

Equalization

After completing this lesson, the student should be familiar with the following concepts:

- High and low frequencies are present in common acoustic sounds.
- There are several specific differences between Graphic EQ and Shelving EQ.
- EQ is used to shape sounds in the studio. This can allow different sounds to blend together more effectively, or it can be used to create various effects.

Glossary for this Lesson:

Band- A range of frequencies.

Bass - Bass sounds are low frequency sounds (usually 250 Hz or lower). Bass is also the usual designation for the lowest band of a shelving EQ unit which affects bass-range frequencies.

EQ- An abbreviation for Equalization.

Equalization- The process of attenuating or amplifying specific ranges of audible frequencies (bands). An EQ unit uses filters to enact this change. By boosting or cutting the amplitude of various bands of the audible spectrum, it is possible to change the tone of a signal. One mundane example of equalization are the tone controls (treble and bass) found on all modern car stereo systems.

Graphic EQ- A type of equalization which allows the user to boost or cut various preset bands of frequencies using small faders which are arranged in a parallel fashion. Each fader controls a filter which amplifies or attenuates a particular band. Graphic EQ typically allows control over 5-9 bands, but larger units feature between 21 and 40 bands. Graphic EQ is sometimes found on larger home stereo tuners.

Hi- A designation given to a shelving equalizer's highest band. This is another name for the treble control. Professional gear tends to use the label 'hi' rather than 'treble,' which is usually found only on consumer electronics.

Lo- A designation given to a shelving equalizer's lowest band. This is another name for the bass control. Professional gear tends to use the label 'Lo' rather than 'bass,' which is usually found only on consumer electronics.

Mid- A designation given to a shelving equalizer's middle band. This band usually centers around 700 Hz to 2.5 kHz depending upon the manufacturer.

Shelving EQ- A type of equalization which allows the user to boost or cut various preset bands of frequencies using knobs. Although very similar in function to graphic EQ, shelving EQ typically provides fewer bands than graphic EQ. Shelving EQ usually provides only three bands at most: (Hi, Mid and Low).

Treble- Treble sounds are high frequency sounds (usually 8 kHz or higher). Treble is also the usual designation for the highest band of a shelving EQ unit.

Equalization

In the last lesson, we learned how to turn sound waves into an electric signal using a microphone. It is important to get sounds into this electrical form because we can do many different things to sounds once they are in this form. One of the most basic ways we can change the sound is through the use of **equalization**, or **EQ**.

HIGH SOUNDS, LOW SOUNDS

On a piano, you can clearly see that there are high (treble) sounds and low (bass) sounds. The keys farther to the right are high sounds, while the keys to the left are low sounds. What you might not know is that there are some high sounds mixed into the low sounds, and there are some low sounds mixed into the high sounds.

In almost any sound, there are high sounds and low sounds. Sometimes, the high sounds are just a lot quieter than the low sounds, so we don't hear them as much.

Sometimes, the low sounds are quieter than the high sounds, and we don't hear the low sounds as much. They are still there, however. We can use EQ to change the volume of the high, middle, and low sounds in any sound. This changes the way the sound sounds to us.

Equalizers come in many shapes and sizes, they might be a narrow black box with a bunch of knobs or faders (you can see one such EQ unit in the middle of this page), or equalizers can be built into another device, such as a boom box, car radio, or a mixer. The simplest kind of EQ might just be a single knob on a boom box that says "tone." On car radios, you frequently see two knobs or sliders: one that says "**bass**" (for adjusting the volume of low sounds) and one that says "**treble**" (for adjusting the volume of high sounds). These controls allow you to change the balance of high and low sounds.

PUT IT ON THE SHELF

EQ that has knobs like these is called **shelving EQ**. In shelving EQ, each knob allows you to adjust the volume level of a specific range of sounds. We call a range of sounds a **band**. You can turn the volume of the high sounds up or down, and you can turn the volume of the low sounds up or down.

When a knob is set to the middle, it has no effect on the sound. When you turn the volume of the bass up, the sound becomes more deep and full, but it can get muddy if you turn it up too high. If you turn the bass down, the sound becomes clearer, but it can start to sound thin if you turn it down too far. When you turn the treble up, the sound becomes more detailed, but it can get harsh if you turn the treble up too far. When you turn the treble down, the sound becomes more mellow, but it can sound dull if you turn it too far down.

Although the controls are called "treble" and

"bass" on car radios, we will



refer to them as "**Hi**" and "**Low**," because this is how they are labeled on most EQ units. Each knob represents one band of sounds whose volume you can adjust. If an equalizer has two tone controls (hi and low), it is called 2-band EQ. Another control many EQ units have is a mid control. The **mid** control allows you to adjust the volume of the middle sounds. (Sounds between high and low.) EQ that has hi, mid, and low controls is referred to as 3-band EQ.

GETTING GRAPHIC

There is another kind of EQ which is sometimes found on home stereos and in recording studios. It is called **graphic EQ**. Graphic EQ usually uses faders instead of knobs to set the volume levels of the different bands. Graphic EQ usually has a lot more bands than shelving EQ units. The number varies from unit to unit, but graphic EQ usually of-

fers at least nine bands. Larger units offer as many as 40 bands!

The faders towards the left side of the graphic EQ unit adjust the volume of the low sounds, while

the faders near the right side adjust the volume of the higher sounds. The farther left you go,

the lower the sounds you adjust, and the farther right you go, the higher the sounds you adjust. When the faders are set in the middle, they have no effect on the sound. When they are raised higher than the middle, they start to increase the volume of some of the sound (the high parts or the low parts), and when the faders are lowered, they reduce the volume of the same part of sound.

Graphic EQ units like the one shown near the top of this page usually have numbers under or above each fader to tell you exactly what part of sound (high or low) you will be adjusting. Lower numbers are for lower sounds, and higher numbers are for higher sounds.

How Is EQ Used?

In a studio, EQ is used on different sounds to make them work better together. For instance, we might turn up the lowest bass sounds in a bass gui-

tar part to make it sound fuller and deeper. We might take some of the bass sounds out of person's voice to make it clearer and easier to hear.

By shaping sounds with EQ, we can actu-

ally make different sounds blend together better. Using EQ effectively is a fine art and takes many years and hundreds of hours of practice to master.

We can also use EQ to create effects. If we want to simulate the way a person's voice sounds over a telephone, we could turn down the Lo control on our EQ until very few low sounds were left. If we want to make someone's voice very piercing and difficult to listen to, we could turn up the mid and hi controls while turning down the bass. Using similar tricks, we can also simulate the sound of a small, cheap, clock radio by turning the Hi and Lo controls down all the way and turning the Mid control up all the way.

The key to learning to use EQ effectively is to experiment with it a lot and compare your results with the work of the music industry's top engineers. If you can get as good a sound as they do, you are really on your way!



Experiments:

1. Look at your family's car radio and see if you can figure out where the treble and bass controls are. Find out what happens if you move them while the radio is on. (Make sure you ask your parent's permission first!)

2. Your teacher will help you to route some music through a computer's equalizer. Try changing the levels of the hi and lo bands. What do you hear?

3. Using a very low pitched sound, trying turning the treble band up and down. What do you hear?

4. Using the very high sound, try turning the bass band up and down. What do you hear now?

5. Can you use EQ to create some of the effects discussed above?

6. Do you see anything that looks like an equalizer built into a mixer?

Words to Know:

Can you tell your parents what each of these words means?

| | |
|--------------|-------------|
| Band | Lo |
| Bass | Mid |
| EQ | Shelving EQ |
| Equalization | Treble |
| Graphic EQ | |
| Hi | |

Let's Review

1. What does an equalizer do?
2. What are the two kinds of equalizers we learned about?
3. What do the treble and bass controls do?
4. How many bands does graphic EQ have?
5. How do we use EQ in a recording studio?
6. Are there high, middle, and low sounds in almost every sound?
7. What are bands?

DID YOU KNOW?

A filter is the part of an equalizer that actually divides up the sound into hi, mid, and lo bands (or into many different bands on graphic EQ). A filter is also one of the parts of a synthesizer. On equalizers, we set the filters in one place and then leave them, but the filter on a synthesizer is always changing. It is the part of a synthesizer that gives the instrument its distinctive sound.

Inventor Robert A. Moog created the first filter specifically designed for a modern synthesizer in the early 1960's, but people have been using filters of one kind or another in studios since the 1930's!

Student Tips!

Ask questions! Ask *lots* of questions! Think about new ways you could use mixers, speakers, microphones, and equalizers. Some of the coolest machines used in the studio today are the result of someone thinking of a new way to use things!

On the Web:

If you would like to see pictures of some real equalizers or read more about them, check out the following sites online:

<http://www.dod.com>
<http://www.rane.com>
<http://www.appliedresearchandtechnology.com>
<http://www.alesis.com>
<http://www.rolandus.com>
<http://www.waves.com>
<http://www.MOTU.com>
<http://www.summitaudio.com>
<http://www.msv.nl/tubetech.html>
<http://www.DUY.com>
<http://www.mercenary.com/eqs.html>