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ELECTRONIC FUEL INJECTION ENHANCER

Installation & Operating Instructions

Implementation of Innovation is Practically all we do

INTRO TO EFIE TECHNOLOGY

In the past, fuel-savers would not work when applied to fuel systems with oxygen sensor feedback. These systems are 'accidentally' designed to prevent efficient combustion!

Modern fuel systems use an oxygen sensor to **infer** the air:fuel ratio of the engine.

Increasing the combustion efficiency increases the percentage of oxygen in the exhaust (as much as 2%) because:

- the engine uses less fuel for the same volume of air and;
- more oxygen is free because the efficient combustion produces less carbon monoxide and oxides of nitrogen. *Carbon dioxide rises slightly.*

The computer thinks the increased oxygen content in the exhaust can only be a lean mixture in the engine. The computer then adds extra fuel to bring the oxygen percentage back to 'normal'. Obviously, this negates the gains the combustion enhancement gave you!

The EFIEs functions is to modify the oxygen sensor's output-signal by adding a 'floating' voltage, so the computer won't 'see' the extra oxygen

and fight your combustion enhancement by adding extra fuel.

The EFIE is specifically designed to work on 1 to 4 wire zirconia (variable voltage) oxygen sensors, there is no possibility of damage to the vehicle's computer. This EFIE will not work on certain oxygen sensors. (sidebar pg.3)

Applying the EFIE by itself is not recommended. The EFIE should always be applied with a combustion enhancement device or method.

Use of the EFIE without combustion enhancement will result in a slightly lean mixture. The vehicle may gain fuel mileage (up to 15%), but at a slight loss of power. Engine life should not be affected because the vehicle's computer will not allow an excessively lean mixture.

The EFIE is recommended alone is when operating vehicles at extremely high altitude. In those conditions the OEM computer systems don't usually compensate for the rich mixture caused by the thin air.

Your actual mileage gains will depend on the capability of the fuel-saver(s) that you apply to your vehicle(s).

Eagle-Research Mission

Eagle-Research develops and distributes practical energy solutions.

We define practical as simple, inexpensive, environmentally-considerate, easy to build, low maintenance and, applicable to small scale energy needs.

We gather information from diverse sources, perform comprehensive experiments using rigorous standards, then publish how-to books to share the results with other researchers and the general public.

We believe that writing books insures that these energy-saving technologies will then be secured public knowledge, and that our patent-free philosophy promotes increasingly better energy solutions.

Eagle-Research does not accept government grants. The money acquired from the sale of our books and devices is used to finance on-going research.

Fine Tuning

Use a high impedance volt-meter (zero to two volt range) to setup (adjust) your EFIE.

Measuring between EFIE green wire (-) and white wire (+) will show the voltage of the EFIE device itself. *This is the test needed to optimize the EFIE.*

A higher voltage will cause the vehicle's computer to reduce fuel going to the engine.

Use of a volt-meter between the oxygen sensor input (green wire) and the output to the computer (white wire) will cause a few millivolts variance in the actual output. Actual output voltage will rise slightly when the volt-meter is removed because the volt-meter is actually a 'load', taking a bit of power to operate.

Additional Tests

1 Measure from green wire to black wire (ground) to show the actual oxygen sensor output.

If you leave the volt-meter hooked up when you start the engine, you will see the interaction between the oxygen sensor and the vehicle's exhaust. This can be helpful to get the most out of your fuel-savers.

2 Measure from EFIE white wire (+) to black wire (-) to show the combined voltages of the oxygen sensor and the EFIE.

If you monitor the oxygen sensor voltage and EFIE voltage you should notice that the computer will try to keep the total voltage at 500 millivolts. (When the vehicle is warm and not idling.)

INSTALLING THE EFIE

Install EFIE's on the O2 sensors located **BEFORE** the catalytic converter. Each O2 sensor needs it's own dedicated EFIE.

The EFIE circuit board is best installed in an assessable place where the electronics will be kept dry and adjustments can be made. *If you decide to mount the EFIE under the hood, be sure to weather-proof it well.* Under the dash is where we prefer to install. *Keep wires away from the exhaust pipes heat.*

The EFIE is slightly temperature sensitive and will change voltage as it gets warmer or cooler. This is another to install it underneath the dash. Set it when the engine is at normal operating temperature.

Oxygen Sensor Notes:

There is a plug connector in the wire from the oxygen sensor. Cut the oxygen sensor 'signal' wire on the vehicle side of the plug. *The oxygen sensor side of the connector usually has special heat resistant wire that is more difficult to solder.*

Solder the cut ends onto the appropriate wires of the EFIE.

Oxygen sensors may have up to four wires. Extra wires are oxygen sensor ground (low), and/or oxygen sensor heating wires. *Your vehicle dealership will have a service manual that will tell you how many O2 sensors you have before the Catalytic Converter and the color codes for the wires. Be prepared for ignorance & poor customer service.*

Install the EFIE into the highside wire. *Some oxygen sensors have wires, labeled 'highside' & 'lowside'. The vehicle's service manual will tell you which is the highside signal wire.*

The correct oxygen sensor signal wire will have no electrical connection (continuity) to:

- the vehicles ground (negative)
- the vehicle exhaust pipe
- any other wire coming from the oxygen sensor

Testing with an ohm-meter will show infinite resistance when connected between the oxygen sensor output, and the metal body of the oxygen sensor, and all other wires. *Do NOT test with ignition turned on.*

Easy installation Steps:

- 1 Connect the Black wire from the EFIE to vehicle ground (negative). *Make sure to ground the EFIE to the vehicle very well.*
 - 2 Connect the Red wire to an ignition switched power source (positive), so that the EFIE will shut off when you shut off the key. *Usually the fuse box has spare terminals for this sort of thing. Alternatively, you can tap into any power wire that shuts off when the key shuts off, such as the radio power.*
 - 3 Route the White and Green wires to the oxygen sensor output (signal) wire. *This can be anywhere from the connector to the computer. Your O2 sensor may have up to 5 wires, We only show the signal wire in our installation drawing.*
- Cut the oxygen sensor signal wire:
- 4 Connect White wire from the EFIE to the end leading **to** the vehicle's computer. *Solder and seal the joint for a solid water-tight connection.*
 - 5 Connect Green wire from the EFIE to the end leading **from** the oxygen sensor. *Solder and seal the joint for a solid water-tight connection.*

Tuning the EFIE

You will have to cut the rubber off the adjustment screw (see corner indicated) before you can get a tiny screwdriver onto it.

When the EFIE is adjusted **off** (total counter-clockwise) the oxygen sensor signal is absolutely OEM normal.

Turning the adjustment screw clockwise causes a voltage across the green and white wires. The oxygen sensor voltage signal runs through the EFIE (in green wire; out white wire) for voltage enhancement.

For initial tuning: Pre-set the EFIE to about 350 millivolts (measured between the white and green wires) when the key is on and the engine is warm and running.

Then adjust the voltage upward (clockwise = leaner fuel mixture) or downward (counter-clockwise = increasingly richer fuel mixture) as you see fit. We lean (adjust voltage up) until we notice performance issues, then richen 'till the issues are gone. Always adjust with the engine warm and running.

Adjust in 25 millivolt increments. Gradually, then fine tune to the exact millivolt you want.

The screw has 15 turn adjustment and a clutch so it will continue to turn (without damage) when the end is reached.

Make small adjustments while testing. Some computers 'learn' as they go. You have to allow the computer to get used to your adjustment before you really know what the actual effect has been. Some vehicle computers take several hours of driving time to completely adjust. Final EFIE optimization adjustments may take place over several days.

Optimum voltage offset varies with each vehicle. Finding what's best for your vehicle will be a trial and error process. If you notice a power or performance loss, richen the mixture until you're satisfied.

If your 'check engine' light comes on, too much voltage offset has been applied. The computer can't adjust the fuel mixture any more. *The computer will never allow the fuel mixture to get so lean that engine damage can occur.*

Finally, a device that allows fuel savers to be applied to vehicles with oxygen-sensor feedback:

EFIE

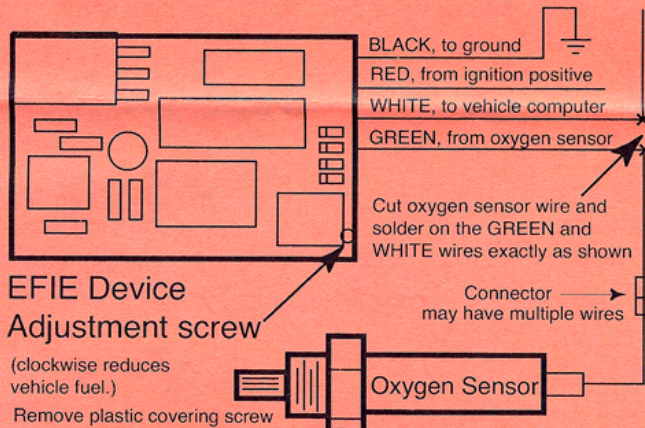
(pronounced Ee-Fy)

Note: Regardless of what you read in our literature, we have discovered that the EFIE works on ALL types of oxygen sensors, including A/F sensors and wideband sensors.

Note: You cannot control more than one Oxygen Sensor per EFIE. Trying to do so will confuse the computer, causing issues that may damage it or your engine.

Note: We do not make an EFIE that controls more than one oxygen sensor. Since nearly every component on the circuit would need to be duplicated anyway, it makes no sense (to us) to stock two different versions of the same circuit. One EFIE per oxygen sensor also allows the customer placement flexibility during installation.

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You'll cut ONLY the high side (+) signal wire which will give you two ends. Connect the end coming from the oxygen sensor to the green EFIE wire. Connect the end going to the computer to the white EFIE wire.

The EFIE wires are color-coded:

BLACK
(vehicle ground)

RED
(ignition positive)

WHITE
(to computer)

GREEN
(to oxygen sensor)

Eagle-Research Guiding Principles

- patent-free energy technology
- practical solutions
- energy conservation
- sharing information
- energy self-sufficiency
- environmental sustainability

Work In Progress

Eagle-Research is a research and development organization dedicated to finding the best energy solutions.

Because the nature of research and development is an evolving process, we are continually improving on the technologies we are working with.

Though we're proud of our commitment to constant and never-ending improvement, we do recognize there is an unfortunate side-effect: At any given date, the Eagle-Research discoveries, which are distributed in the form of web information; books; videos or devices, are at varying stages of development. By the time our most up-to-date can be compiled, organized, produced & distributed, we've already improved upon the information. We're working as fast as we can to keep the information as current as possible.

Guarantee

All Eagle-Research products are sold with a money back guarantee. If you are dissatisfied for any reason, return the product(s) within 60 days of receipt of the product(s) for a full refund of the product(s) price.

If it thinks the mixture is too lean, it'll stop listening to the oxygen sensor and go into 'limp' mode.

If the check engine light does come on, turn down the EFIE and reset your vehicle's computer. Computer reset is needed to take the computer out of 'limp' mode. *During limp mode the computer is not listening to the oxygen sensor. The mixture will be richer than needed to be, which will usually create a mileage loss.*

Many computers can be reset by disconnecting a battery cable for a few minutes (while the engine is **not** running). Then reconnect the battery cable and start the engine. If this does not work, refer to your vehicle's manufacturer for the specific reset procedure.

Most automotive stores sell a device that will reset computers (erase trouble codes) at the click of a button.

When you use more than one EFIE, adjust them all to the same voltage. Then experiment with changing individual voltages for highest efficiency.

The EFIE is designed to be fully automatic. Once optimized, no further adjustment is needed, unless there are changes to the fuel system.

For Your Information

The EFIE will not void any vehicle warrantee.

It is against federal law (USA) for any vehicle manufacturer to void a warrantee simply because the customer installed any kind of after-market device.

Further, if the vehicle has problems and the vehicle manufacturer 'rep' wants to blame the after-market device, the onus is on the vehicle manufacturer to prove

the after-market device caused the problem. *Of course, the vehicle manufacturer's warrantee does not cover the after-market device.*

Learn More...

To learn more about the EFIE, including how it works, why it works and how to build one from scratch, order the [EFIE Manual](#).

continued from page 3 sidebar

Eagle-Research is developing an online EFIE Resources for EFIE customers. It will include:

- Oxygen sensor education links
- Link to Warranty FAQ
- options to increase the efficiency of the EFIE.
- Example Service Manual Wiring Diagram
- links to places you can find service manuals online.

To be informed about the EFIE Resources; go to Eagle-Research.com/store and set up a user account, making sure to check the eNewsletter option and you will be informed when the EFIE Resources are available.

Note: You usually do not need to modify any other sensors (like MAP) unless you have knock sensors.

Eagle-Research is the original developer of the very best Combustion Enhancement Interface Technology (CEIT). Examples include the Carburetor Enhancer (CE) and the Electronic Fuel Injection Enhancer (EFIE).