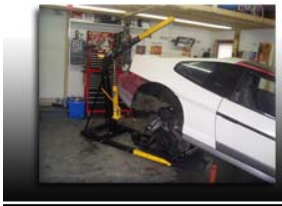

Tech Articles

MAP Sensor

Stock Fieros engines utilize a MAP or Manifold Absolute Pressure sensor. The MAP sensor has 5-volt reference and ground inputs and in turn outputs a voltage signal between 0 and 5 volts depending on the pressure it senses. This sensor is responsible for measuring the pressure in the intake manifold relative to atmospheric pressure. When the pressure it senses is lower than atmospheric pressure (vacuum), the sensor will output a lower voltage. As the pressure it senses rises to match atmospheric pressure (vacuum drops), the voltage output of this sensor rises. This sensor also doubles as a barometric pressure sensor. When you turn the key on before starting the engine, the ECM takes the reading off the MAP sensor and uses that to calculate barometric pressure. The ECM uses barometric pressure as the basis for calculating fuel and spark delivery to the engine.

When the engine is started, the ECM uses the MAP sensor readings to determine engine load. This is the primary sensor it uses to determine fuel and spark delivery to the engine. The MAP sensor reading is factored in with engine RPM to calculate volumetric efficiency. This is known as speed density (engine speed and density of the air charge). Volumetric efficiency (VE) is the term used to describe the amount of air an engine is ingesting vs. the amount of air it can actually hold, expressed in a percentage. If the engine is ingesting the maximum amount of air it can hold, then that engine is considered to be operating at 100% VE. Most naturally aspirated engines never see 100% VE; but engines using specially tuned intake manifolds can accomplish this. Of course this can also be accomplished and exceeded with a turbo or supercharger by adding boost. Most naturally aspirated engines typically see up to 80-90% VE without a tuned intake design.

Obviously if there is a problem with the MAP sensor, or the vacuum/pressure readings it is getting are not accurate, this is going to greatly affect the way the engine runs. GM MAP sensors aren't easily prone to failure, but I have seen them fail if exposed to great pressures such as what could occur if the engine backfired thru the intake. The most common situation that I see that can cause issues with the MAP sensor is a vacuum leak. Any kind of vacuum leak will cause the pressure levels the MAP sensor sees to be lower than expected. This tends to cause the air/fuel mixture to go rich (because the ECM thinks the engine is under a load).

There are two trouble codes associated with the MAP sensor. A code 33 will set if the MAP sensor output voltage is higher than expected (indicating low vacuum) and a code 34 will set if the MAP sensor output voltage is lower than expected (indicating high vacuum). As with any trouble code detected, you should not assume the presence of either one of these codes indicates the MAP sensor itself is bad. All electrical and vacuum connections to the MAP sensor should be verified before replacing the part. To give a couple examples of what to look for should you get a code 33 would be a vacuum leak, mechanical issue with the engine causing very low vacuum levels, or an electrical problem between the sensor and ECM. If you are getting a code 34 you should look for a collapsed or blocked vacuum line going to the MAP sensor or electrical problem between the ECM and sensor. Normal output voltage of a MAP sensor should be about 4.5 volts or so with key on, engine off; and less than 1.5 volts with engine running at idle. At full throttle you should see MAP output voltage above 4 volts. If there is a fault with the MAP sensor or the readings the ECM is getting from it are incorrect, the engine will most likely run very poorly, lack power, hesitate, backfire, or surge. Basically overall engine operation will most likely be unstable.

The stock MAP sensor used on Fiero engines is what as known as a 1-bar MAP sensor. This means the sensor is designed to read up to 1-bar of atmospheric pressure difference. Applications using a turbo or supercharger may have a 2- or 3-bar MAP sensor. A 2-bar MAP sensor will read up to 2-bars of atmospheric pressure difference, and a 3-bar will read up to 3. But all of these sensors must still operate within the same voltage output specs as a 1-bar. So in order to accomplish this, the output voltage must be scaled accordingly. This means the output voltage of a 2-bar map sensor with the key on and engine off is going to be somewhere around 2.5 volts. You cannot mix and match 1, 2, and 3 bar MAP sensors. The computer must be programmed to work with whatever type of MAP sensor you are using, or the fuel and spark delivery will not be correct (and trouble codes may set).

IAT Sensor

If present, the Intake Air Temp (IAT) sensor (aka: MAT – Manifold Air Temp) is used by the ECM to tell it the temperature of the air coming into the engine. The ECM uses this input to aid in the calculation of fuel and spark delivery. The IAT sensor is a simple thermistor, which means its resistance changes based on its temperature. The ECM supplies the IAT sensor with a ground and a reference signal. The IAT sensor pulls down (towards ground) the

reference signal based on temperature and the ECM looks at this to calculate temperature. High resistance equates to less reference voltage pull down which the computer interprets as low temperature while low resistance equates to more reference voltage pull down which the computer interprets as high temperature. The actual amount of impact this sensor has on engine operation is relatively minor, depending on programming. Most stock programming I have looked at doesn't adjust fuel or timing much at all based on IAT sensor readings. Most TBI-type fuel injection systems do not use an IAT sensor.

Two trouble codes are associated with the IAT sensor. A code 23 indicates the intake air temp reading is lower than expected. If this code is present, before replacing the sensor you should check for an open circuit to the IAT sensor wiring. A code 25 indicates the intake air temp reading is higher than expected. If this code is present, check IAT signal wire for a short to ground before replacing the sensor. If either code is set, or there is a problem with the IAT sensor, it is unlikely you may notice any running change in the engine. However, in some cases (depending on computer programming) if the ECM is not getting the correct reading from the IAT sensor, it may be altering the spark advance or fuel delivery to the engine incorrectly which may cause some drivability issues such as spark knock (detonation), loss of power, or exhaust odor because of incorrect fuel mixture.

The IAT sensor can be tested using a simple ohmmeter. In order to test this sensor, unplug it from the wiring harness and measure the resistance across its two terminals. The temperature vs. resistance chart is below:

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

MAF Sensor

The MAF or Mass Air Flow sensor (if present) is the main sensor used by the ECM to determine fuel delivery. MAF sensors usually consist of a tube that may or may not contain passages but all types contain some kind of sensing element. The MAF sensor is usually installed in the induction system close to the engine or might even be part of the throttle body. Most MAF sensors calculate airflow depending on temperature changes detected by its sensing elements using its internal circuitry. In turn the sensor outputs a signal to the ECM that is used to determine airflow and calculate engine load. Most modern MAF sensors output a varying frequency signal, which can only be accurately measured using specialized testing equipment, such as a lab waveform scope.

Most computer systems utilizing MAF sensors tend to use this sensor as the main input for calculations that determine fuel and spark delivery to the engine. However, in some pre-OBD2 and early OBD-2 applications where both a MAP and MAF sensor are present, the computer may be using the MAF sensor to only determine fuel delivery while it uses the MAP sensor to determine spark advance. But in other applications (such as later OBD-2) the MAP sensor is primarily used as a backup should the MAF sensor fail; while the MAF sensor is the primary device used by the ECM to calculate fuel and spark delivery to the engine. Most modern MAF sensors also contain an IAT sensor.

Like the MAP sensor, if a trouble code sets for a MAF sensor error, some things must first be checked before replacing the sensor. Leaks in the air induction system or intake manifold can cause the MAF sensor to produce false readings; so can faulty wiring. MAF sensors that output a frequency signal to the ECM can also give false readings if they are exposed to electromagnetic interference such as what is generated by the ignition system. Output voltage and frequency specs differ depending on application and type of MAF sensor used, so refer to the correct service manual information for your specific testing procedures.

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