

ZEAW®



 Loudspeaker
Owners Manual

Loudspeaker Owner's Manual

Congratulations on the purchase of your new EAW loudspeaker. You now own one of the finest professional audio products available - the result of exceptional engineering and meticulous craftsmanship.

This manual is intended for use with all EAW loudspeakers. As such, it contains information that is common to different types of loudspeakers. This includes: safety precautions; installation, set-up, and operating instructions; troubleshooting, maintenance, and service procedures as well as other information specific to their use. Certain information specific to certain classes of loudspeaker, such as powered products, is so noted. Certain loudspeakers with specialized designs have a manual that accompanies this one with additional instructions and other information specific for their use. Thus, both manuals apply to those loudspeakers.

Please read this manual plus any accompanying manual and follow all relevant precautions and instructions. This should allow you to obtain the maximum performance from your new loudspeaker.

Where there are conflicts or overlaps, the information in any accompanying manual supersedes the information in this manual.

Rigging: Mounting/Suspension

DANGER: Mounting or overhead suspension of any heavy load can result in serious injury and equipment damage. This work should be done by qualified persons following safe rigging practices in accordance with all applicable safety and construction standards. Such persons must determine the required load ratings and design factors. They must determine the mounting or suspension method that meets static, dynamic, shock, and any other load requirements. All such work must be done in accordance with and in compliance with all federal, state, and local regulations governing such work.

CAUTION: The user assumes all responsibility and liability for the proper design, installation, and use of any rigging and mounting systems for EAW loudspeakers.

CAUTION: Accessory items are available from EAW and from aftermarket suppliers to facilitate suspension, wall, ceiling, or other rigging. When using these items, review all enclosed documentation and carefully follow

all instructions and safety precautions.

Purchaser and User Responsibility

It is the responsibility of the purchaser and end-user of EAW products to:

- ▶ Read the product instructions and labels and follow them.
- ▶ Inspect the product immediately upon receipt as well as before and after each use.
- ▶ Receive training in the proper installation and use of the equipment. Proper training includes safety procedures, limitations of the equipment, inspection of the equipment, and risk management. If you are not competent in the use of a product, do not use it.
- ▶ Determine if the product is suitable for its intended use and that it meets all applicable standards and regulations.
- ▶ Use adequate safety precautions and back-up systems.
- ▶ Practice risk management at all times.

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Unpacking

Shipping Damage

You should have visually inspected the outside of the shipping carton and noted any damage on the shipping bill you signed. After unpacking, if you find concealed damage to the loudspeaker, save the packing materials for the carrier's inspection, notify the carrier immediately and file a shipping damage claim. Although EAW will help in any way possible, it is always the responsibility of the receiving party to file any shipping damage claim. The carrier will help prepare and file this claim.

Returning Product to EAW

If this loudspeaker must be returned to EAW, contact the EAW Service Department for a Return Authorization. Use the original shipping carton and packing materials. If the shipping carton is damaged, contact EAW for a new carton at a nominal cost. EAW will not be responsible for damage caused by inadequate packing.

All units returned must have a factory Return Authorization Number. Any units received without a Return Authorization Number assigned and written prominently on the outside of the carton will be refused.

Overview

This loudspeaker is intended for professional use. The construction, components, and hardware have been designed to provide robust, reliable performance for its intended applications. Please ensure that you fully understand proper installation and operation before use.

You will need to perform the following general tasks to properly put the loudspeaker into service. Details concerning each task are provided in this manual.

1. Design and install a rigging system to support the loudspeaker in its intended location and aimed in the desired direction.
2. Connect the loudspeaker to a power amplifier(s) selected to provide the output needed for the loudspeaker in the application. In the case of powered loudspeakers provide an ac mains supply as specified for the particular loudspeaker.
3. Set-up and adjust system gain, signal processing, and limiting, as needed to maximize the loudspeaker's performance.
4. Provide training to operate the loudspeaker within its limits.
5. Provide regular inspection and maintenance to maintain the integrity of the installation and performance of the loudspeaker system.

Rigging, Mounting & Suspension

"Rigging" is used as a general term referring to fixed mounting and suspension as well as the hardware used for such mounting and suspension. It also applies to temporary and permanent installation.

Rigging Information

DANGER: If there is any question about the integrity or capability of any part to perform its intended function when used to suspend or mount a loudspeaker, immediately remove it from service for repair or replacement.

WARNING: Do not under any circumstances use a loudspeaker's handles to support the weight of the loudspeaker except for their intended use: hand carrying. The handles are not rated to support the load of the loudspeaker for temporary or permanent installation.

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WARNING: Rigging loudspeakers is an extremely serious matter with potentially lethal consequences should anything go wrong. It is of vital importance that this task is done by persons qualified to do so and who have a full understanding of all factors involved, with safety as the number one priority. Only persons with the knowledge of and experience with proper hardware and safe rigging techniques should attempt to suspend or mount loudspeaker systems overhead. For all questions involving loudspeaker rigging, consult a licensed, qualified Professional Engineer or Professional Rigger. All rigging work must be done in accordance with and in compliance with all applicable regulations governing such work.

Working Load Limits

To maintain the Working Load Limit (WLL) for the rigging points on EAW loudspeakers, support each loudspeaker independently of any other. This means do not use one loudspeaker to support another.

Most EAW loudspeakers have one or more types of rigging fittings, integral with the enclosure. Depending on the loudspeaker, these will be suitable for fixed mounting, suspension, or both. The WLLs for these fittings are defined and listed on the Mechanical Drawing found on the specification sheet for the loudspeaker. This information may also be found on a yellow sticker applied to the flybar itself. If this is missing from the drawing, contact EAW Design or consult EAW Resolution. The WLLs do not extend to any rigging hardware attached to these fittings nor to the connection of that hardware to structure.

The WLLs listed are the maximum load that should ever be applied to the fittings under any condition. The WLL assumes a straight, tensile pull, perpendicular to the enclosure surface where the fitting is mounted and that the enclosure and fittings are in like-new condition.

The WLL is the Ultimate Strength (breaking or failure point) divided by the Design Factor. The WLL does not apply to any product that has been altered from its manufactured condition. The Design Factor for all WLLs is a minimum of 10:1.

Exceptions:

- ▶ Where a WLL is specified in an accompanying manual for a specific loudspeaker model, that rating supersedes this section.
- ▶ Where the loudspeaker is specifically designed for suspension in touring applications.

Rigging Design

Practices

Rigging a loudspeaker requires determining:

- ▶ The rigging methods and hardware that meet static, shock, dynamic, and any other load requirements for supporting the loudspeaker from structure.
- ▶ The design factor for and the required WLL (Working Load Limit) for this support.

EAW strongly recommends the following rigging practices:

- ▶ Documentation: Thoroughly document the design with detailed drawings and parts lists.
- ▶ Analysis: Have a qualified professional, such as a licensed Professional Engineer, review and approve the design before its implementation.
- ▶ Installation: Have a qualified professional rigger do the installation and inspection.
- ▶ Safety: Use adequate safety precautions and back-up systems.

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Hardware & Accessories

Rigging EAW loudspeakers will invariably require hardware not supplied by EAW. Various types of load-rated hardware are available from a variety of third-party sources. There are a number of such companies specializing in manufacturing hardware for, designing, and installing rigging systems. Each one of these tasks is a discipline in its own right. Because of the hazardous nature of rigging work and the potential liability, engage companies that specialize in these disciplines to do the work required.

EAW does offer certain accessory rigging items, primarily for attachment to the hardware integral with the loudspeaker. Some items, such as eyebolts, can be used with a variety of products. Others, particularly U-brackets and similar hardware, can only be used with a specific product or product Series. While these accessories are intended to facilitate installation, the wide variety of possible installation conditions and array configurations do not permit EAW to determine their suitability or load rating for any particular application.

EAW is not in the business of providing complete rigging systems, either as designers, manufacturers, or installers. It is the responsibility of the installer to provide a properly engineered, load-certified rigging system for supporting the loudspeaker from structure.

Amplifier Power Requirements

Selecting an Amplifier

As is true of all professional loudspeaker systems, the performance of the loudspeaker depends on an amplifier delivering an adequate supply of clean power. Determining the appropriate power amplifier wattage for a given loudspeaker and application is a subject of some debate within the audio industry. As such, there

is no single answer to the question of what amplifier power you should use for a particular loudspeaker. The "Rule-of-Thumb" is an all-purpose metric commonly used for selecting amplifier power. A more exacting approach involves three separate and distinct issues: power ratings, appropriate amplifier size, and preventing loudspeaker damage. These are discussed within this section.

Rule of Thumb for Selecting an Amp

If the loudspeakers are used for professional application with competent operators, a rule of thumb can be applied. Where the full output capabilities of the loudspeakers may be needed to achieve appropriate acoustic output levels, EAW recommends amplifiers with ratings up to 1.4 times the voltage, which equals twice the wattage, listed in the loudspeaker specifications. This provides a peak voltage capability of 6 dB above the specified rms voltage limit. This assumes the audio signals will have a peak to average ratio in excess of 6 dB, which is usually, but not always, true. Under this condition, the thermal limits are unlikely to be exceeded. While this rule of thumb is consistent with the EAW's testing parameters, it does NOT guarantee trouble-free operation.

In some cases, the amplifier power determined by the Rule-of-Thumb may not be available in acceptable products. In this event, select an amplifier within approximately $\pm 25\%$ (± 1 dB) of the desired power. In some cases, particularly subwoofers or multiple LF subsystems powered off one amplifier channel or an amplifier in bridged mode, the desired power will exceed that available in acceptable products. In this event, select the largest amplifier possible.

WARNING: The power amplifier sizes recommended by the above rule of thumb are capable of continuous output levels that can cause damage to or failure of the drivers.

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Exercise caution in operation to avoid exceeding the specified, maximum rms voltage limits. This is especially true when reproducing recorded music. Many recordings have very low peak to average ratios such that much higher continuous levels are possible before amplifier clipping. If an EAW Processor or Amp is used with Greybox settings loaded, a voltage limiter will be automatically applied.

Power Ratings

The voltage and/or power listed in EAW's specifications mean that the loudspeaker has passed EAW's standard Accelerated Life test. In this test, the loudspeaker is "exercised" to a point of damage or failure. The voltage and/or power ratings resulting from this test are intended to be used as a point of comparison with the ratings of other loudspeakers. This rating does not necessarily correspond to the best amplifier size to use nor is it a measure of the "safe" amplifier size to use depending on the actual operating conditions.

Selecting an Appropriate Amplifier Size

The amplifier for your loudspeaker should be sized according to both the sound levels required and the type of audio signals that will be reproduced. This requires a considered analysis for the particular application. If you are unsure of how to determine these parameters, consult a qualified audio professional or contact EAW's Design Team (Design@eaw.com)

Preventing Loudspeaker Damage

Preventing damage to or failure of a loudspeaker is not a function of amplifier size nor the loudspeaker's power rating. Preventing damage is a function of operating an audio system so that a loudspeaker is not stressed beyond its limits. If an audio system is operated improperly, damage to or failure

of a loudspeaker can occur even with an amplifier sized well below the loudspeaker's power rating. Contrarily, if an audio system is operated properly, damage to or failure of a loudspeaker can be avoided even with an amplifier sized well in excess of the loudspeaker's power rating.

It is the responsibility of the audio system operator to ensure that all equipment in the system is operated within its capabilities. This is the only way to ensure that loudspeakers are not stressed beyond their limits to the point of damage or failure.

Locating the Loudspeaker

Placement Precautions for Loudspeakers

CAUTION: Do not permanently mount EAW loudspeakers in outdoor environments, unless they are WP versions, normally special ordered. If using powered loudspeakers temporarily outdoors, protect the loudspeaker from moisture. If rain is expected, make sure the loudspeaker is protected by a rain cover.

Loudspeakers generate magnetic fields, unless specifically designed for audio-visual applications where drivers are magnetically shielded to limit the extent of the magnetic field. Therefore, place a loudspeaker at least 2 ft (0.6 m) or more from any TV set or computer monitor. If it causes distortion or a change in the display color, move it further away. Do not place any audio, video, or computer magnetic media near the loudspeaker as the loudspeaker's magnetic field may damage the data.

Signal Connections

CAUTION: In spite of the listings below, check the input panel labeling to verify proper connections because of possible design differences or production changes.

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Neutrik NL Connectors

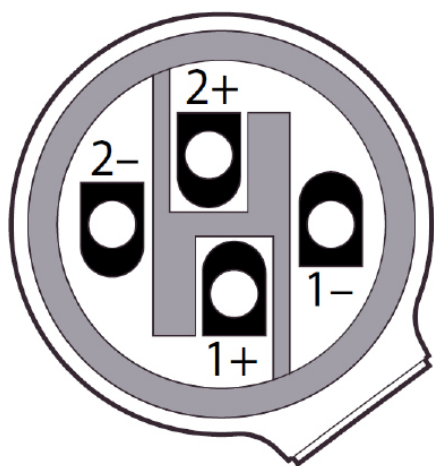
NL4 Full Range:	
Pin 1-	Negative
Pin 1+	Positive
Pin 2-	No connection
Pin 2+	No connection

NL4 Bi-amplified:	
Pin 1-	LF or LF/MF negative
Pin 1+	LF or LF/MF positive
Pin 2-	HF or MF/HF negative
Pin 2+	HF or MF/HF positive

NL4 Single-amplified Subwoofers	
Pin 1-	Driver negative
Pin 1+	Driver positive
Pin 2-	Loop through
Pin 2+	Loop through

NL4 Dual-amplifier Subwoofers	
Pin 1-/1	Driver 1 negative
Pin 1+/2	Driver 1 positive
Pin 2-/3	Driver 2 negative
Pin 2+/4	Driver 2 positive

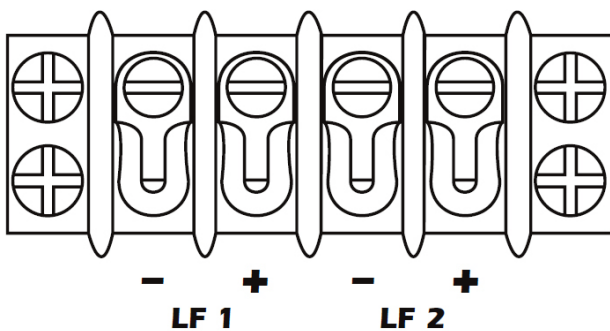
NOTE: Ensure that the connection polarity is correct. To do this, connect with the "+" terminal on the loudspeaker to the like terminal on the amplifier, normally labeled: "+", positive, or hot. Similarly connect the "-" terminal on the loudspeaker to the like terminal on the amplifier, normally labeled, "-", negative, or ground.



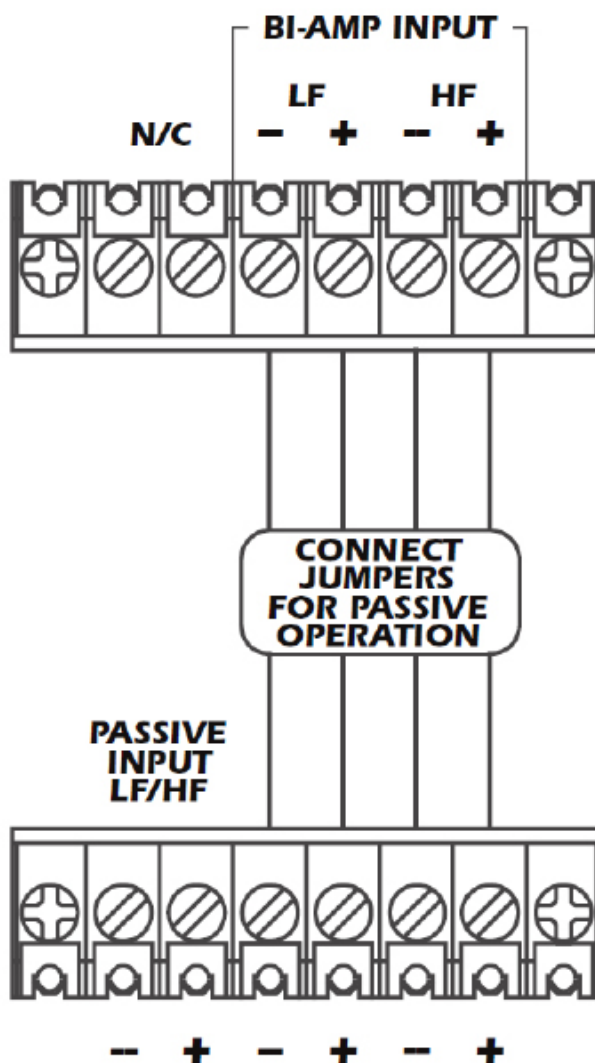
Neutrik® NL4

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Barrier Strip, Terminal Block, and Phoenix Connectors



Typical Barrier Strip Connector



Typical Terminal Strip Connector

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Loudspeaker Wire Gauge

The proper conductor size (wire gauge) to use for the loudspeaker cable is primarily a function of the wire length. The general rule is that lower resistance, in relation to the loudspeaker's impedance, is better. To achieve this, use larger conductor sizes for longer lengths of cable and for lower impedance loudspeaker loads.

For this reason, precision in the frequency, amplitude, and phase of the settings are critical for reproducing EAW's settings and to maintaining those settings over time. The only type of readily available equipment that can provide these capabilities is a digital signal processor (DSP).

EAW signal processing settings are based on EAW's digital processors. The filter algorithms

Maximum Cable Length	Nominal Loudspeaker Z	AWG Size	Metric Size mm ²
50 ft / 15m	8 ohm	14	2.5
100 ft / 30m	8 ohm	12	4
200 ft / 60m	8 ohm	10	6
> 200 ft / > 60m	8 ohm	Not Recommended	Not Recommended
50 ft / 15m	4 ohm	12	4
100 ft / 30m	4 ohm	10	6
> 100 ft / > 30m	4 ohm	Not Recommended	Not Recommended
50 ft / 15m	2 ohm	10	6
> 50 ft / > 15m	2 ohm	Not Recommended	Not Recommended

(AWG = American Wire Gauge)

NOTE: This table is based on achieving adequate damping factor (>20). The associated, worst-case SPL losses are below 0.5 dB and should be considered insignificant.

To provide a sufficient damping factor (DF) for low frequency drivers, use loudspeaker cable with conductor sizes per the following chart. For cable lengths over 200 feet at 8 ohms, over 100 feet at 4 ohms, and over 50 ft at 2 ohms, the conductor sizes required for an adequate damping factor are rarely practical for physical and cost reasons. While it is recommended to avoid such situations the most practical wire gauge for these situations is 10 AWG / 6 mm²

Signal Processing

Digital Signal Processor Compatibility

Note: See appendix at end of manual for configuring non EAW limiters. The processing EAW determines for its loudspeakers is used to modify performance characteristics that are stable over time and under use.

implemented for digital signal processing vary from manufacturer to manufacturer. Therefore, if a different manufacturer's digital signal processor will be used, it is not enough to merely duplicate the numerical settings. The transfer functions for the settings must be made similar, meaning not only the magnitude response but also the phase response. If the transfer functions do not match closely then this will actually redesign the loudspeaker's performance with arbitrary results. Contact **EAW's Design Team** (Design@eaw.com) for assistance about your processor's compatibility with the EAW factory settings.

Single-amplified Mode

Signal processing, whether analog or digital, is required for all single-amplified loudspeakers to implement the specified high-pass filter (HPF).

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Digital signal processing is highly recommended as it can provide not only the required high pass filter, but also better equalization tools, signal delay, limiting, and accurate gain settings. With most DSP units, the settings can be protected from unauthorized changes.

Digital Signal Processing: For certain single-amplified products, DSP is required to achieve the designed performance. This is stated on their specification sheets. In most cases, this design approach was chosen to reduce the complexity of the internal passive components, minimize power losses, and provide far more sophisticated processing to maximize performance. The information in Section 9.2.2 applies to such loudspeakers.

DSP Output Gains: EAW's published processor output gain settings are determined so as to achieve the following conditions. This also applies to gain settings for loudspeakers where the only processing specified is an HPF (High Pass Filter).

Unprocessed Input Signal: EIA-426B spectrum with an average level of 0 dBu / 0.775 V

Processed Output Signal: average level of 0 dBu / 0.775 V

Amplifier Gain Settings: The amplifier gain setting for a single-amplified loudspeaker has no bearing on the loudspeaker's inherent performance. Choose the amplifier gain as needed for optimum system dynamic range or as needed for a desired level relative to any other loudspeakers in the system.

Multi-amplified Mode

Signal processing in the form of a digital signal processor (DSP), is required for all multi-amplified products.

Factory Signal Processing Settings: The signal processing settings determined

by EAW should be fully implemented "as is." They will normally provide excellent results in a variety of venues. These settings are determined from careful laboratory measurements and affect many aspects of the loudspeaker's performance.

DSP Output Gains: EAW's output gain settings are determined so as to achieve this condition.

Unprocessed Input Signal: EIA-426B spectrum with an average level of 0 dBu / 0.775 V

Processed Output Signal: Average level of 0 dBu / 0.775 V for the least sensitive passband.

WARNING: Do not under any circumstances use "generic" or your "favorite" crossover, output equalization, or other settings. Arbitrary settings will actually redesign the loudspeaker's performance with the results being equally arbitrary. Always use EAW's recommended signal processing settings. Performance, in terms of frequency response, beamwidth consistency, output level capability, and wavefront coherency is dependent on the EAW-engineered crossover and other processing settings.

NOTE: The same gain does NOT mean the same input sensitivity, but the same input to output voltage gain. Consult your amplifier manufacturer if this cannot be readily determined. Do not selectively boost or attenuate loudspeaker levels of the amplifiers in order to balance a system. This should be done at the output of the signal processor.

The specific gain setting chosen for the amplifiers has no bearing on the loudspeaker's inherent performance. Choose a gain setting as needed for optimum system dynamic range or as needed for a desired level relative to any other loudspeakers in the system.

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Subwoofer Signal Processing - Limiters

For subwoofers, a digital signal processor (DSP) is the best method for providing crossover, output equalization, protective high pass filter, and limiting. See Section 9.2.1 for signal processing details. These apply equally to any quantity of subwoofer amplifier channels.

CAUTION: The assumptions that must be made about how to set a limiter and what a driver's power handling limits are cannot address all conditions of use. As such, limiters cannot provide absolute protection nor provide any guarantee against damage or failure from excessive inputs. At best, they can only provide some degree of protection.

Limiters can help avoid either of two things, depending on the signal frequency content and the amplifier / driver power ratings. The choice depends on which will be exceeded first.

Exceeding a Loudspeaker's Thermal Limit:

The limiter is used to prevent the amplifier, operating within its capabilities, from exceeding the loudspeaker's capabilities.

Exceeding the Amplifier's Output Limit (Clipping). The limiter is used to prevent the amplifier from exceeding its capabilities, even though the loudspeaker is operating within its capabilities.

EAW has done the work of determining limiter characteristics with real audio signals by performing a number of tests on its behavior with real audio signals and analyzing how this relates to both loudspeaker power handling limits and sonic performance. Based on measurement and analysis of the above variables, EAW Engineering was able to formulate a set of "rules" for setting limiters. Listening tests determined settings that maintain good sound quality while maximizing protection.

Because limiters differ in their behaviors from manufacturer to manufacturer, EAW

can only provide limiter settings for its own processors. These are the only ones on which the required analysis was done to optimize settings. As such, EAW limiter thresholds are only valid for use with an EAW digital processor and with amplifiers that have or are set to 32 dB gain for all passbands. This assumes that the factory gain settings for the processor outputs are also used.

Operating the Loudspeaker

Operator Responsibility - Preventing Damage

It is the responsibility of the audio system operator to operate the loudspeaker within its limits and capabilities. This is the only way to ensure that the loudspeaker is not stressed beyond its limits to the point of damage or failure.

Loudspeaker Limits - Preventing Damage

Operation beyond the loudspeaker's capabilities usually includes, but is not limited to, one or more of the following conditions:

- ▶ Amplifier clipping
- ▶ Voltage input in excess of the specified rms voltage limit
- ▶ Peak voltage input in excess of twice the specified voltage limit
- ▶ Noticeable distortion
- ▶ Mechanical noise (such as a cone bottoming out)
- ▶ A suitable means for determining these conditions is highly recommended. At a minimum, the operator should have a meter display calibrated to indicate when the loudspeaker's maximum rms voltage limits will be exceeded. This assumes amplifiers are not being driven into clipping at these limits.

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Acoustic Level Precautions

CAUTION: If exposure to levels higher than 100 dB will be prolonged, wear earplugs in the ear canals or ear protectors over the ears.

Operating Levels

EAW loudspeakers, when appropriately powered, are capable of producing sound levels that are potentially damaging to your hearing. For a single loudspeaker and depending on the product, this can easily occur within 50 ft / 15 m of the loudspeaker. When used in multiples, such levels can be reached at considerable distances from the loudspeakers.

Avoid operating the loudspeaker systems at levels that exceed 100 dB PL in the listening area for more than short periods. One way to do this for musical performances is to provide some moderate boost at the very low and to a lesser extent, at the very high frequencies. Judicious applications of this type of equalization can make a loudspeaker sound significantly louder than it actually is. Both your listeners and your loudspeakers will thank you. It is recommended that a sound level meter be used to verify listening levels. Relatively inexpensive meters are available that provide adequate accuracy for this purpose.

Be aware that audience members will not have the benefit of ear protection. Therefore, if you need to use ear protection because the levels are loud, the audience also needs ear protection. The remedy is to reduce the system volume to a safer listening level.

Testing & Test Signals

Loudspeakers are designed to reproduce primarily speech and music audio signals. Such signals are highly variable from moment to moment in their level, frequency content, and phase. Accepted loudspeaker measurements and tests that are accurate

and consistent are possible only with signals where the level, frequency content, and phase are accurately known and consistent at all times. Such signals include sine waves, swept tones, pink noise, white noise, and other constant level test signals. These are much harder on a loudspeaker than speech and music signals and therefore the potential for damage is much greater. Keep in mind that the parameters of electronic limiters are also designed for the characteristics of speech and music signals - not test signals. Their capability to protect the loudspeaker is considerably reduced using test signals.

Take certain precautions to avoid loudspeaker damage when using test signals. Never use power inputs that exceed 50% (-3 dB) of the loudspeaker's power rating and do not test at this level for more than a few moments. For sine waves and for any other test signals that must be used for extended periods of time, the input to the loudspeaker should be kept below 10% (-10 dB) of the loudspeaker's power rating.

Measurements

The Smaart™ computer program, from **Rational Acoustics**, is an ideal tool to use to measure and optimize a loudspeaker system or loudspeaker array for a particular venue. This is a fast, yet sophisticated, process that will indicate problem areas due to particular venue characteristics. Usually it is a matter of applying small amounts of equalization to adjust significant anomalies.

While there are a number of other commercially available and quite sophisticated measurement programs, they are not specifically optimized for measurements of loudspeakers in use, but rather for laboratory type measurements. On the other hand Smaart provides the major benefits of using a test signal, including music, for the measurements and providing continuous, real-time data for making system adjustments.

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Operating Tips to Help Avoid Loudspeaker Damage

- ▶ Do NOT drive any of your electronic equipment into clipping, particularly the power amplifiers. This can easily damage the loudspeaker.
- ▶ If driven into clipping, even an amplifier with a power output rating lower than EAW's power rating can cause damage to a loudspeaker.
- ▶ Avoid sustained microphone feedback. This can quickly cause driver failure.
- ▶ Avoid extreme boosts on equalizers as these can cause excessive input to the drivers at the boosted frequencies. Generally, cutting frequencies is preferred to correct for frequency response problems. These problems include attenuating feedback frequencies or reducing excessive energy at certain frequencies due to room acoustics.
- ▶ With appropriate signal processing, your loudspeaker should produce exceptionally good sound. If used in a room with problematic acoustics, there is little you can do to overcome these problems with electronic adjustments. Your best solution is careful placement and aiming of the loudspeaker so that most of the sound is directed only at the audience.
- ▶ EAW loudspeakers are capable of sound levels that can be damaging to human hearing. Take precautions so that audiences are not exposed to such levels. If you must expose yourself to these kinds of volume levels, wear adequate hearing protection.
- ▶ Take care when moving or lifting the loudspeaker. Careless handling can result in equipment damage, injury, or death.
- ▶ Avoid exposing the loudspeaker to extreme cold (below freezing

temperature). If you must operate the loudspeaker in a cold environment, warm it up by sending a full-range, low-level signal through it for about 15 minutes prior to high-power operation.

Inspection & Maintenance

Your EAW loudspeaker should require little to no regular attention for normal use. However, performing regular inspections and maintenance can ensure your loudspeaker remains in optimum operating and cosmetic condition.

Periodic Inspection

DANGER: If there is any question about the integrity or capability of any part used to rig a loudspeaker to perform its intended function, immediately remove it from service for repair or replacement.

Perform complete and thorough inspections of the loudspeaker on a routine, periodic basis. The interval between inspections and scope of the inspections will depend on the installation and the conditions of use. It is strongly recommended that the interval between inspections not exceed 1 year.

- ▶ Inspect for problems and abnormalities, including, but not limited to:
- ▶ Cracks or breaks in the wood
- ▶ Cracks or bends in the grille
- ▶ Loose or missing hardware
- ▶ Damaged mounting/rigging hardware and components
- ▶ Loose input connections

Rigging Inspection

Specifically and thoroughly inspect all rigging hardware and components used to support the loudspeaker.

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Do this on a routine, periodic basis, whether components are integral with or external to the loudspeaker or whether factory or user-supplied. The interval between inspections and scope of the inspections will depend on the installation and the conditions of use. The rigging inspection interval must not exceed 1 year.

Inspect for problems and abnormalities including, but not limited to:

- ▶ Bends
- ▶ Breaks
- ▶ Broken parts
- ▶ Corrosion
- ▶ Cracks
- ▶ Cracks in welded joints
- ▶ Deformation
- ▶ Denting
- ▶ Wear
- ▶ Holes
- ▶ Loose or missing parts or fasteners

Periodic Performance Testing

Periodically perform listening tests and/or formal acoustical measurements for proper performance. The interval between such tests will depend on the frequency of system usage and the conditions of use.

A simple test is to play a CD through it using well-defined, articulate, wide-range program material. Listen to ensure all drivers are working properly and for any evidence of distortion or other extraneous sounds. Test at several volume levels: very low, normal, and high.

All drivers should be tested for functionality and proper performance. A sine wave sweep at approximately 10% of rated power

will usually reveal driver and/or enclosure problems in the form of distortion, buzzes, or rattles.

Routine Maintenance

Periodically do routine maintenance on the loudspeaker. The interval between maintenance times and the scope of the maintenance will depend on the installation and the conditions of use. It is strongly recommended that maintenance intervals not exceed 1 year.

Maintenance shall include but not be limited to:

- ▶ Repair or replace of any item determined by inspection to be sub-standard for their intended use.
- ▶ Replace any load supporting parts whose load handling integrity is the least bit questionable.
- ▶ Lubricate all parts subject to friction using WD-40, Scott oil FS365, or similar. These are water-based lubricants with machine oil, surfactant, an anti-rust treatment.
- ▶ Tighten all accessible screws, nuts, and bolts, especially those that are part of the rigging hardware.
- ▶ Clean the exterior surfaces of the enclosure and rigging system as required, this largely depending on the type of "dirt". Normally, use a cloth dampened with mild soapy water to remove dust, dirt, food spills or similar. Avoid getting moisture into any of the openings of the cabinet, particularly where the drivers are located. After cleaning, use a clean dry cloth to remove any excess moisture and treat metal parts and the rigging system with lubricant to prevent rusting.

CAUTION: To avoid damaging the exterior finishes do not use cleaning solvents or abrasives.

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Cosmetic Maintenance

While the paint finish and the wood used for the enclosures are of high quality and durability, mars, marks, scratches, and other blemishes may appear from normal handling. For cosmetically damaged wood, repair such damage using common woodworking methods and materials as appropriate for the damage. Scratches on the enclosure or hardware can be painted over with an outdoor latex paint or simply colored in with a "Sharpie" or artist's marking pen. More serious gouges or dents should be sanded out, filled with wood putty, and repainted. Black touch-up paint in pints (part #810050) or quarts (part #810049) is available from the EAW Service Department. Tips for repainting are on EAW's website.

Long Term Maintenance

For approximately five years, only routine inspections, performance testing, and maintenance are normally required to maintain the loudspeaker's performance. Over a longer period, there are possible, additional maintenance issues:

Ferrofluid: Some EAW loudspeaker models employ compression drivers with Ferrofluid-filled magnetic gaps. This magnetic fluid fills the loudspeaker's magnetic gap to cool the driver by transferring heat from the voice coil through the fluid to the magnet structure. Over time, the Ferrofluid can thicken enough to affect the acoustical response and should be replaced. For normal conditions of use, Ferrofluid will retain its original properties for 6 years or more. However, if a loudspeaker is driven very hard on a daily basis, the Ferrofluid may retain its properties for only 2 years.

When either of these conditions of use apply, replace the Ferrofluid to restore performance. Contact the EAW Service Department for instructions.

Grille Material: Some EAW loudspeaker

grilles are backed by either cloth or foam. This material can deteriorate over time due to various environmental conditions and effects, particularly if installed outdoors. If these conditions of use apply, periodically inspect and replace any deteriorated grille material. Contact the EAW Service Department for materials and instructions.

Cosmetics: Various finishes are used on loudspeaker enclosures depending on the product and its applications. While these finishes are designed to be durable over long periods, like any applied finish, they can deteriorate over time, largely depending on the conditions of use. While this deterioration will not affect performance, refinish the loudspeaker as needed for aesthetic reasons. Contact the EAW Service Department for instructions.

Troubleshooting

Rigging Problems

Because of the potential serious consequences and liabilities due to faulty rigging, contact EAW to determine the appropriate service solution for any problems with the rigging hardware integral to the enclosure or EAW rigging accessories.

Enclosure & Integral Hardware

Enclosure problems, such as loose hardware, faulty joints, or other structural problems, will usually be heard as distinct buzzes, rattles, or other unwanted noises. To test for enclosure problems, use a sine wave signal manually swept on the LF sub-system. The input level should be varied, because certain problems can be level as well as frequency specific. However, in no circumstances should the sine wave level be higher than 6 dB below rated power (equal to no higher than 1/2 rated rms input voltage). It may be possible to field-repair some enclosure problems.

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Cosmetics

While the paint finish and the wood used for the enclosures is of high quality and durability, marks, and other blemishes may appear from normal handling for an installation. For paint touchup, use good quality latex paint. For a more permanent and cosmetically correct appearance, contact the EAW Service Department for the paint specifications or to purchase small quantities for touch-up. For cosmetically damaged wood, use common woodworking methods and materials as appropriate for the damage.

Isolated Sonic Problems

Loudspeakers invariably consist of an input panel, internal components and wiring, drivers, and an enclosure.

Troubleshooting for various performance problems usually involves isolating the problem to one of these areas. In most cases, the fault can be clearly isolated to one of them and that will determine the appropriate action for servicing.

- ▶ Drivers
- ▶ Input panel, internal crossover/filter components, and wiring (unpowered loudspeakers)
- ▶ Internal electronics (powered loudspeakers)
- ▶ Enclosure & integral hardware

If no problems can be traced to any of these items, look for problems with external electronics or cabling. Troubleshooting these items is beyond the scope of this manual.

Drivers: A faulty driver will usually cause readily audible distortions or other unwanted noises. In other cases, they

may stop functioning. Use your ears and test signals or other sound source to determine which one is at fault. Normally, a faulty driver requires return for service or replacement by EAW.

Input Panel & Wiring: Faults with these items will usually cause a driver to stop working or be intermittent. Check wiring continuity from the input jacks to the crossovers and from the crossovers to the driver terminals. Many faults in this area can be field-repaired.

Crossovers: Faults with these items will usually cause drivers to stop working, be intermittent, or alter the frequency response. If a crossover fault is suspected, the nature of the fault determines the action. A poor connection or obviously open circuited, shorted, or physically damaged component (such as from overheating) can be relatively easy to find and field-repair. An improperly functioning component may require more sophisticated troubleshooting, as the fault will likely be frequency dependent. A faulty crossover is best returned for service or replacement by EAW.

Enclosure & Integral Hardware: Enclosure problems, such as loose hardware, faulty joints, or other structural problems, will usually be heard as distinct buzzes, rattles, or other unwanted noises. To test for enclosure problems, use a sine wave signal manually swept on the LF sub-system. The input level should be varied, because certain problems can be level as well as frequency specific. However, in no circumstances should the sine wave level be higher than 6 dB below rated power (equal to no higher than 1/2 rated rms voltage). It may be possible to field-repair some enclosure problems.

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No Sound or Low Output

- ▶ Loudspeaker cables or connectors are mis-wired or faulty: Check all cabling. Refer to these instructions for correct loudspeaker cable connections. The best way to check a suspect cable is to swap it with a known good cable. Read the loudspeaker's input panel to verify correct cable connections.
- ▶ Electronic equipment is not turned on or level controls are not adjusted properly: Make sure that all equipment in the signal path is powered up and that all controls are set to appropriate levels for normal operation.
- ▶ Loudspeaker is not working: Connect the signal cable to a known good loudspeaker leaving all equipment set to the same levels. If the problem disappears, the loudspeaker is probably not working. Contact EAW Service for appropriate troubleshooting.

Distorted Sound

- ▶ The power amplifier is clipping: The signal level is exceeding the limits of your system and you must reduce the level.
- ▶ Other electronic equipment is clipping: Ensure that no equipment in the signal chain is being overdriven. For example: input(s) or summing bus in the mixing console, equalizers, etc.
- ▶ Driver(s) not working properly: Contact EAW Service for appropriate troubleshooting.

Partial Sound (Some Frequency Bands Missing)

- ▶ Incorrect EQ settings in the electronic equipment: Ensure all EQ settings and filters on the mixing console or preamplifier and on other equipment are set for normal operation. Ensure level

controls on electronic crossovers and associated amplifiers are correctly set and that all cables and connections for such equipment are working properly.

- ▶ Incorrect processor configuration: Make sure the processor configuration is correct for the loudspeaker and its intended mode of operation. This includes settings made using software for powered loudspeakers.
- ▶ For unpowered loudspeakers: Incorrect mode switch settings on the loudspeaker input panel. Ensure this switch is set for the operating mode you are using: single, bi-amplified or tri-amplified.
- ▶ For powered loudspeakers: Incorrect control switch settings on the loudspeaker input panel. Ensure switch settings are correct for the application.
- ▶ Driver(s) not working properly: Contact EAW Support for appropriate troubleshooting.
- ▶ The crossover network inside the loudspeaker is not working properly: Contact EAW Support for appropriate troubleshooting.

SCAN CODE TO CONTACT EAW



For all other information:

Eastern Acoustic Works
One Main Street
Whitinsville, MA 01588 USA
508 234 6158
800 992 5013
<http://www.eaw.com>

Loudspeaker Owner's Manual

Appendix - Configuring NON-EAW Limiters

EAW Products are designed to perform their best using EAW electronics and signal processing within the Greybox settings. When EAW electronics and signal processing cannot be used, it is highly recommended to use the minimum FIR/IIR based processing designed for the specific product along with proper speaker protection. Since EAW cannot control the behavior or protection dynamics of third-party products, these instructions should be considered as a general guide and be aware it is the responsibility of the end-user or person configuring the system to protect the loudspeaker system from damage. EAW cannot be responsible for loudspeaker system damage using third-party products.

ITEMS NEEDED TO CONFIGURE LIMITERS

- **Pink Noise Generator** – This can be an industrial device designed specifically for pink noise measurement or a source such as a mixing console or pre-recorded sound files. It should have a crest factor of 12dB (which is typical of most Pink Noise sources).
- **True RMS Multi-Meter** – Such as a FLUKE 117. Many multi-meters can measure AC voltage. Make certain that it specifies it can measure true-RMS AC voltage.
- **Model-Specific Loudspeaker Specifications** – Each EAW spec sheet will designate values for “Accelerated Life Test”. You will need these values (###Watts/#Ohms) to determine the correct protection voltage. Do not use any other values for determining limiter values.



MKD1000 Series

TECHNICAL SPECIFICATIONS 3-WAY FULL-RANGE LOUDSPEAKERS

	MKD1000A	MKD1000B	MKD1000C
PERFORMANCE			
Max SPL	115dB	115dB	115dB
Operating Range ¹	50Hz - 20kHz	50Hz - 20kHz	50Hz - 20kHz
Minimum Frequency ²	100 Hz (nominal) x 100 Hz (actual)	100 Hz (nominal) x 100 Hz (actual)	100 Hz (nominal) x 100 Hz (actual)
Maximum Frequency ²	20 kHz (nominal) x 20 kHz (actual)	20 kHz (nominal) x 20 kHz (actual)	20 kHz (nominal) x 20 kHz (actual)
Input Impedance	12 kΩ ± 5%	12 kΩ ± 5%	12 kΩ ± 5%
ACCELERATED LIFE TEST			
LF (External Crossover)	80W/8Ω	100W/8Ω	100W/8Ω
LF (Internal Crossover)	70W/8Ω	100W/8Ω	100W/8Ω
HF	70W/8Ω	100W/8Ω	100W/8Ω
CONFIGURATION			
LF Transducers, Loading	2 x 3.5" (90mm) 25W/8Ω	2 x 3.5" (90mm) 25W/8Ω	2 x 3.5" (90mm) 25W/8Ω
HF Transducers, Loading	1 x 1.5" (38mm) 10W/8Ω	1 x 1.5" (38mm) 10W/8Ω	1 x 1.5" (38mm) 10W/8Ω
Operating Modes	Power, B, Standby	Power, B, Standby	Power, B, Standby
PHYSICAL			
Physical Rating	1 x 1.5" (38mm) 10W/8Ω	1 x 1.5" (38mm) 10W/8Ω	1 x 1.5" (38mm) 10W/8Ω
Dimensions (H x W x D)	10.5" (267mm) x 10.5" (267mm) x 10.5" (267mm)	10.5" (267mm) x 10.5" (267mm) x 10.5" (267mm)	10.5" (267mm) x 10.5" (267mm) x 10.5" (267mm)
Net Weight	10.5" (267mm)	10.5" (267mm)	10.5" (267mm)
Shipping Weight	10.5" (267mm)	10.5" (267mm)	10.5" (267mm)
Mounting Accessories	10.5" (267mm)	10.5" (267mm)	10.5" (267mm)
Input Connector	10.5" (267mm)	10.5" (267mm)	10.5" (267mm)
PROCESSING			
Part Numbers			
Black	1000000000	1000000000	1000000000
White	1000000000	1000000000	1000000000
MP (Black only)	1000000000	1000000000	1000000000
Accessories			
MP (Black only)	1000000000	1000000000	1000000000
MP (Black only)	1000000000	1000000000	1000000000

1. Calculated from 100W at 100Hz with 1% THD and 100% duty cycle. Specified in accordance with the IEC 60268-5 standard.
2. Frequency range is defined as the frequency range over which the speaker is designed to operate. Actual performance may vary from the specified range. Actual performance may vary from the specified range. Actual performance may vary from the specified range.

Loudspeaker Owner's Manual

STEPS FOR CONFIGURING LIMITER SETTINGS

- ▶ First setup the system gain structure as required.
- ▶ Disconnect all loudspeakers from the amplifier! Do not connect any loudspeakers while setting limiters. This step is very important since there will be high-level signals sent through the system and damage to the loudspeakers will occur.
- ▶ Connect the RMS Volt meter to the speaker output terminals of the amplifier.
- ▶ Send pink noise through the system.
- ▶ Using the chart and formula below, raise the pink noise level until the meter measures RMS voltage just above the recommended value, approximately 2-3Volts.
- ▶ Reduce the threshold of the limiter until the RMS voltage measured is at or just below the recommended value.
- ▶ If the limiter supports attack/release values, use the table below to set them accordingly

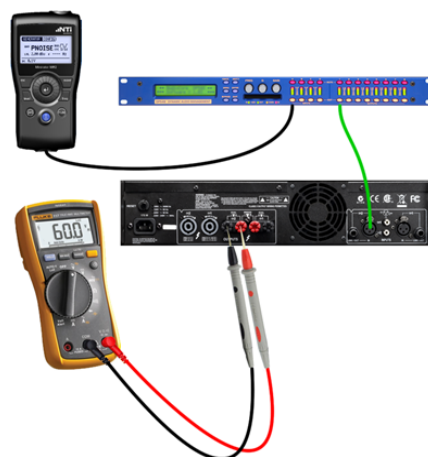
$$\text{SQRT}(\text{WATTS} * \text{IMPEDANCE}) * 0.707$$

Accelerated Life Rating (WATTS)	Impedance	Set Limit Threshold to (Vrms)	Impedance	Set Limit Threshold to (Vrms)
100	8	20	4	14
150	8	24	4	17
175	8	26	4	19
200	8	28	4	20
250	8	32	4	22
300	8	35	4	24
350	8	37	4	26
400	8	40	4	28
450	8	42	4	30
500	8	45	4	32
600	8	49	4	35
750	8	55	4	39
800	8	57	4	40
900	8	60	4	42
1000	8	63	4	45
1100	8	66	4	47
1200	8	69	4	49
1500	8	77	4	55
1800	8	85	4	60
2000	8	89	4	63

Attack/Release Example:

If the HPF is 50Hz, use a release of 256ms

If the LPF is 2000Hz, use an attack of 0.5ms



WARNING!!! Amplifier connections produce high-voltages. Electrical shock or damage to the product can occur if handled improperly.

Attack (ms)	LPF or HPF	Release (ms)
45	31	720
16	63	256
8	125	128
4	250	64
2	500	32
1	1000	16
0.5	2000	8
0.3	22000	4

EAW Warranty

These EAW products were designed and engineered at our headquarters in Whitinsville, MA USA and go through multiple quality checks during manufacturing. We guarantee our loudspeakers against defects in workmanship, materials and against malfunctions for a period of 6 years from date of delivery. Terms and conditions apply. Download the complete warranty policy at

www.eaw.com/warranty



Product Damaged in Transport? Contact the freight carrier immediately and note concealed shipping damage. Then contact EAW for replacement.

Eastern Acoustic Works

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