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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): P1C2D62; Hybrid/EV Battery "A" Voltage Sensor/Boosting Converter Voltage Sensor "A" Signal Compare Failure; 2023 - 2024 MY Prius Prius Prime [12/2022 -]		

DTC	**P1C2D62**	**Hybrid/EV Battery "A" Voltage Sensor/Boosting Converter Voltage Sensor "A" Signal Compare Failure**

DTC SUMMARY

MALFUNCTION DESCRIPTION

The hybrid vehicle control ECU detects a VB sensor or VL sensor malfunction.

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

Inverter voltage (VB or VL) sensor internal circuit malfunction

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

High voltage system malfunction

- HV battery malfunction
- HV battery junction block assembly malfunction
- Inverter with converter assembly malfunction
- High-voltage wire harness malfunction
- High-voltage connector or connection malfunction

Inspection Overview

INSPECTION CONTENT	REASON (NARROW DOWN IN ORDER USING INSPECTION PROCEDURES BELOW)
Check for DTCs (hybrid control, motor generator, HV battery)	Output DTCs
Check for DTCs (check voltage sensor malfunction locations) Check for DTCs (drive test)	Ignition switch ON (READY) (vehicle stopped or being driven) and then check whether DTCs are output again.
Read value using GTS (data list)	Data List value
Check freeze frame data	Freeze Frame Data
Read value using GTS (data list)	Accelerator and brake pedal simultaneously depressed Data List value

DESCRIPTION

For a description of the boost converter.

Click here INFO

The MG ECU uses a voltage sensor (VL) that is built into the boost converter to detect the high voltage before it is boosted. The ECU also uses the battery ECU assembly to detect HV battery voltage (VB).

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P1C2D62	Hybrid/EV Battery "A" Voltage Sensor/Boosting Converter Voltage Sensor "A" Signal Compare Failure	Voltages from HV battery voltage (VB) sensor and boost converter voltage (VL) sensor deviate: Difference between "VL-Voltage before Boosting" and "Hybrid/EV Battery Voltage" is large when the boosting request is given. (1 trip detection logic)	• Inverter with converter assembly • Battery ECU assembly	Comes on	Master Warning: Comes on	Hybrid Control	A	SAE Code: P1C2D

MONITOR DESCRIPTION

The hybrid vehicle control ECU monitors signals of HV battery voltage (VB) and boost converter voltage (VL) sensors. When a large difference occurs between the voltages from the VB and VL sensors, the hybrid vehicle control ECU interprets this as a failure of either of the sensors. The hybrid vehicle control ECU will illuminate the MIL and store a DTC.

MONITOR STRATEGY

Related DTCs	P1C2D (INF P1C2D62): Hybrid / EV battery voltage / DC/DC converter voltage correlation
Required sensors/components	Boost converter
Frequency of operation	-
Duration	TMC's intellectual property
MIL operation	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 P1C2D (INF P1C2D62) 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. Turn the ignition switch to ON (READY). [*1]
4. With the shift lever in D, depress both the accelerator pedal and brake pedal at the same time to raise the "Hybrid/EV Battery SOC" to a sufficient level. [*2]
5. Move the shift lever to P, check that the engine is stopped and move the shift lever to N. [*3]
6. Set the A/C for maximum cooling. [*4]
7. Leave the vehicle for a few minutes. [*5]

HINT:

- When the accelerator pedal is not depressed with the ignition switch ON (READY) and shift lever in P, if "VL-Voltage before Boosting" and the "Hybrid/EV Battery Voltage" is approximately the same after repair, the condition is judged as normal.
- [*1] to [*5] : Normal judgment procedure.

  The normal judgment procedure is used to complete DTC judgment and also used when clearing permanent DTCs.

8. Enter the following menus: Powertrain / Hybrid Control / Utility / All Readiness.
9. 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.

CAUTION / NOTICE / HINT

HINT:

- P1C2D62 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
		P0A1B49	Drive Motor "A" Control Module Internal Electronic Failure
		P060B49	Hybrid/EV Powertrain Control Module A/D Processing Internal Electronic 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
	Motor Generator Control System	P0A1A47	Generator Control Module Watchdog / Safety µC Failure
		P0A1A49	Generator Control Module Internal Electronic Failure
		P0A1B1F	Generator Control Module Circuit Intermittent
		P1C2A1C	Generator A/D Converter Circuit Circuit Voltage Out of Range
		P1C2A49	Generator A/D Converter Circuit Internal Electronic Failure
		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
		P060B16	Hybrid/EV Battery Energy Control Module A/D Processing Circuit Voltage Below Threshold
		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
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

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
Sensor and actuator circuit malfunction	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	Motor Generator Control System	P0E3116	DC/DC Converter Voltage Sensor "A" (VL) Circuit Voltage Below Threshold
		P0E3117	DC/DC Converter Voltage Sensor "A" (VL) Circuit Voltage Above Threshold

PROCEDURE

1.	**CLEAR DTC**

Click here INFO

NEXT

2.	**CHECK DTC OUTPUT (CHECK FAILURE PART)**

Pre-procedure1

(a) Apply the parking brake and secure the wheels using chocks.

NOTICE:

Perform this test with the AUTO function (shift-linked function) of the electric parking brake system off.

HINT:

When the parking brake indicator (red) is illuminated after the electric parking brake switch assembly has been pulled to the lock side, the maximum amount of braking force is applied if the electric parking brake switch assembly is pulled to the lock side one more time.

(b) Connect the GTS to the DLC3. *1

(c) Turn the ignition switch to ON (READY). *2

(d) Read the Data List. *3

Powertrain > Hybrid Control > Data List

TESTER DISPLAY
Hybrid/EV Battery SOC

TESTER DISPLAY
Hybrid/EV Battery Current

(e) If the value of "Hybrid/EV Battery SOC" is less than 55%, move the shift lever to D and charge the HV battery by depressing the accelerator pedal and brake pedal simultaneously until the value reaches 55% or more. *4

(f) Move the shift lever to P. *5

(g) Set the air conditioning to MAX COOL and turn the headlights on. *6

(h) Confirm that "Hybrid/EV Battery Current" is more than 3 A. *7

(i) With the engine stopped and the conditions of steps *5, *6 and *7 satisfied, leave the vehicle for 15 seconds. *8

(j) Enter the following menus: Powertrain / Hybrid Control, Motor Generator / Trouble codes. *9

Procedure1

(k) Check for DTCs. *10

Powertrain > Hybrid Control > Trouble Codes
Powertrain > Motor Generator > Trouble Codes
Powertrain > HV Battery > Trouble Codes

NOTICE:

If the low HV battery information comes on, move the shift lever to P and start the engine to charge the HV battery. After the engine stops, perform steps *1 through *10 again.

RESULT	PROCEED TO
No DTCs are output, or DTCs except the following are output.	A
P0E311C or P0CA300 are output.	B
P0B231C or P1C8349 are output.	C
P300000 is output.	D

Post-procedure1

(l) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

C ▶ **REPLACE BATTERY ECU ASSEMBLY**

D ▶ **LEAVE VEHICLE WITH SHIFT LEVER IN P, AND CHARGE HV BATTERY BY IDLING UNTIL IDLING STOPS (PERFORM STEPS *1 THROUGH *10)**

A

3.	**CHECK DTC OUTPUT (ROAD TEST)**

Pre-procedure1

(a) Turn the ignition switch to ON (READY). *11

(b) Perform a road test that repeats full acceleration to 60 km/h (37 mph) and then braking to a complete stop three times. *12

CAUTION:

Perform this road test only in an appropriate safe location, in accordance with all local laws.

HINT:

This road test is performed to drive the car under high load and cause a change in the HV battery voltage.

(c) Connect the GTS to the DLC3. *13

(d) Enter the following menus: Powertrain / Hybrid Control, Motor Generator / Trouble Codes. *14

Pre-procedure1

(e) Check for DTCs. *15

Powertrain > Hybrid Control > Trouble Codes
Powertrain > Motor Generator > Trouble Codes
Powertrain > HV Battery > Trouble Codes

RESULT	PROCEED TO
No DTCs are output, or DTCs except the following are output.	A
P0E311C or P0CA300 are output.	B
P0B231C or P1C8349 are output.	C
P300000 is output.	D

Post-procedure1

(f) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

C ▶ **REPLACE BATTERY ECU ASSEMBLY** INFO

D **LEAVE VEHICLE WITH SHIFT LEVER IN P, AND CHARGE HV BATTERY BY IDLING UNTIL IDLING STOPS (PERFORM STEPS *11 THROUGH *15)**

A

4.	**READ VALUE USING GTS (DATA LIST)**

Pre-procedure1

(a) Apply the parking brake and secure the wheels using chocks.

NOTICE:

Perform this test with the AUTO function (shift-linked function) of the electric parking brake system off.

HINT:

When the parking brake indicator (red) is illuminated after the electric parking brake switch assembly has been pulled to the lock side, the maximum amount of braking force is applied if the electric parking brake switch assembly is pulled to the lock side one more time.

(b) Turn the ignition switch to ON (READY).

(c) Read the Data List.

Powertrain > Hybrid Control > Data List

TESTER DISPLAY
VL-Voltage before Boosting
VH-Voltage after Boosting
Hybrid/EV Battery SOC
Hybrid/EV Battery Voltage

(d) If the value of "Hybrid/EV Battery SOC" is less than 55%, move the shift lever to D and charge the HV battery by depressing the accelerator pedal and brake pedal simultaneously until the value reaches 55% or more.

Procedure1

(e) Release the accelerator pedal, move the shift lever to P and wait for the engine to stop. Read the Data List when the engine stops.

HINT:

If the engine starts, wait until it stops before continuing.

RESULT	PROCEED TO
Both of the following are not satisfied.	A
Both of the following are satisfied: • Difference between "Hybrid/EV Battery Voltage" and "VH-Voltage after Boosting" is less than 5 V. • Difference between "VL-Voltage before Boosting" and "VH-Voltage after Boosting" is more than 30 V.	B
Both of the following are satisfied: • Difference between "VH-Voltage after Boosting" and "VL-Voltage before Boosting" is less than 5 V. • Difference between "Hybrid/EV Battery Voltage" and "VH-Voltage after Boosting" is more than 10 V.	C

Post-procedure1

(f) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

C ▶ **REPLACE BATTERY ECU ASSEMBLY**

A ▼

5.	**CHECK FREEZE FRAME DATA (VL-VOLTAGE BEFORE BOOSTING, HYBRID/EV BATTERY VOLTAGE)**

Pre-procedure1

(a) None.

Procedure1

(b) Read the Freeze Frame Data of DTC P1C2D62.

Powertrain > Hybrid Control > DTC(P1C2D62) > Freeze Frame Data

TESTER DISPLAY
VL-Voltage before Boosting
Hybrid/EV Battery Voltage

RESULT	PROCEED TO
Both of the following are satisfied or both of the following are not satisfied.	A
"VL-Voltage before Boosting" is less than 162 V or more than 251 V.	B
"Hybrid/EV Battery Voltage" is less than 162 V or more than 251 V.	C

Post-procedure1

(c) Turn the ignition switch off.

B ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

C ▶ **REPLACE BATTERY ECU ASSEMBLY**

A

6.	**READ VALUE USING GTS (DATA LIST)**

Pre-procedure1

(a) Apply the parking brake and secure the wheels using chocks.

NOTICE:

Perform this test with the AUTO function (shift-linked function) of the electric parking brake system off.

HINT:

When the parking brake indicator (red) is illuminated after the electric parking brake switch assembly has been pulled to the lock side, the maximum amount of braking force is applied if the electric parking brake switch assembly is pulled to the lock side one more time.

(b) Turn the ignition switch to ON (READY).

(c) Read the Data List.

Powertrain > HV Battery > Data List

TESTER DISPLAY
Hybrid/EV Battery SOC
Hybrid/EV Battery Voltage
Hybrid/EV Battery Cell 1 Voltage

TESTER DISPLAY
Hybrid/EV Battery Cell 2 Voltage
Hybrid/EV Battery Cell 3 Voltage
Hybrid/EV Battery Cell 4 Voltage
Hybrid/EV Battery Cell 5 Voltage
Hybrid/EV Battery Cell 6 Voltage
Hybrid/EV Battery Cell 7 Voltage
Hybrid/EV Battery Cell 8 Voltage
Hybrid/EV Battery Cell 9 Voltage
Hybrid/EV Battery Cell 10 Voltage
Hybrid/EV Battery Cell 11 Voltage
Hybrid/EV Battery Cell 12 Voltage
Hybrid/EV Battery Cell 13 Voltage
Hybrid/EV Battery Cell 14 Voltage
Hybrid/EV Battery Cell 15 Voltage
Hybrid/EV Battery Cell 16 Voltage
Hybrid/EV Battery Cell 17 Voltage
Hybrid/EV Battery Cell 18 Voltage
Hybrid/EV Battery Cell 19 Voltage
Hybrid/EV Battery Cell 20 Voltage

TESTER DISPLAY
Hybrid/EV Battery Cell 21 Voltage
Hybrid/EV Battery Cell 22 Voltage
Hybrid/EV Battery Cell 23 Voltage
Hybrid/EV Battery Cell 24 Voltage
Hybrid/EV Battery Cell 25 Voltage
Hybrid/EV Battery Cell 26 Voltage
Hybrid/EV Battery Cell 27 Voltage
Hybrid/EV Battery Cell 28 Voltage
Hybrid/EV Battery Cell 29 Voltage
Hybrid/EV Battery Cell 30 Voltage
Hybrid/EV Battery Cell 31 Voltage
Hybrid/EV Battery Cell 32 Voltage
Hybrid/EV Battery Cell 33 Voltage
Hybrid/EV Battery Cell 34 Voltage
Hybrid/EV Battery Cell 35 Voltage
Hybrid/EV Battery Cell 36 Voltage
Hybrid/EV Battery Cell 37 Voltage
Hybrid/EV Battery Cell 38 Voltage
Hybrid/EV Battery Cell 39 Voltage

TESTER DISPLAY
Hybrid/EV Battery Cell 40 Voltage
Hybrid/EV Battery Cell 41 Voltage
Hybrid/EV Battery Cell 42 Voltage
Hybrid/EV Battery Cell 43 Voltage
Hybrid/EV Battery Cell 44 Voltage
Hybrid/EV Battery Cell 45 Voltage
Hybrid/EV Battery Cell 46 Voltage
Hybrid/EV Battery Cell 47 Voltage
Hybrid/EV Battery Cell 48 Voltage
Hybrid/EV Battery Cell 49 Voltage
Hybrid/EV Battery Cell 50 Voltage
Hybrid/EV Battery Cell 51 Voltage
Hybrid/EV Battery Cell 52 Voltage
Hybrid/EV Battery Cell 53 Voltage
Hybrid/EV Battery Cell 54 Voltage
Hybrid/EV Battery Cell 55 Voltage
Hybrid/EV Battery Cell 56 Voltage
Hybrid/EV Battery Cell 57 Voltage
Hybrid/EV Battery Cell 58 Voltage

TESTER DISPLAY
Hybrid/EV Battery Cell 59 Voltage
Hybrid/EV Battery Cell 60 Voltage

(d) If the value of "Hybrid/EV Battery SOC" is less than 55%, move the shift lever to D and charge the HV battery by depressing the accelerator pedal and brake pedal simultaneously until the value reaches 55% or more.

Procedure1

(e) Release the accelerator pedal, move the shift lever to P and wait for the engine to stop. Read the Data List when the engine stops.

HINT:

If the engine starts, wait until it stops before continuing.

RESULT	PROCEED TO
Both of the following are satisfied: • Sum of all "Hybrid/EV Battery Cell 1 to 60 Voltage" is more than ("Hybrid/EV Battery Voltage" - 40 V) • Sum of all "Hybrid/EV Battery Cell 1 to 60 Voltage" is less than ("Hybrid/EV Battery Voltage" + 35 V)	A
The preceding condition is not satisfied.	B

Post-procedure1

(f) Turn the ignition switch off.

A ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**

B ▶ **REPLACE BATTERY ECU ASSEMBLY**