PWM & LCD Display/Controller
Installation Instructions

Note For 24 Volt Systems

Large trucks in the U.S. often operate on 24 volt electrical systems. Many European countries use 24 volt systems as standard for both cars and trucks. If your vehicle uses 24 volts, instead of 12 volts, please see the article on our site: "24 Volt Installations". There is important information about these systems that you must know.

Main Components

1) The LCD Display/Controller module. This device shows you the important readings of your PWM, and also controls the PWM so that it maintains its constant current maximum amperage. This device should be mounted in the passenger compartment of your vehicle so you can see at a glance what is going on with your HHO system.

2) The PWM enclosed in the box with its switch and cooling fan. This is the actual PWM that does the work of pulsing the power to an HHO cell. This device should be mounted near your cell to minimize the length of any wire runs between your battery and the cell.

Connection Instructions

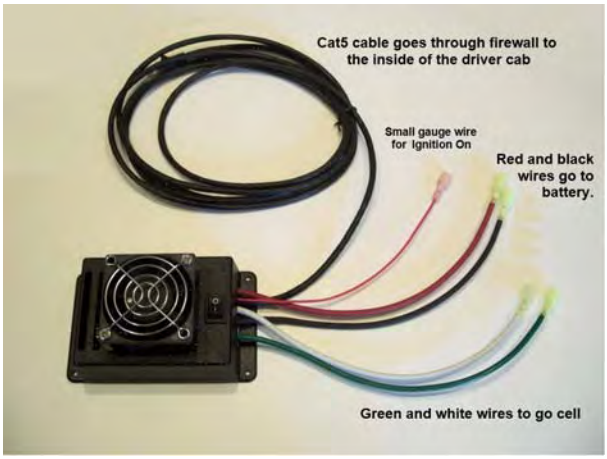
The LCD display only needs to be connected to the Cat5 cable coming out of the PWM. Plug the Cat5 cable into the receptacle in the Display. It gets its power through this cable. You can then secure the back of the display with the 4 screws provided.

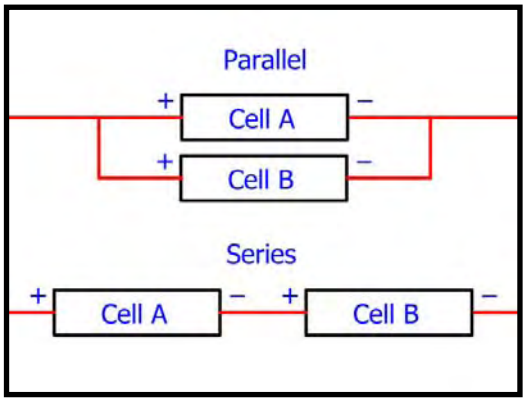
While you are initially setting up your HHO system, it is handy to have the display near your system so you can easily monitor your system when you first start it up. Later, when you have everything working properly, you will want to run the Cat5 cable into your passenger compartment and permanently mount the display where you can see it. Note: to disconnect the Cat5 cable from the Controller's terminal, carefully insert a small screwdriver underneath the cable and press up to disengage the locking tab of the cable.

Now you can connect your PWM. There are 4 heavy gauge wires coming out of the PWM, and one light gauge wire. Your connector kit has matching connectors that will plug into these wires. The use of these connectors will allow you to unplug the PWM unit if you should ever need to remove it in the future.

The 4 heavy gauge wires are as follows: Red and Black are for power and ground from your battery. The power lead (red) should be connected to your battery, via the circuit breaker provided in your kit. The black wire should be extended to a good ground, or the negative

battery terminal.



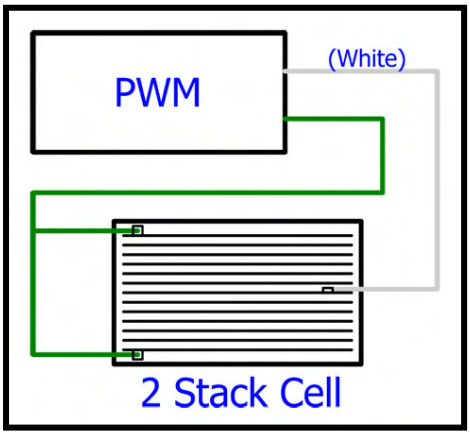


The White and Green wires get extended to your cell or cells. The white wire is the positive lead that goes to your cell. The green wire is the negative lead to your cell. However, don't confuse these with regular power and ground. Once they come out of the PWM they must not be allowed to connect to other power and ground circuits in your vehicle. They must only connect to the terminals of your HHO dry cell.

If you have more than one cell then you can extend one cable out to where your cells are, and then split the cable at the cells so that each cell gets both positive and negative connections. Multiple cells are connected in parallel. The diagram shows both series and parallel connections in order to illustrate the difference between the 2 connection methods. But we never connect our cells in series.

You can use 12 gauge wire to connect to any one cell, and this cell should not be run at over 15 amps. If you need more amperage, you should use 10 gauge wire. You can use 10 gauge wire for circuits that run up to 40 amps provided your total wire run is not over 15 feet. For instance if you are using 10 gauge wire from your battery to your PWM and from your PWM to your cells, then the total length of the power wires should not exceed 15 feet. The total length of the ground wires should also not exceed 15 feet.

For our 6" and 7" cells, you should not run more than 15 amps per cell, or per stack. See below for a description of multi-stack cells. Our 12" cells can run higher amperages, but are usually not run at over 40 amps and often even less for best efficiency.



Multi-stack cells: A stack is defined as 2 hot plates (plates that are connected to the PWM's output white and green wires), with 4 or 5 neutral plates between them. A 2-stack cell, or "Double Stack Cell" can be thought of as 2 adjacent cells. The center hot plate is common to both "cells" on either side of it. It can be either positive

(connected to the white PWM output wire), or negative (connected to the green PWM output wire). The other PWM output wire is split to connect to the outside 2 hot plates. This is sometimes expanded into a Triple Stack Cell, which has 4 hot plates and 3 sets of neutral plates.

IMPORTANT – SAFETY RELATED INFORMATION: The final wire on the PWM is the control wire. This is the smaller red wire (18 gauge). This wire must have 12 volts on it in order for the PWM to turn on. This is used as a safety measure so that the PWM will only run when the engine is running. This wire should be connected to the fuel pump relay circuit. The fuel pump relay circuit powers up briefly when the car is turned on to charge the system, but after that will only be on when the engine is actually running. Since this is the only time we want HHO to be produced, we use this circuit for the source of our control voltage. This will ensure that the PWM is not running when the ACC switch is on, but the engine is not actually running. Be sure to test this circuit carefully to make sure it is only on when the engine is running. *If your HHO system is producing HHO while you are sitting in the car listening to the stereo, you can have HHO build up under your hood, and this can explode when you start your engine. So this point is important.*

Once all the wiring is connected, you may turn on your ignition and turn on the switch on the PWM. If your installation was successful you will see the display light up and start telling you information about the electrical environment.

Programming Instructions

Press the knob once to enter setup. Now you can turn the knob to cycle through the different functions. 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, and 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.

Here’s the full listing of the Menu Items:

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"

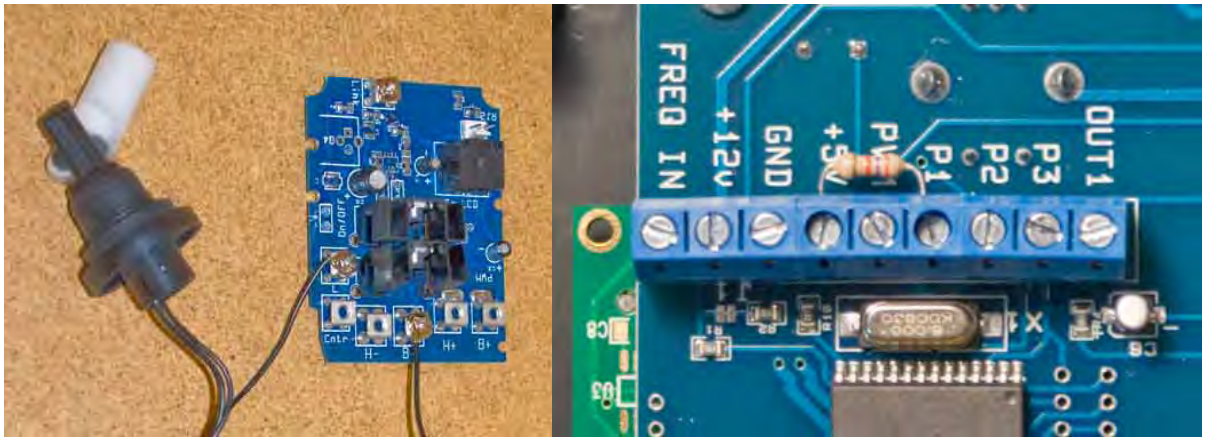
2. Lifetime Timer. There is nothing to set for this one, but it will show you the number of hours the PWM has been running. Press the knob again to exit this screen.

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. The On Voltage is the voltage that must be available in order for the PWM to turn on. Then, if the voltage drops below the Off Voltage, the PWM will shut down. In that case, the voltage must come back up to the On Voltage again in order for it to start back up. We recommend beginning with 13.5 volts for your On Voltage and 12 volts for your Off Voltage. See a further discussion of this item below.

5. Level Alarm. This function causes the display to sound and show an alarm when the level in your reservoir gets too low. It requires that you have a float switch for your installed. We don’t currently include one of these in our kits. But if you install one, you can use this feature. You would change the setting from “N” to “Y”. You would also select the type of switch that you have – normally open or normally closed. Most float switches work either way just by turning them upside down. Route your switch wires to the terminals marked “L” and “B-“ on the PWM circuit board. You also need a resistor installed as per the photo below. 2K to 10K ohms, 1/8 watt (or larger) will be fine. We ship our displays with this resistor installed, but if you have an older display purchased prior to Jan 2012, then you may have to install the resistor yourself.



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.

Voltage Sensing

During your initial set up of your HHO system, we recommend you keep this set to “Off”. We don’t want your PWM shutting off for unknown reasons while we are trying to get everything working for the first time. However, you will want to use this function as it provides another

layer of safety on top of the control wire discussed above. By turning this function on, and getting the voltages set correctly, the PWM will shut off when the engine stops running due to low voltage.

The voltage of your vehicle's electrical system is actually only nominally (in name only) 12 volts. When the engine is shut off, the battery will usually provide less than 12 volts. If any kind of current demand is being made on it, such as would be the case with an HHO system running, it will drop to below 12 volts. However, when the engine is running, the alternator produces well over 12 volts to the electrical system so that the battery will charge. If you measure the voltage at your battery when the engine is running, you will usually see about 13.5 volts or a bit more. We are using this voltage difference to sense when the engine is not running, and to use it as an additional layer of safety.

In the general instructions above, we gave you some voltages to use for this function. You should actually make a few measurements on your system to make sure these voltages are the best to use for your vehicle. For instance, we want the On Voltage to be low enough that it will always come on when it should, but not so low that it will come on when it shouldn't. To test for a good On Voltage, let your car run at idle, then turn on all the devices you will likely ever use. Run your HHO generator at the amperage you plan to use. Turn on your head lights and your stereo (loud), and run you're A/C with the fan on high. Now measure the voltage. You'll want your On Voltage to be a bit below this voltage.

Now turn off all of the accessories, and turn off the car. Measure the voltage. You will find that it quickly drops down to 12 volts or a little below. You'll want your Off Voltage to be a bit above the voltage you see now. When your HHO system is running, it will drag this voltage down even further. But it's safer to use an Off Voltage that doesn't require any other current draw to achieve the desired voltage that will cause the system to turn off.

After activating this function, you'll want to be alert to your display while you are driving. If you see the display go blank when you are at idle, for instance, you will know that you need to make an adjustment to your voltages so that it is not turning off when it shouldn't. Just be very careful not to make the Off Voltage higher than the voltage you read on your meter when the system is off. By the way, you can read these voltages right off the Display.

Getting these voltages correct is easy to do, and will give you an extra layer of safety with your HHO system. Between this function, and the control wire, there is no way that the PWM will operate when the engine is not actually running and therefore consuming the HHO gas you are creating.