

ELECTRONIC CONTROL UNIT

BACKGROUND OF THE INVENTION

The present invention relates to an electronic control unit.

Priority is claimed on Japanese Patent Application Nos. 2011-231806, 2011-231808, and 2011-231809, filed on Oct. 21, 2011, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

In recent years, vehicles (hereinafter, collectively referred to as plug-in vehicles) such as electric cars or plug-in hybrid cars that can be charged by the use of an external power supply have been increasingly put to practical use. A dedicated charging cable having a control unit called a CCID (Charge Circuit Interrupt Device) is used to connect a plug-in vehicle to an external power supply.

The standard on an interface between the charging cable and the plug-in vehicle is defined by the "SAE (Electric Vehicle Conductive Charge Coupler) standard" of the U.S. or the "General Requirements for Electric Vehicle Conductive Charging System (the Japanese Electric Vehicle Standard)" of Japan. The charging sequence of a plug-in vehicle defined in the standard is substantially as follows.

First, a CCID of a charging cable transmits a control pilot signal (hereinafter, abbreviated as a pilot signal) to a charging-control ECU (Electronic Control Unit) mounted on a plug-in vehicle and determines that the charging cable is connected to the plug-in vehicle when the voltage of the pilot signal is changed from an initial value V1 (for example, 12 V) to V2 (for example, 9 V).

Then, the CCID of the charging cable informs the ECU of the plug-in vehicle of the rated current of a power supply facility by transmitting a pilot signal with a duty ratio corresponding to the rated current of the power supply facility (including an external power supply and a charging cable).

The ECU of the plug-in vehicle informs the CCID of the charging cable of the completion of the preparation for charging by changing the voltage of the pilot signal from V2 to V3 (for example, 6 V).

Then, when detecting that the voltage of the pilot signal has changed from V2 to V3, the CCID of the charging cable determines that the preparation of charging of the plug-in vehicle side is completed, and turns on a relay used to supply the power of the external power supply to the plug-in vehicle (that is, starts the supply of power).

In this way, the pilot signal is a signal essential for controlling the charging of the plug-in vehicle and it is very important to detect abnormality of the pilot signal. For example, Japanese Unexamined Patent Application, First Publication No. 2009-71989 discloses a technique of connecting a control line used for transmission of a pilot signal on a plug-in vehicle to the ground via a switch and detecting a disconnection of a pilot signal line extending from a charging port of the plug-in vehicle to an ECU based on a change in potential of the control line when the switch is turned on.

DESCRIPTION OF RELATED ART

As described above, the ECU of the plug-in vehicle is provided with a pilot voltage setting circuit used to change the voltage of a pilot signal transmitted from the CCID of the charging cable in a stepwise manner. In general, the pilot voltage setting circuit is a serial circuit of a pull-down resistor

and a switching element, which is connected between the pilot signal line and the ground in the ECU.

When the processor in the ECU changes the voltage of a pilot signal, the switching element of the pilot voltage setting circuit is turned on.

When the switching element of the pilot voltage setting circuit is out of order, the voltage of a pilot signal cannot be changed and thus a circuit for diagnosing the disorder of the switching element is necessary. However, such a circuit is not disclosed in Japanese Unexamined Patent Application, First Publication No. 2009-71989.

In the technique described in Japanese Unexamined Patent Application, First Publication No. 2009-71989, a switching connecting the pilot signal line to the ground is provided and it is determined that the pilot signal line is normal (no disconnection) when the potential of the pilot signal line is dropped to the ground level by turning on the switch. However, when the pilot signal line is subjected to an earth fault, the potential of the pilot signal line also becomes the ground level. Accordingly, the pilot signal line may be erroneously determined to be normal, while actually being abnormal.

The invention is made in consideration of the above-mentioned circumstances and an object thereof is to provide an electronic control unit that can diagnose at least one of an abnormality of a switching element disposed in a pilot voltage setting circuit so as to change a pilot signal in a stepwise manner and an abnormality of a pilot signal line including disconnection and earth fault.

SUMMARY OF THE INVENTION

The present invention employs the following configurations to solve the above problems.

(1) According to an aspect of the invention, there is provided an electronic control unit that is mounted on a vehicle which is configured to be charged with an external power supply and that receives a pilot signal via a charging cable before being supplied with a power when the vehicle is connected to the external power supply via the charging cable, the electronic control unit including: a control line that is connected to a pilot signal line connecting a charging cable connector disposed in the vehicle to the electronic control unit; a processor that performs a process necessary for the control of charging based on the pilot signal input via the control line; a pilot voltage setting circuit that is connected between the control line and a ground and that includes a serial circuit of a pull-down resistor and a switching element controlled by the processor; a voltage supply circuit that includes at least one of a first diagnosis voltage supply circuit supplying a first diagnosis voltage to the control line under control of the processor and a second diagnosis voltage supply circuit supplying a second diagnosis voltage to the pilot signal line via an abnormality diagnosis line connected to the pilot signal line at the charging cable connector under the control of the processor; and an abnormality diagnosis circuit that is connected to the pull-down resistor and the switching element and that outputs an abnormality diagnosis result signal of at least one of the switching element and the pilot signal line to the processor, wherein the processor performs at least one of a first diagnosis process of determining whether or not the switching element is abnormal based on an output signal of the abnormality diagnosis circuit obtained when turning on and off the switching element while controlling the first diagnosis voltage supply circuit to supply the first diagnosis voltage to the control line and a second diagnosis process of determining whether or not the pilot signal line