DTC	P2A00	A/F SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page 05–165.

DTC No.	DTC Detection Condition	Trouble Area
P2A00	When A/F sensor output voltage change is below compared to fuel trim change, ECM judges that A/F sensor circuit response is slow if conditions (a), (b) and (c) are met (2 trip detection logic): (a) After engine is warmed up (b) Engine speed is 1,100 rpm or more (c) Vehicle speed 60 km/h (37.5 mph) or more	• Open or short in A/F sensor (bank 1 sensor 1) circuit • A/F sensor (bank 1 sensor 1) • A/F sensor heater • EFI M relay • A/F sensor heater and relay circuit • Air induction system • Fuel pressure • Injector • PCV hose connection • ECM

HINT:

Sensor 1 refers to the sensor mounted before the TWC and is located near the engine assembly.

WIRING DIAGRAM

Refer to DTC P2195 on page 05–165.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be found by performing the Active Test / A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform Active Test using the intelligent tester II.

HINT:

The A/F CONTROL operation lowers the injection volume 12.5 % or increases the injection volume 25 %.

(1) Connect the intelligent tester II to the DLC3 on the vehicle.
(2) Turn the power switch ON (IG).
(3) Put the engine in inspection mode (see page 05–1).
(4) Warm up the engine by running the engine at 2,500 rpm, depressing the accelerator pedal more than 60 % for approximately 90 seconds.
(5) Select the item: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
(6) Select the monitor item: AFS B1S1 and O2S B1S2.
(7) Perform the A/F CONTROL operation with the engine in an idle condition (press the right or left button).

Result:

A/F sensor reacts in accordance with increase and decrease of injection volume:

+25 % → rich output: Less than 3.0 V

–12.5 % → lean output: More than 3.35 V

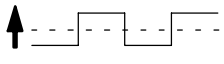
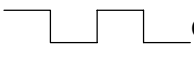
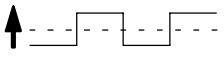
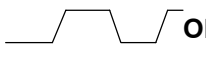
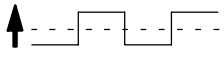
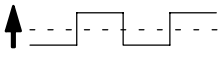
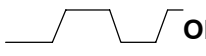
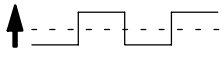
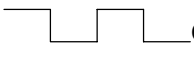
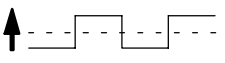
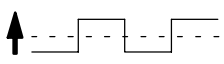
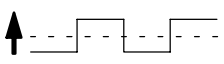
Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:

+25 % → rich output: More than 0.55 V

–12.5 % → lean output: Less than 0.4 V

NOTICE:

The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 %  Output voltage More than 3.35 V Less than 3.0 V  **OK**	Injection volume +25 % –12.5 %  Output voltage More than 0.55 V Less than 0.4V  **OK**	—
Case 2	Injection volume +25 % –12.5 %  Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 %  Output voltage More than 0.55 V Less than 0.4V  **OK**	A/F sensor (A/F sensor, sensor heater, sensor circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 3.35 V Less than 3.0V  **OK**	Injection volume +25 % –12.5 %  Output voltage Almost no reaction **NG**	Heated oxygen sensor (heated oxygen sensor, sensor heater, sensor circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 %  Output voltage Almost no reaction **NG**	Extremely RICH or LEAN actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F CONTROL procedure enables the technician to check and graph the voltage output of both A/F sensor and heated oxygen sensor.

To display the graph, select the item on the tester: View / Line graph.

HINT:

- DTC P2A00 may be also detected, when the air fuel ratio remains RICH or LEAN.
- A low A/F sensor voltage could be caused by a LEAN air–fuel mixture. Check the conditions that would cause the engine to run with the LEAN air–fuel mixture.
- A high A/F sensor voltage could be caused by a RICH air–fuel mixture. Check the conditions that would cause the engine to run with the RICH air–fuel mixture.
- Read freeze frame data using the intelligent tester II. Freeze frame data records the engine condition when malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO A/F SENSOR DTC)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II, select the item: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result:

Display (DTC Output)	Proceed to
P2A00	A
P2A00 and other DTCs	B

HINT:
If any other code besides P2A00 are output, perform troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–39)**

A

2	READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester II to the DLC3.
(b) Put the engine in inspection mode (see page 05–1).
(c) Warm up the A/F sensors (bank 1 sensor 1) by running the engine at 2,500 rpm with depressing the accelerator pedal more than 60 % for approximately 90 seconds.
(d) Read A/F sensor voltage output on the intelligent tester II.
(e) On the intelligent tester II, enter the menus: Powertrain / Engine and ECT / Data List.
(f) Select the monitor item: AFS B1S2 and Engine Speed.

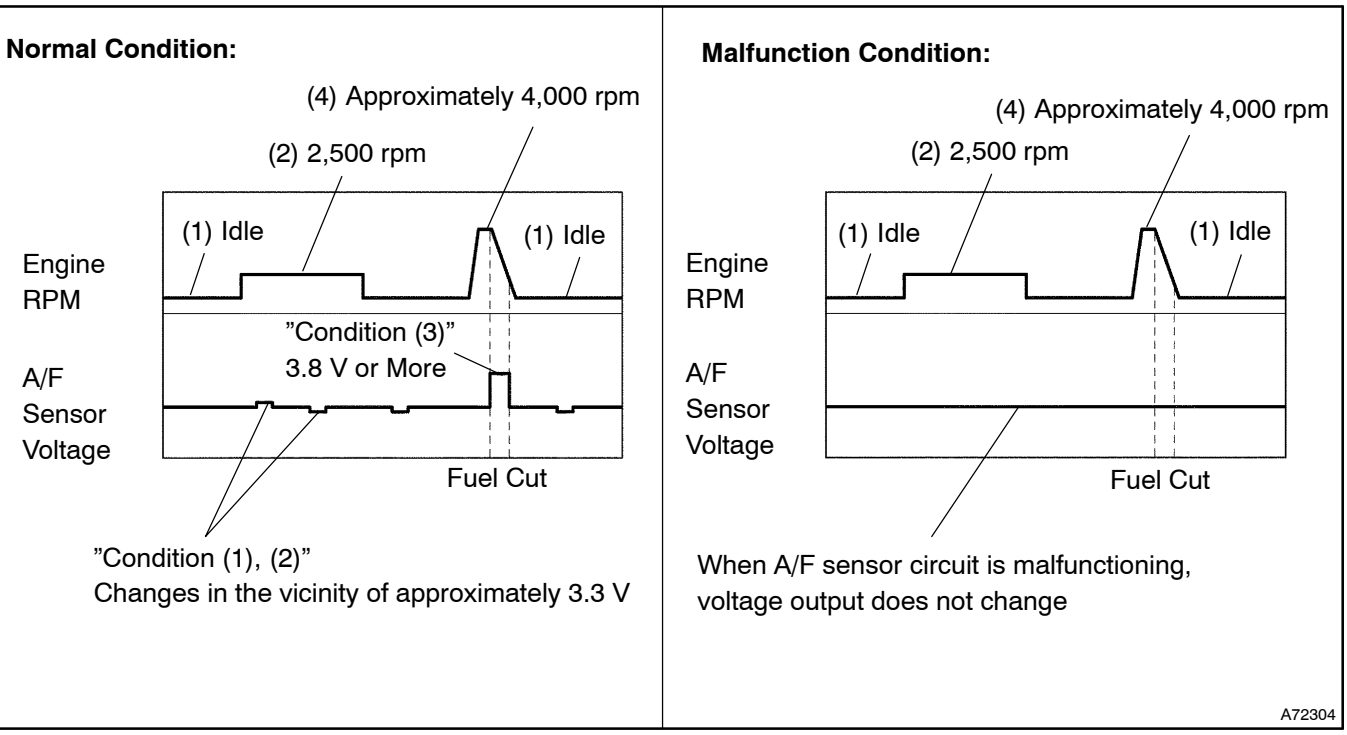
HINT:
If necessary, record the data using the SNAPSHOT function.

(g) Monitor the A/F sensor voltage carefully.
(h) Check the A/F sensor voltage output under the following conditions:
  (1) Put the engine in inspection mode and allow the engine to idle for 30 seconds.
  (2) Put the engine in inspection mode and running the engine at 2,500 rpm with depressing the accelerator pedal more than 60 % (where engine RPM is not suddenly changed).
  (3) Deactivate inspection mode and drive the vehicle with the shift position in B.
  (4) Accelerate the vehicle to 70 km/h (44 mph) and quickly release the accelerator pedal so that the throttle is fully closed.

CAUTION:

- **Strictly observe of posted speed limits, traffic laws, and road conditions when performing these drive patterns.**
- **Do not drive the vehicle without deactivating inspection mode, otherwise damaging the transaxle may result.**

Standard:
Condition (1) and (2)
Voltage changes in the vicinity of 3.3 V (between approximately 3.1 to 3.5 V) as shown in the illustration.
Condition (4)
A/F sensor voltage increases to 3.8 V or more during engine deceleration (when fuel cut) as shown in the illustration.



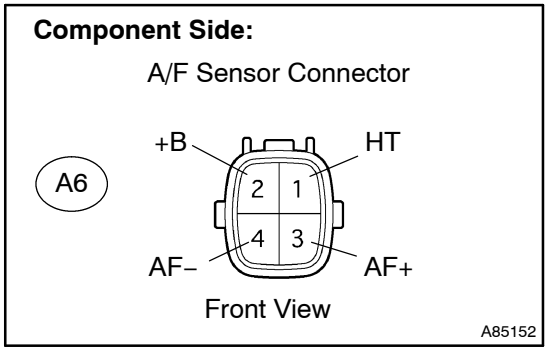
HINT:

- To display the graph, select the item on the tester: View / Line graph.
- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have an open–circuit. (This will happen also when the A/F sensor heater has an open–circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approximately 3.8 V or more, or 2.8 V or less (see diagram Malfunction Condition) under any condition as well as the above conditions, the A/F sensor may have a short–circuit.
- The ECM will stop fuel injection (fuel cut) during engine deceleration. This will cause a LEAN condition and should result in a momentary increase in A/F sensor voltage output.
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal was reconnected, the vehicle must be driven over 16 km/h (10 mph) to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, and therefore the current is converted into voltage inside the ECM. If measuring voltage at connectors of A/F sensor or ECM, you will observe a constant voltage.

OK → Go to step 14

NG

3 INSPECT AIR FUEL RATIO SENSOR(RESISTANCE OF A/F SENSOR HEATER)



(a) Disconnect the A6 A/F sensor connector.
(b) Measure the resistance between the terminals of the A/F sensor.
Standard:

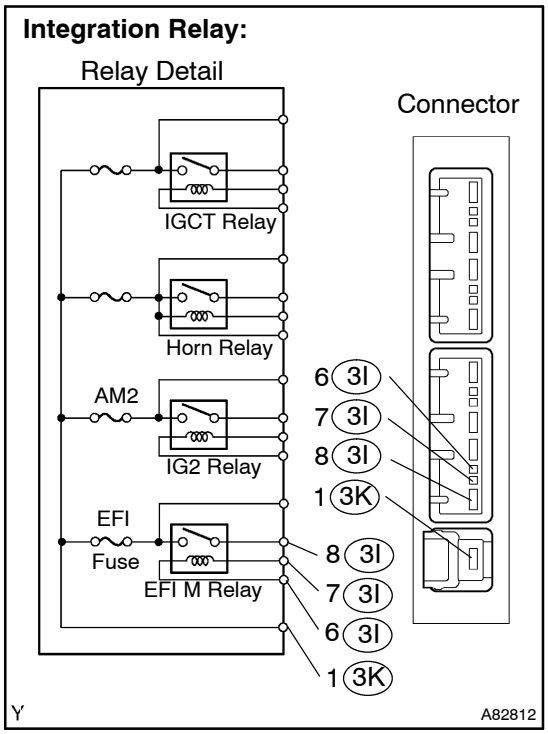
Tester Connection	Resistance
HT (1) – +B (2)	1.8 to 3.4 Ω at 20°C (68°F)

(c) Reconnect the A/F sensor connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT INTEGRATION RELAY(EFI M RELAY)



(a) Remove the integration relay from the engine room R/B.
(b) Inspect the EFI M relay.
Standard:

Tester Connection	Specified Condition
(3K–1) – (3I–8)	10 kΩ or higher
(3K–1) – (3I–8)	Below 1 Ω (Apply battery voltage to terminals 3I–6 and 3I–7)

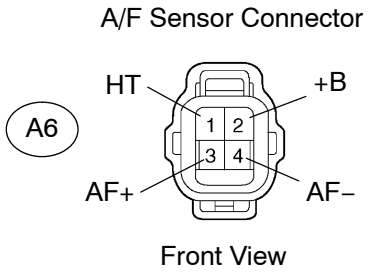
(c) Reinstall the integration relay.

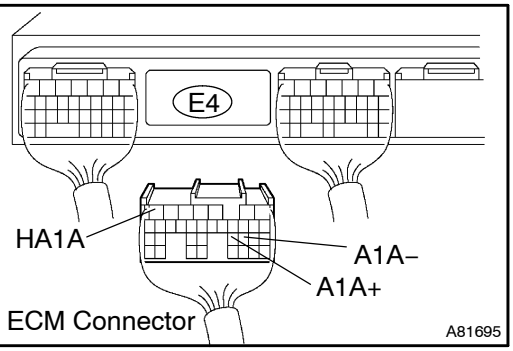
NG → REPLACE INTEGRATION RELAY

OK

5 CHECK HARNESS AND CONNECTOR(A/F SENSOR – ECM)

Wire Harness Side:





(a) Disconnect the A6 A/F sensor connector.
(b) Disconnect the E4 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

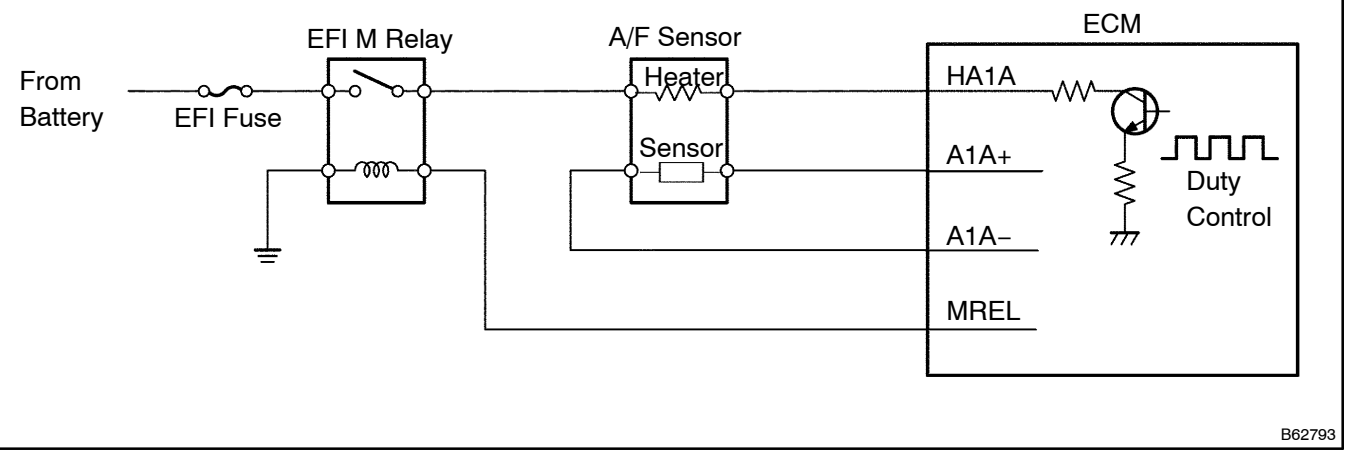
Tester Connection	Specified Condition
AF+ (A6–3) – A1A+ (E4–23)	Below 1 Ω
AF– (A6–4) – A1A– (E4–22)	Below 1 Ω
HT (A6–1) – HA1A (E4–7)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
AF+ (A6–3) or A1A+ (E4–23) – Body ground	10 kΩ or higher
AF– (A6–4) or A1A– (E4–22) – Body ground	10 kΩ or higher
HT (A6–1) or HA1A (E4–7) – Body ground	10 kΩ or higher

(d) Reconnect the A/F sensor connector.
(e) Reconnect the ECM connector.

Reference (Bank 1 Sensor 1 System Diagram):



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in air induction system.
OK: No leak in the air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK CONNECTION OF PCV HOSE

OK: PCV hose is connected correctly and PCV hose is not damaged.

NG → REPAIR OR REPLACE PCV HOSE

OK

8	CHECK FUEL PRESSURE (See page 11–7)

(a) Check fuel pressure (high or low fuel pressure).
OK:
Fuel pressure: 304 to 343 kPa (3.1 to 3.5 kgf·cm^2, 44 to 50 psi)

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

9	INSPECT FUEL INJECTOR ASSY (See page 11–12)

(a) Check injector injection (high or low fuel injection quantity or poor injection pattern).
OK:
Injection volume: 36 to 46 cm^3 (2.1 to 2.8 cu in.) per 15 seconds.

NG → REPLACE FUEL INJECTOR ASSY (See page 11–12)

OK

10	REPLACE AIR FUEL RATIO SENSOR

GO

11	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–165)

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (see page 05–165).

GO

12	READ OUTPUT DTC(SEE IF A/F SENSOR DTC IS OUTPUT AGAIN)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II, select the item: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result :

Display (DTC output)	Proceed to
No output	A
P2A00 again.	B

B → **REPLACE ECM (See page 10–24) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05–155)**

A

13	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–14)**

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

14	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–155)

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (see page 05–155).

GO

15	READ OUTPUT DTC(SEE IF A/F SENSOR DTC IS OUTPUT AGAIN)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II, select the item: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result :

Display (DTC output)	Proceed to
P2A00	A
No output	B

B → **Go to step 19**

A

16	REPLACE AIR FUEL RATIO SENSOR

GO

17	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–155)

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (see page 05–155).

GO

18	READ OUTPUT DTC (SEE IF A/F SENSOR DTC IS OUTPUT AGAIN)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the power switch ON (IG).
(c) Turn the intelligent tester II ON.
(d) On the intelligent tester II, select the item: Powertrain / Engine and ECT / DTC.
(e) Read DTCs.

Result:

Display (DTC output)	Proceed to
No output	A
P2A00	B

B → **REPLACE ECM (See page 10–24) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05–155)**

A

19	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

OK: Vehicle has run out of fuel in past.

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–14)**

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL