

SOUND SYSTEM BASICS

by Bruce Bartlett, Bartlett Microphones

To amplify actors' voices clearly, you need a sound system: microphones, a mixer, a power amplifier and loudspeakers. You'll want to set it up correctly for best results.

Understanding how a sound system works can be confusing, but I'll explain the concepts here in plain English.

The parts of a sound system are:

- **Microphones:** They sit on the stage floor near the front edge, and pick up the actors' voices. The Bartlett TM-125 and TM-125C microphones are designed for that specific purpose.



- **Mic cables:** They carry the signal from the mics to the mixer. The type of mic cables you need are called "2-conductor shielded mic cables" with a male XLR connector on one end, and a female XLR connector on the other end. They typically come in 15 or 20 foot lengths, and you can connect several of them together to reach from the stage to your mixer.



- **Mic snake (optional):** This is a metal box with several mic connectors in it, wired to a long, thick cable (maybe 100 feet long). At the end of the cable are several XLR connectors which plug into your mixer. Using a snake is easier and neater than using many separate mic cables. You still may need some 20-foot mic cables to reach from the stage to the snake box.



- **Mixer:** This device amplifies the mic signals and lets you control their volume and tone (bass, midrange and treble).



- **Power amplifier:** This device further amplifies the mixer signal up to a stronger level that can drive loudspeakers. Note: A **mixer-amplifier** (or **powered mixer**) combines a mixer and power amp in a common chassis.



Power amplifier



Powered mixer

- **Cable between the mixer and power amplifier:** On one end of this cable is a connector that mates with your mixer output connector. The cable connector might be an XLR connector, phone plug or RCA plug. On the other end of the cable is a similar connector that mates with your power amplifier input connector. You won't need this cable with a powered mixer.



Cable with phone plugs



Cable with XLR connectors



Cable with RCA plugs

- **Loudspeakers:** These play the amplified actors' voices to the audience. A typical portable PA speaker has a 10-inch or 12-inch diameter woofer cone plus a horn-shaped tweeter, shown below.

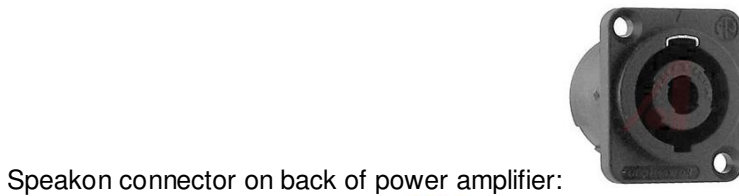


- The best type of speaker to use in a gymnasium is a column speaker or line array speaker (shown below). It focuses sound on the audience rather than radiating it around the room. That helps intelligibility. The Bogen SCW35 is an example of a column speaker. It has six vertically-arrayed 6" speakers in a single cabinet.

<http://www.abconf.com/Store/pc/viewPrd.asp?idproduct=4342>



- **Speaker cables:** These go between the power amplifier and the speakers. Typically a speaker cable has two thick wires, like an electrical cord (lamp cord). On one end of a speaker cable is a connector that mates with your power amplifier: a banana plug, phone plug, Speakon connector or bare wires. On the other end of the speaker cable is a similar connector that mates with your loudspeakers.



- **Speaker stands:** A speaker stand is a collapsible stand that mounts a loudspeaker 6 to 14 feet high off the floor. That way, the speakers don't blast the nearest listeners, and the sound clears the heads of the audience and isn't blocked by them.



- **The theater acoustics:** Hard room surfaces tend to create a lot of reverberation -- the persistence of sound in a room after the original sound has ceased. It's the sound you hear just after you shout in an empty gymnasium.

Excessive reverberation blurs speech, making it harder to understand. A room with carpet and acoustic tile tends to sound "dead" (free of reverberation), and is ideal for hearing speech clearly.

USING THE EQUIPMENT

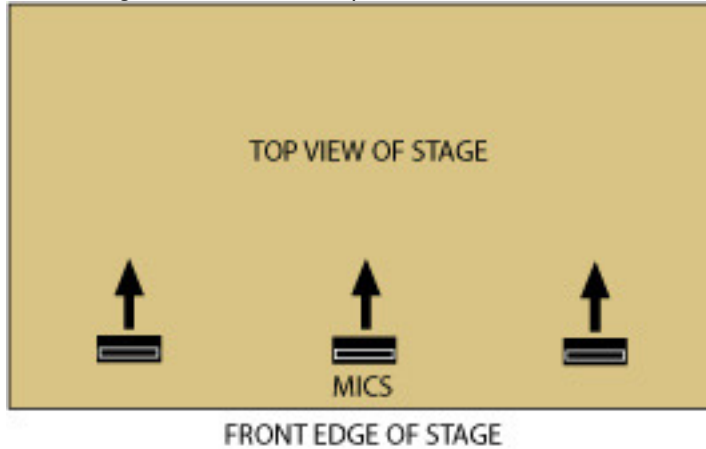
At Bartlett Microphones, we make microphones that you set on the stage floor near the front edge of the stage. The wider the stage, the more mics you need to pick up all the actors.

20 stage: 1 mic center stage.

25-30 stage: 2 mics 12 to 15 feet apart.

35-40 stage: 3 mics 15 feet apart.

45-50 stage: 3 mics 17 feet apart.



If you can stage all the talking parts center stage, you need only one TM-125C microphone in the center of the stage near the footlights.

The microphones plug into long mic cables, and those mic cables plug into a mixer. A mixer has a volume control for each microphone, so you can turn them up and down to the desired loudness.

Most mixers have a feature called **phantom power**. It's a source of power at each mic connector, and it powers the TM-125 or TM-125C microphones automatically when you plug them into the mixer.

Look at your mixer and find the model number. You can look it up online and find out if it has phantom power. If it does, you're all set. You also could check the owner's manual if you still have it.

If your mixer does not have phantom power, you need a phantom power supply, one per microphone, such as this one:

<http://www.amazon.com/Behringer-Ultra-Compact-Microphone-Phantom-Supply/dp/B000SJJCWK>

You plug the mic into the phantom power supply, and connect the phantom power supply's output to a mixer mic input.

A complete audio system is a chain of these devices:

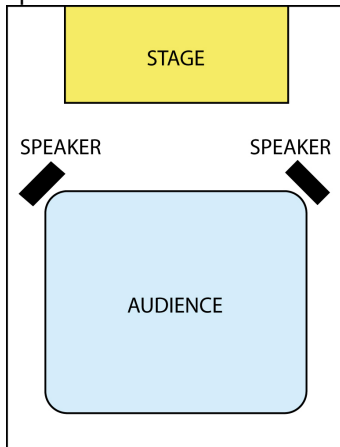
mics > mic cables > mixer > power amplifier > loudspeakers (if the mixer has phantom power)

or

mics > mic cables > phantom power supplies > mic cables > mixer > power amplifier > loudspeakers (if the mixer does not have phantom power).

Where you place the loudspeakers is very important. Are your speakers permanently installed near the ceiling in the center of the gymnasium? That's not good, because the speakers are too far from the audience. The sound these speakers make reverberates around the gym, making the sound muddy and hard to understand.

Ideally, you'd buy or rent two to four portable PA speakers on tall stands, and place the speakers very close to the audience. One suggested placement for the speakers is near the front left and right corners of the audience, aiming diagonally across the audience. Sometimes a single speaker at one corner works well.



The speakers must be closer to the audience than to the mics. For example, if the speakers are 10 feet from the microphones, but 20 feet from the audience, the sound system will not work well -- you'll get a lot of feedback when you turn up the mics loud enough to hear them.

A column speaker focuses sound on the audience so the sound does not radiate all around the room. That prevents a muddy sound and makes speech easier to understand. Two of those on speaker stands can work really well to provide clear sound, even in a gym.

To reduce feedback, try to turn up only one mic at a time -- the one closest to the person speaking. Follow the action with the mixer faders. The more mics in use, the more feedback.

You might install an automatic feedback suppressor between the mixer and power amp. Good ones are made by Sabine and Shure.

Shure DFR22

<http://www.shure.com/americas/products/mixers-dsp/dfr22-audio-processor>

Sabine FBX1200

http://www.sabine.com/Pro_FBX1200_2400_index.htm

Good luck in your quest for clear, intelligible speech.

#

A member of the Audio Engineering Society, Bruce Bartlett is a microphone engineer (www.bartlettmics.com), recording engineer, live sound engineer, and audio journalist. His latest books are "Practical Recording Techniques 5th Edition" and "Recording Music On Location."