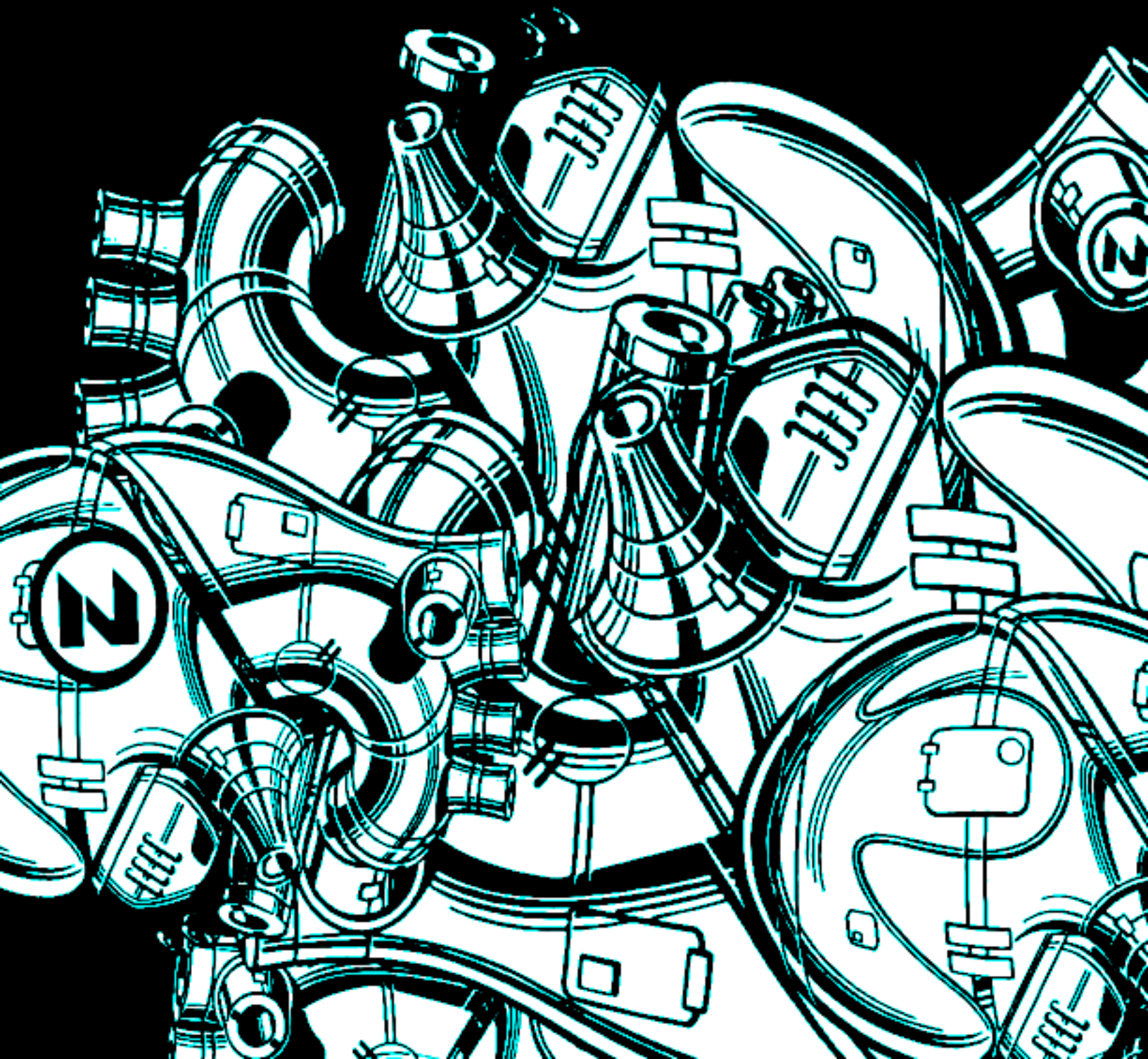
ORGONE ACCUMULATOR



ORGONE ACCUMULATOR USER GUIDE

(firmware version 2.0 beta)

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INTRODUCTION

The Orgone Accumulator (OA) is a digital phase-accumulation oscillator module capable of creating a wide range of timbres, from classic subtractive-synth-style sounds, to PPG-wavetable stuff, and hardcore FM!

Basic operation involves the mixing of a core of three waveforms, which can be dynamically scanned, and applying modulation and effects to produce otherworldly noises. Of course, you don't have to get crazy; the OA will happily produce pedestrian oscillations.

The OA isn't "just" another Eurorack oscillator, though. The on-board effects add another deep layer of tweakability and sound-shaping. Select one of these eight effects and enable it on any or all of the wave-slots: detune, twin (doubling), distortion (two types), chord, spectral, or delay. Each effect's parameters are bipolar, which means the sound can vary wildly depending on which way you turn that knob.

There's even a fully-featured drum-synthesis mode, which allows you to shape the Orgone's sounds into expressive, percussive noises.

Then there's the Pulsar mode, which can be enabled on top of most modes. Based on "pulsar synthesis," you can manipulate "particles" of sound.

You can manipulate the madness by attaching CV sources to the four inputs for **POSITION**, **EFFECT**, **INDEX**, and modulation **FREQUENCY**. Adjust the bipolar, invertable attenuators ("attenuverters") for these controls and listen to the module accumulate that intense orgone energy!

Conveniently, the Orgone Accumulator has built-in non-volatile memory to retain your settings on power-down.

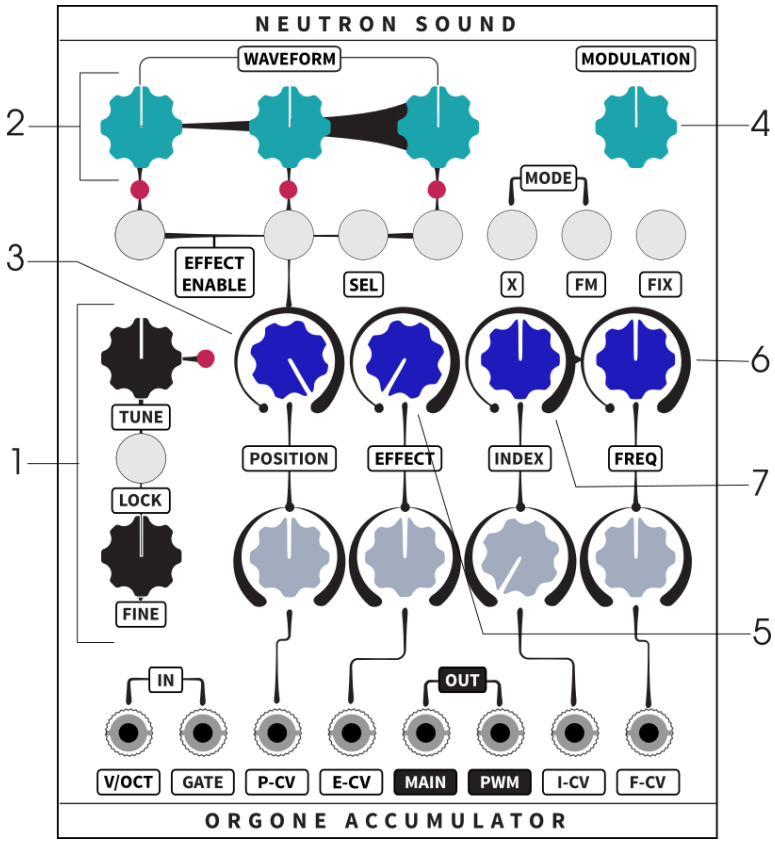
Now that you know what the OA can do, let's learn how to do it. Read on...

QUICK START

The Orgone Accumulator can be daunting at first because it has so many controls and modes. Although it's classified as an "oscillator," it's really an entire synthesizer--with multiple synthesis methods, EFX, etc.--in one module. The best way to enjoy the OA is to simply reach out and tweak, but here's a simple patch to get you started.

- ➔ Set up a standard synth-voice patch with the OA as the oscillator: connect the **MAIN** out to a filter or VCA, have that controlled by an envelope triggered by a keyboard or sequencer, and take the audio output to a mixer
- ➔ Connect a 1V/octave source such as a sequencer or keyboard to the **V/OCT** input
- ➔ Initialize the OA settings by making sure all buttons (the three **EFFECT ENABLE** buttons, **FM**, **X**, and **LOCK**) are in the UP position (disabled)
- ➔ Further, turn **INDEX** and **POSITION** fully counter-clockwise (to the left), and make sure the "**A**" wave selector (the first one) is anywhere but all the way to the right (that waveform is silent)
- ➔ With these initialized settings, play around with your keyboard or sequencer, adjusting the **A** wave selector
- ➔ Turn the **POSITION** knob and notice that the sound transitions from one waveform to the next
- ➔ Adjust the other two wave selectors ("**B**" and "**C**") and continue to scan the position with the, er, **POSITION** knob
- ➔ Now, play with **INDEX** and **FREQ**. They are the modulation amount and frequency, respectively. They work in conjunction with the **MODULATION** (shape) knob
- ➔ Turn **INDEX** and **FREQ** back down and enable the **FM** button
- ➔ Twist **INDEX** back to about 12 o'clock and steadily increase **FREQ**--hey, that's FM!!
- ➔ Enable the FX on all three waves (**EFFECT ENABLE**) and mess around with the **EFFECT** control (refer to the section on effects for full details)
- ➔ Finally, insert a CV source into **POSITION**, **EFFECT**, **INDEX**, or **FREQ**, adjust the input attenuverter, and listen to those parameters be modulated!

DESCRIPTION OF CONTROLS: KNOBS



1: TUNE and **FINE** pitch-control: The former has a range of 3 octaves in semitone steps, the latter has a 4 semitone range. Continuously variable.

2: A, **B**, **C** wave selectors: These select the waveform played in each of the 3 positions. Some of the waves are different in normal, FM, and pulsar modes. The selectors have stepped or smooth transition depending on the active effect.

3: POSITION: Controls a 3-way mixing scanner that fades between the 3 wave positions. The position is indicated by the LEDs below the main wave selectors. The attenuverters for this control, as well as EFFECT, INDEX, and FREQ, are the four knobs in the lower row.

4: MODULATION wave selector: Determines the shape of the wave that is used with the modulation modifier. Some are different depending on mode (context aware.)

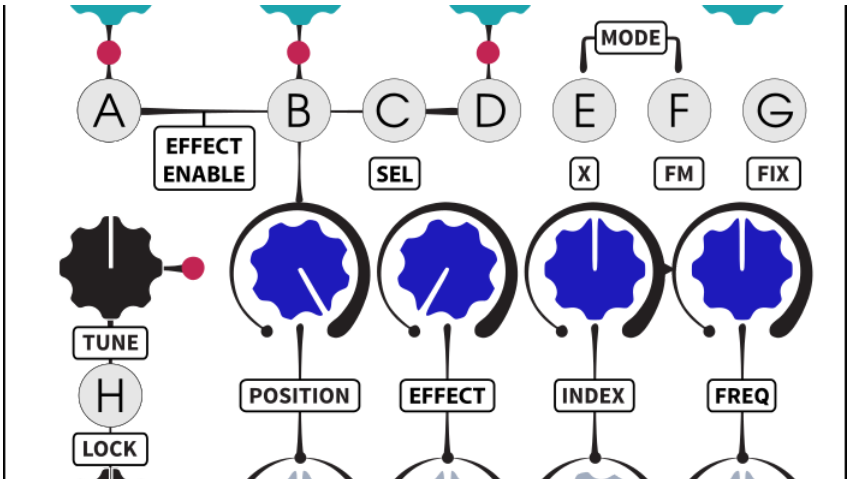
5: EFFECT: A bipolar control for the active effect. There are variations for positive and negative values (see the section on effects for more details.)

6: (Modulation) **FREQUENCY**: Controls the frequency of the modulator. Adjust INDEX to hear an effect on the current sound.

7: INDEX: Controls the amount of modulation in normal and FM modes.

Note: Some controls change in Pulsar mode (**LOCK = ENABLED**). See Pulsar section for details.

DESCRIPTION OF CONTROLS: BUTTONS



A, B, D: EFFECT ENABLE Enables the effect for the associated wave slot, **A, B** or **C**.

C: SEL Cycles through the eight on-board effects. The LEDs will light up in a binary pattern to indicate the effect. (See the section on effects for full details.) The effect selection is retained when the power is turned off.

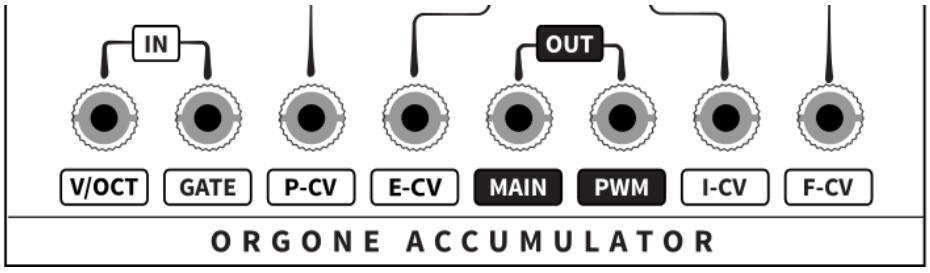
E: X MODE Modifies the behavior of the **C** wave selector. When enabled, **C** will use slot-**B**'s wave and will turn the control for slot-**C** into a pitch-bender of sorts. Knob to the right, the pitch is raised; to the left, it is lowered as POSITION is swept toward **C**.

F: FM MODE Turns on FM mode. Enables different waves for the three wave selectors. The modulation frequency is quantized.

G: FIX When enabled, the modulator no longer tracks the v/oct input and tune controls. When this and **FM** are enabled, the quantization of the FM frequency is disabled, allowing for more range (from LFO range to high-frequency.)

H: TUNE LOCK Turns Pulsar mode on. See the section on Pulsar for more information. (The TUNE LOCK's original function may be restored by editing config.h in the firmware. Look for "`TUNELOCK_SWITCH`".)

INPUTS AND OUTPUTS



V/OCT: Standard 1 volt per octave input for pitch. Over 4-octave resolution. Typical inputs: CV keyboard, LFO, sequencer CV output.

GATE: A trigger or gate signal here sets all the oscillators to zero phase (including those used by the effects), and also triggers the drum effect. Trigger level is about 1.6v.

MAIN: The main output. The hole that matters most.

PWM: A rather crude, 1-bit PWM sub-oscillator. The pulse width varies from 50% to about 4% with the index control.

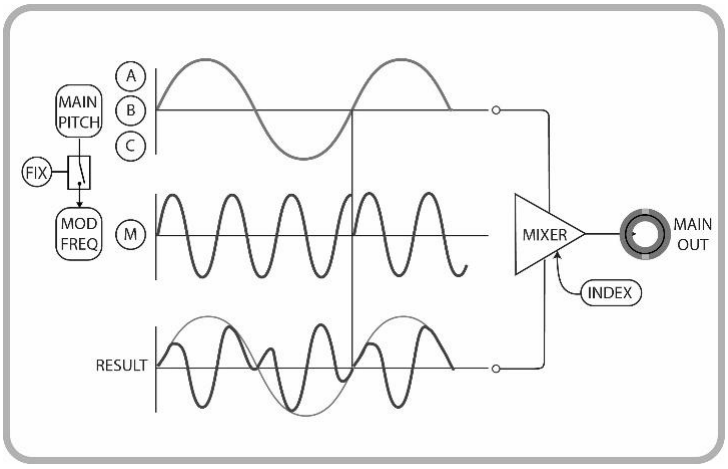
P-CV, E-CV, I-CV, F-CV: Control voltage inputs for the attenuverter controls. **POSITION**, **EFFECT**, **INDEX**, and **FREQ**, respectively. Typical inputs: LFO, ADSR, sequencer output.

- ➔ **About polarity**: Although the CV inputs (P-CV, E-CV, etc.) are bipolar and accept signals like +/-5V LFOs, the controls (the knobs controlling **POSITION**, **INDEX**, **FREQUENCY**) are positive-going, except for **EFFECT**. If you apply a bipolar signal to a CV input, but the knob for that control is zero, only the positive portion of that bipolar signal (an LFO, for example) will affect the parameter (assuming the CV attenuator is to the left of 12 o'clock.) To the right of center, the attenuverter inverts the control signal.
- ➔ **About CV-input normalization:** It is possible for the **EFFECT**, **INDEX**, and **FREQUENCY** parameters to be controlled by the POSITION CV input (**P-CV**) when no jacks are connected at the other CV inputs. On older boards (green), that is the default behavior, and a trace has to be cut to modify it. On newer boards (black), there is a jumper near the bottom left of the board. It may be a switch, jumper or just a wire depending on the builder's preference.

SYNTH MODES

The Orgone Accumulator has a lot going on “under the hood.” This section will provide information on the signal-flow and synthesis methods of the OA.

➔ NORMAL MODE

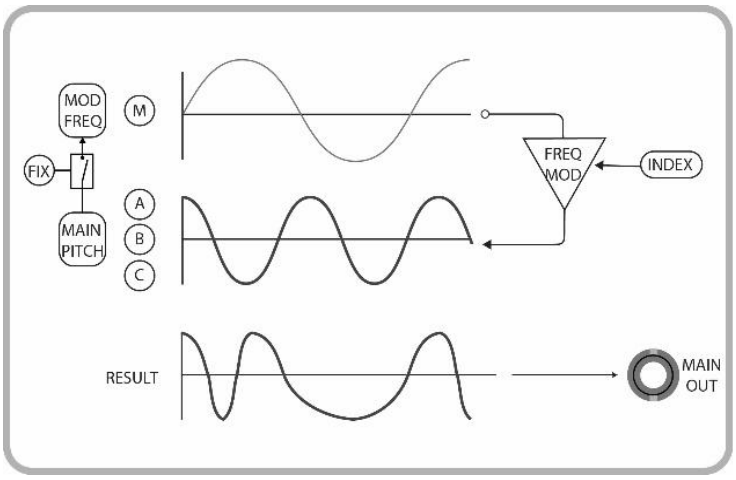


Three oscillators are mixed in a ratio controlled with **POSITION**. The output amplitude-modulates the **MODULATION** oscillator, which is also synced to the main pitch.

INDEX controls the mix between A, B, C and the modulated version of that mix.

FIX decouples the frequency of the modulator from the main pitch.

➔ FM MODE

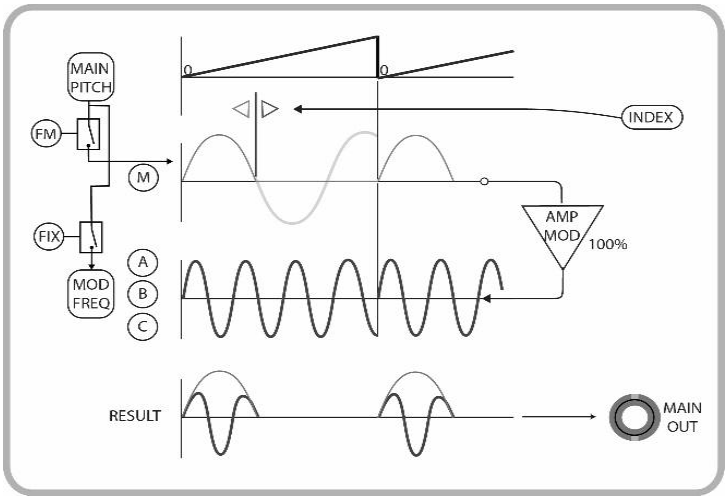


This is a simple FM mode.
FIX decouples the frequency of the modulator from the main pitch, which can allow for more “atonal” sounds.

With **INDEX** turned down, normal and **FM** modes are the same, but with a different set of waves in some slots of the A, B, and C wave selectors.

SYNTH MODES (CONT'D)

➔ PULSAR MODE



This mode is based on a synthesis method proposed by Curtis Roads, first described in "Sound Compositions with Pulsars" (http://is.gd/0eIA7N, 2001). Basically, a pulsar is made up of a particle of sound ("pulsaret"), which is shaped by an envelope whose duty-cycle and frequency can be manipulated.

The main pitch controls a dummy oscillator which in turn controls a synced pulsar-oscillator. This pulsaret (the basic waveform) is constructed from the mixing of A, B, and C oscillators. The frequency of the pulsar envelope is controlled by **FREQ**; the waveshape, by **MODULATION** (half-wave rectified versions).

INDEX controls the duration of the pulsar envelope in relation to the main pitch. FIX decouples the *frequency* of the modulator from the main pitch, whereas FM decouples the pulsar-envelope *duration* from the main pitch.

Pulsar mode is like another layer of synthesis that can be enabled on top of everything already going on, including effects.

This mode cannot be enabled with drum mode.

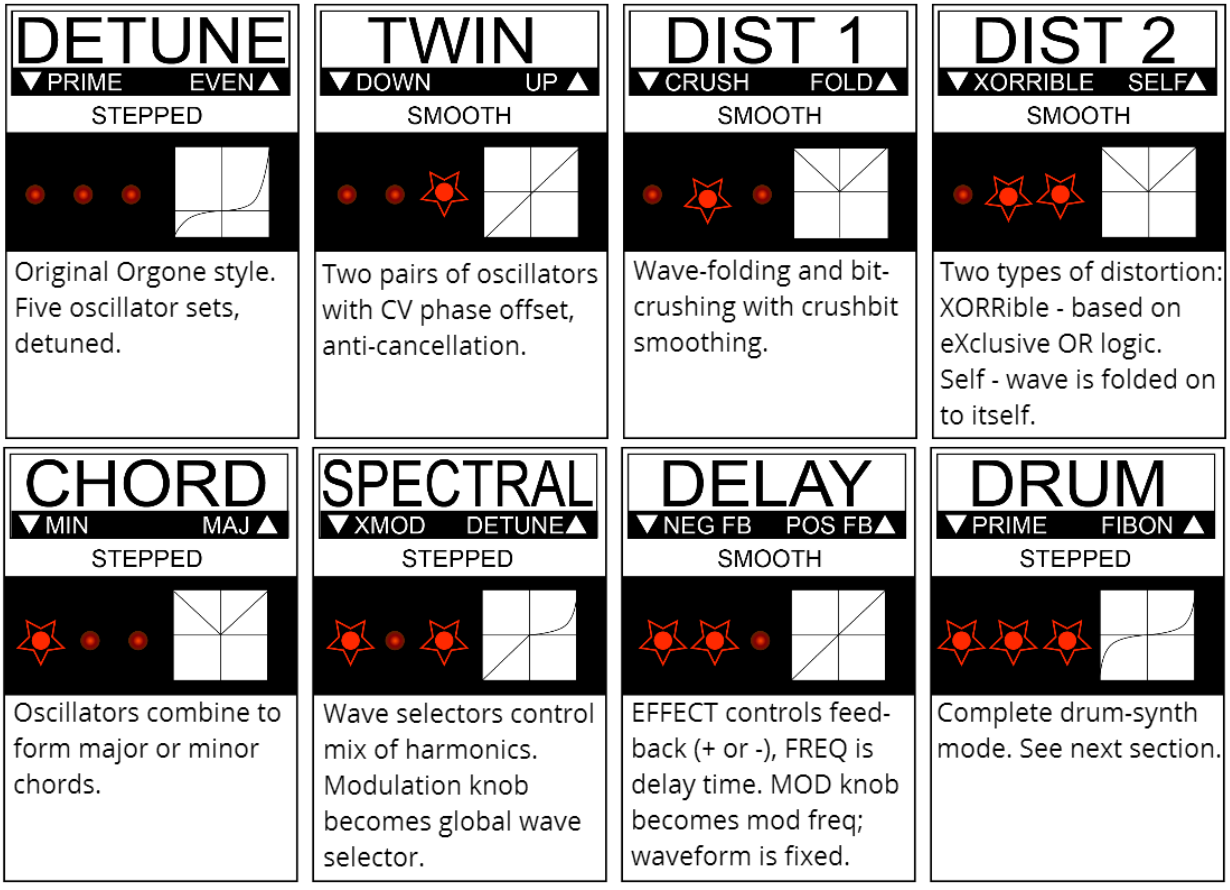
➔ DRUM MODE

Drum mode is a special Orgone Accumulator mode which is accessed via the effects section. Read more about it on pages 10 and 11.

EFFECTS

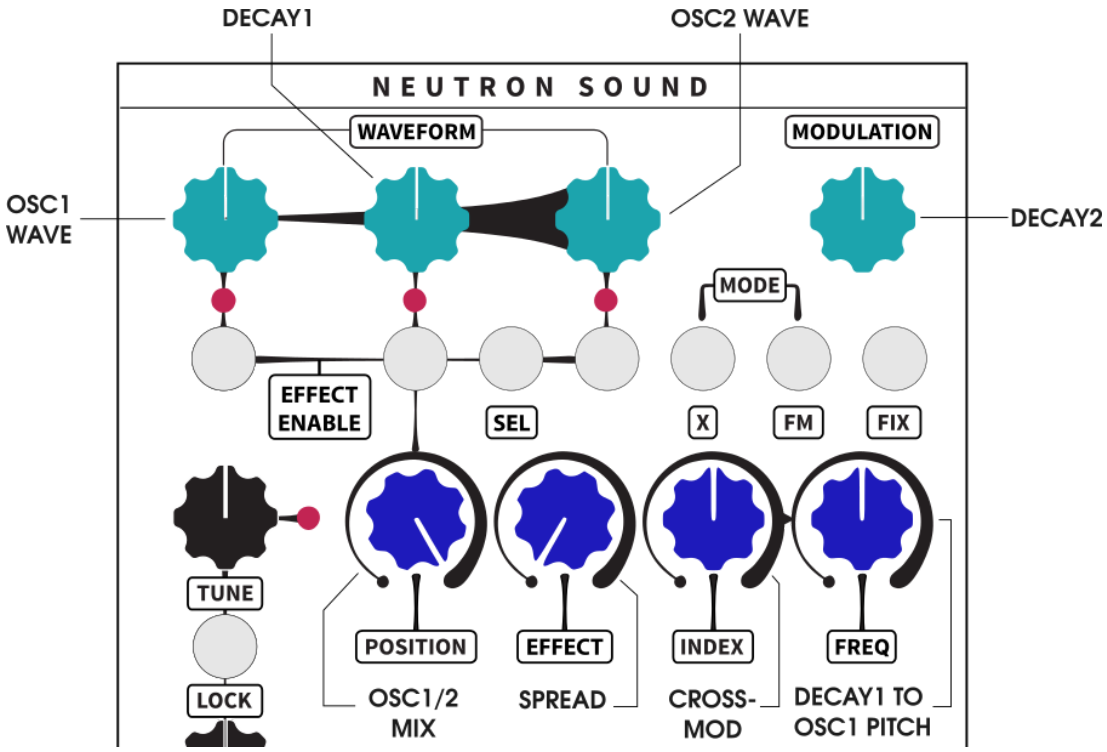
Effects are a huge part of the Orgone Accumulator experience. To explore each one, press the **SEL** button. The setting will be saved after five seconds and be remembered on power-up.

The binary pattern of LEDs indicate which effect mode is active. If you don't know binary, don't worry; either refer to this chart or remember the LED pattern of the effects you like most.



DRUM MODE

Drum mode is the eighth effect mode (all three **EFFECT ENABLE** LEDs = ON). It transforms the Orgone Accumulator from an oscillator to a complete drum-synth voice.



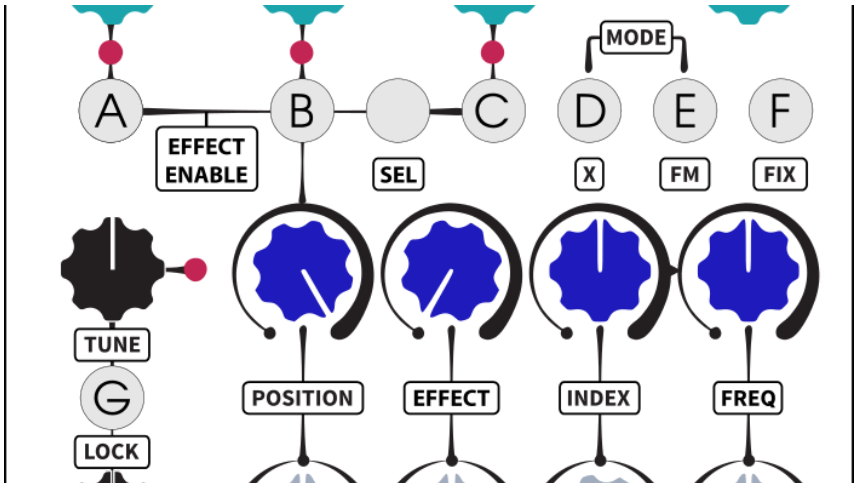
Two oscillators form the basis of the sound: the first functions just like normal Orgone mode with a single oscillator (wave-shape is selectable with wave-selector knob **A**). The second can be "spread" out with the (bipolar) **EFFECT** control. Turn the knob counter-clockwise and you'll hear "**Prime**" tuning (based on prime numbers); turn clockwise and you'll get "**Fibonacci**," based on numbers in the Fibonacci series.

When used in conjunction with the **INDEX** control, the second oscillator becomes chaotic and noisy; an essential percussion building-block.

Further shaping is done with the two envelope controls (formerly the controls for wave-selector **B** and **MODULATION**) and the **FREQ** knob, which acts as oscillator 1's pitch-envelope amount.

POSITION controls the mix-ratio between OSC1 and OSC2.
Of course, all CV inputs are fully-functional in this mode.

DRUM MODE (CONT'D)



The following describes what happens when you engage the buttons in drum mode:

A: EFFECT ENABLE A Scales the decay time (DECAY1) according to OSC1 pitch.
B: EFFECT ENABLE B Holds open OSC1's amplitude to add "body."
C: EFFECT ENABLE C FREQ and DECAY2 affect the pitch of OSC2.
D: X MODE FREQ CV input will control DECAY2 time.
E: FM MODE DECAY2 modulates cross-modulation amount.
F: FIX OSC2 pitch is fixed, controlled with the **TUNE** knob, but not the 1v/oct input.
G: TUNE LOCK INDEX CV input will control DECAY1 time.

TROUBLESHOOTING

Sometimes, silence will fall. It was decided to allow a wider range of sounds with the possibility of silence (and sometimes nasty, awful noises), rather than be "safe" and boring. That's part of the magic of Orgone energy. Here are some possible reasons for silence or very quiet operation, and other strange things you may encounter.

➔ There is silence or gaps in sound.

Solution: There is a "nothing" wave at the top position on the A wave-selector. This can be useful for swells and dynamic control without a VCA. Turn the **A** wave selector or **POSITION** control to an actual waveform.

➔ Drum mode (all three LEDs = ON) doesn't do anything.

Solution: Much like a real drum-module, the OA needs a trigger or gate signal to make a sound. Insert a trigger/gate signal into **GATE**.

➔ Thin or quiet sound in **PULSAR** mode.

Solution: In pulsar mode, it is possible for the envelope to become so short that there is nothing to hear. Turn **INDEX** up, turn **FIX** and **FM** on or off, increase **FREQ**.

➔ The MODULATION knob has no effect.

Solution: **INDEX** knob (essentially, the modulation depth) may be near zero. Turn it up, along with the **FREQ** control.

➔ Quiet or "thin" output in the "detune" effect mode.

Solution: Some of the more complex waves can phase-cancel themselves out. As they say, "It's not a bug, it's a feature!" This feature can be exploited by using the GATE input to reset the oscillators. The result is a phasing, "pluck" type of sound, with the speed of decay controlled by the **EFFECT** control. (Note: quiet output in the "chord" effect mode is possible, too. This is normal.)

➔ The pitch wobbles or bends when you sweep the POSITION knob to the right.

Solution: **X** mode may be on. In normal mode, it serves as a pitch bender. If you don't like it, disable it or center wave-selector **C**.

CREDITS AND REFERENCES

CREDITS

ORGONE ACCUMULATOR CIRCUIT DESIGN: Jim Matheson of Neutron Sound, with additions in the retail version (coming soon) by William Mathewson, of WMD (https://www.wmdevices.com/).

CONTROL, PANEL LAYOUT, AND ART: Jim Matheson

RETAIL CIRCUIT BOARD DESIGN: William Mathewson

PROGRAMMING: Jim Matheson

PCB AND COVER ART: Kris Northern

MANUAL, ART EDITING: Derek Lee (http://www.glitched.org) and Jim Matheson

IMPORTANT WEBSITES AND REFERENCES

ORGONE ACCUMULATOR PROJECT WEBSITE: http://neutron-sound.com/noa.html

MUFF WIGGLER MUSIC DIY SUBFORUM:
https://www.muffwiggler.com/forum/viewforum.php?f=17

GITHUB PROJECT REPOSITORY: https://github.com/jakplugg/neutron-sound

OA SOUNDCLOUD PLAYLIST:
https://soundcloud.com/neutron7/sets/tracks-made-with-the-orgone

ABOUT DIRECT DIGITAL SYNTHESIS (DDS):
http://electricdruid.net/direct-digital-synthesis/

ABOUT PULSAR SYNTHESIS: http://is.gd/0eIA7N (PDF)

ABOUT FM SYNTHESIS: https://en.wikipedia.org/wiki/Frequency_modulation_synthesis