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Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [03/2023 -]
Title: HYBRID / BATTERY CONTROL: MOTOR GENERATOR CONTROL SYSTEM (for PHEV Model): P0A4B21,P0A1A47,P0A4B22,P1C2A49; Generator Position Sensor Signal Amplitude < Minimum; 2023 - 2024 MY Prius Prime [03/2023 -]		

DTC	**P0A4B21**	**Generator Position Sensor Signal Amplitude < Minimum**

DTC	**P0A1A47**	**Generator Control Module Watchdog / Safety MC Failure**

DTC	**P0A4B22**	**Generator Position Sensor Signal Amplitude > Maximum**

DTC	**P1C2A49**	**Generator A/D Converter Circuit Internal Electronic Failure**

DTC SUMMARY

MALFUNCTION DESCRIPTION

These DTCs indicate that the resolver output signal is abnormal. The cause of this malfunction may be one of the following:

AREA	MAIN MALFUNCTION DESCRIPTION
Inverter low-voltage circuit	The connectors are not connected properly
Hybrid vehicle transaxle assembly	• Open or short circuit in the generator resolver circuit • Generator (MG1) internal malfunction (entry of foreign matter, etc.)
Wire harness between the resolver and inverter with converter assembly	• Open or short circuit in the wire harness • The connectors are not connected properly
Inside of inverter	Inverter with converter assembly internal circuit malfunction

DESCRIPTION

Refer to the system description for the Generator Resolver Circuit.

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DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
P0A1A47	Generator Control Module Watchdog / Safety MC Failure	Generator resolver malfunction or motor generator control ECU internal malfunction (1 trip detection logic)	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector	Comes on	Master Warning: Comes on	Motor Generator	A	SAE Code: P0A1A
P0A4B21	Generator Position Sensor Signal Amplitude < Minimum	Open or short circuit in generator resolver circuit: The generator resolver signal is out of the standard range. (Signal amplitude is small) (1 trip detection logic)	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector	Comes on	Master Warning: Comes on	Motor Generator	A	SAE Code: P0A4D
P0A4B22	Generator Position Sensor Signal Amplitude > Maximum	Open or short circuit in generator resolver circuit: The generator resolver signal is out of the standard range. (Signal amplitude is large) (1 trip detection logic)	• Inverter with converter assembly • Hybrid vehicle transaxle assembly • Wire harness or connector	Comes on	Master Warning: Comes on	Motor Generator	A	SAE Code: P0A4E
P1C2A49	Generator A/D Converter Circuit Internal Electronic Failure	Generator resolver malfunction or motor generator control ECU internal malfunction	• Inverter with converter assembly • Hybrid vehicle	Comes on	Master Warning: Comes on	Motor Generator	A	SAE Code: P1C2A

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	WARNING INDICATE	DTC OUTPUT FROM	PRIORITY	NOTE
		(1 trip detection logic)	transaxle assembly • Wire harness or connector					

MONITOR DESCRIPTION

The motor generator control ECU monitors the Generator resolver output signal. If the motor generator control ECU detects output signals that are out of the normal range or specification, it will conclude that there is a malfunction in the generator resolver, illuminate the MIL and store a DTC.

MONITOR STRATEGY

Related DTCs	P0A1A (INF P0A1A47): Generator Control Module P0A4D (INF P0A4B21): Range check P0A4E (INF P0A4B22): Range check P1C2A (INF P1C2A49): Generator Control Module A/D Processing
Required sensors/components	Generator resolver
Frequency of operation	Continuous
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

Motor generator control ECU	DTC P0A1A (INF P0A1A47) is not detected DTC P0A4D (INF P0A4B21) is not detected DTC P0A4E (INF P0A4B22) is not detected DTC P1C2A (INF P1C2A49) 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.

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

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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 and wait for 5 seconds or more. [*1]
4. Turn the ignition switch to ON (READY) with the shift lever in P and wait for 5 seconds or more. [*2]
5. Depress the accelerator pedal of the vehicle with the engine stopped and the shift lever in P to start the engine. [*3]
6. Drive the vehicle forward with the shift lever in D for 5 m (16 ft.) or more. [*4]
7. Drive the vehicle backward with the shift lever in R for 5 m (16 ft.) or more. [*5]

HINT:

[*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 / Motor Generator / 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.

WIRING DIAGRAM

Refer to the wiring diagram for the Generator Resolver Circuit.

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CAUTION / NOTICE / HINT

CAUTION:

Refer to the precautions before inspecting high voltage circuit.

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NOTICE:

- After the ignition switch is turned off, there may be a waiting time before disconnecting the negative (-) auxiliary battery terminal.

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- 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.

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HINT:

- If the problem symptom cannot be reproduced, performing a road test on a road on which the vehicle tends to vibrate will make it easier to reproduce the symptom.
- If the resolver is malfunctioning, the vehicle may not drive smoothly.
- When inspecting the connectors, if it is difficult to judge if a connector was disconnected, deformed or improperly secured, disconnect and reconnect the connector and then check for DTCs again. Check if the same DTC is output. If the same DTC is not output, improper connection of connectors is suspected.

- As a malfunction detection threshold may be exceeded when performing the vibration or heat connector inspections, make sure to perform the following inspection to check that the DTC was not stored due to the malfunction of a part.
- P0A1A47, P0A4B21, P0A4B22 or P1C2A49 may be output as a result of the malfunctions 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.)

Table 1

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
Insulation malfunction	Hybrid control system	P1C7C49	Hybrid/EV Battery Voltage System Isolation (A/C Area) Internal Electronic Failure
		P1C7D49	Hybrid/EV Battery Voltage System Isolation (Hybrid/EV Battery Area) Internal Electronic Failure
		P1C7E49	Hybrid/EV Battery Voltage System Isolation (Transaxle Area) Internal Electronic Failure
		P1C7F49	Hybrid/EV Battery Voltage System Isolation (Direct Current Area) Internal Electronic Failure
		P1C8049	Hybrid/EV Battery Voltage System Isolation (Rear Motor Area) Internal Electronic Failure

Table 2

MALFUNCTION CONTENT	SYSTEM	RELEVANT DTC	
Microcomputer malfunction	Motor generator control system	P0A1A49	Generator Control Module Internal Electronic Failure
		P1C2A1C	Generator A/D Converter Circuit Circuit Voltage Out of Range
		P1C2A71	Generator A/D Converter Circuit Actuator Stuck
		P1CAF38	Generator Position Sensor REF Signal Cycle Malfunction Signal Frequency Incorrect
		P313483	Communication Error from Drive Motor "A" to Generator Value of Signal Protection Calculation Incorrect
		P313486	Communication Error from Drive Motor "A" to Generator Signal Invalid
		P313487	Communication Error from Drive Motor "A" to Generator Missing Message
Power source circuit malfunction	Motor generator control system	P19F81C	Generator Control Module Offset Power Circuit Voltage Out of Range
		P26DF1C	Generator Control Module Position Sensor REF Power Source Circuit Voltage Out of Range

PROCEDURE

1.	**CHECK CONNECTOR CONNECTION CONDITION (INVERTER WITH CONVERTER ASSEMBLY CONNECTOR)**

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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

B ▶ **CONNECT SECURELY**

C ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

A

▼

2.	**CHECK GENERATOR RESOLVER CIRCUIT**

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HINT:

If the "Generator Resolver Circuit" inspection results are normal, perform the next step.

NEXT ▶ **REPLACE INVERTER WITH CONVERTER ASSEMBLY**