

LRAD 100X EQUIPMENT MANUAL

LRAD[®] 100X



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1.0 Important Safety Precautions

The LRAD-100X is capable of producing sound pressure levels (SPLs) that have the potential to cause temporary or permanent hearing damage.

Always follow the safety precautions described in this manual as well as on the unit's interfaces.

The following safety conventions appear throughout this manual. Please heed these warnings and take the appropriate actions to ensure safe operation of the unit.



Important Safety Instructions



Risk of Electric Shock



Hearing Protection Required

Before operating the LRAD-100X, do the following:

1. **Read these instructions.**
2. **Keep these instructions in a place known to and accessible by the potential operators of the LRAD-100X.**
3. **Heed all warnings contained in this document.**
4. **Follow all instructions detailed in this document.**
5. **Install in accordance with the instructions contained in this document.**
6. **Do not expose yourself or others to high volume levels for prolonged periods of time.**
7. **Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatuses (including some electronics) that produce heat.**
8. **Only use attachments or accessories specified by the manufacturer.**
9. **Refer all servicing to qualified service personnel. Servicing is required when the LRAD-100X has been noticeably or substantially damaged in any way, including cord or plug damage, seriously dented or breached housings, or if liquid has penetrated the interior of the device or any of its accessories.**

2.0 System Description

The LRAD-100X is a self-contained, lightweight, and compact battery-powered hailer that communicates with great intelligibility up to 600 meters.

Unlike handheld bullhorn devices, the LRAD-100X emits acoustic sound pressure levels up to 140 dB that result in clear, intelligible communications and unmistakable, stunning alert tones. In addition to broadcasting alert tones, the LRAD-100X is also capable of playing prerecorded messages and audio files stored in its MP3 player, and broadcasting live speech through its handheld microphone.

The LRAD-100X's rugged construction makes the device impact-resistant and completely waterproof. Such construction allows the LRAD-100X to perform reliably in the harshest conditions, whether on land or at sea.

The LRAD-100X's rechargeable Lithium Iron Phosphate (LiFePO₄) battery combines the power density of a traditional lithium ion battery with a rugged design. Constructed with a cathode material, this battery is far more resistant to thermal runaways than traditional lithium ion batteries. This results in a high-powered battery that is safe to use in harsh environments.

The LRAD-100X is highly customizable. There are several different accessories and configurations available, giving it the ability to function effectively in any environment.

The LRAD-100X is the smallest, most portable LRAD available, making it the ideal product for law enforcement, emergency responders, and many other users.

3.0 System Setup

Table 1: System Components

#	System Component
1	LRAD-100X Head Unit
2	MP3 Player
3	Recording Microphone
4	Rechargeable LiFePO4 Battery
5	AC Battery Charger, 100-240 VAC
6	Audio Cable, 20 Feet
7	USB Download Cable, 48 Inches
8	External Audio Cable with 3.5 Millimeter Plug, 39 Inches
9	Normalizer Software, CD
N/A	User Manual (Not Pictured)



Figure 1 – System Components

3.1 Charging the Battery

Prior to powering up the LRAD-100X, the battery must be fully charged. To charge the system battery, perform the following steps:

1. Connect the battery's male-end circular cable connector to its female counterpart on the AC battery charger.
2. Plug the charger into an AC wall outlet. The charger can draw power from wall outlet voltages rated between 100 and 240 VAC.
3. Allow the battery to charge until the indicator LED on the charger shows that charging is complete. The LED will glow red when the battery is charging and will turn green when the battery is fully charged.

3.2 Installing the Battery



Figure 2 – LRAD-100X Battery Compartment

1. Disconnect the battery from its charger.
2. Loosen the thumb screws on both battery retainers (item 1 in Figure 2) and rotate the retainers so that the battery can be inserted into the base compartment.
3. Slide the battery into the base compartment.
4. Rotate the battery retainers so that the retainers hold the battery in its compartment and tighten the thumbscrews.
5. Connect the battery cable connector to the rear power input connector on the bottom-right of the LRAD-100X (item 2 in Figure 2).

3.3 Audio Connections

The handheld MP3 player contains the power and audio controls for the LRAD-100X. To install the audio cable, connect the cable between the MP3 player's top-right AUDIO OUT connector and the matching audio in connector on the bottom-left of the LRAD-100X (see Figure 3).

The audio cable can be wrapped around the LRAD-100X's rear plate for ease of transportation.



Figure 3 – Audio Cable attached to MP3 Player

When it is necessary to broadcast live speech, connect the included microphone to the MP3 player. Install the microphone by connecting the microphone's cable to the MIC/USB connector located on the top-left of the MP3 player (see Figure 4 on the following page).



Figure 4 – Microphone attached to MP3 Player

3.4 Playing Audio Files

To broadcast audio files using the LRAD-100X, perform the following steps:

1. Power on the LRAD-100X by turning the MP3 player's PWR/VOL knob (item 2 in Figure 6) clockwise from the OFF position. The PWR/VOL knob will click on and the unit will power up.
2. Select the desired audio file by cycling through the files on the MP3 player. Use the SKIP FORWARD and SKIP REVERSE buttons (items 6 and 7 in Figure 6) to cycle files.



Warning:

Avoid Exposure to Excessive Sound Levels.

Always initiate audio playback with the volume on a low setting.

3. Press the PLAY/PAUSE button (item 4 in Figure 6) to start playing an audio file from the MP3 player, slowly adjusting the PWR/VOL knob until the desired volume is reached.

NOTE: The LRAD-100X's on-board power converter features capacitive filtering on its input to minimize noise levels. These capacitors will require 3 to 5 seconds to fully discharge after powering off the LRAD. Cycling the power on and off repeatedly within less than one second will result in a popping sound from the LRAD-100X. To prevent this popping sound, allow at least 5 seconds to pass before turning the unit back on.

3.5 Using the Alert Tone

Press the ALERT TONE button (item 8 in Figure 6) to activate a pre-recorded alert sound. Press once for activation, press again for deactivation. The pre-installed alert tone is an intense, pulsating warning tone that is designed to be clearly heard at long distances.

It is recommended that the tone be used in 2-5 second bursts for maximum effectiveness when hailing. Pressing the ALERT TONE button will interrupt playback of any other audio being broadcast through the MP3 player.



Warning:

Avoid Exposure to Excessive Sound Levels.

The Alert Tone produces the loudest output from the LRAD-100X.

Qualified personnel must ensure the area in front of the LRAD-100X is clear for 10 meters before activating the alert tone when the volume control is in the RED zone of the PWR/VOL knob's scale.

3.6 Aiming the LRAD-100X

The LRAD-100X is a highly directional audio device. The majority of the acoustic output power is concentrated in a 30-degree cone in front of the device. This means that the sound directly in front of the LRAD-100X is significantly louder than the sound behind and to the sides of the device.

For optimal results, aim the device directly at the intended target.

4.0 Operation: Hailing and Warning

The LRAD-100X's exceptional sound output and directionality can be used to hail, warn, and notify clearly and intelligibly at distances up to 600 meters. Aim the LRAD-100X at your target and broadcast sound from an audio file on the MP3 player, or speak directly to your target using the handheld microphone. You can also attach an external audio device to the MP3 player and use this device to playback and broadcast audio.

**Warning:****Avoid Prolonged Exposure to Excessive Sound Levels.****Operator Hearing Protection is Required.**

The LRAD-100X can produce acoustic sound pressure levels that OSHA considers hazardous. As with any high-energy acoustic device, proper usage of earplugs will minimize risk of hearing loss to the operator and personnel in the immediate vicinity. Hearing protection is required when operating the device at maximum volume from less than one meter away.

**Warning:****Aim the LRAD-100X with Extreme Care.**

Qualified LRAD-100X operators must ensure the device is positioned, aimed, and operated in a manner that avoids exposing nearby personnel and bystanders to excessive sound pressure levels. Follow these guidelines in conjunction with sound judgment:

- Never operate the LRAD-100X at maximum volume when personnel are within 10 meters of the front of the device, or when the reflected distance between personnel and an acoustically reflective object (i.e., a building, a wall, or a bulkhead) is less than 10 meters.
- Never point LRAD-100X directly at personnel in the immediate vicinity of its operating position.
- Note that the output power of the warning tone is slightly higher than the output power of live broadcasts or other audio files.

4.1 LRAD-100X Operation Zones



Figure 5 – LRAD-100X Zones of Operation

- The LRAD-100X should have an unobstructed transmission path to its target. Even small mast antennas may reflect some sound energy, thereby decreasing the LRAD-100X's effectiveness and increasing the reflected noise levels that will be felt by the operator and others nearby.
- Avoid placing the LRAD-100X in a position where it will transmit sound over areas where personnel may be located.
- For shipboard operation, place the LRAD-100X as close to the ship's sides, bow, or stern as possible.



Warning:

Hearing Protection Required

The LRAD-100X has very directional sound projection. Operators standing behind the unit hear only a small fraction of the sound energy being transmitted. This can lead the operator to falsely think that the LRAD-100X is not producing the required output.










OPERATORS SHOULD NOT ATTEMPT TO LISTEN TO THE OUTPUT FROM THE FRONT OF THE DEVICE! HEARING DAMAGE MAY RESULT FROM SUCH ACTION.

5.0 MP3 Player Controls and Connectors



Figure 6 – LRAD-100X MP3 Player

Table 2: MP3 Player Controls and Connectors

#	Symbol	Name	Function
1		MIC/USB Connector	Connection point: Microphone and USB cables.
2		PWR/VOL Knob	Controls power and volume level.
3		AUDIO OUT Connector	Connection point: Audio out to LRAD-100X head unit.
4		PLAY/PAUSE Button	Plays and pauses playback of selected file.
5		STOP Button	Stops playback of selected file.
6		SKIP FORWARD Button	When playing, starts playback of next track. When stopped, indexes to the start of the next track.
7		SKIP REVERSE Button	When playing, starts playback of selected file or previous file. When stopped, indexes to start of previous track.
8		ALERT TONE Button	Immediately toggles playback of the built-in alert tone.
9		Backlit LCD	Displays MP3 player's status and other information.
10		REPEAT Button	Toggles repeat mode.
11		BRIGHTNESS LEVEL Button	Cycles the LCD and button backlight intensity.

6.0 Button Functions

The MP3 player's buttons are environmentally sealed, backlit, and are sized to allow sufficient tactile feeling through gloved hands.

These raised-edge buttons allow the user to:

- Scroll through available audio tracks.
- Control audio playback.
- Adjust the brightness level of the MP3 player's display and the buttons themselves.
- Toggle repeat mode of the audio file.
- Activate the LRAD-100X's high-intensity alert tone.

7.0 LCD Display

The LCD display (Figure 7) shows: current status of the audio file, time elapsed, audio file name, and whether or not the audio file is playing on repeat mode.

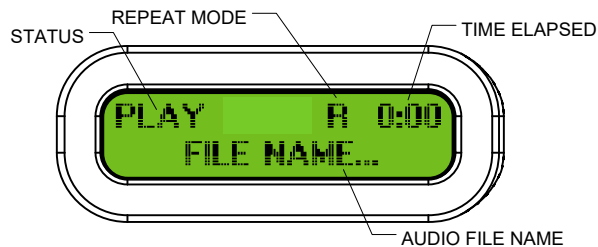


Figure 7 – LCD Display Elements

Status: This is the current state of the player. One of the following statuses will be displayed:

- **PLAY** – This status indicates the selected audio file is being played through the LRAD.
- **PAUSE** – This status indicates the selected audio file is paused. Upon pressing the PLAY/PAUSE button, playback will resume from where it was paused.
- **STOP** – This status indicates the selected audio file is stopped. Upon pressing the PLAY/PAUSE button, playback will restart at the beginning of the file.
- **ALERT** – This status indicates the alert tone is playing through the LRAD.
- **ERROR** – This status indicates the on-board memory is not formatted in the MP3 player.

Time Elapsed: The player's display will show a digital timer that represents the current elapsed playback time of the selected file. The timer will reset to 0:00 when the file restarts playing in Repeat Mode.

Audio File Name: The player's display will show the selected file name in this position. When the file name exceeds the width of this field, the display will continuously scroll the file name from right to left.

Repeat Mode: When the player displays an 'R' in this position repeat mode is enabled on the MP3 player. In repeat mode, the selected file will play to the end and then loop back to the beginning, continuously playing the same file until the STOP button is pressed. If the REPEAT button is pressed again during file playback, the R in the display will be cleared, the file playing will play to the end, and playback will stop.

7.1 Power Up Screen

At power up, the MP3 player displays a splash screen (Figure 8) that shows the current firmware version (i.e., VERSION X.X.X, where X is an alphanumeric value). When needed, check the current version by cycling the connection between the MP3 player and the LRAD-100X. After cycling the connection, review the firmware version displayed on the splash screen.

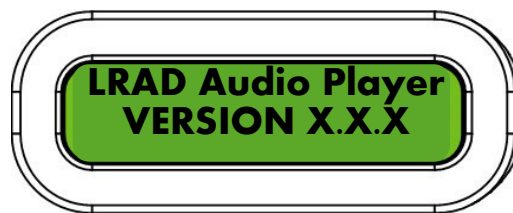


Figure 8 - MP3 Player Splash Screen

8.0 MP3 Player Connectors

The MP3 player has two top connectors: MIC/USB and AUDIO OUT (see Figure 6 and Table 2).

MIC/USB Connector:

- Allows the microphone or an external audio device (Phraselator, CD player, etc.) to connect to the MP3 player. To connect an external audio device, use the included external audio cable.
 - **NOTE:** Audio played through this connection will mix with any audio file being played on the MP3 Player itself if audio is coming from both sources at once.
- Acts as the USB cable connector for downloading prerecorded audio files onto the MP3 player from a computer with a USB connection. This connection can also be used to update the firmware in the MP3 player. To connect, use the included USB download cable.

Audio Out Connector:

- Allows the MP3 player to transmit audio to the LRAD-100X using the audio cable. This connection also delivers power to the MP3 player from the LRAD's battery and allows the MP3 player to control the volume and power of the LRAD.

9.0 Using the MP3 Player

The use of prerecorded messages is recommended whenever possible. Prerecording ensures that messages are appropriately worded and clearly broadcasted to maximize the effectiveness of communications.

The LRAD-100X's MP3 player allows operators to utilize prerecorded messages in the field. Some operators have found it useful to record a message in several different languages to meet their communication needs.

If professionally produced voice recordings in multiple languages are needed, please contact your Genasys sales representative.

The MP3 player is preloaded with a number of warning and test messages that may be freely used or deleted as needed. The MP3 player is capable of playing MP3, WAV, and WMA file formats.

10.0 Downloading Files

Additional audio files can be downloaded onto the MP3 player by connecting to a USB-enabled computer. First connect the USB download cable (item 7 in Figure 1) to the MIC/USB connector on the MP3 player, then connect the USB download cable to the computer's USB port.

NOTE: If the order of the cable connection is not followed as described above, the MP3 player may not be recognized by the USB-enabled computer.

Upon connecting the MP3 player's USB interface to the computer, the MP3 player's display will change from the initial splash screen to the MP3 player's mass storage screen as seen in the figure below.

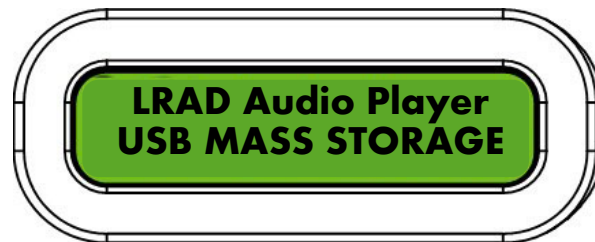


Figure 9 - MP3 Player Mass Storage Screen

The computer will automatically install its USB mass storage drivers and then display two new removable mass storage drives in the computer's file management display. For example, on a Windows™ based machine upon opening "My Computer" you will find two new sequential drive letters.

The first installed drive (i.e., the first new drive letter) will be inaccessible. This drive is locked and reserved for system memory.

The second installed drive (i.e., the second new drive letter) is available to read and to write files. To move files to this second drive, drag and drop the desired files following your operating system's normal file copying procedures.

NOTE: Files copied to the MP3 player will be listed on the MP3 player's LCD interface in the same order they were dragged and dropped onto the MP3 player's mass storage drive. Cycle through these files by pressing the SKIP FORWARD or SKIP REVERSE buttons on the MP3 player.

11.0 Changing the Alert Tone

The MP3 player contains a file named "ALERT.ATC". This is an MP3 file of the alert tone emitted after pressing the ALERT TONE button. This file may be replaced with any digital recording in MP3 format. Simply save the new audio file with the name "ALERT.ATC", then replace the one on the MP3 player with the new file. When pressed, the ALERT TONE button will play this new file.

12.0 Audio File Playback

When an audio file on the MP3 player begins playback, any audio input being played through the MIC/USB connector will be mixed and broadcast with the MP3 player's audio file.

13.0 LCD and Button Brightness Level

The MP3 player's BRIGHTNESS LEVEL button (item 11 in Figure 6) allows the user to cycle the backlight of the buttons and the LCD screen through four levels: off, low, medium, and high. Adjusting the brightness level helps to compensate for glare and to avoid light signature when necessary.

14.0 Recording MP3, WAV or WMA Files

The LRAD-Normalizer software CD included with this kit is provided to optimize audio files for use with the LRAD.

Recordings for playback on the LRAD can be created on any computer with a microphone. The file formats that can be played back on the LRAD's MP3 player include:

- MP3: MPEG Layer-3 compression, all bit rates, stereo or mono.
- WAV: Uncompressed PCM (Pulse Code Modulation), all bit rates, stereo or mono.
- WMA: Windows Media Audio compression, all bit rates, stereo or mono.

15.0 The Recording Microphone

The LRAD-100X system 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 (item 1 in Figure 10) 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.

15.1 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 PUSH TO TALK 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.

15.2 Recording Audio

When necessary, the microphone can be used to record, store, and playback a message of approximately one minute in duration.

To record and playback audio with the microphone, reference Figure 10 on the following page and perform these steps:

1. Press and hold the RECORD button (item 2 in Figure 10).
2. While holding the RECORD button, press and hold the PLAY button (item 3 in Figure 10).
3. The recording/playback indicator LED (item 4 in Figure 10) will light green to indicate that the unit is recording.
 - The unit will record as long as the RECORD and PLAY buttons are held down and as long as there is available storage space in the internal memory.
4. Speak your message into the microphone element (item 5 in Figure 10) and release the RECORD and PLAY buttons when done speaking.
5. Press and release the PLAY button to initiate playback of the recording. The recording/playback indicator LED will flash once when the recording has finished playback.
6. Press and release the PLAY button again to halt playback of the recording.

- The recording will be stored on non-volatile memory, so the recording will persist even after the LRAD is powered down.
- The microphone will only store one recording at a time.
- Repeating this record sequence will overwrite the recording on the microphone.



Figure 10 - Recording Microphone Features and Controls

16.0 Accessories

The LRAD-100X kit includes the MP3 player and recording microphone as standard accessories.

16.1 Accessory Mounting

The MP3 player and recording microphone can be attached to the accessory mounting clips on the top of the LRAD-100X head unit for ease of transportation. Alternatively, the accessory mounting clips can be removed from the top of the LRAD and installed on the rear panel, allowing for rear accessory mounting.



Figure 11 – Accessory Mounting: Top Option (left) and Rear Option (right)

16.2 Optional Accessories

There are several optional accessories available for the LRAD-100X. These accessories increase operational flexibility, allowing the LRAD-100X to function effectively in any situation. Available accessories include:

- LRAD Wireless Kit: Allows for wireless operation of the LRAD over ranges up to 200 meters. This kit includes a wireless transmitter, wireless receiver, MP3 audio device, and headworn microphone.
- HD Action Camera: Allows the user to record date and time stamped video, audio, and images in high definition.
- AC Power Supply: Allows the LRAD to be powered by a standard AC source instead of a battery.
- Cigarette Lighter/Plug Cable: Allows the LRAD to be powered through a 12 VDC cigarette lighter.
- Stud Mount: Mounting yoke kit for LRAD-100X, compatible with LRAD tripod (tripod not included).
- Magnetic Mount: Base and yoke that uses magnets to secure the LRAD to metallic surfaces.
- Tripod Kit: Includes medium-duty tripod and reusable hard case.
- Table Mount Kit: Fixed mount for flat surfaces.
- Tactical Pack: Rugged backpack that allows for operation of the LRAD within the pack while on the move.
- Front Carry Pack: Allows for swift and mobile operation of the LRAD-100X.



Figure 12 – Optional Accessories: Front Carry Pack (left) and Tripod (right)

17.0 Troubleshooting

Problem Description: MP3 player is on but there is no sound from the LRAD.

Cause: Possible low battery.

Solution: Check the battery voltage. It should be greater than 13.6 VDC between Pins 1 and 2, and Pins 3 and 4. If voltage is low, recharge the battery. If the battery will not charge to above 13.6 VDC, the battery or the charger will need to be replaced.

Problem Description: USB device not recognized when attempting to connect the MP3 player to a computer for downloading files.

Cause: The USB mass storage device in the MP3 player was not recognized by the computer upon connection. This may be due to a power surge on the USB port or due to a physical problem with the cable or connection to the computer.

Solution: Try another USB port or a different computer. Cycle the connection at the computer, not at the MP3 Player. Try another USB cable.

18.0 Specifications

Mechanical

Dimensions	14.0" H x 14.0" W x 6.5" D (35.6 cm x 35.6 cm x 16.5 cm)
Weight	15 lbs. (6.8 kg) with batteries, accessories, and cables
Construction	Injection molded, impact resistant polymer, 6061 aluminum

Acoustic

Maximum Peak Output	140 dB SPL @ 1 meter, C-weighted
Maximum Continuous Output	137 dB SPL @ 1 meter, A-weighted
Sound Projection (Acoustic Beam Width)	+/- 15° @ 1 kHz / -3 dB
Communication Ranges (Continuous Output)	Ideal conditions: 600 meters 88 dB of background noise: 250 meters

Electrical

Power Consumption	Voice Broadcast: 20 Watts	
	Alert Tone: 85 Watts	
Power Input	10.8 to 16.8 VDC	Included rechargeable battery: 13.2 VDC
Electromagnetic Compatibility	FCC Part 15 class A radiated emissions, CE	

Environmental

Random Vibration	MIL-STD-810G, Method 516.6, Procedure I, Functional Shock
Shipboard Vibration	MIL-STD-167-1A
Shipboard Shock	MIL-STD-901D, Class I, Shock Grade B
Low/High Temp: Operational	MIL-STD-810G, Method 501.5 and 502.5, Procedure II, -33° to 60° C
Low/High Temp: Storage	MIL-STD-810G, Method 501.5 and 502.5, Procedure I, -40° to 70° C
Rain	MIL-STD-810G, Method 506.5, Procedure I, Blowing Rain
Operational Humidity	MIL-STD-810G, Method 507.5, Procedure II, Aggravated Cycle
Salt Fog	MIL-STD-810G, Method 509.5
Safety	MIL-STD-1474D

19.0 Technical Support

Contact information for Genasys Technical Support is listed below.

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16262 West Bernardo Drive
San Diego, CA 92127

858-676-0574
Technical@genasys.com