Installation Instructions

Please note: We have tried to make these instructions as easy as possible to understand and follow. But if you have trouble with a step, please email us.

Complete Dry Cell Kit includes:

- Dry-Cell Hydrolyzer (larger kit provides 2 cells)
- Constant Current Pulse Width Monitor (PWM) with Liquid Crystal Display.
- Electronic Fuel-Injection Enhancer (EFIE)
- Electrolyte Reservoir
- Two one-way valves
- Heavy-duty plastic tubing (1/2" outside diameter, 1/4" inside diameter)
- One bottle of pre-measured electrolyte
- Additional bottles can be ordered from http://www.dry-cells.com.
- Heavy duty cable ties for clamping hose to fittings

Important

HHO (hydroxy gas) is highly combustible, volatile, and explosive. It is no more dangerous than any other fuel, but only when it is used properly. The most important single element in your installation is to make sure that HHO is only being produced when the engine is actually running. For instance, you don't want HHO being produced when you are sitting in your car with the accessory switch on, listening to your CD player. So the key is to find a circuit that is only on when the engine is actually *running*.

We have made it easy to achieve this with our PWM design. In the diagram above, you'll see at the top, the wire labeled, "Ignition On". The PWM will only operate when 12 volts are applied to that wire. In this way, we have created a safety shutdown circuit for the system. We recommend connecting this wire to the output of your fuel pump relay. The fuel pump relay will only be powered when the engine is actually running, and is designed to shut off when the engine dies or is turned off. You should test the behavior of this circuit in your own vehicle and make sure it is only activated when the engine is running. This point is very important. You don't want to be producing hydroxyl gas when the engine is not running.

Other safety points to consider:

- NO spark or flame should be allowed near HHO gas.
- All one-way valves must be installed.
- Do not operate the Dry Cell indoors.
- Use eye and skin protection when mixing or handling electrolyte.
- In the event of eye or skin contact with the electrolyte, flush with plain water.
- Mix and store in heavy-duty plastic containers - keep away from children

Assemble the following items in addition to those provided in the Dry Cell Kit:

- Voltmeter or multi-meter
- Basic tools: wire stripper, screwdriver, pliers, etc
- 12 AWG insulated, stranded electrical wire

- Any terminals needed to connect power cables to battery
- 1 Gallon steam distilled water for electrolyte (make sure it says "steam distilled)

Assess the space available in the engine compartment. You must find or create space for the following components:

- Dry Cell(s)
- Reservoir
- The Reservoir should be installed above (i.e., higher than) the Dry Cell(s) to facilitate flow within the system.
- PWM

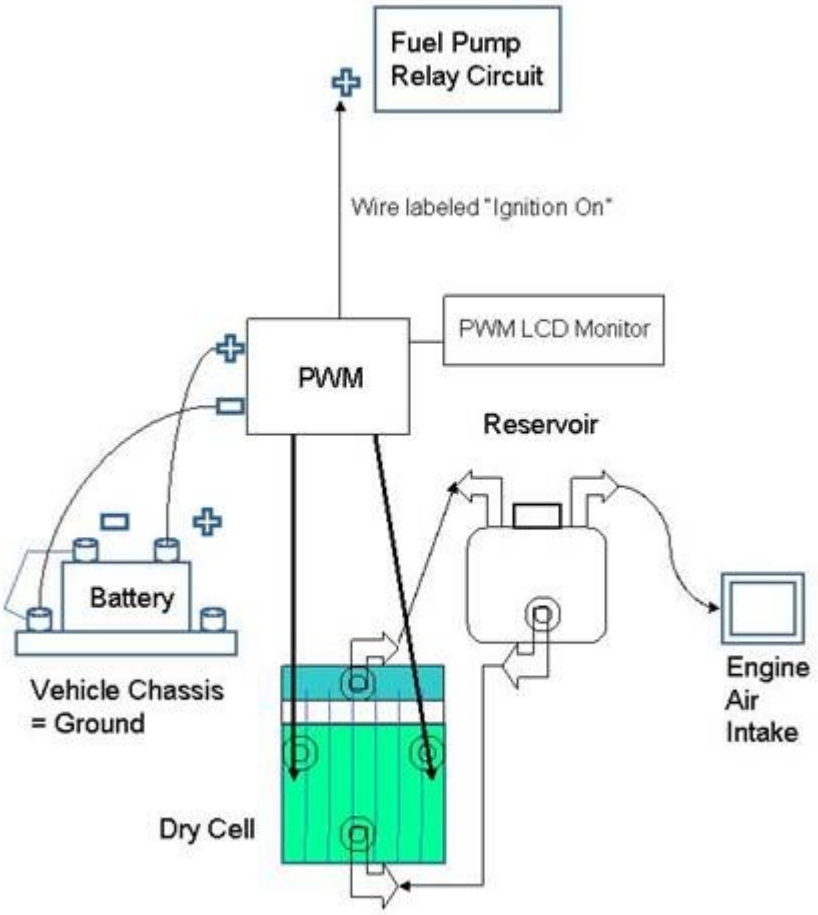
You will want to mount your display in the passenger compartment. Ensure you locate the PWM close enough to the display for the cable to reach. You can pass the cable through a hole in your firewall: Open the back of the display. Unplug the cable from the jack on the board. This is a computer cable connector, and you must depress the tab on the bottom of the plug to release it from the jack. Then you can pass the cable through a hole, and reverse the process. Make sure the strain relief is inside the display case.

Another consideration for location of the PWM is that it shouldn't receive direct water spray. Try to find a location that is relatively safe from water. If needed, it can be located in the passenger compartment, but that will require additional 12 gauge wire. I usually mount mine in the engine compartment in a protected location. I try to keep the distance between the PWM and the battery and the PWM and the cells to a minimum.

If you have a gasoline (not diesel) engine with electronic fuel injection, you must install the included Electronic Fuel Injection Enhancer (EFIE) in order to achieve fuel efficiency gains from your Dry Cell(s). To get the correct EFIE for your vehicle, you must provide us with your make/model/year and engine size when you order. We will then ship you the correct EFIE. If you decide to install your cell on a different vehicle, please make sure you have the correct EFIE before proceeding. You may need to exchange it for the correct type for the new vehicle.

Before mounting your cell(s), check that they have the jumper wires on the tabs on each side of the cell. On each side of each cell there are 3 tabs. They look the same as the tabs on the top of the cell, which are used for connections to the PWM. These side tabs need to be jumpered together. Jumper all 3 together on one side of the cell, and then jumper the 3 tabs on the other side together. The jumpers are provided for this purpose.

System Overview:



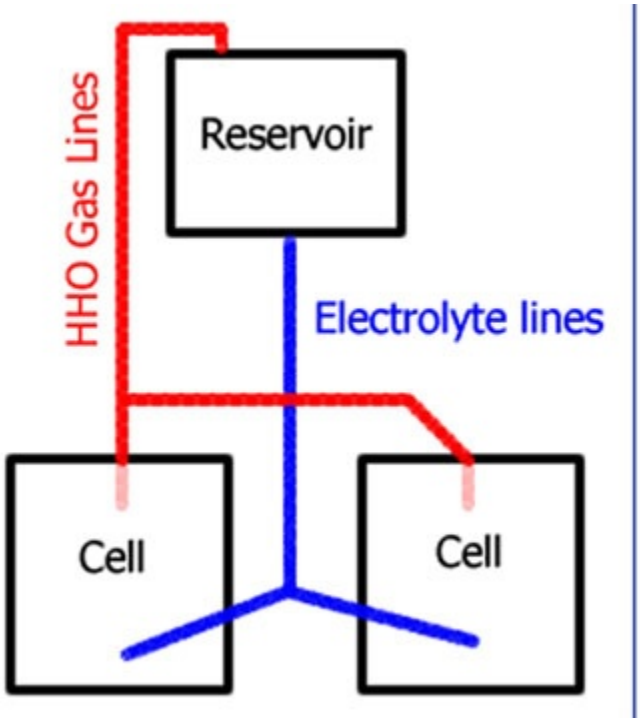
1. Mount your components

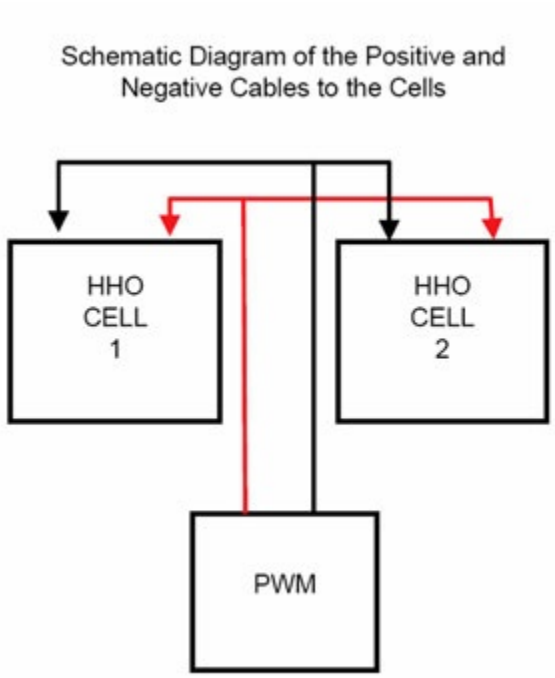
Mount your cells and your reservoir. Make sure the reservoir is higher than the cells. Also mount your PWM. You probably will want to hold off on mounting your display in the passenger compartment, because you will want to use it during the setup of your cell.

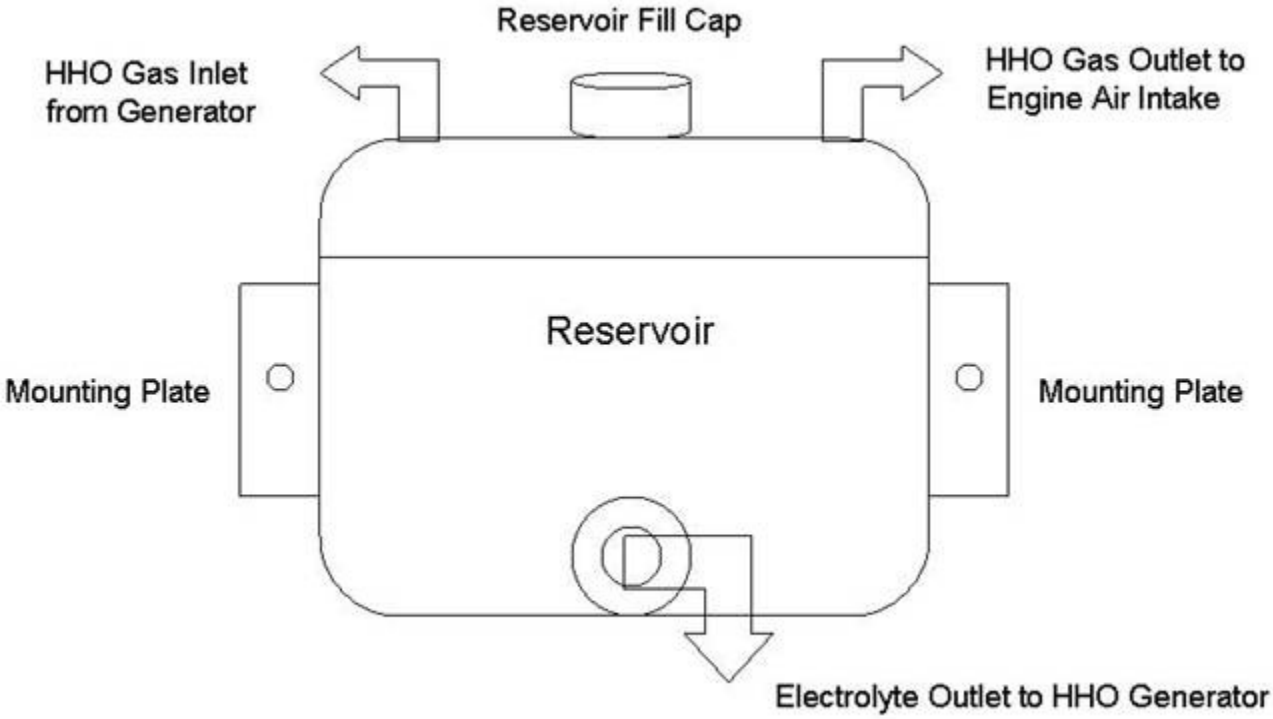
2. Make the tubing connections

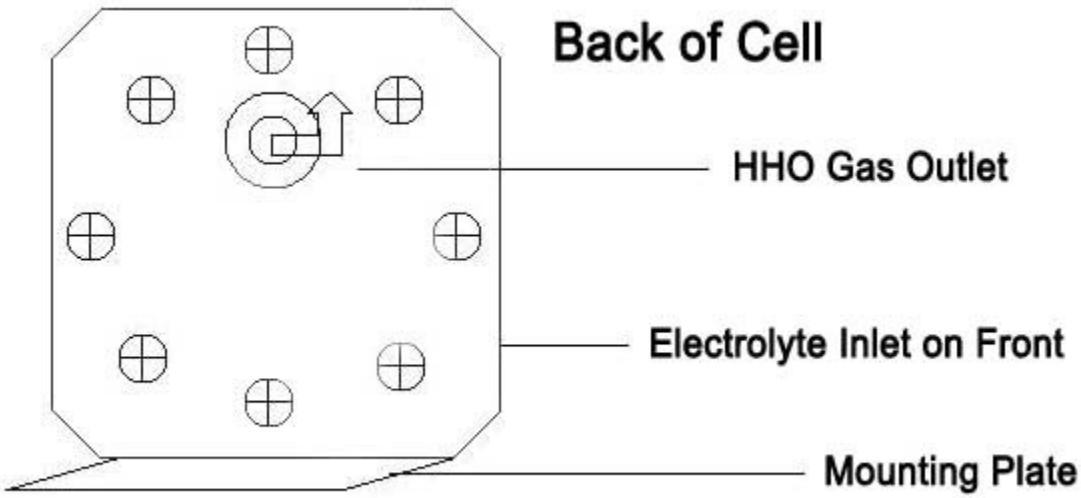
Connect tubing between the cells and the reservoir as shown in the diagrams. Notice that the lower fitting on each cell connects to the lower fitting on the reservoir. This is for the flow of electrolyte into the cell. The upper fitting on each cell goes to one of the upper fittings on the reservoir (it doesn't matter which one). This allows the HHO gas to flow to the reservoir. Any electrolyte that is pushed up this tube will drop into the reservoir. The other top fitting on the reservoir takes the gas out to the engine's air intake.

If you have 2 cells, you will need to make Y's with the supplied Y fittings. The drawing below left will illustrate how you Y the tubing from 2 cells to one reservoir. The drawing on the right shows how you will wire the 2 cells to the PWM when we get to that step.


HHO Gas Lines
Reservoir
Electrolyte lines
Cell
Cell


Schematic Diagram of the Positive and Negative Cables to the Cells
HHO CELL 1
HHO CELL 2
PWM


Reservoir Fill Cap
HHO Gas Inlet from Generator
HHO Gas Outlet to Engine Air Intake
Reservoir
Mounting Plate
Mounting Plate
Electrolyte Outlet to HHO Generator



Install a one way valve between the dry cell(s) and the reservoir on the HHO output line. This valve must flow from the cell(s) towards the reservoir. If you have 2 cells, install the one way valve after the Y. As the one way valve will only allow gas to pass in one direction, you must get this oriented correctly. Blow through the valve to see which way is correct. Then similarly install a one way valve on the electrolyte line. This valve must allow flow from the reservoir back to the cell(s). In this way, electrolyte can flow out of the reservoir and into the cells; and HHO gas can flow out of the cells and into the reservoir.

Now you can make your hose to fitting joints permanent. We do this with a heavy duty cable tie. We used to provide hose clamps for this purpose, but these were found to cause leaks, even when well tightened. The cable ties work much better. Slip the tubing over the fitting and push it on as far as it will go. If needed you may use a heat gun (or hair dryer) to warm and soften the tubing. Place the cable tie between the barb on the fitting and the end of the cable. Its better not to put the cable tie directly over the fitting's barb. Then, you can use a pair of needle nosed pliers to tighten the cable tie around the hose, by gripping the cable tie close to the joint and prying the cable tie tighter. Snip off the excess. Repeat this for all hose to fitting connections.

3. Make the wire connections to the PWM

Refer to the schematic drawings above. The PWM has large wires for connections to the battery and the cells. Make the connections between the battery positive and the PWM, and between the PWM and ground. Use 12 gauge wire for 2 cell systems. 14 gauge wire is fine for 1 cell systems. These cables should be run directly to the PWM.

Then run the cables from the PWM to the cell(s). The connections to the cells are made at the tabs at the top of the cell. We provide 1/4" quick disconnects that you can crimp onto your wire for making these connections. One tab will get the PWM output positive, and the other will get the ground. It doesn't matter which goes to which tab. In fact, its a good idea to switch the connections every 6 months or so, to make the plates last longer.

There is a 5th wire that is labeled "ignition on" or "fuel pump relay". This wire needs to have 12 volts provided to it in order for the system to come on. This can be connected to any circuit that is only hot when the engine is actually running. We almost always use the fuel pump relay for this, but you should test the circuit on your vehicle. Make sure the fuel pump relay only provides voltage when the engine is

running. When the engine is off, and you turn the car key to the "ACC" position, the circuit will possibly activate momentarily, but will otherwise be off. This is what you are looking for. Its very important that the system not make gas unless the engine is actually running. If your fuel pump relay won't work, another good circuit to try is your oil pressure sending unit.

With all of the above being said, the PWM also has a voltage sensing function. The directions for setting up this function will be described in the programming section below. But, when this function is turned on, if the voltage drops below a preset level, the PWM will turn off. It will only be on if the voltage is above its "on preset" level. These presets can be adjusted to your engine's electrical environment. But for example if the "on preset" is at 13.5 volts, the PWM will not come on until that voltage is achieved. This basically means that the alternator must be going to get the voltage higher than 12 volts, and therefore we know the engine is running. If the "off preset" is set to 12 volts, the PWM will not turn off until the alternator has stopped turning, and the voltage at the battery drops back down. Once you have your presets set for your engine environment, this provides an extra margin of safety. But I always use the fuel pump relay connection too, so I have both safety measures working for me. *Failure to employ these safety measures can create a situation whereby HHO gas is being made and accumulating under your hood, and this can lead to a dangerous explosion.*

Since it's part of the PWM wiring, I'll also describe how to install the controller/display unit. I recommend holding off on this step until later, so you can make sure everything is working properly. Once that occurs, you can run the cable through your firewall and mount your display in the engine compartment. To do this, you must remove the back of the display box. There are 4 screws on the back. Then unplug the connector that plugs into the circuit board. Note that this is an 8 pin computer connector that you have probably seen in your home computer and internet network. There is a tab that must be depressed to let the connector come out of the socket. But the tab is under the connector, so you must carefully depress it with a small screwdriver or similar tool before attempting to pull the connector out. Once that's done, you can route the cable through a hole in the firewall, and then plug it back into display.

4. Mix your electrolyte and fill the reservoir

Its very important that you use steam distilled water only. Look closely at the label. Filtered water is not good enough. Do not use tap water, mineral water, spring water, or purified water. It must be "steam distilled". The proportion of potassium carbonate to distilled water is 1 gram per ounce. We provide a container of 128 grams that you can use with 1 gallon of distilled water. This will last for about a dozen tankfuls of gas or more.

In freezing climates you may substitute up to 1/3 of the distilled water with denatured alcohol, such as you will find at Home Depot. Only use about 12% alcohol for temps of 0 degrees Fahrenheit and above, and 25% for areas where it gets colder. Use up to 33% in extreme climates (but you should think about moving South!). Despite the substitution of alcohol for water, the amount of potassium carbonate remains the same. It's 1 gram of potassium carbonate per ounce of water/alcohol mixture.

Acceptable alternative catalysts are potassium hydroxide or sodium hydroxide. But be careful with these chemicals. They are good catalysts, but are much more dangerous to handle and can cause chemical burns. Flush with water if they come in contact. Further they will cause your plates to deteriorate faster than when using potassium carbonate, despite the fact that the plates are 316L stainless. If you do use an alternate electrolyte, be sure adjust your proportions so that your cell draws about the same amperage. This will be considerably less chemical than with potassium carbonate.

Do NOT use baking soda or salt. These are not as good of a catalyst, and salt causes chlorine gas to be

produced.

When filling the Reservoir, keep the electrolyte at least 2” from the top. If you drive on bumpy roads you may want to hold the electrolyte level even lower. This is so electrolyte will not get into the HHO gas output hose to your engine. Further, if you drive on bumpy roads, raise the hose as high as you can above the outlet fitting, so that any electrolyte will fall back into the reservoir. Refill the electrolyte when the level gets to within 1” from the bottom. Note: to get the electrolyte flowing into the Dry-Cell(s), it may be necessary to evacuate air in the lines. Do this by loosening, or removing, the hose connection at the top of the cell, which will allow gravity to feed electrolyte in from the bottom fitting. If water doesn't fill the cell it won't hurt anything, but it won't make much gas until the cell gets filled with electrolyte. The symptom will be very low amperage.

To replenish the electrolyte, add water mixed with the electrolyte as covered in these instructions. This will maintain the correct electrolyte concentration, replenishing electrolyte lost during normal use.

We offer refills of pre-measured electrolyte in our online store. However, you can get better prices when buying it in bulk. www.advance-scientific.com, www.labdepotinc.com, and www.wardsci.com, all supply potassium carbonate at reasonable prices. You want “Anhydrous potassium carbonate”, and you don’t care about lab grade or “reagent” designations (which cost more). If you don’t have an accurate scale, you can mark the level of catalyst in one of our bottles, and then use it to measure batches purchased in bulk.

5. Set up your PWM

Get power to your PWM. To do this, turn on the engine and let it idle. This will activate the control circuit and allow the PWM to power up. This will also light up the display/controller unit. You'll see some statistics for your PWM on the screen after a short intro. Press the knob once to enter setup. Now you can turn the knob to cycle through the different functions that can be set up. When you get to one you want to change, press the knob once, and you'll enter that setup screen. Turn the knob to make any changes you want, then press the knob again to accept the setting. Some screens have multiple settings, and you turn the knob to make any needed changes, and press the knob to accept each setting. Finally, none of your changes will remain in memory unless you turn the knob to the final screen that is labeled, "Exit". You must press the knob at this screen for your changes to be recorded in memory. Now lets go through the screens:

1. Set Intro. This just sets whether you will see the opening screen with the software version information when you first start up the PWM. Settings are "Y" and "N"
2. Lifetime timer. There is nothing to set for this one, but it will show you the number of hours the PWM has been running. Press the knob again to exit this screen.
3. PWM Constant Amps. Use this screen to set the maximum amps that the PWM will allow. This should be set for 12 amps for 1 cell systems and 24 amps for 2 cell systems. We do not recommend putting any more than 12 amps per cell as overheating can occur and damage the cell.
4. Volt Sensing. This item has several settings. The first is "Y" or "N", and sets whether volt sensing is activated. If not activated, the system will not shut down on low voltages, and will only shut down if turned off by the switch or if 12 volts is removed from the control wire. If "Y" is selected then the next 2 screens will allow you to adjust the On and Off voltages. Start out with 13.5 volts for your "on voltage" and 12 volts for your "off voltage". You may need adjust these later, but this will be a good starting point.
5. Level alarm. This is a new function that will cause the display to sound an alarm when the level gets too low. It requires some additional setup of your reservoir, and is not yet fully

implemented. For now, set this to "N".

6. Calib amp meter. This is used to calibrate the amp meter. Before pushing the button on this setting, you must disconnect the cells from the PWM. Just unplug them. We want 0 amps to be passing through the PWM. Then press the button. The controller will then calibrate itself.
7. Exit. If any changes are made in the above steps, you must turn to this function and press the button. This will cause your settings to be saved.

When in normal run mode, the display shows some key operating statistics. The top line, labeled "A" and "D", stands for amperage and duty cycle. You will see these values in real time to the right. The next line has "V" and "R", and these show system voltage and fan revolutions.

6. Install the EFIE

The EFIE we include in our kit was designed and manufactured by www.fuelsaver-mpg.com. The instructions for installing it are posted on their website. You can find them here: Installation Instructions. If you need help with your EFIE install, they are very good about providing tech support. You can reach them at: support@fuelsaver-mpg.com. We also strongly recommend their Documents Page. It has a wealth of general information about HHO systems, and vehicle electronics that will help you be successful with your project.

7. Initializing the system

Now you can start the system and begin making gas. Its a good idea to check all hose connections for leaks by applying soapy water using a spray bottle. If there is a leak, bubbles will be immediately evident. Repair all leaks. Also note, that failure to screw down the lid to the reservoir properly can allow your HHO gas to escape. Make it a point to always screw down that lid firmly. Also check for electrolyte leaks by visual inspection during system operation.

Watch the display and you will see the amperage climb to 12 amps (24 amps for a 2-cell system). It may take a bit for this to occur, particularly in cold weather. Once the amperage comes up to it's set point, it will not go higher. But you'll notice that the duty cycle percentage starts to go lower. This is the PWM controlling the output amperage to maintain it's set point. If the duty cycle drops too far, like below 50% or so, then you'll want to dilute your electrolyte. If the amperage never reaches the set point, this is usually because the electrolyte has not filled up the cells completely. Make sure that the cells get completely filled with electrolyte.

If everything is OK up to this point, you are ready to start operating your cell for mileage gains. This is done by making adjustments to your EFIE as covered in the EFIE installation instructions. You will make adjustments to the EFIE between each gas fillup, until you have reached the best possible mileage gains. We expect that to be at least 25%, and as high as 50% gains or more. 35% is a reasonable average expectation.