

## What Are The Correct Levels To Record At?

As promised, we are going to discuss and explain recording level issues with digital sound cards for you. Let's get started:

In the old, analog days, we wanted to always record as "hot" as we could. That is, we wanted our recording meters to be as near the top of the scale as possible. Sometimes, we'd even push them above the top of the scale for a short period. The purpose of the approach was to reduce the noise inherent in tape recordings. Since all tape has some hiss, AND the amount of hiss is basically fixed, the louder our signal, the greater the difference between our good signal and the hiss.

This is called the signal to noise ratio.

In digital recordings, our noise floor (the amount of noise inherent in the system) is very low with good sound cards like the Audiophile 192 <http://www.tracertek.com/audiophile192.htm>. In fact, the noise is an unhearable -100db. So with a good digital sound device like the Audiophile series, we no longer have to be concerned with noise added when recording as a big problem. Therefore, we no longer have to insure that our signals are recorded as "hot" as they can be.

In fact, with digital recording, we don't want to even get near the top of the scale on our recording meters. The reason is that, unlike tape, digital recording is very unforgiving of signals that are too "hot". In fact, there is a strict maximum possible volume level on recording and this level is 0db. You cannot get any louder than that. If you try, you'll end up with waveforms that are squared off at the top. The signals that should be there are simply gone and they are replaced with distortion. Yuck!

The reason has to do with the nature of digital samples. The rule is that each bit in a digital sample represents 6db of volume. You can trust us that this is so. Therefore, a 16 bit sample will have a volume of 0db when it is all Ones. Remember, there are no Twos in binary, so this is as loud as we can get our recording. When a sample is all Zeros, we'll have a volume of -96db - just about totally silent.

So, for a 16-bit recording, our maximum dynamic range (the difference between the loudest and softest possible signals) is 96db - or 6db per bit.

A vinyl record however only offers a dynamic range of about 65db. Therefore we only need about 11 bits of our sample to fully represent all the possible volumes that can come off your record (11 bits X 6db = 66db). This is the reason we have no worries if our input signal levels are -14db. This is only about 3 bits of information that leaves us with 13 bits - still plenty to get every last bit of volume information from our record. This is a simplified explanation, but the bottom line is the same - the input levels on digital recordings are not really important.

One more quick point - very high quality sound cards typically don't even have a way to

adjust the input levels. Why? Because a level control would add at least some tiny amount of distortion and non-linearity to your audio and, as we've seen, it makes no difference anyway.

Don't forget, though, we DO want to adjust our gain in Diamond Cut after we have recorded it. When you have finished your restoration and enhancement, be sure to use our Gain Normalize tools. This will ensure that your audio CDs are all made with the same volume levels.

If you enjoy this type of audio theory and enjoy learning about audio, you should consider Audio: The Movie, a 2 hour journey into the world of audio that explains this complex science in an easy to understand and fun format. It also eliminates the math!

<http://www.tracertek.com/khxc/index.php?app=ccp0&ns=prodshow&ref=DVDAudio>