

19. MODE DOOR MOTOR

The mode door motor is installed on the left side of the heater unit, and is controlled by the signal sent from the auto amplifier. This motor actuates the defroster door, vent door and heat door via linkage mechanisms so as to provide optimum air circulation.

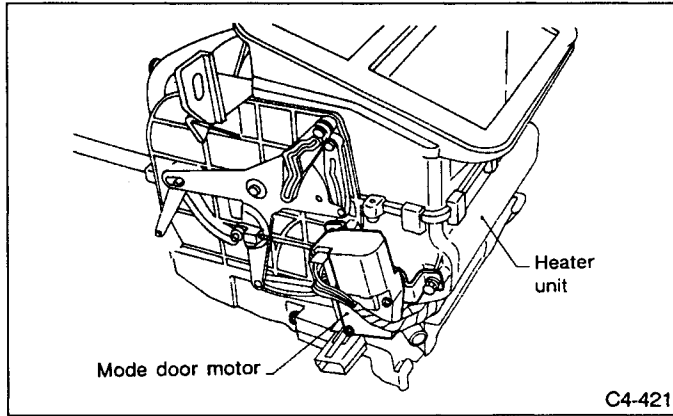


Fig. 60

1) Operation of mode door motor

The auto amplifier determines the mode door position. The mode door motor rotates normally or in reverse direction corresponding to the auto amplifier signal as shown below.

The output shaft and sliding contact are made integral. If the sliding contact exceeds the position of terminal plate A or B (DEF or VENT position), the current is cut off and the motor stops rotating.

If the auto amplifier output signal turns OFF, the motor operation stops irrespective of the position of the sliding contact.

Energizing terminal		Direction of rotation	Remarks
Positive ⊕	Negative ⊖		
①	②	CCW	VENT → DEF
②	①	CW	DEF → VENT

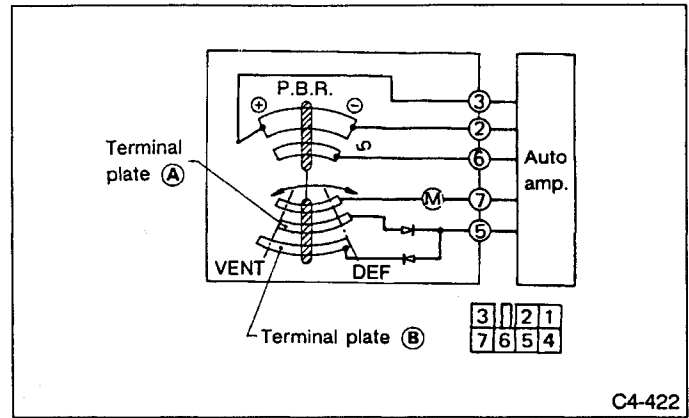


Fig. 61

2) P.B.R. (Potentiometric Balance Resistor)

The potentiometric balance resistor is built into the printed board in the mode door motor. This resistor detects the mode door position corresponding to the output shaft rotation as a ratio of variable terminal voltage V_M to reference voltage V_{DD} , and feeds the signal back to the auto amplifier.

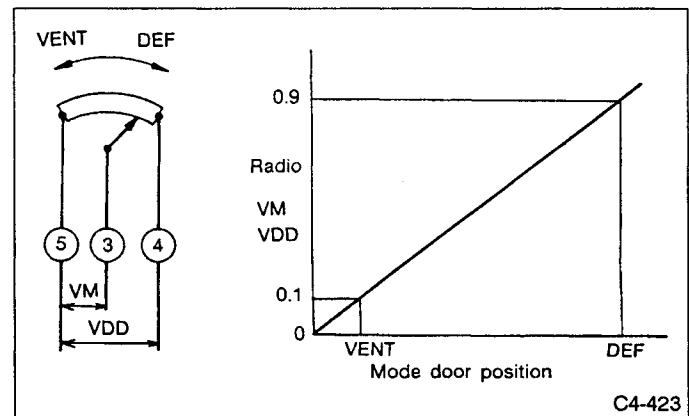


Fig. 62

5. Automatic Climate Control System

A: FEATURES

1. ELECTRONICALLY CONTROLLED VARIABLE DELIVERY COMPRESSOR

- 1) During the initial "cool-down" stage, air conditioning is maximized to quickly bring the compartment to a comfortable range.
- 2) During low ambient temperatures, compressor delivery is electronically controlled to effectively dehumidify the compartment.
- 3) Compressor delivery is controlled to provide power-saving when air conditioning is not required.
- 4) To maintain smooth engine operation when the A/C switch is turned OFF, the compressor clutch is turned OFF after compressor delivery is minimized.
- 5) When the engine coolant temperature is high, compressor delivery is decreased with the A/C system in operation to decrease the coolant temperature and thus protect the engine.

2. AUTOMATIC COMPARTMENT TEMPERATURE CONTROL

The air mix door is automatically controlled to maintain an optimum compartment temperature regardless of

the ambient temperature, sunload or the number of occupants.

3. AUTOMATIC SELECTION OF AIR OUTLET

The VENT, BILEVEL and HEAT mode doors are automatically selected corresponding to the outlet air temperature. Natural compartment ventilation can be achieved by simply pressing the new VENT switch.

4. HEATER START CONTROL

To prevent cool air from discharging into the passenger compartment during starts in cold weather, the air flow rate is controlled between OFF and AUTO until the heater water temperature increases. In this case, the air outlet is controlled to change from DEF to AUTO through DEF/HEAT in the AUTO mode.

5. COOLER START CONTROL

The cooler start control function controls the outlet air quantity between OFF and AUTO levels until the evaporator cools down. This prevents blowing warm air into the compartment when starting the air conditioner during hot weather. (In AUTO mode operation)

6. SUN LOAD CORRECTION

The photo diode is adopted in the sun load sensor. This provides accurate detection of sun load and ensures proper correction of interior temperatures.

B: SYSTEM CONTROL

Type of automatic control	Input unit	Output unit
Room temperature control	AUTO switch, ECON switch, temperature adjustment switch, in-vehicle sensor, ambient sensor, sun load sensor, evaporator sensor	Air mix door actuating motor
Air flow rate control	AUTO switch, ECON switch, temperature adjustment switch, DEF switch, in-vehicle sensor, ambient sensor, sun load sensor, water temperature sensor, evaporator sensor, fan switch	Blower fan motor, fan control amplifier, HI relay
Mode door control	AUTO switch, ECON switch, temperature adjustment switch, DEF switch, in-vehicle sensor, ambient sensor, sun load sensor, evaporator sensor, water temperature sensor	Mode door actuating motor
Intake door control	AUTO switch, ECON switch, temperature adjustment switch, DEF switch, CIRC switch, in-vehicle sensor, evaporator sensor, ambient sensor, sun load sensor, VENT switch	Intake door actuating motor
Compressor control	AUTO switch, ECON switch, temperature adjustment switch, DEF switch, CIRC switch, in-vehicle sensor, ambient sensor, sun load sensor, evaporator sensor, refrigerant temperature sensor, VENT switch, ECU signal (Engine unit)	Solenoid actuator, compressor ON signal (output to engine control unit)

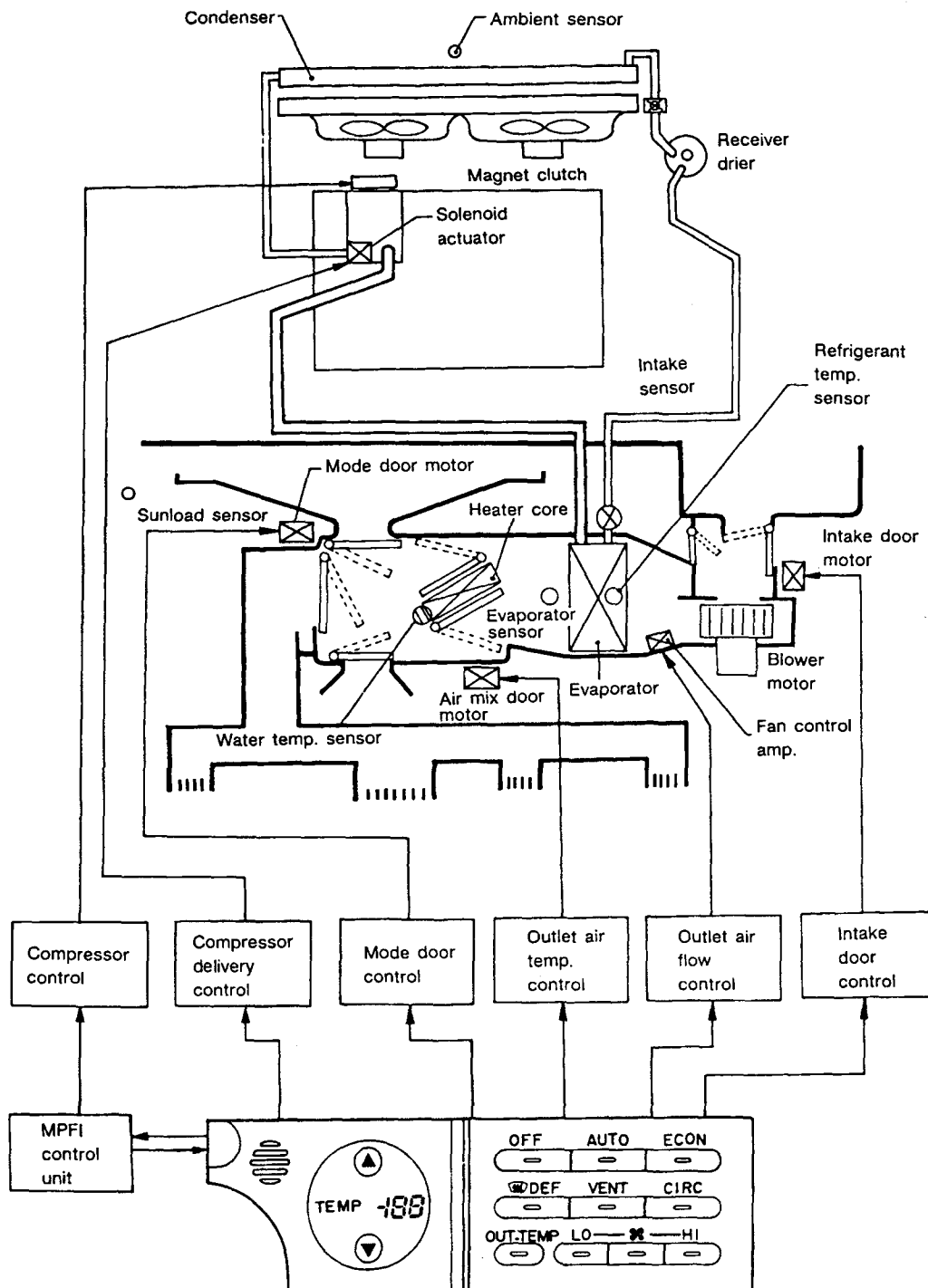
C: SYSTEM LAYOUT

Fig. 63

C4-424

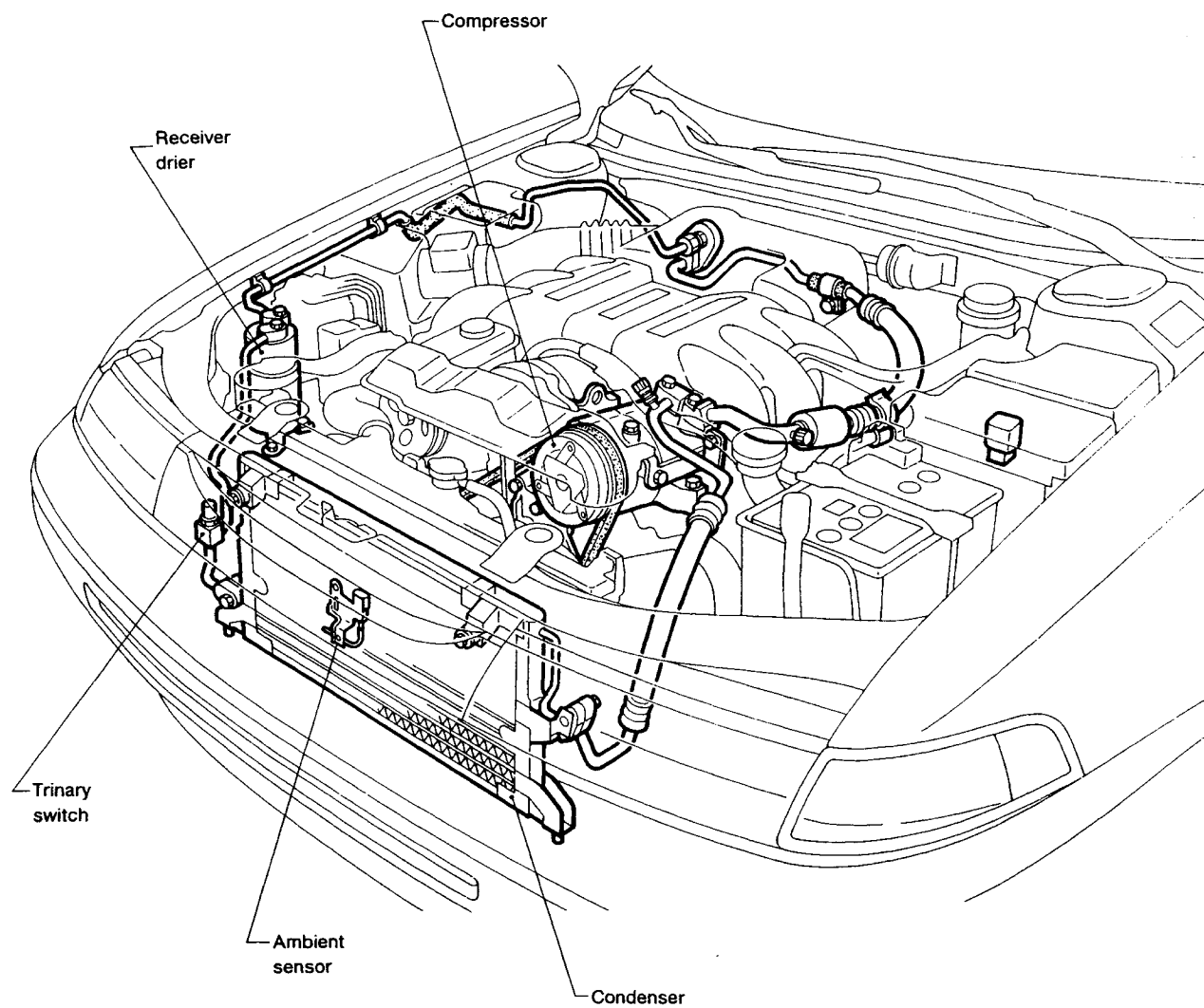
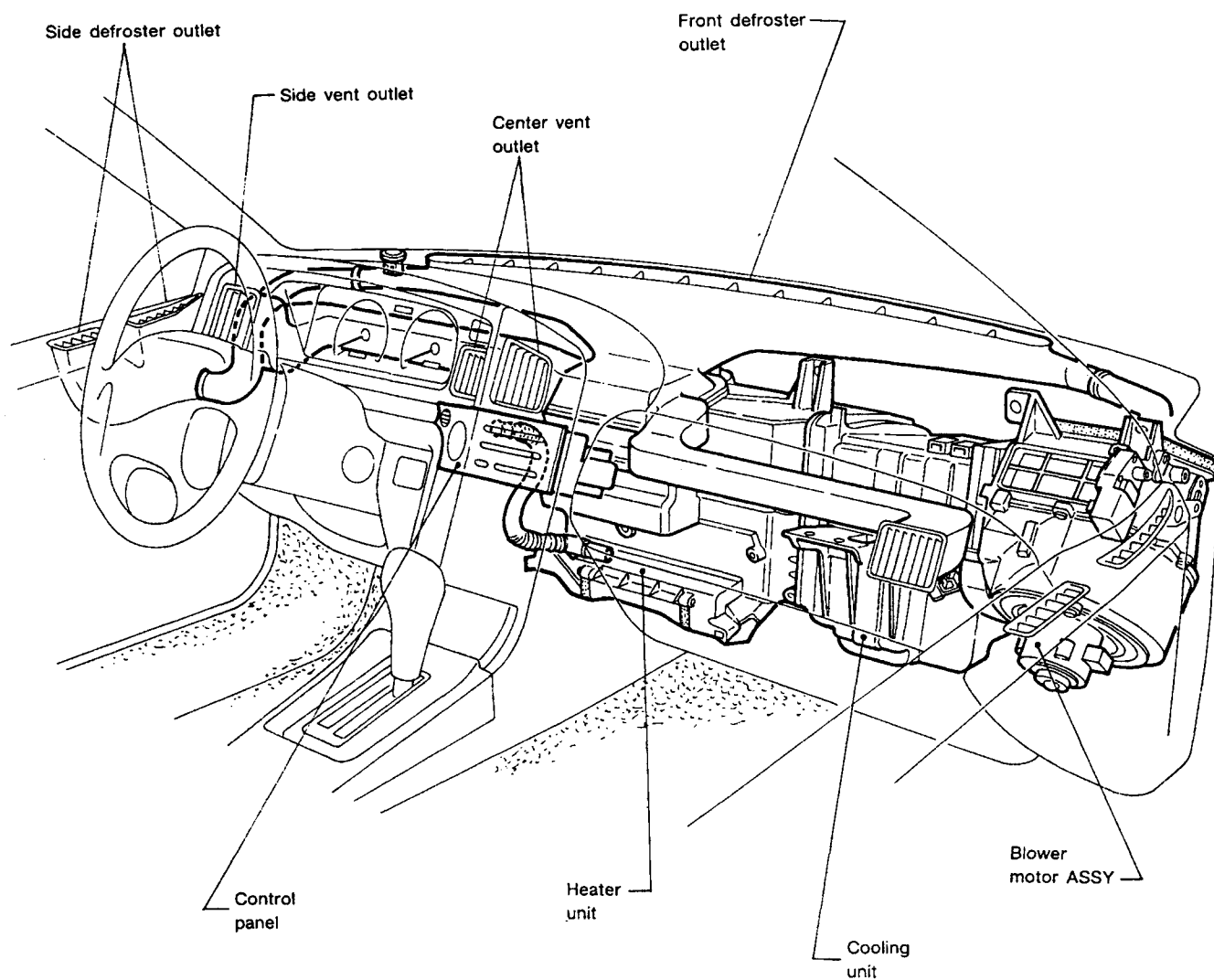
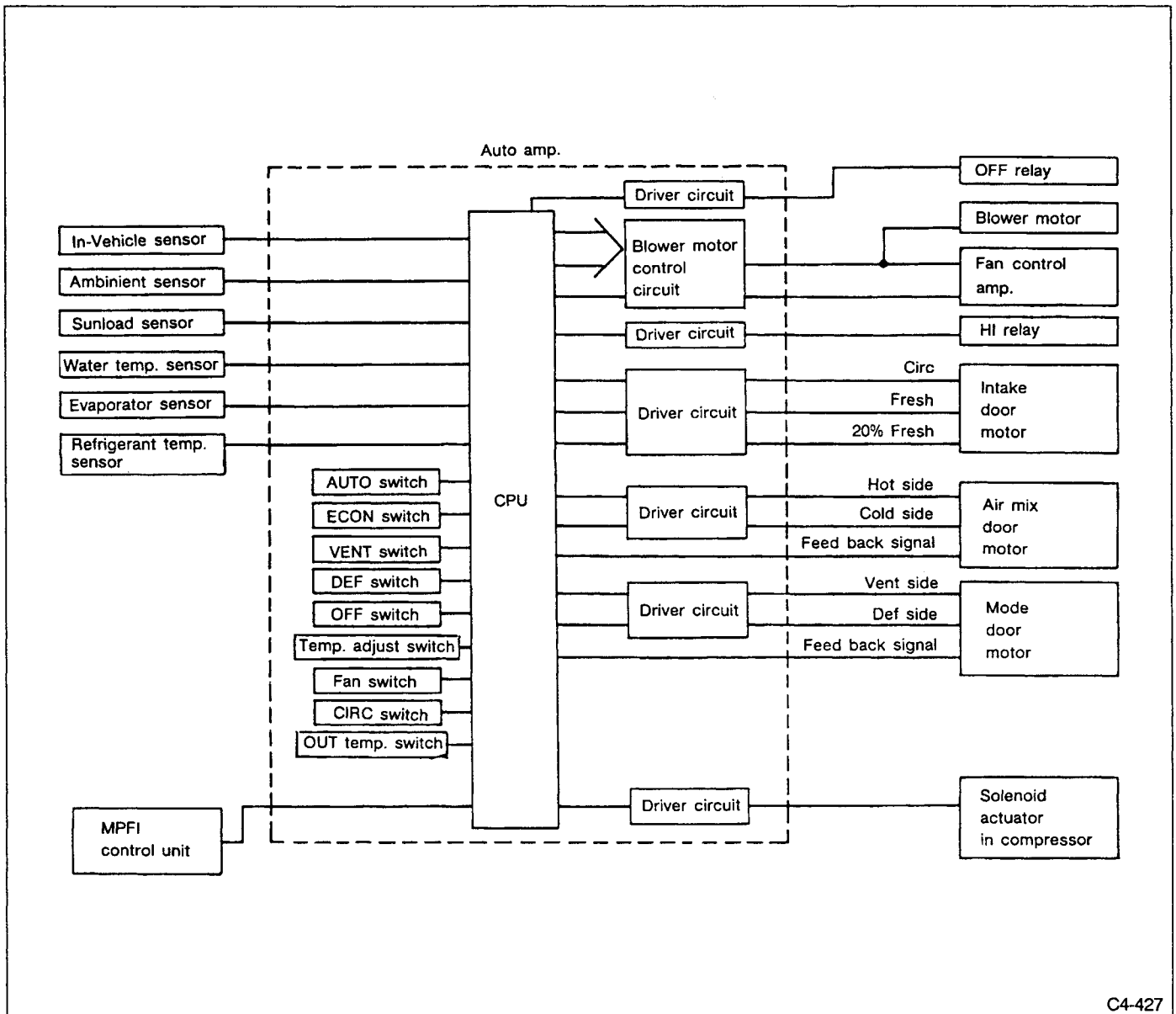
D: COMPONENT LAYOUT**1. ENGINE COMPARTMENT**

Fig. 15

2. PASSENGER COMPARTMENT*Fig. 65*

C4-426

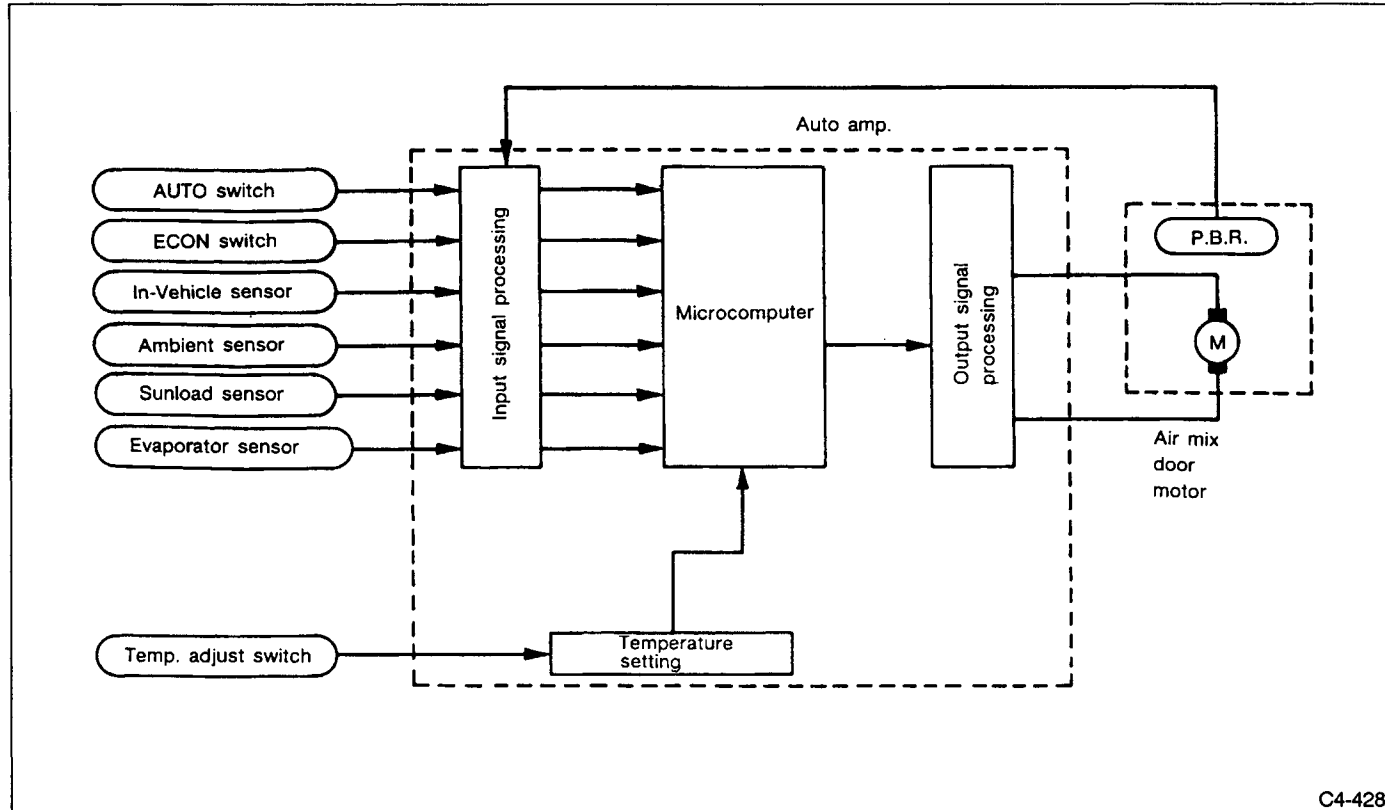
E: SYSTEM FLOW

C4-427

Fig. 66

F: CONTROL SYSTEM

1. AIR MIX DOOR CONTROL (Automatic temperature control)



C4-428

Fig. 67

When the temperature adjustment switch on the control panel is pressed to set a specific temperature, the auto amplifier performs computation based on various input sensor signals, and obtains the overall signal T. Further, it compares the predetermined air mix door opening and P.B.R. signal with respect to this overall signal T, and determines whether the air mix door opening is appropriate.

If the air mix door opening is not appropriate, the air mix door moves toward the heat or cool side so that the appropriate door opening can be obtained.

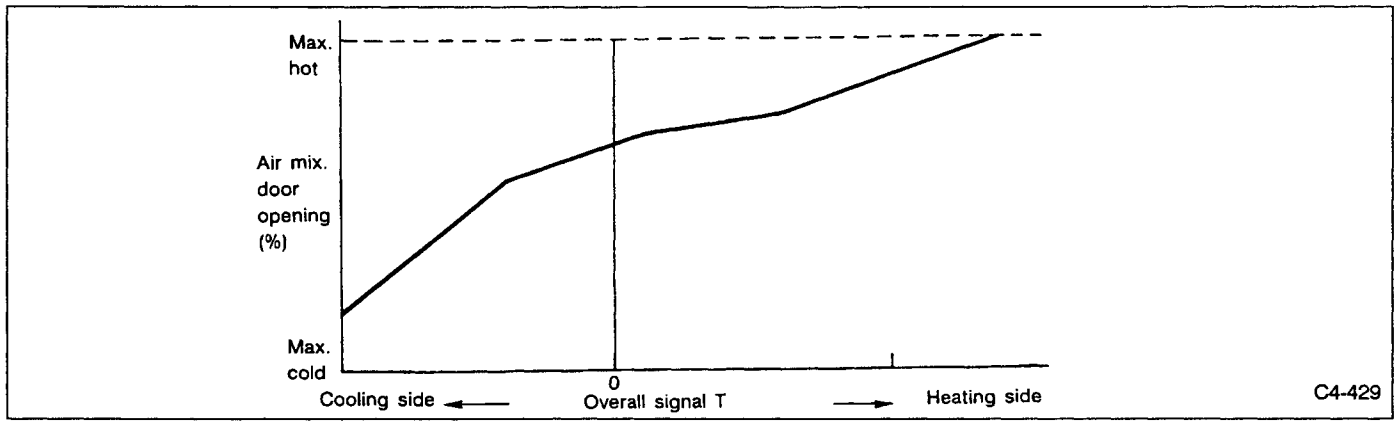
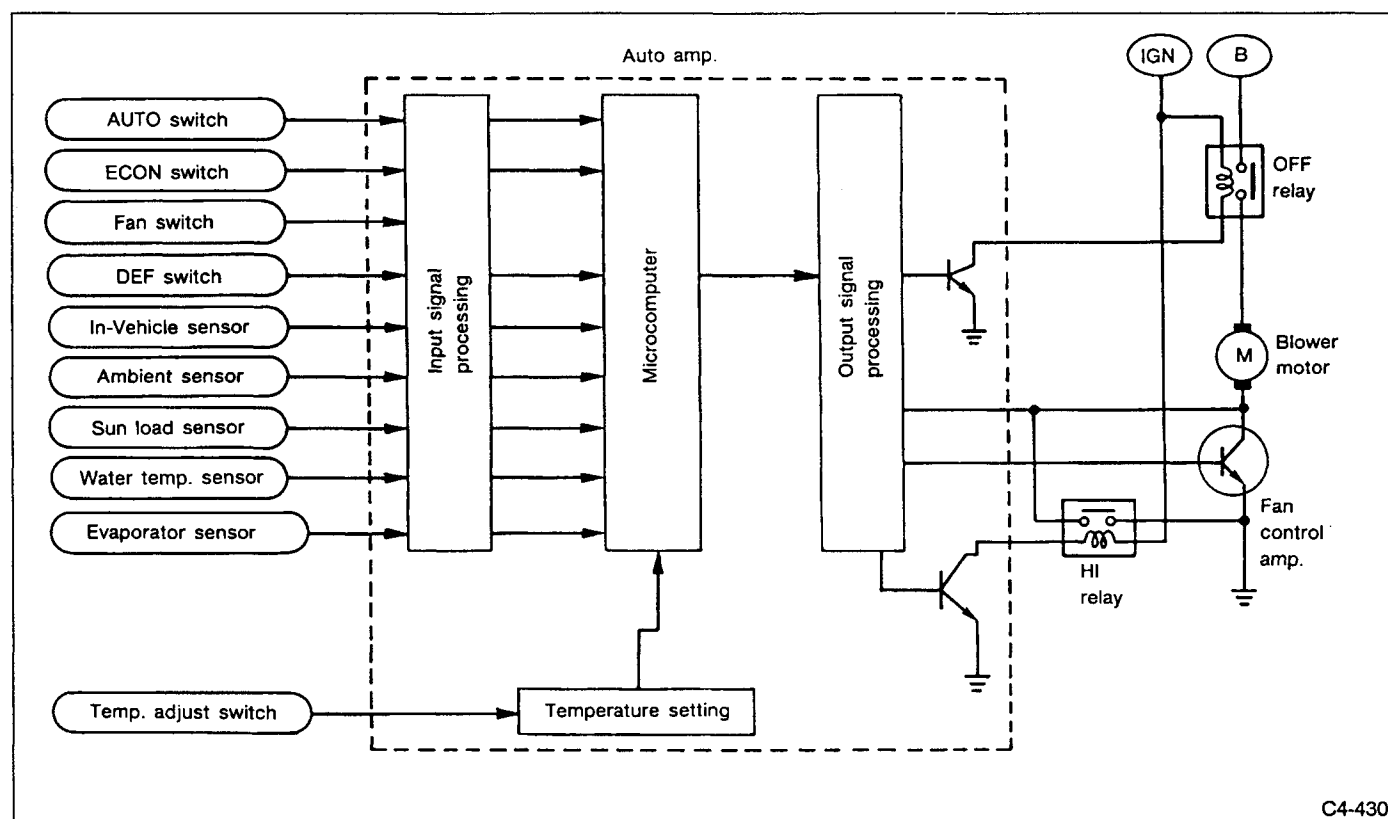


Fig. 68

2. FAN SPEED CONTROL

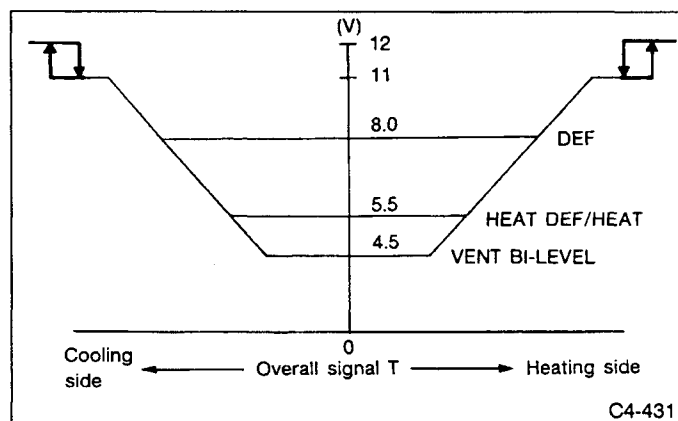


C4-430

Fig. 69

1) Ordinary automatic air flow rate control

The auto amplifier varies the base voltage of the fan control amplifier corresponding to the overall signal T, thus steplessly controlling the fan motor speed. The LO voltage varies with the air outlet position as shown below.



C4-431

Fig. 70

Air outlet position	Air flow LO voltage
VENT, BI-LEVEL	4.5V
HEAT, DEF/HEAT	5.5V
DEF	8.0V

2) Heater start control

(1) The heater start control is performed corresponding to the air outlet position. (This control is not performed when VENT switch or DEF switch is selected.)

The heater start control changes the air outlet and warm-up air flow rate.

(2) If the water temperature is below 30°C (86°F), DEF position and zero air flow are selected.

(3) If the water temperature is greater than 30°C (86°F), DEF/HEAT position is selected and the air flow rate is linearly increased from LO to AUTO level.

If the blower motor voltage is greater than 7 volts, the air outlet will change to the HEAT position.

AUTO switch	ON		
Water temperature	Less than 30°C (86°F)	Over 30°C (86°F)	
Blower motor voltage	0V	Below 7V	Over 7V
Air outlet	DEF	DEF/HEAT	HEAT

The DEF/HEAT mode door position is only set in case of heater start control.

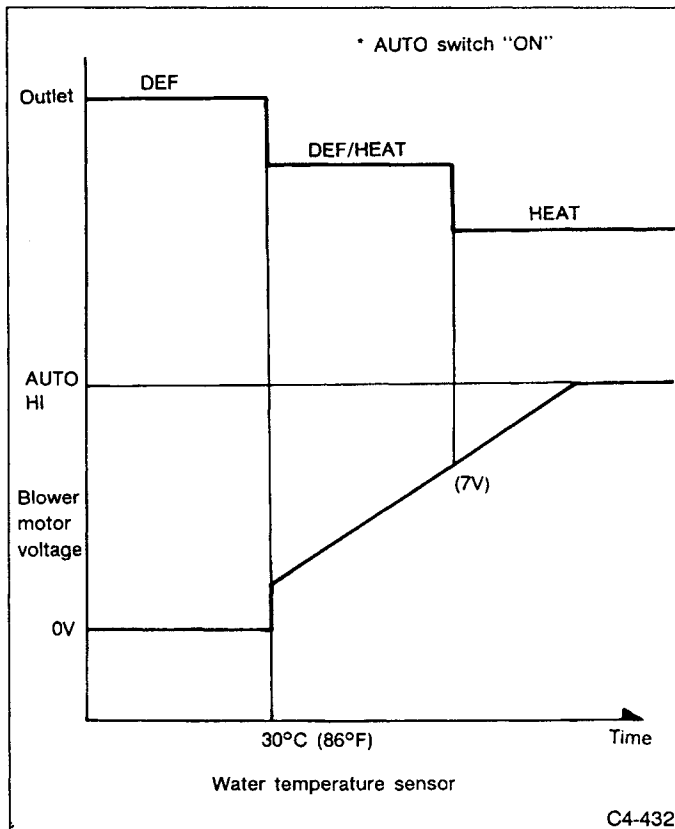


Fig. 71

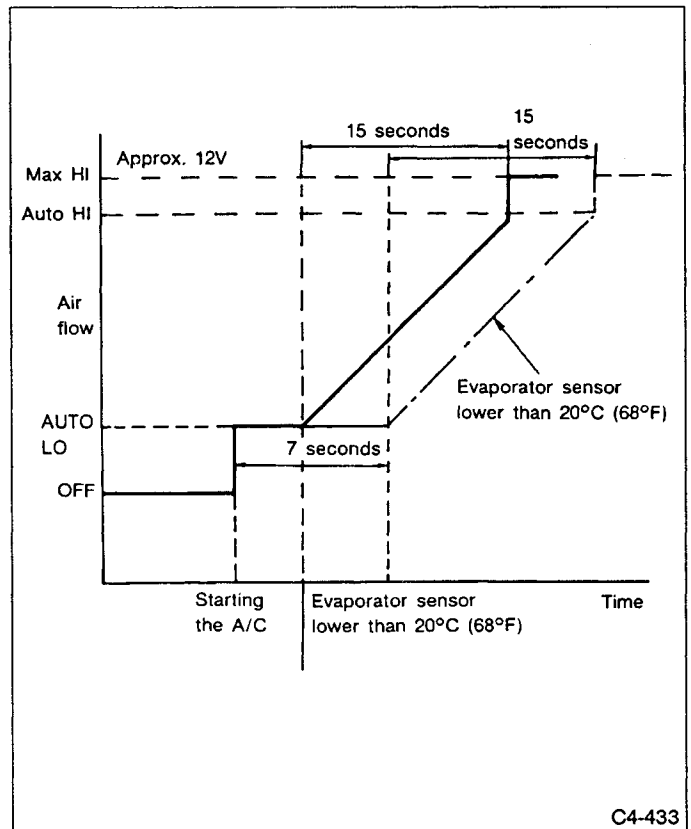


Fig. 72

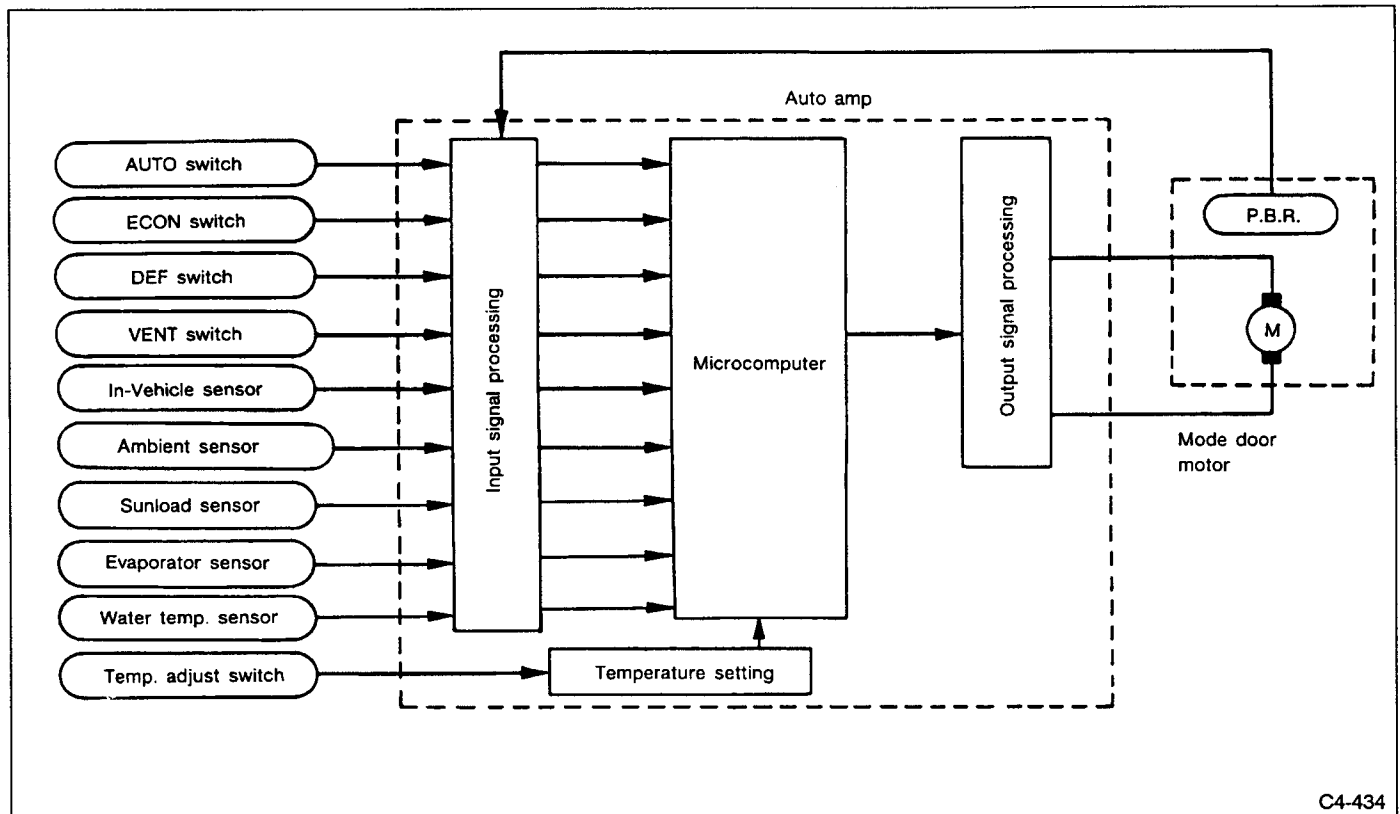
3) Cooler start control

If the temperature detected by the intake sensor is greater than 20°C (68°F) when starting the air conditioner, the auto amplifier performs cooler start control. The air flow is set at AUTO LO level when the intake sensor detected temperature is higher than 20°C (68°F). If the temperature is lower than 20°C (68°F), the air flow is increased to AUTO HI level from AUTO LO in 15 seconds.

Even if the intake sensor detected temperature is now lower than 20°C (68°F), setting air flow at the AUTO LO level is canceled seven seconds after the air conditioner starts, and it turns AUTO HI level in the subsequent 15 seconds.

This control is performed when the fan is turned ON irrespective of the compressor magnet clutch being ON or OFF.

3. MODE DOOR CONTROL



C4-434

Fig. 73

When the AUTO switch on the control panel is pressed, the switch signal is sent into the auto amplifier. The auto amplifier microcomputer computes the outlet air temperature based on the evaporator sensor signal and air mix door opening signal (computed from the temperature setting signal and various sensor signals). It also compares the computed result with the outlet port selection criterion, and drives the mode door actuating motor to select the air outlet from among the VENT, BI-LEVEL and HEAT modes.

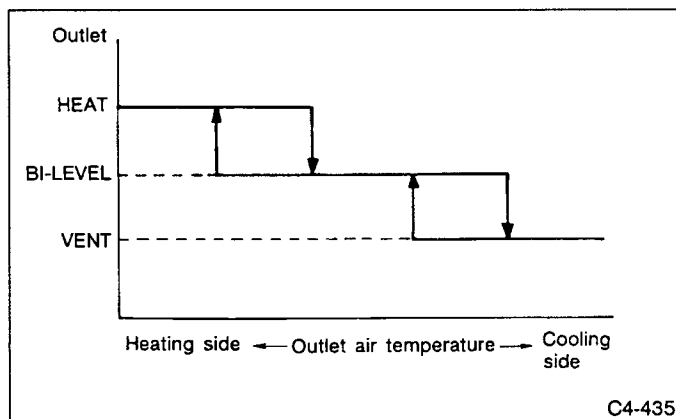
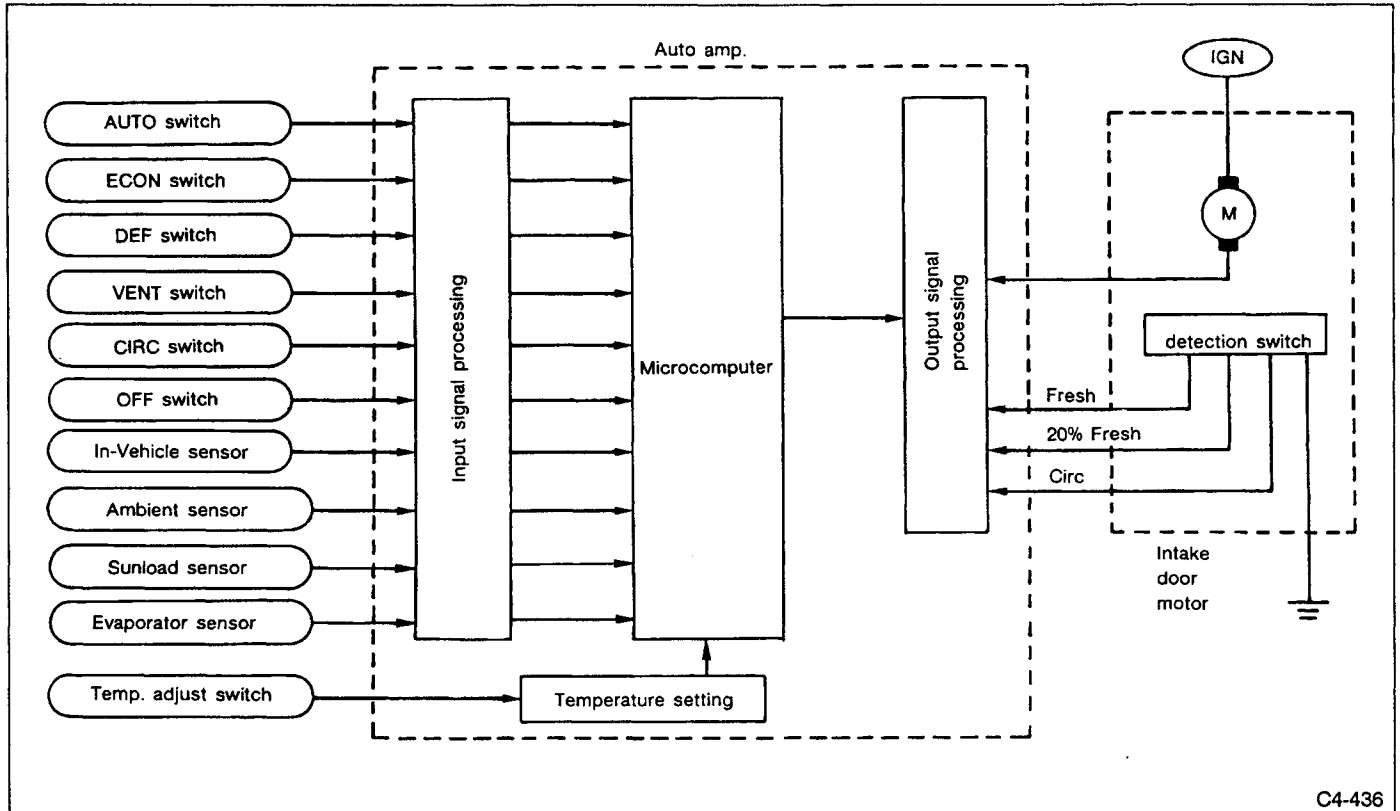


Fig. 74

4. INTAKE DOOR CONTROL (Automatic suction port control)



C4-436

Fig. 75

When the CIRC switch is OFF (LED OFF) and the compressor magnet clutch is OFF, the intake door is normally set in the FRESH position. When the compressor magnet clutch is ON, the intake door is selected among FRESH, 20% FRESH, and RECIRC positions corresponding to the overall signal T and ambient temperature.

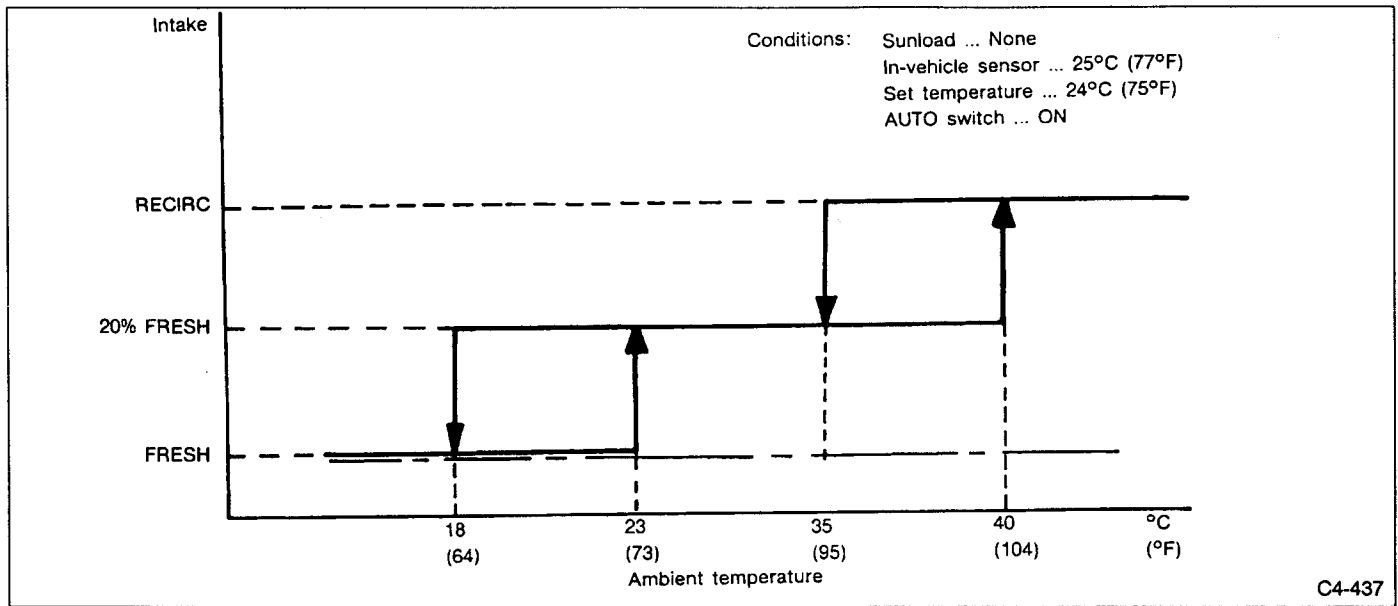
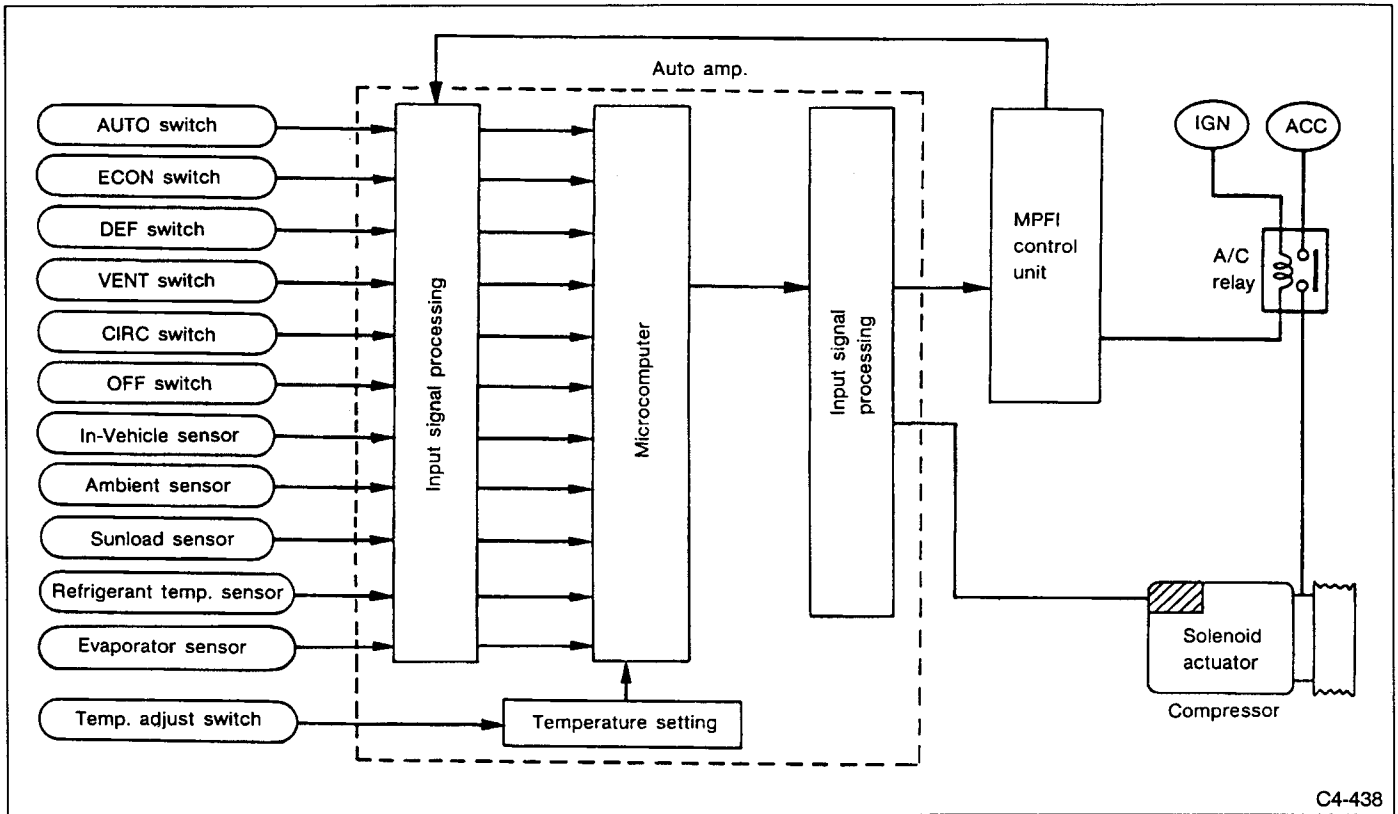


Fig. 76

5. COMPRESSOR CONTROL



C4-438

Fig. 77

1) Automatic control of compressor

The compressor operation mode is controlled as shown below corresponding to the control panel switches and ambient temperature levels.

Ambient temperature Switch	Zone A	Zone B	Zone C
AUTO switch	<ul style="list-style-type: none"> • Ordinary control • Quick cool down control 	Low temperature defrosting control	OFF
ECON switch	OFF	OFF	OFF
DEF switch	Ordinary control	Low temperature defrosting control	OFF

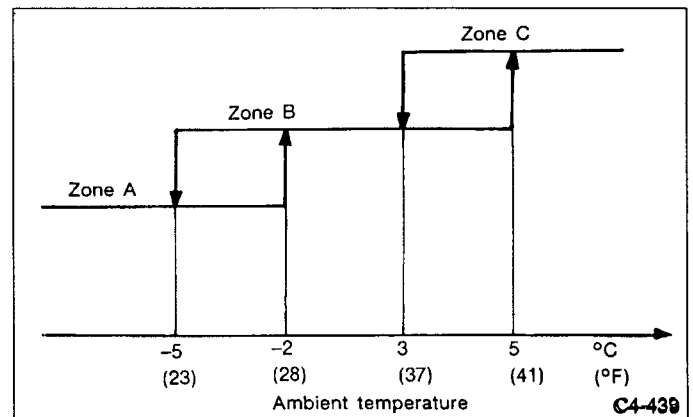


Fig. 78

C4-439

2) Ordinary control

(When AUTO switch or DEF switch is ON)

The compressor delivery is changed so that the evaporator blow-out air temperature is maintained at 3°C (37°F).

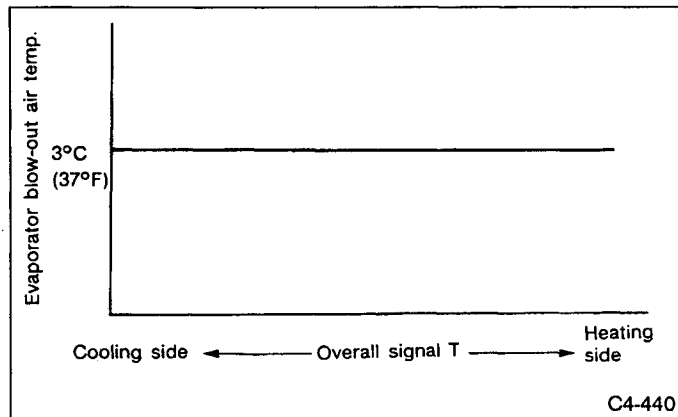


Fig. 79

Evaporator protection against freezing

The compressor magnet clutch is turned OFF depending on the air temperature detected by the evaporator intake sensor.

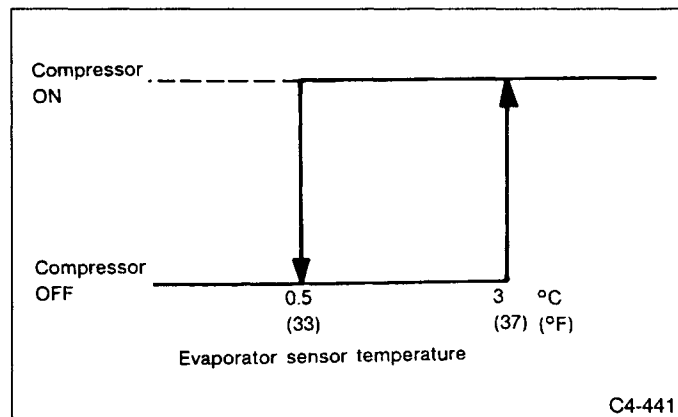


Fig. 80

3) Quick cool-down control [When AUTO switch is ON]
If the auto amplifier decides from the overall signal T that maximum cooling capacity is required, it then maximizes the compressor delivery up to a certain moment.

If the auto amplifier decides that maximum cooling capacity is not needed, it then changes the compressor delivery to the variable control zone.

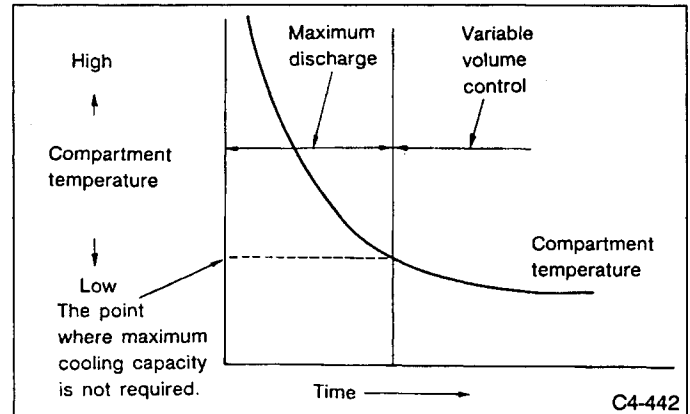


Fig. 81

If the evaporator outlet air temperature is lower than 3°C (37°F) for more than five minutes, the compressor changes from maximum delivery mode to variable delivery mode.

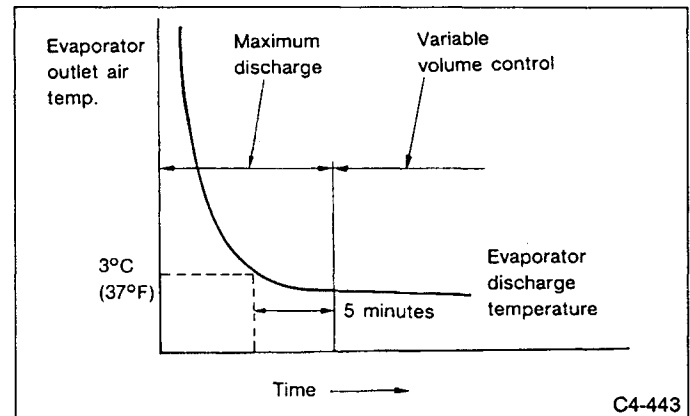


Fig. 82

4) Low temperature defrosting control

[When AUTO switch or DEF switch is ON]

The compressor delivery is varied corresponding to the ambient temperature so that the evaporator outlet air temperature can be kept within the range of 1 — 3°C (34 — 37°F). When the CIRC switch is OFF, the temperature is detected by the refrigerant temperature sensor.

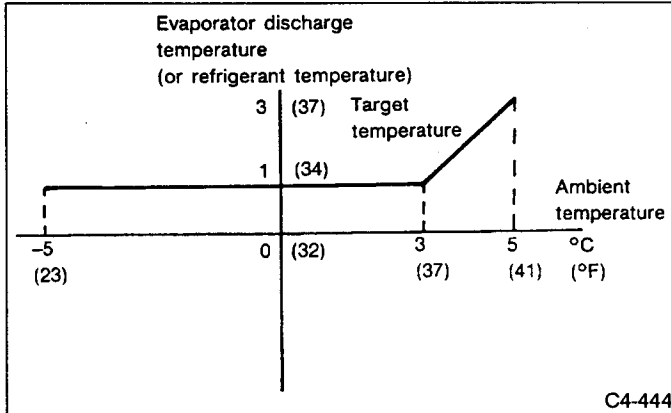


Fig. 83

Evaporator protection against freezing

[When AUTO switch or DEF switch is ON and CIRC switch is ON (RECIRC)]

The compressor magnet clutch is turned OFF depending on the temperature detected by the evaporator sensor.

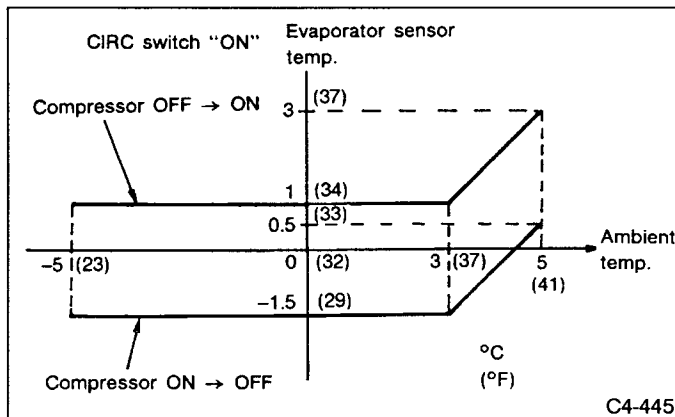


Fig. 84

[When AUTO switch or DEF switch is ON and CIRC switch is OFF (AUTO)]

The compressor is turned OFF depending on the temperature detected by the refrigerant temperature sensor.

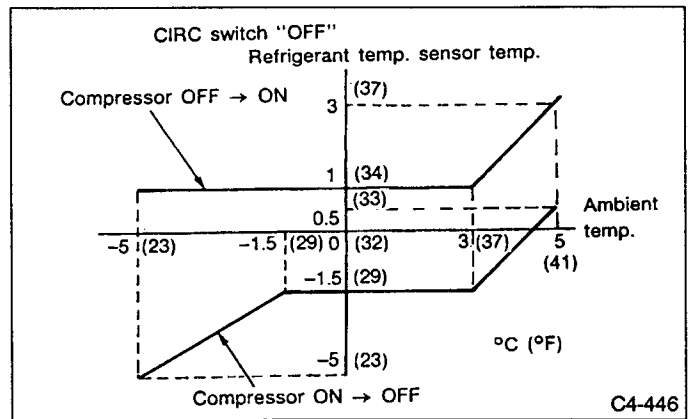


Fig. 85

5) Control by engine control unit (MPFI unit) signal

The engine control unit issues a compressor delivery reduction demanding signal (MPFI unit signal) to the auto amplifier. The auto amplifier, when receiving this signal, controls the solenoid actuator current as shown below.

MPFI signal	Solenoid actuator current
A	Ordinary temperature control
B	0.3(A)
C	0.45(A)
D	0.6(A)
E (Compressor OFF signal)	0(A)
Fault	0.6(A)

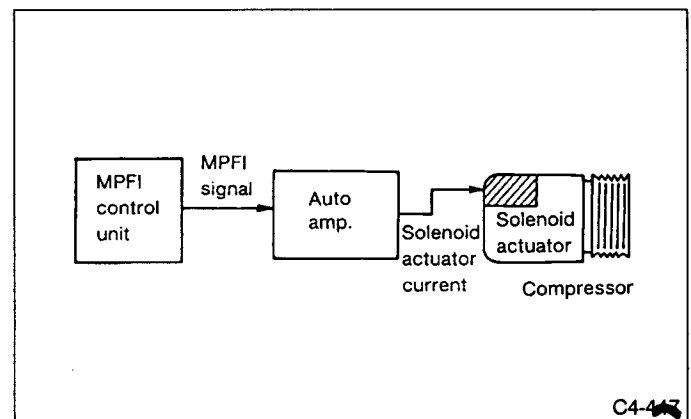


Fig. 86

The engine control unit (MPFI unit) issues the MPFI signal as mentioned above to the auto amplifier.

(1) When engine water temperature is abnormally high

If the engine water temperature rises abnormally, the MPFI unit issues signal A, B, C, D, or E depending on the engine water temperature.

(2) When compressor is turned OFF

When the compressor is turned OFF by the switch operation, the MPFI unit issues signal D (solenoid actuator current 0.6A) for approx. seven seconds before turning OFF.

These control items (1) and (2) are not performed by the auto amplifier.

6) Compressor protection in case of air conditioner trouble

If a trouble occurs in the air conditioner system and if, for example, no air blow is generated, then, the compressor is turned OFF depending on the temperature detected by the refrigerant temperature sensor.

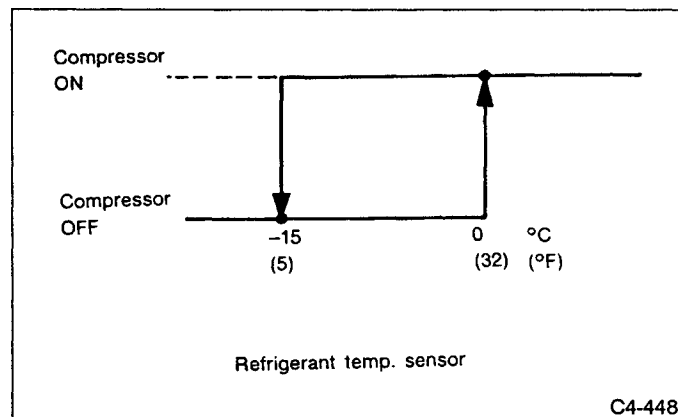


Fig. 87

7) Full-throttle control

When the throttle opening is maximum, the engine control unit (MPFI unit) turns the air conditioner relay OFF for a period of up to twenty seconds, thereby turning OFF the compressor.

This control is not performed by the auto amplifier.

6. AUTOMATIC CONTROL OF AMBIENT TEMPERATURE CORRECTION

The temperature data obtained by the ambient sensor is sent to the auto amplifier as the ambient temperature. Even if the ambient sensor measurement is influenced by the radiator heat and a sudden abnormal rise in temperature is measured, the auto amplifier will not directly respond to such a temperature rise; it only responds slowly owing to this correction function.

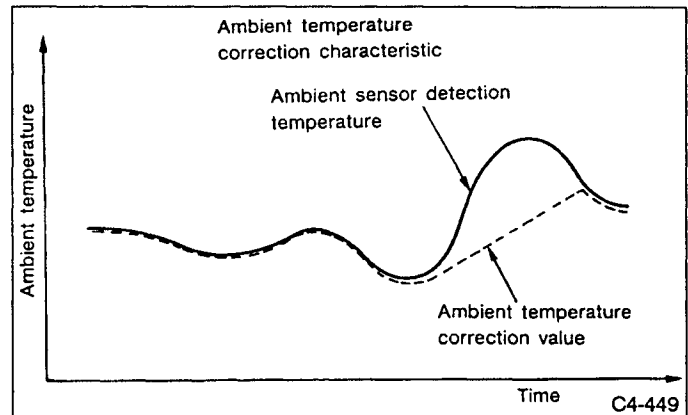


Fig. 88

7. COOLING FAN CONTROL

Electric cooling fans are adopted for cooling the radiator and condenser, and fan speed is controlled in three steps, HI, MED, and LO to reduce fan noise.

Fan speed	Power consumed
LO : 1,600 rpm	115W
MED : 1,950 rpm	145W
HI : 2,300 rpm	175W

This control is not performed by the auto amplifier.

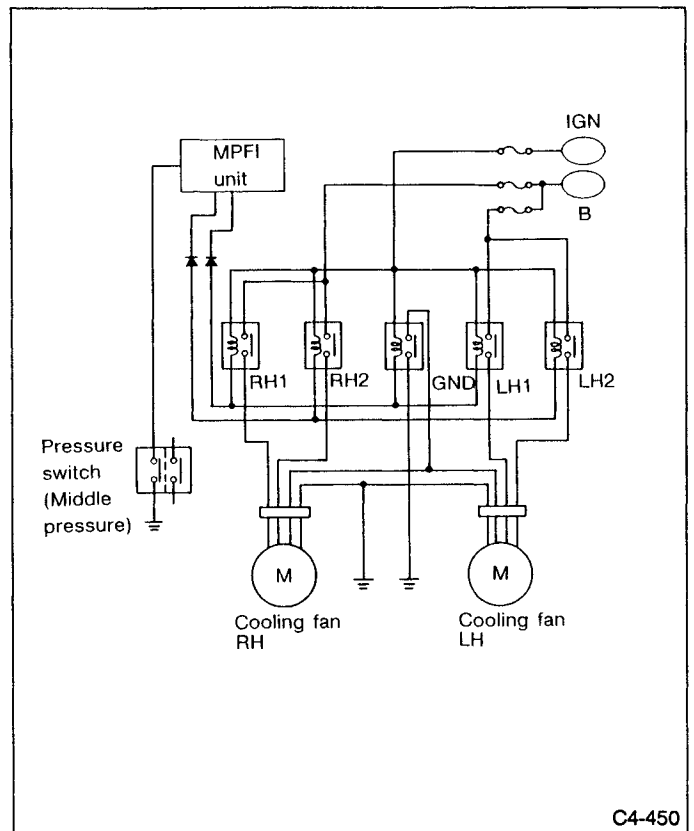


Fig. 89

	Input signal				Output signal		Cooling fan operation status	
	Compressor signal	Vehicle speed	Engine water temperature	Air conditioner intermediate pressure switch	MPFI unit signal			
		 6 (10) 12 (20) MPH (km/h)	 192 (89) 203 (95) °F (°C)	 1,275 ± 147 (13 ± 1.5) 1,569 ± 127 (16 ± 1.3) kPa (kg/cm²)	Terminal ①	Terminal ②	Main (RH)	Sub. (LH)
1	ON	X	X	X	ON	—	Low	Low
2			O	—	ON	Medium	Medium	
3			O	X	—	ON	Medium	Medium
4			O	ON	ON	High	High	
5		O	X	X	ON	—	Low	Low
6			O	ON	ON	High	Hlgh	
7			O	X	ON	ON	High	High
8			O	ON	ON	High	High	
9	OFF	X	X		—	—	Off	Off
10			O		ON	—	Low	Low
11		O	X		—	—	Off	Off
12			O		—	ON	Medium	Medium