HITACHI

PM | NO. 0148E

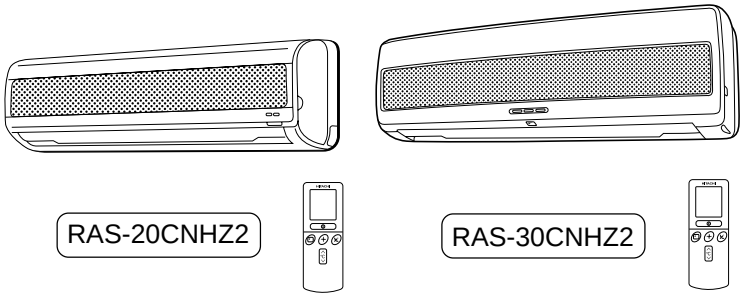
RAS-20CNHZ2
RAS-30CNHZ2 / RAM-50CNHZ2

SERVICE MANUAL

TECHNICAL INFORMATION

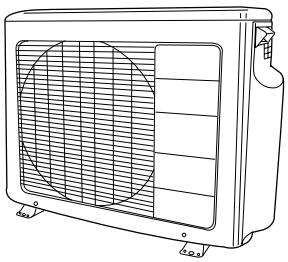
FOR SERVICE PERSONNEL ONLY

REFER TO THE FOUNDATION MANUAL



RAS-20CNHZ2

RAS-30CNHZ2



RAM-50CNHZ2

CONTENTS

SPECIFICATIONS

TYPE		DC INVERTER DUAL SYSTEM MULTI (WALL TYPE)		
		INDOOR UNIT		OUTDOOR UNIT
MODEL		RAS-20CNHZ2	RAS-30CNHZ2	RAM-50CNHZ2
POWER SOURCE		1ø, 220V – 230V, 50Hz		
TOTAL INPUT	(W)	REFER TO THE SPECIFICATIONS PAGE 8.		
TOTAL AMPERES	(A)			
COOLING CAPACITY	(kW)			
HEATING CAPACITY	(B.T.U.)			
DIMENSIONS (mm)	W	745	798	850
	H	248	265	650
	D	175	168	298
NET WEIGHT	(kg)	5.5	6.5	43

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

ROOM AIR CONDITIONER

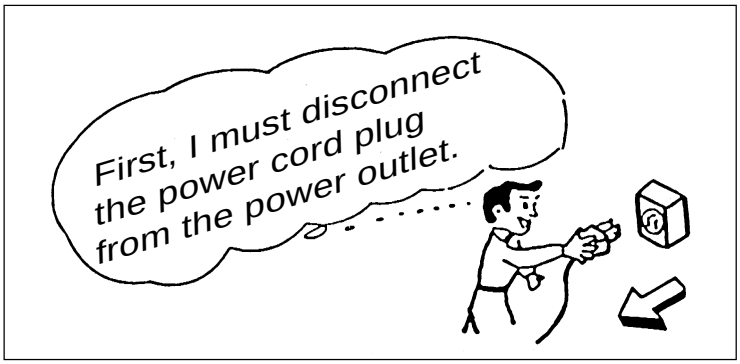
INDOOR UNIT + OUTDOOR UNIT

MAY 2002

H.A.P.M.

SAFETY DURING REPAIR WORK

1. In order to disassemble and repair the unit in question, be sure to disconnect the power cord plug from the power outlet before starting the work.



2. If it is necessary to replace any parts, they should be replaced with respective genuine parts for the unit, and the replacement must be effected in correct manner according to the instructions in the Service Manual of the unit.

> If the contacts of electrical parts are defective, replace the electrical parts without trying to repair them.

3. After completion of repairs, the initial state should be restored.

4. Lead wires should be connected and laid as in the initial state.

5. Modification of the unit by user himself should absolutely be prohibited.

6. Tools and measuring instruments for use in repairs or inspection should be accurately calibrated in advance.

7. In installing the unit having been repaired, be careful to prevent the occurence of any accident such as electrical shock, leak of current, or bodily injury due to the drop of any part.

8. To check the insulation of the unit, measure the insulation resistance between the power cord plug and grounding terminal of the unit. The insulation resistance should be 1MΩ or more as measured by a 500V DC megger.

9. The initial location of installation such as window, floor or the other should be checked for being and safe enough to support the repaired unit again.
   If it is found not so strong and safe, the unit should be installed at the initial location reinforced or at a new location.

10. Any inflammable thing should never be placed about the location of installation.

11. Check the grounding to see whether it is proper or not, and if it is found improper, connect the grounding terminal to the earth.

WORKING STANDARDS FOR PREVENTING BREAKAGE OF SEMICONDUCTORS

1. Scope
   The standards provide for items to be generally observed in carrying and handling semiconductors in relative manufacturers during maintenance and handling thereof. (They apply the same to handling of abnormal goods such as rejected goods being returned).

2. Object parts

   (1) Micro computer
   (2) Integrated circuits (IC)
   (3) Field-effect transistors (FET)
   (4) P.C. boards or the like on which the parts mentioned in (1) and (2) of this paragraph are equipped.

3. Items to be observed in handling

   (1) Use a conductive container for carrying and storing of parts. (Even rejected goods should be handled in the same way).

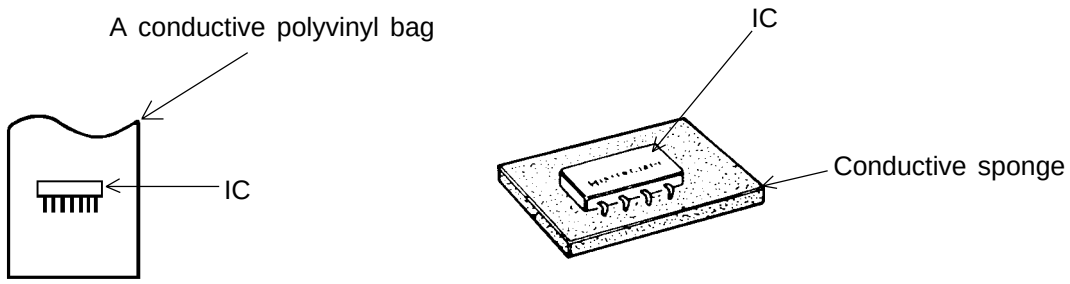


Fig. 1. Conductive Container

   (2) When any part is handled uncovered (in counting, packing and the like), the handling person must always use himself as a body earth. (Make yourself a body earth by passing one M ohm earth resistance through a ring or bracelet).

   (3) Be careful not to touch the parts with your clothing when you hold a part even if a body earth is being taken.

   (4) Be sure to place a part on a metal plate with grounding.

   (5) Be careful not to fail to turn off power when you repair the printed circuit board. At the same time, try to repair the printed circuit board on a grounded metal plate.

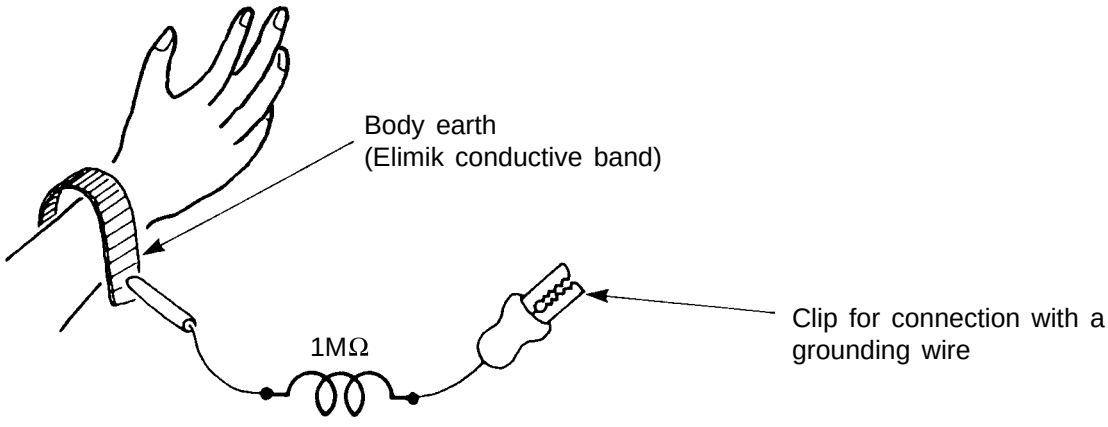


Fig. 2. Body Earth

(6) Use a three wire type soldering iron including a grounding wire.

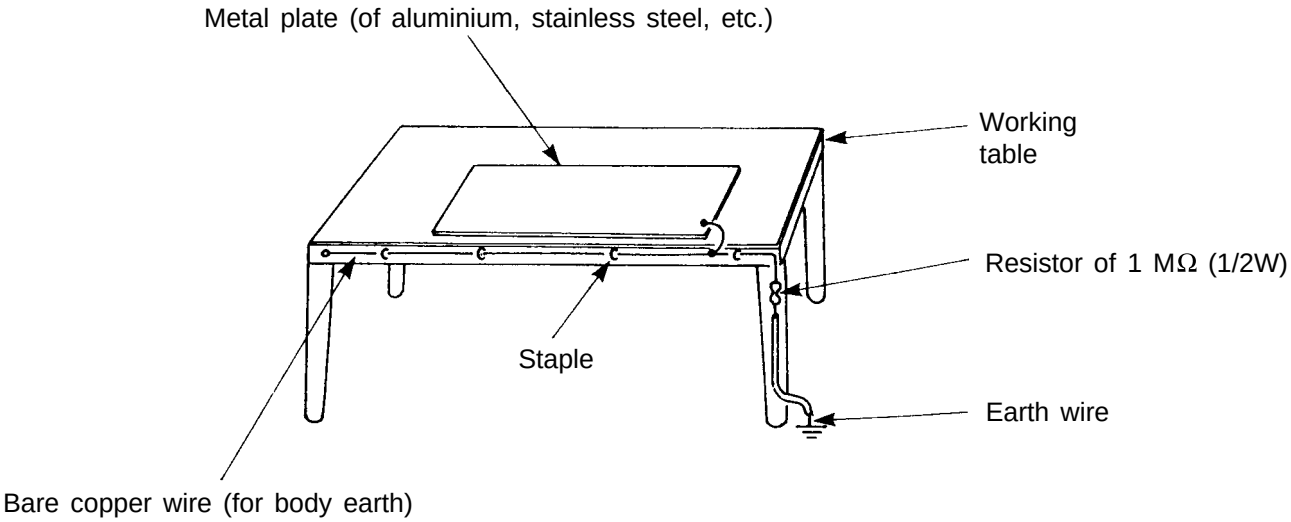


Fig. 3. Grounding of the working table

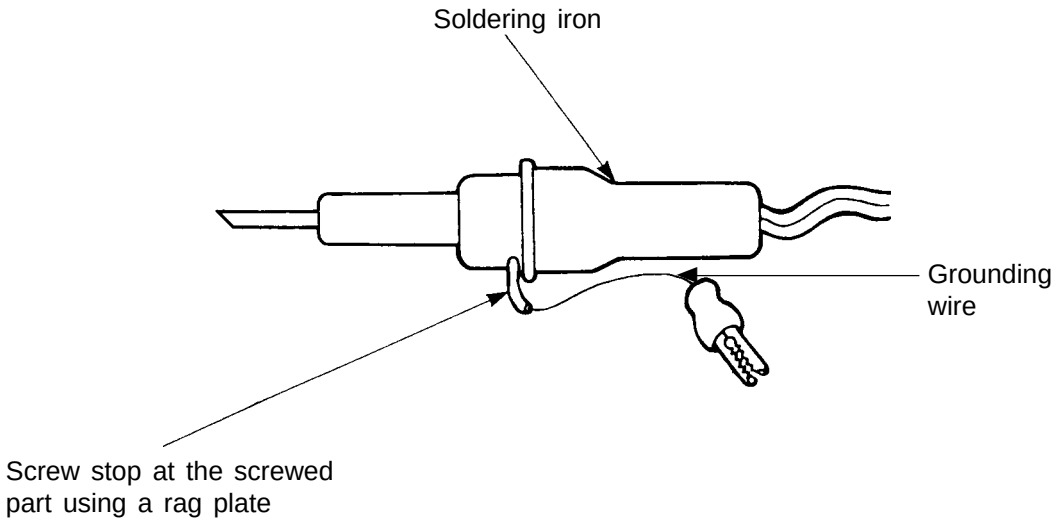


Fig. 4. Grounding a soldering iron

Use a high insulation mode (100V, 10MΩ or higher) when ordinary iron is to be used.

(7) In checking circuits for maintenance, inspection or some others, be careful not to have the test probes of the measuring instrument shortcircuit a load circuit or the like.

⚠ CAUTION

1. In quiet operation or stopping the operation, slight flowing noise of refrigerant in the refrigerating cycle is heard occasionally, but this noise is not abnormal for the operation.

2. When it thunders near by, it is recommend to stop the operation and to disconnect the power cord plug from the power outlet for safety.

3. The room air conditioner does not start automatically after recovery of the electric power failure for preventing fuse blowing. Re-press START/STOP button after 3 minutes from when unit stopped.

4. If the room air conditioner is stopped by adjusting setting temperature, or missoperation, and re-start in a moment, there is occasion that the cooling and heating operation does not start for 3 minutes, it is not abnormal and this is the result of the operation of IC delay circuit. This IC delay circuit ensures that there is no danger of blowing fuse or damaging parts even if operation is restarted accidentally.

5. This room air conditioner should not be used at the cooling operation when the outside temperature is below 10°C (50°F).

6. This room air conditioner (the reverse cycle) should not be used when the outside temperature is below -10°C (14°F).
   If the reverse cycle is used under this condition, the outside heat exchanger is frosted and efficiency falls.

7. When the outside heat exchanger is frosted, the frost is melted by operating the hot gas system, it is not trouble that at this time fan stops and the vapour may rise from the outside heat exchanger.

SAFETY PRECAUTION

- Please read the “Safety Precaution” carefully before operating the unit to ensure correct usage of the unit.
- Pay special attention to signs of “⚠ **Warning**” and “⚠ **Caution**”. The “Warning” section contains matters which, if not observed strictly, may cause death or serious injury. The “Caution” section contains matters which may result in serious consequences if not observed properly. Please observe all instructions strictly to ensure safety.
- The sign indicate the following meanings.

Make sure to connect earth line.	The sign in the figure indicates prohibition.
Indicates the instructions that must be followed.	

- Please keep this manual after reading.

PRECAUTIONS DURING INSTALLATION

WARNING

- Do not reconstruct the unit.
  Water leakage, fault, short circuit or fire may occur if you reconstruct the unit by yourself.

- Please ask your sales agent or qualified technician for the installation of your unit. Water leakage, short circuit or fire may occur if you install the unit by yourself.
- Please use earth line.
  Do not place the earth line near water or gas pipes, lightning-conductor, or the earth line of telephone. Improper installation of earth line may cause electric shock.

CAUTION

- A circuit breaker should be installed depending on the mounting site of the unit. Without a circuit breaker, the danger of electric shock exists.
- Do not install near location where there is flammable gas. The outdoor unit may catch fire if flammable gas leaks around it.

- Please ensure smooth flow of water when installing the drain hose.

PRECAUTIONS DURING SHIFTING OR MAINTENANCE

WARNING

- Should abnormal situation arises (like burning smell), please stop operating the unit and turn off the circuit breaker. Contact your agent. Fault, short circuit or fire may occur if you continue to operate the unit under abnormal situation.

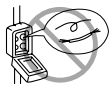
- Please contact your agent for maintenance. Improper self maintenance may cause electric shock and fire.
- Please contact your agent if you need to remove and reinstall the unit. Electric shock or fire may occur if you remove and reinstall the unit yourself improperly.

PRECAUTIONS DURING OPERATION

WARNING

- Avoid an extended period of direct air flow for your health.

- Do not put objects like thin rods into the panel of blower and suction side because the high-speed fan inside may cause danger.
- Do not use any conductor as fuse wire, this could cause fatal accident.

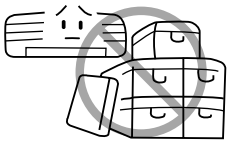


- During thunder storm, disconnect and turn off the circuit breaker.

PRECAUTIONS DURING OPERATION

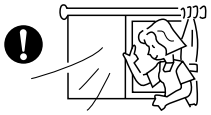
CAUTION

- The product shall be operated under the manufacturer specification and not for any other intended use.



- Do not attempt to operate the unit with wet hands, this could cause fatal accident.

- When operating the unit with burning equipments, regularly ventilate the room to avoid oxygen insufficiency.

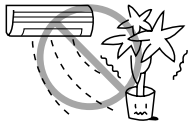


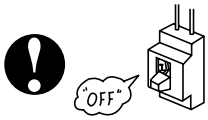
- Do not direct the cool air coming out from the air-conditioner panel to face household heating apparatus as this may affect the working of apparatus such as the electric kettle, oven etc.

- Please ensure that outdoor mounting frame is always stable, firm and without defect. If not, the outdoor unit may collapse and cause danger.

- Do not splash or direct water to the body of the unit when cleaning it as this may cause short circuit.

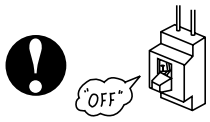
- Do not place plants directly under the air flow as it is bad for the plants.





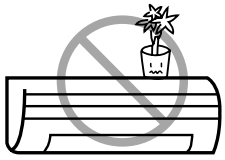
- Please switch off the unit and turn off the circuit breaker during cleaning, the high-speed fan inside the unit may cause danger.

- Turn off the circuit breaker if the unit is not to be operated for a long period.



- Do not climb on the outdoor unit or put objects on it.

- Do not put water container (like vase) on the indoor unit to avoid water dripping into the unit. Dripping water will damage the insulator inside the unit and causes short-circuit.



- When operating the unit with the door and windows opened, (the room humidity is always above 80%) and with the air deflector facing down or moving automatically for a long period of time, water will condense on the air deflector and drips down occasionally. This will wet your furniture. Therefore, do not operate under such condition for a long time.
- If the amount of heat in the room is above the cooling or heating capability of the unit (for example: more people entering the room, using heating equipments and etc.), the preset room temperature cannot be achieved.

SPECIFICATIONS

MODEL		RAS-20CNHZ2/ RAS-30CNHZ2	RAM-50CNHZ2
FAN MOTOR		20 W	40 W
FAN MOTOR CAPACITOR		NO	NO
FAN MOTOR PROTECTOR		NO	NO
COMPRESSOR		—	GW20DN8A
COMPRESSOR MOTOR CAPACITOR		NO	NO
OVERLOAD PROTECTOR		NO	YES
OVERHEAT PROTECTOR		NO	YES
FUSE (MICRO COMPUTER CIRCUIT)		NO	3.0A
FUSE (MAIN SUPPLY)		NO	25A
FUSE (FAN MOTOR)		NO	2A
POWER RELAY		NO	G4A
POWER SWITCH		NO	NO
TEMPORARY SWITCH		YES	NO
SERVICE SWITCH		NO	YES
TRANSFORMER		NO	NO
VARISTOR		NO	450NR
NOISE SUPPRESSOR		NO	20132A
THERMOSTAT		YES(IC)	YES(IC)
REMOTE CONTROL SWITCH (LIQUID CRYSTAL)		YES	NO
FUSE CAPACITY		16 A TIME DELAY FUSE	
REFRIGERANT CHARGING VOLUME (Refrigerant 22)	UNIT	----------	❋ 1350g
	PIPES (MAX. 35m)	WITHOUT REFRIGERANT BECAUSE COUPLING IS FLARE TYPE.	

SPECIFICATIONS FOR INDOOR UNITS COMBINATIONS

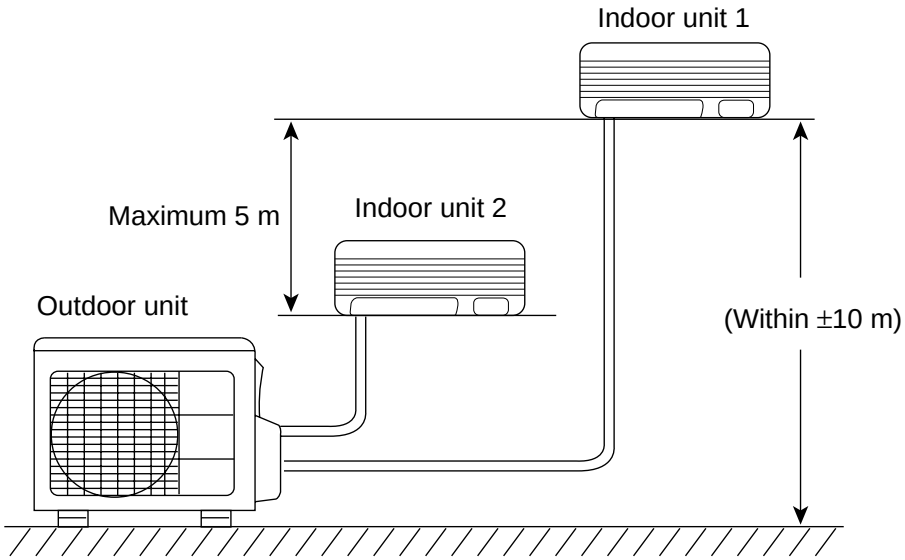
TYPE		WALL TYPE DC INVERTER QUADRUPLE SYSTEM MULTI COOLING AND HEATING	
MODEL	INDOOR UNIT	RAS-20CNHZ2	RAS-30CNHZ2
	OUTDOOR UNIT	RAM-50CNHZ2	
PHASE/VOLTAGE/FREQUENCY		1ø, 220V-230V, 50Hz	
CIRCUIT AMPERES TO CONNECT (A)		16	
COOLING (ONE UNIT)	CAPACITY (kW) (B.T.U./h)	2.50 (1.00~3.00)	3.20 (1.00~3.30)
		8530 (3412~10236)	10919 (3412~11260)
	TOTAL INPUT (W)	1000 (300~1080)	1100 (300~1160)
	EER (B.T.U./hW)	8.53	9.93
	TOTAL AMPERES (A)	4.50	5.00
	POWER FACTOR (%)	97	96
	SOUND LEVEL (INDOOR)	33	35
	AIR FLOW VOLUME (Hi)	5.7m³/min	8.5m³/min
COOLING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	5.40 (1.00~5.60)	
		18426 (3412~19108)	
	TOTAL INPUT (W)	2150 (450~2200)	
	EER (B.T.U./hW)	8.57	
	TOTAL AMPERES (A)	9.40	
	POWER FACTOR (%)	99	
	SOUND LEVEL (OUTDOOR)	50	
HEATING (ONE UNIT)	CAPACITY (kW) (B.T.U./h)	3.60 (0.90~4.00)	4.50 (0.90~4.60)
		12284 (3071~13649)	15355 (3071~15696)
	TOTAL INPUT (W)	1470 (120~1690)	1900 (120~1920)
	EER (B.T.U./hW)	8.36	8.08
	TOTAL AMPERES (A)	6.50	8.30
	POWER FACTOR (%)	98	99
	SOUND LEVEL (INDOOR)	33	37
	AIR FLOW VOLUME (Hi)	7.7m³/min	9.5m³/min
HEATING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	6.40 (1.50~7.00)	
		21838 (5118~23885)	
	TOTAL INPUT (W)	2100 (450~2300)	
	EER (B.T.U./hW)	9.66	
	TOTAL AMPERES (A)	9.20	
	POWER FACTOR (%)	99	
	SOUND LEVEL (OUTDOOR)	52	
AIR DEFLECTORS		YES (AUTO SWING)	YES (AUTO SWING)
FAN SPEED		3	3
LINE CORD		NOT PROVIDED (POWER CORD SHOULD BE PREPARED AND CONNECTED TO OUTDOOR UNIT WHEN INSTALLED)	
REMOTE CONTROL SWITCH		YES (WIRELESS)	YES (WIRELESS)
MAXIMUM LENGTH OF PIPING		MAX. 35m (TWO UNITS TOTAL)	
STANDARD		CE (EMC&LVD)	

MODEL		RAS-20CNHZ2	RAS-30CNHZ2	RAM-50CNHZ2
PACKING (mm)	W	792	850	1008
	H	302	340	698
	D	255	270	394
	cu.ft.	2.15	2.76	9.79
GROSSWEIGHT (kg)		9.5	10	48
FLARENUTSIZE (SMALL/LARGE)		—	—	6.35D/9.52D, 6.35D/9.52D

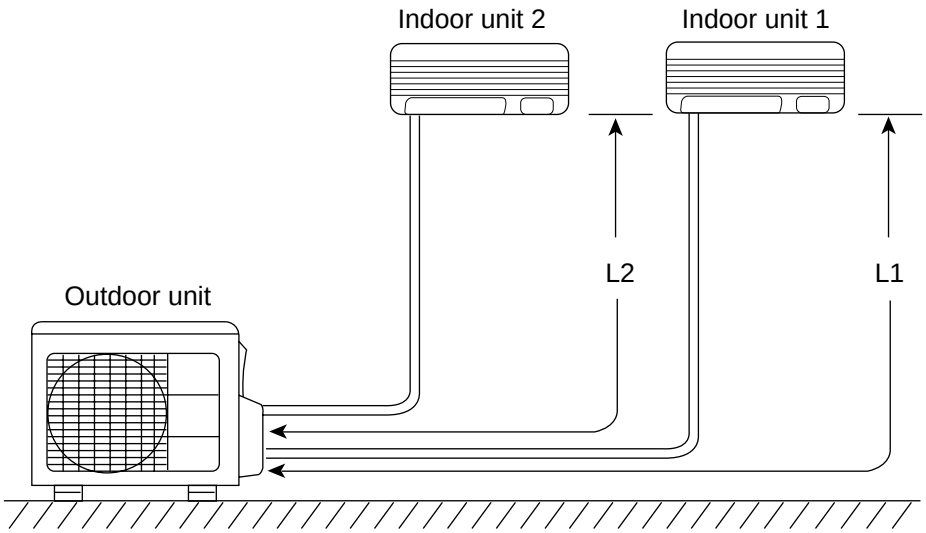
INSTALLATION

HEIGHT DIFFERENCE

Height difference between indoor units should not be more than 5m.



PIPING LENGTH



(L1 + L2) = Maximum 35m

Maximum piping length for one indoor unit is 25m.

		Additional R-22
TWO UNITS	2.5+2.5	0g
	2.5+3.2	0g
	3.2+3.2	~20m add 0g ~25m add 25g ~30m add 50g ~35m add 75g

MULTI-AIR CONDITIONER

With this multi-air conditioner, 2 indoor units can be connected to one outdoor unit to be driven. You can operate the required number of indoor units.

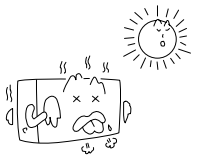
Combination of Operations:

- You cannot operate the indoor units in the following combination.

One unit	Other unit
Heating	Cooling
Heating	Dehumidifying
Heating	Circulating (fan)

- The indoor unit which is switched on first continues to operate, but other indoor units which is switched on later does not operate while the lamp lights.
- To re-start an indoor unit which was operated later, stop the indoor unit which was operated first or later and reset the type of operation, then perform operation again.

Adjusting the Number of Indoor Units:
The more the indoor units to be operated, the lower the power of each unit. Refer to the specification on installation manual. Decrease the number of indoor units to be operated especially when it is very hot or cold or when you want to reach the present temperature quickly.



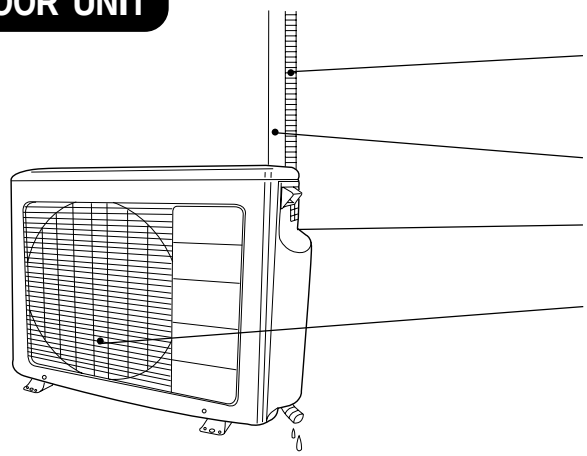
Stopped Indoor Units:
When an indoor unit is operated in the cooling, heating or dehumidifying mode in the room, the sound of refrigerant flow may be heard from a stopped indoor unit or a stopped indoor unit may become warm. This is because the indoor unit returns refrigerant to the outdoor unit to be ready for operation.

Outdoor Units:

- Even after operation is stopped, the fan of the outdoor unit continues to rotate for 10-60 seconds to cool the internal electrical parts.
- During heating, condensed water flows out from the outdoor unit and the defrosting water flows out during defrosting. Do not block the drain outlet of the outdoor unit in a cold place; otherwise the condensed or defrosting water could freeze.

NAMES AND FUNCTIONS OF EACH PART

OUTDOOR UNIT



DRAIN PIPE
Condensed water drain to outside.

CONNECTING CORD

AIR INLET (BACK, LEFT SIDE)

AIR OUTLET

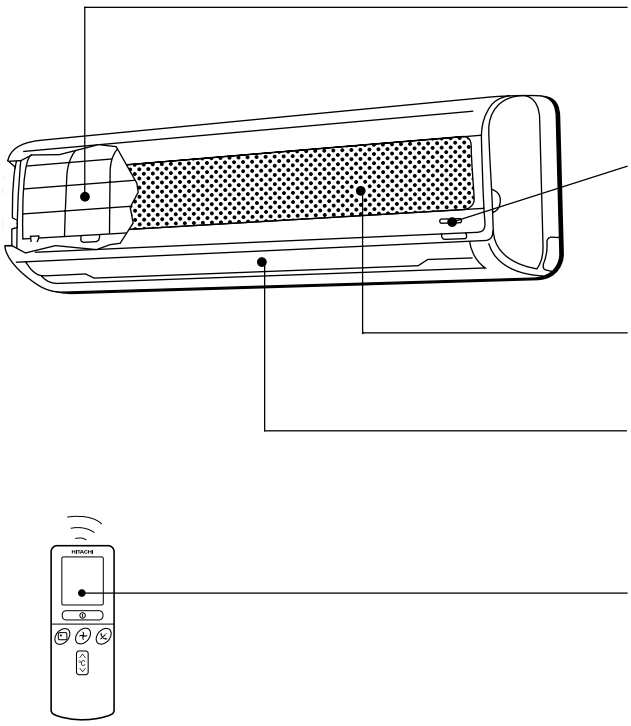
MODEL NAME AND DIMENSIONS

MODEL	WIDTH (mm)	HEIGHT (mm)	DEPTH (mm)
RAS-20CNHZ2	744	248	168
RAS-30CNHZ2	798	265	168
RAM-50CNHZ2	850	650	298

NAMES AND FUNCTIONS OF EACH PART

INDOOR UNIT

RAS-20CNHZ2



AIR FILTER
To prevent dust from coming into the indoor unit.
(Refer page 30)

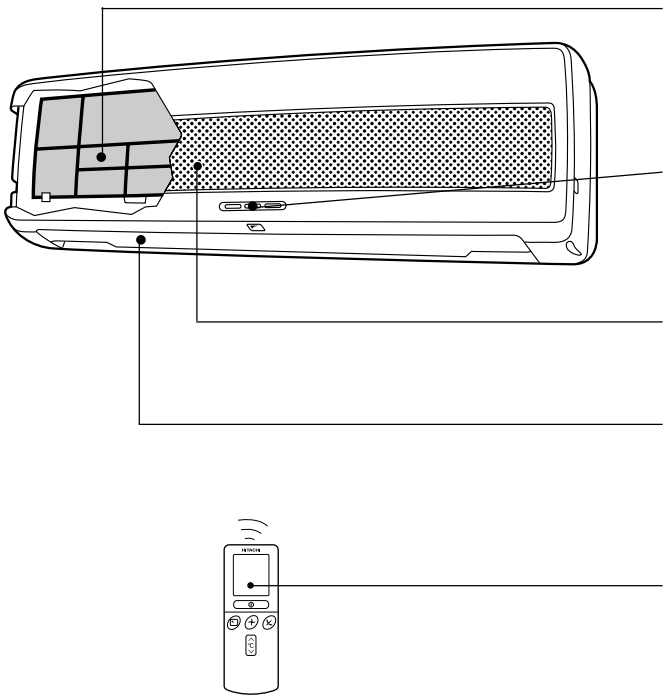
INDOOR UNIT INDICATORS
Light indicator showing the operating condition.
(Refer page 12)

FRONT PANEL (AIR INLET)

HORIZONTAL DEFLECTOR ● VERTICAL DEFLECTOR (AIR OUTLET)
(Refer page 24)

REMOTE CONTROLLER
Send out operation signal to the indoor unit. So as to operate the whole unit.
(Refer page 14)

RAS-30CNHZ2



AIR FILTER
To prevent dust from coming into the indoor unit.
(Refer page 31)

INDOOR UNIT INDICATORS
Light indicator showing the operating condition.
(Refer page 13)

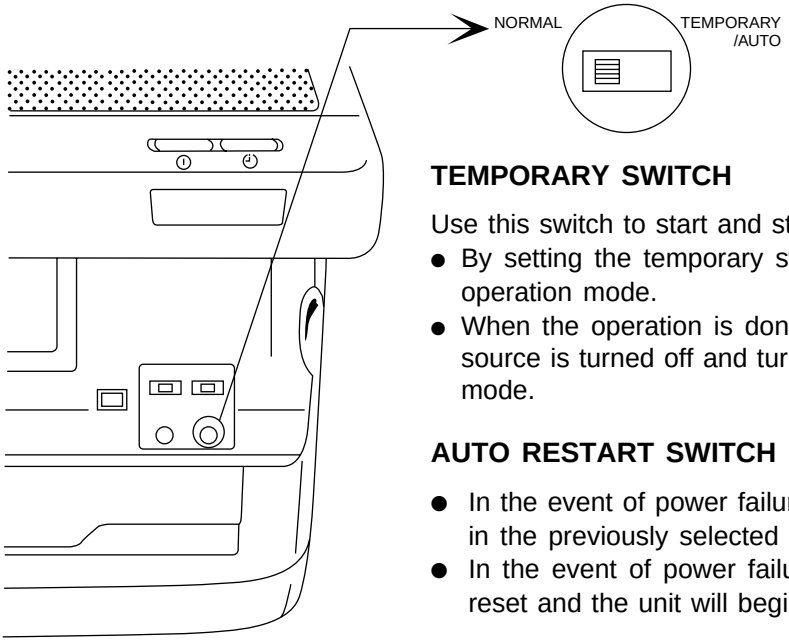
FRONT PANEL (AIR INLET)

HORIZONTAL DEFLECTOR ● VERTICAL DEFLECTOR (AIR OUTLET)
(Refer page 24)

REMOTE CONTROLLER
Send out operation signal to the indoor unit. So as to operate the whole unit.
(Refer page 14)

OPERATION INDICATOR

RAS-20CNHZ2



TEMPORARY SWITCH

Use this switch to start and stop when the remote controller does not work.

- By setting the temporary switch, the operation is done in previously set operation mode.
- When the operation is done using the temporary switch after the power source is turned off and turn on again, the operation is done in automatic mode.

AUTO RESTART SWITCH

- In the event of power failure, the air conditioner will restart automatically in the previously selected mode once the power is restored.
- In the event of power failure during TIMER operation, the timer will be reset and the unit will begin or stop operating under a new timer setting.

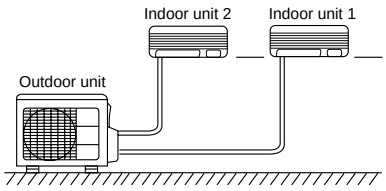
NORMAL

Use this switch in order to prevent the unit from switch ON after the power supply resuming from the power failure.

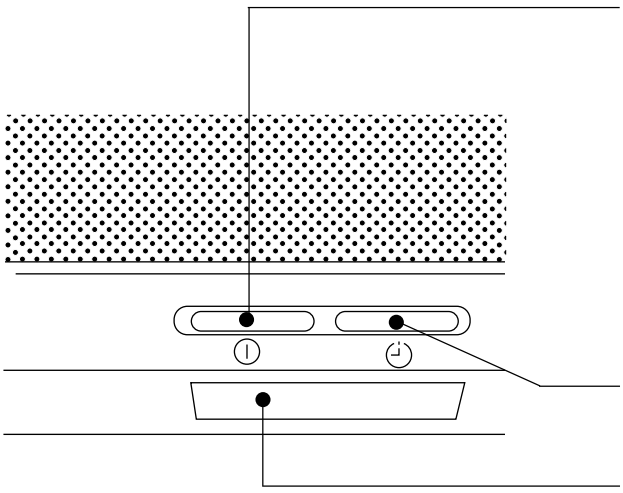
SELECTOR SWITCH IS PRESET AT NORMAL POSITION.

⚠ CAUTION

1. Turn on the circuit breaker first before switching the auto restart switch to AUTO. Failure to do so may result the unit to run at previous preset mode or cannot operate.
2. Operation of indoor units are as mentioned on page 10 “Combination of Operations. (Priority of operation is for unit no. 2)



INDOOR UNIT INDICATORS



OPERATION LAMP

This lamp lights during operation.
The OPERATION LAMP flashes in the following cases during heating.

(1) During preheating
For about 2–3 minutes after starting up.

(2) During defrosting
Defrosting will be performed about 50 minutes when frost forms on the heat exchanger of the outdoor unit, for 5–10 minutes each time.

TIMER LAMP

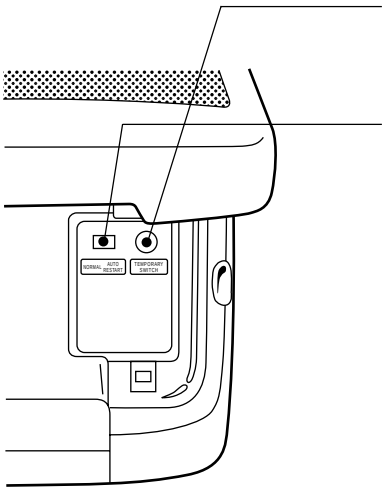
This lamp lights when the timer is working.

SIGNAL RECEIVER

There will be a beep sound when this receiver receives signal from remote controller.

OPERATION INDICATOR

RAS-30CNHZ2



TEMPORARY SWITCH

Use this switch to start and stop when the remote controller does not work.

SELECTOR SWITCH

AUTO RESTART SWITCH

- In the event of power failure, the air conditioner will restart automatically in the previously selected mode once the power is restored.
- In the event of power failure during TIMER operation, the timer will be reset and the unit will begin or stop operating under a new timer setting.

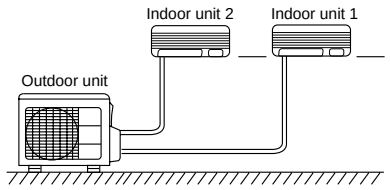
NORMAL

Use this switch in order to prevent the unit from switch ON after the power supply resuming from the power failure.

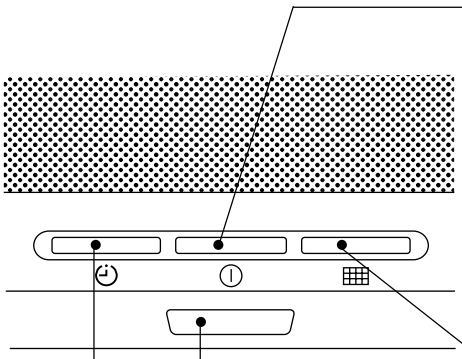
SELECTOR SWITCH IS PRESET AT NORMAL POSITION.

⚠ CAUTION

1. Turn on the circuit breaker first before switching the auto restart switch to AUTO. Failure to do so may result the unit to run at previous preset mode or cannot operate.
2. Operation of indoor units are as mentioned on page 10 “Combination of Operations. (Priority of operation is for unit no. 2)



INDOOR UNIT INDICATORS



OPERATION LAMP

This lamp lights during operation.

The OPERATION LAMP flashes in the following cases during heating.

(1) During preheating

For about 2–3 minutes after starting up.

(2) During defrosting

Defrosting will be performed about 50 minutes when frost forms on the heat exchanger of the outdoor unit, for 5–10 minutes each time.

FILTER LAMP

When the device is operated for a total of about 100 hours, the FILTER lamp lights to indicate that it is time to clean the filter. The lamp goes out when the POWER SWITCH set to OFF and ON again.

SIGNAL RECEIVER

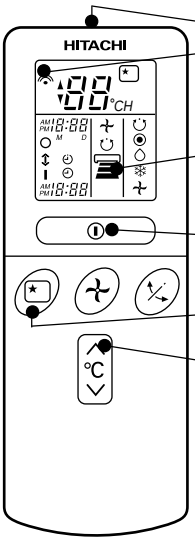
There will be a beep sound when this receiver receives signal from remote controller.

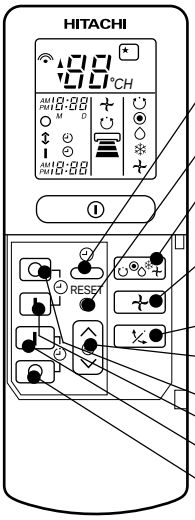
TIMER LAMP

This lamp lights when the timer is working.

NAMES AND FUNCTIONS OF REMOTE CONTROL UNIT

REMOTE CONTROLLER
This controls the operation of the indoor unit. The range of control is about 7 meters. If indoor lighting is controlled electronically, the range of control may be shorter.
This unit can be fixed on a wall using the fixture provided. Before fixing it, make sure the indoor unit can be controlled from the remote controller.





- **Signal emitting window/transmission sign**
  Point this window toward the indoor unit when controlling it.
  The transmission sign blinks when a signal is sent.
- **Display**
  This indicates the room temperature selected, current time, timer status, function and intensity of circulation selected.
- **START/STOP button**
  Press this button to start operation. Press it again to stop operation.
- **SLEEP button**
  Use this button to set the sleep timer.
- **TEMPERATURE buttons**
  Use these buttons to raise or lower the temperature setting. (Keep pressed, and the value will change more quickly.)
- **TIME button**
  Use this button to set and check the time and date.
- **RESET buttons**
- **FUNCTION selector**
  Use this button to select the operating mode. Every time you press it, the mode will change from ↻ (AUTO) to ◉ (HEAT) to ♢ (DEHUMIDIFY) to ❄ (COOL) and to ✣ (FAN) cyclically.
- **FAN SPEED selector**
  This determines the fan speed. Every time you press this button, the intensity of circulation will change from ↻ (AUTO) to ▤ (HI) to ▤ (MED) to ▤ (LOW) (during the ✣ (FAN) mode, from ▤ HI to ▤ MED to ▤ LOW).
- **AUTO SWING button**
  Controls the angle of the horizontal air deflector.
- **TIMER control**
  Use this button to set the timer.
- **OFF-TIMER button** Select the turn OFF time.
- **ON-TIMER button** Select the turn ON time.
- **RESERVE button** Time setting reservation.
- **CANCEL button** Cancel time reservation.

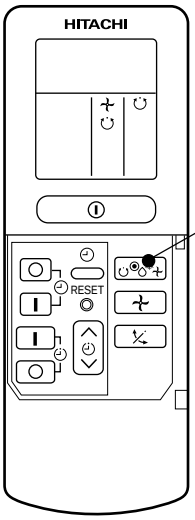
↻	AUTO
◉	HEAT
♢	DEHUMIDIFY
❄	COOL
✣	FAN
▤	FAN SPEED LOW MED HI
★	SLEEPING
○	STOP (CANCEL)
I	START (RESERVE)
⏻	START/STOP
🕘	TIME
🕘	TIMER SET
🕘	TIMER SELECTOR ON TIMER OFF TIMER
⤡	AUTO SWING

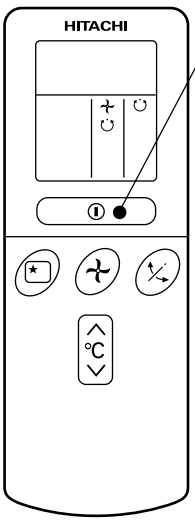
Precautions for Use

- Do not put the remote controller in the following places.
  - In direct sunlight.
  - In the vicinity of a heater.
- Handle the remote controller carefully. Do not drop it on the floor, and protect it from water.
- Once the outdoor unit stops, it will not restart for about 3 minutes (unless you turn the power switch off and on or unplug the power cord and plug it in again).
  This is to protect the device and does not indicate a failure.
- If you press the FUNCTION selector button during operation, the device may stop for about 3 minutes for protection.

AUTOMATIC OPERATION

The device will automatically determine the mode of operation, HEAT, COOL or DEHUMIDIFY depending on the initial room temperature. The selected mode of operation will not change when the room temperature varies.





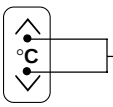
1 Press the FUNCTION selector so that the display indicates the ⟳ (AUTO) mode of operation.

- When AUTO has been selected, the device will automatically determine the mode of operation, HEAT, COOL or DEHUMIDIFY depending on the initial room temperature.

START / STOP Press the ⏻ (START/STOP) button.
Operation starts with a beep.
Press the button again to stop operation.

■ As the settings are stored in memory in the remote controller, you only have to press the ⏻ (START/STOP) button next time.

You can raise or lower the temperature setting as necessary by maximum of 3°C.



Press the temperature button and the temperature setting will change by 1°C each time.

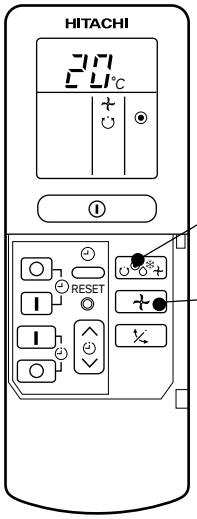
- The preset temperature and the actual room temperature may vary somewhat depending on conditions.
- The display does not indicate the preset temperature in the AUTO mode. If you change the setting, the indoor unit will produce a beep.

■ Condition of Automatic Operation

Initial room temperature (approx.)	Function	Temperature setting	FAN SPEED
Over 27°C ➡	COOL	27°C	HI at start, MED or LOW after the preset temperature is reached
23~27°C ➡	DEHUMIDIFY	Slightly lower than the room temperature	LOW
Under 23°C ➡	HEAT	23°C	HI at start, MED or LOW after the preset temperature is reached

HEATING OPERATION

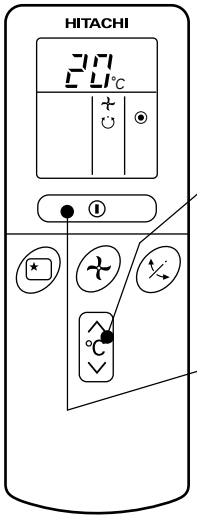
- Use the device for heating when the outdoor temperature is under 21°C.
  When it is too warm (over 21°C), the heating function may not work in order to protect the device.



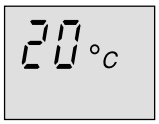
1 Press the FUNCTION selector so that the display indicates ◉ (HEAT).

2 Set the desired FAN SPEED with the (FAN SPEED) button (the display indicates the setting).

- (AUTO): The fan speed is HI at first and varies to MED automatically when the preset temperature has been reached.
- (HI) : Economical as the room will become warm quickly.
  But you may feel a chill at the beginning.
- (MED) : Quiet.
- (LOW) : More quiet.



3 Set the desired room temperature with the TEMPERATURE buttons (the display indicates the setting).



The range of 18-22°C is recommended as the room temperature for heating.
If the temperature setting is 20°C, the room temperature will be controlled at around 20°C.

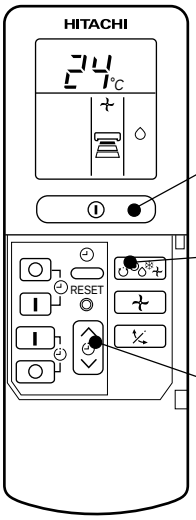
The temperature setting and the actual room temperature may vary somewhat depending on conditions.

START / STOP Press the ⏻ (START/STOP) button. Heating operation starts with a beep. Press the button again to stop operation.

■ As the settings are stored in memory in the remote controller, you only have to press the ⏻ (START/STOP) button next time.

DEHUMIDIFYING OPERATION

Use the device for dehumidifying when the room temperature is over 16°C.
When it is under 15°C, the dehumidifying function will not work.



START
STOP

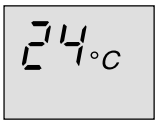
Press the ⏻ (START/STOP) button. Dehumidifying operation starts with a beep. Press the button again to stop operation.

1

Press the FUNCTION selector so that the display indicates ♢ (DEHUMIDIFY).
The FAN SPEED is set at LOW automatically.
The FAN SPEED button does not work.

2

Set the desired room temperature with the TEMPERATURE button (the display indicates the setting).



The range of 20-26˚C is recommended as the room temperature for dehumidifying.

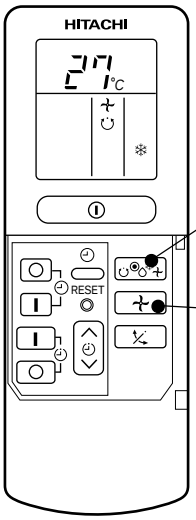
■ As the settings are stored in memory in the remote controller, you only have to press the ⏻ (START/STOP) button next time.

■ Dehumidifying Function

When the room temperature is higher than the temperature setting: The device will dehumidify the room, reducing the room temperature to the preset level.
When the room temperature is lower than the temperature setting: Dehumidifying will be performed at the temperature setting slightly lower than the current room temperature, regardless of the temperature setting. The function will stop (the indoor unit will stop emitting air) as soon as the room temperature becomes lower than the setting temperature.

COOLING OPERATION

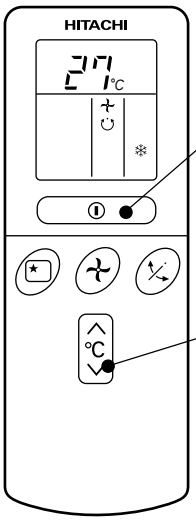
Use the device for cooling when the outdoor temperature is 22-42°C.
If humidity is very high (over 80°C) indoors, some dew may form on the air outlet grille of the indoor unit.



1 Press the FUNCTION selector so that the display indicates ❄ (COOL).

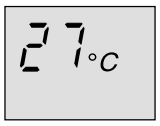
2 Set the desired FAN SPEED with the (FAN SPEED) button (the display indicates the setting).

- (AUTO): The FAN SPEED is HI at first and varies to MED automatically when the preset temperature has been reached.
- (HI) : Economical as the room will become cool quickly.
- (MED) : Quiet.
- (LOW) : More quiet.



START / STOP Press the ⏻ (START/STOP) button. Cooling operation starts with a beep. Press the button again to stop operation. The cooling function does not start if the temperature setting is higher than the current room temperature (even though the ⏻ (OPERATION) lamp lights). The cooling function will start as soon as you set the temperature below the current room temperature.

3 Set the desired room temperature with the TEMPERATURE button (the display indicates the setting).



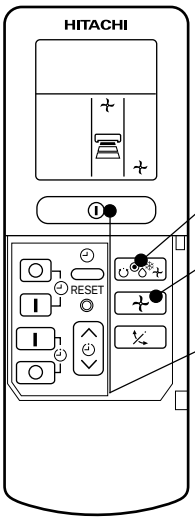
The range of 25-28°C is recommended as the room temperature for cooling.
If the temperature setting is 27°C, the room temperature will be controlled at around 27°C.

The temperature setting and the actual room temperature may vary somewhat depending on conditions.

■ As the settings are stored in memory in the remote controller, you only have to press the ⏻ (START/STOP) button next time.

FAN OPERATION

You can use the device simply as an air circulator. Use this function to dry the interior of the indoor unit at the end of summer.



1 Press the FUNCTION selector so that the display indicates ✣ (FAN).

2 Press the ✣ (FAN SPEED) button.*

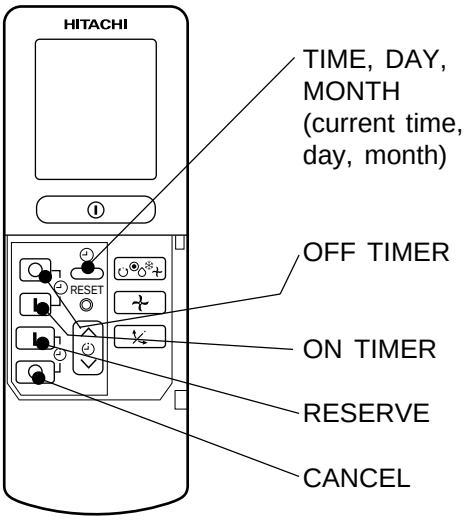
START / STOP Press the ⏻ (START/STOP) button. Fan operation starts with a beep. Press the button again to stop operation.

* Note • In the fan operation mode, only display of FAN SPEED setting will change by pressing FAN SPEED button; the actual fan speed cannot be changed directly from HI to LOW mode.

FAN SPEED (AUTO) ····· When the AUTO fan speed mode is set in the cooling/heating operation:

For the heating operation	● The fan speed will automatically change according to the temperature of discharged air. ● When the difference of room temperature and setting temperature is large, fan starts to run at HI speed. ● When the room temperature reaches setting temperature, fan speed changes to LOW automatically.
For the cooling operation	● When the difference of room temperature and setting temperature is large, fan starts to run at HI speed. ● After room temperature reaches the preset temperature, the cooling operation, which changes the fan speed and room temperature to obtain optimum conditions for natural healthful cooling will be performed.

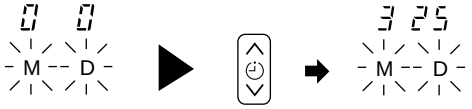
HOW TO SET THE TIMER



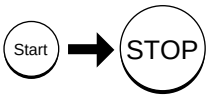
Time, Day, Month

After you change the batteries;

1 Set the current month and day with the TIMER control button.

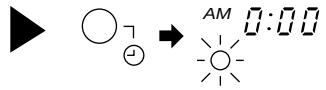


OFF-Timer



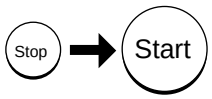
You can set the device to turn off at the present time.

1 Press the ◯ (OFF-TIMER) button. The ◯ (OFF) mark blinks on the display.

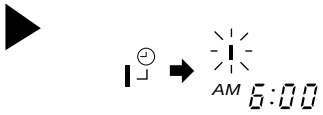


ON-Timer

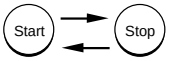
- The device will turn on at the designated times.



1 Press the ❙ (ON-TIMER) button the ❙ (ON) mark blinks on the display.

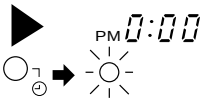


ON/OFF-Timer

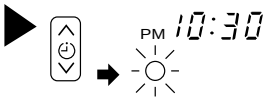


- The device will turn on (off) and off (on) at the designated times.
- The switching occurs first at the preset time that comes earlier.
- The arrow mark appearing on the display indicates the sequence of switching operations.

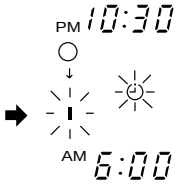
1 Press the ◯ (ON-OFF) button so that the ◯ (OFF) mark blinks.



2 Set the turn-off time with the TIMER control button.
Press the ❙ (RESERVE) button.



3 Press the ❙ (ON-TIMER) button so that the ◯ (OFF) mark lights and the ❙ (ON) mark blinks.



How to Cancel Reservation

Point the signal window of the remote controller toward the indoor unit, and press the ◯ (CANCEL) button.
The ◴ (RESERVED) sign goes out with a beep and the ◴ (TIMER) lamp turns off on the indoor unit.

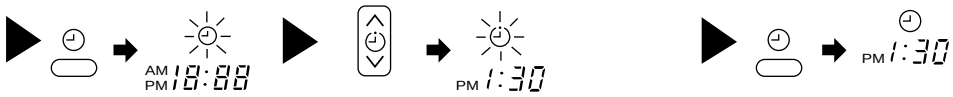
NOTE

You can set only one of the OFF-timer, ON-timer and ON/OFF-timer.

2 Press the ◴ (TIME) button.

3 Set the current time with the TIMER control button.

4 Press the ◴ (TIME) button again.
The time indication starts lighting instead of flashing.

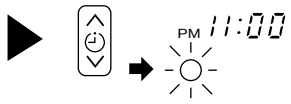


Example: The current time is 1:30 p.m.

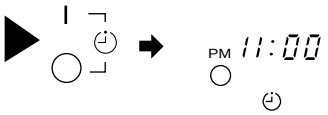
- The time indication will disappear automatically in 10 second.
- To check the current time setting, press the ◴ (TIME) button twice.

The setting of the current time is now complete.

2 Set the turn-off time with the TIMER control button.



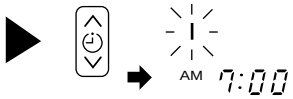
3 Point the signal window of the remote controller toward the indoor unit, and press the ❙ (RESERVE) button.
The ◯ (OFF) mark starts lighting instead of flashing and the sign ◴ (RESERVED) lights. A beep occurs and the ◴ (TIMER) lamp lights on the indoor unit.



Example: The device will turn off at 11:00p.m.

The setting of turn-off time is now complete.

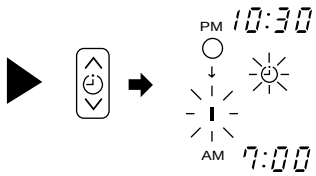
2 Set the turn-on time with the TIMER control button.



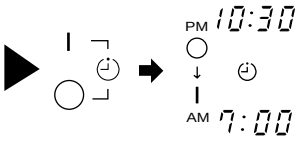
3 Point the signal window of the remote controller toward the indoor unit, and press the ❙ (RESERVE) button.
The ❙ (ON) mark starts lighting instead of flashing and the ◴ (RESERVED) sign lights. A beep occurs and the ◴ (TIMER) lamp lights on the indoor unit.

Example:
The device will automatically turn on earlier so that the preset temperature can be reached at 7:00 a.m.
The setting of the turn-on time is now complete.

4 Set the turn-on time with the TIMER control button.



5 Point the signal window of the remote controller toward the indoor unit, and press the ❙ (RESERVE) button.
The ❙ (ON) mark starts lighting instead of flashing and the ◴ (RESERVED) sign lights. A beep occurs and the ◴ (TIMER) lamp lights on the indoor unit.

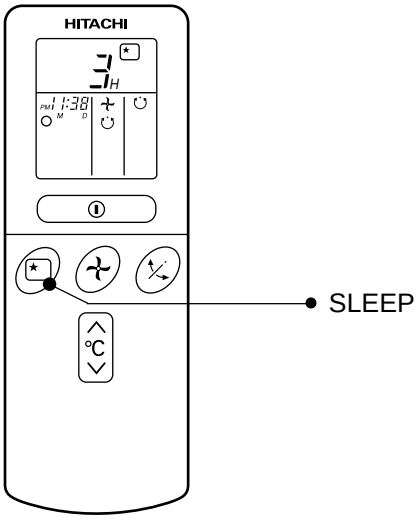


Example:
The device will turn off at 10:30 p.m. and then automatically turn on earlier so that the preset temperature can be reached at 7:00 a.m.
The settings of the turn-on/off times are now complete.

- The timer may be used in three ways: off-timer, on-timer, and ON/OFF (OFF/ON)-timer. Set the current time at first because it serves as a reference.
- As the time settings are stored in memory in the remote controller, you only have to press the ❙ (RESERVE) button in order to use the same settings next time.

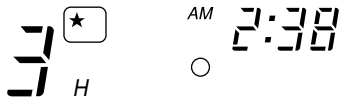
HOW TO SET THE SLEEP TIMER

Set the current time at first if it is not set before (see the pages for setting the current time). Press the ⊡ (SLEEP) button, and the display changes as shown below.

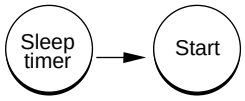


Mode	Indication
Sleep timer	→ 1 hour → 2 hours → 3 hours → 7 hours → Sleep timer off →

Sleep Timer: The device will continue working for the designated number of hours and then turn off.
Point the signal window of the remote controller toward the indoor unit, and press the SLEEP button.
The timer information will be displayed on the remote controller. The TIMER lamp lights with a beep from the indoor unit. When the sleep timer has been set, the display indicates the turn-off time.



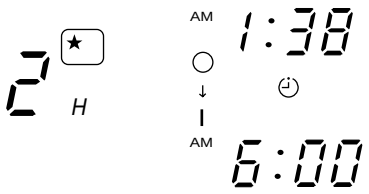
Example: If you set 3 hours sleep time at 11:38 p.m., the turn-off time is 2:38 a.m.



The device will be turned off by the sleep timer and turned on by on-timer.

1 Set the ON-timer.

2 Press the ⊡ (SLEEP) button and set the sleep timer.



For heating:

In this case, the device will turn off in 2 hours (at 1:38 a.m.) and turn on early so that the preset temperature will be almost reached at 6:00 next morning.

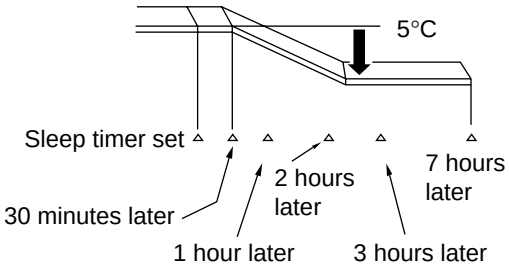
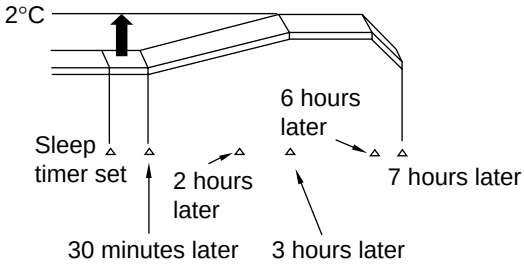
How to Cancel Reservation

Point the signal window of the remote controller toward the indoor unit, and press the ○ (CANCEL) button.
The ◴ (RESERVED) sign goes out with a beep and the ◴ (TIMER) lamp turns off on the indoor unit.

Explanation of the sleep timer

The device will control the FAN SPEED and room temperature automatically so as to be quiet and good for people's health.
You can set the sleep timer to turn off after 1, 2, 3 or 7 hours. The FAN SPEED and room temperature will be controlled as shown below.

Operation with the sleep timer

Function	Operation
Heating " ◉ "	The room temperature will be controlled 5°C below the temperature and the FAN SPEED will be set to LOW setting 30 minutes after the setting of the sleep timer. The room temperature is kept at about 12°C minimum. 
Cooling " ❄ " and dehumidifying " ◯ "	The room temperature will be controlled 2°C above the temperature and the FAN SPEED will be set to LOW setting 30 minutes after the setting of the sleep timer. The room temperature is kept at about 25–28°C. 
Fan " ✣ "	The settings of room temperature and circulation are varied.

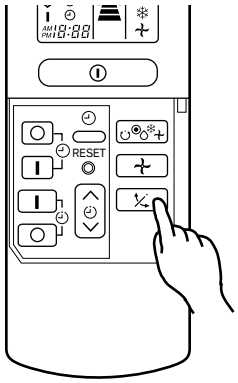
NOTE

- If date or current time is not set, sleep timer can not be set.
- If you set the sleep timer after the off-, on/off- or off/on-timer has been set, the sleep timer becomes effective instead of the off-, on/off- or off/on-timer set earlier.
- You can not set other timer during sleep timer operation.
- After sleep timer time is up and when press sleep button again, the sleep timer will be set as last setting.
- Sleep timer effective only once.

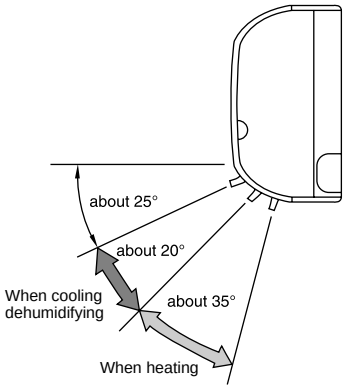
ADJUSTING THE AIR DEFLECTOR

1 Adjustment of the conditioned air in the upward and downward directions.

The horizontal air deflector is automatically set to the proper angle suitable for each operation. The deflector can be swung up and down continuously and also set to the desired angle using the " (AUTO SWING)" button.



- If the " (AUTO SWING)" button is pressed once, the horizontal air deflector swings up and down. If the button is pressed again, the deflector stops in its current position. Several seconds (about 6 seconds) may be required before the deflector starts to move.
- Use the horizontal air deflector within the adjusting range shown on the right.
- When the operation is stopped, the horizontal air deflector moves and stops at the position where the air outlet closes.

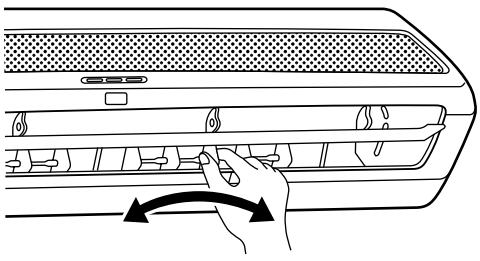


⚠ CAUTION

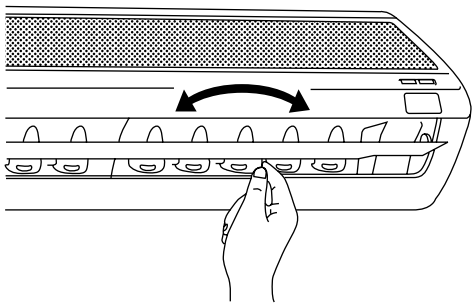
- In "Cooling" operation, do not keep the horizontal air deflector swinging for a long time. Some dew may form on the horizontal air deflector and some dew may fall from it.

2 Adjustment of the conditioned air to the left and right.

Hold the vertical air deflector as shown in the figure and adjust the conditioned air to the left and right.



RAS-30CNHZ2

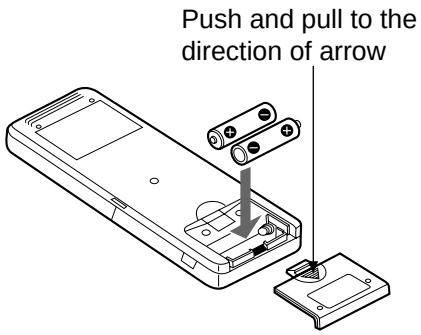


RAS-20CNHZ2

HOW TO EXCHANGE THE BATTERIES IN THE REMOTE CONTROLLER

1 Remove the cover as shown in the figure and take out the old batteries.

2 Install the new batteries.
The direction of the batteries should match the marks in the case.

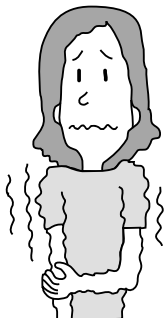


⚠ CAUTION

1. Do not use new and old batteries, or different kinds of batteries together.
2. Take out the batteries when you do not use the remote controller for 2 or 3 months.

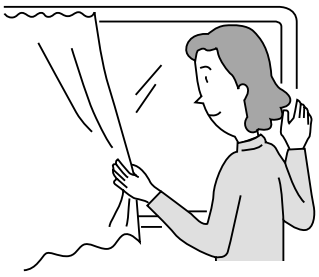
THE IDEAL WAYS OF OPERATION

Suitable Room Temperature



⚠ Warning
Freezing temperature is bad for health and a waste of electric power.

Install curtain or blinds



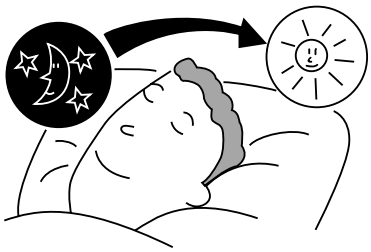
It is possible to reduce heat entering the room through windows.

Ventilation

⚠ Caution
Do not close the room for a long period of time. Occasionally open the door and windows to allow the entrance of fresh air.

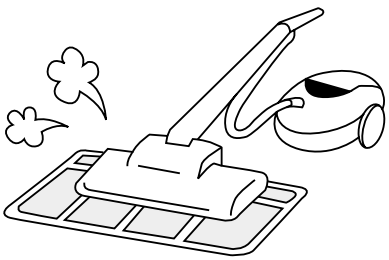
Effective Usage Of Timer

At night, please use the “OFF or ON timer operation mode”, together with your wake up time in the morning. This will enable you to enjoy a comfortable room temperature. Please use the timer effectively.



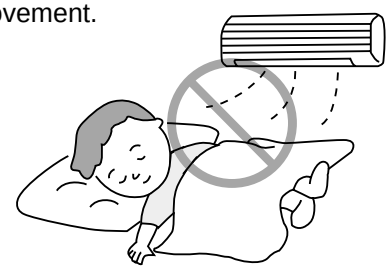
Do Not Forget To Clean The Air Filter

Dusty air filter will reduce the air volume and the cooling efficiency. To prevent from wasting electric energy, please clean the filter every 2 weeks.



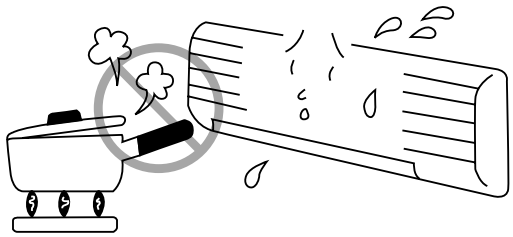
Please Adjust Suitable Temperature For Baby And Children

Please pay attention to the room temperature and air flow direction when operating the unit for baby, children and old folks who have difficulty in movement.



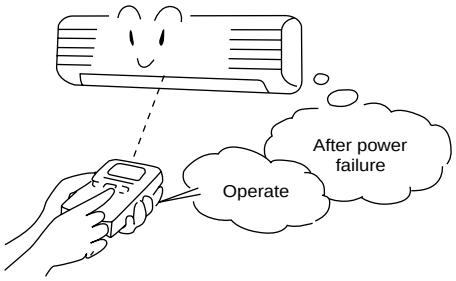
The Air Conditioner And The Heat Source In The Room

⚠ Caution
If the amount of heat in the room is above the cooling capability of the air conditioner (for example: more people entering the room, using heating equipments and etc.), the preset room temperature cannot be achieved.



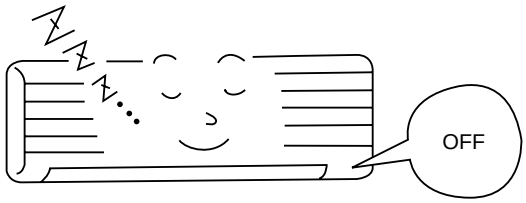
After Power Failure

When the power is resumed after a power failure, the indoor unit will still remain "OFF". To operate the unit, please press the "ON/OFF" button again.



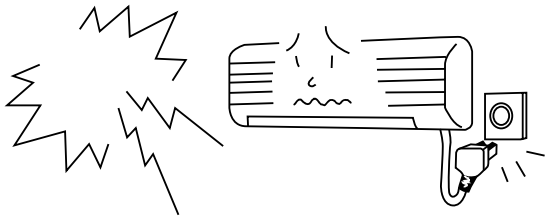
Not Operating For A Long Time

When the indoor unit is not to be used for a long period of time, please switch off the power from the mains. If the power from mains remains "ON", the indoor unit still consumes about 8W in the operation control circuit even if it is in "OFF" mode.



When Lightning Occurs

⚠ Warning
To protect the whole unit during lightning, please stop operating the unit and remove the plug from the socket.



ATTACHING THE AIR CLEANSING AND DEODORIZING FILTERS

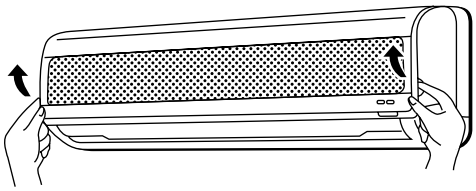
RAS-20CNHZ2

⚠ CAUTION

Cleaning and maintenance must be carried out only by qualified service personal. Before cleaning, stop operation and switch off the power supply.

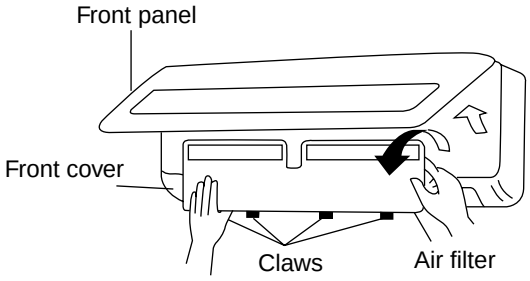
1 **Open the front panel.**

- Pull up the front panel by holding it at both sides with both hands.



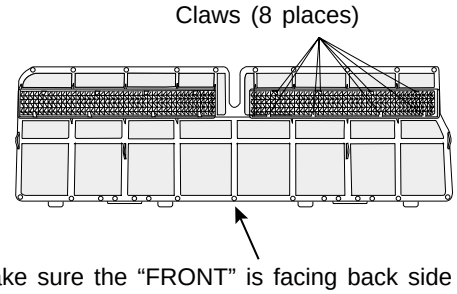
2 **Remove the filter.**

- Push upward to release the claws and pull out the filter.



3 **Attaching the air cleansing and deodorizing filters to the filter.**

- Attach the air cleansing and deodorizing filters to the frame by gently compress its both sides and release after insertion into filter frame.

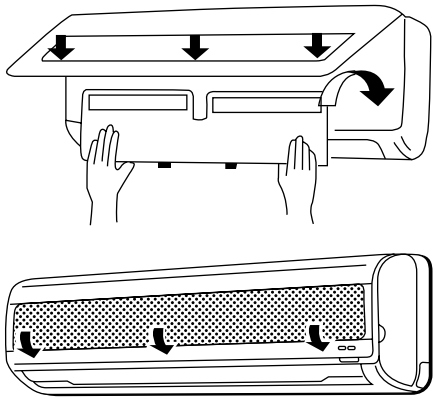


⚠ CAUTION

Do not bend the air cleansing and deodorizing filter as it may cause damage to the structure.

4 **Attach the filters.**

- Attach the filters by ensuring that the surface written “FRONT” is facing front.
- After attaching the filters, push the front panel at three arrow portion as shown in figure and close it.



NOTE

- In case of removing the air cleansing and deodorizing filters, please follow the above procedures.
- The cooling capacity is slightly weakened and the cooling speed becomes slower when the air cleansing and deodorizing filters are used. So, set the fan speed to "HIGH" when using it in this condition.
- Air cleansing and deodorizing filters are washable and reusable up to 20 times by using vacuum cleaner or water rinse under running tap water. Type number for this air cleansing filter is <SPX-CFH5>. Please use this number for ordering when you want to renew it.
- Do not operate the air conditioner without filter. Dust may enter the air conditioner and fault may occur.

ATTACHING THE AIR CLEANSING AND DEODORIZING FILTERS

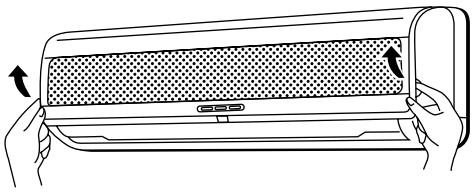
RAS-30CNHZ2

⚠ CAUTION

Cleaning and maintenance must be carried out only by qualified service personal. Before cleaning, stop operation and switch off the power supply.

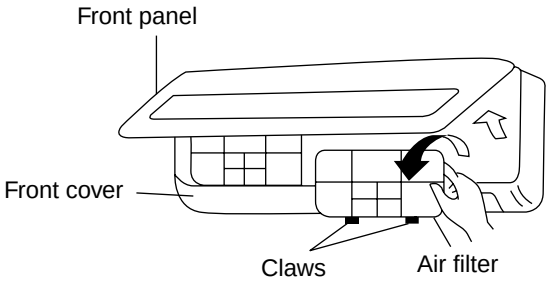
1 **Open the front panel.**

- Be sure to hold the button sides on the left and right of the front panel with both hands and pull up the front panel forward.



2

- Slightly lift the filter and release the claws (2 locations) at the lower part of the front cover and remove the filter from the lower side.

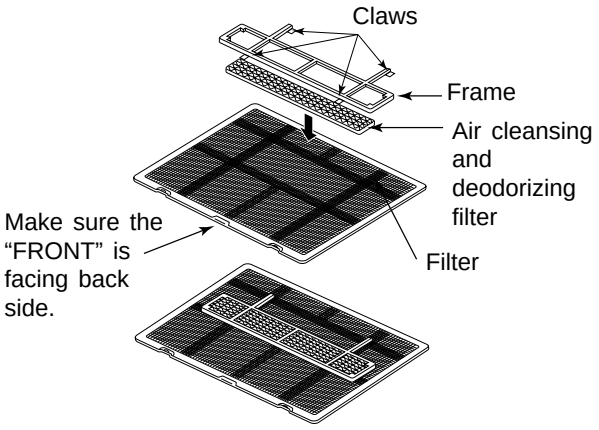


3 **Attaching the air cleansing and deodorizing filters to the filter.**

- Attach the air cleansing and deodorizing filters to the frame by gently compress its both sides and release after insertion into filter frame.

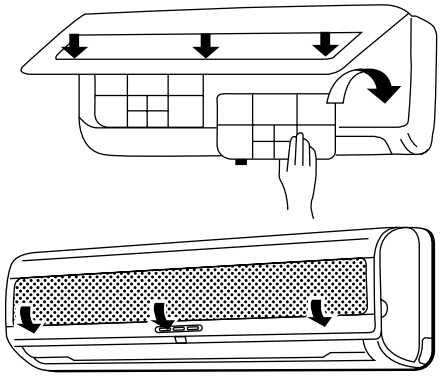
⚠ CAUTION

Do not bend the air cleansing and deodorizing filter as it may cause damage to the structure.



4 **Attach the filters.**

- Attach the filters by ensuring that the surface written "FRONT" is facing front.
- After attaching the filters, push the front panel at three arrow portion as shown in figure and close it.



NOTE:

- The cooling capacity is slightly weakened and the cooling speed becomes slower when the air cleaning and deodorizing filter is used. So, set the fan speed to "HIGH" when using it in this condition.
- Air cleansing and deodorizing filters is washable and reusable up to 20 times by using vacuum cleaner or water rinse. Type number for this air cleaning filter is <SPX-CFH5>. Please use this number for ordering when you want to renew it.

MAINTENANCE

RAS-20CNHZ2

⚠ CAUTION

Cleaning and maintenance must be carried out only by qualified service personal. Before cleaning, stop operation and switch off the power supply.

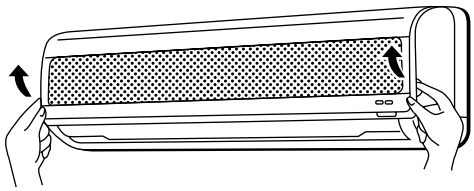
1. AIR FILTER

Clean the air filter, as it removes dust inside the room. In case the air filter is full of dust, the air flow will decrease and the cooling capacity will be reduced. Further, noise may occur. Be sure to clean the filter following the procedure below.

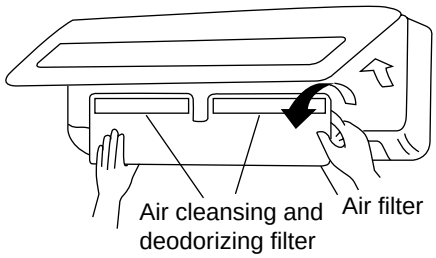
REMOVING METHOD

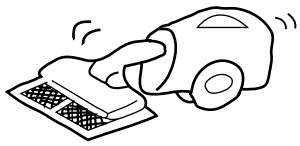
PROCEDURE

1 Open the front panel and remove the filter
- Gently lift and remove the air cleansing and deodorizing filter from the air filter frame.



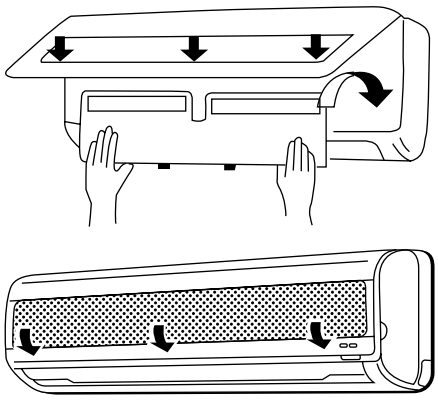
2 Vacuum dust from the air filter and air cleansing and deodorizing filter using vacuum cleaner. If there is too much dust, rinse under running tap water and gently brush it with soft bristle brush. Allow filters to dry in shade.





INSTALLATION METHOD

3
- Re-insert the air cleansing and deodorizing filter to the filter frame. Set the filter with “FRONT” mark facing front, and slot them into the original state.
- After attaching the filters, push the front panel at three arrow portions as shown in figure and close it.



NOTE:
- Air cleansing and deodorizing filter should be cleaned every month or sooner if noticeable loading occurs. When used overtime, it may loose its deodorizing function. For maximum performance, it is recommended to replace it every 3-6 months depending on application requirements.

⚠ CAUTION

- Do not wash with hot water at more than 40°C. The filter may shrink.
- When washing it, shake off moisture completely and dry it in the shade; do not expose it directly to the sun. The filter may shrink.
- Do not use detergent on the air cleansing and deodorizing filter as some detergent may deteriorate the filter electrostatic performance.

MAINTENANCE

RAS-30CNHZ2

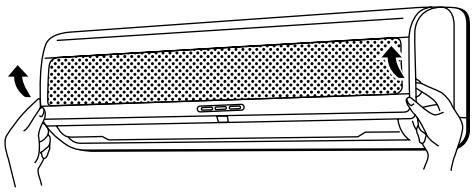
⚠ CAUTION

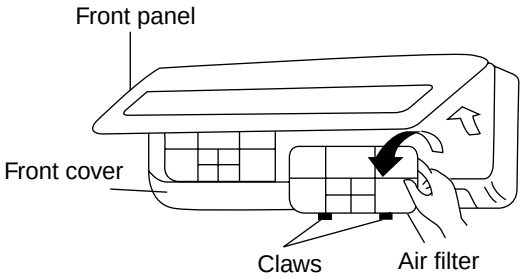
Cleaning and maintenance must be carried out only by qualified service personal. Before cleaning, stop operation and switch off the power supply.

1. AIR FILTER

Clean the air filter, as it removes dust inside the room. In case the air filter is full of dust, the air flow will decrease and the cooling capacity will be reduced. Further, noise may occur. Be sure to clean the filter following the procedure below.

REMOVING METHOD

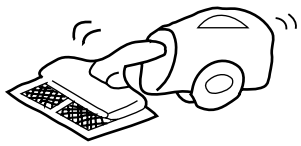




PROCEDURE

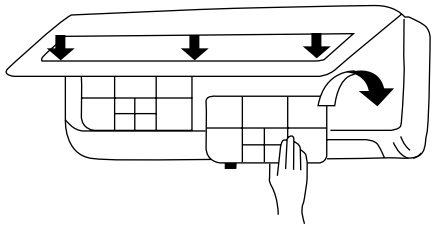
1. Open the panel and remove the filter
   - Slightly lift the filter and release the claws from the front cover.
   - Gently lift and remove the air cleansing and deodorizing filter from air filter frame.

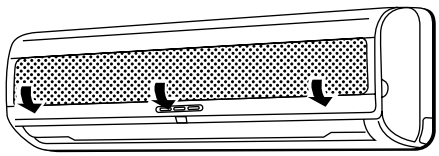
2. Vacuum dust from the air filter and air cleansing and deodorizing filter using vacuum cleaner. If there is too much dust, rinse with clean water and gently brush it with soft bristle brush. Allow filters to dry in shade.



INSTALLATION METHOD

3. Re-insert the air cleansing and deodorizing filter to the filter frame. Set the filter with “FRONT” mark facing front, and slot them into the original state.
   - After attaching the filters, push the front panel at three arrow portions as shown in figure and close it.





NOTE:

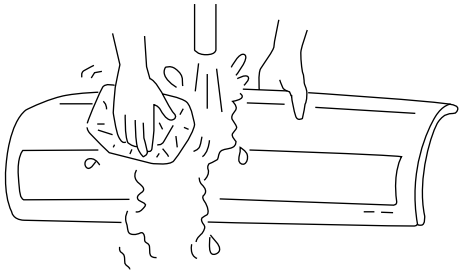
- Air cleansing and deodorizing filter should be cleaned every month or sooner if noticeable loading occurs. When used overtime, it may loose its deodorizing function. For maximum performance, it is recommended to replace it every 3-6 months depending on application requirements.

⚠ CAUTION

- Do not wash with hot water at more than 40°C. The filter may shrink.
- When washing it, shake off moisture completely and dry it in the shade; do not expose it directly to the sun. The filter may shrink.
- Do not use detergent on the air cleansing and deodorizing filter as some detergent may deteriorate the filter electrostatic performance.

2. Washable Front Panel

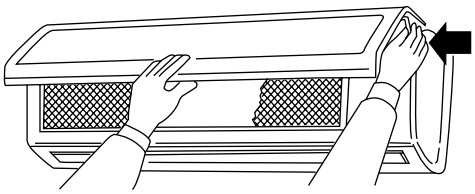
- Remove the front panel and wash with clean water.
  Wash it with a soft sponge.
  After using neutral detergent, wash thoroughly with clean water.



- When front panel is not removed, wipe it with a soft dry cloth. Wipe the remote controller thoroughly with a soft dry cloth.
- Wipe the water thoroughly.
  If water remains at indicators or signal receiver of indoor unit, it causes trouble.

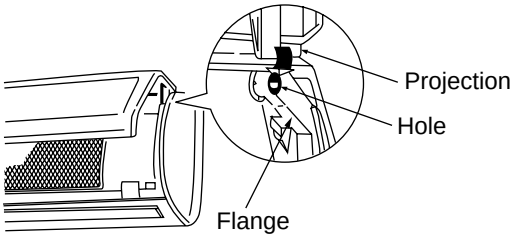
Method of removing the front panel.
Be sure to hold the front panel with both hands to detach and attach it.

Removing the Front Panel



- When the front panel is fully opened with both hands, push the right arm to the inside to release it, and while closing the front panel slightly, put it out forward.

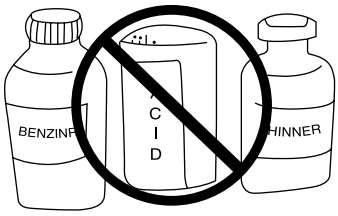
Attaching the Front Panel



- Move the projections of the left and right arms into the **Flanges** in the unit and securely insert them into the holes.

⚠ CAUTION

- Do not splash or direct water to the body of the unit when cleaning it as this may cause short circuit.
- Never use hot water (above 40°C), benzine, gasoline, acid, thinner or a brush, because they will damage the plastic surface and the coating.

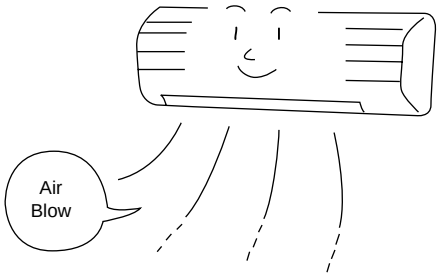


⚠ CAUTION

Cleaning and maintenance must be carried out only by qualified service personal. Before cleaning, stop operation and switch off the power supply.

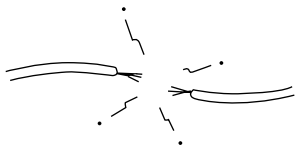
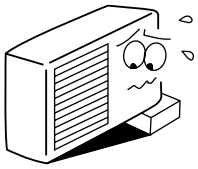
3. MAINTENANCE AT BEGINNING OF LONG OFF PERIOD

- Run the unit by setting the operation mode to ❄ (COOL), the temperature to 32°C and the fan speed to HI for about half a day on a fine day, to dry the unit.
- Switch off the power plug.



REGULAR INSPECTION

PLEASE CHECK THE FOLLOWING POINTS BY QUALIFIED SERVICE PERSONAL EVERY EITHER HALF YEARLY OR YEARLY. CONTACT YOUR SALES AGENT OR SERVICE SHOP.

1		Is the earth line disconnected or broken?
2		Is the mounting frame seriously affected by rust and is the outdoor unit tilted or unstable?

AFTER SALE SERVICE AND WARRANTY

WHEN ASKING FOR SERVICE, CHECK THE FOLLOWING POINTS.

CONDITION	CHECK THE FOLLOWING POINTS
When it does not operate	● Is the fuse all right? ● Is the voltage extremely high or low? ● Is the circuit breaker “ON”?
When it does not cool well When it does not hot well	● Was the air filter cleaned? ● Does sunlight fall directly on the outdoor unit? ● Is the air flow of the outdoor unit obstructed? ● Are the doors or windows opened, or is there any source of heat in the room? ● Is the set temperature suitable?

Notes

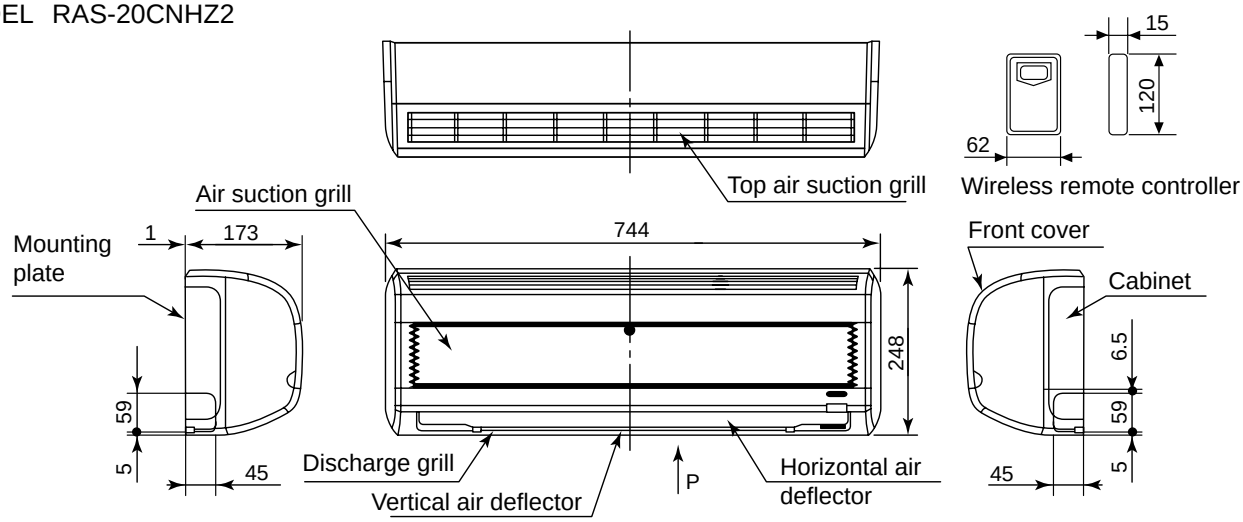
- In quiet operation or stopping the operation, the following phenomena may occassionally occur, but they are not abnormal for the operation.
  (1) Slight flowing noise of refrigerant in the refrigerating cycle.
  (2) Slight rubbing noise from the fan casing which is cooled and then gradually warmed as operation stops.
- The odor will possibly be emitted from the room air conditioner because the various odor, emitted by smoke, foodstuffs, cosmetics and so on, sticks to it. So the air filter and the evaporator regularly must be cleaned to reduce the odor.

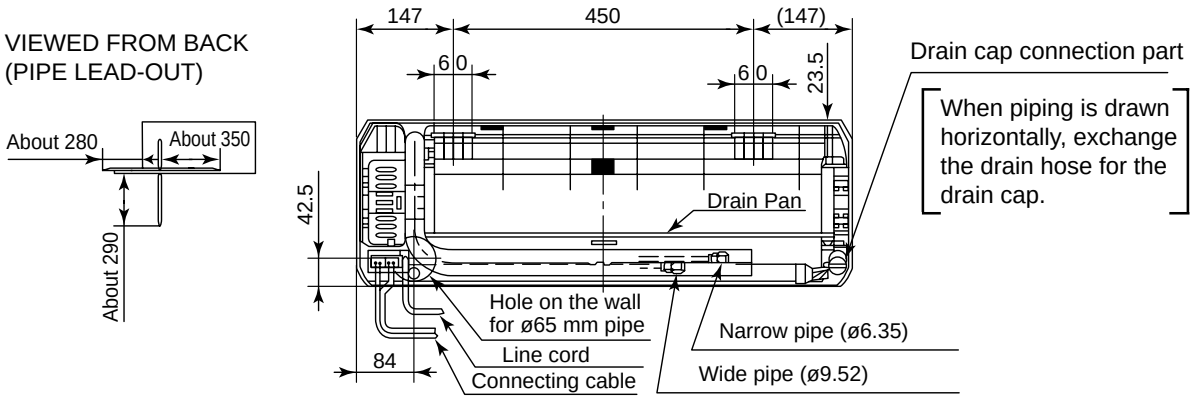
- Please contact your sales agent immediately if the air conditioner still fails to operate normally after the above inspections. Inform your agent of the model of your unit, production number, date of installation. Please also inform him regarding the fault.

- Power supply shall be connected at the rated voltage, otherwise the unit will be broken or could not reach the specified capacity.

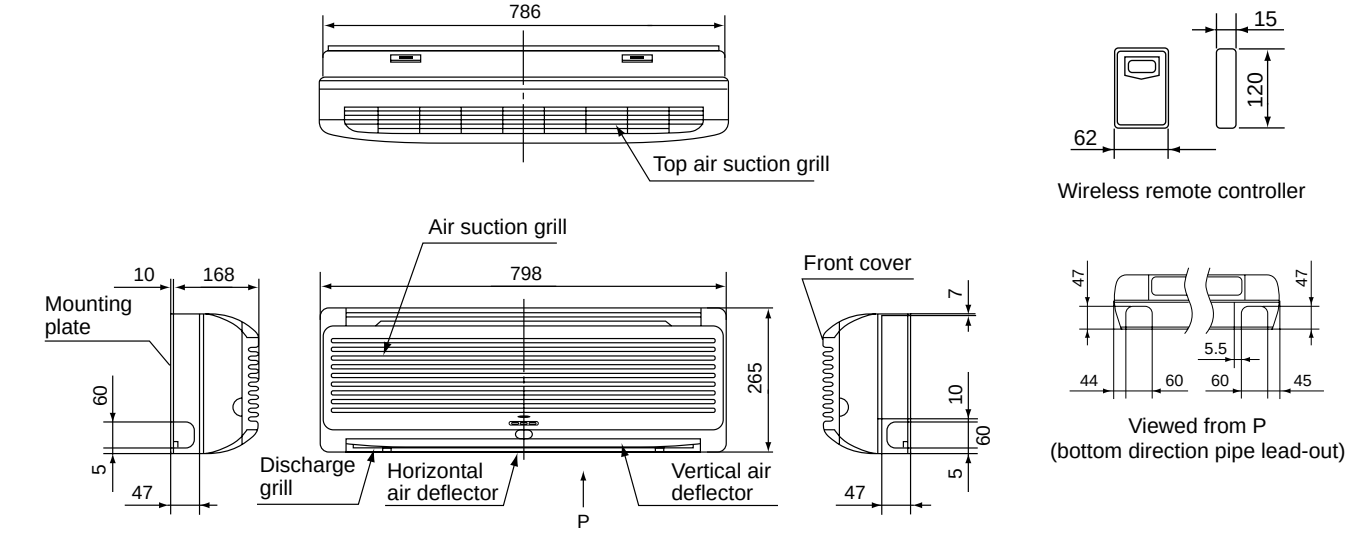
CONSTRUCTION AND DIMENSIONAL DIAGRAM

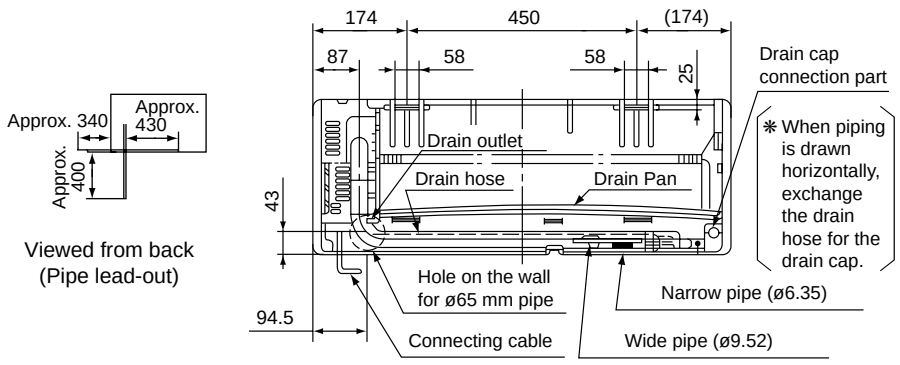
MODEL RAS-20CNHZ2





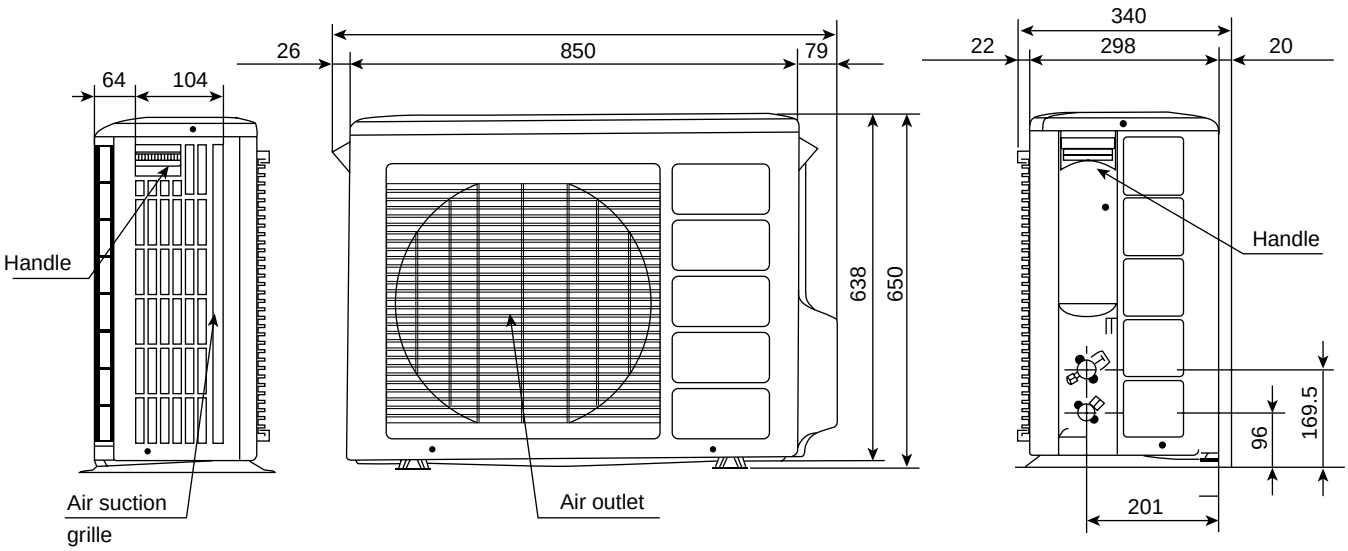
MODEL RAS-30CNHZ2

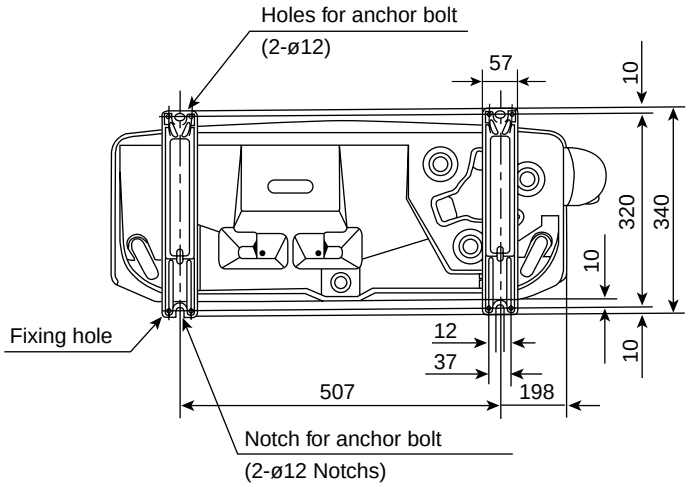


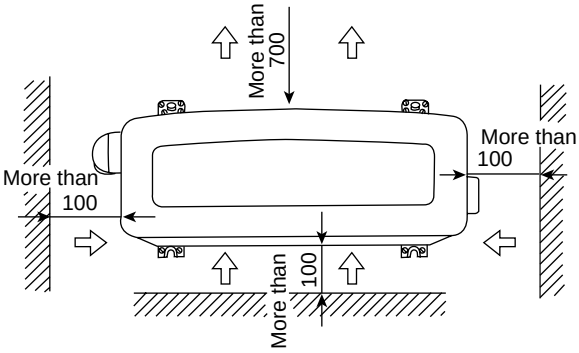


Note:
1. Servicing space of 100mm or more is required on the left and right sides of the indoor unit and also 50mm or more space is required above the unit.
2. Insulated pipes should be used for both the narrow and wide dia. pipes.

MODEL RAM-50CNHZ2







Service space

MAIN PARTS COMPONENT

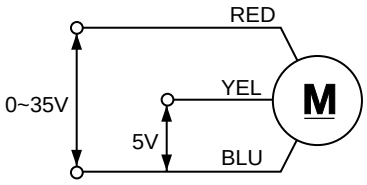
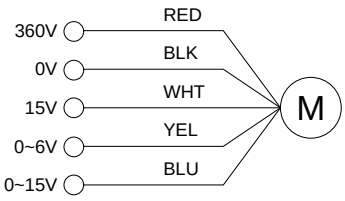
THERMOSTAT

Thermostat Specifications

MODEL			RAS-20CNHZ2, RAS-30CNHZ2	
THERMOSTAT MODEL			IC	
OPERATION MODE			COOL	HEAT
TEMPERATURE °C (°F)	INDICATION 16	ON	14.3 (57.7)	24.3 (75.7)
		OFF	13.6 (56.5)	25.0 (77.0)
	INDICATION 24	ON	22.3 (72.1)	32.3 (90.1)
		OFF	21.6 (70.9)	33.0 (91.4)
	INDICATION 32	ON	30.3 (86.5)	40.3 (104.5)
		OFF	29.6 (85.3)	41.0 (105.8)

FAN MOTOR

Fan Motor Specifications

MODEL	RAS-20CNHZ2, RAS-30CNHZ2	RAM-50CNHZ2
POWER SOURCE	DC: 5V, DC: 0 ~ 35V	DC360V
OUTPUT	20W	40W
CONNECTION	 (Control circuit built in)	

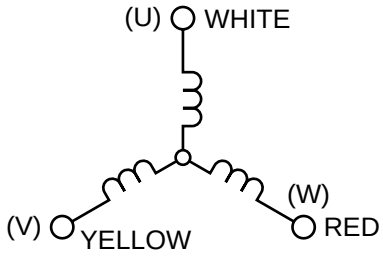
BLU : BLUE YEL : YELLOW BRN : BROWN WHT : WHITE

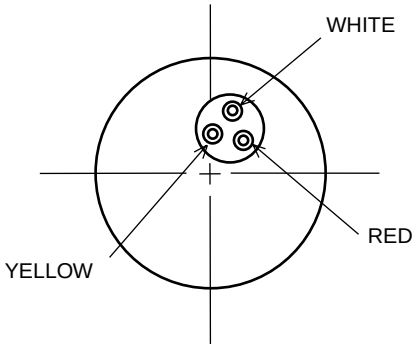
GRY : GRAY ORN : ORANGE GRN : GREEN RED : RED

BLK : BLACK PNK : PINK VIO : VIOLET

COMPRESSOR MOTOR

Compressor Motor Specifications

MODEL		RAM-50CNHZ2
COMPRESSOR MODEL		GW20DN8A
PHASE		SINGLE
RATED VOLTAGE		AC 220 ~ 230 V
RATED FREQUENCY		50/60 Hz
POWER SOURCE FOR COMPRESSOR		Vcc max = 360V
POLE NUMBER		4
CONNECTION		
RESISTANCE VALUE (Ω)	20°C (68°F)	2M = 1.05
	75°C (167°F)	2M = 1.28



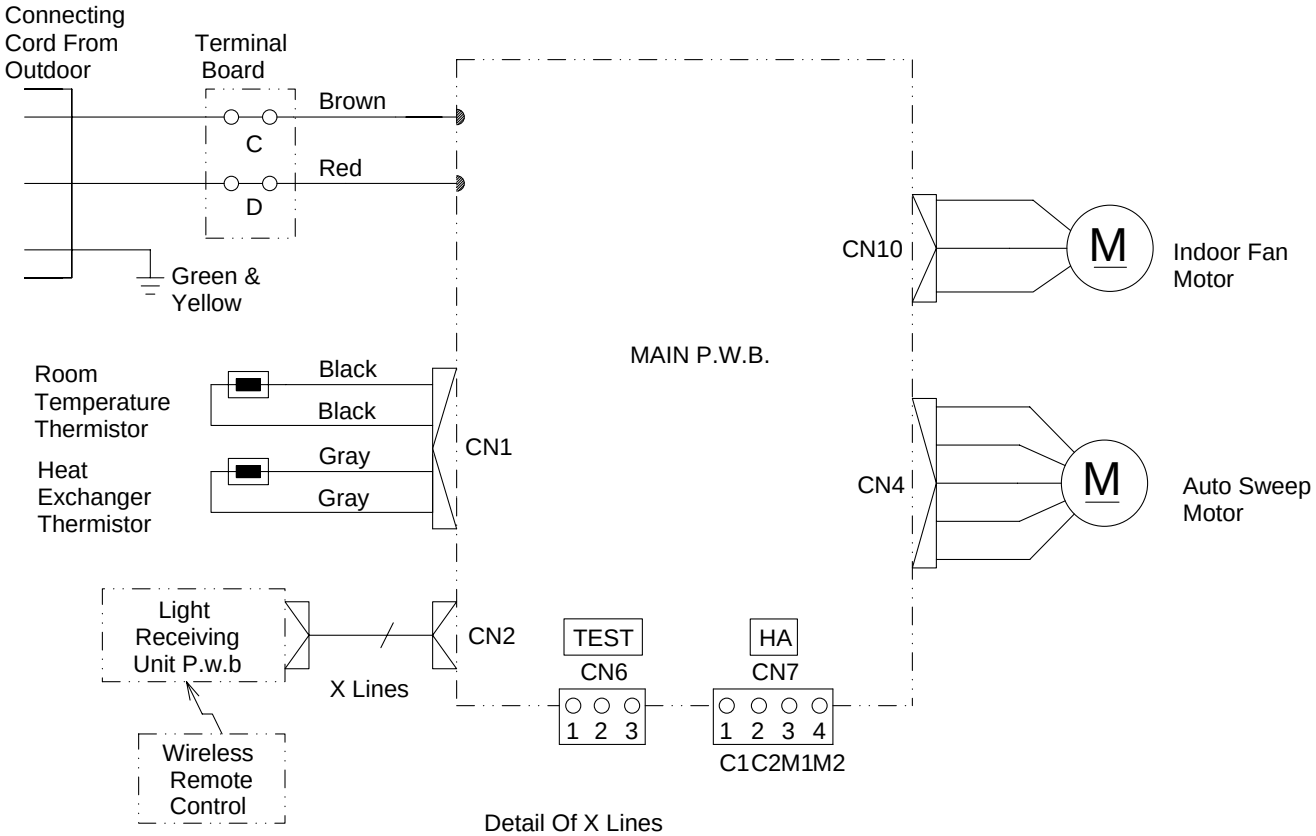
⚠ CAUTION

When the refrigerating cycle has been operated for a long time with the capillary tubes clogged or crushed or with too little refrigerant, check the color of the refrigerating machine oil inside the compressor. If the color has been changed conspicuously, replace the compressor.

WIRING DIAGRAM

INDOOR UNIT

MODEL RAS-20CNHZ2, RAS-30CNHZ2



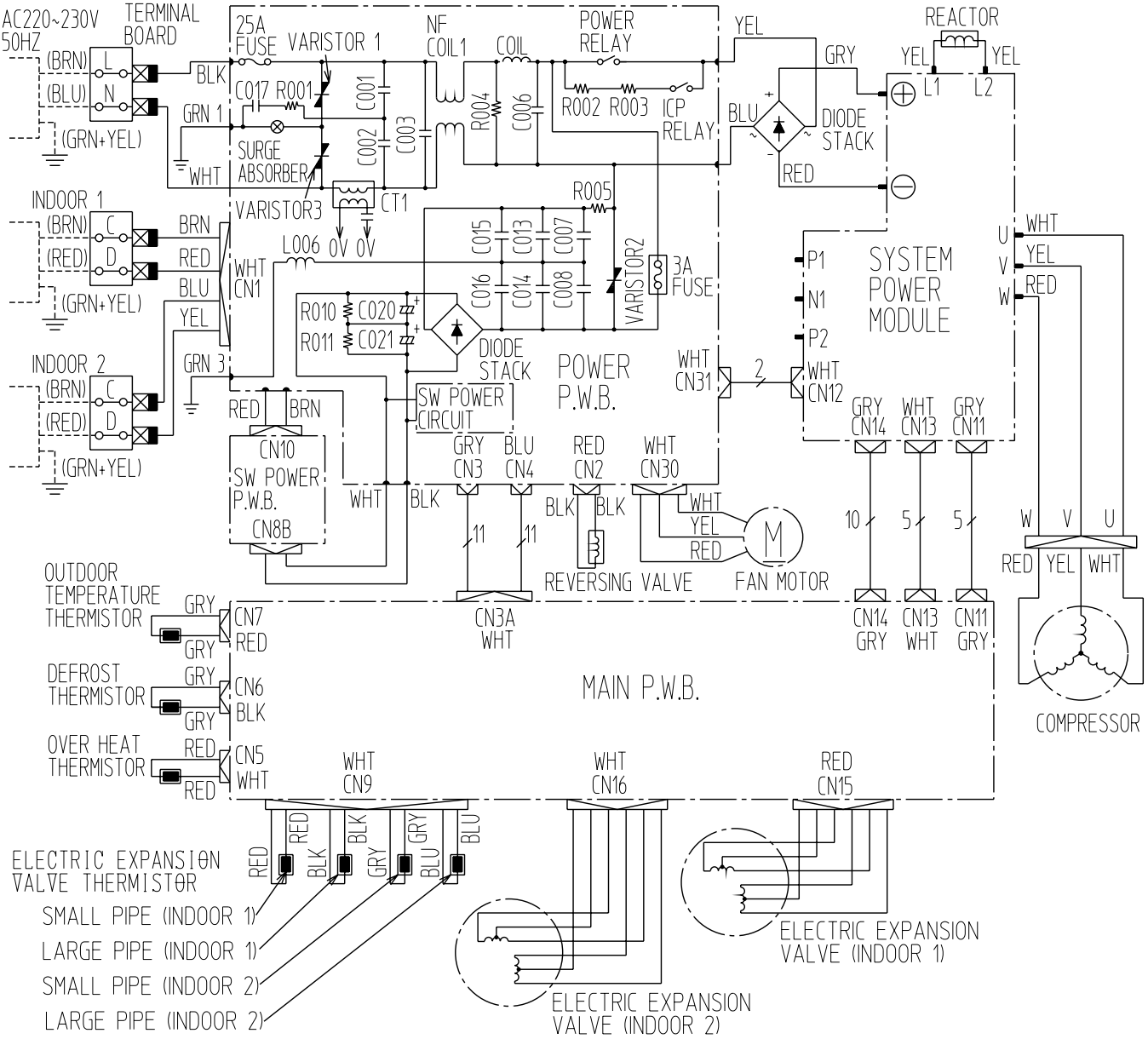
Detail Of X Lines

MODEL NAME	X
RAS-20CNHZ2	7
RAS-30CNHZ2	6

WIRING DIAGRAM

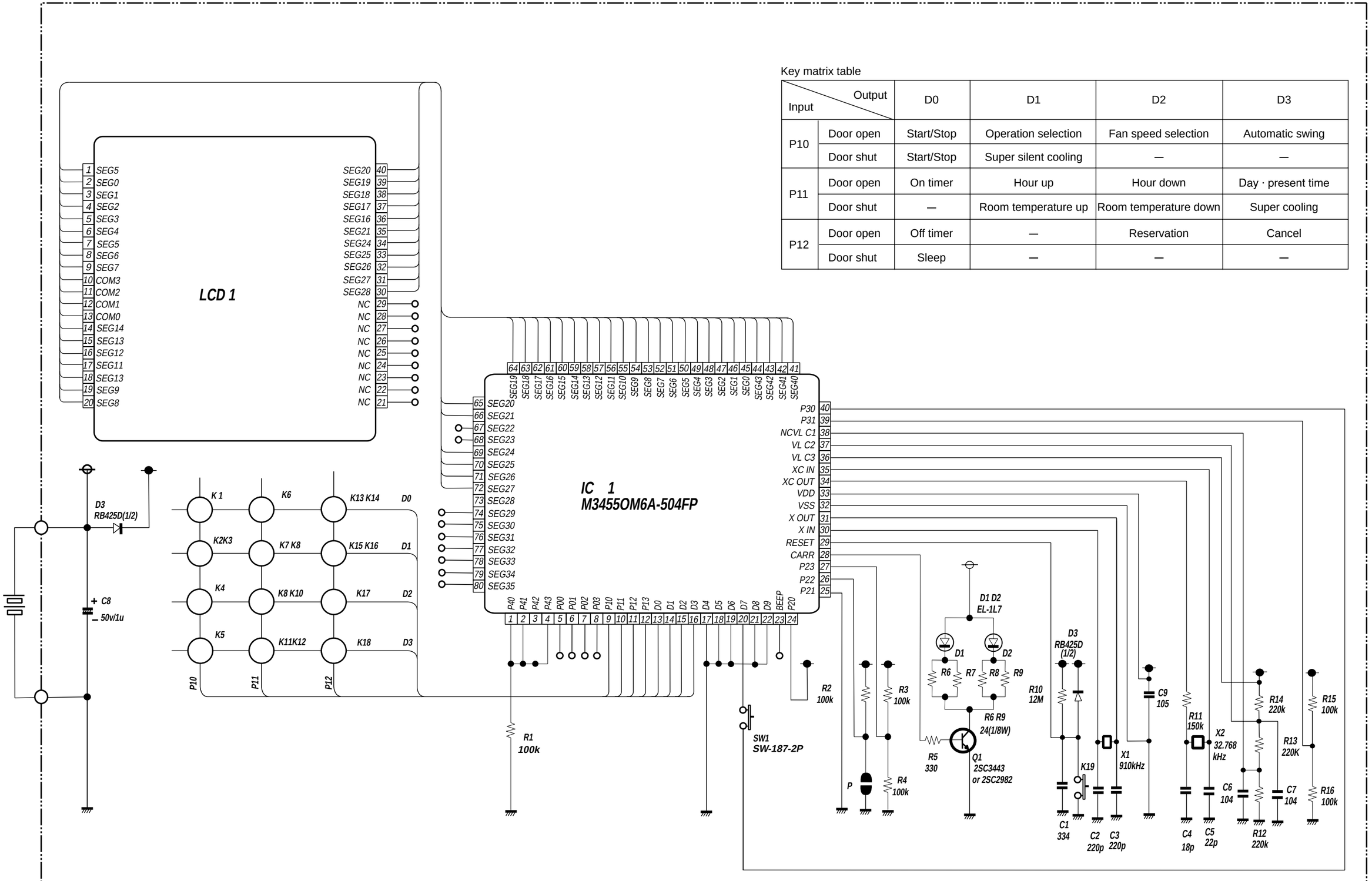
OUTDOOR UNIT

MODEL RAM-50CNHZ2



CIRCUIT DIAGRAM

Remote Control

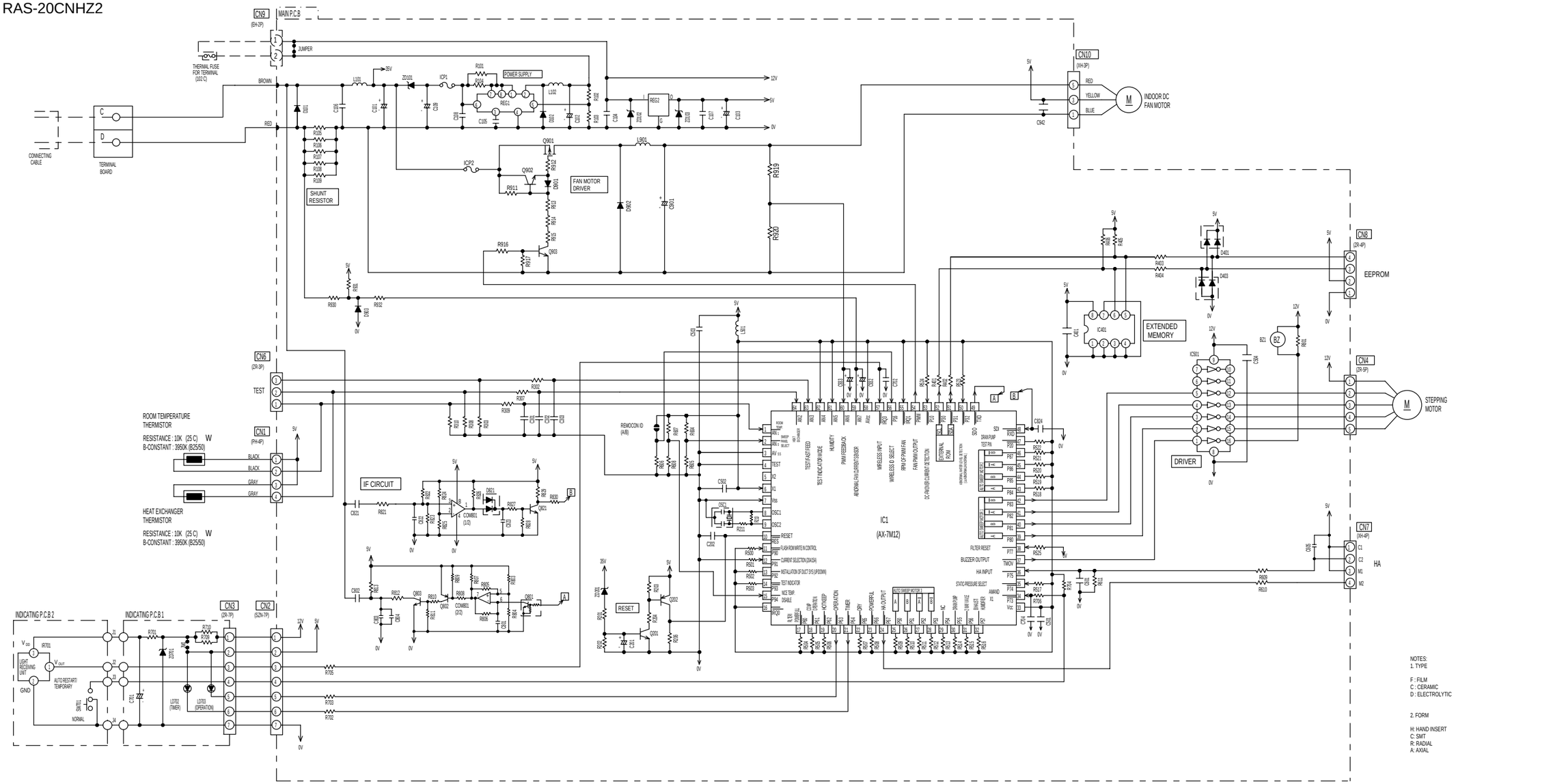


Key matrix table

Input \ Output		D0	D1	D2	D3
P10	Door open	Start/Stop	Operation selection	Fan speed selection	Automatic swing
	Door shut	Start/Stop	Super silent cooling	—	—
P11	Door open	On timer	Hour up	Hour down	Day · present time
	Door shut	—	Room temperature up	Room temperature down	Super cooling
P12	Door open	Off timer	—	Reservation	Cancel
	Door shut	Sleep	—	—	—

PRINTED WIRING BOARD LOCATION DIAGRAM

MODEL RAS-20CNHZ2



RESISTOR

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R101	1.0	–5%	1/4W	C
R102	10K	–2%	1/16W	C
R103	1.2K	–2%	1/16W	C
R104	1.0	–5%	1/4W	C
R105	1.5	–5%	1/4W	C
R106	1.5	–5%	1/4W	C
R107	1.5	–5%	1/4W	C
R108	1.5	–5%	1/4W	C
R109	1.5	–5%	1/4W	C
R201	5.1K	–5%	1/10W	C
R202	2K	–5%	1/16W	C
R203	2.7K	–5%	1/16W	C
R204	5.1K	–5%	1/16W	C
R206	5.1K	–5%	1/16W	C
R210	1M	–5%	1/16W	C
R211	0	–5%	1/16W	C
R302	1K	–5%	1/16W	C
R303	10K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R307	1K	–5%	1/16W	C
R308	12.7K	–1%	1/16W	C
R309	1K	–5%	1/16W	C
R310	12.7K	–1%	1/16W	C
R401	390	–5%	1/16W	C
R402	390	–5%	1/16W	C
R403	390	–5%	1/16W	C
R404	390	–5%	1/16W	C
R405	5.1K	–5%	1/16W	C
R406	5.1K	–5%	1/16W	C
R500	10K	–5%	1/16W	C
R501	10K	–5%	1/16W	C
R502	10K	–5%	1/16W	C
R503	10K	–5%	1/16W	C
R504	10K	–5%	1/16W	C
R505	10K	–5%	1/16W	C
R506	10K	–5%	1/16W	C
R507	10K	–5%	1/16W	C
R508	10K	–5%	1/16W	C
R509	10K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R510	10K	–5%	1/16W	C
R511	10K	–5%	1/16W	C
R512	10K	–5%	1/16W	C
R513	10K	–5%	1/16W	C
R514	10K	–5%	1/16W	C
R515	10K	–5%	1/16W	C
R516	10K	–5%	1/16W	C
R517	10K	–5%	1/16W	C
R518	10K	–5%	1/16W	C
R519	10K	–5%	1/16W	C
R520	10K	–5%	1/16W	C
R521	10K	–5%	1/16W	C
R522	10K	–5%	1/16W	C
R523	10K	–5%	1/16W	C
R524	10K	–5%	1/16W	C
R525	10K	–5%	1/16W	C
R604	1K	–5%	1/16W	C
R605	10K	–5%	1/16W	C
R606	10K	–5%	1/16W	C
R607	10K	–5%	1/16W	C
R608	1K	–5%	1/16W	C
R609	1K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R610	1K	–5%	1/16W	C
R611	10K	–5%	1/16W	C
R701	47	–5%	1/10W	C
R702	390	–5%	1/10W	C
R703	200	–5%	1/10W	C
R704	10K	–5%	1/16W	C
R705	1K	–5%	1/16W	C
R706	1K	–5%	1/16W	C
R709	2K	–5%	1/10W	C
R710	2K	–5%	1/10W	C
R801	3.3K	–5%	1/10W	C
R803	120K	–5%	1/16W	C
R804	120K	–5%	1/16W	C
R805	120K	–5%	1/16W	C
R806	120K	–5%	1/16W	C
R807	4.3K	–5%	1/16W	C
R808	4.3K	–5%	1/16W	C
R809	10K	–5%	1/16W	C
R810	360	–5%	1/10W	C
R811	1K	–5%	1/16W	C
R812	39	–5%	1/4W	C
R813	39	–5%	1/4W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R821	1K	–5%	1/16W	C
R822	10K	–1%	1/16W	C
R823	10K	–1%	1/16W	C
R824	8.25K	–1%	1/16W	C
R825	10K	–1%	1/16W	C
R826	1K	–5%	1/16W	C
R827	3K	–5%	1/16W	C
R828	10K	–5%	1/16W	C
R829	5.1K	–5%	1/16W	C
R830	5.1K	–5%	1/16W	C
R911	1K	–5%	1/4W	C
R912	47	–5%	1/10W	C
R913	1K	–5%	1/4W	C
R914	1K	–5%	1/4W	C
R915	1K	–5%	1/4W	C
R916	3.3K	–5%	1/16W	C
R917	3.3K	–5%	1/16W	C
R919	20K	–1%	1/16W	C
R920	2.21K	–1%	1/16W	C
R930	1K	–1%	1/10W	C
R931	8.25K	–1%	1/10W	C
R932	5.1K	–5%	1/16W	C

CAPACITOR

SYMBOL	CAPACITANCE F	TYPE	FORM
C101	220u,50V	D (PF)	H
C102	100u,50V	D (PF)	H
C103	100u,10V	D (LR)	C
C104	0.1u,25V	C	C
C105	220P,50V	C	C
C106	0.22u,50V	F	H
C107	0.047u,25V	C	C
C108	0.022u,50V	C	C
C109	56u,50V	D (PF)	H
C201	100u, 6V	D (MX)	C
C202	0.1u,25V	C	C
C301	0.1u,25V	C	C
C302	0.1u,25V	C	C
C303	0.1u,25V	C	C
C401	0.1u,25V	C	C
C501	1u,16V	C	C
C502	0.1u,25V	C	C
C503	0.1u,25V	C	C
C504	0.1u,25V	C	C

SYMBOL	CAPACITANCE F	TYPE	FORM
C601	0.1u,25V	C	C
C605		C	C
C701	47u,10V	D (MX)	C
C702	1000P,50V	C	C
C704	0.1u,25V	C	C
C801	150P,50V	C	C
C802	0.15u,50V	F	H
C803		C	C
C804		C	C
C821	0.01u,50V	F	C
C822	1000p,50V	C	C
C823	0.047u,16V	F	C
C824	0.01u,50V	C	C
C901	220u,50V	D (PF)	H
C932	10u,16V	D (MX)	C
C933	10u,16V	D (MX)	C
C942	0.1u,25V	C	C

TRANSISTOR

SYMBOL	MODEL NO.	FORM
Q201	2SC2462LC	C
Q202	2SA1121SC	C
Q801	2SC4398	C
Q802	2SA1121SC	C
Q803	2SC2618RC	C
Q821	2SC2462LC	C
Q901	2SJ245S	C
Q902	2SC2462LC	C
Q903	2SC3360	C

DIODE

SYMBOL	MODEL NO.	FORM
D101	G4DL-6140	H
D102	D1FS6	C
D401	DAN202K	C
D403	DAP202K	C
D821	DAN202K	C
D901	LFB01	C
D902	D1FL20U	C
D903	LFB01	C

IC

SYMBOL	MODEL NO.	FORM
REG1	MC34063AM	C
REG2	MC7805CT	H
IC1	HD6433644H	C
IC401	BR24C02F	C
IC501	ULN2003ANS	C
IR701	RPM6938-V4	H
COM801	NJM2903M-T	C

SWITCH

SYMBOL	MODEL	FORM
SW701	JSM2220	H

BUZZER

SYMBOL	MODEL	FORM
BZ1	PKM13EPY	H

ZENER DIODE

SYMBOL	MODEL	FORM
ZD101	PTZ5.1	C
ZD102	PTZ20A	C
ZD103	RLZ6.8A	C
ZD201	RLZ27D	C
ZD701	RD5.1UJN2	C

LED

SYMBOL	MODEL NO.	COLOR	FORM
LD702	SLR-332DC3F	ORANGE	H
LD703	SLR-332YC3F	YELLOW	H

OSCILLATOR

SYMBOL	MODEL	FORM
OSC1	ER5102065 10MHz	C

INDUCTOR

SYMBOL	RATED VALUE	FORM
L101	82uH, 1.3A	H
L102	560uH, 0.6A	H
L501	450 (1MHz) 0.2A	C
L901	450uH, 1.5A	H

CHIP JUMPER

SYMBOL	MODEL	FORM
JW1		C
JUMPER	0 W/10W	C

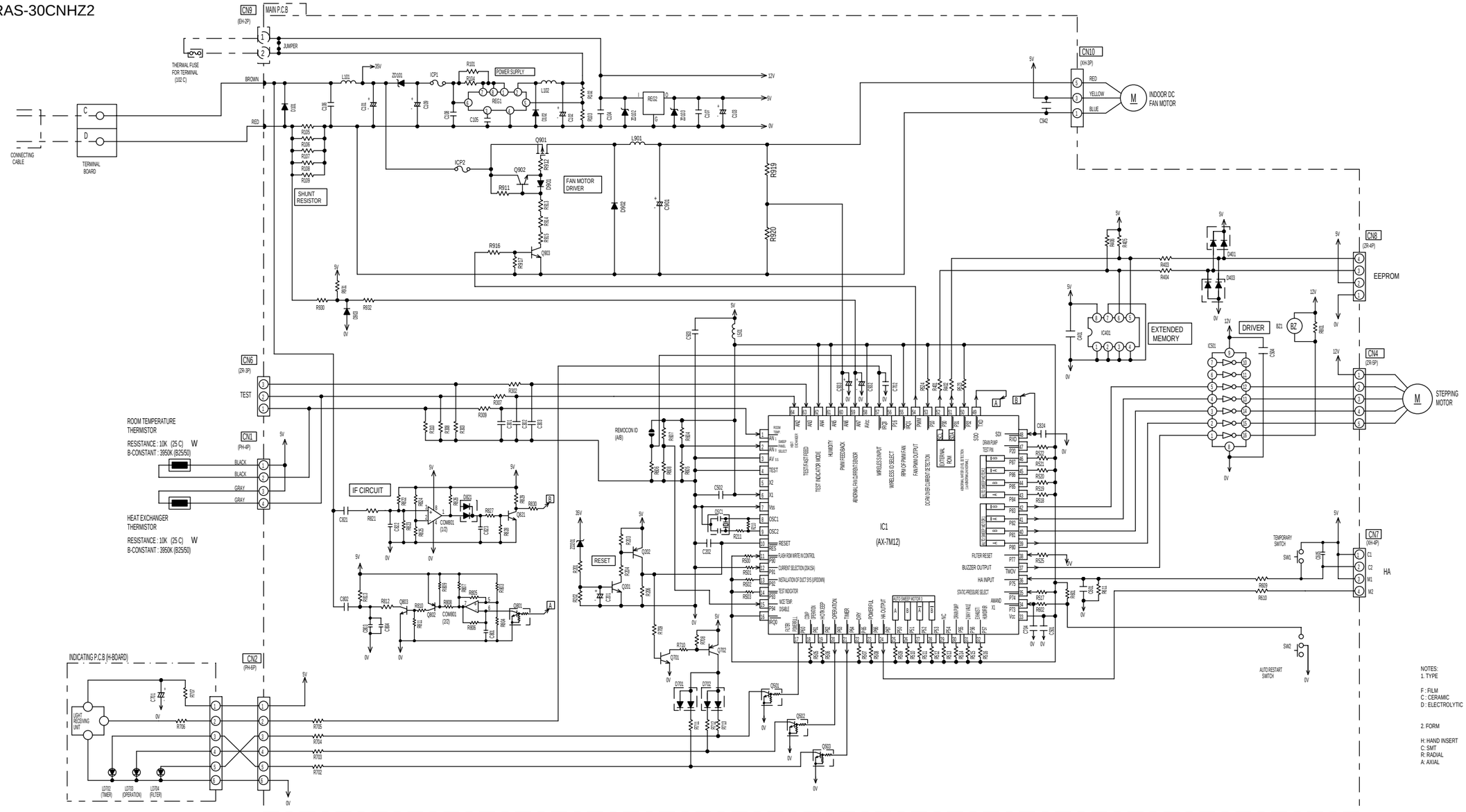
IC PROTECTOR

SYMBOL	MODEL	RATING	FORM
ICP1	ICP-S0.5	0.5A	C
ICP2	CCP2E-50	2.0A	C

CONNECTORS

SYMBOL	MODEL NO.	COLOR	FORM	REMARK
CN1	PH 4P (TOP ENTRY)	WHITE	H	ROOM,HEX. THERMISTOR
CN2	S2N 7P (TOP ENTRY)	IVORY	H	TO INDICATING P.C.B.1
CN3	ZR 7P (SIDE ENTRY)	IVORY	H	INDICATING P.C.B.1
CN4	ZR 5P (TOP ENTRY)	IVORY	H	AUTO SWEEP MOTOR
CN6	ZR 3P (TOP ENTRY)	IVORY	H	TEST PIN
CN7	XH 4P (TOP ENTRY)	BLACK	H	HA TERMINAL
CN8	ZR 4P (TOP ENTRY)	IVORY	H	EEPROM
CN9			H	THERM FUSE
CN10	XH 5P (F.TOP ENTRY)	WHITE	H	FAN MOTOR

MODEL RAS-30CNHZ2



NOTES:
1. TYPE

F : FILM
C : CERAMIC
D : ELECTROLYTIC

2. FORM

H: HAND INSERT
C: SMT
R: RADIAL
A: AXIAL

RESISTOR

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R101	1.0	–5%	1/4W	C
R102	10K	–2%	1/16W	C
R103	1.2K	–2%	1/16W	C
R104	1.0	–5%	1/4W	C
R105	1.5	–5%	1/4W	C
R106	1.5	–5%	1/4W	C
R107	1.5	–5%	1/4W	C
R108	1.5	–5%	1/4W	C
R109	1.5	–5%	1/4W	C
R201	5.1K	–5%	1/10W	C
R202	2K	–5%	1/16W	C
R203	2.7K	–5%	1/16W	C
R204	5.1K	–5%	1/16W	C
R206	5.1K	–5%	1/16W	C
R210	1M	–5%	1/16W	C
R211	0	–5%	1/16W	C
R302	1K	–5%	1/16W	C
R303	10K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R307	1K	–5%	1/16W	C
R308	12.7K	–1%	1/16W	C
R309	1K	–5%	1/16W	C
R310	12.7K	–1%	1/16W	C
R401	390	–5%	1/16W	C
R402	390	–5%	1/16W	C
R403	390	–5%	1/16W	C
R404	390	–5%	1/16W	C
R405	5.1K	–5%	1/16W	C
R406	5.1K	–5%	1/16W	C
R500	10K	–5%	1/16W	C
R501	10K	–5%	1/16W	C
R502	10K	–5%	1/16W	C
R503	10K	–5%	1/16W	C
R505	10K	–5%	1/16W	C
R506	10K	–5%	1/16W	C
R507	10K	–5%	1/16W	C
R508	10K	–5%	1/16W	C
R509	10K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R510	10K	–5%	1/16W	C
R511	10K	–5%	1/16W	C
R512	10K	–5%	1/16W	C
R513	10K	–5%	1/16W	C
R514	10K	–5%	1/16W	C
R515	10K	–5%	1/16W	C
R516	10K	–5%	1/16W	C
R517	10K	–5%	1/16W	C
R518	10K	–5%	1/16W	C
R519	10K	–5%	1/16W	C
R520	10K	–5%	1/16W	C
R521	10K	–5%	1/16W	C
R522	10K	–5%	1/16W	C
R523	10K	–5%	1/16W	C
R524	10K	–5%	1/16W	C
R525	10K	–5%	1/16W	C
R601	10K	–5%	1/16W	C
R602	1K	–5%	1/16W	C
R604	1K	–5%	1/16W	C
R605	10K	–5%	1/16W	C
R606	10K	–5%	1/16W	C
R607	10K	–5%	1/16W	C
R608	1K	–5%	1/16W	C
R609	1K	–5%	1/16W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R610	1K	–5%	1/16W	C
R611	10K	–5%	1/16W	C
R702	200	–5%	1/10W	C
R703	100	–5%	1/10W	C
R704	100	–5%	1/10W	C
R705	1K	–5%	1/16W	C
R706	1K	–5%	1/10W	H
R707	10	–5%	1/10W	H
R708	5.1K	–5%	1/16W	C
R709	6.8K	–5%	1/16W	C
R710	680	–5%	1/16W	C
R711	180	–5%	1/10W	C
R712	100	–5%	1/10W	C
R713	100	–5%	1/10W	C
R801	3.3K	–5%	1/10W	C
R803	120K	–5%	1/16W	C
R804	120K	–5%	1/16W	C
R805	120K	–5%	1/16W	C
R806	120K	–5%	1/16W	C
R807	4.3K	–5%	1/16W	C
R808	4.3K	–5%	1/16W	C
R809	10K	–5%	1/16W	C
R810	360	–5%	1/10W	C
R811	1K	–5%	1/16W	C
R812	39	–5%	1/4W	C
R813	39	–5%	1/4W	C

SYMBOL	RESISTANCE W	TOLERANCE	POWER	FORM
R821	1K	–5%	1/16W	C
R822	10K	–1%	1/16W	C
R823	10K	–1%	1/16W	C
R824	8.25K	–1%	1/16W	C
R825	10K	–1%	1/16W	C
R826	1K	–5%	1/16W	C
R827	3K	–5%	1/16W	C
R828	10K	–5%	1/16W	C
R829	5.1K	–5%	1/16W	C
R830	5.1K	–5%	1/16W	C
R911	1K	–5%	1/4W	C
R912	47	–5%	1/10W	C
R913	1K	–5%	1/4W	C
R914	1K	–5%	1/4W	C
R915	1K	–5%	1/4W	C
R916	3.3K	–5%	1/16W	C
R917	3.3K	–5%	1/16W	C
R919	20K	–1%	1/16W	C
R920	2.21K	–1%	1/16W	C
R930	1K	–1%	1/10W	C
R931	8.25K	–1%	1/10W	C
R932	5.1K	–5%	1/16W	C

CAPACITOR

SYMBOL	CAPACITANCE F	TYPE	FORM
C101	470u,50V	D (F)	H
C102	150u,35V	D (F)	H
C103	100u,10V	D (UF)	C
C104	0.1u,25V	C	C
C105	220P,50V	C	C
C106	0.22u,50V	F	H
C107	0.047u,25V	C	C
C108	0.022u,50V	C	C
C109	56u,50V	D (F)	H
C201	100u ,4V	D (MX)	C
C202	0.1u,25V	C	C
C301	0.1u,25V	C	C
C302	0.1u,25V	C	C
C303	0.1u,25V	C	C
C401	0.1u,25V	C	C
C501	1u,16V	C	C
C502	0.1u,25V	C	C
C503	0.1u,25V	C	C
C504	0.1u,25V	C	C

SYMBOL	CAPACITANCE F	TYPE	FORM
C601	0.1u,25V	C	C
C605		C	C
C701	33u,10V	D	H
C702	1000P,50V	C	C
C704	0.1u,25V	C	C
C801	150P,50V	C	C
C802	0.15u,50V	F	H
C803	0.1u,25V	C	C
C804		C	C
C821	0.01u,50V	F	C
C822	1000p,50V	C	C
C823	0.047u,16V	F	C
C824	0.01u,50V	C	C
C901	220u,50V	D (F)	H
C932	10u,16V	D (MX)	C
C933	10u,16V	D (MX)	C
C942	0.1u,25V	C	C

TRANSISTOR

SYMBOL	MODEL NO.	FORM
Q201	2SC2462LC	C
Q202	2SA1121SC	C
Q501	RN1414-TR	C
Q502	RN1414-TR	C
Q503	RN1414-TR	C
Q701	2SC2462LC	C
Q702	2SA1121SC	C
Q801	2SC4398	C
Q802	2SA1121SC	C
Q803	2SC2618RC	C
Q821	2SC2462LC	C
Q901	2SJ245S	C
Q902	2SC2462LC	C
Q903	2SC3360	C

BUZZER

SYMBOL	MODEL	FORM
BZ1	PKM13EPY	H

ZENER DIODE

SYMBOL	MODEL	FORM
ZD101	PTZ5.1	C
ZD102	PTZ20A	C
ZD103	RLZ6.8A	C
ZD201	RLZ27D	C

IC

SYMBOL	MODEL NO.	FORM
REG1	MC34063AM	C
REG2	MC7805CT	H
IC1	HD6433644H	C
IC401	BR24C02F	C
IC501	ULN2003ANS	C
COM801	NJM2903M-T	C
IR-RECEIVER	GP1U771R	H

SWITCH

SYMBOL	MODEL	FORM
SW1	SKHHANA010	H
SW2	JSA2220	H

DIODE

SYMBOL	MODEL NO.	FORM
D101	G4DL-6140	H
D102	D1FS6	C
D401	DAN202K	C
D403	DAP202K	C
D701	DAP202K	C
D702	DAP202K	C
D821	DAN202K	C
D901	LFB01	C
D902	D1FL20U	C
D903	LFB01	C

LED

SYMBOL	MODEL NO.	COLOR	FORM
LD702	SLR-332MC3F	GREEN	H
LD703	SLR-342YC3F	YELLOW	H
LD704	SLR-332VC3F	RED	H

OSCILLATOR

SYMBOL	MODEL	FORM
OSC1	EFIS1005E5, 10MHz	C

INDUCTOR

SYMBOL	RATED VALUE	FORM
L101	82uH, 1.3A	H
L102	560uH, 0.6A	H
L501	4mH, 0.1A	C
L901	450uH, 1.5A	H

CHIP JUMPER

SYMBOL	MODEL	FORM
JUMPER	0 Ω	C

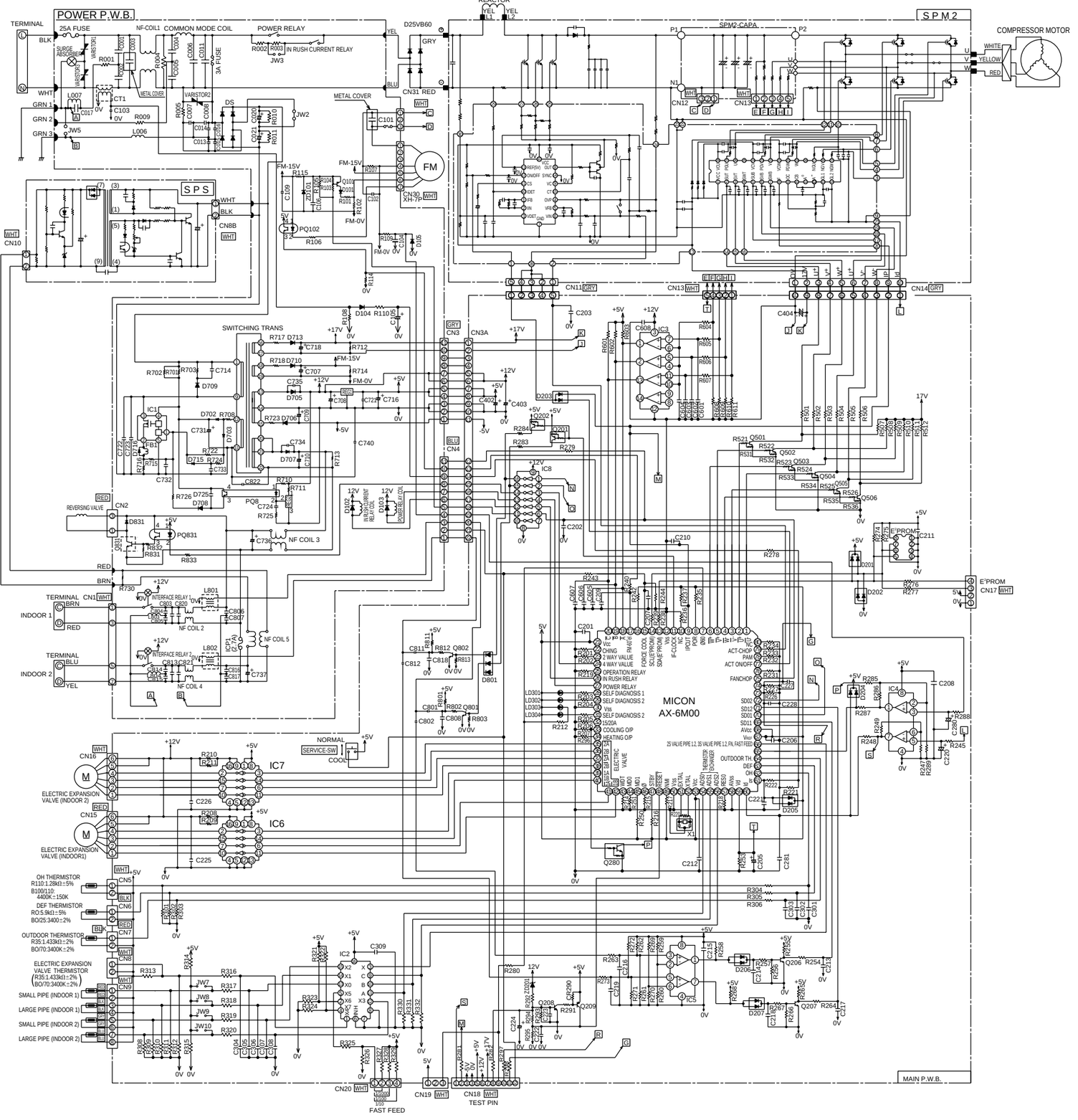
IC PROTECTOR

SYMBOL	MODEL	RATING	FORM
ICP1	ICP-S0.5	0.5A	C
ICP2	CCP2E-50	2.0A	C

CONNECTORS

SYMBOL	MODEL NO.	COLOR	FORM	REMARK
CN1	PH 4P (TOP ENTRY)	WHITE	H	ROOM,HEX. THERMISTOR
CN2	PH 6P (TOP ENTRY)	WHITE	H	TO INDICATING P.C.B.
CN4	ZR 5P (TOP ENTRY)	IVORY	H	AUTO SWEEP MOTOR
CN6	ZR 3P (TOP ENTRY)	IVORY	H	TEST PIN
CN7	XH 4P (TOP ENTRY)	BLACK	H	HA TERMINAL
CN8	ZR 4P (TOP ENTRY)	IVORY	H	EEPROM
CN9			H	THERM FUSE
CN10	XH 3P (F.TOP ENTRY)	WHITE	H	FAN MOTOR

MODEL RAM-50CNHZ2



MOUNTING
R : RADIAL
C : SMD
A : AXIAL
H : HAND INSERT

TYPE
F : FILM
C : CERAMIC
D : ELECTROLYTIC

RESISTOR

MARK	RATING Ω	%	W	MOUNTING	REMARK
R001	39	5%	1/4	A	
R002	100	5%	10	H	
R003	100	5%	10	A	
R004	470K	5%	1/2	A	
R005	2.2	5%	5	H	
R009					
R010	470K	5%	1/2	A	
R011	470K	5%	1/2	A	
R101	3.6K	1%	1/6	A	
R102	3K	1%	1/6	A	
R103	30K	5%	1/6	A	
R104	3.9K	5%	1/6	A	
R105	7.5K	5%	1/6	A	
R106	2.4K	5%	1/6	A	
R107	1	1%	2	R	
R108	1K	1%	1/6	A	
R109	510	5%	1/6	A	
R110	1.69K	1%	1/6	A	
R114	1K	5%	1/6	A	
R115	JUMPER WIRE			A	
R201	10K	5%	1/16	C	1608
R202	10K	5%	1/16	C	1608
R203	2K	5%	1/16	C	1608
R204	2K	5%	1/16	C	1608
R205	2K	5%	1/16	C	1608
R206	10K	5%	1/16	C	1608
R207	10K	5%	1/16	C	1608
R208	200	5%	1/10	C	2125
R209	200	5%	1/10	C	2125
R210	200	5%	1/10	C	2125
R211	200	5%	1/10	C	2125
R212	2K	5%	1/16	C	1608
R214	10K	5%	1/16	C	1608
R215	10K	5%	1/16	C	1608
R216	10K	5%	1/16	C	1608
R217	10K	5%	1/16	C	1608
R218	10K	5%	1/16	C	1608
R219	10K	5%	1/16	C	1608
R220	1M	5%	1/16	C	1608
R221	10K	1%	1/16	C	1608
R222	510	5%	1/16	C	1608
R226	10K	5%	1/16	C	1608
R227	10K	5%	1/16	C	1608
R231	10K	5%	1/16	C	1608
R232	10K	5%	1/16	C	1608
R233	100	5%	1/16	C	1608
R234	10K	5%	1/16	C	1608
R235	10K	5%	1/16	C	1608
R236	10K	5%	1/16	C	1608
R237	5.1K	5%	1/16	C	1608
R238	100	5%	1/16	C	1608
R239	100	5%	1/16	C	1608
R240	1K	5%	1/16	C	1608
R242	10K	5%	1/16	C	1608
R243	100	5%	1/16	C	1608
R244	2K	5%	1/16	C	1608
R245	5.1K	5%	1/16	C	1608
R247	3.16K	1%	1/16	C	1608
R248	1K	5%	1/16	C	1608
R249	20K	1%	1/16	C	1608
R250	10K	5%	1/16	C	1608
R253	3.32K	1%	1/16	C	1608
R254	100	5%	1/16	C	1608
R255	2K	5%	1/16	C	1608
R256	10K	5%	1/16	C	1608
R257	3K	5%	1/16	C	1608
R258	1K	5%	1/16	C	1608
R259	8.25K	1%	1/16	C	1608
R260	10K	1%	1/16	C	1608
R261	10K	1%	1/16	C	1608
R262	10K	1%	1/16	C	1608
R263	1K	5%	1/16	C	1608
R264	100	5%	1/16	C	1608
R265	2K	5%	1/16	C	1608
R266	10K	5%	1/16	C	1608
R267	3K	5%	1/16	C	1608
R268	1K	5%	1/16	C	1608
R269	8.25K	1%	1/16	C	1608
R270	10K	1%	1/16	C	1608
R271	10K	1%	1/16	C	1608
R272	10K	1%	1/16	C	1608
R273	1K	5%	1/16	C	1608
R274	5.1K	5%	1/16	C	1608
R275	5.1K	5%	1/16	C	1608
R276	390	5%	1/16	C	1608
R277	390	5%	1/16	C	1608
R278	JUMPER	5%	1/16	C	1608
R279					

MARK	RATING Ω	%	W	MOUNTING	REMARK
R280	100	5%	1/16	C	1608
R281	100	5%	1/16	C	1608
R282	100	5%	1/16	C	1608
R283	360	5%	1/10	C	2125
R284	360	5%	1/10	C	2125
R285					
R286	2K	1%	1/16	C	1608
R287	2K	5%	1/16	C	1608
R288	1K	5%	1/16	C	1608
R289	1K	1%	1/16	C	1608
R290	10K	5%	1/16	C	1608
R291	4.7K	5%	1/16	C	1608
R292	3K	5%	1/16	C	1608
R293	1.6K	5%	1/16	C	1608
R294	27K	5%	1/16	C	1608
R295	5.1K	5%	1/16	C	1608
R296	10K	5%	1/16	C	1608
R297	1K	5%	1/16	C	1608
R298	1K	5%	1/16	C	1608
R301	3.74K	1%	1/16	C	1608
R302	3.01K	1%	1/16	C	1608
R303	3.01K	1%	1/16	C	1608
R304	100	5%	1/16	C	1608
R305	100	5%	1/16	C	1608
R306	100	5%	1/16	C	1608
R308	2K	2%	1/16	C	1608
R309	2K	2%	1/16	C	1608
R310	2K	2%	1/16	C	1608
R311	2K	2%	1/16	C	1608
R312	10K	1%	1/16	C	1608
R313	5.1K	5%	1/16	C	1608
R314					
R315					
R316	1K	5%	1/16	C	1608
R317	1K	5%	1/16	C	1608
R318	1K	5%	1/16	C	1608
R319	1K	5%	1/16	C	1608
R320	1K	5%	1/16	C	1608
R321					
R322					
R323	10K	5%	1/16	C	1608
R324	10K	5%	1/16	C	1608
R325	1K	5%	1/16	C	1608
R326	2.7K	5%	1/16	C	1608
R327	470	5%	1/16	C	1608
R328	1.6K	5%	1/16	C	1608
R329	4.3K	5%	1/16	C	1608
R330	10K	5%	1/16	C	1608
R331	10K	5%	1/16	C	1608
R332	10K	5%	1/16	C	1608
R501	1K	5%	1/16	C	1608
R502	1K	5%	1/16	C	1608
R503	1K	5%	1/16	C	1608
R504	1K	5%	1/16	C	1608
R505	1K	5%	1/16	C	1608
R506	1K	5%	1/16	C	1608
R507	5.1K	5%	1/8	C	3216
R508	5.1K	5%	1/8	C	3216
R509	5.1K	5%	1/8	C	3216
R510	5.1K	5%	1/8	C	3216
R511	5.1K	5%	1/8	C	3216
R512	5.1K	5%	1/8	C	3216
R521	10K	5%	1/16	C	1608
R522	10K	5%	1/16	C	1608
R523	10K	5%	1/16	C	1608
R524	10K	5%	1/16	C	1608
R525	10K	5%	1/16	C	1608
R526	10K	5%	1/16	C	1608
R531	5.1K	5%	1/16	C	1608
R532	5.1K	5%	1/16	C	1608
R533	5.1K	5%	1/16	C	1608
R534	5.1K	5%	1/16	C	1608
R535	5.1K	5%	1/16	C	1608
R536	5.1K	5%	1/16	C	1608
R601	2K	5%	1/16	C	1608
R602	2K	5%	1/16	C	1608
R603	2K	5%	1/16	C	1608
R604	100	5%	1/16	C	1608
R605	100	5%	1/16	C	1608
R606	100	5%	1/16	C	1608
R607	100	5%	1/16	C	1608
R608	4.02K	1%	1/16	C	1608
R609	4.02K	1%	1/16	C	1608
R610	4.02K	1%	1/16	C	1608
R611	4.02K	1%	1/16	C	1608

MARK	RATING Ω	%	W	MOUNTING	REMARK
R701	560K	5%	1/2	A	
R702	560K	5%	1/2	A	
R703	100K	5%	2	A	
R708	10	5%	1/4	A	
R710	1.8K	5%	1/4	A	
R711	75	5%	1/6	A	
R712	3.3K	5%	1/4	A	
R713	8.2K	5%	1	H	
R714	3.3K	5%	1/4	A	
R715	680	5%	1/4	A	
R716	0.39	5%	1	A	
R717	JUMPER WIRE		1/4	A	
R718	8.2	5%	1/4	A	
R722	2.7K	5%	1/4	A	
R723	33	5%	1/6	A	
R724	2.7K	5%	1/4	A	
R725	JUMPER WIRE		1/4	A	
R726	3.3K	5%	1/4	A	
R730					
R801	3g	5%	1/4	C	
R802	3g	5%	1/4	C	
R803	3K	5%	1/16	C	
R811	3g	5%	1/4	C	
R812	3g	5%	1/4	C	
R813	3K	5%	1/16	C	
R831	10K	5%	1/6	A	
R832	7.5K	5%	1/2	A	
R833	620	5%	1/6	A	

CAPACITOR

MARK	RATING μ	V	TYPE	MOUNTING	REMARK
C001	0.01	AC250	C	R	
C002	0.01	AC250	C	R	
C003	0.56	630	F	H	
C004					
C005					
C006	4.0	AC400	F	H	
C007	0.01	AC250	C	R	
C008	0.01	AC250	C	R	
C010					
C011					
C013	0.01	AC250	C	R	
C014	0.01	AC250	C	R	
C015	0.01	AC250	C	R	
C016	0.01	AC250	C	R	
C017	0.01	AC250	C	R	
C020	220	200	D	H	
C021	220	200	D	H	

CAPACITOR

MARK	RATING μ	V	TYPE	MOUNTING	REMARK
C101	0.082	630	F	H	
C102					
C103	0.1	50	C	R	
C104	1000p	50	C	R	
C105	100	10	D	R	
C106					
C109	0.1	50	C	R	
C201	0.1	25	C	C	1608
C202	2200p	50	C	C	1608
C203	2200p	50	C	C	1608
C205	0.1±	50	D	C	Ø4
C206	0.1	25	C	C	1608
C207	0.047	50	C	C	1608
C208	0.1	25	C	C	1608
C209	0.1	25	C	C	1608
C210	0.047	50	C	C	1608
C211	0.1	25	C	C	1608
C212	0.1	25	C	C	1608
C213	0.047	50	C	C	1608
C214	0.068	16	C	C	1608
C215	0.1	25	C	C	1608
C216	4700p	50	C	C	1608
C217	0.047	50	C	C	1608
C218	0.068	16	C	C	1608
C219	4700p	50	C	C	1608
C220	22	6.3	D	C	Ø4
C221	0.1	25	C	C	1608
C222	0.1	25	C	C	1608
C223	0.1	25	C	C	1608
C224	10	16	D	C	Ø3
C225	0.1	25	C	C	1608
C226	0.1	25	C	C	1608
C227	0.1	25	C	C	1608
C228	0.1	25	C	C	1608
C280	2.2	50	D	C	Ø4
C281	0.01	50	C	C	1608
C301	0.1	25	C	C	1608
C302	0.1	25	C	C	1608
C303	0.1	25	C	C	1608
C304	1	16	C	C	2125
C305	1	16	C	C	2125
C306	1	16	C	C	2125
C307	1	16	C	C	2125
C308	1	16	C	C	2125
C309	0.1	25	C	C	1608
C402	100	10	D	C	Ø6.3
C403	100	25	D	C	Ø8
C404	33	25	D	C	Ø6.3
C601	680p	50	C	C	2125
C602	680p	50	C	C	2125
C603	680p	50	C	C	2125
C604	680p	50	C	C	2125
C605	1000pF	50	C	C	1608
C606	1000pF	50	C	C	1608
C607	1000pF	50	C	C	1608
C608	0.1	25	C	C	1608
C707	100	25	D	R	
C708	330	25	D	R	
C709	180	10	D	R	
C710	330	50	D	R	
C714	0.01	1KV	C	H	
C716	330	10	D	R	
C718	220	25	D	R	
C721	0.1	50	C	R	
C722					
C723	470P	3KV	C	R	
C724	0.1	50	C	R	
C725					
C731	100	25	D	R	
C732	470P	50	C	R	
C733	1000pF	50	C	R	
C734	1000pF	AC250	C	R	
C735	1000pF	50	C	H	
C736	68	50	D	R	
C737	68	50	D	R	
C740	470P	AC250	C	R	
C801	0.15	50	F	C	
C802	0.022	16	F	C	
C803	0.15	50	F	R	
C804	0.01	AC250	C	H	
C805	0.01	AC250	C	H	
C806	0.01	AC250	C	H	
C807	0.01	AC250	C	H	
C808	0.1	25	C	C	1608
C811	0.15	50	F	C	
C812	0.022	16	F	C	
C813	0.15	50	F	R	
C814	0.01	AC250	C	H	
C815	0.01	AC250	C	H	
C816	0.01	AC250	C	H	
C817	0.01	AC250	C	H	
C818	0.1	25	C	C	1608
C820					
C821					
C822	470P	AC250	C	H	

TRANSISTOR

MARK	MODEL	MOUNTING	REMARK
Q101	2SA673	R	
Q201	RN2402	C	SC-59
Q202	RN2402	C	SC-59
Q206	2SC2462LC	C	MP4K
Q207	2SC2462LC	C	MP4K
Q208	2SC2462LC	C	MP4K
Q209	2SA1121SC	C	MP4K
Q280			
Q501	2SC2462LC	C	
Q502	2SC2462LC	C	
Q503	2SC2462LC	C	
Q504	2SC2462LC	C	
Q505	2SC2462LC	C	
Q506	2SC2462LC	C	
Q801	2SC2618RC	C	
Q802	2SC2618RC	C	
Q831	2SC1214CT	R	

ZENER DIODE

MARK	MODEL	MOUNTING	REMARK
ZD101			
ZD201	RLZ6.8A	C	LDS

LED

MARK	MODEL	MOUNTING	REMARK
LD301	LT1D67A	C	
LD302	LT1D67A	C	
LD303	LT1D67A	C	
LD304	LT1K67A	C	

INDUCTOR

MARK	MODEL	MOUNTING	REMARK
L006	EXCEL SA35V	A	
L007			
L801	100uH	H	
L802	100uH	H	
L803	FBA04MA450	H	
L804	FBA04MA450	H	
FB1	BLO1RN1	A	
CT1	S19-J299CT	H	

PHOTO COUPLER

MARK	MODEL	MOUNTING	REMARK
PQ8	PS2501	H	
PQ831	PC817X	H	
PQ102	PS2501	H	

JUMPER WIRE

MARK	MODEL	MOUNTING	REMARK
JW2	NONE	A	
JW3	NONE	A	
JW5	NONE	A	
JW7	NONE	C	1608
JW8	NONE	C	1608
JW9	NONE	C	1608
JW10	NONE	C	1608

SWITCH

MARK	MODEL	MOUNTING	REMARK
SERVICE-SW	KSM0612BTS	R	

OSCILLATOR

MARK	MODEL	MOUNTING	REMARK
X1	CSTCS16.0MHz	C	

ICP

MARK	MODEL	MOUNTING	REMARK
ICP1	ICP-M75(2.7A)	R	

I C

MARK	MODEL	MOUNTING	REMARK
MICON	AX-6M00	QFP	
E²PROM	S24CO2BFJ-TB	SOP	
I C 1	STR-F6523	H	
I C 2	HD74HC4051FP	SOP	
I C 3	NJM2901M-TE1	SOP	
I C 4	NJM2904M-TE3	SOP	
I C 5	NJM2903V-TE1	SOP	
I C 6	M54567FP	SOP	
I C 7	M54567FP	SOP	
I C 8	ULN2003ANS	SOP	
REG1	MC7805CT	H	
REG2	SE012N	H	

DIODE

MARK	MODEL	MOUNTING	REMARK
D101	1GH46	A	
D102	1S2076A	A	
D103	1S2076A	A	
D104	1SS120	A	
D105	1SS120	A	
D201	DAN202K	C	SC-59
D202	DAP202K	C	SC-59
D203	DAP202K	C	SC-59
D204	DAN202K	C	SC-59
D205	DAN202K	C	SC-59
D206	DAN202K	C	SC-59
D207	DAN202K	C	SC-59
D702	1GH46	A	
D703	1SS120	A	
D705	RN2Z	H	
D706	AK04	A	
D707	RN3Z	H	
D708	JUMPER WIRE	A	
D709	RU1P	A	
D710	1GH46	A	
D713	1GH46	A	
D715	1SS120	A	
D716	1S2473	A	
D801	HN2D01FU-TE85L	C	
D831	1SS120	A	

SURGE ARRESTER

MARK	MODEL	MOUNTING	REMARK
VARISTOR1	450NR-12D	R	
VARISTOR2	450NR-12D	R	
VARISTOR3	450NR-12D	R	
SURGE ABSORBER	DSA-102MA-05F2S	H	

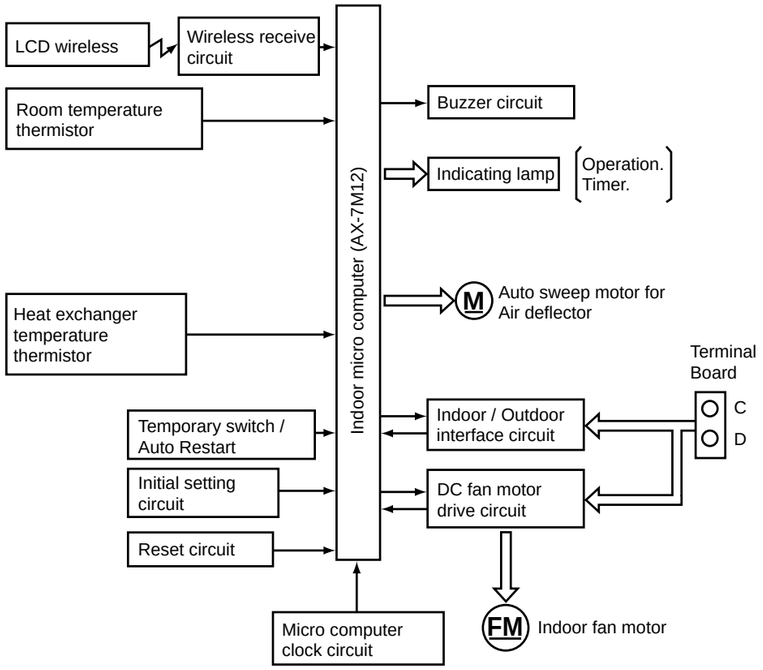
CONNECTOR

MARK	MODEL	REMARK	
CN1	VH-4P	WHITE	
CN2	VH-2P	RED	
CN3A	MINICT-22P	2 ROWS	
CN3	MINICT-11P	GRAY	
CN4	MINICT-11P	BLUE	
CN5	XA-2P	WHITE	
CN6	XA-2P	BLACK	
CN7	XA-2P	RED	
CN8			
CN8B	VH-2P	WHITE	
CN9	PH-8P	WHITE	
CN10	XH-2P	WHITE	
CN11	MINICT-5P	WHITE	
CN13	CT-5P	WHITE	
CN14	MINICT-10P	WHITE	
CN15	XA-6P	RED	
CN16	XA-6P	WHITE	
CN17	PH-4P	WHITE	
CN18	ZR-12P	WHITE	
CN19			
CN20	ZR-4P	WHITE	
CN30	XH-7P	WHITE	
CN31	VH-2P	WHITE	

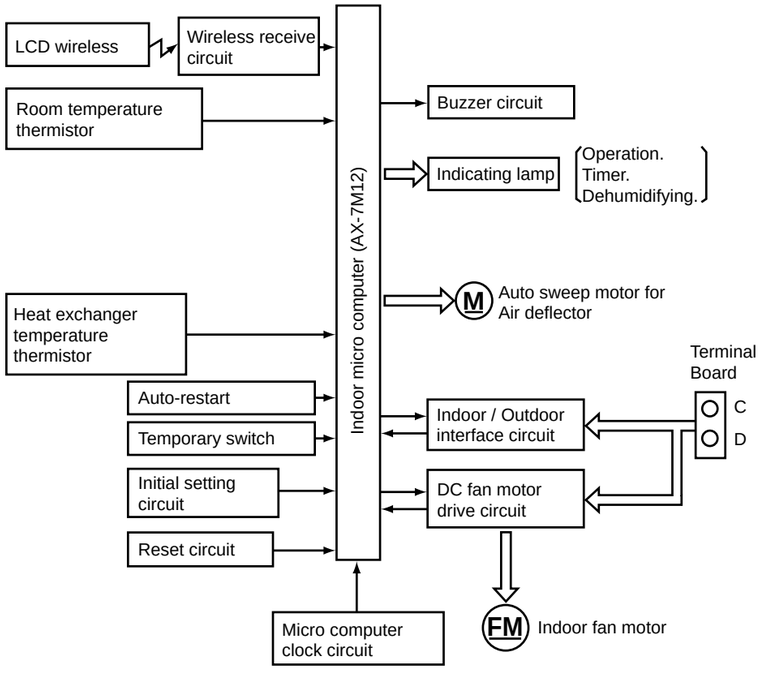
BLOCK DIAGRAM

INDOOR

MODEL RAS-20CNHZ2

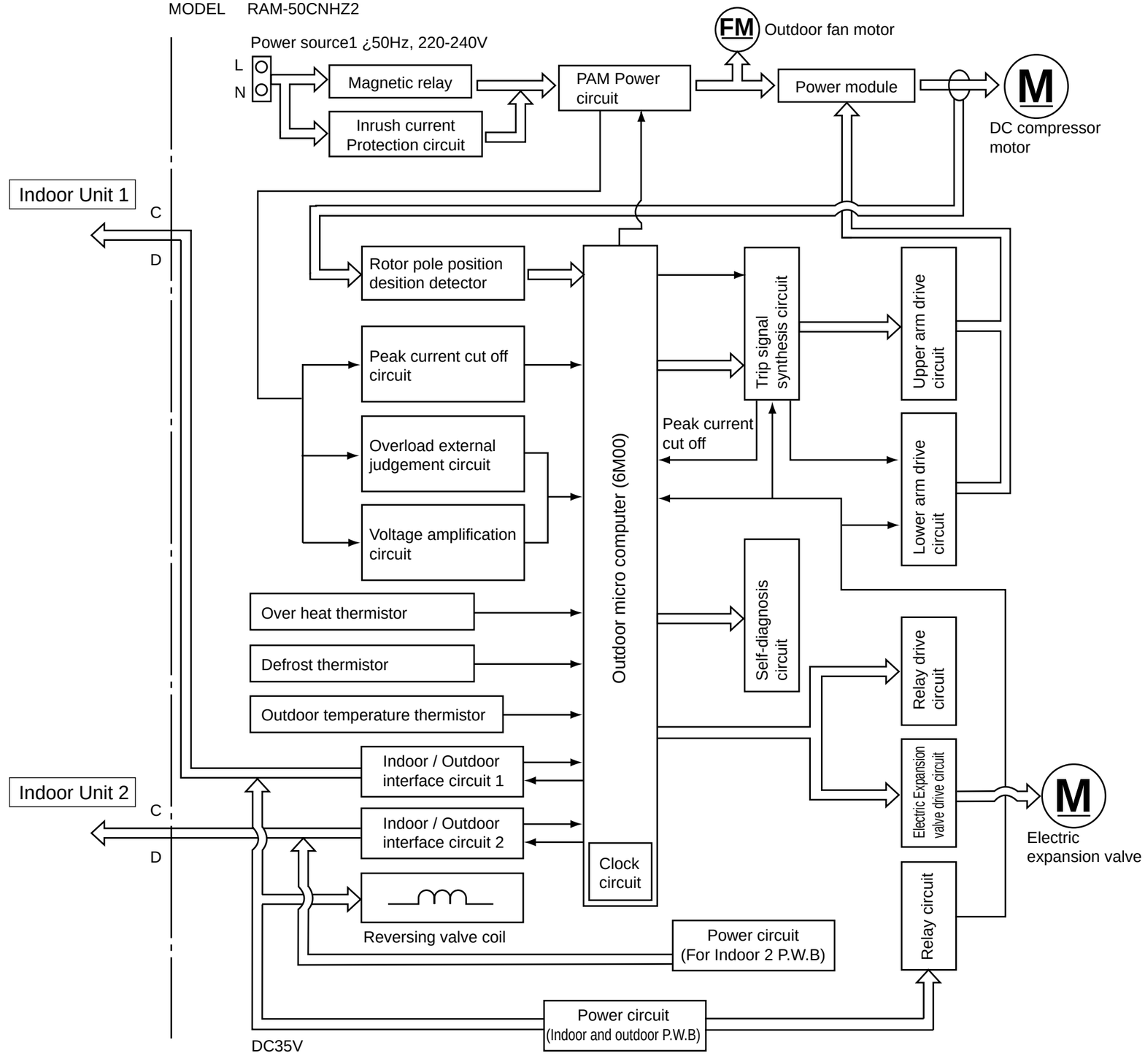


MODEL RAS-30CNHZ2

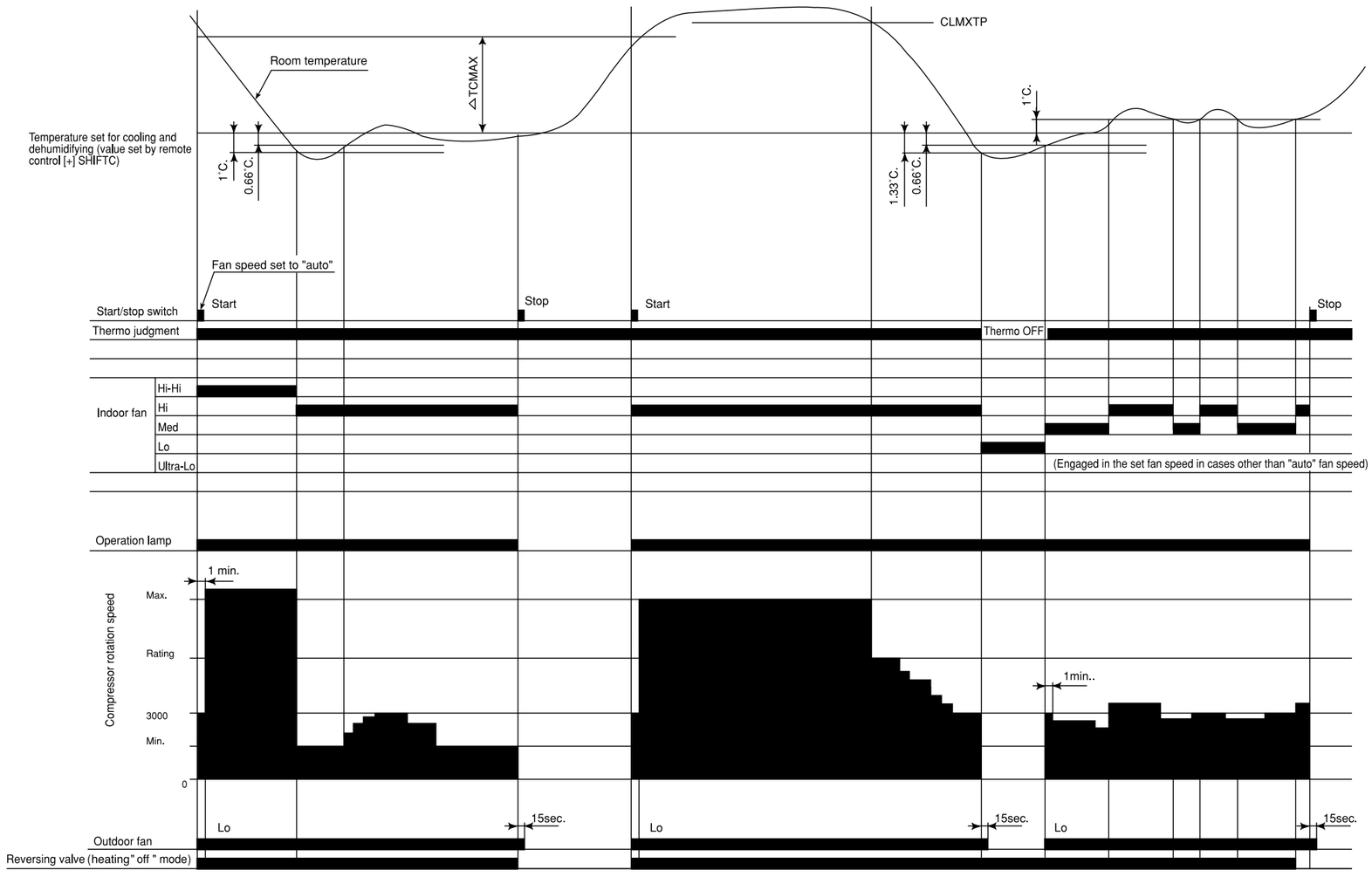


OUTDOOR

MODEL RAM-50CNHZ2

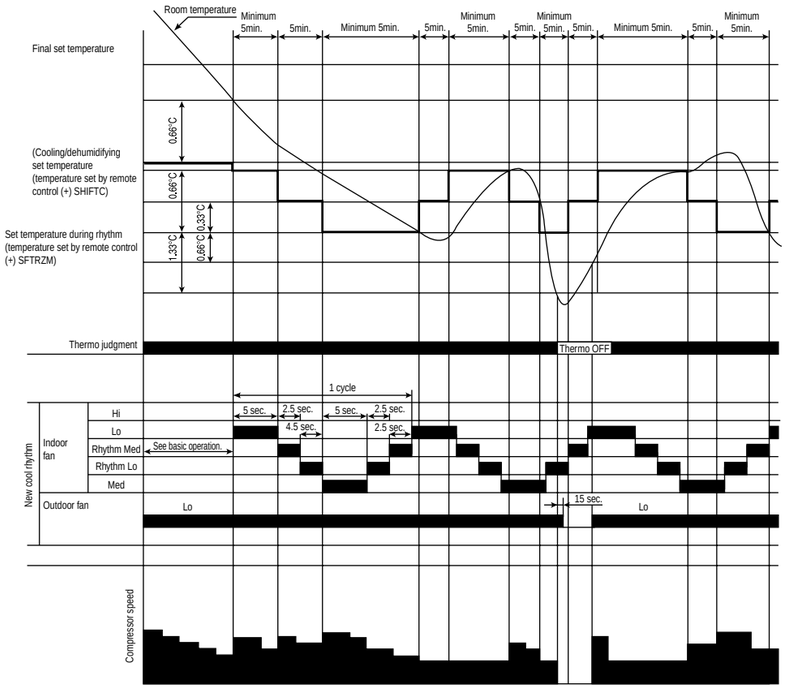


Basic Cooling Operation



Notes:
(1) The compressor minimum ON time and minimum OFF time is 3 minutes.

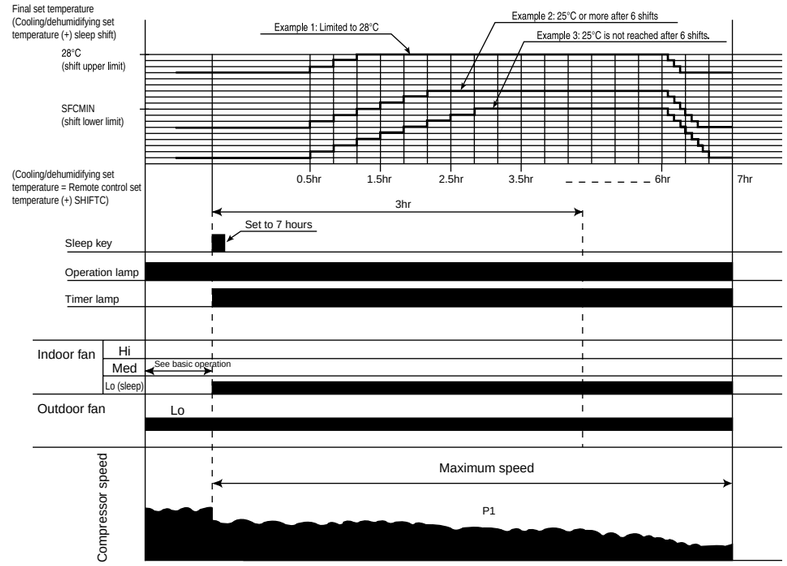
New Cool Rhythm



Notes:

(1) New cool rhythm is engaged when the fan speed is “auto” and the room temperature is less than set one plus 0.66˚C in the “auto” operation mode or cooling mode.
(2) The minimum new cool rhythm time is 10 minutes when the temperature falls and rises.
(3) Cool rhythm is not engaged during Nice temperature, Sleep operation.
(4) PI control is engaged during new cool rhythm: the speed limit is the same as during normal operation.
(5) The new cool rhythm set temperature is also shifted during thermo OFF.

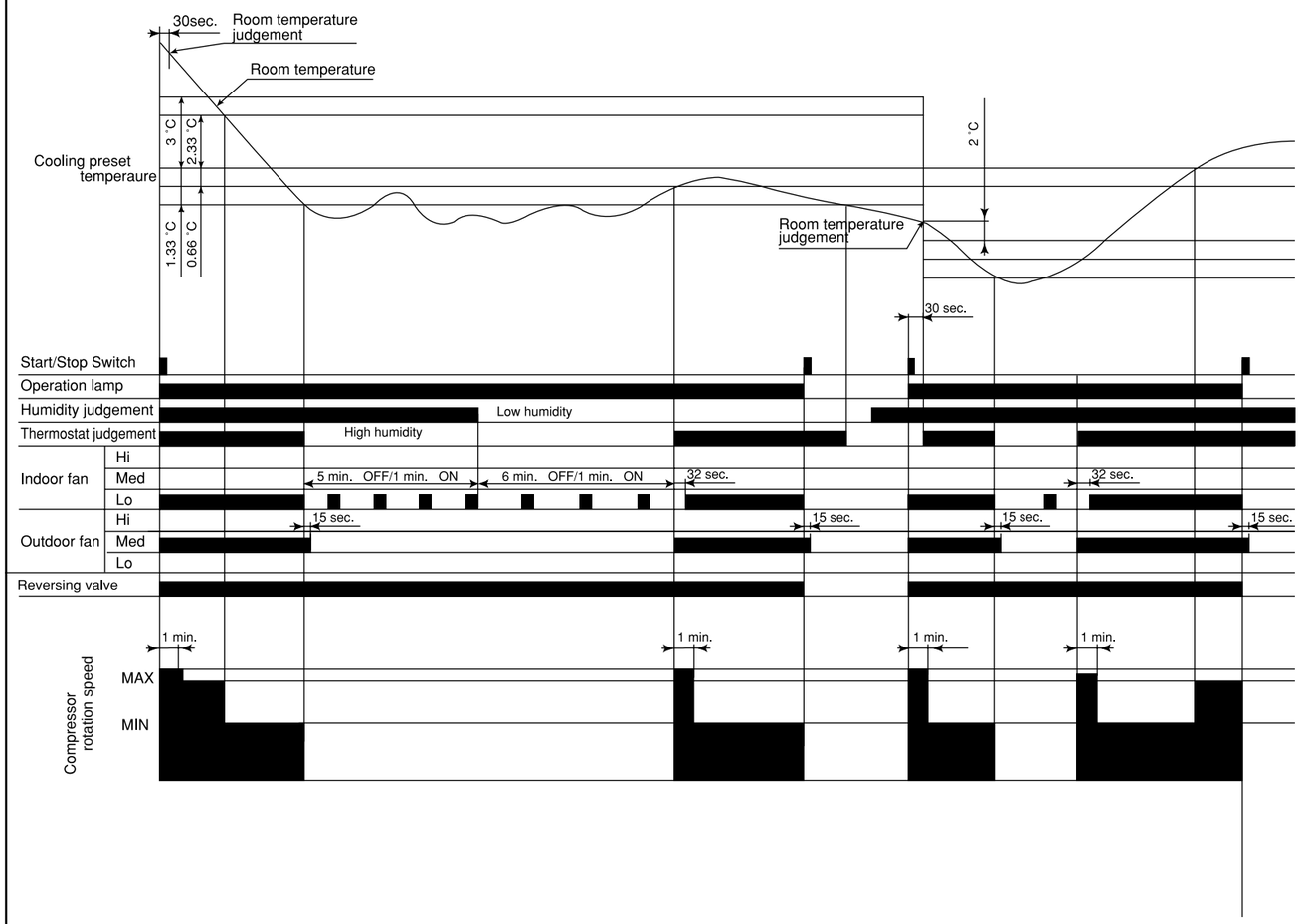
Cooling Sleep Operation



Notes:

(1) The sleep operation starts when the sleep key is pressed.
(2) 30 minutes after the sleep key is set, the sleep shift of temperature starts, and upper shift is made at least 6 times. If 25˚C is not reached after 6 shifts, shifts repeat unit 25˚C is reached.
(3) The sleep shift upper value of set temperature is 28˚C.
(4) After 6 hours, a shift down to the initial set temperature is made at a rate of 0.33˚C/5 min.
(5) If the operation mode is changed during sleep operation, the set temperature is cleared, and shift starts from the point when switching is made.
(6) The indoor fan speed does not change even when the fan speed mode is changed.
(7) When operation is stopped during sleep operation, the set temperature when stopped, as well as the time, continue to be counted.
(8) If the set lime is changed during sleep operation, all data including set temperature, time, etc. is cleared and restarted.
(9) If sleep operation is canceled by the cancel key or sleep key, all data is cleared.

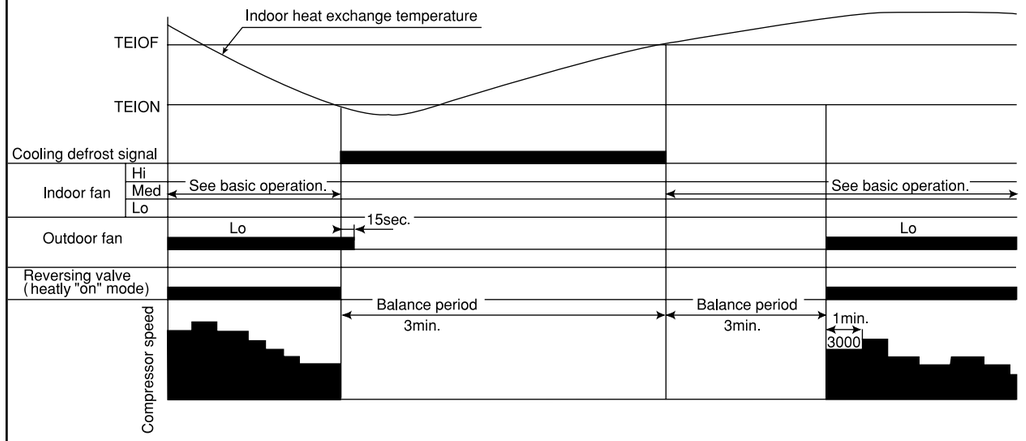
Dehumidifying



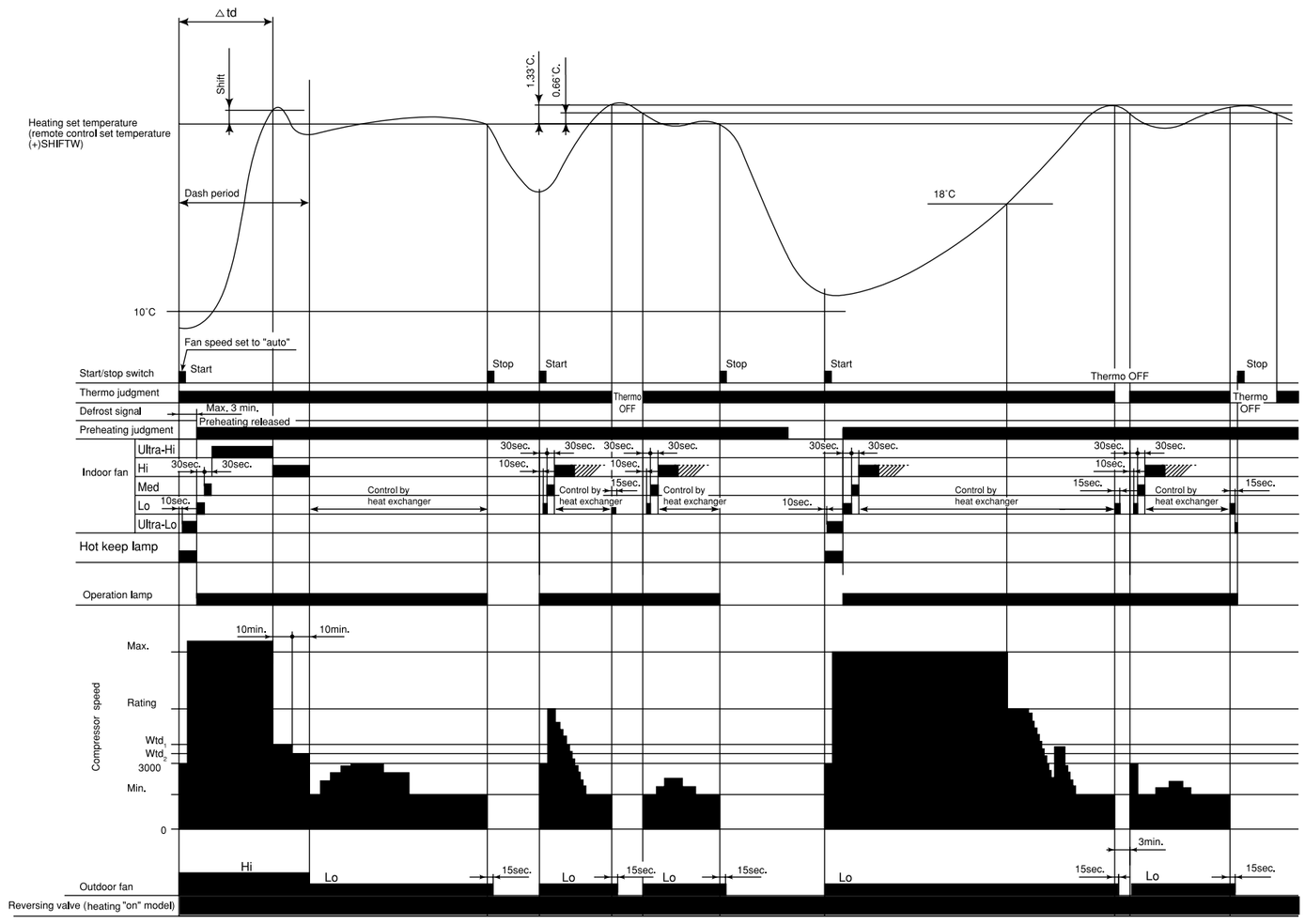
Notes:

(1) 30 seconds after the operation is started, when the room temperature is (cooling preset temperature) - (1.33˚C) or less, the operation is done assuming as the preset temperature = (room temperature at the time) - (2˚C).
(2) The indoor fan is operated in the “Lo” mode, OFF for 5 minutes and ON for 1 minute (at high humidity) or OFF for 6 minutes and ON for 1 minute (at low humidity), repeatedly according to the humidity judgement when the thermostat is turned OFF.
(3) When the operation is started by the thermostat turning ON, the start of the indoor fan is delayed 32 seconds after the start of compressor operation.
(4) The compressor is operated forcedly for 3 minutes after operation is started.
(5) The minimum ON time and OFF time of the compressor are 3 minutes.

Cooling Defrost



Basic Heating Operation



Notes:

(1) Hot dash is engaged if the difference between the room temperature and set temperature is equal to that between the room temperature, at which the compressor reaches maximum speed, and set temperature (△ TWMAX: See Table 7), and the room and outdoor temperatures are less than 10˚C; when the fan speed is "auto", operation is started at "Hi", or the fan speed is changed to "Hi" during heating.

(2) The maximum compressor speed period during hot dash is finished (1) when the room temperature reaches the heating set temperature (including heating shift) when the thermo is off.

(3) The thermo OFF temperature during hot dash is heating set temperature (including heating shift) plus 3˚C. After thermo OFF, hot dash finishes, and PI control starts with item I = 0.

(4) The compressor minimum ON time and minimum OFF time is 3 minutes.

(5) The time limit for which the maximum compressor speed during normal heating (except for hot dash) can be maintained is less than 120 minutes when the room temperature is 18˚C or more; it is not provided when the room temperature is less than 18˚C and outdoor temperature is less than 2˚C.

(6) The operation indicator blinks every second during initial cycle operation, preheating, defrosting (including balance time after defrosting is finished), or auto fresh defrosting.

(7) If the room temperature falls to less than 18˚C in the "ultra-Lo" mode, the indoor fan stops. When the room temperature is 18˚C+0.33˚C or more, the ultra-Lo operation restarts. However, the ultra-Lo operation during preheating or preheating after defrosting does not stop if the room temperature is less than 18˚C.

(8) When thermostat is OFF ; after 3 minutes has elapsed operation with FAN set to ON for 15 seconds and OFF for 60 seconds will be repeated depending on heat exchange temperature.

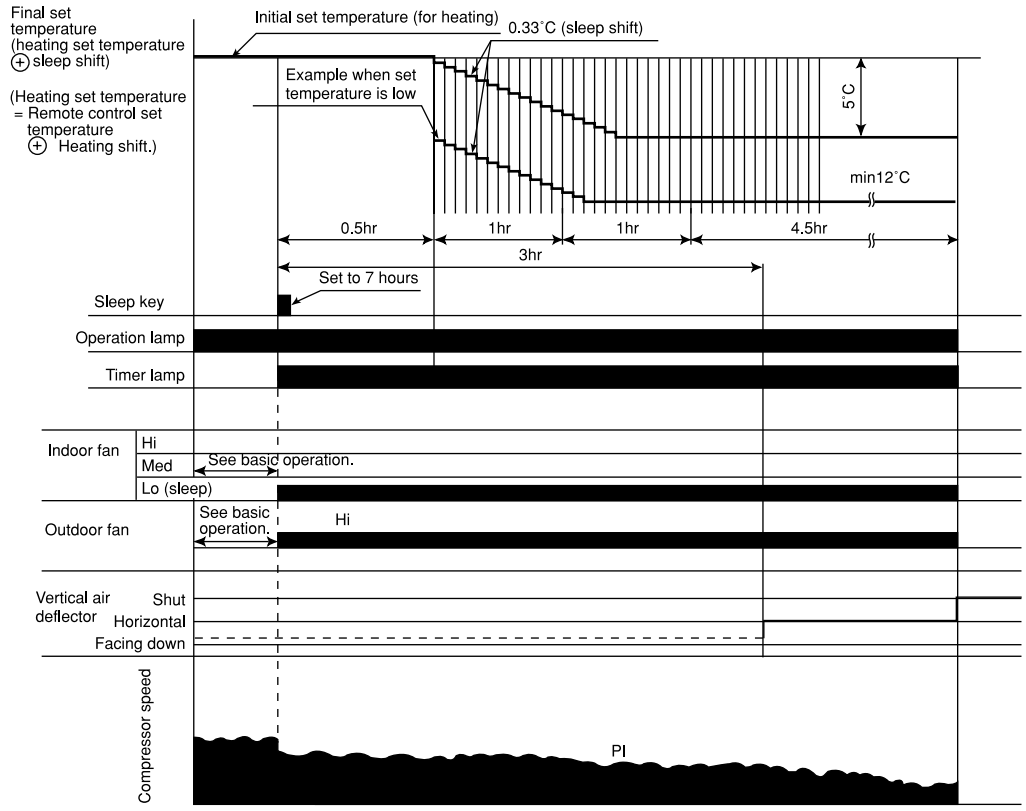
Table 6 Speed Specifications during Steady Speed Period

△ td (Hot dash time)	Wtd_1	Wtd_2
Less than 10 minutes	$2000min^{-1}$	$1600min^{-1}$
10-20 minutes	$3000min^{-1}$	$2400min^{-1}$
20 minutes or more	$4000min^{-1}$	$3200min^{-1}$

Table 7 △ TWMAX

Compressor speed - minimum speed	Set temperature (including shift) room temperature
$1400min^{-1}$	2.00 ˚C
$1800min^{-1}$	2.33 ˚C
$2200min^{-1}$	2.66 ˚C
$2600min^{-1}$	3.00 ˚C
$3000min^{-1}$	3.33 ˚C
$3400min^{-1}$	3.66 ˚C
$3800min^{-1}$	4.00 ˚C
$4200min^{-1}$	4.33 ˚C
$4600min^{-1}$	4.66˚C
$5000min^{-1}$	5.00 ˚C
$5400min^{-1}$	5.33 ˚C
$5800min^{-1}$	5.66 ˚C
$6200min^{-1}$	6.00 ˚C
$6600min^{-1}$	6.33 ˚C
$7000min^{-1}$	6.66 ˚C

Heating Sleep Operation



Notes:

(1) The sleep operation starts when the sleep key is pressed.
(2) 30 minutes after the sleep key is set, the sleep shift of set temperature starts.
(3) The maximum sleep shift of set temperature is 5˚C, and the minimum is 12˚C.
(4) If the operation mode is changed during sleep operation, the changed operation mode is set and sleep control starts.
(5) The indoor fan speed does not change even when the fan speed mode is changed. (Lo)
(6) When defrosting is to be set during sleep operation, defrosting is engaged and sleep operation is restored after defrosting.
(7) When operation is stopped during sleep operation, the set temperature when stopped, as well as the time, continue to be counted.
(8) If the set time is changed during sleep operation, all data including set temperature, time, etc. is cleared and restarted.
(9) If sleep operation is cancelled by the cancel key or sleep key, all data is cleared.

DEFROST

- Reversing valve defrost system is employed: it consists of balancing period → reversing cycle period → balancing period.

(1)Defrost start condition

- When all the following conditions are established, defrost is executed:
  ①Normal operation
  ②Heat exchange temperature is within defrost range specified by outdoor temperature and heat exchange temerature.
  ③Defrost inhibit period linked to outdoor temperature has passed.

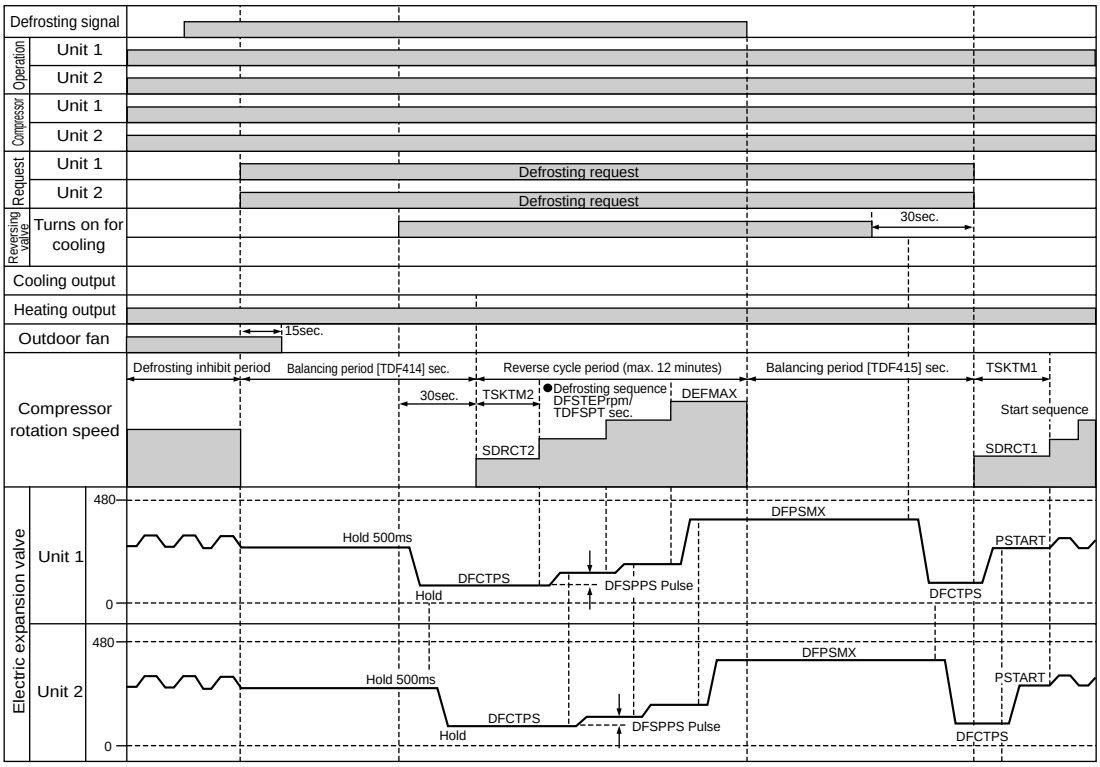
(2)Defrost release condition

- If any one of the following conditions is established, defrost is released:
  ①Heat exchange temperature returns (heat exchange temperature ≧ DEFOFF).
  ②Defrost max time of 12 minutes has elapsed.
- Released by condition ①during balancing period: When remaining balancing period has elapsed, returned to initial condition (ASTUS = 0).
- Released by condition ①or ②during reversing cycle period: Shifted to balancing period.

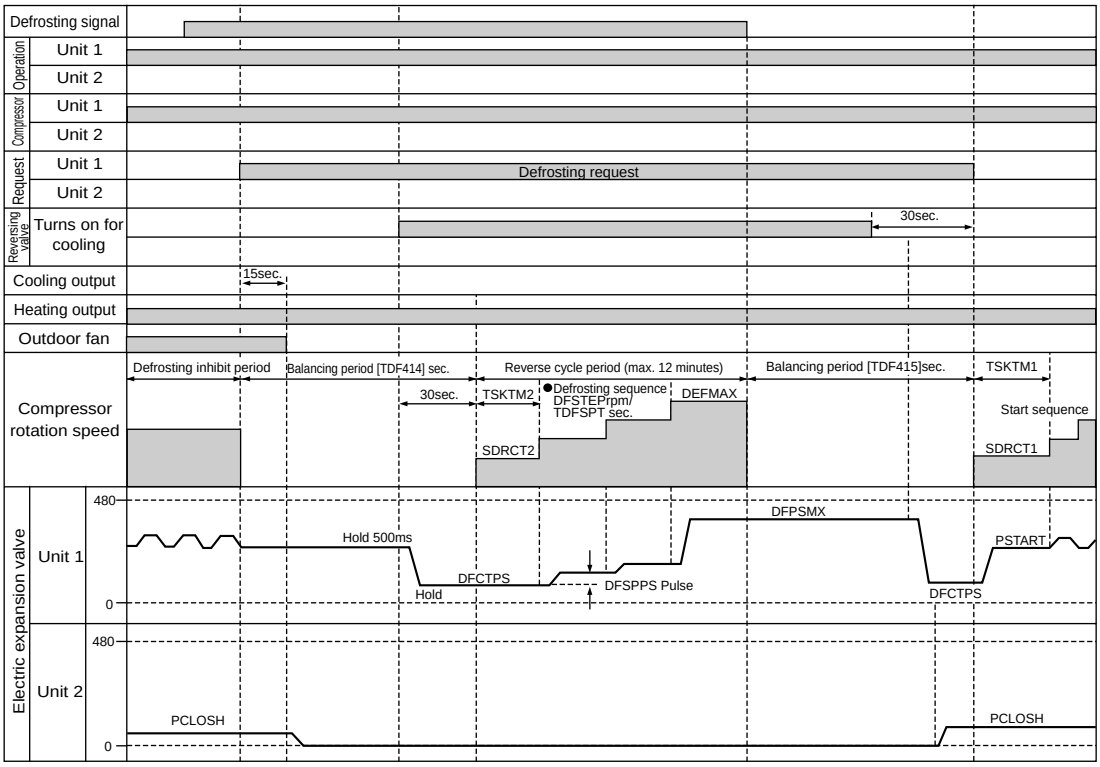
(3)Outputs during defrost

- Indoor defrost request: Transmitted to all units being operated in heating mode.
- Compresor: Balancing period for [TDF414] seconds → Starting of reversing cycle period by [SDRCT2] min^{-1} for [TSKTM2] seconds → Accelerating by [DFCTEP] min^{-1} / [TDFSPT] seconds in remaining reversing cycle period until defrost MAX speed [DEFMAX] is reached → Balancing period for [TDF415] seconds
- Electric expansion valve
  Unit being stopped : [FULL CLOSE] 30 seconds after balancing period has passed → [FULL CLOSE] during reversing cycle period → [PCLOSH] 15 seconds before balancing period is finished.
  Unit being operated : [DFCTPS] 30 seconds before balancing period is finished → Synchronized with step-up of rotation speed of compressor, opened by [DFSPPS] pulses and reaches MAX opening degree [DEFSMX] when rotation speed of compressor reaches [DEFMAX].

● Time chart when executing defrost (both unit 1 and unit 2 operated)



● Time chart when executing defrost (Only unit 1 operated, unit 2 stopped)



AUTO-FRESH DEFROST

- During heating operation is stopped, and when auto-fresh condition is established, defrost operation will be performed while operation is stopped.
  Auto-fresh consists of balancing period at start of defrost for [TDF414] seconds → Reverse cycle period for MAX 12 minutes.
  (1) Start conditions for auto-fresh
    - When all the following conditions are established, auto-fresh is executed:
      ① Defrost request signal is present.
      ② All indoor units are stopped.
      ③ 15 minutes of auto-fresh inhibit period has elapsed.
      ④ Compressor is ON when operation is stopped.
      ⑤ Compressor delay command is sent from indoor unit when operation is stopped.

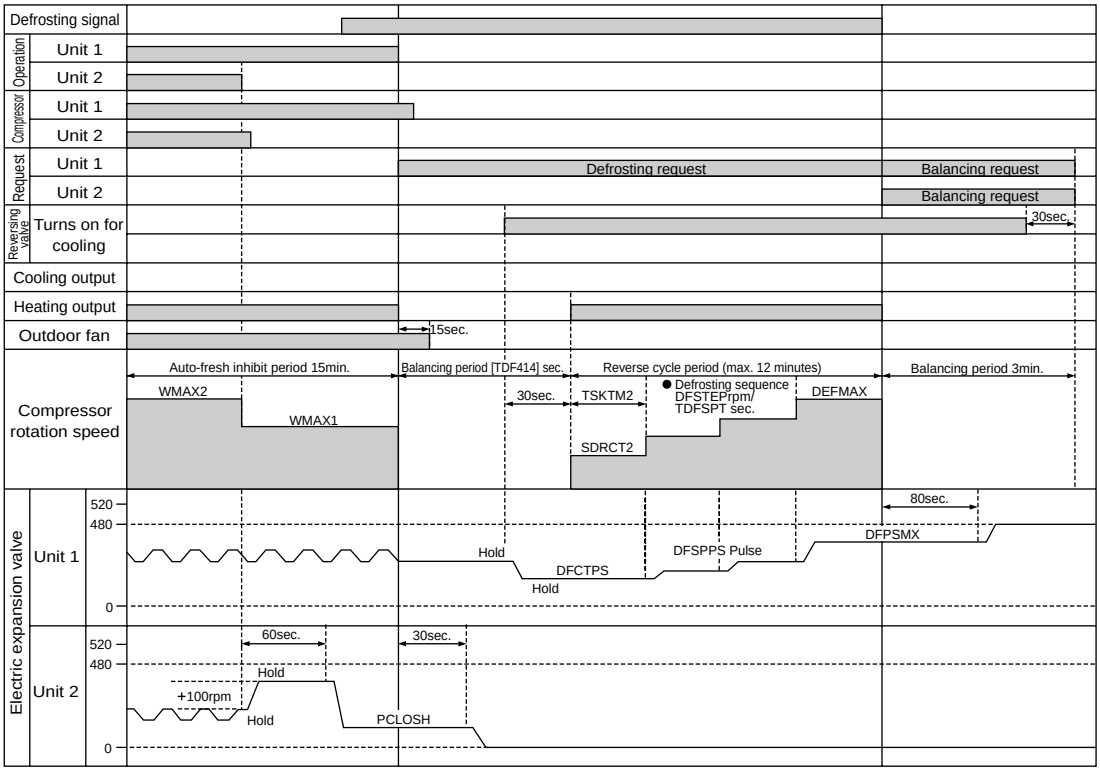
  (2) Release condition of auto-fresh
    - If any one of following conditions is established, auto-fresh is released:
      ① Heat exchange temperature returns (heat exchange temperature ≧ DEFOFF)
      ② 12 minutes of defrost MAX time has elapsed.
      ③ Failure occurred.
      ④ Either unit 1 or unit 2 started operation.

      ❋ Released during start of balancing period: Stopped or started after remaining balancing period has elapsed.

      ❋ Released during reverse cycle period : Stopped or started after balancing for 3 minutes.

  (3) Outputs during auto-fresh
  [Indoor unit defrost request]: Transmitted only to unit to which auto-fresh is applied 9indoor unit stopped last).
  [Compressor]: Accelerated by DFSTEP rpm/TDFSPT seconds and reaches defrost MAX speed [DEFMAX].
  [Electric expansion valve]:
  Unit auto-fresh not applied: FULL CLOSE when balancing for 30 seconds has elapsed at start of defrost.
  Unit auto-fresh applied: Synchronized with step-up of rotation speed of compressor, opened by [pulses and reaches MAX opening degree [DEFSMX] when rotation speed of compressor reaches [DEFMAX].

  (4) Note
    - Shifted to auto-fresh in defrost mode when operation is stopped.
    - All indoor units must be stopped to fulfill condition for auto-fresh.
      If signal is delayed, auto-fresh condition will not be established.



FORCED COOLING

- In order to accumulate refrigerant, units operate in cooling cycle.

  Execution condition and operation status are shown below.

  [Execution condition]

  - With neither indoor unit 1 and 2 not operated, when forced cooling switch is turned ON, forced cooling will be performed.
  - Always operation status of indoor unit are monitored and forced cooling is inhibited when operation of any unit is detected.

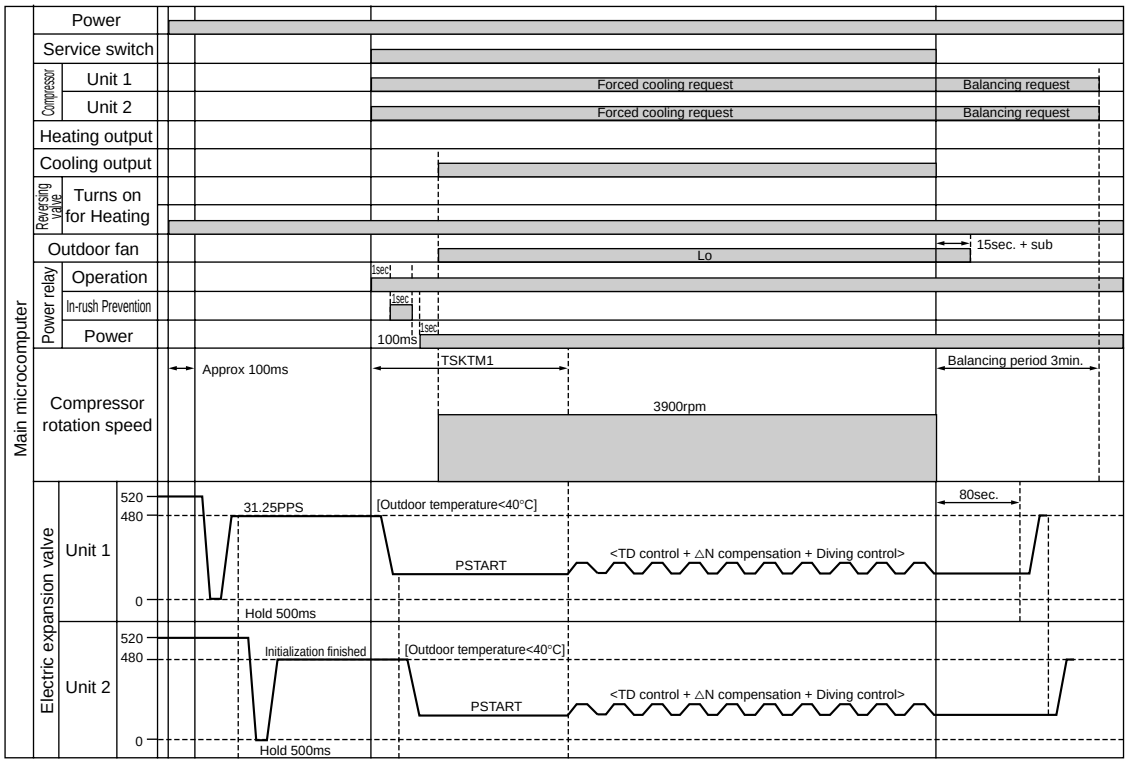
  [Operation status]

  - Outdoor unit fan: Fixed in LO.
  - Compressor rotation speed: Fixed in 3900min^{-1}.

  [Note]

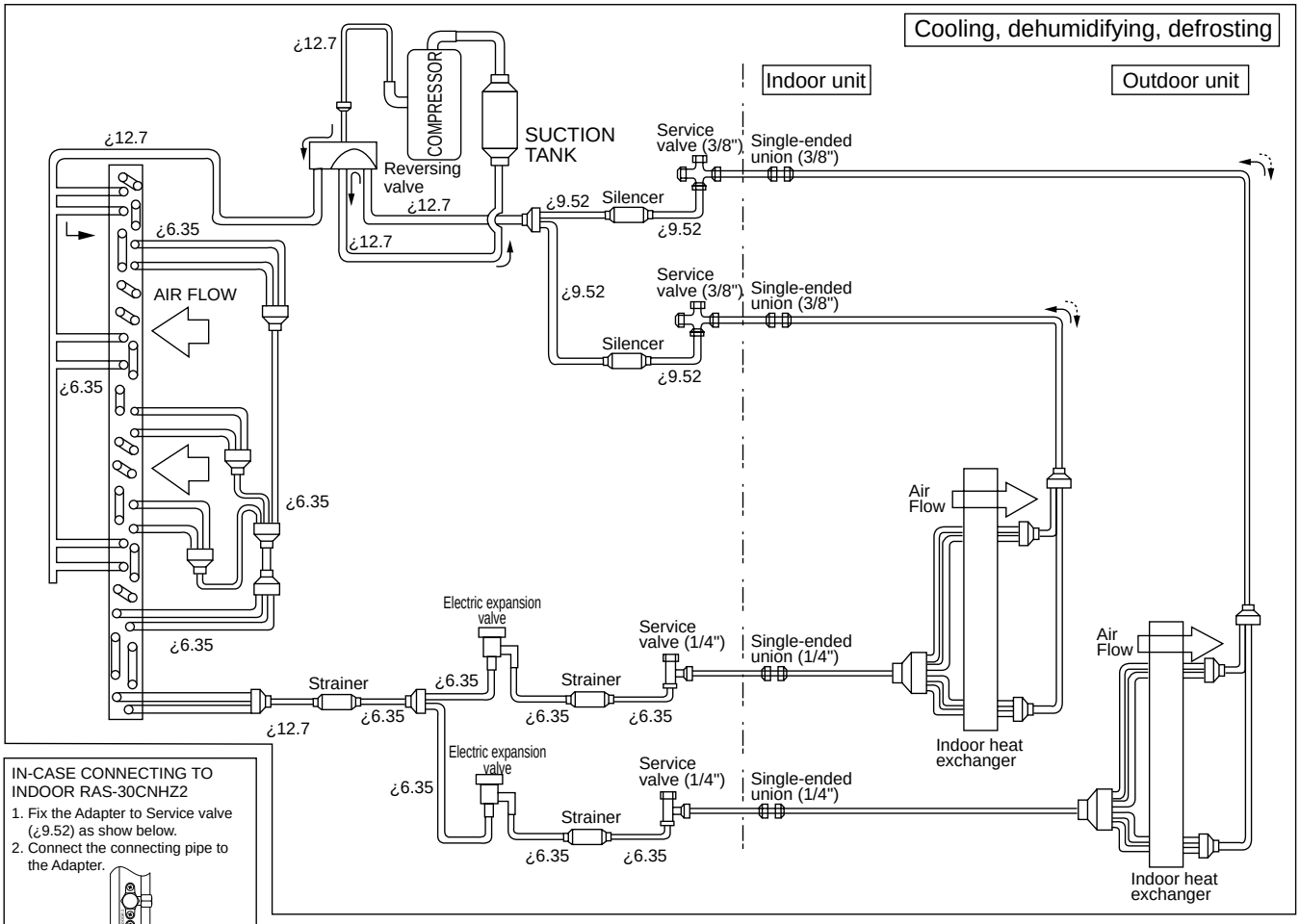
  - During forced cooling, if failure occurs in outdoor unit, thermostat is turned off. However, it is not counted.
  - Since rotation speed of compressor is fixed in 3900min^{-1} during forced cooling, compressor fixed speed control at start is not performed.

• The following shows the operation state of forced cooling.



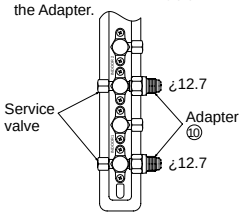
❋ • TSKTM1 and PSTART are EEPROM data.

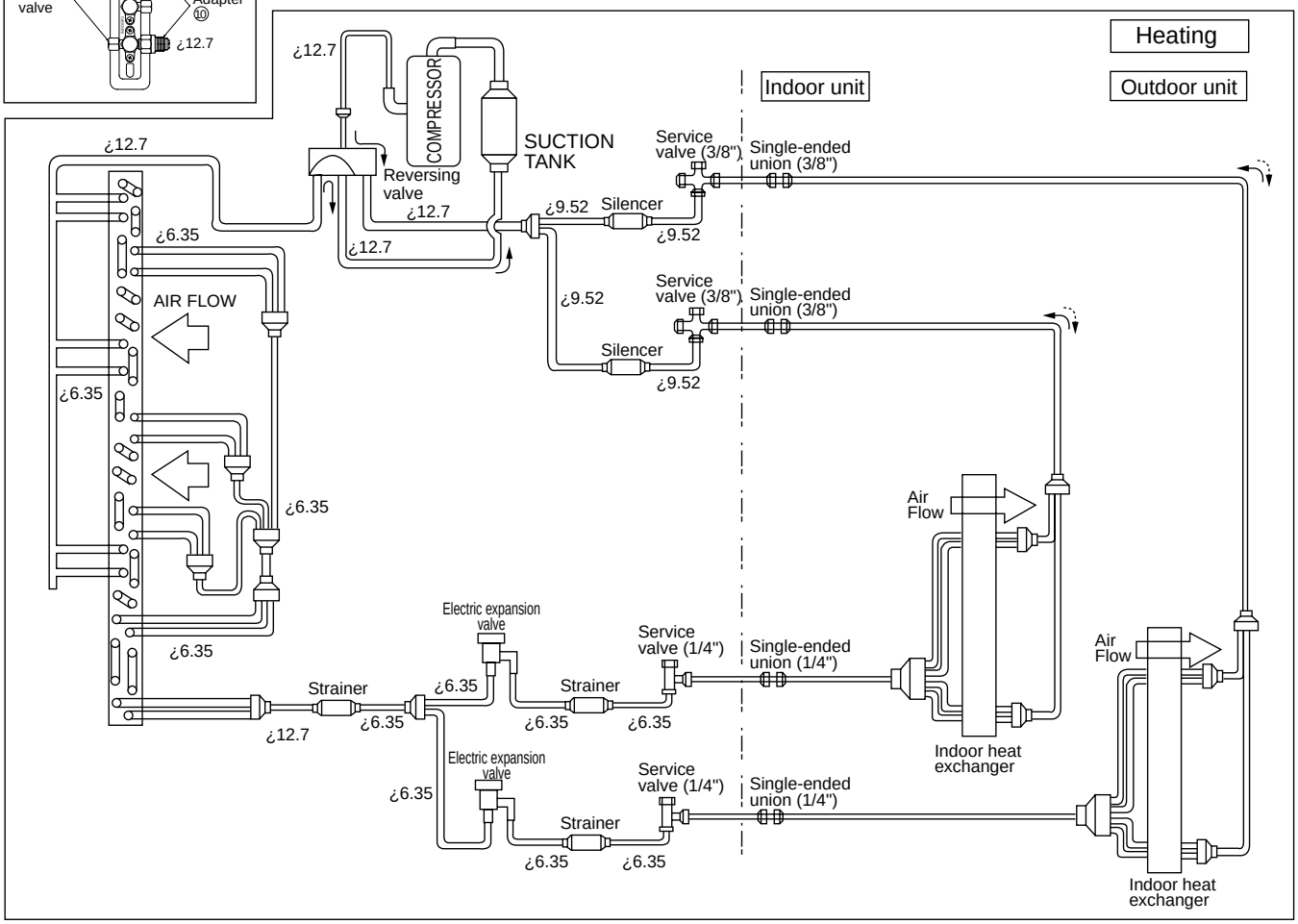
REFRIGERATING CYCLE DIAGRAM



IN-CASE CONNECTING TO INDOOR RAS-30CNHZ2

1. Fix the Adapter to Service valve (¿9.52) as show below.
2. Connect the connecting pipe to the Adapter.





DESCRIPTION OF MAIN CIRCUIT OPERATION (INDOOR)

MODEL RAS-20CNHZ2, RAS-30CNHZ2

1. Reset Circuit

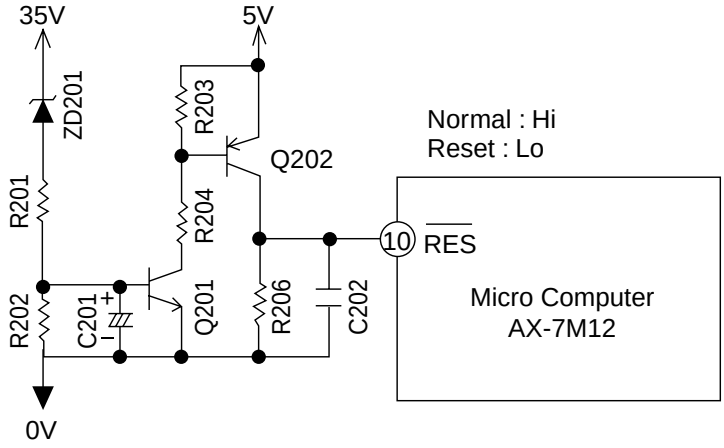


Fig. 1-1

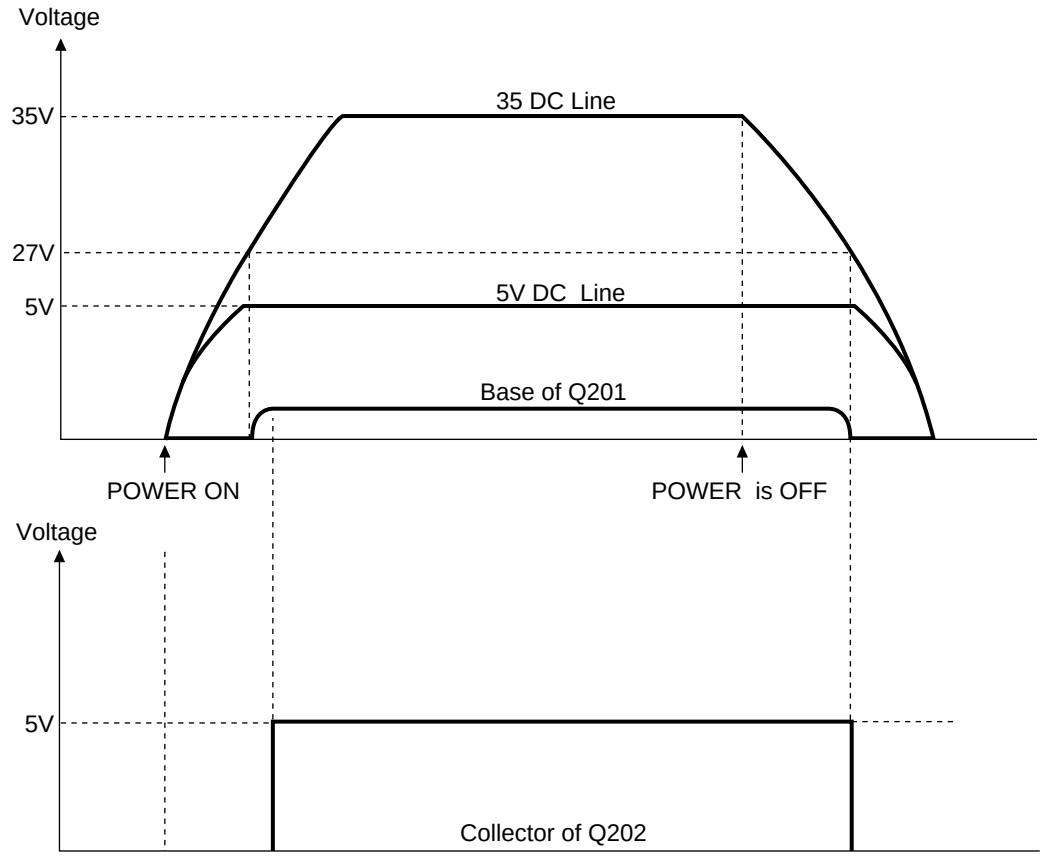


Fig. 1-2

- The reset circuit initializes the program when power is supplied or power is restored following a power failure.
- RESET “Lo” or SET “Hi” activates the micro computer.
- Fig. 1-2 shows the waveforms in each circuit when power is ON and OFF.
- When power is supplied, the voltages on the 35V and 5V lines rise and when the 35V DC line becomes approx. 27V, ZD201 turns on and the voltage at the Reset voltage Q201 rises to turn Q201 on.
  Since the collector of Q201 goes “Lo” at this time , Q202 turns on and the reset input of the micro computer goes “Hi”. The 5V DC line has already been 5V at this time and the micro computer starts operation.
- When power is OFF, the voltage on the 35V DC line drops. and when it is approx. 27V, ZD201 turns off, Q201 and Q202 turn off, and the reset input of the micro computer goes “Lo” to reset it.

2. Receive Circuit

Model: RAS-20CNHZ2

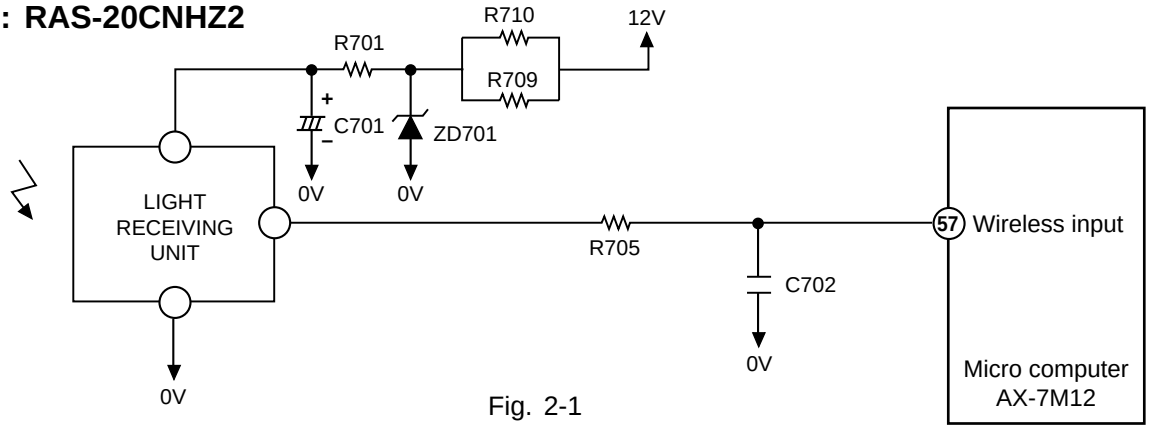


Fig. 2-1

Model: RAS-30CNHZ2

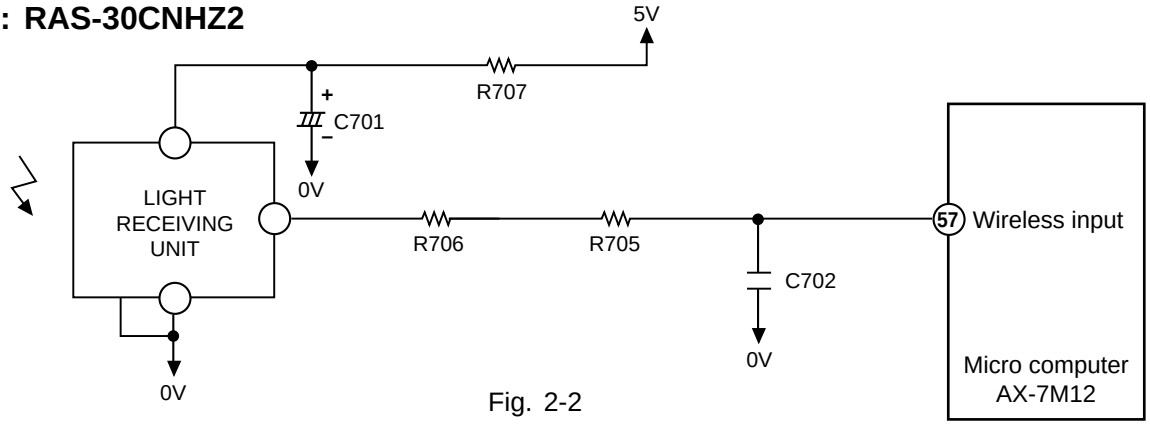


Fig. 2-2

- The Light receiving unit receives an infrared signal from the wireless remote control. The receiver amplifies and shapes the signal and outputs it.

3. Buzzer Circuit

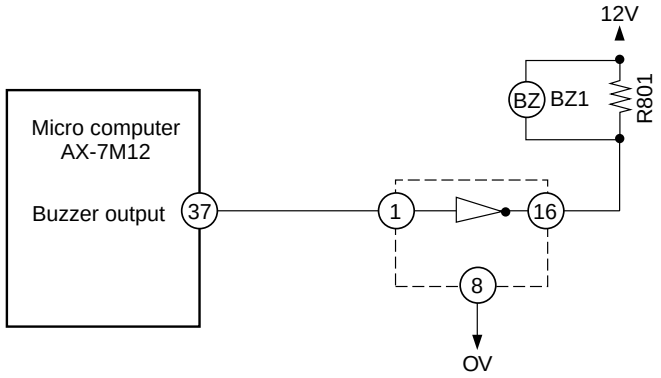


Fig. 3-1 Buzzer Circuit

- When the buzzer sounds, an approx. 3.9kHz square signal is output from buzzer output pin ㊲ of the micro computer. After the amplitude of this signal has been set to 12Vp-p by a transistor, it is applied to the buzzer. The piezoelectric element in the buzzer oscillates to generate the buzzer's sound.

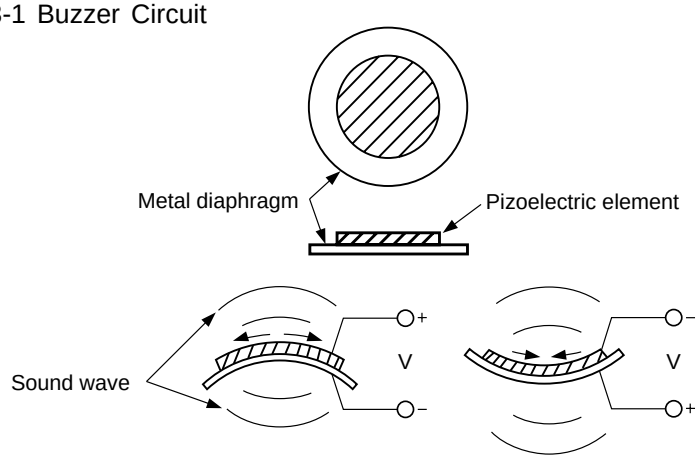


Fig. 3-2 Buzzer Operation

4. Auto Sweep Motor Circuit

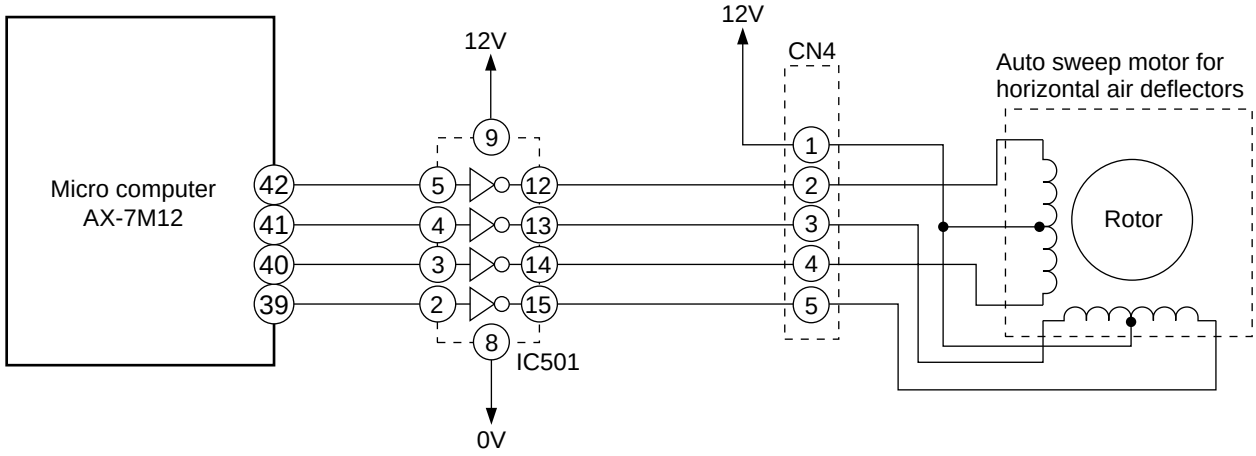


Fig. 4-1 Auto Sweep Motor Circuit (Horizontal air deflectors)

- Fig. 4-1 shows the Auto sweep motor drive circuit; the signals shown in Fig. 4-2 are output from pins ㊽–㊶ of the micro computer.

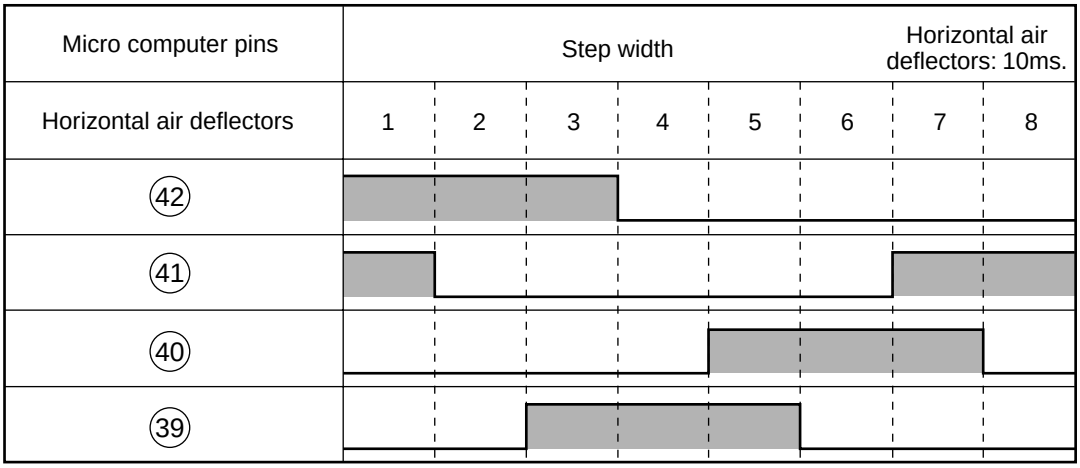


Fig. 4-2 Micro computer Output Signals

- As the micro computer's outputs change as shown in Fig. 4-2, the core of the auto sweep motor is excited to turn the rotor. Table 4-1 shows the rotation angle of horizontal air deflectors.

Table 4-1 Auto sweep Motor Rotation

	Rotation angle per step (°)	Time per step (ms)
Horizontal air deflectors	0.0879	10

5. Room Temperature Thermistor Circuit

- Fig. 5-1 shows the room temperature thermistor circuit.

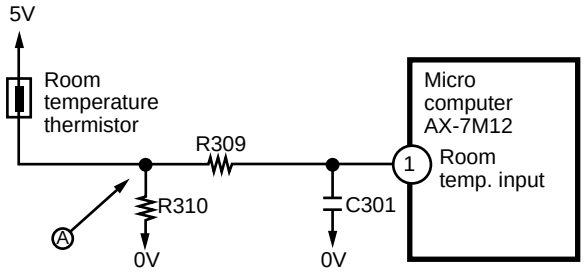


Fig. 5-1

- The voltage at Ⓐ depends on the room temperature as shown in Fig. 5-2.

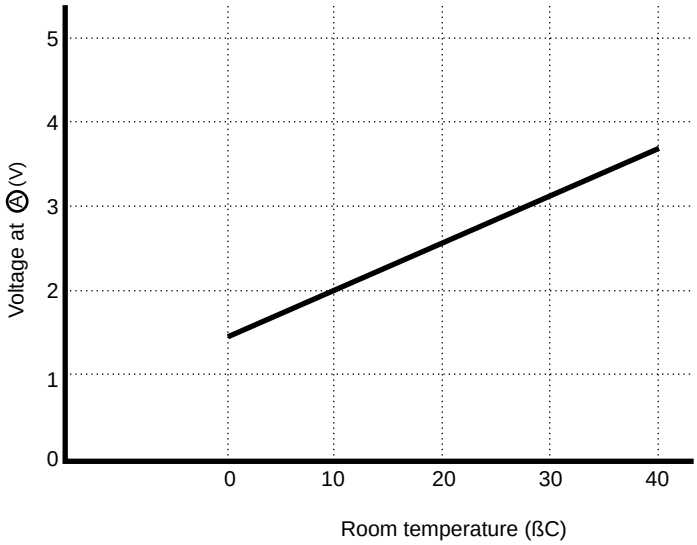


Fig. 5-2

6. Heat exchanger temperature thermistor circuit

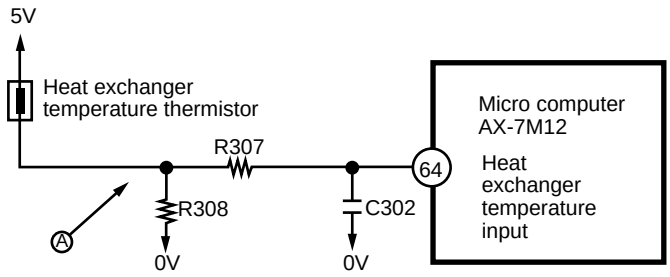


Fig. 6-1

- The circuit detects the indoor heat exchanger temperature and controls the following.

  (1) Preheating.

  (2) Low-temperature defrosting during cooling and dehumidifying operation.

  (3) Detection of the reversing valve non-operation or heat exchanger temperature thermistor open.

  The voltage at Ⓐ depends on the heat exchanger temperature as shown in Fig. 6-2.

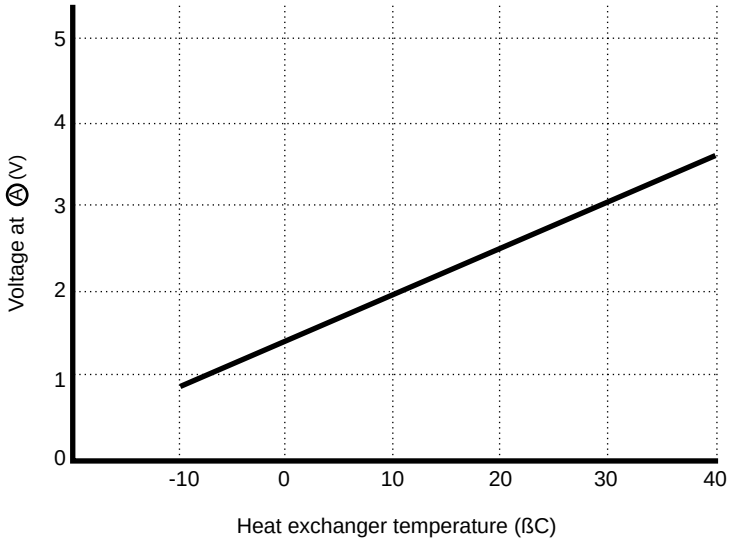


Fig. 6-2

7. Auto Restart / Temporary Switch

- Auto Restart Switch

MODEL : RAS-20CNHZ2

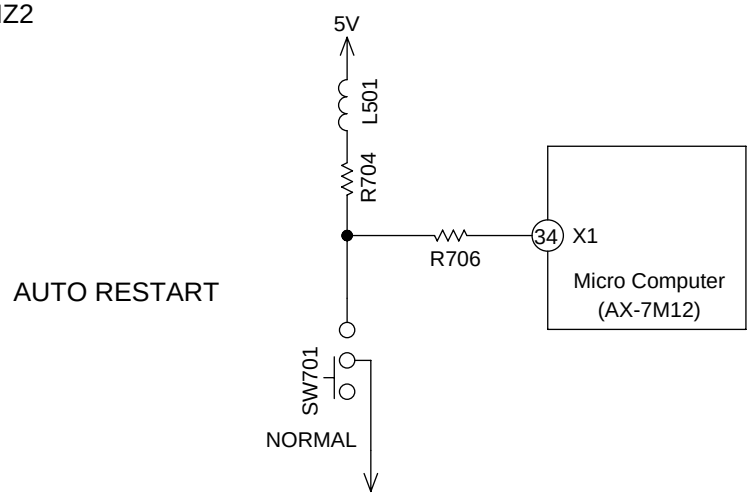


Fig. 7-1

MODEL : RAS-30CNHZ2

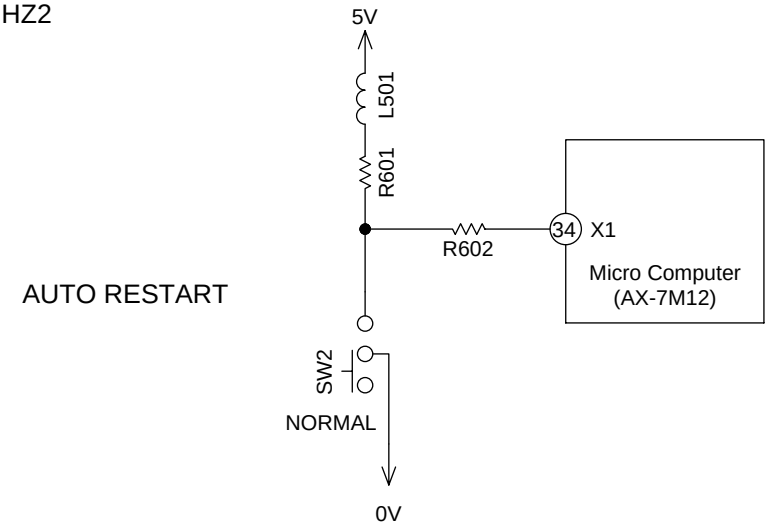


Fig. 7-2

- Temporary Switch

MODEL : RAS-30CNHZ2

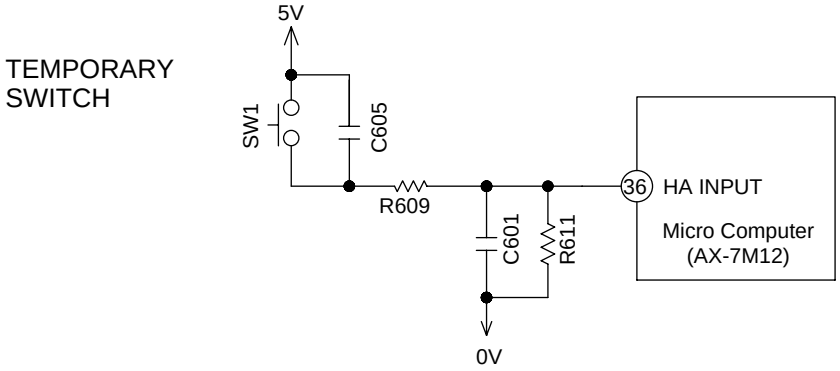


Fig. 7-3

AUTO RESTART SWITCH

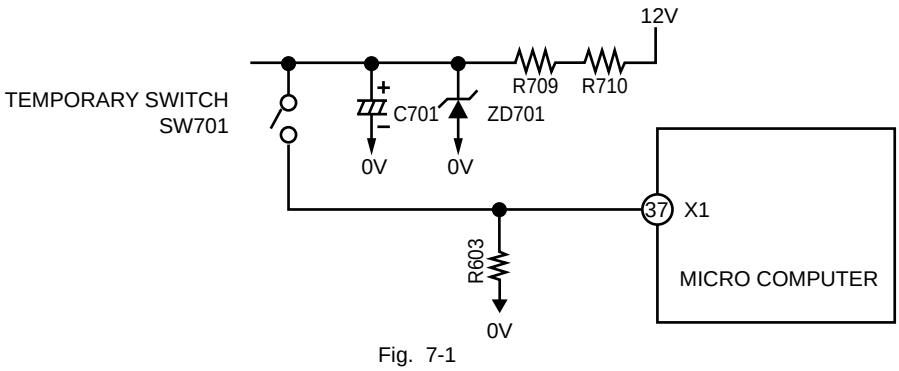


Fig. 7-1

- The temporary switch is used to operate the air conditoner temporarily when the wireless remote control is lost or faulty.
- The air conditioner operates in the previous mode at the previously set temperature. However, when the power switch is set to OFF, it starts automatic operation.

8. DC Fan Motor Drive Circuit

- Fig. 8-1 shows the indoor DC fan motor drive circuit.

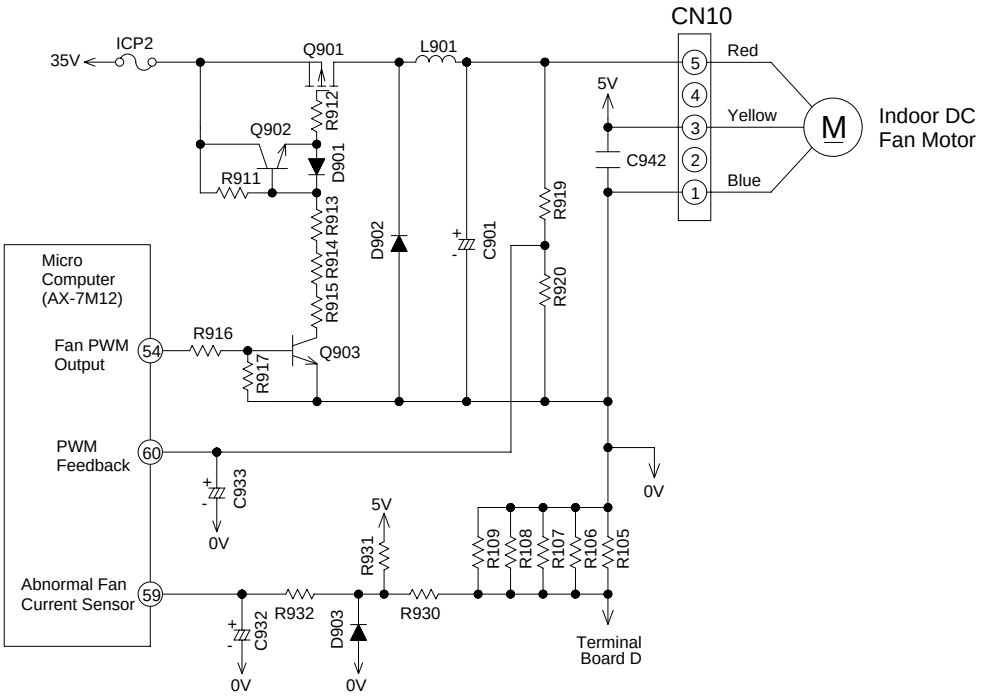


Fig. 8-1

- The circuit produces the fan motor drive voltages, 8-33V, from 35V DC supplied from the outdoor unit and controls the fan motor speed.
- Q903 is switched on and off according to the signal at fan PWM output pin ⑭ to control the voltage which is smoothed by D901, L901 and C901 to drive the fan motor.
- The output voltage is divided by R919 and R920 and is input to divided voltage output pin ⑥⓪; the micro computer controls the fan PWM output so the output voltage is set to the specified value. The chopper frequency of the fan PWM output is 15.7kHz.
- In the Fan current detection circuit, 35V line current is detected by R105 ~ R109 and input to abnormal fan current sensor pin ⑤⑨. Microcomputer detects overcurrent comparing it with the current judgment value corresponding to the fan rotation speed.

DESCRIPTION OF MAIN CIRCUIT OPERATION (OUTDOOR)

Model RAM-50CNHZ2

1. Power Circuit

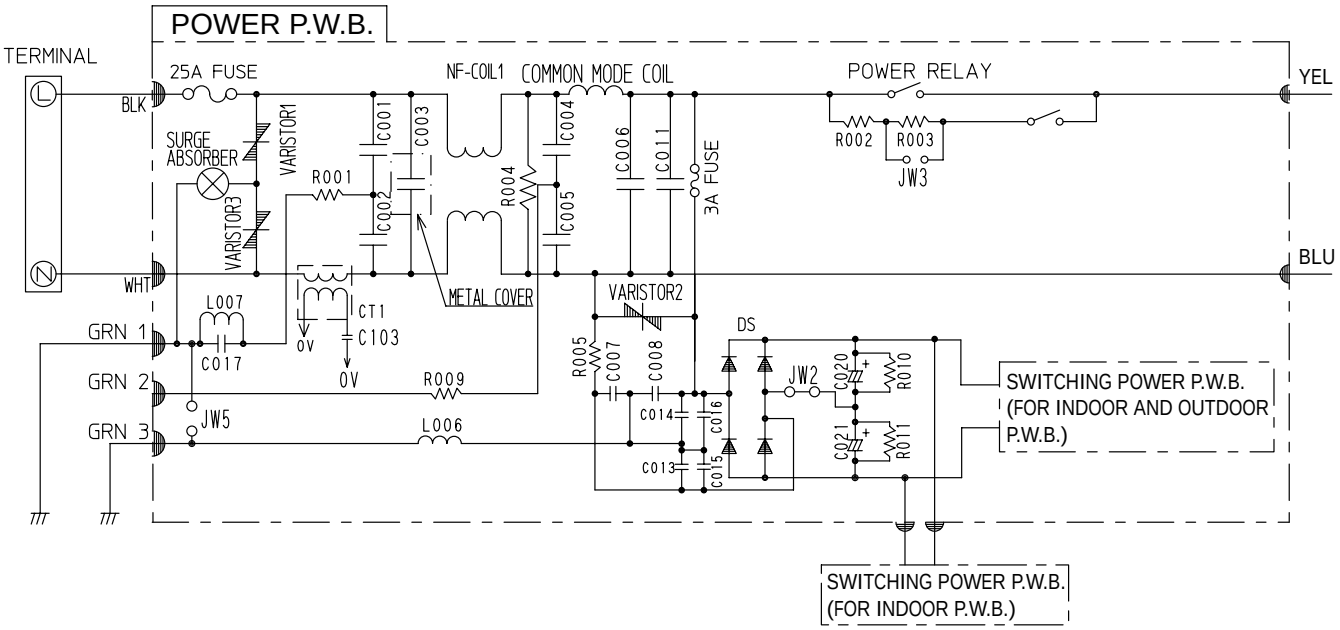


Fig. 1-1

- This circuit full-wave rectifies 220-230V AC applied between terminals L and N, and boosts it to a required voltage with the active module, to create a DC voltage.

The voltage becomes 260-380V when the compressor is operated

(1) System power module (SPM2)

(Surrent ACT module, smoothing capacitors and power module are combined into one unit)

① Active module

The active filter, consisting of a reactor and switching element, eliminates higher harmonic components contained in the current generated when the compressor is operated, and improves the power-factor.

Smoothing capacitor smoothes voltage, which has been rectified by diode stack and boosted at ACT section.

② Power module section

Refer to item 3 System Power Module Circuit.

(2) Diode stacks

These rectify the 220-230V AC from terminals L and N to a DC power supply.

< Reference >

- In case of malfunction or defective connection: Immediately after the compressor starts, it may stop due to “abnormally low speed” active error, etc.

  The compressor may continue to operate normally, but the power-factor will decrease, the operation current will increase, and the overcurrent breaker of the household power board will probably activate.

- In case of active module faulty or defective contact:

  Although the compressor continues to operate normally, the power-factor will decrease, the operation current will increase, and the overcurrent breaker of the household power board will probably activate.

< Reference >

- If diode bridge 1 is faulty, the compressor may stop due to “lp”, “abormally low speed”, etc. immediately after it starts, or it may not operate at all because no DC voltage is generated between the positive ⊕ and negative ⊖ terminals.

  If diode bridge (D25VB60) is faulty, be aware that the 25A fuse might also have blown.

- If diode bridge (DS) is faulty, DC voltage may be not generated and the compressor may not operate at all. Also, be aware that the 3A fuse might have blown.

(3) Smoothing capacitor C501,C52,C503

This smoothes (averages) the voltage rectified by the diode stacks.

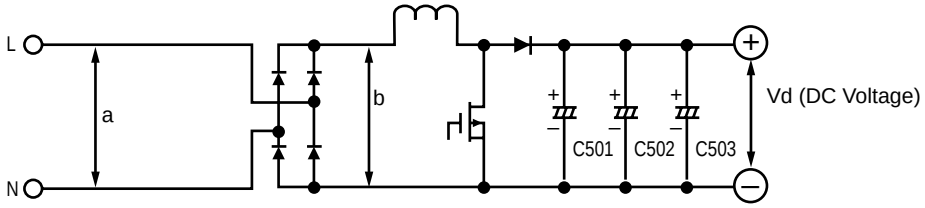


Fig. 1-2

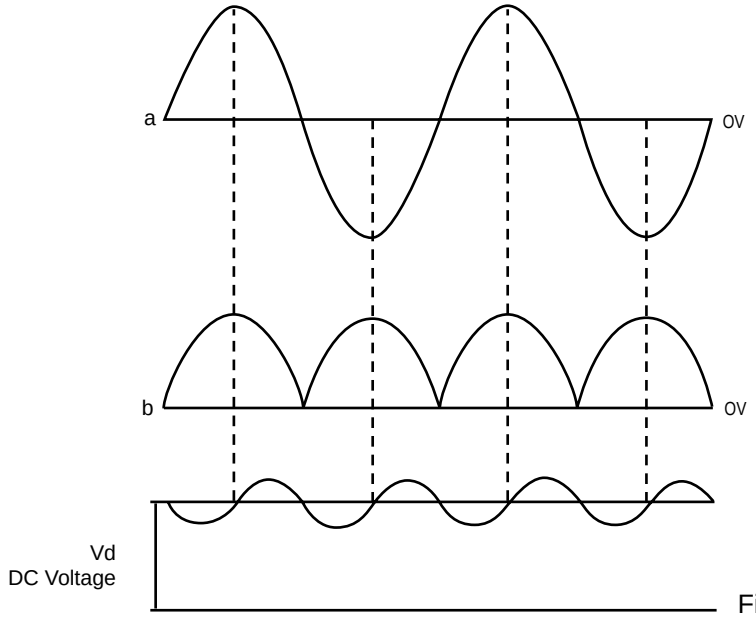
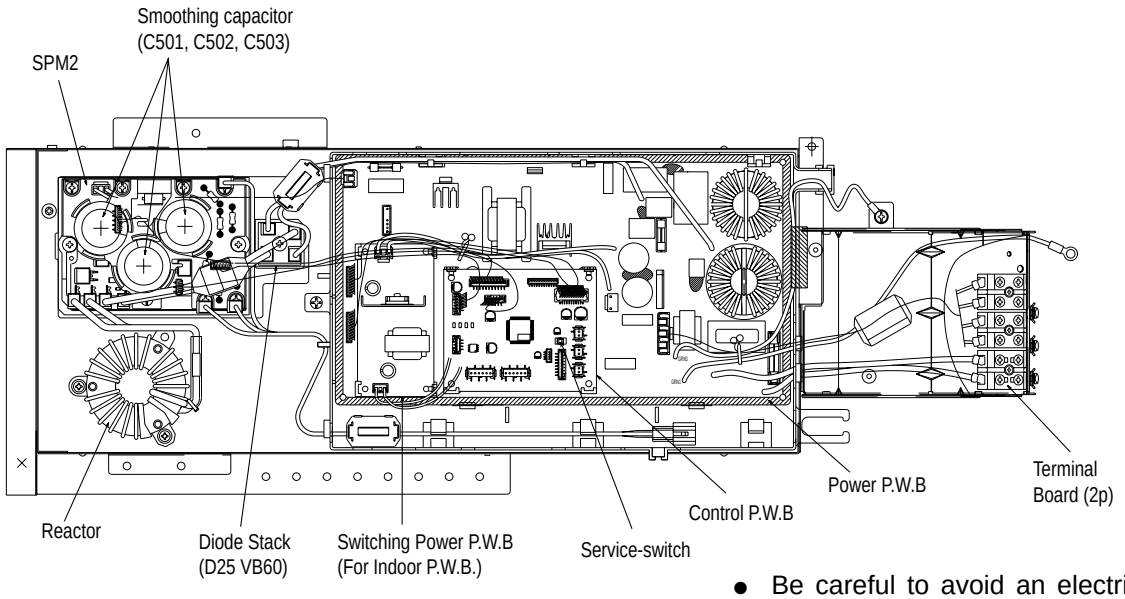


Fig. 1-3

(Approx. 330 or 360V during operation)



- Be careful to avoid an electric shock as a high voltage is generated. Also take care not to cause a short-circuit through incorrect connection of test equipment terminals. The circuit board could be damaged.

(4) Smoothing capacitor (C020, C021)

This smoothes (averages) the voltage rectified by the diode stacks.

A DC voltage is generated in the same way as in Fig. 1-3. Voltage between ⊕ side of C020 and ⊖ side of C021 is about 330V.

(5) C001 to C005, NF COIL 1
There absorb electrical noise generated during operation of compressor, and also absorb external noise entering from power line to protect eletronic parts.

(6) Sugar absorber, varistor 1,2,3
These absorbs external power surge.

(7) Inrush protective resistor (R002, R003)
This works to protect from overcurrent when power is turned on.

✵ Be sure to ground outdoor unit.
If not grounded, noise filter circuit does not operate correctly.

✵ If outdoor unit is not grounded, “sugar absorber”, “varistors 1 and 3” do not operate.
Be sure to perform grounding.

<Reference>
When inrush protective resistor is defective, diode stack may malfunction. As a result, DC voltage is not generated and no operation can be done. In this case, 3A fuse may have been blown.

2. Indoor/Outdoor Interface Circuit

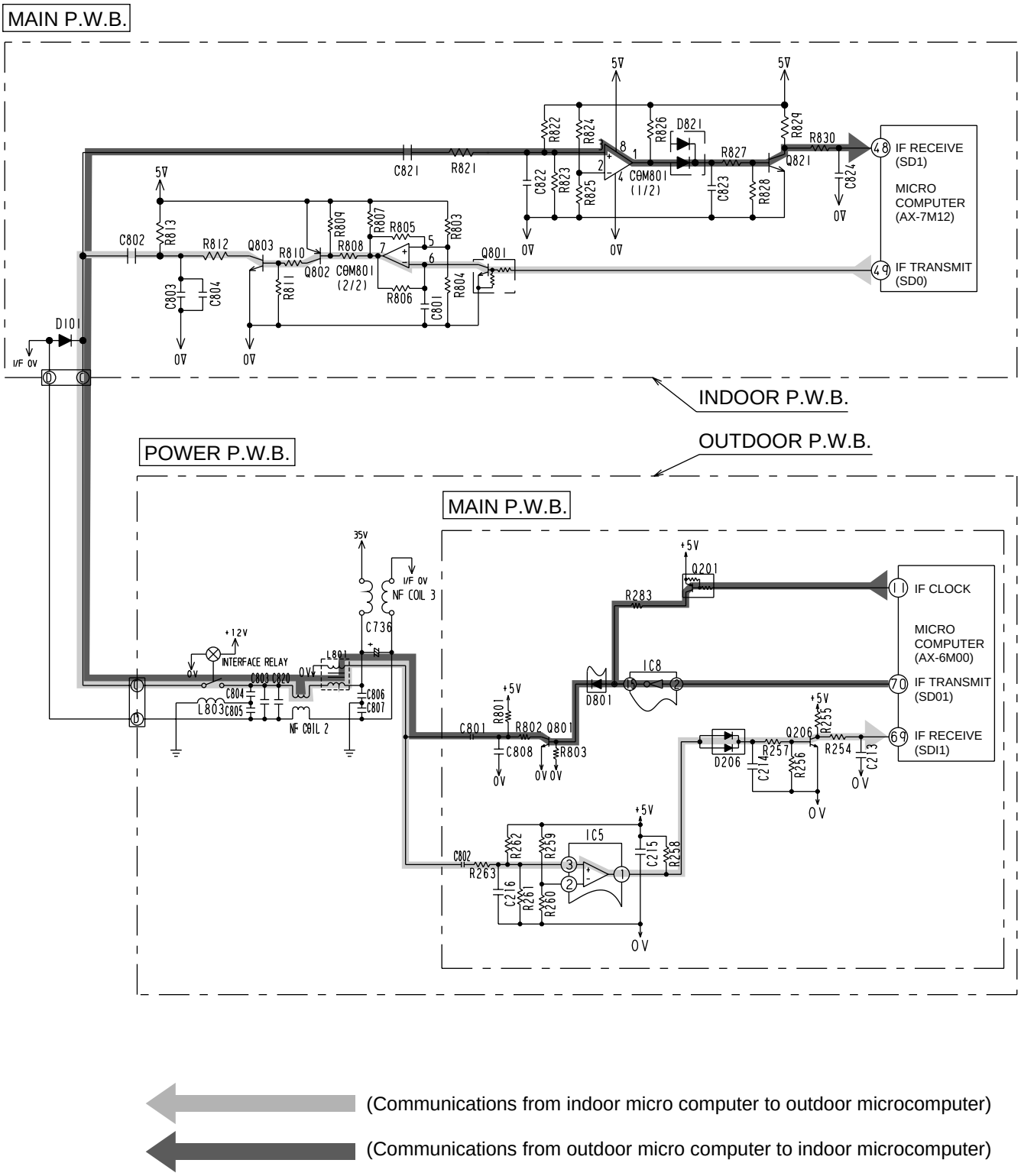
- The interface circuit superimposes an interface signal on the 35V DC line supplied from the outdoor unit to perform communications between indoor and outdoor units. This circuit consists of a transmiting circuit which superimposes an interface signal transmit from the micro computer on the 35V DC line and a transmiting circuit which detects the interface signal on the 35V DC line and outputs it to the micro computer.
- Communications are performed by mutually transmiting and receiving the 4-frame outdoor request signal one frame of which consists of a leader of approx. 100 ms., start bit, 8-bit data and stop bit and the command signal with the same format transmit from the indoor unit.
- From outdoor microcomputer to indoor microcomputer
  The request signal output from microcomputer pins ⑫ is input to the transmitting circuit. The transmitting circuit outputs an approx. 38kHz high-frequency signal via pin ⑪and continues the output intermittently according to the request signal. This high-frequency signal is amplified by a transistor, superimposed on the DC 35V line via C801, C811 and L801, L802 and supplied to the indoor unit.

  To prevent erroneous reception, the outdoor microcomputer is designed so that it cannot receive a signal while it is outputting a request signal,

  The receiving circuit in the indoor unit consists of a comparator and transistor. The interface signal from the outdoor unit on the DC 35V line is supplied to C821, where DC components are eliminated, and is then shaped by the comparator. The shaped signal is detected by diode, amplified by amp, and supplied to receiving ㊽ input of the indoor microcomputer.

  Fig. 2-2 shows the voltages at each component when data is trnsferred from the outdoor microcomputer to the indoor microcomputer.
- Indoor micro computer to outdoor micro computer
  The communications from the indoor micro computer to the outdoor micro computer are the same. Fig. 2-3 shows the voltages and waveforms at each circuit.

- Fig. 2-1 shows the interface circuit used for the indoor and outdoor micro computers to communicate with each other.



(Communications from indoor micro computer to outdoor microcomputer)

(Communications from outdoor micro computer to indoor microcomputer)

Fig. 2-1 Indoor / outdoor interface Circuit

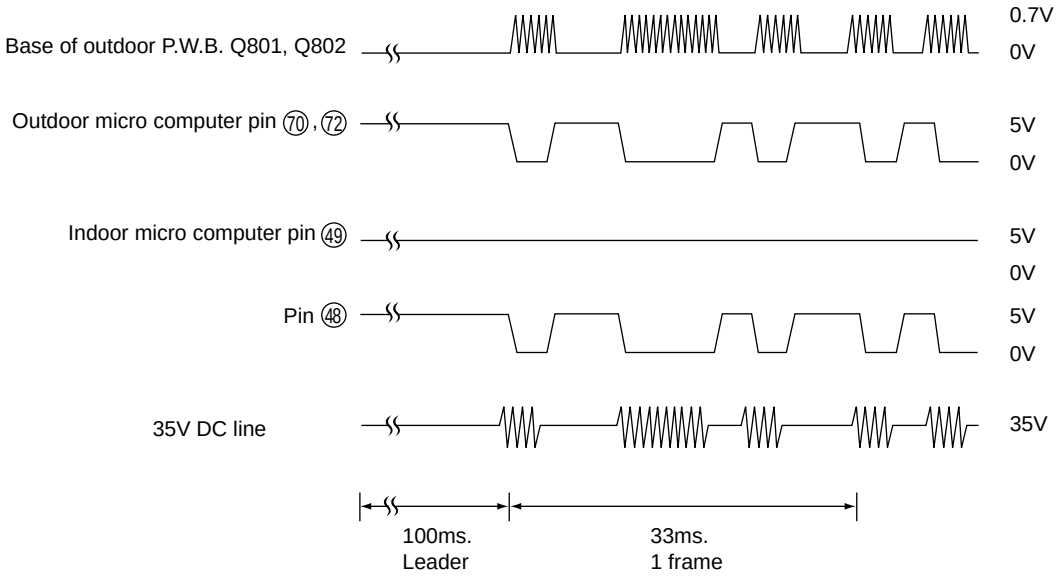


Fig. 2-2 Voltages Waveforms of indoor / Outdoor Micro computers (Outdoor to Indoor Communications)

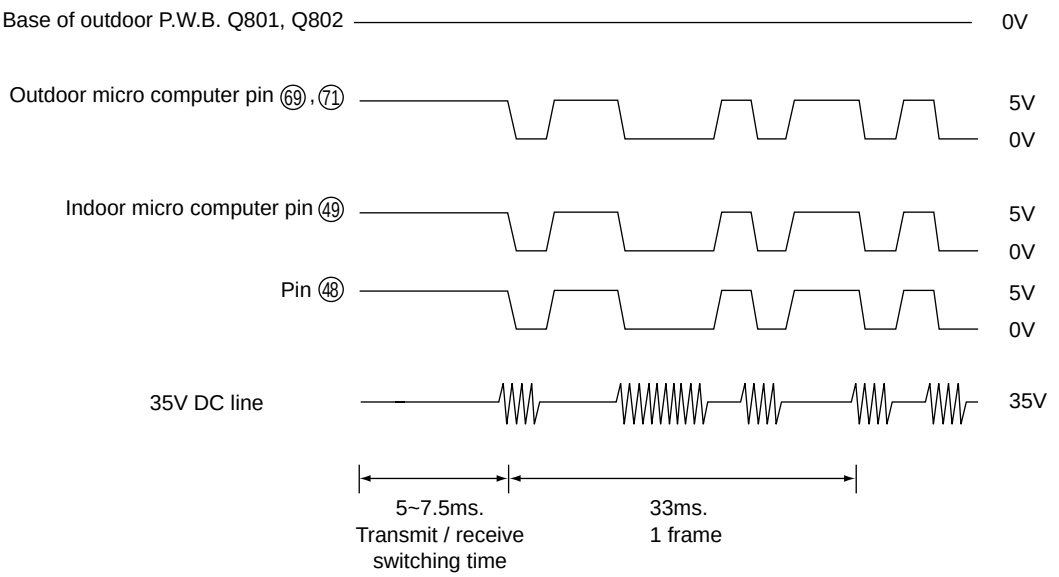


Fig. 2-3 Voltages Waveforms of indoor / Outdoor Micro computers (Indoor to Outdoor Communications)

- Fig. 3-1 shows the system power module and its peripheral circuit. (Current ACT module and power module are combined into one unit.) The three transistors on the positive ⊕ side are called the upper arm, and the three transistors on the negative ⊖ side, the lower arm.

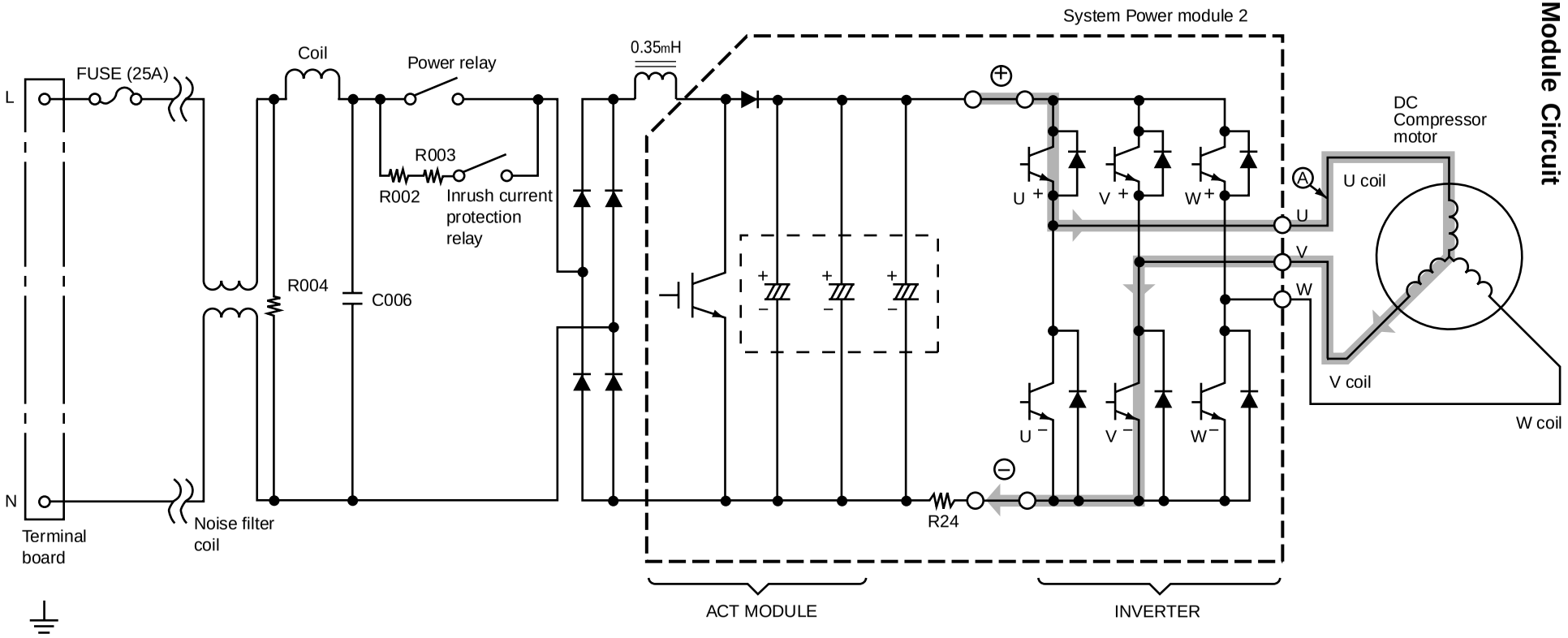


Fig. 3-1 System power module circuit (U^{+} is ON, V^{-} is ON)

- DC 260-360V is input to power module and power module switches power supply current according to rotation position of magnet rotor. The switching order is as shown in Fig. 3-2.

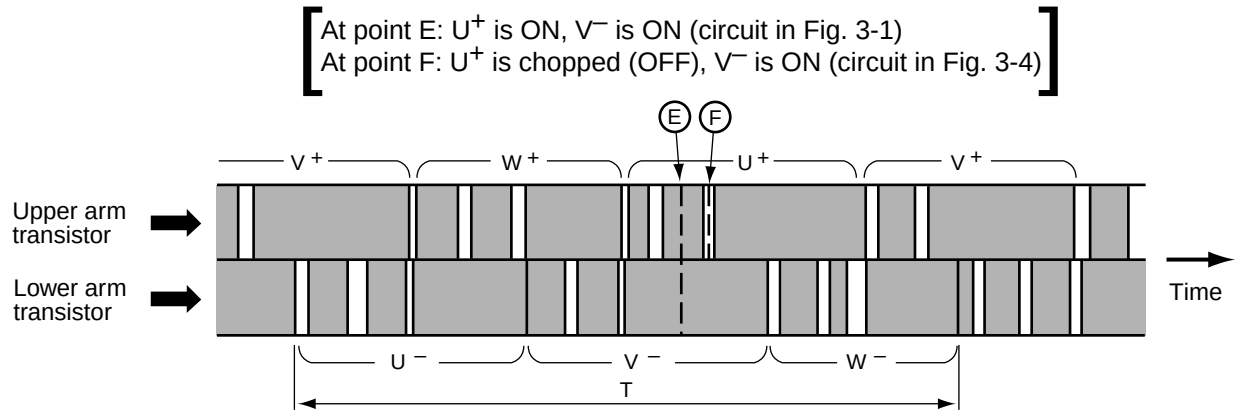


Fig. 3-2 Switching order of power module

- Upper arm transistor is controlled to ON/OFF by 3.2kHz chopper signal. Rotation speed of the compress is proportional to duty ratio (ON time/ ON time + OFF time) of this chopper signal.
- Time T in Fig. 3-2 shows the switching period, and relation with rotation speed (N) of the compressor is shown by formula below;

$$N = 60/2 \times 1/T$$

- Fig. 3-3 shows voltage/current waveform at each point shown in Figs. 3-1 and 3-4. First half of upper arm is chopper, second half is ON, and first half of lower arm is chopper, second half is ON.

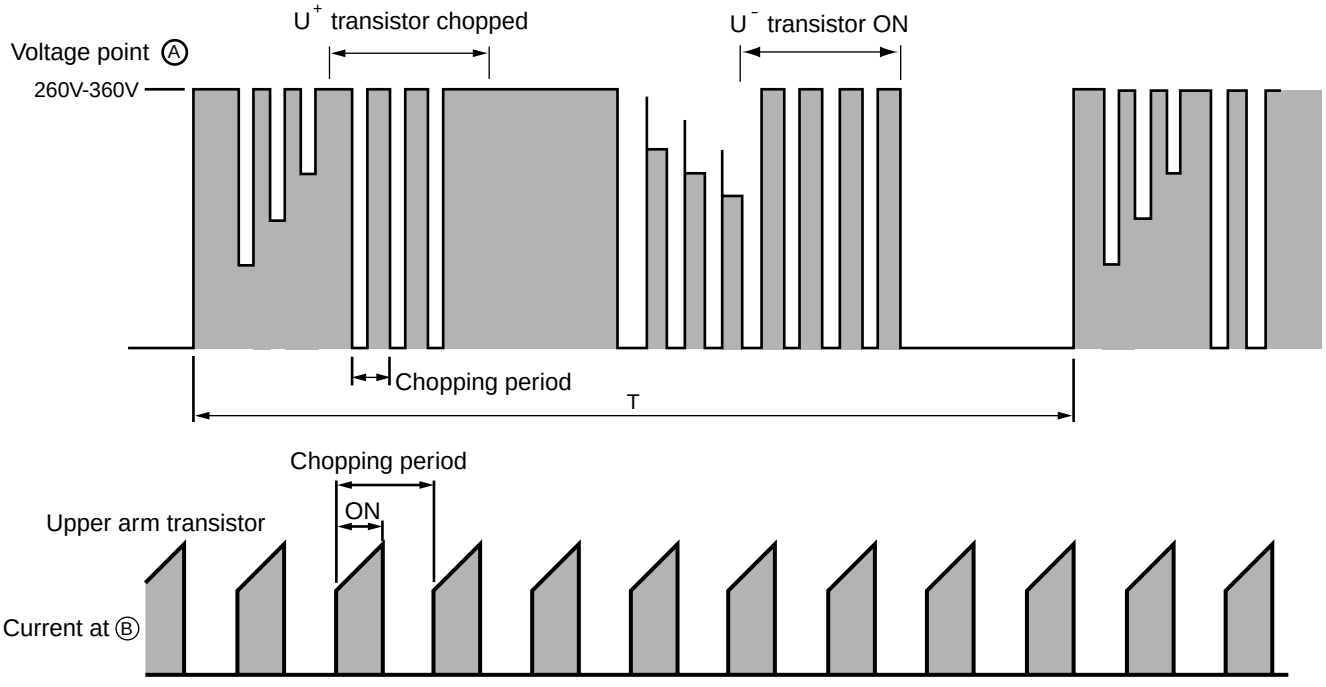


Fig. 3-3 Voltage waveform at each point

- When power is supplied $U^+ \rightarrow U^-$, because of that U^+ is chopped, current flows as shown below; Ⓑ
  (1) When U^+ transistor is ON: U^+ transistor → U coil → V coil → V^- transistor → DC current detection resistor → Point Ⓑ (Fig. 3-1)
  (2) When U^+ transistor is OFF: (by inductance of motor coil) U coil → V coil → V^- transistor → Return diode → Point Ⓐ (Fig. 3-4)

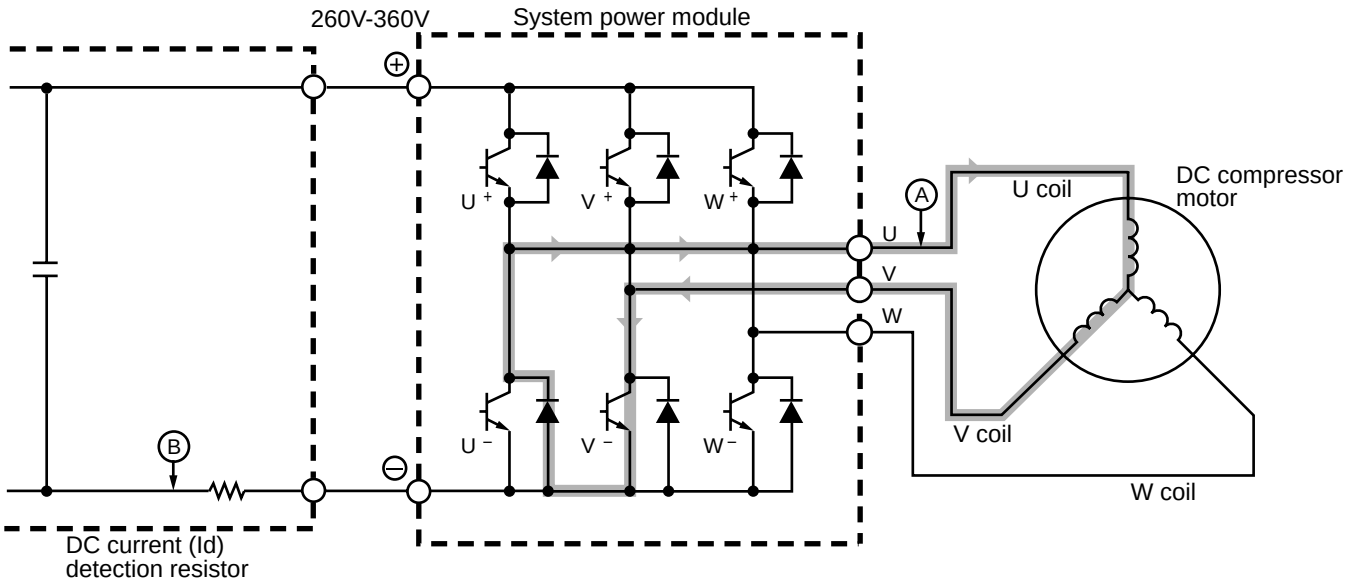


Fig. 3-4 System power module circuit (U^+ is ON, V^- is ON)

- Since current flows at point Ⓑ only when U+ transistor is ON, the current waveform at point Ⓑ becomes intermittent waveform as shown in Fig. 3-3. Since current at point Ⓑ is approximately proportional to the input current of the air conditioner, input current is controlled by using DC current (Id) detection resistor.

<Reference>

If power module is detective, self diagnosis lamps on the control P.W.B. may indicate as shown below:

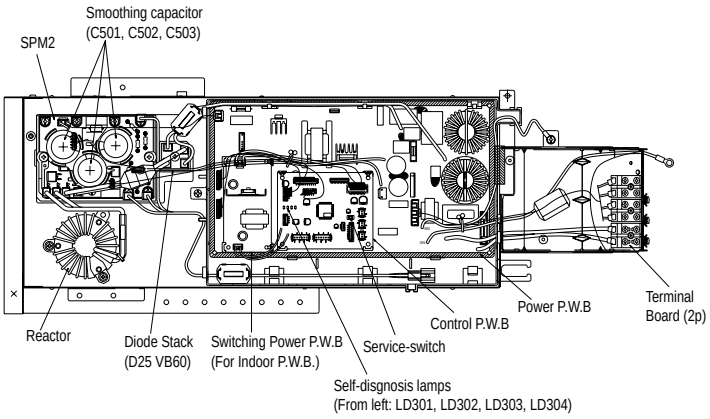


Table 3-1

Self-diagnosis	Self-diagnosis lamp and mode	
Ip (peak current cut)	LD301	Blinks 2 times
Abnormal low speed rotation	LD301	Blinks 3 times
Switching incomplete	LD301	Blinks 4 times

❋ From results of power module simple inspection (inspection mode when operated with compressor lead disconnected), LD310 blinks four times about 2 seconds later: Unit has not entered the normal operation.

4. Power Circuit for P.W.B.

- Fig. 4-1 shows the power circuit for P.W.B.

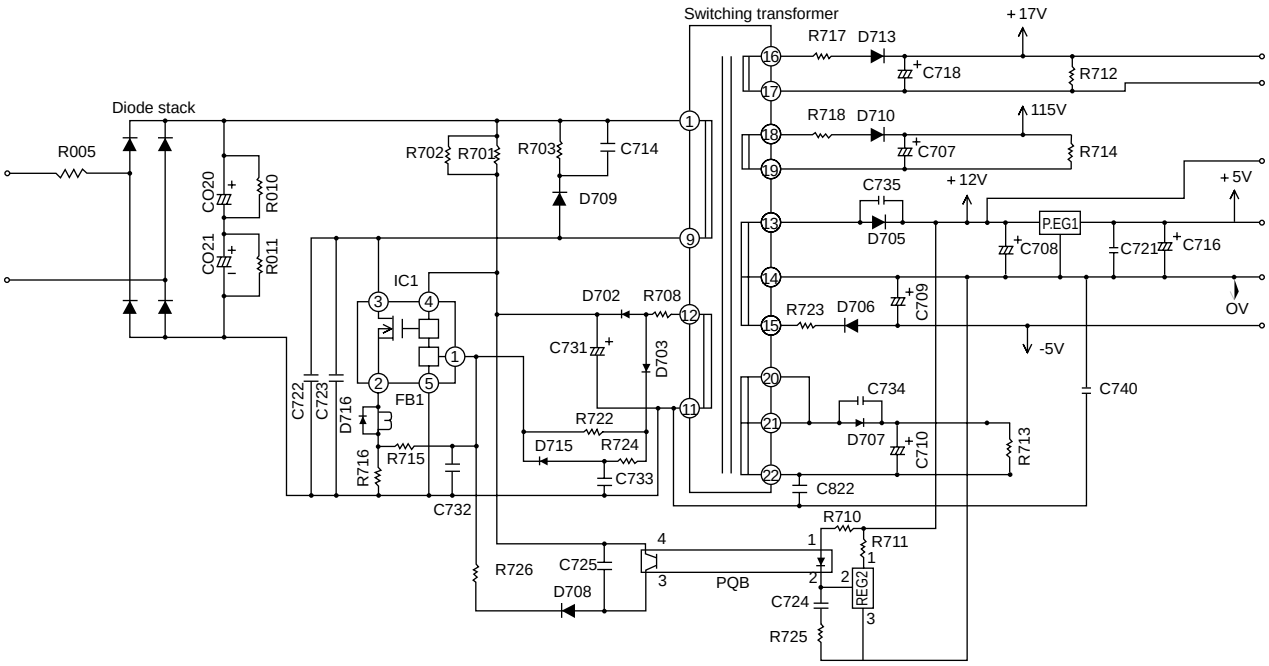


Fig. 4-1 Power circuit for P.W.B.

- In the power circuit for P.W.B., power voltage for microcomputer, peripheral circuits, and system power module drive and, as well as DC35V, are produced by switching power circuit.
- Switching power circuit performs voltage conversion effectively by switching transistor IC1 to convert DC330V voltage to high frequency of about 20kHz to 200kHz.
- Transistor IC1 operates as follows:

(1) Shifting from OFF to ON

- DC about 330V is applied from smoothing capacitors C020 ⊕ andC021 ⊖ in the control power circuit. With this power, current flows to pin ④ of IC1 via R701 and R702 and IC1 starts to tum ON. Since voltage in the direction of arrow generates at pin ⑫ of Switching Transforwer at the same time, current passing through R708 and D702 is positive-fed back to IC1.

(2) During ON

- The drain current at IC1 increases linearly. During this period, the gate voltage and current become constant because of the saturation characteristics of the transformer.

(3) Shifting from ON to OFF

- This circuit applies a negative feedback signal from the 12V output. When the voltage across C708 reaches the specified value, REG2 turns on and current flows to PQ8 ①-②. This turns the secondary circuits on, sets IC1 pin ① to "Hi", and turns IC1 off.

(4) During OFF

- While IC1 is on, the following energy charges the primary windings of the transformer:

  Energy=$LI^2/2$. Here, L : Primary inductance

  I : Current when IC1 is off

  This energy discharges to the secondary windings during power off. That is, C707-C710, C718 is charged according to the turn ratio of each winding.
- At the start, an overcurrent flows to IC1 because of the charged current at C707-C710, C718.
- The drain current at IC1 generates a voltage across R716. If it exceeds the IC1 base voltage, it sets the IC gate voltage to "HI".
- R716 limits the gate voltage to prevent excessive collector current from flowing to IC1.
- This SW power circuit uses a frequency as low as 20kHz, especially at a low load (when both the indoor and outdoor units stop): This reduces power loss in standby status.

<Reference>

If the power circuit for P.W.B. seems to be faulty:

(1) Make sure that 5V, 12V, 15V, 17V and -5V on the control P.W.B. power voltage are the specified values.

(2) When only the 5V output is low:
REG 1 (regulator) faulty, 5V-0V shorted, output is too high, or REG 1 is abnormal.

(3) When 12V and 5V are abnormal:
The following defects can be considered:
① Fan, operation, power, rush prevention relay (shorting in relay, etc.)
② REG 1 (regulator is abnormal), etc.
Shorting on primary circuits.
When shorting occurs in the secondary circuits, there is no abnormality in the primary circuits because of overcurrent protection.
The voltage rises when an opening occurs in the primary circuits, or the feedback system is abnormal.

(4) When 15V/17V power supply is abnormal:
D710, D713 or drive circuit is abnormal.

(5) When all voltage are abnormal:
IC1, R716, may possibly be defective. Also D cable may possibly be reverse connected.

❋ If IC1 is abnormal, be aware that other components, such as the power module, REG (regulator), etc. are possibly defective.

[When the switching power supply seems to be abnormal, the voltage between IC1 pin ④ (to be measured at the leads of R202 and R201) and IC1 pin ⑤ (to be measured at R216 lead) may be between 11 and 16V. This is because the protection circuit of IC1 is operating.]

5. Reversing valve control circuit

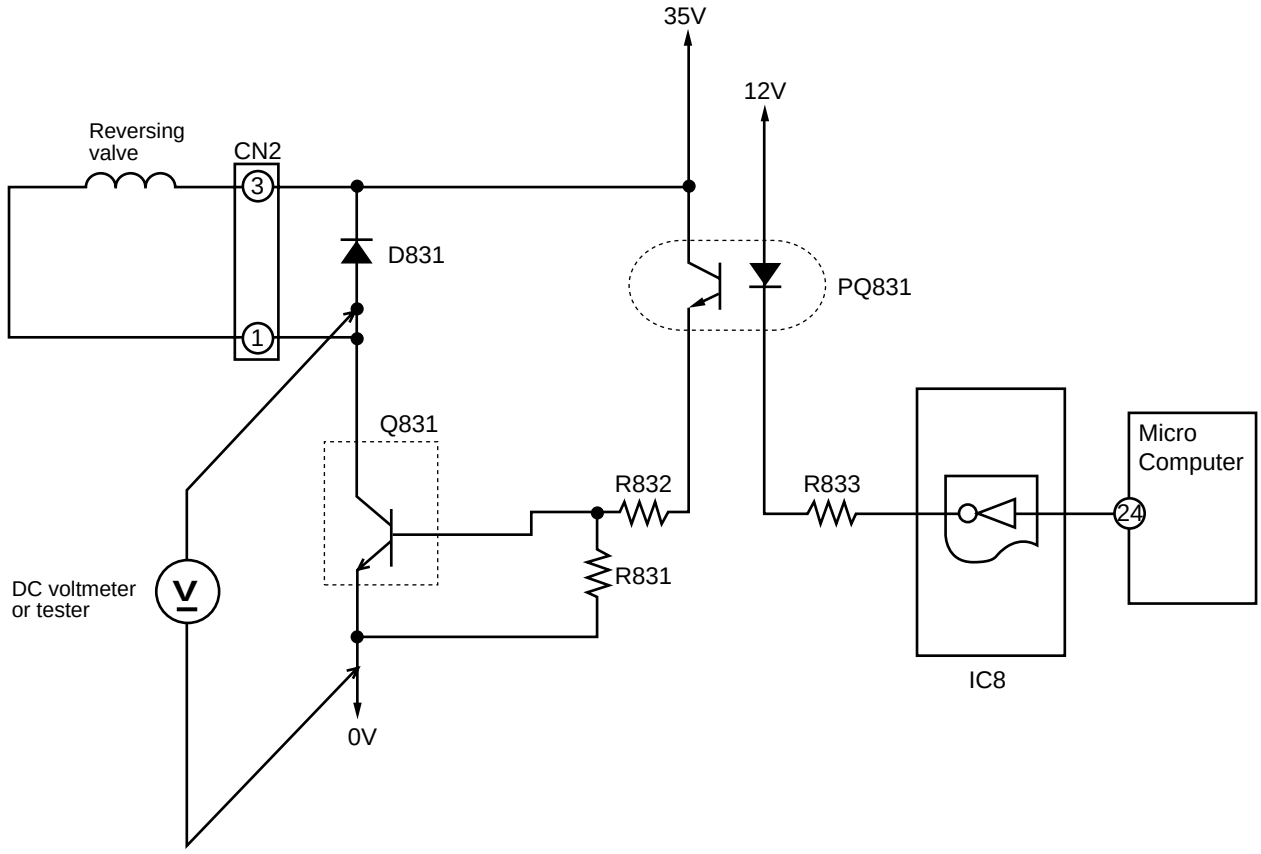


Fig. 5 1

- By reversing valve control circuit you can switch reversing valve ON/OFF (Heating ON) according to instruction from indoor microcomputer and depending on operation condition.

  Voltage at each point in each operation condition is approximately as shown below when measured by tester. (When collector voltage of Q831 is measured)

Table 5-1

Operation condition		Collector voltage of Q831
Cooling	General operation of Cooling	About 35V
Heating	In normal heating operation	About 0.8V
	MAX. rotation speed instructed by indoor microcomputer after defrost is completed	About 0.8V
	Defrosting	About 35V
Dehumidifying	Sensor dry	About 35V

6. Rotor magnetic pole position detection circuit

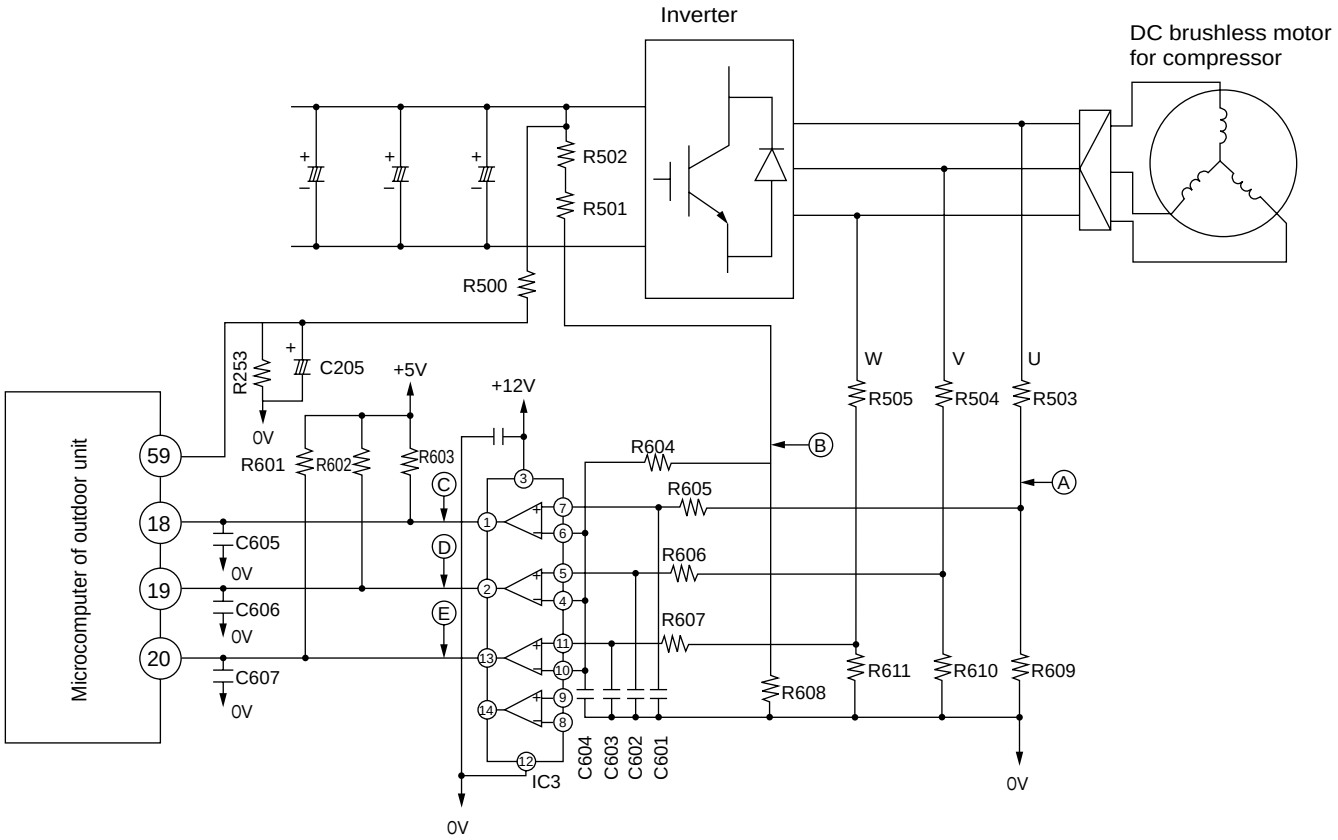


Fig. 6-1 Rotor magnetic pole position detection circuit

When the DC brushless motor is rotated, it also operates as power generator, generating reverse electromotive force according to number of rotations. This reverse electromotive force is voltage-divided by R503-R505 and R604-R011, and appears as point Ⓐ voltage. IC3 compares and digitalizes point Ⓐ voltage with point Ⓑ voltage (in which DC voltage (Vd) is voltage-divided by R501, R502 and R608), and inputs this to microcomputer as position detection signals for points Ⓒ, Ⓓ and Ⓔ. Microcomputer switches inverter using optimum timing based on position detection signals, in order to control the rotation of the brushless motor.

7. Peripheral circuits of microcomputer

- Fig. 7-1 shows the microcomputer and its peripheral circuits.
  Table 7-1, the basic operations of each circuit block and Fig. 7-2, the system configuration.

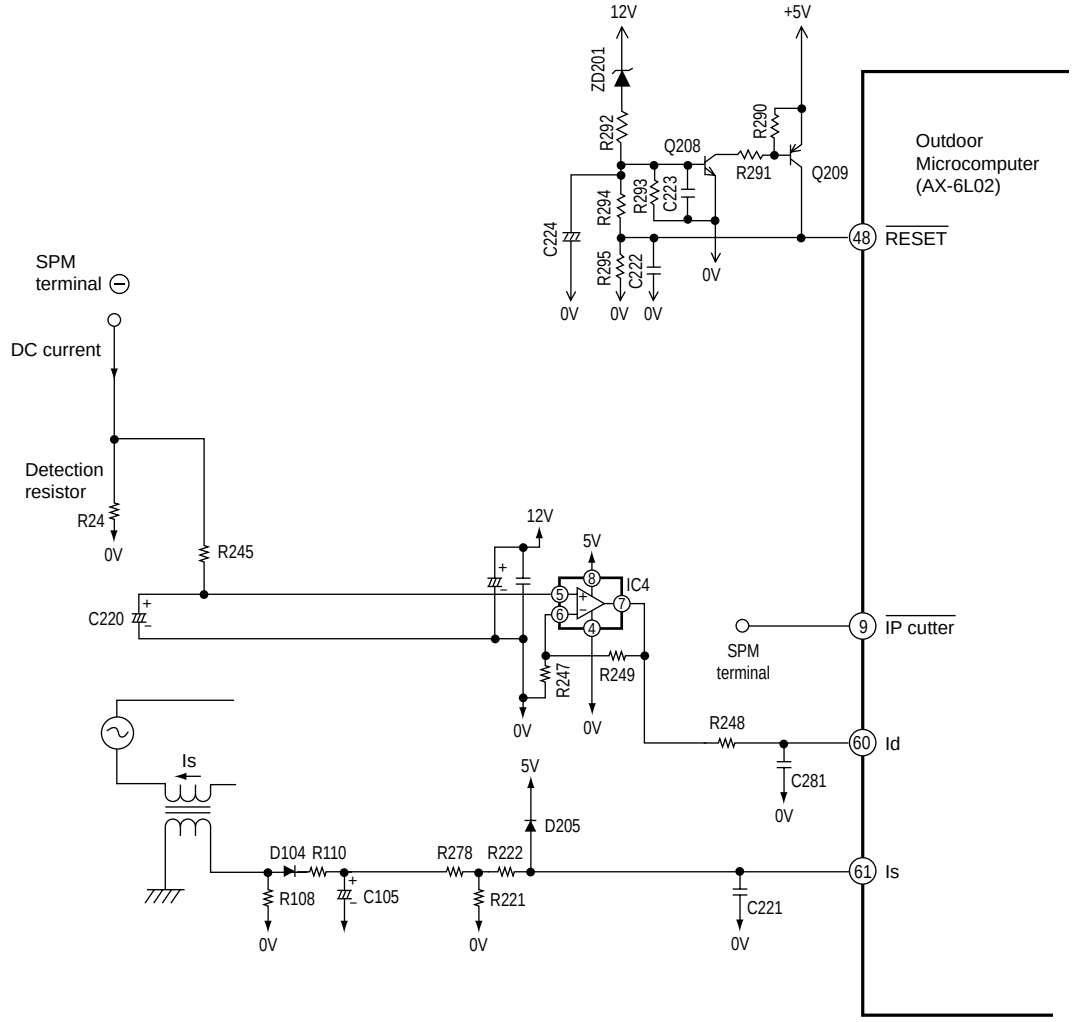


Fig. 7-1 Peripheral circuit of microcomputer (AX-6M00)

Table 7-1

Circuit block	Basic operation
Peak current cut off circuit	This circuit detects DC current flowing to power module: When over-current (instantaneous value) flows, it stops upper and lower arm drive circuits and also produces lp signal to stop microcomputer.
Overload external judgment circuit	This circuit detects DC current flowing to power module and produces signal to notify microcomputer of overload status.
Voltage amplifier circuit	This circuit voltage-amplifies DC cuccrent level detected by detection resistor and sends it to microcomputer. In addition, setting of internal/external overload judgment is performed.
Reset circuit	This circuit produces reset voltage.

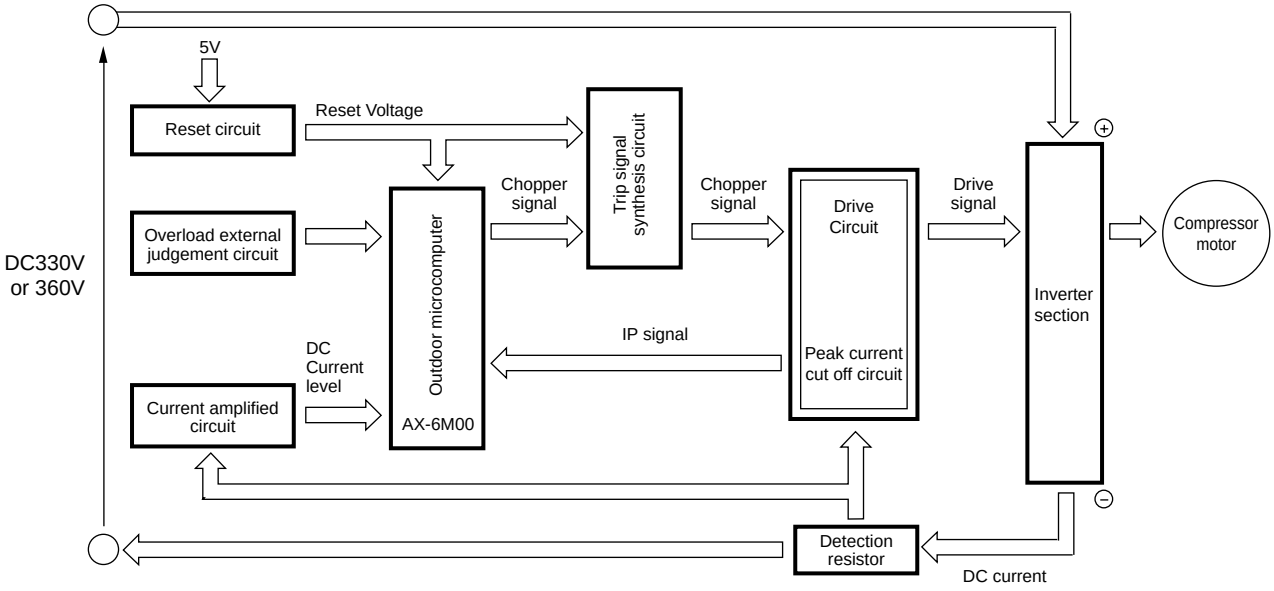


Fig. 7-2

- The following gives details of operation for each circuit:

7-1. Peak current cut off circuit
Fig.7-3 shows peak current cut off circuit and waveforms at each point.

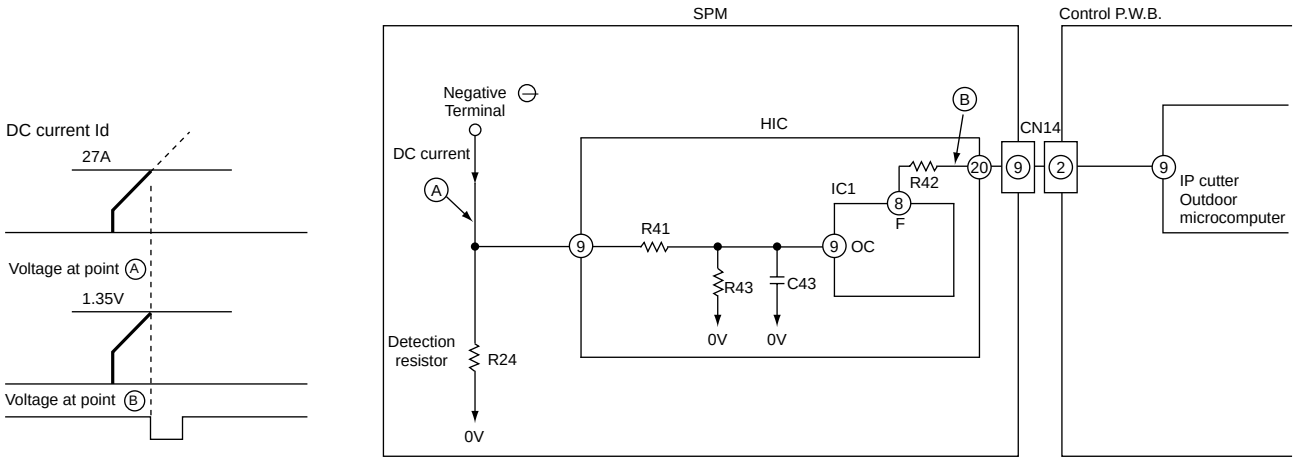


Fig.7-3

- Ip cut circuit detects instantaneous surge current and stops inverter to protect components such as SPM.
- As shown in diagram, when current exceeding 24A flows, voltage at point Ⓐ detected by detection resistor is input to pin ⑨ of INV-HIC, and voltage divided by R41 and R43 is input to pin ⑨ of IC1. Since this voltage exceeds threshold of IC1, LO is output from pin ⑧ (voltage at point Ⓑ). When LO is input to pin ⑨ of microcomputer, microcomputer stops drive output.
- When drive output of microcomputer stops, all drive outputs are set to HI, and IC1 of HIC is initialized to enter drive signal waiting status. Microcomputer again outputs drive signal 3 minutes later to re-start operation.

8. Overload control circuit (OVL control)

- Overload control decelerates speed of compressor reducing load when the load to protect compressor, electronics parts and power breaker, when operation enters overload status due to increase of load for room temperature adjustment.
- To judge overload, DC current and set value are compared.
- Fig. 8-1 shows the overload control system configuration and Fig. 8-2 shows characteristic diagram of overload judgement values. There are two judgements. One is external judgment: External set value and DC current value are compared for judgment regardless of rotation speed. The other is internal judgment: set value varying according to rotation speed programmed in microcomputer is compared with DC current value for judgment.

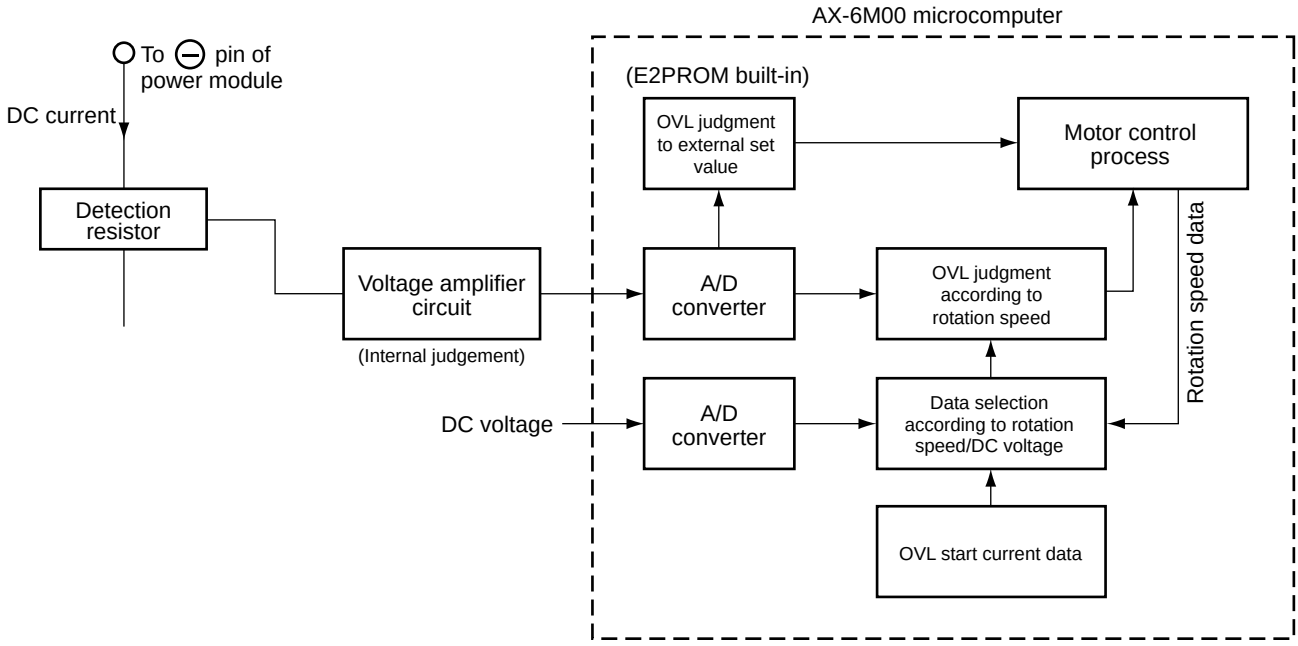


Fig. 8-1 Overload Control System Configuration

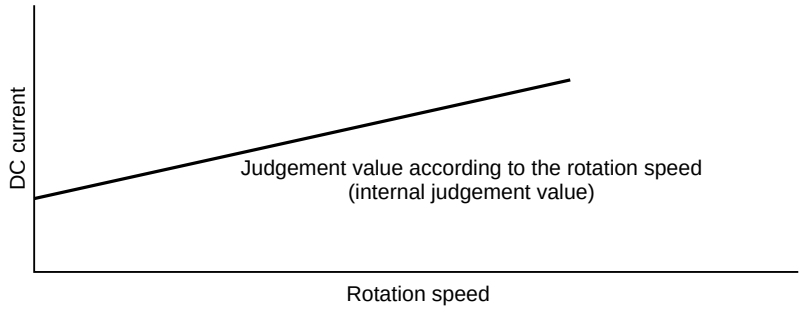


Fig. 8-2

(1) Overload external judgement circuit

- Voltage generated from current flowing in shunt R is balanced by R245 and C220 and input to pin ⑤ of IC4. Then voltage-amplified value is input to pin ⑥⓪ of microcomputer to compare with internal data of EEPROM. When values correspond, microcomputer enters overload control.
- Fig. 8-4 shows the rotation speed control. When value at pin ⑥⓪ of microcomputer exceeds set value, rotation speed of compressor decelerates to reduce load regardless of rotation speed commanded from indoor unit.

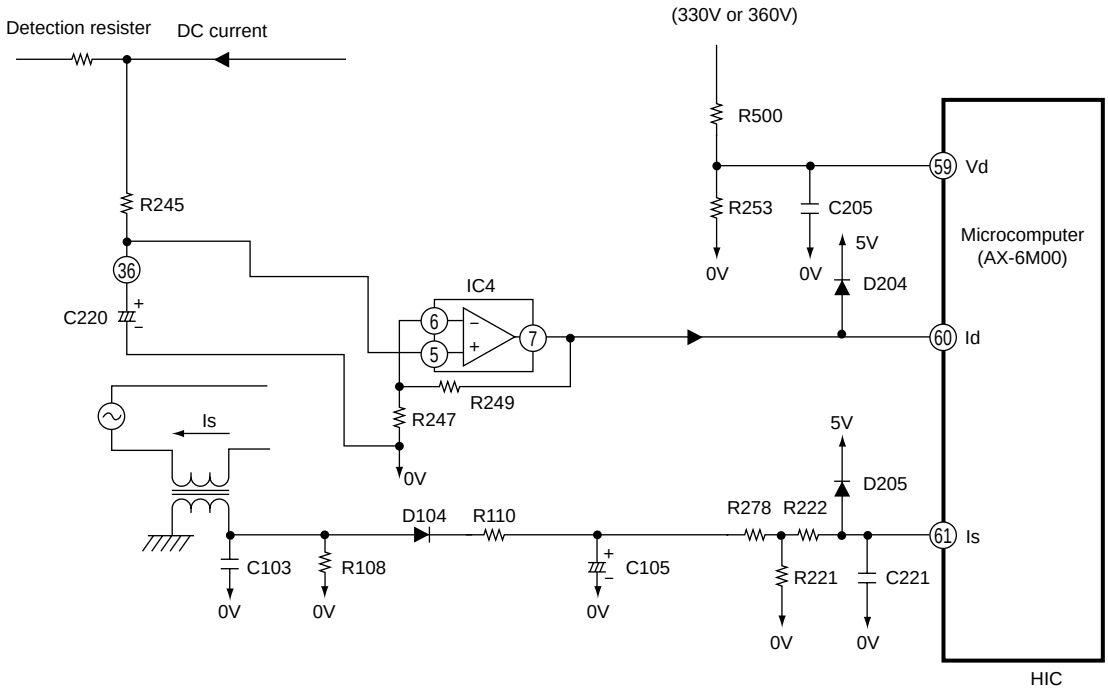


Fig. 8-3

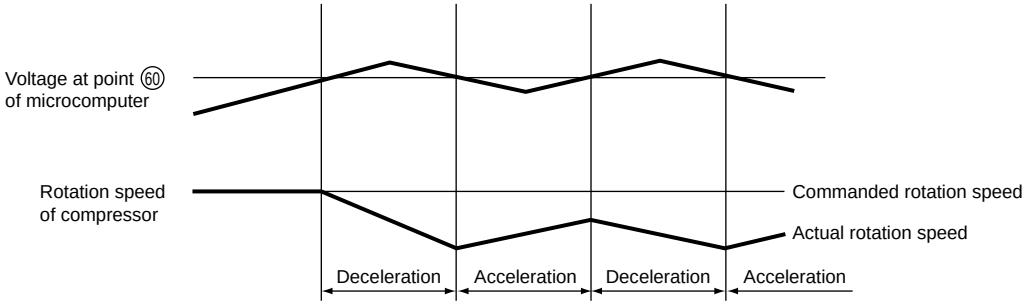


Fig. 8-4

(2) Voltage amplifier circuit

- Voltage amplifier circuit voltage-amplified DC current level detected by converting to voltage using detection resistor and sends this to microcomputer. Microcomputer A/D-converts it and then compares with internal data to judge over-load control.

[During overload control]

- Voltage generated from DC current flowing to detection resistor is balanced by resisitor R245 and C220, then input to pin ⑤ of IC4. IC4 composes non-inverting amplifies, combined with peripheral components.
- As shown in Fig. 8-5, a value varying according to rotation speed is programmed in microcomputer: When DC current value exceeds this set value, overload control is set. Control of compressor motor is the same as that in external judgment.
- Set value is determined by amplification rate of voltage amplifier circuit programmed by software.
  Amplification rate: High → DC current : Low
  Amplification rate: Low → DC current: High

- R500 and R253 detect DC current in current circuit. Microcomputer compensates for overload set value so that the following is obtained:

  { DC voltage: High → DC current: Low
  { DC voltage: Low → DC current: High

  (Since load level is expressed by DC voltage x DC current, this is intended to perform the same load judgment even when voltage varies.)

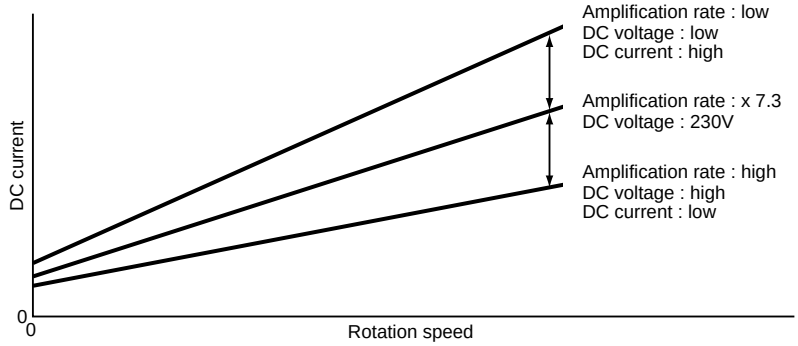


Fig. 8-5

[When starting current control]

- It is necessary to keep starting current (DC current) fixed to ensure smooth starting of DC motor for compressor.
- For RAM-50CNHZ2, starting current control is performed by software.
- Starting current will change reflect to change in power voltage. The control system deals with change in voltage as shown below.
  (1) As shown in Fig. 8-6, U^+ and V^- transistors on power module are turned on to apply current to winding of motor.
  (2) As shown in Fig. 8-7, ON time of W^+ transistor changes according to DC voltage level so that starting current is about 10A.

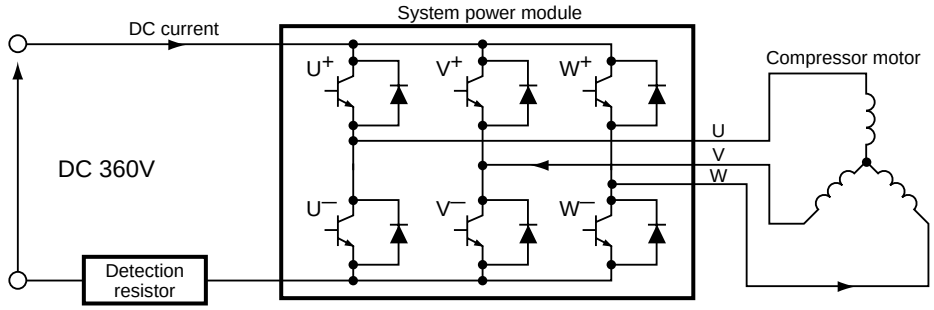


Fig. 8-6

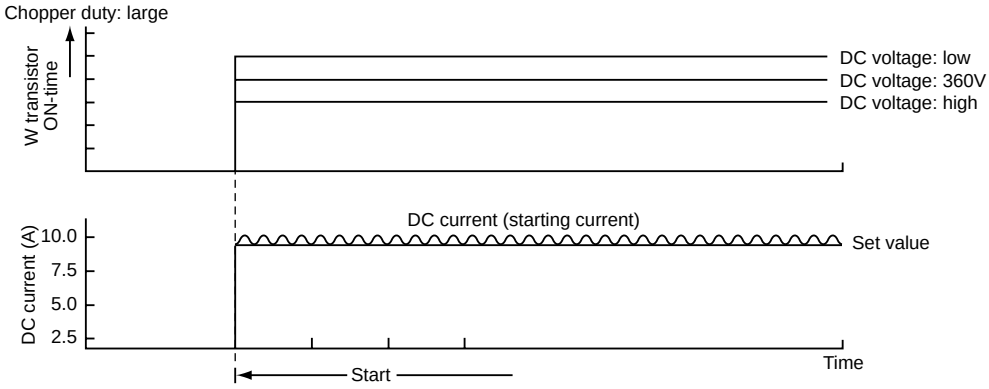


Fig. 8-7

9. Reset Circuit

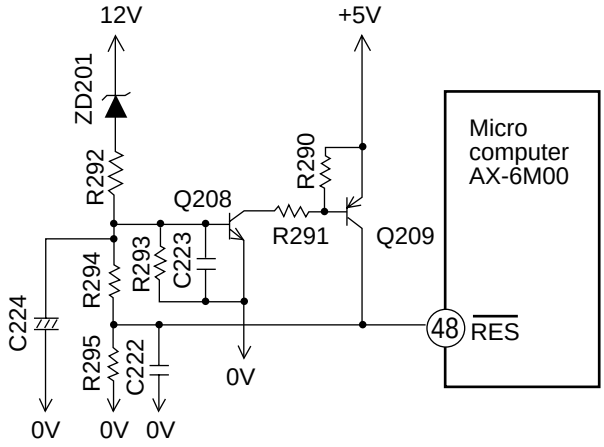


Fig. 9-1

- Reset circuit performs initial setting of microcomputer program when power is turned on.
- Microcomputer resets program with reset voltage set to Lo, to enable operation at Hi level.
- Fig. 9-1 shows the reset circuit, and Fig. 9-2 shows waveforms at each point when power is turned on/off.
- After power is turned on, 12V line and 5V line voltages rise: When 12V line voltage reaches 7.2V (Zener voltage of ZD201), ZD201 turns ON and Q208 and Q209 turn on, and reset voltage becomes Hi. Reset voltage is not set to Hi until VDD of microcomputer rises to 5V, enabling operation, due to ZD201.
- After power turns off, when 12V line voltage drops, ZD201 also turns OFF. However, Q208 is left ON since reset voltage is fed back by R294, until 12V line drops to about 7.6V. This prevents chattering of reset voltage due to voltage chnge in 12V line.

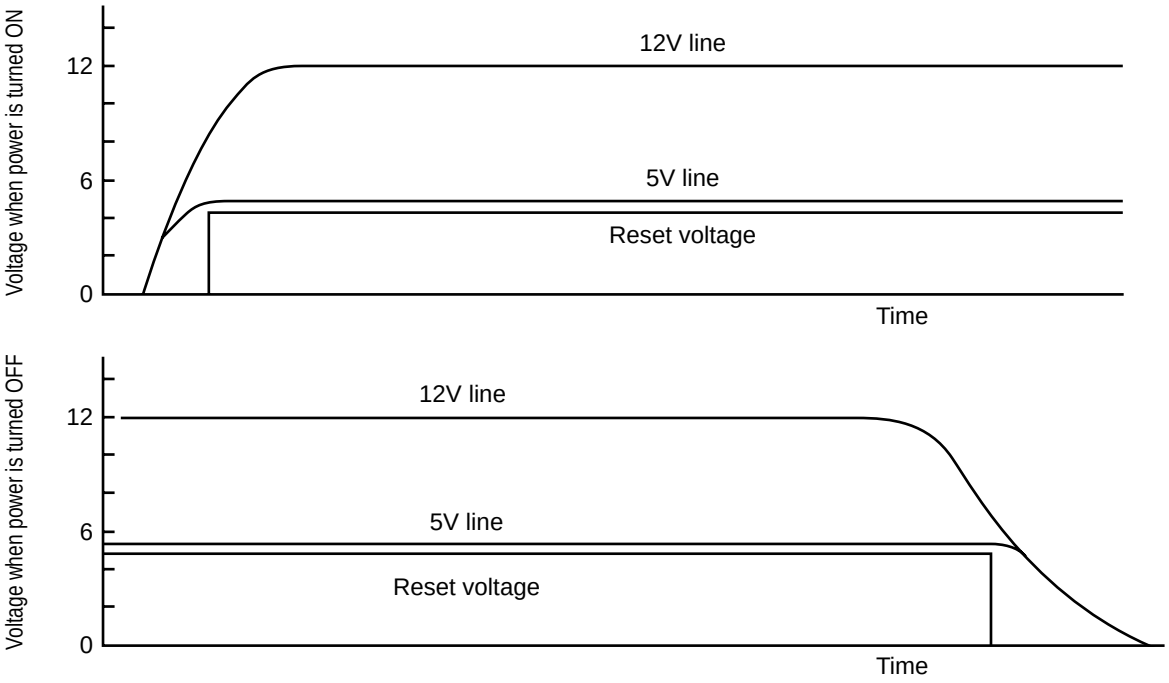


Fig. 9-2

10. Temperature Detection Circuit

HIC

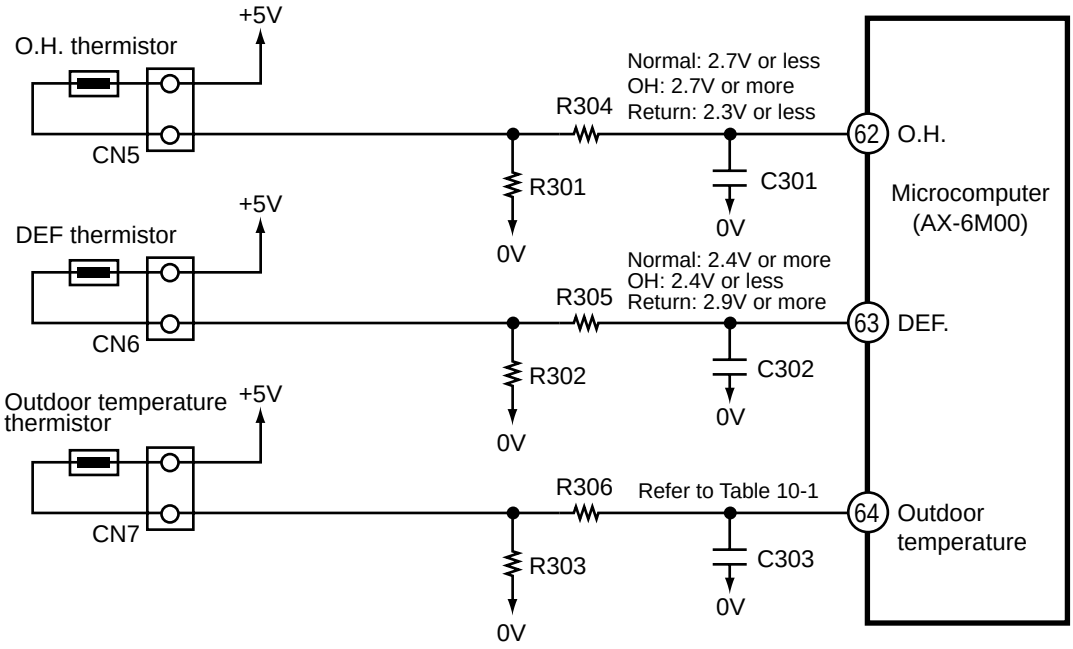


Fig. 10-1

- Compressor head surface temperature is detected by OH thermistor circuit, defrost operation temperature is detected by DEF thermistor circuit, and outdoor temperature is detected by outdoor temperature thermistor circuit.
- Thermistor is a negative resistance element with the following characteristic: Resistance falls when temperature rises, and increases when temperature falls.
- When compressor is over-heated, resistance of OH thermistor decreases and voltage at pin ⑫ of microcomputer rises.
- Voltage at pin ⑫ of microcomputer is compared with set value stored inside: If voltage exceeds set value, microcomputer judges over-heating and stops operation.
- If outdoor heat exchanger is frosted, heat exchanger temperature will rapidly drop. In response, resistance of DEF thermistor increases and voltage at pin ⑬ of microcomputer falls. When the voltage flls under the set value, microcomputr enters defrost control mode.
- During defrost operation, microcomputer transfers indoor unit defrost condition command from IF transmision output at SDO pin of interface (pin ⑳ and ㉒ of microcomputer).
- Outdoor temperature is always read in (voltage at pin ⑭ of microcomputer) by outdoor temperature thermistor, and then transferred to indoor unit side. According to this value, compressor rotation speed control and operation selection (outdoor fan ON/OFF, etc.) in dehumidifying mode are performed.

Represented values of the relationship between outdoor temperature and voltage are shown below.

Table 10-1

Outdoor temperature (°C)	-10	0	10	20	30	40
Voltage at pin ① of CN7 (V)	1.19	1.69	2.23	2.75	3.22	3.62

(Reference)

When thermistor is open or heat is shut off, pins ⑫ to ⑭ of microcomputer are set to about 0 V; when thermistor is short-circuited, pins ⑫ to ⑭ of microcomputer are set to about 5V, and LD301 blinks 7 times. However, OH thermistor detects only short-circuit as error: It will enter a blink mode after 12 minutes or more has elapsed from the start of compressor operation.

11.Drive circuit

Fig. 11-1 shows the drive circuit.
The circuits for U phase, V phase and W phase have the same Configuration.

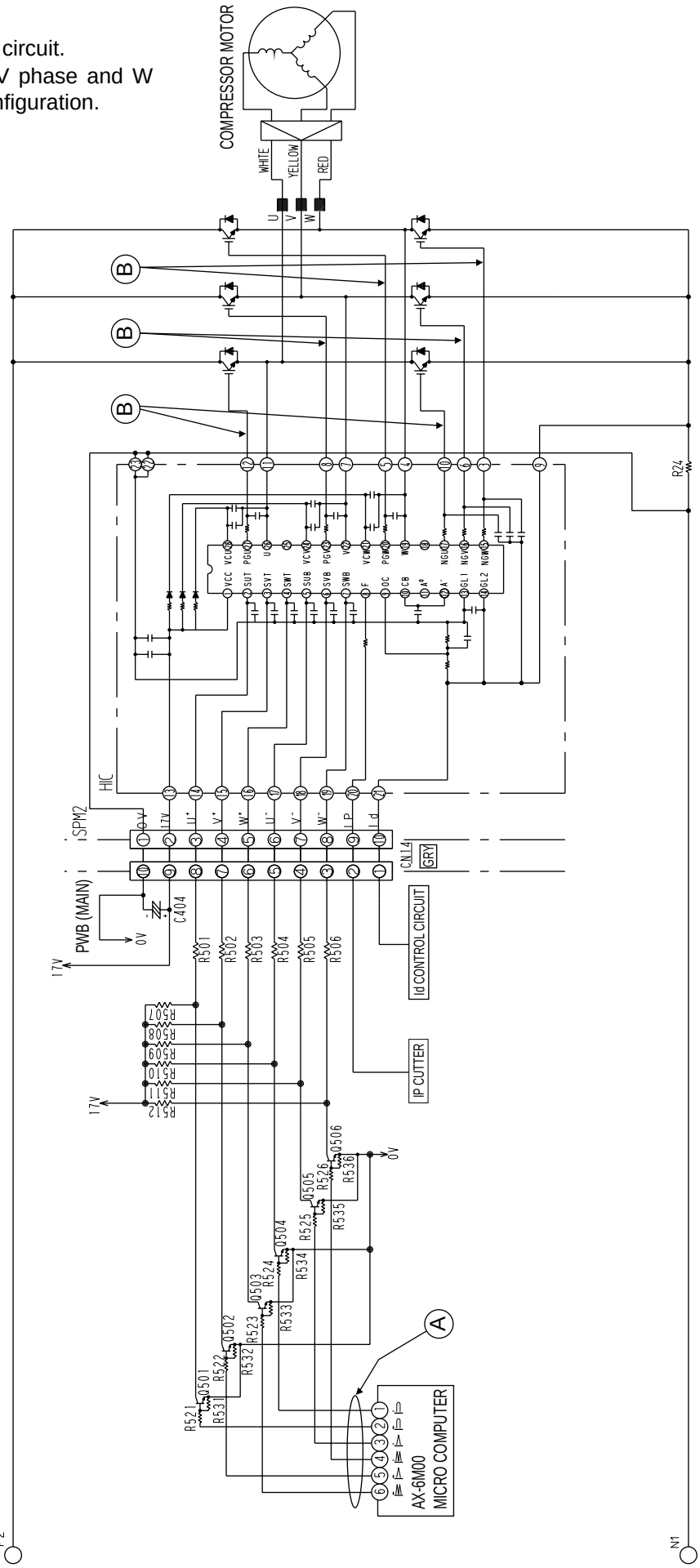


Fig. 11-1

- Fig11-2, 0 to 5V chopper signal is output from microcomputer for each phase. The signal output from microcomputer is input to IC, inverted due to active LO, and 0 to 15V chopper signal is obtained. This signal is then applied to transistor gate of each phase to drive.

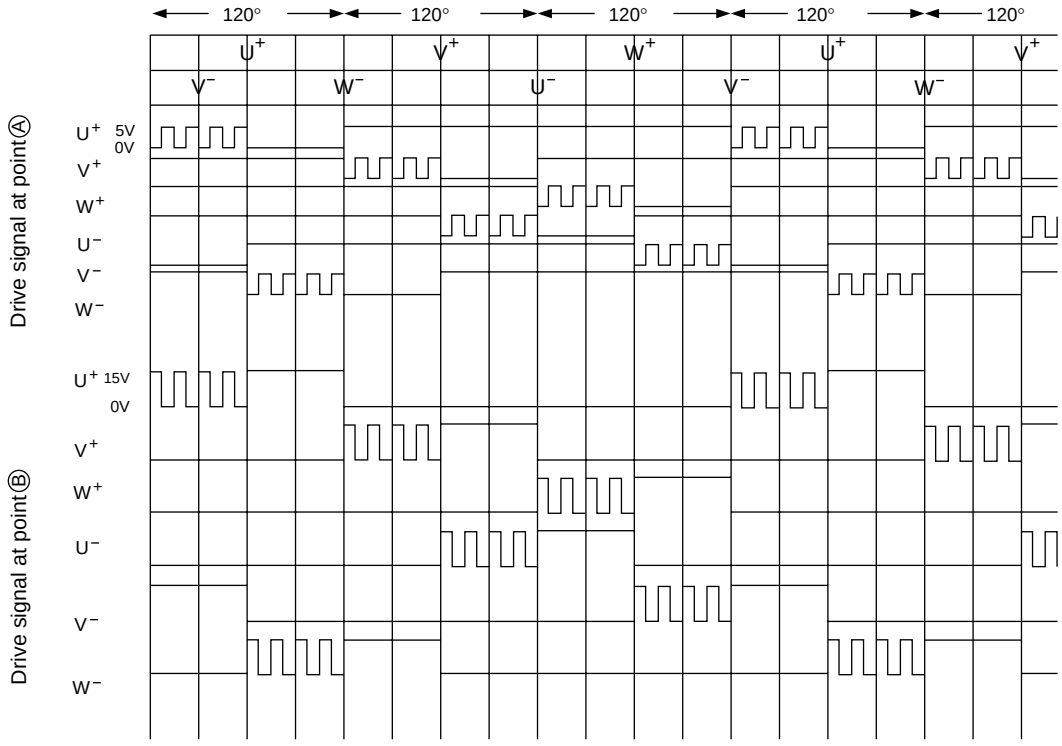

120°
120°
120°
120°
120°
U+
V+
W+
U−
V−
W−
V−
W−
U−
V−
W−
U+
V+
W+
Drive signal at point Ⓐ
Drive signal at point Ⓑ
5V
0V
15V
0V

Fig. 11-2

12. Electric expansion valve

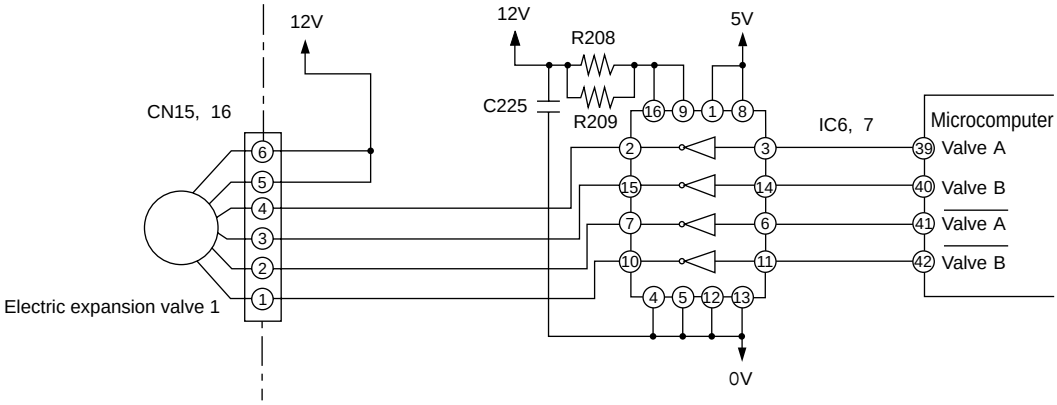


Fig. 12-1

- The electric expansion valve is driven by DC 12V. Power is supplied to 1 or 2 phase winding to switch magnetic pole of winding in order to control opening degree.
- Relationship between power switching direction of phase and open/close direction is shown below.

  When power is supplied, voltages at pins ④ to ① of CN 15 and CN 16 are about 0.9V; they are about 12V when no power is supplied. When power is reset, initialization is performed for 10 or 20 seconds.

  During initialization, measure all voltages at pins ④ to ① of CN15 and CN16 using tester. If there is any pin with voltage that has not changed from around 0.9V or 12V, expansion valve or microcomputer is defective.
- Fig 12-2 shows logic waveform when expansion valve is operating.

Table 12-1

Pin phase No.	Lear wire	Drive status							
		1	2	3	4	5	6	7	8
④	White	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
③	Yellow	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
②	Orange	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
①	Blue	OFF	OFF	OFF	OFF	OFF	ON	ON	ON

Operation mode
1→2→3→4→5→6→7→8 VALVE CLOSE
8→7→6→5→4→3→2→1 VALVE OPEN

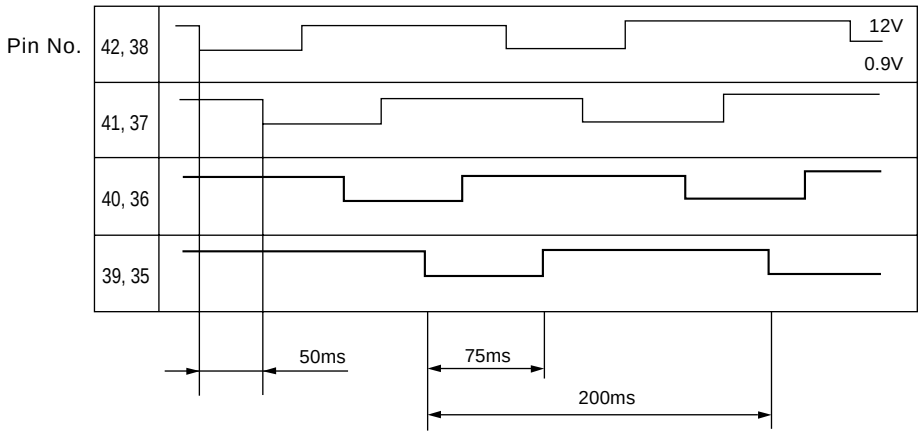
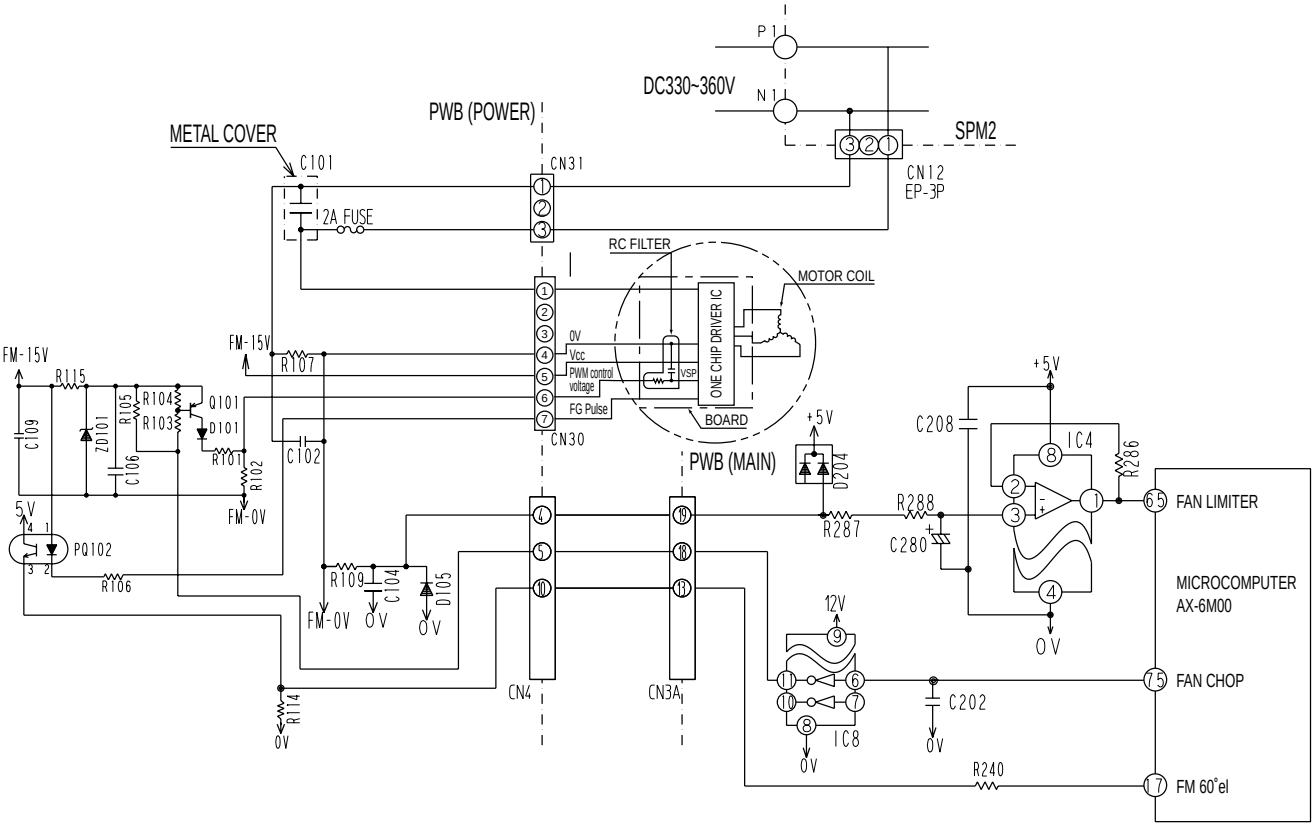


Fig. 12-2

With explosion valve control, opening degree is adjusted to stabilize target temperature, by detecting temperature of compressor head.

The period of control is about once per 20 seconds, and output a few pulses.

Outdoor DC Fan Motor control circuit



- This model uses DC Fan Motor which is including controller circuit into the Motor shell.
- This DC Fan Motor will rotate by control voltage apply to Vsp input. (Voltage range: 1.7 to 7V DC)
  Vsp high : Faster ; Vsp low : slower ; Vsp lower than 1.7V : stop
- Motor will output FG pulse by following this motor revolution.
- Outdoor Microprocessor will output PWM control signal from FAN CHOP terminal by following the instruction from indoor Microprocessor.
- This PWM control signal will convert to Vsp voltage by smoothing circuit (Q101 & RC filter)
- Fan motor will start to rotate when Vsp was proceeding over than 1.7V, and generate FG pulse by rotation speed.
- FG pulse will feed back to Outdoor Microprocessor through PQ102.
- PQ102 is the isolator between Microprocessor circuit and DC Fan Motor circuit, which has to match the Fan Motor revolution with instructed revolution. Such as...
  FG feedback: Faster – Instruction: Slower ... Decrease pulse width
  FG feedback: Slower – Instruction: Faster ... Increase pulse width
- FG pulse is also used for Fan Motor fail detection
- Microprocessor will monitor FG pulse 30 seconds after start the fan motor. If there is no signal detected, it will consider that the Fan Motor was malfunction and stop the operation. In this case, LD301 on control PWB will blink 12 times. (Fan Motor lock detected)
- R107 and IC4 are used for Fan Motor over current detection.

<Reference>

- When stop operation with LD301 blinks 12 times, it may be a DC Fan Motor broken.
- In this case, please check CN30 and CN31 connection first. It makes Fan Motor Lock also it those connectors are in misconnection.
- If 2A Fuse was burned it is possible that the DC Fan Motor may be damaged too.
- DC Fan Motor has broken when 2A Fuse was burned. Please replase both DC Fan Motor and 2A Fuse together.
- Fan lock detecting system may be actidiated when something has disturb the Fan rotation by inserting materials into propeller fan or ice has growing inside of outdoor unit by snowing.
- Fan lock detecting system may be actidiated by strong wind (ex. 17m/sec or above) against the Fan rotation. In this case, unit will be restart again after a while.
- Fan lock detecting system may be actidiated even though the DC Fan Motor is rotating correctly, the possible casue is due to Motor problem or PQ102 on board or control board problem.

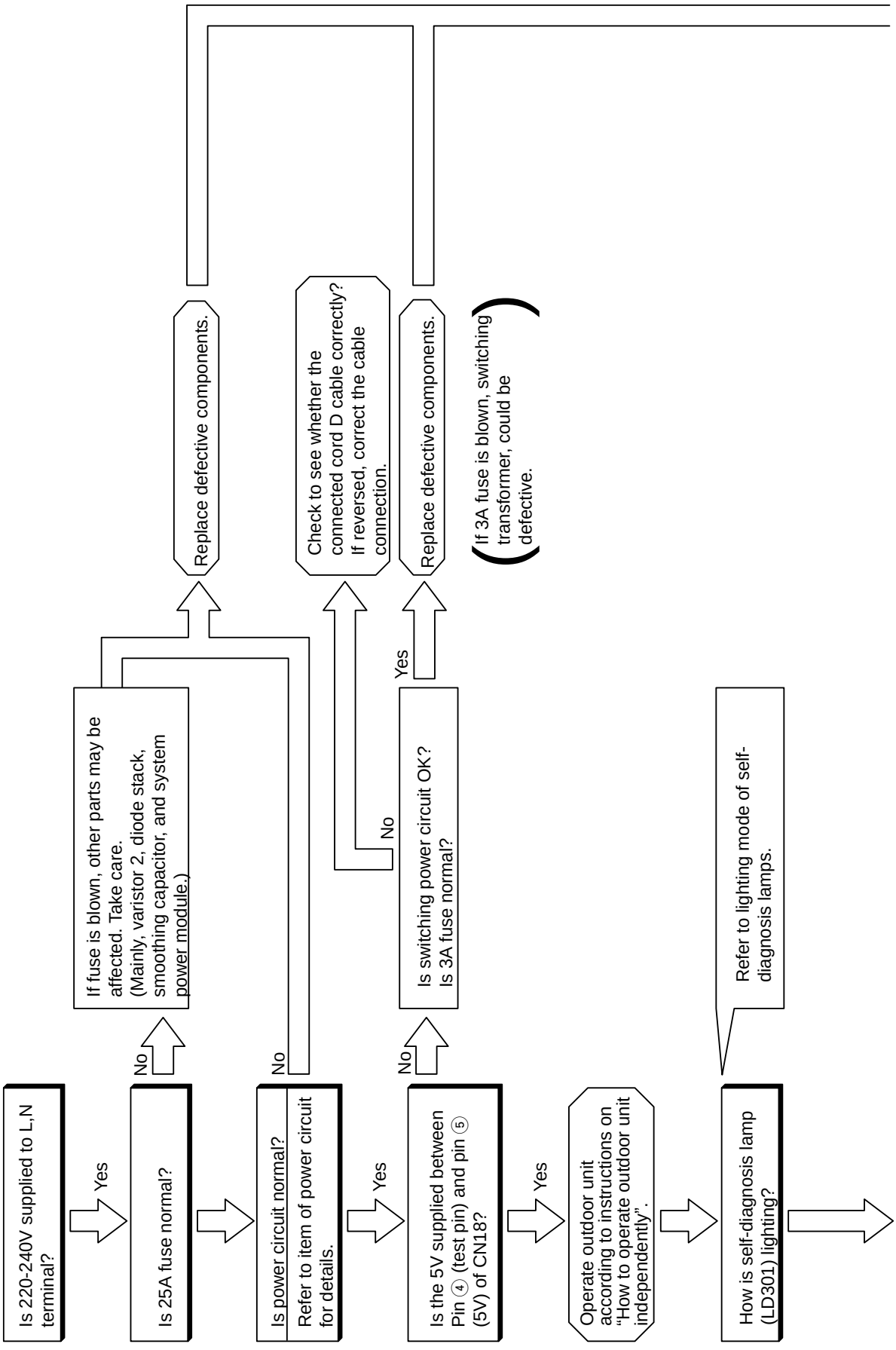
<Caution>

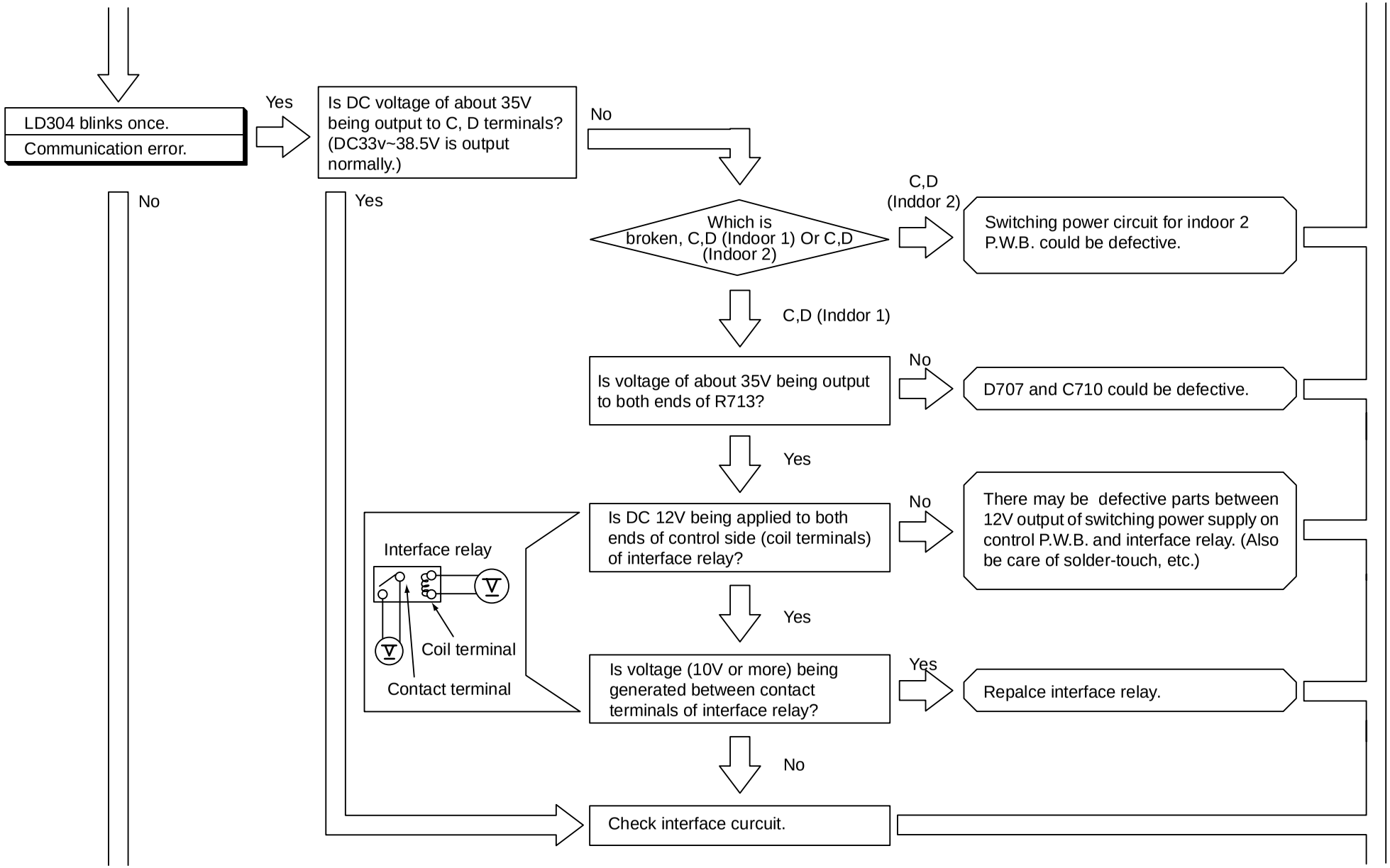
- Please take precaution while servicing Fan Motor circuit, because it carries DC330~360V supply.
- It is impossible to troubleshoot the Fan Motor bacause its circuit is integrated and conceal in the Fan Motor.

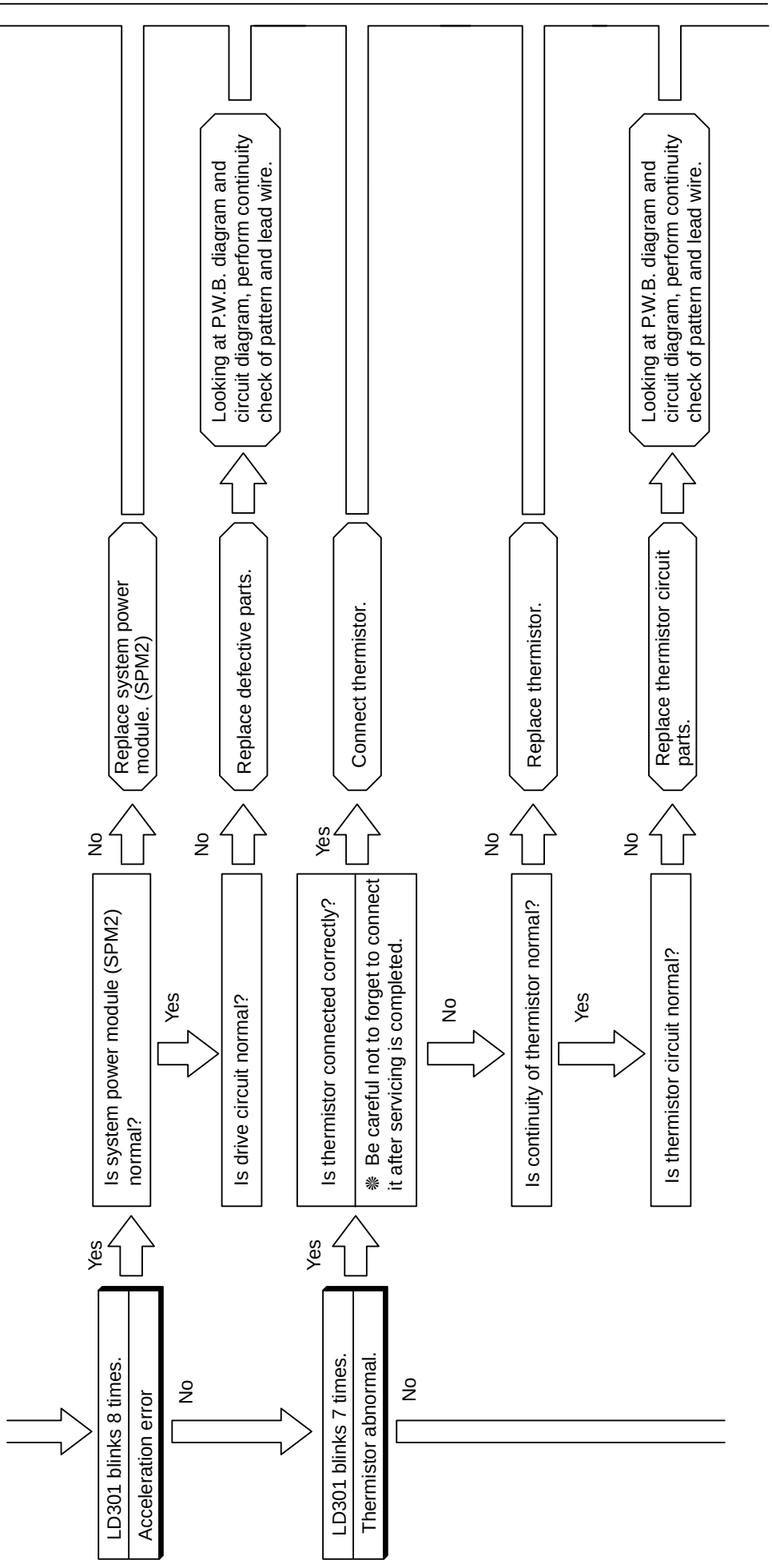
CHECKING THE OUTDOOR UNIT ELECTRICAL PARTS

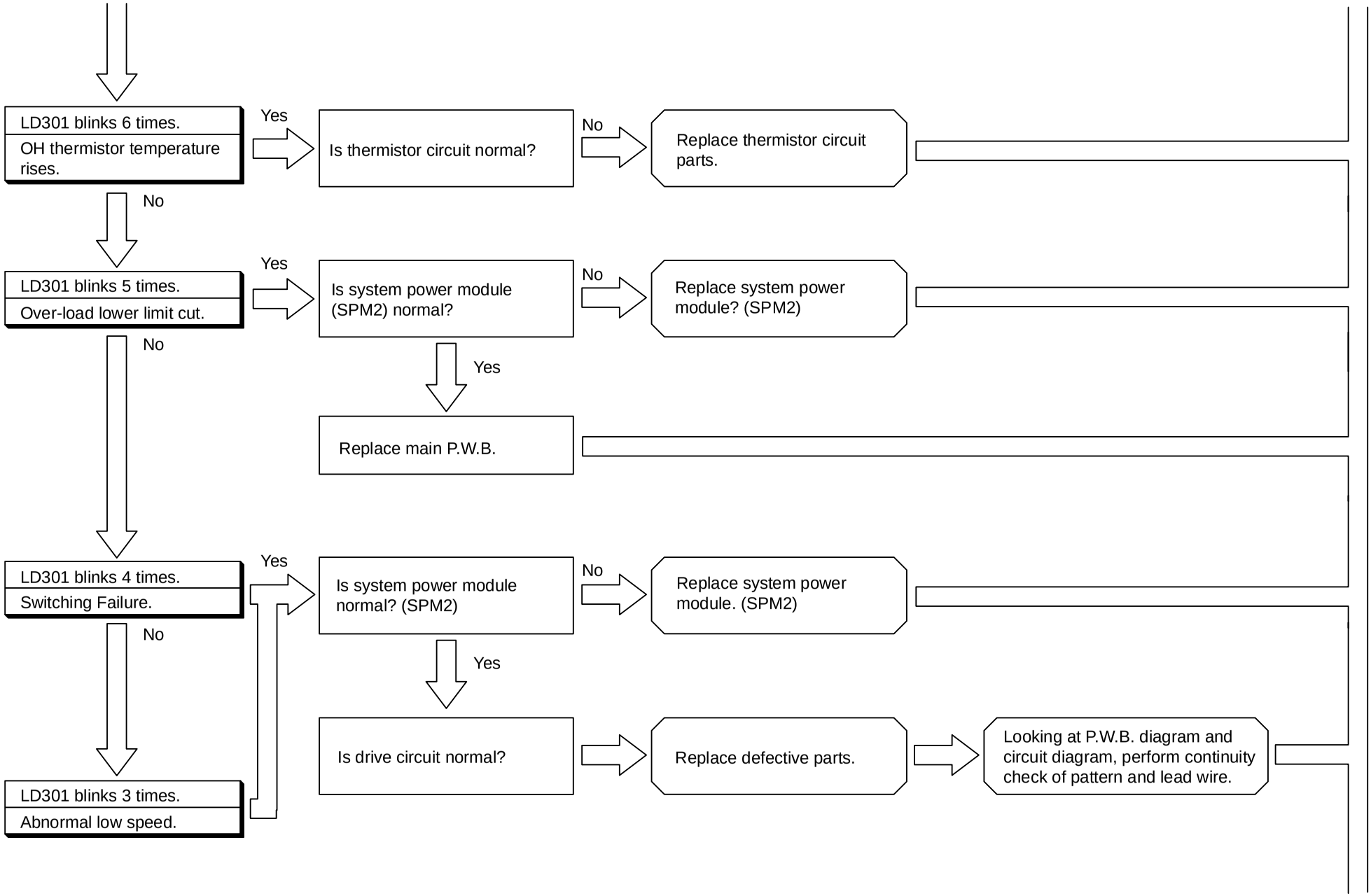
MODEL RAM-50CNHZ2

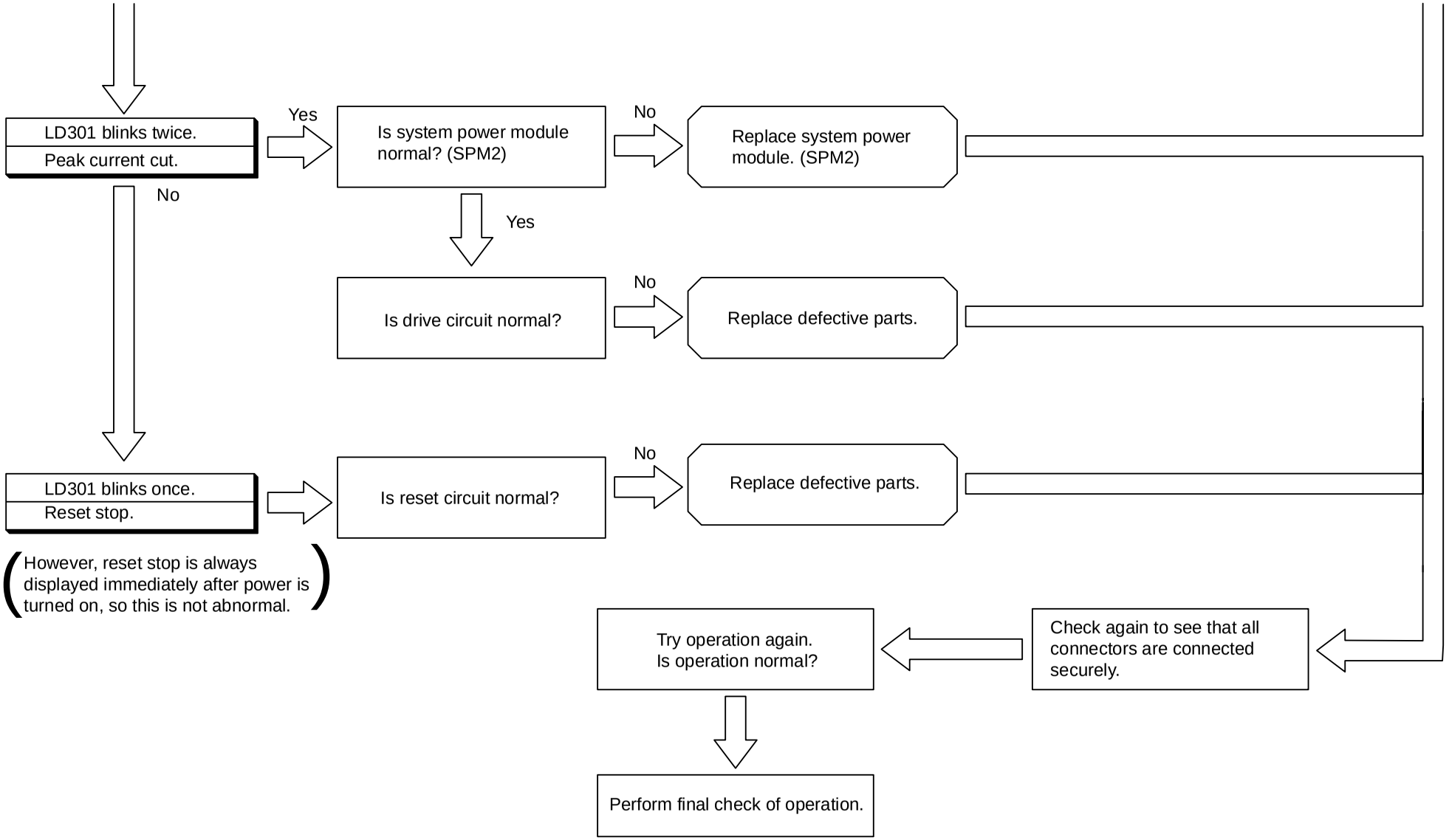
[Air conditioner not operated/not operated correctly]



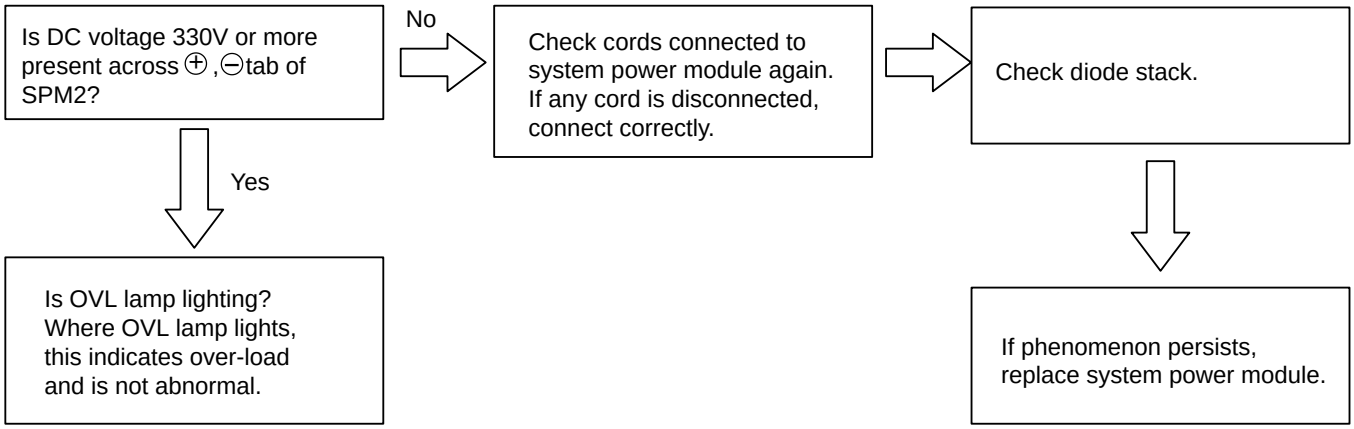

LD304 blinks once.
Communication error.
Yes
Is DC voltage of about 35V being output to C, D terminals? (DC33v~38.5V is output normally.)
No
No
Yes
Which is broken, C,D (Indoor 1) Or C,D (Indoor 2)
C,D (Inddor 2)
Switching power circuit for indoor 2 P.W.B. could be defective.
C,D (Inddor 1)
Is voltage of about 35V being output to both ends of R713?
No
D707 and C710 could be defective.
Yes
Interface relay
Coil terminal
Contact terminal
Is DC 12V being applied to both ends of control side (coil terminals) of interface relay?
No
There may be defective parts between 12V output of switching power supply on control P.W.B. and interface relay. (Also be care of solder-touch, etc.)
Yes
Is voltage (10V or more) being generated between contact terminals of interface relay?
Yes
Repalce interface relay.
No
Check interface curcuit.


LD301 blinks 8 times.
Acceleration error
Yes
No
Is system power module (SPM2) normal?
No
Replace system power module. (SPM2)
Yes
Is drive circuit normal?
No
Replace defective parts.
Looking at P.W.B. diagram and circuit diagram, perform continuity check of pattern and lead wire.
LD301 blinks 7 times.
Thermistor abnormal.
Yes
No
Is thermistor connected correctly?
❋ Be careful not to forget to connect it after servicing is completed.
Yes
No
Connect thermistor.
Is continuity of thermistor normal?
No
Replace thermistor.
Yes
Is thermistor circuit normal?
No
Replace thermistor circuit parts.
Looking at P.W.B. diagram and circuit diagram, perform continuity check of pattern and lead wire.


LD301 blinks 6 times.
OH thermistor temperature rises.
Yes
Is thermistor circuit normal?
No
Replace thermistor circuit parts.
No
LD301 blinks 5 times.
Over-load lower limit cut.
Yes
Is system power module (SPM2) normal?
No
Replace system power module? (SPM2)
Yes
Replace main P.W.B.
No
LD301 blinks 4 times.
Switching Failure.
Yes
Is system power module normal? (SPM2)
No
Replace system power module. (SPM2)
Yes
Is drive circuit normal?
Replace defective parts.
Looking at P.W.B. diagram and circuit diagram, perform continuity check of pattern and lead wire.
No
LD301 blinks 3 times.
Abnormal low speed.


LD301 blinks twice.
Peak current cut.
Yes
Is system power module normal? (SPM2)
No
Replace system power module. (SPM2)
No
Yes
Is drive circuit normal?
No
Replace defective parts.
LD301 blinks once.
Reset stop.
Is reset circuit normal?
No
Replace defective parts.
However, reset stop is always displayed immediately after power is turned on, so this is not abnormal.
Check again to see that all connectors are connected securely.
Try operation again.
Is operation normal?
Perform final check of operation.

PAM circuit
Phenomenon 1 (Rotation speed does not increase)



Over-voltage error (blinks 15 times): System power module (SPM2) is abnormal.

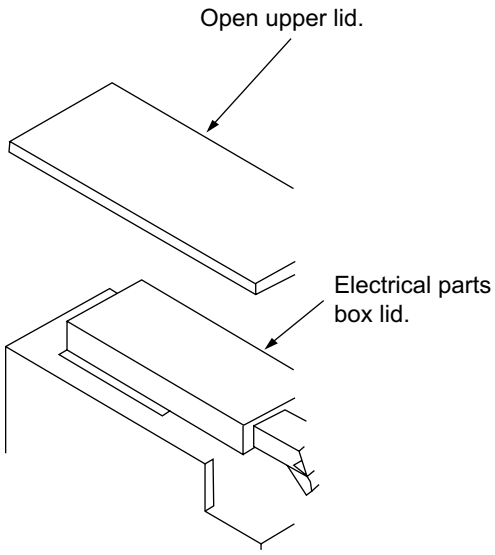
OPERATION USING SERVICE SWITCH OF OUTDOOR UNIT

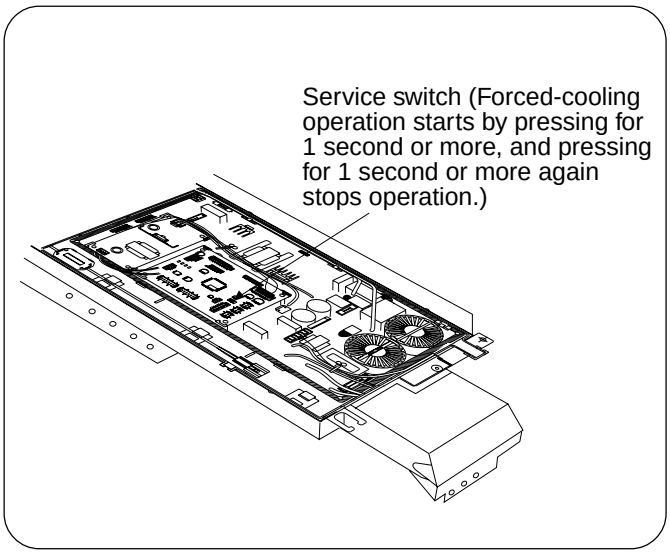
RAM-50CNHZ2

1. Turn OFF power switch, then turn ON again.
2. Remove electrical parts box lid.
3. Press service switch for 1 second or more. (waiting at least 20 seconds after power switch is turned on.)

At this time, LD303 (red) lights and unit operates in forced cooling mode.

Never operate continuously for 5 minutes or more





(Note)

(1) When checking is performed using service switch of outdoor unit, if both indoor units are not connected to interface signal (DC35V) C.D terminals. LD304 (outdoor communication error indicator) will display communication error by blinking once.

(2) If operating is performed with compressor connector disconnected, LD301 will blink 4 times and operation will not start.

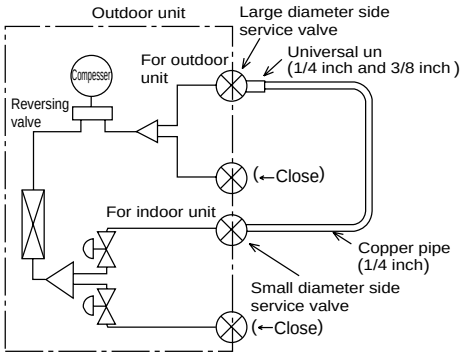
After operation using service switch is completed, turn the power switch OFF and then ON again.

HOW TO OPERATE OUTDOOR UNIT INDEPENDENTLY

1. Connect pipe to high pressure and low pressure side service valves.

Connect large diameter and small diameter side service values of outdoor unit using universal union and copper pipe as shown on the right.

Apply vacuum and then charge refrigerant of 300g.



Parts to be prepared

(1) Universal union
1/4 inch (6.35mm diameter)
3/8 inch (9.52mm diameter)
(2) Copper pipe (1/4 inch and 3/8 inch)
(3) Lead wire for shorting
Two wires of about 10 cm long with alligator clip or IC clip

Never operate continuously for 5 minutes or more.

Operation method is the same as that for operation using service switch of outdoor unit described above. However, interface signal communication error (no input at C, D terminals) will be displayed when operation is complete.

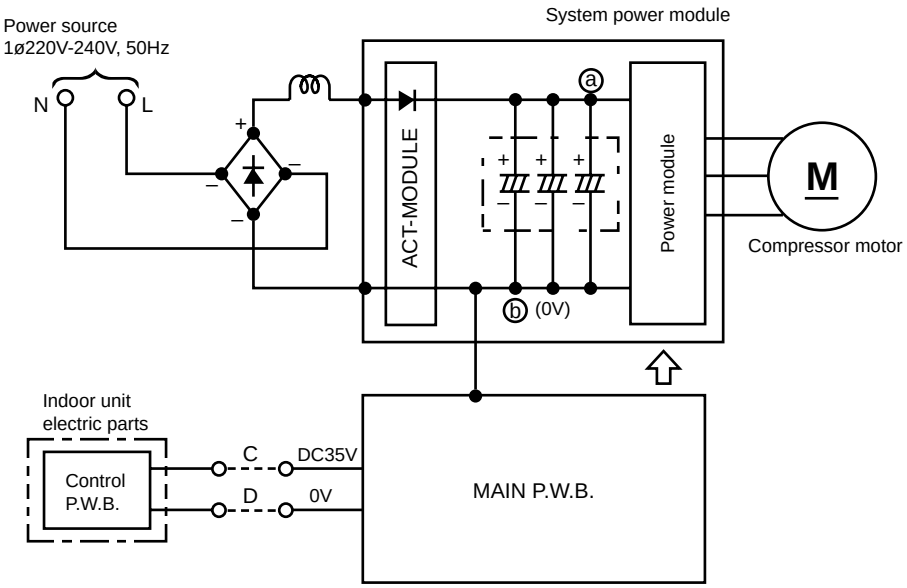
TROUBLE SHOOTING

MODEL RAM-50CNHZ2

PRECAUTIONS FOR CHECKING

DANGER

1. Remenber that the 0V line is biased to 155-170V in reference to the ground level.
2. Also note that it takes about 10 minutes until the voltage fall after the power switch is turned off.



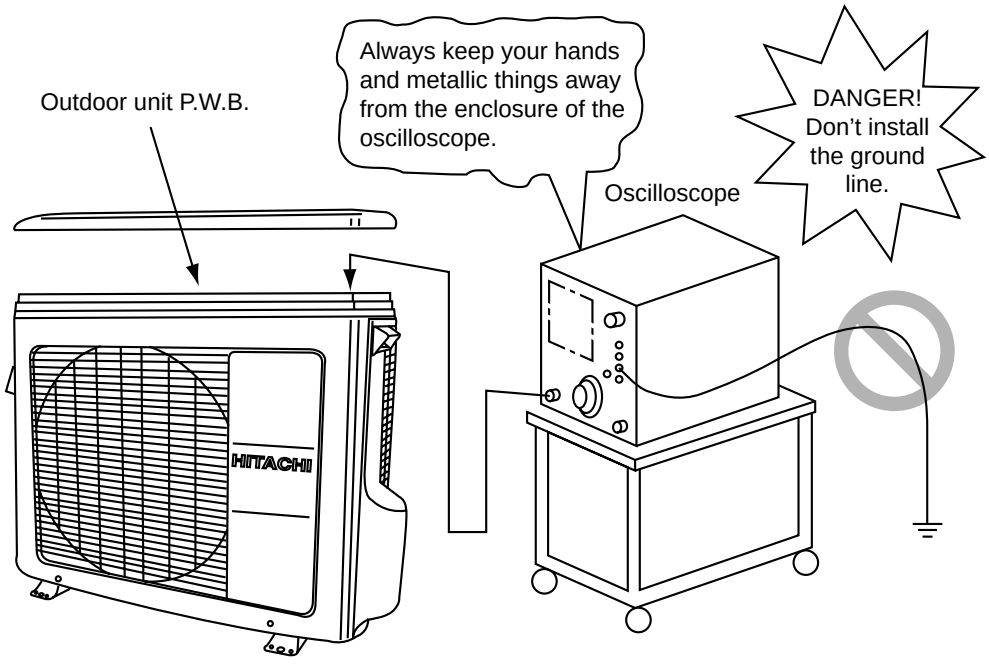
Across ⓐ – ⓑ (0V line)..... approx 360V

Across ⓐ – ground..... approx 155-170V

Across ⓑ (0V line)– ground..... approx 155-170V

DANGER

When using an oscilloscope, never ground it. Don't forget that high voltages as noted above may apply to the oscilloscope.



DISCHARGE PROCEDURE AND HOW TO CUT OFF POWER TO POWER CIRCUIT

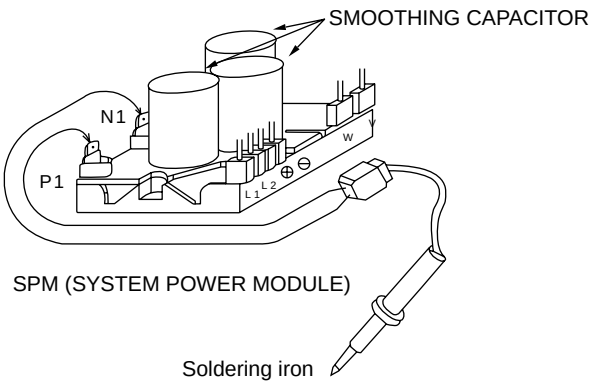
RAM-50CNHZ2

WARNING

Caution:

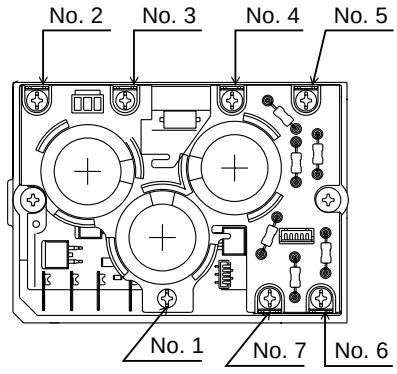
- Voltage of about 360V is charged at both ends of smoothing capacitors 400 μF x 3.
- High voltage (DC 360V) is also charged at screw and terminal sactions of system power module.
- During continuity check for each circuit of electrical parts in outdoor unit is performed, to prevent secondary trouble, disconnect red/gray wire connected to system power module (SPM2) from diode stack. (Also be sure to perform discharging of smoothing capacitor.)

1. Turn off the power switch of indoor unit or disconnect power plug.
2. Wait for 10 minutes or more after power is turned off and then remove electrical parts box lid. As shown below, Apply soldering iron of 30~75W for 15 seconds or more to P1 and N1 black/white lead receptacles on system power module to discharge voltage from smoothing capacitor.
   Do not loosen or remove screws of system power module: If screw is loose, voltage will not be discharged.
3. Before operation check of ech part of circuit, remove receptable of red/gray lead connected to system power module from diode stack.

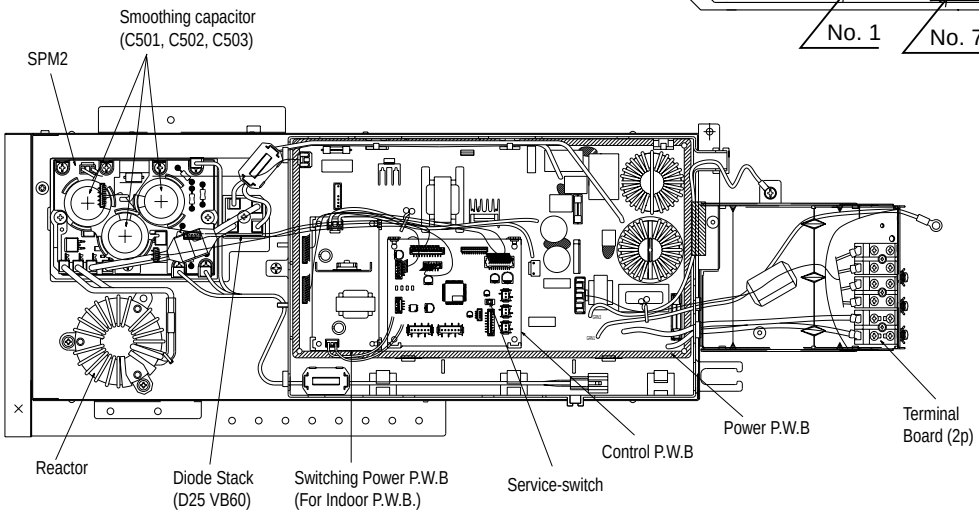


Do not use soldering iron with transformer: Doing so will blow thermal fuse inside transformer.

As shown left, apply soldering iron to metal parts (receptacles) in sleeve corresponding to P1 and N1 terminals of system power module (SPM2).



Screws of system power module (SPM2) are live parts: Do not touch them. Screw tightening torque and method are strictly specified.
When the screw is loosened or removed once, be sure to tighten according to the procedure shown on the right, with tightening torque of 0.8± 0.2 N · m.

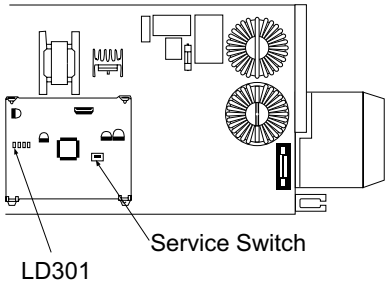


RAM-50CNHZ2

1. Outdoor unit does not operate (remote control signal can be received)

In hot weather, set operation mode to cooling, room temperature to 16°C; in cold weather, set to heating mode and 32°C, and then press operation button.

Remove outdoor unit cover and electrical parts box lid, and check LD301 self-diagnosis lamp.



Does LD301 blink once?
✺ Repeating to light for 0.25 sec. and go off for 2 sec.

Yes → Check room temperature thermistor.
If defective, replace it.
[Normal values]
10°C → approx. 20kΩ
25°C → approx. 10kΩ
30°C → approx. 8kΩ

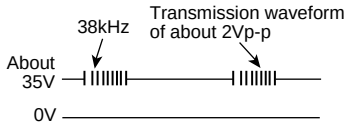
Check heat exchanger thermistor.
If defective,replace it.
[Normal values]
10°C → approx. 20kΩ
25°C → approx. 10kΩ
30°C → approx. 8kΩ

No

Does LD304 in electric parts box blink once when only one indoor unit is connected?

Yes

Is indoor/outdoor communication signal superimposed on DC35V?

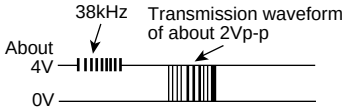


During check using tester:
If superimposed, 35V rapidly changes.
Caution:
Digital tester only.

No → Check electrical parts of outdoor unit and repair defective parts. (Around outdoor interface transmitting circuit).

Yes

Is indoor transmission signal generated at Q803 collector?



During check using tester:
If generated, voltage rapidly changes between 4V and 0V.

No → Check indoor interface transmitting circuit.

Yes → Check electrical parts of outdoor unit and repair defective parts. (Around outdoor interface transmitting circuit).

No

Does LD303 go off a few seconds to ten and few seconds after it is lit?

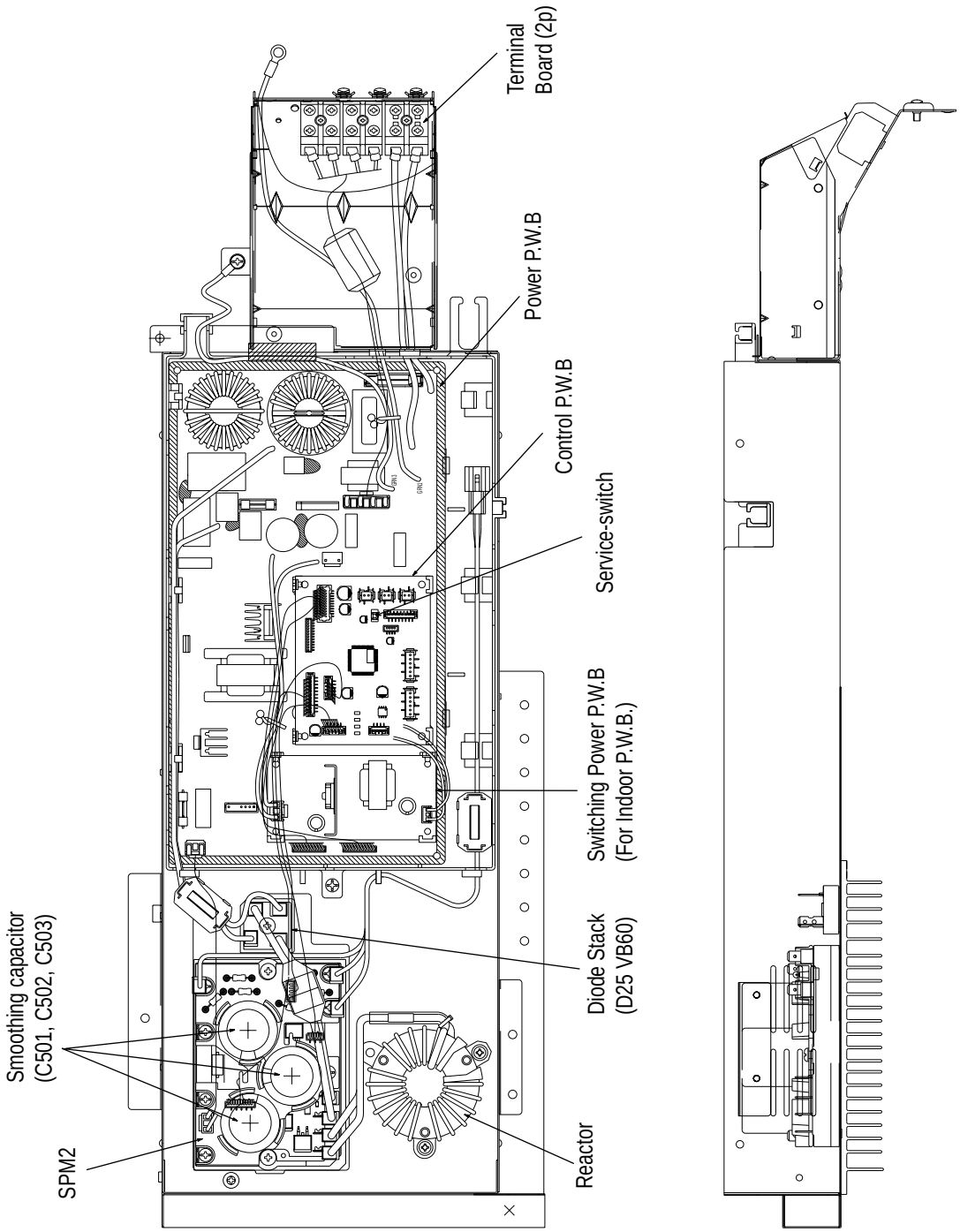
→ Check electrical parts of outdoor unit and repair defective parts.

Perform final operation check.

LIGHTING MODE SELF-DIAGNOSIS LAMP

RAM-50CNHZ2

1 Location of self-diagnosis lamp



2 Lighting mode self-diagnosis lamp

RAM-50CNHZ2

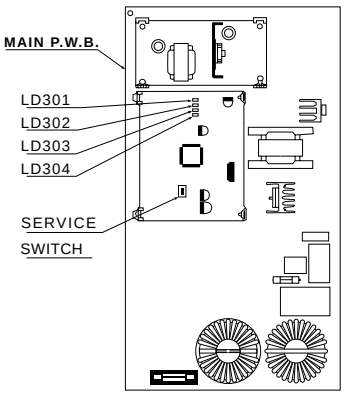
⚠ DANGER (DC360V)

- WAIT FOR TEN-MINUTE(MIN) AFTER TURNING OFF THE POWER SWITCH WHEN SERVICE WORK IS BEING DONE.
- SHOULD BE CONFIRM TO VOLTAGE LESS THAN DC 10V AT MEASURING POSITION.

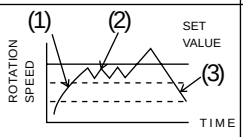
- DO NOT TOUCH SCREW OF SYSTEM POWER MODULE DUE TO HIGH VOLTAGE.
- DO NOT TOUCH OTHER PARTS AT THE CASE OF PUSHING SERVICE SWTCH.

SERVICE OPERATION

REFRIGERANT WITHDRAWAL OR SINGLE OPERATION OF THE OUTDOOR UNIT, SHALL SWITCH OFF THE EXCLUSIVE BREAKER FIRST.
PUT THE SWITCH TO ON POSITION BACK AND WAIT AT LEAST 1 MINUTE.
THEN PUSH THE SERVICE SWITCH WHICH IS ON THE CIRCUIT BOARD FOR MORE THAN 1 SECOND.
(THERE WILL BE A COOLING CYCLE)
TO PRESERVE PARTS FROM DAMAGE, MUST NOT OPERATE IT FOR MORE THAN 5 MINUTES.
TO PAUSE, PUSH THE SERVICE SWITCH AT LEAST 1 SECOND. IN CASE TO START OPERATING ONCE AGAIN PLEASE SWITCH OFF THE POWER BACK.

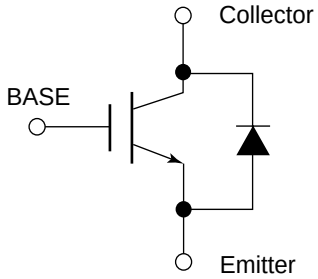
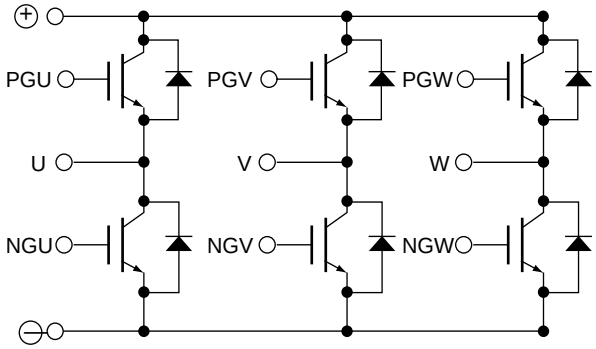
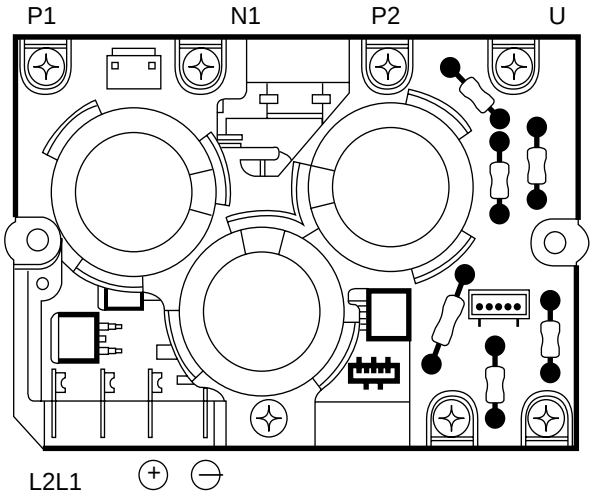


SELF-DIAGNOSIS LIGHTING MODE ☐:LIT ▨:BLINKING ☐:OFF

LD301 RED	LD302 RED	SELF-DIAGNOSIS NAME	DETAILS	MAIN CHECK POINT
		[1]DURING OPERATION	LD303(RED)LIGHTS. ■	
☐	☐	NORMAL OPERATION	COMPRESSOR OPERATION	NOT MALFUNCTION
■	☐	OVERLOAD (1)	 THE ROTATION SPEED IS AUTOMATICALLY CONTROLLED TO PROTECT THE COMPRESSOR IN THE OVERLOAD CONDITION.	THIS SHOWS AN OVERLOAD, NOT MALFUNCTION.
☐	■	OVERLOAD (2)		
■	■	OVERLOAD (3)		
		[2]DURING STOP	LD303(RED)GOES OFF. ☐	
☐	☐	NORMAL STOP	INDOOR THERMOSTAT OFF. MAIN OPERATION OFF.	NOT MALFUNCTION.
▨ 1TIMES	☐	RESET STOP	WHEN STOPPED WITH POWER RESET. (NORMAL WHEN POWER HAS BEEN TURNED ON.)	P.W.B.s (POWER CIRCUIT, MICROCOMPUTER, ETC.)
▨ 2TIMES	☐	PEAK CURRENT CUT	OVERCURRENT IS DETECTED.	①SYSTEM POWER MODULE ②COMPRESSOR ③ P.W.B.s
▨ 3TIMES	☐	ABNORMAL LOW SPEED ROTATION	POSITION DETECTION SIGNAL IS NOT INPUT DURING OPERATION.	①SYSTEM POWER MODULE ②COMPRESSOR ③ P.W.B.s
▨ 4TIMES	☐	SWITCHING FAILURE	SWITCHING FROM LOW FREQUENCY SYNC START TO POSITION DETECTION OPERATION FAILURE.	①SYSTEM POWER MODULE ②COMPRESSOR ③ P.W.B.s
▨ 5TIMES	☐	OVERLOAD LOWER LIMIT CUT	UNDER THE LOWER LIMIT OF ROTATION SPEED WITH OVERLOAD CONTROL CIRCUIT OPERATED.	① OUTDOOR UNIT IS EXPOSED TO DIRECT SUNLIGHT OR ITS AIRFLOW BLOCKED. ② FAN MOTOR ③ FAN MOTOR CIRCUIT ④ THE VOLTAGE IS EXTREMELY LOW.
▨ 6TIMES	☐	OH THERMISTOR TEMP.RISE	OH THERMISTOR OPERATED.	①LEAK OF REFRIGERANT ②COMPRESSOR ③OH THERMISTOR CIRCUIT ④FAN MOTOR ⑤FAN MOTOR CIRCUIT
▨ 7TIMES	☐	THERMISTOR ABNORMAL	THERMISTOR IS OPEN OR SHORTED.	①THERMISTOR ② CONNECTION OF THERMISTOR DEFECTIVE ③THERMISTOR CIRCUIT
▨ 8TIMES	☐	ACCELERATION DEFECTIVE	NO ACCELERATION OVER THE LOWER LIMIT OF THE ROTATION SPEED.	①LEAK OF REFRIGERANT ②COMPRESSOR
▨ 10TIMES	☐	ABNORMAL POWER VOLTAGE	POWER VOLTAGE IS ABNORMALLY LOW.	①POWER VOLTAGE ②CONNECTION OF REACTOR
▨ 12TIMES	☐	FAN LOCK ERROR	OUTDOOR FAN RPM IS NOT ROTATE AS INTENDED RPM	①FAN MOTOR ②FAN MOTOR CIRCUIT
▨ 13TIMES	☐	EEPROM READ ERROR	MICROCOMPUTER CANNOT READ THE DATA IN EEPROM.	P.W.B.s (POWER CIRCUIT, EEPROM. ETC.)
▨ 14TIMES	☐	ACTIVE CONVERTER DEFECTIVE	OVERVOLTAGE IS DETECTED BY SYSTEM POWER MODULE	SYSTEM POWER MODULE
LD304 GRN	☐	NORMAL		
	▨ 1TIME	COMMUNICATIONS ERROR	COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT ARE INTERRUPTED	①CABLE IS WRONG CONNECTED ②CABLE IS OPEN ③INTERFACE CIRCUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT

※ EXAMPLE OF BLINKING (5 TIMES) ■■■■■ 2SEC ■ (■ : LIGHTS FOR 0.25 SEC AT INTERVAL OF 0.25 SEC.)

TROUBLESHOOTING OF THE SYSTEM POWER MODULE

Element circuit	
Circuit diagram of the module	
Terminal symbol of system module ※ See next page for values measured by tester	 ※Do not disassemble the system power module when troubleshooting is performed.

HOW TO CHECK POWER MODULE

Checking power module using tester
Set tester to resistance range (X 100)
If indicator does not swing in the following conductivity check, the power module is normal.
(In case of digital tester, since built-in battery is set in reverse direction, ⊕ and ⊖ terminals are reversed.)

⚠ CAUTION

If inner circuit of power module is disconnected (open), the indicator of tester will not swing and this may assumed as normal. In this case, if indicator swings when ⊕ and ⊖ terminals are connected in reverse of diagram below Fig. 2, it is normal. Furthermore, compare how indicator swings at U, V and W phases. If indicator swings the same way at each point, it is normal.

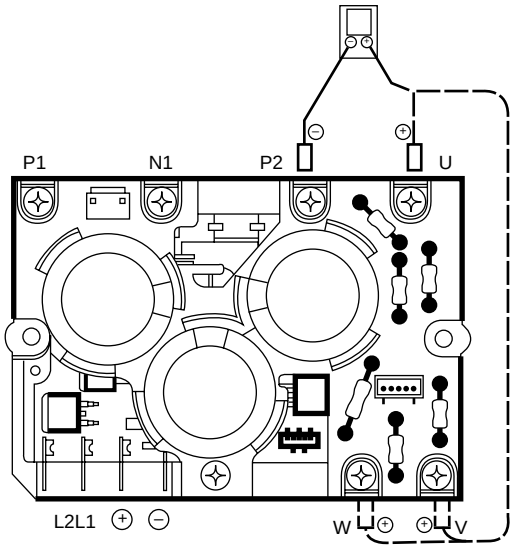


Fig. 1

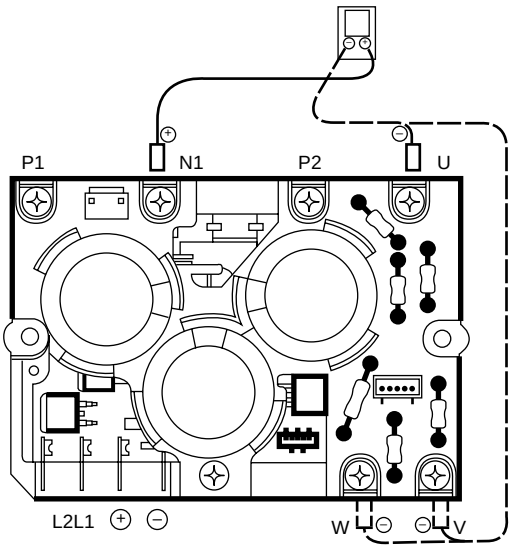
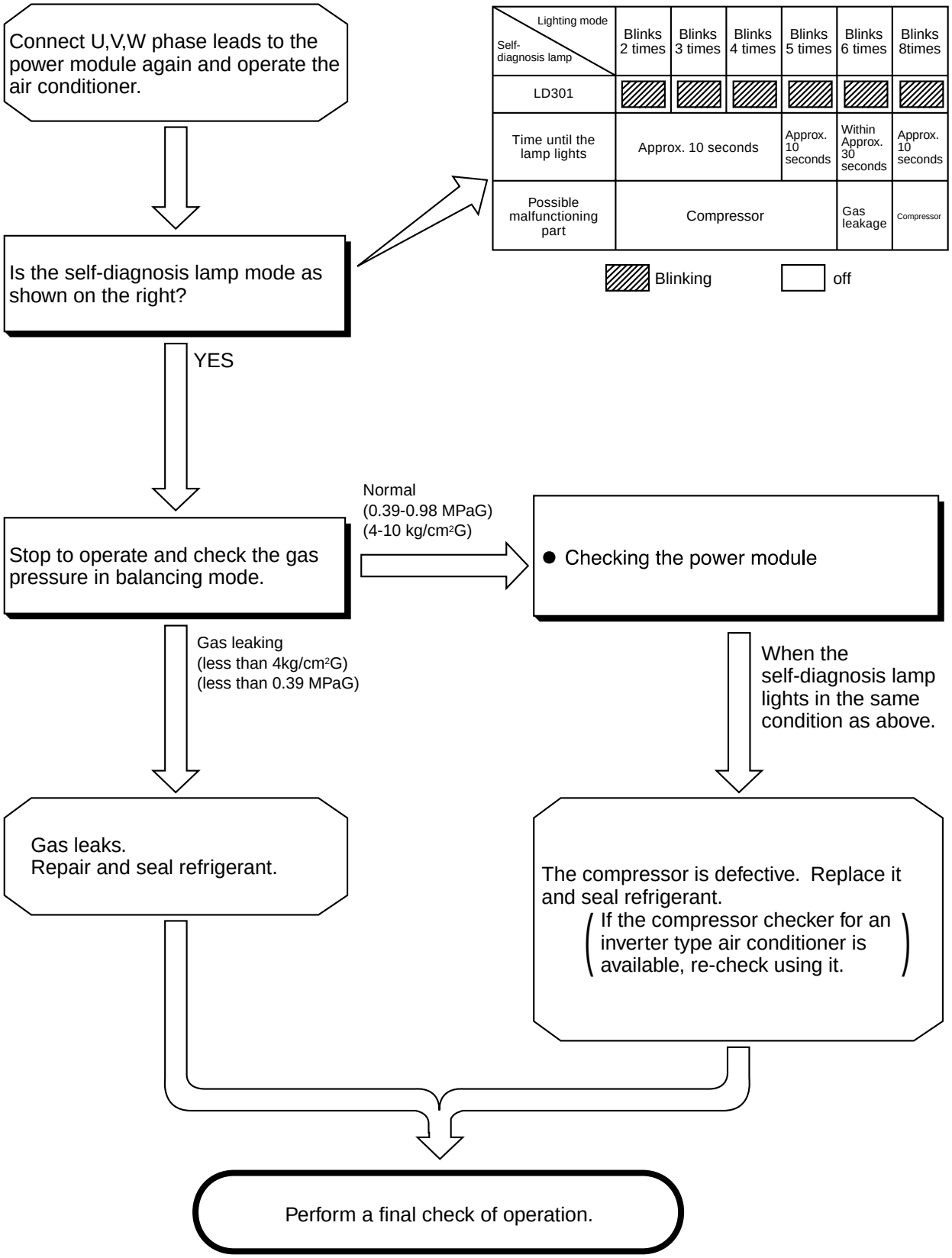


Fig. 2

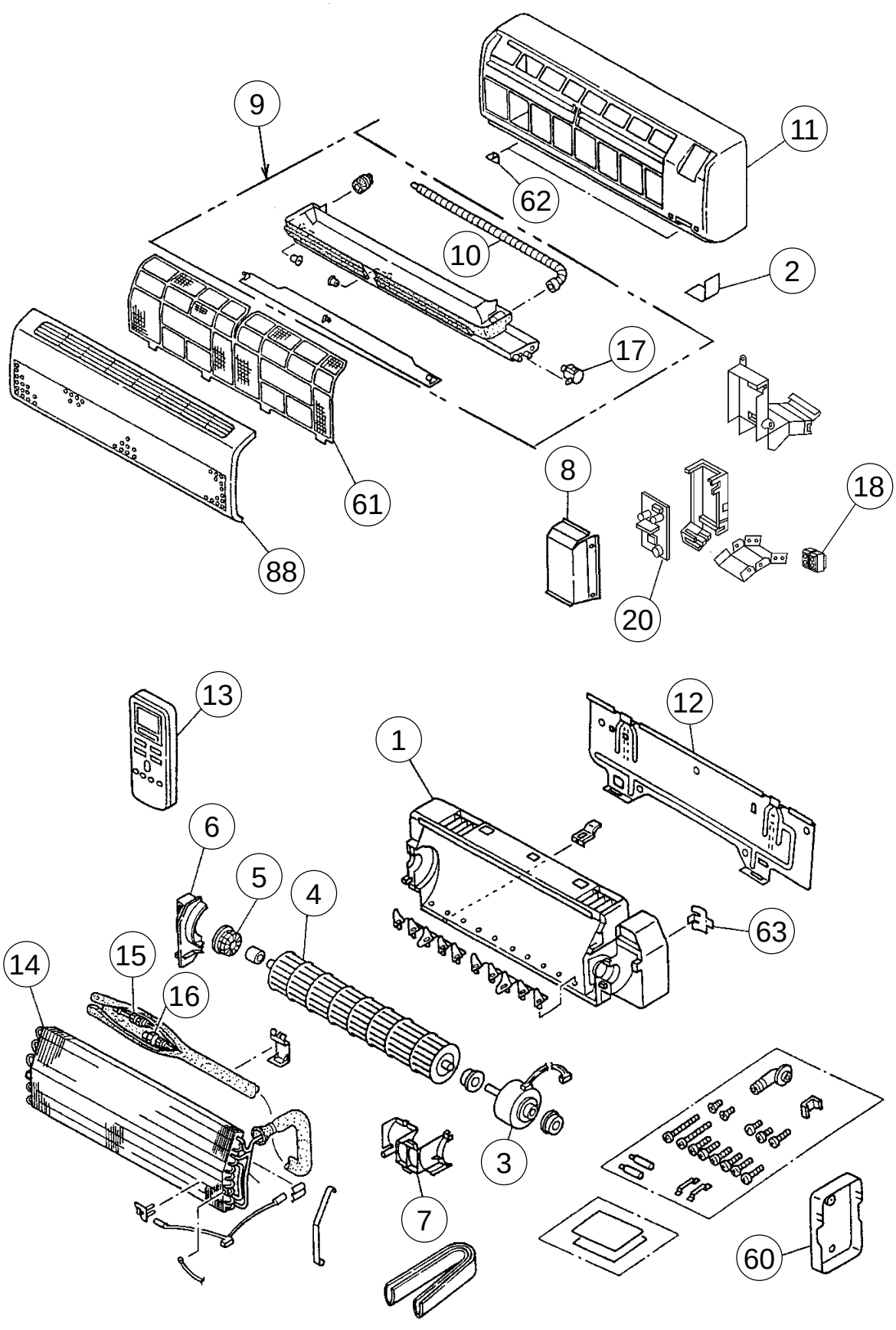
CHECKING THE REFRIGERATING CYCLE (JUDGING BETWEEN GAS LEAKAGE AND COMPRESSOR DEFECTIVE)

1. Troubleshooting procedure (No operation, No heating, No cooling)



PARTS LIST AND DIAGRAM

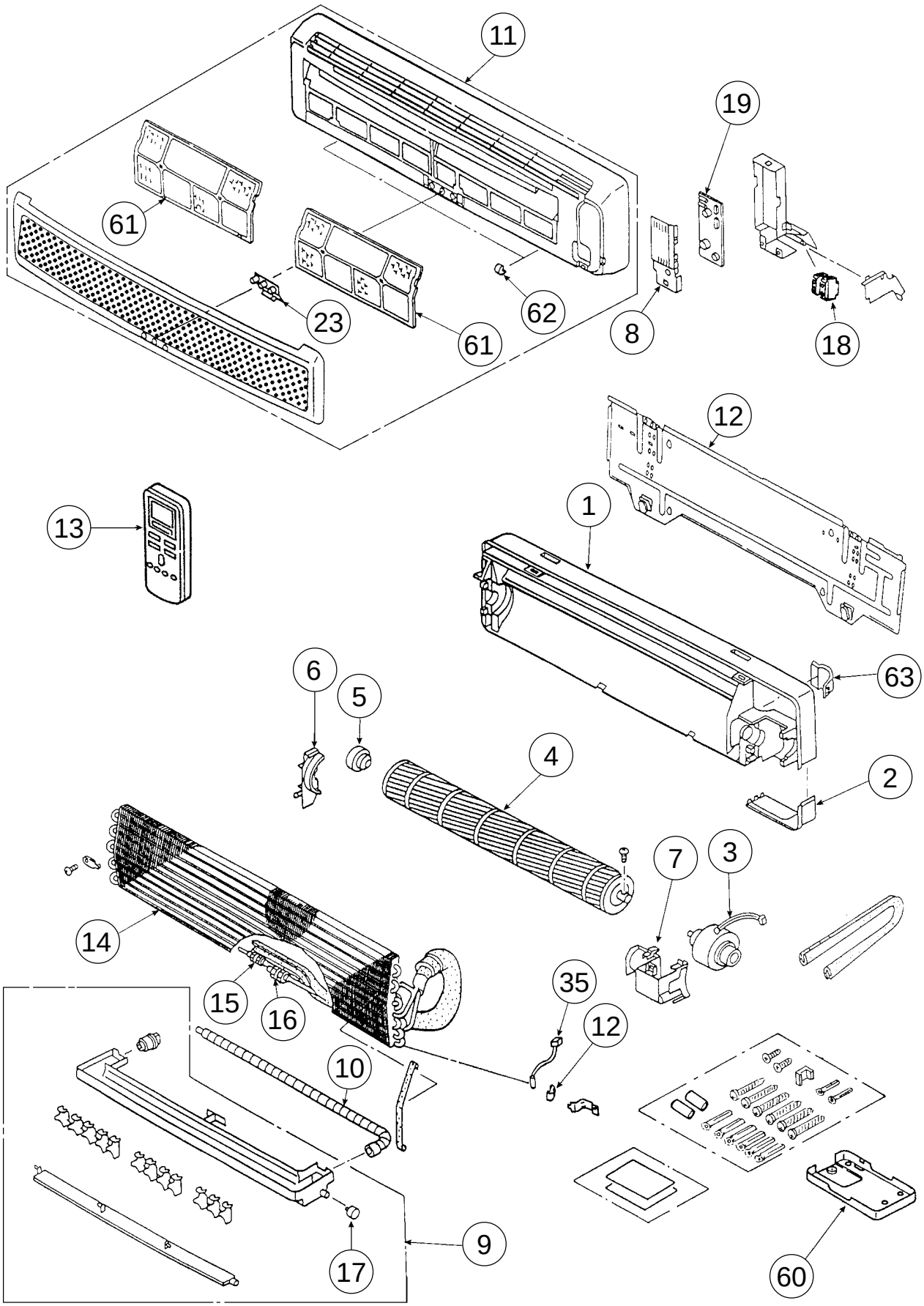
MODEL RAS-20CNHZ2



MODEL RAS-20CNHZ2

NO.	PART N0. RAS-20CNHZ2	Q'TY / UNIT	PARTS NAME
1	PMRAS-20CNH2 004	1	CABINET
2	PMRAS-25CNH2 002	1	LOW-COVER
3	PMRAS-25CNH2 003	1	20W MOTOR
4	PMRAS-25CNH2 004	1	TANGENTIAL FLOW FAN
5	PMRAS-25CNH2 005	1	P-BEA ASSEMBLY
6	PMRAS-25CNH2 006	1	BEARING COVER
7	PMRAS-25CNH2 007	1	FAN MOTOR SUPPORT
8	PMRAS-25CNH2 008	1	ELECTRICAL COVER
9	PMRAS-20CNHZ2 002	1	DRAIN PAN ASSEMBLY
10	PMRAS-07C1 013	1	DRAIN HOSE
11	PMRAS-20CNHZ2 003	1	FRONT COVER ASS'Y
12	PMRAS-25CNH2 012	1	MOUNTING PLATE
13	PMRAS-40CNH2 021	1	REMOTE CONTROL
14	PMRAS-25CNH2 014	3	EVAPORATOR
15	PMRAS-10C6M 006	3	UNION (2)
16	PMRAS-09CHA1R 005	1	UNION (3)
17	PMRAS-10C6M 001	1	STEP MOTOR
60	PMRAS-10C3M 003	1	REMOTE CONTROL HOLDER
61	PMRAS-25CNH2 018	1	FILTER
62	PMRAS-25CNH2 019	2	CAP
63	PMRAS-25CNH2 020	1	PIPE SUPPORT
18	PMRAS-07C1 006	1	TERMINAL BOARD (2P)
20	PMRAS-20CNHZ2 001	1	P.W.B. (MAIN)
22	PMRAS-25CNH2 024	1	THERMISTOR

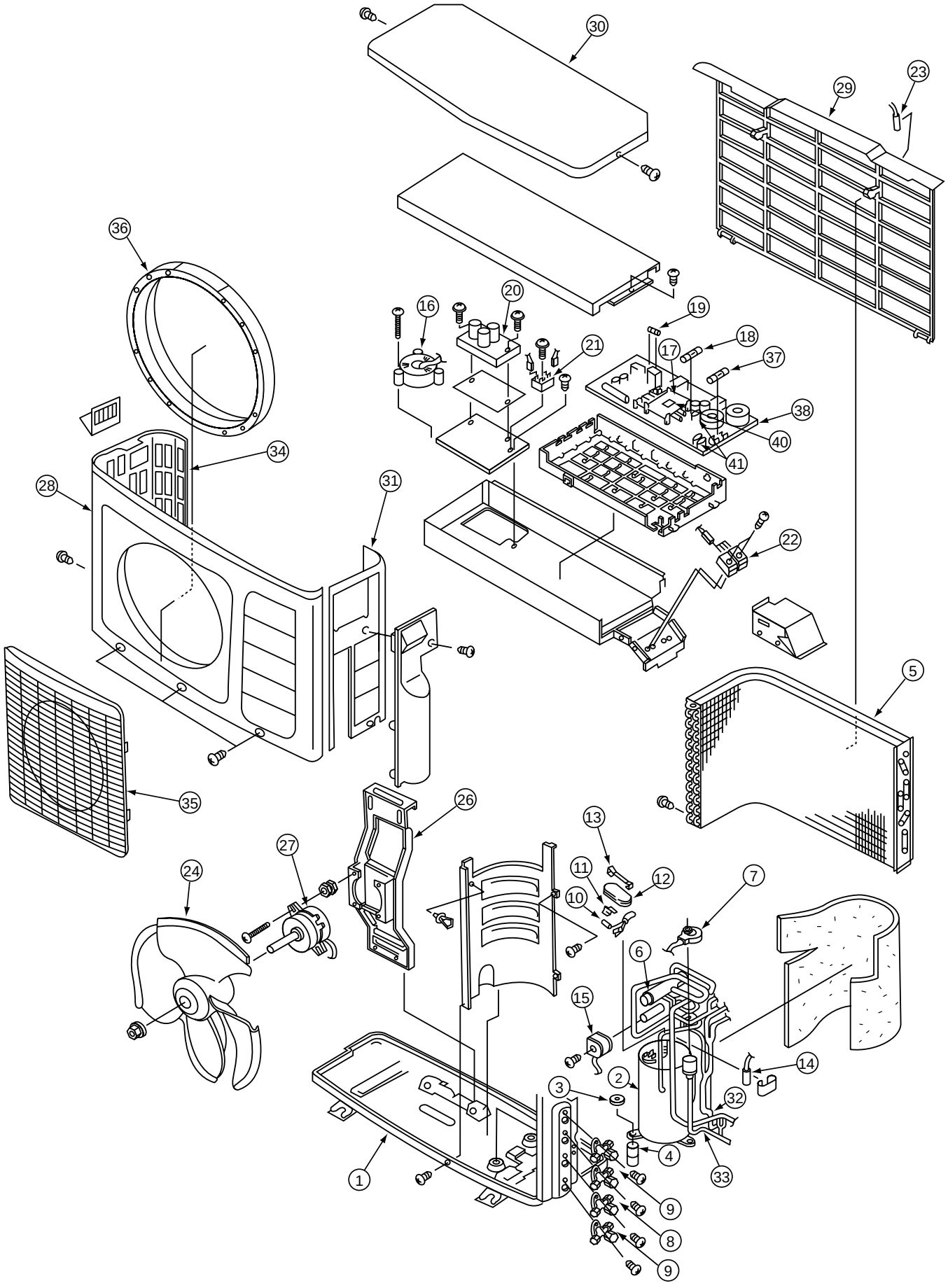
MODEL RAS-30CNHZ2



MODEL RAS-30CNHZ2

NO.	PART N0. RAS-30CNHZ2	Q'TY / UNIT	PARTS NAME
1	PMRAS-30CNHZ2 006	1	CABINET
2	PMRAS-32CNH2 002	1	LOW-COVER
3	PMRAS-13C6M 001	1	20W MOTOR
4	PMRAS-09C1 003	1	TANGENTIAL FLOW FAN
5	PMRAS-05C 013	1	P-BEA ASSEMBLY
6	PMRAS-32CNH2 004	1	BEARING COVER
7	PMRAS-32CNH2 005	1	FAN MOTOR SUPPORT
8	PMRAS-30CNHZ2 002	1	ELECTRICAL COVER
9	PMRAS-30CNHZ2 003	1	DRAIN PAN ASSEMBLY
10	PMRAS-07C1 013	1	DRAIN HOSE
11	PMRAS-30CNHZ2 004	1	FRONT COVER ASS'Y
12	PMRAS-05C 009	1	MOUNTING PLATE
13	PMRAS-40CNH2 021	1	REMOTE CONTROL
14	PMRAS-30CNHZ2 005	1	EVAPORATOR
15	PMRAS-13C6K 003	1	UNION (2)
16	PMRAS-5142C 006	1	UNION (4)
17	PMRAS-05C 041	1	STEP MOTOR
18	PMRAS-07C1 006	1	TERMINAL (2P)
19	PMRAS-30CNHZ2 001	1	PWB (MAIN)
23	PMRAS-32CNH2 009	1	INDICATION BOARD
35	PMRAS-25CNH2 024	1	THERMISTOR
60	PMRAS-10C3M 003	1	REMOTE CONTROL HOLDER
61	PMRAS-32CNH2 015	2	FILTER
62	PMRAS-25CNH2 019	2	CAP
63	PMRAS-32CNH2 006	1	PIPE SUPPORT

MODEL RAM-50CNHZ2



MODEL RAM-50CNHZ2

NO.	PART N0. RAM-50CNHZ2	Q'TY / UNIT	PARTS NAME
1	PMRAM-50CNHZ2 902	1	BASE
2	PMRAM-50CNHZ2 901	1	COMPRESSOR
3	KPNT1 001	4	PUSH NUT
4	RAC-2226HV 805	3	COMPRESSOR RUBBER
5	PMRAM-50CNHZ2 911	1	CONDENSER
6	PMRAC-128JHT 905	1	REVERSING VALVE
7	PMRAM-50CNHZ2 903	2	ELECTRICAL EXPANSION VALVE
8	PMRAM-50CNHZ2 913	2	VALVE (2S)
9	PMRAC-30CVP1 903	2	VALVE (3S)
10	PMRAC-40CNH2 914	1	THERMISTOR (OH)
11	PMRAC-25CNH2 909	1	THERMISTOR (OH) SUPPORT
12	RA-226 015	1	OVERLOAD RELAY COVER
13	RA-226 016	1	COVER SUPPORT
14	PMRAM-50CNHZ2 910	1	THERMISTOR (DEFROST)
15	PMRAC-32CNH2 905	1	MG-COIL
16	PMRAC-40CNH2 908	1	REACTOR
17	PMRAM-50CNHZ2 904	1	P.W.B (MAIN)
18	PMRAM-50CNHZ2 905	1	FUSE (3A)
19	PMRAC-40CNH2 906	1	FUSE (2A)
20	PMRAC-40CNH2 901	1	SYSTEM POWER MODULE
21	PMRAC-40CNH2 902	1	DIODE STACK (D25VB60)
22	PMRAS-07C1 006	2	TERMINAL BOARD (2P)
23	PMRAC-40CNH2 916	1	THERMISTOR (OUTSIDE TEMPERATURE)
24	PMRAC-40CNH2 917	1	PROPELLER FAN
26	PMRAC-40CNH2 918	1	SUPPORT (FAN MOTOR)
27	PMRAM-50CNHZ2 912	1	FAN MOTOR (40W)
28	PMRAC-40CNH2 904	1	CABINET
29	PMRAC-40CNH2 921	1	NET
30	PMRAC-40CNH2 922	1	TOP COVER
31	PMRAM-50CNHZ2 906	1	SIDE PLATE R
32	PMRAM-50CNHZ2 914	1	STRAINER
33	PMRAM-50CNHZ2 915	1	STRAINER
34	PMRAC-40CNH2 926	1	SIDE PLATE-L
35	PMRAC-40CNH2 928	1	GRILL
36	PMRAC-40CNH2 920	1	MOUTH RING
37	PMRAC-40CNH2 905	1	FUSE (25A)
38	PMRAM-50CNHZ2 907	1	PWB (POWER)
39	PMRAM-50CNHZ2 908	1	TERMINAL BOARD (2P)
40	PMRAM-50CNHZ2 909	1	P.W.B. (SW-POWER)
41	RA-108CHLXA 908	3	VARISTOR (450NR)