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SOUND & LIGHTING

THE MICROPHONE - PART i

The prime function of a microphone is to provide a good reproduction of the original sound for the rest of the sound system. No amount of electronic modification can compensate for distortion, lack of frequency response or lack of distinction and definition caused by interference from background noise, or other instruments or speakers. You can't take a bad sound and make it better. You can however take a good sound and make it better.

A microphone is a transducer. It converts acoustical energy (soundwaves) into electrical energy (output signal). Another example of a transducer is a phono cartridge, which takes the information cut into a disc and converts it to electrical impulses. Headphones and speakers are transducers working the other way, converting electrical signal into sound waves.

Despite the fact that speaker systems are designed to accurately reproduce music, they usually sound quite different. Microphones tend to have their own sound as well. This is due to the particular characteristics of a transducer, resulting from the different methods and materials used and their varying ability to convert acoustic and electrical energy. Let's look at some of the considerations.

Frequency Response

The human ear can register sound from about 20 cycles per second to 20,000 cycles per second (20Hz to 20kHz). That's a good ear!

A totally accurate reproduction of this full range should be quite desirable. However microphones are limited in their ability to do this by restrictions of size, durability and price. On the other hand, most sound sources produce a much narrower range of frequencies, so a mic doesn't necessarily have to cover the full audible frequency range. A mic should have a frequency response wide enough to pick up the sounds that you want to reproduce.

The function of a microphone is really an interpretation of the sound from acoustical to electrical energy, so they display particular tonal characteristics of their own. The frequency response of a mic is also a measure of how a microphone affects the tonal quality of the sound it receives.

We will look further into microphone frequency response when we get to actually matching a mic to a particular instrument or voice.

Impedance

Microphones are built either Lo-Impedance (LO-Z) or Hi-Impedance (HI-Z).

In a lo-impedance microphone a 200 OHM nominal impedance is fairly standard, but anything from 100 OHMS to 2000 OHMS is considered lo-impedance.

All professional equipment is designed to operate with LO-Z signal because it can .travel through virtually unlimited lengths of cable without noise problems or suffering loss of signal level or frequency response. Isn't science wonderful!

High impedance mics were used because they have about 10 times more output than a LO-Z mic, but in cables longer than 20' there is a loss of level and high frequency response.

They are also susceptible to Hum, Crackling Noise and Radio Frequency Interference. HI-Z mics can be slightly cheaper but I wouldn't bother with them.

Directional Pattern

The relative sensitivity of a mic to sounds arriving from different directions is referred to as its pickup pattern, directional pattern or its polar response.

A polar response graph shows how the output level changes relative to the position of the sound source either directly in front of the microphone (on axis) or at various positions off axis.

DIRECTIONAL MICROPHONES pick up sound primarily from directly in front while reducing pickup from the sides and rear. They have the best rejection of sound directly behind the microphone (180° OFF AXIS). A graph of their polar response is heart shaped (Cardioid).

A directional mic focuses on a desired sound source while rejecting room acoustics, feedback and other instruments. There are variations on the cardioid pickup pattern (called Super Cardioid and Hyper-Cardioid) which are increasingly more directional, thus providing a tighter focus on the sound. We'll look at directional microphones in more depth at a later date.

An OMNI DIRECTIONAL microphone picks up sound from all directions, although they can tend to be more directional at higher frequencies, causing sound from the sides and rear to be less present than those directly in front. Omni mics can be used when feedback and leakage from other sound sources is not a problem, which is rarely the case in sound reinforcement. For recording they can recreate the ambience of a location or get a blend of a number of voices or instruments with one mic. They provide a flat, smooth response even when the source is not directly on axis. Unlike directional mics omni-directional microphones do not have a proximity effect.

Proximity Effect

The proximity effect is an increase of low frequencies as the sound source is brought closer. As you get within about two inches of most Cardioid (Directional) microphones you will notice the bass response increasing. The closer you get the bigger the bass boost. Some mics have a bass roll-off switch to help eliminate this particular colouration of the sound but the proximity effect can also be used to good advantage.

As *vice-president of Westbury Sound and president at Select Concert Products Inc., Don Barber has been studying sound* systems since *1973. He* a/so *studied theatre at Queen's University.*