Daikin Ductless Service & Troubleshooting

Module TD-10.1 Single & Multi Split Basic Operation

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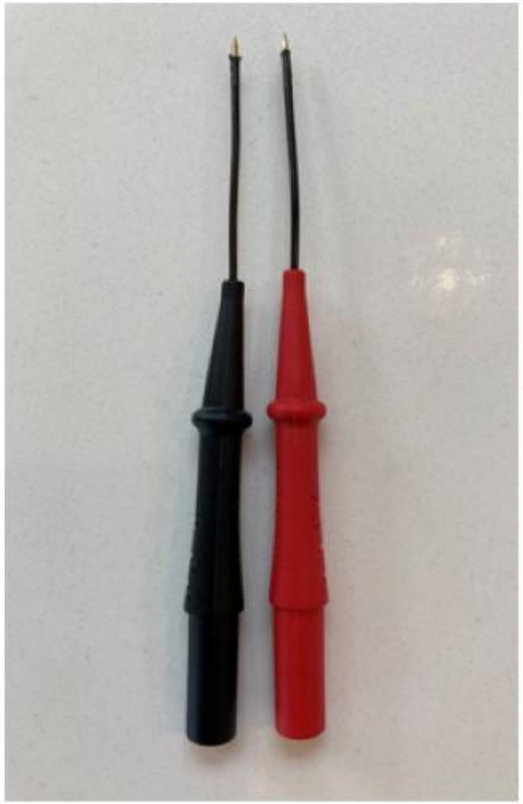
Agenda

- **Tools and Maintenance**
- Basic Operation
- Communication
- Component Testing

Tools

Needle Probes



True RMS Meter

Bluetooth D-checker

Tools

Service Diagnosis Tool

DC Fan Motor Checker

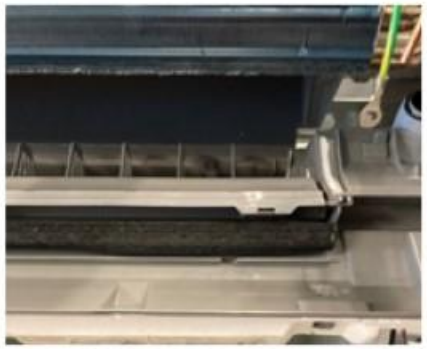
Megger

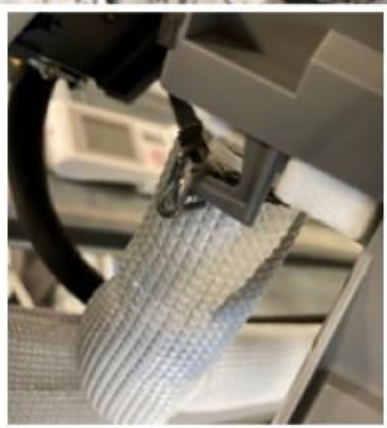
Manual EEV Opener

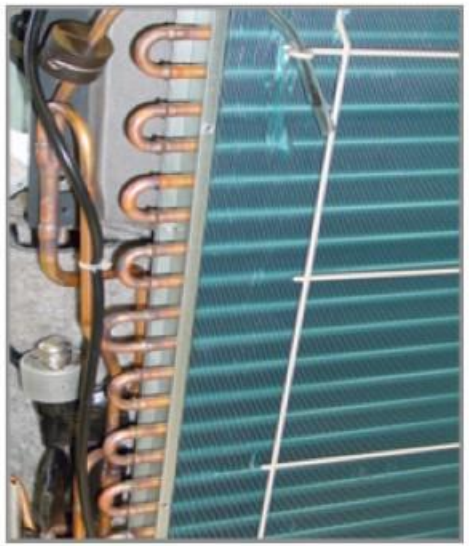
DAIKIN

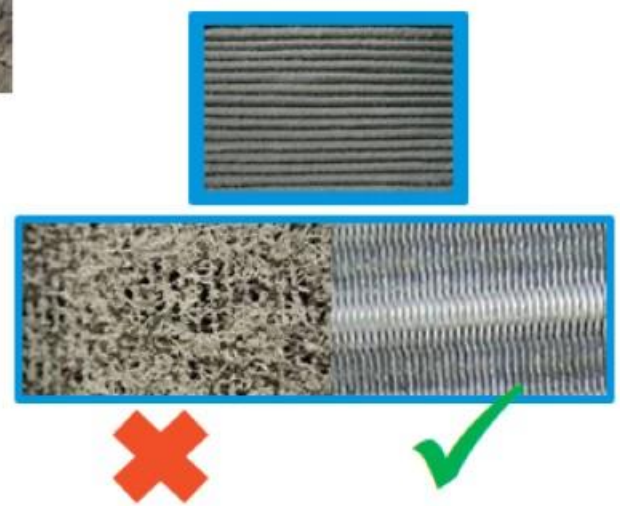
Maintenance

- The owner should be made aware that scheduled maintenance is required to
  - Preserve high performance standards.
  - Prolong the service life of the equipment.
  - Reduces the chances of failure.
- Regular maintenance includes:
  - Inspecting the filters, changing remote batteries.
  - Inspecting condensate piping and drain pan.
    - Check for clogs, cracks, and proper flow.
  - Cleaning the coil, drain pan and blower wheel.
  - Manually rotate the condenser fan and blower motor to be sure the motor shaft rotates freely.
  - Inspect for loose, bent, or broken wiring connections.









Agenda

Tools and Maintenance

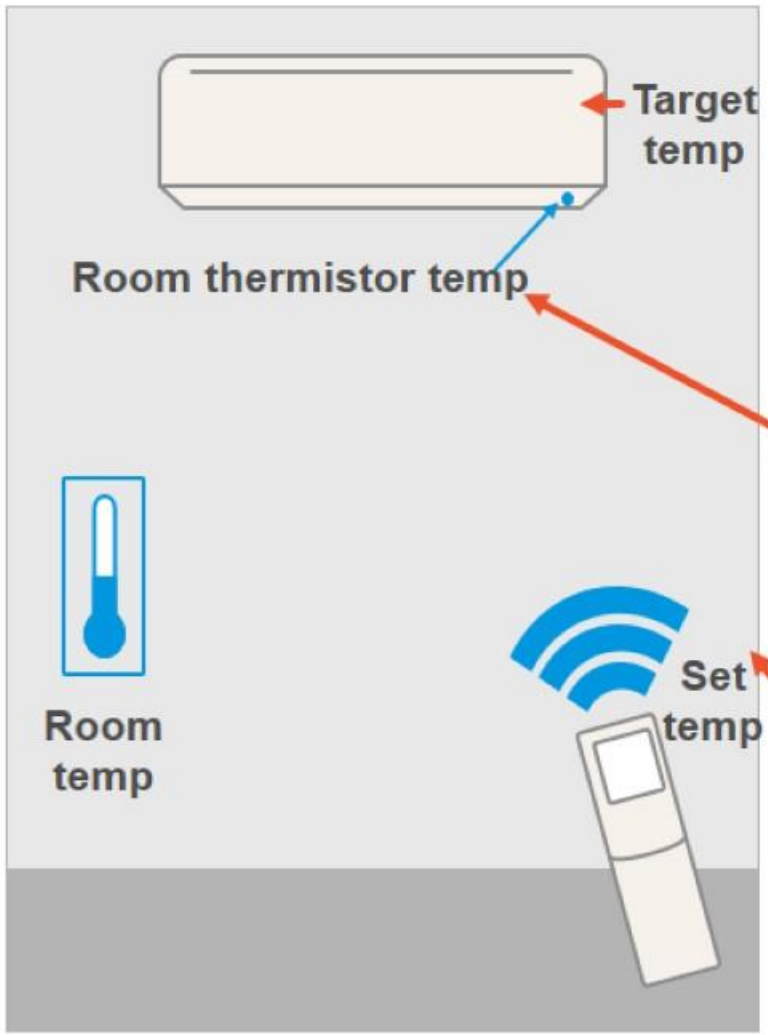
Basic Operation

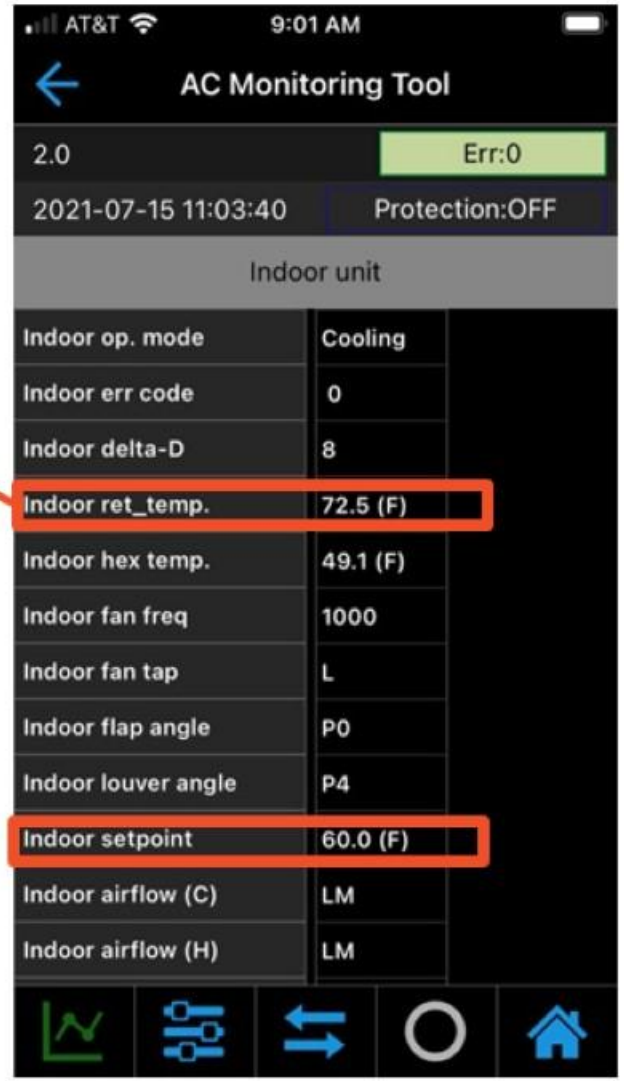
Communication

Component testing

The definitions of temperatures are classified as following:

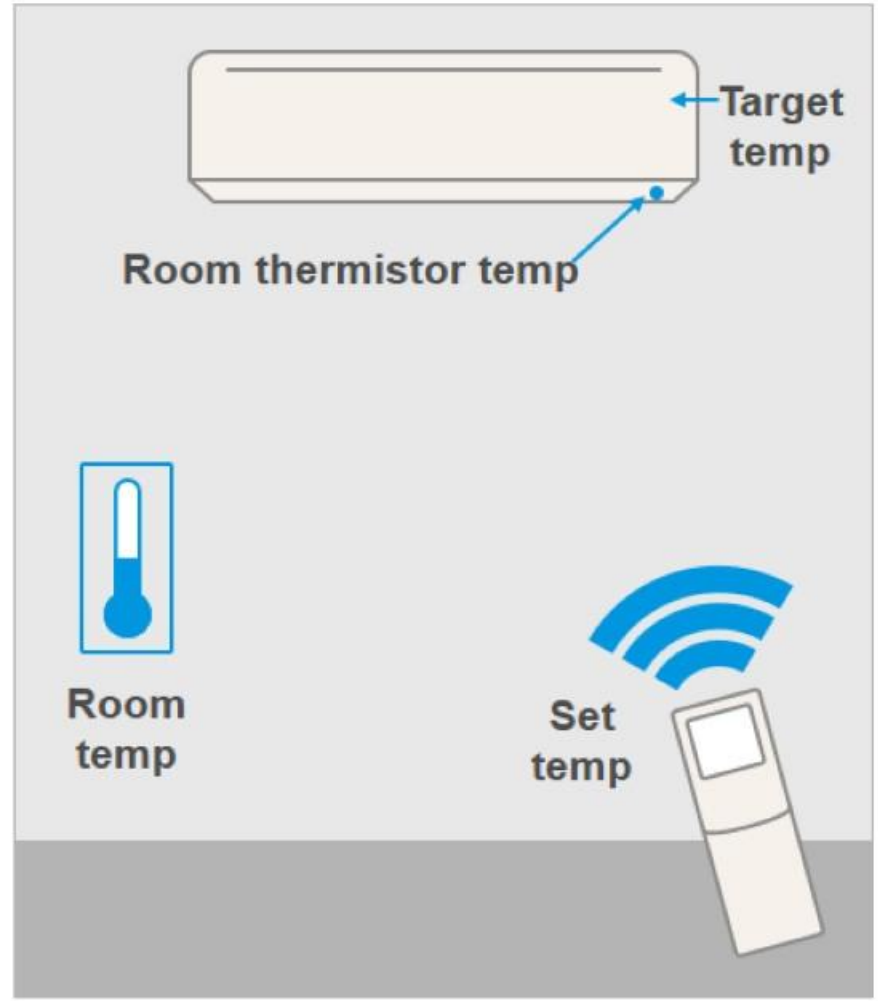
- **Room temperature:** Temperature of lower part of the room.
- **Set temperature:** Temperature set by remote controller.
- **Room thermistor temperature:** Temperature detected by room temperature thermistor.
- **Target temperature:** Temperature determined by microcomputer.





Temperature Control (cont'd)

- The temperature of the room is detected by the room temperature thermistor.
- There is difference between the “temperature detected by room temperature thermistor” and the “temperature of lower part of the room”, depending on the type of the indoor unit or installation condition.
- The temperature control is calculated by the “target temperature adjusted for the indoor unit” and the “temperature detected by room temperature thermistor”.



Frequency Principle

Main Control Parameters

- The compressor is frequency-controlled during normal operation. The target frequency is set by the following 2 parameters coming from the operating indoor unit:
  - The load condition of the operating indoor unit
  - The difference between the room thermistor temperature and the target temperature

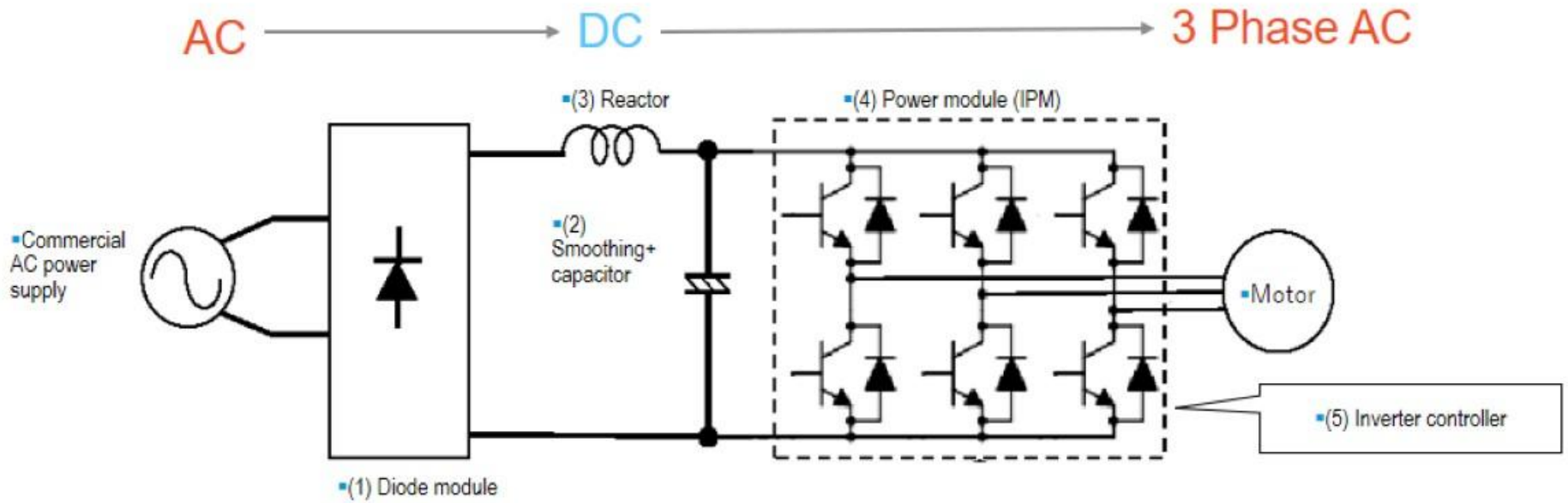
Additional Control Parameters

- The target frequency is adapted by additional parameters in the following cases:
  - Frequency restrictions
  - Initial settings
  - Forced cooling operation

Inverter Principle

To regulate the capacity, a frequency control is needed. The inverter makes it possible to alter the rotation speed of the compressor. The following explains the conversion principle:

- AC power source is rectified into the DC power source for the inverter.
- The DC power source is inverted into the three phase AC power source with variable frequency.
- When the frequency increases, the rotation speed of the compressor increases resulting in increased refrigerant circulation. This leads to a higher amount of heat exchange per unit.
- When the frequency decreases, the rotation speed of the compressor decreases resulting in decreased refrigerant circulation. This leads to a lower amount of heat exchange per unit.



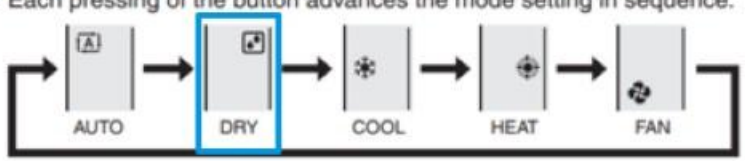
Program Dry Operation

Outline

- Programing dry operation removes humidity while preventing the room temperature from lowering. Since the microcomputer controls both the temperature and airflow rate, the temperature adjustment and [FAN] setting buttons are inoperable.

Press MODE and select an operation mode.

- Each pressing of the button advances the mode setting in sequence.



Detail

- The microcomputer automatically sets the temperature and airflow rate. The difference between the room thermistor temperature at start-up and the target temperature is divided into two zones. Then, the unit operates in an appropriate capacity for each zone to maintain the temperature and humidity at a comfortable level.

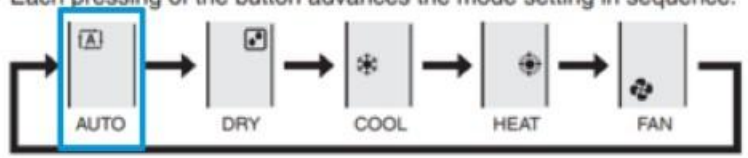
Room thermistor temp at start-up	Target temp X	Thermostat OFF point Y	Thermostat ON point Z
24°C (75.2°F) or more	Room thermistor temp at start-up	X - 2.5°C (- 4.5°F)	X – 0.5°C (- 0.9°F) **or** Y + 0.5°C (- 0.9°F) (zone B) continues for 10 min
23.5°C (74.3°F) ~ 18°C (64.4°F)		X - 2.0°C (- 3.6°F)	X – 0.5°C (- 0.9°F) **or** Y + 0.5°C (- 0.9°F) (zone B) continues for 10 min
17.5°C (63.5°F) ~	18°C (64.4°F)	X - 2.0°C (- 3.6°F)	X – 0.5°C (- 0.9°F) = 17.5°C (63.5°F) **or** Y + 0.5°C (- 0.9°F) (zone B) continues for 10 min

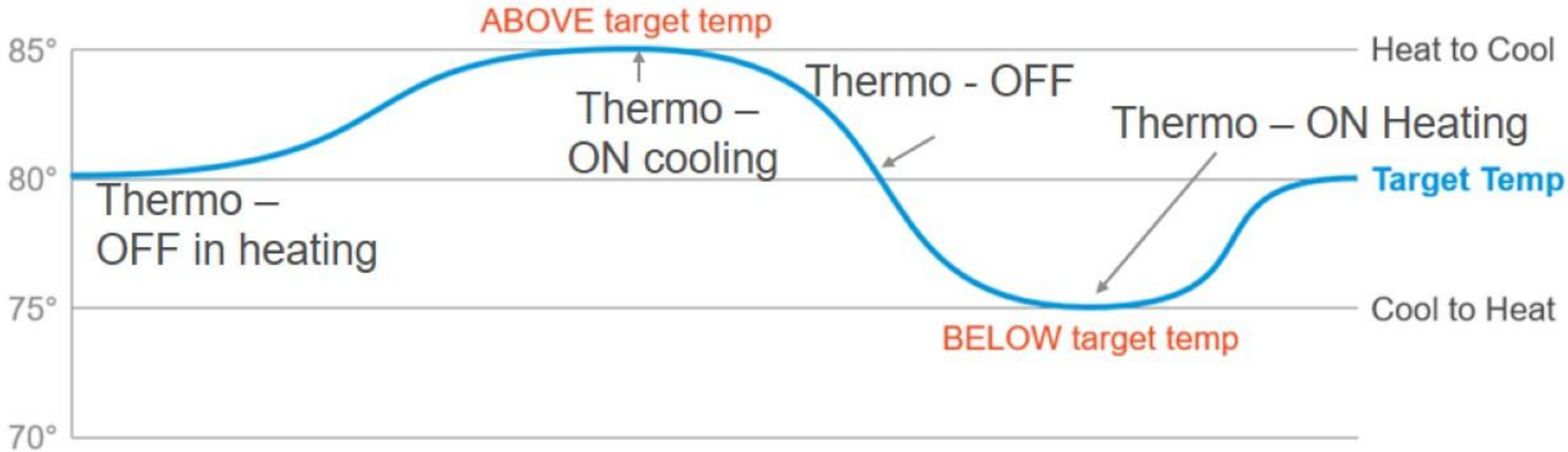
Automatic Cooling / Heating Function

When the automatic operation is selected with the remote controller, the microcomputer automatically determines the operation mode as cooling or heating according to the room temperature and the set temperature at start-up. The unit automatically switches the operation mode to maintain the room temperature at the set temperature.

Press MODE and select an operation mode.

• Each pressing of the button advances the mode setting in sequence.

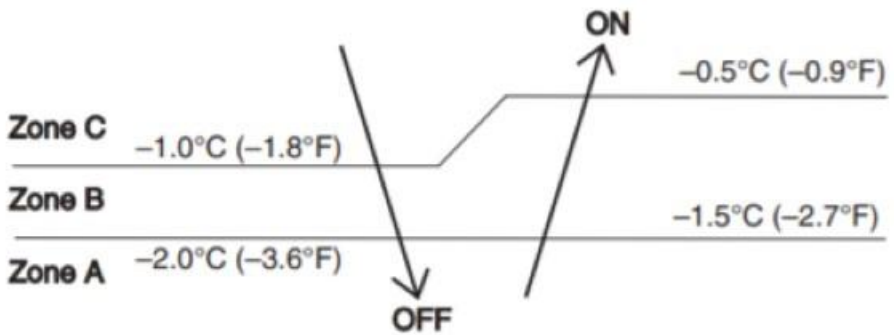




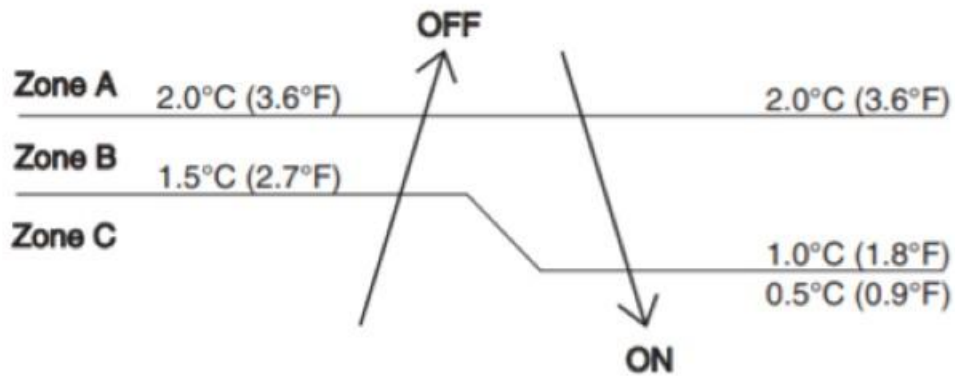
Cooling / Heating Function

- When the either heating or cooling operation is selected with the remote controller, the microcomputer automatically determines a target temperature based on the mode of operation and the type of air handler that is used. The system will slow to match the load in the space by creating a demand value based on the difference between room thermistor temperature and the target temperature.
- **Example:**

Cooling



Heating



Room thermistor temperature – target temperature

PI control

P control

- The ΔD value is calculated in each sampling time (20 seconds), and the frequency is adjusted according to its difference from the frequency previously calculated.

I control

- If the operating frequency does not change for more than a certain fixed time, the frequency is adjusted according to the ΔD value. When ΔD value is low, the frequency is lowered. When ΔD value is high, the frequency is increased.

Frequency control when other controls are functioning

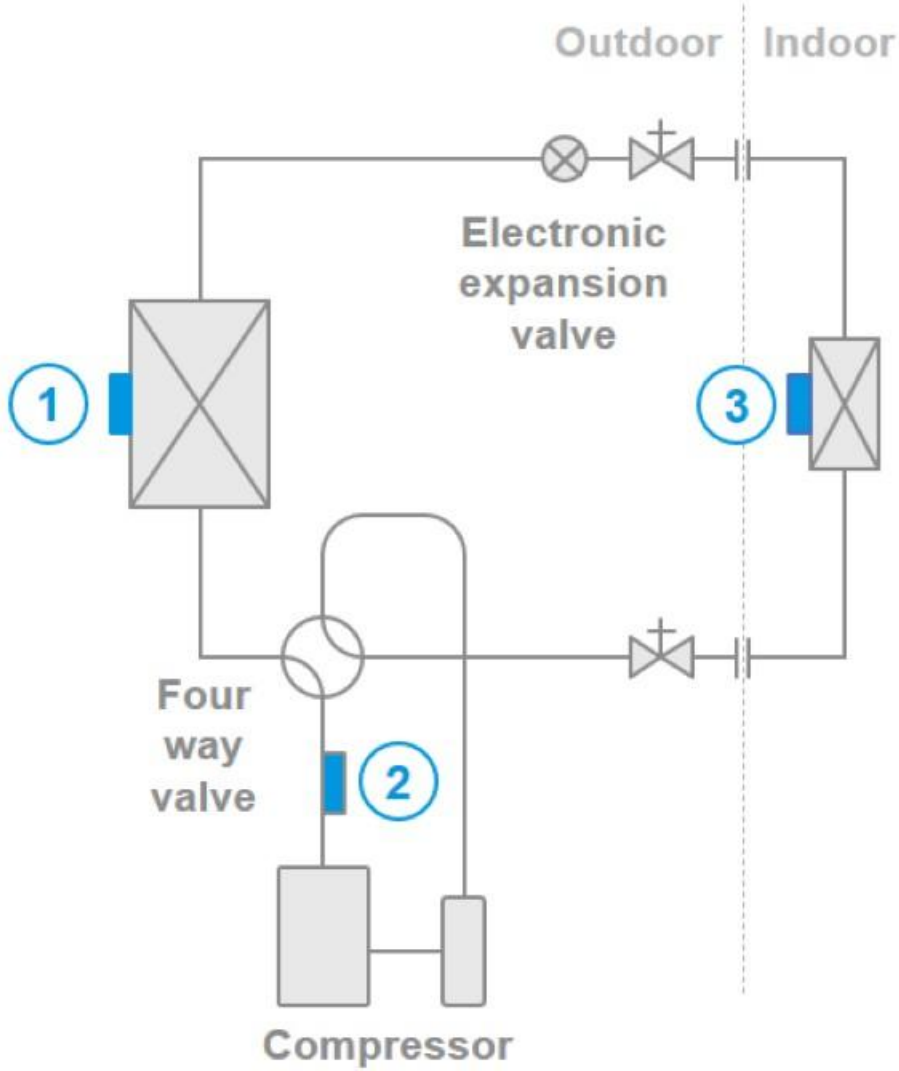
- When frequency is dropping:
  Frequency control is carried out only when the frequency drops.
- For limiting lower limit:
  Frequency control is carried out only when the frequency rises.

Upper and lower limit of frequency by PI control

- The frequency upper and lower limits are set according to the command of the indoor unit. When the indoor or outdoor unit quiet operation command comes from the indoor unit, the upper limit frequency is lower than the usual setting.

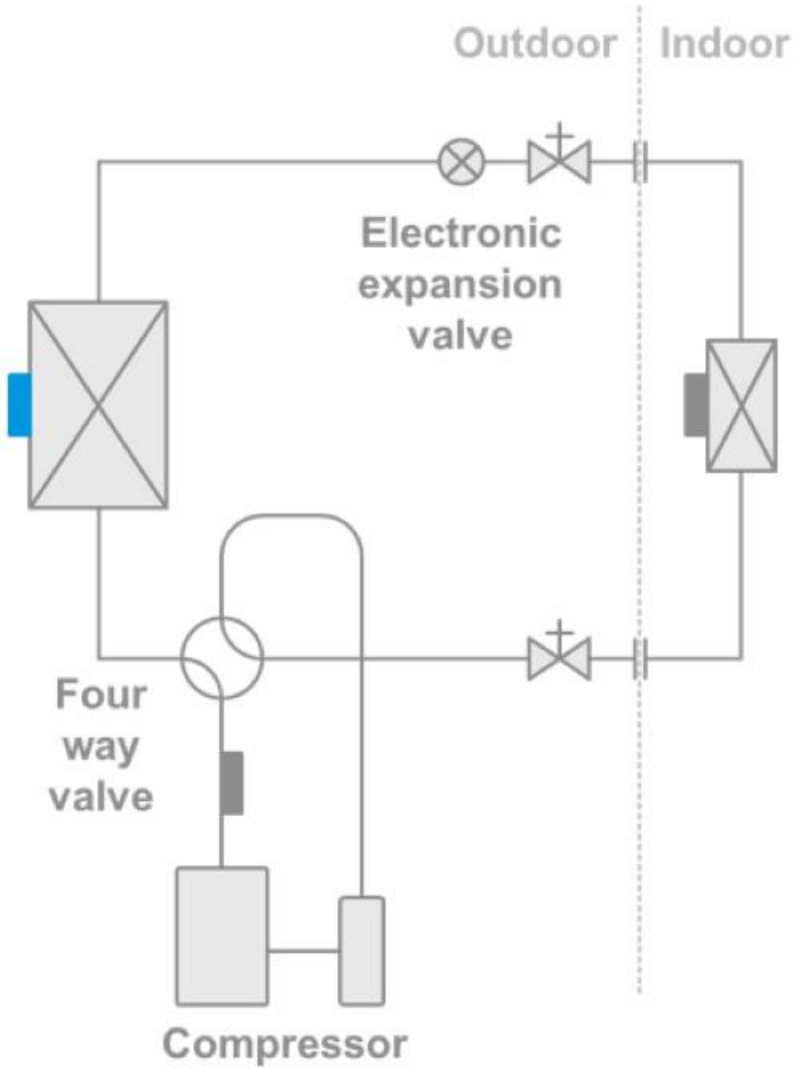
Thermistors

1. Outdoor Heat Exchanger Thermistor
2. Discharge Pipe Thermistor
3. Indoor Heat Exchanger Thermistor



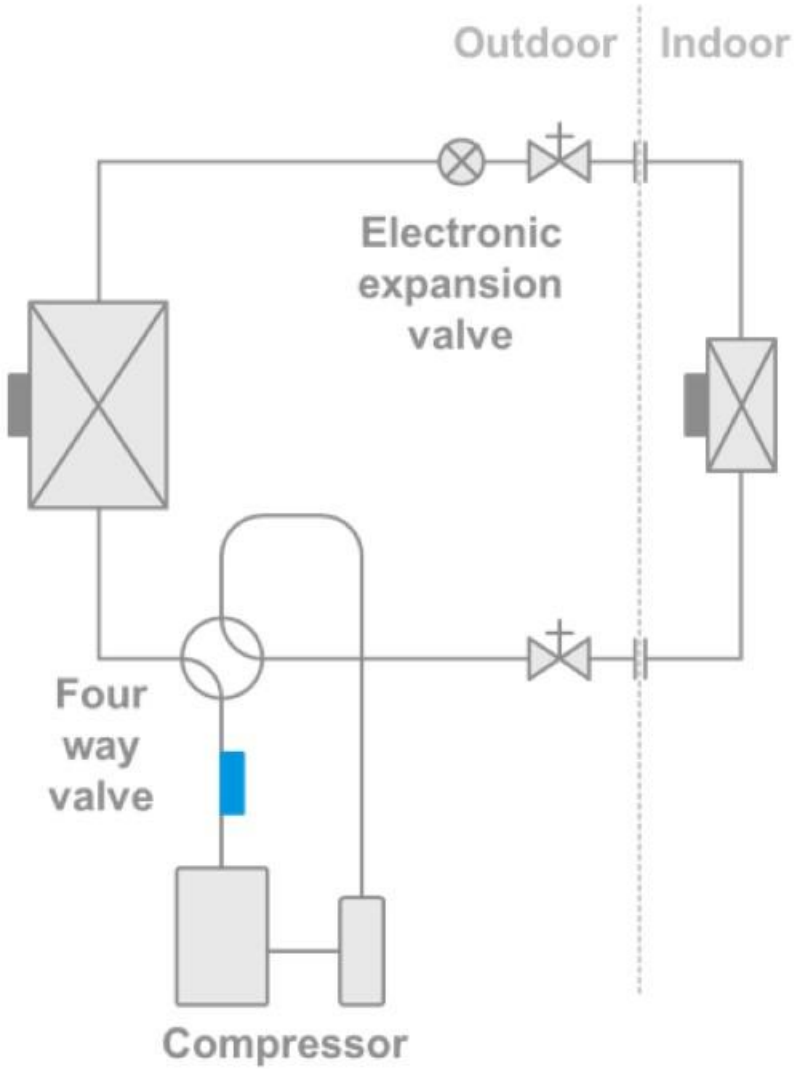
Outdoor Heat Exchanger Thermistor

- The outdoor heat exchanger thermistor is used for controlling the target discharge pipe temperature. The system sets the target discharge pipe temperature according to the outdoor/indoor heat exchanger temperature and controls the electronic expansion valve opening so that the target discharge pipe temperature can be obtained.
- In cooling operation, the outdoor heat exchanger thermistor is used for detecting the disconnection of the discharge pipe thermistor. When the discharge pipe temperature becomes lower than the outdoor heat exchanger temperature, the discharge pipe thermistor is judged as disconnected.
- In cooling operation, the outdoor heat exchanger thermistor is used for high pressure protection.



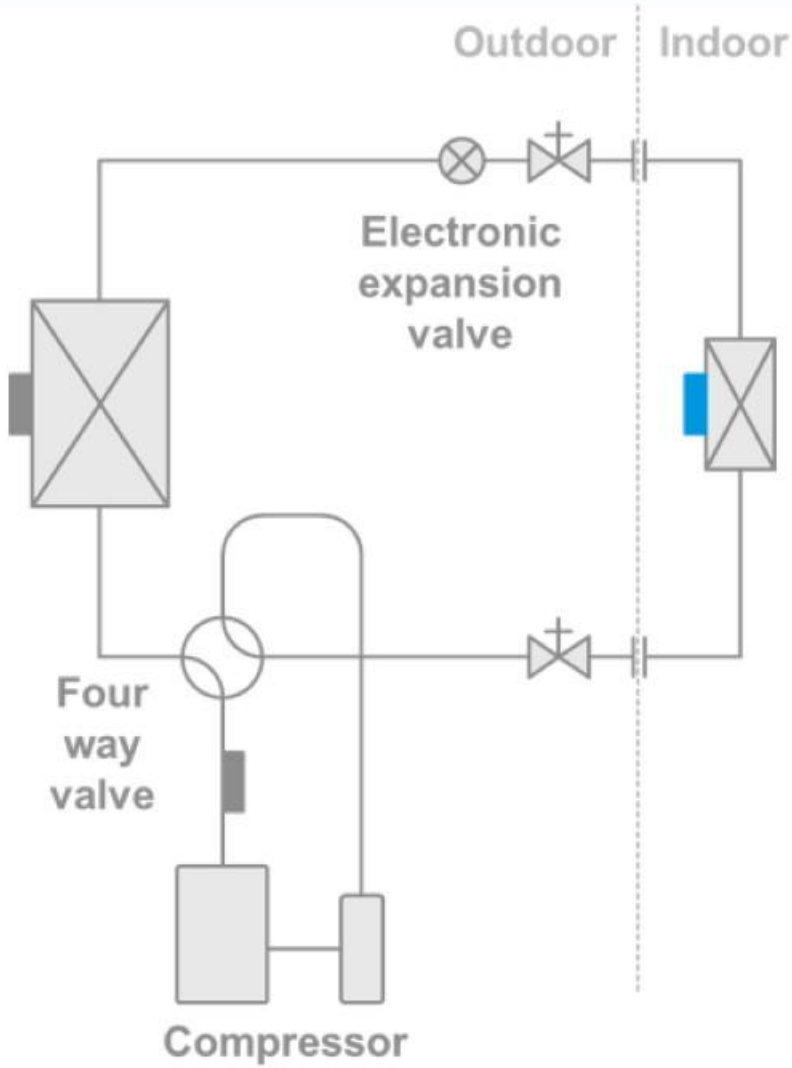
Discharge Pipe Thermistor

- The discharge pipe thermistor is used for controlling discharge pipe temperature. If the discharge pipe temperature (used in place of the inner temperature of the compressor) rises abnormally, the operating frequency becomes lower or the operation halts.
- The discharge pipe thermistor is used for detecting disconnection of the discharge pipe thermistor.



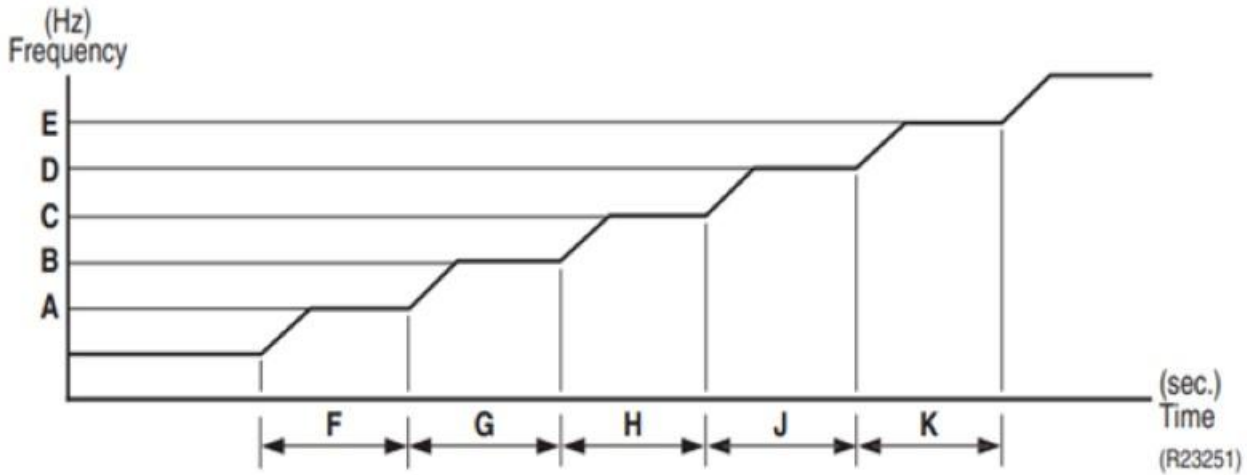
Indoor Heat Exchanger Thermistor

- The indoor heat exchanger thermistor is used for controlling the target discharge pipe temperature. The system sets the target discharge pipe temperature according to the outdoor and indoor heat exchanger temperature and controls the electronic expansion valve opening so that the target discharge pipe temperature can be obtained.
- In cooling operation, the indoor heat exchanger thermistor is used for freeze-up protection control. If the indoor heat exchanger temperature drops abnormally, the operating frequency becomes lower or the operation halts.
- In heating operation, the indoor heat exchanger thermistor is used for detecting the disconnection of the discharge pipe thermistor. When the discharge pipe temperature becomes lower than the indoor heat exchanger temperature, the discharge pipe thermistor is judged as disconnected.



Compressor Protection Function

- When turning the compressor from OFF to ON, the upper limit of frequency is set as follows. (The function is not activated when defrosting.)



*RXM__VVJU

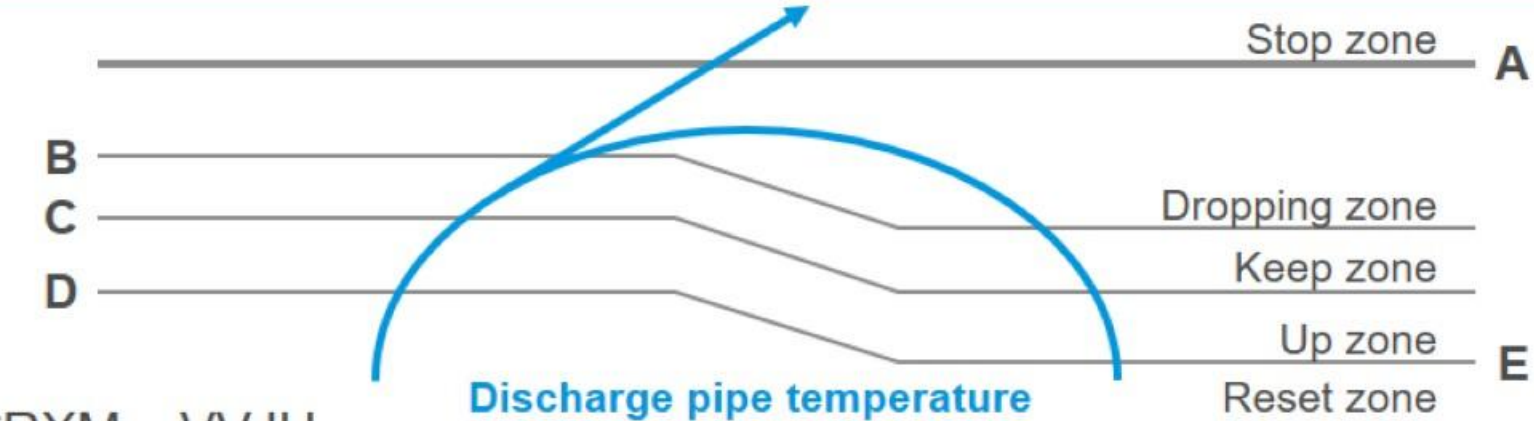
	09/12 class		18/24 class	
	Cooling	Heating	Cooling	Heating
A (Hz)	36	36	48	48
B (Hz)	52	52	48	48
C (Hz)	68	68	62	62
D (Hz)	80	80	80	80
E (Hz)	110	110	—	—
F (sec)	120	120	100	100
G (sec)	120	120	800	800
H (sec)	480	480	300	300
J (sec)	180	180	470	470
K (sec)	600	600	—	—

Discharge Pipe Temperature Control

Outline

- The discharge pipe temperature is used as the internal temperature of the compressor. If the discharge pipe temperature rises above a certain level, the upper limit of frequency is set to keep the discharge pipe temperature from rising further.

Detail



*RXM__VVJU

	(°C)	(°F)
A	118	244
B	108	226
C	103	217
D	97	207
E	85	185

Zone	Control
Stop zone	When the temperature reaches the stop zone, the compressor stops.
Dropping zone	The upper limit of frequency decreases.
Keep zone	The upper limit of frequency is kept.
Up zone	The upper limit of frequency increases.
Reset zone	The upper limit of frequency is canceled.

Input Current Control

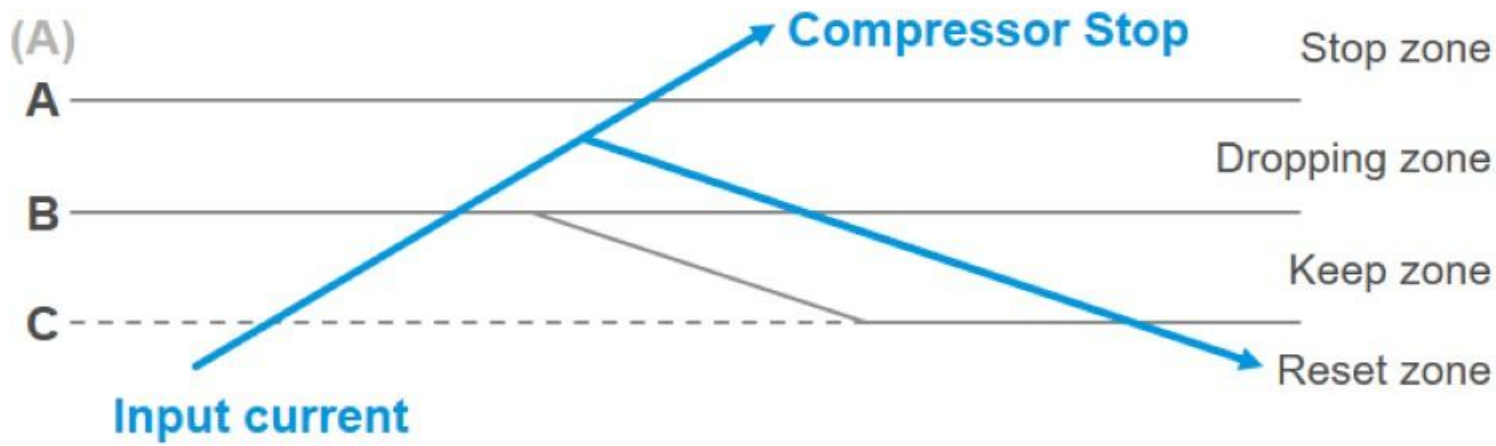
Outline

- The microcomputer calculates the input current while the compressor is running and sets the frequency upper limit from the input current. In case of heat pump models, this control which is the upper limit control of the frequency takes priority over the lower limit of control of four-way valve operation compensation.

Detail

Frequency control in each zone

- **Stop zone:** After 2.5 seconds in this zone, the compressor is stopped.
- **Dropping zone:** The upper limit of the compressor frequency is defined as operation frequency – 2 Hz.
  - After this, the output frequency is lowered by 2 Hz every second until it reaches the keep zone.
- **Keep zone:** The present maximum frequency goes on.
- **Reset zone:** Limit of the frequency is canceled.



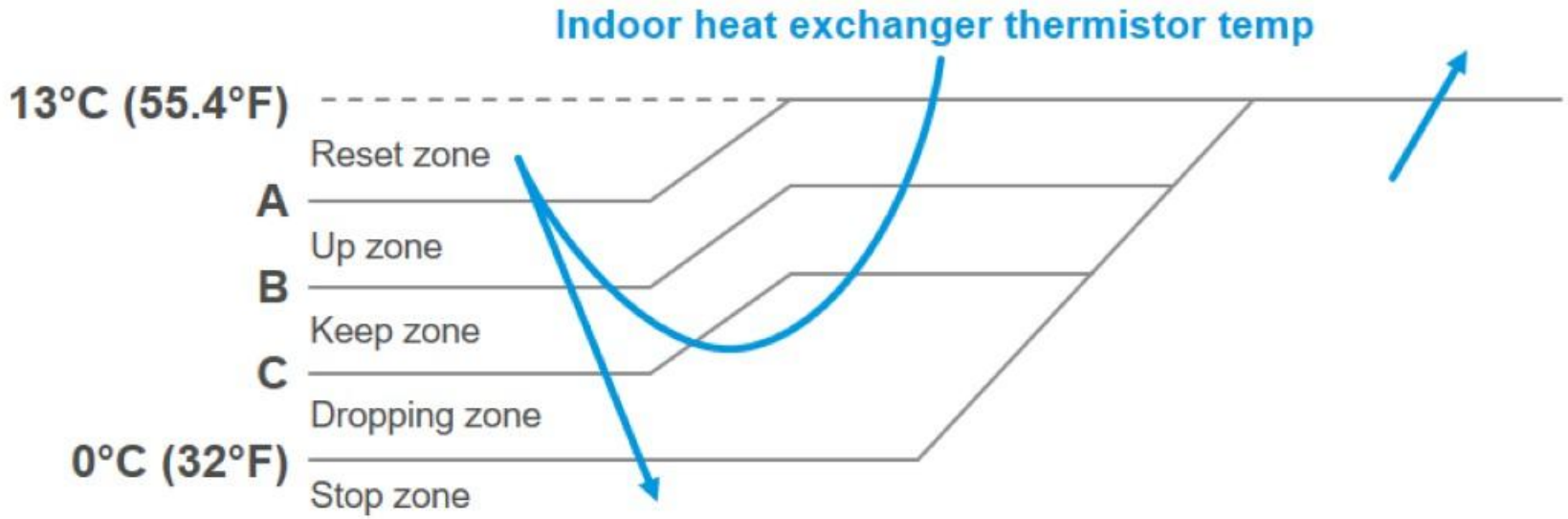
Freeze-up Protection Control

Outline

- During cooling operation, the signal sent from the indoor unit controls the operating frequency limitation and prevents freezing of the indoor heat exchanger. (The signal from the indoor unit is divided into zones.)

Detail

- The operating frequency limitation is judged with the indoor heat exchanger temperature.



	A	B	C
FTXM__VVJU	7°C (44.6°F)	5°C (41°F)	3°C (37.4°F)

Heating Peak-Cut Control

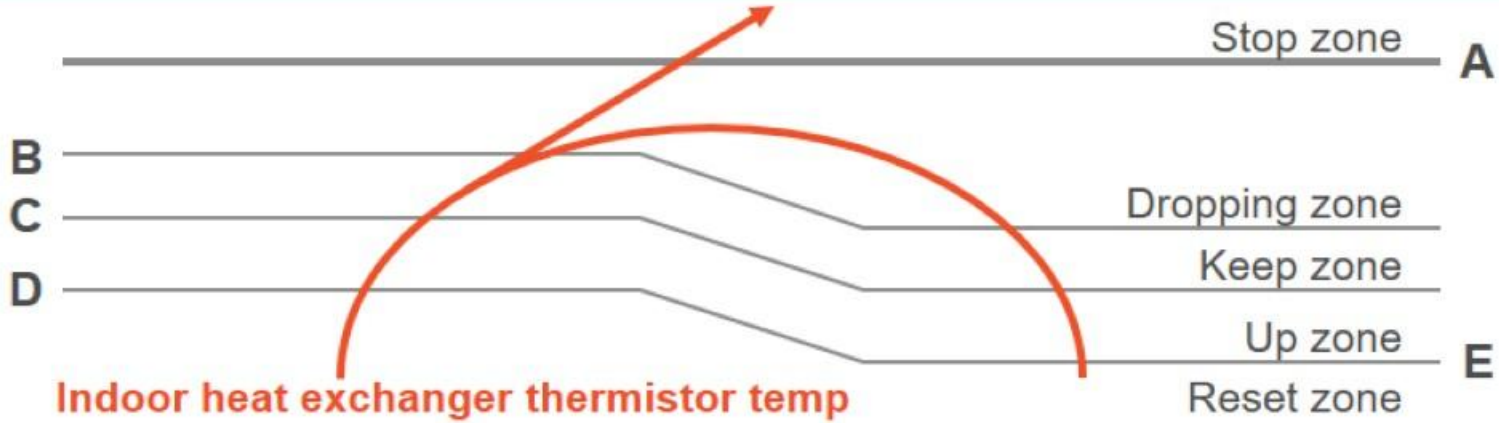
Outline

- During heating operation, the indoor heat exchanger temperature determines the frequency upper limit to prevent abnormal high pressure.

***RXM__VVJU**

	09/12 class		18/24 class	
	(°C)	(°F)	(°C)	(°F)
A	62	144	60	140
B	54	129	54	129
C	50	122	51	124
D	48	118	49	120
E	44	111	44	111

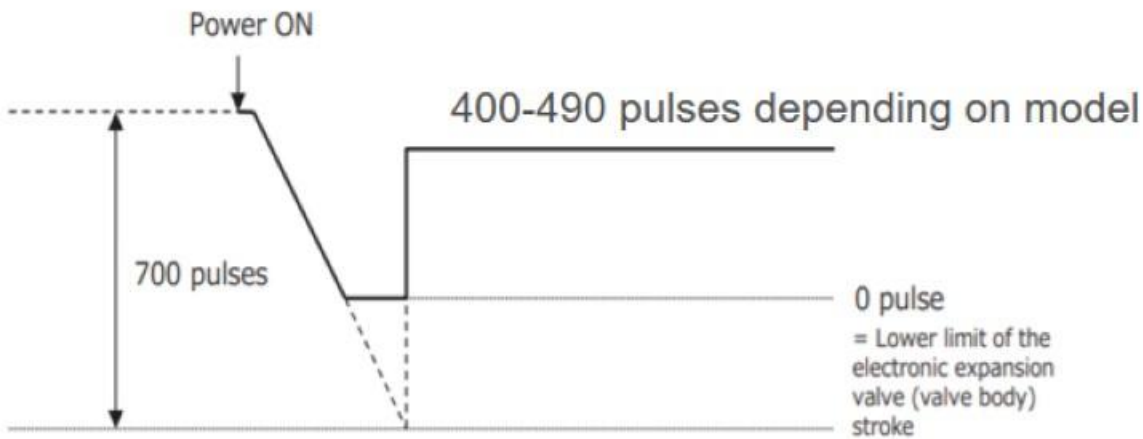
Detail



Zone	Control
Stop zone	When the temperature reaches the stop zone, the compressor stops.
Dropping zone	The upper limit of frequency decreases.
Keep zone	The upper limit of frequency is kept.
Up zone	The upper limit of frequency increases.
Reset zone	The upper limit of frequency is canceled.

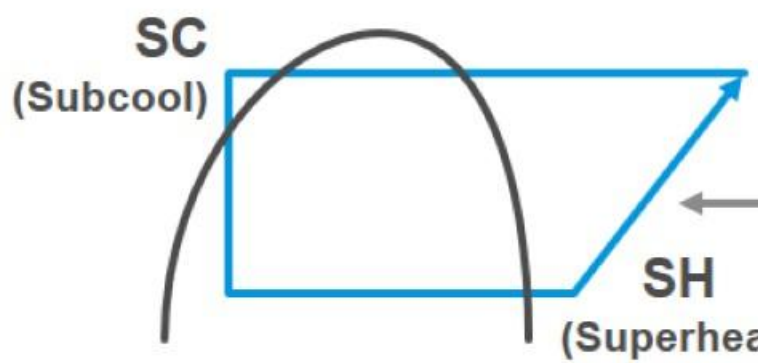
Electronic Expansion Valve Control

- Fully Closing with Power ON
  - The electronic expansion valve is initialized when turning on the power. The opening position is set, and the pressure equalization is developed.
- Pressure Equalizing Control
  - When the compressor is stopped, the pressure equalization control is activated. The electronic expansion valve opens and develops the pressure equalization.
- Opening Limit Control
  - Outline: A maximum and minimum opening of the electronic expansion valve are limited by the PCB which varies depending on the model. Min is generally between 20-50; max between 400-490.
- Normal operating position of EEV in cooling is 25-50% open.



Target Discharge Pipe Temperature Control

- The target discharge pipe temperature is obtained from the indoor and outdoor heat exchanger temperature, and the electronic expansion valve opening is adjusted so that the actual discharge pipe temperature becomes close to the target discharge pipe temperature. (Indirect SH (superheating) control using the discharge pipe temperature)
- The electronic expansion valve opening, and the target discharge pipe temperature are adjusted every 20 seconds. The target discharge pipe temperature is controlled by indoor heat exchanger temperature and outdoor heat exchanger temperature. The opening degree of the electronic expansion valve is controlled by the following:
  - Target discharge pipe temperature.
  - Actual discharge pipe temperature.
  - Previous discharge pipe temperature.



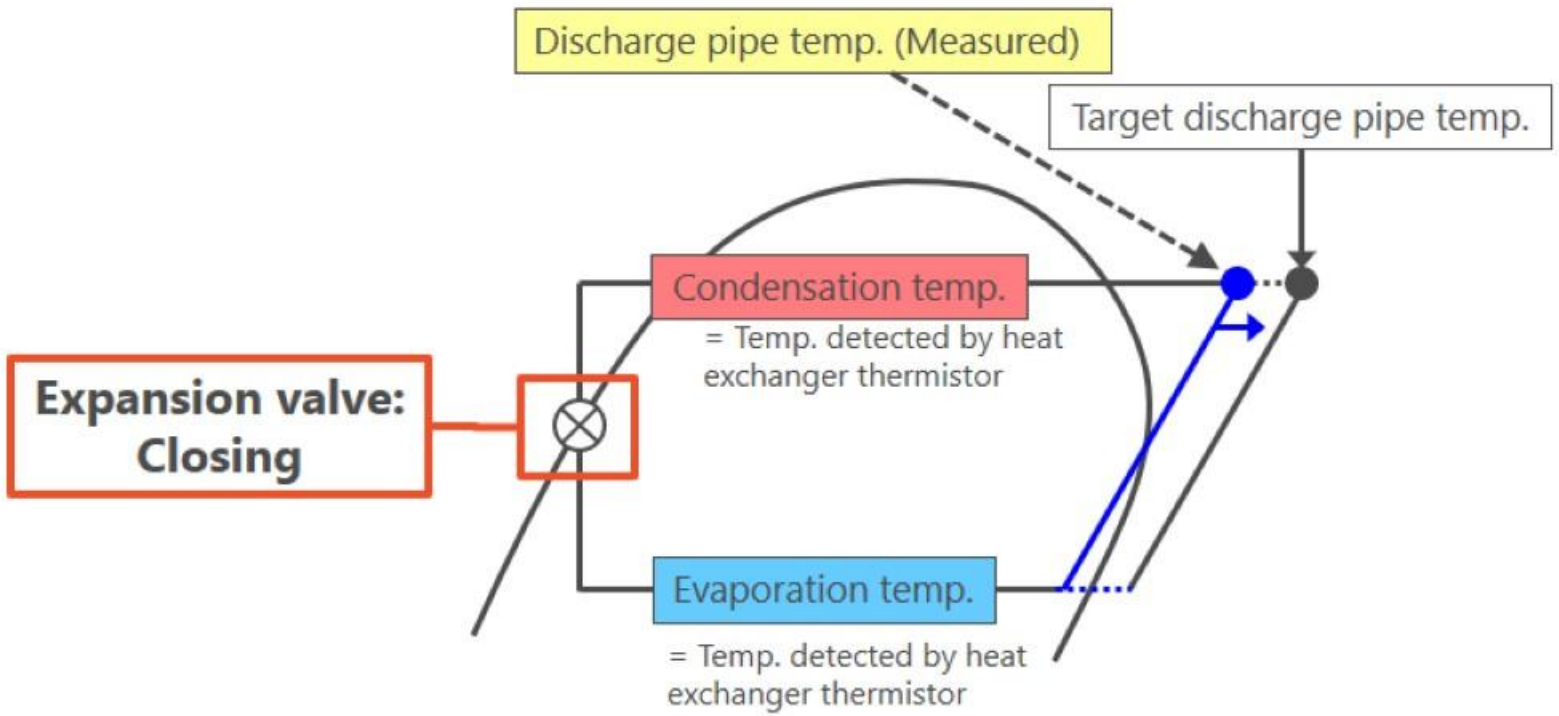
The target discharge pipe temp is set as to become the aiming SH.

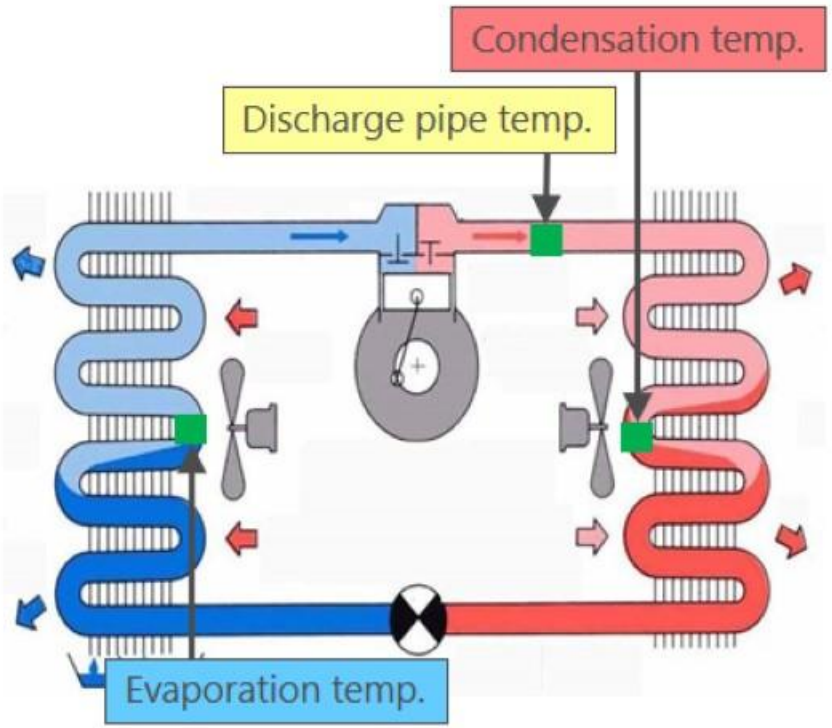
The inclination does not change depending on the operating condition.

Electronic Expansion Valve Control

When “Target discharge pipe temp.” > “Discharge pipe thermistor temp.”

- Typically, you will see Low superheat/more liquid in the evaporator
  - Close the expansion valve.
    - Reduce the refrigerant flow rate to increase the discharge pipe temp.

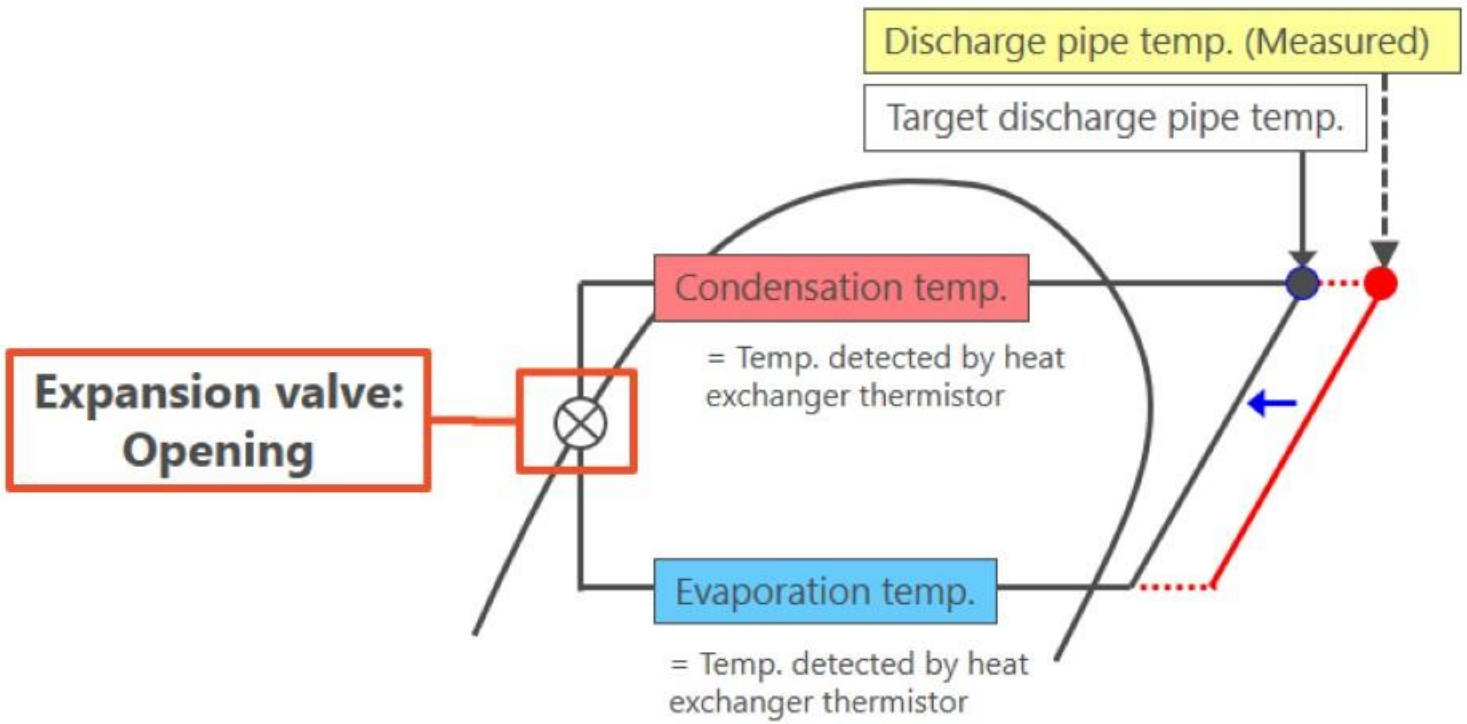


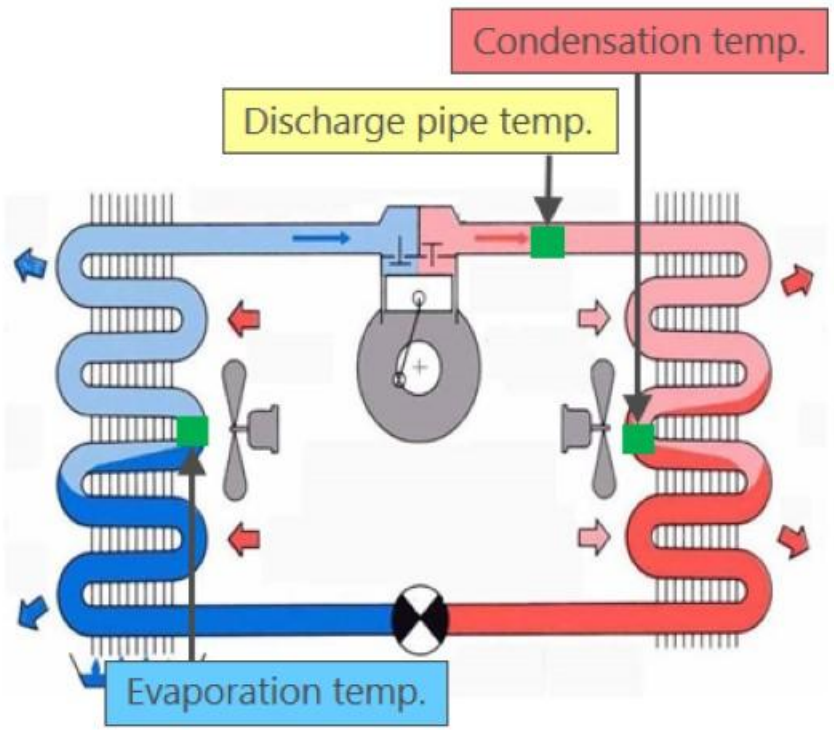


Electronic Expansion Valve Control

When “Target discharge pipe temp.” < “Discharge pipe thermistor temp.”

- Typically, you will see more superheat/less liquid in the evaporator
  - Open the expansion valve.
    - Increase the refrigerant flow rate to lower the discharge pipe temperature.





Agenda

Tools and Maintenance

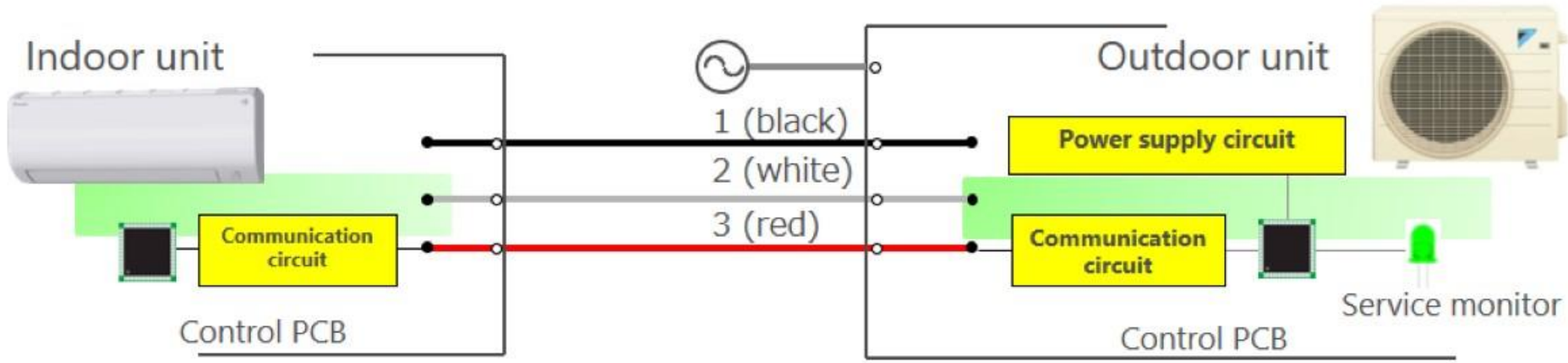
Basic Operation

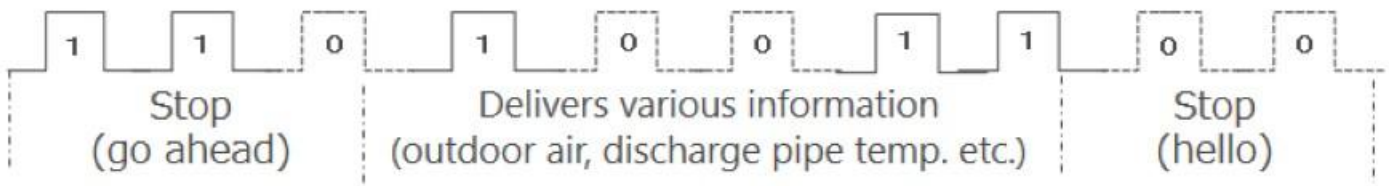
Communication

Components testing

Transmission circuit

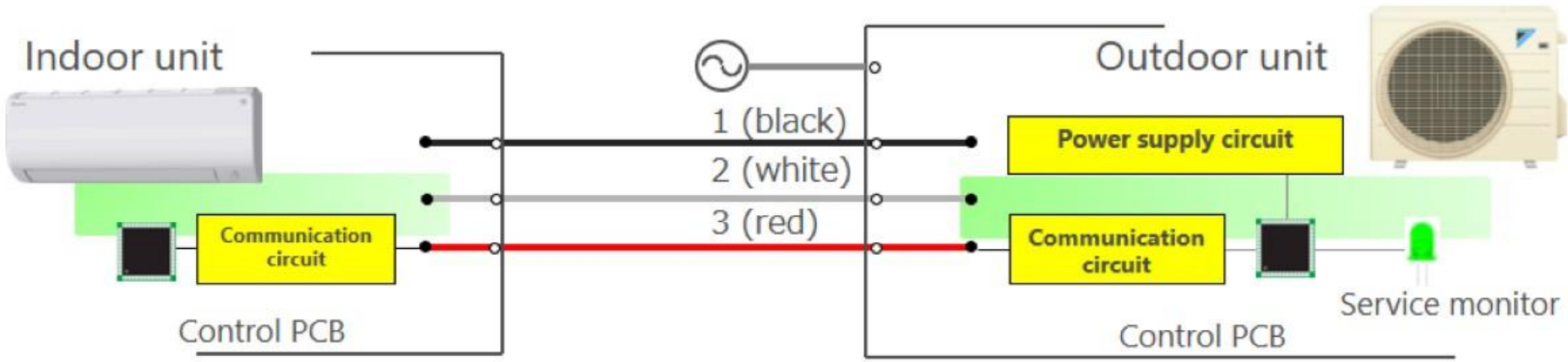
- Mini-split use a serial transmission circuit.
  - Serial transmission transmits a various data through the interunit connection wires.





Transmission circuit

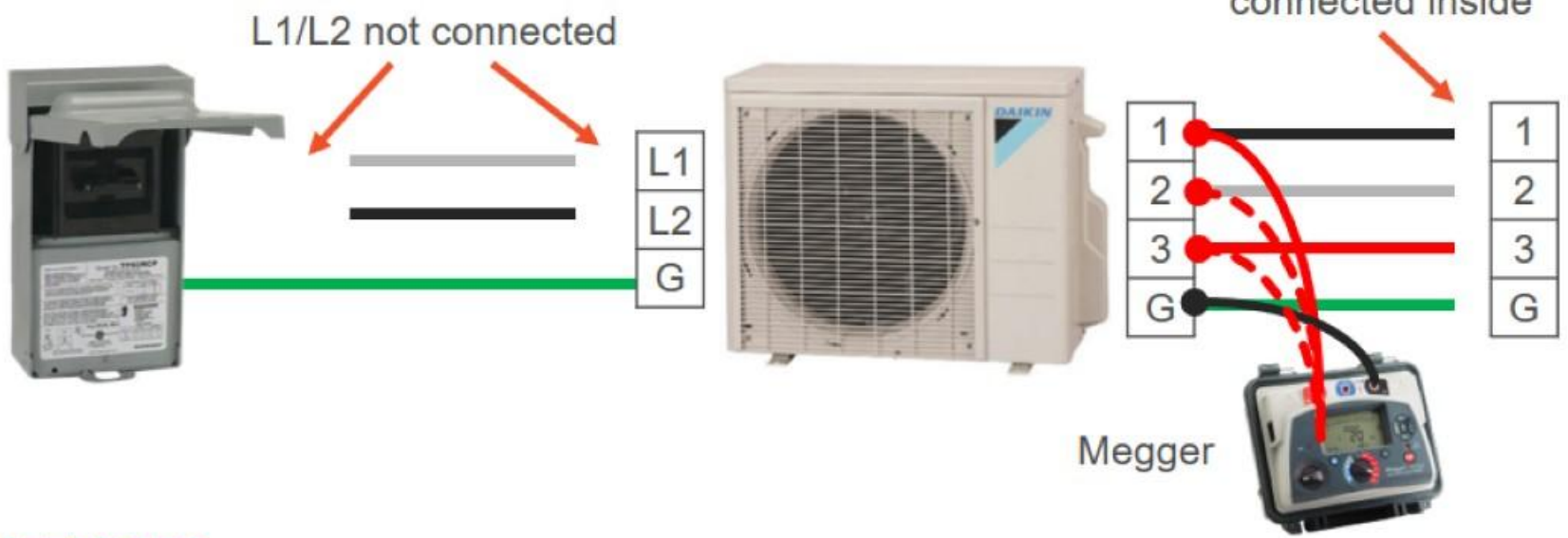
- Verify the wires go to the proper terminals and are not crossed
- Verify the proper wire size is used: stranded wire is recommended
- Verify that there are no breaks, splices, wire nuts in communication wire and that insulation resistance is good between the wires.
- Ensure that they system is properly grounded inside or outside per the installation manual



Insulation Resistance check

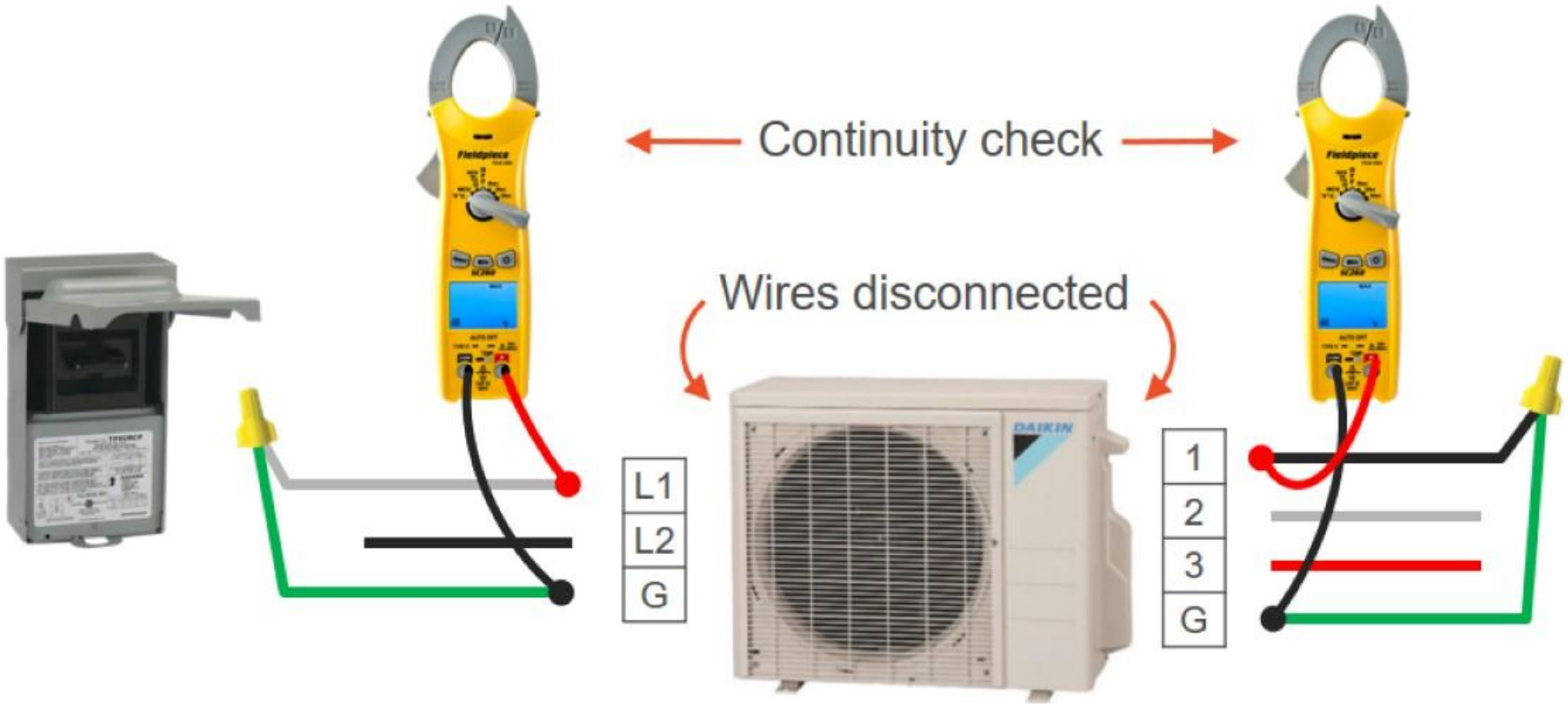
1. Turn the power of air conditioner OFF and confirm no power is on to the supply terminal.
2. Disconnect the power supply line from SCB and the outdoor unit (do not disconnect the grounding wires).
3. Disconnect No.1, No.2 and No. 3 connection wires on the indoor unit side from the terminal block (do not disconnect the grounding wires).
4. Measure insulation resistance of No.1-, No.2- and No.3- grounding wires.

- Points to check
  - Insulation resistance is several 10 MΩ to several hundred MΩ in a normal situation.
    - Criteria of insulation resistance is 1 MΩ or higher. However, if it is several MΩ, insulation resistance may temporarily drop due to rainfall or strong wind, leading to a risk of U4 error occurrence.



Wire integrity check

- Verify continuity between all the wires and the ground wire with a wire nut on one side



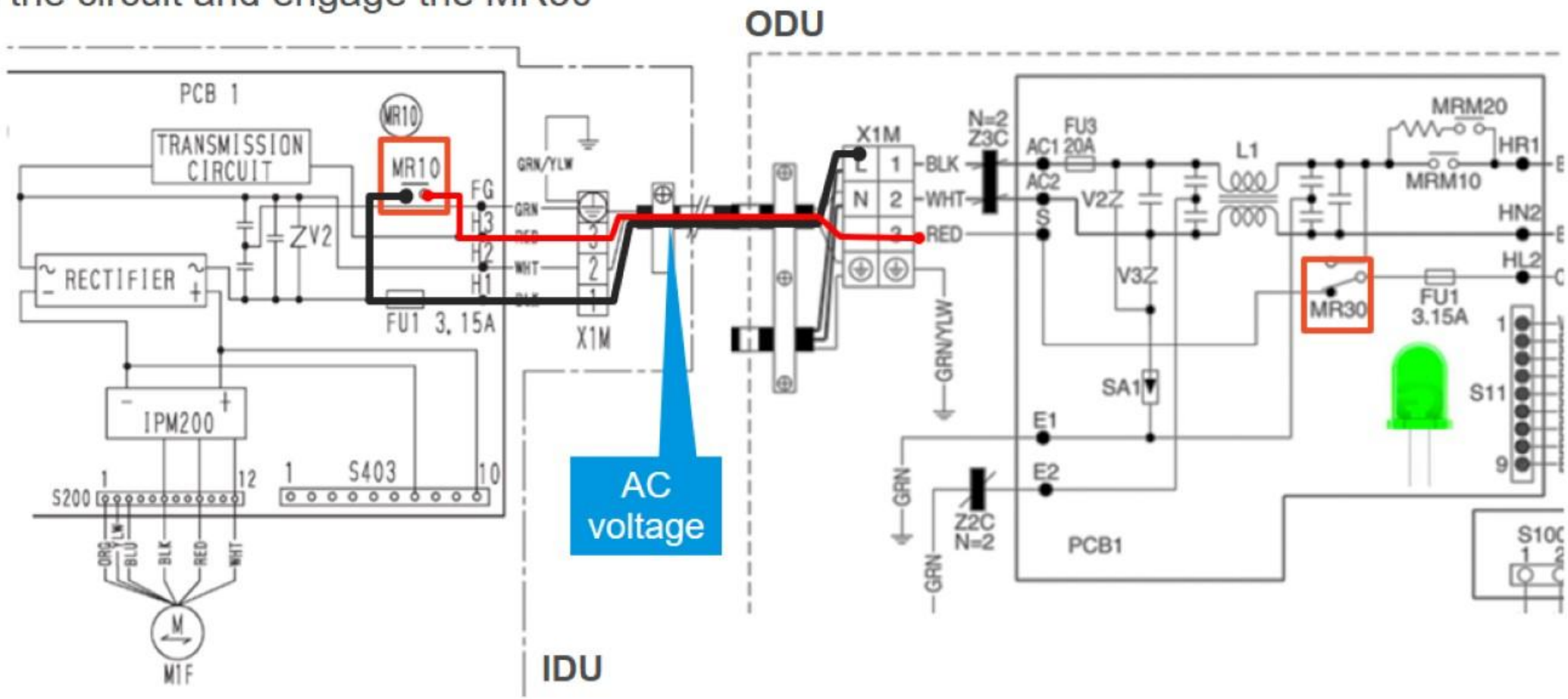
Stand-by or Energy Saving Relay

- To shut off power supply to the outdoor unit PCB to curb stand-by electricity during operation stop.
  - Confirm it by checking whether electricity saving relay exists in the wiring diagram or the main PCB.
- In models with stand-by electricity saving function, power supply to the outdoor unit PCB is shut off when a certain period of time elapsed after operation stopped.
  - Since power to control the O/U is OFF during suspension, the service monitor is also OFF.
  - Be aware that there is a possibility of wrong diagnosis that the outdoor unit PCB is broken down.

Service monitor is OFF while stand-by electricity saving function is working

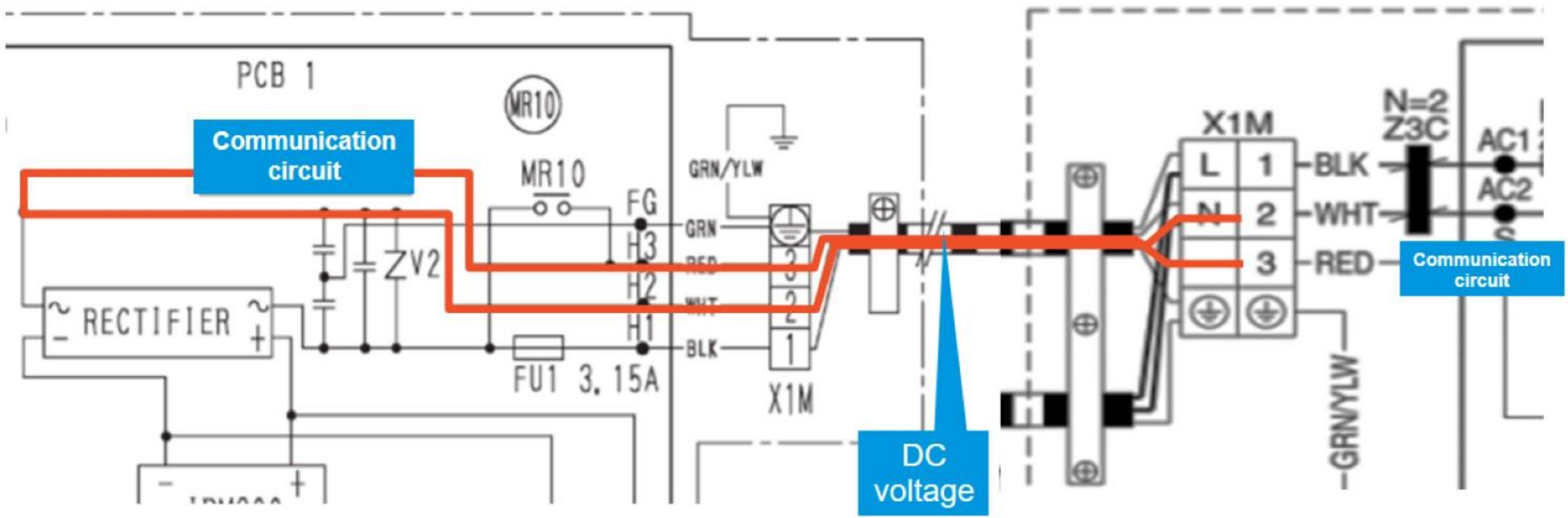
MR30 Energy Saving Relay

- The MR30 is closed by communication circuit in the indoor unit. Therefore, if the circuit is open by a break in the wire or at the Indoor unit, the service monitor will be off, and the outdoor transmission circuit will not be sending DC communication voltage. Setting the air handler to FAN Only mode will close the circuit and engage the MR30



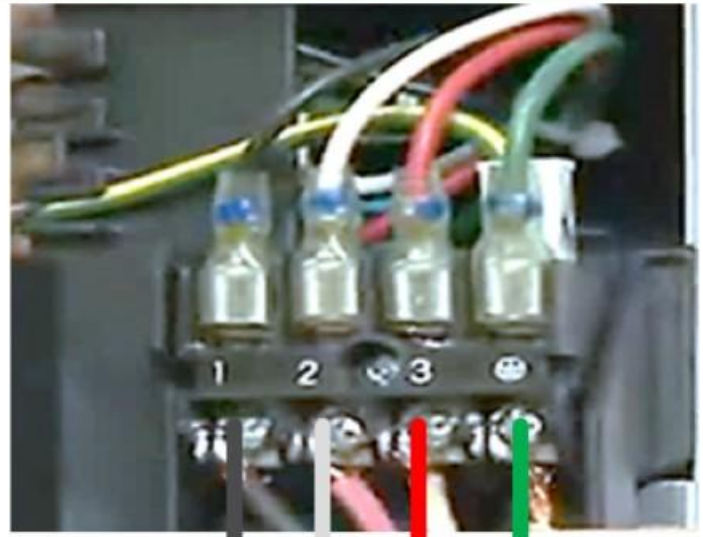
Transmission Circuit

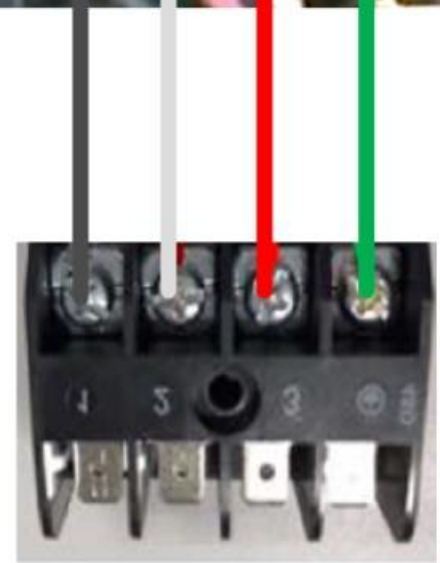
- The transmission circuit can be read on wire 2 and 3 in between the indoor and outdoor units. If both circuits are transmitting, 5-45 VDC will be pulsing up and down.



Power and communication voltage checks

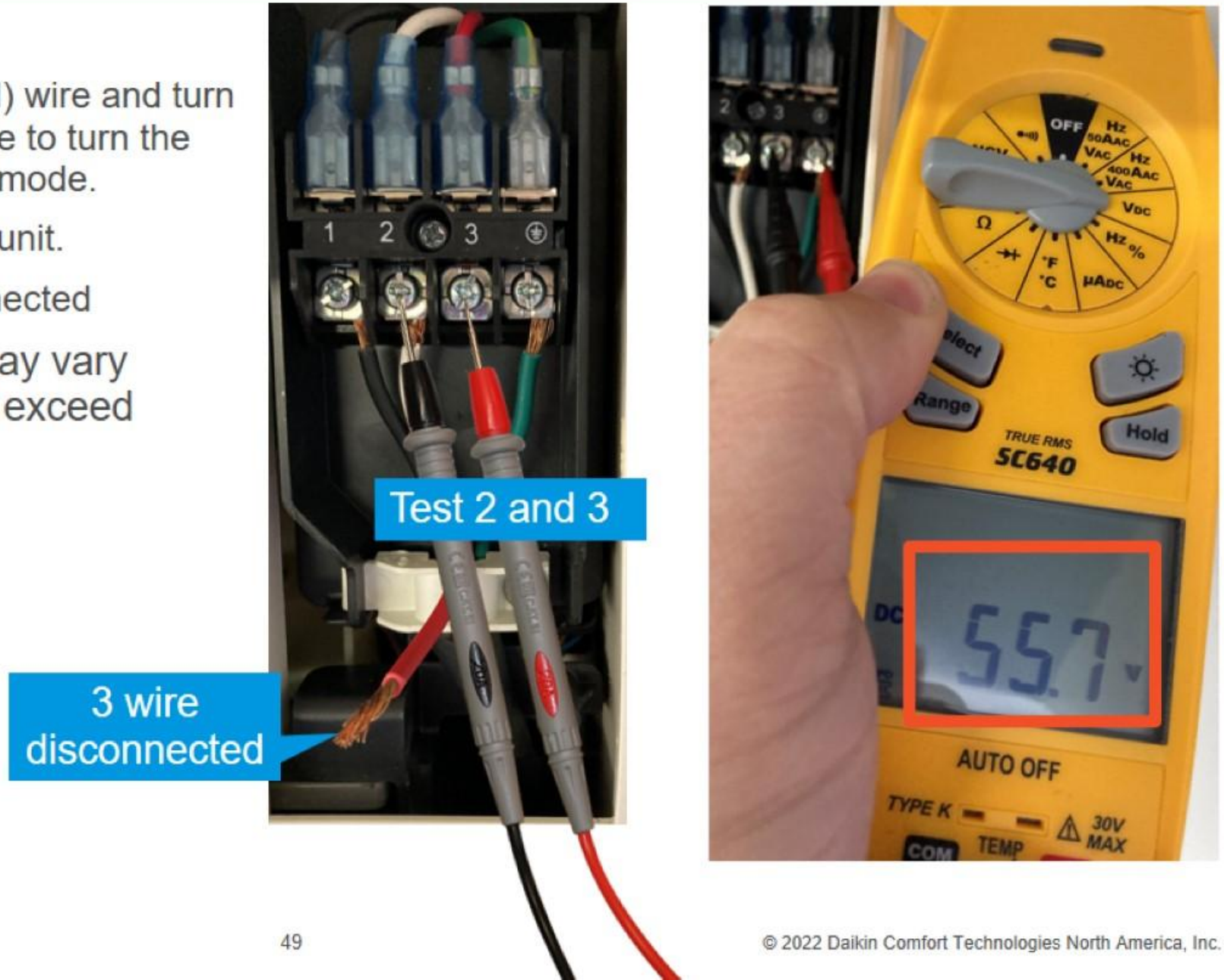
- AC voltage checks:
  - 1-2: 230 vac
  - 1-G: 115 vac
  - 2-G: 115 vac
- DC voltage check:
  - Make sure MR30 has closed by checking to see if outdoor LED is on, if it is not turn on the FAN ONLY mode at the indoor unit.
    - 2-3: 5-45 vdc (pulsing)





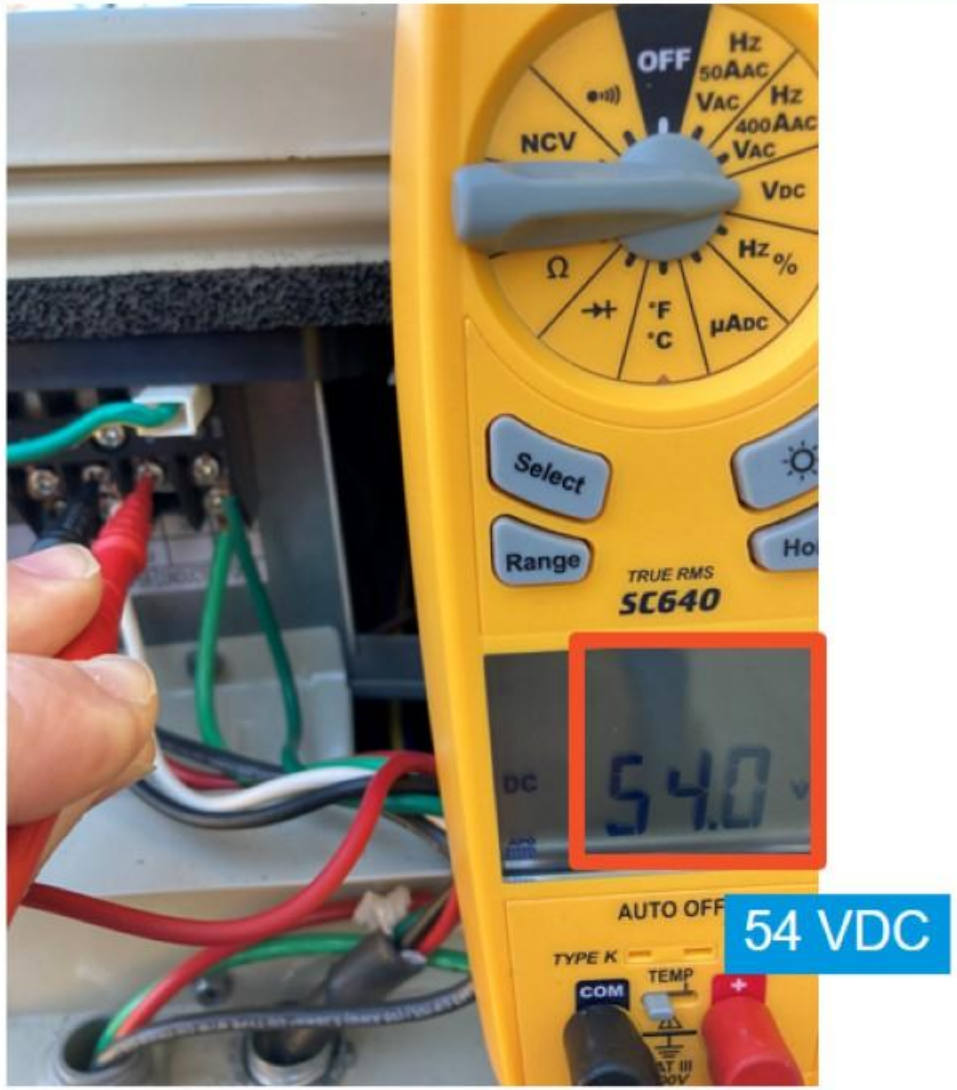
DC voltages checks

- Indoor unit VDC check:
  - Disconnect the number 3 (signal) wire and turn on the power. You should be able to turn the indoor unit on in the FAN ONLY mode.
  - Then Check wires 2-3 at indoor unit.
    - 54 vdc* with wire 3 disconnected
- *This voltage will be stable but may vary between 12-90 vdc. It should not exceed 100vdc



Transmission Voltages

- Outdoor unit VDC check:
  - Disconnect the number 3 (signal) wire and turn on the power. Check to see if the outdoor PCB has an MR30 (if the LED is on with 3 disconnected, you don't have an MR30 and can proceed to the check)
  - Check **2-3 at outdoor unit.**
    - **54 vdc* with wire 3 disconnected**
- If you do have an MR30 start by checking the Indoor PCB communication circuit first



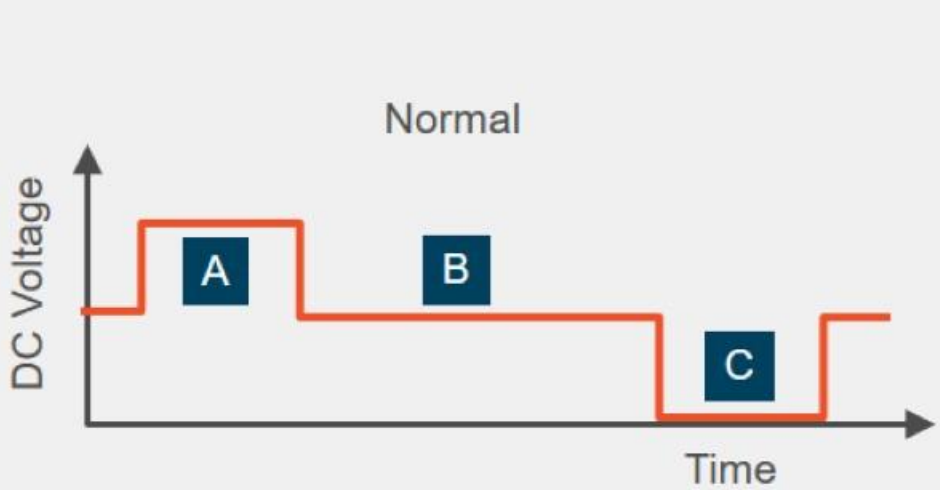
Transmission Voltages

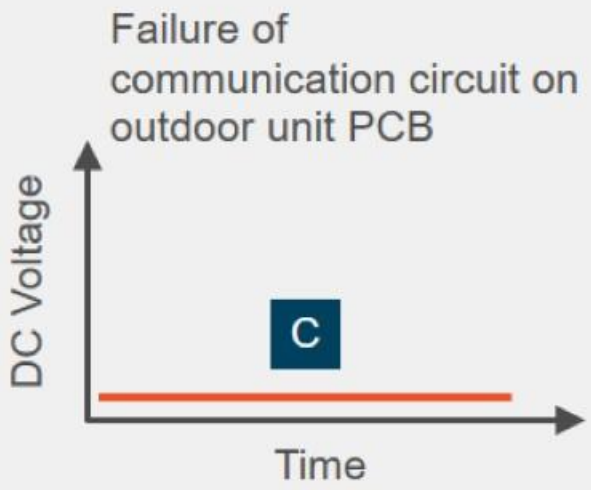
- Ensure that MR30 has closed (if the ODU has one), by turning the indoor unit if the fan only mode. You may not be able to do this is the Fan has failed or the MR10 relay fails to close.

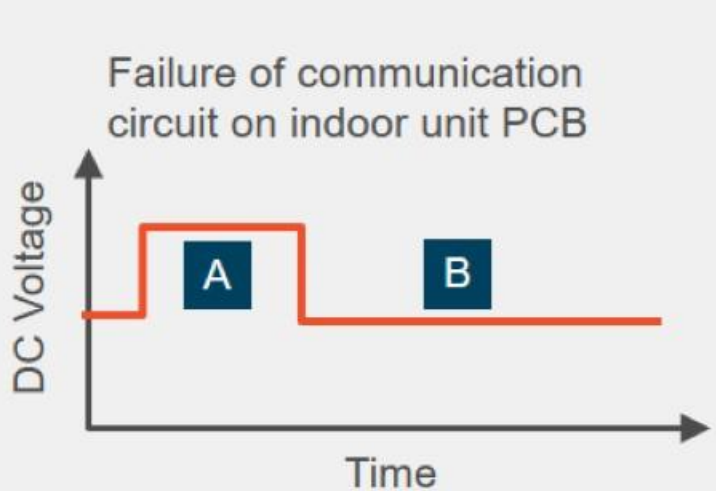
Check the communication voltage between 2-3 with the multimeter DC voltage mode.

A : 35-50V B : 10-30V C : 0-10V

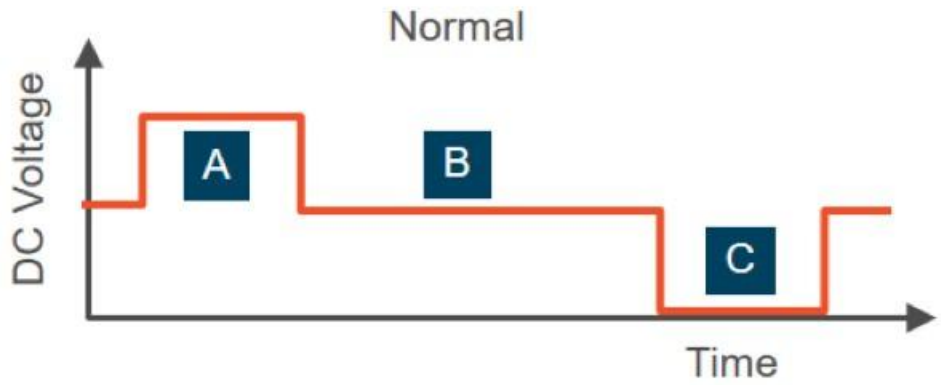
Note: Voltage may differ from the actual value due to simplified service diagnosis by the multimeter.







Transmission Voltage Normal Conditions



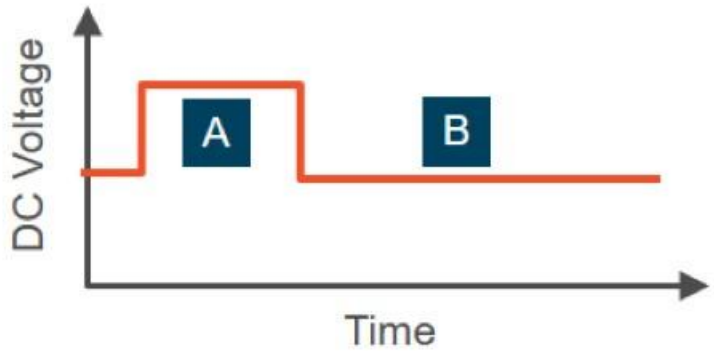
- The numbers should pulse in increasing voltages. The reading below are example voltages

A	B	C
		

Transmission voltage with a failed PCB

- Failure of communication circuit on outdoor unit PCB

- Failure of communication circuit on indoor unit PCB



*Example voltages actual voltages may vary

Agenda

Tools and Maintenance

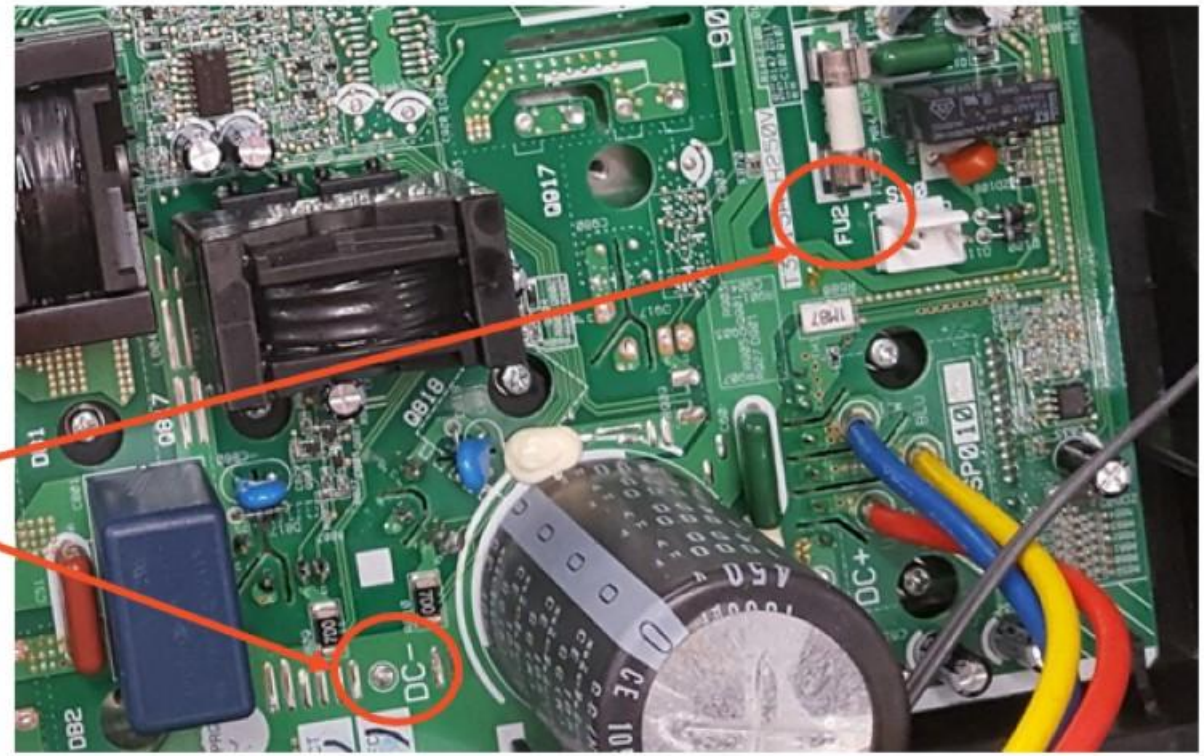
Basic Operation

Communication

Component Testing

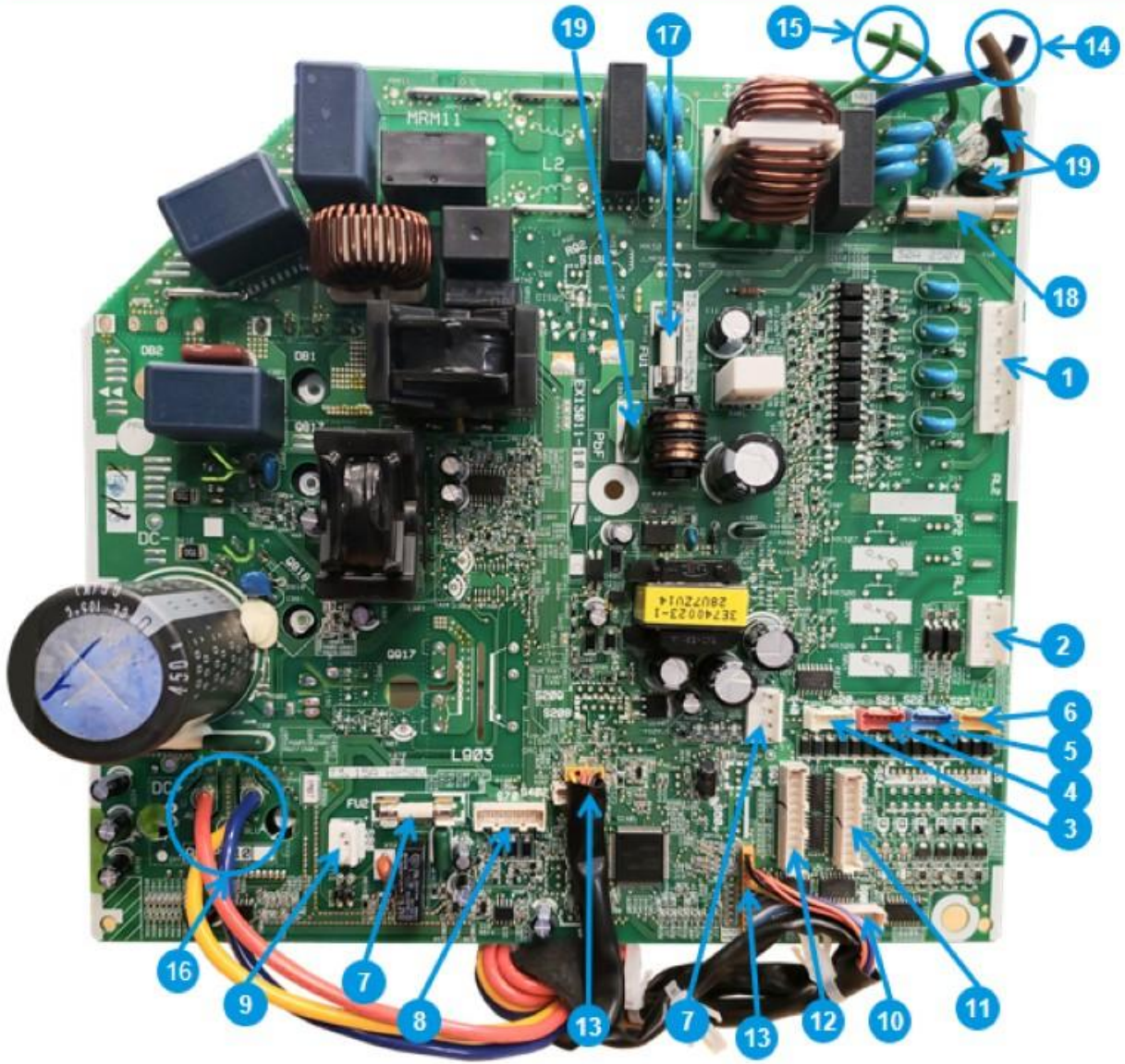
Safety Check

- Check DC voltage at the points on the printed circuit board. The voltage with the relays open on the board will be 25 to 35 VDC. When the main relay is closed VDC will be 297 ±30 VDC



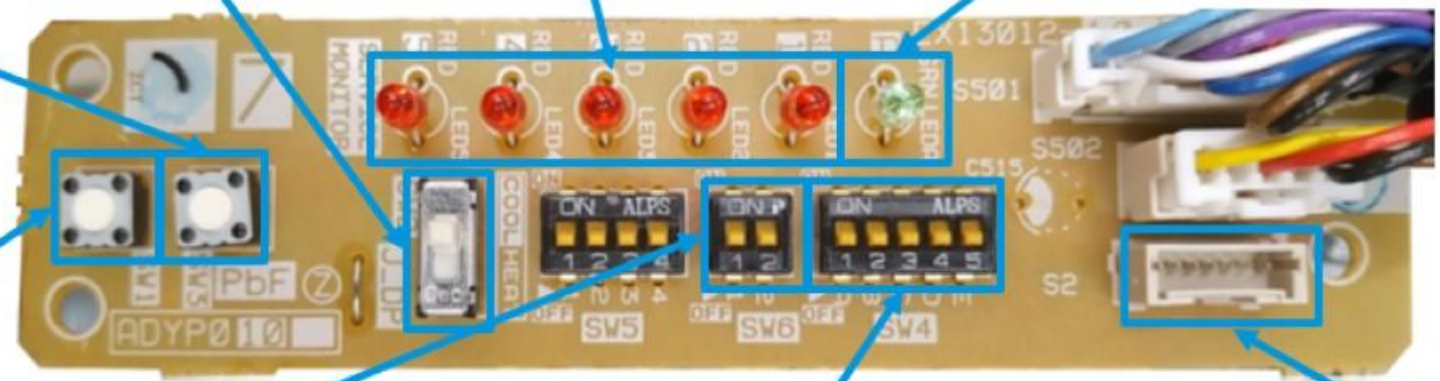
IMPORTANT!!! Be sure the voltage is below 50VDC before removing any connectors from the PCB.

PCB Identification



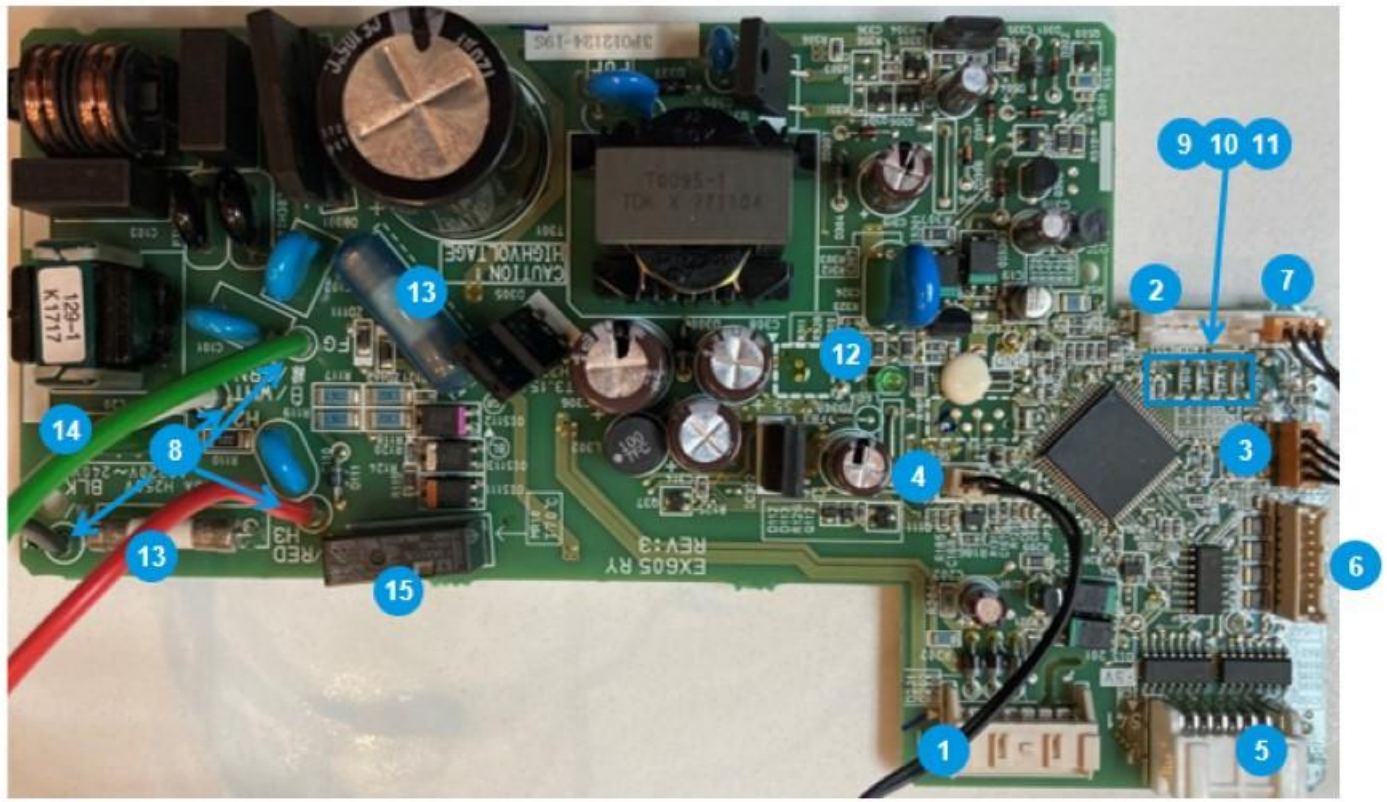
1	S	Connector for terminal board (indoor - outdoor transmission)
2	S15	Connector for COOL/ HEAT mode lock
3	S20	Connector for electronic expansion valve coil A port
4	S21	Connector for electronic expansion valve coil B port
5	S22	Connector for electronic expansion valve coil C port (24/36 class)
6	S23	Connector for electronic expansion valve coil D port (36 class)
7	S40	Connector for overload protector
8	S70	Connector for DC fan motor
9	S80	Connector for four-way valve
10	S90	Connector for thermistor
11	S92	Connector for thermistor
12	S93	Connector for thermistor
13	S201, S202	Connector for service monitor PCB
14	HL1, HN1	Connector for terminal board (power supply)
15	E1, E2	Connector for ground wire
16	U, V, W	Connector for compressor
17	FU1, FU2	Fuse (3.15 A, 250 V)
18	FU3	Fuse (30 A, 250 V)
19	V2, V3, V401	Varistor

Service Monitor Board

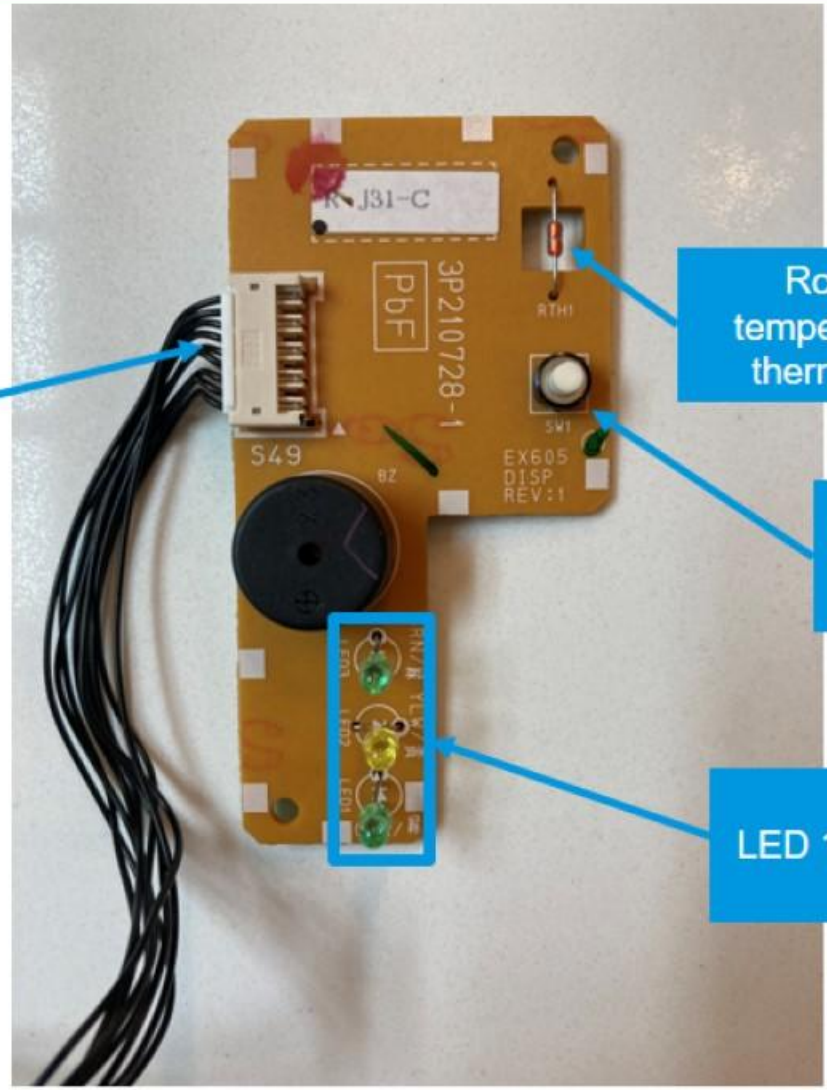


Indoor PCB picture

1	S1	Connector for DC fan motor
2	S21	Connector for controllers
3	S25	Connector for INTELLIGENT EYE
4	S32	Indoor heat exchanger thermistor
5	S41	Connector for swing motors
6	S46	Connector for display PCB
7	S47	Connector for signal receiver
8	H1, H2, H3, FG	Connector for terminal strip
9	JA	Address setting jumper
10	JB	Jumper for fan speed when thermo-off in cooling – cutting turns fan off
11	JC	Jumper to disable auto restart
12	LED A	LED for service monitor (green)
13	FU1, FU2	Fuse (3.15 A, 250 V
14	V1	Varistor
15	MR10	Magnetic Relay



Indoor PCB picture



Connector for control PCB

Room temperature thermistor

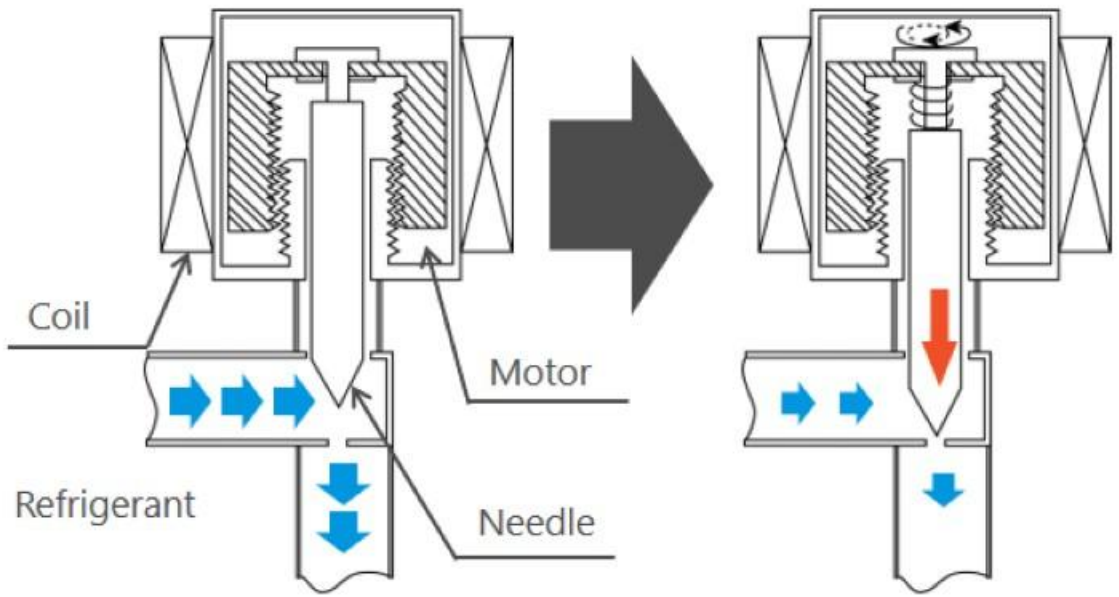
Indoor unit on/off button (SW1)

LED 1, 2, and 3

Expansion valve

- High pressure, high-temperature liquid refrigerant is cooled and changed to low-pressure, low-temperature liquid refrigerant.
- It reduces the pressure to bring the liquid refrigerant into a state that can easily evaporate even at a low temperature.

Switching pulse: 0-480 pls.

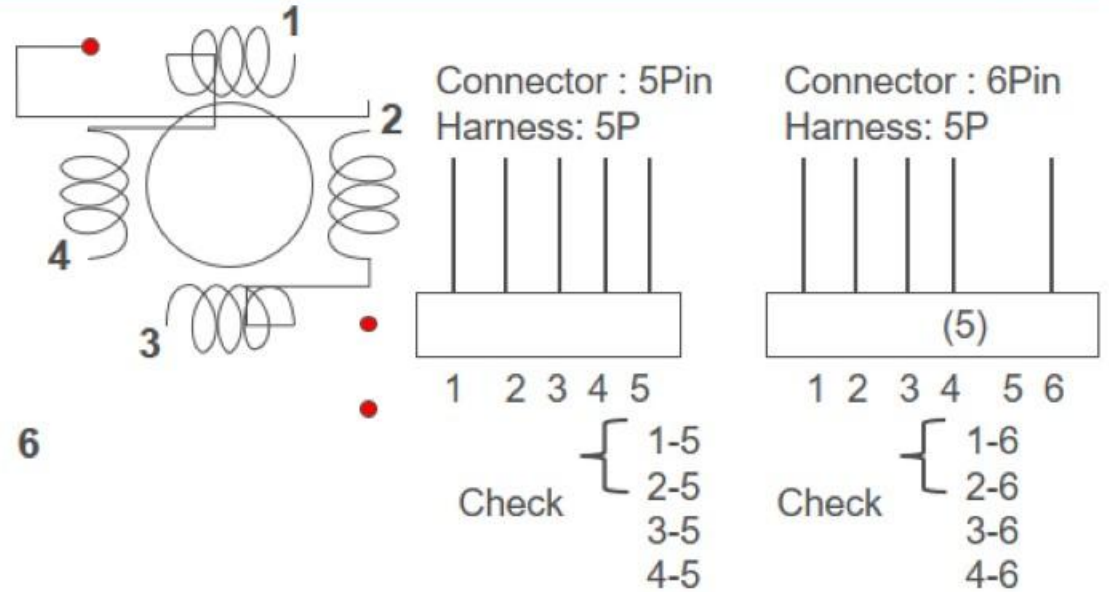


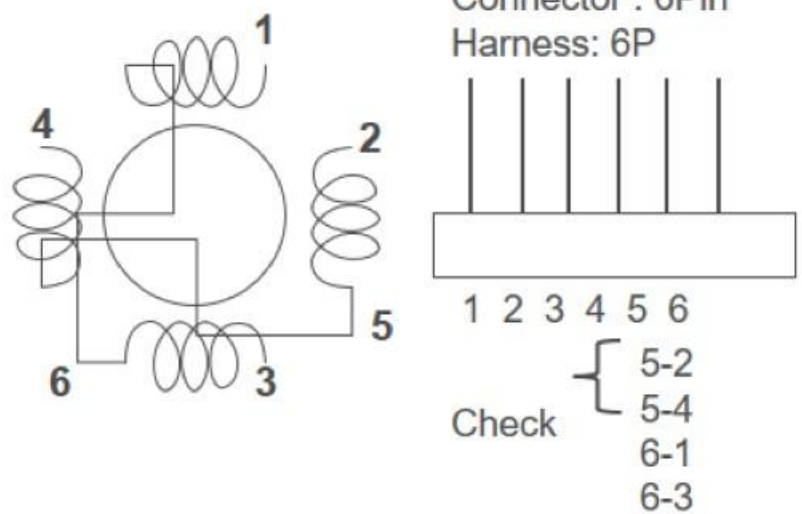
Electric Expansion Valve Check

1. Check if the EV connector is correctly connected to the PCB
2. Turn the power off and on again, and check if the EV generates a latching sound.
3. If the EV does not generate a latching sound in the above step 2, disconnect the connector and check the continuity using a multi-meter.
4. Check the continuity between the pins 1-6, 2-6, 3-6, 4-6 (For 5P connectors*).
   - If there is no continuity between the pins, the EV coil is faulty.
5. If the continuity is confirmed in step3, the outdoor-unit PCB (main PCB) is faulty.

* Check method depends on valve type, so please refer to the “Service Manual”.

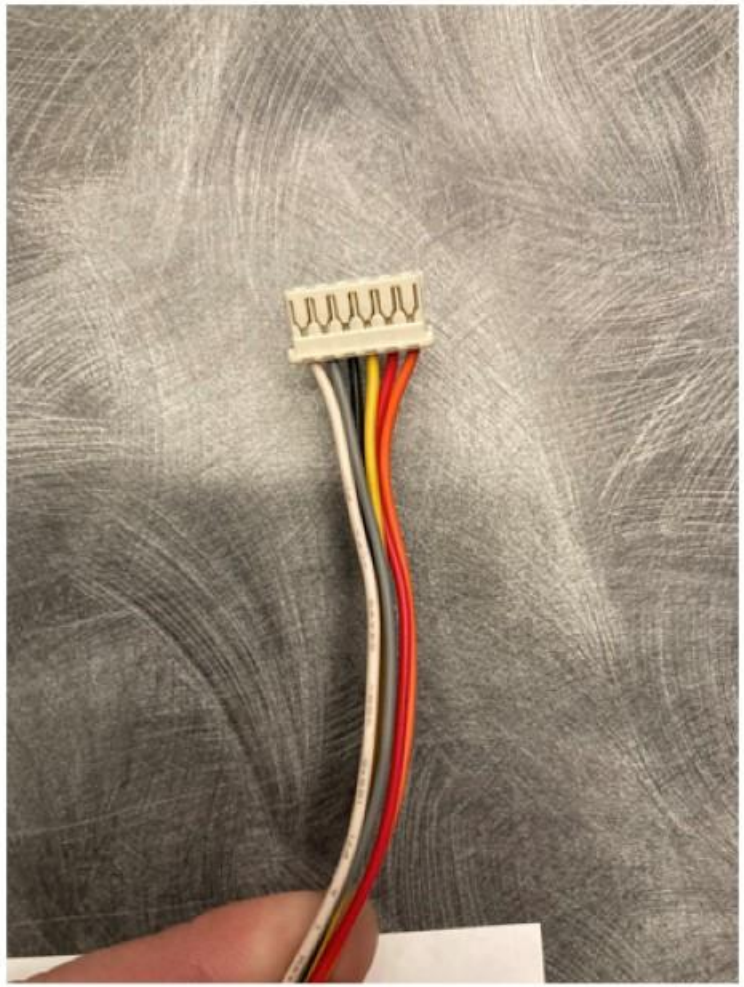
* Latching sound is different depending on the valve.



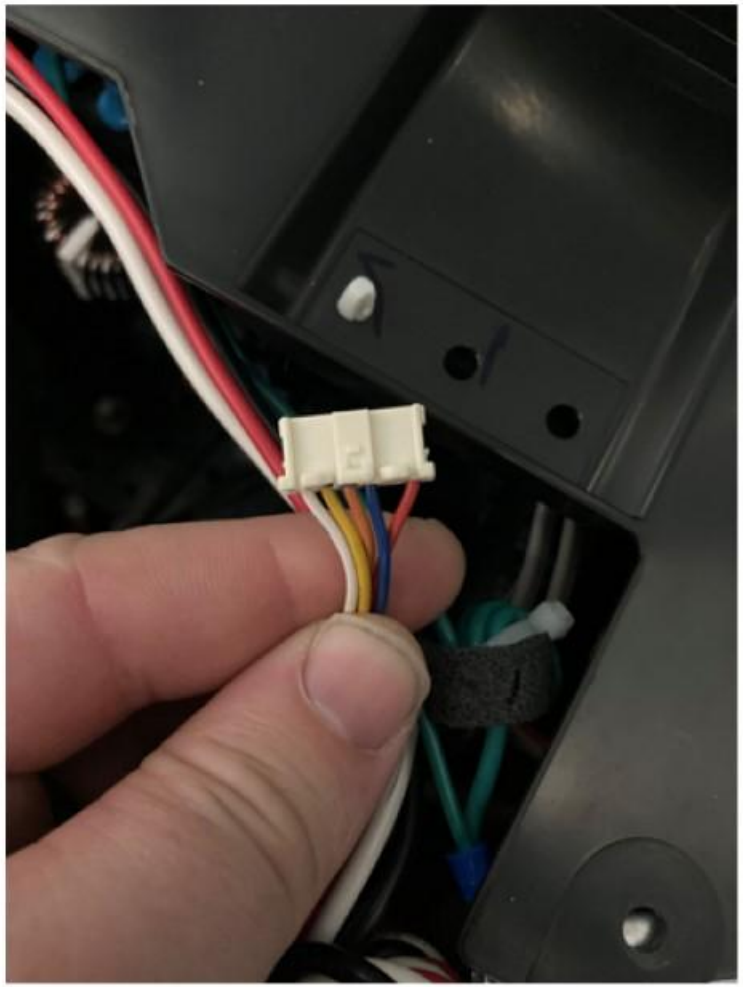


Expansion Valve Plugs

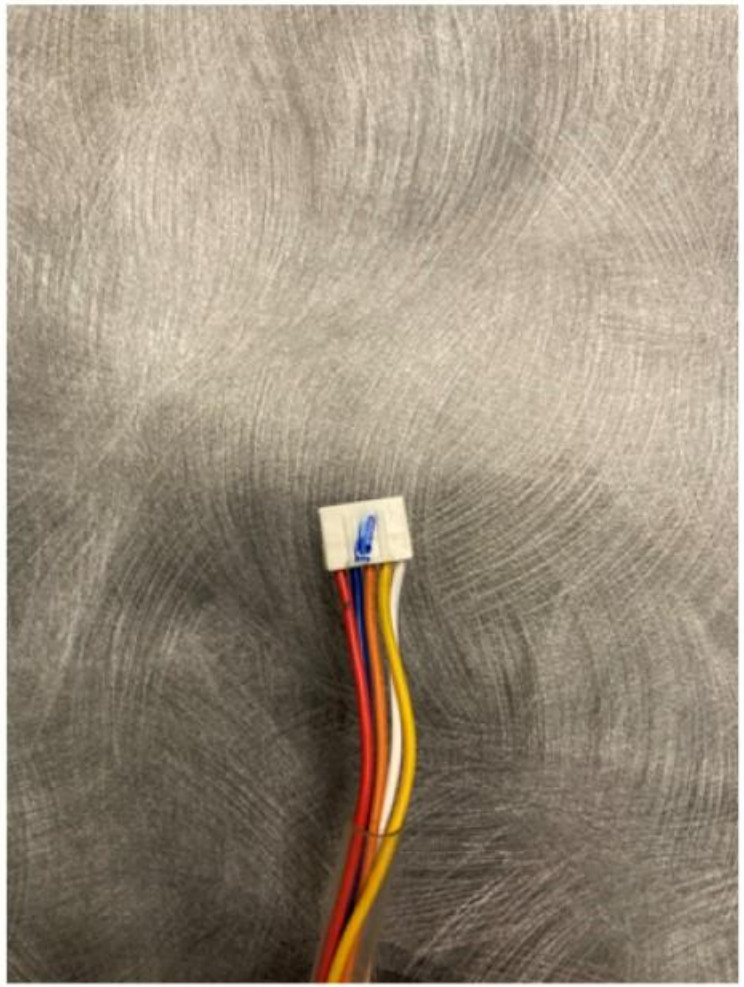
6 wire



6 pin 5 wire



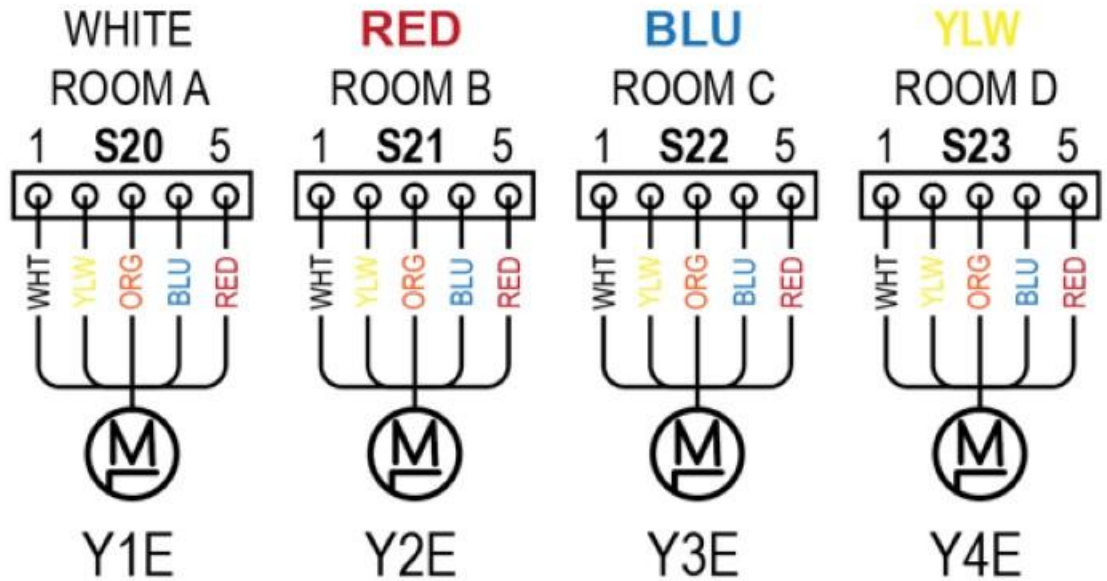
5 wire



Resistance Checks

- Example of good test on a Multi-port.

1-5, 3-5, 2-5, 4-5



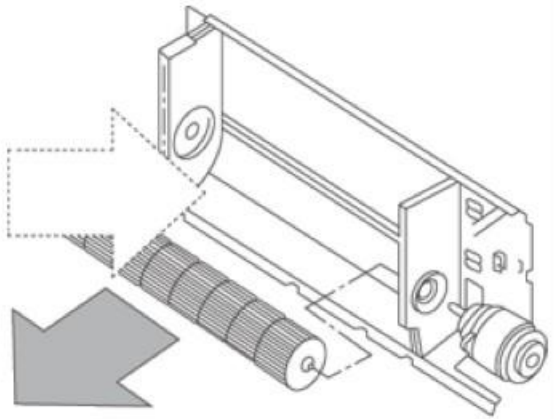
Testing the Expansion Valve

- With the power of Remove the EEV magnet
- Replace it with the manual magnet tool
- Manually drive the valve closed and open
- You will feel the valve stop at the fully open position and you will feel the valve ticking in the fully closed position

Fan Types

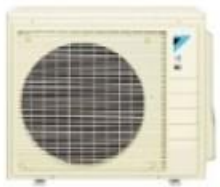
- Various types of fans are used depending on the unit type, operation noise, space, etc.

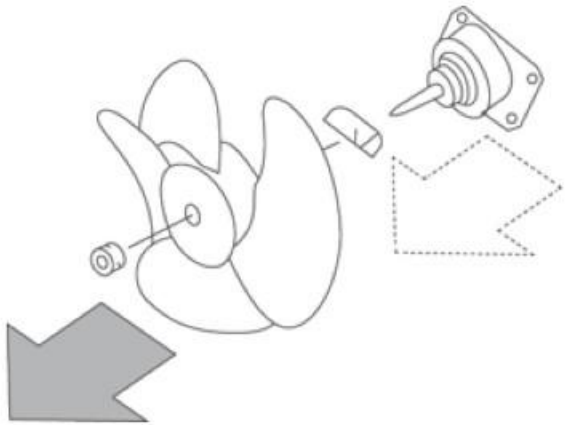
Cross flow fan



e.g.: Wall mounted type, Ceiling cassette type (1-way)

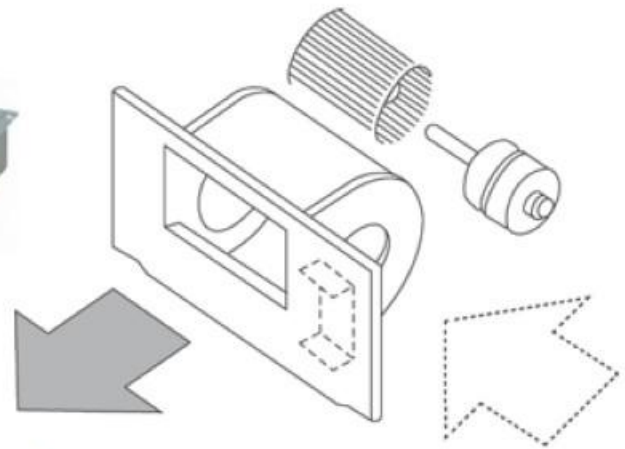
Propeller fan





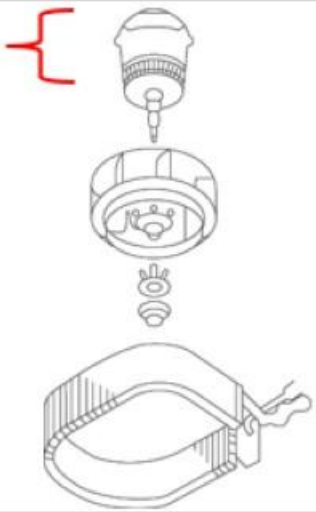
e.g.: Outdoor unit (standard)

Sirocco fan



e.g.: Duct connected type

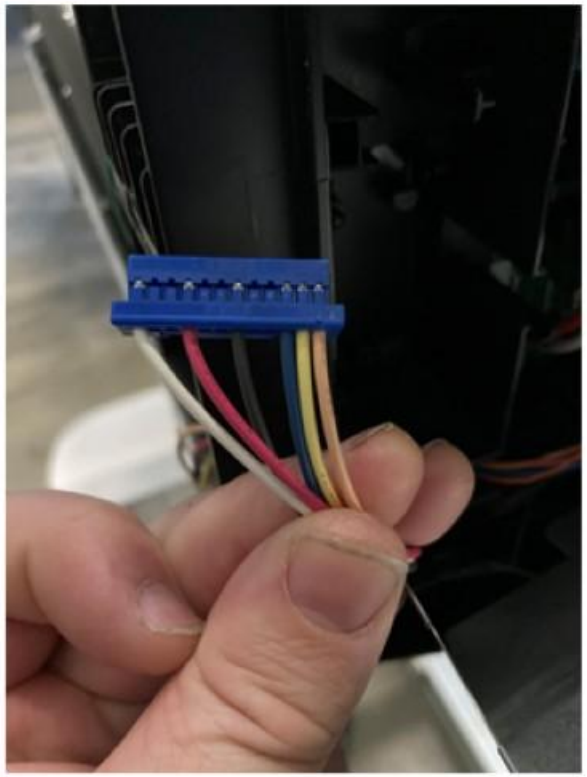
Turbo fan



e.g.: Ceiling cassette type (4-way)

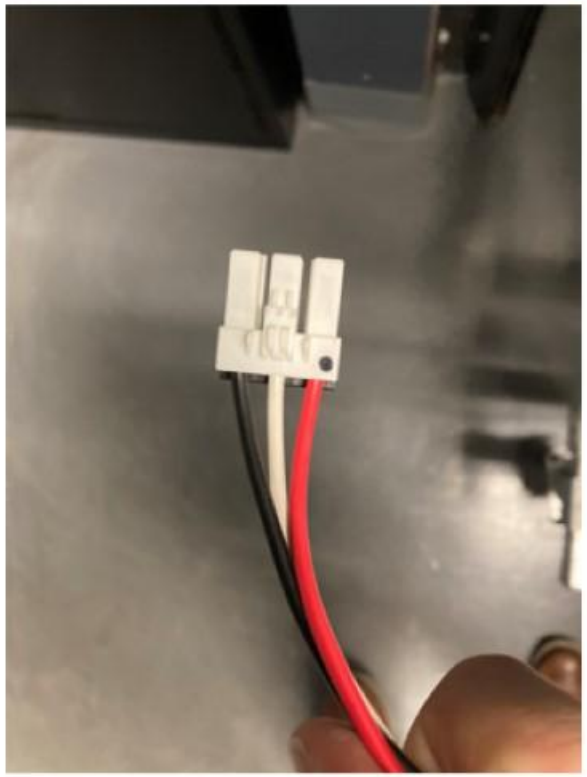
Fan Motor plugs

12 pin

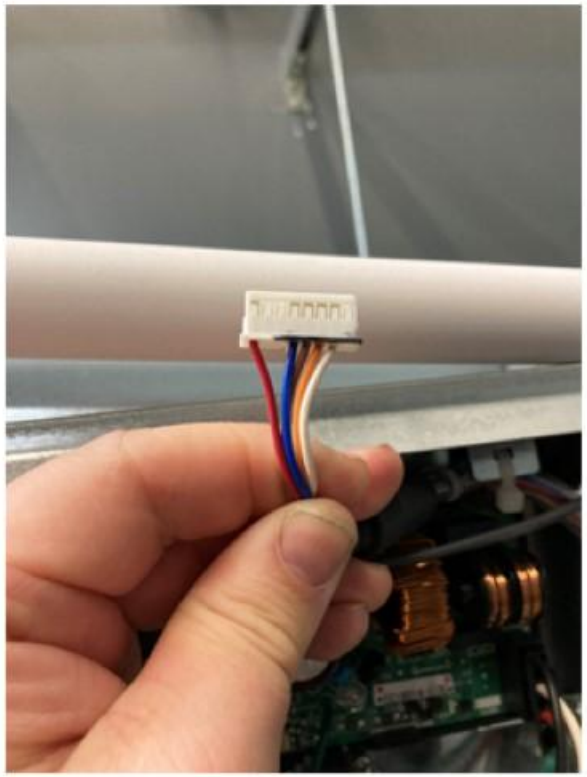


7 pin

3 pin

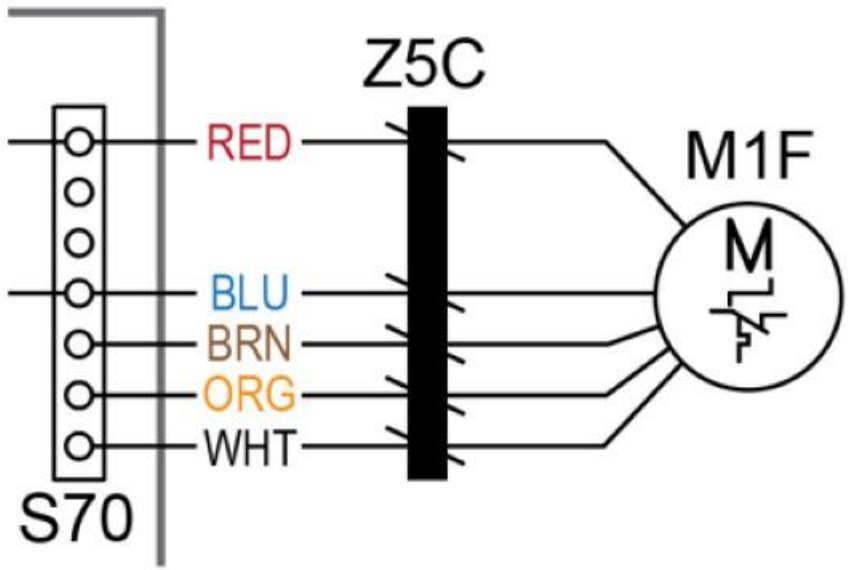


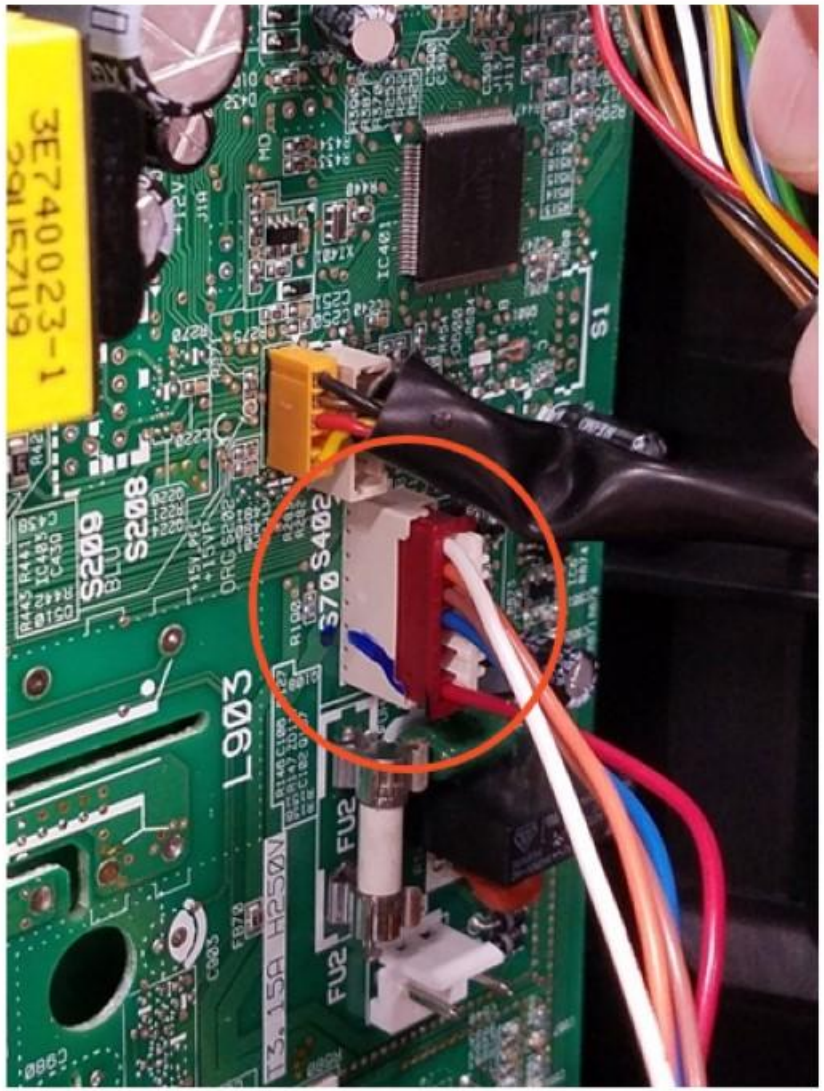
8 pin



7 Pin Fan Motor test example

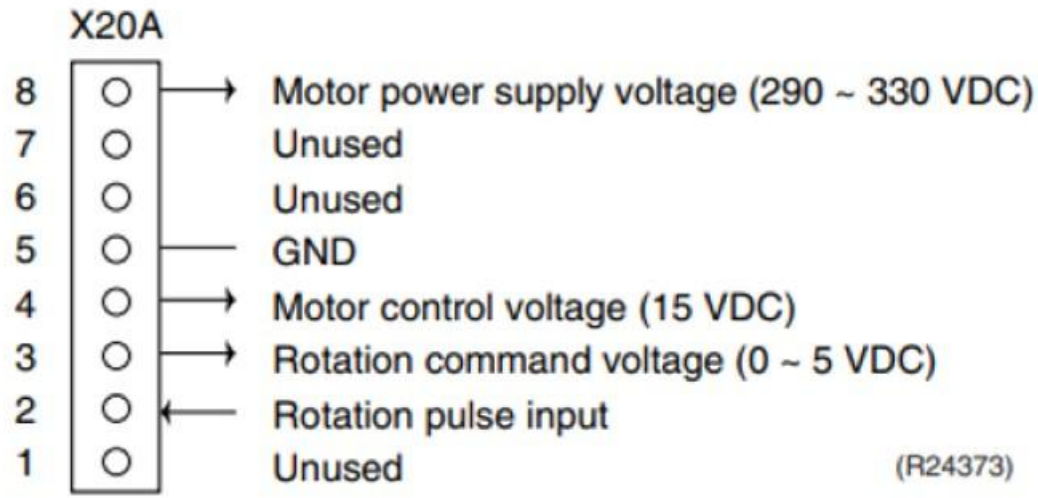
- Pins 1-4 1 MΩ or more
- Pins 2-4 100 kΩ or more
- Pins 3-4 100 Ω or more
- Pins 4-7 100 kΩ or more





Fan motor test for FFQ

1. Check the connection of connector.
2. Check motor power supply voltage output (pins 5 ~ 8).
3. Check motor control voltage (pins 5 ~ 4).
4. Check rotation command voltage output (pins 5 ~ 3).



7 pin fan motor test Example

Command voltage test

- In step 2 you will need power to the Printed Circuit Board and a call for heat/cool to get the voltages
- In step 5 turn off power, measure VDC until below 50 volts, replace motor connector and apply power

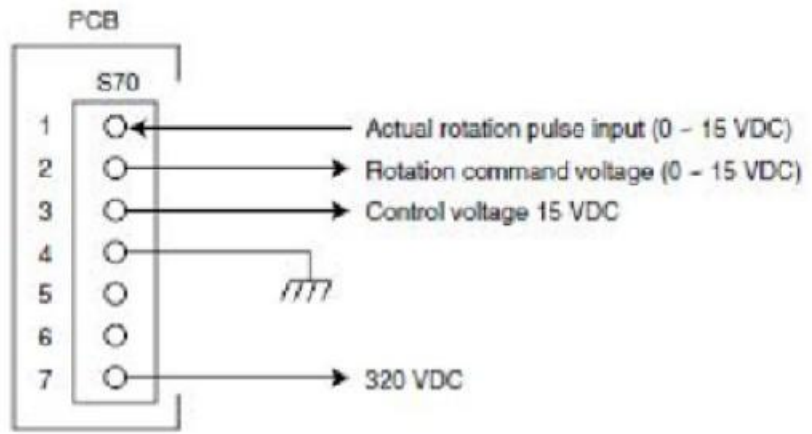
Check No.16

<Outdoor fan motor>
Make sure that the voltage of 320 $^{+100}_{-50}$ V is applied.

1. Set operation off and power off. Disconnect the connector S70.
2. Check that the voltage between the pins 4 - 7 is 320 VDC.
3. Check that the control voltage between the pins 3 - 4 is 15 VDC.
4. Check that the rotation command voltage between the pins 2 - 4 is 0 ~ 15 VDC.
5. Keep operation off and power off. Connect the connector S70.
6. Check whether 4 pulses (0 ~ 15 VDC) are input at the pins 1 - 4 when the outdoor fan motor is rotated 1 turn by hand.

When the fuse is melted, check the outdoor fan motor for proper function.

If NG in step 2 → Defective PCB → Replace the outdoor unit PCB (main PCB).
If NG in step 4 → Defective Hall IC → Replace the outdoor fan motor.
If OK in both steps 2 and 4 → Replace the outdoor unit PCB (main PCB).

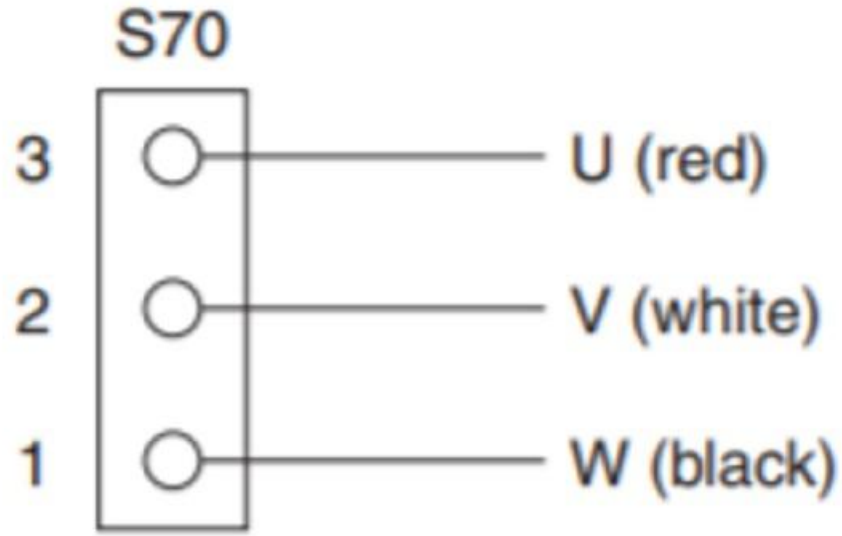


(R21120)

3 pin Outdoor unit Rotation pulse test

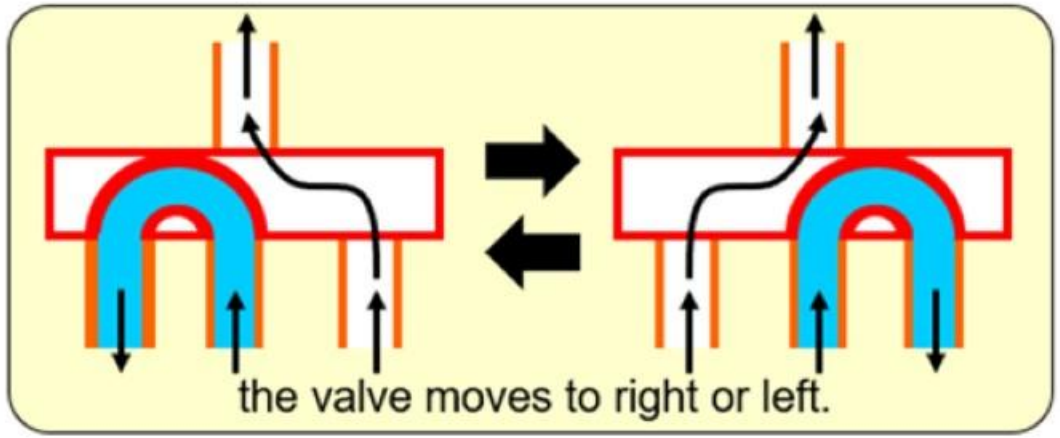
Fan motor for 5MXS and 4MXL outdoor unit

- Manually rotate the outdoor fan motor and check if 4 pulses of sinusoidal voltage are detected between pins 1-2 and then pins 2-3.

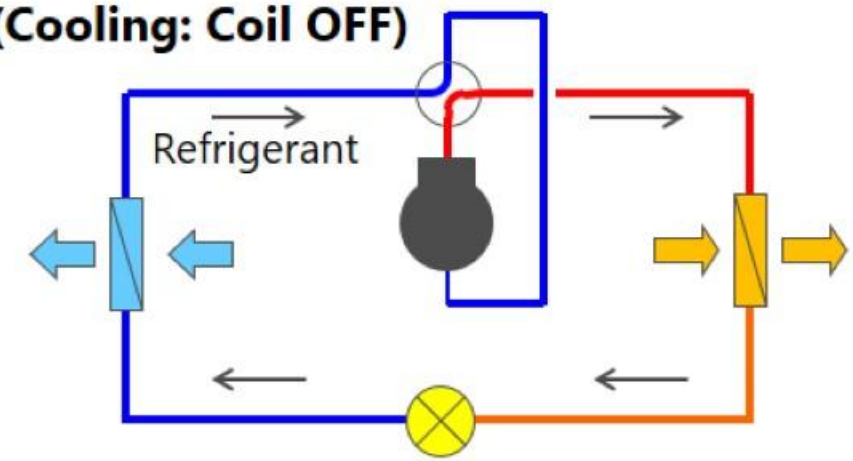


Four-Way Valve

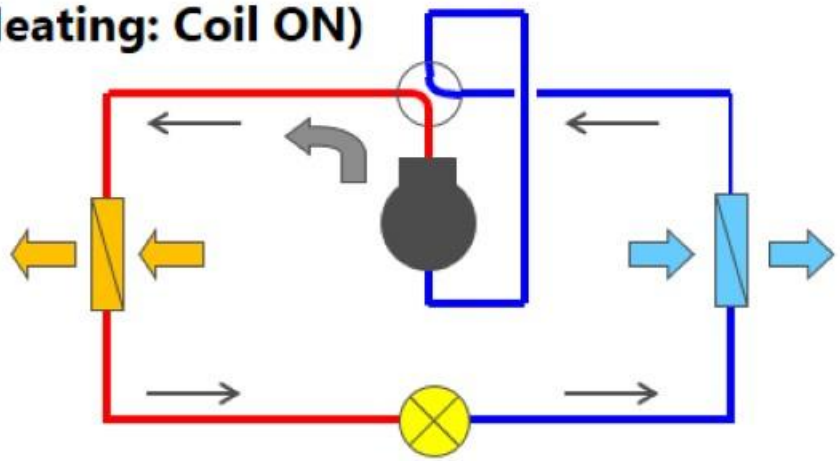
- The four-way valve changes the direction of the refrigerant flow.



(Cooling: Coil OFF)



(Heating: Coil ON)



Example Four-way valve test

Check No. 13

Turn off the power. Then, turn on the power to restart the system.

↓

Start heating operation.

- Four way valve coil
  Cooling/Dry/Defrost: Not energized
  Heating: energized

↓

S80 voltage at 208 - 230 VAC with compressor on? (Fig. 1)

NO → Replace the outdoor unit PCB (main PCB).

YES ↓

Disconnect the four way valve coil from the connector and check the continuity.

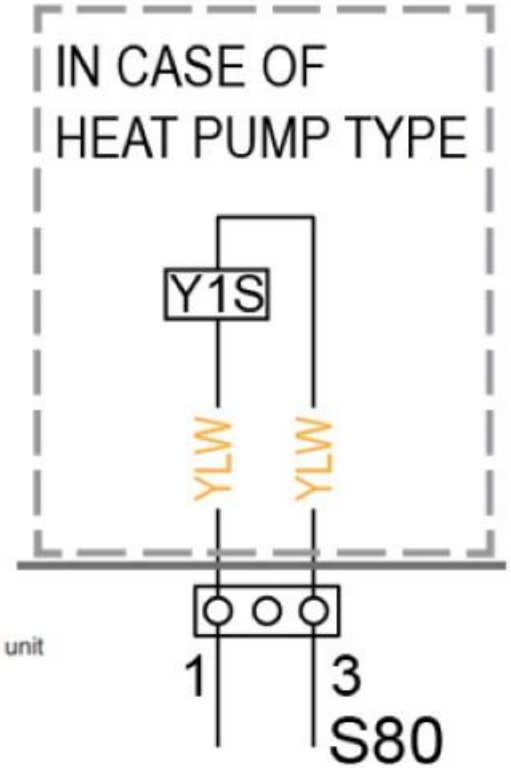
↓

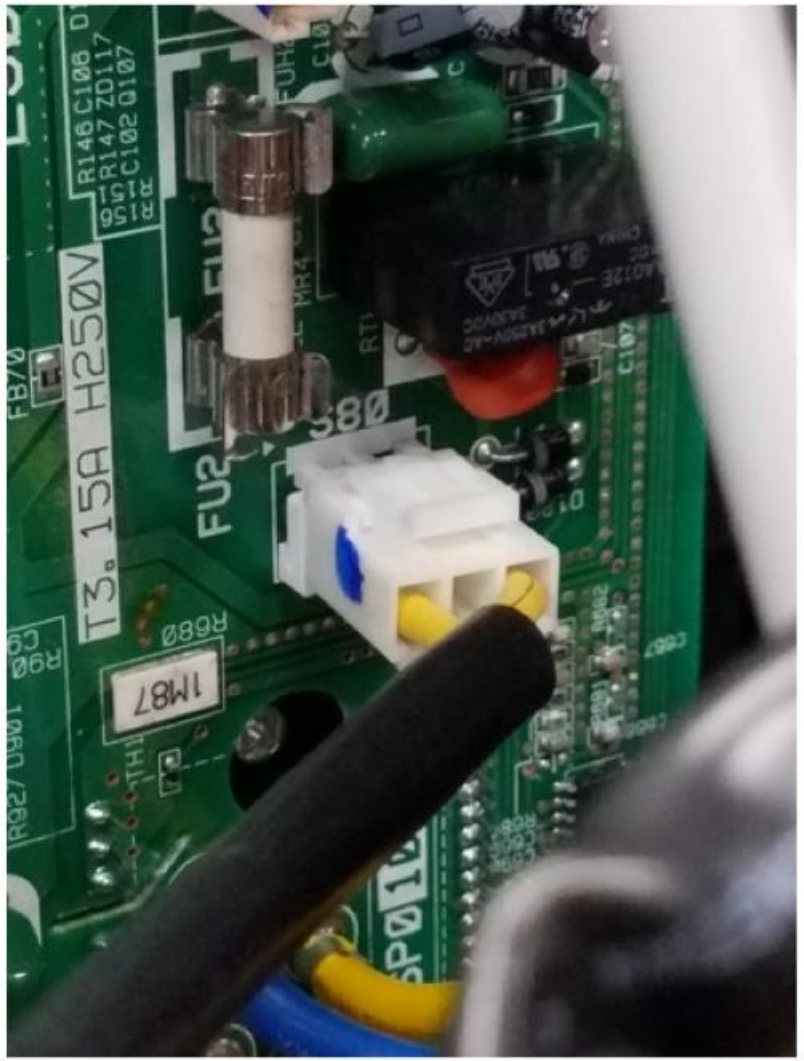
Four way valve coil resistance at 1000 ~ 2000 Ω?

NO → Replace the four way valve coil.

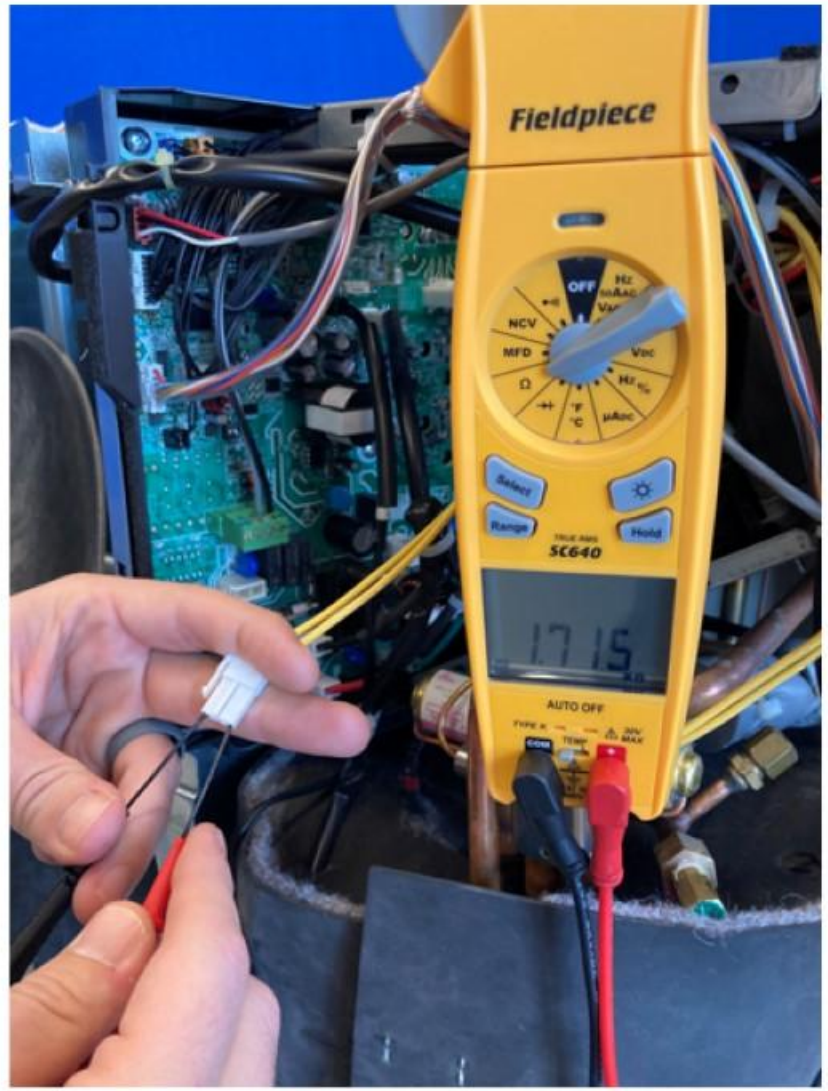
YES → Replace the four way valve.

(R21936)



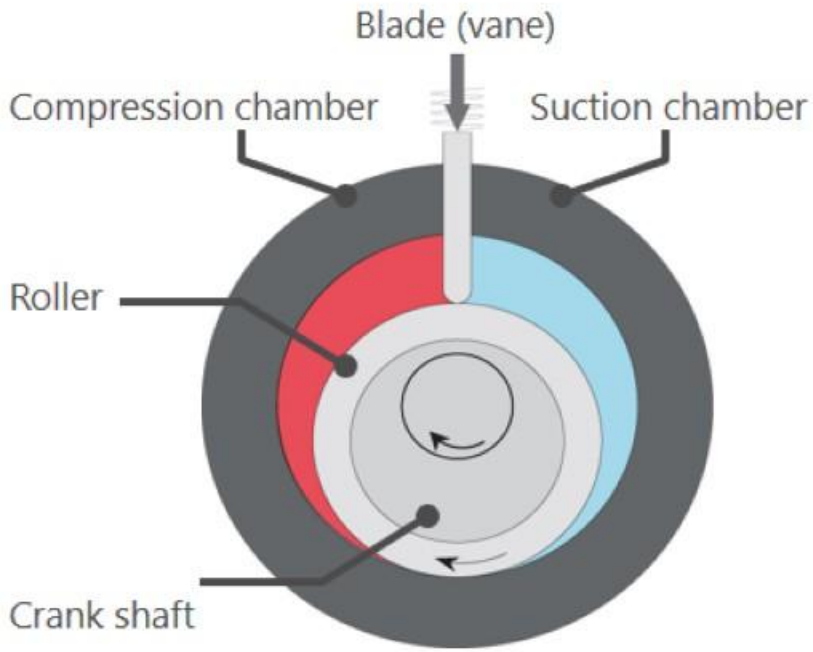


Four way valve Test Example



Compressor

- The compressor acts as a pump to circulate the refrigerant.
- It suctions the low-temp., low-pressure refrigerant gas sent from the evaporator.
- And compresses it to a pressure that can be easily condensed by the condenser.



Plan view of the structure

Examples of problems with Compressor

- Motor/coil part: Wiring break, startup error, motor burnout, insulation failure
- Sliding part: Insufficient compression, startup error, abnormal noise

Compressor insulation resistance test

- An insulation resistance tester, commonly known as a “megger” is a tool that can measure the insulation of the compressor motor windings. This will help to determine the reliability of the compressor. This is a third-party tool that can be purchased in the field.

Compressor insulation resistance test

- Refer to the operation manual that was supplied with your megger. Always follow manufacture's recommendations for proper use

5. Measuring the Insulation Resistance

1. Before Connecting the Probes

⚠ WARNING

- Turn off the power to the measured object before connecting the probes or measuring insulation resistance.
- Electrical charges may be present in the cables attached to or metal of the electrical equipment being tested. Verify that the equipment is free from electrical charges before connecting the testing terminals.

2. Connecting the Earth Probe

- Securely connect the earth probe to the measured object's ground line (if the measured object is not grounded, this process may be omitted).

3. Connecting the Line Probe

- Bring the line probe into contact with the measured object, and then press the MEAS key. The pointer indicates the insulation resistance of the measured object.

Note

During measurement, exercise care to prevent the leadwire of the line probe from coming into contact with the ground, floor or any other object. Not observing this precaution may result in a failure to measure the correct insulation resistance.

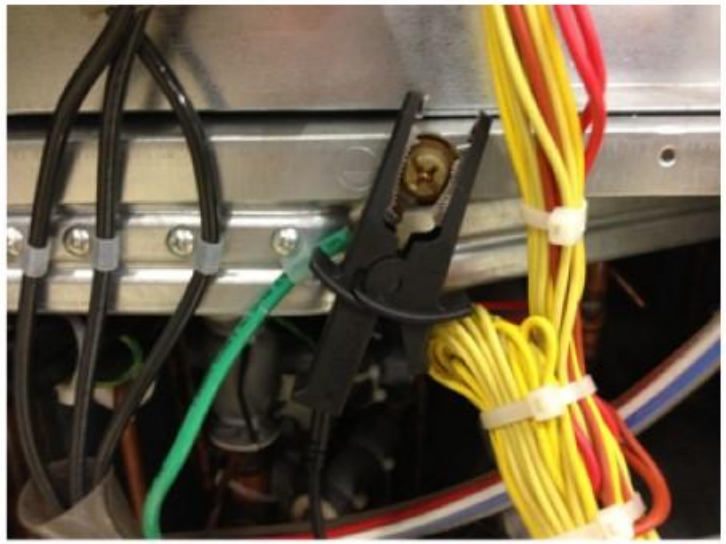
4. After Measurement

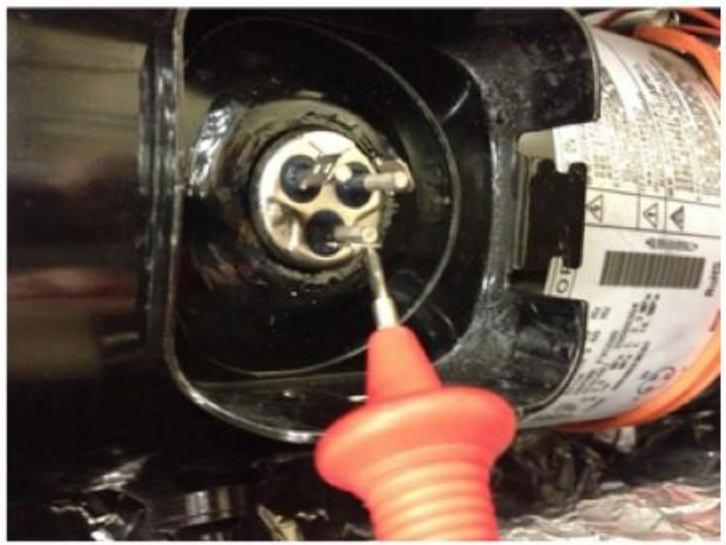
⚠ WARNING

- Immediately after measurement, electrical charges resulting from the applied testing voltage may remain present in the probes or measured object.
- The tester, therefore, is designed to automatically begin discharging electricity upon completion of measurement. Verify that the ALARM LED turns off when discharging is complete.

Compressor insulation resistance test

- Connect the earth lead from the Megger to a proper ground
- Place the line lead off of Megger to each terminal of the compressor and engage tool. This will give you the Mohm (Mega Ohm) reading for each terminal.
- Any reading under 1Mohm and the compressor has failed

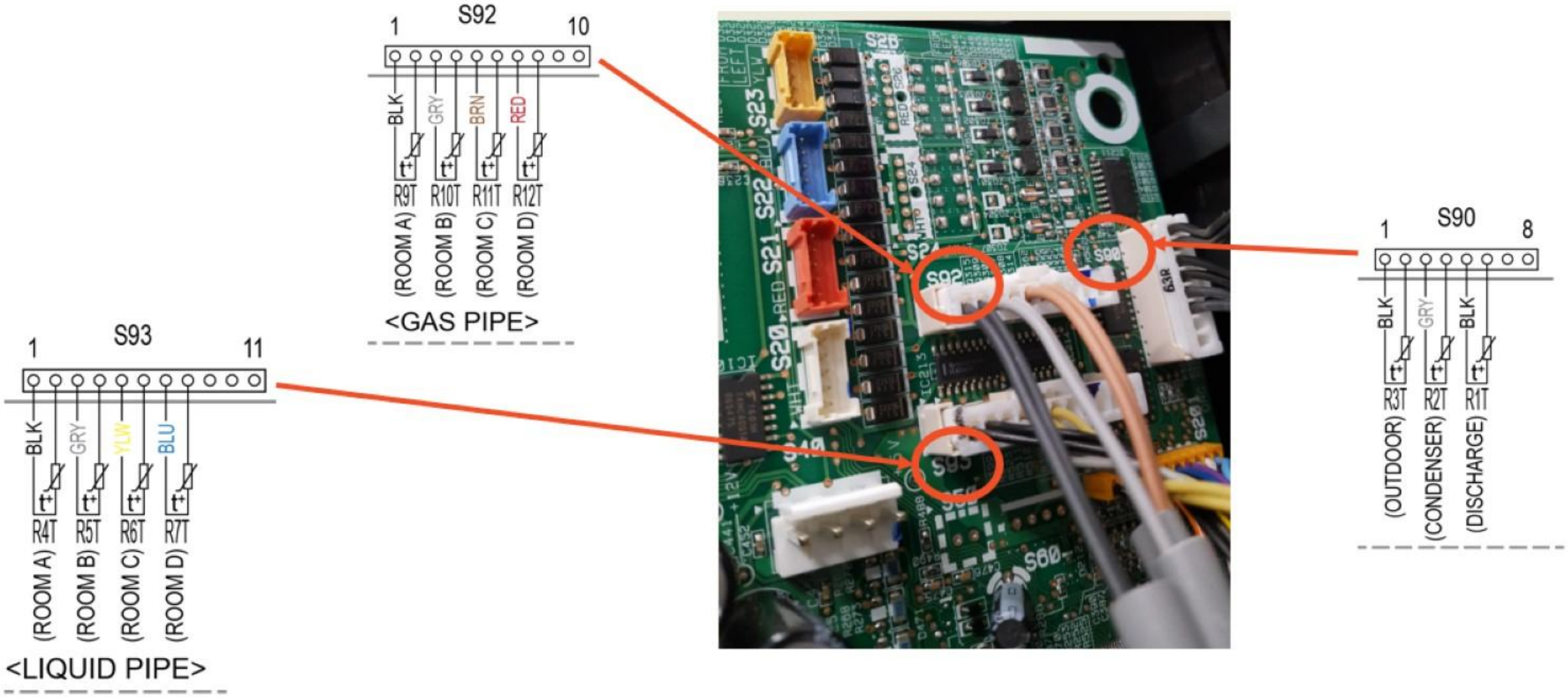




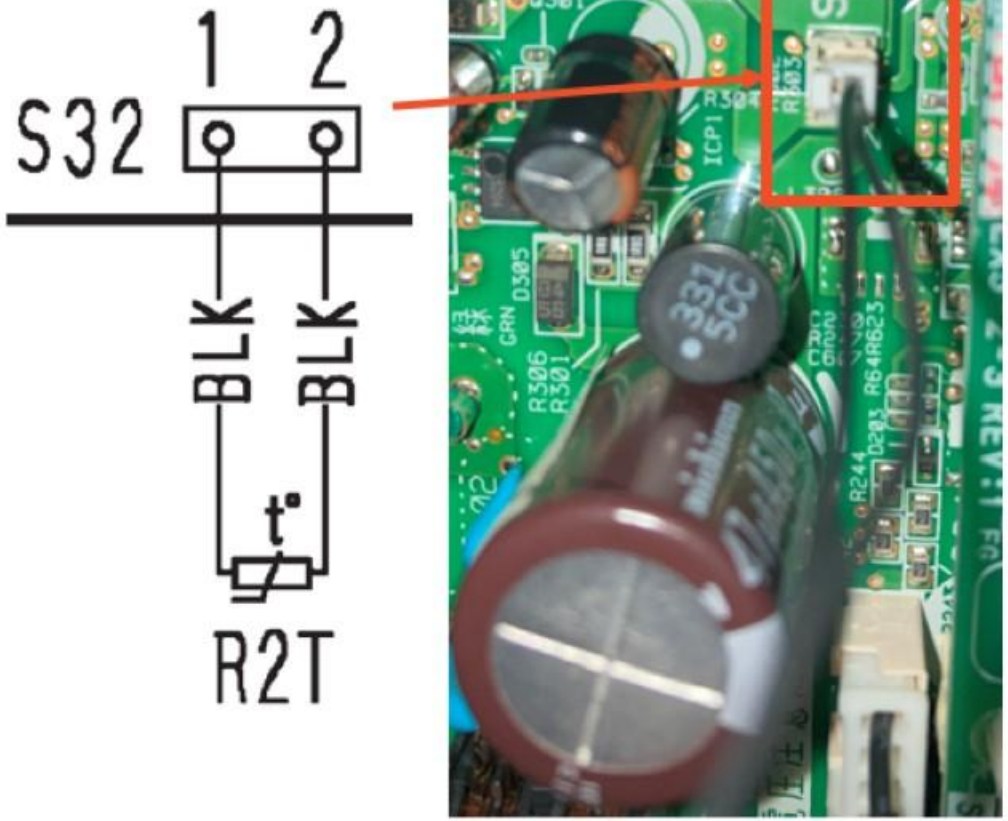
Compressor test

- Test resistance between U and V, W and V, and W and U. They should all have the same resistance.

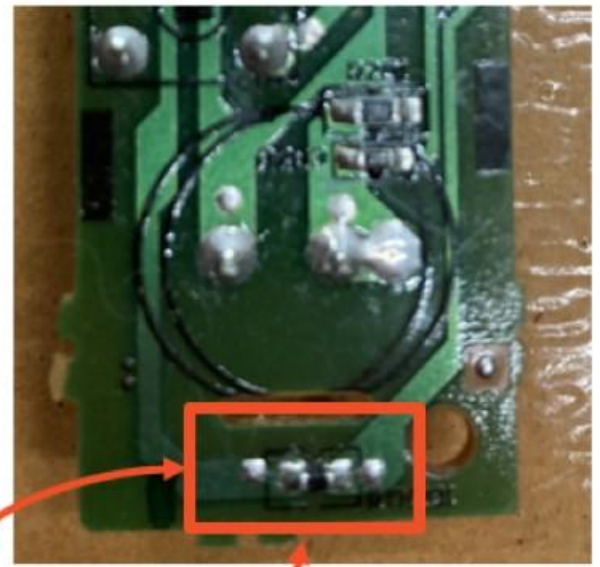
Outdoor unit thermistors

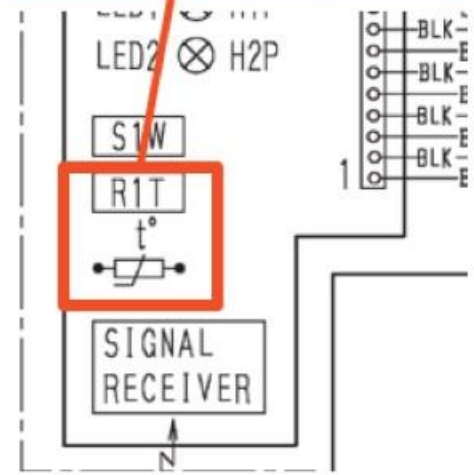


Indoor unit thermistors



Back of PCB



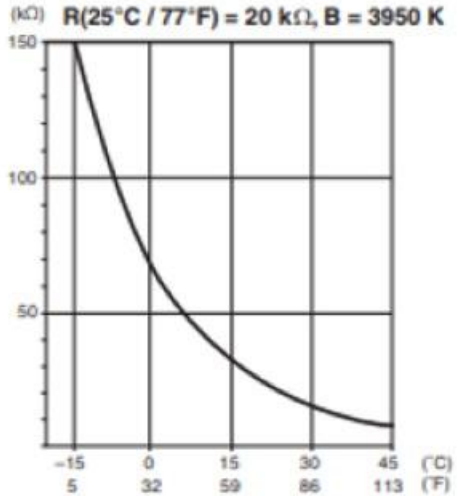


Thermistor Resistance Table

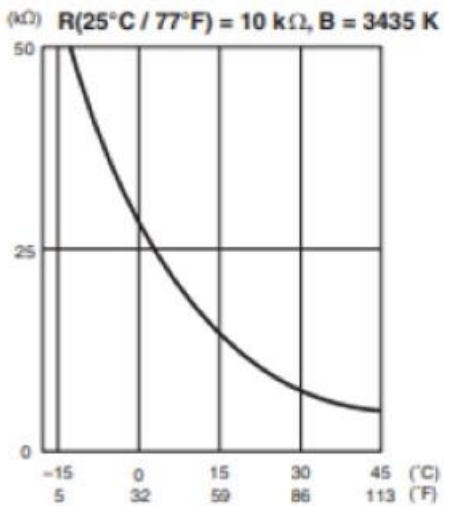
- As the resistance increase the interpreted temperature decreases. As the resistance decrease the interpreted temperature increases.

Thermistor temperature		Resistance (kΩ)	
°C	°F	Room temperature thermistor	Other thermistors
-20	-4	73.4	197.8
-15	5	57.0	148.2
-10	14	44.7	112.1
-5	23	35.3	85.60
0	32	28.2	65.93
5	41	22.6	51.14
10	50	18.3	39.99
15	59	14.8	31.52
20	68	12.1	25.02
25	77	10.0	20.00
30	86	8.2	16.10
35	95	6.9	13.04
40	104	5.8	10.62
45	113	4.9	8.707
50	122	4.1	7.176

(R25°C(77°F)= 10kΩ, B=3435K)



(R 25°C (77°F) = 20kΩ, B=3950K)



Troubleshooting thermistors

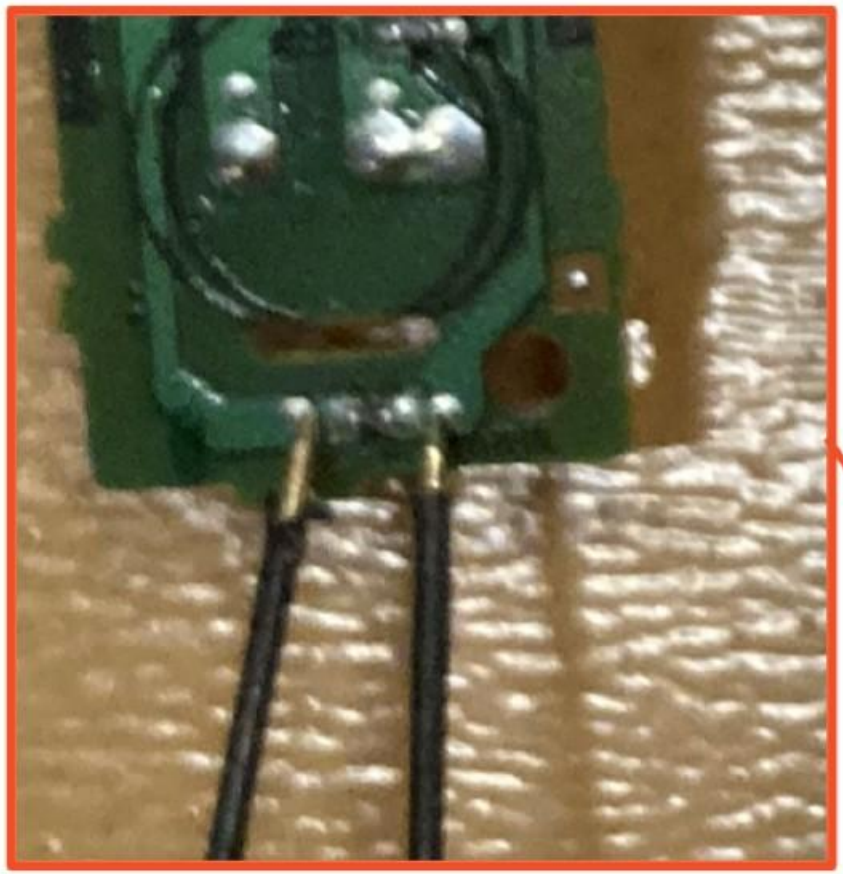
- Compare the measured resistance to the measured temperature

Thermistor temperature		Type A	Type B
°C	°F	R(25°C / 77°F) = 20 kΩ B = 3950 K	R(25°C / 77°F) = 10 kΩ B = 3435 K
–20	–4	197.8	73.4
–15	5	148.2	57.0
–10	14	112.1	44.7
–5	23	85.60	35.3
0	32	65.93	28.2
5	41	51.14	22.6
10	50	39.99	18.3
15	59	31.52	14.8
20	68	25.02	12.1
25	77	20.00	10.0
30	86	16.10	8.2
35	95	13.04	6.9
40	104	10.62	5.8
45	113	8.707	4.9
50	122	7.176	4.1

20 kOhm thermistor

Troubleshooting thermistors

- For soldered thermistors test across the thermistor solder spots



10 kOhm thermistor

Power Checks

- Check voltage at the two points to the right. This will be line voltage coming from the disconnect.
- If there is no voltage check incoming power .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