

Aqua Shock Solutions LLC

Backpack Shocker

Model AP1

Manual



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******* Important *******

Do not switch the voltage under load

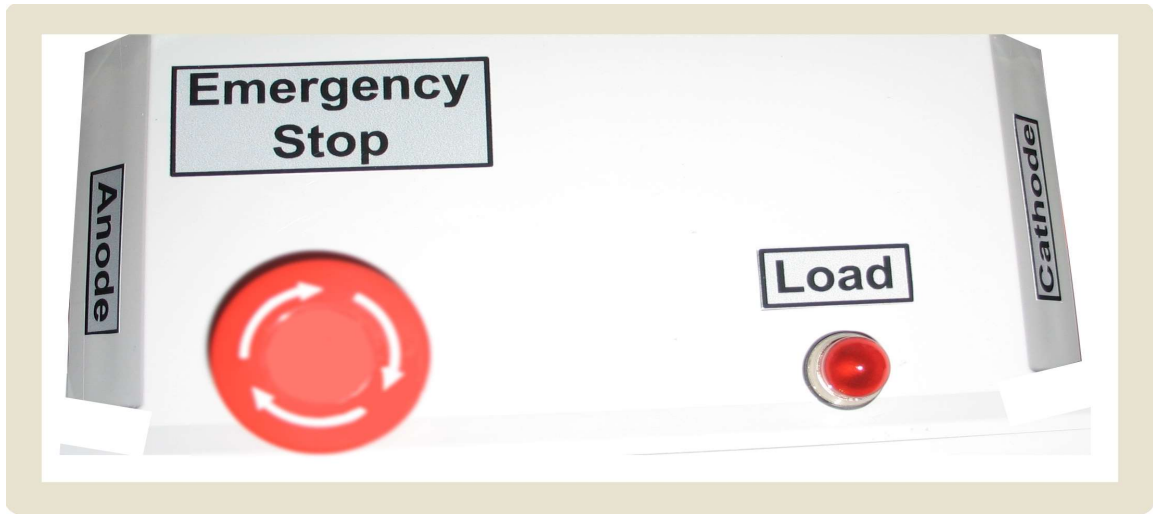
Read and adhere to all safety recommendations

Inspect equipment before each use

User Controls and Inputs



- Main Power:** Turns the unit on/off
- Cathode:** Negative electrode pole input
- Anode:** Positive electrode pole input
- Voltage:** User dial to change voltage
- Frequency:** User dial to change frequency
- Duty Cycle:** User dial to change duty cycle
- Annunciator:** Switch to toggle load annunciation on/off
- Timer Reset:** Resets the load timer



Emergency Stop: Powers off entire unit, twist reset
Load: Illuminates under loading



Battery Box: Accommodates one 24V lithium battery

Specifications table:

Aqua Shock Solutions LLC	
<u>AP1 Electrofisher Technical Specifications</u>	
Controls and Resolution	
Frequency:	10 Hz to 250 Hz Continuously Adjustable 1 Hz Steps
Duty Cycle:	5% to 90% Continuously Adjustable 1%, 100% DC Mode
Voltage Selection:	50V, 100V, 150V, 200V, 250V, 300V, 400V, 500V, 600V, 700V
Annunciator Switch:	Toggles load annunciator on/off
Timer Reset Button:	Resets the load timer
Main Power Switch:	Toggle unit on/off
Emergency Power Mushroom Stop:	Easy accessible power off with twist reset
Display and Metering	
Battery:	Volts, Amps, AH used for session
Output Watts:	Average calculated output watts
Frequency Hz:	Output frequency
Duty Cycle:	Output duty cycle %
Load Feedback:	Time Seconds/Minutes/Hours, Lamp, Annunciator
Power and Performance Capabilities	
Output Watts:	300 watts average, 2,000 watts peak at 20% DC; 5,000 watts at 5% DC
Output Current Limits:	30A pulse average, 50A surge
Output Pulse Energy:	30 Watt-s(Joules)
Conductivity Range:	30 uS to 3,000 uS
Battery:	9.6 AH 24V lithium, 5.5 lbs
Maximum Ambient Temperature:	40-C at 200 watts session average
Safety and Overload Protection	
Unit Construction:	Polycarbonate case, water resistant, 10M-Ohm dielectric isolation
Power Supply:	Isolated, thermally protected, direct independent current control
Overload protection:	Autoreset 300 watts and 50A peak pulse, 40A battery fuse
Case Temperature:	Internal 60-C switch, 50-C autoreset
Load Feedback:	Annunciator, load lamp
Emergency Stop:	Twist reset
Dimensional and Weight Parameters	
Weight:	Dry without battery = 15.0 lbs , With battery 20.5 lbs
Dimensions:	Unit Height = 20" Unit Width = 12" Unit Depth = 6"

Safety Information

General Statement: It is generally known that water and electricity don't mix. Though there are several safety features incorporated into these units, there remains a respectable danger when simple rules are ignored. Proper clothing and daily inspections of the units will also limit the amount of "leak current" felt within the radius of a unit during its use. Below are some safety guidelines. They are not in order of importance. The "user" is defined as the person operating the shocker, and the "crew" is anyone within 10 meters who is assisting the user. "Hot" is defined as electrically active and capable of producing a shock hazard.

1. Clothing/apparel for the user and crew:
 - a: Non-leaking waders, preferably the chest type for deep applications.
 - b: Latex or rubber gloves for any persons within 10 meters of operational units.
 - c: Boots with excellent traction to reduce the chances of falling into "hot" water.
 - d: Dry clothing under the protective layers. This minimizes the overall danger.
2. Use the annunciator at all times to keep the crew alert to the application of current to the water.
3. Never use the poles to move or transfer objects to persons without the clothing specified in #1.
4. Communicate intentions to begin shocking to keep the crew in tune.
5. Immediately stop shocking if the user or any crew comes into raw contact with the water or appears to have lost stability or footing.
6. Crews assisting a user should always be behind the user, such that the current potency is minimized should an accident occur.
7. Electrode pole wires or shocker unit wires with any worn insulators should be taped.
8. Do not touch the Electrode pole ends together during loading.
9. If any leak current is felt, check apparel and dry clothing.
10. Do not assume the pole "metal" sections are only conductive. The entire pole can become "hot" when in use.
11. Do not allow any portion of the shocker box to come in contact with the water.
12. Assume that when the unit is powered on, the water is "hot."
13. Perform equipment inspections on dry land with the unit powered off.

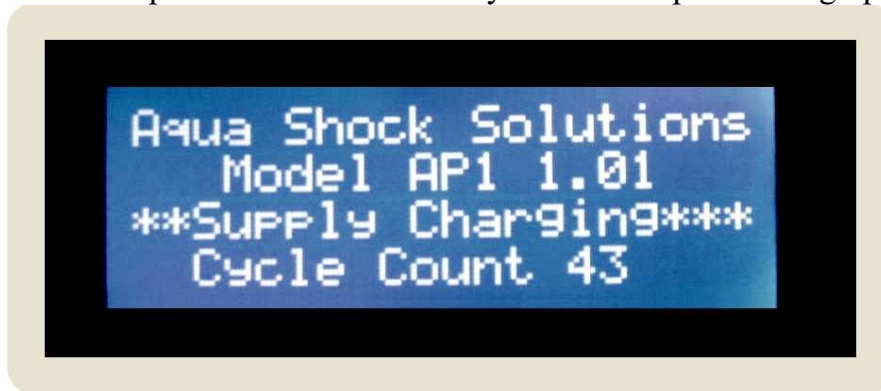
Operation and Example of Use: The following procedure is an example for a general application using the unit to collect fish.

Preparation

1. Inspect the unit and poles for any sign of damage. Cracks in the main housing or missing components may let water in, resulting in a shock hazard. Pole wire insulation should not be worn or breached. The button switch should depress freely and have movement.
2. Dress in accordance with the safety recommendations outlined in the **safety section** within this chapter.
3. Lay the shocker on its back to allow for proper battery installation.
4. Ensure the unit main power switch is off.
5. Unfasten the battery strap and place the battery pack in the holder. Use the battery strap to secure the battery. Plug in the battery. The plugs ensure against reverse polarity.
6. Plug in the pole set to desired polarity and assist the main operator in putting on the pack. Secure backpack straps to desired tightness.
7. If the unit is to be powered on **out of the water**, ensure the pole set is **not plugged in**. Accidental loading out of the water can create a shock hazard.

Powering On Procedure

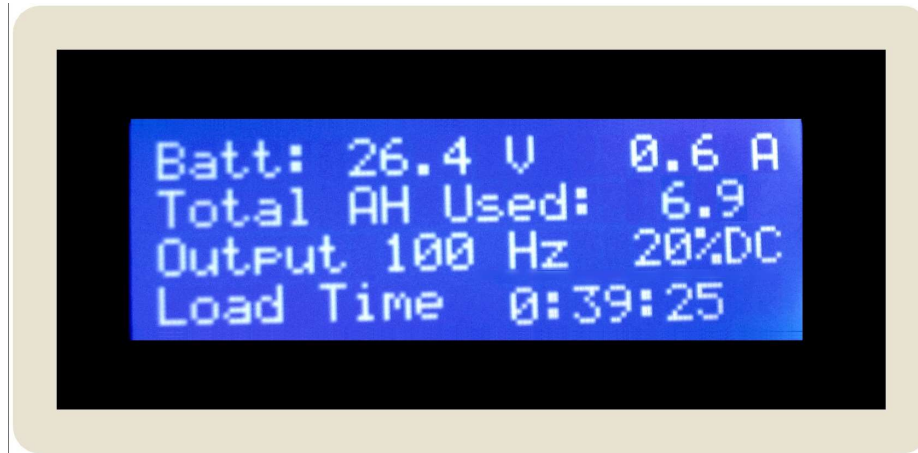
8. Position crew in the water and double check local safety regulations
9. Use the main power switch to power on the unit. Be sure the operator is not engaging the button switch during power up. Ensure the poles are not in contact with personal and assume they are **“hot”** upon starting up the unit.



10. The display LCD will illuminate and the “Charging” power up screen should show for 5 to 7 seconds. It will list the software version and cycle count.

11. If the unit loads without operation of the button switch, **turn it off** and begin “Pole Set Diagnostics” in the troubleshooting section.

Idle Mode



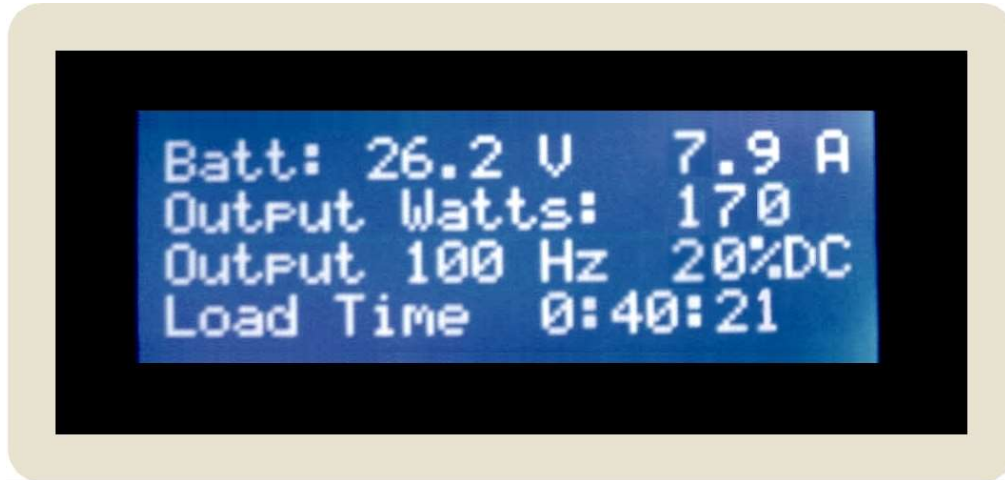
12. The Idle screen above will indicate the unit is ready for loading.
- Battery voltage displays the battery voltage.
 - To the right of voltage is the battery current in amps. An idle current between .5 and 1 amp is considered normal.
 - “Total AH Used” displays the battery amp-hours used during this cycle. This resets every time the unit is powered off.
 - The “Output” frequency and duty cycle will be displayed.
 - Load time is stored in memory and will resume where it left off in the previous session.
13. **Load time** can be reset using the button on the left side of the case.
14. **Load annunciation** can be toggled on/off on the left side of the case. Be sure to adhere to local safety regulations in regards to load annunciation.

Setting the outputs

15. The **voltage** setting can be **adjusted only in idle mode**. Changing the voltage during loading can damage the unit’s power supply and possibly corrupt the software. Change the voltages slowly (1 second). Quickly adjusting the voltages up/down through multiple steps is not recommended.
16. **Frequency** and **duty cycle** can be changed in idle and under load.
- The dials are continuously adjustable and have about 10 turns to complete the range.
 - Duty cycle has a minimum of 5%. To get to pure DC, continue to turn the knob clockwise past 90% until it reads 100%.

Loading the unit

17. The button switch on the pole set is used to load the unit. Upon activation, you should observe:
- a.) The “Load” LED lamp turns red
 - b.) The load annunciator sounds (if activated using the side switch)
 - c.) An audible click inside the case
 - d.) The load screen on the LCD should replace the idle screen



18. The load screen display:
- a.) Battery voltage and amps
 - b.) Output watts
 - c.) Output frequency and duty cycle
 - d.) Load timer/Fault codes, if any
19. Releasing the button switch will return the unit to idle mode.
20. Your choice for voltage and duty cycle will have a major impact on the amount of power used. These are some guidelines to **help maximize battery efficiency** for your chosen frequency.
- a.) The unit’s efficiency is optimal between 100 and 200 watts. Tuning your voltage and duty cycle to operate in this range will also minimize overloading faults during surges.
 - b.) “300 Watts Limit” fault code should be handled **lowering the duty cycle** first, then the voltage.
 - c.) “Pulse Over Current” fault code should always be handled by **lowering the voltage**. Starting with low voltage and low duty cycle and slowly increasing them until proper stunning, is a decent approach towards long battery life.
21. The main power switch can power off the unit at any time. Turn the unit off before leaving the water or removing the pole set.

Physical Reset Procedures

1. The **emergency stop** can be used at any time. This stop will immediately turn off the unit completely. If used, turn the main power switch off. To re-activate, twist the stop button until it pops back up. The unit will not power on until the emergency stop has been reset. Turn on the main power to resume use.
2. **Battery fuses** require physically pulling the fuse out of the fuse holder and replacing it with a new one.
3. The unit is **thermally protected**. Should the internal case temperature exceed **60°C**, the unit will completely shut off. Complete loss of power during heavy use during hot days would warrant this condition. Set aside and allow the unit to cool. The switch will **automatically reset** when the case reaches **50°C**.

Faults on the Display and Beeps

1. **“300 Watts Limit”** This fault replaces the timer on the 4th row of the LCD when the average output watts exceeds **300**. Loading will be disengaged. You will hear a **“Beep, Beep, Beep, 5 second delay, Beep.”** The last beep means the unit can be loaded again using the button switch. If more than 60 seconds pass with no action, the fault will clear automatically and return to idle mode.
2. **“Pulse Over Current”** This fault replaces the timer on the 4th row of the LCD when the output pulse exceeds **50 amps**. Loading will be disengaged. You will hear a **“Beep, Beep, Beep, 5 second delay, Beep.”** The last beep means the unit can be loaded again using the button switch. If more than 60 seconds pass with no action, the fault will clear automatically and return to idle mode.
3. **“Power Supply Fault”** This fault displays when the power up was unsuccessful. You will hear **short beeps** every 2 seconds. This fault can only be cleared by powering the unit off/on.
4. **“Low Battery”** This fault displays when the battery voltage is below 23 volts during power on and 22 volts during use. You will hear **short beeps** every 2 seconds. The battery voltage will be displayed. This fault can only be cleared by powering the unit off/on.

Lithium Battery Safety

General Statement: The choice to use the most recent battery technology comes with an increased responsibility of understanding lithium battery safety. With proper care, your batteries should last for at least 5 years. The following rules and statements should be fully understood and observed.

***** Improper usage could result in fire and property loss *****

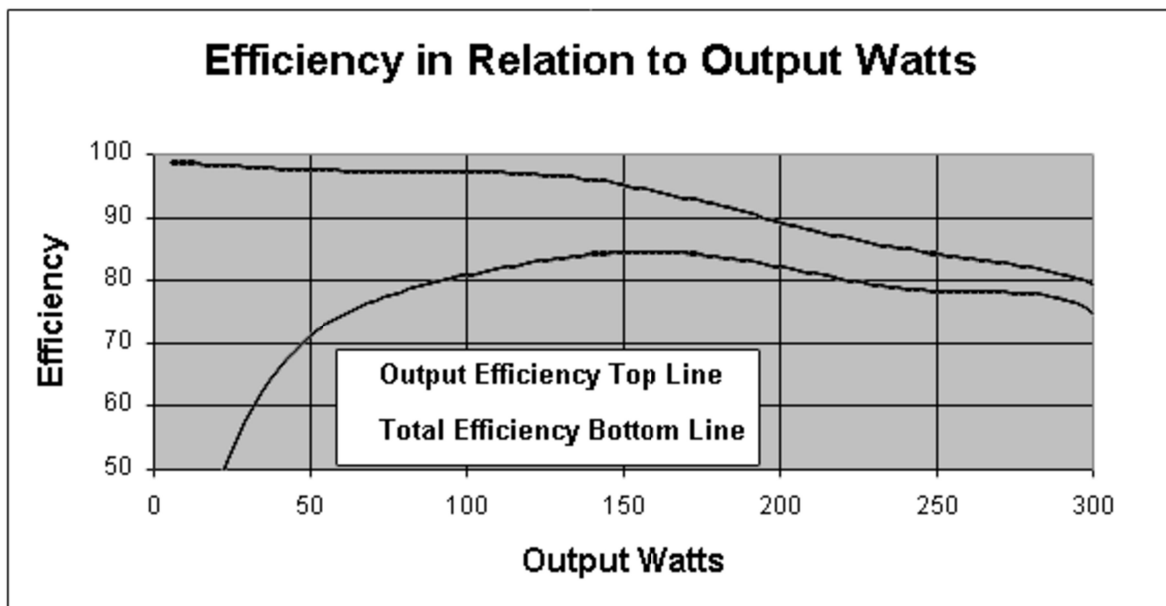
1. Do not leave batteries unattended during the charging process unless:
 - a.) The battery and charger are set on a concrete or metal surface.
 - b.) There is at least 2 meters of space around and above the battery during charging effort.
 - c.) The ambient temperature is between 0 C and 40°C.
2. Do not store or operate the batteries in temperatures $> 40^{\circ}\text{C}$.
3. Blunt damage or visual stress should warrant immediate replacement.
4. There is no diagnostic process for these batteries since they have internal circuitry that regulates the current flow.
5. The batteries should never feel more than warm to the touch. Should this not be the case, discontinue use and replace.
6. Usage of your **provided charger is highly recommended** to ensure battery longevity. Usage of other chargers might conflict with the battery's internal circuitry resulting in improper charging and long term degradation.

AP1 Power Supply Summary

The power supply supplying the energy to delivery pulse DC outputs is a current controlled design. Multiple stages of regulation monitor currents throughout the stages, providing a very robust system. Regulation is done at the analog and digital levels. This approach allows for redundant protection and maximizes the service life of the system.

Voltage output has an associated deviation. The next section describes the range of outputs to be expected.

AP1 Efficiency Graph



Description: Displaying two lines provides two ways of accessing the system. The system uses about 20 watts of power when on, regardless of load usage. For example, requesting just 30 watts of output power results in 97% output efficiency and 59% total efficiency. This is because the base system usage is 20 watts and an additional watt is being lost to produce an output of 30 watts. ($30/51 = 59\%$, $30/31 = 97\%$)

The apex of total efficiency is best between 100 and 200 watts because the base usage becomes relatively small and the power supply is still operating at decent losses. Above 200 watts, the power supply loss steadily increases, reducing both reported efficiencies.

Example of use:

1. At 200 watts of output power, the efficiency of the total system is 83%.
2. At 100 watts of output power, the power output alone is 97% efficient.
3. At a maximum of 300 watts of power, the total efficiency is 75%.

Output Voltage Bandwidth

The AP1 is a current controlled system and voltage is not regulated. Thus, the voltage range seen at the outputs will vary depending on battery life and load usage. At minimum battery life and maximum load, the end of each pulse will be near the “Absolute Min.” With a fresh battery and very light loading, the beginning of each pulse will be near the “Absolute Max.”

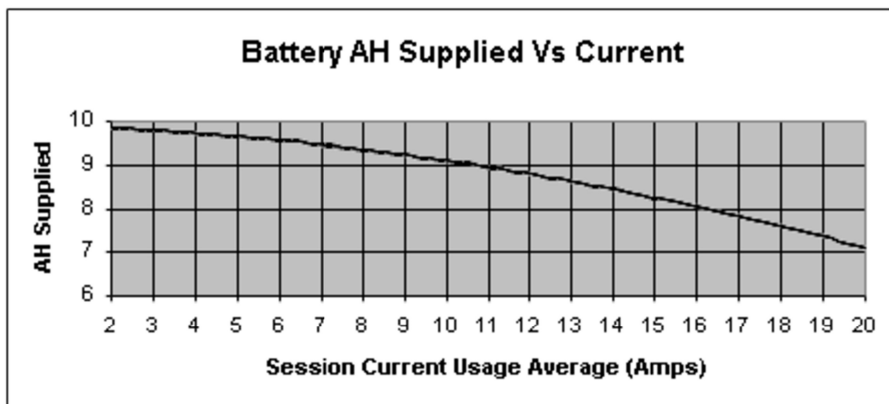
Voltage Setting	Absolute Min	Absolute Max	Range Volts
50 V	35	54	19
100 V	72	108	36
150 V	110	162	52
200 V	148	216	68
250 V	187	270	83
300 V	227	324	97
400 V	306	432	126
500 V	387	540	153
600 V	470	648	178
700 V	554	756	202

Example of Use:

1. At 100 Volts setting, the maximum voltage possible is 108 Volts.
2. At 500 Volts setting, the minimum voltage possible is 387 Volts.

Battery Performance

The latest in lithium battery technologies provides lightweight setups with excellent longevity. These batteries are not immune to internal loss and operating them at higher powers results in less overall amp hours per session. Similar to using your AP1 in 100 to 200 watts range for maximum efficiency, these batteries also benefit from lower currents.



Example of Use:

1. If the average session usage is 5 amps (125 watts), 9.5AH of capacity is available.
2. If the average session usage is 15 amps (350 watts), 8.3AH of capacity is available.

Peak Power and Pulse Power Capabilities

Table Summary of Maximum Output Watts/Amps and Pulse Power Delivery

Voltage Setting	Peak Watts	Peak Amps	Max Pulse Watt-S	Cutoff Freq
50	1278	30	10	30
100	2582	30	15	20
150	3893	30	22	15
200	5120	30	28	10
250	5130	28	10	30
300	5155	26	10	28
400	5300	17	13	20
500	5500	14	23	12
600	5750	11	28	11
700	6000	11	30	10

Peak Watts = The maximum watts delivery capability at any point in time

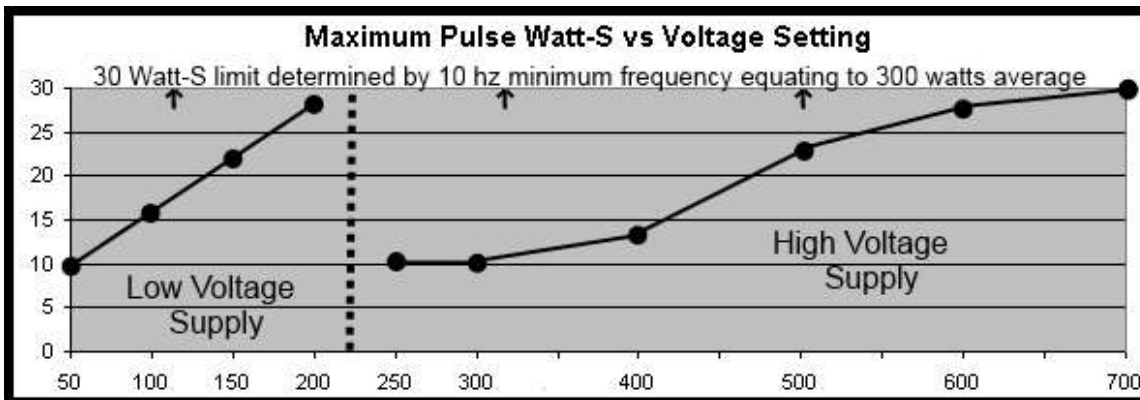
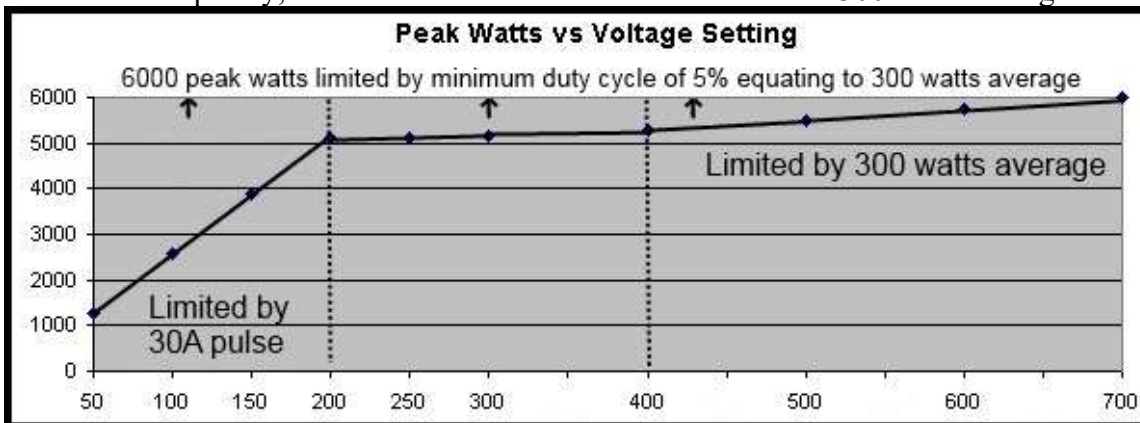
Peak Amps = The maximum amps delivery capability at any point in time

Max Pulse Watt-S = Peak watts * pulse width. Example: 5000 watts for 5 ms = 25 W-S

Cutoff Freq = The minimum frequency that can support the maximum pulse energy.

Example: At 150V, the 22 pulse watt-s capability can be supported down to 15Hz.

Below this frequency, Over-watts limit occurs before the normal 300 watts average.



Display Resolution and Other Data

The LCD display reports sampled data at 10-bit resolution from many sensors. Although internal logistics processing utilize this, the reported values are averaged reducing the resolution for display purposes. Output watts are not directly measured but are calculated from battery volts/amps with an applied efficiency algorithm.

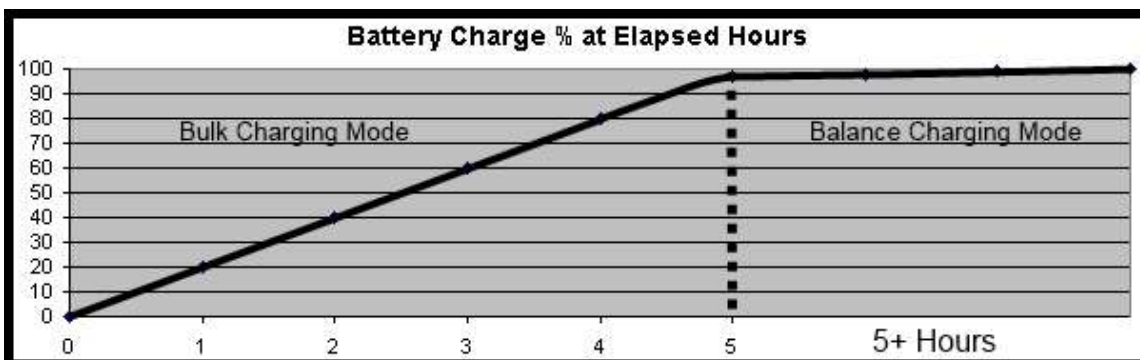
Display	Units	Nominal Range	Resolution	Notes:
Battery Volts	Volts	20 to 28	0.2	-
Battery Amps	Amps	0 to 50	0.1	-
Output Watts	Watts	0 to 400	1 to 10	Increases linearly from 0 watts to 300 watts
Frequency	Hz	10 to 250	0.5	-
Duty Cycle	%	5 to 90,100	0.5	Does not apply to 100% duty cycle
Battery AH	Amp hours	0 to 10	0.1	-
Timer	sec/min/hour	0-59:0-59:0-99	0.1	Applies to total seconds count

Case Internal Temperature Rise at Continuous Watts

Ambient° C	100 Watts	200 Watts	300 Watts
20	25	40	48
25	30	47	52
30	36	55	57
35	46	57	61
40	57	60	65

Notes: The case is actively cooled internally and designed to dissipate 100 watts of heat. At maximum usage, this will maintain the internal temperature to roughly **25°C above ambient**. Heavy session average output watts usage during hot weather greatly increases the chances of thermal shutdown at 60°C. This table does not take into account **sun exposure**, which reduces thermal transfer.

Battery Charge Time



Notes: For a healthy battery fully discharged, **5 hours** completes 97% of the charge. Balance charging can last several hours depending on the health of the battery. Internal battery logistics are balancing the cells to ensure long-term stability of the pack.

Storage and Maintenance

Several simple storage and maintenance techniques can greatly prolong the full functionality of your equipment and greatly reduce the chances of costly maintenance and down time. Improper use may void the warranty.

Main Backpack Shocker Unit:

1. Store you unit in a **cool dry place** when finished. Moist warm environments, such as: truck beds, outdoor sheds and other poorly ventilated areas increase corrosion of connectors and degrade the polymers.
2. Any holes, cracks or missing parts let water and moisture into unit greatly accelerating **internal degradation**. Seal any visible cracks and/or have the unit serviced to replace damaged parts.
3. For cosmetic cleaning, use only mild detergent and a moist towel. The backpack straps can be removed and machine-washed.
4. The XT battery connector plug can be lubricated with dielectric grease, found at any automotive store.

Electrode Pole Set:

1. Store your pole set in a **cool dry place** when finished. Moist warm environments, such as: truck beds, outdoor sheds and other poorly ventilated areas increase corrosion of connectors and internals.
2. Store **upright** to allow water to drain from hoops
3. The plugs can be lubricated with dielectric grease, found at any automotive store.
4. Double check the plugs to ensure the wiring is secure and none of screws are loose.

Battery and Charger:

1. The XT battery connector plugs can be lubricated with dielectric grease, found at any automotive store.
2. Any batteries dropped should be immediately inspected for cracks or breaches. Any physically damaged batteries should be decommissioned and replaced to reduce the risk of fire.
3. The charger and batteries should also be stored in a cool dry place when not in use.
4. Batteries stored long term should be stored at 20% charge. Placing a fully discharged battery on the charger for 1 hour can do this.

Basic troubleshooting

Normal Sounds:

1. A hum coming from the main box during all operations
2. A single click noise during loading and unloading
3. Beeps heard during faults

Scenarios not including normal faults:

1. **The unit will not power on. LCD is not lighted and nothing is heard inside.**
 - a.) Check the emergency stop. Rotate it and check for proper operation.
 - b.) Check that the power switch operates with a clean “click.”
 - c.) The battery fuse may be blown. Open the holder and look for a breakage.
 - d.) Is the unit very warm to the touch and was previously used rigorously? The internal thermal break may be engaged and require a cool down time. It will reset automatically at 50°C.
2. **The unit will power on but will not load or “click” when using the button.**
 - a.) Try a different pole set. A faulty button may not be making contact. Use the pole diagnostics chart to assist in diagnosing pole set issues.
 - b.) If the unit load LED illuminates and a click is heard but there is no power output, the pole set electrodes should be inspected using the diagnostics. A low voltage and/or duty cycle setting may result in negligible power output.
3. **“Power Supply Fault”**
 - a.) If powering up the unit at higher voltages, sometimes the supply will not have time to charge its internal components before entering idle mode. Turn off and set the voltage to 50V. Turn on the unit.
 - b.) Multiple consecutive attempts to power up unit resulting in this fault warrants service.
4. **The unit becomes unresponsive during use or faults under no load.**
 - a.) Changes to voltage and/or duty cycle/frequency are not recommended **during loading**. Although several fail-safes mitigate this condition, random software lockouts can occur. Cycle the unit on/off.
 - b.) “Pulse Over Current” or “300 Watts Limit” faults can be triggered during changes to voltage. The fault can be cleared by reloading the unit after the 5s cool down time discussed in the “Faults” section.

Warranty and Service

Contact Information: Aqua Shock Solutions LLC
aquashocksolutionsllc@gmail.com (865) 963-6685

Warranty and Service Statement

Obligation: Aqua Shock Solutions LLC warrants only to the original end user that the products and parts on the final bill of sale will be free from defects in material and workmanship for **2 years**, this period beginning on product delivery date to the end user. Aqua Shock Solutions LLC is also liable for all shipping expenses within the warranty period. A FedEx shipping account will be used for transit.

What May Void the Warranty. This Limited Warranty shall be null and void in the following circumstances:

1. Modification or repair of any units or parts by the end user or any non-authorized Aqua Shock Solutions LLC personnel.
2. Improper usages or blunt trauma by accident.
3. Failure of the end user to provide basic weather protection or evidence of prolonged water exposure.
4. Failure by the end user to follow the return service procedure outlined below.

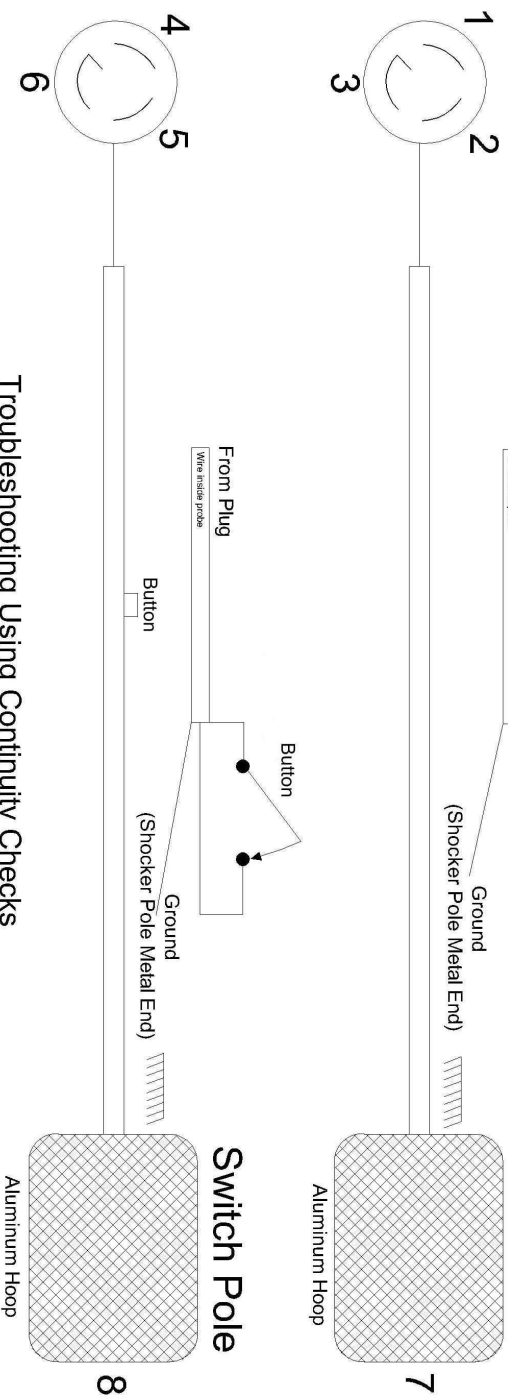
Servicing procedure and obligations within the warranty period:

1. Contact Aqua Shock Solutions LLC.
2. A FedEx shipping label will be emailed.
3. Return equipment to Aqua Shock Solutions LLC using the FedEx label provided.
4. Once equipment arrives at the service location, the return/service date will be communicated based on the level of service required.
5. Repaired, replaced, or refurbished equipment returned to user/customer.

Servicing procedure outside the warranty period:

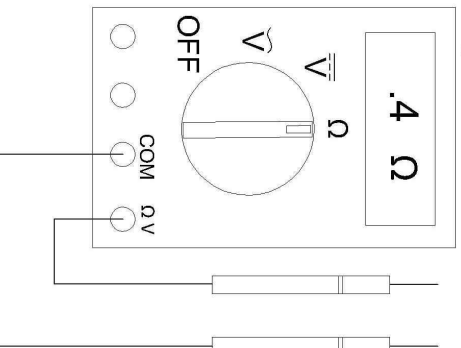
1. Contact Aqua Shock Solutions LLC for return shipping address.
2. Package your equipment securely and ship to address provided.
3. A quote for the service and return shipping will be issued at this time.
4. All serviced equipment will be returned via FedEx ground.
5. Customer is issued an invoice for repair costs, as well as shipping costs.

Electrode Pole Continuity Diagnostics - Switch side does not matter



Troubleshooting Using Continuity Checks

1. Unplug poles from shocker box
2. Set voltmeter to Ohms and compare to "Nominal" column
3. Place voltmeter probes at numbered plug terminals and correlate "nominal" results using table below



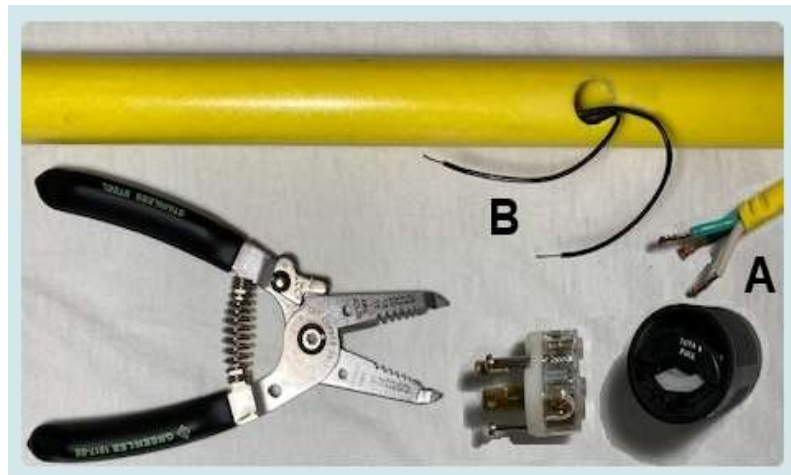
Red Tip	Black Tip	Lever Pressed	Nominal	Abnormal Reading?
1	2	Not applicable	< 10	Rewire jumper inside plug to restore continuity
1	3	Not applicable	OL	Incorrect wiring or short
2	3	Not applicable	OL	Incorrect wiring or short
3	7	Not applicable	<10	Rewire to probe metal housing at hoop connector
4	5	No	OL	Button is stuck in closed position or short, rewire
4	5	Yes	< 50	Button malfunction
4	6	No	OL	Incorrect wiring or short
5	6	No	OL	Incorrect wiring or short
6	8	Not applicable	< 10	Rewire to probe metal housing at hoop connector

OL is defined as an open circuit or little continuity (R > 100K Ohms)

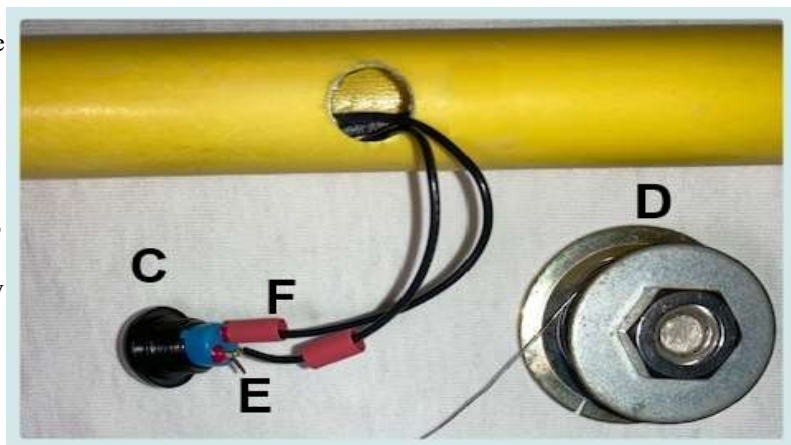
Button Replacement

The button can be quickly replaced in the field if necessary by simply swapping it and taping a new one in place without the sleeve. This guide ensures the best connection and longevity.

- 1.) Disassemble the plug (A) from the yellow wire to allow for the new sleeve.
- 2.) Carefully cut away the old sleeve and any tape.
- 3.) Remove button and cut wires as close to the button as possible. Use wire strippers to expose 1/2" of wiring (B).
- 4.) Inspect all connections and wiring for damage. Damaged pole wiring will require service.



- 5.) Cut two 1/2" pieces of small shrink wrap and slide one on each wire first. Don't use more, or the button won't fit in the hole.
- 6.) Feed newly exposed wires through lugs (E). Twist around the lugs and ensure its tight.
- 7.) Use solder (D) to secure wires onto button (C).
- 8.) Slide shrink over connections fully up onto button. Shrink should completely cover junctions (F) and any exposed wire. If not, redo connections. Use a lighter to shrink.



- 9.) Carefully work button and wiring into hole. Tape the button in place using electrical tape or any robust tape.
- 10.) Slide the sleeve (H) over the button and align it with the sleeve hole. Use a lighter to shrink the sleeve onto the pole. Be careful not to apply too much heat, or it will tear.
- 11.) Assembly the plug (G) onto the wire. The green wire goes to "3" L terminal. White and black can be attached to either "1" or "2."

