

# MANUAL

## 15-A Backpack



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SMITH-ROOT INC.  
MODEL 15-A ELECTROFISHER  
INSTRUCTION MANUAL

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## 1.0 INTRODUCTION TO ELECTROFISHING

For many years it has been known that fish react to electric currents passed through water. These currents either frighten, lead, stun, or kill fish and it is these aspects that have interested fisheries biologists.

Smith-Root has produced the Type V\* Through Model 15-A electrofishers. Our electrofishers represent the state of the art in design and electronic components. Smith-Root electrofishers are manufactured with the highest quality electronic components and materials available insuring maximum reliability and performance. The following discussion should help you to get the most from your electrofisher.

### 1.1 OUTPUT PARAMETERS

ALTERNATING CURRENT is a flow of electricity in which the direction of current flow reverses a specified number of times per second.

When a fish enters an A.C. field of sufficient strength, it is stunned and can be easily picked up with a net for examination. There is usually a very strong contraction of the body muscles, which accounts for the rigid condition of the fish when they are picked up. When using alternating current, care must be taken not to use too high a voltage or the larger fish may be killed. The muscular contractions are sometimes so severe that vertebrae are fractured and/or brain damage may occur.

DIRECT CURRENT is a flow of current in one direction only. This flow is from the negative cathode to the positive anode. (electron flow)

The reaction of fish to direct current is quite different from their reaction to alternating current. The first reaction of the fish is to turn toward the positive anode and start to swim toward it. This reaction, known as galvanotaxis, will continue until the fish either reaches the anode or encounters a current sufficiently strong to cause it to turn on its side and become incapable of any further forward movement. This reaction is known as galvanonarcosis. The severe and often harmful muscle contractions encountered with alternating current do not occur and the fish recover much more quickly from a direct current shock.

\*Smith-Root Inc. no longer manufactures the Type V Electrofisher.

Thus the mortality rate is much less with direct current than with alternating current. Also, galvanotaxis does not occur with alternating current.

Even greater anode attraction is possible by the use of pulsed direct current. Pulsed direct current is obtained by interrupting a direct current flow with an electronically controlled switch which will give a number of on and off pulses of direct current. Different species of fish differ in the number of pulses per second which will best attract them. Pulse frequency can be important to produce the desired galvanotaxis reaction. Research has also shown that a pulse shape with a fast rise slow decay enhances the galvanotaxis reaction.

## 2.0 CONSIDERATIONS FOR ELECTROFISHING

The effectiveness of the shocker's output is sometimes affected drastically by environmental and/or biological factors. The power that reaches the fish is greatly affected by the waters parameters and the animals physiological make-up. If these environmental and biological parameters are too far out of line, poor electrofishing will result. Adjustments in the electrofishers output can help to reduce erratic actions and the escape of fish. The following discussion should help to clarify the wide variation of reactions among fish.

### 2.1 INFLUENCE OF CONDUCTIVITY

The conductivity of the water and of the fish flesh are the main factors that effect electrofishing.

The conductivity of natural water depends on the quantity of dissolved salts and minerals in the water available to carry electric current.

Distilled water is a very good insulator of electric current. If a voltage is applied between two electrodes in distilled water, little or no current would flow through the water and the water would be considered to have extremely low conductivity.

In the past it was customary to talk in terms of volts per inch required to envoke a given response in a fish. From a theoretical standpoint, it is possible to have many volts per inch and not shock the fish at all.

For example, if a fish were placed in distilled water with high voltage applied, no current would flow through the water and hence, no

current would pass through the fish's body even though many volts per inch may be present. What a fish reacts to is the current flowing through its body.

On the other side of the coin if we were able to put a fish in water that had very high conductivity and applied a voltage, a corresponding large current would flow through the water, but negligible current would flow through the fish's body because the electric current would find it much easier to pass through the highly conductive water than through the fish's flesh of medium to low conductivity.

It can be seen from the afore mentioned considerations that a fish will receive the maximum shock (current flow) when a voltage is impressed across water having a conductance per cube equal to the conductance per cube of fish flesh.

Generally in lower conductivity, higher voltage is needed in order to get a response from the fish. It also helps to maintain a large cathode while keeping the anode medium size (not over 100 sq. in.). For a given current the smaller anode has a more intense current field near the anode while a large anode distributes the current over a larger area. The Type VIII-A, Model 11-A, Model 15-A and Type VI-A have the high voltage necessary for low conductivity use down to about 10 microsiemens/cm<sup>3</sup>.

In waters of very high conductivity the only solution is to run very heavy current through the water. However, a limit is soon reached where the electrofisher cannot deliver sufficient current to electrofish successfully. The 7.5 GPP has the high current capability necessary for high conductivity use up to about 10,000 microsiemens/cm<sup>3</sup>.

## 2.2 EFFECTS OF FISH SIZE

Individual variation is notable among fish even though they are of the same species and have similar lengths. However, the longer the individual of a species, generally, the more sensitive it is to electrical shock. Fish absorb power as a function of body surface area.

## 2.3 EFFECTS OF TEMPERATURE

Fish flesh has a certain conductivity that increases with increasing temperature. The success of electrofishing may be enhanced or hindered by this effect depending upon whether the water's conductivity is higher or lower than the fish's flesh. If it is in a direction to cause a closer conductivity match, the fish will receive a greater

shock.

Output energies commonly used in electrofishing are capable of killing fish. Mortalities caused by A.C. electrofishing are usually higher than those caused by D.C. or pulsed D.C.. Harmful effects from pulsed D.C. are usually a result of excessive exposure or very intense electrical fields.

\*\* To convert ohms to microsiemens -  $\text{microsiemen} = 1(10^6)/(\text{ohm/cm}^3)$   
\*\*\* siemen is the internationally used value of conductance - mho=siemen

#### 4.1 DO'S AND DON'TS FOR ELECTROFISHING

DO - Always make sure that all personnel are clear of the area surrounding the anode before turning on the power. DOUBLE CHECK.

DON'T - Continue to electrofish if your boots or gloves become damp or wet.

DO - Make sure that the anode and cathode electrodes make good connection to the output cable and that both electrodes are in contact with the water.

DON'T - Operate an electrofisher if you have any prior heart ailment history or if you have been under abnormal strain, which may weaken your heart.

DO - Study and know how to administer first aid treatment for electrical shock.

DON'T - Operate an electrofisher without a second person to back you up in case of an emergency.

Do - Wear a floatation device when electrofishing. More than one fisherman has been sucked under by his hip waders.

Do - Remove wristwatch, rings and any other jewelry when handling batteries. A battery is capable of producing very high currents that can severely burn.

DON'T - Smoke or permit flame or spark to occur near a battery at any time, particularly when it is charging.

DO - Take precautions to prevent unqualified personnel from tampering with or attempting to operate the electrofisher.

DO - Have electrical circuits serviced only by qualified technicians.

DO - Disconnect the battery when the electrofisher is not in use.

DON'T - Operate generator without covers or screens. Keep hands, hair, necktie and test leads well away from the flywheel and moving engine parts.

DO - Keep hands and face away from the carburetor when the air cleaner is removed. A sudden backfire can cause serious burns.

DO - !BE CAREFUL!

## 5.0 MODEL 15-A ELECTROFISHER

### 5.1 DESCRIPTION

The Model 15-A Electrofisher is a generator powered, backpack mounted, high energy electrofisher. It is designed for use in low to medium conductivity waters. The generator is the TAS model QEG-300. This generator is capable of delivering 250 watts continuous and 300 watts intermittently. The generator output is 115 volts AC at 300 hertz and 12 volts DC rated at 10 amps. The 12 volts DC can be used to charge 12v batteries. The 115 volts AC has been modified for electrofisher operation. The 115 volts can still be used to power lights and hand tools provided they are a two-wire, ungrounded type with a plastic case.

The Model 15-A Electrofisher uses the 115 volts AC to deliver 200 to 1200 volts of DC and pulsed DC for best fish attraction over a wide range of water conductivities. The electrofisher is mounted in a gasket-sealed, weather proof case located above the generator for best weight distribution. The generator is mounted so that the exhaust is directed away from the operator.

The generator and electrofisher are removable as a single unit from the packframe. A hole is provided in the mounting plate near the generator's petrol fill cap for refueling. The recommended fuel mixture is 32 parts petrol to 1 part synthetic chain saw oil. A full tank provides about 1.5 hours of continuous operation.

The backpack is a reinforced nylon plastic frame manufactured by Coleman, which not only provides excellent electrical insulation, but also has proven to be much more durable than its aluminum counterpart. The frame features over 2000 possible adjustment points providing a comfortable fit for almost any size person. For added safety, an "instant pack release" is provided for an emergency situation, should it ever arise. Just pull on two rings and the whole pack frame drops instantly.

A lightweight fiberglass anode pole and floating cathode are supplied with each new Model 15-A Electrofisher. An optional second anode pole can be plugged into the cathode receptical.



## 5.2 CONTROLS AND FEATURES

The voltage control for the Model 15-A is located so that it can be adjusted by the operator without removing the backpack. As a safety feature, an audio tone is provided giving the operator and crew positive indication that an output voltage is present. The LCD timer indicates true shocking time in seconds.

**VOLTAGE RANGE SWITCH** - This switch is located on the left side near the bottom corner. It is placed in this position so that the operator can reach the switch without removing the packframe. The switch has 11 voltage ranges. The 200 to 400 volt ranges are designed for high conductivity waters (300 to 400 microsiemens). The 500 to 800 volt ranges for medium conductivities (100 to 300 microseimens). The 900 to 1200 volt ranges for low conductivities (10 to 100 microseimens).

**FREQUENCY SWITCH** - This switch is located on the left side near the center of the unit. It selects the frequency of the output pulses. The standard frequencies are DC (0), 15, 30, 60, 90 and 120 pulses per second. As many as five additional custom frequencies, ranging up to 250 pulses per second, may be ordered.

**OUTPUT VOLTAGE INDICATOR** - The audio indicator provides a strong audio tone to give positive indication to all crew members that an output voltage greater than about 30 volts is present between the anode and cathode. This audio indicator also serves as an input current indicator. It begins to slowly beep at an input current of 1.25 amps, and beeps faster as the input current goes up.

**OVERLOAD INDICATOR** - Overload condition will be noted by a high beep rate of the audio tone and the L.E.D. overload indicator will come on. The output is disabled when the current drawn from the generator exceeds 3 amps. Overload conditions are cleared by releasing the anode pole switch. It is recommended that a lower output voltage range be selected if an overload condition is encountered.

**SELF TEST INDICATOR** - L.E.D. indicator comes on to give positive indication that the anode and cathode wiring and switches are OK. Failure of this indicator to come on when the anode pole switch(es) are pressed indicates that there is most likely a problem with the anode or cathode.

**TIMER** - The 6 digit timer totalizes seconds of shocking time while the anode pole switch is closed. It accumulates time in fractional seconds to give a more accurate indication of true shocking time. A view window is located on the left side top of the instrument case to read the accumulated time. The timer is resettable by placing a magnet over the word RESET. A reset magnet is provided, and may be found on its keeper under the electrofisher on the left side of the unit. If this magnet is lost, the magnet on the anode pole may be used.

FUELING - Remove the generator and electrofisher from the packframe. Lay the unit on it's back so that the fuel cap is facing upward. Fill the tank with 32:1 fuel mixture. Allow enough time for any spilled petrol to evaporate before mounting the unit back on the packframe. NOTE: Use only synthetic chain saw oil in this generator.

ANODE AND CATHODE - Plug the anode pole and cathode into their connectors on the bottom of the instrument case. Located inside the pole is a sealed magnet-operated reed switch to control the shocker output. Adjust the magnet embedded into the flexible rubber holder so that when it is pressed it lies directly over the mark on the pole. If an optional second anode pole (cathode use) is used, both magnet switches must be activated to operate the electrofisher.

### 5.3 OPERATING PROCEDURE

STARTING THE GENERATOR - With the fuel tank filled and the shocker mounted on the backpack, locate the choke lever on the top left side of the generator near the gas fill. Lower the lever to choke. Pull the starter rope and slowly lift the choke lever as the engine warms up. To kill the engine, press on the red button located near the sparkplug.

CAUTION: Do not attempt to adjust the throttle knob. It has been set and locked in position at the factory.

USING THE ELECTROFISHER - With the generator running and the anode and cathode electrodes in the water, turn the range switch to the 200 volt position. Select the desired frequency. As a rule-of-thumb, use low frequencies for large fish and high frequencies for small fish. Press the anode pole switch and watch for fish reaction. Increase the voltage range setting until satisfactory fish response is obtained. It is recommended that the voltage setting not be increased beyond the point where good fish reaction is observed. A high voltage setting may cause damage to fish. At input currents greater than 1.25 amps, the audio tone switches from a steady tone to a pulsed tone. As higher levels of input current are drawn by the electrofisher, the pulse rate of the audio tone increases. The audio ammeter function is provided to give the operator a relative idea of the loading on the electrofisher. The best setting for the water being shocked is when the output voltage is just below the point where the audio tone pulses on and off.

CAUTION: If you have been shocking small fish, reduce the voltage range 2 or 3 positions before shocking large fish. Large fish are more sensitive to being shocked than small fish. Be careful not to short the electrodes together as this may cause damage to the shocker.

## 6.0 MODEL 15-A SPECIFICATIONS:

Conductivity Range.....	10-400 microsiemens/cm <sup>3</sup>
Output Voltage.....	200-1200VDC in 100 volt steps
Output Current.....	40 amps peak current. 1 amp average current on 200 volt range
Output Frequency.....	DC, 15, 30, 60, 90, 120 p.p.s. Up to 5 additional custom fre- quencies (optional)
Output Protection.....	Output disabled on overcurrent con- dition. Automatic reset by releas- ing anode pole switch. Overload indication LED on side of unit.
Output Pulse Shape.....	Rectangular pulsed DC, <sup>12.5</sup> <del>25</del> % duty cycle
Output Indicator & Audio Ammeter.....	Audio tone for 30 VDC output voltage and greater. Pulsed tone mode to indicate generator loading.
Generator Loading.....	Indicated by audio ammeter above 1.25 amps. Beep rate changes in proportion to generator loading.
Anode & Cathode self test.....	Continuity of anode and cathode wires & switches indicated by LED
Tilt Switch.....	Automatically shuts output OFF when electrofisher is tipped beyond allowable operating angle.
Timer.....	0 - 999,999 seconds +-2% (LCD displa
Construction.....	Sealed weatherproof case
Weight.....	32 lb. wet
Anode Pole.....	6 ft. long, 1" diameter, fiber- glass with 72" curl cord
Electrode Supplied.....	Round aluminum ring, 12" diameter
Cathode.....	Floating aluminum, 84 sq.in. approx.
Pack Frame.....	Coleman, reinforced nylon with padded shoulder straps, hip belt and and emergency quick release. 1.5 lb

STANDARD EQUIPMENT SUPPLIED: Model 15-A Electrofisher & TAS Generator mounted on a Coleman pack frame, 6 foot Anode Pole with one electrode, and a floating cathode.

OPTIONAL EQUIPMENT:

Metering Package.....Input & output current and input & output voltage

Custom Output Frequencies.....DC to 250 Hz

Anode or Cathode Pole (1 piece).....6 ft., 1" diameter  
(2 piece).....6 ft., 1" diameter  
(2 piece).....9 ft., 1" diameter

Anode Arrays.....Diamond, cat whisker or ring

Electrical Dip Net.....Tear-drop shape, 11"W x 18"L x 4"D, 3/16" mesh, with protector and quick disconnect.

Dip Net Handles (1 piece).....6 ft., fiberglass  
(2 piece).....6 ft., "  
(2 piece).....9 ft., "

Electrical Gloves.....10,000 volt rated

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# WARRANTY

SMITH-ROOT INC. (SR) products are backed by SR's reputation as a quality manufacturer, and often by years of proven reliable service.

In addition, the products are backed by the following SR factory warranty:

Solely for the benefit of the original purchaser, SR warrants all new products of its manufacture to be free from defects in material and workmanship; and will replace or repair, f.o.b. at its factories in Vancouver, Wash., or other location designated by it, any part or parts returned to it within ninety (90) days of original delivery, which SR's examination shall show to have failed under normal use and service and non-corrosive application by purchaser. Such repair or replacement shall be free of extra charges for all items except repair or replacement shall be subject to prorated charge based on SR's estimate of the percentage of normal service life realized from the part. SR makes no warranty with respect to parts, accessories, or components manufactured by others. The warranty, if any, which applies to such items is that offered by their respective manufacturers.

SR's obligation under this warranty is conditioned upon it receiving prompt written notice of claimed defects which shall in no event be later than the ninety (90) day warranty period; and is limited to repair or replacement as aforesaid.

This warranty is expressly made by SR and accepted by purchaser in lieu of all other warranties, including WARRANTIES OF MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE, whether written or oral, express, implied, or statutory. SR neither assumes nor authorizes any other person to assume for it any other liabilities with respect to its products. SR shall not be liable for normal wear and tear nor for any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its products for any reason whatsoever.

This warranty shall not apply to products or parts thereof which have been altered or repaired outside of an SR factory, or damaged by improper installation or application, or subjected to misuse, abuse, neglect, or accident.

SR shall not be responsible for any in-transit damage to goods unless inspection clearly reveals defective packaging where SR was responsible for packaging. SR will assist any purchaser or consignee of goods seeking recovery from a carrier for in-transit damage to goods and will, to the extent necessary, assign claims to said purchaser or consignee wherever required in order to provide said purchaser or consignee with complete recourse against said carrier.

Upon buying SR products or parts, purchaser expressly agrees to the foregoing warranty provisions including limitation of remedies, and expressly waives any and all other warranties or undertakings in respect to such products.

*Smith - Root Inc.*





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