Last Modified: 12-04-2024	6.11:8.1.0	**Doc ID:** RM100000002BLU7
Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [03/2023 -]
Title: M20A-FXS (ENGINE CONTROL): SFI SYSTEM: P001600; Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A; 2023 - 2024 MY Prius Prius Prime [03/2023 -]		

DTC	**P001600**	**Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A**

DESCRIPTION

Refer to DTC P001001.

Click here INFO

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
P001600	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Deviation in the crankshaft position sensor signal and camshaft position sensor (for intake camshaft) signal (2 trip detection logic).	• Valve timing • Camshaft timing gear assembly • ECM	Comes on	Engine	B	SAE Code: P0016

HINT:

If initialization is performed using the GTS with any of the connectors of the wire harnesses between the power source or ECM and the cam timing control motor with EDU assembly disconnected, DTC P001600 may be stored. If DTC P001600 is output, check the connection condition of each connector.

MONITOR DESCRIPTION

This DTC is stored when a deviation in the valve timing is detected. If a deviation in the valve timing is detected when the engine is idling (during valve timing learning) after performing learning value reset using the GTS or when the vehicle is being driven, the ECM determines that a malfunction has occurred. If a deviation in the valve timing is detected in consecutive driving cycles, the ECM stores a DTC.

In this case, DTC P03652A or P036531 (Camshaft Position Sensor [for Exhaust Camshaft] Malfunction) may also be stored.

MONITOR STRATEGY

Related DTCs	P0016: Camshaft timing misalignment at idling (for intake camshaft)
Required Sensors/Components (Main)	Camshaft timing gear assembly
Required Sensors/Components (Related)	Camshaft position sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 1 minute

MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever the following DTCs are not stored	None
Engine speed	500 to 1400 rpm

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met	A or B
A. VVT learned value at maximum retarded valve timing	Less than 22.2°CA (Crankshaft Angle)
B. VVT learned value at maximum retarded valve timing	More than 45.1°CA (Crankshaft Angle)

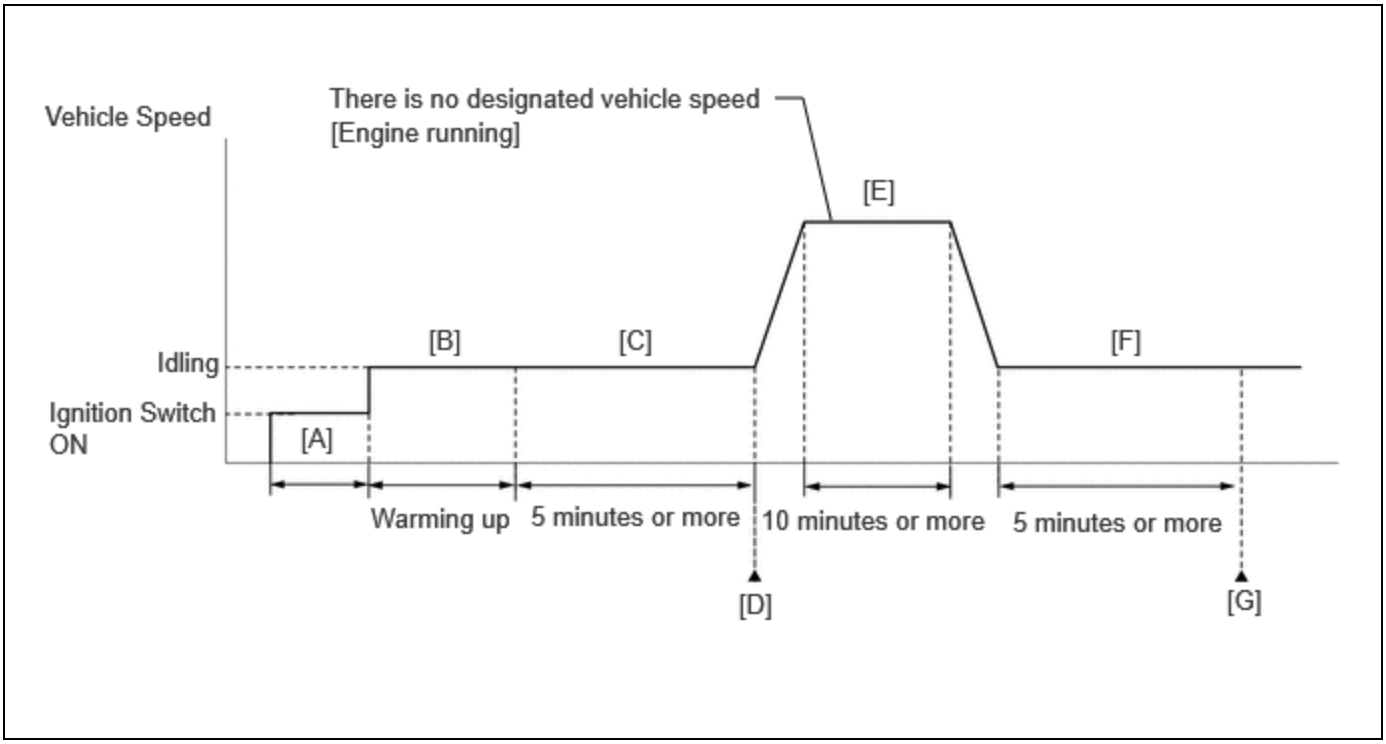
CONFIRMATION DRIVING PATTERN

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 at least 30 seconds.
3. Turn the ignition switch to ON [A].
4. Put the engine in Inspection Mode (Maintenance Mode).

Click here INFO

5. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
6. Idle the engine for 5 minutes or more [C].
7. Enter the following menus: Powertrain / Engine / Trouble Codes [D].
8. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P001600.
11. Check the DTC judgment result.

HINT:

- If the judgment result is NORMAL, the system is normal.
- If the judgment result is ABNORMAL, the system has a malfunction.
- If the judgment result is INCOMPLETE, perform steps [E] through [G].
- [A] to [D]: Normal judgment procedure.

  The normal judgment procedure is used to complete DTC judgment and also used when clearing permanent DTCs.
- When clearing the permanent DTCs, do not disconnect the cable from the auxiliary battery terminal or attempt to clear the DTCs during this procedure, as doing so will clear the universal trip and normal judgment histories.

12. Press the EV/HV mode selection switch to select HV mode. (for PHEV Model)
13. With the engine running, drive the vehicle for 10 minutes or more [E].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

If the engine stops, further depress the accelerator pedal to restart the engine.

14. Idle the engine for 5 minutes or more [F].
15. Enter the following menus: Powertrain / Engine / Trouble Codes [G].
16. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

17. Check the DTC judgment result.

HINT:

- If the judgment result is NORMAL, the system is normal.
- If the judgment result is ABNORMAL, the system has a malfunction.
- [A] to [G]: Normal judgment procedure.

  The normal judgment procedure is used to complete DTC judgment and also used when clearing permanent DTCs.
- When clearing the permanent DTCs, do not disconnect the cable from the auxiliary battery terminal or attempt to clear the DTCs during this procedure, as doing so will clear the universal trip and normal judgment histories.

CAUTION / NOTICE / HINT

NOTICE:

- Vehicle Control History may be stored in the hybrid vehicle control ECU if the engine is malfunctioning. Certain vehicle condition information is recorded when Vehicle Control History is stored. Reading the vehicle conditions

recorded in both the freeze frame data and Vehicle Control History can be useful for troubleshooting.

for HEV Model: Click here INFO

for PHEV Model: Click here INFO

(Select Powertrain in Health Check and then check the time stamp data.)

- If any "Engine Malfunction" Vehicle Control History item has been stored in the hybrid vehicle control ECU, make sure to clear it. However, as all Vehicle Control History items are cleared simultaneously, if any Vehicle Control History items other than "Engine Malfunction" are stored, make sure to perform any troubleshooting for them before clearing Vehicle Control History.

for HEV Model: Click here INFO

for PHEV Model: Click here INFO

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P001600)**

(a) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
P001600 and other DTCs are output	A
P001600 is output	B

HINT:

If any DTCs other than P001600 are output, troubleshoot those DTCs first.

A ▶ **GO TO DTC CHART**

B ▼

2.	**INSPECT CAMSHAFT TIMING GEAR ASSEMBLY**

Pre-procedure1

(a) Remove the cam timing control motor with EDU assembly.

HINT:

Click here INFO

Procedure1

(b) Check if the eccentric shaft of the camshaft timing gear assembly rotates smoothly.

NOTICE:

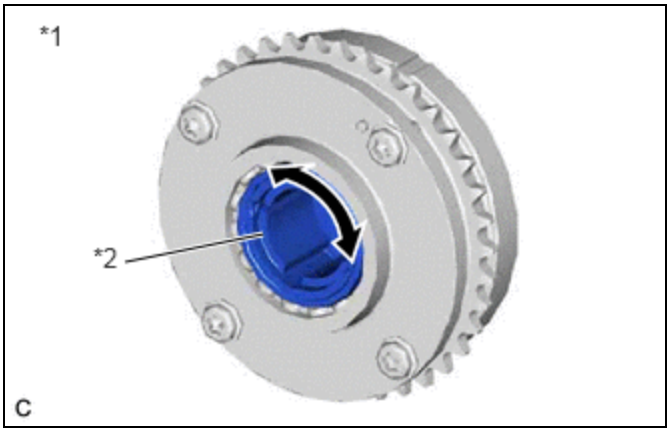
If the camshaft is at a position where a valve is about to open, the eccentric shaft may become difficult to rotate.

OK:

Rotates smoothly.

Result:

PROCEED TO
OK
NG



*1	Camshaft Timing Gear Assembly
*2	Eccentric Shaft

Post-procedure1

(c) Perform "Inspection After Repair" after removing the cam timing control motor with EDU assembly.

HINT:

Click here INFO

NG ▶ **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

OK ▼

3.	CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPED TEETH ON TIMING CHAIN)

Pre-procedure1

(a) Remove the cylinder head cover sub-assembly.

HINT:

for HEV Model: Click here INFO

for PHEV Model: Click here INFO

(b) Turn the crankshaft pulley and align its groove with the TDC timing mark of the timing chain cover.

Procedure1

(c) Check that the timing marks of the camshaft timing gear assembly and camshaft timing exhaust

gear assembly are at the positions shown in the illustration.

HINT:

If the timing marks are not as shown, turn the crankshaft one revolution clockwise.

OK:

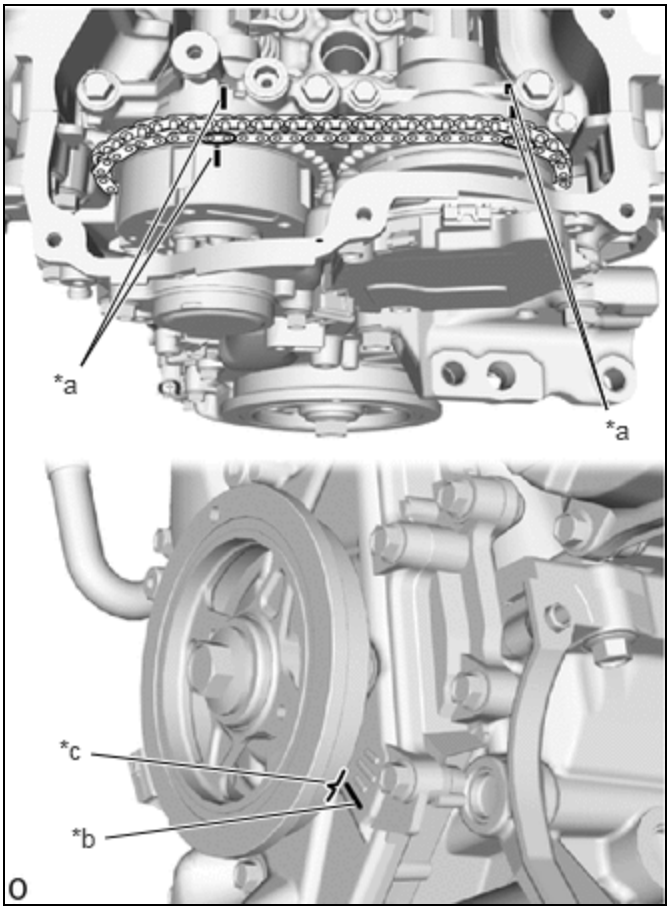
Timing marks on camshaft timing gear assembly and camshaft timing exhaust gear assembly are at the positions shown in the illustration.

HINT:

If the result is not as specified, check for mechanical malfunctions that may have affected the valve timing, such as a jumped tooth or stretching of the timing chain.

Result:

PROCEED TO
OK
NG



*a	Timing Mark
*b	TDC Timing Mark
*c	Groove

Post-procedure1

(d) None

NG ▶ **GO TO STEP 6**

OK ▼

4.	**CLEAR DTC**

Pre-procedure1

(a) None

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

(c) Turn the ignition switch off and wait for at least 30 seconds.

NEXT

5.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P001600)**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A
P001600 is output	B

Post-procedure1

(c) None

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

B ▶ **REPLACE ECM**

6.	**CHECK ENGINE MECHANICAL SYSTEM**

(a) Check for mechanical malfunctions that affect the valve timing, such as a jumped tooth or stretching of the timing chain.

HINT:

Perform "Inspection After Repair" after repairing or replacing the engine mechanical system.

Click here INFO

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

7.	**CLEAR DTC**

Pre-procedure1

(a) None

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

(c) Turn the ignition switch off and wait for at least 30 seconds.

NEXT

8.	**CHECK WHETHER DTC OUTPUT RECURS**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A
P001600 is output	B

Post-procedure1

(c) None

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

B ▶ **REPLACE ECM**