

Air XD Series

Extended-Definition Active Loudspeakers with DSP

Application Guide

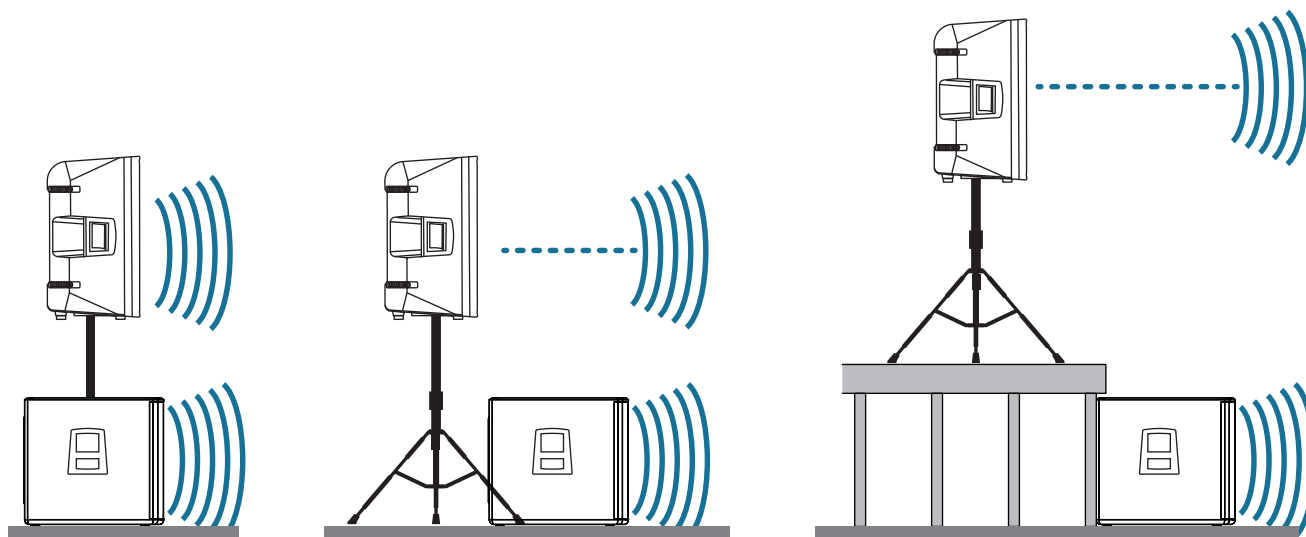
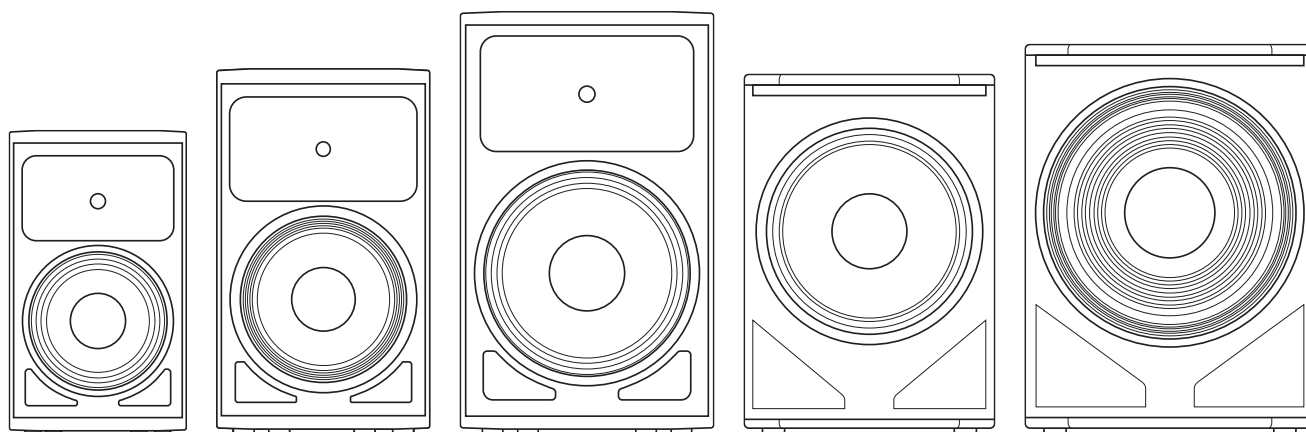


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1 Loudspeaker Placement

Air XD Series full-range loudspeakers are designed to reproduce audio with extreme fidelity and a natural-sounding high-frequency response at any volume level. With any sound reinforcement application, it is important to keep in mind that the performance of any loudspeaker will be influenced by the surrounding acoustics of the listening environment. Difficult environmental acoustics, combined with improper loudspeaker placement, can interfere with achieving the fidelity of which your Air XD Series loudspeakers are capable. PreSonus® has put together this application guide to help you avoid common system-configuration pitfalls and get the best performance out of your PA.

1.1 Recognizing Problem Rooms

In most live environments, the room is not designed to maximize the listening experience. Music venues are often chosen for location or architectural aesthetics, rather than for music reproduction, and more often than not, money is spent on aesthetic appeal rather than acoustic treatment. In any venue, you need to recognize and correct what the space does to the sound system in order to optimize a loudspeaker's performance in the venue.

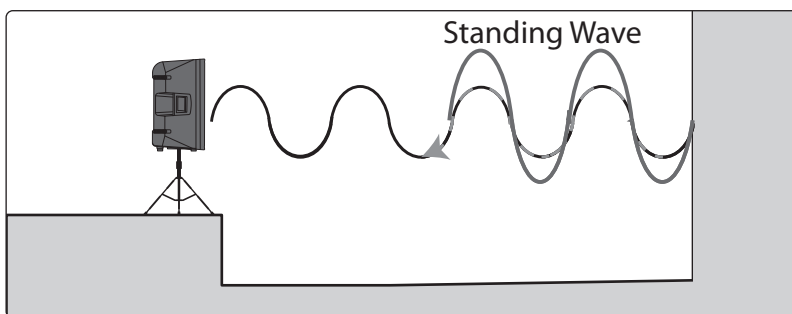
In general, the following physical features of a room can affect a sound system's performance:

- Room size
- Construction
- Reflectivity

The size of the room directly impacts how well certain frequencies are reproduced. For example, if you measure a room diagonally, you will discover how well that room can sustain low frequencies. This may seem odd until you think about the physical size of audio waves at various frequencies. For example, a 50 Hz wave is about 22.6 feet long. So a room that is 45 feet on the diagonal is going to regenerate low frequencies more effectively than a room that is 15 feet on the diagonal.

Power User Tip: To calculate how big an audio wave is, divide the speed of sound—1,130 ft./second—by the frequency. For a 50 Hz wave, $1,130/50 = 22.6$ ft.

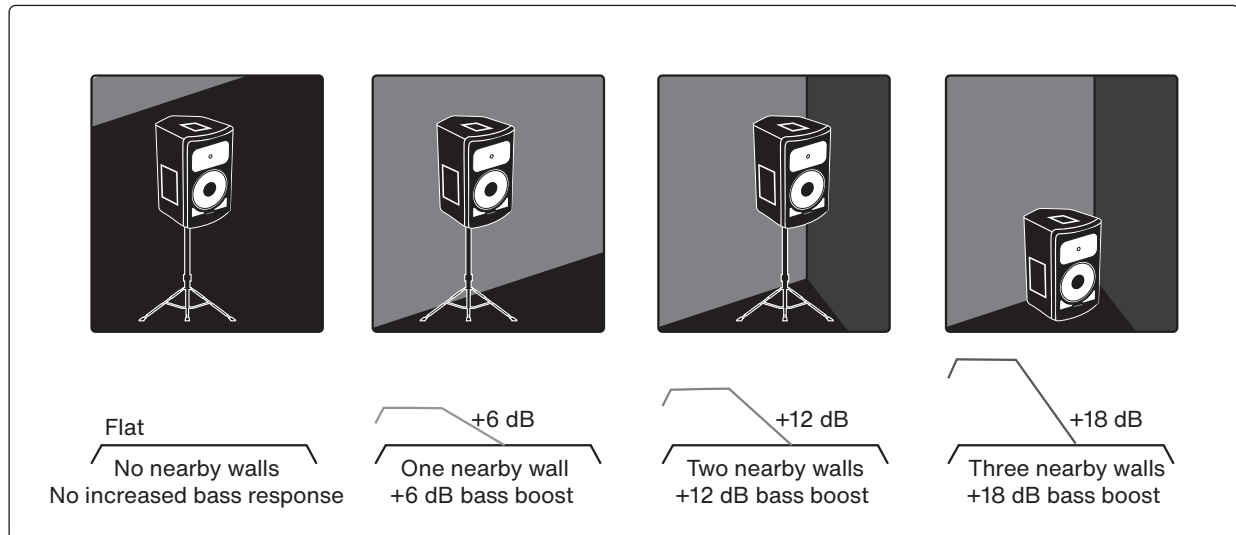
When a room's width or length correlates directly to the size of a waveform at a specific frequency, a standing wave can occur where the initial sound and the reflected sound reinforce each other. Let's say we have a long, narrow room where the distance from one side to the other is 22.6 feet. When a 50 Hz wave bounces off the wall, the reflective wave travels right back along the same path and bounces off the other wall and cycle repeats. In a room such as this, 50 Hz reproduces very well, maybe too well. So any mix will have a heavier low-end.



Additionally, low-frequency waves are powerful enough to cause the walls, ceiling, and even the floor to flex and move. This is called diaphragmatic action, and it dissipates energy and strips away the low-end definition. So if you're in an old cotton mill, and the walls and floor are made of thick concrete that don't vibrate much, the bass response is going to be much more powerful than if you've set up a show in an old warehouse where the walls are made of barge board and tin.

1.1.1 Wall Loading Effect

Very low frequencies are not directional, so they radiate from the sides and back of the loudspeaker, as well as from the front. If you place a loudspeaker against a wall, the rear sound propagates back into the room. This can increase output of bass frequencies as much as 6 dB if the speaker is placed near one wall (half-space loading), 12 dB if placed near two walls (quarter-space loading), and as much as 18 dB if you put the loudspeaker next to the ceiling or on the floor in a corner (eighth-space loading).



To have the most control over your sound, it's best to start with the flattest response, so you normally should avoid wall and corner placement. On the other hand, if you need some extra bass boost, this technique may be worth a try. It is important to be aware of what's happening and be prepared to take advantage of it or compensate for it.

Power User Tip: Because a floor monitor placed on the stage is unavoidably subject to half-space loading, the Monitor preset on your Air XD Series full-range loudspeaker is specifically designed to compensate for bass buildup and maintain a tight mid-bass response.

1.1.2 Maintain a High Direct-to-Reverberant Ratio

Another way a room interacts with sound waves is through reflectivity. Like most room anomalies, reflections can be good and bad. Consider the effect of a cathedral's reflections on a choir or a piano; this type of reverberation (reverb) is quite desirable. But not all reverb is good. For example, if a speaker is placed near a reflective surface (such as a concrete wall), the direct sound coming from the speaker and the reflected sound coming from the wall can arrive at the listener's ears out of phase with each other, causing cancellation and reinforcement. If they're 180-degrees out of phase with respect to each other, they will cancel each other out.



If you are using your loudspeakers in a reverberant environment, position them so that as much sound as possible is focused on the audience area and steered away from reflective surfaces. Air XD Series full-range loudspeakers have a nominal 90-degree horizontal and 60-degree vertical coverage pattern. When you do your placement and positioning, take time for a "walk around" of your loudspeakers, playing either pink noise or program material, so you get a feel for how the sounds translate in the room.

2 System Configuration Suggestions

The following subsections will demonstrate some system configurations for common rooms. The size and shape of your room and the application for which it will be used determine, to a large extent, how many speakers you will need and where they should be placed. In every situation, keep in mind your loudspeaker's coverage pattern.

Every full-range AIR Series loudspeaker offers the same 90° horizontal x 60° vertical coverage pattern. Be sure to pay close attention to these angles when using your speakers. Rotating the cabinet changes the horizontal and vertical coverage.

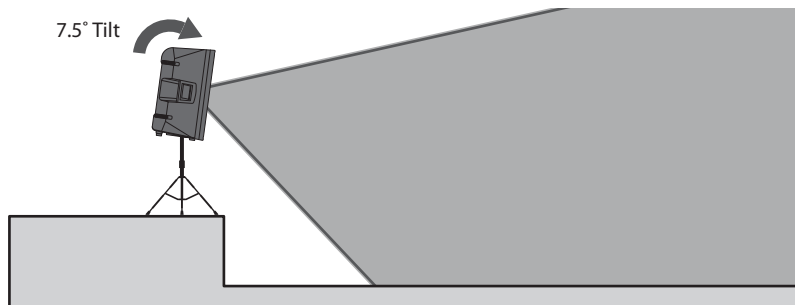
When configured for stereo use, make sure the cabinets are not placed too far back into the corners. Also, ensure that their horizontal placement is not too close to the side walls, or they will direct too much energy onto the walls, causing undesirable reflections. Adjust the left and right speakers, as well as the toe-in angle, to produce the best stereo image. If a room is very narrow, a mono cluster might be a better choice than stereo.

2.1 Vertical Coverage

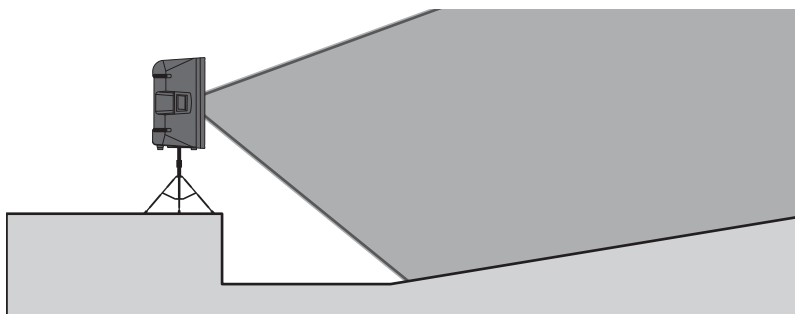
Vertical coverage is just as important as horizontal coverage. If you are using a ground stack with pole mount, make sure your coverage matches the listening plane. Suspension of speakers will provide even further control.

Each Air XD Series full-range loudspeaker features dual-position pole mounts. Using the 7.5° downward tilt mount will focus the loudspeaker's energy onto the audience and avoid destructive reflections. This is ideal for situations where the loudspeaker is mounted atop a tripod stand and placed on a stage, or where the pole-mounted loudspeaker is on the floor and the coverage area is relatively shallow (conference, coffee house, etc.).

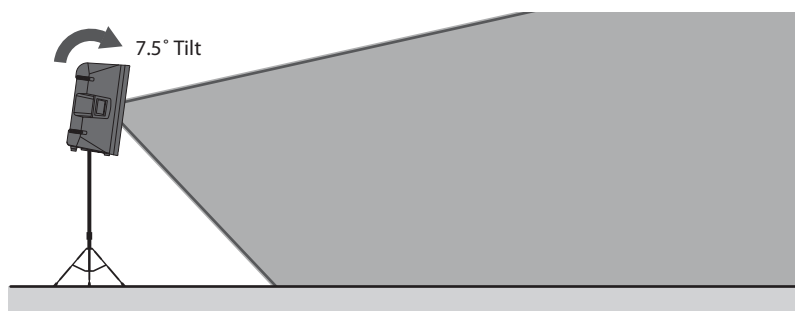
Flat Floor with Stage



Elevated Floor



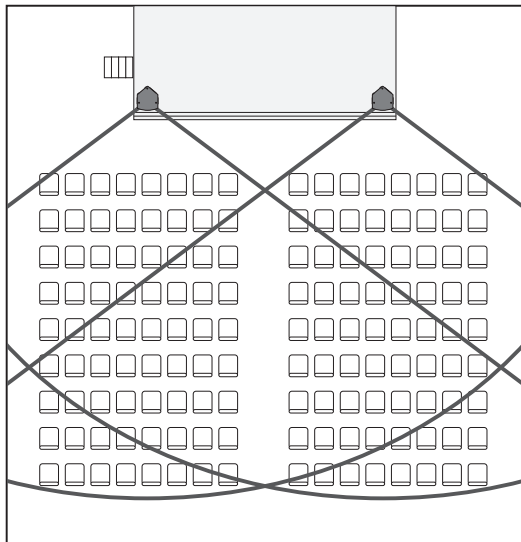
No Stage Flat Floor



2.2 Horizontal Coverage

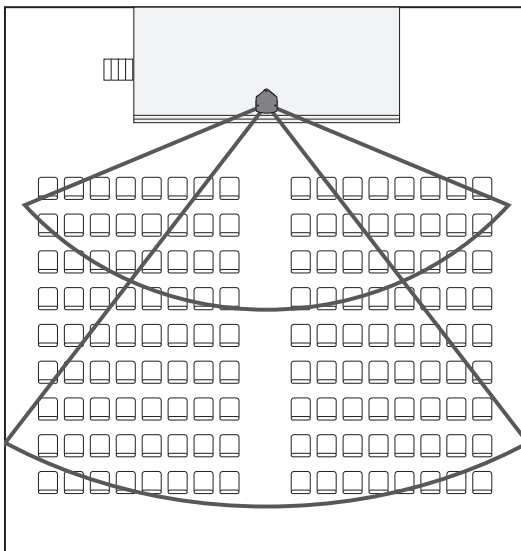
The 90° horizontal dispersion pattern of the Air XD Series loudspeakers provides coverage for a variety of applications. It is important to place loudspeakers so that there is a smooth transition from one loudspeaker's coverage area to the next loudspeaker's coverage area. This creates an even response throughout the listening space. The rest of this section provides some examples of using speakers to provide the best coverage.

2.2.1 Stereo System



A stereo system allows panning and adds depth to the acoustic image. This is good for speech reinforcement and greatly enhances live or pre-recorded music. Locate speakers to give the best horizontal coverage and ensure that listeners are well covered by the pattern.

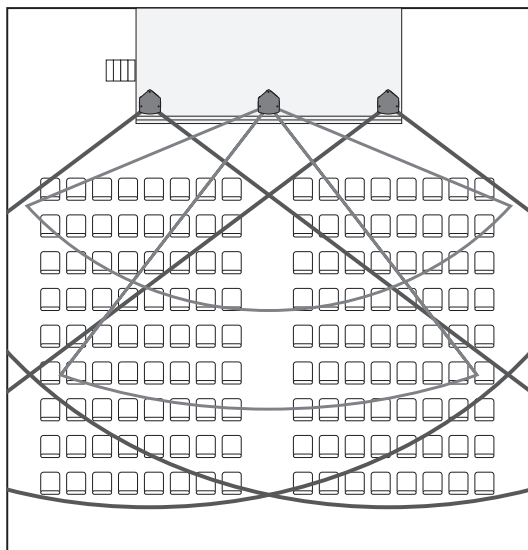
2.2.2 Mono Cluster with Down Fill



Center or mono systems can provide a simple, economical solution for venues where speech intelligibility, rather than music, is the priority. As with a stereo system, make sure the speaker's coverage pattern focuses the energy on the audience.

This graphic actually shows two speakers. The upper speaker is for throwing to the back of the room, and the lower speaker covers the space in the front of the room, closest to the stage.

2.2.3 LCR Systems



An LCR system is a stereo system with a center speaker added. This configuration allows panning and adds depth to the acoustic image. This type of system will provide more control than a basic stereo system and is ideal in situations where music and speech intelligibility are equally important.

2.2.4 Monitor Systems



Above is a typical stage-monitor layout for a five-piece band. For musicians (such as a vocalist) who don't require a lot of low-frequency energy in their floor wedge, we suggest using an Air XD 10. For musicians that need a little more bass, the Air XD 12 or Air XD 15 is preferable. The drum monitor in this example is a full-range, 3-way system (Air XD 15 atop Air XD Sub 18). For smaller stages, an Air XD 15 atop a low tripod or in the horizontal floor-wedge position will be more than adequate.

3 Adding a Subwoofer (or Two)

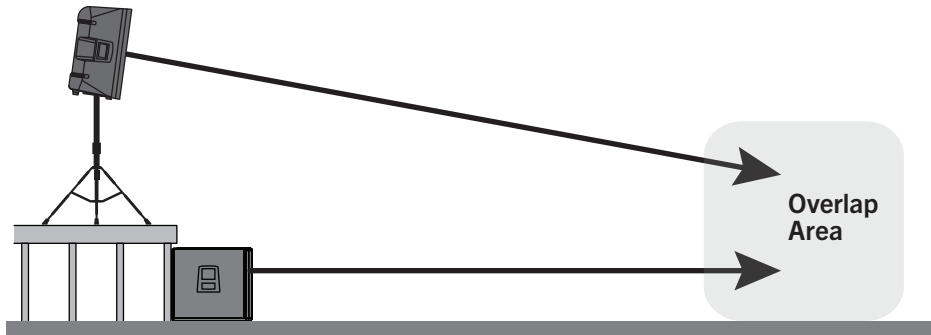
Adding a subwoofer to your Air XD Series sound system allows your system to run more efficiently because the low-frequency content is reproduced by the subwoofer instead of the full-range system. This section will guide you through getting the most out of your Air XD Series subwoofers.

3.1 Subwoofer Alignment

The Air XD Series subwoofers have been designed to be used with any full-range loudspeakers. The Air XD Sub 15 and Air XD Sub 18 feature a variable alignment delay to guarantee that your three-way system stays in alignment.

The alignment delay setting compensates for the cancellation or reinforcement of low frequencies when the same frequencies are reproduced by two sound sources that are set some distance apart. Low frequencies in the crossover region between full-range and subwoofer have wavelengths that are several feet long—the wavelength of a 150 Hz wave is about 7.5 ft—which means that reinforcement and cancellation will occur as the waves interact in the room. The alignment delay provides compensation for this effect when the loudspeaker is about the same distance away from, or in front of, the subwoofer, as specified in the setting. As room acoustics will influence effectiveness, we recommend listening tests using the different alignment settings, in conjunction with alternate polarity settings, to determine the best results.

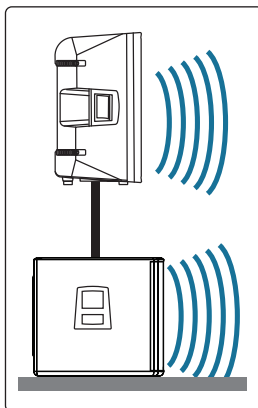
To set the correct delay for a custom installation, or if the subs must be located some distance from the main speakers, you will need to do some calculating.



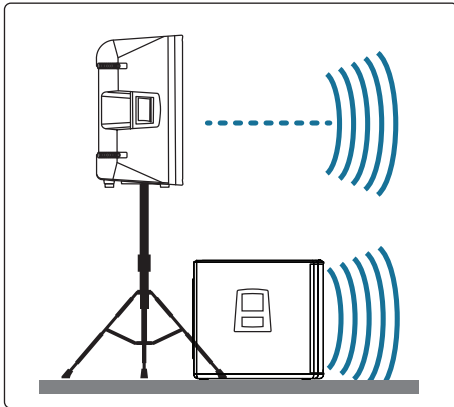
1. Find the spot in the room where coverage from the main speakers and the subwoofers overlap.
2. Measure the distance from the overlap area to each speaker location.
3. Subtract the smaller distance (the distance to the subwoofer) from the larger distance (the distance to the full-range loudspeaker).
4. Divide that number by 1,100 and apply that delay value to the subwoofer. Keep in mind that the overlap area may be behind front-of-house.

Even for mobile applications, where the subwoofer is relatively close to the full-range loudspeakers, aligning the subwoofer to its full-range companion will yield tighter bass response:

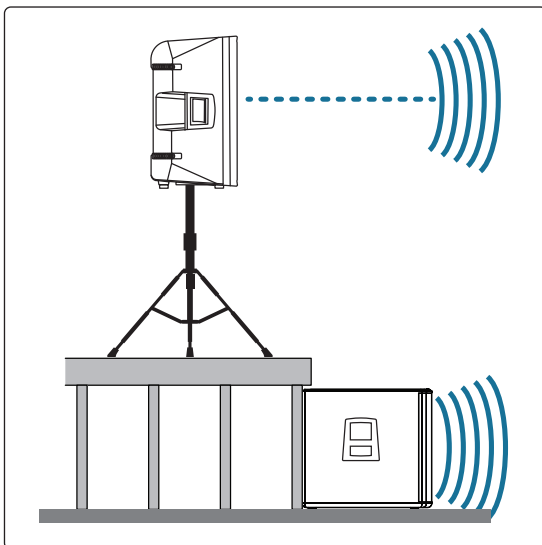
- **Sub-pole mounted.** When your full-range speaker is mounted directly atop your Air XD Series sub, no delay is necessary.



- **Tripod mounted.** When the subwoofer is about one meter from the full-range loudspeaker—a typical distance when the loudspeaker is on an adjacent tripod stand—set the delay on your AIR subwoofer to about 2.9 ms.



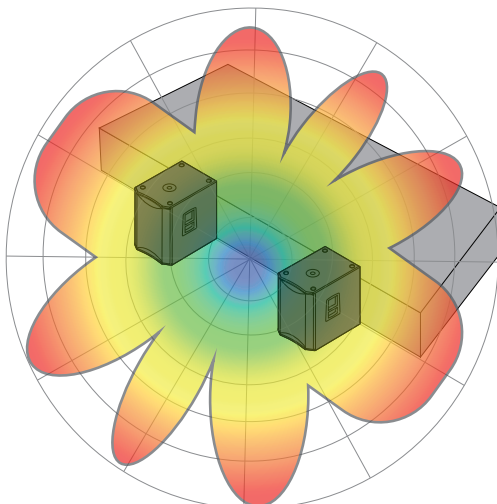
- **Full-range onstage.** When the full-range loudspeaker is on stage and the subwoofer is on the floor, the typical distance is around 2 meters. Set the delay on your AIR subwoofer to about 5.9 ms.



3.2 Subwoofer Arrays

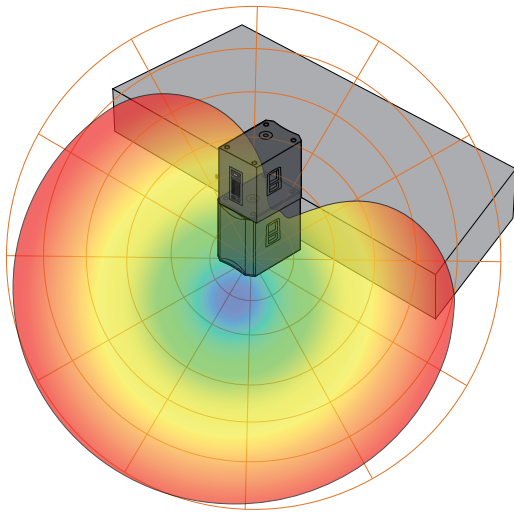
Most subwoofers are essentially omnidirectional. This means that they radiate sound around the entire cabinet, including on the stage. Subwoofer energy can cause feedback onstage and can make monitoring more difficult. In addition, when two subwoofers are arranged on each side of the stage in a traditional stereo configuration, there can be a build-up of energy. The resulting “power alley” is created by energy from each subwoofer arriving at the same time and in phase with each other summing together. Unfortunately, moving left or right of this center summation, one will find cancellation alleys.

Figure 1: Omnidirectional Pattern



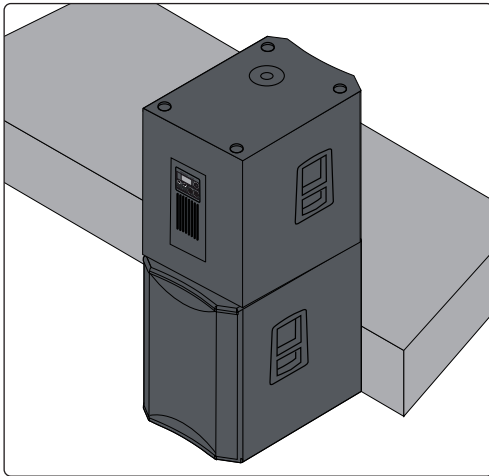
Creating a cardioid subwoofer array forms a more direction radiation pattern that keeps energy off of the stage and in the audience where it is needed more.

Figure 2: Ground-stacked Cardioid Pattern

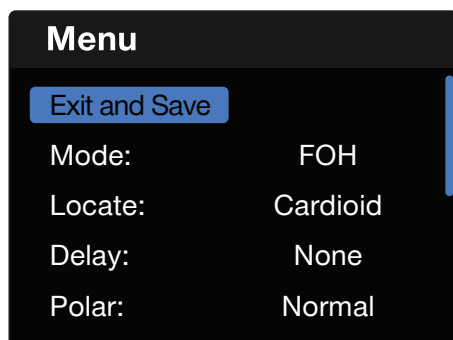


3.2.1 Ground-stacked Cardioid Array

For smaller spaces, creating a ground-stacked subwoofer array is an easy way to focus the subwoofer onto the audience. To build a groundstacked cardioid array with two Air XD Series subwoofers, stack two Air XD Sub 15 or two Air XD Sub 18 one on top of the other, with the top subwoofer facing away from the audience and toward the stage.



On the cabinet that *faces away from the audience*, enter the DSP menu and select Cardioid in the Locate options field.

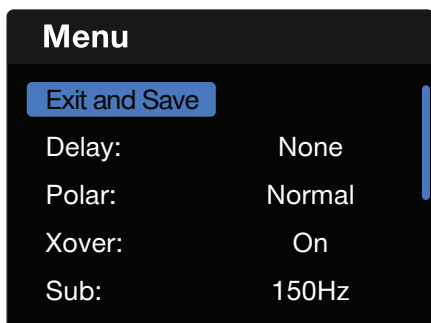


Your two Air XD Series subwoofers will now radiate in a directional cardioid pattern, allowing you greater steering control over low-frequency energy.

Power User Tip: If you delay your subwoofer array relative to your full-range systems, be sure to set the same delay time on both subwoofers.

3.3 Setting the Lowpass Filter

Air XD Series subwoofer are equipped with a variable lowpass filter that allows you to dial in the best crossover point for your system.



1. To begin, push the encoder button and scroll to the Sub field. Set the lowpass filter to its highest cutoff frequency (150 Hz). This will create an overlap between your Air XD Series subwoofers and your full-range system's frequency response.
2. Play program music with a lot of bass through your full system.
3. Experiment with the polarity setting on your Air XD Series subwoofer to see which position provides the best bass response. Leave the polarity in the position that provided the loudest bass response. This means that your subwoofer is in phase with your full-range speaker.
Please note: When using the Air XD Sub 15 with any full-range Air XD model, you must also invert the polarity on the Air XD Sub 15.
4. From this point, you can experiment with the lowpass filter setting until you find the one that provides the smoothest crossover transition while listening to your favorite music.

Power User Tip: Air XD Series subwoofers feature presets for optimizing their performance with each Air XD Series full-range speaker. For example, if you are using an Air XD Sub 15 subwoofer with an Air XD 10 full-range speaker, set the Sub frequency to "Air XD 10." This will correctly set the Air XD Sub 15 lowpass filter for use with the Air XD 10.

4 Installation Guidelines

This section has been created as a reference for safe rigging and mounting practices. It is not an installation tutorial. PreSonus Air XD Series loudspeakers are professional products and are not intended for consumer use. Installation of Air XD Series loudspeakers should only be undertaken by a qualified systems integrator or a professional rigger. Every audio project is unique, and a licensed and insured professional should be consulted to guarantee the safety and performance of the installed system. The installer must have a complete understanding of the design intent, as well as knowledge of safe installation techniques, to create a successful project.

Understanding safe rigging and mounting practices will provide these benefits:

- Proper coverage of listening area with accurate speaker placement
- Best installation methods will be utilized with regard to safety, performance, aesthetics, and cost
- Minimal wasted time during installation

4.1 Ground Stacking

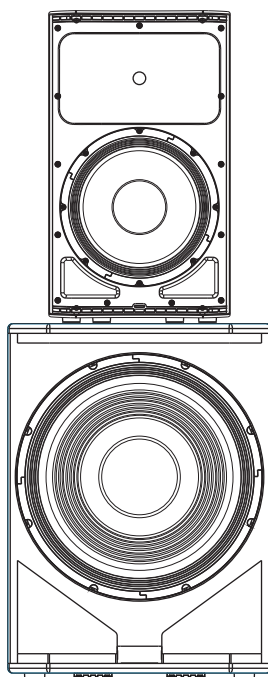
Air XD Series full-range loudspeakers have nonskid rubber feet on the bottom for upright front-of-house use and nonskid rubber feet on one side for stage-monitor applications.

For portable applications, Air XD Series loudspeakers can be easily ground stacked and configured for a variety of venues. When ground stacking, make sure all speakers are securely anchored to the floor using load straps or other anchors. Rubber mats can also be utilized between cabinets to prevent boxes from “walking.” This is particularly important if the speakers are accessible to the public.

Check that the surface the speakers are to be stacked on is level, even, and has sufficient structural integrity to support the speakers. If ground stacking on a portable stage, make sure you know what is directly below the speaker stack.



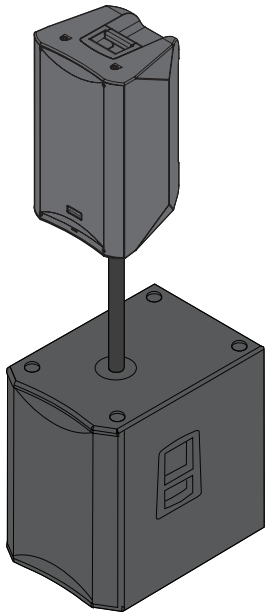
WARNING: Placement on improper or unstable surfaces could cause the loudspeaker to topple, which could result in serious injury or death.



4.2 Pole Mount

Full-range Air XD Series loudspeakers are equipped with a 35 mm pole socket that allows the speaker to be mounted on a speaker stand or on a pole over an Air XD Sub 15 or Air XD Sub 18 subwoofer. This pole socket allows for straight 90° vertical mounting or for tilting the full-range loudspeaker down 7.5° while on a pole.

When using a tripod speaker stand, extend the legs to provide the most stable support to the speaker so that it cannot be tipped over. It is highly recommended that tripod stands be placed away from foot traffic. If the stands are to be used outdoors, theatrical sand bags may be placed on the legs to provide some protection against wind load. When using the tilt-mount, make sure that one of the tripod legs is oriented directly below the tilt angle.



Air XD Series full-range loudspeakers also may be mounted on top of an Air XD Series subwoofer using a standard M20 threaded subwoofer pole.

WARNING: Do not exceed the maximum pole lengths listed for the subwoofers
Air XD Sub 18: 40" pole for all AIR XD full range models. Air XD Sub 15: 36" pole for the AIR XD 15. 40" pole for the AIR XD 12 and AIR XD 10.

WARNING: Use proper lifting techniques and safety precautions when mounting an Air XD Series loudspeaker onto a subwoofer pole or a speaker stand. When mounting atop a speaker stand, verify that it is rated to support the weight of your Air XD Series loudspeaker. ***The weight of each model can be found in your Owner's Manual.***

WARNING: Placement on improper or unstable surfaces could cause the loudspeaker to topple, which could result in serious injury or death.

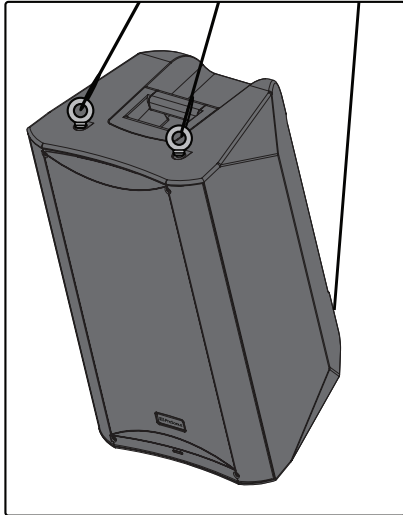
4.3 Suspension Guidelines

WARNING: Failure to observe the following safety precautions may result in severe injury or death. Installations such as described in this guide should only be attempted by a trained professional.

- Inspect all the components associated with the project for damage before assembly. Any suspect parts should not be used, and the component manufacturer should be contacted to arrange for replacement parts.
- Read all instructions shipped with selected speaker or rigging products. Make sure you fully understand all components.
- Always make sure that the structure the loudspeaker is to be suspended from has been approved by the building or structural engineer and will support the weight of all the components of the speaker system, including speakers, speaker cable, wire rope, etc.
- Make sure all installation crew members are trained for loudspeaker rigging and mounting and are in compliance with applicable local laws. Local government offices can help with this information.
- Make sure that all relevant health and safety regulations are known and followed by the installation crew.
- Suspended installations must be completed or supervised by a certified rigger.
- The system should be designed so that it is a static suspension. There should be no dynamic or shock loading.
- Personal protective equipment (hardhats, steel-toed footwear, safety glasses, etc.) should be worn at all times by the installation crew.
- If called for in the design, make sure all installation personnel are trained to work at height and have certifications for scissor lifts, theatrical hoists, and so on.
- Make sure all lifting equipment (slings, span-sets, deck chain, scaffolding, etc.) is in good working order. Thoroughly inspect all components prior to use.
- Keep a tidy workplace. Do not leave tools, rigging components, or other items on top of loudspeakers during installation. Loose items can fall and cause injury.
- Never leave the system unattended during the installation process. Make sure that the workspace is isolated from public access. No one should be allowed to pass beneath the loudspeakers during installation.
- Do not suspend other components or loudspeakers from PreSonus Air XD Series loudspeakers. If secondary steel safeties are required, they should be installed once the entire system is at operating height and before public access is allowed.

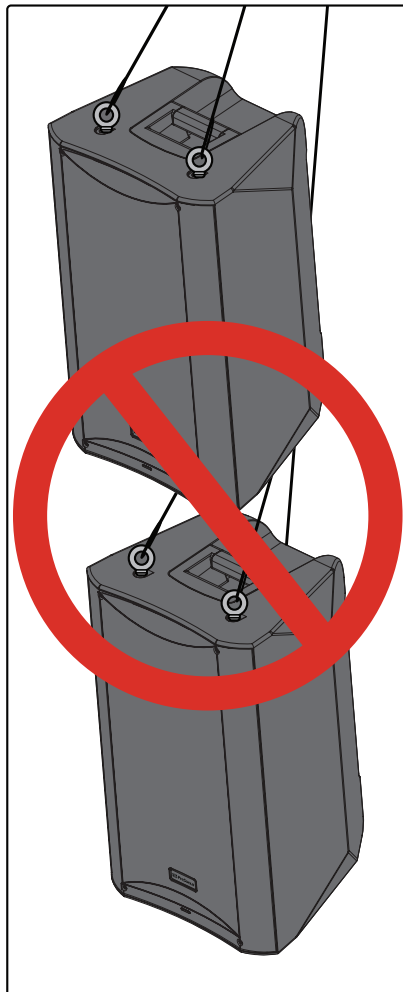
4.3.1 Suspending the Loudspeaker

A minimum of three suspension points must be used per speaker to safely suspend the Air XD Series full-range loudspeakers. Two wires fixed symmetrically to the front of the cabinet to hold the weight and one wire attached to the back for tilt will satisfy this requirement. Select the strongest overhead structure available for the two front points, and if possible, choose two independent points to allow one to act as a backup. Attach the two front points first and then adjust tilt angle to ensure the load is safely suspended during installation. If additional pan or height adjustments are needed, make sure to follow this rule as well.



SUPPORTED: Two front rigging points plus a pull-back

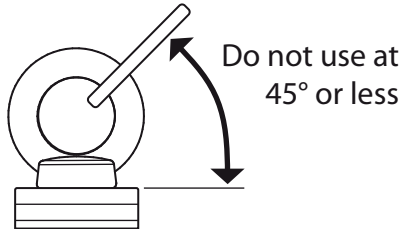
Do not suspend any other items from PreSonus Air XD Series loudspeakers.



NOT SUPPORTED: One Loudspeaker attached to another

PreSonus offers an M10 Kit that includes four (4) forged-shoulder, steel M10 eyebolts. This kit is to be used with the Air XD 10, Air XD 12, and Air XD 15 M10 suspension points. These bolts are specifically designed for safe suspension of PreSonus Air XD Series loudspeakers and must not be substituted. These eyebolts are not a common hardware store item. Please read all included information. Use a minimum of three (3) eyebolts per full-range cabinet.

When using the M10-Kit, please remember that the eyebolt strength rating will vary with the pull angle. It is extremely important to observe appropriate pull angles when suspending any loudspeaker with eyebolts. Suspending an object with eyebolts should always be done in a way that ensures the resultant forces are within the allowed pull angles.



PreSonus also offers a yoke mount for horizontal and vertical mounting. These yokes are designed for each full-range model. When using the yoke mount, follow the installation guidelines included with the yoke. Do not use the PreSonus yoke mounts for any loudspeakers other than the Air XD Series models for which each was designed.

4.3.2 Precautions

Air XD Series loudspeakers, like all electrical devices, must be protected from liquids or excessive moisture. They are not designed for outdoor use during inclement weather. If you are using your Air XD Series loudspeakers outside when rain or other moisture-laden weather occurs, immediately power down your loudspeakers and protect the cabinets with waterproof coverings.

The amplifiers in Air XD Series loudspeakers are convection cooled via the rear-panel heatsink. Free airflow must be maintained around and behind the heatsink, with a minimum clearance of six inches behind the cabinet. Make certain the heatsink is kept clear of any adjacent materials, such as stage curtains, that could impede airflow.

Added bonus: PreSonus' previously Top Secret recipe for...

Chicken and Andouille Gumbo

Ingredients:

- 1 C All-Purpose flour
- ¾ C Vegetable Oil
- 1 large onion (diced)
- 1 small onion (quartered)
- 6 celery stalks (diced)
- 1 large green bell pepper (diced)
- 3 cloves garlic (2 minced, 1 whole)
- 1 lb link Andouille sausage
- 4 Chicken leg quarters
- 4 qt water
- 4 bay leaves
- 1 tsp thyme
- 1 tsp Old Bay seasoning
- 1-2 C frozen okra, sliced
- ¼ C fresh parsley, minced
- 6-8 eggs (optional)

Cooking Instructions:

1. In a large pot, combine whole chicken leg quarters, water, quartered onion, Old Bay, 2 bay leaves and 1 whole clove garlic. Cover and bring to a low boil. Simmer stock until chicken is falling off the bone. Remove the chicken and set aside. Discard the onion, bay leaves, and garlic, reserving the liquid.
2. In a heavy saucepan, heat 1 Tbsp of the oil on medium high heat and brown the andouille until it is cooked through. Set aside sausage for later.
3. In the same saucepan, add and heat remaining oil. Slowly add flour 1-2 Tbsp at a time, stirring continuously. Continue cooking and stirring the roux until it is a dark brown (it should look like melted dark chocolate). Be careful to not get the oil too hot or the flour will burn and you'll have to start over.
4. Once roux has reached the correct color, add diced onion, celery, green pepper, and minced garlic. Cook until vegetables are very tender. Do not cover.
5. Slowly add 1 quart of chicken broth and bring to a low boil, stirring constantly.
6. Transfer roux mixture to a soup pot and bring to low boil. Do not cover, the roux will settle on the bottom of the pot and burn.
7. Add remaining chicken broth, bay leaves, and thyme. Simmer for 30 minutes.
8. While gumbo is simmering, debone and shred chicken and slice the andouille.
9. Add chicken and andouille to gumbo and return to a simmer. Simmer for 30-45 minutes.
10. Stir in frozen okra and parsley and bring to a rolling boil.
11. **Optional:** Crack one egg into a teacup and quickly pour into the boiling gumbo. Repeat with the other eggs being careful not to cluster them too closely. After all the eggs have risen back to the surface, reduce heat and simmer.
12. Correct seasoning with salt and pepper (red, white and/or black) if necessary.
13. Serve over rice with potato salad.

Serves 12

Air XD Series

Extended-Definition Active Loudspeakers with DSP

Application Guide

