

July 7, 2005



Mitsubishi Electric 'Mr. Slim'
P-Series Commercial Models

TROUBLESHOOTING TIPS / P8 ERROR CODE

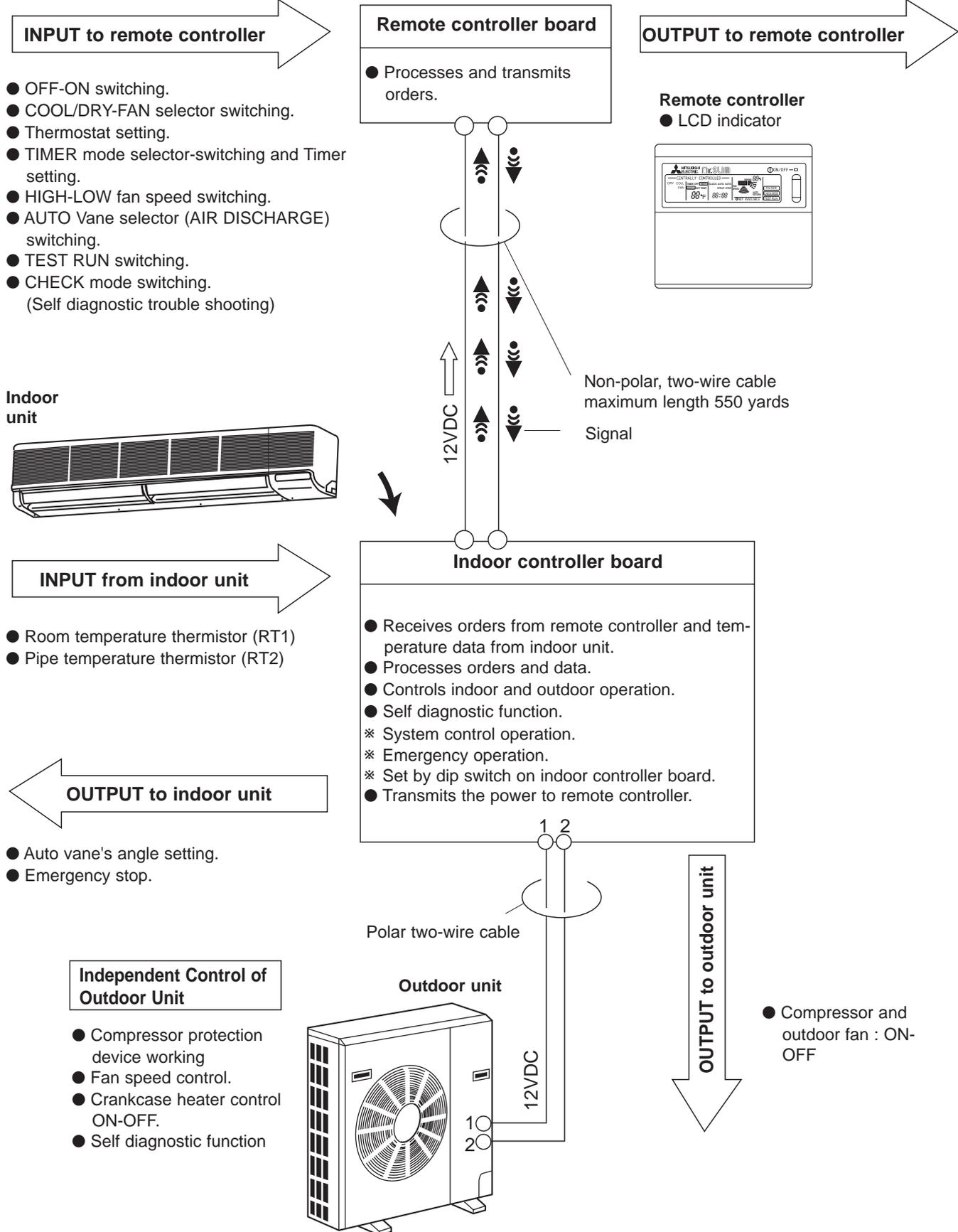
These systems have very sophisticated microprocessor control systems to operate the system efficiently and to protect it from conditions which could lead to damage.

If the P8 Error Code appears on the wall controller this indicates a problem with the condensing (outdoor) unit. There are several possible causes for this fault. A few are mentioned in the literature provided by Mitsubishi, but experience has shown that many other conditions can also result in the P8 Error Code.

1. Is there power to the outdoor unit? P-series indoor and outdoor units are typically wired from separate sources. On cooling only units the indoor section is 120/1/60 volt and the outdoor section is 208-230/1/60 volt. On heat pumps both sections are 208-230/1/60 volt. The indoor unit could have power to it but not the outdoor unit, resulting in a P8 fault.
2. Is the 2-wire 12 VDC communication link between the indoor unit and outdoor unit intact? This wiring is polarity sensitive so if the wires are crossed, shorted or broken this is also a problem to look for. Ensure the wires are secure in the terminals as well. Loose wiring can cause intermittent problems.
3. There is a 208 Volt jumper for the outdoor unit control board. Verify your power supply voltage and insure this jumper is correct for what you actually measure at the unit with your meter. The outdoor board monitors the power.
4. The outdoor board monitors the temperature of the refrigerant leaving the condenser coil and modulates it's condenser fan(s) to try and maintain a 95°F temperature. If the discharge temperature gets too high, or too low, the unit will shut off. Verify that the pipe temperature thermistor is not open or shorted, and that it is snug in the well attached to the refrigerant pipe.
5. Is the condenser fan operating? On the extra low ambient models (-40°F) there is a control to disable the condenser fan(s) during very cold weather. If this control is defective it may be preventing operation of the fan(s) in warm weather. Ensure the condenser fan is ramping up to full speed when required.
6. Is the unit operating year-round but not a -40°F low ambient design? You can determine this easily because the accumulator on -40°F units is heated and insulated. Ensure the accumulator heater is functioning in the winter.
7. Is the system undercharged, or overcharged? It is a capillary tube metering device so the refrigerant charge is critical. P-series units have an accumulator which enables it to store enough refrigerant for up to a 100' line set. After 100' additional refrigerant must be weighed in based on the total 1-way lineset length.

Please refer to the attached pages from the Service Manual for more information on troubleshooting.

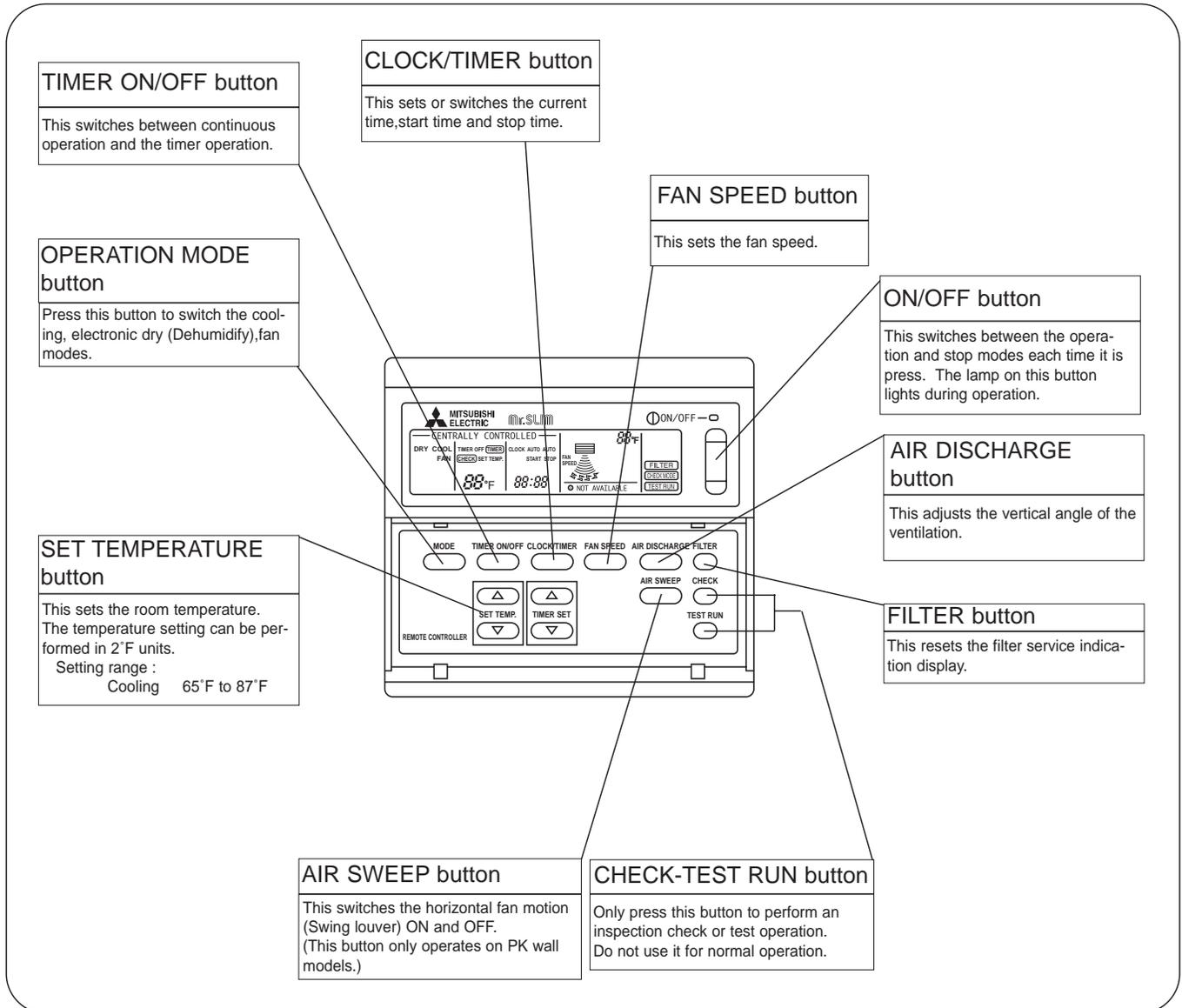
1. OUTLINE OF MICROPROCESSOR CONTROL



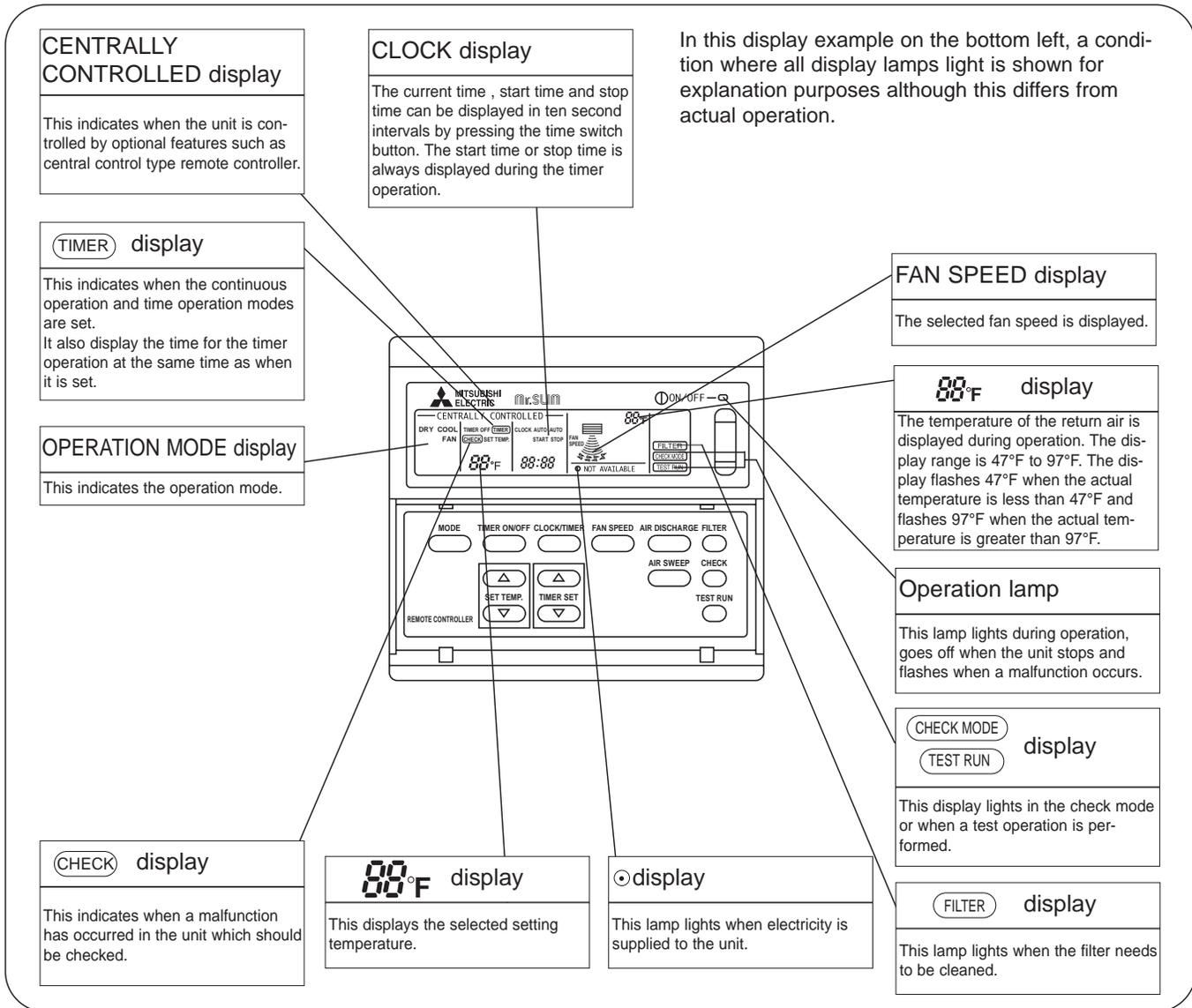
Remote controller

Once the controls are set, the same operation mode can be repeated by simply pressing the ON / OFF button.

Remote controller operation buttons



Remote controller display



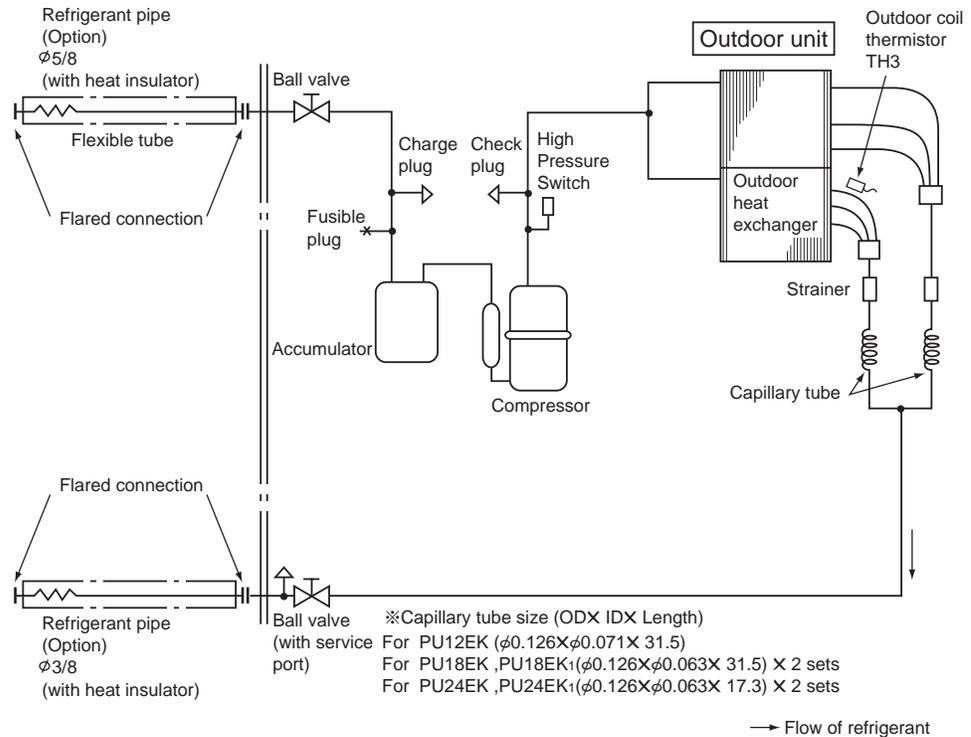
Caution

- Only the ⊙ display lights when the unit is stopped and power supplied to the unit.
- When power is turned ON for the first time the (CENTRAL CTRL) display appears to go off momentarily but this is not a malfunction.
- When the central control remote control unit, which is sold separately, is used the ON-OFF button, OPERATION MODE button and SET TEMP. button do not operate.
- "NOT AVAILABLE" is displayed when the AIR DISCHARGE button are pressed.
(AIR DISCHARGE function is not provided for PC series.)

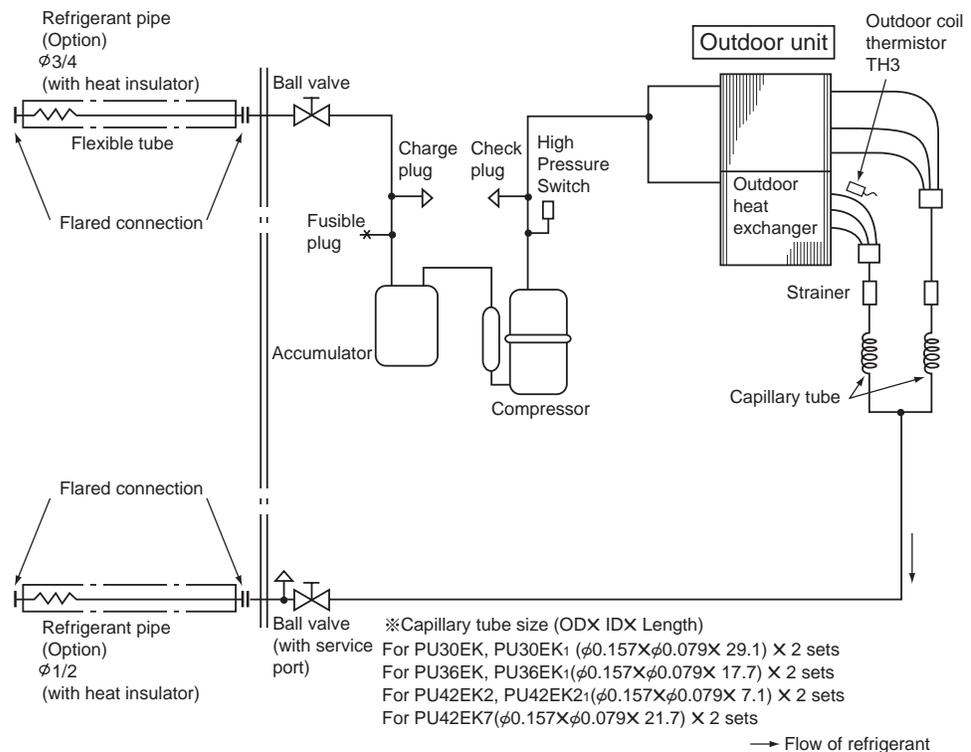
9

REFRIGERANT SYSTEM DIAGRAM

**PU12/18/24EK
PU18/24EK₁**



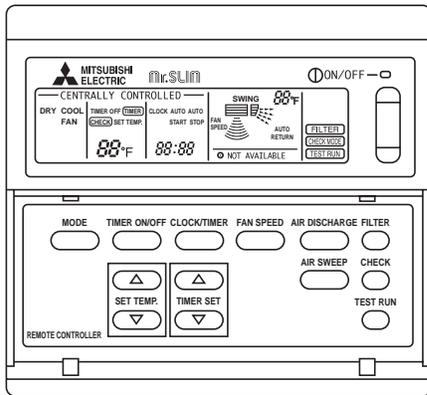
**PU30/36EK , PU42EK2 , PU42EK7
PU30/36EK₁ , PU42EK2₁**



NOTE : The symbol ϕ indicates the diameter.

2. INDOOR UNIT CONTROL

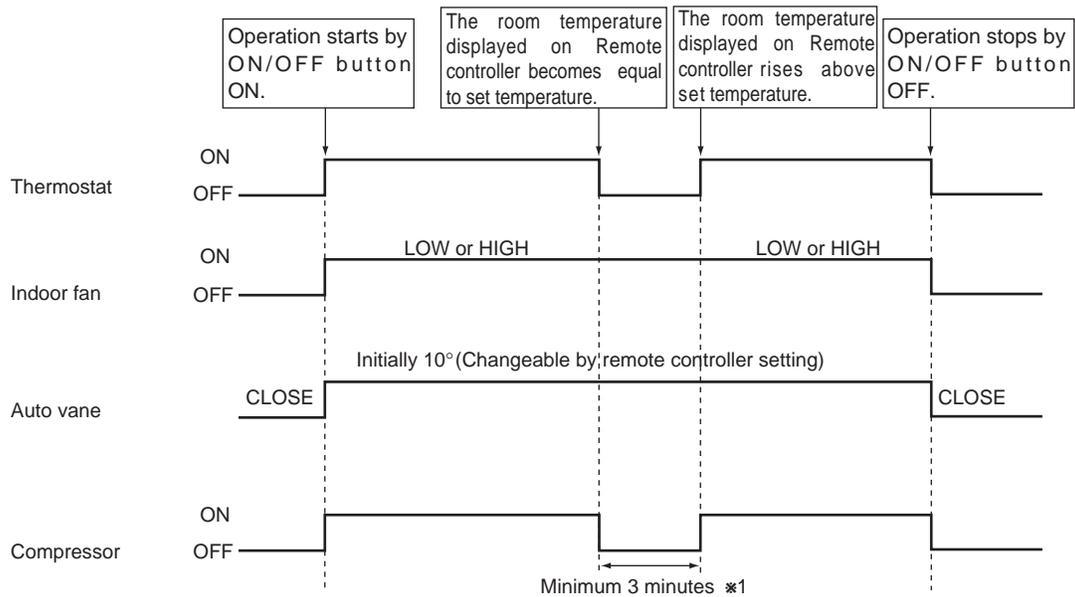
2-1 COOL operation



<How to operate>

- ① Press the ON/OFF button.
 - ② Press MODE button to set operation mode to Cool.
 - ③ To set desired temperature, press SET TEMP.button.
- NOTE :** Set temperature changes by 2°F in the range 65~87°F, each time SET TEMP. button is pressed.

<COOL operation time chart>



※1 Even if the room temperature displayed on remote controller rises above the set temperature during this period, the compressor will not start until this period has ended.

(1) Compressor control

① 3-minute time delay

To prevent overload, the compressor will not start within 3 minutes after stop.

② The compressor runs when room temperature is higher than set temperature.

The compressor stops when room temperature is equal to or lower than the set temperature.

The compressor maintains the previous state when the room temperature minus the set temperature is 0 degrees or more, or lower than 2 degrees.

③ The compressor stops in check mode or during protective functions.

④ Coil frost prevention

To prevent indoor coil frost, the compressor will stop when the indoor coil thermistor (RT2) reads 34°F or below after the compressor has been continuously operated for at least 16 minutes or more. When the indoor coil temperature rises to 50°F or above, the compressor will start in a 3-minute(*2) time delay.

*2 When the indoor coil temperature is 30°F or less, the compressor starts in 6 minutes.

NOTE : By turning OFF the dip switch SW1-3 on indoor controller board, the start temperature of coil frost prevention changes from 34°F to 36°F.

⑤ Coil frost protection

When indoor coil temperature becomes 5°F or below, coil frost protection will proceed as follows.

<Start condition>

After the compressor has been continuously operated for 3 minutes or more, and the indoor coil temperature has been 5°F or below for 3 minutes, the coil frost protection will start.

<Coil frost protection>

Compressor stops for 6 minutes, and then restarts.

If the start condition is satisfied again during the first 10 minutes of compressor operation, both the indoor and outdoor units stop, displaying a check code of "P6" on the remote controller.

<Termination conditions>

Coil frost protection is released when the start condition is not satisfied again during the allowance, or when the COOL mode stops or changes to another mode.

(2) Indoor fan control

Indoor fan speed depends on the remote controller setting.

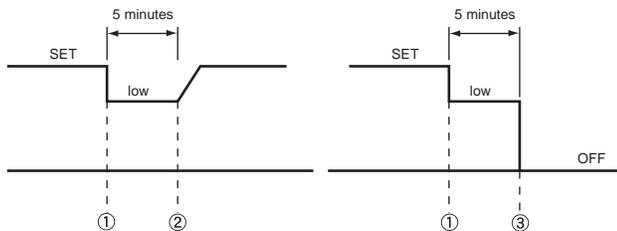
However, if an outdoor unit abnormality is detected, the indoor fan speed will be low, regardless of the remote controller setting.

When the outdoor unit abnormality detection is released and the fan speed returns to the set speed, the quiet cycle control will work.

(a) Normal control

(i) Fan speed depends on the remote controller setting regardless of the thermostat on/off.

(ii) Fan speed will remain on low if an abnormality in outdoor unit is detected. (5 minutes)



- ① Start-up of outdoor unit abnormality detection.
- ② Release of outdoor unit abnormality detection.
- ③ Unit stop due to outdoor unit abnormality with P8 indication.

NOTE 1 : Fan stops immediately if the unit stops or the check mode is started.

(3) Auto vane control

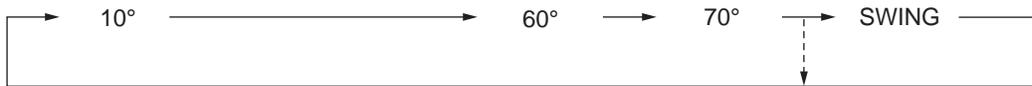
Auto vane position is set to 10 degrees airflow at the start-up of COOL operation. It can then be changed by the remote controller.

(a) Vane position set mode & swing mode.

(i) Every time AIR DISCHARGE button is pressed, setting will be change.

(ii) Airflow direction can be changed with AIR DISCHARGED button.

① Fan speed : LOW



PK12FK3 does not provide SWING function.

② Fan speed : HIGH



PK12FK3 does not provide SWING function.

<AUTO RETURN>

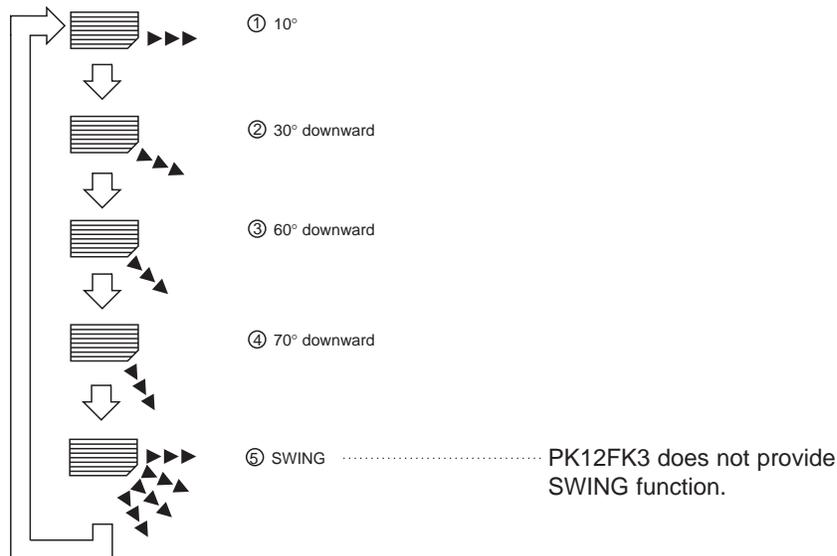
When discharge 60° or 70° continues for 1 hour with the fan speed at LOW, the discharge direction turns to the horizontal discharge automatically.

After that, 60° or 70° is available by setting with the remote controller, and it continues for 1 hour.

If the discharge direction changes from 60° or 70°, the direction returns to the horizontal discharge when 1 hour has passed since the discharge 60° started.

If the discharge direction changes from 60° (or 70°) to the horizontal discharge, the 1-hour timer to return the horizontal discharge is cancelled.

<Remote controller display>



PK12FK3 does not provide SWING function.

Changes by pressing the AIR DISCHARGE button.

(4) Detecting abnormalities in the outdoor unit

After the compressor has been continuously operated for 3 minutes, if the difference between the indoor coil temperature and room temperature is out of RANGE C for 1 minute, the indoor fan speed will turn to low. Five minutes later, if the difference is still out of

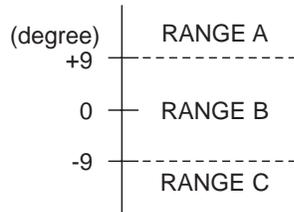
RANGE C, the outdoor unit is functioning abnormally. Thus, the compressor stops and check code "P8" appears on remote controller.

RANGE A : Pipe temperature is more than 9 degrees above room temperature.

RANGE B : Pipe temperature is within 9 degrees either way of room temperature.

RANGE C : Pipe temperature is more than 9 degrees below room temperature.

Pipe temperature
minus room temperature



1. TROUBLE IN TEST RUN

Symptom	Cause	Check points																				
The display "CENTRALLY CONTROLLED" on remote controller does not disappear.	<ol style="list-style-type: none"> 1) Wrong address setting of remote controller/indoor controller board. 2) Timer adapter is connected to the remote controller. 3) Signal transmission error between indoor unit and remote controller. 	<ol style="list-style-type: none"> 1) Check the address setting of remote controller and indoor controller. 2) Make sure the timer adapter is used correctly. 3) ① Turn another remote controller's DIP SW17-7 ON to make it sub controller. ② Connect the sub controller to the unit, and turn circuit breaker ON. ● If the display "centrally controlled" disappears, replace the original remote controller. ● If the display remains the same, replace the indoor controller board. 																				
When remote controller POWER button is turned ON, the check code "E0" appears.	<ol style="list-style-type: none"> 1) Signal transmission error between indoor unit and remote controller 	<ol style="list-style-type: none"> 1) ① Connect a sub remote controller. ② Turn circuit breaker ON. If the display "centrally controlled" remains, replace the indoor controller board. ③ If the display disappears, turn the remote controller POWER button ON and check as follows. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>Remote controller</th> <th>Sub remote controller</th> <th>Malfunction</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Operating Display</td> <td>E0 Display</td> <td>Malfunction of indoor Unit</td> </tr> <tr> <td>2</td> <td>Operating Display</td> <td>Operating Display</td> <td>Malfunction of Remote controller</td> </tr> <tr> <td>3</td> <td>No Display</td> <td>E0 Display</td> <td>Malfunction of indoor Unit and Remote Controller</td> </tr> <tr> <td>4</td> <td>No Display</td> <td>Operating Display</td> <td>Malfunction of Remote controller</td> </tr> </tbody> </table>		Remote controller	Sub remote controller	Malfunction	1	Operating Display	E0 Display	Malfunction of indoor Unit	2	Operating Display	Operating Display	Malfunction of Remote controller	3	No Display	E0 Display	Malfunction of indoor Unit and Remote Controller	4	No Display	Operating Display	Malfunction of Remote controller
	Remote controller	Sub remote controller	Malfunction																			
1	Operating Display	E0 Display	Malfunction of indoor Unit																			
2	Operating Display	Operating Display	Malfunction of Remote controller																			
3	No Display	E0 Display	Malfunction of indoor Unit and Remote Controller																			
4	No Display	Operating Display	Malfunction of Remote controller																			
When remote controller POWER button is turned ON, operating display appears, but disappears soon.	<ol style="list-style-type: none"> 1) Short circuit of indoor/outdoor connecting wire 2) Short circuit of transmission wire. 3) Wrong operation of remote controller due to noise wave emitted by other appliances. 	<ol style="list-style-type: none"> 1), 2) Check the wire 3) Turn the circuit breaker OFF, and then turn ON. If the remote controller remains abnormal, despite the above measures, replace the indoor controller board. 																				
Despite turning POWER button ON, the remote controller display does not appear.	<ol style="list-style-type: none"> 1) Damaged remote controller. 2) Short circuit of transmission wire. 3) Bad contact of indoor CN40. 4) CN40 is attached to a sub unit. 5) Damaged power board. 6) Bad contact of CN2D. 7) Blown fuse. 8) Circuit breaker OFF. 	<ol style="list-style-type: none"> 1) Measure the voltage between terminals of remote controller. If no voltage, remove the terminals and measure the voltage between wires. If the voltage is between 6VDC and 12V, replace the remote controller. 2) ~ 8) Check each point. If it is not defective, replace the indoor controller board. 																				

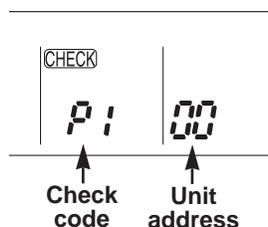
2. SELF DIAGNOSTIC FUNCTION WITH REMOTE CONTROLLER (WIRED REMOTE CONTROLLER)

2-1 When malfunction occurs during operation

When a malfunction occurs, the indoor and outdoor units stop and the malfunction is displayed on the LCD of the remote controller.

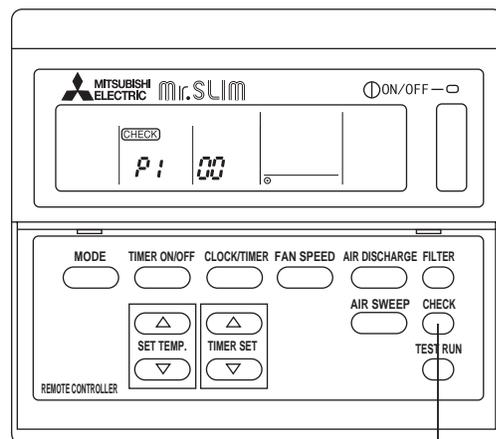
- (1) ON the set temperature display part, "CHECK" appears, and the unit address and the check code are displayed alternately at one-second intervals. (Check mode)

Example



- (2) When one remote controller controls several units in the group control, the LCD shows the unit address and check code of the first malfunctioning unit.
- (3) To cancel the check mode, press the \odot ON/OFF button. In remote ON/OFF control, press the remote \odot ON/OFF switch. In centralised control, turn OFF the \odot ON/OFF button of centralised controller.

CHECK mode



NOTE: The latest check code is memorised, even if the check mode is cancelled by the way mentioned above. It takes 60 seconds maximum to display the memorised check code.

2-2 How to use the self diagnostic function for service

A. For normal control with one unit and one remote controller

- (1) Pressing the CHECK button on the remote controller twice starts the self diagnostic function.
- (2) During the self diagnostic function, "CHECK MODE" appears at two positions on the remote controller display. Then, at least 10 seconds later, the unit address and the check code is alternately displayed at one-second intervals.
- (3) Check and repair the unit according to the check code. (Refer to the next page.)

B. For group control using one remote controller

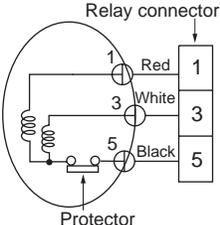
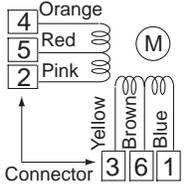
- (1) Pressing the CHECK button on the remote controller twice starts the self diagnostic function.
- (2) Press the \triangle SET TEMP. button or ∇ SET TEMP. button on the remote controller to advance or go back to the unit address. Each time \triangle SET TEMP. button is pressed, the unit address advances by one. Each time ∇ SET TEMP. button is pressed, the unit address goes back by one.
The check code and the unit address, appear alternately.
- (3) The check code "U8" means no malfunction has occurred since installation.
The check code "E0" means the following conditions:
 - The unit address displayed on the remote controller does not apply to any unit.
 - power is not supplied to the unit.
 - Signal transmitting/receiving circuit is abnormal.
- (4) Check and repair the unit according to the check code. (Refer to the next page.)

Check code	Diagnosis of malfunction	Cause	Check points
E0	Signal transmitting/receiving error (Indoor controller does not respond to remote controller signal.)	During individual unit control 1) Bad contact of transmission wire 2) Signal transmitting/receiving circuit is abnormal.	1) Check the transmission wire. 2) Check with another remote controller. If "E0" is still indicated, replace the indoor controller board. If other check code appears, replace the original remote controller.
P1	Abnormality of room temperature thermistor (RT1)	1) Bad contact of thermistor 2) Damaged thermistor	1) Check the thermistor. 2) Measure the resistance of the thermistor. Normal resistance should be as follows. 32°F.....15kΩ 86°F.....4.3kΩ 50°F.....9.6kΩ 104°F...3.0kΩ 68°F.....6.3kΩ If the resistance is normal, replace the indoor controller board.
P2	Abnormality of indoor coil thermistor (RT2)		
P3	Signal transmission error (Remote controller does not respond to indoor controller signal.)	1) Bad contact of transmission wire 2) Signal transmitting/receiving circuit is abnormal. 3) Wrong operation due to noise wave emitted by other appliances	1) Check the transmission wire. 2) Check with another remote controller. If "P3" is still indicated, replace the indoor board. If other check code appears, replace the original remote controller. 3) Short-circuit between ① and ② of CN40 and attach CN40 to the following units. ● Second unit in twin control ● Second and third units in triple control ● Sub units in group control
P4	Abnormality of drain sensor	1) Bad contact of transmission wire 2) Damaged thermistor	1) Check the connector. 2) Measure the resistance of the thermistor ① - ③. 32°F ...6kΩ 59°F ...3.2kΩ 86°F ...1.8kΩ 41°F ...4.8kΩ 68°F ...2.6kΩ 95°F ...1.5kΩ 50°F ...3.9kΩ 77°F ...2.2kΩ 104°F 1.3kΩ If the resistance is normal, replace the indoor controller board.
P5	Malfunction of drain pump	1) Malfunction of drain pump 2) Damaged drain sensor	1) Check the drain pump. 2) Check the drain sensor. (Check the drop of water is on.) If the resistance is normal, replace the indoor controller board.
P6	Freezing protection/overheating protection is working.	1) Short cycle of air cycle 2) Dirty air filter 3) Damaged fan 4) Abnormal refrigerant	1) Clear obstructions from the air cycle. 2) Clean the air filter 3) Check the fan. 4) Check the refrigerant temperature.
P7	System error	1) Wrong address-setting 2) Signal transmitting/receiving circuit of remote controller is abnormal. 3) Wrong SW6-setting	1) Check the address-setting. 2) Check with another remote controller. If check code other than "P7" appears, replace the original remote controller. 3) Check SW6 setting.
P8	Abnormality in outdoor unit	1) Wrong wiring of indoor/outdoor connecting wire 2) Reversed phase 3) Protection device is working 4) Damaged outdoor coil thermistor	1) Check the indoor/outdoor connecting wire. 2) Change the connection of electric wiring. 3) Check the protection device. 4) Measure the resistance of the outdoor coil thermistor. If the resistance is normal, replace the outdoor controller board.

4. OTHER TROUBLES AND CAUSES



5. HOW TO CHECK THE PARTS

Parts name	Check points																					
Room temperature thermistor (RT1) Pipe temperature thermistor (RT2)	<p>Disconnect the connector, then measure the resistance using a tester. (Surrounding temperature 50°F to 86°F)</p> <table border="1"> <tr> <td>Normal</td> <td>Abnormal</td> <td rowspan="2">(Refer to the thermistor)</td> </tr> <tr> <td>4.3kΩ to 9.6kΩ</td> <td>Open or short</td> </tr> </table>	Normal	Abnormal	(Refer to the thermistor)	4.3kΩ to 9.6kΩ	Open or short																
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Fan motor (MF) 	<p>Measure the resistance between the terminals using a tester. (Surrounding temperature 68°F)</p> <table border="1"> <tr> <th rowspan="2">Motor terminal or Relay connector</th> <th colspan="3">Normal</th> <th rowspan="2">Abnormal</th> </tr> <tr> <th colspan="3">PK</th> </tr> <tr> <td></td> <td>12FK3</td> <td>18,24FK3</td> <td>30,36FK3</td> <td rowspan="3">Open or short</td> </tr> <tr> <td>Red-Black</td> <td>34.81Ω±10%</td> <td>33.1Ω±10%</td> <td>22.0Ω±10%</td> </tr> <tr> <td>White-Black</td> <td>40.84Ω±10%</td> <td>30.8Ω±10%</td> <td>30.7Ω±10%</td> </tr> </table> <p>Opening and closing temperature of protector. Open: 266±41°F (Fan motor OFF) Close: 176±68°F (Fan motor ON)</p>	Motor terminal or Relay connector	Normal			Abnormal	PK				12FK3	18,24FK3	30,36FK3	Open or short	Red-Black	34.81Ω±10%	33.1Ω±10%	22.0Ω±10%	White-Black	40.84Ω±10%	30.8Ω±10%	30.7Ω±10%
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Vane motor (MV) 	<p>Measure the resistance between the terminals using a tester. (Surrounding temperature 68°F to 86°F)</p> <table border="1"> <tr> <th></th> <th>Normal</th> <th>Abnormal</th> </tr> <tr> <td>Brown-Yellow</td> <td rowspan="4">186 to 214Ω</td> <td rowspan="4">Open or short</td> </tr> <tr> <td>Brown-Blue</td> </tr> <tr> <td>Red-Orange</td> </tr> <tr> <td>Red-Pink</td> </tr> </table>		Normal	Abnormal	Brown-Yellow	186 to 214Ω	Open or short	Brown-Blue	Red-Orange	Red-Pink												
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Brown-Yellow	186 to 214Ω	Open or short																				
Brown-Blue																						
Red-Orange																						
Red-Pink																						

<Thermistor Characteristic graph>

Thermistor for lower temperature

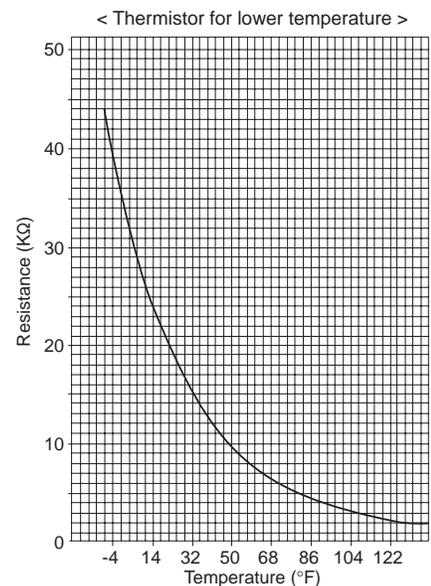
Room temperature thermistor(RT1)
Pipe temperature thermistor(RT2)

Thermistor R₀=15kΩ ± 3%

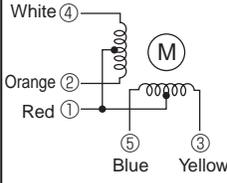
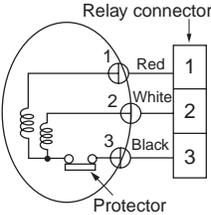
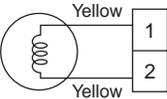
Fixed number of B=3480kΩ ± 2%

$$R_t = 15 \exp \left\{ 3480 \left(\frac{1}{273+t} - \frac{1}{273} \right) \right\}$$

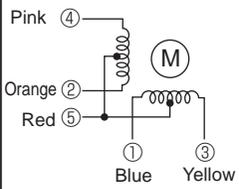
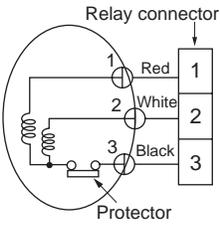
32°F	15kΩ
50°F	9.6kΩ
68°F	6.3kΩ
77°F	5.4kΩ
86°F	4.3kΩ
104°F	3.0kΩ



4. How to check the parts PL12AK/PL18AK/PL24AK/PL30AK/PL36AK/PL42AK

Parts name	Check points																
Room temperature thermistor (RT1) Liquid pipe thermistor (RT2)	Disconnect the connector then measure the resistance using a tester. (Surrounding temperature 50°F~86°F) <table border="1" style="margin-left: 20px;"> <tr> <td>Normal</td> <td>Abnormal</td> <td rowspan="2">(Refer to the thermistor)</td> </tr> <tr> <td>4.3kΩ~9.6kΩ</td> <td>Open or short</td> </tr> </table>	Normal	Abnormal	(Refer to the thermistor)	4.3kΩ~9.6kΩ	Open or short											
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Fan motor 	Measure the resistance between the terminals using a tester. <table border="1" style="margin-left: 20px;"> <tr> <th rowspan="2">Motor terminal or Relay connector</th> <th colspan="2">Normal</th> <th rowspan="2">Abnormal</th> </tr> <tr> <th colspan="2">PL</th> </tr> <tr> <td></td> <th>12/18AK</th> <th>24/36/42AK</th> <td rowspan="3">Open or short</td> </tr> <tr> <td>Red-Black</td> <td>21.7Ω</td> <td>8.5Ω</td> </tr> <tr> <td>White-Black</td> <td>26.5Ω</td> <td>12.2Ω</td> </tr> </table>	Motor terminal or Relay connector	Normal		Abnormal	PL			12/18AK	24/36/42AK	Open or short	Red-Black	21.7Ω	8.5Ω	White-Black	26.5Ω	12.2Ω
Motor terminal or Relay connector	Normal		Abnormal														
	PL																
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Drain pump 	Measure the resistance between the terminals using a tester. (Surrounding temperature 68°F~86°F) <table border="1" style="margin-left: 20px;"> <tr> <td>Normal</td> <td>Abnormal</td> </tr> <tr> <td>101Ω</td> <td>Open or short</td> </tr> </table>	Normal	Abnormal	101Ω	Open or short												
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Drain sensor 	Measure the resistance between the terminals using a tester. (Surrounding temperature 50°F~86°F) <table border="1" style="margin-left: 20px;"> <tr> <td>Normal</td> <td>Abnormal</td> <td rowspan="2">(Refer to the thermistor)</td> </tr> <tr> <td>0.6kΩ~6.0kΩ</td> <td>Open or short</td> </tr> </table>	Normal	Abnormal	(Refer to the thermistor)	0.6kΩ~6.0kΩ	Open or short											
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5. How to check the parts

Parts name	Check points																			
Room temperature thermistor (RT1)	Disconnect the connector then measure the resistance using a tester. (Ambient temperature 50°F to 86°F)																			
Liquid pipe thermistor (RT2)	<table border="1"> <tr> <td>Normal</td> <td>Abnormal</td> <td rowspan="2">(Refer to the thermistor)</td> </tr> <tr> <td>4.3kΩ to 9.6kΩ</td> <td>Open or short</td> </tr> </table>	Normal	Abnormal	(Refer to the thermistor)	4.3kΩ to 9.6kΩ	Open or short														
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4.3kΩ to 9.6kΩ	Open or short																			
Vane motor (MV)	<p>Measure the resistance between the terminals using a tester. (Ambient temperature 77°F)</p>  <table border="1"> <tr> <th rowspan="2">Connector</th> <th colspan="2">Normal</th> <th rowspan="2">Abnormal</th> </tr> <tr> <td colspan="2">PC24/30/36/42GK</td> </tr> <tr> <td>Red — Yellow</td> <td colspan="2" rowspan="4">150Ω</td> <td rowspan="4">Open or short</td> </tr> <tr> <td>Red — Blue</td> </tr> <tr> <td>Red — Orange</td> </tr> <tr> <td>Red — Pink</td> </tr> </table>	Connector	Normal		Abnormal	PC24/30/36/42GK		Red — Yellow	150Ω		Open or short	Red — Blue	Red — Orange	Red — Pink						
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<Thermistor Characteristic graph>

Thermistor for lower temperature

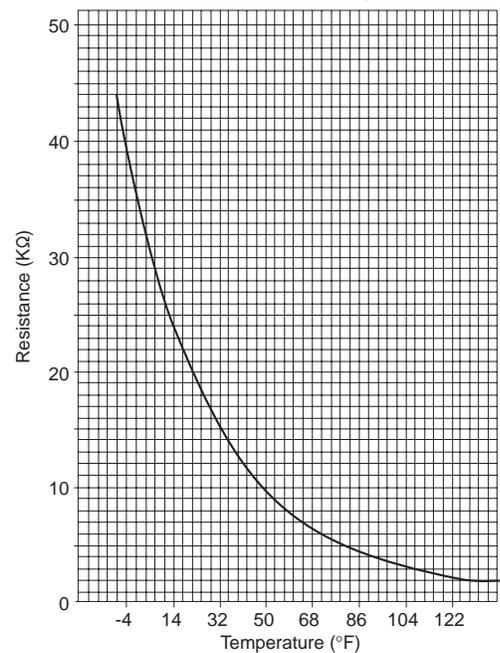
Room temperature thermistor(RT1)
Liquid pipe thermistor(RT2)

Thermistor $R_0=15k\Omega \pm 3\%$
Fixed number of $B=3480k\Omega \pm 2\%$

$$R_t = 15 \exp \left\{ 3480 \left(\frac{1}{273 + \{(t-32)/1.8\}} - \frac{1}{273} \right) \right\}$$

32°F	15kΩ
50°F	9.6kΩ
68°F	6.3kΩ
77°F	5.4kΩ
86°F	4.3kΩ
104°F	3.0kΩ

< Thermistor for lower temperature >



OUTDOOR MICROPROCESSOR CONTROL

1. Protection function

- (1) As soon as a reversed phase, an open phase, or a P. C. board trouble is sensed, the operation stops and the check code is displayed by LED on the outdoor controller board.
- (2) When a protection function such as high pressure switch and overcurrent relay works for the first time, the operation stops and restarts after 3-minute time delay mode. When the second protection function works, the operation stops and the check code is displayed by LED. This condition continues until the outdoor unit receives OFF command from the indoor controller board. Check code indication continues until the outdoor unit receives the ON command from the indoor controller board.
- (3) The second protection function is not necessary to be the same as the first one. The content of the second protection function is loaded in the memory, which is cleared when SW1 turns to ON or the next check mode starts.

2. Control by outdoor coil thermistor

(1) Unit control

Outdoor coil temperature range for control is from -40°F to 194°F . When reading 194°F or above, the outdoor coil thermistor is regarded as short-circuit. When reading -40°F or below, the outdoor coil thermistor is regarded as open-circuit. An open circuit is not sensed for the first 7 min. after the compressor start up, but is sensed during defrosting operation or for the first 10 seconds after the compressor start-up.

(2) Target temperature of outdoor coil temperature

Fan rotational frequency is controlled so that the outdoor coil temperature keeps $95^{\circ}\text{F} \pm 4^{\circ}\text{F}$.

3. Unit operation control

The compressor receives signal from the indoor unit and make the outdoor unit start or stop.

4. Fan control

Fan rotational frequency is phase-controlled so that the outdoor coil temperature reaches the target temperature. This control enables cooling operation even if the outdoor temperature is low. Fan rotational frequency is adjusted by fan output. Fan output is divided into 256 steps from 0 to 255 and is controlled every 30 seconds.

(1) Initial setting

A. When power is turned to on, or when the compressor restarts after interval of 30 minutes or more :

- If the outdoor coil thermistor reads 46°F or above, the fan output step becomes 100.
- If the outdoor coil thermistor reads below 46°F , the fan output step becomes 200.

B. When the compressor restarts within 30 minutes after stop, the fan output step is the same as the fan output before the compressor stops.

C. When the operation mode is changed within 30 minutes after the compressor stop, the fan output step becomes 100.

D. When the operation mode is changed after the compressor interval of more than 30 minutes, the fan output step is the same as described in A.

(2) For the first 2 minutes after the compressor start-up, the fan operates at the initial setting output, and then every other 30 seconds, the fan output is adjusted depending on the difference between the outdoor coil temperature and the target temperature. But as soon as the outdoor coil temperature becomes 122°F or above, the fan output step becomes 255.

(3) When the outdoor coil thermistor reads 122°F or above, the fan output step becomes 255.

(4) When the high pressure switch (63H1) functions, the fan output step becomes 255. After that, when the switch returns, the fan control returns to the normal control.

5. Crankcase heater control

(1) With jumper wire J3

The crankcase heater is ON from the power is turned to on till the compressor starts, and turns to ON 1 hour after the compressor stop.

(2) Without jumper wire J3

The crankcase heater is ON from the power is turned to on till the compressor starts, and repeats ON/OFF on a 1-hour schedule.

6. Fixed fan-output

While the compressor is operating and the fan output step is indicated by LED, pushing SW2 fixes the fan output of that time. The fixed fan-output can be released when either of the following conditions is satisfied.

- ① SW2 is pushed again.
- ② SW3 setting is changed.
- ③ The compressor stops.

7. Function of switches on the outdoor controller board

SW1 : Clears the check code memory (push-button switch)
SW2 : Switches the output state indication and the check code display (push-button switch)
SW3-1and3- 2 : Switches the output state indication items (dip-switch)
For further information, please refer to page 18.

8. Operation during the power-on-reset state

(1) When the circuit breaker is turned to ON, the microprocessor enters the power-on-reset state, which continues until the direct current for the microprocessor control reaches 12V.

Then the microprocessor starts operation in the following order.

- ① Each I/O port clearance
- ② Function input

Function depends on jumper wires set beforehand in the factory.

Jumper wire	Function	With jumper wire	Without jumper wire
J1	Reversed phase sensor	Sensed	Not sensed
J2	Not applied for series PU		
J3	Crankcase heater control	Refer to 5 (1) on page 16.	Refer to 5 (2) on page 16.
J4	Target temperature of outdoor coil temperature	86°F For heat pump units	95°F For cooling unit

- ③ Check for a reversed phase
- ④ Check for an open phase (with J1)
- ⑤ 50/60Hz judgment
- ⑥ EEPROM data loading (check mode, and total time of compressor operation)
- ⑦ Coil temperature initial input

(2) If an open phase or a reversed phase is sensed, LED blinks every other second.

NOTE

- ✳ If power is not supplied to the transformer and the microprocessor, the microprocessor does not work and can sense neither a reversed phase nor an open phase.
- ✳ If a contact point of protective device such as the high pressure switch has already been opened in the power-on-reset state, it is regarded as an open phase.
In this case, all LED are OFF.

9. 100% fan output

Fan output is fixed to 255 (100%) by shorting CN22. However, the fan stops during compressor OFF or defrosting operation. Open circuit of CN22 enables the fan control to start.

10. Time shortening

Short circuit of CN21 shortens the time listed below.

- 1) Fan control period : 30 sec. → 3 sec.
- 2) Three-minute time delay function : 3 min. → 3 sec.
- 3) Compressor ON/OFF time for bypass valve ON/OFF : 30 min. → 30 sec.
- 4) Compressor ON time to start other functions : x min. → x sec.

1.SERVICE DATA INDICATION BY SWITCHES ON OUTDOOR CONTROLLER BOARD

Setting dip switches SW2 and SW3 on the outdoor controller board enables LED to show the output state and check code. Output state is shown by LED lighting, and check code by blinking.

SW1 : Turning SW1 ON clears the check code. If SW1 is turned ON while the check code is blinking , the indication changes to output state indication.

NOTE : SW1 is usually available independent of SW3 setting. As an exception, when the check code shows a reversed phase or an open phase during the power-on-reset state, SW1 is not available.

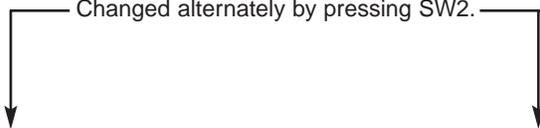
SW2 : SW2 is turned ON by pressing, and OFF by releasing.

When SW3-1 and SW3-2 are OFF, pressing SW2 changes indication between output state and check code alternately.

When SW2 is turned On with SW3-1 OFF and SW3-2 ON, the compulsory defrosting starts.

SW3 : Output state indication items depend on the combination of SW3-1 ON/OFF and SW3-2 ON/OFF.

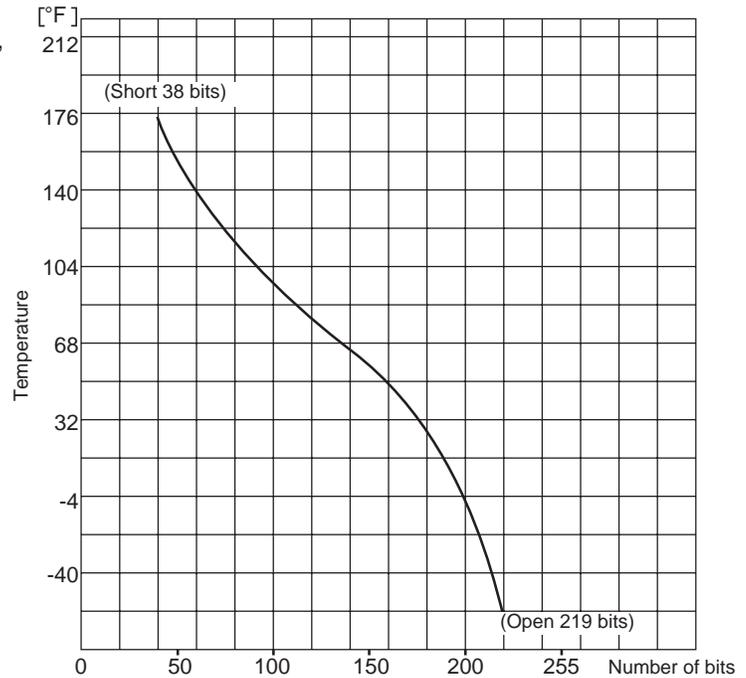
Changed alternately by pressing SW2.



	Check code	Output state	Outdoor coil temperature (bit)	Fan output step (bit)	Total time of compressor operation(Hr)
SW3-1	OFF	OFF	OFF	ON	ON
SW3-2	OFF	OFF	ON	OFF	ON
LED	Blinking	Lighting			
LD1	Reversed phase	Compressor ON command from indoor controller	1	1	256
LD2	Open phase	Heating operation command from indoor controller	2	2	512
LD3	Outdoor coil thermistor is abnormal.	During 63H1 function	4	4	1024
LD4	63H2 function	Compressor ON	8	8	2048
LD5	51C function	Outdoor fan ON	16	16	4096
LD6	26C function	4-way valve ON	32	32	8192
LD7	Overheat protection	Bypass valve ON	64	64	16384
LD8	Input circuit on controller board is abnormal	Crankcase heater ON	128	128	32768

1-1 Outdoor coil temperature

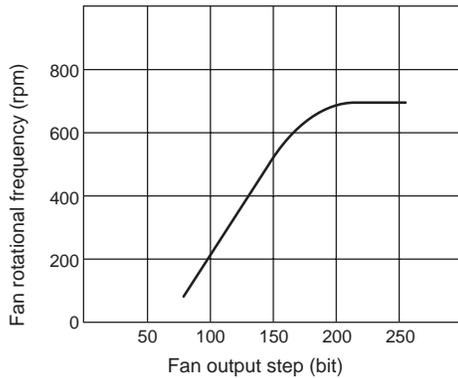
To obtain data on the outdoor coil temperature, add the number of bits of lighting LEDs, and see the graph to find the temperature.



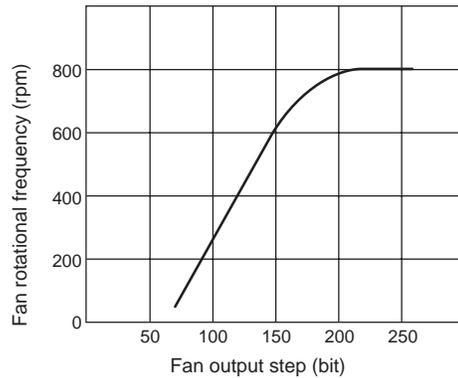
1-2 Fan output step

To obtain data on the fan output step, add the number of bits of lighting LEDs, and see the graph below to find the fan rotational frequency.

① PU12/24/30EK
PU24/30EK₁



② PU18/36EK, PU42EK2, PU42EK7
PU18/36EK₁, PU42EK2₁



1-3 Total time of compressor operation

Compressor operation time is indicated in 256 hour units. To obtain the compressor operation time, add the hours of lighting LEDs. During the compressor operation time indication, SW2 is not available.

1-4 Check code indication

- When a protection function works for the first time during operation, the operation stops and restarts after the 3-minutes time delay mode. When the protection function works again, the operation stops. (Check mode) When both SW3-1 and SW3-2 are OFF, the check code is indicated.
- If the outdoor controller board receives the compressor ON command from the indoor controller board during check mode the indication changes to output state indication.
- By pressing SW2 during normal operation, operation will continue.
- The latest check code is indicated.

2. TROUBLESHOOTING ACCORDING TO CHECK CODE

Blinking LED	Diagnosis of malfunction	Cause	Check point
LD1	Reversed phase	This model does not have this function.	No need to be checked.
LD2	Open phase	This model does not have this function.	No need to be checked.
LD3	Outdoor coil thermistor is abnormal. (Open circuit or short circuit)	<ul style="list-style-type: none"> ● Outdoor coil thermistor is broken. ● Thermistor was connected incorrectly. 	<ul style="list-style-type: none"> ● Measure the resistance of the thermistor. ● Check the thermistor. If normal, replace the outdoor controller board.
LD4	High pressure switch (63H2) function	<ul style="list-style-type: none"> ● 63H2 was badly connected. ● 63H2 was working. 	<ul style="list-style-type: none"> ● Check 63H2 and the outdoor fan motor. ● Check if refrigerant supply is low. ● Check if air cycle is short-cycled.
LD5	Thermal relay function	This model does not have this function.	No need to be checked.
LD6	Thermal switch (26C) function.	<ul style="list-style-type: none"> ● 26C was connected incorrectly. ● 26C is working. 	<ul style="list-style-type: none"> ● Check 26C. ● Check if refrigerant supply is low. ● Check if the capillary tube is clogged.
LD7	Over heat protection	<ul style="list-style-type: none"> ● The thermistor is broken. ● Coil temperature is over 153°F. 	<ul style="list-style-type: none"> ● Measure the resistance of the thermistor. ● Check the outdoor fan motor. ● Check if air cycle is short-cycled.
LD8	Input circuit of outdoor controller board is abnormal.	<ul style="list-style-type: none"> ● Pulse input is abnormal. 	<ul style="list-style-type: none"> ● Replace the outdoor controller board.

3. WHEN OUTDOOR UNIT DOES NOT WORK

Cause	Check points
1) Indoor/outdoor connecting wires are poorly connected. (Refer to next page.) 2) Power supply is poorly connected. 3) Connector or transformer is broken. 4) Fuse (6A) in the outdoor controller board is blown.	1) Check the connecting wires. 2) Check the power supply. 3) Check connector and transformers. 4) Check the fuse.

4. WRONG WIRING ON SITE

4-1 Between remote controller and indoor unit

If wire is disconnected between the remote controller and the indoor unit, the POWER ON display does not appear despite turning the power switch ON. The beep sound is not heard, either.

4-2 Phenomena due to wrong wiring between indoor and outdoor units

Wrong wiring	Thermostat	Phenomena
	OFF	The outdoor unit stops.
	ON	Operation stops. 9 minutes later, the check code "P8" appears on the remote controller display.
Disconnect between 1 and 1 or 2 and 2.	OFF	Operation stops.
	ON	9 minutes later, the check code "P8" appears on the remote controller display.

5. HOW TO CHECK THE PARTS **PU12,18,24,30,36EK** **PU42EK2** **PU42EK7** **PU18,24,30,36EK₁** **PU42EK2₁**

OUTDOOR UNIT

Parts name	Check points																					
OUTDOOR COIL THERMISTOR (TH3)	Disconnect the connector then measure the resistance using a tester. (Surrounding temperature 50°F~86°F) <table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Normal</th> <th>Abnormal</th> </tr> </thead> <tbody> <tr> <td>4.3kΩ~9.6kΩ</td> <td>Open or short</td> </tr> </tbody> </table>	Normal	Abnormal	4.3kΩ~9.6kΩ	Open or short																	
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4.3kΩ~9.6kΩ	Open or short																					
FAN MOTOR(MF,1,2,3,4) [PU12,18,24,30] [PU36,42]	Measure the resistance between the terminals using a tester. (Surrounding temperature 68°F) <table border="1" style="margin-top: 10px;"> <thead> <tr> <th rowspan="2">Motor terminal OR Relay connector</th> <th colspan="4">Normal</th> <th rowspan="2">Abnormal</th> </tr> <tr> <th>PU12,18</th> <th>PU24,30</th> <th>PU36</th> <th>PU42</th> </tr> </thead> <tbody> <tr> <td>White – Blue</td> <td>77.3Ω</td> <td>100.2Ω</td> <td>73.9Ω</td> <td>61.5Ω</td> <td rowspan="2">Open or short</td> </tr> <tr> <td>Blue – Red (Brown)</td> <td>134.6Ω</td> <td>83.8Ω</td> <td>118.7Ω</td> <td>79.8Ω</td> </tr> </tbody> </table>	Motor terminal OR Relay connector	Normal				Abnormal	PU12,18	PU24,30	PU36	PU42	White – Blue	77.3Ω	100.2Ω	73.9Ω	61.5Ω	Open or short	Blue – Red (Brown)	134.6Ω	83.8Ω	118.7Ω	79.8Ω
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Blue – Red (Brown)	134.6Ω	83.8Ω	118.7Ω	79.8Ω																		
CRANKCASE HEATER (HC)	Measure the resistance between the terminals using a tester. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th colspan="2">Normal</th> <th rowspan="2">Abnormal</th> </tr> <tr> <th>PU12,18</th> <th>PU24,30,36,42</th> </tr> </thead> <tbody> <tr> <td>1920Ω</td> <td>1340Ω</td> <td>Open or short</td> </tr> </tbody> </table>	Normal		Abnormal	PU12,18	PU24,30,36,42	1920Ω	1340Ω	Open or short													
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