

DTC	P0031	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)
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DTC	P0032	OXYGEN (A/F) SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)
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HINT:

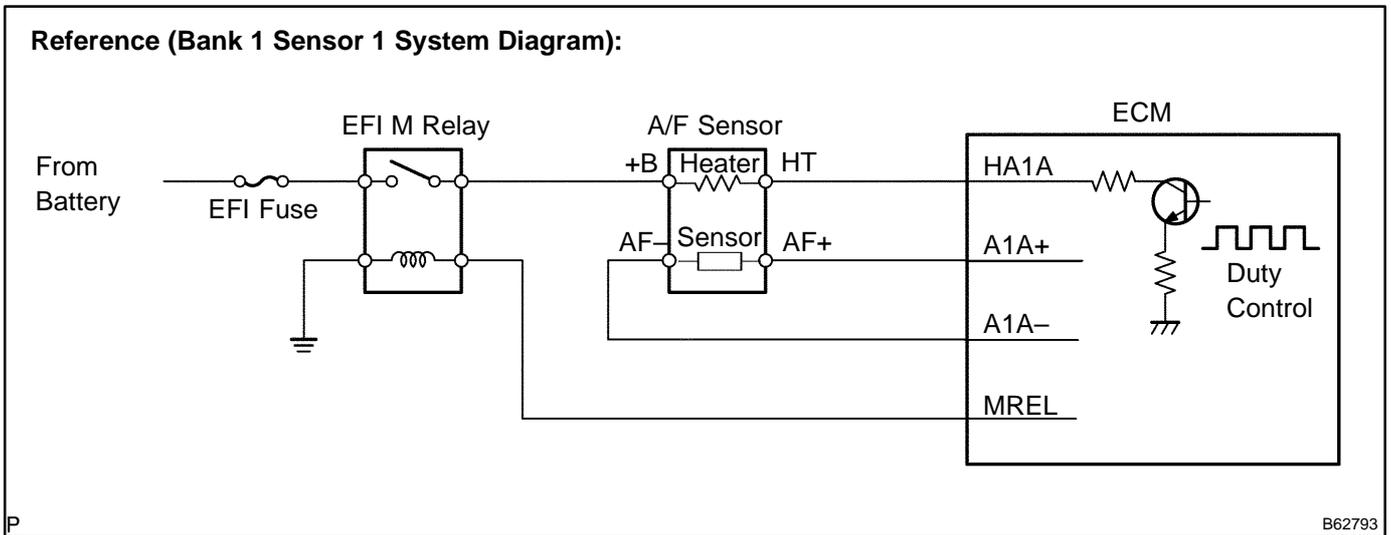
Although each DTC title says "oxygen sensor," these DTCs are related to the air-fuel ratio sensor (A/F sensor).

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page 05-314.

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The A/F sensor heater circuit uses a relay on the +B side of the circuit.



DTC No.	DTC Detection Condition	Trouble Area
P0031	Heater current is 0.8 A or less when the heater operates (1 trip detection logic)	<ul style="list-style-type: none"> • Open or short in heater circuit of A/F sensor • A/F sensor heater • EFI M relay (integration relay) • ECM
P0032	Heater current exceeds 10 A when the heater operates (1 trip detection logic)	<ul style="list-style-type: none"> • Short in heater circuit of A/F sensor • A/F sensor heater • EFI M relay (integration relay) • ECM

HINT:

- Sensor 1 refers to the sensor mounted before the TWC and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted after the TWC and is located far from the engine assembly.

MONITOR DESCRIPTION

The ECM uses the Air–Fuel Ratio (A/F) sensor information to regulate the air–fuel ratio close to the stoichiometric ratio. This maximizes the catalytic converter’s ability to purify exhaust gases. The sensor detects oxygen levels in the exhaust gas and sends this signal to the ECM.

The inner surface of the sensor element is exposed to outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum coated zirconia and includes an integrated heating element. The zirconia element generates a small voltage when there is a large difference between the oxygen concentrations of the exhaust and the outside air. The platinum coating amplifies the voltage generation. When heated, the sensor becomes very efficient. If the temperature of the exhaust is low, the sensor will not generate useful voltage signals without supplemental heating. The ECM regulates the supplemental heating using a duty–cycle approach to regulate the average current in the heater element. If the heater current is out of the normal range, the sensor output signals will be inaccurate and the ECM can not regulate the air–fuel ratio properly.

When the heater current is out of the normal operating range, the ECM interprets this as malfunction of the sensor and sensor circuit and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0031: A/F sensor heater current (low current) P0032: A/F sensor heater current (high current)
Required sensors/components	A/F sensor, ECM
Frequency of operation	Continuous
Duration	10 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See page 05–20
Battery voltage	10.5 V or more
Heater duty ratio–cycle	P0031: 50 % or more P0032: More than 0 %
Time after engine start	10 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0031:

A/F sensor heater current	Less than 0.8 A
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P0032:

A/F sensor heater current	More than 10 A
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COMPONENT OPERATING RANGE

A/F sensor heater current	1.8 to 3.4 A (at 20°C [68°F])
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MONITOR RESULT (MODE 06 DATA)

Test ID / Comp ID	Description of Test Data	Description of Test Limit	Conversion Factor (Unit)
\$07 / \$81	Maximum A/F sensor heater current	Maximum threshold heater current to detect A/F sensor circuit malfunction	Multiply by 0.173 (A)

Refer to page [05–26](#) for detailed information on Checking Monitor Status.

WIRING DIAGRAM

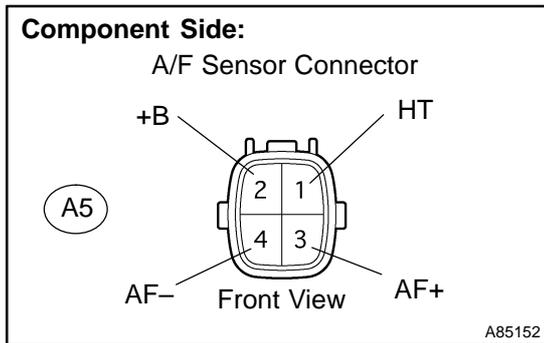
Refer to DTC P2195 on page 05-314.

INSPECTION PROCEDURE

HINT:

- When DTC P0032 is detected, proceed to step 4 if the heater resistance is in normal range.
- Read freeze frame data using the hand-held tester or the OBD II scan tool. 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 INSPECT AIR FUEL RATIO SENSOR(HEATER RESISTANCE)



- Disconnect the A5 A/F sensor connector.
- Measure the resistance between the terminals of the A/F sensor connector.

Standard:

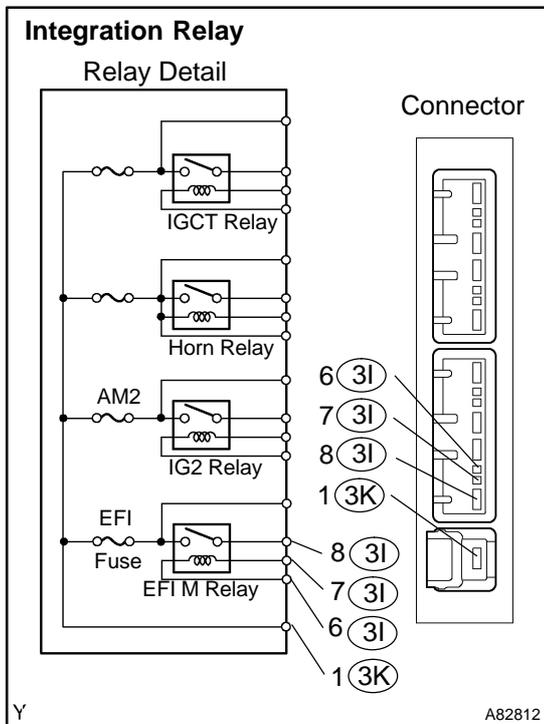
Tester Connection	Resistance
HT (1) - +B (2)	1.8 to 3.4 Ω at 20°C (68°F)

- Reconnect the A/F sensor connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

2 INSPECT INTEGRATION RELAY(EFI M RELAY)



- Remove the integration relay from the engine room R/B.
- Inspect the EFI M relay.

Standard:

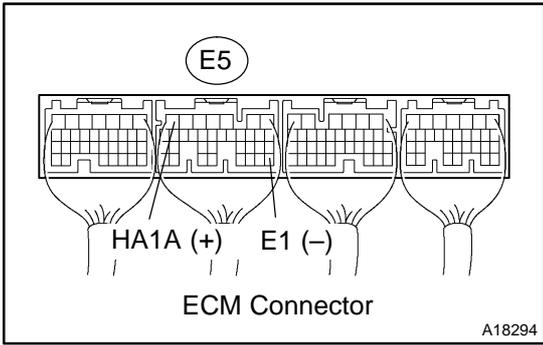
Tester Connection	Specified Condition
(3K-1) - (3I-8)	10 kΩ or higher
(3K-1) - (3I-8)	Below 1 Ω (Apply battery voltage to terminals 3I-6 and 3I-7)

- Reinstall the integration relay.

NG → REPLACE INTEGRATION RELAY

OK

3 INSPECT ECM(HA1A VOLTAGE)



- (a) Turn the power switch ON (IG).
- (b) Measure the voltage between the applicable terminals of the E5 ECM connector.

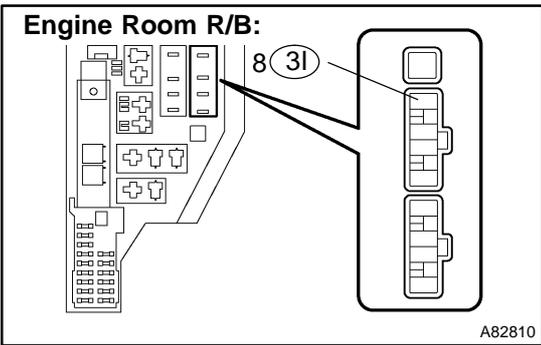
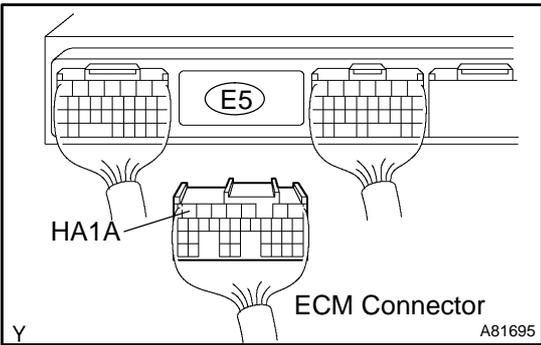
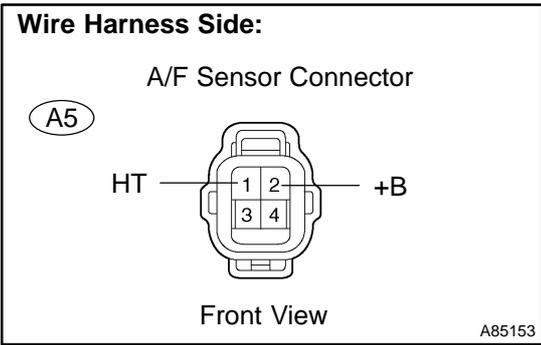
Standard:

Tester Connection	Specified Condition
HA1A (E5-7) - E1 (E5-28)	9 to 14 V

OK → **REPLACE ECM (See page 10-24)**

NG

4 CHECK HARNESS AND CONNECTOR(A/F SENSOR - ECM, A/F SENSOR - EFI M RELAY)



- (a) Check the harness and the connectors between the ECM and the A/F sensor connectors.
- (1) Disconnect the A5 A/F sensor connector.
 - (2) Disconnect the E5 ECM connector.
 - (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
HT (A5-1) - HA1A (E5-7)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (A5-1) or HA1A (E5-7) - Body ground	10 kΩ or higher
HT (A5-1) - +B (A5-2)	10 kΩ or higher

- (4) Reconnect the A/F sensor connector.
 - (5) Reconnect the ECM connector.
- (b) Check the harness and connectors between the A/F sensor connector and the EFI M relay.
- (1) Disconnect the A5 A/F sensor connector.
 - (2) Remove the integration relay from the engine room R/B.
 - (3) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
+B (A5-2) - EFI M relay (31-8)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (A5-2) or EFI M relay (31-8) - Body ground	10 kΩ or higher

- (4) Reconnect the A/F sensor connector.
- (5) Reinstall the integration relay.

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

OK

REPLACE ECM (See page 10-24)