TWD DLX User Manual

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Introduction

The file "TXD DLX-jsfx" is a script of an JSFX plugin which emulates a Fender Tweed Deluxe guitar amplifier. The emulation is based on the famous 5E3 circuit, but in addition some circuit variants are also emulated. This script may directly be run in the DAW REAPER, or it may be loaded with the VST3, AU or CLAP plugin YSFX and used in any host which supports VST3, AU or CLAP plugins. Please note that only the amp is emulated. An impulse response loader needs to be placed after the amp emulation. The file "Tweed Deluxe Loudspeaker.wav" comes with the plugin and is a good choice for the impulse response of a typical close-miked Tweed Deluxe amp speaker. It is recorded with a sample rate of 48 kHz. A good reverb plugin subsequent to the IR-loader is all that is needed to create a typical high-quality electric guitar sound.

Installation

Installing the plugin requires some actions on your (the user's) part:

If you are not a REAPER user you will need to download the plugin YSFX from: https://github.com/JoepVanlier/ysfx/releases

The plugin is available for Windows, MacOS and Linux. Download and unzip the desired zip file, and copy the extracted VST3, AU or CLAP file into your VST3, AU or CLAP folder.

Open the YSFX plugin in your host. Press the "Load" button of the YSFX plugin and watch in which default folder YSFX looks for JSFX files. Then copy the folder "HK" with its complete content from the plugins zip file into that folder. You could also copy the folder "HK" to any other place in your computer memory, but it will then be harder to find it via YSFX. Now press the "Load" button of YSFX again. Open the folder "HK" and open the file "TXD DLX.jsfx". Now you will see the "Main" screen of the TWD DLX plugin as shown in **Fig. 1**.

Now you are ready to use the TWD DLX plugin. First, however, we will describe the rest of the YSFX GUI, and only then concentrate on the TWD DLX plugin.

The "Recent" button of YSFX gives you quick access to the recently loaded JSFX plugins.

The "Reload" button reloads the current plugin.

The "1.0" button toggles between GUI sizes of 1.0, 1.5 and 2.0.

The "Edit" button opens the script of the currently loaded plugin. Here you can edit the script and see all global variables and their current values. Only programmers should use this button, though!

The "Preset" button opens a selector list of presets for the loaded plugin. The next button opens a menu where you can save, rename and delete presets.

The "Graphics" button toggles between the programmed GUI of the plugin, and the standard slider interface.

Between the "Recent" and "1.0" buttons, the file name of the loaded script, the preset name and the number of supported input and output audio channels are displayed.

Fig. 1: Main screen of the TWD DLX plugin when loaded in YSFX

If you already are a REAPER user, you can copy the "HK" folder with its content into the "Effects" folder of the REAPER resource path. This path is easily opened in the explorer or finder via the options menu of REAPER. You will find the TWD DLX plugin under the JS effects with the Name "HK TWD DLX".

The GUI

Fig. 1 depicts the "Main" screen of the TWD DLX plugin. A double click on a dial will restore its default value. The mouse wheel changes the value of a dial if the mouse pointer is moved over that dial. Dragging the mouse pointer upward and downward over a dial will change that dial value, too. Displayed toggle switches change their states by clicking on them.

The input gain value should be set to 12 dBu below the full-scale input level of the deployed audio interface if an authentic distortion behavior is desired. For example, if your audio interface has a full-scale input level of +13 dBu, you should set the input gain to 1 dB. You can of course also use variable input gain to compensate for different output levels of guitars, or just bring in some additional gain or attenuation.

The 5E3 circuit of the Tweed Deluxe amp uses a 12AY7 triode in its first tube stage. However, some amps of this type – such as Neil Young's specimen – are modified via the installation of a 12AX7 triode instead. This leads to an additional input gain of 4.9 dB. However by default we compensate the additional gains of variants with an additional attenuation at the volume control position. This way it is much more easy to compare the effect of the variants on the distortion behavior because the overall gain stays constant. If you do not like this compensation you can turn it off in the "Options" screen. If you want to access the maximum over all gain of some circuit variants you need to switch off the gain compensation too. The "12AY7" is hard to overdrive and produces only negligible distortion at normal input levels where the "12AX7" already brings in some "excitement".

The volume control reduces the gain after the first tube stage. We emulate the "Bright" channel of the original amp and assume that its second volume control is turned off. With the volume control settings of 0, 25, 50, 75 and 100 % we obtain infinite, 24 , 12, 5 and 0 dB of attenuation.

The original 5E3 circuit has two input channels with a separate volume controls and a common tone control. In Manfred Zollner's video "T99 Fender Deluxe" [11] you will find an excellent description of the functions and the complicated interactions of these controls. However we emulate the "Bright" channel only and replace the tone control with a "universal tone stack". We do not emulate any interaction between the volume and the tone stack controls as well.

The "univeral tone stack" of our emulation is much more versatile than the original tone control. It can emulate the three band tone stacks e.g. found in later Fender or Marshall amps and their derivatives very well. However the interactions between the bass, mid and treble controls are eliminated and the different scalings of the controls are omitted. This results in a more predictable frequency response. This tone stack does also enable us to obtain all the tones the 5E3 "Bright" channel, and any combination of the "Bright" and "Normal" channel will give. Moreover, many more tonal settings are possible, as well. The frequency response of the tone stack is always completely flat if the bass, mid, and treble controls are set to the same value. The attenuation applied to the three bands of the tone stack is the same as for the volume control if the same values are set. In **Fig. 2** we see all 27 frequency responses of the tone stack for all 27 control value combinations of 25, 50 and 100%. Note the small negative peak in the setting: bass = 50% , mid = 50 % and treble =100 %. It is typical for three band tone stacks but can not occur in the 5E3 circuit. This negative peak will disappear if the mid-value is increased a bit. Note that the most useful 5E3 tone settings can be achieved by reducing the treble-value in respect to the bass-value a bit for high volume settings. But at low volume settings the treble-value should be higher. than the bass-value. The mid control should always be set somewhere between the bass and treble control for Tweed Deluxe sounds. However the "scooped" tones of later Fender amps may be achieved with mid-values lower than the bass- and treble-values. In the "Options" screen we can further modify the tone stack.
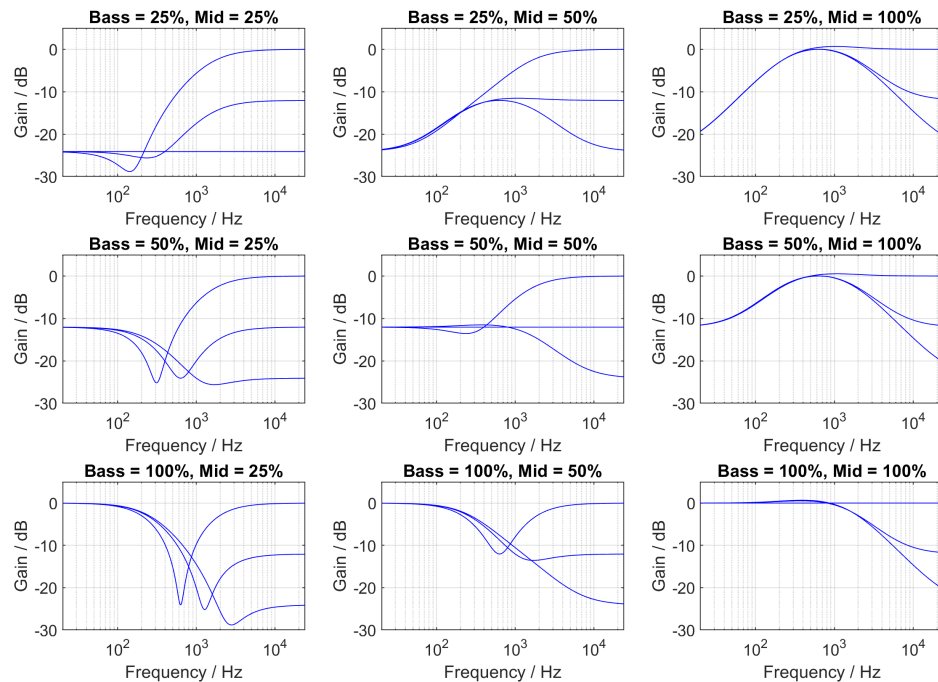
Fig. 2: Frequency responses of the tone stack for Fmid = 630 Hz and Qmid = 0.355

The original 5E3 circuit uses a cathodyne phase splitter. The output impedances of its two output paths are extremely different, the consequence being a very unbalanced power amp that generates a lot of even-order distortion. We call this variant "CD 5E3". The phase splitter circuit variant "CD BAL" uses a series resistor at the cathode output to match both output impedances. This leads to less even order distortion, and to less compression due to blocking distortion of the second power amp tube. The sound of this variant reminds the author of the sound of Marshall Plexi amps. Both cathodyne variants are clipping very harshly due to the very strong local feedback. Since the power amp tubes clip first and in a much softer fashion, this effect is not as strong as it could be – but is still perceivable as an "aggressive" distortion. We therefore introduce variants using the long tail pair phase splitter of the 6G3 circuit of the Fender Brownface Deluxe amp. However, at this point we still do not use the feedback loop from the loudspeaker output to the phase splitter input found in the 6G3 circuit. We simply replace the phase splitter. From this, we can expect a sound closer to a VOX AC 15 than to a Fender Brownface Deluxe. The clipping of the long tail pair circuit is much softer while the gain is about 29.2 dB higher compared to the cathodyne circuit. The output impedances and the gains are reasonably balanced. The output voltage swing is higher compared to the cathodyne circuit. This results in a fairly well-balanced power amp with more compression due to blocking distortion of both power amp tubes. Three "LTP" variants are offered here. In "LTP 3" we use the additional gain of 29.2 dB to its full extent. With the help of an attenuation of 14.6 dB just ahead of the phase splitter, we use only 14.6 dB additional gain in "LTP 2". In "LTP 1", we use no additional gain at all due to an attenuation of 29.2 dB just ahead of the phase splitter. All "LTP" variants sound softer and more compressed than the "CD" variants. To the authors ears, the "LTP-3" variant is the best variant for clean and edge-of-breakup sounds. As with the tube 1 variants, we

compensate the additional gain at the position of the volume control if gain compensation is switched on.

The output gain can vary the output level of the plugin. If it is set to 0 dB the amp will saturate at about -12 dBFS.

We reach the "Options" screen shown in **Fig. 3** by clicking the "Options" button of the "Main" screen.

Fig. 3: Options screen of the TWD DLX plugin when loaded in YSFX

The effect of the gain compensation is already described above with the circuit variant controls. It may be switched off here.

The control "Fmid" can shift the center frequency of the middle-frequency band of the tone stack. The control "Qmid" changes the quality factor and thus the bandwidth of the middle band of the tone stack. For values above 0.5 we enter the territory of active or LC tone stacks. For example, the sound of the "Mid-Booster" in Eric Claptons Stratocaster could be obtained this way without the need of an extra equalizer plugin in front. In **Fig. 4** and **Fig. 5** you can observe the effect of the two optional tone stack controls.
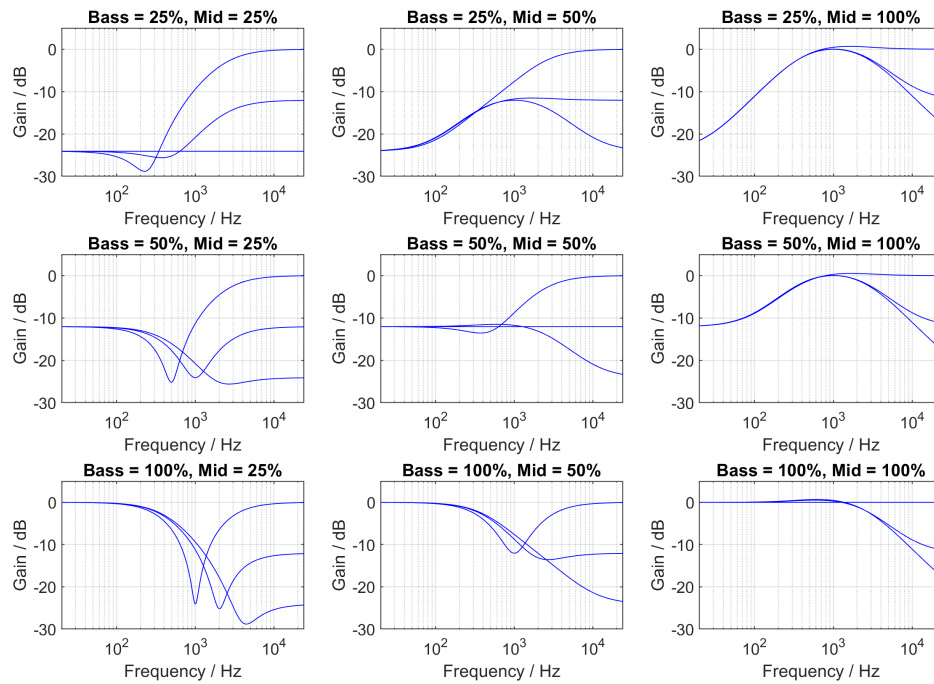
Fig. 4: Frequency responses of the tone stack for Fmid = 1000 Hz and Qmid = 0.355

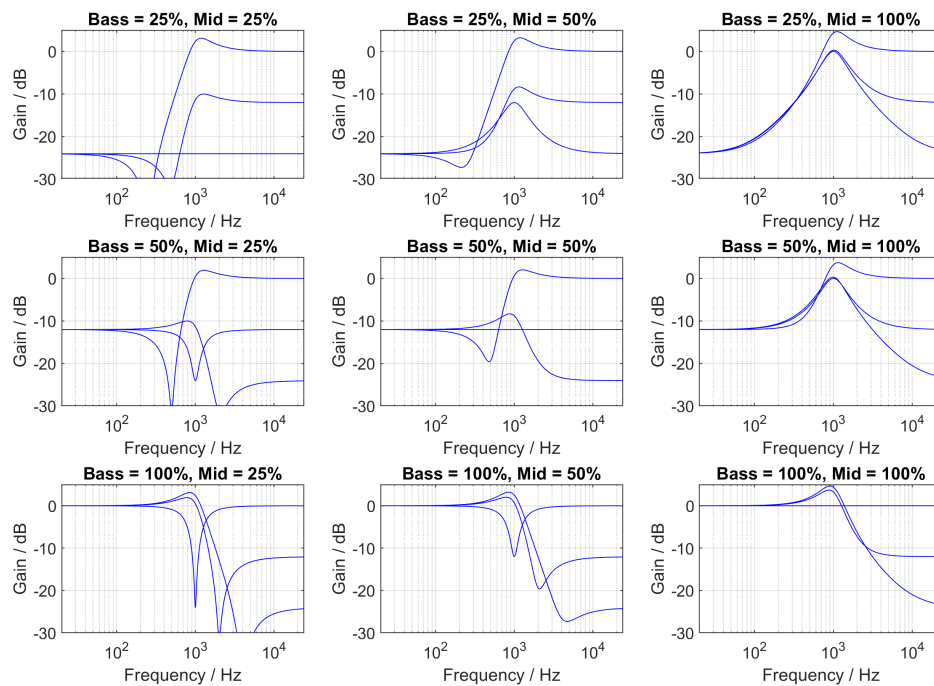**Fig. 5:** Frequency responses of the tone stack for Fmid = 1000 Hz and Qmid = 1.4

The seven controls related to "speaker" allow for modifications of the interaction between the amp and the connected loudspeaker.

"Speaker inductor" with its three controls takes care of modifying two high shelf filters, one located ahead and the other after the power amp tubes. The treble gain is controlled with "Gain 1" and "Gain 2". "Find" sets the frequency where the loudspeaker inductor begins to dominate the loudspeaker impedance. The default values for these three controls are realistic and yield a good sound. However, you are encouraged to modify the settings since they do have a huge impact on the sound. The frequency response of power amps including a global feedback loop could be emulated by reducing "Gain 1" to values close to 0 dB. The frequency response of amps with a presence control could be emulated with moderate values of "Gain 1". Emulating the harder clipping of power amps with a global feedback loop this way is, however, not possible.

The four controls related to "speaker resonance" modify two peak equalizer filters, the first located ahead, and the second after the power amp tubes. The gain at the resonance frequency of the loudspeaker is controlled with "Gain 1" and "Gain 2". The resonance frequency of the loudspeaker is set using the control "Fres". The total system-quality factor of the loudspeaker is set with the control "Qts". Realistic gain values would be 10.5 dB for "Gain 1" and 2.5 dB for "Gain 2". Most guitarist would not like the resulting "boomy" sound, though; they probably would try to counteract with an external equalizer. The default values therefore are much lower. As already mentioned for the "inductor" controls, we can emulate the frequency response of power amps with a global feedback loop by using "Gain 1"-values close to 0 dB.

Please note that we usually work with impulse responses of very closely-miked loudspeakers. The "in the room"-sound of a Tweed Deluxe combo does however have much less bass due to the "acoustic short cut" of its open back enclosure. For this reason, a strong resonance peak could be beneficial for its sound "in the room".

We reach the "About" screen shown in **Fig. 6** by clicking the "About" button of the "Options" screen. Returning to the "Options" screen is done by clicking the "< back" button of the "About" screen. We arrive back at the "Main" screen by clicking the "< back" button of the "Options" screen.

Please note that changes of circuit variants do not use parameter smoothing. Thus you might hear a clicking sound, and a short signal pause during the change. It is consequently not recommended to use different circuit variants in the middle of a running performance. All other parameter changes of the plugin are smooth and generate no gap.

It is worth to mention that the TWD DLX plugin needs only less than half of the computer resources if we compare it with modern amp plugins from Neural DSP or with the NAM plugin with standard quality profiles. However the sound quality and playing experience is at least on par with these competitors. It is worth to mention too that Neural DSP plugins introduce a latency of more than 1 ms compared to only 2 sample periods of the TWD DLX. Thus TWD DLX is a very good choice if you are after a high quality live setup with very low latency and running on a fanless tablet like the authors Microsoft Surface Pro 7.
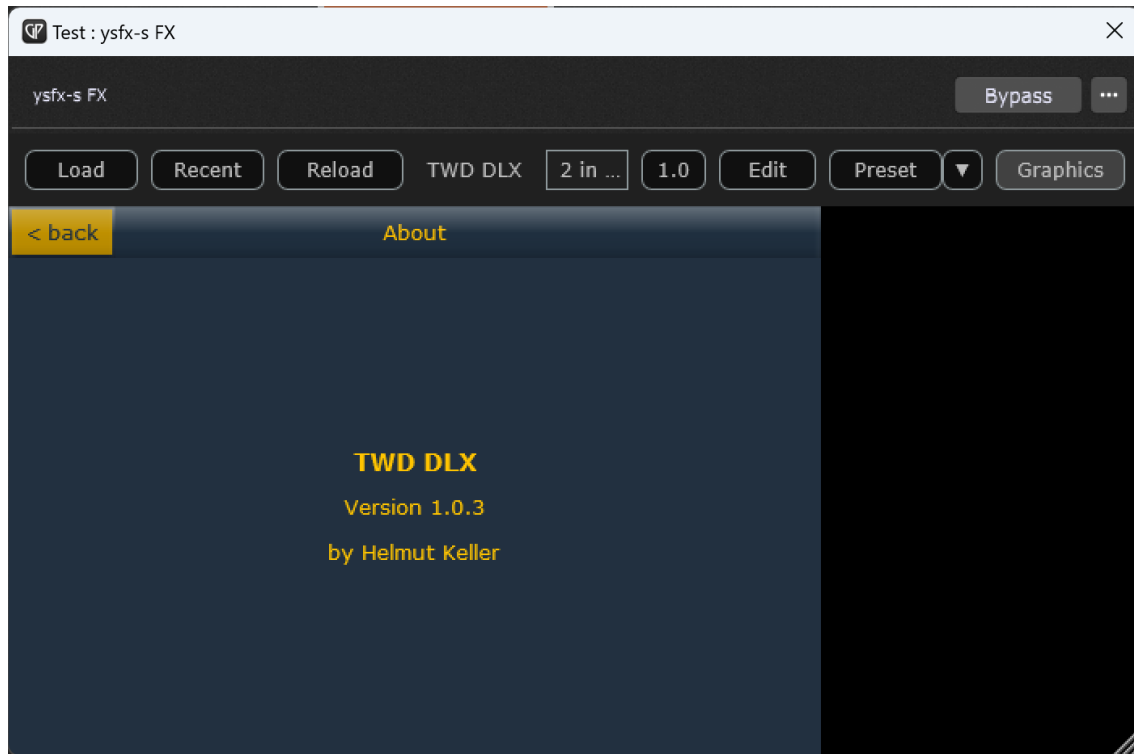
Fig. 6: "About" screen of the TWD DLX plugin when loaded in YSFX

The other plugins

You will find three further JSFX plugin of the author in the folder "HK":

The plugin "Volume Wah" is an improved version of the plugin described in the authors paper "Wah-Wah Plugin": A programmed GUI has been added. The signal processing is modular now by using the authors DSP block libraries. The parameter smoothing is improved. The frequency scaling is even more flexible. With its default settings the plugin emulates the famous VOX V847 Wah-Wah pedal. The plugin can function as volume pedal as well.

The plugin "360 ° Panner" implements a vector rotation based panorama control. When panning hard right for example the original mono signal will appear on the right channel and the original side signal will appear on the left channel. The pan position can be modulated too. This way it is possible to create the illusion that a stereo signal is rotating 360 ° around the listener. You can hear this effect in the middle part of the Pink Floyd song "Poles Apart" where the orchestra seems to rotate slowly around you.

The plugin "Blender" can blend or switch between two audio channels A and B. It is very useful to blend between two IR-loader plugins or to switch between two guitar amp plugins. The plugin has four input channels for two stereo inputs. You may restrict the number of input channels of the plugin to two input channels in your DAW. In this case the plugin will blend between the two mono inputs or between the left and right channel of a stereo input.