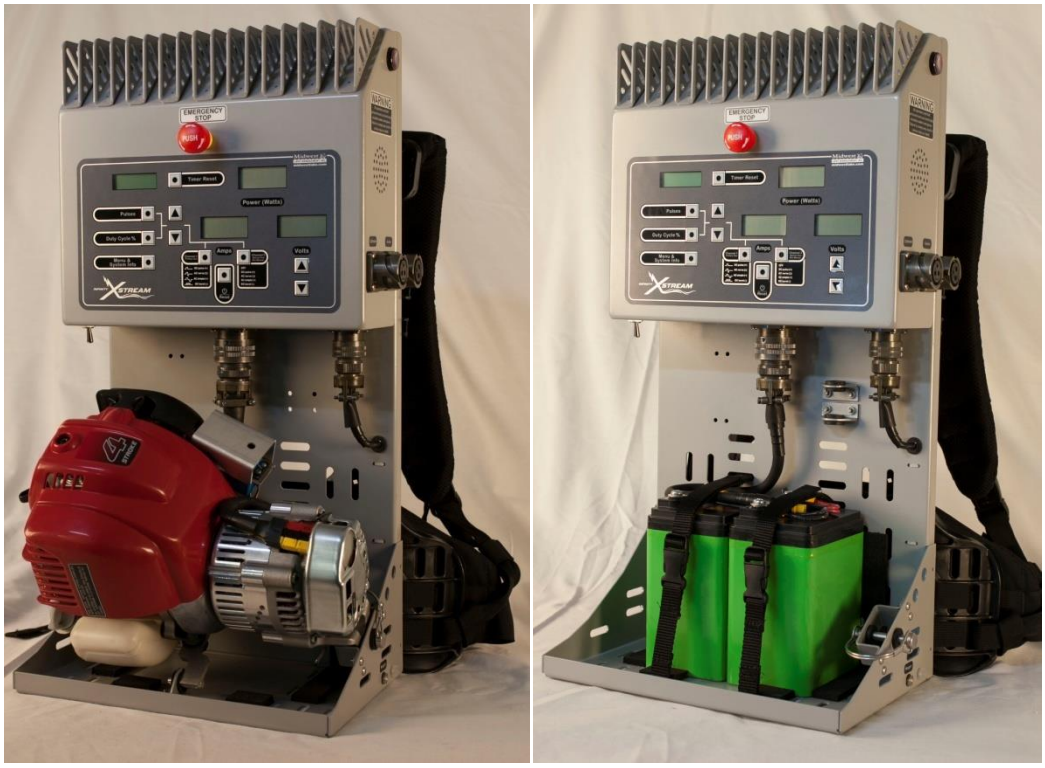
OPERATION GUIDE (v3)

MIDWEST LAKE ELECTROFISHING SYSTEMS (MLES)

INFINITY XSTREAM

BACKPACK ELECTROFISHER



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ELECTROFISHING EQUIPMENT SAFETY

Safety Considerations For Electrofishing

Electrofishing systems use currents and voltages in either an AC or DC waveform that can be injurious or lethal to humans. This is particularly true when using backpack electrofishing equipment, where the user is actually in the water and in close proximity to the energized electrical field. High voltage exists between the anode pole and the cathode (e.g., rattail), as well as the water surrounding the user.

Ensure that personal protective equipment (waders, gloves, etc.) is properly designed and worn to prevent the risk of electrical shock. Never bypass nor disable the safety features designed into the Infinity Xstream (immersion sensor, tilt sensor, safety switches, etc.).

NEVER transport or store the Infinity Xstream while energized. NEVER submerge the Infinity Xstream in water. ALWAYS de-energize and completely power-down the Infinity Xstream prior to attaching to the user or removing from the user. The Infinity Xstream should be transported in a secure container to prevent vibration and damage.

All personnel involved with electrofishing should be trained in electrofishing safety protocol. It is highly recommended that users of this equipment attend a formal electrofishing training course.

Equipment Inspection

All components of an electrofishing system (control unit, booms, anodes, anode poles, cathode connection, wire insulation, junction boxes, bonding, safety switches, plugs, electrical connections, etc.) should be inspected prior to each use. Moisture, vibration, and general use can cause corrosion and loosen connections. Cuts and nicks in wiring and other damage to parts with use may occur as well. Always ensure that every aspect of the electrofishing system is well maintained and in top-working order without any defects. This ensures safety and an efficient electrofishing system.

Any repairs should only be made when the system is off, powered down, and not in use. Never attempt to diagnose problems, make repairs, or perform maintenance while the system is powered on or in use. The capacitors inside the system will maintain a lethal charge for several minutes after power is removed. Untrained personnel should not make repairs without written approval from the manufacturer or a qualified electrical engineer.

INTRODUCTION

The MLES Infinity Xstream has been engineered to meet the backpack electrofishing needs of most freshwater environments. It is designed to be powered with either a 24 Volt Lithium Iron Phosphate smart battery or custom designed 440 Watt Honda powered 4-stroke generator. **The Infinity Xstream should never be connected directly to power source not specifically designed for such use**.

The Infinity Xstream features Intelli-Shock© technology to allow for the simplest and safest operation. This modern technology includes many safeguards to ensure longevity of the circuitry, advanced overload protection, and automatic voltage range shifting capabilities. The Infinity Xstream is hermetically-sealed and comprised of water resistant components and splash resistant features to maintain operation in harsh conditions.

Specifications

Power Source (Battery):	24 volt Lithium battery pack (22.2 Amp-hours)
Power Source (Generator):	Custom engineered w/ 4-stroke Honda engine Output RPM auto-regulated (throttles down under reduced load)
Output Voltage:	0-1,200V in 1V steps; ≥50V @ full power
Output Waveforms:	DC (continuous direct current: square wave) DC Pulse (pulsed direct current) DC Burst (dual-frequency pulsed direct current) AC (alternating current) AC Nerve (alternating current with nerve pulse)
Frequency DC Pulse (Hz):	1-300Hz adjustable in 1Hz steps
Frequency DC Burst (Hz):	1-1,000Hz within the Primary DC Pulse (1Hz steps)
Duty Cycle DC (%):	1-100Hz in 1% steps
Frequency AC & AC Nerve:	1-300Hz adjustable in 1Hz steps
Duty Cycle AC (%):	1-98% in 1% steps
Duty Cycle AC Nerve (%):	1-98% in 1% steps for positive pulse 1-25.5% in 0.1% steps for negative pulse
Max Output Power (Watts):	≥400W average @ 100% Duty Cycle 47,000W peak @ 1% Duty Cycle
Dual Channel Capable:	Easily switch between two independent, unique waveforms
Safety Features :	Wader tester; Immersion sensor; Tilt sensor
Weight (lbs):	28.5 w/22.2 ah lithium battery 30.5 w/custom generator
Storage Temperature:	0°F to 154°F (-17.8°C to 67.8°C)

GETTING FAMILIAR WITH THE MLES INFINITY XSTREAM

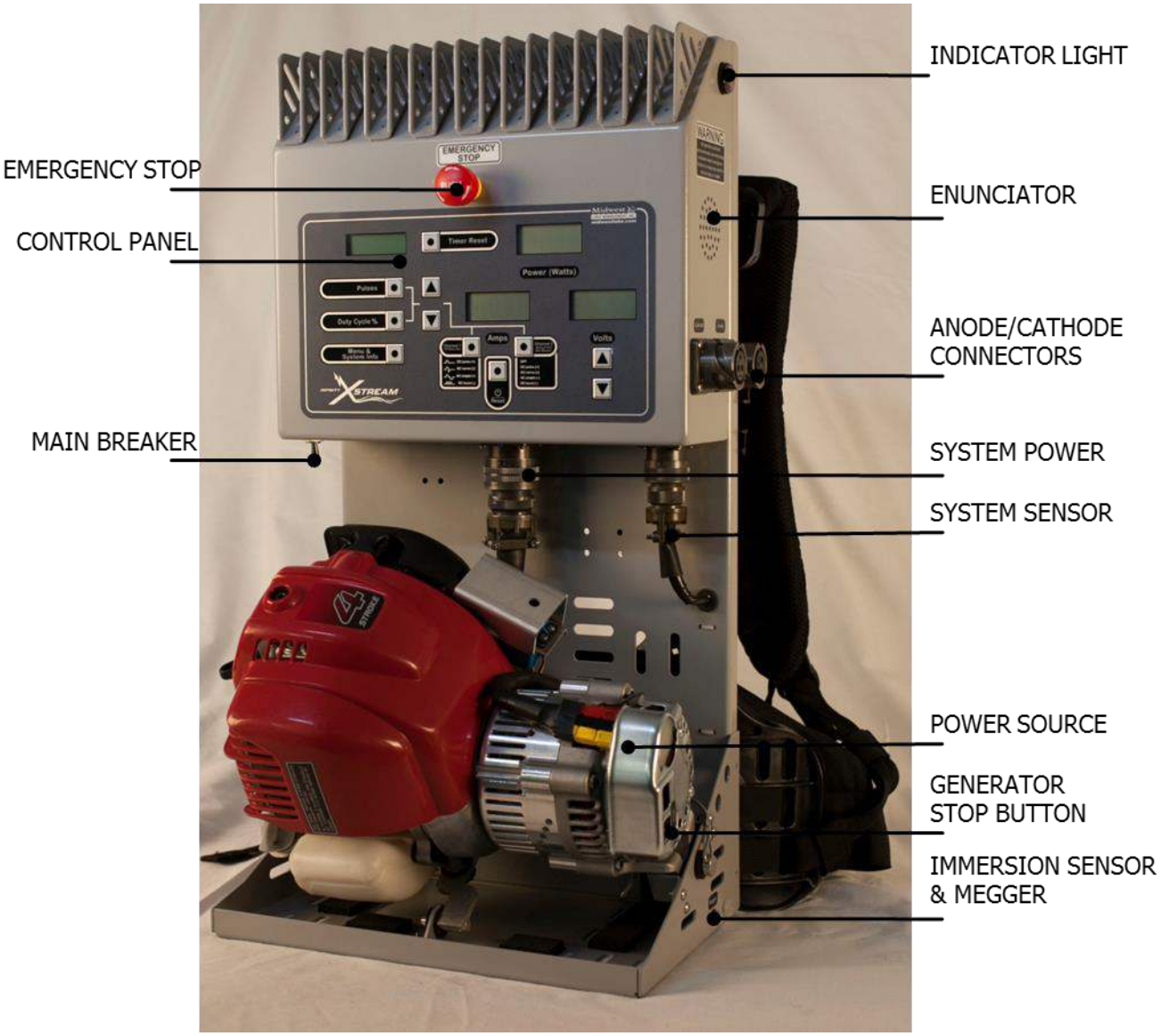

Figure 1. Front Panel of Infinity Xstream

Front Panel Features

Emergency Stop Button: This large red prominently displayed button is easily located for quick and easy access. After it has been pressed, the button must be turned one-quarter (1/4) turn clockwise (to the right) and reset before electrofishing can be resumed.

Control Panel: The control panel functions as the user interface, displaying system settings and allowing the user to make necessary adjustments to system settings (i.e., Power , Amps, Voltage, Waveform, Pulse Rate and Duty Cycle).

Main Power Breaker: The main power breaker is a toggle switch positioned on the lower left side of the control box. The main breaker must be in the "ON" position before power can be applied to the Infinity Xstream.

Indicator Light: Two indicator lights are present on the Infinity Xstream, one on either side of the unit. The illumination pattern of the lights will indicate the operating mode of the Infinity Xstream (Standby or Fishing). If in Fishing Mode, the illumination pattern will indicate which waveform is currently active.

Enunciator: Two enunciators are present on the Infinity Xstream, one on either side of the unit. The enunciation tone will indicate the operating mode of the Infinity Xstream (Standby or Fishing). If in Fishing Mode, the enunciation tone will indicate which waveform is currently active.

Anode/Cathode Connectors: Two bayonet-style, 1/4 turn connectors are located on the right-hand side of the control box, one for connecting the anode pole and once for connecting the cathode (i.e., rattail). These two connectors are uniquely keyed so the anode and cathode cannot be connected improperly.

System Power Connector: This cable/connector combination transfers power from the power source to the Infinity Xstream circuitry.

System Sensor: This cable/connector combination is used to detect immersion faults and to test for faulty waders with the built-in megohmmeter (aka, Megger).

Power Source: The Infinity Xstream can be powered by 24Volt Lithium battery pack or by a custom-engineered 24Volt generator, powered by a Honda engine. The Power source is modular and interchangeable with minimal effort.

Immersion Sensor & Megger: The Infinity Xstream is equipped with and immersion sensor located near the bottom of the unit frame. Should the Infinity Xstream become immersed in water

beyond the sensor, a fault will be triggered and the unit will shut down. Located in conjunction with the immersion sensor, the Megger can be used to test for any potential electrical path from the anode of Infinity Xstream back to the user/wearer of the unit such as might occur with leaky waders and/or gloves.

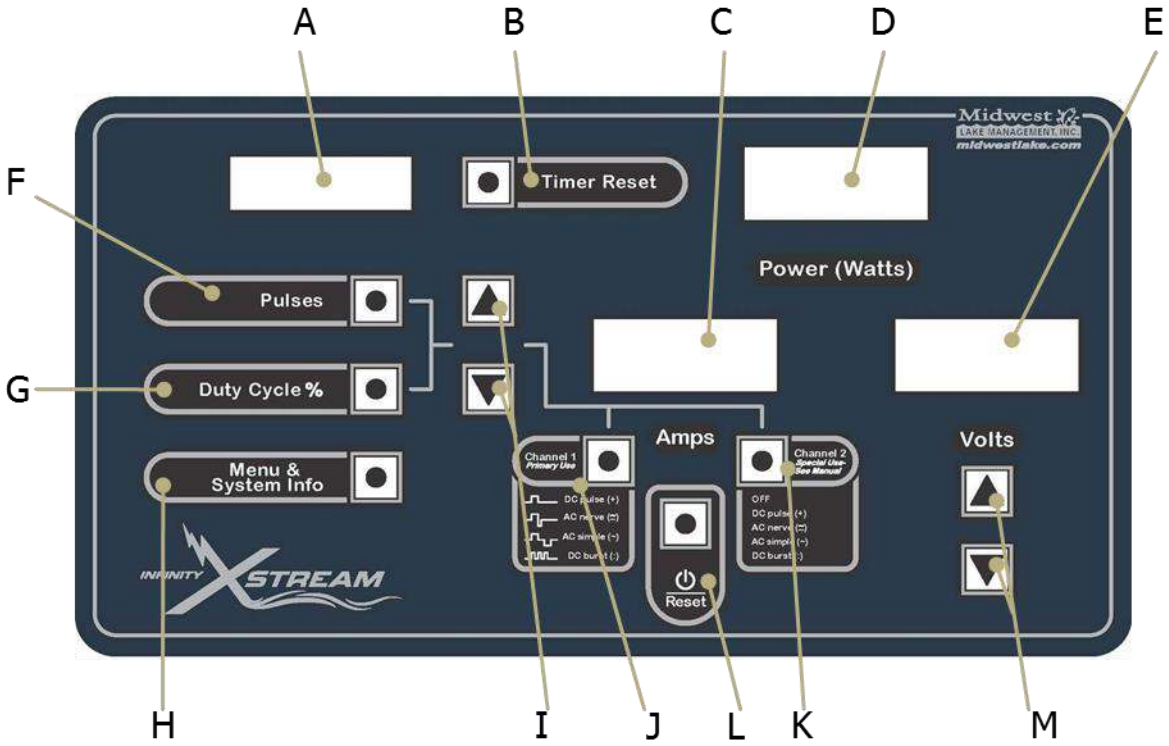

Figure 2. Infinity Xstream control panel functions and locations.

Control Panel Function Descriptions

A – System Information digitally displays data for monitoring and setting system parameters:

- Resettable fishing time (hh:mm:ss)
- Generator input to control box (frequency and volts) if using generator as power source
- Battery voltage and battery usage (amp-hours) since last reset
- Overall control box hour usage meter (hh:mm:ss)
- Tilt sensitivity (adjustable from 0 – 3) by adjusting (I)
- Anode out of water (default to on; may select Off by adjusting (I)
- Megger test function (Off; On; Settings; Results) by adjusting (I)
- Enunciator volume (adjustable from 0 – 7) by adjusting (I)
- Display and power board revisions
- Pulses and Duty Cycle pressing (F) or (G) and adjusting (I)
- Save and Recall for presets (1-8) pressing (H) and adjusting (I)
- Section also displays (flashes) operational notifications such as overloading, output shorted, active channel, active waveform, etc.

B – Press button to reset fishing time (not functional during data recall), or press to reset amp-hour meter after installing completely charged smart battery pack.

C – Displays peak output amperage while the Xstream is operating.

D – Displays peak output power (watts) while the Xstream is operating.

E – Displays peak output voltage while the Xstream is operating; adjusted by (M).

F – Pulses button used to select for pulse rate/frequency (Hz); adjusted by (I); monitored in (A).

G –Duty Cycle % button used to select duty cycle (%); adjusted by (I); monitored in (A).

H – Menu/System Info button used to toggle through all items in (A). Press for data recall* when the Xstream is powered down.

I – The up/down buttons increase/decrease by one unit or hold down for fast increment. Press to save and recall preset electrofishing settings.

J – The Channel 1 button can be depressed to toggle through the four waveform types available. Please refer to the **Waveform Options** section of this manual for a description and illustration of the waveforms available from the Infinity Xstream.

K – The Channel 2 button can be used to enable or disable dual channel mode. Further, if dual channel mode is enabled, the user can assign one of the four waveform types to channel 2. Please refer to the **Advanced Operation Section** of this manual for a description of dual channel operation.

L – The Reset button must be pressed to begin electrofishing. Press the Reset button following turning the main breaker button to ON and twisting the Emergency Stop button one-quarter (¼) turn clockwise to reset.

M – The up/down buttons change voltage by one volt or hold down for fast increment.

*Note: The Infinity Xstream offers a "Data Recall" feature that displays the settings in use when the Xstream was last powered down. The settings (pulses, duty cycle, volts, fishing time and waveform) may be recalled by pressing button (H). In addition, anode switch continuity may be tested when data recall is selected (wattage and amperage will display "0000" when switch is engaged). Thirty seconds after the last button is pressed, the display will turn off. The display is powered by a nickel metal hydride rechargeable battery. The charge on the battery lasts 6 months without powering up the control box.

Uniquely Keyed Anode Pole and Cathode Rattail Connectors

The Infinity Xstream requires two main connectors for proper connection and function. Connectors are industrial grade ¼ turn bayonet style, contain O-rings and gaskets, and have positive locking keyways that only terminate into the correct receptacle. These receptacles provide a watertight seal for the anode and cathode connections.

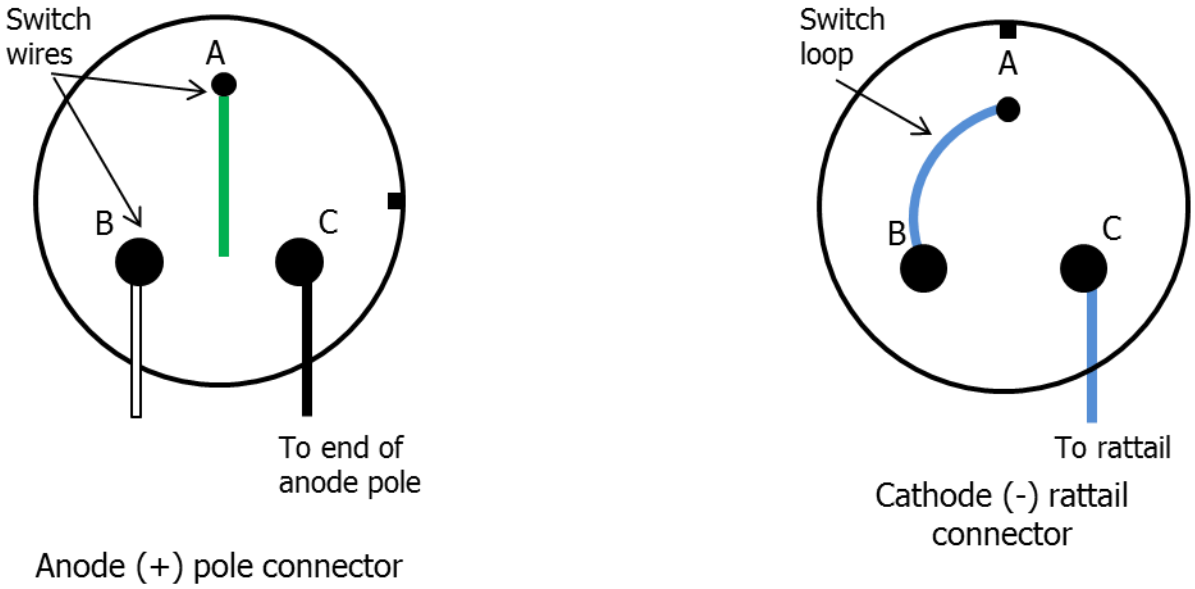

Figure 3. Wiring diagram (internal view of individual wires and contacts) for the two connector plugs on the side panel of the Infinity Xstream. Note that each plug is uniquely keyed to eliminate the chance of improper connection.

Advanced Safety and Protective Features

Internal circuitry protection: This feature prevents internal circuitry from becoming damaged as an overloaded condition is encountered. Should a potential overload situation be detected by the control box circuitry (such as a rapid increase in water conductivity that causes a current surge), the output voltage will automatically be reduced until the current is in a safe operating range. If the water conductivity subsequently decreases, the voltage will automatically rise back to the set value. If the potential overload condition persists, "overload" is flashed and displayed in the system information/status bar, and the emergency stop button will flash to indicate the supply has automatically reduced the fishing voltage. It will continue to flash after the overload has been removed. Press the Volts down button to reset the error. If the Box is still in overload, the error will be turned back on immediately.

High voltage soft start: This feature ensures power source and system safety. The output is quickly ramped from zero to the desired output voltage. If an over current condition occurs, the voltage increase is stopped and an overload condition is triggered. This prevents damage to the supply if the fishing conditions have drastically changed.

Short circuit protection: Protects internal circuitry of the Infinity Xstream in the event the anode makes contact with the cathode. If a dead short is encountered, a fault will be triggered and the Infinity Xstream will become disabled. To resume electrofishing, ensure the short circuit has been fixed, press the reset button, and then resume normal operation. For additional information on short circuit protection, please refer to the **Indicators and Messages from the Infinity Xstream While Electrofishing** section later in this manual.

Anode pole safety switch: The anode pole is equipped with a safety switch that must remain depressed for electrofishing to occur. PLEASE NOTE: as an additional safety feature, both the anode and cathode connectors must be attached to the unit for the switch to function.

Anode out of water sensor: The Infinity Xstream is designed with an anode out of water sensor that will disable the unit in the event the user raises the anode ring out of the water while electrofishing. The anode out of water sensor is defaulted to "on" each time the unit is turned on. It can be turned "off" while electrofishing. If the cathode rattail happens to be completely raised out of the water, the sensor will trip as well.

Tilt sensor: The Infinity Xstream is equipped with a tilt sensor that will disable the unit in the event the user tilts too far from vertical. The tilt sensor sensitivity is adjustable from 0 - 3. A tilt sensitivity setting of 0 disables the tilt sensor and allows the unit to become horizontal without triggering a tilt fault. Conversely, a tilt sensitivity of 3 will trigger a tilt fault if the unit becomes oriented a degree or two past vertical. A sensitivity setting of 1 will trigger a tilt fault when the unit becomes oriented at 45^{o} from vertical.

Immersion sensor: The Infinity Xstream is water resistant. However, it is not completely waterproof. Therefore, in the event the unit becomes immersed in water, a sensor at the base of the chassis frame will detect the immersion and trigger a fault. Such a fault will be displayed on the control panel and it will cause the Infinity Xstream to stop electrofishing.

Megger: The Infinity Xstream is equipped with a megohmmeter (aka, Megger) that can be used to test for faulty waders. Faulty waders (i.e., waders that could cause the user to become electrocuted during normal electrofishing activities) can be identified by using the Megger test available on the Infinity Xstream. Please refer to the **Advanced Operation** section for a detailed procedure on how to use the Infinity Xstream's Megger feature.

OPERATING THE MLES INFINITY XSTREAM

Basic Operation Procedures

- Please reference Figures 1, 2, and 3 of this manual.
- The aluminum chassis of the Infinity Xstream should be firmly secured to the backpack frame.
- The user should don the backpack, close all fasteners and tighten all adjustable straps to ensure a snug and secure fit.
- The male plugs for the anode pole and the cathode rattail should be connected to the appropriate Infinity Xstream female receptacles located on the side of the control panel.
- Ensure that an appropriate power source (either the lithium battery pack or the custom 4-stroke generator) is securely mounted to the Infinity Xstream chassis and properly connected to the Infinity Xstream via the appropriate power cable. PLEASE NOTE: verify the main breaker is "OFF" prior to connecting the power source.
- If using the custom 4-stroke generator as the power source, start it as you would any other small engine. The generator will initially ramp up to full RPM, once breaker is turned on it will throttle down to idle speed (and under no-load conditions).
- Push the main breaker back to the "ON" position. This will cause the LCD display windows on the front panel to become illuminated and, if using generator, generator RPM will reduce to idle speed.
- When the Xstream is turned on, "Fishing Time" will appear in display (select button A). Generator Output or Battery Voltage may be monitored at this time in display (A) by depressing the select button (H).
- Select the desired waveform for Channel 1 by pressing select button J.
- Preset desired level of "Pulses" by pressing select button (F) then increase or decrease with select button I.
- Preset desired "Duty Cycle %" by pressing the select button (G) then increase or decrease with select button (I).
- If desired, preset the voltage by pressing (M) to increase or decrease the volts (voltage shown in display E).
- Select the desired waveform for Channel 2 (or disable dual channel operation) by pressing select button K. For more information about dual channel operation, please refer to **Advanced Operation** in the following section.
- If desired, eight programmable electrofishing settings can be saved and recalled (waveform, duty cycle, pulse rate, and volts). Press (H) to scroll to save and recall shown in (A), then press (I) to save and recall settings. Refer to **Advanced Operation** in the following section.
- Reset fishing time with the "Timer Reset" button (B) when appropriate.

- Disengage “Emergency Stop” by turning ¼ turn clockwise. It will “pop” out and click.
- Press the Reset button (L) and the Indicator Lights on either side of the unit will illuminate and flash. Dashes will appear in the Power (D) and Amps (C) displays. Volts (E) will display set voltage. PLEASE NOTE: anode pole switch must be released (not engaged) to reset.
- At this point, the Xstream is ready to electrofish. Depress the safely switch on the anode pole to complete the circuit and commence electrofishing. NOTE: A click (relays engaging) will be heard from the MLES Infinity Xstream when the safety switch is depressed and the unit commences electrofishing. In addition, the enunciator will sound (tone pattern unique to the selected waveform) and the flashing pattern of the display lights will change (flashing pattern unique to the selected waveform).
- Power (Watts) will appear in display window (D) and Amps in display window (C).
- NOTE: If the Emergency Stop Button is not disengaged as instructed above, or the reset button has not been pressed, and the user engages the anode safety switch, zeros will appear in Power (Watts) and Amps display, the indicator lights and enunciator will not function, and no output will be applied to the anode.
- Monitor fish response and adjust voltage accordingly to attain desired Amps and Power (Watts) to immobilize fish.
- Adjust the Tilt Sensitivity Level and the Enunciator Volume to desired levels. It is highly recommended that these safety features not be disabled. PLEASE NOTE: if using generator power option, Enunciator Volume should be set to the maximum at 7.
- At the cessation of electrofishing, pull the main breaker to the "OFF" position, press the generator "Stop" button to kill the generator, disconnect the anode and cathode, carefully remove the backpack frame from the user and store the Infinity Xstream in a safe and secure location until further use.
- **CAUTION:** Repeatedly shorting (contact with) the anode (+) to the cathode (-) while the MLES Infinity Xstream is operating may cause damage to internal circuitry.

ADVANCED OPERATION OF THE MLES INFINITY XSTREAM

Advanced Operation – Save and Recall Electrofishing Configuration Settings

Eight programmable electrofishing settings may be saved and recalled. Each of the eight presets will store or recall a unique electrofishing configuration (i.e., combination of waveform, voltage, frequency and duty cycle). These eight presets can be saved from, or recalled to, either of the two channels available (see following section); provided that the channel saving from, or recalling to, is the active channel.

Save a setting

- Select desired waveform, duty cycle, pulse rate, and volts.
- Press (H) to scroll through until the display reads “Save (1)” in the display window.
- Release the safety switch to stop fishing.
- Press and hold (H) to save. The display (A) will ask “Sure?” to save.
- Press the up arrow to save as Preset "1" If not sure, press (H) to clear out of save.
- Repeat procedure to save additional settings (2 – 8).
- Save up to eight electrofishing settings.
- Repeat save procedure to write over any saved setting.

Recall a saved setting

- Press (H) until Recall is shown in the display window.
- To view saved settings in (A), scroll (I) up or down to select the desired setting (1-8).
- Stop fishing (release anode pole switch) to recall the desired setting.
- Press and hold (H) to recall the setting.
- The display (A) will ask “Sure?” to recall.
- Press the up arrow (I) to Recall the selected setting into the active channel.

Advanced Operation - Dual Channel Operation

The Infinity Xstream allows the user to simply and rapidly switch between two uniquely different elctrofishing configurations (i.e., combination of waveform, voltage, frequency and duty cycle) without having to power down. A prerequisite for Dual Channel Operation is that the user must assign one of the four waveforms (refer to the **Waveform Options** section) to Channel 2.

Single channel operation is the default configuration with the Infinity Xstream. Accordingly, whenever the Xstream is powered-on or reset in any way, the Xstream will commence electrofishing with the configuration assigned to Channel 1.

The transition from the Channel 1 configuration to the Channel 2 configuration (or vice versa) is accomplished by "double-tapping" the anode pole safety switch within a time period of **one second** as described in the steps below:

- Release safety switch
- Depress the safety switch
- Release the safety switch
- Depress the safety switch

If the above procedure is not accomplished within a one second timeframe, the Infinity Xstream will remain on the active channel.

Advanced Operation – Megger

The Infinity Xstream is designed with an internal megohmmeter (aka, Megger) that can be used to test for faulty waders. A Megger uses a high voltage at very low current to test for electrical resistance. If waders are in proper condition, the result of a Megger test would read "Infinity," meaning an infinitely high resistance to electrical current flow. If however, the Megger test resulted in a relatively low measure of resistance, then the waders worn by the user would in fact allow for the passage of electrical current. If the user were to then commence normal electofishing activities with faulty waders, the potential for electrocution would certainly exist.

In the case of the Infinity Xstream Megger, the user has the option of using three different voltages (500, 1000 or 1200V) to perform the test. The 500 Volt setting is sufficient for moderate to high water conductivities whereas the higher 1,200 Volt setting can be used under conditions of low water conductivity.

The procedure to use the Xstream Megger are listed below:

- Stand in water, wearing waders and wearing Infinity Extreme backpack electrofisher.
- Have an assistant select the Megger and a Megger voltage by scrolling through the Menu (H) on the Xstream control panel.
- Press (I) to select Megger voltage.
- Place a finger on the Megger probe (see photo below).
- Have the observer/assistant read the results of the Megger test in the display window.
- The result of the Megger test (resistance, as measure in ohms) will be displayed as either some value (less than 1.0, indicating at least some path to the flow of electricity through the waders) or it will read "Infinity" (greater than 1.0, indicating that the waders are functioning as perfect insulators, thereby isolating the user from the electrofishing circuit).

Figure 4. Location of the Megger probe on Infinity Xstream chassis. The Megger is used to check the resistance of the user's waders, so the potential of an electrical shock can be avoided.

FAULT INDICATORS AND MESSAGES

Overload Fault

The maximum peak output power of the Infinity Extreme is highly dependent upon the waveform, frequency and duty cycle employed by the user. However, the maximum average power output of the Xstream is slightly more than 400 Watts. The limitations of the system simply will not allow the Xstream to produce more output power, and adjusting the settings to exceed this maximum will trigger an overload condition.

If, during the course of electrofishing, the Infinity Xstream approaches an overload condition such as the voltage being set too high for the ambient water conductivity, a sequence of events (below) will occur to inform the user of an impending overload condition.

- First, as the load on the Xstream is increased to the point where the maximum power output is approached, the enunciator tone will change from a normal cadence to one of a strained or "bogged-down" tone.
- Further output demand on the Xstream toward the threshold of overload will enhance this strained tone to the point where it will become obvious to the user that an overload fault is imminent.
- Further output demand, to the point of exceeding the maximum power capability of the Xstream, will trigger an overload; thereby shutting-down the unit and displaying "Overload Fishing Voltage Reduced" in the display window of the control panel.
- At this point, the user will need to reduce the voltage and/or duty cycle to reduce the load demand, press the Reset button, then resume electrofishing.

Short Circuit Fault

If a dead short is detected (contact with anode to cathode) a message will appear "Power Off Shorted Cycle Pole Switch." If message appears, release switch, clear anode from cathode and/or check for improper wiring of the electrofishing system. To clear the error message and resume electrofishing, release the anode pole safety switch, press the Reset button, then resume electrofishing by depressing the anode pole safety switch. **NOTE:** Although the Infinity Xstream is designed with features to protect internal circuitry when a dead short is encountered, repeatedly shorting (contact with) the anode (+) to the cathode (-) while the Infinity Xstream is operating may cause damage to the unit.

Anode Out of Water Fault

The Infinity Xstream is designed with an anode out of out of water sensor that will disable the unit and display "Pole Out of Water Cycle Pole Switch" in the display window of the control panel if the anode ring is raised out of the water while electrofishing. In the event the user does trigger an anode out of water fault, it can easily be reset by releasing the anode pole

switch, immersing the anode ring into the water, then depressing the anode pole switch to continue sampling.

Tilt Fault

The Infinity Xstream is equipped with a tilt sensor (**refer to Advanced Safety and Protective Features**) that will disable the unit and display a "Tilt Tripped Cycle Pole Switch" in the display window of the control panel if the unit tilts too far from vertical. In the event the user does trigger a Tilt Fault, it can easily be reset and fishing resumed by increasing the vertical angle of the unit and cycling (off and on) the anode pole safety switch.

Immersion Fault

The Infinity Xstream is designed with an immersion sensor to shut down the system in the event the unit becomes immersed in water (**refer to Advanced Safety and Protective Features**). Should the unit become immersed, the unit will stop electrofishing and display an "WET Immersion Sensor" in the display window of the control panel. NOTE: The Xstream should be thoroughly inspected for water damage before resuming electrofishing following an immersion fault. Remove moisture from immersion sensor. Press “Reset” to resume electrofishing

WAVEFORM OPTIONS

The Infinity Xstream is unmatched in the electrofishing industry in terms of its ability to produce such a variety of waveforms. In addition to the four major waveform types provided by the Infinity Xstream, engineered into the Xstream are features that allow the user to modify each waveform type to suit their particular electrofishing needs. Not only is the user able to control the frequency, duty cycle and voltage of each major waveform, the precise metering of the Infinity Xstream allows the user to know **precisely** what is being applied to the water. The ability of the user to visualize the output waveform by referencing the meter readings and settings on the control panel is invaluable to understanding the science of electrofishing.

Components of a Waveform and Terminology

Electrical waveforms, although they can be produced in an infinite number of configurations, can be described by two general types: **DC (direct current)** and **AC (alternating current)**. DC waveforms are described by a steady "direct" voltage above a certain reference voltage (typically ground). AC waveforms are described by voltage thar fluctuates or "alternates" above and below a certain reference voltage (typically ground).

Each waveform, albeit AC or DC, can be described by few general characteristics:

- **Frequency:** Number of cycles per second and measured in Hertz (Hz). When working with pulsed DC waveforms, frequency is also referred to as Pulse Rate (pulses per second).
- **Period (T)**: The amount of time for the completion of one cycle (typically measured in milliseconds). The time for one cycle is measured from the leading edge of one pulse to the leading edge of the following pulse. Period = 1/Hz
- **Pulse Width (Ton)**: The width of the pulse or positive portion of a full cycle (typically measured in milliseconds).
- **Duty Cycle**: The percentage of the entire cycle that is comprised of the pulse or positive portion. Duty Cycle = (Ton/T) * 100

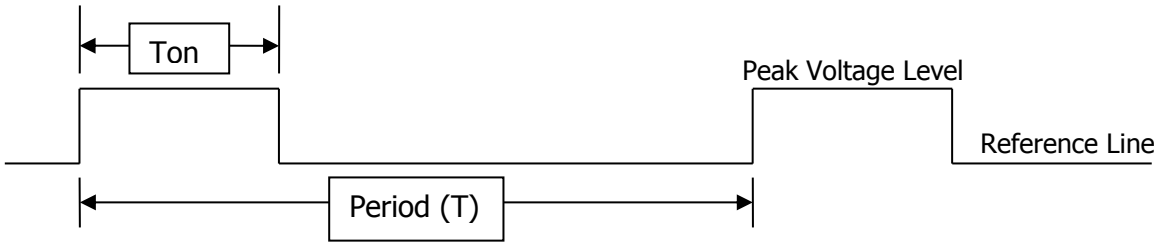

Figure 5. Schematic of a typical pulsed DC waveform produced by the Infinity Xstream. An AC waveform will have similar features, but also a negative portion below the reference line.

DC Pulse (+)

Operating the Infinity Xstream to produce a Pulsed Direct Current (DC Pulse) waveform is relatively straightforward, with the shape of output waveforms easy to visualize by referencing the settings on the control panel. The output produced and sent to the anodes are variations of simple pulsed DC waveforms (Figure 6). The user can adjust the properties of the pulsed DC waveform by adjusting voltage, pulses per second, and duty cycle. NOTE: The metering on the Infinity Xstream control panel monitors peak values for output voltage, current and power, not average. These peak values are displayed on the control panel.

When operating with Pulsed DC, the user can manipulate the shape of the output waveform by independently adjusting the Frequency/Pulses (1-300Hz), Duty Cycle (1-100%) and Voltage 1-1,200V). Also, when operating with Pulsed DC, the **(+)** symbol will be displayed in Volts and Amps display windows on the Xstream control panel.

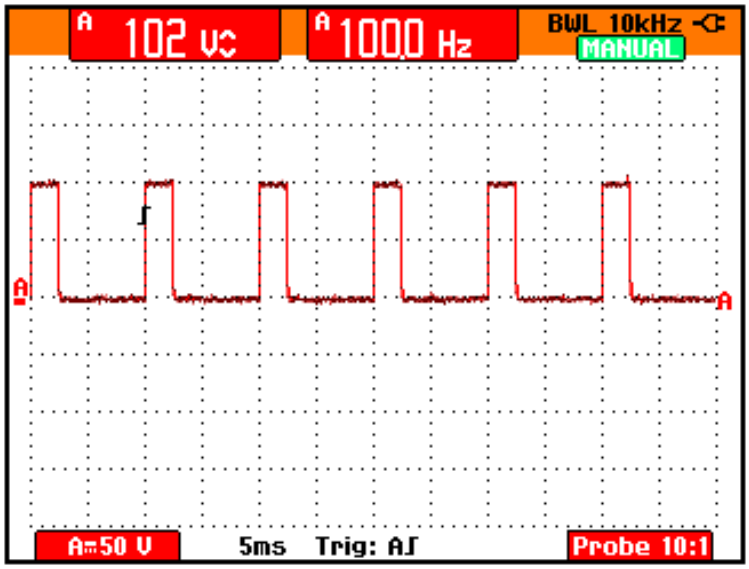

Figure 6. Oscilloscope screenshot of a typical Pulsed DC waveform produced by the Infinity Xstream. This output waveform was created by setting Voltage = 100V, Pulses = 100Hz and Duty Cycle = 25%.

DC Burst (:)

The DC Burst waveform is a variation of the DC Pulse waveform, but instead of producing a straight DC pulse for the Duty Cycle "ON" time, a "Burst Packet" of pulses is produced (Figure 7). Therefore, when operation in DC Burst, the user will need to select and set four settings that determine the overall shape of the waveform.

- **Slow Pul/Sec** is the parameter that determines the frequency of the long wave (i.e., the waveform that starts with the leading edge of the first burst in the packet and ends with the leading edge of the first burst in the next packet [Figure 7]).

- **Fast Pul/Sec** is the parameter that determines the frequency of the narrow waveform (i.e., the pulses within the burst packet [Figure 7 and 8]).

- **Pul/Burst** is the parameter that determines the number of Pulses contained within each Burst Packet. The maximum number the user can choose for this setting is determined by the following equation: Pul/Burst = [(Fast Pul/Sec) / (Slow Pul/Sec)]

- **Burst Duty Cycle** determines the percentage of each pulse within the Burst Packet that is "ON" (Figure 8).

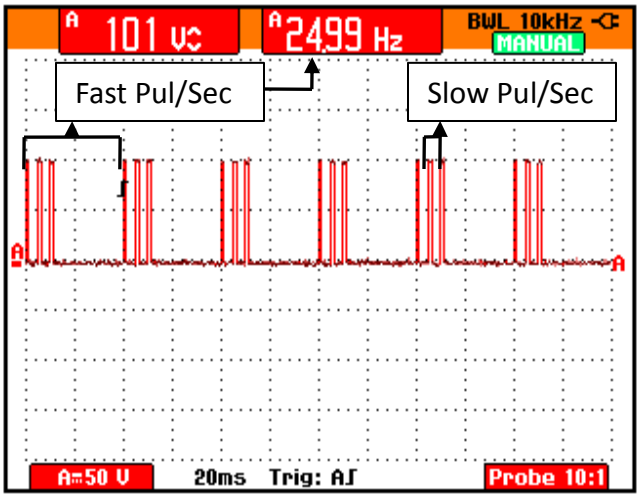

Figure 7. Oscilloscope screenshot of a typical DC Burst waveform produced by the Infinity Xstream. This output waveform was created by setting Voltage = 100V, Slow Pulses/Sec = 25Hz, Fast Pulses/Sec = 200Hz, Burst Duty Cycle = 25% and Pulses/Burst=3.

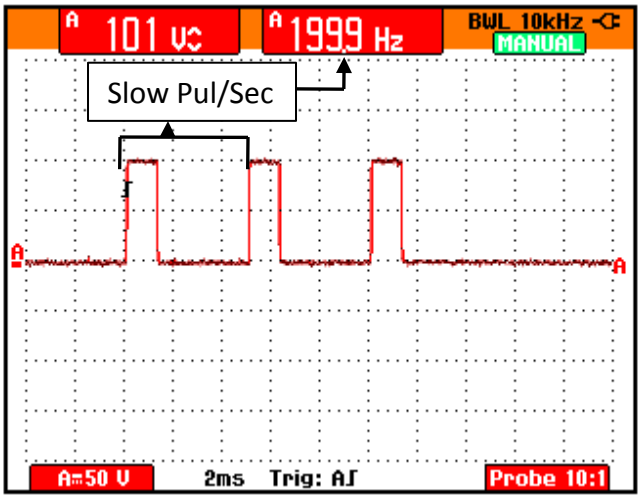

Figure 8. Oscilloscope screenshot of the same waveform depicted in Figure 6, only zoomed in on the "Burst" portion of the waveform. This output waveform was created by setting Voltage = 100V, Slow Pulses/Sec = 25Hz, Fast Pulses/Sec = 200Hz, Burst Duty Cycle = 25% and Pulses/Burst=3.

Visualizing the DC Burst output that is sent to the anode of the Xstream (and is ultimately felt by the fish) is a bit more difficult to visualize than that of the simple DC Pulse waveform. However, by careful examination of the oscilloscope screen shots depicted above, and utilizing the precise metering of the Infinity Xstream, you should be able to determine and visualize a Burst DC waveform based on the parameters selected on the Xstream control panel.

AC Simple (~)

The AC Simple waveform produced by the Infinity Xstream is not a true sinusoidal wave. Rather, the AC produced by the Xstream is a "Pulsed" AC (Figure 8). The shape of the output waveform that is sent to the anode and ultimately felt by the fish is quite easy to visualize based on the settings chosen by the user.

For example, the voltage selected by the user will determine the "peak" voltage of the AC waveform; that is, the voltage from the zero reference line to the peak of the positive pulse. Peak voltage should not be confused with "peak-to-peak" voltage, which is the measurement from the peak of the negative portion of the pulse to the peak of the positive portion of the pulse. Similarly, the output current and power displayed on the Infinity Xstream control panel are measured in peak values.

The frequency and duty cycle of the AC Simple waveform are adjusted in the same manner as the adjustments for the DC Pulse waveform. The Pulses setting determines the frequency (number of pulses per second as measured in Hz) and is adjustable from 1 to 300Hz. The Duty Cycle adjustment is used to determine the percentage of the entire AC pulse (both positive and negative legs) that is "ON." The Duty Cycle can be adjusted between 1 and 98% for the AC Simple waveform. An AC Simple waveform with a 98% duty cycle would have a positive pulse that made up 49% of the entire cycle and a negative pulse that made up 49% of the entire cycle. Similarly, an AC Simple waveform with a 25% duty cycle would have a positive pulse that made up 12.5% of the entire cycle, a negative pulse that made up 12.5% of the entire cycle (Figure 9).

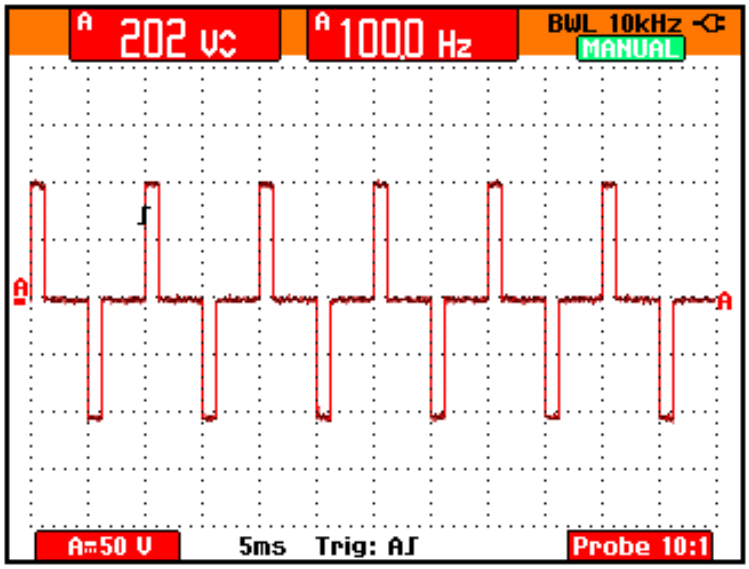

Figure 9. Oscilloscope screenshot of a typical AC Simple waveform produced by the Infinity Xstream. This output waveform was created by setting Voltage = 100V (peak), Pulses = 100Hz and Duty Cycle = 25%.

AC Nerve (~)

The AC Nerve waveform produced by the Infinity Xstream is a specialized waveform that is a modified AC Simple waveform. The AC Nerve waveform is identified by a narrow negative leg, or "Nerve" that is produced directly after the trailing edge of the positive AC leg (Figure 10). Notice that there is no rest time between the positive and negative legs like there is on the AC Simple waveform.

Another difference between the AC Nerve and the AC Simple waveforms is that the Duty Cycle of the positive leg and the negative leg are adjusted independently when operating under AC Nerve (Figures 10 and 11). The Duty Cycle of the positive leg can be adjusted from 1 - 90% in 1% increments, whereas the Duty Cycle of the negative leg can be adjusted from 1 - 25.5% on 0.1% increments.

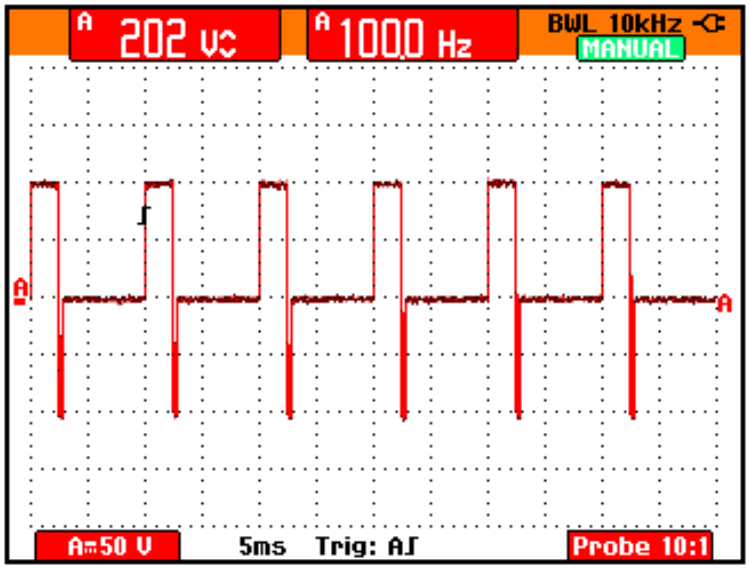

Figure 10. Oscilloscope screenshot of a typical AC Nerve waveform produced by the Infinity Xstream. This output waveform was created by setting Voltage = 100V (peak), Pulses = 100Hz and Duty Cycle (positive) = 25% and Duty Cycle (negative) = 2.5%.

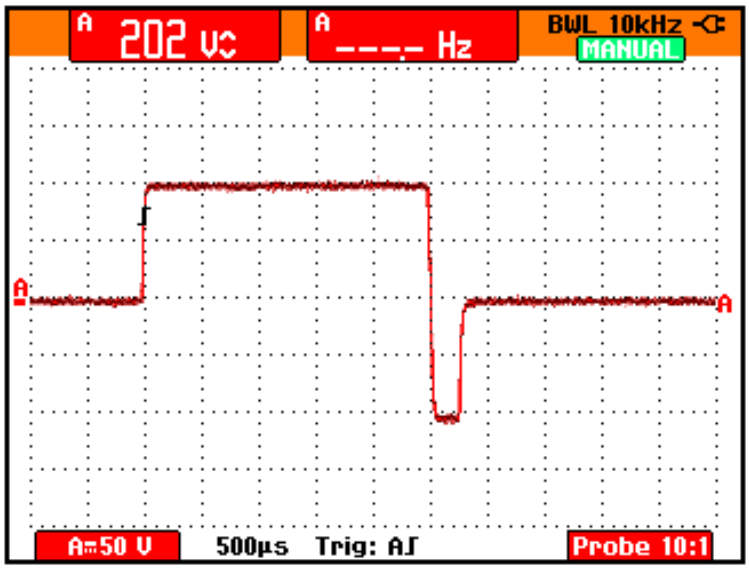

Figure 11. Oscilloscope screenshot of the same waveform depicted in Figure 9, only zoomed in on the "Nerve" portion of the waveform. This output waveform was created by setting Voltage = 100V (peak), Pulses = 100Hz and Duty Cycle (positive) = 25% and Duty Cycle (negative) = 2.5%.

TROUBLESHOOTING and TRANSPORTING

Troubleshooting

Should you encounter any problems with your Infinity Xstream, please follow these troubleshooting steps to remedy the problem:

- All connections are free of corrosion and obstructions so contact can be made.
- All plugs and connectors are secured and firmly tightened.
- Generator (if using) output is functioning properly, providing 24 volts, and small LED lights (located above and below the generator stop button) are blinking on the end of the alternator.
- The battery pack (if using) is charged and providing 24 Volts to the Xstream unit.
- The main breaker on the bottom of the unit is pushed back and in the "ON" position.
- Emergency Stop is turned ¼ turn and popped out.
- Reset button has been pressed and the side red indicator lights are blinking.
- To test the anode pole safety switch, turn the main breaker to the "OFF" position, depress the Menu and System Info button (H), then depress the safety switch. The Power and Amps displays on the control box should read "000". If zeros are not displayed in these windows, the anode pole switch is bad and the pole should be replaced. PLEASE NOTE: cathode rattail must be connected for switch to function.
- Call (816) 804-5604 for additional diagnostic guidance.

Transporting the Infinity Xstream

The Infinity Xstream should be transported in a secure container and/or in a secure location within a vehicle. Avoid dropping or jarring the Xstream, as this could damage internal circuitry. When transporting in the field, the Xstream should be laid horizontal on the pack straps with the control panel facing upward, and packed in a secure container or be worn as you would for elctrofishing operations. Do not drag the unit along the ground, submerse in water or mishandle in any way. The Xstream is a very sophisticated piece of electronic machinery and should be treated as such. Misuse and mistreatment will not be covered by the warranty.

APPENDIX 1

Elevation Correction Factors

Humidity, temperature and elevation affect the power output of a gas motor. In particular, elevation can substantially affect the efficiency of any generator, including the one used to power the Infinity Xstream. The table below lists correction factors that should be applied when using the Infinity Xstream generator at elevations above mean sea level.

Elevation (ft) above mean sea level	Correction factor	Approx. power output (Watts)
0	1.000	500
1,000	0.975	488
2,000	0.934	467
3,000	0.895	448
4,000	0.857	429
5,000	0.820	410
6,000	0.786	393
7,000	0.752	376
8,000	0.720	360
9,000	0.689	345
10,000	0.659	330
11,000	0.631	316
12,000	0.604	302
13,000	0.578	289
14,000	0.552	276
15,000	0.528	264
16,000	0.505	253
17,000	0.483	242
18,000	0.462	231
19,000	0.441	221
20,000	0.420	210

WARRANTY INFORMATION

Midwest Lake Management, Inc. (the Company) warrants to the original purchaser that the MLES Infinity Xstream Backpack Electrofishing System (electrofishing components, wiring, chassis, frame, batteries, generator) is free from defects in material and workmanship and agrees to repair or replace, at the Company's sole discretion.

One year, only if the Infinity Xstream and components are sold directly by Midwest Lake Management, Inc. and the product is used exclusively for electrofishing by trained fisheries biologists. Purchase and/or service from any other vendor will void the warranty.

If the Infinity Xstream becomes non-functional during the warranty period and field sampling must resume, a loaner Infinity Xstream will be issued to the user, at the Company's sole discretion, until the user's Infinity Xstream is repaired (all shipping costs incurred by user). If repairs need to be made outside the one year warranty, the user is responsible for all shipping and repair costs and a loaner Infinity Xstream may be rented. Prior to any shipment, please contact us.

This warranty applies only to the products sold within the United States of America, the District of Columbia, Canada, Mexico, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, the Canal Zone, or American Samoa.

This warranty is not transferable and does not cover damage resulting from defects other than in material or workmanship, or damage caused by unreasonable use, including the failure to provide reasonable and necessary care and maintenance.

Other items not covered under this warranty include:

- Damages caused by abuse, accident, misuse, neglect, alteration, modification, the effects of corrosion, normal wear and tear or repairs by anyone other than the Company.
- Improper connection and/or incorrect wiring up to boat, push barge, canoe, etc.
- Transportation in non-recommended fashion, dropping, damage from a motor vehicle, immersion in water or damage from shipping.

Warranty is voided if the customer fails to maintain and operate the product in accordance with the instructions and recommendations of the Company as set forth in the product operator's manual or if the product is used as rental equipment.

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Serial #

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