



# Tech Articles

## O2 Sensor

by Elmer Schild

A sluggish or defective oxygen sensor is a common problem with the Fiero. When not operating properly, many driveability problems will occur. Usually the engine will show some loss of power, and will not seem to respond quickly. A service engine trouble code will usually be set.

Simply defined, the O2 sensor is a "device that detects the amount of oxygen in the exhaust stream". A more detailed definition would be: A device that is mounted in the exhaust system where it can monitor the oxygen content of the exhaust gas. Based on the oxygen content, the sensor (which is usually made of zirconia, a ceramic material) produces a voltage in response to the amount of unused oxygen in the exhaust stream. It does this by comparing the amount of oxygen in the exhaust to the amount of oxygen in the air outside. When the exhaust is lean (excess air), the sensor produces a low voltage (near zero). When the exhaust is rich (excess fuel), it produces a high voltage (up to 1.0 volts). This voltage is sent to the ECM.

All spark combustion engines need the proper air fuel ratio to operate correctly. For gasoline this is 14.7 parts of air to one part of fuel. When the engine has more fuel than needed, all available oxygen is consumed in the cylinder and gasses leaving through the exhaust contain almost no oxygen. The O2 sensor then sends out a voltage greater than 0.45 volts. If the engine is running lean, all fuel is burned, and the extra oxygen leaves the cylinder and flows into the exhaust. In this case, the sensor voltage goes lower than 0.45 volts. Usually the output range seen is 0.2 to 0.7 volts. (The sensor does not begin to generate its full output until it reaches about 600°. Prior to this time the sensor is not conductive and produces no voltage to the ECM). The mid-point is about 0.45 volts. This is neither rich nor lean. A fully warm O2 sensor will not spend any significant time at 0.45 volts. If the ECM senses a steady 0.45 volts, it knows this is an "illegal" value and then judges that the sensor is not operating. At that point, the ECM directs that the engine stay in open loop. Any time an engine is operated in open loop, it runs somewhat rich and makes more exhaust emissions, which translates into lost power, poor fuel economy and air pollution. As a side note, "open loop" simply means that the ECM is using a pre-determined set of values to operate the engine functions. "Closed Loop" means that all sensors including the O2, coolant, and MAP are operational, sending condition data that are read by the ECM which directs the proper fuel mixture command to the injectors for maximum operating efficiency. The O2 sensor is constantly in a state of transition between high and low voltage. Manufacturers call this crossing back & forth of the 0.45 volt mark "O2 cross counts". The higher the number of O2 cross counts, the better the sensor and other parts of the computer control system are working. It is important to remember that the O2 sensor is comparing the amounts of oxygen inside and outside the engine. If the outside of the sensor should become blocked, coated with oil, insulation, undercoating or antifreeze, (among other things), this comparison is not possible. Also, the use of any silicone sealers in the engine, if

not marked "sensor safe", or "low volatile" will also affect the O2 to the point of being inoperative!

### **What codes does an O2 set?**

Generally a defective sensor will set a :

- Code 13..... could be an open circuit (wire from the ECM to sensor, or bad ground from the O2 sensor signal circuit in the ECM.)
- Code 44.....lean exhaust indication- low voltage (below 0.20 volts for 50 seconds or more)
- Code 45.....Rich exhaust indication- high voltage (over 0.48 volts for 50 seconds or more)

Just because there is a code 44 or 45, does not mean that the O2 sensor is bad. A code 44 or 45 could mean problems with the fuel pressure, fuel contamination, EGR, O2 Sensor wire, MAP sensor, exhaust leak, vacuum leak, TPS, etc. Additional testing may be required.

### **Where is the sensor located?**

On the 4 cyl. it is located in the side of the exhaust manifold facing the passenger compartment firewall. On the 6 cyl. it is located in the exhaust downpipe, approx. 6" down from the "Y" connection of the exhaust manifolds.

### **How can I check the sensor?**

Most owners will not be able to check the O2 sensor since it requires a high impedance digital volt meter. Due to the sensor cost, it is simpler to replace it with a new sensor. Automotive parts stores stock these sensors, and their cost is approx. \$25.00. Be sure to use anti-seize compound when installing the replacement sensor. The GM part # for all years, all engines is #25162693. GM retail @ \$32.09, club wholesale only \$22.77.