!feature

FILTERS—MOLDING YOUR SOUND WITH EQ

BY NORMAN WEINBERG

BEFORE THE MIDI REVOLUTION AND THE advent of the One-Human-Studio, "Pump up da volume and gimme more bass!" was all that most drummers needed to know about sound equalization (better known as EQ). Today, it's hard to find a working drummer who doesn't use EQ in some manner. Whether it's live on stage or in the studio, filters are the number one tool for controlling and modifying the timbre of an electronic musical signal.

Before diving right into filters, let's look at a few basic concepts about sounds and the terms used to describe them.

Pitch—A sound's pitch is its frequency, and the human ear is capable of hearing frequencies ranging from about 20 to 20,000 cycles per second. The term "cycles per second" is often referred to as "Hertz", and the abbreviation "kHz" is used in place of "thousand cycles per second".

Volume—The amplitude of a sound is measured in "dB", an abbreviation for decibel. This is a logarithmic measurement of loudness and, without getting too technical, a change of +6dB will make a sound appear twice as loud. A change of -6dB will cause a sound to seem twice as soft.

Timbre—Timbre (rhymes with amber) is a term that describes a sound's color or identity. The timbre of a trombone is very different from the timbre of a snare drum. The difference is created by the interaction of frequency and amplitude over a period of time. In Ex. 1, we see this relationship in a three-dimensional graph. Notice how the cymbal contains a wide range of frequencies due to its "unfocused" character. The wood block has a very narrow band of frequencies and a much faster decay.

Filter Types

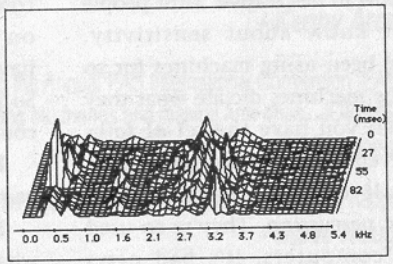
Filters perform their magic by letting certain audio frequencies pass through unaffected, while other frequencies are increased or suppressed. Let's get right to it and see how the different types of filters operate.

Lowpass Filter—As might be expected, the lowpass filter allows the lower audio frequencies to pass through the filter unaffected, while suppressing higher frequencies. On any lowpass filter more sophisticated than a car radio's tone-control knob, the upper frequency limit will be adjustable. This is called the "cutoff frequency", and is defined as the point at which the sound is 71 percent of its maximum value. That's why frequencies near the cutoff point are affected to a minor degree. Ex. 2 shows a graphic representation of a lowpass filter with a 3kHz cutoff.

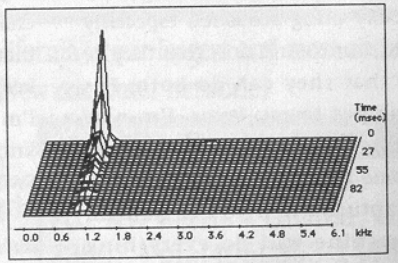
Highpass Filter—The highpass filter is just the opposite. A filter of this type lets signals of high frequency pass through, but attenuates low frequency information. Ex. 2 shows a highpass filter with a 3kHz cutoff.

Low Shelf Filter—A low shelf filter is closely related to a highpass filter. In this type of filter, the high frequencies are passed, but the low frequencies

Ex. 1

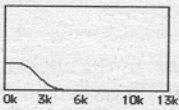


Analysis of the frequency content of a crash cymbal struck with a soft mallet.

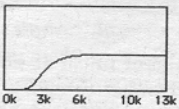


Analysis of the frequency content of a wood block struck with a hard mallet.

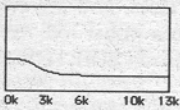
Ex. 2



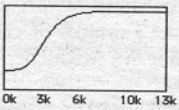
Low Pass Filter
Cutoff Frequency= 3000Hz



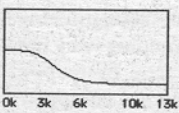
High Pass Filter
Cutoff Frequency= 3000Hz



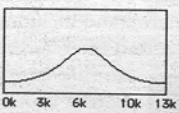
Low Shelf Filter
Cutoff Frequency= 3000Hz
Boost = +3 dB



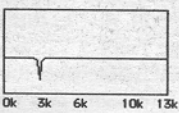
Low Shelf Filter
Cutoff Frequency= 3000Hz
Boost = –6 dB



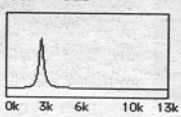
High Shelf Filter
Corner Frequency= 5000Hz
Cut = –6dB



Bandpass Filter
Center Frequency= 7000Hz
Bandwidth = 5000Hz
Cut = –6dB



Notch Filter
Center Frequency= 3000Hz
Bandwidth = 100Hz
Cut = –6dB



Peak Filter
Center Frequency= 3000Hz
Bandwidth = 500Hz
Cut = +8dB

are "shelved." If the shelf filter uses a frequency boost, then all frequencies below the "corner frequency" will be boosted by the same amount. If a shelf filter uses a cut, then they will be attenuated by the same amount. Check Ex. 2 for displays of two different low shelf filters.

High Shelf Filter—The mirror image of the low shelf filter. Low frequencies are passes and higher frequencies are shelved either as a boost or cut.

Bandpass Filter—The bandpass filter passes frequencies within a certain range and attenuates all others. Bandpass filters use two additional terms that decibel their action. The "center frequency" is the point in the middle, and the "bandwidth" is the range on either side of the center frequency. If you look at Ex. 2, you'll see how these two elements affect the sound.

Notch Filter—The notch filter is a type of narrow-band filter that attenuates certain frequencies. Again, the notch is specified by a center frequency and a bandwidth.

Peak Filter—Peak filters are the opposite of notch filters. Instead of cutting a narrow range of frequencies, a peak filter will boost them and make them stronger.

Graphic Equalizers—Graphic equalizers are becoming very popular in home studios. They offer a wide range of flexibility by combining several peak/notch filters into a single case. Each filter has a specific center frequency and a very narrow bandwidth. Since our ears can hear a range of approximately ten octaves, a ten-band equalizer will have ten sliders or knobs, and each slider would be in charge of boosting or cutting a specific octave of sounds. A 1/3 octave equalizer will have 30 sliders, each covering about four notes of the musical scale.

Parametric Equalizers—In a parametric equalizer, each of the parameters (amount of boost or cut, center frequency, and bandwidth) is adjustable. Parametrics are flexible, as they can be made to duplicate the effect of many different types of filters.

EQ can add "punch" to your bass drum and "sizzle" to your cymbals. Next time, we'll add some EQ to different types of drum and percussion sounds and see how they are affected.

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