Limited-Z version 2

LVC-Audio

Contents

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- **Cairo Graphics Library:** Cairo is used within Limited-Z for vector and text drawing routines (https://www.cairographics.org/)
- **Knobman** and **Skinman**: from g200kg (http://www.g200kg.com/index_e.html).
- **Ubuntu Font Family**: (http://font.ubuntu.com/).
- Limited-Z uses portions of **fmath.hpp** and **Xbyak** for fast math calculations. Both source codes Copyright © 2010, 2012, Mitsunari Shigeo under the BSD 3-Clause License. More information is available at http://homepage1.nifty.com/herumi/soft/fmath.html and http://homepage1.nifty.com/herumi/soft/xbyak_e.html.
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Welcome, Thanks, and Contact Information

Thank you for installing and trying Limited-Z. We hope you find this a useful tool in your audio chain, and we would like to hear your suggestions for future enhancements. Please feel free to contact LVC-Audio with any ideas, problems, suggestions, or comments at lvcaudio.com/contact/. Please visit lvcaudio.com for additional news about Limited-Z and other plugins. Additionally, you are welcome to join the LVC-Audio newsletter for the latest updates, new plugins, and sales events. To sign up for the newsletter, visit http://lvcaudio.com/newsletter/.

Introduction

Limited-Z is a specialized and easy-to-use limiter, based on the foundation of being a capable look-ahead brickwall limiter suitable for final mixing or mastering. Limited-Z dynamically combines several unique limiting algorithms to provide transparent limiting on all audio sources. Limited-Z is capable of substantial levels of limiting without inadvertently creating excessive amounts of audible distortion.

Limited-Z is based on LVC-Audio's full-featured mastering limiter, Limited-MAX. It includes many of the underlying limiting processing engines, while simplifying the user interface. This includes a special customized variable clipping algorithm based on LVC-Audio's ClipShifter. The result is a mastering limiter that is both configurable and useful, without a significant learning curve. Internally, Limited-Z includes attack and release controls, look-ahead, stereo linking, program-dependent release timing, dynamic EQ, and DC filtering; however, these internal settings are packaged into several unique limiter modes.

Although Limited-Z is a designed to be easy to use, it includes many features. This includes an resizable interface; output meter including VU-style, PPM-style, and loudness metering; intersample peak (ISP) monitoring and ISP protection; waveform history display with RMS; spectrum analyzer view; configurable and recallable color display options; AutoGain control (for auditioning the sound of the limiter without volume changes); undo/redo history; and A/B comparison controls.

The paid version of Limited-Z adds the following features:

- EBU short-term and momentary metering mode
- K-20, K-14, and K-12 metering mode
- Configurable oversampling: 2x, 4x, 8x, and 16x rate; minimal or linear phase; and high/low quality
- Continually adjustable output margin control between 0 dB and -1.5 dB, and 0 dB and -10 dB for post-production
- Adjustable X/Y controls for the Dynamic Algorithm settings for easily fine-tuning the limiter's overall sound and aggressiveness

Initial Setup and Requirements

WINDOWS (VST, VST3, AND AAX FORMATS):

System Requirements: Limited-Z requires Windows Vista or later, as 32-bit or 64-bit host, and a processor that supports SSE2 (AMD or Intel processor from around 2004 or later).

Installation: To install the software, download and unzip the latest file from the LVC-Audio website. Double-click the installer file to begin the process. The installer will prompt you for the installation location of the VST 32-bit folder, and VST 64-bit folder. The 64-bit plugin will include an "x_64" at the end of the filename. In most DAWs, this should help differentiate between the 32-bit and 64-bit plugins.

If VST3 and/or AAX plugin formats are installed, they will be installed within the default folder(s) for each format. In addition, the AAX plugin format requires the use of a registered iLok device.

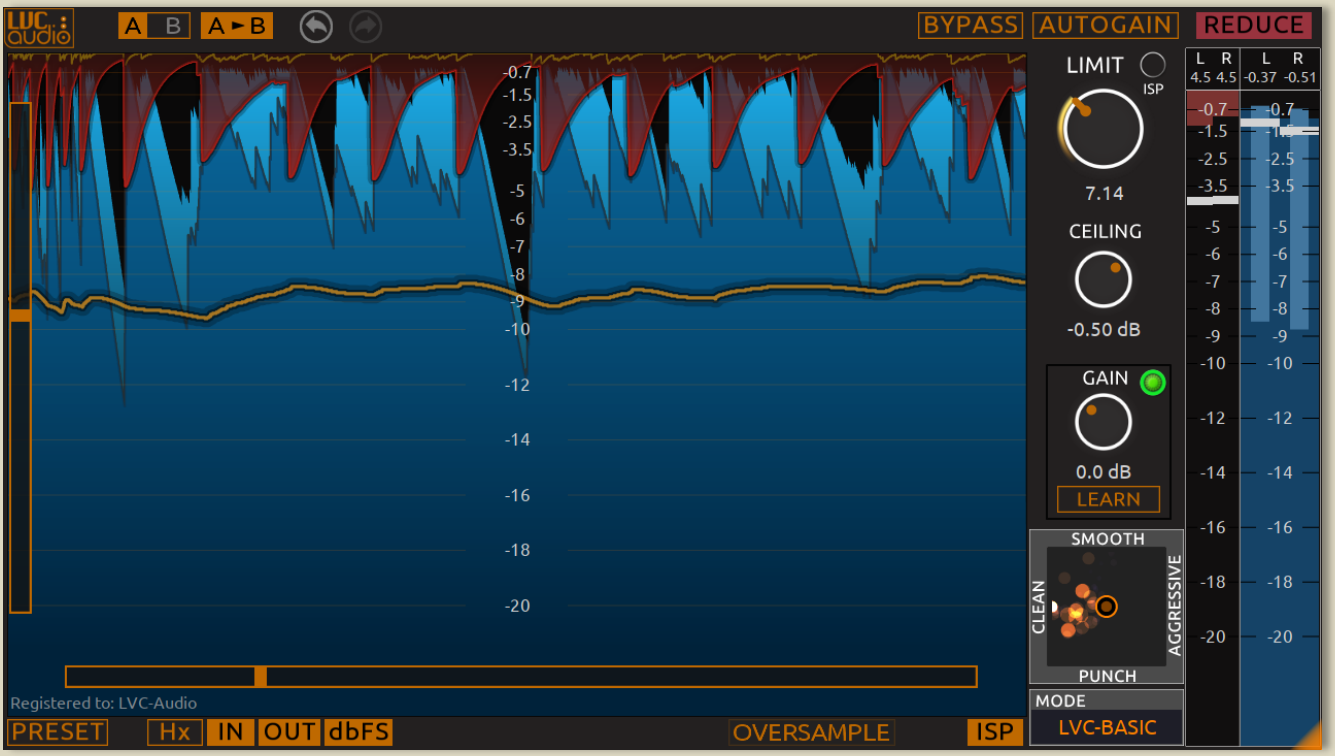
OSX (AU, VST, VST3, AND AAX FORMATS):

System Requirements: Limited-Z requires OSX 10.8 or later, a 32-bit or 64-bit host, and an Intel Core2Duo (or better) processor.

Installation: To install Limited-Z, click to unzip the Zip file. Double-click on the Package file to start the installation process. By default, Limited-Z will be installed as Audio Units, VST, and VST3 Universal Binaries. Additionally, AAX will also be installed. The AAX version is in the Universal Binary format, but may not work properly in Pro Tools version 10 or below. AAX should primarily be used within Pro Tools 11. In addition, the AAX plugin format requires the use of a registered iLok device.

Any of the plugin formats can be excluded from installation by unchecking the checkboxes during the installation process.

User Interface



Button and Selector Features: The main controls of Limited-Z are adjusted by using various knobs and buttons. For buttons such as BYPASS or AUTOGAIN, clicking the button one time will enable the feature. Clicking a second time will disable the feature. Some buttons, such as Oversample, contain more than two different settings (i.e., more than on and off). Clicking the button will either cycle through all choices, or display a popup of the various options.

Knob Control Text Entry: For each of the knobs in Limited-Z, the text value is displayed below. Manual entry of values can be entered by clicking on the text field and typing in the desired value. If a value is entered that is greater than the control's maximum value, the control will automatically be set to the maximum value. Conversely, values that are less than the control's minimum will be set to the control's minimum value. When entering a value on a control which ranges from negative to positive numbers (e.g., -6 to +6), a negative/minus must be used. For controls that have a maximum value of 0 (e.g. -44 to 0), the negative/minus sign can be omitted.

Knob Control Scrolling and Dragging: When hovering over a knob, the mouse wheel can be used to increase or decrease the value of the control. Scrolling produces larger changes in the knob's value. If finer control is needed, the Alt key can be held down while scrolling. When more subtle adjustment is needed, the Shift key can be held down for minute changes.

Similar to using the scroll wheel to adjust a knob, the control can be set by clicking and dragging the knob up and down. This produces larger changes in the control's value. For finer control, the Alt key

can be held down while dragging the control. Additionally, the Shift key can be held down for very small changes.

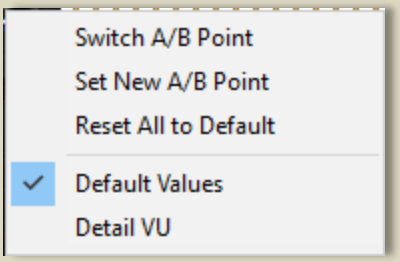
Please note: AAX plugins have slightly different key modifiers based on how typical Pro Tools plugins operate.

Knob Control Reset and A->B Features: Double-clicking (or clicking while holding the Control key) on any knob or slider will return the control to the default value. At the same time, the previous value of the control is stored. Double-clicking the control again will change the control from the default value back to the previous setting. Using this double-click feature, it is very easy to make A->B type comparisons on each of the controls.

Sometimes it might be desirable to compare two values that are not the default value. This can be accomplished by right-clicking on the control. Right-clicking on a control will set a new default value. After this is done, the knob can be readjusted. After double-clicking on the control, the control will be reset to the newly defined default value.

Each time right-click is used on a knob, a new default value will be established. If it is necessary to reset a knob to the factory default value, this can be accomplished by holding down the Shift key while right-clicking on a knob. The knobs default value will be reset to the factory default.

Please note: Knob A/B values are not saved and are separate for each instance of the plugin. When the plugin is closed or a saved session is reloaded, each knob's A and B values will be reset to the factory default values.

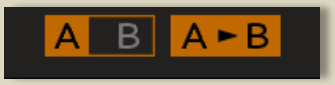


Knob Control Drop-Down Menu and Alternate Settings: Each knob control features a drop-down menu that can be used to compare two values, to reset the knob, or to set an alternate knob range. To access the drop-down menu, use the right mouse button to click on the knob. In some DAW software, the right-click button is not accessible by the plugin. It can also be accessed by holding the Control and Shift keys down while clicking the left mouse button. The first three items are the same features that are also accessible by using the mouse and keyboard modifiers (see Knob Control Reset and A->B Features).

For certain controls, alternate settings are also accessible. Alternate settings are different settings for the knob's default value, minimum value, maximum value, precision (i.e. number of decimal points), and scale (e.g., linear versus logarithmic). Selecting one of the items from the menu will change the settings of the control.

Undo/Redo: At the top of the plugin interface are the Undo and Redo buttons. The Undo button looks like an arrow that points to the left, and the Redo button looks like an arrow that points to the right.

Clicking the Undo button will undo the last user change to the plugin. The undo history holds up to 100 different user changes. Conversely, clicking the Redo button with reapply the last changed setting. If the Undo or Redo buttons are grey, it means that know Undo or Redo is possible.



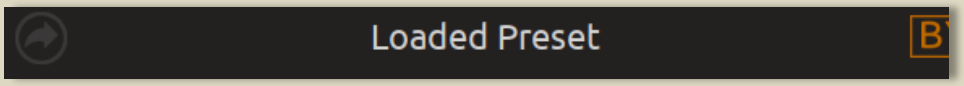
A/B Plugin Comparison: The A/B Comparison buttons also appear on the bottom of the plugin interface. The buttons provide a quick and easy method to compared two different plugin configurations. These configurations are the "A" state, and "B" state.

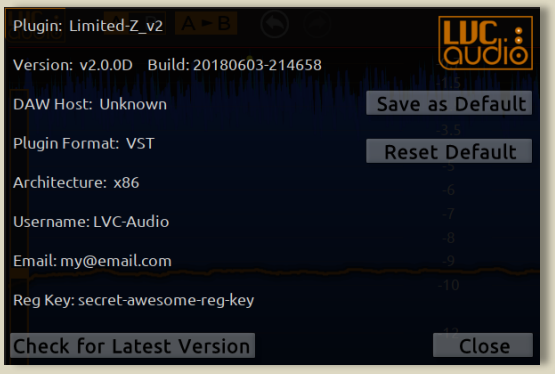
Clicking the A button will save the current plugin configuration to the A state, and then load the B state plugin settings. The button will change to indicate the letter B. Clicking the button again will save the current plugin state and reload the A state. Any number of controls can be changed, as they are automatically saved before the plugin switches to the other plugin state.

The Copy-to button (appearing as an A->B in the picture), copies the current plugin state to the other plugin state. For example, if the plugin is in the A state and the A->B button is pressed, the current plugin state will be copied to the B state. If the plugin is switched to the B state after pressing the Copy-to button, the settings will appear to remain the same because the A and B states are identical.

Please note: When a preset is loaded from the LVC-Audio Preset Menu, it will be loaded and saved into the current state. The other plugin state should not be affected. This may not be the case when saving and loading settings from the DAW (i.e., both plugin states may be copied over with the loaded settings).

Messaging: During certain times, Limited-Z will display information at the top of the plugin. Typically, messages relate to saving and loading presets or alternate knob settings. The message will appear for a few seconds before disappearing.





About Box: Clicking on the LVC-Audio logo at the top of the plugin will display the About Box. The About Box displays basic information, including the plugin name, plugin version, DAW, plugin format, architecture (32- or 64-bit), and registration information (if applicable). Furthermore, a button at the bottom of the About box provides a link that will check for the latest version of the plugin. This loads the Limited-Z plugin page in your default web browser. To close the About box, click the Close button, or anywhere within the plugin's GUI.

Save as Default: When this button is clicked, the current settings of the plugin are saved as the default settings. When another instance of the plugin is opened, the settings will be recalled. This is useful

for customizing colors and/or metering options. Clicking this button will not adversely effect any presets or saved plugin states.

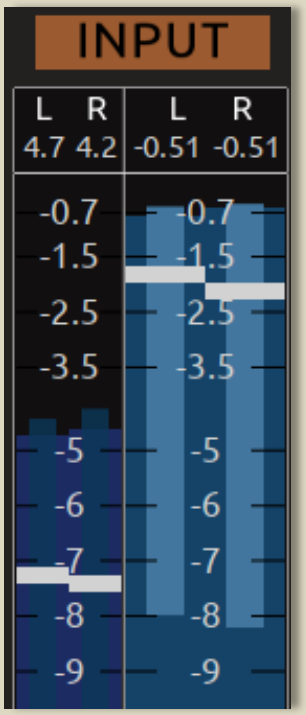
Reset Default: When this button is clicked, the factory default settings will be restored. This overwrites any customized settings.

Username, Email, and Reg Key: Clicking on any of these areas will enable text entry of registration information. When the About Box is closed, the user will be prompted so save changes if any new information is entered into these fields.

Please note: More detailed information regarding registration is sent after each purchase. Entering information through the About Box is typically not needed. Additionally, Limited-Z does not check the registration information for correctness when text is entered.

VU meters and Waveform History

Meter Selector Switch: Limited-Z continually shows output levels through the Output display. The other meter is configurable through the Meter View Switch. Three different views are available: gain reduction, input level, and estimated distortion level.



The default view of the secondary meter is Gain reduction (RED). This indicates the total amount of gain reduction being applied by the limiter. When the view is switched to Input, the meter will display the input signal. This includes any input gain that is applied via the GAIN control.

The third view, DISTORT, estimates the amount of distortion that is occurring due to the limiting process. **The Distortion view is only an estimate of the amount of distortion based on the particular gain settings, limiter settings, and the Dynamic Algorithm settings. This is only an estimate, and the particular decibel readings do not correspond to an audible level of distortion.**

Please note: Additionally, all limiters (regardless of their design) cause distortion. This is inherent to the limiting process. Inevitably, your ears will be the best guide for determining acceptable levels of distortion. The Distortion meter in Limited-Z is showing the amount of signal that is being processed; through the Limited-Z engine; through the peak saturation engine (see Dynamic Algorithm *section); and through any peak clipping.*

VU and Peak Program True Peak Meters: The output meters function as True Peak meter. This means that that output is oversampled in order to estimate peaks that may exist after analog conversion. The amount of oversampling is dependent on the input frequency (either 2x or 4x).

The output meter bar is dependent on the METER TYPE settings. In DBFS mode, the output VU responds similarly to traditional VU meters, but with a quicker rise time (near instantaneous integration time, and 300ms to decrease -20 dB). The dash meter responds more closely to a Peak Program Meter (PPM), with a slower rise and fall (5ms integration time, and 3 seconds to decrease -20 dB). The dash meter is always indicated in a slightly darker color. All meters are calibrated as 0dBFS, meaning that any signal that maximizes the meters represents digital clipping.

When the METER TYPE is set to EBU, the meter changes to show momentary loudness.

Loudness Output Meter: An additional feature of the Output meter is a loudness indicator. This is the smaller rectangular area within the output VU bar. This indicates the relative loudness of the output. The top of the area is determined by the peak output level. The bottom of the area is determined by the RMS value of the output. The peak output is determined using a meter that has a fast attack time,

with a long decay time (i.e., near instantaneous attack time, with a 2.5 second decay time). The bottom RMS point of the meter uses a 500 millisecond time for both attack and release.

The height of the bar relates to the dynamic range of the material. When the output levels approach 0 dBFS and there is heavy saturation and/or clipping, the loudness meter will be shorter (i.e. representing little difference between the peak of the audio and the RMS value). Audio with more dynamic characteristics will have a relatively broader loudness meter. Although this can be useful in determining the overall level of dynamic range, the meter is less accurate at lower audio levels.

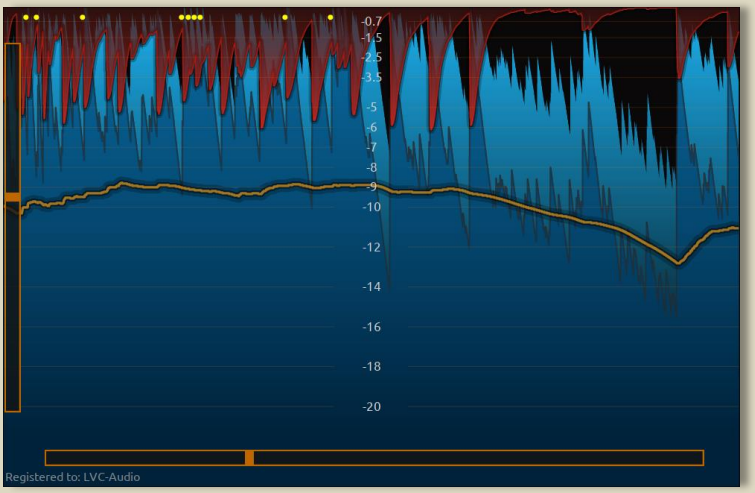
When the METER TYPE is set to one of the K-Meter options, the timing of the loudness meter is slowed down. This more accurately reflects loudness based on the K-Metering type. In EBU mode, the loudness meter changes to show the difference between momentary and short-term loudness, based on EBU/R128 standards.

Please note: The Loudness Output Meter will vary greatly depending on the dynamic nature of the source material. Naturally loud and compressed signals (e.g., distorted guitars) will have a limited dynamic range prior to any processing that is occurring with Limited-Z.

VU Text: Above the Output meters are a text readout of the current output levels in decibels. These numbers have an instantaneous integrations time, and a long decay time. The numbers also are fed by True Peak values, like the output meter. The numbers will only display volume levels above -60dB. Signal levels below -60dB will not be displayed. Any signal that is above 0dBFS will be displayed in red text, indicating digital clipping. To reset the values, click on the numbers. This will automatically reset the numbers to the default -60dB value. Clicking the VU text will also reset the other VU meters within the plugin. Limited-Z also has a text readout for the secondary meter (reduction, input, and distortion). This functions similarly to the text for the Output meters.

The VU text will display true-peak output levels. Certain metering plugins calculate true-peak levels using slightly different methods, and/or with different levels of significance (i.e., tenths, hundredths). There may be some difference between the VU displayed in Limited-Z, and the VU values displayed in a subsequent plugin. This value is typically less than 1 or 2 hundredths of a dB.

Waveform History and Spectrum Analyzer:

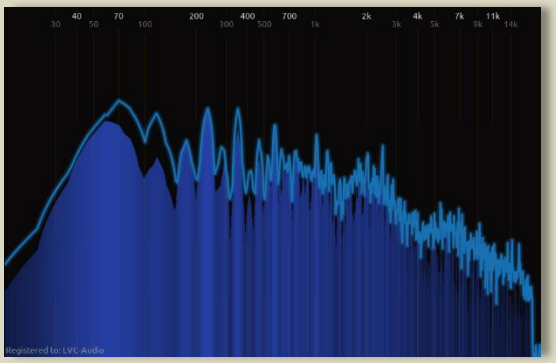


Next to the VU meters is the Waveform History view. By default, this will display input level, output level, output loudness, reduction level, and ISP signals over 0dBFS. At the bottom of the display is a slider to adjust the display time. On the left side of the control is a slider that controls the lowest value of the display. This also adjusts the output meter and secondary meter.

If a yellow dot is displayed, this indicates that the output of the plugin exceeded 0 dBFS. Each event is shown as a dot on the graph.

Below the display are a series of buttons that toggle various elements of the display. The buttons are:

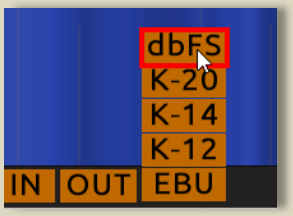
- FFT/Hx – toggles the display between waveform and spectrum analyzer
- IN – toggles display of the input level when in waveform view
- OUT – toggles display of the output level when in waveform view
- dbFS, K-20, K-14, K-12, and EBU – toggles the meter type (see below)



When in spectrum analyzer mode, the display will show the frequency spectrum of the output. This includes a solid line that indicates peak levels, and a solid fill showing instantaneous level. The window type and size can be controlled view a right-click menu (see Color/Option section).

Double-clicking anywhere within the waveform or spectrum view will temporarily pause the view.

Meter Type [PAID VERSION]:



The Meter Type button is located below the Waveform History view. This button determines the type of meter display for both the Waveform History view and the Output meter. In the default mode (DBFS), the meters will be displayed using the default LVC-Audio metering system as indicated in the VU and Peak Program Meters section.

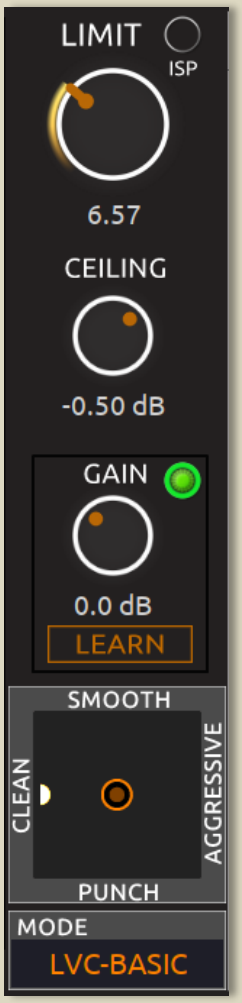
The next three settings correspond to the K-20, K-14, and K-12 scale as suggested by Bob Katz in his paper, An Integrated Approach to Metering, Monitoring, and Levelling (see the full document at http://www.aes.org/technical/documentDownloads.cfm?docID=65). This system "remaps" the decibel scale based on 0 dBFS being +20 dB, +14 dB, or +12 dB, respectively. When the mode is switched, the

scale of the VU meters and Waveform History view are reset to the appropriate setting; however, the Scale control can still be used to alter the view. In addition to the scale being changed, the meter's ballistics are also changed to better indicate overall levels of perceived loudness.

The last setting is EBU mode. In this view, the input, output, and output loudness display will show the signal level based on Tech 3341 – Loudness Metering: 'EBU MODE' Metering to Supplement EBU R 128 Loudness Normalization (https://tech.ebu.ch/docs/tech/tech3341.pdf). This uses filtering and weighting to display short-term and momentary loudness. The meter uses an absolute scale (LUFS).

Please note: Although Limited-Z attempts to comply with all aspects of loudness normalization as specified through the European Broadcasting Union documentation, Limited-Z does not take the place of a full-featured loudness metering plugin. When the output needs to adhere to strict loudness standards, it is useful to use a dedicated loudness metering plugin after Limited-Z, such as Youlean Loudness Meter (https://youlean.co).

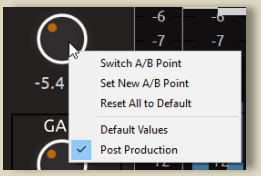
Main Limiter Controls



At the side of the plugin interface are the main limiter controls for Limited-Z. These controls determine the amount of limiting, as well as the overall sound.

LIMIT: The LIMIT knob is the main control for all of Limited-Z. This control determines the global amount of limiting. It is tied to several internal parameters within the Dynamic Algorithm section. When this control is set to 0 dB, only incoming signals that are louder than 0 dB will be limited. As this control is increased, the limiter will start working on more of the signals.

Due to all of the internal parameters associated with Limited-Z, the numerical value displayed on the Amount control is only a rough estimate of the overall amount of gain reduction. For example, a setting of 3 does not indicate that there will be exactly 3 dB of gain reduction at the output of the plugin. The reduction meters, the output levels, and your ears are the best indicators of the overall amount of limiting.



CEILING: There are two types of CEILING controls for Limited-Z. The free version of Limited-Z includes a button with the settings of -0.1, -0.5, and -1.0. The Paid Version of Limited-Z has a knob for the CEILING control. This allows for settings between 0 dB and -1.5 dB, with an accuracy to 0.01 dB. Additionally, the knob control can be set to post-production values between 0 dB and -10 dB by using the knob's alternate settings (see Knob Control Drop-Down Menu and Alternate Settings).

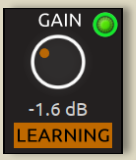
The CEILING control determines the maximum output level of Limited-Z. Typically, this is used to ensure that the output level never exceeds 0 dBFS. The default setting is -0.5 dB. Additionally, the CEILING setting is also used for some of the calculations within the Dynamic Algorithm.

When the CEILING control is set to anything other than 0, the output of Limited-Z is restricted to the CEILING setting. Internal signals that are greater than this amount will be limited and clipped to ensure no signal is over this amount.

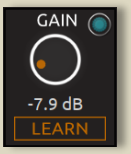
Although the CEILING control ensures that the output of the plugin is within the confines of the CEILING setting, there remains a risk of ISPs. This occurs if further samplerate conversions occur after Limited-Z. The greater the amount of limiting, the greater the risk of ISPs. For most mastering engineers, the Margin setting is set to a level less than 0 to provide a little headroom for any subsequent samplerate conversions.

GAIN and GAIN Indicator: The GAIN control is a simple input gain control. This gain is applied prior to any limiting processing. In general, this control will only be needed when the peaks of the incoming signal are considerably less or more that the current CEILING setting. When the peaks of the incoming audio track are significantly louder or quieter than the CEILING setting, adjusting the GAIN before

increasing the LIMIT control is typically more desirable. This is because of the many internal parameters that are controlled by the LIMIT control. For example, an incoming signal that is quiet can be limited by adjusting the LIMIT control to a high value, but this may produce a sound that is too aggressive. A much better solution is to first bring the GAIN up to an appropriate level and reduce the value of the LIMIT control. To ease in this process, the GAIN can be automatically adjusted using the LEARN control and GAIN Indicator LED (see below).



Auto-Learn (LEARN) and GAIN Indicator: The GAIN Indicator is a small LED-style light that shows the incoming peak level. When the signal is green, it means the incoming signal is correctly adjusted. When the indicator is blue, it means that the signal may be too quiet. Yellow and red indicate that the signal is too loud.

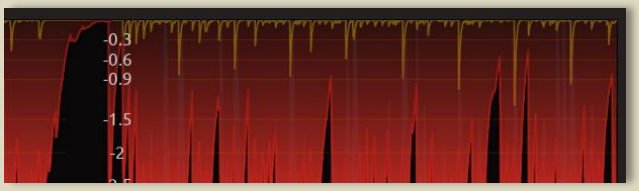


The LEARN control analyzes the peak level of the incoming audio and adjusts the GAIN control automatically. Clicking the LEARN button will start the process. The GAIN volume will drop and then start to increase as the level is analyzed. When the analysis is complete, the LEARN button will turn off and the GAIN control will be adjusted.

This indicator is only a guide for correctly adjusting the GAIN control, you can always do what you want (after using the LEARN feature or without using the LEARN feature). To increase the effectiveness of the Indicator LED and LEARN control, it is recommended to loop several seconds of the loudest section of audio. Regardless of what steps are taken, dynamic sources can be difficult to adjust, but it is recommended that the trim control be set to the loudest peak of the audio material, and then the LIMIT control can be adjusted.

Please note: The peak level of the incoming signal should be at least -20 dB or greater. Incoming signals that are too quiet cannot be adjusted with the Auto-Learn control. It is best to boost the signal through the DAW's faders to a level greater than -20 dB. Additionally, the Auto-Learn function will not work in Bypass mode.

Inter-sample Peak Protect (ISP Button): At the bottom of the plugin is the ISP Button. This enables additional protect against inter-sample peaks. When enabled, Limited-Z adds an additional processing engine that attempts to remove all output values that are greater than the level set by the CEILING. The processing is based on the true-peak output level. This introduces additional CPU processing and latency; however, this is typically less than oversampling loads and latency.



When enabled, the waveform display will begin to show the amount of ISP blocking that is occurring. This appears as a trace at the very top of the graph. It is easiest to conceptualize this as an additional limiter (i.e., gain reduction) that is being applied to the output.

Depending on the CEILING setting, the LIMIT amount, and the MODE, this ISP amount can be only an occasional value of less than 0.1-0.2 dB. With more aggressive settings, this can approach higher

levels. Although the level of ISP protection should be relatively inaudible, there is some level of increased output distortion when ISP protection becomes excessive. Oversampling can reduce the amount of ISP protection; however, it typically will not eliminate all inter-sample peaks. It is best to enable this feature if the output is to have a certain true-peak value.

OVERSAMPLE Controls [PAID VERSION]: A problem with many audio plugins is aliasing artifacts. This occurs with certain algorithms that apply non-linear processing to the audio signal. It is especially prevalent at lower sampling rates (e.g., 44100). The result is that additional audio content is present at unintended frequencies. This can sound like undesired distortion or harmonic ringing. In general, Limited-Z attempts to minimize aliasing; however, certain situations can produce unintended audio artifacts.

Oversampling is a process that greatly minimizes alias effects. The general process is to increase the samplerate internally, process the audio, filter out all of the alias artifacts, and then down convert the samplerate. This occurs internally, and the audio host application is not aware that any samplerate conversion is occurring. Limited-Z has both linear phase and minimal phase oversampling options.

Linear phase oversampling is common for many plugins. It produces several milliseconds of latency, although there is no alteration of the signal's phase. Since latency is introduced, the plugin communicates this information to the DAW application and the latency is compensated during playback. Sometimes the DAW is not able to compensate this latency during playback. If there is any audible issues between tracks with Limited-Z and other tracks, stopping and starting playback usually fixes any latency issues.

Although the linear phase process is the most commonly used procedure for oversampling, there are some unintended consequences other than latency. Although the phase is not altered, slight "ringing" effects can be introduced, especially on transient signals. This is a side-effect of linear phase filtering and cannot be avoided. Minimal phase filtering does not have this side effect.

Minimal phase filtering only has a few samples of latency and does not produce any ringing side effect. The trade-off with linear phase oversampling is that minimal phase filtering introduces some phase shifting. This is most notable above 10 kHz. As a mastering limiter, these phase shifts are not noticeable. In fact, these phase shifts are the same as is introduced with any standard analog or digital EQ. If there is a scenario where the outgoing signal from Limited-Z is mixed with the incoming signal (e.g., parallel compression), minimal phase filtering will produce obvious frequency loss where the phase shifts occur.

Limited-Z has four separate oversampling modes: MINIMAL-LQ, MINIMAL-HQ, LINEAR-LQ, LINEAR-HQ. The LQ refers to low quality and HQ refers to high quality. Although the oversampling process is the same for both HQ and LQ modes, HQ has more robust high-frequency filtering. Of course, this also needs significantly more processing power.

All oversampling modes have the option of being set to 2x, 4x, 8x, or 16x. The number associated with each setting determines the oversampling frequency multiplier. When oversampling is engaged, Limited-Z increases the internal samplerate. On a track that is recorded at a samplerate of 48000 samples per second, Limited-Z processes the audio at a rate of 96000 samples per second (2 times

oversampling). The result is that most of the aliasing artifacts do not occur once the samples are filtered and returned to the original samplerate before passing to the host application.

Since oversampling involves processing more samples per second, as well as filtering, oversampling can tax the computer's CPU. Depending on the computer, this may appear as a CPU usage of 2 to 10 times the amount when compared with oversampling disabled.

Please note: Oversampling involves filtering high frequency content of the audio. Depending on the frequency content of the source and the Input and Amp models, audible difference may exist when oversampling is enabled or disabled. Always listen to a mix with the desired oversampling setting engaged, as opposed to disabling oversampling and only engaging it when rendering a track. It is also recommended to use a higher source rate and less aggressive oversampling. More oversampling doesn't always mean a better sound, especially if the source is greater than 44100.

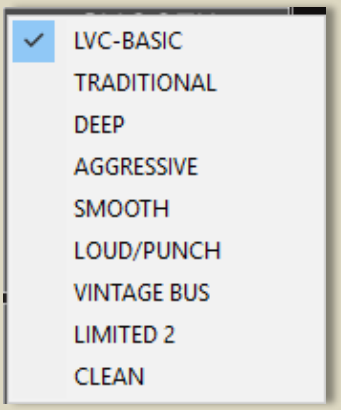
BYPASS Button: The BYPASS control temporarily bypasses all audio processing for Limited-Z. In addition, if oversampling is engaged, the BYPASS button will inform the host DAW that the plugin latency has returned to zero.

AUTOGAIN Button: The AUTOGAIN button is used to audition the sound of Limited-Z while adjusting all of the parameters. With limiters, it is difficult to compare the sound of the limited audio and the bypassed audio objectively. This is due to the inherent volume differences. Of course, the limited version will sound louder. Louder sounds typically trick our ears into thinking they are naturally better (till a certain extent).

When the AUTOGAIN button is engaged, the outgoing audio signal is adjusted roughly to the same level of the incoming audio level. Subsequently, the bypass button can be engaged and disengaged to compare the limited and bypassed sound. Although this is a coarse estimate, it is a better method for comparing the two sounds without being biased by the overall loudness of the limited version.

The AUTOGAIN button is good for listening to the track's overall dynamic level (e.g., punchiness). When the signal is limited to a higher extent, many times it will be less dynamic and sound dull. By adjusting the Limiter Mode and/or Dynamic Algorithm X/Y controls (Paid Version only), some of these losses can be regained.

Before rendering the track, make sure you disengage the Auto Gain control. Additionally, make sure you turn down your monitoring system before turning off the control. After listening to the gain-compensated version, the true "loud" limited version can be extremely shocking (from a volume perspective).



MODE: The Limiter MODE contains several different options. Each of these modes contain numerous internal limiter settings. This includes basic settings such as attack and release times, as well as more esoteric controls associated with LVC-Audio's Limited-MAX.

Clicking on the Limiter MODE box will display a list of current choices. Selecting a mode will load all of the internal settings. Although each mode has a descriptive title, it is best to experiment. One Limiter Mode might sound great on a certain style of song, regardless of what the title is.

The current MODES for Limited-Z are as follows:

- LVC-Basic: Although this is the default mode, it is a balance of all of the complex aspects of limiting within Limited-Z.
- Traditional: This mode functions like a standard dynamic limiter. The complex dynamic processing of clipping and saturation are minimal. There is also a slight roll-off of low and high frequencies with excessive limiting.
- Deep: The Deep mode makes use of the saturation processing, as well as dynamic pre-compression to produce a more "deliberate" style of limiting.
- Aggressive: Similar to the Deep mode, the Aggressive mode is aggressive. It relies more on clipping than the Deep preset, although the processing will change dynamically based on the signal. Additionally, some high and low dynamic EQ is added to bring back some brightness and punch with heavy limiting.
- Smooth: This mode relies more heavily on traditional dynamic limiting. In addition, side-chain filtering is used to prevent bass signals from being overly aggressive in controlling the limiting.
- Loud/Punch: Just like some of the other aggressive modes, this mode uses clipping and saturation more actively than typical dynamic processing. Slightly longer lookahead is used to better determine the best process to use (clipping or saturation) on the incoming signal.
- Vintage Bus: Vintage Bus is similar to the Traditional mode. A softer limiting knee is used, and lookahead is set to a minimum. Release timing is extended, while attack timing is short. Although there is a tendency for pumping sounds, this is a good mode to use as a glue for multiple tracks.
- Limited 2: Like the LVC-Basic mode, Limited 2 is another general purpose mode. It utilizes all features of Limited-Z to produce a balanced sound. Release timing is extended in comparison to the LVC-Basic mode. Additionally, dynamic EQ is used slightly more aggressively.
- Clean: The Clean mode attempts to provide a neutral sounding limiting style, while still taking advantage of the clipping and saturation algorithms. Dynamic pre-compression and dynamic EQing is disabled.

Dynamic Algorithm [PAID VERSION]: Above the Limiter Mode is an X/Y display. This is directly related to the controls found within LVC-Audio's Limited-MAX. The X/Y controls determine how Limited-Z processes the audio. For the free version of Limited-Z, the X/Y control is static. The Paid Version

allows for adjusting these controls. Additionally, some color options are available when right-clicking within the X/Y control (see Color/Option).

Please note: The following controls sound complicated in their explanation. Describing what they do sounds dull, boring, and overly complex. Please remember to play around and listen to the sound. If it sounds good, do it and don't second-guess yourself. In general, the default settings are a good start and playing with X/Y control for a few minutes is all that is needed to get a sense of how to shape the limiter's sound.

The "fire" display indicates how Limited-Z is dynamically analyzing the incoming audio and changing the limiting process. In certain Limiter Modes, this display may not change (e.g., Traditional). In other modes, the display may move only horizontally or vertically. Finally, certain modes will indicate a full range of horizontal and vertical movement. This is part of the internal configuration of each Limiter Mode.

Limited-Z uses several different algorithms and side-chain filtering in order to limit an incoming signal. The first process is a clean limiter/compression engine. The second algorithm within Limited-Z is a process based on LVC-Audio's ClipShifter plugin. This is a clipper that dynamically changes the clipping level based on the look-ahead timing, Margin level, and the Amount control. The ClipShifter engine is particularly well suited for managing fast transient peaks. In addition, the changing of the clipping level is better at dissipating the natural distortion effects resulting from clipping.

The third algorithm is a combination of two different techniques: a fast peak limiter, and a wave shaping saturation function. Combined, these two techniques work better than clipping when the incoming audio level is a sustained loud signal. The peak limiter quickly reduces the signal level based on the look-ahead value. This is one of the reasons why it is recommended to use a longer look-ahead time. When the time is very quick, the peak limiter functions more like a wave shaper, and distorts low frequency sounds.

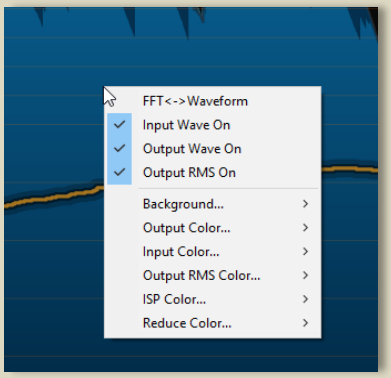
The saturation function obviously produces distortion; however, it also has the natural effect of greatly compressing the input signal. Although distortion is a byproduct, the combined use of saturation and peak limiting are effective when the input signal greatly exceeds the limiter threshold. In addition to these three limiting techniques, Limited-Z also incorporates side-chain filtering to emphasize of deemphasize certain frequencies.

To control all of these parameters, the X/Y pad is used. When the control is moved to the far left side, almost the entire signal is processed through the standard limiter engine while bypassing the other algorithms. As the control is moved towards the right, more of the signal is processed through the Limited-Z and Peak Saturation engines. When the control is moved to the far right and top corner, the Peak Saturation engine is the primary processor. In the bottom right corner, the Limited-Z engine is the primary processor. The color display on the X/Y pad displays the current processing function.

Colors/Option Menu

The colors of the waveform display of Limited-Z are highly configurable. As presets and saved sessions are loaded/saved, the current color configuration is also loaded/saved. In addition, the colors can be configured and saved via the "Save as Default" button within the About box (see section

About Box: above). To access the color configuration, right-click anywhere within the waveform view



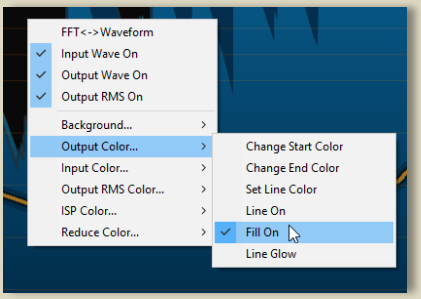
Color/Option Menu

Right-clicking within the waveform or spectrum view will display the color/option menu. When the display is showing the waveform, the menu shows options associated with the various waveforms shown. In the spectrum view, options are available for changing the colors, as well as altering aspects of the spectrum analyzer.

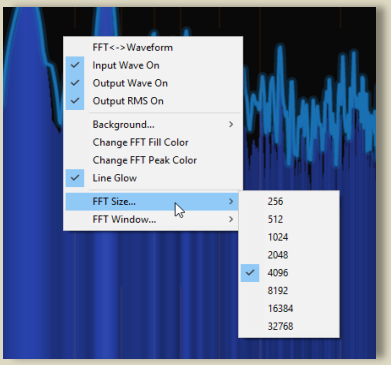
Toggle Options: At the top of the menu, various elements can be toggled on or off. The elements can also be toggled using the buttons just below the waveform display.

Background Color: By default, the background setting is transparent. It can be changed by selecting the option under Background. To toggle the color on/off, use the Set Transparent option. The background color is the same for both the waveform and spectrum analyzer display.

Waveform Color/Options: Each element of the waveform display has various options to configure the display. Please remember that the element needs to be enabled for changes to be shown (e.g., changing the Input Color while the Input Wave is turned off will not make any different on the display). The options are:



- Change Start Color: This is the main color of the control.
- Change End Color: Each element fades from the Start Color, to the End Color. This helps to view multiple overlapping elements. For input and output colors, the End Color represents the color at the bottom of the waveform display. For Reduce, the End Color represents the color at the top of the display.
- Set Line Color: This sets the solid line color for each element. This is not effected by the Start or End colors
- Line On: This toggles the solid line on or off for each element.
- Fill On: This toggles the fill on or off for each element.
- Line Glow: This toggles an additional line feature. To work, the Line On also needs to be toggled on. The Line Glow tends to highlight the line more; however, it is dependent on the other colors set for the control.

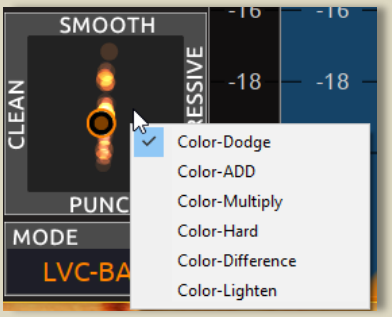


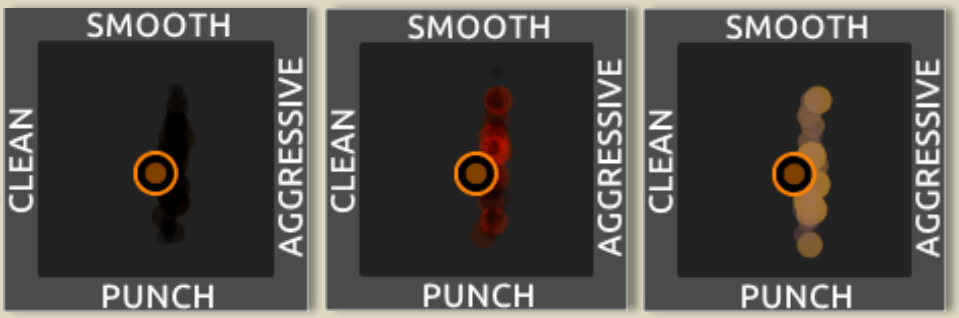
Spectrum Analyzer Color/Options: For the Spectrum Analyzer, there are two color options: Fill Color and Peak Color. The Fill Color corresponds to the momentary color of the analyzer. The Peak Color is the solid line that has a slight "hold" feature to better indicate peak frequency values.

In addition to the color options, the Spectrum Analyzer FFT size and window type can be configured. Just like other spectrum analyzers, the FFT size is a trade off between speed and accuracy. Low values have less latency, but also have a coarser frequency display. Higher numbers are able to show a finer view of the frequency spectrum, but respond much slower to the signal. The default value of 4096 was chosen as a balance between these two factors.

The FFT window can also be changed. Each window type has various trade-offs with discerning close frequencies, lowering the noise floor, and show relatively accurate amplitude levels. Typically, the differences are subtle when looking at the audible spectrum.

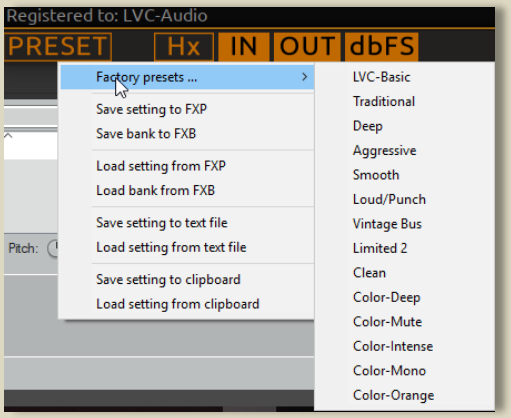
Dynamic Algorithm Color/Options: The Dynamic Algorithm control also has some options that affect the display. Right-clicking the display will show various color options. This control how the various "circles" are drawn on top of each other within the control. Although you cannot change the colors, there are several options that make the control more or less prominent.





Presets

Limited-Z can save and load presets using the standard format for VST, VST3, AAX, and AU. There are 20 slots for user presets. Saving and loading these presets is controlled by the audio host program.



LVC-Audio Preset Menu

Although all audio hosts provide a way to store and recall presets, these methods are different depending on the host and plugin format. The LVC-Audio Preset Menu is a standardized way for loading factory presets, importing presets, and exporting presets.

To access the Preset Menu, click the PRESET button in the lower-left corner of the plugin. The Preset Menu provides several options for loading, exporting, and importing presets.

Factory Presets: The first menu item listed is factory presets. Clicking the preset will load the settings into the current instance of the plugin.

Saving and Loading FXP Presets: FXP presets are a standard format for VST plugins; however, they can be used for any other plugin format (i.e., AU, VST3, and AAX). The FXP format saves the settings of the plugin into a file with the FXP extension. This file can be used to recall a certain preset in the same DAW, in another DAW, and/or with a different plugin format (e.g., VST to AU).

To save a FXP file, click "Save preset to FXP." A file prompt will open that allows naming of the FXP file, and selecting where the file is saved. To recall a preset, click "Load preset from FXP." Navigate and select the appropriate FXP file to recall the saved preset.

Saving and Loading banks (FXB): In the VST format, Limited-Z has 20 slots for user presets. Each of these preset slots can be modified and recalled from within the DAW. Additionally, the entire bank of 20 presets can be saved and reloaded. To save a bank of presets, choose "Save bank to FXB" from the preset menu. Conversely, to load a bank of presets from an FXB file, choose "Load bank from FXB."

Please note: The factory preset banks are typically only included within the VST format. Therefore, saving and loading from FXB many not be useful with different plugin formats.

Saving and Loading with Text Files: As a means to standardize compatibility across plugin formats, Limited-Z can save and load a preset using a plain text file. The individual settings are stored in the text file, which also makes it easy to share presets. To save a preset, click on "Save preset to text file."

A file prompt will open that allows naming of the text file, and choosing the file's location. To load a preset from a text file, click "Load preset from text file" and select the appropriate file.

When settings are saved as text files or to the clipboard (see below), they look like this:

Limited-
ZClipboardPreset:AAAAAAC6w0ACAAAAAgAAAAAAAAAIAAAAAAAAAABOge/8ToHv/AAAAAAA
AAAAAAAAAAAAAAAAAAAAAAOC/AAAAAAAA8D8AAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAUQAAAAAAAAACjAAAAAAAAAAEAAAAAAAAAAAAAAAAAAAElAAAAAAAAAASU
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAA

The text involves a series of parameters and values. Of notable importance is the first few characters of the text string that involve the name of the plugin. If the name of the plugin does not appear in the exact format (e.g., Limited-Z), then the plugin will not load correctly. When loading a preset from the Clipboard (i.e., from an email, forum post, etc.), it is important to select and copy all of the text in order for the preset to load.

Saving and Loading with the Clipboard: Similarly to saving and loading from a text file, presets can be saved directly to the clipboard. This allows for easy sharing by pasting into an email, forum post, etc. Clicking "Save preset to clipboard" will copy the current plugin's settings into the clipboard. Once a preset is copied into the clipboard (e.g., from the internet or email), clicking "Load preset from clipboard" will load the preset into Limited-Z. **Saving and loading to the clipboard uses the same exact text format as saving and loading to a text file. Therefore, text can be copied from within a previously saved preset text file and loaded with the clipboard loading function.**