ONE

SUBTRACTIVE POLYPHONIC SYNTHESIZER

OPERATOR'S MANUAL

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Glossary

DAW

KHs ONE is not a standalone program, it needs to be used in conjunction with a host application where it is loaded as a plugin. These programs are usually called "DAWs" (Digital Audio Workstations) or simply "hosts". There are many different DAWs available on the market, and kHs ONE works with those that support either the VST or the Audio Unit plugin architecture.

Patch

A patch is a configuration of the synthesizer that gives it a certain sound. Whenever you pull a slider or turn a knob on the synth you modify the current patch.

Preset

Presets are ready-made patches which ship with the synthesizer. In kHs ONE you will find one hundred different presets ready to be used in any song. Presets also make good starting points for your own patches.

Voice

A polyphonic synth, like kHs ONE, can play many notes at the same time. It achieves this by playing each note through its own voice, with its own set of oscillators, filters and so on. In kHs ONE you can also turn on unison mode, where each note is played through several voices at the same time.

System requirements

These are the minimum recommended system requirements for running kHs ONE.

CPU
 2 GHz or faster

Memory
 1 GB or more

Operating System
 Windows (7 or newer) or Mac OS X (10.7 or newer)

Software
 A VST or Audio Unit compatible DAW

If you have many instances of kHs ONE running, all playing many voices at the same time the CPU usage will increase accordingly. Thus, we cannot guarantee that kHs ONE will work flawlessly in all use cases even if your system does meet the minimum recommended system requirements.

Overview

This is an overview of the plugin UI. As you can see it is divided into two parts, the **voice part** and the **global part**. In the voice part, all components affect the sound on a per-voice basis, and in the global part they work on the sound after all the voices have been mixed down. This also holds true for the modulation sources, the ones in the voice part can be different for different voices and the ones in the global part will be the same for the whole synth and, if they are routed to a voice parameter, affects all voices equally.

On the overview you can also follow the signal path through the synth. It starts out with the **oscillators**, passes through the **amp envelope** and then **filter 1**, **shaper** and **filter 2** after which it leaves the voice part and all voices are mixed down. The mixed down signal then enters the global part where it passes through the on board effects, **chorus** and **delay**, and then finally the **master** section where EQ and gain is applied.

Operating the controls

Most parameters of kHs ONE are controlled by the knobs and the sliders seen in the UI. To move a knob or slider simply click on it, and while holding the mouse button down move the mouse up or down.

Sometimes you might want more precise control when tuning a parameter. Hold the **shift** key while moving a knob or slider to enter **fine tuning** mode, where the knob or slider will move more slowly.

You can reset a knob to its default position by double clicking it.

Working with patches

The first thing you want to do after installing kHs ONE is probably to try out all the presets it comes with. In kHs ONE, presets and patches are handled a little bit differently depending on if you are using the VST version or the Audio Unit version of the plugin.

If your DAW supports both VST and Audio Unit then we suggest that you try both versions of the plugin and see which you like best.

VST version

In VST synths patches are grouped into banks. A bank in kHs ONE contains 100 different patches, and you can have exactly one bank loaded in each instance. When you load up a new instance of the plugin the bank will be filled with the factory presets.

You can browse the patches in the bank using the patch browser in the top right corner of the plugin UI. To go to the next or previous patch, click on the the small up/down arrows. To open a list of all patches, click on the area where the patch name is displayed. Many DAWs also allow you to change patch from within the DAW interface as well.

If you right-click on the patch browser a context menu will appear that allows you to rename the current patch, as well as save and load banks and individual patches. Again, in many DAWs you can also access these features from within the DAW interface as well.

Audio Unit version

Unlike VST plugins, Audio Unit plugins has no concept of banks. There is also no way of changing preset from within the plugin UI, you have to change preset from within your DAWs interface. Most Audio Unit based DAWs attach a drop down menu for doing this on the window showing the plugin UI.

If you right-click on the area where the patch name is displayed a context menu will appear that allows you to save and load patches in a format compatible with the VST version.

Building your sound

Once you have checked out all the presets you are probably eager to get your hands dirty and create your own patches. A major goal when designing kHs ONE was to make it easy to program, but if you are new to sound synthesis all the knobs and sliders can still look quite daunting. But don't despair, this section describes how each component of the synth works and what every knob does. Read through it, and play around with the synth for a while and you should be able to create your own patches in no time!

Oscillators

It all starts with the oscillators, they generate the the raw tone which you can then shape with the envelopes, filters and all the other components of the synthesizer. In kHs ONE you will find three of them. There are two main oscillators which provide a lot of harmonic content through their saw tooth and pulse waveforms. Just below the main oscillators you will find the sub oscillator, which does not have as much high frequency content and is useful for adding a deep body to your sound, typically playing one octave lower than the main oscillators.

Main oscillators

The main oscillators can operate in three different modes, **double saw**, **pulse** or **noise**.

When in the **double saw** mode, the oscillator emits two saw tooth waves with a phase offset that can be adjusted by the **shape** knob. When the **shape** knob is at its zero position (in the middle), the phase offset will be zero degrees, which will sound indistinguishable from a single saw tooth wave.

In **pulse** mode, the oscillator will emit a pulse wave with a pulse width that can be adjusted by the **shape** knob.

When in the **noise** mode, the oscillator will generate band limited noise. The bandwidth can be controlled by the **shape** knob. When the **shape** knob is in its left-most position the noise will not be band limited at all, and will be equally strong across all frequencies (i.e. white noise). When the **shape** knob is at its right-most position the band width will be narrow and most frequencies will be filtered away, only the frequencies close to the oscillator frequency will be heard.

The **sync** knob adjusts oscillator sync. This means that the oscillator plays at a higher frequency then normal, but that its phase is reset back to zero at the normal frequency. Turning up the sync knob empahsizes the high frequency harmonics of the sound. Modulating the sync of an oscillator with an envelope or a LFO creates an effect similar to a filter sweep. When the sync knob is at its zero position the frequency of the oscillator will not be adjusted, in effect turning off the sync feature. The sync feature is not available when the oscillator is in **noise** mode, where this knob does nothing.

The main oscillators can also be tuned independently of each other by adjusting the **octave**, **semitone** and **cent** controls.

Sub oscillator

The sub oscillator is much simpler than the main oscillator, and its sound barely has any high frequency content. You can adjust its sound by the **shape** knob, and select which octave it plays with the **octave** control.

The sub oscillator is meant as a way beef up the bass of your patches, but it can in fact be used as a lone oscillator in its own right if you want a more soft and mellow sound.

Envelopes

kHs ONE comes equipped with three ADSR Envelopes; the **amp envelope**, the **filter envelope** and the **mod envelope**. The amp envelope adjusts the amplitude of the three oscillators after they have been mixed together. The filter envelope is used to modulate the cutoff frequency of the two filters. Finally, the mod envelope is a general purpose envelope which can be used to modulate pretty much whatever you want (more on this one later).
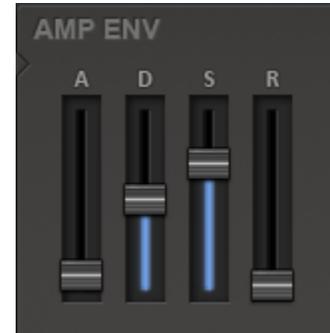
ADSR Envelopes are a quite typical way to modulate parameters in synths, and unless kHs ONE is the first synth you are using you have probably seen them many times before. ADSR stands for "Attack, Decay, Sustain, Release", which is the name of the four parameters that dictates how the envelope behaves.

When you trigger a note the envelope will start to climb up from zero to its maximum level. This is known as the **attack phase**, the length of which is decided by the **attack** parameter of the envelope. Keep the attack low for a short snappy sound, or make it high for a slow sound which builds up over time.

Next follows the **decay phase**, where the envelopes drops down from its maximum level down to the sustain level. The time this takes depends on the **decay** parameter.

After the envelope has dropped down to the sustain level comes the **sustain phase**, which lasts until the note has ended. Thus, the **sustain** parameter does not influence the length of this phase but rather how high the sustain level is. For the amp envelope, a high sustain gives a louder sound and a low sustain a softer one.

When the note is released the envelope moves on to the **release phase**, where the envelope drops back down to zero. The time this takes is dictated by the **release** parameter.

Filters

A filter is a component which attenuates or boosts different frequencies of a sound. In kHs ONE you will find two filters, each of which can operate in four different modes.

LP (low-pass)
Removes high frequencies but keeps the low ones.

HP (high-pass)
Removes low frequencies but keeps the high ones.

BP (band-pass)
Removes both low and high frequencies, but keeps the middle ones.

VOX (vocal)
Formant filter, emulates the sound of different vowels.

In all of these modes you can use the **cutoff** and **Q** sliders to adjust the sound of the filter. The cutoff parameter is very important, since it decides where in the frequency spectrum to start attenuating the sound. For example, when the filter is operating in low-pass mode frequencies below the cutoff frequency will be untouched while frequencies above it will be attenuated. The Q parameter decides the amount of resonance in the filter. Pulling up the Q slider in the LP, HP or BP modes will create a resonance peak which boosts frequencies around the cutoff frequency. In VOX mode the Q parameter works a bit differently, and is instead used to select which vowel the filter will emulate.

The **env** knob controls how much the filter envelope will affect the filter's cutoff. Large values will yield big filter sweeps while low values give more subtle envelope effects.

The **key** knob controls how much the filter's cutoff will be affected by the currently played note. When positive, higher notes will result in a higher cutoff frequency and lower notes in a lower cutoff frequency. When negative, it works the other way around. Usually this is used with positive values as a way to make sure the character of the sound does not change depending on the played note, or to make sure a resonance peak stays the same relative to the played note.

Shaper

The wave shaper is an effect that adds distortion to the sound. Technically, it performs a stateless non-linear mapping of input amplitude to new output amplitudes, "shaping" the waveform. The shaper supports four shaping algorithms, each adding different characteristics to the sound.

The first mode of shaping is **overdrive**. This performs a soft clamp on high amplitudes, resulting in a fairly sharp, aggressive distortion that can be used for making sounds with more edge.

The second mode of shaping is **sine**. This mode folds high amplitudes back down in a sine wave shape, resulting in ringing FM-like sounds.

Next up is **quantization**. This mode forces the wave into a stair case shape, which gives the sound a digital quality.

Lastly we have **fold-back**. This mode folds high amplitudes back down towards zero similarly to the sine mode, but not as aggressively.

The **drive** knob controls how aggressively the signal is shaped. Higher values result in a higher degree of shaping, causing more distortion.

The **mix** knob controls how to mix the shaped signal with the original signal. At the maximum value only the shaped signal is heard, and on the minimum value only the original signal is heard, in effect turning off the shaper.

Chorus

The chorus effect layers the sound from kHs ONE with a slightly delayed copy of itself. In addition to this, the delay time of the copy can be modulated, which all in all can result in anything from subtle space enhancing effects to extreme wobbling strangeness.

The **delay** knob controls the base delay time of the delayed copy.

The **rate** knob controls the rate of modulation of the delay time.

The **depth** knob controls the amount of modulation of the delay time.

The **width** knob controls the amount of stereo effect in the chorus. This is achieved by offsetting the phase of the modulation on the left and right channels.

The **mix** knob controls how much of the delayed signal to mix into the original signal. At the minimum value, only the original signal is passed through, in effect turning off the chorus effect. With the knob turned halfway, both signals are mixed in equal amounts. At the maximum value, only the delayed signal is passed through.

Delay

The delay effect adds an echo to the sound that can be used both for adding more space to the sound, as well as causing interesting rhythmical effects.

The **delay time** number box controls how long the echo time is, i.e. the time between the initial sound to the first echo bounce. The number in the box can mean two different things depending on the setting of the ms/16th buttons to the right of it. In ms mode, the delay time is expressed in milliseconds. In 16th mode the delay time is expressed in 16ths of a bar, tracking the current song tempo.

The **feedback** knob controls the decay rate of the echo. At the maximum value the effect will keep echoing forever. At the minimum value the echo will bounce just once. Values in between will result in a natural decaying echo.

The **width** knob controls the amount of stereo effect in the echo. When zero, right and left channels will echo with the exact same delay time. Higher width means the right and left channel's delay times will be increasingly different, resulting in a stereo echo effect.

The **send** knob controls how much of the synth's output is initially sent to the echo effect. At the maximum value the first bounce will be at the exact same amplitude as the sound from the synth. At the minimum value the first bounce will be totally silent, in effect turning the delay effect off.

Master

This section allows for some final tweaking of the output of kHs ONE, allowing the master level to be set as well as simple equalizing.

The **level** slider controls the total output level of the synth. Next to the level slider the current output level is shown in blue. Levels that are above 0dB are shown in white, and may result in clipping in the final mix, depending on the DAW.

The **treble** knob controls amplification or attenuation of high frequencies. High values will amplify high frequencies and low values will dampen them. The **cutoff** knob paired with the treble knob controls at what frequency the treble knob starts affecting the sound.

The **bass** knob and its accompanying **cutoff** knob works the same way as the treble, but for low frequencies.

The **limiter** button enables or disables a limiter. When enabled, it makes sure the synth will not output levels above 0dB. While useful for controlling the output amplitude of complex polyphonic sounds, it may add slight distortion to the sound when keeping the amplitude down.

Voice configuration

This section controls general voice behavior for kHs ONE when playing notes.

The **pitch bend** number field controls how much the pitch wheel MIDI input will control voice pitch, in semitones. Negative values will invert the pitch bend.

The **polyphony** number field controls how many notes of simultaneous notes to allow. If the number of notes is exceeded, older notes will be removed to keep the total number of notes limited.

The **legato** button controls the behavior of the voice LFO and envelopes when legato (connected or overlapping) notes are played. When enabled, the voice LFO and envelopes will not reset, but continue running from where the last played note is.

The **glide** knob controls the pitch glide time from one note to the next. At the minimum value the pitch will instantly switch, without glide. The **auto** button accompanying the glide knob controls when pitch gliding should happen. When on gliding only happens when notes are played legato (connected or overlapping), and when off new notes will always glide from the pitch of the last played note.

The **unison** number field controls the total number of voices to play when a new note is played. Each voice is identical apart from a slight detune and stereo spread, resulting in a more spacious sound. The accompanying **detune** and **spread** knobs control how much to detune and stereo spread the voices in relation to each other.

Modulation

Most aspects of kHs ONE can be modulated by five different modulation sources: **modulation envelope**, **velocity**, **voice LFO**, **global LFO** and **modulation wheel**. All of these sections have three **slots** controlling the modulation targets for that modulation source. By clicking the slot, a section and parameter to be affected can be selected. Next to each slot is a **modulation amount** knob, which controls how much the source will affect the selected target. Modulation is always added on top of existing knob and slider settings and multiple modulation sources may affect the same modulation target, summing up the modulation.

Modulation envelope

The modulation envelope section controls an ADSR envelope that works just like the filter and amp envelopes, but which is used as a modulation source.

Velocity

The velocity section maps the note velocity (how hard a key is pressed) to its selected modulation targets.

Voice LFO

The voice LFO section controls a per voice LFO (low frequency oscillator) that can be used as a modulation source. That this LFO is "per voice" means that each new note gets its own LFO, restarting its oscillation.

The **shape** selection box controls the shape of the LFO. The available shapes are sine, triangle, saw, square, smooth noise and step noise.

The **rate** knob controls the speed of the LFO. A higher value means the LFO oscillates faster, and a lower value means it oscillates slower.

The **key** knob controls how note pitch affects the rate. With a positive value of key tracking, higher notes will mean faster LFO, and with a negative value of key tracking, higher notes will mean slower LFO.

The **depth** knob controls the overall effect the LFO has on its selected target, as a convenient way of scaling the whole LFO effect. At the maximum value all the modulation targets are affected with their respective modulation amounts, and at the minimum value it does not affect its targets at all.

The **phase** knob controls where in its oscillation the LFO will start when retriggered. The shape selection box will illustrate the start of the LFO.

Global LFO

The global LFO section controls a global (free running) LFO (low frequency oscillator) that can be used as a modulation source. That this LFO is "global" means that it keeps going regardless of how notes are triggered.

The **shape** selection box controls the shape of the LFO. The available shapes are sine, triangle, saw, square, smooth noise and step noise.

The **rate** knob controls the speed of the LFO. A higher value means the LFO oscillates faster, and a lower value means it oscillates slower. The **sync** button controls whether this rate is synchronized with the current song tempo or not. When enabled, rate is specified in note lengths instead of Hz.

The **depth** knob controls the overall effect the LFO has on its selected target, as a convenient way of scaling the whole LFO effect. At the maximum value all the modulation targets are affected with their respective modulation amounts, and at the minimum value it does not affect its targets at all.

The **phase** knob is used to offset the phase of the LFO, which is especially useful when the LFO is running in synced mode. The shape selection box will illustrate one cycle of the LFO.

The **S/H** button, or "sample and hold" button, controls whether the LFO will affect its targets continually as a note is played, or if it should grab the current LFO value when a new note is played and stick with that value for the duration of that note. Note that this only affects modulation targets in sections that are per voice. The global sections, chorus and delay, will be unaffected by this option.

Modulation wheel

The modulation wheel section maps the MIDI modulation wheel (MIDI controller #1) to its selected modulation targets.

Configuring MIDI bindings

MIDI controllers can easily be set to control knobs, sliders and fields in kHs ONE. To bind a control, right click it and select "MIDI Learn", then move the MIDI controller you want to bind to it. This knob will now follow any MIDI input it gets from that controller. To unbind a MIDI controller, right click a bound knob and select "Remove MIDI CC". This will clear the binding.

Note that MIDI bindings are global for all instances of kHs ONE, and will be saved automatically.

Also note that in the VST version of kHs ONE, the "Program change" MIDI controller is statically bound to changing the currently selected preset.

Acknowledgements