



# ***Installation Instructions for 30-1910 Fuel Ignition Controller 6 (F/IC6)***

## **WARNING:**



This installation is not for the electrically or mechanically challenged! Use the F/IC with **EXTREME** caution! If you are uncomfortable with anything about this, please refer the installation to an AEM trained tuning shop or call 800-423-0046 for technical assistance. You should also visit the AEM Performance Electronics F/IC Forum at <http://forum.aempower.com/forum/index.php?board=89.0>

**NOTE:** AEM holds no responsibility for any engine damage that results from the misuse of this product!

**This product is legal in California for racing vehicles only and should never be used on public highways.**

**ADVANCED ENGINE MANAGEMENT INC.**  
2205 126<sup>th</sup> Street Unit A, Hawthorne, CA. 90250  
Phone: (310) 484-2322 Fax: (310) 484-0152  
<http://www.aemelectronics.com/>  
Instruction Part Number: 10-1910 Rev 100129  
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Thank you for purchasing the AEM F/IC6. Inside the box you will find the F/IC module, a universal wiring harness, a software CD, and other components required to install and adjust the F/IC via a laptop or PC. See figure 1. Please note that all hyperlinks in the PDF version of this instruction manual are accessible by clicking on them. For more information on select vehicles, please visit the F/IC section of the AEM Electronics Forum here: <http://forum.aempower.com/forum/index.php?board=89.0>. Before installing this kit, it is highly recommended that you watch the F/IC informational videos located here: <http://www.aempower.com/ViewCategory.aspx?CategoryID=327>.



Figure 1: Kit contents

Kit contents:

- F/IC6 Module
- Flying Lead Harness
- Bypass plug
- Instructions
- Software CD
- USB Cable
- Vacuum Hose (3')
- Tee Fitting
- Zip Tie (3)

### Getting started

Note: The following is a universal wiring installation. For more specific information about many common vehicles, please visit the F/IC section of the AEM Electronics Forum. Also, to make the install easier and to save you from cutting your factory harness, we recommend the use of a “patch” or “extension” harness. These harnesses are available for various vehicles on order from our website:

<http://www.aempower.com/ViewCategory.aspx?CategoryID=315>. The first step in connecting the F/IC is to determine what features/functions are needed and which functions are not needed. The F/IC comes with a universal flying lead that has 46 non-terminated wires. At first glance, the bundle of wires is quite intimidating. However, by answering some questions about your vehicle and what you want to do with the F/IC, some of the wires can be eliminated. Before we begin, we must learn the two types of connections used with the F/IC: the tap and the intercept. See figure 2.

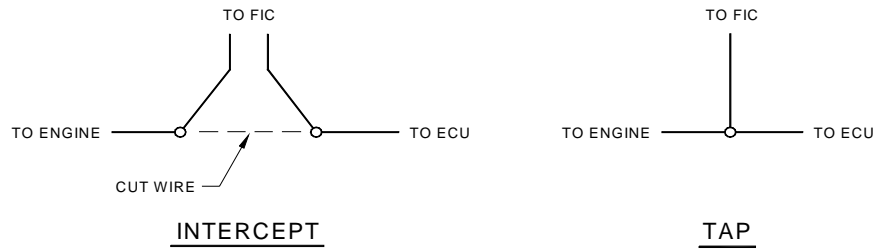


Figure 2: Wire connections

### Does your vehicle have a mag or Hall style Crank Sensor?

Magnetic (mag) style sensors typically have two wires. Hall style sensors typically have three wires. Vehicles have either a mag or a Hall style crank sensor, not both. If your vehicle has a mag sensor, the two Hall sensor wires can be eliminated. If your vehicle has a Hall sensor the four Mag sensor wires may be eliminated. Connect the crank sensor appropriately as shown in Figure 3 or 4.

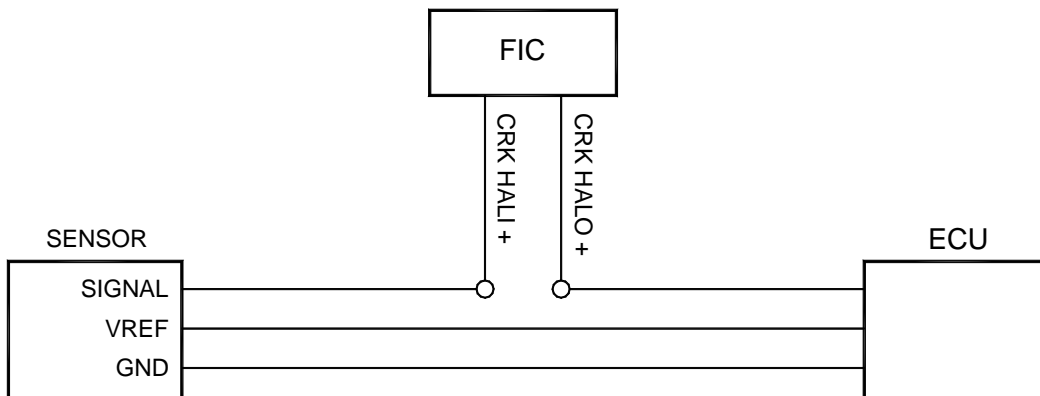


Figure 3: Crank Hall connection

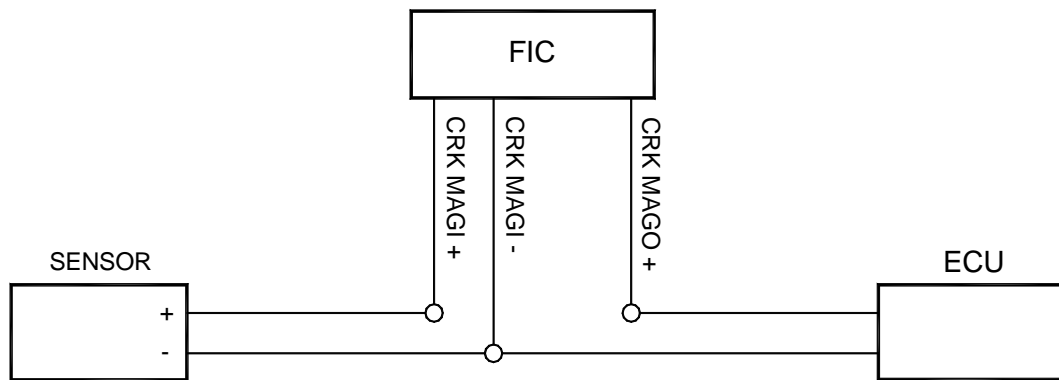


Figure 4: Crank mag connection

**Does your vehicle have one or two cam sensor(s)?**

If your vehicle has one cam sensor, the two “Cam 2” Hall wires and four “Cam 2” mag wires may be eliminated.

**Does your vehicle have a mag or Hall style cam sensor?**

As with the crank sensor, a vehicle will have one or the other, not both. Either the “Cam 1” Hall or the Cam 1 mag wires can be eliminated. Connect the cam sensor appropriately as shown in figure 5 or 6.

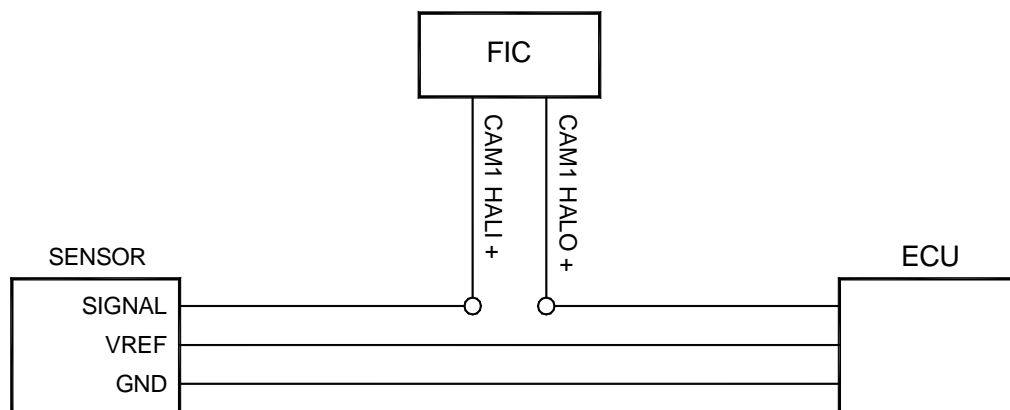


Figure 5: Cam 1 Hall connection

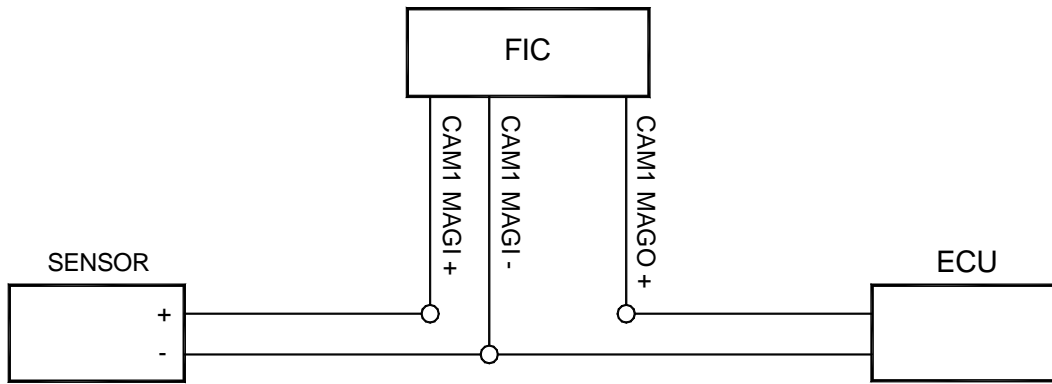


Figure 6: Cam 1 mag connection

If your vehicle has two cam sensors, connect the “Cam 2” sensor as shown below in figure 7 or 8.

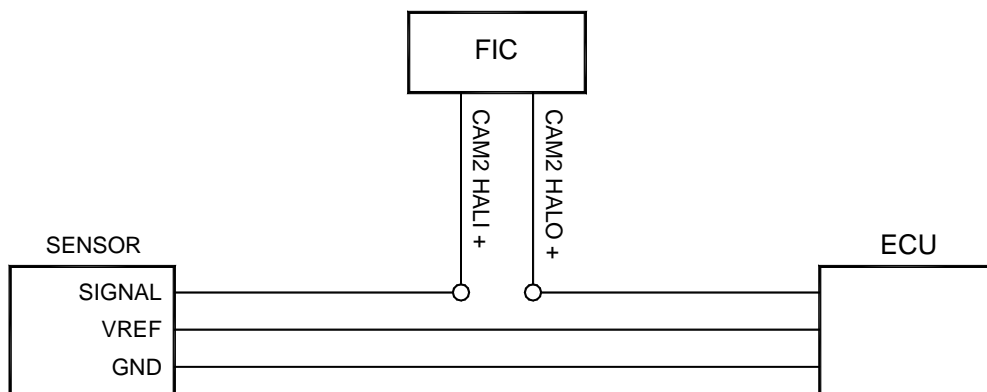


Figure 7: Cam 2 Hall connection

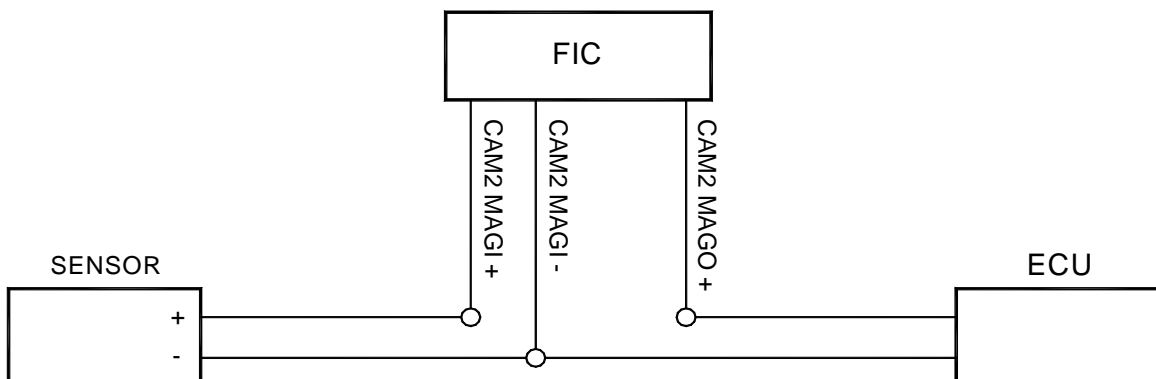


Figure 8: Cam 2 mag connection

**Do you want to modify or clamp the MAF/MAP sensor voltage?**

If not, the two MAF/MAP sensor wires can be eliminated. If so, connect the MAF/MAP sensor as shown below in figure 9.

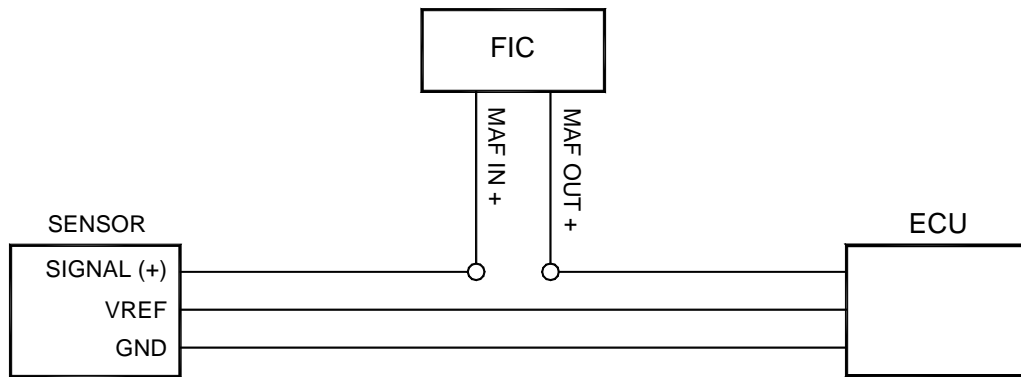


Figure 9: MAF/MAP sensor connection

**Does your vehicle have both a MAP sensor and a MAF sensor? Or do you want to remap another analog signal on your car?**

If so, connect the “Analog A/B” wires as shown below in Figure 10. If not, you may remove the unused wires for “Analog A/B”.

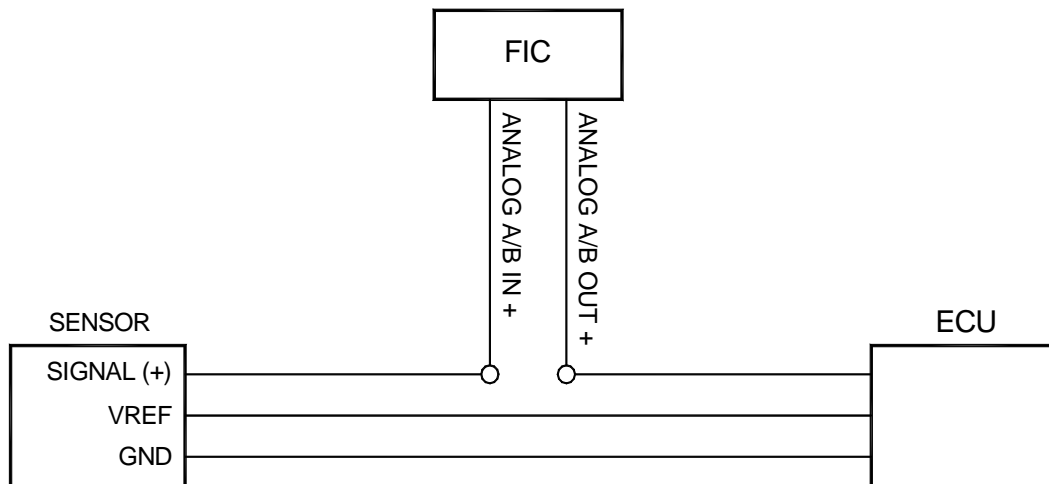


Figure 10: Analog A/B connection

### How many injectors do you want to control with the F/IC?

The F/IC6 has 6 injector drivers with two wires per driver. The wires for the unused drivers can be eliminated.

### Do you want to control the primary injectors on the engine, or add secondary injectors?

Connect the injectors as shown below in figure 11 or 12.

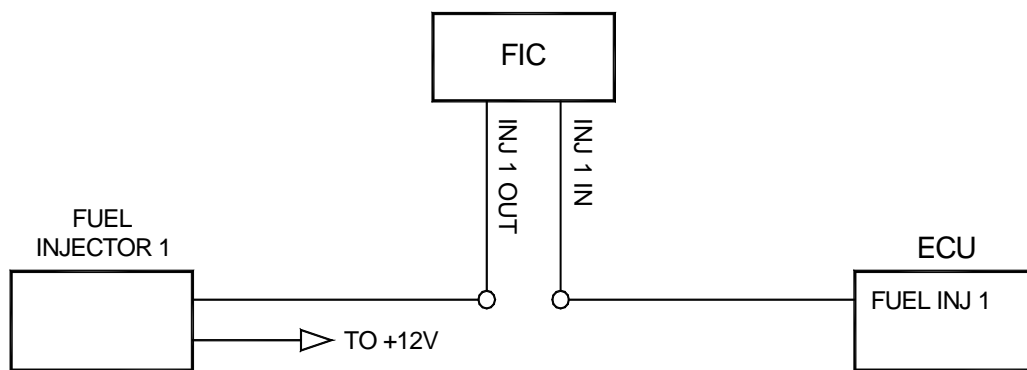


Figure 11: Primary fuel injector connection

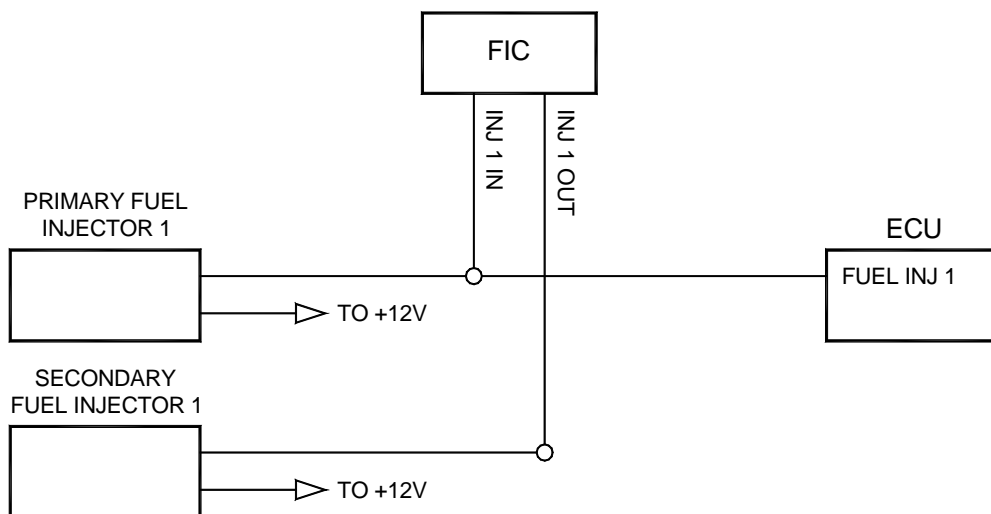


Figure 12: Secondary fuel injector connection

## Do you want to modify the Oxygen(O2)/UEGO sensor signals?

If not, the "O2" sensor wires can be eliminated. If so, connect the sensors as shown below in figures 13, 14, 15 and/or 16.

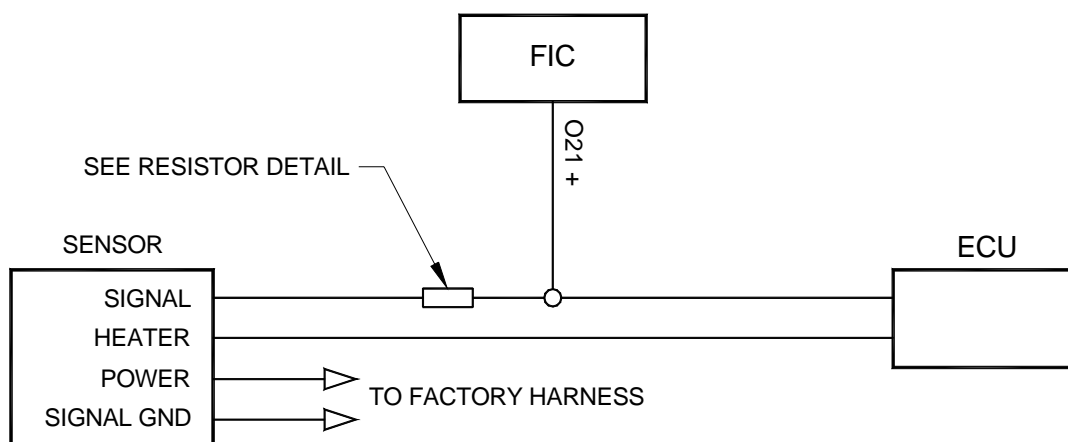


Figure 13: Narrowband O2 sensor connection

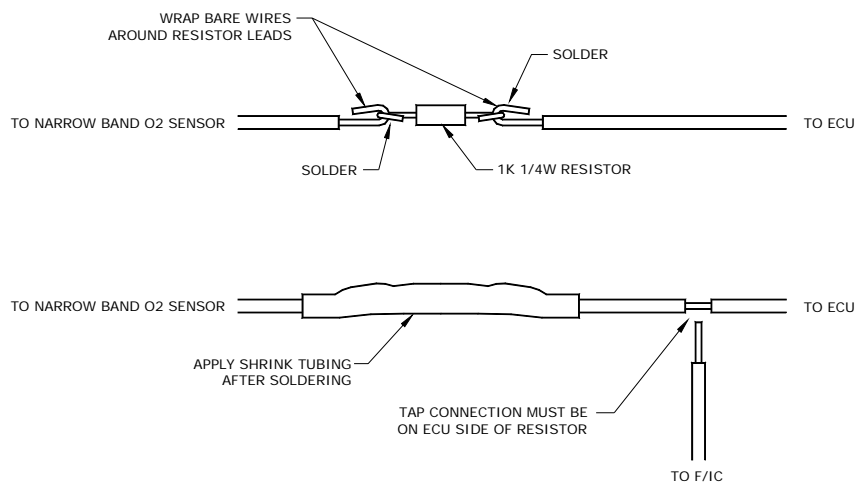


Figure 14: 1K resistor detail for narrowband O2 sensor



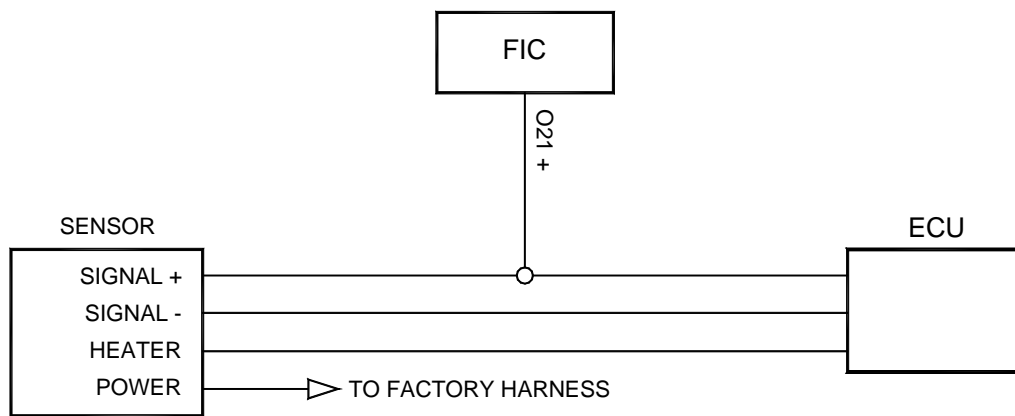


Figure 15: Current sync O2 sensor connection

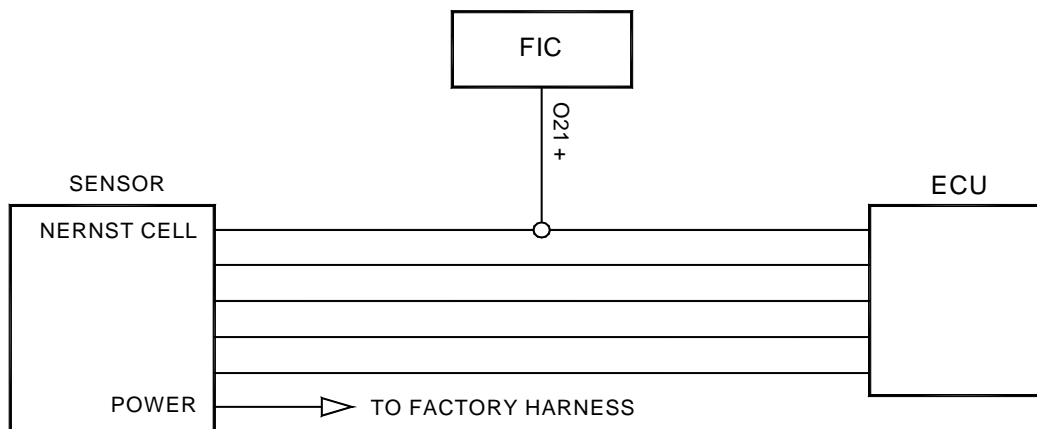


Figure 16: Wideband UEGO O2 sensor

Connect the F/IC power wire as shown below in figure 17.

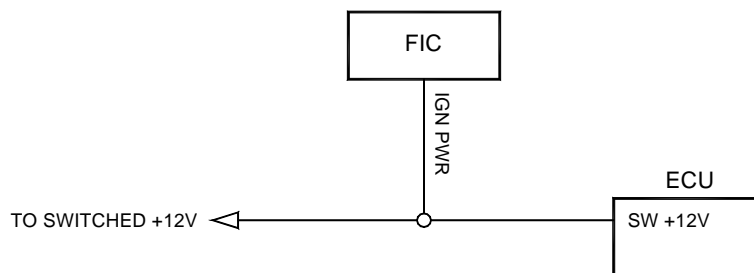


Figure 17: F/IC power connection

Connect the TPS signal to the F/IC as shown below in Figure 18.

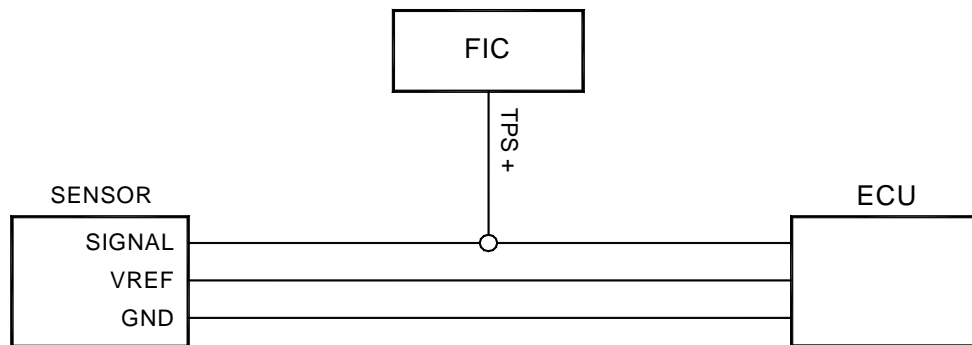


Figure 18: TPS connection

Connect all three F/IC grounds as shown below in figure 19.

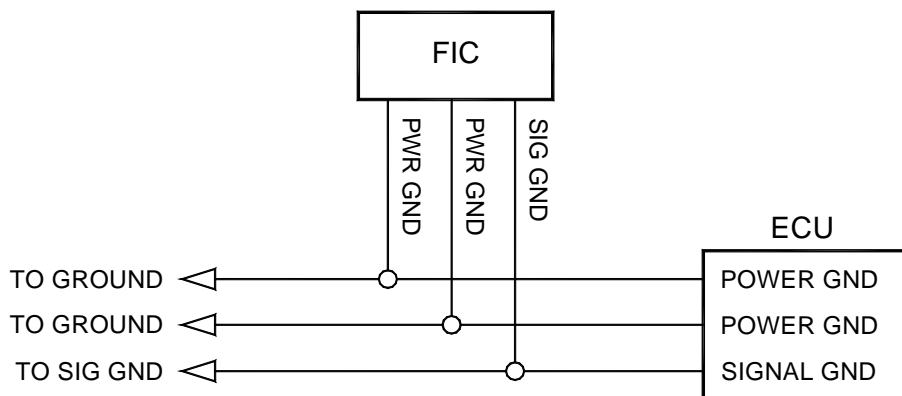


Figure 19: Power ground connections

**Do you want to use the switched 12 volt DC source from the F/IC?**

If so, connect the “Switched 12 Volt” source wire as shown below. (Note: The driver can handle 1 amp max.) See Figure 20.

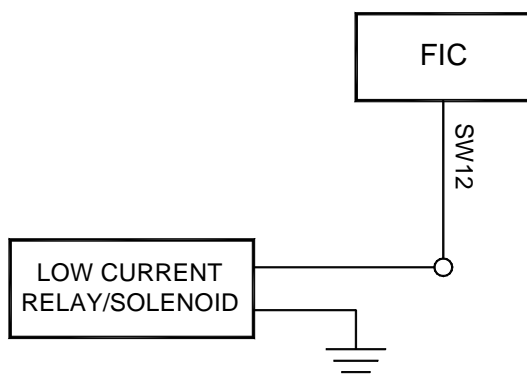


Figure 20: Switched 12V<sub>DC</sub> connection

**Do you want to use the auxiliary gauge in the F/IC?**

If so, connect analog UEGO AEM no. 30-5130 as shown below. See Figure 21.

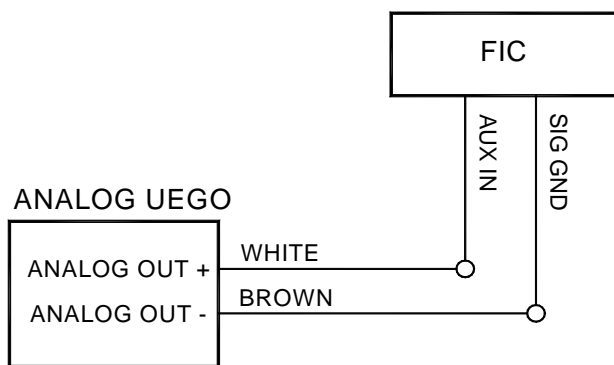


Figure 21: Analog UEGO gauge connection

Or connect digital UEGO AEM number 30-4100 as shown below in figure 22.

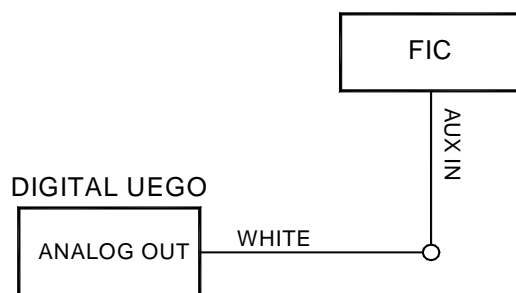


Figure 22: Digital UEGO gauge connection

Or connect the auxiliary input as shown below in figure 23.

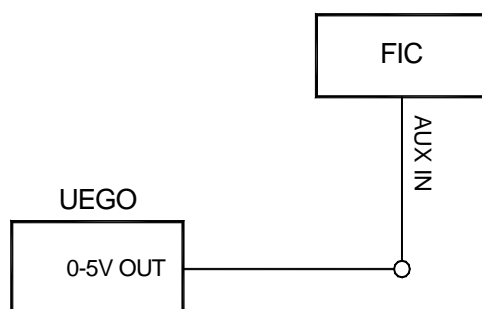


Figure 23: Auxiliary gauge connection

**Do you want to use the F/IC's internal data logger or the dual calibration mode?**  
If so, connect the "Switch Input" as shown below in figure 24.

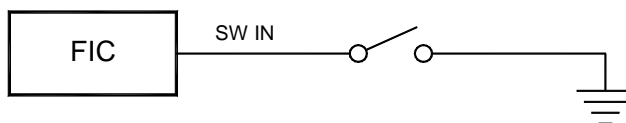


Figure 24: Switch input connection

Connect the “Boost Line” to manifold pressure (after throttle body) as shown below in figure 25.

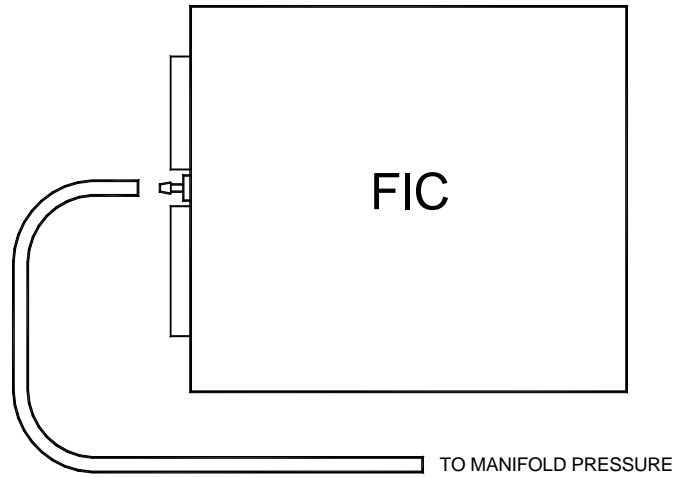


Figure 25: Boost connection

Connect the F/IC to the PC using the supplied USB cable shown below in figure 26.

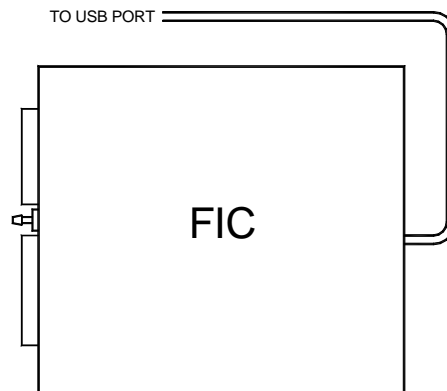


Figure 26: USB com cable connection

## Using the F/IC

The F/IC is a very unique product, capable of precise Fuel and Ignition Control. However, the F/IC, by design, is a “piggyback” engine controller, not a stand-alone ECU. Because of this, the F/IC relies heavily on the factory ECU. As factory ECUs get more and more complex, it is more difficult to sustain improved engine performance without the factory ECU “detuning” the engine. Therefore, the key to using the F/IC is to make it work in harmony with the factory ECU.

## Tuning Tips

- Tuning tips and F/IC informational videos can be viewed on AEM’s website: <http://www.aempower.com/ViewCategory.aspx?CategoryID=327>. The videos will help you become familiar with all of the powerful features the F/IC has to offer. They contain a wealth of useful information to help you extract the maximum from your F/IC unit.
- Tune the F/IC so the factory’s ECU’s closed-loop fuel trims are as close to zero as possible using the fuel maps. Change the factory ECU’s closed loop target air-fuel ratio (AFR) using the O2 table. Most factory ECUs can sense extra fuel and will promptly adjust the fuel trims to remove the extra fuel. For easy reference, fuel trims can be monitored with an OBDII scanner or equivalent device. Positive fuel trims are reduced by adding fuel. Negative fuel trims are reduced by removing fuel.
- **Keep it simple.** Many times it is not necessary to use every function of the F/IC to obtain the desired engine performance. If the desired engine performance can be achieved by adjusting only two maps, use only the two maps. There is no benefit to adding fuel in one map and removing it in another.
- Be conservative when making changes. A small step in the wrong direction is less likely to damage an engine than a large step in the wrong direction.
- Use the Oxygen Sensor functions only when additional closed-loop fuel is needed.

## Absolute Pressure Explained

**(Note: The F/IC reads and displays absolute pressure. Please read the following section before tuning.)**

There are two common ways pressure is represented; gauge, and absolute, with gauge being by far the more common way. Take a tire for example; if the measuring gauge says 50 psi, we say the tire has 50 psi of air in it. However, that is not 100% correct. The tire actually has air at 50 psi above atmospheric pressure, which is known as psi gauge (psi<sub>g</sub>). The total pressure, or absolute pressure (psi<sub>a</sub>), is actually 50 psi on the gauge plus the atmospheric pressure. So, the absolute pressure is the gauge pressure plus the atmospheric pressure. What about boost gauges? Most boost gauges display gauge pressure both above and below atmospheric pressure. Pressure above atmospheric pressure is commonly referred to as “Boost” pressure. Pressure below atmospheric is commonly referred to as “Vacuum”. So why the lesson on absolute pressure? **BECAUSE THE F/IC READS AND DISPLAYS ABSOLUTE PRESSURE!!!** For easy reference, the following formulas can be used to determine “Boost” and “Vacuum” pressures. Atmospheric pressure can be determined by reading the F/IC pressure with the key on and the engine off.

$$P_{(\text{boost})} = P_{(\text{F/IC})} - P_{(\text{atmospheric})}$$
$$P_{(\text{vacuum})} = P_{(\text{atmospheric})} - P_{(\text{F/IC})}$$

Now that you're starting to grasp absolute pressure, you might wonder why the F/IC reads absolute pressure. Well, absolute pressure is the only accurate, repeatable way to measure manifold pressure. Measuring only "Boost" pressure does not account for changes in atmospheric pressure. Changes in atmospheric pressure will cause changes in manifold pressure. For example, let's consider a boost gauge at high elevation, where atmospheric pressure is 12.7 psi<sub>a</sub>. A boost gauge reading of 10 psi will give an absolute pressure of 22.7 psi<sub>a</sub> (12.7 + 10). Now, take the same boost gauge at sea level, where atmospheric pressure is 14.7 psi<sub>a</sub>. A boost gauge reading of 10 psi now gives an absolute pressure of 24.7 psi<sub>a</sub> (10 + 14.7). The boost gauge displayed 10 psi boost in both locations, however, the absolute pressure was two psi greater at sea level. By measuring absolute pressure, instead of gauge pressure, the F/IC can be tuned correctly for all operating conditions.

### Loading the F/IC software

Insert the supplied software disk into your CD drive. The disk should automatically load. To manually load the software, double click the file "FICRelease080609.exe". Follow the on-screen dialogue to finish the install. Load the USB drivers by double clicking on the file "CDM 2.02.04.exe" (**C:\Program Files\AEM\FIC**). Latest software versions can be found on the Electronics Forums at <http://forum.aempower.com/forum/index.php/board,89.0.html>.

### Opening a Calibration

(Note: Changes made to F/IC calibrations are made real-time and are autosaved on the calibration that is currently open. If you do not want to modify a file, it is recommended that you save the file under a different name using the "Save As" function.) Start the F/IC software by double clicking on the "AEM FIC" icon on your desktop. Go to File>Open and locate the file "Base Cal.fi6". If the default file locations were used to load the software, the "Base Cal.fi6" file should be found in the FIC folder **C:\Program files\AEM\FIC\**. See Figure 27.

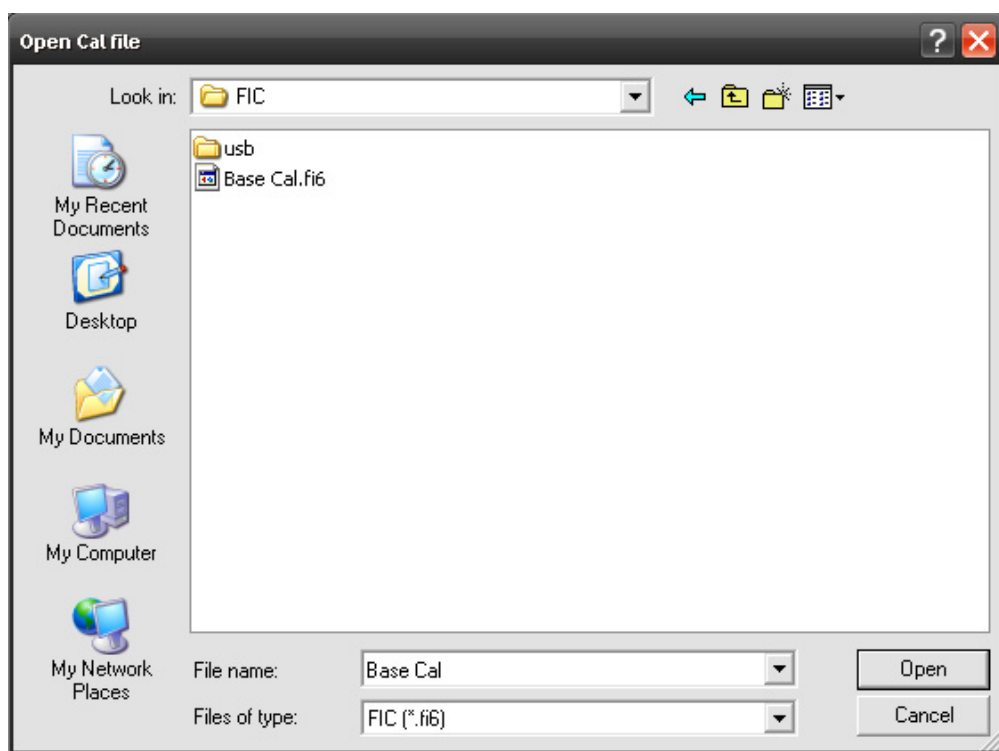


Figure 27: Open file

### Saving a Calibration under a different name

With a Calibration open, go to File>Save As. Select a file name and location to save the file in the “Save As” pop-up window. See Figure 28.

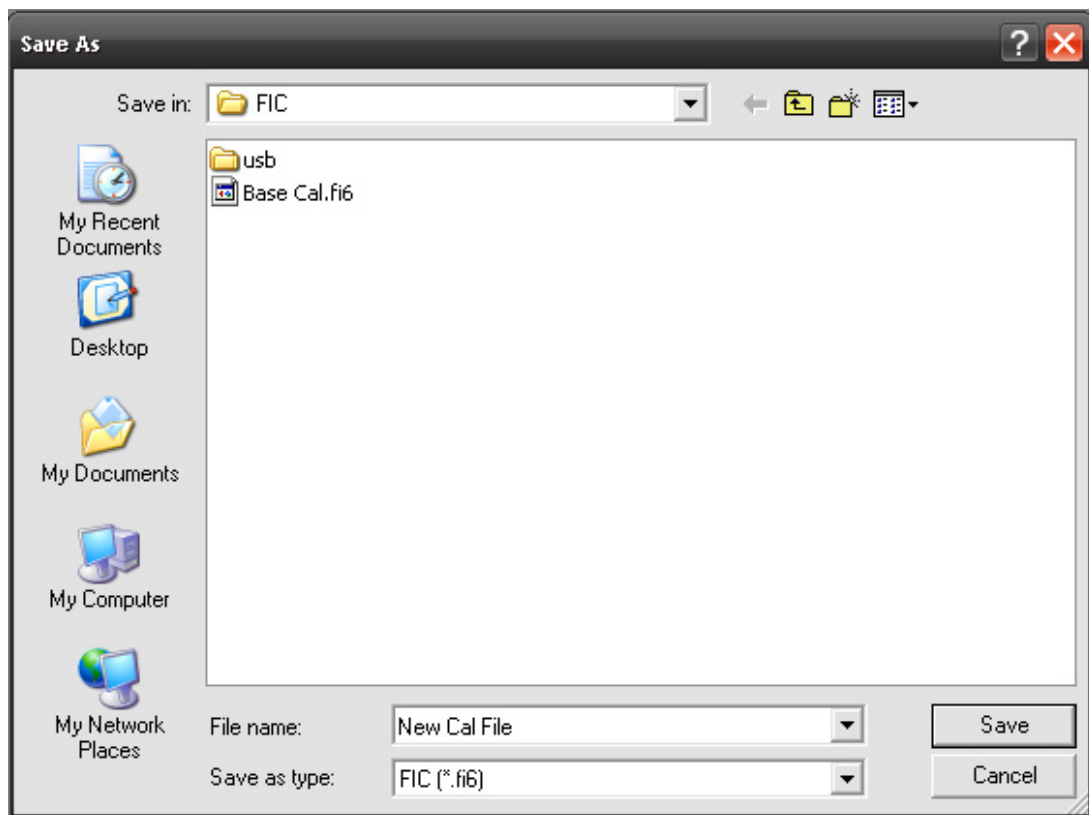


Figure 28: Save As file

### Editing a Calibration

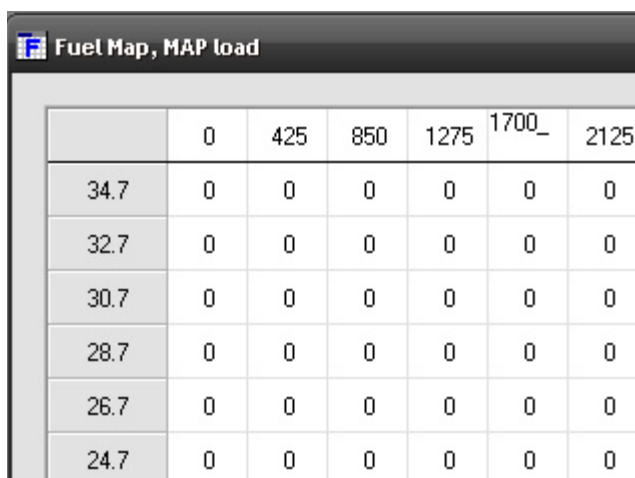
The F/IC6 has 6 user configurable maps. Each map is 21X17 and has user configurable Load and RPM breakpoints. The map cells have a white background, while the Load and RPM breakpoints have a gray background. See Figure 29.

Fuel Map, MAP load						
	0	425	850	1275	1700	2125
34.7	12.5	12.5	12.5	12.5	12.5	0
32.7	12.5	12.5	12.5	12.5	12.5	0
30.7	0	0	0	0	0	0
28.7	0	0	0	0	0	0
26.7	0	0	0	0	0	0

Figure 29: Map cells and breakpoints



To edit breakpoints, double click on a breakpoint. The background for the breakpoints will change from gray to white, signifying that the breakpoints can now be edited. See Figure 30.



	0	425	850	1275	1700_	2125
34.7	0	0	0	0	0	0
32.7	0	0	0	0	0	0
30.7	0	0	0	0	0	0
28.7	0	0	0	0	0	0
26.7	0	0	0	0	0	0
24.7	0	0	0	0	0	0

Figure 30: Editing breakpoints

To change the value of a breakpoint, select the breakpoint and type in the new value. Breakpoints can be selected using the arrow keys or the mouse. To linearly interpolate between breakpoints, highlight the desired breakpoints by using the left mouse button. After the breakpoints have been selected, right click the mouse and select “Calculate” on the pop-up menu. The software will linearly interpolate all breakpoints between the left most and right most RPM breakpoints. When calculating load breakpoints, the software will interpolate between the upper most and lower most breakpoints. To change single cell values, select a cell using the arrow keys or mouse and type a new value. To change multiple cell values simultaneously, highlight the desired cells and right click the mouse. Select either “Set value” or “Change value”. “Set value” is used to give the same values to multiple cells. “Change value” is used to change multiple cells by the same percentage.

The following shortcuts can be used when using the F/IC software.

- CTRL-A = Select All
- CTRL-C = Copy to Clipboard
- CTRL-D = Value-Down
- CTRL-E = Show Aux Gauge Setup screen
- CTRL-F = Show both Fuel Map screens
- CTRL-G = Show Real-time Gauge screen
- CTRL-I = Show Ignition Map screen
- CTRL-J = Show Analog-A map screen
- CTRL-K = Show Analog-B map screen
- CTRL-M = Show MAF map screen
- CTRL-O = Show O2 map screen
- CTRL-S = Show Setup screen
- CTRL-U = Value-up
- CTRL-V = Paste from clip board
- CTRL-X = Show value-change pop-up menu
- CTRL-Y = Redo
- CTRL-Z = Undo

## Fuel Map, MAP Load (See Figure 31)

The MAP based “Fuel Map” uses the onboard MAP sensor for its load input. Fuel can be added or removed from the engine based on engine speed and manifold pressure. With a value of 12% in any of the cells, the F/IC will hold the injector open for 12% longer than the factory fuel pulse. With a value of -18% in any of the cells, the F/IC will hold the injector open for 18% less time than the factory fuel pulse. A value of 0 will not alter the fuel pulse width from the factory ECU.

The “Fuel Map” also has a couple unique features that allow for easy setup of a basic calibration file. The “Injector size change” and the “Create base fuel map” functions reduce the amount of time required to configure a map when starting from scratch. The “Injector size change function” is used to rescale the fuel map when changing injector size. Right click on the “Fuel Map” and select “Injector size change”. Enter the new and old injector sizes and click OK. The “Fuel Map” will automatically rescale for the new injector size. To create a base map, right click on the “Fuel Map” and select “Create base fuel map”. Enter the “New injector size,” if changed, the “Old injector size”, the “Maximum RPM”, and the “Maximum Boost” (must be absolute pressure) and click OK. (Note: Final tuning is required after using the “Create base fuel map” function.)

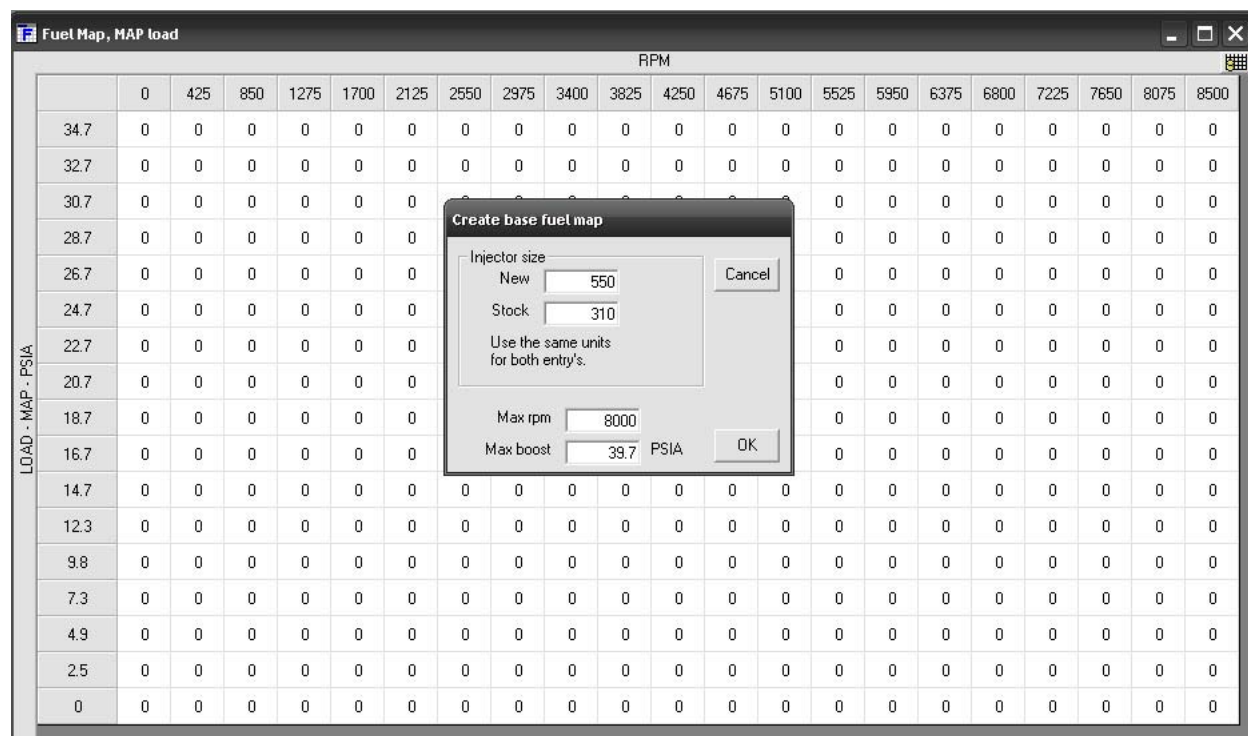


Figure 31: Create MAP sensor based fuel map

## Ignition map (See Figure 32)

The “Ignition Map” is used to retard ignition timing. The load input for the “Ignition Map” is based on MAP or MAF. Timing will be removed from the engine based on the selected load input and engine speed. Since timing can only be removed (retarded) from the engine, the “Ignition Map” **only** accepts negative numbers. For example, a value of  $-4$  will retard the timing  $4^{\circ}$ . The load input for the “Ignition Map” is selected from the “Setup” window. Go to Setup>System and the “Setup” window will appear. In the “Ignition” section, select the desired load input from the drop down menu.

Similar to the “Fuel Map”, the F/IC software will also create a base “Ignition Map”. Right click on the “Ignition Map” and select “Create base ignition map”. Enter the “Maximum RPM”, “Maximum boost” (must be absolute pressure), the desired “Timing retard per unit of Boost”, and click OK. (Note: As with the “Fuel Map”, final tuning is required after using the “Create base ignition map” function.)

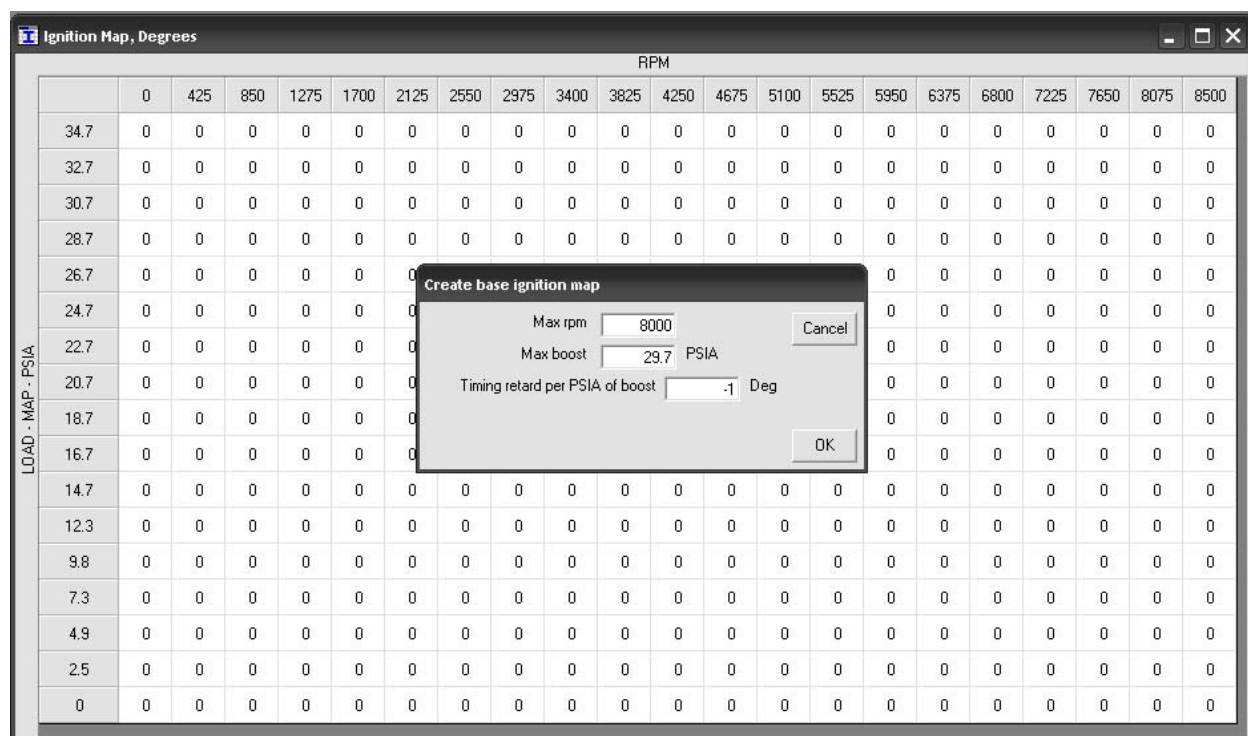


Figure 32: Create base ignition map

### MAF Map (See Figure 33)

The “MAF Map” is used to alter the MAF or MAP signal to the factory ECU. Like the “Ignition Map”, the “MAF Map” load is based on MAP, MAF, or TPS. The load input is selected from the “MAF” section of the “Setup” window. The “MAF Map” has two different operating modes, Percent and Voltage. The mode is also selected in the “MAF” section of the “Setup” window.

- “Percent” mode - The F/IC will measure the input voltage on the MAF input wire and modify the output voltage by the value in the “MAF Map”. For an input voltage of 1 volt, a cell value of 6, the output voltage will be 1.06 volts.
- “Voltage” mode - The F/IC will output the voltage value that is in the “MAF Map”. For example, the F/IC will output 2.5 volts for a value of 2.5 in the “MAF Map”.

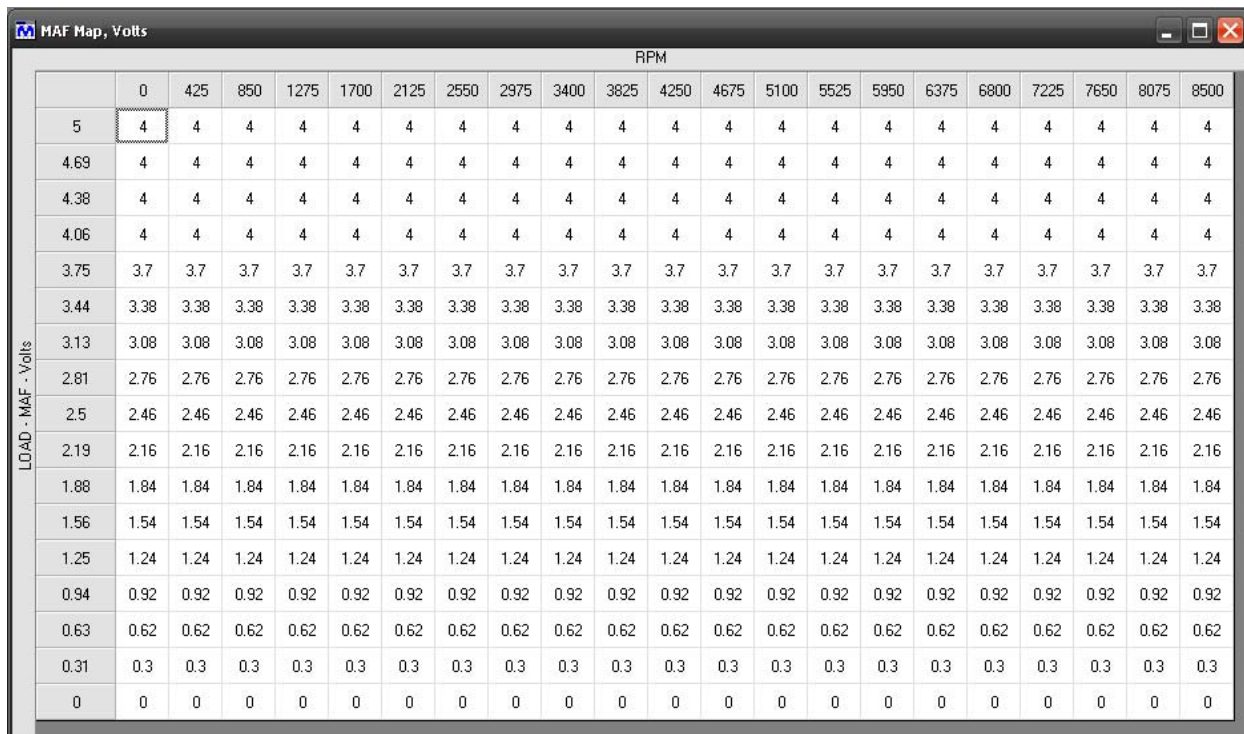
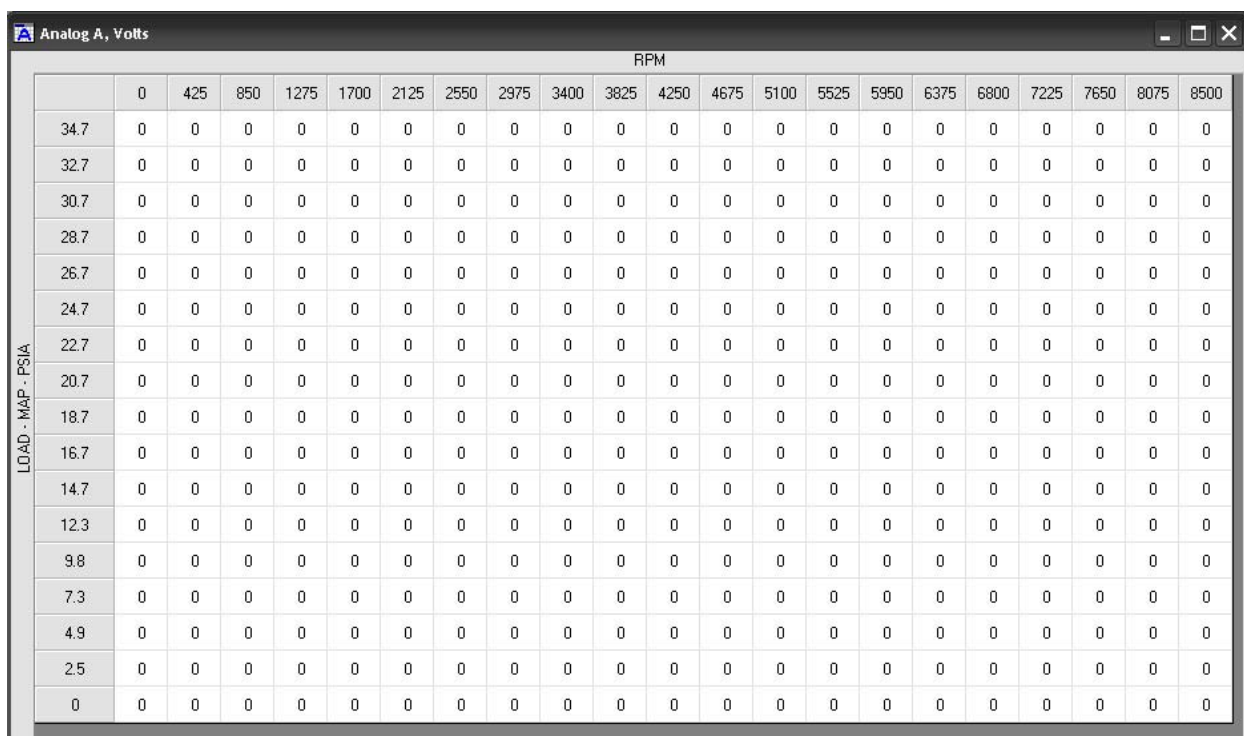


Figure 33: MAF map

### Analog A(B) Map (See Figure 34)

The Analog A(B) map is used to alter the Analog A(B) signal to the factory ECU. The Analog A(B) map load is based on either MAP, MAF, TPS, or the Analog A(B) input voltage. The load input is selected from the “Analog A(B)” section of the “Setup” window. The Analog A(B) map has three different operating modes, Percent, Offset, and Voltage. The mode is also selected in the “Analog A(B)” section of the “Setup” window.

- “Percent” mode - The F/IC will measure the input voltage on the Analog A(B) input wire and modify the output voltage by the value in the Analog A(B) map. For an input voltage of 1 volt, a cell value of 6, the output voltage will be 1.06 volts.
- “Voltage” mode - The F/IC will output the voltage value that is in the “MAF Map”. For example, the F/IC will output 2.5 volts for a value of 2.5 in the Analog A(B) map.
- “Offset” mode - The F/IC will measure in the input voltage on the Analog A(B) in wire and offset the voltage by the number in the Analog A(B) map. For an input voltage of 1.5 volts and a cell value of .25, the F/IC will output 1.75 volts.



		RPM																	
LOAD - MAP - PSIA		0	425	850	1275	1700	2125	2550	2975	3400	3825	4250	4675	5100	5525	5950	6375	6800	7225
	34.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	32.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	30.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	28.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	26.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	24.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	22.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	18.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	16.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	14.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	12.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 34: Analog A/B map

## O2 Map (See Figure 35)

At times, such as a track day or race event, you may desire to alter the closed-loop air-fuel ratio (AFR) of the factory ECU to achieve better engine performance. This can be done using the O2 functionality of the F/IC. By outputting a different signal, the F/IC can alter the target AFR of the factory ECU. The O2 map “Load Input” can be based on MAP, MAF, TPS, or O2 sensors. The “O2 Map” also has four different operating modes, Fixed, Percent, Offset, and Voltage. The load inputs and modes are selected in the “O2” section of the “Setup” window.

- “Voltage” mode - The F/IC outputs a voltage, which is determined by the corresponding cells in the “O2 Map”. In the “Voltage” mode, for an “O2 Map” cell value of 2.5, the F/IC will output 2.5 volts. In “Voltage” mode, a cell value of 0 makes no change, NOT an output voltage of 0 volts.
- “Fixed” mode - The F/IC outputs a square wave that alternates between the Bank Hi voltage and the Bank Lo voltage. The Bank Hi voltage, Bank Lo voltage, and square wave period are set in the O2 section of the setup window. The pulse width is determined by the cell value in the “O2 Map”. For a Bank Hi of 2, and Bank Lo of 1, a period of 200 ms, and a cell value of 60, the F/IC will output 2 volts for 140 ms, 1 volt for 60ms, 2 volts for 140 ms, etc.
- “Percent” mode - The F/IC will measure the O2 voltage, then modify it by the percentage value in the “O2 Map”. For a measured value of 1 volt, a period of 200ms, and a cell value of 20, the F/IC will measure 1 volt for 5ms, then output 1.2 volts for 195ms, then measure again for 5ms, etc.
- “Offset” mode - The F/IC will measure the O2 voltage, and then modify it by the offset value in the O2 map. For a measured value of .7 volts, a period of 200ms, and a cell value of -.25, the F/IC will measure 0.7volts for 5ms, then output 0.45 volts for 195ms, then measure again for 5ms, etc

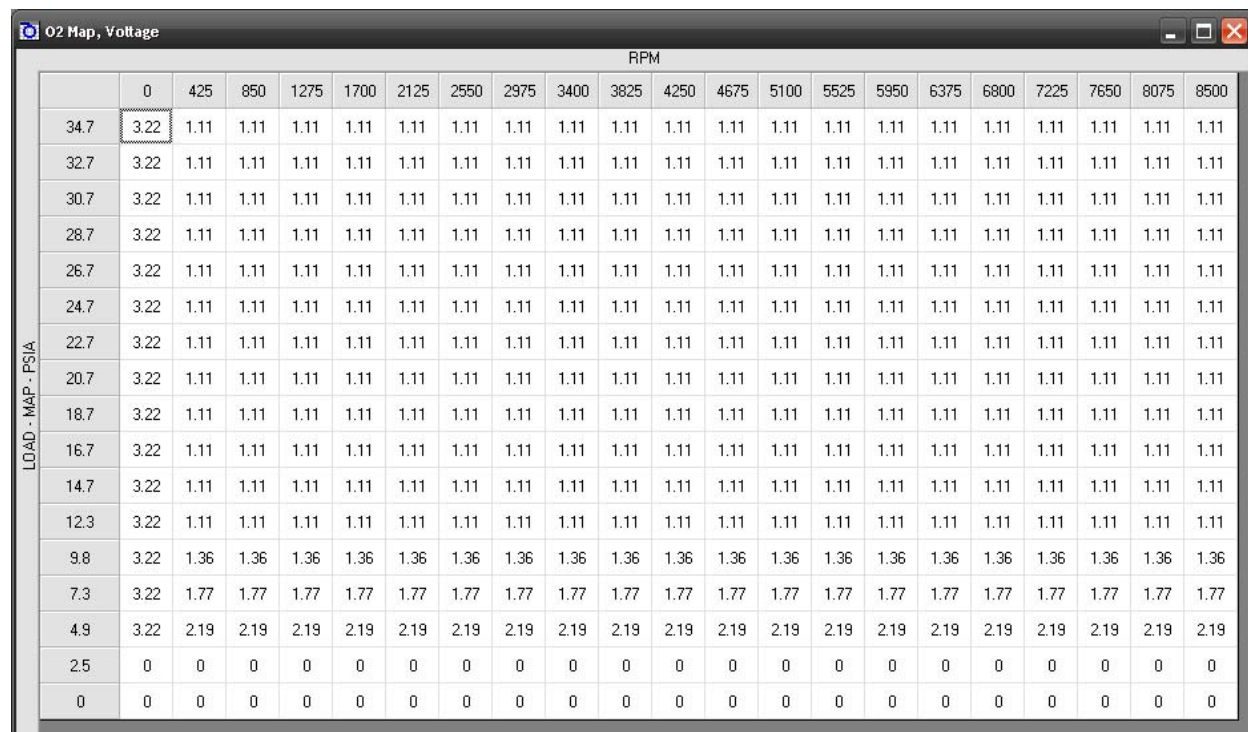
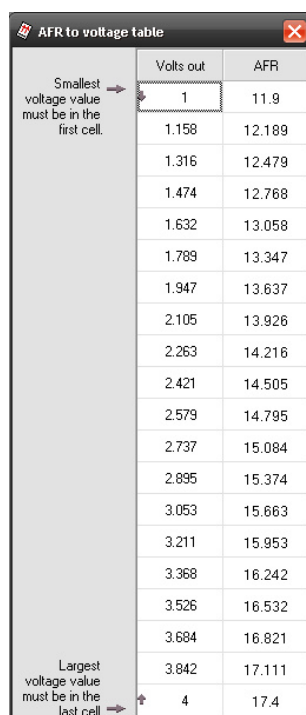


Figure 35: O2 map



## Viewing the O2 Map as AFR (See Figure 36)

In the “Voltage” and “Offset” modes, the software can be configured to view the “O2 Map” as AFR values rather than voltage values. To display the “O2 Map” as AFR values, the “View as AFR” checkbox must be checked, and the “AFR to Voltage Table” must be configured. The “View as AFR” checkbox is located in the “O2” section of the “Setup” window, see Figure 37. To open the “AFR to voltage Table” click on the AFR table icon next to the “View as AFR” checkbox. The “AFR to Voltage Table” contains two columns and 20 rows, see Figure 36. When completing the “Volts out” column, the lowest voltage must be in the top row, while the largest voltage value must go in the bottom row. In the “AFR” column, enter the corresponding AFR for each voltage output. Once the “AFR to Voltage Table” is complete, AFR values can be entered into the O2 map. For a given cell value in the O2 map the F/IC will take the value from the O2 map, look at the “AFR to Voltage Table”, then output the corresponding voltage value.



	Volts out	AFR
Smallest voltage value must be in the first cell.	1	11.9
	1.158	12.189
	1.316	12.479
	1.474	12.768
	1.632	13.058
	1.789	13.347
	1.947	13.637
	2.105	13.926
	2.263	14.216
	2.421	14.505
	2.579	14.795
	2.737	15.084
	2.895	15.374
	3.053	15.663
	3.211	15.953
	3.368	16.242
	3.526	16.532
	3.684	16.821
	3.842	17.111
Largest voltage value must be in the last cell.	4	17.4

Figure 36: AFR to voltage table.

## Using Passwords

The F/IC has user selectable password capabilities. To add a password to a non password file click File>Change Cal-file PIN, then follow the on-screen instructions. When prompted, enter the new PIN. PINs are case sensitive. When opening an existing file with a PIN, the software will prompt the user to enter the PIN before fully opening the file. An error window will appear if an incorrect PIN is entered.

To change a password file to a non password file, follow the procedure described for changing a password. When prompted to enter the new PIN, enter 12345678. A password will not be required the next time the file is opened.

When connecting the F/IC to the PC, the F/IC will connect as normal if both the calibration and password on the PC match the calibration and password in the F/IC. If there is a mismatch of passwords and or calibrations between the PC and F/IC, a pop-up window will appear, explaining the available options. Remember, there is NO undo function for copying cal files. If you don't know what to do, select cancel.

## Configuring the F/IC

With the F/IC software open, select Setup>System. See Figure 37.

The screenshot shows the 'Setup' window for the F/IC6 system. It is organized into several sections:

- Fuel:** Injector response time (486 uS), Load input (TPS), Acceleration (Sensitivity: 5 %, Fuel: 99.6 %, Limit: 199.2 %, Duration: 1275 ms).
- Ignition:** Load input (MAP), Slew rate (0.125 Deg/5ms).
- MAF:** Load input (MAF), Mode (Voltage), Max voltage clamp (5.87).
- Analog A:** Load input (Analog A), Mode (Percent).
- Analog B:** Load input (TPS), Mode (Offset).
- Com Port:** Port number (11) and a 'Find' button.
- Load display units:** A dropdown menu set to 'PSIA'.
- User switch input function:** Radio buttons for 'Logger trigger' (selected) and 'Dual Calibration'.
- O2:** Load input (O2), Mode (Percent), Period (100 mS), Start Delay (10 Sec), Bank1 Hi voltage (1.01), Bank1 Lo voltage (0.5), Bank2 Hi voltage (2), Bank2 Lo voltage (0.19), 'View as AFR' checkbox, and 'High level drive' checkbox (checked).
- FIC Logger:** 'Logger is recording when load is above' (0 PSIA), 'and TPS is above' (0 %), 'and RPM is above' (4000), and 'Sample rate' (10 mS).
- Switched 12Vdc:** 'Output is on when load is above' (0 PSIA), 'and TPS is above' (0 %), 'and RPM is above' (4000), 'Output is off when load is below' (0 PSIA), 'or TPS is below' (0 %), 'or RPM is below' (3000).

Figure 37: F/IC6 setup window

### Com Port:

Displays the com port to which the F/IC is connected. This value will automatically be entered once the F/IC is connected to the computer.

### Load Display Units:

The on board map sensor reads load in absolute pressure. The load can be displayed in psi absolute or kPa absolute.

### User Switch Input Function:

Select the functionality for the User Switch Input Function. The User Switch Input either can be used to trigger the internal F/IC logger or switch between calibrations in the dual calibration mode.



**Injector Response Time:**

This is the amount of time by which the start of fuel flow lags behind the injector open signal from the ECU. A typical value is 500  $\mu$ S.

**Load input:**

This determines whether the fuel map load type will be based on TPS readings or F/IC on-board MAP readings.

**Acceleration Enrichment Pump:**

*Please note the TPS signal must be connected for the acceleration enrichment pump to be activated.*

These settings are used to emulate an acceleration enrichment pump. Sensitivity will determine how fast or slow conditions must change in order to activate the acceleration enrichment pump. Fuel percentage will set how much fuel will be added to whatever area of the map the abrupt increase in load is applied to. Limit percentage is the maximum amount of fuel increase you want to allow for. Duration in ms is the amount of time the pump will be activated for when the F/IC senses an abrupt change in throttle position.

**Ignition:**

Select the load input type for the ignition map. Set the slew rate for the ignition timing. A typical slew rate value is 0.125 degrees per 5 ms.

**MAF:**

Select the load input type and operating mode for the MAF map. Set the maximum voltage clamp (max output voltage) for the MAF map.

**Analog A(B):**

Select the load input type and operating mode for the Analog A(B) maps.

**O2:**

Select the load input type and operating mode for the O2 map. Set the period for the fixed and percentage modes. Set the high and low voltages for bank 1 and bank 2. Set the Start Delay time, which is the amount of time in seconds that the F/IC waits for the O2 outputs to be functional after the F/IC is turned on. Check the High Level Drive option for better AFR resolution on certain vehicles with UEGO style oxygen sensors. Select the view as AFR option if desired.

**F/IC Logger:**

Set the on conditions and sample rate for the F/IC internal logger. Note: The on conditions must be met and the logger trigger input must be grounded before the internal logger will begin logging.

**Switched 12V<sub>DC</sub>:**

Set the on/off conditions for the Switched 12 V<sub>DC</sub> output wire.

### Connecting to the F/IC:

Note: when connecting to the F/IC for the first time, the found new hardware window will appear. The USB drivers will load automatically. If unsuccessful, use the file provided in the F/IC directory: "CDM 2.02.04.exe" (**C:\Program Files\AEM\FIC**).

Connect the F/IC to the PC using the supplied USB cable. With a calibration already open, click on the connect button to connect to the F/IC. See Figure 38.

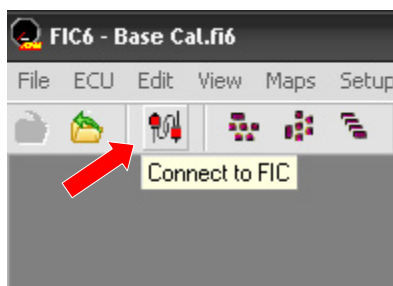


Figure 38: Connect icon

(Note: If the opened file does not match the file in the F/IC, a window will appear, asking if you want to copy the PC file to the F/IC or if you want to copy the F/IC file to the PC. Follow the on-screen instructions to proceed. See Figure 39)

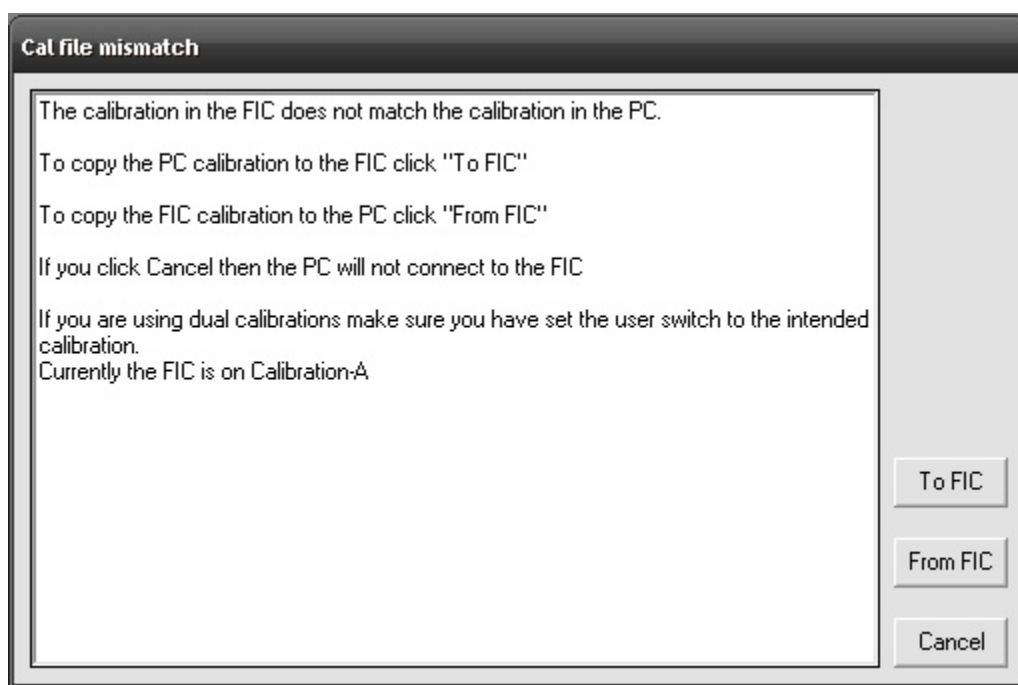


Figure 39: Connecting to the F/IC

To verify the connection status of the F/IC, the footer in the lower left corner of the software will display either "On-line" or "Off-line".

### Uploading a Cal File:

This function is used to upload a calibration only. To upload a cal file to the F/IC, click on file and select "Upload Cal Only". Select the file to upload and click open. Note: When using the "Upload Cal Only" function, the software will overwrite the calibration in the F/IC with the selected calibration.

### Calibrating the F/IC:

When an F/IC is installed on a vehicle, it is necessary to calibrate the F/IC before any tuning is performed. With the F/IC already connected, go to Setup>Calibration. The calibration window will appear. See Figure 40.

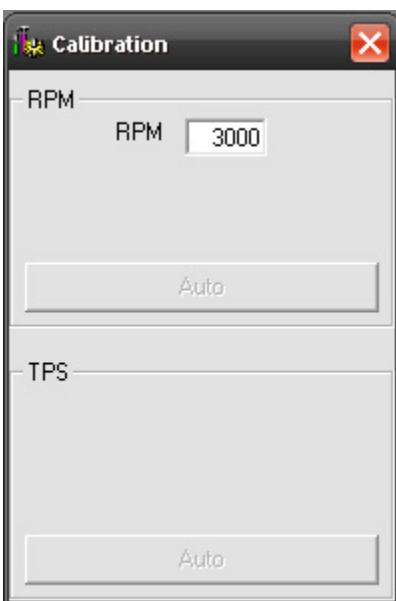


Figure 40: F/IC calibration window

The RPM calibration is performed by running the engine at the RPM shown in the RPM box, as directed by the on-screen instructions. The RPM in the window can be changed if desired. Click Auto in the RPM section and follow the on-screen instructions. The TPS calibration is a two-point calibration, one at 0% throttle and one at 100% throttle. Click Auto in the TPS section and follow the on-screen instructions to calibrate the TPS. (Note: For drive by wire applications, the engine may need to be running in order to open the throttle plate to 100%. Quickly blip the throttle to 100% and click the ok button.) Always verify the TPS and RPM calibrations after uploading a file from a different source. (Note: The TPS and RPM calibration settings are stored in the calibration file.)

### Gauges Window:

To aid in tuning, the F/IC software has a Gauges window that gives real-time reference to the engine's operating conditions. See Figure 41.

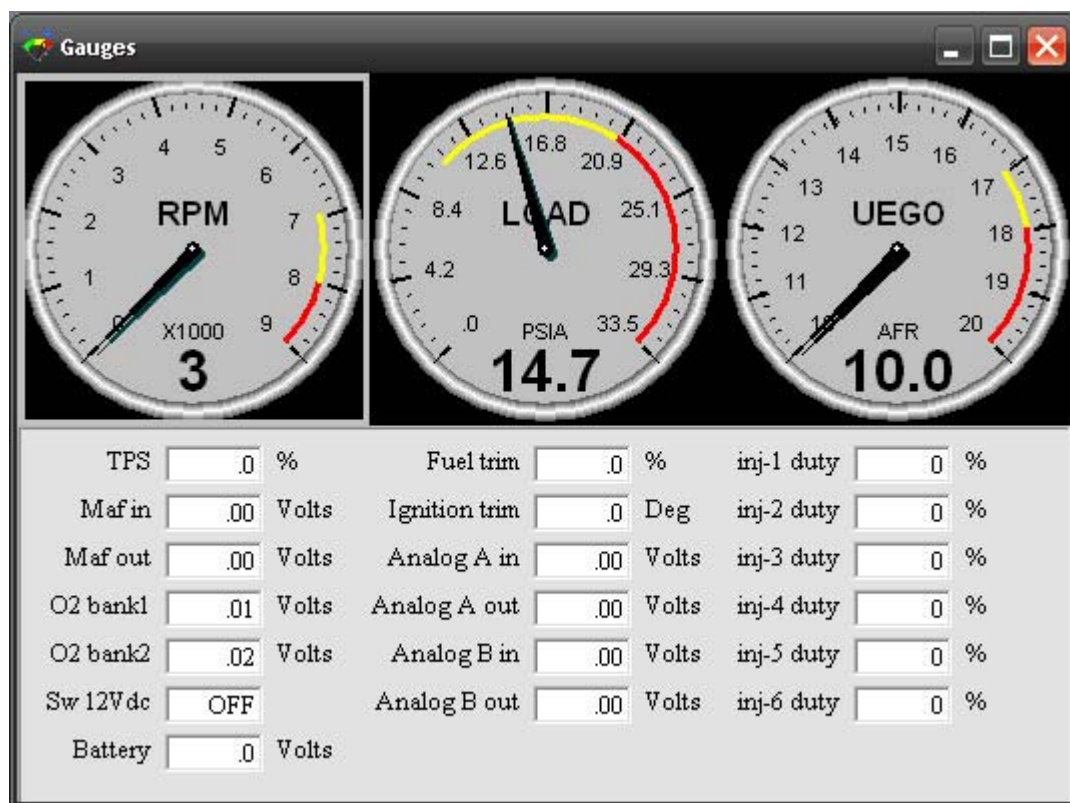
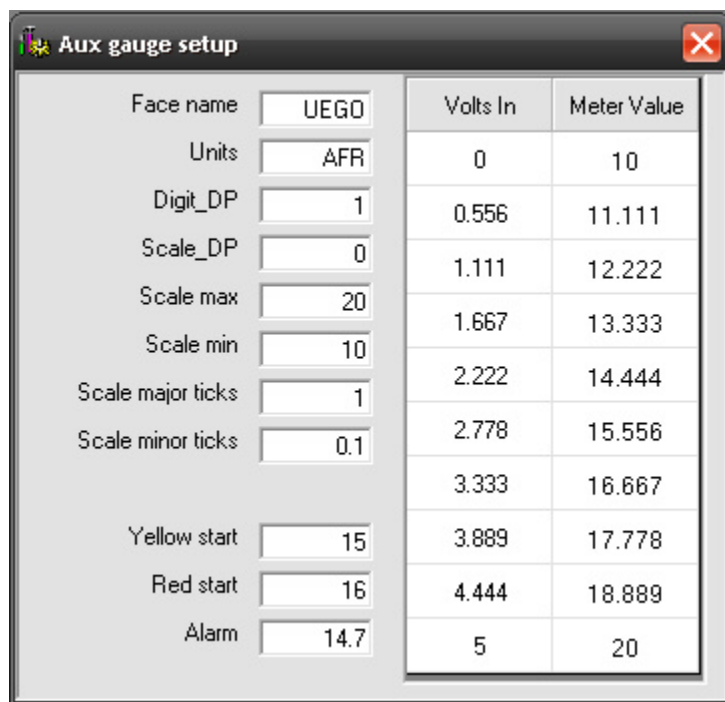


Figure 41: F/IC gauges window

The Gauges window contains a user configurable Tachometer, Pressure (Load) gauge, and an Auxiliary gauge (UEGO in Figure 41), along with real-time displays of TPS, MAF voltage, O2 voltage, Switched 12V<sub>DC</sub> status, Battery voltage, Fuel Trim, Analog A, Analog B, and Ignition trim. Each gauge has an overload alarm, yellow highlight, red highlight, and full-scale settings. To configure a gauge, place the cursor over the gauge and double click the left mouse button. A pink needle will appear. Move the cursor over the needle, hold the left mouse button and drag the needle to the desired value. Double clicking on the left mouse button will move the gauge to the next configurable setting.

## Auxiliary Gauge (UEGO)

The Auxiliary gauge (UEGO) is a user configurable display based on a 0-5 volt analog input. The Auxiliary gauge was specifically created so the F/IC can display and log AFR based on the analog output from the AEM UEGO gauge or controller. However, since the gauge is user configurable, it will work with any 0-5 volt analog signal. To configure the auxiliary gauge, open the “Auxiliary gauge setup” window by clicking on Setup>Aux Gauge. See Figure 42.



The 'Aux gauge setup' window contains configuration parameters on the left and a calibration table on the right.

Parameter	Value
Face name	UEGO
Units	AFR
Digit_DP	1
Scale_DP	0
Scale max	20
Scale min	10
Scale major ticks	1
Scale minor ticks	0.1
Yellow start	15
Red start	16
Alarm	14.7

Volts In	Meter Value
0	10
0.556	11.111
1.111	12.222
1.667	13.333
2.222	14.444
2.778	15.556
3.333	16.667
3.889	17.778
4.444	18.889
5	20

Figure 42: Auxiliary gauge setup

The Auxiliary gauge uses a 10 position calibration. Enter the input voltage value into the “Volts In” column. Enter the value to be displayed for each input voltage in the corresponding row of the “Meter Value” column. The appearance of the gauge is configured by parameters on the left side of the “Aux gauge setup” window. The Face Name is displayed in bold letters just above the center of the gauge. The units are displayed in smaller letters below the center of the gauge. “Digit\_DP” sets the number of decimal places displayed by the large bold numbers at the bottom of the gauge. “Scale\_DP” sets the number of decimal places displayed by the tick mark values on the gauge face. “Scale max” and “Scale min” set the display range of the gauge. “Scale major ticks” and “Scale minor ticks” set the number of major and minor tick marks displayed on the gauge. “Yellow start” and “Red start” set the starting value for the yellow and red regions of the gauge. “Alarm” sets the value at which the gauge needle starts flashing.

## Data Logging:

There are two types of logging available with the F/IC, Internal and PC logging. In both modes of logging, the parameters that appear in the “Gauges” window are logged.

### Internal Logging:

The F/IC contains an onboard 64KB logger. The sampling rate and trip conditions for the onboard logger are set in the “FIC Logger” section of the “Setup” window. The sampling rate can be set from 10mS to 1275mS. Sampling every 10mS will

give 10.23 seconds of data. Sampling every 1275mS will give 21.73 minutes of data. In order to start internal logging, all the trip conditions must be met and the "User Switch Input" must be grounded. (Note: When using the "User Switch Input" in the "Dual Calibration" mode, the "Logger Trigger" is always on by default.) To download data from the Internal logger, go to Logger>Download FIC and save the file to the PC. Logged files are saved as delimited text files.

### **PC Logging:**

The F/IC software allows you to log data to your PC while connected to the F/IC. The sampling rate and file size are determined by the available memory and processor speed of the PC. To start PC logging, go to Logger>PC Logger Start. To stop PC logging go to Logger> PC Logger Stop, give the file a name and save it. Logged files are saved as delimited text files.

### **Dual Calibration:**

The F/IC has a "Dual Calibration" mode, which allows the user to switch between two maps with the flip of a switch. Some common uses for this are a race gas map, a pump gas map, or a valet mode map. The "User Switch Input" is used to switch between maps. In order to use the "Dual Calibration" feature of the F/IC, the "Dual Calibration" mode must be selected in the "Setup" window, see Figure 35. When the "User Switch Input" wire is not connected to ground, the F/IC uses calibration "A". When the user input switch wire is connected to ground, the F/IC uses calibration "B". To upload/edit Calibration A, verify the user input wire is not connected to ground, then follow the instructions in the "Connecting to FIC" section. To upload/ edit Calibration B, verify the "User Switch Input" wire is connected to ground, then follow the instructions in the "Connecting to FIC" section. (Note: The F/IC will disconnect from the PC if you try to switch calibrations while connected.)

### **Flashing the F/IC:**

#### **How to Verify Firmware:**

1. Go into the F/IC software and click on File. Scroll down and click on "Get Slave Version."
2. Follow instructions until you get the "Form1" window.
3. Unplug the USB cable from the F/IC. Press and hold the Re-flashing button on the F/IC with a paperclip while plugging the USB cable back into the F/IC. Continue to hold the button for 5 seconds and click the continue button in the software.
4. The "Form1" window will appear and display the firmware version.

#### **How to Load Firmware:**

1. Go into the F/IC software and click on file. Scroll down and click on "Flash FIC."
2. The Re-flash window should pop up. Click on "x131" for Calibration/PC Software or "z104", "z107", or "z110" for fueling/firmware.
3. Follow instructions until you get to the "Re-flashing" window.
4. Unplug the USB cable from the F/IC. Press and hold the Re-flashing button on the F/IC with a paperclip while plugging the USB cable back into the F/IC. Continue to hold the button for 5 seconds and click the continue button in the software.

5. If done correctly you will see the "Form1" window and the software transmitting data to the F/IC.
6. Wait until you see "Flashing completed!" in green and click ok.
7. Disconnect the F/IC from the USB and plug it back in to do a hard reset.

For a reference as to what the hex files are for and how they are different, please check the Appendix under "Firmware Hex Files".

## Appendix

### Oxygen Sensor theory:

#### Wide-band:

A wide-band sensor works by servo operation between a measuring cell (Nernst cell) and an oxygen pumping cell. These two cells are contained in the O<sub>2</sub> sensor where the exhaust gas is sampled by a chamber connecting the two cells. The controller in the car will change the current applied to the pump cell in an attempt to keep the Nernst cell voltage at a predetermined level. The current that is needed to maintain this balance is the indication of AFR that the ECU uses. When the F/IC is used to modify the signal from a wideband sensor the connection is made to the Nernst cell. Because the Nernst cell acts like a variable voltage source with a predictable impedance the F/IC can modify the current from the Nernst cell to effect a change to the AFR.

#### Narrow-band 0-1 V<sub>DC</sub> Nernst type:

A narrow-band Nernst sensor produces a voltage that represents partial pressure of oxygen left in the exhaust after combustion. This voltage will switch very rapidly as the AFR moves in either direction off of stoich (about 14.7:1). The cars controller manages this by dithering about stoich. The F/IC can override this signal with a programmable square-wave to keep the car ECU from seeing other changes that are being made to the fuel injectors or MAF.

### Firmware Hex Files:

#### Z files (Handle fueling and firmware):

- Z104.hex: Used on older vehicles where multiple injector pulses are not present
- Z107.hex: Updated version of Z104.hex, used for Scion TC
- Z110.hex: Used for newer vehicles that have multiple injector pulses. Faster response time than other hex files.

#### X files (Handle the calibration and PC software):

- X131.hex: Version 1.31 firmware
- X300.hex: Version 3.00 firmware
- X3.81.hex: Version 3.81 firmware updates include: ability to use TPS as a load option in the Fuel map, acceleration enrichment pump, and maximum RPM raised from 12,000 to 17,000 RPM

### F/IC Specs

**Processor:** Dual 16bit 32mips processors.

#### Logger:

**Internal:** 64 KB, 10ms max sample rate,

**PC:** 10 ms fixed sample rate.

**Pressure:** 2 psi<sub>a</sub> - 40 psi<sub>a</sub> +/- .5 psi<sub>a</sub> resolution .1 psi<sub>a</sub>

**MAF:** 0 V<sub>DC</sub> - 6 V<sub>DC</sub> Input, 0 V<sub>DC</sub> - 6 V<sub>DC</sub> Output, overload protected

**Power:** 8-15 V<sub>DC</sub>

**Log switch:** GND to activate

**Switched 12V output:** High-side driver, 6 amps max, overload protected

**Injectors:** 1.7 amps max, overload protected

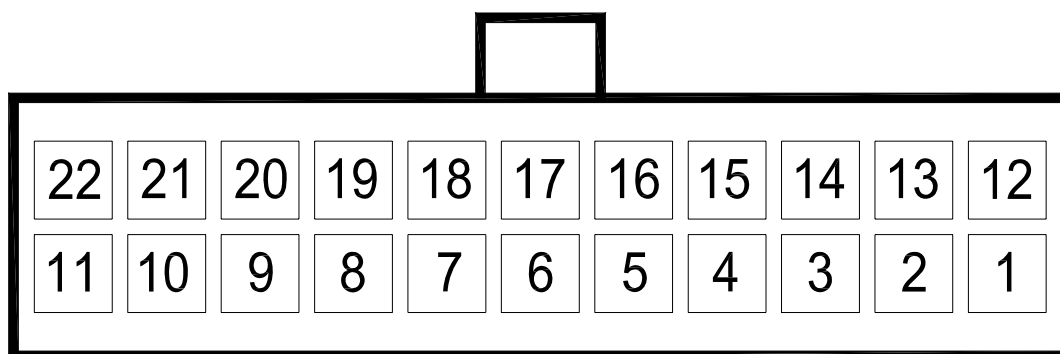
**O<sub>2</sub> :** 0 V<sub>DC</sub> - 4.95 V<sub>DC</sub>,

**Size:** 5.5"L x 4.6"W x 1.4"H



## F/IC Wiring 22 pin connector:

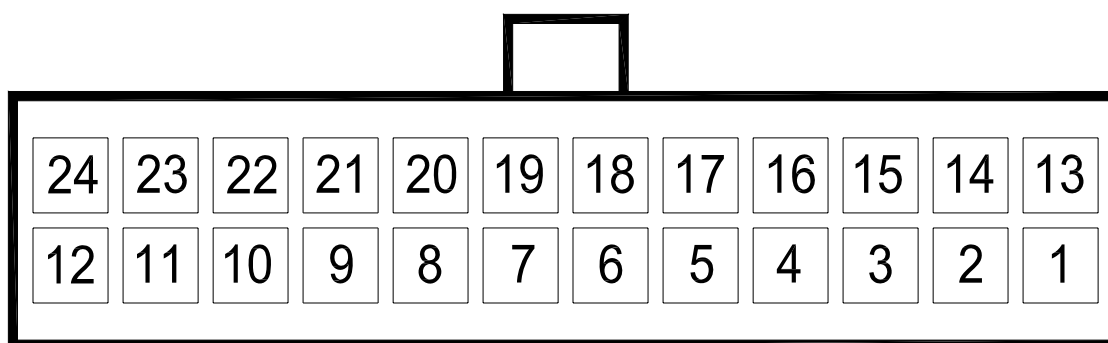
Pin	Name	Wire Color	Wire Marking	Intercept/Tap
1	Fuel injector 1 input	Blue	INJ 1 IN	Intercept
2	Hall style sensor Cam 2 output	Yellow	CAM2 HALO +	Intercept
3	Hall style sensor Cam 1 output	Yellow	CAM1 HALO +	Intercept
4	Power GND	Black	PWR GND	Tap
5	Signal GND	Black	SIG GND	Tap
6	TPS input	White	TPS +	Tap
7	Hall style sensor Crank input	Green	CRK HALI +	Intercept
8	Mag style Crank sensor negative input	Green	CRK MAGI -	Intercept
9	Mag style sensor Cam 2 positive output	Yellow	CAM2 MAGO +	Intercept
10	Mag style sensor Crank negative output	Green	CRK MAGO -	Intercept
11	Mag style sensor Cam 1 negative output	Yellow	CAM1 MAGO -	Intercept
12	Fuel injector 2 input	Blue	INJ 2 IN	Intercept
13	User Switch Input	White	SW IN	NA
14	Hall style Crank sensor output	Green	CRK HALO +	Intercept
15	Power GND	Black	PWR GND	Tap
16	Ignition power	Red	IGN PWR	Tap
17	Analog B out	Orange	ANALOG B OUT	Intercept
18	Aux Input	Brown	AUX IN	NA
19	Mag style Crank sensor positive input	Green	CRK MAGI +	Intercept
20	Mag style Cam 2 sensor negative output	Yellow	CAM2 MAGO -	Intercept
21	Mag style Crank sensor positive output	Green	CRK MAGO +	Intercept
22	Mag style Cam 1 sensor positive output	Yellow	CAM1 MAGO +	Intercept



LOOKING AT WIRE SIDE OF CABLE CONNECTOR

## F/IC Wiring 24 pin connector:

Pin	Name	Wire Color	Wire Marking	Intercept/Tap
1	Bank 2 oxygen sensor modifier	Pink	O22 +	Tap
2	Analog B in	Orange	ANALOG B IN	NA
3	Analog A out	Gray	ANALOG A OUT	Intercept
4	Hall style Cam 2 sensor input	Yellow	CAM2 HALI +	Intercept
5	Mag style Cam 2 sensor positive input	Yellow	CAM2 MAGI +	Intercept
6	Analog A in	Gray	ANALOG A IN	Intercept
7	Mag Style Cam 2 sensor negative input	Yellow	CAM2 MAGI -	Intercept
8	Hall style Cam 1 sensor input	Yellow	CAM1 HALI +	Intercept
9	Mag style Cam 1 sensor positive input	Yellow	CAM1 MAGI +	Intercept
10	Mag style Cam 1 sensor negative input	Yellow	CAM1 MAGI -	Intercept
11	Fuel injector 5 input	Blue	INJ 5 IN	Intercept
12	Fuel injector 3 input	Blue	INJ 3 IN	Intercept
13	Banks 1 oxygen sensor modifier	Pink	O21 +	Tap
14	MAF signal input	Blue	MAF IN +	Intercept
15	MAF signal output	Black	MAF OUT +	Intercept
16	Switched 12Vdc output	White	SW12	NA
17	Fuel injector 6 output	Blue	INJ 6 OUT	Intercept
18	Fuel injector 5 output	Blue	INJ 5 OUT	Intercept
19	Fuel injector 4 output	Blue	INJ 4 OUT	Intercept
20	Fuel injector 3 output	Blue	INJ 3 OUT	Intercept
21	Fuel injector 2 output	Blue	INJ 2 OUT	Intercept
22	Fuel injector 1 output	Blue	INJ 1 OUT	Intercept
23	Fuel injector 6 input	Blue	INJ 6 IN	Intercept
24	Fuel injector 4 input	Blue	INJ 4 IN	Intercept



LOOKING AT WIRE SIDE OF CABLE CONNECTOR

## **AEM Electronics warranty**

Advanced Engine Management Inc. warrants to the consumer that all AEM High Performance products will be free from defects in material and workmanship for a period of twelve (12) months from date of the original purchase. Products that fail within this 12-month warranty period will be repaired or replaced at AEM's option, when determined by AEM that the product failed due to defects in material or workmanship. This warranty is limited to the repair or replacement of the AEM part. In no event shall this warranty exceed the original purchase price of the AEM part nor shall AEM be responsible for special, incidental or consequential damages or cost incurred due to the failure of this product. Warranty claims to AEM must be transportation prepaid and accompanied with dated proof of purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said 12-month warranty period. Improper use or installation, accident, abuse, unauthorized repairs or alterations voids this warranty. AEM disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured by AEM. Warranty returns will only be accepted by AEM when accompanied by a valid Return Merchandise Authorization (RMA number. Product must be received by AEM within 30 days of the date the RMA is issued.

**Please note** that before AEM can issue an RMA for any electronic product, it is first necessary for the installer or end user to contact the EMS tech line at 1-800-423-0046 to discuss the problem. Most issues can be resolved over the phone. Under no circumstances should a system be returned or a RMA requested before the above process transpires.

AEM will not be responsible for electronic products that are installed incorrectly, installed in a non approved application, misused, or tampered with.

Any AEM electronics product can be returned for repair if it is out of the warranty period. There is a minimum charge of \$50.00 for inspection and diagnosis of AEM electronic parts. Parts used in the repair of AEM electronic components will be extra. AEM will provide an estimate of repairs and receive written or electronic authorization before repairs are made to the product.