

# Installation Instructions

## S-7 & D-7 Hydrogen Generator Kit

### Contents:

- Hydrogen Generator
- Constant Current Pulse Width Monitor (PWM) with Liquid Crystal Display (LCD).
- Reservoir Tank
- Dryer with Bracket
- 1/4" Hose (1/4" inside diameter)
- Wire for connections between PWM, Battery and Cell
- Electrolyte – Potassium Hydroxide (not included with international shipments)
- Misc Parts for Installation.

### Important

*HHO gas is highly combustible, volatile, and explosive. It is no more dangerous than any other fuel, but only when it is used properly.*

*Make sure that HHO gas is only being created when the engine is running. You don't want HHO gas being produced when you are in your car with the accessory switch on, listening to music. **So the key is to find a circuit that is only on when the engine is actually running.***

Other safety points to consider:

- NO spark/flame should be allowed near HHO gas.
- Do not operate the Generator 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. **Keep a spray bottle with Distilled Vinegar & Water nearby.** If it gets on your skin it will neutralize it.
- Mix and store in heavy-duty plastic container - keep away from children

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Additional Items Needed For Install:

- Voltmeter or multi-meter
- 7/16 Drill Bit and 1/4" NPT Pipe Thread Tap (for HHO gas-in)
- Basic tools: wire stripper, screwdriver, pliers, etc.
- Silicone Sealant
- 1 Gallon **distilled** water
- Clean Bucket

Find or create space for the following components:

- Generator
- Reservoir. Note: Should be installed higher than the Generator to aid the flow of electrolyte into the generator.

- Dryer
- PWM (see separate instructions for installing the PWM & LCD Controller/Display)

## 1. Mount Your Main Components

Mount your Generator, Reservoir and Dryer.

Make sure the reservoir is higher than the generator, as water must feed to the cell by gravity. If room is an issue you may want to install your Generator in between the radiator and grill.

## 2. Make Hose Connections

### Hose & Fittings Diagram



Complete the hose connections to all the devices as shown in the diagram above **EXCEPT THE HOSE CONNECTION TO THE BARBBED FITTING AT INTAKE, THIS WILL BE DONE In LAST STEP.**

Make your hose to fitting joints permanent. We do this with a cable tie. Cable ties work better than hose clamps, they can be applied behind the barb.

Push the fitting on as far as it will go. If needed you may use a heat gun (or hair dryer) to warm and soften the hose. Wetting the hose with some water can also help it slip on.

Tighten a cable tie between the barb and the end of the tubing. Don't put the cable tie directly over the fitting's barb. After cinching it up by hand, use a pair of needle nosed pliers to tighten the cable tie around the hose. Do this by gripping the cable tie close to the joint and twisting with the pliers to get the cable tie tighter. Snip off excess.

**A. Connect the lower fitting on the Generator to the lower fitting on the Reservoir.**

Note: The Drain T should be routed to a place where you can reach it easily. It is used when you drain the system. **You should tighten the nylon nut with a wrench.**

**B. Connect upper fitting on Generator to the upper fitting on the Reservoir.**

Note: This allows the HHO gas to flow to the reservoir. Any solution that is pushed up this tube will drop into the reservoir.

**C. Connect the remaining fitting on CAP of Reservoir to Dryer IN.**

Note: There is an O-Ring in the cap of the Dryer, put Vaseline on this O-Ring to help seal tight.

**D. At the air intake of your engine, Drill a hole for the 1/4" NPT threaded fitting.**

Drill this hole into one of the plastic air channels that leads to the engine intake. The size of the hole should be 7/16".

Note: We provide a threaded elbow that will screw into this hole. Use some clear silicone sealant to ensure that this connection is air tight.

### **3. Mix Electrolyte Solution & Fill Reservoir Tank**

Only use **Distilled Water. Mix 1 Pound of Potassium Hydroxide (KOH) to 1 Gallon Distilled Water.** However, some adjustments may be necessary.

1. Pour Distilled water in a clean 5 gallon bucket
2. Stir water with a plastic pain paddle on a drill motor to keep the fluid moving in a cyclonic motion.
3. Slowly pour the catalyst into the moving water.
4. Wait 20 minutes for electrolyte temperature to cool down.
5. Fill reservoir.

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, 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.

To replenish the electrolyte, add distilled water only.

You should purchase additional potassium hydroxide in bulk. If you live in the U.S., we recommend getting it from our website under trusted links. They sell a 2 lb bottle for \$6.99.

#### **4. Install the PWM**

Refer to instructions for installing your PWM below.

#### **5. Install Your Enhancement**

Unless it is a carburetor engine, install your enhancement; FS2 HHO Chip, EFIE or Universal MAP Sensor Enhancer.

#### **6. Start Your HHO System**

Now you can start the system and begin making gas. Dip the end of the HHO hose that gets connected to the intake or air cleaner into a cup of water and see if you are getting bubbles, if not check for leaks. It's 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 any leaks. Also note, that failure to screw down the lid to the reservoir or dryer properly can allow your HHO gas to escape. Make it a point to always screw down the lids firmly. Also check for electrolyte leaks by visual inspection during system operation.

##### **Attach Hose to barbed fitting on intake.**

Start your engine and begin creating HHO gas. Place the end of your HHO gas fuel hose (that will connect to the air cleaner or intake) into a glass of water. If you see bubble you are creating HHO gas. If you do not see bubbles, you probably have a leak(s).

#### **Checking For Leaks**

HHO gas is lighter than air. Fill a spray bottle with water and a little dish soap, spray all of your connections. You will easily see bubbles where there are leaks. This is an important step and should be done whether you see bubbles or not.

#### **The LCD Display**

You will see the amperage climb to the desired amperage. Once the amperage comes up to it's set point, it will not increase. However, the duty cycle % starts to go down. This is the PWM controlling the output amperage to maintain its set point. If the duty cycle drops too far, like below 50% or so when the system is cool, then you'll want to dilute your electrolyte. If the amperage never reaches the set point, you'll want to add more KOH.

Before adding KOH, be sure that the electrolyte solution has reached the generator. If so, you will see a steady flow of electrolyte and HHO gas coming out of the HHO gas hose into the reservoir.

Lack of any flow is almost always caused by vapor lock in the tubing, where an air bubble is preventing the electrolyte from getting into the cell. In this case you must bleed the air out of the tubing to get the electrolyte flow started.

There are only 2 reasons for no flow:

1. No voltage being supplied to the generator.
2. No electrolyte (KOH) in the water.

## **Adjusting Electrolyte**

Now that your HHO system is running, you may want to adjust your electrolyte concentration. Ideally the electrolyte solution should be strong enough reach your desired amperage when the engine is cold, but not so strong that the PWM has to start reducing the duty cycle.

Preferably just below the desired amperage. This way as the system warms up, the amperage will climb to my desired point, and the duty cycle will remain fairly high.

If the duty cycle is too low, such as running below 25% - then you are not going to be getting the best efficiency out of your HHO system. Dilute the electrolyte by adding more distilled water.

## **MPG GAINS**

We expect you to achieve at least a 20% MPG gains, if your results are less you need to debug your HHO system. Some customers get over 50% better MPG, but 30% is a reasonable expectation.

If you are not seeing the MPG gains then your installation was not done correctly somewhere, when you discover and correct the issue, you will achieve the MPG gains.

# Installation Instructions for PWM & LCD Controller



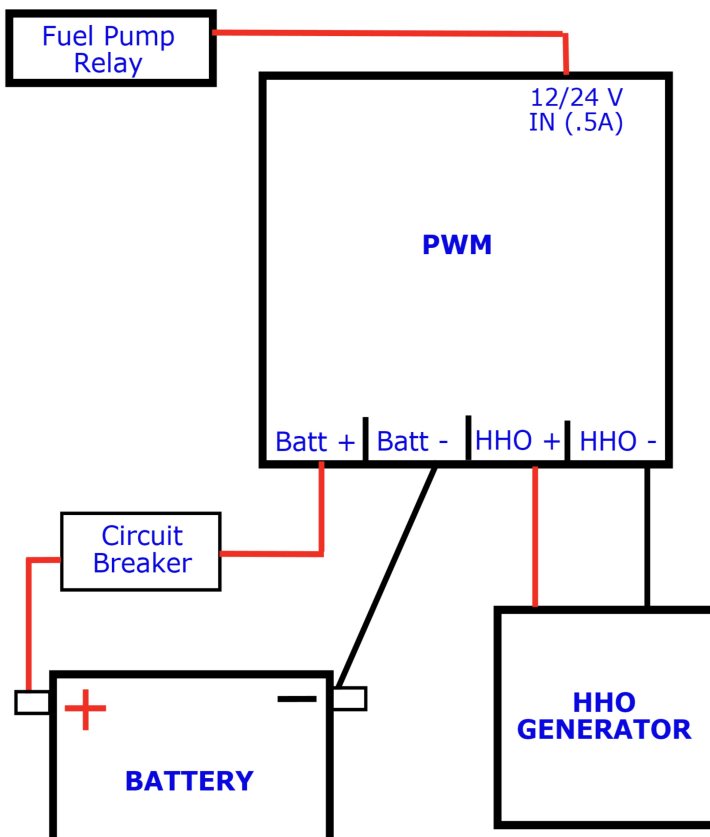
There are two main parts to your PWM:

- The **LCD Display/Controller**. 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 LCD controller should be mounted in the cab of your vehicle.
- The **PWM** in the aluminum enclosure does controls the power to your HHO generator.

## 1. Plug the Cat5 cable into the LCD Controller.

Note: While you are initially setting up your HHO system, it is handy to have the display near your PWM so you can monitor what's happening. Later, after everything is running properly run your Cat5 cable into the cab of your vehicle and mount the LCD display into your dash or a compartment. Some will use double-sided velcro. Wherever it is easily visibly.

**2. Connect your PWM to the generator and battery.** These are clearly marked on the PWM as Batt+, Batt-, HHO+ and HHO-. Use the 10 gauge wire for these connections. Also see the connection diagram below.



**The HHO+ and HHO- terminals get extended to your generator.** 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 generator.

## Small Green Terminal Block



There is a small green pluggable terminal block used for low current connections to the PWM. **It's easiest to unplug the terminal block and then install the wire.** Then plug the terminal block back in, there are screws you can use to secure the block into the PWM.

The following list shows the functions for the PWM:

- **12/24 Volts In:**  
Used to power the PWM. It draws very little amperage - less than 150 milliamps. This will take any voltage from 12 up to 32 volt systems.
- **12V Out (500 mA):**  
Can be used to power EFIEs, MAP Enhancers and the like. No more than 500 milliamps. You can also use this with 24 volt systems because the EFIEs need 12 volts.

## Powering the PWM

The first terminal on the green terminal block 12/24 Volts In powers the PWM.

Any gauge wire can be used for this connection because it carries such a tiny amount of current, we usually use 24 gauge. This terminal would ideally connect to the fuel pump relay, which only gets power when the engine is actually running. 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 gas 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.

However, you can also power it from any source that is activated by the key switch of the vehicle. In this case you must activate voltage sensing so that the PWM will not make HHO when the engine isn't running.

**IMPORTANT SAFETY RELATED INFORMATION:** You must make sure that your HHO system will not run when the engine isn't running. If you are making HHO gas when the key is switched on, but the engine is not running, then you will be creating HHO gas unnecessarily. 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 gas while you are sitting in the car listening to the stereo, you could have HHO gas build up under your hood.*

## LCD Display/Controller

Once all the wiring is connected, start your engine and turn on the PWM. If your installation was successful you will see the display light up and show the information about the electrical environment and the operation of your generator.

The controller for the system is built into the display module. It is the controller that actually adjusts the current and monitors the activity of the PWM. While the system is running, it provides information to the user as to volts, current, frequency, duty cycle and if any errors are present, will display them.



This display is on **Normal Model**



This display is in **Error Mode.**



While operating normally, the display will show Amps and Duty Cycle on the top line, and Volts and Frequency on the bottom line. However, when an error is being displayed, the error takes up the bottom line of the display, until it is cleared only showing Amps, Volts and Duty Cycle.

When the PWM is turned off, it will show that it is off. Instead of displaying a Duty Cycle of 0% it will say "Off" preceded by a letter indicating why it is off. These are the possible letters:

- M Off: means the PWM is off by menu command.
- T Off: means it is off because of the Trigger function.
- V Off: means it is off due to the Voltage Sensing function.
- H Off: means the PWM is shut down because the circuit board is too hot.



## Programming Instructions

To program the PWM, we use the knob below the Liquid Crystal Display. Press the knob once to enter setup. Now you can turn the knob to cycle through the different functions. When you get to the function you want to make changes to, press the knob again, and you'll enter that setup screen.

To make the changes, you will use the knob and button. Use the knob to navigate through any options available, and then press the knob once to select the new 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, turn the knob to the final screen that is labeled, "Exit". You must press the knob at this screen to ensure that your changes are recorded in memory.

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### Here's the full listing of the Menu Items

You May Also Want To Visit Our Instructions Page On Our Website  
To View A Series Of Videos For Most Of These Functions.

**On/Off.** Use this menu option to turn the PWM on or off in software. There is no switch in the cab to turn off the pwm. But you can do it in software, and the PWM will remember this state after power is removed and it is again restarted.

**Constant Amps.** Use this screen to set the amps that the PWM will provide to the cell.

**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 automatically on low voltages. 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 13.0 volts for your On Voltage and 12 volts for your Off Voltage. See a further discussion of this item below.

**Calibrate.** Press this button to calibrate the amps display to your PWM. This step only needs to be done once.

**Enter Codes.** This is used to enter codes that affect the operation of the PWM. Mostly we use these codes to turn on and off a number of PWM functions. When you find that your PWM triggers an error so frequently that it becomes an annoyance, then you can

use one of these codes to turn off checking that error. To enter a code, turn the knob to cycle through the available numbers and characters available. The available numbers are 0-9 and A-F. When you get to the number you want, press the button, and you'll be advanced to the next character position. Again, turn the knob to select the 2nd character, and so on. When you have entered the last character, press the knob one more time on the blank space to complete your entry. If you have entered a valid code, the word "Saved" will flash onto the screen for a moment.

If you enter an unrecognizable code, then "Invalid" will be displayed shortly. Entering an invalid code has no effect whatsoever. So, if you are entering a code and accidentally enter a wrong character, then just press the button twice and start over.

**The following codes are recognized:**

25350 - No Load check off  
25351 - No Load check on

3AC2F0 - Instant Amps Check off (Deleted after v1.29)  
3AC2F1 - Instant Amps Check on

C187A0 - Total Amps Check off (Deleted after v1.29)  
C187A1 - Total Amps Check on

2EE040 - Runaway Amps Check off  
2EE041 - Runaway Amps Check on

232250 - Fan Check off  
232251 - Fan Check on

232252 - Circuit Board Temperature Check Off  
232253 - Circuit Board Temperature Check On

143AC0 - Turn Passwords off (Added in Version 1.29)  
143AC1 - Turn Passwords on  
143AC2 - Change Password  
143AC2 - Reset Password to "1"

1414x - Voltage Tuning - see below for instructions(Added in Version 1.29)

**Trigger Function:**

2340 - Trigger function to be turned off  
2341 - Trigger function to be turned on - with normal voltage - Hi voltage = PWM is turned on  
2342 - Trigger function to be turned on - with reverse voltage - Low or no voltage = PWM is turned on.

**Frequency functions:**

14CB0F0 - turn frequency menu item off  
14CB0F1 - turn frequency menu item on

7. Frequency: If this menu item has been activated, it will show up here. Just set the frequency to the desired number and press enter.

## **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, and run you're A/C with the fan on high. Now measure the voltage. You'll want your On Voltage to be 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 above the voltage you see now.

After activating this function, if the voltage drops below your off voltage threshold, the PWM will set it's duty cycle to 0, effectively turning the system off.

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, we are making very certain that HHO not being produced unknowingly, nor when the engine is off. This is an important safety consideration. You never want your system making HHO while the engine is not running and therefore instantly consuming it.

## **Password Function**

A password function has been added at the request of some of my OEMs. This allows an OEM to lock out the menu after he gets everything set up correctly for his customers. To get to the menu, one must enter a password. This feature can be turned on and off via

the Enter Codes menu command as described above. Once you correctly enter the password, you will be "logged on" until the next time the PWM is powered off. This is by design so that you don't have to keep entering the password when you need to go in and out of the menus during setup

To change the password, go to "6.Enter Codes" on the menu. Enter 143AC2. Then exit the menu. Now, push the button to go back into the menu. Instead of the menu appearing, "Password?" will appear on the screen. Enter the new password followed by a blank space. Note passwords are a maximum of 8 hexadecimal digits. If you enter a longer password, only the first 8 digits will be recorded. Password default is "1", so if you activate this feature you will want to put in your own password. **Be careful to write it down.** If you lock yourself out of the menu, you will have to send your controller in for re-programming before you can access the menus again.

## Voltage Tuning

This function was added to increase the accuracy of the voltage display. In some cases the display can be off by as much as 0.2 volts. This has to do with the accuracy of the the electronic components where the voltage is measured. To increase the accuracy of the voltage display, you must use an accurate meter. Connect the red probe to the **Batt+** on the large black terminal block. Attach the black probe to the **Batt-**. For best results connect your probes directly to these 2 terminals, and not to other "equivalent" locations. It's best to do this test while the engine isn't running so that the voltage is very stable.

Compare the voltage on your meter to the voltage that the PWM shows you on the display. If the voltage on the display is lower, you need to add voltage, and if the display shows a higher voltage, you need to subtract. Voltage is changed using the Enter Codes menu step. The code to enter is 1414x, where the "x" is replaced with a number that will cause the voltage to add or subtract. Replace "x" with 0-5 to add voltage. The higher the number, the larger the amount added. Entering "0" will add a voltage so tiny, you won't see the display change. Entering "3" is 8 times as much as entering "1". Replace "x" with 6-9 to reduce voltage. Using "6" reduces the voltage by a tiny amount. Entering 7-9 reduces it by the same amounts that 1-3 adds voltage. Further, replacing "x" with "A" or "B" will reduce the voltage by even larger amounts. By adding or subtracting as needed, it's possible to get the display to match exactly to an accurate meter.

## Error messages and their meanings:

- **Fan Stopped** - The fan is not turning. This could be an obstruction, or it could be a failed fan. Either way, the PWM is programmed to shut down if the fan fails. This is so it won't overheat.
- **Low Liquid** - You must have the Level Sensing activated in software in order for this one to show up. Note, that Level Sensing is turned off by default. See the description of this function at #3 in the Programming Instructions section above.
- **Low Volt:PWM OFF** - See the section on Voltage Sensing above. This error indicates that the voltage sensing system has detected a low voltage condition and has shut down the PWM. This function is turned off by default. You must activate it in the main menu if you want this check done.
- **No Load** - This error occurs when less than 3 amps are being drawn on the system, yet the duty cycle is above 50%. It is an informational error only. The

PWM will continue trying to run a cell, with the only difference being that the duty cycle will not go above 50% until the error is cleared. It will continue to try to find a load to run.

- **Hi Amps:PWM OFF** - (must be activated after version 1.29) Instant amps too high. 10 A doesn't sound like much, and it isn't. However, if the duty cycle is at 5%, the instant amps being drawn by the system during that fraction of a second is 200Amps, which is enough to fry the mosfets. So we monitor this and shut the system down if these values are exceed.
- **Hi Amps:Alarm** - (must be activated after version 1.29) This one just means that amps have gone above the set point and is not coming back down.
- **Emergency!**  
Disconnect Cell!: This is a 2 line error, and is very insistent. This one occurs only if the PWM has lost control of the cell. The controller will try to reduce duty cycle, but the current doesn't stop flowing. In this case, current will flow until one of the cables to the PWM is disconnected. This requires action. It means that the PWM has been damaged, probably by being short circuited.
- If the normal display shows "**T Off**" in the upper right of the display, this means the trigger voltage is not present, so the PWM will not operate.
- If the normal display shows "**H Off**" in the upper right of the display, this means that the circuit board has become overheated and the PWM has shut itself down so it won't be damaged.

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**541-808-2503**