Wave Arts

Tube Saturator plug-in

Wave Arts claim that *Tube Saturator*, "a basic circuit consisting of a Baxandall-type three-band EQ feeding two 12AX7 triode preamp stages... is the world's most accurate real-time tube-amp plug-in." Let's examine how they can make this outrageous claim — and why I agree. Before we start, I'll say the manual is worth reading. It even publishes the circuits with component values. (You could build them!) It also goes into more detail about the SPICE-like modeling method and explains the theoretical inferiority of other methods for making two-stage digital tube amps. I will try to cover topics that are not in the manual. Let's talk theory first, then listen.

This is the only plug-in I know of that does true component-level modeling; that is, each component has its own equation. This is very similar to SPICE modeling, a regular fixture in computer-aided physical circuit design for many years now. SPICE does not run in real-time though, and it will also utilize the equivalent of very high sampling-rates (GHz or more) to solve a circuit equation at any given point in time, so the *Tube Saturator* designer created his own real-time, bandwidth-limited (limited by the sampling rate) SPICE-like audio-processing system. This is amazing in itself and worth a pause, because within the limits of CPU power, Wave Arts can now make any analog model relatively quickly. Also, they claim it's the only way you're really going to get a two-stage digital tube amp. Unfortunately, this method is extremely CPU intensive. For example, I can barely run a mono instance on my Macintosh Dual 2.3 GHz G5 with Nuendo, on a single audio track at 96 kHz. *[On a 3 GHz Core 2 Duo, a single, 96 kHz mono instance takes up roughly 33% of a single core.]* If your DAW supports it, you can take advantage of non-real-time bouncing to disk, to use the plug-in up to 192 kHz. For reference, I asked Wave Arts when CPUs are expected to have enough power to run a Fender Bassman head model using the Wave Arts engine — about five years.

It's important to consider parasitic effects of components in analog design (see "Behind the Gear" in *Tape Op* #75). In *Tube Saturator*, tube microphonics and noise, for instance, are ignored. The only parasitic effect that was seriously considered for inclusion was having the tubes warm up! They passed on that. Where non-linear components, such as the tubes, are concerned, measurements of actual components were used to derive the equation data, rather than pure theoretical models. The designer claims this sounded way better, and that's not hard to believe. On top of that, the tubes are digitally "matched" (measurements copied from one tube to the other), so if you subscribe to Groove Tubes' theory about tube matching, this is tube paradise. Linear components like resistors and caps are simplified to pure equations and are "perfect." Things like the power supply and I/O impedance are not modeled and are therefore also idealized. In theory, it's a perfect tube amp without noise, microphonics, power-supply problems, etc.

A Baxandall EQ, named for the original designer, uses low and high shelf filters so wide that the flat part of the shelf is out of the audible band, and similarly, the mid band has super-wide Q. *Tube Saturator* models a Wave Arts–modified version of a published circuit. I'd never heard of a Baxandall EQ, so I had to look it up. The only folks that talk about them online are Hi-Fi DIY'ers and Dangerous Music, who released one recently for mastering. I asked, "Why the Baxandall EQ?" and it was simply because they wanted EQ, and wanted "something different." I think they stumbled onto something very special, and this plug-in is easily worth more than $99 just for the EQ. More on that later.

This plug-in is not anti-aliased, which in my mind is sort of like operating a circular saw without the safety guard. Digital processing is capable of generating frequencies above the upper bandwidth limit ("Nyquist frequency") of the system it's on. If allowed to pass into the D/A converter, it is called "aliasing." Aliasing is digital garbage; I've only ever heard aliasing sound good on Tom Yorke's *The Eraser*, where I am pretty sure he did it on purpose. Anti-aliasing filters remove the offending frequencies before the D/A. I asked, "Why no anti-aliasing?" Simple, it increases CPU load even more, and they couldn't hear the difference. Plus, the claim is that no anti-aliasing is needed at 88.2 kHz and above, so the manual suggests that if you can hear aliasing, up-sample before processing. The manual also suggests up-sampling if you want to increase the resolution of the distortion modeling, and that it will be preserved when you down-sample. I did listening tests to confirm both of these assertions.

While this plug-in is not specifically for guitar, guitar is as good of source as any for this test. I tuned my guitar carefully and played around until I got the most glorious sounding open E-major I could play and sampled it at 192 kHz. I used BarbaBatch to make 96 and 44.1 kHz versions. I ran them through *Tube Saturator*. EQ is switchable; I left it enabled but knobs at 0. There is a signal Drive knob which controls a ratio between the input and output volume to keep the level constant as distortion increases. I cranked that to 10. There is a gain-boosting Fat switch, which I left off. There is also an output volume knob that does not affect tone — nice for feeding into other plug-ins. I created versions at each sampling rate, then used BarbaBatch to convert them all to 44.1 kHz. As usual, I thought I could detect small differences, but when I listened without knowing which was which, I could not hear any difference at all. I then compared the files by difference-testing — that is, mixing two files together while flipping the polarity of one. The result is the difference between the two files. There were definite differences.

Comparing the file that was processed at 44.1 kHz to the one at 192 kHz yielded a difference file full of aliasy, raspy, sparkly crap. The file peaked at about –25 dBfs, with the original files at just below 0 dBfs. The difference file between the 192 kHz and 96 kHz had no digital garbage. It peaked at about –40 dBfs. It sounded pretty good, like a thinner version of the original. These tests suggest that there is aliasing at 44.1 kHz, and none at 96 kHz as promised. Three, there is good sounding stuff being generated between 96 and 192 kHz that stays in the signal when you convert to 44.1 kHz. Woah!

Again, *Tube Saturator* is not a guitar amp, but for reference, I compared it to Native Instruments Guitar Rig 3 anyway. I used the amp model that sounded the closest to *Tube Saturator* with gain at 10 and compared using the aforementioned 96 kHz E-major sample. GR3 cleaned up my guitar signal before it went to the amp, so I imitated this with some pre-EQ using another plug-in. I could get them pretty close sounding, but *Tube Saturator* seemed slightly more 3D, lively, and real-life than GR3. I liked it, but I don't think I'd put up with the CPU load to use *Tube Saturator* on guitar in a mix, because GR3 still sounded good and is much less of a CPU hit.

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My trials with the EQ were a revelation. I was confused at first, "Is it supposed to sound this good?" It can't be used for surgery, but if you're asking for (more or less) lows, highs, or mids, this Baxandall thing has a beautiful answer. I think there will be a Baxandall revival if enough people check this out. The EQ is before the tubes in the circuit, so you can also use it to color the way the tubes are driven. In conjunction with the drive knob, you can get pretty creative. It's just viscerally great sounding; check it out.

A cool trick for digital recording is to add inaudible amounts of distortion to each track in a mix. Even though you can't hear it on the solo'ed tracks, it can, for instance, produce a mix with more apparent loudness. Some mixing consoles do this naturally. I tried this with *Tube Saturator* on a 96 kHz session, for a "real" tube version of this trick, without adding noise. Since I can only run one, I bounced one track at a time. It took an hour for 11 tracks, but it was worth it. With the settings used, the mix didn't get louder but without changing the overall tone, all of the little ear-piercing moments that I had been struggling with were gone. Overhearing, my fiancé asked me what was going on; she said, "Well, you can tell *Tape Op* I could hear it; it sounds great."

Mastering engineers could also add a bit of tube distortion to stereo masters and to use the Baxandall EQ as a tone balancer between songs. For high-end mastering folks, I think it would be worth buying a dedicated computer just to run this plug-in, and the whole setup would likely be price competitive with a similar analog unit, if it existed. Plus, *Tube Saturator* doesn't have the noise of analog tube circuitry.

Wave Arts dropped the price from $149.95 to $99.95 while I was writing this review. I think they are valuating *Tube Saturator* too low, because it's relatively impractical to use due to the CPU load, unless you are limiting its use to just a track or two on a high-powered rig. But it sounds spectacular, and this is the only way you're going to get this sound. If I was doing the marketing, this would be called the "Baxandall Mastering EQ with Tube Saturation" and would sell it for at least $495. Be glad I don't work for Wave Arts. In fact, my only wish is that you could disable the tubes and just use the EQ for a much lower CPU hit. Highly recommended. Download the 30-day unrestricted demo, and try for yourself! *($99.95 direct; www.wavearts.com)*

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Classic Audio Products of Illinois

VP26 preamp

Scott Liebers Labs

SL-2520 op-amp

As an owner of a 1976 API model 3232 console, Jeff Steiger has years of experience restoring, repairing, and modifying his desk. The modular build of those APIs is modification-friendly. Being a tech-nerd, he built, duplicated, or sourced many unique printed circuit boards and other components that are crucial to the 3232's sound. He founded Classic Audio Products of Illinois as a way to help other vintage console owners and to share his work with other audio electronics enthusiasts.

Classic Audio Products offers two DIY preamp kits. The VP25 comes with an Ed Anderson EA 2503 output transformer and is more in line with a 312-style preamp. The *VP26* uses an EA 2623-1 output transformer and is more aligned with the vintage console preamp sound. We tested the *VP26*.

As I've mentioned in other DIY reviews, every project has a unique story when it comes to parts/component sourcing. The Classic Audio Products kits come complete except for a Discrete Operational Amplifier (DOA), which must be obtained separately. The project uses the standard 2520 footprint. And since the DOA attaches to the circuit board via Mill-Max sockets, swapping out DOAs is simple. If you don't have your own op-amp, Classic Audio Products has two options at their store. First is the gar2520, which is a nine-transistor DOA by Gary Barnett of Barnett Industries in Amherst, Ohio. Second is the *SL-2520 Red Dot*, a ten-transistor DOA hand-built and tested by Scott Liebers of Scott Liebers' Labs in Minneapolis, Minnesota. We used the *SL-2520* because (a) it comes assembled, and (b) I had been reading about them for a while on Eddie Ciletti's site (www.tangible-technology.com). Neither op-amp is potted, meaning they are not encased in an enclosure filled with epoxy. Manufactures resort to such measures to prevent theft of their designs. Instead, they are exposed, which translates to greater heat dissipation, longer life, and ease of service should they require repair. As of this writing, I have yet to build and test the gar2520, but I will say patience, a steady hand, and experience are required to build one; there are a lot of parts in a very small space.

Everyone's definition of "soldering experience" is different. This kit is designed for moderate to experienced builders. Perhaps I'm biased, but I believe most *Tape Op* readers are much more prepared for this kit than the average recording enthusiast. So, if you've made many microphone / instrument cables, built a few projects from PAiA or your own guitar effects, and know your way around a multi-meter, you're probably ready for this kit. That said, this was one of the quickest projects to build (again, I used the pre-assembled op-amp from SLL). The full-color directions are a solid "A" in terms of clarity and illustration. There is even a page that helps with resistor separation.

Enough of the building, how does it sound? We did direct comparisons against our API 212 preamps, which live in our Sony MXP-3036 console. If you're not familiar with the 212 line, I would describe them as beefier than today's 512c and 3124 preamps, but slightly less colored than '70s era preamps from the 3232 console. Depending on how you set up the gain stage, the 212s can be reference-quality clean. In fact, we purchased our 212s from Sony Classical, who were using them for symphonic recordings.

Our first impression was the *VP26* is not just similar to the API 212, they're closely related. Specifically, on snare drum, it was difficult to tell the two apart, although it seemed that the *VP26* had more headroom and broke up a hair later than the 212. On picked acoustic guitar the difference was more noticeable, with the *VP26* having more clarity. The 212 seemed veiled in comparison. On strummed acoustic, the two were so similar I gave up trying to force a difference for the sake of the review. Likewise, electric guitar was the same story. These tests led me to conclude that on loud sources, the *VP26* is virtually identical to our API 212s. But on softer sources, it's much more revealing than our 212s. Honestly, it was like comparing a Millennia Media against the 212; that's how much more clarity there was.

Speaking of other brands, we decided to shoot the *VP26* against some other makers. Singer/songwriter Ben Shannon was in for a vocal session and volunteered to be our test subject. Using a vintage Neumann U 87, we compared the *VP26* against a Millennia Media TD-1, a Purple Biz (*Tape Op* #55), and a FiveFish SC-1 (#72). Ben has a voice that lives in the midrange but can wander in higher registers. I would say he's similar to Tom Petty from a frequency standpoint. All the preamps sounded good listening to them alone. When we added the backing tracks we started to form opinions. The FiveFish was too thick, leaving Ben's voice fighting with the acoustic guitar. In a similar sense, the Purple let the vocal sit lower in

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