Sound of Worship

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Winter 2012

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Improve Your Ministry

for Those Who Have a Hard Time Hearing

What are the needs of the hard-of-hearing? For many people, the church's regular sound system, no matter how good it is, cannot provide adequate assistance. Hearing aids simply cannot work as well as a pair of normal, healthy ears. A fully functional ear/brain combination works together to isolate the sound we want to hear and ignores all the extraneous noises. That marvelous, natural, God-given combination can tune out the noise of babies crying, feet shuffling, pages turning and noisy air conditioners. Unfortunately, hearing aids cannot filter out noise nearly as well.

The fact is, hearing aids do not correct hearing loss to the same degree that glasses correct vision problems. For example, remember the sound when you videotaped a special musical event? In the room, the sound was clear and distinct to your ears. But when you listened to the program played back on your TV, the recorded sound was indistinct and hollow. What you experienced was the difference between how two good ears function and what a single microphone picks up (like a hearing aid).

Figure 1
Wireless FM radio system

Although hearing aids work well in a small room with very little reverberation, they cannot compensate for the acoustics of a large worship center. The reverberation creates noise that masks the clear, direct sound. The solution is to move the listener closer to the loudspeaker so they hear more of the direct sound. Going one step farther, if we put a tiny loudspeaker right at the ear, the listener only hears the direct sound. That is exactly what a hearing assistance system does. The listener wears an earphone or headset and they can adjust the volume to their own comfort level.

Options Available

Three main types of equipment are used to provide this type of assistance. They are the FM radio system, the infrared system, and the inductive loop system. Each system has pros and cons. Which system you need is determined by many factors including price, privacy, the number of systems needed and how the church is constructed. The following is a brief description of each type of system.

Continued on page 3

Microphone Mysteries Solved

Microphones can seem mysterious to users who do not understand how or why the microphone works. The microphone facts in this article will help those in your church better use microphones.

The Vacuum Cleaner Myth

Some people envision microphones to be like vacuum cleaners, as if the microphone "sucks in" sound.

Microphones are not like vacuum cleaners. A microphone measures (picks up) what happens to the change in air pressure at a particular point. The air pressure changes when someone talks, sings or plays an instrument. Of course the microphone also picks up unwanted pressure changes from airplanes flying overhead or babies crying. The vocal cords of a singer produce changes in the air pressure that emanate from the singer's mouth. The sound waves are like the ripples produced from a rock thrown into a smooth pond. The ripples radiate from the point at which the rock hit the water. As the ripples travel outward, they gradually get weaker until the water is smooth again.

The microphone measures these tiny changes in air pressure. This change is converted into a tiny electrical voltage by the microphone transducer. Therefore, one particular microphone will not naturally "pick up" better than another at a certain distance. There are other factors that make one microphone better suited for certain applications.

Common Types of Microphones

The dynamic microphone (Figure 4) is the most common type of modern microphone. It has three basic parts: the diaphragm, coil and magnet. The diaphragm is a very light dome-shaped form. The coil of very thin wire is attached to the rear of the diaphragm and positioned in the gap of the magnet. A change in air pressure causes the diaphragm and coil to move. The coil movement within the magnetic field produces a very tiny voltage in the coil. This tiny voltage travels along the microphone cable to an amplifier in the microphone mixer.

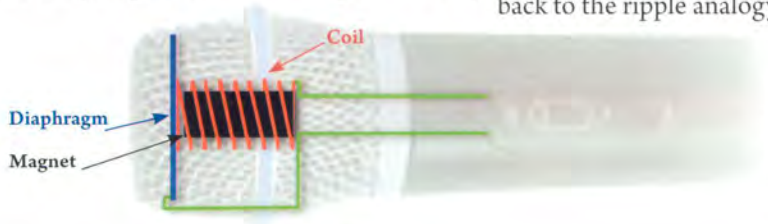


Figure 4
Dynamic microphone

The other major type of microphone transducer is the capacitance or electret microphone (Figure 5). This type also has a diaphragm. However, it does not use a coil and magnet. Instead, the diaphragm is actually a capacitor (a device that stores and releases electricity). When air pressure moves the diaphragm, the distance between it and the back plate changes. This produces a change in capacitance that is converted to an electrical voltage. Power must be provided for the capacitance microphone since it utilizes some electronics. Power can be furnished by a battery or from the mixer. The power from the mixer is called phantom power since the tiny audio signal travels along the same wire as the power for the amplifier in the microphone.

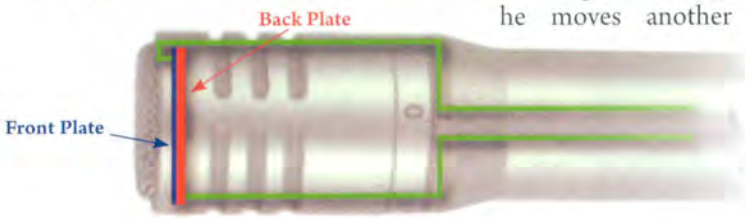


Figure 5
Electret microphone

Microphone Placement

To place a microphone, both the person speaking and the microphone placement need to be considered. To explain, let's go back to the ripple analogy.

The ripples are the strongest or highest at the point of impact. As they radiate from the center, they become weaker. The same is true for sound waves. The sound pressure level (SPL) decreases by six dB every time the distance from the sound source doubles. In real-world terms, a ten dB decrease sounds, to our ears, like the volume drops in half. A three dB drop is barely perceived.

Also, it is necessary to consider the natural movement of the person speaking. Some people move more than others. But, there is always some movement.

How is this helpful in real-world applications? In the top image of Figure 6, the talker is only an inch from the microphone. If he moves an inch, the SPL reaching the microphone drops six dB. If he moves another two inches, the distance doubles again which means the SPL drops 12 dB. Only a three-inch movement has caused the sound system level to drop in half.

Now look at the bottom image in Figure 6. The person speaking is a foot from the microphone. In this scenario, moving another foot would produce only a six dB drop in level. The talker would have to move another two feet for a total of four feet to get the 12 dB level drop. In other words, natural movement would not be very audible if the talker started at the one-foot position.

Maximum Gain-Before-Feedback

What can be done if the volume is not loud enough before that annoying feedback occurs? There are two quick user techniques to help stop feedback.

The first method is to have the talker project more. When the talker speaks louder, the microphone will pick up a louder signal and that will be amplified louder. Too often, the natural reaction of a talker to hearing feedback is to talk softer. That is exactly opposite of what should happen. The talker needs to talk louder so the sound system gain can be turned down.

Figure 6a
The microphone is too close.

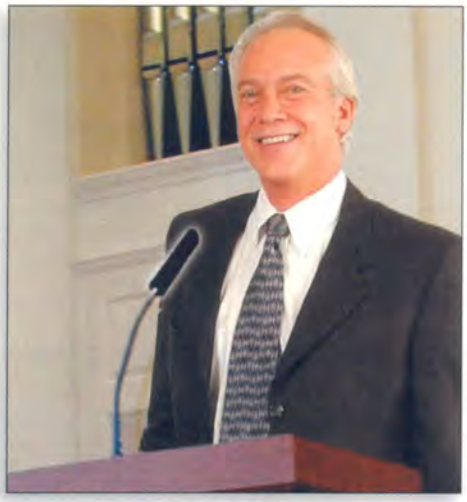


Figure 6b
The microphone placement is much better.

If the talker can't speak louder, they then need to get closer to the microphone. Remember the ripple example? The sound level reaching the microphone will be louder if the talker moves closer. The sound system gain or volume has not been adjusted, but the signal entering it has increased in level. The result is a louder volume from the loudspeaker system.

Summary

Applying these basic microphone facts will help get the most out of your present equipment. If you still have problems, please call us for help.

■ *By Ron Huisinga*

Improve Your Ministry...
Continued from page 1

FM Radio

The FM radio system uses radio waves as the link between the sound system and the listener (Figure 1). A small FM radio transmitter is connected to the sound system. The hard-of-hearing person carries a small, battery-operated receiver that has either an earphone or a neckloop. The earphone is placed in the ear and the listener can adjust the volume to his preference. If the listener has an aid with a T-switch (for use on a telephone), he could use a neckloop instead of the earphone. The listener keeps his own aid in his ear and sets the T-switch on the aid to the T-position, thereby getting increased volume through two sources: his hearing aid plus the receiver.

Since the sound is transmitted over radio waves, the system's coverage is not contained to a single room. The system may have a range of several hundred feet, depending on the building materials. For example, in some cases the system will probably work well in the fellowship hall too. However, if the fellowship hall has its own sound system and both systems are used at the same time, the FM hearing assistance system will not be useful in the fellowship hall. The solution is to have another FM system on a different channel for the fellowship hall sound system. That would require a different receiver for each room. Another solution is to have multi-channel receivers which are tunable to each system.

Infrared

Another method to provide hearing assistance is with an infrared system (Figure 2). This system has the same basic components as the radio system. There is a transmitter which connects to the sound system. The listener wears a special receiver. The big difference between FM and infrared is in how the sound system signal is transmitted. The infrared system uses infrared light as the wireless link. The advantage to infrared is that the room's walls define the coverage area. A fellowship hall next to the nave can have separate transmitters in each room and the same receivers will work in either place without interference.

Figure 2
Wireless infrared personal receiver

If you require many systems with the convenience of using the same receivers, check into infrared.

Inductive Loop

The third type of system is the inductive loop system (Figure 3). This system also has a transmitter and a receiver for the person who has difficulty hearing. Better yet, an aid with a T-switch will not require any receiver. The induction system requires a loop of wire to be installed around the circumference of the area that should be covered. The installation is the biggest disadvantage. It is often difficult to install the loop of wire in an existing church. Inductive loops are also more sensitive to outside electrical interference.

Which system will fit your unique needs? That can be a difficult question to answer. Let us help you find the right answer for your church.

■ *By Ron Huisinga*

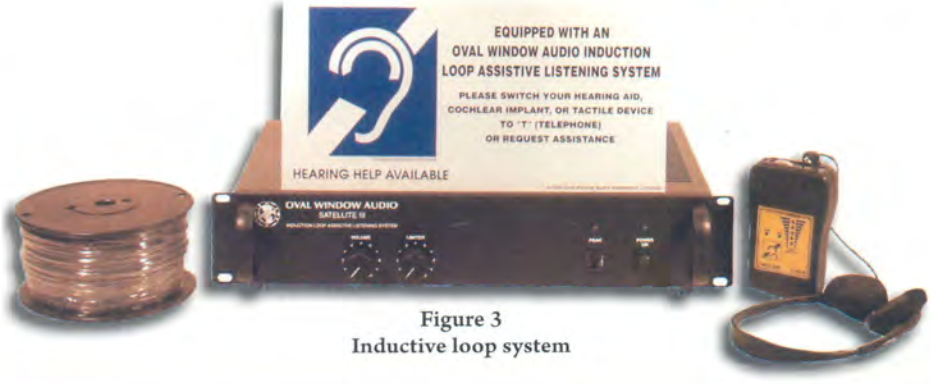
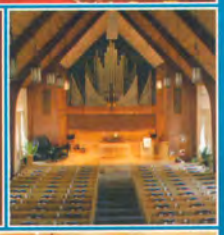
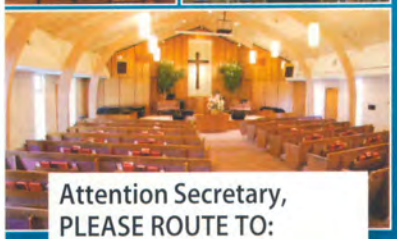


Figure 3
Inductive loop system





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