

# **OPERATOR'S MANUAL**

## **MBS-1D**

### **Boat Electrofishing Unit (Pulsed DC)**

**Wisconsin DNR Style**

**Note: This unit requires a separate 12 volt power supply or battery to operate the safety mat control. If someone steps off the mat during operation, high voltage output will be halted and a reset at the front panel will be required to restart output.**

**Serial no.**\_\_\_\_\_

**Pulsed DC current trip point** \_\_\_\_\_

**Other** \_\_\_\_\_

REV. 2-18-11 (front page edited only)  
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## **SAFETY FIRST: PRECAUTIONARY STATEMENTS**

### **WARNING: HIGH VOLTAGE EQUIPMENT!**

Boat-mounted electronic fish capture devices are designed to introduce AC and/or Pulsed DC high voltages into the water via dropper array(s) hanging over the boat into the water. This high voltage exists between the droppers and the boat hull (if a metal hull is used) as well as in the water surrounding the boat, AND HAS THE POTENTIAL TO CAUSE BODILY HARM OR DEATH if the operator does not observe proper precautions, and comes in contact with the output of the device.

READ AND UNDERSTAND ALL DIRECTIONS, OPERATING WARNINGS, AND CAUTIONS IN THIS MANUAL. Training by experienced operators or attending a formal course is strongly recommended. Operation of this equipment without another individual in the vicinity is strongly discouraged. CPR certification of all operators is strongly recommended.

NEVER DEFEAT, BYPASS, OR MODIFY THE REMOTE FOOTSWITCH/PAD/ MAT!

### **NOTICE: NOT FOR PERSONAL USE**

This equipment may only be used by federal or state agencies, or independent agencies that have been authorized to use electronic fish capture devices by the federal or state agency having jurisdiction in the operator's area. Use for personal purpose is unlawful. Observers and assistants who are not employed by said agencies must be notified of the hazards of electrofishing and related safety procedures, and must be appropriately supervised.

### **WARNING: INSPECT AND MAINTAIN EQUIPMENT**

Prior to each use inspect the control box, boat booms, electrode droppers and related cabling, and accessories for loose connections, missing or damaged parts. Verify that cables are intact with no cuts or tears in the insulation. Verify that the remote switch pad and/or footswitches operate properly before applying high voltage to the droppers. Verify that the STOP/PANIC switch on the control box shuts down the box. NEVER DEFEAT OR BYPASS THE REMOTE FOOTSWITCH, PAD, OR MAT!

### **WARNING: AVOID WATER IMMERSION AND RAINFALL**

The boat control box is designed to be splash resistant, but is not water-tight. In the event the box is exposed to heavy rainfall open the box in a dry location and verify that no water infiltration has occurred. If water is observed within the box, return it to the manufacturer for inspection. Plugs that connect to the control box are not water tight. If immersed in water or exposed to rain, the connectors must be opened and properly dried. Contact factory for specific instructions.

### **WARNING: AVOID DROPPER ELECTRODE CONTACT**

DO NOT TOUCH THE DROPPER ELECTRODES UNTIL YOU HAVE SWITCHED OFF THE MAIN POWER SWITCH AND WAITED 5 MINUTES. Although the control box should disable the output instantly, in the event of a malfunction, there could be sufficient energy to cause a harmful electrical discharge. Alternatively turn the voltage set dial to zero and discharge the remaining power in the control box into the water by depressing the footswitch or safety mat before turning off the main power switch.

## SECTION A – DESCRIPTION

The MBS-1D fish shocker has been developed as a powerful aid to authorized fisheries personnel engaging in field sampling surveys. It is designed for nominal 240 VAC, single phase operation, from a portable alternator. The MBS-1D is capable of delivering 4.8 KW to the electrode system ( Limited by a 20 Amp breaker input). It should never be operated from the comercial power distribution system found in buildings. Such operation will almost certainly damage the triac control section since commercial power systems do not have the surge current-limiting inductance found in alternators.

The MBS-1D has been designed with a number of unique features:

- 1) Electronic Self-Protection - The pulsed DC section is protected electronically against overload. An overload lamp lights to indicate electronic shutdown.
- 2) Continuously Variable Parameters - Pulsed DC output rates can be adjusted from 10 to 1000 pulses per second, and duty cycles from 1% to 100% . Output voltage is adjustable between approximately 100 to 600 Volts peak DC, depending on alternator and water conductivity.
- 3) LCD Metering - Two backlit LCD displays continuously monitor peak pulsed voltage and current. The displays are easily readable in both full sunlight and at night.

## SECTION B - MBS-1D SPECIFICATIONS

### MECHANICAL

DIMENSIONS : 19" x 10" x 10"  
WEIGHT : 37 pounds  
CASE MATERIAL : Galvanized Sheet Metal with  
Stainless Steel Hardware

### ELECTRICAL

TEMP. RANGE : 0 - 35 degrees C operation  
  
DC PULSE  
CAPACITANCE : 3300 uf low range; 1650 uf high range.  
  
INPUT POWER  
REQUIREMENT : 220-240 VAC, single phase,  
55-65 Hz, alternator supplied.  
Recommended alternator power  
rating: 5.5 KW for max. output.

**CAUTION: THE NEUTRAL GENERATOR  
WINDING MUST NOT BE CONNECTED  
TO GENERATOR FRAME! CIRCUIT  
DAMAGE WILL OCCUR!**

OUTPUT POWER : Up to 4800 watts pulsed  
DC. This is equivalent to 600  
volts peak DC at 28 amps peak  
DC, 28% duty cycle.

RESETTABLE LCD  
FRONT PANEL TIMER: The front panel timer accumulates and holds  
actual shocking time in minutes and seconds.  
It can be reset at any time. It is powered by  
an internal lithium battery and holds its time  
independent of the generator power.

OPERATION TIMER: This electromechanical timer on the side of MBS accumulates time as long as the MAIN POWER switch is ON and the "START" button has been pressed. It times in hours and tenths of hours and cannot be reset.

FUSING & OVER-LOAD PROTECTION : 20 Amp main power circuit breaker. Electronic shutdown provides additional overload protection for pulsed DC output circuitry. The 13.5 VDC internal power supply is also fused with a 1 amp 3AG fuse.

### MBS-1SELECTABLE PARAMETERS

RATE  
RANGE : 10 -1000 pps in 1 pps steps  
RESOLUTION : 1.0 pps  
ACCURACY :  $\pm 5\%$  of dial setting

DUTY CYCLE  
RANGE : 1% to 100% in 1 pps steps  
RESOLUTION : 0.1%  
ACCURACY :  $\pm 1\%$  absolute

PEAK DC OUTPUT  
LOW RANGE : Approximately 100 to 300 volts peak.  
HIGH RANGE : Approximately 200 to 600 volts peak.

PULSE OUTPUT DROOP : Exponential decay that is a function of load resistance.

## DIGITAL PANEL METERS & PROTECTIVE FEATURES

### DISPLAY CHARACTERISTICS OF METERS:

DC VOLTAGE (reads peak output voltage pulse)

RANGE	:	0 - 1000 Volts peak
RESOLUTION	:	1 Volt
ACCURACY	:	+5% of reading

DC CURRENT (reads peak output current pulse)

RANGE	:	0 - 50 Ampere
RESOLUTION	:	0 - 0.1 Ampere
ACCURACY	:	$\pm 5\%$ of reading or $\pm 0.3$ amps, whichever is greater

SELF- PROTECTION	:	20 Amp input main power protection. Main breaker may be reset by first turning the VOLTAGE ADJUST knob to minimum (CCW), then toggling the MAIN breaker off, then on.
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Pulsed DC output is additionally protected electronically. If peak output current exceeds approximately 45 amps, the shocker will stop pulsing, and the red OVERLOAD LED lamp will illuminate. The OVERLOAD is Reset by turning the VOLTAGE ADJUST knob to minimum, then pushing the STOP/PANIC switch OFF. After the fault has been corrected, pressing the START/RESET switch will restore operation.



OPERATOR  
PROTECTION

:

The MBS-1D outputs will be disabled whenever continuity is broken between pins B and C of the interlock safety connector on the side of the unit. Any number of safety mats and switches may be wired in series. The interlock operating voltage is 12 VDC. The output voltage also may be disabled on the front panel by the STOP/PANIC switch or the MAIN POWER breaker switch.

TIME DELAY  
FEATURE  
(not a performance  
specification...for  
information only)

:

The MBS-1D has a time delay of approximately 1.5 seconds between the time the START/RESET switch is pressed and voltage is actually applied to the output connector (assuming the main breaker has already been turned ON and footswitch/pad depressed) This is done to protect the voltage control circuitry from high surge current damage when the unit is first turned on.

## **SECTION C : OPERATING PROCEDURES**

**WARNING!** The output of the MBS-1D electrofishing unit is capable of delivering lethal voltages. Safe operation requires a thorough understanding of the principles of boat electrofishing.

**WARNING!** The DC electrode output connections will normally have high voltage with respect to the grounded case of the electrofishing unit and the boat hull. The output is not isolated from chassis or boat ground. Always treat the output connector wires and the booms with respect whenever the generator is running.

**CARELESS MISUSE OF THE MBS-1D CAN KILL YOU OR OTHERS!**

**ALWAYS OBSERVE THE SAFETY PRECAUTIONS !**

THIS MATERIAL SHOULD BE READ AND SIGNED OFF BY ALL PERSONNEL RESPONSIBLE FOR USING THE MBS-1D.

Consult the following publications for further guidelines in the use of electrofishing equipment:

- 1) Electrofishing , National Safety Council Data Sheet # I-696-85 , 6 pages.
- 2) Electrofishing boats , Technical Bulletin No. 73, Wis. Dept. Nat. Res. 1974, 48 pages.

### **GENERAL**

The MBS-1D is connected to the boat alternator receptacle by means of a 3 to 4 ft. cable terminated in a 3-wire twist lock connector (Hubbell 9965-C or compatible). The output connector for DC operation is a 4-wire twist lock receptacle (Hubbell 7410B or compatible).

When the unit is powered-up, high voltage is present at the DC output receptacle. The output receptacle wiring is as follows:

- W - DC High Voltage return negative (connected to pin Z internally)
- X - DC High Voltage positive (connected to pin Y internally)
- Y - DC High Voltage positive (connected to pin X internally)
- Z - DC High Voltage return negative (connected to pin W internally)

The interlock safety connector (Amphenol 3102A-16-10P) has 3 pins. Its wiring is as follows:

- A – This is + 12 VDC from the boat battery. The metal enclosure of the MBS-1D is the return path for the battery negative terminal. **WIRE FROM +12 VOLT BATTERY CONNECTION MUST BE FUSED WITH A 2 AMP FUSE.**
- B - Interlock connection to the external mat, pad, etc.
- C - Interlock connection to the external mat, pad, etc.

A continuous electrical path must be established between B and C pins to permit operation. This may be accomplished by stringing any number of safety mats, foot switches, etc, in series.

**NOTE : The MBS-1D is designed for a nominal 60 Hz alternator system. If the alternator engine is run too slowly, and the frequency approaches 50 Hz, it may not be possible to turn the output voltage all the way off even if the VOLTAGE ADJUST dial is set to minimum.**

### **PULSED DC OPERATION**

Power-up is achieved by first making sure the VOLTAGE CONTROL knob is turned to MIN and the MAIN POWER switch breaker to OFF. Then set the RATE and DUTY controls. Connect the electrode connector to the **DC** output receptacle of the MBS. Bring the alternator drive engine up to speed. Switch the MAIN POWER switch ON. The footswitch/pad(s) must be activated. Press the START/RESET button (this is a momentary switch). The LCD display meters should illuminate as should the STOP/PANIC switch button.

Voltage and current meters should read approximately zero. It is normal to see several volts on the voltmeter and several tenths of an amp on the current meter due to internal offsets. At any practical operating voltage and current these offsets will not affect the stated accuracy of the meter displays. The OVERLOAD lamp should not be illuminated. If it should light, make sure the VOLTAGE CONTROL knob is at MIN, press the STOP/PANIC switch, then push the START/RESET button again.

Increase VOLTAGE control as required. Note that there will be a 1.5 sec. delay between turning the OPERATE switch to START and the application of voltage to the electrodes.

The MBS-1D delivers nominally rectangular high voltage pulses to the electrodes. The resultant peak current flowing through the electrodes will be a function of electrode geometry and spacing, water conductivity and bottom material, as well as the peak voltage you have selected. Peak output voltage is determined by the VOLTAGE RANGE switch, and the VOLTAGE ADJUST dial setting. The LOW range is intended for 100 to 300 Volt operation nominally, while the HIGH range is intended for 300 to 600 volt operation. Use LOW range (unless you need higher voltage) since it provides better voltage control at lower settings. Lower conductivity water may require more droppers from the boom in order to achieve effective current levels in the water.

The operator may select any combination of pulse RATE and DUTY cycle with the front panel dial indicators. Note the decimal point in the DUTY dial. "25.0" is 25% for example. The RATE is in pulses per second. Duty cycles above 25% are possible, but are usually no more effective than 25%. Setting a very high duty cycle in addition to a high voltage may cause excessive AC current to be drawn from the alternator in highly conductive waters. This may trip the MAIN POWER breaker.

**CAUTION: DO NOT SWITCH VOLTAGE RANGE WHILE OPERATING (SHOCKING). THE VOLTAGE RANGE SWITCH COULD BE DAMAGED. ALWAYS PRESS THE STOP/PANIC BUTTON FIRST, THEN SWITCH RANGES. PRESS START/RESET TO RESUME SHOCKING.**

**IN ORDER TO QUICKLY BLEED OFF INTERNALLY STORED VOLTAGE FROM THE BOX AT THE END OF A SESSION, IT IS GOOD PRACTICE TO TURN THE VOLTAGE ADJUST KNOB TO MINIMUM WHILE THE OUTPUT IS STILL ACTIVE BEFORE EITHER STEPPING OFF THE SAFETY MAT/SWITCH, PRESSING THE STOP/PANIC SWITCH, OR TURNING OFF THE MAIN POWER BREAKER.**

RATE and DUTY dial indicators are provided with locking levers located at the base of each indicator. Flip lever to the left to lock the dial...back to the right to unlock. This will provide a measure of assurance to the operator that preset conditions will not be changed by vibration or accidental contact.

The MBS-1D has several self-protection circuits incorporated into its design. Maximum *input* power is limited through the use of the 20 Amp circuit breaker inside the MAIN POWER switch.

Maximum *output* power in the pulsed-DC mode is limited both by the input breaker and by a special current sensing circuit in the DC output. This circuit will shut off the unit if peak output current exceeds about 45 amps. The OVERLOAD lamp will illuminate, and since the load is taken off the alternator, the sound of the alternator motor will change. If an OVERLOAD occurs, reduce the VOLTAGE ADJUST to minimum, and reset the circuit by pushing the STOP/PANIC switch in, then pressing the START/RESET switch. Increase voltage gradually, being careful not to approach too close to 45 amps peak. If for any reason the output transistor used to pulse the DC voltage should fail, a second transistor within the unit may be readily connected. Contact us for information. A failed output transistor usually causes straight DC to be applied to the electrodes. This often results in the MAIN POWER 20 amp circuit breaker shutting off, or the generator motor lugging down excessively as voltage is increased.

**CAUTION:** The output transistor switch that provides the pulsing action is an electronic switch that, even when turned off, is still capable of "leaking" some current. Therefore, the electrode outputs of the MBS-1D should always be treated with caution since an appreciable charge may exist on the internal storage capacitor. **To be safe, stay clear of the electrodes five to ten minutes after the MAIN POWER switch of the MBS-1D has been turned off and the STOP/PANIC switch pushed in.**

Again, as a precaution, when you are finished shocking, it is a good idea to discharge the internal DC storage capacitor by dialing the VOLTAGE ADJUST dial to zero BEFORE stepping off the safety interlock pads/mats/switches, turning off the Main Power switch, or pressing the Panic/Stop switch in.

## **EMERGENCY SHUT DOWN**

The MBS-1D is equipped with an external safety interlock system as well as a front panel STOP/PANIC switch.

However...

**IN ANY EMERGENCY SITUATION, IF NORMAL INTERLOCK AND PANIC  
BUTTON SHUTDOWN CONTROLS DO NOT SEEM TO BE WORKING, TURN  
OFF THE MAIN POWER BREAKER.**

This switch on the front panel provides direct 2-pole mechanical disconnection of the AC power into the unit and will remove power coming out of the electrofishing unit whether the safety interlock relay functions or not.

## **SECTION D: RETURNED UNITS**

### **WE RECOMMEND THAT YOU CONTACT US IN ADVANCE OF SHIPPING.**

Damaged or defective units may be returned for repair to:

ETS Electrofishing, LLC  
3737 Eldorado Court  
Verona, WI 53593

Attention: L. Burke O'Neal

Email: [ets@etselectrofishing.com](mailto:ets@etselectrofishing.com)  
Phone: 608-833-2088

Be sure to box carefully with appropriate cushioning materials. Send postage prepaid.

### **INCLUDE RETURN ADDRESS AND YOUR PHONE NUMBER INSIDE BOX.**

**A short note explaining mode of failure in detail and giving several phone numbers where the user may be reached for questions will greatly expedite turn-around time. Problems or questions regarding operation of the MBS-1DP-MSU may be addressed to the above by email or phone.**

Limited warranty:

We will repair or replace any unit that fails for reasons other than intentional or accidental abuse (operating unit from commercial building mains rather than an alternator, dropping, running over with a truck, etc.) free of charge for labor and parts for a period of one year from date of receipt by user. Purchaser must pay shipping costs associated with transporting failed unit to us. We will pay return costs. Purchaser may have additional rights depending upon applicable state law.

## SECTION E: TIMER

### ELAPSED SHOCKING-TIME RESETTABLE METER

A resettable time meter is located on the front panel of all MBS units. It logs accumulated shocking time. It runs continuously as long as power is applied to the MBS from the generator, the MAIN POWER breaker is ON, the netter is on the pad/footswitch, and the START/RESET button has been pressed to initiate shocking. It pauses and holds the accumulated time when the PANIC/STOP button is pressed or the MAIN POWER switch breaker is turned OFF. The accumulated time indicated on the meter will be "held" unless the reset button on the meter is pressed. This meter is available in units of hours/ hundredths of hours, hours and minutes, minutes and seconds, or all seconds as specified by the user at the time of order. The meter is self-powered by a long-life lithium battery (typically 7-8 years) and is independent of the generator power supply and safety circuit 12 Volt supply.