# The 5 Audio Principles You Gotta Know!

**When starting out (or advancing your knowledge) in Audio, it's been my experience that it's always best to know the foundations really, really well before you move onto other subjects.**
I've been very fortunate to work in the music industry for over 30 years with artists that were my childhood idols like Michael Jackson, Whitney Houston, Earth Wind & Fire, Phil Collins and Chicago but all the knowledge that I learned on the job rested upon me knowing these unchanging principles. Principles that every musician, audio engineer or music producer should know.

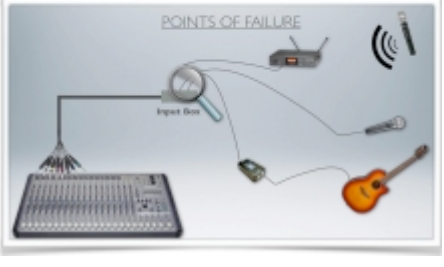
It's my hope that these short explanations will answer some questions you might have and ignite a curiosity to explore these subjects in more detail.

**Principle 1 : Know what SOUND is**
To know how to record, amplify or manipulate sound in general, we need to know exactly what sound is. How instruments and voices produce it. How we measure it in dBs. How it gets recorded, reinforced and played back through DAWs, PA systems and any other audio playback system.

**Principle 2 : Know the FREQUENCY SPECTRUM**
All sound has a fingerprint of frequency ranges that make that particular sound unique. A middle C played on many different instruments sound totally unique to them even though they may share the exact same "fundamental" frequency.

**Principle 3 : Know what DYNAMIC RANGE is**
Any modulating sound has peaks and valleys in terms of how loud they are over time. While our ears are amazingly designed instruments that capture huge ranges between quiet and loud sounds, many stages of our DAWs, Mixers and PAs all like to see audio signals controlled within a certain range.

**Principle 4 : Know what MIXERS do**
Whether you use analog or digital mixers in the real world…or virtual mixers in DAWs or other music or audio software, it's really crucial to know what mixers do. They manipulate audio in terms of levels, EQ and also send signals through aux sends, subgroups and other routing methods.




**Principle 5 : Know how to TROUBLESHOOT**
While there are many foolproof designs that make running sound in live and recorded environments very easy nowadays, nothing replaces the wisdom of a musician, audio engineer or music producer who intuitively knows how to fix a problem when it comes up. Troubleshooting is an indispensable skill.

# Principle # 1 : Know what SOUND is

**At it's core, Sound is fluctuations in sound pressure levels.**

Like ripples emanating out from a pond where a pebble has been dropped, sound is nothing more than fluctuations is sound pressure levels that reveal the character of the sound source. Sound can be described in 3 main criteria.

| | |
|---|---|
| AMPLITUDE: | How Loud (dBs SPL - Sound Pressure Level) |
| TIMBRE: | Frequency Content (hZ or KhZ and Harmonic Content) |
| ENVIRONMENT: | Environmental Refections (Echo/Reverb) |

**Audio Equipment/Software translates that sound to a waveform that can be passed along.**

Audio gear takes the raw sound and turns it into a waveform of either voltage change or a stream of digital signals that can be passed along the audio chain through microphones, cables, mixers, effects and speakers.

- A microphone takes the sound source and converts it to a voltage.
- A preamp bumps up that signal to a level that can be used by a mixer or recording software or device.
- A mixer manipulates the signal with effects, EQ and routing to get the sound you're looking for.

**Because Sound Fluctuates, we MUST know how to pass it along efficiently.**

Setting correct levels is your very first job when handling audio. Setting levels too high gives us distortion. Setting too low compromises the signal to noise levels and results in a noisy signal. Our job is to set our levels "just right" to maximize our signal without unwanted distortion.

The secret to getting crystal clear sound is optimizing the signal level as it goes through your audio gear.

**MISTAKE # 1 - Setting Levels TOO HIGH gives you DISTORTION**

Obviously if you set levels so that your meters peak, you will get distortion and once a signal is distorted it will continue that the way along your signal chain. No matter how much you turn the signal down in later gain stages it will just be a "quieter version" of the original distorted signal.

**MISTAKE # 2 - Setting Levels TOO LOW leaves you in the NOISE FLOOR**

Every signal has low level hiss/hum and junk down in what we call the noise floor. If we set our levels down near the noise floor, we will need to "bump it up" in the next gain stage bringing up the noise as well as our good signal. Even if the signal gets "corrected" in the next gain stage, the noise will still be present.

**CORRECT - Set your Levels at the OPTIMUM POINT**

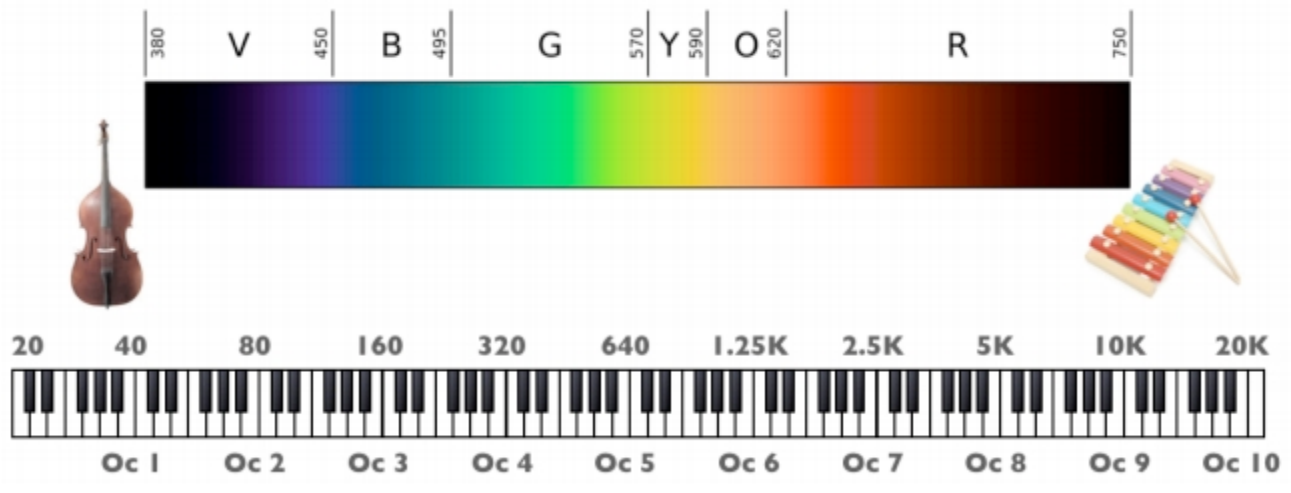
If you set your levels at the optimum point (usually around the 0 dB point on analog type meters or -12 dB FS on digital type meters), then you are placing your signal well above the noise floor to give you a good signal to noise ratio but not high enough to induce distortion.

# Principle # 2 : Know the FREQUENCY SPECTRUM

**Just like the light spectrum that goes from Blue to Red, the Audio Spectrum is made up of a variety of different frequencies that give each sound it's own "fingerprint".**

If you were to strike an A-440 tuning fork the vibrations of the tuning fork would measure at 440 times a second which we perceive as A above middle C. A higher frequency brings a higher note. A lower frequency produces a lower note.

One major thing to understand is that the pitch goes up and down an octave with each doubling or halving of frequencies. If you halve the length of playable string by placing your finger on the 12th fret, you'll double the frequency which make the pitch one octave higher. With each doubling of frequencies you'll go an octave higher. Interestingly all the harmonics and overtones of notes fundamental frequencies are MULTIPLES of that fundamental… but that will be for another lesson ;)

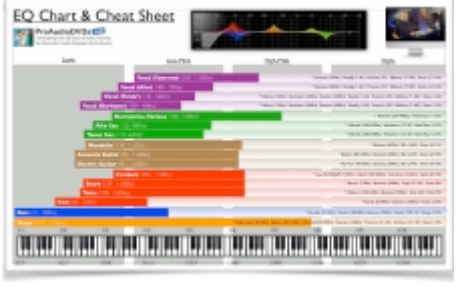



**Humans hear frequencies from about 20Hz to about 20,000hZ or 20kHz…about 10 octaves.**
Note that while the octave relationship is linear (1, 2, 3, 4), the frequency relationship is exponential (20, 40, 80, 160). It takes 9 octaves to get to 10kHz and only 1 octave to cover from 10kHz to 20kHz. Because of this, you need to know your lower numbers far more than your higher numbers in terms of Hz.

### So what do I do with all these Hz numbers?? Who cares??

Once you become familiar with where all our instruments and vocals live in the frequency spectrum, you can either accentuate the pleasing parts or hide the unflattering parts. In real life all know the parts of our bodies that we would like to accentuate or hide. We might avoid horizontal strips in our clothing to hide our tubby tummies. Women might add some eye shadow to highlight their eyes.

We do the same thing with audio. I know that scooping out some EQ at about 500Hz can take some of the "boxiness" out of a lead vocal. Adding a little 1-2kHz in a Kick drum can add some "smack" and highlight the kick drum without adding too much low end.




**Download your own EQ Chart and Cheat Sheet**

If you'd like to dial in EQ and make your tracks come alive, download my free EQ Chart and Cheat Sheet by visiting ProAudioEXP.com and looking under the Free Training section. It's perfect for framing or laminating.

You'll be able to know exactly how to EQ like a pro in no time. It's FREE!

# Principle # 3 : Know what DYNAMIC RANGE is

**If you don't understand how to control Dynamic Range, you'll never get a punchy sound.**
Dynamic Range is the difference between the quietest and loudest part of any audio signal. A tightly controlled dynamic range will result in an overall punchier sound. We control dynamic range with Compressors.


**Compressor:** An audio processing device that reduces the dynamic range of a signal or in other words reduces the difference between the softest and loudest part of the signal. The main controls are…

**Threshold:** Where the compressor kicks in and starts to reduce the gain
**Ratio:** What ratio of Gain Reduction is employed (Example - 2:1 will halve the signal above the Threshold)
**Gain:** How amped up is the resulting signal after the gain has been reduced
**Attack:** How quickly the Compression kicks in
**Release:** How quickly the Compression lets go of the signal

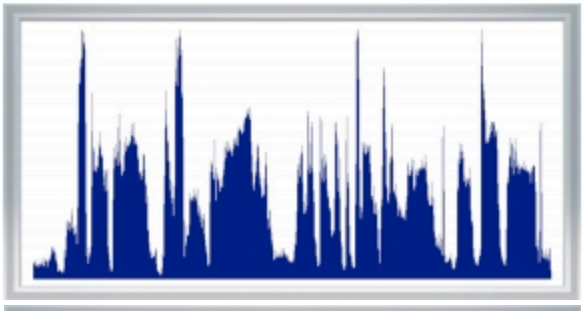


**Figure 1: Original Signal**
In this diagram, you can see the waveform of the original signal with large peaks. Clearly much of the signal is only as half as loud as the peaks. We cannot turn this up because the peaks will go into the red and we'll get distortion.

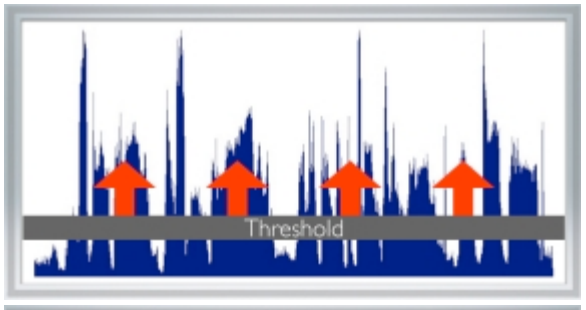



**Figure 2: Setting the Threshold**
When we lower the Threshold down onto the signal, only the peaks that stick their heads out above the Threshold will be compressed. All the other signal that does not meet the threshold will be unaffected.

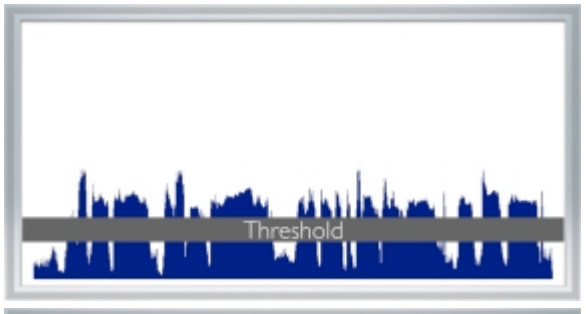



**Figure 3: Setting the Ratio**
Once the Threshold has been set, the a compression ratio is set which is expressed as a ratio. A 2:1 or two to one ratio means that any signal that exceeds the threshold will be reduced by half. For example 6 dB above the threshold will be reduced down to 3dB or a half of that level. In this example we have a 4:1 ratio. See how the peaks have been drastically reduced allowing us to amp up this "compressed" signal.

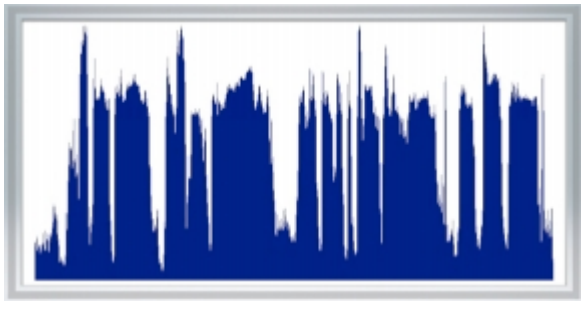


**Figure 4: Using the Makeup Gain**
Once the signal's dynamic range has been squashed, we can then "amp" up the resulting signal with the make up gain.

Note how much more "dense" the signal is versus the original signal in Figure 1. If this were a vocal, the breathiness in the lower level parts could compete with the louder passages.

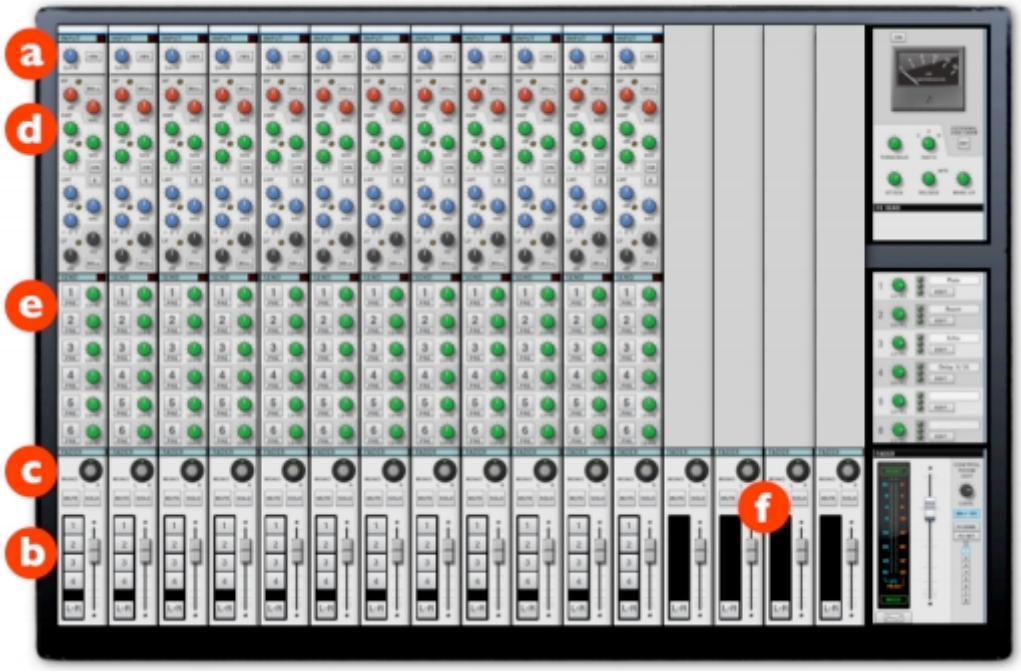
# Principle # 4 : Know what MIXERS do

**Mixers are COOL things. Mixers are INTIMIDATING things. (check one)** 😜

I remember the first time I saw a mixing console at my big brothers' gig. There is a 10 year span between me (the baby) and my older 2 brothers. They were in bands when I grew up so as a young boy I would look at the cool mixing consoles and I be drawn to them and also super intimidated by them. How could ANYONE understand how to use that complicated thing that looks like the cockpit of a 747??

**Mixers basically do 4 things. Once you know how to do them…you'll know any mixer.**

Yes…I admit that when I work with a new mixer I can still get a little overwhelmed. However…once I take a deep breath and simply survey where these 4 things are on this new mixer, I'm good to go. Mixers simply take multiple inputs (kick drum mic, snare drum mic, bass DI box, guitar amp mic, keyboards, vocal mics) and blend their levels, adjust their EQ, add some effects and route their signals to speakers or recording tracks. Let's take a look.




## #1. THEY BLEND LEVELS

Mixers take all the inputs and using the **Gain** **(a)** boost up or pad down the incoming signal for a microphone, line or DI box, then use **Faders** **(b)** and **PanPots** **(c)** to blend all the instruments and vocals together.

## #2. THEY EQ

They use their **EQ Controls** **(d)** to boost or cut specific frequency ranges to either accentuate pleasing parts of the sound source or hide unflattering parts of the sound source.

## #3. THEY USE AUX SENDS

**Aux Sends** **(e)** are a way to siphon off varying portions of any channel to feed either effects like reverb or delays or to feed monitoring systems like in ear monitors or on stage monitors so performers can hear themselves.

## #4. THEY ROUTE SIGNALS

Using **Subgroups** **(f)**, they can sum together a group of channels to come up under a single subgroup channel. They can also route signals to separate outputs on the back of the mixer to feed other things like recording devices, alternate speaker systems that feed other rooms or any other application where you want to route your signals.

# Where to go from here…

**I hope these short lessons have ignited a curiosity that leads you to more learning.**

I have been curious about audio ever since I used to look over the shoulder of my brothers' and tinkered with their band equipment and synthesizers. I've always known that you can be a musician without diving too deep into audio but some knowledge in this area sure makes the whole experience more enjoyable.

- Knowing about EQ helps you master your guitar tone with your amp and pedals
- Nailing down signal levels keeps your recorded sounds and live sound super clean
- Understanding dynamics helps any vocalist cut through a crowded mix
- Learning how to use mixers will help you communicate better with any sound guy who's working with your band
- Mastering troubleshooting will save you hours in any situation where stuff goes wrong

**I have a number of FREE Courses on Recording, Live Sound, EQ and many other subjects.**
I've been teaching hundreds of thousands of musicians, audio engineers and music producers over the last 20 plus years and we have millions of YouTube views. All that to say, I'd love to be a part of your ongoing lifelong learning on these subjects. If you want to learn more simply go to ProAudioEXP.com and click on the **FREE Training link**.

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I hope you have enjoyed this report and that it benefits you in making great music.

The information presented in these courses are a GOLD MINE. If you're serious about honing your skill when it comes to audio engineering, don't pass up this opportunity, they are worth every penny!

Johnathon Oden…La Grange, CA





David has a true gift for teaching. He takes all the mystery out of otherwise complicated stuff and allows you to start really enjoying what you're doing right away.

Edward Bilotto…Belle Mead, NJ