

Vocoder2

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Overview

The Vocoder2 is an extremely flexible device, and yet highly intuitive to operate. But – what *is* a vocoder, actually?

In fact, the vocoder concept was originally developed in the 1930s. It was initially a research project, whose aim was to explore the possibility of transmitting voice signals via telephone in an (analog) encoded form, with a corresponding decoder at the receiving end – hence the name (from "**V**oice **E**ncoder").

The basic technique involved passing the voice signal through a set of sharp bandpass filters which were tuned as a group to span the full voice frequency spectrum. The output *levels* from these filters – a set of relatively low-frequency *envelope* signals requiring much less audio bandwidth than the original audio voice signal – were then transmitted as the encoded signal (an early analog form of "audio compression"). Decoding was done by applying these signals one-to-one to VCAs controlling the output levels of a set of correspondingly tuned filters, through which a simple continuous (and very harmonic-rich) waveform such as a steady square wave was passed. In this manner, the moment-to-moment harmonic content of the original voice signal could be *approximately* reconstructed – the square wave would seem to speak. Crude indeed, but "good enough for government work", as the expression goes.

The Pulsar Vocoder splits the incoming analysis and synthesis signals into eleven bands. The lowest and highest bands are in each case handled by lowpass and highpass filters, respectively. The other nine bands are processed via 4-pole bandpass filters with freely adjustable frequency and Q.

Input and output signals

The Vocoder works best when the input signals are suitably prepared. The input levels should be as high as possible without clipping. Two LED-chain meters with clipping indicators are provided to assist you here.

For optimal results, compression of both input signals is usually necessary. An insert slot is provided in each of the Vocoder input paths to facilitate direction integration of compressors or limiters.



Insert slots for analysis and synthesis inputs

The Interface

The main portion of the Vocoder interface is divided into Analysis and Synthesis sections. Both sections include drawers containing optional controls. In addition, inside the Vocoder is a pin matrix panel permitting the assignment of analyzer frequency bands to the synthesizer section to be rearranged as desired. This permits you to achieve any effect from subtle formant shifts to a complete spectrum inversion in which the low frequencies of the analysis signal control the high frequencies of the synthesis signal and vice versa.

MIDI: This control lets you set the MIDI channel on which the Vocoder sends and receives. This setting is necessary only when you wish to automate control of the Vocoder via MIDI Controller messages.



The Analysis Section

This section permits control over the conversion of the Analysis input signal into synthesis control signals.

Input Gain: Analysis input gain. Set this for the highest possible input signal level without clipping.

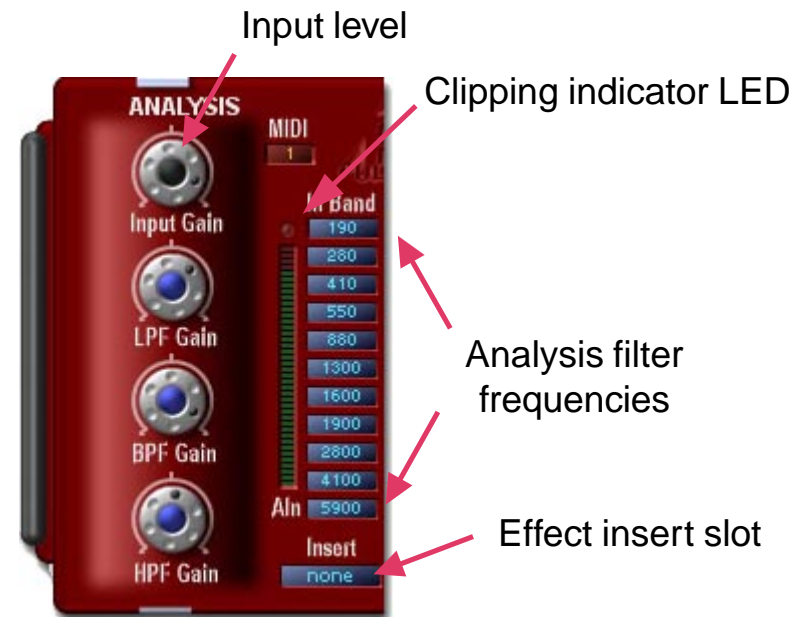
LPF Gain: Adjusts the level of the control signal derived from the output of the lowpass filter. This control signal reflects the level of the low frequency content of the analysis input signal.

BPF Gain: Absektion des Mittenbereichs im resultierenden Klang gleich. Adjusts the level of the control signals derived from the outputs of the bandpass filters. These control signals reflect the levels of the frequency content of the analysis input signal within each filter band.

HPF Gain: Adjusts the level of the control signal derived from the output of the highpass filter. This control signal reflects the level of the high frequency content of the analysis input signal.

Clip LED: Lights when input clipping occurs. The input signal level should be adjusted to keep clipping to a minimum.

In Band: Here, you can directly specify the frequency for each of the Analysis filters.



Insert: Drag-and-drop insert effects into this slot – for example, to compress the input signal (recommended with highly dynamic signals). Equalizers can also be useful here, to emphasize "weak areas" in the input signal frequency spectrum.

Analysis options

Additional analysis controls are found in the drawer at the left edge of the Analysis section.

LPF / BPF / HPF Hold: The control signals produced in the Analysis section are derived by means of *envelope followers* (level detection circuits) applied to the analysis filter outputs. The Hold control determines how rapidly these circuits respond to changes in the corresponding signal levels. Short hold times cause the control signals to more closely follow the signal level changes within each frequency band, while longer hold times have a "smoothing" effect. Separate hold controls are provided for the lowpass and highpass filters and for the bandpass filters as a group.

Analysis Q: Permits control over the "sharpness" of the bandpass filters, i.e., over the "spread" of frequencies (around the specified filter frequencies) which is taken into consideration in the analysis done by each filter.



The Synthesis Section

In this section you specify the frequency bands into which the Synthesis signal is to be split up and make various other adjustments affecting its processing into an output signal.

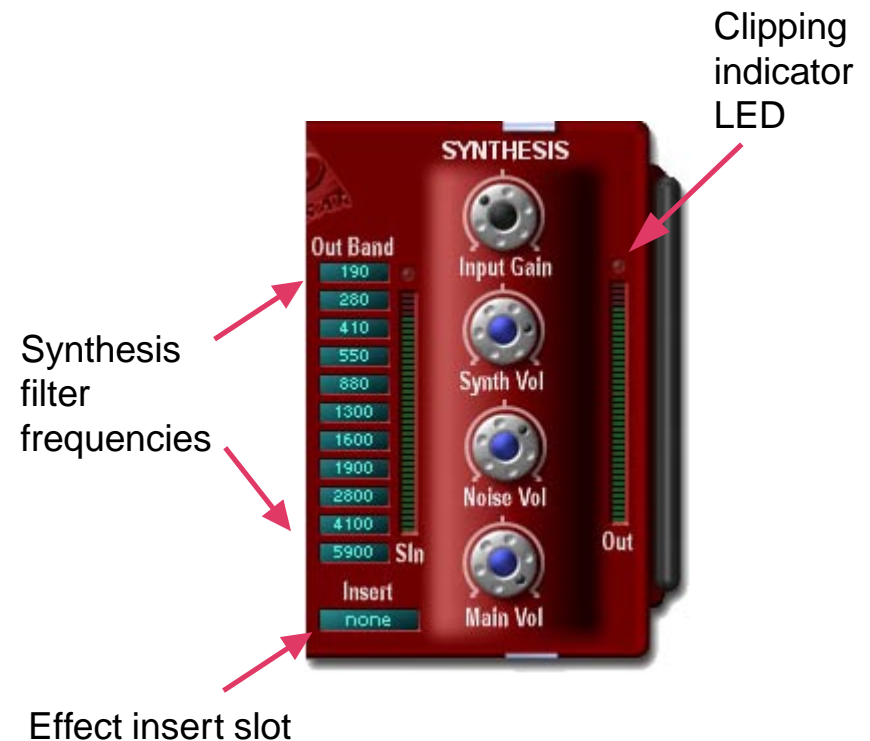
Input Gain: Synthesis input gain. Set this for the highest possible input signal level without clipping.

Synth Vol: The output level control for the synthesized signal – i.e., the mix of the frequency-divided, analyzer-controlled synthesis signal components.

Noise Vol: Noise generator output level control. The noise generator is processed through the highpass filter (under control of the analyzer) and can contribute to a more intelligible result when the analysis input signal is a speech signal and "intelligible speech" output is desired.

Main Vol: The overall output level control for the Vocoder.

Insert: Drag-and-drop insert effects into this slot – for example, to compress the input signal (recommended with highly dynamic signals). Equalizers can also be useful here, to emphasize "weak areas" in the input signal frequency spectrum.



Synthesis options

Noise Type: Choose here between "White" and "BPF" (bandpass-filtered) noise. With the latter, you will usually need to set **Noise Vol** a bit higher.

Noise Color: A "colorful" name for the frequency control of the bandpass filter used for noise generator processing when "BPF" is selected for **Noise Type** (see above).

Synthesis Q: Adjusts the "sharpness" of the synthesis section filters, widening or narrowing the spectrum of frequencies which is passed by each of these filters.

Chorus

On/Off: Chorus on/off control.

Speed: Chorus sweep speed control.

Depth: Chorus sweep depth control.

Dry/Wet: Controls the mix between the "pure" vocoder output signal (Dry) and the chorus-effected vocoder output signal (Wet).



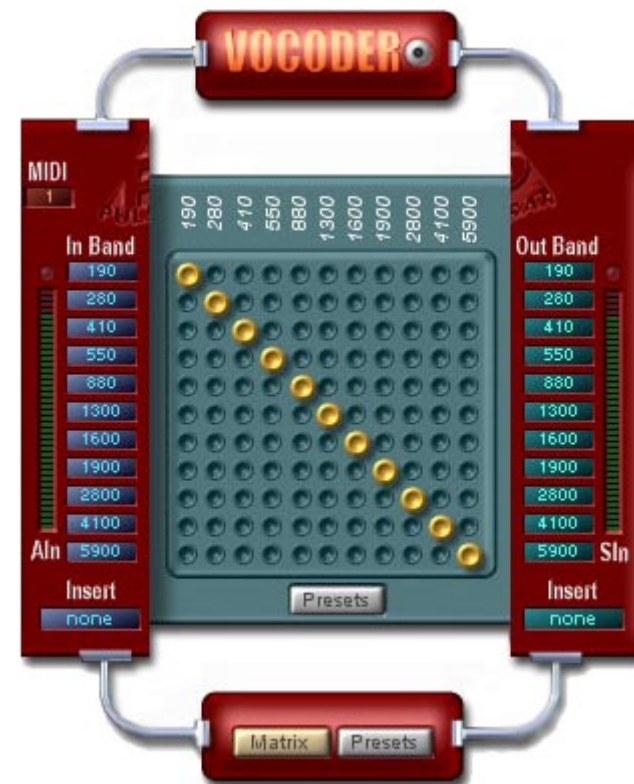
The Matrix

Access to the pin-matrix panel is obtained by clicking on the *Matrix* button on the lower "handle" of the Vocoder.

Via the matrix, you can rearrange the assignment of analysis output signals to synthesis filter control inputs. The control signal source (i.e., the analyzer frequency band) can be separately specified for each synthesis filter. Among other possibilities, you can have a single analysis signal control multiple synthesis filters.

The synthesis filters are designated here by their filter frequencies, which are listed sideways across the top edge of the matrix (note that the frequencies cannot be edited directly here). Below each synthesis filter entry is its grid column. The rows of the grid correspond to individual analyzer output signals (at left, in the Analysis section). Each of the golden pins can be repositioned within its column as desired by clicking on the grid point to which it is to be moved. This connects the control input of the associated synthesis filter to the analyzer output signal associated with that row.

Presets: The matrix has its own preset list. This permits you to store and recall matrix setting presets without affecting other Vocoder settings. Note that recall of a "global" Vocoder preset *will* also recall the matrix settings associated with that preset.



Note: The combination of freely adjustable frequencies for both analysis and synthesis filters and free assignment of analysis control signals to synthesis filters represents huge flexibility, but also enormous potential for confusion! We recommend initially limiting yourself to *either* filter frequency adjustments *or* filter band reassignments before you begin experimenting with combinations of both at one time. (In an emergency, of course, you can always rescue yourself by recalling a known Vocoder preset.)

Connections

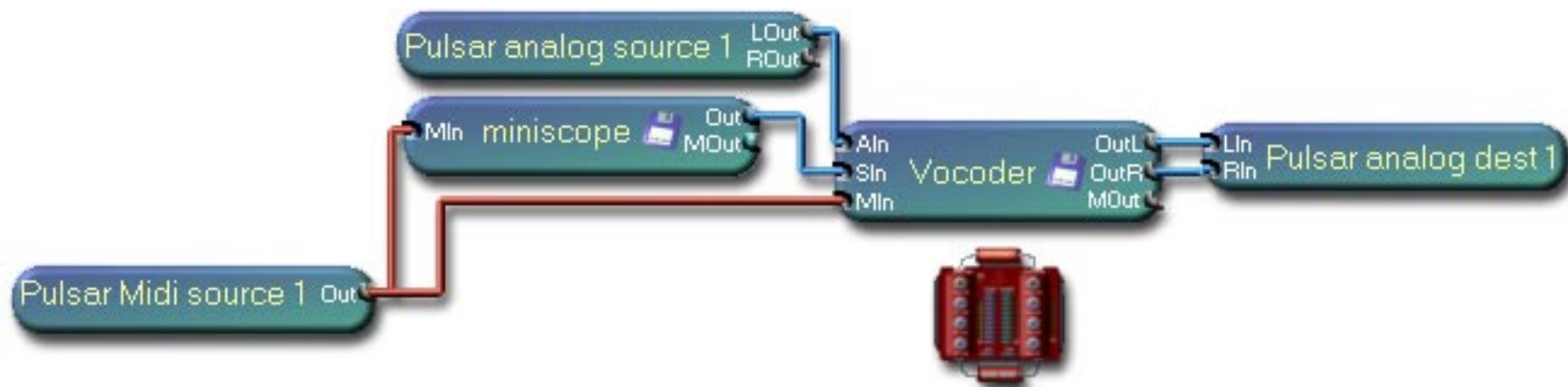
The Vocoder is typically connected as follows (of course, many variations are possible):

Connect the "voice" signal to the Analysis input (this may be samples, or a live voice brought into Pulsar via the Pulsar analog inputs).

Connect a signal source to the Synthesis input (preferably a harmonic-rich one – in the example below, the miniscope synth is used).

The resulting effected signal appears at the Vocoder audio outputs. This signal is the product of both Analysis and Synthesis input signals. Thus, simply speaking into the microphone (for example) produces no output from the Vocoder. However, if you play notes on the miniscope while speaking, you will hear the formant structure of your voice "impressed" onto the sound of the synthesizer.

Have fun Vocoding!



Minimized (icon) representation