HITACHI
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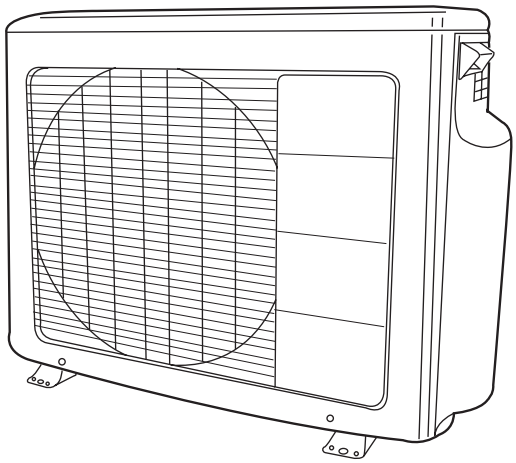
PM | NO. 0270E

RAM-40QH5

REFER TO THE FOUNDATION MANUAL

SERVICE MANUAL
TECHNICAL INFORMATION

FOR SERVICE PERSONNEL ONLY



RAM-40QH5

CONTENTS

SPECIFICATIONS

TYPE		DC INVERTER DUAL SYSTEM MULTI
		OUTDOOR UNIT
MODEL		RAM-40QH5
POWER SOURCE		1ø, 220 - 240V, 50Hz
TOTAL INPUT	(W)	REFER TO THE SPECIFICATIONS PAGE
TOTAL AMPERES	(A)	
COOLING CAPACITY	(kW)	
HEATING CAPACITY	(B.T.U.)	
DIMENSIONS (mm)	W	750
	H	570
	D	280
NET WEIGHT	(kg)	40

※ After installation

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

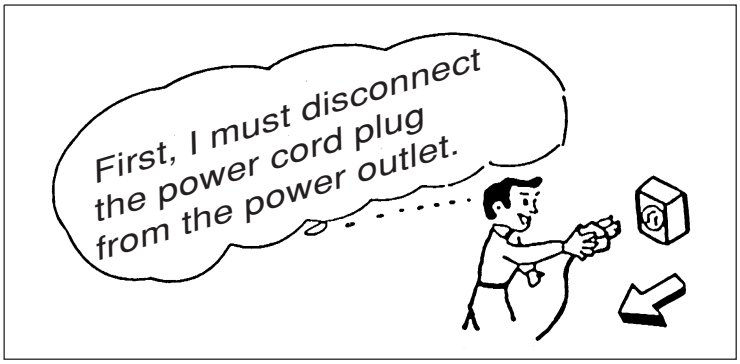
M AIR CONDITIONER

AUGUST 2

Division

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).

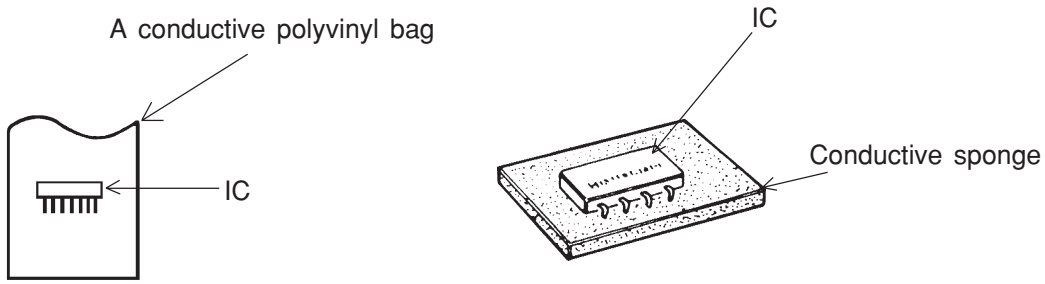


Fig. 1. Conductive Container

   (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.

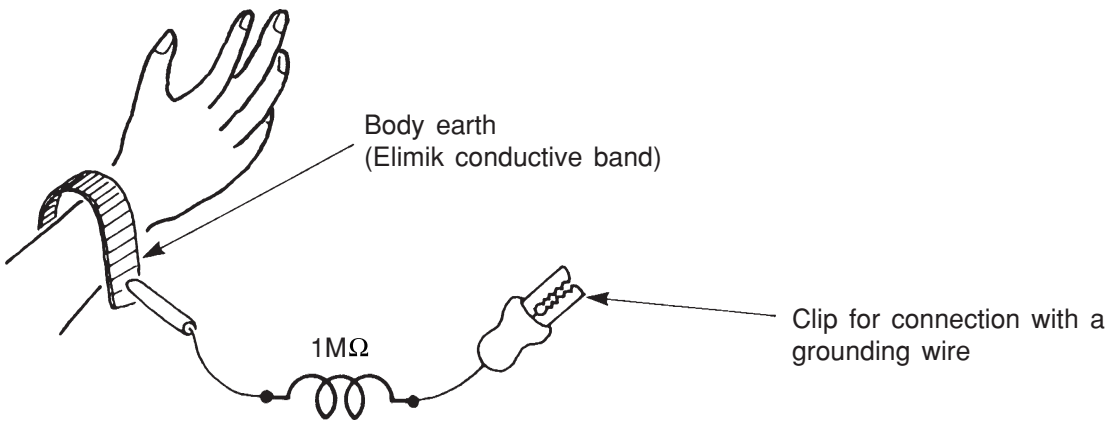


Fig. 2. Body Earth

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

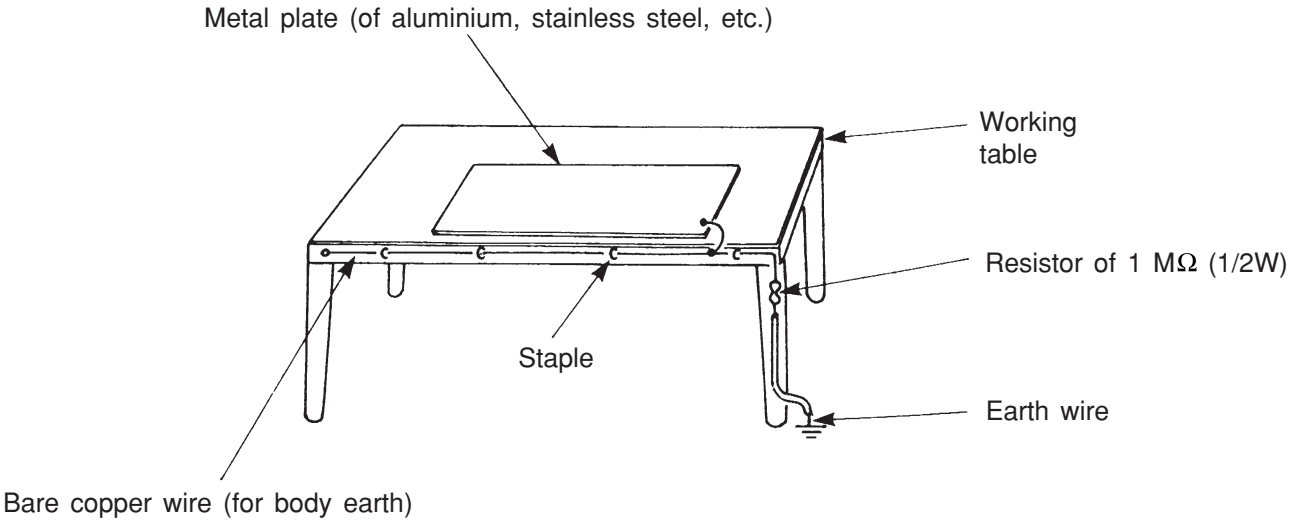


Fig. 3. Grounding of the working table

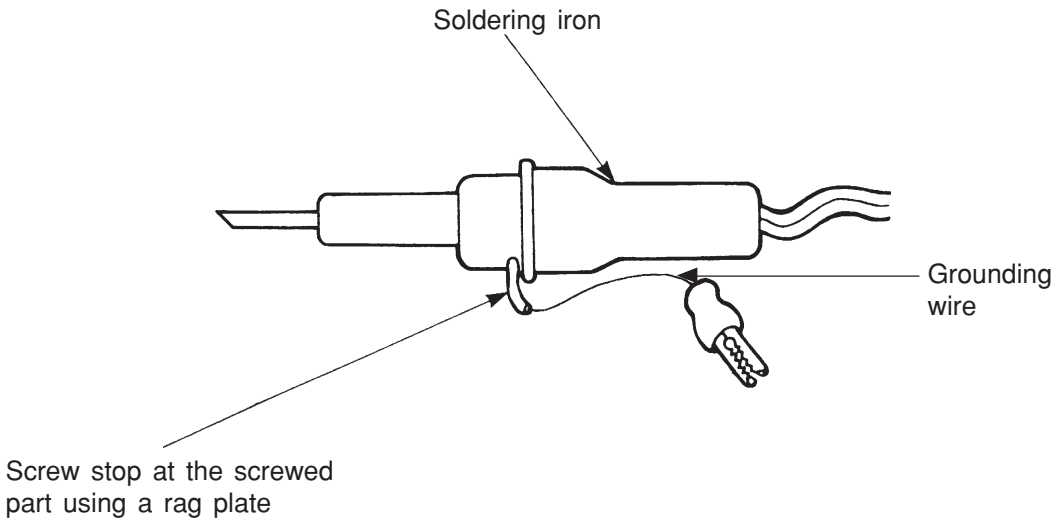


Fig. 4. Grounding a soldering iron

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 running, 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 thermostat, 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 (14°F).

6. This room air conditioner (the reverse cycle) should not be used when the outside temperature is below –15°C (5°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.

SPECIFICATIONS

MODEL		RAM-40QH5
FAN MOTOR		40 W
FAN MOTOR CAPACITOR		NO
FAN MOTOR PROTECTOR		NO
COMPRESSOR		JU1013D2
COMPRESSOR MOTOR CAPACITOR		NO
OVERLOAD PROTECTOR		YES
OVERHEAT PROTECTOR		YES
FUSE (for MICROPROCESSOR)		5.0A
POWER RELAY		G4A
POWER SWITCH		NO
TEMPORARY SWITCH		NO
SERVICE SWITCH		YES
TRANSFORMER		NO
VARISTOR		450NR
NOISE SUPPRESSOR		YES
THERMOSTAT		YES(IC)
REMOTE CONTROL SWITCH (LIQUID CRYSTAL)		NO
REFRIGERANT CHARGING VOLUME (Refrigerant 410A)	UNIT	1600g
		WITHOUT REFRIGERANT BECAUSE COUPLING IS FLARE TYPE.
	PIPES	MAX. 35m

※ RAM-40QH5
Additional charge of refrigerant is not required.

SPECIFICATIONS FOR INDOOR UNITS COMBINATION

TYPE		DC INVERTER DUAL SYSTEM MULTI COOLING AND HEATING
MODEL	OUTDOOR UNIT	RAM-40QH5
PHASE/VOLTAGE/FREQUENCY		1ø, 220 - 240V, 50Hz
CIRCUIT AMPERES TO CONNECT (A)		16
COOLING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	4.0 (1.50 - 4.50)
		13,660 (5,120 - 15,360)
	TOTAL INPUT (W)	1,245 (200 - 1,800)
	EER (B.T.U./hW)	10.97
	TOTAL AMPERES (A)	5.72 - 5.24
	POWER FACTOR (%)	99
HEATING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	5.0 (1.50 - 5.60)
		17,070 (5,120 - 19,120)
	TOTAL INPUT (W)	1,350 (200 - 1,780)
	EER (B.T.U./hW)	12.64
	TOTAL AMPERES (A)	6.20 - 5.68
	POWER FACTOR (%)	99
MAXIMUM LENGTH OF PIPING		MAX. 35m (TWO UNIT TOTAL)
STANDARD		CE (EMC&LVD)

MODEL		RAM-40QH5
PACKING (mm)	W	905
	H	633
	D	394
	cu.ft.	8.27
GROSS WEIGHT (kg)		43
FLARE NUT SIZE (SMALL/LARGE)		6.35D/9.52DX2

OPERATION SCOPE

	INDOOR SUCTION TEMPERATURE (˚C)	OUTDOOR SUCTION TEMPERATURE (˚C)	INDOOR SUCTION HUMIDITY (%)
COOLING OPERATION SCOPE	16 - 32	22 - 41	BELOW 80
DEHUMIDIFYING OPERATION	16 - 32	22 - 42	BELOW 80
HEATING OPERATION SCOPE	BELOW 27	–15 - 23	—

DUAL SYSTEM MULTI R.A.C. *RAM-40QH5*
COOL / HEAT CAPACITY SPEC. FOR INDOOR UNITS COMBINATIONS TO BE ABLE TO OPERATE SIMULTANEOUSLY

Whichever indoor units are installed, cooling and heating capacity depends on how many and which indoor units are operating at that time.

POSSIBLE COMBINATIONS TO OPERATE		COOLING				HEATING			
		CAPACITY RATING (kW) (RANGE)	TOTAL	OUTDOOR UNIT POWER CONSUMPTION (W)	OUTDOOR UNIT AMPERE (A) at 230V	CAPACITY RATING (kW) (RANGE)	TOTAL	OUTDOOR UNIT POWER CONSUMPTION (W)	OUTDOOR UNIT AMPERE (A) at 230V
ONE UNIT	1.8	1.8 (1.00-2.50)	1.8	560 (200-750)	2.5	2.5 (1.10-3.20)	2.5	690 (200-970)	3.0
	2.5	2.5 (1.00-3.10)	2.5	750 (200-880)	3.3	3.4 (1.10-4.40)	3.4	870 (200-1120)	3.8
	3.5	3.5 (1.00-4.00)	3.5	1090 (200-1300)	4.8	4.2 (1.10-5.0)	4.2	1080 (200-1300)	4.7
TWO UNIT	1.8+1.8	1.8+1.8 (1.50-4.00)	3.6	1190 (200-1680)	5.2	2.25+2.25 (1.50-5.20)	4.5	1100 (200-1480)	4.8
	1.8+2.5	1.70+2.30 (1.50-4.50)	4	1245 (200-1720)	5.5	2.20+2.60 (1.50-5.40)	4.8	1240 (200-1750)	5.4
	2.5+2.5	2.00+2.00 (1.50-4.50)	4	1245 (200-1800)	5.5	2.50+2.50 (1.50-5.60)	5	1350 (200-1780)	5.9
	1.8+3.5	1.60+2.40 (1.50-4.50)	4	1245 (200-1800)	5.5	1.70+3.30 (1.50-5.60)	5	1350 (200-1780)	5.9
	2.5+3.5	1.80+2.20 (1.50-4.50)	4	1245 (200-1800)	5.5	2.00+3.00 (1.50-5.60)	5	1350 (200-1780)	5.9

ONE UNIT : The values indicated are only for one unit operation when two indoor units are connected.

RATING CONDITON (DRY BLUB / WET BULB)

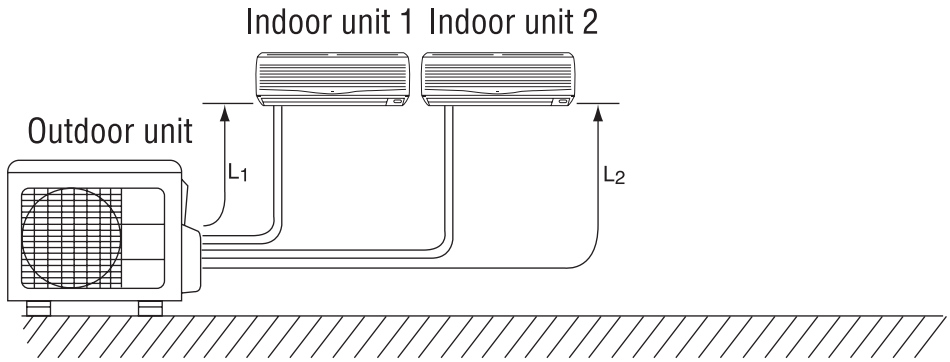
	INDOOR	OUTDOOR
COOLING	27 / 19 ˚C	35 / –˚C
HEATING	20 / –˚C	7 / 6˚C

INSTALLATION

PIPE LENGTH

(1) Total 35m maximum pipe length.

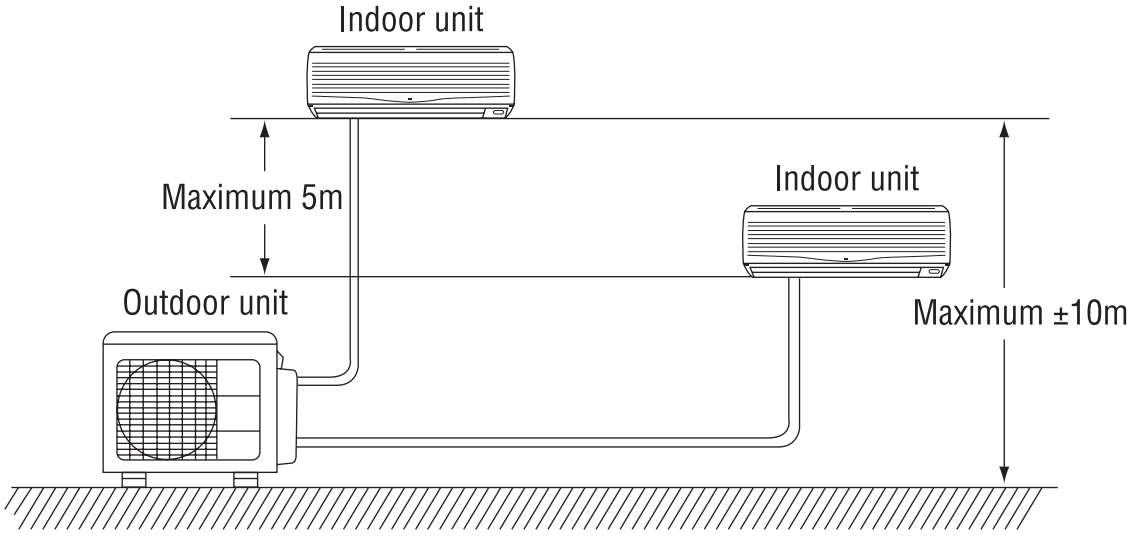
(2) Pipe length for one indoor unit : maximum 25m.



HIGHT DIFFERENCE

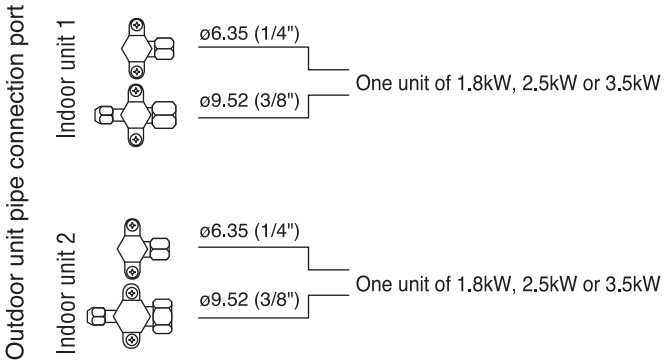
(1) Height : maximum ± 10m

(2) Height difference between each indoor unit ≤ 5m.

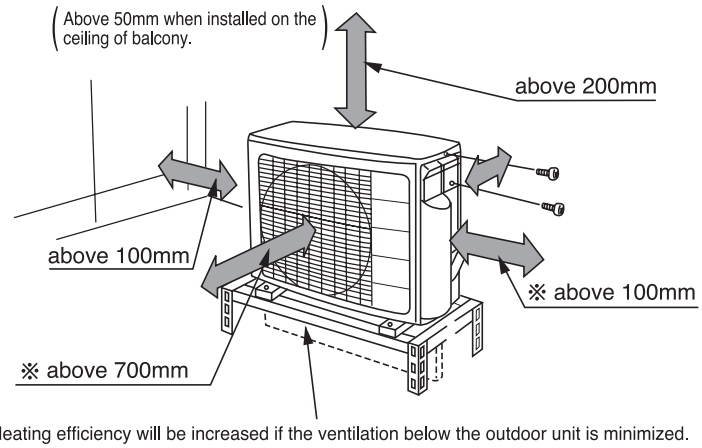


- To the outdoor unit, up to two indoor units can be connected until the total value of capacity from 4.0kW to 6.0kW.
- Make sure to connect to two indoor units.

MODEL: RAM-40QH5

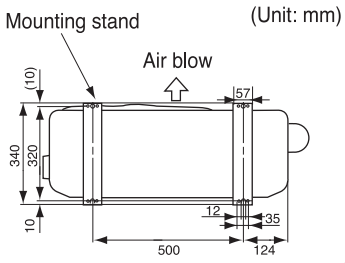


- Remove the side cover.
- For installation, refer as shown below.
- The space indicated with a ⇔ mark is required to guarantee the air conditioner's performance. Install the airconditioner in a place big enough to provide ample space for servicing and repairs later on.



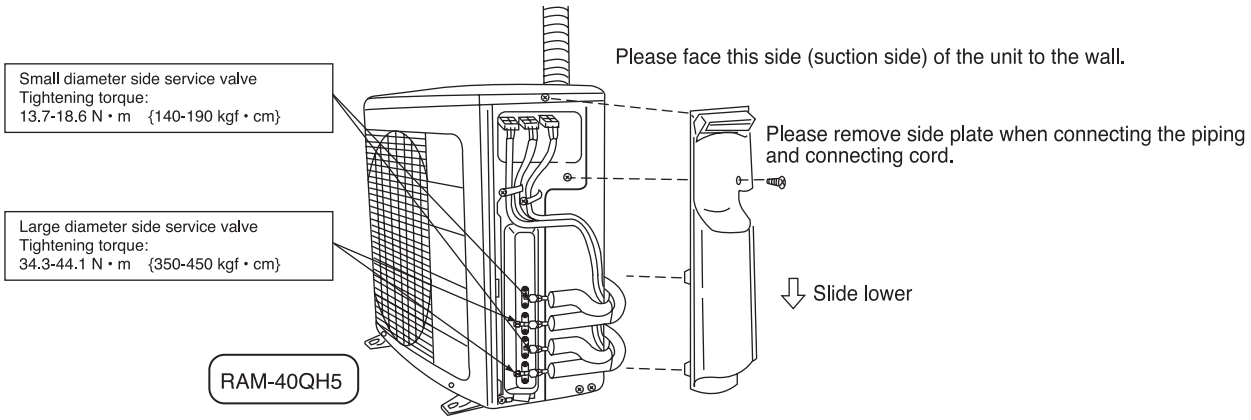
Heating efficiency will be increased if the ventilation below the outdoor unit is minimized.

Dimension of Mounting Stand of the Outdoor Unit



Connecting the pipe

- Install the unit in a stable place to minimize vibration or noise.
- After arranging the cord and pipes, secure them inplace.



- Hold the handle of the side cover. Slide down and takeoff the corner hook, then pull. Reverse these stepswhen installing.

1. Remove flare nut from service valve.
2. Apply refrigerant oil to flare nut sections of servicevalve and pipings.
3. Match center of piping to large diameter side service valve and tank assembly, and tighten flarenut first by hand, then securely tighten using torque wrench.
4. Perform air purge and gas leak inspection.
5. Wrap the provided insulating material around sidepiping using vinyl tape.

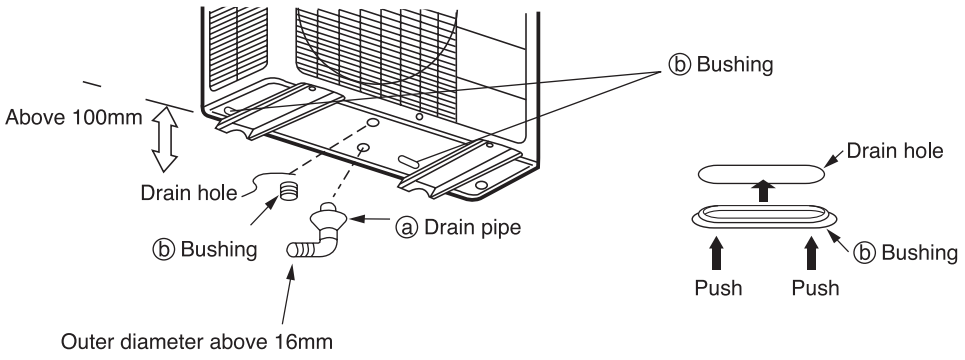
Condensed water disposal of outdoor unit

- There is holes on the base of outdoor unit for condensed water to exhaust.
- To lead condensed water to the drain hole, place the outdoor unit on the mounting stand (optional) or on blocks to raise its level more than 100mm from the ground surface. Connect the drain pipe as shown in the figure. Cover two other water drain holes with the bushings included. (To insall a bushing, push in both ends of the bushing so that it aligns with the drain hole.)
- When connecting the drain pipe, make sure that the bushing does not lift off or deviate from the base.
- Install the outdoor unit on a stable, flat surface and check to see that the condensed water drains.

When Using and Installing in Cold Areas

When the air conditioner is used in low temperature and in snowy conditions, water from the heat exchanger may freeze on the base surface to cause poor drainage. When using the air conditioner in such areas, do not install the bushings. Keep a minimum of 250mm between the drain hole and the ground. When using the drain pipe, consult your sales agent.

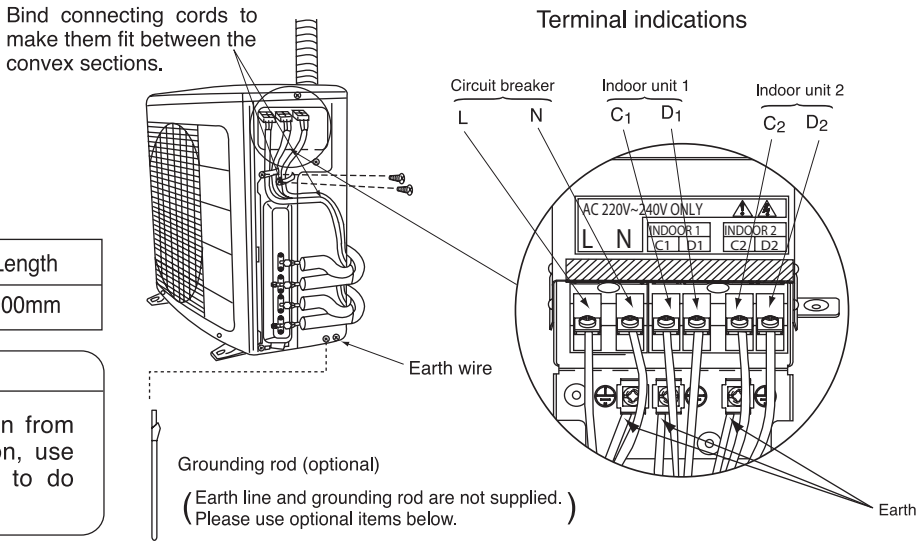
※ For more details, refer to the Installation Manual for Cold Areas.



Connection of the connecting cords and power cord. (Outdoor unit)
RAM-40QH5

⚠ WARNING

- Connecting cord should be connected according to Fig.1, that the Indoor unit No. shall match with terminal board No. of Outdoor unit.
- Be sure to fix the connecting cord with the band as shown below. Otherwise water leakage causes short circuit or faults.



Type of grounding rod	Length
SP-EB-2	900mm

⚠ CAUTION

- If earth line cannot be taken from the power supply connection, use the optional grounding rod to do earthing.

Wiring pattern
Indoor Unit

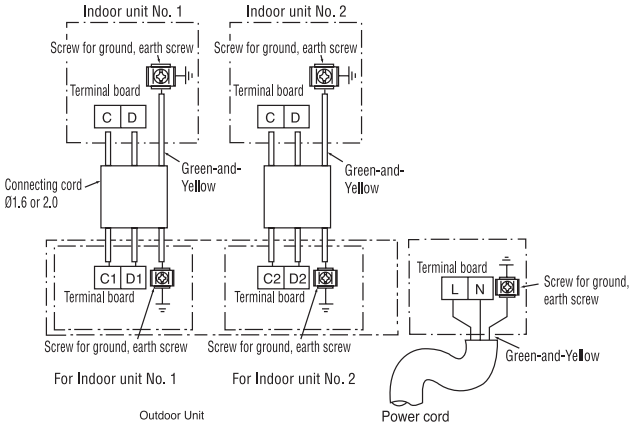
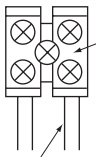


Fig. 1

⚠ WARNING

Connection of the power cord and connecting cord



Power cord and Connecting cord

Securely screw in the power cord and connecting cord so that it will not get loose or disconnect.

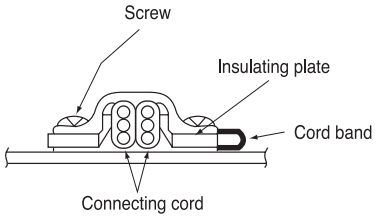
Tightening torque reference value: 1.2 to 1.6 N•m (12 to 16 kgf•cm)

Excessive tightening may damage the interior of the cord requiring replacement.

⚠ CAUTION

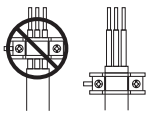
- To prevent a connection error, connecting cords should be bundled and taped to each respective pipe. If connecting cords are mixed with other indoor units, a refrigeration cycle abnormality may occur, causing dripping.

- When putting two connecting cords through the band.



⚠ WARNING

- Leave some space in the connecting cord for maintenance purpose and be sure to secure it with the cord band.
- Secure the connecting cord along the coated part of the wire using the cord band. Do not exert pressure on the wire as this may cause overheating or fire.

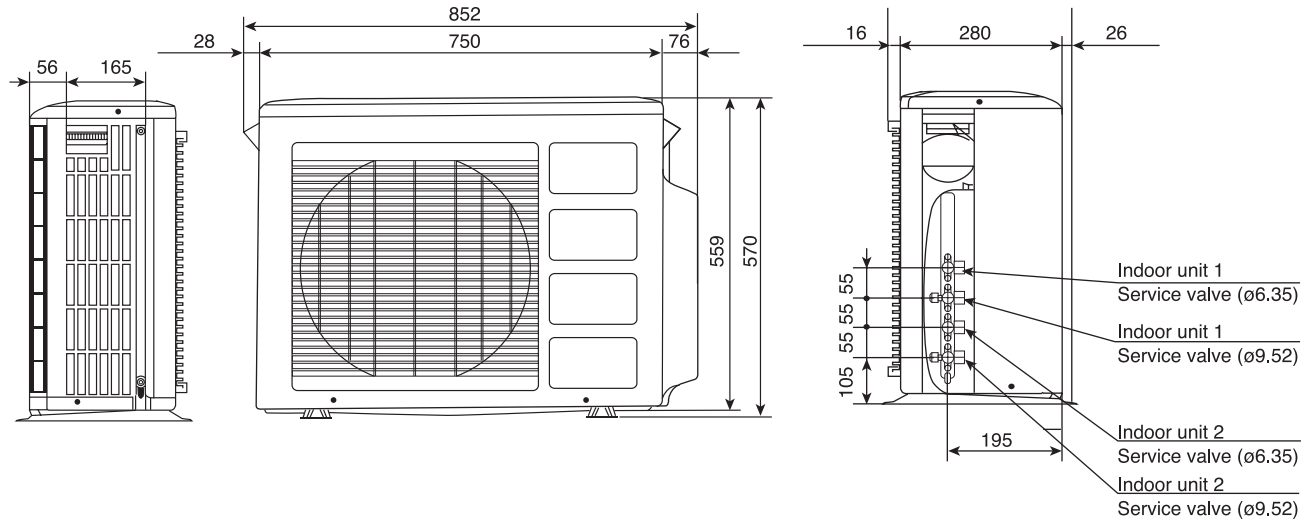


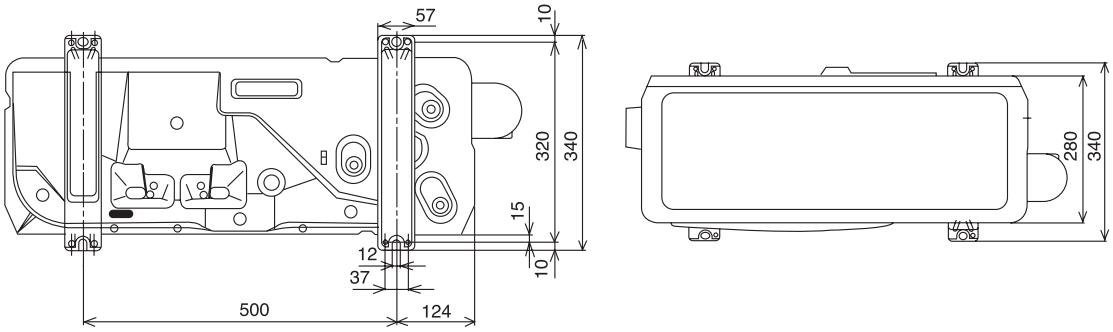
- Hold the handle of the side cover, slide down and take off the corner hook, then pull. Reverse these steps when installing.

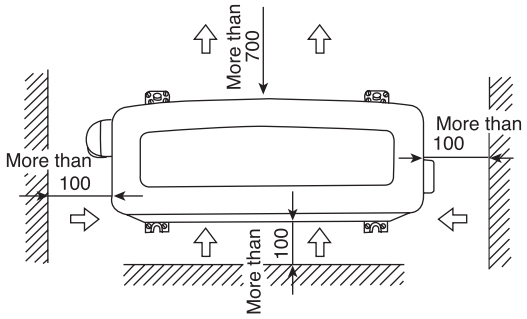
CONSTRUCTION AND DIMENSIONAL DIAGRAM

MODEL RAM-40QH5

Unit: mm







Service space

Note:

1. Insulated pipes should be used for both small and large diameter pipes.
2. Piping length should be within 35m in total.
3. Height difference of piping between indoor unit and outdoor unit should be within 10m.
4. Overhead clearance of outdoor unit should be 200mm to allow servicing.
5. For electrical connection, please refer to the installation manual.

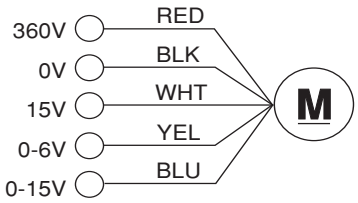
ATTENTION

During service, before opening the side cover, please switch off power supply.

MAIN PARTS COMPONENT

FAN MOTOR

Fan Motor Specifications

MODEL		RAM-40QH5
POWER SOURCE		DC : 360V
OUTPUT		40W
CONNECTION		 (Control circuit built in)
RESISTANCE VALUE (Ω)	20˚C (68˚F)	—
	75˚C (167˚F)	—

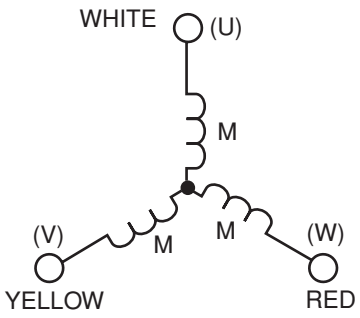
BLU : BLUE YEL : YELLOW BRN : BROWN WHT : WHITE

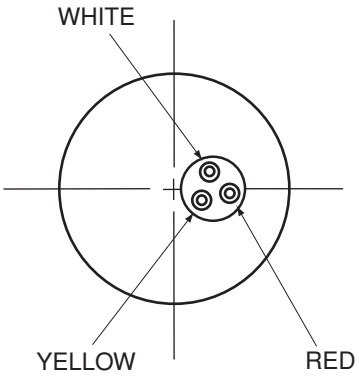
GRY : GRAY ORN : ORANGE GRN : GREEN RED : RED

BLK : BLACK PNK : PINK VIO : VIOLET

COMPRESSOR

Compressor Motor Specifications

MODEL		RAM-40QH5
COMPRESSOR MODEL		JU1013D2
PHASE		SINGLE
RATED VOLTAGE		DC: 280-330V
RATED FREQUENCY		50Hz
POLE NUMBER		4
CONNECTION		
RESISTANCE VALUE (Ω)	25°C (68°F)	2M = 1.063
	75°C (167°F)	2M = 1.268

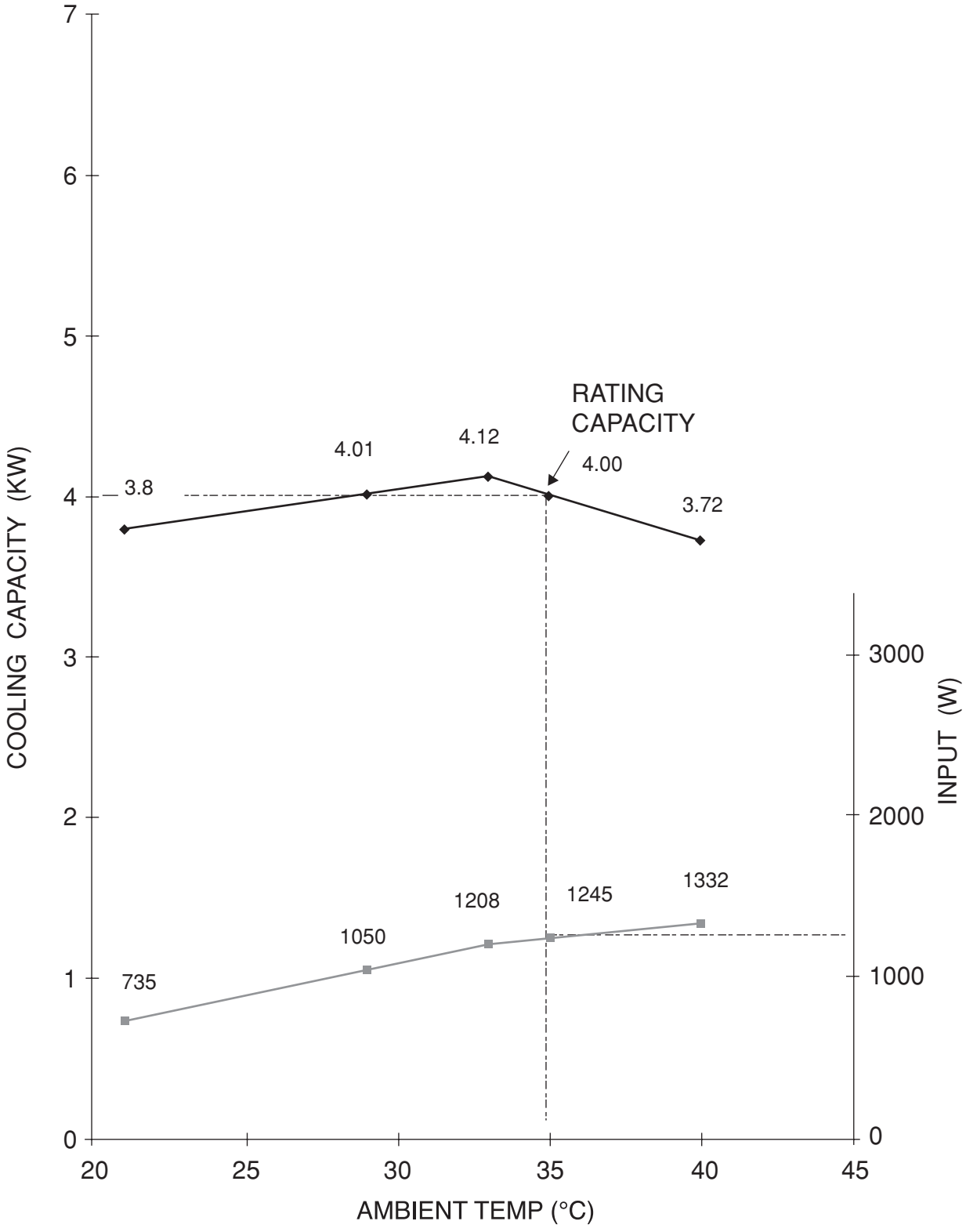


CAPACITY DIAGRAM (RELATED TO THE AMBIENT TEMPERATURE)

MODEL : RAM-40QH5

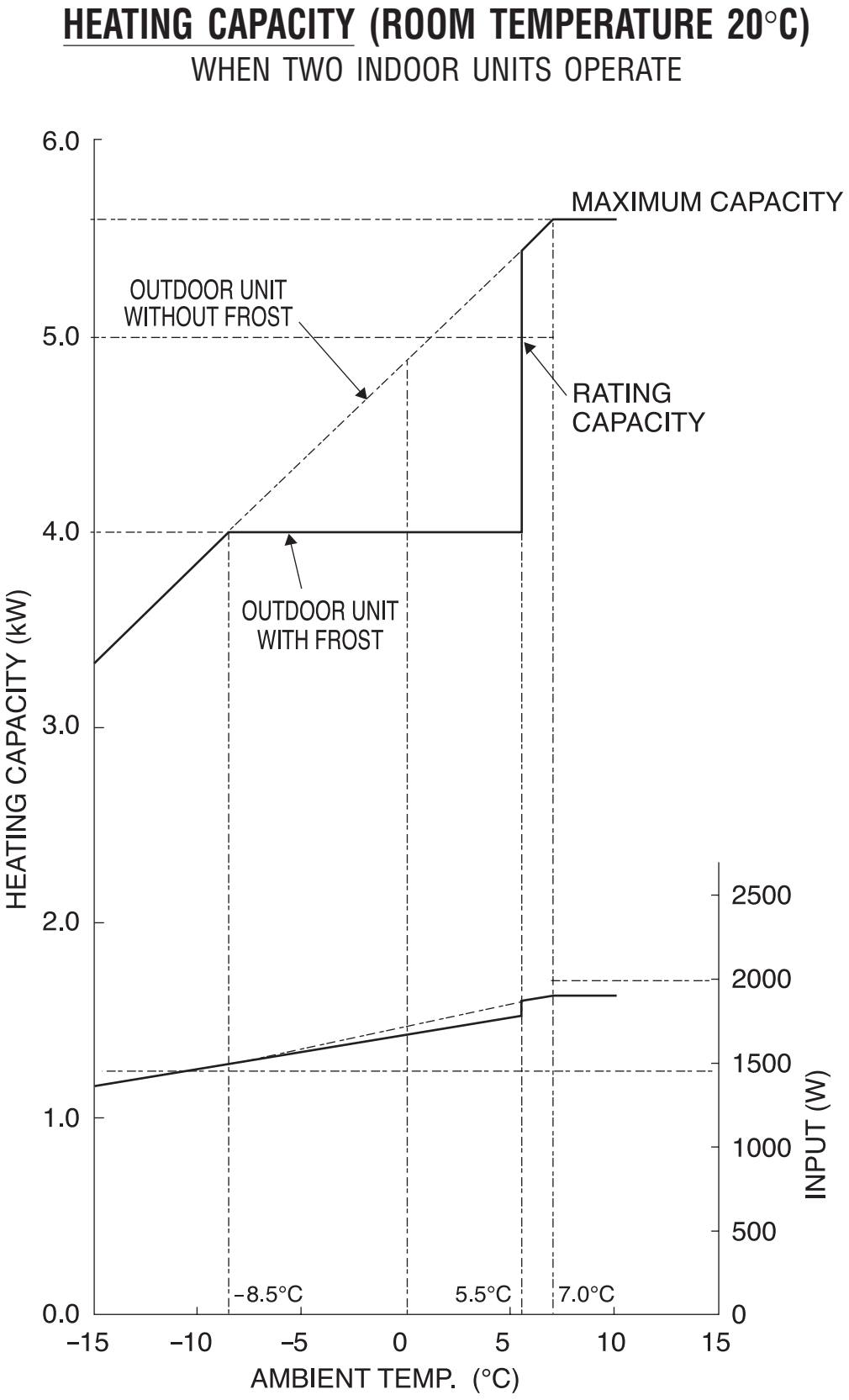
COOLING CAPACITY (ROOM TEMPERATURE 27°C)

WHEN TWO INDOOR UNITS OPERATE



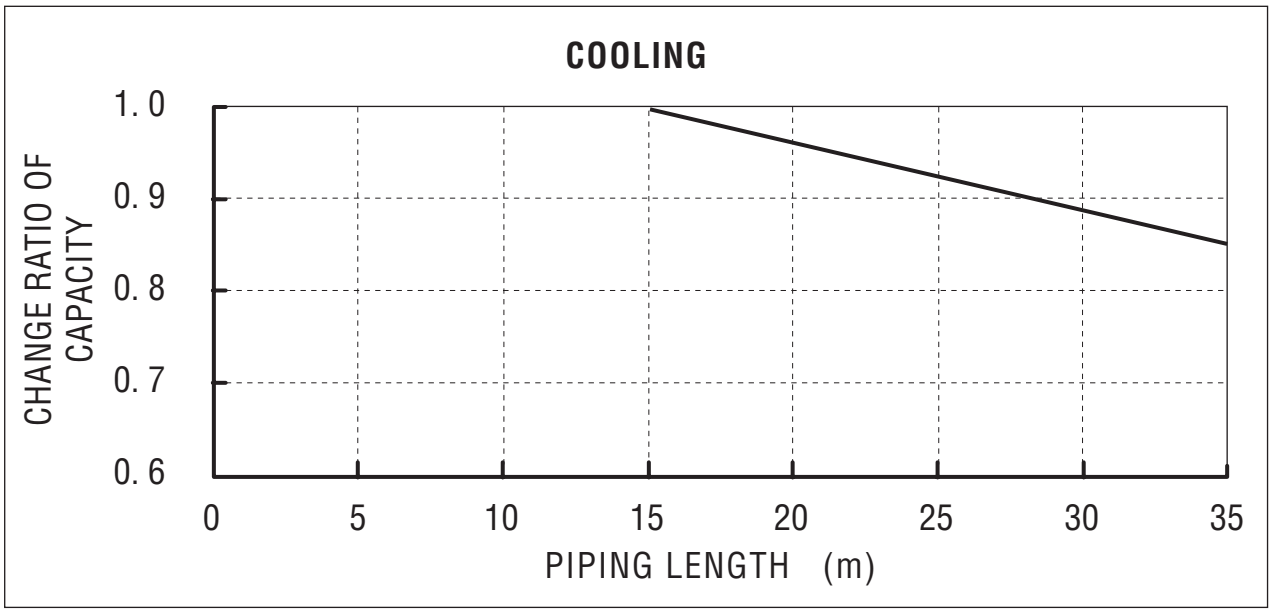
CAPACITY DIAGRAM (RELATED TO THE AMBIENT TEMPERATURE)

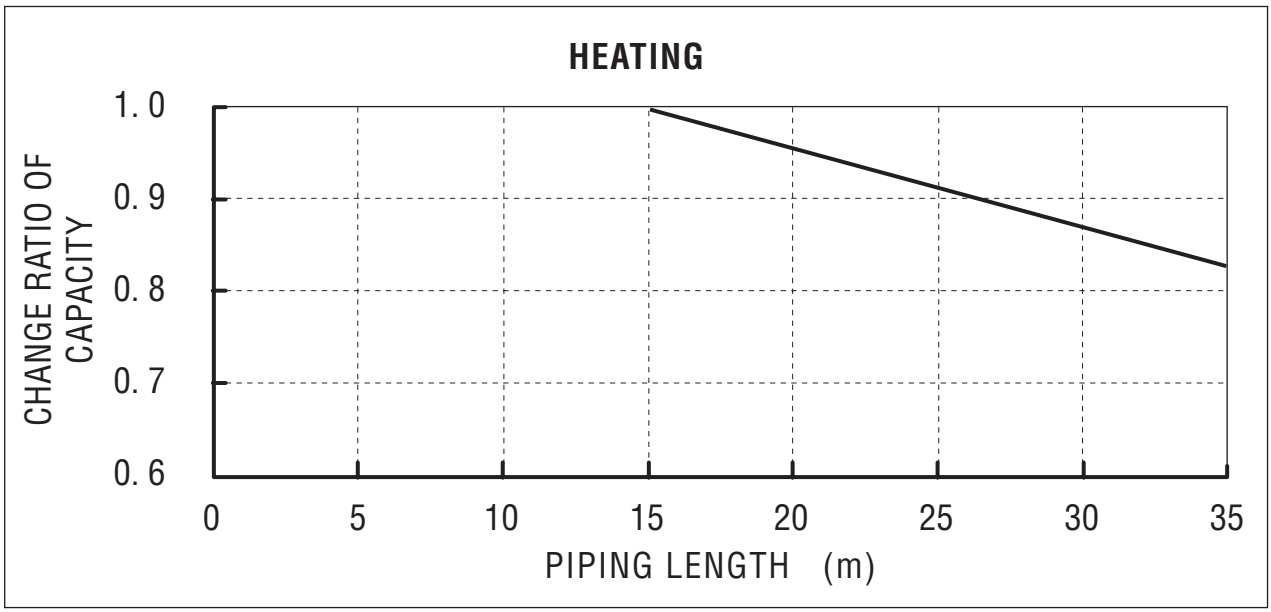
MODEL : RAM-40QH5



CAPACITY DIAGRAM (RELATED TO THE PIPING LENGTH)

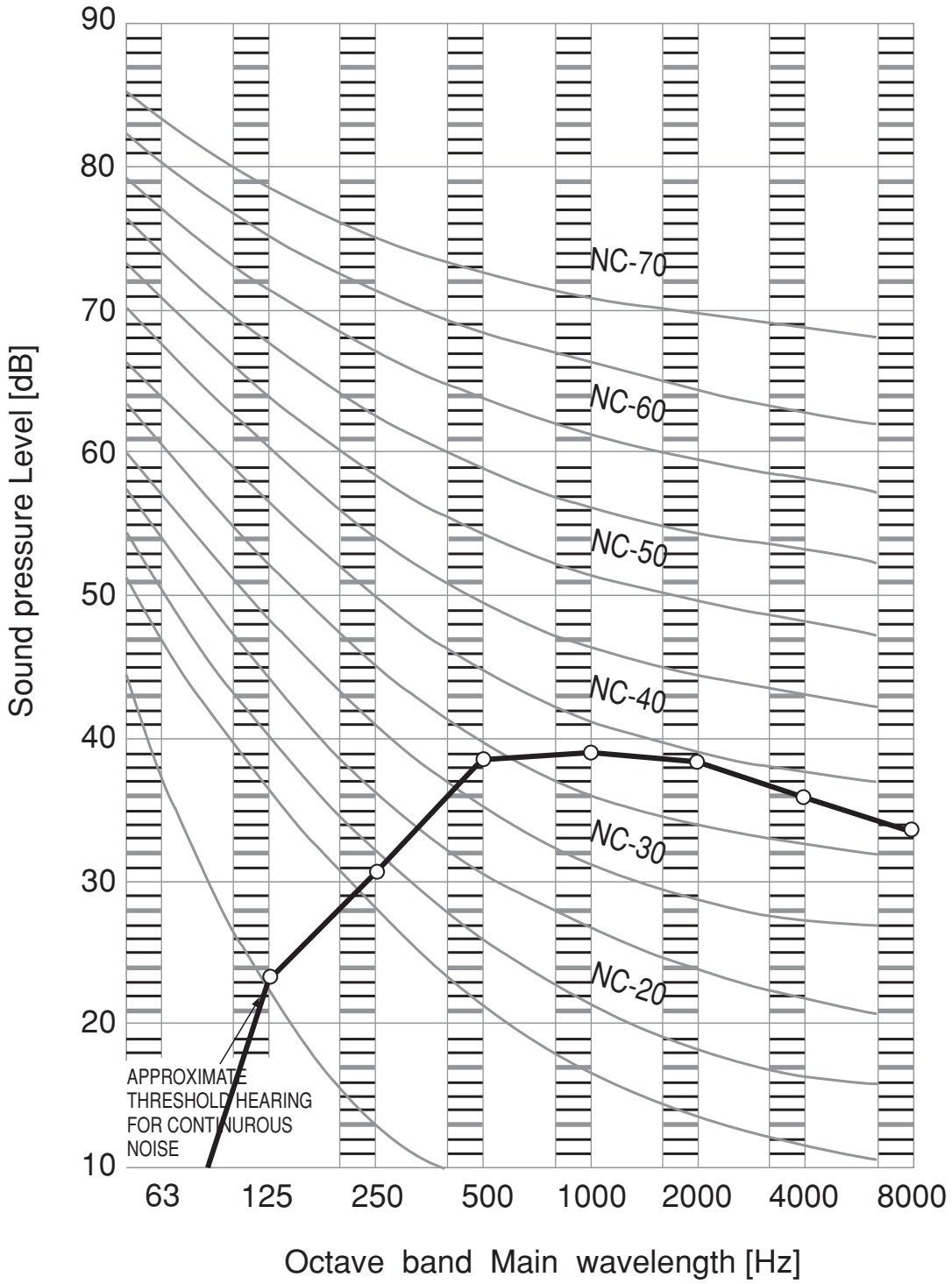
MODEL : RAM-40QH5





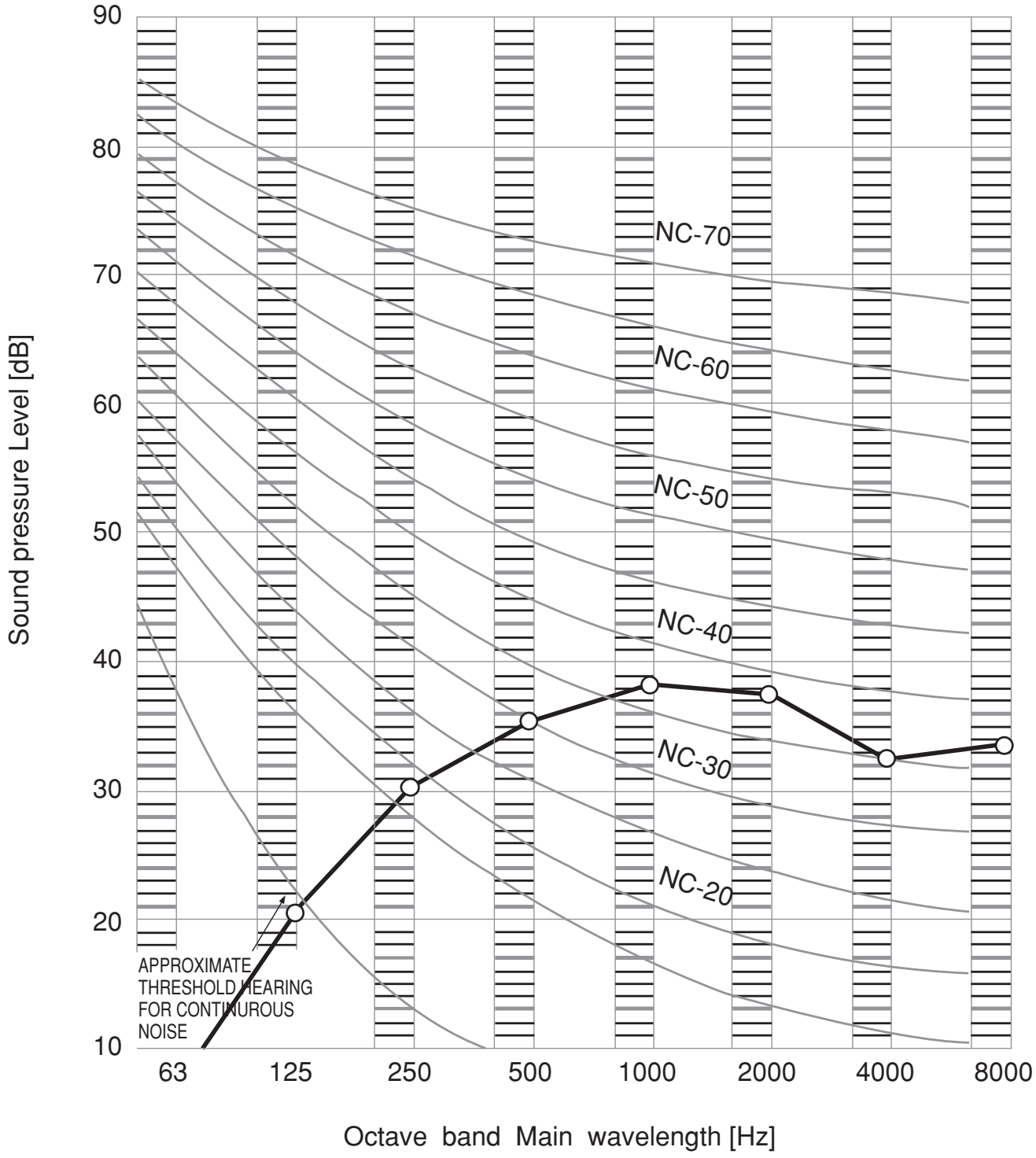
SOUND PRESSURE LEVEL

MODEL : RAM-40QH5 (Heating)



SOUND PRESSURE LEVEL

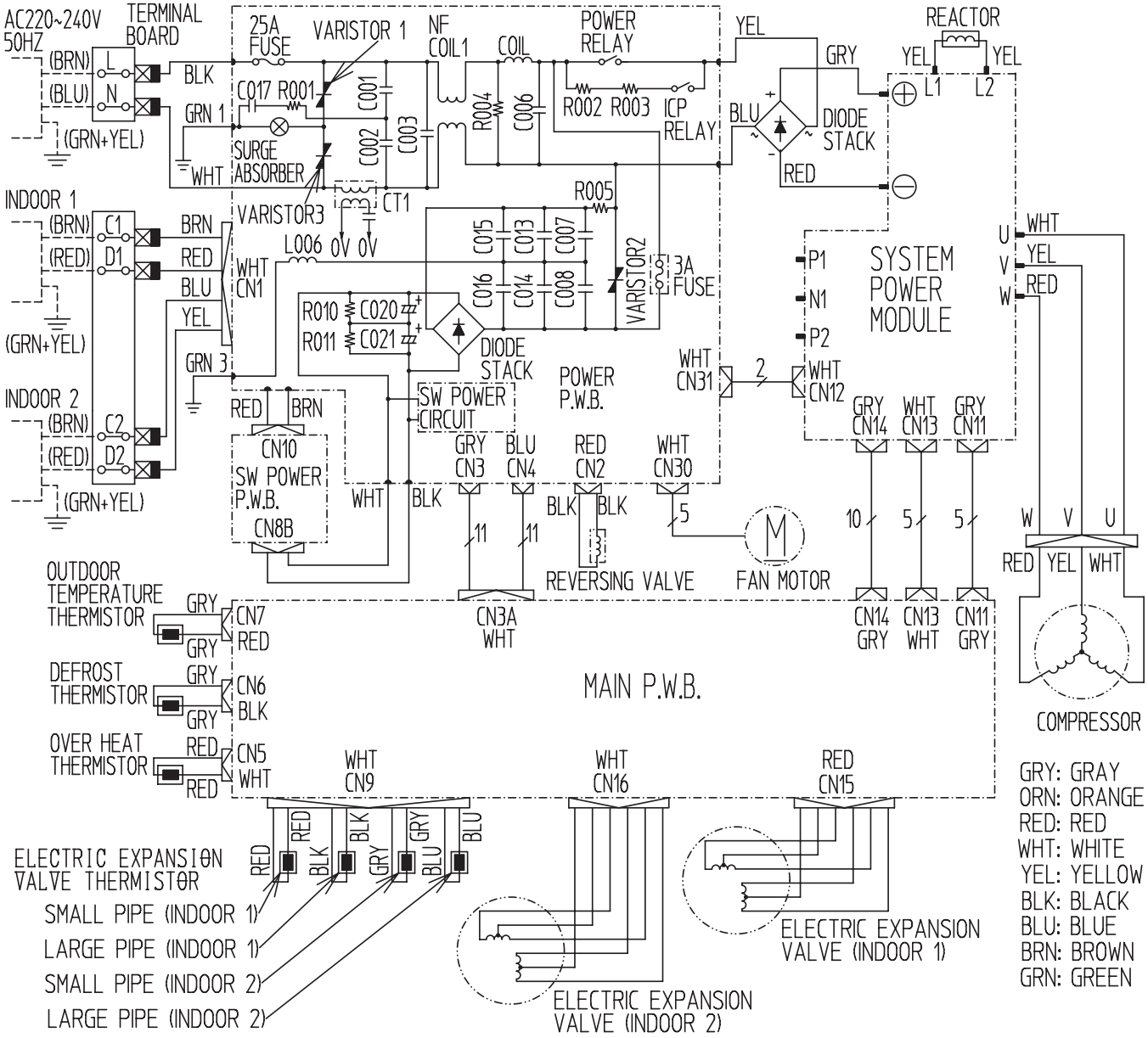
MODEL : RAM-40QH5 (Cooling)



WIRING DIAGRAM

OUTDOOR UNIT

MODEL RAM-40QH5

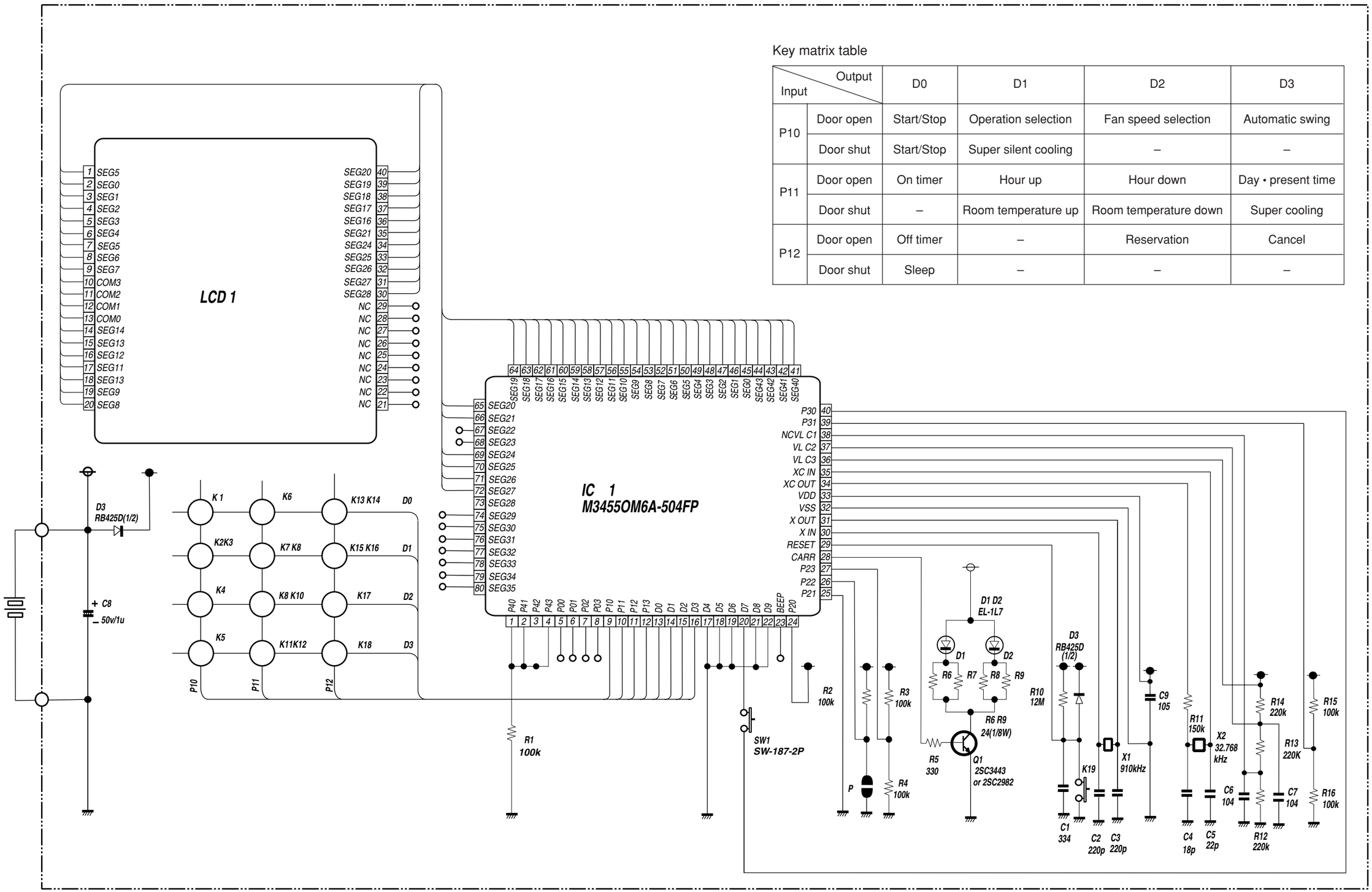


CIRCUIT DIAGRAM

Remote Control

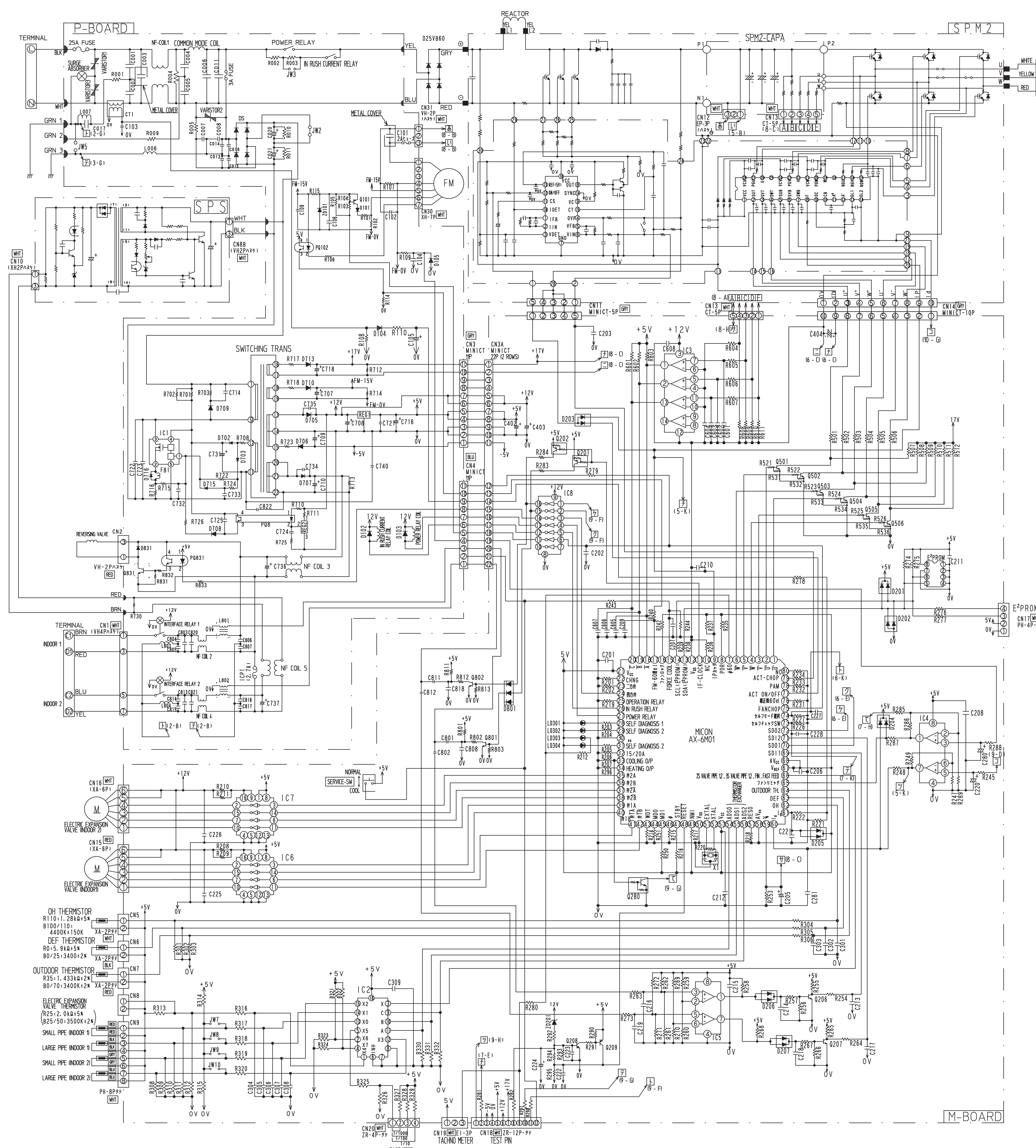
Key matrix table

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 RAM-40QH5



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

PCB SET
NO MARKING : #M-BORD-AS
P : #P-BORD-AS

TYPE
F : FILM
C : CERAMIC
D : ELECTROLYTIC

RESISTOR

MARK	RATING Ω	%	W	MOUNTING	PCB SET	A'SSY NO.	REMARK
R001	39	5%	1/4	A	P	28	
R002	100	5%	10	H	P	14	
R003	100	5%	10	A	P	14	
R004	470K	5%	1/2	A	P	15	
R005	2.2	5%	5	H	P	16	
R009			1/4	A	P		
R010	470K	5%	1/2	A	P	15	
R011	470K	5%	1/2	A	P	15	
R101	3.6K	1%	1/6	A	P	33	
R102	3K	1%	1/6	A	P	34	
R103	30K	5%	1/6	A	P	35	
R104	3.9K	5%	1/6	A	P	36	
R105	7.5K	5%	1/6	A	P	37	
R106	2.4K	5%	1/6	A	P	38	
R107	1	1%	2	R	P	39	ロ-7CW
R108	1K	1%	1/6	A	P	40	
R109	510	5%	1/6	A	P	41	
R110	1.69K	1%	1/6	A	P	42	
R114	1K	5%	1/6	A	P	43	
R115	JUMPER WIRE			A	P		
R201	10K	5%	1/16	C		11	1608
R202	10K	5%	1/16	C		11	1608
R203	2K	5%	1/16	C		13	1608
R204	2K	5%	1/16	C		13	1608
R205	2K	5%	1/16	C		13	1608
R206	10K	5%	1/16	C		11	1608
R207	10K	5%	1/16	C		11	1608
R208	200	5%	1/10	C		15	2125
R209	200	5%	1/10	C		15	2125
R210	200	5%	1/10	C		15	2125
R211	200	5%	1/10	C		15	2125
R212	2K	5%	1/16	C		13	1608
R214	10K	5%	1/16	C		11	1608
R215	10K	5%	1/16	C		11	1608
R216	10K	5%	1/16	C		11	1608
R217	10K	5%	1/16	C		11	1608
R218	10K	5%	1/16	C		11	1608
R219	10K	5%	1/16	C		11	1608
R220	1M	5%	1/16	C		14	1608
R221	10K	1%	1/16	C		12	1608
R222	510	5%	1/16	C		16	1608
R226	10K	5%	1/16	C		11	1608
R227	10K	5%	1/16	C		11	1608
R231	10K	5%	1/16	C		11	1608
R232	10K	5%	1/16	C		11	1608
R233	100	5%	1/16	C		17	1608
R234	10K	5%	1/16	C		11	1608
R235	10K	5%	1/16	C		11	1608
R236	10K	5%	1/16	C		11	1608
R237	5.1K	5%	1/16	C		18	1608
R238	100	5%	1/16	C		17	1608
R239	100	5%	1/16	C		17	1608
R240	1K	5%	1/16	C		20	1608
R242	10K	5%	1/16	C		11	1608
R243	100	5%	1/16	C		17	1608
R244	2K	5%	1/16	C		13	1608
R245	5.1K	5%	1/16	C		18	1608
R247	3.16K	1%	1/16	C		19	1608
R248	1K	5%	1/16	C		20	1608
R249	20K	1%	1/16	C		21	1608
R250	10K	5%	1/16	C		11	1608
R251	10K	5%	1/16	C		11	1608
R253	3.32K	1%	1/16	C		22	1608
R254	100	5%	1/16	C		17	1608
R255	2K	5%	1/16	C		13	1608
R256	10K	5%	1/16	C		11	1608
R257	3K	5%	1/16	C		23	1608
R258	1K	5%	1/16	C		20	1608
R259	8.25K	1%	1/16	C		24	1608
R260	10K	1%	1/16	C		12	1608
R261	10K	1%	1/16	C		12	1608
R262	10K	1%	1/16	C		12	1608
R263	1K	5%	1/16	C		20	1608
R264	100	5%	1/16	C		17	1608
R265	2K	5%	1/16	C		13	1608
R266	10K	5%	1/16	C		11	1608
R267	3K	5%	1/16	C		23	1608
R268	1K	5%	1/16	C		20	1608
R269	8.25K	1%	1/16	C		24	1608
R270	10K	1%	1/16	C		12	1608
R271	10K	1%	1/16	C		12	1608
R272	10K	1%	1/16	C		12	1608
R273	1K	5%	1/16	C		20	1608
R274	5.1K	5%	1/16	C		18	1608
R275	5.1K	5%	1/16	C		18	1608
R276	390	5%	1/16	C		25	1608
R277	390	5%	1/16	C		25	1608
R278	JUMPER	5%	1/16	C		26	1608
R279			1/16	C			

MARK	RATING Ω	%	W	MOUNTING	PCB SET	A'SSY NO.	REMARK
R280	100	5%	1/16	C		17	1608
R281	100	5%	1/16	C		17	1608
R282	100	5%	1/16	C		17	1608
R283	360	5%	1/10	C		27	2125
R284	360	5%	1/10	C		27	2125
R285			1/16	C			1608
R286	2K	1%	1/16	C		46	1608
R287	2K	5%	1/16	C		13	1608
R288	1K	5%	1/16	C		20	1608
R289	1K	1%	1/16	C		47	1608
R290	10K	5%	1/16	C		11	1608
R291	4.7K	5%	1/16	C		29	1608
R292	3K	5%	1/16	C		23	1608
R293	1.6K	5%	1/16	C		30	1608
R294	27K	5%	1/16	C		31	1608
R295	5.1K	5%	1/16	C		18	1608
R296	10K	5%	1/16	C		11	1608
R297	1K	5%	1/16	C		20	1608
R298	1K	5%	1/16	C		20	1608
R301	3.74K	1%	1/16	C		32	1608
R302	3.01K	1%	1/16	C		33	1608
R303	3.01K	1%	1/16	C		33	1608
R304	100	5%	1/16	C		17	1608
R305	100	5%	1/16	C		17	1608
R306	100	5%	1/16	C		17	1608
R308	2K	2%	1/16	C		34	1608
R309	2K	2%	1/16	C		34	1608
R310	2K	2%	1/16	C		34	1608
R311	2K	2%	1/16	C		34	1608
R312	10K	1%	1/16	C		12	1608
R313	5.1K	5%	1/16	C		18	1608
R314			1/16	C			1608
R315			1/16	C			1608
R316	1K	5%	1/16	C		20	1608
R317	1K	5%	1/16	C		20	1608
R318	1K	5%	1/16	C		20	1608
R319	1K	5%	1/16	C		20	1608
R320	1K	5%	1/16	C		20	1608
R321			1/16	C			1608
R322			1/16	C			1608
R323	10K	5%	1/16	C		11	1608
R324	10K	5%	1/16	C		11	1608
R325	1K	5%	1/16	C		20	1608
R326	2.7K	5%	1/16	C		36	1608
R327	470	5%	1/16	C		37	1608
R328	1.6K	5%	1/16	C		30	1608
R329	4.3K	5%	1/16	C		38	1608
R330	10K	5%	1/16	C		11	1608
R331	10K	5%	1/16	C		11	1608
R332	10K	5%	1/16	C		11	1608
R501	1K	5%	1/16	C		20	1608
R502	1K	5%	1/16	C		20	1608
R503	1K	5%	1/16	C		20	1608
R504	1K	5%	1/16	C		20	1608
R505	1K	5%	1/16	C		20	1608
R506	1K	5%	1/16	C		20	1608
R507	5.1K	5%	1/8	C		45	3216
R508	5.1K	5%	1/8	C		45	3216
R509	5.1K	5%	1/8	C		45	3216
R510	5.1K	5%	1/8	C		45	3216
R511	5.1K	5%	1/8	C		45	3216
R512	5.1K	5%	1/8	C		45	3216
R521	10K	5%	1/16	C		11	1608
R522	10K	5%	1/16	C		11	1608
R523	10K	5%	1/16	C		11	1608
R524	10K	5%	1/16	C		11	1608
R525	10K	5%	1/16	C		11	1608
R526	10K	5%	1/16	C		11	1608
R531	5.1K	5%	1/16	C		18	1608
R532	5.1K	5%	1/16	C		18	1608
R533	5.1K	5%	1/16	C		18	1608
R534	5.1K	5%	1/16	C		18	1608
R535	5.1K	5%	1/16	C		18	1608
R536	5.1K	5%	1/16	C		18	1608
R601	2K	5%	1/16	C		13	1608
R602	2K	5%	1/16	C		13	1608
R603	2K	5%	1/16	C		13	1608
R604	100	5%	1/16	C		17	1608
R605	100	5%	1/16	C		17	1608
R606	100	5%	1/16	C		17	1608
R607	100	5%	1/16	C		17	1608
R608	4.02K	1%	1/16	C		44	1608
R609	4.02K	1%	1/16	C		44	1608
R610	4.02K	1%	1/16	C		44	1608
R611	4.02K	1%	1/16	C		44	1608

MARK	RATING Ω	%	W	MOUNTING	PCB SET	A'SSY NO.	REMARK
R701	560K	5%	1/2	A	P	17	
R702	560K	5%	1/2	A	P	17	
R703	100K	5%	2	A	P	29	
R704			1	A	P		
R708	10	5%	1/4	A	P	18	
R710	1.8K	5%	1/4	A	P	19	
R711	75	5%	1/6	A	P	20	
R712	3.3K	5%	1/4	A	P	21	
R713	8.2K	5%	1	H	P	22	
R714	3.3K	5%	1/4	A	P	21	
R715	680	5%	1/4	A	P	23	
R716	0.39	5%	1	A	P	24	
R717	JUMPER WIRE		1/4	A	P		
R718	8.2	5%	1/4	A	P	25	
R722	2.7K	5%	1/4	A	P	27	
R723	33	5%	1/6	A	P	26	
R724	2.7K	5%	1/4	A	P	27	
R725	JUMPER WIRE		1/4	A	P		
R726	3.3K	5%	1/4	A	P	21	
R730	1.6K	5%	2	H	P	28	
R801	39	5%	1/4	C		43	
R802	39	5%	1/4	C		43	
R803	3K	5%	1/16	C		23	
R811	39	5%	1/4	C		43	
R812	39	5%	1/4	C		43	
R813	3K	5%	1/16	C		23	
R831	10K	5%	1/6	A	P	30	
R832	7.5K	5%	1/2	A	P	31	
R833	620	5%	1/6	A	P	32	

CAPACITOR

MARK	RATING μ	V	TYPE	MOUNTING	PCB SET	A'SSY NO.	MODEL	REMARK
C001	0.01	AC250	C	R	P	72		規格品
C002	0.01	AC250	C	R	P	72		規格品
C003	0.56	630	F	H	P	55		
C004			C	R	P			
C005			C	R	P			
C006	4.0	AC400	F	H	P	56		
C007	0.01	AC250	C	R	P	72		規格品
C008	0.01	AC250	C	R	P	72		規格品
C010			D	H	P			
C011			F	H	P			
C013	0.01	AC250	C	R	P	72		規格品
C014	0.01	AC250	C	R	P	72		規格品
C015	0.01	AC250	C	R	P	72		規格品
C016	0.01	AC250	C	R	P	72		規格品
C017	0.01	AC250	C	R	P	72		規格品
C020	220	200	D	H	P	57	KMX	
C021	220	200	D	H	P	57	KMX	

CAPACITOR

MARK	RATING μ	V	TYPE	MOUNTING	PCB SET	A'SSY NO.	MODEL	REMARK
C101	0.082	630	F	H	P	84		
C102		50	C	R	P			
C103	0.1	50	C	R	P	52		
C104	1000p	50	C	R	P	66		
C105	100	10	D	R	P	53		
C106		50	C	R	P			
C109	0.1	50	C	R	P	52		
C201	0.1	25	C	C		51		1608
C202	2200p	50	C	C		50		1608
C203	2200p	50	C	C		50		1608
C205	0.1	50	D	C		67	WX	φ4
C206	0.1	25	C	C		51		1608
C207	0.047	50	C	C		53		1608
C208	0.1	25	C	C		51		1608
C209	0.1	25	C	C		51		1608
C210	0.047	50	C	C		53		1608
C211	0.1	25	C	C		51		1608
C212	0.1	25	C	C		51		1608
C213	0.047	50	C	C		53		1608
C214	0.068	16	C	C		55	B	1608
C215	0.1	25	C	C		51		1608
C216	4700p	50	C	C		56	B	1608
C217	0.047	50	C	C		53		1608
C218	0.068	16	C	C		55	B	1608
C219	4700p	50	C	C		56	B	1608
C220	22	6.3	D	C		57	WX	φ4
C221	0.1	25	C	C		51		1608
C222	0.1	25	C	C		51		1608
C223	0.1	25	C	C		51		1608
C224	10	16	D	C		52	WX	φ3
C225	0.1	25	C	C		51		1608
C226	0.1	25	C	C		51		1608
C227	0.1	25	C	C		51		1608
C228	0.1	25	C	C		51		1608
C280	2.2	50	D	C		54	WX	φ4
C281	0.01	50	C	C		66	R	1608
C301	0.1	25	C	C		51		1608
C302	0.1	25	C	C		51		1608
C303	0.1	25	C	C		51		1608
C304	1	16	C	C		58		2125
C305	1	16	C	C		58		2125
C306	1	16	C	C		58		2125
C307	1	16	C	C		58		2125
C308	1	16	C	C		58		2125
C309	0.1	25	C	C		51		1608
C402	100	10	D	C		59	UR	φ6.3
C403	100	25	D	C		60	WX	φ8
C404	33	25	D	C		61	WX	φ6.3
C601	680p	50	C	C		62	CH	2125
C602	680p	50	C	C		62	CH	2125
C603	680p	50	C	C		62	CH	2125
C604	680p	50	C	C		62	CH	2125
C605	1000pF	50	C	C		63	B	1608
C606	1000pF	50	C	C		63	B	1608
C607	1000pF	50	C	C		63	B	1608
C608	0.1	25	C	C		51		1608
C707	100	25	D	R	P	58	PF	
C708	330	25	D	R	P	59	PF	
C709	180	10	D	R	P	60	PF	
C710	330	50	D	R	P	61	PF	偏平
C714	0.01	1KV	C	H	P	70		
C716	330	10	D	R	P	62	PF	
C718	220	25	D	R	P	63	PF	
C721	0.1	50	C	R	P	52		
C722			C	R	P			
C723	470P	2KV	C	R	P	64		
C724	0.1	50	C	R	P	52		
C725			C	R	P			
C731	100	25	D	R	P	58	PF	
C732	470P	50	C	R	P	65	E	
C733	1000pF	50	C	R	P	66	E	
C734	1000pF	AC250	C	R	P	67		
C735	1000pF	50	C	R	P	66	E	
C736	68	50	D	R	P	68	PF	
C737	68	50	D	R	P	68	PF	
C740	470P	AC250	C	H	P	73		
C801	0.15	50	F	C		64		
C802	0.022	16	F	C		65		
C803	0.15	50	F	R	P	69		
C804	0.01	AC250	C	H	P	72		規格品
C805	0.01	AC250	C	H	P	72		規格品
C806	0.01	AC250	C	H	P	71		
C807	0.01	AC250	C	H	P	71		
C808	0.1	25	C	C		51		1608
C811	0.15	50	F	C		64		
C812	0.022	16	F	C		65		
C813	0.15	50	F	R	P	69		
C814	0.01	AC250	C	H	P	72		規格品
C815	0.01	AC250	C	H	P	72		規格品
C816	0.01	AC250	C	H	P	71		
C817	0.01	AC250	C	H	P	71		
C818	0.1	25	C	C		51		1608
C820			F	R	P			
C821			F	R	P			
C822	470P	AC250	C	H	P	73		

TRANSISTOR

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
Q101	2SA673	R	P	103	
Q201	RN2402	C		81	SC-59
Q202	RN2402	C		81	SC-59
Q206	2SC2462LC	C		82	MPAK
Q207	2SC2462LC	C		82	MPAK
Q208	2SC2462LC	C		82	MPAK
Q209	2SA1121SC	C		83	MPAK
Q280		C			SC-59
Q501	2SC2462LC	C		82	
Q502	2SC2462LC	C		82	
Q503	2SC2462LC	C		82	
Q504	2SC2462LC	C		82	
Q505	2SC2462LC	C		82	
Q506	2SC2462LC	C		82	
Q801	2SC2618RC	C		85	
Q802	2SC2618RC	C		85	
Q831	2SC1214CT	R	P	102	

IC

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
MICON	AX-6M01	QFP		70	
E²PROM	S24C02BFJ-TB	SOP		72	
IC1	STR-F6523	H	P	109	
IC2	HD74HC4051FP	SOP		73	
IC3	NJM2901M-TE1	SOP		74	
IC4	NJM2904M-TE3	SOP		75	
IC5	NJM2903V-TE1	SOP		76	
IC6	M54567FP	SOP		77	
IC7	M54567FP	SOP		77	
IC8	ULN2003ANS	SOP		78	
REG1	MC7805CT	H	P	112	
REG2	SE012N	H	P	115	

ZENER DIODE

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
ZD101		A	P		
ZD201	RLZ6.8A	C		91	LLDS

LED

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
LD301	LT1D67A	C		92	アカ
LD302	LT1D67A	C		92	アカ
LD303	LT1D67A	C		92	アカ
LD304	LT1K67A	C		93	ミドリ

INDUCTOR

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
L006	EXCELSA35V	A	P	139	
L007	EXCELSA35V	A	P	139	
L801	100uH	H	P	145	
L802	100uH	H	P	145	
L803	FBA04MA450	H	P	135	
L804	FBA04MA450	H	P	135	
FB1	BL01RN1	A	P	134	
CT1	S19-J299CT	H	P	140	

PHOTO COUPLER

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
PQ8	PS2501	H	P	120	
PQ831	PC817X	H	P	119	
PQ102	PS2501	H	P	120	

JUMPER WIRE

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
JW2	NONE	A	P		
JW3	NONE	A	P		
JW5	NONE	A	P		
JW7	NONE	C			1608
JW8	NONE	C			1608
JW9	NONE	C			1608
JW10	NONE	C			1608

SWITCH

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
SERVICE-SW	KSM0612BTS	R		100	

OSCILLATOR

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
X1	CSTCS16.0MHz	C		96	

ICP

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
ICP1	ICP-N75(2.7A)	R	P	124	

DIODE

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
D101	1GH46	A	P	92	
D102	1S2076A	A	P	90	
D103	1S2076A	A	P	90	
D104	1SS120	A	P	91	
D105	1SS120	A	P	91	
D201	DAN202K	C		88	SC-59
D202	DAP202K	C		89	SC-59
D203	DAP202K	C		89	SC-59
D204	DAN202K	C		88	SC-59
D205	DAN202K	C		88	SC-59
D206	DAN202K	C		88	SC-59
D207	DAN202K	C		88	SC-59
D702	1GH46	A	P	92	
D703	1SS120	A	P	91	
D705	RN2Z	H	P	93	
D706	AK04	A	P	94	
D707	RN3Z	H	P	95	
D708	JUMPER WIRE	A	P		
D709	RU1P	A	P	100	
D710	1GH46	A	P	92	
D713	1GH46	A	P	92	
D715	1SS120	A	P	91	
D716	1S2473	A	P	96	
D801	HN2D01FU-TE85L	C		90	
D831	1SS120	A	P	91	

SURGE ARRESTER

MARK	MODEL	MOUNTING	PCB SET	A'SSY NO.	REMARK
VARISTOR 1	450NR-12D	R	P	131	
VARISTOR 2	450NR-12D	R	P	131	
VARISTOR 3	450NR-12D	R	P	131	
SURGE ABSORBER	DSA-102MA-05F25	H	P	133	

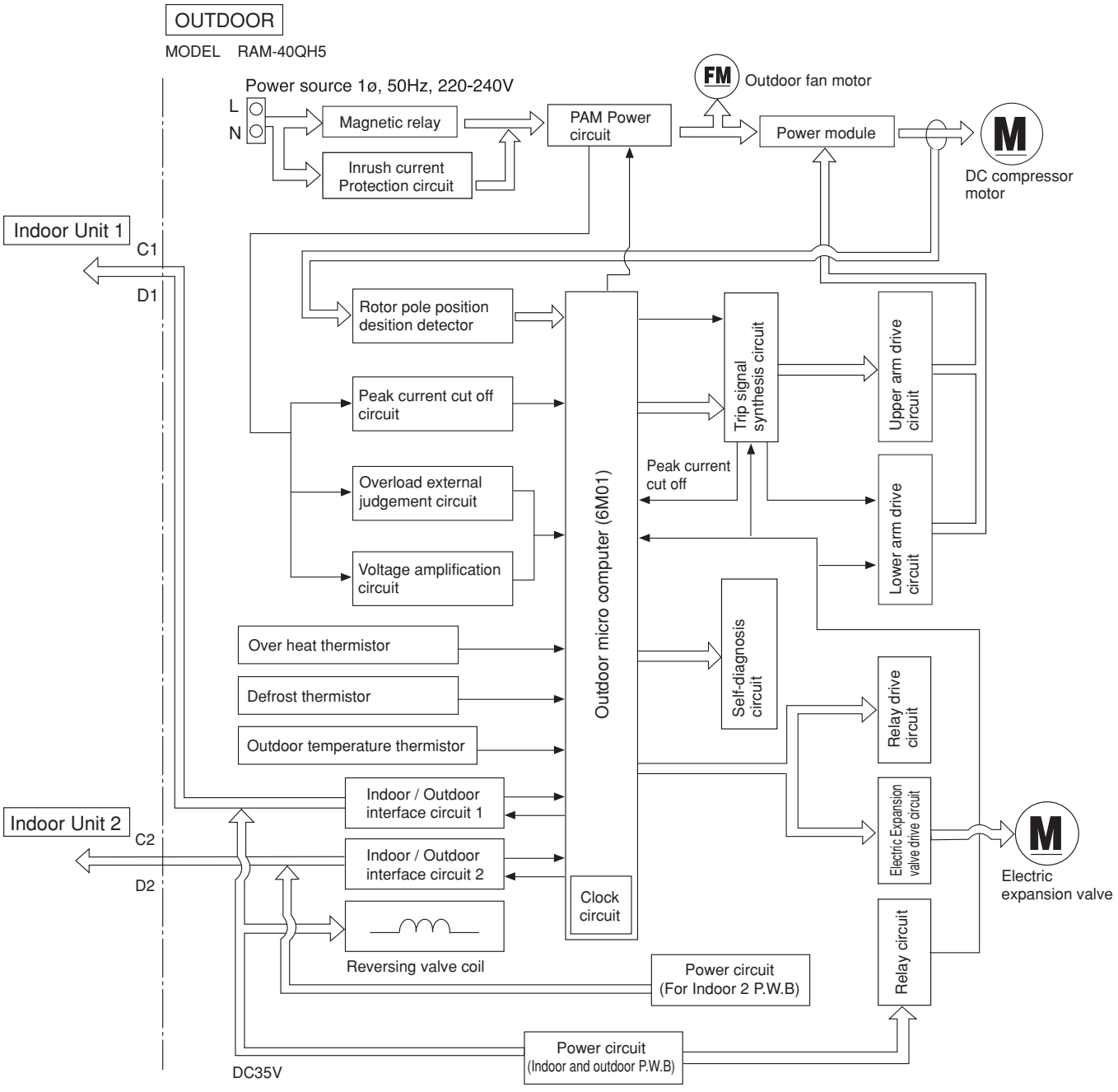
CONNECTOR

MARK	MODEL	PCB SET	A'SSY NO.	REMARK
CN1	VH-4Pハヌケ	P	164	WHITE
CN2	VH-2Pハヌケ	P	165	RED
CN3A	MINICT-22P		101	2 ROWS
CN3	MINICT-11P	P	166	GRAY
CN4	MINICT-11P	P	167	BLUE
CN5	XA-2P縦		102	WHITE
CN6	XA-2P縦		103	BLACK
CN7	XA-2P縦		104	RED
CN8				
CN8B	VH-2Pハヌケ	SW		WHITE
CN9	PH-8P縦		106	WHITE
CN10	XH-2Pハヌケ	SW		WHITE
CN11	MINICT-5P		107	WHITE
CN13	CT-5P		108	WHITE
CN14	MINICT-10P		109	WHITE
CN15	XA-6P		110	RED
CN16	XA-6P		111	WHITE
CN17	PH-4P縦		112	WHITE
CN18	ZR-12P縦		113	WHITE
CN19	EI-3P		114	WHITE
CN20	ZR-4P縦		115	WHITE
CN30	XH-7P	P	168	WHITE
CN31	VH-2Pハヌケ	P	169	WHITE

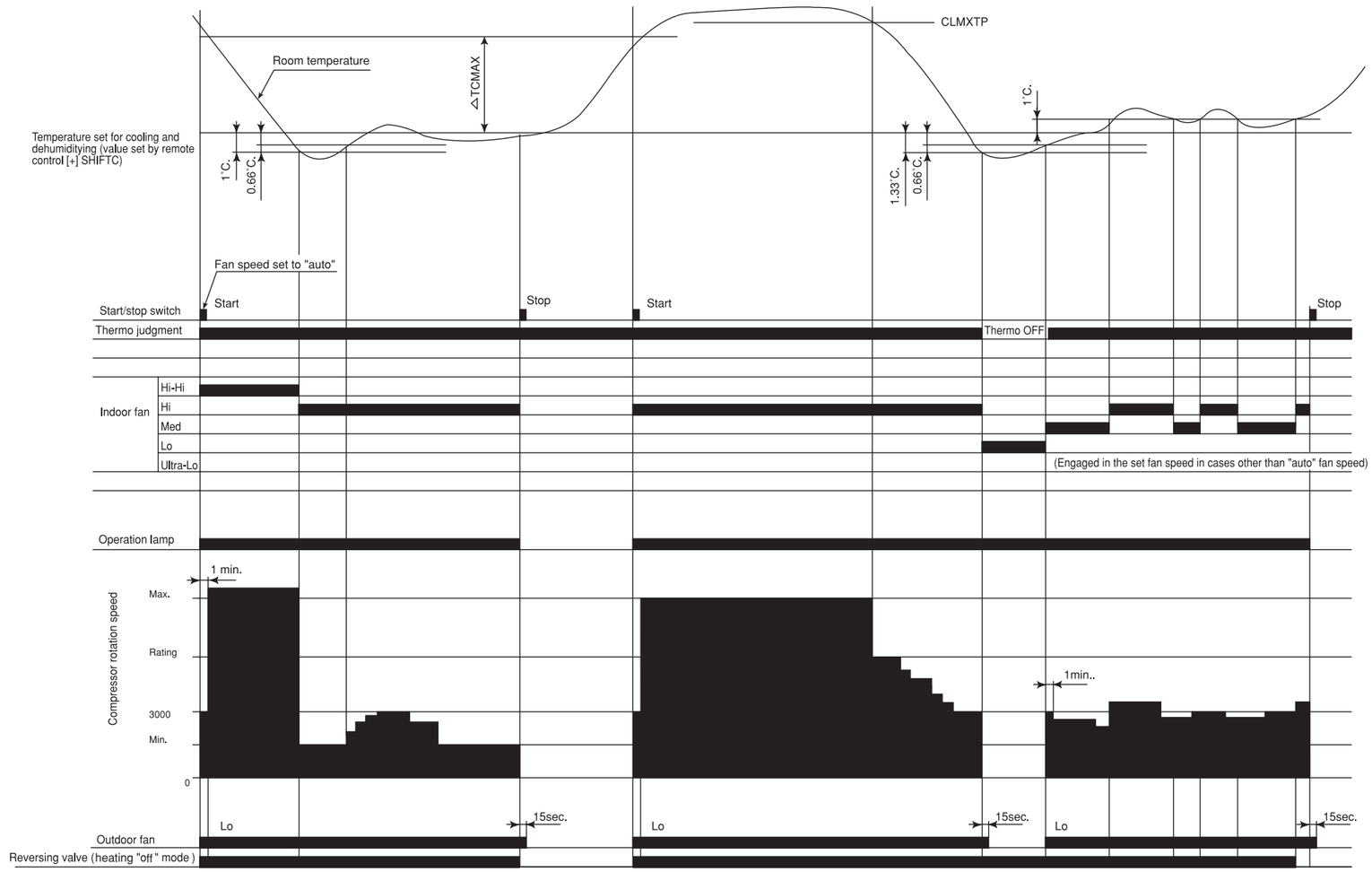
BLOCK DIAGRAM

OUTDOOR

MODEL RAM-40QH5

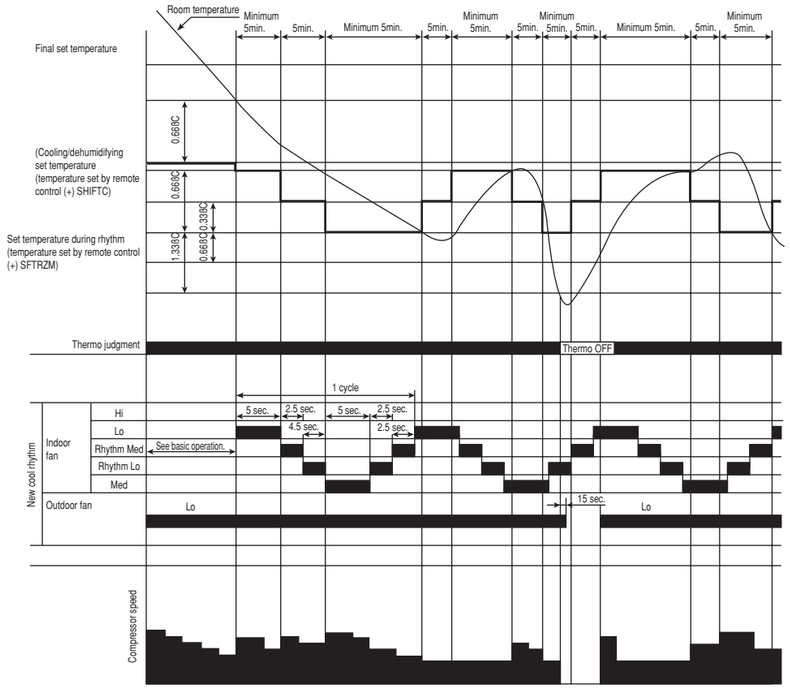


Basic Cooling Operation



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

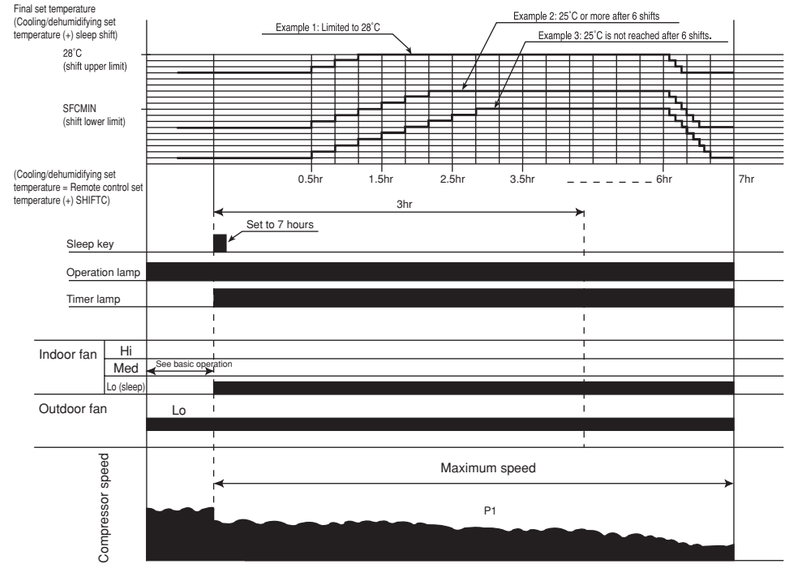
New Cool Rhythm



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.

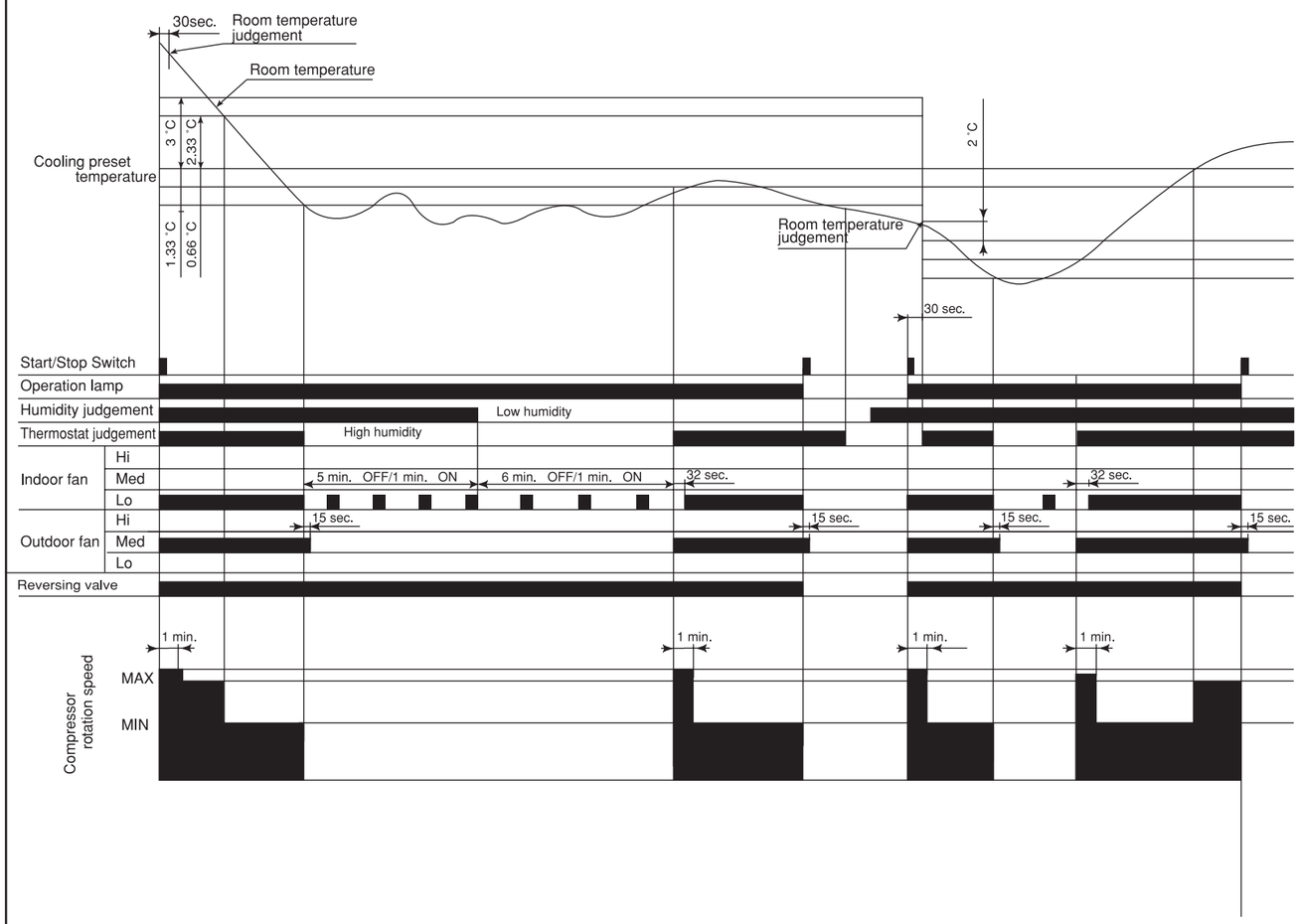
Cooling Sleep Operation



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 5 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).

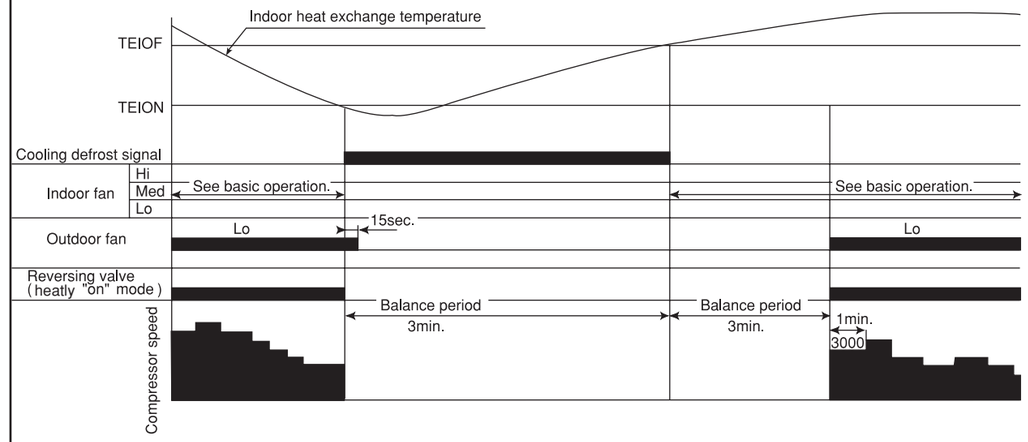
(2) The indoor fan is operated in the “Lo” mode, OFF for 5 minutes and ON for 1 minule (at high humidity) or OFF for 6 minutes and ON for 1 minute (at low humidity), repeatedly acoording to the humidity judgement when the thermostat is turned OFF.

(3) When the operation is started by the themostat 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

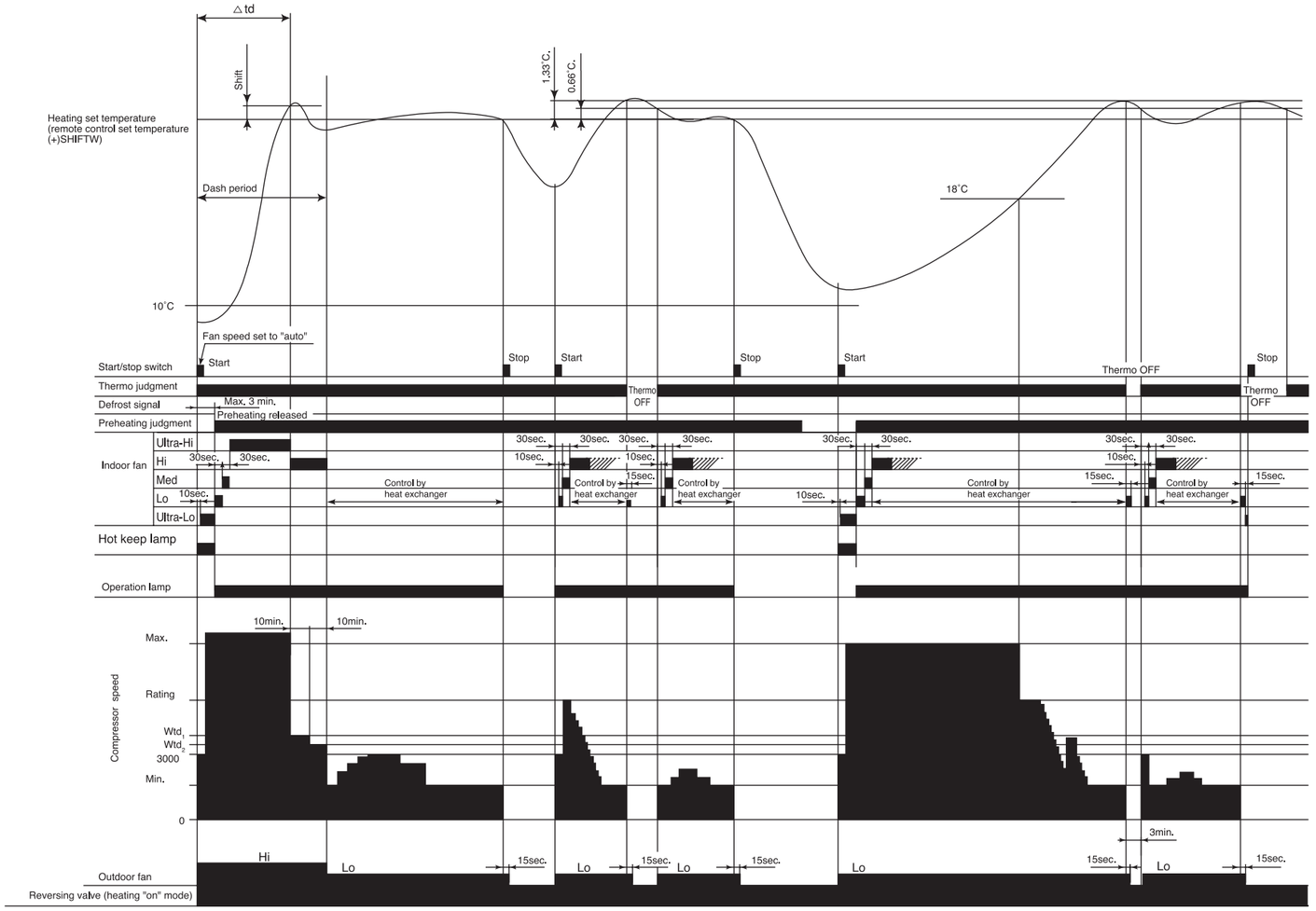


Table 6 Speed Specifications during Steady Speed Period

△ 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

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 (Δ% 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.

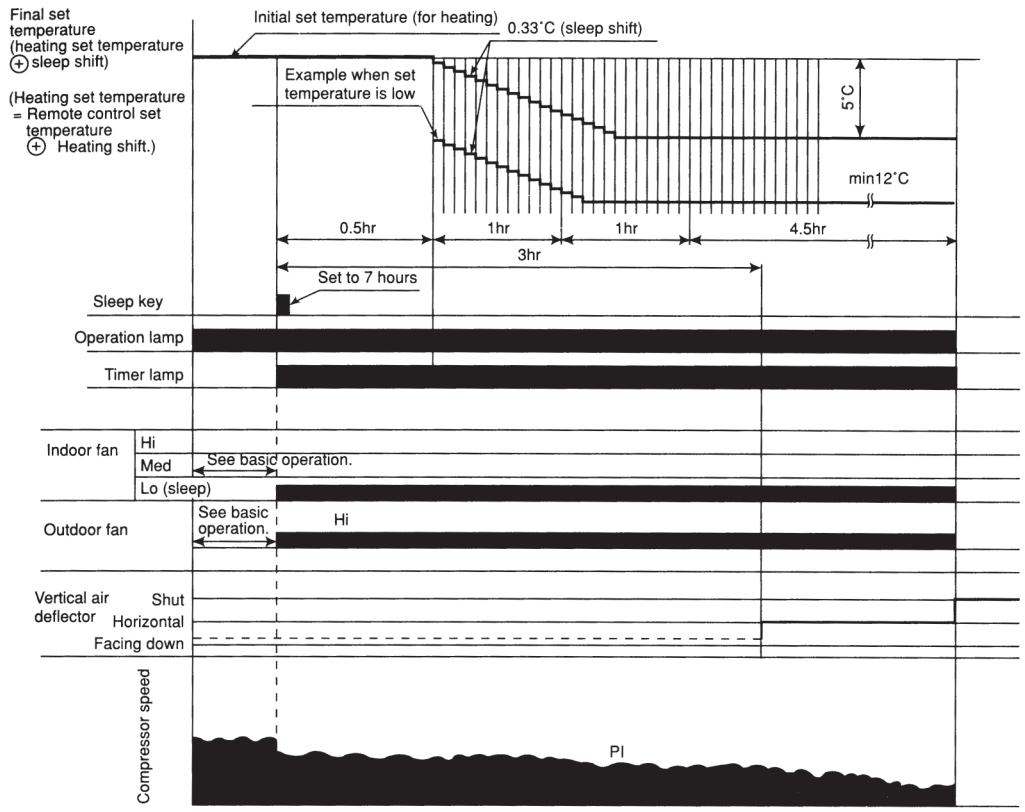
(5) The time limit for which the maximum compressor speed during normal heating (except for hot dash) can be maintained is less than 120 minutes when the room temperature is 18˚C or more; it is not provided when the room temperature is less than 18˚C and outdoor temperature is less than 2˚C.

(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.

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:
  ① Normal operation
  ② Heat exchange temperature is within defrost range specified by outdoor temperature and heat exchange temperature.
  ③ Defrost inhibit period linked to outdoor temperature has passed.

(2) Defrost release condition

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

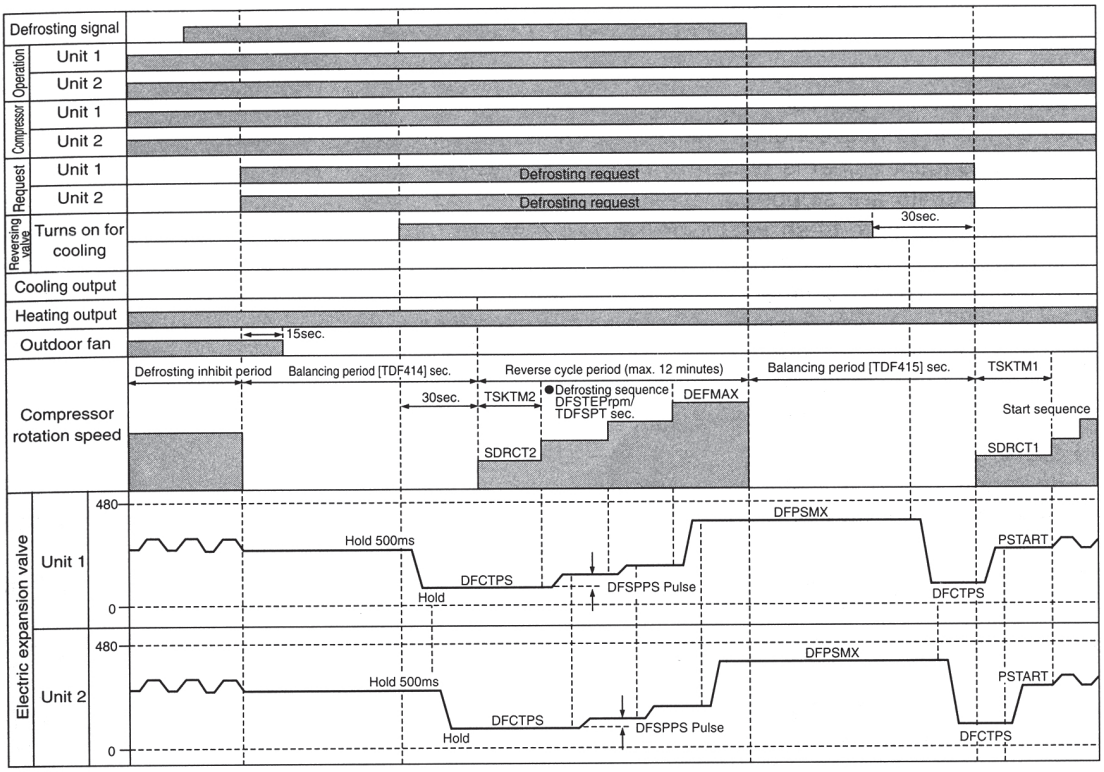
(3) Outputs during defrost

- Indoor defrost request: Transmitted to all units being operated in heating mode.
- Compressor: 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

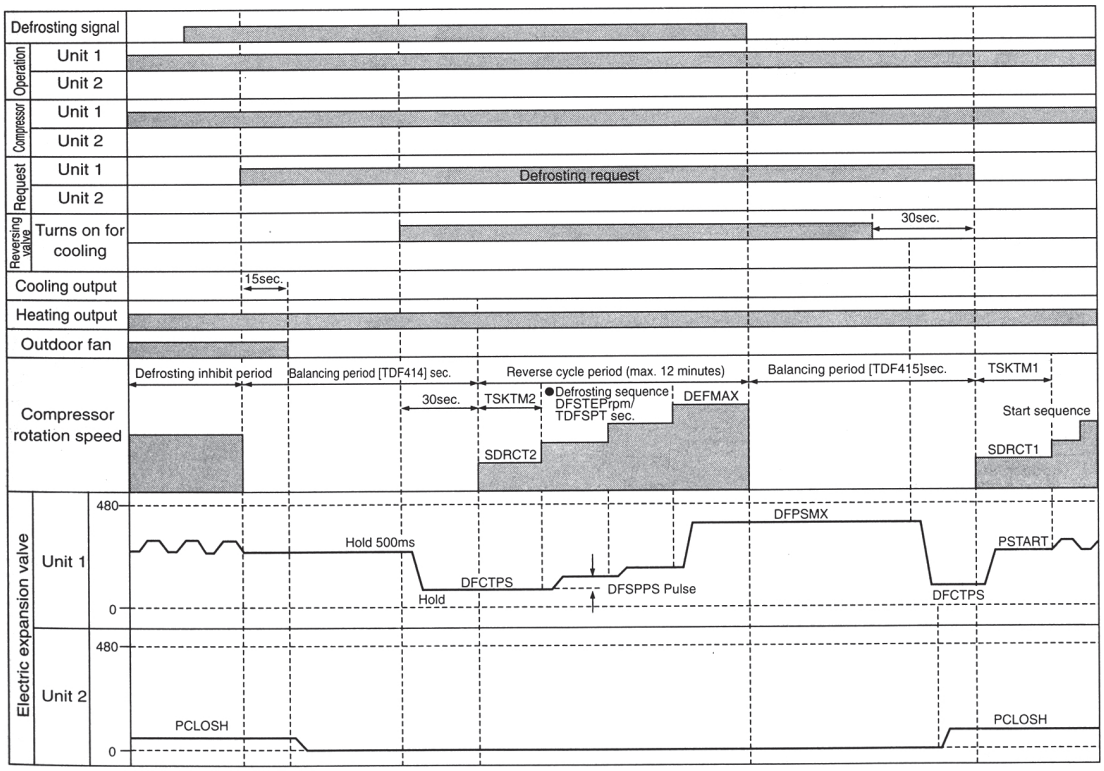
  Unit being stopped : [FULL CLOSE] 30 seconds after balancing period has passed → [FULL CLOSE] during reversing cycle period → [PCLOSH] 15 seconds before balancing period is finished.

  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

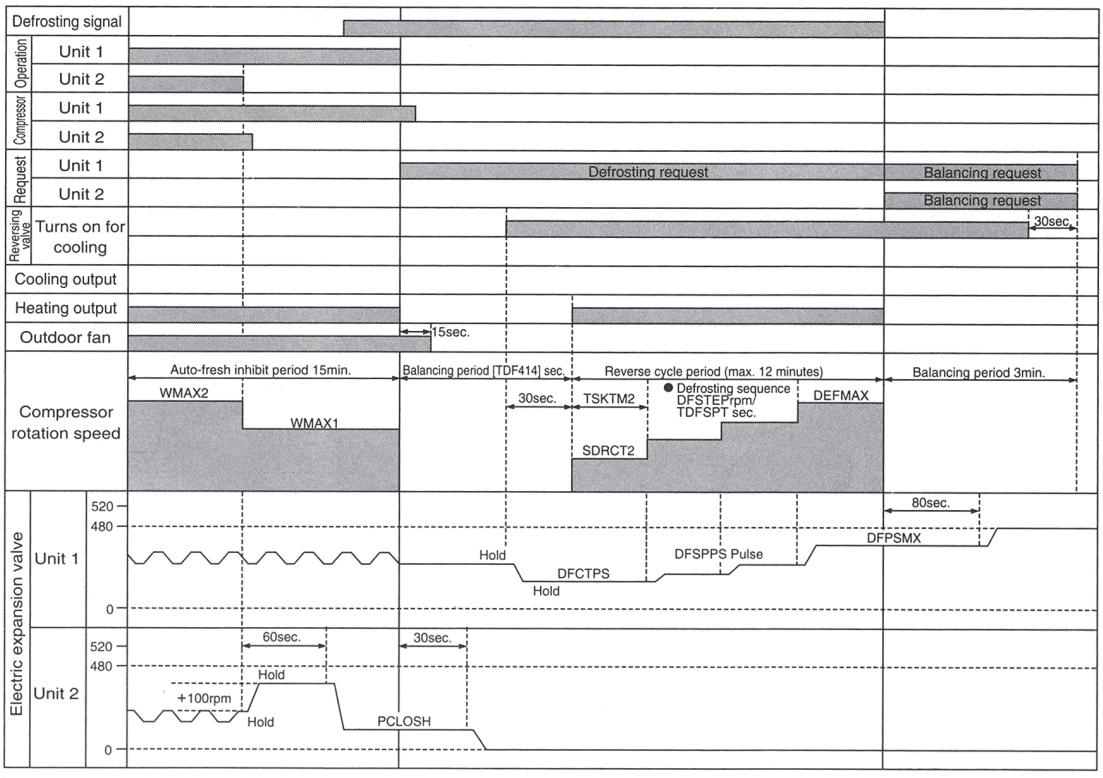
- During heating operation is stopped, and when auto-fresh condition is established, defrost operation will be performed while operation is stopped.
  Auto-fresh consists of balancing period at start of defrost for [TDF414] seconds Æ Reverse cycle period for MAX 12 minutes.

(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 indoor 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.

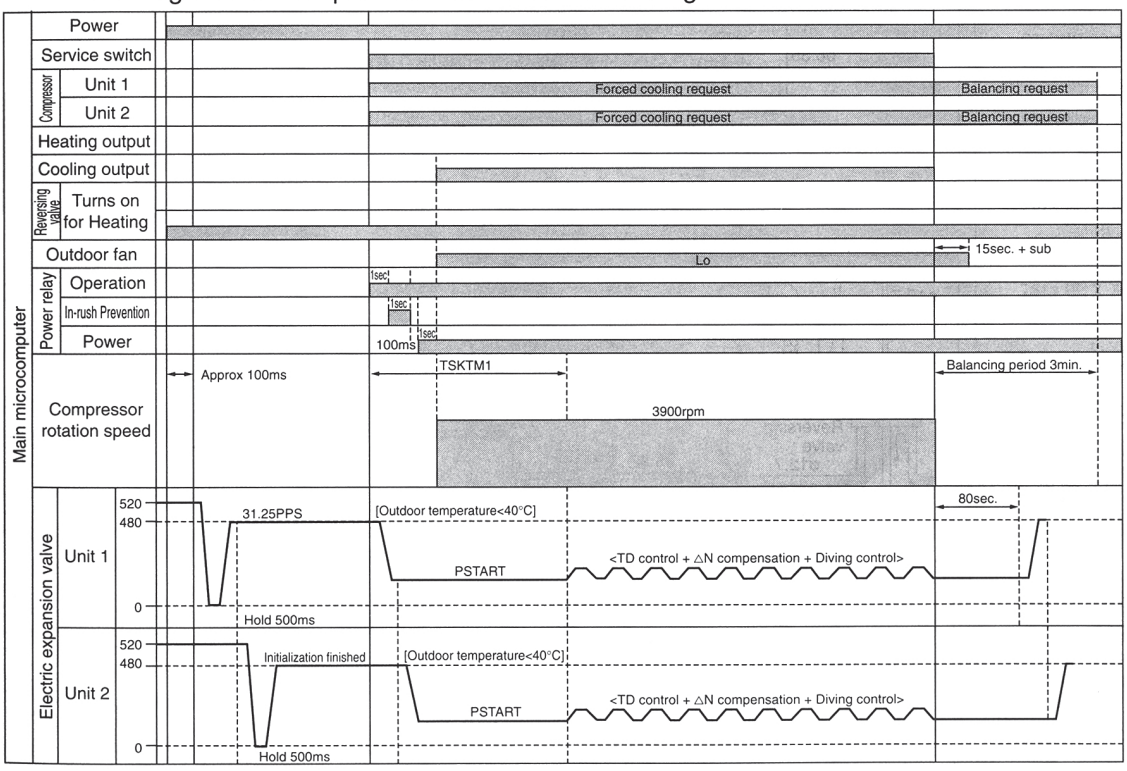
  [Operation status]

  - 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.

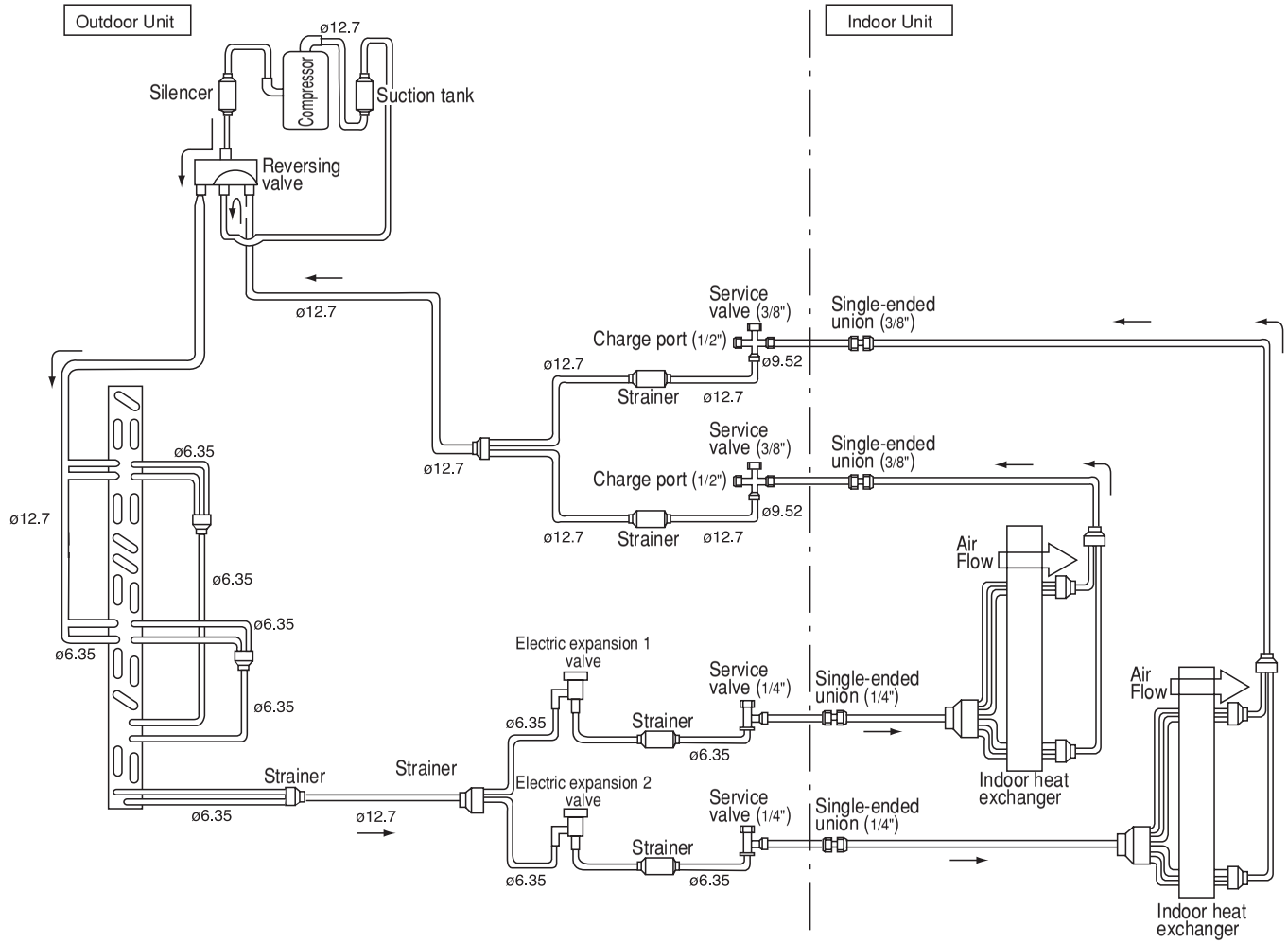
• The following shows the operation state of forced cooling.



❊ • TSKTM1 and PSTART are EEPROM data.

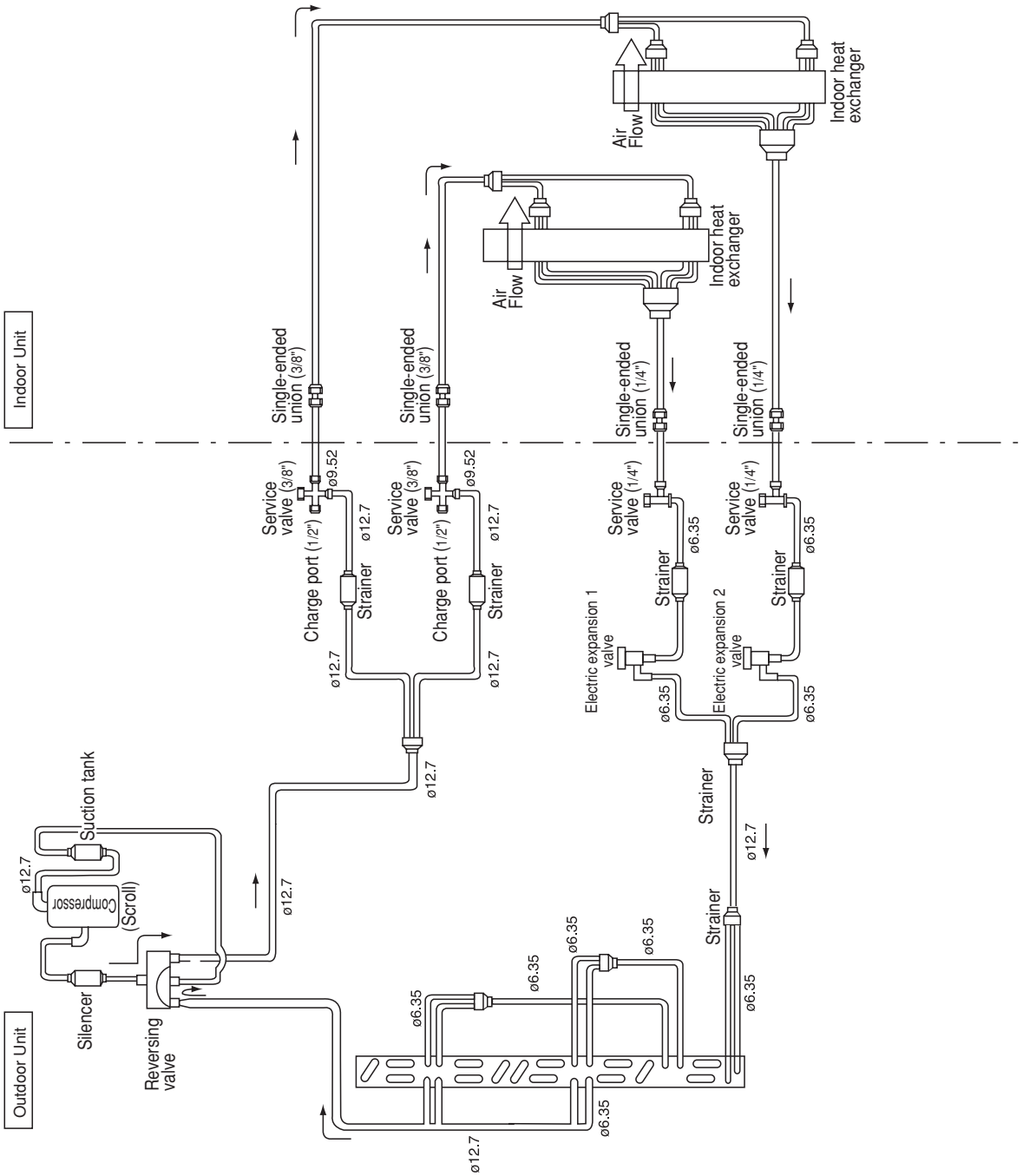
REFRIGERATING CYCLE DIAGRAM
RAM-40QH5

Cooling, dehumidifying, defrosting



REFRIGERATING CYCLE DIAGRAM
RAM-40QH5

Heating



DESCRIPTION OF MAIN CIRCUIT OPERATION (OUTDOOR)

Model RAM-40QH5

1. Power Circuit

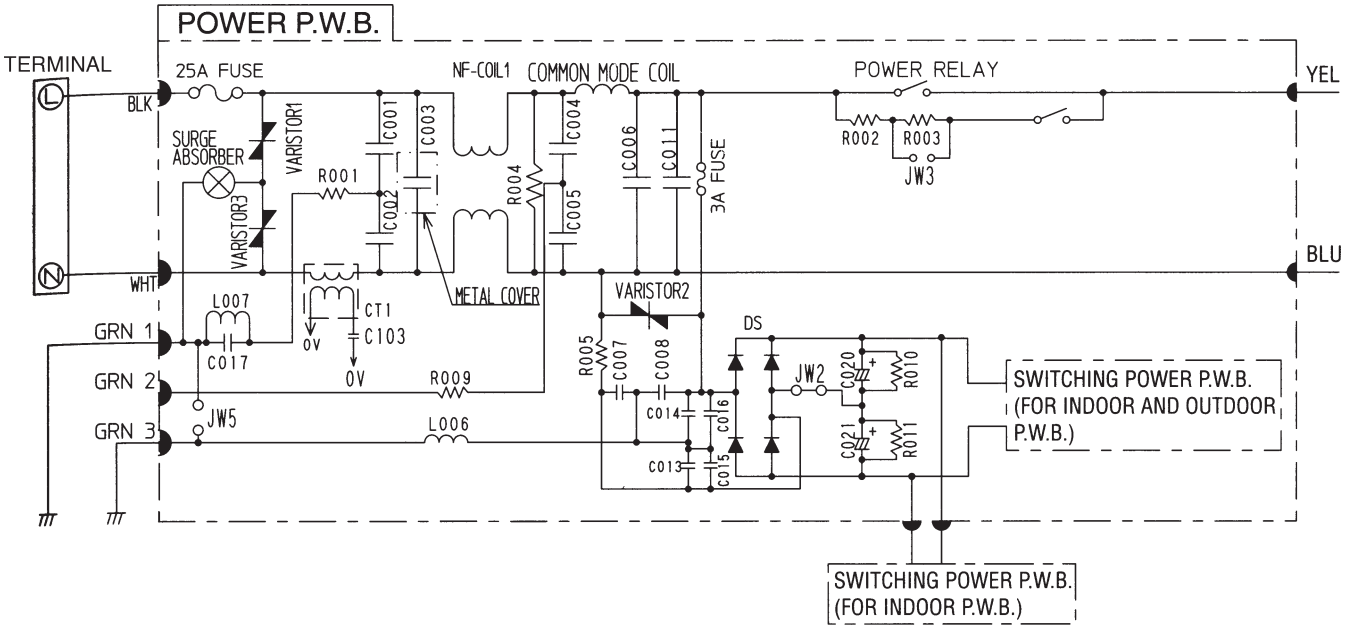


Fig. 1-1

- This circuit full-wave rectifies 220-240V 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)

(Current 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.

② Smoothing capacitor smoothes voltage, which has been rectified by diode stack and boosted at ACT section.

③ Power module section
Refer to item 3 System Power Module Circuit.

(2) Diode stacks

These rectify the 220-240V 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”, “anbormally 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, C502, C503)

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

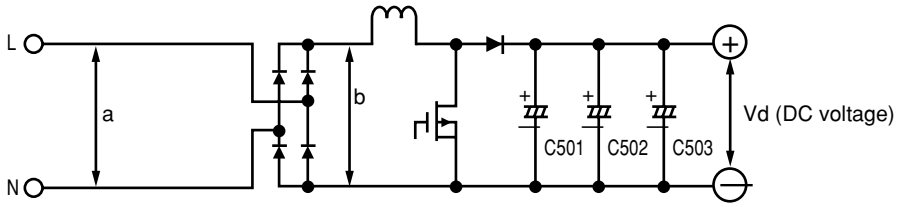


Fig. 1-2

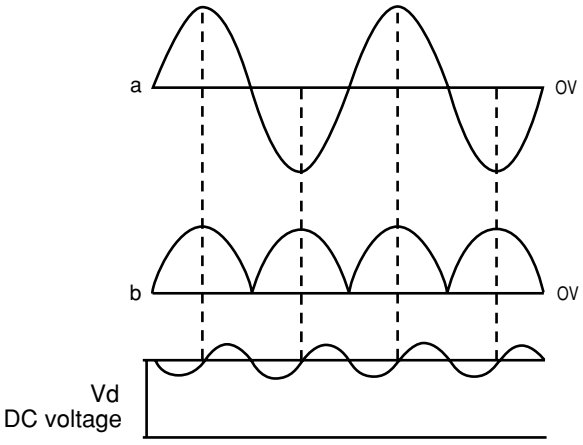
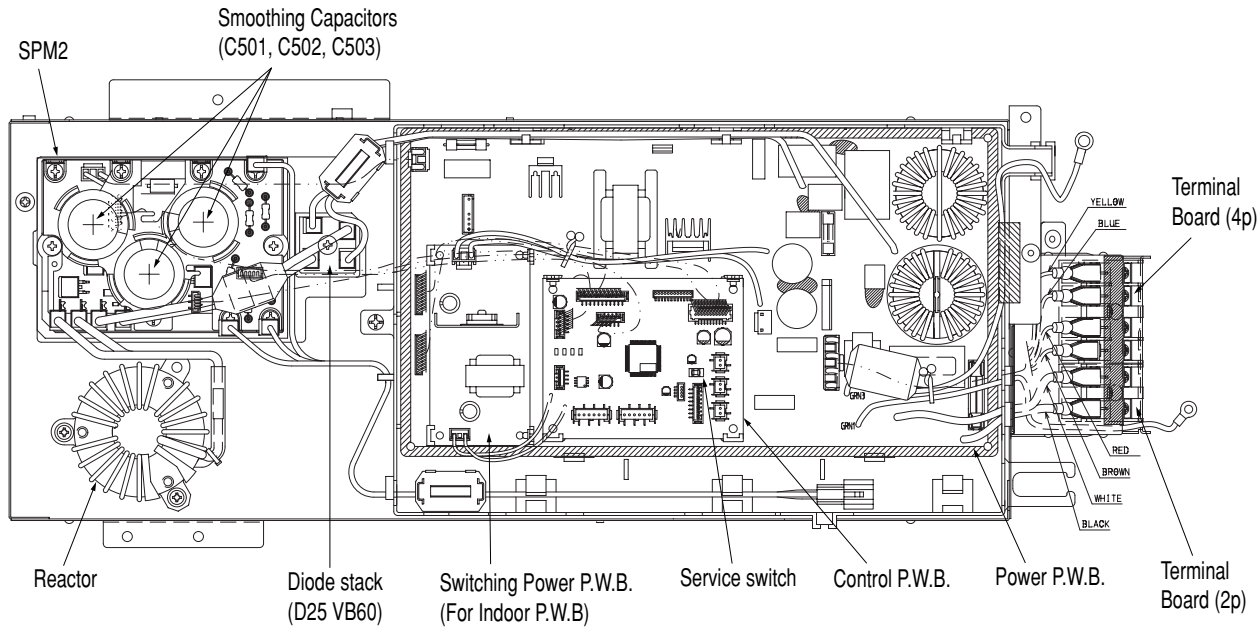


Fig. 1-3

(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 electronic parts.

(6) Surge 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

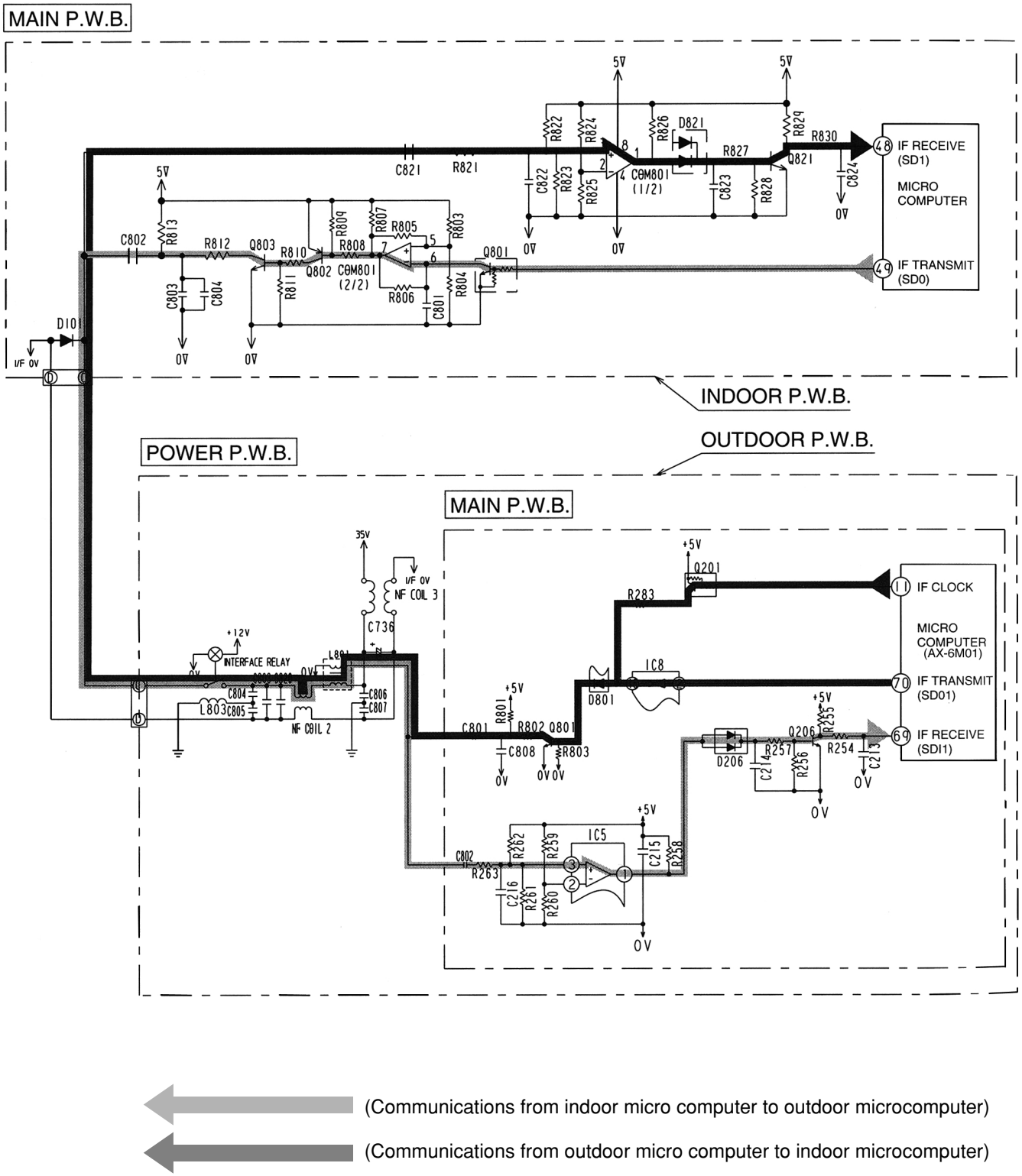
  The request signal output from microcomputer pins ⑫ is input to the transmitting circuit. The transmitting circuit outputs an approx. 38kHz high-frequency signal via pin ⑪ and continues the output intermittently according to the request signal. This high-frequency signal is amplified by a transistor, 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 transferred 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

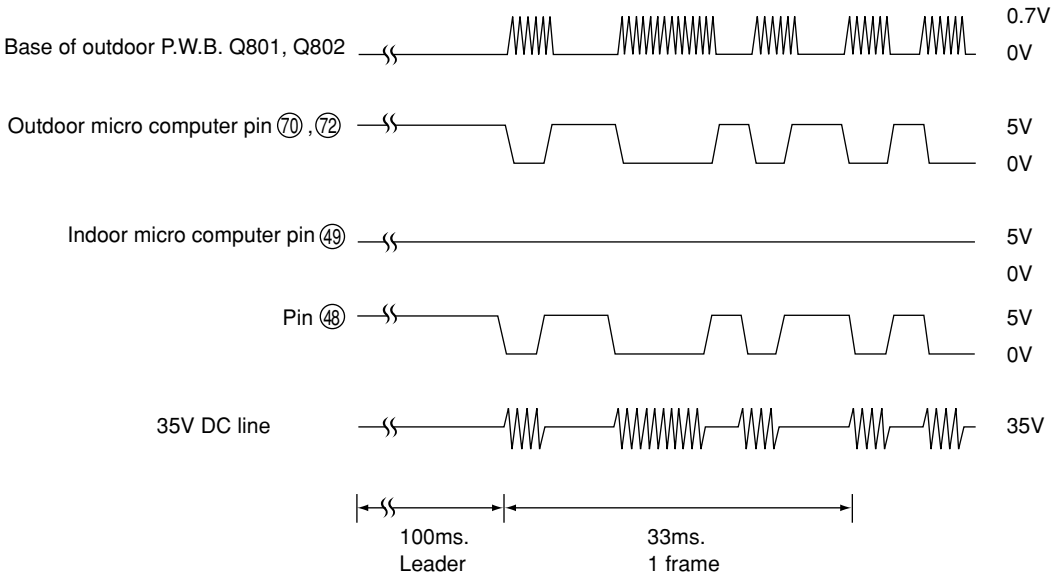


Fig. 2-2 Voltages Waveforms of indoor / Outdoor Micro computers (Outdoor to Indoor Communications)

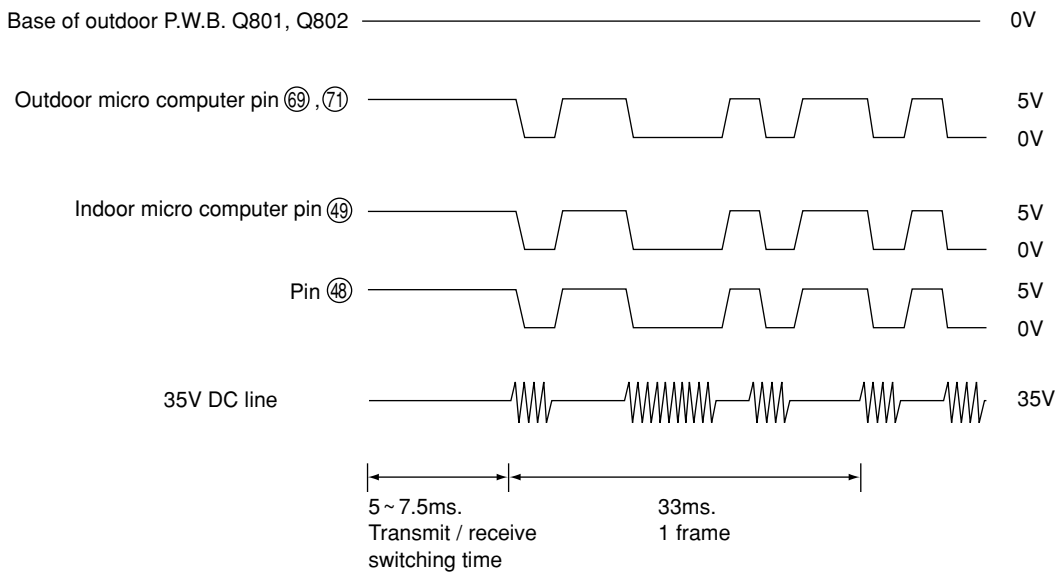


Fig. 2-3 Voltages Waveforms of indoor / Outdoor Micro computers (Indoor to Outdoor Communications)

3. System Power Module Circuit

- 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.

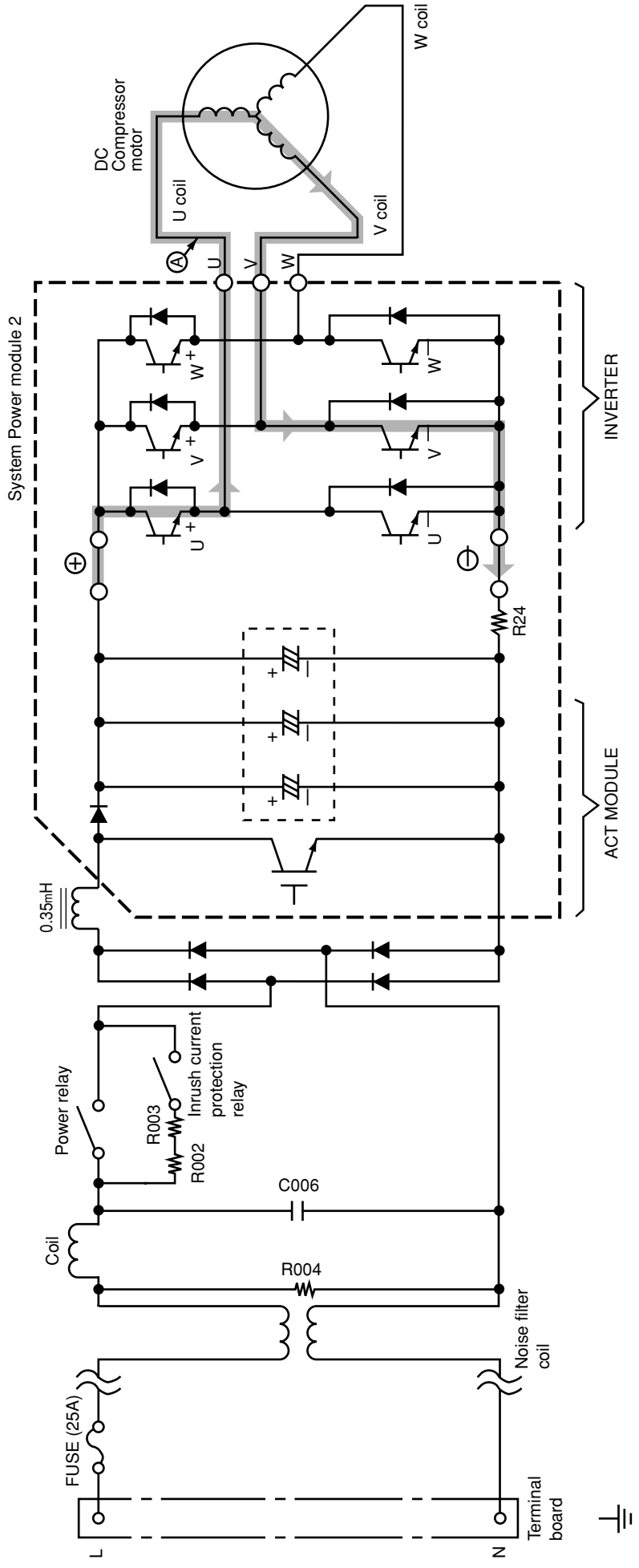


Fig. 3-1 System power module circuit (U^+ is ON, V^- is ON)

- 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.

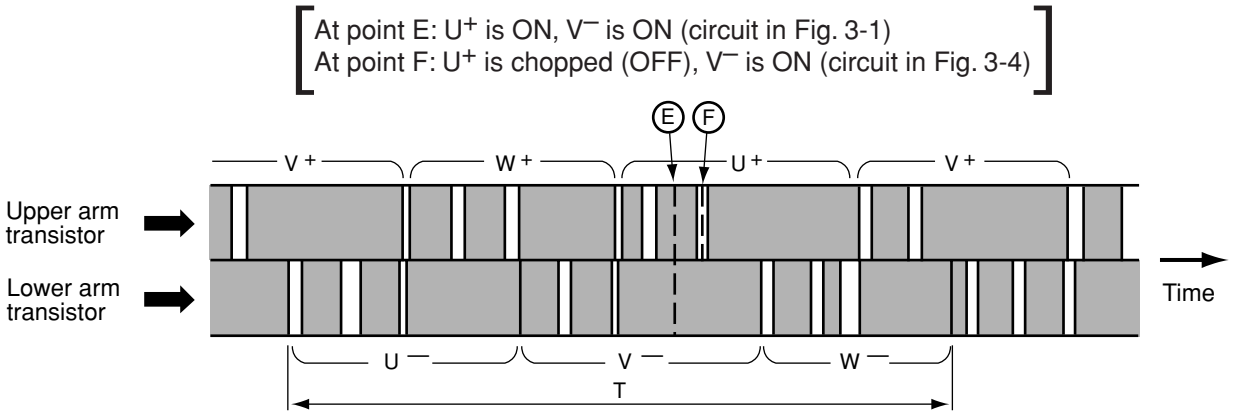


Fig. 3-2 Switching order of power module

- 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.

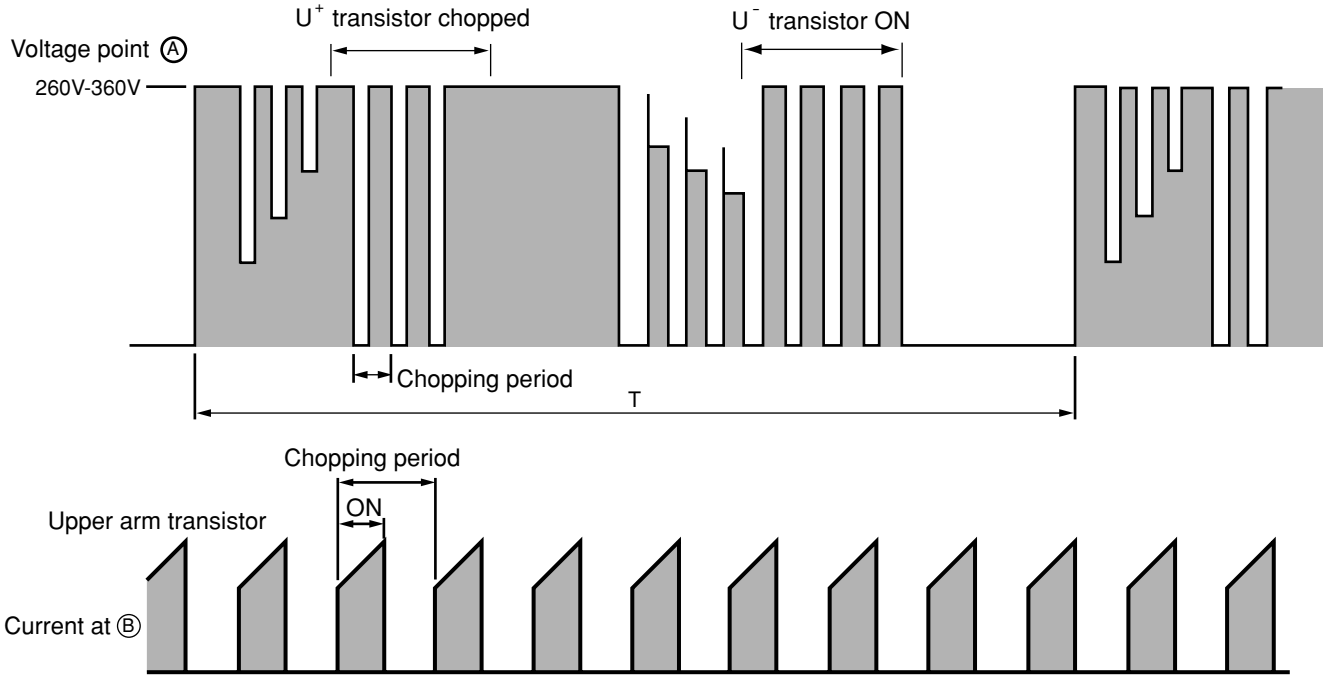


Fig. 3-3 Voltage waveform at each point

- 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)

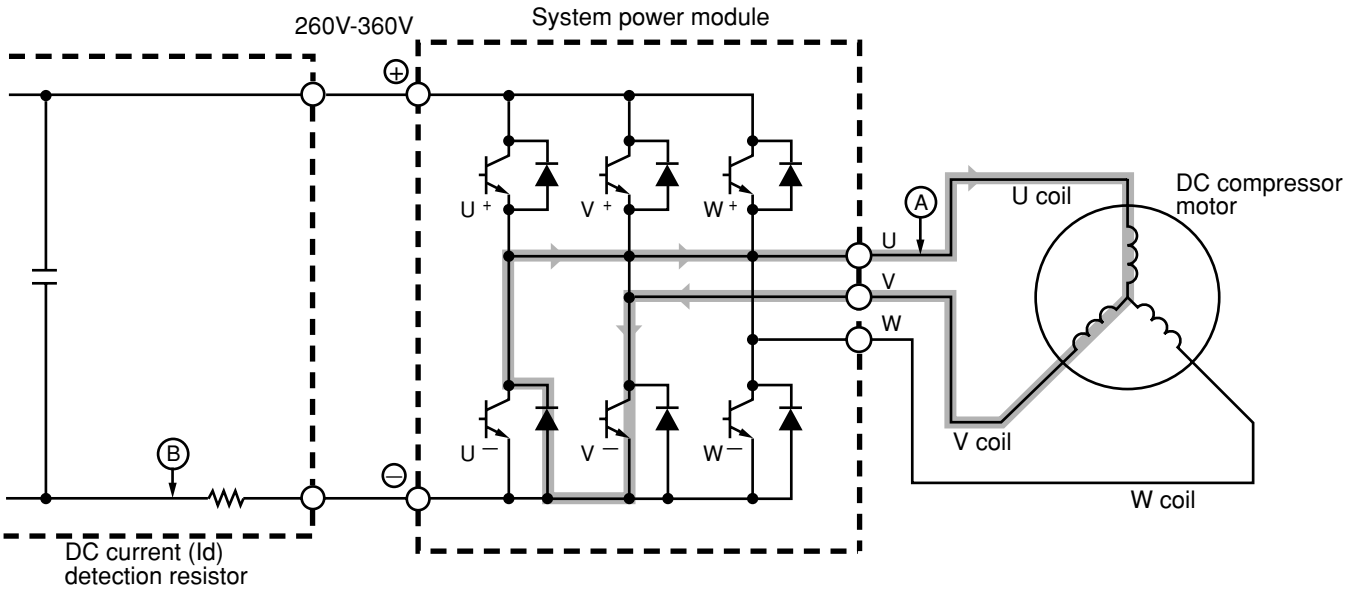


Fig. 3-4 Power module circuit (U^+ is ON, V^- is ON)

- 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:

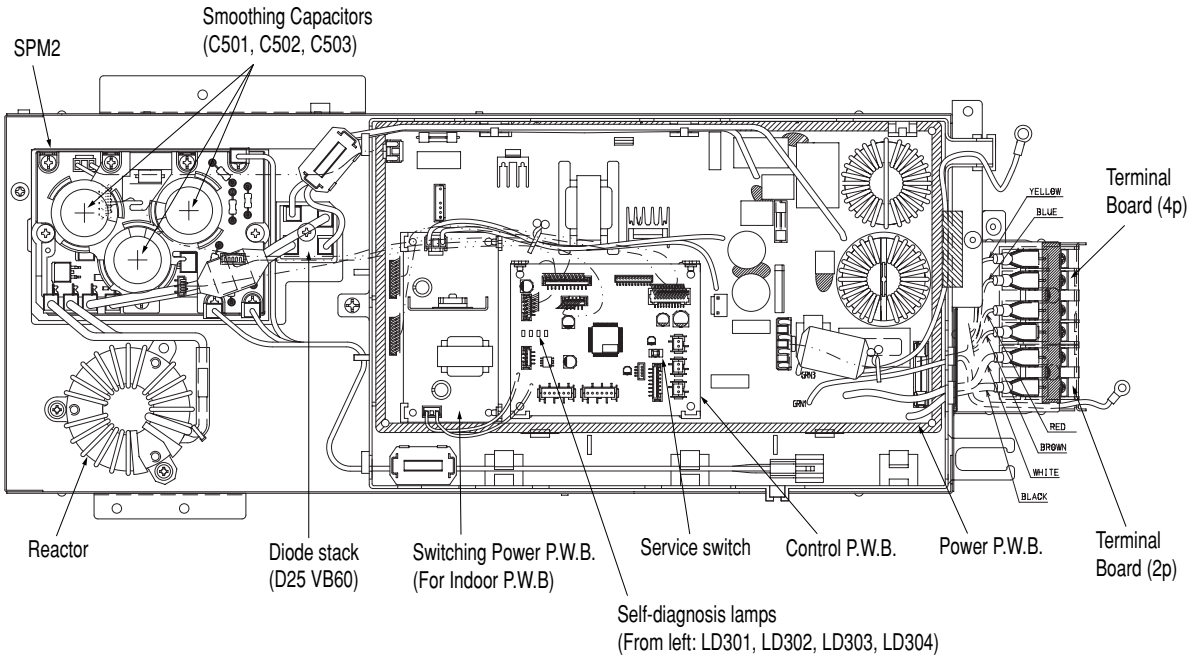


Table 3-1

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.

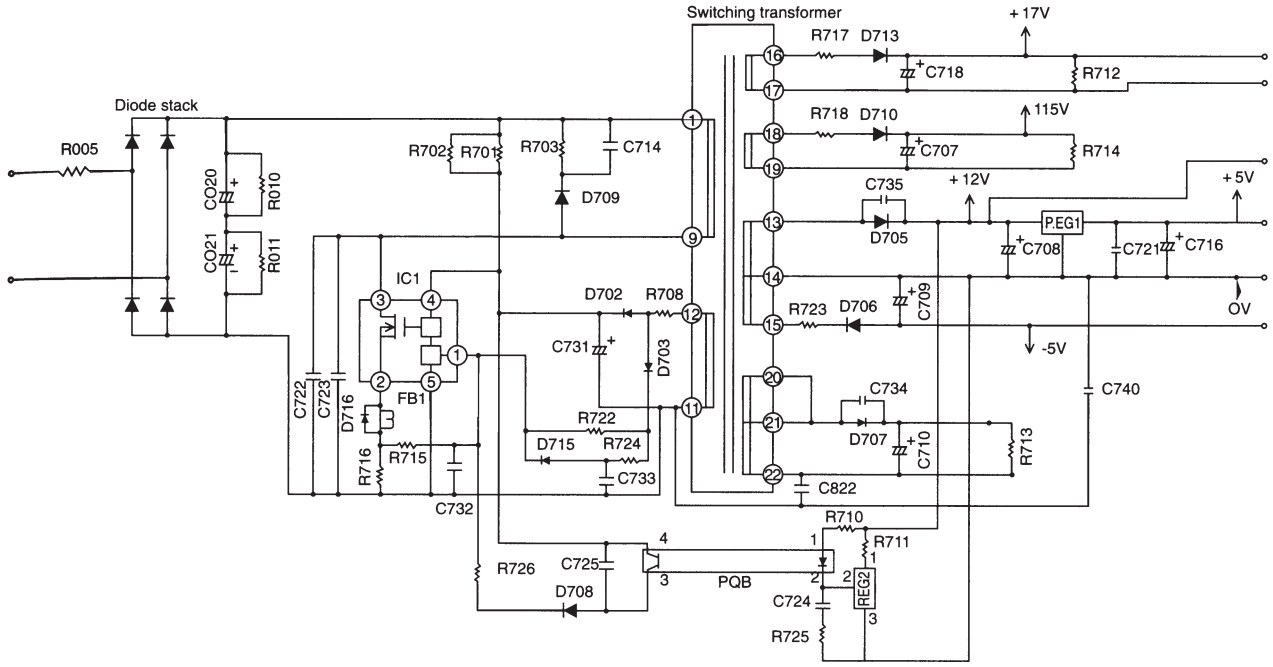


Fig. 4-1 Power circuit for P.W.B.

- In the power circuit for P.W.B., power voltage for microcomputer, peripheral circuits, and system power module drive and, as well as DV35V, 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 ⊕ and C021 ⊖ 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 increase 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

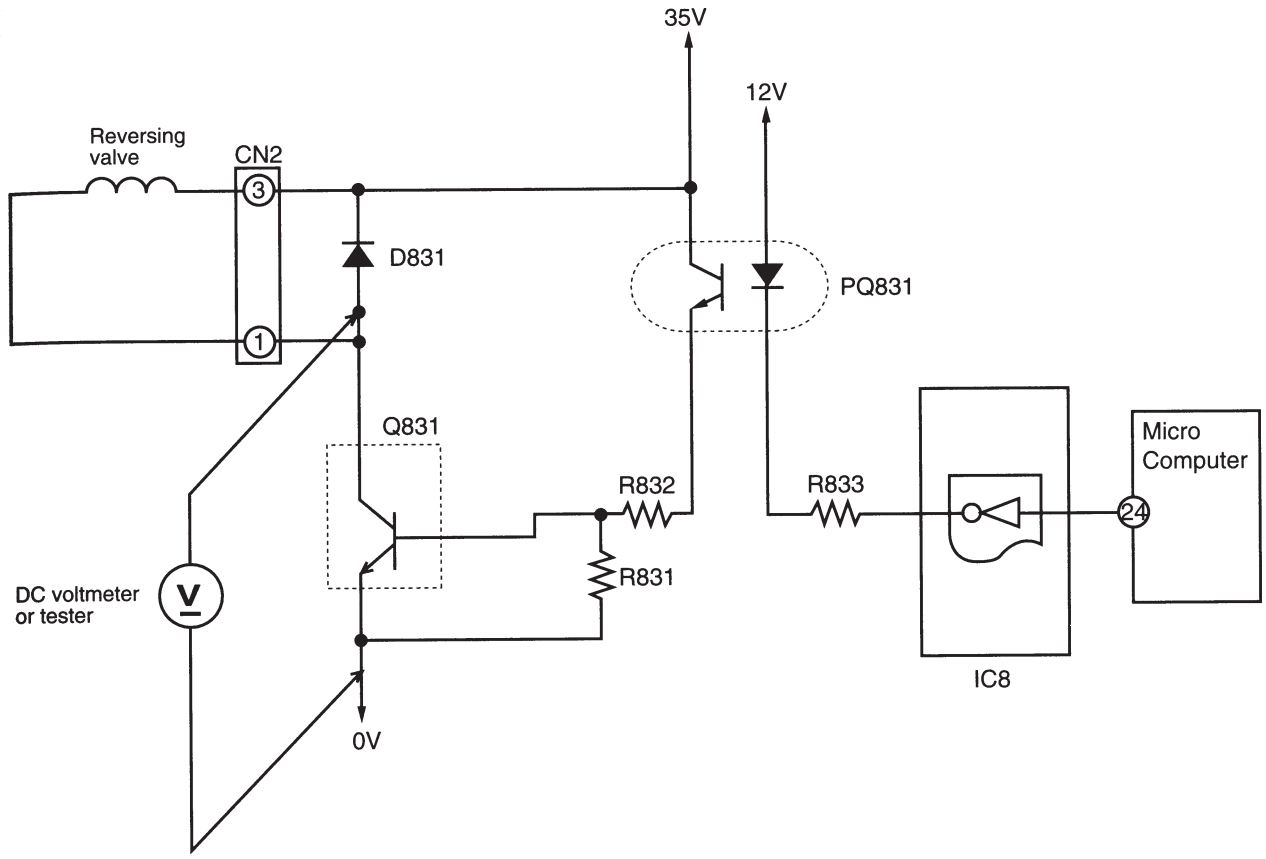


Fig. 5-1

- 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

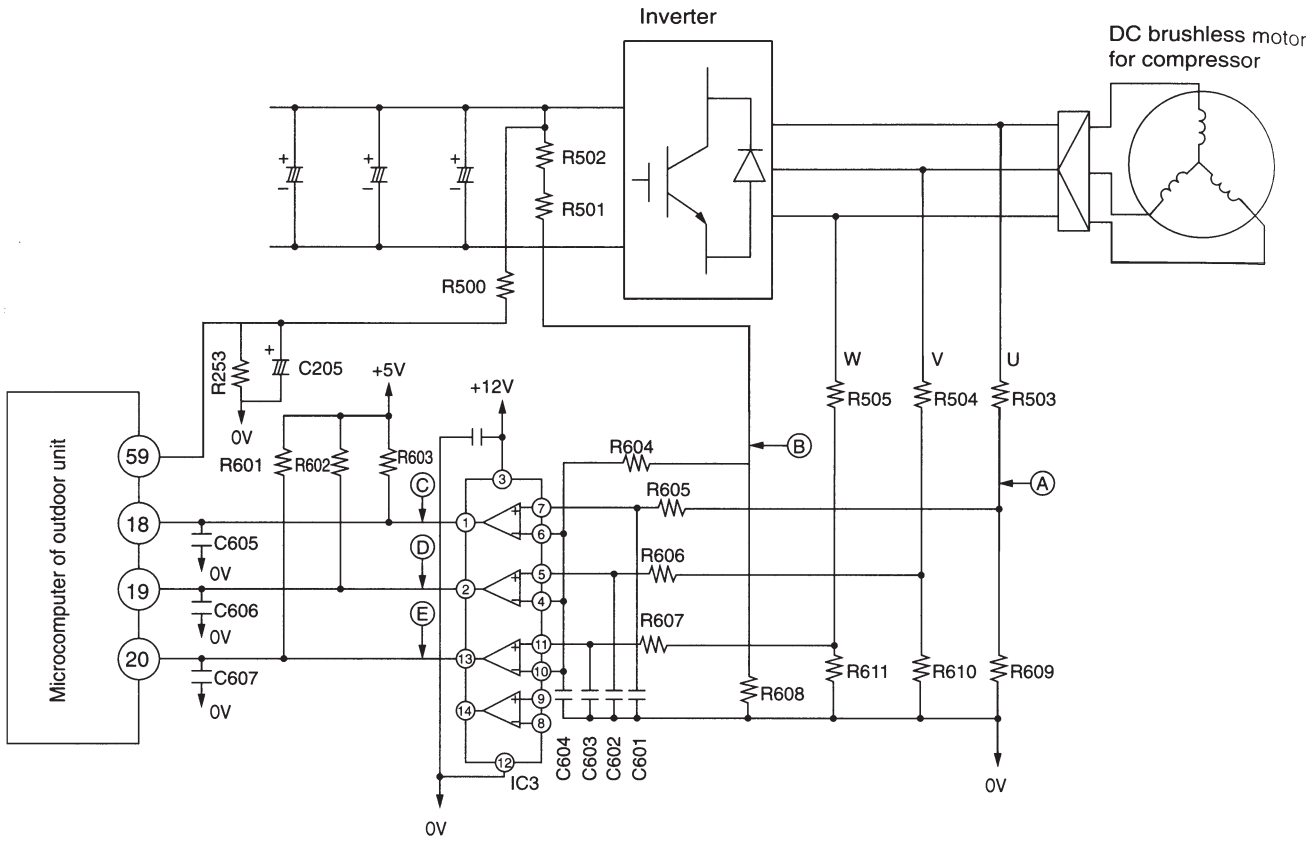


Fig. 6-1 Rotor magnetic pole position detection circuit

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.

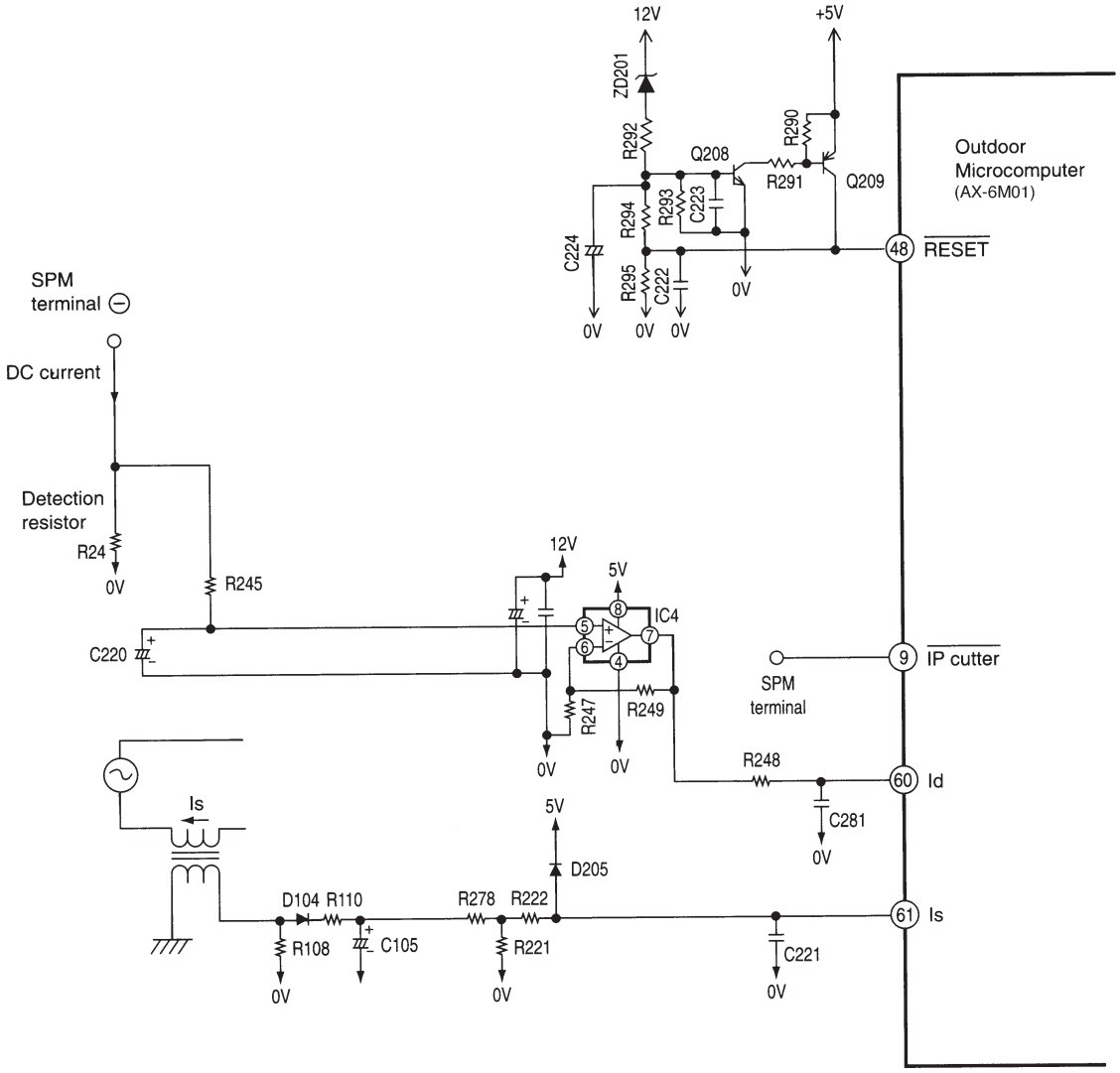


Fig. 7-1 Peripheral circuit of microcomputer (AX-6M01)

Table 7-1

Circuit block	Basic operation
Peak current cutoff 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 Ip 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 current 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.

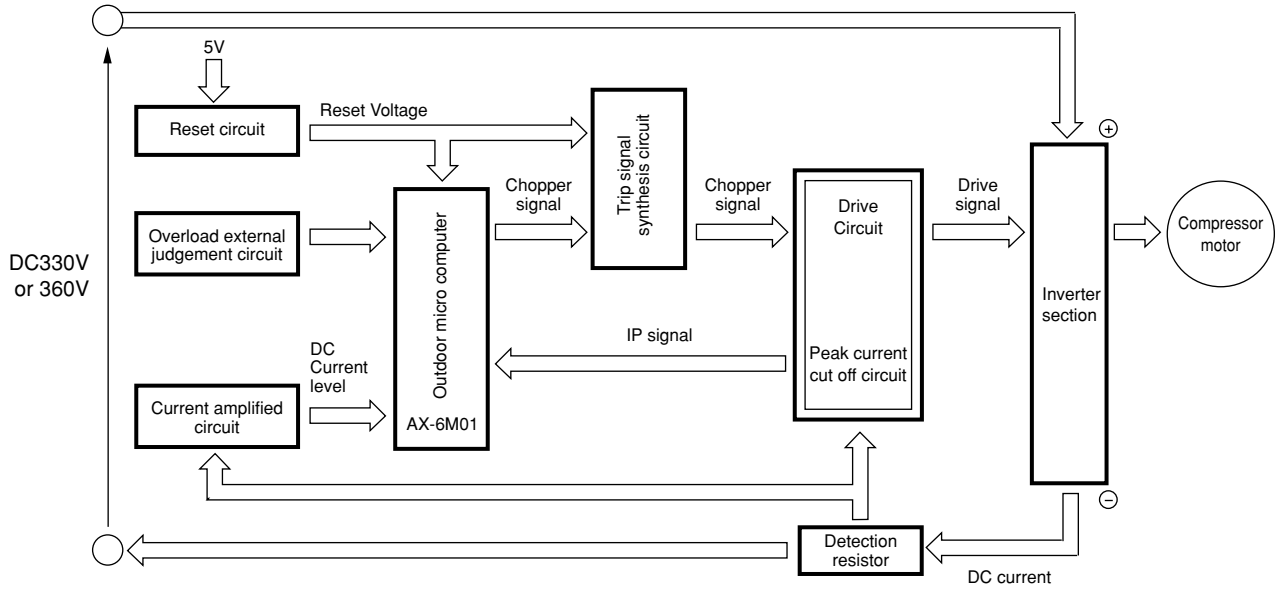


Fig. 7-2

- 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.

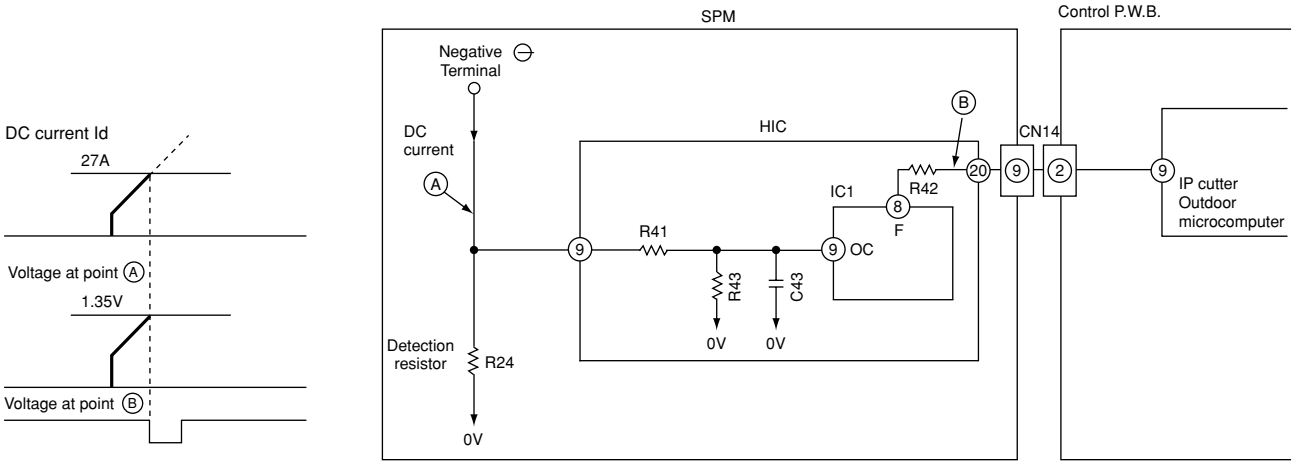


Fig. 7-3

- 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 microcomouter, 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.

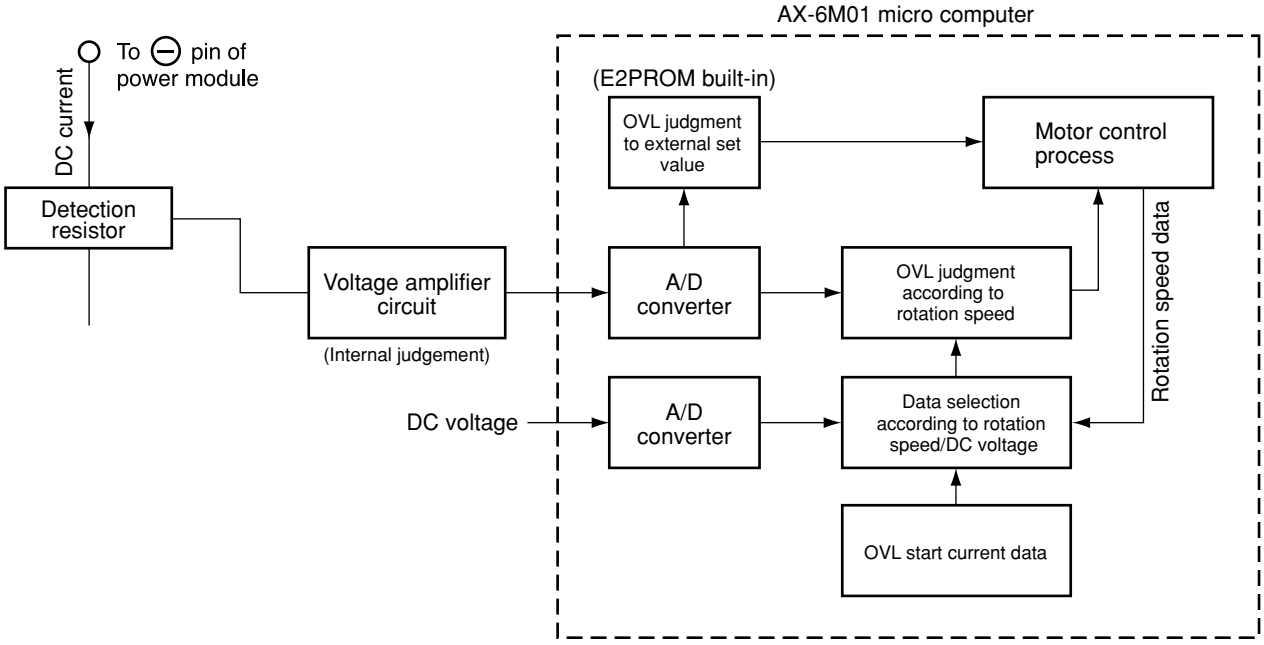


Fig. 8-1 Overload Control System Configuration

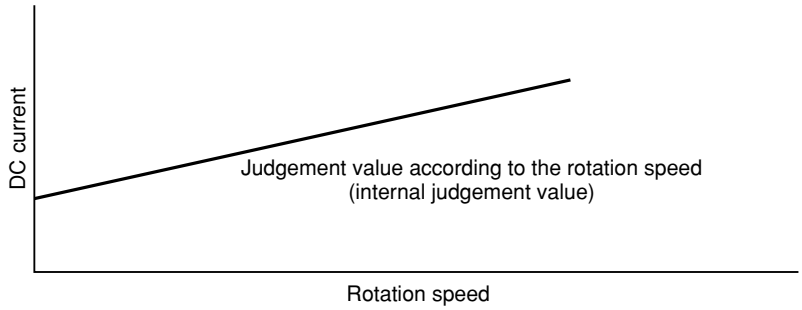


Fig. 8-2

(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.

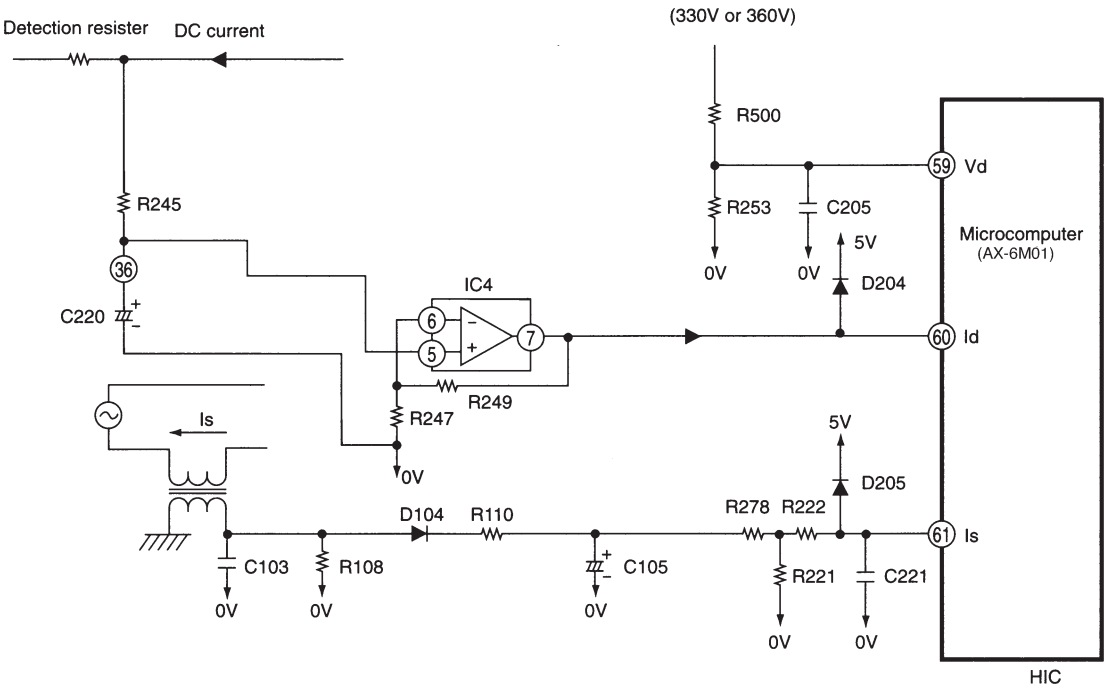


Fig. 8-3

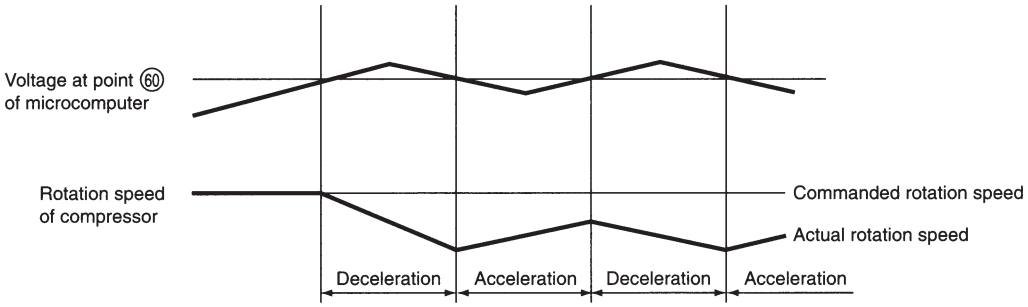


Fig. 8-4

(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 resistor 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 judgement even when the voltage varies.)

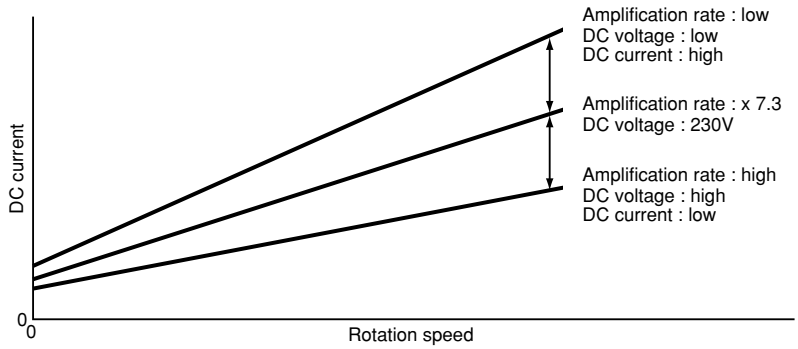


Fig. 8-5

[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-40QH5, 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.

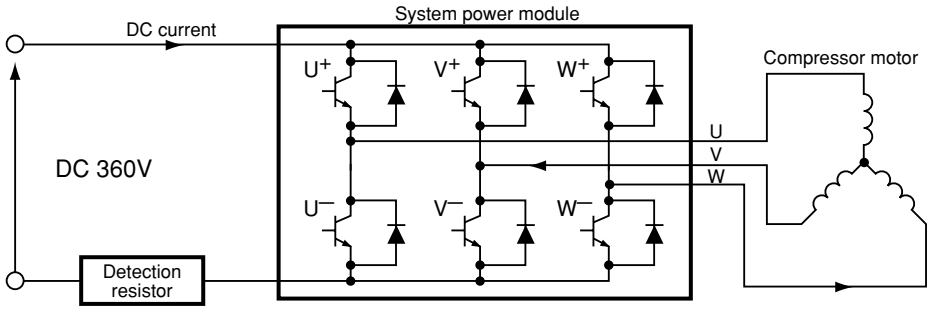


Fig. 8-6

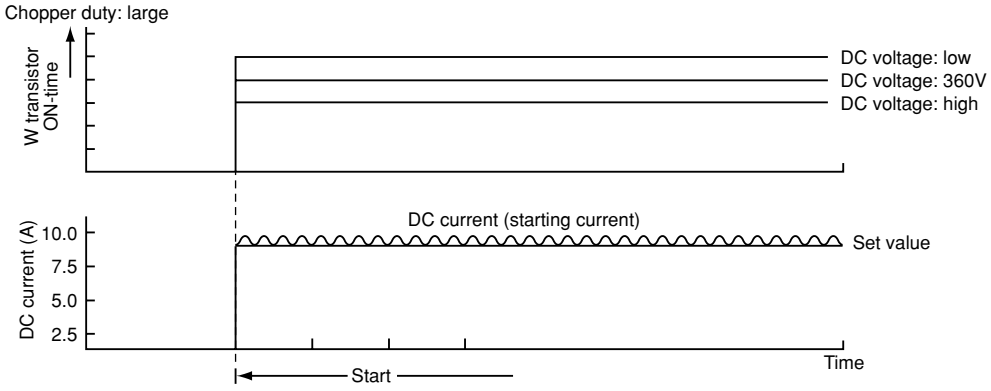


Fig. 8-7

9. Reset Circuit

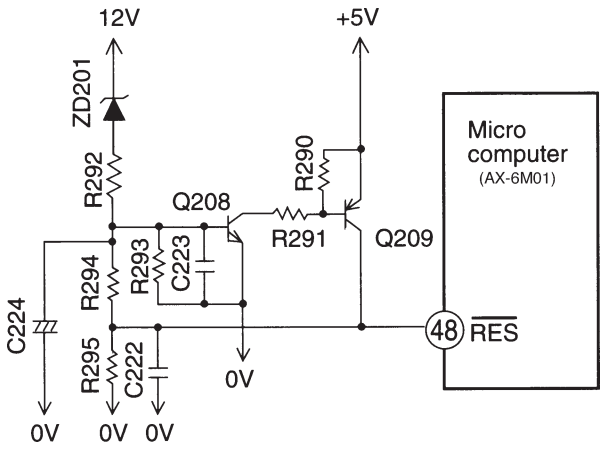


Fig. 9-1

- Reset circuit performs initial setting of the 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 waveform 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 change in 12V line.

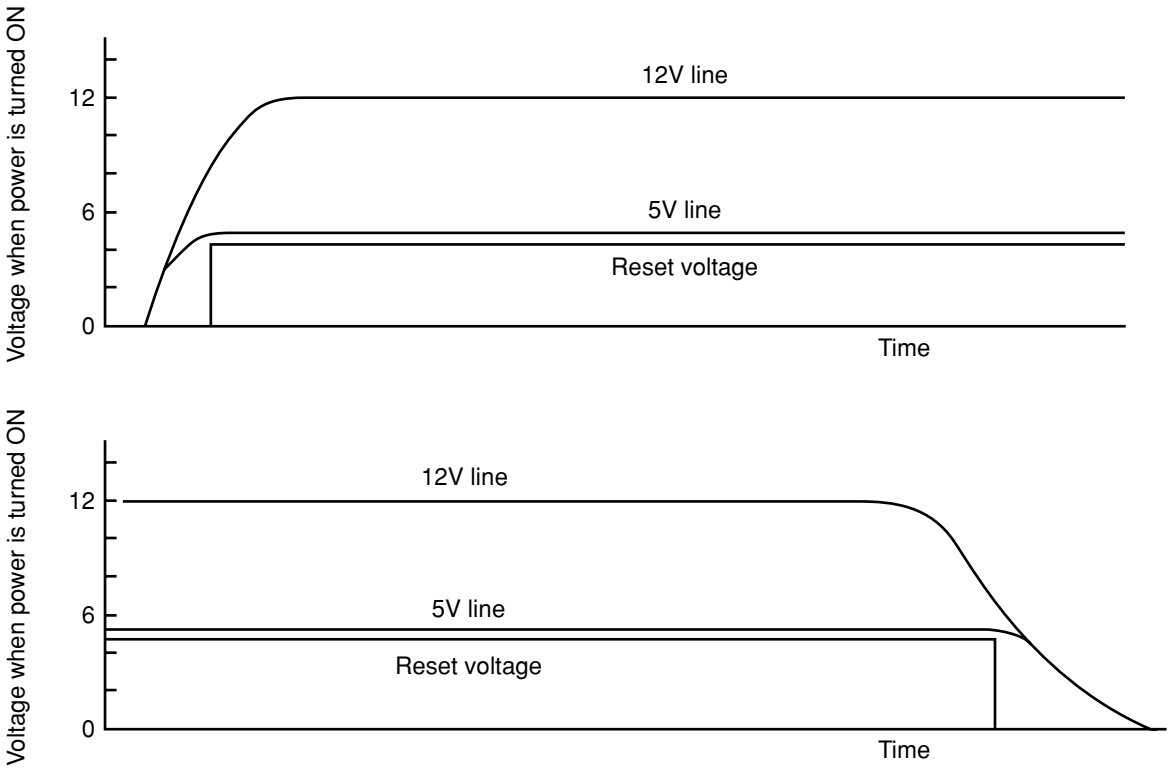


Fig. 9-2

10. Temperature Detection Circuit

HIC

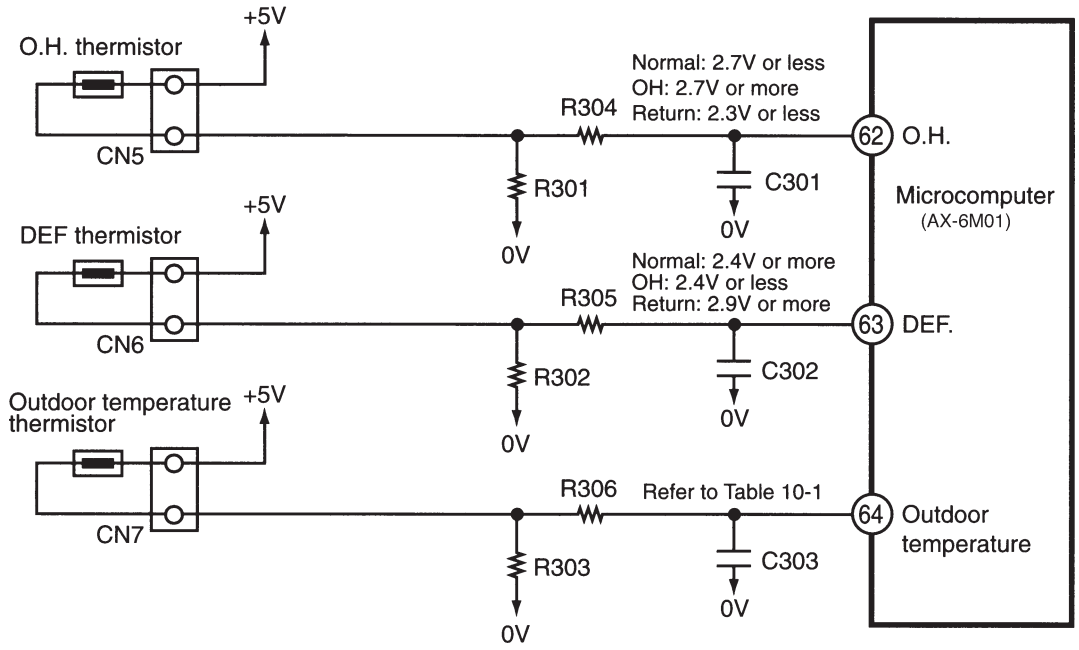


Fig. 10-1

- 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 ⑥② of microcomputer rises.
- Voltage at pin ⑥② 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 ⑥③ of microcomputer falls. When the voltage falls under the set value, microcomputer enters defrost control mode.
- During defrost operation, microcomputer transfers indoor unit defrost condition command from IF transmission output at SDO pin of interface (pin ⑦⓪ and ⑦② of microcomputer).
- Outdoor temperature is always read in (voltage at pin ⑥④ 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 value 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 the thermistor is open or heat is shut off, pins ⑥② to ⑥④ of microcomputer are set to about 0 V; when thermistor is short-circuited, pins ⑥② to ⑥④ 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 dı
The circuits for U phas
phase have the same

- Fig 11-2, 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.

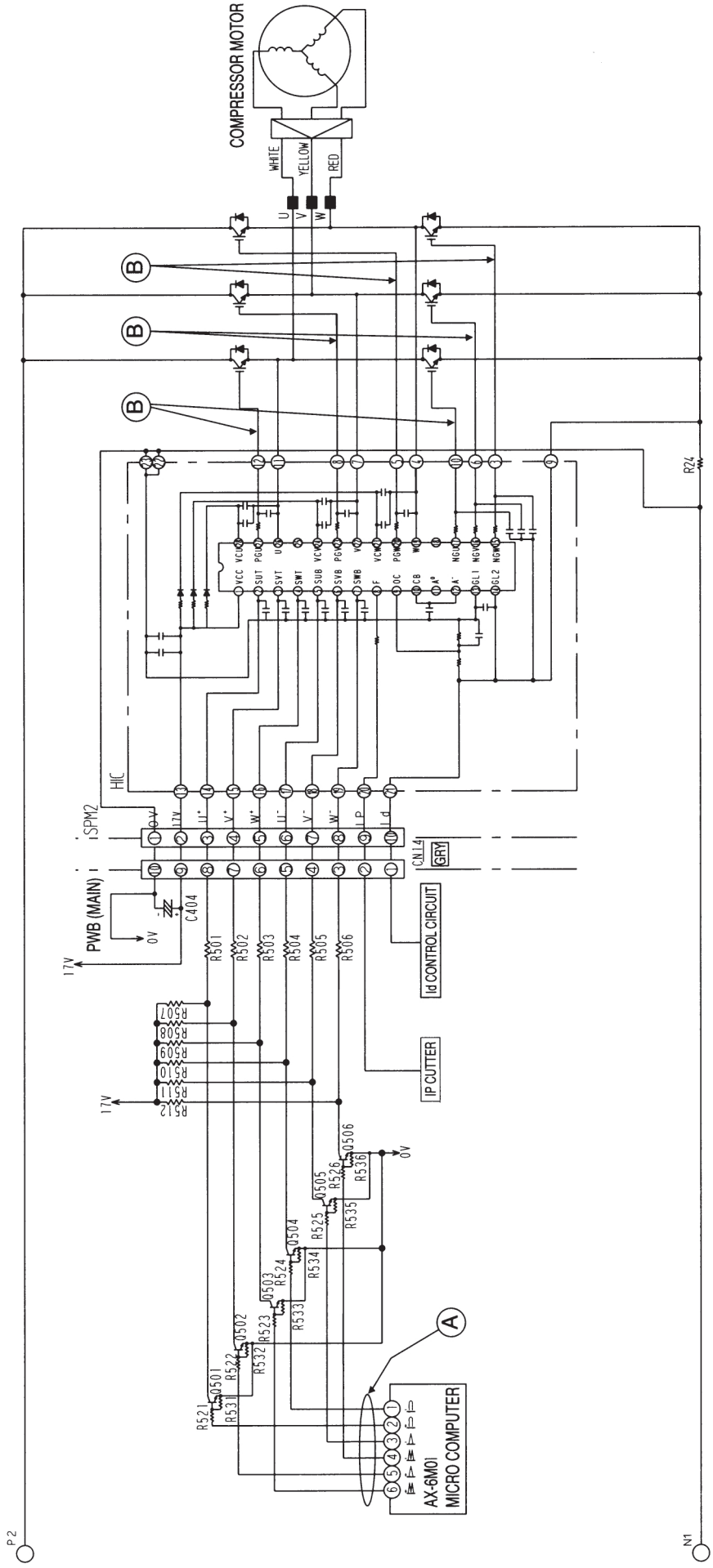


Fig. 11-1

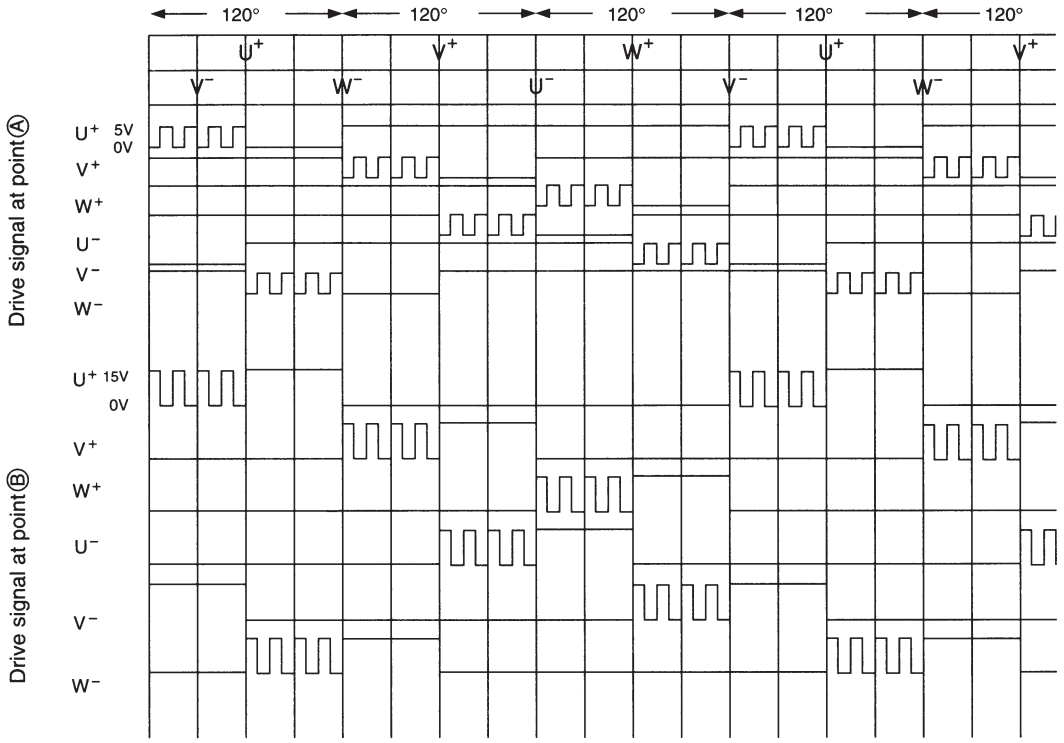


Fig. 11-2

12. Electric expansion valve

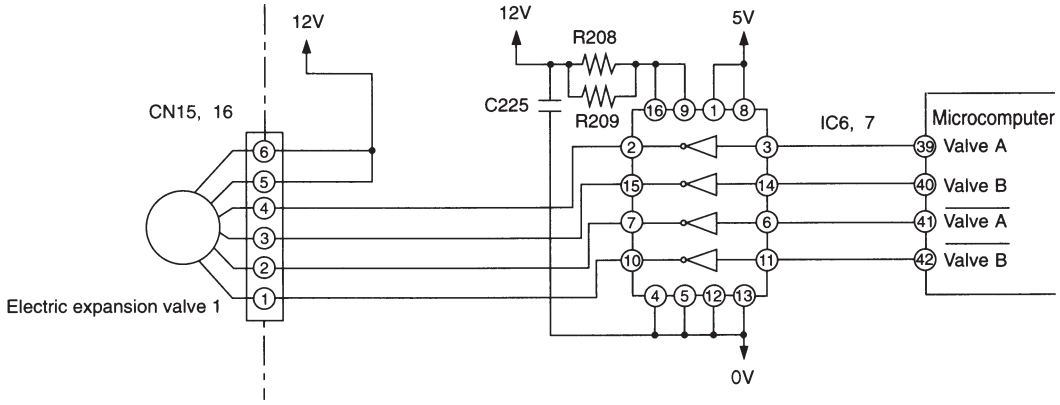


Fig 12-1

- 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.

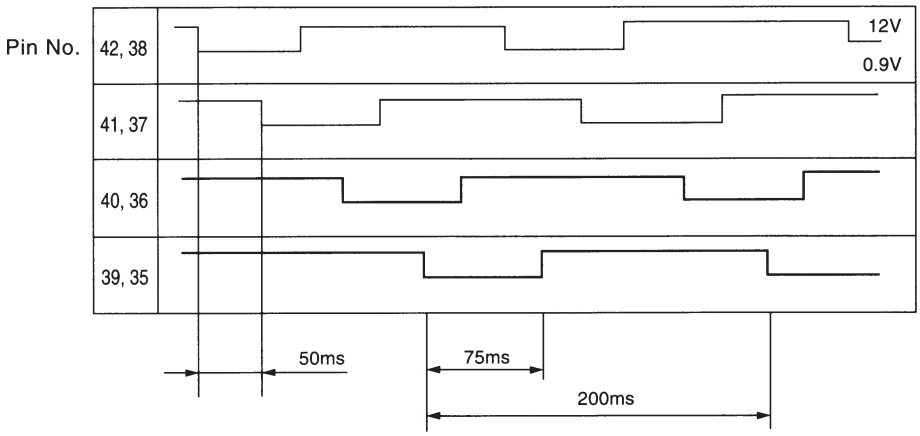
  When power is supplied, voltages at pins ④ to ① of CN 15 and CN 16 are about 0.9V; they are about 12V when no power is supplied. When power is reset, initialization is performed for 10 or 20 seconds.

  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

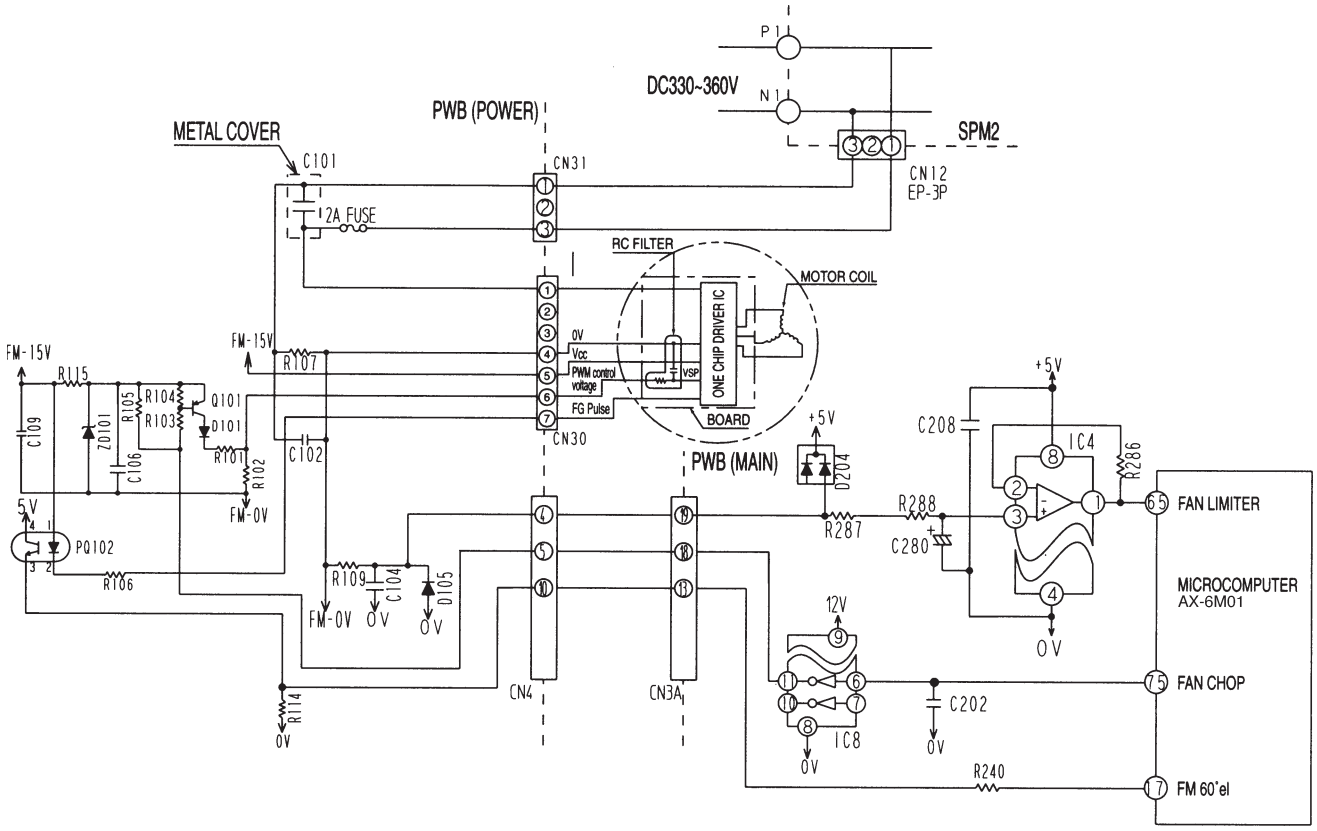
Operation mode
1→2→3→4→5→6→7→8 VALVE CLOSE
8→7→6→5→4→3→2→1 VALVE OPEN



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 >

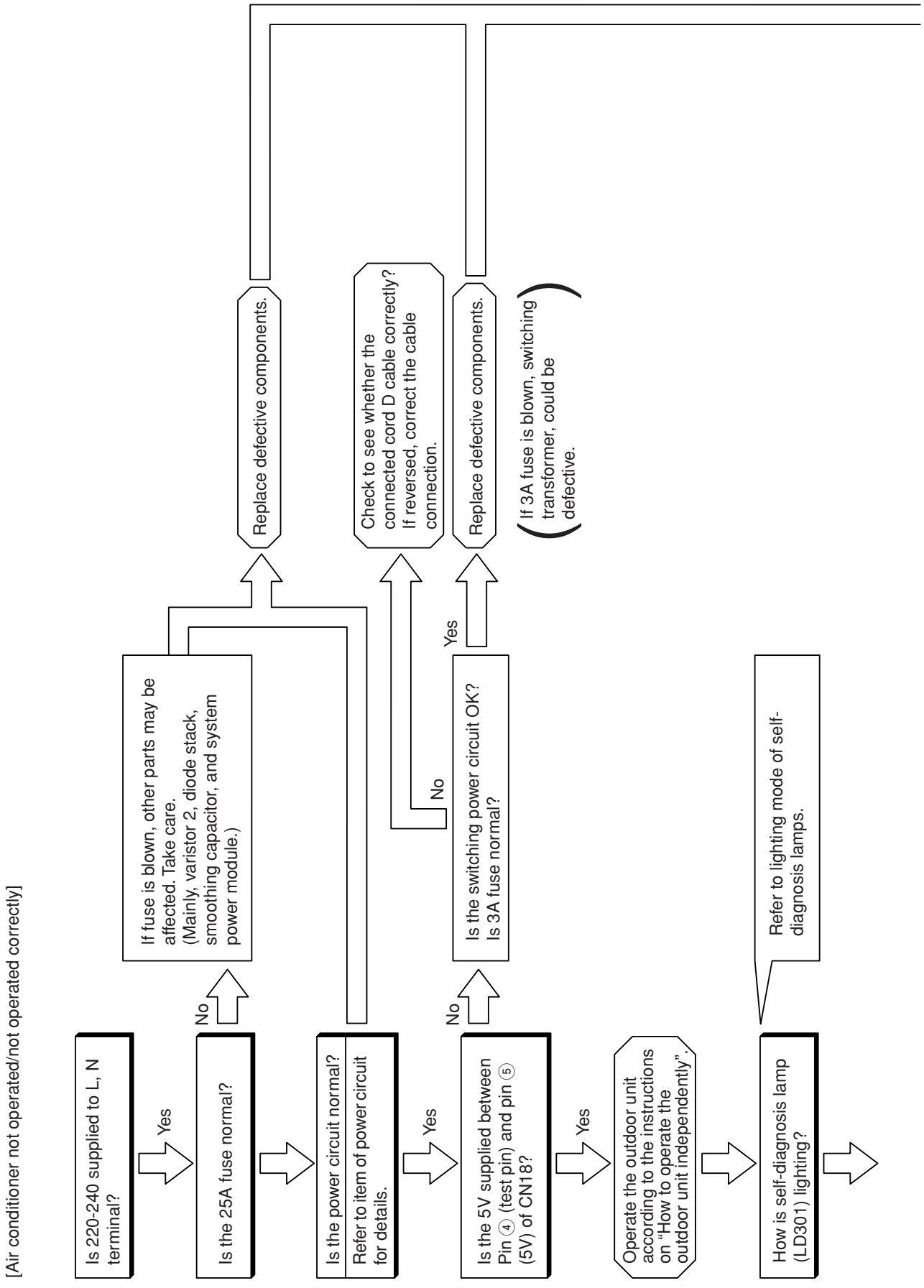
- When stop operation with LD301 blinks 12 times, it may be a DC Fan Motor broken.
- In this case, please check CN30 and CN31 connection first. It makes Fan Motor Lock also if those connectors are in misconnection.
- If 2A Fuse was burned it is possible that the DC Fan Motor may be damaged too.
- DC 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 cause is due to Motor problem or PQ102 on board or control board problem.

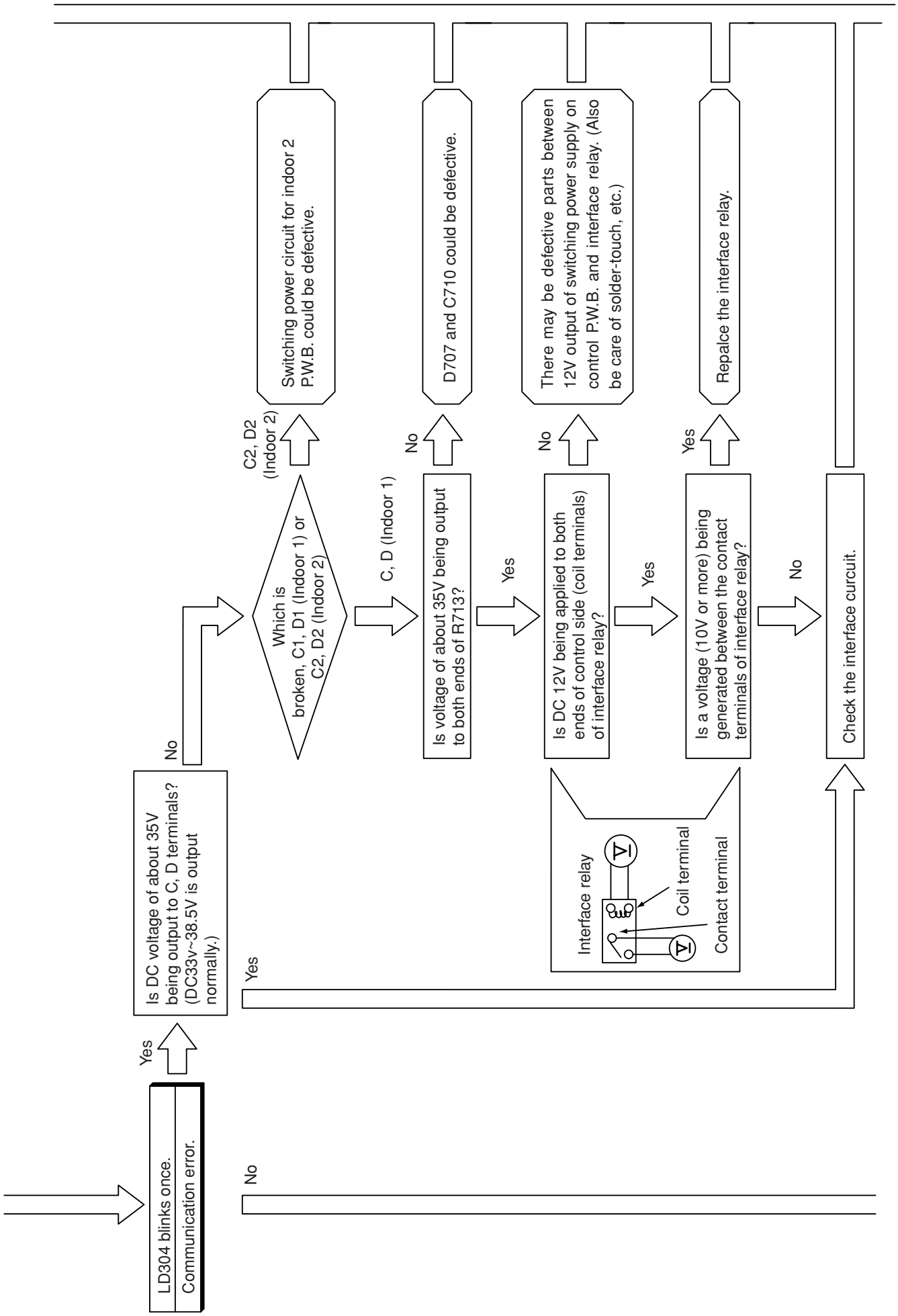
< Caution >

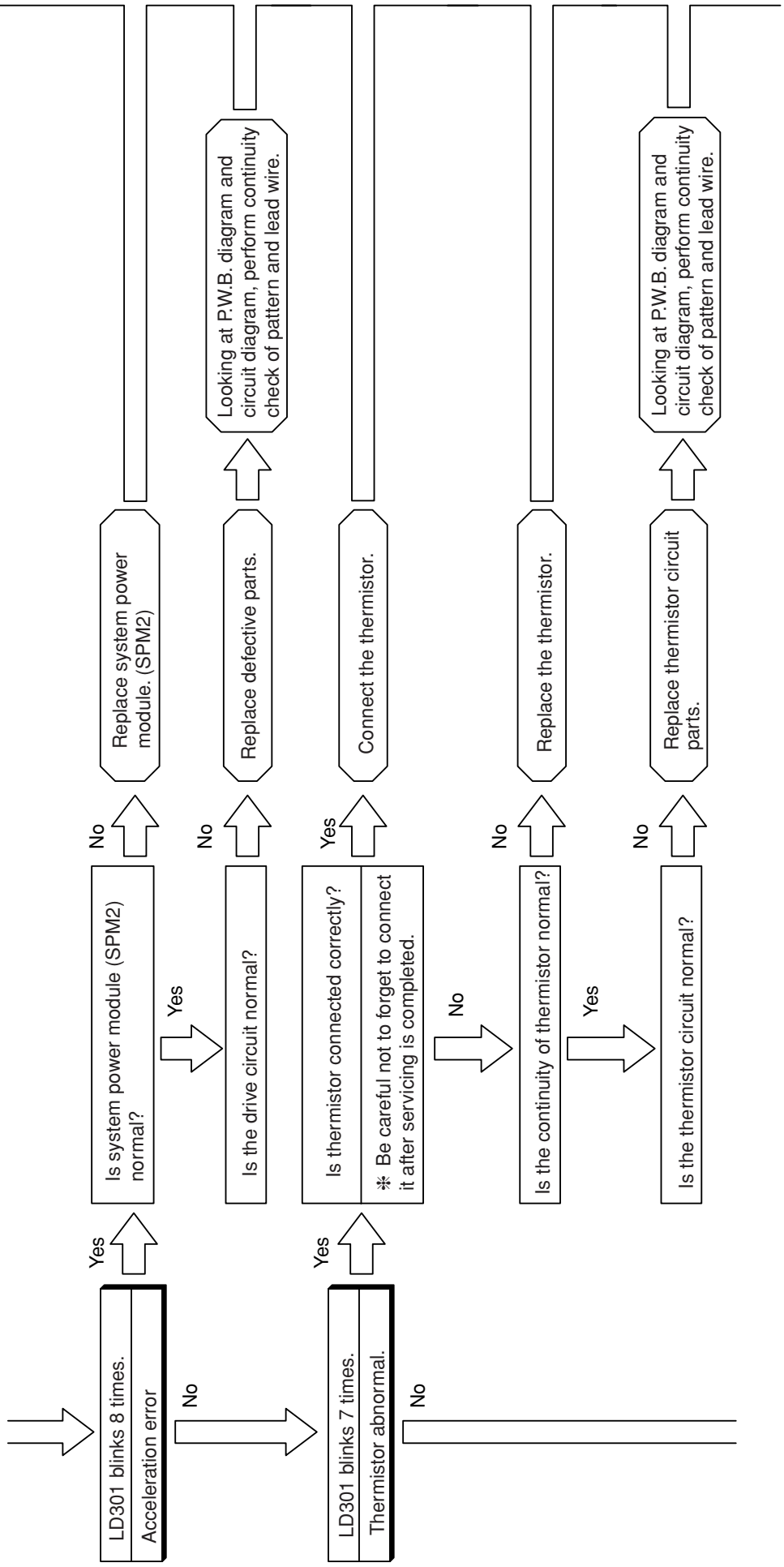
- Please take precaution while servicing Fan Motor circuit, because it carries DC330~360V supply.
- It is impossible to troubleshoot the Fan Motor because its circuit is integrated and conceal in the Fan Motor.

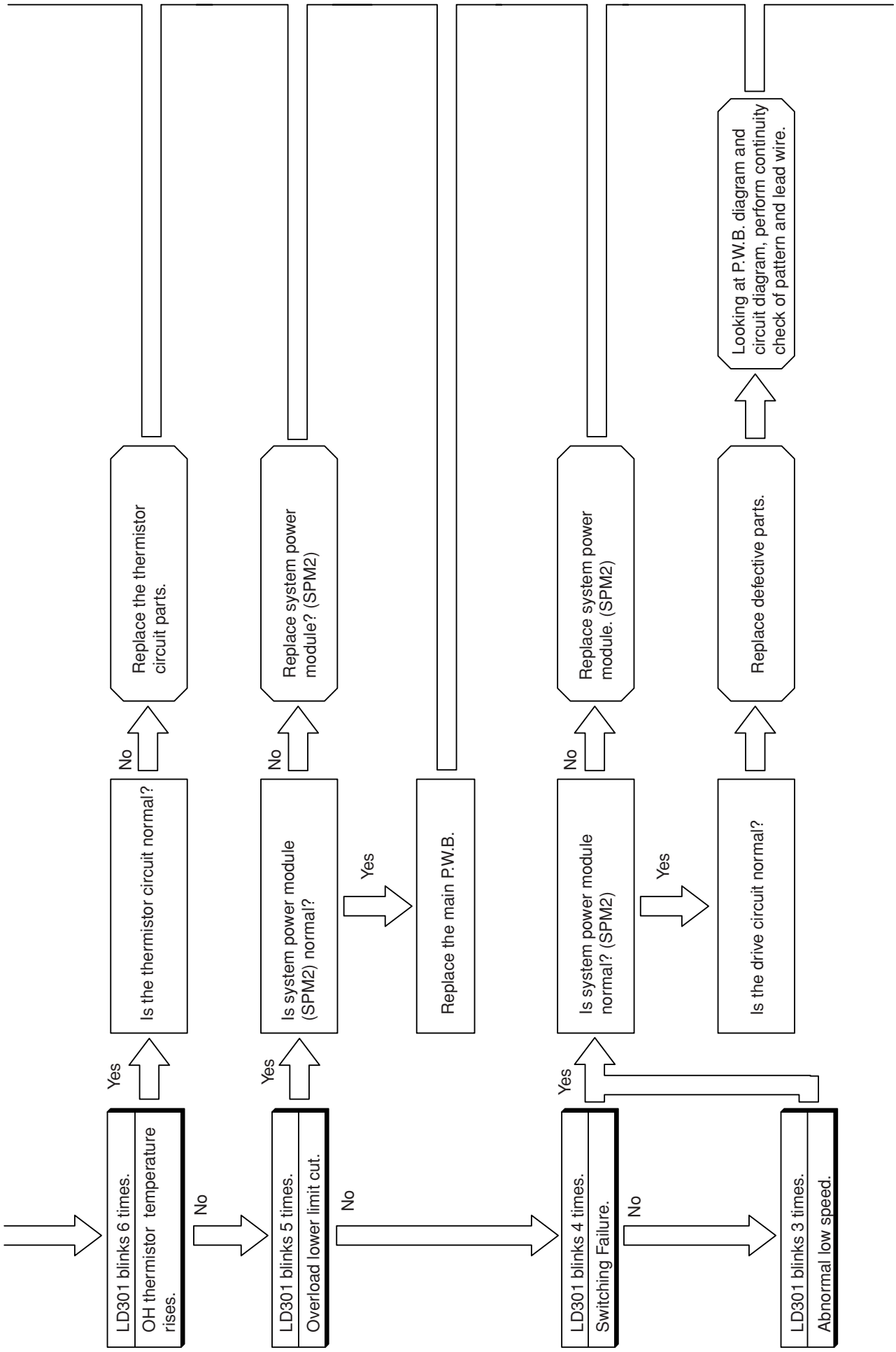
CHECKING THE OUTDOOR UNIT ELECTRICAL PARTS

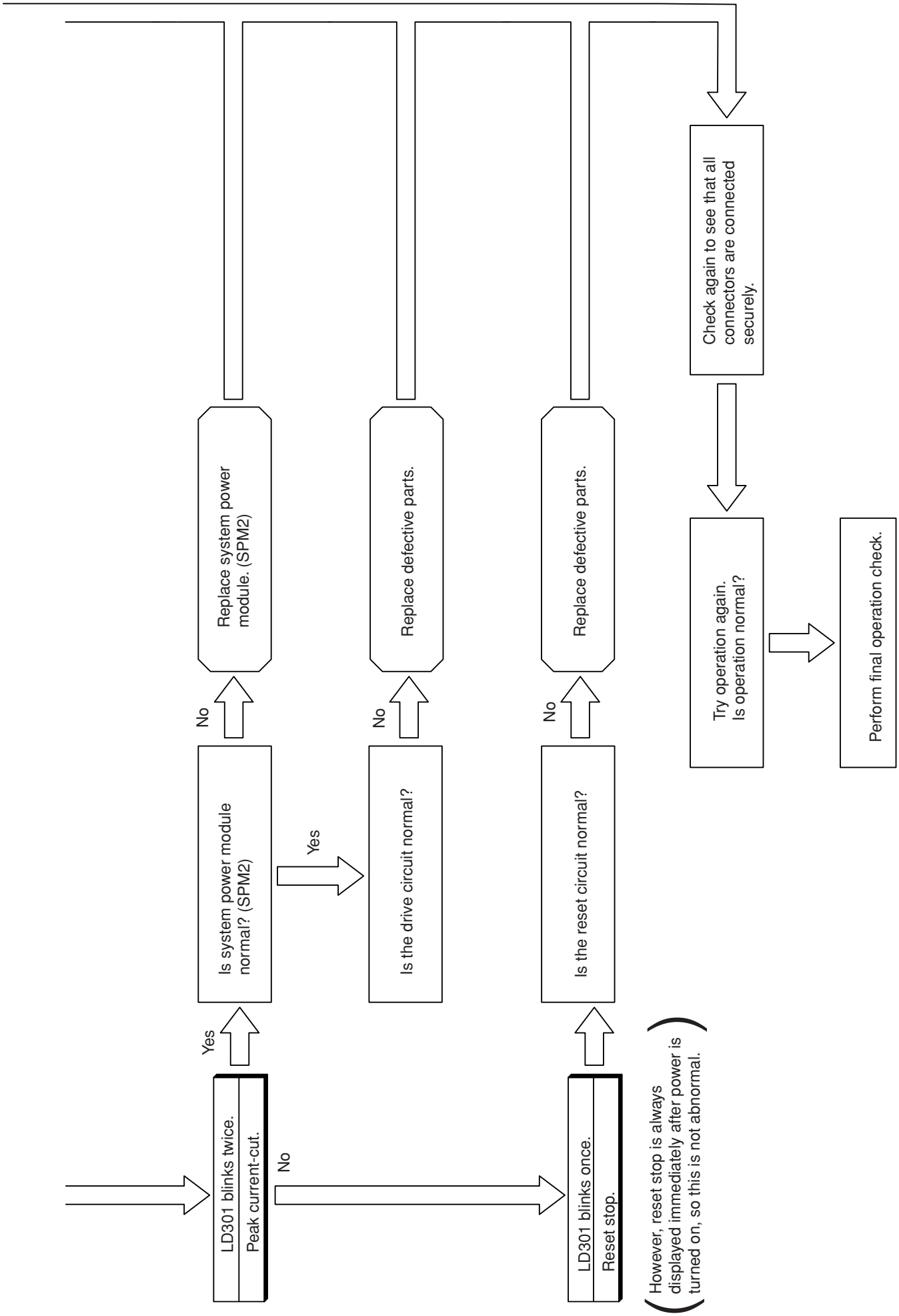
MODEL RAM-40QH5





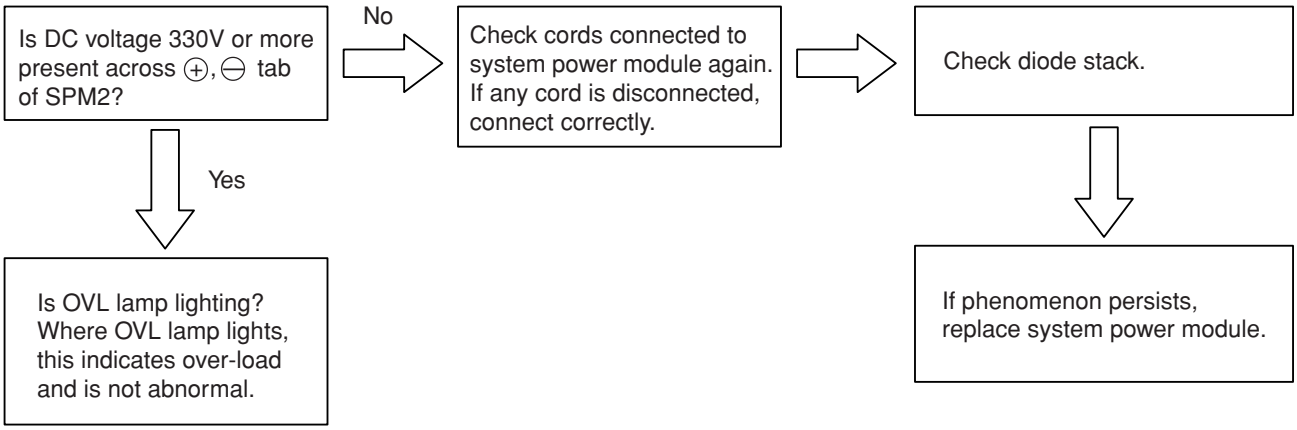






PAM CIRCUIT

Phenomenon 1 (Rotation speed does not increase)



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

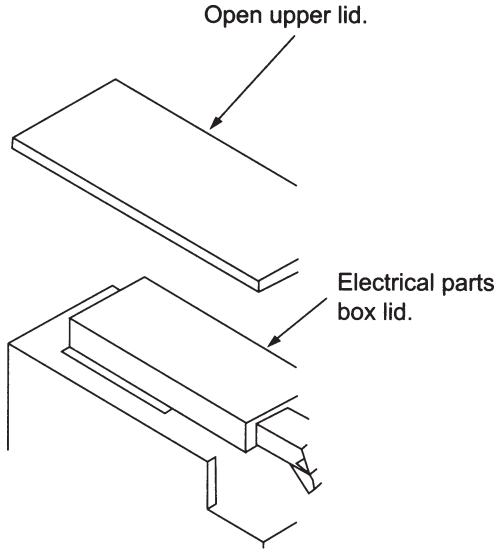
OPERATION USING SERVICE SWITCH OF OUTDOOR UNIT

MODEL RAM-40QH5

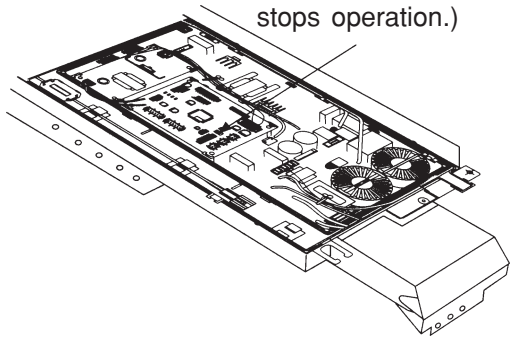
1. Turn OFF power switch, then turn ON again.
2. Remove electrical parts box lid.
3. Press service switch for 1 second or more. (waiting at least 20 seconds after power switch is turned on.)

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

Never operate continuously for 5 minutes or more



Service switch (Forced-cooling operation starts by pressing for 1 second or more, and pressing for 1 second or more again stops operation.)



(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.

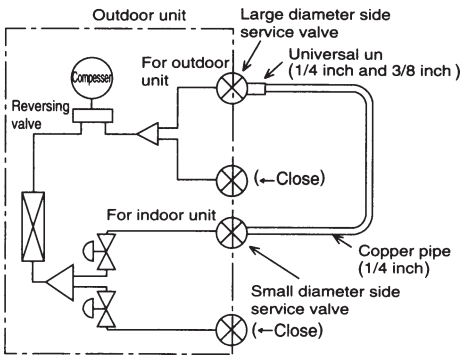
After operation using service switch is completed, turn the power switch OFF and then ON again.

HOW TO OPERATE THE 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.

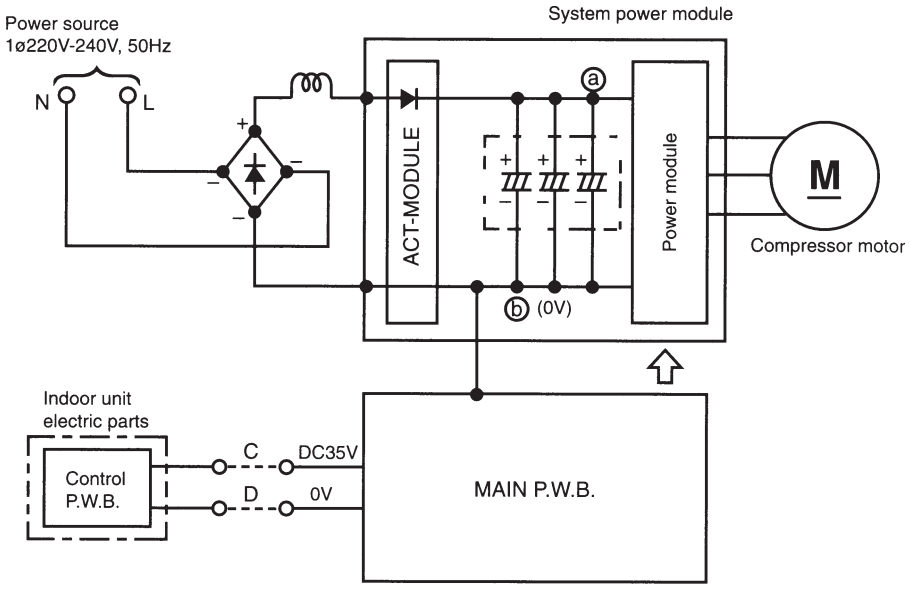
TROUBLE SHOOTING

Model RAM-40QH5

PRECAUTIONS FOR CHECKING

DANGER

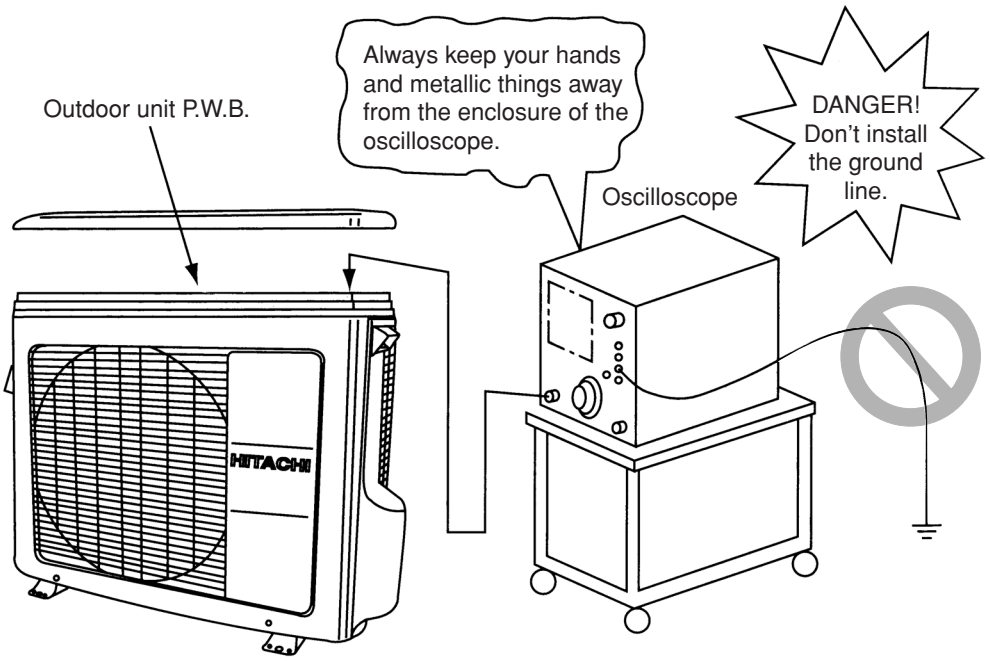
1. Remenber that the 0V line is biased to 155-170V in reference to the ground level.
2. Also note that it takes about 10 minutes until the voltage fall after the power switch is turned off.



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.



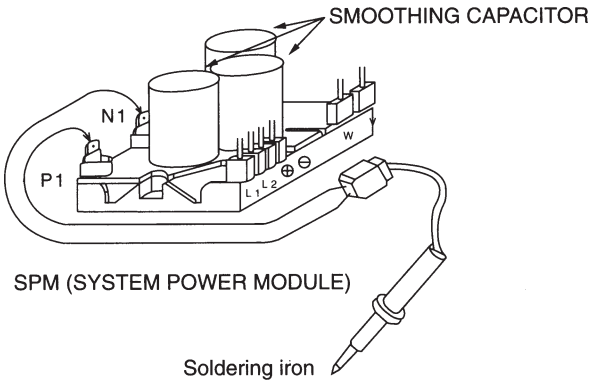
DISCHARGE PROCEDURE AND HOW TO CUT OFF POWER TO POWER CIRCUIT

WARNING

Caution:

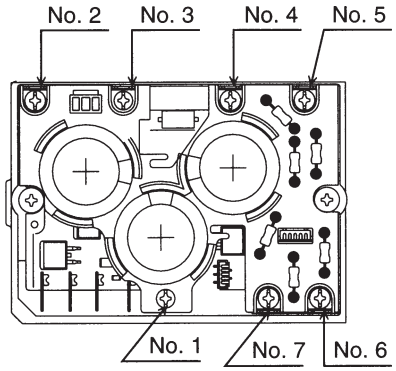
- Voltage of about 360V is charged at both ends of smoothing capacitors 400 μF X 3.
- High voltage (DC 360V) is also charged at screw and terminal sactions of system power module.
- During continuity check for each circuit of electrical parts in outdoor unit is performed, to prevent secondary trouble, 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 each part of circuit, remove receptable of red/gray lead connected to system power module from diode stack.

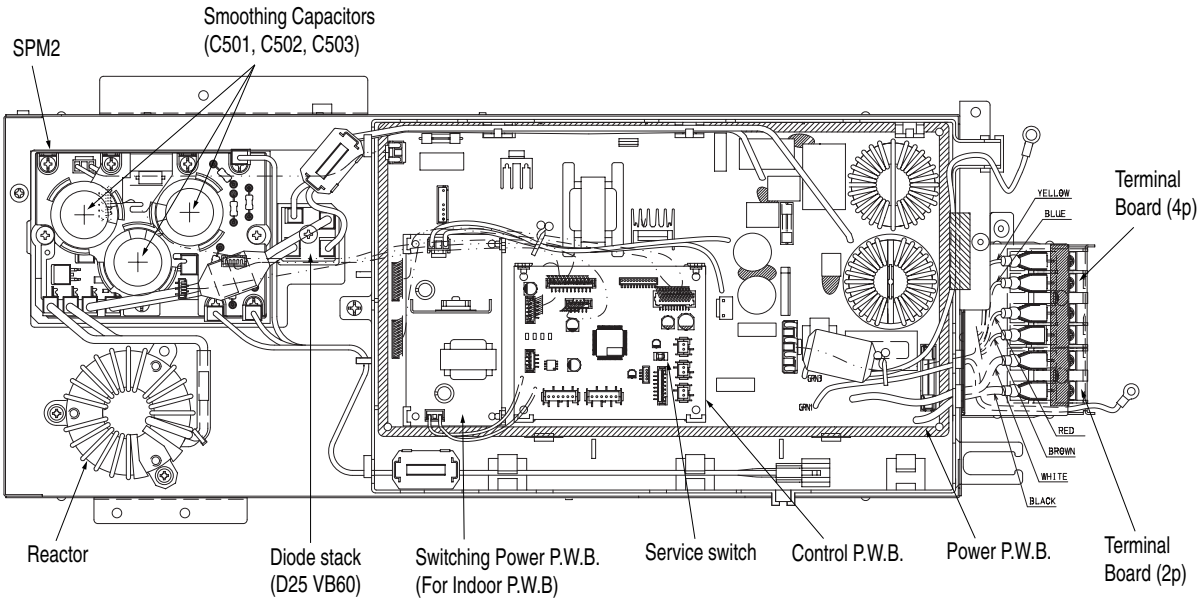


Do not use soldering iron with transformer: Doing so will blow thermal fuse inside transformer.

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.

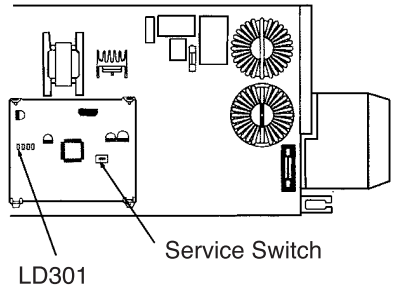


RAM-40QH5

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 the 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 the room temperature thermistor; if it is defective, replace it.
[Normal values]
10°C → approx. 20kΩ
25°C → approx. 10kΩ
30°C → approx. 8kΩ

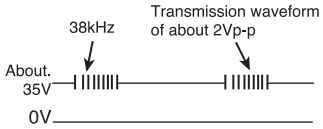
Check the heat exchanger thermistor; if it is defective, replace it.
[Normal values]
10°C → approx. 20kΩ
25°C → approx. 10kΩ
30°C → approx. 8kΩ

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?

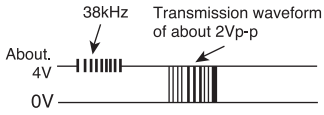


During check using tester:
If superimposed, 35V rapidly changes.
Caution:
Digital tester only.

No → Check outdoor electrical parts, and repair any defective parts (around the 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 the indoor interface transmitting circuit.

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

No

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

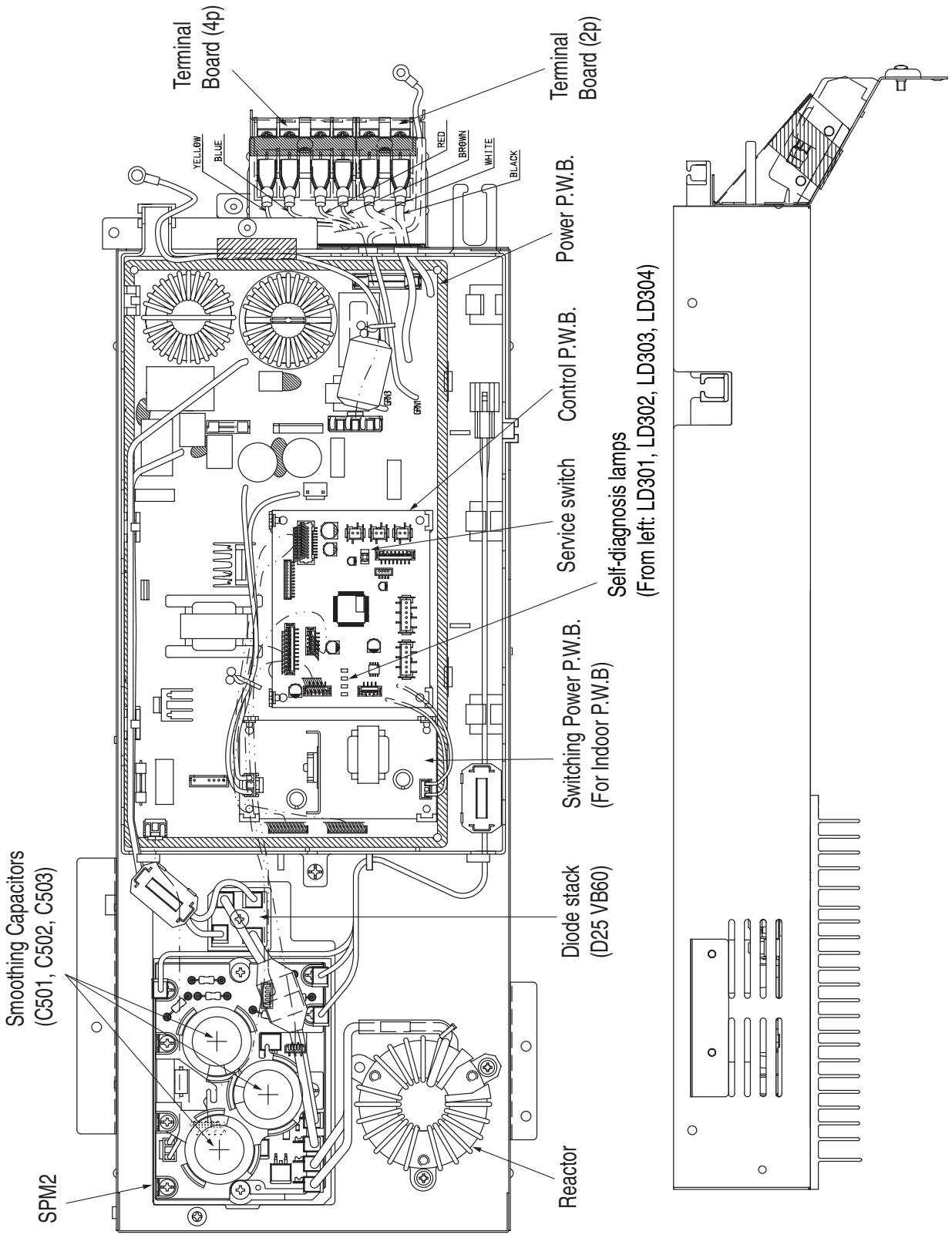
→ Check electrical parts of outdoor unit and repair defective parts.

Perform final operation check.

LIGHTING MODE SELF-DIAGNOSIS LAMP

RAM-40QH5

1 Location of self-diagnosis lamp



2 Lighting mode self-diagnosis lamp

RAM-40QH5

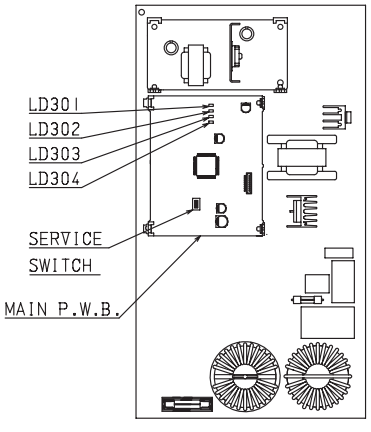
⚠ DANGER (DC360V)

- 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 BY REFERING TO SERVICE MANUAL DISCHARGE PROCEDURE PAGE.

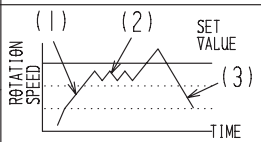
- DO NOT TOUCH SCREW OF SYSTEM POWER MODULE DUE TO HIGH VOLTAGE.
- DO NOT TOUCH OTHER PARTS AT THE CASE OF PUSHING SERVICE SWTCH.

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.

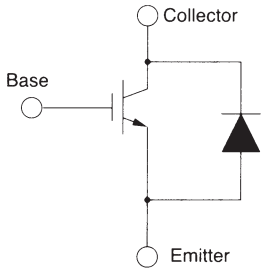
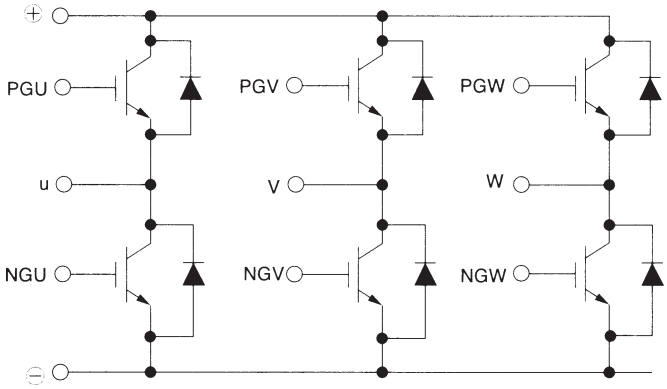
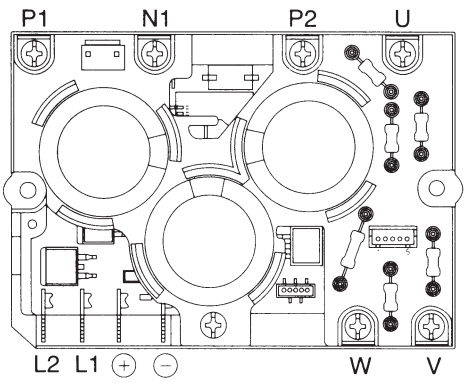


SELF-DIAGNOSIS LIGHTING MODE ■:LIT ▨:BLINKING □:OFF

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.
▨ 1TIME	□	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 ③P.W.B.s
▨ 3TIMES	□	ABNORMAL LOW SPEED ROTATION	POSITION DETECTION SIGNAL IS NOT INPUT DURING OPERATION.	①SYSTEM POWER MODULE ②COMPRESSOR ③P.W.B.s
▨ 4TIMES	□	SWITCHING FAILURE	SWITCHING FROM LOW FREQUENCY SYNC START TO POSITION DETECTION OPERATION FAILURE.	①SYSTEM POWER MODULE ②COMPRESSOR ③P.W.B.s
▨ 5TIMES	□	OVERLOAD LOWER LIMIT CUT	UNDER THE LOWER LIMIT OF ROTATION SPEED WITH OVERLOAD CONTROL CIRCUIT OPERATED.	①OUTDOOR UNIT IS EXPOSED TO DIRECT SUNLIGHT OR ITS AIRFLOW BLOCKED. ②FAN MOTOR ③FAN MOTOR CIRCUIT ④THE 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 ②CONNECTION 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

Type	GT15V31ISM
Element circuit	
Internal circuit 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.

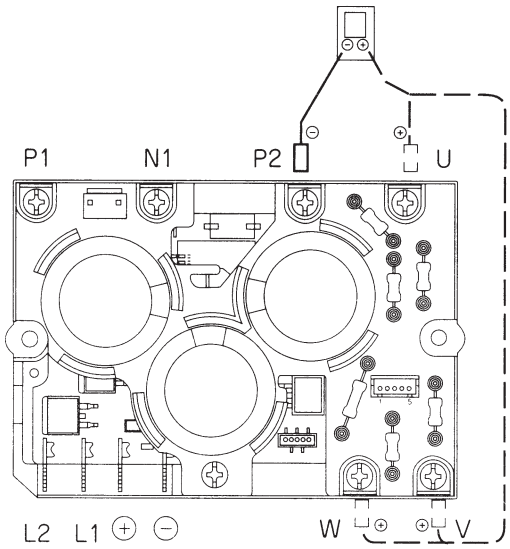
HOW TO CHECK POWER MODULE

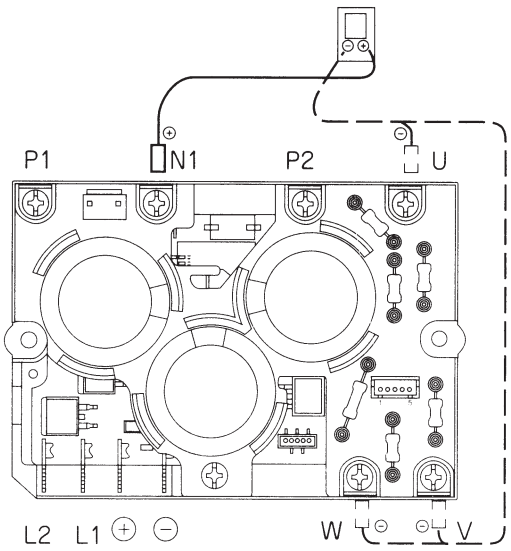
Checking power module using tester

Set tester to resistance range (×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, it is normal. Furthemore, compare how indicator swings at U, V and W phases. If indicator swings the same way at each point, it is normal.





CHECKING THE REFRIGERATING CYCLE

(JUDGING BETWEEN GAS LEAKAGE AND COMPRESSOR DEFECTIVE)

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

If the indoor pipe or service valve becomes frosted during heating of one unit, check the operation of Reversing valve.

Connect U.V.W phase leads to the power module again and operate the air conditioner.

Is the self-diagnosis lamp mode as shown on the right?

Selfdiagnosis Lamp \ Lighting mode	Blinks 2 times	Blinks 3 times	Blinks 4 times	Blinks 5 times	Blinks 6 times	Blinks 8 times
LD301	▨	▨	▨	▨	▨	▨
Time until the lamp lights	2-3 seconds			Approx 10 seconds	Within approx 30 minutes	Approx 10 seconds
Possible malfunctioning part	Compressor				Gas leakage	Compressor

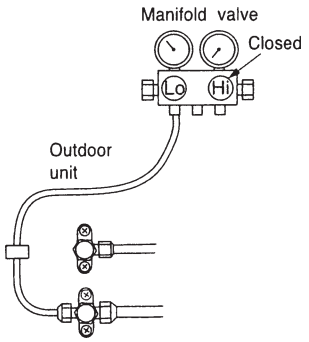
▨ Blinking

YES

Stop to operate and check the gas pressure in balancing mode.

Outdoor air temperature (℃)	Charge port pressure Mpa(G) {kgf/cm²(G)}
50	2.96 {30.14}
45	2.62 {26.72}
40	2.31 {23.58}
35	2.03 {20.73}
30	1.78 {18.14}
25	1.55 {15.79}
20	1.34 {13.66}
15	1.15 {11.74}
10	0.98 {10.02}
5	0.83 { 8.48}
0	0.70 { 7.10}
-5	0.58 { 5.89}
-10	0.47 { 4.81}

(R410A)



Normal

Abnormal
Gas leaking

Checking the power module.

When the self-diagnosis lamp lights in the same condition as above.

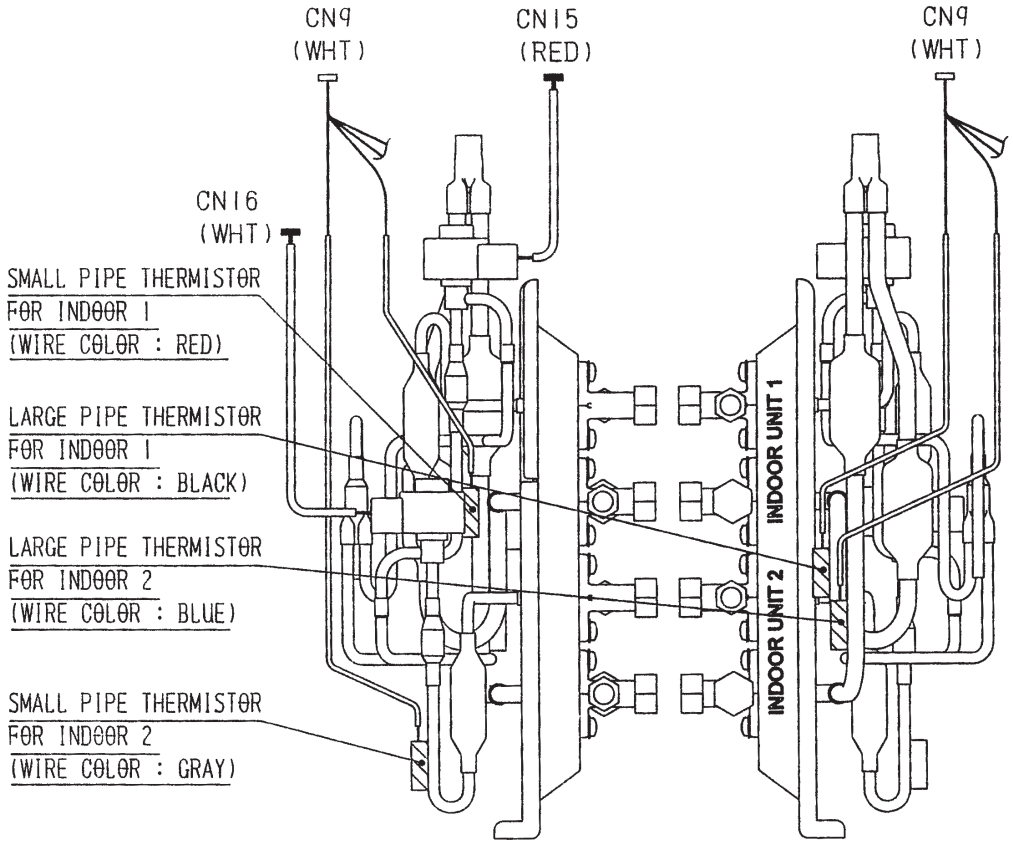
Gas leaks.
Repair and seal refrigerant.

The compressor is defective. Replace it and seal refrigerant.
(If the compressor checker for an inverter type air conditioner is available, re-check using it.)

Perform a final check of operation.

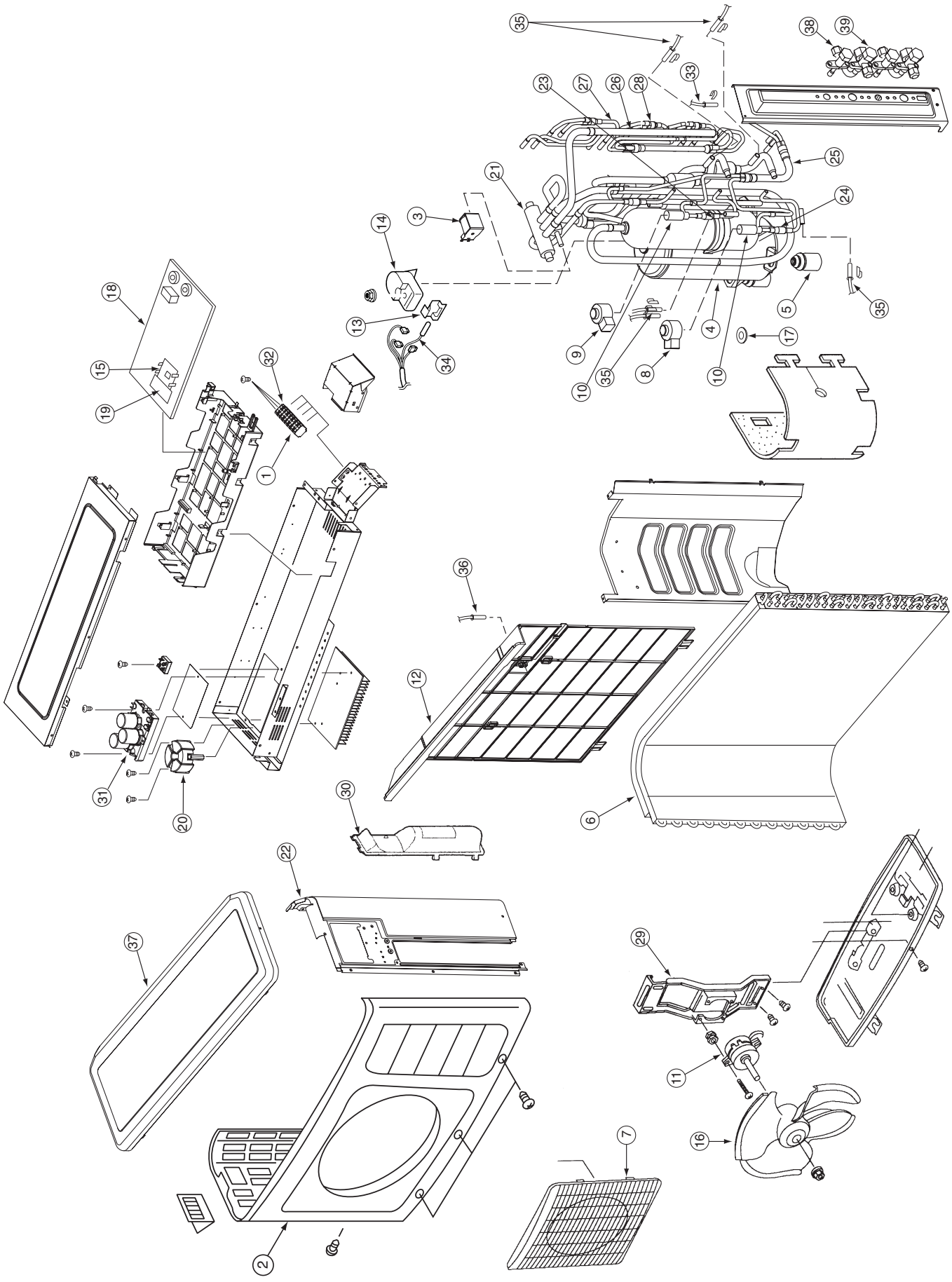
ELECTRIC EXPANSION VALVE & PIPE THERMISTOR POSITION CHARTS

MODEL RAM-40QH5



PARTS LIST AND DIAGRAM

MODEL RAM-40QH5



MODEL RAM-40QH5

NO.	PART N0. RAM-40QH5	Q'TY / UNIT	PARTS NAME
1	PMRAC-63CA1 902	1	2P TERMINAL
2	PMRAC-51CA1 901	1	CABINET
3	PMRAM-40QH5 907	1	COIL (REVERSING VALVE)
4	PMRAM-65QH4 901	1	COMPRESSOR
5	RAC-2226HV 805	3	COMPRESSOR RUBBER
6	PMRAM-40QH5 910	1	CONDENSER
7	PMRAC-09CHA1 903	1	D-GRILL
8	PMRAC-25NH4 903	1	ELECTRICAL EXPANSION COIL
9	PMRAM-40QH5 902	1	ELECTRICAL EXPANSION COIL
10	PMRAM-65QH4 903	2	EXPANSION VALVE
11	PMRAC-40CNH2 919	1	FAN MOTOR 40W
12	PMRAC-51CA1 908	1	NET
13	PMRAC-25NH4 909	1	OVERHEAT THERMISTOR SUPPORT
14	PMRAC-25NH4 910	1	OVERLOAD RELAY COVER
15	PMRAM-40QH5 901	1	P.W.B. (MAIN)
16	PMRAC-25CNH2 902	1	PROPELLER FAN
17	KPNT1 001	6	PUSH NUT
18	PMRAM-40QH5 915	1	PWB (POWER)
19	PMRAS-51CHA1 013	1	PWB (SW. POWER)
20	PMRAC-18SH4 901	1	REACTOR
21	PMRAC-19SH4 904	1	REVERSING VALVE
22	PMRAM-40QH5 903	1	SIDE PLATE (R)
23	PMRAM-40QH5 908	1	STRAINER (COND 1)
24	PMRAM-40QH5 909	1	STRAINER (COND 2)
25	PMRAM-40QH5 904	1	STRAINER (COND)
26	PMRAM-40QH5 912	1	STRAINER (PIPE)
27	PMRAM-40QH5 913	1	STRAINER (ST-PIPE-AS-1)
28	PMRAM-40QH5 914	1	STRAINER (ST-PIPE-AS-2)
29	PMRAC-25NH4 914	1	SUPPORT (FAN MOTOR)
30	PMRAM-40QH5 905	1	SV COVER
31	PMRAC-40CNH2 901	1	SYSTEM POWER MODULE
32	PMRAC-25NH4 913	1	TERMINAL BOARD (4P)
33	PMRAM-40QH5 911	1	THERMISTOR (DEFROST)
34	PMRAC-40CNH2 914	1	THERMISTOR (OH)
35	PMRAM-40QH5 906	1	THERMISTOR-V
36	PMRAC-19SH4 901	1	THERMISTOR (OUTSIDE TEMPERATURE)
37	PMRAC-51CA1 909	1	TOP COVER
38	PMRAM-65QH4 915	2	VALVE 2S
39	PMRAM-65QH4 916	2	VALVE 3S

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PM NO. 0270E

RAM-40QH5

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