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Audio for the Church

• Let's look at the audio needs of smaller churches. So far we have discussed many topics and all of the principles apply, but not the space, time or budget. Therefore, the proper devices and uses for small churches, 200 seats or less, will be discussed.

In my travels to various churches, the smaller churches usually have poor sound systems as a result of their budget. The first step in purchasing equipment is buying quality microphones. Prices vary depending on quality. A good quality microphone costs approximately $150 or more, while a great mic starts at $500, and an excellent mic starts around $850. Any mic costing less than a $150 won't sound very well, or be sensitive enough to do you any good. The key to getting good quality sound is to have good quality transducers (microphones and speakers). Microphones in the good range usually have healthy warranties to back them up, and this is important when shopping for a mic. Other items to shop for, in order of importance, are: buy to fit the job; look at the value, *i.e.* warranty, and; price.

The sound business parallels the entertainment business, and is equally full of hype and buyer beware. The "coolest" looking, best-advertised product is not necessarily the best for the job, and many common myths about audio are always circulating. For example, most small churches only need one choir mic, not four, or one for each section of the choir. If your church has a choir loft and a pulpit, only two mics are needed, which will cost a minimum of $300 and will last for 10 to 15 years or more, providing you purchased a mic with a warranty on its acoustics. The question then arises on whether to use high or low impedance, and balanced or unbalanced lines.

By using both low impedance and a balanced line, you gain a wider frequency response with less noise and problems with outside interference. A balanced line has two conductors and a shield. The audio runs on its own conductor (180 degrees out of polarity with the other conductor) so that any noise entering into the lines will be cancelled at the input. If you want to plug in an electronic instrument, such as a synthesizer, you will need a direct box to match the line level output to a mic level in order to keep the instrument on a balanced low impedance line.

BALANCED LINES

Balanced lines usually use XLR connectors, with pins numbered one through three. Pin one is always the shield and pin two is the + (or hi) lead which can be any color conductor, other than black. Black is the – (or low) lead. XLR connectors are the standard balanced mic line in the audio industry. A quarter-inch connector may come into play when connecting up electronic devices in the system. Please proceed with caution, because many believe that quarter-inch jacks are all high impedance.

There are two conductor (single conductor with shield—referred to as TS conductor) quarter-inch jacks and three-conductor (two-conductor with shield) quarter-inch jacks commonly referred to as stereo jacks, because they are the type of jack used on stereo headphones. This is misleading because when you used the quarter-inch jack to interconnect devices, the tip is the + lead, the ring (or middle) is the – lead and the shield is connected to the sleeve, making it act just like the XLR type connector. The three-conductor quarter-inch connector is more correctly referred to as a quarter-inch TRS (tip, ring, sleeve) jack.

THE MIXER

The next selection in the audio systems chain is a mixer, but a small church usually can't afford a stand alone mixer, so what's left? Let's look at what we need to do first. If the service requires music playback, is a separate feed for performing talent needed? If your services are primarily speech and don't need music played back to the talent, then a line mixer with a built-in amplifier, better known as a package amp, can be used. If you need the talent to monitor the tape or CD playback, then additional mixing facilities and an amplifier are needed. A powered mixer that has two amplifiers and is capable of internal or external patching, preferably both, would be the best choice.

But for some, the typical powered mixer may be out of the budget, and the need for playback monitoring is a must. You can get a smaller mic/line mixer, some terminal blocks, spades, a crimp tool and a smaller utility amplifier similar to the one used in the package amplifier. At this point, the assumption is we are not using condenser microphones. We will put the terminal block into an equipment rack, then pull the mic lines and output of the tape deck, or CD player, to the terminal block and attach each conductor and its respective shield to its own slot. Remember to always mark the cable with numbers at both ends before pulling the cable so you will always know, without a doubt, what is connected to what. Next, hook to the adjacent slot of the terminal block two cables with two red conductors, two black conductors, and two shields to the single red and black conductors and shield (respectively). Now one of the cables will go to your mic/line mixer for your monitor, and the other will go to your mixer/amplifier for the house system. You now have independent control over your monitor and the house. If the singer wanted to hear the prerecorded tape at a comfortable level in his monitor, you could then turn the mic he used all the way down, while still maintaining perfect balance between music and singer to the house system's mixer/amplifier.

EQUALIZATION

If you are using a powered mixer, you will more than likely have an equalizer built into it. In the case of the mixer/amplifier however, it will, at most, have tone controls, so you

will need to add an equalizer. Most of the better mixer/amplifiers have a loop circuit so that you can add an equalizer in the circuit after the mixer section and before the amplifier section. A single octave equalizer, in my opinion, is not worth the investment for a house equalizer, particularly in this situation. Some will say that a single octave is better than none, but for a little more money, you may be better off using a 1/3- octave equalizer.

The next device in the audio chain would be an amplifier, but at this time, you only need to know that it needs to be large enough to handle the speaker load required.

We have come again to the electro-acoustic component of the system, the speaker. I have discussed system design from an electro-acoustic standpoint in the past few issues, covering the five parameters of sound system design, which are *level, bandwidth, coverage, gain before feedback*, and *intelligibility*. These principles still apply, even though I will not go into detail at this time. You should, however, be keeping them in mind as you plan on what you are going to do.

THE SPEAKER SYSTEM

If you have a fairly high ceiling in your church, you should consider a central speaker cluster. All seating locations in the church should be in the line of sight of the speaker location. One or two high quality full-range speaker cabinets should work fairly well, as long as you follow the five parameters. If you have a low ceiling, then your next logical choice would be to use distributed ceiling speakers.

The type of speaker to be used depends on the type of worship service. If your service is mainly voice then you only need the quality of an inexpensive eight-inch ceiling speaker. If you have a fairly active music program, then high quality twelve-inch coaxial ceiling speakers with the appropriately tuned back box should be used to maintain the widest bandwidth possible for this type of installation. When using distributed ceiling speakers, you need to use a "constant voltage" line that is typically 25 volt, or a 70.7 V system. Most "package" amplifiers come with 8 ohm, 25 V and/or 70 V terminals for easy hookup. Powered mixers, on the other hand, only have 8 ohm terminations, usually with a quarter-inch jack.

CONSTANT-VOLTAGE SYSTEMS

Therefore, to use a constant-voltage system, you would need an auto transformer on the output of the power mixer which will match the 8 ohm output with the transformer on the speaker. The transformer on the speaker transforms the 25 V or 70 V line to an 8 ohm load for the speaker. The wattage for the 8 ohm load can be selected (or tapped).

Most transformers will allow you to select between 1/4 W, 1/2 W, 1 W, 5 W, or 10 W. Every speaker can be tapped at a different wattage as long as the total wattage used does not exceed the wattage of the amplifier. For example, let's say you have a 100 W amplifier. You can tap the speaker at 10 W. Therefore, you can only use 10 speakers, but if you use two speakers tapped 5 W, you could only have the nine remaining speakers tapped at 10 W, or you could tap 100 speakers at 1 W.

Although the central cluster would be the most cost-effective and technically a better thing to do, most small churches do not have the ceiling height for it. Therefore, although it's less cost-effective, the distributed ceiling speakers will easily provide better control of the five parameters.

Digital in the Church will be the subject of next issue's column. db