

## Section 8

# Other Systems

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**Air Conditioning System** The A/C unit houses the multi-tank type evaporator and straight flow heater core which are placed in the vehicle's longitudinal direction. The 2-way flow heater type A/C unit can accomplish both heating and de-misting at the same time. This unit introduces external air and internal air simultaneously and discharges warm internal air to the foot well area and the fresh, dry external air to the upper area. Both heating and de-misting performance are excellent.

On the '04 & later Prius, the air conditioning system can be controlled from either the air conditioning screen on the multi display or from switches on the steering pad.

On the '01-'03 Prius, the air conditioning is only controlled at the air conditioning control panel.

**Construction** A partition divides the inside of the A/C unit into two parts, the external air passage and the internal air passage. By separately controlling the external air door and the internal air door, external air and internal air are introduced into the cabin in the three modes: fresh-air mode, recirculation mode and fresh-air/recirculation (2-way flow) mode.

The heat exchange efficiency has been improved through the use of a sub-cool condenser. The condenser is integral with the radiator to minimize the space in the engine compartment.

**Heater Core and PTC Heater** Two Positive Temperature Coefficient (PTC) electric heaters are built into the heater core. The PTC heaters are located in the air duct at the foot well outlet in front of the A/C unit. The honeycomb shaped PTC Thermistor directly warms the air that flows in the duct.

**Sub-Cool Cycle** Refrigerant first passes through the condensing portion of the condenser. Liquid and gaseous refrigerant that were not liquefied are cooled again in the super-cooling portion of the condenser. Therefore, refrigerant sent to the evaporator is almost completely liquefied.

**NOTE**

The point at which the air bubbles disappear in the refrigerant of the sub-cool cycle is lower than the proper amount of refrigerant with which the system must be filled. Therefore, if the system were recharged with refrigerant based on the point at which the air bubbles disappear, the amount of refrigerant would be insufficient. As a result, the cooling performance of the system will be affected. For the proper method of verifying the amount of the refrigerant and to recharge the system with refrigerant, see the Prius Repair Manual.

***Sub-Cool Cycle***

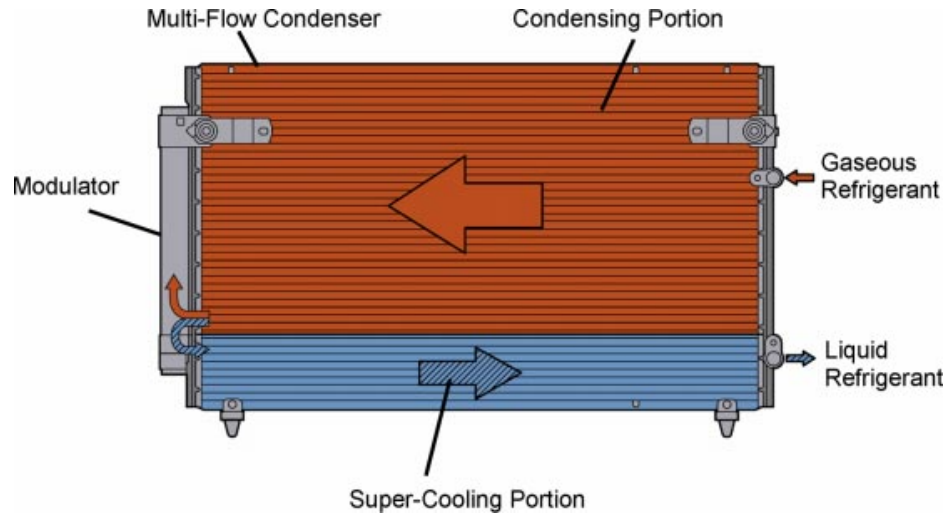


Figure 8.1

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***Electric A/C Compressor***

('04 & later Prius)



Figure 8.2

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**Electric Compressor ('04 & later Prius)** The '04 & later Prius has an ES 18 electric compressor actuated by a built-in electric motor. Except for the portion that is actuated by the electric motor, the basic construction and operation is the same as the scroll compressor in the '01-'03 Prius. The electric motor is actuated by the alternating current power (201.6V) supplied by the A/C inverter integrated into the hybrid system inverter. As a result, the air conditioning system is actuated without depending on the operation of the engine.

The electric compressor consists of a spirally wound fixed scroll and variable scroll that form a pair, a brushless motor, an oil separator, and a motor shaft. The built-in oil separator is used to divide the compressor oil that is intermixed with the refrigerant. The oil then circulates in the refrigeration cycle, thus realizing a reduction in the oil circulation rate.

To insure proper insulation of the internal high voltage portion of the compressor and the compressor housing, the '04 Prius has adopted compressor oil (ND11) with a high level of insulation performance. Therefore, **NEVER** use compressor oil other than ND11.

**NOTE**

The A/C compressor is powered by 201.6V AC. So when servicing the A/C Compressor you should use the same high voltage safety procedures you would use for the vehicles other high voltage circuits.

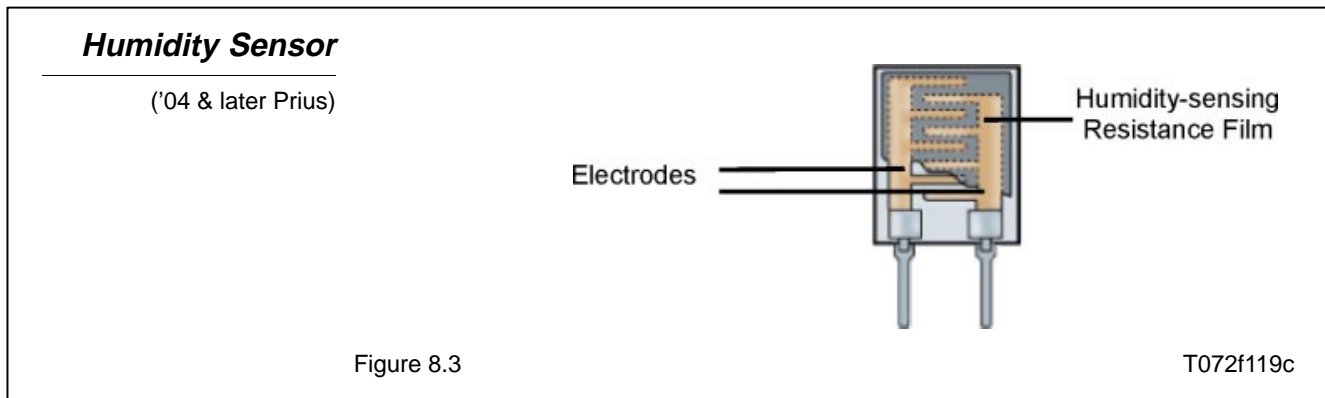
**Compressor ('01-'03 Prius)** On the '01-03 Prius, a scroll compressor with an oil separator is used. When the A/C is operated in the MAX position, the engine will always run to maintain the operation of the A/C compressor. If the HV battery becomes too warm while the recirculation mode is ON, the HV battery ECU will switch to FRESH in order to increase the flow of air across the battery.

The refrigerant gas that is discharged from the discharge port flows by rotation around the cylindrical pipe in the oil separator. At this time, the centrifugal force that is created during the rotation separates the refrigerant gas and the compressor oil due to the difference in their specific gravity. The lighter refrigerant gas passes through the inside of the pipe and travels from the discharge service port to the outside of the compressor. The heavier compressor oil is discharged through the oil discharge hole in the shutter and is stored in the oil storage chamber. The compressor oil travels back to the compressor and circulates inside the compressor.

**Room Temperature Sensor and Humidity Sensor ('04 & later Prius)**

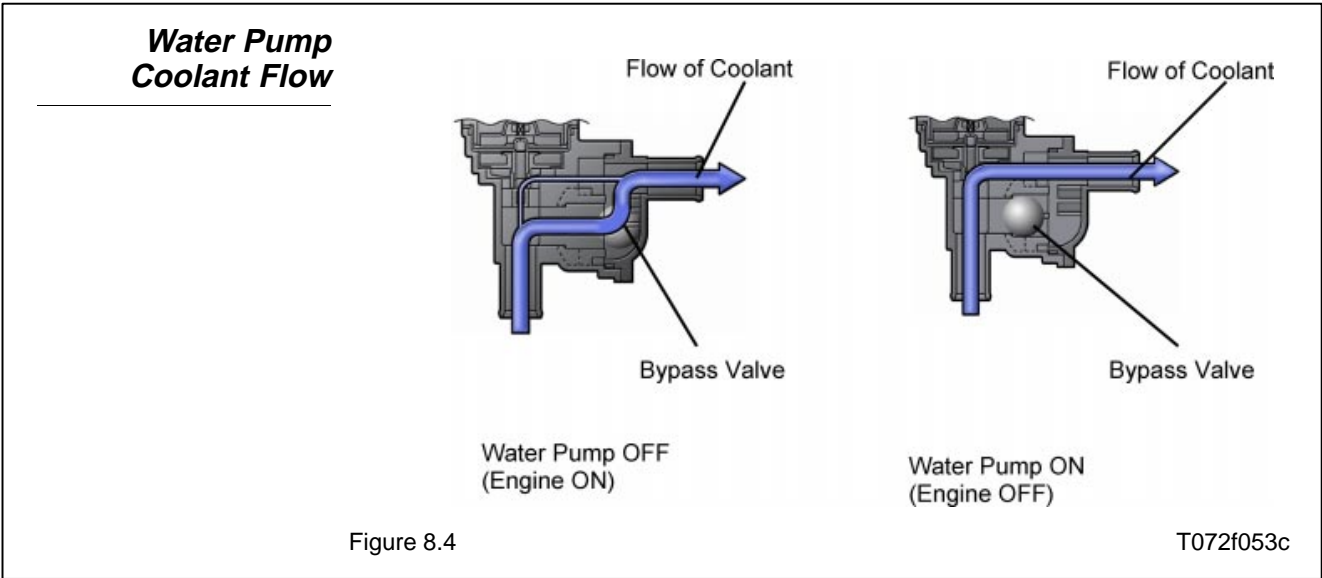
A humidity-sensor function has been added to the room temperature sensor. By enabling the detection of humidity in the vehicle interior this function optimizes the dehumidification effort during the operation of the air conditioning system. As a result, the power consumption of the compressor has been reduced and a comfortable level of humidity has been realized in the vehicle interior.

The humidity-sensing resistance film that is built into the humidity sensor absorbs and releases the humidity in the vehicle interior. During the absorption and releasing processes, the humidity-sensing resistance film expands (during the absorption of humidity) and contracts (during drying). When the clearance between the carbon particles in the humidity-sensing resistance film expands and contracts, it changes the resistance between the electrodes. The A/C ECU determines the humidity in the vehicle interior through the changes in the output voltage of the humidity-sensor.



**Water Pump** The electric water pump provides stable heater performance even if the engine is stopped. When the engine is running the water pump does not operate. On the '01-'03 Prius, the bypass valve opens to minimize the flow resistance of the coolant that is pumped by the engine water pump.

The bypass valve has been discontinued on the '04 & later Prius because a new pump design minimizes water flow resistance.



**NOTE**

If all keys are lost, a new transponder key ECU must be purchased. No additional keys can be duplicated if all the keys are lost. If at least one key remains, new keys can be purchased and then programmed to the vehicle. Programming and erasing procedures are located in the BE section of the Repair Manual.

Also refer to the BE section to perform a pre-check and find out if a particular key is registered as a master or sub.

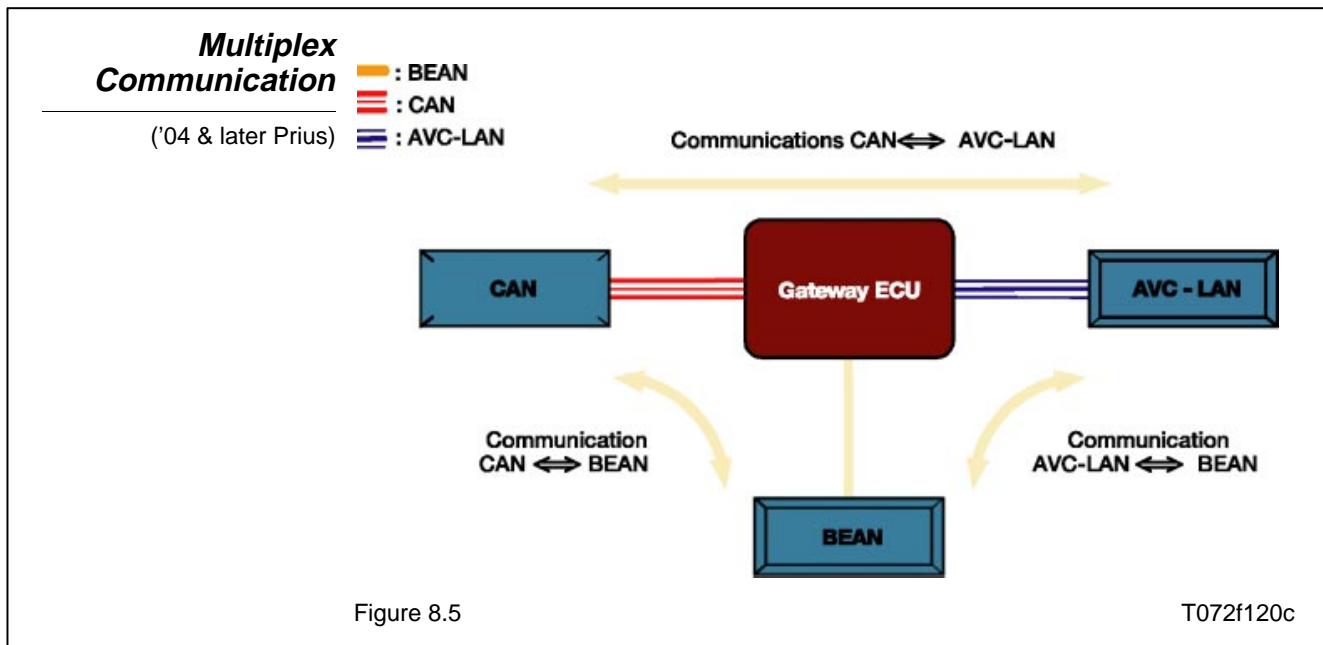
## Multiplex Communication System

The Prius primarily uses three types of multiplex communication systems. The Controller Area Network (CAN) networks the vehicle control systems (engine electrical, chassis electrical and hybrid system) and maintains communication between the ECUs.

The Body Electronics Area Network (BEAN) networks the ECUs of the body electric system control and maintains communication between ECUs.

The Audio Visual Communication - Local Area Network (AVC-LAN) networks the ECUs of the audio visual system and the audio visual devices and maintains communication between the devices and the ECUs.

The gateway ECU is provided with communication circuits that support the three types of multiplex communication systems connected to it.



**CAN System Diagram**

('04 & later Prius)

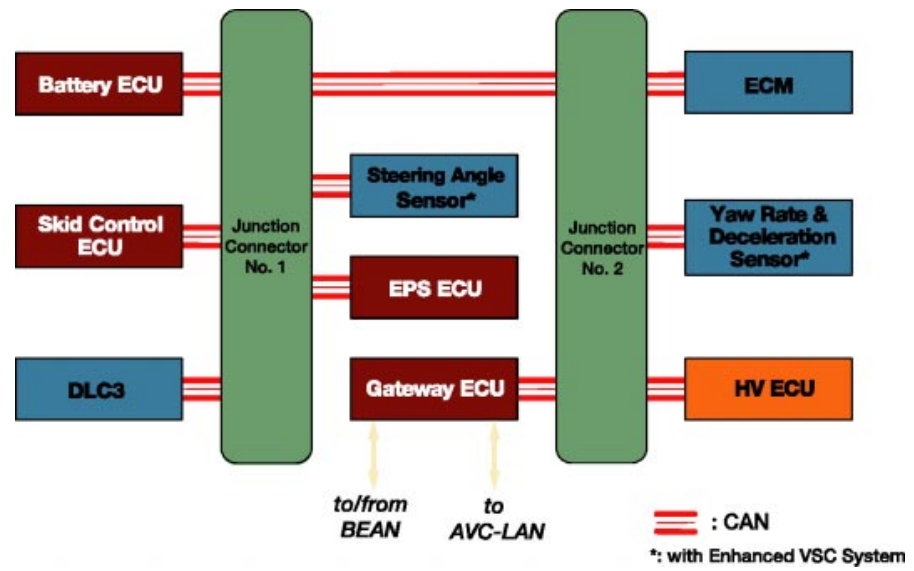


Figure 8.6

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**CAN, BEAN & AVC-LAN Chart**

('04 & later Prius)

Control	Chassis Electrical System Control	Body Electrical System Control	
		BEAN (TOYOTA Original)	AVC-LAN (TOYOTA Original)
Protocol	CAN (ISO Standard)	BEAN (TOYOTA Original)	AVC-LAN (TOYOTA Original)
Communication Speed	500 k bps* (Max. 1 M bps)	Max. 10 k bps*	Max. 17.8 k bps*
Communication Wire	Twisted-pair Wire	AV Single Wire	Twisted-pair Wire
Drive Type	Differential Voltage Drive	Single Wire Voltage Drive	Differential Voltage Drive
Data Length	1-8 Byte (Variable)	1-11 Byte (Variable)	0-32 Byte (Variable)

Figure 8.7

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**Notes**