7. OPERATION DESCRIPTION

7-1. Outline of Air Conditioner Control

This is a fixed capacity type air conditioner, which uses a AC motor for an indoor fan. The AC motor drive circuit is mounted in the indoor unit. And electrical parts which operate the compressor and the outdoor fan motor, are mounted in the outdoor unit.
The air conditioner is mainly controlled by the indoor unit controller. The controller operates the indoor fan motor based upon commands transmitted by the remote control and transfers the operation commands to the outdoor unit controller.
The outdoor unit controller receives operation commands from the indoor unit, and operates the outdoor fan motor and the compressor.

(1) Role of indoor unit controller
The indoor unit controller receives the operation commands from the remote control and executes them.
- Temperature measurement at the air inlet of the indoor heat exchanger by the indoor temperature sensor
- Temperature setting of the indoor heat exchanger by the heat exchanger sensor
- Louver motor control
- Indoor fan motor operation control
- LED display control
- Transferring of operation commands to the outdoor unit
- Receiving of information of the operation status and judging of the information or indication of error

7-1-1. Louver control

(1) Vertical air flow louver
Position of veritcal air flow louver is automatically controlled according to the operation mode.
Besides, position of vertical air flow louver can be arbitrarily set by pressing [FIX] button.
The louver position which is set by [FIX] button is stored in the microcomputer, and the louver is automatically set at the stored position for the next operation.

(2) Swing
If [SWING] button is pressed when the indoor unit is in operation, the vertical air flow louver starts swinging. When [FIX] button is pressed, it stops swinging.

7-1-2. Indoor fan control (AC Fan motor)

(1) The indoor fan is operated by the stepless speed change AC motor.

(2) For air flow level, speed of the indoor fan motor is controlled in five steps (LOW, LOW$^+$, MED, MED$^+$ and HIGH). If AUTO mode is selected, the fan motor speed is automatically controlled by the difference between the preset temperature and the room temperature.

$$LOW^+ = \frac{LOW+MED}{2}$$

$$MED^+ = \frac{MED+HIGH}{2}$$

Table 7-1-1

Model		RAS-13UKH-E		RAS-10UKH-E		RAS-07UKH-E	
		Motor speed (rpm)	Air flow level (m^3/h)	Motor speed (rpm)	Air flow level (m^3/h)	Motor speed (rpm)	Air flow level (m^3/h)
Cooling and Fan only	HIGH	1,300	630	1,200	570	1,200	570
	MED	1,100	520	1,000	460	1,000	460
	LOW	950	430	800	340	800	340
Heating	HIGH	1,350	650	1,250	610	1,250	610
	MED	1,150	550	1,100	520	1,050	490
	LOW	1,050	490	900	400	900	400
Model		RAS-13UK-E		RAS-10UK-E		RAS-07UK-E	
Cooling and Fan only	HIGH	1,300	630	1,300	630	1,200	570
	MED	1,150	550	1,050	490	1,000	460
	LOW	1,000	460	850	370	800	340
Model		RAS-13UKP-HX		RAS-10UKP-HX			
Cooling and Fan only	HIGH	1,300	630	1,300	630		
	MED+	1,220	600	1,180	560		
	MED	1,150	550	1,050	490		
	LOW+	1,070	500	950	430		
	LOW	1,000	460	850	370		

7-2. Description of Operation Circuit

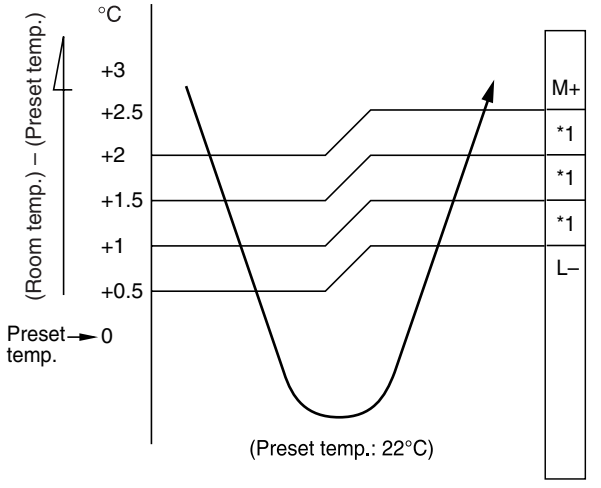
(1) When turning on the breaker, the operation lamp blinks. This means that the power is on (or the power supply is cut off.)

(2) When pressing [START / STOP] button on the remote control, receiving beep sounds from the indoor unit, and the next operation is performed together with opening the vertical air flow louver.

(3) Once the operation mode is set, it is memorized in the microcontroller so that the previous operation can be effected thereafter simply by pressing [START / STOP] button.

7-2-1. Fan only operation ([MODE] button on the remote control is set to the fan only operation.)

(1) When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 7-2-1. When [FAN] button is set to LOW, LOW+, MED, MED+ or HIGH, the motor operates with a constant air flow.



NOTE :

*1: The values marked with *1 are calculated and controlled by the difference in motor speed between M+ and L–.

Fig. 7-2-1 Setting of air flow [FAN:AUTO]

(2) The Hi POWER operation cannot be set.

7-2-2. Cooling operation ([MODE] button on the remote control is set to the cooling operation.)

(1) The compressor, 4-way valve, outdoor fan and operation display on the remote control are controlled as shown in Fig. 7-2-2.

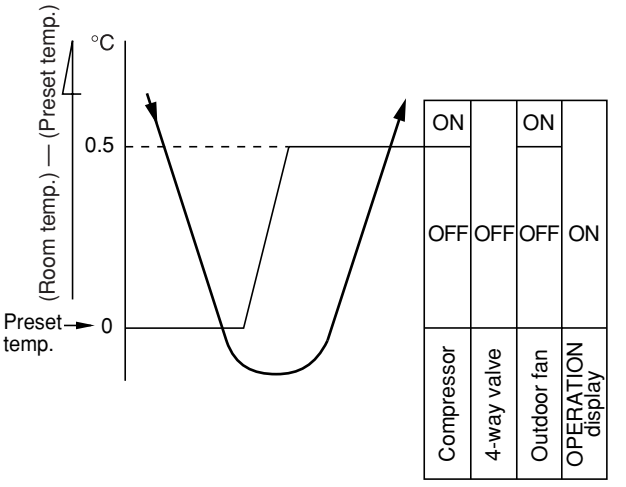
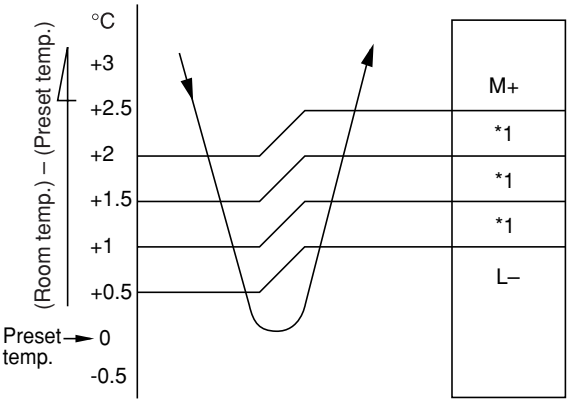


Fig. 7-2-2

(2) When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 7-2-3. When [FAN] button is set to LOW, LOW+, MED, MED+ or HIGH, the motor operates with a constant air flow.



NOTE :

*1: The values marked with *1 are calculated and controlled by the difference in motor speed between M+ and L–.

Fig. 7-2-3 Setting of air flow [FAN:AUTO]

7-2-3. Dry operation ([MODE] button on the remote control is set to the dry operation.)

(1) The compressor, 4-way valve, outdoor fan and operation display on the remote control are controlled as shown in Fig. 7-2-4.

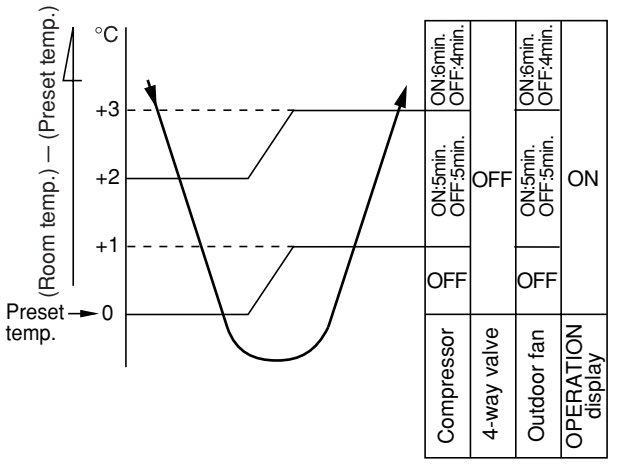


Fig. 7-2-4

(2) The microcontroller turns the compressor on and off at the regular intervals (4 to 6 minutes). While the compressor is turning off, the indoor fan motor operates in the SUPER LOW position.
The pattern of operation depending on the relation between room temperature and preset temperatures is shown in Fig. 7-2-5.

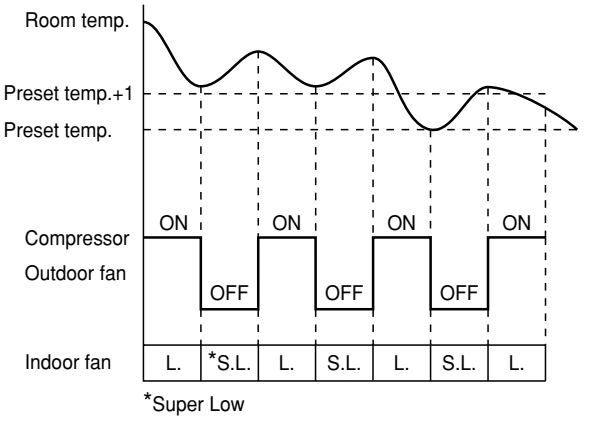


Fig. 7-2-5

(3) [FAN] button on the remote control is set to AUTO only.

(4) The Hi POWER operations cannot be set.

7-2-4. Heating operation *Heating and cooling model only ([MODE] button on the remote control is set to the heating operation.)

(1) The compressor, 4-way valve, outdoor fan and operation display on the remote control are controlled as shown in Fig. 7-2-6.

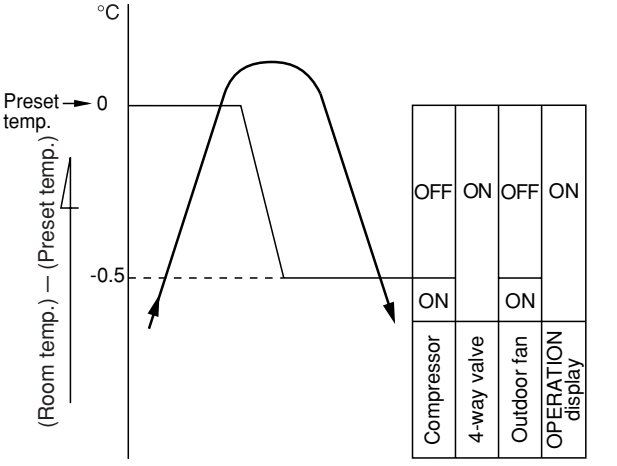
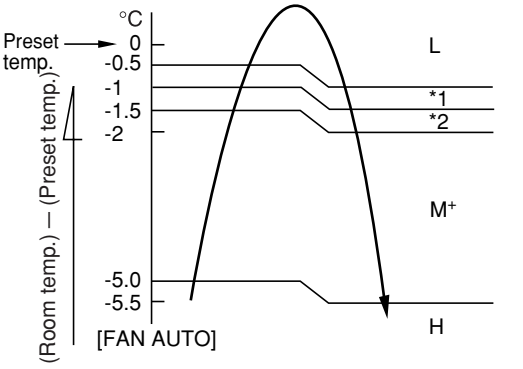


Fig. 7-2-6

(2) When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 7-2-7. When [FAN] button is set to LOW, LOW+, MED, MED+ or HIGH, the motor operates with a constant air flow.

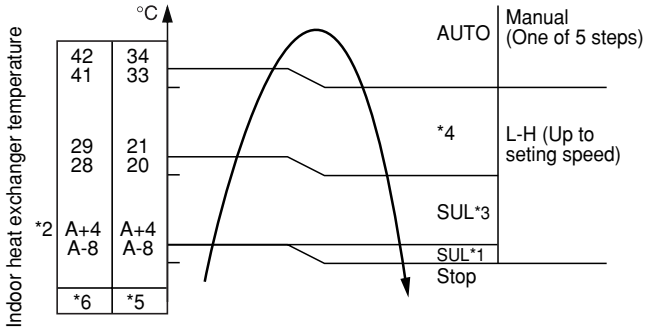


*1, *2 : The values marked with *1 and *2 are calculated and controlled by the difference in motor speed between M+ and L.

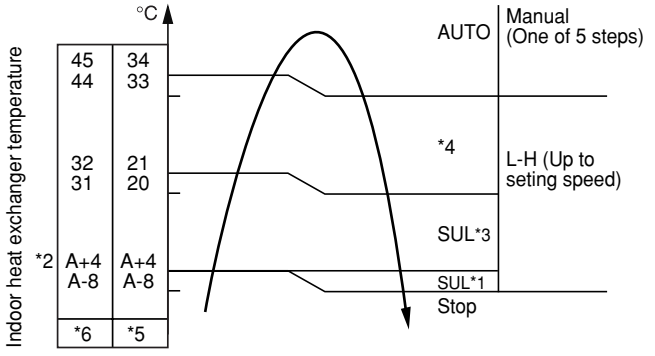
Fig. 7-2-7 Setting of air flow [FAN:AUTO]

(3) The indoor heat exchanger restricts revolving speed of the fan motor to prevent a cold draft. The upper limit of the revolving speed is shown in Fig. 7-2-8 and Table 7-2-1.

RAS-13UKH-E / RAS-13UAH-E



RAS-10UKH-E / RAS-10UAH-E



RAS-07UKH-E / RAS-07UAH-E

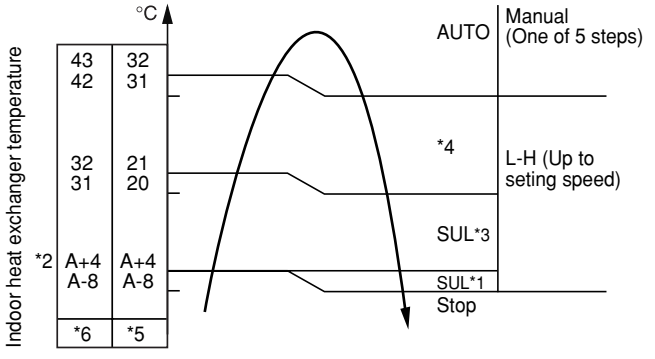


Fig. 7-2-8 Cold draft preventing control

NOTES :

*1: The fan stops for 2 minutes after thermostat-OFF.

*2: A is 24°C when the preset temperature is 24°C or more and A is the preset temperature when it is under 24°C.

*3: SUL means Super Ultra Low.

*4: Calculated from difference in motor speed between SUL and HIGH.

*5 and *6:

Table 7-2-1

Fan speed	*5 Starting period	*6 Stabilized period
AUTO	• Up until 12 minutes passed after starting the unit • From 12 to 25 minutes passed after starting the unit and room temperature is 3°C lower than preset temperature	• From 12 to 25 minutes passed after starting the unit and room temperature is between preset temperature and 3°C lower than preset temperature • 25 minutes or more passed after starting the unit
Manual (L – H)	• Room temperature < Preset temperature –4°C	• Room temperature ≧ Preset temperature –3.5°C

7-2-5. Automatic operation ([MODE] button on the remote control is set to the automatic operation.)

(1) One of 3 operations (Cooling, Fan only or Heating) is selected according to difference between the preset temperature and the room temperature at which the automatic operation has started, as shown in Fig. 7-2-9. The Fan only operation continues until the room temperature reaches a level at which another mode is selected.

(2) Temporary Auto
When the TEMPORARY button on the indoor unit is pushed, the preset temperature is fixed at 24°C and the indoor unit is controlled as shown in Fig. 7-2-9.

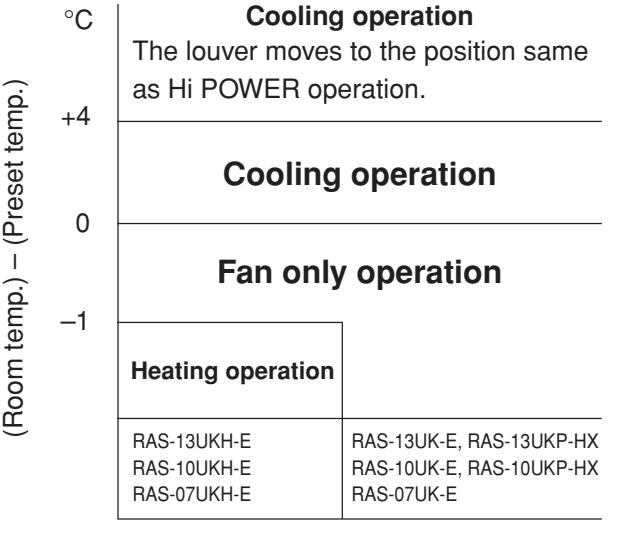


Fig. 7-2-9

7-3. Hi POWER Mode ([Hi POWER] button on the remote control is pressed.)

When [Hi POWER] button is pressed while the indoor unit is in Auto, Cooling or Heating operation, Hi POWER mark is indicated on the display of the remote control and the unit operates as follows.

(1) Automatic operation
- The indoor unit operates in according to the current operation.

(2) Cooling operation
- The preset temperature drops 3°C. (The value of the preset temperature on the remote control does not change.)
- If the difference between the preset temperature and the room temperature is big, the horizontal louver moves to the Hi POWER position automatically. Then when the difference between them gets smaller, the horizontal louver returns automatically.
- FAN speed : [AUTO] If the difference between the preset temperature and room temperature is big, the air conditioner operates at maximum airflow level. If the difference between the preset temperature and the room temperature is small, the air conditioner operates at normal airflow level.
- FAN speed : One of 5 levels The air conditioner operates at normal airflow level.

(3) Heating operation *Heating and Cooling Model only
- The preset temperature increases 2°C, (The value of the preset temperature on the remote control does not change.)
- The indoor unit operates in normal heating mode except the preset temperature is higher (+2°C).

(4) The Hi POWER mode can not be set in Dry or Fan only operation.

7-4. High-Temperature Limit Control

The microcontroller detects the indoor heat exchanger temperature to prevent pressure of a refrigerating cycle from increasing excessively.
The compressor and outdoor fan motor are controlled as shown in Fig. 7-4-1.

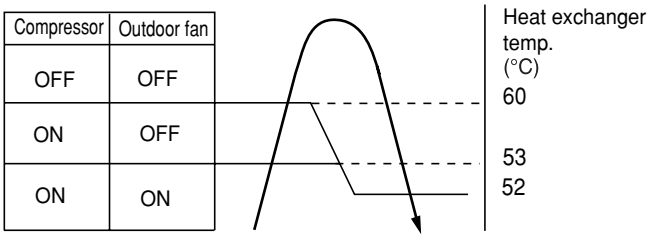


Fig. 7-4-1

7-5. Low-Temperature Limit Control

The microcontroller detects the indoor heat exchanger temperature to prevent the indoor heat exchanger from freezing.
The compressor and outdoor fan motor are controlled as shown in Fig. 7-5-1 and 7-5-2.

RAS-10UKP-HX
RAS-10UKH-E ;RAS-07UKH-E
RAS-10UK-E ;RAS-07UK-E

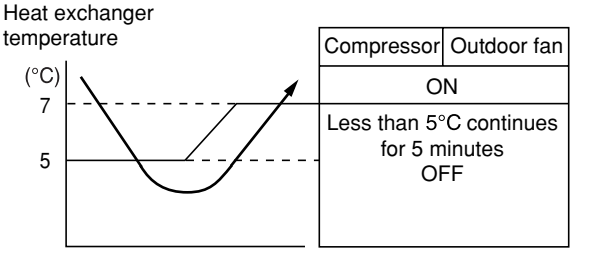


Fig. 7-5-1

RAS-13UKP-HX
RAS-13UKH-E
RAS-13UK-E

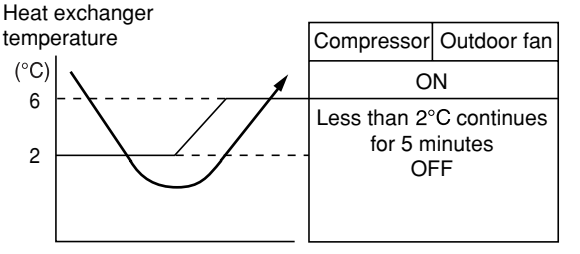


Fig. 7-5-2

7-6. Defrost Operation

During the heating operation, the outdoor heat exchanger temperature goes down and sometimes it is frozen.
In this case, the air conditioner stops the heating operation and starts the defrost operation to melt ice.

7-6-1. Condition to start the defrost operation

The defrost operation starts whichever below conditions are satisfied.

(1) When the cumulative compressor operating time is longer than 40 or 90 minutes and difference between the indoor heat exchanger temperature and the room temperature is less than the specified value. (This value is decided by the microprocessor.) (Control example is shown in Fig. 7-6-1. In case of B or C, the defrost operation starts.)

(2) When the current limit control or the high temperature limit control is performed for total of 90 minutes.

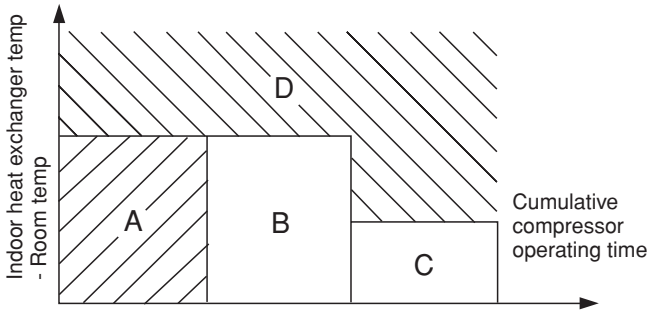


Fig. 7-6-1 (Indoor fan speed : M)

7-6-2. Defrost operation time control

<In case of B>

(1) The heating operation is performed for at least 40 minutes.

(2) The maximum defrost operating time is 6 minutes. The defrost operating time for the 4th cycle is 10 minutes. (When the outdoor temperature is very low, however, the defrost operating time is 10 minutes.)

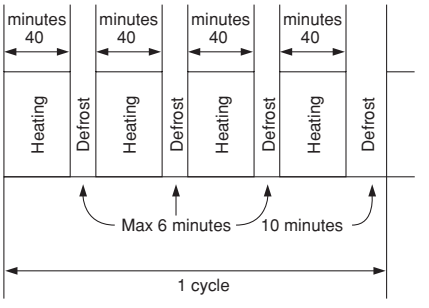


Fig. 7-6-2

<In case of C>

(1) The heating operation is performed for at least 90 minutes.

(2) The defrost operating time is 10 minutes.

7-6-3. Ending condition at defrost operation

(1) When the compressor current becomes 7.5A or more during defrost operation, the defrost operation stops and the heating operation restarts. (The current sensor detects the compressor current.)

(2) The defrost operation continues for at most 6 minutes or 10 minutes.

DEFROST LAMP :

- During defrost operation, the PRE-DEF. lamp is on and the indoor and outdoor fans are off.
- The compressor start protection timer is inter-looked with the PRE-DEF. lamp. So the PRE-DEF. Lamp is off (the fans stop) for about 3 minutes after the START/STOP button is turned on. When the compressor is turned on, the PRE-DEF. lamp comes on. After the heat ex-changer is preheated to about 24°C or higher, the PRE-DEF. Lamp goes off, and the indoor fan starts.

7-7. Current Limit Control

The microprocessor detects the input current so as to prevent it exceeds a specified value by means of controlling the outdoor fan control as described in (1) and (2).

(1) Current limit control (Cooling)
Control is performed as shown below by detecting the compressor operating current with a current sensor (C.T).

RAS-13UKH-E / RAS-10UKH-E, RAS-07UKH-E

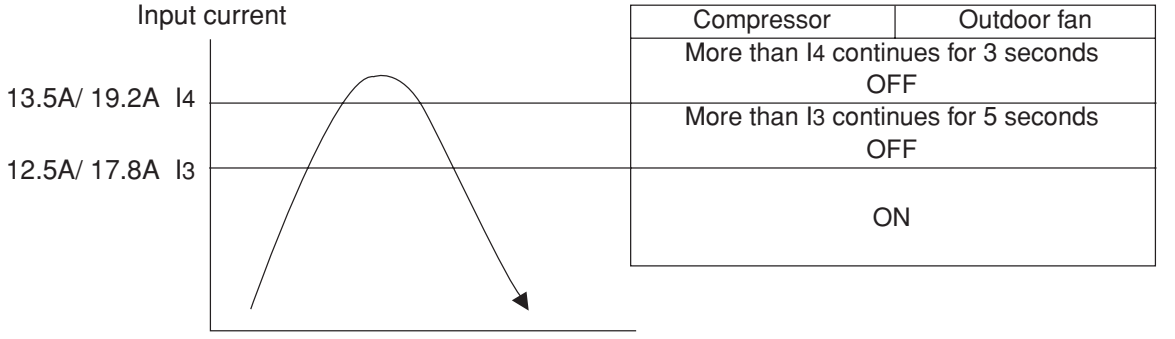


Fig. 7-7-1

(2) Current limit control (Heating)
Control is performed as shown in Fig. 7-7-2

RAS-13UKH-E / RAS-10UKH-E, RAS-07UKH-E

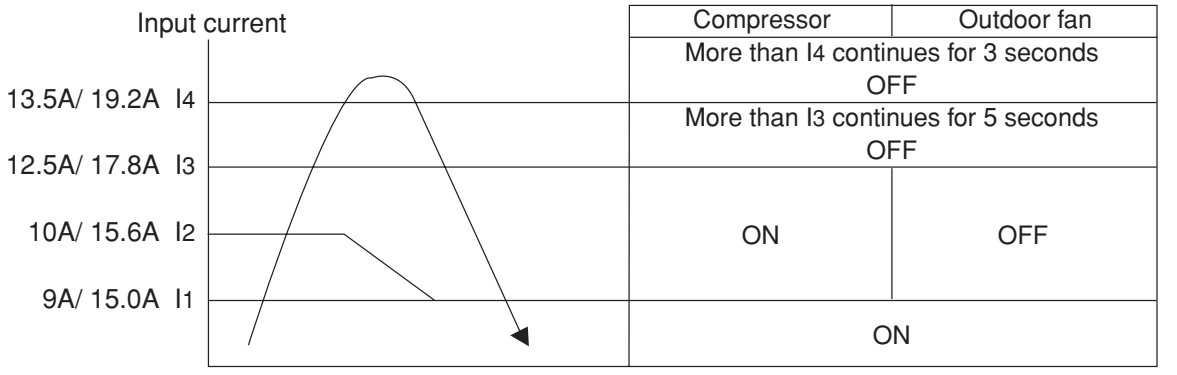


Fig. 7-7-2

Remark :

This function is available only for heat pump model (Cooling models have no a current sensor (C.T.)).

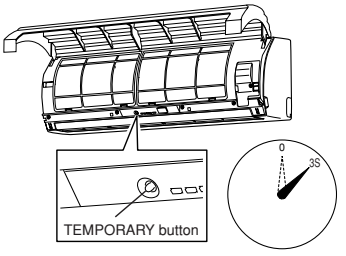
7-8. Auto Restart Function

The indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of power supply being accidentally shut down. The operation will resume without warning three minutes after power is restored.
This function is not set to work when shipped from the factory. Therefore it is necessary to set it to work.

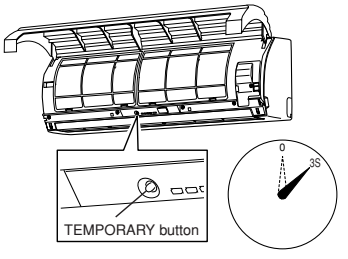
7-8-1. How to set auto restart function

To set the auto restart function, proceed as follows:
The power supply to the unit must be on; the function will not set if the power is off.
Push the [TEMPORARY] button located in the center of the front panel continuously for three seconds.
The unit receives the signal and beeps three times.
The unit then restarts operating automatically in the event of power supply being accidentally shut down.

When the unit is on standby (Not operating)

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The green lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from green to orange. If the unit is not required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it off.

When the unit is in operation

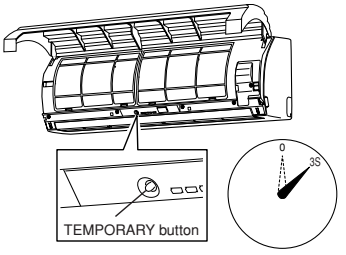
Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is in operation. The green lamp is on. ↓ The unit stops operating. The green lamp is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.
- This function can not be set if the timer operation has been selected.
- When the unit is turned on by this function, the louver will not swing even though it was swinging automatically before shutting down.
- While the filter check lamp is on, the TEMPORARY button has the function of filter reset button.

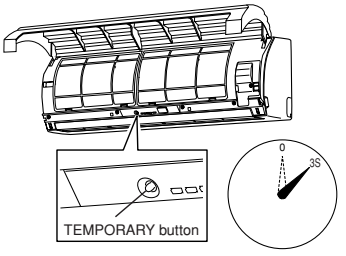
7-8-2. How to cancel auto restart function

To cancel auto restart function, proceed as follows:
Repeat the setting prodedure: the unit receives the signal and beeps three times.
The unit will be required to be turned on with the remote control after the main power supply is turned off.

When the unit is on standby (Not operating)

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The orange lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from orange to green. If the unit is not required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it off.

When the unit is in operation

Operation	Motions
Push [TEMPORARY] button for more than three seconds. 	The unit is in operation. The orange lamp is on. ↓ The unit stops operating. The orange lamp is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, push [TEMPORARY] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.

7-8-3. Power failure during timer operation

When the unit is in Timer operation, if it is turned off because of power failure, the timer operation is cancelled. Therefore, set the timer operation again.

7-9. Filter Check Lamp

When the elapsed time reaches 1000 hours, the filter check lamp indicates. After cleaning the filters, turn off the filter check lamp.

7-9-1. How to turn off filter check lamp

Press [FILTER] button on the remote control.
OR push [TEMPORARY] button on the indoor unit.

Note:

If [TEMPORARY] button is pushed while the filter check lamp is not indicating, the indoor unit will start the Automatic Operation.