service port of the unit. Do not use the service ports located on the stop valve, since vacuum drying can not be performed properly from these ports.

Outdoor units have 1 port on the piping. It is between the heat exchanger and the 4-way valve.

In case complete recharging is required (after a leak, etc.), refer to the information below to determine the necessary amount of refrigerant.

! WARNING

Some sections of the refrigerant circuit may be isolated from other sections caused by components with specific functions (e.g. valves). The refrigerant circuit therefore features additional service ports for vacuuming, pressure relief or pressurizing the circuit. In case it is required to perform brazing on the unit, ensure that there is no pressure remaining inside the unit. Internal pressures need to be released with ALL the service ports indicated on the figures below opened. The location is depending on mode type.

9.4. Total charging weight of the refrigerant (after a leak, etc.)

The total charging amounts relate to the refrigerant piping length.

When the total length (L) of the two indoor units' connecting pipe is less than 5m, it is unnecessary to charge additional refrigerant.

When the connecting pipe (L) exceeds 5m, it shall charge M(g) additional refrigerant per meter. That is: Refrigerant charging amount = (L-5m) x M(g/m)
For 1U24/36/48/66, M=45(g/m)

Only in COOLING operation it can charge the additional refrigerant.

When charging, the refrigerant shall be charged from the charging nozzle of low pressure valve.

Be careful when charging refrigerant, do not let the air mix into the system, and it must charge the additional refrigerant in liquid state.

9.5 Add oil instruction

The amount of oil added can be calculated by the following formula : $Q = (A + (L - 30) * B) / 4 - C$

Model	Factory oil charging
1U48NC1QRB 1U48NC1QAB	1070

Note:

- a. when $Q < 0$, oil added = 0;
- b. when $Q > 0$, oil added = Q(cc);
- c. L is the liquid pipe length, unit(m)

10. Electrical wiring work

WARNING

- All wiring must be performed by an authorized electrician.
All components procured on the site and all electric construction shall comply with the applicable legislation.

DANGER: HIGH VOLTAGE

To avoid electrical shock, make sure to disconnect the power supply 1 minute or more before servicing the electrical parts. Even after 1 minute, always measure the voltage at the terminals of main circuit capacitors or electrical parts and, before touching, make sure that those voltages are 50VDC or less.

NOTICE

To persons in charge of electrical wiring work: Do not operate the unit until the refrigerant piping is complete. (Running it before the piping is ready will break the compressor.)

10.1. Precautions on electrical wiring work

- When servicing the unit requires the refrigerant system to be opened, treatment and evacuation of refrigerant must be done in accordance with applicable legislation. Refrigerant can not be charged until field wiring has been completed.
Refrigerant may only be charged after performing the leak test and vacuum drying.

DANGER

- Before obtaining access to terminal devices, all supply circuits must be interrupted.
- Be sure to install an earth leakage circuit breaker in accordance with applicable legislation. Failure to do so may cause electrical shock.

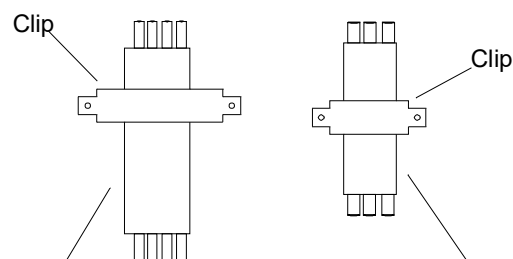
- Use only copper wires.
- A main switch or other means for disconnection, having a contact separation in all poles, must be incorporated in the fixed wiring in accordance with applicable legislation. Do not turn on the main switch until all the wiring is completed.
- Make sure to connect power supply cables in normal phase.
- Never squeeze bundled cables into a unit.
- Fix cables so that cables do not make contact with the pipes (especially on high pressure side).
- Secure the electrical wiring with cable ties as shown in the figure in 10.2 .
- Make sure no external pressure is applied to the terminal connectors.
- When installing the earth leakage circuit breaker make sure that it is compatible with the inverter (resistant to high frequency electrical noise) to avoid unnecessary opening of the earth leakage circuit breaker.
- As this unit is equipped with an inverter, installing a phase advancing capacitor not only will deteriorate power factor improvement effect, but also may cause capacitor abnormal heating accident due to high-frequency waves. Therefore, never install a phase advancing capacitor.

Model	Power Supply Cable Size
1U48NC1QRB 1U48NC1QAB	H05RN-F 3G 6.0mm ²

Model	Connection Cable Size		
	Cable Length L ≤ 40m	40m < Cable Length L < 55m	55m ≤ Cable Length L ≤ 75m
1U48NC1QRB 1U48NC1QAB	H07RN-F 4G 2.5mm ²	H07RN-F 4G 4.0mm ²	H07RN-F 4G 6.0mm ²

Note: If the connection cable size is less than the normal size, there will be some communication error.

- Fix the cable with the clip to prevent slide.



Outdoor-indoor unit connection cable

Power supply cable

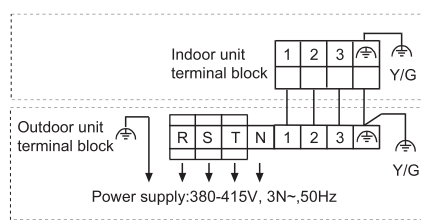
- Secure the cable to the stop valve attachment plate so that it does not slide.
- When cables are routed from the unit, a protection sleeve for the conduits (PG-insertions) can be inserted at the knock-out hole.
- When you do not use a wire conduit, be sure to protect the wires with vinyl tubes to prevent the edge of the knock-out hole from cutting the wires.
- Follow the electric wiring diagram for electrical wiring works.

CAUTION

Be sure to install the required fuses or circuit breakers.

10.2. Connecting power supply and inter-unit wiring

- Connect and fix the power supply cable, indoor-outdoor connection cable as following:



For three phase power supply models:
 1U48NC1QRB 1U48NC1QAB 1U66NC1QRB
 Power supply cable: H05RN-F 5G 4.0mm²
 Indoor and outdoor connection cable:
 H05RN-F 4G 2.5mm²

- Form the wires and fix the cover firmly so that the cover may be fit in properly.
- When you do not use a wire conduit, be sure to protect the wires with vinyl tubes to prevent the edge of the knock-out hole from cutting the wires.
- Follow the electric wiring diagram for electrical wiring works.
- Form the wires and fix the cover firmly so that the cover may be fit in properly.
 - Do not connect wires of different gauge to the same power supply terminal. (Looseness in the connection may cause overheating.)
- Use the correct screwdriver to tighten the terminal screws. Small screwdrivers can damage the screw head and prevent appropriate tightening.
- Over-tightening the terminal screws can damage the screws.

10.3. Specifications of standard wiring components



CAUTION

- Select all cables and wire sizes in accordance with applicable legislation.
 - After finishing the electrical work, confirm that each electric part and terminal inside the electric part box is connected securely.
 - The earth leakage breaker must be a high-speed type breaker of 30 mA(<0.1 s).
-

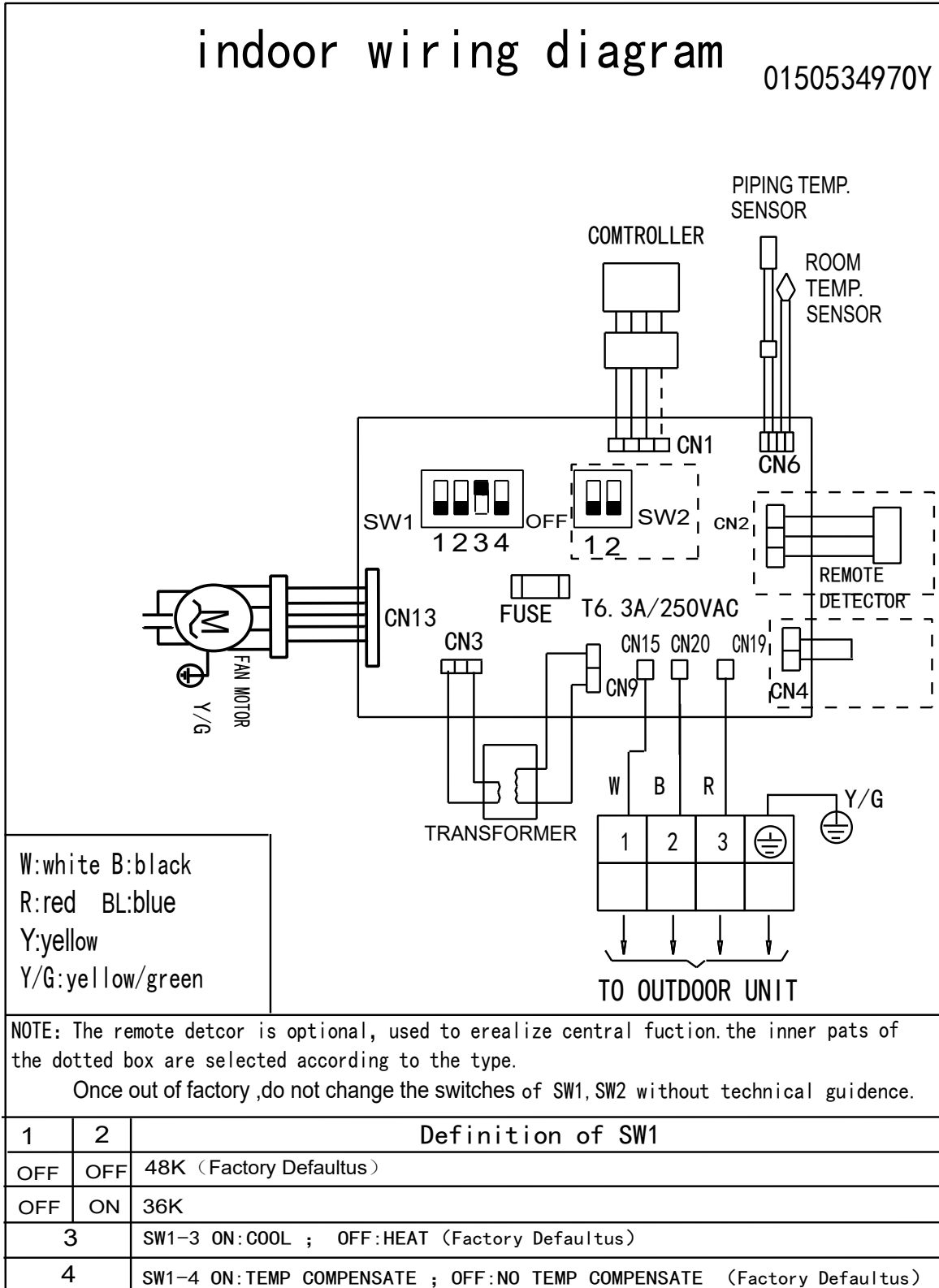
5. Performance data

1U48NC1QRB-AP48KC1QRA									
Outdoor temperature (°C)	Indoor temperature (°C)								
	27/19			25/17			23/16		
	Cooling capacity (kw)	Power input (kw)	EER	Cooling capacity (kw)	Power input (kw)	EER	Cooling capacity (kw)	Power input (kw)	EER
25	16.00	4.57	3.50	15.30	4.64	3.30	14.7	4.59	3.20
27	15.50	4.56	3.40	14.80	4.63	3.20	14.2	4.58	3.10
30	15.00	4.55	3.30	14.30	4.61	3.10	13.8	4.60	3.00
32	14.50	4.68	3.10	14.00	4.67	3.00	13.4	4.62	2.90
35	14.00	4.67	3.00	13.58	4.68	2.90	12.88	4.60	2.80
39	14.00	5.39	2.60	13.58	5.43	2.50	12.88	5.37	2.40
41	13.72	5.72	2.40	13.04	6.04	2.16	12.36	5.86	2.11
43	13.44	6.28	2.14	12.49	6.13	2.04	11.85	5.94	2.00
46	12.88	5.78	2.23	11.95	6.64	1.80	11.33	5.76	1.97
50	9.86	5.55	1.77	10.00	5.65	1.77	9.70	5.54	1.75
55	7.61	4.42	1.72	7.63	4.99	1.53	8.50	5.62	1.51

6. Wiring Diagram

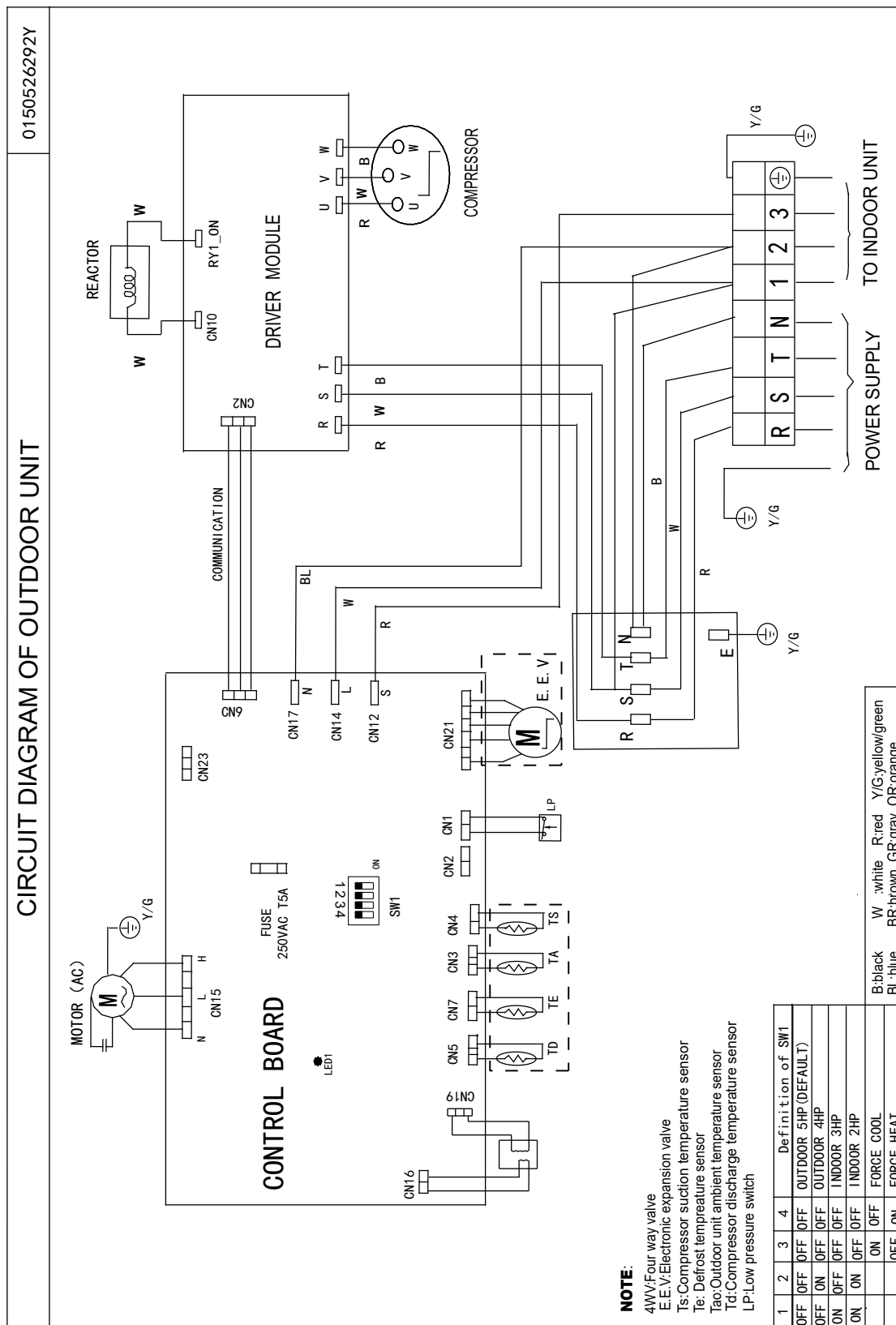
Indoor unit

AP48KC1QRA

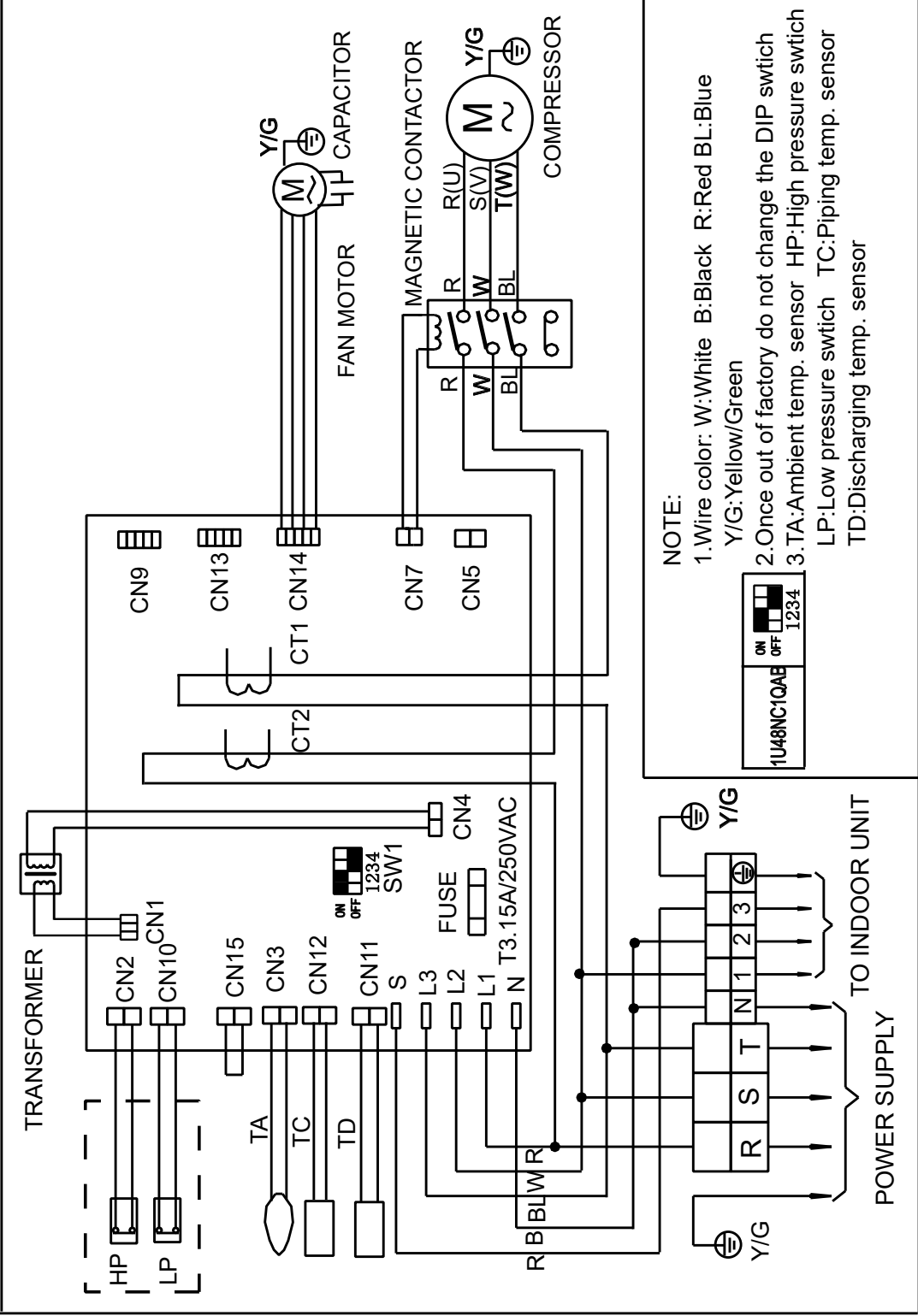


Outdoor unit

1U48NC1QRB

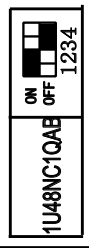


CIRCUIT DIAGRAM OF OUTDOOR UNIT 0150515036A

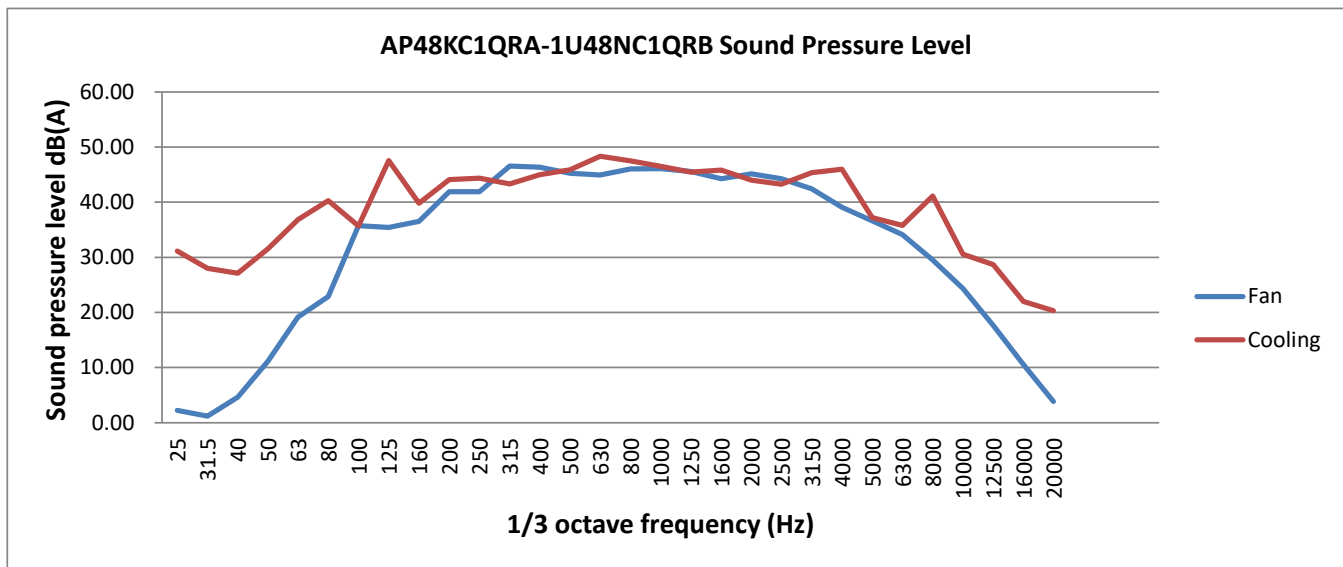
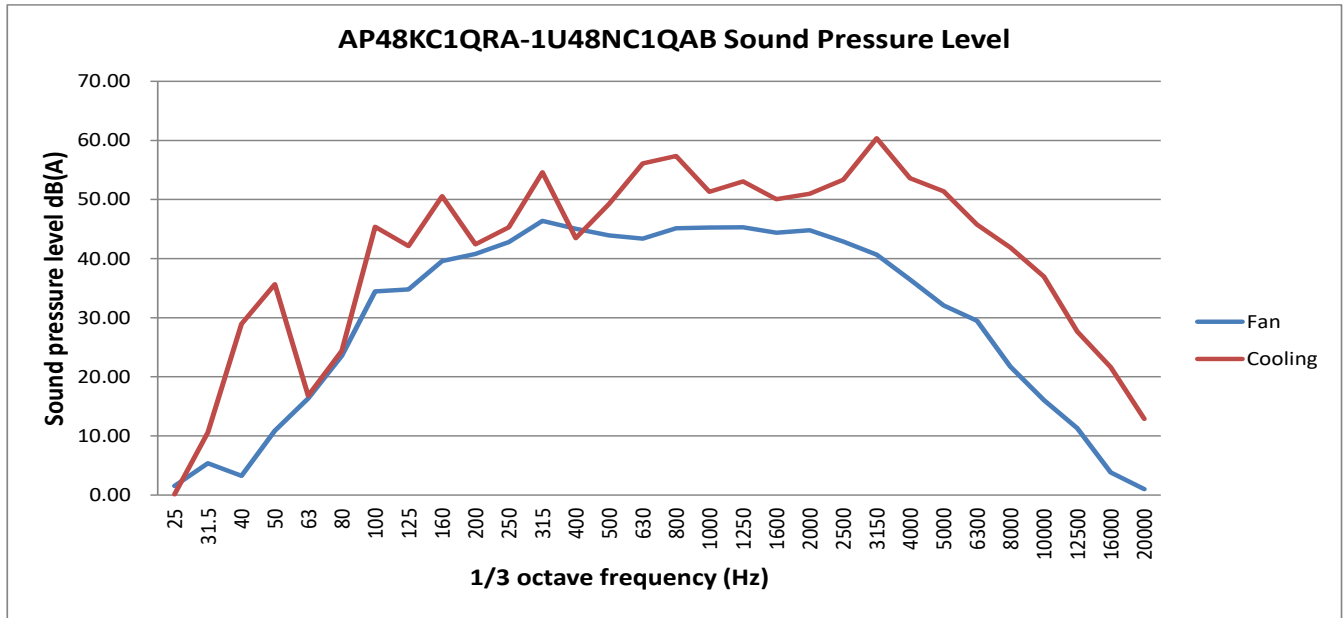


NOTE:

- 1. Wire color: W: White B: Black R: Red BL: Blue Y/G: Yellow/Green
- 2. Once out of factory do not change the DIP switch
- 3. TA: Ambient temp. sensor HP: High pressure switch LP: Low pressure switch TC: Piping temp. sensor TD: Discharging temp. sensor

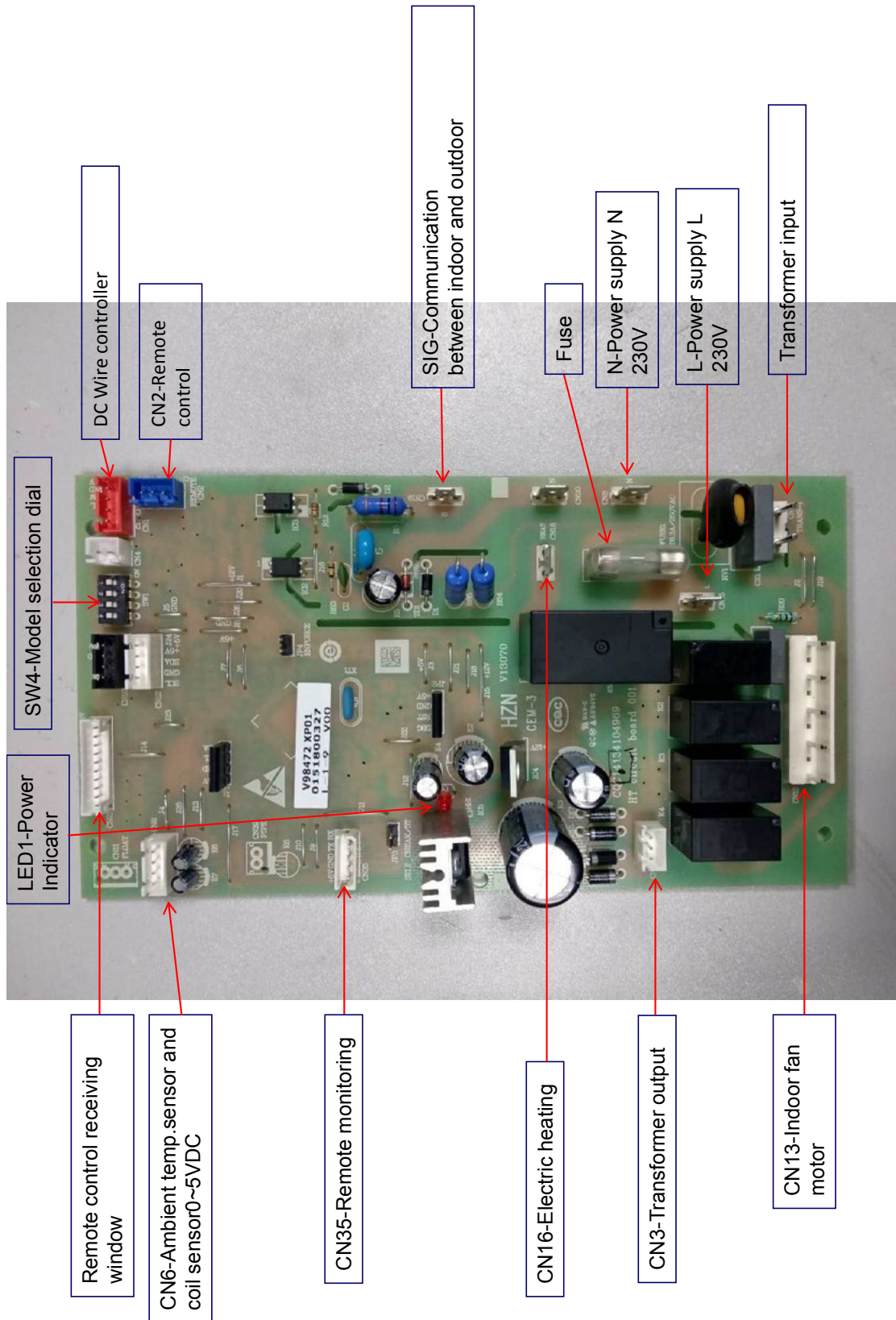


7. Noise level

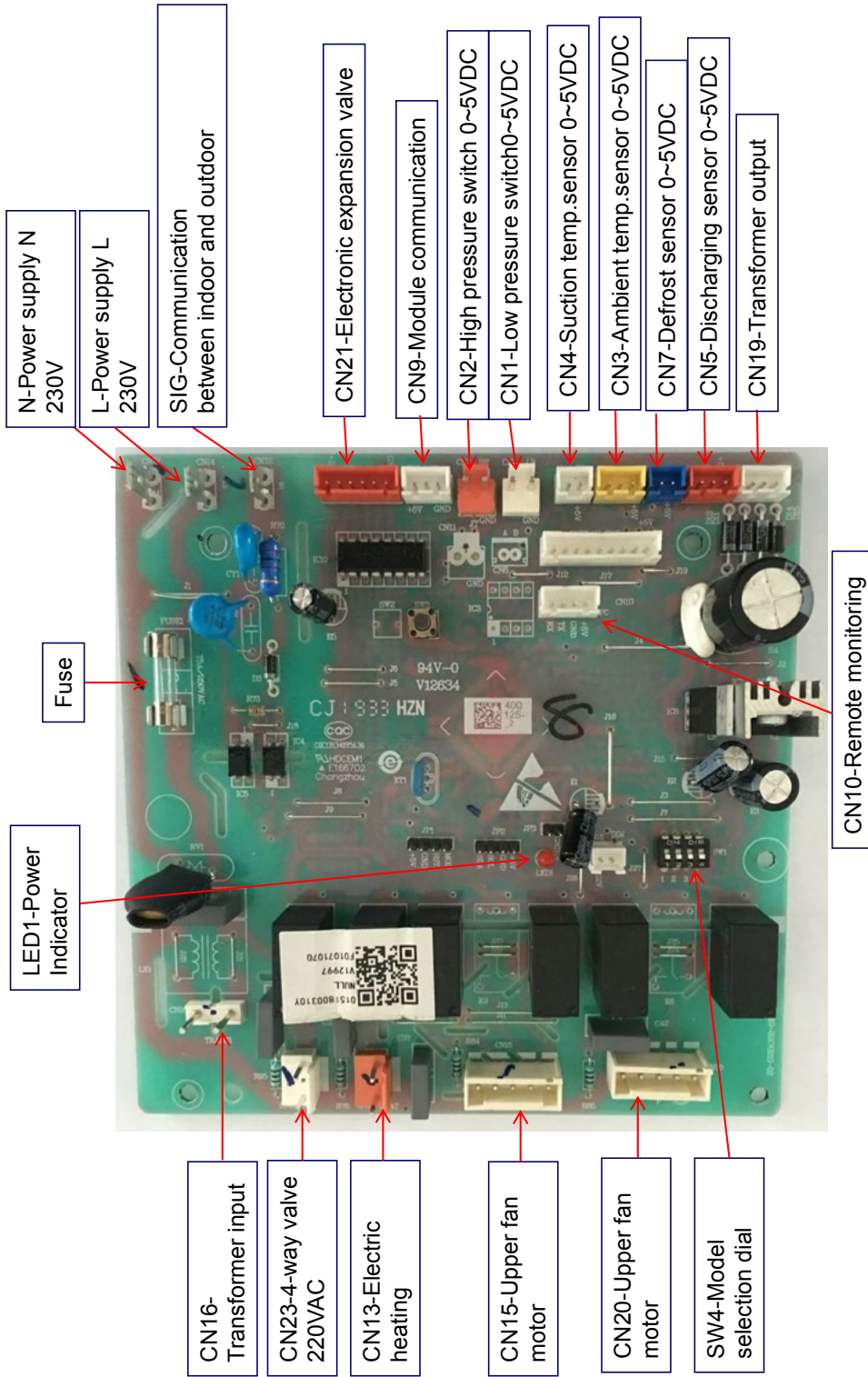


8. PCB photo, Dip Switch and Control Function

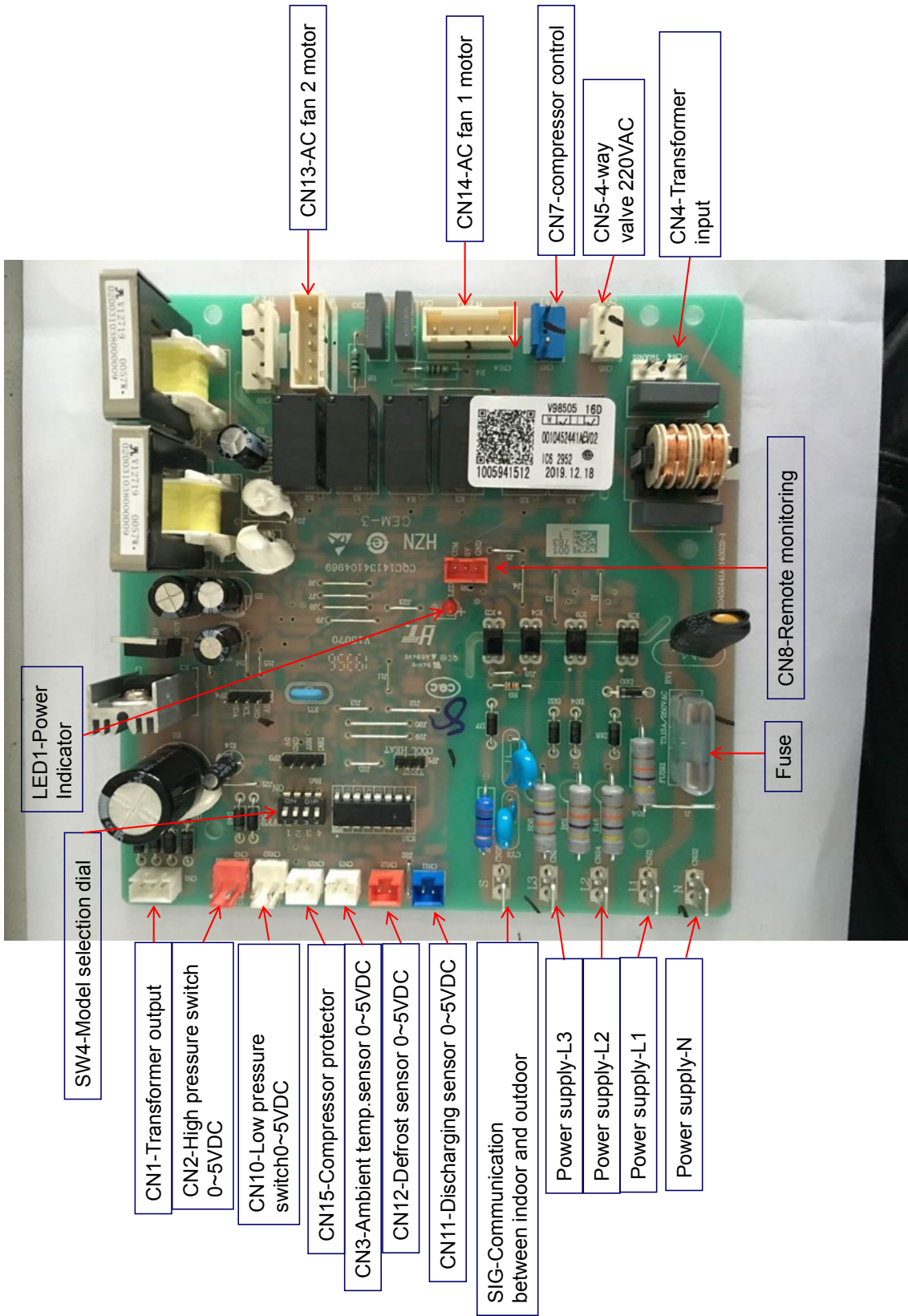
AP48KC1QRA 0151800327Y



1U48NC1QRB 0151800310Y



1U48NC1QAB 0010452441AY



Dip switch setting

1-ON, 0-OFF

No	Model	PCB	Dip switch setting (SW01)
1	AP48KC1QRA	0151800327Y	0010

No	Model	PCB	Dip switch setting (SW01)
1	1U48NC1QRB	0151800310Y	0000

No	Model	PCB	Dip switch setting (SW01)
1	1U48NC1QAB	0010452441AY	1100

9. Failure code

AP48KC1QRA

TROUBLE SHOOTING		0150533044	
Trouble Description	Panel fault code	Indoor fault code	Outdoor fault code
Float switch fault	E0	10	--
Indoor temperature sensor abnormal	E1	1	--
Indoor evaporator sensor abnormal	E2	2	--
Outdoor ambient temp. sensor abnormal	E3	20	12
Outdoor condenser tube temp. sensor abnormal	E4	20	10
Compressor overcurrent	E5	20	24
Outdoor coil sensor abnormal	E6	20	44
Low voltage protection	E7	20	29
High voltage protection	E7	20	28
Communication failure between panel or line controller and main control panel	E8	8	--
Abnormal communication between indoor and outdoor unit	E9	9	15
Low pressure abnormal	F9	20	43
Protection of discharging temp. too high or sensor abnormal	FA	20	13
Indoor EEPROM abnormal	F2	12	--
Outdoor EEPROM abnormal	F3	20	1
Anti-freeze protection indication	--	--	21
Indoor coil sensor abnormal	--	--	20
Abnormal communication between main control board and drive module	FC	20	4
Compressor current exceeds set value	FD	20	7
outdoor inspirationsensor abnormal	F4	20	11
Lack of refrigerant or exhaust plug	F8	20	16
Four valve abnormal	F5	20	17
Temperature anomaly of outdoor module	F6	20	23
outdoor module board Abnormal	F7	20	38

1U48NC1QRB

Flash times	Trouble Description	Analyze and diagnose	Remark
1	EEPROM faulty		Non-resumable
2	Over current protection in course of compressor frequency going down detected by software	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	resumable
3	protection of over current in course of compressor fixed speed operation	Module abnormal, if it occurs 3 times in 1 hour, confirm the failure	Non-resumable
4	Communication abnormal between connecting board and module	It can not get the feedback from module after communicating for 4 minutes	resumable
5	Compressor overcurrent	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
7	Compressor blocked or abnormal operation	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
8	Protection of discharging temp. too high	After compressor starts up, if TD is over 115°C, 10 seconds later compressor stops, if it occurs 3 times in 1 hour, confirm the failure	Non-resumable
9	DC fan motor faulty	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
10	Outdoor defrosting temp. sensor abnormal	Sensor is detected below 20 or over 1000 for 60 seconds, but in cooling mode, this sensor failure will not be dealt with, and in defrosting or within 6 minutes after defrosting, it will not alarm	resumable
11	Suction temp sensor abnormal	Sensor is detected below 20 or over 1000 for 60 seconds, but in defrosting or within 6 minutes after defrosting, it will not alarm	resumable
12	Ambient temp. sensor abnormal	Sensor is detected below 20 or over 1000 for 60 seconds, but in defrosting or within 6 minutes after defrosting, it will not alarm	resumable
13	Discharging temp. sensor abnormal	After compressor running for 3 minutes, Sensor is detected below 20 or over 1000 for 60 seconds	resumable
15	Communication between indoor and outdoor abnormal	Indoor unit can not be inspected for 4 minutes continuously or indoor slave unit malfunction in MAXI split system	resumable
16	Lack of refrigerant or discharging pipe blocked	If it occurs 3 times in 1 hour, confirm the failure	Non-resumable
17	4-way valve converse abnormal	If it occurs 3 times in 1 hour, confirm the failure	Non-resumable
18	Over current in course of compressor frequency going down	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
19	Over current protection in course of compressor fixed speed operation detected by software	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
23	Module temp. too high or module temp.sensor abnormal	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
24	Over current in course of compressor detection by software	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
27	Without connection to compressor	If it occurs 3 times in 1 hour, confirm the failure, the former twice will not alarm	Non-resumable
28	High voltage protection for module	From module board	resumable
29	Low voltage protection for module	From module board	resumable
38	Communication abnormal among modules	It can not detect the input signal for 2 minutes	resumable
39	Mid-condenser temp. sensor abnormal	Sensor is detected below 20 or over 1000 for 60 seconds, but in defrosting or within 6 minutes after defrosting, it will not alarm	resumable
43	Low pressure switch abnormal	After compressor running for 3 minutes, if switch is detected unconnected for 30seconds, it alarms, if it occurs 3 times in 1 hour, confirm this failure, if it occurs 3 times in 1 hour, confirm the failure, but in defrosting or within 6 minutes after defrosting, it will not alarm	Non-resumable
44	High pressure switch abnormal	After compressor running for 3 minutes, if switch is detected unconnected for 30seconds, it alarms, if it occurs 3 times in 1 hour, confirm this failure, or if TCM is over 68 degree for 10 seconds for 3 times	Non-resumable

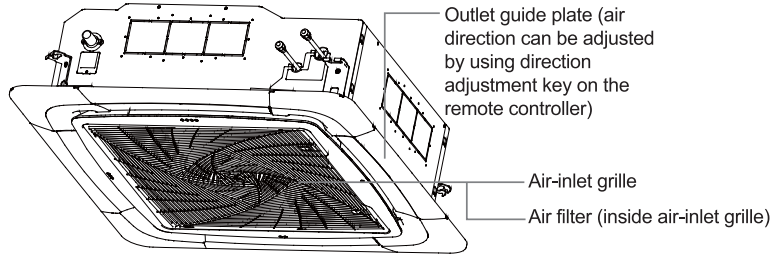
Note: The flash times of outdoor mainboard(ECU) LED1 indicates the malfunction code. for example, LED1 flash 3 times, the malfunction code is 3.The flash times or malfunction code of indoor unit can also indicate the malfunction code too.the method to confirm please refer to indoor unit manual.

TROUBLE SHOOTING 0150515380			
Flash times of LED	Trouble Description	Analyze and diagnose	Remark
3	Outdoor ambient temp. sensor abnormal	Sensor broken down or short circuit	Resumable
11	Protection of discharging temp. too high or sensor abnormal	After compressor starts up,if TD is over120℃,10seconds later compressor stops	Resumable
5	Phase sequence abnormal	Power supply phase sequence wrong	Resumable
5	Compressor current protection abnormal	Overcurrent/low current or current imbalance between two phase after compressor running	Non-Resumable
6	High pressure abnormal	High pressure switch acts abnormal.	Non-Resumable
7	High/Low voltage protection	Phase voltage too high or too low(over270V last 2 seconds; below 187V last 2 seconds)	Resumable
9	Abnormal communication between indoor and outdoor unit	Wrong connection or PCB faulty	Resumable
16	Low presure abnormal	Low pressure switch acts abnormal.	Non-Resumable
4	Outdoor defrosting temp. sensor abnormal	Sensor broken down or short circuit	Resumable
13	Outdoor EEPROM abnormal	Wrong EEPROM used	
14	Anti-freeze protection indication	System into Anti-freeze protection	Resumable

10. Remote controller

Component names and applicable models

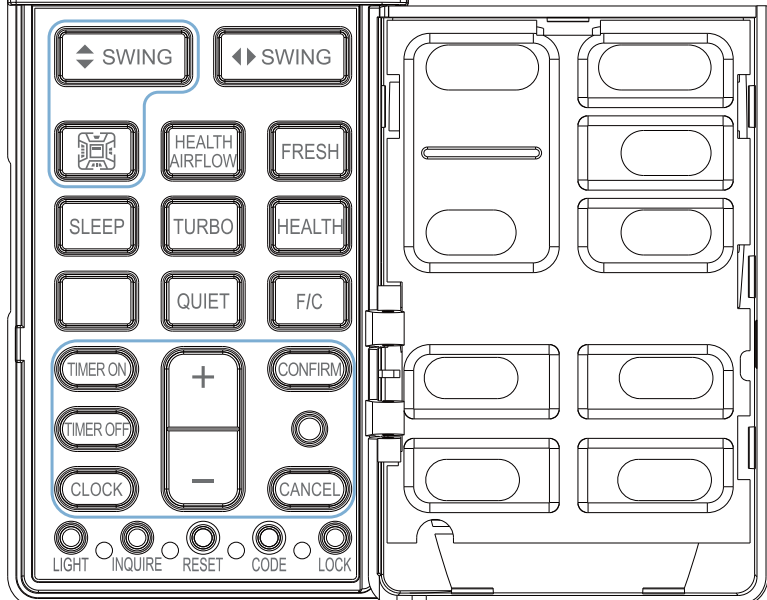
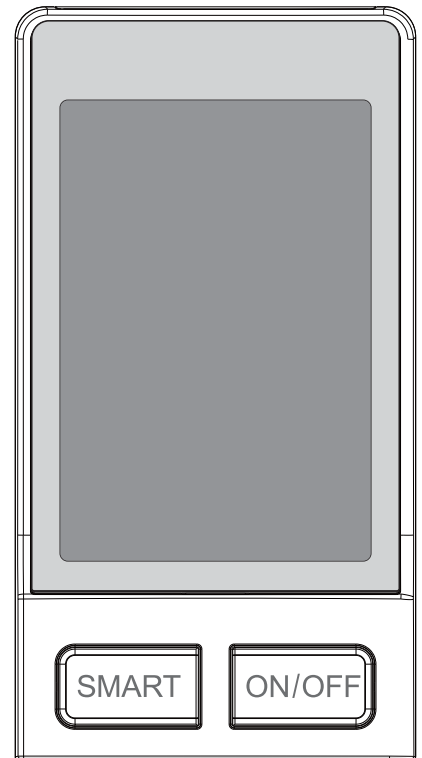
Indoor unit



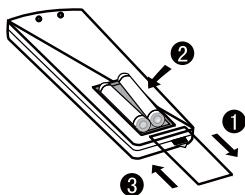
Instructions of HBS-01 Remote Controller:



External View of Remote Controller



Loading of the battery



1. Remove the battery cover
2. Insert 2 AAA batteries as illustrated noting battery polarity
3. Reinstall the battery cover

Note:

The distance between the signal transmission head and the receiver hole should be within 7m without any obstacle as well.

When electronic-started type fluorescent lamp or change-over type fluorescent lamp or wireless telephone is installed in the room, the receiver is apt to be disturbed in receiving the signals, so the distance to the indoor unit should be shorter.

Full display or unclear display during operation indicates the batteries have been used up. Please change batteries.

If the remote controller can't run normally during operation, please remove the batteries and reload several minutes later.

Hint:

Remove the batteries in case won't be in use for a long period. If there is any display after taking-out, just press reset key.

Functional description:

1. Power-up and Show All: the LCD display shows all symbols in this function. 3s later, it just shows time and the initial time is AM 12:00. The initial time is adjustable and will be confirmed automatically 10s later.

2. ON/OFF Button: press the button for power on. The initial default mode is SMART, otherwise it will be the mode before power OFF. Press OFF button after power on.

3. SMART Button:

(1) SMART button is always valid during power ON/OFF;

(2) Press SMART button to execute power OFF in SMART mode;

(3) In OFF and other modes, press SMART button to enter initial default setting of SMART mode. LCD setting temperature is not showed;

(4) In SMART mode, press TEMP. +/- button to show the setting temperature.

4. COOL Button and DRY Button

(1) When the remote controller in ON, press COOL button and DRY button to execute COOL mode and DRY mode.

(2) For initial power-up, temperature and fan speed will be showed as follows when entering each mode, otherwise parameters set last time will be showed;

Mode	SMART	COOL	DRY	FAN
Initial TEMP.	24°C	24°C	24°C	Setting temperature is not showed.
Mode	SMART	COOL	DRY	FAN
Initial Fan Speed	AUTO	HI	AUTO	LOW

5. FAN Mode

(1) During power OFF, press "HEALTH" button or "FRESH" button to enter FAN mode with low fan speed. Meanwhile, the HEALTH or FRESH icon will be showed on the screen.

(2) Temperature is not showed in FAN mode.

(3) Auto fan speed is not available when switching fan speed in FAN mode.

6. FAN SPEED Button:

(1) In other modes except for Fan mode, LOW, MED, HI and AUTO fan speed is adjustable, switching sequence is as LOW-MED-HI-AUTO-LOW.



(2) After TURBO or QUIET is set. Press TURBO button to show on the screen with fan speed as , then press "FAN SPEED" button to exit; press QUIET button to show on the screen with fan speed as , then press "FAN SPEED" button to exit. To cancel TURBO and QUIET, press TURBO and QUIET buttons respectively, and icons will disappear and the fan speed will return to the last one.

(3) This button is invalid during power OFF.

7. TEMP. +/- Button:

- (1) This button is invalid in FAN mode;
- (2) Temperature adjustment range in SMART, HEAT, COOL and DRY mode: 16 ~30°C.
- (3) Press and hold "TEMP. +/- " button, the temperature changes once; long press the button, the temperature changes rapidly.

8. Four-side Embedment (Available for some models):



(1) Initial position of all modes for first power on::

	SMART	HEAT	COOL	DRY	FAN
Four-side Embedment	Show all	Show all	Show all	Show all	Show all
SWING Angle	Position 3	Position 5	Position 3	Position 3	Position 3

(2) After power on, press "Four-side Embedment" button for the first time and the recycle approach is as follows: four-side simultaneous control of Four-side Embedment → Four-side Embedment 1 → Four-side Embedment 2 → Four-side Embedment 3 → Four-side Embedment 4 → Four-side simultaneous control of Four-side Embedment.

(3) When pressing "Four-side Embedment" button to select air deflector, the selected air deflector flashes. Press "Up-and-down Angle" button to adjust angle of air deflector at the moment.

9. Up-and-down SWING Angle:



1: Position 1; 2: Position 2; 3: Position 3; 4: Position 4; 5: Position 5; 6: Position 6 (reserved)

Recycle approach: Position 1 → Position 2 → Position 3 → Position 4 → Position 5 → AUTO → Position 1

Free swing: 1 → 2 → 3 → 4 → 5 → 4 → 3 → 2 → 1 is showed circularly.

10. Right-and-left SWING Angle (Available for some models):

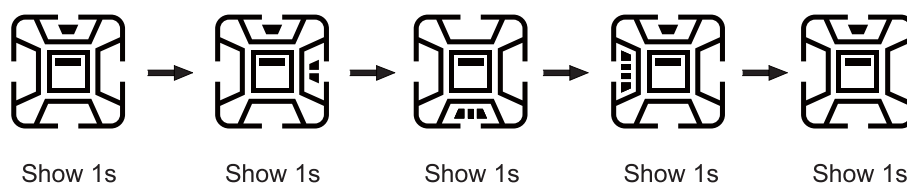
Recycle approach: 34 showed (Position 1) → 25 showed (Position 2) → 16 showed (Position 3) → 1 showed (Position 4) → 2 showed (Position 5) → 5 showed (Position 6) → 6 showed (Position 7) → Auto swing

Auto swing approach: 1 → 2 → 3 → 4 → 5 → 6 → 5 → 4 → 3 → 2 → 1 are showed circularly.



11. HEALTH AIRFLOW (Available for some models):



Press "HEALTH AIRFLOW" button to show icon on LCD display. Each air deflector of swings on four sides alternates circularly to indicate that the swing rotates to exhaust air. Meanwhile, up-and-down SWING angle shows AUTO SWING. Press it again to cancel HEALTH AIRFLOW.




12. SLEEP:

- (1) Valid during power on.
- (2) The SLEEP time is fixed to 8 hours and is not adjustable.
- (3) It is invalid in FAN mode. When setting TIMER ON or TIMER ON to TIMER OFF after setting SLEEP function, once the timer setting is successful, the SLEEP function will be cancelled; after setting TIMER ON or TIMER ON to TIMER OFF, the SLEEP function cannot be set. SLEEP function can be set from TIMER OFF to TIMER ON, TIMER OFF and SLEEP function have priority in canceling the opposite side.







13. HEALTH:

- (1) During power-on or power-OFF, press “HEALTH” button to display icon  on LCD display, and press “HEALTH” button again to cancel.
- (2) During power-OFF, press “HEALTH” button to enter blowing-in mode, start low wind and HEALTH mode, display icon .
- (3) Switch among modes, and keep HEALTH function.
- (4) If HEALTH function is set, power OFF and then on to stay in HEALTH mode.




14. ECO:

- (1) Press ECO button and the display will show .
- (2) ECO is valid under all modes, it is memorized among switch of all modes.
- (3) ECO function power-on or power-OFF is memorized.


15. Turbo/Quiet:

- (1) Press button “Turbo”, display icon  on remote LCD display, display icon  of fan speed; Press button “Quiet”, display icon  on remote LCD display, display icon  of fan speed.
- (2) Turbo and QUIET functions can not exist at the same time, the latter will replace the former.
- (3) If Turbo function is set, press “SLEEP” button to exit turbo, which means that setting SLEEP function while canceling turbo function. At the same time, the icon  disappears and icon  is shown; if QUIET function is set at present, press button “SLEEP” while QUIET function is still kept.
- (4) This function is valid under the mode of COOL or HEAT.
- (5) Turbo/QUIET functions are not memorized among switch of all modes/the state of on or OFF.

16. IFP:

- (1) Press “IFP” button, display , IFP function is set, and press “IFP” button again to cancel.
- (2) Press “Follow/Evade” button, display  that expresses following; press it again, display  that expresses evading. Press it the third time to cancel.
- (3) If follow/evade functions are set, air-out angle will change with position of people, so after setting these functions, Four-side Embedment icons in all sides, up-and-down SWING and left-and-right SWING icons will disappear.
- (4) If air conditioner is in the state of HEALTH airflow, follow/evade functions are set, HEALTH airflow function is cancelled, Four-side Embedment, up-and-down SWING and left-and-right SWING icons will disappear.

17. FRESH (available for some models):

- (1) FRESH function is valid under the state of on or OFF. When air conditioner is OFF, press “FRESH” button, display icon  on LCD display to enter blowing-in mode and low speed. Press “FRESH” button again, this function is cancelled.
- (2) After FRESH function is set, on or OFF functions are kept.
- (3) After FRESH function is set, mode switch function is kept.

18. Timer:

(1) TIMER ON

- Press “TIMER ON” button, character “ON” is flashing, press “+/-” button to adjust, then press “OK” button to confirm, if “OK” button is not pressed within 10 s, TIMER ON function is cancelled.
- If time of TIMER ON is the same as that of clock at present, character “ON” is always flashing and can not be verified, it is necessary to readjust time.
- When the time of TIMER ON is end, the setting time and character “on” disappear.

(2) TIMER OFF

- Press “TIMER OFF” button, character “OFF” is flashing, press “+/-” button to adjust, then press “OK” to confirm, if “OK” is not pressed within 10 s, TIMER OFF function is cancelled.

- If time of TIMER ON is the same as that of clock at present, character “OFF” is always flashing and can not verified, it is necessary to readjust time.
- When the time of TIMER OFF is end, the setting time and character “OFF” disappear.

(3) TIMER ON/OFF

- After TIMER ON/OFF is set, remote will automatically judge sequential order of ON/OFF, arrow indicates that the one performed first points to the one performed second.
- After the time of clock performed first is end, corresponding characters of timer “ON/OFF” disappear.
- If time of TIMER ON is the same as that of TIMER OFF, and can not be verified, corresponding character of the latter of setting time is always flashing, it is necessary to readjust time and confirm again.
- If time of TIMER ON/OFF is the same as that of clock at present, and can not be verified, it is necessary to readjust time and confirm again.

(4) After setting timer, display the setting of timer first and then display time all the time, when timer is active, character “ON/OFF” is always displayed.

19. Button +/-:

- Press button “+/-”, time will change in terms of 1 min as unit, pressing and holding the button will change quickly.

20. Clock:

- Press “Clock” button, “Morning” or “Afternoon” displayed at present are flashing to enter the state of clock adjustment, adjust clock and then press “OK” to confirm.
- It is valid under the state of ON/OFF.

21. LIGHT:

- No display on remote controller LCD, which is processed by indoor unit.

22. RESET:

- Perform one power on reset operation when RESET button is pressed.

23. LOCK:

- Press button Lock, display Lock symbol on LCD display, buttons on remote controller can not be used, press button Lock again to unlock.

24. CODE:

- Function reserved.

25. INQUIRE

- Processing by Indoor unit

11. Sensor characteristic

Model	Name	Part Code	Charistic
AP48KC1QRA	Ambient temp.sensor	0010451323	R25=23K Ω \pm 2% B25/50=4200K \pm 1%
	Coil temp.sensor	0010401922	R25=10K Ω \pm 3% B25/50=3700K \pm 3%
1U48NC1QRB	Ambient temp.sensor	001A3900110	R25=10K Ω \pm 3% B25/50=3700K \pm 3%
	Coil temp.sensor	0010451314	R25=10K Ω \pm 3% B25/50=3700K \pm 3%
	Discharging temp.sensor	0010450398	R25=10K Ω \pm 3% B25/50=3700K \pm 3%
	Suction temp.sensor	001A3900062E	R25=50K Ω \pm 3% B25/80=4450K \pm 3%
1U48NC1QAB	Ambient temp.sensor	001A3900110	R25=5K Ω \pm 3% B25/50=3450K \pm 3%
	Coil temp.sensor	0010451314	R25=5K Ω \pm 3% B25/50=3450K \pm 3%
	Discharging temp.sensor	0010450398	R25=10K Ω \pm 3% B25/80=4450K \pm 3%

R25=10KΩ±3% B25/50=3700K±3%					
Temp (°C)	Resistance (KΩ)			% (resist.tol)	
	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
-30	145.819	135.018	124.217	7	7
-29	138.071	129.126	120.181	6.93	6.93
-28	131.793	123.339	114.885	6.85	6.85
-27	125.665	117.684	109.703	6.78	6.78
-26	119.706	112.18	104.654	6.71	6.71
-25	113.933	106.843	99.753	6.64	6.64
-24	108.361	101.687	95.013	6.56	6.56
-23	102.997	96.719	90.441	6.49	6.49
-22	97.847	91.946	86.045	6.42	6.42
-21	92.915	87.371	81.827	6.35	6.35
-20	88.2	82.994	77.788	6.27	6.27
-19	83.702	78.815	73.928	6.2	6.2
-18	79.417	74.832	70.247	6.13	6.13
-17	75.342	71.041	66.74	6.05	6.05
-16	71.471	67.437	63.403	5.98	5.98
-15	67.798	64.015	60.232	5.91	5.91
-14	64.316	60.769	57.222	5.84	5.84
-13	61.017	57.692	54.367	5.76	5.76
-12	57.895	54.778	51.661	5.69	5.69
-11	54.942	52.019	49.096	5.62	5.62
-10	52.149	49.409	46.669	5.55	5.55
-9	49.51	46.941	44.372	5.47	5.47
-8	47.016	44.607	42.198	5.4	5.4
-7	44.659	42.4	40.141	5.33	5.33
-6	42.433	40.315	38.197	5.25	5.25
-5	40.332	38.345	36.358	5.18	5.18
-4	38.346	36.482	34.618	5.11	5.11
-3	36.472	34.723	32.974	5.04	5.04
-2	34.7	33.059	31.418	4.96	4.96
-1	33.027	31.487	29.947	4.89	4.89
0	31.445	30	28.555	4.82	4.82
1	29.951	28.594	27.237	4.75	4.75
2	28.538	27.264	25.99	4.67	4.67
3	27.202	26.006	24.81	4.6	4.6
4	25.938	24.815	23.692	4.53	4.53
5	24.742	23.687	22.632	4.45	4.45
6	23.61	22.619	21.628	4.38	4.38
7	22.538	21.607	20.676	4.31	4.31
8	21.522	20.647	19.772	4.24	4.24
9	20.559	19.737	18.915	4.16	4.16
10	19.646	18.874	18.102	4.09	4.09
11	18.779	18.054	17.329	4.02	4.02
12	17.958	17.276	16.594	3.95	3.95
13	17.177	16.537	15.897	3.87	3.87
14	16.436	15.834	15.232	3.8	3.8
15	15.731	15.166	14.601	3.73	3.73

R25=10KΩ±3% B25/50=3700K±3%					
Temp (°C)	Resistance (KΩ)			% (resist.tol)	
	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
16	15.061	14.53	13.999	3.65	3.65
17	14.424	13.925	13.426	3.58	3.58
18	13.817	13.349	12.881	3.51	3.51
19	13.24	12.8	12.36	3.44	3.44
20	12.69	12.277	11.864	3.36	3.36
21	12.166	11.778	11.39	3.29	3.29
22	11.666	11.302	10.938	3.22	3.22
23	11.189	10.848	10.507	3.15	3.15
24	10.734	10.414	10.094	3.07	3.07
25	10.3	10	9.7	3	3
26	9.898	9.604	9.31	3.06	3.06
27	9.514	9.226	8.938	3.13	3.13
28	9.147	8.864	8.581	3.19	3.19
29	8.796	8.519	8.242	3.25	3.25
30	8.459	8.188	7.917	3.31	3.31
31	8.137	7.871	7.605	3.38	3.38
32	7.828	7.568	7.308	3.44	3.44
33	7.532	7.277	7.022	3.5	3.5
34	7.248	6.999	6.75	3.56	3.56
35	6.977	6.733	6.489	3.63	3.63
36	6.716	6.477	6.238	3.69	3.69
37	6.466	6.232	5.998	3.75	3.75
38	6.227	5.998	5.769	3.81	3.81
39	5.997	5.773	5.549	3.88	3.88
40	5.776	5.557	5.338	3.94	3.94
41	5.564	5.35	5.136	4	4
42	5.36	5.151	4.942	4.06	4.06
43	5.166	4.961	4.756	4.13	4.13
44	4.978	4.778	4.578	4.19	4.19
45	4.799	4.603	4.407	4.25	4.25
46	4.625	4.434	4.243	4.31	4.31
47	4.46	4.273	4.086	4.38	4.38
48	4.301	4.118	3.935	4.44	4.44
49	4.148	3.969	3.79	4.5	4.5
50	4.001	3.826	3.651	4.56	4.56
51	3.86	3.689	3.518	4.63	4.63
52	3.724	3.557	3.39	4.69	4.69
53	3.594	3.431	3.268	4.75	4.75
54	3.468	3.309	3.15	4.81	4.81
55	3.349	3.193	3.037	4.88	4.88
56	3.233	3.081	2.929	4.94	4.94
57	3.123	2.974	2.825	5	5
58	3.015	2.87	2.725	5.06	5.06
59	2.913	2.771	2.629	5.13	5.13
60	2.815	2.676	2.537	5.19	5.19

R25=10KΩ±3% B25/50=3700K±3%					
Temp (°C)	Resistance (KΩ)			% (resist.tol)	
	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
61	2.721	2.585	2.449	5.25	5.25
62	2.63	2.497	2.364	5.31	5.31
63	2.543	2.413	2.283	5.38	5.38
64	2.459	2.332	2.205	5.44	5.44
65	2.379	2.255	2.131	5.5	5.5
66	2.301	2.18	2.059	5.56	5.56
67	2.228	2.109	1.99	5.63	5.63
68	2.156	2.04	1.924	5.69	5.69
69	2.088	1.974	1.86	5.75	5.75
70	2.021	1.91	1.799	5.81	5.81
71	1.958	1.849	1.74	5.88	5.88
72	1.897	1.791	1.685	5.94	5.94
73	1.839	1.735	1.631	6	6
74	1.782	1.68	1.578	6.06	6.06
75	1.728	1.628	1.528	6.13	6.13
76	1.676	1.578	1.48	6.19	6.19
77	1.626	1.53	1.434	6.25	6.25
78	1.578	1.484	1.39	6.31	6.31
79	1.531	1.439	1.347	6.38	6.38
80	1.486	1.396	1.306	6.44	6.44
81	1.443	1.355	1.267	6.5	6.5
82	1.401	1.315	1.229	6.56	6.56
83	1.362	1.277	1.192	6.63	6.63
84	1.323	1.24	1.157	6.69	6.69
85	1.285	1.204	1.123	6.75	6.75
86	1.249	1.169	1.089	6.81	6.81
87	1.214	1.136	1.058	6.88	6.88
88	1.181	1.104	1.027	6.94	6.94
89	1.148	1.073	0.998	7	7
90	1.116	1.042	0.968	7.06	7.06
91	1.085	1.013	0.941	7.13	7.13
92	1.056	0.985	0.914	7.19	7.19
93	1.026	0.957	0.888	7.25	7.25
94	0.998	0.93	0.862	7.31	7.31
95	0.971	0.904	0.837	7.38	7.38
96	0.944	0.879	0.814	7.44	7.44
97	0.918	0.854	0.79	7.5	7.5
98	0.893	0.83	0.767	7.56	7.56
99	0.867	0.806	0.745	7.63	7.63
100	0.843	0.783	0.723	7.69	7.69
101	0.819	0.76	0.701	7.75	7.75
102	0.796	0.738	0.68	7.81	7.81
103	0.772	0.716	0.66	7.88	7.88
104	0.749	0.694	0.639	7.94	7.94
105	0.727	0.673	0.619	8	8

R25=5K Ω \pm 3% B25/50=4450K \pm 3%					
Temp	Resistance (K Ω)			% (resist.tol)	
($^{\circ}$ C)	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
-30	67.148	62.209	57.268	7.94	7.94
-29	63.782	58.887	54.289	8.31	7.81
-28	60.323	55.769	51.487	8.17	7.68
-27	57.079	52.841	48.85	8.02	7.55
-26	54.036	50.088	46.367	7.88	7.43
-25	51.178	47.499	44.028	7.75	7.31
-24	48.492	45.062	41.822	7.61	7.19
-23	45.968	42.768	39.742	7.48	7.07
-22	43.592	40.606	37.78	7.35	6.96
-21	41.357	38.568	35.927	7.23	6.85
-20	39.251	36.646	34.176	7.11	6.74
-19	37.266	34.833	32.522	6.99	6.63
-18	35.395	33.12	30.959	6.87	6.53
-17	33.631	31.503	29.48	6.75	6.42
-16	31.965	29.975	28.081	6.64	6.32
-15	30.393	28.531	26.757	6.53	6.22
-14	28.908	27.165	25.503	6.42	6.12
-13	27.505	25.873	24.315	6.31	6.02
-12	26.178	24.65	23.19	6.2	5.92
-11	24.924	23.493	22.123	6.09	5.83
-10	23.737	22.396	21.112	5.99	5.73
-9	22.614	21.358	20.153	5.89	5.64
-8	21.551	20.373	19.243	5.78	5.55
-7	20.545	19.44	18.379	5.68	5.46
-6	19.591	18.555	17.559	5.58	5.37
-5	18.687	17.716	16.781	5.49	5.28
-4	17.83	16.919	16.041	5.39	5.19
-3	17.018	16.163	15.338	5.29	5.1
-2	16.247	15.445	14.67	5.2	5.02
-1	15.516	14.763	14.035	5.1	4.93
0	14.822	14.115	13.431	5.01	4.85
1	14.163	13.499	12.856	4.92	4.76
2	13.537	12.914	12.31	4.83	4.68
3	12.943	12.357	11.789	4.74	4.6
4	12.378	11.828	11.294	4.65	4.52
5	11.841	11.324	10.822	4.56	4.44
6	11.33	10.845	10.372	4.48	4.36
7	10.845	10.388	9.944	4.39	4.28
8	10.382	9.954	9.536	4.31	4.2
9	9.943	9.54	9.147	4.22	4.12
10	9.524	9.146	8.775	4.14	4.05
11	9.126	8.77	8.421	4.06	3.97
12	8.746	8.412	8.084	3.98	3.9
13	8.384	8.07	7.761	3.9	3.83
14	8.04	7.744	7.454	3.82	3.75
15	7.711	7.433	7.16	3.74	3.68

R25=5KΩ±3% B25/50=4450K±3%					
Temp (°C)	Resistance (KΩ)			% (resist.tol)	
	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
16	7.398	7.137	6.879	3.66	3.61
17	7.099	6.854	6.611	3.58	3.54
18	6.814	6.583	6.355	3.51	3.47
19	6.542	6.325	6.11	3.43	3.4
20	6.283	6.079	5.876	3.36	3.33
21	6.035	5.843	5.652	3.29	3.26
22	5.798	5.618	5.438	3.21	3.2
23	5.572	5.403	5.233	3.14	3.13
24	5.356	5.197	5.038	3.07	3.07
25	5.15	5	4.85	3	3
26	4.959	4.812	4.665	3.06	3.06
27	4.776	4.632	4.487	3.12	3.11
28	4.601	4.459	4.318	3.18	3.17
29	4.433	4.294	4.156	3.24	3.22
30	4.273	4.136	4.001	3.3	3.28
31	4.119	3.985	3.852	3.36	3.33
32	3.971	3.84	3.71	3.41	3.38
33	3.829	3.701	3.574	3.47	3.44
34	3.694	3.568	3.444	3.52	3.49
35	3.563	3.44	3.319	3.58	3.54
36	3.439	3.318	3.199	3.63	3.59
37	3.319	3.201	3.085	3.68	3.64
38	3.204	3.088	2.975	3.73	3.68
39	3.093	2.981	2.869	3.78	3.73
40	2.987	2.877	2.768	3.83	3.78
41	2.885	2.778	2.671	3.88	3.82
42	2.788	2.682	2.578	3.93	3.87
43	2.694	2.591	2.489	3.98	3.91
44	2.604	2.503	2.404	4.03	3.96
45	2.517	2.418	2.321	4.07	4
46	2.433	2.337	2.243	4.12	4.05
47	2.353	2.259	2.167	4.16	4.09
48	2.276	2.184	2.094	4.21	4.13
49	2.202	2.112	2.024	4.25	4.17
50	2.131	2.043	1.957	4.3	4.21
51	2.062	1.976	1.892	4.34	4.25
52	1.996	1.912	1.83	4.38	4.29
53	1.933	1.851	1.771	4.42	4.33
54	1.871	1.791	1.713	4.46	4.37
55	1.813	1.734	1.658	4.5	4.4
56	1.756	1.68	1.605	4.54	4.44
57	1.701	1.627	1.554	4.58	4.48
58	1.649	1.576	1.505	4.62	4.51
59	1.598	1.527	1.457	4.65	4.55
60	1.549	1.48	1.412	4.69	4.58

R25=5KΩ±3% B25/50=4450K±3%					
Temp (°C)	Resistance (KΩ)			% (resist.tol)	
	Rmax	R (t) Normal	Rmin	MAX(+)	MIN(-)
61	1.502	1.434	1.368	4.73	4.62
62	1.456	1.39	1.326	4.76	4.65
63	1.413	1.348	1.285	4.8	4.68
64	1.37	1.307	1.245	4.83	4.72
65	1.33	1.268	1.208	4.87	4.75
66	1.29	1.23	1.171	4.9	4.78
67	1.252	1.193	1.136	4.94	4.81
68	1.216	1.158	1.102	4.97	4.85
69	1.18	1.124	1.069	5	4.88
70	1.146	1.091	1.038	5.03	4.91
71	1.113	1.059	1.007	5.07	4.94
72	1.081	1.029	0.978	5.1	4.97
73	1.05	0.999	0.949	5.13	5
74	1.021	0.971	0.922	5.16	5.03
75	0.992	0.943	0.895	5.19	5.06
76	0.964	0.916	0.87	5.23	5.09
77	0.937	0.89	0.845	5.26	5.12
78	0.911	0.866	0.821	5.29	5.15
79	0.886	0.841	0.798	5.32	5.18
80	0.862	0.818	0.775	5.35	5.21
81	0.838	0.795	0.754	5.38	5.24
82	0.815	0.774	0.733	5.41	5.27
83	0.793	0.752	0.712	5.44	5.3
84	0.772	0.732	0.693	5.47	5.33
85	0.751	0.712	0.674	5.51	5.36
86	0.731	0.693	0.655	5.54	5.39
87	0.712	0.674	0.638	5.57	5.42
88	0.693	0.656	0.62	5.6	5.45
89	0.675	0.639	0.604	5.63	5.48
90	0.657	0.622	0.587	5.66	5.51
91	0.64	0.605	0.572	5.69	5.54
92	0.623	0.589	0.557	5.72	5.57
93	0.607	0.574	0.542	5.75	5.6
94	0.591	0.559	0.527	5.78	5.62
95	0.576	0.544	0.514	5.81	5.65
96	0.561	0.53	0.5	5.84	5.68
97	0.547	0.517	0.487	5.87	5.71
98	0.533	0.503	0.474	5.89	5.73
99	0.52	0.49	0.462	5.92	5.76
100	0.506	0.478	0.45	5.95	5.78
101	0.494	0.466	0.439	5.97	5.8
102	0.481	0.454	0.428	5.99	5.82
103	0.469	0.443	0.417	6.02	5.84
104	0.458	0.432	0.406	6.04	5.86
105	0.446	0.421	0.396	6.05	5.88



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