

JELSTUDIO's "Otto", version 20161210



Otto is an automatic amplitude wave-shape equalizer for LIVE or mixing/mastering use.

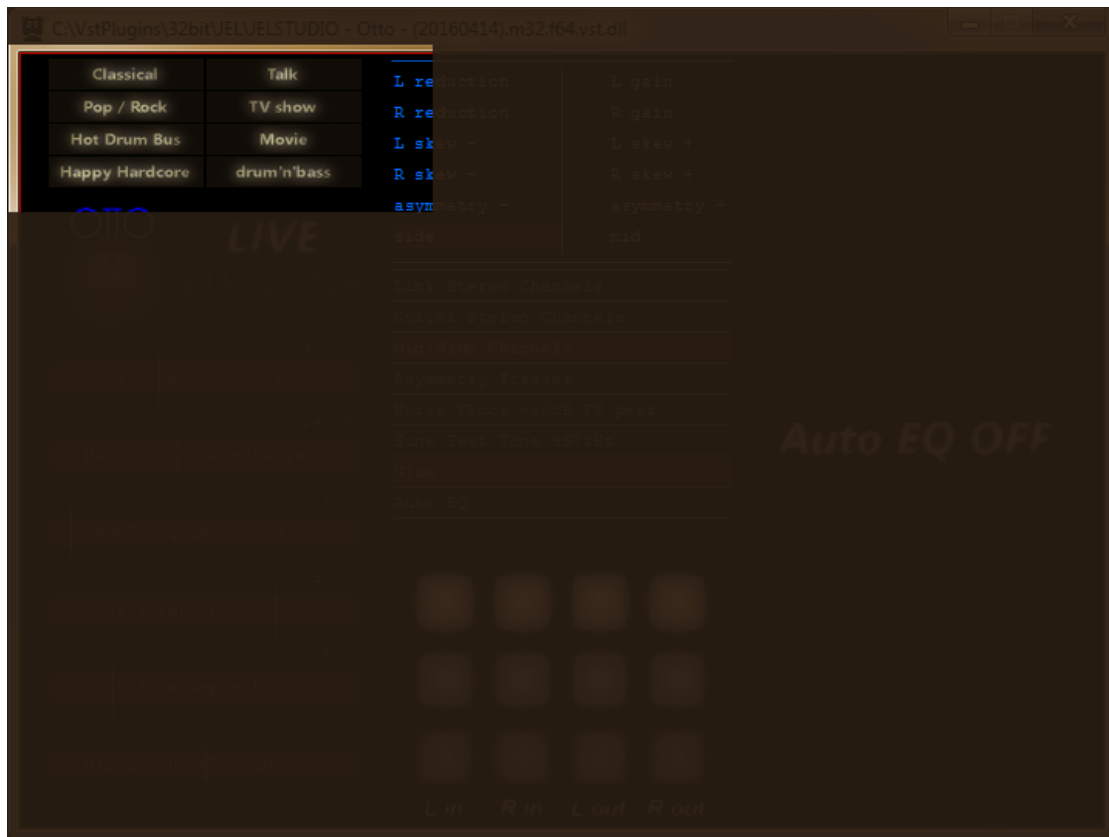
Otto normalizes audio automatically by re-shaping the wave-form to its largest possible size, thereby minimizing the amount of unused headroom.

It is not exactly a dynamic gain-stager, auto-leveler, compressor, DC offset remover, asymmetry remover or limiter, but those would be terms that are not too far off what Otto can be used for.

Technically it is a 32/64 bit VST2 audio-effect plugin mainly for DAWs and sound/video-editors on Windows, but it can also be used in a LIVE VST-host (for example with LIVE stage-performance audio, or with music/TV home-stereo audio)

Some of Otto's key-points:

- Average RMS volume (flat, unweighted) is adjusted to ~ -18 dB FS (can vary with settings)
- Runaway volume peaks are clipped at -0.1 dB FS
- Zero latency (for LIVE use or for tracking)
- DC offset is removed
- Stereo imbalance can be canceled (when stereo-channels are unlinked)
- Stereo image can be dynamically widened to the maximum mono-safe width (when Mid/Side mode is activated)
- Waveform asymmetry can be minimized (this is the only mode with latency, about 1/5th of a second or ~ 8000 samples)
- Can handle incoming audio-signals that has 'overs' (internally handles signals hotter than 0dB, either real peaks or ISPs)
- Program-dependent THD+N ($\sim 0.01\%$ distortion in Classical-music mode)
- Program-dependent harmonic-response curves (Flat in Classical-music mode, 'Smiley'-curve in HappyHardcore-music mode)
- Works on mono and stereo signals.
- Can be locked ('glued') to incoming audio's amp-envelope.
- Can dynamically EQ the signal in various ways
- GUI layout is optimized for 'peripheral vision overview' (when looking at the center of the GUI; all important displays can be read at a glance with peripheral vision)
- Auto Loudness (inspired by ITU-R BS.1770-4)



Quick pre-program select buttons

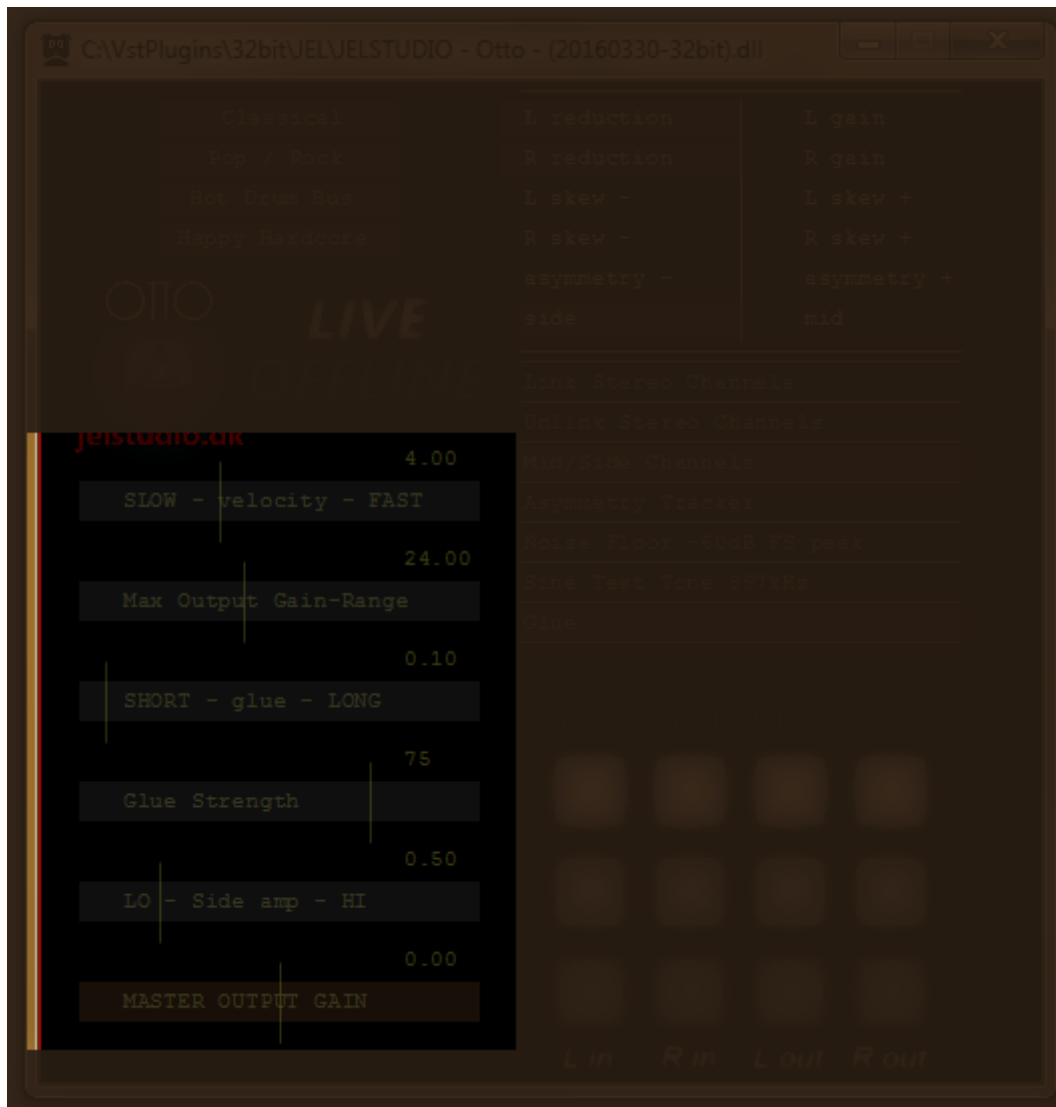
Click one of these buttons to set Otto to a preset state.
[use Left mouse-button]

If, for example, your audio is classical music, or a piano-piece with a female vocal, or some other type of music or audio where you want to keep a good part of the dynamic range intact, click the button labeled "Classical".

You can then further fine-tune the settings by adjusting some of Otto's other controls.

When you first load Otto it defaults to the "Pop / Rock" setting.

The preset your mouse is hovering over will highlight to make selection more intuitive.



Main controls

“SLOW - velocity - FAST”

Controls Otto’s velocity (range from 1 to 10, default is 4)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to default]

This is how fast Otto regains volume.

For a drum-bus with rapid transients you might want faster velocities, while for full mixes you might want slower velocities to avoid ‘pumping’.

Faster velocities can push output peak-volume higher, so generally you might want to lower the “Max Output Gain-Range” or “MASTER OUTPUT GAIN” when using faster velocities to minimize possible distortion.

“Max Output Gain-Range”

Controls Otto’s maximum gain (range from 0 dB to 60 dB, default is 24 dB)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to

default]

This is how far Otto will push the volume (the maximum range between no gain and full gain)

Good practice is to set it near the floor/ground-value of the incoming audio (For example, if the incoming audio generally spans between -24 to -10 dB, then set it to -24. If the incoming audio generally spans between -35 to -1 dB, then set it to -35)

“SHORT - glue - LONG”

Controls how quick Otto should respond to original audio’s amplitude-envelope when in GLUE mode (range from 0.01 to 5, default is 0.1)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to default]

‘Short’ will make Otto’s respond-time shorter (Otto will track the original audio’s amp-envelope quicker), while ‘long’ will make Otto’s respond-time longer (Otto will track the original audio’s amp-envelope slower)

“Glue Strength”

Controls how tight Otto should track original audio’s amplitude-envelope when in GLUE mode (range from 0 to 100, default is 75)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to default]

This is a percentage. Zero is no tracking, 100 is full tracking.

“LO - Side amp - HI”

Controls gain of ‘side’ channel when in Mid/Side mode (range from 0 to 3, default is 0.5)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to default]

0.0 means ‘side’ channel will be silenced. This will give a ‘mid’ channel only signal (no ‘side’ channel signal)

0.25 means ‘side’ channel will be 12dB below ‘mid’ channel.

0.5 means ‘side’ channel will be 6dB below ‘mid’ channel.

1.0 means ‘side’ channel will be at same level as ‘mid’ channel.

2.0 means ‘side channel will be 6dB louder than ‘mid’ channel.

3.0 means ‘side’ channel will be 9dB louder than ‘mid’ channel.

There is no channel-crosstalk, so mono-compatibility is equal to that of the input audio.

Be aware that raising ‘side’ channel gain will increase overall output-volume!

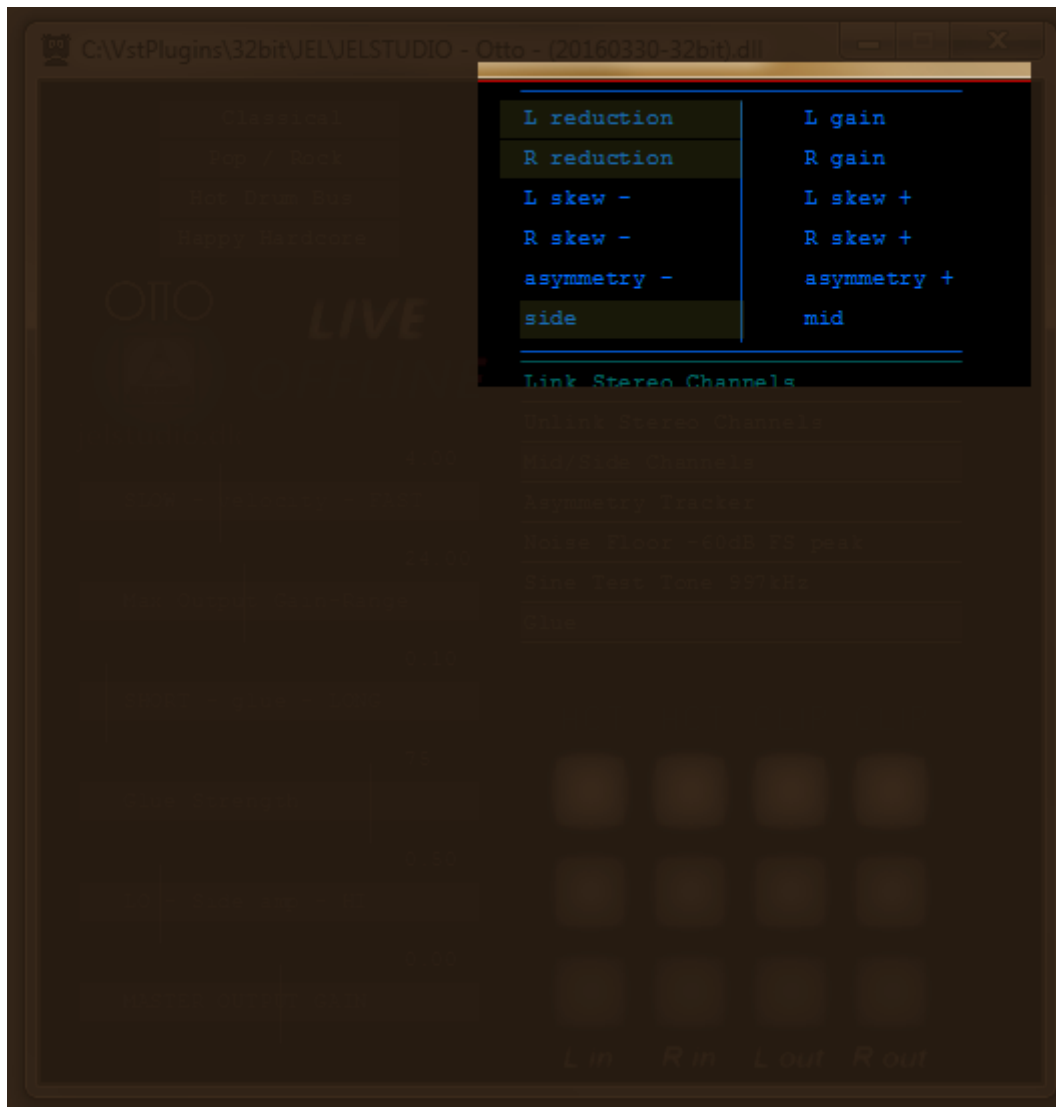
“MASTER OUTPUT GAIN”

Controls main output gain (range from -45dB to 45dB, default is 0.0)

[hold down Left mouse-button while sliding sideways, or right click mouse-button to reset back to default]

This is a basic output-volume control.

It does not impact the wave-shaping, but acts internally before the clipping-limiter so audio-volume can be lowered if clipping is unwanted (or raised if clipping is wanted)



Information display

First two rows shows gain or reduction ratio of Left and Right channel. A colored bar stretching to the right side shows there is internal gain increase, and when stretching to the left side shows there is internal gain reduction.

It will show up to about 24 dB gain increase and about 6 dB gain reduction (even though the actual applied internal gain-change can be beyond these values)

Second two rows show how skewed the Left and Right channel waveform is. It gives a hint of whether the waveform's positive/negative energy-distribution is closer to being equal (which is when the bar is mostly centered) or contains more of one or the other. Generally a well-behaved waveform has little skew, although solo-instruments and vocals can have some skew.

Otto will correct skew (without modifying the waveform's asymmetry) such that the waveform's positive/negative energy-distribution gets closer to an ideal average.

Fifth row shows the asymmetry-tracker (only when the asymmetry-tracker is active)

If there is good tracking; the bar will move slowly. If there is bad tracking; the bar will cycle through the whole range hunting for optimal tracking.

When this mode is ON, Otto will modify the waveform's asymmetry to attempt an even more equal positive/negative energy-distribution than via normal skew-correction.

Last row shows current relation between 'side' and 'mid' channel volume (it will point to the louder channel). When this bar is centered volume will be equally loud in 'mid' and 'side' channel.

It is normal for this bar to be mostly showing in the 'mid' side.

For all six information displays; their purpose is only to give a general idea of what Otto is doing.



Control System Switches

Click these buttons to switch ON or OFF some of Otto's sub-systems.
[use Left mouse-button]

“Link Stereo Channels”

Links the volume between Left and Right channel so stereo-image is maintained.

“Unlink Stereo Channels”

Unlinks the volume between Left and Right channel and allows independent gain-settings for each channel. This can enhance audio where stereo-balance is unintentionally off-center. If stereo-image (the relative balance between Left and Right channel) should be maintained unaltered; then do not use this mode.

“Mid/Side Channels”

Unlinks mid-channel (mono center) from side-channel (stereo) and allows independent gain-settings for each. This can enhance perceived stereo-width. This setting is ‘mono-safe/mono-compatible’ (no phase-cancellations)
(On the info-display; Left channel will display Mid, while Right channel displays Side)

“Asymmetry Tracker”

THIS MODE CAUSES LATENCY! (the display at the bottom will go from “LIVE” to “OFFLINE”)
This mode will attempt to reduce waveform asymmetry. It generally works best with individual instruments/sounds (bas, synth, vocal), while it can get thrown off by mixed sounds or percussive sounds.

“Noise Floor -60dB FS peak”

Activates a white-noise floor that peaks at -60 dB FS.

“Sine Test Tone 997kHz”

Activates a sine-type test-tone at 997 kilo-Hertz. The test-tone is routed through Otto.

“Glue”

Activates the input-audio gain-envelope tracker that will lock Otto’s output-volume more or less (depending on the user-controlled percentage setting) to the input-audio’s amplification-envelope. This is useful if you want Otto to retain more of the input-audio’s dynamics, rather than to constantly aim for the same overall output-volume regardless of input-volume.

“Loudness”

Activates the audio loudness tracker that will auto-adjust Otto’s output-volume (The Loudness-stage is last-in-line, situated just prior to the MasterOutputGain stage) so perceived loudness remains the same. When this is ON; actual output-level in dB FS will vary to maintain the same overall perceived loudness volume. To allow sufficient headroom for this variation in volume; the output is slightly reduced when Loudness is ON (Generally it will be around -24 dB FS)

The algorithm is inspired by recommendation “ITU-R BS.1770-4” (defined October 2015).

Integration-time is variable (On average it is several seconds)

Occasionally there may be small jumps or fluctuations in volume when certain sound-patterns are detected by the algorithm. This is not a bug, but a limitation of the currently used loudness-correction algorithm.

Note that the Loudness tracker is NOT switched ON or OFF by selecting any of the quick pre-program selection presets, but remains at the user-chosen setting!

Tip: To use the Loudness stage as a ‘stand-alone’ effect (Effectively switching OFF Otto’s wave-shaping and routing the clean un-modified input-audio to the Loudness stage), choose the Pop/Rock preset and turn “Max Output Gain-Range” down to zero.

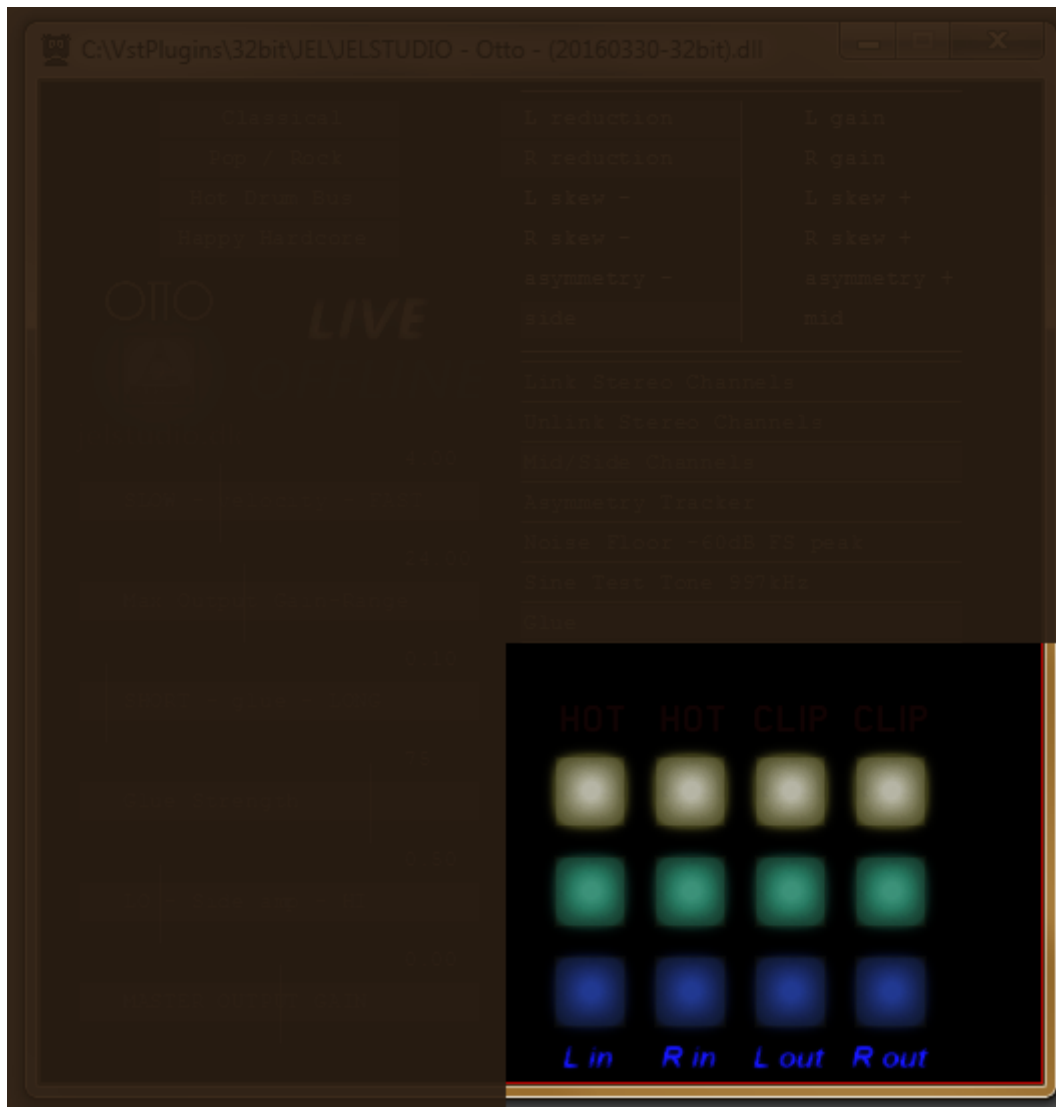
“EQ dark”, “EQ mid” and “EQ bright”

Activates the automatic tonal equalizer.

Dark will aim for a darker sound (a slope of $\sim +6$ dB per octave)

Mid will aim for a flat sound (a slope of $\sim +4.5$ dB per octave)

Bright will aim for a brighter sound (a slope of $\sim +3$ dB per octave)



‘Christmas tree’

This is two sets of vertical peak-level meters (one for input, and one for output)

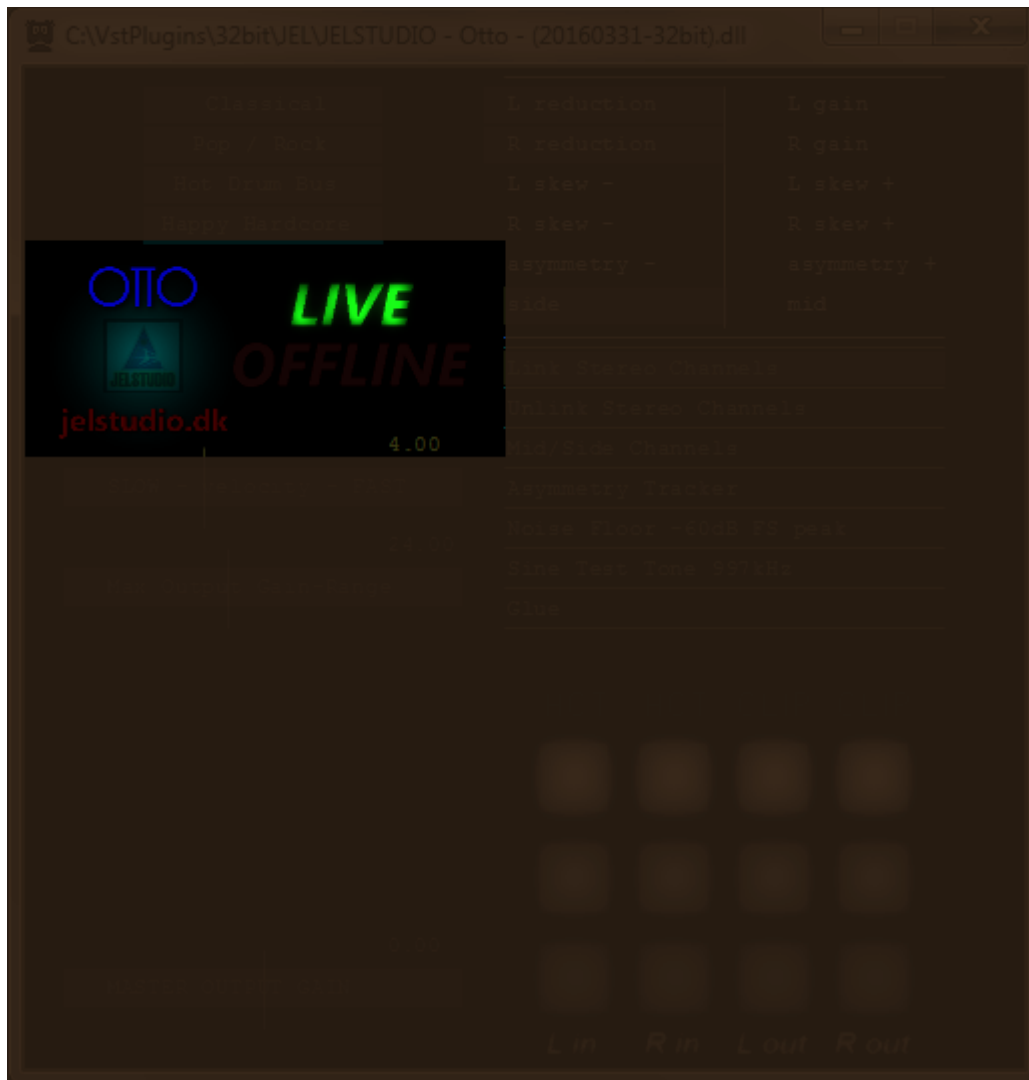
“L in” and “R in” is left and right input.
 “L out” and “R out” is left and right output.

When the lower deep-blue light is ON, the audio-level is slightly low (cold) but good.
 When the middle teal (blue/green) light is ON, the audio-level is good.
 When the top white light blinks ON and OFF, the audio-level is optimal.

If the input-audio level goes above -0.1dB a warning-light will flash the word “HOT” in red.
 (Hot input levels are not a problem for Otto, so the warning can generally be ignored and is mostly for informational purposes)

If Otto’s internal audio level goes above -0.1dB a warning-light will flash the word “CLIP” in red.
 This light signals that Otto’s internal clipper-limiter has caught a peak.
 If clipping the sound is desired (generally it is for the “Happy Hardcore” mode); this warning can be ignored.
 If clipping the sound is NOT desired; the clipping can be avoided by reducing the “MASTER OUTPUT GAIN”.

This is internal clipping (distortion) only. Actual output will not exceed -0.1dB at any time.

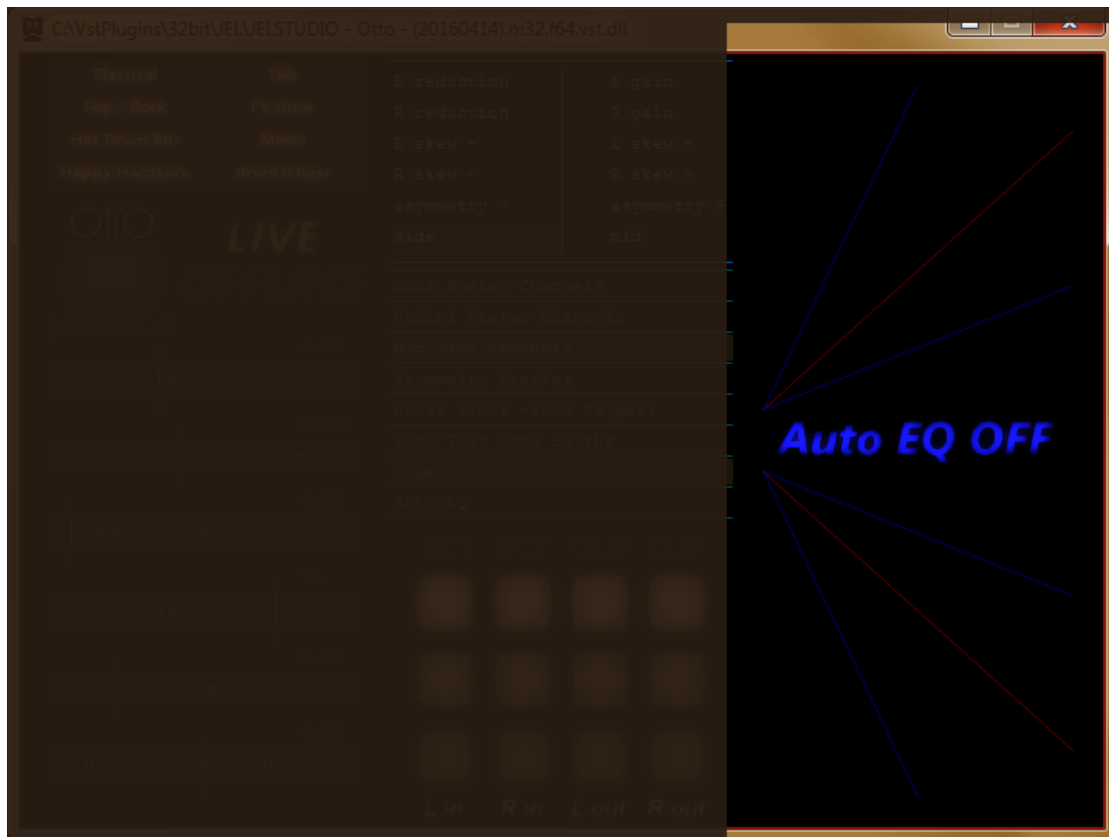


Otto Main Operation display

“LIVE” (in green color) means Otto is operating with zero latency (good for LIVE use)

“OFFLINE” (in red color) means Otto is operating with a latency (output-audio is showing a delay) of about 1/5th of a second (8192 samples).

If Otto is ‘alive’ and ‘thinking’, the main icon will ‘breathe’ continuously.



Automatic tonal EQ display

When the EQ is ON; 3 EQ-mode selector-buttons will show where it says “Auto EQ OFF” in the image above.

Click these buttons to switch ON that specific EQ-mode.
[use Left mouse-button]

“Slow”

Slow EQ changes over time. This mode usually gives the most natural sound.

“Fast”

Fast EQ changes over time. This mode can be good with mixed-content programs (such as TV-shows, or content alternating between speech and music)

“Instant”

Instant EQ changes over time (stepped EQ). This mode can be useful with some electronic music genres.

When the EQ is ON; a line will show if EQ-gain is added (line goes up, tone is brighter) or subtracted (line goes down, tone is darker).

The line has 3 points:

The first point (which does not move) is the bass (the static base-point which all EQ-adjustments originally relate to)

The second point (the middle break of the line) is the mid-band. If it is above the base-point (bass-point); EQ-gain is added to the mid-band. If it is below the base-point (bass-point); EQ-gain is subtracted from the mid-band.

The third point (the end of the line) is the high-band. If it is above the base-point (bass-point); EQ-gain

is added to the high-band. If it is below the base-point (bass-point); EQ-gain is subtracted from the high-band.

In “Link Stereo Channels” mode; the EQ displays a single green line (combined LEFT and RIGHT average)

In “Unlink Stereo Channels” and “Mid/Side Channels” mode; the EQ displays 2 lines (White is LEFT/MID, Red is RIGHT/SIDE)

The 3-band EQ has 2 first-order high-pass filters (each with a standard response curve slope of 6 dB per octave) that move relative to a static low-band. The result is an EQ with overall low (bass), mid (vox) and high (treble) tonal control.

The EQ’s max total gain-span per band is 48 dB (max 24 dB addition or subtraction)

EQ filtering happens before the amp-stage (internal signal-chain routing is: input >>> asymmetry-correction >>> EQ >>> amplitude wave-shaping >>> output)

The purpose of the EQ is not to finalize the tonal spectrum, but to stabilize it so later EQ tonal-sculpting can be more coherent.

The tonal choices of dark, mid and bright are there to make the EQ more flexible (for example; when used with a music or TV home-stereo setup where further EQ-sculpting perhaps is omitted), but when Otto is used for mastering it is generally advised to use the flat ‘EQ mid’ setting.

Because EQ’ing takes place relative to the low-band (the bass sounds) the EQ’s overall output can sometimes create an emphasis-effect when kick-drums and other such ‘bass-thumping’ sounds are playing (resulting in a perceived more powerful beat)

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GUI programming: Jacob Larsen

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