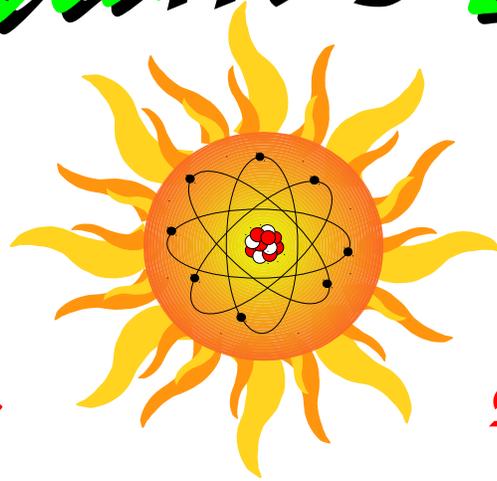


Quantum Harvest[®]

*Faraday
Enclosures*



*Portable Solar
Power Stations*

Owner's Manual

**Quantum Harvest Model 1525 TSW
(Custom)**



Introduction

Congratulations on your purchase of a Quantum Harvest EMP protected* portable solar power station! These units have been carefully designed and hand-crafted to provide many years of trouble-free operation. In the unlikely event of malfunction, we offer a 1 year warranty on the batteries (if provided by us.); 3 years on the inverter and charge controllers; 5 years on everything else. For warranty details, see page 34.

To obtain maximum performance and long life from your new power station, it is important to gain a basic understanding of how such units operate and their limitations. The heart of the unit, and it's main component, is the battery bank. This is where the energy from the solar panels or the included 120 volt AC battery charger is stored for later use. The particular batteries I have selected are state of the art deep-cycle Absorbed Glass Mat (AGM) medical-grade batteries, designed for powered wheel chairs. These batteries are maintenance free and can be stored and used in any position. Since they do not give off gases as they charge, there is no danger of fire and they never need to have water added.

To obtain maximum life from these, or any other batteries, it is important to try to avoid deep cycling, that is, drawing them down flat before allowing them to recharge. Sometimes this cannot be avoided, but if at all possible, strive to avoid doing so.

Another important component is the inverter. This is the device that converts the low voltage DC current from the batteries into the high voltage AC current that we are familiar with. (All Quantum Harvest power stations also have 12 volt DC receptacles and USB charging sockets for the appropriate devices, in addition to standard 120 volt AC house current.) The inverter is protected internally from overheating and low battery voltage, and externally from over-current draw by a 300 ampere ANL type fuse. The Model 1525 will sustain a continuous 1500 watts of current, and will briefly provide up to 3000 surge watts, to start motors and other inductive loads. The inverter relies on air flow around and through the unit to cool it, therefore it is imperative that the inverter not be used with the enclosure door closed.

Because this is a custom model, some of the pictures may not be accurate, but are close enough to convey the general ideas presented.

**A quick note on EMP*

*An EMP, or **Electro-Magnetic Pulse** is a devastating phenomenon that, while harmless to living things, absolutely destroys anything electronic. It consists of extremely powerful electromagnetic fields building and collapsing hundreds of thousands of times per second. This induces potentially huge electric currents in anything that conducts electricity, causing components connected to said conductor to burn out. An EMP can be caused by either a deliberate, high-altitude nuclear warhead detonation, or can be caused naturally by a solar event called a Coronal Mass Ejection, or CME.*

All Quantum Harvest power units are built into a specially designed enclosure, more properly called a Faraday Cage, named after Michael Faraday, an early pioneer in electromagnetic research. The purpose of a Faraday cage is to intercept and divert electromagnetic energy away from the box's interior, thus protecting the contents.

The principles involved are fairly simple, but the proper execution is critical. In order for the enclosure to be useful, it must have a door, but any opening larger than a square centimeter or so allows too much energy to penetrate the interior, thus defeating the purpose of the Faraday cage.

The solution to this conundrum is to gasket the door with a special type of conductive gasket, mated to a copper or silver strip that is electrically bonded to the main box. The key is to have very low electrical resistance between the door and the enclosure, with no gaps. This is not as easy as it sounds, and requires special materials designed specifically for this application.

My experience with Faraday apparatus comes from 8 years experience with very powerful industrial machines called RF welders. These machines use extremely powerful and focused bursts of electromagnetic energy to weld and form plastic parts. These machines basically create a local EMP every time they fire, and it is critical that stray energy be confined and dissipated safely to avoid damage to other sensitive electrical machinery.

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Base Unit Specifications

Assembled Dimensions:	49.5”H x 24”D x 19”W
Assembled Weight:	164 lbs.
Inverter:	Samlex America 1500 watt true sine-wave with soft-start technology.
Battery Bank:	4- ML35-12 AGM Deep-cycle batteries, 35 Amp/hours each.
Battery Bank Capacity:	140 Amp/hours, 1,680 Watt/hours
AC Charger:	NOCO Genius G7200 7.2 Amp Smart Battery Charger
Solar Charger/Controller:	Custom: Midnite Kid 30 amp MPPT .

In this manual, the following symbols are used to highlight important facts:



Denotes circumstances where failure to follow the procedures outlined in the manual may result in property damage.



Denotes circumstances where failure to follow the procedures outlined in the manual may result in personal injury or death.

Always remember that electricity is utterly devoid of mercy and never grants second chances!

Note on Batteries

Quantum Harvest power stations are designed to use batteries that measure 7.68” Long, by 5.16” Wide by 7.13” High. The particular battery model we use is the ML35-12 - 12V 35AH model. Other models of similar dimensions and specifications will also work.



Caution Although the low voltage at the battery terminals means that electrical shock or electrocution is impossible, nonetheless, batteries store an enormous amount of potential energy, that if accidentally released by a short-circuit, can melt metal tools, start fires and cause personal injury. Eye protection **MUST BE WORN** whenever working with batteries of this size, and extreme care must be exercised at all times. Anything electrical is unforgiving of mistakes.



!Warning! Note that although the voltage at the battery terminals is insufficient to shock a person, the current coming from the inverter receptacles is 120 volt house current, and that is indeed capable of inflicting a severe, potentially fatal shock. Always be sure that extension cords are not frayed or worn, and that all equipment plugged into the inverter is in a safe condition.

Section 1: Capacities and recommended usages

This 1500 watt model True Sine-Wave is our most advanced portable solar power system. It will reliably power the items that are problematic with modified sine-wave inverters, such as laser printers and copiers, which makes it perfect for small offices. It will also provide reliable backup power for your home; keeping cell phones and laptops charged, and keeping a refrigerator or freezer operational.

It is NOT recommended to power large resistive loads like central air-conditioners, water heaters and electric space heaters, as well as large electric motors, such as industrial air compressors, etc.

Used within its limits, this unit will provide many years of trouble-free service, and be a joy to own and use. But like most things, if you push it beyond its limits, you will be plagued by expensive repairs and poor performance.

This machine contains a battery bank of four, 35 amp/hour batteries, for a total capacity of 140 amp/hrs. How much real power is that? If we multiply the 140 amp/hours by the nominal voltage (12 volts), we get a capacity of 1,680 watt/hours (watts = volts times amps). Put another way, this machine will run a 100 watt incandescent light bulb for 16.8 hours!

That may not sound like much, but incandescent bulbs are horrendously inefficient. This machine will also run a full-sized refrigerator or freezer for several days, even without the solar panels hooked up.

On the next page is a partial list of common electrical appliances and their approximate loads, provided in part by the good folks at: <http://www.energy.gov>

Appliance

Watts Used

Load type:
R=Resistive
I=Inductive

Notes

Quantum Harvest Model
2,500 1,500 800
X=Will run X*=May run

Aquarium	50-1210	R	1	X	X	X*	X*
Clock radio	10	R	2	X*	X	X	X*
Coffee maker	900-1200	R	2	X*	X*	X*	
Clothes washer	350-500	I		X	X	X	
Clothes dryer	1800-5000	R					
Dishwasher	1200-2400	R					
Dehumidifier	785	I		X	X	X	
Electric blanket (Single/Double)	60-100	R		X	X	X	X
Fans:							
Ceiling	65-175	R		X	X	X	X
Window	55-250	R		X	X	X	X
Furnace	750	R		X	X	X	X*
Hair dryer	1200-1875	R	3	X	X	X	
Heater (portable)	750-1500	R	3	X	X	X*	
Clothes iron	1000-1800	R	3	X	X	X	
Microwave oven	750-1100	R	2	X*	X*	X*	
Personal computer (desktop w/LCD monitor)	150	R		X	X	X	X
Radio (stereo)	70-400	R		X	X	X	X
Refrigerator (frost-free, 16 cubic feet)	725	I		X	X	X	X
Televisions-CRT (color)							
19"	65-110	R		X	X	X	X
27"	113	R		X	X	X	X
36"	133	R		X	X	X	X
53" - 61" Projection	170	R		X	X	X	X
Flat screen	120	R		X	X	X	X
Toaster	800-1400	R		X	X	X	
Toaster oven	1225	R	3	X	X	X	
VCR/DVD	17-21 / 20-25	R		X	X	X	
Vacuum cleaner	1000-1440	R	3	X	X	X	
Water heater (40 gallon)	4500-5500	R					
Water pump (deep well)	250-1100	I	4	X	X	X	
Water bed (with heater, no cover)	120-380	R		X	X	X	X

Notes: 1=Higher usage indicates use of a heater, 800 watt model may not run a large aquarium heater. 2=May have issues with Modified Sine-wave inverter. 3=High power usage, but usually short duration. 4=Will run 120 volt pumps, will NOT run 240 volt pumps.

Section 2: Controls/Circuit Protection Devices

There is one main fuse, a 300 ampere ANL type fuse, shown to the right, located at the bottom of the unit. There is one spare fuse included in the spare parts kit. To replace the fuse,

first, be sure the main switch is turned off, then squeeze the clear plastic cover at the bottom to release the catches, and remove it, then, using a 9/16”

wrench, remove the two nuts. Lift the fuse out and place the new one over the studs; reapply the nuts, being careful to not over-tighten, then snap the plastic cover back in place.

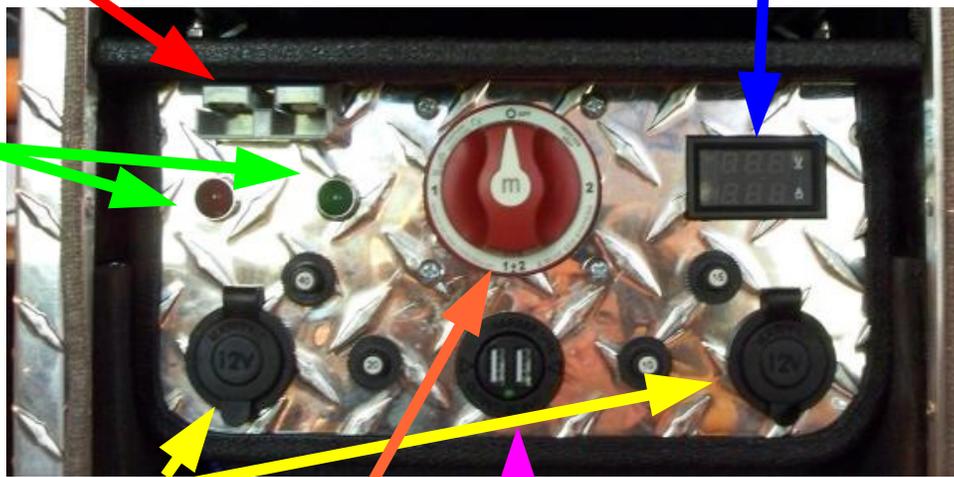


Detail of Main Control Panel

Anderson connector for booster cables

Volt/Charging amps meter

Polarity indicator LEDs for use with the booster cables (see section 5)



12 Volt DC cigarette lighter-style outlets

USB charger ports (2)

Main Switch; 4 positions available.

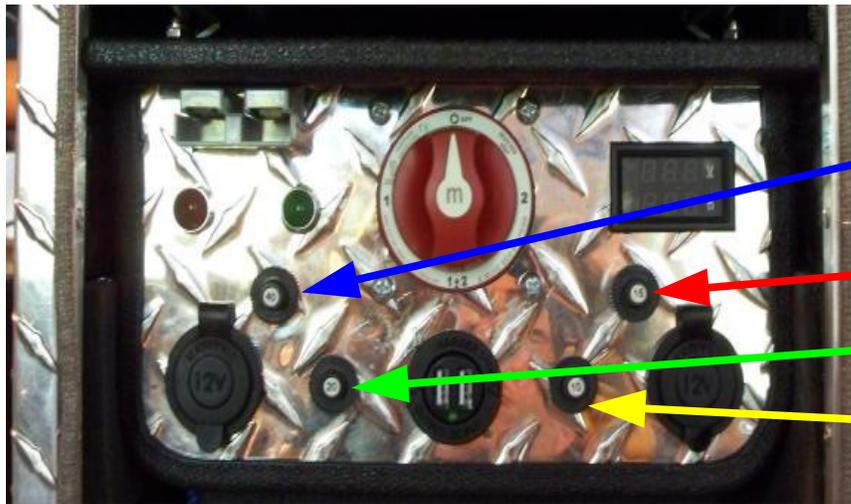
Off position isolates the inverter and control panel from the batteries.

Position #1 is the normal use position in which the unit draws from the internal battery bank.

Position #1&2 is the position used when using the booster cables, and allows the unit to run from both the internal battery bank and the vehicle's charging system.

Position #2 is not normally used, and allows the load to be run directly from an automobile's charging system, bypassing the internal battery bank.

Detail of Main Panel Circuit Breakers



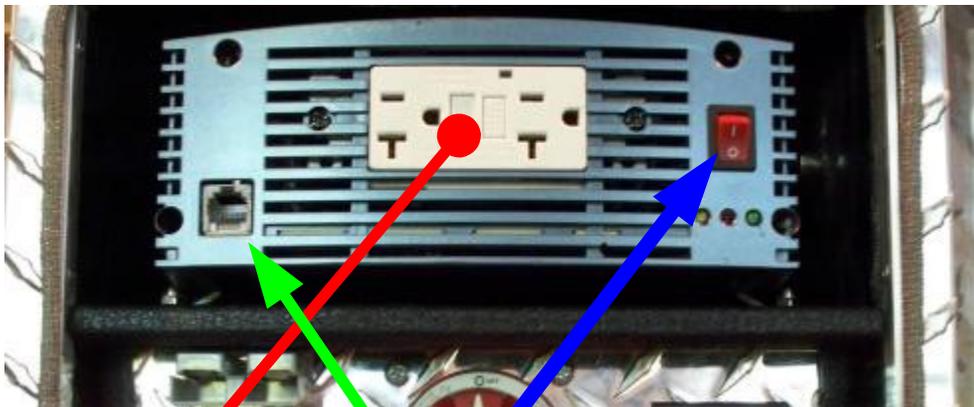
40 Amp. For solar charger

15 Amp for AC charger

20 Amp for 12VDC outlets

10 Amp for USB ports

Detail of 1500 Watt Inverter

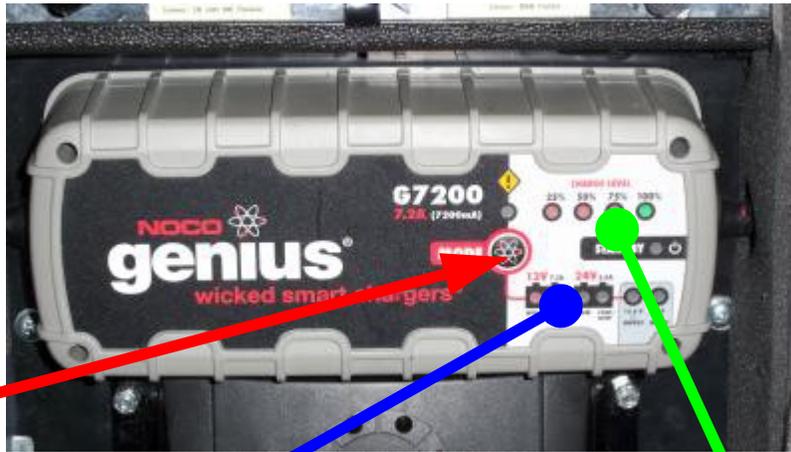


120 volt AC outlets

On/Off switch

Port for optional remote

Detail of AC Charger



Mode switch

Mode indicator LEDs

(Push to select mode of charging and battery bank voltage. Should be set to 12V Normal)

Battery bank state-of-charge LEDs

(Should show 12V Normal, if not, press mode switch until correct LED is lit.)

(Shows current state of charge, these LEDs only operate when the AC charger is plugged into a wall socket.)

Detail of Solar Charger/Controller

(This model uses a custom solar charge controller, with it's own instruction manual.)

Section 3: External Ports and Connectors

The external ports/connectors for attaching the power cord for the AC charger and the solar panels are located on the right side of the unit, when facing the control panel.

Solar Panel Connector Detail



(Note the orientation of the plug; the tab is on the top. The plug just slides straight into the socket. It should go in smoothly, with little resistance. If it seems to require a lot of force, it is most likely started crooked.)

AC Charger port

Insert the plug into the socket with the silver tab on top, and turned slightly to the left. Push it in fully and gently twist it clockwise until it latches.

To remove, use your thumb to pull the silver tab toward you, then twist the plug counter-clockwise and pull it out of the socket.



Section 4: Operation and Maintenance

WARNING! The base unit is NOT water-proof, and must be stored and used in a dry location. Wind-driven rain will ruin the inverter, and worse, set up conditions where people or pets may be electrocuted. The solar panel assemblies may, however be safely used outdoors in any weather, so long as care is taken to prevent wind and falling objects like tree limbs, etc. from causing damage.



Also, please take note that in addition to the above very real danger, the warranty does not cover water or other weather-related damage to any of the components!

To use the unit, unplug the AC charger cord if it is connected, then wheel the unit to a convenient location. Open the cabinet door and turn the main switch clockwise to position #1 and then switch the inverter start button to the on position. Connect any loads to the appropriate receptacles. Be sure to keep the door open and the grill on the back unobstructed so as to allow adequate airflow for inverter cooling.

Note that it is not necessary to have the solar panels connected in order to use the power station, but if they are not connected (and in direct sunlight), you will only have what power is in the batteries. There is no easy way to tell exactly how much charge remains in the batteries, so the best measure we have is to watch the battery bank voltage, which is shown on the inverter's digital display.

Battery voltage gradients change over time as the batteries age, but a good rule of thumb is that 12.8 to 14 volts is a reading for a battery pretty much fully charged. When the voltage drops to 12.1 to 12.3 volts, the batteries are usually about one half to two-thirds discharged. Voltage of 11.0 to 11.9 mean that the battery is pretty much exhausted, and voltages below about 10.7 will cause the inverter to shut off. These numbers are only approximate, experience is still the best teacher!

Please note that the voltage readings, to be accurate, must be read under a no-load condition. The voltage will be much lower when the batteries are under load.

When you are finished with the unit, unplug the solar panel assembly, coil the cable on the brackets and stow the assembly in a safe place. Switch off the inverter, then turn the main switch to the off position. Close the cabinet door, and wheel the unit to a safe, indoor location. Plug the AC charger cord into a wall socket and plug the other end into the appropriate socket on the right side of the base unit. Open the cabinet door and verify that the AC charger is on, and that the left-most 12V Normal LED is lit. If it is not, press the mode button until it is. Also, at least one of the charge indicator LEDs should be lit. Close and latch the cabinet door. Note that the main switch should be OFF. The AC charger will automatically maintain the batteries at the optimum voltage as long as it is plugged in. There is no need for further intervention.

Please note that the AC charger will charge the batteries even if the main switch is off, but in order to charge the batteries with a solar panel, or to use the inverter or other power outlets, the main switch MUST be switched to position #1!

The only other maintenance needed besides keeping the batteries charged is to keep the faces of the solar panels clean to improve their efficiency.

Section 5 : Using the Included Booster Cables

Imagine: It's dark, the power has been out for 2 days and the meat in the freezer is thawing fast....the wife is freaking out, the sun hasn't been seen in 3 days, and the power station has been running the fridge and furnace, and is at less than 25% charge. What do you do now.....?

All Quantum Harvest solar power stations allow the user to use an automobile's electrical system to recharge the power station's batteries in an emergency. I realize that idling a 100+ horsepower engine solely to run the alternator is not very fuel efficient, but compared to losing the contents of a full freezer, or having the pipes freeze for lack of heat, a few gallons of gasoline seems a pretty small price!

The Model 2505l, due to the size of the battery bank, and the fact that the batteries are behind a panel, is furnished with a set of heavy cables that conveniently mate with a corresponding terminal on the control panel. This model also has a unique system to help prevent crossed polarity, which, again, due to the size of the battery bank, may result in damage to the vehicle's charging system. Below, you will see the steps necessary to use these features.



Failure to strictly adhere to the following steps may result in the vehicle's battery exploding, potentially causing severe injuries to the skin and eyes, and could also result in very costly damage to your vehicle's electrical system. Eye and hand protection is mandatory. As I have stated before, batteries, even relatively flat ones, store enormous amounts of energy that can melt tools, cause fires, and cause grave personal injuries. Don't be a statistic!



This is why I designed a polarity check system! A classic example of the "mystery battery syndrome"! Which is positive? Which is negative? Not to worry; see below.....



Step1: Be sure the main switch is either in the off or #1 position! The Polarity Check system is defeated if the main switch is in either the 1&2 or the #2 position!!





!WARNING! Every year, people die needlessly from carbon monoxide poisoning by running engines or heaters or such inside their homes.

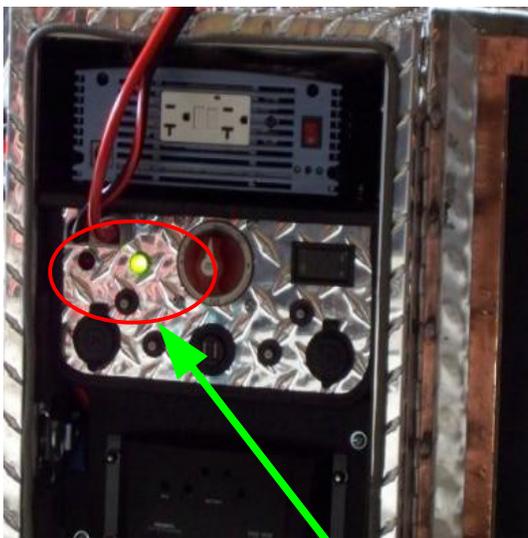


Don't be a statistic! DO NOT run the vehicle's engine inside a garage with the doors closed!



Step 2: Position the power station a comfortable distance from the vehicle, then, first, plug the cables into the power station, then affix the clamps to the vehicles battery.

Step 3: Check for correct cable to battery polarity by looking at the LEDs on the control panel; See below.



Green LED lit indicates polarity is correct. Turn main switch to position "1 & 2" and charge batteries. (Note that the vehicle's engine must be running to actually charge batteries!)



Red LED lit indicates polarity is INCORRECT! DO NOT MOVE THE MAIN SWITCH! Reverse the clamps positions on the battery.

Step 4: After confirming the green LED is illuminated, thus ensuring the correct cable to battery polarity, turn the main switch to position “1 & 2”, and allow the batteries to charge. It is very important to be sure the vehicle's engine remains running, otherwise you will just end up with a flat battery in your car, and very, very, slightly charged batteries in the power station!



Be absolutely sure that the green LED is lit before moving the main switch to the top #1&2 position! If the switch is moved to this or the #2 position when the red LED is lit, there will be a dead short between the power station and the car's electrical system. This will almost certainly do a great deal of very dramatic and costly damage to both the car and the power station!



It is perfectly OK to run the inverter to power other loads while the car is charging the batteries, although it will slow the charging process. It will probably be necessary to use an extension cord from the power station, so be sure the cord is of heavy enough construction to carry the load, is not frayed, and is placed to minimize the tripping hazard.

Section 6: Removal and Re-installation of the Batteries, Power Head, and Charging Board

All Quantum Harvest power stations feature a modular construction that allows faulty components to be easily removed and returned to us for repair, without the necessity of having to crate up the entire heavy unit and paying the costly shipping charges for a 200+ lb. machine.

The power station consists of, in addition to the casing and batteries, two such removable modules; the power head, which contains the control panel, the inverter, and the bulk of the wiring, and the charger board, which contains both the solar controller and the AC charger.

Removal of the charger/battery cover assembly.



Step 1: Remove these two knobs.



Step 2: Remove the clear cover over the fuse by gently squeezing the bottom edges inward & remove. Remove the main fuse.

Step 3, Lay the foam panel from beneath the storage box on the control panel as shown to cushion the charge controller in the next step.

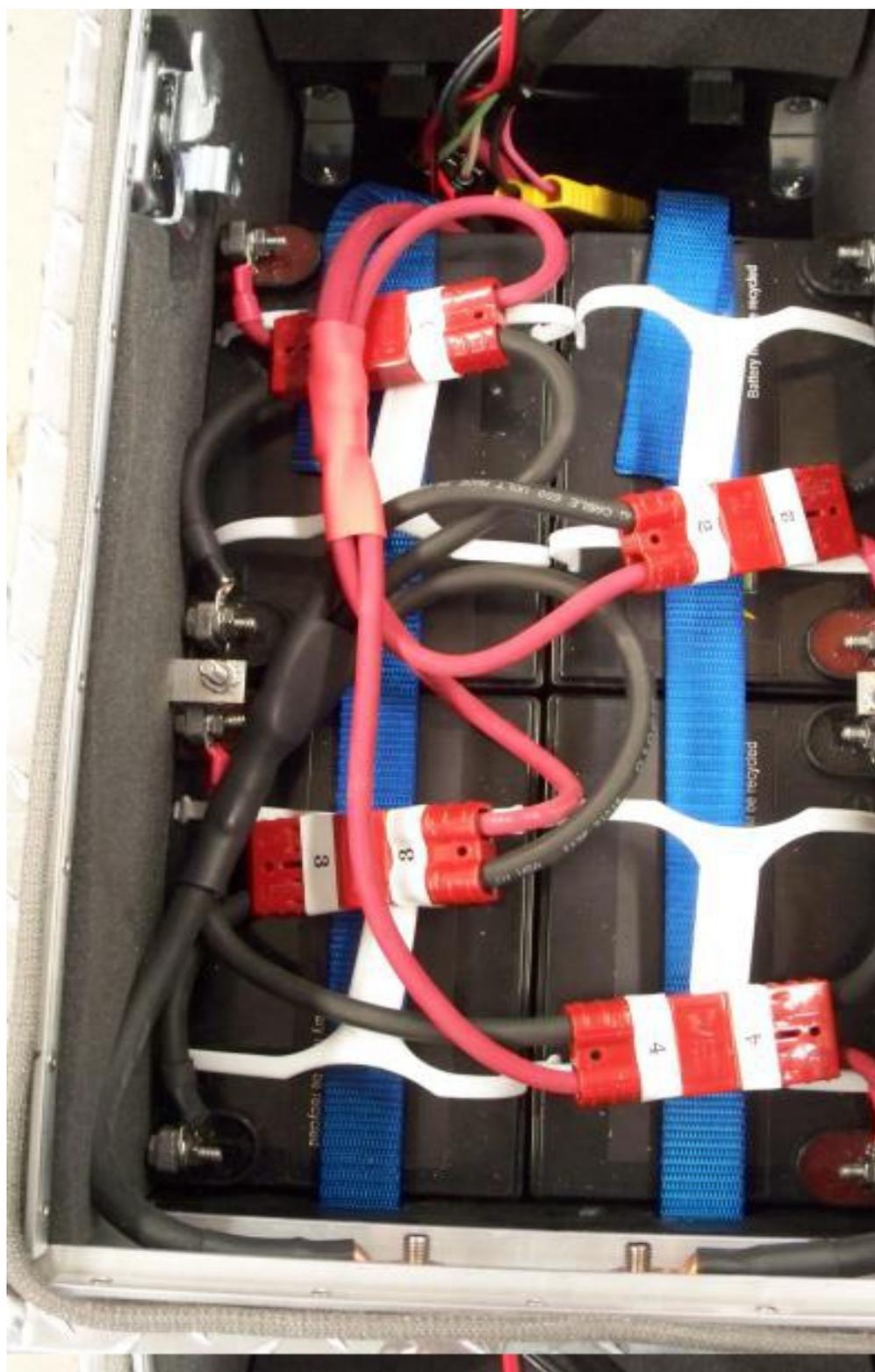


Step 4: Below. Pull the charger board up slightly to clear the studs, and slide it forward to disengage it from the slot by the main fuse. Lay it gently up and over the control panel as shown.



Step 4: Disconnect the 4 connectors to remove the charger board.
(Note that the 4 connectors for the charger board do not have to be disconnected in order to remove/re-install the batteries.)

Reverse the above steps to re-install. Be sure the cables underneath are arranged properly, otherwise the charger board will not seat properly on the studs, possibly preventing the lid from closing. See photo on next page detailing proper cable arrangement.



Battery Removal/Re-installation

Things to note before starting



Be careful with any metal tools that you do not inadvertently short between terminals. Remove any metal jewelry from your hands and avoid loose metal necklaces or such that may droop down and short between adjacent terminals. Work slowly and carefully, and wear eye protection at all times.

Be wary of applying excessive force; things should slide in and together smoothly. If something seems to go hard, it is most likely caught up on something or started crooked.



Caution Although the low voltage at the battery terminals means that electrical shock or electrocution is impossible, nonetheless, batteries store an enormous amount of potential energy, that if accidentally released by a short-circuit, can melt metal tools, start fires and cause personal injury. Eye protection **MUST BE WORN** whenever working with batteries of this size, and extreme care must be exercised at all times. Anything electrical is unforgiving of mistakes.

Step 1: Remove the charger board/battery cover. (Pages 16-17)

Step 2: Remove the main fuse, and disconnect both leads from fuse terminals.

Step 3: Lay the power station down so that the batteries are laying flat.

Step 4: *Below*; Disconnect the 4 red battery connectors. (They simply pull straight apart.)

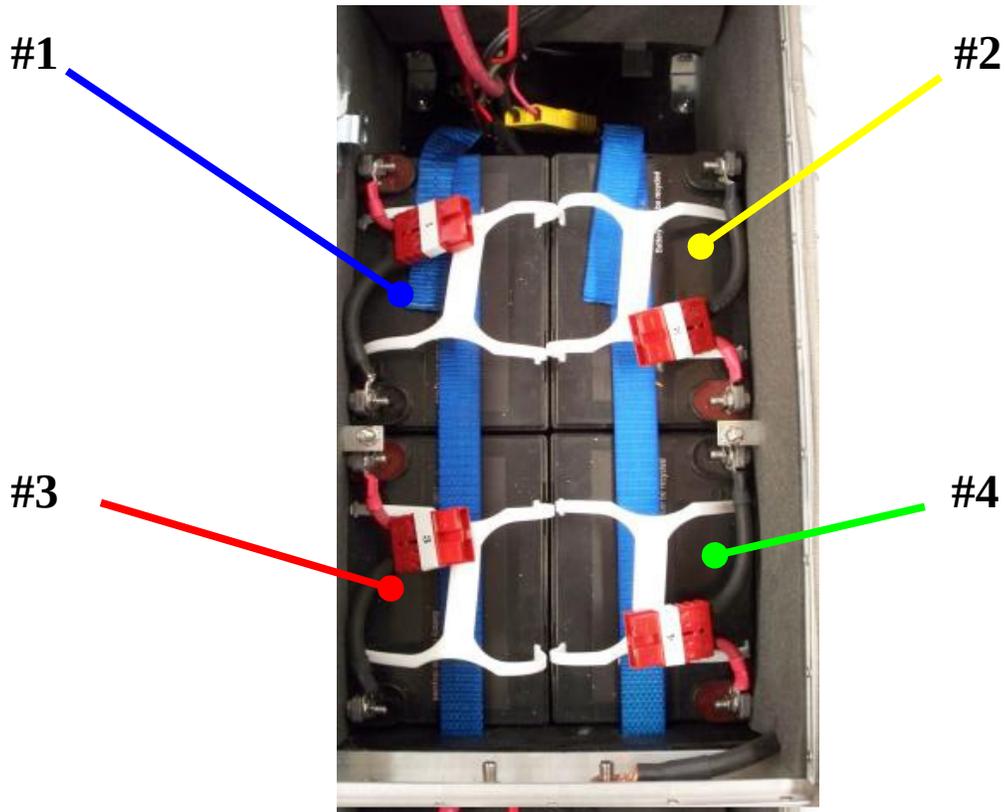


Step 5: *Below*; Loosen battery retention straps and remove D-rings to separate retention strap halves. Pull straps through and hang them and the buckles over the back of the unit to get them out of the way.

(release cam for retention strap buckle)



Battery numbering diagram



Bottom

Step 7: *Below;* Disconnect the heavy black lead from the fuse block left terminal, and lay the wiring harness up and over the power head and out of the way. (Below)



.Step 8: Remove batteries in the following order: #2 straight up and out, then slide #1 over to clear the bracket, then up and out. #3 or #4 can then be slid forward to clear the brackets and removed, then the remaining battery may be removed.

Reverse the above steps for re-installation

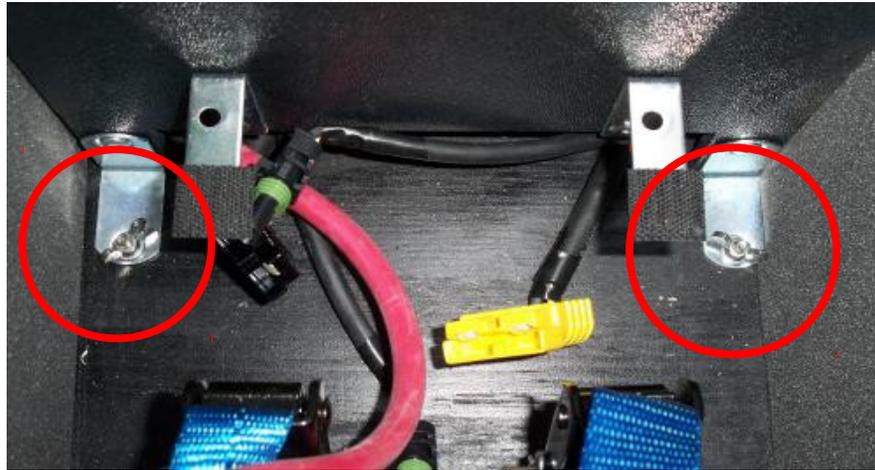
Removal of Power Head Assembly

Step 1: Remove the charger board/battery cover. (Pages 16-17)

Step 2: Remove the main fuse, and disconnect both leads from fuse terminals. (Page 16)

Step 3: Remove the batteries. (Pages 19-21)

Step 4: *Below;* Remove the two wing-nuts and washers securing the power-head underside protection plate, tip it out from under the control panel and remove it from the case.

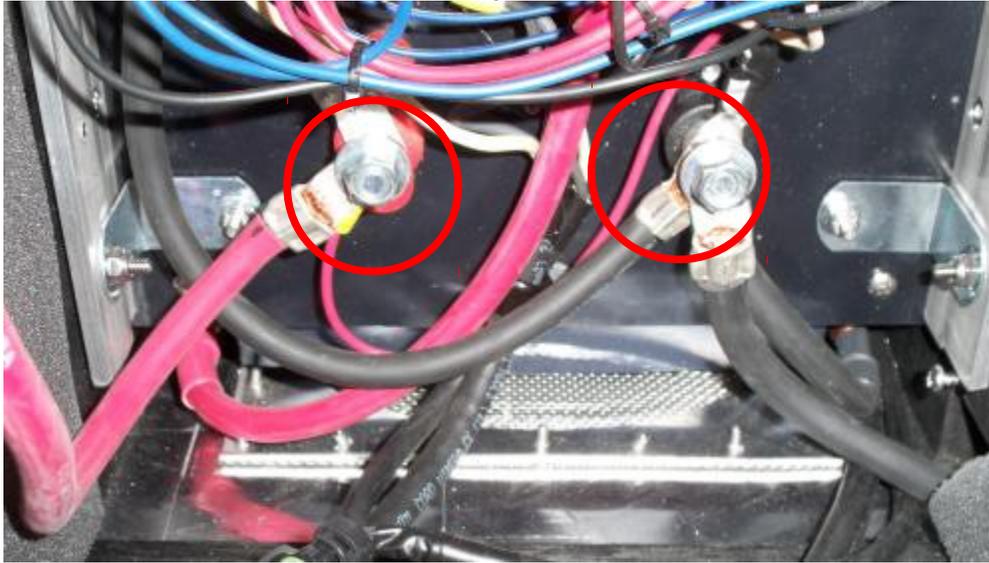


Step 5: Remove the 2 screws (4 total) from each side of the power station. See next illustrations below.

Detail of screws securing the power head. Note that these are the ones with the washers



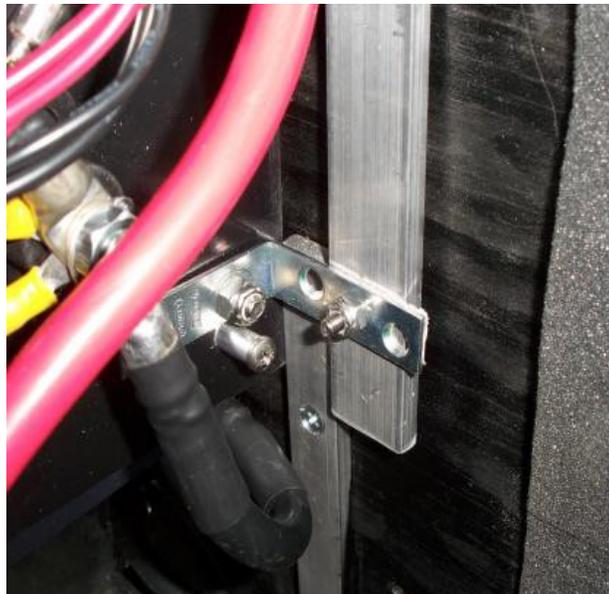
Step 6: Remove the heavy red and black battery cables shown below.



Step 7: Carefully lift the power head straight up out of the case.

Reverse the above steps to re-install the power head.

Note the relationship of the power head supports/guides. (Right)



Contact Information

**Quantum Harvest, LLC
89 Chapman Ridge Rd.
Athens, ME 04912**

Email: support@quantumharvest.net

Warranty Information

All Quantum Harvest power station base units and mobile solar panel units are warranted to be free of defects in materials and workmanship for:

Batteries, if provided by us.....1 year
Inverters, AC chargers and solar charger/controllers.....3 years
Everything else, including solar panels.....5 years

To obtain warranty service, contact us at: support@quantumharvest.net for instructions. We will assist in diagnosing the affected component(s), and furnish an RMA. Shipping both ways is on us. You won't pay a cent for warranty service.

In addition to the above warranty, we are so confident of our products, we will never, as long as you own it, charge you labor for repairs. Even after the warranty period, if a component fails or gets damaged, just contact us at the above email address, and we will assist in diagnosing the problem and either arrange to send you the part at cost, or have you ship us the affected module, where we will diagnose the problem and contact you with the cost of the replacement part(s). You will pay what we pay, no more.

What is NOT COVERED under the warranty:

Physical damage to the solar panels, including, but not limited to; broken glass or broken or bent parts. If this unit falls out of a truck at 65 mph and goes bouncing down the road, one can hardly expect the manufacturer to fix it for free!

Physical damage to the power station itself. It weighs over 200 lbs.! If it gets dropped off a tailgate, it is going to be damaged.

Water damage to the internal components of the power station.

Damage caused by improper use of the booster cables. If someone turns on the inverter with the cables connected improperly to the vehicle, it will blow the main capacitors. (Believe me, I will know what happened when I see the inverter!) Obviously, if this happens, we won't fix the car, either!