Levely Sounding Audio
SETTING LEVELS

by Dave Lewty and Steve Harvey

Many worship sound system operators report that setting the correct gain structure on the mixing console is one of their single most difficult tasks. Setting the gain structure, the correct relative input and output levels through a console or the entire sound reinforcement system, is fundamental to achieving a good sound. Once the correct gain structure is set, that baseline will also make a system operator's job much easier.

Gain refers to the increase in the signal intensity of the original source. Everybody has most likely used a tape cassette recorder at some time in their lives and knows that setting the level (gain) controls correctly while recording is of the utmost importance. Set the level too low and there isn't enough signal on the tape. Turn the amplifier up when you play it back and you will also turn the noise up and hear little more than hiss. But if the level is too high, the recorded signal is distorted. Playing it back at a lower level will not improve the sound quality.

The purpose of any sound reinforcement system is to amplify a source, whether that is a single speaking voice, a group of singers, a collection of musicians, a piece of pre-recorded music, or other sound sources, and to deliver that to the listener. Each individual piece of equipment in the signal chain between the source and the loudspeaker can affect the level of the signal. That means that the mixing console, outboard effects processors, crossovers, and amplifiers (obviously) can all add to or subtract from the signal level.

Gain-EQ.jpg

To set up the console, begin by turning down all the input gain (also known as trim or input level or input sensitivity) controls and set the equalizer level controls to the 12 o'clock position.

The mixing console can almost be considered to be an audio system in itself, containing microphone preamplifiers, equalizers, and perhaps even dynamics processing. Each includes a gain stage that can amplify the signal. Then there are the input channel faders, subgroup faders, and the master faders. Again, each can add gain to the signal.

Each component part of the mixing console, and piece of audio equipment in the following signal chain, also adds noise to the system, since all electrical circuits produce some level of noise. The amount of noise depends on the circuit design, and may be negligible in the case of a digital device or may be a great deal, especially where analog gear is involved, and particularly with older or poorly maintained equipment.

If you turn everything up in your system with no signal going through it then what you hear coming out of the loudspeakers—that hiss—is the sum of the noise being introduced by everything in the signal path (the equivalent of the tape hiss we mentioned). The level of hiss that you hear is known as the noise floor. It may also include buzzes from grounding problems or other interference, but those are issues for a separate article.

At the other end of the scale, too much gain introduced by any device in the signal chain will 'clip' the signal, which means that the signal peaks are flattened by the circuit's inability to handle the level, resulting

in a distorted sound. With analog circuits a little distortion is tolerable. Digital clipping, however, just plain sounds nasty, and is to be avoided at all costs.

There is a window in which the system operates at its optimum, where the noise floor does not mask a signal that has been set too low and high-level signals do not distort. The fundamental aim when setting the gain through a mixing console is to ensure that the loudest signal passes through at a level just below clipping, while also allowing for signal peaks. That extra leeway is known as headroom.

Let's take a basic signal path, a microphone connected to the input of the mixing console, the output of which is connected to an amplifier and a loudspeaker. To set up the console, begin by turning down all the input gain (also known as trim or input level or input sensitivity) controls. Disengage the pad switches, if there are any.

Pull all the faders—inputs, subgroups, and masters—all the way down. Set the equalizer level controls to the 12 o'clock position or switch the EQ out of the signal path. Turn all of the auxiliary sends down and set the pan (also known as balance) controls to the 12 o'clock position.

On the relevant input channel, select PFL or Pre Fade Listen. This switch routes the input signal to the meter (and usually the headphone output) from before the fader, so the fader position has no effect on the signal.

The loudest level of voice or instrument that is likely to occur during the service or performance should be produced during this set up. As the person speaks, sings, or plays their instrument, adjust the channel input gain control while watching the LED or VU meter until the loudest sounds peak at between +6dB and +9dB on the meter scale. On a console outfitted with bargraph meters this zone is typically delineated by yellow LEDs. Avoid setting the level so high that the red LEDs illuminate, or the VU meter needle enters the red area, which will result in a distorted signal.

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To allow yourself some wiggle room later, back the level off slightly. By the way, note that not all models of mixing console offer the same amount of headroom. Once you are familiar with your console you will know just how much headroom you have before distortion and can setup the levels accordingly.

Repeat the procedure for each of the input sources. Remember that gain can be added at other stages in the console. If you add EQ, for example, you will need to recheck the level using PFL and the meter. Those numbers around the EQ controls refer to the dB value added or subtracted in the selected frequency range. Since maximum EQ gain is typically 15dB that will affect the signal level and may require the input gain control to be reset lower to compensate.

A mixing console typically gives its best signal-to-noise performance—where the amplitude of the signal is proportionally at its greatest compared to the amplitude of the inherent circuit noise—with the input faders at 0. This is also known as 'unity' and is often marked by a heavier line or shading next to the fader. At this position, the fader is not adding to or subtracting from the signal level.

Meters-Masters.jpg

Adjust the channel input gain control while watching the LED or VU meter until the loudest sounds peak at between +6dB and +9dB on the meter scale, a zone typically delineated by yellow LEDs.

Also, fader scales are generally logarithmic, which means that small movements at the bottom end of the fader travel will have more of an effect than higher up the scale. You also don't want to be at the top of the scale, as that will prevent you from being able to add any more level, if required.

Audio subgroups may be used to control a group of instruments or voices on one or two faders. If your console has subgroups, these faders, which receive their inputs from the group buss assignment switches on the input channels, should also be set at 0. If you find while you are mixing that they are more than a little above or below the unity position then you should adjust the input gains slightly.

An audio buss is a means of getting the audio from an input to an output of your choice. Think of an input channel as being similar to a narrow side road with dead ends. Traffic on that road, and other roads, may all need to go to the same destination. To do that, they must all join a larger road—a buss.

Pan-Faders.jpg

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Each buss links each input channel with a master channel or section that typically features an output. So, for example, subgroup assign switch #1 on each input channel routes that input signal to subgroup #1, through the subgroup fader, and to an output connector. In turn, that subgroup may also be assigned to the stereo or LCR (left/center/right) master output via another set of busses, through the master fader or faders, and out of the master output connectors.

Consoles may also include any number of auxiliary send and matrix busses, all fed by switches or level controls on each input channel or the subgroup channels.

As with the input levels, you do not want to overload the console busses and cause distortion. Maintaining a good gain structure that essentially passes the signals through at unity, as described above, will help you to achieve this. With all of the console gain stages operating properly together, and at the optimum signal-to-noise ratios, you have the key to a good sounding system. ◆

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