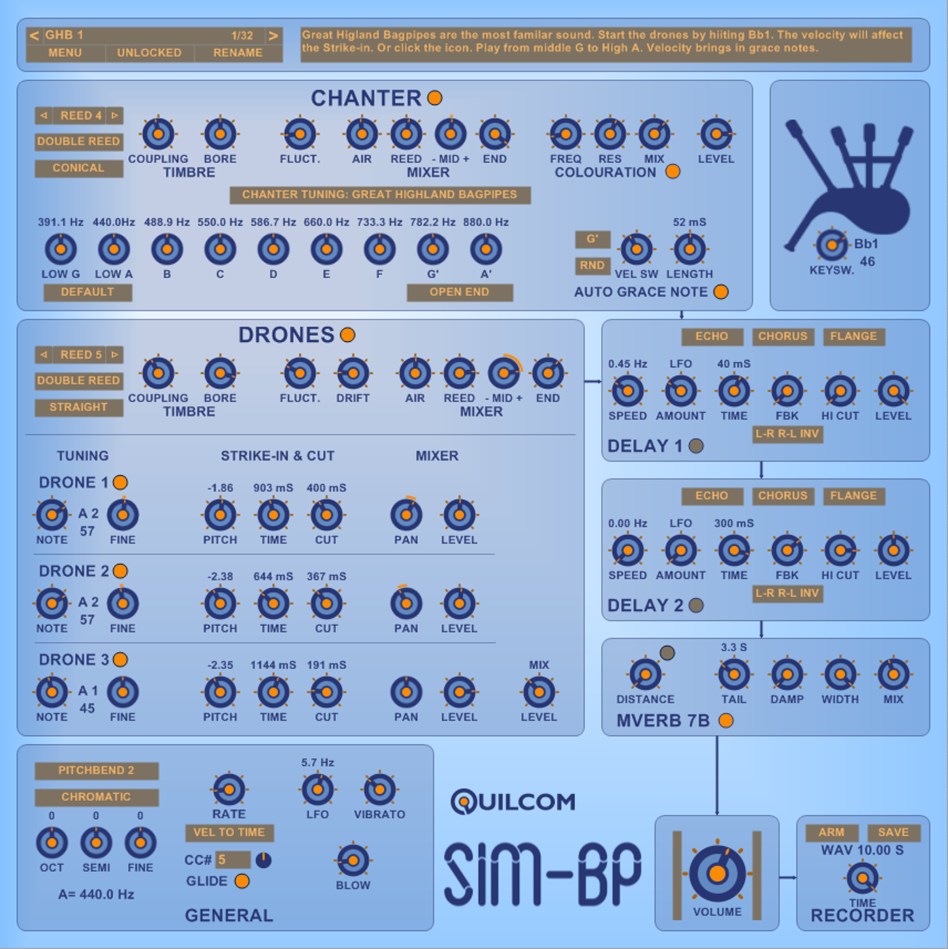
**Quilcom SIM-BP**



**Design**

The Quilcom SIM-BP is a synthesiser made for the purpose of simulating the sound and behaviour of many different types of bagpipes and other enclosed reed instruments.

It uses no samples, just methods of synthesis, to remove the limitations of fixed sample sets. This means you have the advantage of being able to create and tweak a huge range of timbres, tunings and other parameters. In terms of getting a truly *authentic* sound, synthesis will rarely compete with multi-sampled real instruments, but the trade-off is a sound fixed at the time of recording and dependant on many factors. Of course a modern sampler like Kontakt can alter the envelope, filter and so on, but the base sample’s sound can’t be changed unless you buy or select another set of samples.

In the Background info folder you’ll find links and PDFs if you’re interested in the remarkable history and function of this class of instruments.

**Overview**

There are 2 sound generating sections:

* The **CHANTER** is a monophonic synth for simulating the pipe that plays the melody. 3 tuning options are available, each with adjustable micro-tuning.
* The **DRONES** simulates the sound of up to 3 fixed-pitch pipes which normally sound continuously and against which the chanter plays. You can choose the pitch at which each of the drone pipes speak and other parameters.

The air supply may be toggled on/off from the on-screen icon or by operating your chosen keyswitch.

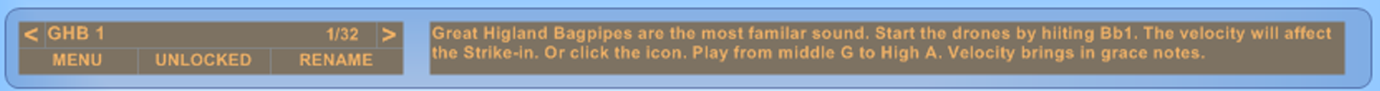
Since this is an acoustic instrument, I supplied only environmental effects, seen on the right-hand side of the front panel.

The **GENERAL** panel sets parameters for the whole instrument.

I’ve provided a **RECORDER** where you can record single sounds or clips as wav files for use in other plugins.

What follows is a detailed description of the various panels, which will include some background information too.

**Preset manager**



I’ve provided several presets to illustrate the potential range of sounds, but these should be thought of as starting points to make it easier to shape the sound you have in mind.

On the left side is the small section where you select the preset either by clicking on the preset name or paging though them using the arrow buttons.

The MENU selector is where you operate on presets or banks. You can save, load, copy or paste presets, or save and load a bank from this menu.

All changes made to any settings will be stored with the DAW song file unless the button **UNLOCKED** is changed to **LOCKED**. This locking feature is to avoid losing settings if you just want to mess with editing but want to keep the original parameters. Of course the factory presets are baked into the code but to get one back you may otherwise have to reload it or use the DAW to return to factory defaults (which returns ALL of them in Reaper).

The **RENAME** button allows you to name or rename a preset providing the preset manager is **UNLOCKED**. Otherwise the **RENAME** button is greyed out.

On the right side is a free text area for adding comments to the preset. These comments are saved with the song and preset providing the preset manager is **UNLOCKED**. Please be aware that you shouldn’t use a carriage return (Enter) in this text because the system won’t store any text after that. Also please be aware that when you RENAME a preset this text will clear, so if you want to keep it and just rename the preset, highlight it and copy then paste back in after you’re renamed.

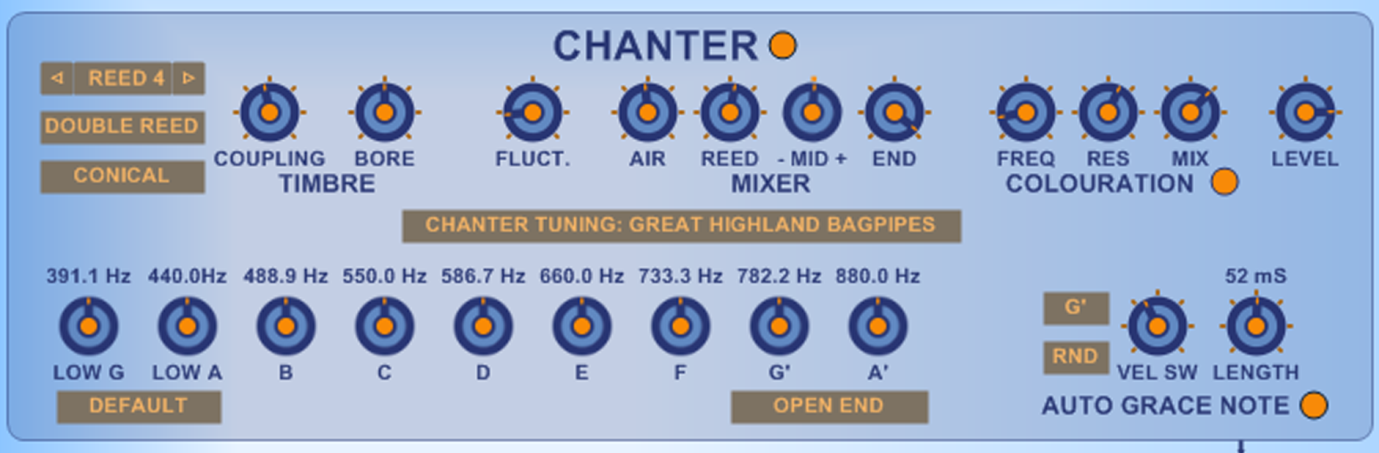
**Air supply**



To hear any sound at all the air supply has to be turned on. There are 2 ways to do this: You just click on the bagpipe icon or press and release the note you’ve set on the **KEYSW.** knob. The action is to toggle on/off.

The default octave numbering system is Middle C = C3 but if you prefer to adopt the ISO or other system you can choose the octave numbering by clicking on the note name (Bb1 is shown).

**CHANTER**



The **CHANTER** is a monosynth, so plays only one note at a time. It features last-note priority, note hold and return. This simulates the behaviour of a real chanter.

The **CHANTER** panel has 2 sections. The upper row is where you set the timbre and the lower row is concerned with tuning, grace notes (only on the Great Highland Bagpipes (GHB)) and whether the playing is on an open or closed pipe (described later). The central selector chooses the type of tuning which changes the view in the lower section. To start playing the chanter turn on the air supply and play a valid note.

**Upper section: Timbre**

The Chanter can be muted using the orange LED switch by the label.

I checked out many different synthesis methods during development and the best I found was to use a spiky reed waveform and feed this into a tapped waveguide. This gives what I think is the best sound and the greatest possibility of timbres. On the top left is where you chose between 9 different reed waveforms, all created in my Quilcom Wavemaker 4.

I confess the naming is fairly arbitrary in terms of accurately modelling the real thing, but providing all these adjustable parameters gives a huge variation in timbre. No science or maths was involved!

Tapped waveguide info:

* **Single reed** = Audio output from the tap.
* **Double reed** = Audio output from the end.
* **Conical** = “Velocity” mode so all harmonics present.
* **Straight** = “Force” mode so more odd harmonics.
* **Coupling** = The tap position for the delays.
* **Bore** = The amount of feedback.
* The reed pulse excites the waveguides at the tap.
* The feedback and noise modulation enters at the input to the Waveguides.
* Feedback is taken from the Waveguide ends, i.e. not the tap.

The **FLUCT.** knob adjusts the amount of fluctuation of the sound. If you listen to a sustained note on a real pipe the sound is often slightly unsteady due to random air turbulence etc.

Next along is the **MIXER**:

* **AIR** is the sound of blown air coloured by the waveguide. This would normally only be audible with close microphones on a solo instrument. I suggest you turn it up until you can just hear it and then back it off a bit.
* **REED** allows you to mix in the raw sound of the reed pulse.
* **-MID +** controls the level of sound from the tap on the waveguide. The – and + refer to the phase of this audio, so when the knob is central there is no audio from the tap.
* **END** sets the level from the final output from the waveguide.

Next is the **COLOURATION** section. This simulates the fixed resonances found within a pipe which leads to notes having different timbres from each other. The best way I found to simulate this is to use a comb filter which has non-harmonic peaks and troughs in the transfer curve. It can be turned on/off with the orange LED switch by the label.

**FREQ** sets the delay time and thus where the frequencies are located in the response curve.

**RES** sets resonance; the height of the peaks and troughs and **MIX** sets the blend between the dry and filtered audio.

Finally the **LEVEL** knob obviously sets the chanter’s volume.

Tip: There are 12 settings here which all affect the timbre in different ways so it’s really tricky, if not impossible, to predict what to set to get a particular sound. I suggest you experiment and simply get a feel for what each one does and stop when it sounds right! For example, you’ll find that the BORE knob increases the lower range of harmonics and leads to a “deeper” sound like having a larger diameter pipe (a bit). When making the presets I used my ears and compared with YouTube videos of real pipe playing and teaching.

Tip: I learned that the same “type” of pipe, although it may be called Uilleann or Highland etc can sound quite different from another pipe with the same name. Variations of timbre are dependent on the pipe maker’s choices, preferences and traditions. This is apparent if you listen to the first 9 presets which were set to simulate different sounds of the “same” 3 pipe types.

**Chanter tuning**

The chanter has 3 different tuning and playing options.

**GREAT HIGHLAND BAGPIPES (GHB)**



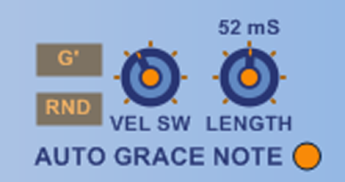
The GHB is the most iconic of all the pipe types, largely because of its history of use in battles and ceremonies around the world in the past. The chanter can play 9 notes from Low G (middle G) up to top A and is normally tuned nominally to A. However, the actual pitches are not properly consistent between pipe makers and modern western scales. For example, the low A is often a slightly sharpened Bb. Bagpipe notation is given on the white notes only, G to A and never mentions that the actual notes heard can include black notes. For this reason I chose the micro-tuning and playing to be active just on the white notes from G to A.

If you want to play in a different key, the GENERAL panel offers a wide range of transposition without affecting the tuning ratios. The tables I found online are given in Hertz so the knobs set the frequency of each note in the pipe’s scale. If you click on **DEFAULT** it will restore a set of frequencies measured on a real chanter made by John McNeil from 1902. The Background info has more tables and information about tuning.

Sometimes frequencies are tabled based on a different frequency from A=440. In this case set the frequency of A on the **GENERAL** panel first, and then adjust the knobs to get the tabulated frequencies.

You can choose whether the pipe has an open or closed end. In fact all GHBs are open ended. This means that once the air pressure goes higher than that needed to strike-in the drones, whatever you are playing will sound and a note will always sound, even with no keys pressed. The note that sounds is the tonic, in this case the low A. This prevents staccato playing because one note will always sound. To get around this limitation, a player will introduce grace notes to form a boundary between the notes played; to break them up with a high note instead of silence. Now, for all 3 tuning methods I’ve given the option to switch to **CLOSED END**. The difference to **OPEN END** is that when no keys are pressed no note sounds. This isn’t authentic for many pipes like the GHBs but you might prefer it. Some pipes are closed and some are closed and operated with keys, similar to a clarinet. So you have the choice.

**Grace notes**



All pipers make use of grace notes to add ornaments to the music. These are very short duration notes played on the beat and normally higher than the target note. If you’re a good keyboard player I’m sure you could play these but I’m not, so I provided the **AUTO GRACE NOTE** feature. This is only on the GHB tuning because the other 2 tunings provide for a much wider and chromatic span.

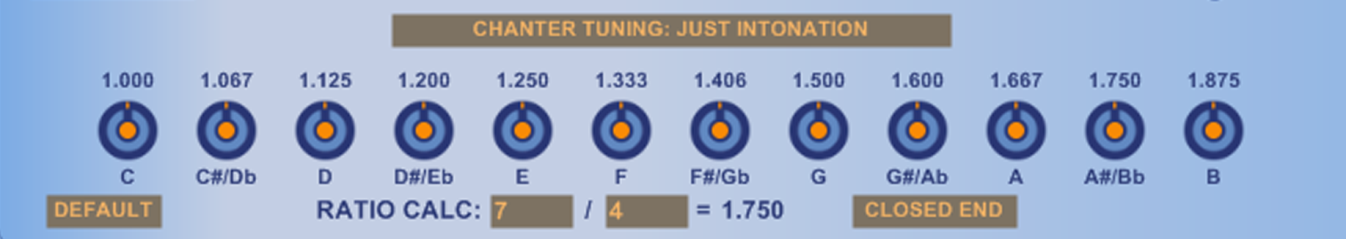
When **AUTO GRACE NOTE** is turned off with the LED switch you have to create the grace notes yourself.

The grace note is only played when the Velocity goes above the threshold value you adjust on the **VEL SW** knob. When you hit a note above this threshold it will trigger a grace note, the length of which is set on the **LENGTH** knob. The note played on GHBs is most often the top G but is sometimes specified as E or D, so you can choose which one of the 3 you want.

To add some variation to your performance you can turn on the **RND** function. This actually cycles through the grace note selection and modulates the length of the note at different rates and so adds variety to your playing.

Tip: If you play legato you don’t get a grace note. This is actually a benefit since it means you have some more control over the generation of grace notes.

**JUST INTONATION**



Just intonation (often with some variation) is set on many bagpipes. The idea is that notes played are set in integer ratios to the drone’s pitch and key of the chanter. The purpose is to reduce harsh beating due to inharmonic intervals for some notes which you get with modern Equal Temperament tuning.

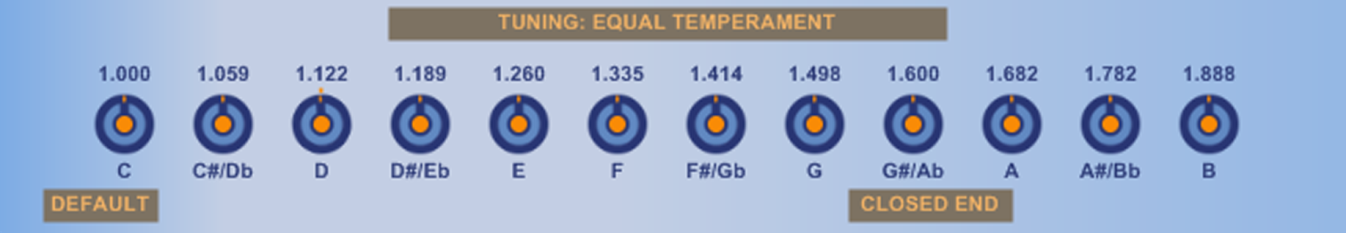
For Just intonation the note tunings are generally specified as a ratio to the tonic. The aim is to make the ratio integers as low as possible to get the best sound. There’s a lot more detail in the Background info folder.

This tuning view is based on C, but it’s the ratios that matter. If you do wish to play in a different key you can choose to transpose on the GENERAL panel BUT you must still play the *keyboard* in the key of C. This was a limitation of the Just system; instruments only sounded right in one key. Keep in mind though that bagpipes were generally considered to be solo instruments. When playing in a band, the Pipe Major would ideally get all the chanters from the same maker, to avoid inconsistencies.

Tuning tables usually specify the *ratios* used for an instrument, so to make it a bit easier I’ve included a **RATIO CALC** so you can enter the ratio and set the result on the knob. For precise setting, hold down the SHIFT key while adjusting the knob to give finer control.

If you click **DEFAULT,** the knobs are all set to what I found to be the most common ratios used for Just Intonation.

**EQUAL TEMPERAMENT**



Equal temperament is the most common tuning for modern instruments, especially those that play in ensembles such as orchestras. The interval ratios are the same throughout the scale so you can change key and it will sound “right”. However, some chords will always beat because it’s not an ideal “harmonic” tuning method. Clicking DEFAULT will restore any changes back to accurate ET tuning.

Equal Temperament is best used if playing with other instrument types. Some modern pipes are actually tuned this way.

Tip: You can make your own scale with these tuning systems. For example, if you listen to my PUNGI preset, the white notes (based on C) are tuned to the Indian Hanumatodi scale. So when you play the white notes it will sound suitably “ethnic”. Of course your actual playing will have a big impact on the authenticity too.

**DRONES**



The drones are pipes adjusted to a fixed pitch and sound throughout the whole performance. The melody is played on the chanter.

The upper row sets the timbre for *all* the drones. There will be some variation of timbre with pitch but in real pipes, where there is more than 1 drone, they are matched by the maker.

The timbre method is identical to the chanter outlined previously. One exception is there is no colouration control because the pitch is constant. A waveguide system is used the same as for the chanter. The other difference is the **DRIFT** knob. **DRIFT** slowly modulates the *phase* of drones 2 and 3 and means you don’t have to detune the drones to get a more authentic ensemble sound. The **DRIFT** knob sets the amount of slow phase modulation.

Each of the 3 drones has a row of dedicated knobs for tuning, strike-in, cut, pan and level. The **MIX LEVEL** knob adjusts the total output volume for the drones.

The pitches chosen for each drone will depend on the tradition of the instrument being simulated. For example, GHBs will have 2 drones tuned 1 octave down and one drone a further octave down from the tonic. Many other pipes have one of the drones set to a fifth above the bass drone. You can set whatever chord you want, as in 2 of my presets.

Tuning on the **GENERAL** panel will automatically adjust the drone pitches to make life a bit easier.

**STRIKE-IN & CUT**

It takes a finite amount of time for a reed to start vibrating and then reach the correct pitch. The sound dies away (cuts) more quickly but with some pipes with larger bags it can still be audible. A good piper will try to start the drones by striking the bag hard. But we are all used to the sound of the drones drifting up to pitch, which we can simulate.

**PITCH** sets the pitch at which the rising sound first starts. **TIME** sets the time it takes to reach the final pitch. **CUT** sets the time it takes to die away.

Tip: To achieve a more authentic sound these values should all be set differently between drones so the drones start off out of tune and then end up in tune.

Each drone sound can be panned and its level adjusted in the mix.

Tip: Wide panning can sound ok on speakers but not on headphones!

Tip: When a piper is close mic’d the drones will be over his left shoulder so they could be panned a little to the right.

**GENERAL**



This **GENERAL** panel mostly affects the while instrument.

The **PITCHBEND** selector is where you set the maximum amount of semitones the pitchbend wheel can influence. Traditional GHB pipers frown on pitch bending and vibrato! Pipers playing other instruments often use it as a form of expression. If you click on **CHROMATIC** it will light up and then the pitch bend will be in *stepped* semitones.

Tip: A pitchbend of 2 along with CHROMATIC will enable you to create grace notes and trill either side of the playing note.

The tuning on this panel affects the whole instrument. Due to the scaling of pipes this is the best way to play in any key or with another instrument.

The readout of the frequency of middle A might be useful for the GHB tuning, because it’s specified in Hz. So if you have a tuning table where A=459 for example, you set it to A=459 here then set the note tuning on the chanter tuning section. This means you don’t have to make Hz conversions for the table being used.

Also don’t forget that any tuning changes here also affect the drones to save time re-tuning them.

The central section is about **GLIDE** (Portamento). The **GLIDE** uses a memory system to glide from the last note played even if it was released before playing a new one. Thus it uses some CPU, so turn it off if not needed.

The **RATE** knob sets the glide time. If you turn on the **VEL TO TIME** button the adjusted time will *reduce* at higher velocities, giving you some real-time control over the glide time.

Additionally you can choose a CC number to control the glide time. If you have an Electronic Wind Instrument (EWI) it may come with a glide time control and I gather is normally mapped to CC#5. The little knob to its right sets the range of operation. Of course you can choose any CC you want and I tried it with the modwheel (CC# 1) and, when you get the hang of it, it can be a useful means of expression. The incoming CC value *adds* to the adjusted RATE value, so I would set this low or to zero.

On the Top right you have controls for the inbuilt **LFO** and **VIBRATO** amount.

The LFO has a specially made waveform and behaviour to simulate what I saw on several videos showing vibrato in action. The waveform is a clipped sine wave to simulate a player “fluttering” a finger over the hole next down to the one playing. This means that the Vibrato is a smoothed on/off modulation and, importantly, it goes up to the note from a slightly lower pitch. This is different from say a violin vibrato which modulates above and below the pitch.

To turn Vibrato on, the system responds to the modwheel or channel Aftertouch, depending on which one is operated most recently. It’s also a switch, just like a piper won’t introduce vibrato gradually; it’s either there or not. So on this synth vibrato comes in when the control goes above about 33%.

The final knob on the GENERAL panel I’ve called BLOW. This simulates that slight drop in pitch when a piper starts to lose pressure before he blows again or squeezes the bellows (the Uilleann system). A great piper will never create this sound but I’ve heard it on recordings quite often. Blow features a special LFO waveform that is zero for a long time then scoops down for a short time. Someone actually measured the average blowing cycle period and found it to be typically about 4 seconds, so that’s what I set. The BLOW knob adjusts the amount of cyclic droop in the pitch. Set it higher for a bad piper!

**EFFECTS**

I chose to offer only “environmental” effects because bagpipes are an acoustic instrument. Of course any external effect can be applied in the DAW and you can turn on or off any of the 4 effects provided. The effects are connected top to bottom in series.

**DELAY**



There are 2 identical delays in series. The 3 buttons at the top provide a fast way to set the genre of the delay. They don’t stay lit, they just set local preset values and any changes to the *values* are stored in the preset.

The **SPEED** and **AMOUNT** knobs adjust the LFO’s influence on the delay time as a proportion of the set **TIME**. Delay feedback is set by the **FBK** knob. Underneath the FBK knob is a switch for setting the stereo routing. **L-L R-R** means no swap of channels and **L-R R-L INV** swaps left and right for the feedback routing and inverts one channel. This latter mode can make a nice wide sound for chorus and panning for echoes. The **LEVEL** knob adjusts the amount of delayed audio mixed in with the dry sound.

**Reverb and distance**

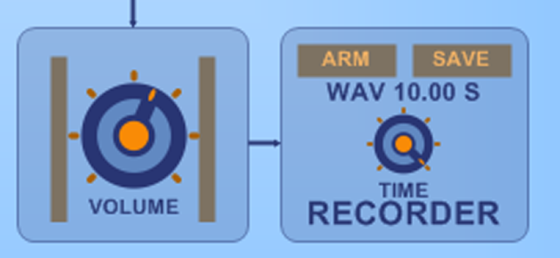


There are actually 2 separate effects in this view.

**DISTANCE** is a multi-effect processor using the Quilcom FARANEAR engine. The idea is to simulate the environmental effect of having a source coming from an adjustable distance. At minimum there is no effect. As you turn the knob up the sound is meant to sound further away. Try it on headphones for the full effect! If you don’t need it turn it off because the CPU usage is higher than a single effect.

Finally the signal goes to the wonderful **MVERB 7B** engine made by Martin Vicanek. **TAIL** adjusts the length of the decay tail and is the time it takes to drop to -60dB. **DAMP** introduces a reduction in high frequencies as the tail decays. **WIDTH** sets the stereo width of the reverb tail. **MIX** provides a balance between the dry and wet signals.

**VOLUME and RECORDER**



The output VOLUME control has 2 meters which indicate approximate average peak levels for left and right channels. If you get even a very short a clipping peak the central ring will turn red for 1 second.

The **RECORDER** allows you to record sounds or short clips and save them as a standard WAV file at 44.1 kHz 16 bit stereo for use in a sampler or DAW.

First you set the time you might need, up to 10 seconds. Press the ARM button and it will light up. When you play a note the recorder will start and a bar will show the progress. If it’s good click on SAVE and save the wav file. If not, just repeat because the buffer is cleared. If you click on ARM by accident just click it again to cancel.