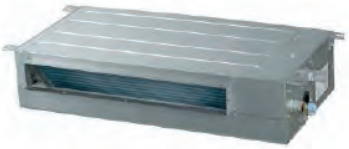
Haier

Multi-Zone Technical Overview



ENGLISH

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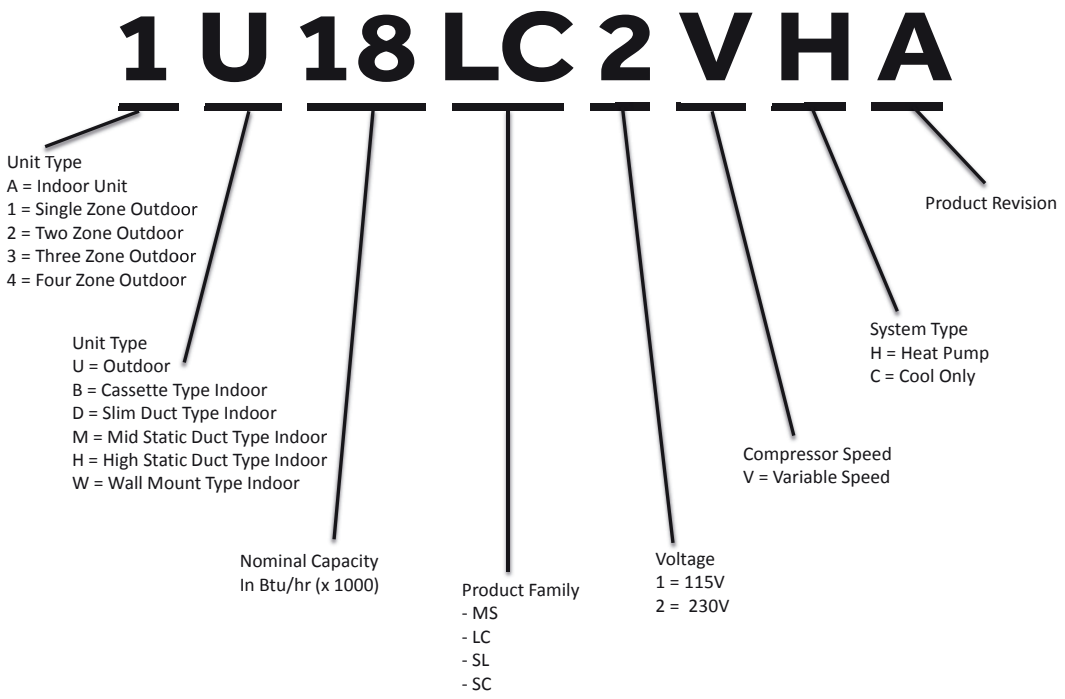
Nomenclature



Multi-Zone Indoor

High Wall

Indoor	AW07LC2VH*	AW09LC2VH*	AW12LC2VH*	AW18LC2VH*
Rated Cooling Capacity *Btu/hr*	7,000	9,000	12,000	18,000
Rated Heating Capacity *Btu/hr*	8,000	10,000	13,000	19,000
Voltage, Cycle, Phase *V/Hz/-*	208-230/60/1	208-230/60/1	208-230/60/1	208-230/60/1
Fan Speed Stages	5+Auto	5+Auto	5+Auto	5+Auto
Airflow (Turbo/High/Med/Low/Quiet) *CFM*	410/350/295/235/205	410/350/295/235/205	440/380/320/265/215	636/530/483/430/383
Motor Speed (Turbo/High/Med/Low/Quiet) *RPM*	1050/950/800/650/600	1050/950/800/650/600	1100/1000/850/700/620	1100/950/850/750/600
Indoor Sound Level dB (Turbo/High/Med/Low/Quiet)	43/38/33/26/22	43/38/33/26/22	44/39/34/27/23	48/45/40/35/30
Dimension: Height *in (mm)*	11 (280)	11 (280)	11 (280)	12 3/4 (332)
Dimension: Width *in (mm)*	33 5/8 (855)	33 5/8 (855)	33 5/8 (855)	39 1/4 (997)
Dimension: Depth *in (mm)*	8 1/16 (204)	8 1/16 (204)	8 1/16 (204)	9 1/4 (235)
Weight (Ship/Net)- *lbs (kg)*	26.8/22(12.2/10)	26.8/22(12.2/10)	26.8/22(12.2/10)	35.3/28.6 (16/13)
Connections	Flare	Flare	Flare	Flare
Liquid O.D. *in*	1/4	1/4	1/4	1/4
Suction O.D. *in*	3/8	3/8	3/8	1/2
Drainpipe Size O.D. *in*	5/8	5/8	5/8	5/8

Cassette

Indoor	AB09SC2VH*	AB12SC2VH*	AB18SC2VH*
Rated Cooling Capacity *Btu/hr*	9,000	12,000	18,000
Rated Heating Capacity *Btu/hr*	10,000	13,000	19,000
Voltage, Cycle, Phase *V/Hz/-*	208-230/60/1	208-230/60/1	208-230/60/1
Fan Speed Stages	5+Auto	5+Auto	5+Auto
Airflow (Turbo/High/Med/Low/Quiet)	410/365/305/265/205	410/365/305/265/205	470/410/365/295/252
Motor Speed (Turbo/High/Med/Low/Quiet)	750/690/620/560/500	750/690/620/560/500	830/750/690/610/550
Indoor Sound Level dB (Turbo/High/Med/Low/Quiet)	42/40/36/32/25	42/40/36/32/25	45/42/40/36/32
Grill Model	PB-700IB	PB-700IB	PB-700IB
Chassis Dimension: Height *in (mm)*	10 1/4 (260)	10 1/4 (260)	10 1/4 (260)
Chassis Dimension: Width *in (mm)*	22 7/16(570)	22 7/16(570)	22 7/16(570)
Chassis Dimension: Depth *in (mm)*	22 7/16(570)	22 7/16(570)	22 7/16(570)
Grill Dimension: Height *in (mm)*	2 3/8 (60)	2 3/8 (60)	2 3/8 (60)
Grill Dimension: Width *in (mm)*	27 9/16 (700)	27 9/16 (700)	27 9/16 (700)
Grill Dimension: Depth *in (mm)*	27 9/16 (700)	27 9/16 (700)	27 9/16 (700)
Weight (Ship/Net)- *lbs (kg)*	46.3/37.5 (21/17)	48.5/40.8 (22/18.5)	48.5/40.8 (22/18.5)
Connections	Flare	Flare	Flare
Liquid O.D. *in*	1/4	1/4	1/4
Suction O.D. *in*	3/8	3/8	1/2
Drainpipe Size O.D. *in*	1 1/4	1 1/4	1 1/4
Internal Condensate Pump	Standard	Standard	Standard
Max. Drain-Lift height *in(mm)*	27 9/16 (700)	27 9/16 (700)	27 9/16 (700)

SPECIFICATIONS

Multi-Zone Indoor

Concealed

Indoor	AD07SL2VH*	AD09SL2VH*	AD12SL2VH*	AD18SL2VH*
Rated Cooling Capacity *Btu/hr*	7,000	9,000	12,000	18,000
Rated Heating Capacity *Btu/hr*	8,000	10,000	13,000	19,000
Voltage, Cycle, Phase *V/Hz/-*	208-230/60/1	208-230/60/1	208-230/60/1	208-230/60/1
Fan Speed Stages	5+Auto	5+Auto	5+Auto	5+Auto
Airflow (Turbo/High/Med/Low/Quiet)	353/312/270/230/188	353/312/270/230/188	400/353/282/247/218	540/500/447/365/306
Motor Speed (Turbo/High/Med/Low/Quiet)	950/850/750/650/550	950/850/750/650/550	1050/950/800/700/600	1050/950/850/750/650
Max. External Static Pressure *in.W.G (Pa)*	0.16 (40)	0.16 (40)	0.16 (40)	0.16 (40)
Indoor Sound Level dB (Turbo/High/Med/Low/Quiet)	35/33/29/26/21	35/33/29/26/22	38/35/29/26/23	31/29/23/29/25
Dimension: Height *in (mm)*	7 5/16 (185)	7 5/16 (185)	7 5/16 (185)	7 5/16 (185)
Dimension: Width *in (mm)*	33 7/16 (850)	33 7/16 (850)	33 7/16 (850)	46 1/16 (1170)
Dimension: Depth *in (mm)*	16 9/16 (420)	16 9/16 (420)	16 9/16 (420)	16 9/16 (420)
Weight (Ship/Net)- *lbs (kg)*	47.2/36.8 (21.4/16.7)	47.2/36.8 (21.4/16.7)	47.2/36.8 (21.4/16.7)	61.8/48.5(28/22)
Connections	Flare	Flare	Flare	Flare
Liquid O.D. *in*	1/4	1/4	1/4	1/4
Suction O.D. *in*	3/8	3/8	3/8	1/2
Drainpipe Size O.D. *in*	1 1/4	1 1/4	1 1/4	1 1/4
Internal Condensate Pump	Standard	Standard	Standard	Standard
Max. Drain-Lift height *in(mm)*	27 9/16 (700)	27 9/16 (700)	27 9/16 (700)	27 9/16 (700)

Multi-Zone Outdoor

Model Number	Outdoor	2U18MS2VH*	3U24MS2VH*	4U36MS2VH*
Cooling Non-ducted	Rated Capacity *Btu/hr*	17,400	22,600	34,000
	Capacity Range *Btu/hr*	4,400-19,400	5,000-24,500	5,000-36,000
	Rated Power Input *W*	1,650	2,250	3,770
	SEER	16.0	18.0	18.0
	EER	10.5	10.0	9.0
Cooling Ducted	Rated Capacity *Btu/hr*	15,000	21,000	31,000
	Capacity Range *Btu/hr*	4,400-19,400	5,000-23,000	5,000-34,000
	Rated Power Input *W*	1,760	2,416	3,590
	SEER	16.0	16.0	16.0
	EER	8.5	8.5	8.5
Heating Non-ducted	Rated Heating Capacity 47°F *Btu/hr*	19,200	23,000	34,600
	Heating Capacity Range *Btu/hr*	6,100-22,100	6,100-25,500	6,100-36,500
	Rated Power Input *W*	1,570	1,700	2,650
	HSPF	9.0	10.0	10.0
	Rated Heating Capacity 17°F *Btu/hr*	13,000	15,000	22,000
	Max. Heating Capacity 17°F *Btu/hr*	14,000	18,000	26,000
	Max. Heating Capacity 5°F *Btu/hr*	12,000	16,000	24,000
Heating Ducted	Rated Heating Capacity 47°F *Btu/hr*	18,000	22,000	33,000
	Heating Capacity Range *Btu/hr*	6,100-22,100	6,100-25,000	6,100-35,000
	Rated Power Input *W*	1,700	2,100	3,000
	HSPF	8.5	8.5	9.0
	Rated Heating Capacity 17°F *Btu/hr*	10,000	14,000	21,000
	Max. Heating Capacity 17°F *Btu/hr*	12,000	17,000	25,000
	Max. Heating Capacity 5°F *Btu/hr*	10,000	15,000	23,000
Operating Range	Cooling *°F(°C)*	14~115(-10~46)	14~115(-10~46)	14~115(-10~46)
	Heating *°F(°C)*	-4~75(-20~24)	-4~75(-20~24)	-4~75(-20~24)
Power Supply	Voltage, Cycle, Phase *V/Hz/-*	208-230/60/1	208-230/60/1	208-230/60/1
Outdoor Unit	Compressor Type	DC Interver Driven Rotary		
	Maximum Fuse Size *A*	25	25	30
	Minimum Circuit Amp *A*	15	18	23
	Outdoor Fan Speed *RPM*	300 ~ 900	300 ~ 900	300 ~ 900
	Outdoor Noise Level *dB*	53	54	56
	Dimension: Height *in (mm)*	27 1/16(688)	28 3/4(730)	33 1/16(840)
	Dimension: Width *in (mm)*	31 7/8(810)	33 7/8(860)	37 5/16(948)
	Dimension: Depth *in (mm)*	11 5/16(288)	12 1/8(308)	13 3/8(340)
	Weight (Ship/Net)- *lbs (kg)*	102.5/95.9(46.5/43.5)	123.4/116.8(56/53)	191.8/167.5(87/76)
Indoor Unit	Max Indoor units	2	3	4
Refrigerate Line	Connections	Flare	Flare	Flare
	Liquid O.D. *in*	1/4 1/4	1/4 1/4 1/4	1/4 1/4 1/4 1/4
	Suction O.D. *in*	3/8 3/8	3/8 3/8 3/8	3/8 3/8 3/8 1/2
	Factory Charge *Oz*	49.5	74.0	113.0
	Maximum Line Length *Ft / m*	82/25	82/25	82/25
	Maximum Height *Ft / m*	50/15	50/15	50/15
	Maximum Line Length for each individual indoor unit *Ft / m*	100/30	200/60	230/70

SAFETY OVERVIEW

Read These Safety Precautions

Be sure to read the safety precautions before conducting work. The items are classified into “Warning” and “Caution.” The “Warning items are especially important since they can lead to death or serious injury if not followed closely. The “Caution” items can also lead to serious accidents under some conditions if they are not followed. Therefore, be sure to observe all safety precautions listed here.

Δ This symbol means be careful when doing this procedure or touching this equipment.

o This symbol indicates a prohibited action.

● This symbol means that an action must be taken; the action will be listed next to the symbol.

After the repair work is complete, be sure to conduct a test operation to ensure that the equipment operates properly; explain the safety precautions for operating the equipment to the customer.

Warning

Disconnect the power cable from electrical socket before disassembling equipment for repair. Working on equipment that is connected to a power supply can cause an electrical shock.	
If the refrigerant gas discharges during the repair work DO NOT touch the discharging refrigerant gas. The refrigerant gas can cause frostbite.	
Before disconnecting the suction or discharge pipe of the compressor at the welded section, recover the refrigerant gas in a well-ventilated area. If refrigerant gas remains inside the compressor, the refrigerant gas or the refrigerating machine oil will discharge when the pipe is disconnected and may cause injury.	
If the refrigerant gas leaks during the repair work, ventilate the area. The refrigerant gas can generate toxic gases when it contacts flames.	
The step-up capacitor supplies high-voltage electricity to the electrical components of the outdoor unit. Be sure to discharge the capacitor completely before conducting repair work. A charged capacitor can cause electrical shock.	
Be sure to use parts listed in the service parts of the applicable model and appropriate tools to conduct repair work. Never attempt to modify the equipment. The use of inappropriate parts or tools can cause electrical shock, excessive heat generation, or fire.	
When relocating the equipment make sure that the new installation site has sufficient strenght to withstand the weight of the equipment. If the new installation site does not have sufficient strength and if the installation work is not conducted securely, the equipment can fall and cause injury.	

Be sure to install the product correctly by using the standard installation frame provided. Incorrect use of the installation frame and improper installation can cause equipment to fall, resulting in injury.	For integral units only
Do not repair the electrical components with wet hands. Working on equipment with wet hands can cause electrical shock.	
Do not clean the equipment by splashing water. Washing the unit with water can cause an electrical shock.	
Make sure that the unit is grounded when reparing the equipment in a wet or humid place to avoid electrical shocks.	
Be sure to turn off the power switch when cleaning the equipment; the internal fan rotates at a high speed and may cause injury.	
Do not tilt the unit when removing it. Water inside the unit can spill, wetting the floor.	
Be sure to check that the refrigeration cycle section has cooled down sufficiently before conducting repair work. Working on the unit when the refrigerating cycle is hot can cause burns.	
Use the welder in a well-ventilated place. Using the welder in an enclosed room can cause oxygen deficiency.	
Be sure to use a dedicated power circuit for the equipment; follow appropriate technical standards for the electrical equipment, the internal wiring regulations, and the instruction manual for installation when conducting electrical work. Insufficient power circuit capacity and improper electrical work can cause an electrical shock or fire.	

Read These Safety Precautions

Be sure to use the specified cable to connect between the indoor and outdoor units. Make the connections securely and route the cable properly so that there is no force pulling the cable at the connection terminals.	
When connecting the cable between the indoor and outdoor units make sure that the terminal cover does not lift off or dismount because of the cable. If the cover is not mounted properly, the terminal connection section can cause an electrical shock, excessive heat generation, or fire.	
Do not damage or modify the power cable. Damaged or modified power cables can cause electrical shock or fire. Placing heavy items on the power cable and heating or pulling the power cable can damage the cable.	
Do not mix air or gas other than the specified refrigerant (R=4 10A/R22) in the refrigerant system. If air enters the refrigerant system, an excessively high pressure results, causing equipment damage and injury.	
If the refrigerant gas leaks, be sure to locate the leak and repair it before charging the refrigerant. If the leak cannot be located and the repair work cannot be stopped, be sure to perform pump-down and close the service valve to prevent the refrigerant gas from leaking into the room. The refrigerant gas itself is harmless, but it can generate toxic gases when it contacts flames, such as fan and other heaters or stoves and ranges.	
When replacing the remote control battery, be sure to safely dispose of the battery to prevent children from swallowing it.	
Do not install the equipment in a place where there is a possibility of combustable gas leaks. If combustible gas leaks and remains near the unit, it may cause a fire.	
Be sure to install the packing and seal on the installation frame correctly. If the packing and seal are not properly installed, water can spill out, wetting furniture and the floor.	For integral units only

Replace power cables and lead wires if they are scratched or deteriorated. Damaged cable and wires can cause electrical shock, excessive heat generation, or fire.	
Check to see if the parts are mounted correctly, that the wires are connected correctly, and that connections at soldered or crimped terminals are secure. Improper installation and connections can cause excessive heat generation, electrical shock, and fire.	
If the installation platform or frame has deteriorated or corroded, replace it. Corroded platform or frames can cause the unit to fall, resulting in injury.	
Check to make sure that the equipment is grounded. Repair it if it is not properly grounded. Improper grounding can cause an electrical shock.	
Be sure to measure the installation resistance of the repair. Be sure that the resistance is 1 M ohm or higher. Faulty installation can cause an electric shock.	
Be sure to check the drainage of the indoor unit after the repair. Faulty drainage can cause the water to spill, wetting the furniture and the floor.	

Important Safety Related Installation Information

Indoor Clearances: If noncompliant may lead to temperature control complaints.

Wire Sizing: If noncompliant may lead to communication errors and inverter irregular operation.

Splices in Field Wiring: Splices between the wires that connect between the outdoor and indoor unit should be avoided. Communication errors may occur if noncompliant.

Sealing Penetrations: If penetrations at back of unit are not sealed, unconditioned air may be drawn into the back of the indoor wall mount unit. Temperature control and capacity complaints may occur.

Functions and Controls

Auto Mode

When the running mode is turned to auto after starting the system, the system will first determine the running mode according to the current room temperature and then will run according to the determined mode: Tr means room temperature; Ts means temperature setting; Tp means temperature of indoor coil pipe

Tr≥73°F Choose Cooling Mode
Tr<73°F Choose Heating Mode

After turning to the auto mode, the running mode will be switched between cooling mode, fan mode, and heating mode according to the change of the indoor ambient temperature. There is a 15 minute delay between mode changes.

Cooling operation mode

Temperature control range: 60°F---86°F
Temperature difference: ±2°F
* Control features: When Tr (input airflow)>Ts (set temperature) °F, the indoor fan will operate at the set speed, the mode signal will be sent to the outdoor system, and the compressor will start. When Tr (input airflow)< Ts (set temperature)°F, the indoor fan will operate at the set speed, and the mode signal will be sent to the outdoor system, and the compressor will stop. The system will keep the original status if Tr= Ts.
Airflow speed control: (temperature difference ±2°F)
Automatic:
When Tr≤Ts +4°F high speed.
When Ts+2°F≤Tr<Ts+5°F, medium speed
When Tr<Ts+2°F, low speed
When the sensor is off, low speed
When the airflow speed has no delay from the high to low switching, the speed should be delayed for 3 minutes (remain at high speed for 3 minutes.) before the next switch.

When the system is operating, you can set the high, medium or low speed manually. (When the sensor is on or off, the system will change the speed 2 seconds after receiving the signal.)

*Louver control: the location for the louver can be set according to your needs.
*Defrosting function: preventing the frosting on the indoor heat exchanger (when cooling or dehumidifying). When the compressor works continuously for 1 to 6 minutes (adaptable in EEPROM) and the temperature of the indoor coils has been below 32°F for 10 seconds, the compressor will be stopped and the malfunction will be recorded in the malfunction list. The indoor system will continue to run. When the temperature of the indoor coil is raised to 45°F, the compressor will be restarted again (the requirement of 3 minutes' delay should be satisfied.)

Dry Mode (Dehumidifying mode)

* temperature control range: 60---86°F
* temperature difference: ±2°F

Control feature: Send the dehumidifying signal to the outdoor system.

When Tr>Ts+4°F, the compressor will be turned on, the indoor fan will operate at the set speed. When Tr is between the Ts and Ts+4°F, the outdoor system will operate at the high dehumidifying frequency for 10 minutes and then at the low dehumidifying mode for six minutes. The indoor fan will operate at low speed.

When Tr< Ts, the outdoor system will be stopped, the indoor fan will be stopped for 3 minutes and then turned to the low speed option.

All the frequency conversions have a ±2°F difference.
* Wind speed control: Automatic:
When Tr≥ Ts+ 9°F, high speed.
When Ts+5°F≤Tr< Ts+9°F, medium speed.
When Ts+4°F≤Tr< Ts+5°F, low speed.
When Tr<Ts+4°F, light speed.
If the outdoor fan is stopped, the indoor fan will be paused for 3 minutes.

If the outdoor fan is stopped for more than 3 minutes and the outdoor system still operates, the system will be changed into light speed mode.

When the airflow speed has no delay from the high to low switching, the speed should be delayed for 3 minutes (remain at high speed for 3 minutes.) before the next switch.

When the sensor is off or Tr< Ts+5°F, the manual operation can not be made. (obligatory automatic operation.)
*Louver location control: the location for the louver can be set according to your needs.
*Defrosting function: preventing the frosting on the indoor heat exchanger (when cooling or dehumidifying). When the compressor works continuously for 16 minutes (adaptable in EEPROM) and the temperature of the indoor coils has been below 32°F for 10 second, the compressor will be stopped and the malfunction will be recorded in the malfunction list. The indoor system will continue to run. When the temperature of the indoor coil is raised to 45°F, the compressor will be restarted again (the requirement of 3 minutes' delay should be satisfied.)

Heat Mode mode.

* temperature control range: 60---86°F

* temperature difference: ±2°F

Control feature: the temperature compensation is automatically added and the system will send the heating signals to the outdoor system.
If Tr≤Ts, the outdoor compressor is turned on, the indoor fan will be at the cold air proof mode.
If Tr>Ts+, the outdoor system is turned off, the indoor fan will be at the heat residue sending mode.
If Tr<Ts+, the outdoor system will be turned on again, the indoor fan will be in the cold air proof mode.

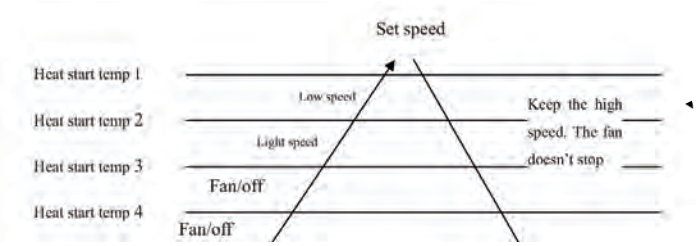
Indoor fan control

Manual Control: You can choose high, medium, low and automatic speed control. Automatic:
When Tr<Ts, high speed.
When Ts≤Tr≤Ts+4°F, medium speed.
When Tr> Ts+4°F, low speed.
When the airflow speed has no delay from the high to low switching, the speed should be delayed for 3 minutes (remain at high speed for 3 minutes.) before the next switch.

*Louver location control: the location for the louver can be set according to your needs.

Cold air-proof operation

1. The indoor operation within 4 minutes after the start up is as the following diagram, the air speed can be raised only



after the speed has reached a certain level.

2. 4 minutes after the start up of the indoor fan, the light airflow and the low airflow will be turned to the set speed airflow.

3. In the cold air proof operation, the fan won't stop after the start up.

4. During the cold air proof operation, the indoor system will continuously send 'indoor high speed' signals to the outdoor system.

* Residue heat sending. The indoor fan will send the residue heat at a low speed for 12 seconds.

If other conditions are satisfied, when the compressor stops, the indoor system will operate at a light speed. The indoor fan will stop when the coil temperature is below the heat start temp 4'.

* Defrosting. When the system receives the defrosting signal from outdoors, the indoor fan will stop and the indoor temperature display won't change. At thistime, any indoor coil malfunctions will be neglected. When the outdoor defrosting finishes, the coil malfunction will still be neglected until the compressor has been started up for 30 seconds. The indoor temperature display will not change and the system operates at the cold air proof mode.

* Automatic heating temperature compensation: when the system enters the heating mode, the temperature compensation (4) will be added. When the status is switched off, the compensation will be erased.

Timing

You can set 24 hours on/off timing. After setting, the timing indicator will be displayed. Also, the light will turn off after the timing is set. The followings are several timing methods:

1. System ON timing: The timing indicator will be displayed and the indoor system is under the waiting mode. The light will be turned off when the timing is finished and the rest of the system will operate under a normal condition. The timing starts since the last reception of the timing signal.

2. System /OFF timing: When the system is turned on, the timing indicator will be displayed; the rest of the system will operate under normal conditions. When the set time expires, the indicator display will turn off and the system will turn off. If you have set the dormant functions, the order of your settings will be operated according to the timing settings.

3 . System ON/OFF timing: The settings will be completed according to the settings.

Indoor Unit Operating Mode Conflicts

Indoor System Mode Conflict

The indoor unit is trying to operate in a mode that is opposite of the mode the outdoor unit is currently operating in. Change the operating mode to either heat or cool, or the indoor unit will shut off.

Outdoor system mode	Indoor system mode	Conflicts
cooling	heating	yes
cooling	cooling	no
cooling	airflow	no
heating	heating	no
heating	airflow	yes
heating	cooling	yes

Abnormality confirmation approaches

1. Indoor temperature sensor abnormality:
Under the operation, the normal temperature ranges from 120°F to -30°F. When the temperature goes beyond this range, the abnormality can be confirmed. If the temperature goes back into the range, the system will automatically resume.

2. Indoor heat interaction sensor abnormality:
Under the operation, the normal temperature ranges from 120°F to -30°F. When the temperature goes beyond this range, the abnormality can be confirmed. If the temperature goes back into the range, the system will automatically resume.

3. Indoor/Out door malfunction: When the indoor system receives the outdoor malfunction codes, it will store the code into E2 for the malfunction list resume. The indoor system will continue to operate according to the original status, the malfunction code will not be revealed or processed.

4. Transmission abnormality:
If the indoor system can't receive the outdoor system for 8 minutes, the communication abnormality can be confirmed and reported and the outdoor system will be stopped.

Low Load Protection Control

In order to prevent the frosting of the indoor heat interaction device, the outdoor system will be stopped if the indoor heat interaction temperature is 32°F for 5 minutes, but the fan will continue to operate. The outdoor system will be started again when the heat interaction temperature is above 108°F, and the system has been stopped for 3 minutes. The malfunction will be stored in the malfunction resume and will not be revealed.

High Load Protection Control

The outdoor system will be stopped if the coil temperature is above 149°F for 2 minutes. The indoor fan will be controlled by the thermostat. The outdoor system can be restarted when the coil temperature is below 108°F and the system has been stopped for 3 minutes. The malfunction will be stored in the malfunction resume and will not be revealed.

Multi-Zone Outdoor

When the compressor first starts

The compresor will start in low frequency. After a brief time delay, the compressor will come up to operating speed to meet the demand requirement for capacity.

The outdoor fan control (exchange fan)

When adjusting the fan speed, the unit should remain at each speed for 30+ seconds to avoid speed-change malfunctions. In Cooling Mode, the wait time between speed levels should be 15 seconds.

The outdoor fan control when in cooling or dehumidifying mode

Five seconds after compressor starts, the outdoor fan will start running at medium speed. After 30 seconds, it begins to control the fans peed according to the temperature conditions of the outdoor environment.

Multi-Zone Outdoor

The Control of the Outdoor Unit Expansion Valve

When unit starts, the EEV valves will energize and change to a standard opening. When operation starts, the EEV will change position to keep the suction vapor superheat level at around 10°F.

When the unit is shut off the opening size of the expansion valve of the indoor unit is 5 steps;

Four-way valve control

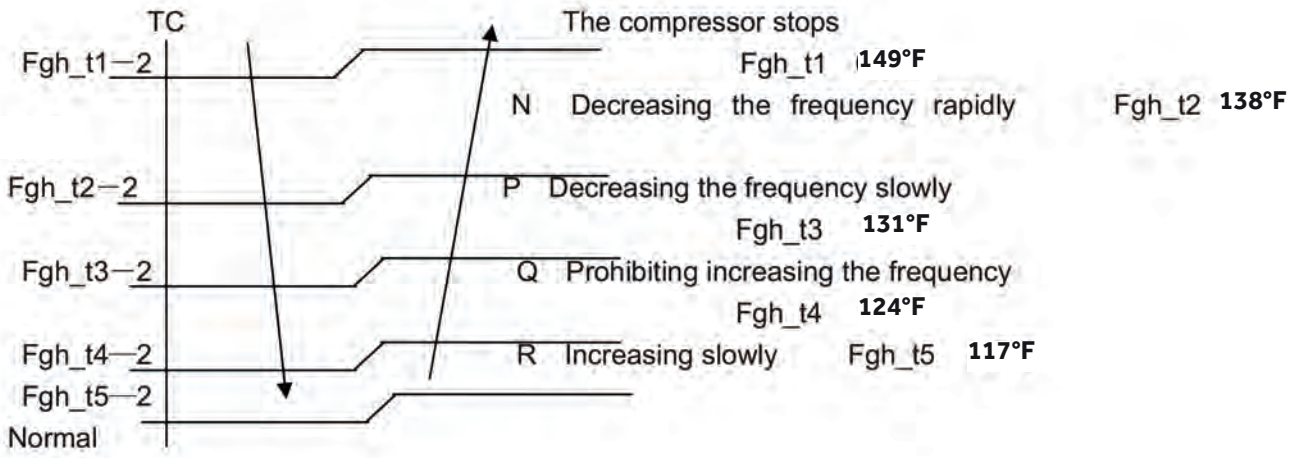
For the details of defrosting four-way valve control, see the defrosting process.

Under heating mode, the four-way valve opens. If the compressor does not start or changes to a non-heating mode, the compressor will be stopped for 2 minutes, and then the four-way valve will shift.

Over-temperature Heat Mode Indoor Coil

The over-temperature routine will protect the system from excessive high indoor coil temperature during heat mode operation. The routine will initiate if the indoor coil temperature sensor reads temperatures in excess of 131F. Conditions that cause high indoor coil temperature include indoor fan failure, dirty indoor coil and operating the system in heat mode when outdoor air temperatures exceed operating limit. (Too warm outside)

Should this routine be initiated, the system will reduce compressor frequency until the indoor coil temperature reaches 117F. Once this is achieved, the system will return to normal operation.



Outdoor Unit Technical Overview

Outdoor Unit Technical Overview

The outdoor unit features a variable speed rotary type compressor that delivers refrigerant flow to up to 4 individual indoor units. The system uses R-410A refrigerant mixed with PVE oil. The system is rated to operate at 208/230 volts single phase 60 Hz power.

Indoor units compatible with this model include high wall type, slim duct type and cassette type.

The indoor cassette unit can be controlled by either a remote control or a wired controller. The indoor high wall unit is controlled by infrared remote. The slim duct unit is controlled by wired controller only.

All indoor units must operate together in either heat mode, or cool mode. The indoor units will not automatically switch between heat and cool modes of operation. The first unit that is turned on and set to provide comfort, will set the operating mode of the system. All other indoor units must now operate in the same mode as the first unit that was energized.

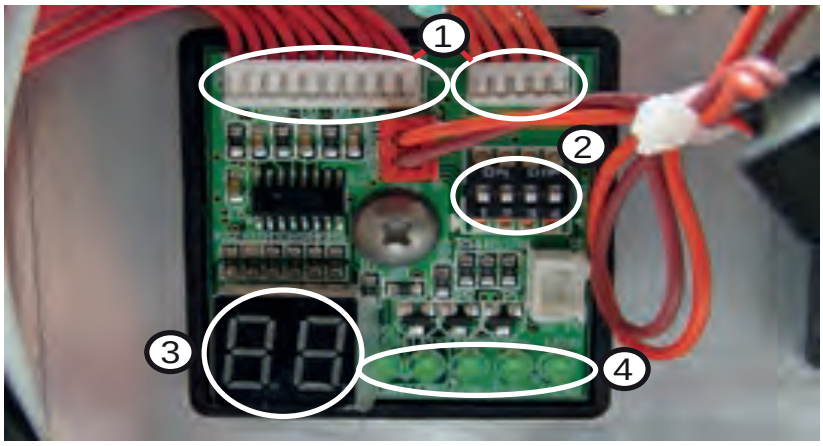
Circuit Boards

The Circuit Boards

There are 4 control boards located in the outdoor unit. To access the boards, remove the top cover and the cover located to the right of the outdoor fan motor opening. The boards are the Electronic Control Unit (ECU), Module Circuit Board (MCB), Power Circuit Board (PCU) and Service Monitor Board (SMB).

Service Monitor Board (SMB)

Service Monitor Board (SMB)



The SMB has important features, including DIP Switches that affect system operation, Digital Error Code Displays, Compressor Operating Frequency Display and Diagnostic capability.

① The SMB is connected to the ECU via Plugs CN-2 and CN-3.

② The SMB DIP switch SW-1 should have all 4 switches in the OFF position. This setting will configure the system for normal operation with variable speed inverter control.

③ The digital display will indicate operating frequency of the compressor when no error code is present. If a system error code occurs, the code will be displayed here.

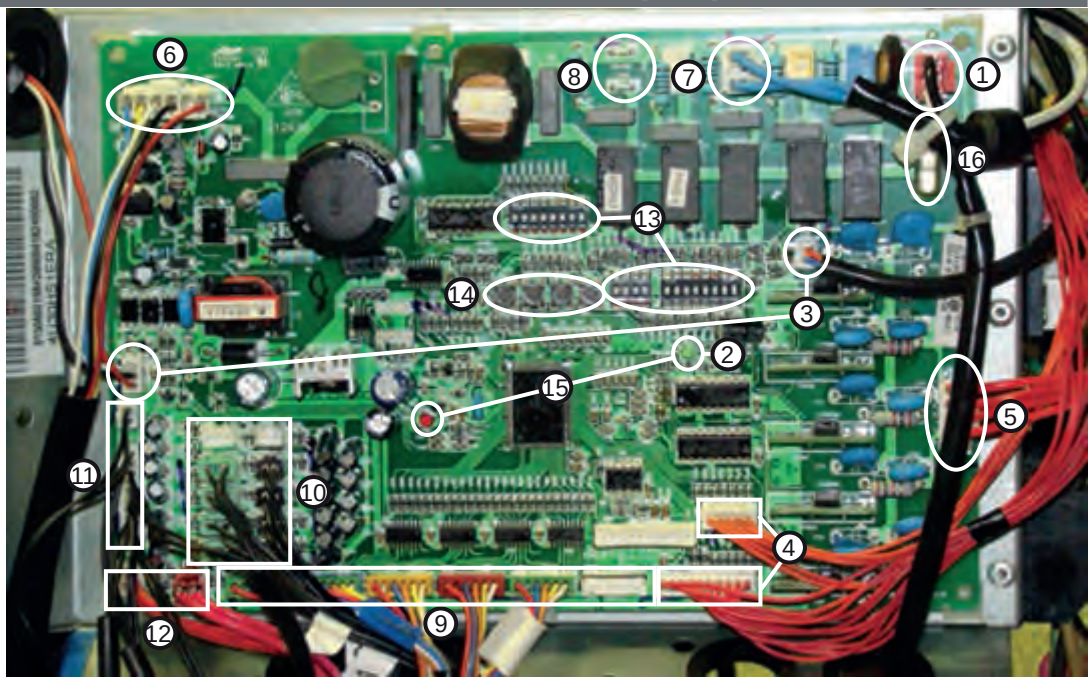
④ There are 4 GREEN LED indicators that indicate the status of the wiring and communication links between the outdoor unit and indoor unit. When lit GREEN, the wiring is correct.

TECHNICAL OVERVIEW

Electronic Control Unit Circuit Board (ECU)

Electronic Control Unit Circuit Board (ECU)

The Electronic Control Unit operates the outdoor fan motor, crankcase heater, EEV stepper motors and the 4-way valve. This board also controls the general operation of the system and makes all of the diagnostic decisions. The ECU is connected via communication cables to the Module Circuit Board, Power Circuit Board and the Service Monitor Board.



① Voltage to operate the ECU is provided by the PCB on terminals ACN and ACL.

② When this power is present, the GREEN LED on the ECU should be lit.

③ The communication cables to the PCB and MCB boards connect via Plugs CN6 and CN-9.

④ The SMB connects to plugs CN-23 and CN-8. When these cables are connected to the SMB, the SMB digital display should be illuminated.

⑤ Plug CN-21 connects the data path between each indoor unit and the outdoor unit ECU board. The connections from this plug terminate at the Number 3 terminal at the voltage connection terminal strips for the indoor units.

⑥ The Outdoor Fan Motor is a DC voltage variable speed type that connects to the ECU at terminal Plug CN-11.

⑦ The 4-Way Valve is energized by line voltage from a connection via Plug CN-5. This valve is energized in HEAT MODE.

⑧ The Crankcase Heater is energized via a connection at terminals CON-9 and CON-8 on the ECU.

⑨ The EEV Stepper Motors are controlled via connections at terminals CN-15 through CN-20. These EEV Stepper Motor connections include the connection for the HEAT MODE EEV located at the outdoor coil.

⑩ Each EEV has a set of temperature sensors that monitor the temperature of the exiting liquid and entering vapor from each evaporator circuit. These sensors are mounted in a group near the center of the circuit board.

⑪ There are 6 system temperature sensors that monitor refrigerant line temperature and outdoor air temperatures. These sensors plug into the ECU via 2 Plugs CN-14 and CN-7.

⑫ The system has two refrigerant pressure switches, a Low Pressure Switch and a High Pressure Switch. These switches are connected to the ECU via Plugs CN-12 and CN-13.

⑬ There are 3 sets of DIP Switches located on the circuit board. They are SW-7. (Factory Settings Only), SW-5 (Defrost Adjustments) and SW-6 (Not Currently Used).

⑭ There are 4 surface mounted buttons located next to SW-5 and SW-6. These buttons are for factory use only.

⑮ The ECU board has two LED Indicators, a GREEN power indicator and a RED Diagnostic Indicator LED. When power is present, both the GREEN and RED LED lights are lit.

⑯ A 15A 250V rated ceramic fuse is located on the ECU. This fuse will open if excessive current occurs or if a power surge is present. This fuse is field replaceable.

Module Circuit Board (MCB)

Module Circuit Board (MCB)

① The Module Circuit Board generates 3 phase DC power to operate the variable speed compressor. The compressor is connected to the MCB via terminals CN-5. CN-6 and CN-7.

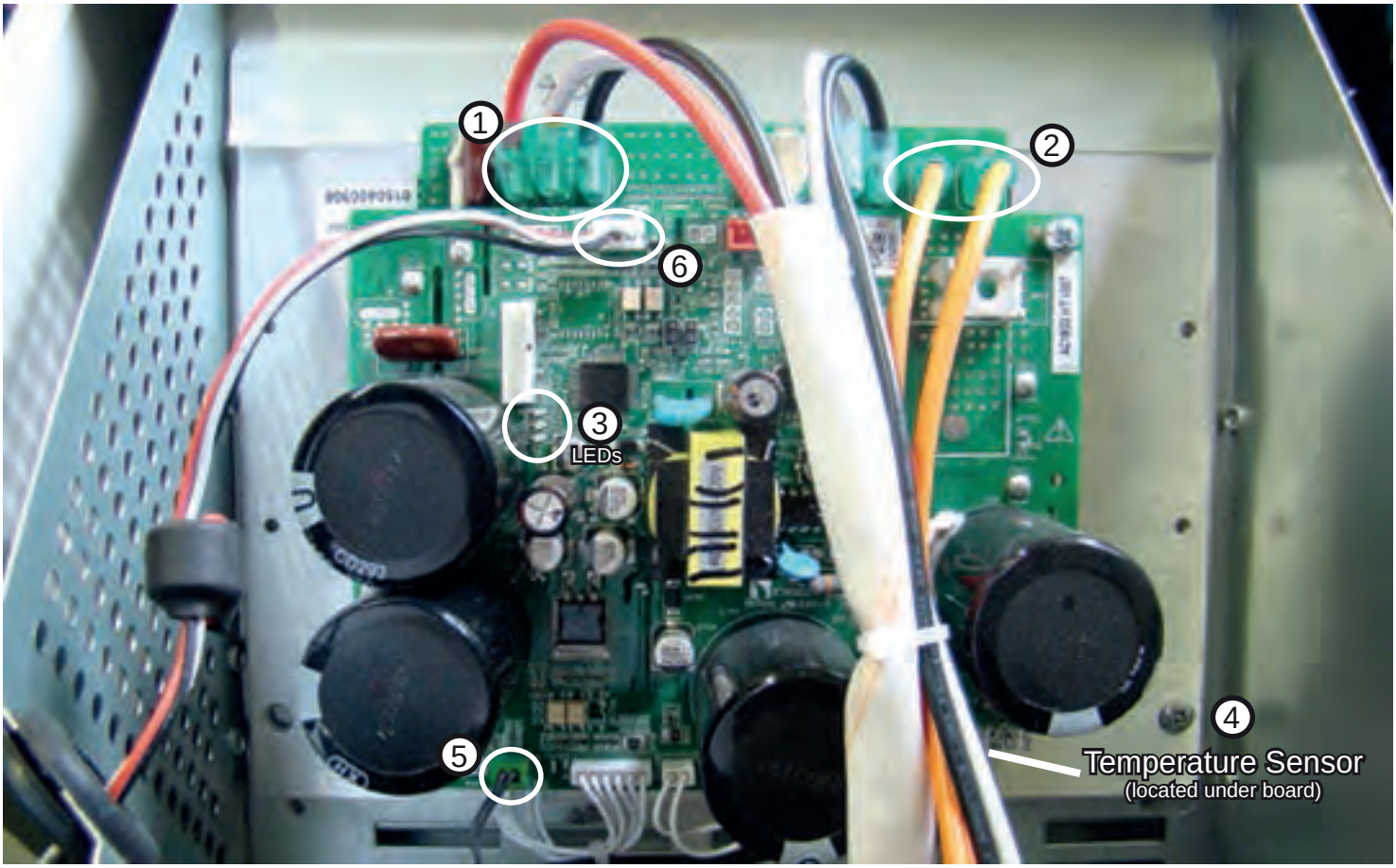
② A Reactor Coil is connected to the MCB at terminals CN-3 and CN-4. The Reactor Coil will filter out electrical noise generated at high frequency operation. The filtering out of electrical noise will prevent pin holes from being burned into the compressor motor windings during high speed operation.

③ The MCB has 3 surface mounted LED indicators to aid in diagnostics. The indicator LED colors are GREEN for Power/ Status, Red and Yellow for Diagnostic Codes.

④ The MCB generates heat that is transferred to a heat sink located on the back of the board. The heat sink transmits this heat to the outdoor air. A temperature sensor Tm is attached to the inverter semi-conductor chip.

⑤ The temperature sensor is connected to the MCB via terminal CN-11. If excessive heat is detected by this sensor, the system will stop operation and generate an Error Code 38. The RED Diagnostic LED indicator located on MCB will flash 14 times. When the sensor cools off, the system will re-start and the diagnostic error codes will clear.

⑥ There is a communication cable connected to the MCV via Plug CN-9. The wire from this plug goes to a connection on the ECU board. If this plug is disconnected or loose, the RED Diagnostic LED located on the MCB will flash 14 times and the system will shut off on an Error Code 04.



OUTDOOR UNIT TECHNICAL OVERVIEW

Power Circuit Board (PCB)

Power Circuit Board (PCB)

The purpose of the Power Circuit Board is to filter out potential electrical noise before it reaches the outdoor unit electronic circuits. All voltage to operate the outdoor unit circuits must pass through the PCB.

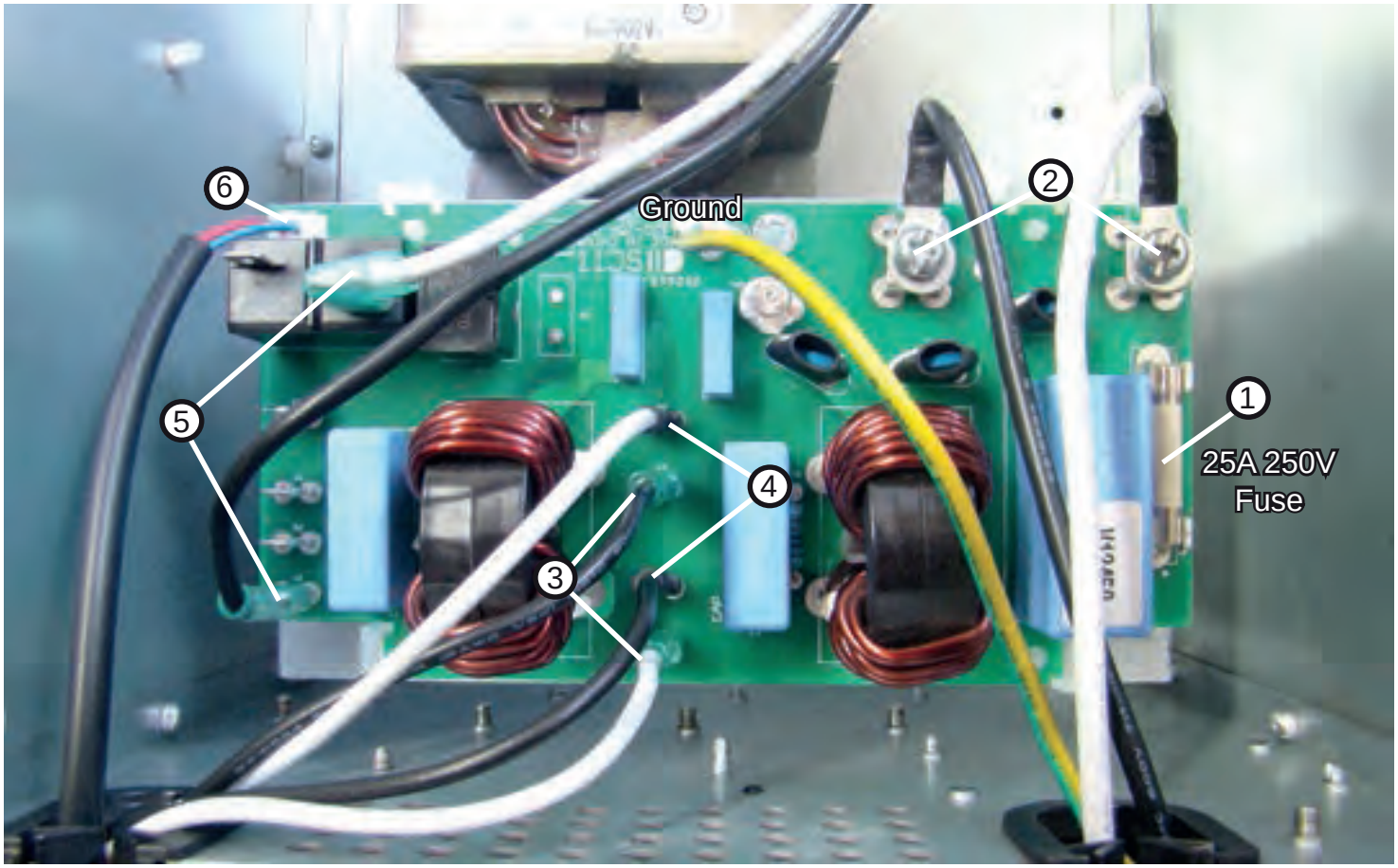
① A replaceable 25A 250V rated ceramic fuse protects the outdoor unit electronics. The fuse would open if a power surge or internal short in the outdoor unit occurred. This fuse is field replaceable.

② The Power Circuit Board (PCB) receives line voltage from the building power supply via a connection between the Line Power terminal on the outdoor unit and the terminals P1 and P2 of the PCB.

③ ④ ⑤ The voltage that powers the indoor units connects to terminals P3 and P4. The Electronic Control Unit receives power to operate via connections at terminals P5 and P6. The Compressor Module board receives power via connections at terminals P7 and TERMINAL 3.

When power is available to the Electronic Control Board and the Compressor Module board, their respective GREEN LED indicators will be flashing if the unit is in standby, or continuously lit if the system is running. If the GREEN LED is not lit, there may not be power to either the PCB or the board receiving power from the PCB. (The Power Control Board does not have a power indicating LED.)

⑥ There is a communication plug labeled CN-1 on the PCB. This plug connects from the PCB to the Electronic Control Unit (ECU). If this cable is disconnected or loose, the system will generate a Code 6 module low or high voltage error. This error will not be displayed in memory on the indoor unit wired controller.



Outdoor Unit Components

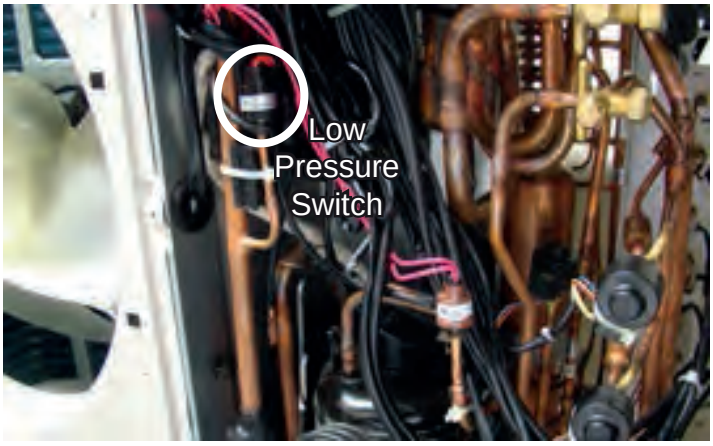
Outdoor Fan Motor

The Outdoor Fan Motor is a variable speed motor. The motor is energized via a connection plug on the ECU. The motor is powered by line voltage from the ECU. The motor has a PWM circuit that feeds back voltage to the ECU. The ECU will control the speed of the motor by a DC voltage applied to the yellow wire of the connection plug. The feedback PWM signal from the fan motor is applied to the ECU via the blue wire on the connection plug.

4 Way Valve

The 4 Way Valve is energized during heating mode operation. The valve is energized with 230 volts via a connection plug on the ECU. When energized, the valve directs the compressor hot gas to the indoor coil.

During Cooling mode and Defrost mode operation, the valve is de-energized. When de-energized, the valve will direct the compressor hot gas to the outdoor coil.

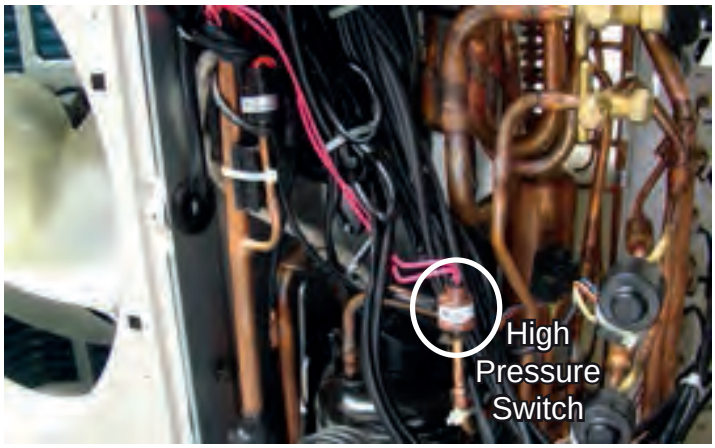


Low Pressure Switch

The system has a Low Pressure Switch that will shut down system operation if abnormally low refrigeration circuit pressure is detected. This switch is connected to the ECU via an electrical plug. During normal operation this switch will be closed.

If the switch were to open during a call for cooling or heating mode operation, the system will shut off the compressor and display an error code. If the pressure rises to re-close the switch, the compressor will re-start and continue on with normal operation. Multiple cycles of opening and closing the switch will cause the system to lock out and display an Error Code 43.

Causes of low refrigerant pressure include leaks, undercharging, restrictions, EEV failure and cold room air temperatures/dirty indoor coils/restricted airflow at indoor unit.



High Pressure Switch

The system has a High Pressure Switch that will shut down system operation if abnormally high refrigeration circuit pressure is detected. This switch is connected to the ECU via an electrical plug. During normal operation this switch will be closed.

If the switch were to open during a call for cooling or heating mode operation, the system will shut off the compressor and display an error code. If the pressure drops to re-close the switch, the compressor will re-start and continue on with normal operation. Multiple cycles of opening and closing the switch will cause the system to lock out and display an Error Code 42.

Causes of high refrigerant pressure include overcharging, restrictions, EEV failure, and dirty outdoor coil.

OUTDOOR UNIT TECHNICAL OVERVIEW

Outdoor Unit Components

Compressor

The compressor is a variable speed dual rotary type compressor. The compressor has a built in accumulator to protect against liquid floodback during running operation. A factory supplied crankcase heater will protect the compressor from off cycle liquid migration. Additionally, there is an oil separator located in the outdoor unit that will aid in the return of compressor oil during both cooling and heating modes of operation.

The normal operating frequency of the compressor is between 20-95 RPS.

The operation of the compressor is monitored by the ECU for starting operation, suction line temperature and discharge line temperature. Should an abnormal condition be detected, the ECU will in some instances adjust the operational frequency of the compressor or may shut down system operation and display an appropriate Error Code.

EEV Valves

The metering devices used in the outdoor unit are EEV type valves. The valve positions are controlled by electronic pulses received from the ECU. These valves have potentially 500 steps. Each indoor unit has an EEV for cooling mode operation. The outdoor unit has 1 EEV that is used for heating mode operation.

When a call for cooling or heating occurs, the EEV will be positioned to a starting position. The starting position is based upon the Outdoor Ambient Air Temperature. For example, in cooling mode, at outdoor air temperature above 68°F, the starting position of the valve will be 250 pulses. If the Outdoor Air Temperature is lower than 68°F, the valve will be opened to a position equal to 210 pulses.

The actual starting position of the valve is not something a service technician can use to aid in solving a diagnostic problem. It is however, good to understand how these systems fundamentally work.

When the compressor starts and the cooling or heating cycle starts, the position of the EEV will be adjusted based upon the Liquid and Gas Temperature Sensors that are associated with each EEV. The EEV open position will be adjusted to try and maintain around 10F of suction vapor superheat.

The ECU may also make an open or close adjustment to the EEV based upon the temperature of the compressor hot gas discharge line. If the line becomes too hot, or cool, the position of the EEV may be altered to ensure the compressor is not damaged by a lack of refrigerant flow or liquid floodback.

Crankcase Heater

The system has an option for a compressor crankcase heater. The heater is powered by line voltage via a connection plug on the ECU. The purpose of the heater is to keep the compressor oil warm during off cycle periods. Warming the compressor oil prevents liquid refrigerant from migrating into the compressor shell and mixing with the oil during periods where the compressor is off.

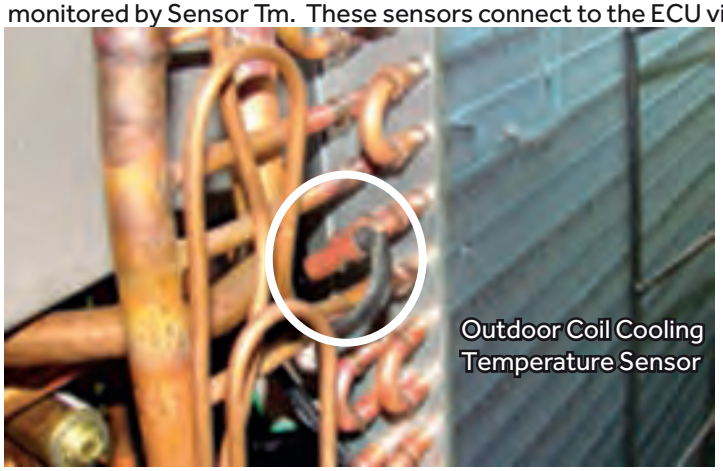
The heater is energized during off cycle periods when the outdoor air temperature is below 90°F. During running operation, the heater will be off.

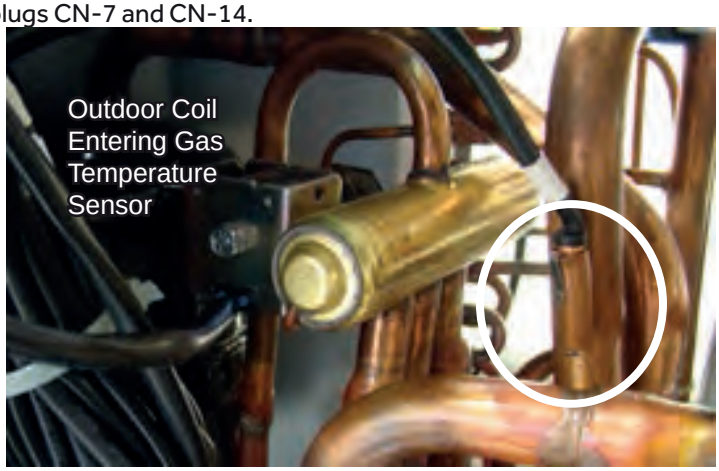
Outdoor Unit Components

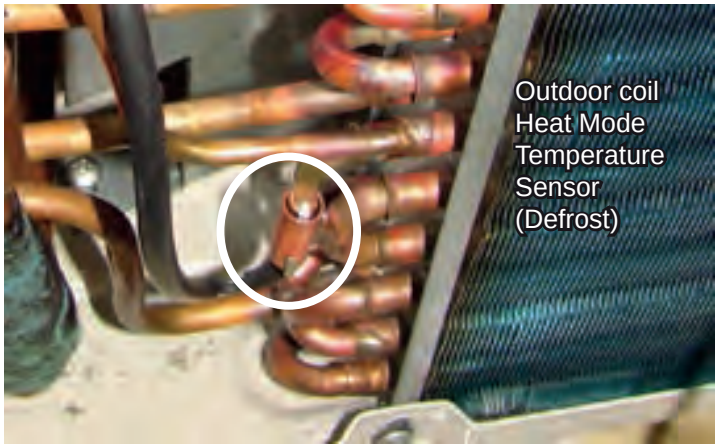
Temperature Sensors Outdoor Unit

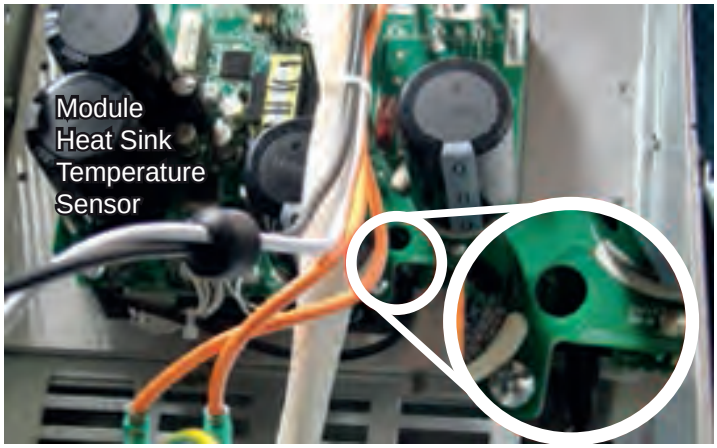
The outdoor unit has two groups of temperature sensors. The first group of sensors are Liquid and Gas Sensors that are associated with each indoor unit EEV. These sensors monitor the leaving liquid temperature from the EEV and the returning Suction Vapor temperature from the indoor units. The difference between the two temperatures is used to calculate the operational suction vapor superheat level of each calling indoor unit. These sensors are labeled Tc1 and Tc2 on the schematic drawing. They plug into the ECU unit on a series of plugs located near the center of the circuit board.

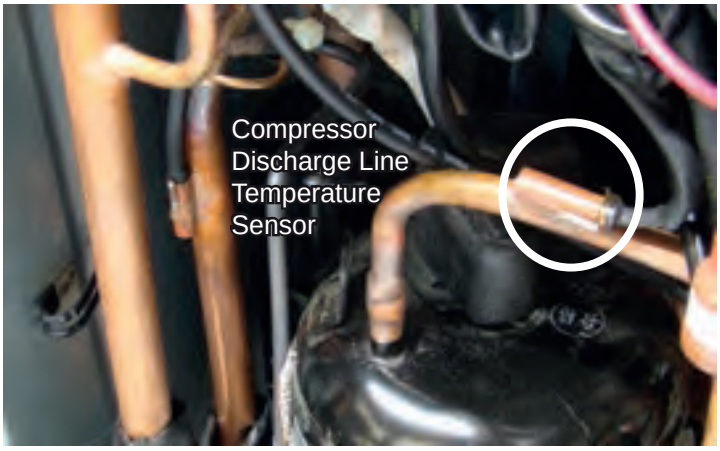
The second group of sensors monitor key temperatures in the refrigeration circuit and outdoor unit. The sensors associated with the refrigeration circuit include compressor discharge line temperature, compressor suction line temperature, outdoor coil entering gas temperature, outdoor coil temperature cooling mode and outdoor coil heat mode temperature (Defrost). The ambient outdoor air temperature is monitored by sensor Ta. The temperature of the heat sink attached to the Module Board is monitored by Sensor Tm. These sensors connect to the ECU via plugs CN-7 and CN-14.

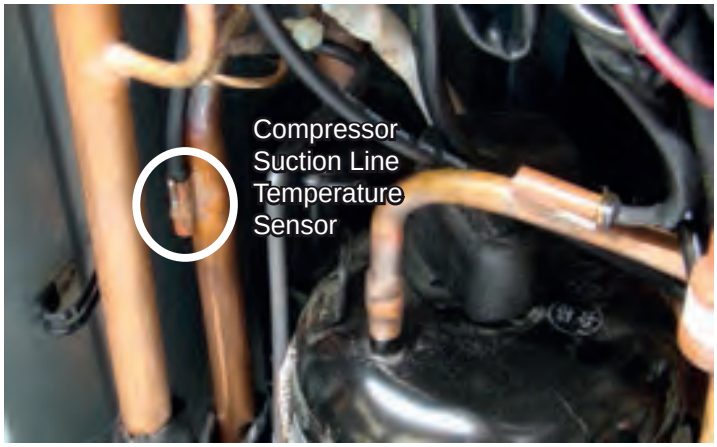












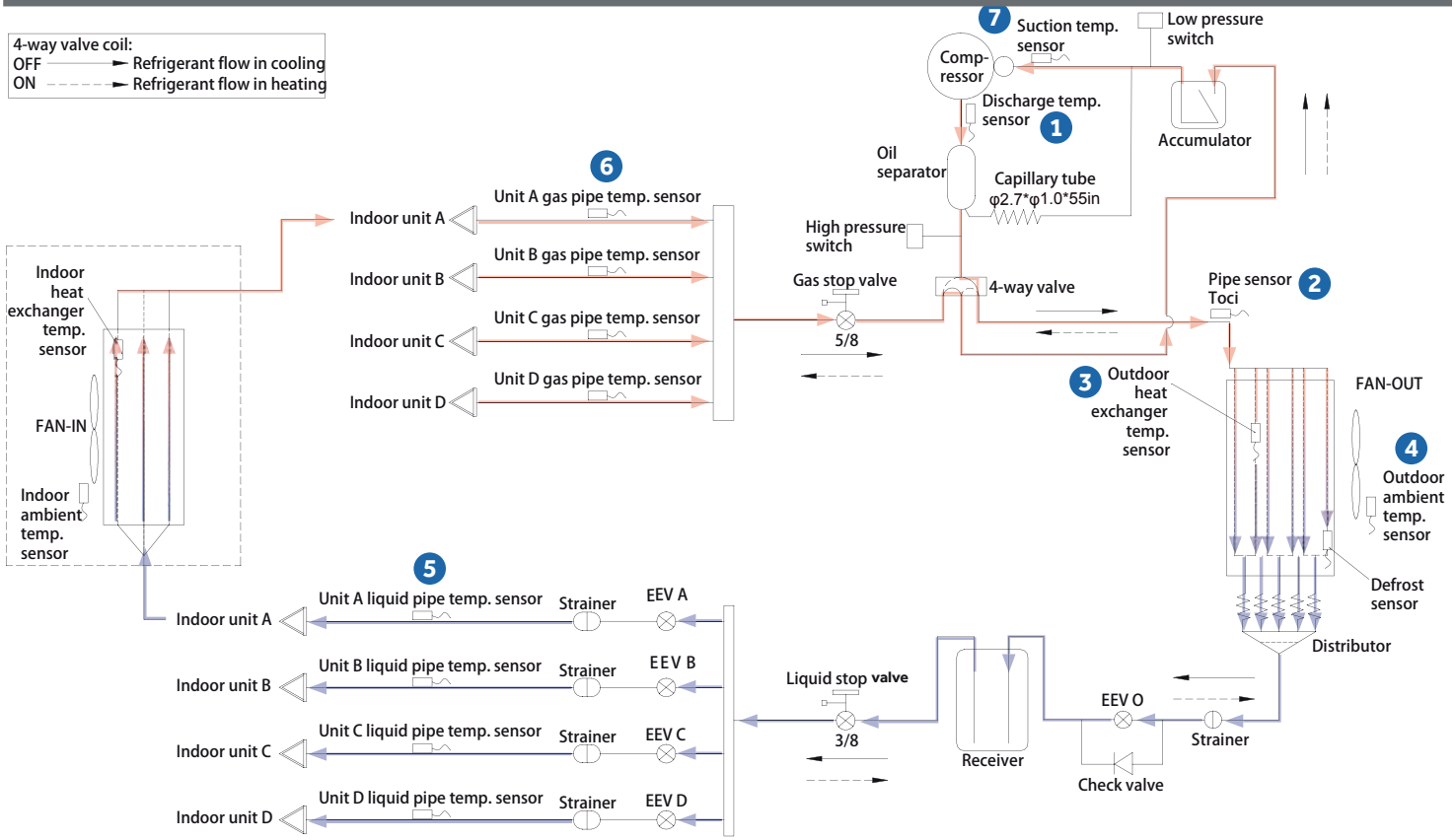
OUTDOOR UNIT SEQUENCE OF OPERATION

The outdoor unit is capable of controlling up to 4 individual indoor units. The outdoor unit will vary compressor capacity and outdoor fan motor speed to match the demand requirement from the indoor units. All capacity and diagnostic decisions are controlled by the outdoor unit ECU. During any period where the outdoor unit is running, all indoor units must be in the same mode of operation. If any unit is energized in a mode that opposes the first indoor unit that was turned on and set to provide cooling or heating, the opposing unit's request will be ignored.

Throughout a call for either heating or cooling operation, the temperature sensors in the indoor and outdoor units will provide critical temperature points to the outdoor unit ECU. If the temperatures being sensed are abnormal or trending to a level that is potentially going to create overheating of the compressor or freezing of the indoor unit.

The frequency adjustments or system responses to temperature sensors readings are explained in the section Temperature Sensor Responses.

Cooling Mode Sequence of Operation



On a call for cooling, the indoor unit will send the room temperature and set-point requirement to the outdoor unit ECU via the data signal wire path. The data travels from the indoor unit to the outdoor unit via the wire located on terminal 3. The indoor unit's louver will open and the indoor fan motor will start.

The outdoor unit will energize the EEV's that are controlling refrigerant flow to the calling indoor units. The position of the EEV valves will be set to a beginning position based upon the outdoor air temperature.

The 4-way valve will be de-energized. After a 3 minute time delay, the outdoor fan motor will be energized. Shortly after the outdoor fan motor turns on, the compressor will start in low frequency. The operating frequency of the compressor will be displayed on the Service Monitor Board Display.

The refrigerant in the system will begin to flow. The compressor will discharge hot gas into the oil separator. Oil will be trapped in the separator and returned to the suction inlet of the compressor via the capillary tube assembly low pressure path.

1 *Temperature Sensor Td*

The temperature of the compressor discharge hot gas will be monitored by the Discharge Temperature Sensor. If the sensor reads too hot or cool, the frequency/status of the operation will potentially be altered.

The hot gas will leave the oil separator and enter the 4 way

Cooling Mode Sequence of Operation

valve. The 4 way valve will direct the hot gas to the outdoor coil. The refrigerant will condense in the outdoor coil and be slightly subcooled. The refrigerant is now in a liquid state.

2 ***Temperature Sensor Toci***
The temperature of the hot gas leaving the 4 way valve will be monitored by the Toci Temperature Sensor. This temperature should be near the temperature of the compressor discharge gas temperature. If it is not, there is a problem with the 4 way valve. The ECU will detect the temperature difference and generate an Error Code.

3 ***Temperature Sensor Tc***
This sensor monitors the temperature of the outdoor coil during condensing operation. If abnormal condensing temperature is detected this sensor, the outdoor fan motor speed or compressor frequency may be adjusted.

4 ***Temperature Sensor Ta***
The outdoor air temperature will be monitored by the ECU. If the outdoor air temperature rises or falls, the speed of the outdoor fan/positions of the EEV's may be changed.

The refrigerant liquid will exit the outdoor coil and enter a strainer where debris is trapped. The refrigerant liquid leaves the strainer and bypasses the outdoor coil EEV via a path through the check valve.

The refrigerant liquid now enters a receiver where excess refrigerant will store. The required liquid leaves the outdoor liquid receiver and passes through the Liquid Stop Valve.

After the liquid leaves the stop valve, it will enter the restriction of the CALLING INDOOR UNIT's EEV. The EEV will drop the pressure of the liquid to low pressure low temperature.

5 ***Temperature Sensor Tc2***
The EEV associated Liquid Pipe Sensor will monitor the temperature of the refrigerant leaving the EEV to calculate system superheat.

The low pressure low temperature refrigerant will enter the mixed phase liquid line and travel to the indoor unit. Heat from the air passing across the indoor unit evaporator will flash off the cold refrigerant into a cold vapor.

The cold vapor will travel down the vapor line and return to the outdoor unit via a path through the Gas Stop Valve.

6 ***Temperature Sensor Tc1***
The EEV Gas Pipe Sensor will monitor the temperature of the suction gas to calculate the difference between Liquid Pipe Temperature and Gas Pipe Temperature. This calculation is the suction vapor superheat. If a change in EEV port opening size is needed, the EEV will make a small adjustment.

The vapor refrigerant will then enter the 4 way valve and be directed to the Compressor suction accumulator. The accumulator will trap any liquid refrigerant that may enter the compressor and potentially damage it.

The vapor will exit the accumulator and enter the compressor. The refrigeration cycle will continually repeat until the demand for cooling ends.

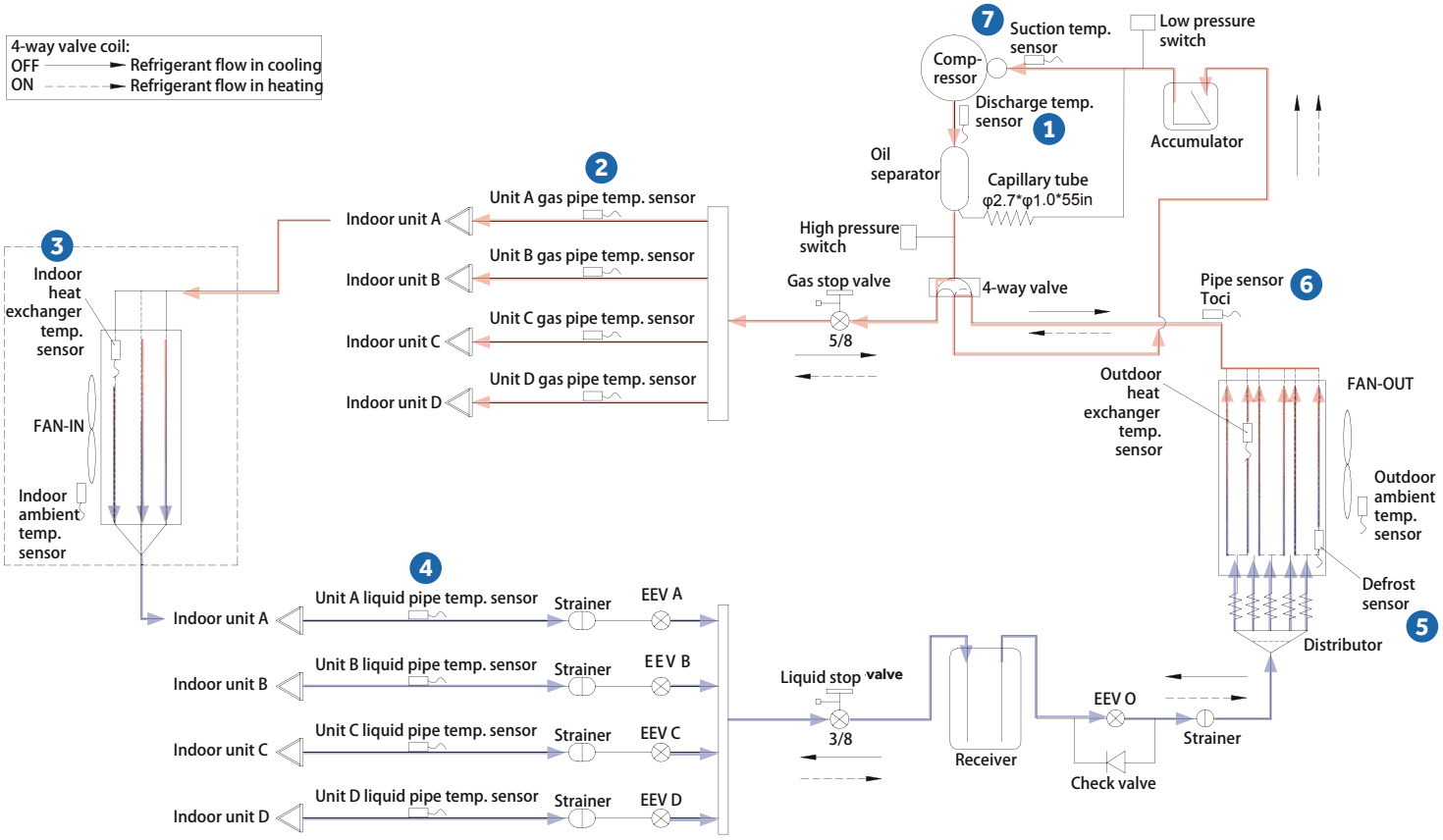
7 ***Temperature Sensor Ts***
The temperature of the suction gas entering the compressor is monitored by the Suction Temperature Sensor. If abnormal temperature either hot or cool is detected, the frequency of the compressor may be adjusted or the system may stop operation to protect the compressor.

During the call for cooling, the indoor air temperature will get closer to setpoint and demand will ease. The compressor will reduce frequency as the demand decreases. Should an additional indoor unit call for cooling, the demand will increase and the compressor speed will increase.

When the temperature setpoint of the indoor units is met, the indoor units will continue to run but the outdoor unit will shut off. This is normal operation.

OUTDOOR UNIT SEQUENCE OF OPERATION

Heating Mode Sequence of Operation



On a call for heating, the indoor unit will send the room temperature and set-point requirement to the outdoor unit ECU via the data signal wire path. The data travels from the indoor unit to the outdoor unit via the wire located on terminal 3. The indoor unit's louver will open the indoor fan will remain off.

EEV valves serving indoor circuits will step to a FULL OPEN BYPASS position. Outdoor EEV valve serving outdoor coil will step open to a pre-set metering position based upon the temperature of the outdoor air.

The outdoor unit 4 way valve will be energized. Equalization noise will be heard.

The outdoor fan motor will start.

The compressor will start in low RPS speed and gradually speed up.

Indoor fan will begin to operate at slow speed and gradually increase speed.

With the compressor operating, refrigerant will begin to flow throughout the refrigeration circuit.

The operating frequency of the compressor will be displayed on the Service Monitor Board Display.

When the compressor starts, the compressor will discharge hot gas into the oil separator. Oil will be trapped in the separator and returned to the suction inlet of the compressor via the capillary tube assembly low pressure path.

1 *Temperature Sensor Td*

The temperature of the compressor discharge hot gas will be monitored by the Discharge Temperature Sensor. If the sensor reads too hot or cool, the frequency/status of the operation will potentially be altered.

The hot gas will leave the oil separator and enter the 4 way valve. The 4 way valve will direct the hot gas to ALL of the indoor coils.

Note: Any indoor unit that is in heating mode will have it's louver open and indoor fan running. Non-calling indoor units will receive hot gas but their fans will remain on very low speed with the louver open. When demand for heat increases, the indoor fan will speed up to meet the increased demand.

2 *Temperature Sensor Tc1 and* 3 *Indoor Heat Exchanger Temperature Sensor*

The temperature of Tc1 should now be hot. This will indicate the 4 way valve is directing hot gas to the indoor coils. If it is not, there is a problem with the 4 way valve. The ECU will detect the temperature difference and generate an Error Code.

Heating Mode Sequence of Operation

The indoor heat exchanger temperature sensor will monitor the temperature of the indoor coil to ensure it is hot enough to prevent blowing cold air. Once adequately warm temperature is sensed at the indoor coil, the ECU will energize the indoor fan to a higher speed.

The hot gas entering the indoor coil will condense into a saturated mix and then be subcooled. The refrigerant will return to the outdoor unit via the mixed phase small line.

4 ***Temperature Sensor Tc2***
This sensor monitors the temperature of the refrigerant liquid returning from the indoor coil. If abnormally warm liquid is sensed, the ECU will make inverter or indoor fan motor speed changes to compensate.

The liquid will enter the Liquid Line Strainer and will pass through the OPEN EEV

The refrigerant liquid now enters a receiver where excess refrigerant will store.

After the liquid leaves the Liquid Receiver, it will enter the restriction of the OUTDOOR UNIT's EEV. The EEV will drop the pressure of the liquid to low pressure low temperature.

Heat from the outdoor air will boil off the cold refrigerant. The outdoor coil absorbs heat from the outdoor air. The refrigerant vapor boiling from the liquid refrigerant in the outdoor coil exits the outdoor coil.

5 ***Temperature Sensor Te***
The outdoor coil temperature will be sensed by the Defrost Sensor. The sensor will use this temperature to maintain EEV position/superheat adjustment and to calculate when a defrost cycle is necessary.

6 ***Temperature Sensor Toci***
This temperature sensor is now sensing the suction line temperature of the refrigerant vapor leaving the outdoor coil. This temperature is used in calculation of the required position of the OUTDOOR UNIT EEV for proper superheat adjustments.

The vapor refrigerant will then enter the 4 way valve and be directed to the Compressor suction accumulator. The accumulator will trap any liquid refrigerant that may enter the compressor and potentially damage it.

The vapor will exit the accumulator and enter the compressor. The refrigeration cycle will continually repeat until the demand for heating ends.

7 ***Temperature Sensor Ts***
The temperature of the suction gas entering the compressor is monitored by the Suction Temperature Sensor. If abnormal temperature either hot or cool is detected, the frequency of the compressor may be adjusted or the system may stop operation to protect the compressor.

During the call for heating, the indoor air temperature will get closer to setpoint and demand will ease. The compressor will reduce frequency as the demand decreases. Should an additional indoor unit call for heating, the demand will increase and the compressor speed will increase.

When the temperature setpoint of the indoor units is met, the indoor units will continue to run but the outdoor unit will shut off. This is normal operation.

OUTDOOR UNIT TEMPERATURE SENSOR RESPONSES

Outdoor Unit Control Information

10.2.1 Outdoor frequency control
A. The compressor running frequency is range is 20-95 RPS.

10.2.2 Electronic expansion valve (EEV) control

A: EEV SPECIFICATION: Maximum open angle is 500 pulses. Driving speed is PPS.

B: Start-up EEV Conditional state

When the system is in the Cool/Dry mode, the standard open angle of the EEV will be set at a position that is determined by the temperature of the outdoor air. When the outdoor air temperature is greater than 68°F, the initial setting of the EEV will be 250 pulse open. If the outdoor air temperature is less than 68°F, the EEV will open 210 pulses.

In Heating mode, the standard open position will be 250 pulses when the ambient air temperature outdoors is greater than 50°F. If the air temperature outdoors is less than 50°F, the open pulse rate is set to 210.

During running operation, the EEV position may be adjusted if the compressor discharge gas temperature indicates a need to supply more or less refrigerant to the evaporator circuit.

Here are the control responses and EEV positional changes that can occur due to either hot or cool discharge gas temperature:

Valve Adjustments

Valve Adjustments Due To Hot Gas Discharge Temperature Limits

If the discharge gas temperature rises above 212°F, the EEV will open to its widest allowed position to try and reduce the temperature of the compressor.

If the discharge temperature is greater than 194°F, but less than 212°F, the EEV will not be adjusted.

If the discharge line temperature drops below 194°F, the EEV will reduce its size to reduce refrigerant flow.

10.2.3 4-way valve control during heating mode

If the 4 way valve fails to switch the hot gas flow to the indoor coil during a call for heat, the system will enter a protection routine. If the indoor coil average temperature is below 59°F, 10 minutes after the compressor has started, and stays there for at least 1 minute, the system will lock out and display a 4-way valve protection fault error code.

10.2.4 Crankcase Heater Control

The crankcase heater is controlled by the ECU. The heater keeps the compressor oil warm to prevent liquid refrigerant from migrating to the oil during periods where the system is not running. The heater will operate during off cycle periods when the outdoor air temperature is below 80.6°F. When the outdoor air temperature is greater than 90°F, the heater will not be energized. When the compressor is running, the heater will not be energized.

10.2.5 On Demand Defrost Logic

The system defrost function during heat mode is a demand type system. Two temperatures are monitored by the ECU to determine if defrosting is needed, they are Outdoor air temperature Sensor Ta and Outdoor coil temperature Sensor Te.

To enter a defrost cycle on demand, the system must be in heat mode and the compressor must have run for 10 minutes continuously and 45 minutes of compressor run time in heat mode must have accumulated. If the following conditions have been met for at least 5 continuous minutes, the system will enter a demand defrost cycle:

Sensor Te must sense a temperature that is less than or equal to:

Te< CxTa-a

C is calculated as follows:

If Ta < 32°F then C=.8 If Ta> 32°F then C=.6

a is set by SW5-2 switch Factory setpoint is 8
Opposite Switch setting is 6

If the system is in an area that is easy to frost, it is recommended to set the SW5-2 switch to opposite setting and change the value of a to 6.

Example: Te = 26°F Ta = 44°F C=.8 a = 8

Solution: 26°F 44 x .8= 35.2-8=27.2 26°F is colder than 27.2°F so the system defrost cycle starts.

The system can only remain in defrost for up to 10 continuous minutes of run time. The defrost cycle will terminate if sensor Te reaches 44.6°F for a period of 60 seconds or 53.6°F for a period of 30 seconds. In either case, the defrost cycle will terminate after 10 minutes.

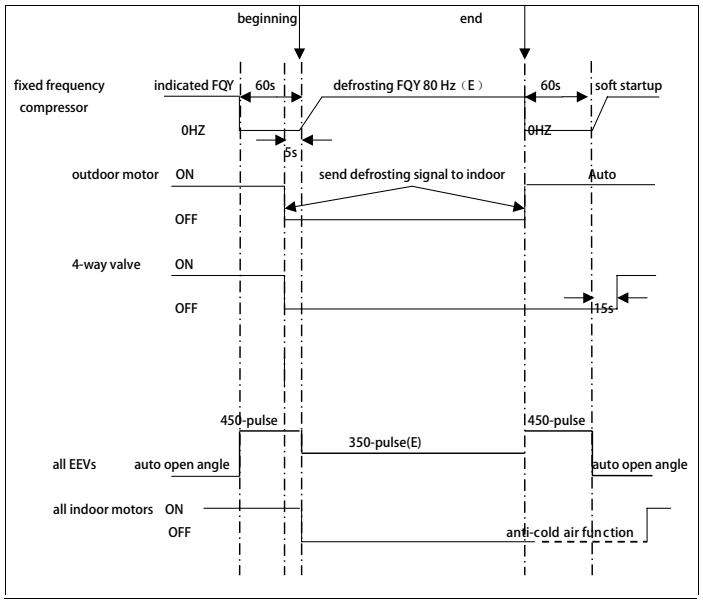
Forced Defrost Operation

10.2.6 Forced Defrost Operation

The system can be placed into a forced defrost cycle from the wired controller. The system will remain in defrost until sensor Te has sensed 53.6°F for at least 1 minute or until the defrost cycle has reached 10 minutes total runtime.

A forced defrost cycle can be initiated with the compressor off. The system will enter a 3 minute time delay prior to energizing the compressor.

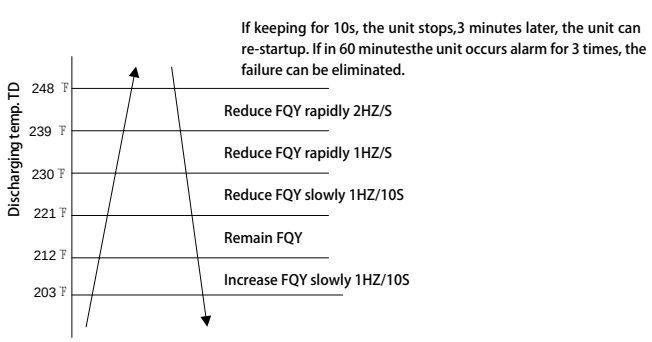
10.2.7 Defrosting Time Flowchart



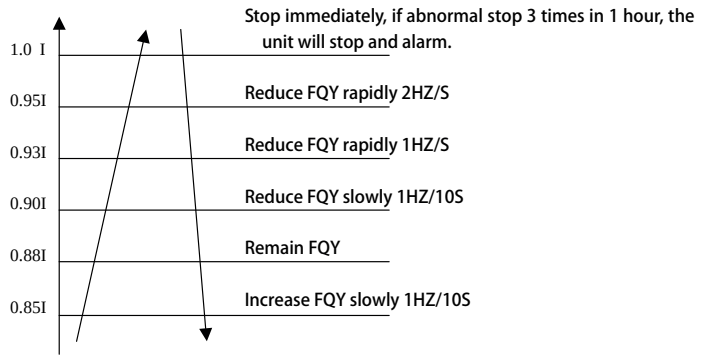
10.2.8 Frequency Control and Compressor Discharge Line Temperature

If the temperature of the discharge line gets too high, and the EEV adjustment cannot correct the problem, the ECU will make frequency adjustment to the speed of the compressor in an attempt to cool it down. The chart here shows the adjustment steps versus the discharge line temperature.

Multi:



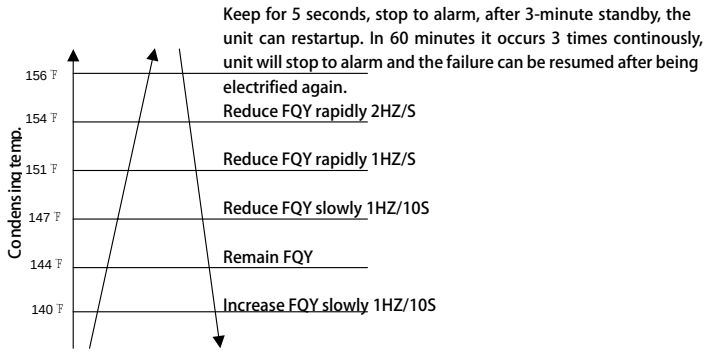
10.2.8 Frequency Control when there is CT Over-current Protection



10.2.9 High Pressure Protection

If abnormally high refrigerant circuit condensing pressure is detected, the high pressure switch will open. The outdoor unit will initiate an Error Code and stop compressor operation. If the system pressure drops enough to re-close the switch the system will re-start. If the failure occurs 3 times, the system will lock out and display the appropriate Error Code.

High condensing temperature can also cause high pressure. The ECU will monitor the temperature of the condensing coil in both heating and cooling modes of operation. Frequency adjustments will be made to the compressor speed in an attempt to manage high pressure that can be caused by dirty condensing coils and high heat loading. The chart below shows the ECU frequency response at high condenser temperatures. (Indoor Coil Heat Mode, Outdoor Coil Cool Mode)



10.2.10 Low Pressure Protection

The system low pressure switch is normally closed. The switch will open when the refrigerant pressure gets too low. Typical causes are refrigerant leaks/undercharging and low evaporator heat loading. The system will auto re-start if the switch re-closes after opening. If the switch opens 3 times in 60 minutes of running, the system will display an error code.

The low pressure switch is checked even when the system is off. This protects the compressor against operating with a great loss of refrigerant when the system has been off for a long time.

OUTDOOR UNIT TEMPERATURE SENSOR RESPONSES

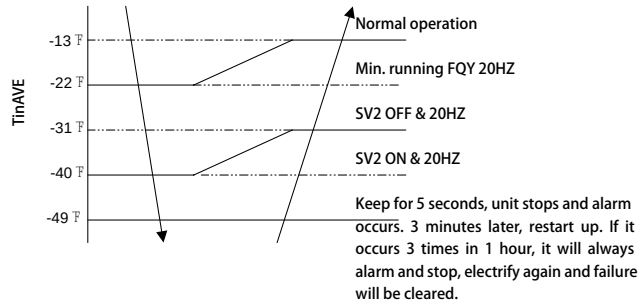
Forced Defrost Operation

There are times when the switch is not active. The periods of inactive switch operation are:

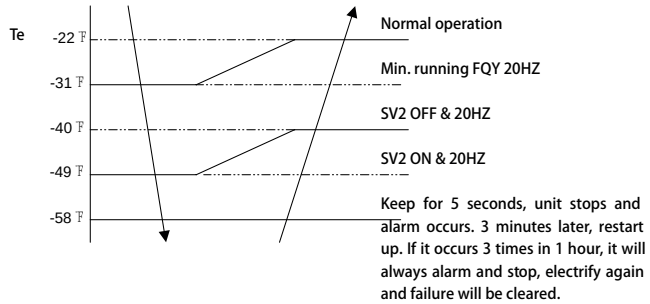
1. When the compressor starts up the switch will be off for 8 minutes.
2. When the system is defrosting the switch is not active.
3. In the oil return cycles the switch is not active.
4. In the refrigerant discharging procedure after the oil return in cooling is over the switch is not active.

The system will recognize cold evaporator temperatures as a likely condition where the low pressure switch may open. The ECU uses the Te sensor in heat mode and the Tc2 sensor in cooling mode to monitor the temperature of the evaporator circuit. If abnormally cold coil temperatures are detected, the ECU will reduce the compressor operating frequency to prevent potential low pressure switch trips. The charts below show the frequency versus evaporator circuit temperature relationships.

In cooling, confirm through Tc2AVE:



In heating, confirm through defrosting temp. Te:



Preventing Compressor Overcurrent

During compressor start-up, if the current of the compressor is greater than 17A for 3 seconds, the compressor will stop and alarm. After 3 minutes, the compressor will restart. If this occurs 3 times in 20 minutes the compressor will stop, lock out, and display an error code. Power must be removed from the system to clear the code.

During compressor start-up, if the AC current is greater than 12A, the frequency of the compressor decreases at the speed of 1HZ/second.

During compressor start-up, if the AC current is greater than 10A, the frequency of the compressor decreases at the speed of 0.1HZ/second.

During compressor start-up, if the AC current is greater than 9A, the frequency of the compressor increases at the prohibited speed.

During compressor start-up, if the AC current is greater than 8A, the frequency of the compressor increases at the speed of no faster than 0.1HZ/second.

The protection function of AC current:

• During the starting process of the compressor, if the AC current is greater than 15A, the frequency of the compressor decreases at the speed of 1HZ/second.

• During the starting process of the compressor, if the AC current is greater than 13A, the frequency of the compressor decreases at the speed of 0.1HZ/second.

• During the starting process of the compressor, if the AC current is greater than 11A, the frequency of the compressor increases at the prohibited speed.

• During the starting process of the compressor, if the AC current is greater than 10A, the frequency of the compressor increases at the speed of no faster than 0.1HZ/second.

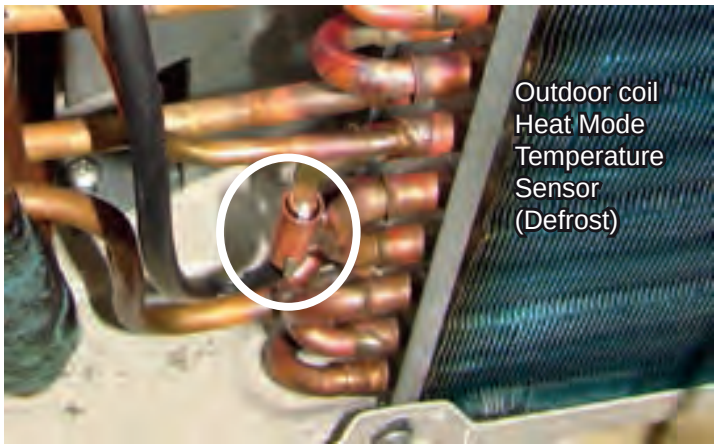
When the outdoor ambient temperature is high, there's compensation for AC current protection.

When the outdoor ambient temperature is higher than 104°F, AC current protection value decreases by 10AD

When the outdoor ambient temperature is higher than 115°F, AC current protection value decreases by 15AD

When the outdoor ambient temperature is higher than 122°F, AC current protection value decreases by 20AD

Antifreezing protection of the indoor heat exchanger
Prevents freeze-up of the indoor coil.



Compressor Testing

If the compressor fails to start, the compressor may have an internal electrical failure, the compressor may be seized mechanically, or the Module Control Board (MCB) may be bad.

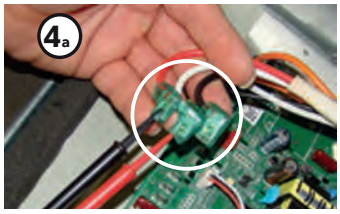
To test for a bad failed compressor, perform the following test:

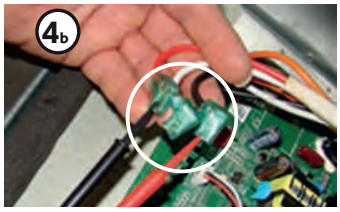
1. Disconnect power and allow 10 minutes. Restore power and call for normal operation. If the compressor starts, the system may have been in a protection mode that prevented the compressor from running. If the compressor does not start, continue on with testing.

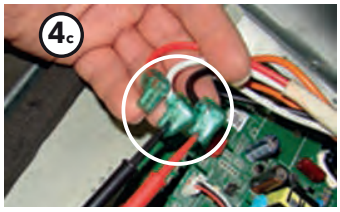
2. Disconnect power. Wait 10 minutes for the capacitors on the MCB to electrically discharge.

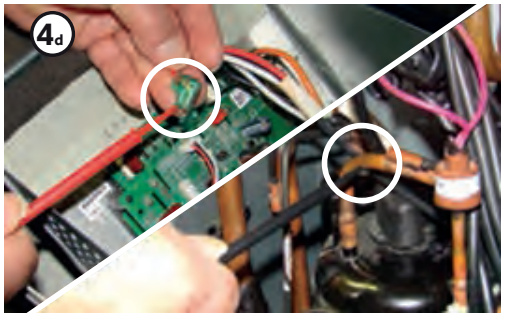
3. Unplug the compressor motor windings terminals from the MCB.

4a-4d. Ohm the windings through each combination of leads to determine if there is an open winding. If a winding is open, replace the compressor. If the windings are good, check each motor winding lead for a short to ground. If the compressor winding is shorted to ground, replace the compressor. If the motor checks out good, continue on with testing.









EEV testing

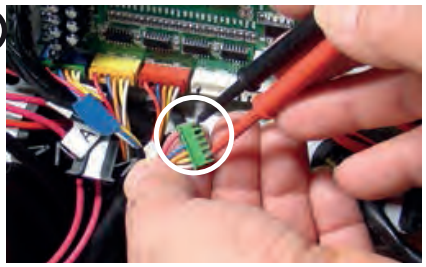
The EEV metering devices are stepper type valves that have up to 500 potential positional changes. The electrical coil that is installed on the end of the EEV body rotates a magnetic field that opens and closes the valve. If the valve has failed, it is either stuck in position or the electrical coil has an internal problem.

To test for an electrical coil problem, perform the following test:

1. Disconnect power to the outdoor unit.
2. Unplug the suspect EEV coil from the connection plug at the ECU.
3. Using an ohmmeter, check the ohms of all combinations of windings.
4. Compare measured Ohms against the chart shown below.
5. Replace the EEV coil if the ohm range is not correct.
6. If the OHM range is correct, yet the EEV does not click/pulse open or closed when it should, check for a mechanically stuck EEV.
7. Move the EEV coil to another EEV circuit to see if the coil will operate the other EEV. If it works, the EEV valve is stuck and must be replaced.
8. Always reset power when working with EEV valves to reset any temperature sensor logic that may be keeping the EEV from being energized during normal operation. (Freezing etc.)

2

3



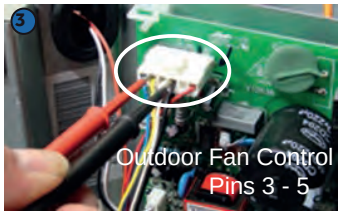
4

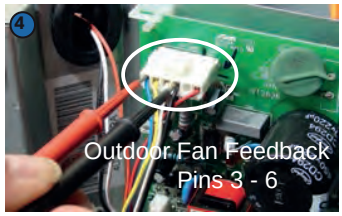
EEV Stepper Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		47 Ω	46 Ω	46 Ω	46 Ω
Violet			92 Ω	92 Ω	92 Ω
Yellow				91 Ω	91 Ω
Orange					91 Ω
Red					

OUTDOOR UNIT TESTING PROCEDURES

Outdoor Fan Motor Testing

If the outdoor unit fan motor does not run or the Service Monitor board indicates an error code of 09, check the following voltages at connector CN11 on the outdoor unit ECU board. Set the meter to read DC volts with a minimum voltage range of 350 volts. All voltage values are approximate. Initiate forced cooling. **(Press and hold the power button for 10 seconds on the wired controller.)**





1) DC voltage between the Red and Black wires on the CN11 plug should read 310 ~ 334VDC. (This is the main voltage for powering the fan motor)

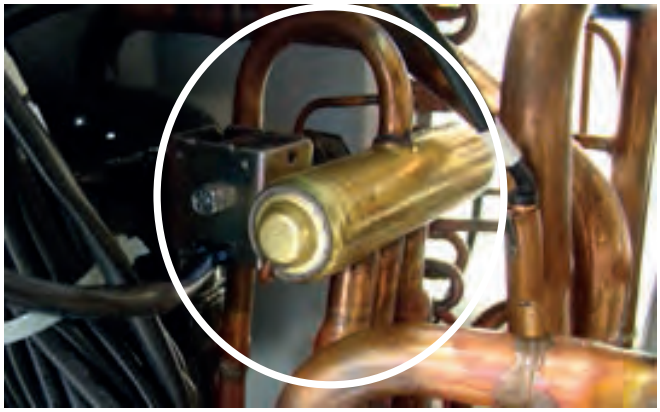
2) DC voltage between the White and Black wires on the CN11 plug should read 15VDC. (This is the voltage for powering the electronic circuit of the fan motor)

3) DC voltage between the Yellow and Black wires on the CN11 plug should read 4VDC. The voltage will read 0VDC when the fan is not being called to operate. (This is the control voltage for regulating the speed of the fan motor)

4) DC voltage between the Blue and Black wires on the CN11 plug should read 8VDC. The voltage will read 14VDC when the fan is not being called to operate. (This is the feedback voltage to the ECU board for determining the speed of the fan motor)

If the outdoor fan initially runs, increases speed and then stops, and the Service Monitor board indicates an error code of 09, the feedback circuit is not functioning. Check that the wiring and plug connections are secure.

4 way valve testing



The 4 way valve will control the direction of hot gas discharge via an internal slide assembly. The valve has a line voltage solenoid that is energized when heat mode operation is desired. The solenoid will direct the internal slide to send the hot gas to the indoor coil. During cooling mode de-energized operation, the internal slide will direct compressor hot gas to the outdoor coil.

4 way valves may have a failure of the electrical solenoid that prevents the valve from shifting, or they may become stuck due to debris lodging inside the valve body. If the valve fails to direct the hot gas in the proper direction, temperature sensors within the outdoor unit will detect the problem and generate an Error Code.

If the valve fails to shift the hot gas to the proper coil, or it only partially shifts, perform the following test:

1. Make sure the system has proper charge.
2. Place the system in heat mode and call for heat. After a time delay, the valve solenoid should be energized by the ECU. Check for line voltage to the solenoid.
3. If the valve has voltage but fails to shift the hot gas to the indoor coil, shut the system down and unplug the 4 way valve from the ECU electrical plug.
4. Use an Ohmmeter to check for continuity through the solenoid coil. Check If the coil checks out good, but the valve will not shift, the 4 way valve is bad. Replace the valve.
5. If the coil checks out bad, replace the coil.
6. Note partial shifting of the valve can be detected by measuring the temperature of the suction gas where it enters the reversing valve and then comparing that temperature to the temperature of the suction gas exiting the 4 way valve. There should be no more than 13°F difference between entering suction gas temperature and leaving suction gas temperature. Excessive temperature rise through the suction gas path is an indication of a partial sliding valve. The temperature rise detected is due to hot gas bleeding through the slide assembly into the suction side of the system. Replace the 4 way valve.

Temperature sensor testing

The temperature sensors are negative coefficient type. These sensors will reduce their electrical resistance as temperature decreases. Should the sensors fail, the ECU will generate an appropriate Error Code.

To check the calibration of the sensors:

1. Shut off power to the outdoor unit.
2. Disconnect the sensor at the circuit board plug.

3. Measure the temperature of the air surrounding the sensor.
4. Measure the electrical resistance of the sensor. Do not force leads into sensor plug.

5. Compare the measured resistance of the sensor against the specification resistance/temperature limit listed in the reference table in this manual.
6. If the sensor resistance is outside of the specification tolerances shown on the resistance/temperature table, replace the sensor.

Restricted/Sticking Outdoor Unit Check Valve Test

The Check Valve allows refrigerant to flow freely around the outdoor unit heat mode EEV during cooling mode. The valve is a one directional device. The check valve has an internal steel ball that will allow refrigerant to bypass or it will backseat and block refrigerant flow.

In heating mode this valve will backseat to force liquid refrigerant to flow into and through the Heat Mode EEV.

If the check valve sticks, the refrigeration cycle will experience malfunction. Depending upon the mode of operation, a sticking check valve may bypass the outdoor EEV and flood the outdoor coil, or it may force liquid refrigerant through the outdoor EEV during heating mode and cause a restriction.

How to test a check valve

1. With the system running in cooling mode, the valve should flow refrigerant freely past the EEV. Take the temperature of the liquid entering and leaving the check valve. If there is a large temperature drop, the check valve is partially restricted. If the temperature of the liquid refrigerant into and out of the check valve are the same, the valve is freely flowing liquid. If the valve is restricted, replace it.

2. In heating mode, the valve should block refrigerant flow and force the liquid into the outdoor unit Heating Mode EEV. Check the temperature of the liquid entering and leaving the check valve. If the valve is working properly, there should be warm liquid at the entrance to the valve and cold refrigerant at the exit. If there is no temperature difference, the valve is allowing liquid to bypass the EEV. Replace the check valve.

OUTDOOR UNIT ERROR CODES

Outdoor Unit Error Codes

If the ECU generates a system ERROR CODE, the code will be displayed on the outdoor unit numeric display. Additionally, error codes generated by the outdoor unit will be displayed on the indoor unit circuit boards. The codes displayed on the indoor unit circuit boards will be represented by flash codes on LED indicators. The error codes displayed on the indoor unit consumer display will not match the outdoor unit code numbers. When performing diagnostic service, it will be necessary at times to use both codes to solve problems.

Sensor Error Codes

The easiest problems to solve will involve codes that are related to potential failure of temperature sensors. Common problems may include loose connections, open electrically, and out of calibration. Checking the condition of the sensors requires a temperature probe and an ohmmeter.

The Reference Section of this manual contains temperature resistance tables that can be used to check the calibration of the sensors. The measured resistance must be within the tolerances printed on the top of the tables.

Testing Procedure (See temperature sensor testing on page 18)

To test the electrical condition of a temperature sensor perform the following:

1. Confirm the sensor is firmly attached to the circuit board connection plug.
2. Remove the sensor wires from the connection plug by releasing holding tension on the plugs tension tab.
3. Use an ohmmeter to test the electrical resistance of the sensor.
4. If the sensor is within calibration, the sensor is good. If the sensor is out of calibration, replace the sensor.

Outdoor Unit Temperature Sensor Error Codes

There are 15 potential Error Codes that can be generated by the ECU to indicate a failure of an outdoor unit temperature sensor. Indoor unit temperature sensor failures will not be detected nor diagnosed by the outdoor unit ECU.

Error Code 10

This code indicates an electrical failure of the sensor that is used to sense the temperature of the outdoor coil during heat mode operation. This sensor is connected to the ECU via a connection at Plug CN-14.

Error Code 11

This code indicates an electrical failure of the sensor that is used to sense the temperature of the suction gas that enters the compressor. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code 12

This code indicates an electrical failure of the sensor that is used to sense the temperature of the outdoor air. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code 13

This code indicates an electrical failure of the sensor that is used to sense the temperature of the compressor hot gas discharge line. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code 28-36

All of these codes indicate a failure of either a Liquid or Gas Temperature Sensor that is part of either the A, B, C, or D EEV circuit. Refer to the outdoor unit Error Code Decal for specific identification of the malfunctioning temperature sensor. These sensors connect to the ECU at connection plugs near the center of the circuit board. (Note that if the sensor has failed, and there is an unused port on the unit available, the sensor from the unused port can be used to temporarily fix the problem.)

Error Code 38

This code indicates a potential failure of the MODULE Board temperature sensor. This sensor connects to the ECU via Plug CN-14. This sensor is mounted near the heat sink attached to the circuit board. A momentary power outage where the sensor has cooled may also trigger this error code. Test the sensor. If it tests go Outdoor Unit Pressure Switch Malfunction Codes

There are two pressure switches in the outdoor unit, a low pressure switch and a high pressure switch. They connect to the ECU via plugs CN-12 and CN-13. The low pressure switch is connected at CN-12 and the high pressure switch at CN-13. A low pressure error will generate an Error Code 44. A high pressure error will generate an Error Code 45.

Error Code 39

This code indicates an electrical failure of the sensor that is used to sense the temperature of the outdoor coil. The sensor is connected to the ECU via two wires at Plug CN-14.

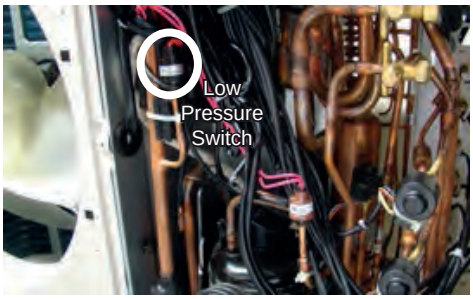
Error Code 41

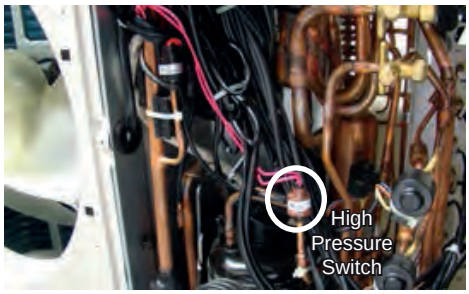
This code indicates an electrical failure of the sensor that is used to sense the temperature of the refrigerant entering or leaving the outdoor coil. The sensor is connected to the ECU via two wires at Plug CN-7.

Pressure Switch Error Codes

Outdoor Unit Pressure Switch Error Codes

There are two pressure switches in the outdoor unit, a low pressure switch and a high pressure switch. They connect to the ECU via plugs CN-12 and CN-13. The low pressure switch is connected at CN-12 and the high pressure switch at CN-13. A low pressure error will generate an Error Code 44. A high pressure error will generate an Error Code 45.





Testing Procedure

If the system generates one of these codes, it is very unlikely that the switch is actually bad, it is much more likely that the refrigeration system pressures are either too high or too low. The vapor line connection can be used to measure the high pressure during heating mode operation and low pressure during cooling mode operation.

There are no pressure ports that can be accessed to measure low pressure in heat mode nor high pressure in cool mode. If the system trips on one of these errors where pressure cannot be measured, it is going to be necessary to remove system charge and re-charge to confirm low or high charge is not causing the problem.

Error Code 43 or 45

This code is indicating that system pressure is too low. Refer to the detailed information on sensor responses for more information.

Typical Causes of Low Pressure Cool Mode
- Lack of charge (hot compressor)
- Low Heat on Indoor Coil (Cool Compressor)
- Restriction (Not likely)

Typical Causes of Low Pressure Heat Mode
- Cold outdoor air (Running system in very cold air.)
- Lack of charge (Hot Compressor and Indoor Coil)
- Restriction (Not Likely)

Error Code 42 or 44

The system is operating at excessive refrigerant pressure. If the system is a new installation, it is likely that the charge is too high. Refer to the reference section for installation and charging procedure. (Note the Weight Method is the ONLY way to charge this system.)

Typical Causes of High Pressure In Cool Mode
- Overcharge
- Dirty Outdoor Coil
- Restriction (Not Likely)

Typical Causes of High Pressure In Heat Mode
- Overcharge
- Undersized Refrigerant Lines/Exceeding Length
- Restriction (Not Likely)

Note: If the refrigerant pressures are correct, yet the system does not close the error reporting pressure switch, replace the defective pressure switch.

OUTDOOR UNIT ERROR CODES

Indoor Unit and Outdoor Unit Communication Errors

Error Code 15

This error indicates the indoor unit and outdoor unit are having a problem communicating information. The wiring path for the data signal is between Terminals 3 to 1 on the Terminal Blocks connecting the indoor unit to the outdoor unit. If the path is correct, the GREEN LED on the Service Monitor Board should be lit. Check the wiring on ECU Plug CN-21 to the individual Indoor Unit Terminal Blocks to ensure there are no loose connections. If OK, make sure the wiring size between indoor and outdoor units is 14 gauge AWG Stranded Wire. Check that no twists in the wires/wire nuts are present in the wires between indoor unit and outdoor unit Terminals 1 and also 3. (These are data path wires.) Reference Section Service Monitor Board Test.

Error Codes Caused by Abnormal Refrigeration Circuit Conditions

Error Code 8

This code indicates the temperature of the compressor hot gas is too high. This error would have occurred despite the ECU attempt at reducing operating frequency. Causes of this type of condition are typically a lack of refrigerant in the system, excessive heat in the conditioned space or a restriction in the refrigeration circuit.

Error Code 16

This error code indicates the system may lack refrigerant. Recover the system charge and check charge level.

Error Code 21

This code indicates the indoor coil has frosted over. Typically this condition will be due to a lack of heat in the conditioned space, operating the indoor unit at excessively cold air temperature or a blockage of air flow to the indoor unit. (Failed indoor fan motor.) This condition will cause the system to try and enter an anti freezing cycle. Refer to the Temperature Sensor Response section for details.

Outdoor Error Code Related to INDOOR UNIT Operation

Error Code 21

This code indicates the indoor coil sensor has detected a coil temperature that is too cold. Refer to Temperature Sensor Responses for diagnostic details. Likely causes are a lack of heat in the space. (Frost is a normal condition.)

Error Code Related to the ECU Board Operation

Error Code 1

The ECU board CPU can not read or write data. Replace the ECU Board.

OUTDOOR UNIT ERROR CODES

Error Codes Related to the MODULE Board Operation

Error Codes Related To The MODULE Board Operation

Error Code 2

The module board detected excessive instantaneous current compressor , IPM hardware automatically stopped the Module Board output to protect the compressor.

Potential causes include:

- overcharge
- dirty outdoor coil
- hot conditioned space
- temperature/high load
- refrigeration circuit restriction
- seized compressor
- Bad Module Board

Error Code 4

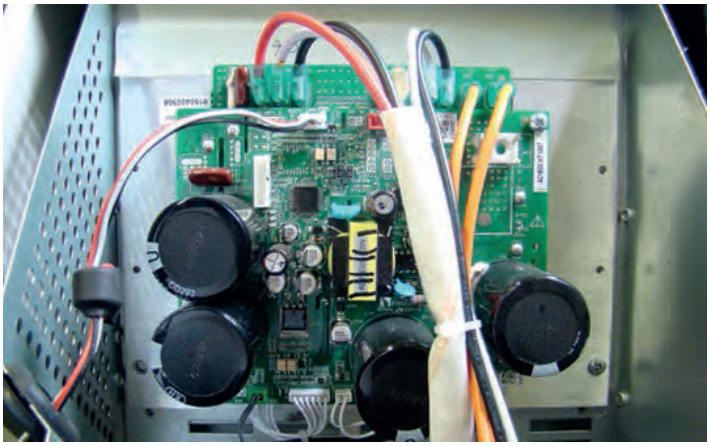
This code indicates the Module board is not communicating with the ECU. Check the wiring Plug connection between the two control boards. Make sure the connection is tight. The Module Plug connection is Plug CN-9 and the ECU plug is also Plug CN-9. If the connection is good, yet the boards do not communicate and the code will not clear, replace the MODULE Board.

Error Code 5

This code indicates the Module board is working very hard to operate the compressor. The most likely cause of the compressor overworking is refrigerant overcharge. Recover the refrigerant charge. Weigh the proper charge into the system and retry operation.

Error Code 6

This code indicates the operating voltage of the system is either too high or too low. Check line voltage for proper limits. The line voltage supplied to the outdoor unit should be now lower than 187V when the compressor starts. The running voltage should be no lower than 197V. The incoming line voltage to the outdoor unit should never be higher than 253V. If improper voltage is present, check the supply voltage circuit from the building for proper size wiring and good connections. If the voltage is still outside operating limits, contact the power company to have the service corrected.



If the line voltage from the power company is correct, check the output voltage of the Power Circuit Board. This voltage connects to the MODULE board at terminals CN-1 and CN-2.

If the voltage is not within specifications shown above, replace the Power Circuit Board.

Error Code 18

Module board detected unstable to flow to the compressor. The power output to the compressor will be stopped to protect the compressor motor windings.

Possible causes include:

- Line voltage spike
- Poor line voltage supply

Error Code 23

This code indicates the temperature of the MODULE Board is too hot. This error was generated by a temperature sensor located on the MODULE Board heat sink. Causes of overheating are typically overcharge of refrigerant, or very hot operating temperatures.

Error Code 25

The electrical current flow in the Module is too high.

- Possible Causes: Hard starting compressor
- Refrigeration circuit overcharge
- Refrigeration circuit restriction
- Compressor Seized
- Excessive high load in conditioned space
- Running system in heat mode at high outdoor air temperature

OUTDOOR UNIT ERROR CODES

Error Codes Related to MODULE Board Operation

Error Code 26

CPU module reset indicates possible drive module power anomalies. Usually when the low line voltage conditions are present. Check for line voltage problems.

Error Code 27

Compressor current abnormal: module driver board detected the
that compressor current is too large, The Module board software protects it and compressor.

Possible Causes:

- overcharge
- dirty outdoor coil
- hot conditioned space temperature/high load
- refrigeration circuit restriction
- seized compressor
- Bad Module Board

Error Codes Related to Compressor, Outdoor Fan, 4-Way Valve

Error Codes Related To Compressor, Outdoor Fan Motor, 4-Way Valve

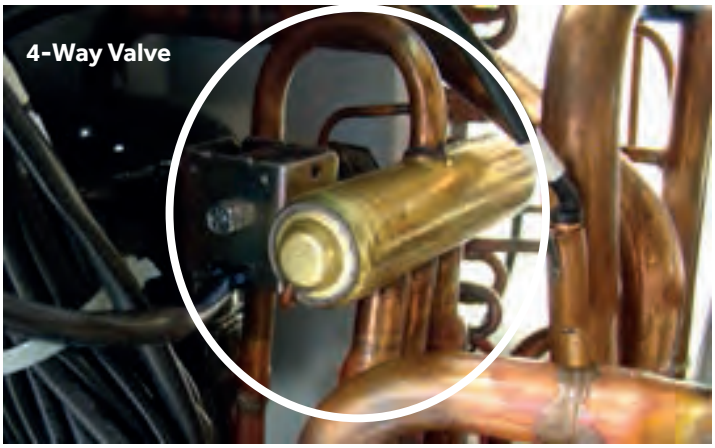
Error Code 9

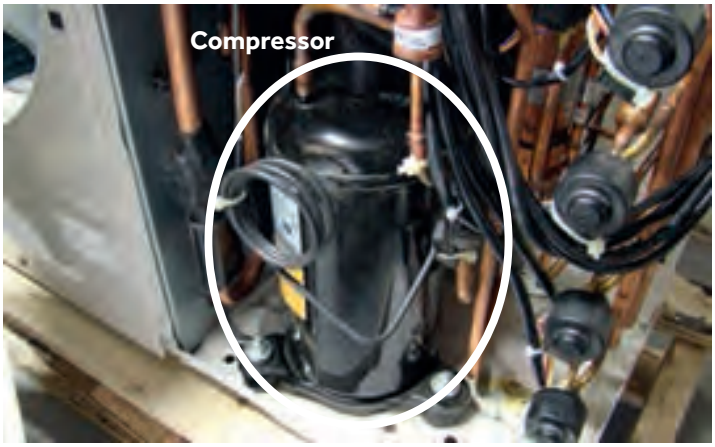
This code indicates the outdoor fan motor is not running. The fault is detected very quickly by the ECU. The system will shut off and display this error code. If this error occurs, reference the Test Procedure for Outdoor Fan Motor. Malfunction Code 17

This error code indicates that the 4 way valve is not directing hot gas to the proper coil. In other words, the system is running the refrigerant in the wrong mode of operation. Refer to the Test Procedure for 4 way valve to diagnose the problem.

Error Code 24

This error code indicates the compressor failed to start when a call for operation occurred. Refer to the Test Procedure for Compressor troubleshooting to diagnose the problem.

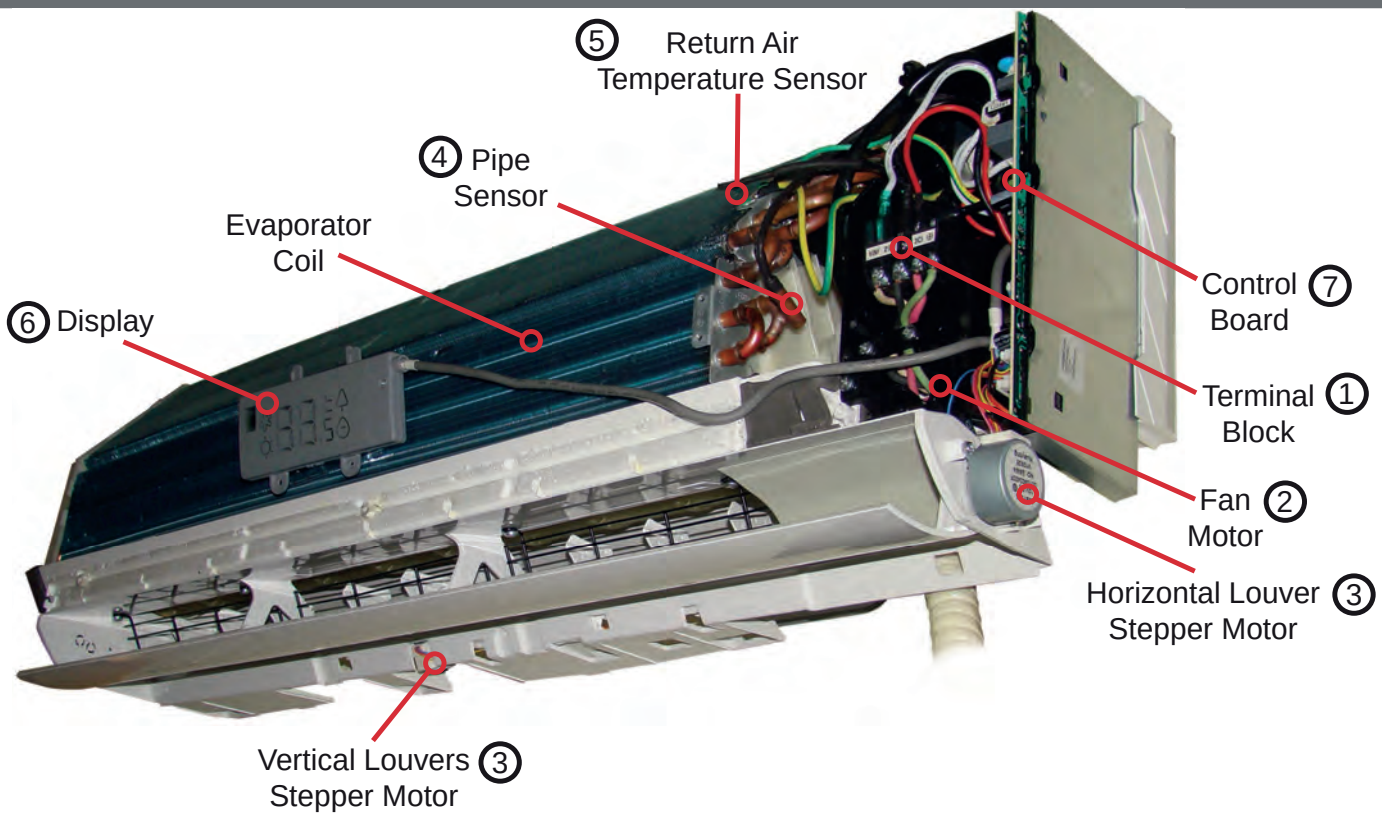




Indoor Unit Technical Overview

INDOOR UNIT TECHNICAL OVERVIEW

Indoor Wall Mount Unit Components



The wall mounted units act as evaporator coils during cooling mode and condenser coils during heating mode. These units have gravity condensate drain systems. If a condensate pump is needed, it must be field provided and mounted external to the indoor unit.

The wall mount unit is shipped with a wireless controller.

1 Power to operate the indoor unit comes from the electrical line voltage terminal block at the outdoor unit. The wiring includes 4 wires: 1, 2, 3 and ground. Wires 1 and 3 complete the data path. These wires should always be 14 gauge AWG Stranded type wire. Splices in wires 1 or 3 may cause communication errors.

2 The indoor unit features a multi-speed blower motor that will change speed to match the capacity demand from the outdoor unit. 3 Separate motors located in the indoor unit control the operation of the motorized louvers. All of the louver motors are controlled via commands received from the remote control. The blower motor is controlled by both the remote control and by commands from the outdoor unit ECU. Refer to the Remote Control Information in the Reference section for louver control/remote procedures.

Unlike typical air handlers found in the US market, these units have metering devices located in the outdoor unit. The metering devices are EEV type that are controlled by the outdoor unit ECU.

Temperature sensors located within the wall mount unit include a pipe temperature sensor and a return air temperature sensor. 4 The pipe temperature sensor is used to sense the temperature of the indoor coil in both cooling and heating modes. 5 The return air sensor senses the temperature of the air being drawn into the wall mounted unit from the conditioned space. The operating functions of these sensors is explained in the Temperature Sensor Function section of this manual.

6 The indoor unit has a display that communicates system mode, room temperature and diagnostic code information. The diagnostic code information shown on the indoor unit will NOT be the same code that is displayed on the outdoor unit. When servicing a diagnostic error, compare the indoor unit code to the outdoor unit code to make diagnostic decisions. Codes that relate to outdoor unit problems should use the outdoor unit display information as priority.

7 The indoor unit circuit board controls the switching functions of the indoor unit. All control decisions are made by the outdoor unit ECU. The indoor board has some limited diagnostic capability which will be covered in this manual.

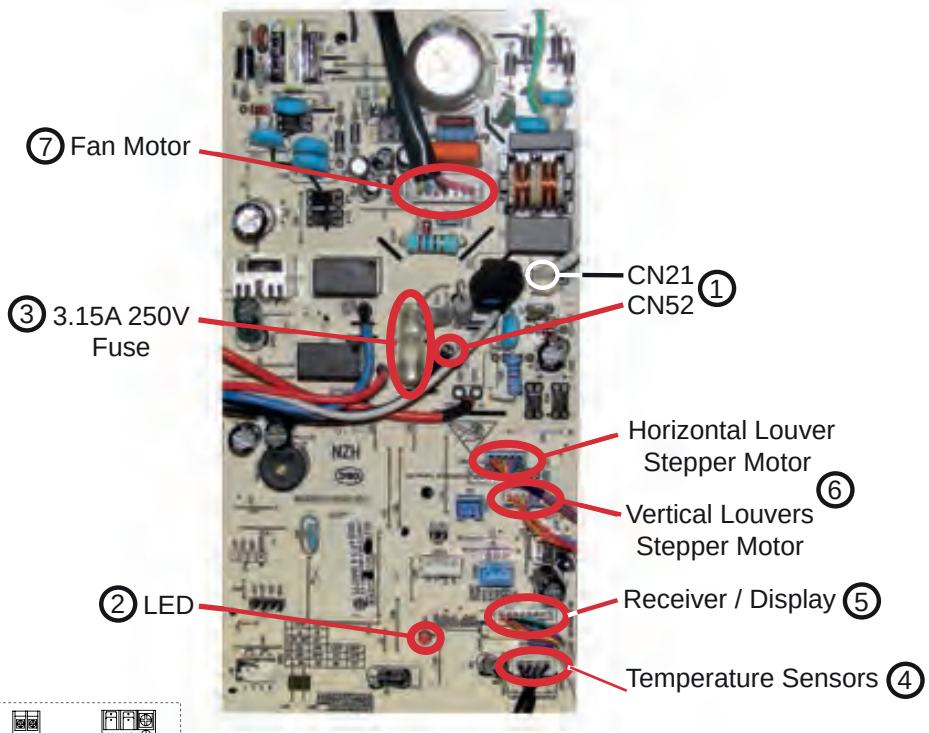
INDOOR UNIT TECHNICAL OVERVIEW

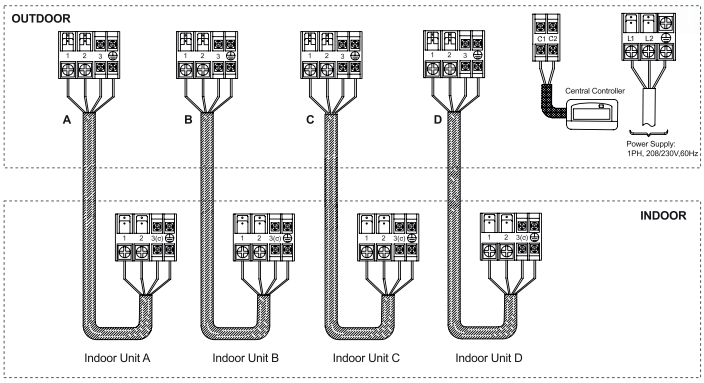
Indoor Wall Mount Unit Circuit Board

The Indoor Unit Circuit Board communicates with the outdoor unit ECU via a connection at Terminal Block screw 3.

The data pulse that sends the communication information can be measured with a voltmeter placed to DCV range. From the ground connection at the Terminal Block to the Number 3 screw connection, the voltage should pulse up and down when data is being transmitted.

This control board has control over the fan louver movement, manual fan blower control, indoor coil temperature and indoor air temperature sensing functions. All operational decisions are controlled by the OUTDOOR UNIT ECU. The connections on the indoor indoor board are shown here in the schematic drawing.





Line voltage to power the indoor unit comes in on Terminal Block connections 1 and 2. Power connects from these terminal connections to CN- 52 and CN-21 on the circuit board. If the board does not respond to commands and has no display, check for line voltage at these connections. When power is present at the indoor board, the RED LED on the circuit board will blink a 2 flash code.

The control board has a replaceable 3.15A 250V fuse that protects against excessive current. If power is present at the board but the board does not work, check for continuity through the fuse. Replace if the fuse is open.

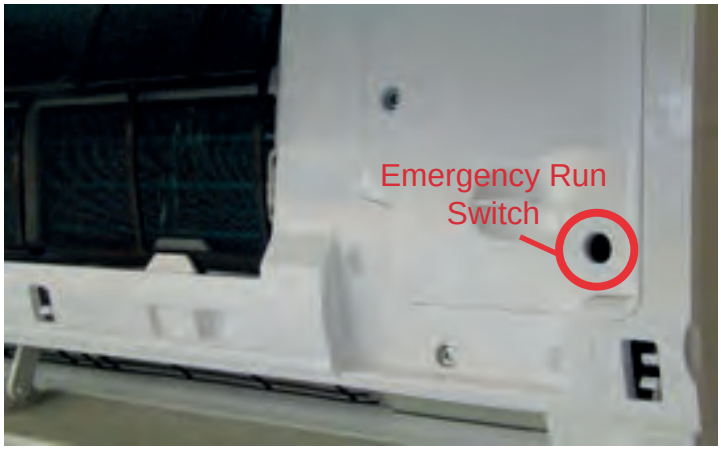
The indoor unit temperature sensors are connected at Plug CN6. When testing the calibration of these sensors, the wires can be released from the plug by pressing on the tension tab on the side of the plug.

The receiver/display unit that is mounted to the front cover of the indoor unit plugs into the circuit board via a connection at Plug CN-7.

There are two to three motors that control the movement of the louvers right, left and up/down. These motors connect at CN5, CN11 and CN10. Some units will use one motor to operate the right and left movement function.

The blower motor is connected to the circuit board at plug CN-9.

There is an Emergency Run switch on the edge of the indoor board that will put the system into Auto Mode should the remote control break or be lost. When this switch is pressed and held for 5 seconds, the indoor unit display will beep twice and the system will enter TEST MODE.



Blower Assembly

The blower assembly consists of a plastic blower wheel that is connected to a variable speed indoor blower motor. A set screw holds the blower wheel to the blower motor.

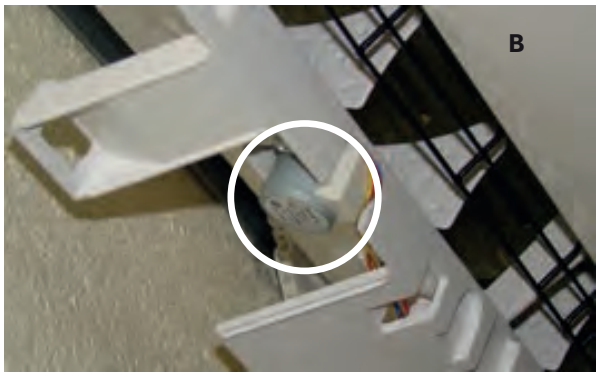
The indoor blower motor is a DC Fan Motor that is connected to the indoor unit control board via Plug CN-9. The wiring from the motor to indoor board consists of 5 wires connected to pins 1, 4, 5, 6 and 7. Pin 1 should have 310 VDC. Pin 4 is ground. Pin 5 +15VDC. Pin 6 is the feedback signal. Pin 7 is the speed control.

During normal operation, the indoor control board will energize the indoor blower motor and request proper speed. The indoor blower motor will control the speed via a command at the Pin 7 speed control. Proper fan speed is verified by the indoor control board via the voltage level at the feedback signal on Pin 6. Should the feedback signal not be present during a call for indoor blower, the indoor control board will indicate a Malfunction Code E14.

Louver motors

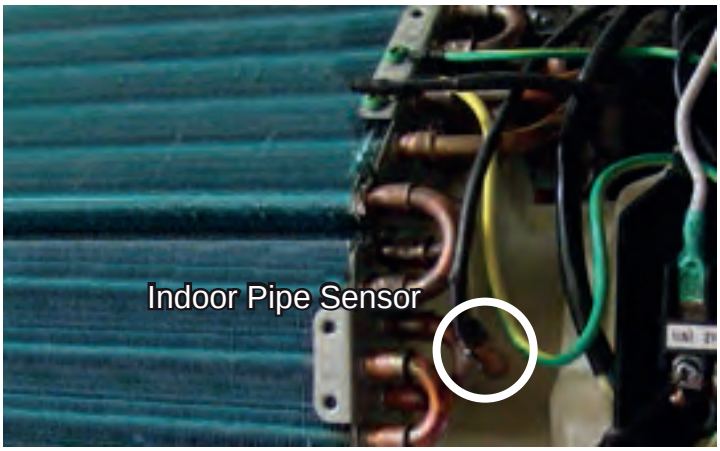
The louver motors are stepper type motors that move the louvers either right/left or up/down. The motors are controlled by pulsed voltage that cannot be measured. If the louver does not move when it should, check for a blockage in the louvers. If the louver is free to move, refer to the Test Procedure Section.

See A and B below.

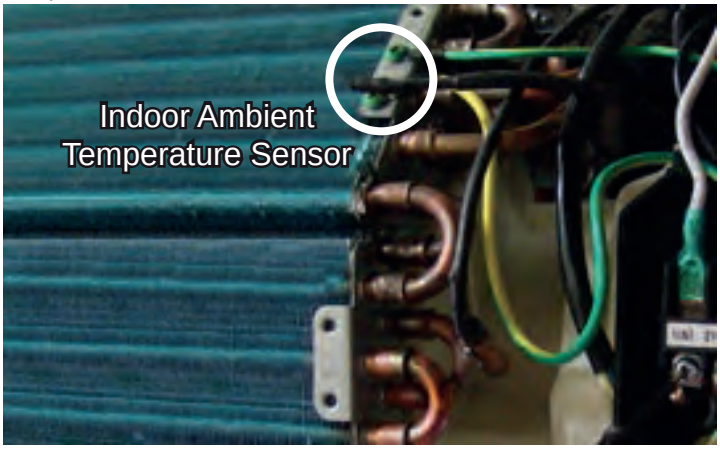


Temperature Sensors

The Piping Temperature Sensor senses indoor coil temperature in the cooling mode and in the heating mode. This sensor is used for Anti Freezing and Anti Cold Blow cycles. The sensor also provides critical temperature information to the ECU that may be used in frequency adjustments. See Temperature Sensor Functions.



The Ambient Temperature Sensor senses room temperature. This sensor provides room temperature information to the ECU for calculation of inverter capacity and temperature control.



Both sensors are negative temperature coefficient type that reduce electrical resistance as temperature rises.

Test Procedures

Accessing components/removing cover

1. To access components for service, first disconnect power to the outdoor unit. This will de-energize the indoor unit.
2. Lift the front cover by prying on the two indented finger holds at each end of the indoor unit.

3. Remove the three Phillips head screws located near the bottom of the indoor unit. These screws are located directly below the bottom of the air filter.

4. Remove the filters.

5. Manually open the louver.

6. Open the 3 caps that cover the screws located behind the bottom of the louver. These caps flip up.

7. Remove the three screws located behind the caps.

8. Remove the two screws that hold the digital display to the front cover. The display can hang free.

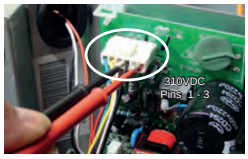
9. Release the air temperature sensor from the clip that holds it.

10. Pull upward on the top of the indoor unit cover to free it from the four retaining clips. The cover will pivot downward. The cover should now pull away from the indoor unit.

Indoor Fan Motor Voltage Check

If the indoor fan motor does not run.

1. Remove the front cover and access the circuit board connection CN-9.
2. Reset power and turn the remote control fan command to Fan On mode.



Motor Test

1. If the motor doesn't run, check for 310VDC between Pins 1 and 3. If it is not present, the indoor board is bad. If voltage is present, continue on.

2. Check the voltage between Pins 3 and 4. The voltage should be +15VDC. If it is not present, the board is bad. If voltage is present, continue on.

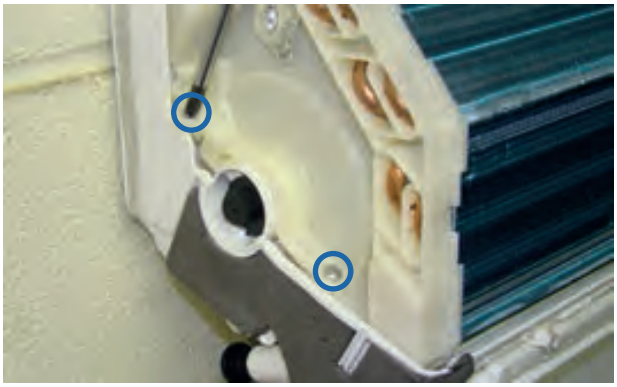
3. Check for voltage between Pins 3 and 6. If no DC voltage is present, the board is bad. If voltage is present, change the motor.

Replace the Blower Motor

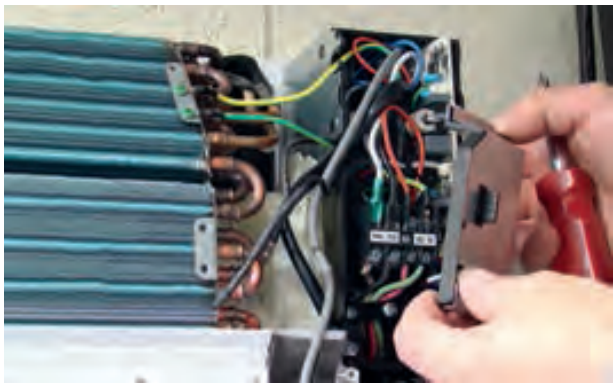
Replace the Blower Motor

Step 1. Disconnect the power.

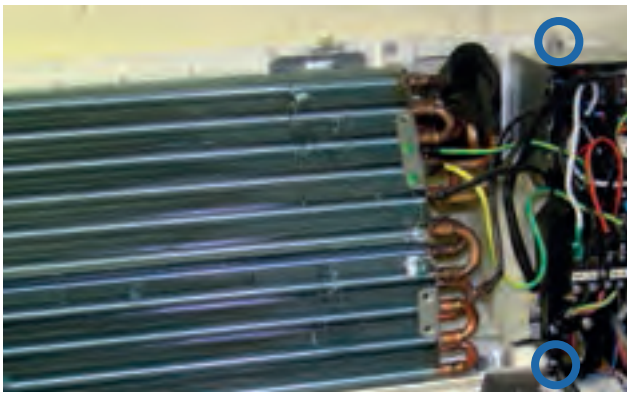
Step 2. With the indoor unit cover removed, remove the two screws on the left plastic evaporator coil bracket.



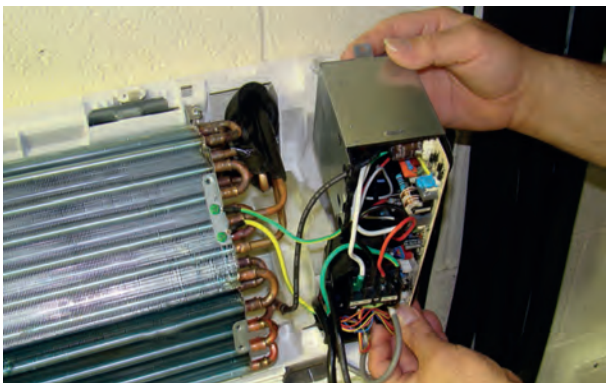
Step 3. Remove the cover from the electrical box on the right side of the indoor unit.



Step 4. Remove the two screws that hold the electrical box in place.

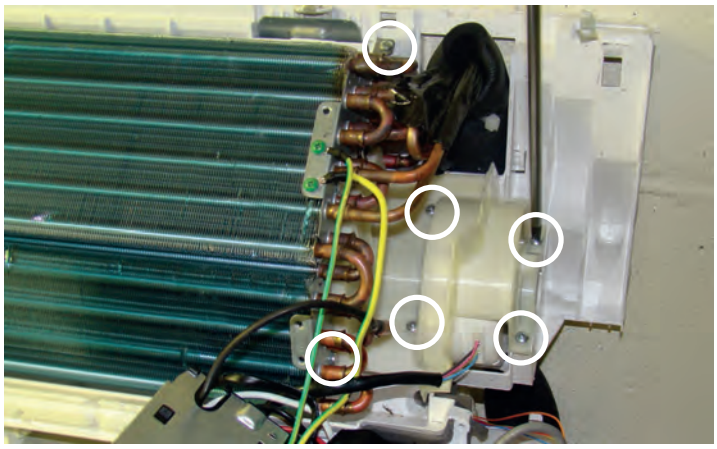


Step 5. Lift and swing the electrical box out of the way.

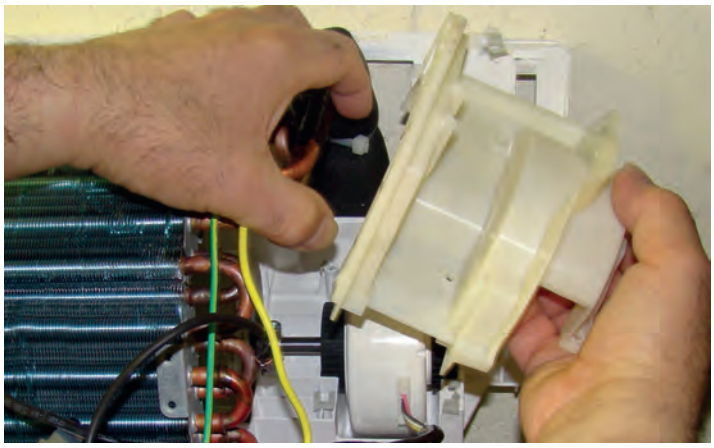


INDOOR WALL MOUNT UNIT TECHNICAL OVERVIEW

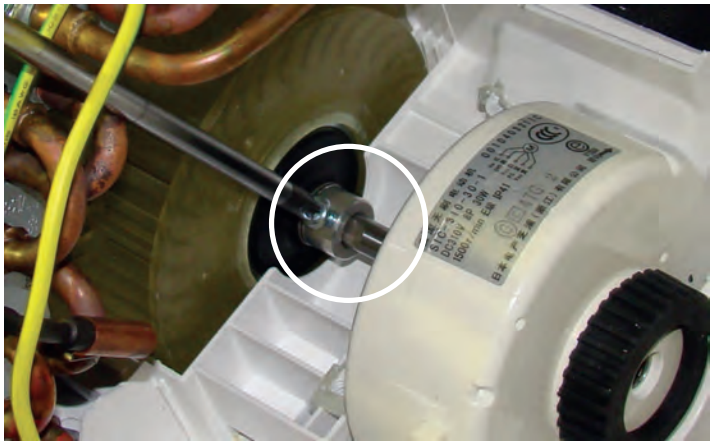
Step 6. Remove 6 screws that hold the motor bracket and evaporator coil.



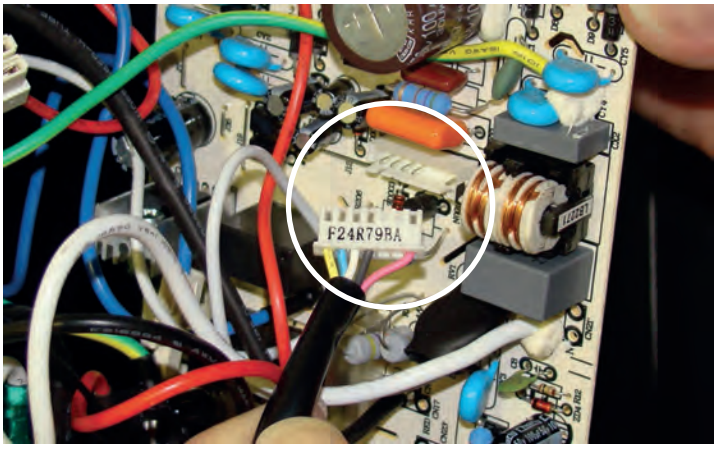
Step 7. Lift the evaporator coil and remove the motor bracket.



Step 8 Loosen the motor shaft set screw. Phillips head screw.



Step 9. Unplug the motor from the circuit board.



Step 10. Lift and slide the motor away from the blower wheel.

Step 11. Remove the two black anti vibration mounts from the defective motor and place them on the new motor.

Step 12 Install new motor in reverse order.

Testing Temperature Sensors and Louver Motors

Testing Temperature Sensors

The easiest problems to solve will involve codes that are related to potential failure of temperature sensors. Common problems may include loose connections, open electrically, and out of calibration. Checking the condition of the sensors requires a temperature probe and an ohmmeter.

The Reference Section of this manual contains temperature resistance tables that can be used to check the calibration of the sensors. The measured resistance must be within the tolerances printed on the top of the tables.

To test the electrical condition of a temperature sensor perform the following:

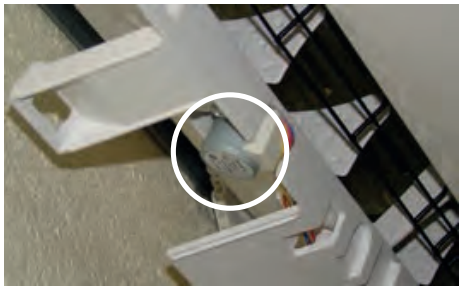
1. Confirm the sensor is firmly attached to the circuit board connection plug.

2. Remove the sensor wires from the connection plug by releasing holding tension on the plugs tension tab.

3. Use an ohmmeter to test the electrical resistance of the sensor.

4. Measure the air temperature near the sensor and compare the required resistance against measured resistance. (See chart in reference section) If the sensor is within calibration, the sensor is good. If the sensor is out of calibration, replace the sensor. (Tube Sensors should be removed from socket and exposed to air temperature during test.)

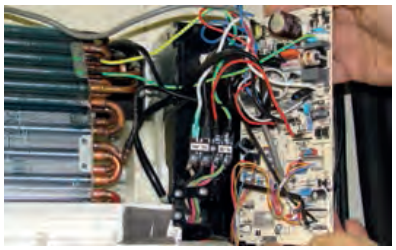
Testing Louver Motors



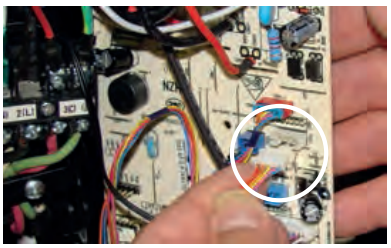
If the louver does not operate with command from the remote control, either the indoor board is bad, or the louver motor is defective. It is more likely the motor is defective than the board. (Make sure the louver assembly is not binding and keeping the vanes from moving.)

1. Remove power from the unit and remove the indoor unit cover.

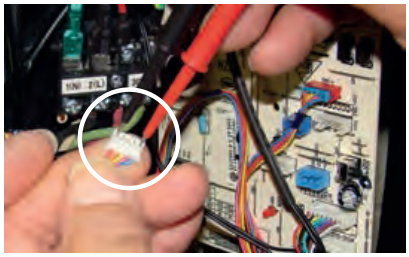
2. Access the circuit board.



3. Identify on the schematic drawing the inoperable louver motor and disconnect the plug from the circuit board. (The up down louver motor is located on the right side of the indoor unit. The left right louver motor is located bottom center.)



4. Use an Ohmmeter to test the electrical continuity of the louver motor windings. The proper resistance for each winding can be found in this table. If the mo tor winding resistance is erratic or shows open, the motor is defective. Replace the motor.



5. If the motor checks out good, replace the indoor control board.

INDOOR WALL MOUNT UNIT SECTION

Testing Communication Circuit

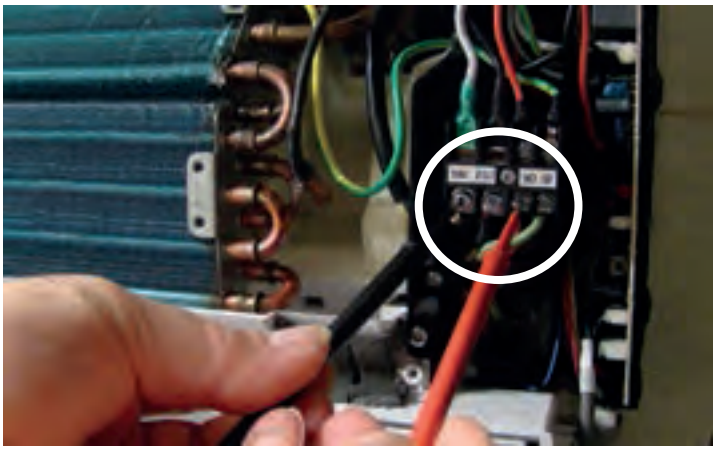
Testing Communication Circuit

If an Error E7 occurs, perform the following test to determine if the indoor control board is functioning properly to send data to the outdoor unit.

Perform this test with the unit powered and all wiring connected between indoor and outdoor unit.

Make sure all wiring between the indoor and outdoor unit are correct. There should no splices between the indoor and outdoor unit wiring connecting terminals 1 or 3. Make sure wiring is correct, before performing this test.

1. Measure the DC voltage between terminals 1 and 3 on the indoor terminal block.



2. The voltage should fluctuate between 8VDC and 23VDC. The fluctuating signal indicates a good communication path.

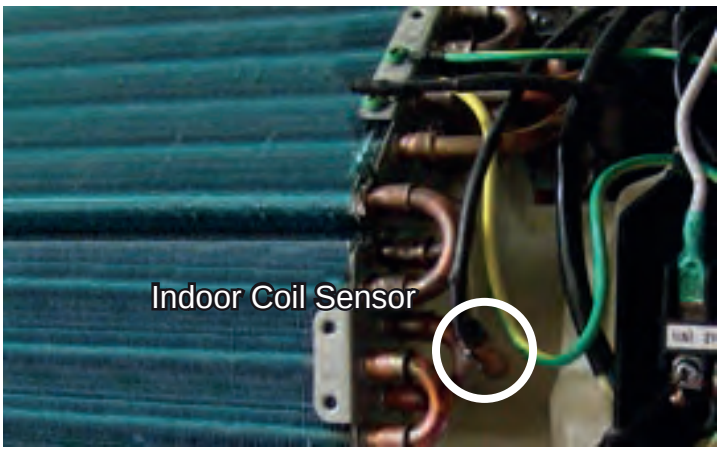
3. If the voltage does not fluctuate, and the wiring is good, the indoor board is defective.

Antifreezing Protection

Antifreezing Protection

Prevents freeze-up of the indoor coil

The indoor unit coil temperature sensor will shut off the outdoor unit and begin a defrosting routine if the indoor coil is below 32°F for more than 2 minutes. The indoor unit will not report this operation. Once the indoor coil warms up, the system will re-enter cooling mode and operate normally, This protection cycle prevents the indoor coil from developing ice coating during low heat load operation.



Indoor Unit Error Codes

Indoor Unit Error Codes (HSU218VHG Only)

The error codes that are displayed on the indoor units may vary from the outdoor unit codes. The information communicated by the error code will be the SAME for both indoor and outdoor units even though the numbers may differ.

Error Code E7

This code is indicating the indoor and outdoor units have lost communication signal. Check wiring between indoor and outdoor unit. Confirm 14 gauge AWG stranded wire present. Confirm no splices in wires 1 and 3. Go to Test Procedures to solve communication error.

Error Code E1

This code indicates a failure of the room temperature sensor. Go to Test Procedure section to solve.

Error Code E2

This code indicates a failure of the Pipe Temperature Sensor on the indoor unit. Go to Test Procedure section to solve.

Error Code E4

This error indicates an EEPROM Error indoor unit control board. Reset power. If error repeats, replace the indoor circuit board.

Error Code E14

This code indicates the indoor fan motor failed to run. Go to Test Procedure Section to solve.

Error Code F12

This code indicates an OUTDOOR UNIT EEPROM error. Cycle power. If the error does not clear, replace the ECU.

Error Code F1

The module board detected excessive instantaneous current compressor , IPM hardware automatically stopped the Module Board output to protect the compressor.

Potential causes include:

- overcharge
- dirty outdoor coil
- hot conditioned space temperature/high load
- refrigeration circuit restriction
- seized compressor
- Bad Module Board

Error Code F22

Compressor current abnormal: module driver board detected that the compressor current is too large, The Module board software protects it and the compressor.

Possible Causes:

- overcharge
- dirty outdoor coil
- hot conditioned space temperature/high load
- refrigeration circuit restriction
- seized compressor
- Bad Module Board

Error Code F3

This code indicates the Module board is not communicating with the ECU. Check the wiring Plug connection between the two control boards. Make sure the connection is tight. The Module Plug connection is Plug CN-9 and the ECU plug is also Plug CN-9. If the connection is good, yet the boards do not communicate and the code will not clear, replace the MODULE Board.

Error Code F19

This code indicates the operating voltage of the system is either too high or too low. Check line voltage for proper limits. The line voltage supplied to the outdoor unit should be now lower than 187V when the compressor starts. The running voltage should be no lower than 197V. The incoming line voltage to the outdoor unit should never be higher than 253V. If improper voltage is present, check the supply voltage circuit from the building for proper size wiring and good connections. If the voltage is still outside operating limits, contact the power company to have the service corrected.

If the line voltage from the power company is correct, check the output voltage of the Power Circuit Board. This voltage connects to the MODULE board at terminals CN-1 and CN-2. If the voltage is not within specifications shown above, replace the Power Circuit Board.

Error Code F27

This error code indicates the compressor failed to start when a call for operation occurred. Refer to the Test Procedure for Compressor troubleshooting to diagnose the problem.

INDOOR WALL MOUNT UNIT

Indoor Unit Error Codes

Error Code F4

This code indicates the temperature of the compressor hot gas is too high. This error would have occurred despite the ECU attempt at reducing operating frequency. Causes of this type of condition are typically a lack of refrigerant in the system, excessive heat in the conditioned space or a restriction in the refrigeration circuit.

Error Code F8

This code indicates the outdoor fan motor is not running. The fault is detected very quickly by the ECU. The system will shut off and display this error code. If this error occurs, reference the Test Procedure for Outdoor Fan Motor.

Error Code F21

This code indicates an electrical failure of the sensor that is used to sense the temperature of the outdoor coil during heat mode operation. This sensor is connected to the ECU via a connection at Plug CN-14.

Error Code F7

This code indicates an electrical failure of the sensor that is used to sense the temperature of the suction gas that enters the compressor. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code F6

This code indicates an electrical failure of the sensor that is used to sense the temperature of the outdoor air. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code F25

This code indicates an electrical failure of the sensor that is used to sense the temperature of the compressor hot gas discharge line. The sensor is connected to the ECU via two wires at Plug CN-14.

Error Code F13

The system is low on refrigerant charge. Correct leak and recharge per installation instructions in Reference Section.

Error Code F11

Recycle power and restart the system. If the compressor initially starts but then stops, replace the MODULE board and COMPRESSOR.

Error Code F28

Recycle power and restart the system. If the compressor initially starts but then stops, replace the MODULE board and COMPRESSOR.

Error Code F2

The current draw into the compressor is too high. Check compressor windings. If OK, replace the Module Board.

Error Code F23

The current draw into the compressor is too high. Check compressor windings. If OK, replace the Module Board.

Error Code E9

This error indicates the temperature of the indoor coil during heating mode is too high and has exceeded the maximum limit. This code will be indicated when the temperature of the indoor coil exceeds 149 F twice in 30 minutes. Causes include low charge, dirty indoor coil, faulty EEV

Important Service Related Installation Information

Indoor Clearances: If non-compliant may lead to temperature control complaints.

Wire Sizing: If non-compliant may lead to communication errors and inverter irregular operation.

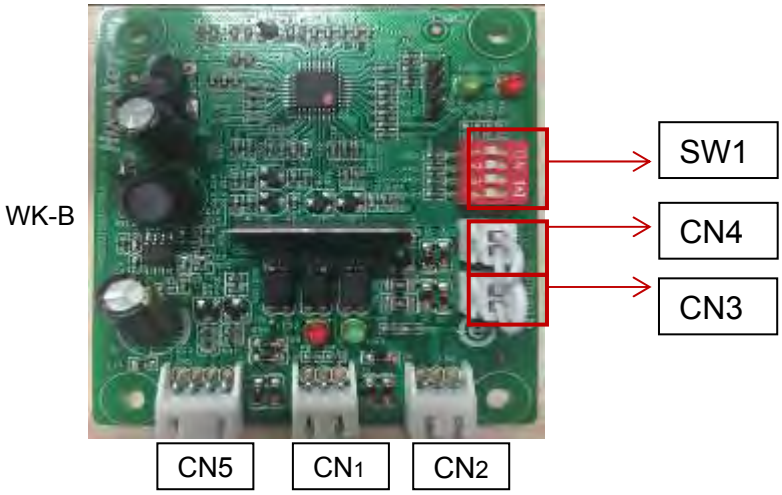
Splices in Field Wiring: Splices between the wires that connect between the outdoor and indoor unit should be avoided. Communication errors may occur if non compliant.

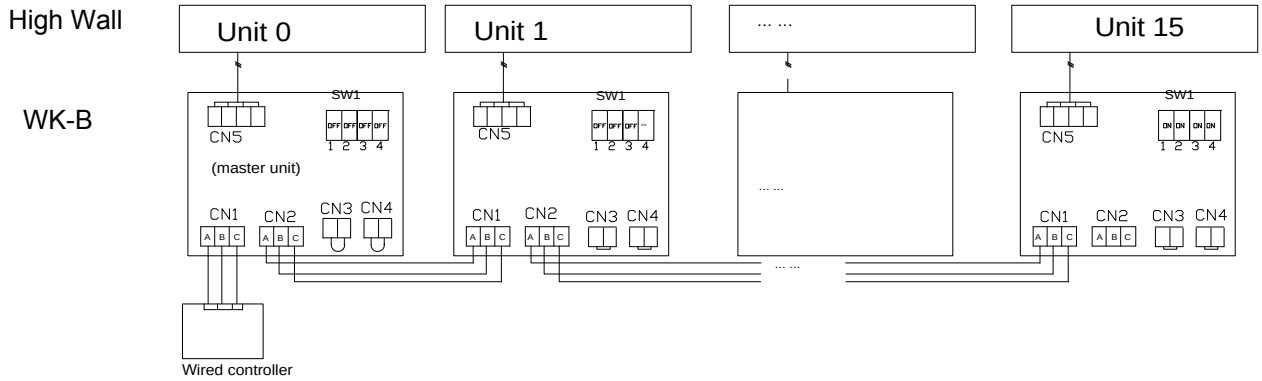
Sealing Penetrations: If penetrations at back of unit are not sealed, unconditioned air may be drawn into the back of the indoor wall mount unit. Temperature control and capacity complaints may occur.

Connection method for one wired controller with multiple Wall Mount

Alert! Ensure do any of the operating during power off.

The wired remote can connect up to16 indoor units at the same time, but each high wall indoor request 1 wired controller kit WK-B. Up to 16 indoor unites can be connected by the wired remote at the same time, but each one requests 1 wired controller kit WK-B.





Remark:
(1) The first high wall indoor unit to connect with WK-B is considered as master unit 0.

(2)There is a jumper between terminal CN3 and CN4 on the WK-B.
- For the master unit, please keep the jumper
- For slave unit(s), please remove the jumper.

(3) The terminal CN1 of WK-B for master unit (unit 0) must connect the wired remote.

(4)The terminal CN2 of WK-B for master unit (unit 0) must connect the CN1 of WK-B for slave unit (unit 1), and the terminal CN2 of WK-B for slave unit #1 will need to be connect to terminal CN1 of WK-B for the next slave unit.

(5) Please see the attached list for Master/slave DIP switch setting of WK-B.

INDOOR WALL MOUNT UNIT

Connection method for one wired controller with multiple Wall Mount

Unit No.	Dip Switch Position of of WK-B			
	1	2	3	4
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON
10	ON	OFF	ON	OFF
11	ON	OFF	ON	ON
12	ON	ON	OFF	OFF
13	ON	ON	OFF	ON
14	ON	ON	ON	OFF
15	ON	ON	ON	ON

Cassette Unit Technical Overview

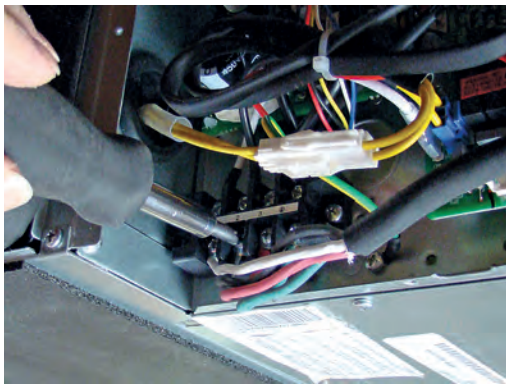
Cassette Unit Components

Component Overview

The indoor cassette type units act as evaporator coils during cooling mode and condenser coils during heating mode. These units have a built in condensate pump with an associated condensate level switch. The condensate pump is capable of lifting water out of the indoor unit. If high water lift is needed, the water from the cassette pump should be pumped into a field supplied condensate pump with high lift power.

Cassette type indoor units can be operated with a wired controller or a remote control.

Power to operate the indoor unit comes from the electrical line voltage terminal block at the outdoor unit. The wiring includes 4 wires, 1, 2, 3 and ground. Wires 1 and 3 complete the data path. These wires should always be 14 gauge AWG Stranded type wire. Splices in wires 1 or 3 may cause communication errors.



The indoor unit features a multi speed blower motor that will change speed to match the capacity demand from the outdoor unit. Separate motors located in the indoor unit control the operation of the motorized louvers. All of the louver motors are controlled via commands received from the remote control. The blower motor is controlled by both the remote control and by commands from the outdoor unit ECU. Refer to the Remote Control Information in the Reference section for louver control/remote procedures.

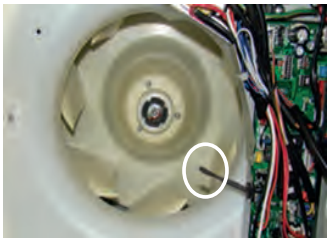
Motor Blower

Unlike typical air handlers found in the US market, these units have metering devices located in the outdoor unit. The metering devices are EEV type that are controlled by the outdoor unit ECU.

Temperature sensors located within the cassette unit include a pipe temperature sensor and a return air temperature sensor. The pipe temperature sensor is used to sense the temperature of the indoor coil in both cooling and heating modes. The return air sensor sense the temperature of the air being drawn into the wall mounted unit from the conditioned space. The operating functions of these sensors is explained in the Temperature Sensor Function section of this manual.

Terminal Block

Pipe Sensor



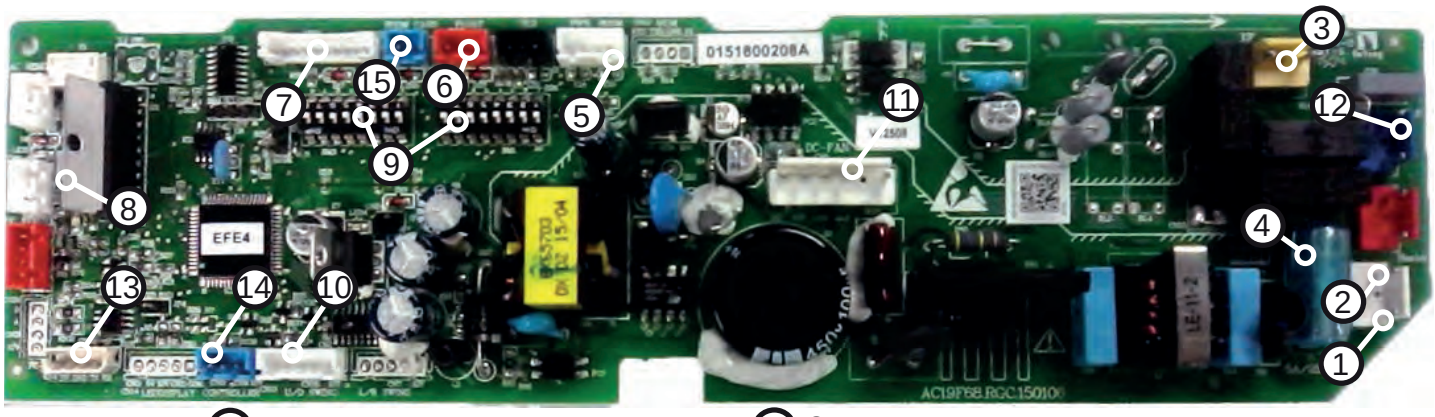
Ambient Sensor

The indoor unit has a display that communicates system mode. The indoor unit does not display temperatures or diagnostic codes. When a wired controller is used, this information is displayed on the wired controller. It is recommended to use a wired controller with the cassette unit.

When servicing a diagnostic error, ALWAYS refer to the outdoor unit code to make diagnostic decisions.

CASSETTE UNIT TECHNICAL OVERVIEW

Cassette Unit Indoor Circuit Board



1. N Terminal
2. L Terminal
3. Communication Terminal
4. 3.15A 250V Fuse
5. CN3 Pipe/Room Temp Sensors
6. CN19 Float Switch
7. CN21 Louver Panel
8. CN11 Wired Remote
9. DIP Switches
10. CN7 Stepper Motor
11. CN6 Fan Motor
12. CN9 Condensate Pump
13. CN4 U-HOME
14. CN13 Remote Central
15. CN1 Room Card

The indoor unit circuit board controls the switching functions of the indoor unit. All control decisions are made by the outdoor unit ECU. The indoor board has some limited diagnostic capability which will be covered in this manual.

The Indoor Unit Circuit Board communicates with the outdoor unit ECU via a connection at Terminal Block screw 3. The data pulse that sends the communication information can be measured with a voltmeter placed to DCV range. From the ground connection at the Terminal Block to the Number 3 screw connection, the voltage should pulse up and down when data is being transmitted.

This control board has control over the fan louver movement, manual fan blower control, indoor coil temperature and indoor air temperature sensing functions. All operational decisions are controlled by the OUTDOOR UNIT ECU.

The connections on the indoor board are shown here in the schematic drawing.

Line voltage to power the indoor unit comes in on Terminal Block connections 1 and 2. Power connects from these terminal connections to CH- 3 and CH-4 on the circuit board. If the board does not respond to commands and has no display, check for line voltage at these connections. When power is present at the indoor board, the Display Power Indicator will be lit.

The control board has a replaceable 3.15A 250V fuse that protects against excessive current. If power is present at the board but the board does not work, check for continuity through the fuse. Replace if the fuse is open.

The indoor unit temperature sensors are connected at Plug CN-13. When testing the calibration of these sensors, the wires can be released from the plug by pressing on the tension tab on the side of the plug.

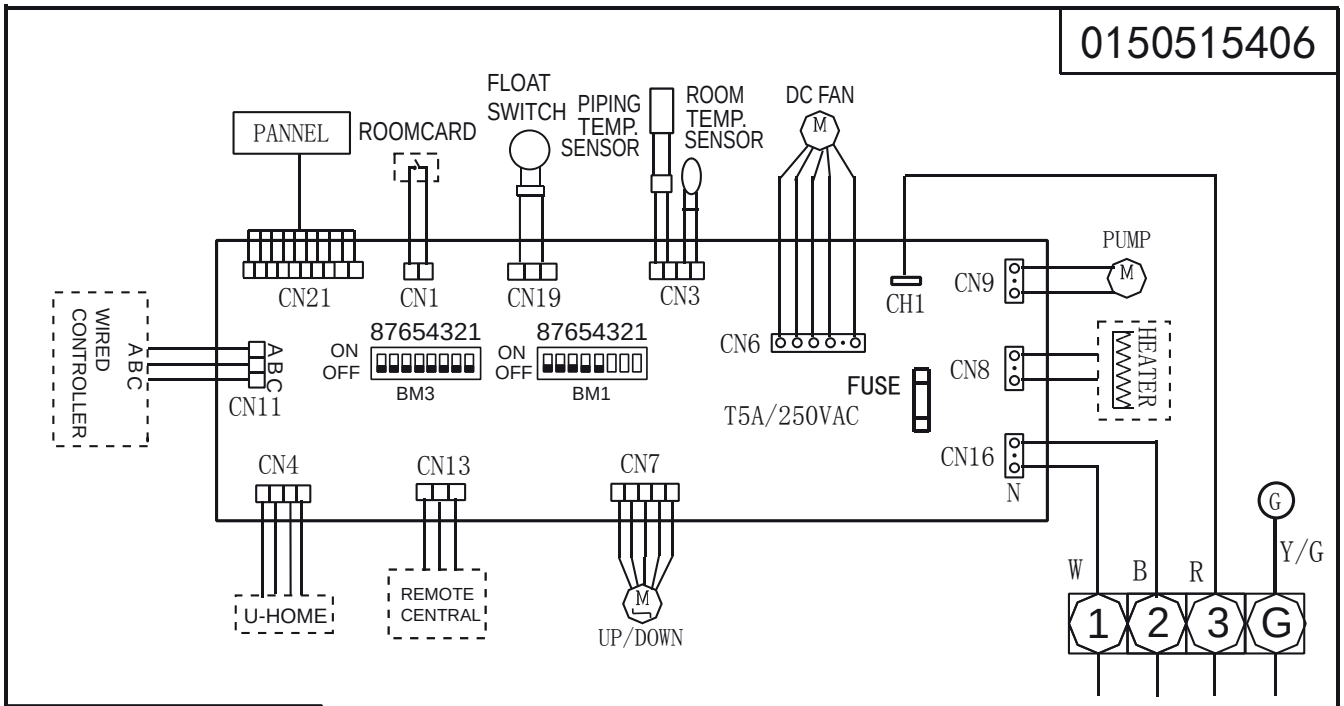
The receiver/display unit that is mounted to the front cover of the indoor unit plugs into the circuit board via a connection at Plug CN-29.

There is one motor that controls the movement of the louvers. The motor connects to the circuit board at Plug CN-14. The motor is located in the over of the louver assembly.

The blower/fan motor is connected to the circuit board at plug CN-11.

The Cassette unit has a built in condensate pump. The pump is connected to the circuit board on Plug CN-9. The pump is energized whenever the Float Switch indicates that water needs to be pumped from the cassette. The float switch connects onto the circuit board via Plug CN-18.

Cassette Unit Wiring Diagram



BM1-1	BM1-2	BM1-3	BTU	
OFF	OFF	OFF	9000	AB09SC2VHA
ON	OFF	OFF	12000	AB12SC2VHA
OFF	ON	OFF	18000	AB18SC2VHA
ON	ON	OFF	24000	
OFF	OFF	ON	28000	
ON	OFF	ON	36000	
OFF	ON	ON	48000	
ON	ON	ON	60000	

NOTE1. DASHED PART ARE OPTIONAL.
2. USER SHOULD NOT TO SET BM1 AND BM3

BM1-4	BM1-5	Room card
ON	OFF	available
OFF	OFF	unavailable

BM1-6	BM1-7	BM1-8	TYPE DEFINE
OFF	OFF	OFF	Default

R:RED
B:BLACK
W:WHITE
Y/G:YELLOW/GREEN

Cassette Unit DIP Switch Settings

BM1-1	BM1-2	BM1-3	BM1-4	BM1-5	BM1-6	BM1-7	BM1-8	Description
OFF	OFF	OFF	--	--	--	--	--	Unit capacity: 9000
ON	OFF	OFF	--	--	--	--	--	Unit capacity: 12000
OFF	ON	OFF	--	--	--	--	--	Unit capacity: 18000
--	--	--	OFF	--	--	--	--	Room card invalid(default)
--	--	--	ON	--	--	--	--	Room card valid
--	--	--	--	OFF	--	--	--	Heat pump(defult)
--	--	--	--	ON	--	--	--	Cooling only
--	--	--	--		OFF	OFF	OFF	Cassette(American)

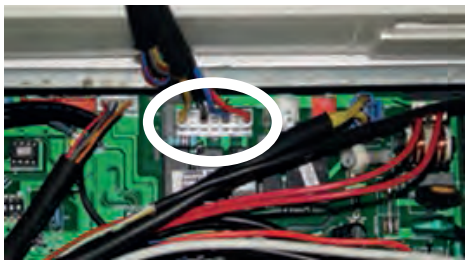
Cassette Unit Components

The Blower Assembly

The blower assembly consists of a plastic blower wheel that is connected to a PSC indoor blower motor. A set screw holds the blower wheel to the blower motor.

Blower/Fan Assembly

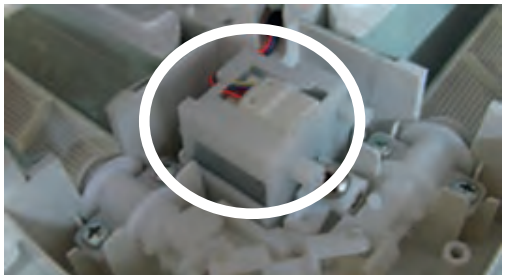
The indoor blower motor is a Multi Speed Fan Motor that is connected to the indoor unit control board via Plug CN-11. The wiring from the motor to indoor board consists of 4 wires connected to pins common, low , medium and high speeds.



During normal operation, the indoor control board will energize the indoor blower motor and request proper speed. The motor has a run capacitor that is located in the Cassette unit's control box. The run capacitor connects to the motor via two orange wires. This capacitor is field replaceable.

Louver motors

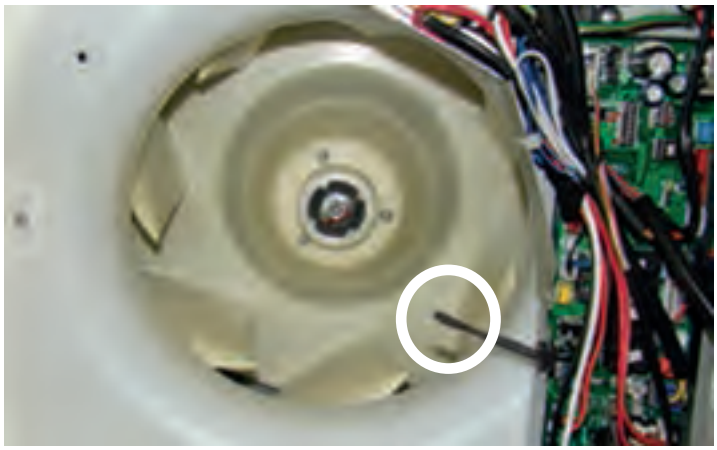
The louver motors are stepper type motors that move the louvers up/down. The motors are controlled by pulsed voltage that cannot be measured. If the louver does not move when it should, check for a bind in the louvers. If the louver is free to move, refer to the Test Procedure Section.



Louver motor

The Piping Temperature Sensor senses indoor coil temperature in the cooling mode and in the heating mode. This sensor is used for Anti Freezing and Anti Cold Blow cycles. The sensor also provides critical temperature information to the ECU that may be used in frequency adjustments. See Temperature Sensor Functions.

The Ambient Temperature Sensor senses room temperature. This sensor provides room temperature information to the ECU for calculation of inverter capacity and temperature control.



Both sensors are negative temperature coefficient type that reduce electrical resistance as temperature rises.

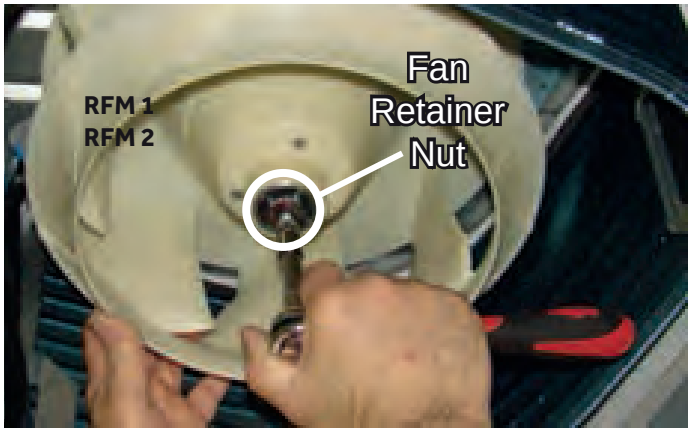
Cassette Unit Components

Accessing the blower motor and condensate pump

A1. Disconnect power to the outdoor unit.
A2. Remove the louver assembly.
A3. Disconnect the main power wire to the indoor unit.
A4. Unplug the condensate pump and float switch from wiring harness.
A5. Unplug fan motor from wiring harness.
A6. Remove ground wire from ground screw on electrical box.
A7. Remove 5 screws holding foam condensate pan bottom in place.
A8. Slide condensate pan from cassette.

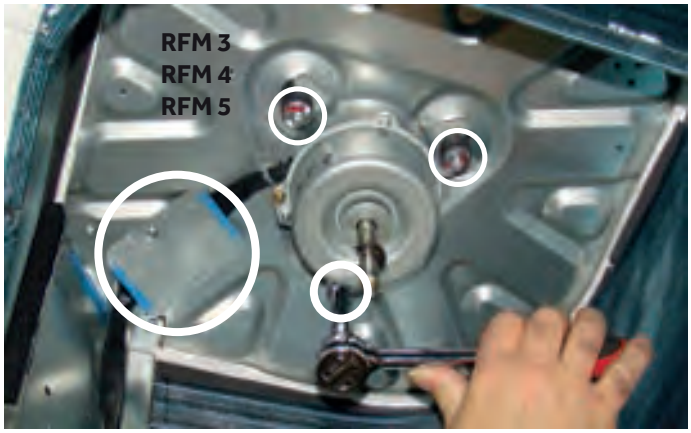
Removing Fan Motor

RFM1. Remove holding nut from fan blade.
RFM2. Fan blade will slide off motor shaft.
RFM3. Remove Phillips head screw holding cover plate over motor wiring leads.
RFM4. Remove 3 nuts that hold fan motor in place.
RFM5. Fan motor will come loose.

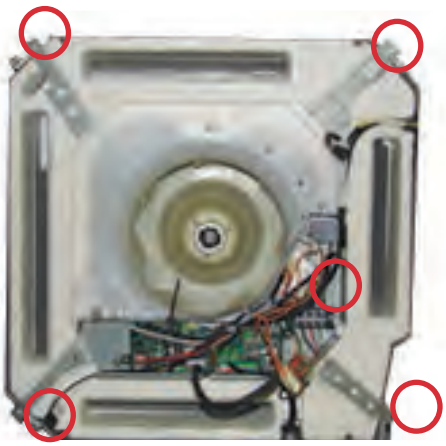


Removing Condensate Pump

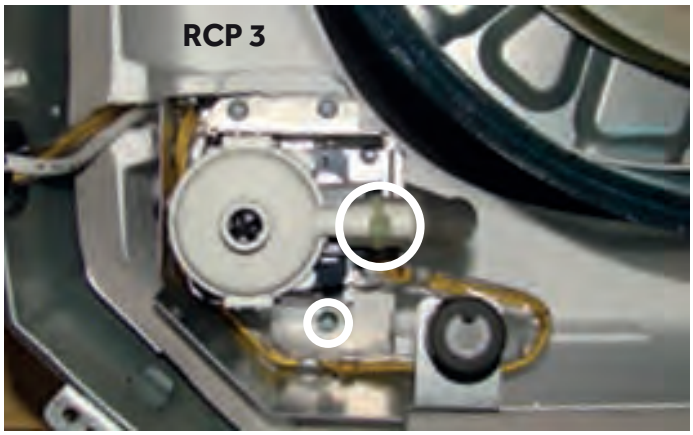
RCP1. Remove screws holding condensate pump and float switch in position.
RCP2. Disconnect condensate hose from condensate pump.
RCP3. Remove assembly.



Louver Assembly



A7. Image shows screw locations



Cassette Unit Testing Procedures: Accessing Components/Removing Cover

Indoor Fan Motor Test Procedure

If the indoor fan motor does not run.

1. Disconnect power to the system.
2. Remove the return air cover and access the circuit board connection CN-11.
3. Reset power and turn the remote control fan command to Fan On mode.

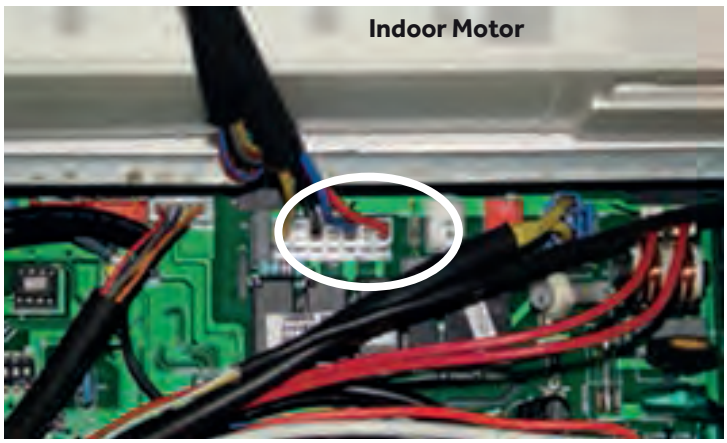
Motor Test

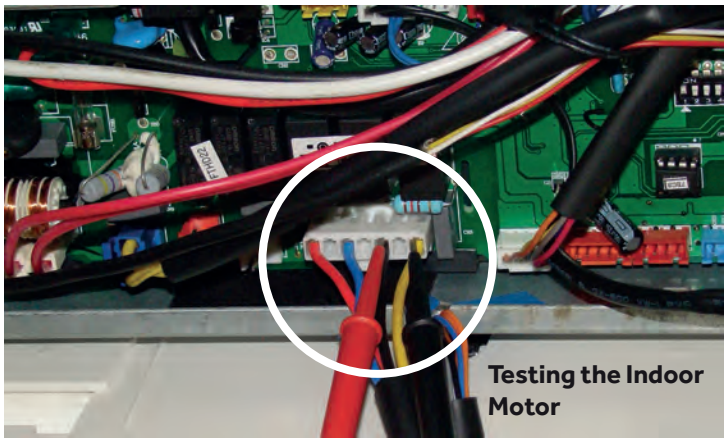
1. If the motor doesn't run, check for voltage on the CN-11 between the Plug N Pin to all 3 speed pins. There should be around 230 volts on each motor lead. If voltage is not present, the indoor board is bad. If voltage is present between Pin N to any lead, the motor's internal overload is open. Wait until the motor cools and test the run capacitor.

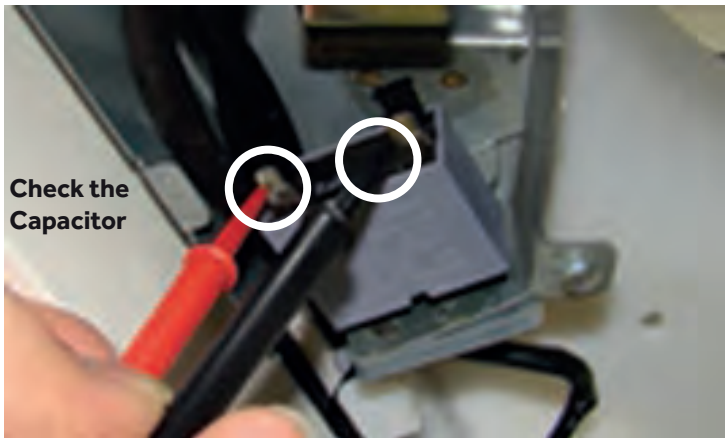
2. Shut the power off to the outdoor unit. Unplug the indoor motor run capacitor.

3. Use an ohmmeter to charge and discharge the capacitor. If the capacitor charges and discharges with the ohmmeter, the capacitor is good. If the capacitor does not charge, the capacitor is bad. Replace the capacitor.

If the run capacitor is good, and there is voltage between Pin N and all motor leads, yet the motor doesn't run, replace the motor.







Cassette Unit Sensor Testing Procedures

Testing Temperature Sensors

The easiest problems to solve will involve codes that are related to potential failure of temperature sensors. Common problems may include loose connections, open electrically, and out of calibration. Checking the condition of the sensors requires a temperature probe and an ohmmeter.

The Reference Section of this manual contains temperature resistance tables that can be used to check the calibration of the sensors. The measured resistance must be within the tolerances printed on the top of the tables.

Testing Procedure

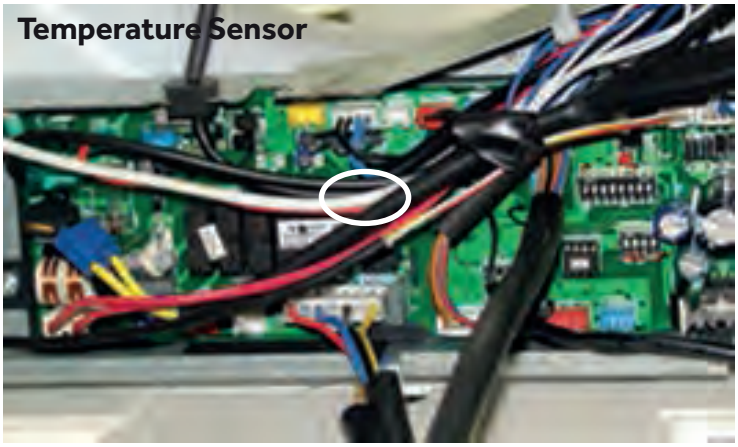
To test the electrical condition of a temperature sensor perform the following:

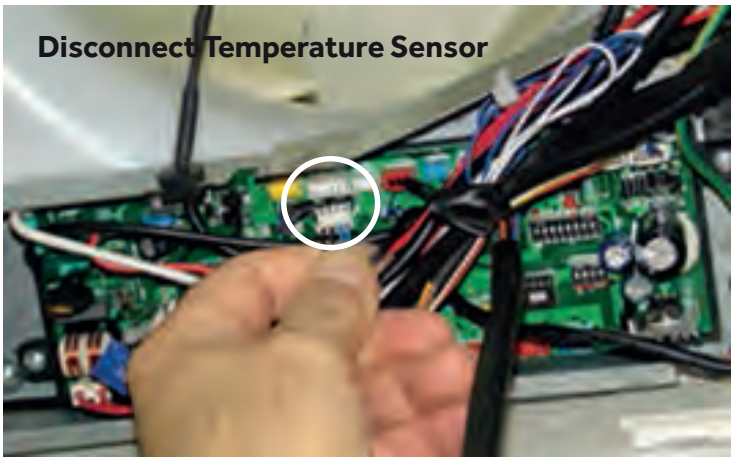
1. Confirm the sensor is firmly attached to the circuit board connection plug.

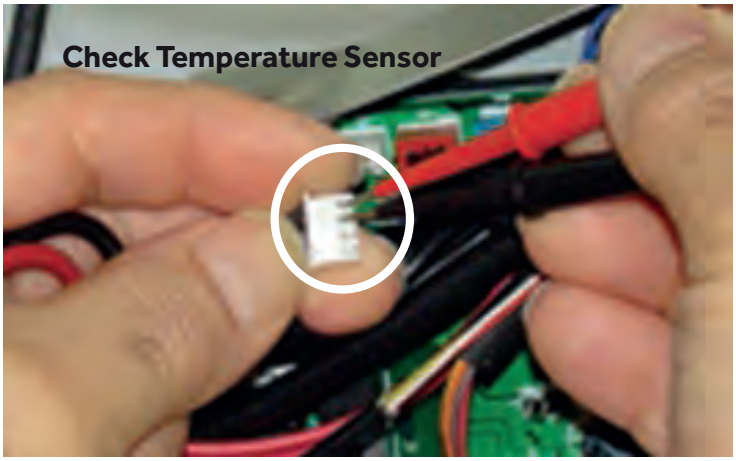
2. Remove the sensor wires form the connection plug by releasing holding tension on the plugs tension tab.

3. Use an ohmmeter to test the electrical resistance of the sensor.

4. Measure the air temperature near the sensor and compare the required resistance against measured resistance. (See chart in reference section) If the sensor is within calibration, the sensor is good. If the sensor is out of calibration, replace the sensor. (Tube Sensors should be removed from socket and exposed to air temperature during test.)







Cassette Unit Testing Procedures: Louver Motor

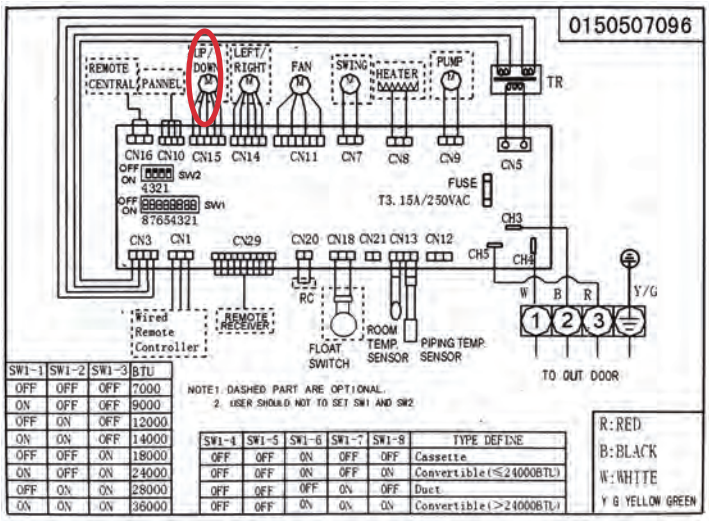
Testing Louver Motors

If the louver does not operate with command from the remote control, either the indoor board is bad, or the louver motor is defective. It is more likely the motor is defective than the board. (Make sure the louver assembly is not binding and keeping the vanes from moving.)

1. Remove power from the unit and remove the indoor unit cover.

2. Access the circuit board.

3. Identify the inoperable louver motor on the schematic drawing below and disconnect the plug from the circuit board.



SW1-1	SW1-2	SW1-3	BTU
OFF	OFF	OFF	7000
ON	OFF	OFF	9000
OFF	ON	OFF	12000
ON	ON	OFF	14000
OFF	OFF	ON	18000
ON	OFF	ON	24000
OFF	ON	ON	28000
ON	ON	ON	36000

SW1-4	SW1-5	SW1-6	SW1-7	SW1-8	TYPE DEFINE
OFF	OFF	ON	OFF	OFF	Cassette
OFF	OFF	ON	OFF	ON	Convertible(≤24000BTU)
OFF	OFF	OFF	ON	OFF	Duct
OFF	OFF	ON	ON	ON	Convertible(>24000BTU)

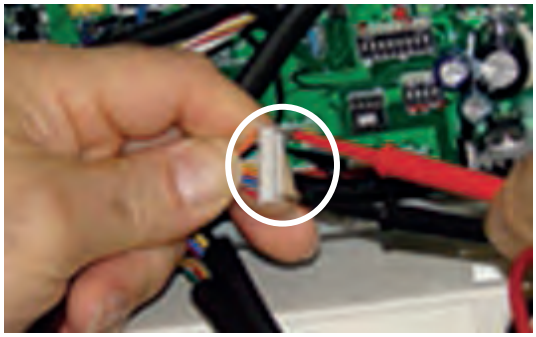
4. Use an Ohmmeter to test the electrical continuity of the louver motor windings. The proper resistance for each winding can be found in this table. If the motor winding resistance is erratic or shows open, the motor is defective. Replace the motor.

5. If the motor checks out good, replace the indoor control board.

Take electric box cover off

Front Panel Connector

Check Louver motor connector



Cassette Unit Testing Procedures: Communication Circuit, Condensate Pump & Float Switch

Testing Communication Circuit

If an Error E7 occurs, perform the following test to determine if the indoor control board is functioning properly to send data to the outdoor unit.

Perform this test with the unit powered and all wiring connected between indoor and outdoor unit.

Make sure all wiring between the indoor and outdoor unit are correct. There should no splices between the indoor and outdoor unit wiring connecting terminals 1 or 3. Make sure wiring is correct, before performing this test.

Check E7

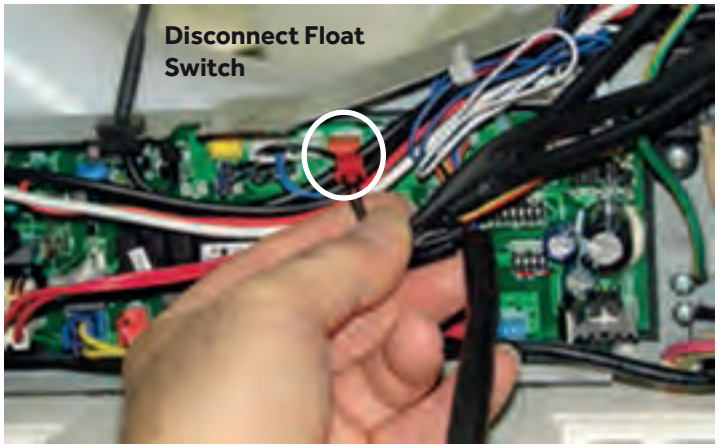
1. Measure the DC voltage between terminals 1 and 3 on the indoor terminal block.
2. The voltage should fluctuate between 8VDC and 23VDC. The fluctuating signal indicates a good communication path.
3. If the voltage does not fluctuate, and the wiring is good, the indoor board is defective.

Test Condensate Pump and Associated Float Switch

If the internal condensate pump does not operate, the pump may be bad or the float switch may be defective. Perform the following test:

Float Switch and Condensate Pump

1. Access the electrical control box.
2. Unplug the float switch from the circuit board. Plug CN-18.
3. The pump should start.
4. If the pump does not start, check for voltage to the pump at connector CN-9. There should be 230 Volts AC to the pump. If there is not, the circuit board is defective. If there is proper voltage to the pump, either the pump or associated pump wiring is defective.



Connection method for one wired controller with multiple Cassette

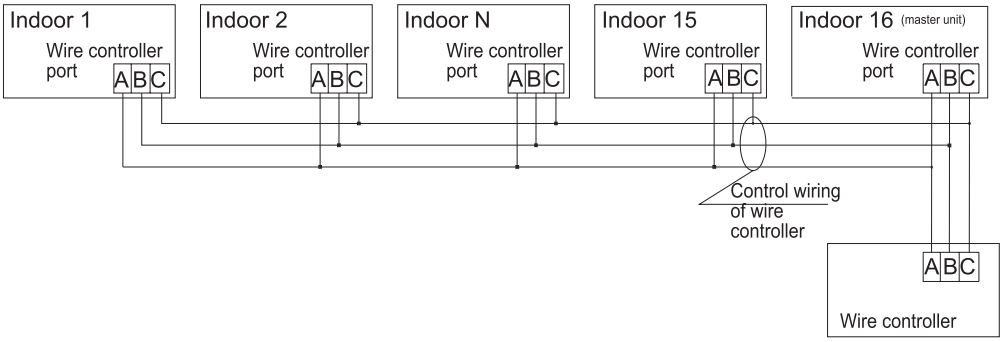
Alert! Ensure do any of the operating during power off

For wired controller connect with cassette (ABSC2VH*)**

Step 1:

The wiring connection between ①wired controller - the master unit (directly connected to the wired controller), ②master unit - slave unit, ③slave unit-slave unit should be one to one match of all three lines.

The connection wiring is as following, and max. Quantity of the connected indoor units is 16.



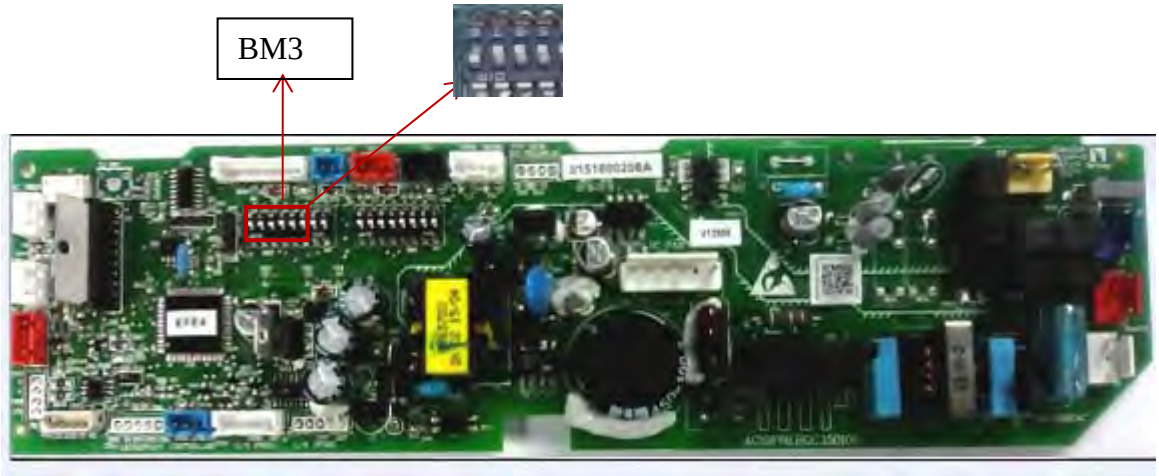
Note:

1) Shielded lays of the communication line should be connected as a daisy chain from the first master unit to the last slave unit.

2)The shielding lay of the communication line must be grounded at the end of the last slave unit.

Step 2

Setting the dip switch BM3, and the indoor unit should be set according to the following table:



Connection method for one wired controller with multiple Cassette

Wired controller address	BM3-8	BM3-7	BM3-6	BM3-5
Master indoor unit	0	0	0	0
Slave unit 1	0	0	0	1
Slave unit 2	0	0	1	0
Slave unit 3	0	0	1	1
Slave unit 4	0	1	0	0
Slave unit 5	0	1	0	1
Slave unit 6	0	1	1	0
Slave unit 7	0	1	1	1
Slave unit 8	1	0	0	0
Slave unit 9	1	0	0	1
Slave unit 10	1	0	1	0
Slave unit 11	1	0	1	1
Slave unit 12	1	1	0	0
Slave unit 13	1	1	0	1
Slave unit 14	1	1	1	0
Slave unit 15	1	1	1	1

Note: The above step 1, step 2, and step 3 must be operated in power off status.

Slim Duct Unit Technical Overview

Slim Duct

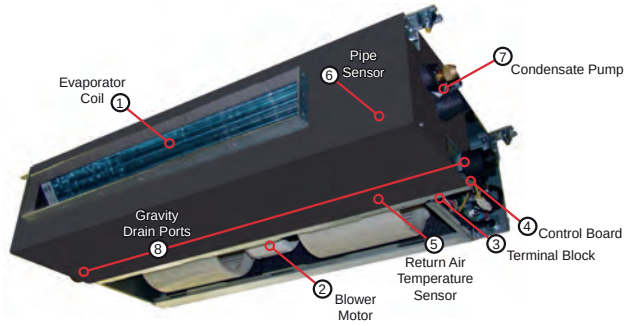
The Slim Duct Indoor Unit will act as evaporator coils during cooling mode and condenser coils during heating mode. This unit can operate with a motorized supply air louver or it can have a LIMITED amount of ducting added to the unit's return and supply air duct connection flanges. The return air ducting can be connected to the end of the cabinet or the bottom blank off plate can be removed for bottom return configuration.

DIP Switches on the unit's circuit board configure the fan power to match the ducting configuration.

The Slim Duct cabinet is insulated so that it can be installed in unconditioned air. The unit is well suited for mounting in soffits, attics, and garages.

These units have a built in condensate pump with an associated condensate level switch. The condensate pump is capable of lifting water out of the indoor unit. If high water lift is needed, the water from the cassette pump should be pumped into a field supplied condensate pump with high lift power.

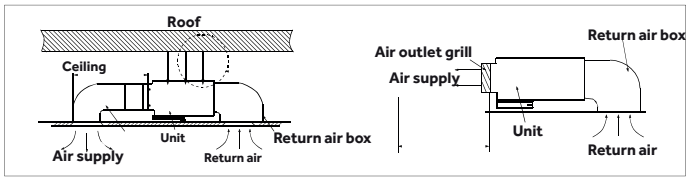
Slim Duct units are controlled by a wired controller only.



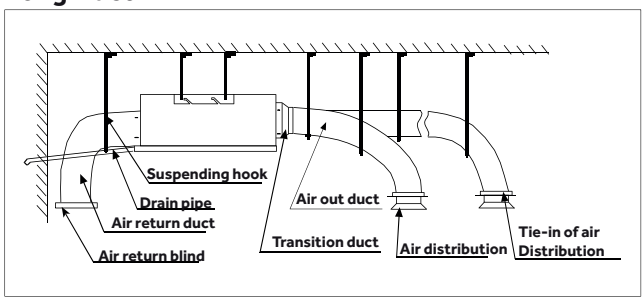
1 Evaporator Coil
2 Blower Motor
3 Terminal Block
4 Control Board
5 Return Air Temperature Sensor
6 Pipe Sensor
7 Condensate Pump
8 Gravity Drain Ports

Duct work Installation

Roof Installation

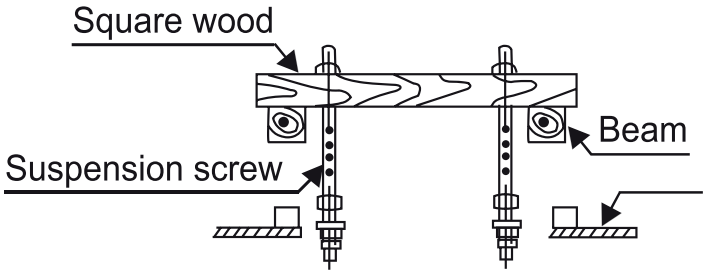


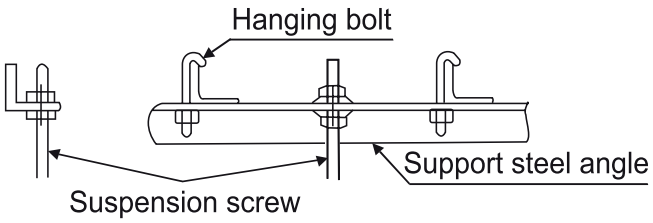
Long Duct



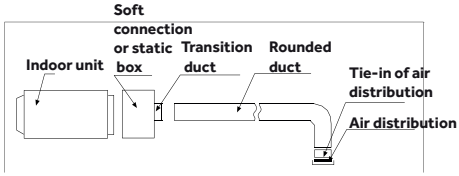
Basic Duct Configurations

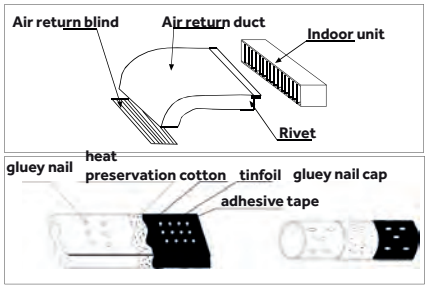
Here are the typical duct configurations that can be used with the unit.





Use rivet to connect the air return duct on the air return inlet of the indoor unit, then connect the other end with the air return





SLIM DUCT OVERVIEW

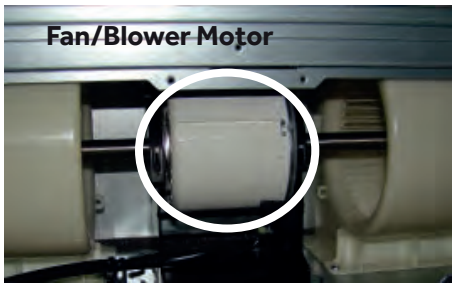
Slim Duct Components

Layout of Components

The layout of the system is very straightforward and components are easily accessed should service be required.

- The circuit board is located under the electrical control box cover.
- The blower motor and blower assemblies and room air temperature sensor are accessed at the rear of the unit.
- The evaporator coil and piping temperature sensor are located under the top cover.
- The condensate pump and float switch are accessed under the removable panel next to the electrical control box.

Power to operate the indoor unit comes from the electrical line voltage terminal block at the outdoor unit. The wiring includes 4 wires, 1, 2, 3 and ground. Wires 1 and 3 complete the data path. These wires should always be 14 gauge AWG Stranded type wire. Splices in wires 1 or 3 may cause communication errors.

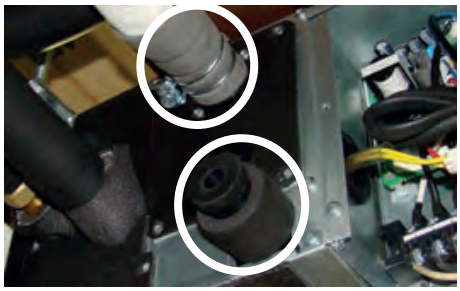


The indoor unit features a multi speed blower motor that will change speed to match the capacity demand from the outdoor unit. The motor is a dual shaft type that powers two individual blower assemblies.

Separate motors located in the accessory supply air louver control the operation of the motorized louvers. All of the louver motors are controlled via commands received from the remote control. The blower motor is controlled by both the remote control and by commands from the outdoor unit ECU. Refer to the Remote Control Information in the Reference section for louver control/remote procedures.

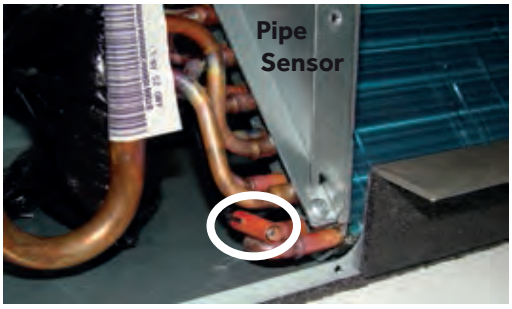
Unlike typical air handlers found in the US market, these units have metering devices located in the outdoor unit. The metering devices are EEV type that are controlled by the outdoor unit ECU.

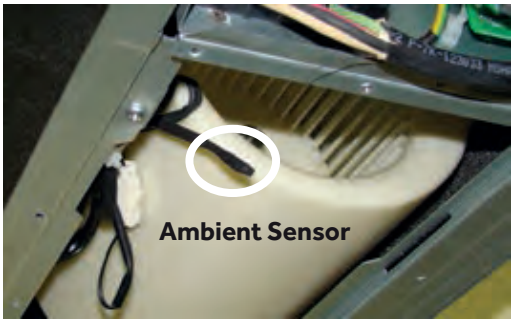
Drain Ports



The indoor unit has the option for either gravity drain systems or the use of an internal condensate pump with float switch. The pump is capable of minimal lift. If high lift is required, the water from the Slim Duct unit should be pumped to a field supplied condensate pump that is capable of high lift.

Temperature sensors located within the slim duct unit include a pipe temperature sensor and a return air temperature sensor. The pipe temperature sensor is used to sense the temperature of the indoor coil in both cooling and heating modes. The return air sensor sense the temperature of the air being drawn into the wall mounted unit from the conditioned space.





The wired controller can be configured to sense room air temperature. The operating functions of these sensors is explained in the Temperature Sensor Function section of this manual.

All operating status and information is displayed on the wired controller. The Slim Duct unit does not have a display.

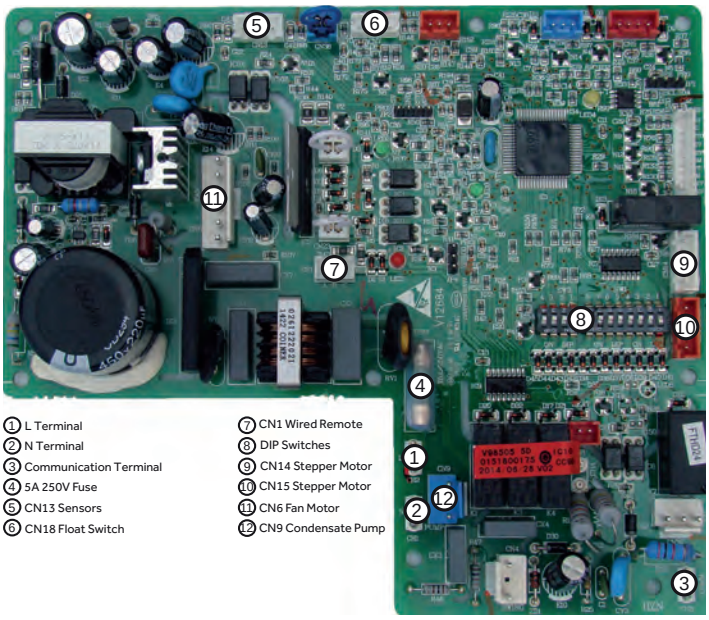
There is no option for use with remote control.

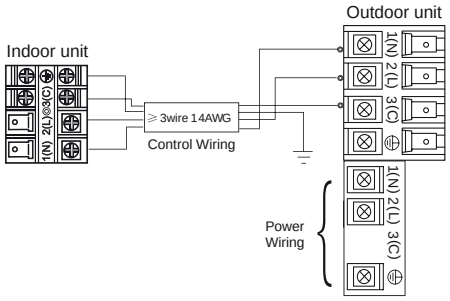
When servicing a diagnostic error, ALWAYS refer to the outdoor unit code to make diagnostic decisions.

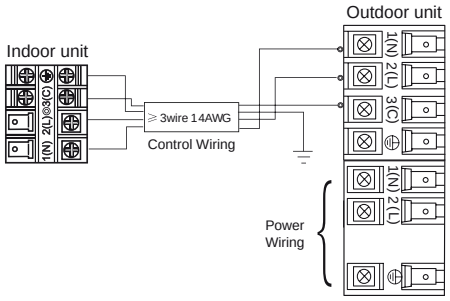
Slim Duct Components

Indoor Unit Circuit Board

The indoor unit circuit board controls the switching functions of the indoor unit. All control decisions are made by the outdoor unit ECU. The indoor board has some limited diagnostic capability which will be covered in this manual.







The Indoor Unit Circuit Board communicates with the outdoor unit ECU via a connection at Terminal Block screw 3. The data pulse that sends the communication information can be measured with a voltmeter placed to DCV range. From the ground connection at the Terminal Block to the Number 3 screw connection, the voltage should pulse up and down when data is being transmitted.

This control board has control over the fan louver movement, manual fan blower control, indoor coil temperature and indoor air temperature sensing functions. All operational decisions are controlled by the OUTDOOR UNIT ECU.

The connections on the indoor board are shown here in the schematic drawing. Line voltage to power the indoor unit comes in on Terminal Block connections 1 and 2. Power connects from these terminal connections to CH- 1 and CH-2 on the circuit board. If the board does not respond to commands and has no display, check for line voltage at these connections. When power is present at the indoor board, the wired controller will be energized.

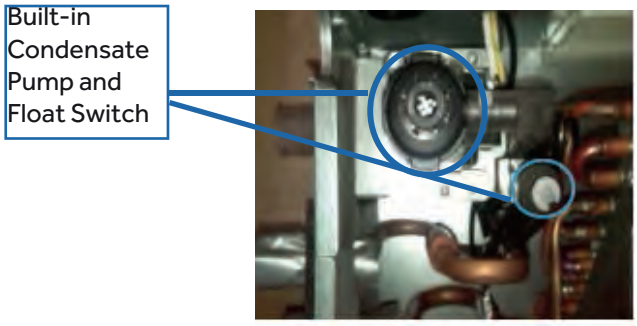
The control board has a replaceable 5A 250V fuse that protects against excessive current. If power is present at the board but the board does not work, check for continuity through the fuse. Replace if the fuse is open.

The indoor unit temperature sensors are connected at Plug CN-13. When testing the calibration of these sensors, the wires can be released from the plug by pressing on the tension tab on the side of the plug.

There 3 motors that control the directional movement of the accessory louver. The motor connects to the circuit board at Plug CN-14, CN-15 and CN-16. The motors are located in the louver assembly.

The blower motor is connected to the circuit board at plug CN-6.

The Slim Duct unit has a built in condensate pump. The pump is connected to the circuit board on Plug CN-9. The pump is energized whenever the Float Switch indicates that water needs to be pumped from the cassette. The float switch connects onto the circuit board via Plug CN-18.

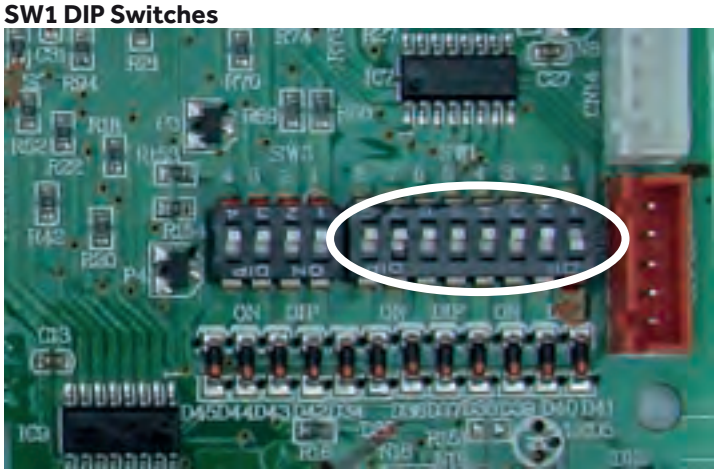


The float switch and pump are located behind the removable insulated cover next to the electrical control box. The pump is hermetically sealed and requires no maintenance. The float switch is a normally closed switch, that opens as water rises. The float switch requires no maintenance.

The connection for the wired controller is made via Plug CN1

Slim Duct Components

SW1 DIP Switches

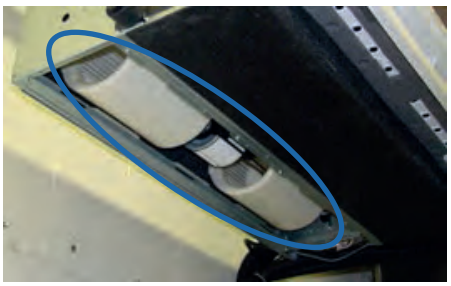


There are two sets of DIP switches on the Circuit Board. SW3 is for factory use only. SW1 is used to set the configuration of the indoor unit operation. The first three switches SW1-1, SW1-2 and SW1-3 select the indoor unit capacity.

Air Delivery Power is set with DIP Switches SW1-4 and SW1-5. The settings are shown in Hydrostatic Selection of 0Pa, up to 30Pa. SW1-7 and SW1-8 define the unit type. The conversions are as follows:
0Pa=0"w.c.
10Pa= .04"w.c.
20Pa=.08"w.c.
30Pa=.12"w.c.

- Recommended settings are for motorized Louver set to 10Pa.
- Ducting limited to a total of .12"w.c. External Static set to 30Pa.

The Blower Assembly



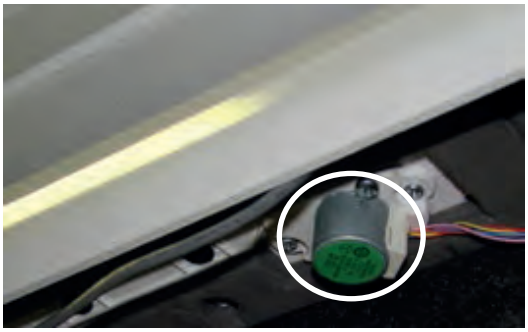
The blower assembly consists of 2 plastic blowers. The blower motor is a DC variable speed dual shaft type. A set screw holds each blower wheel to the blower motor.

The indoor blower motor is a Multi Speed Fan Motor that is connected to the indoor unit control board via Plug CN-6. The wiring from the motor to indoor board consists of 5 wires connected to pins that deliver line voltage, speed, and feedback information.

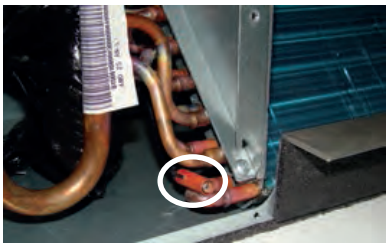
During normal operation, the indoor control board will energize the indoor blower motor and request proper speed. Fan power should be set using the DIP Switches SW1 settings.

Accessory Louver Motors

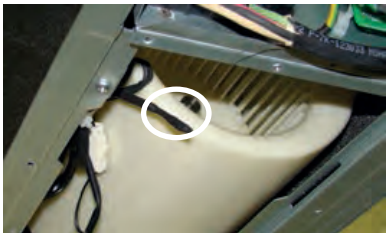
The louver motors are stepper type motors that move the louvers up/down. The motors are controlled by pulsed voltage that cannot be measured. If the louver does not move when it should, check for a bind in the louvers. If the louver is free to move, refer to the Test Procedure Section.



Temperature Sensors



The Piping Temperature Sensor senses indoor coil temperature in the cooling mode and in the heating mode. This sensor is used for Anti Freezing and Anti Cold Blow cycles. The sensor also provides critical temperature information to the ECU that may be used in frequency adjustments. See Temperature Sensor Functions.



The Ambient Temperature Sensor senses room temperature. This sensor provides room temperature information to the ECU for calculation of inverter capacity and temperature control.

Both sensors are negative temperature coefficient type that reduce electrical resistance as temperature rises.

Test Condensate Pump and Associated Float Switch

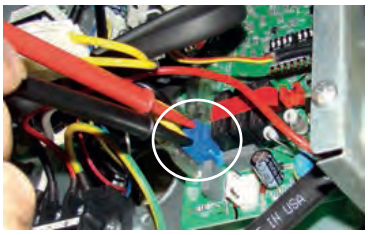
If the internal condensate pump does not operate, the pump may be bad or the float switch may be defective. Perform the following test:

Float Switch and Condensate Pump

1. Access the electrical control box.

2. Unplug the float switch from the circuit board. Plug CN-18.

3. The pump should start.



4. If the pump does not start, check for voltage to the pump at connector CN-9. There should be 230 Volts AC to the pump. If there is not, the circuit board is defective. If there is proper voltage to the pump, either the pump or associated pump wiring is defective.

Testing Temperature Sensors

The easiest problems to solve will involve codes that are related to potential failure of temperature sensors. Common problems may include loose connections, open electrically, and out of calibration. Checking the condition of the sensors requires a temperature probe and an ohmmeter.

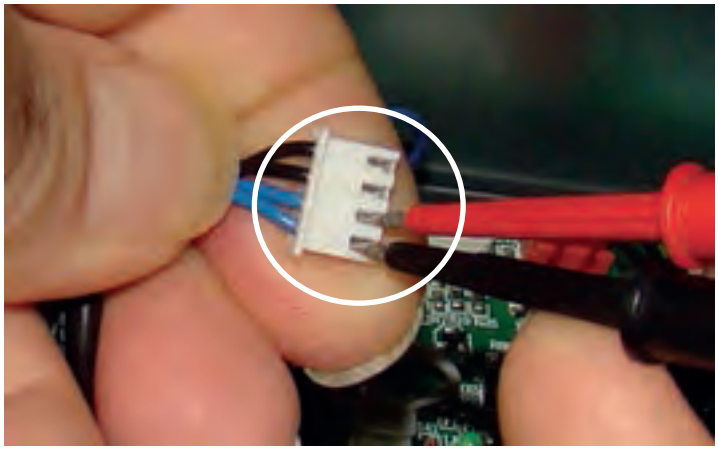
The Reference Section of this manual contains temperature resistance tables that can be used to check the calibration of the sensors. The measured resistance must be within the tolerances printed on the top of the tables.

Testing Temperature Sensors Procedure

To test the electrical condition of a temperature sensor perform the following:

1. Confirm the sensor is firmly attached to the circuit board connection plug.
2. Remove the sensor wires from the connection plug by releasing holding tension on the plugs tension tab.

3. Use an ohmmeter to test the electrical resistance of the sensor.



4. Measure the air temperature near the sensor and compare the required resistance against measured resistance. (refer to charts in reference section) If the sensor is within calibration, the sensor is good. If the sensor is out of calibration, replace the sensor. (Tube Sensors should be removed from socket and exposed to air temperature during test.)

Testing Communication Circuit

If an Error E7 occurs, perform the following test to determine if the indoor control board is functioning properly to send data to the outdoor unit.

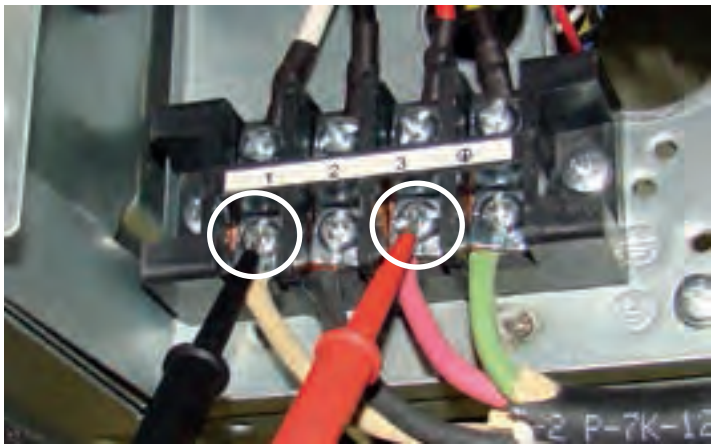
Perform this test with the unit powered and all wiring connected between indoor and outdoor unit.

Make sure all wiring between the indoor and outdoor unit are correct. There should no splices between the indoor and outdoor unit wiring connecting terminals 1 or 3. Make sure wiring is correct, before performing this test.

1. Measure the DC voltage between terminals 1 and 3 on the indoor terminal block.

2. The voltage should fluctuate between 8VDC and 23VDC. The fluctuating signal indicates a good communication path.

3. If the voltage does not fluctuate, and the wiring is good, the indoor board is defective.



Connection method for one wired controller with multiple Slim Duct

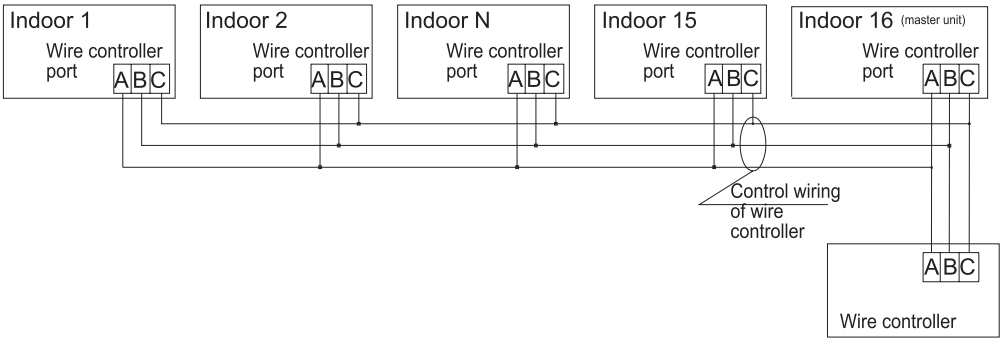
Alert! Ensure do any of the operating during power off.

For wired controller connect with slim duct (ADSL2VH*)**

Step 1:

The wiring connection between ①wired controller - the master unit (directly connected to the wired controller), ②master unit - slave unit, ③slave unit-slave unit should be one to one match of all the three wires.

The connection wiring is as following, and maximum quantity of the connected indoor units is 16.



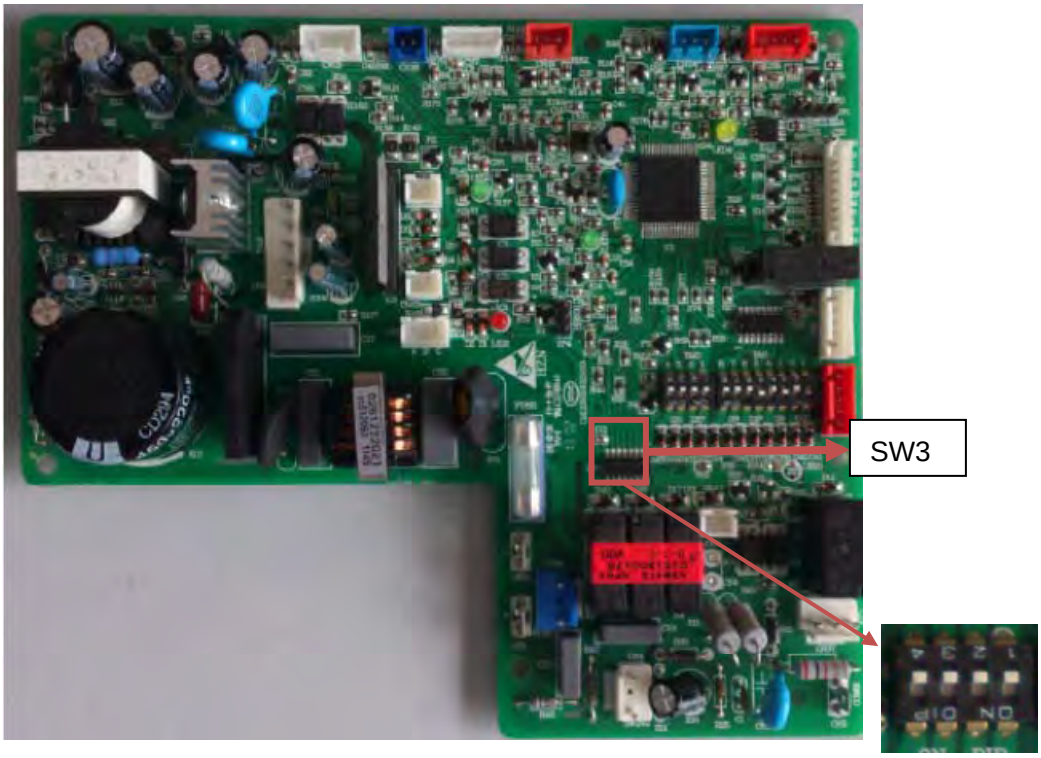
Note:

1) Shielded lays of the communication line should be connected as a daisy chain from the first master unit to the last slave unit.

2) The shielding lay of the communication line must be grounded at the end of the last slave unit.

Step 2

Setting the dip switch SW3, and the indoor unit should be set according to the following table:

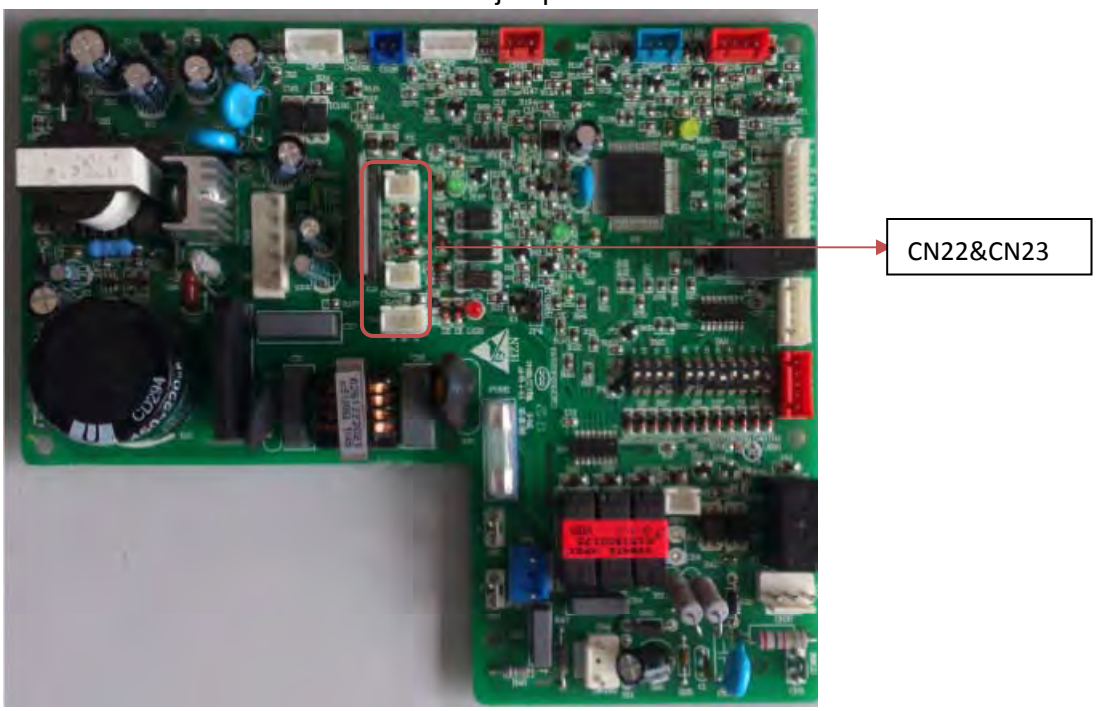


Connection method for one wired controller with multiple Slim Duct

Wired controller address	SW3-4	SW3-3	SW3-2	SW3-1
Master indoor unit	0	0	0	0
Slave unit 1	0	0	0	1
Slave unit 2	0	0	1	0
Slave unit 3	0	0	1	1
Slave unit 4	0	1	0	0
Slave unit 5	0	1	0	1
Slave unit 6	0	1	1	0
Slave unit 7	0	1	1	1
Slave unit 8	1	0	0	0
Slave unit 9	1	0	0	1
Slave unit 10	1	0	1	0
Slave unit 11	1	0	1	1
Slave unit 12	1	1	0	0
Slave unit 13	1	1	0	1
Slave unit 14	1	1	1	0
Slave unit 15	1	1	1	1

for ON,“ 0” stands for OFF.

Step 3: setting the jumper CN22& CN23
The master indoor unit: Remain connected in CN22&CN23 (default)
The slave indoor unit: Remove all the jumpers in CN22&CN23.



Note:The above step 1, step 2, and step 3 must be operated in power off status.

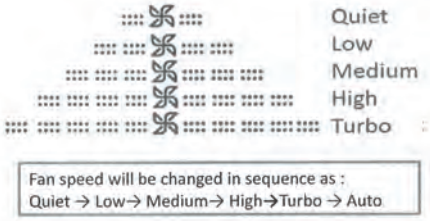
Wired Controller YR-E17

WIRED CONTROL PANEL FUNCTIONS

Features and Interface

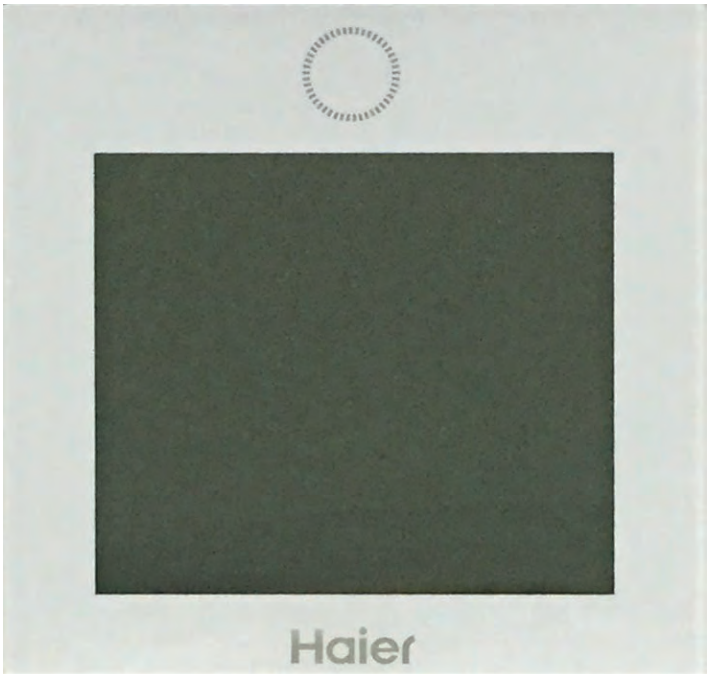
88:88	Clock; Parameter setting/Inquiry; Malfunction display
88:88 ON OFF	Timer ON/OFF; Sleep function; Parameter setting/Inquiry; Malfunction display
ROOM SET 88.8 °C/°F	ROOM/SET temp. and humidity display, each step is 0.5°C (1°F). For example, if the temp is 25°C (77°F), it will display 25.°C (77°F). Humidity display function is reserved.
ECO	Energy Saving function. This icon will be displayed only when energy saving function is set.
	Filter Cleaning
	Child Lock
/	Lock/Central
	Motion Sensing (Reserved)
	Left/Right Swing. This icon is displayed only when in swing function
	Up/Down Swing. This icon is displayed only when in swing function

	Sleep function. This icon is displayed when setting the sleep function. Remaining sleeping time is displayed in the top right corner.
	Heat Reclaim Ventilation. This icon is displayed when setting the heat reclaim ventilation.
	Electrical Heating. This icon is displayed when electrical heating is set on DC wired control.
	Intelligent Mode--automatic cycling.
	Cooling Mode
	Heating Mode
	Fan Mode
	Dry Mode



User Friendly: Back light; Room temperature display

Functions: Clock; Timer; Sleep Function; Heat Reclaim Ventilation; ECO; Filter Cleaning; Error Code display; Child Lock; Parameter Inquiry; Unit NO. Setting; Static Pressure Grade Inquiry; Temp. Compensation setting; Forced Cooling/Heating



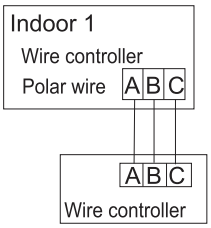
WIRED CONTROLLER INSTALLATION

Wired Controller Wiring Instructions

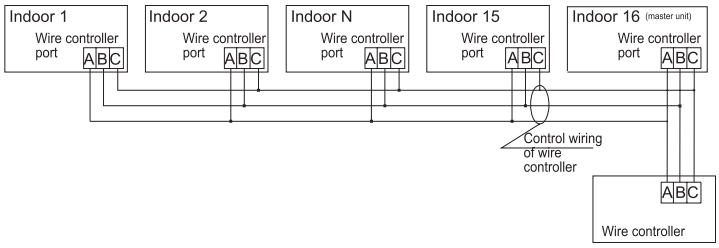
Step By Step Guide To Installation

There are three methods connect the wired controller to the indoor units.

A. One wired controller controls one indoor unit; the indoor unit connects with the wired controller through a 3 conductor shielded cable



B. One wired controller can control up to 16 sets of indoor units (max); A 3 conductor shielded cable must connect the wired controller and the master unit (the indoor unit connected to the wire controller directly). The others connect to the master unit also through a 3 conductor shielded cable.

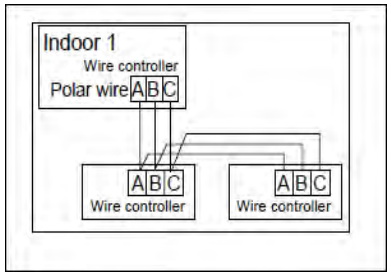


Note: The wiring method is used for the below unit

Cassette	AB09/12/18SC2VHA
Slim duct	AD07/09/12/18SL2VH*
High wall	AW07/09/12/18LC2VHB AW09/12/18/24ES2VHB AW09/12/18EH2VHA AW09/12TE1VHA AW18/24TE2VHA

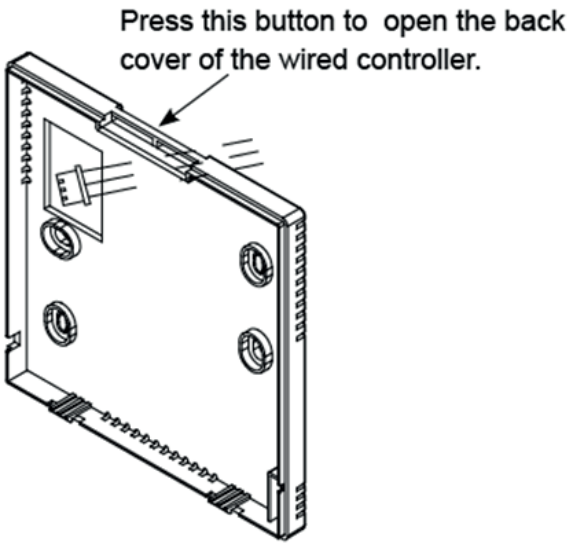
Notice:
For wired controller connection with cassette and slim duct indoor unit,please do follow the corresponding indoor unit installation manual's instruction while WK-B kit installation manual for high wall indoor unit.

C. Two wired controllers control one indoor unit. The wired controller that connects with the indoor unit is called the master controller, the other is called the slave controller. The master wired controller and the indoor unit (as well as the master controller and the slave controller) are all connected through 3 conductor shielded cables.



Communication Wiring

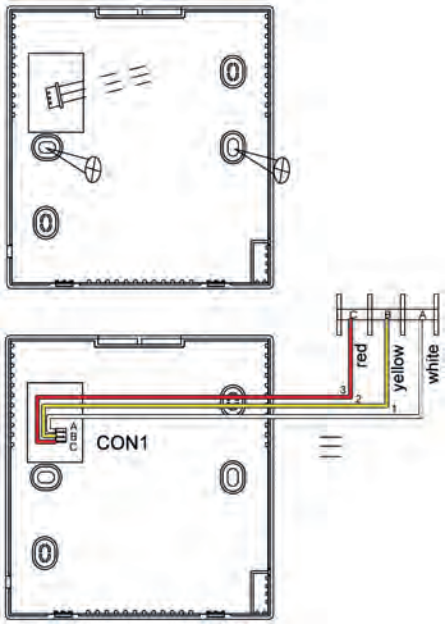
Communication Wiring length	Dimension of Wiring
0~100 ft (0~30m)	22AWG(0.3mm^2)x3-core shielded wire
100~200 ft (30~60m)	20AWG(0.5mm^2)x3-core shielded wire
200~300 ft (0~90m)	18AWG(0.75mm^2)x3-core shielded wire
300-400 ft (90~120m)	16AWG(1.25mm^2)x3-coreshielded wire



. Put communication wire through the hole in the back cover as shown

Mount the back cover in the desired location, making sure not to pinch the communication wire. Then connect the communication wire to CON1 port of the wired controller.

Replac

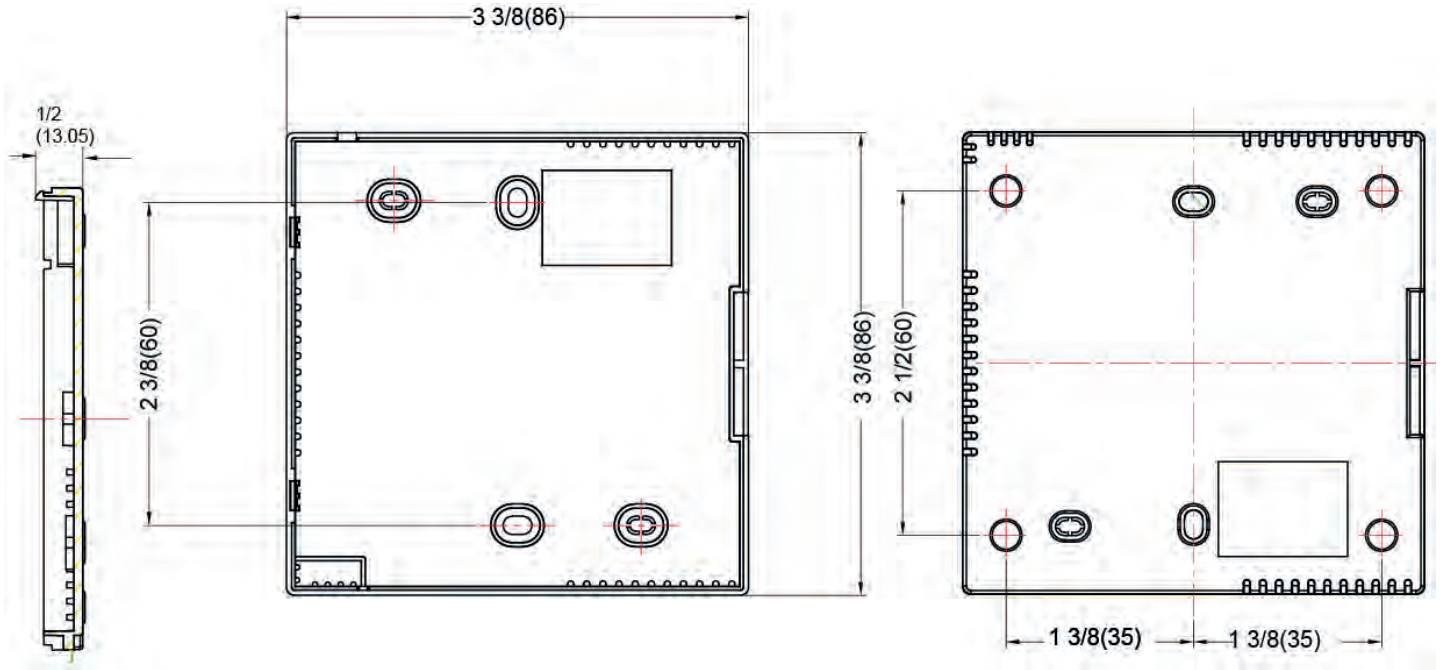


WIRED CONTROLLER INSTALLATION

Wired Controller Wiring Instructions

Dimensions

Unit: inch (mm)



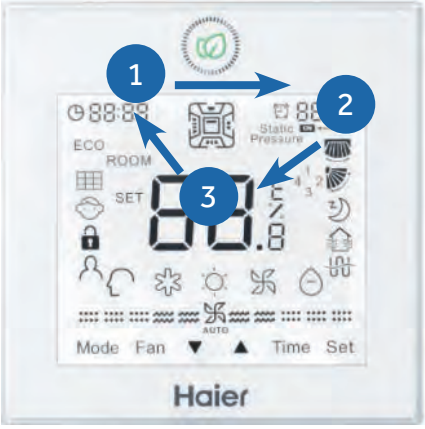
Dip Switch

Dip Switch	ON/OFF	Function	Default Setting
SW1-1	ON	Set as the slave controller	OFF
	OFF	Set as the master controller	
SW1-2	ON	Ambient temp. display available	OFF
	OFF	Ambient temp. display unavailable	
SW1-3	ON	Display ambient temp. from PCB of indoor	OFF
	OFF	Display ambient Temp. from wired controller	
SW1-4	ON	Auto-restart invalid	OFF
	OFF	Auto-restart valid	
SW1-5	ON	Fahrenheit	OFF
	OFF	Celsius	
SW1-6	ON	Swing angle adjustment available	OFF
	OFF	Swing angle adjustment unavailable	
SW1-7	ON	Up/Down and Left/Right swing	OFF
	OFF	Up/Down swing	
SW1-8	ON	Fresh Air unit	OFF
	OFF	General unit	

WIRED CONTROLLER OPERATION

Settings & Functions

Initialization



The wired controller will momentarily display all display icons upon powering up or when resetting the system.

During the initialization process, the controller will display, in a repeating order: 88:88 (upper left corner), 88:88 (upper right corner) 88.8 (main temperature). This cycle keeps repeating until initialization is complete. The green ON/OFF LED will also flash continuously until initialization is complete.

If the wired controller is unable to communicate with the indoor unit PCB after powering on, initialization will terminate in 4 minutes. The communication malfunction can be checked using the malfunction inquiry function. (See Malfunction Display)

Mode Setting

NOTE: This function requires the ON/OFF key LED to be turned OFF and the screen backlight to be illuminated.
Press and hold the MODE key for 5 seconds, the number of the mode currently being used will display in the upper left corner of the screen. (Default is 0) Press the ▲▼ keys to change to one the different modes available: 0, 1, 2, or 3. Press SET to confirm the setting.

NOTE: Corresponding modes
0 – [Intelligent] [Cooling] [Heating] [Fan] [Dry]
1 – [Cooling] [Heating] [Fan] [Dry]
2 – [Cooling] [Fan] [Dry]
3 – [Cooling] [Heating] [Fan] [Dry] (same as 1)

Error Code Display

Note: This function requires the ON/OFF key LED to be turned OFF and the screen backlight to be illuminated.
Press and hold the TIME key for 10 seconds. The unit number will display in the upper left corner of the screen. The error code/historical error code will display in the upper right corner of the screen. Press ▲▼ keys to select the unit number to view its error codes. Under Error Code display screen, press and hold the TIME key for 5 seconds to clear the fault codes of all the units.

Press the MODE, FAN, TIME, SET, or ON/OFF key to exit the function. If no key is pressed in 10 seconds, the function will also exit. If there are no current errors or historical error codes, "--" will be displayed.

Switching between Fahrenheit & Celsius

To switch from Celsius to Fahrenheit, select the mode you wish to operate (COOL, HEAT, DRY, INTELLIGENT/AUTO). Press and hold the ▲ key to reach 30 °C then continue holding the ▲ key for 15 seconds until the display reads 86 °F. Use the ▲▼ keys to adjust to desired temperature.

To switch from Fahrenheit to Celsius, select the mode you wish to operate (COOL, HEAT, DRY, INTELLIGENT/AUTO). Press and hold the ▼ key to reach 60 °F then continue holding the ▼ key for 15 seconds until the display reads 16 °C. Use the ▲▼ keys to adjust to desired temperature.

Clock Function

1. The clock is displayed in 24 Hour time
A. It cannot be set for AM/PM.
B. The clock function cannot be set when SLEEP function or a timer function is currently set.

When the system is first powered up, after initialization, the clock will default to 12:00. Within 10 seconds of the clock being displayed, the time can be set. The clock icon and minutes portion of the time display will be flashing. Press the ▲▼ keys to adjust the minutes. (Pressing and holding the ▲▼ keys will accelerate the time adjustment.) With the minutes set, press the TIME key. The clock icon and hours portion of the time display will now begin flashing. Press the ▲▼ keys to adjust the hours. Press the SET key to confirm the setting.

To set the clock after initial power up or reset time has expired, press and hold the TIME key for 5 seconds. The clock icon and minutes portion of the time display will begin flashing. Press the ▲▼ keys to adjust the minutes. With the minutes set, press the TIME key. The clock icon and hours portion of the time display will now begin flashing. Press the ▲▼ keys to adjust the hours. Press the SET key to confirm the setting. If neither ▲▼ key is pressed within 10 seconds, or if the MODE, FAN, or ON/OFF keys are pressed prior to pressing the SET key, the setting function is canceled and the time reverts back to the previous setting.

Screen Saving

With the system turned off, tap the TIME key to activate the screen backlight (if not already lit).
1. Press and hold the TIME and ▼ keys for 5 seconds to set the backlight "on" time. The set time will be displayed in the upper right corner of the screen.
2. Press the ▲▼ keys to adjust the time. Set times available are: 0 seconds (backlight always on), 15 seconds, 30 seconds, and 60 seconds. Initial default time is 15 seconds.
3. With time selection made, press the SET key to confirm the setting.

If neither ▲▼ key is pressed within 10 seconds, or if the MODE, FAN, or ON/OFF keys are pressed prior to pressing the SET key, the setting function is canceled and reverts back to the previous setting.

Settings & Functions

ECO Energy Saving Function

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

ECO

Press the SET key. The swing louver function icon will be displayed. Press the ▲▼ keys to advance through the functions to select ECO function. (The icon will be flashing) Press the SET key to confirm the setting. The ECO icon will remain on.

To cancel ECO function, repeat the above steps.

NOTE: The energy saving default parameters are listed below:
74°F Lowest temperature limit of Cooling and Dry mode.
78°F Highest temperature limit of Heating mode.
74°F – 86°F Temperature adjustment range in Cooling and Dry mode.
60°F – 78°F Temperature adjustment range in Heating mode.

ECO Parameter Setting

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

For Cooling
Under Cooling mode, set the temperature to 86°F. Press and hold the FAN key for 5 seconds. The Cooling ECO parameter (flashing) will be displayed in the upper left corner of the screen. Default temperature is 74°F. Press the ▲▼ keys to adjust the lowest target cooling temperature. Press the SET key to confirm the setting and exit setup.

For Heating
Under Heating mode, set the temperature to 60°F. Press and hold the FAN key for 5 seconds. The Heating ECO parameter (flashing) will be displayed in the upper right corner of the screen. Default temperature is 78°F. Press the ▲▼ keys to adjust the highest target heating temperature. Press the SET key to confirm the setting and exit setup.

Static Pressure Grade Inquiry & Adjustment

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

Press and hold the SET and FAN keys for 5 seconds. The current static pressure will be displayed in the upper right corner of the screen and the "Static Pressure" icon will begin to flash.

Press the TIME key to shift the unit no. displayed in the upper left corner of the screen. The unit numbers are from 00-15. Press the ▲▼ keys to change the static pressure grade, shown in the upper right corner of the screen.
Number range is 01-04. Press the SET key to confirm the setting. Press the MODE, FAN, or ON/OFF key to exit the function. If no key is pressed in 10 seconds, the function will also exit.

Timer Function Setting

NOTE: The display backlight must be illuminated before proceeding. To turn the backlight on, press any key (MODE, FAN, ▲▼, TIME, or SET) located at the bottom of the display, or press the ON/OFF key located at the top of the display.

Timer ON
Press the TIMER key once, the ON timer icon will appear in the upper right corner of the screen. The ON icon and hour position are flashing. Press the ▲▼ keys to set the hour. Press the TIMER key again, the ON icon and minutes position are now flashing. Press the ▲▼ keys to set the minutes. Press the SET key to confirm the setting.

Timer OFF
Press the TIMER key 3 times, the OFF timer icon will appear in the upper right corner of the screen. The OFF icon and hour position are flashing. Press the ▲▼ keys to set the hour. Press the TIMER key again, the OFF icon and minutes position are now flashing. Press the ▲▼ keys to set the minutes. Press the SET key to confirm the setting.

Timer ON/OFF
Press the TIMER key 5 times, the ON/OFF timer icon will appear in the upper right corner of the screen. The ON icon and hour position are flashing. Press the ▲▼ keys to set the hour. Press the TIMER key again, the ON icon and minutes position are now flashing. Press the ▲▼ keys to set the minutes. Press the TIMER key again, the OFF icon and hour position are now flashing. Press the ▲▼ keys to set the hour. Press the TIMER key again, the OFF icon and minutes position are now flashing. Press the ▲▼ keys to set the minutes. Press the SET key to confirm the setting. Based on the times set, the indoor unit will determine which event happens first (ON-OFF or OFF-ON) and adjusts the arrow direction accordingly.

If neither ▲▼ key is pressed within 10 seconds, or if the MODE, FAN, or ON/OFF keys are pressed prior to pressing the SET key, the setting function is canceled and reverts back to the previous setting.

Timer Cancel
Press the TIME key up to 9 times to cycle through the timer settings. When the timer icon disappears, the timer function is canceled.

Note: An active timer function will remain displayed on screen until the set time has been reached and command completed.

WIRED CONTROLLER OPERATION

Settings & Functions

Left/Right/Up/Down Swing

The swing function determines air circulation.

1. Press SET key to access Swing function circulation.
2. Use ▲▼keys to select desired swing function.

If **SW7** is on, air will circulate **UP/DOWN/LEFT/RIGHT.**

3. Press SET key to confirm swing function selection.

Parameter Inquiry

NOTE: This function requires the screen backlight to be illuminated. The ON/OFF key LED can be either On or Off.

Press and hold the SET key for 5 seconds. The unit number will be displayed in the upper left corner of the screen. The data type and current data will be displayed in the upper right corner of the screen.
Press the ▲▼ keys to scroll through the data types. (See chart for data type/current data)

Press the MODE, FAN, SET, or ON/OFF key to exit the function. If no key is pressed in 10 seconds, the function will also exit.

Data	Type meaning	System
A	Indoor sensor Tai temp.	Actual value, decimal sys.
b	Indoor sensor Tc1 temp.	Actual value, decimal sys.
C	Indoor sensor Tc2 temp.	Actual value, decimal sys.
d	Indoor unit PMV opening/2	Actual value, decimal sys.
E	Indoor unit address	Actual value, hexadecimal sys.
F	Indoor unit central address	Actual value, hexadecimal sys.

Unit Number Setting

NOTE: This function requires the screen backlight to be illuminated. The ON/OFF key LED can be either On or Off.

Press and hold the SET key for 10 seconds. The wired controller address and communication address between the indoor and outdoor unit are displayed in the upper left corner of the screen. The central address is displayed in the upper right corner of the screen.

Press the ▲▼ keys to select the indoor unit number: 0 - 3F. Press the SET key to confirm the setting. Press the MODE, FAN, or ON/OFF key to exit the function. If no key is pressed in 10 seconds, the function will also exit.

Forced Cooling/Heating

Note: This function requires the ON/OFF key LED to be turned OFF and the screen backlight to be illuminated.

Forced Cooling
When the system is turned off in cooling mode, press and hold the ON/OFF key for 10 seconds. The system will enter forced cooling. The temperature display will display a flashing "LL". Press the ON/OFF key to exit forced cooling mode.

Forced Heating
When the system is turned off in heating mode, press and hold the ON/OFF key for 10 seconds. The system will enter forced heating. The temperature display will display a flashing "HH". Press the ON/OFF key to exit forced heating mode.

NOTE: When in forced cooling or heating, all keys are disabled except for the ON/OFF key.

Child Lock Function

NOTE: This function requires the screen backlight to be illuminated. The ON/OFF key LED can be either On or Off.

Child Lock can be used to prevent unintended operation of the control unit.

1. Press SET and the ▼ keys together for 5 seconds to activate the Child Lock function. The child lock icon will be displayed on the left side of the screen. All normal functions of the keys will be disabled.

2. To unlock the Child Lock function, press the SET key and the ▼ arrow together for 5 seconds. The child lock icon will disappear from the screen. All normal functions of the keys will be restored.

Temperature Compensation Setting

Note: This function requires the ON/OFF key LED to be turned OFF and the screen backlight to be illuminated.

Press and hold the FAN keys for 5 seconds, the current temperature compensation value is displayed in the upper right corner of the screen. (The default value is 00). Press the ▲▼ keys to change the temperature compensation value. The adjustment range is -07°F to +07°F. Press the SET key to confirm the setting. Press the MODE, FAN, TIME, or ON/OFF key to exit the function. If no key is pressed in 10 seconds, the function will also exit.

NOTE: The compensation value is used for ambient temperature and is valid only for the wired controller sensor.

Settings & Functions

Sleep Function

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

Press the SET key. The swing louver function icon will be displayed. Press the ▲▼ keys to advance through the functions to select the SLEEP function. The Sleep and Sleep "off" time icons will be displayed. (The Sleep icon will be flashing) Press the TIME key, the "off" icon will begin to flash. Press the ▲▼ keys to set the "off" time. (Time range is 0.5h to 72h) Press the SET key to confirm the setting. The Sleep function and "off" time icons will remain on.

If neither ▲▼ key is pressed within 10 seconds, or if the MODE, FAN, or ON/OFF keys are pressed prior to pressing the SET key, the setting function is canceled and reverts back to the previous setting.

To cancel the Sleep function. Press the SET key. The swing louver function icon will be displayed. Press the ▲▼ keys to advance through the functions to select the SLEEP function. The Sleep and Sleep "off" time icons will be displayed. (The Sleep icon will be flashing) Press the SET key to cancel the function.

Filter Cleaning

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

The Filter Cleaning icon will start flashing when the indoor unit has reached 500 hours of operating time.

After cleaning or replacing the filter, press the SET key to clear the icon and reset the operating time.

Heat Reclaim Ventilation

NOTE: This function requires the ON/OFF key LED to be turned ON and the screen backlight to be illuminated.

Press the SET key. The swing louver function icon will be displayed. Press the ▲▼ keys to advance through the functions to select the Heat Reclaim Ventilation function. (The icon will be flashing) Press the SET key to confirm the setting.

To cancel the Heat Reclaim Ventilation function, repeat the above steps.

If neither ▲▼ key is pressed within 10 seconds, or if the MODE, FAN, or ON/OFF keys are pressed prior to pressing the SET key, the setting function is canceled and reverts back to the previous setting.

This function is reserved for future models.

Other Functions

Note: These functions require the ON/OFF key LED to be turned OFF and the screen backlight to be illuminated.

Auto Restart

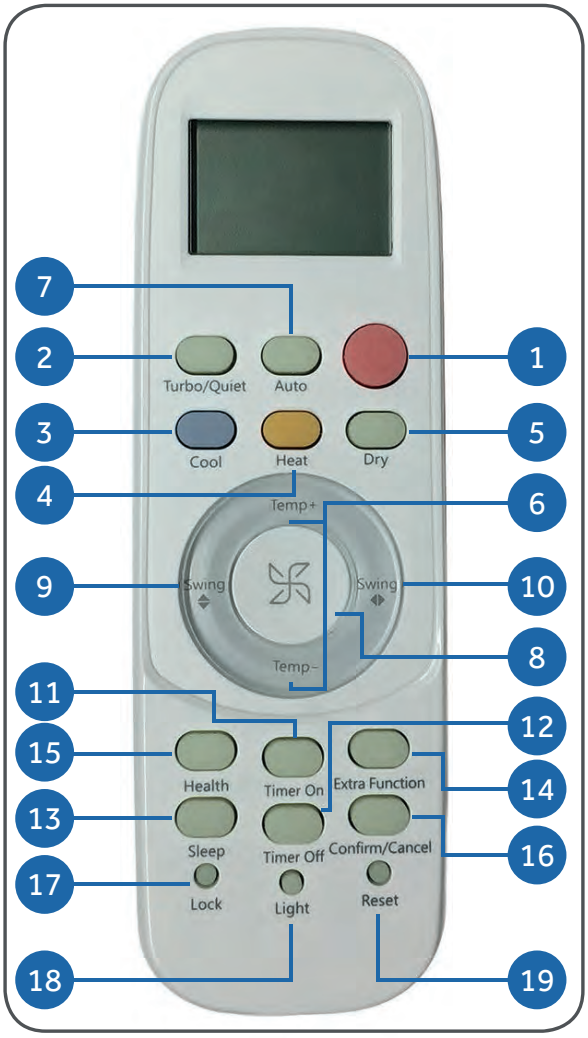
Setting DIP switch SW1-4 located on the PCB of the wired control to the "on" position will disable the auto restart function. When the switch is in the "off" position, auto-restart is enabled (default position). When the switch is in the "on" position, auto-restart is disabled.
Information retained in auto-restart are: Mode, Fan Speed, Temperature Setting, Swing State, and Heat Reclaim Ventilation function.

Communication Error of Wired Controller

If there is no communication between the wired controller and indoor unit for 4 minutes, when checking error codes, "07" will be displayed in the upper right corner of the display.

Wireless Remote Controller

Functions



1 Power Button

Press the ON/OFF button on the remote control to start the unit.

2 TURBO/QUIET Button

The TURBO function is used for fast heating or cooling.

Press the TURBO/QUIET button once and the remote control will display the TURBO icon on the bottom right side of the remote display and switch the unit to the TURBO function.

The QUIET function may be used when silence is needed for fast rest or reading. Press the TURBO/QUIET button again to switch to QUIET mode and the remote control will display the QUIET icon on the bottom left side of the remote display.

Press the TURBO/QUIET button a third time to cancel TURBO/QUIET and return to normal operation.

Note:
TURBO/QUIET modes are only available when the unit is under cooling or heating mode (not for auto or fan mode).

Running the unit in QUIET mode for a long period of time may cause the room temperature to not reach the set temperature. If this occurs, cancel QUIET mode and set the fan speed to a higher setting.

3 COOL Button

In COOL mode, the unit operates in cooling. When FAN is set to AUTO, the air conditioner automatically adjusts the fan speed according to room temperature. The will be displayed during COOL mode.

4 HEAT Button

In HEAT mode, warm air will blow out after a short period of the time due to cold-air prevention function. When FAN is set to AUTO, the air conditioner automatically adjusts the fan speed according to room temperature. The will be displayed during HEAT mode.

5 DRY Button

DRY mode is used to reduce humidity. In DRY mode, when room temperature becomes lower than temp. setting +2°F, unit will run intermittently at LOW speed regardless of FAN setting. The will be displayed during DRY mode.

6 Temperature +/- Buttons

Temp + Every time the button is pressed, the temperature setting increases.
Temp - Every time the button is pressed, temperature setting decreases.
The operating temperature range is 60°F-86°F.

7 AUTO Button

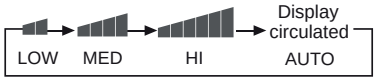
Under the mode of auto operation, the air conditioner will automatically select Cool, Heat, or Fan operation according to set temperature. When FAN is set to AUTO the air conditioner automatically adjusts the fan speed according to room temperature. The will be displayed during AUTO mode.

8 FAN Button

Fan speed selection

Press the FAN button. For each press, fan speed changes as follows:

Remote control:



The air conditioner fan will run according to the displayed fan speed.
When FAN is set to AUTO, the air conditioner automatically adjusts the fan speed according to room temperature.

9 Louver SWING Button - Vertical

Air Flow Direction Adjustment
Press the SWING UP/DOWN button to choose the position of the vertical airflow louvers.

Status display of air flow
COOL/DRY:

HEAT:

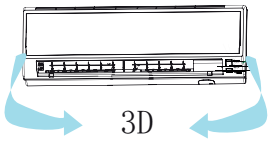
Caution:
- It is advisable not to keep the vertical louver in the downward position for an extended period of time in COOL or DRY mode, otherwise condensate water may form on the louver.
-

Note:
When turning the unit on, the remote control will automatically return the louver to the previous set swing position. When turning the unit off, the louver will rotate to the full open position prior to closing.

10 Louver SWING Button - Horizontal

Press the SWING UP/DOWN button to choose the position of the horizontal airflow louvers.

Status display of air flow
COOL/DRY/HEAT:



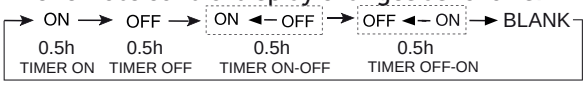
Caution:
- When humidity levels are high, condensate water may occur at the air outlet if all horizontal louvers are adjusted to left or right.

Note:
When turning the unit on, the remote control will automatically return the louver to the previous set swing position. When turning the unit off, the louver will rotate to the full open position prior to closing.

11 Timer ON Button

On-Off Operation
1. Start the unit and select the desired operating mode.
2. Press the TIMER ON button to enter the TIMER ON mode. The remote control will start flashing "ON".
3. Every time the TIMER ON button is pressed the length of time increases in 0.5 hour increments between hours 0 and 12, and 1 hour increments for times between hours 12 and 24.
4. Once the desired length of time is selected for the unit to turn on, press the CONFIRM/CANCEL to confirm this setting.

The remote control display changes as follows:



Cancel TIMER ON setting:
With a TIMER ON set, press the CONFIRM/CANCEL button once to cancel the TIMER ON.

Turning the unit ON with the TIMER from it being OFF will look like this on the remote control display:

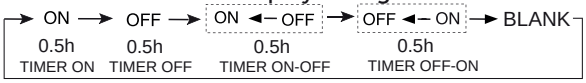
Note:
Holding the TIMER ON button down will rapidly cycle the time. After replacing batteries or a power failure occurs, the time setting will need to be reset.

According to the Time setting sequence of TIMER ON or TIMER OFF, either Start-Stop or Stop-Start can be achieved.

12 Timer OFF Button

On-Off Operation
1. Start the unit and select the desired operating mode.
2. Press the TIMER OFF button to enter the TIMER OFF mode. The remote control will start flashing "OFF".
3. Every time the TIMER OFF button is pressed the length of time decreases in 0.5 hour increments between hours 0 and 12, and 1 hour increments for times between hours 12 and 24.
4. Once the desired length of time is selected for the unit to turn off, press the CONFIRM/CANCEL to confirm this setting.

The remote control display changes as follows:



Cancel TIMER OFF setting:
With a TIMER OFF set, press the CONFIRM/CANCEL button once to cancel the TIMER OFF.

Turning the unit OFF with the TIMER from it being ON will look like this on the remote control display:

Note:
Holding the TIMER OFF button down will rapidly cycle

the time. After replacing batteries or a power failure occurs, the time setting will need to be reset.

According to the Time setting sequence of TIMER ON or TIMER OFF, either Start-Stop or Stop-Start can be achieved.

13 SLEEP Button

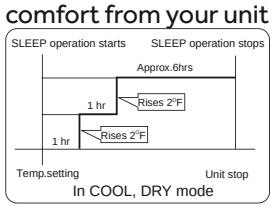
Sleep mode

Press the Extra Function button to enter additional options, cycle the button to display the icon, the icon will flash. Press the Confirm/Cancel button to enter the sleep function.

Sleep Operation Mode

1. SLEEP mode during COOL, DRY modes

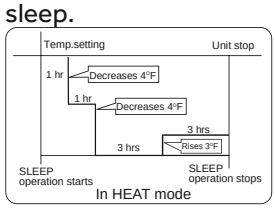
One hour after SLEEP mode starts, the temperature will rise 2°F above set temperature, after another hour, the temperature rises an additional 2°F. The unit will run for an additional six hours, then turns off. The final temperature is 4°F higher than the initial set temperature. Using this feature will help with achieving maximum efficiency and comfort from your unit while you sleep.



In COOL, DRY mode

2. SLEEP mode during HEAT mode

One hour after SLEEP mode starts, the temperature will decrease 4°F below set temperature, after another hour, the temperature will decrease an additional 4°F. After an additional three hours, the temperature will rise by 2°F. The unit will run for an additional three hours, then turns off. The final temperature is 6°F lower than the initial set temperature. Using this feature will help with achieving maximum efficiency and comfort from your unit while you sleep.



In HEAT mode

3. In AUTO mode

The unit operates in corresponding sleep mode adapted to the automatically selected operation mode.

Note:

-When the unit is set to sleep mode, the fan speed will be set to low speed and cannot be changed.

-When the TIMER function is set, the sleeping function cannot be set. If the sleeping function has been set, and the user sets the TIMER function, the sleeping function will be canceled, and the unit will be set to the timer function.

14 EXTRA FUNCTION Button

Function:

A) Refresh air - Feature not available on this series.

B) A-B Yard - This will allow you to control two separate units with a single remote control.

Note: this feature would be setup at the time of installation by the contractor.

C) Fan Mode - Is indicated by the icon. Only the fan will operate in this mode. See section 8 "FAN Button" for changing the fan settings.

D) Intelligent upward airflow, E) Intelligent downward airflow, F) Reset intelligent airflow position

1. Press the ON/OFF button on the remote control to turn the unit on.

Select the desired operating mode.

2. Setting the intelligent airflow function

Press the EXTRA FUNCTION button to enter additional options. Press this button repeatedly to access the louver settings. The louver icon will cycle through the following three settings.

Select the desired position, then press the CONFIRM/CANCEL button to set the function.

3. Canceling the intelligent airflow function

Press the EXTRA FUNCTION button to enter additional options. Press this button repeatedly to access the louver settings. Cycle the button to the louver icon "present" position, then press the CONFIRM/CANCEL button to cancel the function.

Notice: Do not reposition the horizontal louver by hand. This may cause the louver to run incorrectly and not match the icon displayed on the remote control. If the louver is not running correctly, turn the unit off for one minute, then back on, and adjust the louver setting with the remote control.

Note:

1. After setting the intelligent airflow function, the louver position is fixed.
2. In cooling, it is better to select the mode.
3. In heating, it is better to select the mode.
4. In cooling and dry modes, using the air conditioner for a long period of time under high humidity conditions, condensate water may form on the grille/louver.

G) Fahrenheit/Celsius mode shift on unit and remote - To switch between Fahrenheit and Celsius press the EXTRA FUNCTION button until either Celsius or Fahrenheit is displayed. Press the CONFIRM/CANCEL button to apply the change.

H) 50°F low temperature heating - Feature not available on this series.

I) Electrical heating - Feature not available on this series.

15 HEALTH Button

Feature not available on this series.

16 Confirm/Cancel Button

Function: Setting and canceling timer and other functions.

17 LOCK Button

Used to lock buttons and LCD display

18 LIGHT Button

Turns indoor unit display on and off

19 RESET Button

If the remote control is not functioning properly, use a pen point or similar object to depress this button to reset the remote.

Troubleshooting

Trouble shooting

Outdoor LED display	Outdoor unit fault possible reasons	Wired controller display(Hex)---for duct	Cassette indoor display outdoor		Wall mounted indoor display
			Timer lamp flash time	Running lamp flash time	
1	Faulty of outdoor unit EEPROM	15	2	1	F12
2	IPM overcurrent or short circuit	16	2	2	F1
4	Communication failure between Module and ECU	18	2	4	F3
5	Module operated overload	19	2	5	F20
6	Module low or high voltage	1A	2	6	F19
8	Discharging temperature overheating.Lack of refrigerant, ambient temperature too high or PMVs blocked.	1C	2	8	F4
9	Malfunction of the DC fan motor	1D	2	9	F8
10	Malfunction of defrosting temp. sensor	1E	3	0	F21
11	Malfunction of compressor suction temp. sensor	1F	3	1	F7
12	Malfunction of ambient temp. sensor	20	3	2	F6
13	Malfunction of compressor discharge temp. sensor	21	3	3	F25
15	Communication failure between indoor&outdoor unit	23	3	5	E7
16	Lack of refrigerant or discharging	24	3	6	F13
17	4-way valve switching failure	25	3	7	F14
18	Loss of synchronism detection	26	3	8	F11
20	Indoor thermal overload	28	4	0	E9
21	Indoor frosted	29	4	1	E5
23	Module thermal overload	2B	4	3	F5
24	Compressor start failure	2C	4	4	F2
25	Module input overcurrent	2D	4	5	F23
26	MCU reset	2E	4	6	F9
27	Module current detect circuit malfunction	2F	4	7	F24
28	Malfunction of liquid pipe temp. sensor for indoor unit A	30	4	8	F10
29	Malfunction of liquid pipe temp. sensor for indoor unit B	31	4	9	F16
30	Malfunction of liquid pipe temp. sensor for indoor unit C	32	5	0	F17
31	Malfunction of liquid pipe temp. sensor for indoor unit D	33	5	1	F18
32	Malfunction of gas pipe temp. sensor for indoor unit A	34	5	2	F29
33	Malfunction of gas pipe temp. sensor for indoor unit B	35	5	3	F30
34	Malfunction of gas pipe temp. sensor for indoor unit C	36	5	4	F31
35	Malfunction of gas pipe temp. sensor for indoor unit D	37	5	5	F32
36	Malfunction of gas pipe temp. sensor for indoor unit E	38	5	6	F26
38	Malfunction of module temp.sensor Momentary power failure detection	3A	5	8	F35
39	Malfunction of condensing temp. sensor	3B	5	9	F36
40	Malfunction of liquid pipe temp. sensor for indoor unit E	3C	6	0	F33
41	Malfunction of 'Toci'temp. sensor	3D	6	1	F38
42	System high pressure switch off	3E	6	2	F39
43	System low pressure switch off	3F	6	3	F40
44	System high pressure protection.Refrigerant overabundance, High condensing temp. or malfunction of fan motor.	40	6	4	F41
45	System low pressure protection.Refrigerant shortage, Low defrosting temp., or malfunction of fan motor.	41	6	5	F42

REFERENCES

Resistance Values for Wall Mounted, Ducted, and Cassette Units

Wall Mount Fan Motor Resistance Values					
	Yellow	Blue	White	Black	Red
Yellow		Infinity Ω	345K Ω	238K Ω	Infinity Ω
Blue			4.7K Ω	4.54M Ω	Infinity Ω
White				107K Ω	Infinity Ω
Black					Infinity Ω
Red					

Wall Mount Horizontal Louver Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		393 Ω	394 Ω	395 Ω	196 Ω
Violet			396 Ω	397 Ω	198 Ω
Yellow				398 Ω	199 Ω
Orange					200 Ω
Red					

Wall Mount Vertical Louver Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		383 Ω	388 Ω	390 Ω	195 Ω
Violet			381 Ω	385 Ω	189 Ω
Yellow				388 Ω	193 Ω
Orange					196 Ω
Red					

Ducted Fan Motor Resistance Values					
	Red	Black	White	Yellow	Blue
Red		Infinity Ω	Infinity Ω	Infinity Ω	Infinity Ω
Black			1.23K Ω	211.5K Ω	4.75M Ω
White				212.7K Ω	4.75M Ω
Yellow					5.05M Ω
Blue					

Ducted Horizontal Louver Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		298 Ω	297 Ω	297 Ω	149 Ω
Violet			299 Ω	299 Ω	151 Ω
Yellow				298 Ω	149 Ω
Orange					150 Ω
Red					

Ducted Vertical Louver Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		590 Ω	596 Ω	591 Ω	297 Ω
Violet			593 Ω	588 Ω	294 Ω
Yellow				595 Ω	300 Ω
Orange					295 Ω
Red					

Outdoor Unit Fan Motor Resistance Values					
	Red	Black	White	Yellow	Blue
Red		Infinity Ω	Infinity Ω	Infinity Ω	Infinity Ω
Black			1.23K Ω	211.5K Ω	4.75M Ω
White				212.7K Ω	4.75M Ω
Yellow					5.05M Ω
Blue					

EEV Stepper Motor Resistance Values					
	Blue	Violet	Yellow	Orange	Red
Blue		47 Ω	46 Ω	46 Ω	46 Ω
Violet			92 Ω	92 Ω	92 Ω
Yellow				91 Ω	91 Ω
Orange					91 Ω
Red					

Cassette Fan Motor Resistance Values						
	Orange	Orange	Red	Brown	Yellow	Blue
Orange		758 Ω	758 Ω	159 Ω	189 Ω	233 Ω
Orange			0 Ω	600 Ω	570 Ω	526 Ω
Red				600 Ω	570 Ω	526 Ω
Brown					31 Ω	75 Ω
Yellow						45 Ω
Blue						

Cassette Louver Motor Resistance Values					
	Orange	Yellow	Blue	Violet	Red
Orange		398 Ω	398 Ω	399 Ω	200 Ω
Yellow			396 Ω	397 Ω	198 Ω
Blue				399 Ω	199 Ω
Violet					200 Ω
Red					

Error Detection

The LED flashes when any of the following errors are detected:

1. When a protection device of the indoor or the outdoor unit activated or when the thermistor malfunctions, disabling equipment operation

2. When a signal transmission error occurs between the indoor and outdoor units. In either case. conduct the appropriate diagnostic procedures.

Error Codes and Description indoor display

	Code indication		fault description
	Indoor displaying panel code indication	Outdoor (LED1 flash times)	
Indoor and Outdoor	E7	15	Communication fault between indoor and outdoor units
Indoor Malfunction	E1	--	Room temperature sensor failure
	E2	--	Heat-exchange sensor failure
	E4	- -	indoor EEPROM error
	E14	--	Indoor fan motor malfunction
Outdoor Malfunction	F12	1	Outdoor EEPROM error
	F1	2	The prtotect of IPM
	F22	3	Overcurrent protection of AC electricity for the outdoor model
	F3	4	Communication fault between the IPM and outdoor PCB
	F19	6	Power voltage is too high or low
	F4	8	Overheat protection for Discharge temperature
	F8	9	Outdoor DC fan motor fault
	F21	10	Defrost temperature sensor failure
	F7	11	Suction temperature sensor failure
	F6	12	Ambient temperature sensor failure
	F25	13	Discharge temperature sensor failure
	F11	18	deviate from the normal for the compressor
	F28	19	Loop of the station detect error
	F2	24	Overcurrent of the compressor
	F23	25	Overcurrent protection for single-phase of the compressor
	E9	21	High work-intense protection

REFERENCES

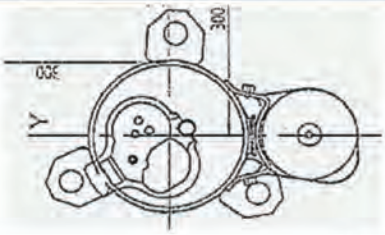
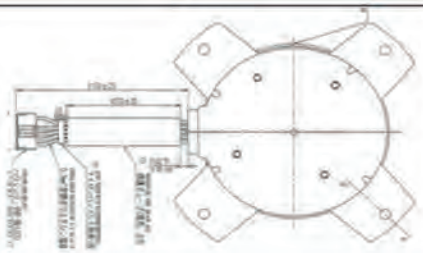
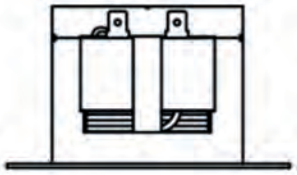
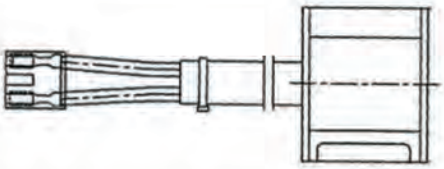
Problems & Solutions

Problem	Check Item	Details of Measure
None of the units operates	Check the power supply.	Check to make sure that the rated voltage is supplied.
	Check the indoor PCB	Check to make sure that the indoor PCB is broken
Operation sometimes stops.	Check the power supply.	A power failure of 2 to 10 cycles can stop air conditioner operation.
Equipment operates but does not cool, or does not heat (only for heat pump)	Check for faulty operation of the electronic expansion valve.	Set the units to cooling operation, and compare the temperatures of the liquid side connection pipes of the connection section among rooms to check the opening and closing operation of the electronic expansion valves of the individual units.
	Diagnosis by service port pressure and operating current.	Check for insufficient gas.
Large operating noise and vibrations	Check the installation condition.	Check to make sure that the required spaces for installation (specified in the Technical Guide, etc.) are provided.

Piping Length Limits

	Total Length Limit	Max Length Limit for each individual Indoor	Max Lift Between Indoor & Indoor	Max Lift Between Indoor & Outdoor
2U	100ft	82ft	50ft	50ft
3U	200ft	82ft	50ft	50ft
4U	230ft	82ft	50ft	50ft

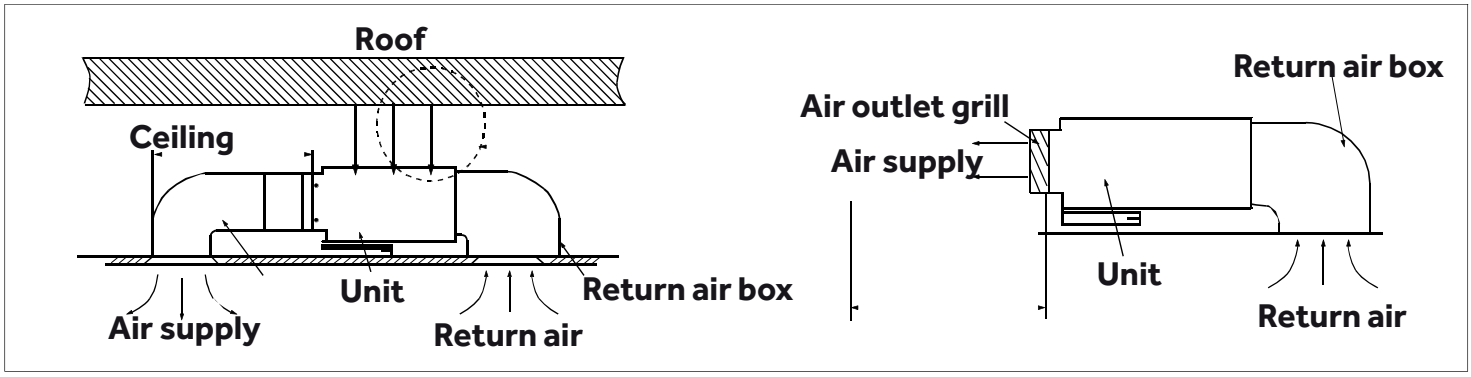
Component Ratings

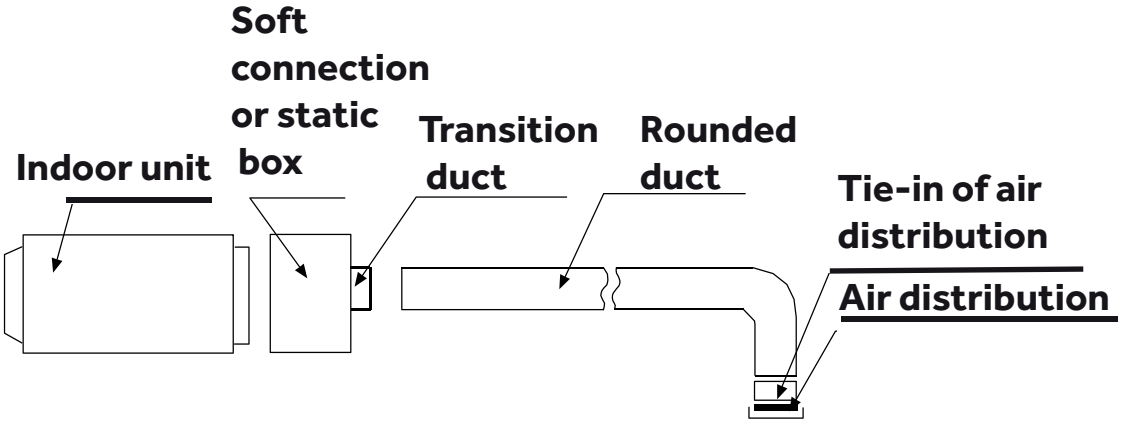
NO	Name	Parameter	Picture
	Compressor	Rated voltage:220-230V Rated current:8.4A Rated frequency:50/60Hz Resistance:0.93Ω	
2	Fan motor	Rated voltage:220-230V Rated current:0.2A Rated frequency:50/60Hz Resistance:14.5Ω	
3	Reactor	Rated voltage:29.4V±10% Rated current:18.0A Rated frequency:50Hz Rated ductance:5.2mH±10%	
4	4-way valve	Rated voltage:230V Rated current:0.1A Rated frequency:50Hz Rated inductance:2.1KΩ	

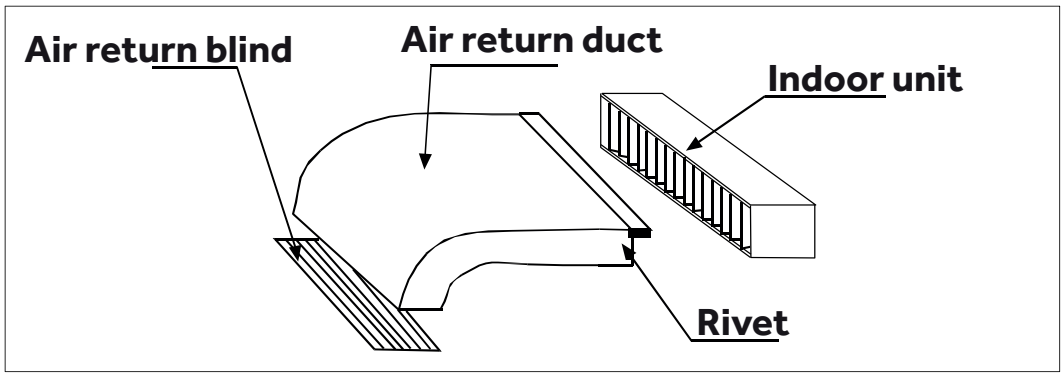
REFERENCES

Duct Work Installation

Roof Installation







Use rivet to connect the air return duct on the air return inlet of the indoor unit, then connect the other end with the air return.

Wiring

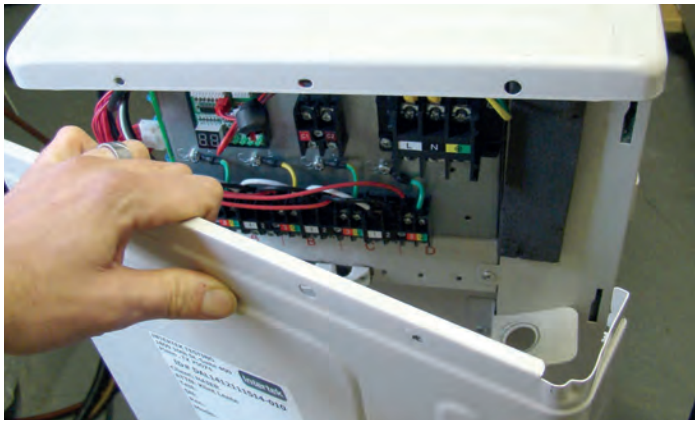
Cover plate of the outdoor unit to expose the terminal block connections.

Line Voltage from Circuit Breaker/Disconnect to outdoor unit wire terminal

Always follow local and national codes when installing electrical wiring. The required fuse size can be found in the product specification section of this manual.

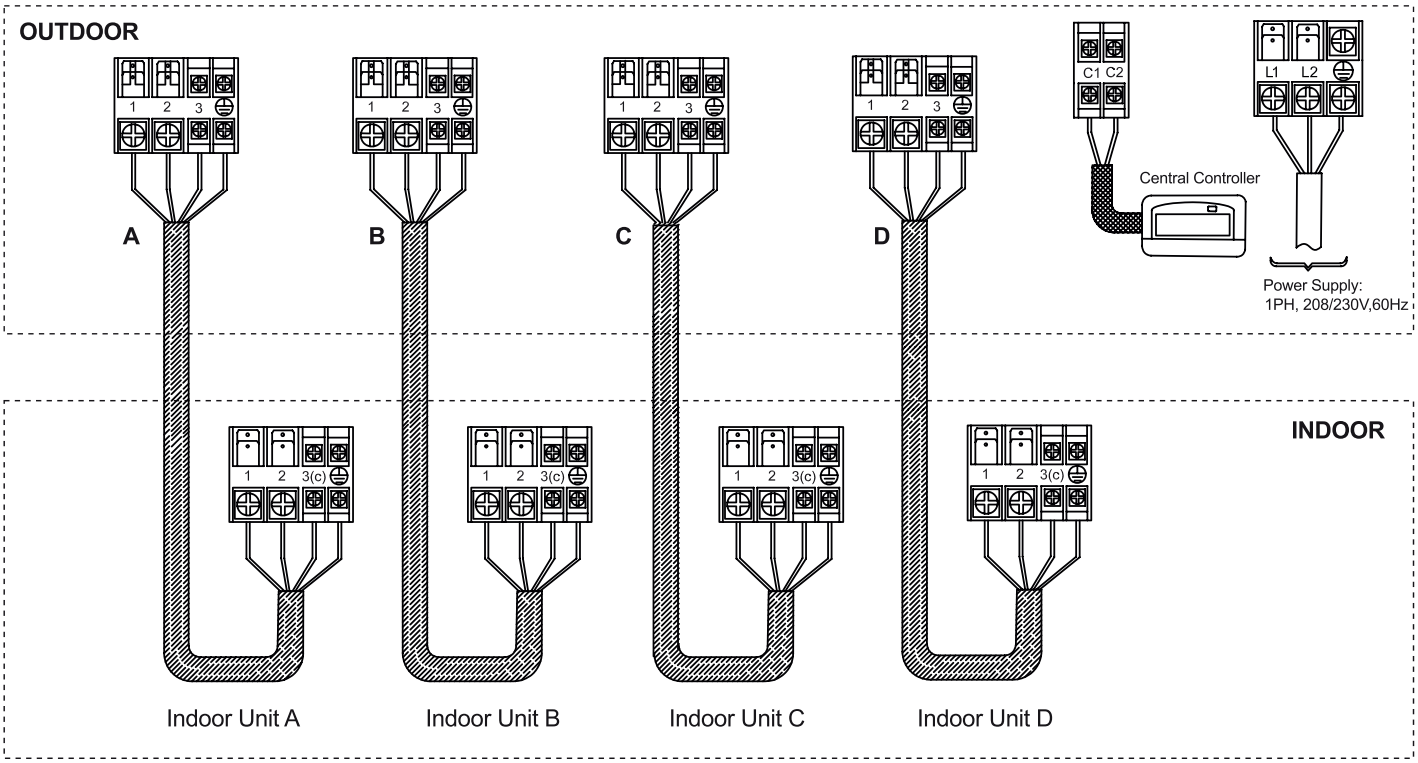
Connect wiring from indoor units

Use 14/4 AWG Stranded wire when connecting the outdoor unit to the indoor unit. **Connect the wiring to the correct terminals based upon the piping connections. For example, Circuit A wiring goes to the piping feeding Circuit A. Do not cross the wiring and piping.**



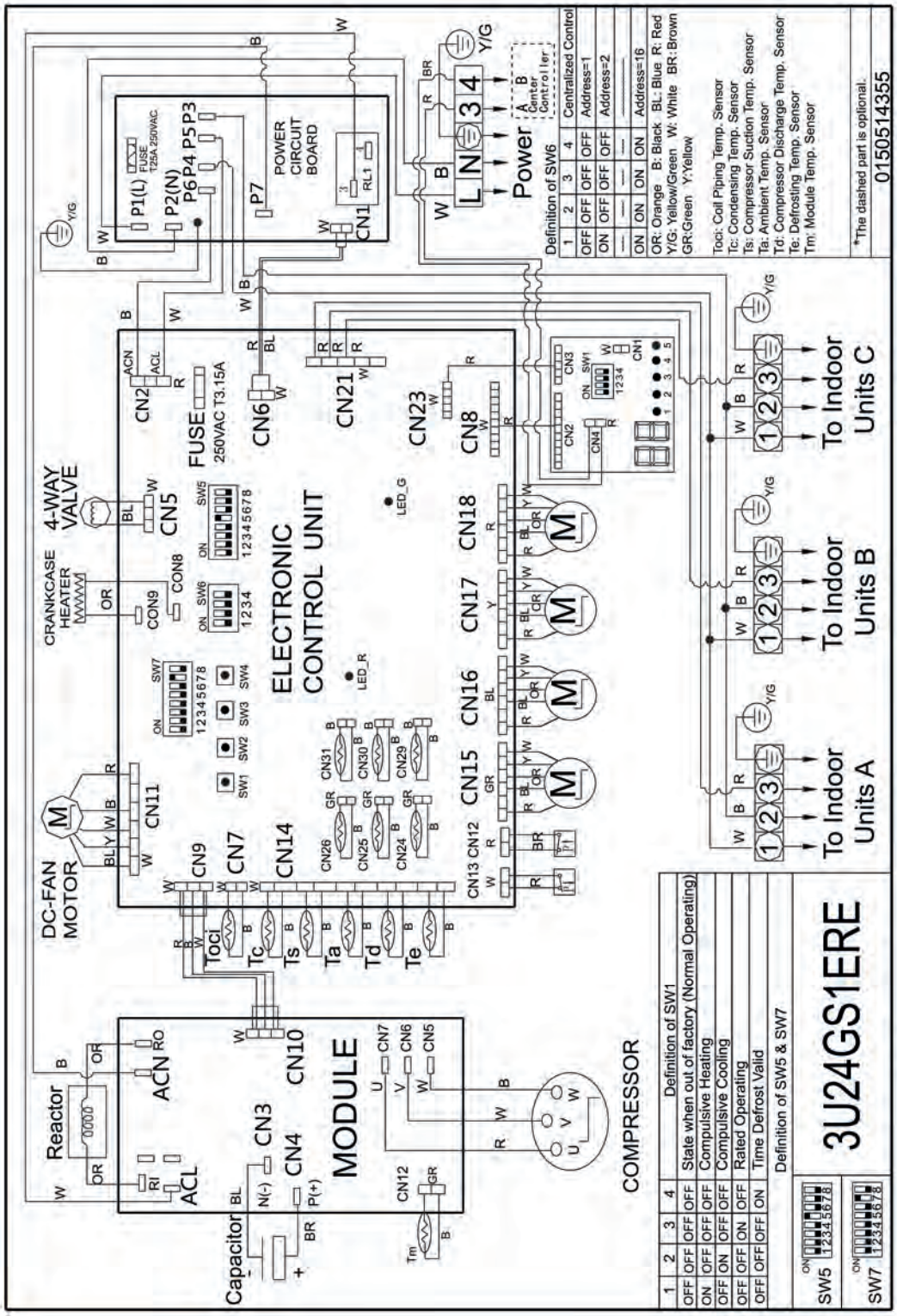
Electrical Connections Indoor and Outdoor Units

14 AWG Stranded Wire Only. (Central Controller Not Used)
Maintain 10 feet of separation between TV and any Radio wiring.



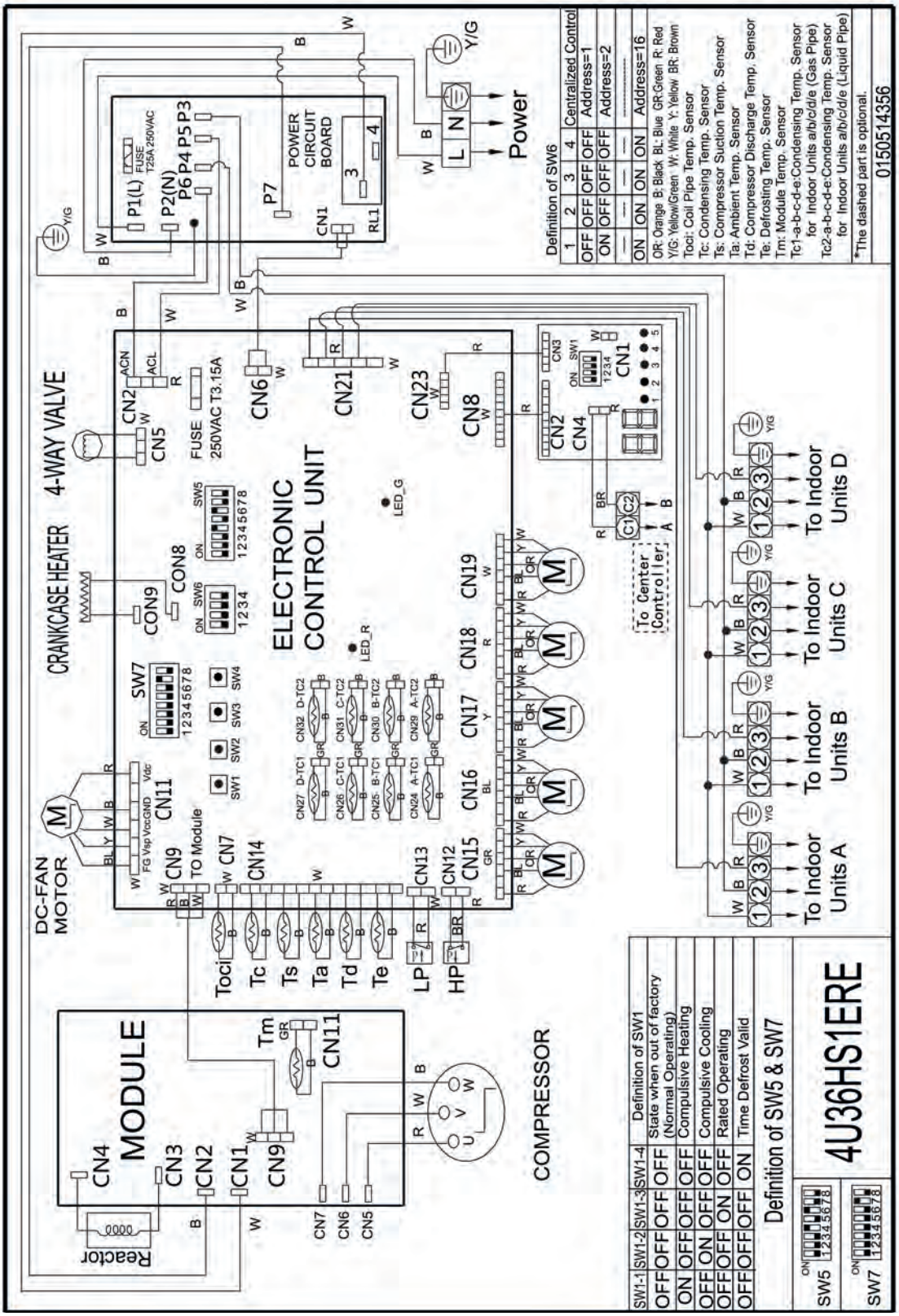
3. Wiring diagram

3U24MS2VHB



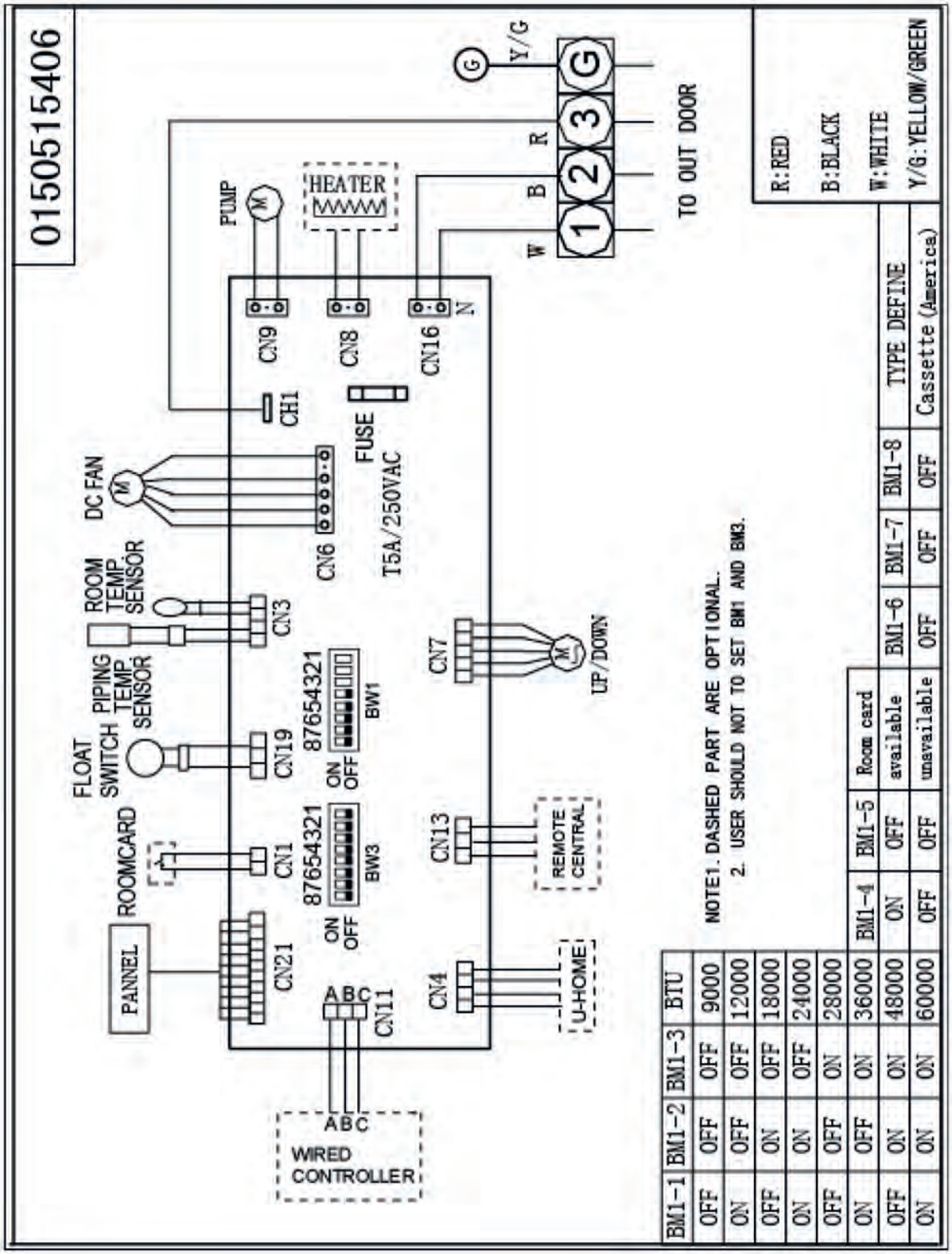
Wiring

4U36MS2VHB



Wiring

AB09SC2VHA AB12SC2VHA AB18SC2VHA



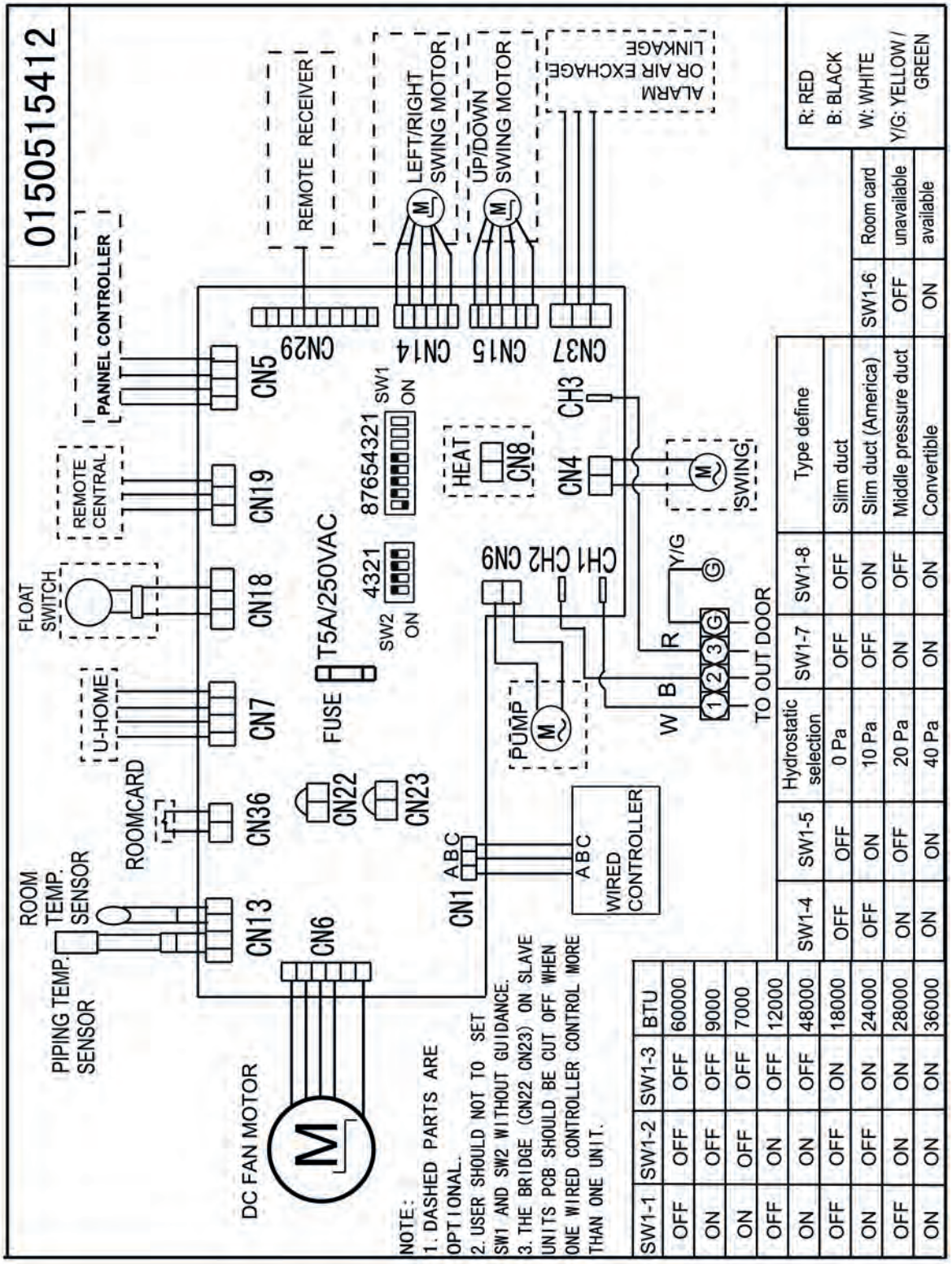
BM1-1	BM1-2	BM1-3	BTU
OFF	OFF	OFF	9000
ON	OFF	OFF	12000
OFF	ON	OFF	18000
ON	ON	OFF	24000
OFF	OFF	ON	28000
ON	OFF	ON	36000
OFF	ON	ON	48000
ON	ON	ON	60000

BM1-4	BM1-5	Room card
ON	OFF	available
OFF	OFF	unavailable

BM1-6	BM1-7	BM1-8	TYPE DEFINE
OFF	OFF	OFF	Cassette (America)

Wiring

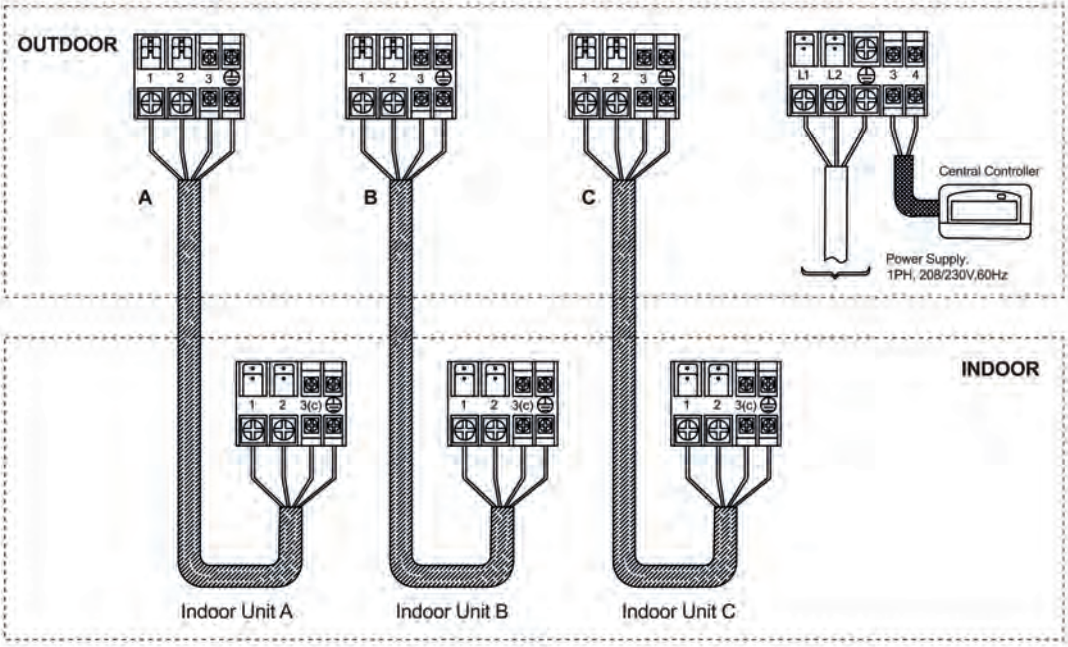
AD07SL2VHA AD09SL2VHA AD12SL2VHA AD18SL2VHA



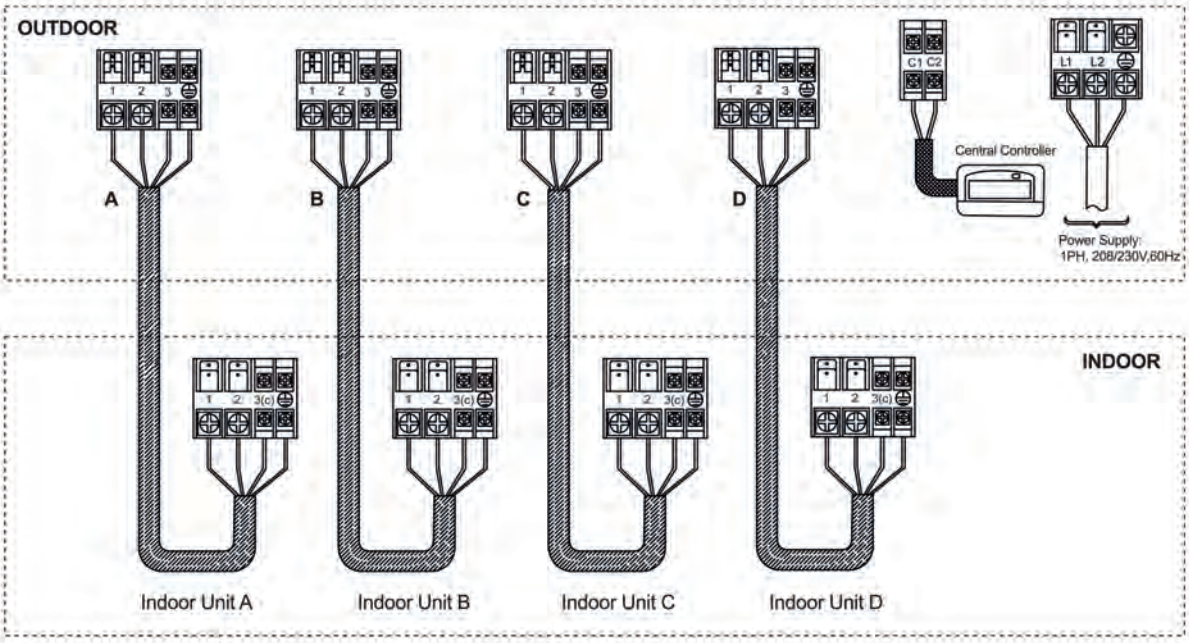
SW1-1	SW1-2	SW1-3	BTU	SW1-4	SW1-5	Hydrostatic selection	SW1-7	SW1-8	Type define	SW1-6	Room card
OFF	OFF	OFF	60000	OFF	OFF	0 Pa	OFF	OFF	Slim duct	OFF	unavailable
ON	OFF	OFF	9000	OFF	ON	10 Pa	OFF	ON	Slim duct (America)	OFF	unavailable
ON	OFF	OFF	7000	ON	OFF	20 Pa	ON	OFF	Middle pressure duct	OFF	unavailable
OFF	ON	OFF	12000	ON	ON	40 Pa	ON	ON	Convertible	ON	available
ON	ON	OFF	48000	OFF	OFF						
OFF	OFF	ON	18000	OFF	OFF						
ON	OFF	ON	24000	ON	ON						
OFF	ON	ON	28000	ON	OFF						
ON	ON	ON	36000	ON	ON						

4. Wiring connection

3U24GS1ERE 3U24MS2VHB



4U36HS1ERE 4U36MS2VHB



Power Supply Cable: 10AWG

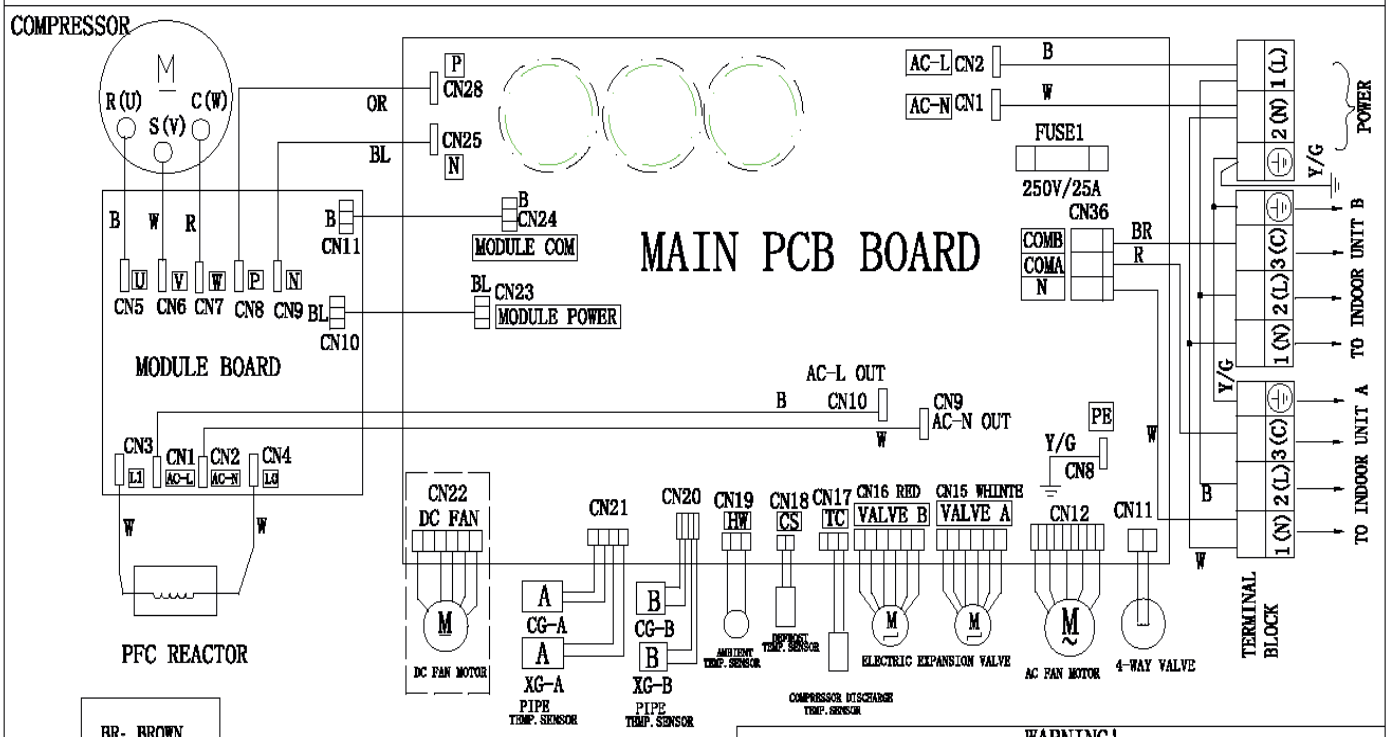
Connecting Cable: 14AWG

Connecting Cable: 14AWG

Connect the connecting wires between indoor and outdoor units and ensure the sequence numbers on terminals match with each other.

Wiring

2U OUTDOOR WIRING DIAGRAM 0010518048



BR: BROWN
B: BLACK
R: RED
OR: ORANGE
BL: BLUE
W: WHITE
Y/G: YELLOW /GREEN

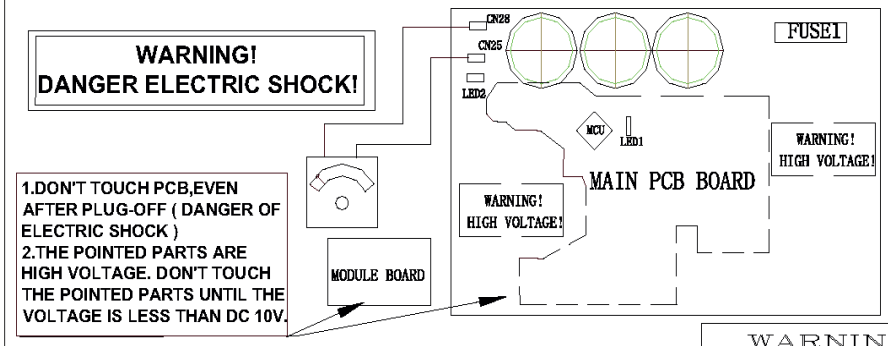
Remarks:
1.the dotted parts are optional for different unit.
2.The components of main pcb board is fixed facing to the compressor .

WARNING!
CAUTION

DON'T TOUCH CAPACITOR, EVEN AFTER PLUG-OFF (DANGER OF ELECTRIC SHOCK)

THE CAPACITOR RETAINS HIGH VOLTA GE EVEN AFTER THE PLUG-OFF.FOR YOUR SAFETY,BE SURE TO WAIT AT L EAST 5 MINUTES.AFTER PLUG OFF AN D USE A TESTER TO CONFIRM THE VOLT AGE BETWEEN CONNECTOR CN25 AND CN28(ON MAIN PCB BOARD) IS LESS THAN DC 10V BEFORE START SERVICING OR LED2 EXTINGUISHED.

OUTDOOR WIRING DIAGRAM 0010516371



Remarks:
1.Fault diagnosis by LED1 on outdoor unit PCB.
2.Count times of LED1 flashing to judge the malfunction.
3.The details refer to the technology notebook.

DIAGNOSIS		
LED1 FLASHING	abnormal →	according to times of LED1 flashing to check
LED1 ON	normal →	check the indoor unit
LED1 OFF	abnormal →	power supply fault or check the main PCB board

WARNING!
CAUTION

DON'T TOUCH CAPACITOR, EVEN AFTER PLUG-OFF (DANGER OF ELECTRIC SHOCK)

THE CAPACITOR RETAINS HIGH VOLTAGE EVEN AFTER THE PLUG-OFF.FOR YOUR SAFETY,BE SURE TO WAIT AT LEAST 5 MINUTES.AFTER PLUG OFF AND USE A TESTER TO CONFIRM THE VOLTAGE BETWEEN CONNECTOR CN25 AND CN28(ON MAIN PCB BOARD) IS LESS THAN DC 10V BEFORE START SERVICING OR LED2 EXTINGUISHED.

80

4.Printed Circuit Board Connector Wiring Diagram

indoor unit

Connectors

PCB(1) (Control PCB)

1) CN9、CN27 Connector for fan motor and feedback
2) CN1 Connector for heat exchanger thermistor and Room temperature thermistor
3) CN11 Connector for UP&DOWN STEP motor
4) CON2 Connector for power N wire
5) CON1 Connector for power L
6) CN30、CN31 Connector transformer
7) CN32 Connector for display board
8) CON6、CON8 Connector for ions generator
9) CON7 Connector for communicate between the indoor board and the outdoor board
10) CN20 Connector for room card

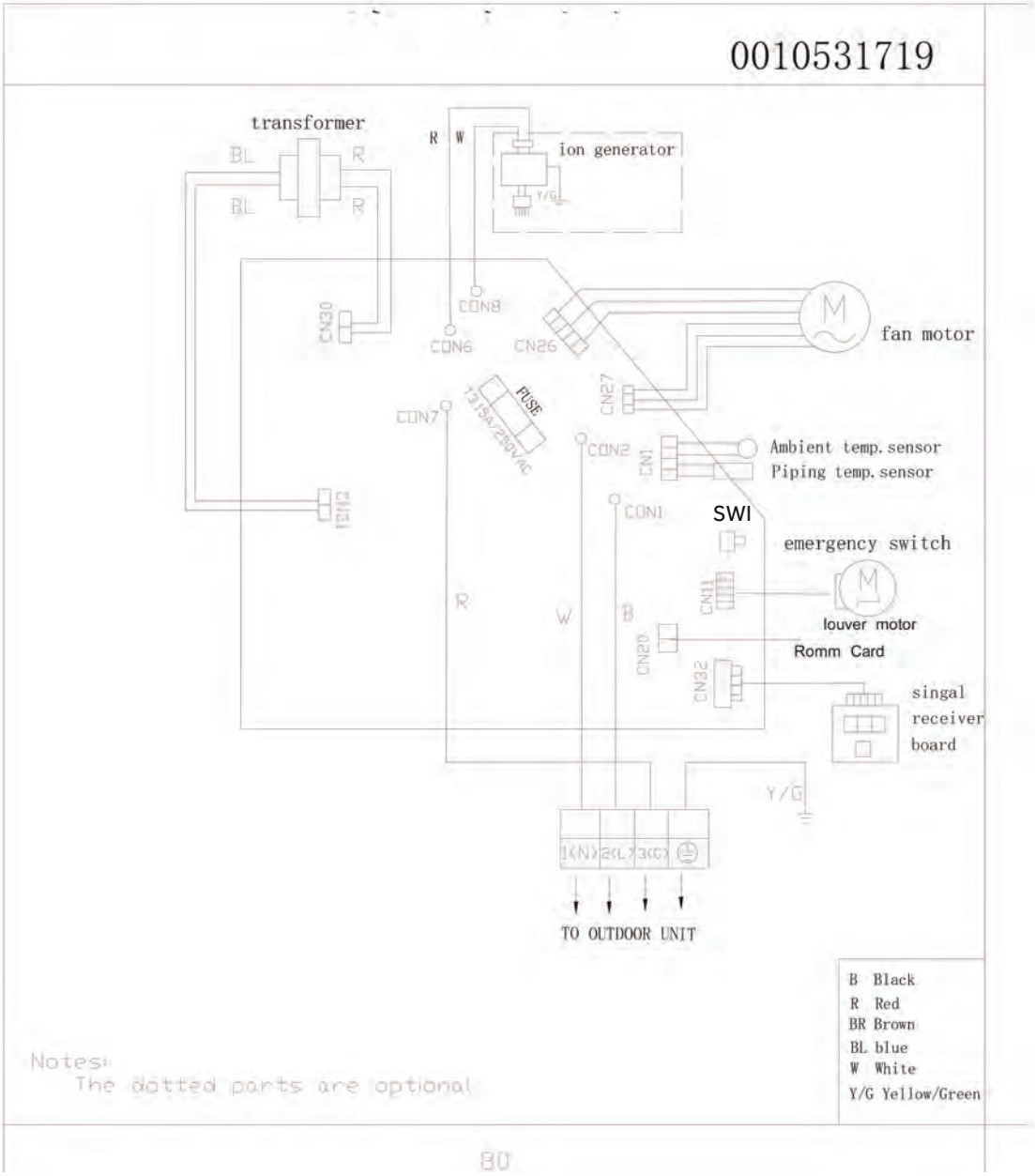
Note: Other designations

PCB(1) (Indoor Control PCB)

1) SW1 Connector for Forced operation ON / OFF switch
2) SW2 1 Select remote code A or B,2 Select 25 or 35 ,3 Select room card able or disable
3) RV1 Varistor0
4) FUSE1 Fuse 3.15A/250VAC

Wiring Diagrams

INDOOR UNIT



Wiring

Outdoor unit

Connectors

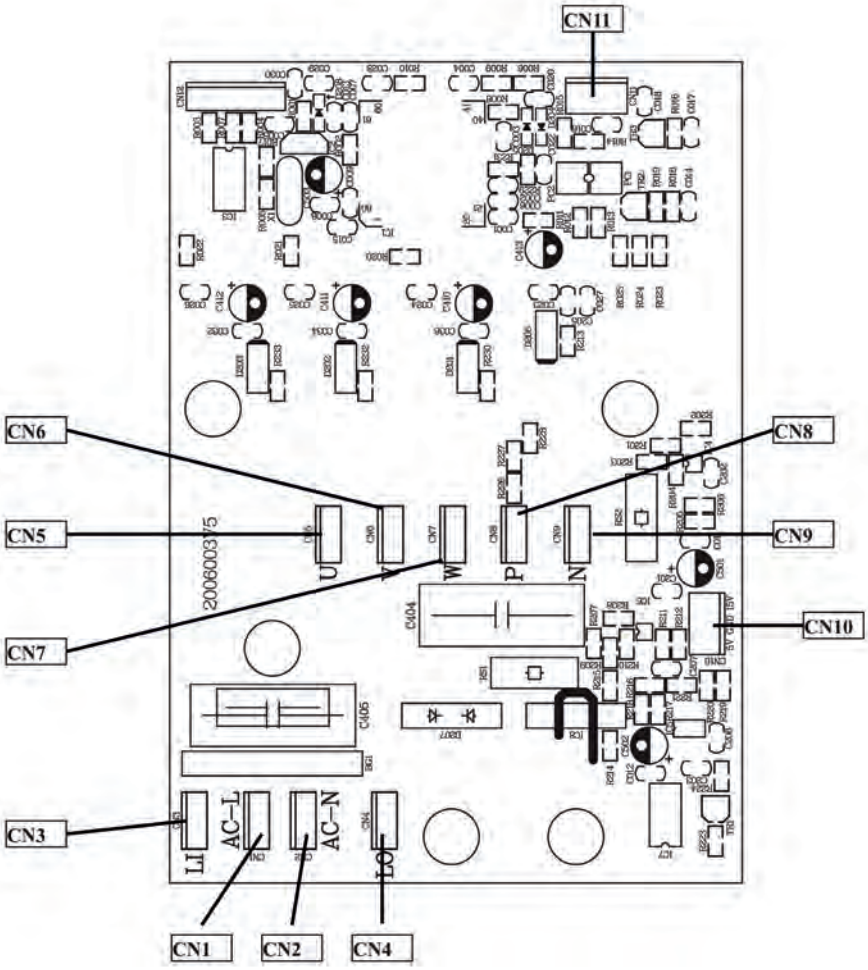
PCB(1) (Control PCB)

1) CN1,CN2 Connector for power N and L
2) CN3 Connector for ground
3) CN23 Connector for DC POWER 15Vand 5V to the module board
4) CN9,CN10 Connector for CN2,CN1 on the module board
5) CN22 Connector for fan motor
6) CN11 Connector for four way valve coil
7) CN17,CN18,CN19,CN20,CN21 Connector for thermistors
8)CN24 Connector for communicate between the control board and the module board
9) CN28,CN25 Connector to P and N of the module board
10) CN36 Connector for communicate between indoor and outdoor unit
11) CN15,CN16 Connector for electric expansion valves

PCB(2) (module PCB)

CN10 Connector for the DC power 5V and 15V form the control PCB
CN11 Connector for communicate between the control board and the module board
P(CN8), N(CN9) Connector for CN27,CN25 on the control board
LI (CN3),LO(CN4) Connector for reactor
AC_L(CN1),AC_N(CN2) Connector for CN10,CN9 on the control board
CN5(U), CN6(V), CN7(W) connector for the compressor

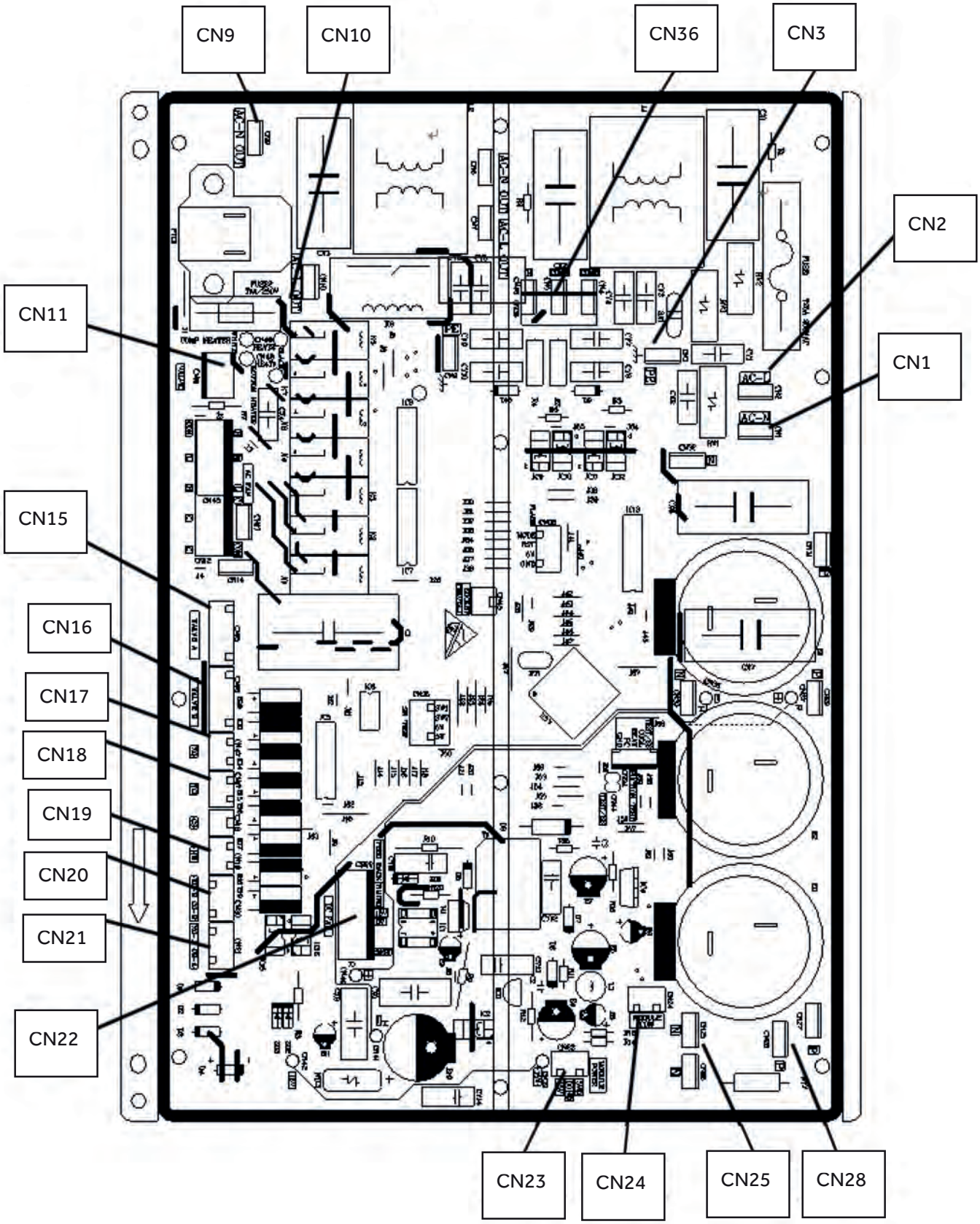
Note: Other Designations
PCB(1) (Control PCB)
1) FUSE 1, Fuse (25A,250VAC)
2)LED 1 keep light representative norma
3)RV1,RV2,RV3 Varistor



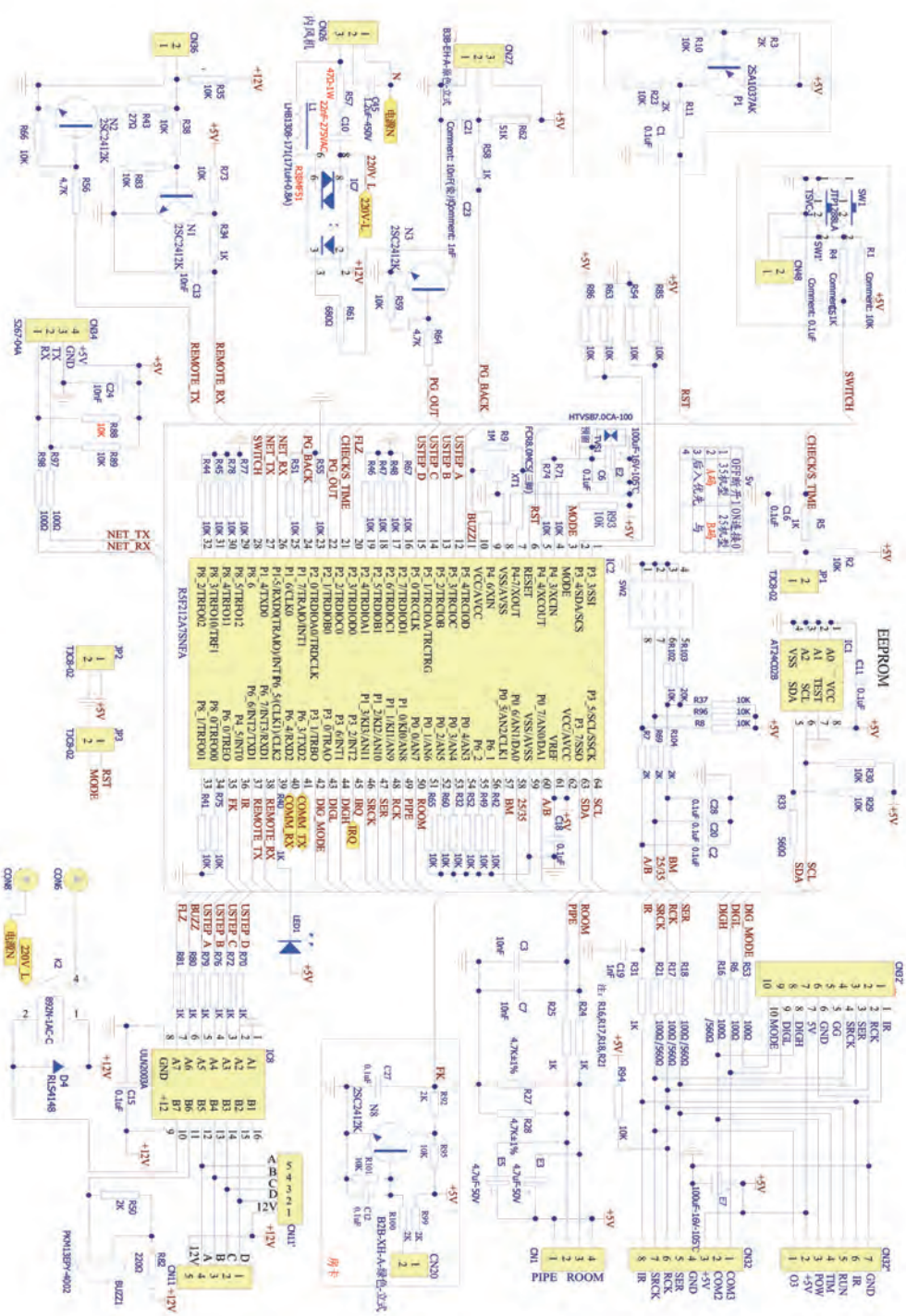
PCB(2)

Wiring

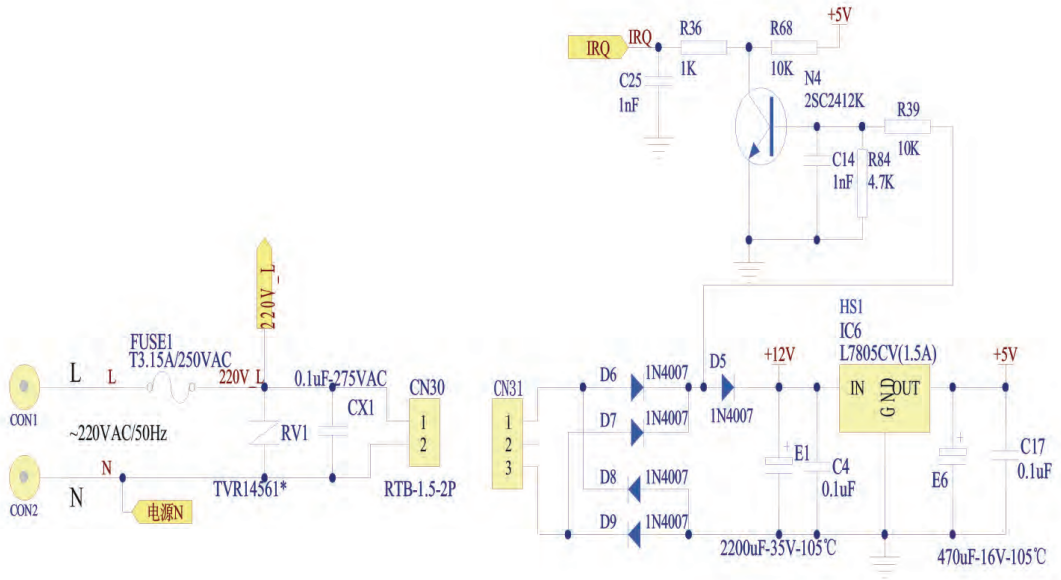
PCB(1)

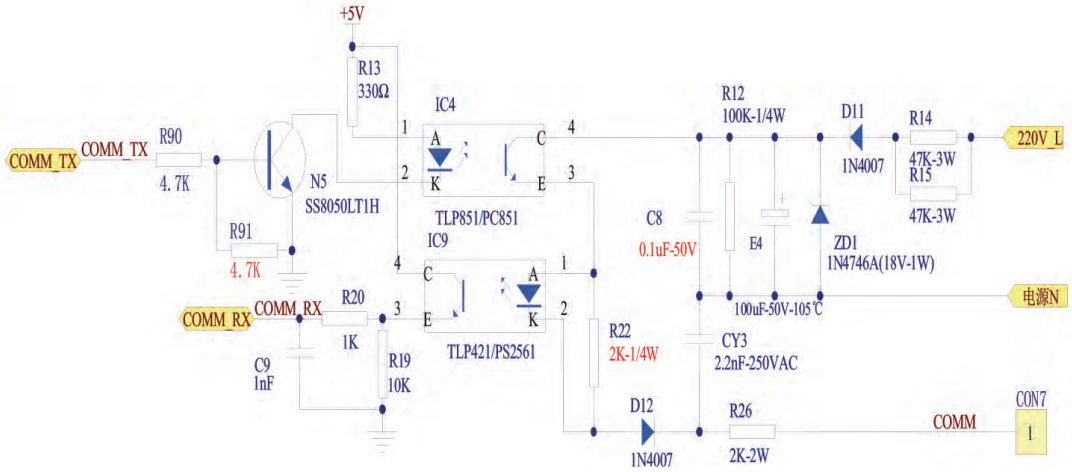

CN9
CN10
CN36
CN3
CN2
CN11
CN1
CN15
CN16
CN17
CN18
CN19
CN20
CN21
CN22
CN23
CN24
CN25
CN28

Circuit Diagrams



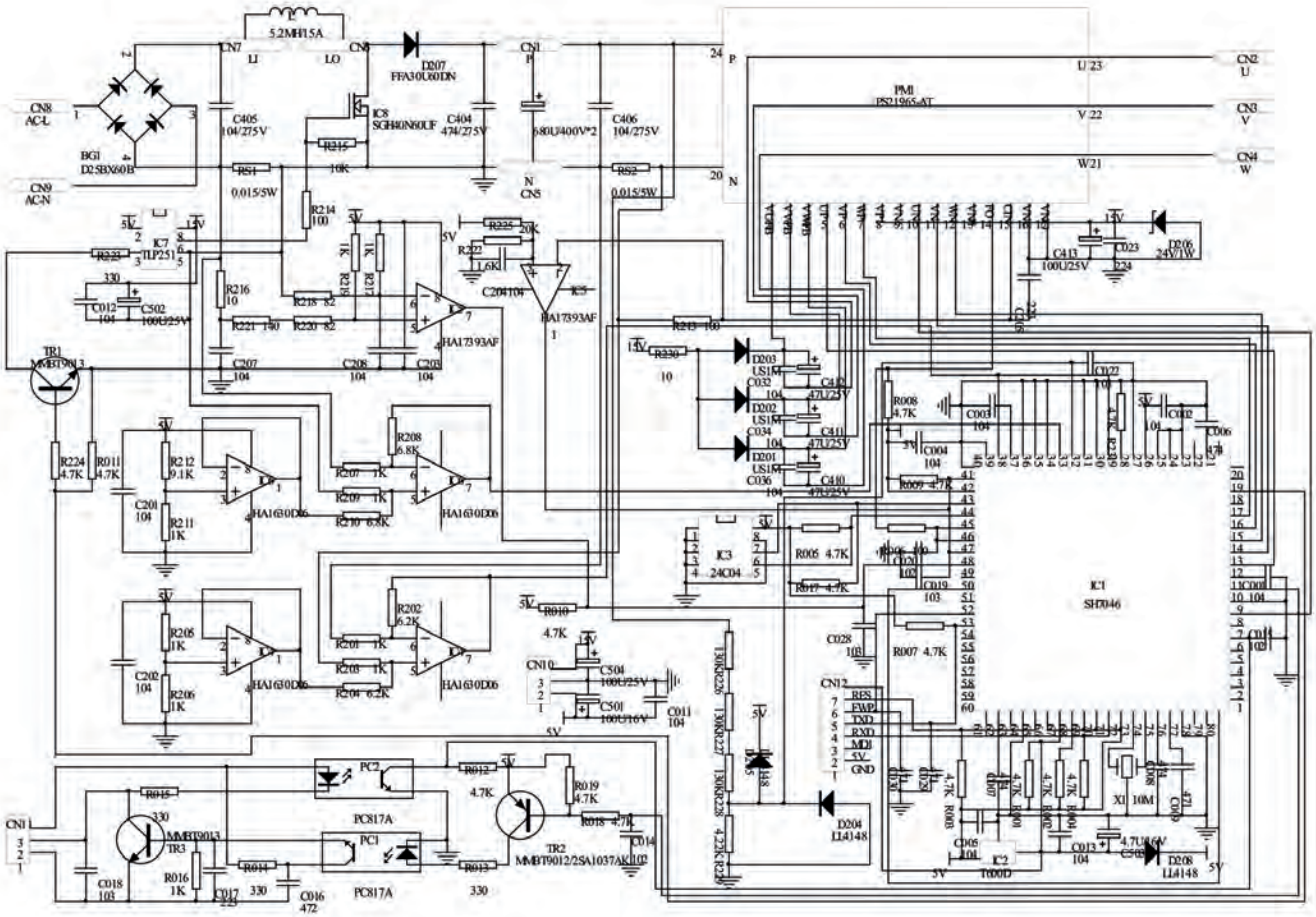
CIRCUIT DIAGRAMS





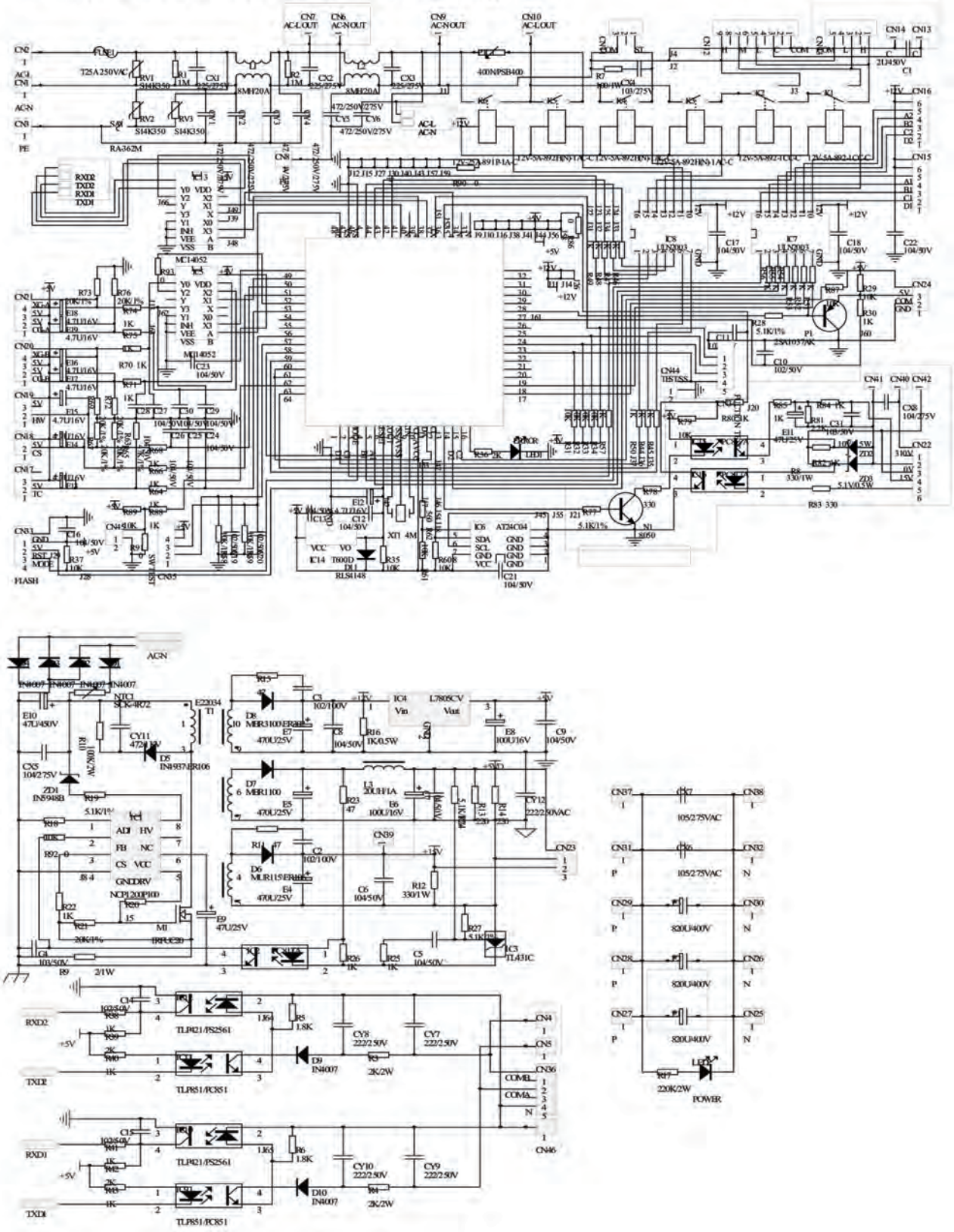
WIRING DIAGRAMS

Outdoor unit module board Circuit Diagram



WIRING DIAGRAMS

Outdoor unit control board Circuit Diagrams



2U - Piping Installation Dimensions

Model	09 12
Liquid pipe OD (mm)	Φ1/4（6.35）
Gas pipe OD. (mm)	Φ3/8（9.52）

Add Additional Refrigerant Charge when required

Model	**2U18MS2VH**
Max. liquid pipe length does not require additional refrigerant charge	L≤50ft (15m)
Additional refrigerant charge rate if needed	0.2OZ/ft (20g/m)
Maximum total refrigerant line length allowed	100 ft (30m)
Maximum vertical difference between indoor units and outdoor unit	50 ft (15m)
Maximum refrigerant line length from outdoor unit to any indoor unit	65ft (20m)

2U - Piping Installation Dimensions

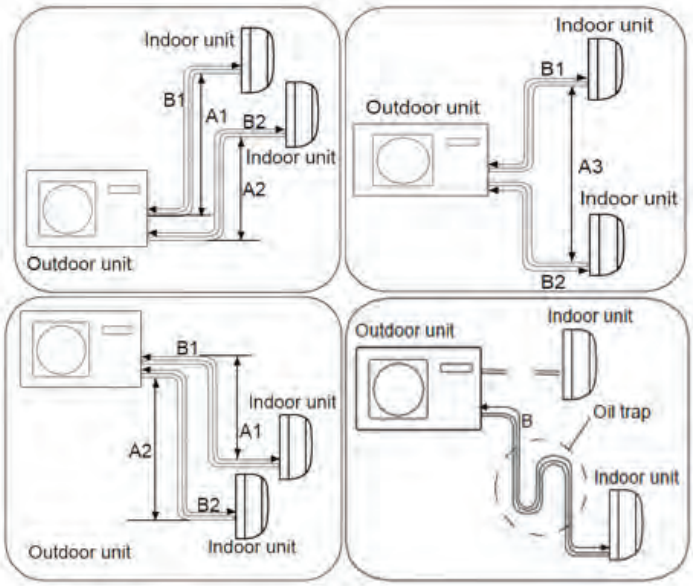
Example 1 - Adding Additional Refrigerant Charge

Item	Type	Refrigerant Line length	Refrigerant Line Vertical length
A	Wall mount	30 ft	20ft
B	Wall mount	35 ft	15ft
Total		65ft < 100 ft	35 ft < 50ft

1. Check if the layout meet all the requirement (Yes)
2. Check if additional charge needed (Yes)
3. Calculate additional charge: 0.2 Oz x (65 – 50) = 3 Oz

Conclusion: This layout is approved to be valid, but need additional refrigerant charge of 3Oz.

Pipe length limit of the system



Item	Max Elevation ft(m)		Max length ft(m)	
1	A1	50 ft (15m)	B1	65ft (20m)
2	A2	50 ft (15m)	B2	65ft (20m)
3	A3	50 ft (15m)	B1+B2	100 ft (30m)

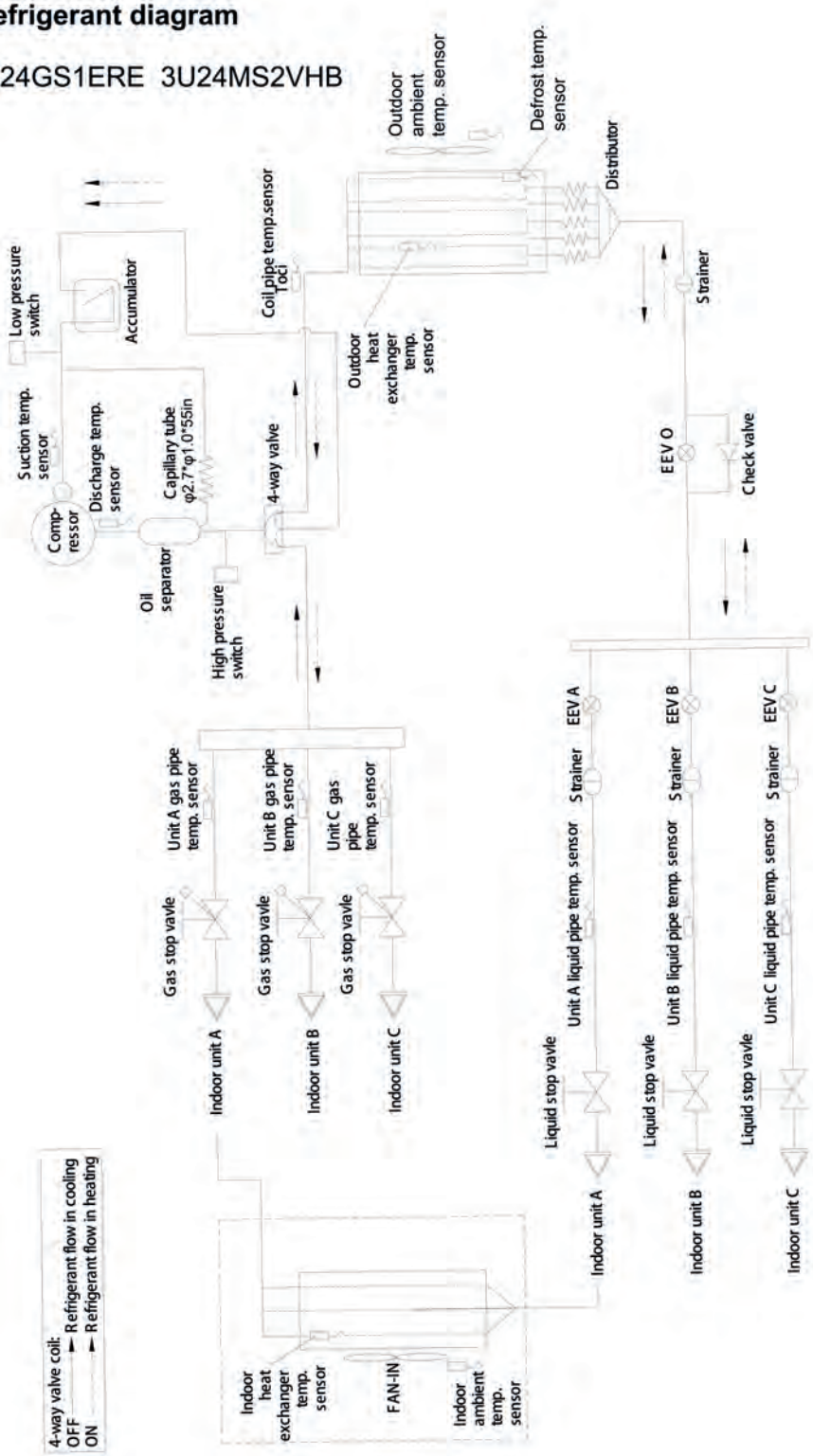
In case elevation B is more than 16 feet, the oil trap should be installed every 16 to 23 feet.

In case the total pipe length (B1+B2) is more than 66 feet, the refrigerant should be charged according to 66 g/ft (20g/m)

Refrigerant Diagram

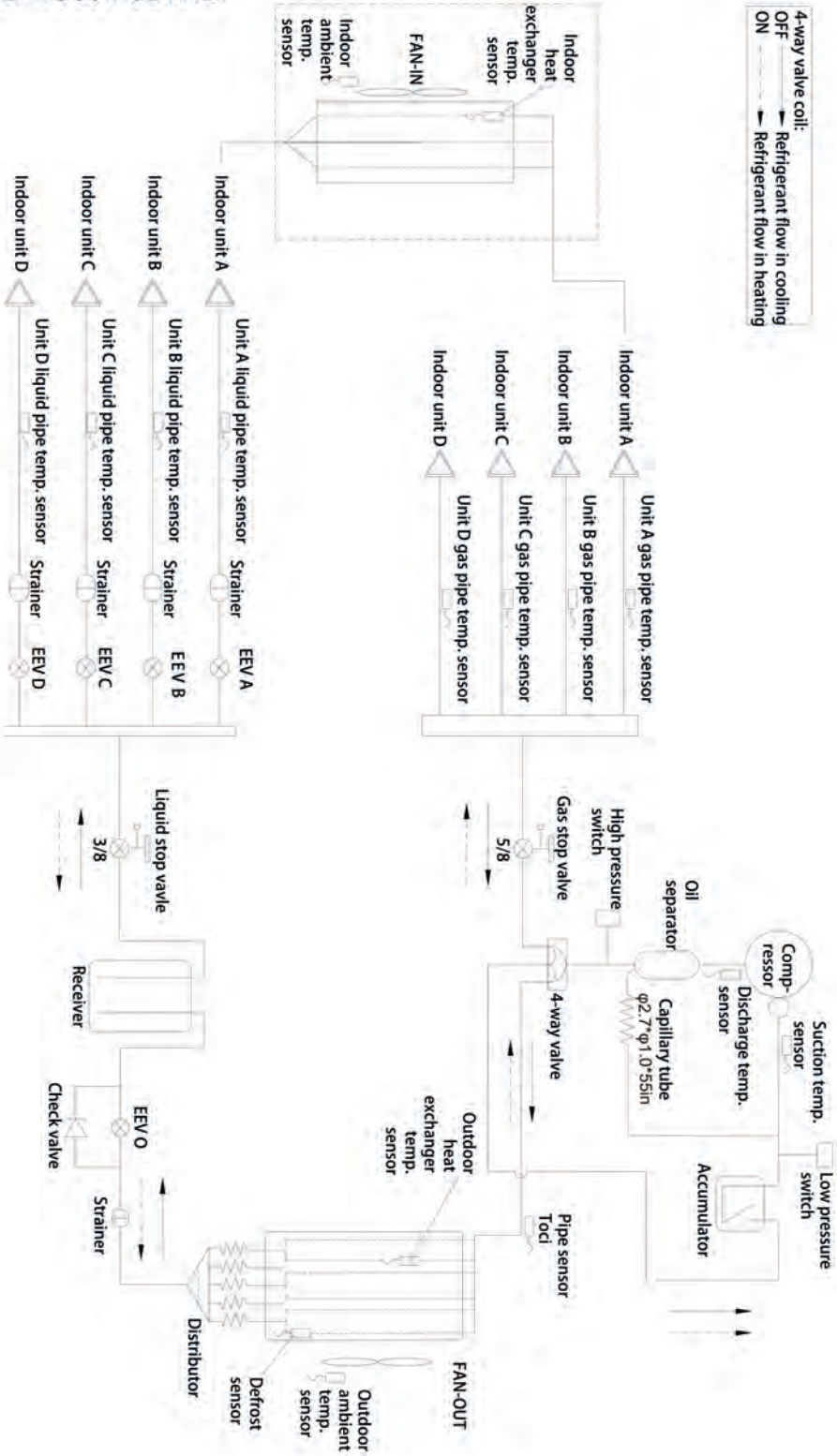
5. Refrigerant diagram

3U24GS1ERE 3U24MS2VHB



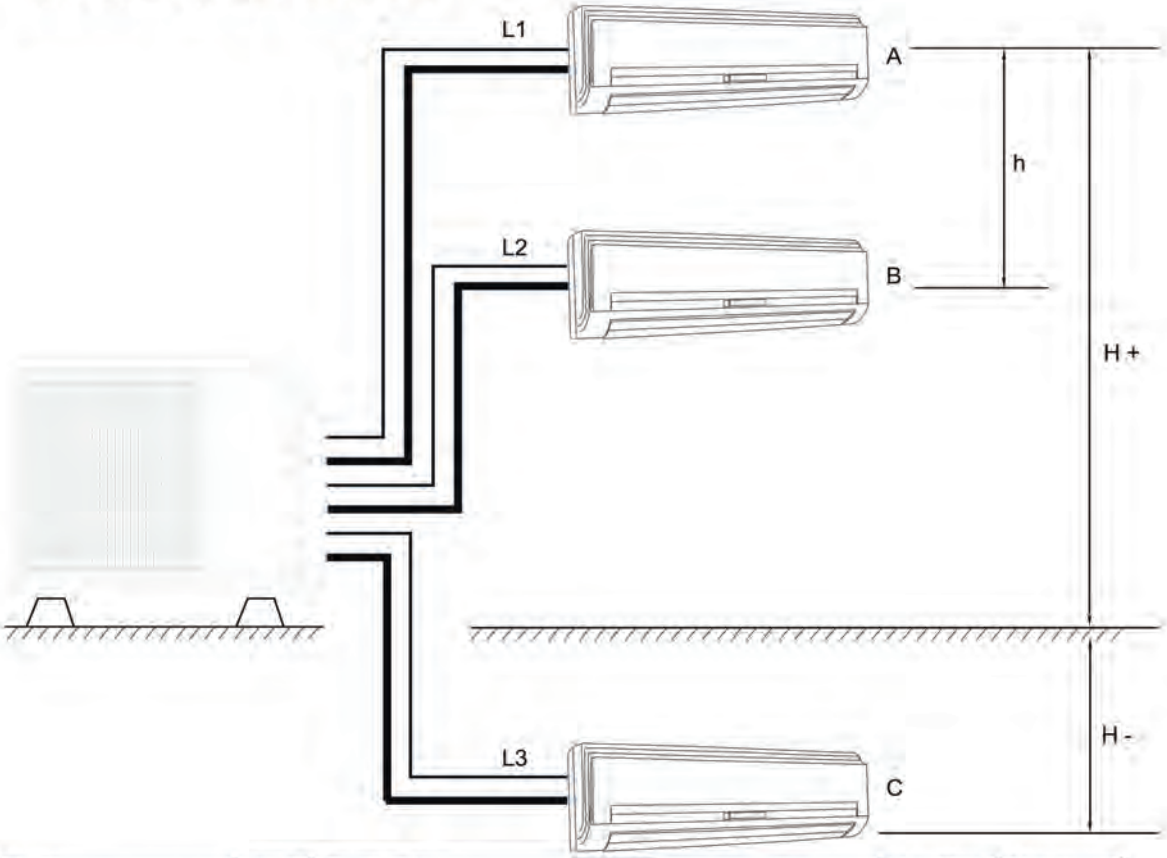
Refrigerant Diagram

4U36HS1ERE 4U36MS2VHB



6. Limitation values on pipe installation

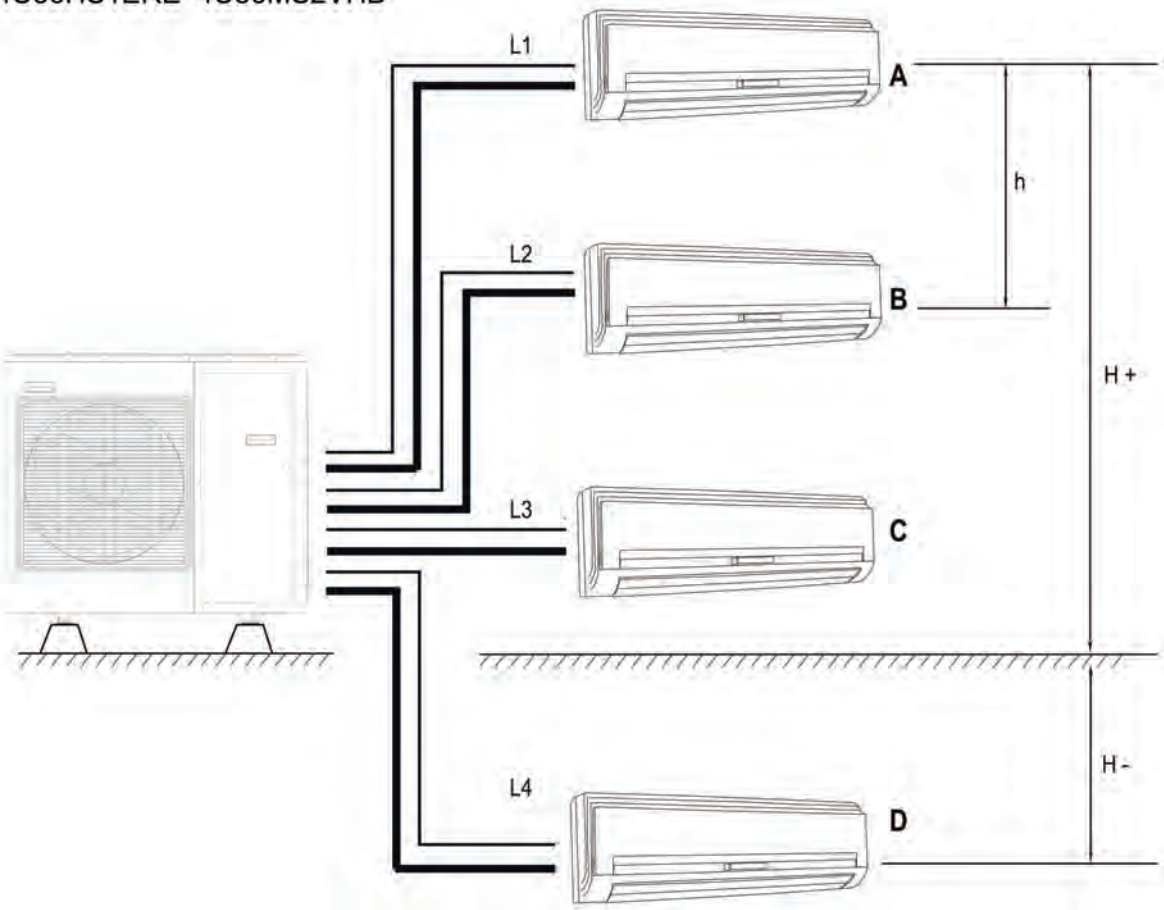
3U24GS1ERE 3U24MS2VHB



Item	unit	Description	Standard	Maximum
A,B,C liquid pipe	inch	Size of the liquid side connection pipe	Φ0.25	/
A,B,C gas pipe	inch	Size of the gas side connection pipe	Φ0.375	/
L1(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L2(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L3(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L1+L2+L3	ft	Total liquid piping length	≤9.1	≤15.2
h	ft	Drop between every two indoor units when the location of the outdoor unit is among indoor units	≤0.3	≤4.5
	ft	Drop between every two indoor units when the location of the outdoor unit is at one side of indoor units	≤0.3	≤2.2
H+	ft	Drop between the outdoor unit and the indoor unit	≤1.51	≤4.5
H-	ft	Drop between the outdoor unit and the indoor unit when the location of outdoor unit is among the indoor units	≤1.5	≤2.2
	ft	Drop between the outdoor unit and the indoor unit when the location of outdoor unit is at one side of indoor units	≤1.5	≤4.5

4U - Piping Installation Dimensions

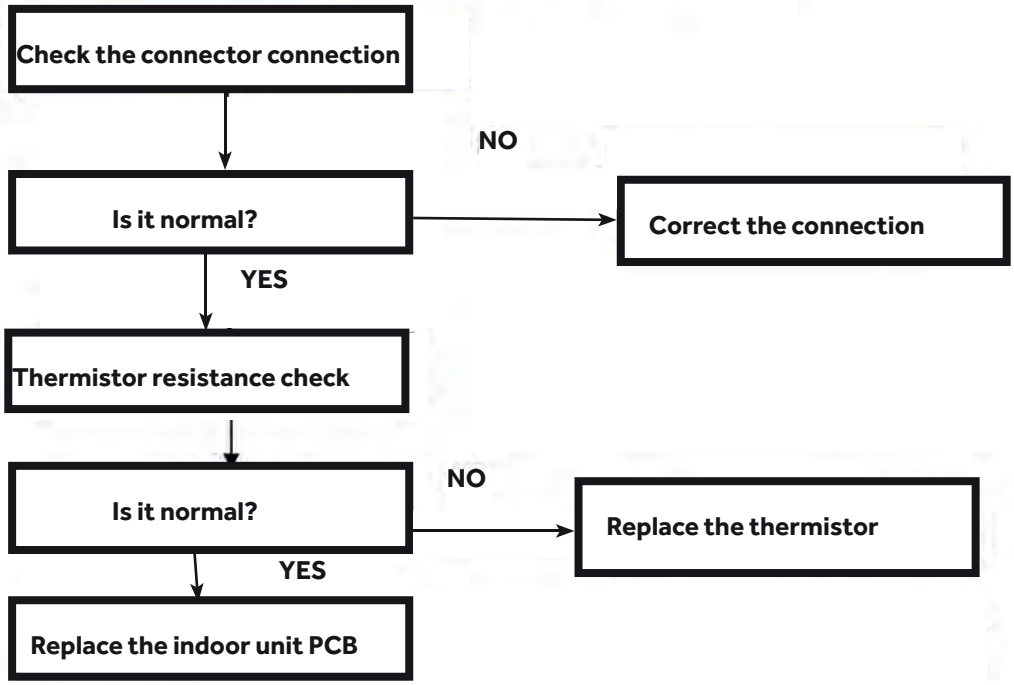
4U36HS1ERE 4U36MS2VHB



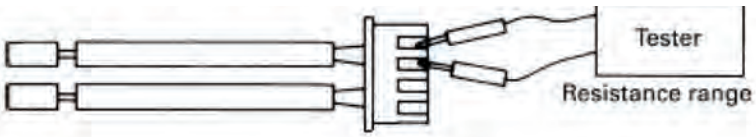
Item	unit	Description	Standard	Maximum
A,B,C liquid pipe	inch	Size of the liquid side connection pipe	Φ0.25	/
A,B,C gas pipe	inch	Size of the gas side connection pipe	Φ0.375	/
D gas pipe			Φ0.5	
L1(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L2(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L3(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L3(one way)	ft	Max.piping length between IU and OU of the way	≤3.1	≤7.6
L1+L2+L3+L4	ft	Total liquid piping length	≤12.1	≤21.3
h	ft	Drop between every two indoor units when the location of the outdoor unit is among indoor units	≤0.3	≤4.5
	ft	Drop between every two indoor units when the location of the outdoor unit is at one side of indoor units	≤0.3	≤2.2
H+	ft	Drop between the outdoor unit and the indoor unit	≤1.51	≤4.5
H-	ft	Drop between the outdoor unit and the indoor unit when the location of outdoor unit is among the indoor units	≤1.5	≤2.2
	ft	Drop between the outdoor unit and the indoor unit when the location of outdoor unit is at one side of indoor units	≤1.5	≤4.5

Thermistor or Related Abnormality

Indoor display	E1: Room temperature sensor failure E2: Heat-exchange sensor failure
Outdoor display	LED1 flashes 10 times: Defrost temperature sensor failure LED1 flashes 11 times: Suction temperature sensor failure LED1flashes 12 times: Ambient temperature sensor failure LED1 flashes 13 times: Discharge temperature sensor failure
Method of malfunction tection	The temperatures detected by the thermistors are used to determine thermistor errors
Malfunction detection conditions	When the thermistor input is more than4.92V or less than 0.08V during compressor operation ● Note: The values vary slightly in some models
*Thermistor resistance check	■ Faulty connector connection ■ Faulty thermistor ■ Faulty PCB
Troubleshooting	Caution: Be sure to turn power off before connecting or disconnecting the connector, or parts may sustain damage.



Thermistor resistance check method:
Remove the connector of the thermistor from the PCB and measure the resistance of the thermistor using an ohmmeter. The relationship between normal temperature and resistance is shownin the indoor thermistor chart located in the reference section.



EEPROM abnormal

Indoor Display	E4: Indoor EEPROM error
outdoor display	F12: Outdoor EEPROM error; Outdoor LED flashes 1 time
Method of malfunction detection	The Data detected by the EEPROM are used to determine MCU
Malfunction detection conditions	When the data of the EEPROM is in error or the EEPROM is damaged
Supposed causes	■Faulty EEPROM data ■Faulty EEPROM ■Faulty PCB
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.

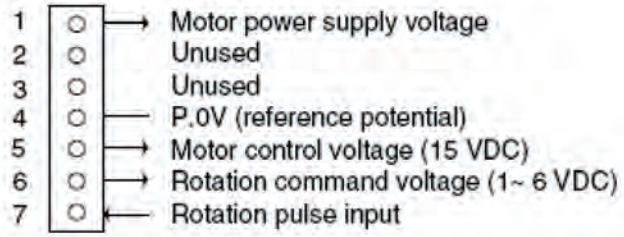
Replace the indoor or outdoor main board

Indoor fan motor malfunction

Indoor Display	E14
Method of Malfunction Detection	The rotation speed detected by the Hall IC during fan motor operation is used to determine abnormal fan motor operation
Malfunction Decision Conditions	When the detection rotation signal is not received in 2 minutes
Supposed Causes	■ Operation halts due to broken connections inside the fan motor ■ Fan motor overheat protection ■ Operation halts due to broken fan motor lead wires ■ Detection error due to faulty indoor unit PCB
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.

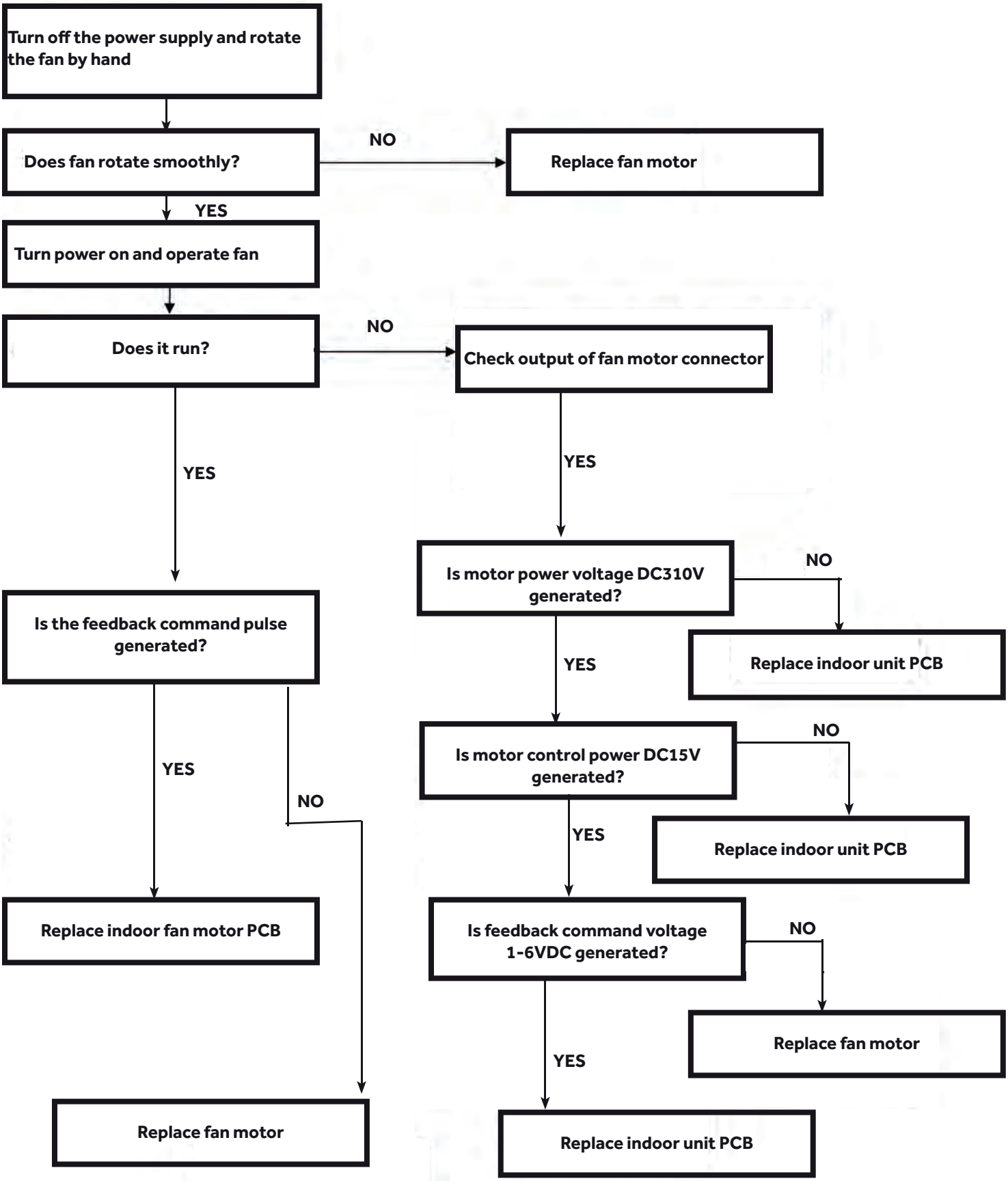
How to Check the Fan Motor (DC)

1. Check connector connection.
2. Check motor power supply voltage output (pins 1-4).
3. Check motor control voltage (pins 4-5).
4. Check rotation command voltage output (pins 4-6).
5. Check rotation pulse input (pins 4-7).



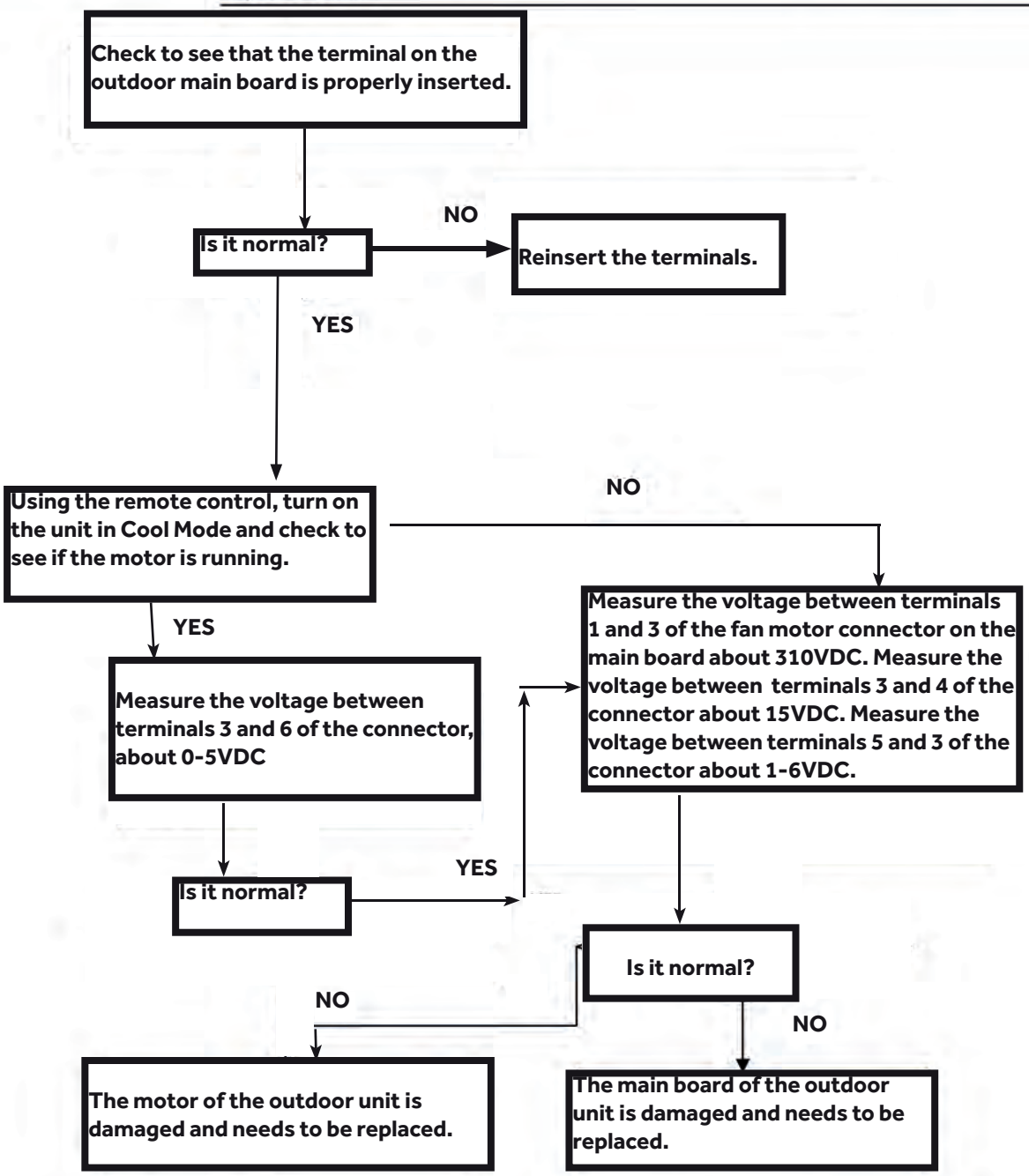
Note: When the unit is operating, do not remove or insert plugs in order to avoid damage to the motor.

FLOW CHARTS


Turn off the power supply and rotate the fan by hand
Does fan rotate smoothly?
NO
Replace fan motor
YES
Turn power on and operate fan
Does it run?
NO
Check output of fan motor connector
YES
YES
Is the feedback command pulse generated?
YES
NO
Replace indoor fan motor PCB
Replace fan motor
Is motor power voltage DC310V generated?
NO
Replace indoor unit PCB
YES
Is motor control power DC15V generated?
NO
Replace indoor unit PCB
YES
Is feedback command voltage 1-6VDC generated?
NO
Replace fan motor
YES
Replace indoor unit PCB

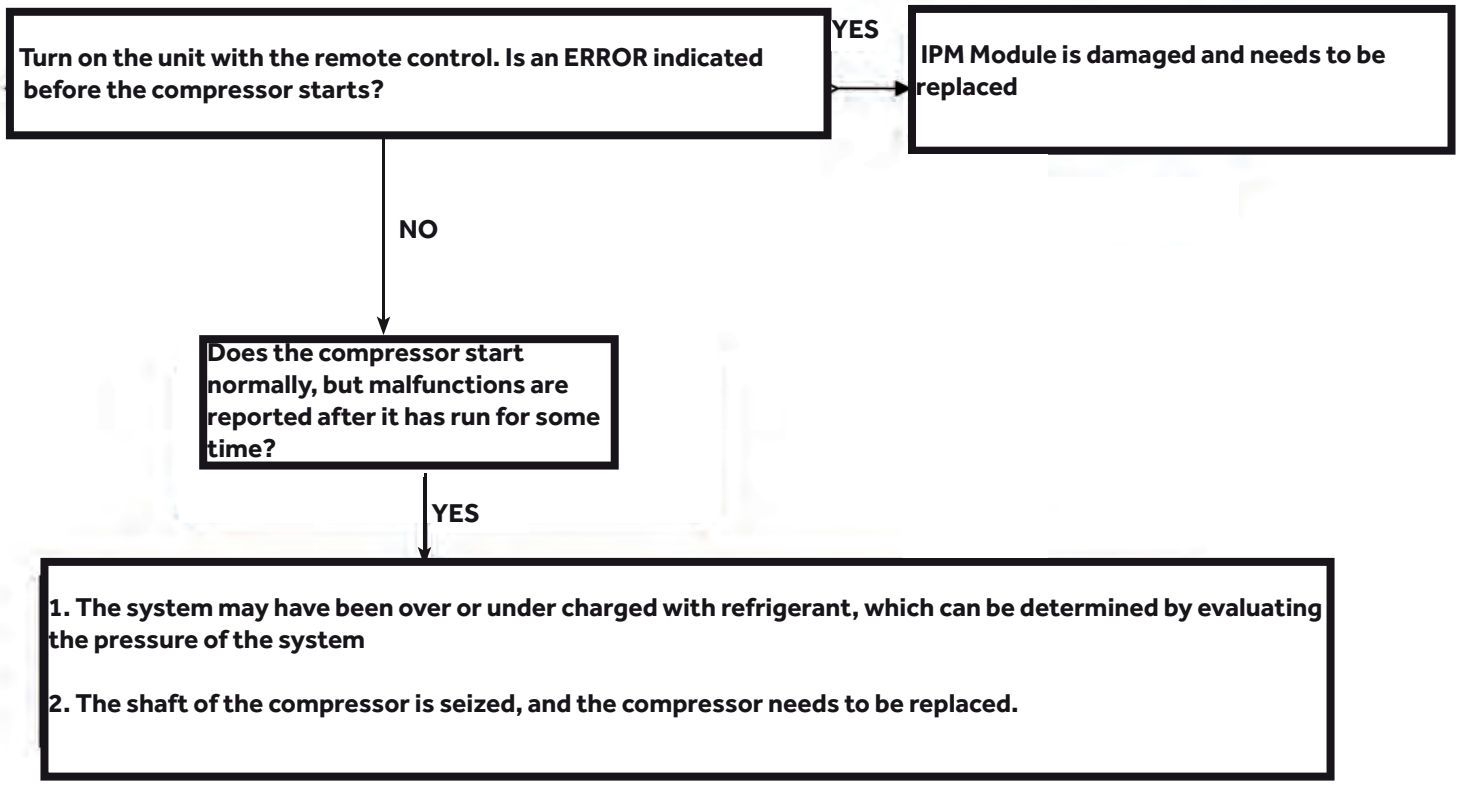
9.4.4 Outdoor DC fan motor fault

Outdoor diplay	LED 1 flashes 9 times
Method of malfunction detection	DC fan motor error is detected by checking the fan running condition
Malfunction detection conditions	When the data of the EEPROM is in error or the EEPROM is damaged
Supposed causes	• DC fan motor protection due to a fault in the DC fan motor • DC fan motor protection due to faulty PCB
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



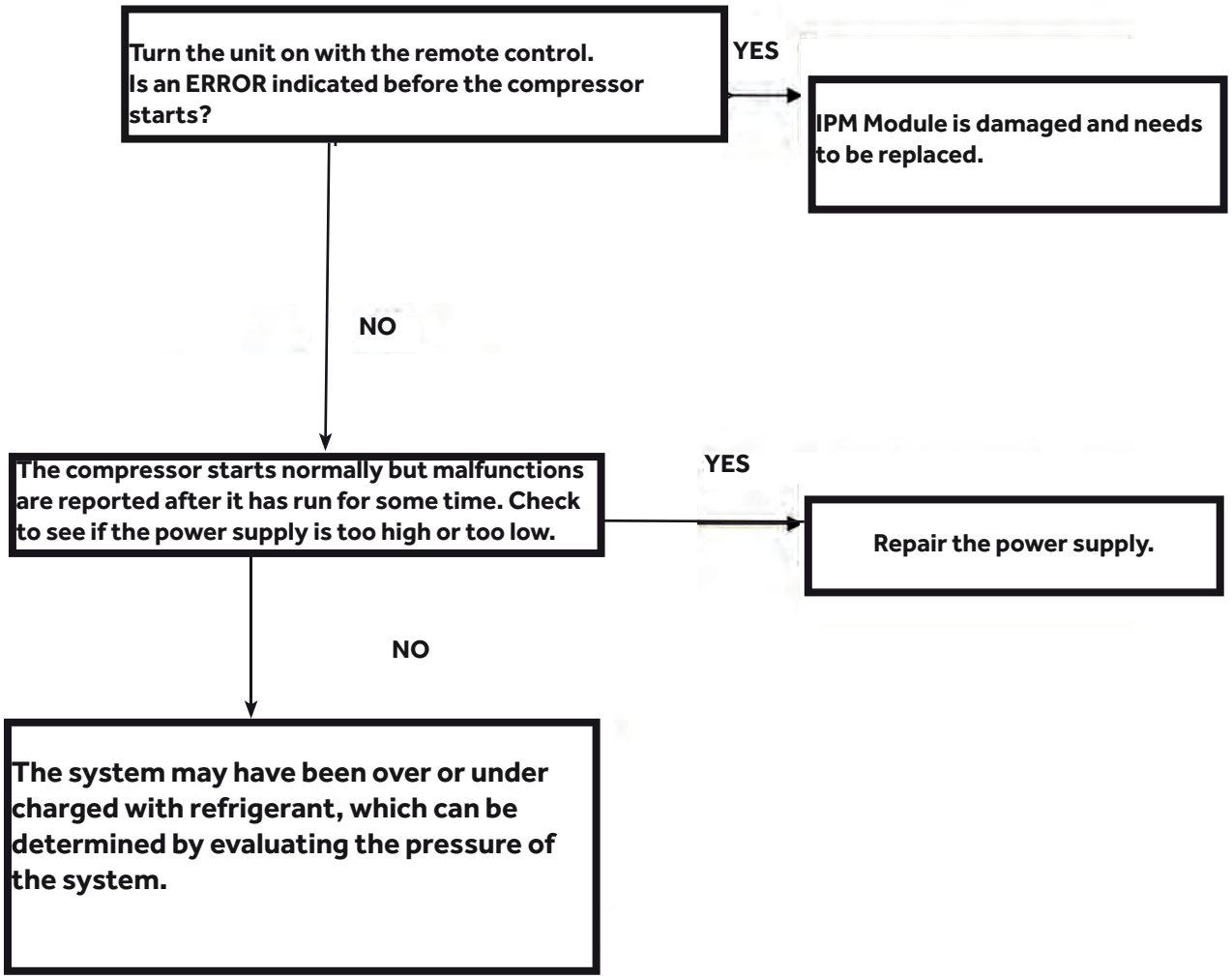
9.4.5 IPM protection

Outdoor diplay	LED 1 flashes 2 times
Method of malfunction detection	IPM protection is detected by checking the operating condition of the compressor
Malfunction detection conditions	• The sytem leads to IPM protection due to overcurrent • A compressor fault leads to IPM protection • Circuit component of IPM is broken and leads to IPM protection
Supposed causes	• IPM protection due to compressor fault • IPM protection due to faulty PCB of IPM module • Circuit component of IPM is broken and caused IPM protection
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



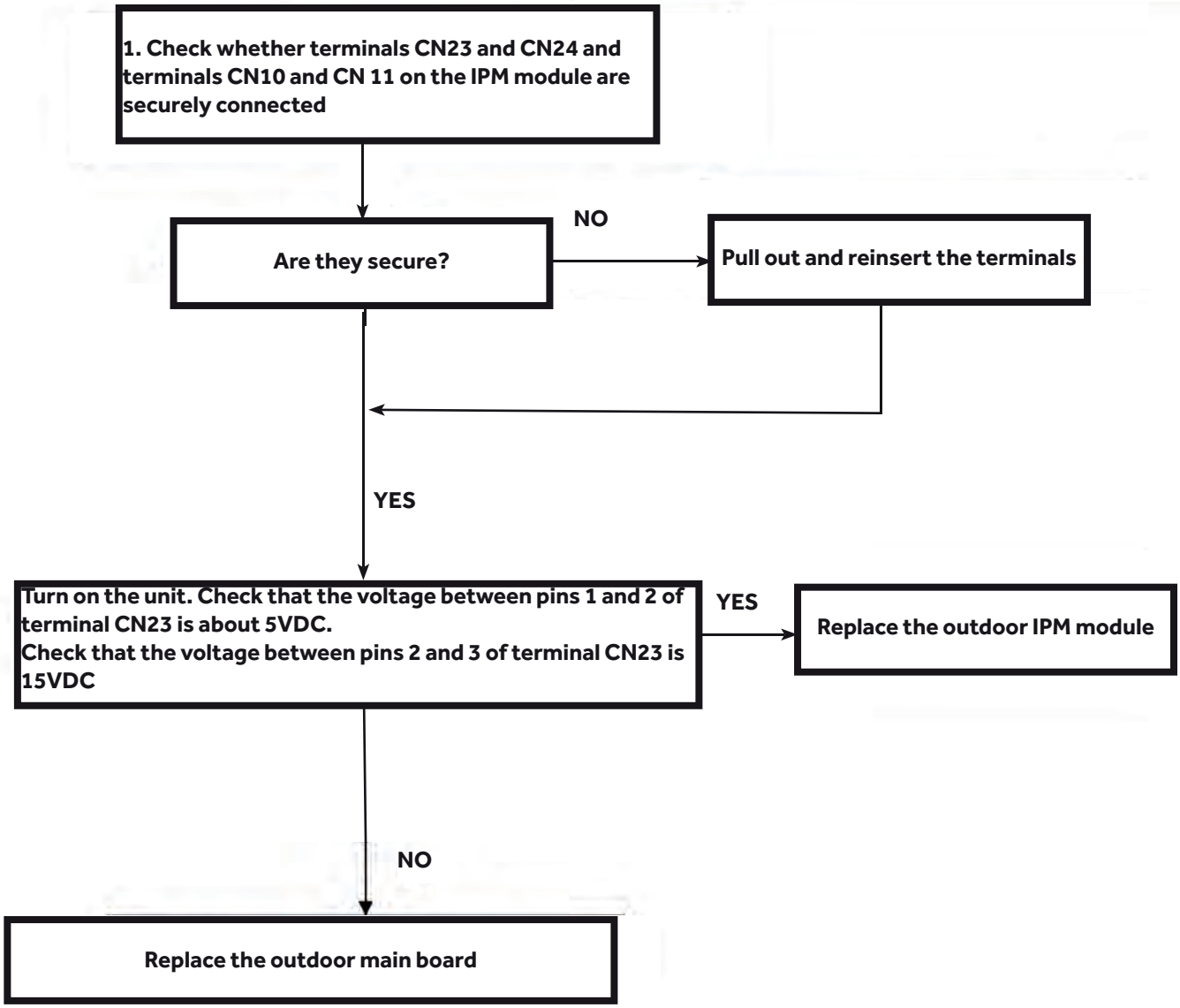
Over-current of the compressor

Outdoor diplay	LED1 flashes 3 , 24, 25 times
Method of malfunction detection	The current of the compressor is too high
Malfunction detection conditions	When the IPM module is damaged or the compressor is damaged. The power supply voltage is too high or too low.
Supposed causes	■Faulty IPM Module ■ Faulty compressor ■Faulty power supply
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



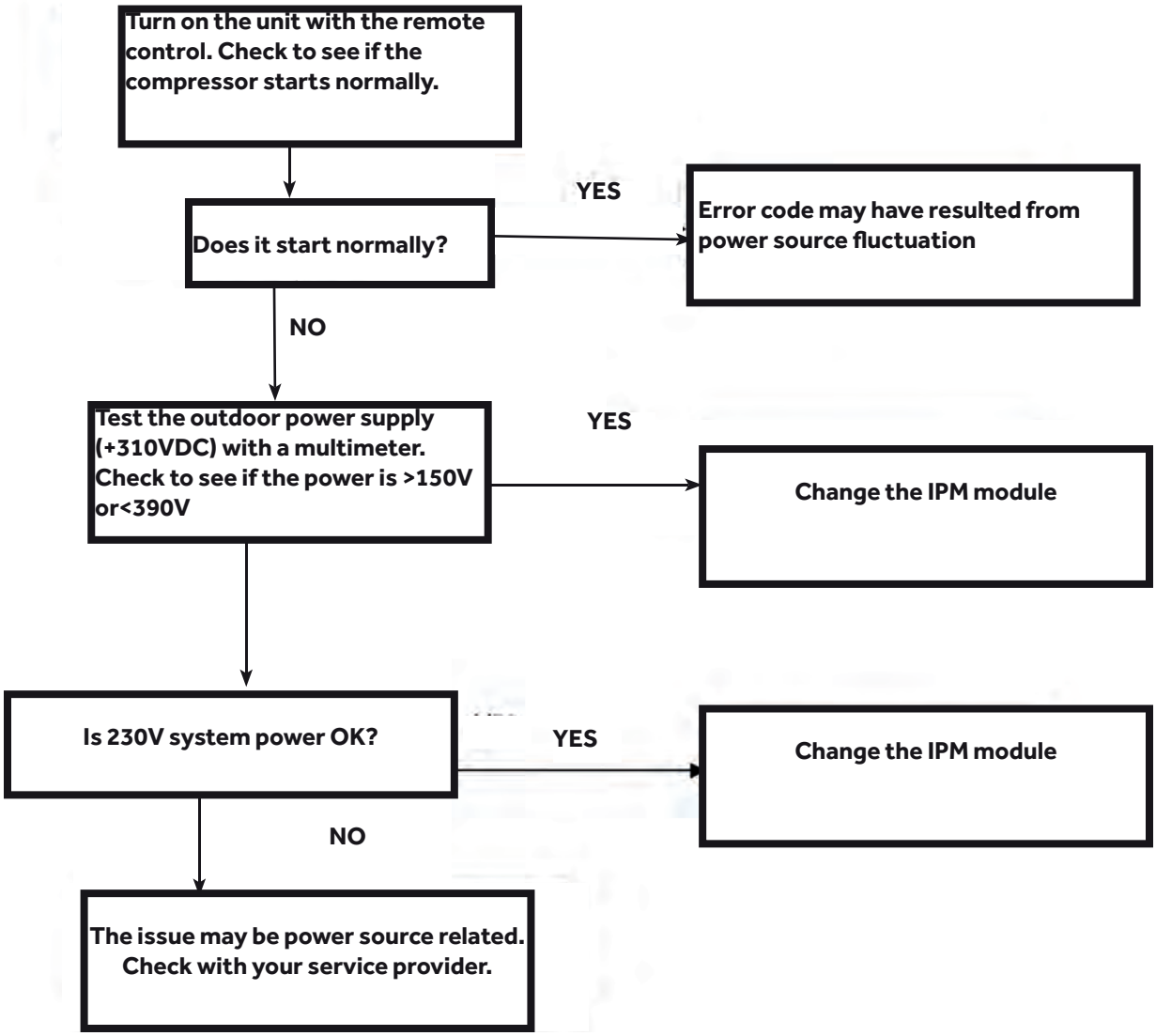
9.4.7 The communication fault between IPM and outdoor PCB

Outdoor diplay	LED1 flashes 4 times
Method of malfunction detection	Communication is detected by checking the IPM module and the outdoor PCB
Malfunction detection conditions	• The outdoor PCB is defective and will lead to a communication fault • The IPM module is defective and will lead to a communication fault
Supposed causes	•The outdoor PCB is defective •The IPM Module is defective • Communication wiring connections
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



9 .4.8 Power Supply Over or under voltage fault

Outdoor diplay	LED1 flashes 6 times	The power supply is over voltage
Method of malfunction detection	An abnormal voltage rise or fall is detected by checking the specified voltage detection	
Malfunction detection conditions	A voltage signal is fed from the voltage detection circuit to the microcomputer	
Supposed causes	• Improper supply voltage •The IPM Module is defective • The outdoor PCB is defective	
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.	



9.4.9 Overheat Protection For Discharge Temperature

Outdoor diplay	LED1 flashes 8 times
Method of malfunction detection	The Discharge temperature control is checked with the temperature being detected by the Discharge pipe thermistor
Malfunction detection conditions	When the temperature compressordischarge temperature is above 230°F
Supposed causes	■Electronic expansion valve defective ■Faulty thermistor ■Faulty PCB
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.

Turn on the unit with the remote control. Measure the temperature at the exhaust temperature sensor of the compressor on the outdoor unit.

↓

Does the temperature exceed 230°F?

→ **YES** → **The refrigerant may have leaked during installation or there may be leakage in the piping system. There may be other causes for the overly high exhaust temperature.**

↓ **NO**

Malfunctions occur after running for some time even though the temperature is running below 230°F.

Pull out the exhaust sensor and measure its resistance at standard temperatures according to the resistance temperature table

↓

Is there a deviation in the results?

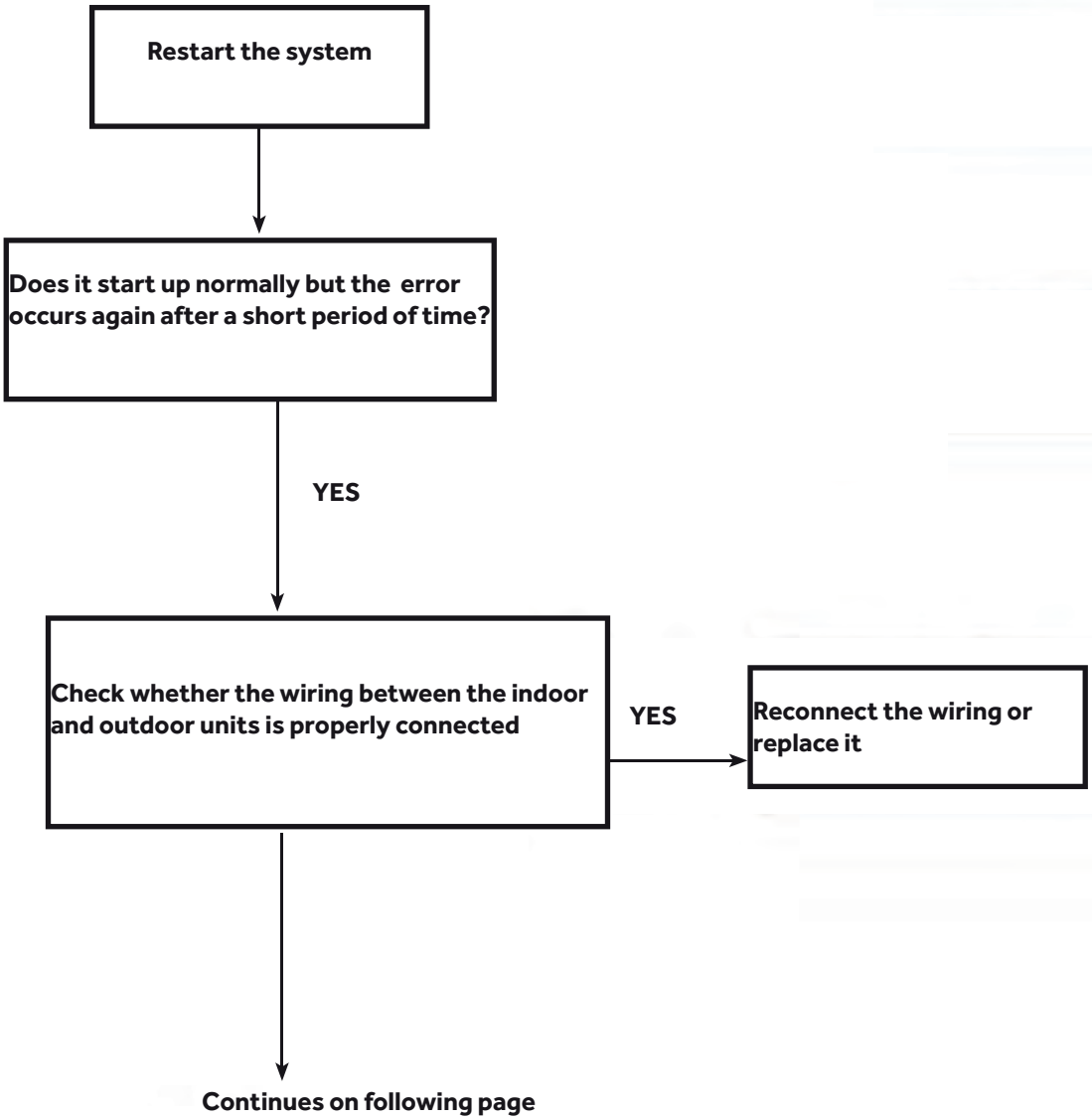
→ **YES** → **The sensor is damaged and must be replaced.**

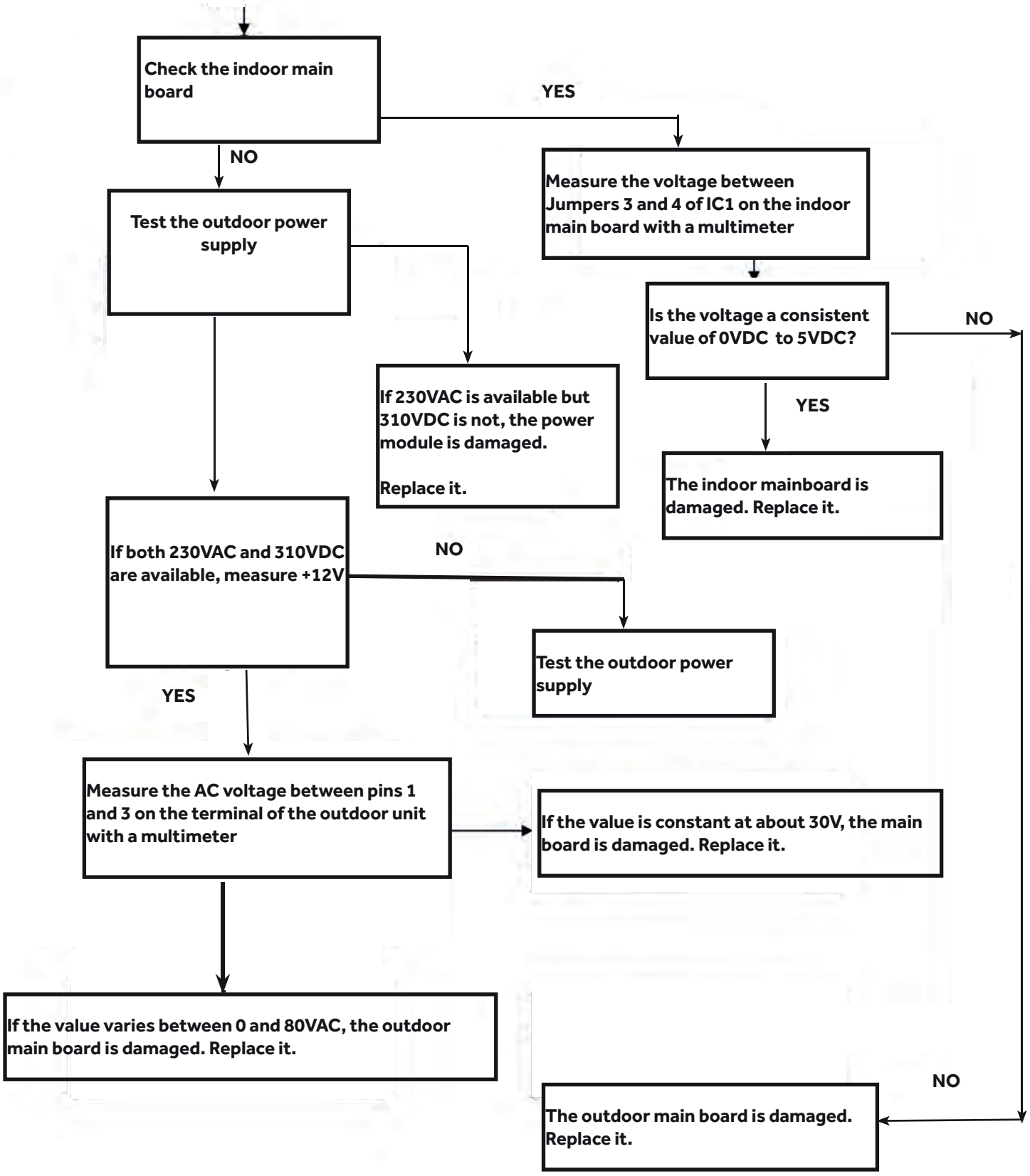
↓ **NO**

The outdoor mainboard is damaged and must be replaced.

The communication fault between indoor and outdoor

indoor diplay	E7
Outdoor diplay	LED1 flashes 15 times
Method of malfunction detection	Communication is detected by checking the indoor PCB and the outdoor PCB
Malfunction detection conditions	• A defective outdoor PCB can cause communication errors • A defective indoor PCB can cause communication errors
Supposed causes	•The indoor PCB is defective •The outdoor PCB is defective • The Module PCB is defective • Communication wiring is disconnected
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.

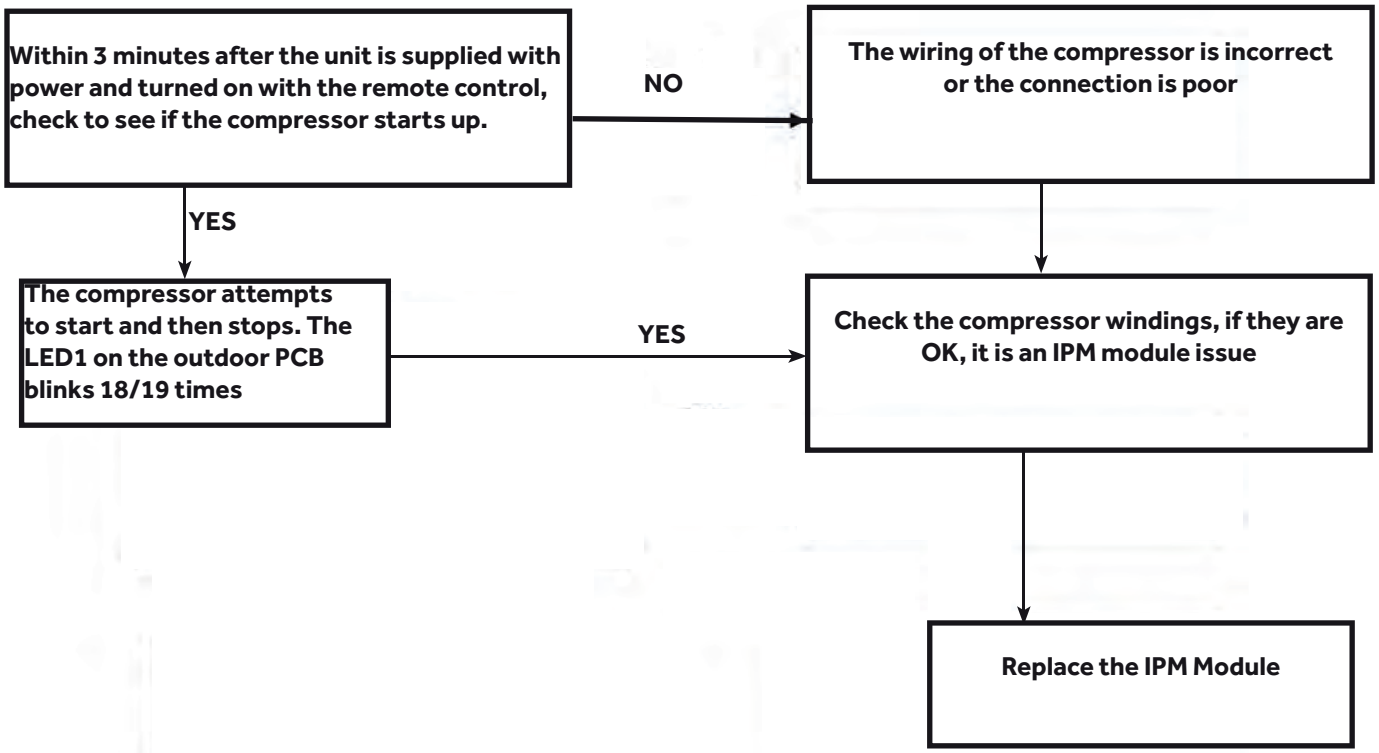



Check the indoor main board
YES
NO
Measure the voltage between Jumpers 3 and 4 of IC1 on the indoor main board with a multimeter
Test the outdoor power supply
Is the voltage a consistent value of 0VDC to 5VDC?
NO
YES
If 230VAC is available but 310VDC is not, the power module is damaged.
Replace it.
The indoor mainboard is damaged. Replace it.
If both 230VAC and 310VDC are available, measure +12V
NO
Test the outdoor power supply
YES
Measure the AC voltage between pins 1 and 3 on the terminal of the outdoor unit with a multimeter
If the value is constant at about 30V, the main board is damaged. Replace it.
If the value varies between 0 and 80VAC, the outdoor main board is damaged. Replace it.
NO
The outdoor main board is damaged. Replace it.

Loss of synchronism detection

Inverter side current detection is abnormal

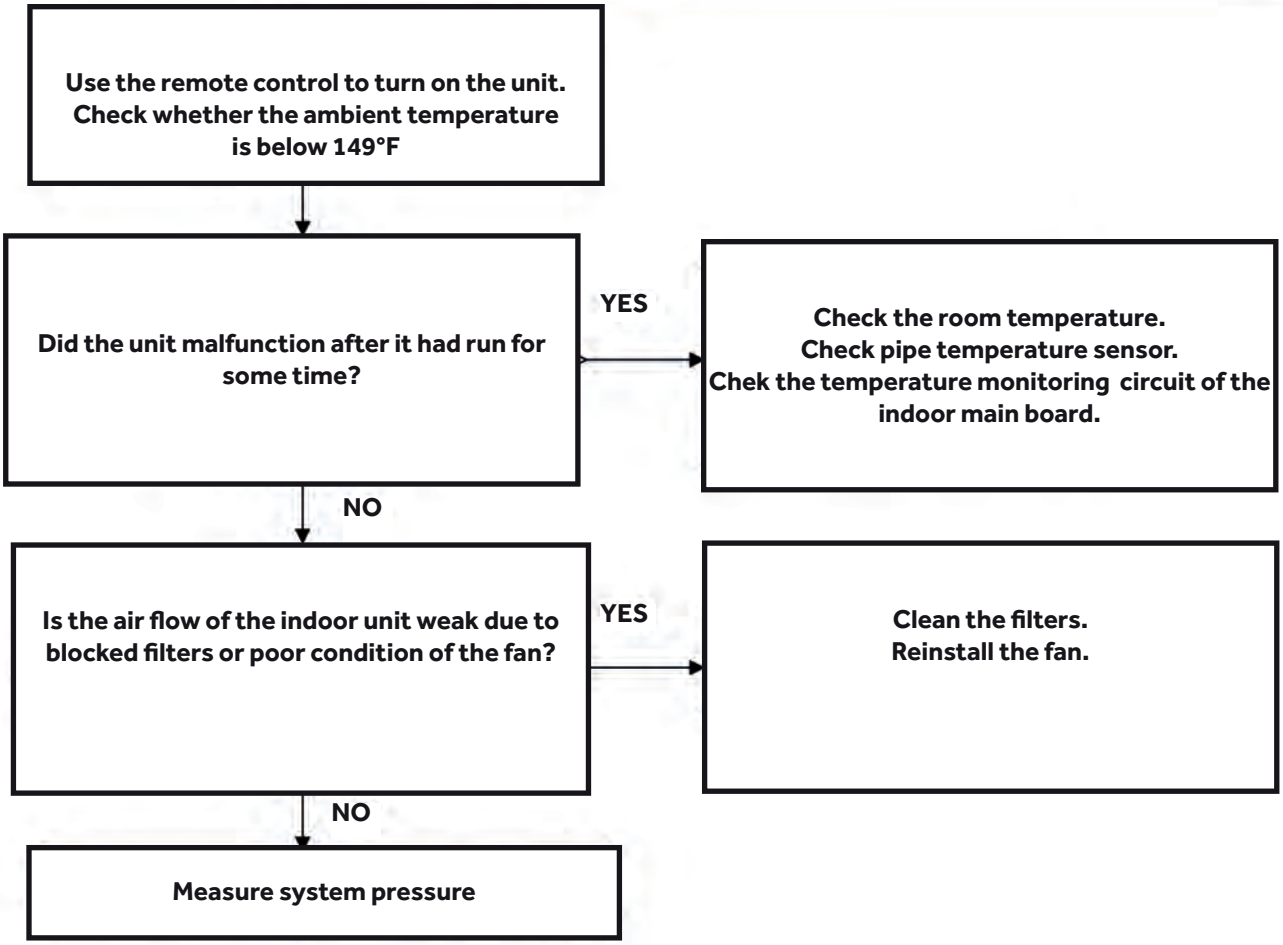
Outdoor diplay	LED1 flash 18 times LED1 flash 19 times
Method of malfunction detection	The position of the compressor rotor can not detected normally
Malfunction detection conditions	when the wiring of compressor is wrong or the connection is poor; or the compressor is damaged
Supposed causes	■Faulty The wiring of compressor ■Faulty compressor ■Faulty PCB
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



High work-intense protection

Outdoor diplay: LED1 flashes 21 times

Method of malfunction detection	High work-intense control is activated in the heating mode if the temperature being sensed by the heat exchanger thermistor exceeds the limit.
Malfunction detection conditions	Activated when the temperature being sensed by the heat exchanger rises above 149°F twice in 30 minutes
Supposed causes	■Faulty electronic expansion valve ■Dirty heat exchanger ■Faulty heat-exchange sensor ■Insufficient gas
Troubleshooting	Caution: Be sure to turn power switch off before connecting or disconnecting the connector, or parts may sustain damage.



Value of Thermistor - Indoor Unit

Room sensor and Pipe Sensor

R77°F=10KΩ±3%;

B77°F/122°F=3700K±3%;

Temp.((°F))	Max.(KΩ)	Normal(KΩ)	Min.(KΩ)	Tolerance(°F)	
-22	165.217	147.9497	132.3678	-3.492	3.15
-20.2	155.5754	139.56	125.0806	-3.474	3.132
-18.4	146.5609	131.7022	118.2434	-3.438	3.114
-16.6	138.1285	124.3392	111.8256	-3.402	3.078
-14.8	130.2371	117.4366	105.7989	-3.366	3.06
-13	122.8484	110.9627	100.1367	-3.33	3.042
-11.2	115.9272	104.8882	94.8149	-3.294	3.006
-9.4	109.441	99.1858	89.8106	-3.258	2.988
-7.6	103.3598	93.8305	85.1031	-3.24	2.952
-5.8	97.6556	88.7989	80.6728	-3.204	2.934
-4	92.3028	84.0695	76.5017	-3.168	2.916
-2.2	87.2775	79.6222	72.5729	-3.132	2.88
-0.4	82.5577	75.4384	68.871	-3.096	2.862
1.4	78.123	71.501	65.3815	-3.06	2.826
3.2	73.9543	67.7939	62.0907	-3.024	2.79
5	70.0342	64.3023	58.9863	-2.988	2.772
6.8	66.3463	61.0123	56.0565	-2.952	2.736
8.6	62.8755	57.911	53.2905	-2.916	2.718
10.4	59.6076	54.9866	50.6781	-2.88	2.682
12.2	56.5296	52.2278	48.2099	-2.844	2.646
14	53.6294	49.6244	45.8771	-2.808	2.628
15.8	50.8956	47.1666	43.6714	-2.772	2.592
17.6	48.3178	44.8454	41.5851	-2.718	2.556
19.4	45.886	42.6525	39.6112	-2.682	2.52
21.2	43.5912	40.58	37.7429	-2.646	2.502
23	41.4249	38.6207	35.9739	-2.61	2.466
24.8	39.3792	36.7676	34.2983	-2.574	2.43
26.6	37.4465	35.0144	32.7108	-2.538	2.394
28.4	35.6202	33.3552	31.2062	-2.484	2.358
30.2	33.8936	31.7844	29.7796	-2.448	2.322
32	32.2608	30.2968	28.4267	-2.412	2.304
33.8	30.7162	28.8875	27.1431	-2.376	2.268
35.6	29.2545	27.5519	25.925	-2.322	2.232
37.4	27.8708	26.2858	24.7686	-2.286	2.196
39.2	26.5605	25.0851	23.6704	-2.25	2.16
41	25.3193	23.9462	22.6273	-2.214	2.124

42.8	24.1432	22.8656	21.6361	-2.16	2.088
44.6	23.0284	21.8398	20.6939	-2.124	2.052
46.4	21.9714	20.8659	19.7982	-2.07	2.016
48.2	20.9688	19.9409	18.9463	-2.034	1.962
50	20.0176	19.0621	18.1358	-1.998	1.926
51.8	19.1149	18.227	17.3646	-1.944	1.89
53.6	18.258	17.4331	16.6305	-1.908	1.854
55.4	17.4442	16.6782	15.9315	-1.854	1.818
57.2	16.6711	15.9601	15.2657	-1.818	1.782
59	15.9366	15.277	14.6315	-1.764	1.728
60.8	15.2385	14.6268	14.0271	-1.728	1.692
62.6	14.5748	14.0079	13.451	-1.674	1.656
64.4	13.9436	13.4185	12.9017	-1.638	1.62
66.2	13.3431	12.8572	12.3778	-1.584	1.566
68	12.7718	12.3223	11.878	-1.548	1.53
69.8	12.228	11.8126	11.4011	-1.494	1.494
71.6	11.7102	11.3267	10.9459	-1.458	1.44
73.4	11.2172	10.8634	10.5114	-1.404	1.404
75.2	10.7475	10.4216	10.0964	-1.35	1.35
77	10.3	10	9.7	-1.35	1.35
78.8	9.8975	9.5974	9.298	-1.368	1.368
80.6	9.5129	9.2132	8.9148	-1.44	1.44
82.4	9.1454	8.8465	8.5496	-1.512	1.494
84.2	8.7942	8.4964	8.2013	-1.566	1.548
86	8.4583	8.1621	7.8691	-1.638	1.62
87.8	8.1371	7.8428	7.5522	-1.71	1.674
89.6	7.8299	7.5377	7.2498	-1.764	1.746
91.4	7.5359	7.2461	6.9611	-1.836	1.8
93.2	7.2546	6.9673	6.6854	-1.908	1.872
95	6.9852	6.7008	6.4222	-1.98	1.926
96.8	6.7273	6.4459	6.1707	-2.034	1.998
98.6	6.4803	6.2021	5.9304	-2.106	2.052
100.4	6.2437	5.9687	5.7007	-2.178	2.124
102.2	6.017	5.7454	5.4812	-2.25	2.196
104	5.7997	5.5316	5.2712	-2.322	2.25
105.8	5.5914	5.3269	5.0704	-2.394	2.322
107.6	5.3916	5.1308	4.8783	-2.466	2.394
109.4	5.2001	4.943	4.6944	-2.538	2.448
111.2	5.0163	4.763	4.5185	-2.61	2.52
113	4.84	4.5905	4.35	-2.682	2.592
114.8	4.6708	4.4252	4.1887	-2.754	2.646
116.6	4.5083	4.2666	4.0342	-2.826	2.718
118.4	4.3524	4.1145	3.8862	-2.898	2.79

120.2	4.2026	3.9686	3.7443	-2.97	2.862
122	4.0588	3.8287	3.6084	-3.06	2.916
123.8	3.9206	3.6943	3.478	-3.132	2.988
125.6	3.7878	3.5654	3.3531	-3.204	3.06
127.4	3.6601	3.4416	3.2332	-3.276	3.132
129.2	3.5374	3.3227	3.1183	-3.366	3.204
131	3.4195	3.2085	3.0079	-3.438	3.276
132.8	3.306	3.0989	2.9021	-3.51	3.33
134.6	3.1969	2.9935	2.8005	-3.6	3.402
136.4	3.0919	2.8922	2.7029	-3.672	3.474
138.2	2.9909	2.7948	2.6092	-3.744	3.546
140	2.8936	2.7012	2.5193	-3.834	3.618
141.8	2.8	2.6112	2.4328	-3.906	3.69
143.6	2.7099	2.5246	2.3498	-3.996	3.762
145.4	2.6232	2.4413	2.27	-4.068	3.834
147.2	2.5396	2.3611	2.1932	-4.158	3.906
149	2.4591	2.284	2.1195	-4.248	3.978
150.8	2.3815	2.2098	2.0486	-4.32	4.05
152.6	2.3068	2.1383	1.9803	-4.41	4.122
154.4	2.2347	2.0695	1.9147	-4.482	4.212
156.2	2.1652	2.0032	1.8516	-4.572	4.284
158	2.0983	1.9393	1.7908	-4.662	4.356
159.8	2.0337	1.8778	1.7324	-4.734	4.428
161.6	1.9714	1.8186	1.6761	-4.824	4.5
163.4	1.9113	1.7614	1.6219	-4.914	4.572
165.2	1.8533	1.7064	1.5697	-5.004	4.644
167	1.7974	1.6533	1.5194	-5.094	4.734
168.8	1.7434	1.6021	1.471	-5.184	4.806
170.6	1.6913	1.5528	1.4243	-5.256	4.878
172.4	1.6409	1.5051	1.3794	-5.346	4.95
174.2	1.5923	1.4592	1.336	-5.436	5.04
176	1.5454	1.4149	1.2942	-5.526	5.112
177.8	1.5	1.3721	1.254	-5.616	5.184
179.6	1.4562	1.3308	1.2151	-5.706	5.274
181.4	1.4139	1.291	1.1776	-5.796	5.346
183.2	1.373	1.2525	1.1415	-5.886	5.418
185	1.3335	1.2153	1.1066	-5.976	5.508
186.8	1.2953	1.1794	1.073	-6.084	5.58
188.6	1.2583	1.1448	1.0405	-6.174	5.67
190.4	1.2226	1.1113	1.0092	-6.264	5.742
192.2	1.188	1.0789	0.9789	-6.354	5.832
194	1.1546	1.0476	0.9497	-6.444	5.904
195.8	1.1223	1.0174	0.9215	-6.552	5.994

197.6	1.091	0.9882	0.8942	-6.642	6.066
199.4	1.0607	0.9599	0.8679	-6.732	6.156
201.2	1.0314	0.9326	0.8424	-6.84	6.228
203	1.003	0.9061	0.8179	-6.93	6.318
204.8	0.9756	0.8806	0.7941	-7.02	6.39
206.6	0.949	0.8558	0.7711	-7.128	6.48
208.4	0.9232	0.8319	0.7489	-7.218	6.552
210.2	0.8983	0.8088	0.7275	-7.326	6.642
212	0.8741	0.7863	0.7067	-7.416	6.732
213.8	0.8507	0.7646	0.6867	-7.524	6.804
215.6	0.8281	0.7436	0.6672	-7.614	6.894
217.4	0.8061	0.7233	0.6484	-7.722	6.984
219.2	0.7848	0.7036	0.6303	-7.812	7.056
221	0.7641	0.6845	0.6127	-7.92	7.146
222.8	0.7441	0.6661	0.5957	-8.028	7.236
224.6	0.7247	0.6482	0.5792	-8.118	7.326
226.4	0.7059	0.6308	0.5632	-8.226	7.416
228.2	0.6877	0.614	0.5478	-8.334	7.488
230	0.67	0.5977	0.5328	-8.442	7.578
231.8	0.6528	0.582	0.5183	-8.532	7.668
233.6	0.6361	0.5667	0.5043	-8.64	7.758
235.4	0.62	0.5518	0.4907	-8.748	7.848
237.2	0.6043	0.5374	0.4775	-8.856	7.938
239	0.5891	0.5235	0.4648	-8.964	8.01
240.8	0.5743	0.51	0.4524	-9.072	8.1
242.6	0.56	0.4968	0.4404	-9.18	8.19
244.4	0.546	0.4841	0.4288	-9.288	8.28
246.2	0.5325	0.4717	0.4175	-9.396	8.37
248	0.5194	0.4597	0.4066	-9.504	8.46

Outdoor unit

Ambient Sensor, Defrost Sensor, Pipe sensor

R77°F=10KΩ±3%

B77°F/122°F=3700K±3%;

Temp.((°F))	Max.(KΩ)	Normal(KΩ)	Min.(KΩ)	Tolerance(°F)	
-22	165.217	147.9497	132.3678	-3.492	3.15
-20.2	155.5754	139.56	125.0806	-3.474	3.132
-18.4	146.5609	131.7022	118.2434	-3.438	3.114
-16.6	138.1285	124.3392	111.8256	-3.402	3.078
-14.8	130.2371	117.4366	105.7989	-3.366	3.06
-13	122.8484	110.9627	100.1367	-3.33	3.042
-11.2	115.9272	104.8882	94.8149	-3.294	3.006
-9.4	109.441	99.1858	89.8106	-3.258	2.988

-7.6	103.3598	93.8305	85.1031	-3.24	2.952
-5.8	97.6556	88.7989	80.6728	-3.204	2.934
-4	92.3028	84.0695	76.5017	-3.168	2.916
-2.2	87.2775	79.6222	72.5729	-3.132	2.88
-0.4	82.5577	75.4384	68.871	-3.096	2.862
1.4	78.123	71.501	65.3815	-3.06	2.826
3.2	73.9543	67.7939	62.0907	-3.024	2.79
5	70.0342	64.3023	58.9863	-2.988	2.772
6.8	66.3463	61.0123	56.0565	-2.952	2.736
8.6	62.8755	57.911	53.2905	-2.916	2.718
10.4	59.6076	54.9866	50.6781	-2.88	2.682
12.2	56.5296	52.2278	48.2099	-2.844	2.646
14	53.6294	49.6244	45.8771	-2.808	2.628
15.8	50.8956	47.1666	43.6714	-2.772	2.592
17.6	48.3178	44.8454	41.5851	-2.718	2.556
19.4	45.886	42.6525	39.6112	-2.682	2.52
21.2	43.5912	40.58	37.7429	-2.646	2.502
23	41.4249	38.6207	35.9739	-2.61	2.466
24.8	39.3792	36.7676	34.2983	-2.574	2.43
26.6	37.4465	35.0144	32.7108	-2.538	2.394
28.4	35.6202	33.3552	31.2062	-2.484	2.358
30.2	33.8936	31.7844	29.7796	-2.448	2.322
32	32.2608	30.2968	28.4267	-2.412	2.304
33.8	30.7162	28.8875	27.1431	-2.376	2.268
35.6	29.2545	27.5519	25.925	-2.322	2.232
37.4	27.8708	26.2858	24.7686	-2.286	2.196
39.2	26.5605	25.0851	23.6704	-2.25	2.16
41	25.3193	23.9462	22.6273	-2.214	2.124
42.8	24.1432	22.8656	21.6361	-2.16	2.088
44.6	23.0284	21.8398	20.6939	-2.124	2.052
46.4	21.9714	20.8659	19.7982	-2.07	2.016
48.2	20.9688	19.9409	18.9463	-2.034	1.962
50	20.0176	19.0621	18.1358	-1.998	1.926
51.8	19.1149	18.227	17.3646	-1.944	1.89
53.6	18.258	17.4331	16.6305	-1.908	1.854
55.4	17.4442	16.6782	15.9315	-1.854	1.818
57.2	16.6711	15.9601	15.2657	-1.818	1.782
59	15.9366	15.277	14.6315	-1.764	1.728
60.8	15.2385	14.6268	14.0271	-1.728	1.692
62.6	14.5748	14.0079	13.451	-1.674	1.656
64.4	13.9436	13.4185	12.9017	-1.638	1.62
66.2	13.3431	12.8572	12.3778	-1.584	1.566
68	12.7718	12.3223	11.878	-1.548	1.53

69.8	12.228	11.8126	11.4011	-1.494	1.494
71.6	11.7102	11.3267	10.9459	-1.458	1.44
73.4	11.2172	10.8634	10.5114	-1.404	1.404
75.2	10.7475	10.4216	10.0964	-1.35	1.35
77	10.3	10	9.7	-1.35	1.35
78.8	9.8975	9.5974	9.298	-1.368	1.368
80.6	9.5129	9.2132	8.9148	-1.44	1.44
82.4	9.1454	8.8465	8.5496	-1.512	1.494
84.2	8.7942	8.4964	8.2013	-1.566	1.548
86	8.4583	8.1621	7.8691	-1.638	1.62
87.8	8.1371	7.8428	7.5522	-1.71	1.674
89.6	7.8299	7.5377	7.2498	-1.764	1.746
91.4	7.5359	7.2461	6.9611	-1.836	1.8
93.2	7.2546	6.9673	6.6854	-1.908	1.872
95	6.9852	6.7008	6.4222	-1.98	1.926
96.8	6.7273	6.4459	6.1707	-2.034	1.998
98.6	6.4803	6.2021	5.9304	-2.106	2.052
100.4	6.2437	5.9687	5.7007	-2.178	2.124
102.2	6.017	5.7454	5.4812	-2.25	2.196
104	5.7997	5.5316	5.2712	-2.322	2.25
105.8	5.5914	5.3269	5.0704	-2.394	2.322
107.6	5.3916	5.1308	4.8783	-2.466	2.394
109.4	5.2001	4.943	4.6944	-2.538	2.448
111.2	5.0163	4.763	4.5185	-2.61	2.52
113	4.84	4.5905	4.35	-2.682	2.592
114.8	4.6708	4.4252	4.1887	-2.754	2.646
116.6	4.5083	4.2666	4.0342	-2.826	2.718
118.4	4.3524	4.1145	3.8862	-2.898	2.79
120.2	4.2026	3.9686	3.7443	-2.97	2.862
122	4.0588	3.8287	3.6084	-3.06	2.916
123.8	3.9206	3.6943	3.478	-3.132	2.988
125.6	3.7878	3.5654	3.3531	-3.204	3.06
127.4	3.6601	3.4416	3.2332	-3.276	3.132
129.2	3.5374	3.3227	3.1183	-3.366	3.204
131	3.4195	3.2085	3.0079	-3.438	3.276
132.8	3.306	3.0989	2.9021	-3.51	3.33
134.6	3.1969	2.9935	2.8005	-3.6	3.402
136.4	3.0919	2.8922	2.7029	-3.672	3.474
138.2	2.9909	2.7948	2.6092	-3.744	3.546
140	2.8936	2.7012	2.5193	-3.834	3.618
141.8	2.8	2.6112	2.4328	-3.906	3.69
143.6	2.7099	2.5246	2.3498	-3.996	3.762
145.4	2.6232	2.4413	2.27	-4.068	3.834

147.2	2.5396	2.3611	2.1932	-4.158	3.906
149	2.4591	2.284	2.1195	-4.248	3.978
150.8	2.3815	2.2098	2.0486	-4.32	4.05
152.6	2.3068	2.1383	1.9803	-4.41	4.122
154.4	2.2347	2.0695	1.9147	-4.482	4.212
156.2	2.1652	2.0032	1.8516	-4.572	4.284
158	2.0983	1.9393	1.7908	-4.662	4.356
159.8	2.0337	1.8778	1.7324	-4.734	4.428
161.6	1.9714	1.8186	1.6761	-4.824	4.5
163.4	1.9113	1.7614	1.6219	-4.914	4.572
165.2	1.8533	1.7064	1.5697	-5.004	4.644
167	1.7974	1.6533	1.5194	-5.094	4.734
168.8	1.7434	1.6021	1.471	-5.184	4.806
170.6	1.6913	1.5528	1.4243	-5.256	4.878
172.4	1.6409	1.5051	1.3794	-5.346	4.95
174.2	1.5923	1.4592	1.336	-5.436	5.04
176	1.5454	1.4149	1.2942	-5.526	5.112
177.8	1.5	1.3721	1.254	-5.616	5.184
179.6	1.4562	1.3308	1.2151	-5.706	5.274
181.4	1.4139	1.291	1.1776	-5.796	5.346
183.2	1.373	1.2525	1.1415	-5.886	5.418
185	1.3335	1.2153	1.1066	-5.976	5.508
186.8	1.2953	1.1794	1.073	-6.084	5.58
188.6	1.2583	1.1448	1.0405	-6.174	5.67
190.4	1.2226	1.1113	1.0092	-6.264	5.742
192.2	1.188	1.0789	0.9789	-6.354	5.832
194	1.1546	1.0476	0.9497	-6.444	5.904
195.8	1.1223	1.0174	0.9215	-6.552	5.994
197.6	1.091	0.9882	0.8942	-6.642	6.066
199.4	1.0607	0.9599	0.8679	-6.732	6.156
201.2	1.0314	0.9326	0.8424	-6.84	6.228
203	1.003	0.9061	0.8179	-6.93	6.318
204.8	0.9756	0.8806	0.7941	-7.02	6.39
206.6	0.949	0.8558	0.7711	-7.128	6.48
208.4	0.9232	0.8319	0.7489	-7.218	6.552
210.2	0.8983	0.8088	0.7275	-7.326	6.642
212	0.8741	0.7863	0.7067	-7.416	6.732
213.8	0.8507	0.7646	0.6867	-7.524	6.804
215.6	0.8281	0.7436	0.6672	-7.614	6.894
217.4	0.8061	0.7233	0.6484	-7.722	6.984
219.2	0.7848	0.7036	0.6303	-7.812	7.056
221	0.7641	0.6845	0.6127	-7.92	7.146
222.8	0.7441	0.6661	0.5957	-8.028	7.236

224.6	0.7247	0.6482	0.5792	-8.118	7.326
226.4	0.7059	0.6308	0.5632	-8.226	7.416
228.2	0.6877	0.614	0.5478	-8.334	7.488
230	0.67	0.5977	0.5328	-8.442	7.578
231.8	0.6528	0.582	0.5183	-8.532	7.668
233.6	0.6361	0.5667	0.5043	-8.64	7.758
235.4	0.62	0.5518	0.4907	-8.748	7.848
237.2	0.6043	0.5374	0.4775	-8.856	7.938
239	0.5891	0.5235	0.4648	-8.964	8.01
240.8	0.5743	0.51	0.4524	-9.072	8.1
242.6	0.56	0.4968	0.4404	-9.18	8.19
244.4	0.546	0.4841	0.4288	-9.288	8.28
246.2	0.5325	0.4717	0.4175	-9.396	8.37
248	0.5194	0.4597	0.4066	-9.504	8.46

Discharge Sensor

R176°F=50KΩ±3%

B77°F/176°F=4450K±3%

Temp.((°F))	Max.(KΩ)	Normal(KΩ)	Min.(KΩ)	Tolerance(°F)	
-22	14646.0505	12061.7438	9924.4999	-5.328	4.41
-20.2	13654.1707	11267.873	9290.2526	-5.31	4.392
-18.4	12735.8378	10531.3695	8700.6388	-5.274	4.392
-16.6	11885.1336	9847.724	8152.2338	-5.256	4.374
-14.8	11096.6531	9212.8101	7641.8972	-5.238	4.356
-13	10365.4565	8622.8491	7166.7474	-5.22	4.356
-11.2	9687.027	8074.3787	6724.1389	-5.184	4.338
-9.4	9057.2314	7564.2244	6311.6413	-5.166	4.338
-7.6	8472.2852	7089.4741	5927.0206	-5.148	4.32
-5.8	7928.7217	6647.4547	5568.2222	-5.112	4.302
-4	7423.3626	6235.7109	5233.3554	-5.094	4.302
-2.2	6953.293	5851.9864	4920.6791	-5.076	4.284
-0.4	6515.8375	5494.2064	4628.5894	-5.04	4.266
1.4	6108.5393	5160.4621	4355.6078	-5.022	4.266
3.2	5729.1413	4848.9963	4100.3708	-4.986	4.248
5	5375.5683	4558.1906	3861.6201	-4.968	4.23
6.8	5045.9114	4286.5535	3638.1938	-4.95	4.212
8.6	4738.4141	4032.7098	3429.0191	-4.914	4.212
10.4	4451.4586	3795.391	3233.1039	-4.896	4.194
12.2	4183.5548	3573.426	3049.5312	-4.86	4.176
14	3933.3289	3365.7336	2877.4527	-4.842	4.158
15.8	3699.5139	3171.3148	2716.0828	-4.806	4.14
17.6	3480.9407	2989.246	2564.6945	-4.788	4.122

19.4	3276.5302	2818.6731	2422.6139	-4.752	4.104
21.2	3085.2854	2658.8058	2289.2164	-4.734	4.104
23	2906.2851	2508.9126	2163.923	-4.698	4.086
24.8	2738.6777	2368.3158	2046.1961	-4.68	4.068
26.6	2581.6752	2236.3876	1935.5371	-4.644	4.05
28.4	2434.5487	2112.5459	1831.4826	-4.608	4.032
30.2	2296.623	1996.2509	1733.6024	-4.59	4.014
32	2167.273	1887.0018	1641.4966	-4.554	3.996
33.8	2045.9191	1784.3336	1554.7931	-4.536	3.978
35.6	1932.0242	1687.8144	1473.146	-4.5	3.96
37.4	1825.0899	1597.0431	1396.2333	-4.464	3.942
39.2	1724.654	1511.6468	1323.7551	-4.446	3.906
41	1630.287	1431.2787	1255.4324	-4.41	3.888
42.8	1541.5904	1355.6163	1191.0048	-4.374	3.87
44.6	1458.1938	1284.3593	1130.2298	-4.338	3.852
46.4	1379.7528	1217.2282	1072.8813	-4.32	3.834
48.2	1305.9472	1153.9626	1018.7481	-4.284	3.816
50	1236.4792	1094.32	967.6334	-4.248	3.798
51.8	1171.0715	1038.0743	919.3533	-4.23	3.762
53.6	1109.4661	985.0146	873.7359	-4.194	3.744
55.4	1051.4226	934.944	830.621	-4.158	3.726
57.2	996.7169	887.6792	789.8583	-4.122	3.708
59	945.1404	843.0486	751.3077	-4.086	3.672
60.8	896.4981	800.8922	714.838	-4.068	3.654
62.6	850.6086	761.0603	680.3265	-4.032	3.636
64.4	807.3024	723.4134	647.658	-3.996	3.6
66.2	766.4212	687.8205	616.7252	-3.96	3.582
68	727.8172	654.1596	587.4271	-3.924	3.564
69.8	691.3524	622.3161	559.6694	-3.888	3.528
71.6	656.8979	592.1831	533.3634	-3.852	3.51
73.4	624.3328	563.6604	508.4261	-3.816	3.474
75.2	593.5446	536.654	484.7796	-3.78	3.456
77	564.4275	511.076	462.351	-3.762	3.42
78.8	536.9865	486.9352	441.1516	-3.726	3.402
80.6	511.0105	464.05	421.0258	-3.69	3.366
82.4	486.4151	442.3499	401.9146	-3.654	3.348
84.2	463.1208	421.7683	383.7626	-3.618	3.312
86	441.0535	402.243	366.5175	-3.582	3.294
87.8	420.1431	383.7151	350.1301	-3.546	3.258
89.6	400.3242	366.1295	334.5542	-3.51	3.24
91.4	381.535	349.4341	319.746	-3.474	3.204
93.2	363.7176	333.5801	305.6645	-3.42	3.168
95	346.8176	318.5216	292.2709	-3.384	3.15

96.8	330.7839	304.2151	279.5286	-3.348	3.114
98.6	315.5682	290.6199	267.4031	-3.312	3.078
100.4	301.1254	277.6976	255.862	-3.276	3.06
102.2	287.4128	265.4119	244.8745	-3.24	3.024
104	274.3905	253.7288	234.4118	-3.204	2.988
105.8	262.0206	242.6161	224.4465	-3.168	2.952
107.6	250.2676	232.0436	214.9529	-3.132	2.934
109.4	239.0983	221.9825	205.9065	-3.078	2.898
111.2	228.4809	212.406	197.2844	-3.042	2.862
113	218.386	203.2887	189.0648	-3.006	2.826
114.8	208.7855	194.6066	181.2273	-2.97	2.79
116.6	199.6531	186.3369	173.7524	-2.934	2.772
118.4	190.9639	178.4584	166.6217	-2.88	2.736
120.2	182.6945	170.9508	159.8181	-2.844	2.7
122	174.8228	163.7951	153.3249	-2.808	2.664
123.8	167.328	156.9733	147.1268	-2.754	2.628
125.6	160.1904	150.4683	141.209	-2.718	2.592
127.4	153.3914	144.2641	135.5577	-2.682	2.556
129.2	146.9136	138.3454	130.1598	-2.646	2.52
131	140.7403	132.698	125.0027	-2.592	2.484
132.8	134.8559	127.3081	120.0746	-2.556	2.448
134.6	129.2457	122.163	115.3645	-2.52	2.412
136.4	123.8956	117.2504	110.8618	-2.466	2.376
138.2	118.7926	112.5589	106.5564	-2.43	2.34
140	113.9241	108.0776	102.4388	-2.376	2.304
141.8	109.2784	103.7961	98.5	-2.34	2.268
143.6	104.8443	99.7046	94.7315	-2.304	2.214
145.4	100.6112	95.7939	91.1253	-2.25	2.178
147.2	96.5692	92.0553	87.6735	-2.214	2.142
149	92.7088	88.4805	84.369	-2.16	2.106
150.8	89.0211	85.0614	81.2048	-2.124	2.07
152.6	85.4976	81.7908	78.1744	-2.07	2.016
154.4	82.1303	78.6615	75.2715	-2.034	1.98
156.2	78.9116	75.6668	72.4902	-1.98	1.944
158	75.8343	72.8004	69.8249	-1.944	1.908
159.8	72.8916	70.0561	67.2703	-1.89	1.854
161.6	70.077	67.4283	64.8213	-1.854	1.818
163.4	67.3844	64.9115	62.4731	-1.8	1.782
165.2	64.808	62.5006	60.2211	-1.764	1.728
167	62.3423	60.1906	58.0609	-1.71	1.692
168.8	59.9821	57.977	55.9885	-1.656	1.656
170.6	57.7223	55.8552	53.9998	-1.62	1.602
172.4	55.5583	53.821	52.0912	-1.566	1.566

174.2	53.4856	51.8706	50.2591	-1.53	1.512
176	51.5	50	48.5	-1.53	1.512
177.8	49.7063	48.2057	46.7083	-1.53	1.53
179.6	47.9835	46.4842	44.9911	-1.602	1.602
181.4	46.3286	44.8323	43.3452	-1.674	1.656
183.2	44.7385	43.2468	41.7672	-1.728	1.71
185	43.2105	41.7248	40.254	-1.8	1.782
186.8	41.7386	40.2604	38.7996	-1.854	1.836
188.6	40.3241	38.8545	37.4048	-1.926	1.908
190.4	38.9643	37.5045	36.0668	-1.998	1.962
192.2	37.6569	36.2078	34.7831	-2.052	2.034
194	36.3996	34.9622	33.5513	-2.124	2.088
195.8	35.1903	33.7653	32.3689	-2.196	2.142
197.6	34.0269	32.6151	31.2338	-2.268	2.214
199.4	32.9075	31.5096	30.1438	-2.34	2.286
201.2	31.8302	30.4467	29.097	-2.394	2.34
203	30.7933	29.4246	28.0915	-2.466	2.412
204.8	29.795	28.4417	27.1254	-2.538	2.466
206.6	28.8337	27.4961	26.197	-2.61	2.538
208.4	27.9078	26.5864	25.3048	-2.682	2.592
210.2	27.016	25.711	24.447	-2.754	2.664
212	26.1569	24.8685	23.6222	-2.826	2.736
213.8	25.329	24.0574	22.8291	-2.898	2.79
215.6	24.5311	23.2765	22.0662	-2.97	2.862
217.4	23.762	22.5245	21.3323	-3.042	2.934
219.2	23.0205	21.8002	20.6261	-3.114	2.988
221	22.3055	21.1025	19.9465	-3.186	3.06
222.8	21.6159	20.4303	19.2924	-3.258	3.132
224.6	20.9508	19.7825	18.6626	-3.33	3.186
226.4	20.3091	19.1582	18.0563	-3.402	3.258
228.2	19.6899	18.5564	17.4723	-3.474	3.33
230	19.0924	17.9761	16.9098	-3.564	3.402
231.8	18.5157	17.4166	16.368	-3.636	3.474
233.6	17.959	16.8769	15.8458	-3.708	3.528
235.4	17.4214	16.3564	15.3427	-3.78	3.6
237.2	16.9023	15.8542	14.8577	-3.87	3.672
239	16.401	15.3696	14.3902	-3.942	3.744
240.8	15.9167	14.902	13.9394	-4.014	3.816
242.6	15.4489	14.4506	13.5047	-4.086	3.888
244.4	14.9968	14.0149	13.0855	-4.176	3.942
246.2	14.5599	13.5942	12.6811	-4.248	4.014
248	14.1376	13.1879	12.2909	-4.338	4.086
249.8	13.7294	12.7955	11.9144	-4.41	4.158

251.6	13.3347	12.4165	11.551	-4.5	4.23
253.4	12.9531	12.0503	11.2003	-4.572	4.302
255.2	12.584	11.6965	10.8617	-4.644	4.374
257	12.227	11.3545	10.5348	-4.734	4.446
258.8	11.8817	11.024	10.2191	-4.824	4.518
260.6	11.5475	10.7046	9.9142	-4.896	4.59
262.4	11.2242	10.3957	9.6197	-4.986	4.662
264.2	10.9112	10.097	9.3352	-5.058	4.734
266	10.6084	9.8082	9.0602	-5.148	4.806
267.8	10.3151	9.5288	8.7945	-5.238	4.878
269.6	10.0312	9.2586	8.5378	-5.31	4.95
271.4	9.7563	8.9971	8.2895	-5.4	5.04
273.2	9.4901	8.7441	8.0495	-5.49	5.112
275	9.2322	8.4993	7.8175	-5.562	5.184
276.8	8.9824	8.2623	7.5931	-5.652	5.256
278.6	8.7404	8.0329	7.376	-5.742	5.328
280.4	8.5059	7.8108	7.166	-5.832	5.4
282.2	8.2787	7.5958	6.9629	-5.922	5.472
284	8.0584	7.3875	6.7664	-5.994	5.562

NO.	Unit Model	Part code	Description	Characteristic
1	3U24MS2VHB 4U36MS2VHB	0010452538	Discharge pipe sensor	R176^{O}F=50KΩ±3% B25/50=4450K±3%
2			Suction pipe sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
3			Condensing temp. sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
4		0010451305	Liquid pipe sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
5		0010452099	Gas pipe sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
6		0010450194	Defrosting sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
7	AB09SC2VHA AB12SC2VHA AB18SC2VHA	001A3900006	Coil temperature sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
8		001A3900159	ambient temp.sensor	R77^{O}F=23KΩ ±2% B25/50=4200K±1%
9	AD07SL2VHA AD09SL2VHA AD12SL2VHA AD18SL2VHA	0010401922	Coil temperature sensor	R77^{O}F=10KΩ±3% B25/50=3700K±3%
10		001A3900159	ambient temp.sensor	R77^{O}F=23KΩ ±2% B25/50=4200K±1%

R77^{O}F=10KΩ±3% B25/50=3700K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（^{O}F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
-22	144.350	134.907	125.464	7.00	7.00
-20.2	136.519	127.675	118.831	6.93	6.93
-18.4	129.381	121.081	112.781	6.85	6.85
-16.6	122.638	114.849	107.060	6.78	6.78
-14.8	116.268	108.958	101.648	6.71	6.71
-13	110.249	103.388	96.527	6.64	6.64
-11.2	104.563	98.123	91.683	6.56	6.56
-9.4	99.190	93.144	87.098	6.49	6.49
-7.6	94.111	88.435	82.759	6.42	6.42
-5.8	89.311	83.982	78.653	6.35	6.35
-4	84.518	79.529	74.540	6.27	6.27
-2.2	80.484	75.785	71.086	6.20	6.20
-0.4	76.428	72.015	67.602	6.13	6.13
1.4	72.591	68.447	64.303	6.05	6.05
3.2	68.963	65.071	61.179	5.98	5.98
5	65.530	61.874	58.218	5.91	5.91
6.8	62.283	58.848	55.413	5.84	5.84
8.6	59.210	55.983	52.756	5.76	5.76
10.4	56.300	53.269	50.238	5.69	5.69
12.2	53.547	50.699	47.851	5.62	5.62
14	50.940	48.264	45.588	5.55	5.55
15.8	48.472	45.957	43.442	5.47	5.47
17.6	46.134	43.770	41.406	5.40	5.40
19.4	43.918	41.697	39.476	5.33	5.33
21.2	41.819	39.731	37.643	5.25	5.25
23	39.830	37.868	35.906	5.18	5.18
24.8	37.944	36.100	34.256	5.11	5.11
26.6	36.157	34.423	32.689	5.04	5.04
28.4	34.462	32.832	31.202	4.96	4.96
30.2	32.854	31.322	29.790	4.89	4.89
32	31.362	29.920	28.478	4.82	4.82
33.8	29.881	28.527	27.173	4.75	4.75
35.6	28.507	27.234	25.961	4.67	4.67
37.4	27.202	26.006	24.810	4.60	4.60
39.2	25.965	24.840	23.715	4.53	4.53
41	24.788	23.731	22.674	4.45	4.45
42.8	23.672	22.678	21.684	4.38	4.38
44.6	22.610	21.676	20.742	4.31	4.31
46.4	21.601	20.723	19.845	4.24	4.24
48.2	20.642	19.817	18.992	4.16	4.16
50	19.730	18.955	18.180	4.09	4.09
51.8	18.864	18.135	17.406	4.02	4.02
53.6	18.039	17.354	16.669	3.95	3.95
55.4	17.254	16.611	15.968	3.87	3.87
57.2	16.507	15.903	15.299	3.80	3.80
59	15.797	15.229	14.661	3.73	3.73
60.8	15.120	14.587	14.054	3.65	3.65
62.6	14.476	13.975	13.474	3.58	3.58
64.4	13.862	13.392	12.922	3.51	3.51
66.2	13.277	12.836	12.395	3.44	3.44
68	12.720	12.306	11.892	3.36	3.36
69.8	12.189	11.801	11.413	3.29	3.29
71.6	11.683	11.319	10.955	3.22	3.22
73.4	11.200	10.858	10.516	3.15	3.15

R77^{O}F=10KΩ±3% B25/50=3700K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（^{O}F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
75.2	10.739	10.419	10.099	3.07	3.07
77	10.300	10.000	9.700	3.00	3.00
78.8	9.894	9.600	9.306	3.06	3.06
80.6	9.505	9.217	8.929	3.13	3.13
82.4	9.134	8.852	8.570	3.19	3.19
84.2	8.779	8.503	8.227	3.25	3.25
86	8.441	8.170	7.899	3.31	3.31
87.8	8.116	7.851	7.586	3.38	3.38
89.6	7.805	7.546	7.287	3.44	3.44
91.4	7.509	7.255	7.001	3.50	3.50
93.2	7.225	6.976	6.727	3.56	3.56
95	6.953	6.710	6.467	3.63	3.63
96.8	6.692	6.454	6.216	3.69	3.69
98.6	6.443	6.210	5.977	3.75	3.75
100.4	6.204	5.976	5.748	3.81	3.81
102.2	5.976	5.753	5.530	3.88	3.88
104	5.756	5.538	5.320	3.94	3.94
105.8	5.546	5.333	5.120	4.00	4.00
107.6	5.345	5.136	4.927	4.06	4.06
109.4	5.151	4.947	4.743	4.13	4.13
111.2	4.967	4.767	4.567	4.19	4.19
113	4.788	4.593	4.398	4.25	4.25
114.8	4.618	4.427	4.236	4.31	4.31
116.6	4.455	4.268	4.081	4.38	4.38
118.4	4.298	4.115	3.932	4.44	4.44
120.2	4.147	3.968	3.789	4.50	4.50
122	4.004	3.829	3.654	4.56	4.56
123.8	3.863	3.692	3.521	4.63	4.63
125.6	3.729	3.562	3.395	4.69	4.69
127.4	3.601	3.438	3.275	4.75	4.75
129.2	3.478	3.318	3.158	4.81	4.81
131	3.359	3.203	3.047	4.88	4.88
132.8	3.246	3.093	2.940	4.94	4.94
134.6	3.136	2.987	2.838	5.00	5.00
136.4	3.031	2.885	2.739	5.06	5.06
138.2	2.930	2.787	2.644	5.13	5.13
140	2.833	2.693	2.553	5.19	5.19
141.8	2.739	2.602	2.465	5.25	5.25
143.6	2.649	2.515	2.381	5.31	5.31
145.4	2.562	2.431	2.300	5.38	5.38
147.2	2.478	2.350	2.222	5.44	5.44
149	2.398	2.273	2.148	5.50	5.50
150.8	2.320	2.198	2.076	5.56	5.56
152.6	2.246	2.126	2.006	5.63	5.63
154.4	2.174	2.057	1.940	5.69	5.69
156.2	2.104	1.990	1.876	5.75	5.75
158	2.038	1.926	1.814	5.81	5.81
159.8	1.974	1.864	1.754	5.88	5.88
161.6	1.912	1.805	1.698	5.94	5.94
163.4	1.853	1.748	1.643	6.00	6.00
165.2	1.795	1.692	1.589	6.06	6.06
167	1.739	1.639	1.539	6.13	6.13
168.8	1.686	1.588	1.490	6.19	6.19
170.6	1.634	1.538	1.442	6.25	6.25

R77^{O}F=10KΩ±3% B25/50=3700K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（^{O}F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
172.4	1.585	1.491	1.397	6.31	6.31
174.2	1.537	1.445	1.353	6.38	6.38
176	1.490	1.400	1.310	6.44	6.44
177.8	1.445	1.357	1.269	6.50	6.50
179.6	1.402	1.316	1.230	6.56	6.56
181.4	1.361	1.276	1.191	6.63	6.63
183.2	1.321	1.238	1.155	6.69	6.69
185	1.281	1.200	1.119	6.75	6.75
186.8	1.244	1.165	1.086	6.81	6.81
188.6	1.209	1.131	1.053	6.88	6.88
190.4	1.173	1.097	1.021	6.94	6.94
192.2	1.140	1.065	0.990	7.00	7.00
194	1.107	1.034	0.961	7.06	7.06
195.8	1.076	1.004	0.932	7.13	7.13
197.6	1.045	0.975	0.905	7.19	7.19
199.4	1.016	0.947	0.878	7.25	7.25
201.2	0.987	0.920	0.853	7.31	7.31
203	0.960	0.894	0.828	7.38	7.38
204.8	0.934	0.869	0.804	7.44	7.44
206.6	0.907	0.844	0.781	7.50	7.50
208.4	0.883	0.821	0.759	7.56	7.56
210.2	0.859	0.798	0.737	7.63	7.63
212	0.836	0.776	0.716	7.69	7.69
213.8	0.814	0.755	0.696	7.75	7.75
215.6	0.791	0.734	0.677	7.81	7.81
217.4	0.771	0.715	0.659	7.88	7.88
219.2	0.750	0.695	0.640	7.94	7.94
221	0.731	0.677	0.623	8.00	8.00

R77°F=23KΩ ±2% B25/50=4200K±1%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（°F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
-22	511.383	487.031	462.68	5	5
-20.2	478.574	456.022	433.47	4.95	4.95
-18.4	448.361	427.455	406.549	4.89	4.89
-16.6	420.23	400.844	381.458	4.84	4.84
-14.8	394.026	376.044	358.062	4.78	4.78
-13	369.606	352.922	336.238	4.73	4.73
-11.2	346.838	331.355	315.872	4.67	4.67
-9.4	325.602	311.229	296.856	4.62	4.62
-7.6	305.786	292.44	279.094	4.56	4.56
-5.8	287.287	274.892	262.497	4.51	4.51
-4	269.723	258.221	246.718	4.45	4.45
-2.2	253.871	243.171	232.471	4.4	4.4
-0.4	238.784	228.84	218.896	4.35	4.35
1.4	224.677	215.433	206.189	4.29	4.29
3.2	211.482	202.887	194.292	4.24	4.24
5	199.133	191.14	183.147	4.18	4.18
6.8	187.574	180.139	172.704	4.13	4.13
8.6	176.749	169.832	162.915	4.07	4.07
10.4	166.607	160.171	153.735	4.02	4.02
12.2	157.103	151.113	145.123	3.96	3.96
14	148.191	142.616	137.041	3.91	3.91
15.8	139.834	134.644	129.454	3.85	3.85
17.6	131.993	127.161	122.329	3.8	3.8
19.4	124.634	120.134	115.634	3.75	3.75
21.2	117.724	113.534	109.344	3.69	3.69
23	111.235	107.332	103.429	3.64	3.64
24.8	105.139	101.503	97.867	3.58	3.58
26.6	99.408	96.021	92.634	3.53	3.53
28.4	94.022	90.866	87.71	3.47	3.47
30.2	88.955	86.015	83.075	3.42	3.42
32	84.22	81.479	78.739	3.36	3.36
33.8	79.704	77.151	74.598	3.31	3.31
35.6	75.481	73.102	70.723	3.25	3.25
37.4	71.505	69.288	67.071	3.2	3.2
39.2	67.759	65.693	63.627	3.15	3.15
41	64.23	62.304	60.378	3.09	3.09
42.8	60.903	59.108	57.313	3.04	3.04

R77°F=23KΩ ±2% B25/50=4200K±1%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（°F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
44.6	57.767	56.094	54.421	2.98	2.98
46.4	54.808	53.249	51.69	2.93	2.93
48.2	52.017	50.564	49.111	2.87	2.87
50	49.383	48.029	46.675	2.82	2.82
51.8	46.896	45.635	44.374	2.76	2.76
53.6	44.548	43.373	42.198	2.71	2.71
55.4	42.331	41.236	40.141	2.65	2.65
57.2	40.235	39.215	38.195	2.6	2.6
59	38.254	37.304	36.354	2.55	2.55
60.8	36.381	35.497	34.613	2.49	2.49
62.6	34.611	33.788	32.965	2.44	2.44
64.4	32.935	32.169	31.403	2.38	2.38
66.2	31.351	30.638	29.925	2.33	2.33
68	29.85	29.187	28.524	2.27	2.27
69.8	28.43	27.813	27.196	2.22	2.22
71.6	27.086	26.512	25.938	2.16	2.16
73.4	25.811	25.278	24.745	2.11	2.11
75.2	24.604	24.109	23.614	2.05	2.05
77	23.46	23	22.54	2	2
78.8	22.397	21.948	21.499	2.04	2.04
80.6	21.387	20.95	20.513	2.09	2.09
82.4	20.429	20.003	19.577	2.13	2.13
84.2	19.521	19.105	18.689	2.18	2.18
86	18.656	18.251	17.846	2.22	2.22
87.8	17.835	17.44	17.045	2.26	2.26
89.6	17.054	16.67	16.286	2.31	2.31
91.4	16.313	15.938	15.563	2.35	2.35
93.2	15.608	15.243	14.878	2.39	2.39
95	14.936	14.581	14.226	2.44	2.44
96.8	14.299	13.953	13.607	2.48	2.48
98.6	13.691	13.354	13.017	2.53	2.53
100.4	13.113	12.785	12.457	2.57	2.57
102.2	12.563	12.243	11.923	2.61	2.61
104	12.038	11.727	11.416	2.66	2.66
105.8	11.539	11.236	10.933	2.7	2.7
107.6	11.063	10.768	10.473	2.74	2.74
109.4	10.611	10.323	10.035	2.79	2.79

R77^{O}F=23KΩ ±2% B25/50=4200K±1%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（^{O}F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
111.2	10.178	9.898	9.618	2.83	2.83
113	9.766	9.493	9.22	2.88	2.88
114.8	9.373	9.107	8.841	2.92	2.92
116.6	8.998	8.739	8.48	2.96	2.96
118.4	8.64	8.388	8.136	3.01	3.01
120.2	8.299	8.053	7.807	3.05	3.05
122	7.974	7.734	7.495	3.09	3.09
123.8	7.661	7.428	7.195	3.14	3.14
125.6	7.363	7.136	6.909	3.18	3.18
127.4	7.079	6.858	6.637	3.23	3.23
129.2	6.807	6.592	6.377	3.27	3.27
131	6.547	6.337	6.127	3.31	3.31
132.8	6.3	6.095	5.89	3.36	3.36
134.6	6.061	5.862	5.663	3.4	3.4
136.4	5.834	5.64	5.446	3.44	3.44
138.2	5.617	5.428	5.239	3.49	3.49
140	5.41	5.225	5.04	3.53	3.53
141.8	5.21	5.03	4.85	3.58	3.58
143.6	5.019	4.844	4.669	3.62	3.62
145.4	4.837	4.666	4.495	3.66	3.66
147.2	4.662	4.495	4.328	3.71	3.71
149	4.494	4.332	4.17	3.75	3.75
150.8	4.333	4.175	4.017	3.79	3.79
152.6	4.179	4.025	3.871	3.84	3.84
154.4	4.032	3.881	3.73	3.88	3.88
156.2	3.89	3.743	3.596	3.93	3.93
158	3.754	3.611	3.468	3.97	3.97
159.8	3.624	3.484	3.344	4.01	4.01
161.6	3.498	3.362	3.226	4.06	4.06
163.4	3.378	3.245	3.112	4.1	4.1
165.2	3.263	3.133	3.003	4.14	4.14
167	3.153	3.026	2.899	4.19	4.19
168.8	3.046	2.922	2.798	4.23	4.23
170.6	2.944	2.823	2.702	4.28	4.28
172.4	2.845	2.727	2.609	4.32	4.32
174.2	2.751	2.636	2.521	4.36	4.36
176	2.659	2.547	2.435	4.41	4.41

R77^{O}F=23KΩ ±2% B25/50=4200K±1%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（^{O}F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
177.8	2.573	2.463	2.353	4.45	4.45
179.6	2.488	2.381	2.274	4.49	4.49
181.4	2.407	2.303	2.199	4.54	4.54
183.2	2.329	2.227	2.125	4.58	4.58
185	2.253	2.154	2.054	4.63	4.63
186.8	2.182	2.085	1.988	4.67	4.67
188.6	2.112	2.017	1.922	4.71	4.71
190.4	2.046	1.953	1.86	4.76	4.76
192.2	1.981	1.89	1.799	4.8	4.8
194	1.919	1.83	1.741	4.84	4.84
195.8	1.859	1.772	1.685	4.89	4.89
197.6	1.801	1.716	1.631	4.93	4.93
199.4	1.745	1.662	1.579	4.98	4.98
201.2	1.691	1.61	1.529	5.02	5.02
203	1.639	1.56	1.481	5.06	5.06
204.8	1.589	1.512	1.435	5.11	5.11
206.6	1.54	1.465	1.39	5.15	5.15
208.4	1.494	1.42	1.346	5.19	5.19
210.2	1.449	1.377	1.305	5.24	5.24
212	1.406	1.335	1.264	5.28	5.28
213.8	1.363	1.294	1.225	5.33	5.33
215.6	1.322	1.255	1.188	5.37	5.37
217.4	1.283	1.217	1.151	5.41	5.41
219.2	1.244	1.18	1.116	5.46	5.46
221	1.208	1.145	1.082	5.5	5.5

R176°F=50KΩ±3% B25/50=4450K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（°F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
32	2094.972	1921.993	1749.014	9	9
33.8	1975.099	1813.265	1651.431	8.93	8.93
35.6	1863.127	1711.646	1560.165	8.85	8.85
37.4	1758.449	1616.593	1474.737	8.78	8.78
39.2	1660.513	1527.611	1394.709	8.7	8.7
41	1568.817	1444.25	1319.683	8.63	8.63
42.8	1482.897	1366.096	1249.295	8.55	8.55
44.6	1402.336	1292.773	1183.21	8.48	8.48
46.4	1326.746	1223.935	1121.124	8.4	8.4
48.2	1255.774	1159.265	1062.756	8.33	8.33
50	1189.098	1098.474	1007.85	8.25	8.25
51.8	1126.419	1041.293	956.167	8.18	8.18
53.6	1067.463	987.477	907.491	8.1	8.1
55.4	1011.977	936.799	861.621	8.03	8.03
57.2	959.732	889.052	818.372	7.95	7.95
59	910.51	844.042	777.574	7.88	7.88
60.8	864.114	801.59	739.066	7.8	7.8
62.6	820.361	761.533	702.705	7.73	7.73
64.4	779.081	723.717	668.353	7.65	7.65
66.2	740.117	688.001	635.885	7.58	7.58
68	703.323	654.254	605.185	7.5	7.5
69.8	668.565	622.355	576.145	7.43	7.43
71.6	635.715	592.189	548.663	7.35	7.35
73.4	604.657	563.651	522.645	7.28	7.28
75.2	575.282	536.644	498.006	7.2	7.2
77	547.49	511.076	474.662	7.13	7.13
78.8	521.186	486.862	452.538	7.05	7.05
80.6	496.281	463.922	431.563	6.98	6.98
82.4	472.693	442.182	411.671	6.9	6.9
84.2	450.344	421.572	392.8	6.83	6.83
86	429.165	402.028	374.891	6.75	6.75
87.8	409.087	383.489	357.891	6.68	6.68
89.6	390.047	365.898	341.749	6.6	6.6
91.4	371.986	349.201	326.416	6.53	6.53
93.2	354.85	333.349	311.848	6.45	6.45
95	338.586	318.295	298.004	6.38	6.38
96.8	323.147	303.995	284.843	6.3	6.3
98.6	308.485	290.407	272.329	6.23	6.23
100.4	294.559	277.493	260.427	6.15	6.15
102.2	281.328	265.216	249.104	6.08	6.08
104	268.753	253.541	238.329	6	6
105.8	256.801	242.437	228.073	5.93	5.93
107.6	245.438	231.873	218.308	5.85	5.85
109.4	234.63	221.82	209.01	5.78	5.78
111.2	224.35	212.252	200.154	5.7	5.7
113	214.569	203.142	191.715	5.63	5.63
114.8	205.26	194.467	183.674	5.55	5.55
116.6	196.399	186.204	176.009	5.48	5.48
118.4	187.963	178.333	168.703	5.4	5.4
120.2	179.929	170.832	161.735	5.33	5.33
122	172.275	163.682	155.089	5.25	5.25
123.8	164.984	156.866	148.748	5.18	5.18
125.6	158.036	150.367	142.698	5.1	5.1
127.4	151.412	144.168	136.924	5.03	5.03

R176°F=50KΩ±3% B25/50=4450K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（°F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
129.2	145.099	138.255	131.411	4.95	4.95
131	139.078	132.613	126.148	4.88	4.88
132.8	133.336	127.229	121.122	4.8	4.8
134.6	127.858	122.089	116.32	4.73	4.73
136.4	122.63	117.181	111.732	4.65	4.65
138.2	117.641	112.494	107.347	4.58	4.58
140	112.879	108.018	103.157	4.5	4.5
141.8	108.332	103.741	99.15	4.43	4.43
143.6	103.989	99.654	95.319	4.35	4.35
145.4	99.841	95.748	91.655	4.28	4.28
147.2	95.879	92.014	88.149	4.2	4.2
149	92.091	88.443	84.795	4.13	4.13
150.8	88.472	85.028	81.584	4.05	4.05
152.6	85.011	81.761	78.511	3.98	3.98
154.4	81.703	78.636	75.569	3.9	3.9
156.2	78.538	75.645	72.752	3.83	3.83
158	75.51	72.781	70.052	3.75	3.75
159.8	72.614	70.04	67.466	3.68	3.68
161.6	69.842	67.415	64.988	3.6	3.6
163.4	67.189	64.901	62.613	3.53	3.53
165.2	64.649	62.493	60.337	3.45	3.45
167	62.216	60.185	58.154	3.38	3.38
168.8	59.886	57.973	56.06	3.3	3.3
170.6	57.653	55.852	54.051	3.23	3.23
172.4	55.515	53.82	52.125	3.15	3.15
174.2	53.465	51.87	50.275	3.08	3.08
176	51.5	50	48.5	3	3
177.8	49.684	48.206	46.728	3.07	3.07
179.6	47.94	46.484	45.028	3.13	3.13
181.4	46.267	44.832	43.397	3.2	3.2
183.2	44.659	43.246	41.833	3.27	3.27
185	43.114	41.723	40.332	3.33	3.33
186.8	41.629	40.26	38.891	3.4	3.4
188.6	40.203	38.856	37.509	3.47	3.47
190.4	38.831	37.506	36.181	3.53	3.53
192.2	37.513	36.209	34.905	3.6	3.6
194	36.244	34.962	33.68	3.67	3.67
195.8	35.025	33.764	32.503	3.73	3.73
197.6	33.851	32.612	31.373	3.8	3.8
199.4	32.722	31.504	30.286	3.87	3.87
201.2	31.636	30.439	29.242	3.93	3.93
203	30.59	29.413	28.236	4	4
204.8	29.583	28.427	27.271	4.07	4.07
206.6	28.614	27.478	26.342	4.13	4.13
208.4	27.68	26.564	25.448	4.2	4.2
210.2	26.781	25.685	24.589	4.27	4.27
212	25.914	24.838	23.762	4.33	4.33
213.8	25.08	24.023	22.966	4.4	4.4
215.6	24.275	23.237	22.199	4.47	4.47
217.4	23.5	22.481	21.462	4.53	4.53
219.2	22.753	21.752	20.751	4.6	4.6
221	22.031	21.049	20.067	4.67	4.67
222.8	21.336	20.372	19.408	4.73	4.73
224.6	20.667	19.72	18.773	4.8	4.8

R176°F=50KΩ±3% B25/50=4450K±3%					
Temp	Resistance（KΩ）			Resistance tolerance%	
（°F）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)
226.4	20.02	19.091	18.162	4.87	4.87
228.2	19.397	18.485	17.573	4.93	4.93
230	18.795	17.9	17.005	5	5
231.8	18.215	17.337	16.459	5.07	5.07
233.6	17.655	16.793	15.931	5.13	5.13
235.4	17.114	16.268	15.422	5.2	5.2
237.2	16.593	15.763	14.933	5.27	5.27
239	16.09	15.275	14.46	5.33	5.33
240.8	15.603	14.804	14.005	5.4	5.4
242.6	15.133	14.349	13.565	5.47	5.47
244.4	14.681	13.911	13.141	5.53	5.53
246.2	14.243	13.488	12.733	5.6	5.6
248	13.821	13.08	12.339	5.67	5.67
249.8	13.412	12.685	11.958	5.73	5.73
251.6	13.019	12.305	11.591	5.8	5.8
253.4	12.638	11.938	11.238	5.87	5.87
255.2	12.271	11.584	10.897	5.93	5.93
257	11.917	11.242	10.567	6	6
258.8	11.573	10.911	10.249	6.07	6.07
260.6	11.243	10.593	9.943	6.13	6.13
262.4	10.923	10.285	9.647	6.2	6.2
264.2	10.614	9.988	9.362	6.27	6.27
266	10.315	9.701	9.087	6.33	6.33
267.8	10.028	9.425	8.822	6.4	6.4
269.6	9.75	9.158	8.566	6.47	6.47
271.4	9.481	8.9	8.319	6.53	6.53
273.2	9.222	8.651	8.08	6.6	6.6
275	8.972	8.411	7.85	6.67	6.67
276.8	8.731	8.18	7.629	6.73	6.73
278.6	8.498	7.957	7.416	6.8	6.8
280.4	8.273	7.741	7.209	6.87	6.87
282.2	8.055	7.533	7.011	6.93	6.93
284	7.846	7.333	6.82	7	7

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Haier America,
Wayne, NJ 07470