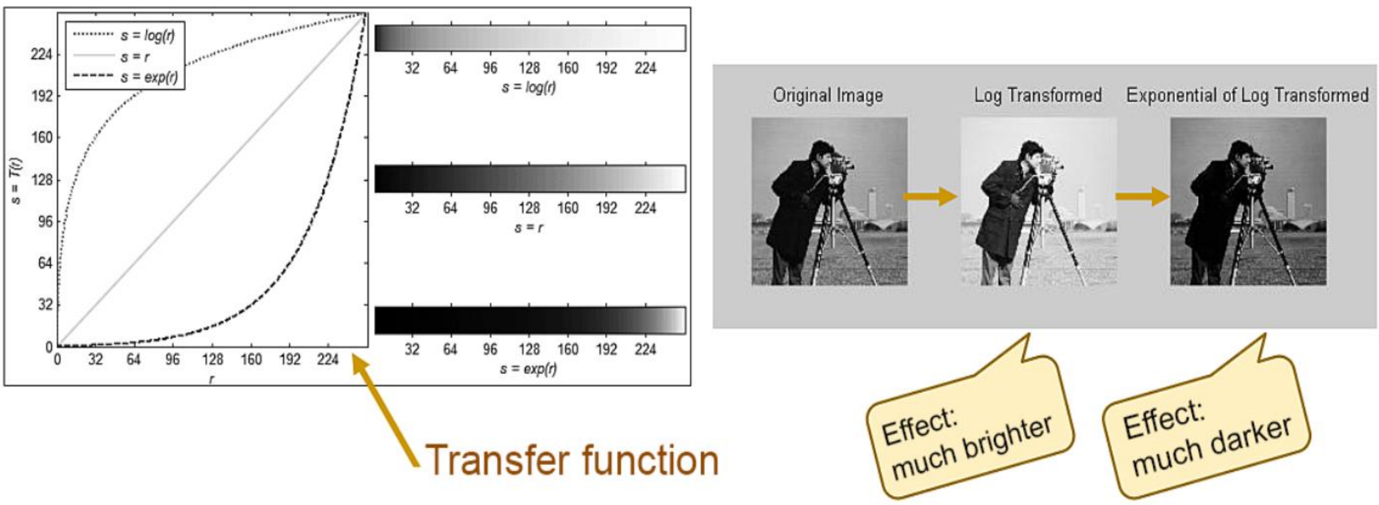
Lookup table

Lookup tables (LUT) are generally arrays, used to replace runtime computing operations with a simpler consultation operation.

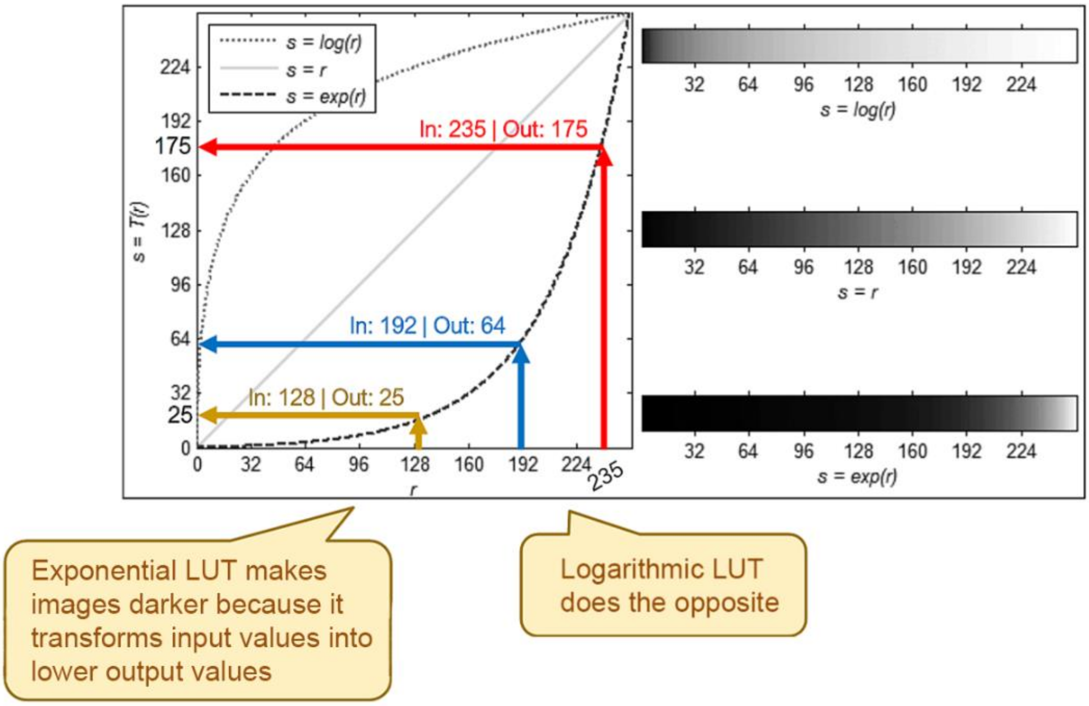
The LUT is implemented as a data structure, usually an (associative) array that replaces complicated runtime calculations with simple indexed access to the data structure. This leads to a significant speed increase if the required memory accesses are faster than the normal calculation.

In a LUT, pre-calculated results or other information are defined for certain constellations. The individual entries of the LUT are identified by their position (entry 01-nn applies to situation 1-nn) and each entry contains the predefined information. In the execution of programs, i.e. H. to use the LUT contents, the individual entries of the LUT are accessed by referencing (using keys formed or available in the program).



Benefit and purpose of LUT: Complex calculations can generally be replaced by a faster value search at program runtime. Storage space can be saved because only a short code is kept in the actual databases (with a large number of entries) and the associated long name from the table is used.

In data analysis applications, such as image processing, a lookup table is used to transform the input data into a more desirable output format. The same principle applies to sound processing programs and devices.

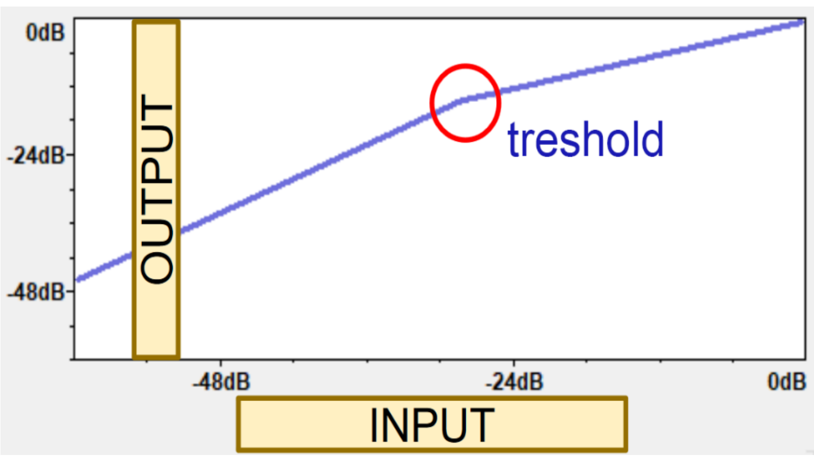


Dynamic range operations

The equalizer is a tool for equalizing the frequencies of a signal. It affects both the dynamic range and the gain to "fix" the frequencies.

The typical function of an operation on dynamics is to vary the output level of a signal based on the input level.

The operations can be defined with a diagram of the so-called transfer function, in which the amplitude of the incoming signal is indicated on the abscissas and the outgoing one on the ordinates.



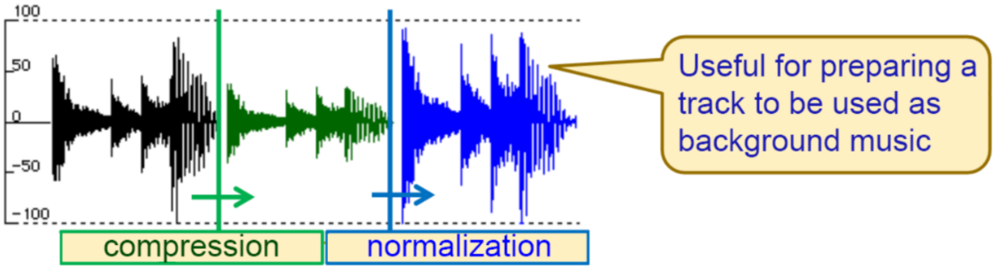
On the dynamic range, which is the difference in dB between the maximum volume that the component can sustain without distortion and the background noise it produces, operations are possible, respectively: Compressor, Limiter, Expander, Noise limit.

Normalization

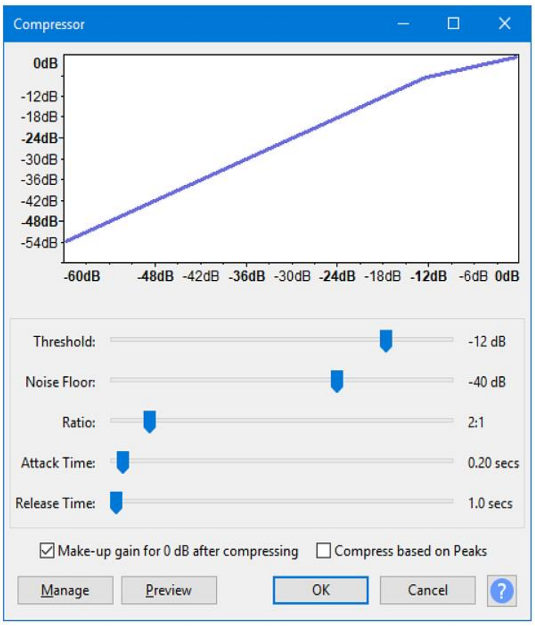
After the equalizer has acted on the amplification, the normalization process can take place. Through this process, the maximum possible amplification can be carried out without digital distortions or overloads occurring.

Compressor

Compression can be described, as an automatic volume control operation, i.e. a reduction in the dynamic range of a signal. Loud sounds that exceed a certain threshold are reduced in volume, while weak sounds are not changed below the threshold or increase below it. The compressor will modify all the available values, then a Normalization will be automatically applied.



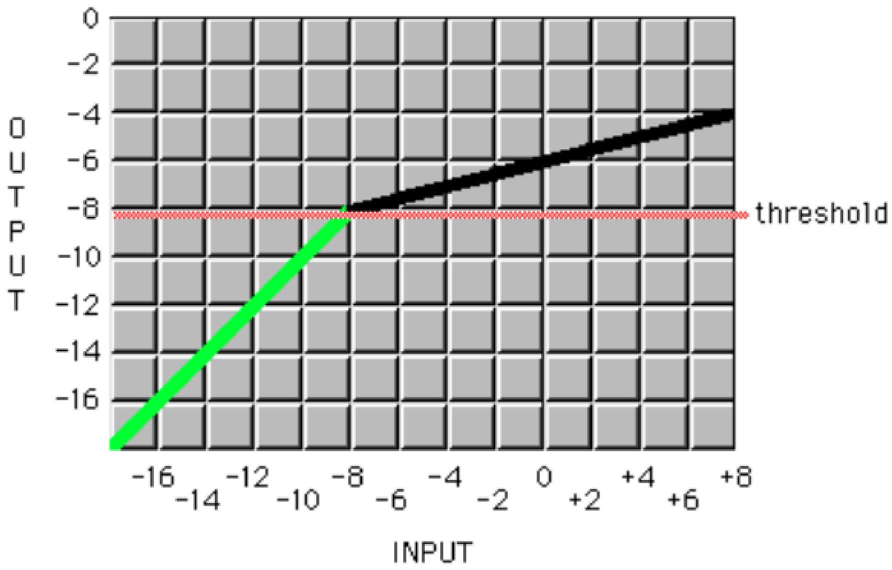
A compressor will be used wherever overrides due to sudden volume jumps are to be avoided, where differences between very quiet and very loud signal components are to be reduced (e.g. useful for audio reproduced in a noisy environment, such as in a car or in speech, to make the distant voice louder than the close one), or where a consistent loudness is required from different signals that can be heard simultaneously or in succession (e.g. at concerts, radio broadcasts or in discotheques).



Compressor Audacity

Controls of the compressor

Threshold: The level above which compression is applied to the audio. Above this level, the power increases more slowly than the corresponding input change. At a lower threshold, a larger part of the signal is compressed.



Noise Floor: The gain of the audio signal is adjusted below its background level so that it is not excessively amplified during processing. Useful when compressing speech so that the gain does not increase during pauses and the background noise is increased excessively.

Ratio: This value describes the relationship between the rise of the uncompressed input signal and the rise of the compressed output signal above the set threshold. The higher the Ratio the more the loud parts of the audio will be compressed.

Example ratio 6 to 1: If the input signal exceeds the threshold by 6 dB, the output signal only increases by 1 dB. From a ratio of 10: 1, one speaks of a limiter.

Attack: Attack is the calibrated switch-on time of the compressor. The time it takes the compressor to reduce the output signal to the set dynamic reduction after the set threshold value has been exceeded.

Rapid reactions to sudden, loud noises make the volume changes much clearer for the listener and can be caused by short attack times. For a less noticeable change in volume, Attack can be set to a high value.

Release: The calibrated compressor shutdown time. The time it takes the compressor to pass the output signal back to the unreduced level after falling below the set threshold.

A high release time value tends to lose soft sounds that come after loud sounds. However, this setting prevents the volume from being raised too much during short, quiet sections, such as pauses in speech.

Makeup Gain: With Makeup Gain the level reduced by the set characteristic can be made up again, so that the level peaks of the signal reach the same level as before. This means that the resulting audio in all selected tracks will be amplified to a peak level of 0 dB after compression. If the signal reduced in its dynamic range is raised in its entirety, a higher volume is achieved at the same volume. However, this can also increase noise and noise in the signal (noise floor).

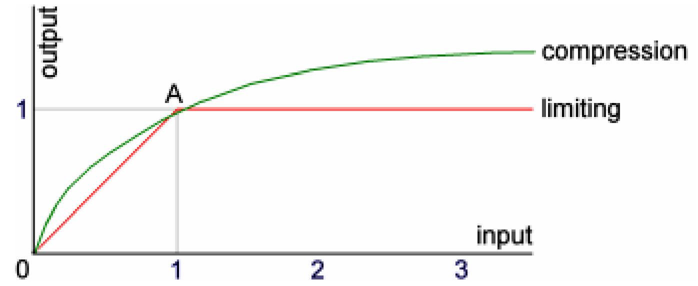
The excessive use of dynamic compressors in both the mixing and the transmission of music results in an increase in loudness at the expense of sound quality. This tendency is also called loudness war and has been criticized for years.

It is a fact that the average volume level of today's CD productions is significantly above that which was still recorded in the 1980s and 1990s. At the same time, the dynamics in today's CD productions have declined sharply.

Limiter

Limiters are required for radio, cinema and television as well as for music production. A common application in recording is to limit dynamic sound sources (such as speech / vocals) to a defined level. Here, the limiter has the function of a protection limiter to avoid distortion in subsequent devices.

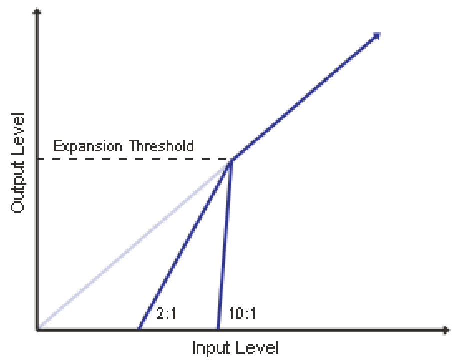
The Limiter comes in handy when dealing with a signal which is fairly constant as a level, but which occasionally presents rapid modulation peaks that lead the system to saturate or distort. Examples of these modulation peaks are gunshots or sounds generated by the drums in an orchestra. To correct these signal fluctuations a limiter is necessary, i.e. an apparatus that operates as a normal amplifier for signals below a certain predetermined level, but which compresses signals that exceed this level.



Therefore, all the amplitude values above a threshold are reduced to the value of the threshold itself and unlike the compressor it does not change all the values, but only those beyond the threshold. It can be anticipated by an amplification or normalization.

Expander

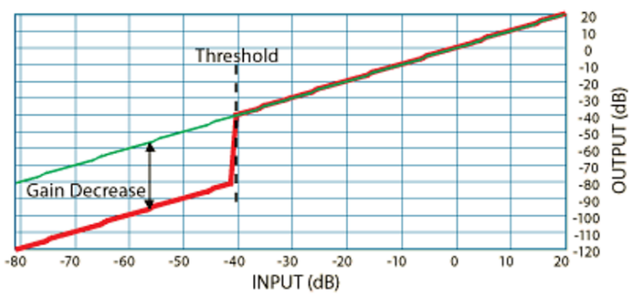
These are control amplifiers that stretch sound information that has been compressed in its dynamics accordingly in order to maintain the authenticity of the acoustic event.



The expanders perform the reverse operation of the compressors. Already weak signals become softer and already strong signals will be intensified.
The slope of the straight lines is always greater than that at 45 ° of a linear amplifier. It will increase the dynamic range of the signal then increase the amplitudes above the threshold and decrease the negative amplitudes below the threshold.

Noise Gate

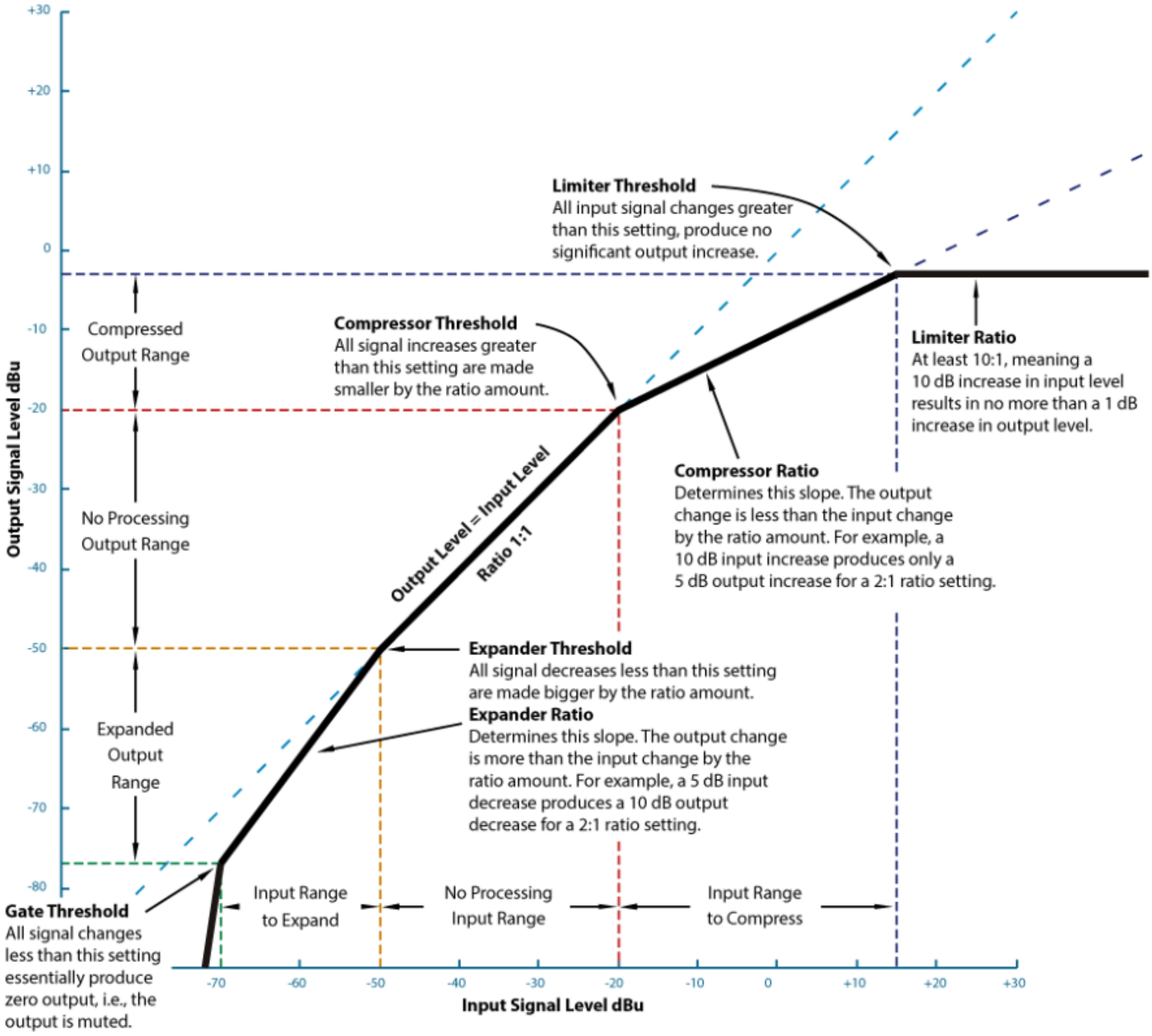
The Noise Gate has the opposite effect of the Limiter. All the values in amplitude lower than a threshold are increased to the threshold value. It will only change the values below the threshold.



The noise limiters attenuate signals by a fixed amount, known as a range. A limited noise allows the main signal to pass only when it is above a set threshold: in this case, the gate is 'open'. If the signal falls below the threshold, no signal can pass (or the signal is substantially attenuated): the gate is 'closed'. A noise gate is used when the "signal" level is above the unwanted "noise" level.

For example, a gate is typically used to record the bass drum through a microphone. The microphone cannot record a clean sound because the fur of a bass drum is excited to resonate with other sound sources and therefore resonates too long. Only the actual impulse while beating the bass drum is passed through a gate, which makes the sound of the bass drum clearer.

Summary presentation:



Dynamic Operations