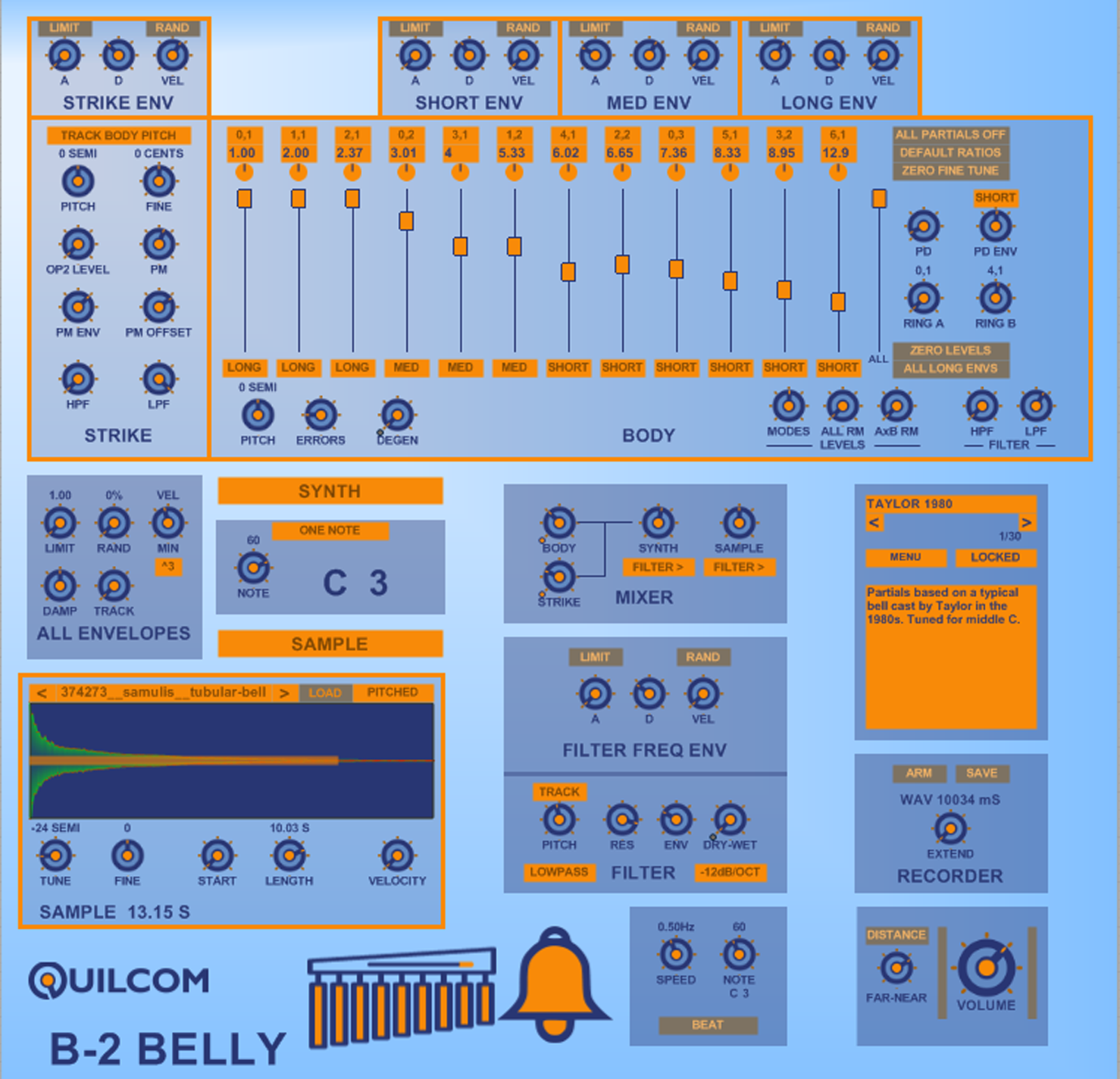
**Quilcom B-2 BELLY**



**Design**

The B-2 (Beater version 2) BELLY is part of a family of B-2 percussion synths and this one is designed specifically to simulate Bell-like sounds and most of the presets reflect this. However, since it’s a synthesiser, it can be set to create a very wide of non-imitative sounds too.

It’s a popular practice to mix sampled sounds with synthesised sound, so there is a flexible sample player provided which can optionally be routed through a dynamic filter. Individual hits within a loop can be isolated for this purpose, and the hits can be played at their native pitch or chromatically across the keyboard.

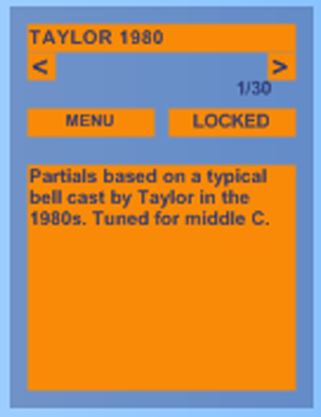
When you have the sound you like, you can export it by using the inbuilt recorder and save the result as a WAV file for use in your favourite sample player or drum machine and/or DAW. This means you aren’t compelled to use the plugin live in a DAW and could thus save CPU.

For anyone interested in the physics and theory of bells and similar, and their synthesis, I have included some papers and links in the download. You will also find a small selection of acoustic samples to play around with right away.

One benefit of the B-2 series is the ability to take a sample and use it as a base, adding other components to the sound, or maybe dynamically filtering the sample itself.

The synth comes with a range of generic presets. These are not meant to be definitive, but to act as starting points for your own sounds. I suspect that if you have a specific sound in mind, or just want something a little different, using this instrument may well be quicker than auditioning loads of samples!

What follows is a detailed description of all the panels or sections that make up the instrument.



This is the preset manager. The top line is a selector where you choose the preset. You also have arrows to page through them. MENU gives you the file management options so you can save/load individual presets or banks and copy/paste presets to a new slot.

You can only rename a preset when the right hand button is showing UNLOCKED. While unlocked, the DAW will save any new adjustments in the song file. If you just wish to experiment but keep the original settings, change the button to LOCKED (as shown).

Each preset can have a free descriptive or reminder text, and this is entered in the large lower box. The text is cleared when you RENAME a preset, but you can copy and paste it back in if you wish to keep the text.



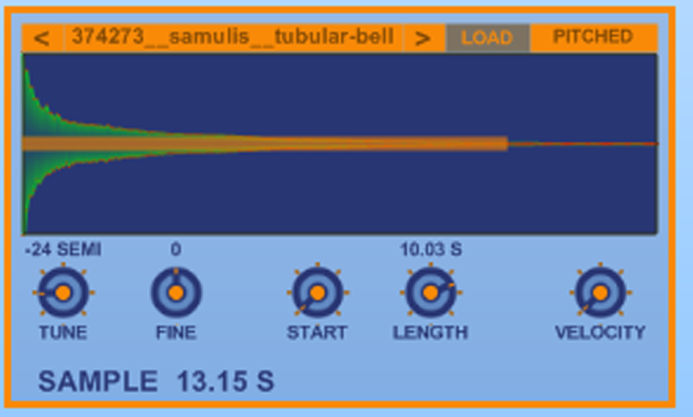
This is the VOLUME knob and DISTANCE setting for the whole plugin. The 2 vertical strips are bar graphs which indicate the average Left and Right peak level (the Synth is mono but the sample may be stereo). If a peak goes into clipping, the inner ring of the knob will turn red for 1 second.

If you turn on the DISTANCE switch, the FAR-NEAR knob allows you to set a psychoacoustic distance cue. This makes the sound of synthesised bells seem a bit more authentic since *multiple* ambience parameters are controlled simultaneously. The engine behind this is taken from the Quilcom FARANEAR plugin. When turned fully up there is no ambience effect. If you don’t need this, please turn it off to save some CPU processing.



Here you see the 2 buttons for turning the SYNTH and SAMPLER on and off.

The panel in-between is where you set which MIDI note will trigger the sound. The ONE NOTE switch can be changed to show ALL NOTES, in which case the whole MIDI keyboard span becomes available. The NOTE knob is where you set the note to respond to, and the readout “C 3” will change accordingly. If you click on the note name, you can choose whether middle C is classified as C3, C4, or C5 since there is no universally accepted octave numbering system.



The option to layer any SAMPLE with the SYNTH brings endless possibilities to create composite (layered) sounds. The panel shown in the picture deals with all the handling of the loaded SAMPLE.

Click on the LOAD button to navigate to the folder containing your samples. Double click on any file to load it and then *all* the samples in that folder will become available in the browser. These can be paged through with the arrow buttons or selected by clicking on the sample name and choosing from a dropdown list.

The UNPITCHED switch allows you to also choose PITCHED. UNPITCHED means the sample only plays back at one pitch, ignoring the incoming MIDI pitch values. PITCHED means it will track the MIDI keyboard. It is not affected by the PITCH knobs in the Synth section.

The TUNE knob provides for an adjustable semitone offset to the sample’s playing pitch, along with the FINE knob. When set to zero (double-click for default) the sample will play at its native recorded pitch. The system is set up internally to expect C1 (note 36) to sound the sample natively. Changing the TUNE value can be useful if you wish to use an alternative note for triggering, or to spread a sample sound over the keyboard with suitable pitch mapping. Note that if you use a pitched *musical* sample recorded at say middle C, *it will play* ***correctly*** *at C1*. If you want to play it at middle C, as it may have been recorded, set -24 on the TUNE knob which tells the system that it was actually recorded 2 octaves higher.

You can set the region of the sample you wish to play. The START knob sets the point at which the sample will play from, when triggered. The LENGTH knob will set the point at which playing stops. The central horizontal orange bar shows the play region.

The VELOCITY knob simply sets the level according to MIDI velocity. At zero it’s always at maximum volume and, as you increase the value, softer-hit notes become quieter.

Tip: You may only need to play a reduced *section* of a sample, such as the strike or decay phase, to embellish the synthesised sound.

Tip: You may have a *loop* which contains a sound you like. In this case, load up the loop and create a region just for that sound. You don’t necessarily need to slice it in an editor first!

Tip: The *end* of the chosen region is set to fade out over 40mS to help avoid a click at the end. However, the start is *not* faded in. This allows you to make a click at the start of the sound. While *operating* the region knobs and playing, you may hear clicking due to randomly hitting peaks in the sample.

Tip: If you want to *avoid* a click at the start, maybe in a longer loop with many events, turn on the BEAT and hold down the ***shift key*** while you adjust the START knob. This give you a fine-adjust mode for the knob so you are more easily able to find the best start point while listening to the result. This is also useful for synchronising the sample with the synth so they start at the exact same time.

Tip: Some samples don’t start instantly or may have reverb tails. You can use the region controls to alter the START point, and LENGTH to cut out the tail.

Tip: The download includes a selection of various samples, so you can start to experiment straight away.



Any sound you create or modify in the B-2 BELLY can easily be exported, to use in your favourite sample player or drum machine. This is done with the RECORDER section. It makes a one-shot recording of a hit which you can then save as a WAV file. The duration of the recording is determined automatically by taking the *longest* time currently set on the system, providing you have the EXTENDED TIME set to *minimum*. This recording time could come from the SAMPLE or from the longest total envelope time adjusted. This means the recording will always contain the whole sound with no added silence at the end of the file. If you have too long a time showing, check the decay times of *unused* generator envelopes or the filter envelope.

You can also record a short performance, say from the chime bar. In this case the system will not know how long your performance will last so you can increase the Recording time up to 10 seconds using the EXTEND TIME knob.

Once you have the sound you like, click the ARM button then trigger the sound from the keyboard or icons or, for a *performance*, just start playing. A progress bar will appear for the duration of the recording and the ARM button will then go dark again. Click on SAVE and use the usual Windows dialogue to save it. If you mess up, just start again and the old recording is over-written.

Tip: The time taken to *write* the file can be longer than its duration, so wait for a few seconds before using the wav file you just saved.

Tip: If you want to record a damped or shortened version of the sound, press the sustain pedal *before* you ARM and RECORD.



This is the panel for *global* settings for all 5 envelope generators.

The LIMIT knob is similar to an audio level limiter but operates on the envelopes instead, so I think provides a better result. When set to 1.00 there is no limiting. With increased limiting, the envelopes have their level chopped off at the adjusted point, but their output is compensated to give the same operating range. This results in a flattened peak, and the result is similar to having a hold period or short sustain. The effect is to give the sound more “punch” since maximum volume is held for a short time. The attack phase of some larger or cracked bells may benefit from this.

Each envelope can be set to receive the limit value or not. This means you can add punch to any sound source with any envelope generator you wish.

Tip: Limiting doesn’t sound good or better for *all* sounds, and the “hold time” will be affected by the total Attack and Decay times set. Just experiment! At extremes the sound can change considerably.

Tip: Start sculpting the sound with *no* limiting applied, only then turn up the limiting and decide if it helps or hinders.

The RAND knob provides a degree of randomisation available to all the ENVs. The idea is to provide subtle (or otherwise) variations to successive hits. You choose which ENVs respond to these variations with their RAND buttons on each ENV. There are actually 5 random numbers generated individually, 1 for each ENV, so this increases the randomness, such that one Env may increase while another decreases.

Incoming velocity signals are processed by the VEL MIN system. The MIN knob sets the minimum velocity level so if you hit a key very softly you will still get a sound. The orange selector below it allows you to set the response curve to match you keyboard and playing style. You can choose between LIN (linear) and an exponential response of power 2, 3 or 4. The default values in the image above are a good starting point for having an easy-to-play accent note.

The DAMP knob setting comes into play when you step on the sustain pedal (its label turns orange). The pedal is configured not to sustain, but to *shorten* all the envelopes’ decay times proportionally. The idea is you can press the pedal to choke a longer sound and can thus provide 2 expressions from one preset. When set to off there is no damping. When set half-way the decay times are approximately halved and so on. It works this way round because not all keyboard players will have or use a sustain pedal, so the presets wouldn’t sound right.

The TRACK knob affects *all* the envelopes and determines the amount of shortening of *decay* times as you ascend the keyboard. When set to zero, the decay will be the same for all notes. As you increase this value, notes above C1 (36) will be shorter for higher notes. The maximum ratio is 50% reduction per octave (usually too much!).



The MIXER is where you mix together the outputs from the SYNTH and SAMPLE. The composite SYNTH sound can be a mix between the BODY and STRIKE generators (see later).

You can route the SYNTH and SAMPLE signals each into the main filter or directly to the output, using the switches under the SYNTH and SAMPLE level knobs. In this way you could use the main FILTER for either, both or neither sources.

The SYNTH and SAMPLE level knobs will only be seen when the SYNTH or SAMPLE switches on the front panel are lit and thus turned on and using CPU.



The B-2 BELLY has 5 identical envelope generators of the percussive Attack-Decay type and the main FILTER uses one of them. The Attack shape is linear and the Decay shape is exponential. The VEL knob sets the responsiveness to the incoming velocity as trimmed on the ALL ENVELOPES panel. When turned fully down the volume is always maximum and when turned up more the sound is quieter for softer key strikes.

If you turn on the LIMIT, the envelope will be limited at the level set on the ALL ENVELOPES panel, and will get a sustained flat top. It’s level-compensated, so the actual maximum output will be constant.

If you turn on RAND the volume will vary randomly by the amount set on the ALL ENVELOPES panel.

The main FILTER gets its input from the MIXER, based on the routing set on the MIXER. If SYNTH *and* SAMPLE are set to DIRECT, the filter panel controls disappear and are replaced by a notice saying the filter is not in use.

The FILTER FREQ ENV can influence the centre frequency according to the adjustment of the ENV knob.

The selector showing LOWPASS allows you to choose the filter type and the -12dB/OCT switches between that slope and -24dB/OCT.

The PITCH knob sets the centre frequency, and if the TRACK switch is lit, keyboard tracking is added to the PITCH knob’s value. When you turn TRACK on, you may need to alter the PITCH knob to take account of the note range played.

The RES knob sets the filter’s resonance. This is calibrated so that, when set to maximum, the filter can ring like the analogue equivalent.

The DRY-WET knob adjusts the balance between the incoming unfiltered sound and the filtered sound. When set to fully DRY, the little orange lamp dims and the FILTER is bypassed, and then it doesn’t use any CPU.



For ease of use you don’t have to keep hitting the keyboard, or have the DAW running, to audition the sound as you tweak away. You can click on the Bell icon which will trigger the note set on the BEAT panel. This note setting is independent from the main set note. Alternatively (or as well) you can turn BEAT on with the BEAT switch. This gives a repeating trigger at the SPEED you set. This is independent from the DAW’s tempo and the actual speed will not be as accurate; it’s there for convenience only.

Tip: If you leave the BEAT running you can page through your presets and hear them as you go.



There are two icons you can use to trigger sounds using the mouse. The Bell icon creates a single note whose pitch is set on the BEAT panel.

The Chime Bar icon can trigger notes as you click or drag horizontally over it. This is a means of making Bell Tree sounds for example. There are two zones available. The upper zone is fully chromatic and the lower zone just plays the “white” notes. The pitch range generated is from Middle C and upwards, and covers nearly 3 octaves. To get a different pitch mapping, adjust the PITCH knobs on the STRIKE and/or BODY generators (see below).



There are two sound generators for the SYNTH section; STRIKE and BODY. The STRIKE generator relies on FM synthesis although you can utilise it to make 2 pure tones.

The B-2 BELLY has 5 identical envelope generators of the percussive Attack-Decay type. The Attack shape is linear and the Decay shape is exponential. The VEL knob sets the responsiveness to the incoming velocity as trimmed on the ALL ENVELOPES panel. When turned fully down the volume is always maximum and when turned up more the sound is quieter for softer key strikes.

If you turn on the LIMIT, the envelope will be limited at the level set on the ALL ENVELOPES panel, and will get a sustained flat top. It’s level-compensated, so the actual maximum volume will be constant.

If you turn on RAND the volume will vary randomly by the amount set on the ALL ENVELOPES panel.

The STRIKE Env is dedicated to the STRIKE generator below it. It has two uses; volume contour and PM (Phase Modulation) which is akin to FM.

The STRIKE generator contains 2 sinewave oscillators arranged as carrier and modulator pair (OP1 and OP2). When the switch above shows TRACK BODY PITCH the carrier, which is *always* heard, will follow the pitch set on the BODY generator. The alternative selection on this switch is FIXED AT MIDDLE C which is then the nominal static pitch.

The *actual* pitch of the carrier can be offset or detuned with the PITCH and FINE knobs. This means that if you set the nominal fixed pitch at middle C you can still have any pitch relative to this and it won’t track the keyboard.

Unlike many FM synths you can also bring up the Modulator output, using the OP2 LEVEL knob. This extends the versatility of the STRIKE generator system. There is no OP1 Level knob because you *always* hear it.

There are 3 knobs to control the Phase Modulation (PM).

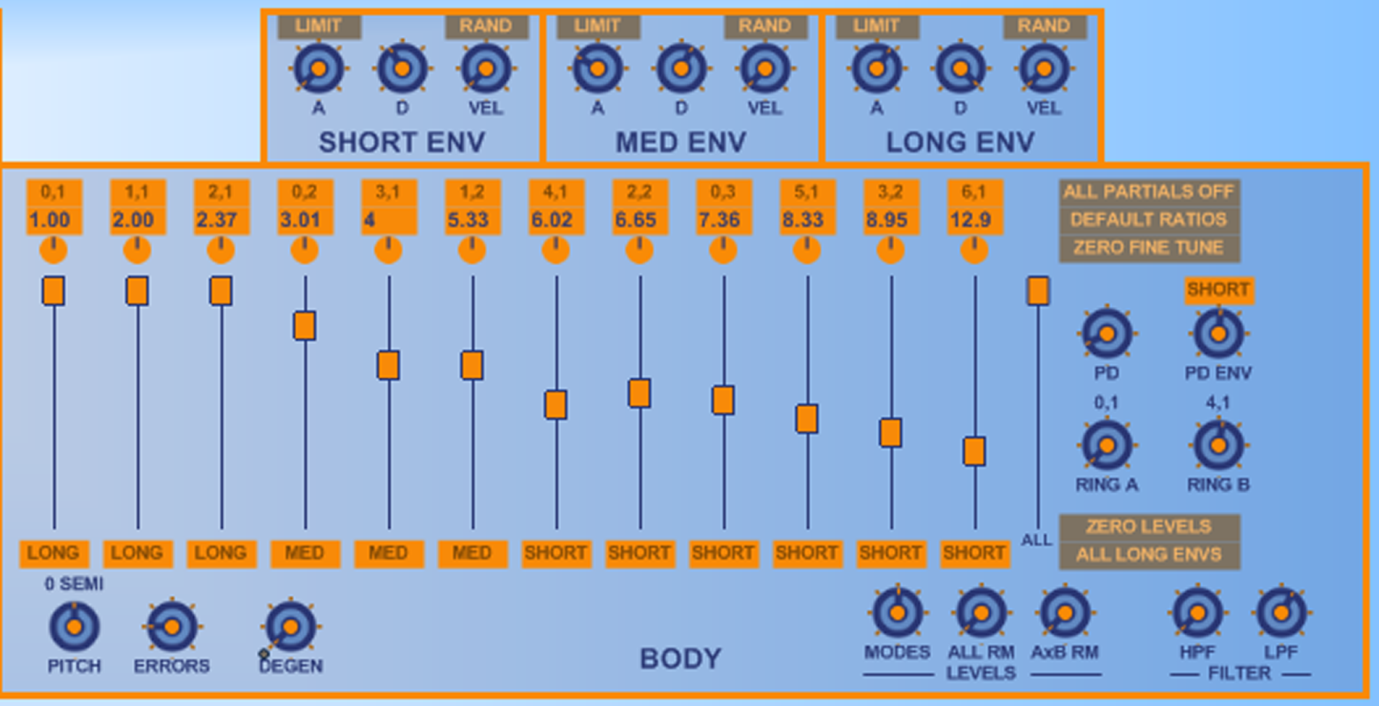
PM sets a *static* amount of phase modulation from Modulator to carrier (OP2 to OP1).

PM ENV allows the STRIKE ENV to add to the static setting, thus making it dynamically change the PM amount as the note decays.

PM OFFSET is where you set the pitch of the Modulator OP2. This is a relative or offset pitch based on the OP1 carrier’s pitch. In this way the timbre will be similar over the keyboard span rather than be different for every note.

PM (and FM) techniques generate partials either side of the nominal pitch. In many cases the lower ones may be undesirable. Additionally the higher ones can go too high. For this reason there are two 24dB/octave key-tracking filters provided which can strongly influence the timbre.

Tip: Start designing your preset with the HPF and LPF knobs as shown, and then adjust each one until the sound is suitable.



The other SYNTH generator available is the BODY, which would generally be used for the more sustained part of the sound (but it doesn’t have to be!).

The concept is a combination of additive synthesis using sinewave Partials combined optionally with Phase Modulation (PM) and Ring Modulation (RM).

The B-2 BELLY has 5 identical envelope generators of the percussive Attack-Decay type and 3 of them are used for the BODY. The Attack shape is linear and the Decay shape is exponential. The VEL knob sets the responsiveness to the incoming velocity as trimmed on the ALL ENVELOPES panel. When turned fully down the volume is always maximum and when turned up more the sound is quieter for softer key strikes.

If you turn on the LIMIT, the envelope will be limited at the level set on the ALL ENVELOPES panel, and will get a sustained flat top. It’s level-compensated, so the actual maximum volume will be constant.

If you turn on RAND the volume will vary randomly by the amount set on the ALL ENVELOPES panel.

Since this is an additive synth you can enter whatever ratios you want to experiment with, and make fine tuning to each one. If you want to start over again, using the nominal ratios for a typical bell, click the DEFAUL RATIOS and/or ZERO FINE TUNE buttons. The labels at the top of each slider give the vibration *mode number*, and are just for reference.

Each of the 12 partials has a level slider to get the amplitude balance which sounds right. You can set them all to zero with the ZERO LEVELS button. Also you can adjust them all together with the ALL slider (this will override previous slider settings).

One of the issues with additive synthesis is that different partials need to decay at different rates. Typically (but not necessarily) the higher frequencies will decay faster. I found by experimentation that 3 envelopes will suffice, and 4 or more is overkill and eats up more CPU without audible benefit. I’ve named the 3 *amplitude* envelopes SHORT, MED and LONG even though they all have the same operating range. This is to help with identification when selecting which envelope to use for which partial (chosen at the bottom of each slider).

Tip: I found it useful to start designing a sound with all partials set to the LONG ENV, then modifying as necessary. Just click the ALL LONG ENVS button to achieve this quickly.

The PD knob is for statically setting the amount of Phase Distortion. It affects all partials equally and at the minimum setting the partials are pure sine waves. As you increase the PD setting more of the output signal of each partial affects in own phase, thus producing a higher harmonic content at the start of the sound, fading as the decay progresses. This produces a broader spectrum of enharmonic partials when using the Ring Modulators and can add some extra “snap” to the sound.

The PD ENV knob can use one of the 3 ENVs to modulate the *amount* of Phase Distortion as set on the PD knob. This can be used to further emphasise the wide range of inharmonic partials a typical bell produces when first struck.

There are 2 Ring Modulator systems available which are level-set on the LEVELS knobs. RM ALL is a summation of successive pairs of partials being processed by 6 Ring modulators. The other is RM AxB and in this case you use the RING A and RING B knobs to select a pair of partials feeding a single separate Ring Modulator. This latter arrangement gives you full control of the Ring Modulator pair. Whereas the RM ALL is a more dense enharmonic sound, the RM AxB can be much better defined to maybe pick out a specific element for the sound.

There is a LEVELS mixer with 3 knobs. MODES is the signal generated by the additive synth (with optional PD) and the other two are for the two Ring Modulators.

PD and RM techniques create inharmonic partials above and below the nominal pitch. Often the lower ones are undesirable, especially for bell sounds. Also the higher ones can be too harsh. For this reason tracking HPF and LPF filter knobs are available to trim the bandwidth to taste.

Tip: Start designing with the HPF and LPF knobs to minimum and maximum respectively. Then adjust away from these settings until you hear a suitable timbre.

The PITCH knob sets the base frequency of the BODY generator so you can map it to the keyboard or the single note you choose to trigger the sound.

The accepted tolerance for the pitch of a bell is +/- 10 cents. In many cases, especially for older bells, this was never achieved even when first cast and turned. When you hear a peal of bells it’s often easy to pick out regular dissonances between individual bells. The ERRORS knob is used for simulating this situation. This knob brings in a fixed error table with one pitch offset per note. It’s not randomly generated in real time because any tuning error must always be the same for each strike. For “correct” tuning leave the knob at minimum. Turn up the knob to get more pitch variation errors. At maximum the variation can be up to +/- 25 cents and doesn’t sound nice!

The vibration modes of bells are often paired around a nominal value. This is due to many aspects of the structure, such as roundness and uniformity of circular thickness. This type of pairing is referred to *degenerate* and causes the beating sound often apparent when listening to bells carefully. The DEGEN knob simulates this effect by introducing a further set of 12 partial oscillators when the knob is not at minimum. The knob controls the pitch offset between the two sets of partials. For some sounds it’s not needed so turn it to minimum to save CPU.

Tip: You can also make partials degenerate by setting two pitch ratios very close together. This means less CPU at the cost of fewer partial values, but you do then have fine control over each degenerate amount.