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Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [03/2023 -]
Title: M20A-FXS (ENGINE CONTROL): SFI SYSTEM: P020113-P020413,P062D13; Cylinder 1 Injector "A" Circuit Open; 2023 - 2024 MY Prius Prius Prime [03/2023 -]		

DTC	**P020113**	**Cylinder 1 Injector "A" Circuit Open**

DTC	**P020213**	**Cylinder 2 Injector "A" Circuit Open**

DTC	**P020313**	**Cylinder 3 Injector "A" Circuit Open**

DTC	**P020413**	**Cylinder 4 Injector "A" Circuit Open**

DTC	**P062D13**	**Fuel Injector Driver Circuit Performance Bank 1 Circuit Open**

DESCRIPTION

The D-4S system has two fuel injection systems. One is an in-cylinder direct injection system that directly injects pressurized fuel into the combustion chamber. The other is an intake port injection system. The ECM determines which fuel injection system to use in accordance with the engine conditions. The direct injection system uses an injector driver (EDU) built into the ECM to rapidly operate the direct fuel injector assemblies. It converts injection request signals from the ECM to high-voltage and high-current injector-drive signals that drive the direct fuel injector assemblies.

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
P020113	Cylinder 1 Injector "A" Circuit Open	One of following conditions is met (1 trip detection logic): • Short to +B in direct fuel injector assembly (No. 1 cylinder) circuit for 40 times or more. • Open or short to ground in direct fuel injector assembly (No.	• Open or short in direct fuel injector assembly (No. 1 cylinder) circuit • Direct fuel injector assembly (No. 1 cylinder) • D-INJ relay • ECM	Comes on	Engine	A	SAE Code: P0201

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
		1 cylinder) circuit for 20 times or more. • Direct fuel injector assembly (No. 1 cylinder) circuit current reaches the high limit for 20 times or more.					
P020213	Cylinder 2 Injector "A" Circuit Open	One of following conditions is met (1 trip detection logic): • Short to +B in direct fuel injector assembly (No. 2 cylinder) circuit for 40 times or more. • Open or short to ground in direct fuel injector assembly (No. 2 cylinder) circuit for 20 times or more. • Direct fuel injector assembly (No. 2 cylinder) circuit current reaches the high limit for 20 times or more.	• Open or short in direct fuel injector assembly (No. 2 cylinder) circuit • Direct fuel injector assembly (No. 2 cylinder) • D-INJ relay • ECM	Comes on	Engine	A	SAE Code: P0202
P020313	Cylinder 3 Injector "A" Circuit Open	One of following conditions is met (1 trip detection logic): • Short to +B in direct fuel injector assembly (No. 3 cylinder)	• Open or short in direct fuel injector assembly (No. 3 cylinder) circuit	Comes on	Engine	A	SAE Code: P0203

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
		circuit for 40 times or more. • Open or short to ground in direct fuel injector assembly (No. 3 cylinder) circuit for 20 times or more. • Direct fuel injector assembly (No. 3 cylinder) circuit current reaches the high limit for 20 times or more.	• Direct fuel injector assembly (No. 3 cylinder) • D-INJ relay • ECM				
P020413	Cylinder 4 Injector "A" Circuit Open	One of following conditions is met (1 trip detection logic): • Short to +B in direct fuel injector assembly (No. 4 cylinder) circuit for 40 times or more. • Open or short to ground in direct fuel injector assembly (No. 4 cylinder) circuit for 20 times or more. • Direct fuel injector assembly (No. 4 cylinder) circuit current reaches the high limit for 20 times or more.	• Open or short in direct fuel injector assembly (No. 4 cylinder) circuit • Direct fuel injector assembly (No. 4 cylinder) • D-INJ relay • ECM	Comes on	Engine	A	SAE Code: P0204

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
P062D13	Fuel Injector Driver Circuit Performance Bank 1 Circuit Open	Open or short in direct fuel injector assembly (all cylinders) circuits for 60 times or more (1 trip detection logic).	• Open or short in direct fuel injector assembly circuit • Direct fuel injector assembly • D-INJ relay • ECM	Comes on	Engine	A	SAE Code: P062D

MONITOR DESCRIPTION

The fuel injection sequence occurs in numerical order from No. 1 to No. 4.

The ECM monitors the Injector Driver (EDU) at all times. If drivers or direct fuel injector assembly is malfunctioning, the EDU sends direct fuel injector assembly operation condition signals (fail signals) to the ECM. When the ECM receives the signals, the ECM stops the fuel injection control of the appropriate cylinders, cuts voltage to the appropriate D-INJ relay, and illuminates the MIL.

MONITOR STRATEGY

Related DTCs	P0201: Injector circuit open (cylinder 1) P0202: Injector circuit open (cylinder 2) P0203: Injector circuit open (cylinder 3) P0204: Injector circuit open (cylinder 4) P062D: Injector driver performance
Required Sensors/Components (Main)	Direct fuel injector assembly ECM (injector driver)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	-
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0201, P0202, P0203 and P0204

All of the following conditions are met	-
Confirmed injection	2 times or more
Either of the following conditions is met	A or B
A. All of the following conditions are met	(a), (b) and (c)

(a) Starter	Off
(b) Auxiliary battery voltage	10.5 V or higher
(c) Time after condition (b) is met	0.5 seconds or more
B. All of the following conditions are met	(d), (e) and (f)
(d) Starter	On
(e) Auxiliary battery voltage	8 V or higher
(f) Time after condition (e) is met	0.5 seconds or more
Engine speed	100 to 6000 rpm
Injection time	0.00023 seconds or more
Injector driver relay	On
Fuel injector driver performance fail (P062D)	Not detected
The other injector of the same INJECTOR DRIVER FAIL SIGNAL	Not operating
Ignition switch	ON
Time after ignition switch off to ON	0.5 seconds or more

P062D

Monitor runs whenever the following DTCs are not stored	None
All of the following conditions are met	-
Confirmed injection	2 times or more
Either of the following conditions is met	A or B
A. All of the following conditions are met	(a), (b) and (c)
(a) Starter	Off
(b) Auxiliary battery voltage	10.5 V or higher
(c) Time after condition (b) is met	0.5 seconds or more
B. All of the following conditions are met	(d), (e) and (f)
(d) Starter	On
(e) Auxiliary battery voltage	8 V or higher
(f) Time after condition (e) is met	0.5 seconds or more
Engine speed	100 to 6000 rpm
Injection time	0.00023 seconds or more
Injector driver relay	On
The other injector of the same INJECTOR DRIVER FAIL SIGNAL	Not operating
Ignition switch	ON
Time after ignition switch off to ON	0.5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0201, P0202, P0203 and P0204

One of the following conditions is met	A, B or C
A. No confirmed injection signal input	20 times or more
B. Both of the following conditions are met	40 times or more
Current injector voltage for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	4.8 V or higher
Last injector voltage for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	4.8 V or higher
C. Either of the following conditions is met	(a) or (b)
(a) Both of the following conditions are met	20 times or more
Current injector driver MOSFET current detected by injector driver IC	30 A or more
Last injector driver MOSFET current detected by injector driver IC	30 A or more
(b) Both of the following conditions are met	1 and 2
1. Either of the following conditions is met	20 times or more
Current injector current during peak current control for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	125 A or more
Current injector current during hold current control for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	100 A or more
2. Either of the following conditions is met	20 times or more
Last injector current during peak current control for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	125 A or more
Last injector current during hold current control for the same INJECTOR DRIVER FAIL SIGNAL* detected by injector driver IC	100 A or more

P062D

No confirmed injection signal input in all cylinders	60 times or more

*: Definition of the INJECTOR DRIVER FAIL SIGNAL	-
INJECTOR DRIVER FAIL SIGNAL 1	#1 and #4
INJECTOR DRIVER FAIL SIGNAL 2	#2 and #3

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. Put the engine in Inspection Mode (Maintenance Mode).

   Click here INFO
4. Start the engine [A].
5. Idle the engine for 15 seconds or more [B].
6. Enter the following menus: Powertrain / Engine / Trouble Codes [C].
7. Read the pending DTCs.

   HINT:

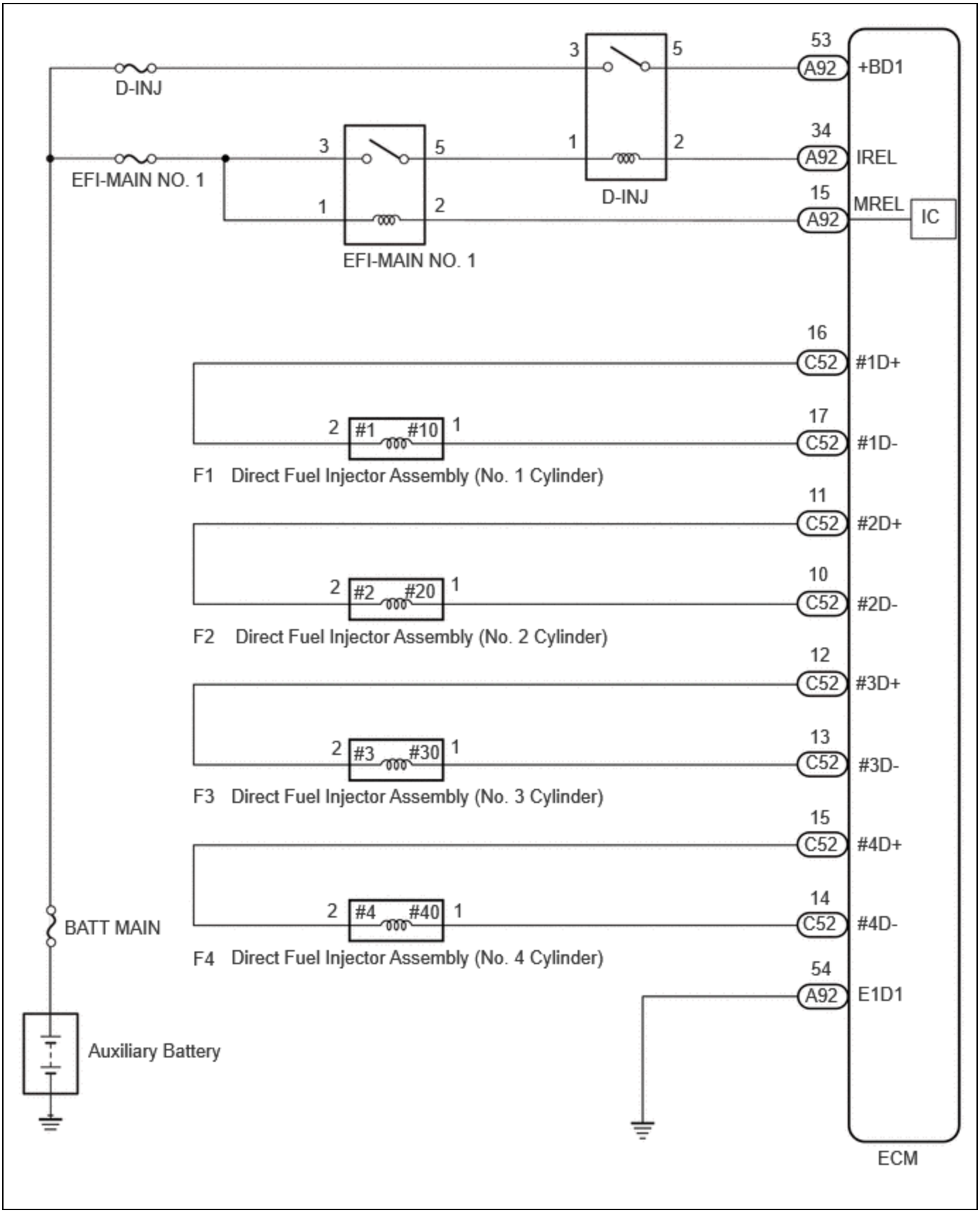
   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P020113, P020213, P020313, P020413 or P062D13.
10. Check the DTC judgment result.

    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 [B] through [C] again.
    - [A] to [C]: 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.

WIRING DIAGRAM



CAUTION / NOTICE / HINT

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following procedure.

- 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

HINT:

If the current from the D-INJ relay is cut because DTC P062D13 is stored, DTC P123513 will be stored even if the fuel (engine room side) pump assembly (for high pressure side) is normal.

PROCEDURE

1.	**CHECK DTC OUTPUT (DTC P020113, P020213, P020313, P020413 AND/OR P062D13)**

(a) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
P020113, P020213, P020313 or P020413 is output	A
3 or more of the following DTCs are output: P062D13, P020113, P020213, P020313 and P020413	B
P062D13 is output	

B ▶ **GO TO STEP 4**

A ▼

2.	**CHECK HARNESS AND CONNECTOR**

Pre-procedure1

(a) Disconnect the ECM connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(C52)
Click Connector(C52)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
C52-16 (#1D+) - C52-17 (#1D-)	20°C (68°F)	1.34 to 1.64 Ω	Ω
C52-11 (#2D+) - C52-10 (#2D-)	20°C (68°F)	1.34 to 1.64 Ω	Ω
C52-12 (#3D+) - C52-13 (#3D-)	20°C (68°F)	1.34 to 1.64 Ω	Ω
C52-15 (#4D+) - C52-14 (#4D-)	20°C (68°F)	1.34 to 1.64 Ω	Ω
C52-16 (#1D+) or C52-17 (#1D-) - Body ground and other terminals	Always	1 MΩ or higher	MΩ
C52-11 (#2D+) or C52-10 (#2D-) - Body ground and other terminals	Always	1 MΩ or higher	MΩ
C52-12 (#3D+) or C52-13 (#3D-) - Body ground and other terminals	Always	1 MΩ or higher	MΩ
C52-15 (#4D+) or C52-14 (#4D-) - Body ground and other terminals	Always	1 MΩ or higher	MΩ

HINT:

The standard values shown are direct fuel injector assembly resistance values.

Post-procedure1

(c) None.

OK ▶ **REPLACE ECM**

NG ▼

3.	**INSPECT DIRECT FUEL INJECTOR ASSEMBLY (RESISTANCE)**

(a) Check the resistance of the direct fuel injector assembly.

Click here INFO

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (DIRECT FUEL INJECTOR ASSEMBLY - ECM)**

NG ▶ **REPLACE DIRECT FUEL INJECTOR ASSEMBLY**

4.	**INSPECT D-INJ RELAY**

Click here INFO

NG ▶ **REPLACE D-INJ RELAY**

OK ▼

5.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF D-INJ RELAY)**

Pre-procedure1

(a) Remove the D-INJ relay from the No. 1 engine room relay block and No. 1 junction block assembly.

Procedure1

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
3 (D-INJ relay) - Body ground	Always	11 to 14 V	V

Post-procedure1

(c) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AUXILIARY BATTERY - D-INJ RELAY)**

OK ▼

6.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF D-INJ RELAY)**

Pre-procedure1

(a) Remove the D-INJ relay from the No. 1 engine room relay block and No. 1 junction block assembly.

(b) Turn the ignition switch to ON.

Procedure1

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
1 (D-INJ relay) - Body ground	Ignition switch ON	11 to 14 V	V

Post-procedure1

(d) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (EFI-MAIN NO. 1 RELAY - D-INJ RELAY)**

OK ▼

7.	**CHECK HARNESS AND CONNECTOR (D-INJ RELAY - ECM)**

Pre-procedure1

(a) Remove the D-INJ relay from the No. 1 engine room relay block and No. 1 junction block assembly.

(b) Disconnect the ECM connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(A92)
Click Connector(A92)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
5 (D-INJ relay - A92-53 (+BD1)	Always	Below 1 Ω	Ω
2 (D-INJ relay) - A92-34 (IREL)	Always	Below 1 Ω	Ω
5 (D-INJ relay) or A92-53 (+BD1) - Body ground and other terminals	Always	10 kΩ or higher	kΩ
2 (D-INJ relay) or A92-34 (IREL) - Body ground and other terminals	Always	10 kΩ or higher	kΩ

Post-procedure1

(d) None.

OK ▶ **REPLACE ECM**

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