
Heated Oxygen Sensor (HO2S) Monitor

The HO2S monitor is an on-board strategy designed to monitor the HO2Ss for concerns or deterioration which can affect emissions. The fuel control or stream 1 HO2S are checked for correct output voltage and response rate. Response rate is the time it takes to switch from lean to rich or rich to lean. Stream 2 HO2Ss are used for catalyst monitoring, and stream 3 HO2Ss used for fore-aft oxygen sensor (FAOS) control are also monitored for correct output voltage. A stream 3 HO2S is only available on the Fusion/Milan 2.3L partial zero emission vehicle (PZEV). Vehicles with universal HO2Ss use the stream 2 sensors for FAOS control. Input is required from the camshaft position (CMP), crankshaft position (CKP), engine coolant temperature (ECT) or cylinder head temperature (CHT), fuel rail pressure temperature (FRPT), fuel tank pressure (FTP), intake air temperature (IAT), mass air flow (MAF), manifold absolute pressure (MAP), and throttle position (TP) sensors and the vehicle speed sensor (VSS) to activate the HO2S monitor. The fuel system monitor and misfire detection monitor must also have completed successfully before the HO2S monitor is enabled.

1. The HO2S senses the oxygen content in the exhaust flow. The typical HO2S outputs a voltage between 0 and 1.0 volt. Lean of stoichiometric, air/fuel ratio of approximately 14.7:1, the HO2S generates a voltage between 0 and 0.45 volt. Rich of stoichiometric, the HO2S generates a voltage between 0.45 and 1.0 volt. The current required to maintain the universal HO2S at 0.45 volt is used by the PCM to calculate the air/fuel ratio. The HO2S monitor evaluates the HO2Ss for correct function.
2. The time between HO2S switches is monitored after vehicle startup and during closed loop fuel conditions. Excessive time between switches or no switches since startup indicates a concern. Since lack of switching concerns can be caused by HO2S concerns or by shifts in the fuel system, DTCs are stored that provide additional information for the lack of switching concern. Different DTCs indicate whether the sensor always indicates lean, rich, or disconnected. The HO2S signal is also monitored for high voltage, in excess of 1.1 volts. An over-voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.

A functional test of the rear HO2Ss (stream 2 or stream 3 [Fusion/Milan 2.3L PZEV]) is done during normal vehicle operation. The peak rich and lean voltages are continuously monitored. Voltages that exceed the calibrated rich and lean thresholds indicate a functional sensor. If the voltages have not exceeded the thresholds after a long period of vehicle operation, the air/fuel ratio may be forced rich or lean in an attempt to get the rear sensor to switch. This situation normally occurs only with a green, less than 804.7 km (500 mi), catalyst. If the sensor does not exceed the rich and lean peak thresholds, a concern is indicated. Also, a rear HO2S response test is done during a deceleration fuel shut-off (DFSO) event. Carrying out the HO2S response test during a DFSSO event helps to isolate a sensor concern from a catalyst concern. The response test monitors how quickly the sensor switches from a rich to lean voltage. It also monitors if there is a delay in the response to the rich or lean condition. If the sensor responds very slowly to the rich to lean voltage switch or is never greater than a rich voltage threshold or less than a lean voltage threshold, a concern is indicated.

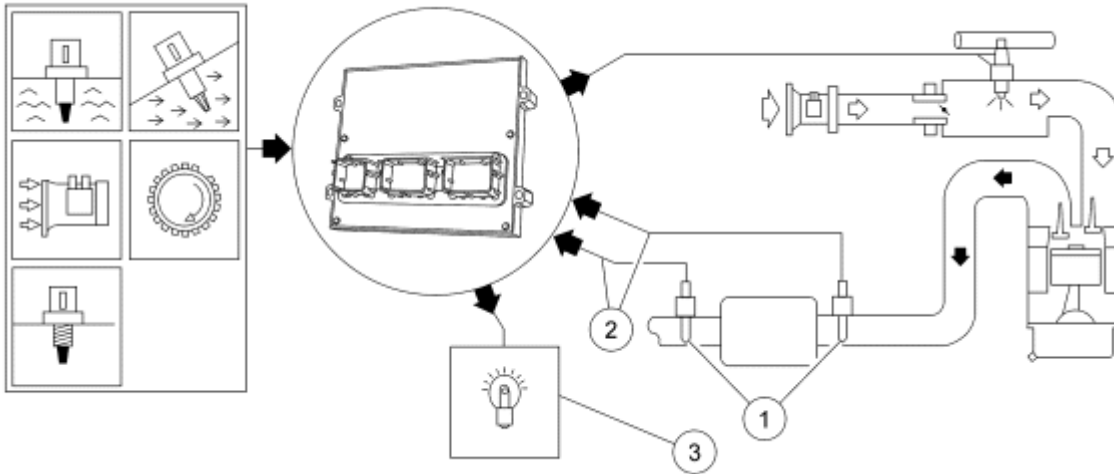
3. The malfunction indicator lamp (MIL) is activated after a concern is detected on two consecutive drive cycles.
4. Some PZEVs use three HO2Ss. The front sensor (HO2S11) is the primary fuel control sensor. The next sensor downstream in the exhaust is used to monitor the light-off catalyst (HO2S12). The last sensor downstream in the exhaust (HO2S13) is used for very long term fuel trim in order to optimize catalyst efficiency (FAOS control).

The HO2S monitor DTCs can be categorized as follows:

- P0030, P0050 - HO2S heater control (universal HO2S)
- P0040, P0041 - Swapped HO2S connectors
- P0053, P0054, P0055, P0059, P0060 - HO2S heater resistance
- P0130, P0150 - HO2S circuit concerns (universal HO2S)
- P0132, P0138, P0144, P0152, P0158 - HO2S circuit high voltage
- P0133, P0139, P0153, P0159 - HO2S slow response rate
- P0134, P0154 - HO2S circuit no activity detected (universal HO2S)
- P0135, P0141, P0155, P0161, P0147 - HO2S heater circuit

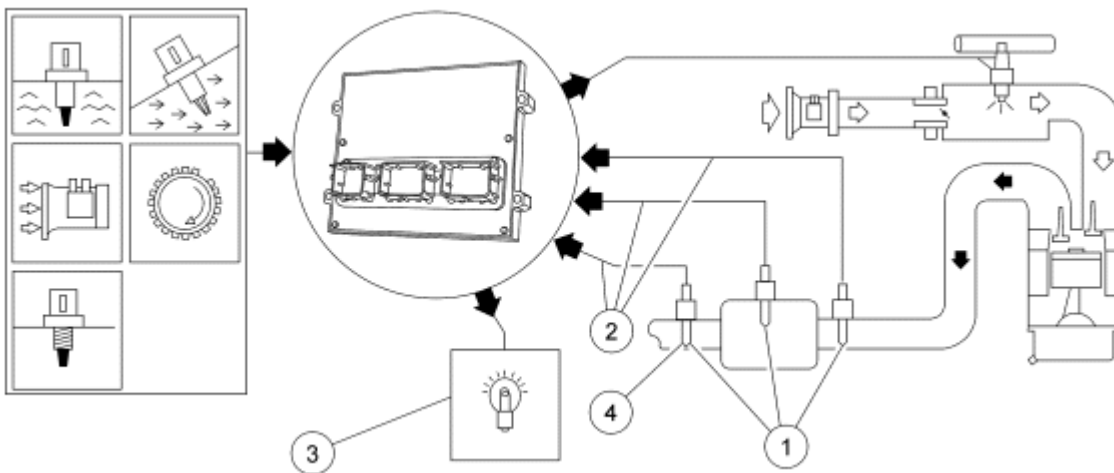
- P013A, P013C, P013E, P0144A - Rear HO2S DFSO response test
- P1127 - Downstream HO2S not running in on-demand self-test
- P2096, P2097, P2098, P2099 - Post-catalyst fuel trim (universal HO2S)
- P2195, P2196, P2197, P2198, P2270, P2271, P2272, P2273, P2274, P2275 - HO2S lack of switching

For applications using a universal HO2S in the upstream or stream 1 position, there are additional DTCs such as heater temperature control, additional circuit diagnostics, lack of movement, and fore/aft sensor catalyst optimization.



N0072957

Heated Oxygen Sensor (HO2S) Monitor — 2 Sensor



N0072958

Heated Oxygen Sensor (HO2S) Monitor — 3 Sensor

