Community
R2 Models
Installation and Operation Guide



Models

R2-52Z
R2-77Z
R2-94Z
R2-474Z
R2-694Z

FEATURES

- Three-way, triaxial, full-range horn-loaded systems that excel at both voice projection and full-range, high-fidelity music reproduction
- Drivers: 1” exit, titanium compression HF driver, 2” exit M200 midrange compression driver (s), and two 12” FerroFluid-cooled LF with water-resistant cones
- Highly weather-resistant fiberglass enclosure.
- Unique coverage patterns provide a range and evenness of coverage not available with conventional loudspeakers
- Easy to install and aim
- 3-layer grille with polyester mesh and UV-resistant foam, bonded to a zinc-rich epoxy dual-layer powder-coated perforated marine-grade aluminum

CONTENTS

Each shipping carton contains the following items:

- R2-xxZ loudspeaker
- Steel mounting yoke (pre-installed with the 1/2" mounting hardware listed at right)
- Multi-angle aiming strap [R2 (2)]
- QR sheet - with QR link to installation manual
- Loudspeaker Safety Guide
- Mounting hardware: 1/2" hex bolts (2" x3, 1-1/4" x3), 1/2" lock washers (x6), 1/2" flat washers (x7), 1/2" hex nut (x1), and 2" OD rubber gaskets (x5). All hardware is stainless steel.

IMPORTANT SAFETY INSTRUCTIONS

Always follow these basic safety precautions when using or installing R SERIES loudspeakers and accessories:

- Read these instructions prior to assembly.
- Keep these instructions for reference.
- Heed all warnings.
- Follow all instructions, particularly those pertaining to rigging, mounting, hanging and electrical connections.
- Only use attachments and accessories that are specified and approved by the manufacturer.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, does not operate normally, or has been dropped.

The terms caution, warning, and danger may be used in this manual to alert the reader to important safety considerations. If you have any questions or do not understand the meaning of these terms, do not proceed with installation. Contact your local dealer, distributor, or call Biamp directly for assistance. These terms are defined as:



CAUTION: describes an operating condition or user action that may expose the equipment or user to potential damage or danger.



WARNING: describes an operating condition or user action that will likely cause damage to the equipment or injury to the user or to others in the vicinity.



DANGER: describes an operating condition or user action that will immediately damage the equipment and/or be extremely dangerous or life threatening to the user or to others in the vicinity.

These servicing instructions are for use by qualified service personnel only. To reduce the risk of fire or electric shock do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

RIGGING AND ELECTRICAL SAFETY



DANGER: The loudspeakers described in this manual are designed and intended to be ‘flown’ or suspended using a variety of rigging hardware, means, and methods. Installation of loudspeakers should only be performed by trained and qualified personnel. It is strongly recommended that a licensed and certified professional structural engineer approve the mounting design. Severe injury and/or loss of life may occur if these products are improperly installed! All electrical connections must conform to applicable city, county, state, and national (NEC) electrical codes.



DANGER: R SERIES rigging fittings are rated at specific Working Load Limits (WLL) per model line. No single rigging fitting should ever be subjected to a load that is greater than the stated load. Failure to heed this warning could result in injury or death!

- R2 models have a WLL of 100 lbs (45.4 kg) with a 10:1 safety margin.



IMPORTANT: Refer to the sections on installation and connections later in this manual for additional information on rigging and electrical safety.



DANGER: It is possible to experience severe electrical shock from a power amplifier. Always make sure that all power amplifiers are in the “OFF" position and unplugged from an AC Mains supply before performing electrical work.

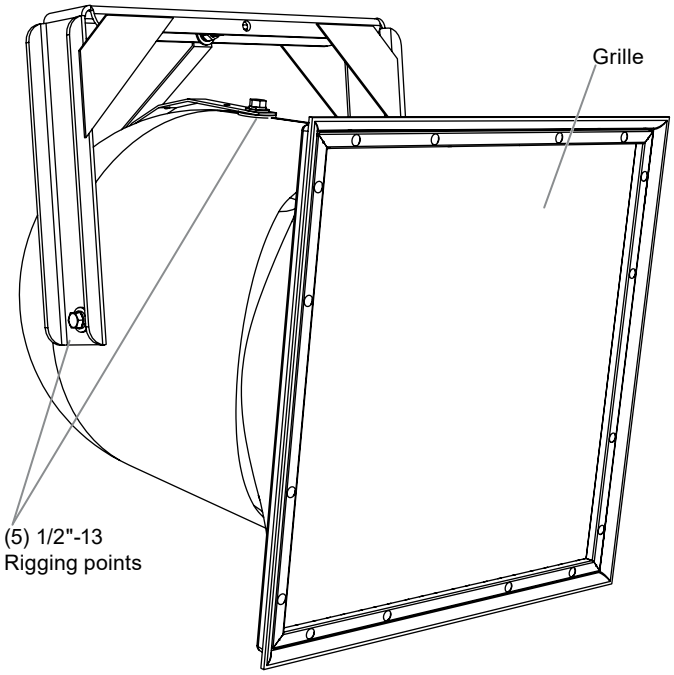


DANGER: It is essential that a safety cable (not supplied) be utilized whenever an R SERIES Loudspeaker is installed. The safety cable must be secured to a suitable load-bearing point separate from the loudspeaker mounting point, with as little slack as possible so as not to develop undue kinetic force if the mounting bracket were to fail. Utilize one of the unused threaded mounting points on the enclosure for this purpose.

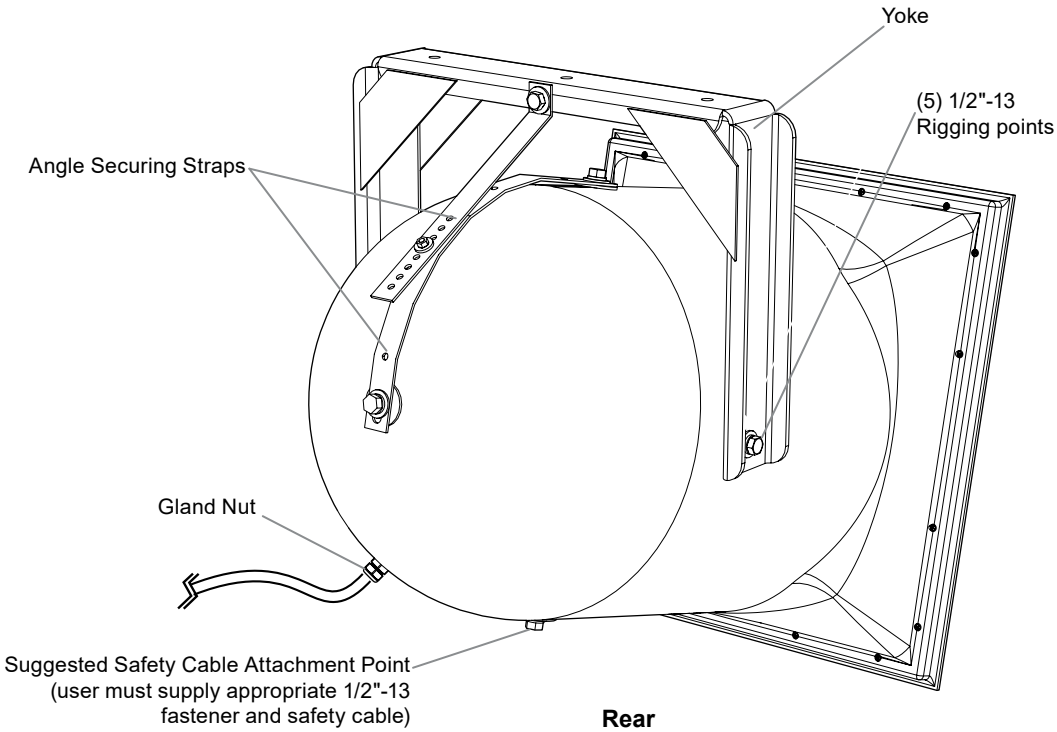
PRODUCT FEATURES IDENTIFICATION

Typical R2 Full-range Model

Safety Cable Attachment Point: (Utilize empty rigging point. User must supply appropriate fastener and safety cable)



Front



Rear

CAUTION: Installation of R SERIES loudspeakers should only be performed by trained and qualified personnel. It is strongly recommended that a licensed and certified professional structural engineer approve the mounting. Severe injury and/or loss of life may occur if this product is improperly installed.

RIGGING / SUSPENSION AND SAFETY

TERMINOLOGY: The terms “rigging", “flying" and “suspension" are often used interchangeably to describe the installation of loudspeaker systems above ground level. None of these terms pertain to, or attempt to describe, the actual method that is used (cables, brackets, chains, etc.).

DANGER: The loudspeakers described in this manual are designed and intended to be suspended using a variety of rigging hardware, means, and methods. It is essential that all installation work involving the suspension of these loudspeaker products be performed by competent, knowledgeable persons who understand safe rigging practices. Severe injury and/or loss of life may occur if these products are improperly suspended.

DANGER: All rigging fittings and inserts must remain sealed with the included hardware or they must be fitted with properly rated optional mounting hardware. Any missing fasteners will compromise the weather resistance of the enclosure.

BIAMP RIGGING HARDWARE WARRANTY:
Biamp warrants that its loudspeaker systems and its optional mounting and rigging hardware have been carefully designed and tested. Biamp loudspeakers may be safely suspended when each loudspeaker model is suspended with Biamp-manufactured mounting and rigging brackets specifically designed for use with that particular model of loudspeaker. This warranty applies only for use under normal environmental conditions, and when all loudspeakers, component parts, brackets and hardware are assembled and installed in strict accordance with Biamp’s installation guidelines contained herein. Beyond this, Biamp assumes no further or extended responsibility or liability, in any way or by any means whatsoever. It is the responsibility of the installer to insure that safe installation practices are followed, and that such practices are in accordance with any and all local, state, federal, or other, codes, conditions, and regulations that may apply to, or govern the practice of, rigging, mounting, and construction work in the relevant geographic territory. Any modifications made to any parts or materials manufactured or supplied by Biamp shall immediately void all pledges of warranty or surety, related in any way to the safe use of those parts and materials.

WARNING NON-Biamp RIGGING HARDWARE: Non-Biamp hardware used for rigging an R SERIES loudspeaker must be certified by the supplier for such use and must be properly rated for safety.

IMPORTANT NOTES ON RIGGING LOUDSPEAKERS
There are three (3) areas of responsibility for rigging loudspeakers.

- The building structure: Always consult with the building architect or structural engineer to assure the ability of the structure to support the loudspeaker system.
- The loudspeaker itself: Biamp certifies its loudspeaker systems and rigging accessories for suspension when they are properly installed according to our published guidelines.
- Everything between the loudspeaker and the building structure and the process of installation: The installing contractor assumes this responsibility. Loudspeaker rigging should be performed only by certified rigging professionals using certified rigging hardware chosen for the specific application. Prior to installation, the contractor should present a rigging plan, with drawing and detailed parts list, to a licensed structural engineer (P.E.) or architect for written approval.

WARNING: R SERIES rigging fittings are rated at the Working Load Limits (WLL) listed on page 3. No single rigging fitting should ever be subjected to a load that is greater than the stated load. Failure to heed this warning could result in injury or death!

Acceptable Mounting Point Loading

The mounting points should always be used so that either shear force is applied perpendicular to the direction of and in tight proximity to the mounting hole, or tension force is applied perpendicular to the enclosure surface. See **Figure 1** below.

DANGER: Use the mounting points only as described above. Do not use them in such a way as to apply sideways leverage to them. Failure to follow this instruction could result in immediate failure of the mounting points resulting in damage to the loudspeaker and serious injury or death to personnel.

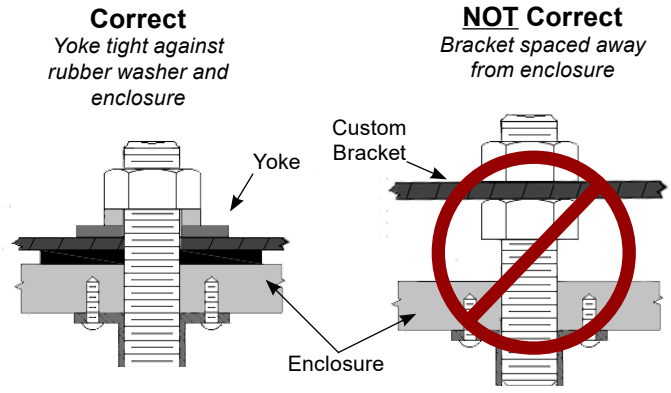


Figure 1. Mounting point load

INSTALLATION

Before you start

NOTE: Read all instructions and gather tools necessary before starting the installation. Please read all safety instructions and warnings regarding rigging and installation of the loudspeaker.

Every effort has been made to ensure that the information contained in this manual was complete and accurate at the time of printing. However, due to ongoing technical advances, changes or modifications may have occurred that are not covered in this publication. The latest version of this manual is always available at biamp.com. The revision date can be found on the rear cover.

WARNING: Loudspeakers are heavy. To prevent injury or damage, they should be supported during the mounting process until the connection is secure.

1. The R2 loudspeaker is shipped with the yoke attached. If it is necessary to position the yoke differently, please remove the mounting hardware and reserve the hardware for repositioning. Attach the R2 loudspeaker to the yoke. See **Figure 2a.** Determine and orient the loudspeaker correctly for the coverage desired for your application. Mount the loudspeaker to the yoke with the rubber washers between the yoke and enclosure and attach as shown. This is intentionally a tight fit to maintain weather resistance. Tighten bolts to finger tight (enough to hold the loudspeaker in position).

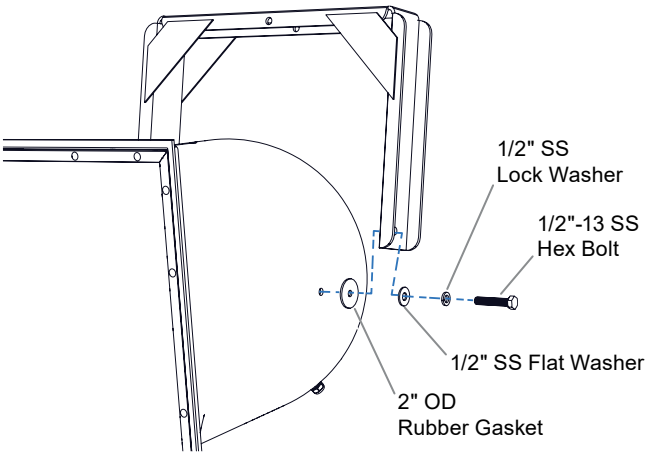


Figure 2a. Mount the R2 loudspeaker to the yoke

2. Attach the short flat end of the contour strap to the mounting point located at the back/center of the enclosure bell using the bolt, rubber washer, flat washer, and lock washer supplied in the mounting point. Make sure that the rubber washer is between the contour strap and the enclosure. See **Figure 2b.** Leave the other end (the long flat end) of the contour strap temporarily unattached. Eventually this will be attached to the mounting point below where the yoke crossbar is positioned when the loudspeaker is mounted and aimed properly.

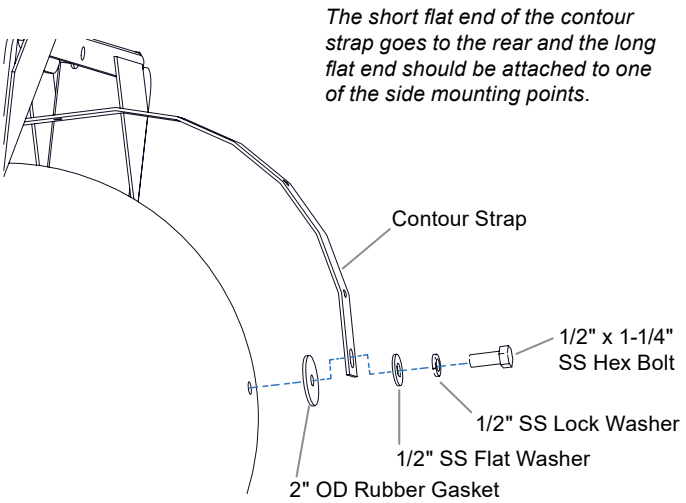
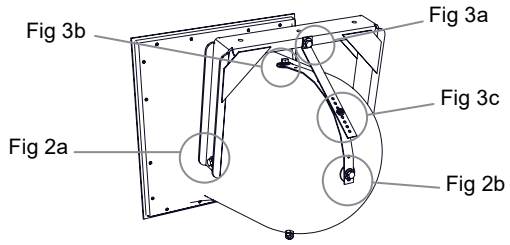


Figure 2b. Attach the contour strap

R2 INSTALLATION (cont'd)

3. Mount the R2 and yoke to the support structure. If the center hole is being used to mount the yoke, that hardware must be installed before attaching the securing strap to the yoke. All mounting hardware must be supplied by the installer and be weather-resistant and properly rated for the weight and potential wind load by a structural engineer.



Connection Reference key

4. Attach the securing strap to the yoke. Align the short bent end with the 9/16" hole with the yoke, and attach as shown in Figure 3a. The securing strap should be positioned on the yoke crossbar with the long end positioned over the contour strap.

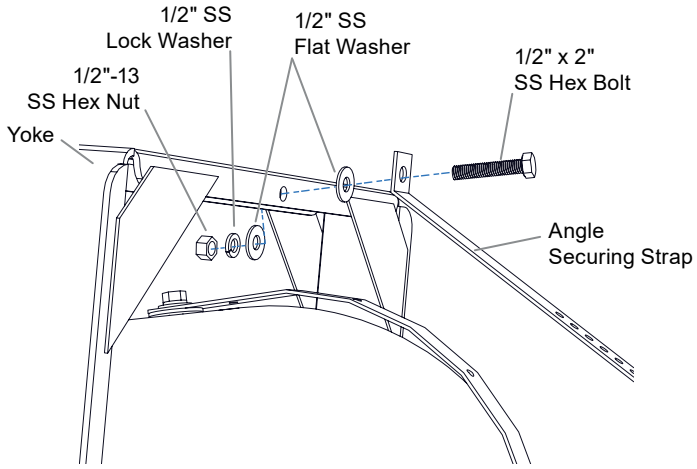


Figure 3a. Attach the securing strap to the yoke

5. Determine the approximate angle of downward tilt and adjust the angle accordingly. It must be angled at least 5° down from horizontal to maintain the stated enclosure EIEMA rating and reduce the possibility of rain and other precipitation compromising the performance. Once the aiming angle is set, bend the securing strap against the contour strap. The series of holes in the securing strap should line up with one of the three 5/16" (8 mm) holes in the contour strap. This determines where to locate the bolt in the contour strap to attach the securing strap. Lift the contour strap away from the R2 enclosure and put the 1/4"-20 x 1" (25 mm) stainless steel bolt in this hole so that the bolt head is between the contour strap and the enclosure. Secure it with a lock washer and hex nut as shown at right.

6. Attach the free end of the contour strap to the enclosure as shown in Figure 3b. Make sure that the rubber washer is located between the contour strap and the enclosure.

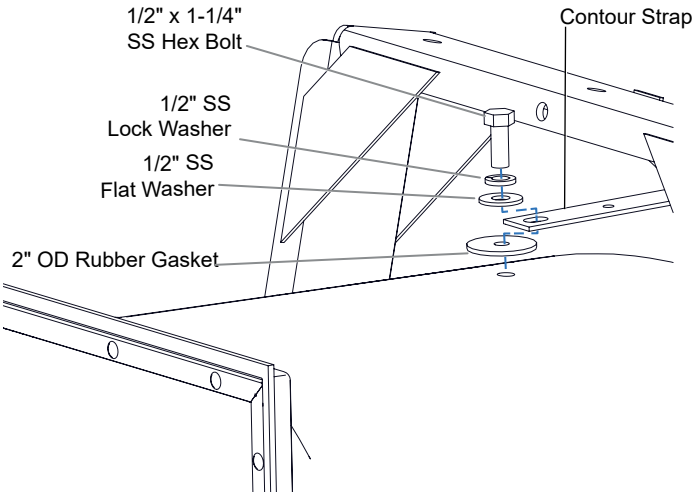


Figure 3b. Attach the contour strap to the enclosure

7. Fully attach the securing strap to the contour strap as shown in Figure 3c. First ensure that the loudspeaker is aimed at the appropriate angle. Bend the securing strap towards the enclosure to put it on the bolt previously installed on the contour strap. You will have to bend the securing strap towards the enclosure to put it on the bolt. First place one of the 1/4" flat washers on the bolt, followed by the securing strap. Finish with the remaining 1/4" flat washer, 1/4" lock washer, then secure with a 1/4"-20 hex nut.

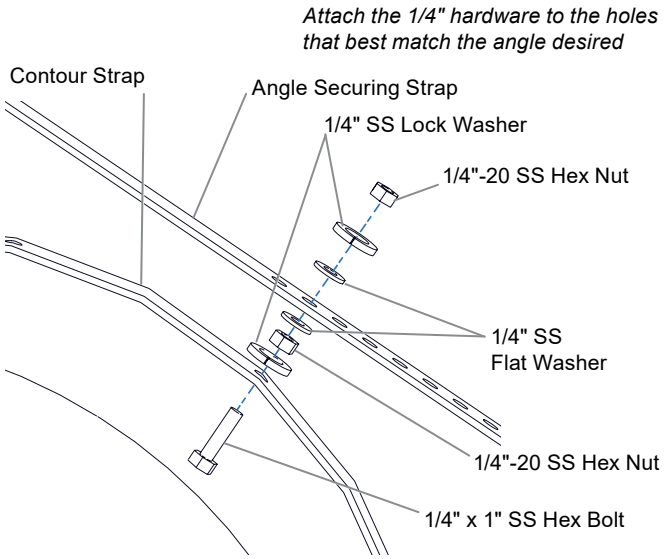


Figure 3c. Attach the securing strap to the contour strap

WIRING AND ELECTRICAL SAFETY

All standard R-MAX loudspeakers come with attached SJOW rated input cables, 12' (3.6m) in length. The cable enters the enclosure through a waterproof gland nut. The other end of the cable is un-terminated. The designer must account and compensate for cable losses between the amplifier and the speaker system. Do not remove the gland nut attaching the cable to the rear of the loudspeaker, as this will compromise the weather integrity of the enclosure. Please contact the Customer Support for additional assistance (email: support@biamp.com)

1. Wire the loudspeaker. A typical installation method is to bring the cable into a waterproof junction box (J-box) equipped with a waterproof gland nut. Connections within the J-box may be made with barrel-type crimp connectors, wire nuts, solder and heat-shrink, or terminal strips. Terminate per your local electrical code. *We recommend using barrel-type crimp connectors that are crimped with a forged crimp or a ratcheting tool, as this method, when properly executed, results in a gas-tight connection that is easy to accomplish.*

IMPORTANT: All electrical installation connections for loudspeaker lines are subject to all applicable governmental building and fire codes. The selection of appropriate electrical hardware to interface with the R SERIES loudspeaker lies solely with the installation professional. Biamp recommends that an appropriately licensed engineer, electrician, or other qualified professional identify and select the appropriate conduit, fittings, wire, etc. for the installation.

DANGER: The output power capabilities of audio amplifiers present a danger to installers. To minimize the risk of electric shock from loudspeaker connecting cables, confirm that the power amplifiers are turned “off" before connecting loudspeaker cable(s) to the loudspeaker or amplifier. Always follow local electrical codes and proper electrical safety procedures.

WARNING: After wiring the amplifier(s) to the loudspeaker(s), first power-up all devices that are upstream of the amplifier, such as mixers, equalizers, compressor/limiters, etc., before powering-up the amplifier. This is to avoid passing any clicks or pops that may originate in the upstream devices to the loudspeakers. The amplifier should initially be powered-up with its gain controls turned all the way down. After making sure that a continuous signal is present, such as a CD playing, slowly raise the level of the gain controls to establish that the wiring has been installed correctly. Only then should the loudspeaker be operated at normal output levels.

Standard Wiring

Connect as shown in **Figure 4**. The cables are 2-conductor standard weather-resistant cables 12' (3.6m) in length.



Figure 4. Standard wiring

FINAL ASSEMBLY AND TESTING

1. All holes should be filled with the provided hardware or other suitable replacement in order to maintain weather-resistance.
2. Attach a safety cable to an attachment point on each loudspeaker. The safety cable and hardware are not included. Please consult a structural engineer for the appropriate cable for the load and application. The safety cable attachment points should not be located on opposite sides of the cabinet in such a manner that they present a significant force that pulls the insert points away from each other. The safety cable must be secured to a suitable load-bearing point separate from the loudspeaker mounting point, with as little slack as possible, so as not to develop undue kinetic force if the R SERIES mounting were to fail.
3. Power and test the system.

PERFORMANCE

Use A Digital Signal Processor

For best performance, loudspeaker protection and system longevity, a digital signal processor (DSP) should be used with all R SERIES loudspeakers. Biamp recommends using Biamp's Voltera DM series or Amplified Loudspeaker Controllers (ALCs). Each amplifier controller has software (VenueTune™ or ArmoníaPlus™ software*) containing all of the information (high pass filters, limiters, factory tunings) and DSP settings to fully optimize your system. For more information on installing and operating your R SERIES loudspeaker, please contact our Loudspeaker Support Group at support@biamp.com.

SIGNAL PROCESSING

High and Low Pass Filters

R2 models use fully horn-loaded low frequency drivers. Refer to the DSP settings files or product data sheets on the Biamp website for the recommended high and low pass filter values. Attempts to reproduce significant levels below these frequencies can result in over-excursion of the low frequency drivers due to the uncoupling of the low frequency horn.

The appropriate electronic high-pass filter with a minimum slope of 12 dB per octave must be employed. Its usage will protect the drivers from much of the extreme low frequency content found on media sources. The high-pass filter will also protect against unwanted low frequency energy that can originate from microphone wind noise - an important consideration for outdoor applications.

Equalization

Equalization is the icing on the cake for sound systems. And like the use of icing, it should not be overdone. Small amounts of frequency boost can brighten-up the higher frequencies and round out the lower frequencies, but they should be restricted to no more than approximately +3 dB in order to avoid damage to the drivers.

Equalization cuts can be very effective for removing the effects of room resonance and other unwanted acoustical artifacts, but here again should be kept to a minimum. Extreme EQ cuts (or attenuation) will not cause driver damage, but should be used with discretion to avoid acoustic ‘holes’ in the audible spectrum.

External equalization can be used to "voice" the loudspeaker for particular applications and is especially effective in attenuating feedback-prone frequencies.



CAUTION: Do not attempt to boost frequencies at, or below, 40 Hz with an equalizer (either graphic or parametric). This will counteract the effect of the high-pass filter discussed previously, potentially causing damage to the drivers.

Power Amplification

Power amplifiers for R SERIES models should be capable of providing enough power to properly drive the loudspeaker without the amplifiers entering into a state of clipping.

Clipping occurs when an amplifier runs out of power. The peaks of the reproduced waveform begin to ‘clip’ and resemble a square wave instead of the typical sine waves and saw-tooth waves that form the basis of most speech and music. Clipping leads to rapid driver failure because the driver is no longer moving as it’s designed to. When power is flowing into a driver, but movement is limited because of amplifier clipping, much of the energy is converted to heat which will soon cause the driver’s voice coil to burn out.

Power Rating

Refer to the model specification sheets for the recommended amplifier for each model. It is better to oversize the amplifier to avoid clipping, than to undersize it. Power amplifiers should exhibit good sonic properties while providing high reliability to keep the system functioning properly.

* Software trademarks:

ArmoníaPlus™ is a trademark of Powersoft S.p.A.

VenueTune™ is a trademark of Biamp Systems LLC.

COMMISSIONING THE SYSTEM

Commissioning is the process of optimizing the performance of a sound system after it has been installed. There are several important steps in commissioning a system; these include the following:

1. Verifying the proper operation of each system component:
    a. Every source such as mixers, microphones, media players, audio feeds from other locations, and so on, should be tested independently of the newly installed system to insure that they are working properly.
    b. All amplifiers should be tested independently of the main system to verify that they are each receiving their intended signal (i.e. HF, MF, LF, delayed, etc.). Many amplifiers have numerous modes in which they can function. It's extremely important to make sure that each amplifier in the system has the right settings applied in order to properly perform its intended function in the system.
    c. The DSP 'front end' must be set up carefully to insure that its internal routing and gain structure are correct for the overall system requirements. It's possible to almost instantly damage mid and high frequency drivers if the LF, MF and HF outputs are accidentally crossed.
    d. After all electronic components and interconnects have been tested and verified, it's then time to test each loudspeaker element in the system. Such testing should be performed at VERY low audio levels to avoid damage to drivers from possible wiring errors. Each loudspeaker section should be carefully listened to, in order to make sure it is performing properly. It should then be checked with a hand-held phase checker to verify that no phase errors are present.
2. Next, the gain structure of the system should be established. Each component in the signal path should be adjusted to provide the intended input and output levels. Gain structure is a somewhat complex subject that goes beyond the scope of this Manual. Moreover, 'proper' gain settings vary significantly from one device to another. We recommend that you read the User's Manual for each device that is present in the signal path, and adjust according to the manufacturer's recommendations, so that your system will operate will the lowest possible noise floor and highest possible headroom – which is what gain structure is all about.
3. Set protective limiters and high-pass filters.
4. Set delay times (if any) to align one or more ancillary loudspeakers with the arrival time of the sound from the primary source. If delayed speakers are used to augment the main source, their timing must be set so that the sound arriving at the listener's ears from each delay speaker will be in sync with the sound arriving from the primary source. This is usually accomplished with test and measurement instrumentation, but in a pinch can be set by applying a short duration pulse to the system and establishing the delay time by ear. An inexpensive electronic metronome is a good source for adjusting delay times by ear.
5. Equalize the system to achieve the best possible sound quality. This last step in system commissioning is known as system equalization or "voicing." Equalization is the process of adjusting the frequency response of the system, by use of an equalizer, to optimize voice intelligibility, musical sound quality, or both. Note that all R SERIES loudspeakers are factory voiced to optimize speech intelligibility as well as musical sound quality. For this reason, many designers and installers find that they can minimize overall system equalization and still achieve excellent voice intelligibility and high grade sonic properties.

MAINTAINING WEATHER RESISTANCE

Guidelines for R Series Outdoor Use

R SERIES is suitable for outdoor direct exposure installation when used as recommended. For best results in outdoor applications, follow these guidelines:

- Always orient the loudspeaker so the mouth of the horn is, at a minimum, pointing at least 5 degrees downward. Failure to do this could result in water collecting inside the enclosure under extreme weather conditions.
- When handling an R SERIES loudspeaker, be careful not to scratch or scrape the finish on the grille, bracket, or enclosure.
- All mounting holes must be sealed off with the plugs or stainless steel bolts, washers, and rubber washers supplied. If, for any reason, the hardware must be removed, seal off the hole with silicone caulking or some other suitable weather-tight sealant.
- The gland-nut securing the loudspeaker cable(s) to the enclosure is sealed at the factory. Do not attempt to remove this nut or the weather-tight seal will be broken. If you need to replace the gland-nut with a detachable electrical connector, such connector must be of a weatherproof design and sealed to the enclosure with silicone caulk or other suitable weather-tight sealant. The Neutrik model NL4MP is an excellent connector for this purpose.
  NOTE: The gland-nut should be at the bottom when installing the loudspeaker. It is also advisable to leave a “drip loop” so water will not migrate toward the loudspeaker.
- The rubber washers supplied with the mounting bolts must always seat against the enclosure.
- The grille assembly is designed to prevent normal and wind-driven rain from directly entering the mouth of the loudspeaker. The grille is not designed to withstand such things as being directly sprayed from a hose; therefore this should be avoided.
- If you use any hardware in place of hardware provided with your R SERIES loudspeaker, it should also be made of stainless steel.



CAUTION: If the above instructions are not observed, the weather-resistant integrity of the loudspeaker can be compromised. This may result in damage or failure of the hardware or internal components which will void the warranty.

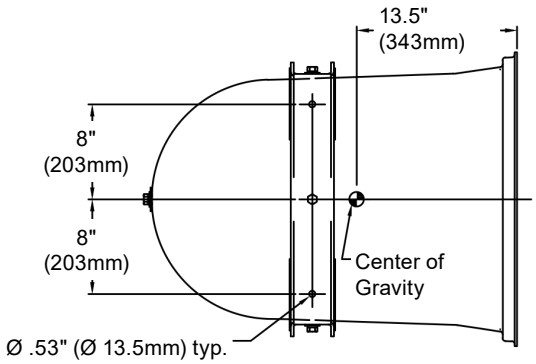
SPECIFICATIONS

Specifications and Information

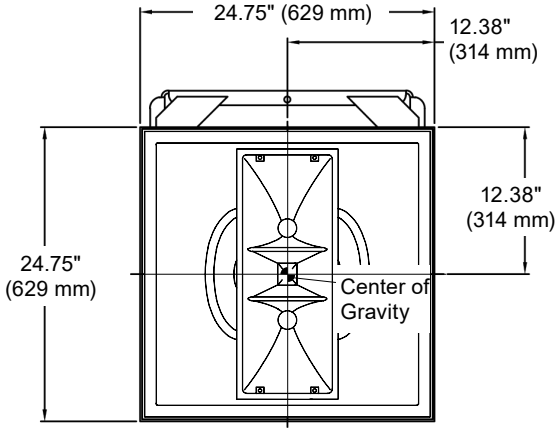
Full product specifications and current documentation (manuals, sales literature) is available at biamp.com in the Community section or on the specific model page under the resources tab. Additional technical information to assist you in operating and optimizing your system or understanding more about loudspeaker operation is also available on the website or by contacting Customer Support at support@biamp.com.

TECHNICAL DRAWINGS

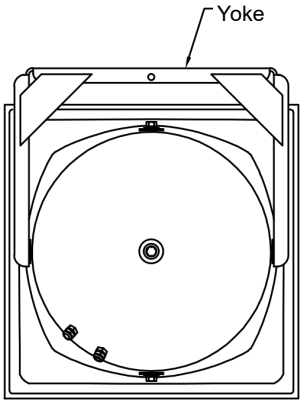
Typical R2 Coaxial Loudspeaker



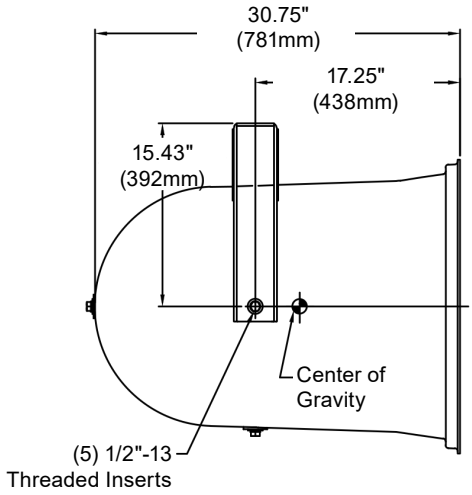
Top



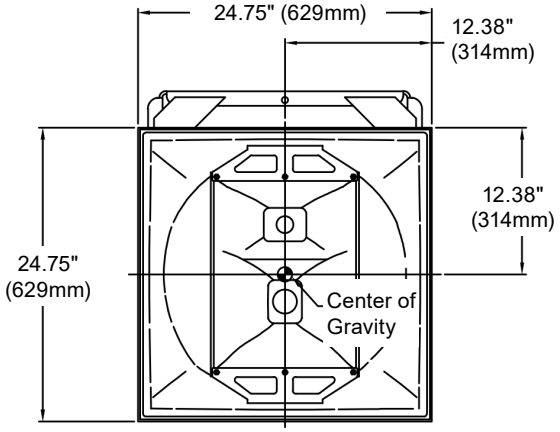
Front
R2-52



Rear

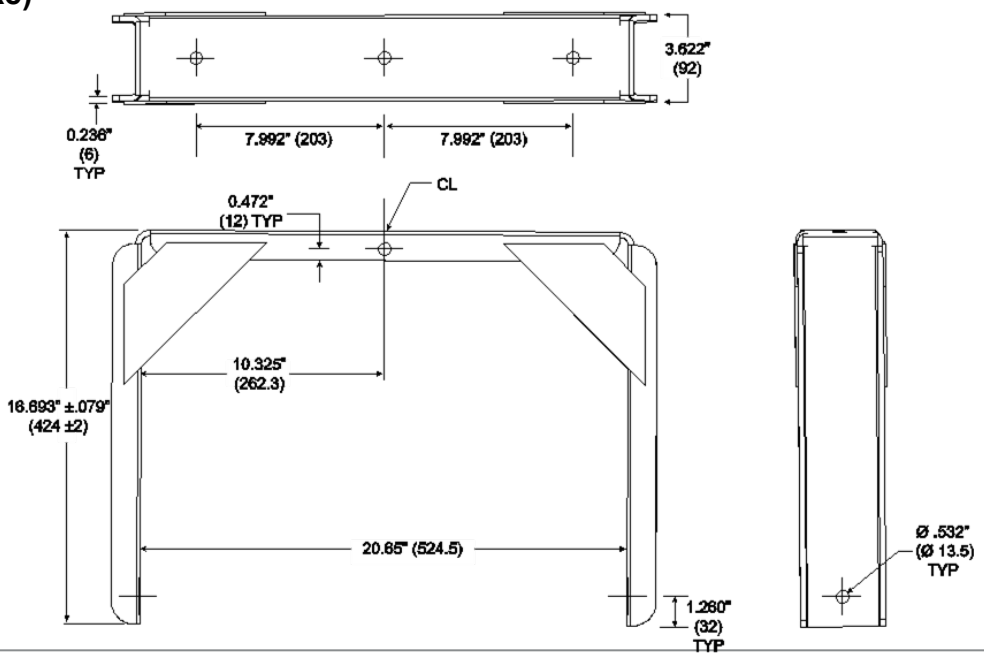


Sides



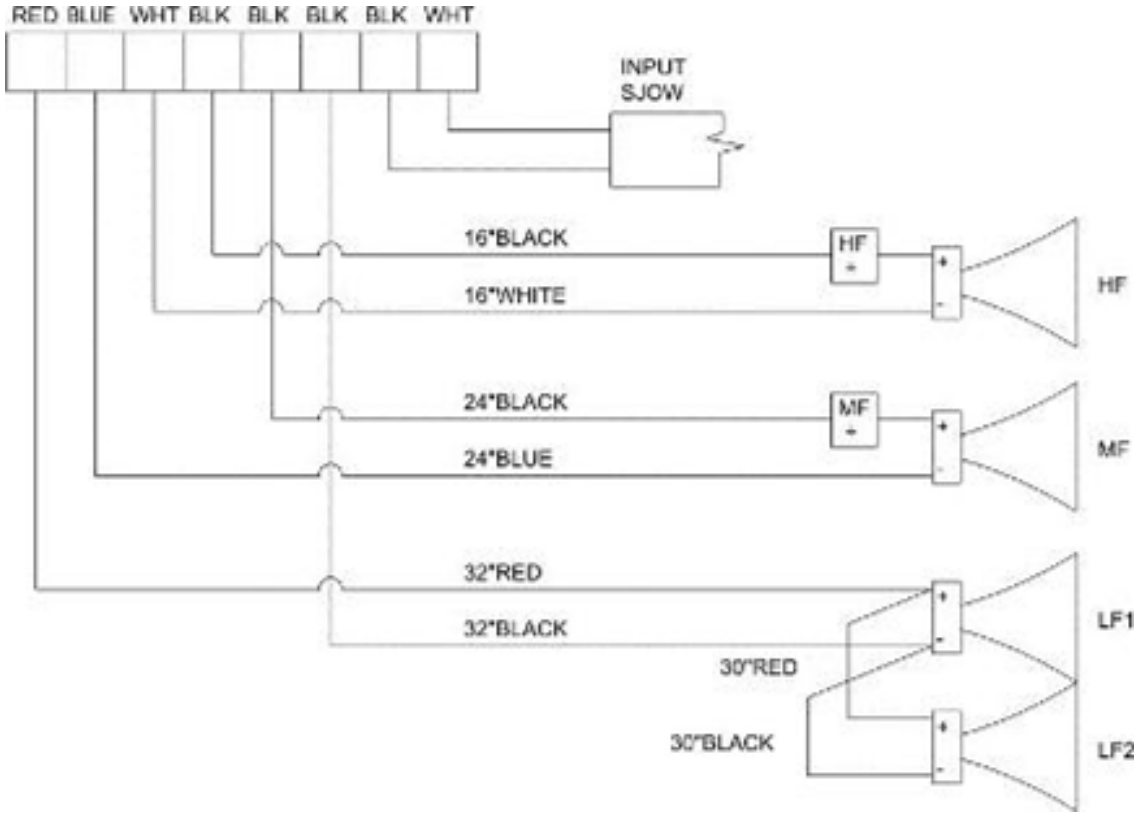
Front
R2-64Z, R2-66Z, R2-96Z,

R2 U-Bracket (Yoke)



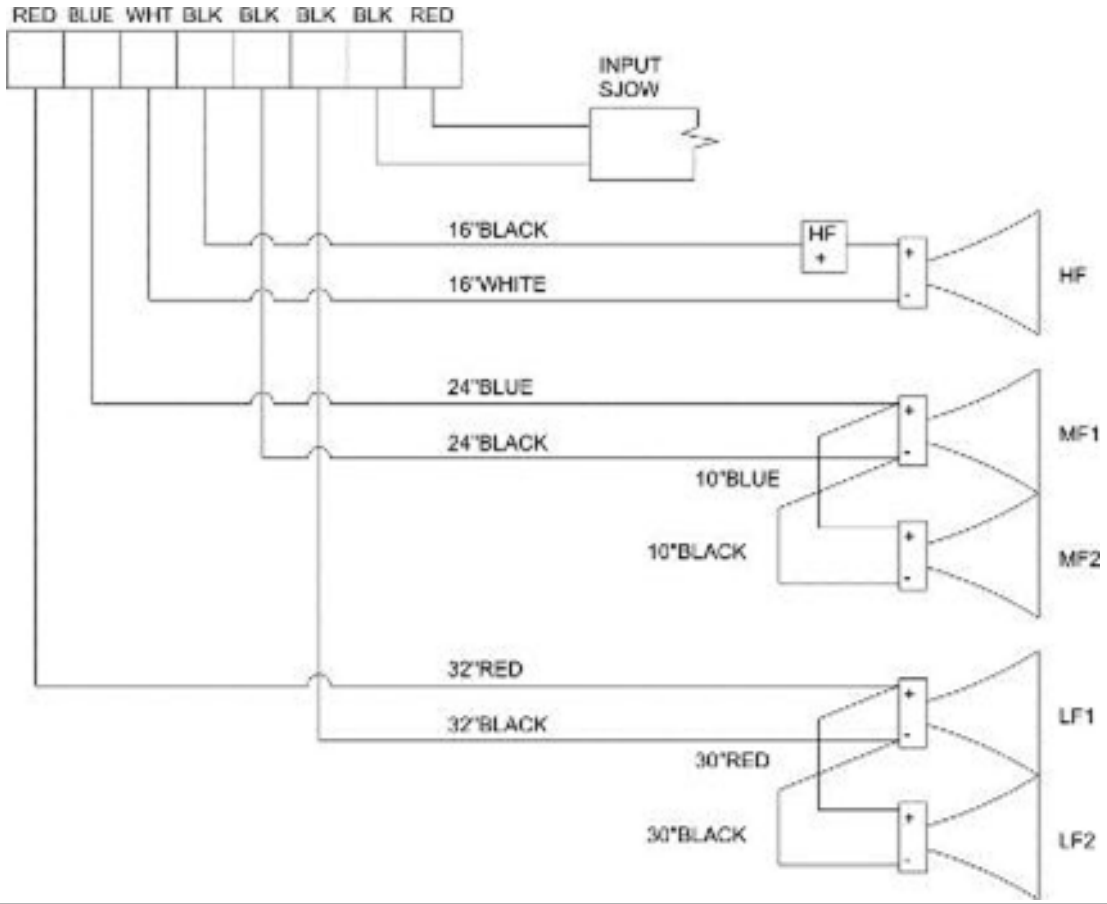
INTERNAL WIRING GUIDE

R2-77Z, R2-94Z, R2-474Z, R2-694Z



Note: The polarity reversal shown for the MF/HF is intentional.

R2-52Z



Note: The polarity reversal shown for the HF is intentional.

TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	WHAT TO DO
No Sound.	Equipment is turned off.	Check and make sure that all equipment in the audio signal path is turned on. The amplifier should not be turned on until all equipment before it is turned on.
No Sound.	Bad or open connection.	Make sure the signal and input wire connections for all connectors in the system and to all terminal screws are properly connected or soldered. Make sure all wire and cables are intact and not severed or damaged.
No Sound.	Crossover or all the drivers have completely failed.	This would be an unusual cause but could occur with severe abuse or an adverse amplifier failure. All other possibilities should be explored before assuming this is the cause. If it is, replace or repair the failed components.
No sound or very low volume.	System control is turned down.	Check to make sure that the audio signal to the amplifier is high enough to drive it properly. Check all volume/level controls and gain switches in the system including the amplifier input attenuator.
Low volume level.	System electronic gain is too low.	Check to make sure that the audio signal to the amplifier is high enough to drive it properly. Check all volume/level controls and gain switches in the system including the amplifier input attenuator.
Low volume level.	Signal or speaker wire connection is shorted.	Make sure the signal and input wire connections inside all system connectors are not shorted. Even one small wire strand shorting the +/- terminals either before or after the amplifier can cause this problem.
Volume level drops and comes back.	The crossover protection circuits have been activated.	This usually means that the loudspeaker is being constantly overdriven and the crossover protection circuits are reducing the power to the loudspeaker as a protective measure, which is normal. Reduce the volume level to the loudspeaker.
Sound cuts in and out.	Bad connection.	Check all connections and cabling for shorts or loose connections.
During high output operation the volume drops suddenly and does not come back.	The crossover protection circuits have “given up”.	This usually means that the loudspeaker was continually overdriven for an extended period and the protection relays have “fused” in their protect mode. The crossover must be replaced.
Distortion, low volume, or no volume from any or all drivers.	Cold/open solder joint on the crossover or faulty wiring connection.	Using an ohmmeter, check the continuity of the crimp connectors, all solder joints on the crossover and the wiring to the drivers. Also visually inspect solder joints as cold joints may only malfunction with higher current than an ohmmeter supplies. Repair as needed.
Distortion from the loudspeaker at higher volume levels.	Too little amplifier power.	If the power rating of the amplifier being used is too low, it will clip at higher volume levels. Reduce the volume level or use a more powerful amplifier equal to the loudspeaker’s “Program” power rating.
Distortion from the loudspeaker at higher volume levels.	Driver is malfunctioning.	Using a sine wave oscillator or wide range program at moderate levels, listen to each driver to isolate the problem. Repair or replace as needed.
Low volume for the bass frequencies.	Low frequency driver or crossover is malfunctioning.	Using an ohmmeter, measure the resistance of the input cable (with the amplifier disconnected). If the meter reads 4–7 ohms, one driver may not be working. Replace as needed.

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