

DTC	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)
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DTC	P2A03	A/F Sensor Circuit Slow Response (Bank 2 Sensor 1)
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CIRCUIT DESCRIPTION

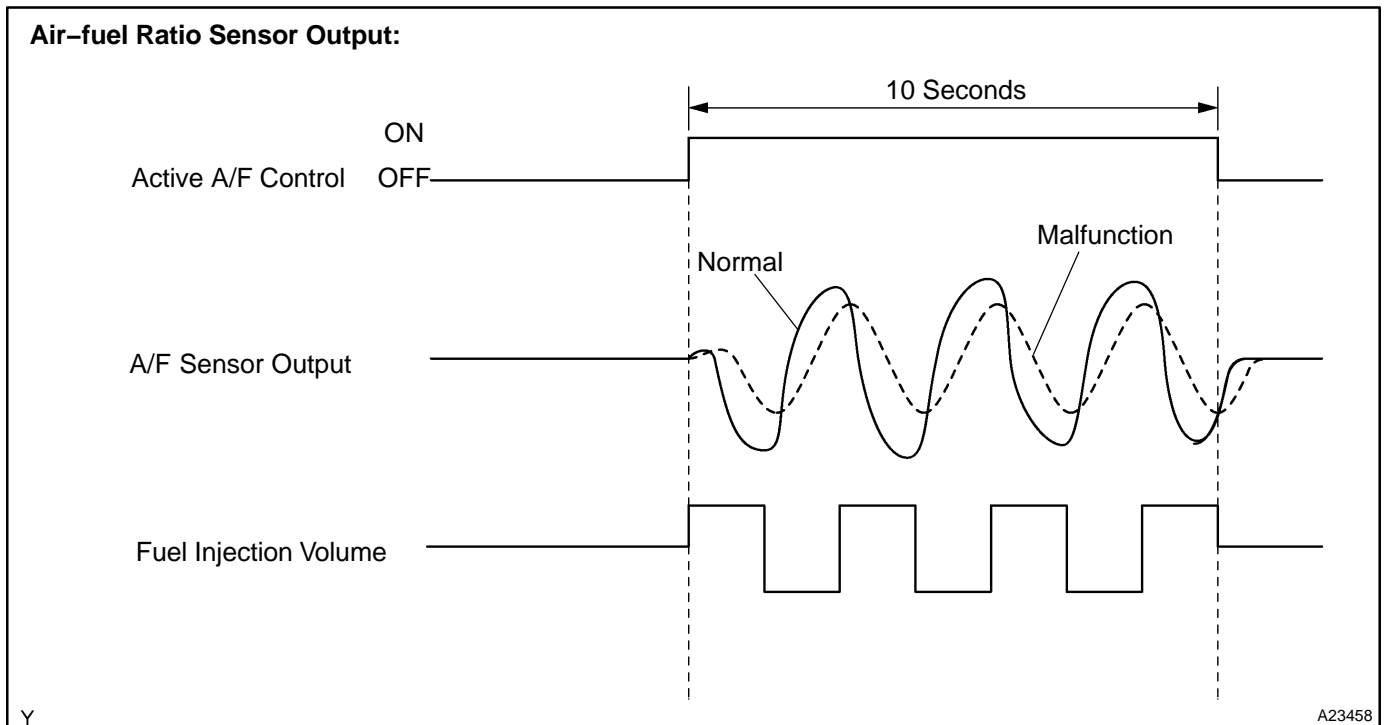
Refer to DTC P2195 on page [DI-806](#).

DTC No.	DTC Detection Conditions	Trouble Areas
P2A00 P2A03	Calculated test value for A/F sensor response rate deterioration level is less than threshold.	<ul style="list-style-type: none"> • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • ECM

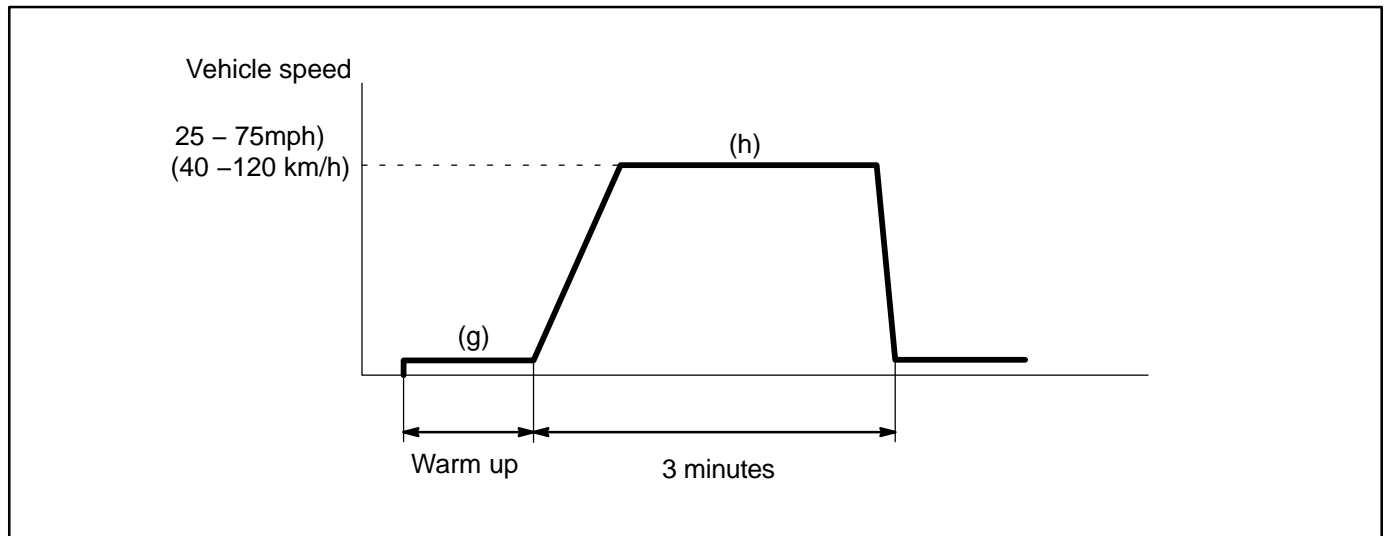
MONITOR DESCRIPTION

After engine is warmed up, the ECM performs air–fuel ratio feedback control to regulate the air–fuel ratio at stoichiometric ratio. In addition, this vehicle performs Active A/F Ratio Control for approximately 10 seconds after preconditions met in order to measure the A/F sensor response rate. During active air–fuel ratio control, the ECM forcibly increases and decreases the injection volume for certain amount based on learned stoichiometric air –fuel ratio during usual air–fuel feedback control, and measures the A/F sensor response rate. The ECM calculates the signal from the A/F sensor while value for A/F sensor response rate deterioration level.

If the test value for A/F sensor response rate deterioration level is less than threshold, ECM interprets this as a malfunction, and sets the DTC.



CONFIRMATION DRIVING PATTERN



- (a) Connect the hand-held tester to the DLC3.
- (b) Turn the ignition switch to ON.
- (c) Turn the hand-held tester ON.
- (d) Clear DTCs.
- (e) Select the following menu items: DIAGNOSIS/ENHANCED OBD II/MONITOR INFO/MONITOR RESULT.
- (f) Check that RES RATE B1 S1 is INCOMPL.
- (g) Start the engine and warm it up.
- (h) Drive the vehicle at between 25 mph and 75 mph (40 km/h and 120km/h) for 3 minutes. However, the vehicle should be driven at constant-speed.
- (i) When detection is complete, Response rate of MONITOR RESULT changes.
If the value does not change, perform step (g) once more.
- (j) Notes the value of the Monitor Result.
- (k) Select the following menu items: DIAGNOSIS/ENHANCED OBD II/DTC INFO/ PENDING CODES.
- (l) Check if any DTCs (any pending DTCs) are set.

MONITOR STRATEGY

Related DTCs	P2A00	A/F sensor (Bank 1) slow response
	P2A03	A/F sensor (Bank 2) slow response
Required sensors/components	A/F sensor	
Frequency of operation	Once per driving cycle	
Duration	10 to 15 sec.	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever these DTCs are not present	See page DI-437	
Active A/F control	Performing	
Active A/F control is performed when the following conditions are met:	–	
Battery voltage	11 V	–
ECT	75°C (167°F)	–
Idle	OFF	
Engine RPM	–	4,000 rpm
A/F sensor status	Activated	
Fuel cut	OFF	
Engine load	10 to 70%	
Shift position	2nd	–
Catalyst monitor	Not executing	
Intake air amount	2.5 to 12 g/sec	

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Response rate deterioration level	Less than 0.2 V

MONITOR RESULT

Refer to page [DI-445](#) for detailed information.

The test value and test limit information are described as shown in the following table. Check the monitor result and test values after performing the monitor drive pattern (refer to "Confirmation Monitor").

- MID (Monitor Identification Data) is assigned to each emissions-related component.
- TID (Test Identification Data) is assigned to each test value.
- Scaling is used to calculate the test value indicated on generic OBD II scan tools.

A/F sensor bank 1 sensor 1

MID	TID	Scaling	Description of Test Value	Minimum Test Limit	Maximum Test Limit
\$01	\$8E	Multiply by 0.0003 (no dimension)	Response rate deterioration level for A/F sensor	Malfunction criterion	FF

A/F sensor bank 2 sensor 1

MID	TID	Scaling	Description of Test Value	Minimum Test Limit	Maximum Test Limit
\$05	\$8E	Multiply by 0.0003 (no dimension)	Response rate deterioration level for A/F sensor	Malfunction criterion	FF

WIRING DIAGRAM

Refer to DTC P2195 on page [DI-806](#).

INSPECTION PROCEDURE

HINT:

Hand-held tester only:

Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Air-Fuel Ratio (A/F) sensor, Heated Oxygen (HO2) sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the A/F CONTROL operation using a hand-held tester.

- (1) Connect a hand-held tester to the DLC3.
- (2) Start the engine and turn the tester ON.
- (3) Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
- (4) On the tester, select the following menu items: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- (5) Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
- (6) Monitor the voltage outputs of the A/F and HO2 sensors (AFS B1S1 (AFS B2S1) and OS2 B1S2 (O2S B2S2)) displayed on the tester.

HINT:






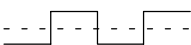



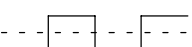


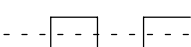
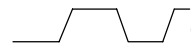


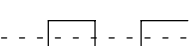



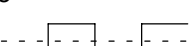
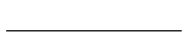

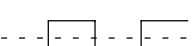


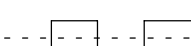

- The A/F CONTROL operation lowers the fuel injection volume by 12.5 % or increases the injection volume by 25 %.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard:

Tester Display (Sensor)	Injection Volumes	Status	Voltages
AFS B1S1 (AFS B2S1) (A/F)	+25 %	Rich	Less than 3.0
AFS B1S1 (AFS B2S1) (A/F)	-12.5 %	Lean	More than 3.35
O2S B1S2 (O2S B2S2) (HO2)	+25 %	Rich	More than 0.55
O2S B1S2 (O2S B2S2) (HO2)	-12.5 %	Lean	Less than 0.4

NOTICE:

The Air–Fuel Ratio (A/F) sensor has an output delay of a few seconds and the Heated Oxygen (HO2) sensor has a maximum output delay of approximately 20 seconds.

Case	A/F Sensor (Sensor 1) Output Voltage	HO2 Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Areas
1	Injection volume +25 %   -12.5 % Output voltage More than 3.35 V  OK Less than 3.0 V 	Injection volume +25 %   -12.5 % Output voltage More than 0.55 V  OK Less than 0.4V 	—
2	Injection volume +25 %   -12.5 % Output voltage Almost no reaction  NG	Injection volume +25 %   -12.5 % Output voltage More than 0.55 V  OK Less than 0.4V 	<ul style="list-style-type: none"> • A/F sensor • A/F sensor heater • A/F sensor circuit
3	Injection volume +25 %   -12.5 % Output voltage More than 3.35 V  OK Less than 3.0V 	Injection volume +25 %   -12.5 % Output voltage Almost no reaction  NG	<ul style="list-style-type: none"> • HO2 sensor • HO2 sensor heater • HO2 sensor circuit
4	Injection volume +25 %   -12.5 % Output voltage Almost no reaction  NG	Injection volume +25 %   -12.5 % Output voltage Almost no reaction  NG	<ul style="list-style-type: none"> • Injector • Fuel pressure • Gas leakage from exhaust system (Air–fuel ratio extremely lean or rich)

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the A/F and HO2 sensors.
- To display the graph, select the following menu items on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL / USER DATA / AFS B1S1 and O2S B1S2, and press the YES button and then the ENTER button followed by the F4 button.

HINT:

- DTC P2A00 may be also set, 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 a hand–held tester or OBD II scan tool. 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 any other DTCs output (in addition to DTC P2A00 or P2A03).**PREPARATION:**

- (a) Connect a hand-held tester to the DLC3.
- (b) Turn the ignition switch to ON and turn the tester ON.
- (c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

CHECK:

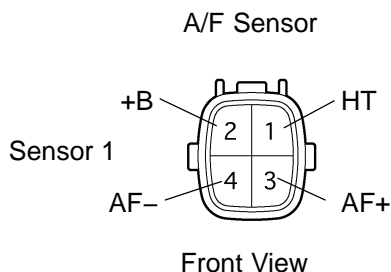
- (a) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P2A00 and/or P2A03	A
P2A00 and/or P2A03 and other DTCs	B

HINT:

If any DTCs other than P2A00 and/or P2A03 are output, troubleshoot those DTCs first.

B**Go to relevant DTC chart (See page [DI-477](#)).****A****2 Check resistance of air-fuel ratio (A/F) sensor heater.****Component Side:**

B17396

PREPARATION:

Disconnect the air-fuel ratio (A/F) sensor connector.

CHECK:

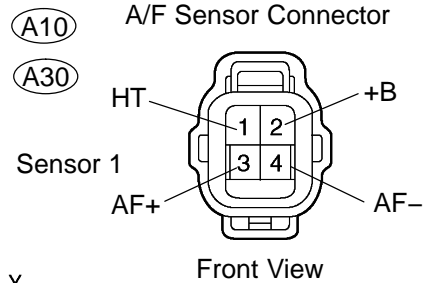
Measure resistance between the terminals of the A/F sensor connector.

OK:**Standard:**

Tester Connection	Specified Condition
HT (1) – +B (2)	Between 1.8 Ω and 3.4 Ω at 20°C (68°F)
HT (1) – AF– (4)	10 k Ω or higher

NG**Replace air-fuel ratio (A/F) sensor.****OK**

3

Check for open and short in harness and connector between ECM and A/F sensor.**Wire Harness Side:**

Y

A23659

PREPARATION:

- Disconnect the A10 or A30 A/F sensor connector.
- Turn the ignition switch to ON.

CHECK:

- Measure the voltage between the +B terminal of the A/F sensor connector and body ground.

OK:**Standard:**

Tester Connections	Specified Conditions
+B (2) – Body ground	Between 9 V and 14 V

PREPARATION:

- Turn the ignition switch to OFF.
- Disconnect the E6 ECM connector.

CHECK:

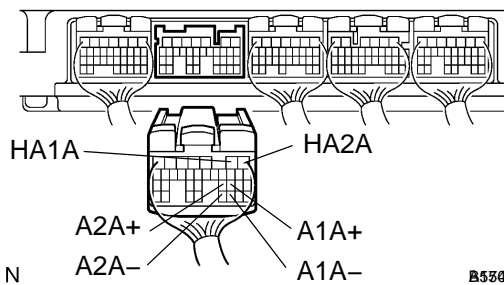
- Check the resistance.

OK:**Standard (Check for open):**

Tester Connections	Specified Conditions
HT (A10-1) – HA1A (E6-2) HT (A30-1) – HA2A (E6-1)	Below 1 Ω
AF+ (A10-3) – A1A+ (E6-22) AF+ (A30-3) – A2A+ (E6-23)	Below 1 Ω
AF- (A10-4) – A1A- (E6-30) AF- (A30-4) – A2A- (E6-31)	Below 1 Ω

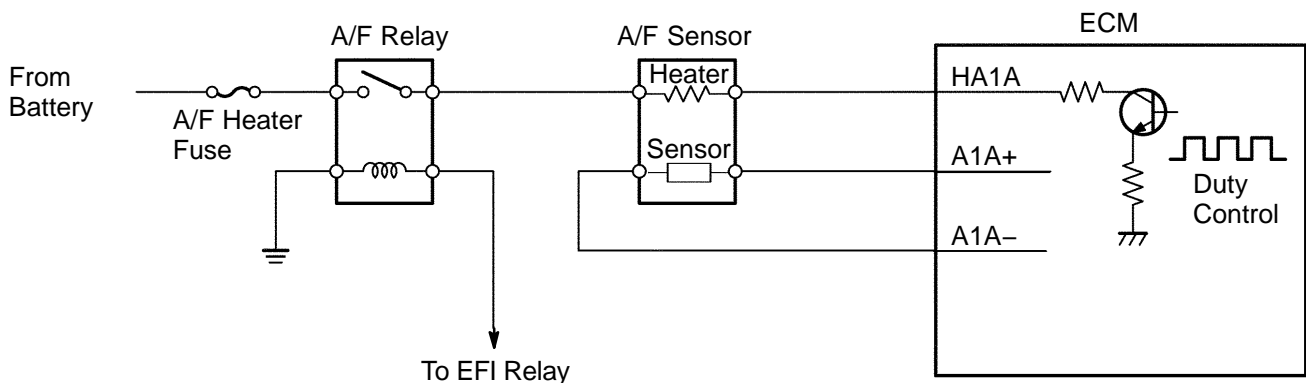
Standard (Check for short):

Tester Connections	Specified Conditions
HT (A10-1) or HA1A (E6-2) – Body ground HT (A30-1) or HA2A (E6-1) – Body ground	10 k Ω or higher
AF+ (A10-3) or A1A+ (E6-22) – Body ground AF+ (A30-3) or A2A+ (E6-23) – Body ground	10 k Ω or higher
AF- (A10-4) or A1A- (E6-30) – Body ground AF- (A30-4) or A2A- (E6-31) – Body ground	10 k Ω or higher

(E6) ECM Connector

N

B55005

Reference (Bank 1 Sensor 1 System Drawing):

P

A23512

NG

Replace or replace harness or connector.

OK

4

Perform confirmation driving pattern.

NEXT

5

Check whether DTC output recurs (DTC P2A00 or P2A03)

CHECK:

- (a) On the hand-held tester, select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
- (b) Read DTCs.

RESULT:

Display (DTC Output)	Proceed To
P2A00 or P2A03	A
No output	B

B

Check for intermittent problems
(See page [DI-430](#)).

A

6

Replace air fuel ratio sensor.

NEXT

7

Perform confirmation driving pattern.

NEXT

8 Check whether DTC output recurs (DTC P2A00 or P2A03)**CHECK:**

- (a) On the hand-held tester, select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
- (b) Read DTCs.

RESULT:

Display (DTC Output)	Proceed To
P2A00 or P2A03	A
No output	B

A

**Check air-fuel ratio extremely lean or rich
(See page [DI-586](#)).**

B**END**