

# Advanced Guide to the Oxford Limiter Output Section.

**Last Updated: 20<sup>th</sup> June 2007**

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## Introduction

The Oxford Limiter has many inter-related features in the output section that can cause surprise or confusion when not correctly understood. This guide is an attempt to impart some clarity so that users can get the best out the Oxford Limiter while avoiding common pit-falls.

The Oxford Limiter is designed primarily to be the last plugin in the mastering plugin chain. The aim is to provide artistic control over the loudness, impact and level, while also making sure that the audio is composed of legal sample sequences that will not cause unwanted clipping when written to file, or unwanted saturation when output to a DAC.

The Oxford Limiter consists of five sections that are processed in the order given, each of which has profound consequences on the sections following.

### 1. The Limiter Section.

The Limiter section is generally well understood as to its function. In terms of this article, the primary aspect to consider is the **Attack time**, because this controls the level and duration of the transients that will reach the output section.

**If you have a slow attack time**, which generally sounds more musical, then you must be aware that the leading edges of transients may **not** be gain limited by the limiter section. This means that, in combination with a high input gain, over-unity transients may escape the limiter section to arrive at the next section. In one way or another, these transients **must** be controlled if you are to avoid hard clipping.

Your choices to control the level of the transients are as follows:

- a) **Reduce the Input or Output level** until the Output Meter no longer shows clipping, or
- b) **Use the Enhance Section** to “soft clip” transients, either by enabling Safe Mode, or by using at least 100% Enhance, or
- c) **Reduce the Attack time** as much as needed. Beware that attack times that are too short, as well as being less musical will cause distortion if combined with very short release times, because you will begin to modulate not so much the gain envelope of the waveform, but the waveform itself, or
- d) **Enable dithering** (because this will hard clip any over-unity transients if that is the sound you like)

Each of these choices has repercussions to the sound.

**If you have faster attack times** (perhaps you want that sound for the material you are using) then you will not need to worry about transients escaping the limiter so much, and so you will not need to worry about how to control them.

## 2. The Enhance Section.

The Enhance Section is composed of the Safe Mode button and the Enhance Fader. The enhance section of the Limiter is basically an Oxford Inflater modified to work on transients only...not just the leading edge transients escaping the limiter section, but transients in general. Instead of giving overall “warmth” to the sound like the Inflater, the action of the Enhance section, because it works only on transients, tends to give a “Shimmer” or “Sparkle” effect. When combined with higher input gains, it tends to fatten the sound.

The main reason the Enhance section was added to the Oxford Limiter was to allow you to use slower attack times, but without resulting in hard clipping of the leading edges of transients that would otherwise escape the limiter. The Enhance section, if enabled, will allow these over-unity transients to pass to the output with the same apparent over-unity loudness, but without causing clipping. This allows an unprecedented degree of apparent loudness increase without real clipping occurring.

**For the cleanest Enhance sound**, use Safe Mode On and 0% Enhance. But there are many variations of sound achievable with the Enhance section:

**When Safe Mode is off**, the Enhance fader acts as a cross fade between 0% and 100% effect for a fixed “curve” setting of the underlying Inflater. Between 100% and 125%, the curve and cross-fade remain the same (at max), but the time-constant controlling the triggering of the inflation effect is expanded to make the sound fatter.

**When Safe Mode is on**, the cross-fade is permanently at 100%, and now the Enhance fader acts to control the “Curve” setting of the underlying Inflater. However, at no point in its travel will the curve be the same as for when Safe Mode is Off...so this is an additional creative possibility. Between 100% and 125%, the curve and cross-fade remain the same (at max), but the time-constant controlling the triggering of the inflation effect is expanded to make the sound fuller.

Provided you have Safe Mode On, or you have at least 100% Enhance, you are guaranteed that you do not have to worry about over-unity transients clipping the output. The Safe Mode can therefore be used as a safety net to catch transients that are not quite caught by the Limiter.

## 3. The Auto-Compensation /Reconstruction Meter

Next in the chain of processing is the possibility of reconstructing the peaks between samples, and correcting for them. It must be very carefully understood that a signal that is already 2dB over unity when it hits the Auto-Compensation section will remain 2dB over unity. It is only inter-sample-peaks that are corrected, not sample-peaks. Therefore the Auto-Comp feature should be understood as a feature that “**Corrects for illegal sequences of legal sample values**”, and not “corrects illegal sample values”.

Before examining the Recon Meter, and using the Auto-Comp feature, you need to ensure that you have already controlled your transients in some other way to bring them below unity, as described in the choices given above (see The Limiter Section).

The Recon Meter option allows you to correct for inter-sample peaks manually if you want to, by showing how much over unity your inter-sample peaks are, and therefore by how much you need to reduce the output fader to compensate if you do not want to use the Auto-Comp feature.

**The Recon Meter will not work correctly unless the samples are already limited to digital maximum.**

#### **4. The Output Fader.**

The Output Fader is your last access point into the overall level of the output signal. Bearing in mind that the Dither (if used) will be added **after** the output fader has adjusted the gain, you may need to reduce the output gain very slightly to avoid clipping, say 0.0008dB, even if Safe Mode is on.

If you have not enabled the enhance section to control transients (presumably because you are looking for a particularly clean and transparent sound), and you cannot reduce the attack time, this is your only other choice to reduce levels below unity to stop hard clipping at a later stage.

Reducing the Output fader is not the same as reducing the Input fader. Reducing the input level means that dynamic level changes inherent to your material will not be affected so much by the limiter section and its time-constants. Nor will the sound be affected so much by the Enhance section, if it is enabled.

#### **5. The Dither Control Section.**

Generally speaking, a signal must be dithered if it is to be output via any form of DAC (for example, you are listening to it) or to any limited resolution media. The only time you can get away with not dithering your material is if you know for certain that dithering will be applied later (for example your material will be sent to a mastering studio).

**The Dither section, if enabled, must hard clip your signal** if it has not already been controlled to legal sample values. This may surprise some people. This is because dither must be referenced to a digital maximum, and any sample value beyond that maximum

must be limited to the maximum in order for the dither to work correctly to preserve the information below the truncation floor. This is particularly true for hardware accelerated DSP. On Native plugins this remains the same to make sure the results are identical to non-Native versions.

This means you need to **monitor your output levels on the Output Meters with the Dither Mode set to NONE (and Recon Meter mode set to OFF) if you are to see when the output signal would have been clipped by the Dither section.** In combination with the Peak Hold button, if you play your entire track, you can find out how far over unity your maximum sample value is (for your given setup). The output meter LED's are arranged to be exactly 0.5dB per LED above 0dB. You can then use the output fader to compensate by the same amount. Finally, you would normally want to put the Dither mode back to ON after doing this.

If you are preparing a file or a track that will be burned directly to CD, and you are using the Oxford Limiter as your Mastering Tool, it is imperative that you set Dither mode to 16-bits. If you wish, you can also experiment with the other dither shapes to see if this improves the sound of your mix, especially if your tracks contain particularly quiet material.

## Recipes for Oxford Limiter Sounds.

Given the above interactions here is a step by step guide for three of the different extremes of sound you may be aiming for.

### Recipe 1: Setting up the Oxford Limiter for the cleanest, most transparent output that is suitable for output to a file or a DAC:

1. Set the attack and release times to relatively slow (for example about midway) so that you like the sound (Start with the preset “**Clean gentle no enh**”)
2. Push the input gain to about +6dB.
3. Set Safe Mode Off, and Enhance fader to 0%
4. Set Dither to None.
5. Set Peak hold On, Auto-Comp on, Recon off.
6. Run through your entire material, and at the end note how much over unity your peak value is.
7. **Either:** Reduce the Output Fader by the same amount. If there were no over unity peaks, you can increase your output gain by the amount the peak value was under-unity.  
**Or:** Reduce the Input fader by the same amount. The less you push the input gain, the less compressed the sound (or the more its dynamic characteristics remain untouched.)
8. If you changed the **Input** level in stage 7, you must repeat stage 6 and 7 to check where the peak sample turns out to be. This is because changing the input level will have non-linear consequences to the output level.

9. Set dither mode to 16-bits (for CD) or 24-Bits (for a good DAC feed by a digital output), and rerun through your mix to check that the output does not clip. If it does, reduce the **Output** fader by a fraction, say 0.0008dB.
10. You are now ready to burn to CD or output to a DAC.

### **Recipe 2: Setting up the Oxford Limiter for the Loudest Possible Impact:**

1. Set Attack and Release times to relatively slow (for example about midway) so that you like the sound. (Start with preset “Hot and Pumpy” or “Slammer Safe”)
2. Set Safe Mode On, and set Enhance fader to 0%.
3. Set dither mode to 16-bits (for CD) or 24-Bits (for a good DAC feed by a digital output).
4. Set Peak hold On and Auto-Comp on.
5. Set Output fader to -0.0008dB.
6. You can now experiment with pushing the input level while listening to the sound, and pushing the Enhance level while listening to the sound, or both. The more Enhance you have, the bigger and fatter the sound. The more input you have, the louder the perceived result. No matter what you do to the input fader or enhance fader, you should not get hard clipping.

### **Recipe 3: Setting up the Oxford Limiter as a “Brick-wall” Limiter:**

1. Set Attack and Release times to relatively fast (near the bottom) so that you like the sound without distortion appearing (Start with preset “Brickwall Enh”)
2. Set Safe Mode On, and set Enhance fader to 0%.
3. Set dither mode to 16-bits (for CD) or 24-Bits (for a good DAC feed by a digital output).
4. Set Peak hold On and Auto-Comp on.
5. You can now experiment with pushing the input level while listening to the sound. The more input you have, the more “compressed” the perceived result, up to a point. You can also experiment with pushing the enhance fader to fatten your sound. No matter what you do to the input fader or enhance fader, you should not get hard clipping, but you may hear soft distortion if either are pushed too much.
6. For a cleaner sound, you may want to turn the Safe Mode off, and proceed as for the Recipe 1 above, but with faster attack time.

## **Related Issues**

### **What is the difference between the Enhance section of the Limiter, the Overdrive of the TransMod, the Warmth of the Dynamics, and the Inflator?**

The “Overdrive” of the Oxford TransMod and the “Warmth” of the Oxford Dynamics both use the Inflator algorithm with a fixed “Curve” setting. In each case, however, the curve setting is different and set to the best sound for that particular application.

The Enhance section of the Oxford Limiter is again based on an Inflator, but this time is activated by transients only, not by steady state signals. This gives a new creative sound that is different from the Oxford Inflator plugin.