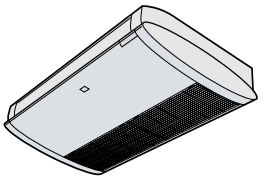
IVT

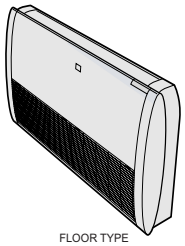
SERVICE MANUAL

No. XXXXXXXXXXXXX

SPLIT TYPE ROOM AIR CONDITIONERS



CEILING TYPE



FLOOR TYPE

MODELS INDOOR UNIT OUTDOOR UNIT

GS-XP12HR-N AE-X12FR-N

In the interests of user-safety (Required by safety regulations in some countries) the set should be restored to its original condition and only parts identical to those specified should be used.

CONTENTS

Parts marked with " ⚠ " are important for maintaining the safety of the set. Be sure to replace these parts with specified ones for maintaining the safety and performance of the set.

CHAPTER 1. SPECIFICATION

[1] SPECIFICATION

1. GS-XP12HR-N / AE-X12FR-N

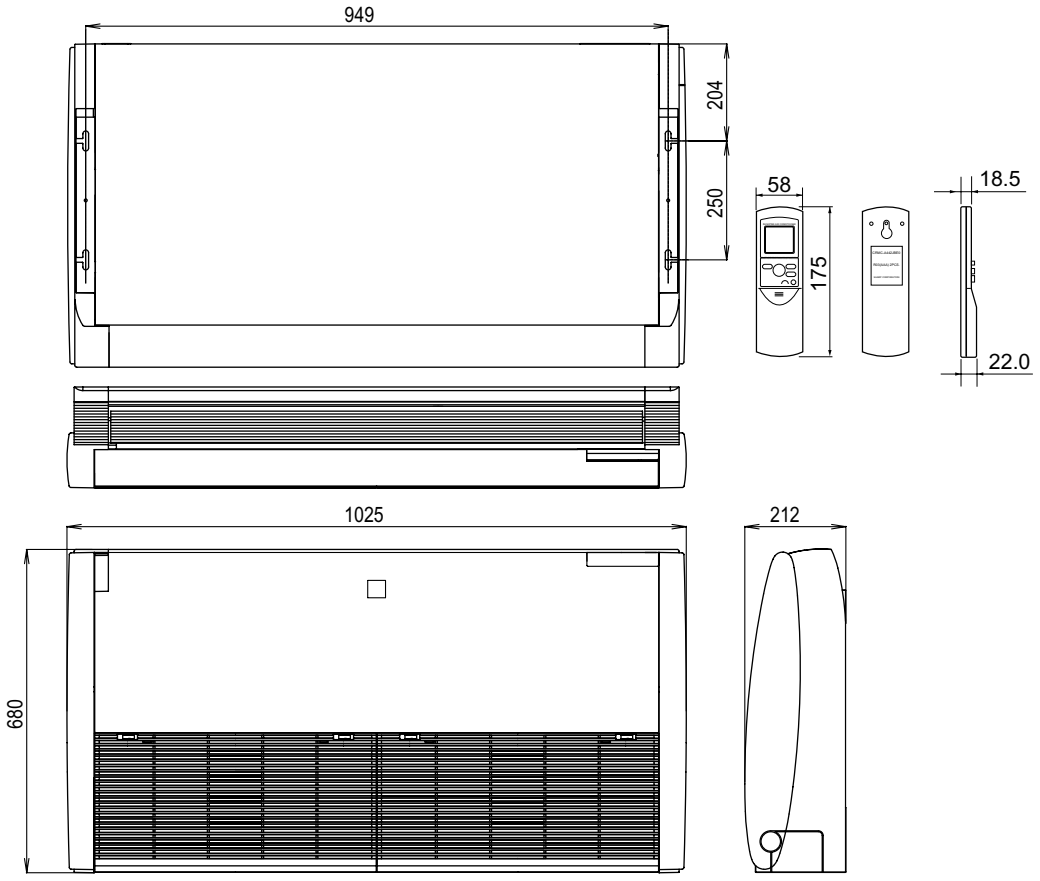
ITEMS	MODEL		INDOOR UNIT GS-XP12HR-N	OUTDOOR UNIT AE-X12FR-N
Cooling capacity (Min. ~ Max.)	kW		3.5 (0.9 - 4.0)	
Heating capacity (Min. ~ Max.)	kW		4.2 (0.9 - 6.0)	
Moisture removal (at cooling)	Liters/h		0.9	
Electrical data				
Phase			Single	
Rated frequency	Hz		50	
Rated voltage	V		230	
Rated current ☆ (Min - Max.)	Cool	A	4.5 (1.2 - 6.0)	
	Heat	A	4.7 (1.3 - 7.0)	
Rated input ☆ (Min - Max.)	Cool	W	900 (200 - 1300)	
	Heat	W	970(180 - 1800)	
Power factor ☆	Cool	%	87	
	Heat	%	90	
Compressor	Type		Hermetically sealed rotary type	
	Model		5RS092XDF	
	Oil charge		RB68A or FREOL ALPHA68M 320ml	
Refrigerant system	Evaporator		Louver Fin and Grooved tube type	
	Condenser		Corrugate Fin and Grooved tube type	
	Control		Expansion valve	
	Refrigerant (R410A)		1000g	
	De-Ice system		Micro computer controled reversed systems	
Noise level (at cooling)	High	dB(A)	43	49
	Low	dB(A)	35	-
	Soft	dB(A)	29	-
Fan system				
Drive			Direct drive	
Air flow quantity (at cooling)	High	m^3/min.	12.9	30.2
	Low	m^3/min.	10.3	–
	Soft	m^3/min.	7.3	–
Fan			Centrifugal fan	Propeller fan
Connections				
Refrigerant coupling			Flare type	
Refrigerant tube size Gas, Liquid			1/2", 1/4"	
Drain piping mm			O.D ϕ 20	
Others				
Safety device			Compressor: Thermal protector	
			Fan motors: Thermal fuse	
			Fuse, Micro computer control	
Air filters			Polypropylene net (Washable)	
Net dimensions	Width	mm	1025	780
	Height	mm	212	540
	Depth	mm	680	265
Net weight		kg	31	37

NOTE: The condition of star "☆" marked item are 'ISO5151' : 1994(E), condition T1, Voltage 230V.

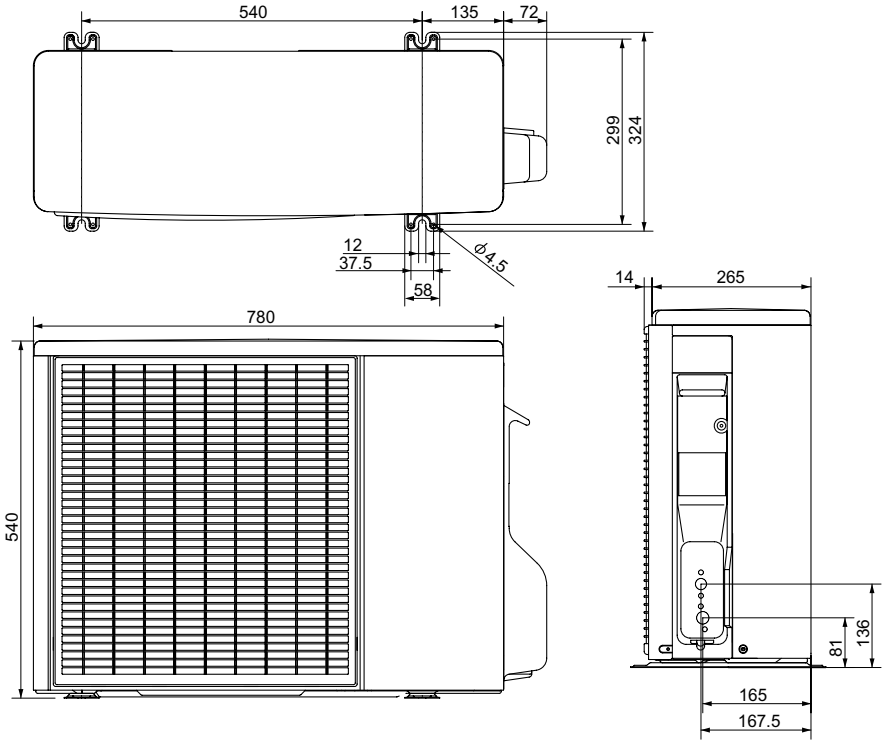
[2] EXTERNAL DIMENSION

1. GS-XP12HR-N / AE-X12FR-N

1.1. Indoor unit

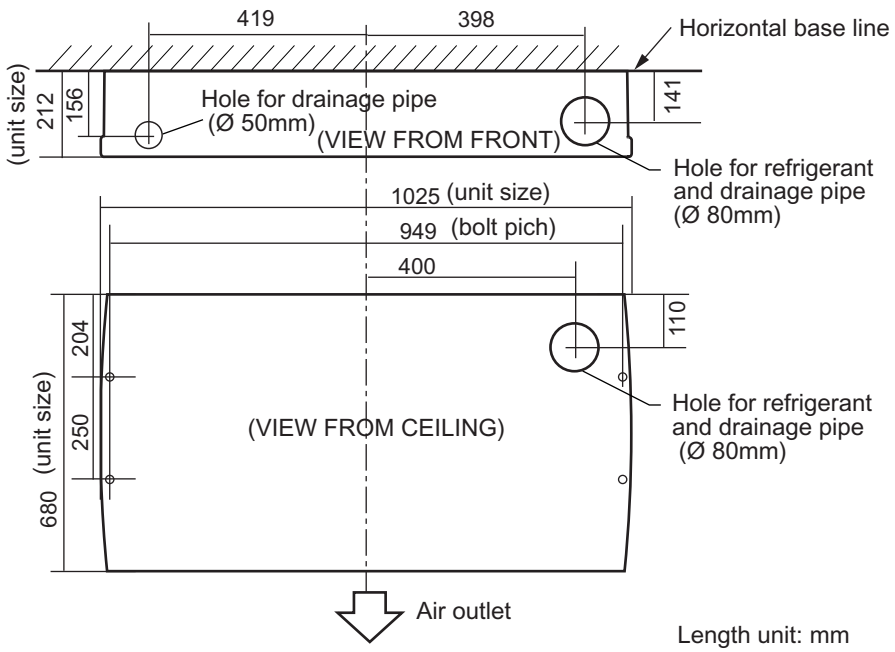


1.2. Outdoor unit



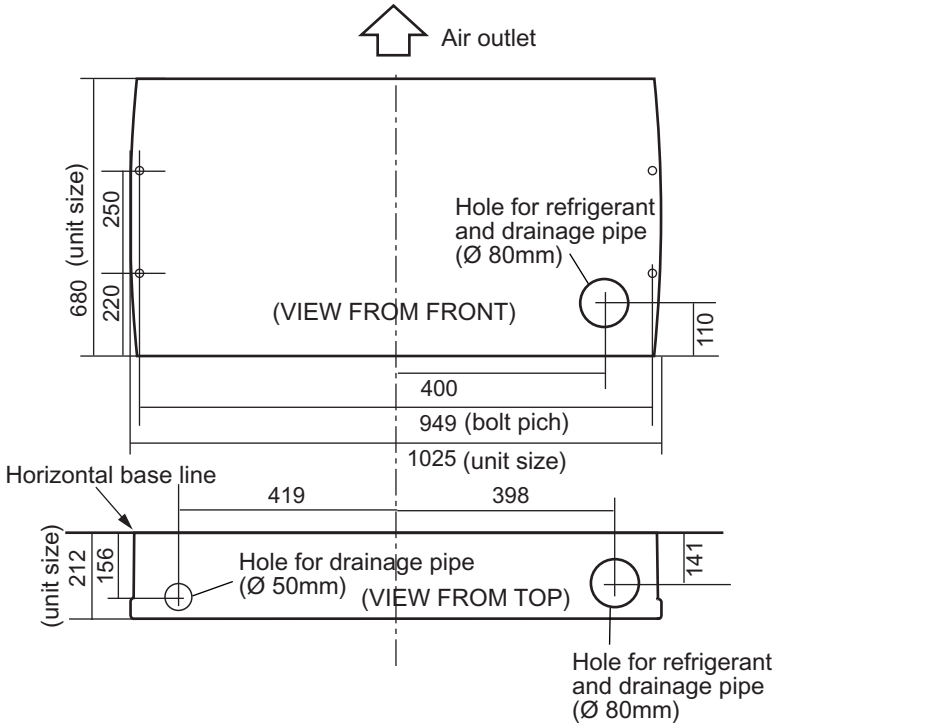
1.3. Installation demensions

1.3.1 Ceiling type



Length unit: mm

1.3.2 Floor type

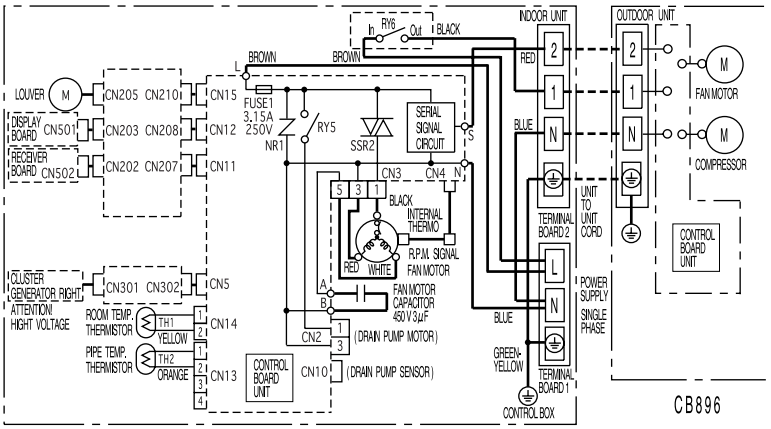


Length unit: mm

[3] WIRING DIAGRM

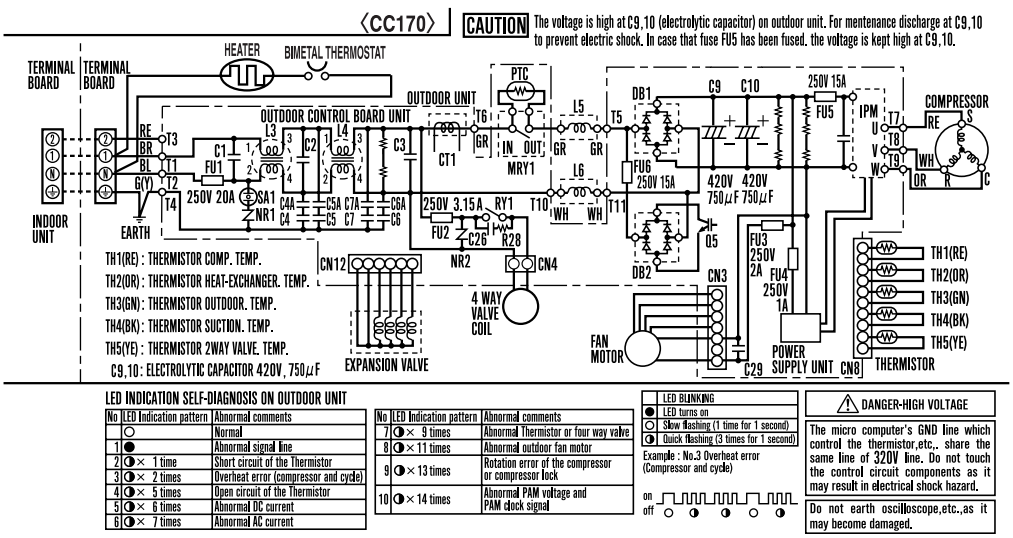
1. Indoor unit

1.1. GS-XP12HR-N



2. Outdoor unit

2.1. AE-X12FR-N



[4] ELECTRICAL PARTS

1. Indoor unit

1.1. GS-XP12HR-N

DESCRIPTION	MODEL	REMARKS
Indoor fan motor	MLB052	220 - 240V, 50Hz
Indoor fan motor capacitor	–	450V, 3μF
Transformer	–	Primary; AC 220 - 240V, 50Hz Secondary; AC19V, 50Hz
FUSE1	–	QFS-GA062JBZZ (250V, 3.15A)
FUSE2	–	QFS-GA064JBZZ (250V, 1A)

2. Outdoor Unit

2.1. AE-X12FR-N

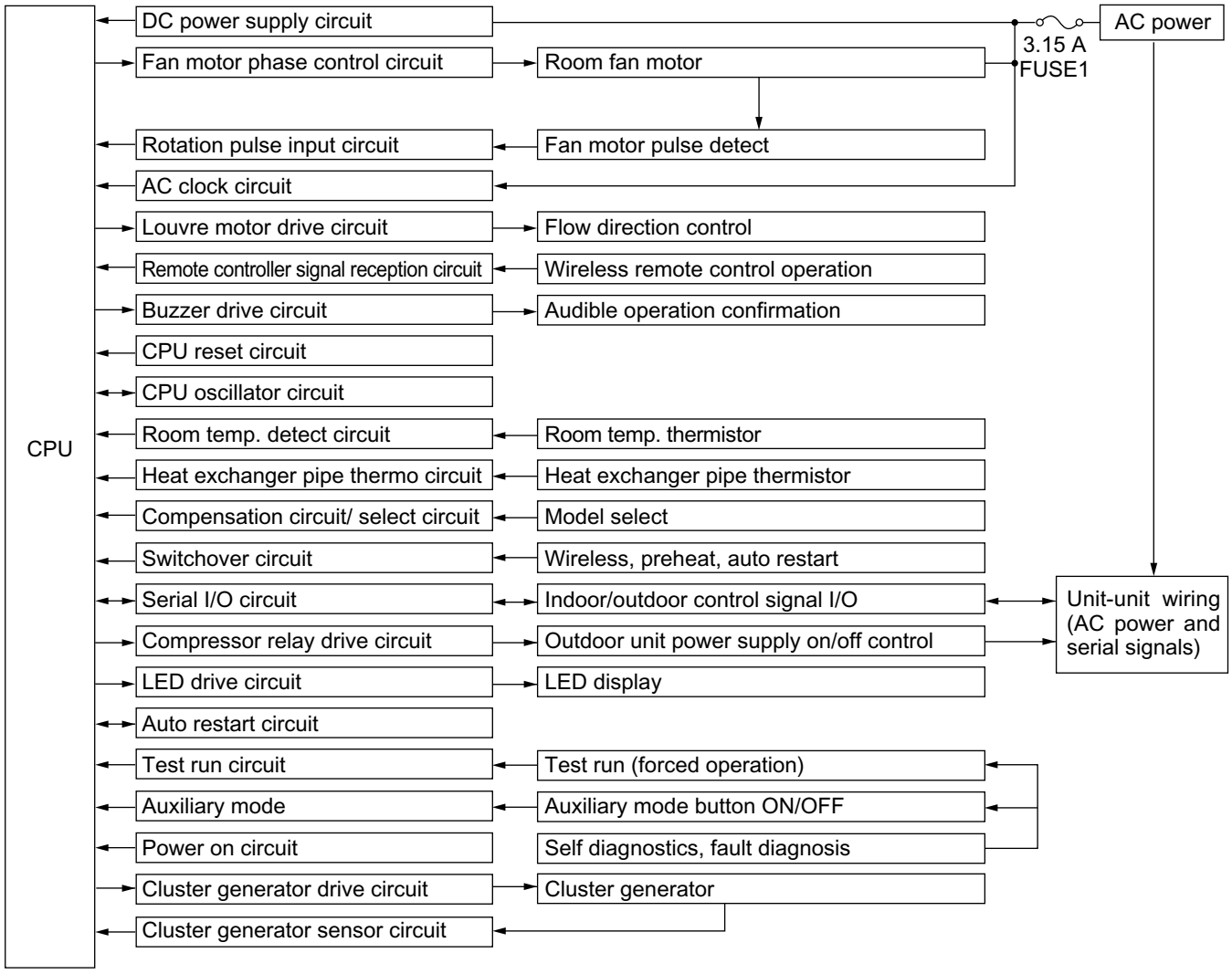
DESCRIPTION	MODEL	REMARKS
Compressor	5RS92XDF	D.C. brush-less motor

DESCRIPTION	MODEL	REMARKS
Outdoor fan motor	ML-A902	DC Motor
Fu4	–	QFS-GA064JBZZ (250V, 1A)
Fu3	–	QFS-GA051JBE0 (250V, 2A)
Fu2	–	QFS-GA052JBZZ (250V, 3.15A)
Fu1	–	QFS-CA001JBZZ (250V, 20A)
Fu5, 6	–	QFS-CA002JBZZ (250V, 15A)

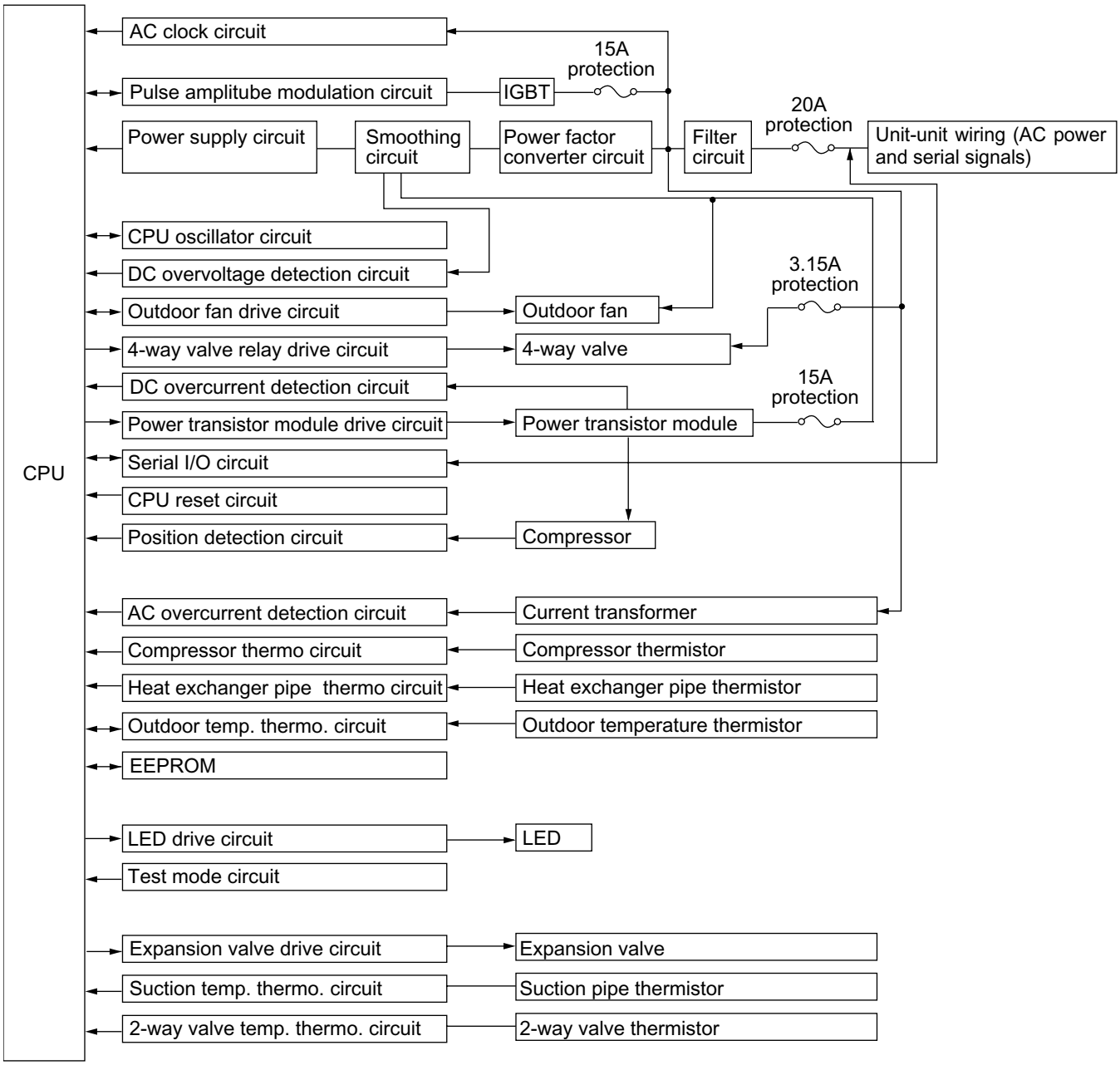
CHAPTER 2. EXPLANATION OF CIRCUIT AND OPERATION

[1] BLOCK DIAGRAMS

1. INDOOR UNIT



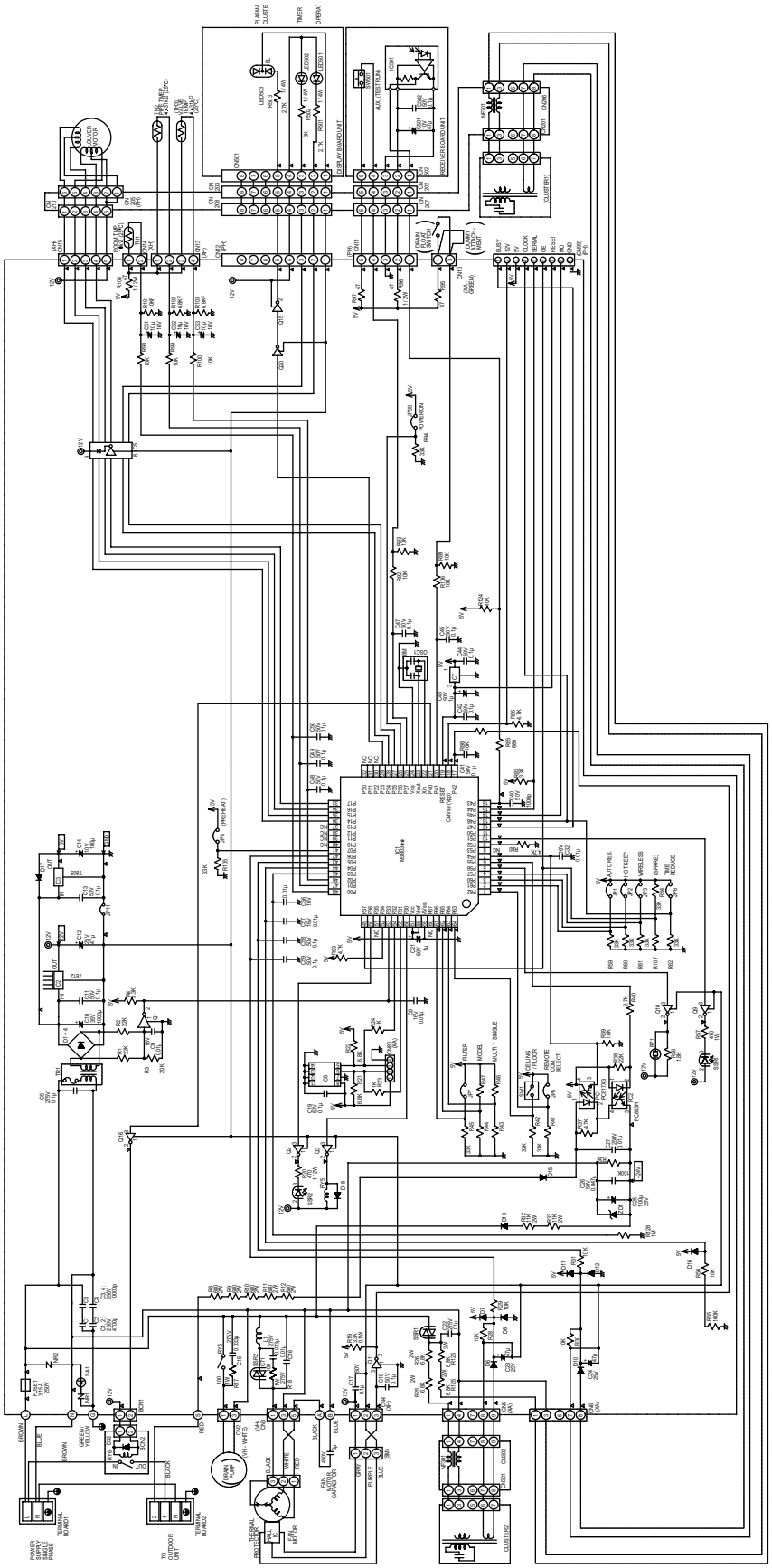
2. OUTDOOR UNIT



[2] MICROCOMPUTER CONTROL SYSTEM

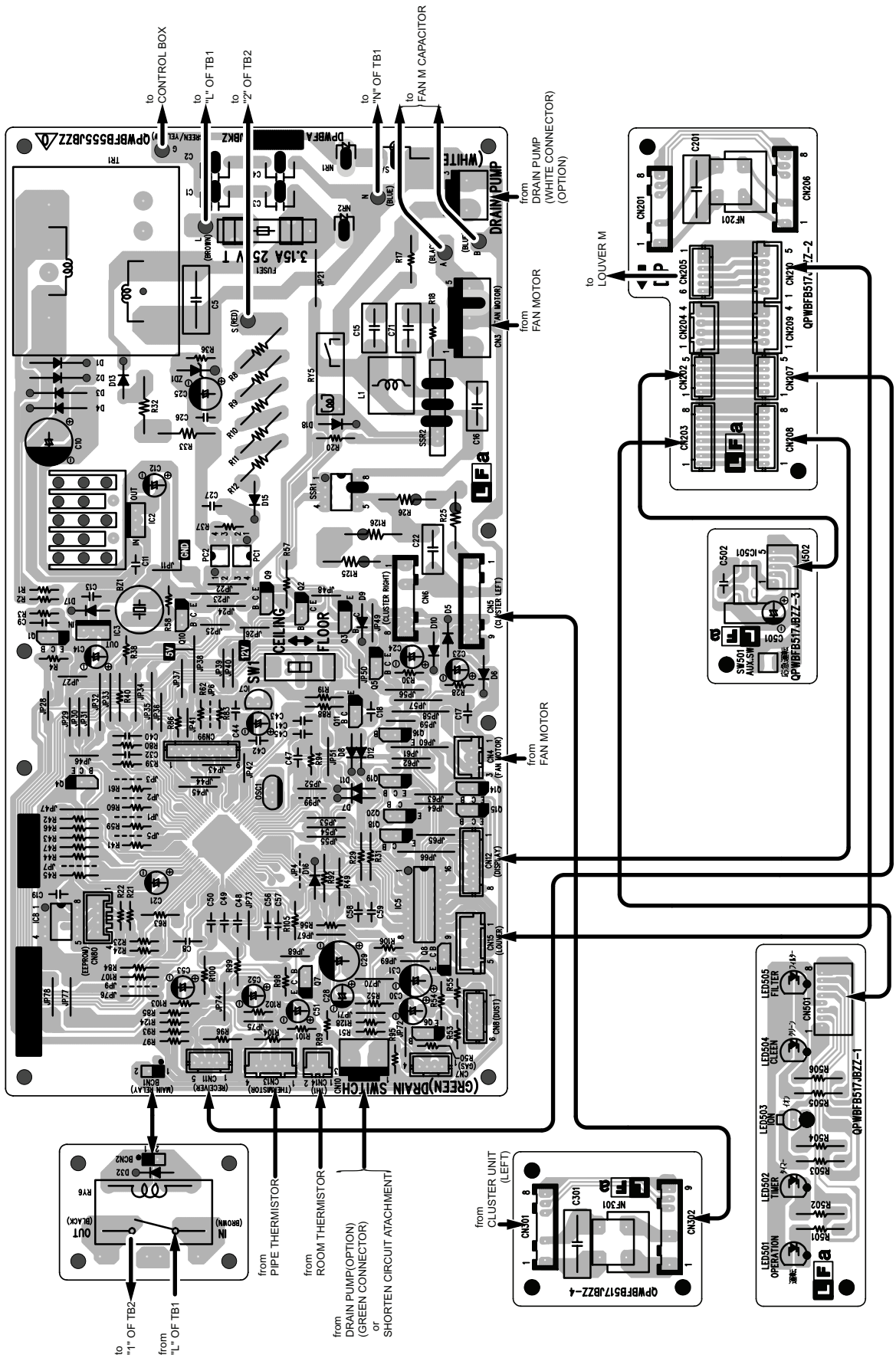
1. INDOOR UNIT

1.1. Electronic Control Circuit Diagram



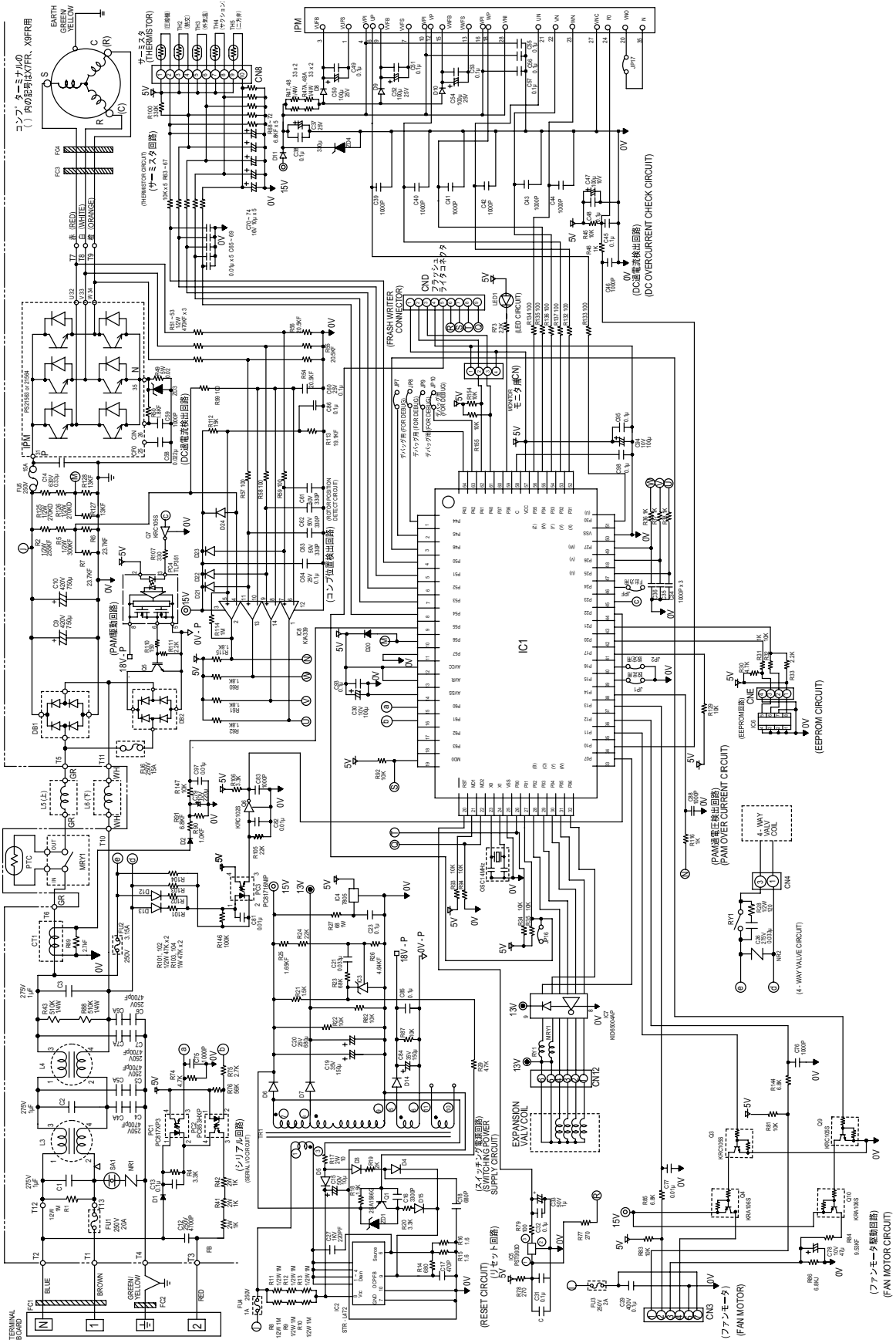
GS-XP12HR	USE	USE	USE	USE	USE	NONE	USE	USE	USE	NONE	NONE	JP	13K	NONE	NONE	NONE
NO.	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP11	JP99	R43	R46	R44	R47	R107	TH3	CLUSTER1, NF201, CN201, CN6, D10, D11, D12, CN206, C24, R125, R126

1.2. Printed Wiring Board

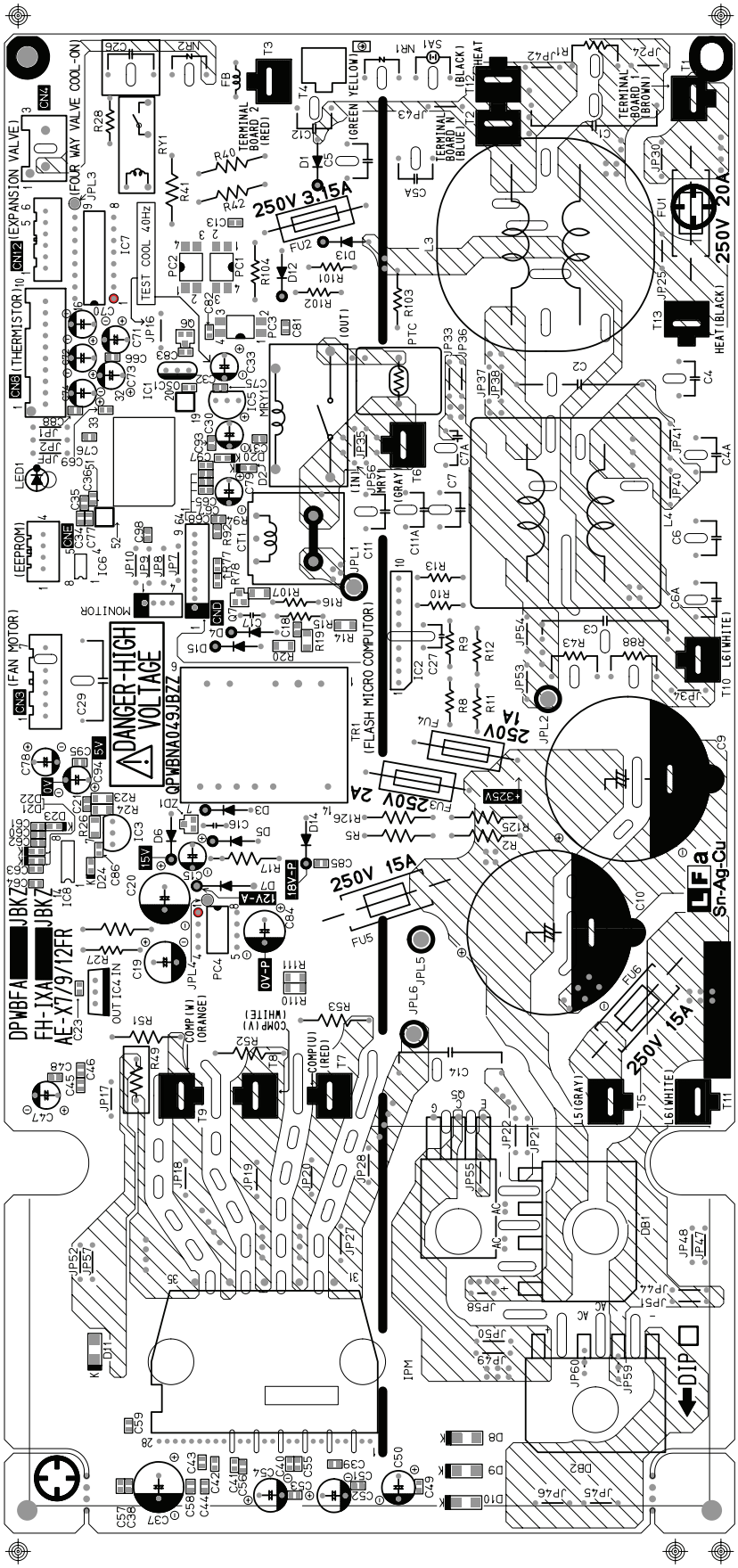


2. OUTDOOR UNIT

2.1. Electronic Control Circuit Diagram



2.2. Printed Wiring Board



[3] FUNCTION

1. INDOOR UNIT

1.1. Startup control

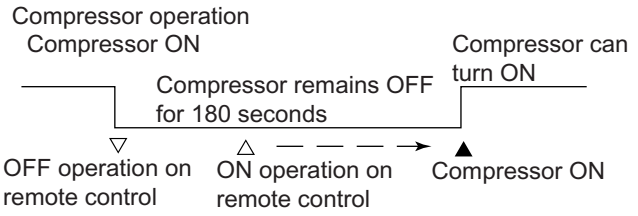
The main relay remains off during the first 45 seconds (first safety time) immediately after the power cord is plugged into an AC outlet in order to disable outdoor unit operation and protect outdoor unit electric components.

1.2. Restart control

Once the compressor stops operating, it will not restart for 180 seconds to protect the compressor.

Therefore, if the operating compressor is shut down from the remote control and then turned back on immediately after, the compressor will restart after a preset delay time.

(The indoor unit will restart operation immediately after the ON switch is operated on the remote control.)



1.3. Temperature Adjustment

1.3.1 Cooling

When the room temperature is higher than the preset temperature by 2°C or more, the unit runs at the maximum operation frequency until the temperature comes down to the preset temperature.

When reaching the preset temperature, the unit runs at the frequency calculated by the fuzzy operation and switches to the normal control.

1.3.2 Heating

When the room temperature is lower than the preset temperature by 3.5°C or more, the unit runs at the maximum operation frequency until the temperature comes down to the preset temperature.

When reaching the preset temperature, the unit runs at the frequency calculated by the fuzzy operation and switches to the normal control.

1.3.3 Dry

After operation begins, 2 minutes of the room temperature is stored in memory, and that becomes the set value.

1.4. Indoor fan control

1.4.1 Cooling

The fan speed can be selected from “Auto”, “Soft”, “Low”,and “HIgh”.When “Soft”, “Low” or “HIgh” is selected, the fanspeed is constant regardless of the room temperature.When “Auto” is selected, the fan speed automatically changes between “Soft” and “HIgh” depending on the difference between the room and preset temperature.

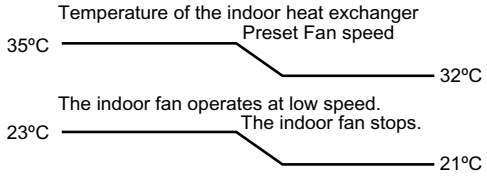
Control for indoor freezing prevention

If the temperature of the indoor heat exchanger stays below approximately 0°C for 4 minutes during cooling or dry, this control stops the compressor. Over 2°C the compressor will run again.

1.4.2 Heating

Control for cold air blowing prevention

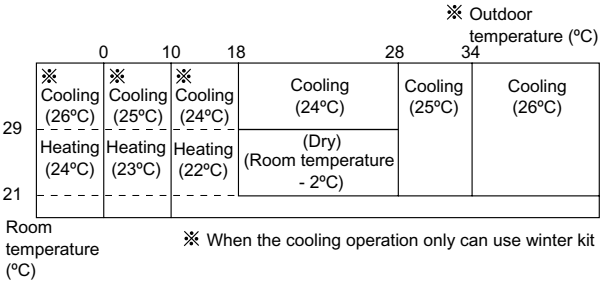
When heating begins, this control stops the indoor fan until the temperature of the indoor heat exchanger reaches 23°C. It also stops the fan if the temperature goes below 21°C during operation.



1.5. Automatic operation

The operating mode and temperature setting are determined by the room temperature and the external air temperature.

The operating mode will changeover automatically with the following condition.



1) From cooling to heating

   Cooling mode will changeover to heating mode when condition of indoor temperature 1.7°C lower than the set temperature conditions for 5 minutes.

2) From heating to cooling

   Heating mode will change over to cooling mode when condition of indoor temperature 1.3°C higher than the set temperature conditions for 25 minutes under compressor off condition.

3) When the set temperature is adjusted within the range of ±2°C by the remote control’s key.

   (▼ ▲), the changeover judgement room temp. will also be shifted within the range of ±2°C.

1.6. ON-timer

The ON-timer is set by pressing the ON-timer button.

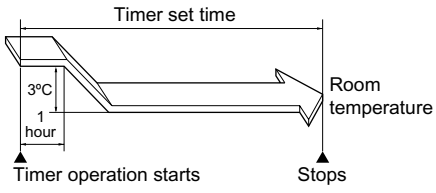
In order to attain the set temperature at the set time.

1.7. OFF-timer

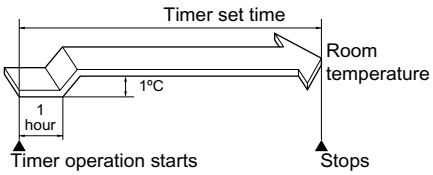
The OFF-timer is set by pressing the OFF-timer button. Operation is as follows:

	Set temperature
Cooling Heating	By fuzzy computing Set the shift up time Final Cooling setting + 1°C Heating setting - 3°C
Dry	Same as above (Final setting + 1°C)

* During Heating



* During Cooling / Dry



1.8. Swing louvre

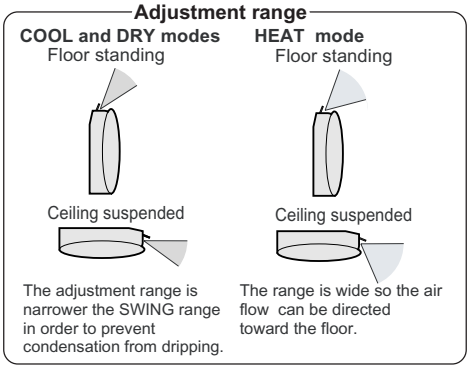
The louvre is moved by a stepping motor to perform swing and fixing in the set position.

If the “FLOW DIRECTION” button is prossed during swing, it will stop. If the “FLOW DIRECTION” button is pressed while it is stopped, it will swing.

The vertical adjustment louvre will change its angle continuously.

Press the SWING button again when the vertical adjustment louvre is at the desired position.

- The louvre will stop moving within the range shown in the diagram.
- The adjusted position will be memorized and will be automatically set to the same position when operated the next time.



1.9. One-hour operation

If this button is pressed when operation is stopped, operation will begin and then stop after 1 hour.

If pressed when it is operating, will stop after one hour.

1.10. Full power operation

Immediately begins cooling or heating at maximum power and air flow.

(During heating)

Operates at setting of 32 °C.

(During cooling)

Operates at setting of 18 °C.

1.11. Power ON start

If a jumper wire is inserted into the place indicated JP99 on the indoor control board, and the power plug is inserted. cooling or heating will be automatically determined by the room temperature sensor on the main unit, and operation will begin.

1.12. Auto Restart

When power failure occures, after power is recovered, the unit will automatically restart in the same setting which were active before the power failure.

Operating mode (Cool, Heat, Dry)

- Temperature adjustment (within 2°C range) automatic operation
- Temperature setting
- Fan setting
- Air flow direction
- Power ON/OFF
- Automatic operation mode setting
- Swing louver
- Plasmacluster operation mode

Setting not memorized

- Timer setting
- Full power setting

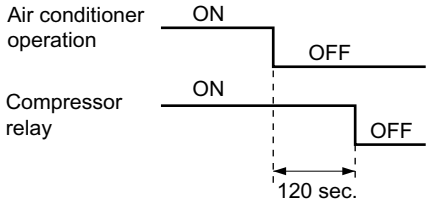
1.13. Error diagnostic display

Indoor unit

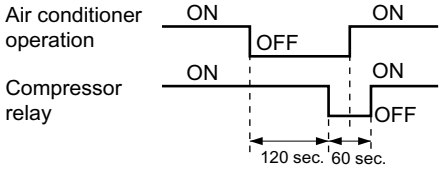
1) If the operation is stopped and the emergency operation button is pressed down for 5 seconds or more, the self-diagnosis memory can be recalled.
2) Details of self-diagnosis (error mode) are informed by the flashing number as well as the lighting pattern of the operation lamp which flashes with the timer lamp.(For details, refer to Error diagnostic method.)

1.14. Compressor relay

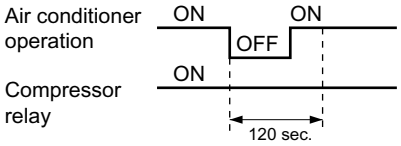
1) It is ON during operation, and when operation is stopped, goes OFF after a delay of 120 seconds (not immediately).



2) The minimum OFF time of the relay is 60 seconds. It will not go ON again before 60 seconds elapses.



3) If air conditioner operation is turned on again during the 120 second delay before the compressor relay goes off, the compressor relay will stay on.



1.15. Drain water control (option)

When the float switch turns OFF (full level), the drain pump is forcibly operated for 5 minutes.

After the pump operates for 5 minutes, the pump turns OFF if the float switch is ON (empty). If the float switch is not ON (empty) even when 6 minutes elapse from the time of pump ON, the equipment stops operating due to a drain pump error.

1.16. Plasmacluster Ion function

Operating the Plasmacluster Ion button while the air conditioner is in operation or in non-operation allows the switching of the operation mode in the following sequence: “Air Clean operation” → “Stop”.

- “Self Clean operation” generates about equal amounts of (+)ions and (-)ions from the cluster unit to provide clean air.

If the Plasmacluster Ion generation function is operated together with the air conditioner operation, the indoor unit fan speed and louver direction are in accordance with the air conditioner settings.

If the Plasmacluster Ion generation function is used without operating the air conditioning function, the indoor unit fan operates at a very low speed and the upper louver is angled upward and the lower louver remains horizontal. (The airflow volume and direction can be changed by using the remote control.)

2. OUTDOOR UNIT

2.1. Outdoor unit 2-way valve freeze prevention control

If the temperature of the outdoor unit 2-way valve remains below 0°C for 10 consecutive minutes during cooling or dehumidifying operation, the compressor operation stops temporarily in order to prevent freezing.

When the temperature of the 2-way valve rises to 10°C or higher after about 180 seconds, the compressor restarts and resumes normal operation.

2.2. Indoor unit overheat prevention control

During heating operation, if the temperature of the indoor unit heat exchanger exceeds the indoor unit heat exchanger overheat prevention temperature (about 45 to 54°C) which is determined by the operating frequency and operating status, the operating frequency is decreased by about 4 to 15 Hz. Then, this operation is repeated every 60 seconds until the temperature of the indoor unit heat exchanger drops below the overheat protection temperature.

Once the temperature of the indoor unit heat exchanger drops below the overheat protection temperature, the operating frequency is increased by about 4 to 10 Hz every 60 seconds until the normal operation condition resumes.

If the temperature of the indoor unit heat exchanger exceeds the overheat protection temperature for 60 seconds at minimum operating frequency, the compressor stops operating and then restarts after about 180 seconds, and the abovementioned control is repeated.

2.3. Outdoor unit overheat prevention control

During cooling operation, if the temperature of the outdoor unit heat exchanger exceeds the outdoor unit heat exchanger overheat prevention temperature (about 55°C), the operating frequency is decreased by about 4 to 15 Hz. Then, this operation is repeated every 60 seconds until the temperature of the outdoor unit heat exchanger drops to about 54°C or lower.

Once the temperature of the outdoor unit heat exchanger drops to about 54°C or lower, the operating frequency is increased by about 4 to 10 Hz every 60 seconds until the normal operation condition resumes.

If the temperature of the outdoor unit heat exchanger exceeds the outdoor unit heat exchanger overheat protection temperature for (120 sec : outdoor temperature ≥ 40°C • 60 sec : outdoor temperature < 40°C) at minimum operating frequency, the compressor stops operating and then restarts after about 180 seconds, and the abovementioned control is repeated.

2.4. Compressor overheat prevention control

If the temperature of the compressor exceeds the compressor overheat prevention temperature (110°C), the operation frequency is decreased by about 4 to 10 Hz. Then, this operation is repeated every 60 seconds until the temperature of the compressor drops below the overheat protection temperature (100°C).

Once the temperature of the compressor drops below the overheat protection temperature, the operating frequency is increased by about 4 to 10 Hz every 60 seconds until the normal operation condition resumes.

If the temperature of the compressor exceeds the overheat protection temperature (for 120 seconds in cooling operation or 60 seconds in heating operation) at minimum operating frequency, the compressor stops operating and then restarts after about 180 seconds, and the abovementioned control is repeated.

2.5. Peak control

If the current flowing in the air conditioner exceeds the peak control current (see the table below), the operation frequency is decreased until the current value drops below the peak control current regardless of the frequency control demand issued from the indoor unit based on the room temperature.

Model	Peak control current	
	Cooling operation	Heating operation
GS-XP12HR-N	Approx. 6.4 A	Approx. 7.5 A

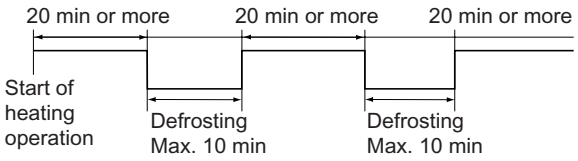
2.6. Outdoor unit fan delay control

The compressor stops immediately after cooling, dehumidifying or heating operation is shut down, but the outdoor unit fan continues operation for 50 seconds before it stops.

2.7. Defrosting

2.7.1 Reverse defrosting

The defrost operation starts when the compressor operating time exceeds 20 minutes during heating operation, as shown below, and the outside air temperature and the outdoor unit heat exchanger temperature meet certain conditions. When the defrost operation starts, the indoor unit fan stops. The defrost operation stops when the outdoor unit heat exchanger temperature rises to about 13C or higher or the defrosting time exceeds 10 minutes.



2.8. Winter cool

Cooling operation is available during the winter season by the built in winter cool function.

Lower limit of outdoor temperature range is -10°C DB.

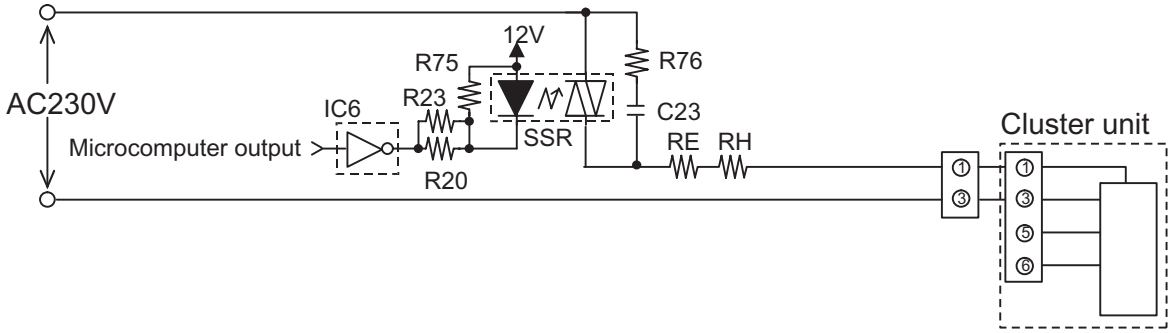
When the outside air temperature is low, the outdoor unit fan operates at slower speed.

NOTE: Built-in protect device may work when outdoor temperature falls below 21°C DB., depending on conditions.

3. Explanation of cluster circuit

The cluster unit generates cluster ions, which are circulated throughout the room by the air flow created by the blower fan (indoor unit fan motor) in the air conditioner unit.

1) When microcomputer output turns "H," the IC6 output changes to "Lo," turning ON the SSR and applying 230 V to the cluster unit for the generation of cluster ions (positive and negative ions).

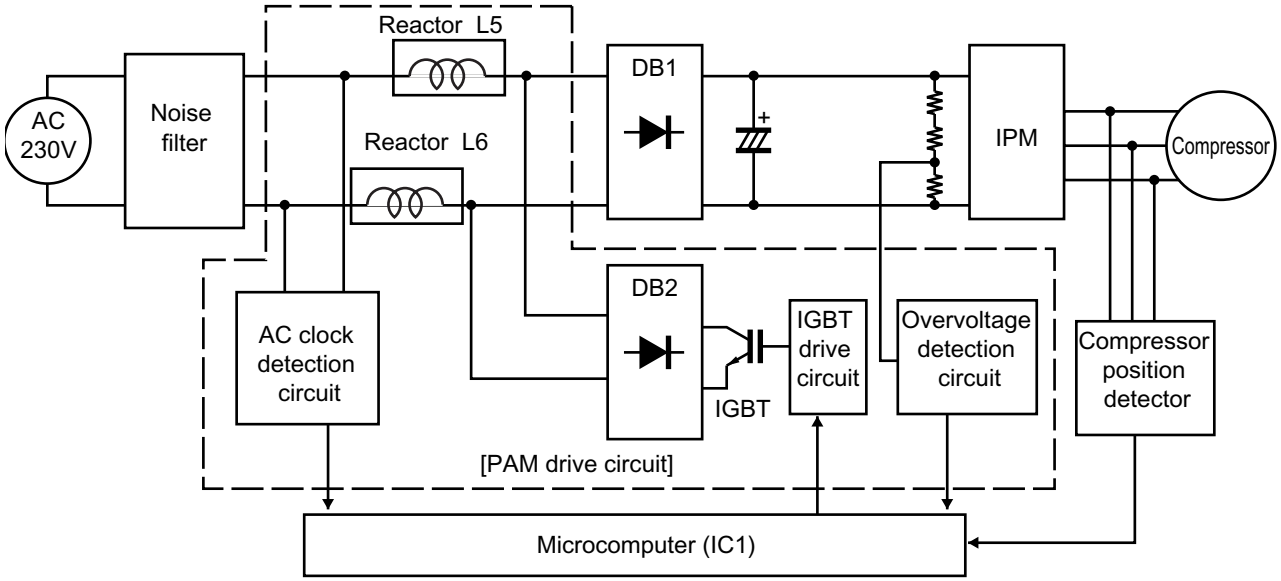


4. Outline of PAM circuit

4.1. PAM (Pulse Amplitude Modulation)

The PAM circuit varies the compressor drive voltage and controls the rotation speed of the compressor.

The IGBT shown in the block diagram charges the energy (electromotive force) generated by the reactor to the electrolytic capacitor for the inverter by turning ON and OFF.

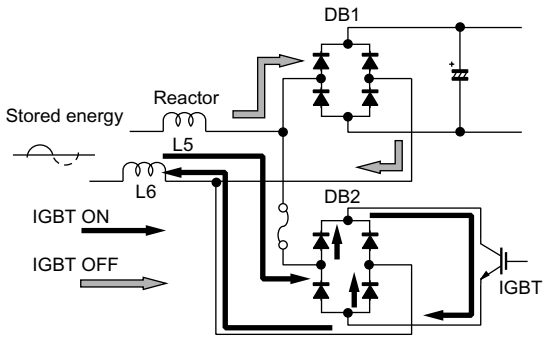


PAM drive circuit block diagram

When the IGBT is ON, an electric current flows to the IGBT via the reactor (L5), (L6) and diode bridge (DB2).

When the IGBT turns OFF, the energy stored while the IGBT was ON is charged to the voltage doubler capacitor via the diode bridge (DB1).

As such, by varying the ON/OFF duty of the IGBT, the output voltage is varied.



4.2. High power factor control circuit

This circuit brings the operating current waveform closer to the waveform of commercial power supply voltage to maintain a high power factor.

Because of the capacitor input, when the PAM circuit is OFF, the phase of the current waveform deviates from the voltage waveform as shown below.

To prevent this deviation, a current is supplied during the periods indicated by "O" in the diagram.

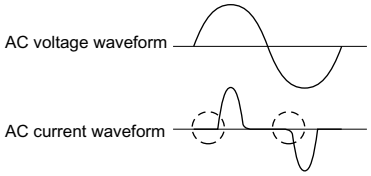
To determine the length of period to supply a current, the zero-cross timing of the AC input voltage is input to the microcomputer via the clock circuit.

The power source frequency is also determined at the same time.

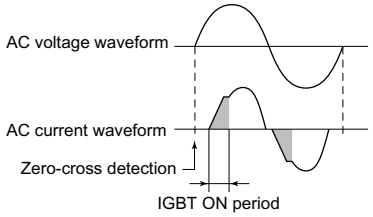
The IGBT turns ON after the time length determined by the zero-cross point to supply a current to the IGBT via the reactor.

This brings the current waveform closer to the voltage waveform in phase.

As described above, the ON/OFF operation of the IGBT controls the increase/decrease of the compressor power supply voltage (DC voltage) to improve the compressor efficiency and maintain a high power factor by keeping the current phase closer to that of the supply voltage.

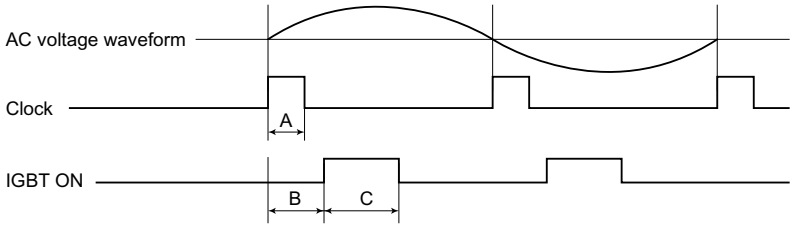


AC voltage and current waveforms when PAM is OFF



AC voltage and current waveform when PAM is ON

4.2.1 Detailed explanation of PAM drive circuit sequence



	50Hz
A	1.2mS
B	1.2mS
C	0.25~2.3mS

4.2.2 AC clock (zero-cross) judgment

- The clock circuit determines the time from one rising point of the clock waveform to the next rising point.
  The detected clock waveform is used to judge the power source frequency (50Hz).
- The zero-cross of the AC voltage is judged as the rising of the clock waveform, as shown in the diagram above.

4.2.3 IGBT ON start time (delay time B)

- Based on the zero-cross of the AC voltage, the IGBT turns ON after a delay time set according to the power source frequency.

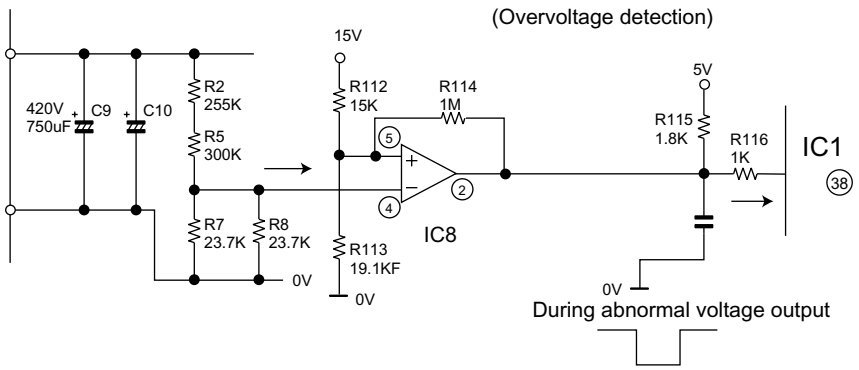
4.2.4 IGBT ON time (C)

- After the above delay time, the IGBT turns ON to supply a current to the reactor.
- The ON time of the IGBT determines the amount of energy (level of DC voltage rise) supplied to the reactor.
  DC voltage level in each operation mode (varies depending on external load conditions)
  - Cooling operation --- 220 to 240 V
  - Heating operation --- 220 to 280 V

4.3. PAM protection circuit

To prevent excessive voltage of PAM output from damaging the IPM and electrolytic capacitor as well as the control printed circuit board (PCB), this circuit monitors the PAM output voltage and turns off the PAM control signal and PAM drive immediately when an abnormal voltage output is generated. At the same time, it shuts off the compressor operation.

The PAM output voltage is distributed to pin (4) of the comparator (IC8). If this voltage exceeds the reference voltage at pin (5) of the IC8, the output of the comparator (IC8) reverses (from H to L) and it is input to pin (38) of the microcomputer (IC1) to halt the PAM drive.



The protection voltage level is as follows.

4.3.1 Details of troubleshooting procedure for PAM

1) PAM shutdown due to error

1) When the DC voltage detection circuit sends a signal exceeding the specified voltage to the microcomputer

   DC voltage of 350 V or higher (detection circuit input voltage of about 9.2 V or higher) [IC8 pin (4)]

   – When an error is detected
   - PAM IGBT turns OFF.
   - Compressor turns OFF.
   - All units shut down completely when the error occurs four times.

2) When the outdoor unit clock waveform differs from the specified value immediately before the PAM IGBT turns ON

   When there is no clock waveform input

   When a clock signal of other than specified power source frequency (50/60 Hz) is input

   – When an error is detected
   - PAM IGBT does not turn ON.
   - Compressor operates normally.
   - Complete shutdown does not occur.

2) PAM error indication

In case of error “1)”

– An error signal is sent to the indoor unit as soon as an error is generated.
- Malfunction No. 14-0 is indicated when the error code is called out by the indoor unit's self-diagnosis function.

– The LED on the outdoor unit flashes 14 times when an error is generated.
- The LED continues flashing in the 14-time cycle even after the compressor stops operating.
- The LED turns off (data is deleted from the memory) when the outdoor unit power is turned off.

In case of error “2)”

– An error signal is sent to the indoor unit as soon as an error is judged.
- Malfunction No. 14-1 is indicated when the error code is called out by the indoor unit's self-diagnosis function.

– The LED on the outdoor unit flashes 14 times when an error is judged.
- The LED on the outdoor unit flashes in normal pattern when the compressor stops operating.

  (Compressor OFF or Thermostat OFF from remote control)

* When a user complains that the air conditioner does not provide sufficient cool air or warm air

  In addition to conventional error-generating reasons, there is a possibility that the PAM IGBT does not turn ON even if the compressor is operating.

  In that case, the DC voltage does not rise even though the compressor is operating, and lowers to the 180-VDC level.

  – Check items
  - Clock circuit check
  - PAM IGBT check
  - Fuse (Fu6) open-circuit check

5. Explanation of IPM drive circuit

The IPM for compressor drive is made by Mitsubishi Electric.

The power supply for the IPM drive, the shunt resistance for overcurrent detection, etc., are provided outside the IPM (control PCB).

5.1. IPM drive power supply circuit

The power supply for the upper-phase IGBT (HU, HV, HW) drive employs a bootstrap system, and provides power to the upper-phase IC.

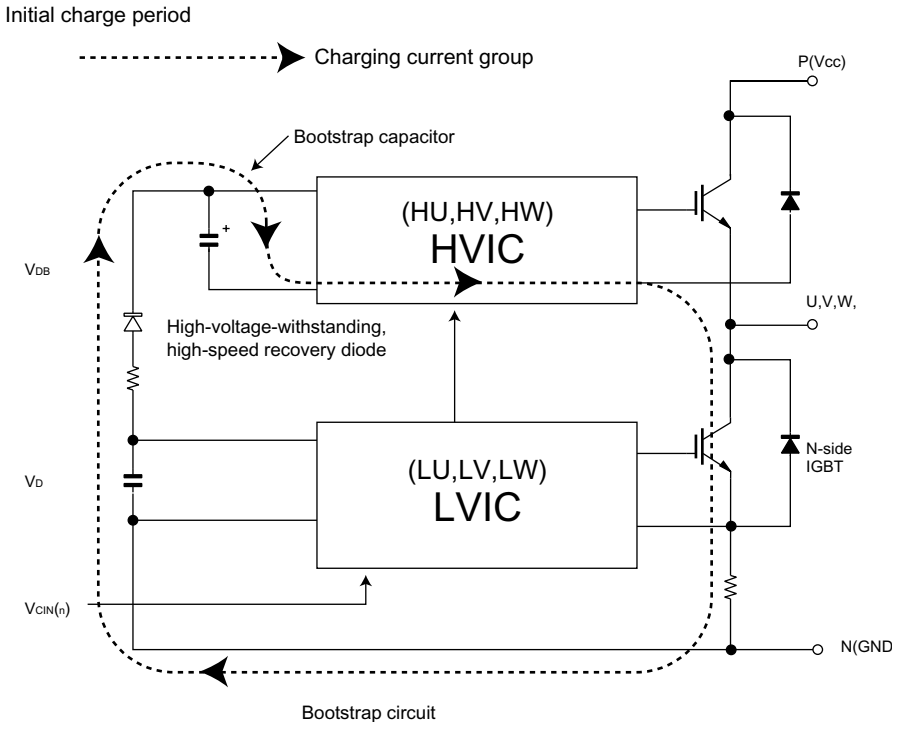
The 15-V power supply for the lower-phase IC is provided by the control printed circuit board (PCB).

5.1.1 Brief explanation of bootstrap system (single power drive system)

To supply power to the upper-phase IC, the microcomputer (IC1) turns ON the lower-phase IGBT (LU, LV, LW).

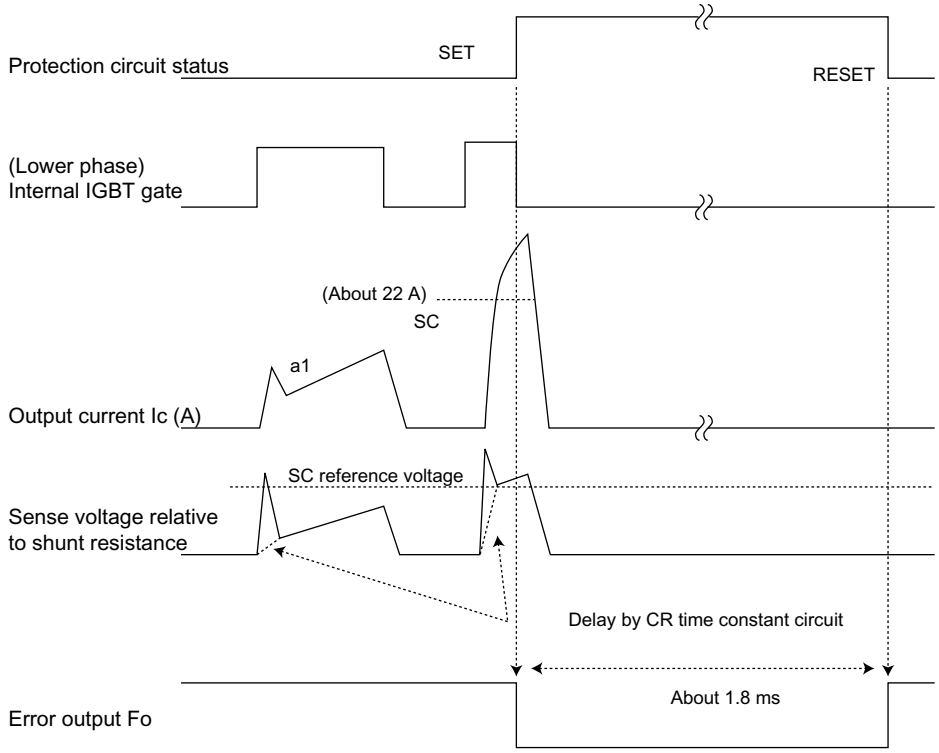
This results in a charging current that flows to the electrolytic capacitor of each upper-phase IC input and charges the bootstrap capacitor with a 15-V current.

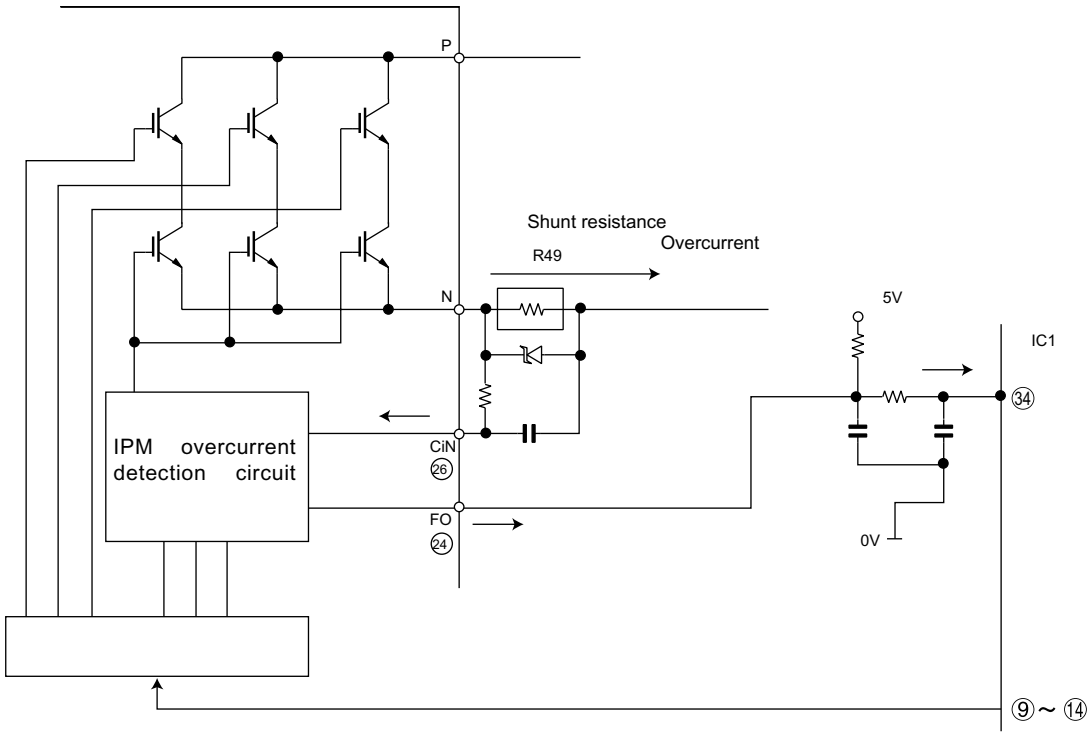
The power supply for the subsequent stages is charged while the lower-phase IGBT is ON in ordinary compressor drive control.



5.1.2 DC overcurrent detection circuit

When a current of about 25 A or higher flows through the shunt resistance (R49) on the control printed circuit board (PCB), the voltage at this resistance is input to IPM CIN pin (26). Then, the gate voltage of the lower-phase IGBT (LU, LV, LW) inside the IPM turns OFF to cut off the overcurrent. At the same time, an L output of about 1.8 ms is generated from IPM Fo pin (24), and this results in an L input to overcurrent detection input pin (34) of the microcomputer (IC1) and turns OFF the PWM signal output (IC1 pins (51) through (56)) to the IGBT gate.





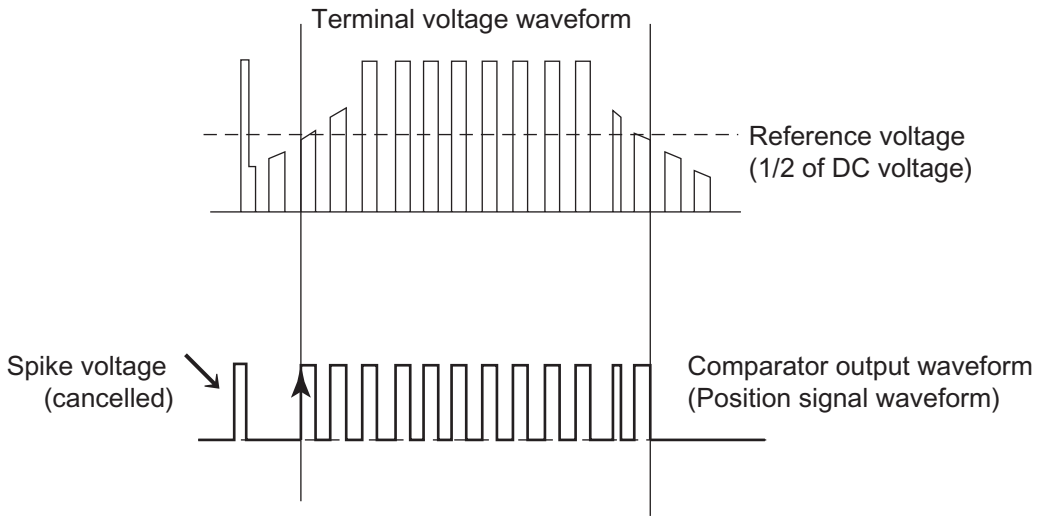
6. 120° energizing control (digital position detection control)

This control system detects the digital position detection signal and adjusts the rate of acceleration/deceleration accordingly.

The motor's induced voltage waveform is input to the comparator in the form of PWM-switched pulse waveform, and a position detection signal is generated as a reference voltage equaling 1/2 of 280 VDC. However, since there is no induced voltage waveform when the PWM waveform is OFF, the microcomputer performs internal processing so that detection is enabled only when it is ON. Based on the detected position signal, actual PWM waveform output timing is determined. Since it does not use a filter circuit, the detection accuracy is high.

The microcomputer performs internal processing to cancel spike voltage during the regenerative process.

Furthermore, even if the induced voltage is low, position detection is still possible, thus allowing sensor-less operation at low rotation speed in the initial stage of operation. This reduces the starting current and improves the IPM reliability.



CHAPTER 3. TROUBLESHOOTING

[1] TROUBLESHOOTING GUIDE

1. SELF-DIAGNOSIS FUNCTION AND DISPLAY MODE

1) To call out the content of the self-diagnosis memory, hold down the emergency operation button for more than five seconds when the indoor unit is not operating.

   a) According to the content of the self-diagnosis memory, the Operation LED (main category) and the Plasmacluster Ion LEDs (sub-category) flash in sync with the Timer LED on the indoor unit.

   b) In the event a complete shutdown occurs due to a malfunction, the Operation LED (red), Timer LED (yellow) and Plasmacluster Ion LED (blue) flash to indicate the general information of the generated malfunction.

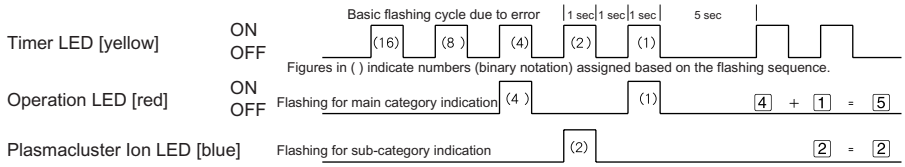
   c) If the power cord is unplugged from the AC outlet or the circuit breaker is turned off, the self-diagnosis memory loses the stored data.

2) Display of detailed self-diagnosis result with main category and sub-category indications

   When malfunction information is called out, the main category and sub-category of the self-diagnosis result are indicated by the Operation, Timer, and Plasmacluster Ion LEDs on the indoor unit.

   * 1:Example of self-diagnosis result displayed on indoor unit: Suction thermistor open-circuit error

*1: Example of self-diagnosis result displayed on indoor unit: Suction thermistor open-circuit error (Malfunction No. 5 – 2; Main category / Sub-category)

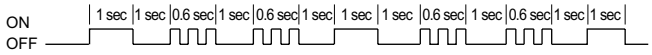


   * 2:The self-diagnosis display function of the outdoor unit indicates the error information by flashing LED1 on the outdoor unit according to the content of self-diagnosis.

     The self-diagnosis display function of the outdoor unit is active only for about 3 to 10 minutes after self-diagnosis is performed during operation, and the display returns to normal condition after this display period.

     The content of self-diagnosis cannot be called out by the self-diagnosis display function of the outdoor unit.

Example of self-diagnosis display on outdoor unit : Compressor high-temperature abnormality



   * 3:The content of diagnosis is transferred to the indoor unit via serial communication, but it does not trigger a complete shutdown operation.

⚇: Flashes in 2-sec intervals (normal), ●: On, ×: Off, ◑: Flashes 3 times in 0.2-sec intervals
(When LED1 on the outdoor unit flashes in 2-sec intervals, the outdoor unit is in normal condition.)

Status of indoor/outdoor units	Indication by LED1 on outdoor unit *2	Indication by operation lamp on indoor unit Lighting pattern at the time of timer lamp lighting ● × ● × ● × ● × ● → Off for 5 seconds	Malfunction No. Main category	Malfunction No. Sub-category	Content of diagnosis Main category	Content of diagnosis Sub-category	Inspection location/method	Remedy
Indoor/outdoor units in operation	⚇ Normal flashing		0	0		Normal	———	———
Indoor/outdoor units in complete shutdown	◑ 1 time	● Operation lamp(RED) Cluster lamp(BLUE)	1	-0	Outdoor unit thermistor short-circuit	Heat exchanger thermistor short-circuit error	(1) Measure resistance of the outdoor unit thermistors. (TH2 to TH5: Approx. 4.4 k at 25¼C) (2) Check the lead wire of the outdoor unit thermistor for torn sheath and short-circuit. (3) No abnormality found in above inspections (1) and (2).	(1) Replace the outdoor unit thermistor assembly. (2) Replace the outdoor unit thermistor assembly. (3) Replace the outdoor unit control PCB assembly.
		● Operation lamp(RED) ● Cluster lamp(BLUE)		-1		Outside temperature thermistor short-circuit error		
		● Operation lamp(RED) Cluster lamp(BLUE)		-2		Suction thermistor short-circuit error		
		● Operation lamp(RED) ● Cluster lamp(BLUE)		-3		2-way valve thermistor short-circuit error		
Indoor/outdoor units in complete shutdown	◑ 2 times	● Operation lamp(RED) Cluster lamp(BLUE)	2	-0	Cycle temperature	Compressor high-temperature error	(1) Check the outdoor unit air outlet for blockage. (2) Check if the power supply voltage is 198V or higher at full power. (3) Check the pipe connections for refrigerant leaks. (4) Measure resistance of the outdoor unit compressor thermistor. (TH1: Approx. 53 k at 25¼C) (5) Check the expansion valve for proper operation.	(1) Ensure unobstructed air flow from the outdoor unit air outlet. (2) Connect power supply of proper voltage. (3) Charge the specified amount of refrigerant. (4) Replace the outdoor unit compressor thermistor assembly. (5) Replace the expansion valve coil, expansion valve or outdoor unit control PCB assembly.
Indoor unit in operation Outdoor unit in temporary stop		● Operation lamp(RED) ● Cluster lamp(BLUE)		-1		Temporary stop due to compressor discharge overheat *3	(Temporary stop for cycle protection)	———
		● Operation lamp(RED) ● Cluster lamp(BLUE)		-2		Temporary stop due to outdoor unit heat exchanger overheat *3	(Temporary stop for cycle protection)	———
		● Operation lamp(RED) ● Cluster lamp(BLUE)		-3		Temporary stop due to outdoor unit heat exchanger overheat *3	(Temporary stop for cycle protection)	———
		● Operation lamp(RED) Cluster lamp(BLUE)		-4		temporary stop due to 2-way valve freeze *3	(Temporary stop for cycle protection)	———
Indoor unit in operation Outdoor unit in temporary stop	◑ 3 times	● Operation lamp(RED) ● Cluster lamp(BLUE)	3	-0	Dry operation	Temporary stop due to dehumidifying operation *3	(Temporary stop for cycle protection)	

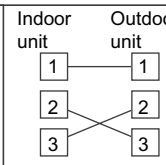
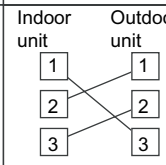
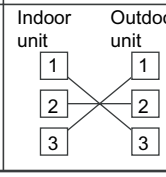
❍: Flashes in 2-sec intervals (normal), ●: On, ×: Off, ◑: Flashes 3 times in 0.2-sec intervals
(When LED1 on the outdoor unit flashes in 2-sec intervals, the outdoor unit is in normal condition.)

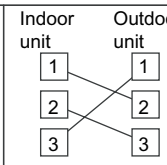
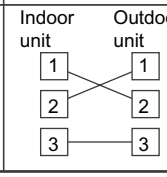
Status of indoor/outdoor units	Indication by LED1 on outdoor unit *2	Indication by operation lamp on indoor unit Lighting pattern at the time of timer lamp lighting ↳●×●×●×●×●→Off for 5 seconds┘	Malfunction No.		Content of diagnosis		Inspection location/method	Remedy
			Main category	Sub-category	Main category	Sub-category		
Indoor/outdoor units in complete shutdown	◑ 5 times	Operation lamp(RED) Cluster lamp(BLUE)	5	-0	Outdoor unit thermistor open-circuit	Heat exchanger thermistor open-circuit error	(1) Check connector CN8 of the outdoor unit thermistor for secure installation. (2) Measure resistance of outdoor thermistors TH1 to TH5. (3) Check the lead wires of thermistors TH1 through TH5 on the outdoor unit control PCB for open-circuit. (4) No abnormality found in above inspections (1) through (3).	(1) Correct the installation. (2) Replace the outdoor unit thermistor assembly. (3) Replace the outdoor unit thermistor assembly. (4) Replace the outdoor unit control PCB assembly.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		Outside temperature thermistor open-circuit error		
		Operation lamp(RED) Cluster lamp(BLUE)		-2		Suction thermistor open-circuit error		
		Operation lamp(RED) Cluster lamp(BLUE)		-3		2-way valve thermistor open-circuit error		
		Operation lamp(RED) Cluster lamp(BLUE)		-4		Discharge thermistor open-circuit error		
Indoor/outdoor units in complete shutdown	◑ 6 times	Operation lamp(RED) Cluster lamp(BLUE)	6	-0	Outdoor unit DC	DC overcurrent error	(1) IPM continuity check (2) Check the IPM and heat sink for secure installation. (3) Check the outdoor unit fan motor for proper rotation. (4) No abnormality found in above inspections (1) through (3). (5) No abnormality found in above inspections (1) through (4).	(1) Replace the outdoor unit control PCB assembly. (2) Correct the installation (tighten the screws). Apply silicon grease. (3) Replace the outdoor unit fan motor. (4) Replace the outdoor unit control PCB assembly. (5) Replace the compressor.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		IPM pin level error	Check the IPM is attached correctly to the outdoor unit control PWB	Replace the outdoor unit control PWB assembly
Indoor/outdoor units in complete shutdown	◑ 7 times	Operation lamp(RED) Cluster lamp(BLUE)	7	-0	Outdoor unit AC	AC overcurrent error	(1) Check the outdoor unit air outlet for blockage. (2) Check the outdoor unit fan for proper rotation.	(1) Ensure unobstructed air flow from the outdoor unit air outlet. (2) Check the outdoor unit fan motor.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		AC overcurrent error in OFF status	(1) IPM continuity check	(1) Replace the outdoor unit control PCB assembly.
		Operation lamp(RED) Cluster lamp(BLUE)		-2		AC maximum current error	(1) Check the outdoor unit air outlet for blockage. (2) Check the outdoor unit fan for proper rotation.	(1) Ensure unobstructed air flow from the outdoor unit air outlet. (2) Check the outdoor unit fan motor.
		Operation lamp(RED) Cluster lamp(BLUE)		-3		AC current deficiency error	(1) Check if there is an open-circuit in the secondary winding of the current transformer of the outdoor unit control PCB. (2) Check if the refrigerant volume is abnormally low. (3) Check if the refrigerant flows properly.	(1) Replace the outdoor unit control PCB assembly. (2) Charge the specified amount of refrigerant. (3) Correct refrigerant clogs. (2-way valve, 3-way valve, pipe, expansion valve)
Indoor/outdoor units in complete shutdown	◑ 9 times	Operation lamp(RED) Cluster lamp(BLUE)	9	-0	Outdoor unit cooling/heating switchover	Thermistor installation error or 4-way valve error	(1) Check to make sure outdoor unit thermistor TH2 (heat exchanger) TH5 (2-way valve) are installed in correct positions. (2) Measure resistance of thermistors TH1 and TH5. (3) Check the 4-way valve for proper operation. (4) No abnormality found in above inspections (1) through (3).	(1) Correct the installation. (2) Replace the thermistor assembly. (3) Replace the 4-way valve. (4) Replace the outdoor unit control PCB assembly.
Indoor unit in operation Outdoor unit in temporary stop		Operation lamp(RED) Cluster lamp(BLUE)		-3		Torque control error	(1) Check if the refrigerant volume is abnormally low. (2) Check the 4-way valve for proper operation. (3) Check to see if the compressor type is correct.	(1) Charge the specified amount of refrigerant. (2) Replace the 4-way valve. (3) Replace the compressor with the correct part.
Indoor/outdoor units in complete shutdown	◑ 11 times	Operation lamp(RED) Cluster lamp(BLUE)	11	-0	Outdoor unit DC fan	Outdoor unit DC fan rotation error	(1) Check connector CN3 of the outdoor unit DC fan motor for secure installation. (2) Check the outdoor unit fan motor for proper rotation. (3) Check fuse FU3. (4) Outdoor unit control PCB	(1) Correct the installation. (2) Replace the outdoor unit fan motor. (3) Replace the outdoor unit control PCB assembly. (4) Replace the outdoor unit control PCB assembly.
Indoor/outdoor units in complete shutdown	◑ 13 times	Operation lamp(RED) Cluster lamp(BLUE)	13	-0	DC compressor	Compressor startup error	(1) Check the colors (red, white, orange) of the compressor cords for proper connection. (PCB side, compressor side) (2) Check if the IPM terminal resistance values are uniform. (3) No abnormality found in above inspections (1) and (2). (4) No abnormality found in above inspections (1) through (3).	(1) Correct the installation. (U: Red, V: White, W: Orange) (2) Replace the outdoor unit control PCB assembly. (3) Replace the outdoor unit control PCB assembly. (4) Replace the compressor.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		Compressor rotation error		
Indoor/outdoor units in complete shutdown	◑ 14 times	Operation lamp(RED) Cluster lamp(BLUE)	14	-0	Outdoor unit active filter	PAM overvoltage error	(1) Check the AC power supply voltage for fluctuation. (2) No abnormality found in above inspection (1).	(1) Connect stable power supply. (2) Replace the outdoor unit control PCB assembly.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		PAM clock error	(1) Check the PAM clock for proper input.	(1) Replace the outdoor unit control PCB assembly.
Indoor unit in operation Outdoor unit in complete shutdown	●	Operation lamp(RED) Cluster lamp(BLUE)	17	-0	Wires between units	Serial open-circuit	(1) Check the wires between units. (2) Check voltage between Nos. 1 and 2 on the indoor/outdoor unit terminal boards.	(1) Connect stable power supply. (2) Replace the outdoor unit control PCB assembly.
	×	Operation lamp(RED) Cluster lamp(BLUE)				Outdoor unit does not turn on due to erroneous wiring	(1) Check the wires between units. (2) Check the outdoor unit fuse. (3) Check 15-V, 13-V and 5-V voltages on the PCB. Check resistance between IPM terminals. (4) Check pins No. 5 and 8 of connector CN3A of the outdoor unit fan motor for short-circuit. (5) Outdoor unit control PCB	(1) Correct the wiring. (2) Replace the fuse/outdoor unit control PCB assembly. (3) Replace the outdoor unit control PCB assembly. (4) Replace the outdoor unit fan motor. (5) Replace the outdoor unit control PCB board.
	●	Operation lamp(RED) Cluster lamp(BLUE)	18	-0	Wires between units	Serial short-circuit	(1) Check the wires between units.	(1) Correct the wiring.
		Operation lamp(RED) Cluster lamp(BLUE)		-1		Serial erroneous wiring	(1) Check the wires between units.	(1) Correct the wiring.

◐: Flashes in 2-sec intervals (normal), ●: On, ×: Off, ◑: Flashes 3 times in 0.2-sec intervals
(When LED1 on the outdoor unit flashes in 2-sec intervals, the outdoor unit is in normal condition.)

Status of indoor/outdoor units	Indication by LED1 on outdoor unit *2	Indication by operation lamp on indoor unit Lighting pattern at the time of timer lamp lighting ● × ● × ● × ● ● → Off for 5 seconds	Malfunction No. Main category	Malfunction No. Sub-category	Content of diagnosis Main category	Content of diagnosis Sub-category	Inspection location/method	Remedy
Indoor/outdoor units in complete shutdown	×	Operation lamp(RED) Cluster lamp(BLUE)	19	-0	Indoor unit fan	Indoor unit fan error	(1) Check the indoor fan motor for proper rotating operation. (Check fan lock.) (2) Check the lead wire of the indoor fan motor for open-circuit. (3) Check CN1 of the indoor unit fan motor for secure installation. (4) No abnormality found in above inspections (1) through (3).	(1) Replace the indoor fan motor. (2) Replace the indoor fan motor. (3) Correct the installation of CN1 of the indoor fan motor. (4) Replace the indoor unit control PCB.
Indoor/outdoor units in operation	×	Operation lamp(RED) Cluster lamp(BLUE)	20	-0	Indoor unit control PCB	EEPROM data error	(EEPROM read data error)	(1) Replace the indoor unit control PCB.
Indoor/outdoor units in operation	×	Operation lamp(RED) Cluster lamp(BLUE)	22	-0	Cluster circuit	Cluster voltage error	(1) Check if the cluster feedback voltage is proper (0.1 V to 4.9 V). (2) Check CN5 of the cluster for secure installation.	(1) Replace the cluster unit. (2) Correctly install CN5 of the cluster.
		Operation lamp(RED) Cluster lamp(BLUE)		-1				
		Operation lamp(RED) Cluster lamp(BLUE)		-2				
Indoor/outdoor units in operation	×	Operation lamp(RED) Cluster lamp(BLUE)	30	-0	Drain pump unit	Drain pump unit error	(1) Check connector CN2 and CN10.	(1) Replace the Drain pump unit unit. (2) Re-insertion of CN2 and CN10.

Malfunction indications due to erroneous wiring during air conditioner installation

Inter-unit wiring error mode		Symptom
I		Indoor unit relay Turns On momentarily, then turns Off. Malfunction diagnosis display "18-1"
II		Indoor unit relay Relays turns Off after about 30 sec. Malfunction diagnosis display None (Displays "18-0" when malfunction code is called out.)
III		Indoor unit relay Relays turns Off after about 30 sec. Malfunction diagnosis display None (Displays "18-0" when malfunction code is called out.)

Inter-unit wiring error mode		Symptom
IV		Indoor unit relay Turns On momentarily, then turns Off. Malfunction diagnosis display "18-1"
V		Indoor unit relay Turns On momentarily, then turns Off. Malfunction diagnosis display "18-1"

3) In addition to those described above, the following error, which does not result in a complete shutdown, is notified by the flashing LED on the indoor unit.

Malfunction	Flashing LED (◐: flashing in 1-sec intervals) Operation	Timer	Cluster (blue)	Cluster (green)	Malfunction No. (main category)
Serial open-circuit error	(The Operation and Cluster LED conditions vary based on the equipment operation.)	◐			17 Serial open-circuit error

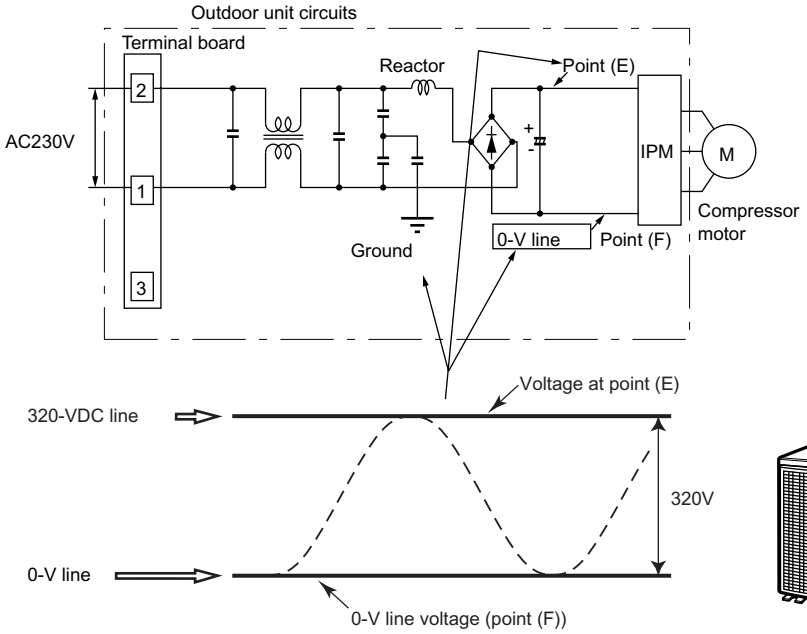
2. CAUTION IN CHECKING PRINTED CIRCUIT BOARDS (PWB) [GS-XP12HR-N]

2.1. Non-insulated control circuit

The GND terminals of the low-voltage circuits (control circuits for microcomputer and thermistors and drive circuits for expansion valve and relays) on the control printed circuit board (PWB) are connected to the compressor drive power supply (320-VDC negative terminal). Therefore, exercise utmost caution to prevent electric shock.

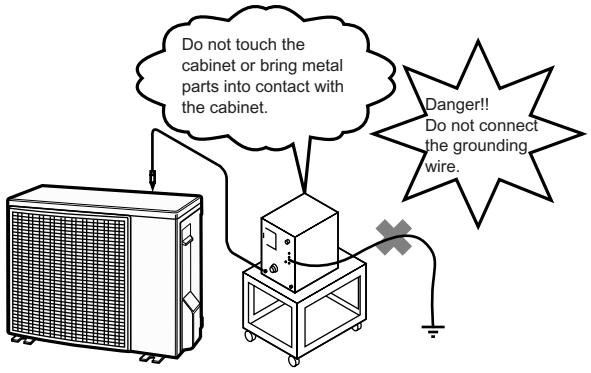
If a measuring instrument used for the test is grounded, its chassis (ground) has the same electric potential as the 0-V probe. Since non-insulated circuits have the following voltage potential difference from the ground, connection of the grounding wire results in a short-circuit between the 0-V line and the ground, thus allowing an excessive current to flow to the tester to cause damage.

If the sheaths of the thermistor lead wires or expansion valve lead wires inside the outdoor unit become damaged due to pinching by the front panel or other metal parts or contacting a pipe, a high voltage can flow and destroy the circuits. To prevent these problems, carefully conduct assembly work.



Reason

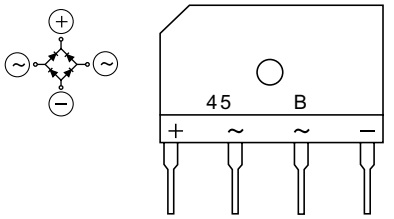
The oscilloscope (chassis ground) has the same electric potential as the 0-V probe. The entire electronic control section of the outdoor unit has a voltage potential difference from the ground as shown in the above diagram. When the oscilloscope is set up, the 0-V line and the ground voltage (ground) will be short-circuited, resulting in an excessive current flow to cause damage to the oscilloscope or indoor electric circuits.



3. DIODE BRIDGE CHECK METHOD

Turn off the power and let the inverter electrolytic capacitor (C9, C10) discharge completely. Then use a tester and check continuity.

When using a digital tester, the (+) and (-) tester lead wires in the table must be reversed.

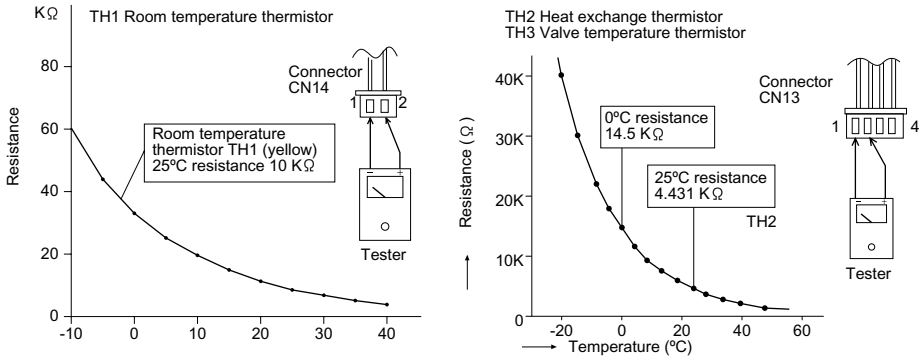


Needle-type tester		Normal resistance value
+	−	∞ (several MΩ)
~	+	
−	~	

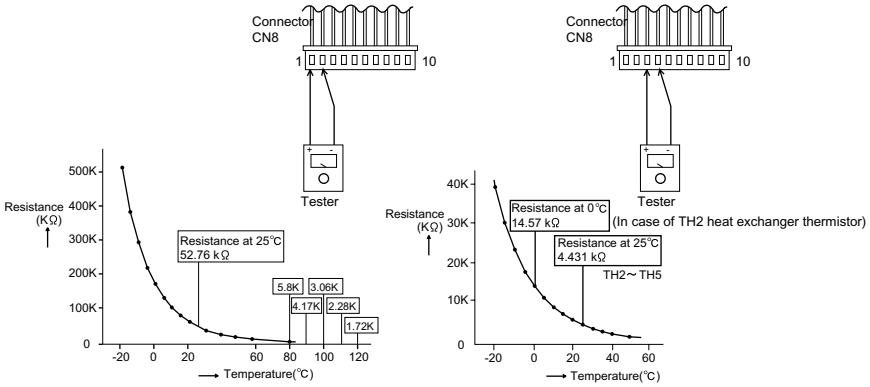
Value in ( ) is for digital tester.

[2] THERMISTOR TEMPERATURE CHARACTERISTICS

0.1. Temperature properties of indoor thermistors



0.2. Temperature properties of outdoor thermistors



TH1 Compressor thermistor

TH2 Heat exchanger thermistor
TH3 Outdoor air temperature thermistor
TH4 Suction thermistor
TH5 2-way valve thermistor

Thermistor	No.	Connector	Color
Compressor thermistor	TH1	No. (1) - No. (2)	Red
Heat exchanger thermistor	TH2	No. (3) - No. (4)	Orange
Outdoor air temperature thermistor	TH3	No. (5) - No. (6)	Green
Suction thermistor	TH4	No. (7) - No. (8)	Black
2-way valve thermistor	TH5	No. (9) - No. (10)	Yellow

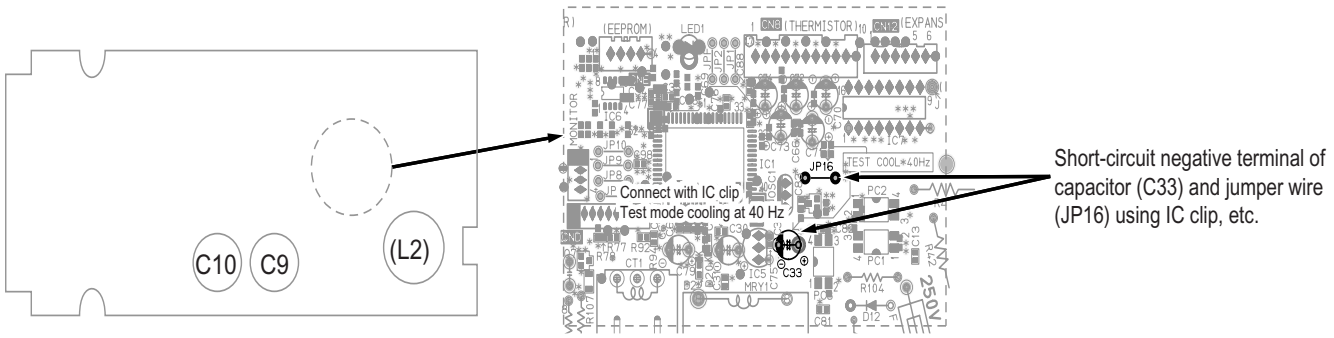
Before measuring resistance, disconnect connectors from PWB.

[3] HOW TO OPERATE THE OUTDOOR UNIT INDEPENDENTLY

1. Cooling in 40 Hz fixed mode

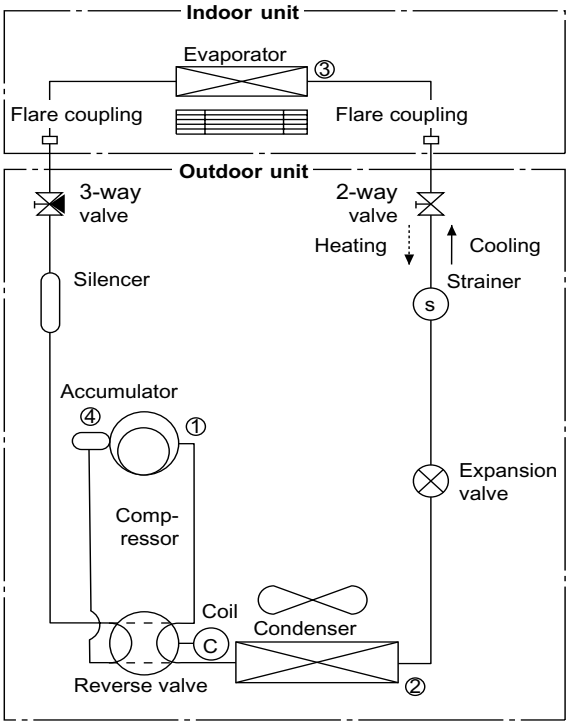
To operate the outdoor unit independently, short-circuit the sections indicated by arrows in the diagram below with an adapter, and apply 230 VAC between (1) and (N) on the terminal board of the outdoor unit. This allows the outdoor unit to be operated in cooling mode independently.

(Do not operate the outdoor unit in this condition for an extended period of time.)



CHAPTER 4. REFRIGERATION CYCLE

[1] FLOW FOR REFRIGERANT



[2] STANDARD CONDITION

	Indoor side		Outdoor side	
	Dry-bulb Temp.	Relative Humidity	Dry-bulb Temp.	Relative Humidity
Cooling	27°C	47%	35°C	40%
Heating	20°C	–	7°C	87%

* REFRIGERANT PIPE LENGTH 5.0m

[3] TEMPERATURE AT EACH PART AND PRESSURE IN 3-WAY VALVE

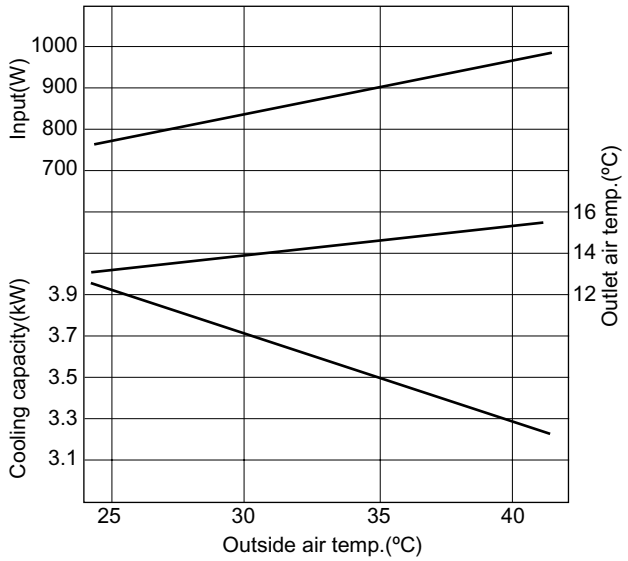
Model	GS-XP12HR-N			
Operation mode	MAX.		TEST RUN	
	Cool	Heat	Cool	Heat
No. R.P.M.	5000	5600	2500	2500
1	73.6°C	70.4°C	68°C	55°C
2	41°C	2°C	38°C	3°C
3	14°C	34°C	16°C	27°C
4	15°C	1°C	17°C	4°C
3-way valve pressure (MPaG)	0.81	2.72	1.03	1.93

[4] PERFORMANCE CURVES

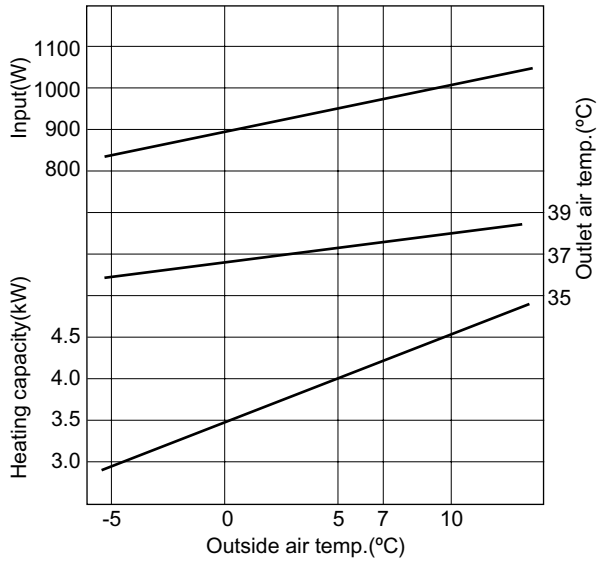
NOTE

1) Indoor fan speed: Hi
2) Vertical adjustment louver "0°", Horizontal adjustment louver "front"
3) Indoor air temp. : Cooling 27°C, Heating 20°C
4) Power source : 230V, 50Hz

0.1. At Cooling



0.2. At Heating

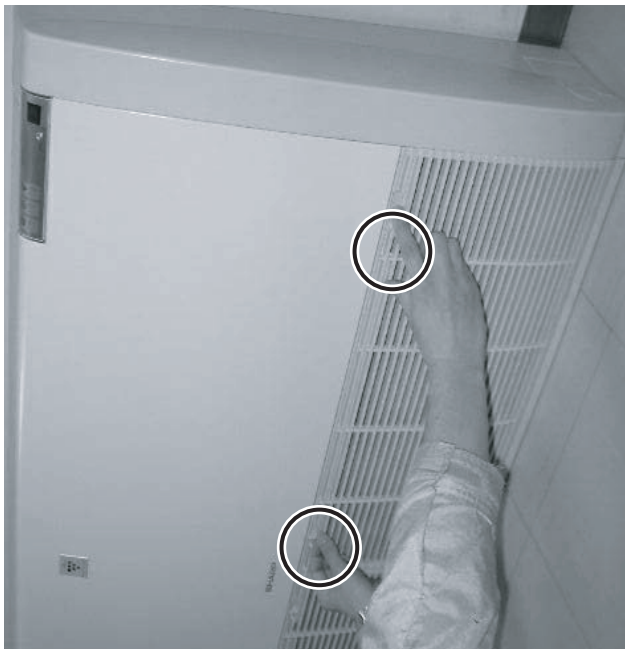


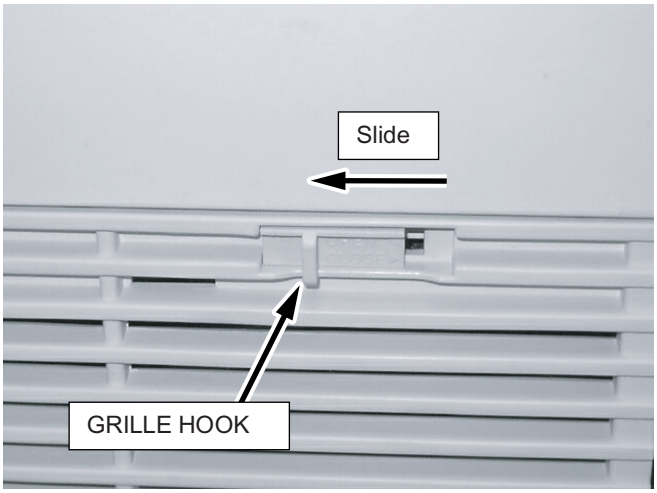
CHAPTER 5. DISASSEMBLING PROCEDURE

[1] DISASSEMBLY OF INDOOR UNIT

CAUTION: DISCONNECT THE UNIT FROM POWER SUPPLY BEFORE ANY SERVICING.

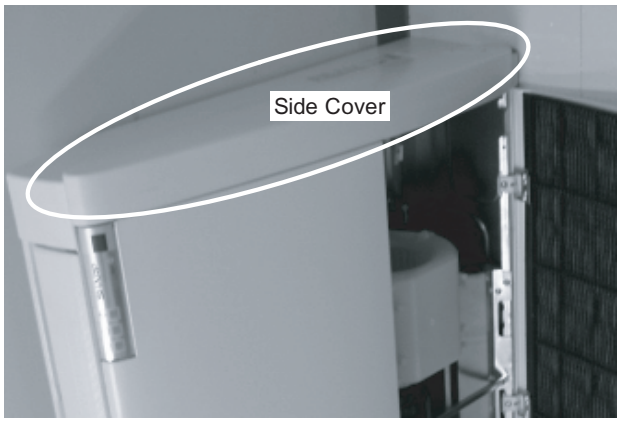
1) Slide 2 Grille hooks to the left, and open the Grille. (Right and left Grille.)

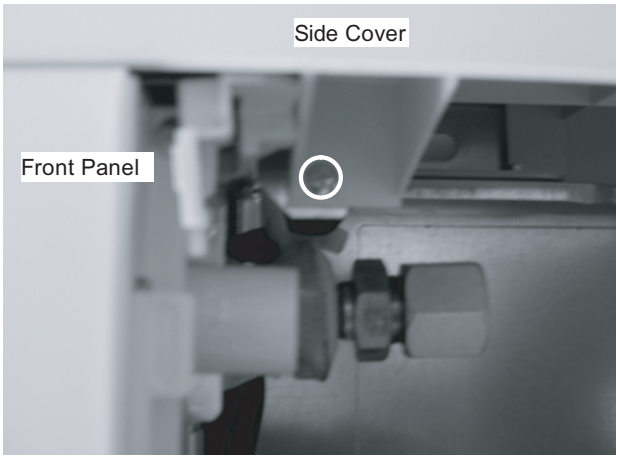




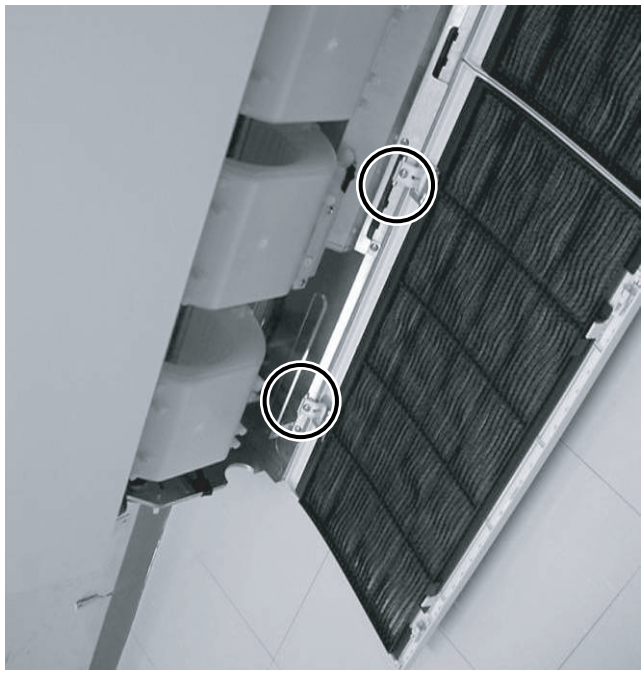
2) Remove 4 screws fixing the Girlls.

3) Remove the screw fixing the Side cover. (Right and left Side cover.)



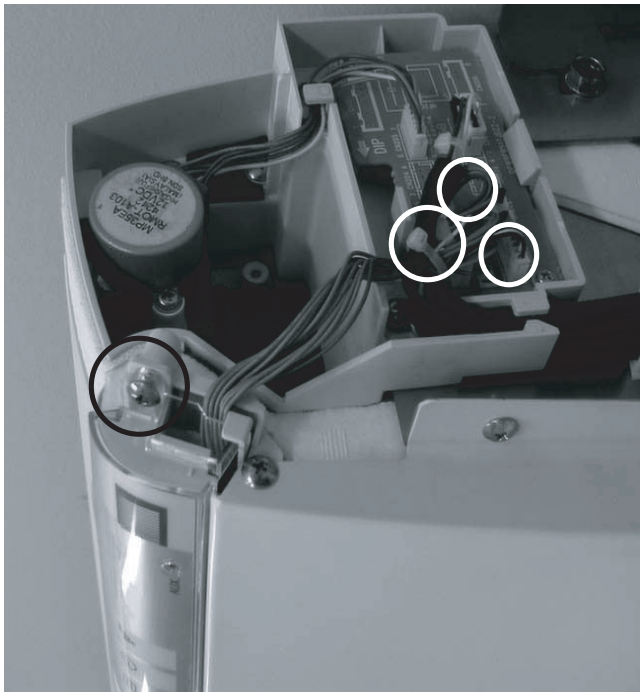


4) Remove 2 screws fixing the Grille. (Right and left Grille.)

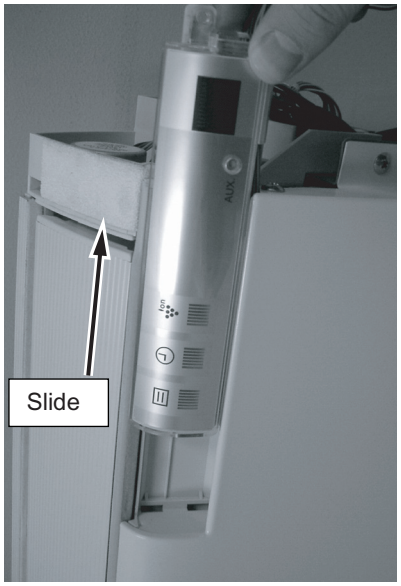


5) Remove 1 screw fixing the Angle.
Remove the Angle to the direction of arrows.

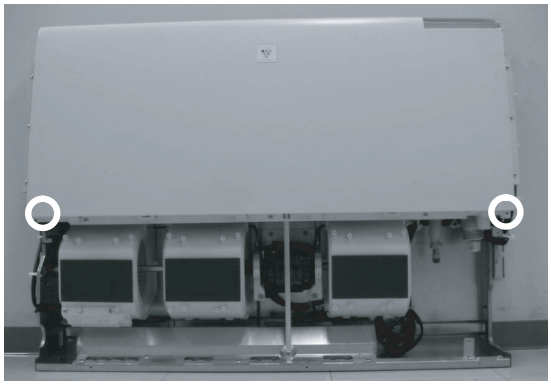
6) Cut the fixing band.
Disconnect 2 connectors (CN202, CN203).
Remove the screw fixing the Display unit.



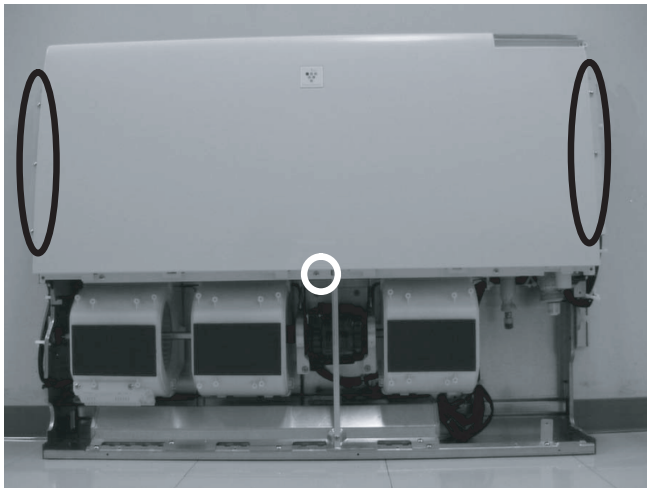
7) Slide the Display unit to the direction of arrow.



8) Remove 2 screws fixing the Angle to the Front panel.

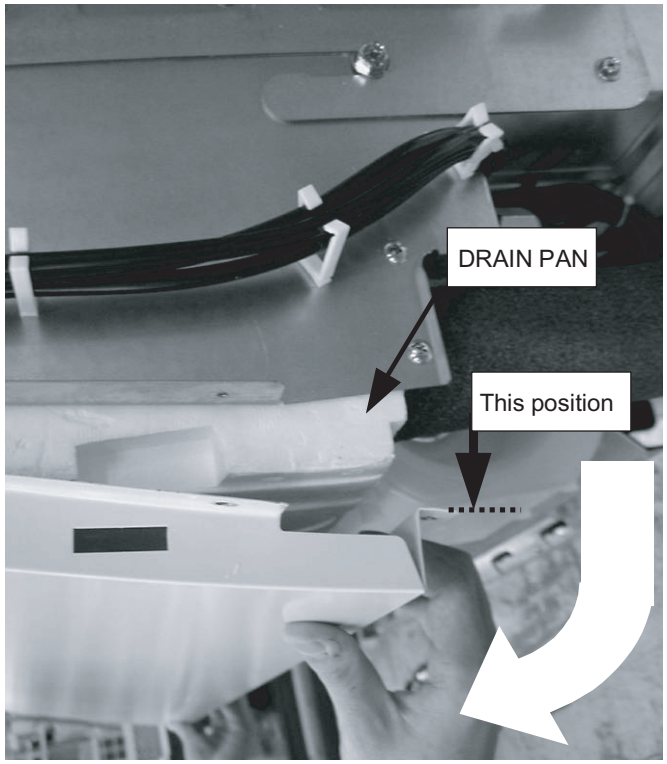


9) Remove 8 screws fixing the Front panel.



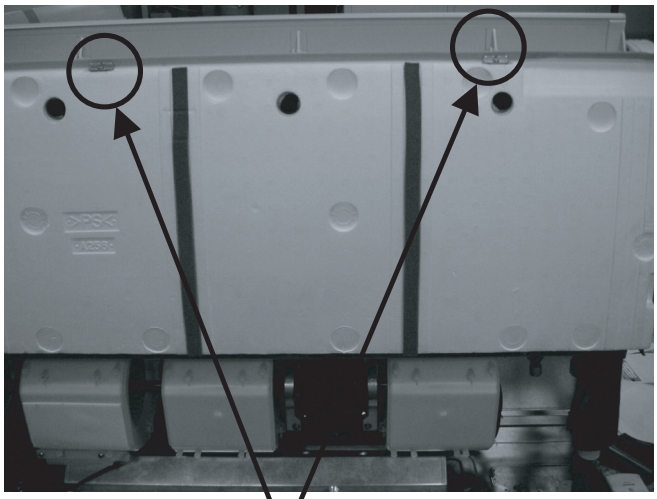
10)Support the Front panel with your hand, and remove the screw.

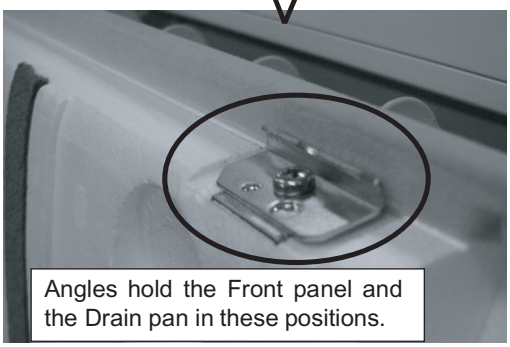
11)Remove the Front panel to the position where the Front panel is separated from the Drain pan.



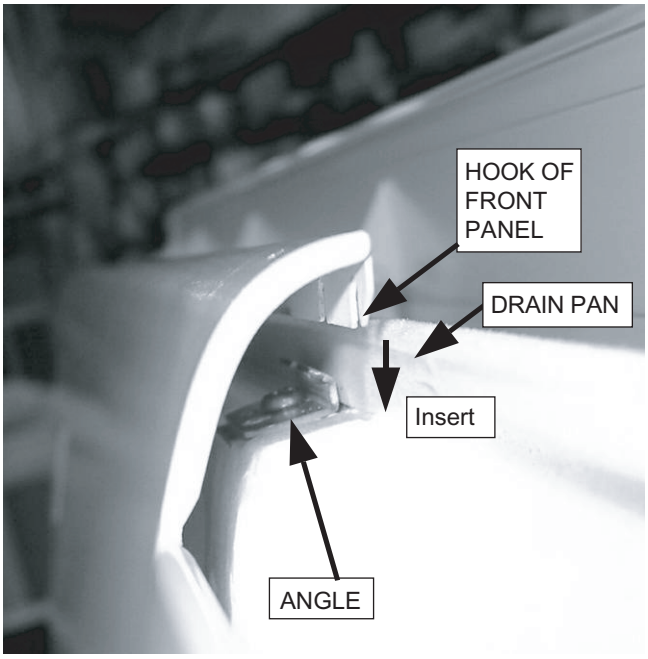
12)Remove the Front panel to the direction of arrow.

CAUTION: DO NOT DAMAGE THE DRAIN PAN WITH THE DISPLAY HOLDER.



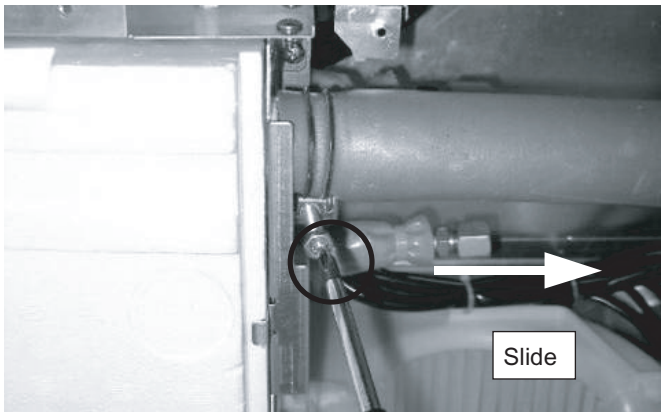


CAUTION: WHEN YOU ASSEMBLE THE FRONT PANEL TO DRAIN PAN, INSERT HOOK OF THE FRONT PANEL BETWEEN ANGLE AND DRAIN PAN (2 POSITIONS).
(ACTUALLY ASSEMBLE THE FRONT PANEL TO THE DRAIN PAN AFTER FIXING THE DISPLAY HOLDER TO THE FRONT PANEL.)

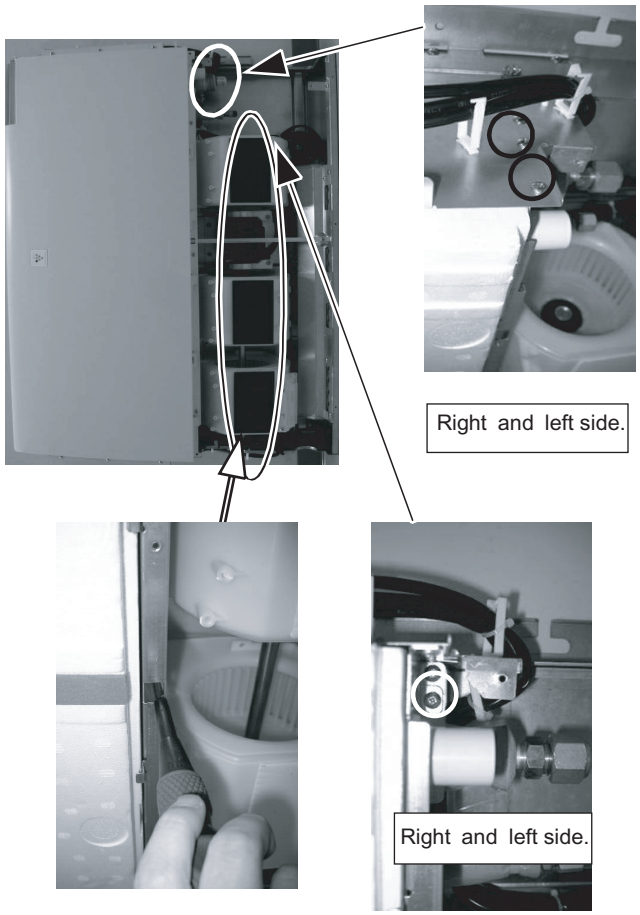


CAUTION: DISCHARGE THE WATER IN THE DRAIN PAN ASS'Y BEFORE REMOVING THE DRAIN PAN ASS'Y.

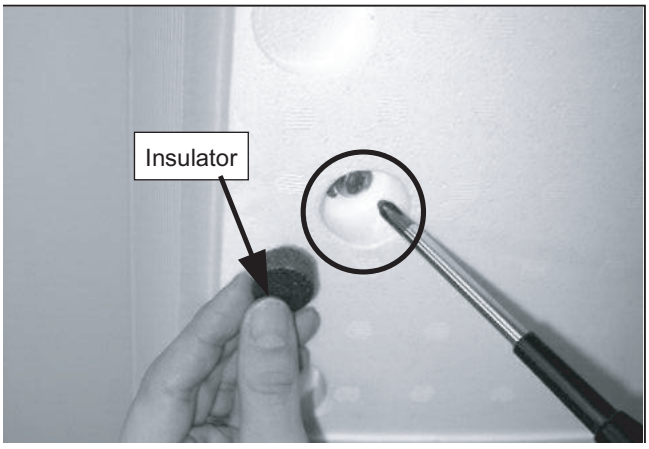
13)Loosen the screw of the Hose band. Remove the Drain hose.



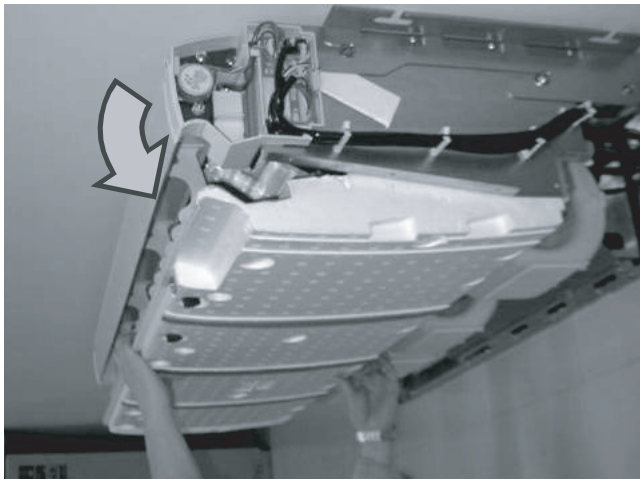
14)Remove 9 screws fixing the Drain pan ass'y.

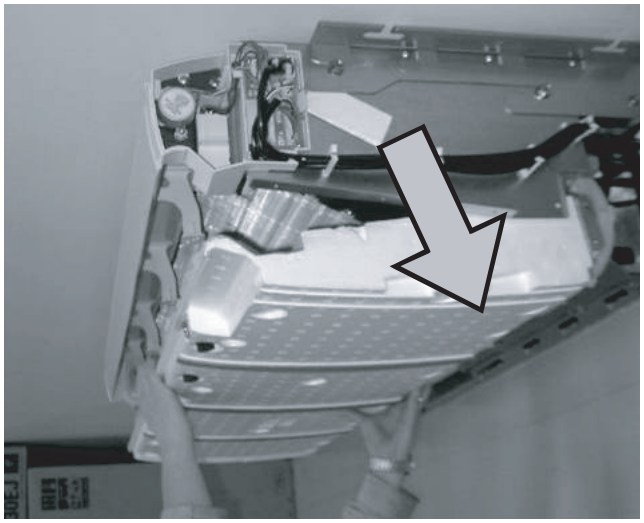


15)Remove 3 insulators and 4 screws fixing the Drain pan ass'y.



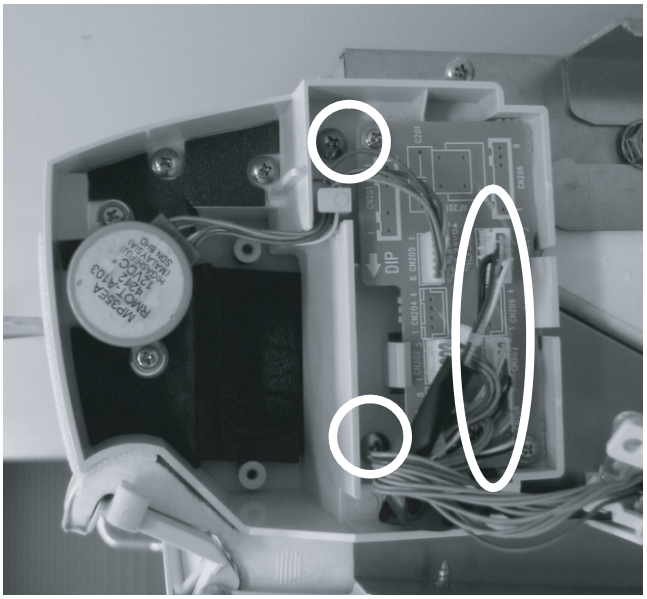
16)Tilt the Drain pan ass'y, slide the Drain pan ass'y to the direction of arrow.





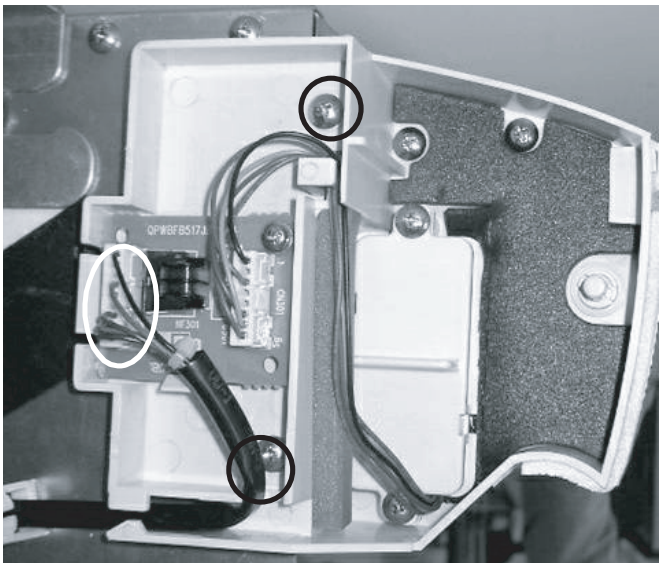
17)Disconnect 4 connectors (CN206, CN207, CN208 and CN210).

Remove 2 screws fixing the Top duct cover R.

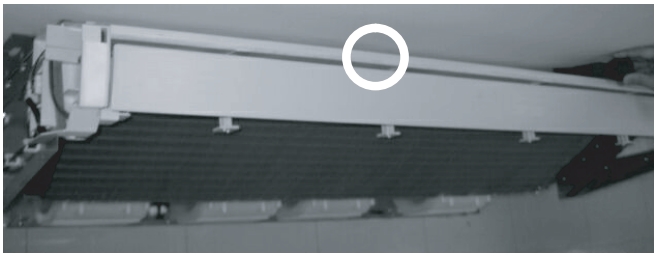


18)Disconnect the connector (CN302).

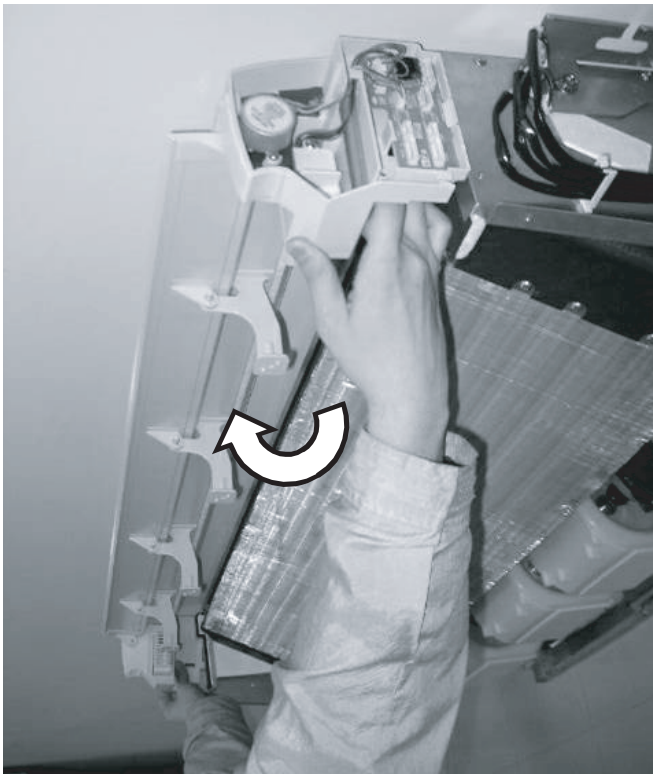
Remove 2 screws fixing the Top duct cover L.

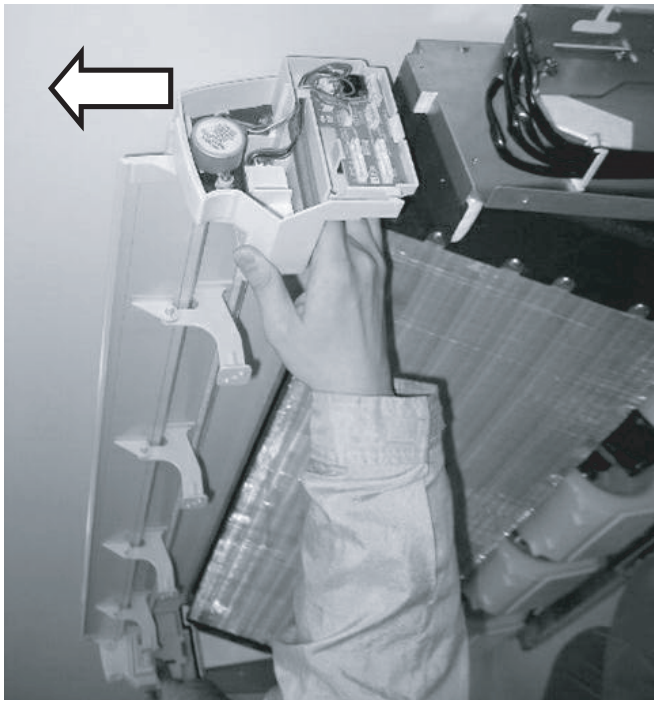


19)Remove 2 screws fixing the top duct.

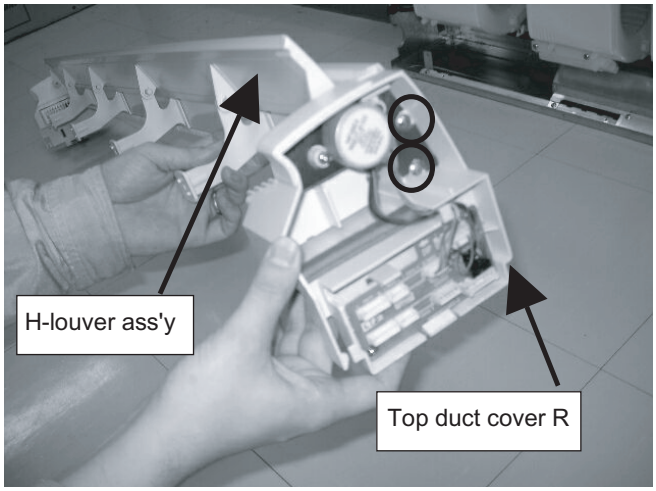


20)Tilt the Top duct for removing the rib of the Top duct , remove the unit to the direction of arrow.





21)Remove 2 screws fixing the Top duct cover R. Remove the Top duct cover R and H-louver ass'y.



22)Remove 6 screws fixing the End plate sub.