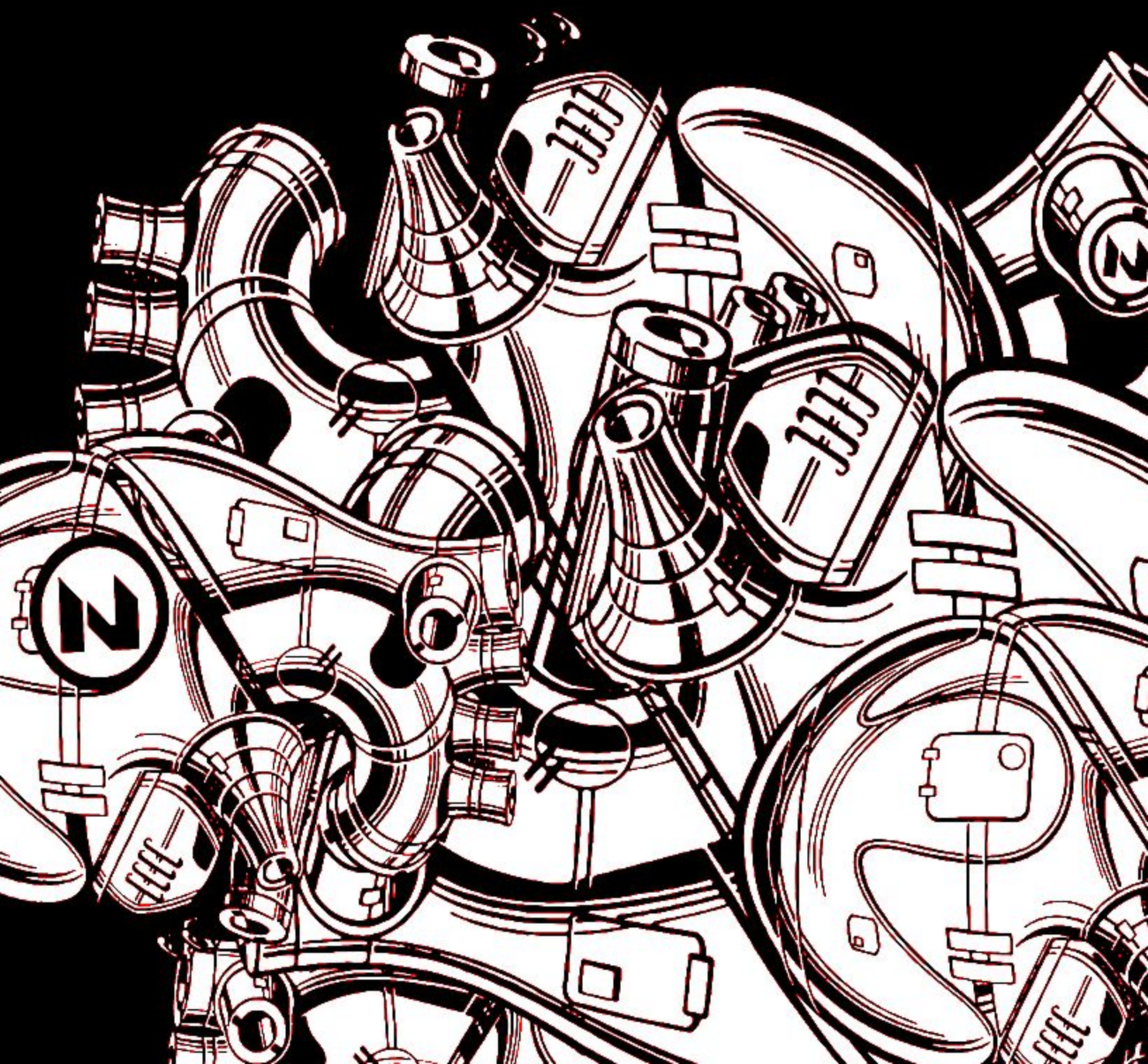


# ORGONE ACCUMULATOR



# ORGONE ACCUMULATOR USER GUIDE

## TABLE OF CONTENTS

Introduction	<i>About this module</i>	2
Quick Start	<i>Begin here</i>	3

### DESCRIPTION OF CONTROLS

Knobs	<i>14 of them to wiggle</i>	4
Buttons	<i>Enable FX, FM, Pulsar, and more</i>	5
Inputs and Outputs	<i>Signals go in, sound comes out</i>	6

### THE ORGONE ACCUMULATOR

Synth Modes	<i>Normal, FM, and Pulsar</i>	7-8
Effects	<i>Eight awesome, controllable FX</i>	9
Drum Mode	<i>A fully-featured drum-synth</i>	10-11

### CONCLUSION

Troubleshooting	<i>Get help here</i>	12
Credits and References	<i>They made this possible</i>	13
FX Cheat Sheet	<i>Cheat with this sheet</i>	14

# 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 inputs for **SCAN**, **EFFECT**, **INDEX**, modulation **FREQUENCY**, and the four oscillator waveshapes: **A**, **B**, **C**, and **MODULATION**. 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.

All this creative power is at your fingertips thanks to an original circuit-design, centered around the ARM Cortex M4 microprocessor, the brains of the operation.

So, now that you know what the OA can do, let's go in-depth...

# 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**, **CX**, and **TUNE LOCK**) are in the UP position (disabled).
- Further, turn **INDEX** and **SCAN** 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 **SCAN** 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, **SCAN** 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 (**FX ENABLE**) and mess around with the **EFFECT** control (refer to the section on effects for full details).
- Finally, insert a CV source into **SCAN**, **EFFECT**, **INDEX**, or **FREQ**, adjust the input attenuverter, and listen to those parameters be modulated!



# DESCRIPTION OF CONTROLS: KNOBS

**1: 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.

**2: SCAN:** 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.

**3: 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.

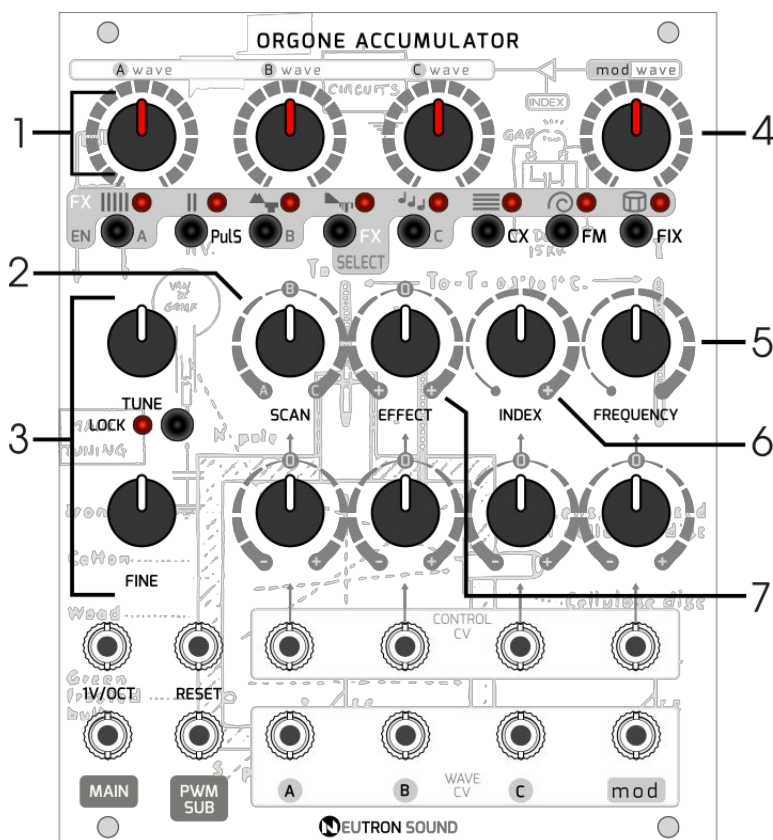
**4: MODULATION** wave selector: Determines the shape of the wave that is used with the modulation modifier. Some are different depending on mode.

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

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

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

**Note:** Controls change in Pulsar and Drum modes. See those sections for details.



# DESCRIPTION OF CONTROLS: BUTTONS



**FX EN(able) A, B, C:** Enables the effect for the associated wave slot, **A**, **B** or **C**.

**Puls** Turns Pulsar mode on. See the section on Pulsar synthesis for more information.

**FX SELECT** This is how you select an, um, effect. Press the button and choose one of the eight, awesome effects. The selection is retained when the power is turned off. (See the section on effects for full details.)

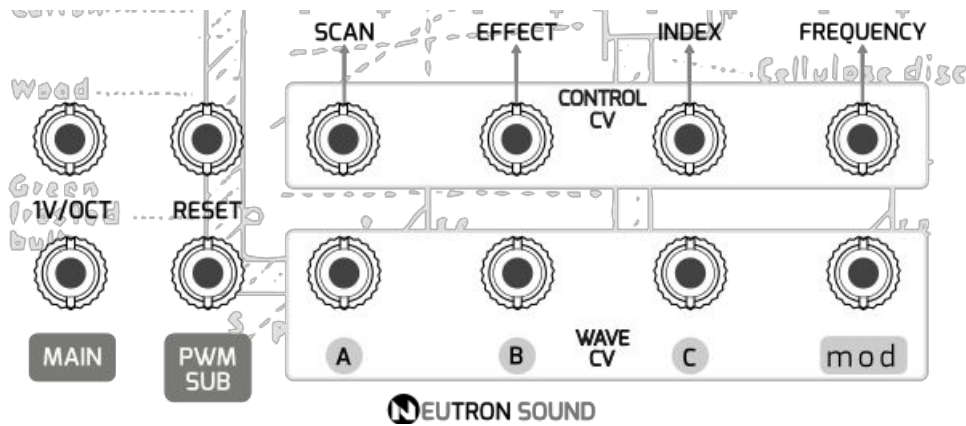
**CX MODE** Modifies the behavior of the **C** wave selector. When enabled, **C** will use slot-**B**'s wave and will turn the control for slot-**C** into a pitch-bender of sorts. Knob to the right, the pitch is raised; to the left, it is lowered as **SCAN** is swept toward **C**.

**FM MODE** Turns on FM mode. Enables different waves for the three wave selectors. The modulation frequency is quantized in relation to the pitch.

**FIX** When enabled, the modulator no longer tracks the 1V/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.)

**TUNE LOCK** Disables the tuning controls to prevent accidental adjustments while wiggling.

# INPUTS AND OUTPUTS



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

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

**CONTROL CV:** Control voltage inputs for the attenuverter controls. **SCAN**, **EFFECT**, **INDEX**, and **FREQ**, respectively. Typical inputs: LFO, ADSR, sequencer output.

**A, B, C, MOD WAVE CV:** Use a control voltage to change the waveshapes of these oscillators.

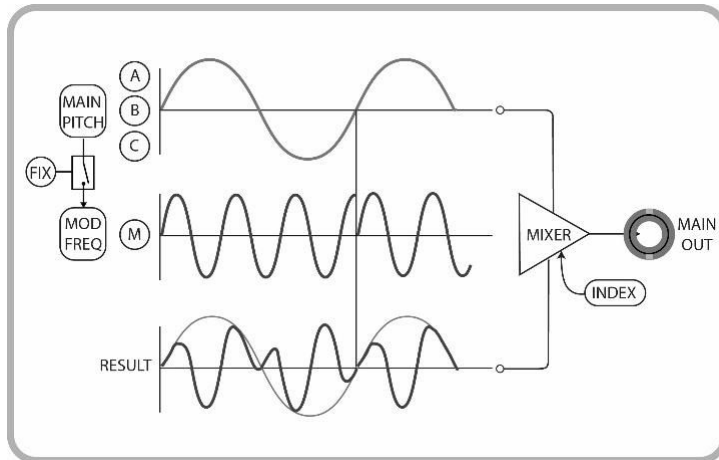
→ **ABOUT POLARITY:** Although the CV inputs are bipolar and accept signals like +/-5V LFOs, the controls (the knobs controlling **SCAN**, **INDEX**, **FREQUENCY**) are positive-going, except for **EFFECT**. If you apply a bipolar signal to a CV input, but the knob for that control is zero, only the 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:** **EFFECT**, **INDEX**, and **FREQUENCY** parameters can be controlled by the **SCAN** CV input when no jacks are connected at the other CV inputs. There is a switch at the back of the OA, near the jacks, if you wish to enable or disable this feature. Switch to the right enables normalization; to the left disables it.

# 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

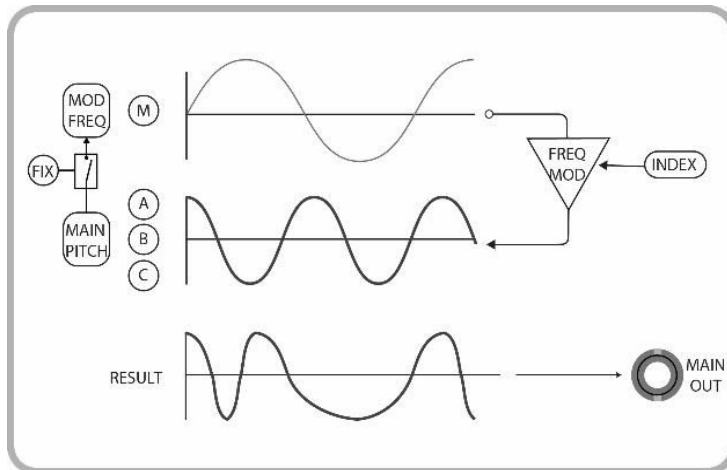


Three oscillators are mixed in a ratio controlled with **SCAN**. The output amplitude-modulates the **MODULATION** oscillator, which is also synced to the main pitch.

**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.

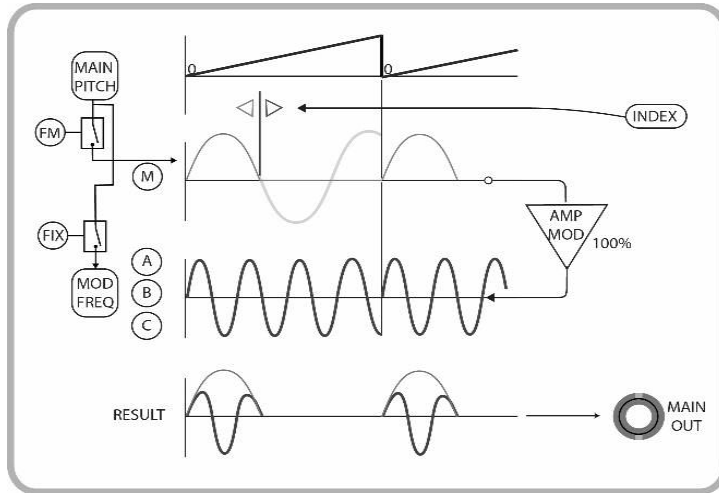
**FIX** decouples the frequency of the modulator from the main pitch, which can allow for more “atonal” sounds.

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/0elA7N>, 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 the eight effects, press the **FX SELECT** button and choose one. The setting will be saved after five seconds and be remembered on power-up.

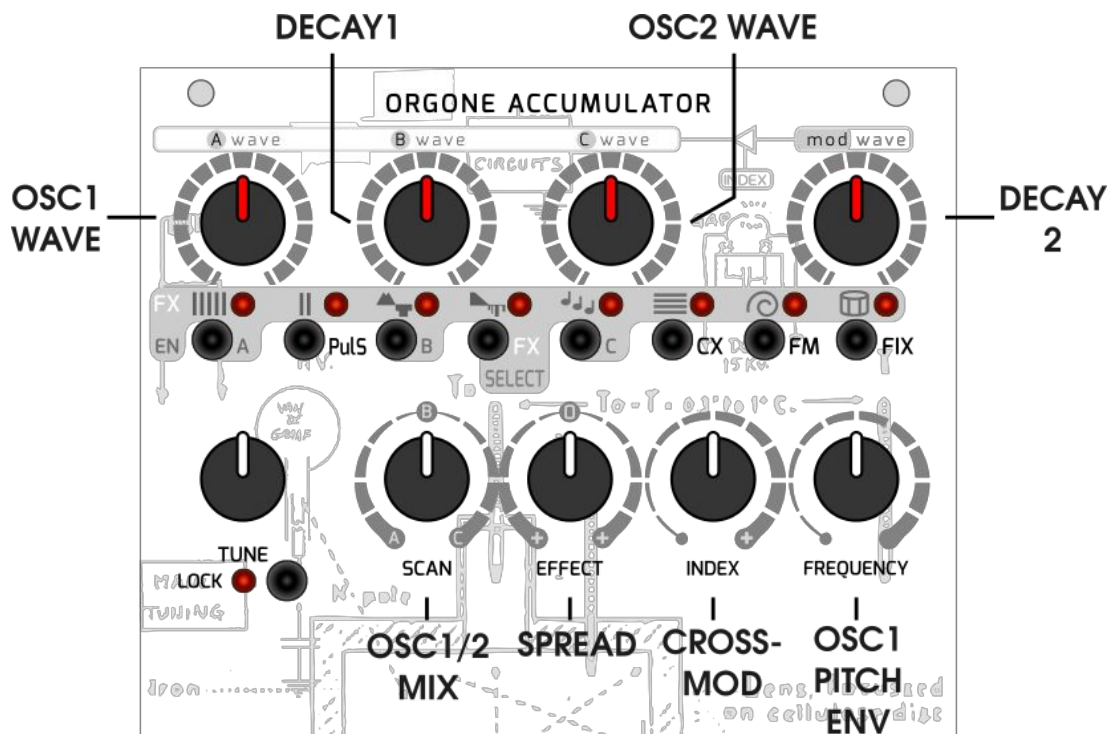
To see which effect mode you're in, just press the **FX SELECT** button again. The lit LED is the one that's active.

Refer to this chart for detailed information on each effect. (There's a larger, printable "cheat-sheet" version at the end of this manual, too.)

<div>DETUNE</div> <div>▼ PRIME    EVEN ▲</div> <div>STEPPED</div> <div></div> <div>Original Orgone style: 5 oscillator sets, detuned.</div>	<div>TWIN</div> <div>▼ DOWN    UP ▲</div> <div>SMOOTH</div> <div></div> <div>Two pairs of oscillators with CV phase-offset, anti-cancellation.</div>	<div>DIST 1</div> <div>▼ CRUSH    FOLD ▲</div> <div>SMOOTH</div> <div></div> <div>Wave-folding and bit- crushing with "crushbit" smoothing.</div>	<div>DIST 2</div> <div>▼ HORRIBLE    SELF ▲</div> <div>SMOOTH</div> <div></div> <div>Two types of distortion: XORrible- based on eXclusive OR operation. Self - wave is folded on to itself.</div>
<div>CHORD</div> <div>▼ MIN    MAJ ▲</div> <div>STEPPED</div> <div></div> <div>Multiple copies of oscillators combine to form major and minor chords.</div>	<div>SPECTRAL</div> <div>▼ XMOD    DETUNE ▲</div> <div>STEPPED</div> <div></div> <div>Wave-selectors control a mix of harmonics. MODULATION knob controls the global wave-shape.</div>	<div>DELAY</div> <div>▼ NEG FB    POS FB ▲</div> <div>SMOOTH</div> <div></div> <div>EFFECT controls feedback (+/-). FREQ is delay time. MODULATION becomes mod freq; waveshape is fixed.</div>	<div>DRUM</div> <div>▼ PRIME    FIBON ▲</div> <div>STEPPED</div> <div></div> <div>A fully-featured drum- synthesis mode. See the dedicated section in this manual for more info.</div>

# DRUM MODE

Drum mode is the eighth effect mode. 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 (waveshape 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.

**SCAN** 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:

**FX ENABLE A** Scales the decay time (DECAY1) according to OSC1 pitch.

**PulS** Changes the shape of DECAY1 to have a longer final tail on the decay.

**FX ENABLE B** Holds open OSC1's amplitude to add "body."

**FX SELECT** No function in this mode, other than to change FX modes.

**FX ENABLE C** FREQ and DECAY2 will affect the pitch of OSC2.

**CX** Changes the shape of DECAY2 to have a longer final decay tail.

**FM** DECAY2 modulates the amount of cross-modulation amount between 0 and set level.

**FIX** OSC2 pitch is fixed, controlled with the **TUNE** knob, but not the 1V/OCT input.

**TUNE LOCK** Performs the same function in this effect.



# TROUBLESHOOTING

The OA can be unpredictable. 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 **SCAN** control to an actual waveform.

→ Drum mode 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 **RESET**.

→ 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 **SCAN** knob to the right.

Solution: **CX** 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 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 DEMOS:**

<https://soundcloud.com/neutron7/sets/neutron-orgone-accumulator>

**OA SOUNDCLOUD PLAYLIST ARTISTS:**

<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)

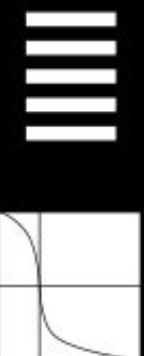
**ABOUT FM SYNTHESIS:** [https://en.wikipedia.org/wiki/Frequency\\_modulation\\_synthesis](https://en.wikipedia.org/wiki/Frequency_modulation_synthesis)



# DETUNE

▼ PRIME EVEN ▲

STEPPED



Original Orgone style:  
5 oscillator sets,  
detuned.

# TWIN

▼ DOWN UP ▲

SMOOTH



Two pairs of oscillators  
with CV phase-offset,  
anti-cancellation.

# DIST 1

▼ CRUSH FOLD ▲

SMOOTH



Wave-folding and bit-  
crushing with  
"crushbit" smoothing.

# DIST 2

▼ XORIBLE SELF ▲

SMOOTH

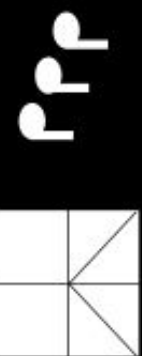


Two types of  
distortion: XORible-  
based on exclusive OR  
operation. Self - wave  
is folded on to itself.

# CHORD

▼ MIN MAJ ▲

STEPPED



Multiple copies of  
oscillators combine to  
form major and minor  
chords.

# SPECTRAL

▼ XMOD DETUNE ▲

STEPPED



Wave-selectors control  
a mix of harmonics.  
MODULATION knob  
controls the global  
wave-shape.

# DELAY

▼ NEG FB POS FB ▲

SMOOTH



EFFECT controls  
feedback (+/-). FREQ is  
delay time.  
MODULATION  
becomes mod freq;  
wavsshape is fixed.

# DRUM

▼ PRIME FIBON ▲

STEPPED



A fully-featured drum-  
synthesis mode. See  
the dedicated section  
in this manual for  
more info.