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Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [12/2022 -]
Title: HYBRID / BATTERY CONTROL: HYBRID CONTROL SYSTEM (for M20A-FXS): P212012,...,P21382B; Throttle/Pedal Position Sensor/Switch "D" Circuit Short to Auxiliary Battery; 2023 - 2024 MY Prius Prius Prime [12/2022 -]		

DTC	**P212012**	**Throttle/Pedal Position Sensor/Switch "D" Circuit Short to Auxiliary Battery**
DTC	**P212014**	**Throttle/Pedal Position Sensor/Switch "D" Circuit Short to Ground or Open**
DTC	**P21201C**	**Throttle/Pedal Position Sensor/Switch "D" Voltage Out of Range**
DTC	**P21201F**	**Throttle/Pedal Position Sensor/Switch "D" Circuit Intermittent**
DTC	**P212512**	**Throttle/Pedal Position Sensor/Switch "E" Circuit Short to Auxiliary Battery**
DTC	**P212514**	**Throttle/Pedal Position Sensor/Switch "E" Circuit Short to Ground or Open**
DTC	**P21251C**	**Throttle/Pedal Position Sensor/Switch "E" Voltage Out of Range**
DTC	**P21251F**	**Throttle/Pedal Position Sensor/Switch "E" Circuit Intermittent**
DTC	**P213800**	**Throttle/Pedal Position Sensor/Switch "D"/" E" Voltage Correlation**
DTC	**P21382B**	**Throttle/Pedal Position Sensor/Switch "D"/"E" Signal Cross Coupled**

DTC SUMMARY

MALFUNCTION DESCRIPTION

The hybrid vehicle control ECU calculates the accelerator pedal opening angle based on the output voltage of the main sensor (VPA) and sub sensor (VPA2) of the accelerator pedal (with sensor) rod assembly. If the output voltage of either the main sensor (VPA) or sub sensor (VPA2) deviates, a malfunction will be detected.

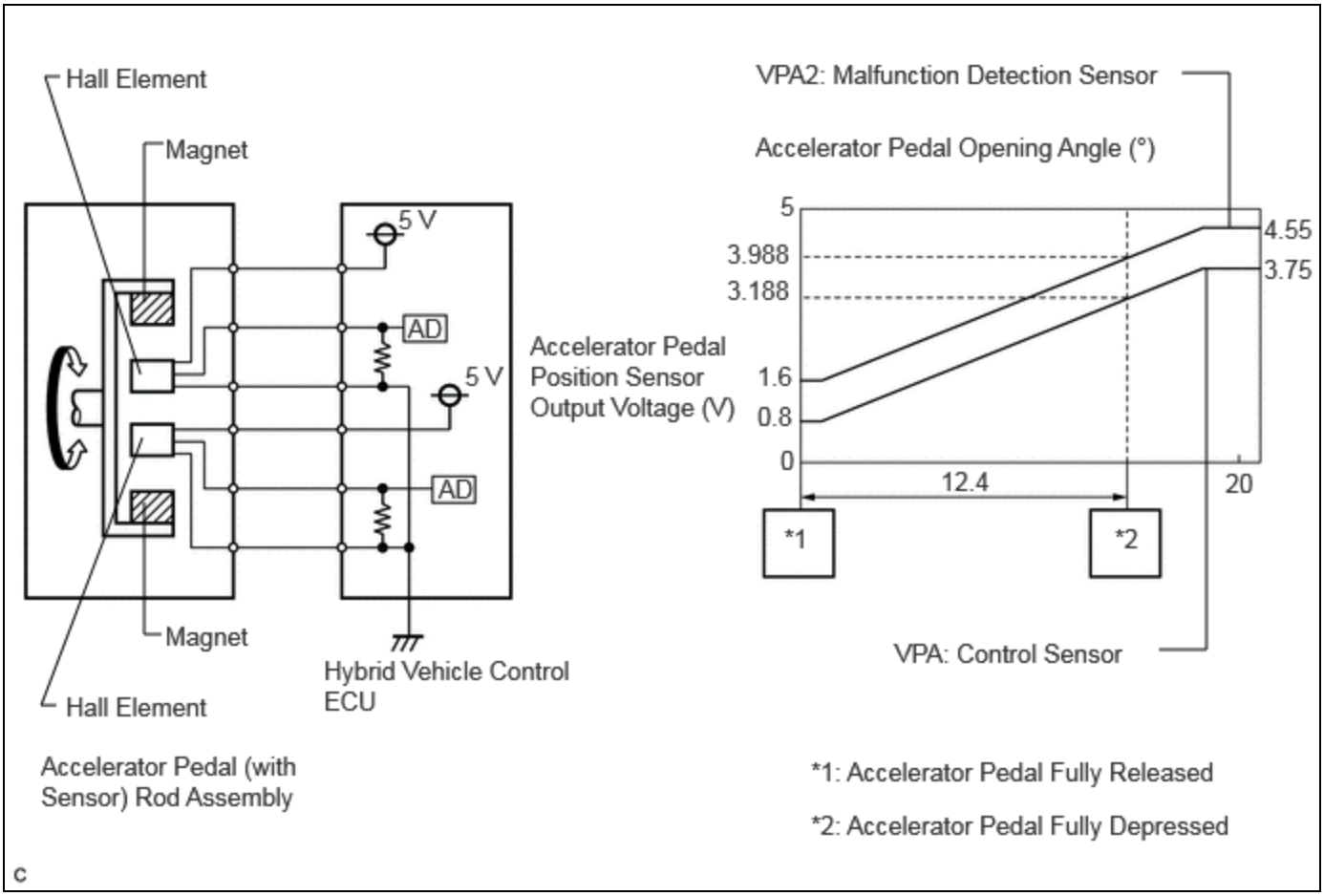
The cause of this malfunction may be one of the following:

- Accelerator pedal (with sensor) rod assembly malfunction

- Wire harness or connector malfunction
- Hybrid vehicle control ECU malfunction

DESCRIPTION

The accelerator pedal position sensor is built into the accelerator pedal (with sensor) rod assembly and detects how much the pedal is depressed. This is a non-contact sensor with Hall elements. There are 2 outputs from the sensor. One is used to detect the accelerator pedal position and the other is used as a confirmation to allow the detection of a malfunction in the sensor itself. Voltage is output from the accelerator pedal position sensor to terminals VPA and VPA2 of the hybrid vehicle control ECU. This voltage varies from 0 to 5 V in accordance with the accelerator pedal position. Terminal VPA2 is primarily used to detect a malfunction in the sensor itself. The hybrid vehicle control ECU determines the current accelerator pedal position and controls the hybrid control system based on signals received by terminals VPA and VPA2.



DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P212012	Throttle/Pedal Position Sensor/Switch "D" Circuit Short to Auxiliary Battery	Short to +B in the main sensor circuit: The main sensor voltage is 4.8 V or more for 2 seconds.	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2123

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		(1 trip detection logic)	control ECU					
P212014	Throttle/Pedal Position Sensor/Switch "D" Circuit Short to Ground or Open	Open or short to ground in the main sensor circuit: The main sensor voltage is 0.4 V or less for 0.5 seconds. (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2122
P21201C	Throttle/Pedal Position Sensor/Switch "D" Voltage Out of Range	Internal malfunction in the main sensor: Main sensor output changes rapidly (detected when there are no circuit malfunctions such as an open or short). (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2121
P21201F	Throttle/Pedal Position Sensor/Switch "D" Circuit Intermittent	Main sensor circuit wiring malfunction or level is not stable: Main sensor voltage is 0.4 V or less or 4.8 V or more for a certain period of time. (Both of the following conditions are met: The main sensor voltage is 0.4 V or less for a certain period of time and 4.8 V or more for a	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2120

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		certain period of time.) (1 trip detection logic)						
P212512	Throttle/Pedal Position Sensor/Switch "E" Circuit Short to Auxiliary Battery	Short to +B in the sub sensor circuit: Main sensor is normal and sub sensor voltage is 4.8 V or more for 2 seconds. (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2128
P212514	Throttle/Pedal Position Sensor/Switch "E" Circuit Short to Ground or Open	Open or short to ground in the sub sensor circuit: The sub sensor voltage is 1.2 V or less for 0.5 seconds. (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2127
P21251C	Throttle/Pedal Position Sensor/Switch "E" Voltage Out of Range	Internal malfunction of the sub sensor: Sub sensor output changes rapidly (detected when there are no circuit malfunctions such as an open or short). (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2126
P21251F	Throttle/Pedal Position Sensor/Switch "E" Circuit Intermittent	Sub sensor circuit wiring malfunction or level is not stable: When the main sensor circuit is	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2125

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		normal, the sub sensor voltage is 1.2 V or less or 4.8 V or more for a certain period of time. (Both of the following conditions are met: Sub sensor voltage is 1.2 V or less for a certain period of time, and the main sensor is normal and sub sensor voltage is 4.8 V or more for a certain period of time.) (1 trip detection logic)	• Hybrid vehicle control ECU					
P213800	Throttle/Pedal Position Sensor/Switch "D"/" E" Voltage Correlation	Difference between the main sensor value and sub sensor value is large. (1 trip detection logic)	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2138
P21382B	Throttle/Pedal Position Sensor/Switch "D"/"E" Signal Cross Coupled	Main or sub sensor circuit wiring malfunction: The difference in voltage between the main sensor and sub sensor is 0.02 V or less, or a low output malfunction continues in both the main and sub sensors for a	• Wire harness or connector • Accelerator pedal (with sensor) rod assembly • Hybrid vehicle control ECU	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P2138

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		certain period of time. (1 trip detection logic)						

MONITOR DESCRIPTION

The hybrid vehicle control ECU calculates the differences of the voltage of main accelerator sensor and sub accelerator sensor. If the differences exceed prescribed values, the hybrid vehicle control ECU determines that there is a malfunction in the accelerator sensor circuit. If the hybrid vehicle control ECU detects this malfunction, it will illuminate the MIL and store a DTC.

MONITOR STRATEGY

Related DTCs	P2123 (INF P212012): Accelerator Pedal Position Sensor (APP Sensor) Sensor 1 Range Check (High voltage) P2122 (INF P212014): Accelerator Pedal Position Sensor (APP Sensor) Sensor 1 Range Check (Low voltage) P2121 (INF P21201C): Throttle/Pedal Position Sensor/Switch "D" Voltage Out of Range P2120 (INF P21201F): Accelerator Pedal Position Sensor (APP Sensor) Sensor 1 Range Check (Chattering) P2128 (INF P212512): Accelerator Pedal Position Sensor (APP Sensor) Sensor 2 Range Check (High voltage) P2127 (INF P212514): Accelerator Pedal Position Sensor (APP Sensor) Sensor 2 Range Check (Low voltage) P2126 (INF P21251C): Throttle/Pedal Position Sensor/Switch "E" Voltage Out of Range P2125 (INF P21251F): Accelerator Pedal Position Sensor (APP Sensor) Sensor 2 Range Check (Chattering) P2138 (INF P213800): Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation P2138 (INF P21382B): Accelerator Pedal Position Sensor (APP Sensor) Correlation
Required sensors/components	Throttle/Pedal Position Sensor/Switch
Frequency of operation	Continuous
Duration	TMC's intellectual property
MIL operation	Immediately / 1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not stored	TMC's intellectual property
Other conditions belong to TMC's intellectual property	-

TYPICAL MALFUNCTION THRESHOLDS

TMC's intellectual property	-

COMPONENT OPERATING RANGE

Hybrid vehicle control ECU	DTC P2123 (INF P212012) is not detected DTC P2122 (INF P212014) is not detected DTC P2121 (INF P21201C) is not detected DTC P2120 (INF P21201F) is not detected DTC P2128 (INF P212512) is not detected DTC P2127 (INF P212514) is not detected DTC P2126 (INF P21251C) is not detected DTC P2125 (INF P21251F) is not detected DTC P2138 (INF P213800) is not detected DTC P2138 (INF P21382B) is not detected

CONFIRMATION DRIVING PATTERN

HINT:

- After repair has been completed, clear the DTC and then check that the vehicle has returned to normal by performing the following All Readiness check procedure.

  Click here INFO
- When clearing the permanent DTCs, refer to the "CLEAR PERMANENT DTC" procedure.

  Click here INFO

1. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
2. Turn the ignition switch off and wait for 2 minutes or more.
3. Wait for approximately 10 seconds with the ignition switch ON (READY) and shift lever in P, then fully depress and release the accelerator pedal several times.[*1]

   HINT:

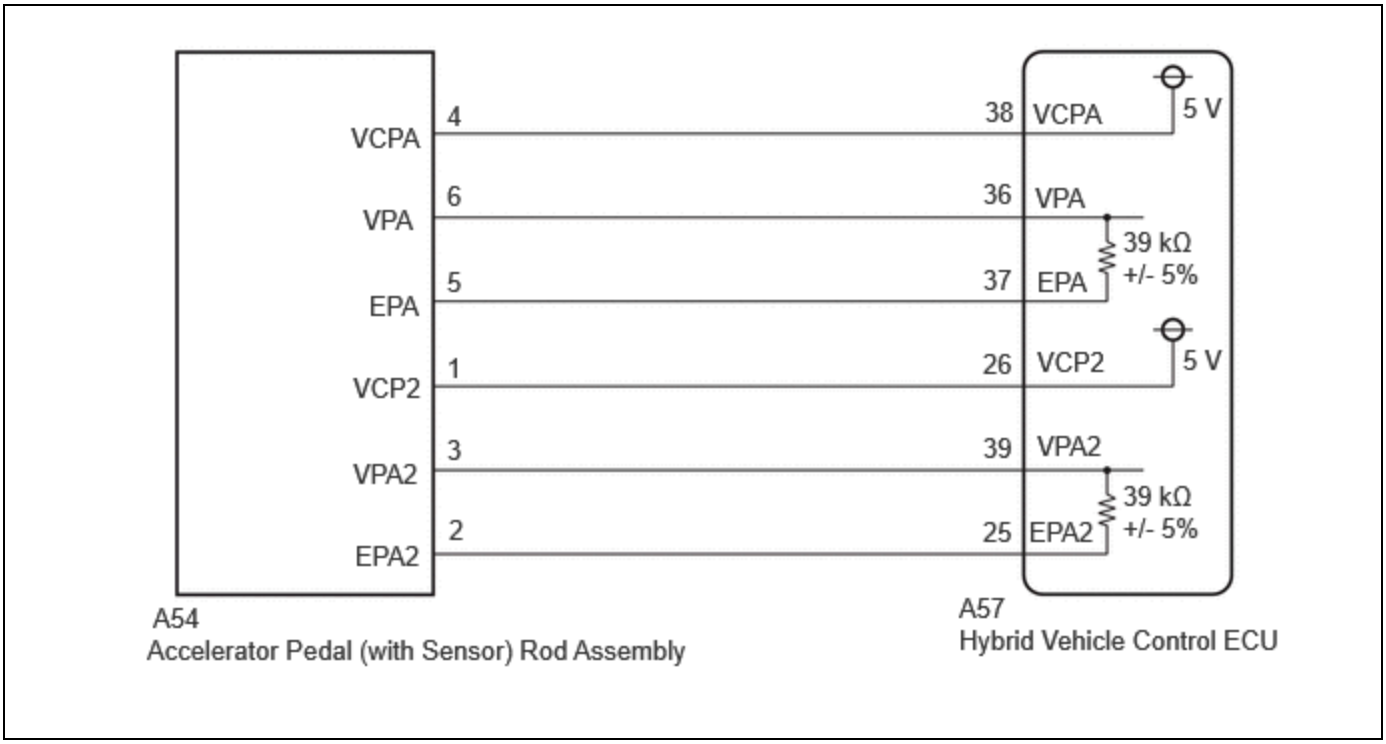
   [*1]: Normal judgment procedure.

   The normal judgment procedure is used to complete DTC judgment and also used when clearing permanent DTCs.
4. Enter the following menus: Powertrain / Hybrid Control / Utility / All Readiness.
5. Check the DTC judgment result.

   HINT:

   - If the judgment result shows NORMAL, the system is normal.
   - If the judgment result shows ABNORMAL, the system has a malfunction.
   - If the judgment result shows INCOMPLETE, perform the normal judgment procedure again.

WIRING DIAGRAM



PROCEDURE

1.	**READ VALUE USING GTS (ACCELERATOR POSITION SENSOR NO. 1 VOLTAGE %, ACCELERATOR POSITION SENSOR NO. 2 VOLTAGE %)**

Pre-procedure1

(a) None.

Procedure1

(b) Read the Data List.

Powertrain > Hybrid Control > Data List

TESTER DISPLAY
Accelerator Position Sensor No.1 Voltage %
Accelerator Position Sensor No.2 Voltage %

Standard:

TESTER DISPLAY	ACCELERATOR PEDAL CONDITION	SPECIFIED CONDITION
Accelerator Position Sensor No. 1 Voltage %	Not depressed	10 to 22%
	Fully depressed	52 to 90%

TESTER DISPLAY	ACCELERATOR PEDAL CONDITION	SPECIFIED CONDITION
	Not depressed → Fully depressed → Not depressed (Accelerator pedal should be operated slowly)	Value changes progressively
Accelerator Position Sensor No. 2 Voltage %	Not depressed	24 to 40%
	Fully depressed	68 to 99%
	Not depressed → Fully depressed → Not depressed (Accelerator pedal should be operated slowly)	Value changes progressively

Post-procedure1

(c) Turn the ignition switch off.

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

NG

▼

2.	**CHECK CONNECTOR CONNECTION CONDITION (ACCELERATOR PEDAL (WITH SENSOR) ROD ASSEMBLY CONNECTOR)**

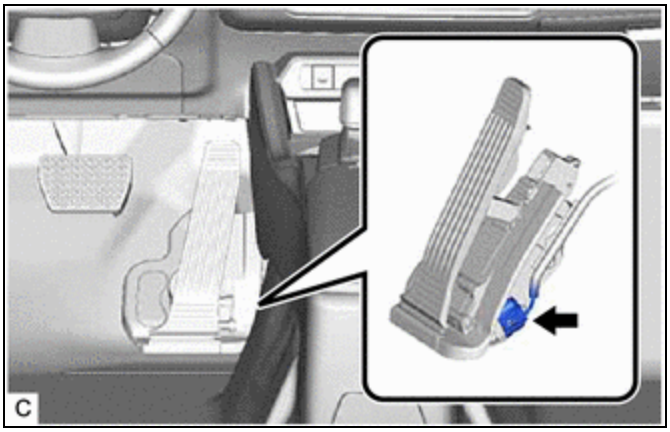
(a) Check the connector connections and contact pressure of the relevant terminals for the accelerator pedal (with sensor) rod assembly connector.

HINT:

Click here INFO

OK:

The connectors are connected securely and there are no contact pressure problems.



NG ▶ **CONNECT SECURELY**

OK

▼

3.	**CHECK CONNECTOR CONNECTION CONDITION (HYBRID VEHICLE CONTROL ECU CONNECTOR)**

Click here INFO

NG ▶ **CONNECT SECURELY**

OK ▼

4.	CHECK HYBRID VEHICLE CONTROL ECU (CHECK VOLTAGE)

Pre-procedure1

(a) Disconnect the accelerator pedal (with sensor) rod assembly connector.

(b) Turn the ignition switch to ON.

Procedure1

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

EWD INFO

Click Location & Routing(A54)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A54-4 (VCPA) - A54-5 (EPA)	Ignition switch ON	4.5 to 5.5 V	V
A54-1 (VCP2) - A54-2 (EPA2)	Ignition switch ON	4.5 to 5.5 V	V

Post-procedure1

(d) Turn the ignition switch off.

(e) Reconnect the accelerator pedal (with sensor) rod assembly connector.

NG ▶ **GO TO STEP 6**

OK ▼

5.	CHECK HYBRID VEHICLE CONTROL ECU (CHECK RESISTANCE)

Pre-procedure1

(a) Disconnect the accelerator pedal (with sensor) rod assembly connector.

Procedure1

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

EWD INFO

Click Location & Routing(A54)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A54-6 (VPA) - A54-5 (EPA)	Ignition switch off	36.60 to 41.61 kΩ	kΩ
A54-3 (VPA2) - A54-2 (EPA2)	Ignition switch off	36.60 to 41.61 kΩ	kΩ

Post-procedure1

(c) Reconnect the accelerator pedal (with sensor) rod assembly connector.

OK ▶ **REPLACE ACCELERATOR PEDAL (WITH SENSOR) ROD ASSEMBLY**

NG ▶ **GO TO STEP 7**

6.	**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL (WITH SENSOR) ROD ASSEMBLY)**

Pre-procedure1

(a) Disconnect the hybrid vehicle control ECU connector.

(b) Disconnect the accelerator pedal (with sensor) rod assembly connector.

(c) Turn the ignition switch to ON.

Procedure1

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

EWD INFO

Click Location & Routing(A57)
Click Connector(A57)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-38 (VCPA) - Body ground	Ignition switch ON	Below 1 V	V
A57-37 (EPA) - Body ground	Ignition switch ON	Below 1 V	V
A57-26 (VCP2) - Body ground	Ignition switch ON	Below 1 V	V
A57-25 (EPA2) - Body ground	Ignition switch ON	Below 1 V	V

NOTICE:

Turning the ignition switch to ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the ignition switch off.

(f) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

EWD INFO

Click Location & Routing(A57,A54)
Click Connector(A57)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-38 (VCPA) - A54-4 (VCPA)	Ignition switch off	Below 1 Ω	Ω
A57-37 (EPA) - A54-5 (EPA)	Ignition switch off	Below 1 Ω	Ω
A57-26 (VCP2) - A54-1 (VCP2)	Ignition switch off	Below 1 Ω	Ω
A57-25 (EPA2) - A54-2 (EPA2)	Ignition switch off	Below 1 Ω	Ω

Standard Resistance (Check for Short):

EWD INFO

Click Location & Routing(A57,A54)
Click Connector(A57)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-38 (VCPA) or A54-4 (VCPA) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-37 (EPA) or A54-5 (EPA) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-26 (VCP2) or A54-1 (VCP2) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-25 (EPA2) or A54-2 (EPA2) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ

Post-procedure1

(g) Reconnect the accelerator pedal (with sensor) rod assembly connector.

(h) Reconnect the hybrid vehicle control ECU connector.

OK ▶ REPLACE HYBRID VEHICLE CONTROL ECU

Click here INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

7.	**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - ACCELERATOR PEDAL (WITH SENSOR) ROD ASSEMBLY)**

Pre-procedure1

(a) Disconnect the hybrid vehicle control ECU connector.

(b) Disconnect the accelerator pedal (with sensor) rod assembly connector.

(c) Turn the ignition switch to ON.

Procedure1

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

EWD INFO

Click Location & Routing(A57)
Click Connector(A57)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-36 (VPA) - Body ground	Ignition switch ON	Below 1 V	V
A57-39 (VPA2) - Body ground	Ignition switch ON	Below 1 V	V
A57-37 (EPA) - Body ground	Ignition switch ON	Below 1 V	V
A57-25 (EPA2) - Body ground	Ignition switch ON	Below 1 V	V

NOTICE:

Turning the ignition switch to ON with the hybrid vehicle control ECU connector disconnected causes other DTCs to be stored. Clear the DTCs after performing this inspection.

(e) Turn the ignition switch off.

(f) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

EWD INFO

Click Location & Routing(A57,A54,A32)
Click Connector(A57)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-36 (VPA) - A54-6 (VPA)	Ignition switch off	Below 1 Ω	Ω
A57-37 (EPA) - A54-5 (EPA)	Ignition switch off	Below 1 Ω	Ω
A57-39 (VPA2) - A54-3 (VPA2)	Ignition switch off	Below 1 Ω	Ω
A32-25 (EPA2) - A54-2 (EPA2)	Ignition switch off	Below 1 Ω	Ω

Standard Resistance (Check for Short):

EWD INFO

Click Location & Routing(A57,A54)
Click Connector(A57)
Click Connector(A54)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
A57-36 (VPA) or A54-6 (VPA) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-37 (EPA) or A54-5 (EPA) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-39 (VPA2) or A54-3 (VPA2) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ
A57-25 (EPA2) or A54-2 (EPA2) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ

Post-procedure1

(g) Reconnect the accelerator pedal (with sensor) rod assembly connector.

(h) Reconnect the hybrid vehicle control ECU connector.

OK ▶ **REPLACE HYBRID VEHICLE CONTROL ECU**

Click here INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**