

A/F Sensor Monitor Introduction

A/F Sensor Monitor Summary

As00Q-01

MODEL YEAR APPLICATION TABLE

Use the table below to determine whether the front A/F sensor is used or not on each model.

○: A/F sensor equipped

Engine Family	1996 MY	1997 MY	1998 MY	1999 MY	2000 MY	2001 MY	2002 MY	2003 MY	2004 MY
4A-FE and 7A-FE	–	–	–	–	–	–	–	–	
1AZ-FE and 2AZ-FE	–	–	–	–	–	○	○	○	
5E-FE	–	–	–	–	–	–	–	–	
1FZ-FE	–	–	–	–	–	–	–	–	
1GR-FE	–	–	–	–	–	–	–	○	
2JZ-GE	–	–	–	–	–	–	–	–	
2JZ-GTE	–	–	–	–	–	–	–	–	
1MZ-FE Avalon	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	○	○	○	
1MZ-FE (A/T) Camry	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	○	○	○	
1MZ-FE (M/T) Camry	–	–	–	–	–	–	–	–	
1MZ-FE ES300	–	–	– (Fed.) ○ (Calif.)	○	○	○	○	○	
1MZ-FE Highlander	–	–	–	–	–	○	○	○	
1MZ-FE RX300	–	–	–	○	○	○	○	○	
1MZ-FE Sienna	–	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	○	○	○	
1MZ-FE (A/T) Solara	–	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	○	○	○	
1MZ-FE (M/T) Solara	–	–	–	–	–	–	–	–	
3MZ-FE	–	–	–	–	–	–	–	–	○
1NZ-FE	–	–	–	–	○	○	○	○	
2RZ-FE and 3RZ-FE	–	–	–	–	– (Fed.) ○ (Calif.)	○	○	○	
3S-FE	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	–	–	–	
5S-FE Camry	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	–	–	
5S-FE Celica	–	–	–	–	–	–	–	–	
5S-FNE Camry CNG	–	–	–	–	–	–	–	–	
2TZ-FZE	–	–	–	–	–	–	–	–	
1UZ-FE	–	–	–	–	–	–	–	–	
2UZ-FE	–	–	–	–	–	–	–	–	
3UZ-FE	–	–	–	–	–	–	–	–	
5VZ-FE 4Runner	–	–	–	– (Fed.) ○ (Calif.)	– (Fed.) ○ (Calif.)	○	○	–	
5VZ-FE Others	–	–	–	–	– (Fed.) ○ (Calif.)	○	○	○	
1ZZ-FE	–	–	–	–	–	–	–	–	
2ZZ-GE	–	–	–	–	–	–	–	–	

MONITOR DTC TABLE

DTC		Document Title	See Page
Extended Code	Previous Code		
P0031	P1135	A/F Sensor Heater Monitor De- scription	As-5
P0032			
P0051	P1155		
P0052			
P0135	P1135		
P0155	P1155		
P2195	P1130	A/F Sensor Monitor Description	As-12
P2196			
P2197	P1150		
P2198			
P2237	P1130		
P2238			
P2239			
P2240	P1150		
P2241			
P2242			
P2252	P1130		
P2253			
P2255	P1150		
P2256			
P2A00	P1133	A/F Sensor Slow Response Moni- tor Description	As-22
P2A03	P1153		

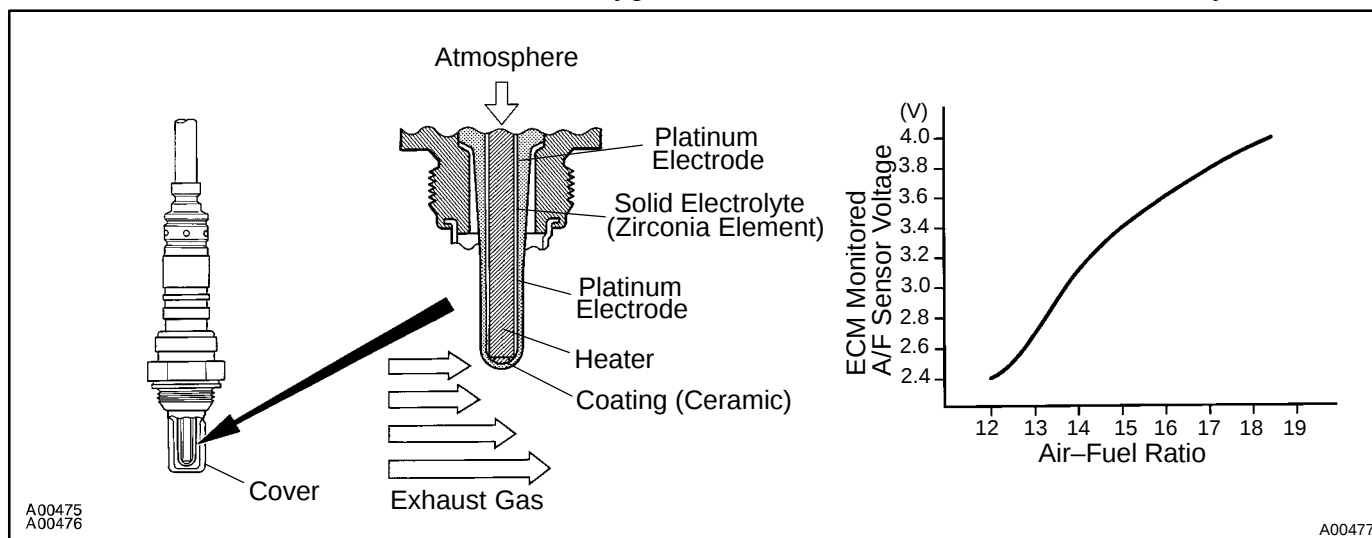
GENERAL DESCRIPTION

The ECM uses A/F sensor information to regulate the air/fuel ratio so that it is close to a stoichiometric ratio. This maximizes the catalytic converter's ability to purify the exhaust emissions. The sensor detects air–fuel ratio in the exhaust emissions and sends this signal to the ECM.

The inner surface of the sensor element is exposed to outside air and the outer surface of the sensor element is exposed to exhaust emissions. The sensor element is made of platinum–coated zirconia and includes an integrated heating element. The A/F sensor has the characteristic of outputting voltage at an approximately proportional rate to the existing air–fuel ratio. Using this A/F sensor output, the ECM can determine the deviation amount from the stoichiometric air–fuel ratio and immediately adjust to proper injection time.

If the A/F sensor is out of order, the ECM is unable to perform an accurate air–fuel ratio adjustment.

The A/F sensor is equipped with a heater which heats the zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temperature of the exhaust emissions is low), the current flows to the heater to heat the sensor so that the oxygen concentration can be detected accurately.



1. A/F Sensor Heater Monitor

When the heater current deviates from the normal operating range, the ECM interprets this as a malfunction in the sensor heater. The ECM will illuminate the MIL and a DTC is set.

2. A/F Sensor Monitor

If the voltage output from the A/F sensor indicates RICH more than 2 seconds even though the voltage output from the rear oxygen sensor does not remain RICH, the ECM will conclude that there is a malfunction in the A/F sensor. The ECM will illuminate the MIL and a DTC is set.

If the sensor voltage output from the A/F sensor indicates LEAN more than 2 seconds even though the voltage output from the rear oxygen sensor does not remain LEAN, the ECM will conclude that there is a malfunction in the A/F sensor. The ECM will illuminate the MIL and a DTC is set.

If the sensor outputs conductance or voltage (depending on model) far from the normal range, the ECM interprets this as an open or short circuit in the A/F sensor or sensor circuit. The ECM will illuminate the MIL and a DTC is set.

3. A/F Sensor Response Monitor

Based on the voltage output variation, the ECM judges whether the air–fuel ratio is RICH or LEAN and adjusts it to be close to the stoichiometric air–fuel ratio. The ECM observes variation in the voltage output from the A/F sensor and compares the compensation. The ECM uses the fuel injection volume (fuel trim) to detect deterioration in the response of the A/F sensor. Normally, the voltage output from the sensor sharply fluctuates in accordance with rapid variation in the air–fuel ratio. This variation in the output voltage is represented as locus length. When the response rate has deteriorated, the locus length becomes shorter as the fluctuation of the output voltage comparatively slow and small. The ECM concludes that there is a malfunction in the A/F sensor when the locus length is short and the response rate has deteriorated.

