P2A03: O2 SENSOR CIRCUIT RANGE/PERFORMANCE BANK 2 SENSOR 1

OVERVIEW

Severity	:	High
DIY Difficulty Level	:	Advanced
Repair Cost	:	**$100-$1690**
Can I Still Drive?	:	**Yes** (Short-term only)

What Does The P2A03 Code Mean?

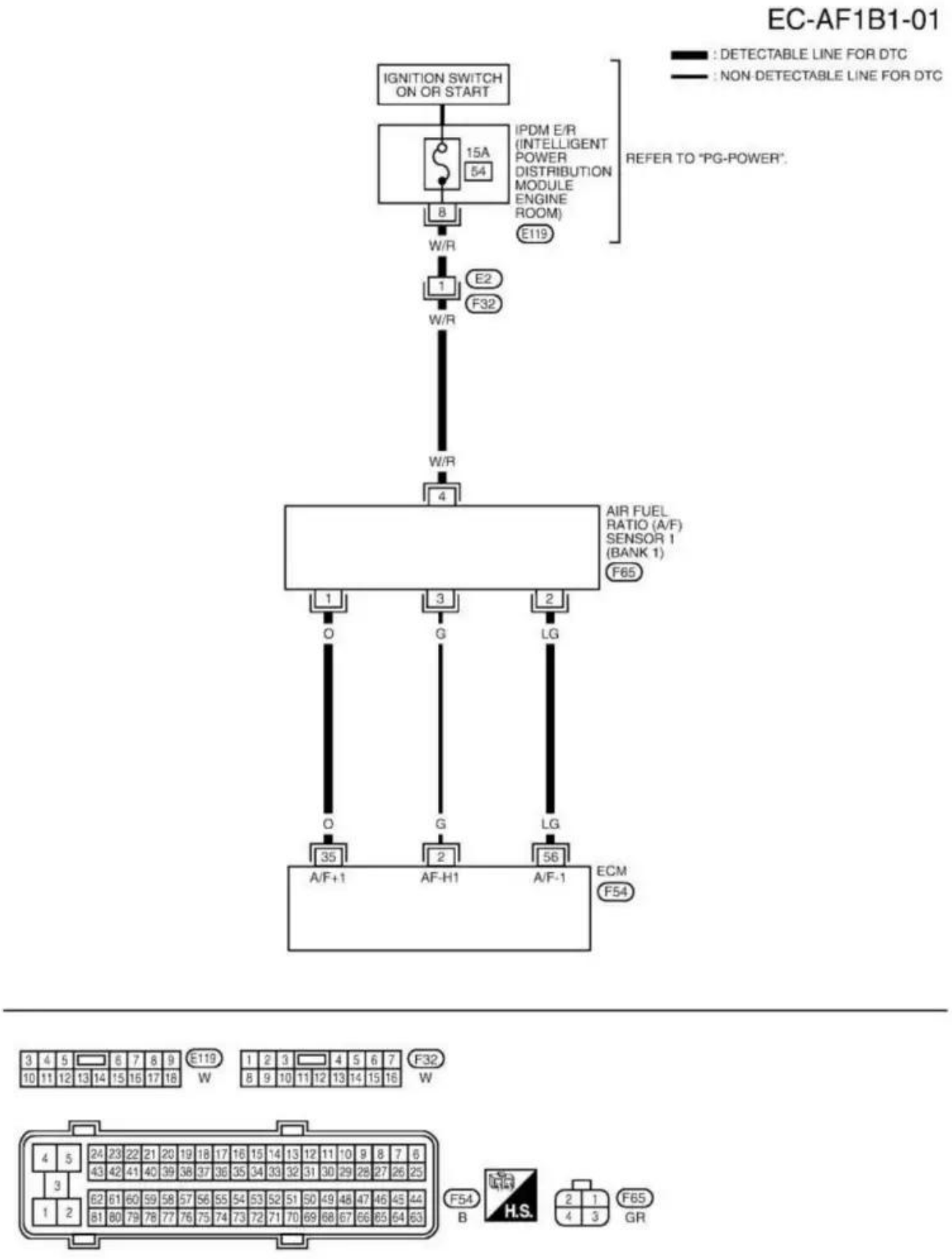
In my experience, when an OBD-II equipped vehicle has stored a P2A03 code, it means that the powertrain control module (PCM) has detected a malfunction in the upstream (or pre catalytic converter) oxygen (O2) sensor or circuit on Bank 2. Bank 2 denotes the bank of the engine that does not contain cylinder #1 and Sensor 1 indicates that the malfunction is related to the upstream sensor.

O2 sensors are made with a zirconium dioxide sensing element protected by a vented steel housing. The sensing element is attached to wire leads in the O2 sensor wiring harness using platinum electrodes. A controller area network (CAN) connects the PCM to the O2 sensor wiring harness. The O2 sensor provides the PCM with data regarding the percentage of oxygen particles in the engine exhaust as compared to the oxygen content of ambient air.

Exhaust gases escape the engine into the exhaust pipe and through the catalytic converter; after passing over the upstream O2 sensor. As exhaust flows through the vent holes in the steel housing and across the sensing element, ambient air is drawn through the wire lead cavities and into a small chamber in the center of the sensor. In the chamber, the ambient air is heated by the exhaust, forcing the oxygen ions to produce (energy) voltage. Variations between the number of oxygen molecules in ambient air (drawn into the O2 sensor) and the concentration of oxygen ions in the spent exhaust gases cause voltage levels to change.

These changes cause the oxygen ions inside the O2 sensor to bounce between platinum layers very rapidly and repetitiously. Voltage variations occur as the rushing oxygen ions bounce between platinum layers. The PCM recognizes these variations in voltage as changes in exhaust oxygen concentration. These changes indicate whether the engine is either running lean (too little fuel) or rich (too much fuel). The voltage signal from the O2 sensor is lower when more oxygen is present in the exhaust (lean condition) and higher when less oxygen is present in the exhaust (rich condition). This data is used by the PCM to calculate fuel delivery and ignition timing strategy.

If the upstream O2 sensor circuit fails to cycle as expected, over a set period of time and under certain programmed circumstances, a P2A03 code will be stored and a malfunction indicator lamp may be illuminated.



P2A03 wiring diagram

What Are The Symptoms Of The P2A03 Code?

Symptoms of a P2A03 code may include:

- Diminished fuel efficiency
- A lack of general engine performance
- Other related diagnostic trouble codes may also be stored
- Service engine soon lamp illumination

What Are The Potential Causes Of The P2A03 Code?

Possible causes for this engine code include:

- A failed O2 sensor on bank 2
- Burnt, broken, or disconnected wiring and/or connectors
- Engine misfires
- Vacuum leaks
- Bad mass air flow or manifold absolute pressure sensor
- Engine exhaust leaks

How Can You Fix The P2A03 Code?

A good starting point is always to check for technical service bulletins (TSB) for your particular vehicle. Your issue may be a known issue with a known fix put out by the manufacturer and can save you time and money during diagnosis.

I would require a diagnostic scanner, digital volt ohmmeter (DVOM), and a reliable vehicle information source to diagnose a code P2A03.

Misfire codes, throttle position sensor codes, manifold air pressure code, and mass air flow sensor codes should be diagnosed and repaired prior to diagnosing a code P2A03. The engine must be running efficiently before a successful diagnosis can be made.

Step-by-step Guide

Professional technicians typically begin with a visual inspection of system wiring harnesses and connectors. Focus on harnesses that are routed near hot exhaust pipes and manifolds, as well as those that are routed near sharp edges like the ones found on exhaust shields.

Proceed by retrieving all stored trouble codes and freeze frame data by connecting the scanner to the vehicle diagnostic port. This information may be helpful if the P2A03 proves to be intermittent, so write it down. Clear the codes and test drive the vehicle to see if the P2A03 is immediately reset.

Should the P2A03 be reset, start the engine and allow it to reach normal operating temperature,

then let it idle (with the transmission in neutral or park). Bring up the scanner data stream and observe O2 sensor input data. Narrow the data stream display to include only pertinent data so you can get a faster data response. If the engine is running efficiently, upstream O2 sensor data should fluctuate regularly between .01 and .09-volts. A P2A03 will be stored if there is little or no fluctuation.

Connect the DVOM test leads to the sensor ground and signal wires in order to monitor live data from the O2 sensor. You may also be use the DVOM to check resistance of the O2 sensor in question, as well as voltage and ground signals. Prior to testing system circuit resistance with the DVOM, disconnect all related controllers.

Additional diagnostic notes:

- Once the PCM has entered closed loop operation, the upstream O2 sensor should cycle regularly between lean, middle, and rich conditions
- Low grade replacement catalytic converters are prone to repeated failure and should be avoided

Severity Description

Since a P2A03 code means that the upstream O2 sensor has failed to input an acceptable signal to the PCM, it should be considered severe.

Reference Sources

P2A03 O2 Sensor Circuit Range/Performance Bank 2 Sensor 1, OBD-Codes.