■AUTOMATIC AIR CONDITIONING SYSTEM CONTROL

1. General

The air conditioning system uses the following types of control.

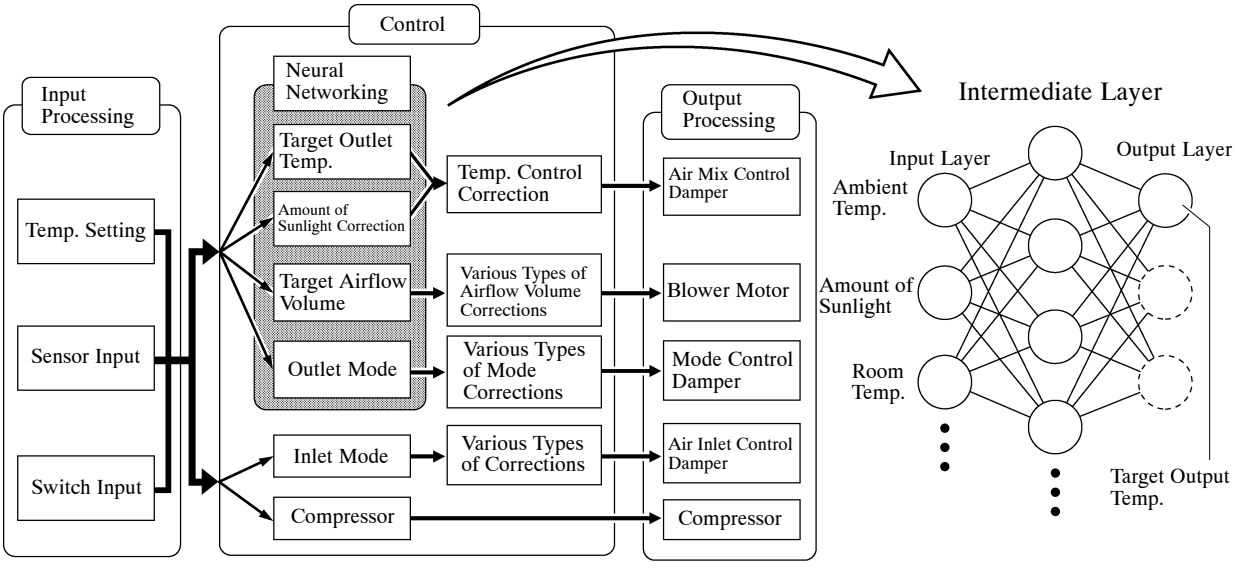
Control		Outline
Neural Network Control [See page BE-76]		This control is capable of performing complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to a human brain.
Outlet Air Temp. Control		Based on the temperature set at the temperature control dial, the neural network control calculates the outlet air temperature based on the input signals from various sensors.
	Left & Right Independent Control	The temperature setting for the driver and front passenger is controlled independently in order to provide a separate vehicle interior temperature for the right and left side of the vehicle. Thus, air conditioning that accommodates the occupants' preferences has been realized.
Blower Control		Controls the blower motor in accordance with the airflow volume that has been calculated by the neural network control based on the input signals from various sensors.
Air Outlet Control		Automatically switches the air outlets in accordance with the outlet mode that has been calculated by the neural network control based on the input signals from various sensors.
		In accordance with the engine coolant temperature, ambient air temperature, amount of sunlight, required blower, outlet temperature, and vehicle speed conditions, this control automatically switches the blower outlet to the FOOT/DEF mode to prevent the windows from becoming fogged when the ambient air temperature is low.
Air Inlet Control		Automatically controls the air inlet control damper to help achieve the calculated outlet air temperature that is required.
		Drives the air inlet control servo motor according to the operation of the air inlet control switch and moves the dampers to the FRESH or RECIRC position.
Compressor Control [See page BE-77]	Compressor Speed Control	The air conditioning amplifier calculates the target speed of the compressor based on the target evaporator temperature (which is calculated by the room temperature sensor, humidity sensor, ambient temperature sensor, and the solar sensor) and the actual evaporator temperature that is detected by the evaporator temperature sensor in order to control the compressor speed.
		The air conditioning amplifier calculates the target evaporator temperature, which includes corrections based on the vehicle interior humidity (which is obtained from the humidity sensor) and the windshield glass inner surface humidity (which is calculated by the humidity sensor, solar sensor, room temperature sensor, mode damper position, and wiper operation condition). Accordingly, the air conditioning amplifier controls the compressor speed to an extent that would not inhibit the proper cooling performance or defogging performance.
Rear Defogger & Mirror Heater Control [See page BE-226 or 237]		When the power source mode is changed to IG-ON, and the rear defogger switch or rear defogger & mirror heater switch is pushed, this system is activated to keep the defogger heater and mirror heaters on for approx. 15 minutes. However, the operating time of the rear defogger can be extended up to approx. 60 minutes when the following requirements are met. The operating time of the mirror heaters will not be extended. • Ambient Temperature: 0°C or less • Vehicle Speed: 40 mph (65 km/h) or more

(Continued)

Control	Outline
Front Wiper Deicer [See page BE-235]	Switches the front wiper deicer on for approx. 15 minutes when the deicer switch assembly is pressed.
Water Pump Control	When the blower motor is on and the engine has been stopped by the hybrid control, the air conditioning amplifier turns on the water pump in accordance with the judgment of the air mix damper opening.
Diagnosis [See page BE-77]	A DTC (Diagnostic Trouble Code) is stored in the memory when the air conditioning amplifier detects a problem with the air conditioning system.

2. Neural Network Control

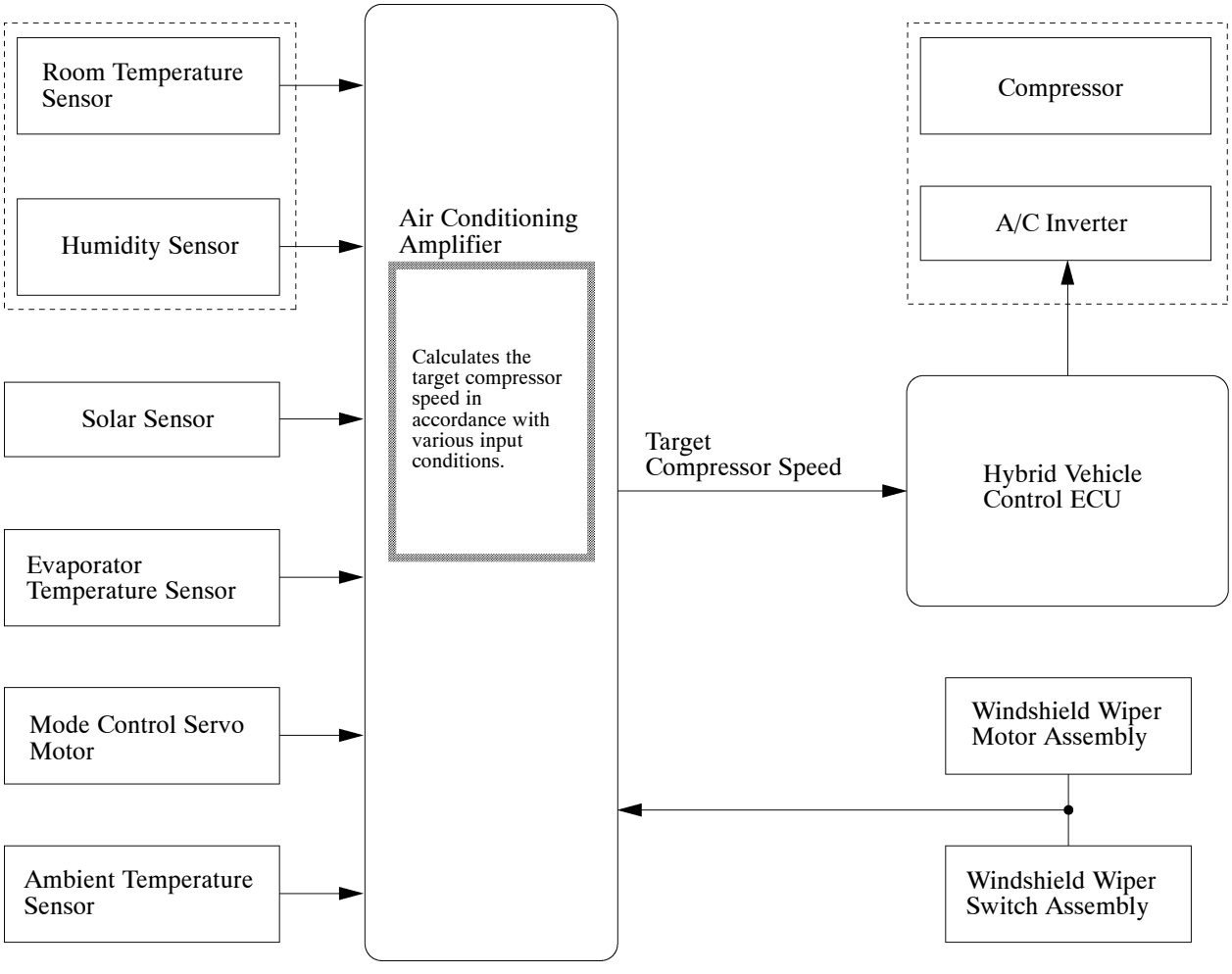
- In conventional automatic air conditioning systems without neural network control, the air conditioning amplifier determined the required outlet air temperature and blower air volume in accordance with the calculation formula that has been obtained based on information received from the sensors.
  However, because the senses of a person are rather complex, a given temperature is sensed differently, depending on the environment in which the person is situated. For example, a given amount of solar radiation can be felt comfortably warm in a cold climate, or extremely uncomfortable in a hot climate. Therefore, as a technique for performing a higher level of control, a neural network has been adopted in the automatic air conditioning system. With this technique, the data that has been collected under varying environmental conditions is stored in the air conditioning amplifier. The air conditioning amplifier can then perform control to provide enhanced air conditioning comfort.
- The neural network control consists of neurons in the input layer, intermediate layer, and output layer. The input layer neurons process the input data of the ambient temperature, the amount of sunlight, and the room temperature based on the outputs of the switches and sensors, and output them to the intermediate layer neurons. Based on this data, the intermediate layer neurons adjust the strength of the links among the neurons. The sum of these is then calculated by the output layer neurons in the form of the required outlet temperature, solar correction, target airflow volume, and outlet mode control volume. Accordingly, the air conditioning amplifier controls the servo motors and blower motor in accordance with the control volumes that have been calculated by the neural network control.



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3. Compressor Control (Compressor Speed Control)

- The air conditioning amplifier calculates the target compressor speed based on the target evaporator temperature (calculated by the room temperature sensor, humidity sensor, ambient temperature sensor, and solar sensor) and the actual evaporator temperature detected by the evaporator temperature sensor. Then, the air conditioning amplifier transmits the target speed to the hybrid vehicle control ECU. The hybrid vehicle control ECU controls the A/C inverter based on the target speed data in order to control the compressor to a speed that suits the operating condition of the air conditioning system.
- The air conditioning amplifier calculates the target evaporator temperature, which includes corrections based on the vehicle interior humidity (which is obtained from the humidity sensor) and the windshield glass inner surface humidity (which is calculated by the humidity sensor, solar sensor, room temperature sensor, mode damper position, and wiper operation condition). Accordingly, the air conditioning amplifier controls the compressor speed to an extent that does not inhibit the proper cooling performance or defogging performance. As a result, comfort and low fuel consumption can be realized.



4. Diagnosis

The air conditioning amplifier has a diagnosis function. It stores a record of any air conditioning system failures in memory in the form of DTCs (Diagnostic Trouble Codes).

- There are two methods for reading DTCs. One is to use Techstream, and the other is to use the heater control panel display.

For details, see the 2008 HIGHLANDER HYBRID VEHICLE Repair Manual (Pub. No. RM07V0U).

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