Sound with a soul
Voxengo

Voxengo TEOTE User Guide

Version 1.15

https://www.voxengo.com/product/teote/

Contents

Introduction

TEOTE is an automatic spectral balancer plug-in for professional music production applications. It was designed to be a very useful tool for both mixing and mastering. It automatically performs such tasks like gentle resonances taming, de-essing, tilt equalizing, usually performed during mixing and mastering. In mixing, TEOTE sounds good on pretty much any material.

While by definition TEOTE is a dynamic equalizer, its technology is solely based on multi-band dynamics processing. This allows TEOTE to have only minor phase issues, and to produce a subtle transient-emphasis effect associated with dynamics processing. TEOTE tries to make the program material follow the specified spectral profile, tuned to the contemporary mastering standards by default. It can be said that TEOTE "straightens" the frequency response, making further adjustments a lot easier; it removes a lot of repeating work.

Is TEOTE an AI plug-in? In a sense that AI usually boils down to a "curve-fitting task", TEOTE is an AI plug-in that performs gain adjustment decisions in a quantity equal to "SampleRate multiplied by BandCount" per second. However, TEOTE does not use neural networks; it is based on an extremely-refined, completely predictable, curve-fitting function.

"TEOTE" is an acronym for "That's Easier On The Ear". TEOTE is a serious contender in helping bring your music production to the next level!

Features

- Automatic spectral balancing
- Selectable processing band count
- Unlinked stereo processing
- Multi-band gain adjustments meter
- Stereo and multi-channel processing
- Internal channel routing
- Channel grouping
- Up to 8x oversampling
- 64-bit floating point processing
- Preset manager
- Undo/redo history
- A/B comparisons
- Contextual hint messages
- All sample rates support
- Zero processing latency

Compatibility

This audio plug-in can be loaded into any audio host application that conforms to the AAX, AudioUnit, VST, or VST3 plug-in specification.

This plug-in is compatible with Windows (32- and 64-bit Windows XP, Vista, 7, 8, 10 and later versions, if not announced otherwise) and macOS (10.11 and later versions, if not announced otherwise, 64-bit Intel and Apple Silicon processor-based)

computers (2.5 GHz dual-core or faster processor with at least 4 GB of system RAM required). A separate binary distribution file is available for each target computer platform and audio plug-in specification.

User Interface Elements

Note: All Voxengo plug-ins feature a highly consistent user interface. Most interface elements (buttons, labels) located on the top of the user interface are the same in all Voxengo plug-ins. For an in-depth description of these and other standard features and user interface elements please refer to the "Voxengo Primary User Guide".

Dynamics

This panel contains parameters that affect plug-in's dynamic characteristics. Note that a threshold parameter is not required as this plug-in uses a weighted loudness estimation instead, similar to the one defined in the ITU-R BS.1770 specification. TEOTE estimates the momentary spectrum, and applies multi-band gain adjustments relative to the overall momentary loudness level.

The "FX" parameter specifies the "strength" of effect applied per band, when the input signal requires adjustments. This parameter is equivalent to a usual "Dry/Wet Mix" parameter. The required gain change solely depends on the program material relative to the "Spectral Profile" (see below), it is a parameter-less function.

The "C/S/F/CS" selector adjusts dynamics envelope follower's topology. While the numerical modes adjust timings, this selector specifies structure (scheme) of the envelope follower that produces a dynamic envelope. The "C" mode is a "classic" topology first introduced in TEOTE 1.0. The "S" and "CS" modes have a symmetric topology that is similar to the "C" topology, but with some of its boost-cut asymmetries removed. The "S" mode may require a lower "Slope" setting since it sounds brighter (with presence effect); it is modern-sounding, and less "vintage". The "CS" mode sounds softer, similarly to the "C" mode. The "CS" mode is now the default mode.

Compared to the "C" topology, the "S" and "CS" topologies produce fewer low-frequency overshoots and have more pronounced mid-frequencies. The "F" topology implements a filter-like scheme which works as a low-pass filter, without attack-release switching logic. This topology usually sounds overly snappy and "in your face", so adjustments to the "Base Atk" and "FX" parameters may be required; this mode does not require the "Base Rls" parameter. The "F" mode is good at getting sounds to "cut through" the mix.

The numerical selector on the "FX" knob specifies an alternative dynamics envelope mode: in practice, modes above 1 are equivalent to "transient emphasis" modes. This selection does not change the schematic/topology of the plug-in, but adjusts (increases) internal constants of algorithm's dynamics envelope, so may in some cases also require adjustment of the attack, release and "HF Timing" (see below) parameters, if the effect seems too strong.

The "Boost T" (boost threshold) parameter specifies band's loudness level (relative to the overall loudness level) at which band's gain adjustment "stops", and either returns to the unity gain (in the "U" mode), or is limited (in the "L" mode), is gradually reduced (in the "W" wrap mode) towards the unity gain, when the threshold level is crossed. Tuning the "Boost T" parameter is required when working with a highly-dynamic or narrow-band program material so that both quiet parts and noise-floor are not over-boosted. Setting this parameter to "0" enables the "compression only" mode of operation, useful for narrow-band program material.

It may be useful to first test the maximal achievable gain change by setting the "FX" to the maximum, and the "Boost T" to the minimum: if the gain change metering does not go above +/-4.5 dB it means the program material already follows the spectral profile closely. If the gain change is too large, and rarely crosses zero, it may mean the program material still needs some basic preliminary processing, at least some tilt-like equalizing. After this test, both parameters may be set to less extreme values, to produce a more natural action. In this aspect, when bypassed, TEOTE can be used as a mixing and mastering equalization guide. Note that when analyzing "reference" tracks this way, you need to fine-tune the "Slope" first, and enable the "Apply to Range" switch (see below) since low- and high-frequency roll-offs of mastered tracks may vary greatly.

The "Base Atk" and "Base Rls" parameters specify dynamic adjustments' timing. These are similar to timing constants used in compressors and expanders. However, in TEOTE they specify times for the base (20 Hz) band, with higher bands receiving successively smaller timing constants, relative to the base (subject to the "HF Timing" parameter). Depending on the "HF Timing" parameter, 20 kHz band may receive as little as 1/20 of the base band's timing values: that's a very fast compression/expanding action.

Note that TEOTE uses the same dynamics algorithm as found in Voxengo Marquis Compressor's "New" mode, for both compression and expanding; it is a very natural-sounding algorithm. It may be useful to set the "Base Rls" to a value smaller than the "Base Atk", especially if it is apparent that the plug-in over-reacts on bass-drums. The balance between the "Base Atk" and "Base Rls" parameters affects the peak gain change, in tandem with the "FX" parameter.

Since TEOTE works simultaneously as compressor and expander, the attack and release settings do not react the way they usually react in a compressor. It's useful to perceive these settings as "coloration" settings. For example, if you want to tame resonances, a lower attack and release settings should be used. And if you would like to boost transients, higher values can be used. Only when the "Boost T" parameter is set to "0", these settings react in a more usual "compressor" way.

The "Ch Link" parameter specifies the strength of linking between channels. In a fully unlinked mode (0) the plug-in adjusts all channels independently of each other; it also consumes a lot more CPU resources. Unlinked mode can skew the stereo-field information, and may not reach the overall spectral balance goals. In most cases, it is suggested to leave this parameter at "100", or close to "100", as TEOTE even in a fully-linked stereo mode does not affect the sound stage adversely, due to its multi-band processing algorithm; lower values can be used to produce artistic sound stage coloration effects.

The "P" and "A" switch selects the mode of channel linking: Peak or Average (RMS). This switch affects stereo material only, at higher channel linking values; it has no effect on mono material. The "P" mode usually offers "heavier" sounding basses while the "A" mode usually sounds "snappy" on full-stereo masters. To be more specific, "peak" in the channel-linking algorithm means "extremum of signals". If the "left" signal equals "right" signal, the extremum is same as the average. So, the "A" mode's sound differs only on stereo signals with a lot of side-channel information: in this case the "average" may be substantially different from the "peak". Also, at low "Ch Link" values the "P" and "A" modes are mostly equivalent since individual channel levels are prevalent anyway.

The “Energetic/Balanced/Controlled/Fluid/Fluid Stable/Fluid Punch” switch selects the overall loudness estimator’s response mode. This mode affects both the handling of transients, “stability of sound”, and overall sonic coloration of the result. While for an untrained ear the difference may not be large, for a trained ear it may be decisive. The difference is most apparent at lower “Base Atk” and “Base Rls” settings. The “Balanced” and “Controlled” modes offer “more instant” loudness estimations producing a minimal dynamic over-reaction, but they may sound a bit too controlled. The “Fluid” modes use a substantially different method of loudness estimation, they usually sound a lot gentler.

The “Mastering” switch enables the so called “Mastering mode” of dynamics processing. It offers a lot gentler gain adjustments, especially in the bass range, and usually reaches only ¾ of the gain of the non-mastering (feed-forward) mode, so it also requires the “FX” parameter fine-tuning. Technically speaking, it is a feedback dynamics mode, and only adds a single instruction to the processing topology; however, in practice this mode takes 80% more computing resources on some processors, and it may require lowering of the band count. This mode is best used on full-spectrum material that is initially close to the target spectral profile.

The “OLE Roll-off” slider present in the “Out/In Gain Change” panel controls the low-frequency roll-off’s width (in octaves) of overall loudness estimator’s (OLE) weighting filter. Higher values reduce the weight of the lower frequencies: values above 3.0 can be used on program material with a highly-dynamical low-frequency content like in EDM music. Higher roll-off values reduce resulting “swings” of high-frequency content in such genres, make it more “stable”. Lower roll-off values are best used on program material with even dynamics across the spectrum, usually on acoustical sound. Value of 2.54 makes the weighting filter very close to EBU R128 weighting. Note that roll-off values above 4.0 may give a “bass-thinning” effect: in this case it is advisable to use a lower “Slope” value (see below).

Spectral Profile

This panel displays knobs that control the target spectral profile that TEOTE makes program material follow. TEOTE balances the program material to this profile. Note that the plug-in does not apply any filters, so these knobs are not related to filtering of any kind. However, as the spectral profile acts as a reference, if the program material’s spectrum deviates from the profile, this may result in spectral adjustments that reflect the required spectral profile.

The provided set of profile parameters was designed for contemporary music mastering: this includes the “Slope” parameter which controls the target spectral slope, in decibel per octave, with -4.5 dB being a de-facto standard in contemporary music. This parameter affects the “brightness” of the result. Note that -5.0 slope is “lower” than -4.0 slope by value, but it has a steeper spectral slope.

The “Lo Cut” and “Hi Cut” parameters apply -12 or -6 dB/oct roll-offs (depending on the “Cut -6”/“Cut -12” switch) to the profile: these can be also commonly found in contemporary music. The “Room Dip” parameter, though not being common, applies a -2.5 dB, 1-octave wide, bell-shaped dip to the profile. Such dip accounts for usual listener room’s acoustics deficiency where the first offending room mode happens at 130-200 Hz, which makes the music sound a bit “mushy”. This dip can be disengaged by moving it to 20 Hz.

The “Bands” parameter adjusts the number of processing bands. This parameter affects both the precision of the processing and the CPU load requirements. For mastering it is suggested to set this parameter to a higher value while when processing the individual tracks, lower values can be used. At lower values, the “Lo Cut”, “Hi Cut” and “Room Dip” parameters may not be followed closely. The “Bands” values below 20 produce a slight -0.4 dB base- and highest-frequency roll-off due to plug-in’s band-splitting design. The algorithm won’t be able to detect sharp resonances at lower “Bands” values; however, even at higher “Bands” values, TEOTE mostly performs smoothing of resonances rather than removes them completely. Higher “Bands” values do not always produce “better” result; higher values may even produce “overly sterile” sound, removing too much nuances in the program material.

The “Apply to Range” switch can be enabled if you would like to apply the effect to a selected range of frequencies only; in this case, the “Cut” parameters will be transformed into the “Range” parameters. When the “Range Lo” parameter is set to a value higher than the “Range Hi” parameter, the mid frequencies’ processing will be bypassed. If you would like to compare the “full spectrum” and “spectrum range only” performances, it’s suggested to use the “A/B comparison” feature of the plug-in. Note that in this mode the “Cut -6”/“Cut-12” switch affects the frequency range roll-off, its “width”.

The “Flat/Eq.Loud/EQL+Rock” switch selects an additional profile setting, which may be useful during mastering. The “Eq.Loud” setting applies a 2-2.5 dB, 0.8-1 octave wide, boosts to 60, 1.57k and 9.1 kHz spectrum areas. The “EQL+Rock” additionally applies a boost to 3.4 kHz spectral area, which is often used in rock and metal music. When using these settings, a post-equalizer after TEOTE usually becomes unnecessary. These settings are best used for “Slope” values less than minus 4.2 dB/oct; for higher “Slope” values they may be excessive. Note that these profile settings may make the sound a bit “thin”, so they are not universally-applicable. Also note that for these settings to be precise, at least 30 bands processing is required.

As this plug-in only performs spectral balancing or normalization, it cannot create spectral content (except dynamics processing-associated harmonics, especially at lower frequencies). So, for example, if the program material generally lacks the higher frequency content, but mostly contains high-hat hits, they may be boosted considerably. While statistically the outcome will be balanced, compositionally it may sound like it’s filled with high-hat hits mostly. Similarly, this plug-in may not be immediately efficient on bass guitar (that lacks full-frequency content), but works well on vocals and drum buses. The “Lo Cut” and “Hi Cut” parameters can be used to reduce over-reaction on a lack of spectral content. Alternatively, the “Apply to Range” mode can be used on a narrow-band input signal.

Note that this plug-in uses analog-style band-splitting which produces a slightly non-even (+/- 0.15 dB) frequency response and induces a minor phase coloration (dependent on the “FX” parameter). In such a tremendously dynamic plug-in like TEOTE (which features a very fast response at higher frequencies) such approach is desirable in comparison to linear-phase band-splitting or dynamic equalization, which both may introduce transient artifacts. TEOTE uses the same band-splitting technology as Voxengo Soniformer plug-in, which is being used by engineers for more than a decade, without any objections to its sonic qualities.

More specifically, TEOTE, like Soniformer, changes the phase over the spectrum only minimally (approximately for 4 degrees, with the phase-shift being close to linear across the audible spectrum), while its dynamic adjustments do not change the phase by itself, but may induce harmonics. On the other hand, usual dynamic equalization

may induce both phase-shift/ringing and harmonics at the same time, depending on the EQ steepness and change timing. Moreover, in TEOTE, if you leave the "FX" parameter at e.g. "50", it will be only 50% of the full, initially minor, phase coloration. Plug-in's phase coloration is so small the full processed signal sounds well as just a mix with the dry signal (what the "FX" parameter does).

Level Meters

TEOTE features a multi-band gain adjustments meter, and the "Out" meter. The display range of the meter can be changed. Note that the gain adjustments meter displays integral per-band gain adjustments with 200-millisecond integration time. It may be beneficial to enable the "Density Mode" in the plug-in's Settings window to have a somewhat more informative gain metering.

The "Out" meter shows plug-in's master output level. You may take a look at the "out/in" indicator to see the average loudness change taking place, which may be accounted for with the "Out Gain" knob, or via clicking on the numerical value of this indicator.

In-Chain Position

This plug-in is best placed before the final clipper and/or mastering limiter, and after any equalizing and dynamics processing plug-ins. However, if the music style requires augmentation of certain frequency bands (e.g. 2.5-4 kHz boost in metal music, or 60Hz, 1.5 kHz, and 9 kHz equal-loudness boosts), a plain equalizer can be placed right after this plug-in: since TEOTE produces a somewhat balanced spectrum, post-equalizing it becomes an easy task. TEOTE is in no way a complete mastering solution: for best results, it may require a prior static tilt equalizing; preliminary dynamics processing is, however, less of a requirement, especially if individual tracks in a mix were also balanced with TEOTE.

It can be suggested to use a spectrum analyzer like Voxengo SPAN Plus, tuned to the required spectrum slope, with a longer averaging time, after TEOTE in the chain. Since TEOTE bases its multi-band gain adjustments on momentary spectrum, whose correlation to the integrated spectrum greatly depends on the program material and its dynamics, TEOTE may not always reach the target integrated spectral profile; in this case, a correction to the "Slope" parameter, or a preliminary tilt equalizing may be required.

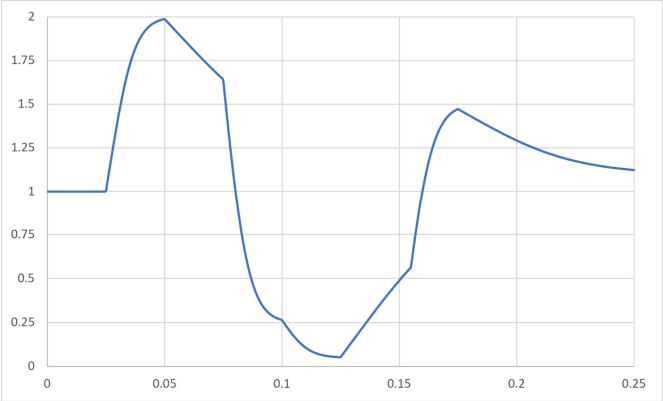
To sum up, the most flexible plug-in chain looks like this:
EQ (preliminary) -> TEOTE (balancer, "straightener") -> EQ (profiling) -> Limiter.

The "profiling" EQ may be omitted if TEOTE's result sounds satisfying.

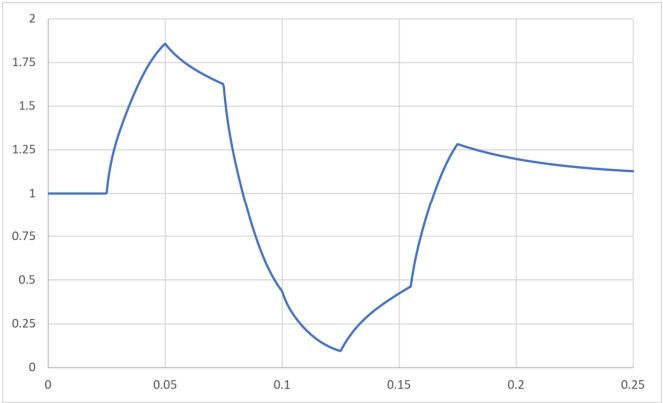
It is a common question, why TEOTE does not offer a way to define more elaborate profiles. The main reason they are not offered is because TEOTE is a multi-band processor; it is discrete relative to the required final EQ profile, and may not be precise towards required peak gains. Secondly, TEOTE is not "hard precise" in applying an integrated EQ profile as it is precise only relative to a momentary spectrum. Thirdly, fine-tuning a profile is as time-consuming as using an EQ, so there may not be any workflow-efficiency gains in such profiles.

Dynamics Envelope

If you are interested in how TEOTE's dynamics envelope operates, here you can see an example graph (for "classic" mode "FX 1C"). On this graph, the vertical scale displays the linear gain value (with 2.0 being 6 dB, and 0.5 being -6 dB). This graph uses attack time equal to 20 milliseconds, and release time equal to 60 milliseconds (250 milliseconds overall time span). The envelope starts at 1.0, then the next goal is 2.0 (attack), then 1.25 (release), then 0.25 (attack), then 0.05 (attack), then 0.99 (release), then 1.5 (attack), then 1.1 (release). As you can see, such attack/release logic is usual for a compressor or expander, but in TEOTE, when the signal gain goes from boost to cut, and from cut to boost, an attack phase is always activated.



For comparison, here is the graph of the "FX 4C" mode. As you can see, it features a considerably different shape beside somewhat lengthened timing.



Note that the release stage on both graphs is apparently a bit longer than 60 milliseconds. The specified release time is multiplied internally by a fixed factor to match a commonly-expected release timing.

Credits

DSP algorithms, internal signal routing code, user interface layout by Aleksey Vaneev.

Graphics user interface code by Vladimir Stolypko. Graphics elements by Vladimir Stolypko and Scott Kane.

This plug-in is implemented in multi-platform C++ code form and uses “zlib” compression library (written by Jean-loup Gailly and Mark Adler), “base64” code by Jouni Malinen, FFT algorithm by Takuya Ooura, filter design equations by Magnus Jonsson and Robert Bristow-Johnson, VST plug-in technology by Steinberg, AudioUnit plug-in SDK by Apple, Inc., AAX plug-in SDK by Avid Technology, Inc., Intel IPP and run-time library by Intel Corporation (used under the corresponding licenses granted by these parties).

Beta-Testers

Alan Willey

gl.tter

Michael Anthony

Niklas Silen

Questions and Answers

Q. I'm hearing that TEOTE produces "pumping".

A. TEOTE is unable to create classic "pumping" kind of sound, because plug-in's reaction time is almost instantaneous. What you hear is most probably due to TEOTE raising loudness of spectral parts that were not compressed enough in the first place. For example, ride cymbals are a common case: since they are often not compressed in the mix, when their relative loudness is increased, they may sound like being out of control. To reduce this effect, applying a multi-band compression before TEOTE is advisable. Also, the "Controlled" mode can be used in this particular case, to reduce plug-in's over-reaction. Another possible source of over-reaction on a master bus can be a case where a narrow-band part is followed by a broadband sound: this situation can be solved by using the Boost T "W" mode, and using the "Base Rls" values lower than the "Base Atk" values. Fine-tuning the "OLE Roll-off" value may also help in finding a "sweet spot" of plug-in's dynamic response.

Q. Is there some kind of multi-band compression involved in TEOTE?

A. As was initially stated, TEOTE does use dynamics processing. But it is simultaneously compression and expanding, depending on the required gain adjustment. This should not be compared to a usual compression/expanding as timing constants in TEOTE can be extremely small. TEOTE has a completely different resulting dynamics to most, even multi-band, compressors. It does not work like a usual compressor which can "squash" the dynamic range. Mainly because gain adjustments are made relative to the momentary loudness.

Q. How problematic is it to use TEOTE twice on a mix? For example, someone does a mixdown using TEOTE on their mix-bus, then they send it to a mastering engineer who also uses TEOTE, possibly with differing settings.

A. There should be no problems applying TEOTE twice as long as the result sounds good. Technically, TEOTE's phase and harmonic coloration are usually subtle, so the only aspect that matters is the obtained spectral balance and dynamics. Using a differing number of bands is not important, but may be beneficial: this will produce a slightly more even phase coloration.

Happy Mixing and Mastering!