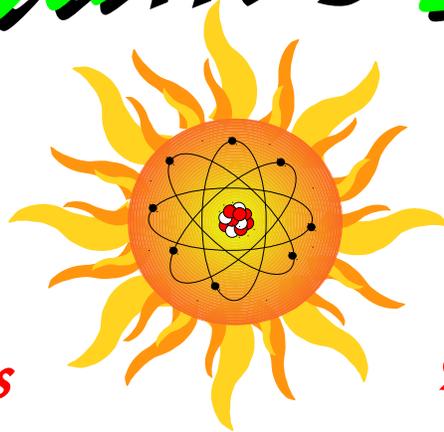


Quantum Harvest[®]

*Faraday
Enclosures*



*Portable Solar
Power Stations*

Owner's Manual

For Quantum Harvest Model 800



quantumharvest.net

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 resettable circuit breaker. The 800 watt model will sustain a continuous 800 watts of current, and will briefly provide up to 1600 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.

Another important part is the solar panels. We currently (as of 8/2013) offer a choice of a 100 watt single-panel mobile assembly, as well as a 200 watt dual-panel mobile assembly. We plan to offer a 300 watt, three panel assembly in the near future. All our models of power stations can also be purchased without solar panels, allowing the client to supply their own panels, if they so desire. We recommend an absolute minimum of 100 watts rated panel capacity, and 200 or even 300 watts would be better. All of our stations utilize a charge controller that will handle up to 30 amps of array current, or about 350 watts total array capacity. If unsure, email me at support@quantumharvest.net with the specifications of the proposed panels and I can quickly look them up and confirm whether or not they will work.

**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.

Table of Contents

Specifications.....	Page 3
Note on Batteries.....	Page 4
Section 1.....Capacities and recommended usages.....	Page 5-6
Section 2.....Controls/Circuit Protection Devices.....	Page 7-8
Section 3.....External Ports and Connectors.....	Page 9-10
Section 4.....Operation and Routine Maintenance.....	Page 11-13
Section 5.....Using Booster Cables.....	Page 14-15
Section 6.....Battery/Power Head Removal, Re-installation.....	Page 16-18
Contact Information.....	Page 19
Warranty Information.....	Page 20

Base Unit Specifications

Assembled Dimensions:	Height, handle extended: 39.5"; retracted: 25" x 17" D x 15.75" W
Assembled Weight:	84 lbs.
Inverter:	Cobra 800 watt; 1600 watt surge capacity, with USB port
Battery Bank:	3- ML35-12 AGM Deep-cycle batteries, 35 Amp/hours each.
Battery Bank Capacity:	105 Amp/hours, 1,260 Watt/hours
AC Charger:	CTEK Multi US 3300 12-Volt Smart Battery Charger; 3.3 amps charging current
Solar Charger/Controller:	Instapark PRS-3030 PWM 30 Amp Solar Power Charge Controller.

Solar Panel Assembly Specifications (100 Watt Model)

Assembled and folded Dimensions:	48"H x 6"D x 25"W
Assembled Weight:	26 lbs.
Rated Output (Nominal)	Optimum Operating Voltage (Vmp): 18.9V Optimum Operating Current (Imp): 5.29 A Open - Circuit Voltage (Voc): 22.5 V Short- Circuit Current (Isc): 5.75 A Maximum Power at STC: 100 W Operating Module Temperature: -40°C to + 90°C

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 800 watt model is the most compact unit we currently produce, which makes it perfect for camping! It will reliably power anything within it's capability, including compact refrigerators and freezers, as well as any hand-held tools, such as drills, grinders and circular saws, etc. It will also, of course, power smaller items such as TVs, cell phones, laptops, tablets, etc.

It will NOT power large resistive loads like central air-conditioners, water heaters and electric space heaters, nor will it power full-size refrigerators and freezers.

Used within it's 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 it's limits, you will be plagued by expensive repairs and poor performance.

This machine contains a battery bank of three, 35 amp/hour batteries, for a total capacity of 105 amp/hrs. How much real power is that? If we multiply the 105 amp/hours by the nominal voltage (12 volts), we get a capacity of 1,260 watt/hours (watts = volts times amps). Put another way, this machine will run a 100 watt incandescent light bulb for 12.6 hours!

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

In my own load and endurance tests, which are still ongoing, some real-world numbers I have seen so far for the 800 watt model are detailed below.

These tests were run without the solar panels plugged in, nor was the AC charger plugged in. These were endurance tests, and as such, were run until the batteries were exhausted.

Test 1: Compact (dorm-sized) refrigerator, in the house, ambient temperature was between 71 to 82 degrees F, ran for 52 hours

Test 2: Home theater system; 65" DLP TV, Blu-Ray player, 500 watt Surround Sound system. Average draw was 415 watts, ran continuously for 3 hours.

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:

Quantum Harvest Model

R=Resistive
I=Inductive

2,500
1,500
800

X=Will run
X*=May run

Appliance	Watts Used	Load type:	Notes	Quantum Harvest Model
		R=Resistive I=Inductive		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
Clothes dryer	1800-5000	R		
Dishwasher	1200-2400	R		
Dehumidifier	785	I		X X X X
Electric blanket (Single/Double)	60-100	R		X X X X
Fans:				
Ceiling	65-175	R		X X X X X
Window	55-250	R		X X X X X
Furnace	750	R		X X X X*
Hair dryer	1200-1875	R	3	X X X X
Heater (portable)	750-1500	R	3	X X X X*
Clothes iron	1000-1800	R	3	X X X X
Microwave oven	750-1100	R	2	X* X* X* X*
Personal computer (desktop w/LCD monitor)	150	R		X X X X X
Radio (stereo)	70-400	R		X 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 X
27"	113	R		X X X X X
36"	133	R		X X X X X
53" - 61" Projection	170	R		X X X X X
Flat screen	120	R		X X X X X
Toaster	800-1400	R		X X X X
Toaster oven	1225	R	3	X X X X
VCR/DVD	17-21 / 20-25	R		X X X X X
Vacuum cleaner	1000-1440	R	3	X X X X
Water heater (40 gallon)	4500-5500	R		
Water pump (deep well)	250-1100	I	4	X 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 over-current protection device, a 300 ampere resettable circuit breaker, as well as 4 smaller resettable circuit breakers for individual circuits, located on the control panel.

Detail of Main Control Panel

Circuit Breakers

30 Amp for Solar Charger

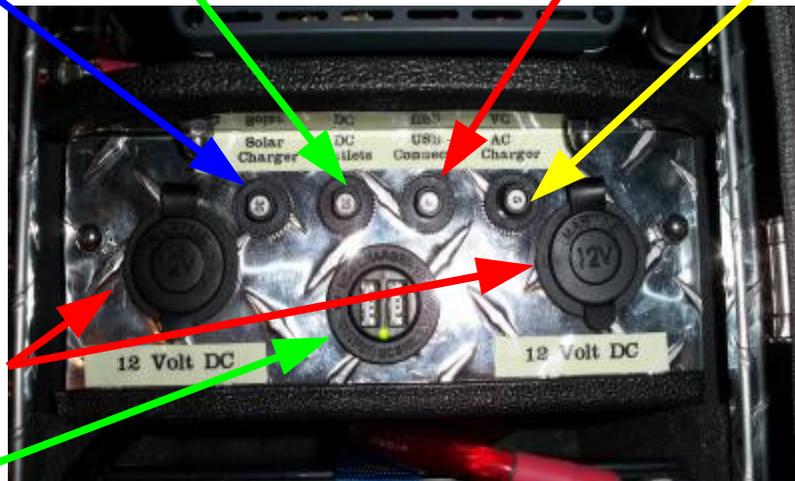
5 Amp for AC Charger

20 Amp for DC Outlets

5 Amp for USB Charger

12 volt DC outlets

USB Charger
Ports



Detail of AC Charger

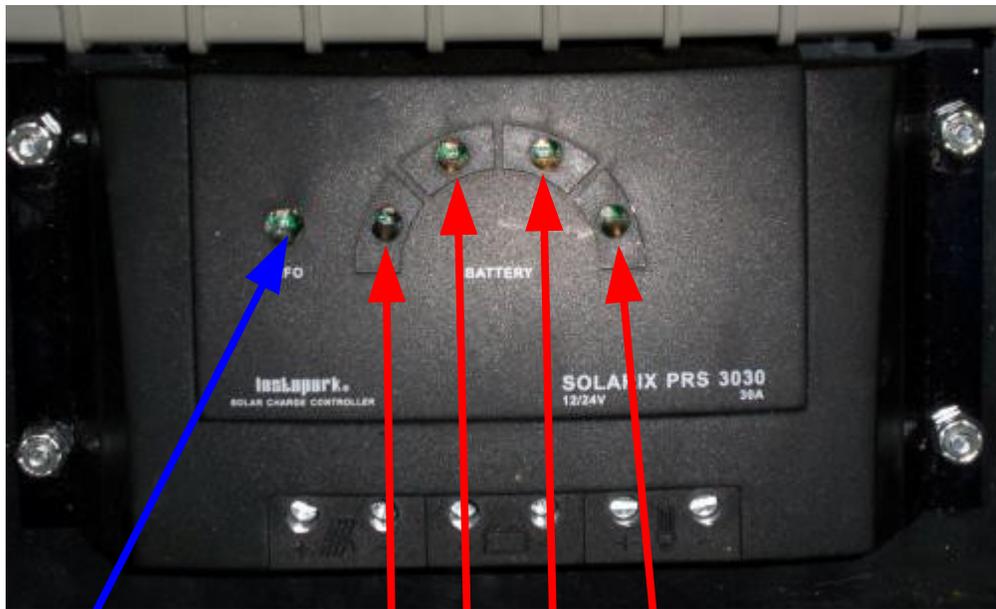


Mode button

Mode setting indicator

Battery charge level indicator

Detail of Solar Charger/Controller



Status LED

(Should be green; will flash red on start-up and to indicate an error condition)

25% 50% 75% 100%

State-of-charge LEDs

(Shows Approximate State of Charge)

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!



Detail of main circuit breaker. Note that the lever is raised. This is the “off” position.



To turn the main breaker on, press the lever down until it locks. To turn the breaker off, press the red button.

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 circuit breaker on and turn the inverter switch on. 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 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.

To use the mobile solar panel assembly, wheel it to a location with a good Southern exposure to the sun, and if using the 200 or 300 watt multiple panel models, retract the wheel assemblies as shown in the pictures below, release the latch and unfold the panels, then loosen the knobs and position the support struts such that the panels face the sun at approximately a 45 degree angle, and re-tighten the knobs. Uncoil as much cable as needed to reach the base unit, and plug it in. Procedure is the same for the 100 watt single-panel model except that the wheels must be locked with the brake knobs to prevent rolling.



The solar panel assembly has been built to be as sturdy as possible, but remember that the panels themselves are made of a low-iron glass, that while quite robust, is nonetheless glass, and WILL BREAK if the panels are dropped or fall onto a hard surface or object. The warranty DOES NOT cover broken solar panels!! Take care in setting up the panels so that the wind will not blow them over, and that they do not tip over. It is recommended that they be guyed in place in potentially windy situations.

On the multi-panel models; it is vital that the wheel assemblies be retracted to allow the panels to sit directly on the ground/floor when the panels are being used and also when they are being stored, otherwise the wheels will allow the unit to roll forward and collapse, falling onto the backs of the panels, possibly resulting in breakage! The single-panel model must likewise have the wheels locked in the same situations for the same reasons. The only time the wheels are lowered/unlocked is when the units are being moved!



Wheel locked in position for moving cart. To unlock, pull out the knob above the



Wheel unlocked. It must be in this position whenever the cart is not being moved.



100 watt single-panel cart wheel brake assembly.

Wheel and turn it 90° to lock it in the outward position, then tip the wheel strut back as shown.

To the right, detail of 200 watt unit with wheels unlocked; support struts extended and strut locking knobs tightened. At this point, just uncoil whatever cable is needed, and plug it into the base unit.



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 main circuit breaker by pressing the red button, then switch off the inverter. 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 LED under the car icon 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 circuit breaker 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 breaker is off, but in order to charge the batteries with a solar panel, or to use the inverter or other power outlets, the main breaker MUST be switched on!

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 booster cables to charge the batteries

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.



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!



!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!



Positive (+)

Negative (-)

Attachment Points for Booster Cables



Be ABSOLUTELY CERTAIN that the cables are correctly connected; that the polarities are correct!



Step 1, above and right: Connect the negative (black) lead only to the power unit, then the vehicle's battery negative terminal.

Step 2, below: Connect the positive (red) lead to the power unit, then the vehicle's positive battery terminal. *Note that vehicle's engine must be running in order to actually charge the batteries!*



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 80+ 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 assembly.



Connectors

Attachment nuts

Detail of the 4 bolts/nuts and connectors that secure the charger assembly

Remove the foam panel, then the 4 nuts shown above, and disconnect the 2 connectors. Lift the charger assembly free of the case lid. Reverse the above steps to re-install.

Battery Removal



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.

In order to reduce the chance of accidental short-circuits while removing batteries, clear plastic tubing sections are provided to slip over the cable ends as they are removed.



Remove all the bolts (6) and connecting cables, release the blue retention strap, remove the D-ring and pull the 2 parts of the strap free of the batteries, and lift the batteries free of the case. **Reverse the above steps to re-install, observing the above picture for correct cable to battery connections**

Things to note before reinstalling the batteries:

Be careful with the wrench(s) and other 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. Bolts and nuts should be snug, not white-knuckled tight. Be absolutely sure that ALL 6 bolts and nuts are tightened! A loose connection will arc and eventually destroy the battery terminal and cable ends, necessitating replacement.

This battery bank is wired in what is called a parallel circuit, so all the positive (red) terminals are wired together, and all the negative (black) terminals are wired together.

When a cable is joined to a terminal in the course of installation, any sparks should be very tiny and faint. A large spark indicates something is connected wrong. Go back and recheck your work.

Note that the large cables from the power head are connected to opposite corners of the battery bank. If they were connected to the same battery, even though cables connect the other batteries, a disproportionate load would be placed on the one battery, dramatically shortening it's life, and degrading system performance.

Removal of Power Head Assembly

Step 1: Remove the batteries. (Page 17)

Step 2: Remove the screw from each side of the power station. See illustrations below.

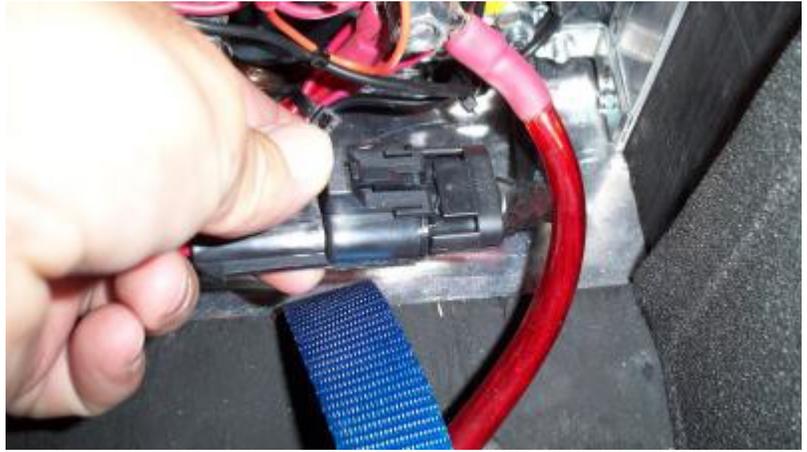
Step 3: Remove the 2 screws securing the circuit breaker



Circuit breaker retention screws.

Power head retention screw. One on each side of case.

Step 4, right: Disconnect the connector by gently pushing up the latch and pulling the 2 halves apart.



Step 5, below: Press the circuit breaker against the side of the inverter, and slide the power head straight up and out.



Reverse the above steps to reinstall.

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 80 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!