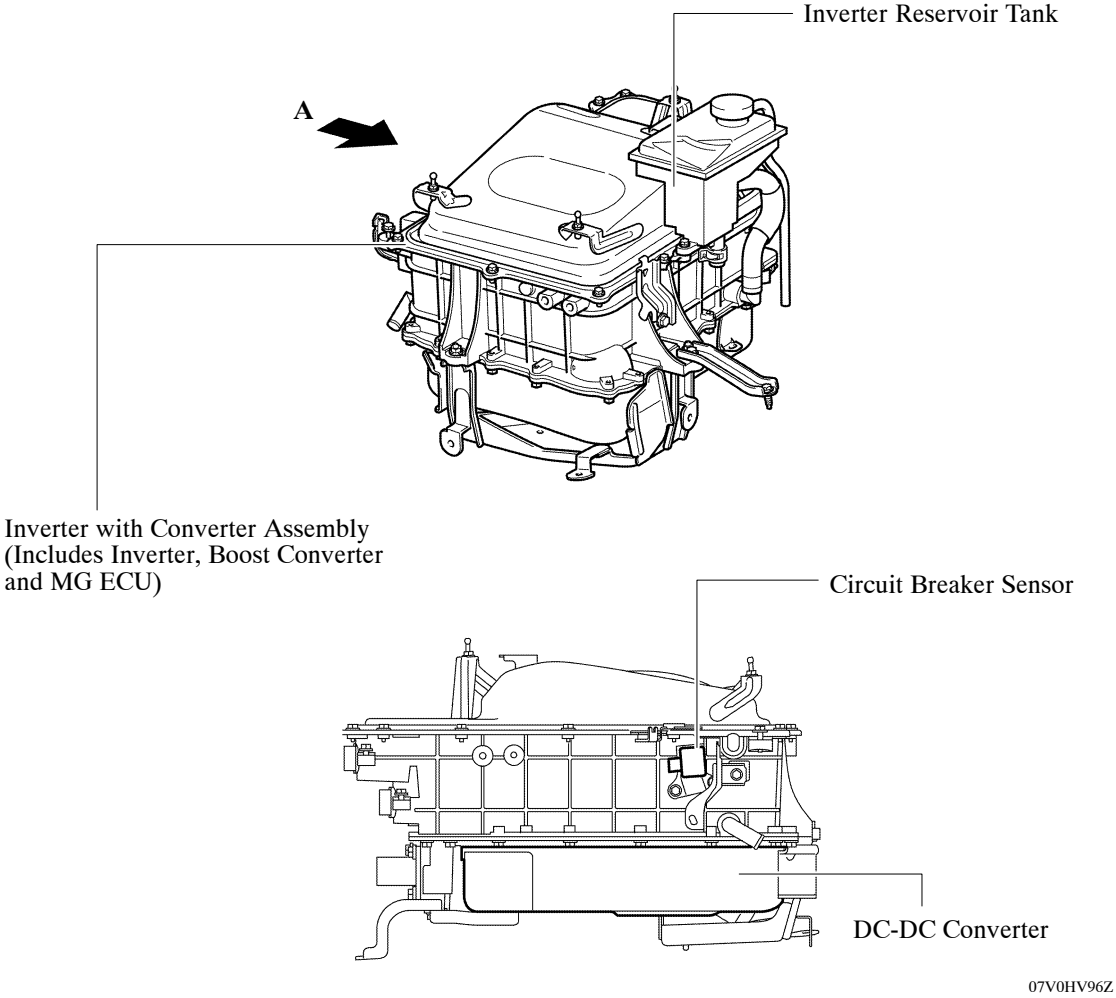
■INVERTER WITH CONVERTER ASSEMBLY

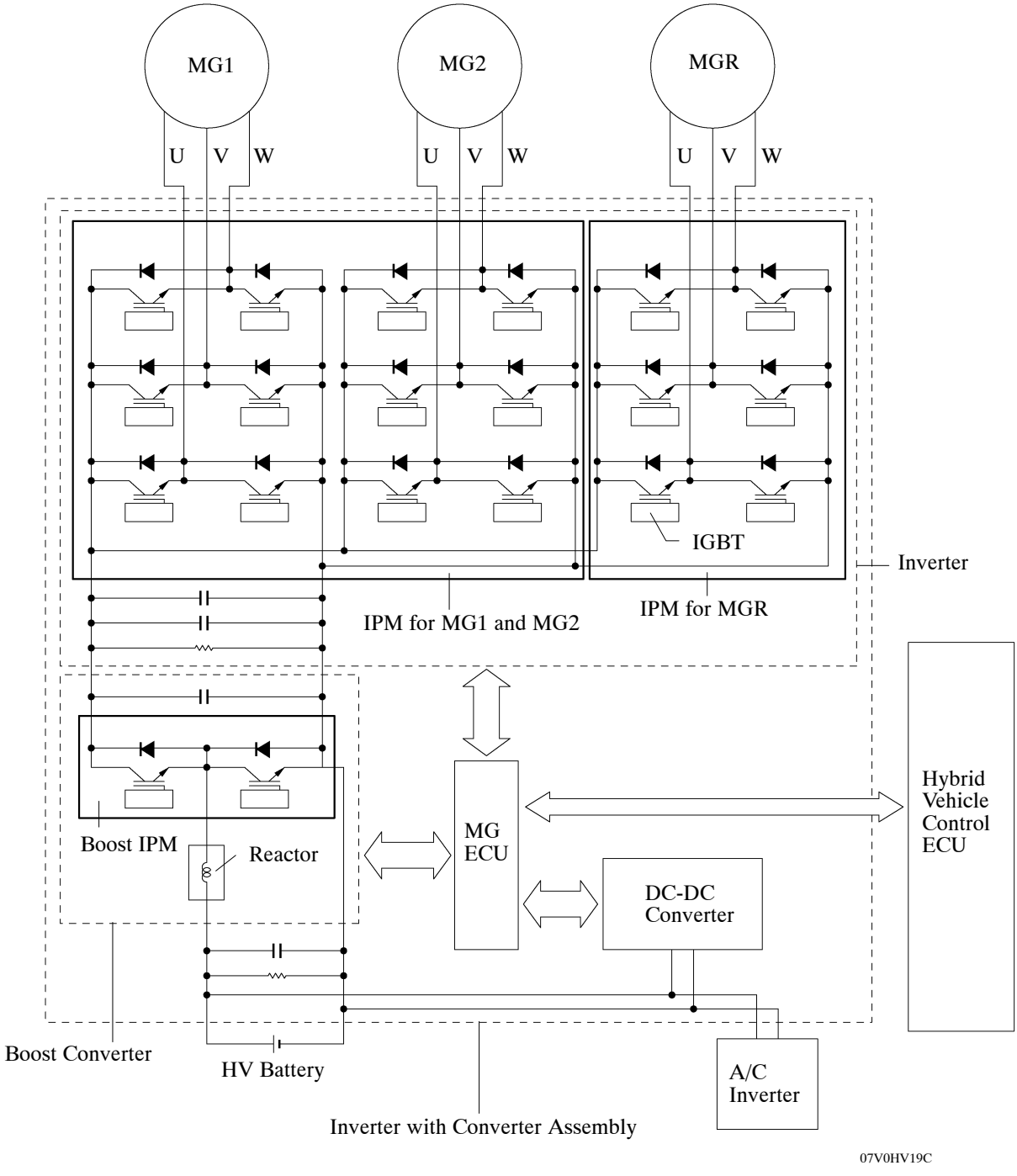
1. General

- The inverter, DC-DC converter, boost converter and MG ECU are combined in the inverter with converter assembly.
- Together with MG1 and MG2, the inverter with converter assembly is cooled by the dedicated radiator of a cooling system that is separate from that of the engine cooling system.
- In the event of a collision involving the vehicle, the circuit breaker sensor, which is installed on the inverter with converter assembly, detects a collision and sends a signal in order to stop the system. For details, refer to "During Collision Control" on page HV-76.
- A boost converter is used in the inverter with converter assembly, in order to boost the nominal voltage output by the HV battery from DC 288V to a maximum voltage of DC 650V. After the voltage is boosted, the inverter converts the direct current into alternating current.



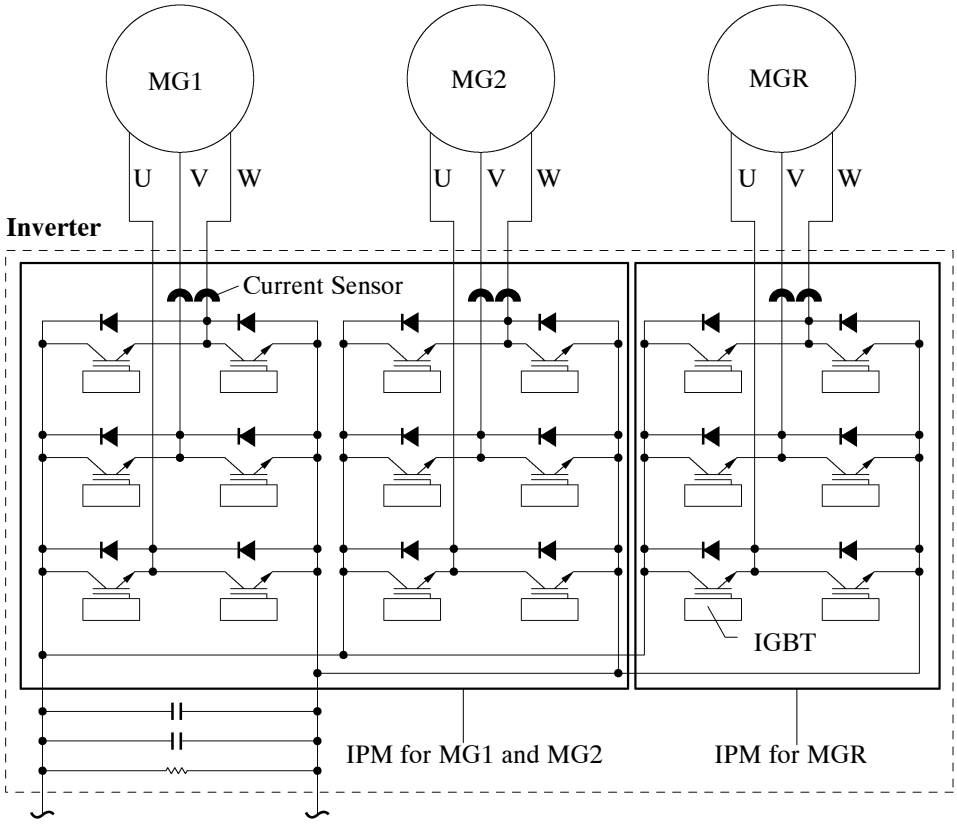
View from A

2. System Diagram



3. Inverter

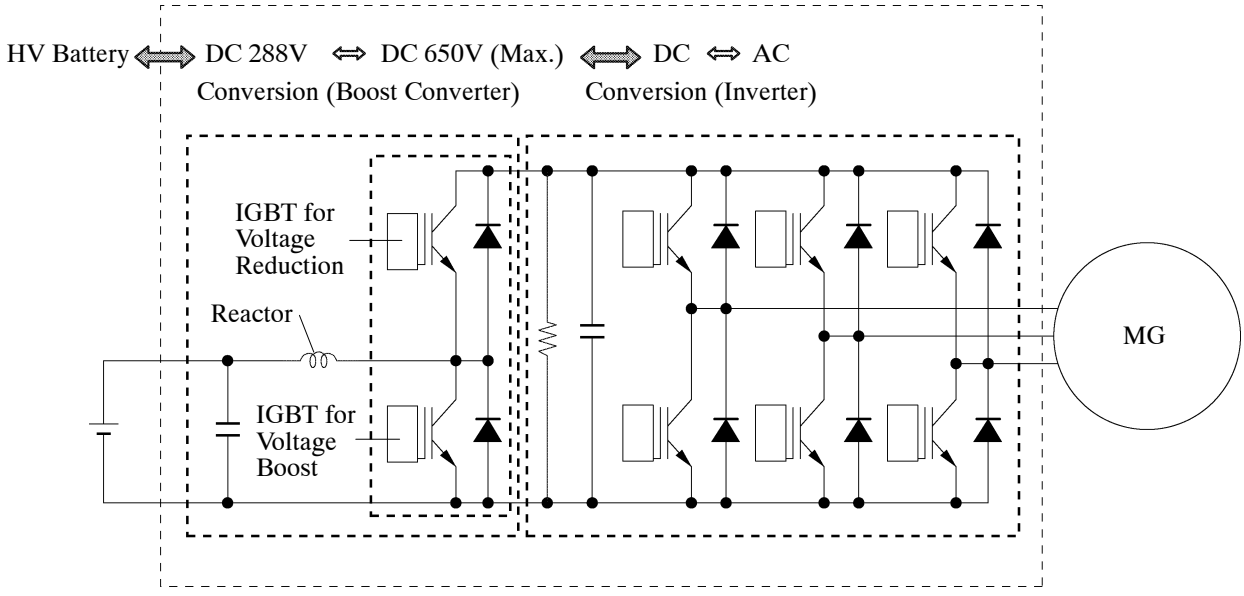
- The inverter converts the boosted high-voltage direct current of the HV battery into three-phase alternating current to drive MG1, MG2 and MGR.
- The activation of the power transistors is controlled by the hybrid vehicle control ECU, via the MG ECU. In addition, the inverter transmits information that is needed for current control, such as the output amperage or voltage, to the hybrid vehicle control ECU via the MG ECU.
- The power transistors used in the inverter are IGBTs (Insulated Gate Bipolar Transistors).
- Each of the bridge circuits for MG1, MG2, and MGR contains 6 IGBTs, mounted on the high voltage, high current module portion of an IPM (Intelligent Power Module). In addition, a signal processor/protective function processor has been integrated into control portion of the IPM. The IPM is used to operate the power transistors based on signals from the MG ECU.



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4. Boost Converter

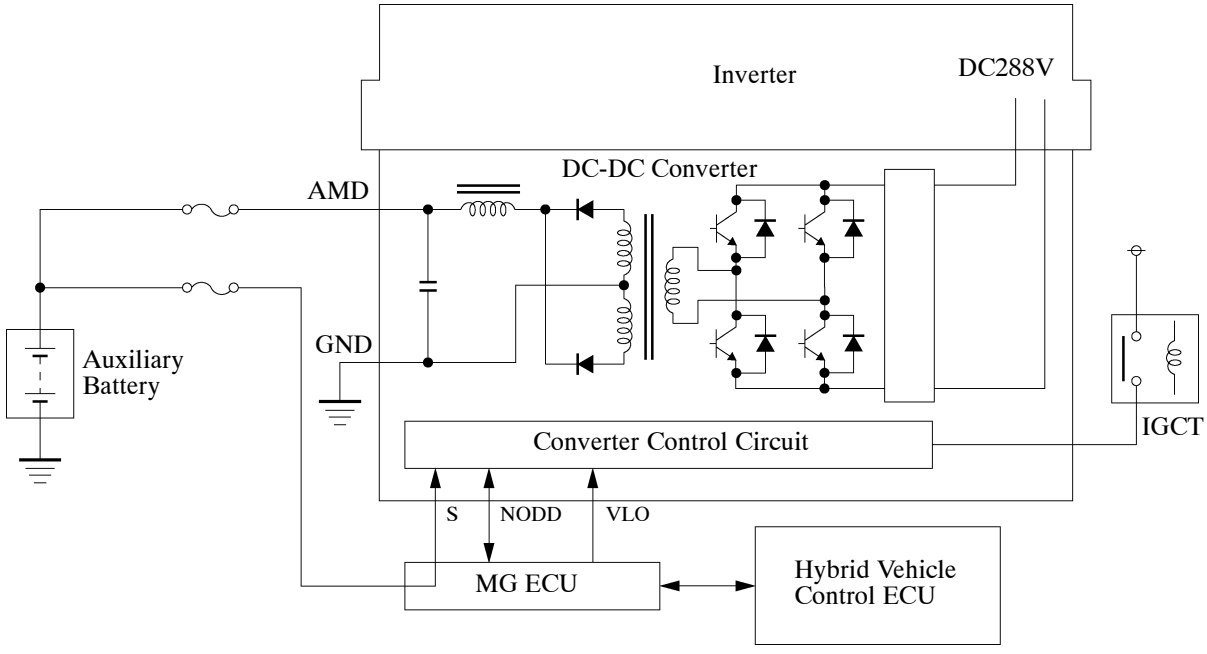
- This boost converter boosts the nominal voltage of DC 288V that is output by the HV battery to a maximum voltage of DC 650V. The converter consists of the boost IPM (Intelligent Power Module) with a pair of built-in IGBTs (Insulated Gate Bipolar Transistors) which perform switching control, and a reactor which acts as an inductor. By using these components, the converter boosts the voltage. For details, refer to Inverter with Converter Assembly Control on page HV-70.
- When MG1, MG2 or MGR acts as a generator, the inverter converts the alternating current (maximum voltage of 650V) into DC, and then the boost converter reduces the voltage to a nominal voltage of DC 288V, thus the HV battery is charged.



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5. DC-DC Converter

The power source for auxiliary equipment of the vehicle such as the lights, audio system, and the air conditioning system (except the A/C compressor), as well as the ECUs, is based on a DC 14V system. Because the THS-II system generates output with a nominal voltage of DC 288V, the DC-DC converter is used to transform the voltage from DC 288V to approximately DC 14V in order to recharge the auxiliary battery. The converter is installed on the underside of the inverter.



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6. Circuit Breaker Sensor

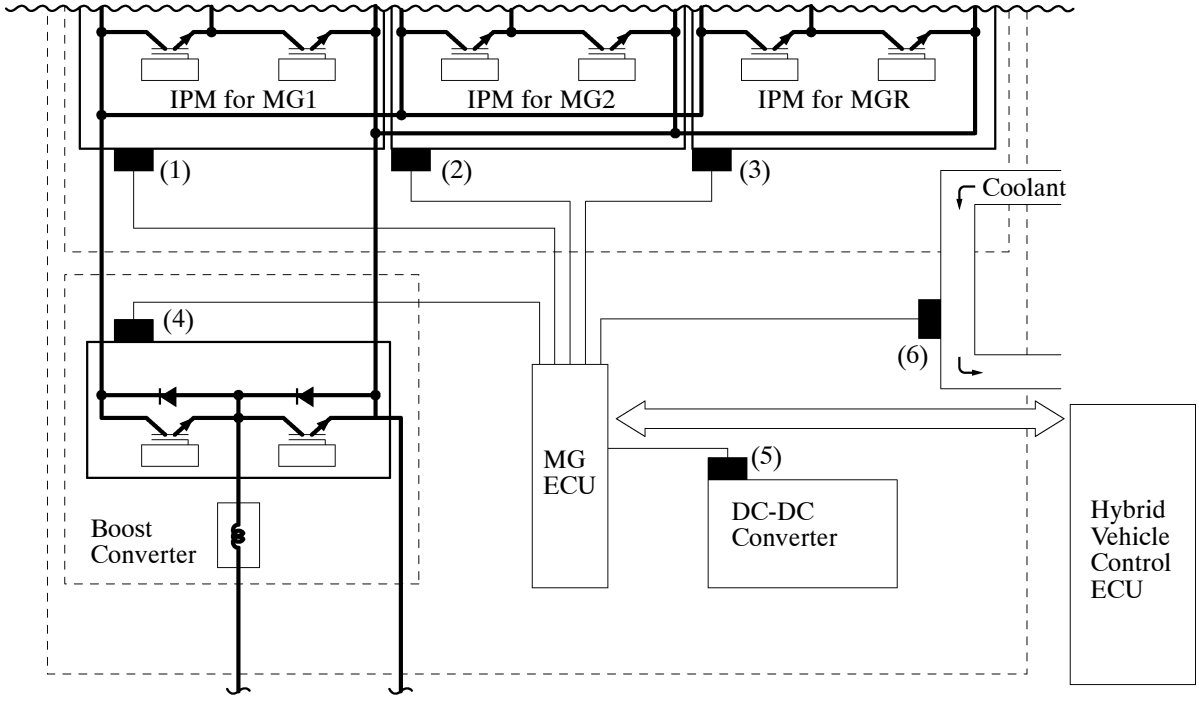
The circuit breaker sensor uses an electrical type deceleration sensor. Based on the deceleration of the vehicle during a frontal collision, distortion is created in the sensor and converted into an electrical signal. When the circuit breaker sensor detects a frontal collision, the hybrid vehicle control ECU shuts down the high voltage circuit.

7. MG ECU

- The MG ECU is provided in the inverter with converter assembly. In accordance with signals received from the hybrid vehicle control ECU, the MG ECU controls the inverter and boost converter in order to drive MG1, MG2, or MGR or to cause them to generate electricity. Furthermore, the MG ECU controls the DC-DC converter in accordance with signals received from the hybrid vehicle control ECU.
- The MG ECU transmits information that is required for vehicle control, such as the inverter output amperage, inverter temperature, and failure information, to the hybrid vehicle control ECU. It receives information that is required for controlling the motor generators, such as the required motive force or the motor temperature, from the hybrid vehicle control ECU.

8. Inverter Temperature Sensors

In the inverter with converter assembly, there are 6 different temperature sensors, there is a sensor for the DC-DC converter, boost converter, coolant temperature, and for the IPMs for MG1, MG2 and MGR. The MG ECU confirms the effectiveness of the inverter cooling system based on the temperature information sent from these sensors. In addition, inverter output is limited when the temperature is high.

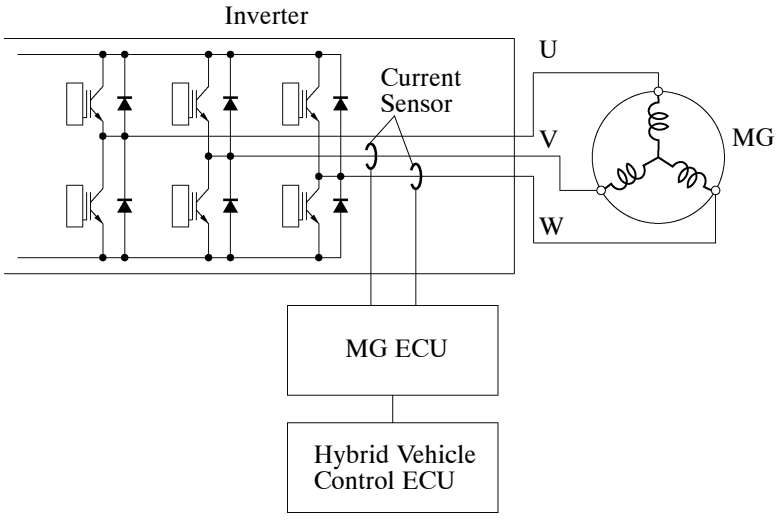


(1): Temperature sensor on IPM for MG1Inverter
(2): Temperature sensor on IPM for MG2 Inverter
(3): Temperature sensor on IPM for MGR Inverter
(4): Temperature sensor on IPM for Boost Converter
(5): DC-DC Converter Temperature Sensor
(6): Coolant Temperature Sensor

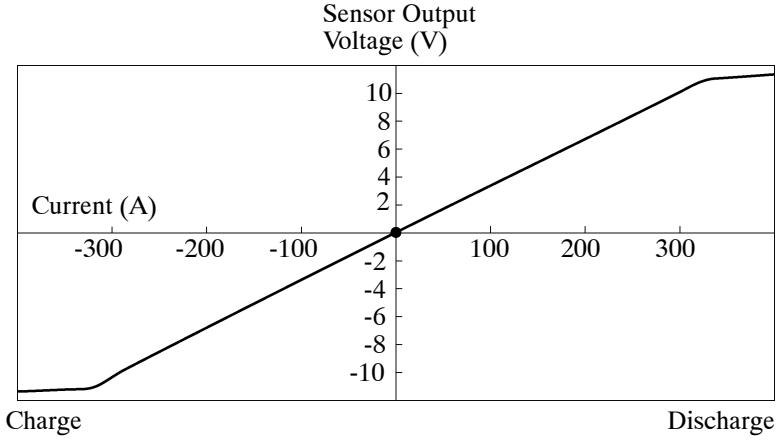
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9. Current Sensor

- For the 3-phase AC used to drive MG1, MG2 and MGR, there are current sensors for the V and W phases. The actual current value is measured, and used as feedback by the hybrid vehicle control ECU.
- If the current value of two phases (V and W phases) is measured, the current of the U phase can be determined, even though it is not equipped with a current sensor. (U phase current + V phase current + W phase current = 0)



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