

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

4. Automatic Air Conditioning

A: GENERAL

When the AUTO mode is selected, the automatic air conditioner controls the air temperature and air flow rate automatically.

The system can maintain a comfortable cabin air condition always when the temperature control dial is set in the vicinity of position "75" (vehicles for US) or position "25" (vehicles for Canada).

AC-19

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

1. SPECIFICATIONS

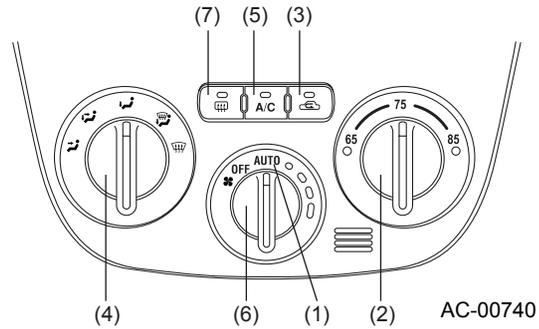
Item	Specifications		Remarks	
Air conditioning	"Full-air-mix" type			
Cooling performance	Cooling capacity (W)	5000		
	Air flow rate (m ³ /h)	450		
Refrigerant (g)	500±50			
Compressor	Type	Rotary type with vanes	Calsonic CR14	
	Capacity (cm ³ /rev)	144		
	Maximum permissible speed (rpm)	7000		
	Lubricant (amount contained in compressor in g)	DH-PR (180)		
Magnetic clutch	Type	Dry, single disc		
	Power consumption (W)	47		
	Pulley ratio	1:1.064 (crankshaft pulley diameter: 133 mm; compressor pulley diameter: 125 mm)		
	Belt	Polyurethane V-belt with four ribs		
Condenser	Type	Multi-flow type (with built-in liquid tank for subcooling)		
	Fan	Type		Electric-motor-driven axial flow fan
		Fan diameter		320 mm (7+5 blades)
		Power consumption (W)		120 × 2
Evaporator	Type	Laminated		
	Expansion valve	External pressure equalizing type		
	Temperature control sensor	Thermistor		
Automatic control system	Temperature control	"Full-air-mix" system		
	Fan speed control	Automatic control: stepless Manual control: four steps		
	Air introduction selection	Manual (inside air recirculation/fresh air introduction)		
	Air outlet selection	Manual (ventilation, bi-level, heater, defroster and heater/defroster)		
Other controls	Fast idle control system	Engine control module (ECM)		
	High and low pressure limit control	Low-pressure switch: Turns off compressor at a pressure higher than 0.278 MPa High-pressure switch: Turns off compressor at a pressure higher than 2.8 MPa		
	High-speed limit control	Performed by ECM		
	Radiator and condenser fan control	Performed by ECM		
Diagnosis function	The auto A/C control module has a sensor and actuator diagnosis function.			
Other controls	Manual adjustment possible at maximum heating and maximum cooling positions			

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

B: CONTROL PANEL

There are three dial-type switches and three push-button switches on the control panel.



- (1) AUTO position of fan speed control dial:
When the fan speed control dial is placed in this position, the blower speed and air temperature is automatically controlled according to signals from various sensors.
- (2) Temperature control dial:
The cabin temperature can be set in 11 steps between positions 65 and 85 (vehicles for US) or between positions 20 and 30 (vehicles for Canada). (The left and right ends are for fixing the system operation for maximum cooling and maximum heating.)
- (3) FRESH/RECIRC switch:
Used to select either the outside-air-introduction or cabin-air-recirculation.
- (4) Air flow control dial:
Used to change the air outlets. The air flow mode changes in the order shown below as the switch is turned clockwise.



AC-00127

- (5) A/C switch:
Used to turn on and off the air conditioner compressor.
- (6) Fan speed control dial:
Used to change the blower speed. When a speed is selected, the blower keeps that speed.
- (7) Rear window defogger switch:
Used to activate the rear window defogger. The defogger stays on for 15 minutes (unless manually turned off intermediately) and then is deactivated automatically.

AC-21

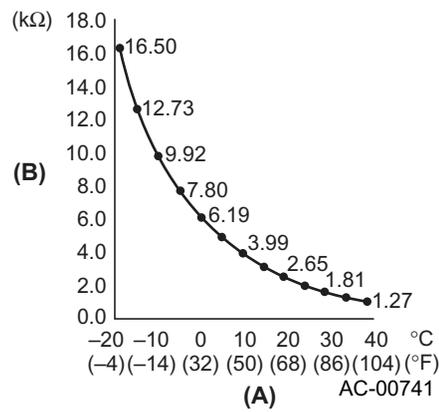
AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

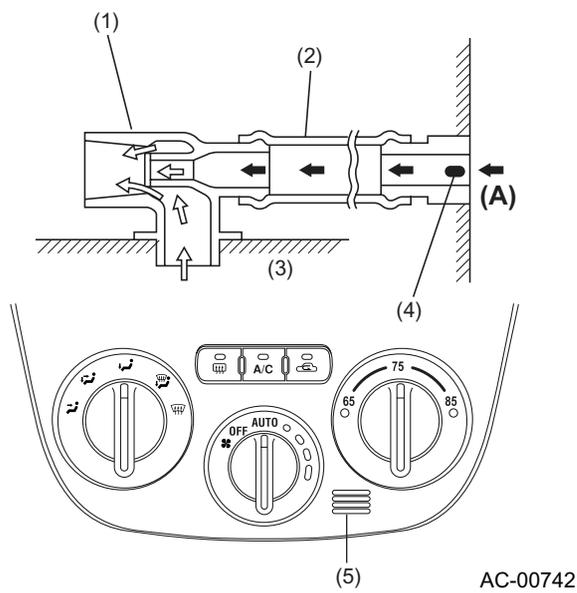
C: IN-VEHICLE SENSOR

The in-vehicle sensor detects the cabin temperature and sends an electric signal corresponding to the temperature to the A/C control module.

This sensor consists of an aspirator and a thermistor, the resistance of which changes in inverse proportion to the temperature. The aspirator operates by a vacuum generated in the heater unit (only when the blower unit is turned on).



- (A) Temperature
- (B) Resistance



- (1) Aspirator
- (2) Aspirator duct
- (3) Heater unit
- (4) In-vehicle sensor
- (5) Cabin air inlet
- (A) Cabin air

AC-22

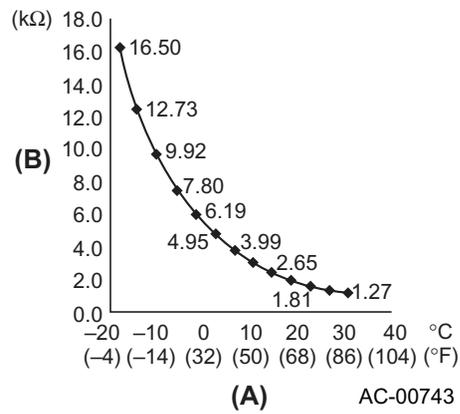
AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

D: AMBIENT SENSOR

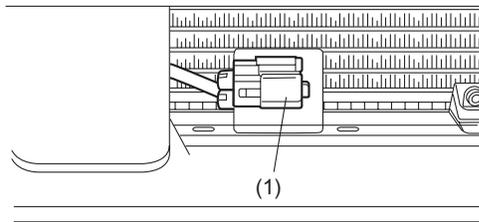
The ambient sensor uses a thermistor to detect the ambient temperature and outputs a signal corresponding the detected temperature to the auto A/C control module.

The thermistor is covered with a plastic molding to increase its thermal capacity, thus preventing it from being too sensitive to rapid changes in the temperature and enabling the sensor to output an average ambient temperature.



- (A) Temperature
- (B) Resistance

The ambient sensor is attached to the radiator lower panel at the portion where the radiator panel is located in such a way that it is exposed to outside air most efficiently.



AC-00712

- (1) Ambient sensor

AC-23

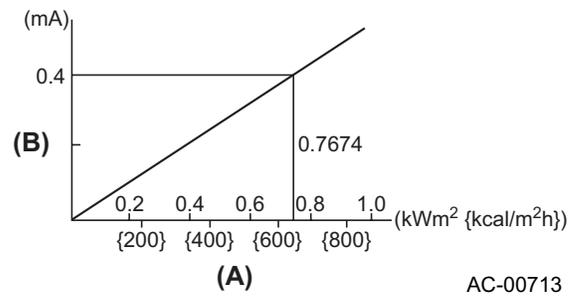
AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

E: SUN-LOAD SENSOR

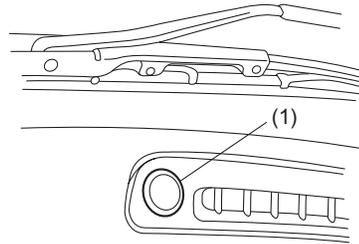
The sun-load sensor uses a photodiode which can convert change in the intensity of solar radiation into change in the electric current. The output signal of the sensor is sent to the auto A/C control module.

Sun-load sensor characteristics



- (A) Solar radiation
- (B) Photoelectric current

The sun-load sensor is attached to the front defroster grill.



AC-00714

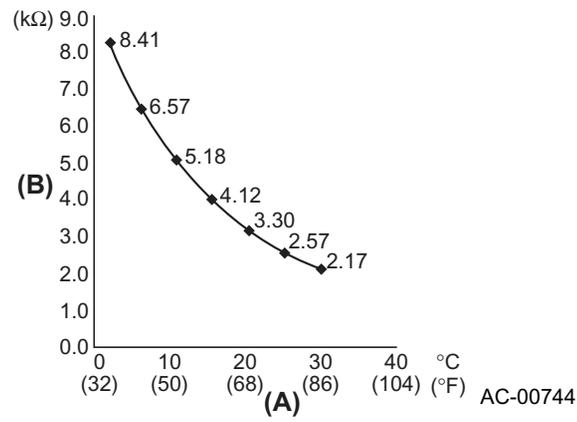
- (1) Sun-load sensor

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

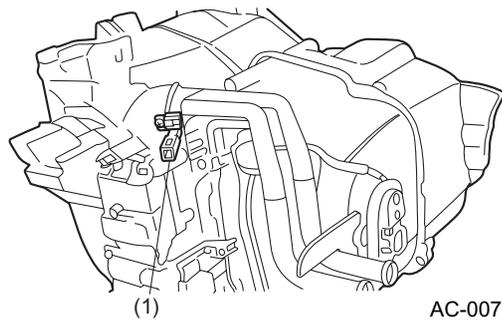
F: EVAPORATOR SENSOR

The evaporator sensor detects the temperature of the air that has passed over the evaporator and transmits a signal corresponding to the temperature to the auto A/C control module.



(A) Temperature

(B) Resistance



(1) Evaporator sensor connector

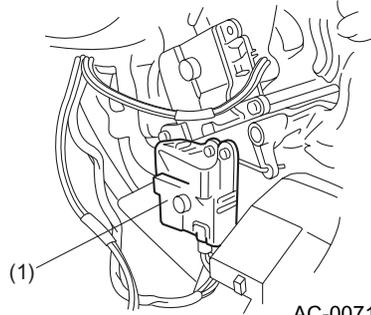
AC-25

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

G: AIR MIX DOOR ACTUATOR

The air mix door actuator incorporates an electric motor which turns in one or the other direction in response to signals from the auto A/C control module. The motion of the electric motor is transmitted to the air mix door via a linkage to move the door to an appropriate position.

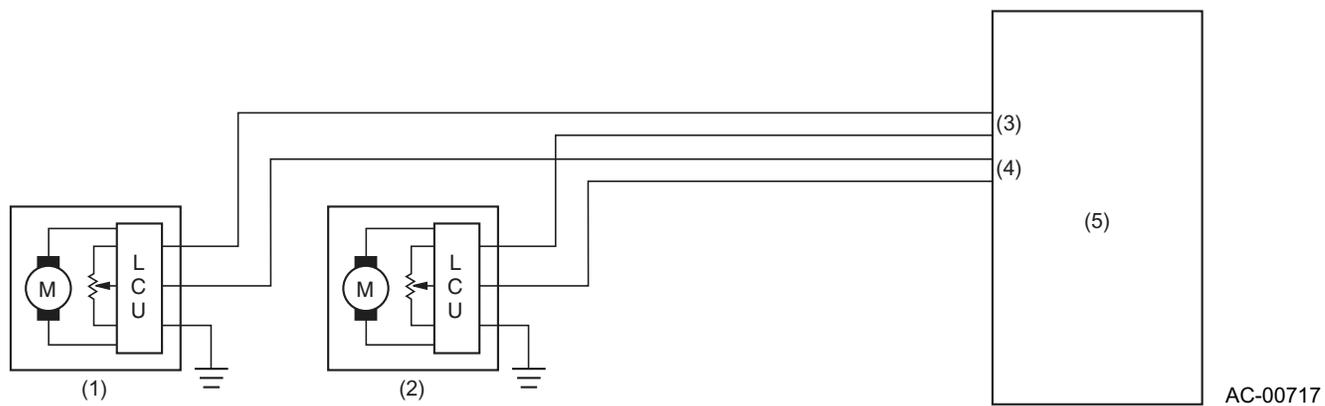


(1) Air mix door actuator

1. CONTROL SYSTEM

The air mix door actuator and mode door actuator have their own local control units (LCUs) so that they can be controlled through a single communication line by using the local area network (LAN) technology.

When each LCU receives from the auto A/C control module a control signal (a combination of two pulse signals with different amplitudes), it causes the corresponding door to move to a target position by calculating an appropriate amount of movement based on a door position signal. When the movement of the door has completed, the LCU sends a signal to the auto A/C control module to inform it of the fact.



- (1) Air mix door actuator
- (2) Mode door actuator
- (3) Actuator power source

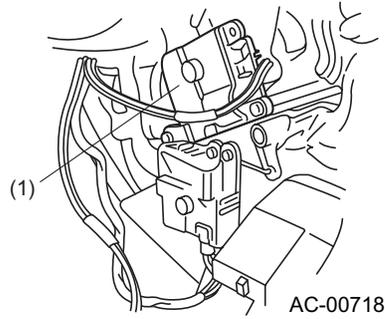
- (4) LAN signal
- (5) Auto A/C control module

AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

H: MODE DOOR ACTUATOR

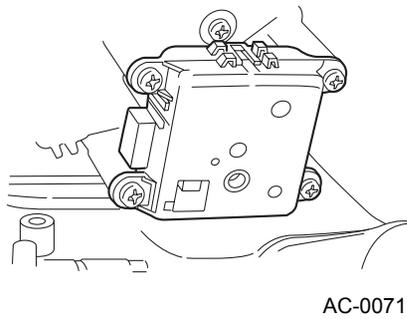
The mode door actuator incorporates an electric motor which turns in one or the other direction in response to signals from the auto A/C control module. The motion of the electric motor is transmitted to each mode door via a linkage and moves the door to the position appropriate for the selected air flow mode.



(1) Mode door actuator

I: FRESH/RECIRC DOOR ACTUATOR

The FRESH/RECIRC door actuator incorporates an electric motor which turns in one or the other direction in response to a signal from the auto A/C control module. The motion of the electric motor is transmitted to the FRESH/RECIRC door via a linkage to move the door to the outside-air introduction or cabin-air-recirculation position.



AUTOMATIC AIR CONDITIONING

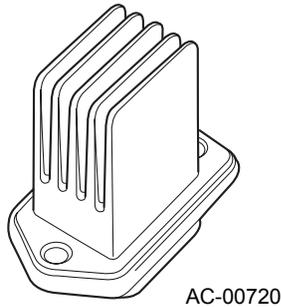
HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

J: FAN CONTROL AMPLIFIER

The fan control amplifier uses a MOS* type field effect transistor. This amplifier steplessly regulates the blower motor voltage (in the range between approximately 3V and 12V) in response to gate voltage signals issued by the auto A/C control module.

Since this fan control amplifier features very small voltage drop, it can handle the maximum voltage for the maximum blower speed without need for a high-voltage relay.

*MOS = metal oxide semiconductor



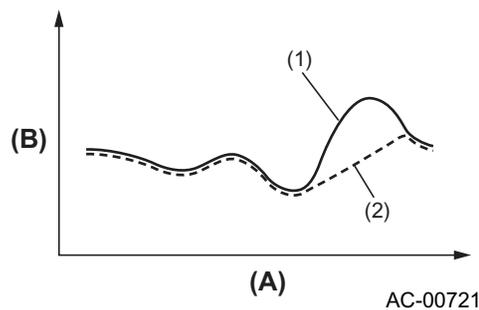
K: CONTROL SYSTEM

1. CORRECTION TO INPUT DATA

1) Correction to ambient sensor data

- The auto A/C control module receives ambient temperature data from the ambient sensor.
- If the ambient sensor data shows a rapid temperature rise by some causes such as heat from the radiator, the auto A/C control module performs a delay correction. By effecting this correction, the rate of temperature rise recognized by the auto A/C control module becomes slower than that detected by the ambient sensor. The auto A/C control module performs no correction when the ambient temperature drops.

Characteristics of correction to ambient sensor data



(1) Temperature detected by the sensor

(2) Outside air temperature after correction

(A) Time

(B) Outside air temperature

AC-28

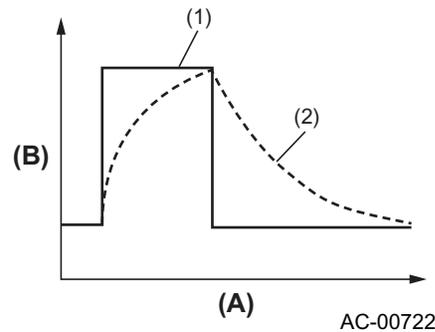
AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

2) Correction to sun-load sensor data

- The auto A/C control module receives solar radiation intensity data from the sun-load sensor.
- If the solar radiation intensity changes rapidly when, for example, the vehicle enters or goes out of a tunnel, the auto A/C control module performs a correction that slows down the rate of change in the solar radiation intensity recognized by itself.
- The auto A/C control module performs this correction in such a way that the rate of change in the solar radiation intensity it recognizes becomes higher when the intensity differs much from the sensor-detected intensity than when the difference between the two intensities is little. Also, the auto A/C control module performs the correction such that the rate of change in the recognized intensity becomes higher when the detected intensity changes upward than when it changes downward. This is to make the control match the way in which the human senses respond to change in the solar radiation intensity.

Characteristics of correction to sun-load sensor data



- (1) Solar radiation intensity detected by the sensor
 (2) Solar radiation intensity read by the ECM

- (A) Time
 (B) Solar radiation intensity

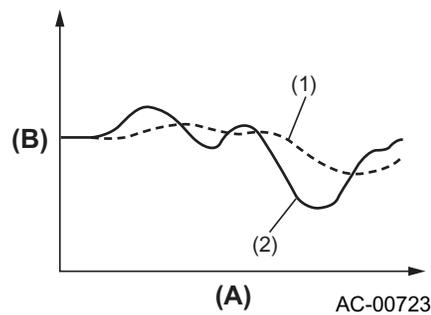
AUTOMATIC AIR CONDITIONING

HVAC SYSTEM (HEATER, VENTILATOR AND A/C)

3) Correction to in-vehicle sensor data

- The auto A/C control module receives cabin temperature data from the in-vehicle sensors.
- To prevent the air temperature control from directly reflecting non-uniformity of the cabin temperature or effects of external thermal factors, the auto A/C control module performs a correction that slows down the rate of change in the cabin temperature recognized by itself.
- The auto A/C control module performs this correction in such a way that the rate of change in the cabin temperature it recognizes becomes higher when the temperature differs much from the sensor-detected temperature than when the difference between the two temperatures is little.

Characteristics of correction to in-vehicle sensor data

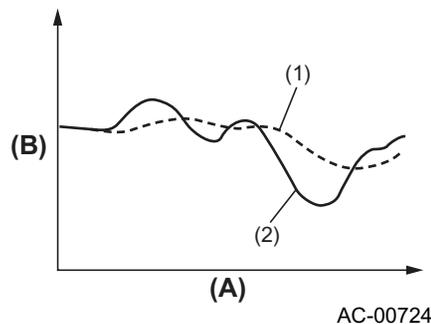


- | | |
|--|-----------------------|
| (1) Solar radiation intensity read by the ECM | (A) Time |
| (2) Solar radiation intensity detected by the sensor | (B) Cabin temperature |

4) Correction to evaporator sensor data

- The auto A/C control module receives data of the evaporator downstream air temperature from the evaporator sensor.
- To prevent the air temperature control from directly reflecting non-uniformity of the evaporator downstream air temperature or effects of external disturbances, the auto A/C control module performs a correction that slows down the rate of change in the evaporator downstream air temperature recognized by itself.
- The auto A/C control module performs this correction in such a way that the rate of change in the evaporator downstream air temperature it recognizes becomes higher when the temperature differs much from the sensor-detected temperature than when the difference between the two temperatures is little.

Characteristics of correction to evaporator sensor data



- | | |
|--|---|
| (1) Temperature read by the ECM | (A) Time |
| (2) Temperature detected by the sensor | (B) Air temperature at downstream of evaporator |

AC-30