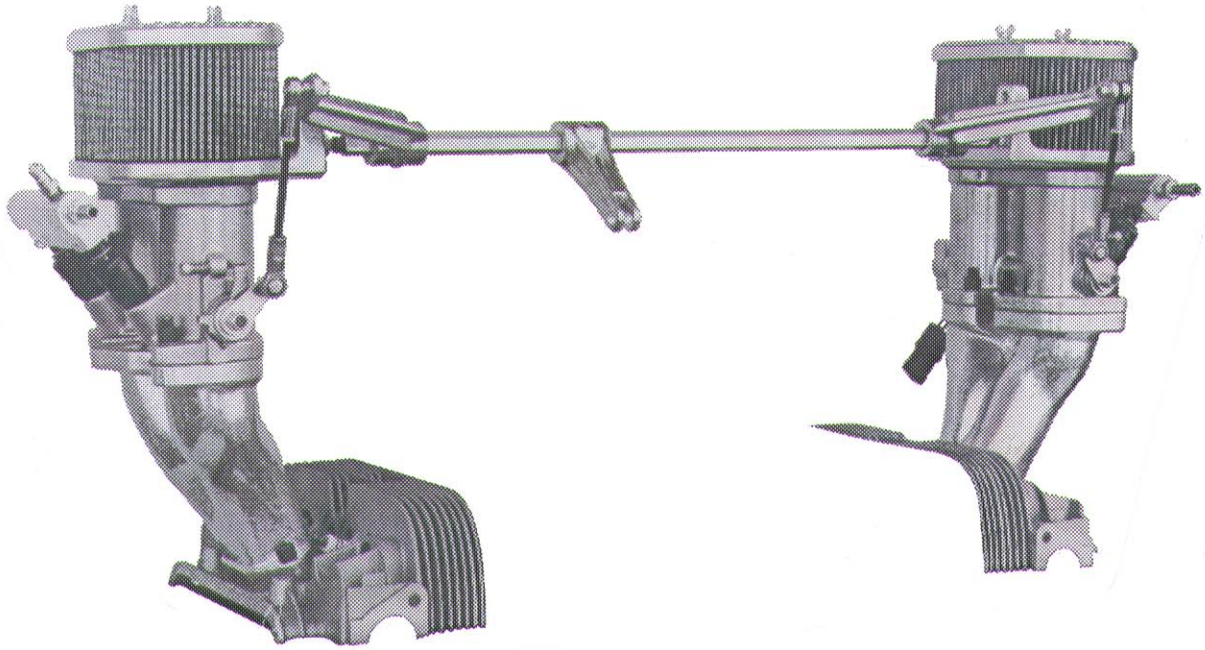
ULTRA COMPETITION
FUEL INJECTION
Installation and Tuning Manual



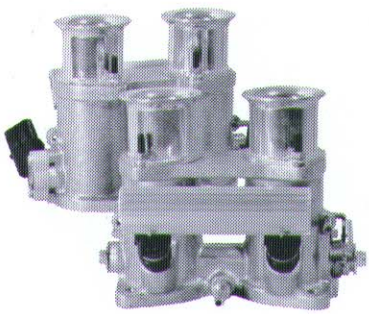
Installing a set of dual throttle bodies is a lot like bolting on a set of dual carburetors. One key point is that throttle bodies are manufactured in left and right side models. This makes throttle bodies easier to deal with than a set of dual IDF Webers which are only available in right side configurations.

The first step to your Ultra Competition Fuel Injection Kit is to start with your fuel system. You'll have to scrap your old fuel system and pump because you're going to require a modern fuel delivery system. One similar to that used on all new automobiles where fuel is pumped from the tank, to the injectors and pressure regulator under high pressure. Fuel then returns to the tank at reduced pressure. A continuos supply of fuel is circulated throughout the system. The fuel pressure is regulated according to the engines requirements.

Replace the present fuel outlet at the bottom of your tank with the "T" supplied in your kit. There are two supplied brass barbed fittings. One ¼" NPT x ½" hose (to the fuel filter - main fuel supply) and one ¼" NPT x 5/16" hose (used for the return line of the fuel system). Be sure to use Teflon tape on all fuel fittings. Make certain not to get any excess Teflon or strings of Teflon into the fuel system.

Mount the fuel filter and fuel pump under the fuel tank and below the fuel level. Use the supplied ½" hose to connect the fuel filter to the "T" and the other side of the filter to the pump. Be sure to have the fuel from the tank enter the fuel filter before it passes through the fuel pump. Installation is easy in a race car or dune buggy because most of these have rear mounted fuel tanks. Make certain to use clamps on all connections.

Installation in a VW sedan is a little more complicated because it requires the installation of two steel fuel lines. One 3/8" line, used for the main pressure line from the pump to one of the throttle bodies and one 5/16" line for the return from the regulator to the tank. On sedan installations, the lines can be run so that one goes down the passenger side of the car (main line) and the other goes down the drivers side of the car (return line), or vice versa depending on how you choose to route the main and return lines. Doing it this way creates a big circle. Fuel comes from the tank, to both throttle bodies, to the regulator and back to the tank again. How ever you decide on mounting the fuel lines for your system, make sure to use the ½" fitting as the main fuel supply to the engine and the 5/16" fitting as the return to the tank. These lines will be running the length of the car, ***rubber fuel line is not an option here!*** Rubber line can be used to connect all hard line connections. Where ever a con-



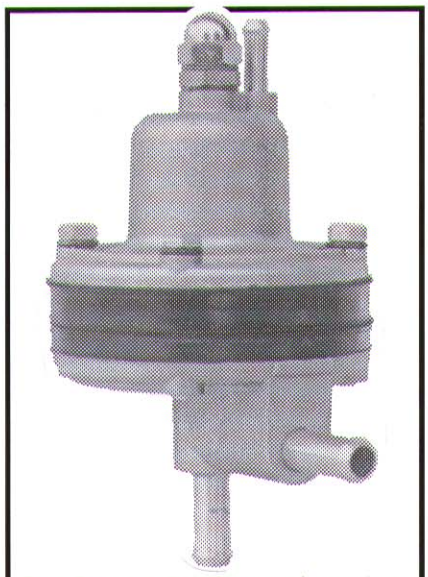
Ultra Competition Fuel Injection with Throttle Body mounted fuel injectors.

nection is to be made using rubber line, do not use normal fuel line, ***use only high pressure fuel line!*** When securing the hard lines to the bottom of your car, use some type of rubberized clamp to help reduce vibration. On a buggy, you naturally won't have to run your line from the front of the vehicle to the back, in this case rubber line would be acceptable. Make certain to have your lines secure and away from heat and any moving parts. Again, use only high pressure fuel line, especially if your complete system will consist of rubber line. This refers to buggies only though, not sedans or any other type of vehicle where the lines will need to run the entire length of the vehicle! Refer to (drawing #1 on this pg.) for illustration on running your fuel system.

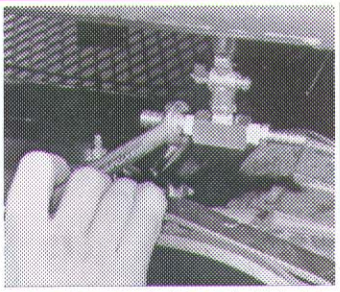
Two styles of Fuel Pressure Regulators are available. One is tapped for 1/8" NPT and the other has pre-installed 5/16" fittings. The regulator can be secured to one end of the fuel rail, firewall, engine, frame or where ever convenient. Do not mount the regulator on or near the exhaust or any type of heat source. There are too many variables for us to point out one specific location for the installer to mount the fuel pressure regulator.

Before the pre-assembly procedure of the throttle bodies and manifolds begins, it's always a good idea to pre-tune your throttle bodies. Balancing and dialing in a set of dual throttle bodies can be greatly simplified by making certain that each throttle body is adjusted to the same idle speed setting before you bolt'em on. Let's call it pre-tuning. You can pre-tune your throttle bodies by sliding a .003" feeler gauge between the butterfly and throttle bore. Adjust the idle speed screw until you can feel a snug .003" fit between the butterfly and the wall of the throttle bore. Make certain that both throttle bodies are set at the same .003" opening. Check only the butterflies nearest the idle speed adjusting screws.

The idle speed throttle settings obtained in this manner might not be exactly what your engine requires to idle at a desired speed, but they will be reasonably in sync. Increasing or decreasing the idle speed is just a matter of turning the idle speed control screws in or out ½ turn at a time until a desired speed is reached. In for more idle speed and out for less idle speed. Be sure to adjust the idle speed screws equal and this will keep both throttle bodies closely in sync. The function of the throttle bodies is to control air flow. The trick is to start out even and keep them even throughout the opening and closing



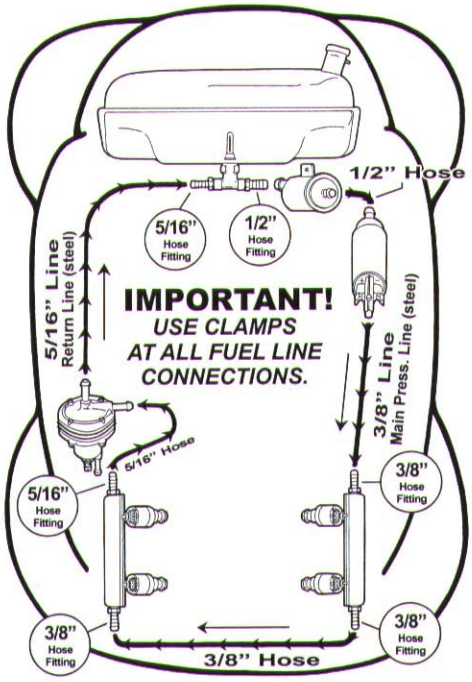
Fuel Pressure Regulator with pre-installed barbed fittings.



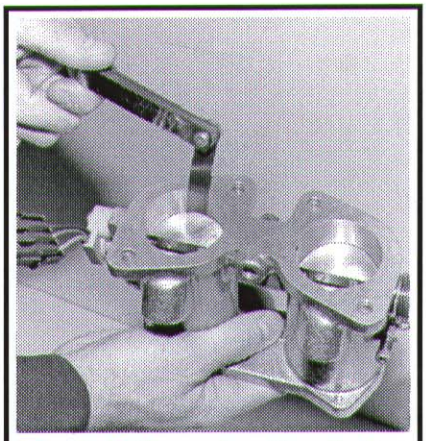
View of barbed fittings installed in "T" at the bottom of fuel tank. On dune buggies, if space is available, install a fuel shut off valve.

CAUTION - CLEAN AND FLUSH YOUR GAS TANK BEFORE INSTALLING YOUR NEW FUEL LINES. THIS IS AN ABSOLUTE MUST! YOUR FUEL SYSTEM MUST BE CLEAN TO OPERATE CORRECTLY!

Refer to pg. 17 for an exploded view of the fuel system.

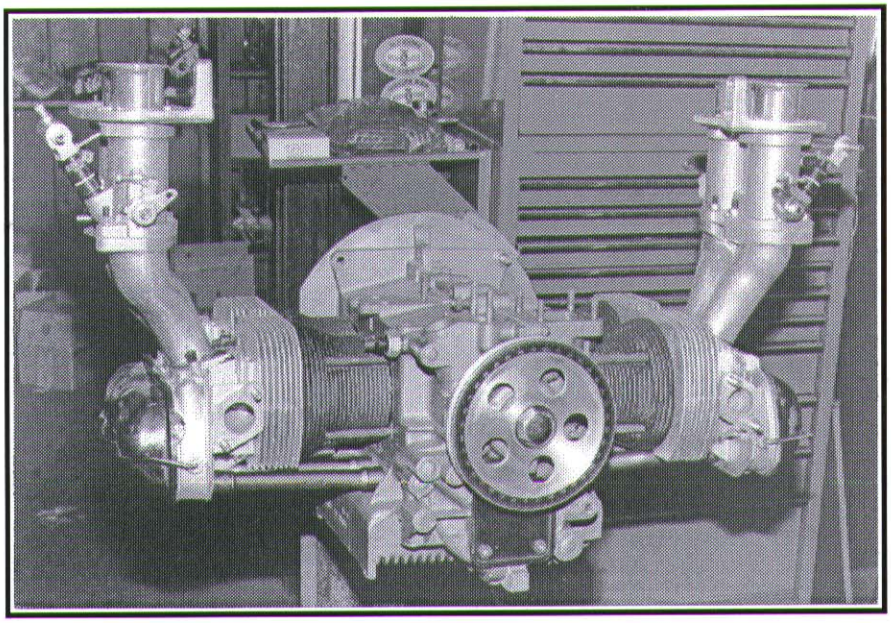


Drawing #1



Throttle Bodies can be set by adjusting the butterfly to wall clearance with a .003" feeler gauge. Check only the butterfly closest to the idle speed control screw.

This procedure will provide equal flow through each throttle body. You can then further balance the throttle bodies with a Uni-Syn gauge with the engine running.

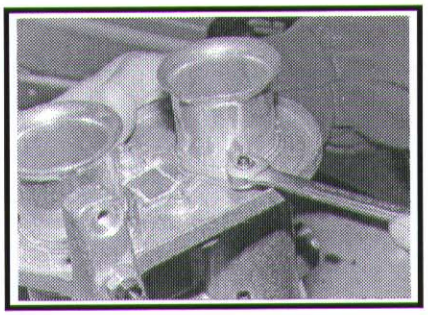


cycle. The feeler gauge is a good starting point, but the finishing touch to a good balance job is the use of a Uni-Syn gauge, we'll get into that procedure later.

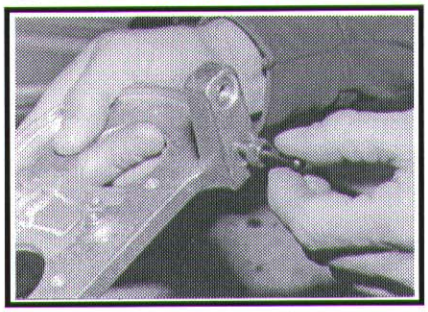
Start by bolting the throttle bodies to the intake manifolds. Each throttle body is held in position by four 8mm studs. Thread the short end of the studs into the manifolds and tighten them by double locking two nuts. This technique requires the use of two wrenches, but it assures you that the studs won't back out later. When you have secured all of the studs, install the base gasket and position the throttle bodies on the manifolds. Place one washer on each mounting stud, thread the nuts on and torque them down to twelve pounds.

Now determine which throttle body will serve as the right side assembly and which one will be the left side assembly. Keep in mind that the throttle linkage control arms face the rear of the engine. That's the end of the engine with the fan belt. When the throttle bodies are installed and sitting at closed idle speed, the throttle shaft control arms tilt in at about 45 degrees towards the center line of the engine. The TPS (Throttle Position Sensor) should be on the right side throttle body and face the flywheel end of the engine. On Sedan Competition applications, the throttle bodies will be the exact opposite of what was just explained. The injectors will be inboard and the TPS switch will be on the drivers side throttle body facing the flywheel side of the engine. The throttle control arms should still be on the pulley side, but will tilt away from the center of the engine. (Refer to pg.4 for illustration).

With the throttle bodies mounted and secured to the intake manifolds, it's time to install the throttle linkage. Thread in four 6mm studs in the top of each throttle body. They will be used to hold the air cleaner bases in position. Locate the air cleaner bases and a/c base gaskets. Place one gasket and a/c base on each throttle body, making sure to get the bases on the correct side. The vertical supports should face the back of the engine and each other. Back meaning fan belt side. Position the velocity stacks over the throttle bores with the 6mm threaded studs protruding through the mounting holes in the base of the velocity stacks. Install one washer and shake proof nut on each velocity stack stud and torque them down to about 8 lbs. It may be necessary to leave one base loose in order to install the cross bar assembly. Depending on the width of your engine, there is sometimes not enough room to get the cross bar past the cross bar swivel ball mounts. If so, you will just have to wait a bit before snugging that base down.



Two swivel ball mounts are required to support the throttle linkage cross bar, one at each end. The cross bar swivel balls thread into the vertical supports on each of the air cleaner bases. They are locked in position with 8mm nuts.The supports located on the air cleaner bases have two

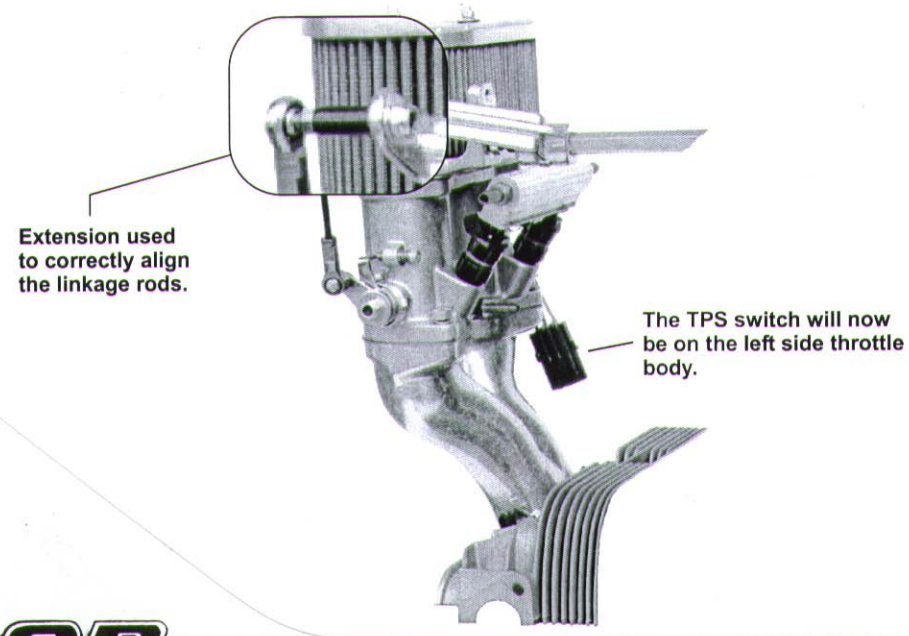


swivel ball mounting locations. This is to provide the engine builder with a choice in cross bar installation height. Center Mount fan shrouds for example, locate the fan at a higher elevation and require the use of the top mounting holes. Thread the cross bar swivel balls and locking nuts into their respective mounting holes. Don't lock them down just yet. We will get back to finishing the linkage up once we have finished the fuel rail assemblies and the throttle body/manifold assemblies have been secured to the cylinder heads.

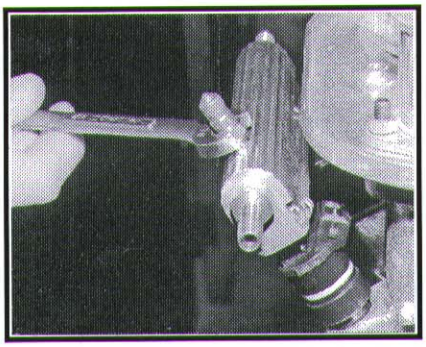
Start the assembly of the fuel rails by threading the barbed fittings into each fuel rail. The brass fittings can be replaced with A/N fittings and stainless line. How ever you plan on doing it, be sure to use Teflon tape on all threaded fuel fittings. Don't let strings of Teflon precede the end of the threaded fittings into the tapped

Sedan Competition
Fuel Injection

This instruction manual is intended for standard Ultra Competition Fuel Injection Kits. The Sedan Competition Fuel Injection Kit is installed in a similar manner. The major difference is the use of the Space Saver style linkage and manifolds. This enables throttle bodies machined for injectors to be used within a sedan engine compartment. The TPS will now be on the left side throttle body (drivers side) and the injectors will be inboard. There are two extensions used on the aluminum linkage arms to correctly align the linkage rods. Refer to the above photo for a completed view of a Sedan Competition Kit.

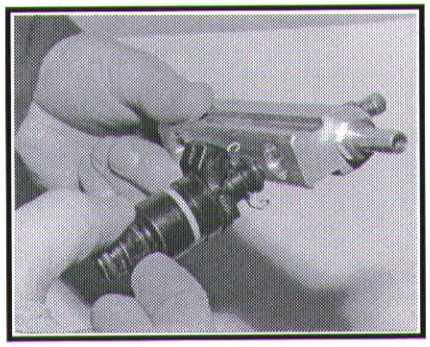


holes. As good as Teflon is, it can raise havoc with fuel pressure regulators and electronic fuel injectors. Make certain to use steel hose clamps at every connection. When using rubber line, make sure it is high pressure fuel line. When installing the brass fittings, there are three ¼" NPT x 3/8" hose fittings and one ¼" NPT x 5/16" hose fitting. The 5/16" fitting can be threaded in either of the two fuel rails. But when it's time to secure the fuel rails, the rail with the 5/16" fitting will need to be installed in the throttle body that will be closest to the Fuel Pressure Regulator. Refer to (drawing #1 on pg. 2) for illustration on how to run your fuel system.

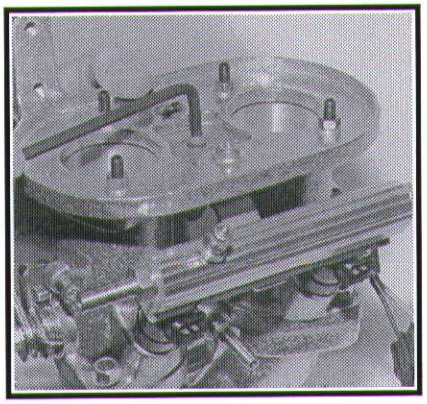


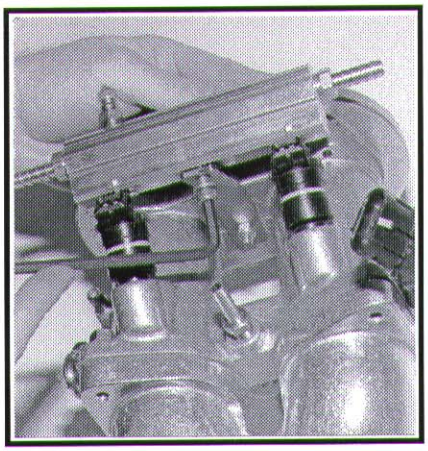
Locate the Schrader Valve and 1/8" pipe plug provided in the kit. The Schrader Valve can be installed in either of the two fuel rails, it's best to install it where you will have the most access to it. The Schrader Valve will be used to check the fuel pressure later on. When you have the valve installed, the 1/8" pipe plug has been provided to plug the hole in the other fuel rail. Remember to use Teflon tape on all fittings. Don't over tighten, pipe threads are tapered and seal with very little effort.

Four clips are required to secure the injectors to the fuel rails. The clips are pushed onto the top groove of each injector. Then push each injector into a port on both fuel rails. To ease the installation of the injectors into the fuel rails, it's a good idea to apply a small amount of oil to the "O" rings. With a little bit of pressure the injectors should slide right in. Excessive force should not be necessary. No hammering! Once the injectors have been pushed in, check to make sure the clips are secure over the edge of the fuel rail. Installing the completed fuel rail assembly into the throttle body is simply accomplished by lining up the injectors with the ports. Then pushing them down until they feel like they are in all of the way. They should bottom out. If not, check your alignment.

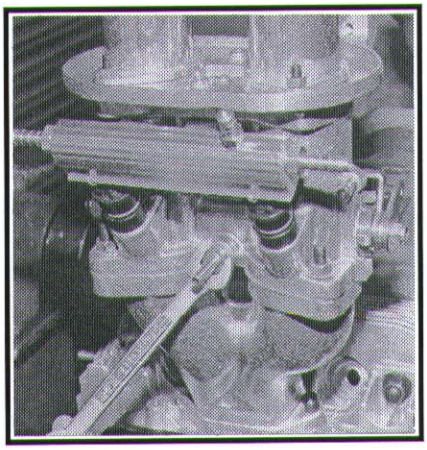


There are two fuel rail retaining brackets, one for each throttle body. The brackets provide a safety factor and must be installed. The brackets are mounted to the throttle body and to the bottom of the fuel rail with 6mm allen head bolts, washers and nyloc nuts. The retaining brackets have two different size holes. The end with the straight cut hole is fastened to the throttle body side. The other end with the oval shaped hole is fastened to the fuel rail side for ease of alignment. There are two short 6 x 10mm and two long 6 x 25mm bolts. The 6 x 10mm bolts are used on the fuel rail side and the 6 x 25mm bolts on the throttle body side. Secure the bracket to the throttle body first, using a 6 x 25mm bolt, two washers and a nut. After the bolt has been pushed through the throttle body from the top side, slide the bracket on, followed by the washer and nut. Both fuel rails have been drilled and tapped to except 6mm bolts. They require no nuts. Line the bracket up with the fuel rail and thread in the 6 x 10mm bolt. In the future if you need to remove the fuel rail/injector assembly, do so from the fuel rail side of the bracket by removing the short 6mm bolt.

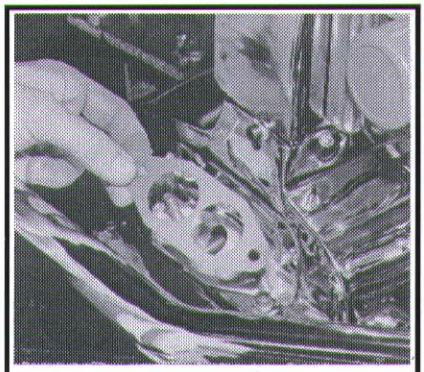




Each throttle body is equipped with a threaded vacuum port. The port is used to supply vacuum (mani-



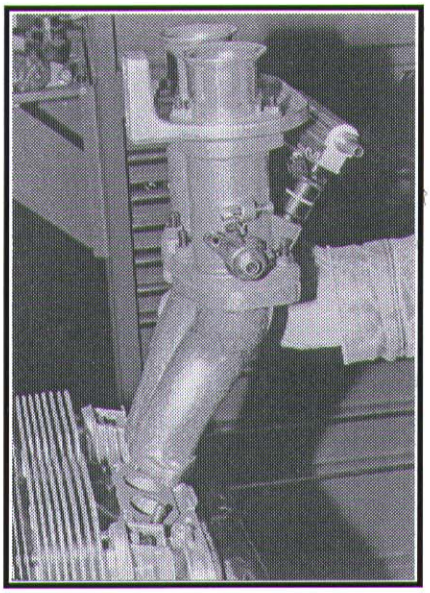
fold pressure) to the fuel pressure regulator. The vacuum port feeds from an internal passage that senses manifold pressure from both intake ports. The internal passage provides a dampening action between the intake ports which levels out the manifold pressure signal en route to the fuel pressure regulator. Locate the two brass barbed fittings, 1/8" NPT x ¼" hose. Wrap the threaded ends of the fittings with Teflon tape, thread one fitting into each vacuum port and snug'em down. Snug is enough, we're dealing with tapered pipe threads, and over tightening could result in a cracked vacuum port boss.



Only use HIGH PERFORMANCE intake gaskets when securing the Throttle Body/Manifold Assemblies to the head.

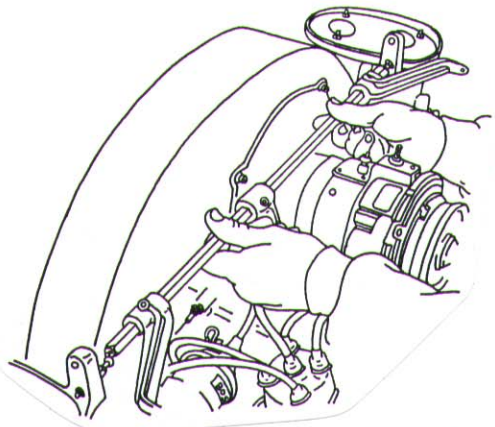
Bolt the completed throttle body/manifold assemblies to the cylinder heads. Before positioning the cylinder head to manifold gaskets on the cylinder heads, make sure the sealing surface is clean and free of any old gasket material. Make certain to use the gaskets supplied in your kit. They work a lot better than thin paper or steel gaskets. Line up the intake manifold assemblies with the mounting studs on each head and slide them onto the cylinder heads. Install two 8mm nuts at the base of each manifold and slowly tighten them. The manifolds and throttle bodies will pull inwards as the nuts are tightened. Torque the nuts down to about 14 pounds.

Now back to setting up the linkage. Assembling the linkage is a carbon copy of the procedures followed during the installation of dual carbu-



retors. Start by sliding the aluminum linkage arms and throttle cable bracket onto the steel hex bar. The arms are locked in place with allen set screws. The throttle cable bracket locates one hex degree down from the linkage arms. Don't tighten anything down just yet, we'll do that once everything is lined up properly.

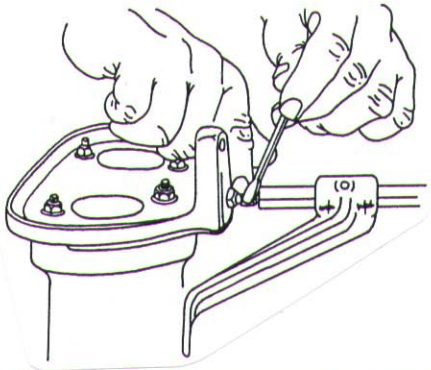
Internal tension springs are placed in each end of the cross bar to aid in centering the cross bar assembly. Place a small amount of heavy grease inside the support holes at each end of the cross bar. Insert the tension springs and place the right end of the hex bar over its respective cross bar swivel ball. Push the cross bar onto the swivel ball and line up the left side end of the cross bar with



The throttle linkage mounts to the air cleaner bases.

its cross bar swivel ball. If it is necessary to loosen one base, do so and line up the cross bar with the swivel mount and then re-secure the base. Hopefully your installation of the cross bar assembly has gone smoothly up to this point. If not, as we mentioned earlier when installing the a/c bases, there are different variables when building an engine. The width of your engine may differ from stock. It may be necessary to shorten or lengthen the length of the cross bar so that enough clearance is provided on the cross bar swivel balls. If the clearance is too far off, it may necessary to purchase a new cross bar with the correct length so that the installation is done correctly.

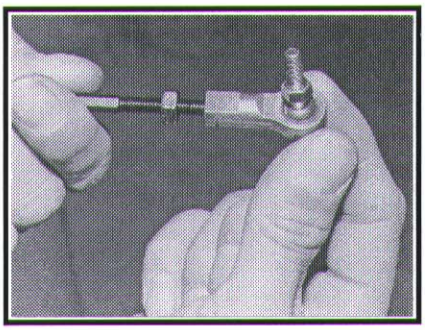
Now screw the swivel balls out until the cross bar is fully supported by the swivel ball mounts. Center the cross bar linkage assembly by rotating the swivel balls. Adjust the length of the swivel ball mounting screws until the cross bar is centered. Over tightening, resulting in not enough side play, will cause the linkage bar to bind. Leave about an 1/8" of side



The cross bar linkage rotates on the swivel ball mounts.

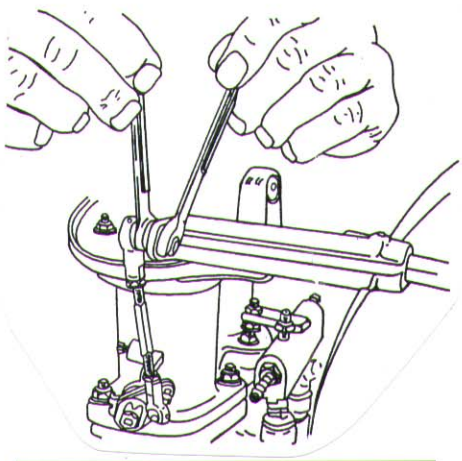
play and tighten up the swivel ball locknuts. Make certain that the cross bar is free to rotate on its axis. Any resistance or binding of the cross bar can be a real problem later.

The linkage rods and heim joints are next. There are four heim joints in all. Two right hand and two left hand heim joints. Each side will need one of each. The linkage rods are equipped with matching right and left



hand threads. Once installed you'll be able to fine tune your throttle adjustments by rotating the throttle rods. After all adjustments are made, lock them in position by tightening down the lock nuts. The lock nuts are also supplied in right and left hand threads. Leave the lock nuts loose for now. After the assembly of the linkage rods is done, secure them to the cross bar linkage arms and the throttle body linkage arms. You will need two open end wrenches for this operation, an 8mm and 3/8". Thread the four shake proof nuts down on all four heim joint connections. Not all of the way though, leave them a little loose for now.

Position the aluminum linkage arms on the cross bar so that the throttle linkage rods are vertical when viewed from the rear of the engine. Lock the aluminum linkage arms into position by tightening the allen set screws to prevent the aluminum linkage arms from sliding on the cross bar. Slide the aluminum throttle cable arm into position to line up with the throttle cable and tighten down the set screw. Now check the installed linkage rods, both left and right, making certain that the rods rotate freely. Observe the way the rotation changes the length of the rod assembly. Up to this point the linkage assembly should work freely without any drag or binding. If there is any type of resistance, something is not right. Go back and double check your installation. If everything is in correct working order, tighten up the shake proof lock nuts that secure the heim joints to the upper and lower linkage arms. Tighten these to no more than 2lbs. of torque.



Tighten the heim joint lock nuts to no more than 2lbs. of torque.

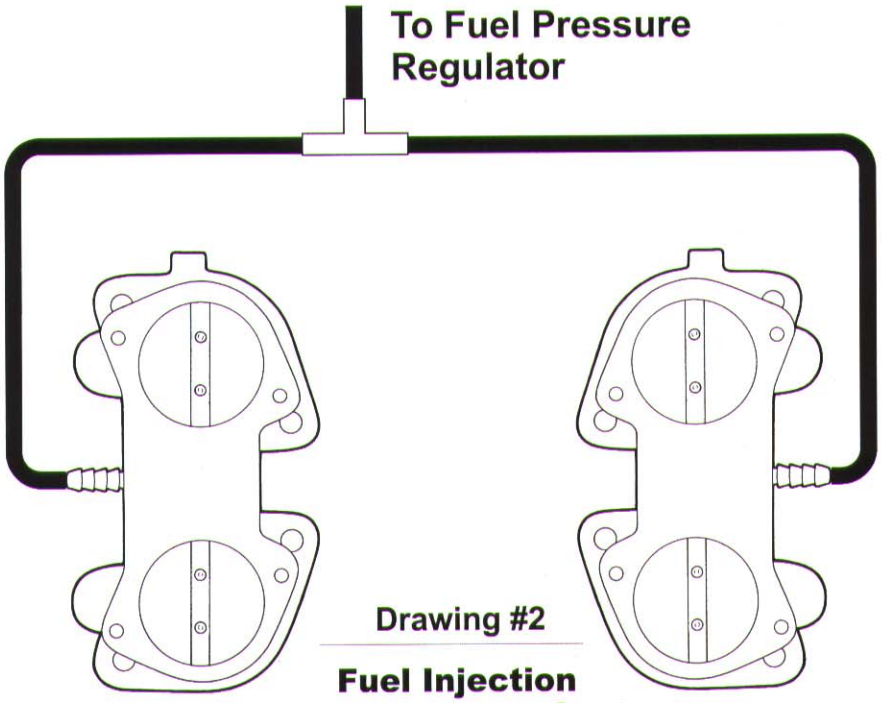
The trick now is to get your linkage aligned to match your preset throttle bodies. Adjust the throttle linkage rods by rotating in right or left hand directions, until both throttle stop arms are resting on the idle speed set screws. By rotating the linkage rods you'll be able to extend or shorten the length of the rods. This will allow you to match the preset throttle bodies. ***Do not*** change the position of the idle speed set screws to match your linkage. You already set both throttle bodies to the same opening. ***Adjust the linkage to match the throttle bodies.***

When you think that you've got the linkage dialed in, push the aluminum throttle arm downwards and watch the linkage arms as they move from closed to open. If one throttle body "leads" the other, you've got some more dialing in to do. The opening and closing throttle action of fuel injection with dual throttle bodies is just like dual carburetors, it has to be precise. So play with your linkage until it works like a Swiss watch. Don't try to reinvent the linkage system. Simply adjust it to match your ***preset*** throttle bodies and tighten up the four lock nuts on the throttle linkage rods.

Look over the complete assembly carefully prior to connecting the throttle cable. The cross bar linkage assembly should work accurately and freely. Both throttle bodies should snap to closed position when the linkage is released without protest.

Connect the throttle cable. Have someone operate the throttle pedal from inside the car while you watch the action taking place in the engine compartment. Make certain that the pedal attains the end of its "stroke" at the same time or slightly before the throttle reaches full open. Excessive travel of the throttle pedal can bend the throttle linkage. It may be necessary to install a throttle pedal stop to control or limit pedal movement. If the drag of the throttle cable and pedal seem to be slowing down the closing action of the linkage, it may be necessary to install two helper throttle return springs. The helper springs will provide a safety factor and should be seriously considered for use on any type of vehicle. The slight amount of increase in throttle pressure will never be noticed.

The rest of the fuel system can now be completed. Up to this point all fuel line (hard line), fuel pump/fuel filter, throttle body/manifold assembly and throttle linkage have been installed. The main line (previously installed) needs to be hooked up to the front of the passenger side fuel rail (flywheel side). Keep in mind, your fuel system may differ from that of what is being described, you may have decided to route your system differently. Use the supplied 3/8" fuel line to make the required connections. Always use clamps to secure connections. Now run a line from the back of the passenger side fuel rail (pulley side) across the engine to the back of the drivers side fuel rail. All connections up to this point should have been done with 3/8" line. The remaining connection needs to be 5/16" line, and it runs from the front of the drivers side fuel rail (flywheel side) to the inlet side of the Fuel Pressure Regulator. Connect the outlet side of the regulator to the return line going to the fuel tank. This will complete the fuel system. Refer back to (drawing #1 on pg. 2) for illustration.



Drawing #2

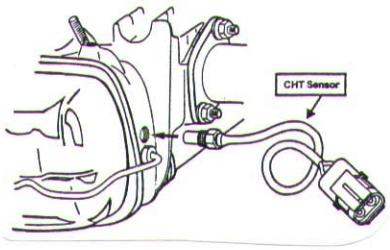
Fuel Injection Vacuum/Pressure System

The two 1/8" NPT x ¼" hose barbed fittings threaded into the throttle bodies will now be used to supply vacuum to the fuel pressure regulator. A ¼" brass "T" is used to connect both throttle bodies together to supply the needed vacuum to the regulator. It's important to use the "T" when hooking up the vacuum lines in an effort to maximize and smooth out the engine vacuum signals. If only one barrel is connected to the pressure regulator, the signal will pulse and create undesired effects on the fuel pressure. When functioning properly, the fuel pressure regulator uses manifold pressure to reduce fuel pressure at an idle speed and increase fuel pressure during peak requirements. Refer to (drawing #2) on this page for illustration on the vacuum line system.

The wiring harnesses supplied by CB Performance are complete and ready to snap on. The GM Weather-Pack connectors are designed for easy installation. Each connector is marked as to usage and keyed to fit only one application. Data is fed to the computer by two engine mounted sensors.

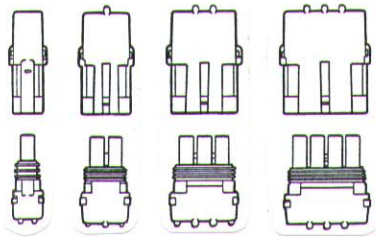
1. TPS - The throttle position switch is mounted on the right side throttle body. The exact throttle position in degrees is reported to the computer while the engine is switched on.

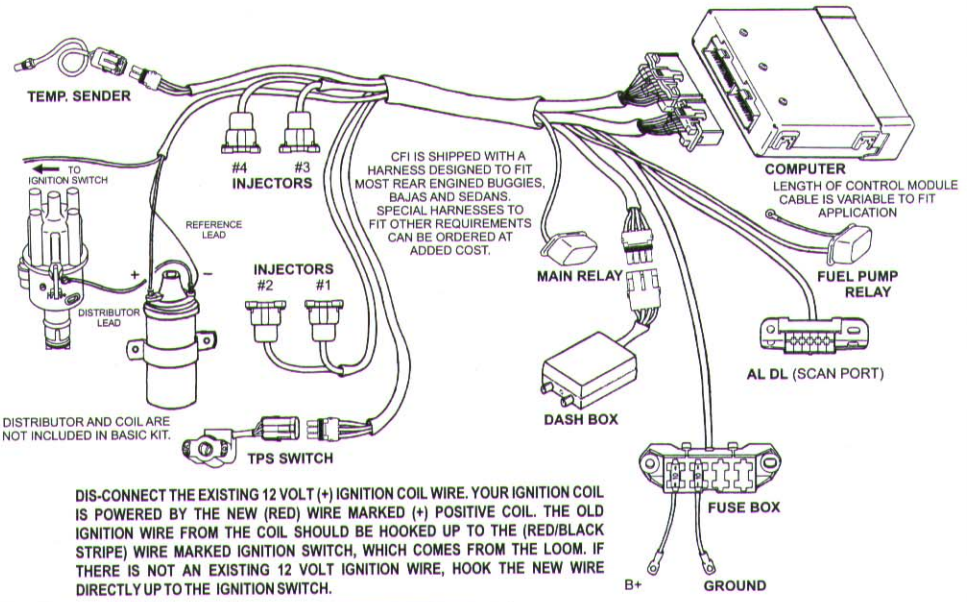
2. CHT - The cylinder head temperature sensor monitors the temperature of the left side cylinder head. The computer uses information to adjust the air/fuel mixture to compensate for cold start, warm up and fuel delivery during high engine temperature. If your cylinder head is not equipped with an OEM injection boss, it will be necessary to drill and tap (1/8" NPT.) the left side cylinder head as shown to provide a mounting location for the CHT.



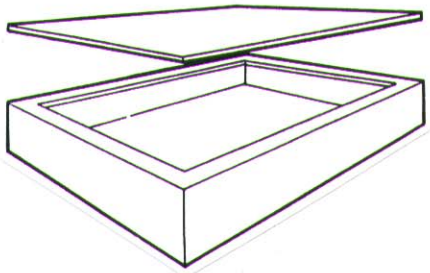
View is Cylinder Head at #4 Cylinder.

Wiring harnesses are offered in variuos stock configurations. Special wiring harnesses can be ordered to fit exact requirements. GM Weather-Pack connectors are used throughout.





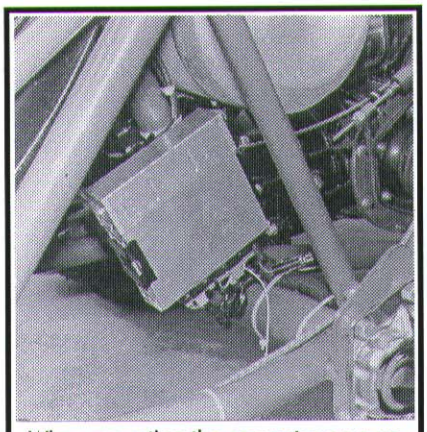
DIS-CONNECT THE EXISTING 12 VOLT (+) IGNITION COIL WIRE. YOUR IGNITION COIL IS POWERED BY THE NEW (RED) WIRE MARKED (+) POSITIVE COIL. THE OLD IGNITION WIRE FROM THE COIL SHOULD BE HOOKED UP TO THE (RED/BLACK STRIPE) WIRE MARKED IGNITION SWITCH, WHICH COMES FROM THE LOOM. IF THERE IS NOT AN EXISTING 12 VOLT IGNITION WIRE, HOOK THE NEW WIRE DIRECTLY UP TO THE IGNITION SWITCH.



Example of protected enclosure for mounting the computer.

Your computer (ECM) is mounted inside a sturdy aluminum chassis. This enclosure is rugged and designed to withstand severe shock and rapid temperature changes. However the outer shell is ***not*** moisture proof. If you plan on operating your vehicle in wet or moist conditions, it's advisable to mount your computer in the driest possible location and provide further moisture protection in the form of a heavy duty plastic zip cover or outer enclosure. Various types of plastic snap together boxes and trays are available for this purpose. Aluminum boxes in various sizes are also available that provide a secure moisture resistant installation.

The computer should be mounted away from engine heat and in a protected location. Locate the wire connector end of the computer downward if the computer is to be mounted vertically. This will help keep any foreign debris away from the terminals. Check the length of the harness before you mount your computer. This kit doesn't include wire stretchers, so plan your harness layout before you mount the computer, fuse block, or other electronic components. When your satisfied with the harness layout, mount the computer in as dry and secure a location as possible. And no, the computer won't work under water! If mounted properly, it's moisture resistant, but not water proof.



When mounting the computer on a vehicle intended for off-road use, secure it in a dry safe location

Do not use silicon based sealers in an attempt to prevent moisture from entering the computer. Silicon sealers contain acetic acid. Acetic acid emits corrosive gasses during its curing stage. These gasses can cause severe corrosion of the computer and wiring terminals. It's effect on solder joints is well documented.

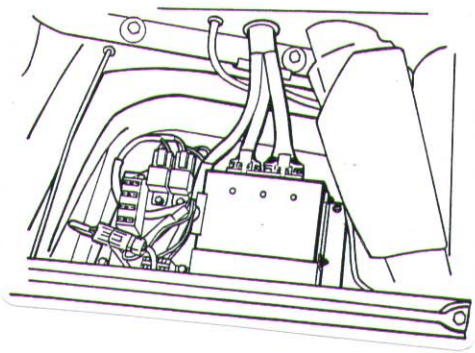
Your computer has two male connector plugs. A large one and a small one. The female connectors on the harness are keyed and will only plug in one way. The connectors are held in place by tension snaps. Depressing the snap lever releases the connector to allow it to be removed.

The ALDL (scan port) connector can be located in any convenient location. The ALDL provides system access to allow the use of a diagnostic scanner. Your CFI system is GM compatible and can be accessed under GM 1990 L 05 5 27R. The scan will indicate engine RPM, temperature, TPS setting, injector pulse rate and condition of the voltage system.

Position and mount the fuse block in a dry, convenient location that provides easy access for servicing the fuses. Each CFI system includes two relays. They are connected to special five pin terminal plugs that only plug in one way. Mount the relays in a protected area. One relay operates the entire system. The other relay operates the fuel pump. The fuel pump relay is equipped with a fuel pump lead wire. The lead wire is marked (+) positive, and fitted with a round lug ring. It connects to the (+) positive terminal on the fuel pump. The (-) negative terminal on the fuel pump must be routed to ground. Use the supplied piece of wire and lug rings. Make certain to secure it to a good clean ground.

The fuel pump is activated by the computer. A special timing circuit in the computer will turn the fuel pump off when the ignition is left on with the engine not running. The computer will also turn the fuel pump off should the engine stall and the ignition is left on. The fuel pump will restart when the ignition is switched off, and then back on.

Connect the four injector connectors coming from the harness. Each connector is numbered with a corresponding cylinder number. The plastic connectors simply push onto the injectors. They are held in position by wire snaps. Make certain to position the wires so that they don't interfere with the throttle linkage. Tie the wires with nyties to prevent them from being pulled into the cooling fan (if necessary). Connect the red wire marked (+) positive, to the hot side (12 volt) of the ignition coil. Connect the fused ignition lead to the "switched" hot side of the ignition switch.



The computer can be located under or behind the rear seat in a VW Sedan. **Do not** mount the computer in the engine compartment. **Excessive heat will damage the internal components.**

CB's Ultra Competition Fuel Injection can be used with most any type of ignition with the exception of magnetos. Breaker point, solid state, crank fired and other ignition systems can be used. A 40,000 volt MAGNA-SPARK HEI ignition system is ideal for use with Competition Fuel Injection. For those using MSD or Compufire DIS-IX systems, (refer to pgs. 11-13) for special installation guides on these systems.

The control module connects to the main harness with an extension cord. The cord is fitted with a four wire Weather-Pack connector. The module needs to be mounted in a location where the driver can reach it easily and where it won't get in the way or get disturbed. The module contains a microprocessor that allows you to adjust the idle speed and upper end fuel curves.

The knobs on the control module are labeled Idle A/F and W.O.T A/F. The Idle A/F knob is used to set the idle and slow speed air fuel mixture. Turning the knob to the left (counter clockwise) leans the mixture. Turning the knob in the other direction (clockwise) richens the air fuel mixture.

The W.O.T A/F knob is used to set the midrange and high speed fuel curve. Counter clockwise rotation leans the midrange and high speed fuel curve. Clockwise rotation richens the midrange and high speed fuel curve.

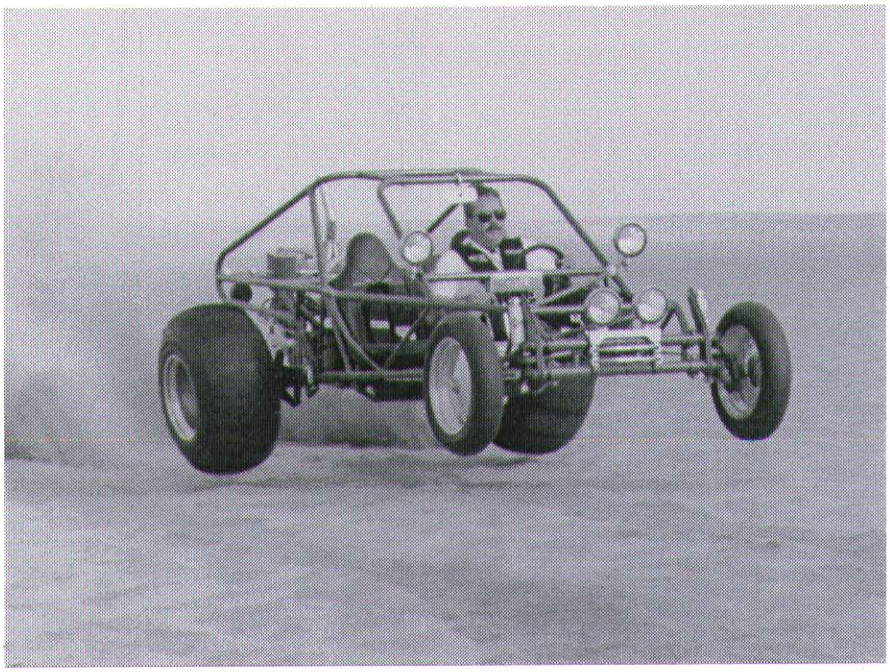
The control module has been preset to an established fuel curve. Try the preset fuel curve before altering it. The knobs function on 10 turns, stop to stop. This allows you a lot of latitude to dial in the exact air fuel curve your engine requires for peak performance.

When you are at the point to start tuning your engine with the control module, refer back to this section for important tuning procedures! Keep in mind that these steps are based on idle fuel pressures of 45-50 P.S.I.

The idle knob needs to be set with the engine running at idle speed. Allow the engine to reach a normal operating temperature before any adjustments are made.When the engine is warm, simply begin to lean the idle control knob until the engine RPM begins to fall off. This is done by rotating the knob counter clockwise. Once the idle begins to fall off, turn the knob in the other direction. This will start to richen up the idle circuit. When the engine begins to raise in RPM and starts to stabilize, you're there. This adjustment is just like adjusting the mixture screws on a carburetor, only you are able to adjust all 4 cylinders at one time.

Front view of the control module and adjusting knobs. The module needs to be mounted in a location where the driver can easily reach it and also won't get disturbed.

The W.O.T A/F knob is next. To set the W.O.T knob, you will need some place to drive your vehicle. This is not an idle setting. In order to achieve the best setting, it must be adjusted under a wide open throttle situation to get the best power from your engine. This control determines how much fuel is delivered to the engine under the load of wide open throttle. Sitting in your driveway rapping up the engine will not work. It has to be under a load. This setting is just like changing main jets. If your adjustment is too rich, your engine's power curve will mush out, or flatten during high RPM operation. Black smoke out of the exhaust during acceleration is a certain indication of an over rich condition. If the air/fuel mixture is too lean, the engine will hunt during cruise speed and stumble or hesitate from first midrange acceleration. A lean condition will create a weak upper end RPM response. Increased exhaust temperature is another indication of a lean condition. Some place between too rich or too lean, lies the perfect fuel curve for your engine and driving style.



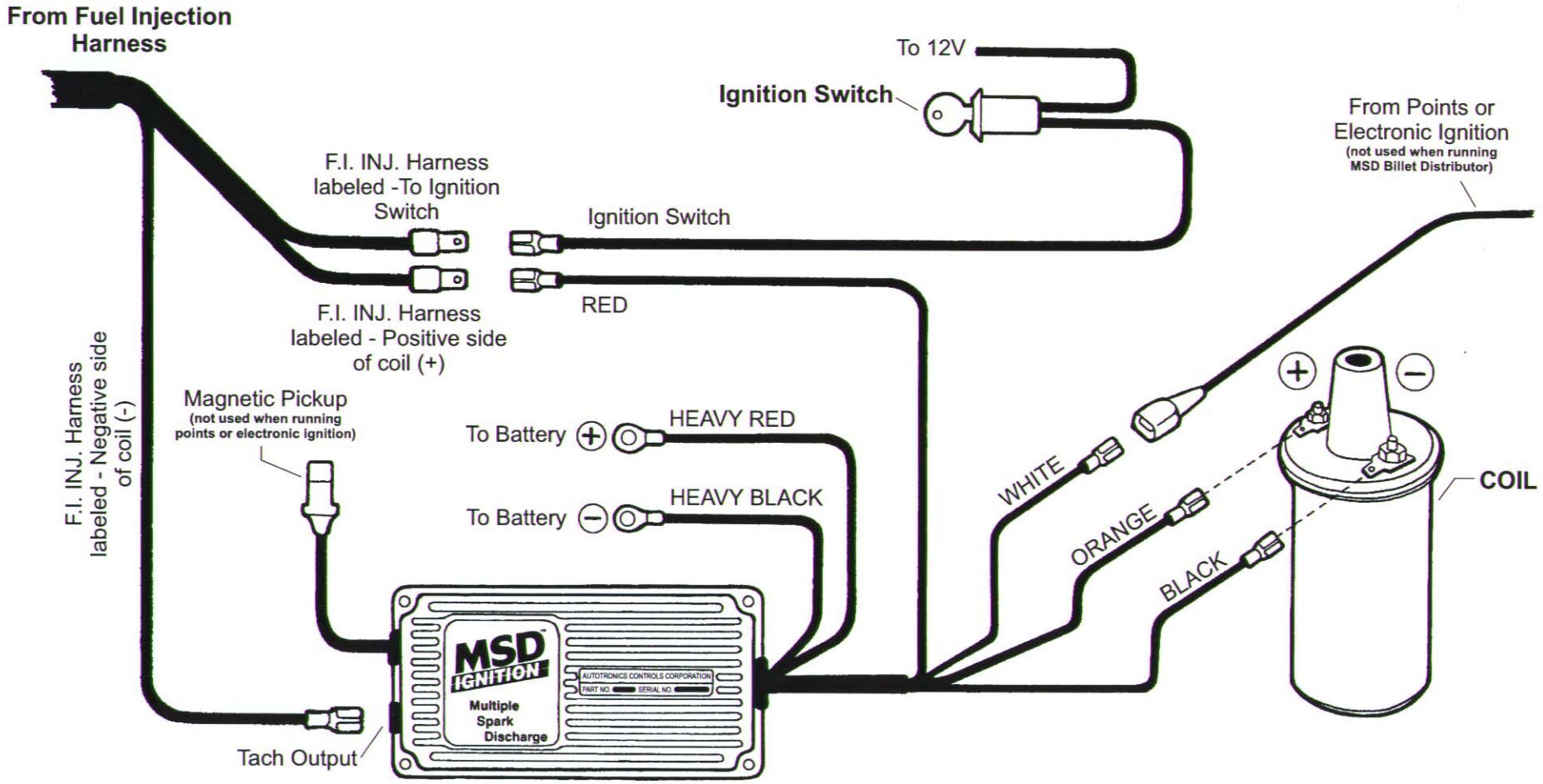
IMPORTANT UPDATED INFORMATION

When using an aftermarket ignition system, such as ***MSD*** or a complete ***COMPUFIRE DIS-IX*** system, refer to the following pages for important installation procedures and wiring diagrams. In instances where engine "***run on***" is occurring (when engine stays running when you turn key off) there is a wiring diagram to guide you through curing this simple problem.

CB PERFORMANCE
1715 N. Farmersville Blvd., Farmersville, CA 93223 PH:(559) 733-8222

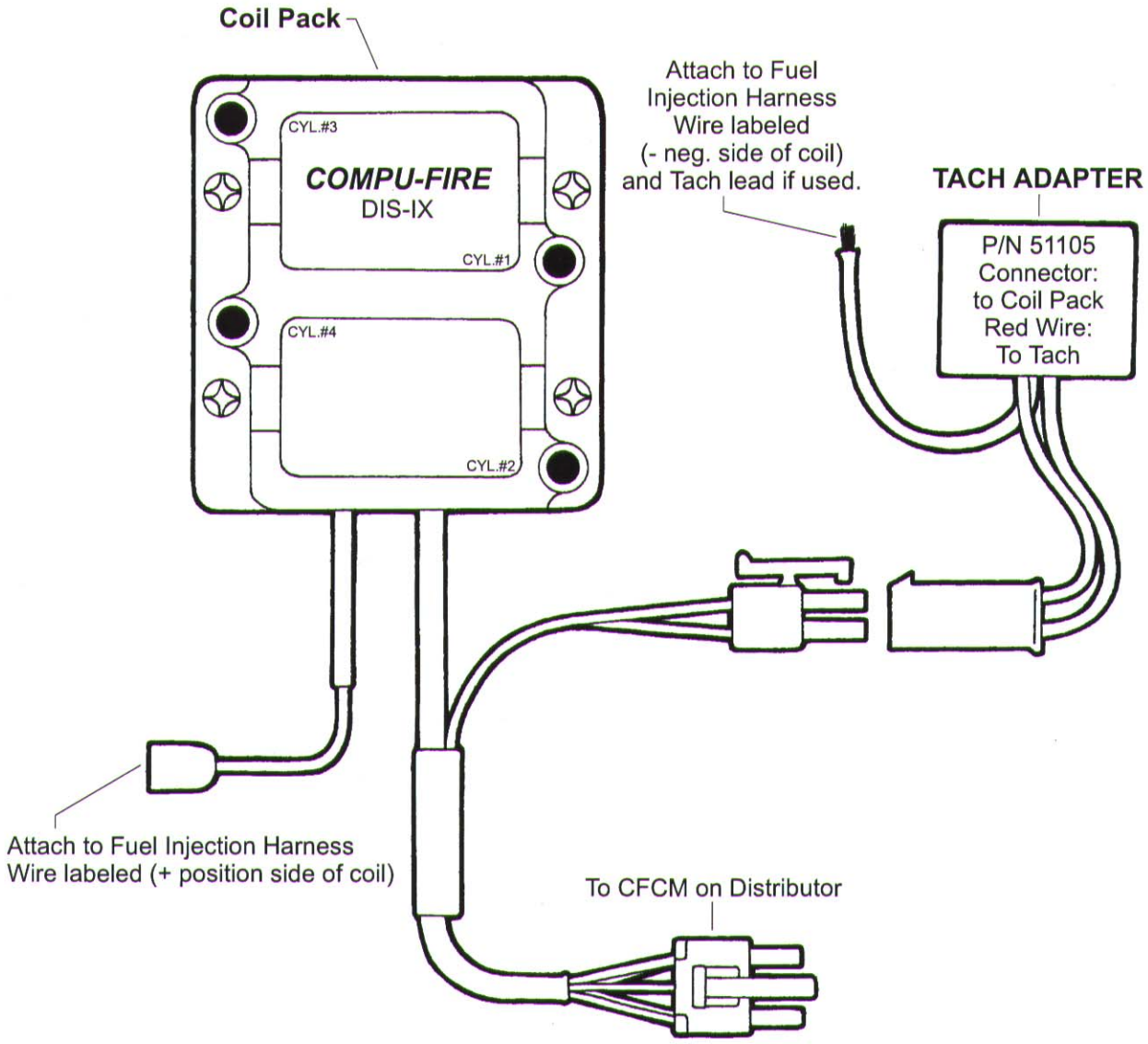
Special Installation Guide
for
MSD 6AL IGNITION

Refer to the original manufacturers mounting instructions. Attach the wiring as shown on this page. Wiring connections for other types of ignition systems will vary.



Special Installation Guide
for
COMPU-FIRE DIS-IX

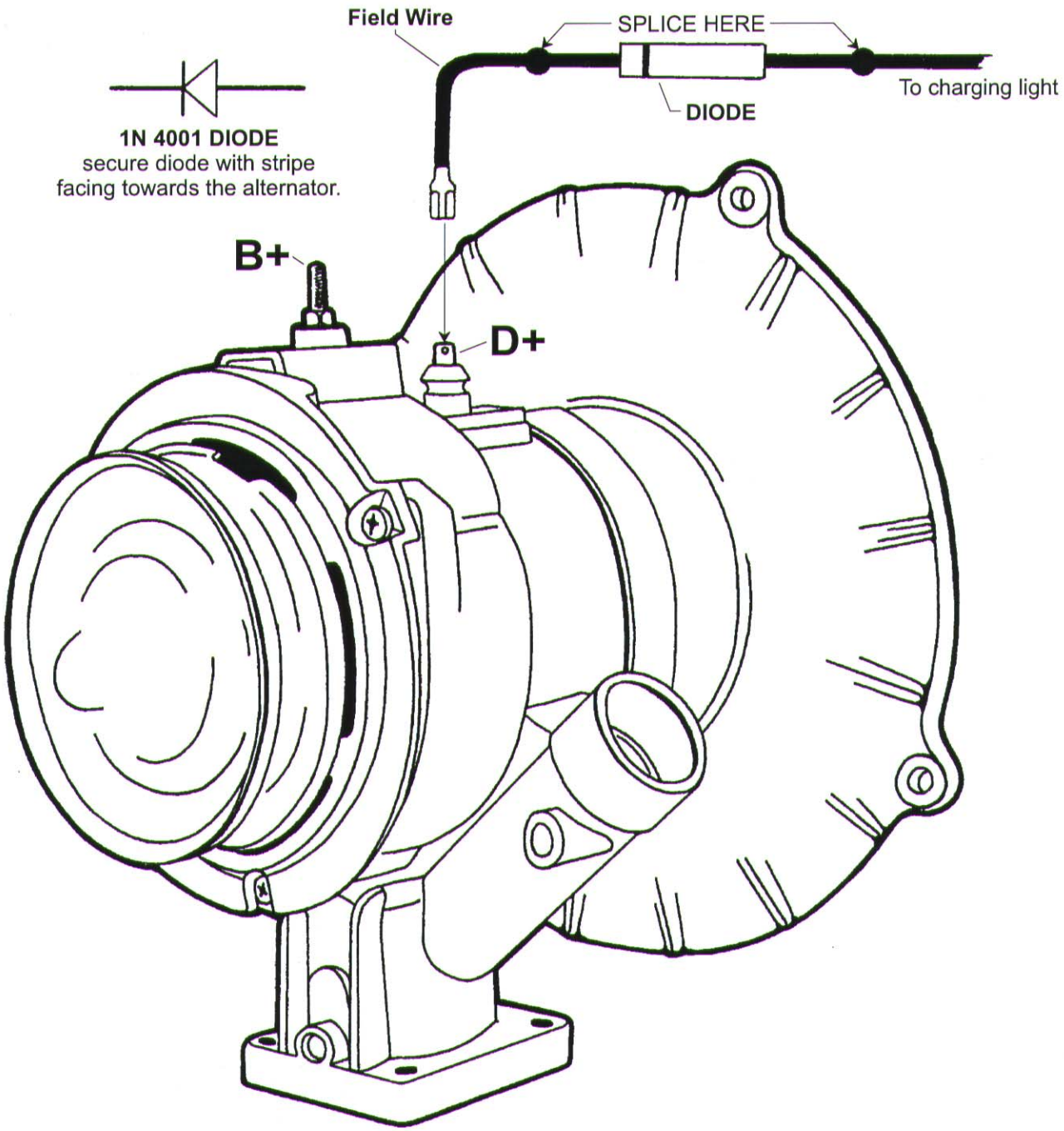
Refer to the original manufacturers mounting instructions. Attach the wiring as shown on this page. Wiring connections for other types of ignition systems will vary.



The above ignition system (***COMPU-FIRE DIS-IX***) will function only with special CB Dash Module part #7650

Engine RUN - ON

In some applications a situation referred to as "Run-On" will occur. This is where the engine continues to run after the ignition switch is shut off. In a run on situation a diode can be put in line with the alternator field wire. This diode will keep voltage from leaking through to the fuel injection system.



12.5 VOLTS ARE REQUIRED TO RUN ELECTRONIC FUEL INJECTION

Set the fuel pressure to 60 P.S.I with the engine not running. This will provide a "get it" running setting. The computer activated fuel pump can complicate this procedure, because the pump will automatically shut off in less than one second. Disconnect the wire leading to the fuel pump relay and hot wire the fuel pump. This will give you time to set the fuel pressure and check the fuel system for any leaks.

The fuel pressure is set by removing the cap nut from the top of the fuel pressure regulator and loosening the lock nut on the threaded shaft. Fuel pressure is increased by rotating the adjusting shaft clockwise. Less fuel pressure by rotating the shaft counter clockwise. Pressure can be checked at the Schrader valve located in the fuel rail. If you don't have a special fuel injection kit, a tire pressure gauge will get the job accomplished. When you have the pressure set, lock the jam nut and replace the cap nut. Remove the jumper wire used to hot wire the fuel pump and reconnect the fuel pump to the fuel pump relay.

Start your engine, your fuel pressure will drop depending on the amount of vacuum produced by your engine. Camshafts with less duration will produce more vacuum which in turn will drop your fuel pressure accordingly. Vice versa for engines with longer duration camshafts. Stabilize your engine RPM high enough so that it can hold a steady idle.

Your next procedure is to use a Uni-Syn gauge and synchronize your throttle bodies. It is very important to get your throttle bodies in sync. Stable fuel pressure is greatly influenced by a set of unbalanced throttle bodies. Once you have achieved a balanced situation, stabilize your engine idle between 800-900 RPM. Go back and readjust your fuel pressure to 45-50 P.S.I. Balancing the throttle bodies and adjusting the fuel pressure are two of the most important steps to installing CFI. Please don't try to guess with these adjustments.

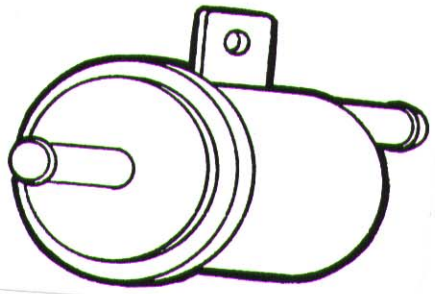
Double check your installation for any loose ends or leaks, hopefully everything checks out all right. Pick everything up and make sure you don't have tools lying around on the vehicle. It's time for a test drive. Refer back to (pg. 10) for important tuning adjustment instructions using the dash module. Good Luck!

IMPORTANT NOTICE
ABOUT YOUR CAR'S FUEL SYSTEM

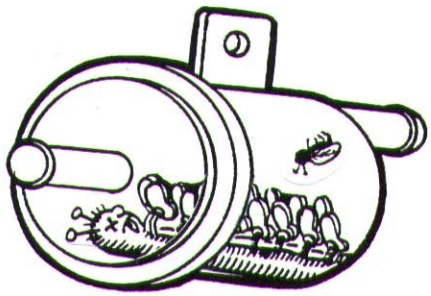
Fuel contamination can be the cause of a poorly running engine. Even though your gas tank is relatively new it can still contain enough dirt, metal filings and other debris to plug up a kitchen sink. A close inspection of most any dune buggy gas tank will quickly illustrate the end result of contaminated storage tanks. Most five gallon fuel cans often have junk waiting in the bottom to end up in your fuel tank. Make sure this doesn't get you stranded.

Dirt, sand and other sludge builds up in the filter as the fuel is circulated through the system. The filter will eventually clog to the point that the fuel will only trickle through the filter. When this happens the engine will idle, and depending on the amount of fuel flow, might even run at mid-speed. Full throttle operation with a partially plugged filter will result in serious fuel starvation. Your engine will tell you about this by popping and snapping out of the exhaust pipe as it goes lean due to a lack of fuel.

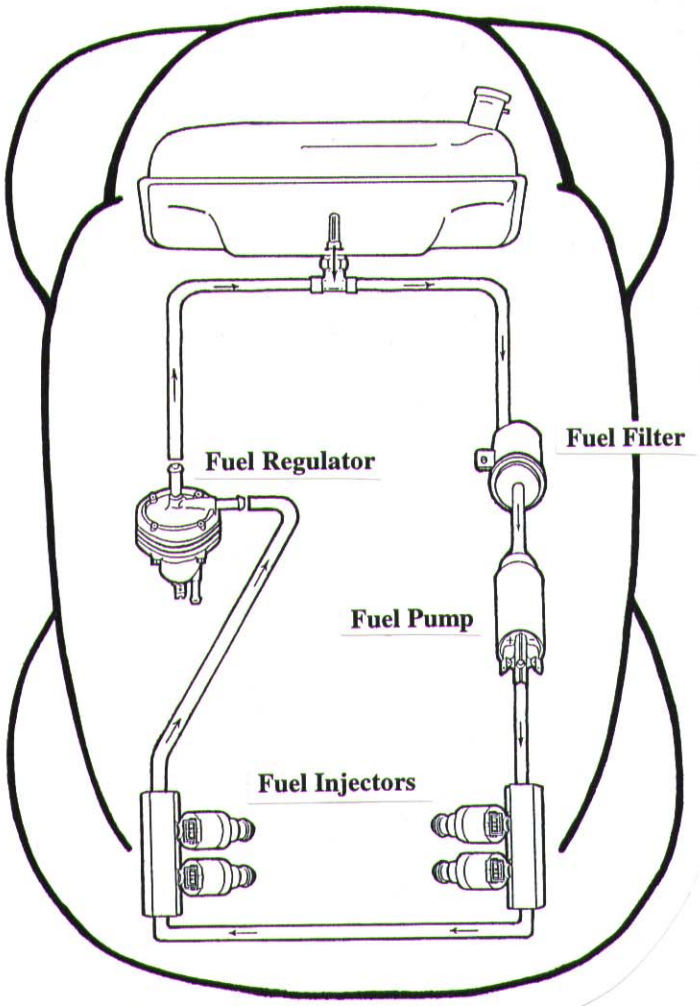
This condition is often mis-read as burnt points, fouled spark plugs and even tight valves. Check your cars fuel filter on a regular basis. Check the fuel filter as often as you check your oil if you operate your engine in dirty conditions. Also make sure that the fuel filter and fuel pump are installed in the correct order. First the fuel filter and then the fuel pump. The filter can be quickly replaced, and if that doesn't solve the problem work your way through the following Trouble Shooting Guide.



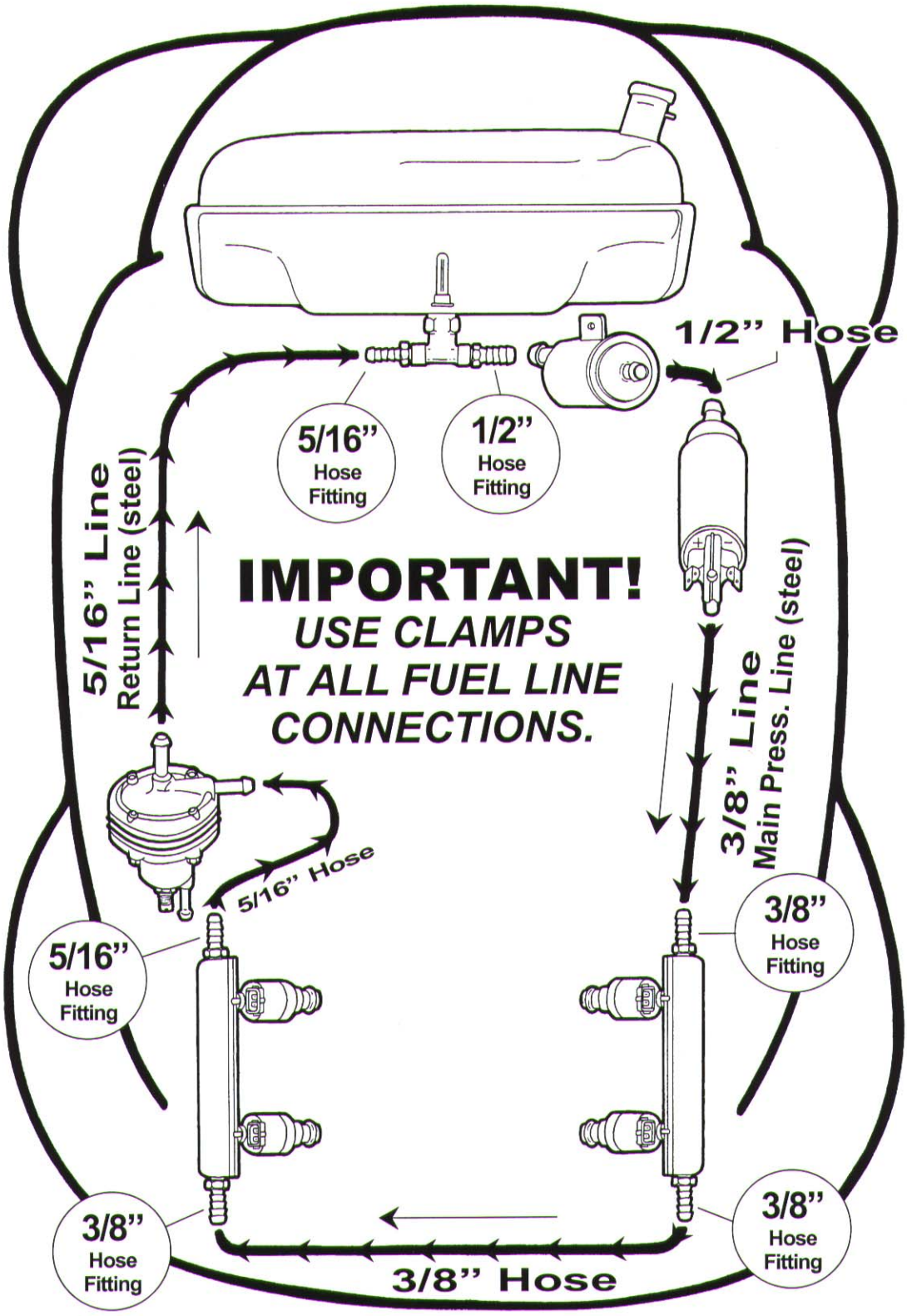
Keep the tank and fuel filter clean.



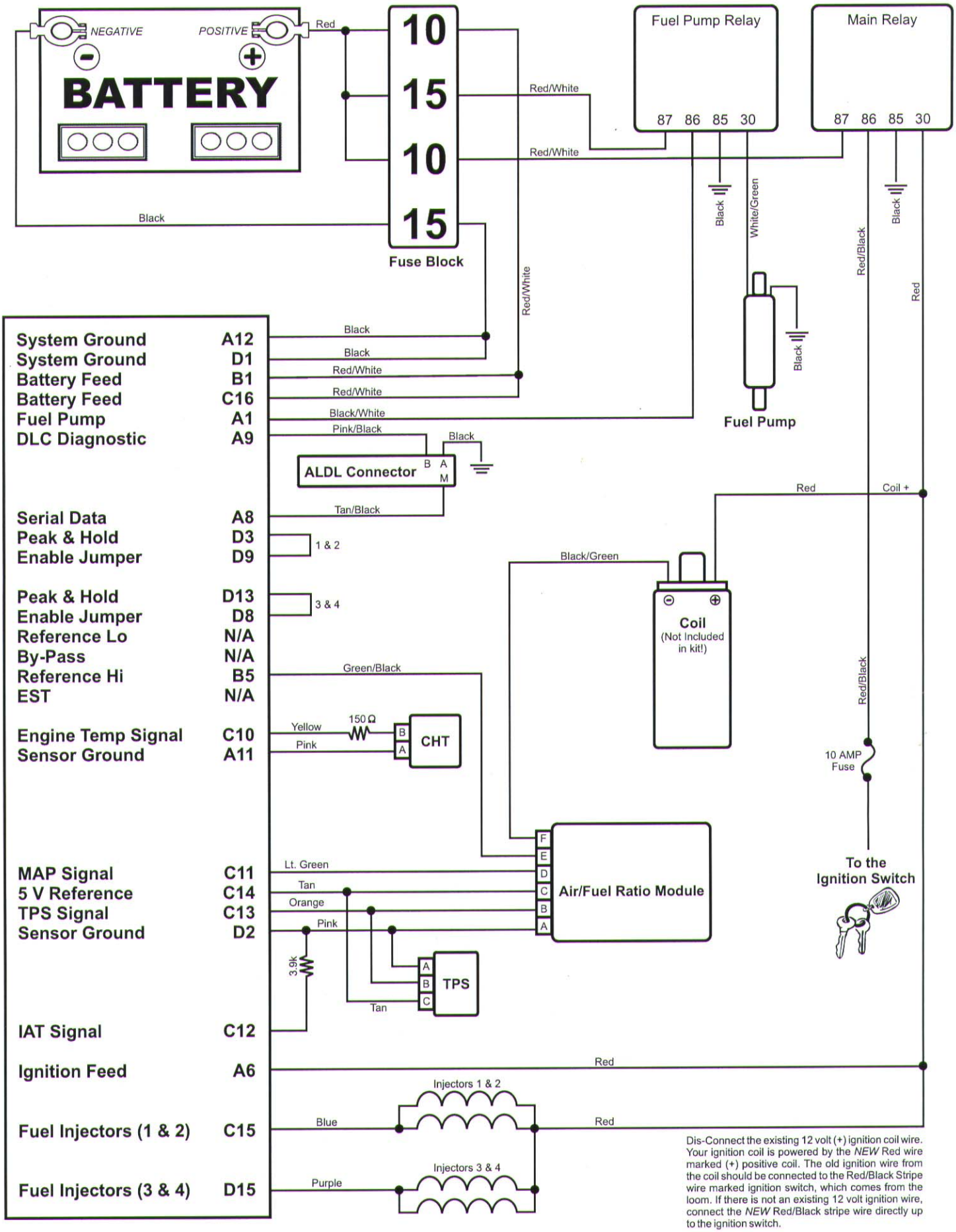
Don't get bugged with a dirty fuel filter.



CAUTION - CLEAN AND FLUSH YOUR GAS TANK BEFORE INSTALLING YOUR NEW FUEL LINES. THIS IS AN ABSOLUTE MUST! YOUR FUEL SYSTEM MUST BE CLEAN TO OPERATE CORRECTLY!

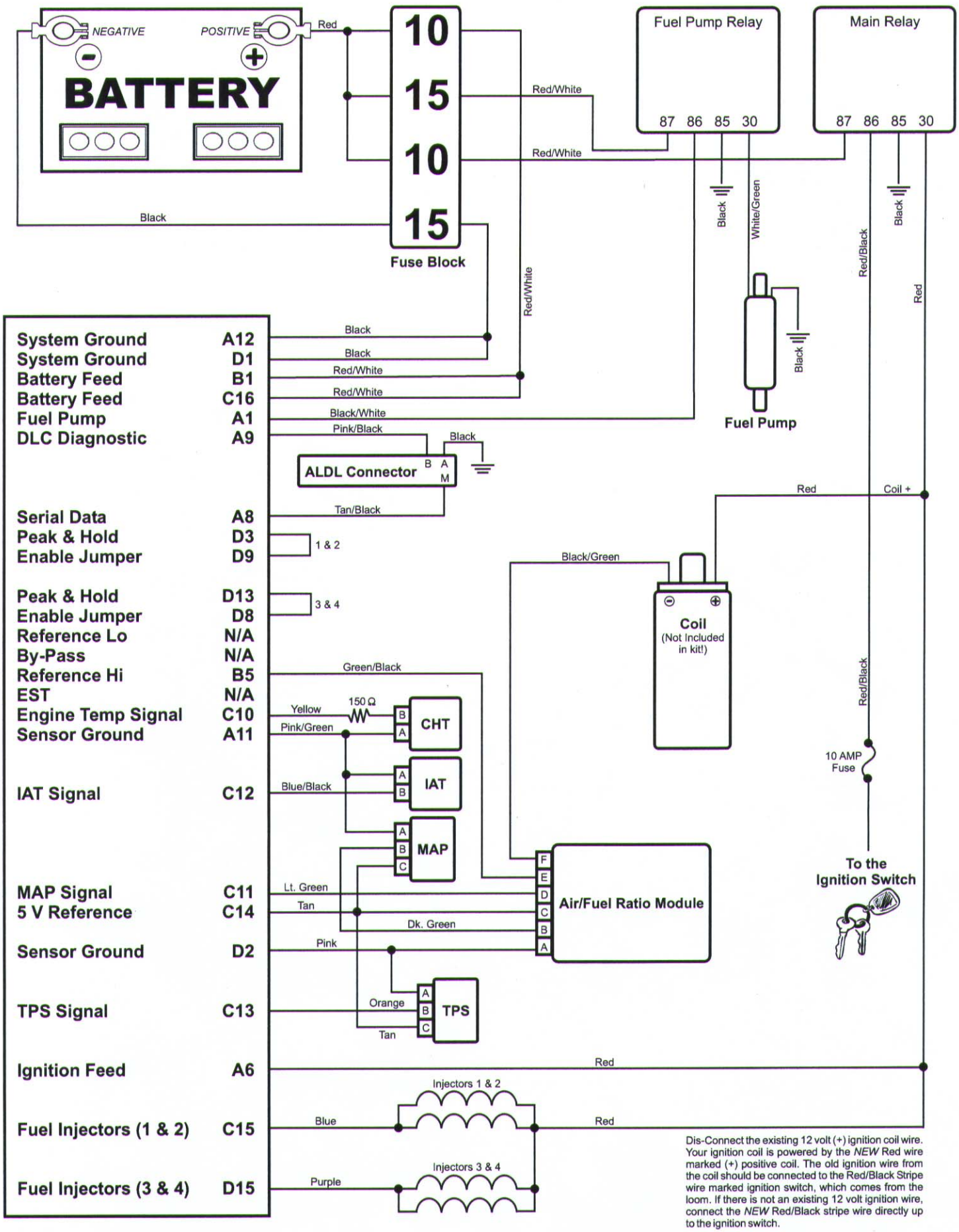


Comp. & ULTRA Comp. Injection - (4 injectors)



Dis-Connect the existing 12 volt (+) ignition coil wire. Your ignition coil is powered by the *NEW* Red wire marked (+) positive coil. The old ignition wire from the coil should be connected to the Red/Black Stripe wire marked ignition switch, which comes from the loom. If there is not an existing 12 volt ignition wire, connect the *NEW* Red/Black stripe wire directly up to the ignition switch.

Smogable Comp. & ULTRA Comp. Injection - (4 injectors)



Dis-Connect the existing 12 volt (+) ignition coil wire. Your ignition coil is powered by the *NEW* Red wire marked (+) positive coil. The old ignition wire from the coil should be connected to the Red/Black Stripe wire marked ignition switch, which comes from the loom. If there is not an existing 12 volt ignition wire, connect the *NEW* Red/Black stripe wire directly up to the ignition switch.

Trouble Shooting CFI

CFI is a simplified easy to understand electronic injection system. Most of the bells, whistles, and complications normally attached to electronic fuel injection have been eliminated from this new CFI package. The logic for CFI is solid state digital. The only electronic components with moving parts that are used in the actual injection system are the fuel injectors, the TPS, two relays, and the fuel pump. All other components such as the computer and engine temperature sensor are solid state.

The fastest and most accurate way to check the electronic system is with the use of a GM compatible scanner. The scanner will supply information concerning but not limited to: TPS setting, engine temperature, injector pulse rate, RPM, system voltage and possible trouble codes. This range of information can be accessed under GM 1990 L 05 5 27 R. The use of the scanner requires technical training which is normally supplied by the manufacturer of the unit. Most modern automotive repair shops are equipped with scanners and can quickly perform the service for you.

You can however, run a series of checks by using an inexpensive digital multi meter. Other basic testing can be accomplished with a non-powered test light. A complete systems check should begin by confirming that your electrical system maintains a voltage range of 12 to 14 volts. This range of voltage must hold true during switch on only, cranking and running modes. Low voltage, less than 12 volts, can cause the computer to misread the engine generated signals. This will result in faulty engine performance. Other problems that accompany low voltage center around the fact that the electronic relays in this system are designed to function in a prescribed voltage range. Initial low voltage due to low battery reserve can cause hard starting problems. However, once started, and proper system voltage is restored and maintained, by the alternator, the engine will run as it should.

Make certain that your electrical system including the battery is up to specs. If necessary use a hydrometer to test your battery. If jump starting or charging is required, ***DO NOT USE 24 VOLT CHARGING EQUIPMENT.***

CFI has been designed to operate with most ignition systems. The computer triggers the injectors based on signals received from the distributer. The computer fires all four injectors at the same time. This event happens once each engine revolution. The computer varies the length of time that the injectors are opened. This determines how much fuel is squirted in to the engine during each revolution. The time that the injectors are open is referred to as the pulse width. The injector pulse width is measured in milliseconds. The injector pulse width or rate, will vary from 1.7 milliseconds during idle speed to over 9.0 milliseconds at full throttle.

The injector pulse width is a product of engine temperature, RPM, and TPS settings. During cold start, the injector pulse rate is longer to supply the additional fuel required to run the engine. The injector pulse rate is automatically shortened as the engine warms. The injectors are turned off during rapid deceleration.

The easiest way to see if the injectors are actually firing, (squirting fuel) is to remove a complete fuel rail assembly and crank the engine over. Make certain to pull the coil wire before cranking the engine because you only need a quick visual check of each injector. If one or more injectors fail to produce a spray pattern on command, you can use a test light or digital multi meter to verify an electrical pulse. This is done by removing the injector wiring connectors from ***all of the injectors.*** Attach the test instrument to both leads of one injector. An easier way, if you have the special test equipment, is to use a node light for the test. A node light can be plugged into an injector connector to supply a visual indication of an electrical pulse at that location.

If the test device fails to indicate a 12 volt pulse during engine cranking its possible that you've got some type of wiring problem. Check the other injectors to see if you have a partial or complete system failure.

If you determine that an electrical pulse is present at each injector, and the injector does not produce a spray pattern, check the fuel pressure. Is pressure present at each injector? Are the injectors plugged? If not, check the fuel pump to make certain that it is functioning when turned on. Remember, the fuel is on a timed safety circuit. If you require a longer length of time to check the fuel pressure, use jumper wires to run the fuel pump. Make certain to first disconnect the fuel pump from the fuel pump relay before you hook up the jumper wires.

But slow down before you rip up the electrical system. Fuel delivery problems can often be traced to basic big thumb problems such as a plugged fuel filter. A filter that is completely plugged is easy to spot. The pump runs but nothing comes out the pressure end. A partially plugged filter is a little harder to deal with because it can allow enough fuel to trickle through the system to idle the engine. Slight opening of the throttle will result in a typical lean condition with lots of snapping and popping out the throttle bodies and exhaust. Your best shot here is to remove and clean the fuel tank and install a new filter. Before you do all of that, make certain that you've got enough fuel in the tank to get around the block.

If pressure is present in the lines, and the injectors don't seem to be responsive it's time to check the red wires at the injectors. Each injector is connected to a common fused circuit. 12 volts should be present and continuous at each red injector terminal with ignition switch turned on. If 12 volts is not indicated, check the fuse and power supply to determine where the fault or break in the power supply lies. Don't forget to remove the fuel pump jumper wires before continuing your search for fuel delivery problems.

The blue wires at injectors 1 and 2 are connected to terminal C 15 at the computer. Injectors 3 and 4 are connected via blue wires to computer terminal D 15. The computer grounds these circuits on command, thereby energizing the injectors. One way to determine if the computer is signaling the injectors to open is as follows: disconnect all of the injector terminals from the injectors. Connect a 12 volt test light across one injector terminal. Crank the engine over, and observe the test light. It should wink on briefly with every complete rotation of the engine. A multi meter can also be used for this test.

If the test light shows no response to engine rotation, check the red wire at the injector terminal to verify that 12 volts is present at all times when the ignition switch is on. If voltage is not present, check the complete circuit to origination. Check computer terminals C 15 and D 15 to make certain that the wires are making contact with the computer pins. Use a continuity tester for this check. Remove the wiring connectors from the computer. Examine computer pins C 15 and D 15 to make certain that they are not bent, thereby preventing contact with the connector. ***Never use direct battery voltage to test computer circuits.***

An improperly grounded main system ground can cause partial or total loss of injector function. Make certain the main system ground is bolted or screwed to a chassis ground. The ground surface must be free from paint or rust. The engine must also be wired to chassis ground. Use a continuity tester to verify ground to computer terminals A 11, A 12, and D 11. It is not necessary to provide a separate ground wire for the computer housing or chassis. Computer terminal A 12 provides a main ground circuit. ***Caution, Never use direct battery current to test computer circuits. Always use a continuity tester for this purpose.*** The use of direct battery or power supply current to check computer circuits will most always result in unrepairable damage to the computer.

The dash mounted tuning module connects to the main harness with a four wire connector. The wires are color coded to facilitate inspection procedures. The green wire, terminal D at the connector provides varying voltage (1 to 5 volts) to computer terminal C 11. This is the MAP circuit. The left side knob controls the amount of voltage supplied to this wire. Clockwise rotation increases the voltage. Counter clockwise rotation decreases the voltage. Normal idle speed voltage at C 11 varies between 1.25 and 2 volts. Voltage settings higher than 2 during idle speed will produce an over rich condition. This circuit can be scanned under MAP. A multi meter can be used at computer C 11 or terminal D at the plug.

The right side knob on the dash module provides enrichment information to the computer during midrange and W.O.T. The high speed system is made richer by turning the knob clockwise. This information is also routed to the computer via green wire to connector terminal B and then to computer terminal C 11. Initial upper end voltage should be set at 4.25 volts. This can be checked with a scanner or multi meter.

Computer terminal C 14 supplies a 5 volt reference to the dash module via the tan wire and connector terminal B. This circuit is controlled by the TPS switch. A varying voltage between 1 and 5 volts feeds into the dash module from computer terminal C 13 via green wire and connector D. Average voltage at C 13 with throttles closed is .95 to 1 volt. Full throttle settings with the right side knob advanced should read 4.75 to 5 volts. TPS voltage is scannable or can be monitored with a multi meter.

The scanner will also provide throttle setting information in degrees of throttle plate advance as well as voltage. A TPS switch set in an advanced position can cause an engine to idle uncontrollably rich. Initial TPS voltage should not exceed 1.10 volts. Do not advance your TPS beyond its original factory setting. An unbalanced set of throttle bodies can create a serious idle speed over rich condition, here's how.

If the right side butterflies are significantly advanced (opened) ahead of the left side butterflies, the TPS will indicate an advanced throttle setting. The advanced throttle position will tell the computer to richen the mixture in order to begin acceleration. For this and other reasons, it's imperative to proper engine operation that the throttle bodies be in close sync. A final check of the throttle body sychronization must be done with a unisyn gauge. The procedure is similar to balancing a set of dual carburetors. TPS voltage at idle speed must not exceed 1.10 volts. This voltage can be probed at the 3 wire TPS plug, terminal B, or at computer terminal C 13.

If the engine refuses to run, check C 14 with the switch on. It should produce a constant 5 volt reference voltage. Make certain that the D 2 sensor ground is functional. Check C 11 with switch on for idle speed voltage. It should read 1.25 to 2.00 volts. Advance the throttle. The voltage at C 11 should advance to 4.75 to 5.00 volts at W.O.T. If voltage is not present at C 11 recheck complete power supply to computer.

An over rich condition can be caused by a short to ground or failed ETS. C 10 should indicate approx. 3,400 OHMS at 70 degrees F. The accompanying chart will provide a range of temperature to OHM values. A grounded ETS wire will result in a reading of more than 100,000 OHMS at terminal C 10. This will cause the engine to run super rich. Conversely, a broken or open lead to C 10 will create a lean condition resulting in hard starting due to cold weather. An open or broken lead is indicated by a reading of zero OHMS at C 10. The engine will run ok after it warms. So if you have a hard cold start problem, check the OHM reading at C 10. When using the engine temperature chart keep in mind that it represents only approximate resistance values.

Tuning Hints-

Most VW engines run in the 1.60 to 4.25 MAP voltage range. Higher revving race engines can be further richened on the upper end by increasing the high end MAP output. Heres where the stomp tuning comes in because you can only set the upper end MAP voltage during full throttle with the engine under load. Your best shot for a realistic dial in is in fourth gear, which gives you adequate time to "feel the engine". Third gear is second best, but you can use it when suitable high speed terrain is limited. The problem with power tuning in third gear is that your engine will actually use more fuel when it's in fourth gear. Why? Because it's pulling harder, a lot harder. So if you attempt to use third gear to dial it in, it's possible that your engine could run out of fuel at higher revs during a hard pull in fourth gear.

A lean condition will sometimes announce itself as the engine hunts or surges while traveling at constant highway speeds. An additional hint of a lean condition is a stumble from first acceleration, followed by possible snapping back through the throttle bodies as the engine attempts to gain speed. The stumble and snapping is the engines way of saying, help.... give me some more fuel! Trying to run an engine too lean will cause the engine to run hot. Chrome exhaust pipes often turn dark blue when an engine is pushed to high RPM while running a dangerously lean fuel mixture.

On the other side of the fuel equation, full rich often isn't the answer. You'll quickly find that an

engine that is too fat on the upper end of the air/fuel curve will sort of mush out at high RPM. A slight tad down (counter clockwise on the right side knob) from rich will usually bring in that crisp, snappy just feel right. When you've got it right you can sense it from the seat of your pants as the engine lights up and screams to life.

Don't expect your new CFI kit to work miracles. It won't restore lost power due to worn engine parts or ignition timing that was set by guesstimate. So do your home work, adjust your valves, set the timing, fix those exhaust leaks and tie down all the loose wires before you blast off. Make certain that your engine is ready for the task ahead. When you get it running , don't misinterpret high speed valve float. If your engine flattens out and lays down on the upper end it isn't necessarily the fault of your new CFI package. Check out those valve springs. When your gonna wind it over 4700 RPM you'll need some type of high rev valve springs, because stock VW springs just won't do the job. Dual valve springs will be required for anything over 7,000 RPM.

As previously stated, you can't dial in the upper end fuel curve while parked at the curb, or while just cruising down the street with a light load on the engine. But you can dial in the bottom end by just turning the left knob on the control module until your engine idles smoothly. Then with the idle speed set, try an easy transition into fourth gear. If the engine bogs or snaps out the pipe as it comes under load, increase the air/fuel mixture by turning the left knob clockwise. If you manage to get it to rich, the engine will quickly tell you by emitting black smoke and performing on the lazy side. Play with the low speed adjustment until the engine idles smoothly, and moves the car forward at first acceleration and slow speed without hesitation.

Dialing in the bottom end is a snap. Upper end tuning poses a challenge because like we said, you can only find that magic mix of air and fuel that your engine requires for upper end peak efficiency by repeated full throttle testing. Old fashioned trial and error. And you can't power tune on a public street because serious power tuning usually puts you over the speed limit.

An upper end dial in session is really what it is all about. It's where all of the bench racing stops and the real stuff starts. This is the reason that you spent the last three months getting your engine ready! Power tuning requires that you first locate a 100% unrestricted "OFF ROAD" area. Race tracks and sand dunes work just great. You're going to be traveling at high rates of speed during the tuning procedure and the chosen test route must be well sorted out. Safety first.... Drive through the test area once or twice at low speed, check it out, look it over before beginning your power tuning procedures.