



DeScratcher Plug-In

for

Pyramix
VIRTUAL *Studio*

USER'S MANUAL

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Algorithmix® DeScratcher Plug-In

Click and Crackle Removal Processor for Pyramix Systems

Overview

The **De-Scratcher** PlugIn effectively removes *clicks* and *crackles* from old vinyl and shellac (78rpm) records, or audio recordings tainted by switching noise, digital cross-talk, or thyristor buzz. Unlike other systems, **Algorithmix® De-Scratcher** PlugIn works virtually without artifacts, providing the correct setting for all parameters.

Since the **De-Scratcher** PlugIn works in real-time, you can optimize all the parameters while listening to the processed signal.

The *de-scratching* algorithm consists of two main parts: the *de-clicking* module and the *de-crackling* module. While the *de-clicking* module is used to remove heavy clicks from old 78rpm and vinyl records, or switching noise coming from audio equipment, the *de-crackling* module removes any remaining small clicks and crackles. In addition to its main task, removal of clicks and crackles, the **DeScratcher** PlugIn successfully smoothes any kind of distortion causes by signal overload (*Clips*).

It's very easy to get satisfactory results with the **DeScratcher** PlugIn. There are only three knobs that need to be adjusted properly. You start with the *Declick* knob and continue with the *Decrackle* knobs. Normally you need to readjust recursively the *Declick* and *Decrackle* functions a few times to achieve a perfect balance between the parameters. To save your time we avoided implementation of additional decision parameters and provided instead well defined, application oriented *Profiles* which preset the internal parameters for typical restoration situations: *Shellac (78rpm)*, *Vinyl1* and *Vinyl2*.

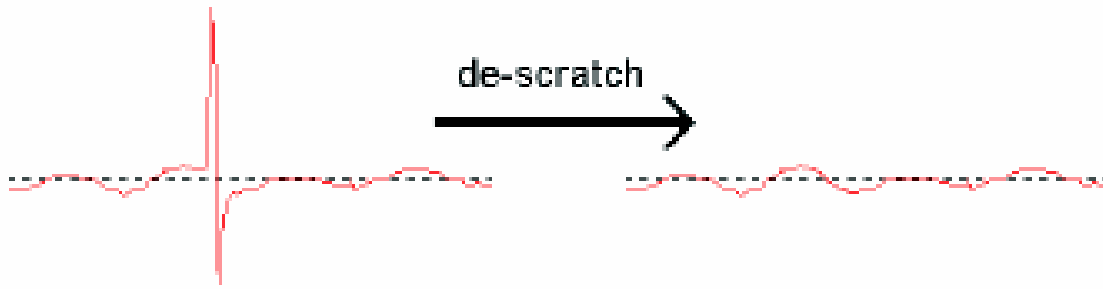
The *signal scope* is intended to help you finding the optimal setting for the *DeCrackler*. We recommend you, however, to perform final precise real-time parameter optimization with a critical listening to the signal removed with the *de-scratching* algorithm by using the *Difference* feature.

In the most restoration tasks, especially if remastering old vinyl or 78rpm records, it is recommended to use both the **DeScratcher** and the **DeNoiser** PlugIn. The order in which these processes are applied is very important to the final result achieved. The correct way is to remove clicks and impulse-like disturbances first with the **DeScratcher** Plug-In and then subsequently to apply the **DeNoiser** Plug-In to clean the remaining broadband noise from the signal. Applying the **DeNoiser** directly to heavy clicks will create significant, singing-birds-type artifacts and is not recommended.

The DeClicking Process

The *Declicking* module of the **DeScratcher** PlugIn removes clicks from old records as well as any impulse-like noise arising from analog or digital audio equipment. The higher the *Sensitivity* parameter is set, the more clicks are removed. At a setting of zero, virtually all clicks pass through the module. For the *de-clicking* of typically polluted vinyl records transferred to the digital domain, a *Sensitivity* value of approximately 50 to 70 works well in the most cases. Higher values can cause artifacts and should be adjusted to get a good

compromise between clicks removal performance and sound quality of the remaining original signal.



Typical click in the signal taken from a vinyl record (left) and restored signal (right)

The internal parameters of the *de-clicking* algorithm are well predefined for the typical audio restoration situations and can be select in the *Profile* field. For restoring 78rpm shellac records press just *shellac*. Vinyl records which are normally characterized by wider clicks are best treated after pressing *Vinyl 1* or *Vinyl 2* button. Make your choose comparing sonic results out of both setups. For general *de-clicking* tasks use *Vinyl1*.

For additional help, we highly recommend using the *Difference* feature, allowing for intuitive and optimal parameter setting. You can switch between the original input signal and the *input/output difference*, i.e., the part of signal taken out by the *de-scratching* algorithm. Normally, this differential signal should not contain any audible parts of the original signal you want to preserve.

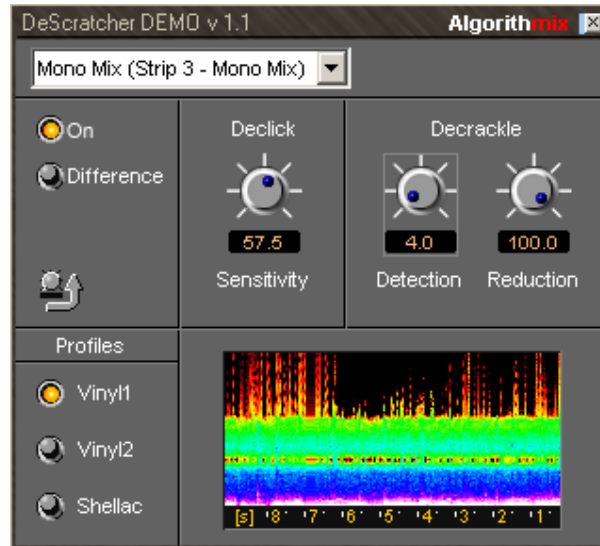
The DeCrackling Process

The *Decrackler* module of the **De-Scratcher** PlugIn removes crackles and small clicks left after the *de-clicking* process, or other crackle-like disturbances included in audio signals. The higher the parameters *Deteccion* and *Reduction* are set, the more crackles are removed from the original signal. Normally the value of 50 for *Deteccion* and between 50 and 70 for *Reduction* works well in most situations. The extreme settings result in smoothing of the input signal, but they are sometimes useful for heavily damaged audio material. However, it is up to you to find the proper compromise between the level of disturbances and the relative audio quality of the signal after processing.

As in the *de-clicking* process, the final setting of the parameters *Deteccion* and *Reduction* should be performed by critically listening to different parts of the audio file to be de-crackled. We highly recommend using the *Difference* feature, allowing optimal parameter set-up in a very intuitive way. You can switch over between the original input signal and the *input/output difference*, i.e., the part of signal removed by the *de-scratching* algorithm. This difference signal normally should not contain parts of the original signal you want to preserve.

To achieve the highest possible performance when restoring and mastering old mono vinyl or 78 rpm shellac records to CD, we recommend using a stereo pick-up to record the signal in stereo mode. Applying the stereo recording mode to mono records and merging both channels to mono first after de-clicking and de-crackling each channel individually improves signal-to-noise ratio by at least 3dB (which is actually a factor of two) compared to restoration procedures applied to pure mono files.

DeScratcher Quick Reference



Screen shot of the **DeScratcher Plug-In**

The **DeScratcher Plug-In** provides following controls:

- **On** – switches the Plug-In on or off (bypass function)
- **Difference** – allows to hear to the “garbage” being removed during *de-scratching*
- **Sensitivity** – defines the gain threshold for the *Declicker* and thus amount of clicks being removed
- **Detection** – adjust the *Decrackler* to affect narrower or wider frequency range
- **Reduction** – set up the amount of crackles being removed
- **Profiles: Vinyl1/Vinyl2/Shellac** – predefines the internal parameter setup
 - Vinyl 1 – recommended for vinyl records and general de-clicking tasks
 - Vinyl 2 – recommended for vinyl records (different click characteristic as Vinyl 1)
 - Shellac – recommended for restoration of 78rpm shellac records

and a display:

- **Signal Scope** – displays the last 20 seconds of frequency spectrum of the input signal part being not affected by the *Decrackler*

Understanding the Signal Scope

The *Signal Scope* allows monitoring the influence of the *Detection* parameter controlling the activity of the *Decrackler* module. It shows spectrum of the last 20 seconds of the signal part being classified as correct. This signal part is coming through the *Decrackler* without changes, the remaining part is repaired.

The *Signal Scope* shows the analyzed audio signal in the three dimensional view. The vertical axis is associated with the frequency of the signal spectrum, the horizontal axis shows the time, and the colors represent the intensity for every spectral component. The intensity scale corresponds to the rainbow colors: black, red, orange, yellow, green, blue, violet, and white. The black color represents zero intensity, the white color maximal intensity. The spectrum moves from the right to the left after starting playback.

The *Signal Scope* allows to investigate suspicious signal anomalies which are difficult to hear. Discrete high-frequency tones coming from switching signals or interferences with digital equipment can be successfully localized. Even if they have very low level they appear as a horizontal line in the moving spectrum.

The Wow & Flutter can be also detected quite easy. They appear as the modulation of the low-frequency components. Similar behavior can be observed if looking on the spectrogram of a voice with vibrato. In that case the fundamental frequency and quite often the associated formants looks like sinusoidal horizontal lines. Clicks are visible as bright vertical lines.

Applications Tips

The **De-Scratcher** PlugIn is an easy-to-use audio restoration tool based on extremely efficient signal processing algorithms. In most cases you will automatically achieve good results. To get the maximum, especially when working with heavily damaged audio material, there are some practical rules:

- Use a stereo record player if you restore old mono vinyl or 78rpm records and process both channels individually before merging again to mono. This improves the *signal-to-noise ratio* by at least 3dB (actually a factor of two) when compared to the one-channel *de-scratching* procedure.
- Transfer recordings directly to .WAV file without using any processing devices like *limiter* or *compressor* prior to the *de-scratching* procedure.
- If the audio material to be restored contains very strong clicks, you may allow some *clipping* while transferring to the digital domain. We recommend you make a few versions recorded with different input gain and compare the results after the *de-scratching* process.
- To get good results in short time work systematically: first set up the *Declicker* (setting up the *Reduction* parameter at 0) and then subsequent *Decrackler* of the **DeScratcher** PlugIn. Start with proper profile (*Shellac, Vinyl*) and *Sensitivity* equal to 70. Dependent on how heavy are clicks you need to remove, look for a proper *Sensitivity* setup (good compromise between original material to be prevented and possible artifacts). In the second step you should activate the *Detection* parameter starting with 50 and find the best setting for *Reduction*.
- Do not exaggerate with the parameters *Sensitivity, Detection, and Reduction* to avoid artifacts. When working on heavily disturbed material, use a good acoustical compromise between the level of remaining disturbances and artifacts introduced to the output signal. Be indulgent if you have hopelessly damaged material; nobody can restore original data from nothing.
- To complete the restoration process for old records, use the **De-Noiser** PlugIn to remove broadband residual noise and then eventually other processing modules like PEQ.
- For the best results, use your own ears in combination with the *Difference* feature. Switch between the original input signal and the *input/output difference*, i.e., the part of the signal taken out by the *de-scratching* algorithms. This difference signal normally should not contain any parts of the original signal you want to preserve.

Latency when used in Pyramix Virtual Studio Mixer

The Algorithmix real-time restoration Plug-Ins, (De-Scratcher and De-Noiser) are not subject to automatic delay compensation. These are highly complex processes requiring several tens of milliseconds of audio material buffering to perform their tasks. The exact latency of the De-Noiser Plug-In is 3072 samples (3×1024) corresponding to approx. 70 ms at 44.1 kHz while the De-Scratcher latency is even higher at 7168 samples (7×1024) corresponding to 162 ms at 44.1 kHz. Due to the very real-time nature of these Plug-Ins it is not possible to time align their output with respect to unprocessed channels without severely delaying all the unprocessed channels. Rather than automatically delaying all unprocessed channels in a given mixer configuration (which we felt could be a more significant inconvenience) we recommend nudging the audio material in the tracks to be processed to the left. I.e. later by the exact Plug-In latency value. It should also be mentioned that while some users insert these Plug-Ins in the mixer's strips, most often they are inserted in the master output. In the latter case there is usually no need to compensate for any inter-channel delays.

Important Remark:

The **De-Scratcher** PlugIn is a very fast and very effective tool. Unlike many other systems **Algorithmix® DeScratcher** PlugIn not only removes unwanted clicks and crackles, but keep your original sound as natural as possible. You will be amazed by how dramatically the audio quality of old records can be improved. But please do not expect miracles if you process material with long gaps or jumps. The information theory says that once the information is lost and there is not enough redundancy in the remaining material, the restoration process for the original material is impossible. In such hopeless cases, experienced mastering engineers try to transfer similar recording parts into gaps using very precise audio editors.