

Proper Console Gain Structure

And maximizing signal-to-noise ratio

By Jon Baumgartner

On a typical console, each channel strip includes a knob at the top that behaves like a volume control. Meanwhile, the fader at the bottom of the channel strip also controls volume. Why are there two controls that appear to do the same thing?

We've all heard systems that issue a fairly audible hiss in an otherwise quiet room, as well as distortion when someone speaks loudly or when a singer gets aggressive. Both of these problems are usually caused by improper gain structure at the console.

In many applications, several different types of microphones (and direct inputs) are used. At a church, for example, the pastor wears a wireless lavalier mic, the pulpit has a condenser mic, the praise team has four dynamic vocal mics, and there is one acoustic guitar pickup with no pre-amp and one electronic keyboard.

All of these devices send a different signal level to the console. The guitar pickup and the dynamic mics send a relatively weak signal. The keyboard sends a strong signal because it's a powered device. And the wireless and the pulpit mics are somewhere between the two.

A RELATED IDEA

All electronic devices have a "noise floor." Whether it's a \$50 component or a \$50,000 component, all produce a certain amount of noise.

Most manufacturers of audio equipment attempt to maximize audio signal while holding noise floor to a minimum. The difference in level is the "signal-to-noise ratio" seen on manufacturer data sheets. (Typically, a 90 dB ratio is considered to be "studio quality.")

In order to maintain a correct signal-to-noise ratio for each channel, thereby eliminating hiss and lessening

the possibility of distortion in the channel, try this:

- 1) Set the top control on the channel strip (usually called gain or trim) to the fully counter-clockwise (off) position;
- 2) Set the channel fader at the "0" position, indicated with "+" numbers above it and "-" numbers below it;
- 3) Set the master output fader at the "0" position. However, be aware that on some consoles, the master output fader has the "0" position at the top of its travel;
- 4) Have the person talking or performer address the mic the same way as during a performance or worship service. Slowly increase the gain clockwise until it is loud enough for the typical application of the system in the venue;
- 5) Shut off that channel with the channel fader, and move to the next (and the next and so on) until all channels to be used are optimized.

Depending upon the level each channel has at the input, you'll notice that the gain controls are all over the place. Some are high, some are low and some are in between.

But despite the fact that many different signal levels are now coming into the console, as soon as they all pass through their respective gain stages, they're all at the same level. Things that once were different are now all the same, hence the term "unity gain."

INPUT TO OUTPUT

A wonderful side benefit of doing this procedure is that now all channels and master faders are set to "0". The bot-





Two volume settings on each channel. The goal is unity!

tom line is that the signal-to-noise ratio is now maintained all the way through the console, from input to output.

Further, the noise floor is low, the audio signal is high, and gain settings are likely lower than they were previously. This decreases the possibility of overdriving the input.

If your input gain settings tend to be near or past the 3 o'clock position on the rotary dial, it's an indicator to turn up the system's power amplifiers. However, be careful not to overpower your loudspeakers, and lower the gain setting a bit.

If left at the higher position, a strong momentary vocal signal may push the input into distortion. Finally, if power amplifiers are already turned all the way up, use equalization to make additional adjustments.

Just keep in mind that all of the pieces of equipment in the signal path have a relationship to each other. It's important to maximize signal and headroom while minimizing noise and distortion. Starting with the proper input gain is a vital first step. ■

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Butterfly... Perfectly Simple

(*) Source: Butterfly System White Paper by Guido Nosselli

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