EKSSPERIMENTAL SOUNDS STUDIO

SQUARE-SWARM
SQUAREWAVE SYNTHESIZER

USER MANUAL v1.0.0

The Sound of a Square Wave

A square wave is one of the most iconic and fundamental waveforms in synthesis. Characterized by its rich, buzzy tone, a square wave consists only of odd harmonics (1st, 3rd, 5th, etc.), giving it a hollow and woody character that's ideal for both basslines and leads. As the frequency increases, the amplitude of each harmonic drops off, resulting in a bright yet focused sound.

One key aspect of a square wave is its **pulse width** – the ratio between its high and low phases. When the pulse width is exactly 50%, it produces a classic square shape. Adjusting this width alters the harmonic content, unlocking a wide range of sonic variations. This technique is known as **Pulse Width Modulation (PWM)**.

Oscillator Lines

SQUARE-SWARM features 8 independent oscillator lines, each built around a square wave VCO (Voltage Controlled Oscillator) and complete signal chain. The architecture per line is:

VCO + MOD LFO + PWM + VCF + VCA

These lines are arranged into two groups:

Group 1: Oscillators 1, 2, 3, 4
Group 2: Oscillators 5, 6, 7, 8

Each group includes syncable oscillator pairs:

- OSC 2 syncs to OSC 1
- OSC 3 syncs to OSC 4
- OSC 6 syncs to OSC 5
- OSC 7 syncs to OSC 8

When sync is activated, the phase of the syncing oscillator (2, 3, 6, 7) is reset by its sync source (1, 4, 5, 8), creating harmonically rich and dynamic results.

Practical Tip:
Lower the volume of the sync source OSC and modulate its pitch with the envelope.

MOD LFO
(Modulation Low Frequency Oscillator)

OSC 1, 4, 5, 8 all have individual MOD LFOs. The MOD LFO can modulate VCO Pitch, Pulse Width, Filter Cutoff, and VCA Level. OSC 2&3 share one MOD LFO, and OSC 6&7 share another MOD LFO.

The MOD LFO has 8 waveforms:

The MOD LFOs can be set to be SYNCed to the song tempo and RETRIG to new notes by switches on the back panel.

Practical Tip:
Activate SYNC via the front panel by clicking on the SYNC indicator LED.

PWM
(Pulse Width Modulation)

Each oscillator's pulse width can be modulated with an amount (set by the bipolar **AMT** knob) of modulation from one of the selectable sources:

- MAN. (Manual - offsets the pulse width with a constant value)
- MOD (MOD LFO per oscillator line)
- ENV1 (OSC 5-8) / ENV2 (OSC 1-4)
- LFO (The global LFO)
- KBD (keyboard tracking)
- VEL (velocity)

It can also be simultaneously modulated by Aftertouch (via backside trimmer).

VCF
(Voltage Controlled Filter)

Each oscillator line includes a multimode VCF. Use the white switch to select between these modes:

- Lowpass (24dB/oct)
- Bandpass (12dB/oct)
- Highpass (12dB/oct)

The filter frequency can be modulated either by the per line MOD LFO or ENV2 (Osc 1-4) / ENV1(Osc 5-8) set by the white switch.

KBD (Keyboard Tracking) is set on (up) or off (down) with the switch at the backside. On the back there is also a trimmer for Aftertouch. By raising the trimmer value harder pressure will raise the filter frequency (if your keyboard supports Aftertouch).

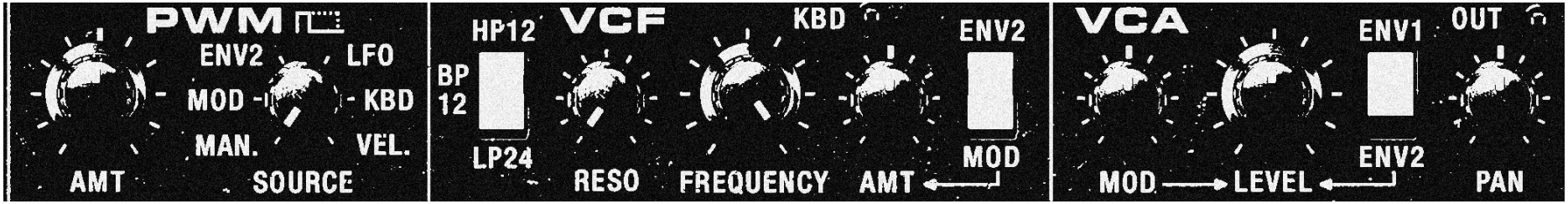
VCA
(Voltage Controlled Amp)

Each oscillator line ends with a VCA with:

- MOD (Based on MOD LFO)
- Level (Based on ENV1 or ENV2)
- Pan (Left/Right)
- LED

The LED activity indicator is showing current output level for quick identification of what oscillators are sounding.

VCA Level can also be modulated by Aftertouch (via backside trimmer)



GLOBAL CONTROL

At the top of the GLOBAL section:

Pitch 1–4: Offsets pitch for Group 1
-/+ 24 semitones

Pitch 5–8: Offsets pitch for Group 2
-/+ 24 semitones

Volume: Controls overall output volume

SPREAD / OFFSET

Clicking the section header (indicated by a downward-pointing triangle) reveals the two available modes:

SPREAD ODD/EVEN and **OFFSET ALL**.

In **SPREAD** mode the controls affect odd and even oscillators in opposite directions. Turning a knob clockwise will increase the parameter value for odd-numbered oscillators (1, 3, 5, 7) and decrease it for even-numbered ones (2, 4, 6, 8). Counter-clockwise movement inverts this behavior.

PITCH: Dial in a small value for unison effects. Full range is -/+12 semi tones.

PAN: Spreads the OSCs in the stereo field.

VCF: Offsets the filters cutoff frequencies.

OFFSET instead applies a uniform offset across all oscillators, rather than applying inverse values to odd/even sets. This allows you to quickly offset these parameters with global consistency.

EFFECTS

The effects section of **SQUARE-SWARM** adds dimension and character to the sound and includes three onboard effects:

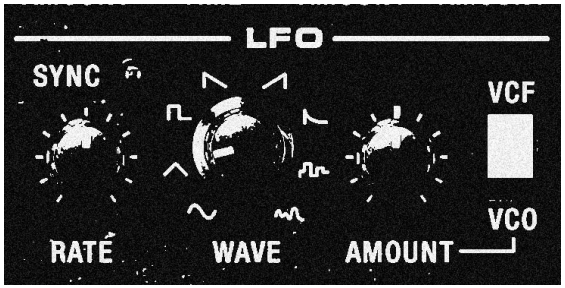
CHORUS: A modulation-based effect that thickens the sound by slightly delaying and detuning copies of the signal. The single Amount knob adjusts the intensity and depth of the effect.

ECHO: A delay effect with one TIME knob and one AMOUNT knob. The echo has three taps with subtle filtering and stereo spreading to enhance the sense of space and rhythm.

SPACE: A spring reverb based on an exclusive vintage unit, deep and metallic yet warm and wide.

These effects are streamlined for ease of use and are placed after the oscillator sections in the signal path, making them ideal for enhancing the complex textures generated by the oscillator lines.

Global LFO



The Global LFO (Low-Frequency Oscillator) can be used as a mod source for the PWM (amount set at each OSC) for modulating VCF (Filter cutoff frequency) or VCO (oscillator pitch).

Sync: It can be synced to the song tempo by engaging the switch on the backside (or clicking the indicator LED on the front panel).

Retrig: The Global LFO can be retrigged at note on events by engaging the switch on the backside.

KBD (Keyboard Tracking): The Global LFO can have its frequency scale across the keyboard by engaging the switch on the backside.

Quadrature and Octature Modes:
The global LFO offers phase offset modes, creating complex, evolving modulation patterns by offsetting the starting phase of the LFO per oscillator.

No Shift: All oscillators share the same LFO start phase (0°).

Quadrature 1: Oscillators split into two groups (1-4 and 5-8), each oscillator within the group offset by 90°:

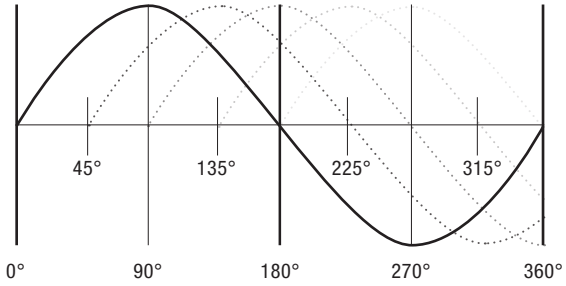
VCO1 & VCO5: 0°
VCO2 & VCO6: 90°
VCO3 & VCO7: 180°
VCO4 & VCO8: 270°

Quadrature 2: Oscillators split into odd and even groups, each oscillator within the group offset by 90°:

VCO1 & VCO2: 0°
VCO3 & VCO4: 90°
VCO5 & VCO6: 180°
VCO7 & VCO8: 270°

Octature: Each oscillator receives a unique LFO start phase, evenly spaced at 45° intervals:

VCO1: 0°
VCO2: 45°
VCO3: 90°
VCO4: 135°
VCO5: 180°
VCO6: 225°
VCO7: 270°
VCO8: 315°



Practical Tip:
For an intuitive demonstration, set the LFO to a slow rate, pan each oscillator differently, and apply the LFO to pitch or filter cutoff. You'll hear how the modulation shifts phase between oscillators.

Modulation Envelopes

SQUARE-SWARM includes two ADSR envelopes. Each envelope can modulate various parameters either by being seleced as a mod source at various parameters (PWM, VCF & VCA) for each OSC (1-8) or by using the knobs located directly to the right of the ADSR fader controls.

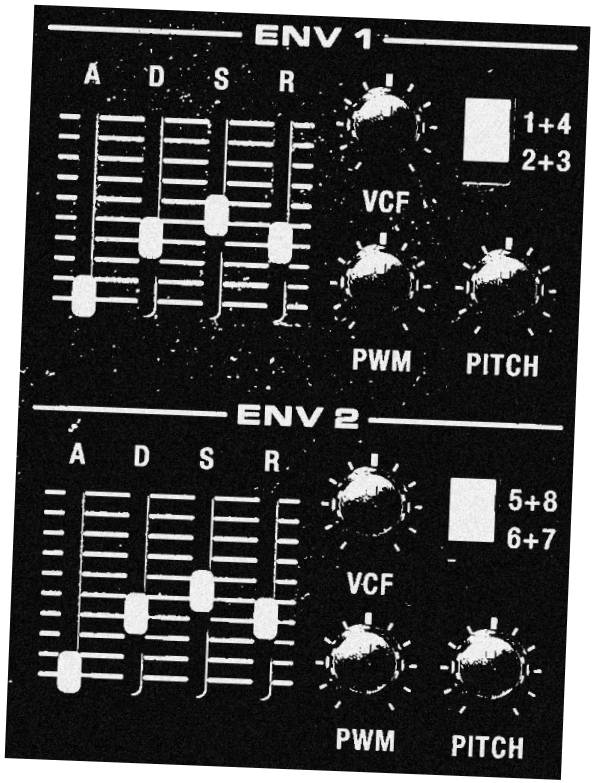
White Selector Switch: Selects which oscillators will be modulated:

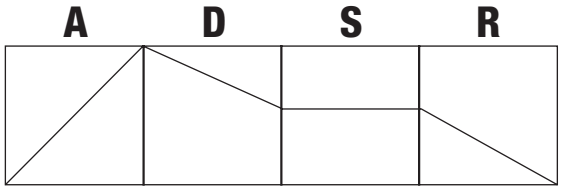
For example, position “1&4” applies modulation to oscillators 1 and 4, “2&3” targets oscillators 2 and 3.

Knobs: Adjusts the amount of (bipolar) modulation applied to the corresponding parameter. The modulation follows the ADSR envelope shape.

PITCH (Oscillator Pitch)
VCF (Filter Cutoff Frequency)
PWM (Pulse Width Modulation)

For maximum flexibility OSC 1-4 has ENV2 as a mod source for PWM & VCF while OSC 5-8 has ENV1 at the OCS settings. Since the opposite is available here at the ENV section any combination can be achieved.





- Attack: Time to reach maximum level
- Decay: Time to reach sustain level
- Sustain: Level while a note is held
- Release: Time to reach zero after release

Example Usage 1:
Turning up the “PITCH” knob applies pitch modulation from the envelope to the oscillators selected by the white switch. This is especially useful for an oscillator that is used as a sync source for a synced oscillator.

Example Usage 2:
Turning up the “VCF” knob at the ENV section applies frequency modulation from the envelope to the oscillators selected by the white switch. This way you can choose to modulate the VCF frequency with both ENV1 and ENV2, or both the MOD LFO and one of the ENV.

Back Panel Connectivity

Each oscillator line has CV inputs for:

- Pitch Offset
- Pulse Width
- VCF Frequency
- VCA Level
- VCA Pan

There are also global CV inputs that affect all oscillator lines simultaneously.

Each MOD LFO offers:

Retrig: Restart LFO with each note event
SYNC: Sync LFO rate to tempo (also toggled via front panel LED)

The VCF has a KBD switch on the back with LED status indicator on the front that also can be used as a “shortcut” for enabling KBD..

SEQUENCER Section

CV and Gate inputs for sequencing via external CV Gate devices.

Velocity & Aftertouch Trimmers

Velocity:

- OSC 1-4 VCF Frequency
- OSC 5-8 VCF Frequency
- ALL OSCs VCA Level

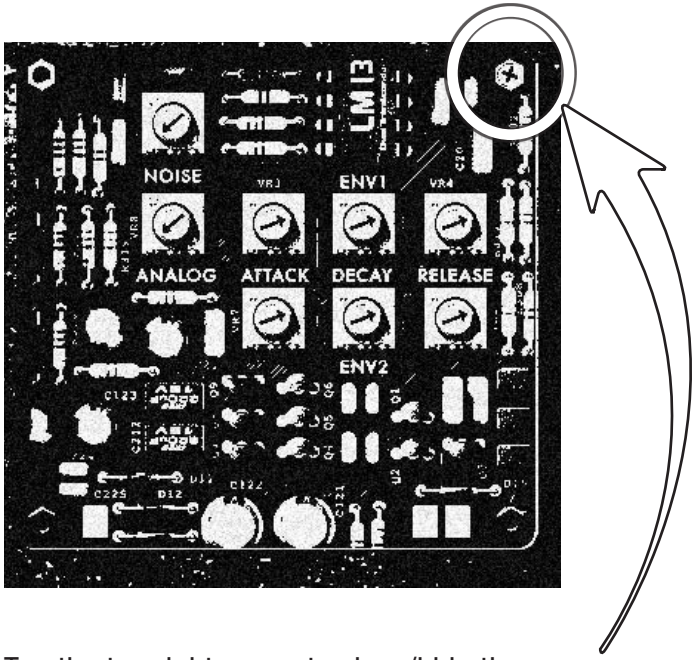
Aftertouch:

- VCF Frequency (All)
- VCA Level (All)
- Pulse Width (All

Polyphony Settings

Selectable polyphony from 1 to 8 voices per oscillator line.
Higher notes are prioritized, meaning lower notes will be released when max polyphony is exceeded.

Secret Service Door



Tap the top right screw to show/hide the eight hidden tweak controls:

1) NOISE – Adds analog-style noise to VCOs and VCAs

2) ANALOG – Simulates analog oscillator drift

3–8) Envelope Curves – Adjusts Attack, Decay and Release curves of the two envelopes from logarithmic to exponential.

Keyboard Mapping

SQUARE-SWARM offers flexible options for how incoming MIDI notes are routed to the 8 oscillator lines. This allows for different playing styles, layered textures, or complex mapping setups:

All OSC – All Keys: Every incoming MIDI note (C-2 to G8) will trigger all 8 oscillators simultaneously. This mode is useful for creating massive, layered sounds where all oscillators respond to the same pitch input.

OSC Pairs – Octave Split: Each oscillator pair is assigned to a specific octave range:

- OSC 1 & 2: C-2 to B1
- OSC 3 & 4: C2 to B2
- OSC 5 & 6: C3 to B3
- OSC 7 & 8: C4 to G8

This setup is useful for spreading oscillator groups across different registers or for multitimbral-style playing.

Ind. OSC – Ind. Keys: Each oscillator is assigned to specific MIDI note ranges or keys:

- OSC 1: C & C#
- OSC 2: D & D#
- OSC 3: E
- OSC 4: F & F#
- OSC 5: G
- OSC 6: A
- OSC 7: B
- OSC 8: G#

This mode provides direct key-based triggering for each oscillator, enabling precise control over which oscillator responds to which notes.

Mixed – All / Oct / Keys: A hybrid mode combining multiple behaviors:

- OSC 1 & 2: C-2 to G8 (All Keys)
- OSC 3: C-2 to B2 (Low Octaves)
- OSC 4: C2 to B2 (Mid Low Octave)
- OSC 5: C3 to B3 (Mid Octave)
- OSC 6: C4 to G8 (High Octaves
- OSC 7: C & C# (Any C or C# key)
- OSC 8: G & G# (Any G or G# key)

This mode provides flexible layering and mapping, ideal for experimental setups or multi-part performances.

Thank you for supporting Ekssperimental Sounds Studio!

Ekssperimental Sounds Studio is a one man project driven by the passion for experimental electronic sounds, new and old synthesizers and music gear.
As a Reason user since 2001 it truly is a dream come true to finally be able to create my own synthesizers and effects for the Reason rack.

Thanks to all of you who buy my products I can continue to learn and develope more fun and inspiring devices for our beloved rack.

I hope you will enjoy SQUARE-SWARM!

Cheers,
Erik Söderberg 2025

Thanks to the beta testers:
Rory / Deep Link Audio
Tendekai/ FLVZ Music
Cam / Mr.Figg

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