

Installation Instructions

S-7 & D-7 Hydrogen Generator Kit

(Updated 10/2020)



Contents:

- Hydrogen Generator
- Constant Current Pulse Width Monitor (PWM) with Liquid Crystal Display (LCD).
- Reservoir Tank (OR a PWM 369, w/dash controller)
- Dryer with Bracket
- 1/4" Hose (1/4" inside diameter)
- Wire for connections between PWM, Battery and Cell
- Electrolyte – Sodium Hydroxide (not included) NaOH, Food grade 100% lye.
- Misc Parts for Installation. (Dudadiesel.com or essentialdepot.com)

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

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 Ace Hardware : "Marine Goop" is lye proof
- 1 Gallon **distilled** water and 1 lb. of caustic soda (NaOH, LYE, sodium hydroxide
- 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. Follow the “tier build”.

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. See diagram the next page.

2. Make Hose Connections

Hose & Fittings Diagram



TIER BUILD

The OUT-let of the filter housing & hose goes to your truck's air filter right below it where the air comes in. NO metal fittings allowed. We must have our HHO - Hydroxy Gas © mix with the air coming in

OUT up



The IN-let of the filter housing allows all condensation to flow back into tank.

IN down

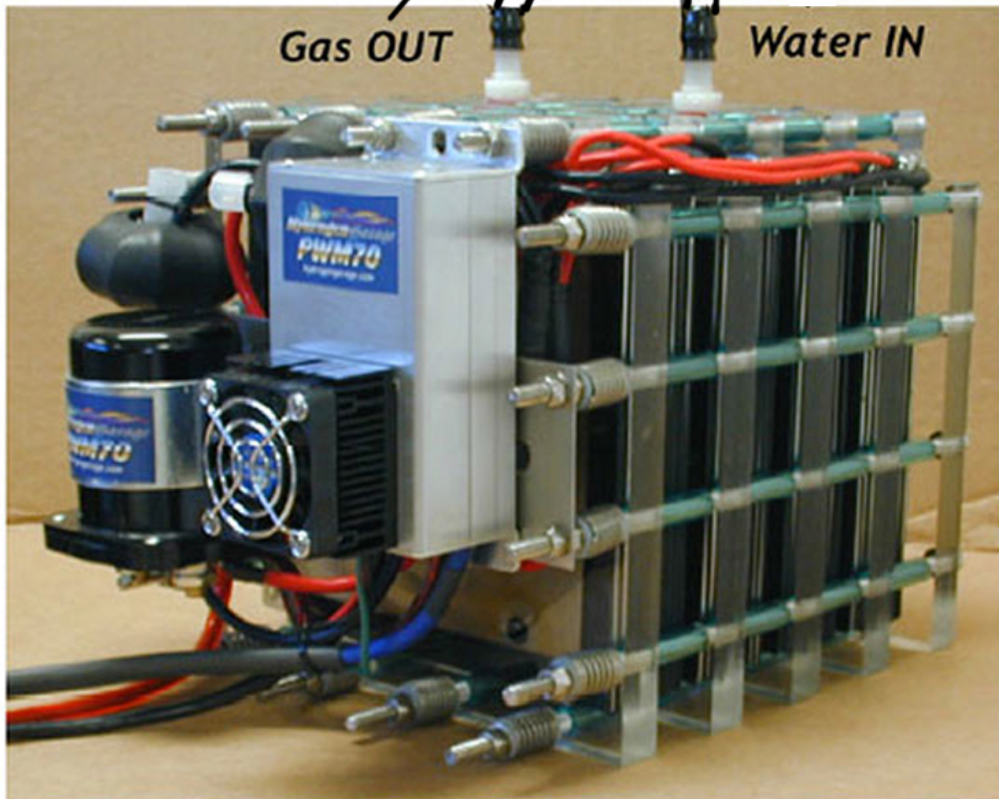


bubbles & scrubs off the NaOH

BOB'S BIG BOY

Gas OUT

Water IN



You are reading Rich Varble's HHO install instructions. Rich passed away in 2018, his wife Tracy took over the HydrogenGeneratorsUSA.com site and sales. We work together. Andrew took over Rich's HHO cell design and Bobafied the cell. (Hydrogen Garage is licensed to sell Bob Boyce™'s 1981 gag-ordered patent for a Sealed, series H2O cell design, 7 plate, 60 plate and 101 plate cell designs. In October 2020, I decided I must also redo Rich's HHO Install instructions in which is close to how we install following Bob's design. Bob is a retired DOD scientist, he says Deuterium water gas is classified and weapon's grade of HHO gas. We focus on making a higher quality hho gas. Ortho HHO, Bob calls Hydroxy Gas™ We pay a royalty to every cell sold to Bob. He is still available for questions and answers. Call us any time, we want you to install correctly, so you see MPG gains and feel the HP.

We use 3/8" ID clear vinyl reinforced clear hose on the cell, tank and out to the dryer filter. We use 1/4" hose from the dryer to the air filter box. Most cars and trucks today have a plastic air engine intake and we use non-conductive hose and fittings to introduce the gas at the beginning of the air intake. The more mixing with the incoming air the better (78% nitrogen and 20% oxygen) before the MAF sensor, before the diesel turbo or gas.

We use 1/4" ID hose after the dryer as to get the gas into the engine faster with a narrower hose, it shoots it out the end better into the air filter box from below or into the air in take snorkel under the hood or fender.

We mix a 10% lye to 100% water mix for our water electrolyte. The lye causes the water to carry a current very easily. We split the water, not the lye in Bob's cool running HHO cells. We do not get gains from water vapor and ionic water vapor gas that is powerful, but too ugh maintenance. Bob's cool running cells are less maintenance and a cell that will can last a life time. 10% = 1/2 dry cup of NaOH to 1 liter of distilled water. Bob says you can use 20%, he actually recommends it. Mix 20% for freezing climates, as NaOH water is anti-freeze. We cleanse the cells with NaOH, so we continue to use NaOH, as our electrolyte. The Ice block HHO instructions below, explain mixing the electrolyte in more detail. You can use KOH, but make sure you flush the cell well before changing over to KOH. Never mix the KOH and NaOH together, and never switch over. Only use one type of electrolyte the life of the cell. We mix up the electrolyte in a gallon clear plastic sweet tea jug, for example a Arizona Ice tea jug. Start with 1 liter of water or 2 and add the dry caustic soda beads into the gallon jug with a funnel and close lid and shake immediately. Do outside and wear gloves and eye goggles. Do not breath the fumes, a hot chemical action takes place and if you do not shake the jug, the lye will melt the bottom of the plastic jug. Mix and shake and take off the lid and place in the shade outside. Please wait till the mix has cooled (2 hours) before pouring into the water tank. The lye batch is nasty, mix a spray bottle of vinegar and water 50/50 to spray on hands or painted surfaces, it dulls aluminum. So watch out. During the life of the cell when refilling the tan we only add distilled water only. Put a jug of distilled water in the trunk. You only need a cup or 2 at every gas fill up. We go though the water slowly. Do not fill tank to the top, give a few inches to the top of the water tank.

Refill the electrolyte when the level gets to within 1" from the bottom.
To replenish the electrolyte, add distilled water only.

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; Volo FS2 circuit
Volo VP15 or Volo VP16 or a Darol Mason EFIE.

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.

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 (Mike's PWM and Blue Screen Controller)

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.

If you got the PWM369, read those instructions. We have a small blue box dash display that runs a 3 wire audio cable through the fire wall to the PWM and HHO cell. One thin red wire comes out of the blue box dash display, this red (+) wire needs to go the fuse box in the dash area and piggy back onto a 10 amp fuse or less that is only ON when the engine is ON only. Test with a multi-meter on the fuse box.

Installation Instructions for Mike's PWM LCD Controller

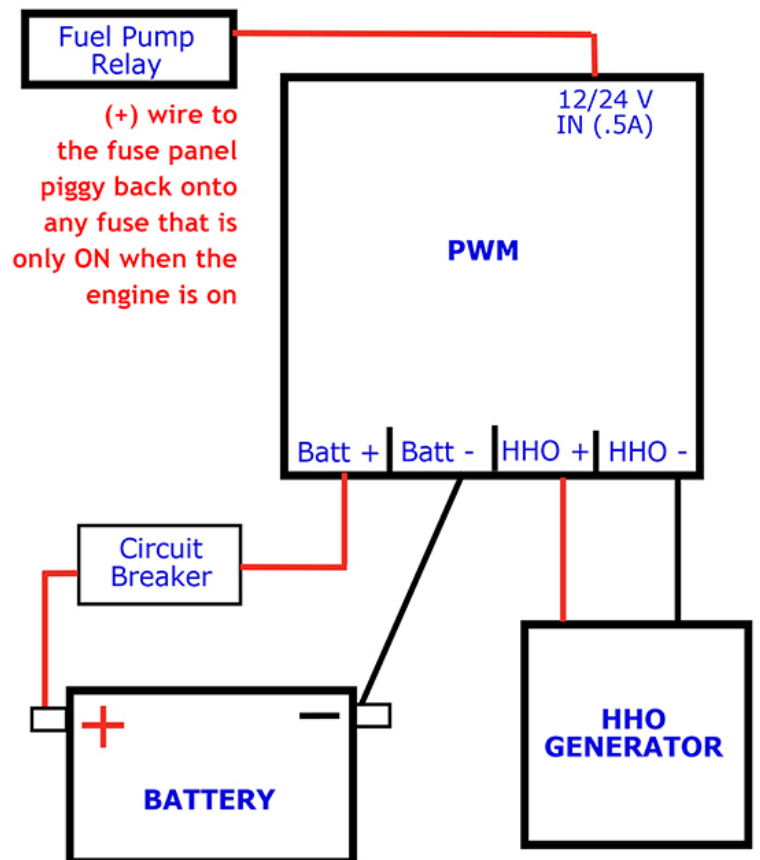
There are two main parts to your PWM:

- 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.



Use 12 or 10 awg. wire

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.*

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

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.

For more info on Mike's PWM Controller go to :

fuelsaver-mpg.com/pwm-instructions

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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

14CB0F2 - turn frequency menu item on but hide it again after next power 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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