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MPFI / TPI INSTALLATION INSTRUCTIONS

Congratulations on the purchase of your AFI MPFI system. These instructions which follow are intended to give you the most information possible to install your MPFI system. Please read through the instructions completely before beginning your installation. Many questions that you may have are covered within the following pages.

Verify that all of the components are included in your shipment.

1. Wiring Harness
2. ECM with specially calibrated chip (the chip is already installed in the ECM).
3. Fuel Pump
4. Throttle Body
5. Intake Manifold with injectors and fuel rail.
6. Fuel Pressure Regulator
7. ECT sensor (Engine Coolant Temp)
8. IAT sensor (Intake Air Temp, this is the same type sensor as the ECT)
9. MAP Sensor (Manifold Absolute Pressure)
10. O2 Sensor with exhaust ring for installation (not included with Marine applications)
11. VSS Vehicle Speed Sensor (optional)
12. EGR Solenoid (if requested)
13. Knock Sensor (if requested)
14. Adapter Plate (if needed for some MPFI units)
15. Fan Relay (if requested)
16. Fuel Pump Relay
17. Fuse Link for overall circuit protection
18. Power Relay
19. Distributor

If you are purchasing just a harness these instructions are also included as a reference. Not all of the above parts are included with a harness or transplant kit.

NOTE: **THIS IS A CUSTOM FUEL INJECTION SYSTEM BUILT FOR YOUR VEHICLE. AS WITH ALL CUSTOM PROJECTS SOME FABRICATION MAY BE REQUIRED. THERE MAY ALSO BE SOMED SMALL PARTS REQUIRED THAT ARE NOT INCLUDED WITH YOUR SYSTEM.**

NOTE: THE PINK WIRE (IGNITION WIRE) MUST BE HOOKED UP CORRECTLY FOR THE SYSTEM TO OPERATE PROPERLY. PLEASE READ THE INSTRUCTIONS CAREFULLY AND THOROUGHLY.

ECM the ECM is the central unit of the fuel injection system. This unit provides the signals that trigger the injectors and deliver the proper spark for the ignition. The ECM is to be mounted inside of the vehicle preferably behind the dash. In many cases this is mounted in the glove box area either in spare space, or even mounted to the glove box itself. The ECM should be mounted so that it does not move around in the vehicle. It can be mounted with brackets, bolts, Velcro etc. Weatherproof ECM units do not require installation inside of the vehicle.

WIRING HARNESS

The wiring harness included with this kit has been specially built for your specific application. This harness includes only the connectors and leads that are required to run your particular engine based upon what you have ordered. Therefore if something is left over, the system may not have been put together correctly. Each connector will be marked with a label to the correct sensor that it is to be connected too. We will also describe in the text to follow, each sensor and the connector that attaches to it. The wiring harness is fabricated to only allow the proper sensor to be hooked up to the proper connector. The "keying" of the connector will not allow for an improper connection.

A wire labeled "A/C" may be included on your wire harness. If your vehicle is equipped with Air Conditioning this wire is spliced into the power side of the A/C clutch. This enables an RPM increase to compensate for the load of the A/C unit. If requested this same line can be used for an onboard compressor or winch. If so equipped, this wire can be connected directly to the power side of the winch or compressor to serve the same function as the A/C line. This must be requested in advance so that the calibration chip can be set up accordingly for this purpose. A dash mounted switched 12 v source can also be used with this wire. The switch would provide 12v to this wire providing the same condition. Make sure that the switch is turned off before normal driving operation.

Fuse Protection- An orange fuse holder is included with your kit. This fuse is for protection to your vehicle and components in case of a wire grounding out or some sort of malfunction. This holder can be installed at the termination end of the Red battery wire if you are not attaching this wire to an already fused or circuit breaker voltage source.

The PINK wire needs to be attached to an Ignition 1 (battery power only with key on) power source, insure that this is an ignition 1 source. An ignition 1 source is 12volts available any time that the key is not in the off position. Also this PINK wire has to have 12V while the vehicle is in the cranking mode (starting). This means the wire will have power when the key is on, or start, or back to on. Usually this wire can be taken from the

power side of the coil (+) or the power from the old distributor or the fuse box. The system will not work if power is not provided to the (PINK) ignition wire while cranking.

The red wire is to be connected to a direct battery lead which has 12v always feeding it; a direct connection to the battery is the most desirable. It is important that these wires are connected to the indicated source or your fuel injection system will not operate properly. The supplied fuse link or equivalent is required for proper circuit protection.

It is very important that the ECM and components be supplied with proper voltage all the time.

IMPORTANT NOTE: Single wire alternators do not work well with fuel injection systems. ***We do not recommend or provide support for vehicles equipped with single wire alternators such as described above.*** Many people like to use single wire GM Delco alternators. These alternators need to see elevated engine RPMs before they begin to charge. If you are using this type of single wire alternator, beware that you may not have the proper voltage provided to your system on initial start-up. Simply blipping the throttle will bring you up to proper voltage. We do not recommend these types of single wire alternators for fuel injection applications.

A hole needs to be drilled into your firewall to allow the harness to pass from the dash area to engine area. In some cases there may already be a hole that can be used to pass the harness through. If this is the case then use and seal up the hole appropriately. If you need to drill a hole this hole needs to be approx. 1 1/2", or whatever size you need to fill with a grommet when sealing up.

Pass the engine connector ends of the harness through the hole in the firewall or through the glove box first if mounting there.

The fuel pump wire can also go through the firewall or be run inside of the vehicle to the rear of the vehicle area for hook up. This would require a small hole in the floor pan someplace. Ensure that you have insulated it so that it cannot be grounded out to the body. It is advisable to hold off permanently placing your harness until all of the sensors and ECM have been connected.

The fuel pump relay is part of the harness on the inside of the vehicle. This relay should be mounted in a location that will keep it from moving around in the vehicle. This relay is the same type relay as the power relay with fuse protection.

Included also is a power relay. This relay is used to ensure proper voltage is supplied to your system on any vehicle. Some vehicles have insufficient wiring to operate a fuel injection system. This relay connects to Ign. 1 feed to power up the relay (pink wire you connected above), and the input to the relay is battery powered. This battery lead is labeled and can be attached directly to the battery, the starter solenoid, or any other appropriate full

time 12-volt supply. We have included a length of wire long enough to choose your own connection option.

An ALDL connector is another extension of the harness mounted inside of the vehicle. This connector is a two-row rectangular connector with mounting tabs on it. This is usually mounted under the dash, and available for diagnostics and scan tool hook up. This can be hooked up to a GM scan tool to monitor the sensors and retrieve trouble codes. You can use an early 90's GM TPI definition for proper operation. If you have access to a scan tool use a hook up for a 1990 350 cu. in. 5.7L Camaro. For some scan tools enter VIN 10th "L" 3rd "1" 8th "F".

A wire is also provided which is connected to a check engine light. This light can be mounted in the dash, use an empty "idiot light" socket in the instrument panel, or mounted in a small bracket under the dash. It should be mounted in an area noticeable in case of any malfunctions. The wire from the ECM is the ground for the light. When a fault exists, or the system is in diagnostic mode, or the engine is not running with the key on, the light is illuminated. The other side of the light requires a 12v ignition feed that you need to supply from the fuse box, or other source.

The harness has been designed to pass under the plenum of the manifold. This allows for a better looking underhood package while maintaining all of the necessary connections. The harness will be marked as to which side of the engine the injectors are connected to. It does not make any difference which side they are hooked up to, but the harness may not reach properly if not hooked up to its design intent.

FUEL PUMP An external fuel pump may have been included with your MPFI system. This pump delivers a constant high pressure to the fuel rail where it is regulated down to 35-45 psi, and returned to the fuel tank. This pump should be mounted to the frame or body of your vehicle in an area that will be protected from the elements as best as possible. The fuel pump should be mounted below the fuel tank fuel level for the pump to work properly. If necessary put a cover over it to keep the environment away from the pump. A fuel filter is to be installed in the fuel line **PRIOR** to the fuel pump. Premature failure of the pump can be the result of improper fuel filter installation. The fuel filter supplied is sufficient for proper filtering of the fuel. Some aftermarket high density fuel filters can cause a large drop in fuel pressure under load and are not recommended for use with your system. If you are using one of these types of filters insure that you have proper fuel pressure during all modes of operation.

Recent fuel pump installations have kept the vehicle's mechanical fuel pump intact and used it as scavenger pump for the electric fuel pump. With this type of installation the electric fuel pump can be mounted in any location that you would choose, as a constant fuel flow is available for the electric pump. Ensure that the fuel filter is still installed between the mechanical and the electric pump if you choose this type of fuel pump installation.

A 12 Ga. pink wire labeled "Fuel Pump", with sufficient length has been included with the wiring harness for the pump power feed. This wire comes from the fuel pump relay, which is mounted on the inside of the vehicle. ***Very important*** for proper operation of the fuel pump is the mounting and the ground. A ground wire is to be attached to a good clean body ground or run back to a battery ground. An improper ground will result in insufficient fuel flow and or premature pump failure. Mount the fuel pump in the rubber brackets supplied or similar, to keep the pump noise from radiating into the vehicle. You can use the mounting screws supplied with the pump, or supply your own to ensure proper mounting. You may want to "prime" the fuel feed line with gasoline to aid in the priming of the pump for proper operation.

FUEL LINES

An MPFI fuel injection system requires two fuel lines for proper operation; a feed line and a return line. Some vehicles are built with two lines for this purpose, even with carburetors. If you are starting from scratch, you will need to install both of these lines from the fuel tank to the fuel rail. Usually a 3/8" or a 5/16" line is used for the feed, and a 5/16" or ¼" line for the return. If you do not have a place to return the fuel to the tank within the fuel-sending unit, parts are available to return the fuel into the filler neck tube. Use only fuel line and fittings approved for fuel injection.

INTAKE MANIFOLD AND THROTTLE BODY

The fuel rails and lines for your manifold may have been assembled but have not been tightened down. You will need to tighten each fitting appropriately before you pressurize the system. Install the throttle body on the intake manifold. Install the throttle cable and transmission cable if so equipped. The throttle lever is universal and may require additional brackets to hold the cables and return spring. Ensure that smooth unrestricted movement can be obtained from the accelerator pedal from idle to WOT. Connect the wires to the injector (s), TPS, (Throttle Position Sensor), and IAC (Idle Air Control) valve. Connect a vacuum line to a full vacuum source for the MAP sensor. You can also mount the MAP sensor to the fire wall or other sufficient location. Connect another vacuum line to the fuel pressure regulator. It is important that this line is connected properly or your system will run extremely rich. Plug all vacuum ports not being used, it is critical that there are no vacuum leaks.

Connect fuel lines to the rear of the fuel rail. There are two different fittings for the fuel feed and return. The feed is connected directly to the rail on the drivers side. The return line comes directly off the fuel pressure regulator.

When installing some MPFI or TPI systems an externally mounted fuel pressure regulator is used. If this is the case with your installation there are several fittings to work with. The

small fitting on the top of the regulator is for a full manifold vacuum line. Insure proper fit and no leak installation of the vacuum line for this fitting. The fitting on the side of the regulator body is the connection from the return line of the fuel rail. The bottom fitting is connected to the return line going back to the fuel tank.

ADAPTER PLATE

Some of our MPFI applications use an adapter plate on the intake manifold to adapt a carburetor style intake manifold to the throttle body. Installation of these plates is pretty straight forward but there are some things to be aware of when installing the plate and the throttle body unit. Vacuum leaks are the largest problem facing fuel injection systems and the addition of the adapter plate has the potential of providing more sources for leaks.

Before installing the adapter plate on the engine loosely bolt the throttle body to the adapter plate with the gasket between the throttle body unit and plate. Ensure that the washers are under the bolts that hold down the throttle body and turn the plate over to make sure the bolts do not extend past the bottom of the plate. If the bolts are too long there is the potential of creating a leak between the plate and the intake manifold.

When installing the adapter plate to the intake manifold be careful to not drop anything in the opening when cleaning gasket surfaces.

Lay the adapter on the manifold to get an idea how it fits. Apply a small amount of gasket sealer to both sides of the gasket one at a time. Spread it very thin with your finger to make the gasket appear wet. With the gasket on the adapter slip the adapter bolts supplied through the adapter and gasket to hold them together. Then apply a couple drops of blue loctite to the threads of all bolts. Line up to the intake manifold and start bolts by hand then tighten. The throttle body gasket in many cases should be sufficient to seal but many people have found the gasket sealer treatment as described above to eliminate any problems here as well. Ensure that all is OK with the throttle body and that it has the proper clearances to the intake and other accessories before sealing it down. A small amount of blue loctite should be applied to the bolts attaching the throttle body to the adapter plate. This interface is also a source of vacuum leaks and the use of blue loctite will not allow the bolts to loosen up and will prevent leaks in that location.

ENGINE SENSORS MAP SENSOR

The MAP sensor is a very important part of the fuel injection system. This sensor sends a voltage to the ECM in relation to the amount of vacuum (pressure) the engine is creating. This signal is used in conjunction with the engine speed to infer the amount of air that is being used by the engine. This is what is called a speed/density system. Because fuel control is very dependent upon this signal it is very important to install correctly. This sensor is to be installed as close to the manifold vacuum source as possible. The port on the sensor is to face down, with the vacuum line attached. This vacuum line is to have no

sags or dips and be as short of a length as possible. Some people install this sensor in the center of the firewall towards the cowl, or even under the air cleaner at times. Attention needs to be given to the connection of the vacuum line ensuring no leaks.

COOLANT SENSOR

The coolant sensor is just like it sounds; it sends an electrical signal to the ECM in proportion to the engine coolant temperature. This sensor is to be installed before the thermostat preferably in the intake manifold coolant crossover. In many instances there is an NPT fitting that is plugged that can be used to install the sensor. Connect the twowire connector when installed. Ensure that there are no coolant leaks from the threads of the sensor. It is also important that a continuous flow of coolant is present at the tip of the sensor or a false reading and engine damage can occur.

INTAKE AIR TEMPERATURE SENSOR, the IAT sensor is located at he back of the manifold just below the throttle body or at the bottom of the plenum in a TPI system. This sensor monitors the temp. of the air coming into the engine and adjusts spark and air calculations accordingly.

OXYGEN SENSOR

The oxygen sensor is installed in the exhaust pipe and samples the exhaust to determine if the engine is running rich or lean of 14.7:1 air/fuel ratio. The O2 sensor should be installed as close to the engine as possible. If you are installing headers, the sensor should be installed in the collector. A threaded boss has been included with your kit that needs to be welded into the exhaust pipe to hold the O2 sensor. Placement of this boss should always be in a position that is somewhere between horizontal to vertical. In no instance should the sensor wire be pointed in a position that would be considered facing down. Many muffler shops are equipped to install these sensors if you are looking for someone to install it.

ENGINE GROUND

An eye terminal with 1-3 black wires and labeled “engine ground” needs to be properly attached to the engine block. It is very critical that a proper ground is used for this input to the ECM and that it is mounted to the engine itself. Many people attach this to one of the bolts on the back of the intake manifold; this works fine. ***It is most critical that this is a connection going to a bare grounding surface and not a painted surface. It is a good idea to run an extra ground wire from the negative (-) on the battery to the ground wire coming from the ECM (from the wire harness Engine ground) Make sure that the ground from the engine to the body of the vehicle is intact. An improper ground will not allow the system to operate properly.***

DISTRIBUTOR

Your fuel injection system requires one of several different ways to trigger the ECM and control spark. If you are installing a complete EFI system it will include a distributor. If

this is the case simply install your distributor and plug in the 4-pin connector to the distributor from the wiring harness.

If you are using the small distributor cap system an external coil is required and is not included in your system. A high energy coil rated for electronic ignition needs to be used. A coil that was for an engine with points is not sufficient for a fuel injection system. There will be two more wires required to operate the coil. These two wires are provided and marked "coil – and 12 volts". The wires will be pink and white; the white wire connects to the negative terminal of the coil and the pink wire attaches to 12 volts which can also be taken from the positive side of the coil. Your original engine had a "hot" or "12 volt" wire that was used for the distributor or coil. This wire should be used to power the coil for your fuel injection system.

If you are using an MSD or other after market ignition system without an ECM controlled distributor you will only have control of the fuel for your engine; however your ignition module will provide the trigger to the ECM. Simply hook the tach output from the module to the wire labeled "tach input" on the wiring harness.

If this installation is using an electronic ignition system that is part of your vehicle already, a tach filter will be used. A wire marked "tach input" will be part of your wiring harness and connects to the "-" terminal of the ignition coil or the tach lead of your MSD or Jacobs ignition module as mentioned in the previous paragraph.

FINAL CHECKS AND START UP

After you have finished the above installations you are ready to check the system for operation. Turn the ignition key to the "ON" position, but do not start the vehicle. The fuel pump should turn on for about 2 seconds and then turn off. If this does not happen see #7 below in troubleshooting. Leave the ignition in the "ON" position until the fuel pump has turned off. Turn the ignition off for at least 10 seconds and repeat the ignition cycle. Perform this operation 2 or 3 times to allow fuel to fill the system preparing to start. Inspect all fuel lines and connections to ensure there are no fuel leaks.

For systems supplied with adjustable fuel pressure regulators the fuel pressure needs to be adjusted to 40 psi with the fuel pump running and no vacuum on the regulator. The adjustment screw for the pressure regulator (if equipped) is also where the vacuum line attaches from a full manifold vacuum source.

Assuming no fuel leaks, you are ready to start the engine. Do not press on the accelerator pedal to start the engine. The IAC valve should provide the proper amount of air for the vehicle to start and run. Start the engine and let it idle; it may take a bit to run smoothly. At this point your timing has not been set, the control system has not "learned" the engine and the IAC valve has not learned its proper position. These are all functions of the fuel injection system that happen after the engine has been running.

If you have access to a scan tool use a hook up for a 1990 350 cu. in. 5.7L Camaro. For some scan tools enter VIN 10th "L" 3rd "1" 8th "F".

If you have installed a new distributor or manifold, you will need to set the timing. This is accomplished by disconnecting the single lead wire electrical connector breaking out of the harness near the distributor. With this wire disconnected, set your timing to "6" deg. BTDC. The ECM does all of the timing for you and uses the reference of "6" degrees to properly deliver the correct spark angle. With the set timing wire disconnected, your check engine light will illuminate and set a code "42" EST malfunction. After the timing has been properly set, reconnect the single lead wire and turn the vehicle ignition off. Wait for at least 10 seconds and restart the vehicle. The ECM will not control the timing until the vehicle has been turned off and restarted with the connector in proper position. If you choose you can clear the code "42" by disconnecting the battery lead to the ECM for at least 10 seconds.

If your system is equipped with a tach filter and not using the ECM controlled distributor set ignition timing to the factory specifications for your engine.

Restart the engine and let it idle for a while. Ensure that there are no fuel or vacuum leaks while running and that the idle appears to be controlled by the ECM. The engine speed will be higher while cold and first started and will come down to a base idle on its own. Do not turn the idle adjustment screw on the Throttle Body, this screw is preadjusted and does not need to be tampered with for most standard engines. If the engine will not idle properly check for vacuum leaks, proper timing setting, or a check engine light illuminated. If all of these checks have been made and you are experiencing a problem, please go to the troubleshooting section of this booklet for further assistance.. When you are confident that all is running properly, you may shut it down and complete the remainder of the installation.

Secure any wires that you may choose, ensuring that none of them are close to any exhaust manifolds, cables, etc. You can seal the wiring harness to the firewall at this time when you are confident of the amount of wire required running into the engine compartment. You may want to cut into the plastic loom around the main portion of the wiring harness to seal the grommet to the wires. Depending on how many wires are included with your harness, it may be necessary to tape up the wires in the main portion of the harness to seal to the firewall grommet that you will need to provide.

Install an air cleaner and you should be ready for operation. A standard air cleaner in some instances will not clear the throttle linkage. This will require a spacer to be used between the throttle body and the air cleaner assembly. If you will be operating the vehicle in below freezing temperatures, a heat riser to prevent throttle body freeze up is highly suggested. Ensure that the heat riser is attached so that it allows for warm air only during start up and extremely cold operation, and allows unheated air during all other operations. You can also add a coolant heated base plate which will provide the same result.

Once you have installed your Affordable Fuel Injection system you will enjoy the modern technology of fuel injection system for years to come. You will enjoy a low maintenance system that provides good drivability and adjusts for towing, altitude, severe angles, off roading and other normal drive situations. The biggest advantage of EFI is dependability and drivability. EFI for the most part is relatively maintenance free once installed and working properly. The sensors are robust and provide for many miles of maintenance free operation. EFI also provides seamless drivability. The system takes care of all of your engine functions whether it is –20 deg. Or 100 deg, at sea level or climbing Pikes Peak There is no stalling and waiting for the choke to come off for most stock and slightly modified engines. Drivability is in most cases a given and allows for good response and power in all driving conditions.

Troubleshooting your Fuel Injection System

Most of the problems encountered while installing your fuel injection system or after a time of operation are very simple. If your check engine light is on you more than likely have a hard fault meaning something is grounded out, unplugged or has gone bad. See Below for how to determine what your fault may be and what the codes mean.

If you have installed a Fuel Injection system in your vehicle and are having some initial issues here is a quick checklist to work from to get you started.

1. Check to make sure your check engine light is not on, or that it is on with the key on but the engine is not running.
2. Make sure that the red battery wire is connected to a battery source (It is highly recommended that this wire is connected directly to the battery) and the pink wire is connected to an ignition 1 source. If your ignition wire is not connected to an ignition 1 source your ECM will not be powered while cranking the engine.

Pink Ignition wire MUST be connected to 12 volt switched ignition that receives power during crank and key on.

3. Check that the ground wire is securely fastened to the block and that the interface between the block and the terminal are clean.
4. Insure that there are **NO** vacuum leaks.
5. Insure that your MAP sensor is connected to a full manifold vacuum source and not a ported source.
6. Set the timing correctly making sure that you disconnect the set timing connector to set it. In some cases you cannot set the timing with the connector disconnected and keep the engine running. If this happens set timing to 15 degrees, allow the engine to fully warm up, then disconnect the set timing connector to set the base timing to the correct specification.
7. Insure that you have full manifold vacuum routed to your fuel pressure regulator and there are no vacuum leaks with this connection.
8. Check your fuel pressure to insure that you are getting the proper pressure to the system.

Fuel Pressure is critical for proper operation. Fuel tank must be free from debris and fuel pressure needs to be constant and consistent.

99% of all issues are usually taken care of with one or more of these 8 steps of diagnosis.

First and foremost the engine and fuel injection system must be free from vacuum leaks. Vacuum leaks are the leading cause of installation issues with your fuel injection system. Check all sources of potential vacuum leaks including components not related to the fuel injection system.

There are instances where the vacuum leak is coming from the adapter plate used to attach the throttle body to the manifold. If this is the case make sure that the seal is positive between the manifold and the adapter plate; also between the adapter plate and the throttle body. In some instances it is necessary to seal these with silicone to provide a positive seal.

Another common issue is a lack of good grounding. Many issues have been resolved simply by making sure that the ground path is secure and clean.

Fuel Pressure is critical to the operation of a fuel injection system. Always check to insure that you have the proper fuel pressure. On an MPFI or TPI system the fuel pressure should be between 30 – 40 PSI at idle with the vacuum hose connected to the fuel pressure regulator. A reading from 35-45 PSI is normal with the vacuum disconnected from the regulator.

Fuel pressure on an MPFI system should vary 4-8 PSI from high vacuum to low vacuum conditions.

With retrofit fuel injection systems many times we are drawing fuel from gas tanks that are many years old hence many years have passed where contamination can settle into the fuel tank. The electric fuel pump installed for a fuel injection system is drawing a considerable more volume of fuel from your tank than your old system did. If there are any contaminants in the tank this many times will plug up or greatly restrict the flow of fuel to the system causing many issues.

Your fuel injection system has been pre calibrated to your particular vehicle. As long as the information about your engine was correctly stated, the system as received will provide many years of trouble free use. However from time to time problems are encountered with your fuel injection system. Here are a few commonly asked questions about fuel injection problems. Match the issue # with the chart below for an explanation of the issue.

1. **My engine is running way to rich, what is the problem?**
2. **My engine is running to lean, what is the problem?**
3. **My engine cranks but will not start.**
4. **I do not seem to have as much power as I should?**
5. **I am getting a sag when I accelerate.**
6. **My engine takes longer to start than I think it should.**
7. **The fuel pump is not coming on when I first turn the key on.**
8. **The RPM on my engine does not come down when I come to an idle.**
9. **I am not getting as good of fuel economy as I think I should.**
10. **The engine is reving up and down when I come down to an idle.**
11. **My fuel pump is real noisy.**
12. **My check engine light does not come on when I turn the key on.**

13. My check engine light is flashing fast all the time.
14. My check engine light is on.

1. You may have your MAP sensor connected to a ported vacuum source and not full manifold vacuum. You may have a vacuum leak causing low engine vacuum to the MAP sensor. Your fuel pressure is not set properly or your fuel return line is restricted. On a TBI system your base gasket may be the wrong size or not sealed properly. On an MPFI system you may not have the vacuum line connected or a secure connection to the fuel pressure regulator; this is also a full manifold vacuum source.
2. You will see a recurring theme in these troubleshooting notes and that is vacuum leaks. This is the biggest cause of engines running too lean and should not be taken lightly. Fuel pressure is not coming up to proper pressure. See discussion on fuel pressure in previous paragraphs. Plugged fuel filter; make sure that your fuel tank is not contaminated.

3. Make sure that your distributor is powered up with an ignition 1 source. Ignition 1 provides 12v of power at all times the key is in the on or the crank position. Ensure that the relay and the ECM are receiving power from the battery and an ignition 1 source to the red and pink wires respectively. The battery wire must be connected to a battery source and the ignition wire must be to an ignition 1 source. On TBI units ensure that the crank wire is connected to the crank side of the ignition switch or the crank side of the starter solenoid.
4. Verify that you have set your timing properly by disconnecting the set timing connector, setting the timing to the specified value, reconnecting the connector and shutting the engine off and starting it back up before proceeding. Ensure that your plug wires are properly connected with the correct firing order. Your fuel pressure may be insufficient; see fuel pressure discussion in previous paragraphs. Verify that there are no vacuum leaks and that the MAP sensor is properly connected.

5. Timing is a critical issue with sags. Verify that your timing is correctly set by disconnecting the set timing connector and properly setting the timing; see #4 also. Fuel pressure is not adequate for proper operation, make sure that there is not contamination in the tank or your fuel filter is plugged. A plugged fuel filter may be an indication of a contaminated tank. Bad ground to the block, insure that the surface that you are making the connection to on the block is clean and making a positive connection. Your O2 sensor may be contaminated, bad or not properly installed in the exhaust. You may have left out some of the important specifications for the proper calibration chip to be made.

6. Check that the MAP sensor is properly connected to a full manifold vacuum source. Ensure that the vacuum source to your MAP sensor is free from restrictions and has a secure connection. Check for vacuum leaks, this is the most common cause. Make sure that your timing is set correctly; see #4. Fuel pressure is not adequate for proper operation. See previous paragraph for discussion on fuel pressure and proper operation. Fuel pump relay is not coming on or is faulty. On a TBI system verify that the crank wire is connected to the crank side of the ignition switch or the crank side of the starter solenoid.

7. Your battery and ignition wires are improperly connected. You have not provided a good ground to the fuel pump. Fuel pump relay is not connected. ECM is not properly installed and/or the chip is not properly installed.

8. More than likely you have a large vacuum leak, verify that your system is free from vacuum leaks. Your ignition wire is connected to a battery source and not an ignition 1 source. The engine has not come to full operating temperature as of yet. Your thermostat is inoperable or opens at too low of a temperature. You should be using at least a 180° stat. Throttle cable or throttle on the throttle body is not coming to a complete close. Throttle plate is binding in the throttle bores.

9. If all is set up properly with the installation of your fuel injection system you are probably getting as good of fuel economy as you are going to get. Ensure that your timing is set properly, your thermostat is in good working order and your fuel pressure is at the specified pressure. You may have other factors such as tires, brake drag or other external issue from the fuel injection system that is not working properly. Re-evaluate your driving habits and insure that you are driving in a fashion that will provide you optimum fuel economy. If you are trying to race everyone from the light chances are you will not get the fuel economy that you expect.

10. This is usually an indication of a vacuum leak; again make sure that you have no vacuum leaks. This could also be an indication of the wrong base ignition timing. Verify that you have set your ignition timing correctly (see #4). Your engine may also require more air going through the throttle plates at idle than it is currently set for. Here is a procedure to check this setting. Make sure your engine temperature is at full operating temperature. Jumper Pins A & B of the ALDL connector (I use a paper clip) with the key on but the engine
off. This is the same thing you do when checking for engine codes and your check engine light will flash off and on. Wait about 45 seconds or until any trouble codes present have flashed through; code 12 is normal (see #14) After this then unplug your IAC valve which is on the throttle body. Remove the jumper from the ALDL, turn the key off and then start the engine. It may start hard and you might have to depress the throttle pedal a little bit to start the engine. If you have a fast idle this did not work and you may have to tape over the fresh air hole that the IAC receives it air from. If you do not have a fast idle then it is OK and you can proceed to adjust the throttle plates. Let the engine idle for a little bit and then check you idle speed. The speed should be about 550 – 600 in idle or about 100 rpm less than you requested for your chip. If it is lower than this you can raise the idle up or if it is above this determine if you should bring the speed down. More than likely it will always be lower. There is a little cap on the side of the throttle body by your throttle lever that has an adjustment screw under it. Remove this cap and use the screw under there to adjust your base idle speed without the IAC operational. If you have done all of this and you still have an issue we may not have received all of the proper information to build your chip.

11. If your fuel pump is real noisy you may not have isolated it from the body or the frame real well. Isolation brackets were provided with your fuel pump. If these are properly installed it should isolate any radiated noise from the pump. If this is insufficient you may need to isolate it more with some rubber grommets. We have also diagnosed noisy fuel pumps with fuel return lines being too small. By stepping up the size of the return line you may eliminate fuel pump noise after the other items have been addressed.

12. Your check engine light should illuminate when you turn the key to the on position for a bulb check. If this does not come on it is possible that it is not receiving 12 volts to the one side of the bulb. The wire provide that comes from the ECM provides a ground circuit for the light. You will need to provide a 12 volt ignition source to the other side of the light. Check to ensure that you have 12 volts on one side of the light and that the light is functional. If the light is

functional and you have verified that you have 12 volts provided to one side of the light then the ECM is not operating. Ensure that the fuse for the ECM is OK. If the fuse is OK insure that you are receiving 12 volts to the ECM where indicated (see wiring diagram provided) If you are not receiving 12 volts to the ECM something in the vehicle's power circuit is not connected properly. If 12 volts is available at the proper cavities of the ECM please check that you have a proper ground circuit to the engine block. When all of these steps have been taken the ECM may not be working properly, please contact us for further diagnosis.

13. A constant rapid flashing check engine light indicates that you have a fault in the ECM and it is operating in back up or limp home mode. Make sure that the calibration chip is in the ECM and there are no bent pins on the chip. If the chip is properly installed and there are no bent pins the ECM or the chip is faulty and needs to be replaced or repaired.

14. A check engine light indicates a hard fault with your fuel injection system. Ensure that all of your sensors are connected, you have a good ground and that no wires are pinched. Also insure no vacuum leaks and that your MAP sensor is connected to a full manifold vacuum source. If all of these steps indicate a proper installation and no issues you will need to read the codes from the memory area of the ECM. If you have a scan tool this is very easy. If you do not have a scan tool you can use your check engine light to output the fault codes. Below you will find this procedure along with a definition of all the different fault codes that can be output.

THE CONNECTOR

```
--------tab------------
| F  E  D   C   B   A |
| M  L  K   J   I   H |
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To Display Trouble Codes

Run a wire (I use a paper clip that is in a "U") from Pin A to Pin B with the ignition on but the engine not running. The "Check Engine " light will flash in the following sequence: flash, pause, flash-flash, long pause flash, pause, flash-flash, long pause flash, pause, flash-flash, long pause. This is a code "12" which will always be there. After this series of flashes and pauses any stored trouble codes will now flash. If you do not see the "12" flash three times, your diagnostic circuit is defective.

Some vehicles will display stored trouble codes, then "12" again, followed by energizing "most system controlled relays." The fuel pump relay will not energize. The idle air control valve will fully extend to enable checking minimum idle speed.

Clearning the Trouble Codes

Turn the keyswitch to the off position. To clear any trouble codes, disconnect the battery for 30 seconds or unplug the connectors to the ECM. If this is done at the battery, and your car stereo is equipped and programmed with a four digit pin code, you may have to re-enter that as well to use your stereo again. A better place to remove power is at the fuse.

TROUBLE CODES

12. **No reference pulses to Electronic Control Module (ECM).**

13. **Oxygen sensor signal stays lean during warm engine cruise, your O2 sensor could be unplugged.**
14. **High temperature indicated at engine coolant temp. sensor. Sensor could be unplugged**
15. **Low temperature indicated at engine coolant temp. sensor**

21. High voltage at throttle positon sensor. Sensor could be unplugged.
22. Low voltage at throttle positon sensor
23. Low temperature at manifold air temperature sensor
24. Circuit fault in vehicle speed sensor
25. High temperature at manifold air temperature sensor
29. Fault in 4th gear switch
32. Fault in exhaust gas recirculation valve diagnostic switch
33. High voltage (low vacuum) at MAP sensor.
34. Low voltage (high vacuum) at MAP sensor.
41. Cylinder select error
42. Fault at electronic spark timing circuit (sets when timing is set also, clear code and verify that it does not return.) 43. Low voltage at electronic spark timing circuit
44. Oxygen sensor lean
45. Oxygen sensor rich
46. Fault at vehicle anti-theft system
51. PROM error
52. Low voltage at oil temperature sensor
53. High voltage at battery
54. Low voltage at fuel pump OR Low voltage at Fuel pump relay
55. Problem at Electronic Control Module (ECM) - ECM failure OR Serial bus error
62. High voltage at oil temperature sensor

MPFI WIRE PINOUT

A4 ORANGE MAP SEN. PIN C
A5 ORANGE TPS PIN A ROUND TPS, (FLAT TPS PIN C)
A6 PINK IGN 1 FROM RELAY
A8 BROWN ALDL PIN M
A11 BLUE FUEL PUMP PIN F
A12 BLACK BLOCK GROUND
B1 18" BATTERY CONNECT W/C-16
B5 BLK/WHT TPS RETURN PIN B & (MAT) (FLAT TPS PIN A) B6
BLACK/WHITE PIN A ON MAP& ECT RETURN
B9 BLK/WHT VEHICLE SPEED SEN RETURN B10
PURPLE VEHICLE SPEED SENS INPUT
B11 BROWN VSS OUT TO INSTRUMENT CLUSTER
C7 BLUE DIST BYPASS PIN C (TO SET TIMMING) (PIN B ON SMALL DIST)
C8 TAN DIST SIGNAL PIN A (PIN D SMALL DIST)
C9 GREEN A/C ON
C11 PURPLE INJ. CONTROLS
C12 GREEN INJ CONTROLS
C16 RED BATTERY
D1, D6, D7, ALSO E-15 ALL GO TO BLOCK GROUND
D8 TAN DIST REF PIN B (PIN C SMALL DIST) D9
BLACK/WHITE DIST PIN D (PIN A SMALL DIST)
D12 COLANT REQUEST (if equipped)
D14 GREEN HIGH GEAR INPUT PIN B MALE W/P ON WHITE CONN.
D16 PARK NUTRAL SWITCH

	FLAT	SQUARE
E3 GREEN IAC PIN A		(PIN A)
E4 GREEN IAC PIN D	"	" (PIN B)
E5 BLUE IAC PIN C	"	" (PIN C)
E6 BLUE IAC PINB	"	" (PIN D)

E7 ORANGE CHECK ENGINE LITE
E8 COOLANT FAN RELAY CONTROL (if equipped)
E9 WHITE EGR SOL CONTROL (if equipped)
E12 WHITE PIN B ON ALDL
E13 ORANGE FUEL PUMP RELAY PIN A
E14 PURPLE O/2 SENS
E16 BROWN ECT

F6 PURPLE TORQUE CONVERTER SOLINOID CONTROL PIN D (if equipped)
F9 GREY KNOCK (if equipped)
F13 BROWN TPS PIN C (FLAT TPS PIN B)
F15 BROWN MAP SEN INPUT PIN B

F16 TAN ACT INPUT (MAT)
PIN D ON FUEL PUMP RELAY BLOCK GROUND PIN E ON FUEL PUMP RELAY TO ING.
PIN A ON ALDL TO BLOCK GROUND

RELAY

85 FROM ING SWITCH
86 GROUND
30 12V CONN W/C16
87 ING. OUT