
EFIE Digital Control Panel - Installation Manual

HHO Hydrogen on Demand Dual Fuel Generator Systems



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Disclaimer

When purchasing this device, you are held responsible for any damage that may occur during installation or operation of this device. The manufacturer or seller are not held liable and holds no responsibility for any personal harm or property damage. Thank you for purchasing the EFIE Digital Control Panel. Please read the contents below carefully in order to understand the installing and operation procedures before getting started.

Safety Precautions

Read and follow these safety precautions to avoid hazards. If you do not understand these instructions or do not like to work on vehicles, please have a qualified mechanic do the installation for you. Incorrectly installing or using the EFIE Digital Control Panel and/or the HHO System may result in serious damage to you and/or your vehicle.

It should take approximately 1,5 hours to install this device, so ensure that you have enough time to complete the installation. Be sure to work outside and make sure the engine is off and with the battery terminals not connected.

Be sure to wear goggles and rubber gloves and only use professional tools; use common sense and general safety procedures used for any work carried out on automotive installations and maintenance.

Parts List

The EFIE Digital Control Panel package includes the following items:

- 1 Main Connection Box
- 1 Digital Control Panel
- 1 Connecting Cable
- 4 Red Scotchlock Terminals.





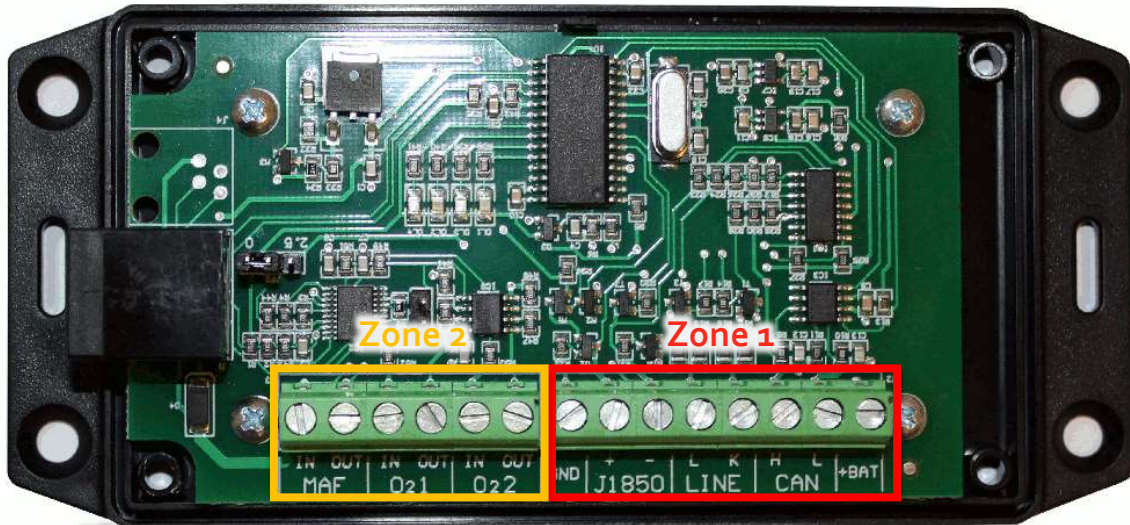
Main Connection Box

Introduction

Thank you for purchasing the EFIE Digital Control Panel. Please take the time to read through this manual to understand the installation and operation procedures before getting started. The EFIE Digital Control Panel is a new concept developed by the HHO Plus Team, and is not offered anywhere else.

The Main Connection Box is splitted in 2 different working zones:

- 1) Zone 1 OBD Diagnostic Port (OBD-II);
- 2) Zone 2: Electronic Injection Sensors (MAF/MAP Sensor Enhancer, Lambda Sensors).



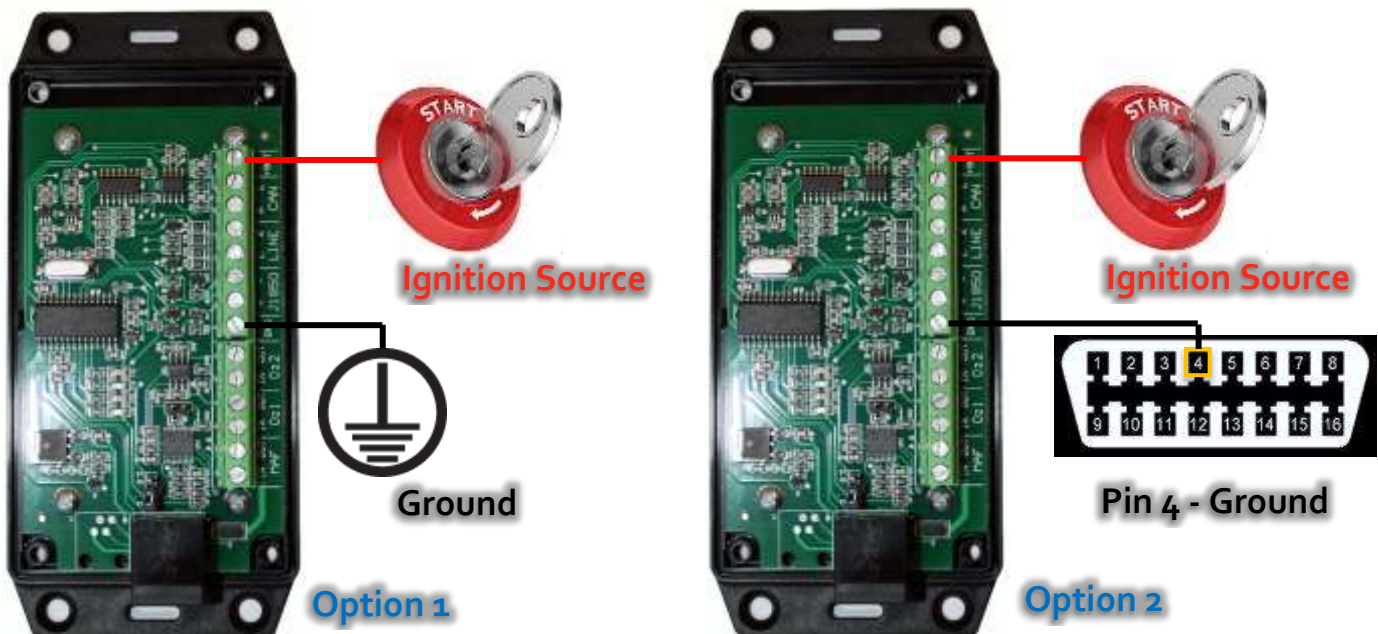
Electronic Injection Sensors **OBD Diagnostic Port**

In the following points we will learn how to make the connections in each one of these working zones.

Zone 1 - OBD Diagnostic Port

Powering the Main Connection Board

Please refer to the illustration below for typical powering of the EFIE Digital Control Panel:



In order to have the EFIE Digital Control Panel working only when the engine is also working avoiding the battery discharge we must identify a point in your vehicle's electrical system which has current (positive) present only when the engine is running or when the ignition key is on the third position before starting the engine. Connect it to +BAT in the Main Connection Box.

The ground connection (GND) can be made to the negative terminal of the battery, a metallic component in your car or to Pin 4 of the OBD Diagnostic port (best practical option).

Locating the OBD-II Diagnostic Port

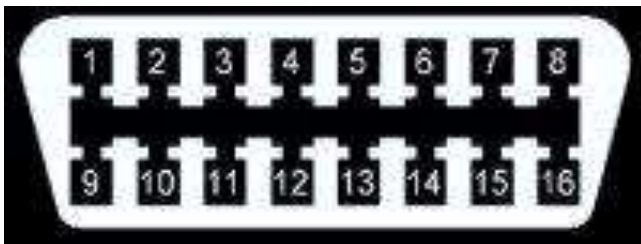
On-board diagnostics, or OBD, is an automotive term referring to a vehicle's self-diagnostic and reporting capability. OBD systems give the vehicle owner or a repair technician access to state of health information for various vehicle sub-systems. Start by locating your OBD II Port. If you don't know where it is, go to

<http://www.obdclearinghouse.com/index.php?body=oemdb>

Normally the OBD II Port is located in the compartment located underneath the steering wheel.

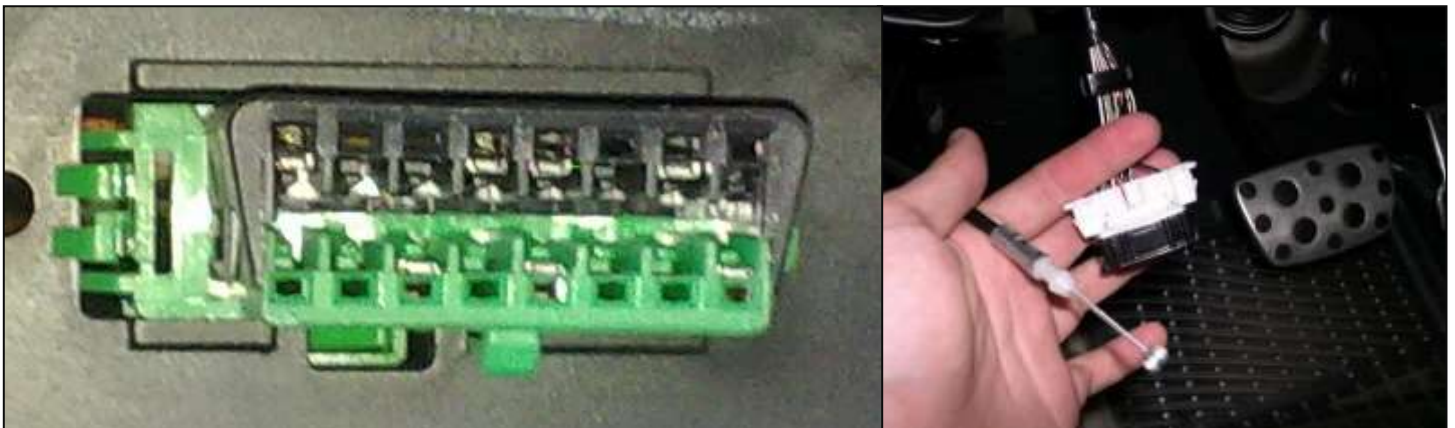
Pins populated in the OBD-II Port

The OBD-II Port has 16 pins arranged in a numerical order. Please refer to the illustrations below for typical configuration of the OBD-II pins according to the position of the port in the car:



As you can verify the numeration is exactly the same whatever is the position of the port.

Use a paper to write down the pin numbers populated in the OBD-II port. Look at the example below:



Populated pins are: 1, 4, 5, 7, 11, 13 and 16. If you are not sure, take out the OBD-II port and check the wires connected on the back.

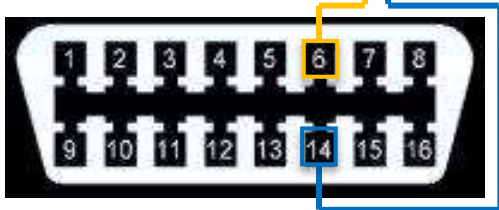
Protocol verification and wire connections

There are 2 wires of the Main Connection Box to be connected to the wires on the back of the OBD-II port according to the protocol. You can check your car protocol in the following link:

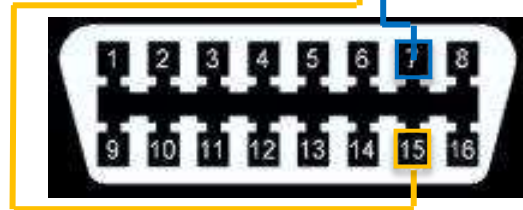
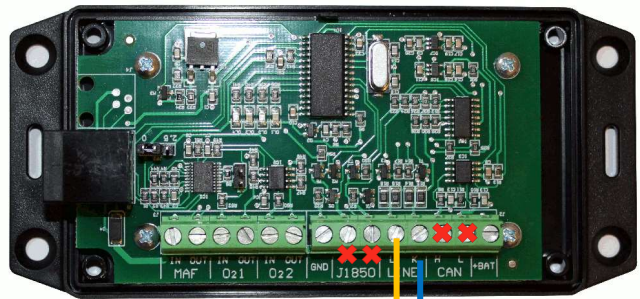
<http://www.outilsobdfacile.com/vehicle-list-compatible-obd2.php>

Only one of this 3 options is the right selection for your car:

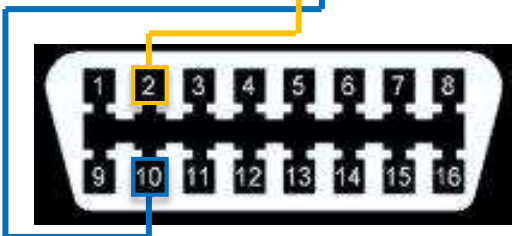
CAN Protocol – Pins 6 and 14 populated:



ISO Protocol – Pins 7 and 15 populated:



SAE BUS Protocol – Pins 2 and 10 populated:



Use the Blue Scotchlocks Terminals to make the wire connections to the cables, in the back of the OBD-II port, coming from the pins selected according to the protocol in your car.

Zone 2 - Electronic Injection Sensors

Electronic fuel injection explained

The Electronic Control Unit (ECU) controls the internal combustion operation of all modern engines. ECUs determine the quantity of fuel, ignition timing, and other parameters by monitoring the engine through several sensors. The most important sensors are the MAP/MAF (airflow) and the lambda sensors that are able to be regulated by our EFIE.

For example: If the accelerator pedal is pressed further down, this will open the throttle body and allow more air to be pulled into the engine. The ECU will inject more or less fuel according to how much air is passing into the engine being measured by MAF/MAP sensor.

When adding a fuel cell to an older vehicle that is carbureted, we will see immediate improvements in fuel economy without the need of additional tuning. However, this is not the case for modern cars. This is because the fuel burned inside the cylinders has significantly improved, but the lambda sensor placed in the exhaust is expecting the same amount of un-burnt oxygen to come out the engine onto the exhaust where it is monitoring the oxygen to fuel vapor. This causes a signal to be fed back to the ECU, increasing the air:fuel mixture (Richer), which counter acts the fuel gains you might have otherwise received/anticipated.

With our **EFIE Digital Control Panel** you will be able to control and regulate the MAF/MAP sensor and 2 lambda sensors in the car according to the information described in the following points.

MAF/MAP Sensor (Airflow)

Location and function

The MAF/MAP is a small device normally installed in your air intake manifold after the air filter box and before the turbo. Please check right image for typical location of the MAF/MAP Sensor.

It has normally 5 Volts coming in, and it simply senses the airflow in the manifold and attenuates (reduces, weakens) this incoming voltage by a certain factor. In other words it reduces the supply voltage to a direct-current voltage in the range of 15% to 60% of the supply voltage (depending on the car's design these numbers will vary), and this varying (but non-pulsing) signal is then sent back to the computer.



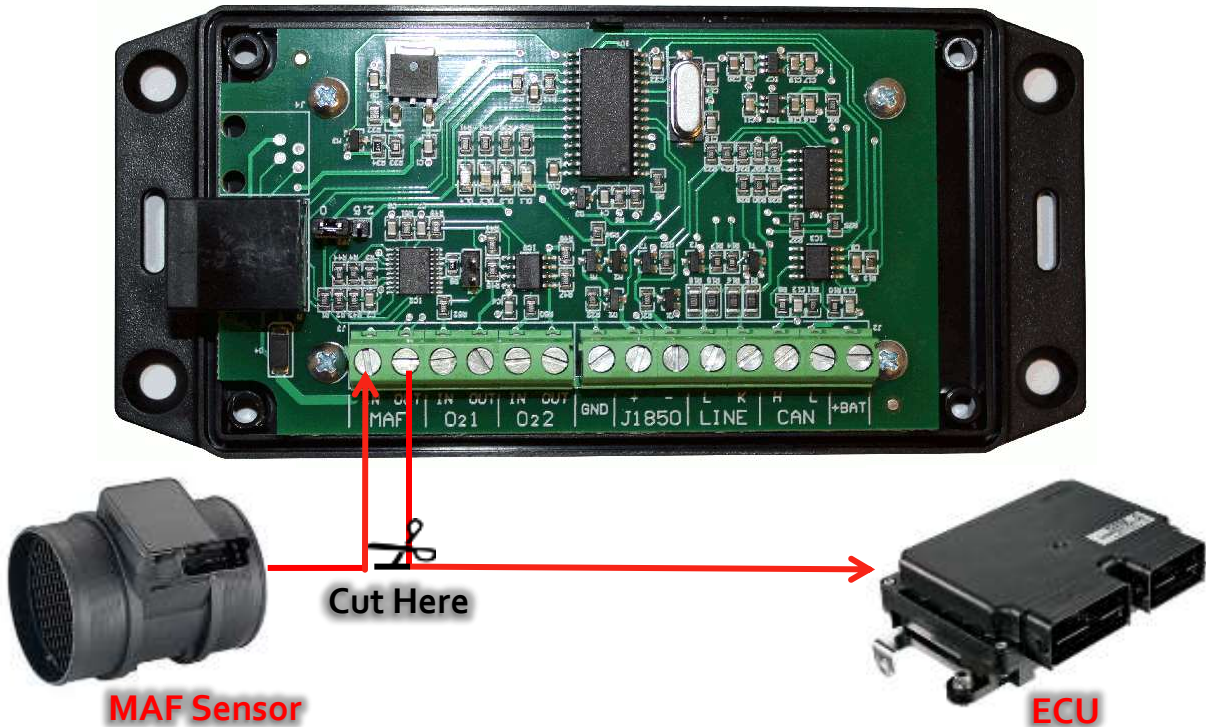
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As mentioned before the MAP/MAF are sensors normally found in cars responsible for giving information to the computer (ECU - Environmental Control Unit) regarding the quantity of air being aspirated by the engine and, in this way, be able to calculate the quantity of fuel needed to be injected in order to maintain the predetermined air/fuel ratio. If more air is going into the engine then more fuel will be injected in the engine and vice-versa.

The MAF/MAP sensor pick a 5 volt signal from the ECU, and returns a lower voltage signal in accordance with the aspiration in the engine and the quantity of air going inside. A higher output voltage means more air passing, which is then calculated as "more fuel is needed". Lower output signal indicates higher engine vacuum, which requires less fuel.

Our EFIE Digital Control Panel simply takes this already attenuated (reduced, weakened) signal and attenuates it further. In this way the ECU will think that less air is going inside the engine (although it is the same in reality) and give order to inject less fuel. The loose of power is compensated by the injection of the HHO gas.

Wire connections



Locate the wires connected to the MAF/MAP sensor. The wire to cut will be the one where the voltage change from around 1V to 5V with the acceleration of the engine. If you cannot locate the sensor or the wires, or you're not sure, you'd better get an auto-electrician to install it for you.

To find the MAP/MAF Sensor Signal Wire, use a Circuit Tester to find the correct wire. You can hook this tester in series with your multi-meter to find the actual voltage of the wires coming out of the MAF/MAP Sensor. The correct wire is the one with the lowest voltage or the one with a voltage that increases when the engine RPM is increased.

Cut the wire, and connect the two ends like presented in the picture above.

Lambda Sensors

Function

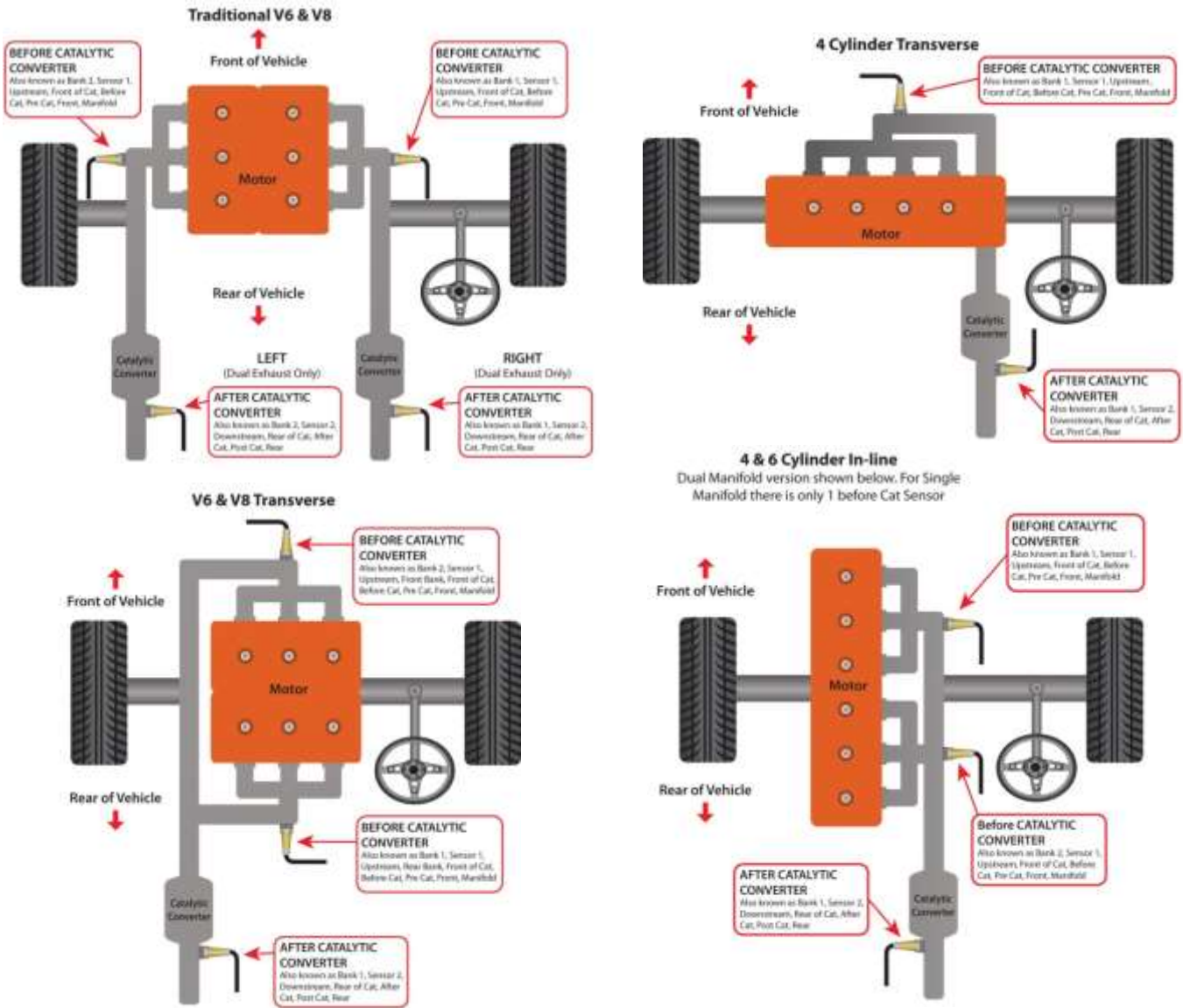
Lambda sensors or Oxygen sensors measure the amount of the oxygen in the exhaust gases. This information is used by the engine computer system to control engine operation.

When adding a fuel cell to an older vehicle that is carbureted, we will see immediate improvements in fuel economy without the need of additional tuning. However, this is not the case for modern cars. This is because the fuel burned inside the cylinders has significantly improved, but the lambda sensor placed in the exhaust is expecting the same amount of un-burnt oxygen to come out the engine onto the exhaust where it is monitoring the oxygen to fuel vapor. This causes a signal to be fed back to the ECU, increasing the air:fuel mixture (Richer), which counter acts the fuel gains you might have otherwise received/anticipated.

Location

Lambda sensors can be found in a variety of places, depending on the vehicle make, model and engine type. The accompanying illustrations depict some of the more common locations. As a general rule, each exhaust manifold has at least one pre-cat sensor. Most vehicles manufactured since the early 1980s are equipped with pre-cat sensors. With the advent of Onboard Diagnostic Systems II (OBDII) in the mid-1990s, O2 sensors were positioned both upstream and downstream of the catalytic converter.

Please check diagrams presented in the next page:

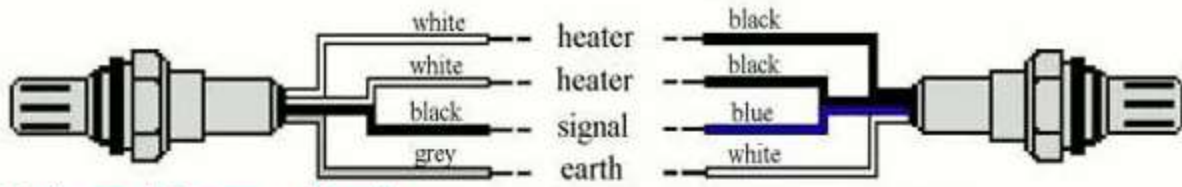


Signal wire

Now you will need to locate the signal wire by testing. The lambda sensor can have 2, 3 or 4 wires, and you have to know which one is the signal wire. If you have 4 wires they will be:

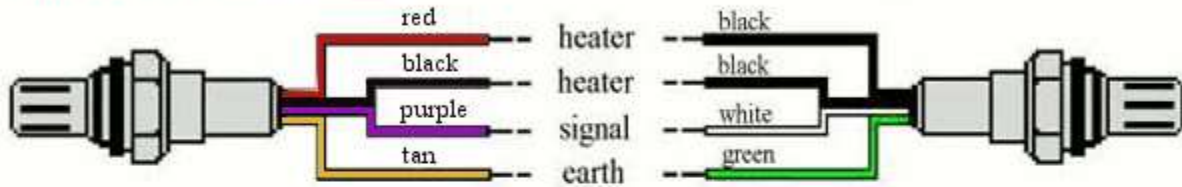
- Heater 12 Volts +
- Heater ground
- Oxygen sensor signal +
- Oxygen sensor signal ground

In the following images you will be able to identify the wire identification by color and lambda sensor manufacturer:

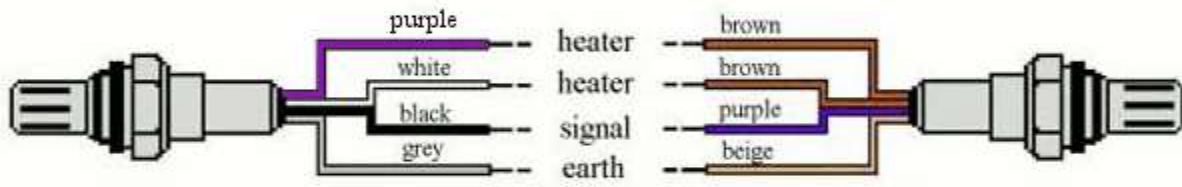


Universal Sensor - Bosch

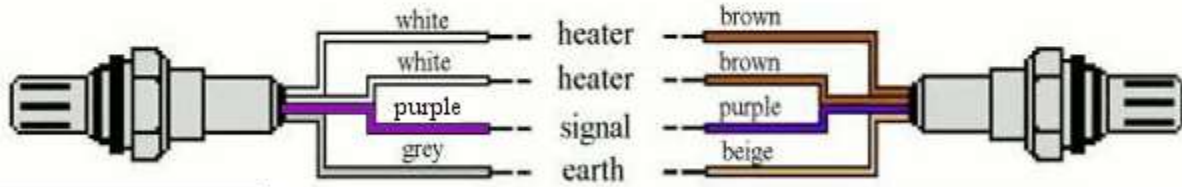
Toyota Sensor



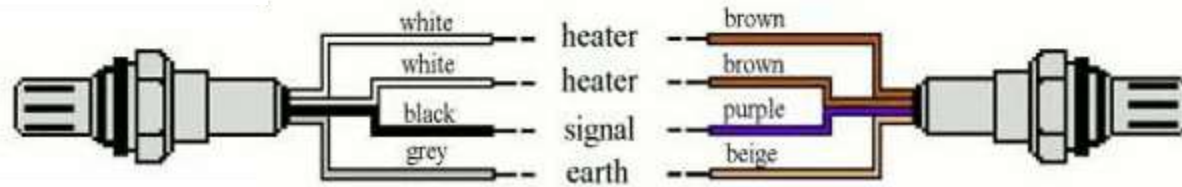
Honda Sensor



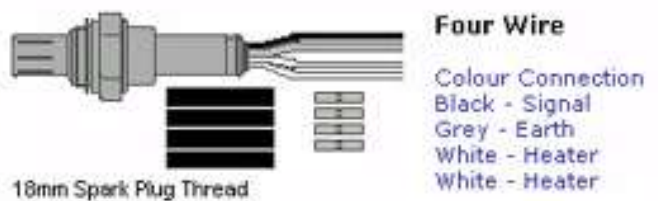
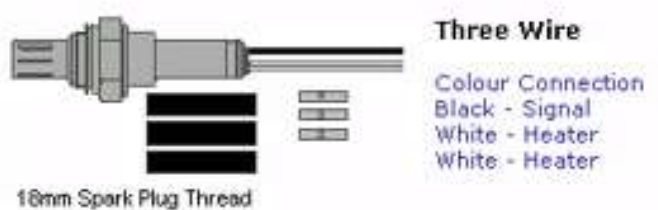
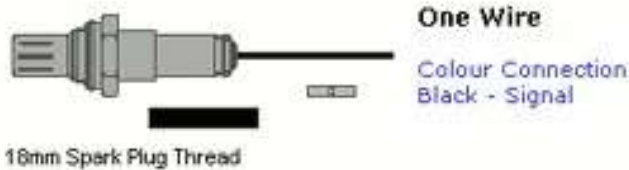
Peugeot Sensor



AC Delco Sensor

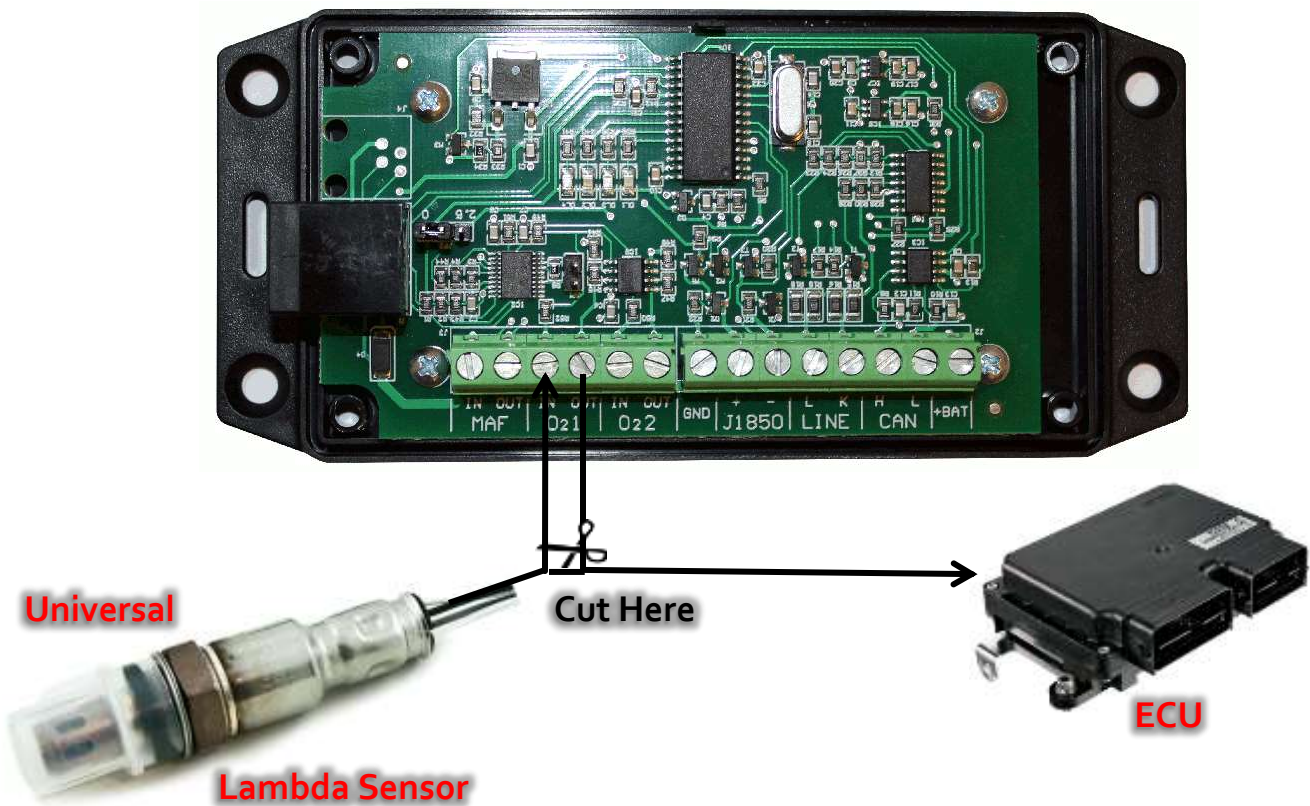


AC Delco Sensor



If you have 2 or 3 wires, then you can have a common ground, or no heater wires etc. The simplest setup is a single wire, which is the signal wire and the sensor gets it's ground from the exhaust pipe. You can use the following procedure to narrow down which wire is which:

1. Stick straight pins into the sensor's wires and measure them to ground with then engine running. One of these will show 12 volts, and this will be power for the heater.
2. Next find any wires that produce 0 volts. These will be ground wires. The remaining wire should be your signal wire.
3. Measure the signal wire to ground with the engine running. The voltage on this wire will vary from nearly 0 to about 1 volt. Since your meter will not be fast enough to see the lows and highs, it will average them out to about .2 to about .8 volts. The fluctuations will be so fast you have a hard time reading the numbers. Note, that you have to let the engine warm up a bit before you will get these voltages from the sensor.
4. Cut this wire at a convenient location for connecting the EFIE. We'll call the sensor side of this cut the sensor wire, and the other side of the cut, the computer wire.



Special Note: Once you have determined the signal wire, you should always test it. The most common reason for installation failures is an incorrectly located signal wire. To test the wire, you want to have the engine

running, and you want to measure the voltage between the signal wire and ground. Please watch the following video to see what these voltages look like this:

<http://www.youtube.com/watch?v=ilhXeLHnfa8>

The engine must be at operating temperature to perform this check. Many lambda sensors do not produce a signal until the sensor is warmed to 600 F. If you cannot find a signal wire with fluctuations between 0-1 volt, there is a possibility that you have Wideband O2 sensors. Contact us for more informations.

Digital Control Panel

Main Features

There are 4 programs available that will automatically be activated depending on the speed of the vehicle:

- ❖ Preset 1 – Speed below 40 km/h;
- ❖ Preset 2 - Speed between 40-80 km/h;
- ❖ Preset 3 - Speed between 80-120 km/h;
- ❖ Preset 4 – Speed above 120 km/h.

Important: These programs will only be automatically activated when we select the **Auto Mode**.



These programs are standard for most cars and may require some adjustments in order to achieve maximum fuel savings and/or avoid the appearance of Engine Warning Lights (normal when we are regulating the sensors).

To make these adjustments we need to get out of **Auto Mode** and enter **Manual Mode**. Only in manual we are able to edit the Presets, by regulating the MAF/MAP sensor and lambda sensors with the car running.



When all Presets are tested and tuned for the user car we should get out of **Manual Mode** and enter **Auto Mode** again in order for the Presets to be automatically activated according to the speed of the vehicle.

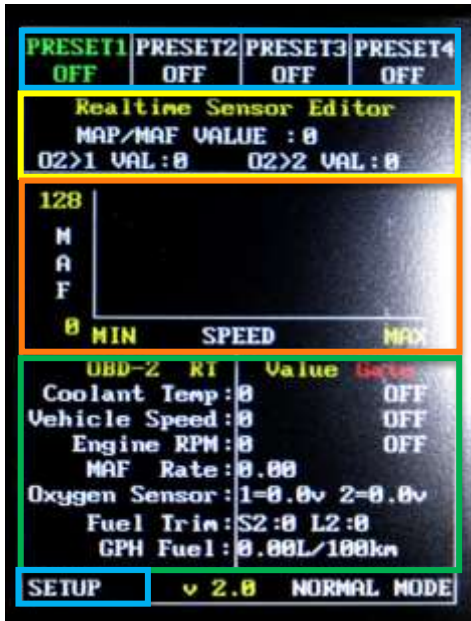
Operating the Control Panel

In the Digital Control Panel, below the panel, we have a central knob that will help us to operate the device according to 2 options:

- ❖ Option 1 - Turn knob left and right to move selection point reflected in red letters moving;
- ❖ Option 2 - Push knob down to select feature and start editing using Option 1 again.

Display Pages

The display is composed of two principal pages: **MAIN Page** and **SETUP Page**. When you reboot the device the display will go directly to Main Page where you will be able to check the following features:



Predefined programs

Realtime Sensor Editor

Graphic Speed/Maf Readings

Realtime OBDII

Go to SETUP Page

Activate Sensors

According to your installation configuration you need to activate the sensors in order to be able to regulate and change the electronic injection. You may work with the following options:

- ❖ 3 sensors enhanced – 1 x MAF/MAP + 2 x Lambda sensors;
- ❖ 2 sensors enhanced – 1 x MAF/MAP + 1 x Lambda sensors;
- ❖ 2 sensors enhanced – 2 x Lambda sensors;
- ❖ 1 sensor enhanced – 1 x MAF/MAP;
- ❖ 1 sensor enhanced – 1 x Lambda sensor.

To activate sensors

- Select Preset 1 on MAIN Page;
- Go to **SETUP** on bottom left of the display and enter SETUP Page;
- On SETUP Page go to **Activate MAF sensor** and **Activate O2 sensors**. Change Information from OFF to ON.
- Goto EXIT on bottom left of the display and return to MAIN Page.

The ON option allows the user to activate the potentiometers of the MAP/MAF sensor and lambda sensors. If it is placed on OFF position, potentiometer will remain in its default value. If it is placed on ON position, potentiometer value will change according to the set values selected by user.

Once changed the system settings, it will store the status in EPROM memory. Next time you reboot the system



 Push Knob



Auto Mode

As mentioned before, by Selecting Auto Mode we will use the default programs encrypted on the firmware of the device. There are 4 programs that will be automatically activated depending on the speed of the vehicle:

- ❖ Preset 1 – Speed below 40 km/h;
- ❖ Preset 2 - Speed between 40-80 km/h;
- ❖ Preset 3 - Speed between 80-120 km/h;
- ❖ Preset 4 – Speed above 120 km/h.

There is no option for the user to change these speed limits in Auto Mode because it is coded in the firmware.

To activate Auto Mode:

- Select Preset 1 on MAIN Page;
- Go to **SETUP** on bottom left of the display and enter SETUP Page;
- On SETUP Page go to **Activate Preset**. Change Information from **MANUAL** to **AUTO**.
- Goto **EXIT** on bottom left of the display and return to MAIN Page.



Once changed the system settings, it will store the status in EPROM memory. Next time you reboot the system

Manual Mode

The manual mode is installed by default in the software of the device when you start the first time. Nevertheless to activate Edit Mode:

- Select Preset 1 on MAIN Page;
- Go to **SETUP** on bottom left of the display and enter SETUP Page;
- On SETUP Page go to **Activate Preset**. Change Information from **AUTO** to **MANUAL**.
- Goto EXIT on bottom left of the display and return to MAIN Page.

Editing Presets

Presets active features

We have 4 programs available that we can use to regulate and set the values of one (1) MAF/MAP Sensor Enhancer and two (2) Lambda Sensors on-real time sensor editor:

- Select Preset 1, 2, 3 or 4 on MAIN Page;
- Go to **Realtime Sensor Editor** and select sensor to edit;
- Change Information according to your requirements;
- Go to **NORMAL MODE** on bottom right of the display and enter to save your data.



In the following tables you will be able to check the values relation with signal reduction

MAP/MAF Sensor Editor	MAF IN	VALUE	MAF OUT	% Reduced
	1000 mV	0 Step	1000 mV	0%
	1000 mV	+32 Step	750 mV	- 25%
	1000 mV	+64 step	500 mV	- 50%
	1000 mV	+96 step	250 mV	- 75%
	1000 mV	+128 Step	0 mV	- 100%

O2 Sensors Editor	O2 IN	VALUE	O2 OUT	% Reduced
	500 mV	0 Step	500 mV	0%
	500 mV	+32 Step	625 mV	- 25%
	500 mV	+64 step	750 mV	- 50%
	500 mV	+96 step	875 mV	- 75%
	500 mV	+128 Step	1000 mV	- 100%

Important: The values changed will only be active if you save your work entering in Normal Mode. After this you will be able to edit new preset.

We suggest the following procedure:

- ❖ Preset 1 - Set MAF to 10% (value edited #13) and continue increasing until the engine continues working normally. If you increase to much the engine will start “dying” or you will get errors on car engine light. If this happens just reduce a little bit the MAF value;
 - ❖ Preset 2 - Set MAF to 20% (value edited #26) and continue increasing until the engine continues working normally. It is the same procedure as before. You need to be running the car to verify your values;
 - ❖ Preset 3 - Set MAF to 30% (value edited #39) and continue increasing until the engine continues working normally. It is the same procedure as before. You need to be running the car to verify your values;
 - ❖ Preset 4 - Set MAF to 40% (value edited #51) and continue increasing until the engine continues working normally. It is the same procedure as before. You need to be running the car to verify your values;
-

After all Presets are working as have selected then return to **SETUP** page and enable **AUTO Mode** in order for the 4 programs to be automatically activated according to the speed of the vehicle.

Presets working limits

As mentioned before in the MAIN Page we are able to verify the car/engine performance in the Graphic Readings and Realtime OBD-II data. The parameters we can check are:

- ❖ Coolant temperature in degree Celsius;
- ❖ Vehicle speed in km/h;
- ❖ Engine speed in rpm;
- ❖ MAF rate in g/s;
- ❖ Oxygen sensor in voltage;
- ❖ Fuel trim in %;
- ❖ Fuel consumption gph in l/100 km.

The 4 default programs (presets) working limits can be edited in order to have higher fuel savings. From the above parameters we can change the following:

Presets Limits	PARAMETER	MINIMUM	MAXIMU
	Coolant temperature	- 40°C	215°C
	Vehicle speed	0 km/h	255 km/h
	Engine speed	0 rpm	8000 rpm

For these 3 parameters if edited value is lower than the real time obd value (from vehicle continuously readings), **GATE** should be **ON** and it indicate in red color. Otherwise it will be OFF and indicate in white color.

Important: Only when **GATE** is **ON** obd2 parameter can be edited.

From the image on the right we can understand that edited value of coolant temperature (13°C) is higher than real time value of coolant temperature from vehicle being indicated as **GATE OFF**. Other set values for vehicle speed and engine rpm are lower than real time values and the **GATE** is **ON**.

The set values in each are compared continuously with corresponding real time obd values in NORMAL mode and will determines if the preset is active or inactive. For the preset to be active all GATE values must be ON.



Software Update

Please download software updates in the following link:

www.oktanplus.com/manuals

- Copy the file (extension .bin) to a memory SD Card (formatted with no other files);
- Insert SD Card in the device as shown in the right image;
- Turn ON the device ON and wait for the system to reboot;
- After appearance of Main Page go to **SETUP** on bottom left of Main Page;
- On **SETUP Page** it will be shown binary file in the memory card (highlighted in yellow). On clicking the binary file (.BIN), it will start to update software after a booting process.
- Remove SD Card and Update is complete.

