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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): P0AA373; Hybrid/EV Battery Negative Contactor Actuator Stuck Closed; 2023 - 2024 MY Prius Prius Prime [12/2022 -]		

DTC	**P0AA373**	**Hybrid/EV Battery Negative Contactor Actuator Stuck Closed**

DTC SUMMARY

MALFUNCTION DESCRIPTION

The hybrid vehicle control ECU detects a stuck closed malfunction of a system main relay on the HV battery negative side.

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

Inverter voltage sensor (VH) internal circuit malfunction

- Voltage sensor (VH) malfunction
- Motor generator control ECU (MG ECU) malfunction
- Communication (wire harness) malfunction

High voltage system malfunction

HV battery junction block assembly malfunction

Low-voltage circuit (12 V) malfunction

- Hybrid vehicle control ECU malfunction
- HV battery junction block assembly malfunction
- Low voltage wire harness malfunction
- Low voltage connector malfunction

DESCRIPTION

Refer to the description for DTC P0AA000.

Click here INFO

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P0AA373	Hybrid/EV Battery Negative Contactor Actuator Stuck Closed	Even the system main relay of HV battery negative (-) terminal side is turned off, the inverter voltage (VH) does not drop. (1 trip detection logic)	• HV battery junction block assembly • Inverter with converter assembly • Hybrid vehicle	Does not come on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P0AA4

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
			control ECU • Wire harness or connector					

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

1. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
2. Turn the ignition switch off and wait for 30 seconds or more.
3. Turn the ignition switch to ON (READY).
4. Turn the ignition switch off and wait for 30 seconds or more.
5. Turn the ignition switch to ON (READY).

HINT:

According to the display on the GTS, read the Data List and monitor the values of "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" for 3 minutes. If the difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is always less than 100 V, the vehicle has returned to normal.

6. Enter the following menus: Powertrain / Hybrid Control / Utility / All Readiness.
7. 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 driving pattern again.

WIRING DIAGRAM

Refer to the wiring diagram for the HV Battery High-voltage Line Circuit.

Click here INFO

CAUTION / NOTICE / HINT

CAUTION:

Refer to the precautions before inspecting high voltage circuit.

Click here INFO

NOTICE:

- If the DTCs are cleared or the cable is disconnected and reconnected to the negative (-) auxiliary battery terminal before performing repairs, turning the ignition switch to ON (READY) may cause a malfunction. Do not turn the ignition switch to ON (READY).
- After the ignition switch is turned off, there may be a waiting time before disconnecting the negative (-) auxiliary battery terminal.

Click here INFO

- When disconnecting and reconnecting the auxiliary battery

HINT:

When disconnecting and reconnecting the auxiliary battery, there is an automatic learning function that completes learning when the respective system is used.

Click here INFO

HINT:

- If DTC P0AA373 is output, the ignition switch cannot be turned to ON (READY).
- P0AA373 may be output as a result of the malfunction indicated by the DTCs in table below.

a. The chart above is listed in inspection order of priority.
b. Check DTCs that are output at the same time by following the listed order. (The main cause of the malfunction can be determined without performing unnecessary inspections.)

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
Microcomputer malfunction	Hybrid control system	P060647	Hybrid/EV Powertrain Control Module Processor Watchdog / Safety MCU Failure
		P060687	Hybrid/EV Powertrain Control Module Processor to Monitoring Processor Missing Message
		P060A47	Hybrid/EV Powertrain Control Module Monitoring Processor Watchdog / Safety MCU Failure
		P060A87	Hybrid/EV Powertrain Control Module Processor from Monitoring Processor Missing Message
		P0A1B49	Drive Motor "A" Control Module Internal Electronic Failure
		P1C9E9F	Hybrid/EV System Reset Stuck Off
		P060B49	Hybrid/EV Powertrain Control Module A/D Processing Internal Electronic Failure
	Motor generator control system	P0A1B1F	Generator Control Module Circuit Intermittent
		P0A1A47	Generator Control Module Watchdog / Safety µC Failure
		P0A1A49	Generator Control Module Internal Electronic Failure
		P1C2A1C	Generator A/D Converter Circuit Circuit Voltage Out of Range
		P1C2A49	Generator A/D Converter Circuit Internal Electronic Failure
		P1C2B1C	Drive Motor "A" Control Module A/D Converter Circuit Voltage Out of Range
		P1C2B49	Drive Motor "A" Control Module A/D Converter Circuit Internal Electronic Failure
		P1CAC49	Generator Position Sensor Internal Electronic Failure
		P1CAD49	Drive Motor "A" Position Sensor Internal Electronic Failure
		P1CAF38	Generator Position Sensor REF Signal Cycle Malfunction Signal Frequency Incorrect
		P1CB038	Drive Motor "A" Position Sensor REF Signal Frequency Incorrect

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
		P313383	Communication Error from Generator to Drive Motor "A" Value of Signal Protection Calculation Incorrect
		P313386	Communication Error from Generator to Drive Motor "A" Signal Invalid
	Hybrid battery system	P060B49	Hybrid/EV Battery Energy Control Module A/D Processing Internal Electronic Failure
		P060687	Hybrid/EV Battery Energy Control Module Processor to Monitoring Processor Missing Message
		P060A47	Hybrid/EV Battery Energy Control Module Monitoring Processor Watchdog / Safety MCU Failure
		P060A87	Hybrid/EV Battery Energy Control Module Processor from Monitoring Processor Missing Message
		P0E2D00	Hybrid/EV Battery Energy Control Module Hybrid/EV Battery Monitor Performance
Power source circuit malfunction	Motor generator control system	P06D61C	Generator Control Module Offset Power Circuit Voltage Out of Range
		P06B01C	Generator Control Module Position Sensor REF Power Source Circuit Voltage Out of Range
Communication system malfunction	Hybrid control system	U011187	Lost Communication with Hybrid/EV Battery Energy Control Module "A" Missing Message
	Motor generator control system	P313387	Communication Error from Generator to Drive Motor "A" Missing Message
Sensor and actuator circuit malfunction	Hybrid control system	P0AD911	Hybrid/EV Battery Positive Contactor Circuit Short to Ground
		P0AD915	Hybrid/EV Battery Positive Contactor Circuit Short to Auxiliary Battery or Open
		P0ADD11	Hybrid/EV Battery Negative Contactor Circuit Short to Ground
		P0ADD15	Hybrid/EV Battery Negative Contactor Circuit Short to Auxiliary Battery or Open
	Motor generator control system	P0A3F16	Drive Motor "A" Position Sensor Circuit Voltage Below Threshold
		P0A4B16	Generator Position Sensor Circuit Voltage Below Threshold
		P0A4B21	Generator Position Sensor Signal Amplitude < Minimum
		P0A4B22	Generator Position Sensor Signal Amplitude > Maximum
		P0C5013	Drive Motor "A" Position Sensor Circuit "A" Circuit Open
		P0C5016	Drive Motor "A" Position Sensor Circuit "A" Circuit Voltage Below Threshold
		P0C5017	Drive Motor "A" Position Sensor Circuit "A" Circuit Voltage Above Threshold

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
		P0C5A13	Drive Motor "A" Position Sensor Circuit "B" Circuit Open
		P0C5A16	Drive Motor "A" Position Sensor Circuit "B" Circuit Voltage Below Threshold
		P0C5A17	Drive Motor "A" Position Sensor Circuit "B" Circuit Voltage Above Threshold
		P0C6413	Generator Position Sensor Circuit "A" Circuit Open
		P0C6416	Generator Position Sensor Circuit "A" Circuit Voltage Below Threshold
		P0C6417	Generator Position Sensor Circuit "A" Circuit Voltage Above Threshold
		P0C6913	Generator Position Sensor Circuit "B" Circuit Open
		P0C6916	Generator Position Sensor Circuit "B" Circuit Voltage Below Threshold
		P0C6917	Generator Position Sensor Circuit "B" Circuit Voltage Above Threshold
	Hybrid battery system	P301A1C	Hybrid Battery Stack 1 Cell Voltage Detection Voltage Out of Range
		P1A001C	Hybrid Battery Stack 2 Cell Voltage Detection Voltage Out of Range
		P1AFD1C	Flying Capacitor/Internal Control Module Hybrid/EV Battery Monitor Voltage Out of Range
System malfunction	Hybrid control system	P0C7600	Hybrid/EV Battery System Discharge Time Too Long
		P0D2D1C	Drive Motor "A" Inverter Voltage Sensor Voltage Out of Range
		P1C8349	High Voltage Power Resource Circuit Voltage Sensor after Boosting Malfunction
	Motor generator control system	P0D2D16	Drive Motor "A" Inverter Voltage Sensor (VH) Circuit Voltage Below Threshold
		P0D2D17	Drive Motor "A" Inverter Voltage Sensor (VH) Circuit Voltage Above Threshold
		P1CB69E	Drive Motor "A" Inverter Voltage Sensor (VH) Stuck On

PROCEDURE

1.	**CHECK FREEZE FRAME DATA (HYBRID CONTROL)**

Pre-procedure1

(a) None.

Procedure1

(b) Read the Freeze Frame Data of DTC P0AA373.

Powertrain > Hybrid Control > DTC(P0AA373) > Freeze Frame Data

TESTER DISPLAY
VL-Voltage before Boosting
VH-Voltage after Boosting

NOTICE:

As freeze frame data is stored immediately before and after a DTC is stored, make sure to only read the values for the moment the DTC was stored ("0(s)").

RESULT	PROCEED TO
Difference between "VL-Voltage before Boosting" and "VH-Voltage after Boosting" is less than 90 V.	A
Difference between "VL-Voltage before Boosting" and "VH-Voltage after Boosting" is 90 V or more.	B

HINT:

If VH-Voltage after Boosting is output even when an off command is being sent to the system main relay (positive side), P0AA373 is output. If the difference between the "VL-Voltage before Boosting" and the "VH-Voltage after Boosting" is large, it is determined that there is an inverter (VH sensor) malfunction.

Post-procedure1

(c) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

A

▼

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

Click here INFO

OK ▶ **GO TO STEP 4**

NG

▼

3.	**CONNECT SECURELY**

NEXT

4.	**CHECK CONNECTOR CONNECTION CONDITION (FLOOR WIRE CONNECTOR)**

Click here INFO

RESULT	PROCEED TO
OK	A
NG (The connector is not connected securely.)	B
NG (The terminals are not making secure contact or are deformed, or water or foreign matter exists in the connector.)	C

A ▶ **GO TO STEP 7**

C ▶ **GO TO STEP 6**

B

5.	**CONNECT SECURELY**

NEXT ▶ **GO TO STEP 7**

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT

7.	**CHECK CONNECTOR CONNECTION CONDITION (HV BATTERY JUNCTION BLOCK ASSEMBLY CONNECTOR)**

Click here INFO

OK ▶ **GO TO STEP 9**

NG

▼

8.	**CONNECT SECURELY**

NEXT

▼

9.	**CHECK GROUND WIRE CONNECTION CONDITION (SMR ACTIVATION LOW-VOLTAGE CIRCUIT)**

Click here INFO

OK ▶ **GO TO STEP 11**

NG

▼

10.	**CONNECT SECURELY**

NEXT

▼

11.	**CHECK HARNESS AND CONNECTOR (HYBRID VEHICLE CONTROL ECU - HV BATTERY JUNCTION BLOCK ASSEMBLY)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

(a) Check that the service plug grip is not installed.

NOTICE:

After removing the service plug grip, do not turn the ignition switch to ON (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the HV battery junction block assembly connector.

(c) Disconnect the hybrid vehicle control ECU connector.

Procedure1

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

Standard Resistance (Check for Open):

EWD INFO

Click Location & Routing(K11,R42)
Click Connector(K11)
Click Connector(R42)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
K11-27 (SMRG) - R42-6 (SMRG)	Ignition switch off	Below 1 Ω	Ω

Standard Resistance (Check for Short):

EWD INFO

Click Location & Routing(K11,R42)
Click Connector(K11)
Click Connector(R42)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
K11-27 (SMRG) or R42-6 (SMRG) - Body ground and other terminals	Ignition switch off	10 kΩ or higher	kΩ

Post-procedure1

(e) Reconnect the hybrid vehicle control ECU connector.

(f) Reconnect the HV battery junction block assembly connector.

OK ▶ **GO TO STEP 13**

NG

▼

12.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT

▼

13.	**CHECK HARNESS AND CONNECTOR (HV BATTERY JUNCTION BLOCK ASSEMBLY - BODY GROUND)**

Click here INFO

OK ▶ **GO TO STEP 15**

NG

▼

14.	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NEXT

▼

15.	**INSPECT HV BATTERY JUNCTION BLOCK ASSEMBLY (SMRG)**

CAUTION:

Be sure to wear insulated gloves.

Pre-procedure1

(a) Check that the service plug grip is not installed.

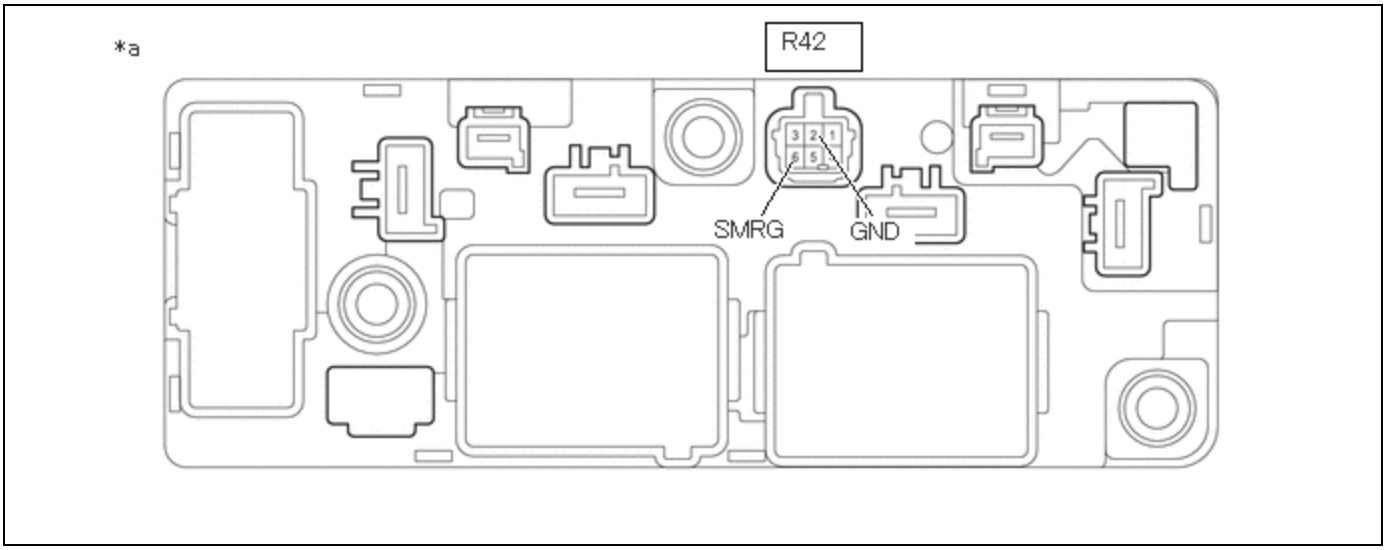
NOTICE:

After removing the service plug grip, do not turn the ignition switch to ON (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the HV battery junction block assembly connector.

Procedure1

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



*a	Component without harness connected (HV Battery Junction Block Assembly)	-	-

Standard Resistance:

EWD INFO

Click Location & Routing(R42)
Click Connector(R42)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
R42-6 (SMRG) - R42-2 (GND)	-40 to 80°C (-40 to 176°F)	20.6 to 40.8 Ω	Ω

Post-procedure1

(d) Reconnect the HV battery junction block assembly connector.

NG ▶ **GO TO STEP 18**

OK ▼

16.	CHECK HV BATTERY JUNCTION BLOCK ASSEMBLY (SMRG)

CAUTION:

Be sure to wear insulated gloves.

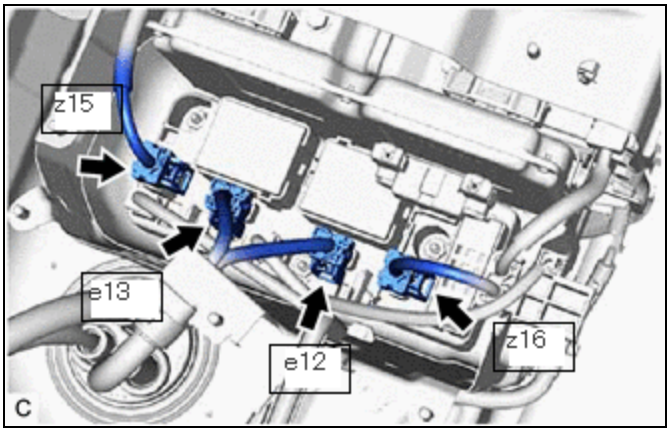
Pre-procedure1

(a) Check that the service plug grip is not installed.

NOTICE:

After removing the service plug grip, do not turn the ignition switch to ON (READY), unless instructed by the repair manual because this may cause a malfunction.

(b) Disconnect the HV battery high voltage connectors from the HV battery junction block assembly.



NOTICE:

Insulate each disconnected high-voltage connector with insulating tape. Wrap the connector from the wire harness side to the end of the connector.

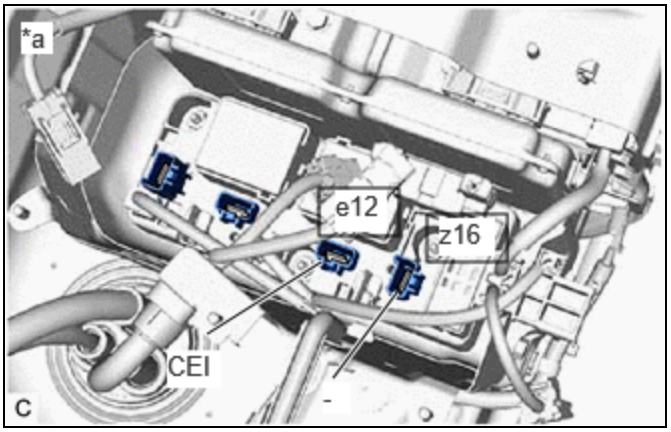
Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(e12,z16)
Click Connector(e12)
Click Connector(z16)



*a	Component without harness connected (HV Battery Junction Block Assembly)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
e12-1 (CEI) - z16-1 (-)	Ignition switch off	10 kΩ or higher

HINT:

- If a system main relay is stuck closed, inspect the HV battery junction block assembly without removing it from the vehicle, in order to keep the relay closed.
- If the result of reading the freeze frame data is A, the HV battery junction block assembly must be replaced. Measuring resistance can determine that this is either a present or past malfunction.

Result:

RESULT	JUDGMENT	PROCEED TO
OK	Past malfunction	A
NG	Present malfunction	B

Post-procedure1

(d) Reconnect the HV battery high voltage connectors.

B ▶ **GO TO STEP 19**

A

17.	**REPLACE HV BATTERY JUNCTION BLOCK ASSEMBLY**

HINT:

Click here INFO

NEXT ▶ **GO TO STEP 21**

18.	**REPLACE HV BATTERY JUNCTION BLOCK ASSEMBLY**

HINT:

Click here INFO

NEXT ▶ **GO TO STEP 21**

19.	**REPLACE HV BATTERY JUNCTION BLOCK ASSEMBLY**

HINT:

Click here INFO

NEXT

20.	**CHECK DTC OUTPUT (HYBRID CONTROL, MOTOR GENERATOR, HV BATTERY)**

Click here INFO

RESULT	PROCEED TO
DTCs are not output	A
DTCs of Hybrid Control System are output.	B

RESULT	PROCEED TO
DTCs of Motor Generator Control System are output.	C
DTCs of Hybrid Battery System are output.	D

B ▶ **GO TO DTC CHART (HYBRID CONTROL SYSTEM)**

C ▶ **GO TO DTC CHART (MOTOR GENERATOR CONTROL SYSTEM)**

D ▶ **GO TO DTC CHART (HYBRID BATTERY SYSTEM)**

A ▼

21.	CHECK HYBRID VEHICLE CONTROL ECU (CHECK FOR NORMAL OPERATION)

Click here INFO

RESULT	PROCEED TO
Difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is always less than 100 V.	A
Difference between "Hybrid/EV Battery Voltage" and "VL-Voltage before Boosting" is 100 V or more.	B

A ▶ **END**

B ▶ **REPLACE HYBRID VEHICLE CONTROL ECU AND HV BATTERY JUNCTION BLOCK ASSEMBLY**

HYBRID VEHICLE CONTROL ECU: Click here INFO

HV BATTERY JUNCTION BLOCK ASSEMBLY: Click here INFO