

Acon Digital Restoration Suite

User Guide

Acon AS

Acon Digital Restoration Suite

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1 Introduction

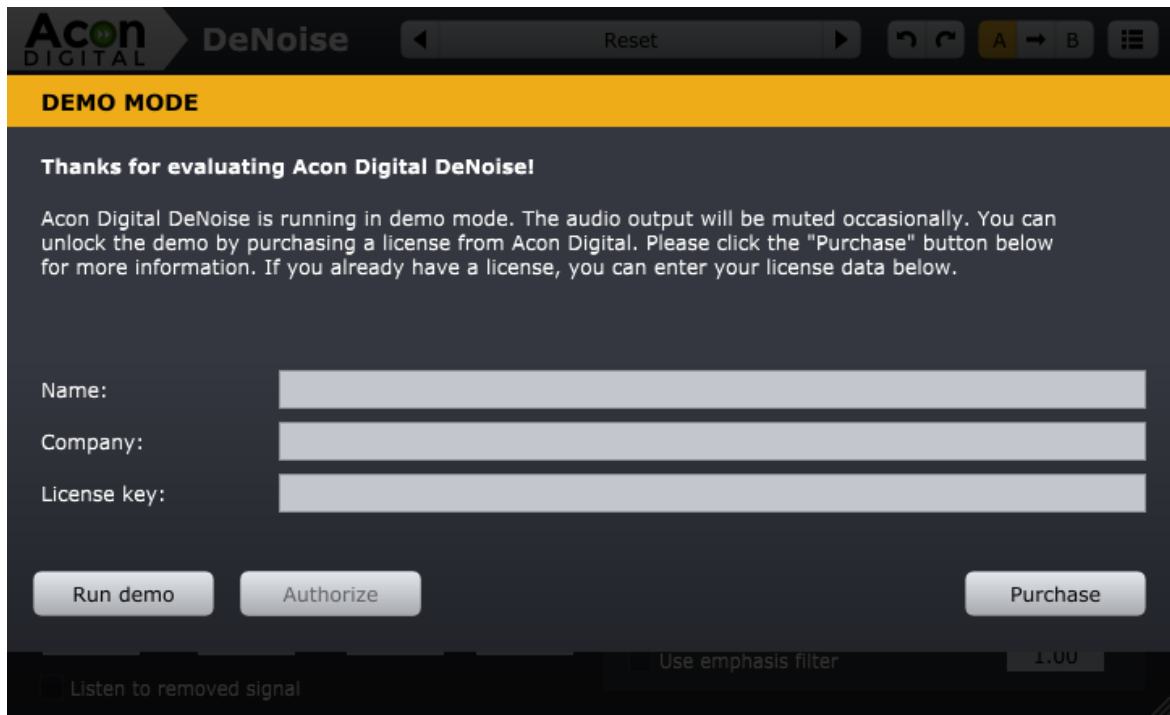
Thanks for using Acon Digital Restoration Suite. The restoration suite consists of four audio restoration plug-ins that are the result of several years of research within the field of noise reduction and audio restoration algorithms:

- **DeNoise** is a plug-in designed to reduce stationary noise, such as broadband noise, hiss, wind noise, buzz and camera noise. Great efforts have been put into preserving as much of the original signal as possible during the noise reduction process. As a result, DeNoise can reduce or in many cases completely remove the noise in a very transparent manner without loss of transients, attacks or "air" in the recording.
- **DeHum** targets hum and buzz typically introduced by poorly grounded electrical equipment, but also other tonal noise sources like electrical motor noise.
- **DeClick** is designed to remove impulsive noise such as clicks and crackle. These distortions are frequently encountered on LP and 78 RPM records, but also occur in digital recordings due to drop-outs or distorted data packets. The latest version of DeClick introduces a dethump algorithm, which allows you to reduce plosives and thump sounds, as often found in recordings from scratched vinyl records or in vocal recordings.
- **DeClip** restores audio recordings distorted by analog or digital clipping.

1.1 Purchase and Authorization

Acon Digital Restoration Suite will run in demo mode the first time you open any of the plug-ins from your audio editor or digital audio workstation (DAW). The demo mode is fully functional with exception of short passages with muted audio output at irregular intervals. The demo version can be unlocked by purchasing a license key from Acon Digital (see Acon Digital online shop). When a plug-in is opened in the demo mode, a dialog box appears where you can choose to continue with the demo version or enter a license key. There is also a purchase button which directs you to the Acon Digital online shop.

If you have purchased a license key from Acon Digital, please enter your name, company name if applicable and the license key you obtained. The *Authorize* button will remain deactivated until the license key has been accepted. After having successfully authorized *Acon Digital Restoration Suite* or a single plug-in in the suite, the demo dialog box will not appear again.



The demo dialog box appears when starting any of the plug-ins prior to authorization.

2 Using the Plug-Ins

You can access any of the plug-ins in the *Acon Digital Restoration Suite* from your host application (audio editor or DAW) of choice. The plug-ins are available as 32 or 64 bit VST or AAX plug-ins (Pro Tools) on the Windows platform or as VST, AAX or AU plug-ins on Mac OSX (32 / 64 bit fat binaries). Some host applications will require a plug-in rescan and possibly adding the Acon Digital Restoration Suite installation directory to the list of VST directories. Please consult the manual for the host application for further details.

The following plug-ins are part of Acon Digital Restoration Suite:

- DeNoise
- DeHum
- DeClick
- DeClip

2.1 DeNoise

The DeNoise plug-in targets stationary noise such as broadband noise, hiss, wind noise, buzz and camera noise. Great efforts have been put into preserving as much of the original signal as possible during the noise reduction process. As a result, DeNoise can reduce or in many cases completely remove the noise in a very transparent manner without loss of transients, attacks or "air" in the recording.

DeNoise operates either in an adaptive mode or by learning from a selection containing noise only. Regardless of the operating mode, the noise reduction algorithm requires an estimate of the expected frequency distribution of the noise called *noise profile*. In the adaptive mode, the noise profile is evaluated constantly using advanced statistical methods. When using the learning mode, DeNoise measures the average frequency distribution of the input signal which should contain only noise. You can choose to freeze the noise profile in order to perform the actual noise reduction.



The DeNoise plug-in window. The graph shows the current noise profile as well as frequency spectrum of the input signal.

General Settings

Reduction

Reduction factor scales the estimated noise profile and allows you to remove more (positive values) or less (negative values) noise than the analysis algorithm detected.

Soft knee

The soft knee parameter reduces the steepness of the transition between noise and the wanted signal. Higher soft knee values result in a more natural transition.

Maximum attenuation

Maximum attenuation allows you to adjust a maximum attenuation factor for each frequency band component. By leaving a certain noise floor, you can mask artifacts from the noise reduction algorithm.

Attack time

The attack time is the maximum response time of the noise suppression when the signal level of a frequency component increases.

Release time

The release time is the maximum response time of the noise suppression when the signal level in a frequency component decreases.

Listen to removed signal

Enable this option if you wish to monitor the signal removed by the noise reduction algorithm.

Noise Profile Settings

Adaptive noise profile

Enables the adaptive noise profile estimation. In the adaptive mode, DeNoise adapts to changes in the noise profile. You can choose to limit the noise reduction to broadband noise or to target both broadband and tonal noise such as buzz (combined mode) by choosing either broadband or combined from the drop down list. The combined mode can be useful for dialogue or rhythmic audio material, but might remove too much of the wanted signal when used with music. The adaptive mode is ideal when you need to remove noise with a changing noise profile such as wind noise or when it is not possible to isolate a region of the recording containing only noise. In the latter case, it is possible to use the adaptive mode to create an estimate of the noise profile, ideally in softer passages, and then freeze the noise profile.

Adaptation time

Selects the working mode of the denoiser. Choose adaptive to let the denoiser change the noise profile to adapt to changes in the source material.

Learn from noise only

Enables the noise profile learning mode. When you use the learning mode, you should select a region containing only noise in your audio editor or digital audio workstation (DAW). Play the section containing noise only through Acon Digital DeNoise. No noise reduction is performed when the learning mode is activated. To start the actual noise reduction, enable *Freeze noise profile*.

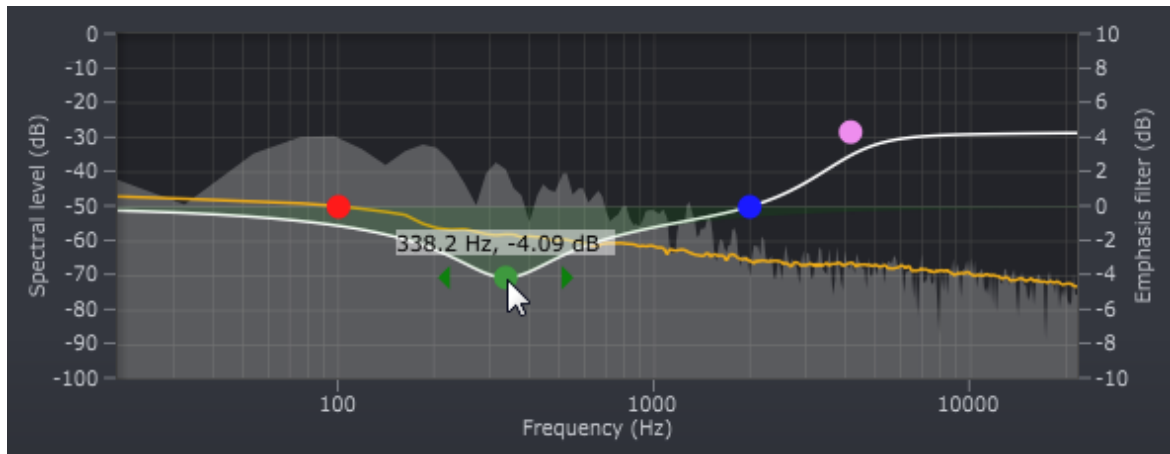
Freeze noise profile

Enable this if you wish to freeze the noise profile estimated in either the adaptive or learning mode.

Use emphasis filter

The emphasis filter allows you to apply frequency weighting to the noise profile estimate. This is very useful if you wish to make manual corrections to the estimated noise profile. The frequency weighting curve consists of a low shelf filter, two peak filters and a high shelf filter, similar to a parametric equalizer. You can modify the filter characteristics by clicking the handles (colored bullets) in the curve and move them around and the current frequency and

gain settings of the frequency band is displayed.. You can also change the filter slope of the shelving filters or the bandwidth of the peak filters. Click handle of for the filter you wish to modify. Arrows appear surrounding the handle. Move these to change the bandwidth for peak filters or the filter slope for the shelving filters.

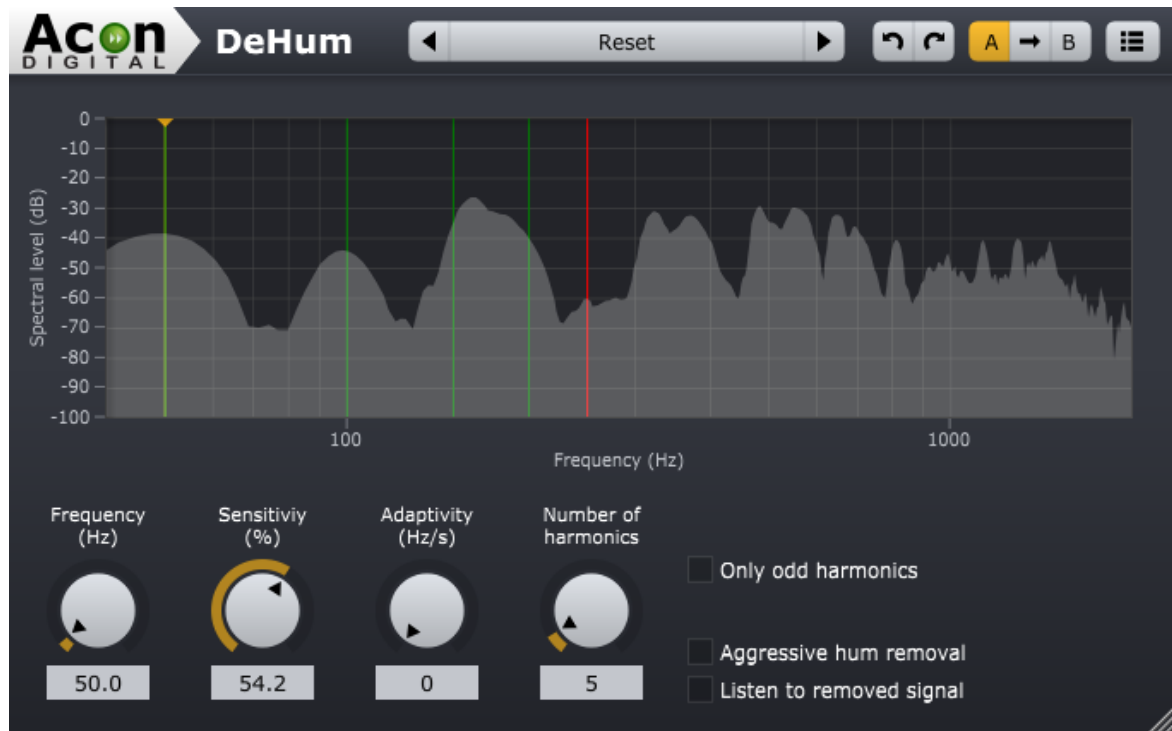


Acon Digital DeNoise running with the emphasis filter enabled.

2.2 DeHum

Acon Digital DeHum is designed to remove hum and buzz typically introduced by poorly grounded electrical equipment, but also other tonal noise sources like electrical motor noise. The dehum algorithm also supports adaptive hum reduction so that the algorithm adapts to fluctuations in the fundamental frequency of the hum signal. Real life hum noise is likely to consist of a fundamental frequency and a set of harmonic frequencies. These are multiples of the fundamental frequency. DeHum allows you to set the number of harmonics to remove and also has the option to address only odd harmonics, since hum noise with only odd harmonics are frequently encountered.

There are two different operating modes and you can set the operating mode using the "aggressive hum removal" check box. When aggressive hum removal is disabled, DeHum subtracts a hum signal reconstructed using a sinusoidal resynthesis technique in order to minimize distortions of the wanted signal. When the aggressive mode is enabled, the dehum process is performed using conventional notch filters.



The DeHum user interface.

Settings

Frequency

The frequency knob can be used to set the fundamental frequency of the hum noise. If the hum noise originates from the power distribution net, the fundamental frequency should be set to either 60 Hz (American standard) or 50 Hz (European standard), depending on frequency of the AC power distribution in the country the recording was made.

Sensitivity

The sensitivity parameter is only available when the *aggressive hum removal* option is deactivated. Higher sensitivity values cause the dehum algorithm to classify more frequency components as hum noise.

Adaptivity

The adaptivity knob controls the maximum fluctuation of the fundamental frequency in number of Hertz per second that is allowed in the detection of the fundamental frequency. This value should be as low as possible while still detecting the fluctuations of the hum signal being removed.

Number of harmonics

The number of harmonics to address. This should be as low as possible while still removing all the harmonics present in the hum noise.

Only odd harmonics

Activate this check box to address only odd harmonics. Hum signals consisting of a

fundamental frequency with only odd harmonics are frequently encountered in real life situations and are typically the result of sine wave signal with a symmetrical nonlinear distortion.

Aggressive hum removal

The aggressive hum removal check box toggles between the notch filter operating mode and the sinusoidal resynthesis mode. The advantages of the aggressive mode is that it doesn't introduce any latency and it consumes less CPU. However, the sinusoidal resynthesis mode introduces considerably less distortion to the wanted signal (you can enable the "Listen to removed signal" option to monitor the difference).

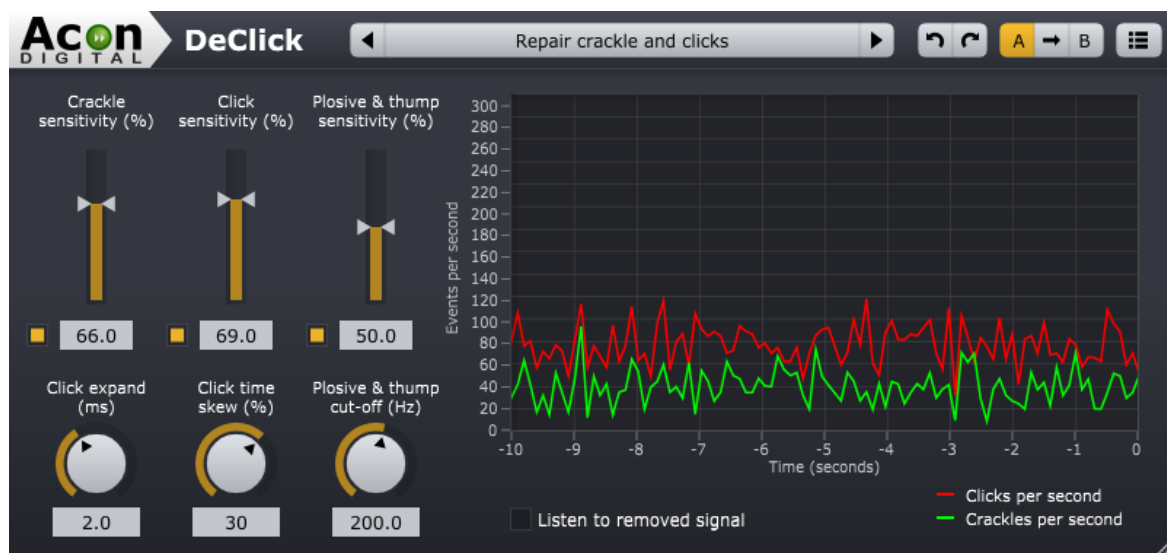
Listen to removed signal

Enable this option if you wish to monitor the signal removed by the hum reduction algorithm.

2.3 DeClick

Acon Digital DeClick is designed to remove impulsive noise such as clicks and crackle. These distortions are very frequently encountered on LP and 78 RPM records, but also occur in digital recordings to drop-outs or distorted data packets. DeClick contains two different algorithms to deal with clicks and crackle. The actual declicker algorithm eliminates large clicks and pops in the recording, while the decrackler algorithms eliminates the frequent, but short clicks that the human ear perceives as crackle. DeClick removes clicks by substituting the recorded signal in the short period of time during the click with a signal estimated using the undistorted audio surrounding each click.

DeClick also features a third algorithm, which is designed to reduce plosives and thumps. These distortions are typically found in recordings from scratched vinyl records or in vocal recordings, where words that start with a P or B can cause a strong blast of air to reach the microphone diaphragm, resulting in a thump sound.



The DeClick user interface.

The DeClick user interface contains a reduction meter that gives visual feedback of the restoration process. It shows a history of the reduction activity during the past ten seconds. The red line shows the number of clicks removed per second, where the green line shows the number of crackles removed per second.

Settings

Crackle sensitivity (%)

Sets the sensitivity of the decrackler algorithm. Higher crackle sensitivity values result in more crackle reduction. You can use the toggle button to activate or deactivate the decrackler algorithm.

Click sensitivity (%)

Sets the detection sensitivity of the declicker algorithm. Higher click sensitivity values result in more click reduction. You can use the toggle button to activate or deactivate the declicker algorithm.

Plosive & thump sensitivity (%)

Sets the sensitivity of the dethump algorithm. Higher plosive & thump sensitivity values result in more thump reduction. You can use the toggle button to activate or deactivate the dethump algorithm.

Click expand (ms)

The amount of smoothing applied to the click detection signal. This will expand the average duration of the detected clicks and should be kept as small as possible, while still covering the clicks. This can be set between 0.1ms and 5.0ms.

Click time skew (%)

The shape of the clicks, where 0% represents a symmetrical clip. Positive values should be used when the clicks cause more post ringing.

Plosive & thump cut-off (Hz)

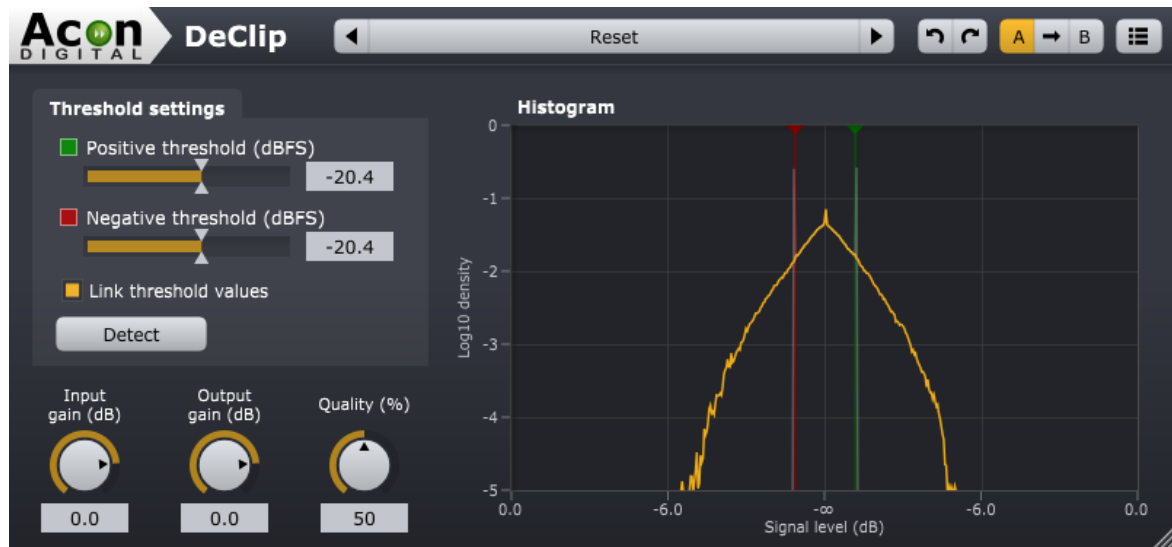
The upper frequency limit for the dethump algorithm. This can be set between 20 Hz and 350 Hz.

Listen to removed signal

You can use this to listen to the removed signal, which can be considered an audible representation of the reduction meter.

2.4 DeClip

Acon Digital DeClip restores audio recordings distorted by analog or digital clipping. Clipping occurs during recording when the recording level is too high and the highest peaks cannot be correctly recorded. DeClip substitutes such distorted peaks with an estimation of the signal curve in such a way that the frequency content obtained from the sampled values in the reliable range (i.e. the parts of the waveform not affected by clipping) is preserved as far as possible.



The Acon Digital DeClip user interface.

DeClip shows a histogram of the signal level distribution in order to visualize restoration process and simplify the adjustment of the threshold values. DeClip will substitute all recorded signals above the upper and below the lower threshold value with an estimate of the signal. The threshold values can be adjusted using their corresponding slider controls or in the histogram by dragging the colored handles.

Settings

Positive threshold (dBFS)

All samples values above the positive threshold value specified in dBFS are substituted by an estimation of the signal.

Negative threshold (dBFS)

All samples values below the negative threshold value specified in dBFS are substituted by an estimation of the signal.

Detect

By clicking this button, DeClip will automatically detect the threshold values. Please note that this button requires audio input to work properly.

Link threshold values

Usually, the clipping introduced during recording will be symmetrical, which means that the upper and lower thresholds will have the same absolute value. By activating the upper and lower threshold link, the adjustment of the declipper is simplified in the case of symmetrical clipping.

Input gain

The input gain is specified in dB and useful for adjusting the signal level before the declipping process and adding enough headroom for the restoration process.

Output gain

The output gain in dB allows you to make up for peak level changes caused by the declipping process.

Quality

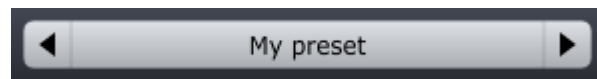
The quality slider controls the quality at the cost of CPU usage of the algorithm. Increased quality factors lead to higher CPU usage.

2.5 Header tools

The upper region of the all the four plug-ins in the Restoration Suite lets you manage presets, undo or redo changes or quickly compare different settings using the A / B compare tools:

Preset section

Restoration Suite is shipped with a set of factory presets that serve as a starting point for further adjustments. You can browse through preset categories and presets as well as create and manage your own presets using the preset management section:



The preset management section available in all the Restoration Suite plug-ins.

You can browse through the presets using the arrow buttons. Alternatively, you can click the current preset name and a drop-down menu appears. You can also save your own presets by choosing "Save user preset file..." from the menu. A file chooser dialog box appears where you can enter the name of the preset you wish to save. You can create sub folders and place your preset files inside, and these will appear as categories in the user presets.

Undo and redo

You can undo (or redo) any changes to the parameter settings by clicking the circular arrow back or forward buttons:



Undo and redo buttons

A / B comparisons

It is frequently useful to be able to quickly compare different parameter settings. You can do this using the A / B comparison buttons:



The A / B comparison buttons allows you to quickly compare different settings

You can keep two independent sets of parameter settings, the A and B settings, and switch between them using the corresponding buttons. The arrow button copies the settings from A

to B or the other way around depending on which parameter set that is currently active.

The plug-in menu

The last button in the plug-in header displays the plug-in menu:



You can click the plug-in menu button for the plug-in specific menu

From the plug-in menu you can among other choose different visual themes, show this help or information about the plug-in.

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