

<b>DTC</b>	<b>P2A00</b>	<b>A/F SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)</b>
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## CIRCUIT DESCRIPTION

Refer to DTC P2195 on [page 05-192](#).

DTC No.	DTC Detection Condition	Trouble Area
P2A00	In conditions (a), (b) and (c), when the A/F sensor output voltage changing value is below the regular changing value against the fuel trim changing 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 of 1,400 rpm or more (c) Vehicle speed 60 km/h (38 mph) or more	<ul style="list-style-type: none"> <li>• Open or short in A/F sensor (sensor 1) circuit</li> <li>• A/F sensor (sensor 1)</li> <li>• A/F sensor heater</li> <li>• EFI relay</li> <li>• A/F sensor heater and relay circuit</li> <li>• Air induction system</li> <li>• Fuel pressure</li> <li>• Injector</li> <li>• ECM</li> </ul>

**HINT:**

Sensor 1 refers to the sensor closest to the engine assembly.

## WIRING DIAGRAM

Refer to DTC P2195 on [page 05-192](#).

## INSPECTION PROCEDURE

**HINT:**

Intelligent tester II only:

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 by 12.5 % or increases the injection volume by 25 %.

- (1) Connect the intelligent tester II to the DLC3.
- (2) Start the engine and turn the intelligent tester II ON.
- (3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
- (4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
- (5) Select the following monitor items: AFS B1 S1 and O2S B1 S2.
- (6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

**Result:**

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

+25 % → Rich output: Less than 3.0 V

-12.5 % → Lean output: More than 3.35 V

**The heated oxygen sensor reacts in accordance with increase and decrease of the 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 <b>OK</b> Less than 3.0 V	Injection volume +25 % -12.5 % Output voltage More than 0.55 V <b>OK</b> Less than 0.4V	—
Case 2	Injection volume +25 % -12.5 % Output voltage Almost no reaction <b>NG</b>	Injection volume +25 % -12.5 % Output voltage More than 0.55 V <b>OK</b> Less than 0.4V	A/F sensor (A/F sensor, sensor heater, sensor circuit)
Case 3	Injection volume +25 % -12.5 % Output voltage More than 3.35 V <b>OK</b> Less than 3.0V	Injection volume +25 % -12.5 % Output voltage Almost no reaction <b>NG</b>	Heated oxygen sensor (Heated oxygen sensor, sensor heater, sensor circuit)
Case 4	Injection volume +25 % -12.5 % Output voltage Almost no reaction <b>NG</b>	Injection volume +25 % -12.5 % Output voltage Almost no reaction <b>NG</b>	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 following menu items on the tester: View / Line graph.

**HINT:**

- DTC P2A00 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 with a rich air-fuel mixture.
- 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 with a lean air-fuel mixture.
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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)

- Connect the intelligent tester II to the DLC3.
- Turn the ignition switch to ON and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / DTC.
- Read DTCs.

### Result

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

### HINT:

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

**B**

**GO TO RELEVANT DTC CHART**  
(See page 05-29)

**A**

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

- Connect the intelligent tester II to the DLC3.
- Start the engine and turn the intelligent tester II ON.
- Warm up the A/F sensor with the engine at 2,500 rpm for approximately 90 seconds.
- On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List.
- Select the following monitor items: AFS B1 S1 and Engine Speed.
- Monitor the A/F sensor voltage carefully.
- Check the A/F sensor voltage under the following menu conditions.
  - Allow the engine to idle for 30 seconds.
  - Run the engine at approximately 2,500 rpm (where engine RPM is not suddenly changed).
  - Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle valve is fully closed.

### Standard:

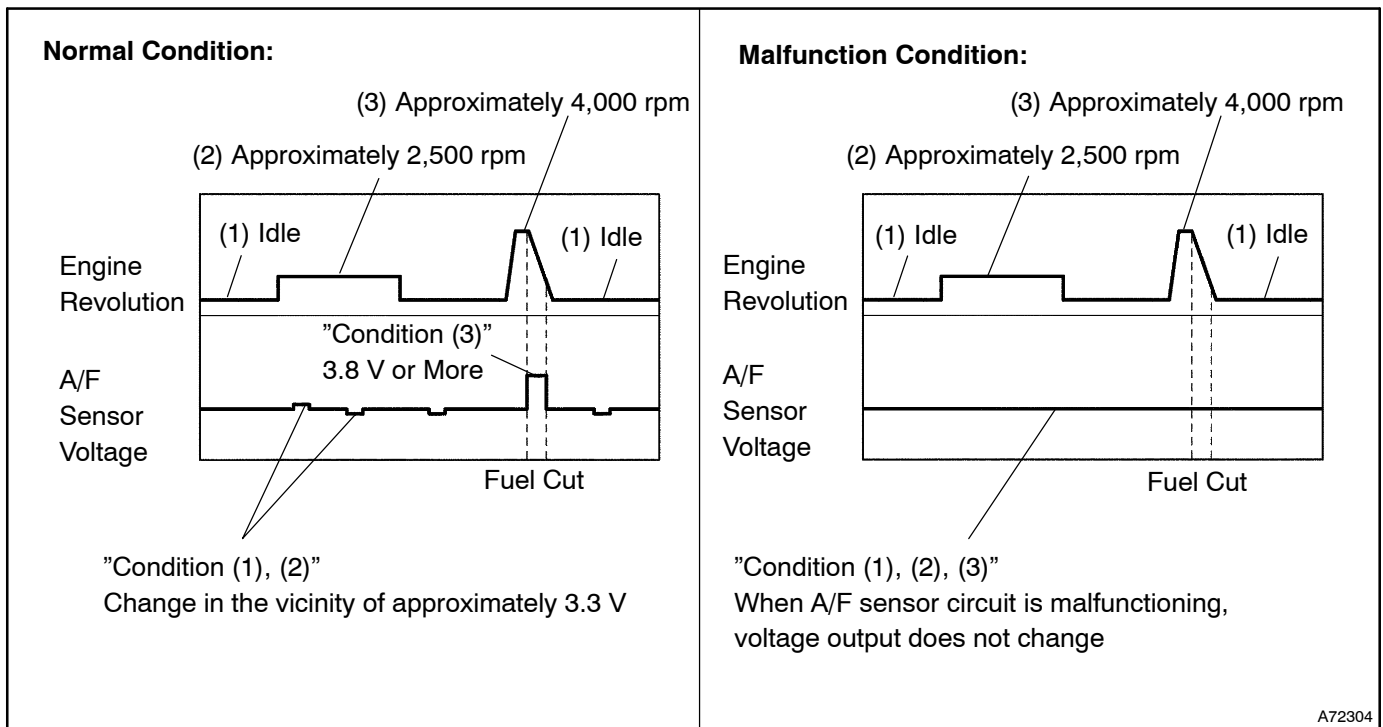
#### Condition (1) and (2)

The voltage changes in the vicinity of 3.3 V (0.66 V\*) (between approximately 3.1 to 3.5 V) as shown in the illustration on the next page.

#### Condition (3)

The voltage increases to 3.8 V (0.76 V\*) or more during engine deceleration (when fuel is cut) as shown in the illustration on the next page.

\*: Voltage when not using intelligent tester II.

**HINT:**

- Whenever the output voltage of the A/F sensor remains at approximately 3.3 V (0.660 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 (0.76 V\*) or more, or 2.8 V (0.56 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 lean condition and should result in a momentary increase in the 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 (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 (0.76 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, therefore the current is converted into voltage inside the ECM. If measuring voltage at the connectors of the A/F sensor or ECM, you will obtain a constant voltage.

\*: When not using the intelligent tester II.

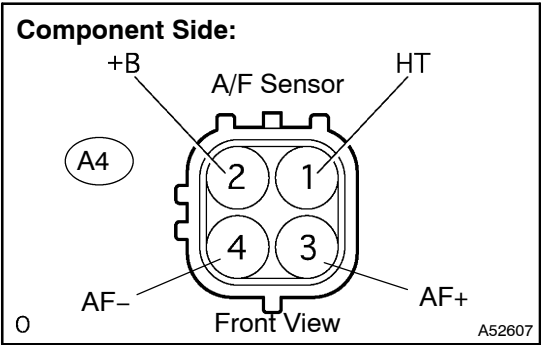
OK

Go to step 13

NG

3

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



- (a) Disconnect the A4 A/F sensor connector.
- (b) Measure the resistance between the terminals of the A/F sensor.

**Standard:**

Tester Connection	Specified Condition
HT (1) - +B (2)	1.8 to 3.4 $\Omega$ at 20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$ )

- (c) Reconnect the A/F sensor connector.

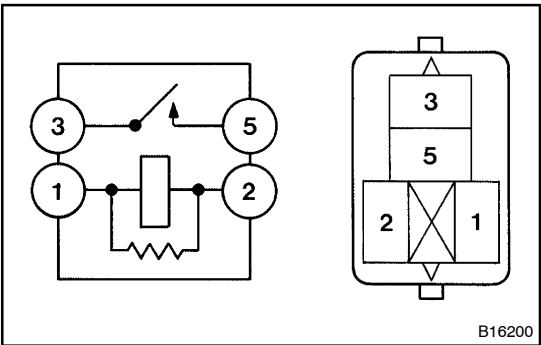
NG

REPLACE AIR FUEL RATIO SENSOR

OK

4

INSPECT EFI RELAY



- (a) Remove the EFI relay from the engine room R/B.
- (b) Check the EFI relay resistance.

**Standard:**

Tester Connection	Specified Condition
3 - 5	10 k $\Omega$ or higher
3 - 5	Below 1 $\Omega$ (Apply battery voltage to terminals 1 and 2)

- (c) Reinstall the EFI relay.

NG

REPAIR OR REPLACE EFI RELAY

OK

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

Wire Harness Side:

A4 A/F Sensor Connector

HT

AF+

AF-

Front View

A76787

- (a) Disconnect the A4 A/F sensor connector.
- (b) Disconnect the E10 ECM connector.
- (c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
HT (A4-1) - HA1A (E10-5)	Below 1 Ω
AF+ (A4-3) - A1A+ (E10-23)	Below 1 Ω
AF- (A4-4) - A1A- (E10-31)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (A4-1) or HA1A (E10-5) - Body ground	10 kΩ or higher
AF+ (A4-3) or A1A+ (E10-23) - Body ground	10 kΩ or higher
AF- (A4-4) or A1A- (E10-31) - Body ground	10 kΩ or higher

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

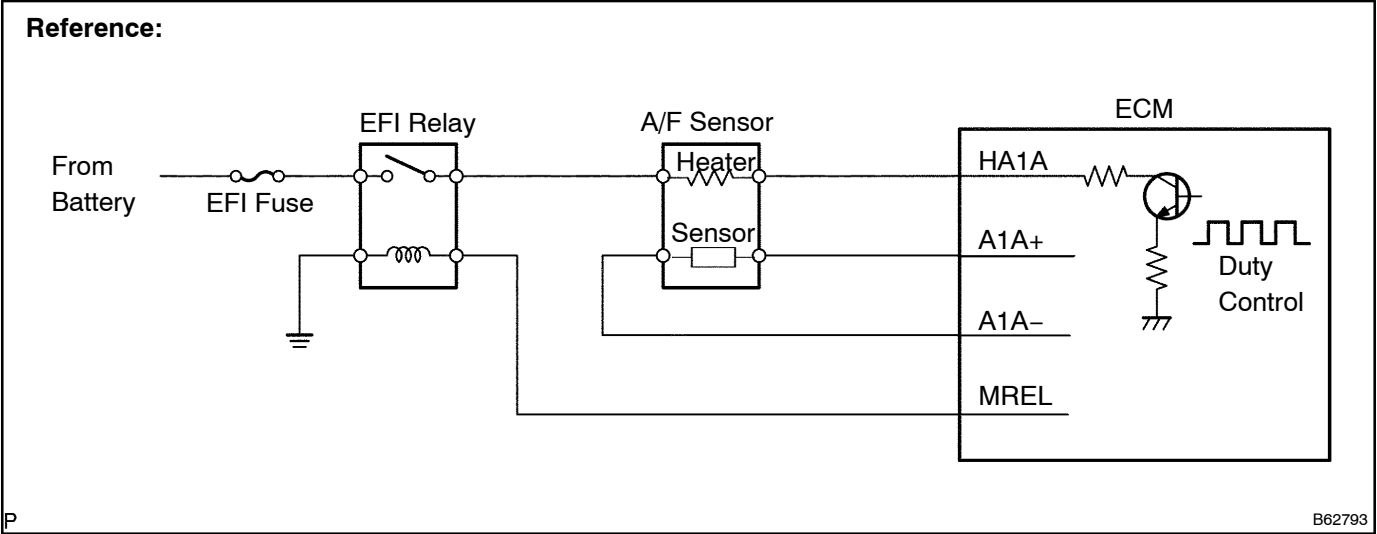
HA1A

A1A+

A1A-

ECM Connector

A55005



NG REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

**6 CHECK AIR INDUCTION SYSTEM**

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

**OK:** There is a leak in the air induction system.**NG****REPAIR OR REPLACE AIR INDUCTION SYSTEM****OK****7 CHECK FUEL PRESSURE (See page 11-5)**

- (a) Check the fuel pressure (high or low fuel pressure).

**NG****REPAIR OR REPLACE FUEL SYSTEM****OK****8 INSPECT FUEL INJECTOR ASSY (See page 11-8)**

- (a) Check the injector injection (high or low fuel pressure).

**NG****REPLACE FUEL INJECTOR ASSY  
(See page 11-11)****OK****9 REPLACE AIR FUEL RATIO SENSOR****GO****10 PERFORM CONFIRMATION DRIVING PATTERN (See page 05-192)****HINT:**

Clear all DTCs prior to performing the confirmation driving pattern (see page 05-192).

**GO****11 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCs)**

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read DTCs.

**Result**

Display (DTC Output)	Proceed To
No output	A
P2A00	B

**B****REPLACE ECM (See page 10-30)  
AND PERFORM CONFIRMATION DRIVING PAT-  
TERN (See page 05-192)****A**

**12 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST****NO****CHECK FOR INTERMITTENT PROBLEMS**  
(See page 05-9)**YES****DTC IS CAUSED BY RUNNING OUT OF FUEL****13 PERFORM CONFIRMATION DRIVING PATTERN (See page 05-192)****HINT:**

Clear all DTCs prior to performing the confirmation driving pattern (see page 05-192).

**GO****14 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCs)**

- (a) Connect the Intelligent Tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the Intelligent Tester II ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (d) Read DTCs.

**Result**

Display (DTC Output)	Proceed To
P2A00	A
No output	B

**B****Go to step 18****A****15 REPLACE AIR FUEL RATIO SENSOR****GO****16 PERFORM CONFIRMATION DRIVING PATTERN (See page 05-192)****HINT:**

Clear all DTCs prior to performing the confirmation driving pattern (see page 05-192).

**GO**



**17 CHECK IF DTC OUTPUT RECURS (A/F SENSOR DTCs)**

- (a) Connect the intelligent tester to the DLC3.  
 (b) Turn the ignition switch to ON and turn the intelligent tester ON.  
 (c) Select the following menu items: Powertrain / Engine and ECT / DTC.  
 (d) Read DTCs.

**Result**

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

**B**

**REPLACE ECM (See page 10-30)  
 AND PERFORM CONFIRMATION DRIVING PAT-  
 TERN (See page 05-192)**

**A****18 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

**OK:** The vehicle has run out of fuel in the past.

**NO**

**CHECK FOR INTERMITTENT PROBLEMS  
 (See page 05-9)**

**YES**

**DTC IS CAUSED BY RUNNING OUT OF FUEL**