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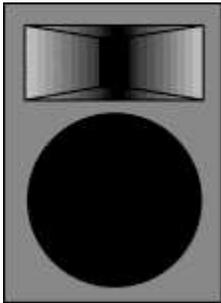
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## CHOOSING A PORTABLE P.A. FOR PLAYS AND LIVE MUSIC

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As we recommend to our customers, you often need to use a pair of portable PA speakers to get enough volume with floor microphones. We'll offer some tips on choosing those speakers.

Also, touring musicians need a portable PA system to amplify their sound for audiences. Here's some advice on choosing the right portable PA for your needs and setting it up.

Any portable PA system includes these basic items:

- Microphones (and sometimes direct boxes)
- Mixer and power amplifier, or powered mixer, or mixer and powered speakers
- A pair of loudspeakers
- Speaker stands
- Optional floor monitor speakers for touring musicians
- Mic cables, optional mic snake, line-level cables, speaker cables
- Packaging and transport devices

Another option for musicians is an instrument amp. That combines a mixer, power amp, and loudspeaker in one package.

Let's look more closely at each component.

### **Microphones**

We sell these types of mics:

- Floor microphones to pick up actors
- Mini clip-on mics for acoustic instruments

Stage plays also might require headworn wireless mics. Many touring musicians need headworn or handheld microphones for vocals.

### **Power amplifier**

Now ask yourself, "How much amplifier power do I need?"

- Speech-only system in medium room: 50 W continuous per channel
- Folk music in a coffee shop with 50 seats: 25 to 250 W
- Folk music or speech in a medium-size auditorium, club or house of worship with 150 to 250 seats: 95 to 250 W
- Folk music or speech at a small outdoor festival (50 feet from loudspeaker to audience): 250 W
- Pop or jazz music in a medium-size auditorium, club or house of worship with 150 to 250 seats: 250 to 750 W
- Pop or jazz music in a 2000-seat concert hall: 400 to 1,200 W
- Rock music in a medium-size auditorium, club or house of worship with 150 to 250 seats: At least 1,500 W
- Rock music at a small outdoor festival (50 feet from loudspeaker to audience): At least 1,000 to 3,000 W

### **Mixer or powered mixer?**

Let's move on to another choice. Because a powered mixer has the power amp built in, it's easier to carry and hook up than a separate mixer and power amplifier. Also, many powered mixers include onboard effects. Some include a graphic equalizer, which is useful for tuning the frequency response of the speakers in different environments.

One advantage of a separate mixer and power amp is that if either one fails, you need to replace only that component. A separate mixer is more ergonomic than a powered mixer and has faders rather than knobs. Also, using a standalone mixer lets you buy only the size of mixer that you need, such as a mini mixer with 3 to 5 inputs.

Make sure the mixer has enough balanced XLR mic inputs to handle all the mics that your act will require. For example, if you use 4 wireless lavalier mics and 2 floor mics for a play, your mixer should have at least 6 XLR mic inputs, and more is better in case you need to expand. You also may need some RCA jacks for a CD or mp3 player.

### **Loudspeakers**

A small PA uses two loudspeakers, either powered or passive. Typically, each speaker is a 2-way system consisting of a 12" or 15" ported woofer and a horn tweeter. Horn dispersion (6 dB-down points) is commonly 40 degrees vertical x 90 degrees horizontal, or 40 degrees vertical x 120 degrees horizontal. The purpose of that polar pattern is to focus sound on the audience -- to cover all the listeners, but not to send sound to the ceiling where reflections can muddy the sound.

Look for a frequency response that is wide enough to reproduce the sound source accurately. A speech-only system could be 100 Hz - 12 kHz, a guitar-

singer system might be 80 Hz - 15 kHz, while a system for a rock band should cover 40 Hz - 15 kHz or higher. Those frequency limits are typically 10 dB down or less from the level at 1 kHz. Of course, the flatter the response over the passband, the more accurate is the reproduction.

Decide whether you want a separate power amplifier and passive speakers, or active (powered) speakers which have the power amp built into the cabinet. Most powered PA speakers are bi-amplified: they have one amplifier for the woofer and another for the tweeter. The advantages of bi-amplification include:

- Distortion frequencies caused by clipping the woofer power amplifier will not reach the tweeter, so there is less likelihood of tweeter burnout if the amplifier clips. In addition, clipping distortion in the woofer amplifier is made less audible.
- Intermodulation distortion is reduced... you get a cleaner sound.
- Peak power output is greater than that of a single amplifier of equivalent power... the speaker sounds louder.
- Direct coupling of amplifiers to speakers improves transient response—especially at low frequencies... a tighter sound results.
- Bi-amping reduces the inductive and capacitive loading of the power amplifier... it's easier on the power amp.
- The full power of the tweeter amp is available regardless of the power required by the woofer amp... the tweeter is always fully powered.

If you're planning a high-quality music system, consider a subwoofer/satellite configuration. One or two subwoofers on the floor provide the deep bass, while two smaller satellite speakers on stands provide the rest of the spectrum. Since the ears don't localize extreme low frequencies, all the sound appears to come from the satellites. The advantage of this system is that you don't have to raise large, heavy speakers on stands.

Some manufacturers offer speaker cabinets made of plastic to reduce weight. A 12" 2-way speaker with a plastic cabinet might weigh only 24 pounds. You come to appreciate low weight after several nights of raising the speakers on stands. Plastic cabinets, however, tend to leak low frequencies or resonate, possibly degrading the frequency and time response of the loudspeaker system.

Most PA speaker cabinets include a bottom mounting cup that accepts a 1-3/8" or 1-1/2" speaker-stand pole. In most speakers the pole cups are vertically aligned, but some are angled so that the speaker aims down toward the audience when raised. Portable stands (such as made by Ultimate Support Systems) are made of hollow, sturdy tubes. The stands can be collapsed and telescoped for easy transport.

A new speaker format is a combination column speaker, subwoofer and power amp such as the Bose L1 system. A column speaker without a sub is the Fishman SA220 Solo Performance System designed for singer/songwriters. It's a

small line array speaker on a stand with a 220 watt power amp. With either system, you place the speaker behind the band, so it serves as both monitor and FOH system. One speaker per musician is the common setup. Two advantages are: the musician hears the same mix that the audience hears, and the sound level is more constant with distance than with a woofer/horn system.

For semi-permanent installations, look for speakers with mounting points that bolt onto steel cables or yokes that can be aimed as needed. Also consider delayed speakers that are placed 50 feet or more out in the audience. Front-fill speakers near the stage help provide sound for the first few rows of the audience.

Floor monitor speakers have a cabinet that angles the drivers up toward the performers. Some house speakers also have angled cabinets so that they can double as floor monitors -- a versatile feature.

Speaker cables should be thick (low gauge number) to minimize power loss through cable heating. You could use #14 or #12 zip cord (lamp cord) for most jobs, or use cylindrical speaker cable of the same gauge. Speakon connectors are more reliable than phone plugs and pass more current.

### **Transportation and packing**

A very helpful item is a dolly, wheeled cart or hand truck to transport heavy equipment into the venue. Consider getting some lightweight tubular carts. Being collapsible, they store easily in your car or truck. Two makers of equipment carts are Rock n Roller and Kart-A-Bag. Look for roll-around racks and trunks with casters. You might pack speakers in protective bags, and move them into a venue on top of rolling trunks that hold mics, mic stands and cables. Some trunks have trays and lid storage to make it easier to organize items.

Some people prefer to leave cable harnesses connected to rack equipment when they are packed. At the gig they pull out the cables and attach them to the mixer.

### **Installation**

OK, you've assembled a sound system and it's time to locate the speakers. Typically, touring musicians place the speaker stands near the audience on either side of the stage (see Figure 1 below). This positions the speakers toward the "dead" rear of your cardioid microphones and reduces the potential for feedback. Try to place the speakers far from the mics and close to the audience.

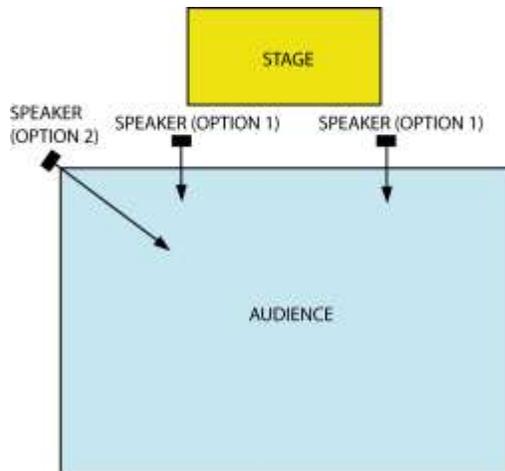


Figure 1. Typical speaker placement for a touring musician.

A recommended speaker placement for plays and musicals is shown in Figure 2 below. Use 2 to 4 loudspeakers on stands, angled in to aim at the opposite far corners of the audience.

TOP VIEW OF LOUDSPEAKER PLACEMENT

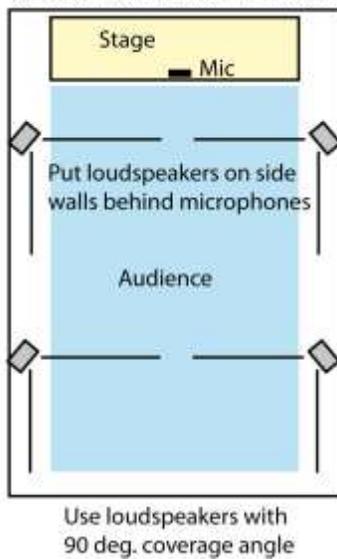


Figure 2. Recommended speaker placement for plays and musicals.

Also, raise the speakers on the stands high enough to clear the crowd. Otherwise, people in the back will hear muffled sound because the crowd attenuates the high frequencies. Also, raising the speakers prevents sound from blasting the audience members who sit closest to the speakers.

Articulation is best if the direct-sound level is high relative to the reflected-sound level. This happens if you place the speakers close to the audience, and aim the speakers to direct their sound on the audience, not on reflecting surfaces.

Rather than using two speakers on either side of the stage, you might try this method suggested by sound consultant Ray Rayburn: Mount a single speaker at

one front corner of the audience, shooting across to the opposite corner (Figure 1, option 2). Also, stack the two speakers vertically (horn to horn) which narrows their coverage angle in the vertical plane. Clamp them solidly together. The advantages of this arrangement are: (1) no comb filtering from hearing two speakers at different distances, and (2) a clearer sound with less reverb because of reduced ceiling reflections.

There you have some tips on setting up a quality portable PA system -- one that sounds loud enough, natural, and intelligible.

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### **GUITAR PICKUP IMPEDANCE**

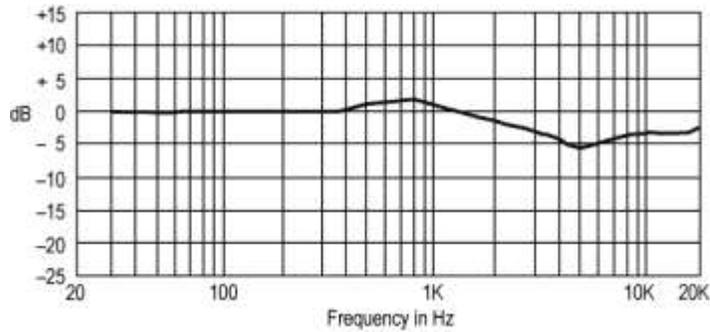
By Gene Brandt, Brandt Audio & Acoustics, <http://www.baudioacoustics.com/>

With my tests, I have found [that the impedance of guitar] pickups is more commonly 10-25k (or higher - depends if it's single-coil or humbucking coil). But most importantly, [impedance can] rise at its resonance around 3-5kHz (depending on pickup) to 100 kilohms or more! This is the region that determines most of the sound of the pickup. This can be seen by running an impedance sweep into the guitar. This is why guitar amp input impedances are 1 megohms. Anything less loads the pickup and changes the sound. This is also why guitars are so sensitive to cable capacitance. We have made variable input impedance tests from 100k up to 10 meg and found 1 megohms to be optimum for the characteristics sought by most guitarists as this is the pickup design load.

### **EFFECT OF CARPETED STAGE ON FLOOR MIC FREQUENCY RESPONSE**

If you are using floor mics on a carpeted stage, the high frequencies tend to be absorbed by the carpet, causing a dull or muffled sound. It helps to put the mic on a hard, foot-square panel such as 1/8" thick masonite, plywood, Plexiglas or Lucite. That keeps the sound clear.

The graph below shows how the frequency response of a floor mic CHANGES when you move the mic from a hard panel to directly on top of 1/2" thick carpet. The high frequencies are diminished, weakening the sibilance ("s" sounds) in the actor's voices. So be sure to place a hard, thin panel under each mic when the stage is carpeted.



### **USING A STAGE-FLOOR MIC ON A LECTERN**

Some people place a stage-floor mic on a lectern to use it in place of a lectern or gooseneck mic. The lectern surface (boundary) causes a boost around 500 Hz and a low-frequency loss around 100 Hz due to sound diffraction. The exact frequencies depend on the lectern dimensions.

You can equalize the microphone to make it sound more natural in this application. For starters, cut 6 dB at 500 Hz and boost 5 dB at 100 Hz (but watch out for feedback).

It makes little difference whether the mic is lying flat on the lectern surface or is tilted up to aim at the talker – the output level is the same. The mic tilted up sounds slightly brighter in the high frequencies and more “colored” in the midrange.

It’s easiest just to place the mic flat on the surface. Be sure to warn the users not to cover up the mic with notes or books.