

Lecture #20 – Sound System Basics

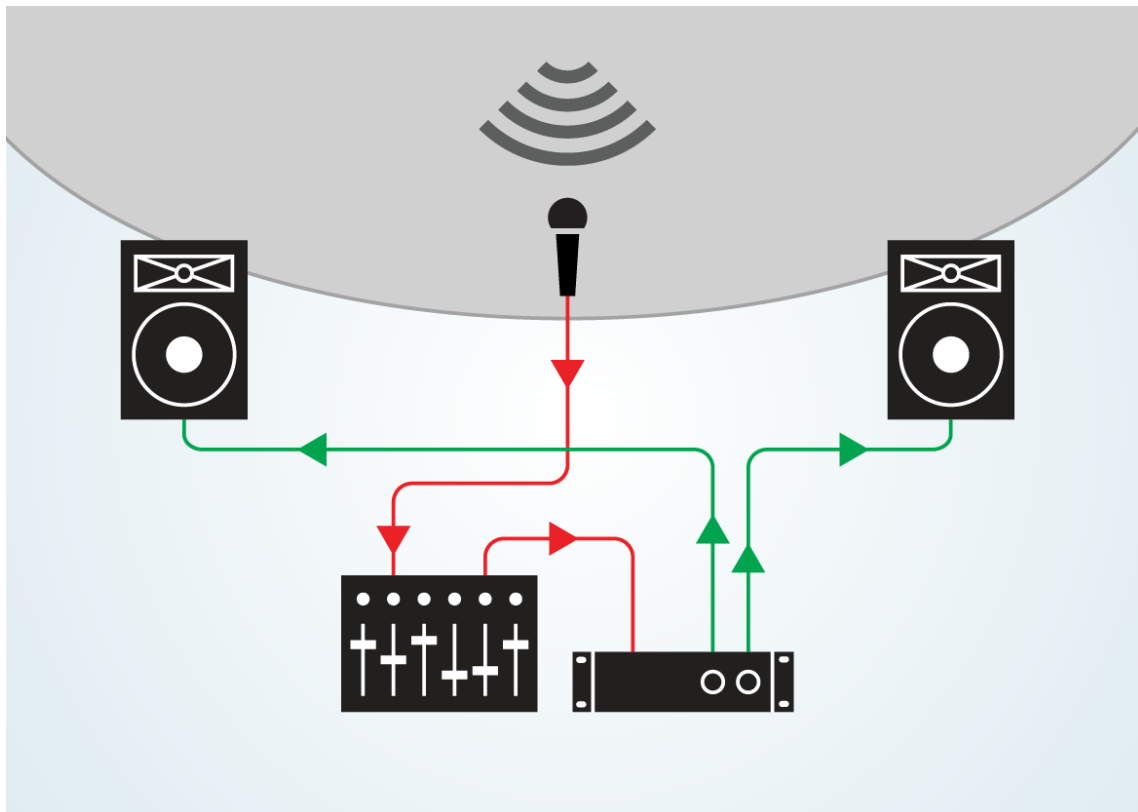
I. Introduction

Sound Systems have become almost ubiquitous in our churches today and a key part of the presentation of our services. In this lesson we will look at the basics of how sound systems work.

II. Processing Sound

Merriam-Webster.com defines *sound* as “mechanical radiant energy that is transmitted by longitudinal pressure waves in a material medium (such as air) and is the objective cause of hearing.”¹ When we speak, sing, or play an instrument we are creating vibrations in the air that radiate around us. With distance and other factors, the sounds will taper off to the point that it is indiscernible. Modern sound systems give us the ability to amplify sound to make it more powerful and to reach distant hearers.

The four-step process to process sounds is (1) convert the sound waves to an electronic signal, (2) mix and process the signal, (3) amplify the signal, and (4) convert the electronic signal back into sound waves.



¹ <https://www.merriam-webster.com/dictionary/sound> - accessed 10-14-22

III. Converting Sound to Electronic Signal

Microphones

Microphones are used to convert sound waves to an electronic signal. There are three major types of microphones: Dynamic, Condenser, and Ribbon.

Dynamic microphones capture sound as it vibrates a metal diaphragm. The diaphragm transfers the vibrations to a metal coil around a magnet. The coil's movement in relation to the magnet alters the electrical flow through the coil to produce the signal.

Dynamic microphones are the most common type of microphone used in churches. They are the most affordable and more durable.

Condenser microphones capture sound as it vibrates a diaphragm. That vibration changes the distance between the diaphragm and a backplate, which alters the signal through changing capacitance. These require an active electrical current, which is supplied through **phantom power**.

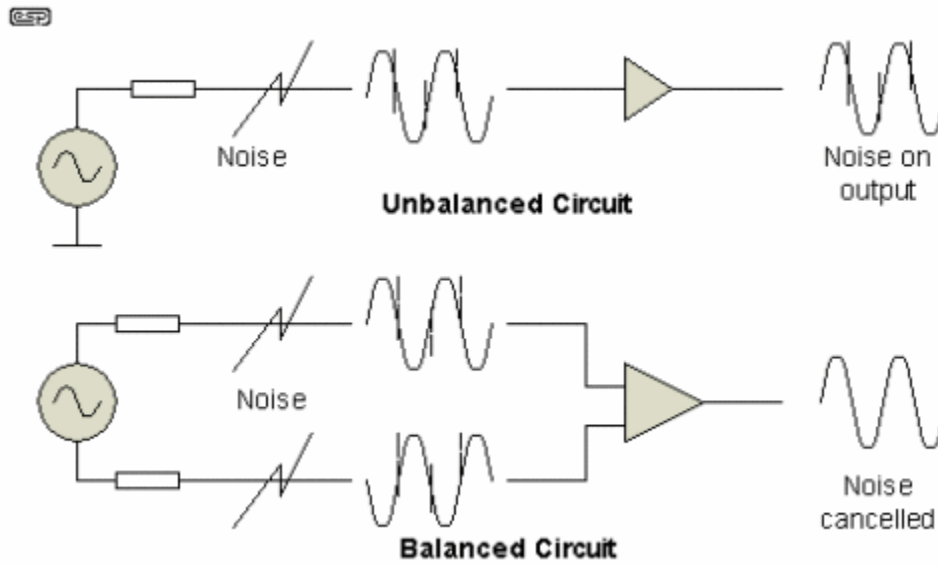
Condenser microphones are typically more expensive and less durable than dynamic microphones. They are often used in recording studios.

Ribbon microphones use some of the oldest microphone technology. These capture sound as it vibrates a metal ribbon that is suspended between the poles of a magnet. As the ribbon vibrates, the magnet causes the electronic fluctuations that create the signal.

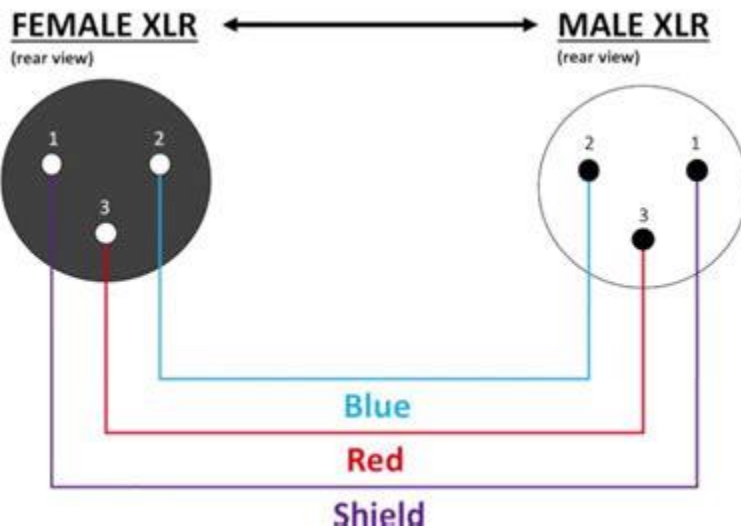
Ribbon microphones are not very durable and require some careful use. In the earliest days of church sound systems these were one of the few options available. They are generally not used on church platforms today except in very specialized applications.

Cables

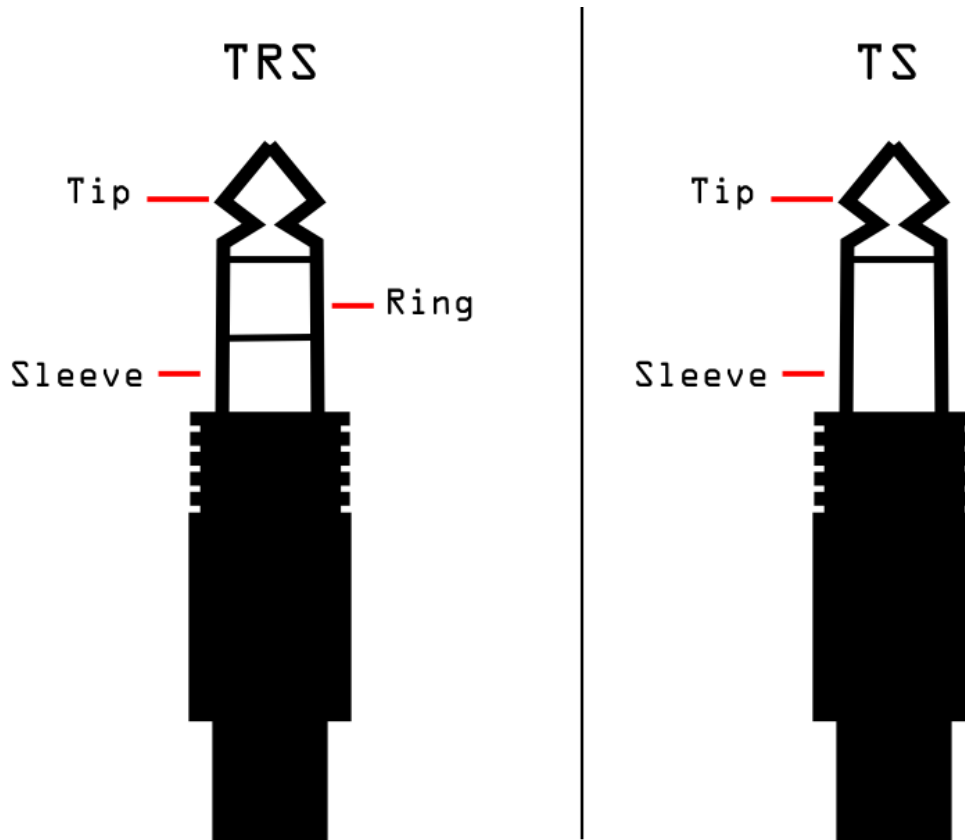
Cables carry the signal throughout the rest of the process. There are two types of cables **Balanced** and **Unbalanced**, which can vary by the construction or application of different cable types. Balanced cables have two conductor wires and help to cancel out any noise or interference. Unbalanced cables have a single conductor wire and will be affected by interference. All cables today will be composed of combinations of conductor wires, a ground wire, insulation, and protective sheathing.



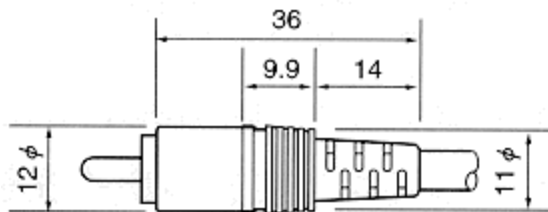
Most think of cables today according to their connectors. The **XLR** connector is one of the most common in sound systems. The most common form has three wires (ground, positive, negative) and has a latching mechanism. These are Balanced and can be run up to 200 ft.



The **TRS** connection is common in consumer electronics, sometimes simply called a “headphone jack”. The two main sizes are 1/4 inch (6.35 mm) and 1/8 inch (3.5 mm). Depending on the type of cable and its application, these can be either Balanced or Unbalanced. The **TS** connection is a type of these connections that only transmits one channel and is always Unbalanced.



Another connection that is sometimes used is the RCA connector, which has been very popular in home electronics in the past. These typically come with multiple cables connected with multiple plugs. The standard is that a red plug is the right stereo channel, and a white plug is the left stereo channel. These are always Unbalanced.



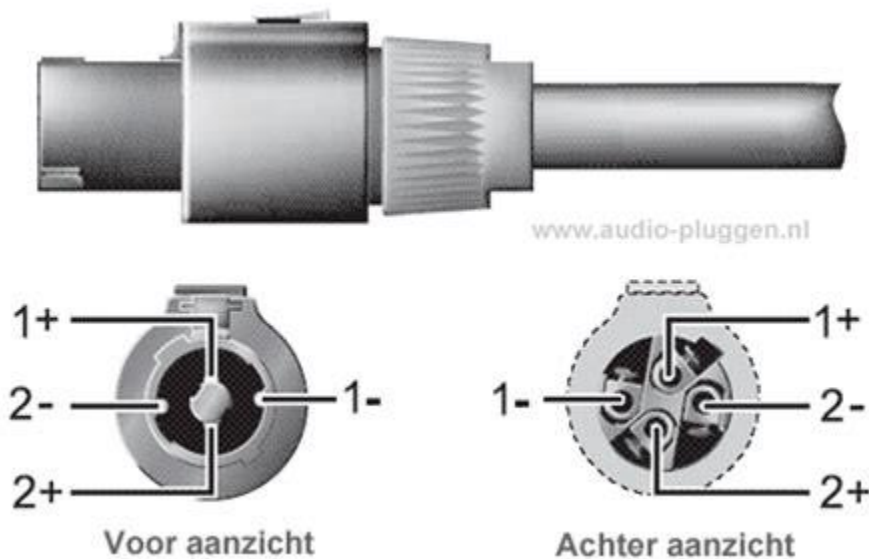
IV. Mixing the Signal

The signal from the microphones is carried to the **sound or mixing board**. Here the signal can be altered and processed in many ways. **Gain** refers to how much the sound is amplified. **Equalizer (EQ)** controls can find tune the sound. **Faders** are the sliders that adjust the sound levels of each channel (input) in the final mix. **Auxiliary Channels** allow for creating different sound mixes for output simultaneously.

V. Amplifying the Signal

The signal that is carried from the microphone and through the sound board is not very strong. For the sound to be projected, it must be amplified in strength. Some speakers have their own built-in amplifiers.

Speakon connectors are specialized connectors that are sometimes used to connect amplifiers to speakers. They have a latching mechanism that locks after the plug is inserted and twisted into place.



VI. Converting Electronic Signal to Sound

The amplified signal is then sent to the speakers, which convert the signal into sound waves. This is typically done by vibrating a cone-shaped diaphragm with an electromagnet.

The primary speakers will be used to broadcast the sound to the audience. In many churches, additional speakers may be located in other areas, such as fellowship halls or nurseries.

Monitors are speakers that are used to project sound to the platform, which is especially needed by musicians. Without monitors, the singer/musician would hear the sound after it had been broadcast into the room and bounced back to them off the back wall. This delay can disrupt the timing of the singer/musician. Wireless ear monitors are a very popular alternative today.

VII. Wireless Microphones

Wireless microphones gather sound like regular microphones, but the signal is transferred through a wireless connection. A receiver will receive the wireless signal and convert it into an electronic signal that is sent to the sound board.

VIII. Processing Audio for Streaming

While the primary purpose for sound systems is to ensure that the congregation can hear and understand what is happening on the platform, today many churches will also broadcast their services through an online streaming service. The sound board can be connected directly to a computer to receive the clearest audio possible for the stream. Currently,² my church (Faith Baptist Church, Decatur, TX) combines a video feed from an iPod with the audio feed from our sound board using an application called Open Broadcaster Software (OBS).

There are many people or services today that can help with improving streaming. Highly recommended is Tim Hartman with ProclaimAV.com.³

² 10-14-2022. We have been discussing making some upgrades.

³ This is who Bro. Andrew Johnson recommends and I would too.