Audio Compression

A talk / lecture by
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Audio Compression

Dynamic Processors

Dynamic signal processing affects the dynamic range of an audio signal (amplitude), reducing or increasing the difference between positive and negative peaks. This process is very important for any audio and music production (music, theatre, film, games, etc).
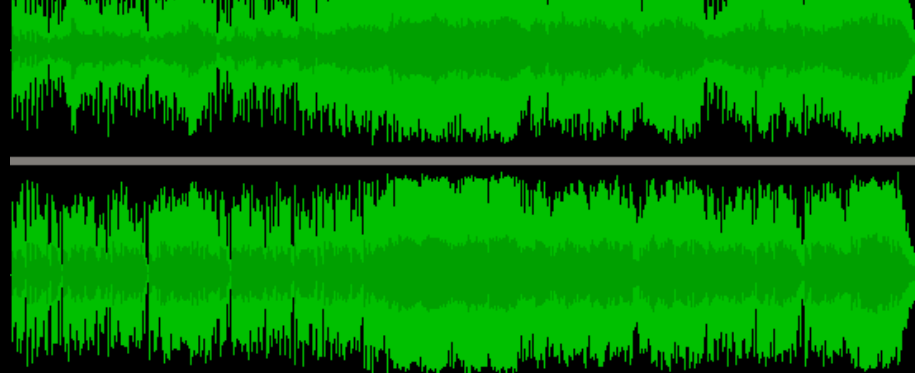
Dynamic processors are arranged in the following categories:

- Compressors
- Limiters
- Expanders
- Noise Gates

1983
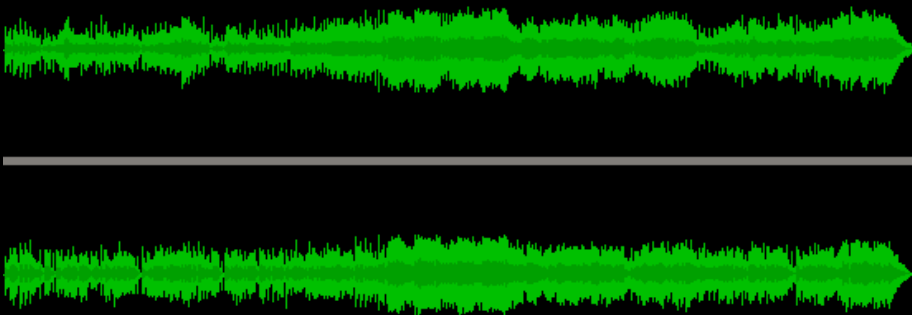
2000

Here you can see the difference between dynamic processing of
older and newer studio productions

Audio Compression

Compressors are used to automatically reduce the dynamic range of the signal when its intensity exceeds a certain threshold. The range of the dynamic processing as also the compression ratio, is set by the user. The higher the compression ratio, the more reduced the signal (measured in dB).
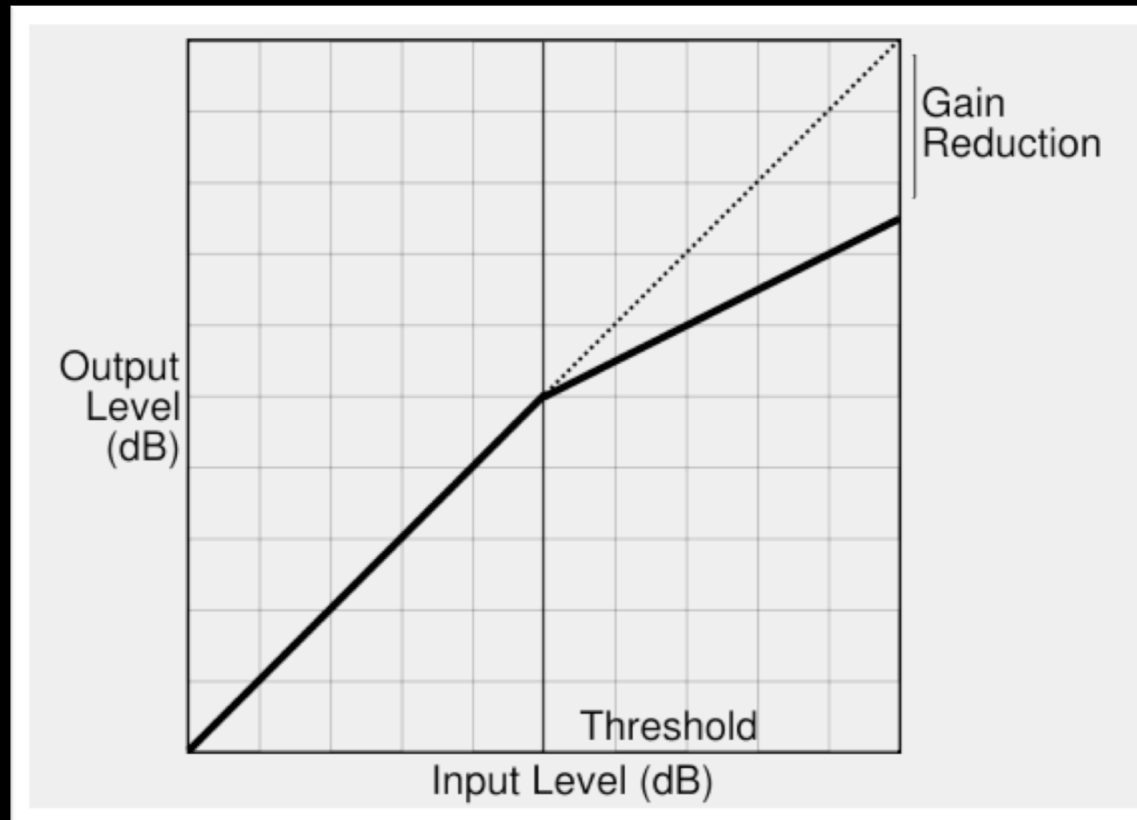
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For a better compression control there are also settings for the attack and release of the compression. The attack defines the time in msec that the processor starts compressing the incoming signal once it exceeds threshold, and release defines the time in msec that the signal will cease to be compressed and return to its normal state with the provision that it is below the compression threshold.

Input Gain

Output Gain

Threshold

Attack

Ratio

Release

Audio Compression

Dynamic compression is used in cases where the intensity/volume is problematic, and in particular it is used mainly in the following cases:

- Maximize intensity (without distortion)

- Avoid masking-effect

- Reduce or eliminate peaks

- Speaker protection

Dynamic compression helps to maximize sound quality by removing a significant portion of noise that exists in a signal, and also it helps to avoid distortion or clipping.

Also, it is used to correct masking-effect between overlapping frequency ranges of different sources, adjusting their acoustic spectra and making the sound more smooth and balanced.

Compression will enhance the overall volume level – something very important in all modern productions. The compression ratio that is normally used in mastering is 2:1 or 3:1.

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In the above picture the sound is not compressed, and it shows the great different between lower and maximum levels.

In the middle picture the sound has been compressed with a 3:1 ration, and it is noticeable that the differences between peaks and main sound body is getting closer together.

In the last photo there is a really strong compression (9:1 ratio), and the dynamic differences are almost non-existent.
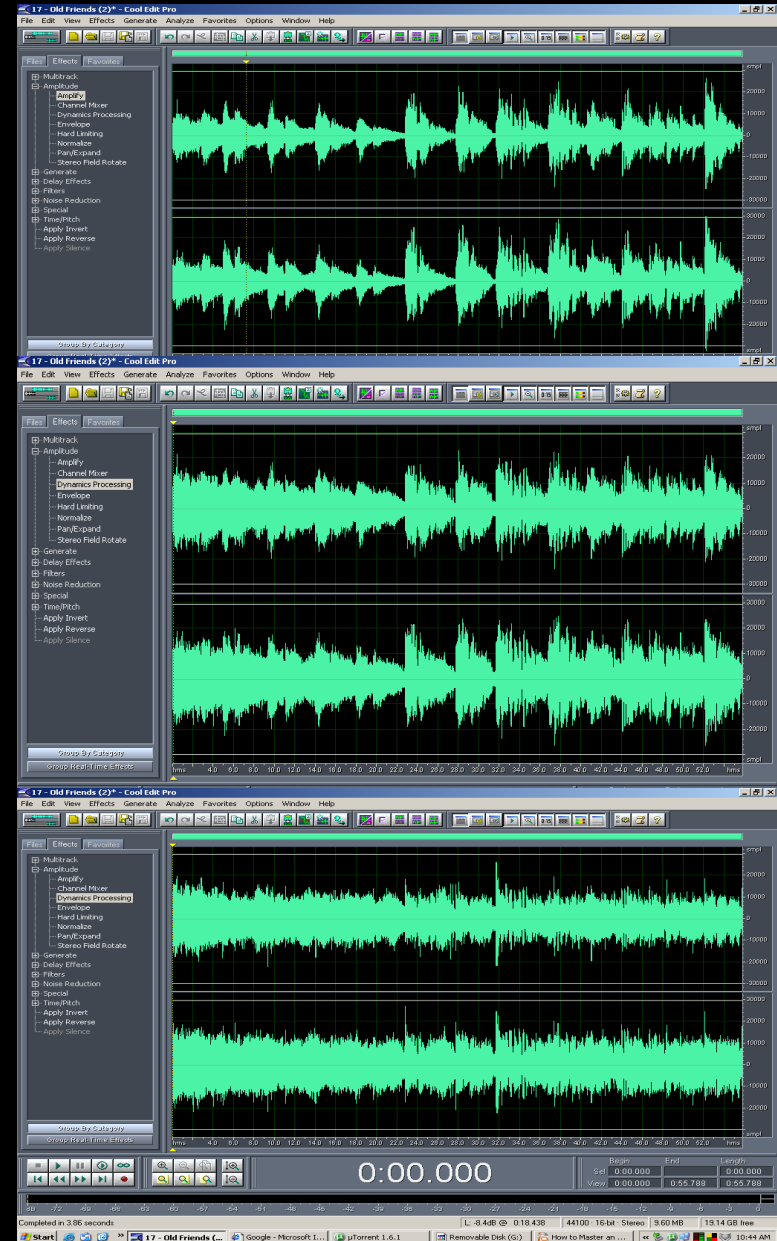
Audio Compression

	Attack	Release	Threshold	Ratio	Knee
Full Track	Fastest Possible	Fastest Possible or Auto	-5dB to -9dB	2:1 to 3:1	Soft
Drums	5 ms	10ms to Auto	-15dB	5:1 to 8:1	Hard
Synth Bass	4ms to 10ms	10ms	-4dB to 8dB	4:1	Hard
Real Bass	4ms to 10ms	10ms	-2dB to -10dB	8:1	Hard
Vocals	Fastest Possible	Lowest Possible or Auto	-3dB to 8dB	4:1 to 12:1	Soft
Brass Instruments	Fastest Possible	Fastest Possible or Auto	-10dB to 14dB	2:1 to 8:1	Hard to Soft
Guitar	Fastest Possible	Fastest Possible or Auto	-10dB to 14dB	2:1 to 8:1	Hard to Soft

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Limiting is a form of dynamic compression that reduces input volume with a very high compression ratio. Limiter is like a very powerful compressor, as it operates at compression ratios of 10:1. This means that once the signal passes the limit threshold, the intensity remains exactly at that level, no matter how strong it comes in the input. This prevents the increase of volume beyond this level, avoiding clipping and distortion.
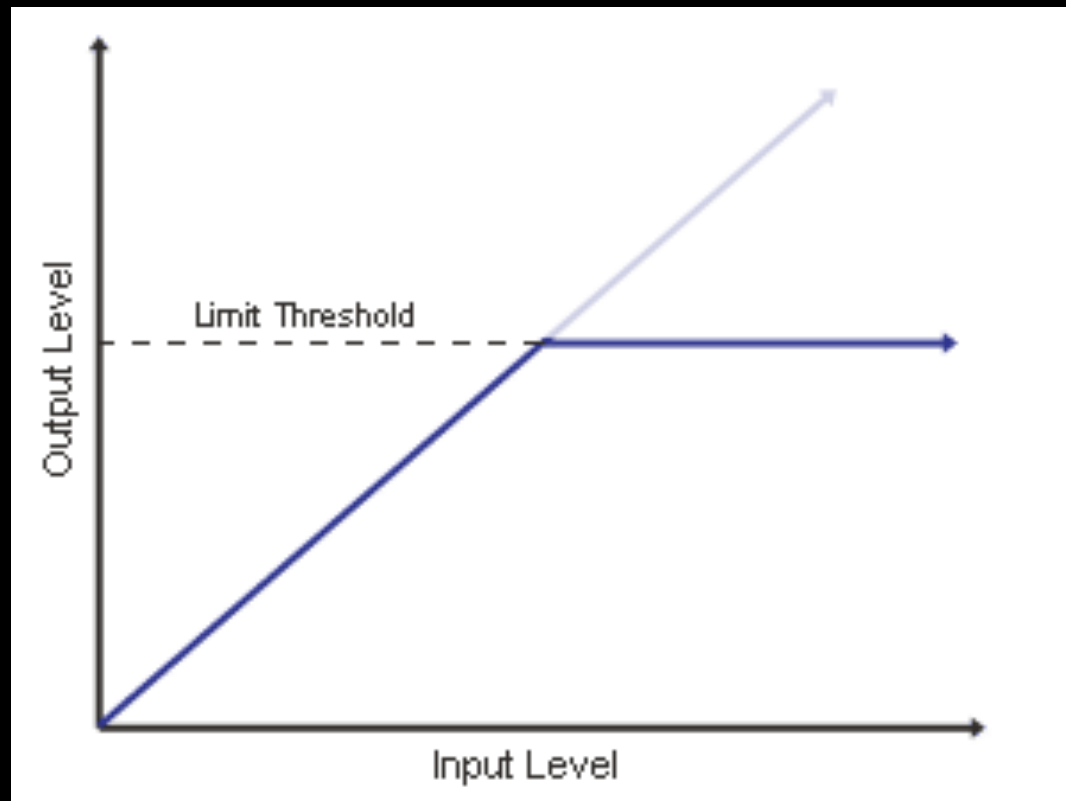
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Despite the significant processing properties that is offered by the limiter, great care is needed to regulate it, as it may create unwanted sound effects such as clicks or distortion. Also, it needs to be used carefully in large and sudden volume cuts.

Limiting is mostly used to control the master mix, and it allows to strengthen the whole sound without causing any clippings. Compessors and limiters are temporal processors, which means that they affect intensity and time axes, and they can also be used to create rhythmic effects. Sudden attack and release settings can cause a desired vibration effect.

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The opposite processor of the compressor is the expander. Expander helps to enhance the dynamic range of the sound, and more specifically to increase the difference between negative and positive peaks. Expander is an amplifier whose output level is reduced to a predetermined gain when the input signal falls below an intensity threshold.
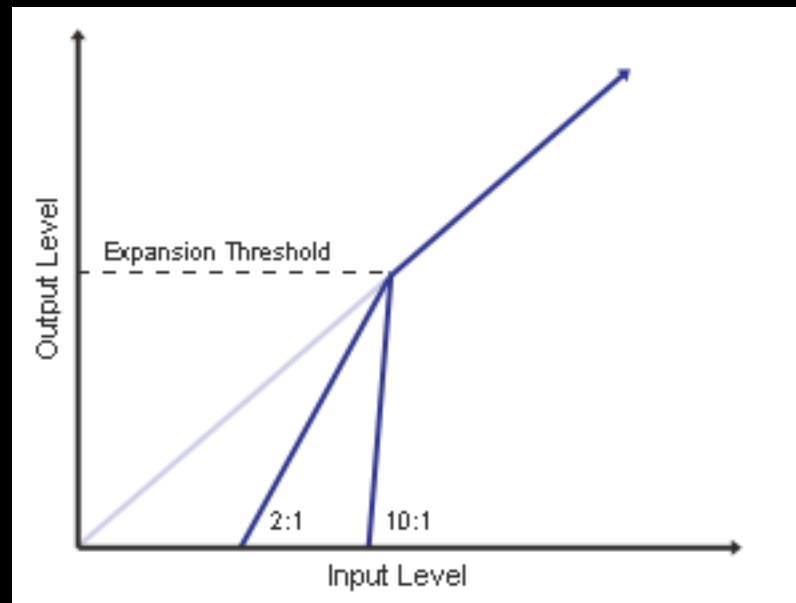

In other words, expander reduces the incoming sound from the point of threshold, thereby reducing the intensity of the specific point and below. For example, we use expanding during recording drums, eliminating sounds that may be created from another source. An expander normally has two more adjustments for the range of the intensity that we want to reduce, and the slope, which is the reduction in linear or logarithmic scale.

Audio Compression

As we said before limiting works like an extreme compressor, and in the same sense in the case of extreme expansion we have another processor called Noise Gate. This works with a ratio of 1:10 and above, and it is used to automatically shut down all sound activity. This is helpful if we want to reduce all noise activity in specific parts, or even isolate sounds that we don't need.
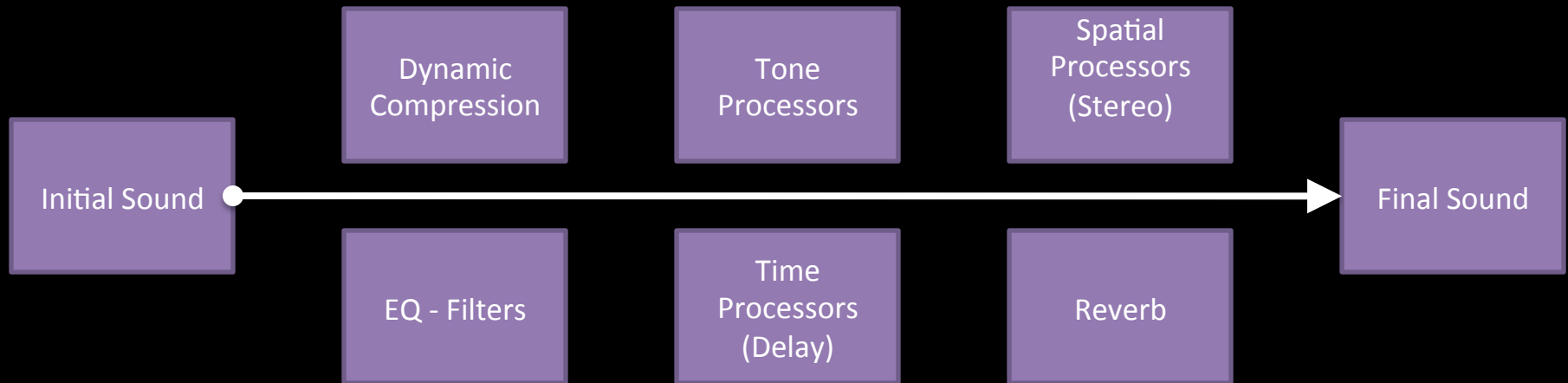
Moreover, it is used as a method of producing side-chain configurations in various effects and production techniques. (audio example: Phil Collins – In the air tonight)
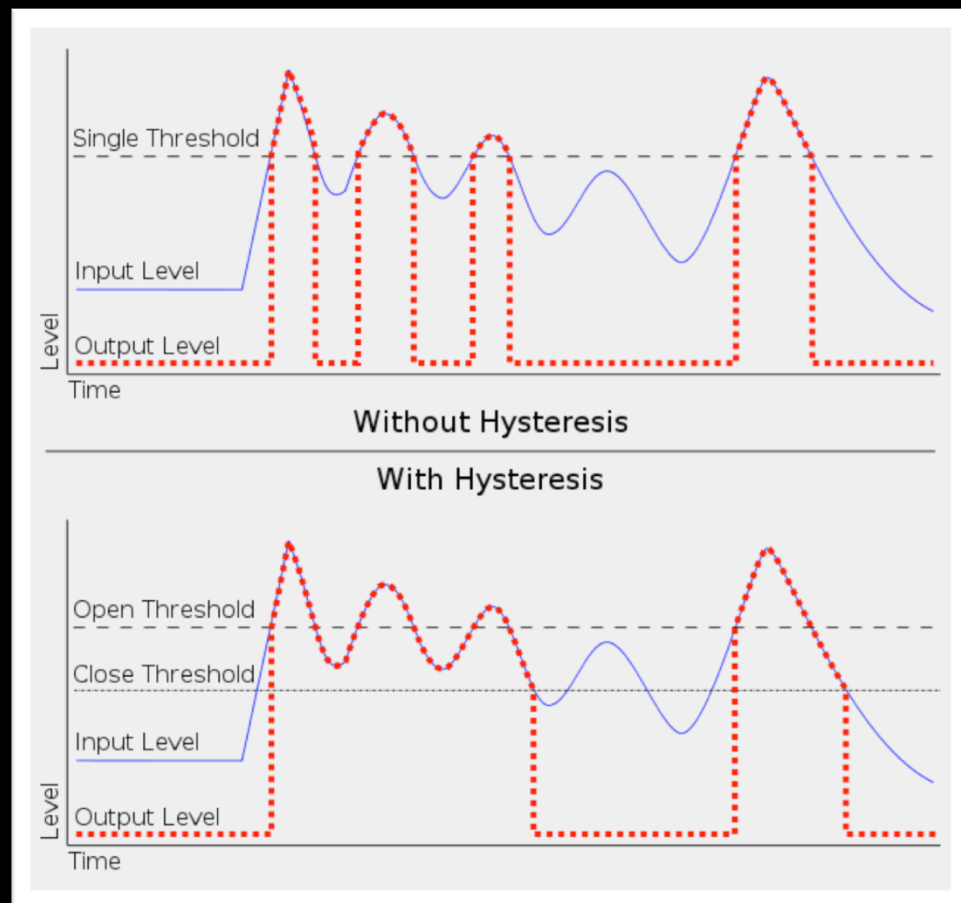
Audio Compression

Signal Routing

During an audio production, it is very important to use a series of processors so that we reach an aesthetic result. Yet, the order of each processor must be specific, otherwise it can accidentally destroy our final result.

Dynamic Compression	Tone Processors	Spatial Processors (Stereo)

Initial Sound →→→→→→→→→→→→→→→→→→→→→→→→→ Final Sound

EQ - Filters	Time Processors (Delay)	Reverb

In some cases there is only one place that a processor can be placed, while there are others that their placement does not play so much importance. Although there are specific rules on how to configure the processors, there is also room for experimentation.
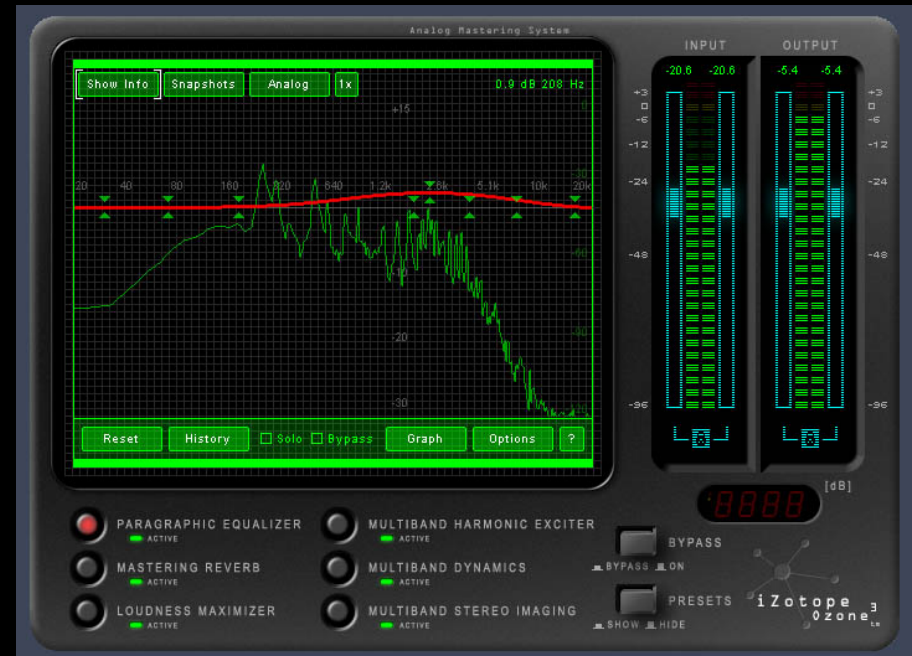
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Mastering

The mastering is a very important stage in audio production (post-production), where the last adjustments and refinements take place before our sound takes its final form (CD, DVD, etc)

At this stage we merge all the different tracks together, and we try to reach a smooth and homogenized sound quality so that we can achieve a pleasing listening process.

The sound result at this point should be checked for consistency through different media (radio, TV, nightclubs).

During mastering we DON'T try to correct a track that has bad quality. It is a process to put the final touches. The principles of mastering remain the same regardless of the software or DAW (Digital Audio Workstation) we use.

Audio Compression

To recap, during the process of adding effects and processors in our mix, we need to know beforehand how each of them affect our sound. The solution is not to recall preset settings, but to shape our sound in the way we really desire. Surely, if a preset gives us a satisfying result we can use it, although this rarely happens – to truly meet our needs. Thus, we must always experiment and try different things until we reach a result that meets our criteria. Saving our own presets is a good strategy as after a period this will make the process easier, and it will define our unique taste that distinguishes us from others.

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