For the specific DTCs required for each system, see table. Systems such as fuel delivery, misfire, and comprehensive components may not be listed in a system status list. These tests run continuously on some vehicles and may not require an indicator.

DTC P0101: MASS AIR FLOW SENSOR PERFORMANCE

NOTE: To locate components, see COMPONENT LOCATIONS . For circuit reference, see WIRING DIAGRAMS article. For connector terminal identification, see CONNECTOR IDENTIFICATION .

Description

The Mass Air Flow (MAF) sensor is an air flow meter that measures the amount of air entering the engine. The Powertrain Control Module (PCM) uses the MAF sensor signal in order to provide the correct fuel delivery for a wide range of engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle. A large quantity of air entering the engine indicates an acceleration or high load condition. The MAF sensor has an ignition 1 voltage circuit, a ground circuit, and a signal circuit. The PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage in order to produce a frequency based on inlet air flow through the sensor bore. The frequency varies around 2000 Hertz at idle to about 11,500 Hertz at maximum engine load. The PCM uses the following sensor inputs in order to calculate a predicted MAF value:

- The Manifold Absolute Pressure (MAP).
- The Intake Air Temperature (IAT).
- The Engine Coolant Temperature (ECT).
- The engine speed (RPM).

The PCM compares the actual MAF sensor frequency signal to the predicted MAF value. This comparison will determine if the signal is stuck based on a lack of variation, or is too low or too high for a given operating condition. DTC P0101 sets if the actual MAF sensor frequency signal is not within a predetermined range of the calculated MAF value.

Conditions For Running DTC

- DTCs P0102, P0103, P0107, P0108, P0112, P0113, P0121, P0122, P0123, P1111, P1112, P1120, P1121, P1122, P1220, and P1221 are not set.
- The engine is running.
- The ignition 1 signal is between 11 volts and 18 volts.
- The Throttle Position (TP) sensor angle is less than 95 percent.
- The change in the TP sensor angle is less than 5 percent.
- The MAP sensor is more than 17 kPa.
- The change in the MAP sensor is less than 3 kPa.
- The conditions are met for 1.5 seconds.

Conditions For Setting DTC

The PCM detects that the actual MAF sensor frequency signal is not within a predetermined range of the calculated MAF value for more than 0.5 seconds.

Action Taken When DTC Sets

- The control module illuminates the Malfunction Indicator Lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions For Clearing MIL/DTC

- The control module turns OFF the Malfunction Indicator Lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers in the diagnostic procedures.

4

This step will determine if the MAP sensor voltage is within the proper range at idle.

5

This step will determine if the MAP sensor responds properly to the change in manifold pressure.

6

This step will determine if the Throttle Position (TP) sensor is operating properly.

7

This step will determine if any mechanical faults have caused this DTC to set.

Diagnostic Procedures

1. Did you perform the Diagnostic System Check-Engine Controls? If yes, go to next step. If no, see **DIAGNOSTIC SYSTEM CHECK - ENGINE CONTROLS** under SELF-DIAGNOSTIC SYSTEM.

2. Start the engine. Monitor the Diagnostic Trouble Code (DTC) Information with the scan tool. Does the scan tool display any other DTCs set? If yes, see **DIAGNOSTIC TROUBLE CODE DEFINITIONS** . If no, go to next step.
3. Observe the Freeze Frame/Failure Records data for this DTC. Turn OFF the ignition for 30 seconds. Start the engine. Operate the vehicle within the Conditions for Running DTC or as close to the Freeze Frame/Failure Records data that you observed. Does the DTC fail this ignition cycle? If yes, go to next step. If no, see **DIAGNOSTIC AIDS** .
4. Allow the engine to reach operating temperature. Observe the MAP sensor voltage with a scan tool. Is the MAP sensor voltage 0.8-4.0 V? If yes, go to next step. If no, see **DTC P0106: MAP SYSTEM PERFORMANCE** .
5. Idle the engine. Observe the MAP sensor kPa with a scan tool. Increase the engine speed slowly to 3000 RPM and then back to idle. Does the MAP sensor kPa change smoothly and gradually through the specified range of the test? If yes, go to next step. If no, see **DTC P0106: MAP SYSTEM PERFORMANCE** .

NOTE: If the vehicle is equipped with Throttle Actuator Control (TAC), proceed to the next step.

6. Turn OFF the ignition. Turn ON the ignition, with the engine OFF. Observe the TP sensor angle from closed throttle to wide open throttle. Depress completely and then release the accelerator pedal. Does the scan tool indicate that the TP sensor angle changed smoothly and completely through 0-100%? If yes, go to next step. If no, see **DTC P0121: TP SENSOR PERFORMANCE** .
7. Inspect for the following conditions:
   - A restricted air intake duct.
   - A collapsed air intake duct.
   - A misaligned air intake duct.
   - A dirty air filter element.
   - A deteriorating air filter element.
   - Any objects blocking the air inlet screen of the MAF sensor.
   - Any debris on the sensing elements of the MAF sensor.
   - Any vacuum leak downstream of the MAF sensor.
   - A poor vacuum connection at the MAP sensor.
   - A restricted exhaust system.

   Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
8. Test for an intermittent and for a poor connection at the MAF sensor. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
9. Replace the MAF sensor. After repairs, go to next step.
10. Clear the DTCs with a scan tool. Turn OFF the ignition for 30 seconds. Start the engine. Operate the vehicle within the Conditions for Running DTC. Does the DTC run and pass? If yes, go to next step. If no, go to step 2 .

11. Observe the stored information, Capture Info with a scan tool. Does the scan tool display any DTCs that you have not diagnosed? If yes, see **DIAGNOSTIC TROUBLE CODE DEFINITIONS** . If no, system is okay.

Diagnostic Aids

Inspect for the following conditions:

1. An incorrectly routed harness. Inspect the harness of the MAF sensor in order to verify that it is not routed too close to the following components:
    - The secondary ignition wires or coils.
    - Any solenoids.
    - Any relays.
    - Any motors.
2. Any excessive deposits on the throttle plate or in the throttle bore.
3. A skewed or stuck TP sensor.
4. A low minimum air rate through the sensor bore may cause this DTC to set at idle or during deceleration. Inspect for any vacuum leaks downstream of the MAF sensor.
5. A wide open throttle acceleration from a stop should cause the MAF sensor g/s display on the scan tool to increase rapidly. This increase should be from 4-7 g/s at idle to 190 g/s or more at the time of the 1-2 shift. If the increase is not observed, inspect for a restriction in the induction system or the exhaust system.
6. The barometric pressure that is used in order to calculate the predicted mass air flow value is initially based on the MAP sensor at key ON. When the engine is running, the MAP sensor value is continually updated near wide open throttle. A skewed MAP sensor will cause the calculated mass air flow value to be inaccurate. The value shown for the MAP sensor display varies with the altitude. With the ignition ON and the engine OFF, 103 kPa is the approximate value near sea level. This value will decrease by approximately 3 kPa for every 1000 feet (305 meters) of altitude.
7. A high resistance on the ground circuit of the MAP sensor may cause this DTC to set.
8. Any loss of vacuum to the MAP sensor may cause this DTC to set.

Condition may be related to aftermarket accessories. If the condition is intermittent, see **INTERMITTENT CONDITIONS** under SELF-DIAGNOSTIC SYSTEM.

The Powertrain Control Module (PCM) supplies 5 volts to the MAP sensor on the 5-volt reference circuit. The PCM also provides a ground on the low reference circuit. The MAP sensor provides a signal to the PCM on the MAP sensor signal circuit which is relative to the pressure changes in the manifold. The PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. The PCM should detect a high signal voltage at a high MAP, such as the ignition is ON, with the engine OFF, or at a Wide Open Throttle (WOT). The MAP sensor is also used in order to determine the Barometric (BARO) pressure. This occurs when the ignition switch is turned ON, with the engine OFF. The BARO reading may also be updated whenever the engine is operated at WOT. The PCM monitors the MAP sensor signal for voltage outside of the normal range. The PCM calculates a predicted value for the MAP sensor based on throttle position and engine speed. The PCM then compares the predicted value to the actual MAP sensor signal. The DTC P0106 will set if the MAP

sensor signal is not within the predicted range. Thoroughly inspect any circuitry that is suspected of causing the intermittent complaint. See under SELF-DIAGNOSTIC SYSTEM. The Powertrain Control Module (PCM) monitors the voltage on the 5-volt reference 1 circuit. If the voltage is out of tolerance, the PCM will set DTC P1635.