Principles of Equalization

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Equalization: overview
An equalizer, in its broad description, allows you to boost or cut the volume of specified frequencies. During the mix, equalization can be effectively used in different ways to correct problems that were created during the recording session or from incompatibility among instruments. Equalization can also be used in a creative way in order to produce original effects.

No matter which way you are going to use an equalizer, there are few notions and concepts that you should know before beginning an equalization session. First, equalizers are generally used as inserts on the channel and not as auxiliary sends. Next, you have to be familiar with the most used types of equalizers in a digital audio workstation setting. Among the several types of equalizers available nowadays there are five main categories that have proven to be the most useful in a mixing situation: peak, high shelf, low shelf, high pass and low pass. Table 1 is a list of each equalizer's description, parameters and common uses. In Figure 1 you can see the symbols with which they are usually indicated.

Type of Equalizer	Description and parameters	Typical uses
Peak	It allows you to cut or boost frequencies around the center frequency. **Center frequency:** it determines the frequency to cut or boost **Gain:** positive gain boosts, negative gain cuts **Q point:** it determines the "shape of the bell" or how wide the area around the cutoff point is going to be: the lower the value the larger the bell and vice versa the higher the value the smaller the bell. The Q parameter can usually (but not always) vary from a value of 0.7 (equal to a 2 octaves frequency range) to a 2.8 (1/2 octave)	A Peak Eq. is extremely versatile. It can be used to pinpoint and cut/boost a very precise frequency or it can be used in a broader way to correct wider acoustic problems. It is usually utilized in the middle of the frequency range.
High Shelf	It cuts or boosts the frequency at the cutoff and all the frequencies higher than the set cutoff point. It has only two parameters: the cutoff frequency and the gain	It is usually used in the mid-high and high end of the spectrum. It can be effectively used to brighten up a track by using a positive gain of 3 or 4 dB and a cutoff frequency of 10 kHz and higher (be careful because this setting can increase the overall noisiness of the track). It can also be used to reduce the noise of a track by reducing by 3 or 4 dB frequencies around 15 kHz and higher
Low Shelf	It cuts or boosts the frequency at the cutoff and all the frequencies lower than the set cutoff point. It has only two parameters: the cutoff frequency and the gain	It is usually used in the low-mid and low range of the audible spectrum to reduce some of the rumble noise caused by microphone stands and other low end sources

Type of Equalizer	Description and parameters	Typical uses
High Pass	It cuts all the frequencies below the cutoff point. It has only one parameter which is the cutoff frequency.	It is a very drastic filter. It is often used to cut very low rumble noises below 60 Hz
Low Pass	It cuts all the frequencies above the cutoff point. It has only one parameter which is the cutoff frequency.	It is a very drastic filter. It is often used to cut very high hiss noises above 18 kHz. Use with caution in order to avoid cutting too much high end of the track.

Table 1: Characteristics and parameters of the most common types of equalizer

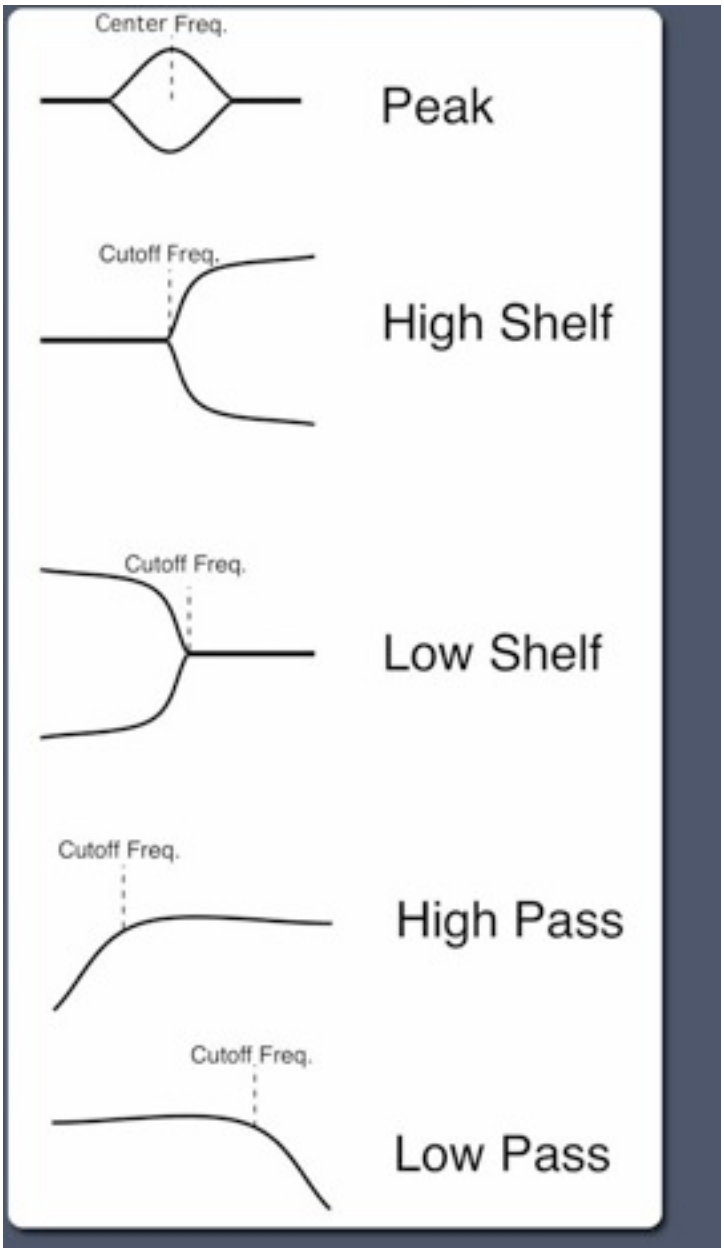

Fig. 1: Conventional symbols for most common types of equalizers

Think First
Remember that equalization is a problem-solving procedure. This means that there's no point in playing around with the settings if you don't know what you want to achieve and how the final result should sound. A good approach to equalization is to listen carefully to the soloed track and come up with a list of things you might want to improve or correct. If you are using a parametric EQ, the next step is to bring up the gain and sweep across the frequency range until you find the frequency range you want to cut or boost. After that, boost or cut as desired.

Keep in mind that when equalizing you will have to make small adjustments every time you add tracks to the mix since the frequencies and respective ranges of the other instruments affect the way an instrument sounds. The most important concept here is to be able to emphasize the characteristic frequencies of the track you are working on and eliminate frequencies that do not enhance its sonic features in any particular way. In fact, you should be able to "carve" a small niche inside the audible range for each instrument and section so that it is clearly intelligible and not masked by other instruments. If the mix sounds muddy and cluttered you should start trying to focus on which instruments contribute to the clutter. Try to use the equalizer to add clarity by gently shifting the center of each instrument involved so that they do not overlap with each other. As a general rule it is always better to cut than to boost, mainly because the human ear is more used to a reduction than to an augmentation in intensity of frequencies.

While it is hard to generalize, there are a few common settings that are useful to use as a starting point during an equalization session. I summed them up in Table 2.

Frequencies	Application	Comments
20-60 Hz	- Cut to reduce rumble and noises related to electric interferences	It is a good idea to always reduce by 4 to 6 dB this area in order to lower the low frequencies noise
60-80 Hz	- Boost to add fullness to low frequency instruments such as bass and bass drums	
100-200 Hz	- Boost to add fullness to guitars, French horns, trombones, piano, snares - Cut to reduce "boomy" effect on mid-range instruments	This frequency range effectively controls the powerful low-end of a mix
200-300 Hz	- Cut to reduce low and unwanted resonances on cymbals - Boost to add fullness to vocal tracks	Be careful not to boost too much of this frequency range in order to avoid adding muddiness to the mix
400-600 Hz	- Cut to reduce unnatural "boxy" sound on drums - Boost to add presence and clarity to bass	This frequency range can also be effective to boost the low range of the guitar
1.4-1.5 kHz	- Boost for intelligibility of bass and piano	
2.8-3 kHz	- Boost to add clarity to bass - Boost to add attack and punch to guitars	This range can also be used effectively to add clarity on vocal parts

Frequencies	Application	Comments
5-6 kHz	- Boost for vocal presence - Boost for attack on piano, guitars and drums	A general mid-range frequency area to add presence and attack
7.5-9 kHz	- Cut to avoid sibilance on vocal and voice - Boost to add attack on percussions - Boost to add clarity, breath and sharpness to synthesizers, piano and guitars	A mid-high range area that controls the clarity and the attack of the mid-high range instruments
10-11 kHz	- Boost to increase sharpness on cymbals - Boost to add sharpness on piano and guitars - Cut to darken piano, guitars, drums and percussions	High range section that affects clarity and sharpness
14-15 kHz	- Cut to reduce sharpness on cymbals, piano and guitars - Boost to add brightness on vocals - Boost to add real ambience to synthesized and sampled patches	
18 kHz	- Cut to reduce hiss noise - Boost to add clarity to overall mix	A delicate high range section that should require drastic positive or negative gain settings only in extreme situations

Table 2: General frequency ranges and their features used in an equalization session

EQ Rules of Thumb

When equalizing you must pay attention to some of the most common mistakes that sometimes even the seasoned engineer makes. First of all try always to keep your equalization gain parameter at a reasonable level. As a general rule, avoid cutting or boosting by more than 6 dB unless absolutely necessary. If for some reason you see that some of your EQ settings go over this limit try to question why and see if there is a better solution to the problem. The same can be said for situations where you end up boosting (or cutting) several frequencies at the same time that have the only effect of raising (or lowering) the overall volume of the track without really affecting its sonic content. In this case try to bypass the equalizer and experiment with volume changes instead.

You will be surprised how much a small amount of equalization can change, and hopefully improve your mix. Try to hear the sound in your head that you want to achieve through equalization and avoid playing around with the parameters trying to "find" the perfect sound. Leave luck for Las Vegas!

To learn more about Andrea Pejrolo visit www.geocities.com/pejobass.