

DTC	P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)
DTC	P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)
DTC	P2241	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 2 Sensor 1)
DTC	P2242	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 2 Sensor 1)
DTC	P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)
DTC	P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)
DTC	P2255	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 2 Sensor 1)
DTC	P2256	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 2 Sensor 1)

ES

DESCRIPTION

Refer to DTC P2195 (see page [ES-334](#)).

DTC No.	DTC Detection Condition	Trouble Area
P2238 P2241	<ul style="list-style-type: none"> • Case 1: Condition (a) or (b) continues for 5.0 seconds or more (2 trip detection logic): (a) AF+ voltage 0.5 V or less (b) (AF+) - (AF-) = 0.1 V or less • Case 2: A/F sensor admittance: Less than 0.022 1/Ω (2 trip detection logic) 	<ul style="list-style-type: none"> • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • ECM
P2239 P2242	AF+ voltage more than 4.5 V for 5.0 seconds or more (2 trip detection logic)	<ul style="list-style-type: none"> • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • ECM
P2252 P2255	AF- voltage 0.5 V or less for 5.0 seconds or more (2 trip detection logic)	<ul style="list-style-type: none"> • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • ECM

DTC No.	DTC Detection Condition	Trouble Area
P2253 P2256	AF- voltage more than 4.5 V for 5.0 seconds or more (2 trip detection logic)	<ul style="list-style-type: none"> • Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater (sensor 1) • Integration relay • A/F sensor heater and integration relay circuits • ECM

HINT:

- DTCs P2238, P2239, P2252 and P2253 indicate malfunctions related to the bank 1 A/F sensor circuit.
- DTCs P2241, P2242, P2255 and P2256 indicate malfunctions related to the bank 2 A/F sensor circuit.
- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that includes cylinder No. 2.

MONITOR DESCRIPTION

ES

The Air-Fuel Ratio (A/F) sensor varies its output voltage in proportion to the air-fuel ratio. If the A/F sensor impedance (alternating current resistance) or output voltage deviates greatly from the standard range, the ECM determines that there is an open or short in the A/F sensor circuit.

MONITOR STRATEGY

Related DTCs	P2238: A/F sensor (bank 1) open circuit between AF+ and AF- P2238: A/F sensor (bank 1) short circuit between AF+ and AF- P2238: A/F sensor (bank 1) short circuit between AF+ and GND P2239: A/F sensor (bank 1) short circuit between AF+ and +B P2252: A/F sensor (bank 1) short circuit between AF- and GND P2253: A/F sensor (bank 1) short circuit between AF- and +B P2241: A/F sensor (bank 2) open circuit between AF+ and AF- P2241: A/F sensor (bank 2) short circuit between AF+ and AF- P2241: A/F sensor (bank 2) short circuit between AF+ and GND P2242: A/F sensor (bank 2) short circuit between AF+ and +B P2255: A/F sensor (bank 2) short circuit between AF- and GND P2256: A/F sensor (bank 2) short circuit between AF- and +B
Required Sensors/Components (Main)	A/F sensor
Required Sensors/Components (Related)	Engine Coolant Temperature (ECT) sensor, Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds: A/F sensor open circuit between AF+ and AF- 5 seconds: Other
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0031, P0032, P0051, P0052 (A/F sensor heater - Sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0223, P2135 (TP sensor) P0125 (Insufficient ECT for Closed Loop) P0171, P0172 (Fuel system) P0300 - P0306 (Misfire) P0335 (CKP sensor) P0340 (CMP sensor) P0455, P0456 (EVAP system) P0500 (VSS)
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P2238 and P2241 (open circuit between AF+ and AF-):

AF+ terminal voltage	0.5 to 4.5 V
AF- terminal voltage	0.5 to 4.5 V
Difference between AF+ and AF- terminal voltages	0.1 to 0.8 V
ECT	5°C (41°F) or more (varies with ECT at engine start)

Engine	Running
Fuel-cut	OFF
Time after fuel-cut OFF	5 seconds or more
A/F sensor heater	ON
Battery voltage	10.5 V or more
Ignition switch	ON
Time after ignition switch is turned from OFF to ON	5 seconds or more

Other:

Battery voltage	10.5 V or more
Ignition switch	ON
Time after ignition switch is turned from OFF to ON	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS**P2238 and P2241 (Open circuit between AF+ and AF-):**

A/F sensor admittance	Below 0.022 1/Ω
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P2238 and P2241 (Short circuit between AF+ and GND):

AF+ terminal voltage	0.5 V or less
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P2238 and P2241 (Short circuit between AF+ and AF-):

Difference between AF+ and AF- terminal voltages	0.1 V or less
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P2239 and P2242 (Short circuit between AF+ and +B):

AF+ terminal voltage	More than 4.5 V
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P2252 and P2255 (Short circuit between AF- and GND):

AF- terminal voltage	0.5 V or less
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P2253 and P2256 (Short circuit between AF- and +B):

AF- terminal voltage	More than 4.5 V
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WIRING DIAGRAM

Refer to DTC P2195 (see page [ES-339](#)).

INSPECTION PROCEDURE**HINT:**

- Although the DTC titles say oxygen sensor, these DTCs relate to the Air-Fuel Ratio (A/F) sensor.
- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC) and located near the engine assembly.

HINT:

Intelligent 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 the intelligent tester.

- Connect the intelligent tester to the DLC3.
- Start the engine and turn the tester ON.
- Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
- On the tester, select the following menu items: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- Perform the A/F CONTROL operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).

(f) Monitor the output voltages of the A/F and HO2 sensors (AFS B1 S1 and O2S B1 S2 or AFS B2 S1 and O2S B2 S2) 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%.
- The sensors react in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volume	Status	Voltage
AFS B1 S1 (A/F)	+25%	Rich	Less than 3.0
	-12.5%	Lean	More than 3.35
O2S B1 S2 (HO2)	+25%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4
AFS B2 S1 (A/F)	+25%	Rich	Less than 3.0
	-12.5%	Lean	More than 3.35
O2S B2 S2 (HO2)	+25%	Rich	More than 0.55
	-12.5%	Lean	Less than 0.4

NOTICE:

The A/F sensor has an output delay of a few seconds and the 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 Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.5 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		<ul style="list-style-type: none"> • A/F sensor • A/F sensor heater • A/F sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.5 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		<ul style="list-style-type: none"> • HO2 sensor • HO2 sensor heater • HO2 sensor circuit
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection volume +25% -12.5%		Injection Volume +25% -12.5%		<ul style="list-style-type: none"> • Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

Following the A/F CONTROL procedure enables technicians to check and graph the output voltages 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 B1 S1 and O2S B1 S2 or AFS B2 S1 and O2S B2 S2; then press the YES button and then the ENTER button followed by the F4 button.

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records 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 INSPECT AIR-FUEL RATIO SENSOR (HEATER RESISTANCE) (See page ES-110)

NG → REPLACE AIR-FUEL RATIO SENSOR

OK

2 INSPECT INTEGRATION RELAY (A/F RELAY) (See page ES-111)

NG → REPLACE INTEGRATION RELAY

OK

3 CHECK WIRE HARNESS (A/F SENSOR - ECM) (See page ES-354)

NG → REPAIR OR REPLACE HARNESS AND CONNECTOR

OK

4 REPLACE AIR-FUEL RATIO SENSOR

NEXT

5 CHECK WHETHER DTC OUTPUT RECURS

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Clear DTCs (see page ES-39).
- (d) Start the engine.
- (e) Allow the engine to idle for 5 minutes or more.
- (f) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
- (g) Read pending DTCs.

Result

Display (DTC Output)	Proceed to
No output	A
P2238, P2239, P2252, P2253, P2241, P2242, P2255 or P2256	B

B → REPLACE ECM

A

END