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|---|---|---|
| **Last Modified:** 12-04-2024 | 6.11:8.1.0 | **Doc ID:** RM100000002BM1C |
| **Model Year Start:** 2023 | **Model:** Prius Prime | **Prod Date Range:** [03/2023 - ] |
| **Title:** M20A-FXS (ENGINE CONTROL): SFI SYSTEM: P21CF13,P21D013-P21D213; Cylinder 1 Injector "B" Circuit Open; 2023 - 2024 MY Prius Prius Prime [03/2023 - ] | | |

| | | |
|---|---|---|
| **DTC** | **P21CF13** | **Cylinder 1 Injector "B" Circuit Open** |

| | | |
|---|---|---|
| **DTC** | **P21D013** | **Cylinder 2 Injector "B" Circuit Open** |

| | | |
|---|---|---|
| **DTC** | **P21D113** | **Cylinder 3 Injector "B" Circuit Open** |

| | | |
|---|---|---|
| **DTC** | **P21D213** | **Cylinder 4 Injector "B" Circuit Open** |

# DESCRIPTION

The D-4S system has two 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 the percentage of direct injection and port injection necessary in accordance with the engine speed and load.

| DTC NO. | DETECTION ITEM | DTC DETECTION CONDITION | TROUBLE AREA | MIL | DTC OUTPUT FROM | PRIORITY | NOTE |
|---|---|---|---|---|---|---|---|
| P21CF13 | Cylinder 1 Injector "B" Circuit Open | Open or short in port fuel injector assembly (1 trip detection logic). | • Open or short in port fuel injector assembly circuit<br>• Port fuel injector assembly<br>• ECM | Comes on | Engine | A | SAE Code: P21CF |
| P21D013 | Cylinder 2 Injector "B" Circuit Open | Open or short in port fuel injector assembly (1 trip detection logic). | • Open or short in port fuel injector assembly circuit<br>• Port fuel injector assembly<br>• ECM | Comes on | Engine | A | SAE Code: P21D0 |

| DTC NO. | DETECTION ITEM | DTC DETECTION CONDITION | TROUBLE AREA | MIL | DTC OUTPUT FROM | PRIORITY | NOTE |
|---|---|---|---|---|---|---|---|
| P21D113 | Cylinder 3 Injector "B" Circuit Open | Open or short in port fuel injector assembly (1 trip detection logic). | • Open or short in port fuel injector assembly circuit<br>• Port fuel injector assembly<br>• ECM | Comes on | Engine | A | SAE Code: P21D1 |
| P21D213 | Cylinder 4 Injector "B" Circuit Open | Open or short in port fuel injector assembly (1 trip detection logic). | • Open or short in port fuel injector assembly circuit<br>• Port fuel injector assembly<br>• ECM | Comes on | Engine | A | SAE Code: P21D2 |

## MONITOR DESCRIPTION

The ECM monitors the injection control of the port fuel injector assemblies. If a malfunction is detected in a port fuel injector assembly circuit, the ECM cancels the injection control for the corresponding cylinder, illuminates the MIL and stores a DTC.

## MONITOR STRATEGY

| | |
|---|---|
| Related DTCs | P21CF: Port injector (cylinder 1) circuit/open<br>P21D0: Port injector (cylinder 2) circuit/open<br>P21D1: Port injector (cylinder 3) circuit/open<br>P21D2: Port injector (cylinder 4) circuit/open |
| Required Sensors/Components (Main) | Port fuel injector assembly (cylinder 1 to 4) |
| Required Sensors/Components (Related) | - |
| Frequency of Operation | Continuous |
| Duration | 10 times |
| MIL Operation | Immediate |
| Sequence of Operation | None |

## TYPICAL ENABLING CONDITIONS

| | |
|---|---|
| Monitor runs whenever the following DTCs are not stored | None |
| All of the following conditions are met | - |
| Auxiliary battery voltage | 8 V or higher |

| | |
|---|---|
| Fuel cut | Off |
| Synchronous injection | Operating |
| Ignition switch | ON |
| Either of the following conditions is met | Condition A or B |
| A. Engine | Running |
| B. Starter | On |
| Injection time | Higher than 0 seconds |

## TYPICAL MALFUNCTION THRESHOLDS

| | |
|---|---|
| One of the following conditions is met | A, B or C |
| A. Both of the following conditions are met | 10 times or more |
| Command to injector | Off |
| Injector voltage detected by injector driver IC | [Auxiliary battery voltage multiplied by 0.55] V or less |
| B. Both of the following conditions are met | 10 times or more |
| Command to injector | Off |
| Injector voltage detected by injector driver IC | Higher than [auxiliary battery voltage multiplied by 0.55] V, and [auxiliary battery voltage multiplied by 0.7] V or less |
| C. One of the following conditions is met | (a), (b) or (c) |
| (a) Both of the following conditions are met | 10 times or more |
| Command to injector | On |
| Injector voltage detected by injector driver IC | [Auxiliary battery voltage multiplied by 0.12] V or higher |
| (b) Both of the following conditions are met | 10 times or more |
| Command to injector | On |
| Injector current detected by injector driver IC | 2.6 A or higher |
| (c) Following condition is met | 10 times or more |
| Injector driver IC internal temperature detected by injector driver IC | 150°C (302°F) or higher |

## 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 3 minutes or more [B].
6. Enter the following menus: Powertrain / Engine / Trouble Codes [C].
7. Read the pending DTCs.

   **HINT:**

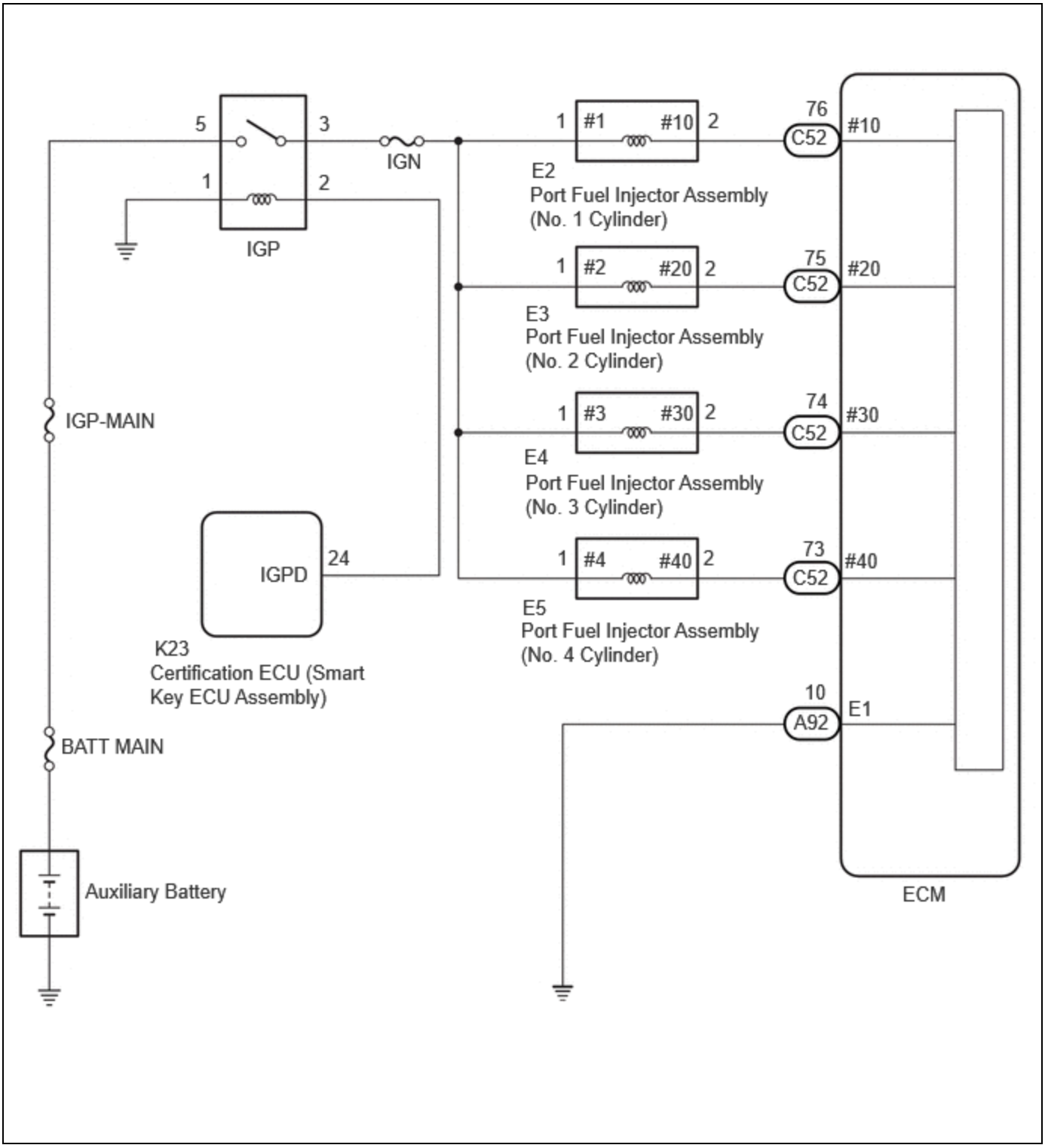
   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.
8. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
9. Input the DTC: P21CF13, P21D013, P21D113 or P21D213.
10. Check the DTC judgment result.

    **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

## PROCEDURE

| | |
|---|---|
| 1. | **CHECK DTCS OUTPUT (IN ADDITION TO DTC P21CF13, P21D013, P21D113 OR P21D213)** |

(a) Read the DTCs.

**Powertrain > Engine > Trouble Codes**

| RESULT | PROCEED TO |
|---|---|
| Only P21CF13, P21D013, P21D113 and P21D213 are output | A |
| P21CF13, P21D013, P21D113 or P21D213 is output | B |

**A** ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGP RELAY - PORT FUEL INJECTOR ASSEMBLY)**

**B** ▼

| | |
|---|---|
| 2. | **CHECK TERMINAL VOLTAGE (POWER SOURCE OF PORT FUEL INJECTOR ASSEMBLY)** |

Pre-procedure1

(a) Disconnect the port fuel injector assembly connector.

(b) Turn the ignition switch to ON.

Procedure1

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

Standard Voltage:

EWD INFO

**Click Location & Routing(E2,E3,E4,E5)**
**Click Connector(E2)**
**Click Connector(E3)**

**Click Connector(E4)**
**Click Connector(E5)**

| TESTER CONNECTION | CONDITION | SPECIFIED CONDITION | RESULT |
|---|---|---|---|
| E2-1 (#1) - Body ground | Ignition switch ON | 11 to 14 V | V |
| E3-1 (#2) - Body ground | Ignition switch ON | 11 to 14 V | V |
| E4-1 (#3) - Body ground | Ignition switch ON | 11 to 14 V | V |
| E5-1 (#4) - Body ground | Ignition switch ON | 11 to 14 V | V |

Post-procedure1

(d) None.

**NG** ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (IGP RELAY - PORT FUEL INJECTOR ASSEMBLY)**

**OK** ▼

| | |
|---|---|
| **3.** | **CHECK HARNESS AND CONNECTOR (PORT FUEL INJECTOR ASSEMBLY - ECM)** |

Pre-procedure1

(a) Disconnect the port fuel injector assembly connector.

(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(E2,C52,E3,E4,E5)**
**Click Connector(E2)**
**Click Connector(C52)**
**Click Connector(E3)**
**Click Connector(E4)**
**Click Connector(E5)**

| TESTER CONNECTION | CONDITION | SPECIFIED CONDITION | RESULT |
|---|---|---|---|
| E2-2 (#10) - C52-76 (#10) | Always | Below 1 Ω | Ω |
| E3-2 (#20) - C52-75 (#20) | Always | Below 1 Ω | Ω |
| E4-2 (#30) - C52-74 (#30) | Always | Below 1 Ω | Ω |
| E5-2 (#40) - C52-73 (#40) | Always | Below 1 Ω | Ω |

| TESTER CONNECTION | CONDITION | SPECIFIED CONDITION | RESULT |
|---|---|---|---|
| E2-2 (#10) or C52-76 (#10) - Body ground and other terminals | Always | 10 kΩ or higher | kΩ |
| E3-2 (#20) or C52-75 (#20) - Body ground and other terminals | Always | 10 kΩ or higher | kΩ |
| E4-2 (#30) or C52-74 (#30) - Body ground and other terminals | Always | 10 kΩ or higher | kΩ |
| F5-2 (#40) or C52-73 (#40) - Body ground and other terminals | Always | 10 kΩ or higher | kΩ |

Post-procedure1

(d) None.

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

**OK** ▼

| | |
|---|---|
| **4.** | **INSPECT PORT FUEL INJECTOR ASSEMBLY (RESISTANCE)** |

Click here INFO

**OK** ▶ **REPLACE ECM**

**NG** ▶ **REPLACE PORT FUEL INJECTOR ASSEMBLY**