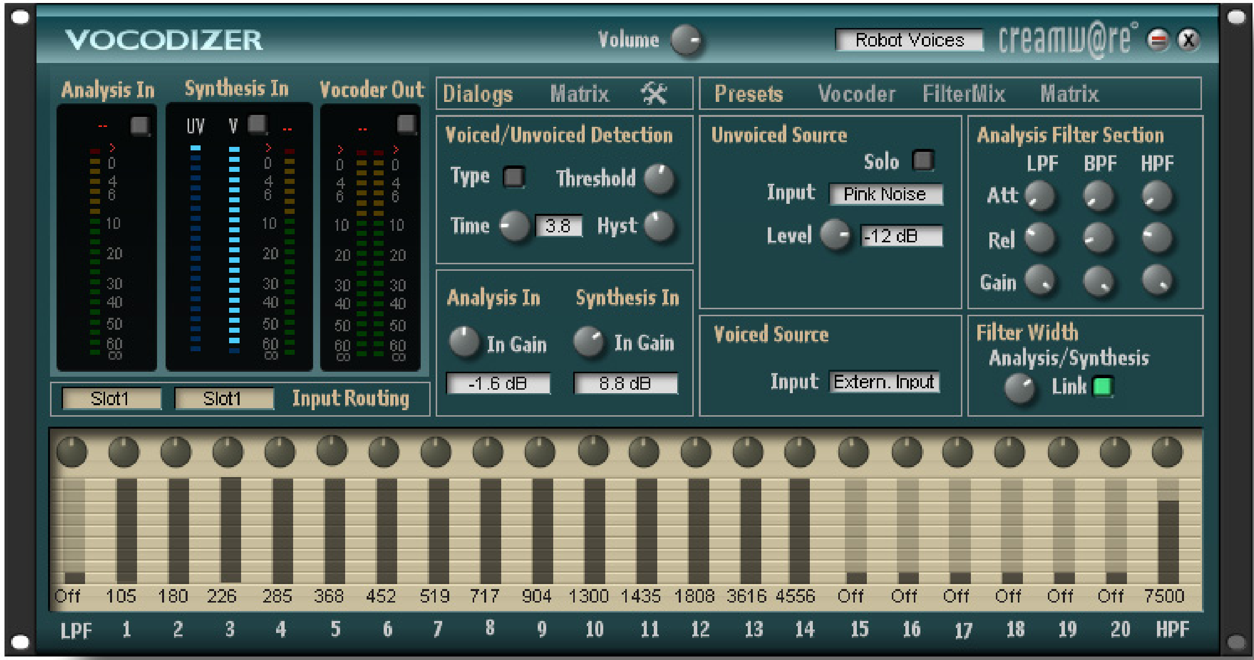
Vocodizer



- Tactive Instrument Modeller

Introduction

With the Vocodizer, Noah offers an extremely flexible vocoder. From its freely configurable and assignable filters, to individual level and pan controls for each synthesis filter output, the vocoder part of the Vocodizer gives you not only what you would expect in a classic vocoder–it extends the concept significantly. Switchable Voiced/Unvoiced Detection allows you to optimize the voicing intelligence depending on the input signal.

When the Vocodizer is used, it occupies its own slot, in the same manner as a synthesizer. Its analysis and synthesis inputs can be connected to any desired signal source. Typically, the analog input or a USB audio input is used as the analysis source, while the synthesizer input is connected to a synthesizer in one of the parallel slots. Naturally, an external synthesizer – for example, brought in via a USB audio input – is also possible as a signal source for the synthesis input.

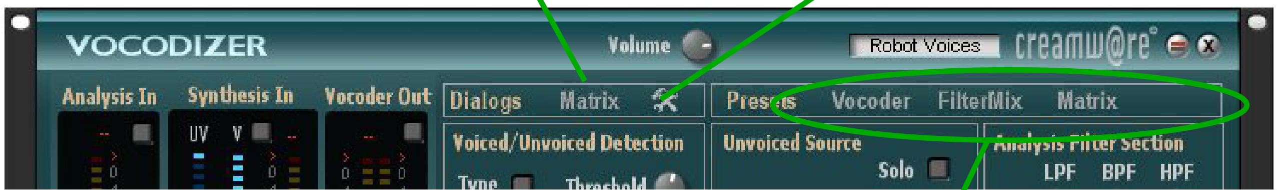
> **If you don‘t want the analysis signal or the synthesis signal itself to be audible in the mix, remove it from the Master bus by switching off the *Mix* button in the corresponding channel strip of the Mixer.**

Editor

In addition to the main editor, the Vocodizer also includes two independent dialogs: the ***Filter Matrix*** and the ***Frequency Calculator***.

Opens the Filter Frequency Calculator

Opens the Filter Matrix



Opens preset list dialogs for the Vocodizer and its individual sections

Presets

The Vocodizer stores different parameter groups in separate preset lists. This lets you manage, for example, the synthesizer presets completely independent of the vocoder presets.

The following preset lists are available:

Vocoder: Stores and recalls settings specific to the Vocoder section.

> **A few settings are not stored, however. For example, settings related to input signal levels are not stored in presets, as it would be self-defeating to do so. Usually you will be experimenting with different presets to process the same input signal. If the input level changed each time you loaded a new preset, the process would be unnecessarily clumsy.**

Settings *not* stored in presets include: all Voiced/Unvoiced Detection, Analysis/ Synthesis Input gains, Input Insert Effects, Solo, Voiced Source, and Master Insert Effects.

> **These settings are stored in the Multi, so that your setup will be restored exactly the next time you load it.**

FilterMix: These presets store the filter settings. Along with the frequency, they also store the volume and pan positions of the individual filters. Depending on the number of filter bands, and their proximity to each other (in terms of frequency) the bandwidth of each filter is also important, and is also saved in the preset.

Matrix: The Matrix also has its own preset list. The positions of each of the 22 routing switches are stored in the Matrix presets.

How does a Vocoder actually work?

A typical vocoder contains two filter banks: an *analysis* bank and a *synthesis* bank. As the name implies, the analysis bank takes the incoming voice signals and analyzes them to extract frequency and timing information, creating a "signature" for each filter in the bank. These signatures are later applied to an identically tuned filter bank in the synthesis section, and used to process a secnd, synthesized, signal (or, it could be an entirely unrelated external input signal). In both filter sections, the filters are divided into an equal number of frequency bands.

After the analysis phase, the vocoder examines each individual analysis filter output with an envelope follower to extract dynamic level information. The envelope follower then generates control signals corresponding to the changing volume levels.

The component signals from the synthesis filter bank (whose filters are tuned to the same "signatures" as the analysis filters) are multiplied by the control signals from the envelope follower. In other words, the dynamic level progression of the signals filtered by the synthesis section match exactly the dynamics of the filtered signals of the original voice input. Finally, the synthesized signal components are mixed to produce the final output. The result is vocoder output that produces a synthesized sound with the character and articulation of the original input voice. The vocoder is often used to produce the "talking synthesizer" effect made popular by artists such as Stevie Wonder.

To guarantee the highest quality results, the Vocodizer implements Voiced/ Unvoiced Detection. During the analysis phase, the signal is examined for its tonal vs. noise content. Vowels, such as "A" are identified as tonal (voiced), and consonants such as "S" as noise (unvoiced). Depending on the results of this analysis, either the synthesizer signal or a noise signal is passed on to the synthesis filter bank. A noise signal (noise, in this case, referring to a signal containing all frequencies in appropriate proportions) can help to reproduce the sibilant portions of the original signal. Often the synthesized results produced by a traditional vocoder do not contain enough high frequencies. The Vocodizer's "noise substitution" strategy is able to produce more convincing results.

If you want, you can use the sibilant portions of the original signal for the unvoiced source instead of a random noise signal. In this case, the vocoder section filters the input signal in such a way that only the higher frequency components remain, letting you use the original "S" sounds to replace noise as the unvoiced source. In most cases, though, the broadband noise signal is a more appropriate source for unvoiced signal components, as the output already has a synthetic quality to it, and the original signal, if used, tends to stand out too much. But this option can come in handy sometimes, and in the long run it's all a matter of taste and appropriateness for the situation.

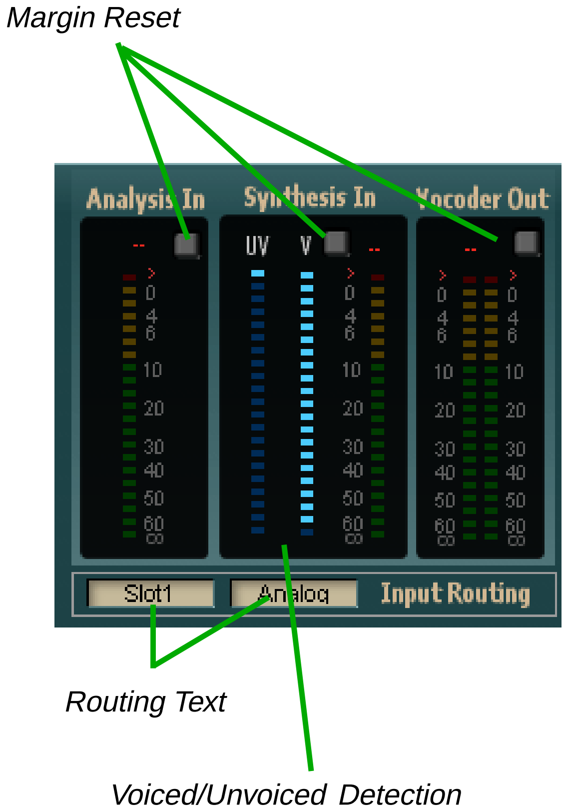
Controls

Level Meter

The Vocodizer's level meters are located in the upper left side of the main window. Use these meters to monitor the input levels of the source and synthesis signals, and the level of the output. Well regulated signals are important for optimal results.

Margin: Displays the highest signal level reached so far. Use the Margin Reset button to set the margin display back to 0.

Routing Text: Select the signal sources to which the analysis and synthesis inputs of the Vocodizer are connected by clicking (left mouse button) on the appropriate field and selecting one of Slot 1/2/3/4, Analog or USB.



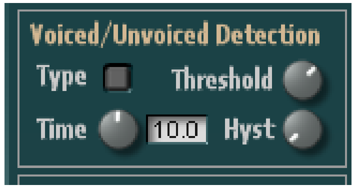
Volume: Controls the Vocodizer's basic volume level.

To be able to produce very narrow filter settings while retaining sufficient output level, the Vocodizer amplifies signals internally by up to 24dB. In most cases you will not find it necessary to adjust this control.

MIDI: Specify the MIDI channel on which the vocoder and synthesizer should respond to MIDI messages.

Voiced/Unvoiced Detection

The Voiced/Unvoiced Detection feature examines the analysis input signal for its tonal and noise content to determine which is dominant.

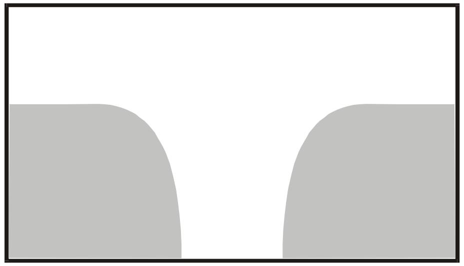


Voiced/Unvoiced Detection, as we have said, determines whether the input signal contains noise (like a sibilant "s" sound) or tone (like a spoken "a", or other vowel). Depending on the content, one of two possible signals is sent to the synthesis filter bank: Unvoiced source (usually noise) or Voiced source (the filtered internal synth or external audio source).

Type: The Detection algorithm can operate in one of two modes depending on some specific signal criteria.

Standard Mode (Type = off)

In standard mode the Vocodizer splits the signal's energy content into high and low frequency components by means of two filters, and then analyzes the two components separately. By adjusting the Threshold setting you can determine how



Lowpass *Highpass*

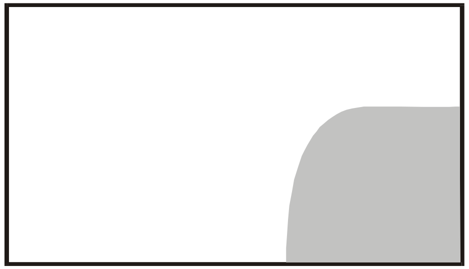
much high frequency content triggers the detection circuit to identify the signal as unvoiced. However, at the same time, the Vocodizer also examines the spectrum of the low frequency component. The Vocodizer therefore considers two conditions: Only if the high frequencies contain sufficient energy AND the low frequencies do not, will the Vocodizer interpret the signal as being unvoiced.

Example: A pure "s" sound contains sufficient high frequencies to satisfy the requirements of the first criterion, but the lower frequency energy is not sufficient to qualify it as a tonal sound (second criterion). The Vocodizer interprets this signal to be unvoiced.

With the same settings, the detection circuit now encounters a spoken "k" sound. As before, the high frequency component is determined to be sufficiently high in energy to qualify it as an unvoiced signal. But this time there is also enough tonal energy in the low frequencies to override the initial determination, and the Vocodizer interprets the signal to be voiced. You can adjust the relationship of the weighting of the two criteria with the Hyst (Hysteresis) setting.

Alternate Mode (Type = On)

As an alternative to the standard mode in which the Vocodizer analyses both upper and lower frequency ranges, you can use a simplified detection mode in which only the high frequencies are examined to determine the signal characteristic (voiced or unvoiced).



Highpass

In this mode it is sufficient only for the high frequency content to exceed the threshold for the signal to be identified as unvoiced. In Alternate mode the signal is determined to be unvoiced more frequently than in Standard mode, and the intelligibility in some cases improves because, along with the consonants like "k" and "s", some of the other overtone-rich parts of the signal are also identified as unvoiced.

Threshold: Sets the level at which the high frequency energy triggers the detection circuit to identify the signal as unvoiced.

When set to minimum, none of the signal will be classed as unvoiced, and the noise source will never replace the original signal in the output. And, as you would expect, setting this parameter to maximum results in the entire signal being identified as unvoiced. In this case, the noise source replaces the entire signal.

Hyst: Hysteresis describes the difference in threshold values for the upper and lower frequency ranges. At 0, the same level criterion applies to both ranges. With increasing hysteresis values, less energy is required in the lower frequency range to defeat the unvoiced detection in the upper range. Therefore, as you increase the hysteresis value, signals with sibilance are less likely to be identified as unvoiced leading to fewer replacements of the synthesized signal with noise.

The Hyst setting applies only in Standard mode as Alternate mode employs only a single threshold value.

Time: Depending on the result of the V/UV detection, the synthesis filter is fed either with noise (unvoiced) or the synthesized signal (voiced). However, the change from one to the other does not take place immediately; rather, the signals are cross-faded. The Time setting adjusts the duration of the cross-fade in milliseconds. With higher values, noise is fed into the synthesis section more slowly after unvoiced detection.

Input

Here you control the levels of the analysis and synthesis inputs, and include effects if desired.

Analysis Input

InGain: Adjusts the level of the analysis input signal with up to 24dB of amplification. Use the level meters to help set a satisfactory level.

> **Pay close attention to your levels. In particular, avoid letting signals overload the input. It's not so much that strong signals create audible problems with distortion; the bigger problem is that they influence the automatic controls to produce unexpected results.**

> **Note that changes to the input gain have an influence on the voiced/unvoiced detection process. Usually you will also have to adjust the Threshold setting after you change the gain control setting.**

Synthesis Input

Here you ajust the level of the synthesis input signal with amplification of up to 24dB. Use the level meters to help set the correct level.

> **Again, pay close attention to the level, especially avoiding signals that are too strong. Such signals will produce unexpected high frequency components in the synthesis signal.**

Solo: Click one of these buttons to hear only the analysis or synthesis input signal.

> **Attention: Often the input signal level is higher than the Vocodizer's output level. In this case, turn down the Master Volume control.**

Unvoiced Source

Here you select the source signal to use for passages determined by the detection circuit to be unvoiced.

Input: Selects one of the following possible sources: White Noise, Pink Noise, and Filt. Original.

Level: Adjusts the level of the unvoiced source signal.

LowCut: If Filt. Original is your noise source, this control adjusts the cutoff frequency below which frequencies in the original signal are attenuated. This filter reduces the tonal (low frequency) content of the original signal.

Analysis Filter Section

The settings in this section control the behavior of the Envelope Follower. You can make adjustments independently for each filter type–low pass, band pass, and high pass. In each case the parameters are the same.

Att (Attack): Adjusts the rate with which the Envelope Follower responds to rising signal levels.

Rel (Release): Adjusts the rate with which the Envelope Follower responds to falling signal levels.

Gain: Adjusts the output level of the Envelope Follower signals. When you adjust the gain, you are indirectly controlling the overall weighting of the low pass, band pass, and high pass section.

Filter Width Section

These controls adjust the bandwidth of the filters in the analysis and synthesis bandpass filter banks. The width for the filters in each bank can be adjusted separately, or they can be coupled together. As a general guide, the closer the center frequencies lie to each other, the narrower the bandwidth should be.

Link: Couples the two controls so they operate together. When Link is activated, the synthesis control is hidden.

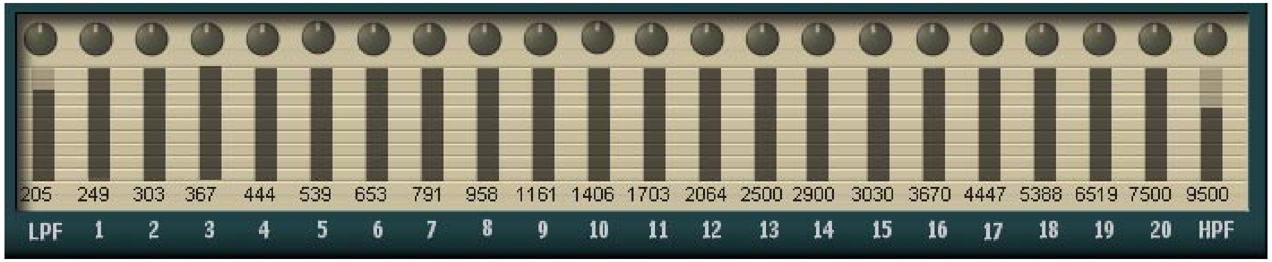
FilterMix

Here you can adjust the cutoff or center frequencies of each filter individually. To adjust a filter's frequency, click on its frequency value and enter the new value with your keyboard. The new value applies to each respective analysis and synthesis filter.

After modulation by the Envelope Follower, the 22 synthesis filters in the synthesis bank are mixed down to stereo through an internal mixer. You can set each filter output's stereo pan position individually to create some very pleasing and spacious stereo effects.

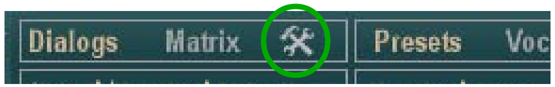
If you also modulate the frequency or pitch of the synthesized sound, you can create some very striking stereo effects.

Because you can control the volume levels of each individual filter output, extremely detailed control of the vocoder effect is possible.



The Frequency Calculator

To open the Frequency Calculator, click the Tool icon in the Page selector area.



This dialog lets you adjust the frequencies of all the filters by specifying a base frequency and a factor.

Calculate Frequencies: Click this option to re-compute the filter frequencies. The new frequencies replace the old ones.

Lowest Frequency: Specify the base frequency here. The low pass filter is given this value as its cutoff frequency. For the band pass filters to start at a value of 200 Hz, set the low pass filter to 100 and adjust the volume to 0.

Multiplier: This is the factor used to calculate subsequent filter frequencies. For example, if the sequence starts at 200 Hz, a factor of 2 will produce the following sequence: 200, 400 (200*2), 800 (400*2), 1600 (800*2)...

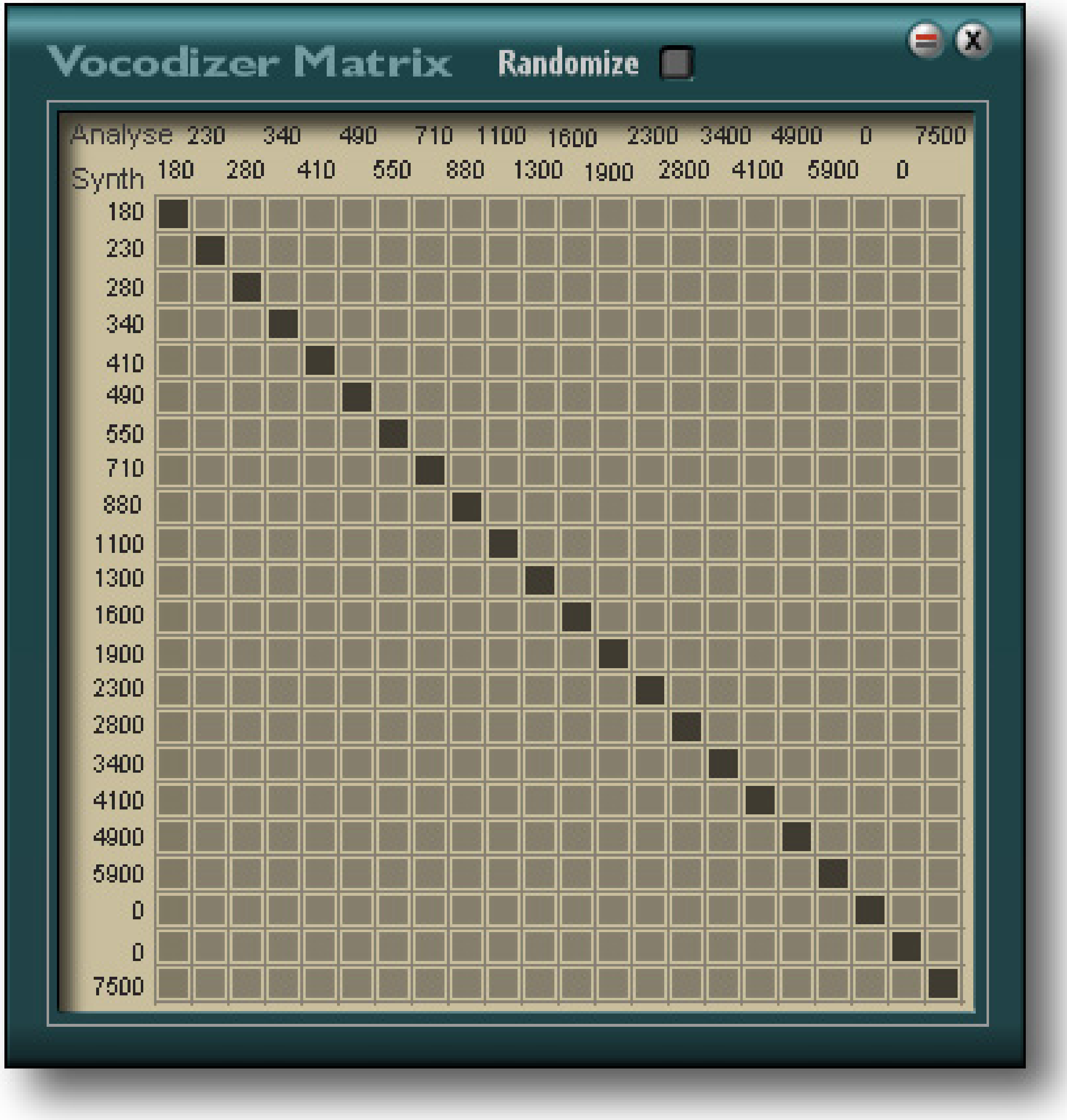
The maximum allowable frequency is 12,000 Hz. Any filters exceeding this value are automatically switched off, and the volume controls associated with them will have no effect.

The Matrix

With the Vocodizer's Matrix you can route the control signals of the Envelope Follower to any arbitrary synthesis filter. You can also route the control signal of a particular analysis filter to multiple synthesis filters. The Matrix lets you accomplish a variety of effects, from "simple" formant displacement to a complete inversion of the filter assignments.

> You can also change the frequencies of individual filters in the Matrix. However, note that each analysis and synthesis filter pair is always adjusted to the same frequencie.

Randomize: Click here to establish random assignments of the analysis section to the synthesizer section. Use this to experiment with completely unpredictable results. Many of these will suggest new ideas, or provide new points of departure.



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