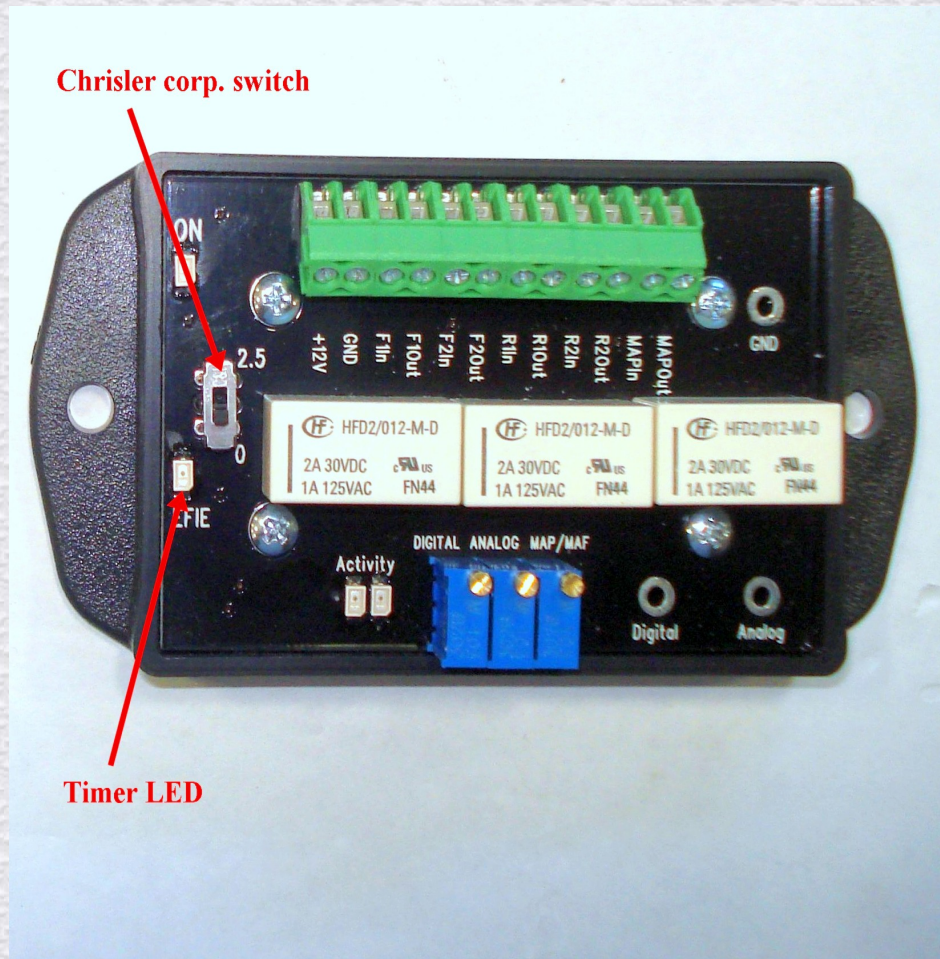


**NEW SIMPLIFIED—EASY TO FOLLOW AND UNDERSTAND**  
**Install instructions for the New 2014 EFIE & MAF/MAP 2 in 1 Combo.**  
**For Narrow Band Oxygen Sensors Only.**  
**If you can read, you can install this device very easily.**

Hi Guys

Although you can get by without a repair manual if you are a really good experienced mechanic, I highly recommend that you purchase a Haynes, Clymer or Chilton's repair manual for your specific vehicle with a schematic wiring diagram and wire color codes for easier wire identification. It will help you a lot throughout your installation and tuning procedures. I have noticed that these companies are not including the wiring diagrams on a lot of the newer model vehicles, and you have to order the wiring diagrams separately. You may want to check this before you buy, and order them if you need to. I guess this is their way of taking a little more money out of our pockets.



## The Chrysler Bias Switch

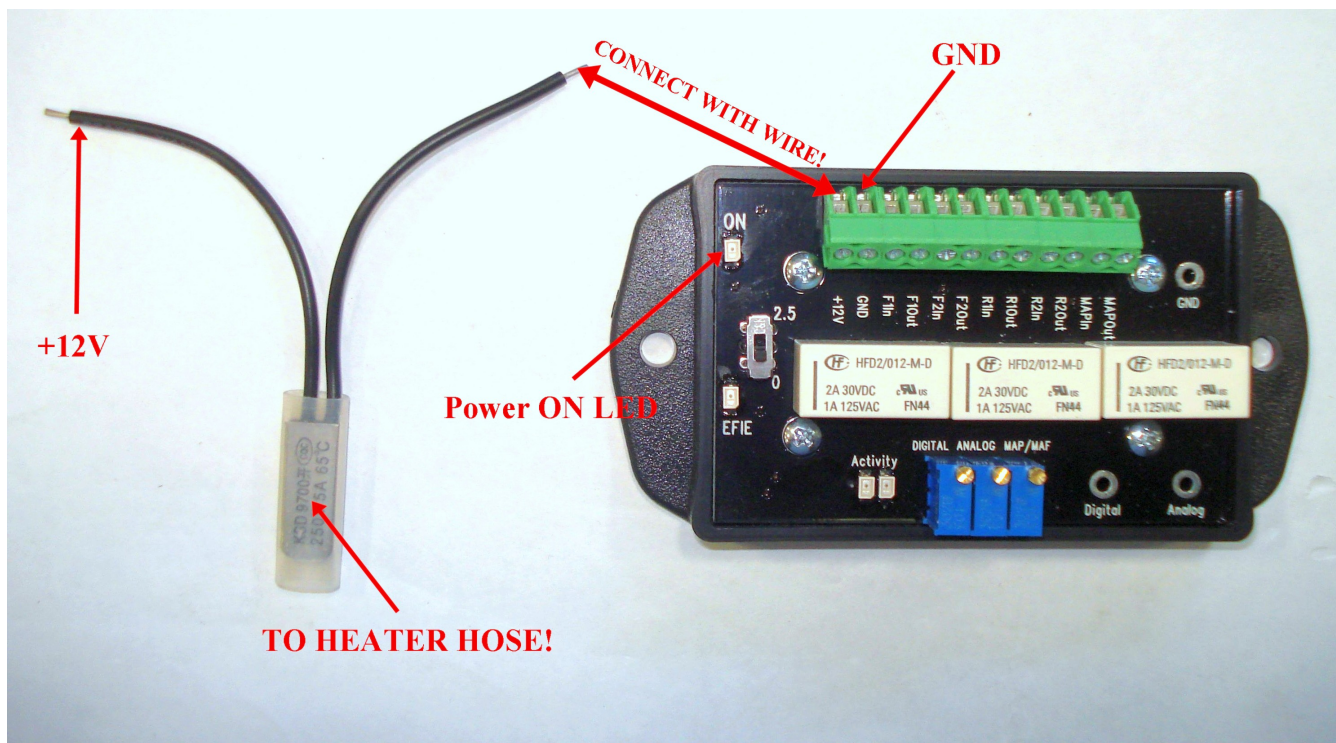
If you are installing on a Chrysler Product, (Chrysler, Dodge, Jeep, Plymouth ) with a V6 or V8 engine you may have a 2.5 volt bias voltage on your Signal Wire. Measure the voltage from the signal wire to ground **with the engine running**. **If the voltage is jumping between 2.6 volts and 3.4 volts, you have the bias voltage, and you will have to slide the chrysler switch upward to the 2.5 position. Make certain that you slide it all the way up. See above photo. If your voltage is the normal .100 to .900 place the switch in the "0" downward position for all normal vehicles.**

## **Mounting your Tstat Switch.**

You must mount your Tstat switch on your Inlet Heater hose. If you do not know which hose this is, then just do the following. It is very easy to tell. Start your engine and let it warm up a little. While it is warming up, I want you to find the 2 hoses that run from your water pump to your heater. Your heater is normally mounted inside the passenger compartment behind the firewall. When your vehicle is warmed up a little, I want you to turn your heater on. I don't care if it is 98 degrees outside, go ahead and turn it on. Now go back under the hood and feel the 2 heater hoses that you found before. One of them is going to be warmer than the other one. This will be your inlet heater hose. This is the hose you will mount your Tstat switch to. We recommend using a universal hose clamp to hold it in place. DO NOT over tighten. Locate the Tstat as close to the water pump as possible. **DO NOT let any part of the metal sensor come in contact with the vehicles Ground or ANY metal part of the vehicle. The metal part of the sensor is "HOT" carrying 12+ volts of positive current. Grounding it will immediately destroy the Tstat switch. We do not want to have to SELL you another one.**

If you live in a cool climate, it is a good idea to wrap some fiberglass pipe insulation around your hose and Tstat Switch, and then wrap your insulation, and Tstat Switch with black electricians tape. This will insulate your Tstat Switch from cold air flow when you are driving in very cold or below freezing Freezing temperatures.

**Before you mount your Tstat, you are going to have to solder some wire on each of the 2 wires on your Tstat. One of them has to be long enough to reach your 12 volt ( ignition switched ) power source, and the other one has to be long enough to comfortably and safely reach your EFIE& MAP/MAF Tuner and attach to the 12+ connector on the Tuner. See Photo below.**



## Connecting Your 12 V. Ignition Switched Source

With the new Tstat switching device, you will need to solder on lengths of wire to the Tstat stub wires long enough in length to reach your chosen 12 volt ignition switched power source on one side of the Tstat, and long enough to reach the 12v input of your EFIE & MAP/MAF 2 in 1 Combo to the other wire of the Tstat. Refer to above photo. Connect your terminal marked GND to either the negative terminal of the battery or a GOOD clean chassis ground. No dirty or rusty bolts. You will need a very good ground connection. So take your time and make sure it is. When you make your solder connections to the Tstat stubs, please use heat shrink tubing to insulate and weather proof your connections. Please do not use electricians tape unless you absolutely have to.

It is now time to figure out how many O<sub>2</sub> ( oxygen ) sensors your vehicle has. You can use your repair manual to determine this. If you are uncertain and can not determine this on your own, you should call your favorite auto parts house, and most would be glad to supply you with this information. If you happened to have purchased a "Haynes Repair Manual" it will have photos showing you where your sensors are and how many.

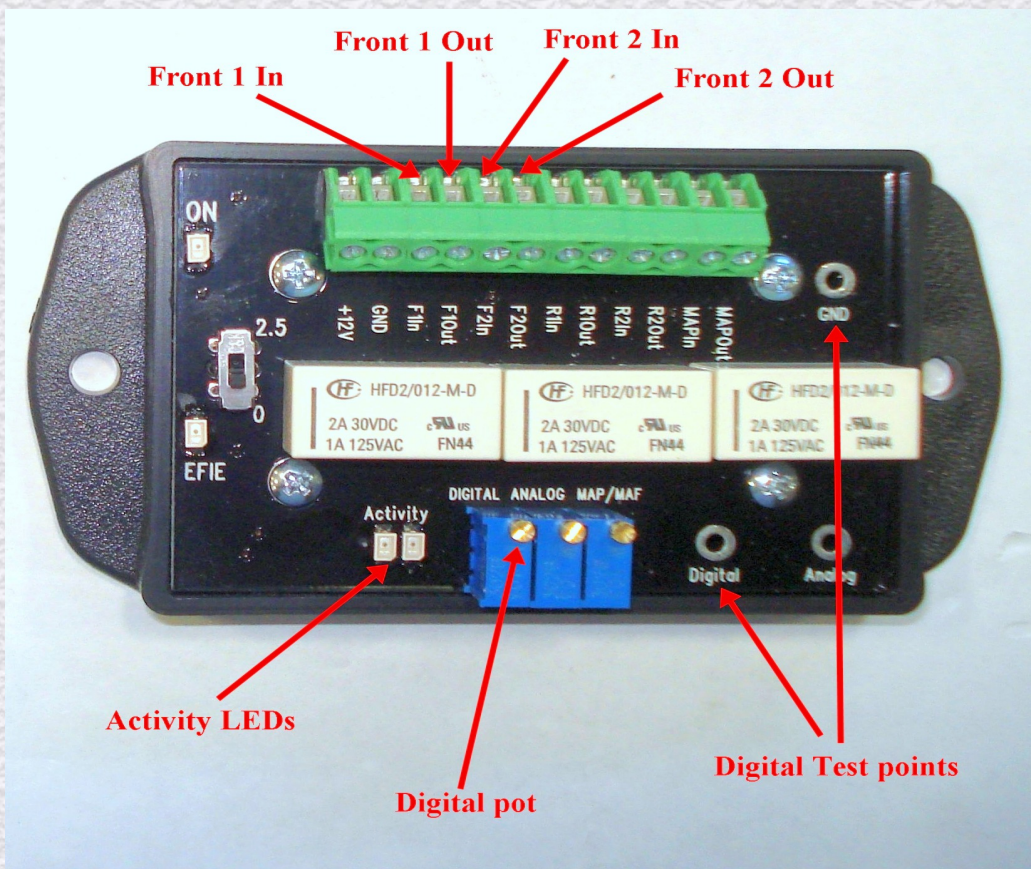
I hope you took the time to read the article that we sent called Locate your O<sub>2</sub> signal wire. It is very helpful. Specially if you did not buy a repair manual. If you follow the manual check method, all you will need are some straight pins and a voltmeter to locate your signal wire on each O<sub>2</sub> ( oxygen ) sensor.

An upstream oxygen sensor is an oxygen sensor that is located between the catalytic converter, and the exhaust manifold(s). Depending on the Year, Make, Model, and Engine Size of your particular vehicle, you will either have 1 or 2 upstream O<sub>2</sub> (oxygen) sensors.

Any oxygen sensors located between the catalytic converter and the end of your tail pipe are called Downstream O<sub>2</sub> ( oxygen ) sensors. You will normally have either 1 or 2 of these, depending once again on your particular vehicle.

We will now proceed and connect your upstream O<sub>2</sub> sensors.

### Connecting Your Upstream O<sub>2</sub> Sensors



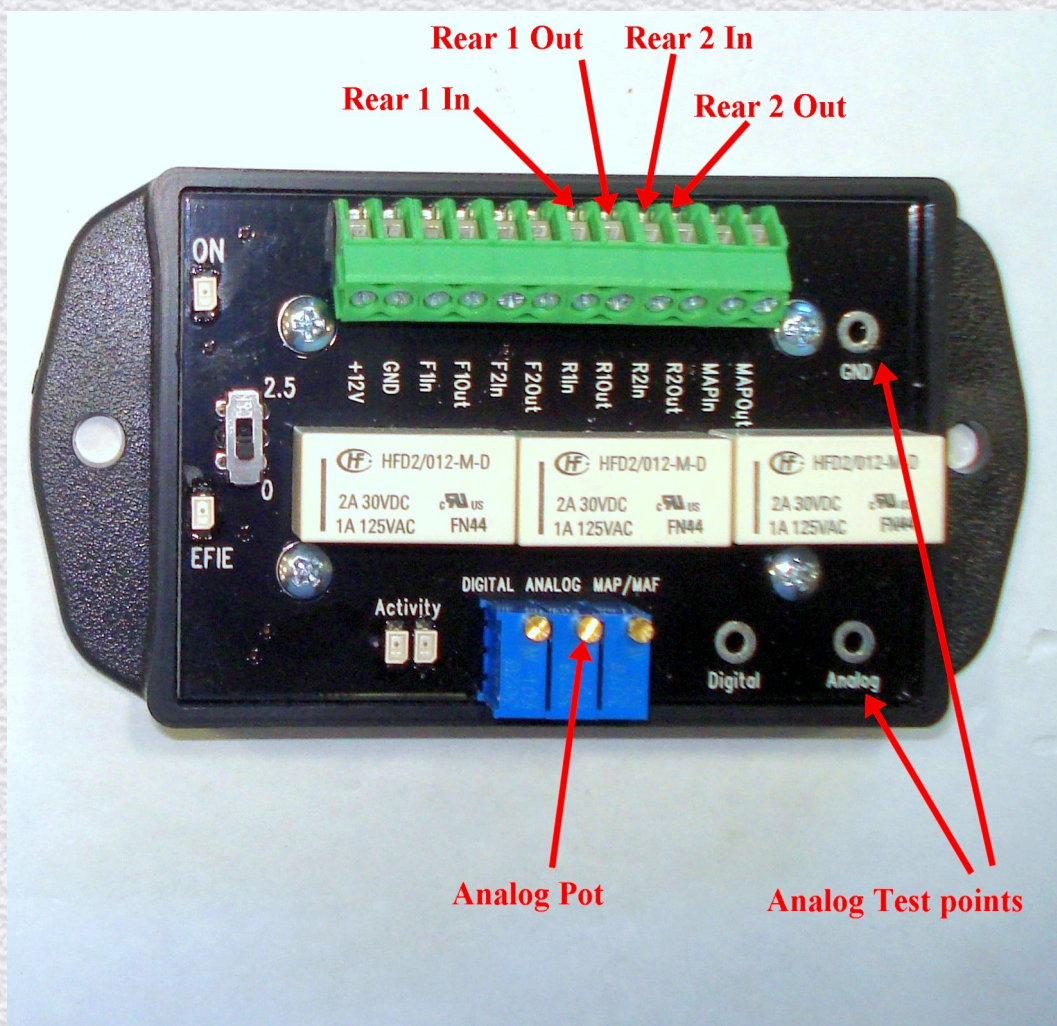
We have included in a separate document, instructions for determining all of your signal wires with your volt meter and as a double check to your Haynes or Chilton's Service Manual diagram.

Now that you have located your upstream oxygen sensor(s) You will now cut the signal wire of your upstream O2 sensor above the plug in block on the O2 sensor wiring harness anywhere between the plug in block and the computer. What ever location is easiest for you to get to. Now that you have cut the wire, we will call the part of the wire that goes to the sensor, " The sensor wire" and the other part of the cut wire will be called " The computer wire " You will need to solder on a length of wire to the "Sensor wire" long enough to reach the **F1in** connector on your tuner. You will now solder on a length of wire to the "Computer Wire" long enough to reach the **F1out** connector on your EFIE tuner. Connect both of these wires to their proper connector on the EFIE tuner.

If your vehicle has Two O2 upstream ( **before the catalytic converter** ) sensors you will repeat the same process that you have just completed. Locate the signal wire and cut it. This time The "Sensor Wire" connects to the **F2in** connector and the "Computer Wire connects to the **F2out** connector. **If your vehicle only has 1 upstream sensor, leave the F2 connectors empty and do not use them.**

***We highly recommend that you heat shrink or silicone seal, all of your wiring connections after you have completed your soldering.***

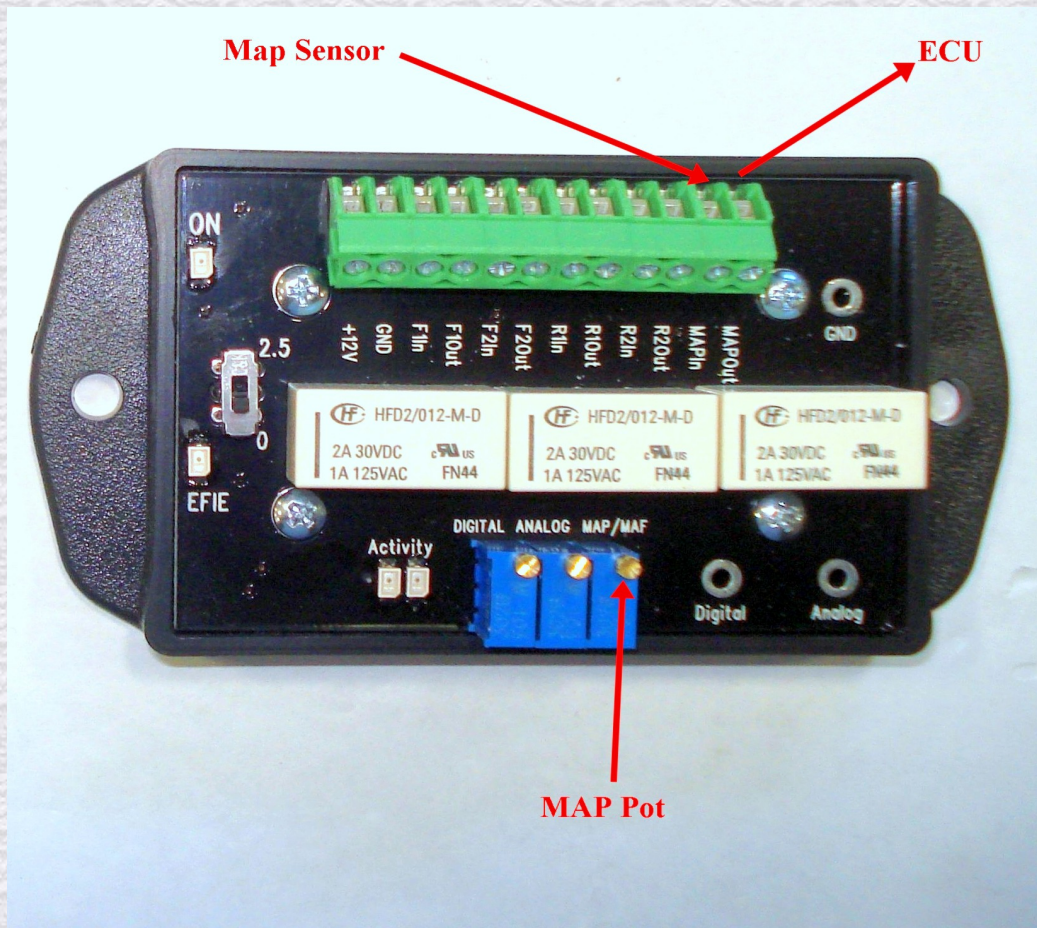
### Connecting Your Downstream O2 Sensors



We will now be connecting your downstream ( **after the catalytic converter** ) O2 sensors if your vehicle has them. This is done exactly the same as your upstream sensors. Locate the signal wire of your First downstream sensor and cut it. You will need to add lengths of wire to each side of your cut signal wire in order to reach your EFIE Control mounting location. The “Sensor Wire” is inserted into **R1In** and the “Computer wire” is inserted into **R1Out**.

If you have a second downstream O2 sensor, once again locate the signal wire, cut it, and add enough wire to each end of the cut signal wire to reach the mounting location of your EFIE Control. The “Sensor Wire” is inserted into the connector marked **R2In**, and the “Computer” wire is inserted into the connector marked **R2Out**. You are now finished with the wiring of the EFIE portion of the Control Center.

## Connecting your MAF/MAP Enhancer



This AFR Control device contains a voltage based MAF/MAP enhancer, which is the most common in most vehicles today. There are some vehicles that use a frequency based MAF sensor and a voltage based MAP sensor. These are rare, and are usually found on very few Fords & larger V8 GM products. **If your vehicle has this combination, use which ever of the two sensors is voltage based. You do not need to adjust the signals of both.** Either the MAF or the MAP will work just fine.

If your vehicle has a voltage based MAF sensor we recommend using the MAF.

Locate your MAF or MAP sensor. They will normally have three wires.

+ 5volt  
- Ground  
Signal Wire

Once again, cut the signal wire. Add additional wire if necessary to reach your EFIE mounting location. The "Sensor Wire of the MAF or MAP sensor is inserted into **MAP In** connector. The "Computer Wire" is inserted into the **MAP Out** connector. If you have any doubts about your signal wire, here is the easiest way to find it.

## Finding the Signal Wire

Of course the easiest way to find the signal wire is to use your manual's wiring diagram for your vehicle. This can tell you the exact wire, and it's color code, and save you some time. But if you didn't take our advice and don't have a wiring diagram, you can still find your signal wire by measuring it

A MAP or a MAF will have 3 wires. One will be 5 volts, which powers the device and is supplied by the ECU. One will be ground, or 0 volts. So if you measure the 3 wires, just eliminate the 5 volt wire and the 0 volt wire, and the remaining wire is the signal wire. This is slightly complicated by the fact that many MAF sensors today also include an Intake Air Temperature sensor in the same housing. In this case you'll have 5 wires going to the sensor. But it's OK, it's easy to find the correct wires you need. The temp sensor will have a ground wire and a signal wire. The signal wire will be up near 5 volts when the sensor is cold, but as it heats up that voltage gets lower. But a temp sensor's voltage will not change when you goose the engine, and that's how you can tell the difference. Also, if you unplug the sensor, and measure the signal wire on the computer side, it will read 5 volts.

Now, how do you make sure your MAP is a voltage type, and not a frequency type? You will need to watch the voltage as you make changes to the engine's RPMs. The best way is to goose the engine. The voltage will change dramatically on either a MAP or a MAF if it is voltage type. You will see a small change in DC voltage for a frequency type device too, but the changes will be slight, like tenths of a volt. Whereas the changes on a voltage type will be much more dramatic. Changes of over a volt indicate a voltage type MAP or MAF.



Tip: You can steal a straight pin from your wife's sewing box and push it through the insulation of the wire you want to test. Make sure you get into the conductor (wire) inside. This will be much easier than scraping away the insulation to test the wire

Even if you find your signal wire using a diagram, you should still test it before proceeding. You must make sure that you see a voltage change when you rev the engine, and that the voltage drops back down when the engine slows back down again. If you see this phenomena, you can proceed to install the circuit. If you don't see this phenomena, then you have the wrong wire, or an incompatible sensor type. Do not try to use this circuit unless you find a signal wire that matches this phenomena.

**The biggest single cause of failure for any sensor modification project is to mis-identify the signal wire. So it's best to be absolutely sure.**

\*Note If your vehicle is one of the very rare models that uses frequency based circuitry for both the MAF & MAP sensor this MAF/MAP enhancer will not work with your vehicle. Contact us and we will advise you where you can purchase a frequency based MAF/MAP enhancer.

**All of Your Control Potentiometers Have been pre-set to their “ 0 “ positions**

### **Sequential Timing: What to expect.**

When you start your vehicle your ECU will take a barometric reading from your MAF/MAP sensor.

1. When your engine temperature reaches approximately 160 degrees farenheit, Your Tstat switch will switch on and send power to your EFIE & MAP/MAF control device.
2. Your power indicator LED will light up.
2. 30 Seconds later your EFIE-- LED will light and activate the EFIE controls.

### **Tuning Your EFIE and making Ajustments**

Start you vehicle and let it warm up to operating temperature. You will know when it is warm enough, because the power indicator and the EFIE LED will be lit, and the ACTIVITY--LED's begin to blink, ( They will not blink until your O2 sensors have reached 600 F. and start to emit a signal ) You will begin to make your adjustments to your Upstream O2 sensors. It is a very simple process if you follow my directions. Get out your volt meter and set it to it's lowest DC voltage scale, unless you are working on a Chrysler vehicle with the bias voltage. Then you will have to use a 10 or 20 volt scale. Which ever your voltmeter has. If you have a newer automatic voltmeter it will automatically choose the correct voltage range. Now I want you to place the positive probe of your volt meter into the hole of the “**Digital Test Point**” then place your negative probe into the “**GND**” **Test Point**. Find your Digital pot, and while viewing your volt meter, I want you to begin turning your Digital Pot Clockwise. The more you turn, the lower the voltage reading will be. If you have a normal vehicle and not a bias voltage Chrysler, keep turning clockwise until your volt meter displays **.300 volts. The lower the voltage is, the leaner the fuel mixture will be. Too low a setting can possibly trigger a Check Engine Light. Please refer to previous photos for reference.**

If you have a bias voltage Chrysler, follow this same procedure, but you are looking for a voltage of **2.80 volts**

We are now going to adjust our Downstream O2 Sensors. You can leave your negative probe in the "GND Test Point, but move your Positive Probe to the Analog Test Point, Now find your analog adjustment Pot and begin turning it Clockwise. This time the voltage will rise as you are turning it clockwise. The downstream O2 sensors work differently than the upstream. I want you to set your voltage so that your volt meter shows **.250 volts** On your downstream sensors, the higher the voltage is the leaner the the fuel mixture will be.

**CAUTION.** There is only so far that you can adjust your O2 sensors before your computer will not believe your adjusted signal. Every vehicle is slightly different as to how much adjustment it will take. When the Computer no longer believes your adjusted signal you will trip a trouble code, and your computer will go into "Open Loop" mode. If this happens you will need to reduce your adjustment and clear the trouble code from your vehicles computer.

### **MAF/MAP Adjustment:**

With the engine running, and if you have a Scan Tool, turn the MAF/MAP pot clockwise until you see a 10% to 15% reduction on the engine Load % gauge of your Scan Tool.

If you do not have a scan tool, turn your pot clockwise until you feel or hear a slight drop in the engine RPM, and the engine feels sluggish on acceleration. You will then need to turn the pot counter clockwise slowly and a little bit at a time, until power is restored. This will give the the maximum MAF/MAP adjustment that your vehicle computer will allow.

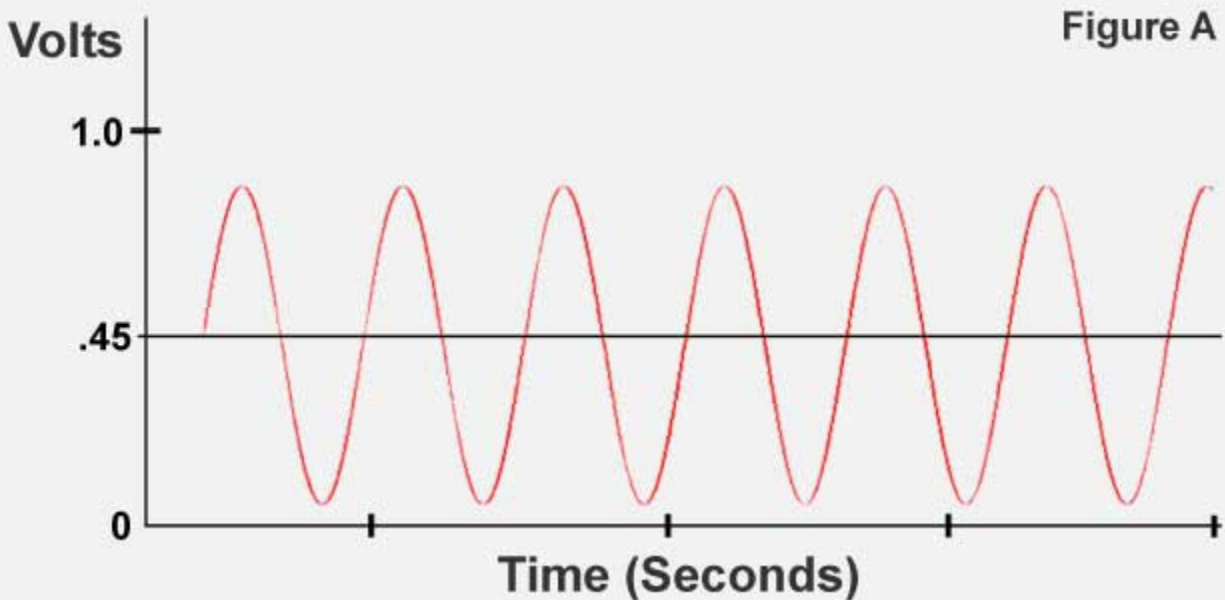
**The important point to remember is that turning any of the potentiometers clockwise, leans out your fuel mixture, and turning them counter clockwise, richens the fuel mixture. If you attempt to lean your fuel supply too much, your vehicles ECU will go into open loop mode, and usually a CEL ( check engine light ) will appear. You will need reduce your setting that triggered the CEL and clear the Trouble code for the computers memory. On some vehicles this can be done by disconnecting the Negative battery cable for 15 to 20 minutes and then reconnecting it. On other vehicles you will need a code reader or scan tool to clear the codes. Refer to your Repair manual that you purchased for clearing trouble codes for your vehicle.**

**For all of you who would like to know the technical reasons of How our Digital EFIE works and why it is better than any other on the market, Please read the following explanation.**

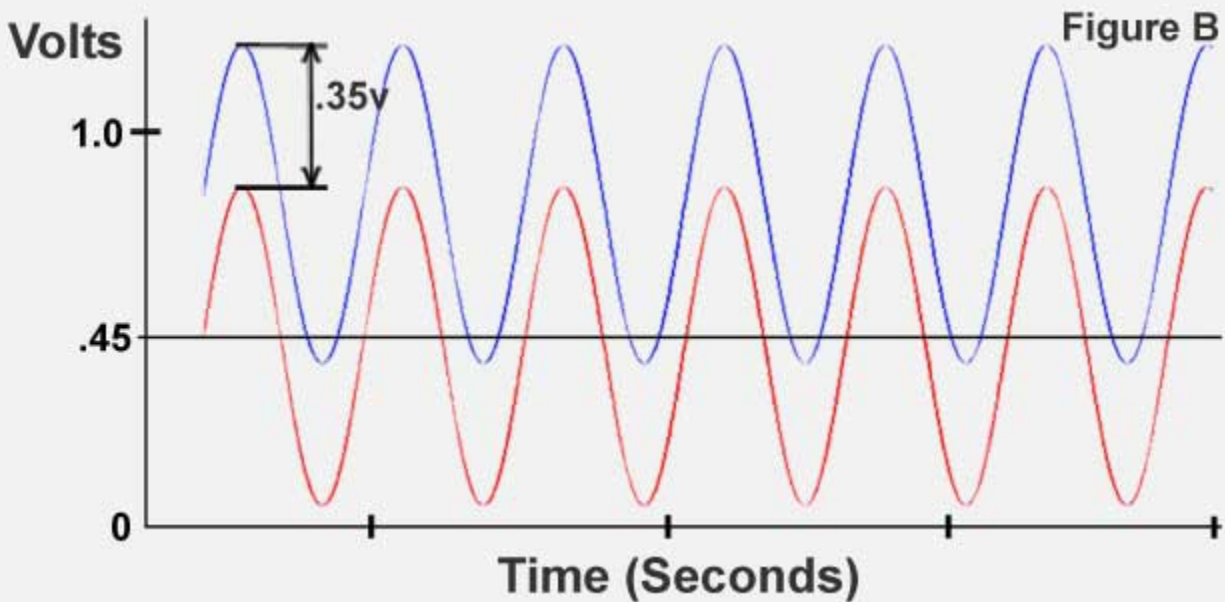
## Previous EFIE Designs

First, let's have a look at how oxygen sensors work. Have a look at Figure A below. Here we have a graph that is a *representation* of the voltage output of a typical oxygen sensor while the engine is running. Note, that this is only an approximation of a real voltage graph. A real graph would be much more jagged and would not be so regular as this one. But I'm using this graph to make it easier to visualize the concept of what the sensor is doing.

Narrow band oxygen sensors don't tell the ECU what the air/fuel ratio is. They only tell if the mixture is rich or lean. The line that is marked ".45" volts denotes the make/break point for the sensor's voltage output. Any voltages that are higher than .45 volts is considered to be rich, and any voltages that are less than .45 volts is considered to be lean. When the sensor produces .45 volts, that is considered to be the correct air/fuel mixture which happens to be 14.7 to 1, air to fuel (by weight). The trouble with narrow band sensors is that they can't tell the ECU how rich or how lean the mix is. They only tell the ECU "rich" or "lean". Therefore, in normal operation, they are constantly changing voltages similarly to the graph in Figure A.



Now look at Figure B. The blue line in this graph represents how an EFIE changes the voltage graph of the sensor. As the sensor produces its voltages (as represented by the red graph), the EFIE adds additional voltage. We are showing an EFIE set to 350 millivolts (.35 volts). Therefore the output of the EFIE that goes to the computer will be the voltages in the blue line on the graph. Because higher voltages mean a richer mix to the ECU, the ECU will then lean the mix when it "sees" these "richer" mixture signals coming from the oxygen sensor.



Almost all EFIE designs that are in use today work like the above graph, by adding a voltage to the output of the oxygen sensor. While this approach does work, and has been the only solution available for many years, it has 2 problems that make it not the ideal design.

1. There is a definite limit to the amount of voltage you can add. Notice that if we added .5 volts in the above graph, that the blue line would never dip below the .45 volt line. This is an illegal condition and the ECU will quickly stop using the oxygen sensor if it never sees the voltage transitioning from rich to lean. In actual fact many ECUs need to see voltages lower than .45 volts before it will consider that the mix is lean, and so often you can't set an EFIE higher than 250 millivolts or so without throwing engine error codes.
2. It takes a relatively large change in the voltage to make a small change in the air/fuel ratio. This wouldn't be a problem in itself, but coupled with the fact that we can only add a limited amount of voltage, this causes an end result of a small change in air/fuel ratio.

There is one other approach in EFIE design in use today, and that is to use an amplifier. Instead of adding voltage to the sensor's output, EFIEs of this type will amplify the signal. This, in effect, multiplies the signal. This is a better approach in that the lower voltages are not increased as much as the higher voltages, and you should be able to shift the air/fuel ratio further than with a voltage "adder". However, it is still limited to the amount it can shift the voltage before all voltages are higher than .45 volts. Also, the amplified voltages at the top of the graph can get quite high, possibly high enough that it will set off alarms in the ECU.

## Enter the Digital Narrow Band EFIE

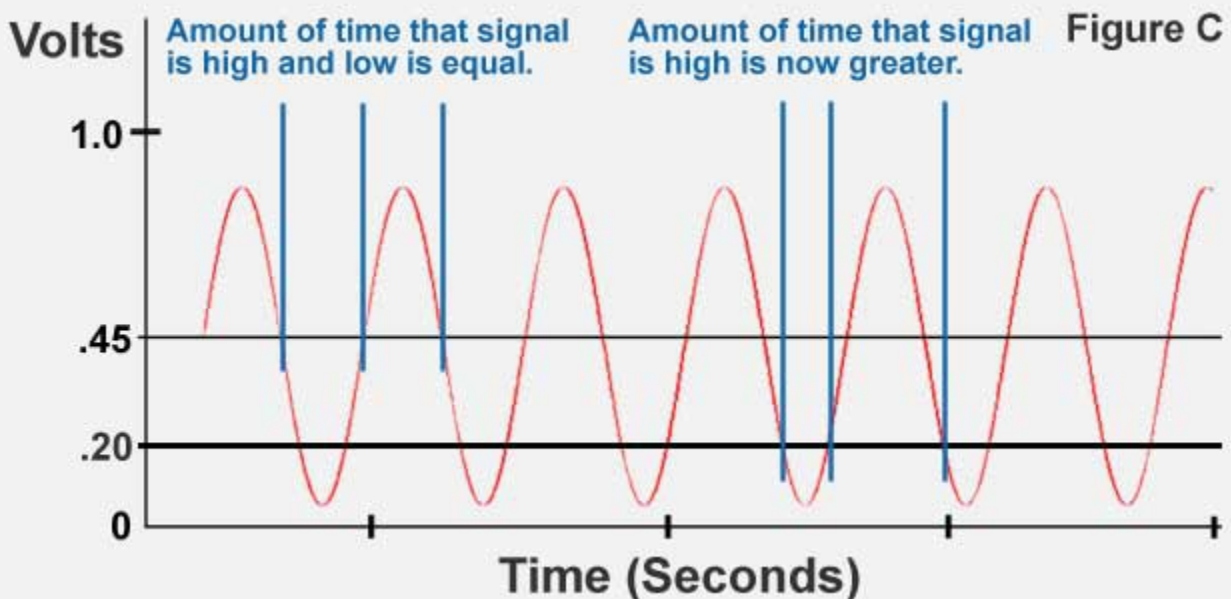
There are other EFIE designs being marketed as "digital". In each case, as of this writing, the only thing digital about them is the pot used to control the EFIE. It's a digital pot and will have one of 64 or 128 resistance values, or possibly more depending on the resistor chip design. While this is cool, it makes no difference in the operation of the EFIE. It will still be operating like one of those described in the section above.

Our new Digital Narrow Band EFIE operates completely differently from any other EFIE made. Our

new EFIE is called digital, because its output is either on or off. Or in other words is either high or low. Or to put in terms the ECU will understand, the output will be either rich or lean. Or to put it in terms of voltage, the output is either going to be .100 volts or .900 volts. This is perfectly acceptable to the ECU and tells it exactly what we want it to see. But because its output is only one of 2 states, we rightfully call this device a "digital" device.

So how do we know when to switch from the high state to the low state? We have a comparator in the EFIE that "decides" when to switch states. If the EFIE were to be set so that there was no change in air/fuel ratio, the comparator would be set to .45 volts. This would mean that if the voltage coming in from the sensor were below .45 volts, the output would be low, and likewise if the voltage coming in from the sensor were above .45 volts, the output would be set to high. This would cause a flat response in the ECU where it would provide the same air/fuel ratio as if the EFIE were not involved.

To lower the air/fuel ratio we need to make the mix appear richer. In order to do this, we make the EFIE transition to a high output even though the input is below .45 volts. In other words, instead of using .45 volts as the switching threshold, we use .20 volts (see Figure C). By adjusting the pot on our new EFIE, we are adjusting at which voltage the comparator will use to determine if the output should be set to high or low. In the graph below, we show 2 comparator voltages for comparison. At .45 volts, we can see that the output will be high about 1/2 of the time. This is the same as it would be without the EFIE. Now notice the line at .2 volts. By setting the EFIE's comparator at .2 volts, the EFIE output will be low for about 30% of the time and high about 70% of the time. This will make the air/fuel mix look richer than it is, and the ECU will respond by leaning out the mix.



Note that .2 volts is probably too low for your vehicle. You will probably not need to set it this low. We only set it here to make it easy to see the principal involved with our new Digital EFIE. An actual setting would probably be closer to .300 - .325 volts.

*Note: When downstream sensors need to be treated, do not use this device. Use an older style, voltage adding type of EFIE. The reason for this is that we're not certain how the downstream sensor information is used by the ECU. In some cases, we have read the voltages from downstream sensors and they don't jump up and down as shown in the graphs above. We've seen them just float around in the .2 to .3 volt range, not changing much. This is not the behavior that the Digital EFIE was designed*

*for. It may work fine. But we prefer that the ECU just see the same behavior, but shifted up a bit, the way a voltage adding type of EFIE will do. Any of our Narrow Band EFIEs that aren't labeled "Digital" will work for this application.*

Using this device, some people have been able to lean the mix to the point that the engine will die. However, in some cases, it is still necessary to do other treatments to get the leaning results needed. For instance many ECUs use the downstream sensors as part of the air/fuel calcs, and many more will use the downstream sensors to verify the upstream sensors and throw odd engine errors. In these cases, downstream EFIEs are needed to get the needed results. That's why we created the Digital EFIE & MAP/MAF Combo It has 2 digital EFIEs for the upstream sensors and 2 analog EFIEs for the downstream sensors. This will give you the optimum treatment for each sensor, and is the most powerful solution we've seen yet for optimizing your engine for use with HHO or other fuel combustion enhancement technologies.

### **Special Note\*\*\***

If you have only one upstream O2 sensor attached to the digital EFIEs, then only that one LED will show activity. We recommend connecting a jumper wire from the ground terminal to the F2 **input** port of the unused digital EFIE. Otherwise the LED for the unused EFIE will randomly turn on or off, and can be confusing. There is no other harm to leaving the unused port ungrounded. But jumpering it as mentioned above will cause the LED for the unused EFIE to be off all the time, making the other LED much easier to use.

### **Step Three:**

Downstream sensors should be treated with analog EFIE's. Analog EFIE's work better on downstream sensors than digital EFIE's due to the nature of the signal they generate. But analog EFIE's also work differently than the digital EFIE's and therefore are adjusted differently. For Digital EFIE's, you lower the voltage to make the mix leaner. For analog EFIE's you raise the voltage to make the mix leaner. Once again, to keep things simple, our EFIE's make the mix leaner when you turn the adjustment screw clockwise, and richer when you turn the adjustment counter clockwise. When you turn the Digital EFIE clockwise, the voltage gets lower, and the mix gets leaner. When you turn the analog EFIE clockwise the voltage goes higher, but the mix gets leaner.

We're sorry that this can be a bit confusing, but the 2 types of EFIE work on a different technology. Once again, using your Volt Meter, place the Negative probe in the Gnd. Test Point, and the Positive probe in the White Analog test point. Now adjust your ANALOG potentiometer. We recommend starting out your rear sensors at about 200mV. Once again, you will need to experiment with the settings on these sensors, and make adjustments based on your fuel mileage gains. In general, you shouldn't ever need to go above 350 mV on any analog EFIE. We also recommend fine tuning the front EFIE's first, with the rear EFIE's set at about 200 mV. Then, you can try experimenting with raising the rear EFIE's to see if you get better results. But realize that the bulk of your results will come from the front sensors.