MIL Eliminator
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I am in no way responsible for what you do on your own time with your own hands to your own car. The following information is provided for informational purposes only. Assume the worst, that the following modification COULD cause damage to your vehicle. If you choose to modify your car it is your own business and I'm not part of the equation.

Introduction

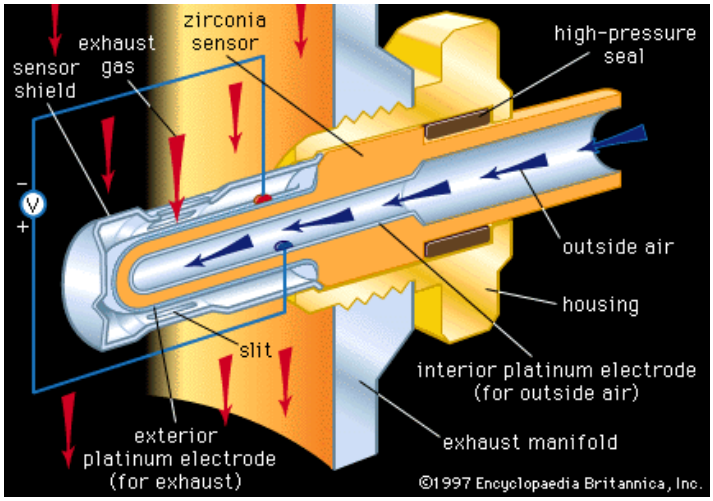
Recently I installed a MAC ProChamber on my '98 Mustang. Since the new exhaust does not have Catalytic Converters this generates an error code in the computer which causes the check engine light to come on. This does not really hurt anything since the code just reports that the cats are not functioning properly. However, staring at the check engine light can be a little worrisome since you do not know if anything else may be trying to trip the light. The light also shines like the sun in your face at night.

Dallas Mustang does sell a set of Mil (Malfunction Indicator Light) Eliminators which will get rid of this light for $70. What these do are simulate a pair of working cats so that the computer does not trip the code. After doing some research I decided to make these on my own. I figured I could keep the cost down to a more reasonable level by figuring it out myself. It turns out that I was right, since Dallas Mustang is the only available source for these parts they can charge whatever they want, but in reality the Mil Eliminators can be constructed for under $6 a set. Here I intend to provide you with the information you need to create your own set of MIL Eliminators.

About the O2 Sensor

Building a set of Mil Eliminators gave me a chance to learn quite a bit about the emissions system of my car. Before proceeding I would like to share that information with you so that you can become more familiar with these mysterious o2 sensors.

The O2 sensor can be considered a small battery that has an operating range of 0 to 1 volt when fully warmed up to 600°F. Its voltage depends on the amount of oxygen in the exhaust stream.



All O2 sensors are vented to the atmosphere which contains Approximately 21% oxygen. The exhaust of a gasoline Powered engine typically contains up to 2% oxygen. The Sensor's output voltage depends on the oxygen content of the exhaust stream. That is, if the exhaust has 2% oxygen, it is lean. This produces a low voltage, below .3 volt (300 millivolts). If the exhaust has near 0% oxygen, it is rich. This produces a high voltage, above .6 volt (600 millivolts). These voltages are sent to the computer and it reacts by adjusting the air/fuel ratio. This is commonly known as the O2 feedback system and when this system is operating it is said to be in "closed loop". When it is not operating, meaning the computer is not reading and responding to the oxygen sensor, it is said to be in "open loop".

Keep in mind that the computer uses all the sensors to control timing, fuel mixture, and emission systems. The O2 sensor as an input is used by the computer to keep the mixture as balanced as possible. When the air/fuel ratio is "balanced" it is at 14.7 parts of air to 1 part of fuel by weight. That means that for every pound of gasoline the engine burns, it will need 14.7 pounds of air. Keep in mind that oxygen occupies only 21% of the total air volume needed by the engine. The term "stoichiometric" is the term referring to the point at which the catalytic converter can be at its maximum efficiency when converting the three major pollutants (CO, HC, NOX) into harmless emissions (CO2, H2O, N, H).

The computer can only use the sensor's output information under certain conditions. First, the sensor must be hot to produce a normal signal. (600°F). This is why most sensors today have built-in heaters to counteract the cooling effects of prolonged idling and to achieve closed loop mode sooner during warm-up. Heating the sensor also keeps it cleaner and extends its life considerably. The heater usually gets voltage from a constant "key-on" source like the fuel pump relay or a fuse. This is what the second and third wires are for on today's sensors. By the way, the late model Chrysler products are now using 4 wire O2 sensors. The four Wires are; O2 sensor output, O2 sensor ground, 12 volt heater feed, and heater ground. On 3 wire sensors, the O2 sensor grounds through its case and doesn't require a separate ground wire

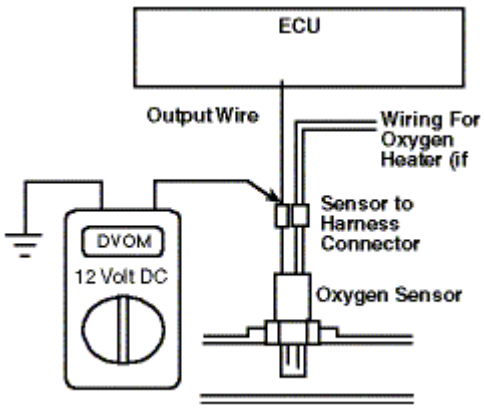
Secondly, the computer is programmed not to go into closed loop operation until the coolant temperature sensor tells the computer the engine is warmed up. If the system tries to go into closed loop too early in the warm-up period, the leaning effect of the system would cause driveability problems and pollutants.

Thirdly, the computer is also programmed to ignore the O2 sensor at near wide open throttle conditions. Maximum power requires maximum enrichment.

Also, some manufacturers have a built-in time delay. For example, on some GM models, closed loop is delayed for 1 to 2 minutes every time the car starts. This allows engine stabilization to take place before the engine goes into closed loop.

We can then conclude from the open loop conditions above that O2 sensor feedback is used when the engine is warmed up, at Idle, and at part throttle (cruise) conditions.

In order to read the O2 sensor, most computers send out a certain voltage to the output terminal of the sensor. This is typically around 450 millivolts. Since we know that the sensor sends low voltage (under 300mv) when a lean condition is present and a high voltage (over 600mv) when a rich condition is present, the computer can count the number of times the sensor crosses the 450mv mark. Cross-counts are the number of times an O2 sensor crosses 450mv. A scanner can "look" at this for you.



Even though you can't see the number of cross-counts without a scanner, you can use a digital voltmeter to watch the open/closed loop system operate. Just connect your meter as Illustrated above, while the O2 sensor is still connected, and start-up the car.

Caution: Do not ground the output wire of the sensor. This can damage the sensor and your readings will be erroneous.

When the car starts (cold), you should see approximately .450 Volt (450mv) on the O2 output wire. This reading often varies slightly. The system is now in open loop.

After a few minutes (less if the engine is warm or the O2 Sensor is heated), this reading should begin to fluctuate. You will see changing numbers ranging from near 0 volt to near 1 Volt. If these readings occur, everything is ok. The O2 sensor's output should vary relatively quickly. A lazy sensor, would show up here and the readings will vary slowly. If the readings don't start to vary (stay in open loop), you now are aware of it and can begin to look for the reason.

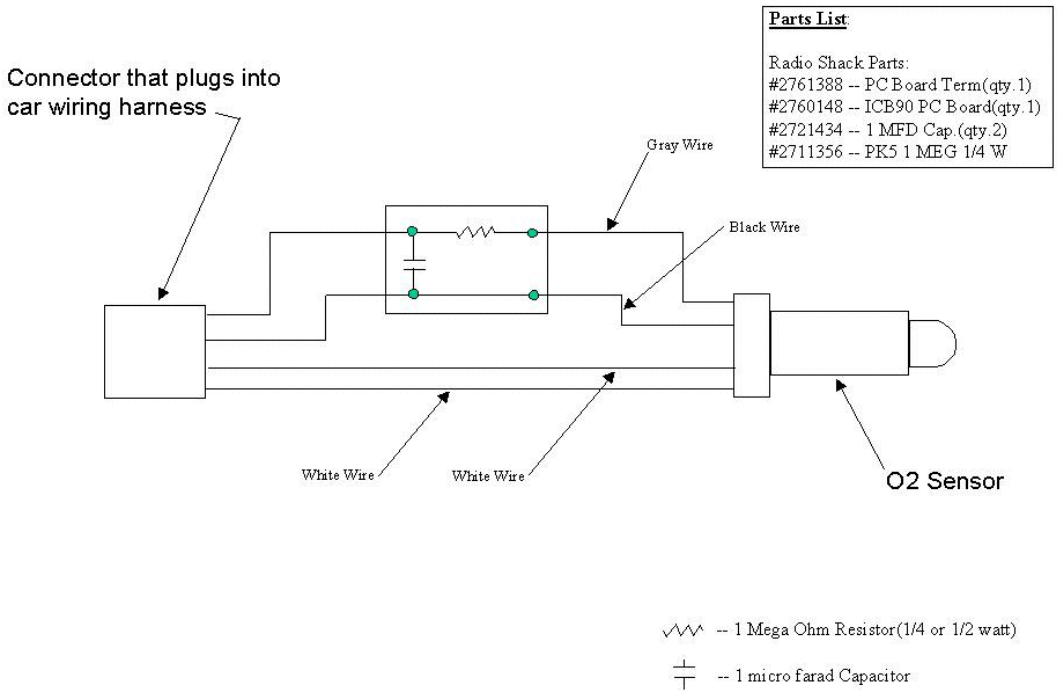
Building Mil Eliminators

After absorbing the previous information we can now see how easy it would be to create some Mil Eliminators. There are four o2 sensors on the car, two before the cats and two after. The two o2 sensors after the cats are the ones that are used to read emisions, and they are the ones that we need to change to make the MIL light go off. The o2 sensor on my Mustang is a 4 wire type sensor. The four wires are the following:

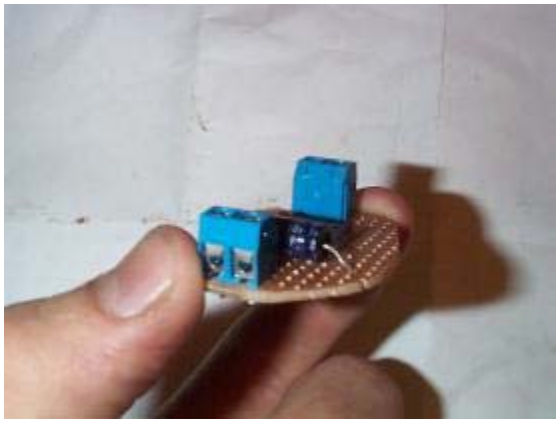
- White Wire - 12V Heater +
- White Wire - Heater Ground
- Grey Wire - Output Signal
- Black Wire - 450 millivolts reference signal sent from the computer

We know that after the cats the mixture should be lean (because the cats function is to burn up any excess fuel that the engine did not) so all we have to do is make the Output Signal sense a low voltage (under 300mv) reading and oscillate the reading to make it look like a working o2 sensor. This can be done via the following painfully simple circuit:

Schematic (Electrical Blueprint) of the Mil Eliminator:



Assemble the components on the project board and trim it to fit, then connect the wires from the o2 sensor to the correct inputs on the circuit. Reinstall your o2 sensors and reset the computer (disconnect the battery for 5 - 10 minutes) and you should be MIL light free.



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