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

DTC	P2A03	A/F SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1)

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page 05–182.

DTC No.	DTC Detecting Condition	Trouble Area
P2A00 P2A03	In conditions (a), (b) and (c), when the A/F sensor output voltage change value is below the regular value against the fuel trim change value, the ECM judges that A/F sensor circuit has slow response (2 trip detection logic) (a) After engine is warmed up (b) During vehicle driving at engine speed 1,400 rpm or more (c) Vehicle speed 60 km/h (38 mph) or more	• Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • A/F sensor heater • A/F sensor heater relay • A/F sensor heater and relay circuit • Air induction system • Fuel pressure • Injector • ECM

HINT:

- DTC P2A00 means malfunction related to the bank 1 A/F sensor.
- DTC P2A03 means malfunction related to the bank 2 A/F sensor.
- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that includes cylinder No. 2.
- Sensor 1 refers to the sensor closest to the engine assembly.

WIRING DIAGRAM

Refer to DTC P2195 on page 05–182.

INSPECTION PROCEDURE

HINT:

Hand–held tester only:

Narrowing down the trouble area is possible by performing ACTIVE TEST of the following ”A/F CONTROL” (A/F sensor, heated oxygen sensor or other trouble areas can be distinguished).

(a) Perform ACTIVE TEST by the hand–held tester (A/F CONTROL).

HINT:

”A/F CONTROL” is an ACTIVE TEST which changes the injection volume to –12.5 % or +25 %.

(1) Connect the hand–held tester to the DLC3 on the vehicle.
(2) Turn the ignition switch ON.
(3) Warm up the engine with the engine speed at 2,500 rpm for approx. 90 sec.
(4) Select the item ”DIAGNOSIS / OBD/MOBD / ACTIVE TEST / A/F CONTROL”.
(5) Perform ”A/F CONTROL” when 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

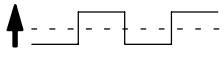
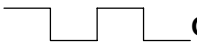
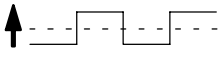
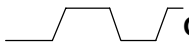
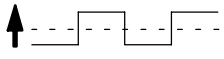
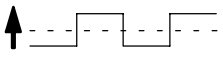
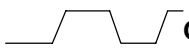
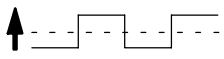
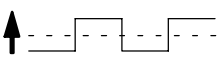
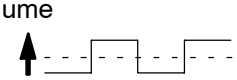
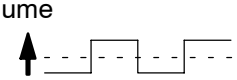
–12.5 % → lean output: More than 3.35 V

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:
There is a few second delay in the A/F sensor output and there is about 20 seconds delay in the heated oxygen sensor output.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Mainly 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 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, heater, A/F 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 No reaction **NG**	Heated oxygen sensor (heated oxygen sensor, heater, heated oxygen sensor circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Injection volume +25 % –12.5 %  Output voltage No reaction **NG**	Extremely rich or lean of the actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following procedure of A/F CONTROL enables the user to check its output (show its graph indication) of A/F sensor and heated oxygen sensor.
For displaying the graph indication, enter ”ACTIVE TEST/ A/F CONTROL/USER DATA”, then select ”AFS B1S1 and O2S B1S2” or ”AFS B2S1 and O2S B2S2” by pressing ”YES” button and push ”ENTER” button before pressing ”F4” button.
HINT:

- DTC P2A00 or P2A03 may be also detected, when the air fuel ratio is stuck rich or lean.
- A low A/F sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high A/F sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.
- Read freeze frame data using the hand–held tester, as freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

1	CHECK OTHER DTC OUTPUT (BESIDES A/F SENSOR DTC)

(a) Read the DTC using the hand–held tester.

Result:

Display	Proceed to
DTC "P2A00 and/or P2A03" are output.	A
DTC "P2A00 and/or P2A03" and other codes are output.	B

HINT:

If any other code besides P2A00 are/or P2A03 are output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–22)**

A

2	READ VALUE OF HAND–HELD TESTER (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the hand–held tester to the DLC3.

(b) Warm up the A/F sensors (bank 1, 2 sensor 1) with the engine at 2,500 rpm for approximately 90 seconds.

(c) Read A/F sensor voltage output on the hand–held tester.

(d) Hand–held tester only:
Select the "DIAGNOSIS / OBD/MOBD / SNAPSHOT / MANUAL SNAPSHOT / USER DATA" mode on the hand–held tester.

(e) Select "AFS B1 S1 or AFS B2 S1/ENGINE SPD" and press button "YES".

(f) Monitor the A/F sensor voltage carefully.

(g) Check the A/F sensor voltage under the condition as follows.

(1) Allow engine to idle for 30 seconds.

(2) Engine is racing at approx. 2,500 rpm (when engine revolution is not suddenly changed).

(3) Raise the engine speed to 4,000 rpm and release the accelerator pedal fully closed quickly.

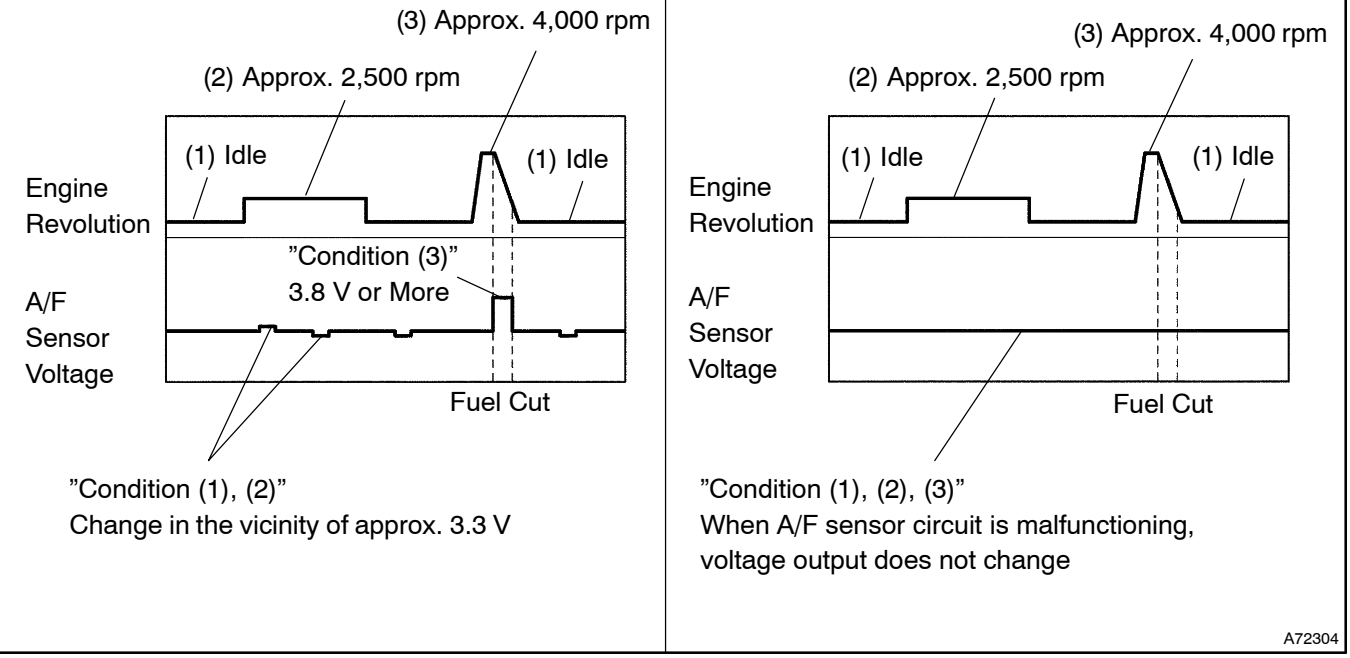
Standard:

Condition (1) and (2)

Voltage change in the vicinity of 3.3 V (0.66 V)* (between approx. 3.1 to 3.5 V) as shown in the illustration.

Condition (3)

A/F ratio sensor voltage increase to 3.8 V (0.76 V)* or more during engine deceleration (when fuel cut) as shown in the illustration.



HINT:

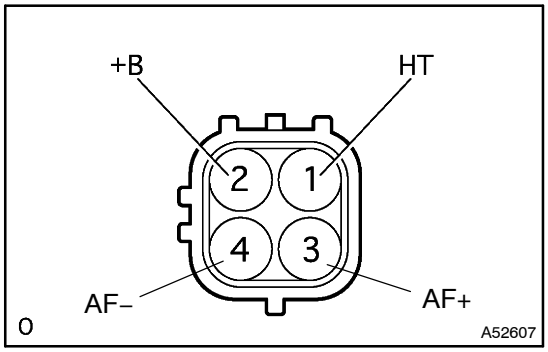
- Whenever the output voltage of the A/F sensor remains at approx. 3.3 V (0.660 V)* (see dwg. 2) under any condition as well as the above conditions, the A/F sensor may have an open–circuit. (This will happen also when the A/F sensor heater has an open–circuit.)
- Whenever the output voltage of the A/F sensor remains at a certain value of approx. 3.8 V (0.76 V)* or more, or 2.8 V (0.56 V)* or less (see dwg. 2) 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 has been disconnected, the vehicle must be driven over 10 mph to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  In the case that the output voltage of the A/F sensor is below 2.8 V (0.76 V)* during fuel enrichment (for example, when the vehicle tries to overtake another vehicle on a highway, the vehicle speed is suddenly increased with the accelerator pedal fully depressed), 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 obtain a constant voltage.

*: When not using the hand–held tester.

OK	**Go to step 13**

NG

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

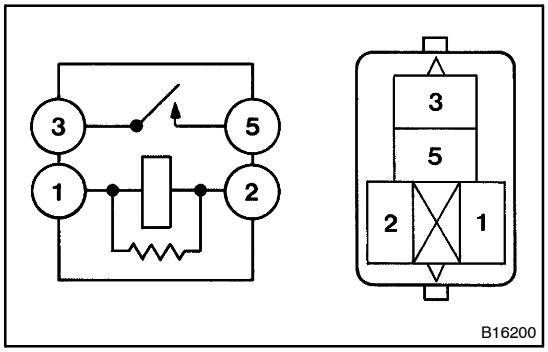


(a) Disconnect the A/F sensor connector.
(b) Measure resistance between terminals HT and +B of the A/F sensor.
Resistance: 1.8 to 3.4 Ω (20°C)

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

4 INSPECT AIR FUEL RATIO SENSOR HEATER RELAY



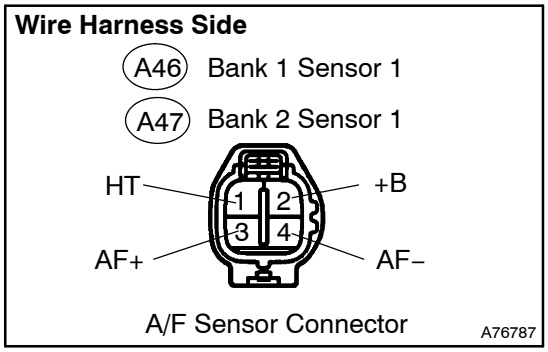
(a) Remove the A/F sensor heater relay from the engine room R/B.
(b) Inspect the A/F senor heater relay.
Standard:

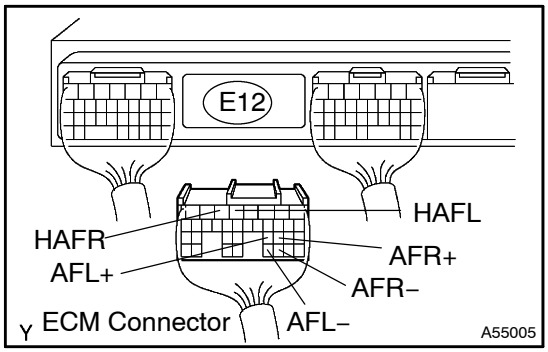
Terminal No.	Specified condition
1 – 2	Continuity
3 – 5	No Continuity
	Continuity (Apply battery voltage terminals 1 and 2)

NG → **REPAIR OR REPLACE AIR FUEL RATIO SENSOR HEATER RELAY**

OK

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





(a) Disconnect the A46 or A47 A/F sensor connector.
(b) Disconnect the E12 ECM connector.
(c) Check for continuity between the wire harness side connectors.

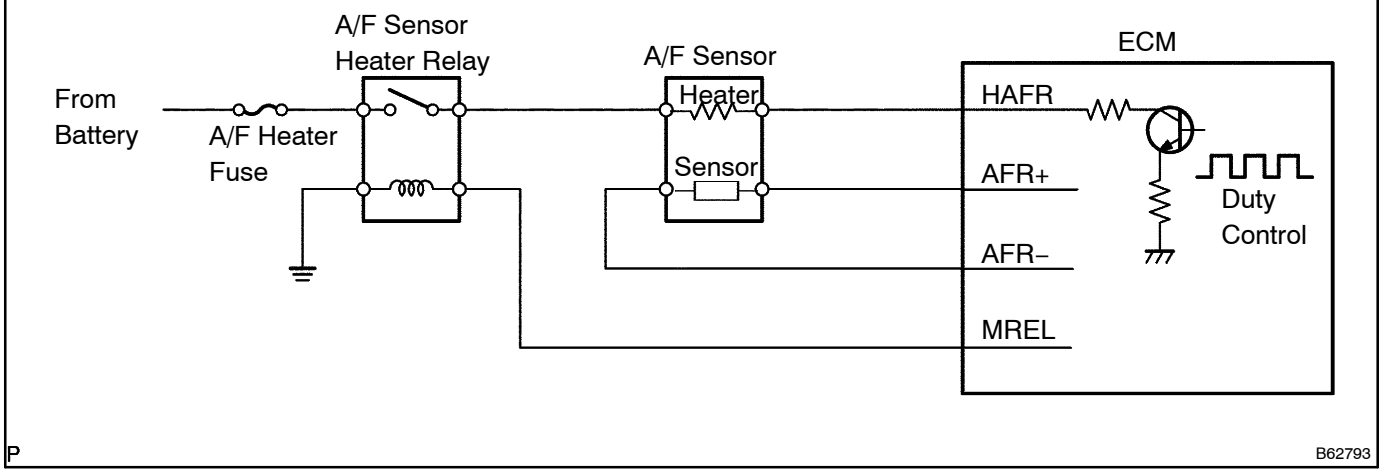
Standard (Check for open):

Symbols (Terminal No.)	Specified condition
AF+ (A46–3) – AFR+ (E12–22)	Continuity
AF– (A46–4) – AFR– (E12–30)	
HT (A46–1) – HAFR (E12–5)	
AF+ (A47–3) – AFL+ (E12–23)	
AF– (A47–4) – AFL– (E12–31)	
HT (A47–1) – HAFL (E12–4)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
AF+ (A46–3) or AFR+ (E12–22) – Body ground	No continuity
AF– (A46–4) or AFR– (E12–30) – Body ground	
HT (A46–1) or HAFR (E12–5) – Body ground	
AF+ (A47–3) or AFL+ (E12–23) – Body ground	
AF– (A47–4) or AFL– (E12–31) – Body ground	
HT (A47–1) or HAFL (E12–4) – Body ground	

Reference (Bank 1 Sensor 1 System Drawing)



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

OK →

6	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK FUEL PRESSURE (See page 11–5)

(a) Check fuel pressure (High or low fuel pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR ASSY (See page 11–7)

(a) Check injector injection (High or low fuel pressure).

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

OK

9	REPLACE AIR FUEL RATIO SENSOR

GO

10	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–182)

HINT:
Clear all DTCs prior to perform the confirmation driving pattern (See page 05–182).

GO

11	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the hand–held tester.

Result:

Display	Proceed to
DTC "P2A00 and/or P2A03" are not output.	A
DTC "P2A00 and/or P2A03" are output.	B

B → CHECK AND REPLACE ECM (See page 01–35) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05–182)

A

12	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → CHECK FOR INTERMITTENT PROBLEMS (See page 05–7)

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

13	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–182)

HINT:
Clear all DTCs prior to perform the confirmation driving pattern (See page 05–182).

GO

14	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the hand–held tester.

Result:

Display	Proceed to
DTC "P2A00 and/or P2A03" are output.	A
DTC "P2A00 and/or P2A03" are not output.	B

B → Go to step 18

A

15	REPLACE AIR FUEL RATIO SENSOR

GO

16	PERFORM CONFIRMATION DRIVING PATTERN (See page 05–182)

HINT:
Clear all DTCs prior to perform the confirmation driving pattern (See page 05–182).

GO

17	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the hand–held tester.

Result:

Display	Proceed to
DTC "P2A00 and/or P2A03" are not output.	A
DTC "P2A00 and/or P2A03" are output.	B

B → CHECK AND REPLACE ECM (See page 01–35) AND PERFORM CONFIRMATION DRIVING PATTERN (See page 05–182)

A

18	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → CHECK FOR INTERMITTENT PROBLEMS (See page 05–7)

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL