LRAD 500X-RE MMT
EQUIPMENT MANUAL

LRAD® 500X-RE MMT

Genasys™

Catalog: LRAD-500X-RE-MMT-MANUAL
Part No.: 116666-00 Rev.07
Aircraft Models: HH-60, UH-1
Revised September 2020

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1.0 System Description

1.1 Introduction

The LRAD-500X-RE MMT consists of a head unit with four acoustic drivers, helicopter mounting equipment, and a control unit. The control unit includes a built-in digital media (MP3) player and a handheld microphone as well as controls for audio volume, power, voice boost and beam width.

Designed specifically for airborne operation, the LRAD-500X-RE MMT is equipped with a mounting plate and yoke compatible with either HH-60 or UH-1 helicopter models.

The LRAD-500X-RE MMT is capable of broadcasting prerecorded audio files through the control unit and live speech through the handheld microphone. Additionally, alert tones designed to gain attention and/or irritate can be played at extreme volume levels for effective use over distance.

Audio from the LRAD-500X-RE MMT is amplified and intelligibly projected for effective in-flight communications at distances of 650 meters or more. The acoustic transducer module is designed to significantly minimize the acoustic sound pressure levels (SPLs) at the rear of the device, making for safe operation with hearing protection, such as foam earplugs.

1.2 Specifications

Weight

Head Unit, Control Unit, and Microphone	51.8 lbs.	
Yoke	25.6 lbs.	
Yoke, Head Unit, Control Unit, and Microphone	77.4 lbs.	
Mounting Plate and Battery Box	**HH-60:** 98.6 lbs.	**UH-1:** 104.2 lbs.
Total System Weight	**HH-60:** 176.0 lbs.	**UH-1:** 181.6 lbs.

Dimensions

Head Unit	24.8” W x 25.5” H x 12.4” D
Overall	**HH-60:** 30.0” W x 44.0” H x 24.0” D
	UH-1: 30.5” W x 44.0” H x 23.1” D

Acoustic

Maximum Continuous Output	149 dB SPL @ 1 meter, A-weighted
Maximum Peak Output	154 dB SPL @ 1 meter, C-weighted
Acoustic Beam Width	Narrow Setting: +/- 15°
	Wide Setting: +/- 30°

Electrical

Normal Power Consumption	60 Watts (Voice content)
Peak Power Consumption	265 Watts (Alert tone)
Electromagnetic Compatibility	FCC Class A radiated and conducted emissions

Battery (MFG Part Number: MK Battery ES33-12)

Chemistry	Sealed Lead-Acid, AGM
Capacity	33 Ah
Normal Individual Battery Voltage	12 VDC
Charger Input	100-230 VAC 50/60 Hz
Charger Output	24 VDC 7 A
Typical Charge Time from 25% Capacity	4-6 Hours
Max Volume Alert Tone Runtime on Full Charge	1 Hour*
Max Volume Voice Message Runtime on Full Charge	1.5 Hours*

*Runtime depends greatly on the files being played and the frequency of the playback. Voice messages typically use less power than constant tones.

Environmental

Random Vibration	MIL-STD-810F, Method 514-4, Wheeled Vehicles
Shipboard Vibration	MIL-STD-167-1A
Shipboard Shock	MIL-S-910D, Class I, Shock grade B
SRS Shock	MIL-STD-810F, Method 516.5, Procedure 1 (Functional Shock)
High/Low Temp Operational	MIL-STD-810F, Method 501.4 & 502.4, Procedure 2, -33° to 71° C
Rain	MIL-STD-810F, Method 506.4, Procedure 2, Blowing Rain
Operating Humidity	MIL-STD-810F, Method 507.4
Salt Fog	MIL-STD-810F, Method 509.4
Safety	MIL-STD-1474D

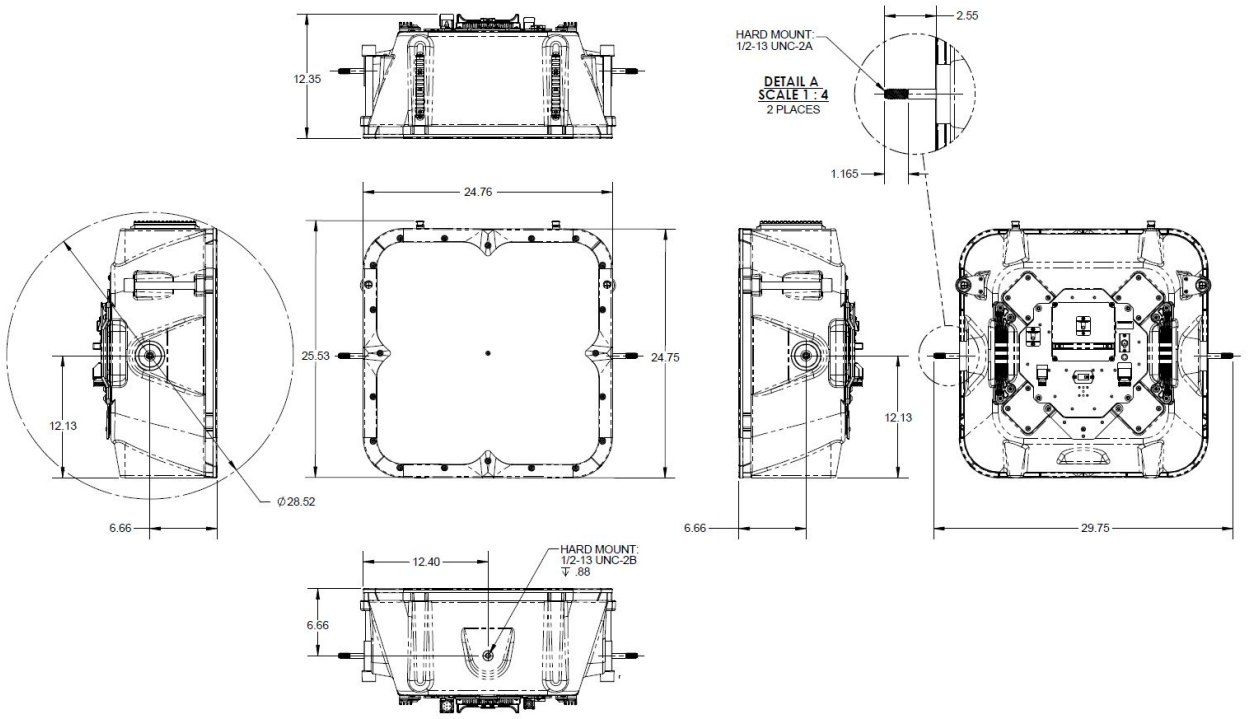


Figure 1: Head Unit Dimensions and Hard Mounts

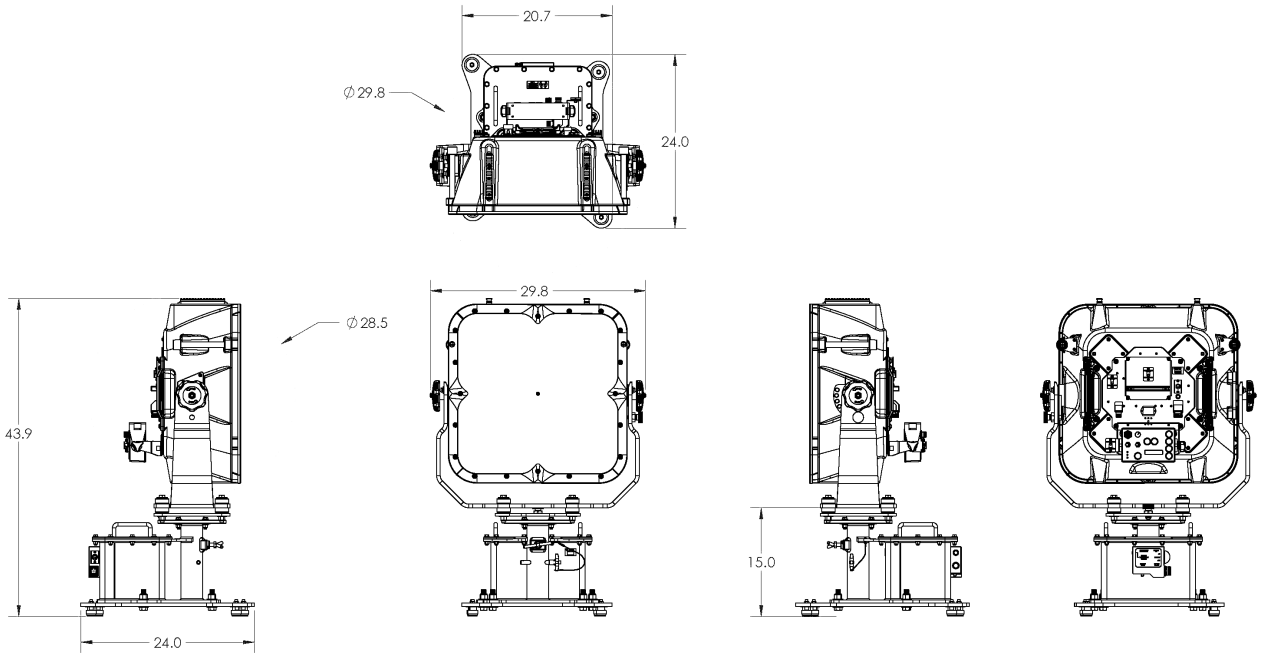


Figure 2: LRAD-500X-RE MMT Total System Dimensions – HH-60

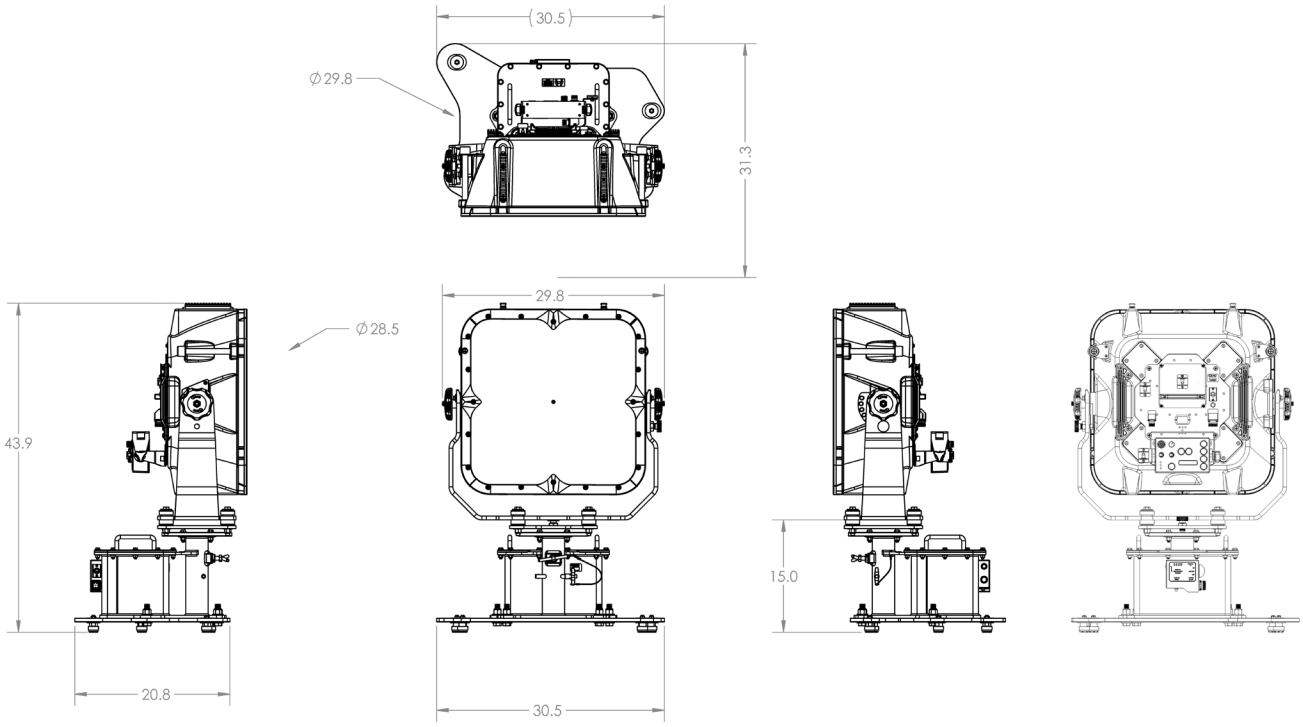


Figure 3: LRAD-500X-RE MMT Total System Dimensions – UH-1

1.3 Functional Block Diagram

Figure 4 shows a block diagram of the major subsystems of the LRAD-500X-RE MMT.

The battery box provides power to the DC to DC converter located in the sealed LRAD-500X-RE MMT electronics enclosure. The DC-DC converter accepts 10.5 to 28 VDC on the input and converts it to 48 VDC to drive the 500 W class “D” digital amplifier module while also supplying battery input to power the control unit. A preamp on the amplifier board receives input from the control unit and any attached accessories such as the recording microphone. A volume control stage then processes the audio prior to entering the pulse width modulator. Audio passes through the pulse width modulator and into each of four independent amplifier power stages, driving the acoustic drivers with up to a 24 VRMS analog audio signal. An electromagnetic voice coil and diaphragm in the acoustic driver is excited by the amplified audio signal to produce sound.

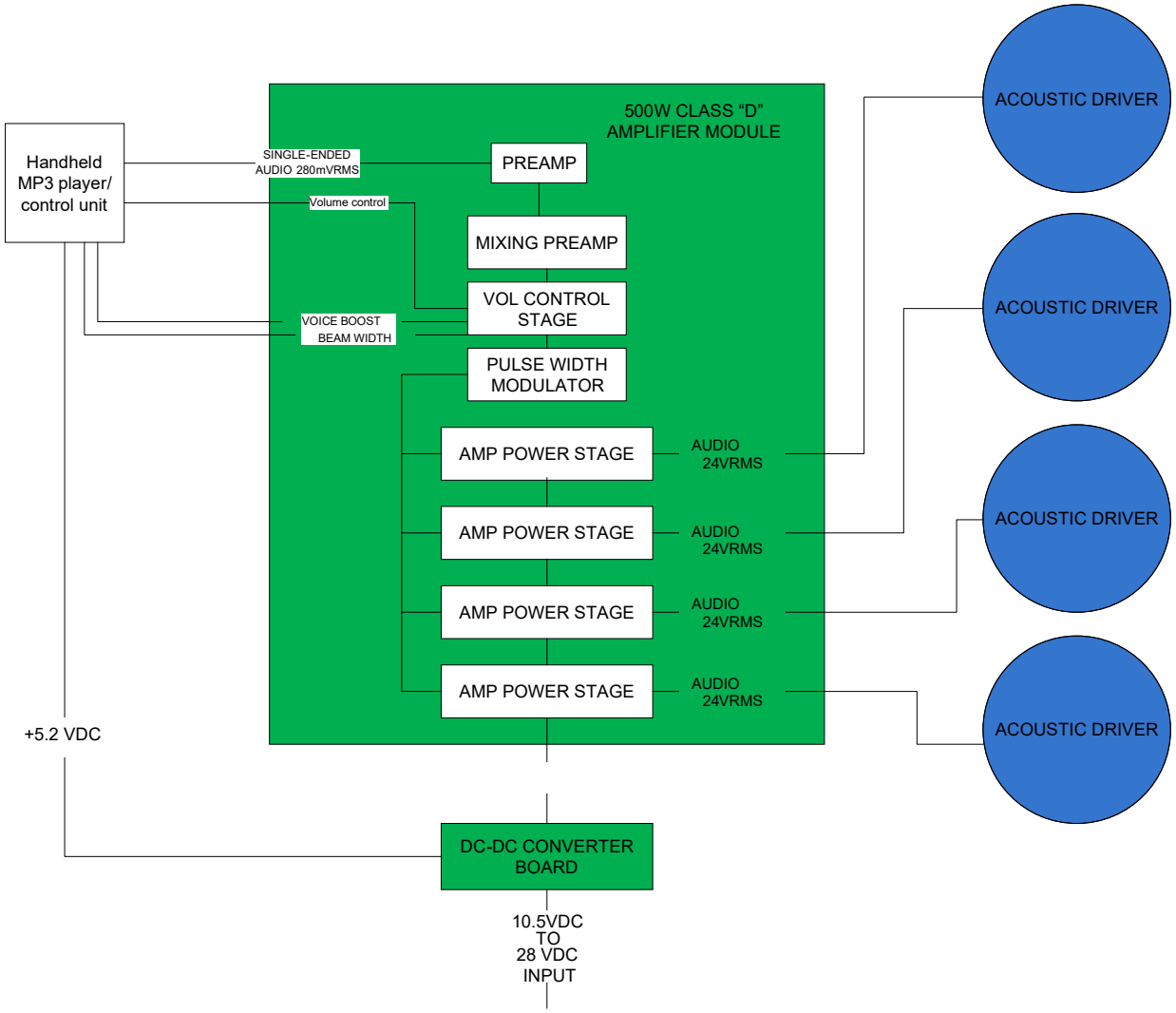


Figure 4: Functional Block Diagram

1.4 Acoustic Performance

The LRAD-500X-RE MMT is capable of projecting extremely loud voice communications or tones towards intended targets. The LRAD's acoustic output is "focused" in order to achieve maximum sound intensity directly in front of the device. This allows the LRAD-500X-RE MMT to achieve a maximum continuous SPL of 149 dBA at one meter from the front of the LRAD. The following figure shows the direction in which the sound is projected from the LRAD head unit.

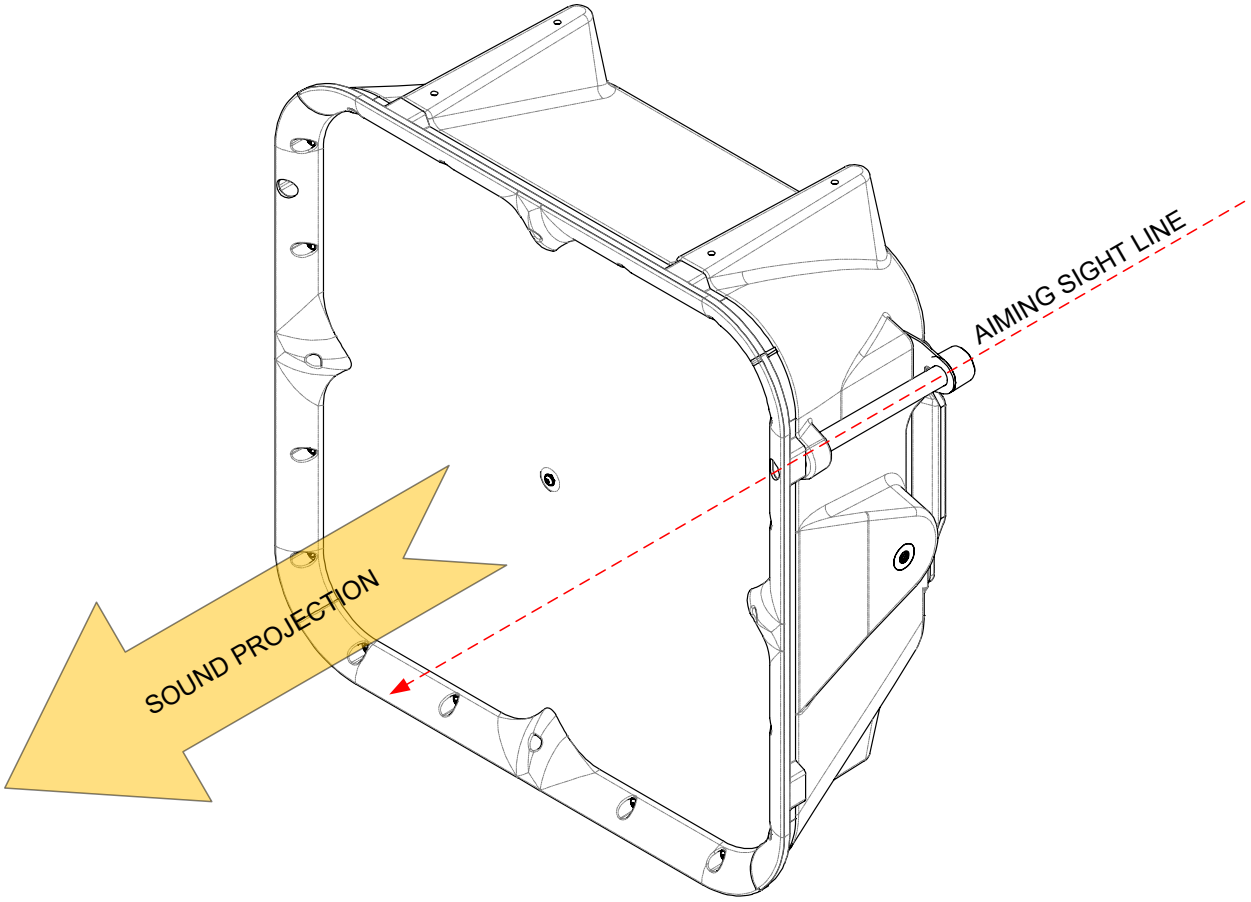


Figure 5: LRAD-500X-RE MMT Sound Projection Orientation

The sound projected from the LRAD will decrease by approximately 6 dB per doubling of the distance from the LRAD following the Inverse Square Law for sound. The following equation can be used to calculate maximum potential SPL at a given distance:

$$SPL_{new} = SPL_{ref} + (20 \times \log(D_{ref}/D_{new}))$$

The SPL at a given distance (SPL_{new}) is equivalent to the reference SPL (SPL_{ref}) plus 20 times the log of the ratio of the reference Distance (D_{ref}) to the given Distance (D_{new}).

The reference SPL and distance for the LRAD-500X-RE MMT is 149 dB at 1 meter at maximum continuous volume. The SPL can be plotted as a function of distance from the LRAD as shown in the following chart:

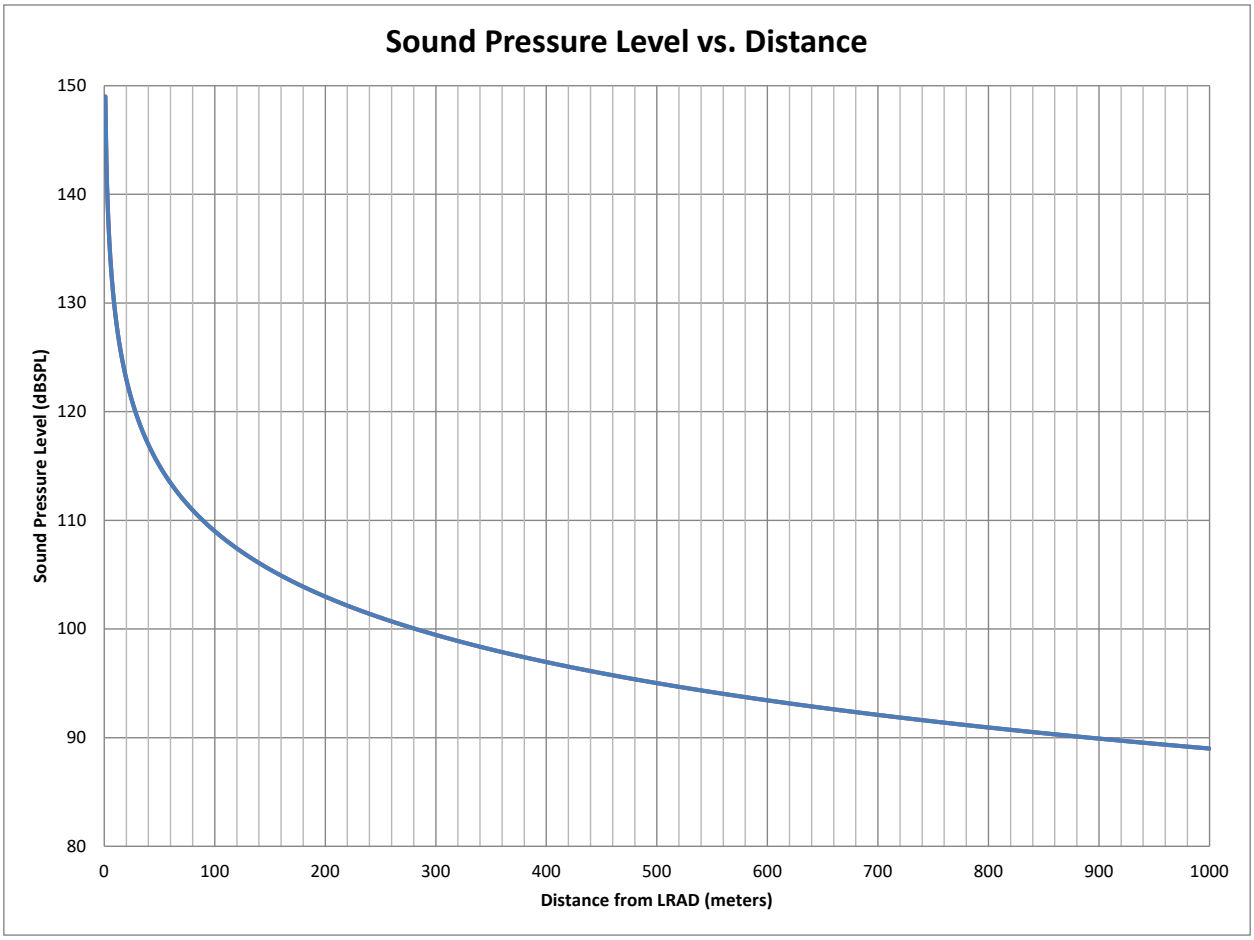


Figure 6: SPL vs. Distance

The "focused" nature of the acoustic output of the LRAD-500X-RE MMT results in at least a 30 dB decrease in SPL from the front of the device to the rear (in the operator's position). The polar plot in Figure 7 shows SPL readings taken while playing a 3 kHz tone from the LRAD. The result is a similar polar plot to what you would see when playing the aversion tone. The SPL will drop as the reference point moves off axis from the LRAD's main acoustic beam. At 30 degrees off axis the SPL will be around 14 dB down, and at 75 degrees (to the sides and directly behind the LRAD) the SPL will be about 33 dB down.

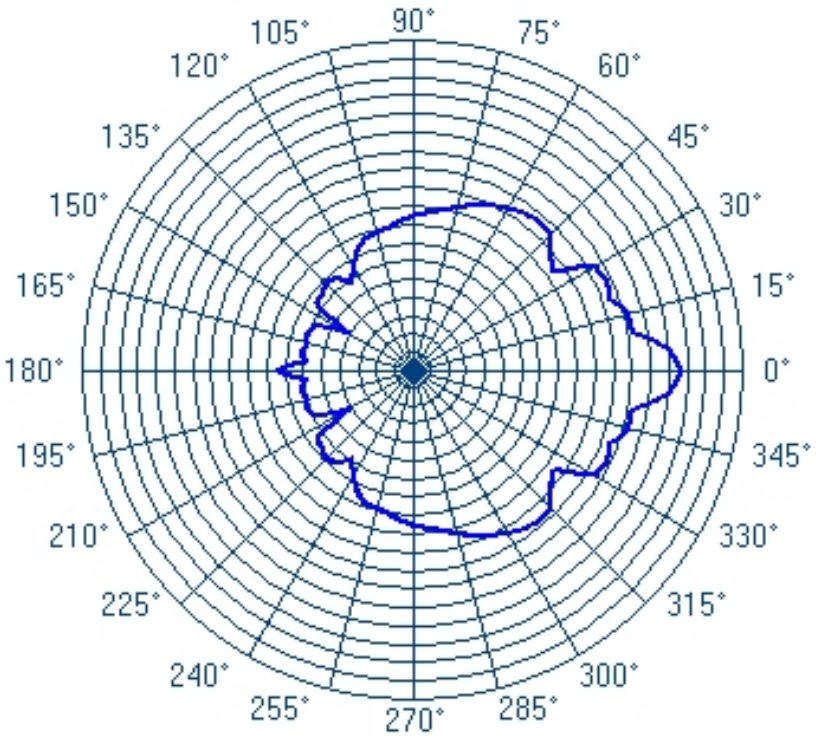


Figure 7: LRAD-500X-RE MMT Polar Plot at 3 kHz

Table 1: SPL Level Ranges from Polar Plot

Angle Range	SPL Drop from Polar Plots	Actual Max SPL at 1 m in this Angle Range with alert tone	Distance to Reach 104 dBA max in this Angle Range
+/-30 Deg.	0 to 20 dBA	149 dBA	60 m
+30 to +105 and -30 to -105 Deg.	20 to 33 dBA	129 dBA	6 m
+75 to -75 through 180 Deg.	35 to 50 dBA	114 dBA	1 m

The data in Table 1 is taken from the 3 kHz polar plot for the LRAD-500X-RE MMT. Since the LRAD-500X-RE MMT produces maximum SPL at this frequency, the ranges shown in this table were used to generate the safe zones diagram located on the rear panel of the LRAD.

1.5 LRAD-500X-RE MMT Features

1.5.1 Mount and Yoke Features

This section contains important information on the mount and yoke, which are used to secure and manipulate the LRAD-500X-RE MMT inside of a helicopter.

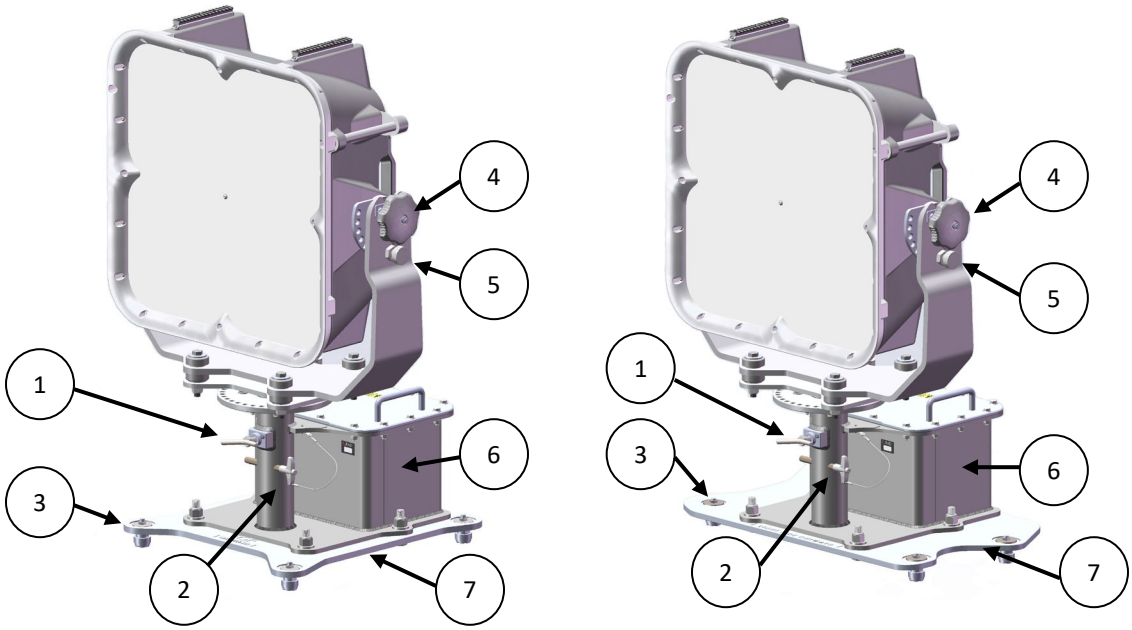


Figure 8: Mount and Yoke - HH-60 (Left) UH-1 (Right)

1. Friction Lock T-Handle
    - This screw T-handle is used to take the free play out of the mount when in a fixed azimuth position.
2. Stud Safety Pin
    - This pin is used to secure the yoke stud in the mount.
3. Airframe Attachment Joints (aka 12-Jaw Cargo Fittings)
    - These attachment points are used to secure the cargo payload to the helicopter.
4. Friction Tilt Knobs
    - These knobs are located on both sides of the LRAD-500X-RE MMT and can be utilized to fine tune the tilt of the head unit.
5. Tilt Lock Pin
    - This feature allows the user to lock and unlock the head unit and the yoke. It also locks the head unit in a fixed tilt position.
    - There is also a pan (azimuth) lock (not shown).
6. Battery Box
    - This houses the batteries and important power information and features.
7. Mounting Plate
    - This plate secures the LRAD-500X-RE MMT to the helicopter (Figure 9).

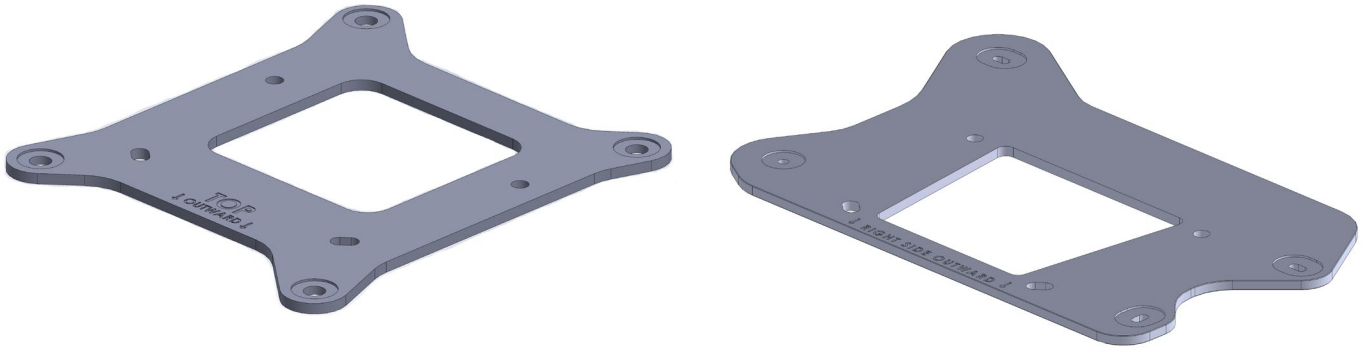


Figure 9: Mounting Plate - HH-60 (Left) and UH-1 (Right)

Disclaimer: Genasys offers mounting plates compatible with the HH-60 and UH-1 helicopter models. It is the customer's responsibility to verify hole alignment and fit if they intend to install this mount in any similar helicopters.

1.5.2 Head Unit Features

This section contains important information on the head unit, which contains the speakers and power controls for the LRAD-500X-RE MMT.

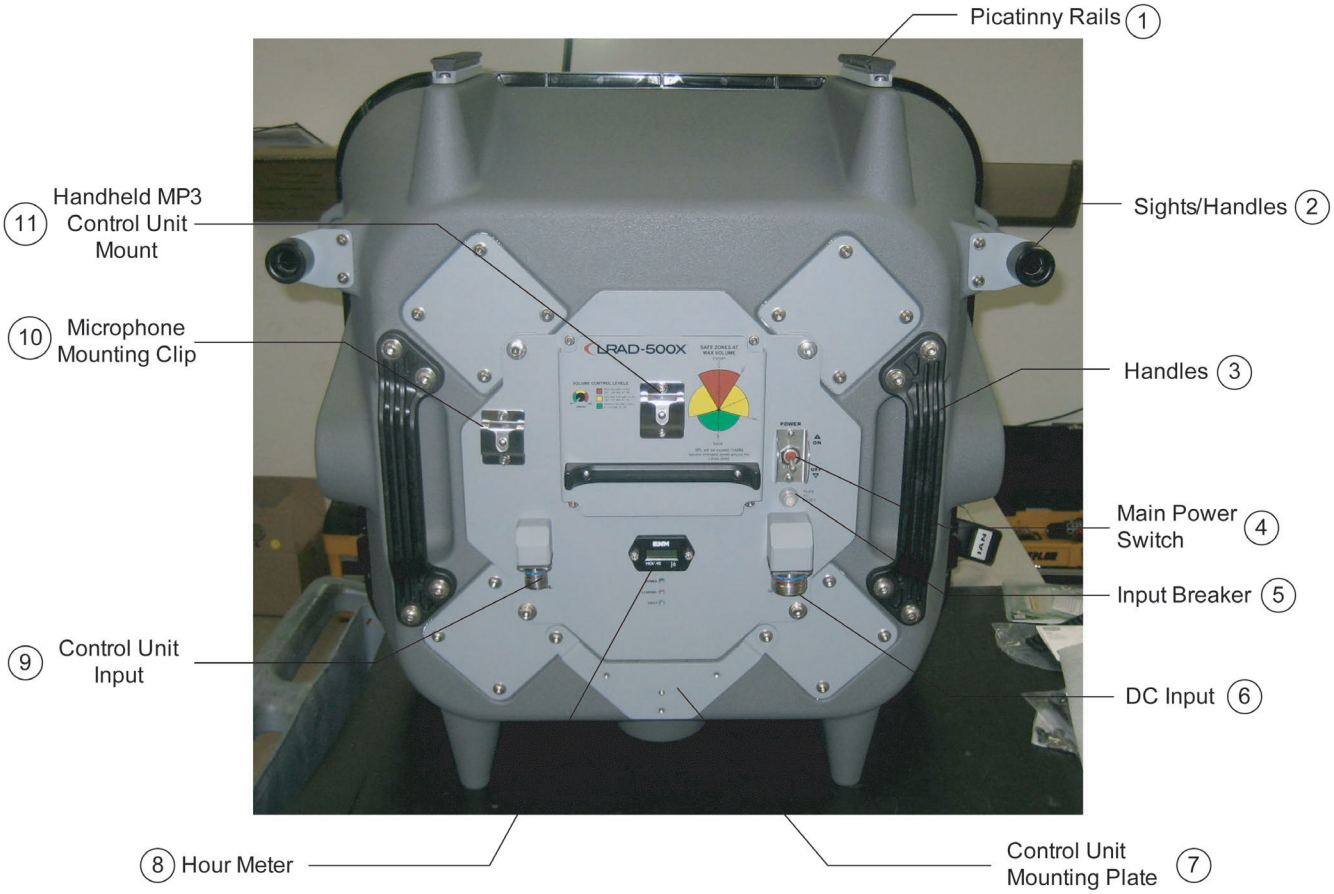


Figure 10: LRAD-500X-RE MMT Head Unit

1. Picatinny Rails
    - Used to mount accessories, such as a Maxabeam or green laser.
2. Sights/Handles
    - Used to lift the LRAD in a two person carry and to aim the sound beam at the intended target.
3. Handles
    - Used for lifting and aiming the LRAD.
4. Main Power Switch
    - Disconnects the power input from the internal DC to DC power converter.
5. Input Breaker
    - Limits input current in the event of an internal short.
6. DC Input
    - Accepts DC power input from batteries or AC adaptor.

7. Control Unit Mounting Plate
    - Allows control unit to be attached to the head unit for local operation of audio controls.
8. Hour Meter
    - Displays power on hours.
9. Control Unit Input
    - Connects to the control unit and accepts audio and control signals from the unit.
10. Microphone Mounting Clip
    - Attach the microphone here when not in use.
11. Handheld MP3 Control Unit Mount
    - Attach the handheld MP3 control unit here when not in use.

1.5.3 Battery Box Features

This section highlights specific features and controls found on the LRAD500X-RE MMT's battery box.

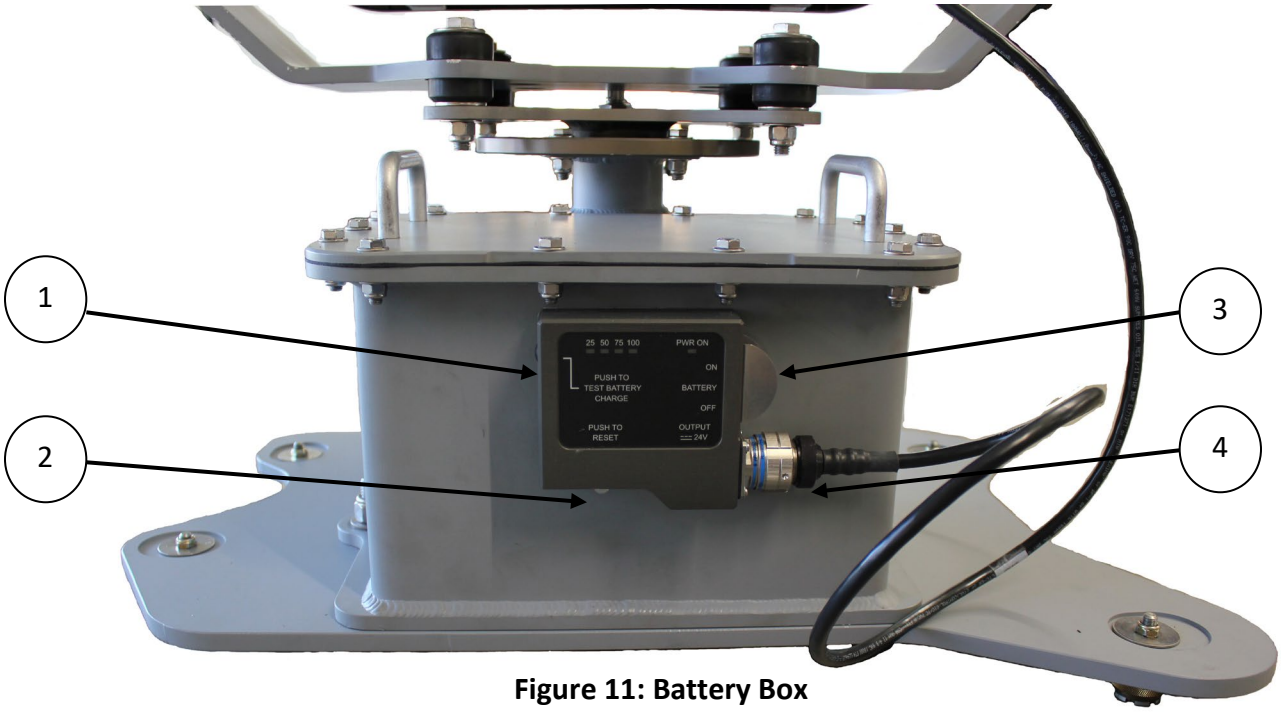


Figure 11: Battery Box

1. Battery Level Gauge
    - There is a button on the side that, when pressed, will illuminate a set of lights on the front panel indicating battery level (the user should not let the battery level drop below 25%).
2. Circuit Breaker
    - A water-resistant circuit breaker reset in the event of an electrical short or overcurrent.
3. Battery Box DC Power Supply Switch.
    - This switch enables the 24 VDC to reach the LRAD-500X-RE MMT head unit.
4. Power Connector
    - This connector acts as both the power connection for the LRAD-500X-RE MMT head unit and the battery charging port. Connecting the charger directly to this port will initiate charging no matter the state of the power switch on the battery box (Item 3).

1.6 Control Unit Features

The section contains important information on the Control Unit, which has several important features used to operate the LRAD-500X-RE MMT.

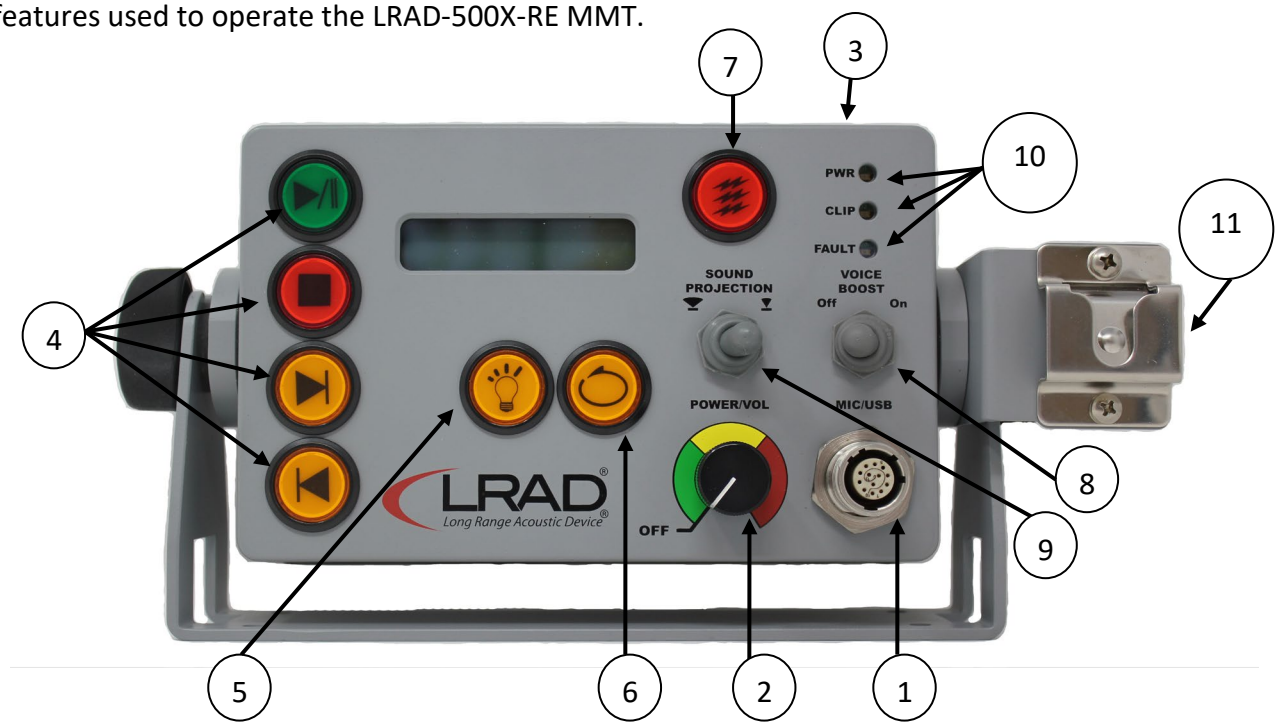


Figure 12: Control Unit

1. Mic and Audio In, USB Interface
    - This interface allows for audio input from an external audio source (microphone, CD player, tablet, etc.). Connect to an external audio source using the AUX IN cable (Figure 13).
    - This interface is also used to download audio files to the MP3 player's onboard memory. Download files using the USB download cable.

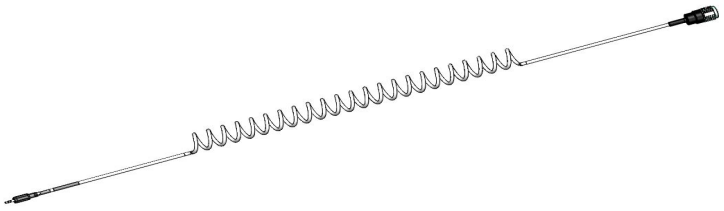


Figure 13: AUX IN Cable (D38999 to 3.5mm)

2. Power On/Off, Volume Control
    - This knob controls the power and volume of the LRAD-500X-RE MMT.
3. Audio Out Interface to LRAD (back side)
    - This connects the MP3 Player/Control unit to the head unit.

4. Play/Pause, Stop, Skip Forward, Skip Reverse Buttons
    - These buttons control playback of MP3 audio files stored on the unit.
5. Backlight Brightness
    - Cycles button and LCD brightness levels.
6. Repeat Mode
    - Causes MP3 file to playback in a continuous loop until the user presses the stop button or the LRAD is turned off.
7. Alert Tone
    - This button activates the alert tone, overriding any other audio file that is playing at the time.
8. Voice Boost Switch
    - Boost output power of audio files and microphone recordings.
    - Voice boost in the ON position may cause feedback when broadcasting live speech in close proximity to the LRAD.
9. Sound Projection Switch
    - Controls the width of the LRAD's audio beam. User can adjust projections according to environment and target (NARROW = +/- 15°, WIDE = +/- 30°).
10. LED Status Indicators
    - **PWR:** LED illuminates in green when main power switch is on and amplifiers are powered up.
    - **CLIP:** LED illuminates in yellow when input signal is too high. Excessive input signal level will cause distortion of audio output and may damage the amplifier if applied continuously.
    - **FAULT:** LED illuminates in red when amplifiers have reported a general fault (overtemperature, overcurrent, etc.) and have shut down or failed. Cycling the power may clear some types of faults.
11. MIC Hanger
    - Allows microphone to clip to control unit.

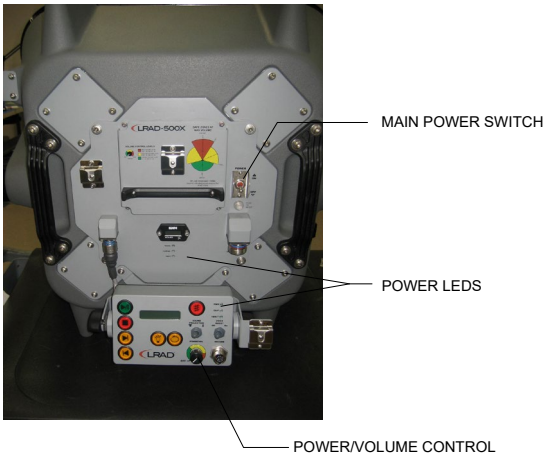


Figure 14: LRAD-500X-RE MMT Head Unit and Control Unit

1.7 Recording Microphone Features

The LRAD-500X-RE MMT includes a rugged microphone with an integrated digital recording chip. This microphone can record and store approximately one minute of audio and is also capable of broadcasting live speech. To broadcast live speech, simply press and hold the Push To Talk (PTT) button and speak into the microphone.

In certain situations, the user may prefer to record a message instead of broadcasting live speech. The recording feature is extremely useful when a message needs to be quickly recorded for repeated continuous use, or when feedback cannot be avoided when broadcasting live speech through the microphone.

1.7.1 Microphone Feedback

About microphone feedback:
Microphone feedback is caused when the microphone picks up the LRAD's audio output, causing a loud harmonic hum through the device. Placing the microphone directly in the sound projection path of the LRAD and keying the PTT button will result in the worst-case feedback scenario. This is because the sound being produced by the LRAD is being fed back into itself, causing a reverberation and resulting in a loud screech from the device. When operating the LRAD, the user should always be vigilant about limiting feedback.

How to Limit Feedback*:*

- Adjust the volume: Lower the LRAD's volume until feedback is negated.
- Avoid reflections: If the output from the LRAD is bouncing off a solid object, such as a building, and making its way back to the microphone, feedback will occur. Try repositioning the LRAD or the microphone to prevent feedback.
- Maintain your distance: The farther away the microphone is from the LRAD, the less feedback you will experience. Only use the microphone behind the LRAD, keeping it out of the main acoustic beam.
- Shield the microphone: If possible, shield the microphone and the microphone operator from the LRAD's acoustic output to reduce feedback. Stand behind a physical barrier, or inside a guard house or ship's bridge. You may also use your free hand to cover the area surrounding the microphone to attempt to limit feedback.
- Use the PUSH TO TALK button to your advantage: Releasing the PTT button on the microphone immediately after speaking will limit feedback. Pressing and holding the PTT button for longer than necessary may lead to feedback.

1.8 Electrical Connections and Signals

The following figures show the pin locations and electrical signal designations for the two connectors found on the LRAD-500X-RE MMT:

DC Power Input:

The DC power input is the main power input connector for the unit. The LRAD-500X-RE MMT can operate at DC input voltage levels between 12 and 28 VDC.

The connector provided is of the following MIL-38999 Type III designation:

MIL-38999/24WE6P

This connector provides six #12 pin contacts. Figure 15 shows the pinout for this connector:

Pin A: DC in + (RED WIRE)
Pin B: DC in + (ORANGE WIRE)
Pin C: Shield
Pin D: DC in – (BLACK WIRE)
Pin E: DC in – (BROWN WIRE)
Pin F: Not used

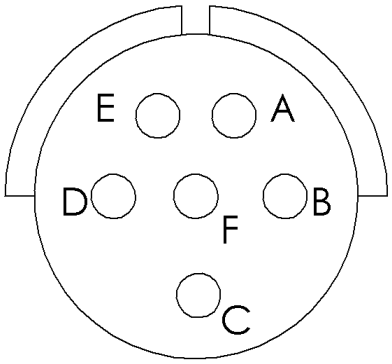


Figure 15: DC Input Connector Pinout

Control Input:

The control input connector is provided for connection with the included audio control unit. This connection powers the control unit and receives audio and control signals from the control unit.

The connector provided is of the following MIL-38999 Type III designation:

MIL-38999/24WB35S

This connector provides thirteen #22 socket contacts. Figure 16 shows the pinout for this connector:

Pin 1: Not connected
Pin 2: Audio Signal In + (.28VRMS relative to pin 3 for full volume)
Pin 3: Audio Signal In -
Pin 4: DC ground
Pin 5: Drain wire
Pins 6 and 7: Not used
Pin 8: 12 to 28 VDC out to control unit.
Pin 9: 10VDC in. Apply 10VDC to turn LRAD amplifiers on.
Pin 10: Beam Width switch. Pull to GND for narrow beam.
Pin 11: Voice Boost Switch. Pull to GND to enable Voice Boost.
Pin 12: Amplifier fault. 3.3V CMOS output low when amplifier is faulted.
Pin 13: GND

Note: Input signal level is not to exceed 280 mV RMS.

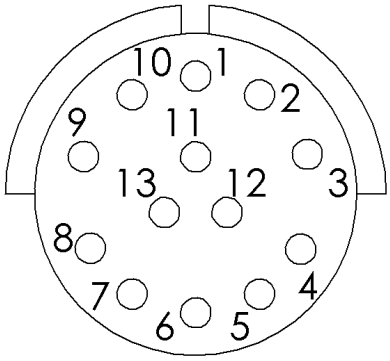


Figure 16: Control Input Connector Pinout

- The Control unit is powered by the +12 to 28 VDC on pin 8 of the Control input connector. This voltage is provided by the batteries when the main power switch is in the on position.
- When the Power/Volume control on the Control unit is turned on, the unit will supply +10 VDC to the LRAD to turn on the amplifier.
- **NOTE**: The LRAD hand-held MP3 Player/Control Unit P/N LRAD-X-CM-HH-SS (not included with this system) will also function with the LRAD-500X-RE MMT when connected to Control Input connector.

2.0 Operating Limits

2.1 Operation Zones

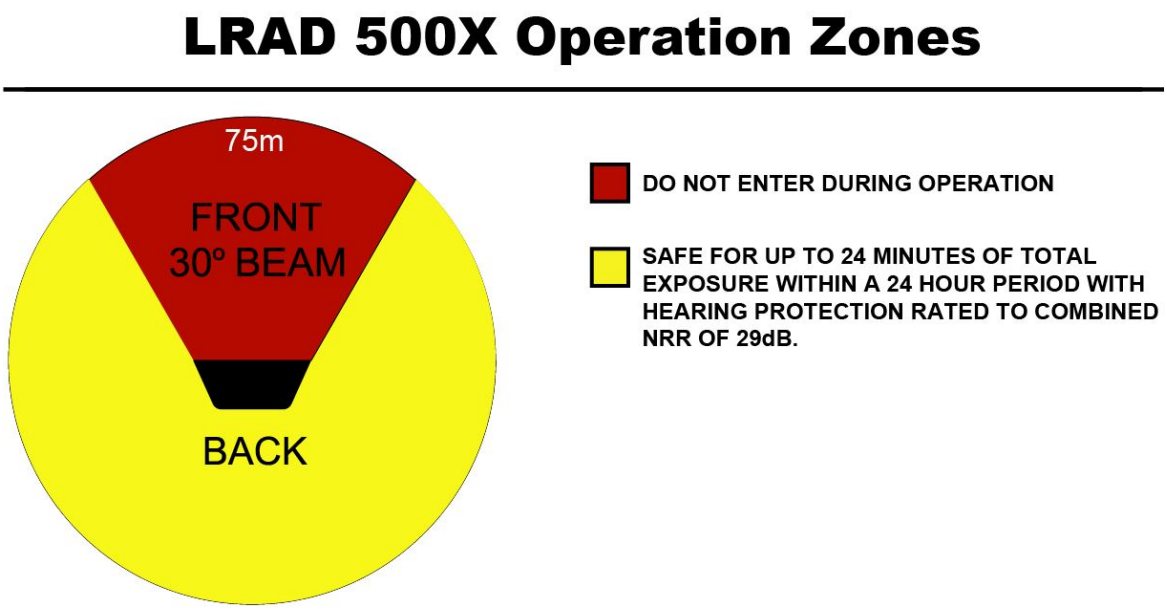


Figure 17: LRAD-500X-RE MMT Safe Zones at Max Volume at 3 kHz

WARNING
Failure to adhere to operation zones, exposure limits, and hearing protection guidance may result in hearing damage.

WARNING
Operation zone limits are only applicable to typical cabin configurations when loudspeaker sound projection is oriented perpendicular to the cabin door, and all cabin doors and windows are open. Operation with any cabin doors or windows closed or adjusted speaker tilt and azimuth may result in hearing damage.

The operation zones in Figure 17 represents safety zones for the LRAD-500X-RE MMT in an open-air environment.

The LRAD should be used outdoors in as open of an area as possible. Avoid aiming the LRAD device towards areas where personnel or reflective surfaces such as walls or overhangs may be present.

When installed in an enclosed environment such as a helicopter cargo cabin, the cabin may create acoustic reflections capable of causing the noise exposure levels around the LRAD device to vary in ways that are not reflected in the Operation Zones diagram. Each helicopter cabin configuration may have a different acoustic effect, depending on its layout.

3.0 Normal Procedures

3.1 Major Components

This section details the major components of the LRAD-500X-RE MMT. The battery box and mounting plate will come fully assembled with 12-jaw cargo fittings. Leaving the 12-jaw cargo fittings loose will allow for easier location of aircraft mounting features.

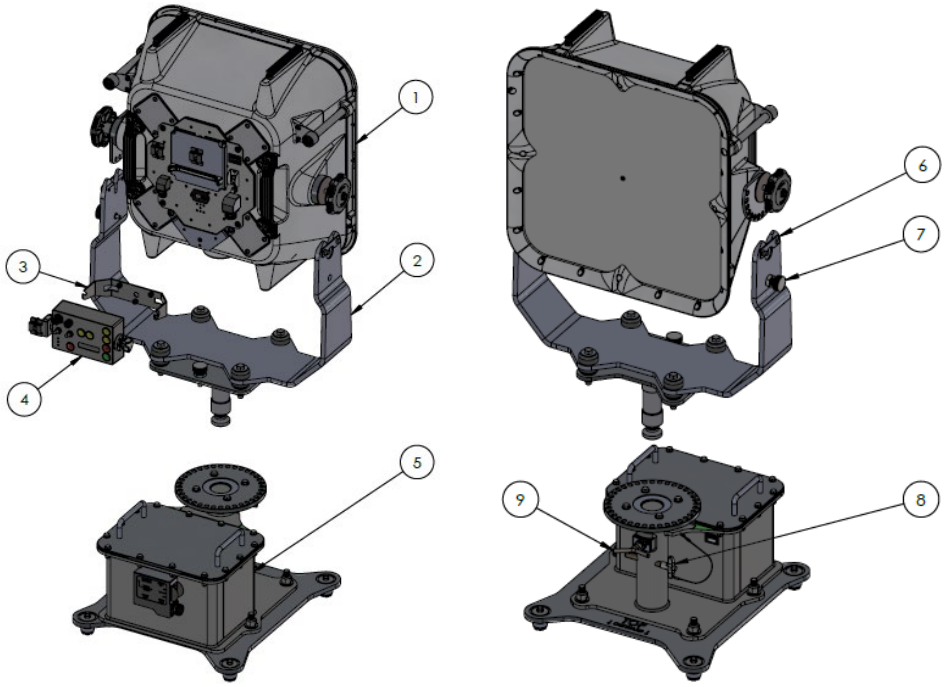


Figure 18: Major Components

1. LRAD-500X-RE MMT Head Unit
2. LRAD-500X-RE MMT Yoke

3. Control Unit Mounting Bracket
    - This attaches to the back of the LRAD-500X-RE MMT to mount the Control Unit.
4. Control Unit
5. Battery Box and Mounting Plate
    - This includes the 12-jaw cargo fittings.
6. Yoke Safety Bar
    - This secures the LRAD head unit in the yoke. Installed using a 7/16” wrench.
7. Tilt Lock Pin
    - This pin needs to be open when mounting yoke to LRAD.
8. Stud Safety Pin
    - This pin must be removed before inserting the yoke into the battery box and mounting plate.
9. Friction Lock T-Handle
    - This feature must be backed out before inserting the yoke into the battery box and mounting plate.

3.2 Control Unit Setup

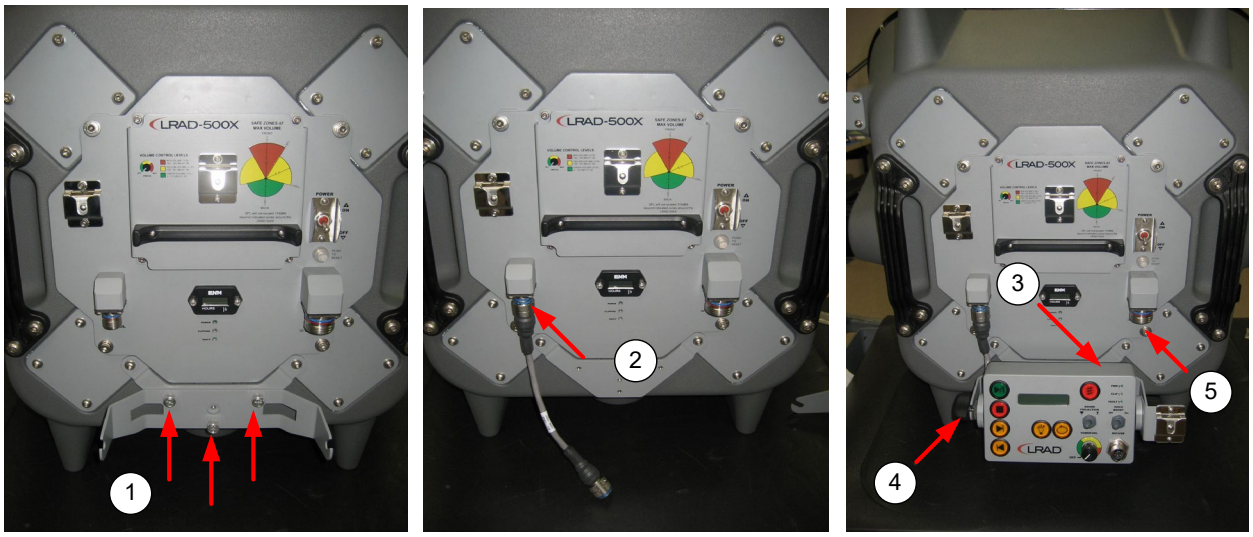


Figure 19: Control Unit Setup and Connections

1. Install the Control Unit Mounting Bracket by tightening the three thumbscrews as shown.
2. Plug one end of the 10-inch remote control cable into the control unit input on the LRAD.
3. Plug the other end of the 10-inch remote control cable into the LRAD audio out interface on the back of the control unit.
4. Lower the control unit into the mounting bracket and tighten the tilt knobs after positioning the face of the control unit at the desired angle for operation.
5. Connect the power cable between the battery box and the LRAD.

3.3 Battery Charging and Status

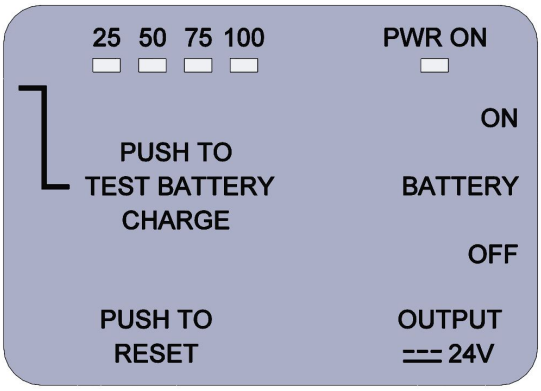


Figure 20: MMT Battery Charge Indicator

The battery charge indicator, located on the battery box, has 4 graduations for charge level (25%, 50%, 75% and 100%). To test the charge of the unit, press the button labeled “Test Battery Charge.”

To charge the batteries, remove the power cable that feeds LRAD-500X-RE MMT from the battery box. Using the supplied battery charger, connect the D38999 connector into the plug connector that was previously connected to the LRAD power cable (Figure 21).

CAUTION

Do not let the batteries drop below the 25% charge level. If the 25% LED is not lit the integrity of the batteries needs to be evaluated by a voltage meter after the unit has been charged. If the voltage is not at least 24 VDC after a full charge the batteries need to be replaced.

Figure 21: Connected Battery Charger

3.4 Aircraft Cabin Loading and Unloading

Figure 22: Transporting LRAD-500X

Above is an example of flight line transport. The LRAD-500X-RE MMT arrives in two pieces: (1) the yoke and head unit and (2) the mounting plate and battery box.

CAUTION
Use caution while loading and unloading both pieces. The 12-jaw cargo fittings are prone to damage if dragged over a rough surface or loaded without care.

WARNING
Ensure yoke tilt lock is engaged to prevent inadvertent speaker rotation before moving yoke and LRAD-500X-RE MMT assembly.

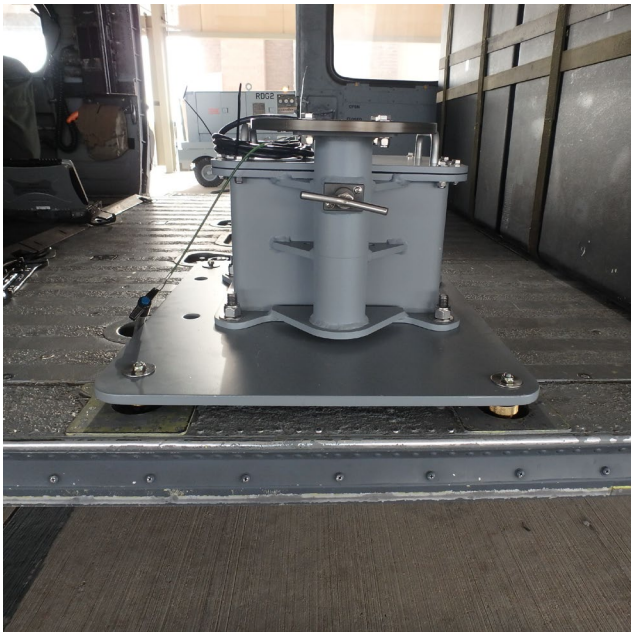


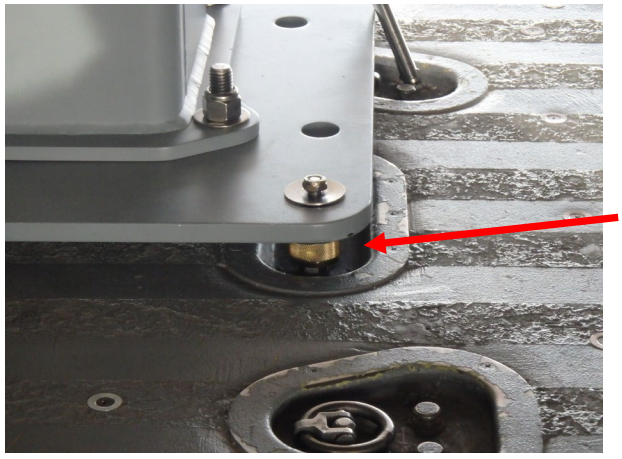
Figure 23: Placing Mounting Plate and Battery Box into Aircraft (FRONT)

Figure 24: Placing Mounting Plate and Battery Box into Aircraft (BACK)

The above figures show the mounting plate and battery box installed on the mating cargo hold features.

WARNING
The mounting plate and battery box should be considered a two person lift when moving to and from transport vehicles and aircraft.

- Use provided ½" wrench and 15/16" wrench to tighten 12-jaw features in place.
- Torque specifications
    - 12-jaw cargo features should be torqued to 27 ft-lb.



NOTE: Make sure that all Spring Pins on the 12-jaw cargo fittings are pointed outward for easy removal of baseplate

Figure 25: MMT Base Installed

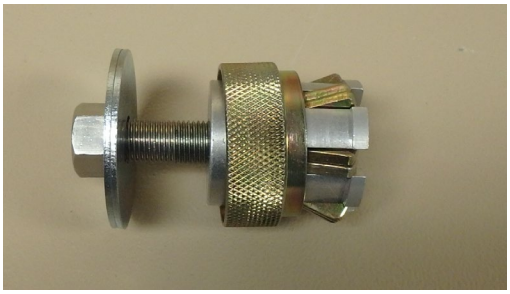


Figure 26: 12-Jaw Cargo Fitting Example

Figure 27: Carrying LRAD-500X-RE MMT out to Aircraft

The Figure above depicts the transportation of the head unit with the yoke connected. Leaving the yoke connected to the head unit eases installation and transportation to and from the aircraft.

WARNING
The head unit and yoke assembly should be considered a two person lift when moving to and from transport vehicles and aircraft.

Figure 28: Transporting Head Unit and Yoke out to Aircraft

CAUTION
Friction T-handle and Capture Pin should be removed and backed out to receive head unit and yoke.

Figure 29: Installed LRAD-500X-RE MMT System

FOR MORE INFORMATION ON HEAD UNIT AND YOKE INSTALLATION, SEE SECTIONS 4.3 & 4.4.

3.5 System Power Up and Shutdown

WARNING
Ensure all personnel are clear of the red operational zone (Figure 17) and are wearing adequate hearing protection before applying power to the LRAD-500X-RE MMT system. Failure to observe power up and shutdown sequences may result in momentary audio feedback.

Power Up

1. Connect power cable between battery box and head unit.
2. Turn on battery box DC power supply switch.
3. Turn on LRAD-500X-RE MMT unit main power switch.
4. Rotate control unit POWER/VOLUME knob to desired setting.

Shutdown

1. Rotate control unit POWER/VOLUME knob counterclockwise to OFF position.
2. Turn off LRAD-500X-RE MMT unit main power switch.
3. Turn off Battery Box DC power supply switch.

3.6 MP3 Loading and Playback

Figure 30: Control Unit with USB Loading Cable

MP3 Loading

1. Connect USB loading cable between control unit input and computer on which MP3 files are stored.
2. Copy and paste MP3 files from computer into LRAD-500X-RE MMT USB drive folder.

MP3 Playback

1. Connect control unit and head unit using control cable.
2. Use control unit Skip Forward and Skip Reverse buttons to scroll through available MP3 files, stopping on the desired file.
3. Push control unit Play/Pause and Stop buttons to start/stop MP3 playback.
4. Push control unit Repeat button to start/stop continuous playback of MP3 file.

3.7 Microphone Recording and Playback

NOTE: When recording messages during flight operations, speak loudly and closely into the microphone while simultaneously shielding it from ambient aircraft noise.

Microphone Recording

1. Connect microphone cable to control unit input.
2. Simultaneously press and hold microphone Record and Play buttons. The recording/playback indicator light illuminates green while recording is in progress.
3. Speak message into the microphone.
4. Release microphone Record and Play buttons when finished recording.

Microphone Playback

1. Connect microphone cable to control unit input.
2. Press and release microphone Play button to start/stop playback. The indicator light flashes once when playback is finished.

Figure 31: Recording Microphone Features and Controls

3.8 Microphone PTT Operations

CAUTION

Using microphone PTT at max volume with voice boost on will result in significant audible feedback in any condition. Microphone PTT use during flight operations at max volume, even with voice boost off, may also result in feedback. Voice boost should be turned off and volume reduced to avoid feedback.

NOTE: When using the microphone during flight operations, speak loudly and closely into the microphone while simultaneously shielding it from ambient aircraft noise.

1. Connect microphone cable to control unit input.
2. Turn off voice boost and rotate POWER/VOLUME knob out of red volume range on control unit.
3. Press and hold microphone PTT button.
4. Speak into microphone and adjust control unit POWER/VOLUME knob as required.
5. Release microphone PTT when finished speaking.

3.9 Aux Input Operations

1. Connect aux audio cable between control unit input and external audio device.
2. Turn external audio device volume to max and use control unit POWER/VOLUME knob to adjust sound level.
3. Start/stop audio playback on external audio device.

4.0 Maintenance Procedures

4.1 Troubleshooting

The following table lists potential symptoms, causes, and actions to troubleshoot the problems.

Table 2: Troubleshooting Guide

Symptom	Potential Cause	Corrective Action
LRAD will not power up, power LED will not illuminate.	Low battery.	Ensure that the battery voltage is above 10.5 V.
	Faulty battery cable or connector.	Check the pins on the DC Input connector to ensure they are not corroded or bent.
	Faulty battery.	Recharge the battery and measure the DC voltage. If low or no voltage after charging, replace the battery.
	Faulty DC-DC converter.	If all previous items check OK, replace the DC-DC converter board.
No audio output from microphone.	No 5.2 VDC power to the microphone.	Check the +5.2 VDC pin on the MIC input connector and the Audio Input connector of the LRAD. If +5.2 VDC is not present, the 5 Volt Regulator on the DC-DC board has malfunctioned, and the DC-DC board will need to be replaced.
	Faulty connection.	Inspect the pins in the microphone cable connector and ensure they are not bent, contaminated, or corroded.
	Faulty microphone element or circuit board.	If +5.2 VDC is present and live voice or recorded voice is not working, replace the microphone.
No audio output from audio files, microphone, and alert tone.	Faulty amplifier.	If the power LED is indicating that the unit is powered on, but no audio is played the amplifier may be defective.

4.2 Preventative Maintenance

The LRAD-500X-RE MMT is an all-weather hailing and warning device that requires minimal maintenance. As with all equipment, proper care and maintenance will ensure a long and useful life.

Clean the LRAD-500X-RE MMT and inspect for wear or other damage as required. Ensure that all fastening hardware is kept tight and all electrical connections are secure and damage-free. Fasteners and other components that become loose may represent a serious hazard to personnel as well as the LRAD-500X-RE MMT and nearby equipment.

Use non-flammable cleaning solutions with clean rags to wipe the exterior surfaces of the LRAD-500X-RE MMT. The LRAD-500X-RE MMT head unit can be sprayed down with fresh water to remove salt and dust buildup. The LED status window can be cleaned with soap and water. For corrosion control in sea applications, apply anti-corrosion lubricant to the metal connectors on the LRAD device.

Do not spray the LRAD-500X-RE MMT front grille with pressurized liquid or air. Do not spray or otherwise introduce caustic solutions to the front grille. Doing so will increase the risk of damaging the emitters as well as other electronics contained within the unit.

If the grille becomes obstructed with dust, dirt, dried mud, or sand, remove the grille and clean it with soap and water. Turn the unit with the emitters facing down and wipe away any dust and dirt that may have accumulated in the emitter cavities.

CAUTION
Do not use compressed air to blow away dust from the emitter cavities, as this may damage the emitters.

The grille on the head unit can be removed periodically by unfastening the screws around the front bezel and cleaned using pressurized air and/or water. This operation will ensure maximum output is maintained in the unit.

Spare parts are available from Genasys.

4.3 Removing the Head Unit

1. Remove one screw from each of the yoke safety bars, located on both sides of the head unit.
    - Yoke safety bars are located behind friction tilt knobs.

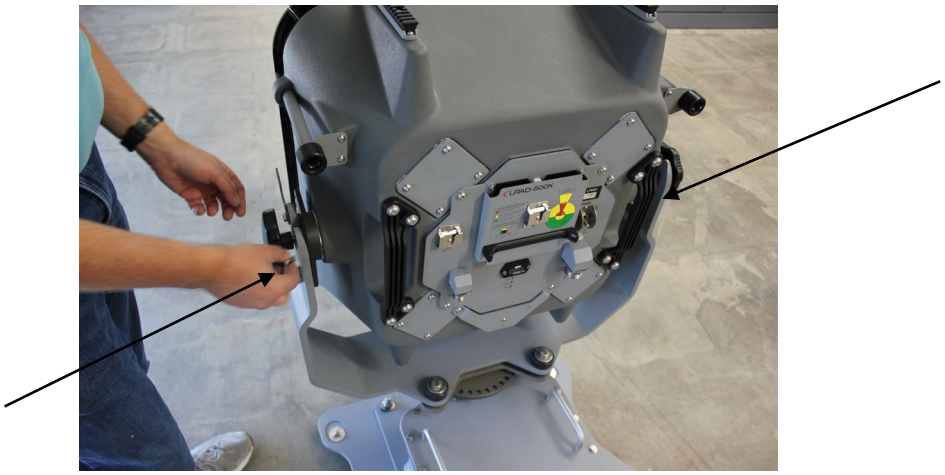


Figure 32: Removing Screws from Yoke Safety Bars

2. Pull tilt lock pin to release head unit from yoke.

Figure 33: Tilt Lock Pin

3. Remove the head unit.

CAUTION
Moving and transporting the head unit is a two-person lift.

TO INSTALL HEAD UNIT, PERFORM THESE STEPS IN REVERSE.

4.4 Removing the Mounting Yoke

1. Loosen friction lock T-handle and remove stud safety pin from mount.

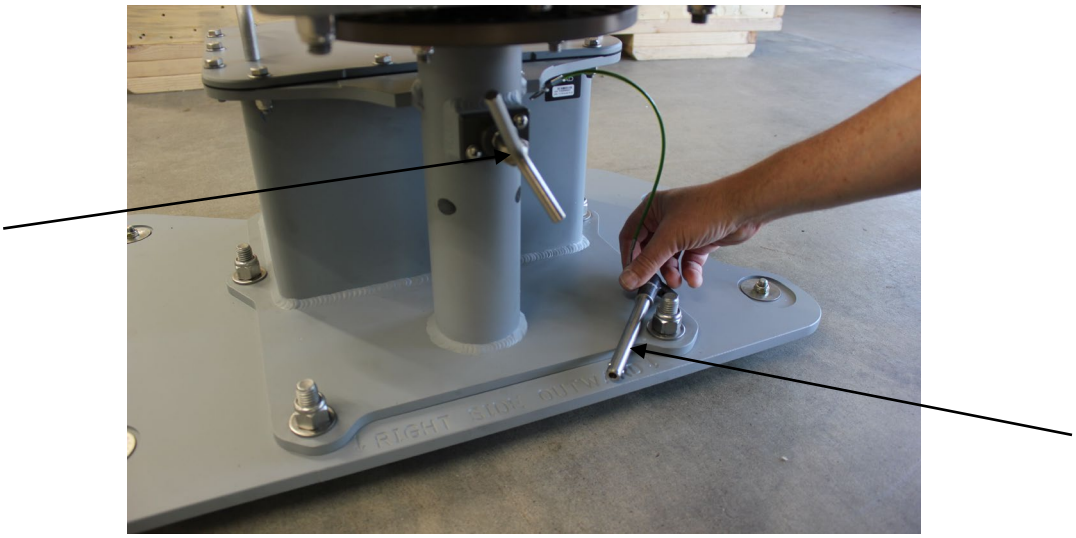


Figure 34: Friction Lock T-Handle (left) and Stud Safety Pin (right)

2. Remove yoke.

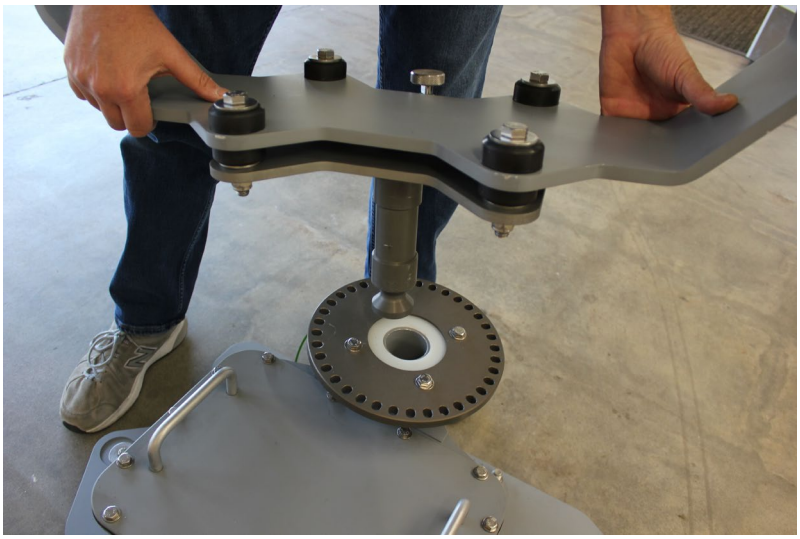


Figure 35: Removed Yoke

TO INSTALL YOKE, PERFORM THESE STEPS IN REVERSE.

4.5 Battery Maintenance and Replacement

Batteries are to be charged prior to use. When not in use they should be left on trickle charge or charged once per month. Batteries should be replaced every two to three years, depending upon use and criticality of the missions that they are used for.

CAUTION

Do not let the batteries drop below the 25% charge level. If the 25% LED is not lit the integrity of the batteries needs to be evaluated by a voltage meter after the unit has been charged. If the voltage is not at least 24 VDC after a full charge the batteries need to be replaced.

NOTE: Batteries are installed in series to achieve 24 VDC with 33 Ah capacity.

4.5.1 Accessing Batteries

To access the batteries and their components, the head unit and yoke must already be removed. Then, follow these steps:

1. Remove bolts from battery box cover using 1/2” wrenches. On reinstall torque to 10 ft-lb.

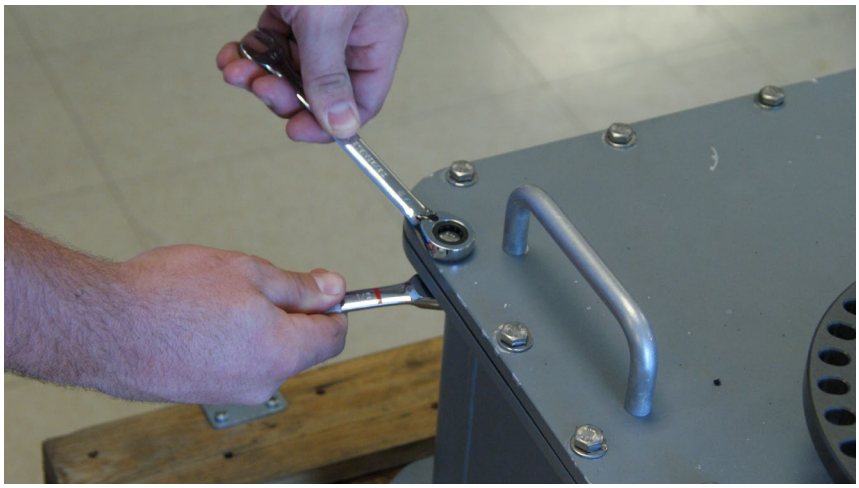


Figure 36: Removing Bolts from Battery Box Cover

2. Remove battery box cover and set aside.

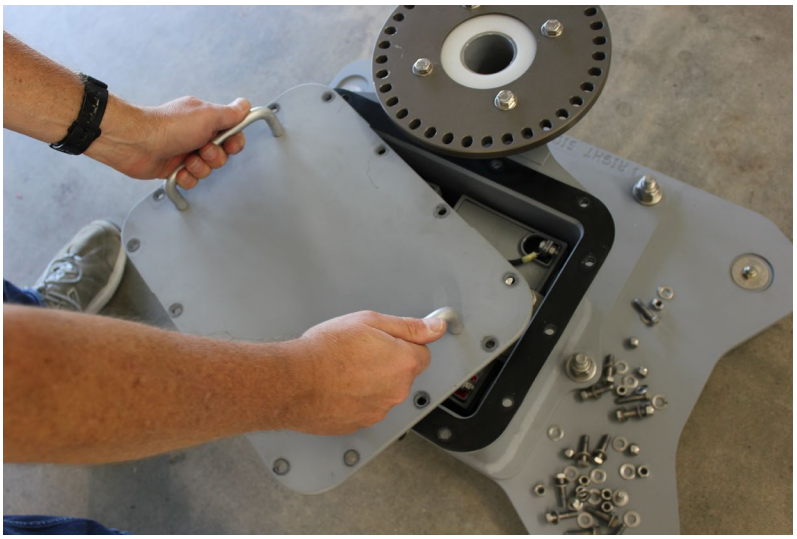


Figure 37: Battery Box Cover Removal

NOTE: When removing battery cover be careful not to damage rubber gasket.

4.5.2 Disconnecting and Replacing Batteries

Follow these steps and refer to Figures 38 and 39 to disconnect and replace one or both batteries.

WARNING
When disconnecting battery terminals ensure tools do not short the housing or the connection to the opposite terminal. Significant power can be applied even when a battery appears to be "dead".

1. Disconnect black cables from hold down bracket to negative battery terminal.
2. Disconnect current sense connector.
3. Disconnect battery monitor harness connector.
4. Disconnect voltage sense cable to positive battery terminal.
5. Disconnect red cables from front panel to positive battery terminal.

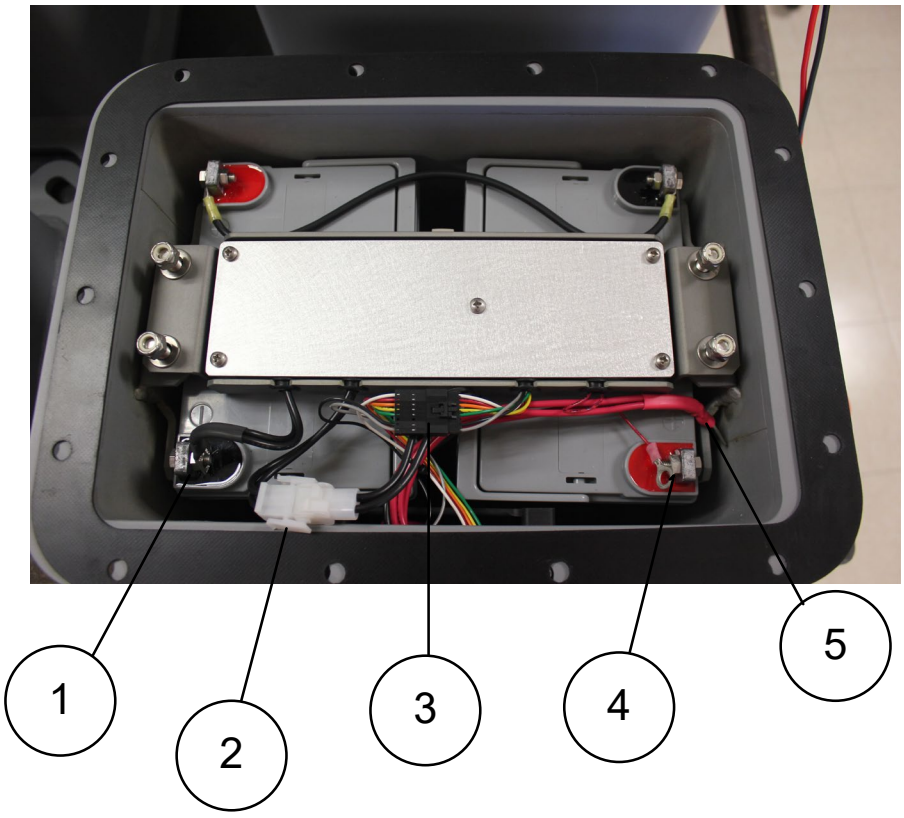


Figure 38: Battery Box Wiring

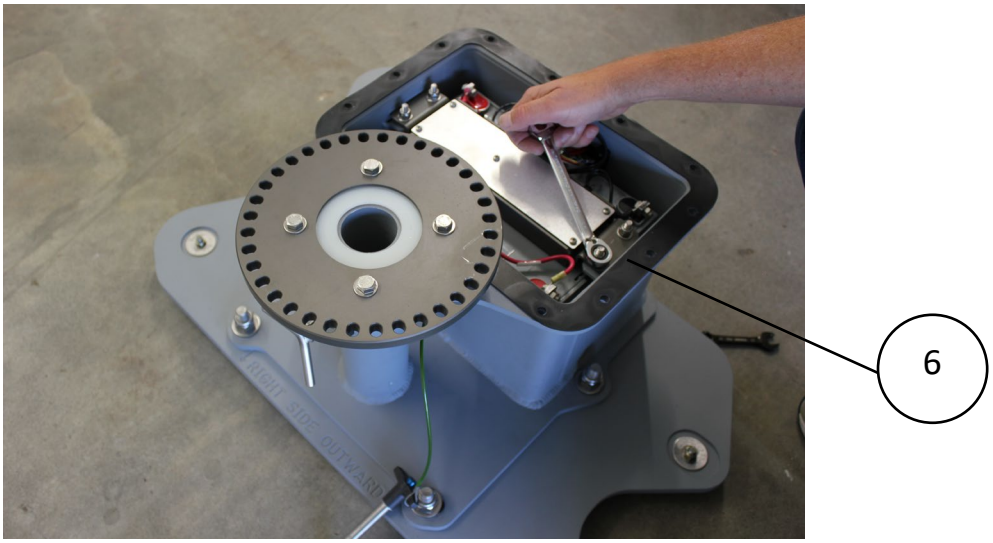


Figure 39: Battery Hold Down Hardware

6. Then, remove the (4) four nuts and washers that secure the battery hold down using 1/2" Wrench. On reinstall torque to 10 ft-lb.

TO REPLACE BATTERY OR BATTERIES, PERFORM THESE STEPS IN REVERSE.

CAUTION
During replacement, ensure that cables are free and that none are pinched under the battery hold down bracket.

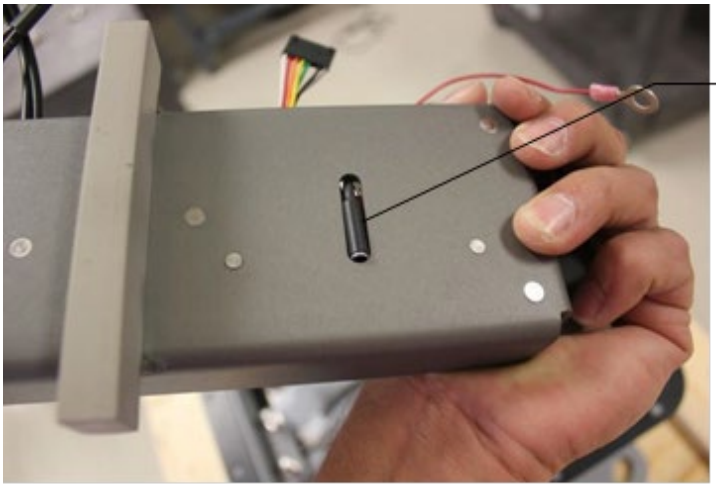


Figure 40: Battery Box Temperature Sensor

CAUTION

Before installation, Inspect the bottom of the battery hold down bracket. Make sure that the temperature sensor is seated in the slot before installing the battery hold down bracket. It should adhere to the foam pad found inside the slot. If the temperature sensor is not properly seated in the slot, it can be damaged.

5.0 Recording Audio Files Using LRAD Normalizer Software

The LRAD-500X-RE MMT ships with a CD-ROM that contains LRAD Normalizer software. This software can be used on a Windows based PC to record optimized audio files that will enable you to get optimal acoustic performance when playing these recordings on the LRAD.

5.1 System Requirements

LRAD Normalizer Software is designed for use on a PC running Windows 7, Windows 8, or Windows 10. The software will work on 32bit or 64bit versions of these operating systems. The PC must be equipped with a windows compatible sound card with speakers and a microphone.

5.2 Installing the Software

Insert the provided CD-ROM into the computer and run the setup file found in the root directory. Follow the on-screen prompts during the installation.

5.3 Running the Software

LRAD Normalizer software will create a program group named “LRAD Corporation” in your Start Menu. Select the shortcut from the “LRAD Corporation” folder in the Start menu, or double click on the shortcut created on your desktop.

The main screen for the Normalizer software is depicted in Figure 41, showing the interface’s three sections.

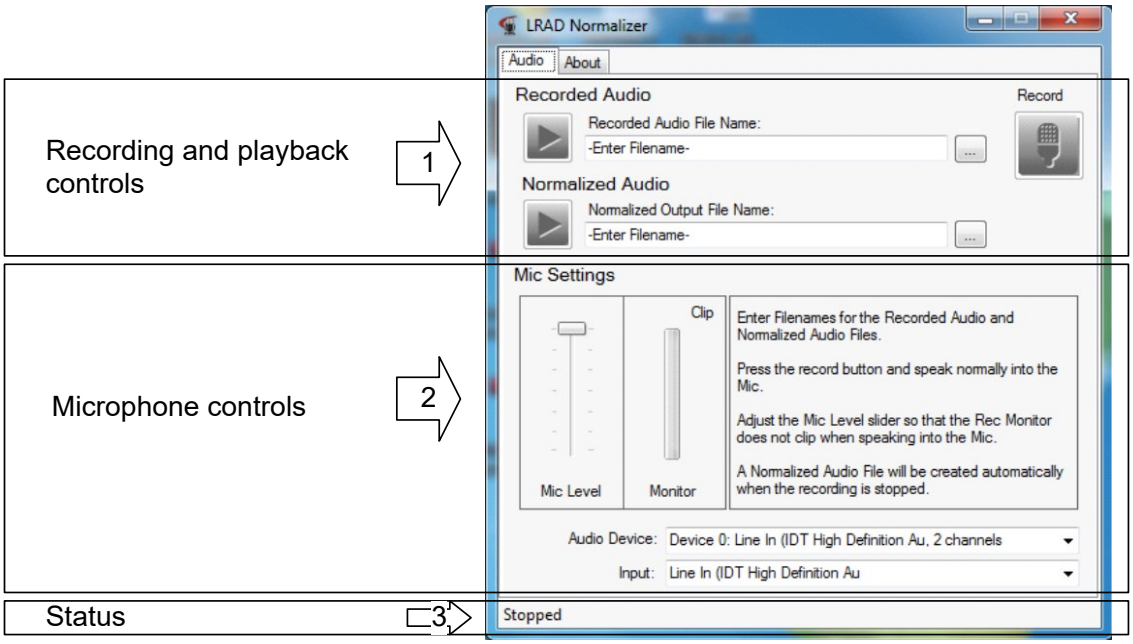


Figure 41: Normalizer Interface Screen

1.) Recording and playback controls
This section of the interface allows the user to record a new audio file using the PC's built in microphone. It also allows the user to playback the original Recorded Audio and the Normalized Audio file that is automatically created after a recording is made.

2.) Microphone controls
This section allows the user to adjust the microphone recording level, monitor the audio recording level during recording, and to select the audio device (sound card) and microphone input port being used for the recording.

3.) Status
This section displays the recording or playback status of the software.

5.4 Recording an Audio File

1. Enter a file name for the audio file you are about to record. The Record button will be grayed out and will not work until you have entered a filename.
2. The default file name for the Normalized Audio file will be your file name with "_NORMALIZED" appended. You may change this file name by overwriting the file name in the text box.
3. The default folder for Recorded Audio files and Normalized Audio files is the Music folder on your Windows PC. If you wish to change the location of the recordings, press the "…" button to the right of the filename fields and select the directory you would like to use.
4. Press the Record button once to start recording and again to stop the recording.
5. The status section of the screen will indicate whether the system is recording. Talk clearly into the microphone and view the Monitor level on the Microphone Controls section of the interface.
6. If the monitor indicates "Clip", then this means that you are speaking too loudly into the mic, or you are holding the mic too close. Recordings with clipped audio cannot be corrected by this software and may cause damage to the Acoustic Driver in the LRAD. Press the Record button again to stop the recording. You may make adjustments to the mic position or your speaking volume and reinitiate the recording by pressing the Record button. If you have not changed the filename, you will be prompted to overwrite the existing recording.
7. If you are creating a recording in a noisy environment and you have to speak loudly into the mic to overcome background noise, lower the Mic Level slider until you can record at a Monitor level that does not produce clipping.
8. Once a recording has been created, a Normalized Audio file will be automatically created and saved in the specified file location.
9. You may listen to the original recording by pressing the play button to the left of the Recorded Audio File Name text box. Audio will be played back through your PC's speakers or headphones.
10. You may listen to the optimized recording by pressing the play button to the left of the Normalized Output File Name text box. Audio will be played back through your PC's speakers or headphones.
11. The Normalized Output File should have the following characteristics:
    a. Silence is removed from the beginning and end of the recording. This allows for the audio to start up quickly after the play button is pressed on the MP3 player used with the LRAD.
    b. The level of the recording is increased (normalized), so it will sound louder than the original recording when played back if the original recording was not loud enough.
    c. The recording is equalized to remove low frequency content that cannot be reproduced by the LRAD.
12. The "About" tab of the application shows the current software version.

The following figure shows the LRAD Normalizer software while a recording named “GREETING 1” is being made. Note the Record button changes to green and the status bar shows “Recording”.

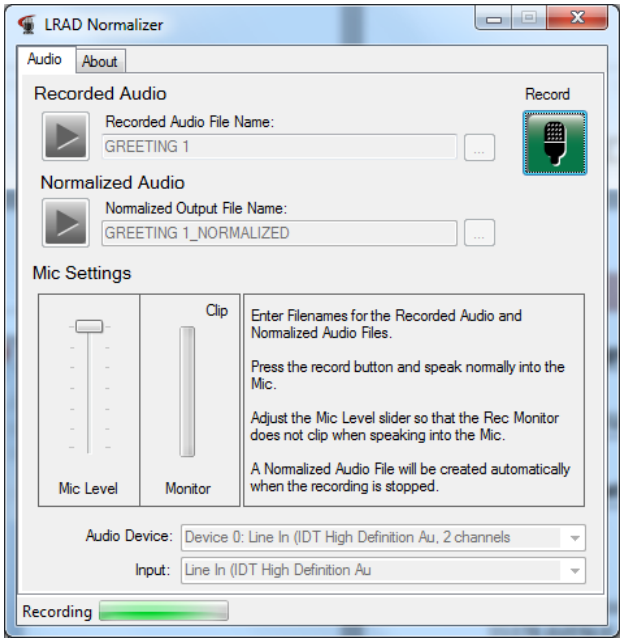


Figure 42: LRAD Normalizer During Recording

Audio files created by LRAD Normalizer are saved as WAV format.

These recordings can be dragged onto the USB Mass Storage drive that appears when the MP3 Player/Control unit is connected to a PC via the provided USB download cable.

6.0 Technical Support

Contact information for Genasys Technical Support is listed below.

Genasys Inc.
16262 West Bernardo Drive
San Diego, CA 92127

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Fax: 858-676-1120
Technical@genasys.com