

Computers and Control Systems: Diagnostic Trouble Code Tests and Associated Procedures

P0171

CIRCUIT DESCRIPTION

Fuel trim refers to the feedback compensation value compared to the basic injection time. Fuel trim includes short-term fuel trim and long-term fuel trim.

short-term fuel trim is the short-term fuel compensation used to maintain the air-fuel ratio at its ideal theoretical value.

The signal from the A/F sensor is approximately proportional to the existing air-fuel ratio, and ECM comparing it with the ideal theoretical value, the ECM reduces fuel volume immediately if the air-fuel ratio is rich and increases fuel volume if it is lean.

Long-term fuel trim compensates the deviation from the central value of the short-term fuel trim stored up by each engine tolerance, and the deviation from the central value due to the passage of time and changes of using environment.

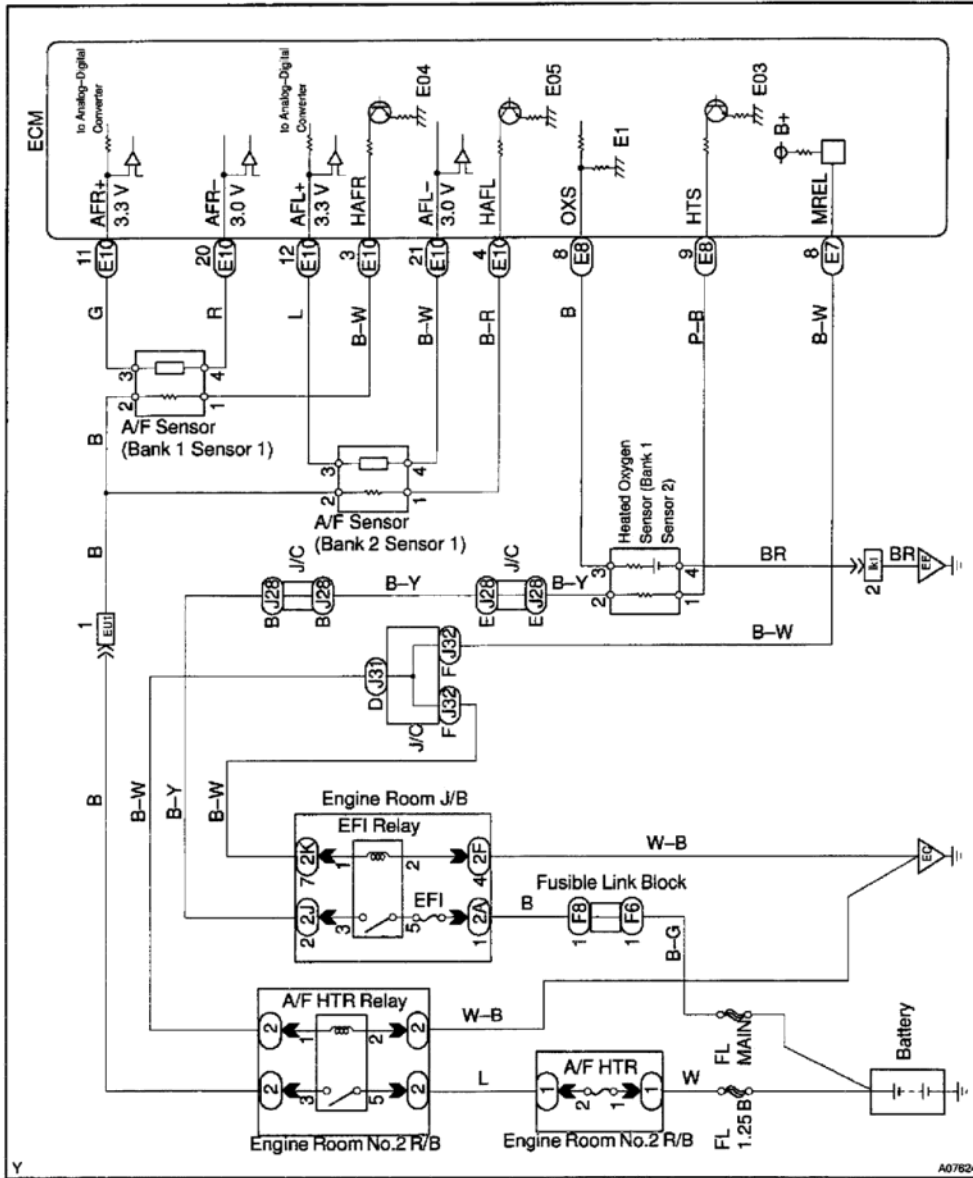
If both the short-term fuel trim and long-term fuel trim exceed a certain value, it is detected as a malfunction and the MIL lights up.

DTC No.	DTC Detecting Condition	Trouble Area
P0171	When air-fuel ratio feedback is stable after engine warming up, fuel trim is considerably in error on rich side (2 trip detection logic)	<ul style="list-style-type: none"> • Air induction system • Injector blockage • Mass air flow meter • Engine coolant temp. sensor • Fuel pressure • Gas leakage on exhaust system • Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • ECM
P0172	When air-fuel ratio feedback is stable after engine warming up, fuel trim is considerably in error on lean side (2 trip detection logic)	<ul style="list-style-type: none"> • Injector leak, blockage • Mass air flow meter • Engine coolant temp. sensor • Ignition system • Fuel pressure • Gas leakage on exhaust system • Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • ECM

DETECTING CONDITIONS

HINT:

- When the DTC P0171 is recorded, the actual air-fuel ratio is on the lean side. When DTC P0172 is recorded, the actual air-fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171 is recorded. The MIL then comes on.
- If the total of the short-term fuel trim value and long-term fuel trim value is within $\pm 35\%$ ($80\text{ }^{\circ}\text{C}$ ($176\text{ }^{\circ}\text{F}$) or more), the system the system is functioning normally.
- The A/F sensor (bank 1, 2 sensor 1) output voltage and the short-term fuel trim value can be read using the OBD II scan tool or LEXUS hand-held tester.
- The ECM controls the voltage of the AF+ and AF- terminals of the ECM to the fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without OBD II scan tool or LEXUS hand-held tester.
- OBD II scan tool (excluding LEXUS hand-held tester) displays the one fifth of the A/F sensor output voltage which is displayed on the LEXUS hand-held tester.



WIRING DIAGRAM

1	Check air induction system.
OK	Repair or replace.

2 Check injector injection.

NG Replace injector.

OK

3 Check mass air flow meter and engine coolant temperature sensor.

NG Repair or replace.

OK

4 Check for spark and ignition.

NG Repair or replace.

OK

5 Check fuel pressure.

NG Check and repair fuel pump, pressure regulator, fuel pipe line and filter.

OK

6 Check gas leakage on exhaust system.

NG Repair or replace.

OK

7 Check output voltage A/F sensor (bank 1, 2 sensor 1).

PREPARATION:

- (a) Connect the OBDII scan tool or LEXUS hand-held tester to the DLC3.
- (b) Warm up the A/F sensor with the engine speed at 2,500 rpm for approx. 90 sec.

CHECK:

Read the voltage value of the A/F sensor on the screen of OBDII scan tool or LEXUS hand-held tester when you perform all the following conditions.

HINT:

The voltage of the AFR+ or AFL+ terminal of the ECM is 3.3 fixed the AFR- or AFL- terminal is 3.0 V fixed. Therefore, it is impossible to check the A/F sensor output voltage at the terminals (AFR+, AFL+/AFR-, AFL-) of the ECM.

OK:

Condition	A/F Sensor Voltage value
Engine idling	<ul style="list-style-type: none"> • Not remains at 3.30 V (0.660 V*) • Not remains at 3.8 V (0.76 V*) or more • Not remains at 2.8 V (0.56 V*) or less *: When you use OBDII scan tool (excluding LEXUS hand-held tester)
Engine racing	
Driving at engine speed 1,500 rpm or more and vehicle speed 40 km/h (25mph) or more, and operate throttle valve open and close	

HINT:

- During fuel enrichment, there is a case that the output voltage of the A/F sensor is below 2.8 V (0.56 V*), it is normal.
- During fuel cut, there is case that the output voltage of the A/F sensor is above 3.8 V (0.76 V*), it is normal.
- If the output voltage of the A/F sensor remains at 3.30 V (0.660 V*) even after performing all the above conditions, the A/F sensor circuit may be open.
- If the output voltage of the A/F sensor remains at 3.8 V (0.76 V*) or more, or 2.8 V (0.56 V*) or less even after performing all the above conditions, the A/F sensor circuit may be short.

*: When you use the OBDII scan tool (excluding LEXUS hand-held tester).

OK → Go to step 9.

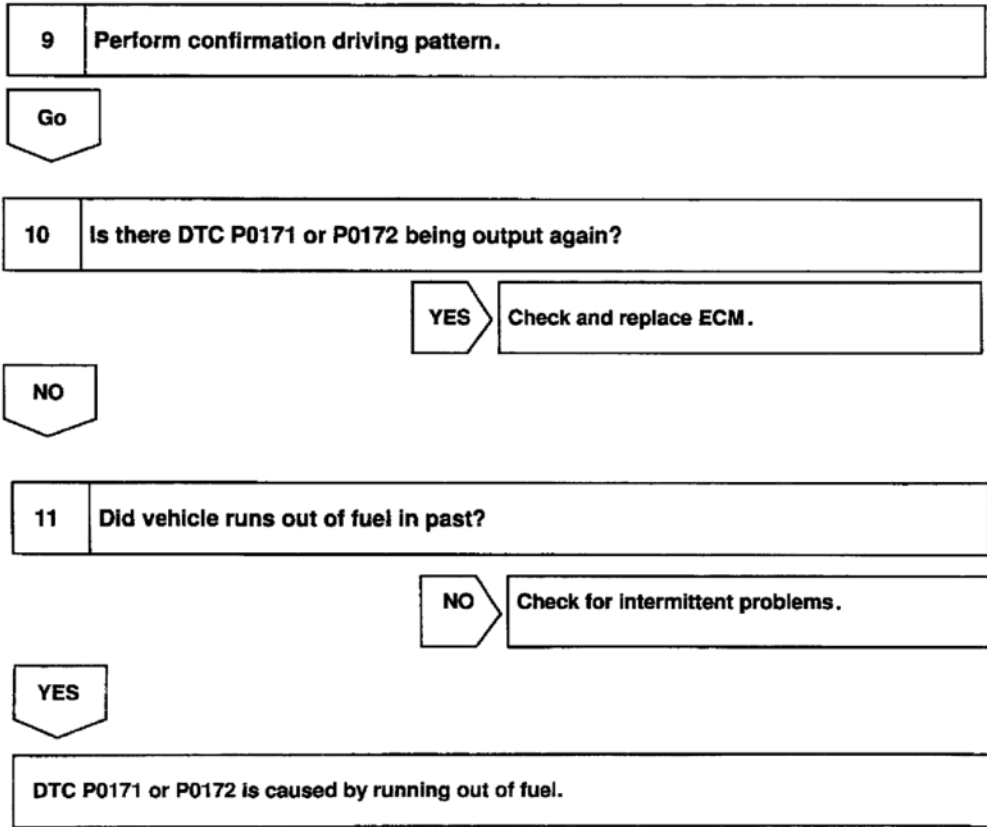
NG

8 Check for open and short in harness and connector between ECM and A/F sensors (bank 1, 2 sensor 1).

NG → Repair or replace harness or connector.

OK

Replace A/F sensor.



INSPECTION PROCEDURE

HINT: Read freeze frame data using LEXUS hand-held tester or OBD II scan tool. Because freeze frame records the engine conditions when the 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.