

## SERVICE MANUAL

# AIR-CONDITIONER

## CONTROLS

### BUILT-IN DUCT TYPE

RAV-134CH/CHR-PE/164AH-PE  
RAV-164CH/CHR-PE/264AH-PE  
RAV-264CH/CHR-PE/264AH8-PE  
RAV-364CH/CHR-PE/364AH8-PE  
RAV-464CH/CHR-PE/464AH8-PE

### CEILING TYPE

RAV-134CH/CHR-PE/134AH-PE  
RAV-164CH/CHR-PE/164AH-PE  
RAV-264CH/CHR-PE/264AH-PE  
RAV-264CH/CHR-PE/264AH8-PE  
RAV-364CH/CHR-PE/364AH8-PE  
RAV-464CH/CHR-PE/464AH8-PE

### WALL TYPE

RAV-134KH/KHR-PE/134AH-PE  
RAV-164KH/KHR-PE/164AH-PE  
RAV-264KH/KHR-PE/264AH-PE  
RAV-264KH/KHR-PE/264AH8-PE

### CARCASE TYPE

RAV-104NH-PE  
RAV-134NH-PE/134AH-PE  
RAV-164NH-PE/164AH-PE  
RAV-264NH-PE/264AH-PE  
RAV-264NH-PE/264AH8-PE

### LOW WALL/PAINTED FLOOR TYPE

RAV-164SH/SHR-PE/164AH-PE  
RAV-264SH/SHR-PE/264AH-PE  
RAV-264SH/SHR-PE/264AH8-PE

### 2 WAY CASSETTE TYPE

RAV-104TUH-PE  
RAV-134TUH-PE/134AH-PE  
RAV-164TUH-PE/164AH-PE

### 4 WAY CASSETTE TYPE

RAV-164UH-PE/164AH-PE  
RAV-264UH-PE/264AH-PE  
RAV-264UH-PE/264AH8-PE  
RAV-364UH-PE/364AH8-PE  
RAV-464UH-PE/464AH8-PE



# CONTENTS

---

1.	HEAT PUMP INDOOR UNIT FUNCTION	3
2.	COOLING ONLY INDOOR UNIT FUNCTION	9
3.	OUTLINE OF HEAT PUMP OPERATION	10
4.	OUTLINE OF COOLING OPERATION	17
5.	CONTROL WIRING CONFIGURATIONS	18
6.	MALFUNCTION CODES	22

## SUMMARY

---

The units referred to within this Manual conform with the protection requirements of Directives 89/336/EEC Electromagnetic Compatibility and 73/23/EEC Low Voltage.

Operating conditions of units are as follows:

OUTDOOR TEMPERATURE	-2 to 43°C
ROOM TEMPERATURE	18 to 32°C
ROOM HUMIDITY	LESS THAN 80%

**Note 1:** For details on Heat Pump Units, refer to Service Manual A90-9923.

**Note 2:** For details on Cooling Only Units, refer to Service Manual A90-9924.

# 1. HEAT PUMP INDOOR UNIT FUNCTION

---

## Indoor PCB Layout

The AI indoor printed circuit board provides an electrical interface between the controllers and the outdoor unit. The PCB controls all of the other electrical items, such as the circulating fans, condensate lift pumps and louver motor.

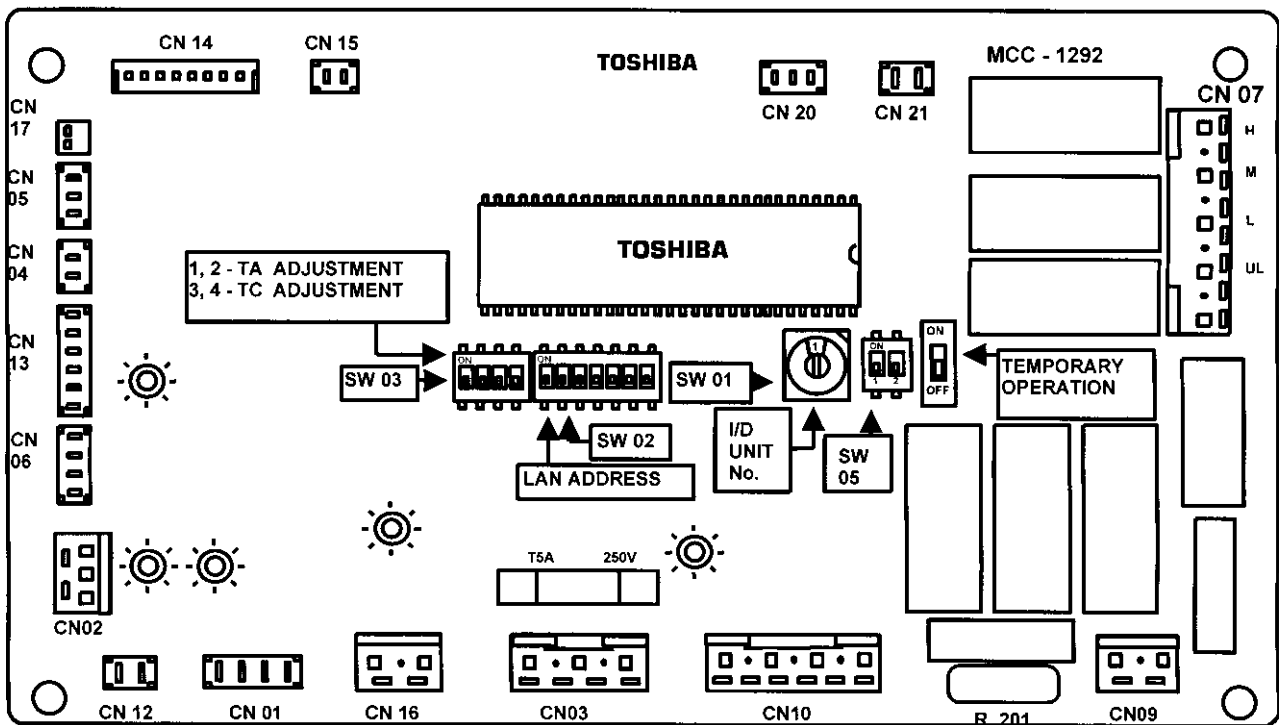
It is necessary for the installing and service technician to understand the function of this PCB, how to set it up for operation and how to diagnose faults.

It has visual indication by means of LED's of the status of the analogue serial signal communication between the outdoor section and the controller. It is also equipped with DIP switches whereby the operating control choices can be made.

These instructions explain:

- The purposes of these switches, their positions on the PCB and how to set them.
- The function of LED indicators.

## PCB Layout



### PCB SET - UP SYSTEM ADDRESS SWITCHES

The PCB is equipped with several switches for setting the unit up their function is outlined below. The LED's indicate the Unit status data transfer and any emergency conditions.

- Switch SW01 – Unit Number for group Control.
- Switch SW02 – LAN Address selector.
- Switch SW03 – High temperature trip / Heating set - up selector.
- Switch SW04 – Service override.
- Switch SW05 – Auto Restriction / Twin Selection.

**When making any adjustments to any switch the supply power to the unit must be turned off. Restoration of power registers the new settings. New settings cannot be registered until this is done.**

## Switch SWO1

16 Position selector used when in-group control.

Position 1 –	Master
Position 2 –	Slave no: 1
Position 3 –	Slave no: 2
Position 4 –	Slave No: 3 ...etc.

Maximum 16 indoor units in one group, including the master unit.

Group Control allows up to sixteen indoor units to be controlled from one remote controller. Units in a group will always obey any command signals given by the master unit, although they will cycle in heating or cooling according to their local requirements. Twin units will always follow instructions from the master. A group may use twin units, single units or a combination of both; whichever is chosen, the basic rules remain the same.

The advantages of group control is that it will minimise conflicting commands in a large installation and allow a simpler and more economical form of control, especially in open plan areas where one control set point is desired.

A Master unit must always be selected as No: 1; slave units can be selected in any order provided that the same number is not duplicated on the same group.

## Switch SW02

7 Bit DIP switch configures the Local Area Network (LAN) Address.

TABLE - 1							
SWITCH 02 - LAN ADDRESS							
Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Function
SIGNIFICANT PLACE				NOT USED ALWAYS SET SWITCHES 5 & 6 AT OFF POSITION		ON	LAN ADDRESS SET AT THE PCB
4TH	3RD	2ND	1ST			OFF	LAN ADDRESS SET AT THE CONTROLLER
OFF	OFF	OFF	OFF			ON	0000 - UNIT No: 1
ON	OFF	OFF	OFF			ON	0001 - UNIT No: 2
OFF	ON	OFF	OFF			ON	0010 - UNIT No: 3
ON	ON	OFF	OFF			ON	0011 - UNIT No: 4
OFF	OFF	ON	OFF			ON	0100 - UNIT No: 5
ON	OFF	ON	OFF			ON	0101 - UNIT No: 6
OFF	ON	ON	OFF			ON	0110 - UNIT No: 7
ON	ON	ON	OFF			ON	0111 - UNIT No: 8
OFF	OFF	OFF	ON			ON	1000 - UNIT No: 9
ON	OFF	OFF	ON			ON	1001 - UNIT No: 10
OFF	ON	OFF	ON			ON	1010 - UNIT No: 11
ON	ON	OFF	ON			ON	1011 - UNIT No: 12
OFF	OFF	ON	ON			ON	1100 - UNIT No: 13
ON	OFF	ON	ON			ON	1101 - UNIT No: 14
OFF	ON	ON	ON	ON	1110 - UNIT No: 15		
ON	ON	ON	ON	ON	1111 - UNIT No: 16		

DIP switches 1 - 4 set the indoor unit address in binary combination from 1 to 16 as shown above; the above table translates into decimal notation.

DIP switches 5 & 6 are factory set at OFF. They are not used and **must be set in the OFF position at all times**. If these switches are altered and the setting registered the address display on the centre controller will flash.

If it is not equipped with its own controller, the system incorrectly addressed will default to **fan only** until the error on switches 5 & 6 is rectified. In the event that it is connected to a room controller in addition to the centre controller, it will function according to the remote controller settings, but will not accept any commands from the central controller.

DIP switch 7 selects the location at which the addresses can be altered.

ON position - the Indoor unit PCB.

OFF position - Remote Controller.

### Switch SW03

Is a 4 Bit Dip Switch which alters the values of the TA and TC sensors.

Switch positions 1 & 2 add a compensation value to the set point displayed on the controller. The space temperature is sensed by TA is offset by this value this works in heating.

e.g. a setting of 210 combined with 40 reset will allow the sensor to control the system at 25°C.

This facility may be selected where ceiling heights in excess of 3 m. are used in order to combat temperature stratification error.

<b>TABLE - 2</b>			
<b>SWITCH 03 - SENSOR SETTINGS</b>			
<b>Position 1</b>	<b>Position 2</b>	<b>TA SENSOR Heating reset</b>	
ON	ON	No reset	
ON	OFF†	Reset + 2°	
OFF	ON	Reset + 4°	
OFF	OFF	Reset + 6°	
<b>HIGH TEMPERATURE TRIP</b>			
<b>Position 3</b>	<b>Position 4</b>	<b>Trip temp.</b>	<b>Reset temp.</b>
ON†	ON†	54° (52°)*	52° (50°)
ON	OFF	58° (56°)*	56° (54°)
OFF	ON	60° (58°)*	58° (56°)
OFF	OFF	This setting is not used	

#### † Factory setting

\* The high temperature trip operates by detecting excessive surface temperatures on the indoor coil during the heating mode. The lower trip temperature shown in brackets in each case is the threshold of the first trip, the higher temperature is the second and subsequent trips. This operation is described in the system operation section.

### Switch SW04

Temporary service Switch.

Allows the service engineer to operate the unit from the outdoor unit without setting the controller.

**IMPORTANT**  
**This switch should never be left in the ON position.**

### Switch SW05

2 Bit DIP Switch, configures multiple indoor unit operation, and allows the Automatic mode function to be deleted.

<b>TABLE - 3</b> <b>SWITCH 05</b>		
<b>Position 1</b>	OFF	SINGLE OPERATION
	ON	TWIN CONFIGURATION
<b>Position 2</b>	OFF	AUTO ENABLED
	ON	AUTO DISABLED*

- Bit 2 disables the controller's automatic function and only allows manual Heat or Cool. This facility should be selected and the Auto facility should be disabled when the indoor units are connected to 2 - pipe super multi systems. The 2 pipe Super Multi can only operate in either heating or cooling this will prevent conflicts.

For all other heat pump systems, including 3 pipe Super Multi, enable the Auto setting.

### LED Indicators

<b>TABLE - 4</b> <b>INDOOR UNIT - LED INDICATION</b>		
<b>SERIAL SIGNAL INDICATION</b>		
<b>D – 14 ORANGE</b>	IRREGULAR FLICKER	OUTDOOR UNIT TO INDOOR UNIT
<b>D – 15 GREEN</b>	IRREGULAR FLICKER	INDOOR UNIT TO OUTDOOR UNIT
<b>D – 31 ORANGE</b>	IRREGULAR FLICKER	CONTROLLER TO INDOOR UNIT (IF FITTED)
<b>D – 32 GREEN</b>	IRREGULAR FLICKER	INDOOR UNIT TO CONTROLLER (IF FITTED)
<b>FAULT INDICATION</b>		
<b>D – 40 RED</b>	OFF	UNIT NORMAL
	ON	UNIT FAULT - CHECK THE MALFUNCTION CODES

\* A fault condition exists if any of these LED's is continuously on or off. Check the codes and refer to the fault code section.



## 2. COOLING INDOOR UNIT FUNCTION

---

### Indoor PCB Layout

The cooling indoor printed circuit board provides an electrical interface between the controller, outdoor unit and other electrical items, such as the circulating fans, condensate lift pumps and louver motor this board controls the compressor in the outdoor unit by directly providing the on/off signal.

It has visual indication by means of LED of the status of the analogue serial signal communication between the controller and indoor unit. It is also equipped with a rotary switch the purpose for which is explained below.

These instructions explain:

The purposes of the rotary switch, its positions on the PCB and how to set it. It also shows the LED position that shows the communication between the controller and the indoor unit.

### PCB Layout

DRAWING TO COME???

### Switch SWO1

16 Position selector Switch used when in group control.

- Position 1 - Master
- Position 2 - Slave No: 1
- Position 3 - Slave No: 2
- Position 4 - Slave No: 3 ...etc.

Maximum 16 indoor units in one group, including the master unit.

Group Control allows up to sixteen indoor units to be controlled from one remote controller. Units in a group will always obey any command signals given by the master unit, although they will cycle in cooling according to their local requirements. Twin units will always follow instructions from the master. A group may use either twin units, single units or a combination of both; whichever is chosen, the basic rules remain the same.

The advantages of group control is that it will minimise conflicting commands in a large installation and allow a simpler and more economical form of control, especially in open plan areas where one control set point is desired.

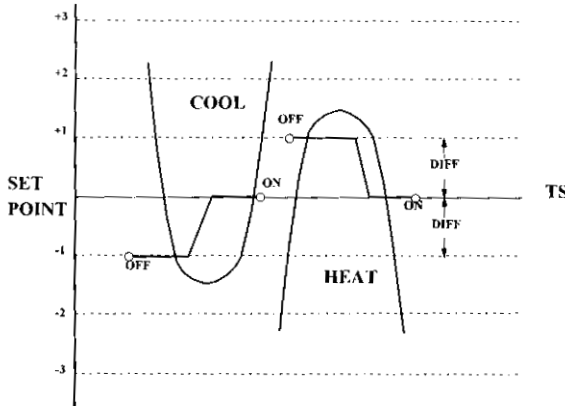
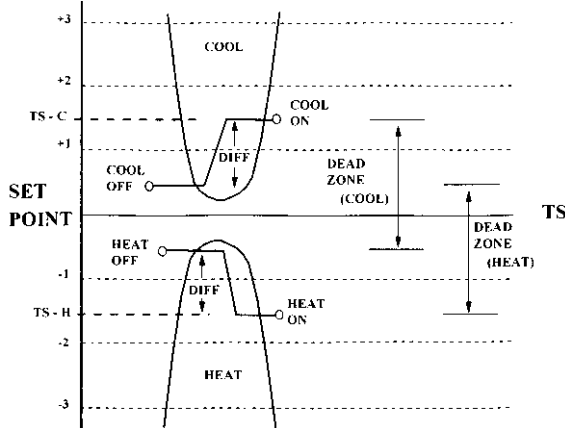
A Master unit must always be selected as No: 1; slave units can be selected in any order provided that the same number is not duplicated on the same group.

### 3. OUTLINE OF HEAT PUMP OPERATION

The Heat Pump AI systems use analogue serial signal communication as the main method of communication between the indoor, outdoor and remote control. If the Central Controller is connected the digital Local Area Network (LAN) is used.

#### Indoor Unit Control

The indoor units are controlled in accordance with the settings selected at the Remote or Central controllers. The room temperature is constantly sampled by the TA sensor, which is positioned in the return air path of each indoor unit, directly before the fan input.

<p>Compressor Control Heating or Cooling</p>	<p>The compressor will be switched on or off according to the diagram below. Where an indoor unit is connected to a super multi system a variable demand will be transmitted dependant on the difference between the TA and Ts Values.</p> 	<p>TA: Room Temperature TS: Set Temperature</p>
<p>Compressor Control Auto</p>	<p><b>Auto Mode Cooling</b> When the temperature at the TA sensor rises to a value of TSC (<math>TS + 1.5^{\circ}C</math>) the compressor starts. The unit operates in cooling until the TA sensor detects a value equal to TS plus <math>0.5^{\circ}C</math>. At this point the compressor operation stops and the system enters a dead zone. If auto fan speed has been selected, the fan will run in Low speed.</p>  <p><b>Auto Mode Heating</b> This operation acts in reverse of Auto Mode Cooling above. When the temperature sensed at TA falls to a value of TS H (<math>TS - 1.5^{\circ}C</math>) the compressor starts. The unit operates in heating until the TA sensor detects a temperature value of <math>0.5^{\circ}C</math> below TS. The compressor will stop and indoor fan speed reverts to ultra low for the duration of the dead zone.</p>	

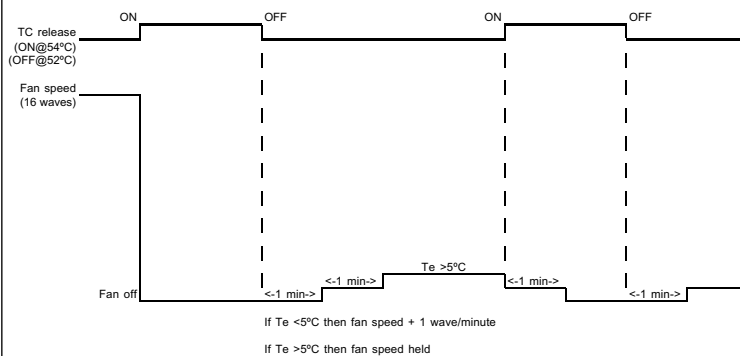
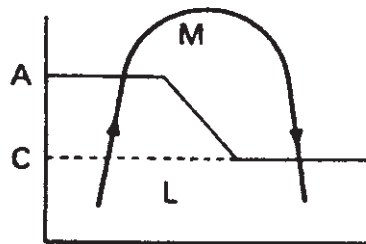
<p>Fan Operation</p>	<p>The fan speed of the indoor unit can be set to HIGH, MEDIUM, LOW or AUTO. When the demand is satisfied the fan will stop in cooling or operate in ULTRA LOW in heating. When AUTO fan Speed is selected the selection for the fan speed is made depending on the difference between Ts and TA as shown in the diagram below.</p> <p>The diagram consists of three graphs showing fan speed selection based on indoor temperature (Ts) and outdoor temperature (TA).  - <b>-Cooling-</b>: Shows three fan speed levels: "H" (High) at +2, "M" (Medium) at +1, and "L" (Low) at Ts. The fan speed is "H" when TA is above +2, "M" when TA is between +1 and +2, and "L" when TA is below +1.  - <b>-Heating-</b>: Shows three fan speed levels: "UL" (Ultra Low) at +1, "L" (Low) at Ts, and "H" (High) at -2. The fan speed is "UL" when TA is above +1, "L" when TA is between Ts and +1, and "H" when TA is below -2.  - <b>-Auto-changeover-</b>: Shows fan speed levels for different temperature ranges: "H" (High) at +3.5, "M" (Medium) at +2.5, "L" (Low) at Tsc, "UL" (Ultra Low) at -0.5, "L" (Low) at Tsh, "M" (Medium) at -2.5, and "H" (High) at -3.5. The fan speed is "H" for TA &gt; +3.5, "M" for +2.5 &lt; TA &lt; +3.5, "L" for Tsc &lt; TA &lt; +2.5, "UL" for -0.5 &lt; TA &lt; Tsc, "L" for Tsh &lt; TA &lt; -0.5, "M" for -2.5 &lt; TA &lt; Tsh, and "H" for TA &lt; -3.5.</p>	
<p>Indoor Fan Temperature Hold Off</p>	<p>In the heating modes, the indoor fan is automatically turned off if the Indoor coil surface temperature detected by the TC sensor falls below 10°. It resumes operation at low speed when the coils surface temperature reaches 26°. For full details see diagram below</p> <p>The graph shows indoor coil surface temperature in °C. Zone A is below 10°C (Fan stop), Zone B is between 10°C and 26°C (Indoor fan at "L"), and Zone C is above 26°C (Depending upon fan speed setting of the remote controller). The temperature curve shows a peak in Zone C, a drop into Zone B, and a further drop into Zone A.</p> <p>C zone: Depending upon fan speed setting of the remote controller  B zone: Indoor fan at "L"  A zone: Fan stop</p>	
<p>Indoor Heat Exchanger Frost prevention</p>	<p>When the air conditioner operates in the cooling mode the indoor heat exchanger can freeze to prevent this control is carried out as detailed below</p> <ul style="list-style-type: none"> <li>● When cooling operation is commenced the point P is made at +3°C.</li> <li>● When zone J is detected the timer starts.</li> <li>● When zone K is detected the timer is held.</li> <li>● When zone I is detected the timer is cleared</li> <li>● When the timer reaches its maximum time the point P is changed to +12°C and a check code is generated the fan speed is fixed to Ultra low until zone I is reached.</li> </ul> <p>The graph shows indoor heat exchanger temperature. Point P is at +3°C. Zone J is below -2°C, Zone K is between -2°C and P, and Zone I is above P. The temperature curve shows a drop from P into Zone J, a rise into Zone K, and a further rise into Zone I.</p>	

High Temperature Release

When performing heating operation, the following control is done based on the temperature direction of the TC and TE Sensors

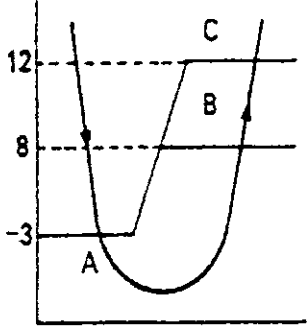
- In M zone, release signal is transmitted. Outdoor fan is controlled in accordance with the diagrams below.
- The control point for A and C can be chosen from the below table:

Dip Switch 3	ON	ON	OFF	OFF
Setting 4	ON	OFF	ON	OFF
A/C (°C)	54/52	58/56	60/58	-



On receiving first release signal ON, the fan speed is changed from full speed to off. After receiving release signal OFF, there is a 1 minute delay and then fan speed is increased by 1 wave if  $T_e < 5^\circ\text{C}$ . Fan speed continues to increase by 1 wave/minute until  $T_e > 5^\circ\text{C}$  at which point the fan speed is held constant. A subsequent release signal ON reduces the fan speed by 1 wave/minute and continues until minimum speed is reached. When release signal OFF is transmitted then after 1 minute fan speed will be increased by 1 wave if  $T_e < 5^\circ\text{C}$ .

<p>Test Operation</p>	<p>An air conditioner or a group of air conditioners can be put into a test operation this is done by holding down the on off button for 5 seconds the air conditioner will start in the previous operating mode. If a group of air conditioners are connected pressing the temperature increase keys can individually start them.</p>	<p>Test Operation</p>
<p>High Pressure switch Operation</p>	<p>In cooling operation if the high pressure switch operates for 5 seconds the condition will be registered as abnormal turning off the compressor.</p> <p>In heating operation if the high pressure switch operates for 30 seconds the condition will be registered as abnormal turning off the compressor. If the pressure switch closes within the 30 seconds the compressor will restart within 2 minutes 20 seconds and operates according to the diagram below.</p> <p>If the high pressure switch operates during the defrost the compressor turns off and returns back to heating</p>	<p>When the abnormal condition is registered the LEDs light on the Outdoor PCB and a fault code is transmitted</p> <p>L-α=0 (fan stops)</p>
<p>Magnetic Switch Failure (Contact Welding)</p>	<p>If the high pressure switch continues to operate for 5 seconds while the compressor has been instructed to stop. The magnetic switch is deemed to have failed.</p> <p>When the 4way valve is off (including during the defrost operation)  Turn the outdoor fan on to H  When the 4 way valve is on  Turn the outdoor fan off  (When the compressor is stopping the outdoor fan should be off)</p>	

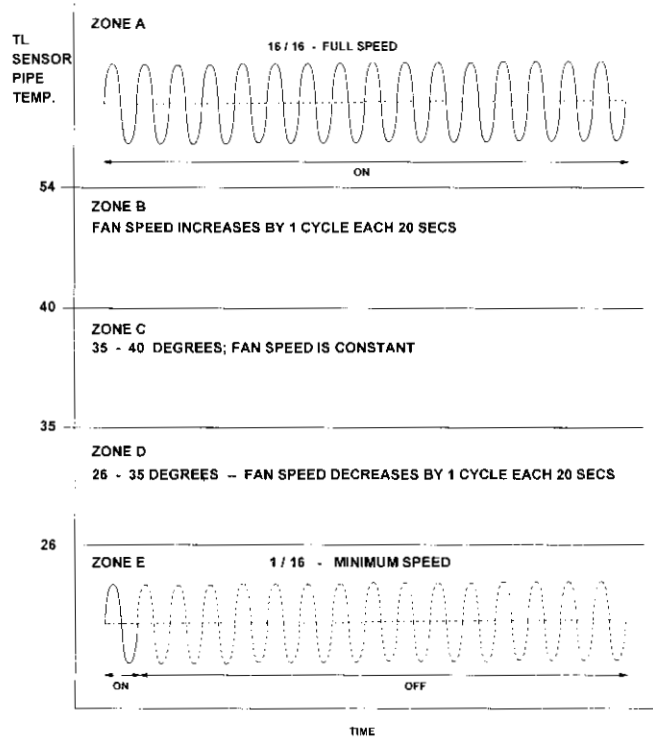
<p>Defrost (Heating Mode)</p>	<ul style="list-style-type: none"> <li>● During heating operation, defrost is controlled by the Outdoor unit heat exchanger temperature sensor (TE).</li> <li>● When the cumulative operating time with TE in zone [A] has amounted to 25 minutes, defrost operation starts. Subsequent defrosts occur after a cumulative time of 55 minutes. When heating operation resumes after defrost, the timer is reset.</li> <li>● The maximum defrost period after TE returns to zone [B] is 1 minute.</li> <li>● Heating operation resumes immediately after TE returns to zone [C].</li> </ul> <p style="text-align: center;">Temp. (°C)</p> 	
<p>4 Way Valve Control</p>	<p>When the compressor starts the 4 way valve will be energised. The 4 way valve will be energised 10s prior to the compressor starting. After the anti restart timer has timed out the specified mode will be selected.</p>	
<p>Anti Restart Timer</p>	<p>To prevent the compressor from cycling on and off a timer to delay restarting to 2minutes 20s.</p>	
<p>Check Codes</p>	<p>The air conditioner system reports fault codes to the remote controllers these can be interrogated by pressing the check key at the remote controller or the central remote controller.</p>	

Low Ambient Fan Control

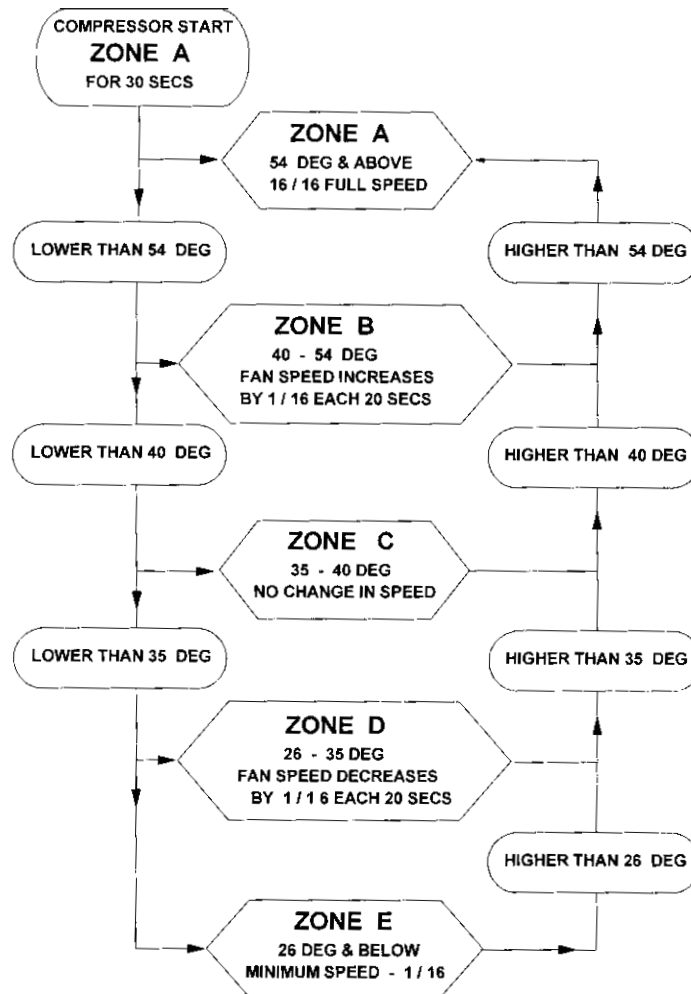
Over condensing at low ambient temperatures are avoided by controlling the speed of the outdoor fans. This is done by modifying the A.C waveform that supplies the the out door fan motors.

In the cooling mode the fans speed is monitored continuously and compared to the surface temperature at the outdoor coil detected by the TL sensor. As the temperature at this point drops, the fan speed reduces in order to maintain a constant condensing pressure.

The 50 Hz a/c waveform in the fan circuit is divided into groups of 16 cycles controlled by the Triac. Each cycle in these groups of 16 can be deleted either singly or in consecutive groups of cycles to modify the speed of the fan motor from the slowest speed, 1 / 16 to 15 / 16 and finally 16 / 16 which is full speed. This is shown below.



The sequence of switching is time and temperature based and is determined by the temperature detected at the TL sensor. The sequence is shown in below



When the compressor starts, the fans assume the maximum speed for 30 seconds; at the end of this period, the fans come under temperature control. Below 26° the fans are at the minimum allowable speed, above 40° they run at full speed. The TL sensor temperature range from 26° to 54° is divided into three additional temperature zones:

40° - 54°: In this range the fans **increase** their speed by 1 cycle in 16 ( $\frac{1}{16}$ ) until 54° is reached. They then assume maximum speed.

35° - 40°: Constant fan speed at any input from  $\frac{1}{16}$  to  $\frac{5}{16}$ , no change in fan speed.

26° - 35°: In this range the fans **decrease** their speed by 1 cycle in 16 ( $\frac{1}{16}$ ) until 26° is reached. They then assume minimum speed.



## 4. OUTLINE OF COOLING ONLY OPERATION

The cooling only control systems use serial communication between the remote controller and the indoor unit. The outdoor unit does not contain a PCB so a 240V signal is sent from the indoor unit to operate the compressor via a magnetic contactor.

### Indoor Unit Control

The indoor units are controlled in accordance with the settings selected at the Remote. The room temperature is constantly sampled by the TA sensor, which is positioned in the return air path of each indoor unit, directly before the fan input.

Mode Of Operation	<p>The air conditioners operating mode will be selected by pressing the mode button on the remote controller.</p> <table border="1" style="width: 100%; margin: 10px 0;"> <thead> <tr> <th style="text-align: center;">REMOTE CONTROLLER INSTRUCTION</th> <th style="text-align: center;">OUTLINE OF CONTROL</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Stop</td> <td style="text-align: center;">Stopping air conditioner</td> </tr> <tr> <td style="text-align: center;">Cool</td> <td style="text-align: center;">Performing cooling operation</td> </tr> <tr> <td style="text-align: center;">Fan only</td> <td style="text-align: center;">Performing fan only operation</td> </tr> </tbody> </table>	REMOTE CONTROLLER INSTRUCTION	OUTLINE OF CONTROL	Stop	Stopping air conditioner	Cool	Performing cooling operation	Fan only	Performing fan only operation	
REMOTE CONTROLLER INSTRUCTION	OUTLINE OF CONTROL									
Stop	Stopping air conditioner									
Cool	Performing cooling operation									
Fan only	Performing fan only operation									
Control of room Temperature	<p>Adjusting range °C</p> <table border="1" style="width: 100%; margin: 10px 0;"> <thead> <tr> <th></th> <th style="text-align: center;">In Cooling</th> </tr> </thead> <tbody> <tr> <td>Remote controller setting temperature</td> <td style="text-align: center;">18 – 29</td> </tr> <tr> <td>Operating temperature</td> <td style="text-align: center;">18 – 29</td> </tr> </tbody> </table> <p>Operating point is compressor:                   off            Operating temperature accuracy:           ± 1°C            Differential:                                       1 deg.</p>		In Cooling	Remote controller setting temperature	18 – 29	Operating temperature	18 – 29			
	In Cooling									
Remote controller setting temperature	18 – 29									
Operating temperature	18 – 29									
Fan Speed Control	<p>[HIGH], [MED], [LOW] and [AUTO] are available. In the auto fan, the fan speed is changed by the difference between Ta and Ts, as shown below.</p> <div style="text-align: center; margin: 10px 0;"> <p>- Cooling -</p> </div>	Ts = setting temperature								
Test Operation	<p>If the remote controller's ON/OFF switch is pressed 5 seconds continuously, the unit goes into test run mode, and cooling operation is performed with the indoor fan in the [HIGH].</p>	Display L								
Low ambient Fan Control	<p>This method of fan speed control works differently from the heat pump system it uses a two stage pressure switch to control different speed tapings on the motors. The change over values is shown in the diagram below.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>A = RAV-464A8-PE, RAV-364A8-PE, RAV-164A-PE, RAV-134A-PE            B = RAV-264A8-PE, RAV-264A-PE</p>									

## 5. CONTROL WIRING CONFIGURATIONS

### Remote Controller

#### Connecting the Remote Controller — BH, CH, KH, NH, SH, TUH, UH only

- ⚠ Any standard 3-core cable operating at 12V AC with a cross-sectional area ranging from 0.3mm<sup>2</sup> to 0.75mm<sup>2</sup> and with a maximum length of 500 metres can be used.
- ⚠ When routing this cable, care should be taken to ensure that it is not in direct contact with mains cable or routed in duct or conduit containing power cables.
- ⚠ Connect the terminals A, B and C on the remote controller with the terminals A, B and C on the indoor unit terminal block, ensuring that the terminals are matched up correctly.
- ⚠ Full instructions on the setting and operation of this controller are included in the owner's manual, supplied with the remote controller.

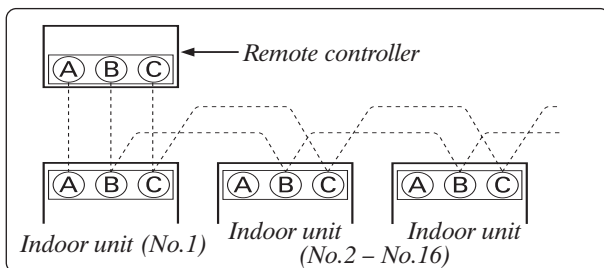
#### Group Control

Up to 16 air conditioners can be controlled as a group using a single remote controller.

- ⚠ (The control circuit for each indoor unit originates at the outdoor unit from the incoming phase connection marked L or L<sub>1</sub>. It is important that on a group system that all the control circuits throughout the group are derived from the same phase.)
- ⚠ No parts (except for the connecting cable) are required for group control.
- ⚠ Proceed with the power cable connections and with the wiring connections between the indoor and outdoor units in exactly the same way as for individual air conditioner operation.

Connect the remote controller and the indoor unit in the following sequence:

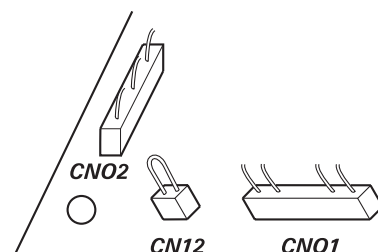
- ① Connect together the terminals A, B and C on both the remote controller and indoor unit No.1 ensuring that the terminals are matched up correctly;
- ② Connect together terminals B and C on indoor units No.1 and No.2;
- ③ Connect together terminals B and C on indoor units No.2 and No.3;
- ④ Proceed in the same way to make the necessary connections up to indoor unit No.16;



- ⑤ Leave the (CN12) connector in unit No.1 but remove from any further indoor units to prevent malfunction due to miswiring.
- ⑥ Set the rotary switch position on each indoor unit to a different number, starting with position 1 for unit No.1 which is connected to the remote controller. This will also ensure that each unit will start up at a slightly different time therefore ensuring no increase in start-up current.

#### Precautions

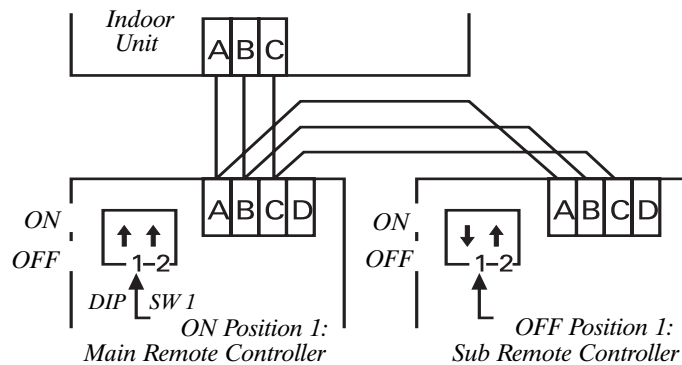
- ⚠ Use cables with a cross-sectional area of at least 0.75mm<sup>2</sup> to connect the indoor units. The maximum length of 500 metres for the remote controller cable denotes the maximum length from the remote controller to the furthest indoor unit.



## Two Remote Controllers AI Indoor Units Only

- With the AI system the air conditioner can be controlled by two remote controllers the priority is the last remote controller touched.
- The remote controllers should be wired as shown in the diagram below:
  - ① Connect the remote controller terminals ABC together in parallel.
  - ② On the Sub remote controller set the dip SW1 switch 1 to the OFF position.

The total amount of cable between the indoor units and the remote controllers must not exceed 500m.



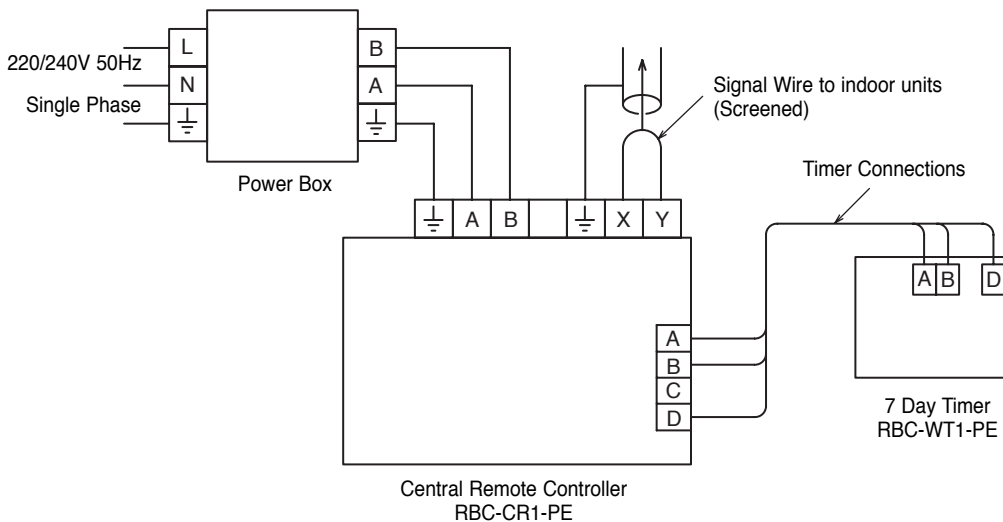
## Central Remote Control AI Indoor Units Only

### POWER SUPPLY SPECIFICATIONS

- The unit is to be supplied by a single phase supply with the running current at 1A.

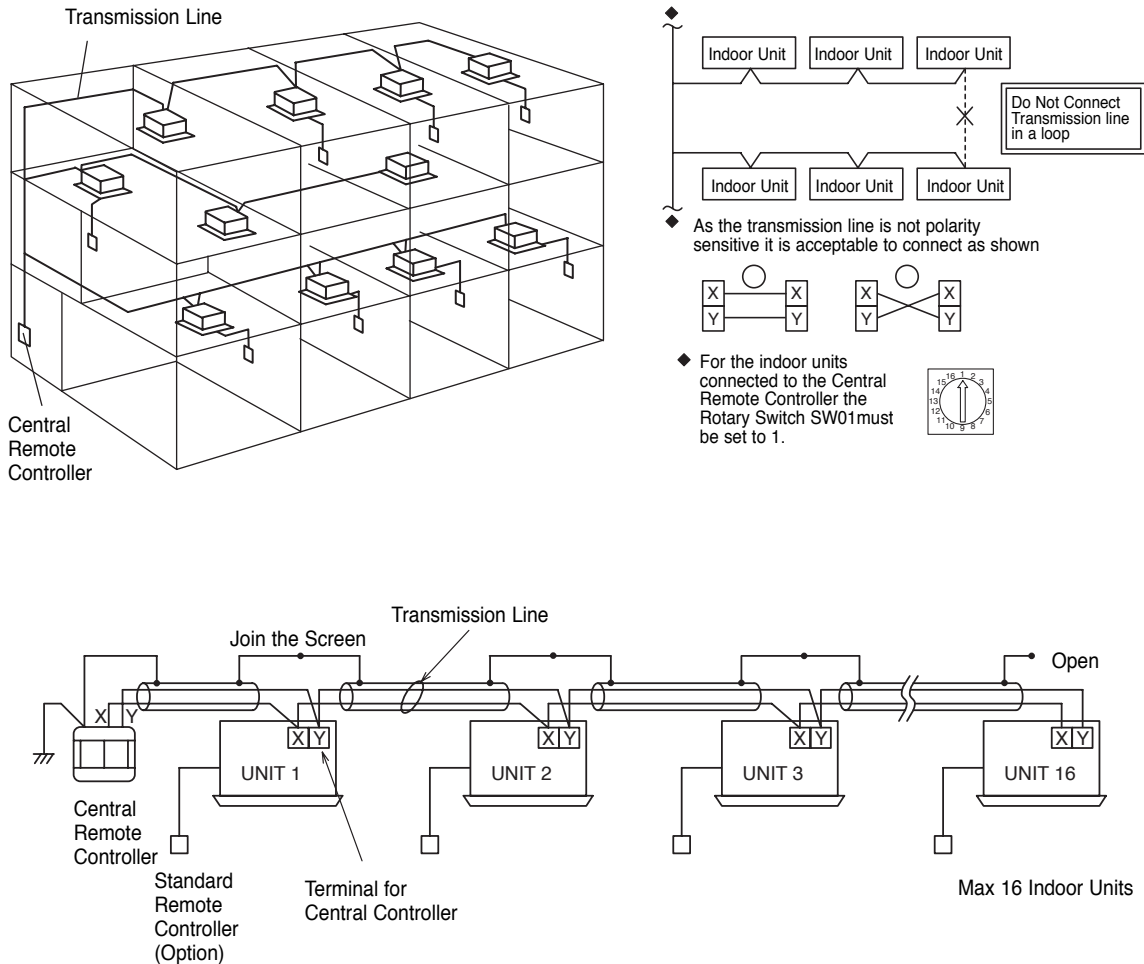
### POWER SUPPLY WIRING

- Connect the power wiring to the L and N terminals. (See the drawing below.)



## Wiring to the Indoor Units

- Connect the wires between the units correctly. Errors made in the connections can result in the unit malfunctioning.
- The X and Y connections are a high-speed data line, the specification for the cable is outlined below.
- The cable required is 2 core Screened Twisted PAir Microphone Cable
- The length of the transmission line is restricted by the diameter of the cable
  - Cable size 1.2mm<sup>2</sup> CSA Maximum transmission line length 500M
  - Cable size 2mm<sup>2</sup> CSA Maximum transmission line length 1000M
  - The transmission line is not polarity sensitive
- Connect the controls wires between the outdoor unit and indoor unit as shown in the figure below:



- The screen for the transmission line is to be grounded only at the Central Remote Controller. The screen is to be joined at each unit but not grounded. At the last indoor unit do not connect the screen.

## Setting the Network Address

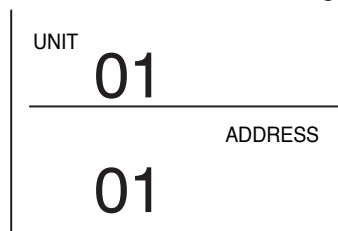
- The network address must be set for each indoor unit connected to the central remote controller. This is so that each of the indoor units can be individually addresses.
- Each connected unit must have a unique address between 1 and 16.

## Setting the Address from the Remote Controller

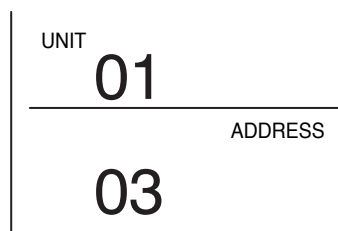
- (1) SW01 (Group Control Switch) on the indoor unit must be set to 1.
- (2) SW02 (Lan Address Switch) positions 1 to 7 must be set to the off position.

### Procedure

- (1) Supply the power to the outdoor units and the Central Remote Controller.
- (2) Press and hold the FILTER button for 5 seconds, the display will change as shown below. The remote controller is now in the Network address setting mode.



- (3) The address can be set by pressing the timer ▲ to increase or ▼ to decrease the address number. In the example below the address is set to 03.



- (4) If the Filter button is pressed again the changes are registered and the display returns to normal. If the Remote Controller is not touched for 15 seconds in the address setting mode the Remote Controller returns to normal display.

## Setting the Address from the Indoor Unit

If it is decided that a Remote Controller is not required or you want to fix the address preventing adjustment at the Remote Controller, adjusting the SW02 switches can set this.

- (1) Supply the power to the Outdoor Units and the Central Remote Controller.
- (2) Set the DIP SW02 position 7 to the ON Side as shown below.



- (3) Changing the SW02 position 1 to 4 can set the address. The example below shows the address set at 16. The table on page?? shows the switch combinations for each address number.

## 6. MALFUNCTION CODES

---

### Introduction

### FAULT CODES

The Toshiba control system has an easily accessible fault code system, which gives a Hexadecimal code, which can be related to the fault. These can be accessed via the fascia check buttons:

At the Main Controller

At the Sub – Controller (Not Used on Cooling Only Systems).

At the Centre Controller (Not Used on Cooling Only Systems).


All the codes are displayed in Hexadecimal code the meanings are explained on the following pages.


When responding to a fault code, locate and rectify the cause, then clear the fault code memories of all applicable controllers. Allow the unit to function and observe the operation for at least 20 minutes before checking the memory again for further fault codes which may reappear.

### Clearing the Memory:

The fault code memory can be accessed and cleared by the check keys on the fascia of both the controller and the Central Controller. Holding down the check key clears the memory on the remote controller for 10 seconds.

## Heat Pump Indoor Unit Fault Codes

	<p><b>Loss of Serial signal - outdoor to indoor unit</b>  <b>Location: Outdoor unit, Interconnecting wiring, indoor unit PCB.</b></p>
	<p>The serial return signal transmitted from the outdoor unit to the indoor unit is not received within 1 minute. Check the Green transmit LED at the outdoor PCB and the Orange receive LED on the Indoor PCB ( D14): both should flicker intermittently</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>Continuity of the interconnecting wiring especially wires ' 2 &amp; 3'.</li> <li>Supply control wiring to the outdoor unit PCB, Plug CN01.</li> <li>The outdoor PCB transformer.</li> <li>Crossed interconnecting wiring, (2 &amp; 3).</li> <li>Crossed interconnecting wiring with other units</li> <li>Auxiliary circuits connected to the serial signal terminals.</li> </ul>

	<p><b>Reversal of Temperatures at the Indoor unit</b>  <b>Location: Outdoor unit.</b></p>
	<p>The TC sensor, which detects the temperature on the indoor heat exchanger, will react to a reversal of temperatures. If a temperature shift greater than five degrees from the TC measured value is detected within 5 minutes of the compressor starting the code 08 will be displayed.</p> <p>In cooling - measured value + 5°          In heating - measured value - 5°</p> <p><b>Check:</b></p> <p>The correct wiring of the reversing valve – energises in heating.          Reversing Valve operates – requires pressure difference to slide the Internal piston assembly.          Compressor pumping – fit pressure gauges and pumps the unit down. The compressor should achieve and hold good vacuum. A defective compressor may result in the reversing valve not operating due to a lack of pressure differential.</p>

<b>12</b>	<p><b>Indoor PCB / Microprocessor Fault</b>  <b>Location: Indoor unit, PCB.</b></p>
	<p>Indicates a failure of the information transmission within the microprocessor.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● Indoor PCB – replace if necessary.</li> </ul>

<b>97</b>	<p><b>AI Network Communication Line Fault</b>  <b>Location: Indoor unit PCB.</b></p>
	<p>Communication line fault – Central Controller  Loss of communication between the central controller and any of the units connected to the AI Network. This could be caused by incorrect or broken wiring.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● All AI Network Connections</li> <li>● Network Continuity</li> <li>● Indoor Unit PCBs.</li> </ul>



<b>98</b>	<p><b>AI Network Communication Addressing Fault</b>  <b>Location: Indoor unit PCB.</b></p>
	<p>Conflict of AI Network Addresses  Check all addresses on the AI network</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● All AI Network Addresses at Remote controllers / Indoor Units</li> <li>● Review SWO5 Switch Settings on the Indoor PCB in accordance with the installation instructions.</li> </ul>

<b>87</b>	<p><b>Indoor unit Group Failure Central Remote Controller</b>  <b>Location: Indoor unit</b></p>
	<p>Indicates a common fault on a group of slave systems connected to a master unit on the AI Network</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● Check the local remote controller for the actual fault code and proceed as above.</li> </ul>





## Heat Pump and Cooling only Indoor Unit Fault Codes

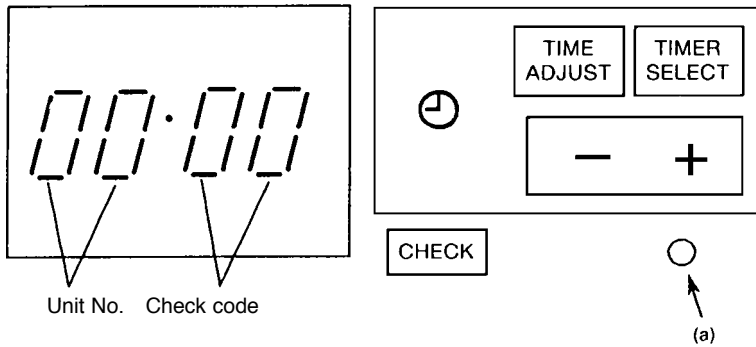
09	<p><b>Unauthorised unit stoppage</b>  <b>Location: Indoor unit, outdoor unit or pipework.</b></p>
	<p>This code is generated if a temperature change &gt;20 is not detected at the TC sensor located on the indoor unit within 5 minutes of a heating or cooling command. In some instances where the unit resets automatically after a stoppage, the unit may be functioning normally, whilst displaying this code.</p> <p>Reset the code from the memory, allow the unit to function for 20 minutes and re-check.</p> <p><b>Check:</b>  System cut out on built -in safety devices:</p> <ul style="list-style-type: none"> <li>- Compressor case over temperature thermostat.</li> <li>- Compressor contactor overload ( 3 phase outdoor units only)</li> </ul> <p>No refrigerant flow - pipe blockage.</p> <p>Low indoor unit coil temperature: If the indoor unit coil surface temperature is &lt; 2° for longer than 20 minutes.</p> <ul style="list-style-type: none"> <li>- Examine the filters,</li> <li>- Check for low refrigerant charge.</li> <li>- Check ambient temperature, cross refer to possibility of over-condensing. Check both evaporating and condensing pressures.</li> </ul>
99	<p><b>Remote Controller Wiring Fault</b>  <b>Location: Indoor Units and Remote Controllers</b></p>
	<p>If the wiring between the ABC terminals or if SW01 on the master unit of a group is not set to 1 then this fault code will be generated.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● Check All remote controller wiring</li> <li>● Check the position of SW01.</li> </ul>

	<p><b>Condensate Pump or Drainage Failure.</b>  <b>Location: Indoor unit. (UH, U TUH &amp; TU Series CASSETTES ONLY)</b></p>
	<p>Cassette indoor units are fitted with an automatic lift pump and a water level switch. The condensate pump is intended to run continuously during the cooling mode; if the system switches to heating mode the pump stops. If the water level in the condensate tray rises at any time when the indoor unit is supplied with power, even when the compressor is off or the unit is in standby mode, the pump will start automatically and clear the water in the tray.</p> <p>If the condensate level switch rises in normal cooling operation above a pre-set level, the compressor will stop while the fans run continuously. If at this time the level switch resets within 2 minutes, normal operation will resume and no fault code will be stored.</p> <p>If the level switch remains open for a period longer than two minutes, the compressor remains off and the fault code will be shown when the check button on the controller is pressed. Normal operation will resume when the level switch detects a safe water level.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>Power to condensate pump.</li> <li>Condensate pump / motor.</li> <li>Relay and controls wiring.</li> <li>Condensate drain line for blockage.</li> </ul>
	<p><b>Sensor Abnormality</b>  <b>Location: Indoor unit.</b></p>
	<p>All Sensors fitted to these systems are NTC type. (Negative Temperature Coefficient). As the temperature increases, the corresponding electrical resistance decreases. This is not a linear relationship.</p> <p>If either a short circuit (zero resistance) or open circuit (infinite resistance) is detected for longer than 1 minute the relevant code will be displayed.</p> <p><b>0C</b> - T A Sensor  <b>0d</b> - T C Sensor.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>PCB plug connections. <ul style="list-style-type: none"> <li>- TA - CN04</li> <li>- TC - CN05</li> </ul> </li> <li>Continuity through the sensor. (Short or open circuit).</li> <li>Centre value resistance: 10 K at 250.</li> </ul>

## Heat Pump Outdoor Unit Fault Codes

	<p><b>TE,TL,TD Sensor Abnormality</b>  <b>Location: Outdoor unit.</b></p>
	<p>All Sensors fitted to these systems are NTC type. (Negative Temperature Coefficient). As the temperature increases, the corresponding electrical resistance decreases. This is not a linear relationship.</p> <p>If either a short circuit (zero resistance) or open circuit (infinite resistance) is detected for longer than 1 minute the relevant code will be displayed.</p> <p><b>18 - T E Sensor</b>  <b>19 - T L / T D Sensor.</b></p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● PCB plug connections. <ul style="list-style-type: none"> <li>- TE - CN08</li> <li>- TL - CN09</li> <li>- TD - CN07</li> </ul> </li> </ul> <p>Continuity through the sensor. (Short or open circuit).  Centre value resistance: 10 K at 25°.</p>
	<p><b>High Pressure Fault</b>  <b>Location: Outdoor Unit</b></p>
	<p>The high-pressure switch operates in either cooling or heating modes of operation if the switch remains open for 5 seconds in cooling or 30 seconds in heating. The Fault code will be displayed, the unit will stop operating.</p> <p><b>Check:</b></p> <ul style="list-style-type: none"> <li>● Check the high pressure switch</li> <li>● Check the Outdoor Unit</li> </ul>

## Cooling Only Fault Codes



[CHECK] key switch  
Provides check code display by pressing for one second and indoor microcomputer reset by pressing for 5 seconds.

- \* Remote controller clear by pressing the key for 10 sec. Check code is cleared (normally not used).
- (a) Reset key (pushed by a needle and the like). Resetting remote controller (to the initial setting).

NOTE: (RAV-264/364/464/A8-PE)

If the red LED on the remote controller does not flash when the system is switched on, then the wiring to the outdoor unit needs to be checked to ensure that the THREE PHASES are wired in the correct sequence. (Return Lock Operation).

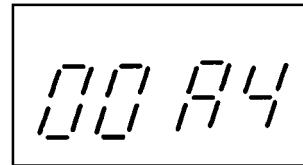
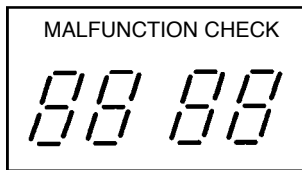
For full details of the above Fault Codes, please refer to the front of this section.

## Cooling Only Compressor Operations

By pressing [CHECK] key, times of No. 1 unit compressor-ON actuations as well as the check code information of 2 faults x 16 units are displayed on the time display area. (2 sec. per one phenomenon)

< Times of compressor-ON >

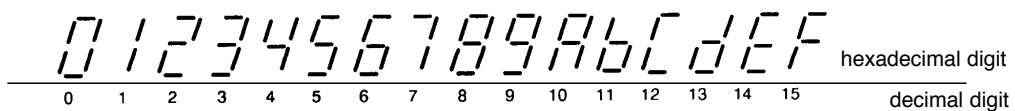
Ex. In case of the number of times of compressor actuations of 164



Display in 4 digits of hexa-decimal notation

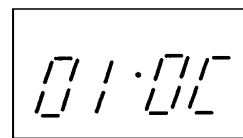
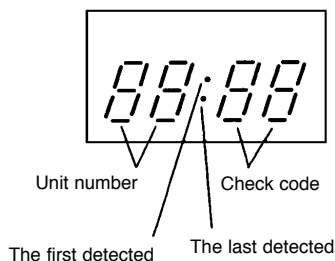
$$16^3 \times 0 + 16^2 \times 0 + 16 \times 10 + 4 = 164$$

Display in 7 segments



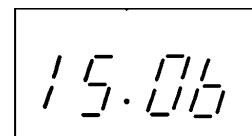
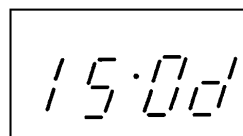
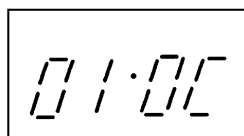
< Check code information >

Ex. In case of room temperature sensor of No. 1 unit in trouble.



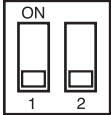
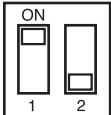
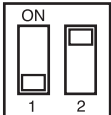
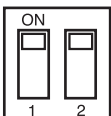
For No. 15 unit, firstly heat-exchanger sensor and secondly float switch circuit are in trouble.

No display is made if there is no fault.

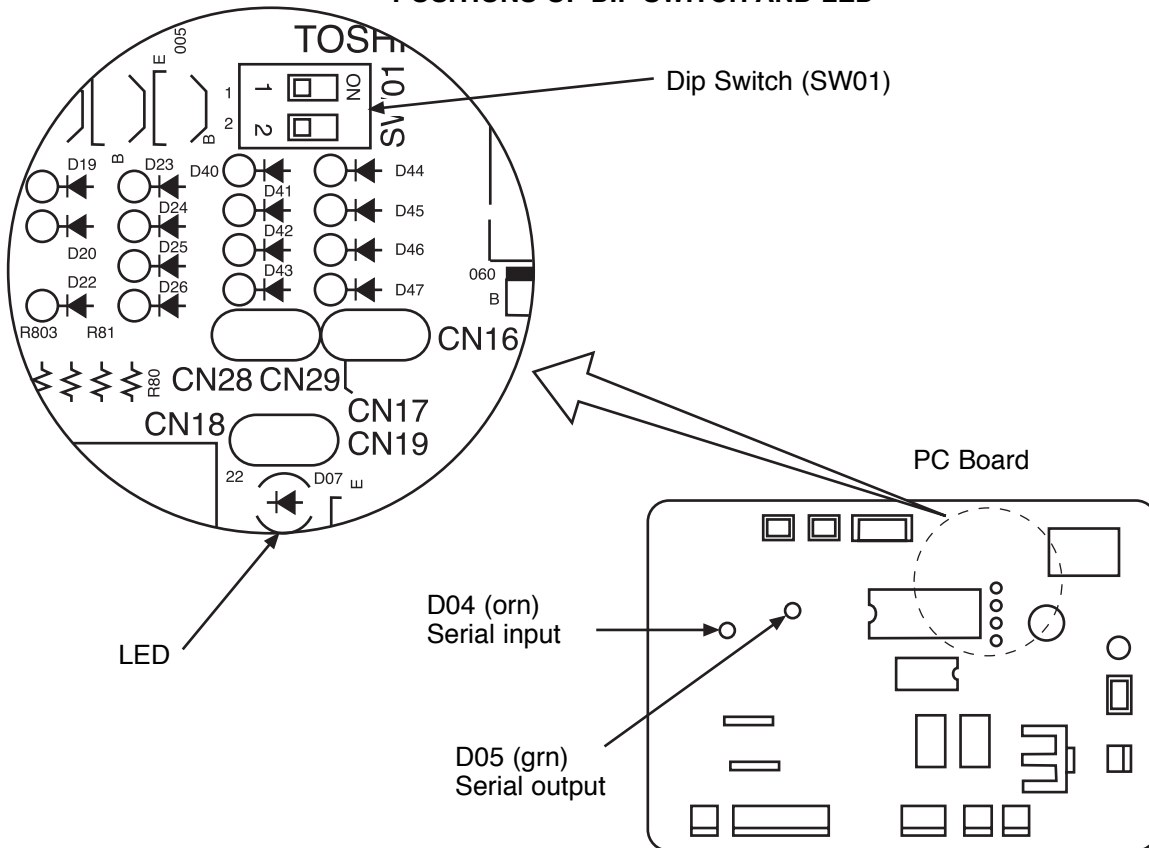


**Malfunction check  
Using LED display on outdoor PC board**

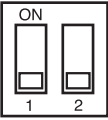
**LED display vs. check code**

	Dip switch settings (DSW01)	LED			
		1 (RED)	2 (YELLOW)	3 (YELLOW)	4 (YELLOW)
Table-1					21 High pressure switch fault
Table-2					
Table-3		Serial input data			
Table-4		Serial output data			

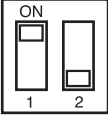
**POSITIONS OF DIP SWITCH AND LED**



<Table -1>

Dip switch settings	LED				Judgement
	1	2	3	4	
	●	●	●	●	Normal operation
	◐	●	●	●	Timer short
					Full stop
	○	○	○	◐	21 High pressure switch fault
	○	○	○	○	18, 19 Fault codes (refer to Table-2)

<Table -2>

Dip switch settings	LED				Judgement
	1	2	3	4	
	●	●	●	●	Normal operation
	●	●	●	◐	Number of protective device operations: one
	●	●	○	●	Number of protective device operations: two
	●	●	○	○	Number of protective device operations: three
	LEDs 3 & 4 flashing (1Hz) faults shown below		◐	◐	Number of protective device operations: four
	◐	○	◐	◐	18 Temperature sensor (TE) faulty 19 Temperature sensors (TD/TL) open/short circuit
					Full stop
	○	○	◐	◐	

**LED status**

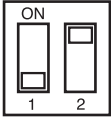
☀ : on

☀ : 5Hz flash

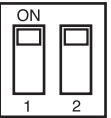
☀ : 1Hz flash

● : off

<Table -3>

Dip switch settings	LED				Status of compressor
	1	2	3	4	
	●	●	●	●	Stop
	●	●	○	○	Operating
	●	○	●	●	
	●	○	●	○	
	●	○	○	●	
	●	○	○	○	
	○	●	●	●	
	○	●	●	○	
	○	●	○	●	
	○	●	○	○	
	○	○	●	●	
	○	○	●	○	
	○	○	○	●	
	○	○	○	○	

<Table -4>

Dip switch settings	LED				Status of compressor
	1	2	3	4	
	●	●	●	●	Stop
	●	●	○	○	Operating
	●	○	●	●	
	●	○	●	○	
	●	○	○	●	
	●	○	○	○	
	○	●	●	●	
	○	●	●	○	
	○	●	○	●	
	○	●	○	○	
	○	○	●	●	
	○	○	●	○	
	○	○	○	●	
	○	○	○	○	

# **TOSHIBA**

## **AIR CONDITIONING**

**PORSHAM CLOSE, BELLIVER INDUSTRIAL ESTATE, PLYMOUTH, PL6 7DB U.K.**

A division of Toshiba Carrier UK Ltd