

5. Air Conditioner Control

The air conditioner ECU has following control.

Control		Outline
Calculation of Required Outlet Air Temperature (TAO: Temperature Air Outlet)		After receiving the signals from the sensors and the temperature control switching setting for driver and front passenger. Then, it uses a prescribed formula to calculate the required outlet air temperature, and regulate the servomotors and the blower motor. This outlet air temperature is required in order to maintain the set temperature in a stable manner.
Outlet Air Temp. Control	MAX Fix Control	This control sets the TAO to –200 when the temperature is set to MAX COOL, and to 200 when the temperature is set to MAX HOT.
	Air Mix Damper Control	In response to the temperature control switch setting, the required outlet air temperature, evaporator temperature sensor, and water temperature sensor compensations are used by the air mix damper control to calculate a tentative damper opening angle, through an arithmetic circuit in the air mix damper, to arrive at a target damper opening angle.
		This control calculates a tentative damper opening angle for the resistance value in accordance with the temperature control switch setting, and arrives at a target damper opening angle through an arithmetic circuit in the air mix damper.
Blower Control	Blower Motor Start Up Control	When the blower motor is started up, the blower voltage in the LO speed in output to the blower controller for 2 seconds. This is designed to protect the blower controller from a sudden start up voltage surge.
	Automatic Control	Step Less Air Volume Control: <ul style="list-style-type: none"> When the AUTO switch in the heater control panel is pushed, the A/C ECU automatically regulates the voltage to the blower controller, in accordance with the required outlet air temperature, to deliver step less air volume. Warm-up Control: <ul style="list-style-type: none"> When the air outlet is in the FOOT, BI-LEVEL, or FOOT/DEF mode, the blower will not operate until the water temperature increases above a prescribed value. When the temperature increases above a prescribed value, the blower motor operates at the LO speed. Thereafter, control is effected by comparing the airflow calculated from the water temperature and the airflow calculated from the TAO.
		Time-Lagged Air Flow Control: <ul style="list-style-type: none"> 2 types of time-lagged air flow control (in accordance with the detected by the evaporator temperature sensor) help prevent hot air from being emitted from FACE or BI-LEVEL vent. For details, see page 265.
	Automatic Control	Sunlight Air Flow Control: <ul style="list-style-type: none"> Controls the blower speed in accordance with the intensity of the sunlight when the air outlet mode is at FACE or BI-LEVEL. The blower speed can be adjusted in response to the signal received from the solar sensor.
Air Outlet Control	Manual Control	Changes the air outlet in accordance with the selected position of the mode select switch.
	Automatic Control	Mode Damper Switching Servomotor Control: <ul style="list-style-type: none"> When the AUTO switch of the heater control panel has been turned ON, automatic control causes the mode servomotor to rotate to a desired position in accordance with the target damper opening, which is based on the calculation of the TAO. Low-Temperature FOOT/DEF Control: <ul style="list-style-type: none"> In accordance with the water temperature, ambient temperature, amount of sunlight, required outlet temperature (TAO), and vehicle speed conditions, this control automatically switches the blower outlet between the FOOT/ DEF modes to prevent the window from becoming fogged when the outside air temperature is low.

Control		Outline
Compressor Control	Refrigerant Pressure Malfunction Detection	By monitoring the A/C pressure sensor signal, this system can judge the refrigerant pressure as being abnormal and turns the operating capacity of the compressor to 0%.
	Evaporator Temperature Sensor Judgment	When the detected temperature of the evaporator temperature sensor is below –4, the operating capacity of the compressor turns to 0% in order to prevent the evaporator from becoming frosted.
	Ambient Temp. Sensor Judgment	When the detected temperature of the ambient temperature sensor is below –1.5, the operating capacity of the compressor turns to 0%.
	Evaporator Supercooling Control	When the vehicle is decelerating, this control implements evaporator supercooling in order to reduce the operation rate of the compressor during idle. For details, see page 266 .
	Variable Capacity Compressor Control*	The variable capacity compressor control consists of 5 controls. For details, see page 266 . <ul style="list-style-type: none"> ● Acceleration Control ● Low-Speed Control ● Frost Control ● A/C switch ON/ OFF Control ● Compressor Protect Control
Electronic Cooling Fan Control		The A/C ECU and the engine ECU control the cooling fan speed in accordance with the water temperature signal, vehicle speed signal, and refrigerant pressure signal.
Rear Window Defogger Control		Switches the rear defogger and outside rear view mirror heaters on for 15 minutes when the rear defogger switch is switched on. Switches them off if the switch is pressed while they are operating.
Self-Diagnosis		Check the indicator, sensor, and actuator the check in accordance with operation of the heater control panel switches, then LCD portion a DTC (Diagnostic Trouble Codes) to indicate if there is a malfunction or not.

*: Only on the models for Australia

Time-Lagged Air Flow Control

1) General

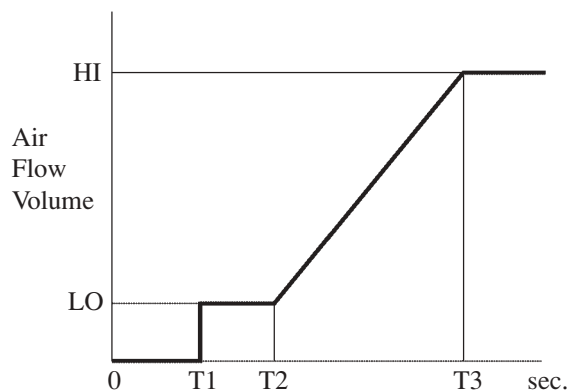
2 types of time-lagged air flow control (in accordance with the detected by the evaporator temperature sensor) help prevent hot air from being emitted from FACE or BI-LEVEL vent.

a. Evaporator Temperature Sensor Above 30°C

- 1) As shown in the diagram on the below, this control turns OFF the blower motor for T1 sec. and turns ON the compressor to cool the air conditioner unit. After T1 sec. has elapsed, the blower motor rotates in the manual LO mode, allowing the cooled air to be discharged from the vents. Thus, the discomfort that is associated with the discharge of warm air is prevented.
- 2) Between T2 and T3 sec. the air flow volume according to the time-lagged air flow control and the air flow volume of the blower control according to the calculation of the TAO are compared. The air flow volume is then regulated at the smaller volume of the two.
- 3) After T3 sec. has elapsed, control is effected by the blower control according to the calculation of the TAO.

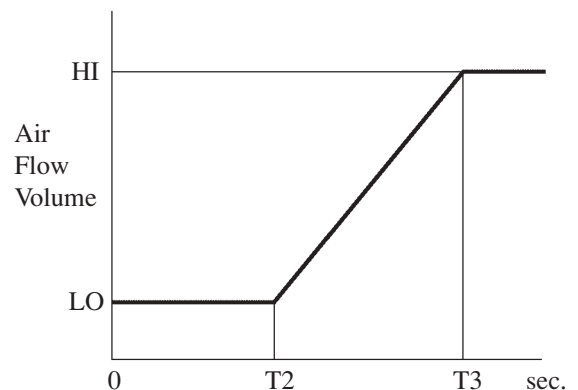
b. Evaporator Temperature Sensor Below 30°C

- 1) As shown in the diagram on the below, for T1 sec., the blower motor rotates in the manual LO mode.
- 2) Thereafter, up to T2 sec., the air flow volume according to the time-lagged air flow control and the air flow volume according to the blower control of the calculation of the TAO are compared. The air flow volume is then regulated at the smaller volume of the two.
- 3) After T3 sec. has elapsed, control is effected by the blower control according to the calculation of the TAO.



Above 30°C

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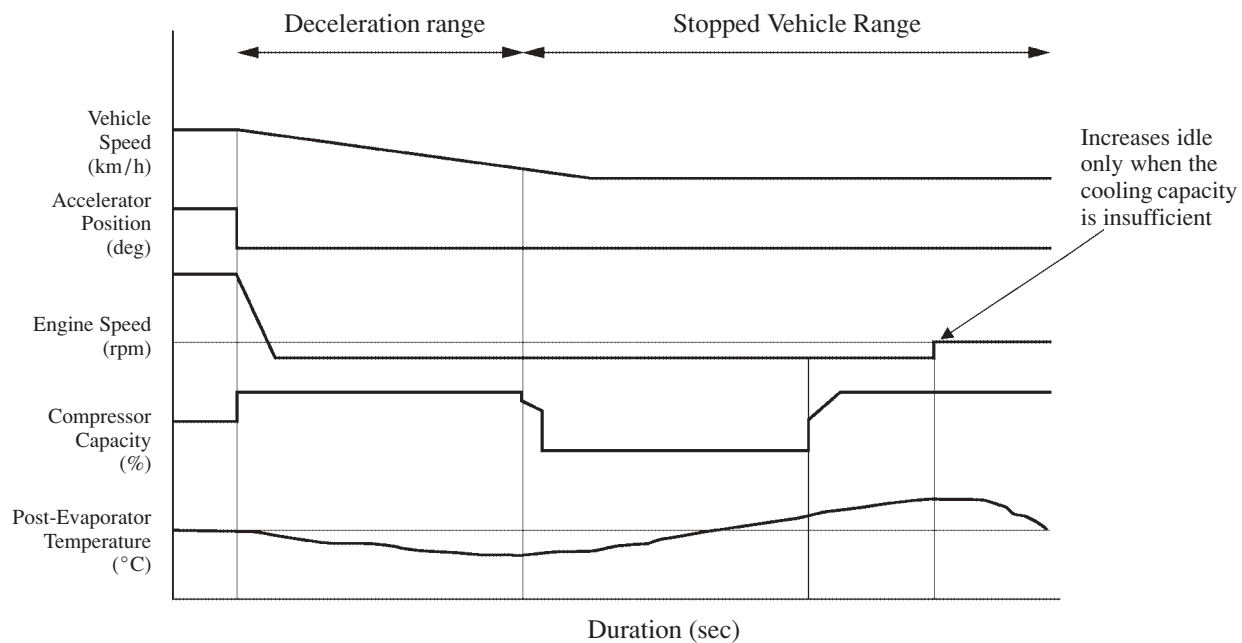


Below 30°C

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c. Evaporator Supercooling Control

In the entire deceleration range of the vehicle, this control implements evaporator supercooling, in order to reduce the operation rate of the compressor during idle. As a result, fuel economy has been improved.



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Variable Capacity Compressor Control

1) General

The variable capacity compressor control constantly compares the compressor operating capacities that have been calculated. It uses the lowest among them as the actual compressor operating capacity. As a result, efficient compressor control is realized to suit the air conditioner operation conditions and the vehicle driving conditions.

- Acceleration Control
- Low-speed Control
- Frost Control
- A/C Switch ON/ OFF Control
- Compressor Protect Control

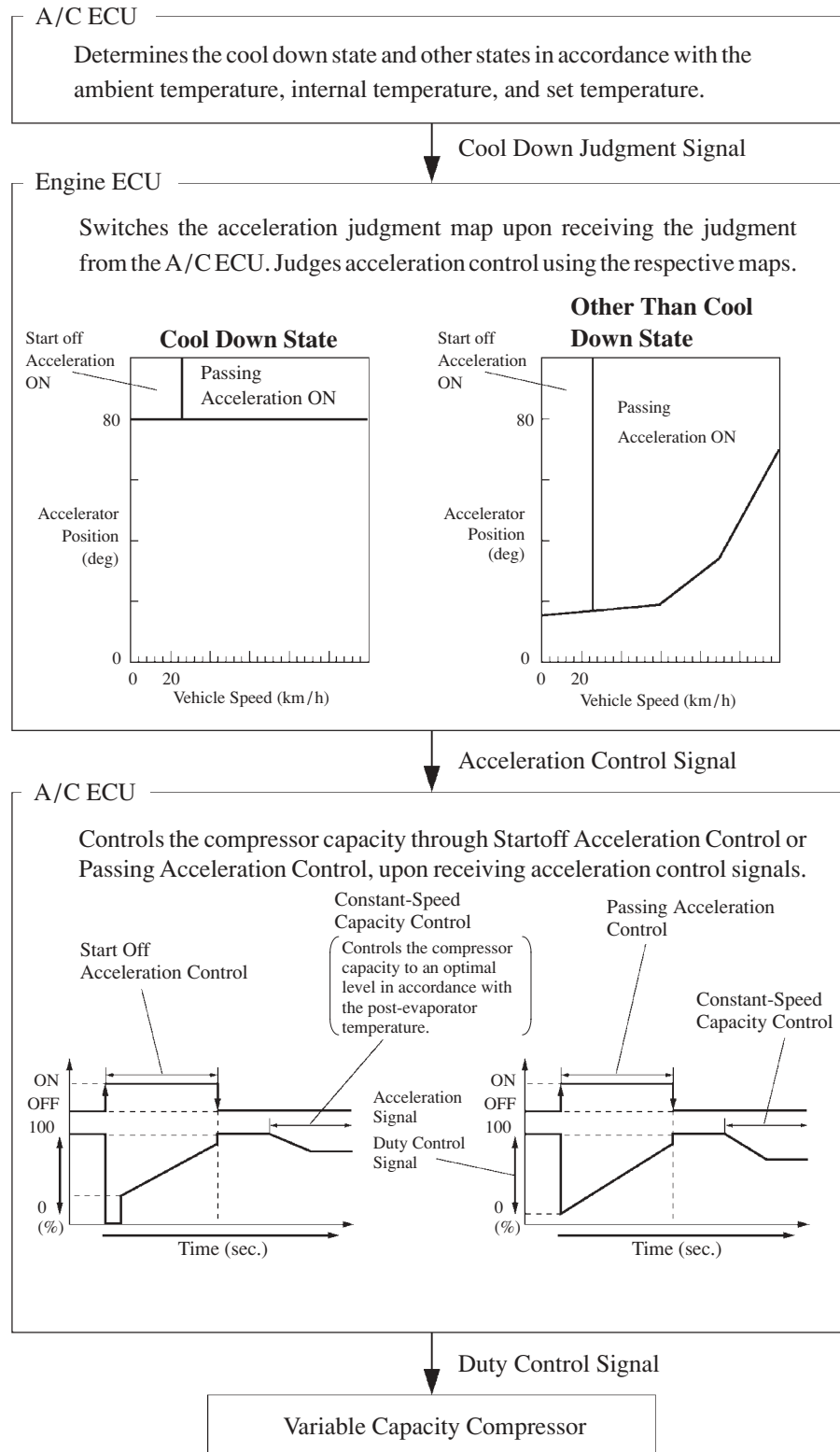
2) Acceleration Control

The acceleration control consists of start off and passing acceleration control.

The A/C ECU controls the cooling capability during acceleration in accordance with the ambient temperature, internal temperature, and the set temperature.

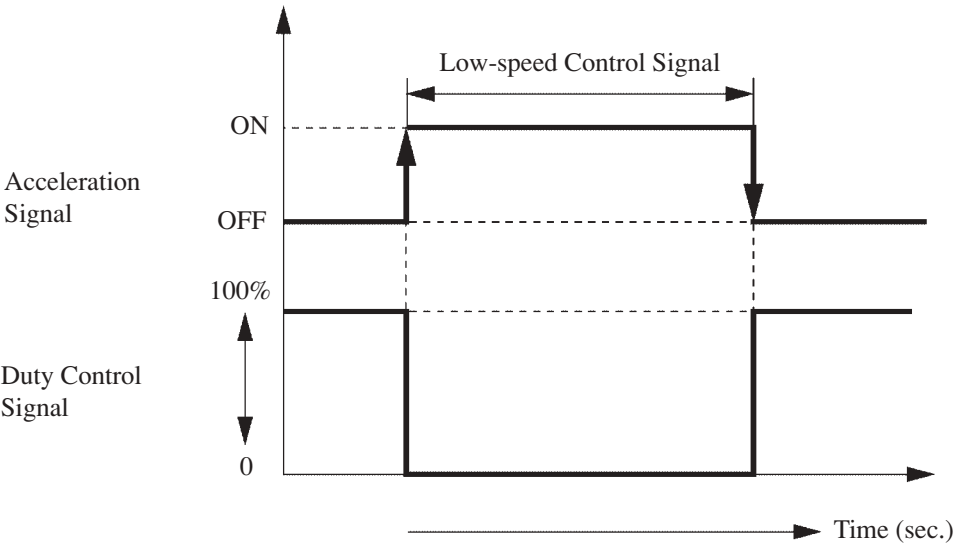
It varies acceleration control during the cool down state and other states in order to control the capacity of the compressor. This prevents the vehicle's acceleration performance from being negatively affected and improves fuel economy, while ensuring the proper cooling performance.

After effecting acceleration control, the A/C ECU effects constant-speed capacity control in order to optimally control the compressor capacity.



3) Low-speed Control

When the engine ECU inputs an acceleration signal at low engine speeds, the A/C ECU lowers the compressor operating capacity output as shown in the table below. As a result, proper drivability at low engine speeds is ensured.



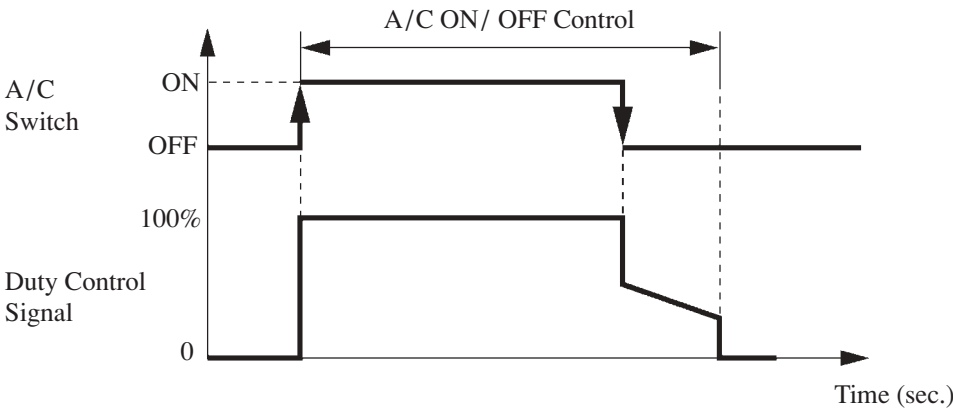
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4) Frost Control

To prevent the evaporator from frosting, this control calculates the compressor operating capacity using a calculation formula that has been established based on deceleration control, evaporator temperature sensor, and A/C pressure sensor signal.

5) A/C Switch ON/ OFF Control

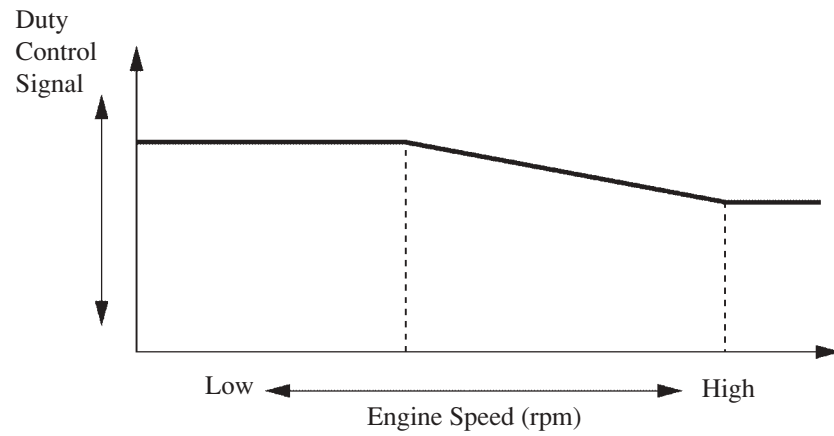
Controls the compressor operating capacity as shown in the following table in accordance with the A/C switch.



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6) Compressor Protect Control

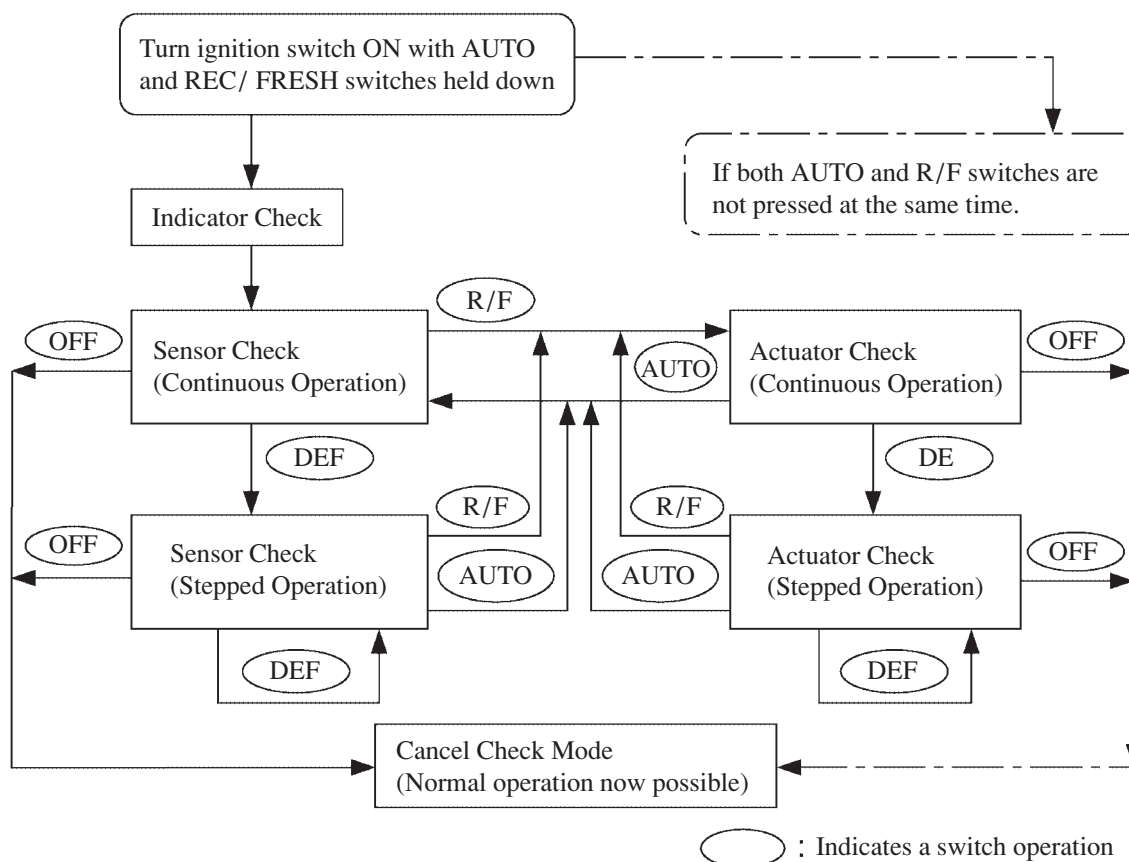
The A/C ECU controls the compressor operating capacity as shown below in accordance with the engine speed.



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Self-Diagnosis

- The A/C ECU has a self-diagnosis function. The self-diagnosis mode, which starts when the switches on the heater control panel are operated as shown below, has three functions: indicator check, sensor check, and actuator check.



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► Function ◀

Function	Outline
Indicator Check	Checks indicator lights and temperature setting display.
Sensor Check	Checks the past and present malfunctions of the sensors, and clearing the past malfunction data.
Actuator Check	Checks against actuator check pattern if blower motor and servomotors are operating correctly according to signals from A/C ECU.