

UNDERSTANDING COMPRESSORS, LIMITERS, NOISE GATES, AND EXPANDERS

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COMPRESSOR: USED TO CONTROL THE ENVELOPE OF A WAVEFORM
A compressor is an above threshold device, that is the gain of the processor is dynamically altered when the input signal is above threshold.

LIMITER: USED TO CONTROL THE MAXIMUM LEVEL OF A SIGNAL
A limiter is a device which attenuates signals above the threshold selected.

Let's start out by trying to understand the basic controls and the parameters which they adjust. The following terms and definitions, once they are understood, will make the use of a compressor, limiter, noise gate, or expander much easier.

DETECTION: This is the heart of any signal processor, as the type of detection scheme used sets the basis of the sound quality of the compressor or limiter. Dynamics processing equipment is designed to perform audible-level dynamics control; it then must employ a detection scheme which will measure the audible content of the program and take into account the frequency response of the human ear.

Valley People has pioneered a detection scheme called Linear Integration Detection. What Linear Integration does is simply to slightly under-read the RMS value of the input waveform to an extent proportional to the complexity of the waveform itself. Thus, if the performer "codes" a particular note or passage by giving it increased waveform complexity, the Linear Integration Detector allows that note or passage to go through at a slightly higher level than it would have had the waveform been more pure (less complex). Thus, the intent of the performer has been recognized, rather than being ignored (as in the RMS detector). The degree of this purposeful reading error is not severe... on the order of 2 or 3 dB on most music and speech waveforms, yet it is enough to give that "edge" or "life" to the processed signals. Thus, the operator is allowed to take advantage of the dynamics modifying advantages of a compressor or limiter within a framework of maintaining program integrity.

The **ATTACK TIME** of a compressor or limiter is characterized as the time required for the processor to alter its gain from some starting point to within a specified percentage of its required ultimate gain or attenuation. Unfortunately, there is no single attack time which is optimum for all possible varieties of signals to be processed. When processing highly transient material, such as percussion, if the attack time is tuned from "very fast" to "very slow", the degree of impact intensity will increase dramatically, as will the apparent level of the overall instrument.

At the fast settings, the program sounds very much like it has been limited... the impact transients are squashed, while the after-ring of the instrument is accentuated. It does not sound like what you hear in front of the mic. As the attack time is increased, the sound of the instrument begins to open up...to sound more like what you hear in the studio. Still, you have control over the level. This point is perhaps the optimum point of attack time for processing that particular instrument. But what happens if you make the attack time still slower than this optimum point? Through controlled overshoot of the processor, the audibility of the IMPACT SIGNAL begins to become accentuated, with respect to the after-ring of the instrument. The compressor begins to sound like an expander. So, if you want "punch" from your percussion tracks, this is the way to do it. This sort of effect can only be gotten with a compressor which has a variable, or selectable attack time.

There remains one other problem with Linear Integration Detectors and RMS detectors. That is how do we handle the low frequencies? Valley uses a process called Peak Reversion Correction. We know that if a compressor attack time control is set for about 5 msec, the processor will sound very good on frequencies above 500 Hz, for frequencies below this figure, the processor will cease measuring the integrated value of the waveforms, and will revert to the measurement of the peak value of the waveforms. At the point where the detector begins to deviate from accurate measurement of the integrated value, we begin to modify the input to the detector so that the errors resulting from the reversion to peak detection are taken care of, and the low frequencies maintain the same effective compression threshold as do the higher frequencies, or perhaps only slightly higher.

RELEASE TIME: As with the attack time, there is no optimum release time setting for all sorts of program material. This is because the use of long release times, while preventing low frequency modulation effects, tends to lead to excessive recovery times, and holes in the continuity of the material. On the other hand, fast release times encourage severe intermodulation distortion. Valley uses what we call an Anticipatory Release Computer. The Anticipatory Release Computer monitors the action of the control circuitry, and during periods of attack, substantially lengthens the release time. This circuit allows a 20 dB decrease in dynamic and intermodulation distortion without subjectively lengthening the release time selected by the operator, thus allowing the use of shorter release times without the usual compromises in transparency.

RATIO: Compression is a method of reducing the dynamic range of a signal by increasing the gain of the processing signal chain in the presence of signal levels below a given threshold and decreasing the gain in presence of signals above the threshold and below the rotation point (0 dB). Above the rotation point (0 dB) the signal is attenuated. The degree to which the gain is altered above the threshold setting is expressed as the ratio of a signal level change at the input to the resulting signal level change at the output. For example, a 2 dB increase in signal level above the threshold may result in a 1 dB increase in output level, thus the compression ratio may be stated as 2:1.

While it is true that a compressor with a high ratio selected, say 20:1, can be used as a limiter, it is only a limiter if the threshold is set at 0 dB or higher. A true limiter will not add gain to signals below threshold.

Hopefully, you have gained some insight, as to the proper adjustment of the parameters such as attack, ratio, and release. When properly applied, there are unlimited uses for the compressor/limiter as effects devices as well as level control devices.

The use of Linear Integration Detection, Peak Reversion Correction, and Anticipatory Release make Valley compressor & limiters the best sounding processors available; better, even, than the more expensive multi-band units.

NOISE GATE/EXPANDER: USED TO ELIMINATE TRACK LEAKAGE AND NOISE
The noise gate/expander is a below threshold device, that is, the processor attenuates the undesirable portions of the signal which are below the threshold. For signals above threshold, the processor is a unity gain device.

The **RATIO** selected determines whether the processor is considered a gate or expander. Any unit with a ratio of 1:10 or greater is generally considered to be a gate, any unit with a ratio of 1:10 or less is considered to be an expander. A ratio of 1:10 indicates that for a 1 dB drop in signal level below threshold, the output of the processor will drop 10 dB.

The **ATTACK TIME** of the gate/expander is the time required for the processor to return to unity gain from its point of maximum attenuation.

The **RELEASE TIME** of the gate/expander is the time required for the processor to perform a set amount of attenuation.

The **RANGE** control determines the maximum amount of attenuation.

Valley offers a variety of gate/expanders which allows the user to select the level of sophistication which will fit his or her needs.



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APPLICATIONS FOR COMPRESSORS AND LIMITERS

Instrument	Device	Effect
1. Kick drum	compressor	creates a "tighter" sound
2. Snare drum	compressor	creates a "tighter" sound
3. Tambourines	peak limiter	prevents tape saturation
4. Percussion	compressor	control the dynamics of all percussive instruments such as a cow bell, triangle, etc
5. Electric bass	compressor	tighten up low end of bass
6. Acoustic bass	compressor	control dynamics and with an interactive expander, room leakage can be eliminated
7. Synth bass	compressor	tighten up low end and make a "puncher" sounding bass
8. Elect guitar	compressor	adds sustain and compensates for level changes which can occur between notes
9. Rty guitars	compressor	adds sustain
10. Synthesizers (horns & strings)	compressor	makes these sounds more real
11. Vocals	compressor	makes some vocals appear richer and more powerful, also used to control dynamics
12. Vocals	limiter	control the maximum level to the recorder
13. BG vocals	compressor	controls the dynamics of each of the background vocals and makes it easier to get a nice blend
14. 2 mix out	limiter	stereo limiter to control the s maximum level sent to the 2 track mastering machine

As you can see from the above list, the only limit to the use of compression and limiting is your imagination and good taste.

VALLEY COMPRESSORS:

1. 610
2. 430 DYNA MITE
3. 440
4. COMANDER

VALLEY LIMITERS

1. 810 GAIN BRAIN
2. 430 DYNA MITE
3. LEVELLER

APPLICATIONS FOR NOISE GATES AND EXPANDERS

Instrument	Device	Effect
1. Kick drum	noise gate	eliminate track leakage, tighten kick sound.
2. Snare drum	noise gate	eliminate track leakage, tighten snare sound.
3. Elect drum	noise gate	make drums sound more real, eliminate digital noise
4. Guitars	expander	eliminate amplifier and pickup noise
5. Keyboards	expander	eliminate noise and leakage
6. Synthesizer	expander	eliminate digital noise
7. Vocals	expander	eliminate leakage and other annoying noise
8. Reverb	gate or expander	gate if you are wanting gated reverb sound and expander if you want to eliminate noise.
9. Recorders	expander	dynamic noise reduction

Remember, when we speak of expanders, we are talking about downward expansion only and a ratio of less than 1:10. The more sustain an instrument or a vocal has the lower the ratio must be. For example, when expanding strings, the ratio should be 1:3 or less and the range should be set for around 20 dB.

VALLEY NOISE GATES/ EXPANDERS

1. KEPEX
2. 430 DYNA MITE
3. GATEX
4. AUTO GATE