

# Restoration Suite 2

## User Guide

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Acon AS

# Restoration Suite 2 User Guide

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# 1 Introduction

Thanks for using *Acon Digital Restoration Suite 2* which consists of four audio restoration plug-ins for audio restoration:

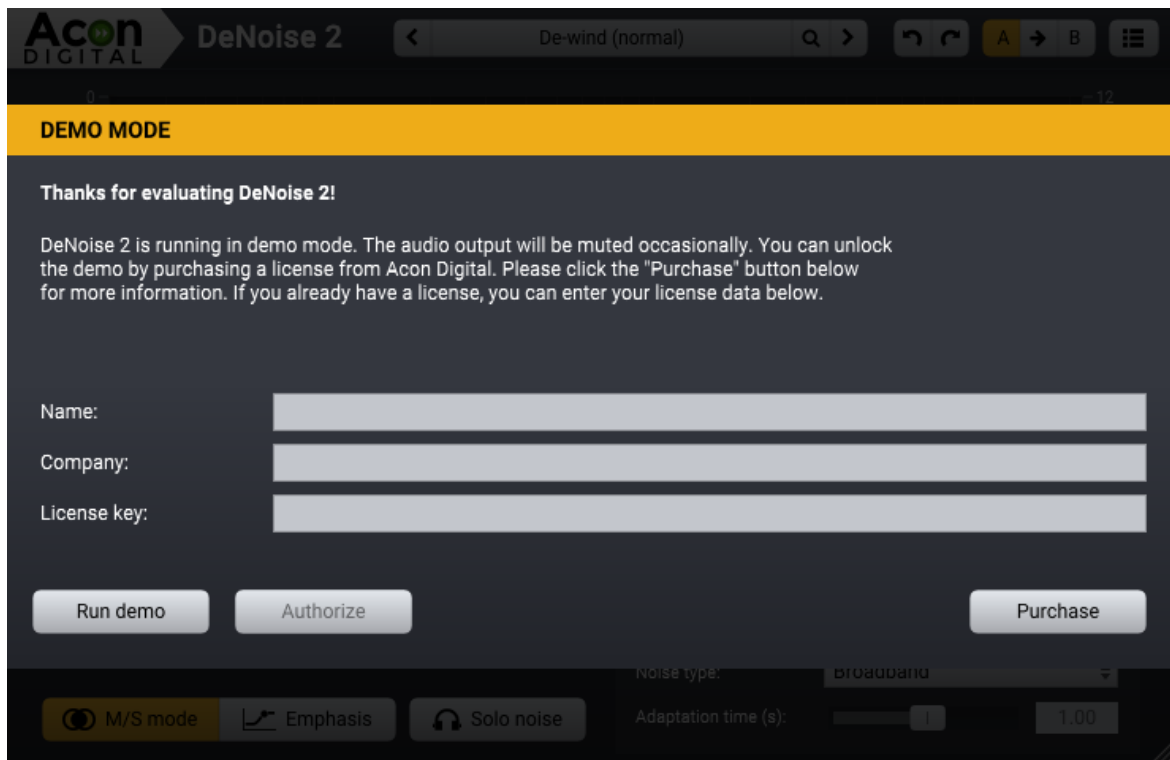
- **DeNoise 2** is a plug-in designed to reduce noise such as hiss, wind noise, buzz and camera noise. The noise can be reduced automatically in the *adaptive mode* or after measuring the characteristics of the noise in the *noise profile mode*. New in version 2 are dynamic noise profiles that capture the dynamic properties of the noise so that noise that fluctuates over time, such as wind noise, can be effectively reduced. The new algorithm has also been greatly improved and is now even less prone to typical de-noising artifacts.
- **DeHum 2** targets hum and buzz typically introduced by poorly grounded electrical equipment, but also other tonal noise sources like electrical motor noise. The hum detection algorithm has been improved in version 2 and there's now a new *Scan* button that automatically fine tunes the fundamental hum frequency.
- **DeClick 2** is designed to remove impulsive noise such as clicks, crackle and thumps. 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. DeClick 2's thump reduction works also effectively on vocal recordings with unwanted plosives. The algorithm has been improved in version 2 and is now less prone to reducing attacks and transients in the wanted signal.
- **DeClip 2** restores audio recordings distorted by analog or digital clipping with an improved algorithm.

## 1.1 Purchase and Authorization

The plug-ins in the *Acon Digital Restoration Suite* will run in demo mode the first time you open it 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 you 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*, the demo dialog box will not appear again.



*The demo dialog box appears when starting any of the plug-ins in the Acon Digital Restoration Suite prior to authorization.*

## 1.2 Requirements

Before you install *Acon Digital Restoration Suite*, please make sure your computer fulfills the following requirements:

### PC Version (Windows)

- Windows 10 / 8 / 7
- Intel Core i3 or AMD multi-core processor (Intel Core i5 or faster recommended)
- 1366 x 768 display resolution (1920 x 1080 or higher recommended)
- 1 GB RAM (4 GB or more recommended)
- 1 GB free HD space
- A host application that is compatible with VST (32 bit or 64 bit), VST3 or AAX (Pro Tools 10.3.5 or higher)

### Macintosh Version (OS X)

- OS X 10.8 or later
- 1 GB RAM (4 GB or more recommended)
- 1 GB free HD space
- A host application that is compatible with AU, VST, VST3 or AAX (Pro Tools 10.3.5 or higher)

## 2 Host Integration

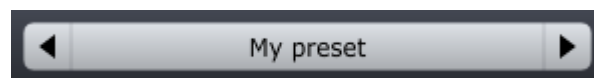
You can access the plug-ins in the *Acon Digital Restoration Suite 2* from your host application (audio editor or DAW) of choice. The plug-ins are available as a 32 or 64 bit VST or AAX plug-in on the Windows platform or as a VST, AU or AAX plug-ins on Mac OS X (32 / 64 bit fat binaries). Some host applications will require a rescan and possibly adding the *Acon Digital Restoration Suite* installation directory to the list of VST directories. Please consult the manual for your host application for further details.

## 3 Using the Plug-ins

The plug-ins in *Acon Digital Restoration Suite 2* have some properties in common such as preset management, A/B comparisons and bypassing. You can find a common set of buttons and controls in the header section of the included plug-ins and these are described below.

### Preset Manager

*Acon Digital Restoration Suite 2* 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 integrated processors.*

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

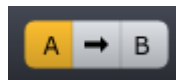
You can undo (or redo) changes to the parameter settings by clicking the circular arrow back or forward buttons:



*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 Processor Menu

The last button in the header section displays the processor menu:



*You can click the processor menu button for the processor specific menu*

The processor menu allows you to access the processor help topic directly along with other processor specific features.

### Using Sliders to Adjust Parameters

Horizontal, vertical and rotary sliders (or knobs) are frequently used in the plug-in user interfaces. Clicking with the mouse on a knob and moving up or down will allow you to modify the setting. You can also use the scroll wheel of your mouse. For more precise control, you can hold down the Ctrl key on your keyboard at the same time as you use your mouse to modify the setting.

## 3.1 DeNoise 2

The *DeNoise 2* plug-in reduces noise such as hiss, wind noise, buzz and camera noise. It operates either in an *adaptive mode* or in *noise profile mode*, by learning from a selection containing noise only. Regardless of the operating mode, an accurate estimation of the frequency content of the noise is crucial for a good result.

### Adaptive De-Noising

In the adaptive mode, the noise frequency spectrum is constantly estimated using statistical methods. You can choose to address only broadband noise (noise type set to *broadband*) or both tonal and broadband noise (noise type set to *combined*). Broadband noise doesn't have a perceivable pitch and tape hiss is one example. Addressing only broadband noise reduces the probability of affecting the wanted signal, but noise that has tonal elements such as buzz will not be removed unless the noise type is set to *combined*.

You can choose how quickly *DeNoise 2* responds to changes in the noise floor by adjusting the *Adaptation time* slider. However, the risk of affecting the wanted signal increases with lower adaptation times. For dialogue, one second is usually sufficient, but we recommend longer adaptation times for music.

### De-Noising Based on Noise Measurements

If there's a section of the noise without the wanted signal available, you can guide the noise estimation algorithm by creating a *Noise Profile*. Traditionally, these *noise profiles* (sometimes also called *noise finger prints*) are stationary, which means that their frequency distribution doesn't vary over time. However, Version 2 of *DeNoise* introduces the new *Dynamic profiles* that measure how noise fluctuates over time. A common example is wind noise. *DeNoise 2* is able to gather statistics that is used to estimate a noise floor that changes rapidly over time.





The DeNoise 2 plug-in window. The graph shows an estimation of the noise (yellow curve) as well as frequency spectrum (filled gray curve) of the input signal.

## General Settings

- **Reduction (dB)**

The Reduction knob controls the noise estimation level and allows you to remove more (positive values) or less (negative values) noise than the estimation 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 (dB)**

Maximum attenuation allows you to adjust a maximum attenuation factor for each frequency band, and thus control the noise floor after processing.

- **Reaction time (ms)**

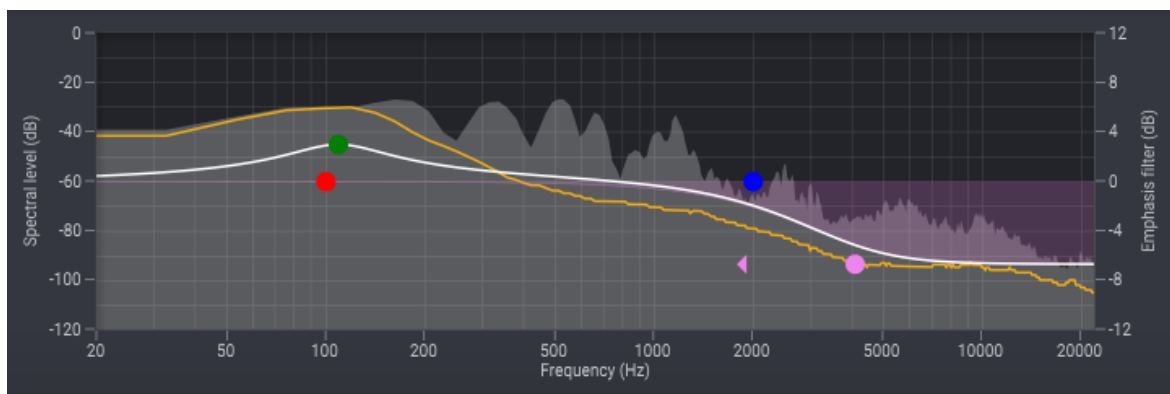
The reaction time controls the maximum time for the algorithm to respond to level changes in each frequency band. Longer reaction times effectively reduces tonal and burst-like processing artifacts.

- **M/S Mode**

The Mid / Side (M/S) mode is only available when working with source material in stereo and it avoids drifting in the stereo image after processing. When enabled, the incoming audio is converted to a M/S signal prior to processing and decoded back to normal left / right stereo at the output.

- **Emphasis**

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 the handle of the filter you wish to modify. Arrows surrounding the handle will appear. Move these to change the bandwidth for peak filters or the filter slope for the shelving filters.



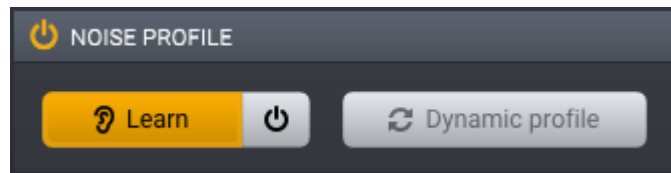
*The Emphasis filter curve boosts or reduces the noise reduction in frequency bands similar to an equalizer.*

- **Solo Noise**

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

### Noise Profile Section

The *Noise Profile* section contains user interface elements for de-noising based on a noise measurement. The first step is to measure the noise to remove using the learn button:

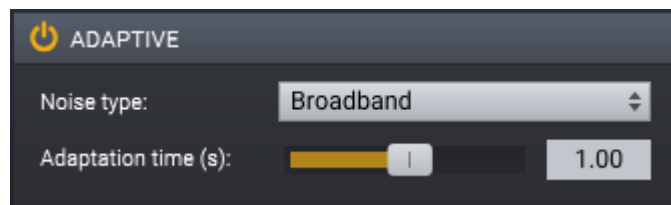


*DeNoise 2 in Noise Profile mode with the Learn button activated*

Now play a section that contains the noise you want to remove in your host application. No noise reduction is performed when the learning mode is activated. You can now click the button with the *power on* icon to enable the profile based de-noiser. If your noise varies over time, you can click the *Dynamic profile* button to enable the new dynamic noise profile mode in *DeNoise 2*. In the dynamic mode, *DeNoise 2* will constantly adapt the noise floor to fit the input signal.

### Adaptive Section

The *Adaptive* section contains user interface elements for adaptive de-noising:



*DeNoise 2 in Adaptive mode*

The Noise type can be set to one of two types:

- *Broadband*, which is noise without a perceivable pitch such as tape hiss. When this noise type is selected, *DeNoise 2* will not try to reduce tonal noise
- *Combined*, which is noise that can have tonal components such as hum and buzz. The risk of affecting the wanted signal is higher when choosing this noise type

The *Adaption time* controls how quickly *DeNoise 2* will respond to changes in the noise floor and is specified in seconds. A shorter adaptation time will reduce the time before *DeNoise 2* is able to reduce noise effectively after an increase in noise level, but at the cost of a higher risk of affecting the wanted signal.

## 3.2 DeHum 2

*DeHum 2* 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 *Notch filter* toggle button. When *Notch filter* mode is disabled, DeHum subtracts a hum signal reconstructed using a sinusoidal re-synthesis technique in order to minimize distortions of the wanted signal. With *Notch filter* mode enabled, the hum reduction is performed using conventional notch filters.



*The DeHum 2 user interface with green and red lines indicating the hum harmonics. The lines turn green when hum is detected.*

## Settings

- **Frequency (Hz)**

The *Frequency* knob sets the fundamental frequency of the hum or buzz noise. If the hum 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. You can let *DeHum 2* fine-tune this fundamental frequency automatically using the *Scan* button on the lower left hand side of the *Frequency* control knob.

- **Sensitivity (%)**

The sensitivity parameter is only available when the *Notch filter* mode is deactivated. Higher sensitivity values cause the hum reduction algorithm to classify more frequency components as hum.

- **Adaptivity (Hz / s)**

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.

- **Harmonics**

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

- **Odd harmonics**

Click this toggle button to reduce only odd harmonics. Hum noise 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 non-linear distortion.

- **Notch filter mode**

The *Notch filter* button toggles between the notch filter and the sinusoidal re-synthesis modes. The advantages of *Notch filter* mode is that it doesn't introduce any latency and it consumes less CPU. However, the sinusoidal re-synthesis mode introduces considerably less distortion to the wanted signal (you can enable the *Solo hum* button to hear the difference).

- **M/S mode**

The Mid / Side (M/S) mode is only available when working with source material in stereo and it avoids drifting in the stereo image after processing. When enabled, the incoming audio is converted to a M/S signal prior to processing and decoded back to normal left / right stereo at the output.

- **Solo hum**

Click this button if you wish to monitor the signal removed by the hum reduction algorithm.

### 3.3 DeClick 2

*DeClick 2* removes 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 2 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.

- **M/S mode**

The Mid / Side (M/S) mode is only available when working with source material in stereo. When enabled, the incoming audio is converted to a M/S signal prior to processing and decoded back to normal left / right stereo at the output.

- **Solo noise**

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

## 3.4 DeClip 2

*DeClip 2* 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 2* 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 DeClip 2 user interface.*

*DeClip 2* shows a histogram of the signal level distribution in order to visualize restoration process and simplify the adjustment of the threshold values. *DeClip 2* 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.

- **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.

- **Detect**

By clicking this button, *DeClip 2* will automatically detect the threshold values. Please note that this button requires audio input to work properly.



- **Input gain (dB)**

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

- **Output gain (dB)**

The output gain in dB allows you to make up for peak level changes caused by the de-clipping 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.



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