



## **User Manual**

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<http://www.soft-amp.com>

[axp@soft-amp.com](mailto:axp@soft-amp.com)

## Introduction

**SoftAmp PSA** is a virtual-analog guitar pre-amp supplemented with noise gate and compressor, all modeled after famous guitar gear that needs no introduction.

The preamp that was an inspiration and a prototype for this plugin is considered by many to be one of the most versatile preamps for recording electric and bass guitar, as well as giving extra spark to drum and vocal tracks. It is proudly solid-state and has a very broad sonic palette for a device with an all-analog signal path.

This device has a complex gain structure with many overdrive stages and tone shaping filters in-between. Just as you would expect from AXP plugins, this one goes a step beyond and provides several ways to further modify the preamp sound, such as parametric control of speaker simulation and different overdrive modes.

As a free bonus (to the free plugin!), you also get two more effects, carefully modeled after well-known guitar effects.

The **PSI Denoiser** is guitar-oriented noise gate with adaptive release time to handle both the sustained and staccato notes.

The **Squeezeo Range** is a vintage guitar compressor, a very nonlinear, but musical sounding one. It does both upward and downward compression depending on the gain and bias settings.

This plugin was made for the KVR Audio Developer Challenge 2016:

[www.kvraudio.com/kvr-developer-challenge/2016](http://www.kvraudio.com/kvr-developer-challenge/2016)

If you happen to have a KVR Audio account, please consider voting for SoftAmp PSA (Before December, 18<sup>th</sup>, 2016).

## Installation

Get the latest version at: <http://www.soft-amp.com/softamp-psa>

Unzip the archive and put the "AXP SoftAmp PSA.dll" or "AXP SoftAmp PSA x64.dll" to your VST folder. Make sure to select the one appropriate for the host software you are using (32- or 64-bit).

This plug-in requires the Windows Imaging Component library. It's included in all Windows versions starting with Windows XP SP3. If you are using Windows XP SP2, you can get it as a stand-alone library here: <http://www.microsoft.com/en-us/download/details.aspx?id=32>

## User Interface

The SoftAmp PSA user interface is divided into two “rack units”. The bottom one is the SoftAmp PSA pre-amp itself, while the top one is the dynamics processing unit consisting of PSI Denoiser and Squeeze Range.

PSI Denoiser and Squeeze Range both have their own “Enable” buttons. When disengaged, they completely bypass the corresponding effect not degrading the sound or wasting any performance.

The SoftAmp PSA pre-amp's panel can be logically divided into two rows. The upper one with the larger knobs closely replicates the faceplate of the original hardware unit. The knobs control various parameters of the gain and filtering stages. To the right there's a digital LCD display that shows the exact value of the current parameter. It works for all knobs, including those in the upper rack unit.

The lower part of the pre-amp provides additional controls and visualization.

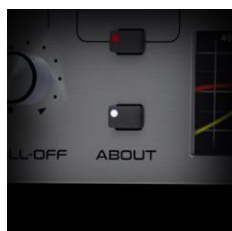
For in-depth description of each control see the next section.



All knobs are operated by holding the left mouse button over them and dragging the mouse up or down. To reset any knob to the 50% setting, click the knob while holding the "Ctrl" key on your keyboard or double click it with the left mouse button. Holding "Shift" key while dragging the mouse will rotate the knob in 10% increments. Alternatively, for finer adjustment, you can scroll the mouse button while hovering the mouse over the knob.

If the plug-in's interface doesn't look like pictured above, make sure your desktop is configured for 32-bit color depth.

SoftAmp PSA will not check for updates automatically. It was done deliberately to make sure it doesn't get in the way of your audio production workflow. The new version availability is checked each time the "About" screen is opened by pressing the corresponding button.



The label under the version number will read "Latest" or "Update Available":



## Description of Controls

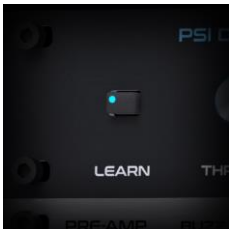
**PSI Denoiser** – guitar-oriented noise gate. Since it is based on an analog circuit its behavior is non-linear and dynamic. One of its distinctive features is the auto-release function that dynamically adjusts the release time based on the incoming signal. The gate will close quickly for short, muted notes and act slow for long sustained ones.



“Enable” toggles the effect on and off. When switched off it is completely out of the signal chain.



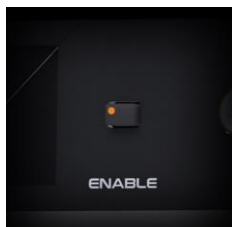
“Threshold” controls the level below which the signal will be gated. The control is almost exponential (i.e. linear in dB scale). The gate knee is soft.



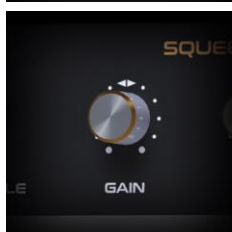
“Learn” function performs automatic configuration of the threshold value. When engaged, it will briefly monitor the input level and set the threshold to cut off the noise it just heard.

Make sure that PSI Denoiser is enabled, mute the strings of your guitar and hit the Learn button. As soon as the blue LED on the button goes off, the threshold will be automatically set.

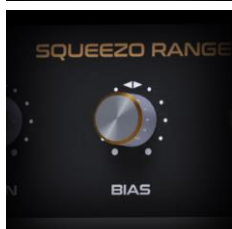
**Squeeze Range** – guitar-oriented orange compressor. It is well known for its pleasing sound, even though technically it is very nonlinear and definitely not transparent. It has feedback topology with half-wave rectification of the control signal and JFET dynamic gain stage. It acts as both downward (quieting the loud peaks) and upward (amplifying quiet signals) compressor. Even when not compressing much, the Squeeze Range saturates the signal with harmonics which add more sparkle to the PSA preamp. The original unit only had the Level control, with Bias being hidden inside the box as a trim-potentiometer.



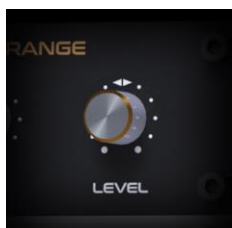
"Enable" toggles the effect on and off. When switched off it is completely out of the signal chain.



"Gain" control linearly scales the signal at the input of the compressor. Increasing gain will drive the circuit harder and get more of the signal "body" into the compression active range.



"Bias" control changes the biasing of the JFET transistor. It affects threshold, ratio and makeup gain all at the same time and in a very non-linear way. The general guidance is that overall compression amount increases with bias.



"Level" is just a linear scaling of the output signal. It doesn't affect the way the compressor sounds.

However it could be used to overdrive the input of the PSA preamp, which may sound really good!

**Gain Scope** – between PSI Denoiser and Squeeze Range there is a shared dynamic gain metering instrument. Its purpose is to visualize the nonlinear behavior of both dynamic processors. Essentially it is a X/Y plot, showing the input signal as the horizontal axis and output signal as the vertical axis. Both axes are logarithmic, the displayed range is from -80dB to 0dB. The diagonal line shows the linear range where output = input. Linear gain would look like a straight line with a different slope. Ideally, the scope should follow a classic compression curve, but since it's a really dynamic and unpredictable circuit the shapes produced by the scope may look strange at first. However, if you know what to expect, it should be pretty helpful in setting input/output levels and controlling the amount of compression applied.

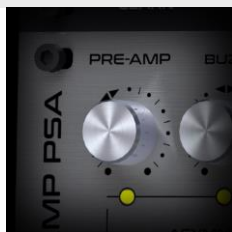


**PSA Pre-amp** – At its core there are 5 distortion stages. First three are based on op-amps with zener diodes in the feedback chain, while the last two are just op-amps being overdriven into saturation. They are followed by tonestack, speaker simulator and an output level control. Each overdrive stage has a distinct frequency shaping quality according to their names.

In addition to the basic controls, there are two more knobs that control the speaker simulator parameters - Shape and Roll-off. With both knobs at 0, the speaker simulator is completely bypassed (for example, to be used with external impulse loader).

Giving even finer control over the gain structure, there are two more buttons - Asymmetric and Soft-Clip

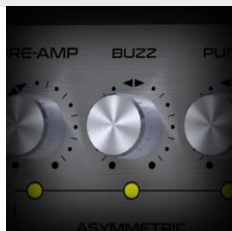
There are several tools that help visualize the pre-amp's behavior. They are the clipping LED indicators that show which stages are being overdriven and a frequency response plot, showing the EQ curves.



"Pre-amp" sets the wide-band input gain which affects all the further stages. Increasing it above the "unity" setting marked with double-arrows at 40% acts as an additional boost before the preamp, while decreasing it cleans-up the signal.

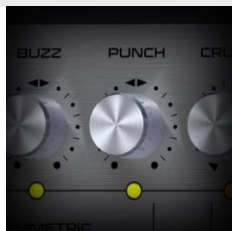
As the control approaches the maximum setting, a low-cut filter is gradually applied resulting in a more pleasant overdrive tone.

The clipping LED below the control shows the amount of distortion introduced by this stage.



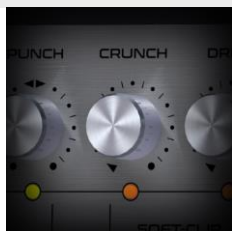
"Buzz" control is responsible for low-end overdrive. It boosts or cuts lower frequencies. For high-gain distortion, reduce Buzz for more clarity and definition and for low-gain modes increase it to provide softer break-up.

The clipping LED below the control shows the amount of distortion introduced by this stage.



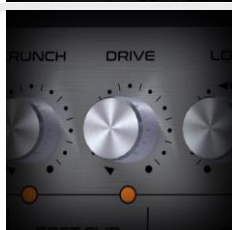
"Punch" controls the amount of mid-range distortion. In the "cut" range it provides nice chimney sounds, suitable for low-gain modes, while the "boost" range adds screaming harmonics to the high-gain configurations.

The clipping LED below the control shows the amount of distortion introduced by this stage.



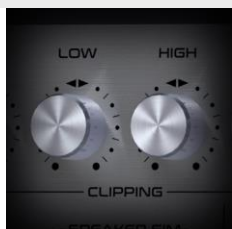
"Crunch" controls high-end overdrive. Cut it down for mellower, low-gain tones and boost it to give extra attack to the high-gain ones.

The clipping LED below the control shows the amount of distortion introduced by this stage.

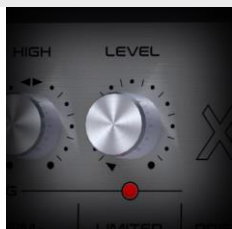


"Drive" controls the wide-band overdrive. Since it comes after all the character shaping stages it may be thought of as the amount of power amp distortion.

The clipping LED below the control shows the amount of distortion introduced by this stage. All further stages are perfectly linear, so this is the last stage to introduce any distortion.

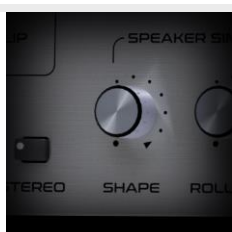


"Low" and "High" tone controls are the bands of generic two-band shelf equalizer. Start with both controls in the middle position and adjust to match your liking from there.

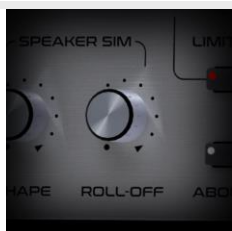


"Level" is the master output level control. It also slightly affects the overall frequency response.

The clipping LED below the control lights up when the output signal exceeds 0dB. If Limiter is enabled (see below), the LED will light up when limiter is actively reducing the gain.

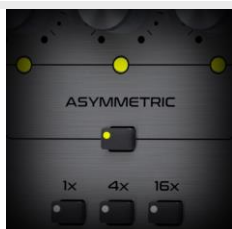


"Shape" is one of the two speaker simulation controls. It changes the amount of resonant behavior in the simulation filters. Increasing shape makes the peaks and valleys more pronounced. At the minimum setting, the peak filters are bypassed, giving the speaker simulator a flat low- and mid-range response. Drawing an analogy to the SoftAmp GT pre-set speaker simulator controls, increasing shape would morph the virtual microphone position from "classic" to "center".



"Roll-off" control affects the speaker simulator high-frequency roll-off, thus setting the amount of "speaker-ness". At maximum setting, it follows the frequency response of the original unit. At the minimum setting, the low-pass filters are bypassed, thus making it suitable to be used with an external impulse loader.

When both "Shape" and "Roll-off" controls are at zero, the speaker simulator is completely bypassed. If you are using external impulses, start with such setting and then adjust from there.

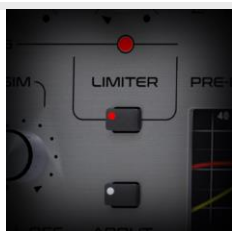


"Asymmetric" switch changes the overdrive characteristic of the first three stages. When enabled, it replaces the default pair of identical 4.7v zener diodes, with the intentionally unbalanced 2.7v/4.7v pair to saturate the signal with even harmonics giving them a somewhat tube-like sound. The more the first three stages are overdriven, the more pronounced is the effect. It also becomes more apparent on transients rather than on a steady level signal.



"Soft-Clip" only affects the two overdriven op-amp stages, Crunch and Drive. By lowering the op-amp open-loop gain from 1 million (typical for the TLC2262 op-amp) to just 200 it softens the transition between the linear and saturation regions. It gives a slightly softer and more pleasing tone with less high-order harmonics and also makes the notes fade out more naturally.

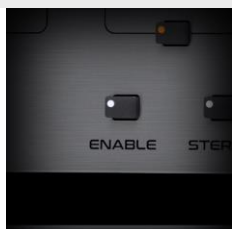
As a side effect, it slightly flattens the frequency response peaks of the affected stages.



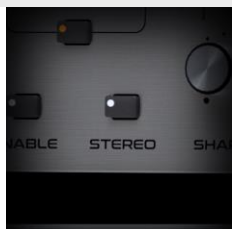
"Limiter" switch engages an instant attack, instant release hard knee limiter set just below 0dB. When pushed into limiting it will sound terrible, thus its main purpose is to protect the devices further in the processing chain.

It is recommended to keep it enabled, but lowering the Level so that the clipping LED never lights up.





"Enable" switch toggles the PSA pre-amp on and off. When set to off, it bypasses the whole preamp, thus leaving only the PSI Denoiser and Squeeze Range in the signal chain.



"Stereo" switch affects all three effects. When enabled, all effects are duplicated and applied in parallel to both channels. When disabled, only the left channel is processed and the output is written to both left and right channels. In mono mode, both PSI Denoiser and Squeeze Range are driven by the left channel only (similar to an external side-chain arrangement). This behavior might change in further versions.

In order to keep the CPU consumption low, it is recommended to switch the Stereo mode off, unless you really need it.



"Oversampling" sets the amount of extra CPU power used to improve the accuracy of computations. The main purpose of oversampling is reducing the aliasing of harmonics caused by the nonlinear distortion. Another benefit is improving the frequency response of all stages. Anything above 1x will sound more open and transparent. Oversampling affects only the PSA pre-amp.

It is recommended to keep oversampling at 4x or higher all the time and 16x for the final mix-down.

## Visualization



The 3-digit "Parameter" display shows the value of the last changed parameter. It helps to fine-tune and remember the exact values.



The EQ display shows the frequency response of all stages, logically combined into two groups – Pre-EQ (yellow) and Post-EQ (red).  
Pre-EQ group consists of Pre-amp, Buzz, Punch, Crunch and Drive stages.  
Post-EQ group consists of Tone, Speaker Sim and Level stages.

The vertical range is 80dB, but both plots are separately shifted vertically to fit the display. It means that for each control it will show the effect on the tonal balance without showing constant wide-band gain.

## Known issues

- The Squeezeo Range Bias knob produces crackling noise when turned
- PSI Denoiser has an error that affects the gate knee softness.
- PSI Denoiser and Squeezeo Range may not work properly in Stereo mode
- Gain Scope is not intuitive, needs rework
- PSI Denoiser Threshold control middle mark doesn't make sense
- Switching Oversampling mode produces loud clicks
- No presets

## Plans

- Fix the known issues
- Implement proper auto-release limiter
- Use better discretization for the filters to improve frequency response with no oversampling
- Add peak indicators to Gain Scope
- Further performance optimization

## Credits

I'd like to thank:

- My wife for putting up with me spending endless nights on this work and for her suggestions on the GUI design.
- All the users of my plugins who provided their feedback, donated, voted or just sent a "thank you" letter.

It is my hobby to develop the VST audio effect models. I'm not getting paid for it and I use my own (very limited) spare time to do this work. If you like my projects and would like to encourage the future development, please consider doing something of the following:

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- Send me audio tracks you've made with my plug-ins
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