

FerricTDS

MANUAL

revision 1.5

Content

Chapter 1: Introduction	5
1.1. License	5
1.2. Installation	6
1.1. Overarching topics	6
1.1. Credits	6
Chapter 2: Jump Start	7
2.1. Overview	7
2.1. Quick reference	8
2.2. Basic operation and advice	9
2.3. Some tips on using the presets	9
Chapter 3: Advanced Usage	11
3.1. Internals	11
3.2. Workflow 1: Starting with DYNAMICS	13
3.3. Workflow 2: Starting with SATURATION	14
3.4. The RECOVERY parameter	14
3.1. The SC (sidechain) filter option	15
3.2. The two tape modes	15
3.3. Limiting and Maximizing	15
3.4. Dry/Wet mixing	16
3.5. Non-linearities and level changes	16
Chapter 4: Addendum	17
4.1. A brief history of tape	17
4.2. Judging saturation effects	18
4.3. Updates and further information	18

1 Introduction

1.1. License

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1.2. Installation

Requirements:

- Win32 compatible system with SSE2 (or higher) instruction set support
- Tested and known to work in many VST compatible hosts

Put the DLL file contained in this archive in the VST plug-in folder of your host.

1.1. Overarching topics

Warning: Lower your listening volume while operating the plug-in to avoid hearing damage or damage of speakers or any other equipment.

Usage tips:

- Use the TRIM knob to level the outgoing audio and for handy A/B comparisons
- For optimum processing and results, the input level to the plug-in could be adjusted to peak around 0dBFS
- Alternatively, use the INPUT adjustment knob to bring the incoming signal onto duty level (plug-in internally)
- Use <ctrl> + mouse left click on a knob or switch to restore default position
- Use <shift> + mouse left click on a knob to fine adjust values
- Use this plug-in as an insert effect in any mono or stereo channel of your VST host

1.1. Credits

Visual concept by Patrick Barca, www.suxesiv.ch.

Many thanks to all the beta testers!

Many thanks to Christian Budde for his famous plug-in analyzer.

2 Jump Start

2.1. Overview

FerricTDS – Tape Dynamics Simulator.



Inspired by the smooth dynamic shaping capabilities of some high-end reel-to-reel tape recorders, this plug-in simulates three of the most distinctive and much appreciated sonic effects generated by these devices:

- DYNAMICS – gently shaping the overall dynamic response
- SATURATION – adding extra harmonic-related content
- LIMITING – controlling peak performance

Other rather ugly side effects, such as tremendous phase and frequency alterations, wow and flutter, noise and crosstalk and others, are not included in this simulation.

Functions at a glance

- performs gentle audio dynamic treatments
- masters difficult to handle audio material
- adds extra harmonics and saturation effects
- controls outgoing audio peaks

Plug-in specification

- Win32 / VST compatible
- state-of-the-art digital signal processing
- performance-critical parts are written in assembler
- completely SSE optimized

Getting the most out of it

Please read the following chapters to get the most out of this device. Learn how to efficiently set the three main parameters:

- obtain some effective tips on getting the most out of the presets
- understand the basic workflow of this device
- learn how to efficiently level the three main parameters
- take advantage of the RECOVERY and sidechain options in the DYNAMICS section

2.1. Quick reference



Knobs and “screws”:

DYNAMICS – increases audio compression type effects

SATURATION – increases saturation type effects such as harmonic additions

LIMITER – controls the overall peak performance

RECOVERY – controls the recovery time of the dynamic processor

TRIM – adjusts the outgoing audio level

SC OFF / 250Hz – this “small screw” controls the dynamic processor’s response to low frequency material by a high-pass filter

INPUT – adjusts the incoming audio level

Switches:

ON / BYPASS – basic on/off operation. The VU meter still operates in bypass mode to allow the user to set optimum input level

MOD/CLASS – the tape mode switch which selects between a “classic” and “modern” sound processing

Meters:

Main “VU” meter – indicates the outgoing signal level (averaged)

Horizontal meters – roughly indicate the amount of signal processing in the DYNAMICS (left) and the SATURATION (right) processors

2.2. Basic operation and advice

Use this plug-in as an insert effect in any stereo or mono channel of your VST host. It can be operated both as a mono or stereo plug-in.

The best performance is obtained if the audio input is leveled to around 0 dBFS peak performance. In BYPASS mode the VU style meter needle should occasionally hit the red marked range. This indicates the “sweet spot” of the device. Alternatively, the INPUT dial could be used to compensate the incoming audio level instead.

Make sure that the BYPASS switch is in ON position now. The two horizontal metering displays on the top left and right side are now responding to the incoming audio if processing actually occurs.

Next, dial in some DYNAMICS to obtain compression effects and SATURATION for some gentle distortion effects. Depending on the audio material, this effect can be rather subtle. Increase the input level to the plug-in if the effects appear too subtle.

Use a combination of both effects, then add some limiting by turning the LIMITER knob clockwise to block outgoing audio signal peaks. Since version 1.5 this works as a true and accurate brickwall limiter.

Use the TRIM knob to adjust the overall output volume as needed. This feature is also handy for A/B testing at equal volume levels.

2.3. Some tips on using the presets

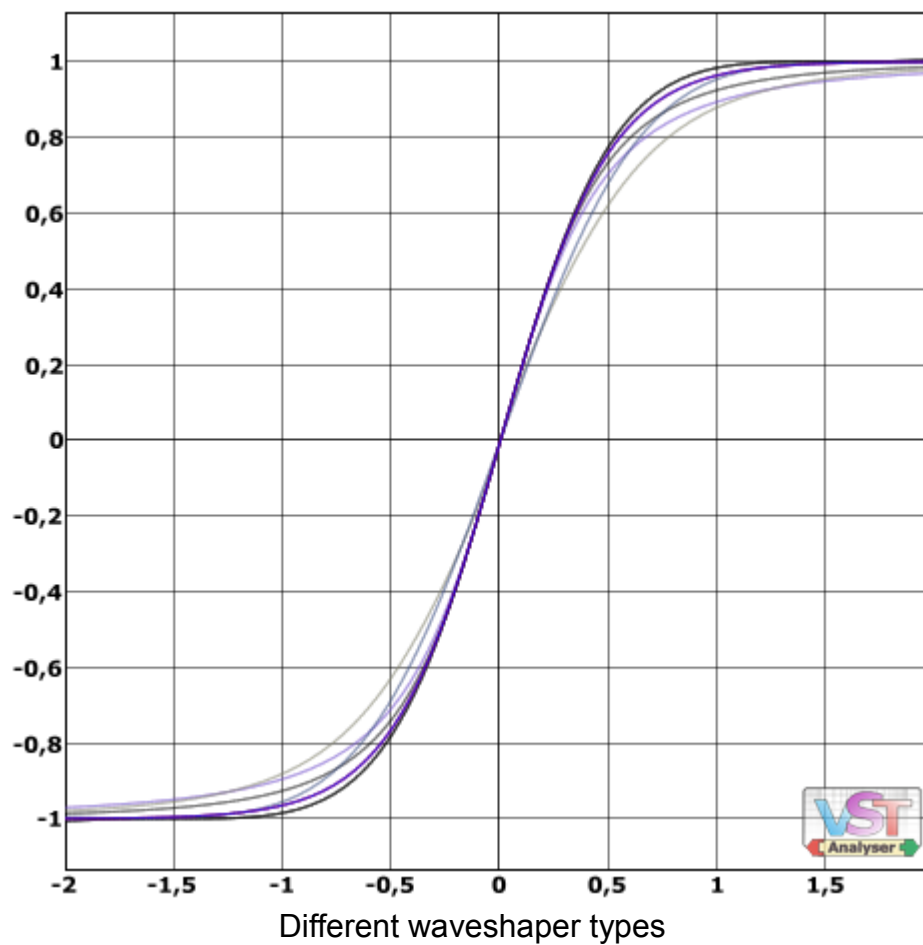
Explore the presets, but always adjust them to your current mixing situation:

- Always adjust the DYNAMICS and SATURATION parameters to your current track or mix in order to adapt the actual processing to your specific needs.
- Always adjust the TRIM parameter to your current mix for equal loudness levels during A/B comparisons.

- All presets were designed on audio material with levels peaking at around 0 dBFS.
- Take advantage of the small INPUT dial to level up or down your incoming audio to fit to a preset setting.

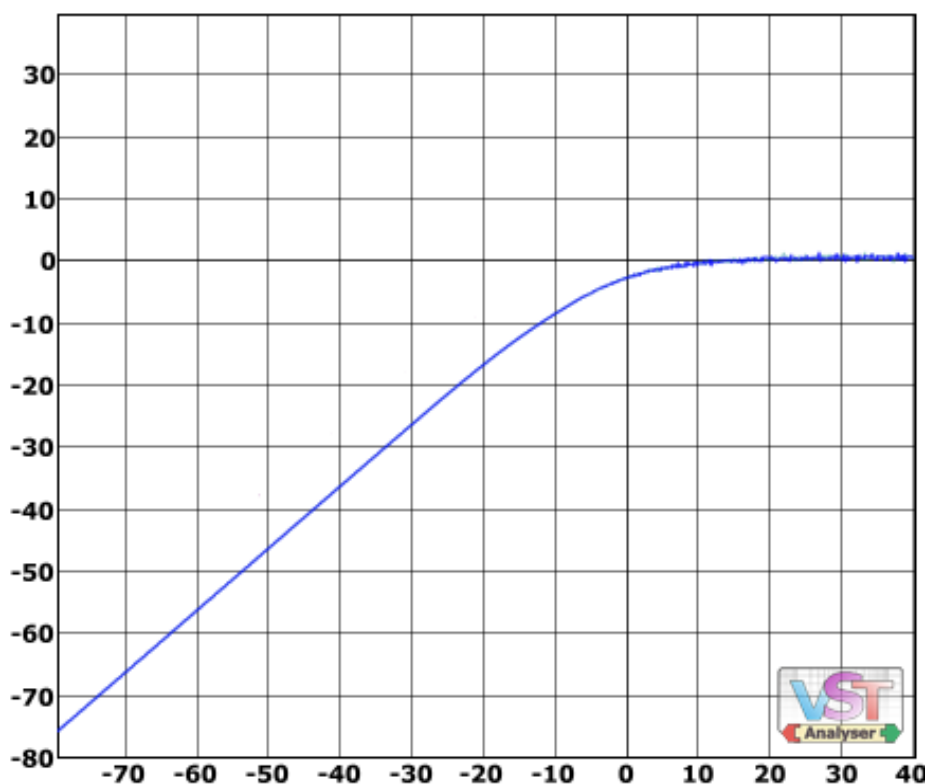
3 Advanced Usage

3.1. Internals



Under the hood, FerricTDS consists of quite a bunch of different waveshapers and envelope generators. One of them, for example, is used to obtain a frequency sensitive gain reduction signal to be used by the DYNAMICS processor, which works hand in hand with an additional processor that generates odd order saturation effects (controlled by SATURATION). Finally, peak control is performed by yet another processor.

You can regard this as one single circuit with just some different parameter controls. However, there is one exception to this: Straight peak limiting occurs not till the output of the device, after all other processing has already taken place. It is one important consequence of this design that all peak and transient information which passes the prior stages has to be handled in the output limiting stage. Otherwise, it will remain unmanaged when leaving the device. This design leaves it to the user to decide how much peak and transient information actually leaves the device. It also permits the use of an external limiter of your own choice if desired.



An analog style limiter transfer curve

The limiter reacts instantaneously to incoming peaks, offers an analog style transfer curve (similar as shown in the diagram above) and is a true and accurate brickwall limiter. Due to this design, both aspects are regarded: The tribute to the “tape” concept where no hard-knee thresholds can occur and the same time “zero overshoot” performance is guaranteed as well.

Given this short introduction, two different workflow approaches are recommended, depending on your specific goals when using FerricTDS:

1. Precise dynamics handling **or**
2. limiting and maximizing.

In both workflow scenarios 1 or 2, always start tweaking with DYNAMICS, SATURATION, and LIMITER set to the leftmost position and SC set to OFF (as in the default preset).

3.2. Workflow 1: Starting with DYNAMICS



To get the dynamics most accurately handled by FerricTDS, start by adjusting the DYNAMICS knob until you achieve a suitable amount of compression. Fine-tune the processing with the RECOVERY option. For example, slow the response time if too much compression is applied to snare drum hits in a mix-bus or mastering application.

If necessary, use the SC parameter to adjust the compressor's response to bass. Now, dial in SATURATION to obtain a blend of saturation effects. In the last step, dial in LIMITER amounts if more peak control is necessary or wanted.

3.3. Workflow 2: Starting with SATURATION



If, in contrast, you are after more saturation and peak limiting control (for more distorted effects or maximizing purposes), start by setting the SATURATION knob to the right. Apply further LIMITER amounts to obtain the level of peak control needed in your situation (or let an external limiter do this job).

As a final step, dial in small amounts of DYNAMICS, but this time with RECOVERY set to 'fast' and SC set to OFF (0 Hz). This enables some smooth overall gain-riding that slightly relaxes the peak limiting module. If pumping occurs, adjust the sidechain high-pass filter or lower the DYNAMICS amount.

3.4. The RECOVERY parameter

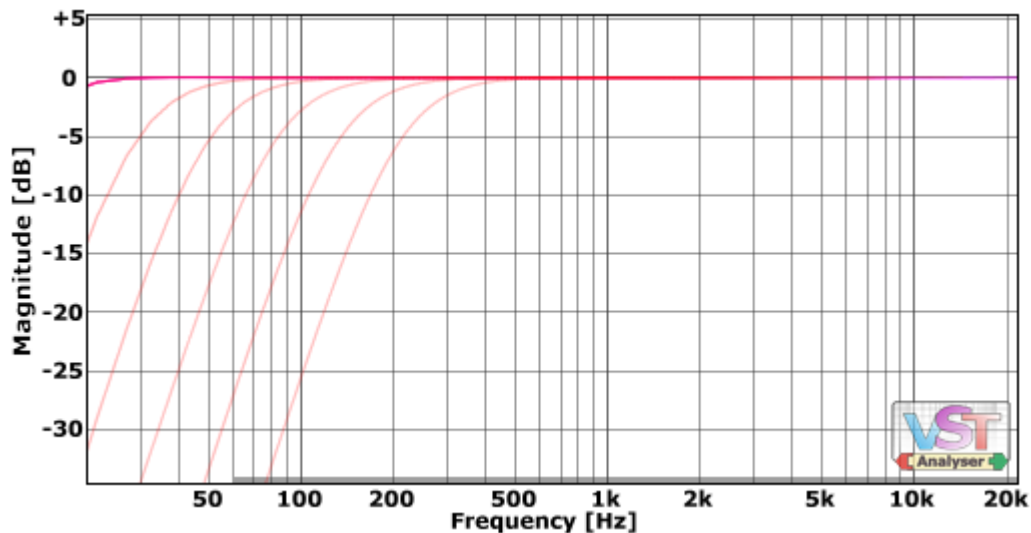
This parameter lets you control how fast the DYNAMICS processor is recovering from its duty cycle. 'Fast' operation (knob in leftmost position) enables faster gain riding, but bear in mind that a faster operation might introduce more unwanted distortion resulting from audio inter-modulation.

'Slow' settings usually result in more audible compression type effects. This can be unwanted in some cases, e.g.:

- the snare drum in a mix is affected too much by compression
- overall limiting/maximizing is desired

3.1. The SC (sidechain) filter option

The SC filter option (the “small screw”) controls a 12dB/oct Butterworth high-pass filter in the sidechain path (**not** in the audio path itself). It operates from 0 Hz (aka OFF) up to 250 Hz. This filter lets you control the amount of low-frequency audio content that will affect the DYNAMICS processor. This parameter is available to host automation (named “HP”).



Some example HP filter plots

This can be used, for example, to avoid “pumping” compression effects. Be aware that if the LIMITER option is enabled, it must handle major parts of the low frequency content that passes through the DYNAMICS processor untouched.

For further orientation: In the screw's 12-o'clock position, the filter is tuned to 100Hz (at -3dB reference).

3.2. The two tape modes

Since version 1.5 an additional tape saturation mode is offered. Both modes are selectable with the MOD/CLASS switch:

CLASS – (similar as offered in version 1.0.2), a type of classic tape saturation which attenuates the bass response and brings in more mid frequency information. HF frequencies might also appear to be more “tamed”.

MOD – a rather modern tape variation which offers a more relaxed sound especially in the bass range and allows more peak control at same output RMS levels.

3.3. Limiting and Maximizing

When using the LIMITER at larger input levels you might notice that the overall output volume appear quieter opposed to the unprocessed signal. This is normal with FerricTDS due to the internal gain staging.

However, if you are after audio level maximizing then compensate this effect by simply increasing the INPUT level dial until equal (or higher) perceived loudness is achieved at lowered peak performance.

When using FerricTDS as a maximizer just use the default preset and dial in the LIMITER to 100%. Now drive the unit by the INPUT dial. More sophisticated and program dependent behavior can of course be obtained by utilizing different DYNAMICS and SATURATION settings. For this purpose in most cases the modern tape setting performs way better opposed to the classic one.

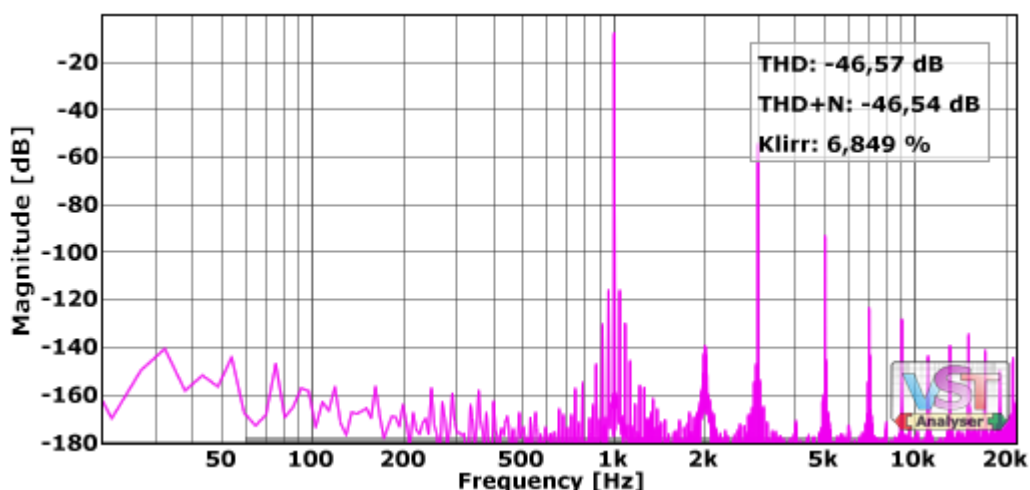
3.4. Dry/Wet mixing

Since version 1.5 FerricTDS has a 100% flat frequency and phase response. This allows external dry/wet mixing of the entire effect which means that one could mix the processed signal back into the unprocessed (e.g. by utilizing send effect configurations in a host).

3.5. Non-linearities and level changes

Most parameters are roughly volume compensated, but due to the complex internal design and non-linear behavior, there is no guarantee that accurate compensation can be achieved for all kinds of input sources.

About non-linearities and harmonic spectrum alterations: The main saturation circuit mainly produces odd order harmonics, similar as shown below.



Harmonic spectrum generated by the main saturator

Note: Actual spectrum measurements vary with different parameter settings. The spectrum varies between the two tape modes.

4 Addendum

4.1. A brief history of tape

The concept of magnetic recording to a moving tape was invented by the German-Austrian engineer Fritz Pfleumer and received a patent back in 1928. The basic idea was to translate the voltage from the audio signal straight into magnetic energy, which then induces magnetic particles on a tape (moving along the inductor at constant speed). These particles manage to store the audio information. The whole process goes the other way around for recall.

Although this was a revolution for both broadcast and recording industry, there were many technical challenges to be addressed before its success during the middle of the last century. Some physical limitations can't be ignored even today. While electromechanical problems, such as wow and flutter or noise and crosstalk have been improved over the years, the electromagnetic phenomena, such as magnetic permeability, hysteresis or the Barkhausen effect still must be addressed.

Additionally, since a tape can't store unlimited amounts of energy, a natural saturation occurs when signal levels are driven too hot. Normally this has to be avoided, as it can lead to heavy distortion. Nonetheless, this type of saturation was (and still is) frequently used as an artistic audio effect.

The new digital recording technologies that emerged towards the end of the 20th century overcame these shortcomings of analog recording and made tape obsolete – if regarded from a purely technical and workflow-related point of view. Yet some of the positive effects of high quality tape and recorders are still highly appreciated in today's audio production, and there is quite a lot of myth and buzz going on about its “magical” qualities.

In fact, what makes a good tape and recorder still attractive in the digital age is its overall ability to balance audio dynamics while adding harmonic content and gently limiting the peaks. If properly applied, this can result in a very pleasant sonic experience. However, it still comes at the expense of some of the mentioned artifacts and side effects, not to mention the time and cost of operation and maintenance.

4.2. Judging saturation effects

There are quite some mistakes floating around on how to judge a saturator's sonic quality and here are some tips to avoid the most common pitfalls:

1. A good saturator does not appear as distortion in the very first place. Firstly it just saturates incoming audio signals which means that at a similar RMS output level it simply reduces the peak performance (which results in a smaller "crest factor").
2. This immediately implies that you need a RMS meter in your output chain to compare different saturation settings or devices to another. Basically this is the same when comparing limiters or maximizers.
3. Distortion is a side-effect which typically occurs at higher saturation levels. It can have different sonic qualities, e. g. due to the frequency distribution of distortion which makes a huge difference to human hearing and if the effect is perceived as to be rather gentle or not.
4. Don't rely here on a simple spectrum analyzer since it does not know anything about the concept of being "gentle" or not.

Summary: Always assure equal RMS output levels and then use your ears.

4.3. Updates and further information

Refer to my Blog at <http://varietyofsound.wordpress.com> for some additional information and updates on this plug-in or leave a note there if any issues did occur.

Peace,
Herbert