**Quilcom SIM-HC**



**Design**

The Quilcom SIM-HC is a plugin designed specifically for simulating harpsichords.

The brief I set myself was to use conventional synthesiser techniques and to use NO sample clips.

Generally speaking, using sets of samples will give more authentic results but, for truly convincing sounds, you would need a large amount of disk space and sophisticated direct-from-disk streaming for the sustaining parts. You would also need multiple Round Robin or random sample selection methods and detailed key-zoning/mapping. Finally, at least the attack phases would need to be loaded into RAM for latency-free playing, thus needing a high specification and more expensive PC (for the better samplers) and long load times.

For reducing the hard drive space, developers often use reduced length sample sets and have to make loop points for the “sustain” phase (actually slow decay). If I listen to a sample-based harpsichord note I can often hear the unnatural looping because true harpsichord sounds change their timbre *smoothly* as they decay. This can’t happen with reduced sample lengths which have to loop while the sound is faded out by an envelope generator.

Another advantage of synthesising the sound is that of parameter control. Even when all the conditions are right for the sampling session, the sound is “baked in” and only superficial variations can be made after the event.

So the SIM-HC should not be expected to sound as authentic as an expensive sample-based instrument, but it does offer you the advantages outlined above.

Rather than go into the various techniques used at this point, the operating instructions below will touch on the theory relevant to the various panels’ functions in the instrument.



**Overview**

From top to bottom:

The preset manager includes a range of presets to use as starting points and to hear some examples of what the instrument can do, including some alternative uses.

The GENERAL panel is where you control most aspects of the basic harpsichord timbre and system settings for tuning etc.

The ENVELOPE generator not only controls volume but is also used in the synthesiser model to strongly influence timbre.

The SYMPATHISER is where you control the characteristics of sympathetic resonance between the strings.

The whole signal is then passed into the Soundboard which simulates the resonances of the instrument’s case.

Next is a TONE control panel to provide shaping of the overall harmonic balance.

Harpsichords are generally thought of as purely acoustic instruments, but Baldwin made an electric version with a solid body (no soundboard). This was more portable and allowed electronic amplification with a much reduced likelihood of feedback mechanical noises. This also means that effects can be added easily, as with the Effects section next down.

To add “space” to the sound the very excellent MVERB 7B, whose engine was designed by Martin Vicanek, is provided at the end of the chain.

A RECORDER is provided so you can capture any sound you make up to 10 seconds long and save as a WAV file for use in samplers etc.

**Panel Descriptions**



This is the preset (patch) manager. Click on the preset name to open a drop-list selector, or page through them with the arrow keys. The FILE button is for saving, loading, copying and pasting of presets. You can also save and load a whole bank. The FlowStone presets are saved as plain text files, which can be read and edited in Notepad for example.

When LOCKED is selected, any changes you make to the controls will NOT be remembered by the DAW. This enables you to experiment and easily get back to the original sound by just re-selecting the preset.

When the LOCKED button is clicked, and then shows UNLOCKED, the current settings will be saved with the DAW song file. The dimmed RENAME button will become available to call the preset whatever you want.



The VOLUME knob is for the plugin’s audio output and features two bar graphs which indicate average peak values. Maximum is clipping point. If clipping happens, even for a very short time, the central ring of the knob turns red and holds for 1 second, so you don’t miss short clipping times.



The recorder allows you to capture any sound from the synth for up to 10 seconds, the length of the created WAV file being set with the TIME knob. This allows you to capture a sound to use elsewhere.

Set up the sound you want and the recording time. Click ARM and then the recording will start when you press any MIDI note. A bar shows the progress.

If you want to save it, click on SAVE and use the standard Windows dialogue box to choose a location and name. If you’re not happy with it, just repeat the above without saving. The internal buffer is over-written.



The GENERAL panel is where you set the instrument’s tuning and timbre parameters.

The SEMI knob allows you to tune +/- 1 octave in semitone steps and the FINE knob provides fine tuning for +/- 50 cents.

The STRETCH button turns on stretch tuning which simulates the famous Railsback curve. Stretch tuning is more appropriate for *acoustic pianos* since their strings’ higher harmonics go slightly sharp and this needs to be accounted for to get a more agreeable sound. Real harpsichords exhibit less of this effect, but some owners still like to stretch-tune their harpsichords so they match regular pianos.

The synthesiser modelling aims to give control over many parameters which affect the resulting timbres of real instruments. A harpsichord can have more than one set of strings and each set is called a choir. Where there is more than 1 choir, stops are usually provided so you can select which choirs speak. The placement of the plectra that pluck the strings has an effect on the timbre of the sound.

BACK 8’ refers to normally pitched strings plucked further away than the FRONT 8’. The FRONT 8’ is often described as a more “nasal” sound and has a reduced fundamental harmonic. The 4 FOOT choir strings speak one octave higher and have a different timbre due to being shorter and having different tension. The 3 different choirs can be turned on or off with their named buttons, so you can have any combination you wish.

Harpsichords don’t have a sustain pedal like that found on a piano. So on the SIM-HC the sustain PEDAL can be used to turn on and off any of the choirs. When lit, the midi sustain pedal then turns its choir on and off. This is akin to a player operating stops while playing, to add a little expression of soft and loud. In fact most classical pieces and performers expect the stops to be set up before playing and *not* changed during the performance. So you have the option at least.

To the left of the FRONT 8’ button is a delay that can be turned on and off. This is provided to simulate the timing of the plectra for a given key press. The BACK 8’ strings are plucked very slightly ahead of the FRONT 8’ strings, due to the placement of the “Jacks” which are lifted by the key leverage. The jacks are small carriers for the plectra. For very soft and slow key presses the delay can be heard, but at normal to high strikes the delay becomes undetectable. To simulate this, the delay time is velocity sensitive.

Harpsichords often have what is called a Lute or Buff stop. The stop lever brings in little pieces of leather to rest on the end of the choir strings. It has the effect of reducing sustain (decay) time and the decay of the higher harmonics is more rapid too. It is said to resemble the sound of a plucked lute and extends the range of the instrument. On the SIM-HC each choir can have the BUFF on or off.

Choir strings vary widely in harpsichords. Material can be iron, steel or brass. They can be long and set with a higher tension, or shorter and set with a lower tension. The 3 little orange knobs allow a range of different string types to be emulated. At minimum, the sound simulates thin strings with low tension and turning the knob up tends towards the opposite balance. This gives you possibility to simulate different string types in one instrument!

Another thing that affects harpsichord sounds is the material the plectra are made from. This is simulated by using the PLECTRUM HARDNESS knob. At minimum it gives a softer sounding pluck like you might get from leather plectra, (called “peau de buffle”). Turning it up moves through Kwill (from a bird), plastic and metal.

When the key falls back, the string vibration is rapidly choked by a damper. The hardness of the damper’s felt can influence the release sound, so hard felt will give a more prominent buzz when damping. This can be simulated using the HARDNESS DAMPER knob. At minimum there is no release buzz heard.

The FINE knobs can set the detuning for the individual choirs. Double-click them to get back to zero de-tuning. Most harpsichords had wooden frames to support the choirs, rather than the cast iron now used on pianos. As a result they often suffer some detuning in practice.

The 5 octave key span is panned left to right as per the note number. The WIDTH knob allows you to narrow this or even widen the field. Fully minimum is mono, central (double-click) default is stereo and beyond that the sound goes wider.



The ENVELOPE generator controls the volume contour and several internal parameters simultaneously. I have set the operating ranges purely for simulating a harpsichord envelope, but there is sufficient flexibility for making different sounds, as per some of the presets.

The ATTACK knob has 2 areas of operation. Up to 9 o’clock the attack time is not influenced by velocity. Beyond this, higher velocity will start to *reduce* the attack time. That allows for new non-harpsichord sounds and provides for more expressive control when a softer attack is set.

HOLD time is provided because the initial attack from a pluck tends to last for a few milliseconds as the plectrum “slides” to a small extent.

DECAY sets what is often referred to as the “sustain” of the note. At maximum the decay is very slow. Decay time is influenced by string length, diameter, material and tension.

Tip: If you play a harpsichord MIDI file, you can reduce the sound to be more staccato by setting shorter decay times.

The decay time is key-tracked internally to provide somewhat shorter notes at the high end of the keyboard. This effect is spread non-linearly across the key span, as in a real harpsichord.

The SUST sustain level knob would normally be set at zero for a plucked instrument, but advancing it can give a very different sound, as with a few of the presets provided.

The RELEASE knob sets the time for the sound to decay to zero after the note is released. The release (damping) time for a harpsichord is longer than a piano because the damper is closer to the end of the string. This means it takes longer for the felt to absorb the energy, and also makes that release buzz more audible.

The KEY knob sets the level of the sound of the key hitting the support and being released. If you want to simulate a Baldwin electric harpsichord you would set it to zero since all the sound comes from a wound pickup. If you want to simulate close mic placement on an acoustic harpsichord it should be turned up higher. Also it can add a little transient to the sound. The key release sound is softer than the strike sound.



The SYMPATHISER simulates the sound of strings, other than those speaking, resonating in sympathy. On a piano you have a sustain pedal which releases *all* the dampers when pressed. On a harpsichord there is no such pedal. However there is still a degree of resonance because the dampers are very close to the end of the strings, allowing a little sympathetic resonance to happen. You can set the DECAY time of the resonance and the LEVEL added to the signal. The orange LED/Switch turns it off. If you don’t need it turn it off to save CPU load.



As with an electric guitar, the sound produced by the string *on its own* is really quiet. In a real harpsichord the string vibration is coupled to a soundboard which amplifies and projects the sound, in principle similar to an acoustic guitar. When I examined the frequency response of typical soundboards I noticed they took a form similar to a comb filter; lots of regular peaks and troughs getting closer together at higher frequencies. This is the method used in the SIM-PF.

The SIZE knob sets the delay time in the comb filter. At a low setting this simulates a smaller soundboard with a shorter delay, and increasing the SIZE sets a longer delay. This is not *strictly* analogous to instrument size though, but it allows you to set a colouration according to taste. If you chose to automate this knob in your DAW it can add a mild to extreme flanginess to the sound, depending on the RES setting.

The RES resonance knob sets the height of the peaks of the comb filter. At minimum the effect is subtle and at maximum the sound is very “ringy”. The LEVEL knob sets the amount of filtered signal added to the dry signal.

The orange LED switch turns the SOUNDBOARD on/off, and when off reduces CPU usage.



This panel provides a simple way to sculpt the overall “tone” of the instrument. I noticed that on commercial pop recordings (versus real classical performance and samples) that the rather piercing sound is often “calmed down” a bit with equalisation and the bass reduced to avoid low end muddiness. This panel provides a quick way to adjust the tonal balance. You can boost or cut the BASS and TREBLE and also adjust the changeover frequency for the shelving filters (made by Martin Vicanek).

If you want more precise control you could use an instance of the graphic equaliser included in the effects bins (see later).

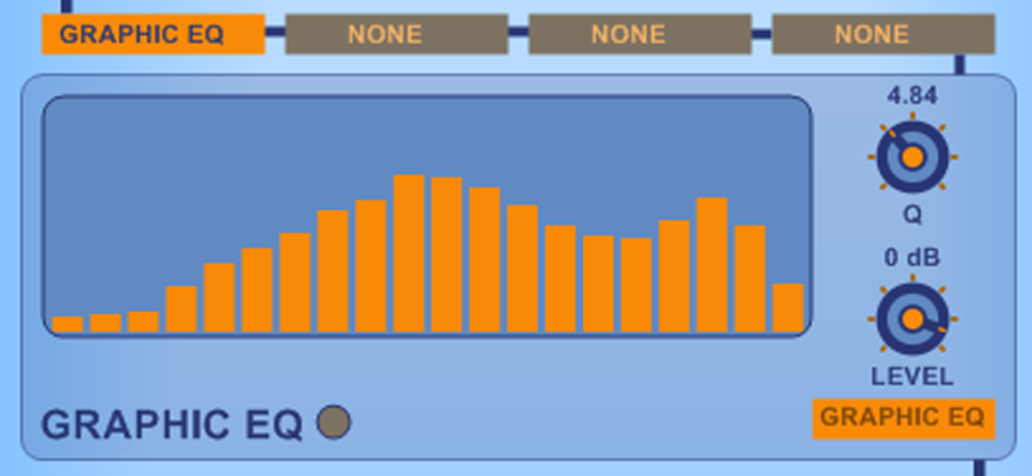
This TONE control uses low CPU but if you don’t need it turn it off!

**Effects chain**

As mentioned before, there exists an electric harpsichord made by Baldwin. So I’ve provided the same effects system as used on my Quilcom SIM-EP.

I looked into what is the preferred *order* of effects and came to the conclusion, for guitarists at least, that if you ask 10 of them, you get 11 different opinions.

So what I settled on is you have 4 “bins” and each one can have any one of the 8 effects inside. All the bins are wired in series, like a pedal-based effect chain. So you could have 3 delays and a graphic eq for example, or 4 Graphic EQs if you’re a bit crazy. Only the selected effects use CPU and they can all individually be turned off (bypassed).



This screenshot shows the Bin view selectors above the effect’s window. Click on a bin’s rectangle to view the effect in that bin. The name in the bin is the effect chosen for that bin. Inside the effect’s window, bottom right, is where you pick the effect for that bin (here showing GRAPHIC EQ).

As mentioned above, you can put the GRAPHIC EQ anywhere in the signal path, to shape the frequency response of its input signal.

When you pass the mouse over the adjustment bars you’ll see a readout of the centre frequency of each bar. These frequencies are chosen to match the key span in half-octaves. So, for example, one of them is set to 262Hz which is roughly Middle C.

When you click and drag on a bar you’ll see a readout of the dB offset in the range of +/- 18dB. You can also “draw” the frequency response by dragging the mouse over the bars in one sweep. A right-double-click will reset all the bars to 0dB. If you wish, you can automate individual bars in the DAW.

The Q knob sets the bandwidth of *all* the filters. When set to 3, the response is pretty much flat when all the bars are at 0dB. Turning it higher increases the colouration of the signal.

If you set a “peaky” response curve you can offset the overall gain of the eq using the LEVEL knob.



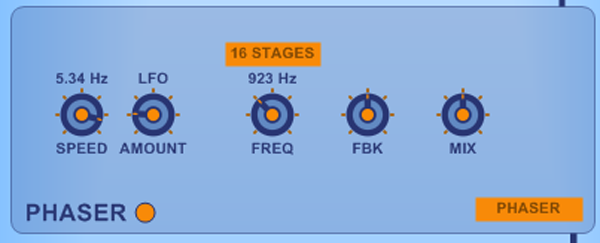
The Wah-Wah effect can have its frequency controlled by the on-board LFO whereby the SPEED and AMOUNT operates on the cutoff frequency of the Bandpass filter. Static frequency is set on the CUTOFF knob and the LFO modulates plus or minus around this setting. RES sets the resonance of the filter.

The 2 MODWHL knobs set the amount of influence of the modwheel on the settings above them. So you can alter the amount of LFO and the cutoff frequency in whatever proportions you wish.

Important to note is that the MODWHL signals can also come from a midi foot controller (set to CC 4) and the last one touched will take control.



For a more vintage sound you can insert a SPRING REVERB. This adds a spring-like “twang” to the start of the reverb tail.

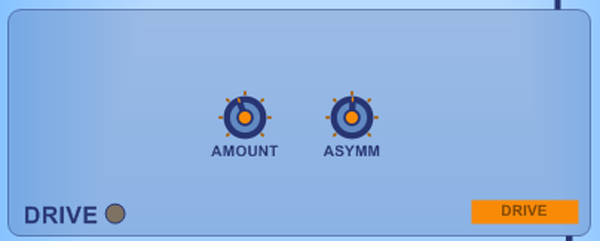


This PHASER effect can add a nice warm swirl to the sound and Phasers are popular effects for many keyboard instruments. The LFO modulates the centre frequency of the all-pass filters and adds to or subtracts from the set FREQ. The effect can be deepened by adding more feedback with the FBK knob. The MIX knob allows a blend between live and effect but should be left half way for the richest sound.

The 16 STAGES selector allows you to choose the number of all-pass filter blocks, and more will increase the intensity.



This has a wonderful Chorus engine made by Martin Vicanek.



The DRIVE effect is to simulate a vacuum tube preamp. It adds warmth at low levels and moves into soft clipping at higher settings of AMOUNT, giving a typical overdriven distortion.

I discovered that real overdriven vacuum tubes often soft-clip the sound asymmetrically, so the positive going peaks may be more affected that the negative going ones. This is simulated with the ASYMM knob.

Please note that even when the AMOUNT knob is at minimum there is still a small warming effect present.



This is a general purpose delay. The 3 buttons at the top are local defaults or presets. They set all the controls up to just be starting points for the type of delay effect you want. These momentary buttons only light briefly when clicked.

The LFO SPEED and AMOUNT set modulation of the static delay TIME you adjust, and are modulated plus and minus by the sine wave LFO.

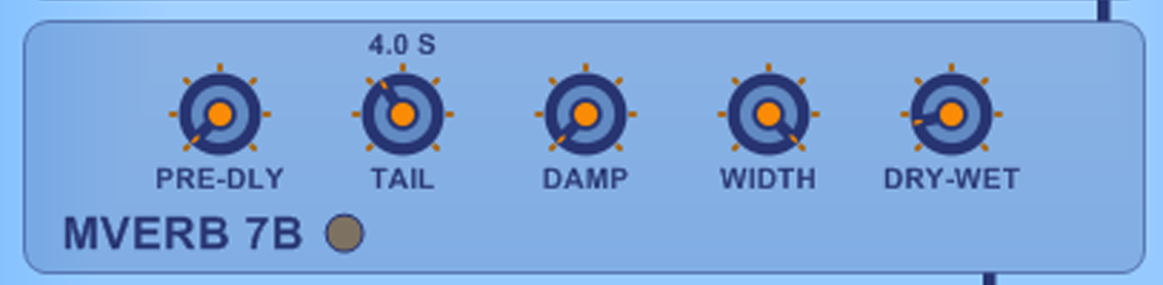
FBK sets the amount of feedback and DAMPING sets a progressive loss of high frequencies as echoes repeat. LEVEL sets the level of the delayed signal added to the dry signal.

Under the FBK knob is a switch here showing L-L R-R which means that left and right stereo channels are not swapped. Clicking it switches to L-R R-L INV which swaps channels over and inverts one. This is useful for chorus and some echo situations to give a wider stereo field.



The CABINET simulates the resonances you might get from a speaker enclosure. It’s a simple solution making use of a comb filter which can mimic spectrograms of formants generated in hard enclosed boxes and such. If you want accuracy you should use a convolution plugin in the DAW, but the CABINET effect can be quite interesting in its own right.

SIZE is really the delay time in the comb filter, and is only loosely analogous to the cabinet volume. RES sets the height of the peaks in the spectrum. LEVEL sets the amount of resonances added to the dry signal. The range is from very subtle to extreme!



The MVERB 7B is always available on the front panel at the end of the signal effects chain. It uses a wonderful reverb engine created by Martin Vicanek and I think is of very high quality. If you prefer to use your own favourite, just turn it off with the orange LED switch and it won’t use CPU.

The knobs do what you would expect of a digital reverb:

PRE-DLY is a delay time before the reverb is introduced.

TAIL is the length of the reverb tail; the time it takes to drop to -60dB.

DAMP reduces the high frequency content during the decay of the tail. It simulates a “softer” space which behaves this way.

WIDTH controls the width of the *reverb* in the stereo field.

DRY-WET sets the balance between the incoming signal and the reverberation signal.