

# THE FUNDAMENTALS OF COMPRESSION

## MINI GUIDE

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Let's talk about **COMPRESSION**.

After EQ, compression is the most important way to process sound in a mix. It can be very confusing and hard to manage if you don't have a clear understanding of how a compressor works. Compression is playing an enormous role in today's modern music. Some will say that today's music sound is the compression.

I hope this guide will help you understand the fundamentals of compression in a practical and simple way.

The compression's job is to control the level of a signal. Like an automatic level controller. E.g. Bringing the quieter part of a sound louder and the loudest part of a sound quieter.

Compression will also tone-shape a signal by affecting the sound envelope of that signal. E.g. Adding punch to a snare drum, bring a sound closer in the mix, add excitement to a sound. To fully understand this is important to understand the principle of the Sound Envelope.

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The **SOUND ENVELOPE** represents the varying levels of a sound wave over time and is broken down into four areas; attack, decay, sustain and release like we see on synthesizers. Note that I am not referring to the Compressor controls yet.

**Attack:** The first initial part of a sound. Where the sound reaches its maximum level.

**Decay:** The drop in amplitude of a sound over time from the highest peak point until reaching the sustain level.

**Sustain:** The period of time during which the sound will resonate before it begins to fade out.

**Release:** The final reduction in amplitude of a sound over time.

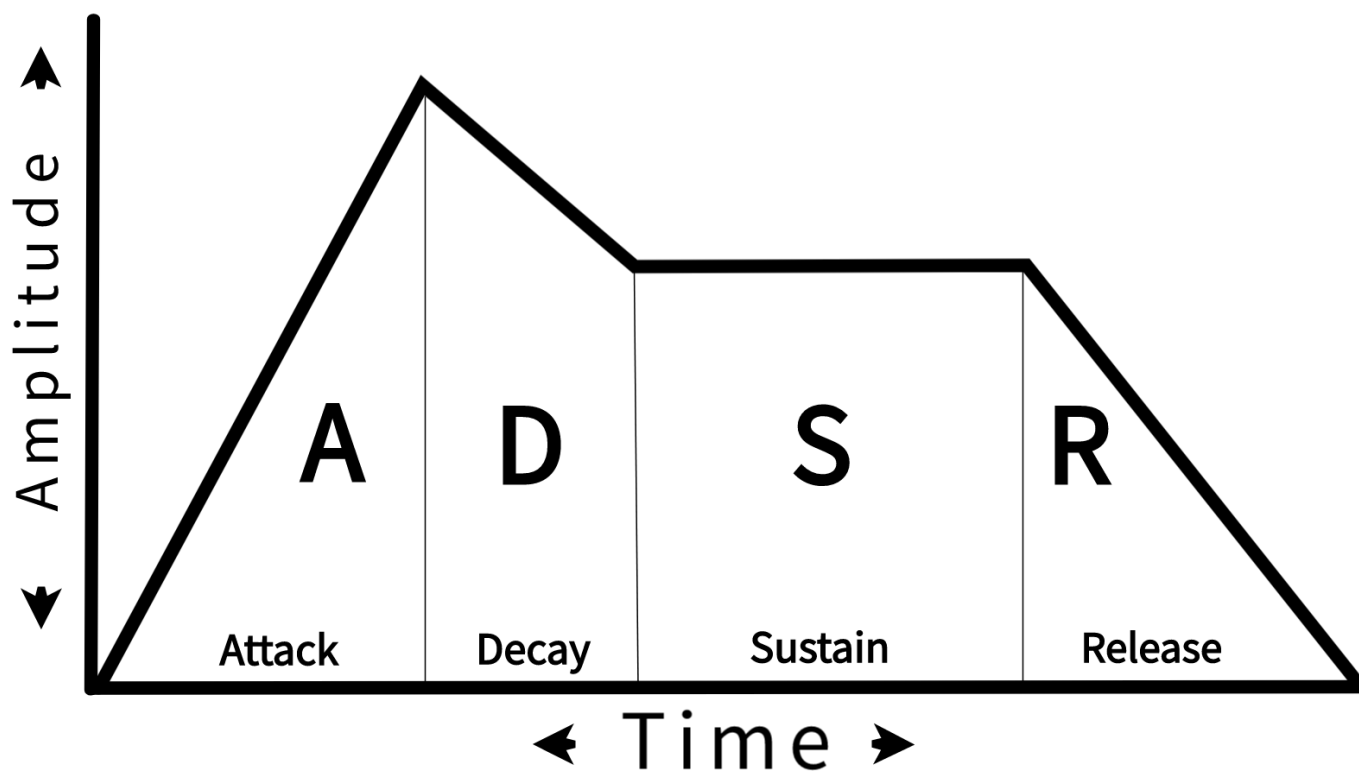
The sound envelope of a signal will mainly be affected by the attack and release controls found on a compressor, and this is where a compressor is a powerful mixing tool.

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### THE SOUND ENVELOPE



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# Compressor Controls

## THRESHOLD

The threshold is the point where Gain Reduction starts happening or when the audio starts getting compressed. The gain reduction meter will show the gain reduction according to the level of the Threshold. Some compressors will have an input control instead of a Threshold control.

## RATIO

The Ratio is how hard the compressor is going to work or the amount of compression applied when the signal goes above the Threshold. It is gonna pull the signal way down or just a little bit.

With a 2:1 ratio, for 2db that comes in the compressor and goes above the Threshold, only 1 db comes out. With a 4:1 ratio, for 16 db that goes above the Threshold, 4 will come out of the compressor. To make it simple a 2:1 Ratio is mild compression, 4:1 medium, 8:1 heavy and 10:1 and above is considered as heavy compression. At this point, we're talking about Limiting.



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### ATTACK

The Attack is the time it takes for the signal to apply roughly\* two-thirds of the targeted amount of gain reduction. In other words, once the Threshold has been reached, you will get gain reduction, but that gain reduction will not kick in immediately, but will ramp up over the course of time set up by the Attack to reach roughly two-thirds of its total gain reduction target.

Now I think I sound a bit geeky. What is important to understand is that the Attack time of a compressor has to do with how quickly it can reduce the level of a sound that goes above the Threshold point. If you get this, you're good!

A slow Attack will sound more punchy since the transients will take more time to get fully compressed. A fast attack will tame down the initial transients of a signal and make the sound smoother and less punchy. It will make the sound further away, it will take the punch away. Good to smooth a perky sound or heavy consonant on a vocal etc...The Attack Time is like your PUNCH CONTROL

\* Compressor designers will not all agree on exactly how to define, and therefore measure, attack. My definition of "two thirds" is within the average of most thinking.



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### RELEASE

It is the opposite of the Attack.

The Release is the speed in which the Compressor restores roughly two-thirds of the reduced gain (to be geeky again).

But what you need to remember is that the Release is the time it takes for a compressor to restore the gain after gain reduction has been applied.

A fast Release will bring up the sustain of a sound and make the signal sound more in your face. As for a slow Release, it will keep the body and sustain of a sound under control.

### AUTO RELEASE

Some compression will have an Auto-Release option. When enabled, the compressor will automatically set up the release time of the signal depending on the current amount of gain reduction. Auto Release will generally be a good place to start if you're not too familiar with setting up the Release control. It will also be more forgiving with aggressive compression and will be the safest setting for inaudible compression. That doesn't mean Auto is the best way to go, but is a good start point.



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### **MAKE UP GAIN**

Make up gain control is used to bring the gain back up after compression is applied. You have to keep in mind that when compressing a signal, the general volume of the signal will be lower in gain, so the job of the Make Up Gain is to bring that signal back up to re-balance the general volume of the signal.

Some compressors, like the 1176, will have an Output control instead of a Make up gain control.

### **KNEE**

On a lot of compressors, 2 Knee settings will be available, Hard et Soft. The Hard Knee will tell the compressor to start acting at the Threshold point opposed to start acting gradually before the Threshold point (Soft Knee). A lot of Digital Compressors will a variable Knee control.

### **WET/DRY**

Will act as parallel processing. Will determine the balance between the Dry uncompressed sound and the Compressed sound. aka Parallel Compression



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### EXTERNAL SIDE-CHAIN

By default a Compressor will compress the signal in relation to its own signal. In other words, the signal coming in the compressor's input will trigger the detector circuit of the compressor to then apply gain reduction.

Most of compressors will have an external Side-Chain option. When activated, the Side-Chain will use an external signal to trigger the detector circuit of the compressor so that the compressor can apply the gain reduction to the regular input signal in relation to the signal coming from the Side-Chain.

Basically, the signal sent to the input of the Side-Chain is the trigger that will feed the compressor's detector circuit to then apply the gain reduction.

The perfect example, adding a compressor on a Synth Pad and use a Kick drum sound to trigger the compressor so the compressor can then apply the gain reduction on the Synth Pad every time the Kick drum is playing.





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### INTERNAL SIDE-CHAIN FILTERS

The Internal Side-Chain Filter is an advanced feature found on some compressors. When activated, the Side-Chain will use an EQ Filter that will filter out the signal that feeds the Detector Circuit of the compressor.

A lot of Side-Chain Filters will only have a High Pass Filter (HPF) to trigger the compressor and other compressor like the Pro C2 from FabFilter will have a full EQ as a filter.

If I set the Side-Chain HPF to 250Hz, that means that the frequencies above 250Hz will be sent to the detector circuit of the compressor. The compressor will then apply the gain reduction to the FULL range signal, but in relation to the Side-Chain Filter. Meaning that only frequencies above 250Hz will trigger the compressor to apply the gain reduction to the FULL range signal.



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## The 5 Main Types of Compressors

### 1. Vari-mu Compressor (Tube)

One of the oldest compressor designs out there, which offers a pretty unique vintage sound. This family of compressors uses a tube at the heart of the compressor circuit for gain reduction, a so-called vari-mu tube. Which means Variable Gain. That gives the vari-mu compressor a distinct coloration or "vintage" sound that is nearly impossible to get with other compressor.

Another characteristic of a Vari-mu Compressor is the absence of Ratio Controls. Instead, the ratio or amount of compression will vary in relation to the Threshold or how much gain reduction is applied. The higher the gain reduction, the higher the "Ratio".

Vari-mu compressors are generally slower than FET and VCA compressors, but faster than an OPTO compressor. The Fairchild is one of the most popular Vari-Mu Compressors out there.



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## 2. Optical Compressors

Optical compressor designs use a light source (like a bulb or an LED) and a light-sensitive resistor (Optical cell), in order to achieve compression of the audio signal.

On one side there is a light source, which changes its brightness in relation to the level of the incoming signal, and on the other side a light-sensitive resistor. The louder the incoming signal, the brighter the light gets which causes the light-sensitive resistor to inform the compression circuit how much and how quickly the audio signal should be attenuated. They also have, by nature, a soft knee.

A unique aspect of the Opto compressor is the multi-stage Release time. If we look at the Teletronix LA-2A (that is probably still the most used optical compressors), it has a frequency dependent attack, with an average attack time of 10ms and 60ms for the first 50 % of the release time, then a gradual release over a period of 1 to 15 seconds to the point of complete release.

Optical compressors are known for being incredibly smooth and transparent, which makes them very popular to use on bass and vocals.



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### 3. FET “Field Effect Transistor”

FET compressors emulate the tube sound with transistor circuits. A transistor is a semiconductor that can both amplify and attenuate signal in accordance with the settings you dial in. It's the beast of all compressor designs. It is aggressive and has a unique, clear sound quality.

It has the fastest attack and release time of all designs. The slowest attack time on a FET compressor is still faster than a tube compressor. The most popular FET compressor is the 1176. It's attack time goes down to 20 microseconds (0.02ms) and the slowest Release time of 800 microseconds (0.8ms) which makes the 1176 FET compressor a super fast compressor. They also have, by nature, a hard knee.

A FET compressor adds a lot of color to the sound, which can be quite nice on drums, vocals, bass, and basically anything else. However, If you want soft compression the FET won't do the work, might not be the best compressor for the mix bus. Many engineers use the 1176 for parallel processing because of the aggression and vibe it is more suitable if you want hard peak limiting, compression or if you want to add a none musical coloration to your mix.



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### 4. VCA “voltage-controlled amplifier”

The VCA compressor is by far the most popular of all analog compressors. It's fast, punchy and mostly, it has a transparent sound, making the VCA compressor less colorful than its other analog friends, a popular choice to use on the Mix Bus, as a Mastering compressor and also on instruments that have big differences in transients such as drums and percussions.

The design of a VCA compressor allows for a lot of control. Attack, release, threshold, ratio, and knee are often found on a VCA compressor which makes the VCA compressor more flexible as a general rule (there are always exceptions).

VCA compressors can be found on SSL, API channel strips and compressors, and gear from Rupert Neve Designs. The DBX 160 is also a popular VCA compressor.

If you want to add compression without changing the characteristics of the audio signal too much, the VCA is a good option.



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### 5. Digital Compressors

Digital compressors will usually be found as the main compressor plugin on a DAW. Working using a set of mathematical operations, precision will be the main character of the Digital compressor. It goes straight to the point. It is the most flexible compressor out there.

All compressor controls like the Threshold, Ratio, Attack, Release, Auto-Release, Make up Gain, Wet/Dry and Knee, can mostly be found on a Digital compressor.

The Digital compressor will also sound neutral and uncolored and is the perfect choice for all types of instruments. This compressor is also a very good learning tool if you're new to mixing.

If you're looking for a compressor that is "musical" and has more character, the Digital compressor will not be a good choice.



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### 3 Reasons to use a COMPRESSOR in your MIX

#### 1. To control the dynamic range of a sound or to tame down "edgy" transients of a sound.

Recommended Settings:

Attack: 1-10 ms (Fast)

Release: 25-50 ms (Fast)

Ratio: 4:1 to 10:1 (High)

Set the Threshold low enough to attenuate the Peaks.

This way, your recording will sound more consistent and will sit better in the mix.

The Threshold level will depends on how much you want to attenuate those peaks.



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### 2. To add **PUNCH** to your Mix.

Recommended Settings:

Attack: 30+ ms

Release: Slower (100+ ms) or based on the tempo of the song

Ratio: 2:1 (Low) to 4:1

Threshold: Set the Threshold low enough to get Gain Reduction.

The amount of Gain Reduction is up to you, it depends on the on the sound and vibe you're looking for.

### 3. To **GLUE** Instruments or your Mix together.

Recommended Settings:

Attack: 30-60 ms

Release: 50-100 ms or Auto-Release can also work

Ratio: Low Ratio 1.5:1 to 2:1

Threshold: Set your threshold to get around 1-2 dB of gain reduction.

