



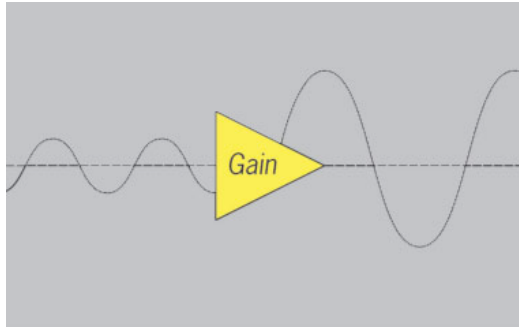
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Gain Structuring With Plug-Ins

By Daniel Keller



For those of us who toiled over faders back when the earth was still cooling, the concept of gain structure was fairly easy to grasp. Each separate box was a link in the audio chain, visibly connected via patch cables, and analog distortion was easy to hear and identify. In today's all-digital, all-in-the-box world, it's not that simple. Signal paths can be unconventional and convoluted, and digital distortion can be subtle and sneaky.

But while the dawn of the DAW has fundamentally changed the way we make records, proper gain structure is no less critical to good recording. The user-friendly, forgiving design of computer audio programs can make it all too easy to overlook a poorly-thought-out signal chain, and the results can sneak up and bite you.

Everything to Gain

From its initial capture to its place in the final mix, a signal in a typical recording chain travels through a multitude of stages or devices. Each of these devices, whether "real" hardware or software plug-ins, needs to receive an optimal signal level at its input; not enough level can add noise, while too much can cause clipping and distortion. Keeping an eye on the input and output levels of every plug-in in the

chain can ensure that each device's output feeds a clean signal to the next device's input.

Other than channel inserts, most plug-ins' input levels are controlled via the mixer's effects send, as well as the plug-in's own input level control. Matching the mixer's send level with the plug-in's input level is key to proper gain structure. Sending too low a level to the effects buss and then turning up the plug-in's input level to compensate will result in a noisier signal. Conversely, sending too hot an effects send level and then turning down the plug-in's input level will result in a distorted signal.

Generally speaking, unity gain is the goal. With some exceptions (most notably compressors and other dynamics processors), a good rule of thumb when building your gain structure is to try and achieve the same peak level whether the plug-in is inserted into the signal chain or not. If your signal level is noticeably higher or lower when you bypass the device, it's a good idea to examine your gain structure.

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If a Signal Clips in the Forest

Clipping can be particularly problematic in the digital domain. Raise the input signal to an analog device, and distortion will gradually rise until it clips. Digital circuitry has no such safety zone—a single dB too high will take your signal from clean to clipped.

Unlike analog clipping, this digital clipping can be difficult to hear, particularly when it's just one element of a dynamic mix. If the clipping goes undetected, the digital information for that sound is permanently corrupted, even if the levels are brought back down later in the mix. The distortion from digital clipping can have a subtle but undesirable effect on the sonic quality of your track, usually in the form of barely perceptible levels of a brittle, harsh digital sheen that can fatigue your listeners.

Even a relatively small bit of gain from certain plug-ins—for example, a high-pass filter—can boost peaks and transients pretty significantly. Don't depend on your meters to alert you to these, either. In most DAW setups, plug-in inserts occur pre-fader, so even if you keep the levels of your channel strips below clipping, distortion within a given plug-in may not show up if the level was brought back down further along the signal chain. Once again, your ears are your most important tools. Solo each device and listen.

What to Watch For

Needless to say, different types of signal processors will affect overall gain structure differently, and some are easier than others to work with. With a reverb like the [EMT 250 Classic Electronic Reverb](#), distortion is typically not that hard to hear. But the "soft" nature of some reverb algorithms can mask other artifacts, including noise resulting from too low an effect send level.

Multiband EQ can be particularly nefarious, especially when it comes to peaks and transients. With modern multiband EQ plug-ins like the [Neve 88RS Channel Strip](#), it's not hard to inadvertently overlap a range of frequencies in two different bands, and the cumulative boost can result in clipping.



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