SONICSMITH

Squaver P1+

Audio Controlled Synthesizer

Owner's manual

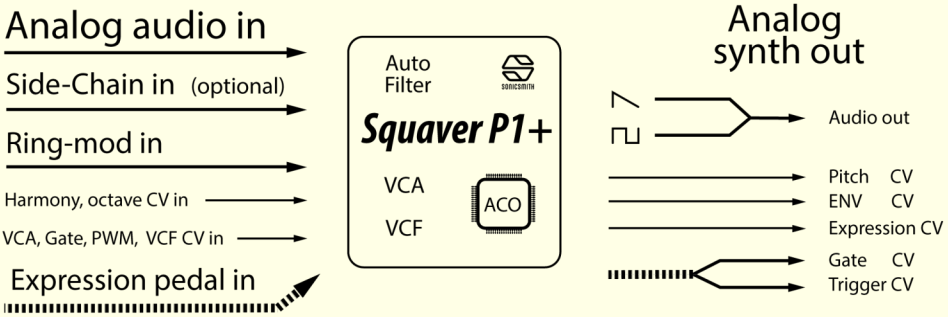
Audio Controlled
semi-modular
analog synthesizer

www.sonicsmith.com

Hello and thank you for purchasing a Squaver P1+ synthesizer!

The Squaver P1+ is a semi-modular, audio controlled, analog synthesizer. It's fully equipped to play a large range of sounds using a mono audio signal alone, but has the power to become much more complex with other CV gear. It generates its sound using a patented custom analog chip called the Audio Controlled Oscillator (ACO100). The ACO chip has an analog audio input at line level, and is able to identify the fundamental frequency (pitch) of a monophonic input audio signal. It then plays a square wave and a sawtooth wave simultaneously at the pitch of the input audio (or optionally at one of several discrete harmony intervals offset from the input audio) while generating Control Voltages (CV) representing pitch and gate. The gate's threshold is now variable via the new GATE knob. That means that as long as the audio input is louder than the gate's threshold, the gate will remain "open" (+9V) and let the synthesized sound through to the output. When the input audio drops below the threshold, the gate will be "closed" (0V) and the ACO's output will be silent. The pitch CV output of the ConVertor synth varies between 0V and 8V at 1V per octave like other Eurorack-compatible synths. Whether you choose to use the Squaver P1+ as a sound generator and/or as a controller for other synths, you will find that you have everything you need to get started.

The Squaver P1+ general input and output map



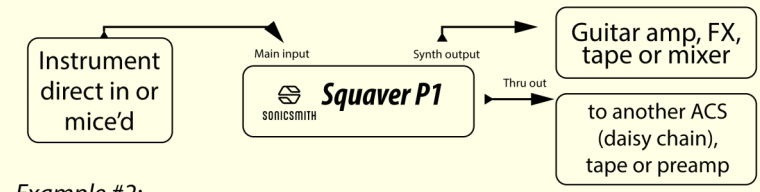
Pitch tracking / The ACS*

The ACO chip is powered from 4.5V and its inputs and outputs are scaled to 9V (to achieve 1V/oct pitch CV) inside the ACS (our term for any product containing an ACO). Using the ACO, the Squaver P1+ provides the main modular synth essentials: Pitch, ENV, gate and trigger CV's. The ACO can detect frequencies between 25Hz and 6.4kHz and will lock to the fundamental frequency with the aid of the Squaver P1+'s auto-tracking low-pass filter. Some recommendations for better pitch tracking include:

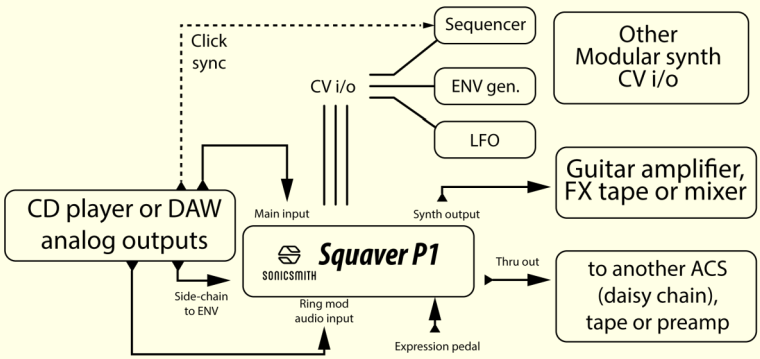
* Playing with the neck pickup, as the bridge pickup generally contains much less bass (more energy in higher harmonics).
* Turn down the treble tone knob, if you have one.
* Picking (or stroking the bow) further away from the bridge towards the middle of the string for more "bassy" sound.
* Try playing as "cleanly" as possible - muting adjacent strings etc. The ACO sometimes does some interesting things with polyphonic input but make sure that is what you are going for!

2 examples of Audio Controlled Synths usage

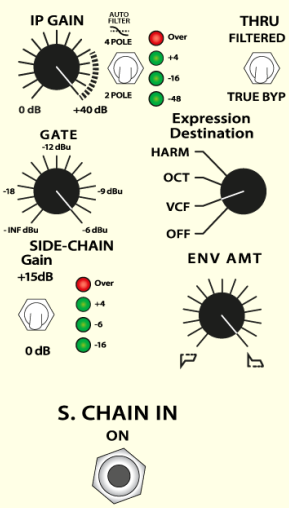
Example #1:



Example #2:



A - The input section



9V DC input – Plug a standard 9V pedal PSU (plus outside) or insert a 9V battery.

(Main) INPUT – Plug a TS instrument jack cable carrying line, instrument or dynamic mic signal. Be sure to use a proper XLR to mono TS adapter jack. Unit won't function with a stereo (TRS) cable.

THRU – An unbuffered copy of the input.

IP GAIN – Can amplify the input from 0 to 40dB. The impedance looking into the input is 100kOhm. Set this knob while the source audio is playing. Turn up until the "over" LED lights up on the highest peaks..

2 POLE / 4 POLE sw. - The auto-filter which helps frequency detection can be configured as 2-pole in the down position (for faster transient response) or 4-pole in the up position (for more filtering of harmonics).

Input LED meter – A 4 character LED meter to show the input's level. The bottom LED lights up when the gate is open.

THRU sw. – Up position = Thru is the auto-filter output (biased at 4.5V DC); Down position = Thru is unbuffered true bypass.

GATE – Controls the gate threshold level. Turn it low if the source doesn't have much noise and you wish to enjoy more dynamic range or sustain. Turn it higher to reject any noisy bursts present in a less clean source.

Exp. Dest. - Determines what the expression pedal will affect: OFF, VCF, OCTAVE or HARMONY.

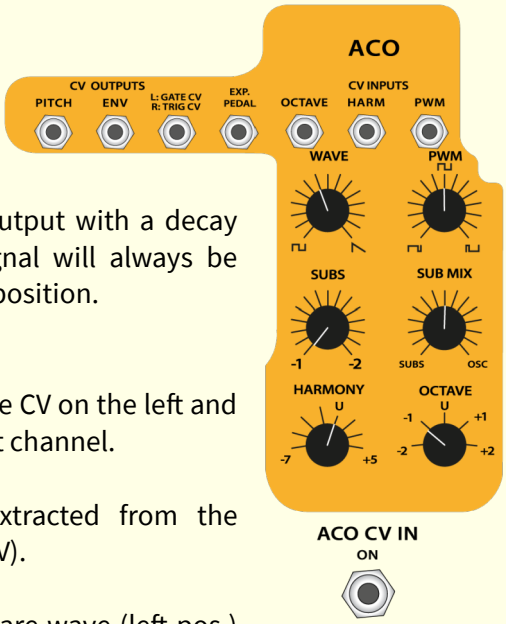
SIDE CHAIN GAIN sw. - Up pos. = S. Chain input boosted by 15dB.

ENV AMT – Can gradually change the ENV from 1:1 fully clockwise to -1:1 fully counter-clockwise.

S. CHAIN IN sw. – Will engage the 2nd ENV follower at the S. Chain input.

S. Chain LED meter – A 4 Character LED meter which reflects the level of the S. chain input. It will also reflect the CV voltage level which will come out of the ENV follower and the ENV CV out if the S. Chain switch will be pressed "on".

B - The ACO section



PITCH CV out – A 1V/oct pitch CV out. 25Hz=0V, 6.4kHz=8V

ENV CV out – An envelope CV output with a decay factor of 50ms. The ENV CV signal will always be influenced by the ENV AMT knob position.

L:gate R:trig CV out –
A stereo minijack output with gate CV on the left and trigger CV (8.8V 15ms) on the right channel.

EXP PEDAL – A CV output extracted from the expression pedal position (0V-8.8V).

WAVE – A Mix knob between square wave (left pos.) and a saw wave (right pos.)

SUBS – Blends between the -1 and -2 sub voices

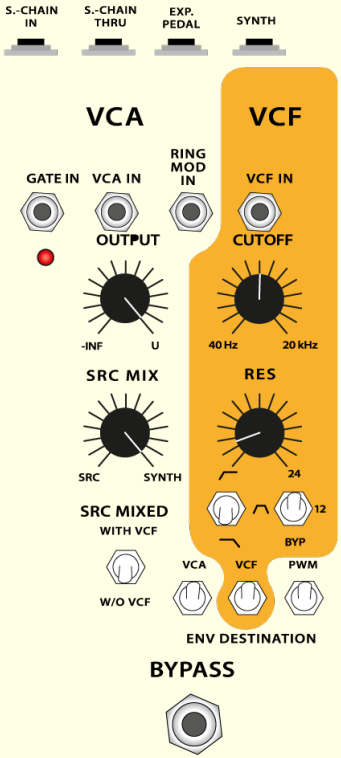
SUB MIX – Blends between the SUBS mix and the OSC mix.

OCTAVE – Can shift the oscillator's sound output from -2 octaves in its minimum position to +2 octaves at its maximum position. The pitch CV out will not be affected by these shifts.

HARMONY – Can shift the semitones by -7 in its minimum position to +5 in its maximum position according to a just intonation scale. Just intonation scales are slightly different from western scales especially on certain notes. See table on page 9 to see an exact comparison between our just intonation scale and the familiar western equal-tempered scale.

OCTAVE CV in – Patch any CV source here to shift the octave just like the knob does. The CV value will be mixed with the knob's position. Neither the Harmony CV input nor the Octave one will have any effect until the ACO CV IN foot-switch is pressed "on".

HARMONY CV in – Patch any CV source here to shift the semi-tones just like the knob does. The CV value will be mixed with the knob's position. Neither the Harmony CV input nor the Octave one will have any effect until the ACO CV IN foot-switch is pressed "on".



C - The VCF & VCA section

SYNTH – Line level output of the synth.

EXP PEDAL – TRS input accepting a standard expression pedal (5V).

S. CHAIN IN – A line level input into the 2nd ENV follower.

S.C THRU – An unbuffered copy of the S. Chain input.

GATE IN – Patch a CV source here to turn the sound output on or off. The V threshold is 3.5V.

VCA IN – Patch a CV source here to control the audio output's loudness. Range is 0V – 9V.

GATE off LED – The red LED under the GATE IN lights up when gate is off.

RING MOD IN – A line level AUDIO input which multiplies the synth's output (a true four-quadrant analog multiplier).

VCF IN - CV input to control the VCF's cutoff frequency (0V-9V)

OUTPUT – The output attenuation knob. Fully clockwise, it will not attenuate and counterclockwise it will mute the output.

SRC MIX – Blends between the input source and the synth sounds.

RES – Controls the amount of emphasis given at the cutoff frequency.

SRC MIXED – up pos. = source passes through the VCF. Down = not.

Filter shapes switch - Selects HP, BP or LP filter shape.

Filter poles / bypass – Down position = bypass VCF;
Middle position = 2 pole filter (12dB/oct); Up position = 4 pole (24dB/oct).

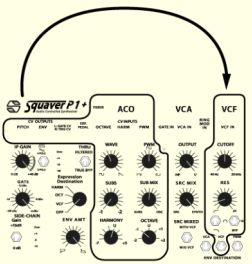
ENV destination... VCA, VCF, PWM switches – These three switches route the ENV CV to their respective destination when placed in their up position.

Recommendation:
Filter tracking

- Pitch CV out to VCF CV in

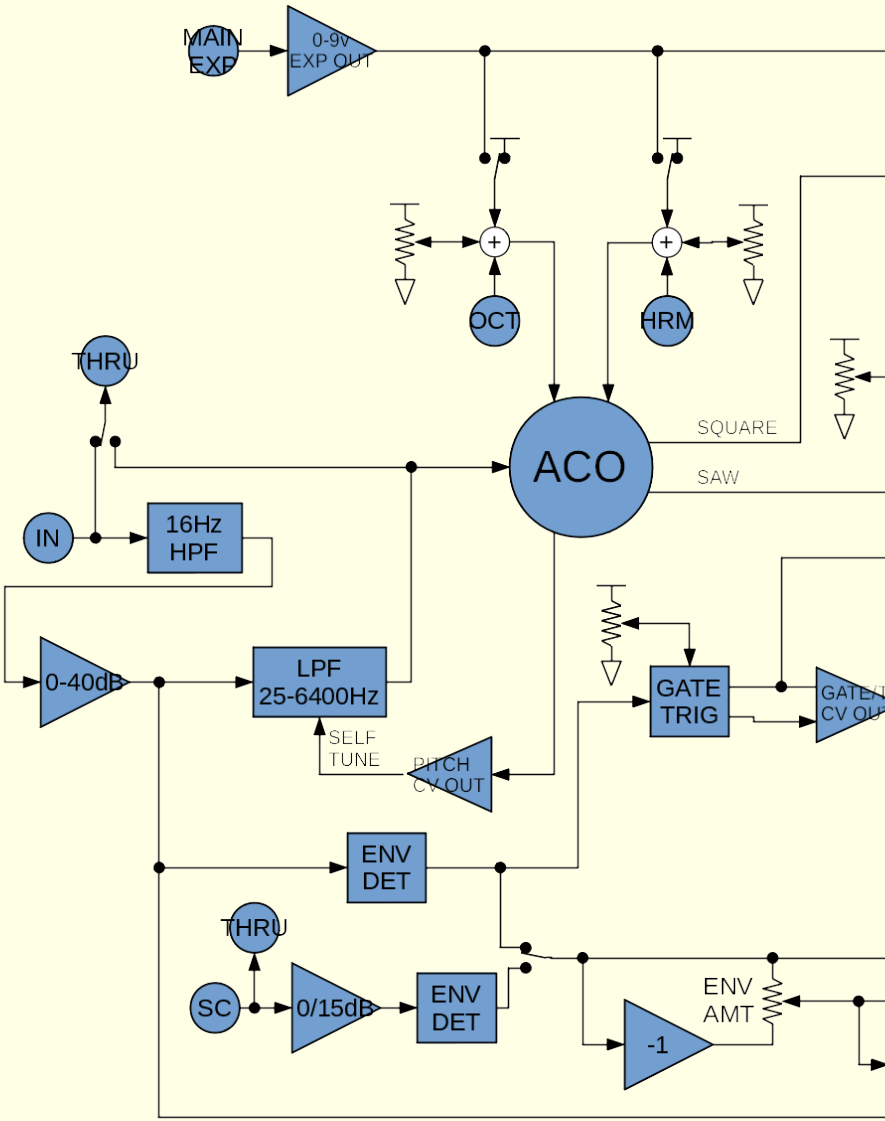
Will couse the VCF (also 1V/oct) to move along with the source pitch.

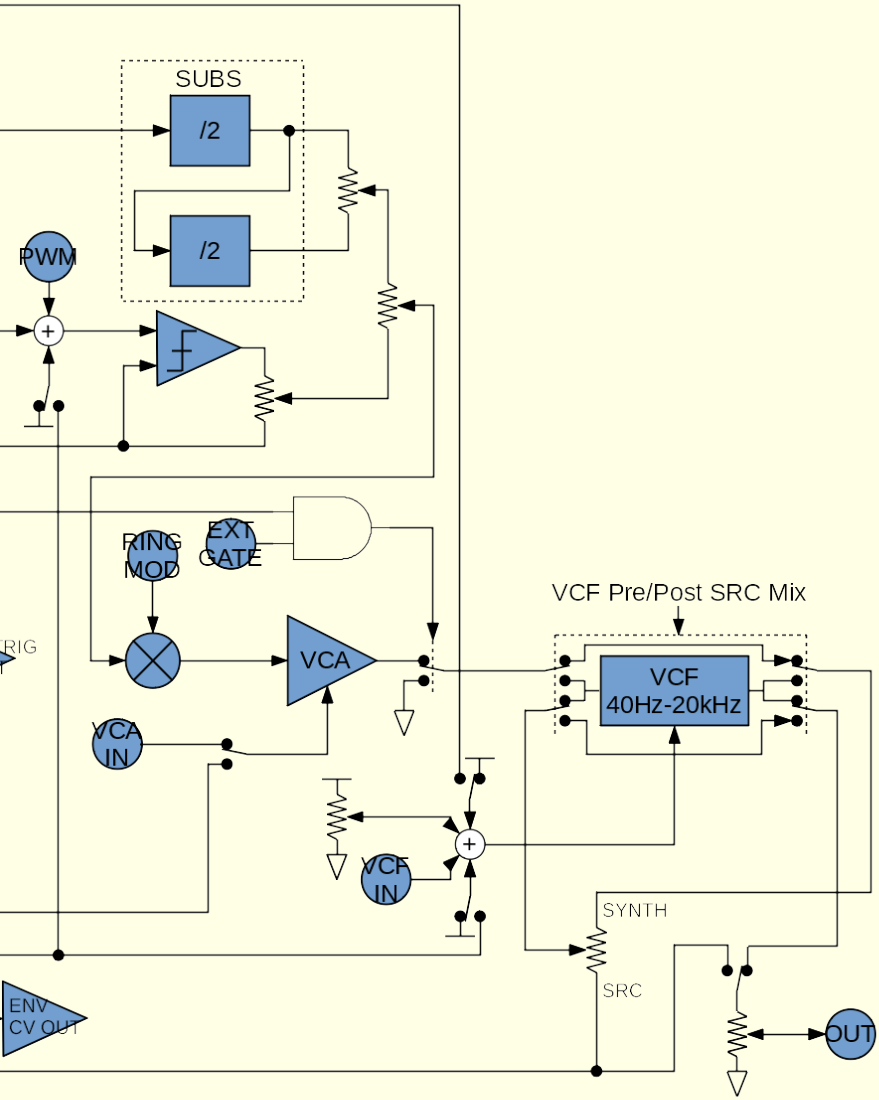
This is great to avoid having notes being too high or too low beyond the filter point and will keep a more consistant sound across the pitch range.



Squaver P1+ Audio Controlled Synthesizer

Block diagram




SUBS
/2
/2
PWM
RING MOD
EXT GATE
VCA
VCA IN
VCF Pre/Post SRC Mix
VCF 40Hz-20kHz
VCF IN
SYNTH
SRC
OUT
ENV CV OUT

D – Troubleshooting

No Sound

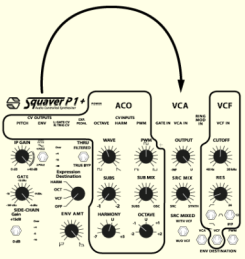
1) Make sure you have input signal and the level meter shows it's loud enough.
2) Make sure the output knob is not set too low
3) Make sure the side-chain switch is not engaged, and if it is then make sure you have a healthy signal into the S. Chain input.
4) If you have any CV cables connected to the CV inputs, disconnect them one by one to see if any of them "silenced" the output.
5) Make sure the PWM position is not causing the square wave to disappear

Noisy output

1) Make sure you are not inputting any noise by dialing the SRC MIX knob fully counterclockwise.
2) If you have, disconnect any CV cables that you may have patched one by one to see if any of them makes the synth go crazy.
3) Send us a video with that phenomenon so we can advise on a solution or repair the unit.

Special Note:
Reversing the VCA envelope

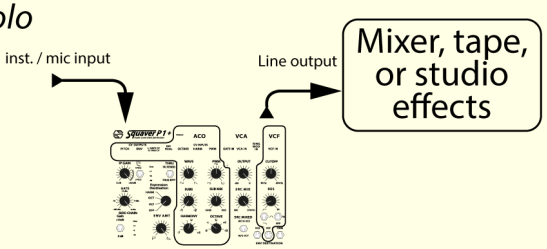
You might notice that the ENV AMT knob is able to reverse the ENV internally for the VCF and PWM but not for the VCA. If you want to reverse the VCA ENV you must manually patch ENV CV out into VCA CV in. We made this decision because patching reversed envelope to VCA can result in noisy output when the input envelope decays, which is not always desirable.



Squaver P1+ example patches

Example #1: Playing solo

- ENV switches: to VCF & PWM
- VCF Cutoff: Around 9-11 o'clock
- ENV AMT: Around 3 o'clock
- Try using an external expression pedal (5V TRS) and apply it to either the octaves or the VCF.

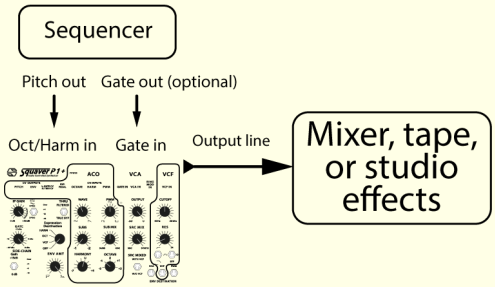


Example #2: Ext. arpeggiation

Sequencing shifts

For rhythmical pitch shifts

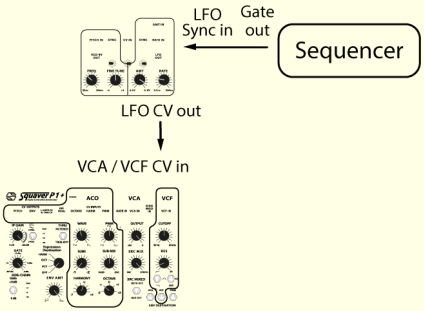
- The position of the HARM, OCT knobs and expression pedal will mix along to determine the final pitch shifts.
- Try modulating the ENV via external ENV gen or another audio source into S. Chain in.



Example #3: Wobble bass

Using external LFO

- LFO WAVE: Triangle
- LFO AMT: High
- Experiment by patching the LFO into any other CV destination.
- The same patching can apply using an external ENV generator instead of the LFO.

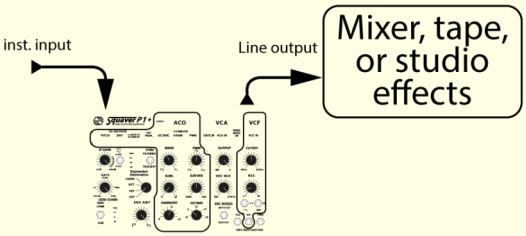


Squaver P1+ example patches

Example #4:

Harmonizing with the source

- Set SRC MIX around the middle position to blend the source sound.
- Shift HARMONY to a desired interval



Example #5:

Harmonizing via external VCO

- Set external VCO to a desired harmony to the Squaver.
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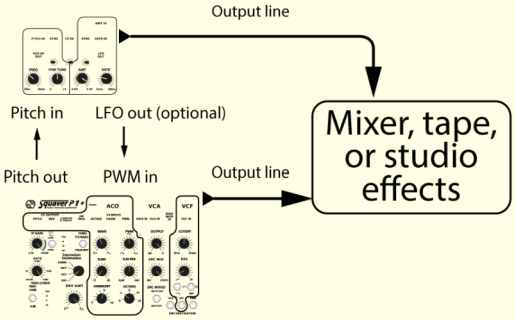
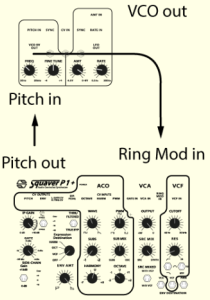


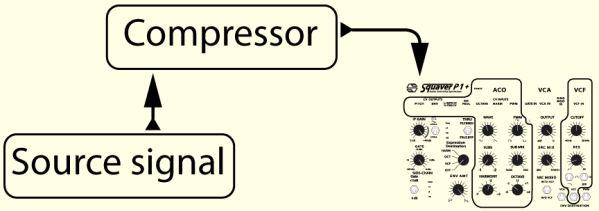
Example #6:

Pitched ring modulation Using external VCO

- Set VCO to a harmony to the Squaver pitch
- Tweak the OCT knob for different flavours.

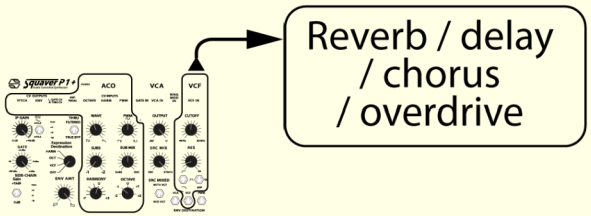


Squaver P1+ with FX pedals



Patching your source audio into a compressor before patching it into the Squaver P1+'s input can help you in getting more consistent and controllable dynamics. If you don't have a compressor and you want more sustain you can increase the input gain and distort the input. The pitch tracking shouldn't be affected by it much.

Remember that patching other effects like overdrive / distortion / chorus on the source before the input, may cause the pitch tracking to not follow the sources pitch properly however it should be an interesting experiment.



You can patch the Squaver P1+'s output straight into professional studio effects but if you want to patch it into guitar pedal effects then make sure the OUTPUT attenuation knob is set around 9-10 o'clock.

Just intonation scale vs. equal tempered

The HARMONY knob shifts the semitone of the ACO square and sawtooth audio outputs on a just intonation scale. Such tuning systems were used in history before the equal-tempered scale was adopted as a de facto standard. On the right column we can see the exact deviation between the two tuning methods in cents. While the octave shifts are exactly the same and the 4th and 5th harmonies (-7 and +5 semitones) are almost exactly the same, other harmonies may deviate farther from modern tuning so be advised. We believe you'll agree that shifting in just intonation results in very pleasing sounds when used as a ring modulation source or carrier.

Table 1: Selected Octave and Harmony Intervals

Octave	Harmony	Just Intonation Interval	JI interval (decimal)	Closest ET Interval (semitones)	Deviation (cents)
U	1 (-7)	2/3	0.6667	-7	-2
U	2	16/21	0.7619	-5	29
U	3	4/5	0.8000	-4	14
U	4	32/35	0.9143	-2	45
U	5 (U)	1/1	1.0000	0	0
U	6 (rising)	8/7	1.1429	2	31
U	6 (falling)	16/15	1.0667	1	12
U	7	32/25	1.2800	4	27
U	8 (+5)	4/3	1.3333	5	-2
+1	1 (-7)	4/3	1.3333	5	-2
+1	2	32/21	1.5238	7	29
+1	3	8/5	1.6000	8	14
+1	4	64/35	1.8286	10	45
+1	5 (U)	2/1	2.0000	12	0
+1	6 (rising)	16/7	2.2857	14	31
+1	6 (falling)	32/15	2.1333	13	12
+1	7	64/25	2.5600	16	27
+1	8 (+5)	8/3	2.6667	17	-2

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as updated on our website sonicsmith.com/products

Modulor A1

Analog Modulation synth

- Analog VCO, LFO and dual VCA
- 1V/oct compatible
- LFO range from 0.2Hz up to 200Hz
- Sync inputs on both the VCO and the LFO
- 2nd VCA combines the LFO CV and AMT knob

ConVertor+

Audio Controlled Synthesizer

- Audio Controlled Synthesizer
- Analog, semi-modular design
- 1V/oct pitch, ENV, gate & trig CV outs.
- -2 - +2 octave range -7 - +5 semi-tones shift
- 2 ENV followers, one at main input and the second at side-chain input

Experiment hard experiment often

Our products are meant to be experimented with, to find their real potential. Please don't hesitate to send us videos of your experiment / performance so we can share them on our social media.

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