SoundMod

TRI TONE

Re
Rack Extension

TABLE OF CONTENT

TRITONE MULTIBAND WAVESHAPER

INTRODUCTION

While subtractive synthesis involves the uses of filters to remove harmonic content from its audio source, the use of waveshaping technic simply does the opposite. Often simply called "distortion", a waveshaper add extra harmonic content to the original signal fed into it using various mathematical function or look-up table where an input x gives an output $f(x)$. Waveshaping synthesis can be tricky and unpredictable due to its nature especially when using single band distortion unit. Depending on the material fed into such a device and the device itself you can sometimes ends up with audio material which is hard to sit properly in your mix.

The SoundMod Tritone has been designed with that optic in mind and which consist of;

Getting a better control over your distorted tones. Creating movement between different harmonic content generated from the same audio source. Distorting your sound heavily with the ability of keeping clarity, definition, warmth and musicality. Allowing the user to get the best compromise between functionality, ease of use and creativity. And finally, having a clean visual design which should fit with the Propellerhead Reason's rack.

TRITONE MULTIBAND WAVESHAPER

SIGNAL FLOW OVERVIEW
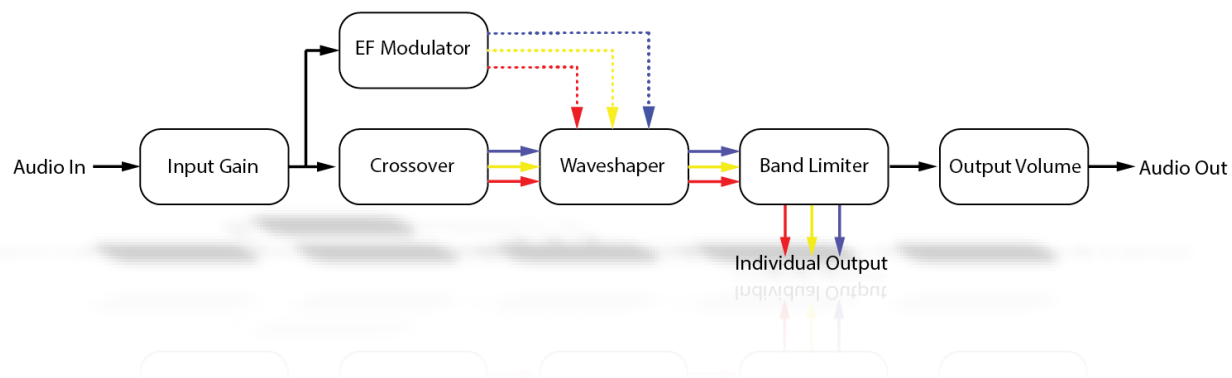
To get a better understanding on how to operate Tritone, a little overview of the signal flow should help. The diagram above illustrate how the signal flows inside the unit. As you can see, Tritone is divided into six main section which are the "Input Gain", the "Crossover", the "EF Modulator", the "Waveshaper", the "Band Limiter" and the "Output Volume". Details of each section will be discuss into the next section. Note that the color convention used here will be describe later. Dotted lines are not audio signal but modulation signal generated from audio.

FRONT PANEL DETAILS

INPUT AND OUTPUT

INPUT GAIN
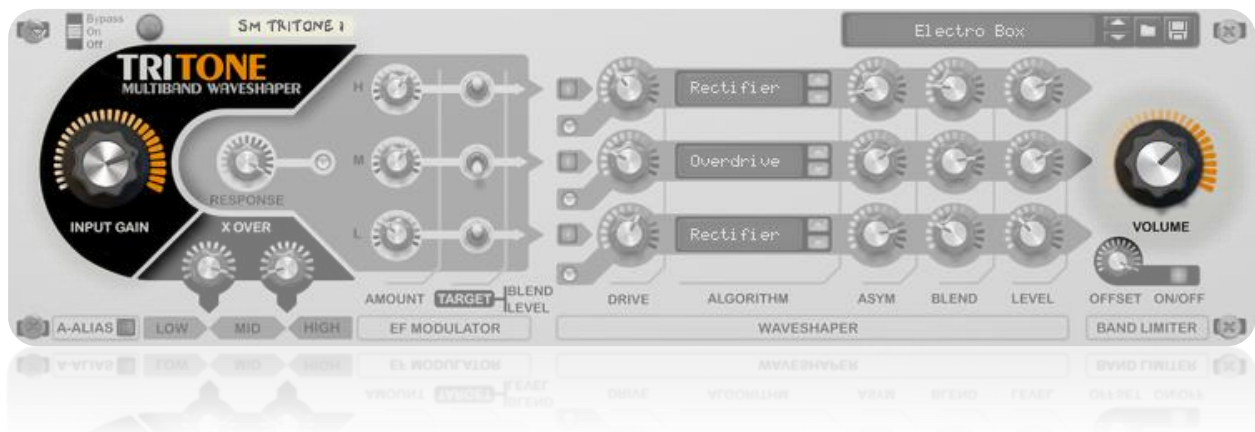
Use the input gain control to simply attenuate or amplify the input signal. Pushing the knob higher than 0dB will overdrive the input by applying some tube like saturation to the signal before the waveshaping processor. The range of value for the input gain is **–INF:+9dB**.

VOLUME

This control help you to match the output amplitude of Tritone before entering into the next rack's inputs. Contrary to the INPUT GAIN parameter, VOLUME don't add extra saturation at the output where signal amplitude reaches values higher than 0dB.

Tips and tricks:

- *Even if the INPUT GAIN is set at 0dB or less, the signal fed through crossover can be saturated if the input reaches levels near or above 0dB. If this is the case and you want a less overdriven signal sent to crossover you just have to lower the knob value until your needs are met.*
- *Create nasty distortion by increasing INPUT GAIN's value or only use that saturation by dropping BLEND knobs values to 0%. [See WAVESHAPER below]*
- *If the output is too high in amplitude turn down the VOLUME knob, doing so will only attenuate the output without modifying the tone character.*

CROSSOVER
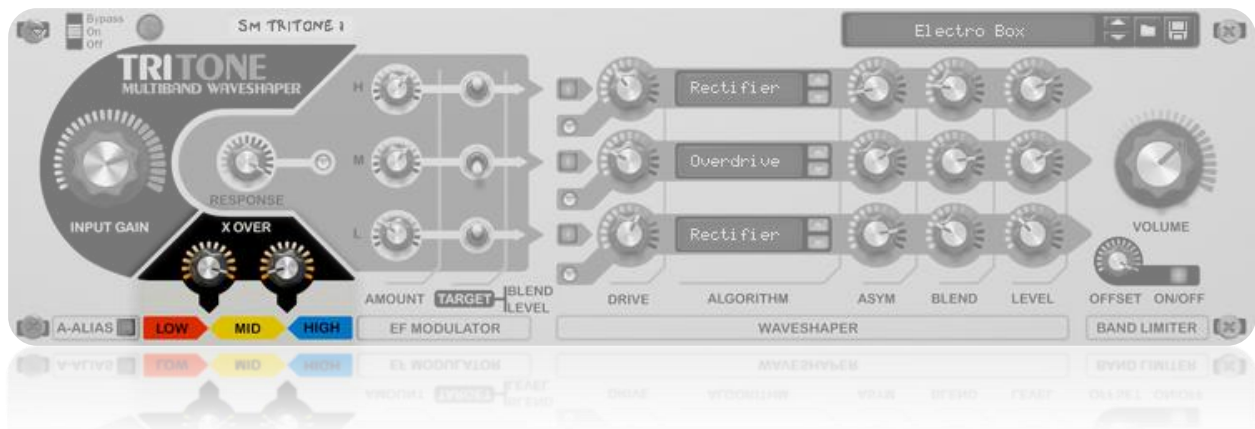
Labeled as "X OVER", this section is a two point crossover which split the signal coming from the "INPUT GAIN" stage into three separated bands. The left knob sets the frequency of the first crossover to split the low and the mid-low frequencies while the right knob sets the frequency of the second crossover to separate the mid-high and the high frequencies. The arrow shape under each knob illustrate the frequency crossing point between each crossover, while the colored shape are labeling each new bands. This gives a quick way to visualize Tritone's control and signal flow.

The range for both frequency control are as follow:

- LOW/MID crossover frequency range: **80:320Hz**
- MID/HIGH crossover frequency range: **420:1680Hz**

This mean that the maximal bandwidth for the low band is 320Hz, 1360Hz for the mid band and 19580Hz for the high band.

Tips and tricks:

- *Automating these knobs before a breakdown can help to create tension in your track.*
- *When your song is playing automate these knobs with smooth and long curves to create movement and morphing in the harmonic content of your audio signal.*

WAVESHAPER
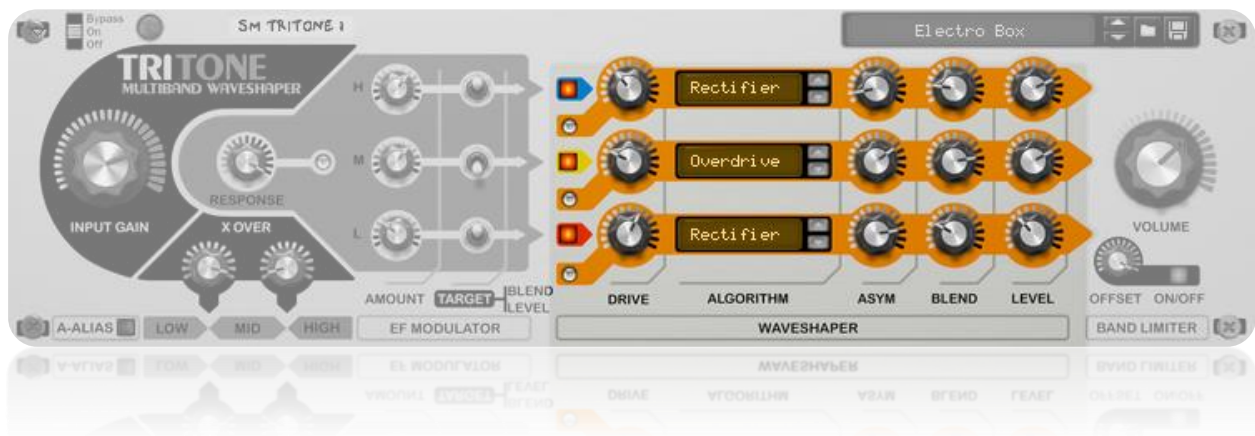
The waveshaper section is the biggest of Tritone and is where most of the magic happens. As we have seen previously the crossover splits our input signal into three individual band. The waveshaper interface is showing three horizontal orange stripes where each of them receive one of the crossover band. There is five thin grey line passing at the right of each sets of control and going at the bottom of the front panel, those lines groups each sets of similar control.

At the bottom an outlined rectangle with the label "WAVESHAPER" is used to identify the waveshaper section. You will see this convention again for the "EF MODULATOR", the "BAND LIMITER" and the "A-ALIAS" section.

TRI**TONE** MULTIBAND WAVESHAPER

The sets of control available are as shown below;

DRIVE, ALGORITHM, ASYMMETRY, BLEND and LEVEL. There is also two other elements, an ON/OFF toggle button and a metering lamp.

ON/OFF

The graphical design around that switch identify which band own the following stripes of controls. In this example you can see that the color of the graphic shape around the toggle switch is red and is pointing the sets of parameters on its right. According to the color code in the "X OVER" section, it means that these sets of controls are those for the low band. If the switch light is off the channel is disabled.

METERING LAMP

The metering lamp is a tri-color LED, green light show a normal level, yellow show that the signal is around the 0dB level and the red color above 0dB. Notice that this lamp are positioned to the left of the DRIVE knob, which mean that this lamp show the level coming from the X OVER. Increasing the DRIVE knob will not increase the lamp intensity. Note that this lamp is only a simple indicator and aren't designed to be extremely precise.

DRIVE

Use that knob to boost the signal if needed before the waveshaping process. Increasing this knob will increase signal distortion. The range of value for this knob is: **0:+18dB**.

ALGORITHM

The ALGORITHM selector allow you to choose which method to use to shape the audio signal. There is two way to make the algorithm selection. Clicking on the up or down arrow button will cycle through algorithms or clicking on the algorithm display will show a popup menu with available algorithms [see ALGORITHMS OVERVIEW in the APPENDIX of the manual for more details].

TRITONE MULTIBAND WAVESHAPER

ASYMMETRY

The ASYM knob determine the way algorithm should process the positive and the negative part of the signal and the range for this control is: **0:100%**. That means that if control is set to 0% both positive and negative signal's parts are processed the same way. Setting the value to 100% will process both parts in a different way.

BLEND

The BLEND knob allow you to take the audio signal directly from the corresponding crossover band unshaped and blend it with its shaped copy. The range of values for this knob is: **0:100%**.

At 100%, that means that you have the full shaped wave. If you set this parameter to 50% this mean that you get 50% of the unshaped crossover signal mixed to 50% of the shaped signal, while 0% means that you only have the crossover unshaped signal. The blend is also made by using the equal power method, the same as the pan knob on Reason's ReMix mixers which allow the user to get the same power through all knob's values.

LEVEL

This is where you can merge back each band by controlling their individual level. It is acting like a simple mix control. The range of values for this knob is: **-INF:+6dB**.

Tips and tricks:

- *Instead of turning down the LEVEL knob on an unused band, disable that waveshaper band by using its ON/OFF switch, this will save CPU load.*

- *If your signal is heavily distorted with every DRIVE knobs sets to 0dB, you can drop the master volume of the instrument fed into Tritone's input or turn down the INPUT GAIN knob.*

- *On heavily distorted signal use the BLEND or DRIVE knob to help you adjust the level of shaped signal.*

- *ASYM effect might not be audible in one of these situation; if the BLEND value is sets to low, if the DRIVE or INPUT GAIN is too high or on some material.*

TRITONE MULTIBAND WAVESHAPER
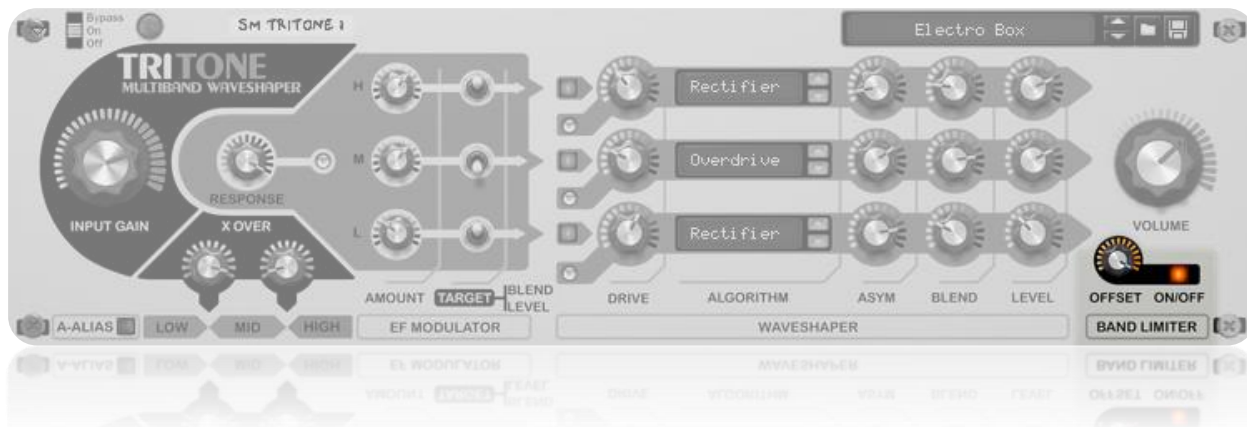
BAND LIMITER

To avoid confusion band limiter is not a compressor/limiter which limit signal's dynamic. The band limiting section is composed of three filters at the end of each band allowing you to remove harmonic content. The "BAND LIMITER" terms are used because this section limit the individual band's bandwidth. The configuration and the filter used help you to get a better control over the mix of each distorted band at the output and get an overall warmer tone. In simple words you can see it as a tone control.

As shown, there is only two controls for that section.

ON/OFF
Use that switch to simply enable or disable the bandwidth limiting.

OFFSET
The OFFSET knob allow you to offset the operation frequencies of band limiter filters by fraction of octave. The range of value for the OFFSET knob is **1.0:2.5 oct**. That offset is calculated by looking at the crossover frequencies and by an octave value sets from the knob. As example, suppose the LOW/MID knob (left knob in crossover section) value is sets at 320Hz and offset sets at 1.0 octave. Then the frequency of the band limiter for the LOW band is 640Hz. The same happens with the MID band but this time by taking the value of the MID/HIGH knob (right knob in crossover section). For the high band, its follow the same rules as for the MID band except that there is an extra operation. This extra operation is not in the scope of that document and will not compromise your creativity.

Tips and tricks:

- *As simple rules, a higher value means more harmonic content passing while a lower value means less harmonic passing through outputs.*

- *Band limiter is not only effective on the master output but on the individual output as well.*

- *If you prefer to use your own filters you should disabled band limiter for best results.*

EF MODULATOR
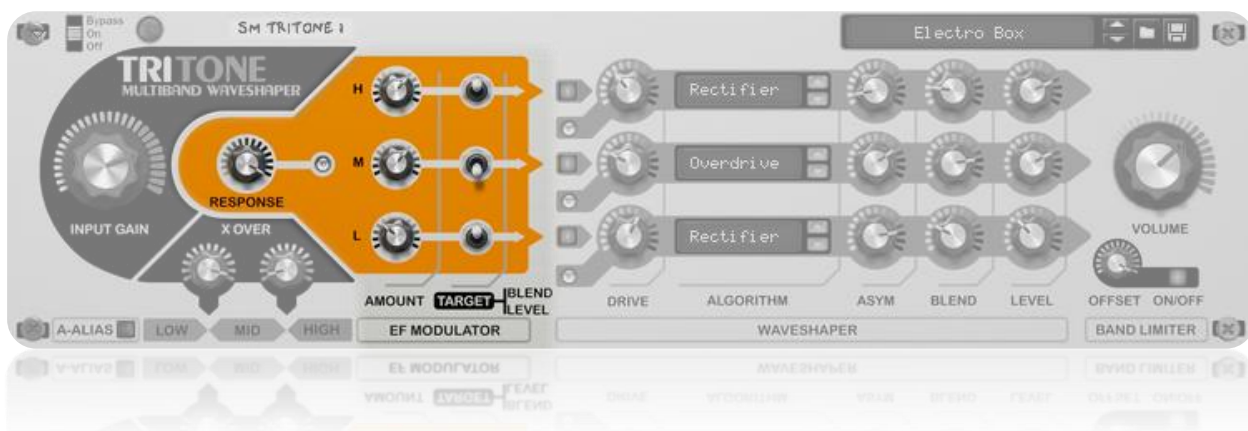
If you want to add movement to your audio material this is why EF MODULATOR stands for. EF MODULATOR is the abbreviated form of "Envelope Follower Modulator". In simple terms, EF MODULATOR listen the audio at the inputs and generate from that an envelope which follow the amplitude peaks of the signals. With the generated envelope you can now modulate parameters which allows you to have dynamic modulation, thus creating variation at the output responding to the input dynamic change. The EF MODULATOR have a sets of control described as follow:

RESPONSE
Use it to control the RESPONSE of the generated envelope. A lower value, will generated an envelope less sensitive to the input peaks while a higher value will increase the response sensitivity to input changes. The range of values for that knob is **0:100%**. To get the EF MODULATOR working you should set the RESPONSE knob to a value higher than 0% (1:100%). At 0%, the EF MODULATOR is turned off.

METERING LAMP

There is an associated tri-color LED which you can use to approximately monitor the generated envelope. If the LED merely light green and stay green most of the time, this means that the envelope generated is merely following the inputs changes and have a small dynamics variations. At the opposite, if the LED stays red this means that the generated signal is too responsive and have no time to drop in level, the envelope generated is more like a DC component. In both case, according to the AMOUNT and TARGET settings you might not hear sounds variations. The best practice is to get the LED oscillating between green, yellow and red.

AMOUNT

It controls the amount of modulation sent to the targeted parameters. There is three AMOUNT knobs one for each bands. The band where they are sending the modulation signal are identified with those three letters;
L (LOW), **M** (MID), **H** (HIGH).

The range of value for AMOUNT is **-100:100%**. This means that you can also control the polarity of the modulation signal. Setting the AMOUNT to a negative value will "subtract" the modulation signal to the targeted value while setting to a positive value will "add" the modulation signal to the target value. Setting it to 0% will stop sending the envelope to the target but it will not turn off EF MODULATOR like for RESPONSE case.

TARGET

You can toggle between two modulation targets. Which are BLEND or LEVEL. The lower position indicate that you are modulating the LEVEL parameter while the higher position indicate that you are modulating the BLEND parameter. But are identify on the front panel.

Tips and tricks

- *Works great on material which have a rhythmic component, a too much sustained sound might not works properly.*
- *Target to the LEVEL to create compressor/expander effect.*
- *Create transient shaping on drums with heavy RESPONSE and target set to BLEND.*
- *Use the EXTERNAL INPUT to sidechain the EF MODULATOR [see REAR PANEL below].*

- *Use the EF MODULATOR CV OUTPUT [see REAR PANEL below] and created wicked sounds by routing back that modulation output to one or several parameter(s) from the device feeding Tritone (ex.: Osc Pitch, Filter Cutoff, Filter Res, Mod Wheel).*

- *If you are not using the EF MODULATOR sets the RESPONSE knob to 0% to save CPU load, remember that AMOUNT knobs sets to 0% will stop modulating its target but will not turn down the EF MODULATOR.*

PATCH BROWSER
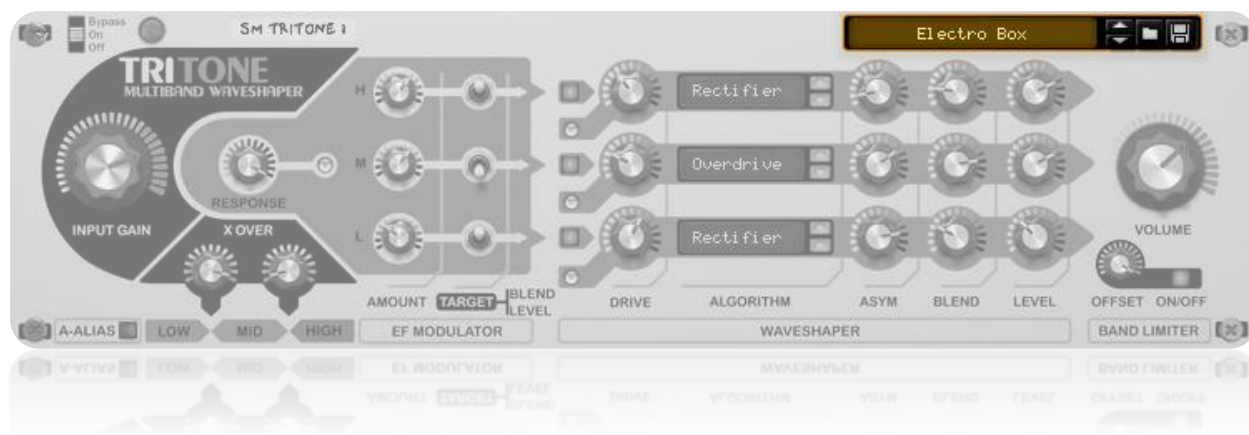
As in many other native Reason's devices. Tritone supports patch browsing. Presets and Combinators patches coming with Tritone are organised this way.

PRESETS FOLDER
This is where presets for Tritone are and it is divided into these three sub-directories; Bass, Beat and Lead. Bass folder contains presets which were created using bass sounds. Beat folder contains presets which were created using drums or percussions loops. Lead folder contains presets which were created using synths, pianos, rhodes and vocals sounds.

REASON ESSENTIAL / REASON FOLDERS
Both folders are sub-divided into two folders; Effects and Instruments. Each folders contains different patches made with Combinator rack and at least one Tritone. The main difference lives in the fact that Reason Essential owners will be able to use patches living inside Reason Essential folders only. Reason full version owners can use patches included into both folders. Patches contained into these folders are also labeled with the name of the artist who created them.

TRITONE MULTIBAND WAVESHAPER

OPERATING MODE
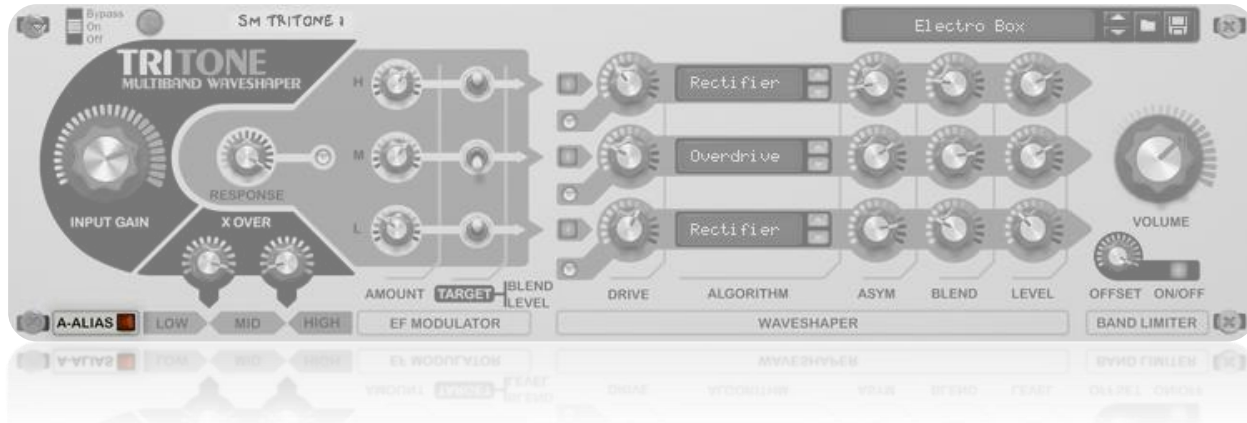
The change of operating mode is simply done by toggling the switch labeled A-ALIAS. That switch allow you to enable or disable the Anti-Aliasing operating mode. Aliasing occurred when some frequencies are higher than the system sampling rate.

Because waveshaping sounds involves the addition of overtones in the audio spectrum you can easily create frequencies higher than the sampling rate. In such a situation, there is no way for the host to reproduce frequencies higher than the sampling rate and it will generate frequencies in the lower range of the spectrum which can sound really unnatural.

For example, if your sample rate is running at 44100Hz your maximum bandwidth is 22050Hz. If you have an overtone in the range of 25000Hz, instead you will get a harmonic created at 2950Hz (25000Hz − 22050Hz). To avoid this, we use oversampling to increase the internal sampling rate.

Tritone uses polyphase filters solution to increase internal sampling rate and to remove frequencies which can cause aliasing. If enabled, internal sampling rate will be 2X host's sampling rate. Thus, if your host is running at 44100Hz Tritone is internally running at 88200Hz which increase the audio bandwidth to 44100Hz instead of 22050Hz.

The filters involved here have been designed to be the most efficient as possible while being as transparent as possible and not being too heavy on CPU. You can turn ON and OFF A-ALIAS to see if you get an improvement in the sound quality. This parameter is not automatable but is remotable.

TRITONE MULTIBAND WAVESHAPER

Tips and tricks

- *Try to leave A-ALIAS off while working on big project, turn it ON before bouncing or exporting your audio.*

- *Even if A-ALIAS removes frequencies which can cause aliasing, aliasing can still occurred if the material fed into Tritone is high in harmonic and if Tritone's settings are heavily distorting the sound.*

- *Using several instance of Tritone and letting A-ALIAS enabled on each instance in your Reason session can dramatically increase your CPU load, if you experience this disable A-ALIAS and enable it only when needed (audio bounce and audio export).*

- *According to the audio material you are working with and Tritone's settings you might not have to use A-ALIAS. If there is no aliasing occurring at all or if you just like the aliasing effect produced leave it disabled.*

REAR PANEL DETAILS

When you flip back Reason's rack this is what Tritone's rear panel looks like. There is plenty of connectors allowing you to create complex CV and audio routings.

MAIN I/O

The main input/output connectors is where you will hook up Tritone most of the time. These I/O are true stereo type. This means that if you only hook up the left/mono input channel the right audio outputs will not receive signal from the Tritone's left channel. To save CPU load try to only hook up the left/mono input and output if your source is not stereo.

WAVESHAPER I/O

All the inputs on the WAVESHAPER section are CV type while all outputs are audio type. Each three waveshaper's band have the following sets of CV and audio connectors;

DRIVE CV INPUT
Connect that input to override the DRIVE parameter on the front panel.

ASYM CV INPUT
Connect that input to override the ASYM parameter on the front panel.

BLEND CV INPUT
Connect that input to override the BLEND parameter on the front panel.

LEVEL CV INPUT
Connect that input to multiply the LEVEL parameter on the front panel. This CV input is not overriding the LEVEL parameter and is the only one which behaves like this.

CV INPUTS POLARITY
All CV inputs are unipolar types which means that CV in the range -1:1 will be converted to 0:1 range.

CV INPUTS TRIM
All CV inputs have a trim knob which you can use to adjust amplitude of the CV signal coming in.

AUDIO OUTPUT
Each waveshaper bands own a pair of audio connector for the left and right channel. They are labeled as INDIVIDUAL OUTPUT. Type of these connectors are true stereo like main I/O. These output allow you to take directly the processed band and add external extra processing to one or several bands.

There is two things to consider when creating patches with these outputs. The first is that the master VOLUME on the panel have no effect on these outputs because the signal is taken before the main output amplifier. However, you can still use the LEVEL knobs to control the signal level on these outputs.

Another way could be the use of a Reason's mixer and control the bands level on that mixer. The second consideration is when using BYPASS switch, these output

are shut off and it is a normal behavior. Otherwise, Tritone would not meets Propellerhead's requirement.

EF MODULATOR I/O

The EF Modulator own one mono audio input and one CV output;

EXTERNAL AUDIO INPUT
When connecting an external audio signal to that input, the EF MODULATOR will leave the internal audio signal and take that signal to generate its envelope. Use it for sidechain purpose.

EF CV OUTPUT
That output send the envelope generated internally and is unipolar type.

CROSSOVER INPUTS

You can modulate crossover frequencies using those two inputs;

LOW/MID FREQ CV INPUT
Connect that input to override the LOW/MID bandsplit frequency knob's value.

MID/HIGH FREQ CV INPUT
Connect that input to override the MID/LOW bandsplit frequency knob's value.

CV INPUT POLARITY
All CV inputs are unipolar types which means that CV in the range -1:1 will be converted to 0:1 range.

CV INPUTS TRIM
All CV inputs have a trim knob which you can use to adjust amplitude of the CV signal coming in.

APPENDIX

ALGORITHMS OVERVIEW

Because computer power is more and more available, Tritone uses the mathematical function method instead of the look-up table method for shaping the signal. This reduce the needs in memory space when one Tritone instance is created inside the rack. There is 11 algorithms at that time. Furthermore, algorithms are using various method of calculation. The algorithms are:

1. Crunch
2. Overdrive
3. Hard Clip
4. Soft Clip
5. Rectifier
6. Diode Drop
7. Foldback
8. Wrap
9. Expo AM (Exponent Amplitude Modulation)
10. Tanh Diff (Hyperbolic Tangent Difference)
11. Hash Rectifier

TRITONE MULTIBAND WAVESHAPER

ANTI-ALIASING OVERVIEW

The following illustration show you the impulse response for the anti-aliasing polyphase filters. That graph show you the response at 2X 44100 Hz (88200 Hz).

Both interpolation and decimation filter have the same specification;

- Cutoff frequency: 18 kHz
- Stop band frequency: 22 kHz
- Stop band attenuation: 56dB
- Pass band ripple: 0.25dB

TRITONE MULTIBAND WAVESHAPER
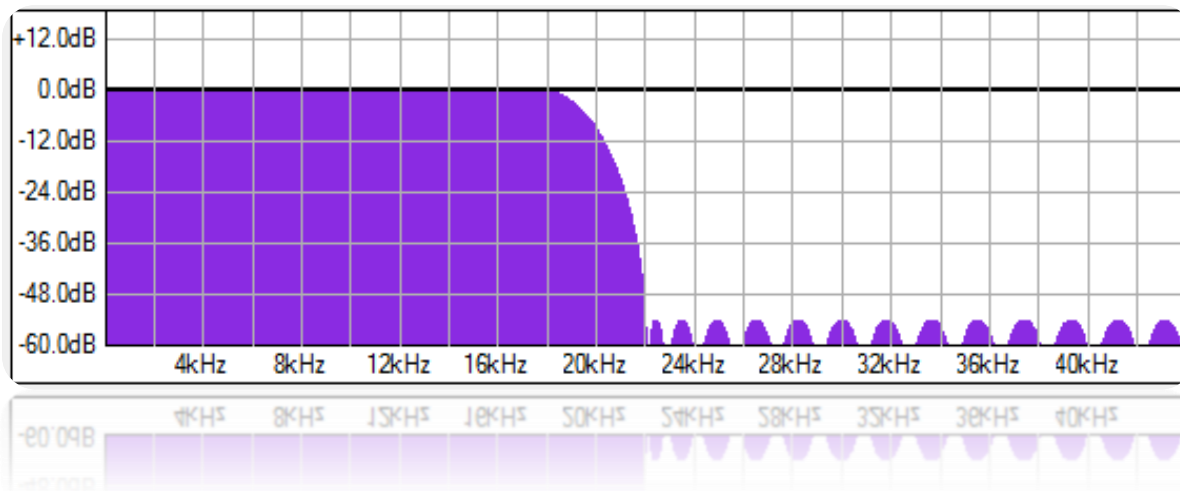
MIDI IMPLEMENTATION CHART

MIDI IMPLEMENTATION CHART		
SECTION NAME	PARAMETER NAME	MIDI CC#
MAIN	BYPASS/ON/OFF	42
	INPUT GAIN	12
	VOLUME	13
CROSSOVER	LOW/MID FREQUENCY	14
	MID/HIGH FREQUENCY	15
LOW WAVESHAPER	ON/OFF	43
	DRIVE	18
	ALGORITHM	19
	ASYMMETRY	20
	BLEND	21
	LEVEL	22
MID WAVESHAPER	ON/OFF	44
	DRIVE	23
	ALGORITHM	24
	ASYMMETRY	25
	BLEND	26
	LEVEL	27
HIGH WAVESHAPER	ON/OFF	45
	DRIVE	28
	ALGORITHM	29
	ASYMMETRY	30
	BLEND	31
	LEVEL	33
EF MODULATOR	RESPONSE	34
	LOW AMOUNT	35
	MID AMOUNT	36
	HIGH AMOUNT	37
	LOW TARGET	39
	MID TARGET	40
	HIGH TARGET	41
BAND LIMITER	ON/OFF	102
	OFFSET	103

TRITONE MULTIBAND WAVESHAPER
REMOTE IMPLEMENTATION CHART

REMOTE IMPLEMENTATION CHART			
SECTION NAME	**PARAMETER NAME**	**INTERNAL NAME**	**REMOTE NAMES** [SHORT : SHORTEST]
MAIN	INPUT GAIN	Input Gain Level	In Lvl : Ilev
	VOLUME	Output Gain Level	Out Lvl : Olev
CROSSOVER	LOW/MID FREQUENCY	Crossover Low/Mid Frequency	BandFC1 : BFC1
	MID/HIGH FREQUENCY	Crossover Mid/High Frequency	BandFC2 : BFC2
LOW WAVESHAPER	ON/OFF	Low On/Off	LowONOFF : Lact
	DRIVE	Low Drive	LoDriv : LDr
	ALGORITHM	Low Algorithm	LoAlgo : Lal
	ASYMMETRY	Low Asymmetry	LoAsym : Las
	BLEND	Low Blend	LoBlend : LBl
	LEVEL	Low Level	LoPost : LPG
MID WAVESHAPER	ON/OFF	Mid On/Off	MidONOFF : Mact
	DRIVE	Mid Drive	MidDriv : MDr
	ALGORITHM	Mid Algorithm	MidAlgo : Mal
	ASYMMETRY	Mid Asymmetry	MidAsym : Mas
	BLEND	Mid Blend	MidBlend : MBl
	LEVEL	Mid Level	MidPost : MPG
HIGH WAVESHAPER	ON/OFF	High On/Off	HiONOFF : HAct
	DRIVE	High Drive	HiDriv : HDr
	ALGORITHM	High Algorithm	HiAlgo : Hal
	ASYMMETRY	High Asymmetry	HiAsym : Has
	BLEND	High Blend	HiBlend : HBl
	LEVEL	High Level	HiPost : HPG
EF MODULATOR	RESPONSE	Modulator Response	EF Res : Efol
	LOW AMOUNT	Low Modulator Amount	EFLoAmt : EFLA
	MID AMOUNT	Mid Modulator Amount	EFMidAmt : EFMA
	HIGH AMOUNT	High Modulator Amount	EFHiAmt : EFHA
	LOW TARGET	Low Modulator Target	EFLoTarg : EFLT
	MID TARGET	Mid Modulator Target	EFMiTarg : EFMT
	HIGH TARGET	High Modulator Target	EFHiTarg : EFHT
BAND LIMITER	ON/OFF	Band Limiter On/Off	BandLim : Blim
	OFFSET	Band Limiter Offset	BLOffst : Boff
OPERATION MODE	ON/OFF	Anti-Aliasing On/Off	AAlias : Aals