



eTAP2 Engineer Vintage Tape/Disc Echo Emulator

Instruction Manual

eTAP2 Engineer a free Vintage Tape/Disc Echo Emulator

1. Introduction



eTAP2 Engineer, showing the VOX LongTOM configuration

Obviously, There is nothing better then the real vintage gear. As vintage gear is very difficult to get anymore there are a lot of developments ongoing utilizing DSP units mainly available as H/W input devices to the guitar sound chain. All devices claiming to be a valid replacement for the wonderful vintage effects but most are a very poor representation of this vintage era.

The utilization of VST modules allows the effects designer to utilize more features and specific vintage effects including a better fine tuning over the mentioned

expensive hardware based DSP units available. Building a product that will be better than what's on the market today is an interesting challenge as it is a discovery tour of what can be achieved with the present VST development environments on standard windows PC's.

The VST module we present is a result of about 6 years experience in analyzing, developing and creating patches for various echo gear. From an engineering point of view, the objective was to emphasis on the already available vintage measurement libraries and applying the do- act-improve cycle to the design at hand as to maximum the possible performance possible.

The final approach taken is a dual approach. In many cases the guitar player is not interested in fine- tuning an echo device but would just like to select a recommended setting and play along with it. For this type of player the preset manager is loaded with a extensive set of pre-programmed patches ready to be used. In other cases where the guitar player requires matching the exact echo with the echo that was used to record the track from his/her favourite artist. The eTAP Engineer VST module is the assigned module that fits this requirement as it allows customizing the various filter and timing characteristics in minute details.

The emphasis for eTAP is geared towards the vintage echo's used by H.B. Marvin during the 1960- 1965 era. We believe "from the man himself" that the early recording are made without the Meazzi gear but with some sound- engineering tricks.

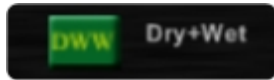
The mentioned vintage echo gear allowed the Shadows to sound like the recording while performing live. Our approach would allow also for a fine tuning towards the "studio delivered" echo's. The VST module presented here allows for those two mentioned approaches as it will act as a normal vintage device emulator or can be fine-tuned to your specific needs.

Developed, designed, build and calibrated by: Piet Verbruggen & Jacob Heijer

2. General Description

2.1 The Audio In/Out Button

As the guitar is a mono device eTAP is adhering to the following mono conventions:

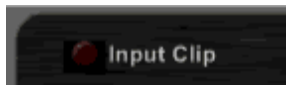


There are both a left and a right channel. One of the channels will carry the Dry signal including the Wet signal and the other channel only the Wet signal.

A button on the left panel allows for having Dry+Wet on one channel and Wet on the other channel or, when switched on Wet on both channels.

Hint: The module could also accept stereo. Please be aware of the fact that two mono signals like LEFT+RIGHT together are twice the signal strength so an overload of the module is then possible. A clip LED is added to warn you about a clipping input to the VST module so you can correct this.

2.2 Input Clipping LED



The input clipping LED will be activated when the input signal to the eTAP module is > 0 dB. Care is to be taken to avoid clipping, the signal to the eTAP module should be always reduced.

2.3 The Heads Layout

The Heads Layout

Recording Head



Obviously, there is no recording head.

The Wet In knob is the only visible component of the "recording" part of the tape emulator and controls therefore only the wet part of the audio signal.

By doing so it can be also seen as a master control for the replay heads. Care should be taken in not overdoing the volume set as it sums with the sums of all active playback heads.

Feedback head



The feedback head is the cumulative head control. It takes all outputs from the multiple heads feedback streams selected and joined together so it controls the overall feedback.

Note: The feedback signals from the assigned heads are taken before the output amplitude is controlled for the echo head so the signal for feedback is always available and controlled by the mechanism explained.

Playback heads



Heads layout for 6 playback heads



Heads layout for 4 heads

All playback head configurations are controlled by the preset manager only. When, as an example, the Echomatic- I is selected all heads are active. When, again as an example, the Echomatic-II is selected only the 4 heads are displayed and the feedbacks are aligned to the last 3 heads.

When a knob/dial label is coloured RED the function is not enabled so can be regarded as being switched-off.

Hint: Pressing the [SHIFT] key on your keyboard while adjusting the knob allows for a fine control

2.4 Feedback Configuration

The feedback is controlled for possible of 3 assigned heads separately. The maximum amplification per feedback is 0dB. Care is to be taken to assure no clipping is introduced when all are selected.



Note: In the case that you've selected different feedback heads the amplification or the feedback per head is maximized to 100% (as a ratio of the adjusted feedback) care should be taken to not overload the feedback circuitry.

2.5 Feedback Cut-off frequency

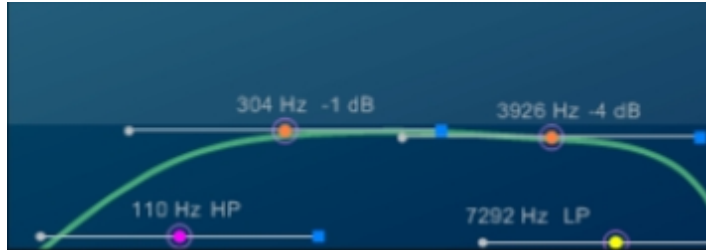
Feedback Cut-off Control



The Feedback Cut-off knob controls the frequency slope of the feedback audio stream and act therefore as a precise instrument controlling the tone of the feedback. The marking C is the calibrated setting that's comparable with most of the echo gear that's on the market. The tone envelope provided fits the total tonal range.

2.6 The Equalizer

The graphics EQ (Equalizer) is the main WET curve used through the audio chain that requires to be fine tuned for each device. The user can adjust this to his/her liking



- We've selected a HighPass filter (■) and a LowPass filter (■) to assure the curve can be finely controlled on both ends of the curve. In the middle area there are 2 peak equalizers (■) selected as they are much better suited to fine- tune the filter for this particular purpose.
- The dot/circle is the centre frequency and the horizontal line with the blue square's is the bandwidth selectable.
- The green curve represents the active throughput curve.

Using the cursor to select a filter makes it simple to move the centre frequency to a place you like and dragging the blue square to/from the centre frequency will change the bandwidth also to your liking. Moving upwards or downwards will change the amplification of that particular filter.

Tip: For fine- tuning press the SHIFT button on your keyboard while using the cursor to drag the setting.

Remember that the DRY signal is not altered by the WET Equalizer settings. The rule to optimize your chain of sound events is to apply an equalizer before you enter the module and fine tune the echo equipment throughput curve so that the sound is a sub- set of what came in. As an example, when the feedback trail sounds totally different from the first dry signal then you need to correct that in your wet filter.

Some rules you have to obey are related to staying below about 5dB and a bandwidth of 5kHz as this is also being the upper limit of your guitar. It is also highly recommended to have the peak equalizers (■) slightly above 0dB (each or just one) as this would enable a shelving effect that will be helping sculpturing your feedback sound.

Warning: When building your own patches:

When developing your own settings it is key to assure that the position of the 1kHz equalizing is be set to 0dB as this value is part of the calibrated dB calculation of the total audio chain:

(dB value wet)+ (dB value one head) + (dB value equalizer@1kHz)

By doing so the result is then exact. After this calibration you can bring the middle equalizer(s) back to an higher value to enable a correct shelving.

Rule1: The echo shall never be higher in dB's then the dry pulse. Remember that in a hall each reflection is

lower than the dry signal. An echo that's higher is not natural and should be avoided.

Rule2: Although Halo and/or a low output of the first heads simulates reverb you have to understand that reverbs never returns a bass so it's never be a perfect solution to get reverb through an echo device.

2.7 The Preset Manager

The Preset manager is the main components or the control room of this application:



The Preset manager is pre-loaded with a complete set of JPatches to allow "playing like the Shadows". The JPatches are based on the following vintage Meazzi echo equipment:

- Echomatic -I
- Echomatic-II
- Meazzi PA304
- VOX LongTOM
- Roland RE301
- Binson Echorec Baby
- BPM (Special mode)

Tip: The JPatches coding versus the tracks they cover is available from www.echotapper.nl

The preset manager shows the current JPatch in the left top of the window and, for additional convenience, the "root" echo equipment used as the basis for this patch is displayed at the bottom.

In addition there is a LED button added to allow switching between a locked preset manager and an unlocked preset manager. When selected, the LED and the label will be shown in vivid colours so the users is made

aware of the fact that the current settings could be altered.

By selection Unlock an additional button appears that allows for saving the new patch or the change to an existing patch. After completion of the change/addition the save button should be pressed to assure the changes are recorded and the unlocked state of the LED button should be switched to locked to make the changes R/O during the session.

The preset-manager works with data stored in the module and is therefore read-only. The data is also copied in RAM memory so any change you make to the patches (or new patches designed) are only kept in the RAM being memory that's freed-up when the module is switched-off again.

The best way to manage this is to use the load and store all programs facility.

Let's assume you've changed patch 1 and would like to move on to the next patch before saving. In this case your first patch is deleted and replaced with the default patch! Here are some rules so you can achieve saving them:

Rule1: Any change on a patch should be saved before moving on (switch the locked LED to unlock and just switch the save button below the LED) Then if you go to the next patch and changed it then do this procedure again...

Rule2: When all changes are in: conduct a save all programs before you're quit using eTAP.

Rule3: When you start a new session with eTAP just load all programs with your file and it's all there to be used.

It's also good practice to use a naming convention for each new set of (save all programs) patches and to keep the old text files for backup. I'm using programs120108.txt for a configuration I've saved on 12Jan08

2.8 Tape/Disc Artefact's

The tape artefact's, also part of the DESO objects can be controlled through the knobs on the right panel of the engineer module or at the top in the forthcoming eTAP Standard model. Care is to be taken not to overdo the activity.

Halo: Halo is the leakage effect of all playback heads in the Echomatic-II configuration. It is believed that it's only around 0-1%. The range provided is extended so it can be investigated/utilized to the fullest

W&F: Wow and Flutter are artefact's belonging to the way pulley and capstan but also other mechanical wear (like capstan dents in a rubber wheel) are affecting the tape/head interaction. Our W&F is based on a measured tape mechanism as no information is available on discs behaviour.

Saturation: Saturation is mimicking the tape's saturation behaviour as it really compresses the signal. Our saturation fits a typical 15IPS tape.

In addition, extra 12ax7 valve characteristics are added to the audio chain including a signal/noise/distortion relationship that's comparable with vintage echo machines.

Tip: Pressing the SHIFT key on your keyboard while adjusting the knob allows for a fine control

2.9 BPM

The BPM mode (Beats per Minute) allows for a head timing mode that fits exactly the beats per minute. By using this mode the user can create an unique set of timings and the related amplifications of the heads including a wet filter characteristic to emulate other devices.

First some theoretical stuff to get a common understanding:

To create a tempo-synchronized effect, you simply divide 60 by the tempo of the music in beats per minute. For instance, if the tempo is 120 beats per minute (bpm), the duration of one quarter note (that is, one beat) is $60/120$, or 0.5 seconds. Engineers commonly refer to that as 500 milliseconds (ms).

An eighth note at 120 bpm lasts half as long, or 0.25 seconds (250ms). And a sixteenth note lasts 125ms. Because a dotted eighth note is equivalent to three sixteenths, it lasts 3×125 or 375ms. A thirty-second (1/32nd note) is therefore 62mS

Now the eTAP2 implementation:

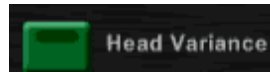
So, as per the example described, the resulted value would be 62mS. This will be our first head timing in eTAP2 when BPM is used according the example given. Remember that this first head is not used that much as it's rather short, in our example much too short, and would act more then a sort-of-reverb thing.

This is the way we've implemented BPM on eTAP it is exactly conform those mentioned rules. As you've seen now, with the thirty-second (1/32nd note) designated as being the first head and the other heads always 1st head's timing incremented spaced so it's a series of equal spaced timings in compliance with the BPM rule with possible the 1/4th timing not within the range of the calculated head timing.

By using this method all equal spaced echo devices can be emulated. If you need, as an example that 500mS@ 1/4th note then the BPM setting of around 90 would give you 1 head (#6) with a exact 500mS timing. By changing the BPM to 60 you could get both the 1/4th timing and the 1/8th timing in range . Remember adjust the heads not used to be set to '0' (red colour) to disable them.



2.10 Head Variance



The head variance switch provides a variance in the spacing of each head in a random fashion. The variation is based on the assumption that the drill plan to mount the heads is ± 0.02 mm so the heads will be "moved" around in a space of $\pm 5\text{mS}$ based on a 15IPS tape speed. The main purpose of this approach is to make the leading echo samples not completely in- sync as they are equal spaced as a basis the net result will be more natural tape/disc behaved echo.

Note: The head variance cannot be stored.

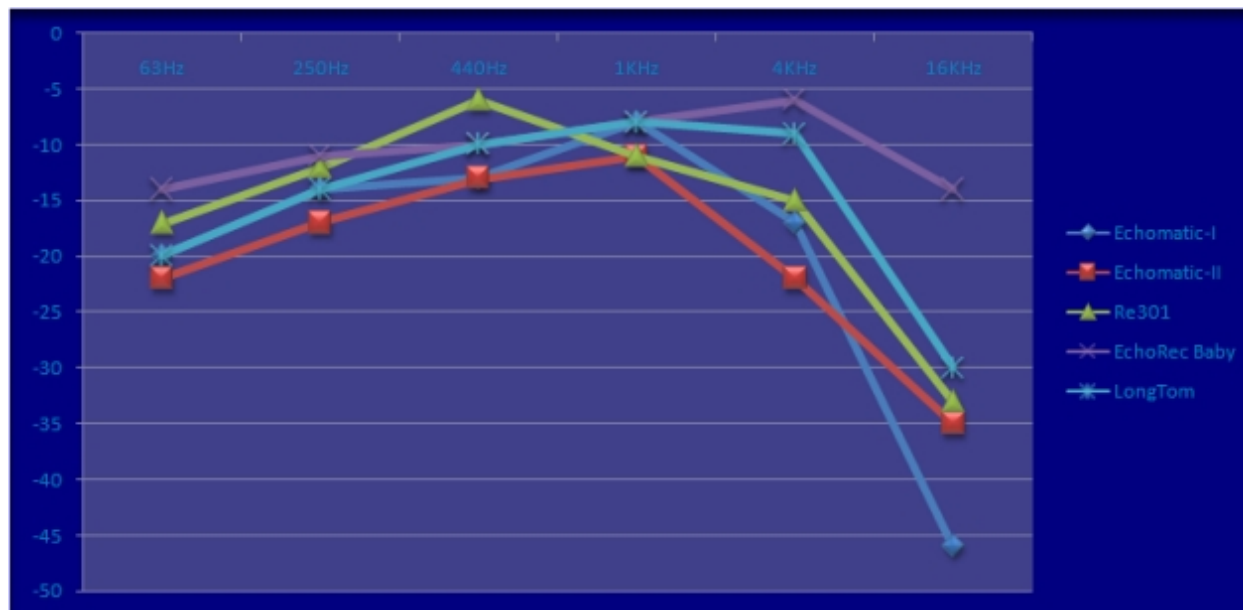
3. Recommended Use

- The eTAP2 Engineer module is created to allow the specialist to create new patches It is a platform for the specialist to fine- tune timings and filtering to produce echo's that are not available otherwise.

3.1 How to use the JPatches

The main setup of the JPatches is always based towards a pivoting point around a centre frequency pending the echo gear to be emulating. The plot below, based on vintage measurements, shows a slightly skewed curve for each machine with the centre moved from about 900Hz/1kHz to 4kHz pending the echo device. When adjusting the equalizer it is key to assure this centre frequency to be slightly above the 0dB line as it will also directly affect the feedback characteristics by allowing for a shelving effect.

Tip: All our calibrations are done by using a 1kHz pulse (after we know the total curve that is) to assure they are exact. So, in contradiction to the shelving settings, while calibrating using the dials the 1kHz value should be exact 0dB while calibrating as it is part of the sound chain (WET + HEAD + EQ). note: HEAD is then 1 head only!! Obviously those settings should be altered to enable the shelving effect when calibrated.



Some typical curves of vintage machines

4. Software

4.1 Version management

version and build information can be obtained by selection the   buttons.

The help button provides a direct link to the information kept on the www.echotapper.nl site so you can always check if there is a new version available as reported in the left top of the web page:



Version management is achieved through parameter passing when the HELP button on the module is selected. The parameter is checked against the current version and a "you have the last version" is displayed at the left top corner of the website.



When this is not the case the message "There is a newer version" is displayed on at the left top corner of the website. the latest version can be download directly from [here on the site](#) . The version control is listed [here](#)

The build information button will display the build version, exact build date and time .

Note: The interaction to the website for version management is not monitoring IP addresses or other elements.

4.2 Download the Software

The latest software is located here:

eTAP2 Engineer 	Version 2
eTAP2 Engineer Large GUI	n/a

4.3 Installing the module on your PC

The recommended installation of the VST module is in the location that's already being pointed to by your VST host.

4.4 Version control

31-12-2007 version 1.05c

Added LED to allow detection of clipping in the input signal to the eTAP modules.

2-01-08 version 1.05e

Reinstalled and checked initial patches and issued the package on the site for general use.

13-01-08 version 1.05f

Resolved erratic settings behaviour by removing the echo device selector interaction with the VST manager. This was also possible as the preset manager contains sufficient data for re- use in new patches.

Changed the feedback characteristics as per request from key test users.

Extended range saturation to distortion point at 100%.

Added device information in the preset manager

14-01-08 version 1.05g build 004 Issued and available via web

Implemented a variable feedback cut-off frequency iso the fixed version.

Implemented a system to allow altering/adding new patches in the preset manager.

07-02-08 version 1.05g build 006 in final testing

Added sample rates 44200,48000,88200,96000 and 192000

Added display of current sample rate in preset manager's window including rate detection and error reporting.

Improved W&F functionality to work with periodic/apperiodic frequency modulation based on a per device related pulley/capstan mechanism

Changed equalizer with LP/HP and two peak equalizers this to ease adjustments and avoiding unwanted side-effects

Added new device "VOX LongTom"

Added new device "BPM Tempo" and added BPM Tempo input to allow changing head times per BPM

Added a "Head Variance" switch to randomly displace heads within the tolerance band of head placement on mechanical systems.

Changed toggle switches to buttons to improve readability while limiting footprint.

Change GUI to a brushed metal look

Applied rim around equalizer to prevent graphics from overflowing into the GUI.

All dB scales and displays are now fully calibrated.

28-02-08 version 105g build 006f final version

W&F assembler code changed to high level language (C++ like) to avoid reported incompatibility.

Noise floor for valve noise upped to -100dB as the level was not measurable anymore due to the addition of the on/off switch.

Feedback control low level 0.01% leakage to avoid CPU loading.

Build with extreme large GUI available on request to support life performances.

Note: Publication to a wider audience will take place when JPatches are available.

Note2: The 007 build was with extensive machine language and was put back on the shelf as we had 2 reports of non-compatibility.

10-03-08 version 2 build 001 final version

While producing the first set of core patches we decided to, based on very positive feedback, extend the feedback capability by 3 heads (yes, selecting all 3 in one go if required) to allow for some very special patches to be included in the forthcoming delivery. By doing so we've now conditionally removed heads from the GUI (when required for, as an example, Meazzi Echomatic II and a Copycat models) so it's much easier for the user to understand and the precise workings in the future. At the present we are in the process of building the JPatches.

We also decided to move from an input-window to input BPM values to a knob as this is easier to fine adjust the required settings, again, this to make it the user easier to work with eTAP.

---eof--

4.5 Some Software facts

- The eTAP2 module is written in Synthmaker. This environment is object oriented. The top level is all with graphics building blocks and the lower levels are mostly written in an object oriented C++ like language or directly in assembly the latter to maximize performance.
- The unit's VST protocol is in compliance with VST SDK 2.3000
- In eTAP2 both SSE and SSE2 are used throughout the program. The core of our product is based on our own developed set of **d**igital **e**cho **s**imulation **o**bjects (DESO) to assure the product is as close as possible to the vintage machines covered. The eTAP VST general modules and this DESO core are licensed under the Creative Commons.
- The total cycle from the initial phase to completion in real hours work is around 350 hours. It is not a product that's being put together in a couple of weeks but care was taken throughout the project to create excellence

5. System Requirements

Windows 2000/XP operating system with any VST 2.3 [functional VST Host](#) already functional for other VST modules. and a Pentium/AMD CPU with SSE/SSE2 support (1.4Ghz+ recommended).

eTAP2 is capable in sensing sample rates automatically. When a incorrect value is offered to eTAP2 it will report an error.

6. Compatible hosts

The following hosts are regarded as compatible as they load the VST module and the module works perfectly while staying stable:

- Cubase SX2
- Kore 1.1
- EnergyXT 2.0
- VSTHost 1.44 ([free version from here](#))
- Cakewalk Guitar Tracks Pro
- Kristal Audio Engine 1.0.1 (free)
- Adobe Audition 1.5
- Sound Forge
- Acid Pro 6
- Samplitude V8 SE
- Cubase SX3 (vst 2.3)
- and many more

Please understand that testing of potential compatible VST hosts is limited to availability of the host software at the eTAP creators venues and therefore possible limited for this free eTAP product. We therefore are depending on kindness of potential users to carry-out some initial yes/no testing to proceed in making the compatible host listing more complete.

7. Support

Support of the module is done through communications utilizing various MSN communities.

It is assumed that patches developed by users will be published throughout the MSN guitar playing community and the dedicated forum. A set of JPatches will be eventually part of the deliverable but also published on www.echotapper.nl.

Additional information regarding the way the JPatches are designed can be found on the www.echotapper.nl site under the DIY (do it yourself) menu.

8. Trademarks



VST is a trademark of Steinberg Media Technologies GmbH

[Syntmaker](#) is the development tool used and is trademark of Outsims Ltd.

9. License



The eTAP VST modules are licensed under the Creative Commons "Attribution-ShareAlike" license.

The original authors and copyright holders are Piet Verbruggen and Jacob Heijer. The software is available [here](#)

10. Who are We?

We are Piet (Peter) Verbruggen and Jacob Heijer the owners of the www.echotapper.nl site. In the last 5 years we've obtained an in-depth knowledge of echo's as used by the recordings of The Shadows and H.B. Marvin. We both live in the Netherlands and are very active in playing guitars and building echo patches.

We both own various types of echo equipment ranging from a 1959 build tape unit to various DSP and BBD units.

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