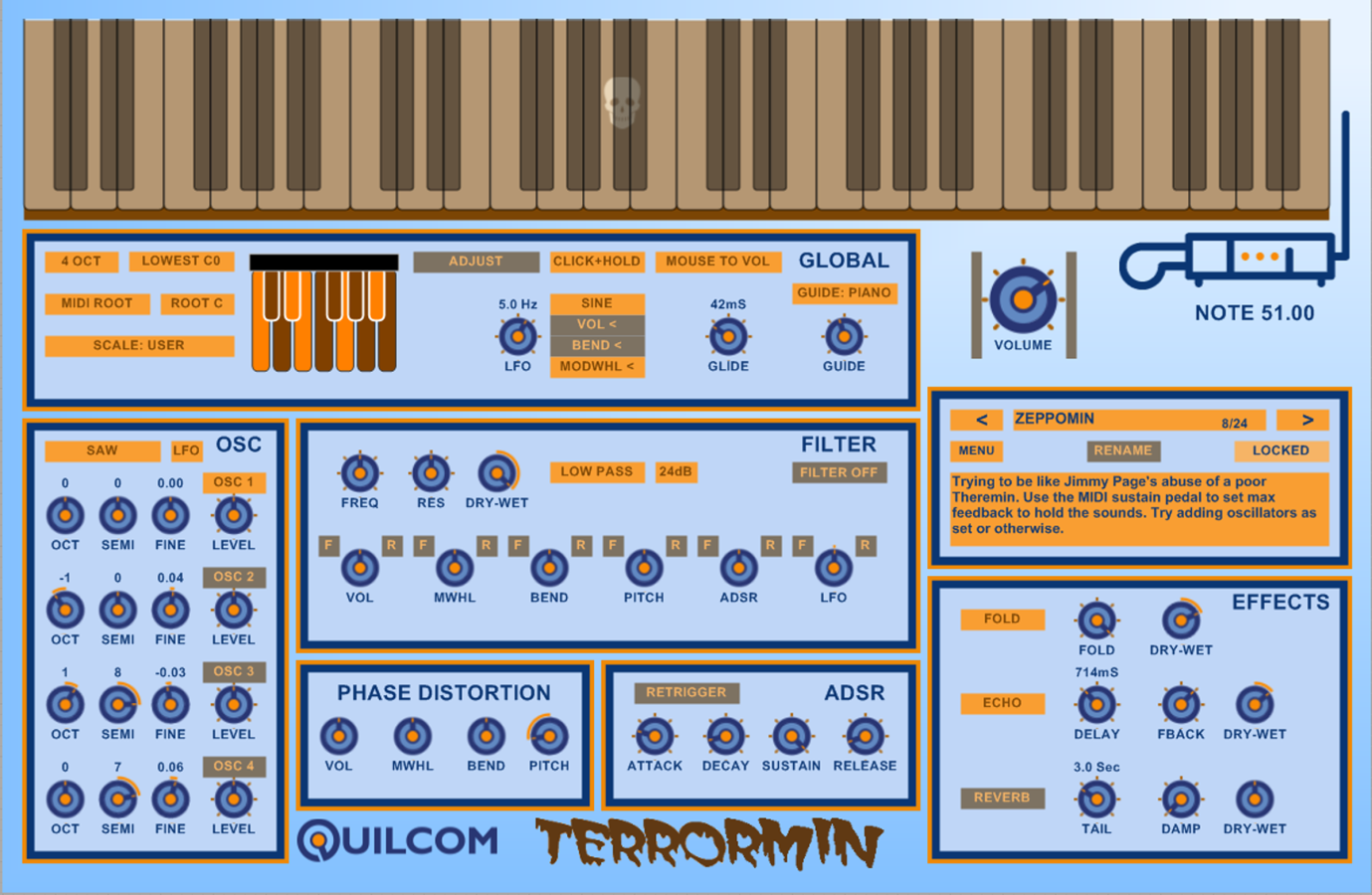
**The Quilcom TERRORMIN**



**Design**

Lev Sergeyevich Termen, better known as Léon Theremin, invented a fascinating device for playing music without touching the instrument. It was patented in 1928 and RCA took up mass production of what is the first electronic musical instrument. It was initially called the Thereminvox.

Using the principle of heterodyning, the proximity of one’s hand to the vertical aerial could change the pitch of an RF oscillator against a fixed one. By multiplication, a sum and difference signal is created, and the *difference* frequency is in the audio range. This creates a smoothly variable pitch under the player’s control. One might expect the waveform to be a pure sinewave but “shortcomings” in the valve oscillators and the multiplier meant that, at lower frequencies, there was a tendency for the fixed oscillator to pull towards locking. This produced phase distortion, meaning that lower pitches had more harmonics than higher ones, and this gave a more vocal or cello-like character to the sound.

A similar system is used with a horizontal loop aerial, and here the proximity of the performer’s other hand controls the volume of the sound. By raising the hand higher above the loop, the volume could be increased proportionally from zero to maximum.

Here is a video of him playing this wonderful instrument:

<https://www.youtube.com/watch?time_continue=50&v=_3H5JbkPXpw>

In the 1950s Bob Moog got interested and started making Theremins. Fast forward to today and we have the Moog Theremini which extends the principle considerably, and provided further inspiration for the TERRORMIN.

There are two main aspects to the instrument: the musical control and the sound generating system. I’ve tried to make the Terrormin as easy to play as possible, using the mouse and MIDI keyboard modwheel, pitch bend wheel and sustain pedal. In addition, in some situations, you can select notes on the MIDI keyboard to shift the root note of scales and chords.

It was tempting to go overboard with the synthesiser aspect, but I decided to keep it as simple as possible whilst retaining sufficient flexibility and range of tones available. Those who know and own FlowStone can easily add any extra features they might like.

Similarly, I’ve incorporated only 3 effects which I chose carefully to allow the production of classic Theremin sounds. Of course, further effects can be added in your DAW.

I made a YouTube video to demo the instrument:

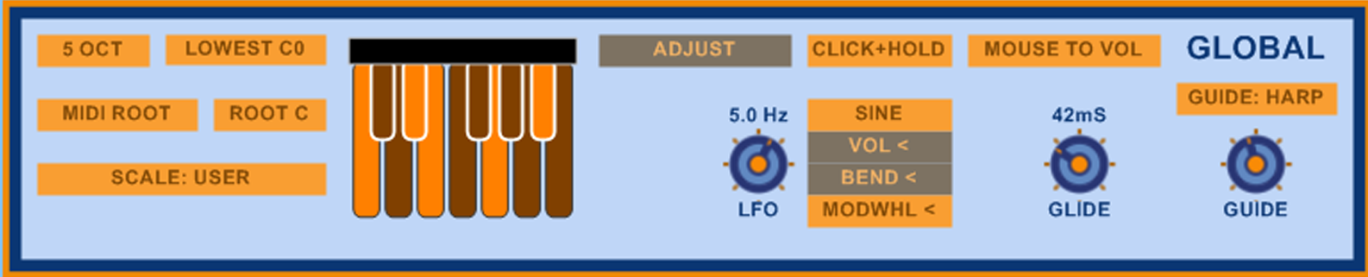
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What follows is a detailed description of the functions and operation of the plugin…

**The Play area and GLOBAL section**







The long panel at the top of the GUI is where you play the Terrormin. Moving the mouse to the right increases the pitch and moving the mouse towards the top can increase the volume if **MOUSE TO VOL** is selected in the **GLOBAL** section.

On the right of the **GLOBAL** section you can choose which type of **GUIDE** to see. The choice from the selector, here showing **GUIDE:HARP**, allows you to choose between **HARP** and **PIANO** as shown above. The **GUIDE** knob allows you to fade the guide to a brightness you like.

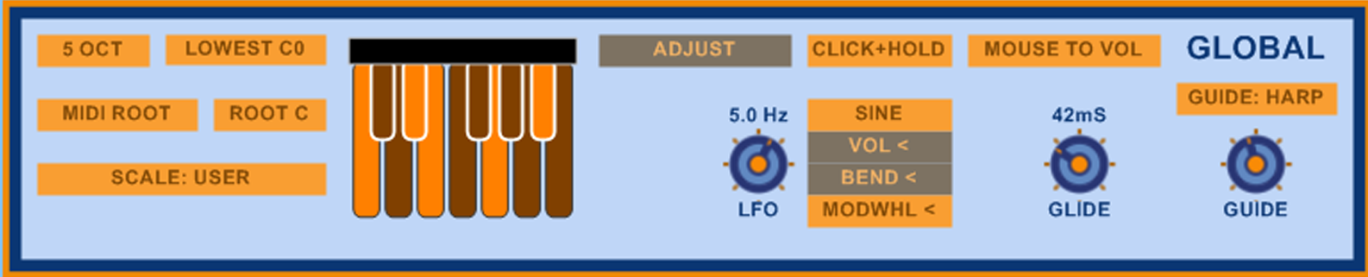
**GUIDE:PIANO** shows a keyboard layout to help locate the pitches you are aiming for. This is the best guide to use for **SLIDE** and **CHROMATIC** “scales”. If you choose the piano guide for scales, only the notes corresponding to a scale will play, but their spacing will be keyboard-based and so uneven for glissandos.

**GUIDE:HARP** differs in that it only shows the centre positions of each note *region*. The orange lines show the root notes per octave and the black lines the notes in-between. The Harp guide is better for scales since the spacing between consecutive notes is equal. This enables you to run smoothly up and down the available notes with equal temporal spacing. This is not like a “real” harp where you pluck the thin strings. The lines show the *centre* of a note’s region. However, like a real pedal harp, you decide on what notes make up the scale you can play, and the root note.

If you prefer to just use your ear for pitching, you might find the guide display distracting, so fully turn down the **GUIDE** knob.

The selector showing **MOUSE TO VOL** offers the alternative of **MODWHL TO VOL**. If this is chosen, you can use the MIDI keyboard’s modulation wheel to directly control the volume while your right hand sets only the pitch. This is actually more like a real Theremin’s operation.

The **GLIDE** knob is where you set the Portamento *time* between successive notes. If you have a scale other than **SMOOTH** set this can help iron out sharp pitch transitions to make you sound more professional!



On the left side of the GLOBAL section you set the parameters for the Play area:

**5 OCT** selector sets the range of the play area; the amount of octaves.

**LOWEST C0** sets the starting note (here “C3” is middle C). This means you could have say a 3 octave range starting at C3 for example.

**MIDI ROOT** enables you to choose between the note name taken from the *last* MIDI note played, or you can choose **SET ROOT** which keeps the scale root set by the **ROOT C** selector.

When **MIDI ROOT** is selected the **ROOT C** changes the note name as you play the MIDI keyboard, to dynamically change the root note while you play the Terrormin.

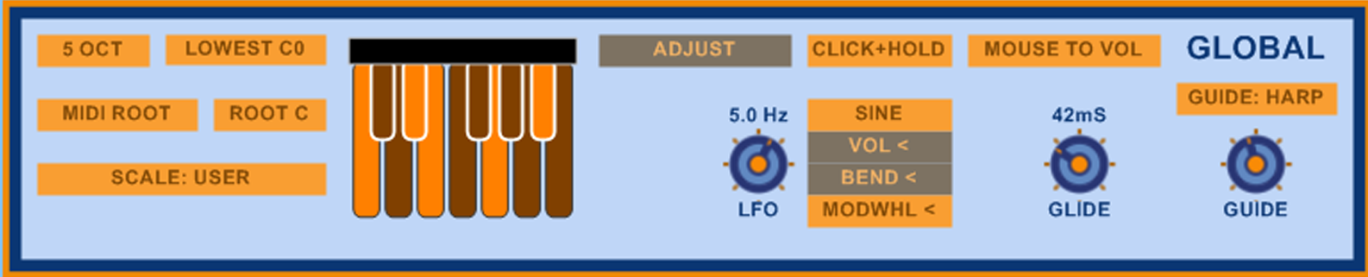
**SCALE:USER** is where you choose between **SLIDE**, **CHROMATIC** and a limited range of preset scales you might find useful. However, the real creative power comes into play when you select **SCALE:USER**. In this situation the on-screen keyboard will appear and enables you to set whatever notes you want to be available. The scale is always shown as C-based, but don’t forget you can transpose into any key want (see above). Also note that the C key is always on and represents the root note, which is always present.

The top bar on the scale keyboard toggles between all on and all off (except the root note), to make setting a bit quicker.

Note that if you select **SLIDE** or **CHROMATIC** the **MIDI ROOT** and **ROOT C** selectors are no longer visible because there would be no actual scale.

The selector here showing **CLICK + HOLD** provides 3 options for how the mouse is used in the Play area:

* **CLICK** means you click on a note region to start a sound. If you release, the sound fades according to the ADSR settings (see later). If you click and drag the pitch will change whilst dragging. *If you take the mouse outside the Play area the sound will be soft-muted.*
* **CLICK + HOLD** is the same as **CLICK** except the sound will hold *outside* the Play area.
* **HOVER** works more like an original Theremin and you don’t need to click with the mouse. Note that in this mode the ADSR isn’t available because you are in full control of the volume expression.



The **ADJUST** button is essential for adjusting the sound that you want. When turned on, the sound is held permanently so you can use the mouse on the other controls. Click it again to turn it off after adjusting. After turning on **ADJUST** you need to click somewhere in the Play area to play your note, which is then held on for you.

The Terrormin has a single **LFO**. Use the **LFO** knob to set the speed.

To the right of the **LFO** knob are a stack of buttons:

* The selector, here showing **SINE,** allows you to select from a range of **LFO** waveforms.
* **VOL <** connects the mouse vertical position to the LFO *amount*.
* **BEND <** allows you to use the MIDI pitchbend wheel to be pushed forward (not backwards) to vary the **LFO** *amount*.
* **MODWHL <** allows you to control the LFO *amount* with the MIDI modwheel.

You can use any combination of these routing buttons. The resulting amount will be the *sum* of any control signals fed to the internal **LFO** level control. The **BEND <** option is present in case you choose the modwheel to provide other function, such as volume etc.

**VOLUME**

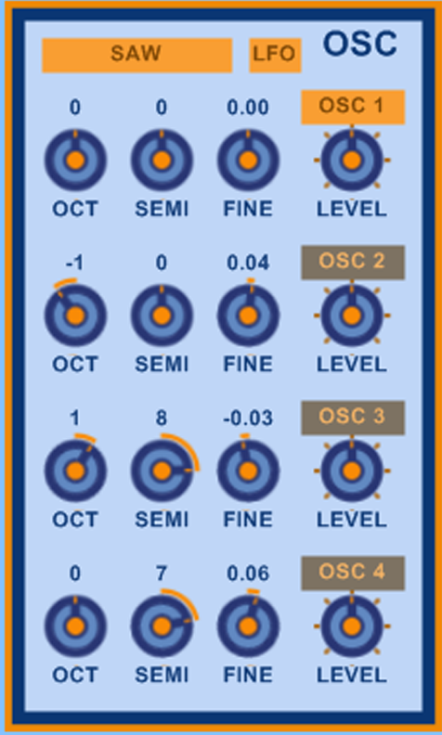


Guess what this does!

The vertical strips are average peak readouts for left and right outputs. They aren’t calibrated but do provide an indication. The sound generator system is mono but the REVERB is stereo, hence the two meters.

If there is a clipping peak the paler blue knob infill will turn red and hold for 1 second: It can happen that very short peaks are missed by you or the meters.

**OSC section**



There are 4 oscillators available. The waveform for *all* of them is chosen with the selector here showing **SAW**.

The **LFO** button turns vibrato (slow FM) on or off. The Vibrato is taken from the **LFO** (see above).

Each oscillator can be turned off or on from the **OSC** number button. This can be useful when setting up a sound to evaluate the contribution made.

You can individually tune each **OSC** using the **OCT**, **SEMI** and **FINE** knobs. The **LEVEL** knobs act as a mixer for the 4 **OSC**s

The 4 **OSC**s are identical apart from an additional feature in **OSC 4**: The **OSC 4** button is actually a selector. The top menu selection and the 2nd one both say **OSC 4**. The top one is OFF and the 2nd one is ON. The other selection options are **WHITE**, **PINK** and **BROWN** noise.

Tip: The original RCA Thereminvox produced a waveform most similar to the **PARABOLA** selection. Due to component tolerances, I read that no two Theremins sounded exactly the same!

**PHASE DISTORTION**



As mentioned before, the original valve Theremin behaved in a surprisingly “organic” way. The waveform produced varied across the note span, varying with pitch and amplitude. Having looked at what waveforms and descriptions I could find, it looked as though the principle process was phase distortion. The two valve oscillators would interact slightly, more so at lower pitches, and the single valve producing the “ring modulation” (multiplication) was far from sophisticated (using two grids, one for each signal). Without sampling a million notes we can only *simulate* the sound, but phase distortion of a sinewave or parabola wave seems to give pretty good results.

The 4 knobs in the **PHASE DISTORTION** section amount to a source mixer to control the amount of phase distortion. The mixed output is summed up and limited to an internal maximum.

Note **PHASE DISTORTION** is not FM or PM, since only the oscillators *output* is used to modulate its own phase. This gives rise to a “skewing” of the waveform to give more harmonics.

All four knobs are bipolar, so in the centre default position there is no modulation source passed through. This is useful since the original had more harmonics at lower pitch values and this can be achieved by setting the **PITCH** control as shown; *more* phase distortion at *lower* pitches.

Tip: If you use the modwheel for **LFO** *and* **PHASE DISTORTION** there is a greater range of expression available.

**FILTER**



This is a multi-mode filter. You can set the type using the selector, here showing **LOW PASS,** and choose between 24dB and 12 dB/octave

Below the **FILTER** label is a switch for turning the **FILTER** on or off (bypass).

On the top row of knobs you can set the centre (cutoff) frequency with the **FREQ** knob, the resonance with the **RES** knob and you can mix between filtered and unfiltered sources with the **DRY-WET** knob.

The bottom row of knobs amounts to a modulation source mixer, defined by the name of each knob.

Each knob features an **F** and **R** button, to determine whether the modulation source affects the **F**requency and/or **R**esonance of the **FILTER**. The modulation values for **F**requency and **R**esonance are summed and limited to an internally set maximum.

**ADSR envelope generator**



This **ADSR** envelope generator is for the loudness contour, and is also available to modulate the **FILTER** (above).

The **DECAY** and **RELEASE** phases are exponential.

If you turn the **RETRIGGER** button on, every *whole* pitch change will re-start the envelope.

The **ADSR** is replaced with a warning that it’s not available in **HOVER** mouse mode (see earlier). In **HOVER** mode it’s you, the player, who has full control of the level.

Please be aware that the instrument is monophonic; one note at a time only. This means that if you choose **RETRIGGER** you may not get what you would expect from a polyphonic synth. There is no new-note channel assignment, so the envelope will go from where it is currently, and start the **ATTACK** phase from that point. This becomes more apparent with longer attack and release times whereby it appears the retriggering isn’t working. So, it’s mostly useful for more “percussive” sounds.

**EFFECTS**



As mentioned previously, the 3 effects provided are for simulating common or classic Theremin performances. Obviously you can use whatever effects you want in the DAW.

The 3 effects are turned on/off with their label switches. When turned off, they don’t use any CPU (bypassed). The signal flow is top to bottom.

**FOLD**: This is a versatile distortion effect whereby if the signal exceeds the level set on the **FOLD** knob, that part of the waveform is inverted. The effect is bipolar and so affects negative and positive excursions equally. The effect simulates a seriously overdriven valve amplifier and can be useful for adding edge to higher volume positions. Whilst the actual level is limited to the **FOLD** setting it may *sound* louder due to more high harmonics being created.

Note that, of course, the **FOLD** is level sensitive, so adjusting other parameters on the Terrormin may mean changing the **FOLD** setting.

The **DRY-WET** knob allows you to mix between incoming dry and folded sounds.

**ECHO**: Echo is the most familiar effect for Theremin sounds.

**DELAY** adjusts thetime before the first iteration and **FBACK** adjusts the rate of decay of the repeats.

**DRY-WET** provides a balance between incoming dry sound and the delayed sound.

There is a special feature for the **FBACK** system: If you press the MIDI sustain pedal, the feedback is set to exactly 1 (infinite repeats) while the pedal is down. This means you can creatively manipulate the **ECHO** decay while playing. When the pedal is pressed the **FBACK** knob infill goes red to indicate infinite repeats.

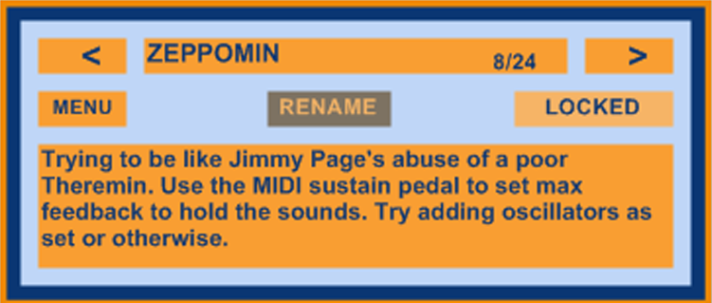
**REVERB:** This lovely sounding reverb was made by DSP expert Martin Vicanek (as were many of the internal modules). It’s a Feedback Delay Network system so avoids the typical colouration from comb filtering.

**TAIL** sets the time for the reverb to drop to -60dB.

**DAMP** sets the rate of loss of higher frequencies as the tail decays. With **DAMP** set at minimum the tail sounds bright for its whole duration.

**DRY-WET** balances the incoming signal with the effect signal.

**Preset Manager**



The TERRORMIN comes with 20 presets pre-loaded to demonstrate ideas which you can use as starting points, and hopefully for inspiration.

Click on the box, here showing **ZEPPOMIN**, to open the preset selection menu, or use the Left and Right arrow keys to page through them.

The **MENU** selector gives options to load/save individual presets or whole banks, and also to copy & paste existing single presets to new locations.

If you want to add or edit the comments, just click inside the comments box. If you save a preset the comment will be saved along with the preset. Please avoid using newline/enter because the comment has to be a single paragraph.

The **LOCKED** button, if lit, prevents the DAW from saving any edits you make to a preset in the song. This can be useful if you are experimenting, but don’t wish to make any changes permanent within the DAW project file (you can’t overwrite the factory presets hard coded inside the plugin).

The **RENAME** button is only available when **LOCKED** is *off* and is used to name or re-name the preset.