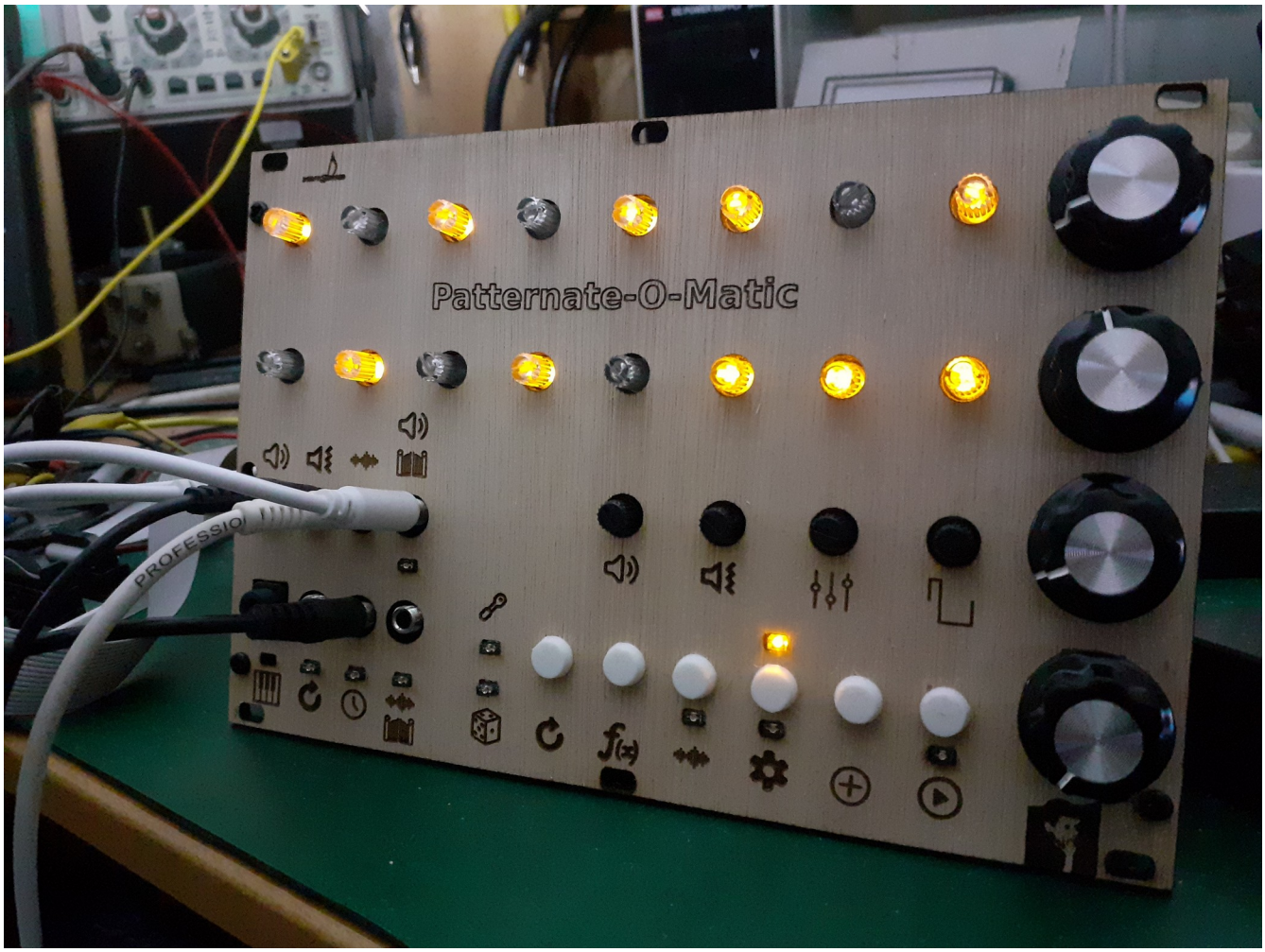
Patternate-O-Matic User Manual



What is Patternate-O-Matic?

Patternate-O-Matic is a double sequencer with up to 16 steps per sequence.
The 1st sequencer resembles part of a 960 style sequencer. 16 potentiometers can be set to some voltage and they will sequentially be connected to a CV output following a chosen on/off-pattern. The on/off pattern of these steps can be set using a table of preset patterns or dialled in from scratch using the 4 rotary encoders on the right hand side of the device. The 2nd sequencer is a noise sequencer that will result in noise bursts and gate pulses. It has an analog output and a gate output. The CV sequencer can be used to e.g. play a melody using the V/Oct input of a synthesizer. But the CV values can also be used to e.g. control the frequency settings of a filter. The noise from the noise sequencer can e.g. be sculpted into a snare or hihat using external ADSR and filter modules. For both sequencers the start and end step can be set (separately) and furthermore the odds that a step will ‘fire’ can be set as well. When operated using the controls both sequencers will either run or be paused simultaneously but via midi you can run or pause them separately. The sequencers can be controlled from its own control surface and via midi from an external keyboard or DAW. Amongst others built-in patterns can be selected via midi program change commands. Of course you can use just the gate outputs of both sequencers if you are only interested in triggering percussive sound generators.

The hardware and software of Patternate-O-Matic was designed and built by J.S. Bouten in 2024. This manual describes the functions implemented in firmware v0.1.
You can find code, schematics and gerbers at https://github.com/josbouten

Nov. 2024
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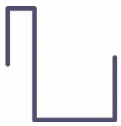
Quick start

Connect an external clock to the clock input. The sequencer will follow that clock. If no clock is connected for more than 10 seconds, the sequencer will accept midi clock	
Connect a V/Oct input of a synth to the CV output.	
Connect the CV gate output to e.g. the VCA input of a synth.	 
Connect the 2nd V/Oct output of Patternate-O-Matic to e.g. a frequency modulation input of the synth. This can be used for key tracking the filter.	
Connect the noise output to a mixer. Optional: use an ADSR/filter/VCA to turn it into a snare of hihat.	
Optional, connect the noise gate to the ADSR/filter/VCA.	 
Connect the synth and noise output to a mixer and amplifier.	
The sequencer when switched on starts in Pause mode (led is blinking). Press the **run button** to make it run. The led will then be lit continuously.	

Use the 4 encoders on the right to set a pattern. The chosen pattern will be shown but not played immediately. After pressing the **+ button**, this pattern will be played starting starting from the first step of the sequencer loop.	
Set the PWM-control potentiometer to its center position. Choose a gate duty cycle using the PWM-control that is long enough so that the CV-gate and/or Noise gate have an audible effect. If the duty cycle is too low, some steps may not produce an output, if the duty cycle it very high, the output steps may sound as if there is no pause between them.	

Modes

There are 3 modes. Pressing the mode button once will step forward to the next mode, pressing the **function**-button and the **+ button** will step back one mode. The sequence of modes is detailed below.

There are 2 LEDs above the mode button. The top LED signals the mode, the bottom **changes-LED** when blinking tells you that a change was made to one of the patterns that is still pending. After pressing the **+ button**, at the start of a new loop the changes will be copied to the running pattern.

mode 0: this is CV mode 0; the mode LED is lit continuously. The potentiometer leds light up for every step in the pattern that is running. Mode 0 is meant to facilitate setting the potentiometers. When the sequencer is paused you can step through the sequence (forward) using the **+ button** and set each potentiometer. You can step backwards by pressing the **function button** and the **+ button**. It is easiest to set the CV values if the oscillator you are controlling with the sequencer has a long or continuous sustain.

mode 1: CV mode 1; the mode LED flashes slowly. The potentiometer leds show the steps as a static pattern which makes changes to a pattern more easily visible.
Here you can set the step pattern, the odds for the steps, the start and end step of the sequencer using the rotary encoder knobs. After pressing the **+ button** the changed pattern will be copied to the running sequence (see paragraph **changes**). In this mode the running pattern will be shown a few seconds after user inactivity.

mode 2: Noise mode: the mode LED flashes and the noise mode LED is lit.
Here you can set noise pattern, the odds for the steps, the start and end step of the sequencer using the rotary encoder knobs. After pressing the **+ button** the changed pattern will be copied to the running sequence (see paragraph **changes**). In this mode the running pattern will be shown a few seconds after user inactivity.

If you want to ‘escape’ any changes made since last pressing the **+ button**, simply long press one of the rotary encoder buttons. All changes are then lost and the **signal change led** will stop flashing.

CV patterns and noise patterns

There are some preset patterns for CV and for noise patterns. You can choose these by pressing the **function** button and dialing for a pattern using encoder 1 (the top encoder). The patterns will be shown by the potentiometer leds. Furthermore (without pressing the **function** button) using the encoders you can edit or change the current pattern or create a new pattern. Encoder 1 will (re)set step 1, 5, 9 and 13. Encoder 2 will (re)set step 2, 6, 10 and 14. Encoder 3 will (re)set step 3, 7, 11 and 15. Encoder 4 will (re)set step 4, 8, 12 and 16. All encoders follow the same sequence of 4 step patterns as show in the table below.

Generic Patterns (here for encoder 1)

	step	**1**	**5**	**9**	**13**
velocity					
1		**-**	**-**	**-**	**-**
2		**X**	**-**	**-**	**-**
3		**-**	**X**	**-**	**-**
4		**X**	**X**	**-**	**-**
5		**-**	**-**	**X**	**-**
6		**X**	**-**	**X**	**-**
7		**-**	**X**	**X**	**-**
8		**X**	**X**	**X**	**-**
9		**-**	**-**	**-**	**X**
10		**X**	**-**	**-**	**X**
11		**-**	**X**	**-**	**X**
12		**X**	**X**	**-**	**X**
13		**-**	**-**	**X**	**X**
14		**X**	**-**	**X**	**X**
15		**-**	**X**	**X**	**X**
16		**X**	**X**	**X**	**X**

The change of pattern will be visible immediately but only after pressing the **+ button**, the pattern will be copied to the sequencer steps and played (see paragraph **changes**). When dialing for a pattern, all steps will be shown while the current begin and end step are flashing. Only when setting a pattern using midi the change is executed immediately.
You can build your own pattern by using a preset pattern and changing that with the 4 rotary encoders. The resulting pattern will be the one shown by the potentiometer LEDs (WYSIWYG). After a short while, the pattern will be replaced by the sequencer's running leds showing the running pattern.

Changes

Delayed changes

After changing one of the patterns or rotating one of the dials, the **signal change** led will flash. If you next press the **+ button** the changes will become active at the beginning of the next loop. If you want to ‘escape’ any changes before pressing the **+ button**, simply long press one of the rotary encoder buttons. All changes are then lost and the **signal change led** will stop flashing.

Immediate changes

If you want the changes to be implemented “immediately”, there are 2 ways.
1: Combine the changes with a reset of both sequencers i.e. setting the current step to the start step of both sequences by pressing the **+ button** to prepare the sequencer to the new changes and next pressing the **reset button** while pressing the **function button** preceding the step you want the changes to be activated. The changes will be activate when the next step is made.
2: Changes will become active at the next step by pressing the **+ button** while pressing the **function button** preceding the step (by at least one step) you want the changes to be activated at. The changes will be activate when the next step is made.

If you want to ‘escape’ any changes you dialed in simply long press one of the rotary encoder buttons. All changes are then lost and the **signal change led** will stop flashing.

Pattern

You can choose a pattern in all modes. If the leds are showing the running pattern and you want to see the whole pattern, simply press the **+ button** once.

Flashing potentiometer leds

The first step of the sequence will flash very fast when it is an active step and slowly when it is a rest . The last step of the sequence will flash fast, when it is an active step and slowly when it is a rest. When a step is a rest no cv or noise is sent to the respective outputs and no gate signals are produced.

Setting the start and end of the sequence

Setting the start and end stop can be done for the CV-sequencer and for the noise sequencer independently. Switch to the sequencer you want to set the start and end step for. Press and rotate rotary knob 1 and 2 to set the start and end of the sequence. You can see the range of the sequence light up temporarily while rotating the knobs. The starting and end step leds will flash, the end step led at a more moderate pace than the starting step led. If you select a starting step before the end step, the steps between those (and including those steps) will be played. If you select a starting step past the end step, then the excluded steps will be played. While selecting a starting or end step the steps that will be looped are shown. After a few seconds of inactivity by the user, the running sequence is shown again. Press the **+ button** to copy the change to the running sequence. The new start and end point will become active after the running loop finishes. If you want to ‘escape’ any changes made since last

pressing the **+ button**, simply long press one of the rotary encoder buttons. All changes to the starting step and end step are then lost and the **signal change led** will stop flashing.

Playback direction

You can toggle the stepping direction between left-to-right, random and right-to-left by pressing the function key and rotating the 2nd rotary encoder. The display will show briefly in what direction the steps will go.

Setting the odds of outputting a gate

You can use rotary knob 3 and 4 to set the odds that the sequencer will output a gate (or not). This can be set for the CV-sequencer and the noise sequencer independently. Switch to the sequencer you want to set the odds for. Switch to mode 0 or mode 1 for the CV-sequencer. Switch to mode 2 for the noise sequencer. Press the **function button** and rotate the rotary knob to the left for lowering the odds and to the right for raising the odds. Using knob 3 will let you set the odds in steps of 5%, knob 4 is meant for fine tuning in 1% steps. The probability can be set from 0 to 100. While setting the odds the potentiometer leds will function as a voltmeter. Top left corresponds to 0%, bottom right to 100%. The voltmeter will be replaced by the running sequence after a few seconds. Press the **+ button** to copy the change to the running sequencer.

Shortcuts

In any mode you can press the noise button to set all noise steps to 1. This will make the **noise led** flash. Press again and the most recently chosen pattern is restored. The **noise led** will return to its prior state.

Knob functions

Key combination	**function**
function + knob 1	Choose a built in pattern
function + knob 2	Choose the direction of play: left-to-right, random, right-to-left
function + knob 3	Set probability at a coarse level
function + knob 4	Set probability in fine steps
Press and rotate knob 1	Set start step
Press and rotate knob 2	Set end step

Midi implementation

The device accepts midi on all channels. Note data can be used to shift the sequence start and end point for the CV and noise sequencer independently. Also the gate out duty cycle and the probability of a note being played can be set via midi notes for both sequencers individually.

You can use the following notes for external control (when using a keyboard you may have to shift it down to its lowest octave). Note, the values here are in decimal and in hex f:

CV Sequencer	
Note (decimal, hex note value)	**Command**
C-2 (0, 0x00)	Shift left start step.
C#-2 (1, 0x01)	Immediately activate the change.
D-2 (2, 0x02)	Shift right start step.
D#-2 (3, 0x03)	Delay activating the change to the end of current loop.
E-2 (4, 0x04)	Shift left end step.
F-2 (5, 0x05)	Shift right end step.
F#-2 (6, 0x06)	Toggle stepping direction between left-to-right and right-to-left.
G-2 (7, 0x07)	Start cv sequencer immediately.
G#-2 (8, 0x08) <velocity>	Convert velocity to duty cycle of cv gate out (1 .. 90%).
A-2 (9, 0x09)	Stop cv sequencer immediately.
A#-2 (10, 0x0A) <velocity>	Convert velocity to cv gate out probability (1 .. 100%) immediately.
Program Change <pattern no>.	Will switch to CV preset pattern <pattern no>. For CV sequencer use [Pgm1 ... Pgm11]
C#-1 (13, 0x0D)	Immediately activate the change.
D-1 (14, 0x0E)	Shift right start step.
D#-1 (15, 0x0F)	Delay activating the change to the end of current loop.
E-1 (16, 0x10)	Shift left end step.
F-1 (17, 0x11)	Shift right end step.
F#-1 (18, 0x12)	Toggle stepping direction between left-to-right and right-to-left.
G-1 (19, 0x13)	Start noise sequencer immediately.
G#-1 (20, 0x14) <velocity>	Convert velocity to duty cycle of noise gate out (1 .. 90%) immediately.
A-1 (21, 0x15)	Stop noise sequencer immediately.
A#-1 (22, 0x16) <velocity>	Convert velocity to gate out noise probability (1 .. 100%)

	immediately.
B-1 (23, 0x17)	Toggle between current noise pattern and all noise steps on
C0 <velocity 1-16 >	Emulate encoder 1 and choose a generic pattern with the velocity value for steps 1, 5, 9 and 13 for the CV sequencer immediately.
D0 <velocity 1-16 >	Emulate encoder 2 and choose a generic pattern with the velocity value for steps 2, 6, 10 and 14 for the CV sequencer immediately.
E0 <velocity 1-16 >	Emulate encoder 3 and choose a generic pattern with the velocity value for steps 3, 7, 11 and 15 for the CV sequencer immediately.
F0 <velocity 1-16 >	Emulate encoder 4 and choose a generic pattern with the velocity value for steps 4, 8, 12 and 16 for the CV sequencer immediately.
G0 <velocity 1-16 >	Emulate encoder 1 and choose a generic pattern with the velocity value for steps 1, 5, 9 and 13 for the noise sequencer immediately.
A0 <velocity 1-16 >	Emulate encoder 2 and choose a generic pattern with the velocity value for steps 2, 6, 10 and 14 for the noise sequencer immediately.
B0 <velocity 1-16 >	Emulate encoder 3 and choose a generic pattern with the velocity value for steps 3, 7, 11 and 15 for the noise sequencer immediately.
C1 <velocity 1-16 >	Emulate encoder 4 and choose a generic pattern with the velocity value for steps 4, 8, 12 and 16 for the noise sequencer immediately.
Program Change <pattern no +64>	Will switch to noise preset pattern <pattern no> immediately. For noise sequencer use [Pgm64 ... Pgm88]

You have to send an ‘Activate shift’ command to activate the shift of the start or end step.

This overlay can be used to find the right key on the keyboard:

According to the Midi specification, the middle C (that is the C nearest under tuning A of 440Hz) is (always) assigned midi note number 60. Which means a midi tune/file will always play in the same octave on every midi player (made acc to the midi spec and under default conditions with no key transpose active of course). What is not standardized however is how to name the octave this middle C/#60 is assigned to. Some say it's number 4 and hence call this note C4 because it's the fourth C on a normal 88-keys piano. Some say it's C5 because it's C number 5 starting with C0 as the midi note number 0. In the table we’ve added the note value to make things more clear. So to be sure the sequencers respond well to the midi notes, check the numerical note value when entering notes.

Control change messages can be used to set various things.

Midi CC messages	
0x01 <n>	Shift left CV sequencer start and end step <n> steps.
0x02 <n>	Shift right CV sequencer start and end step <n> steps.
0x11 (17) <n>	Shift left noise sequencer start and end step <n> steps.
0x12 (18) <n>	Shift right noise sequencer start and end step <n> steps.
0x27 (39) <n>	Set cv gate out duty cycle to n where n = 0...127 is translated to 0 … 100 %
0x28 (40) <n>	Set noise gate out duty cycle to n where n = 0...127 is translated to 0 … 100 %
0x21 (33) <pos>	Set CV sequencer start step to position <pos>.
0x22 (34) <pos>	Set CV sequencer end step to position <pos>.
0x23 (35) <pos>	Set Noise sequencer start step to position <pos>.
0x24 (36) <pos>	Set Noise sequencer end step to position <pos>.
0x25 (37) <prob>	Set probability for CV gate out to <prob> where prob = 0...127 is translated to 0 … 100 %
0x26 (38) <prob>	Set probability for noise gate out to <prob> where prob = 0...127 is translated to 0 … 100 %
0x31 (49) <->	Reset both sequencers to their start step at the following step.
0x41 (65) <percentage>	Set the probability of playing a CV note immediately.
0x51 (81) <percentage>	Set the probability of playing a Noise event immediately.
0x61 (97) <percentage>	

Midi CC messages are executed without the need to send an ‘activate’ message.

Tip: As shown above each sequence can be shifted (or ‘rotated’) forward or backward by a number of steps. So if you’ve created a noise sequence (or if you are using the CV sequence purely as a series of gates e.g. to trigger a kick or bass) that ‘feels’ like it has its downbeat on step 3, you can shift that pattern two steps to the left, so that the downbeat sits on step 1.

Clock

Patternate-O-Matic will respond to a clock pulse on the input. As long as there is a clock pulse, midi clock signals will be ignored. If there has not been a clock puls for more than 10 seconds, Patternate-O-

Matic will assume there is no clock pulse and will start to respond to midi clock. At least one clock should be active for the sequencers to run. If there are 2 clocks the pulse clock will take precedence over the midi clock (as long as the pulse cycle time is less than 10 seconds).

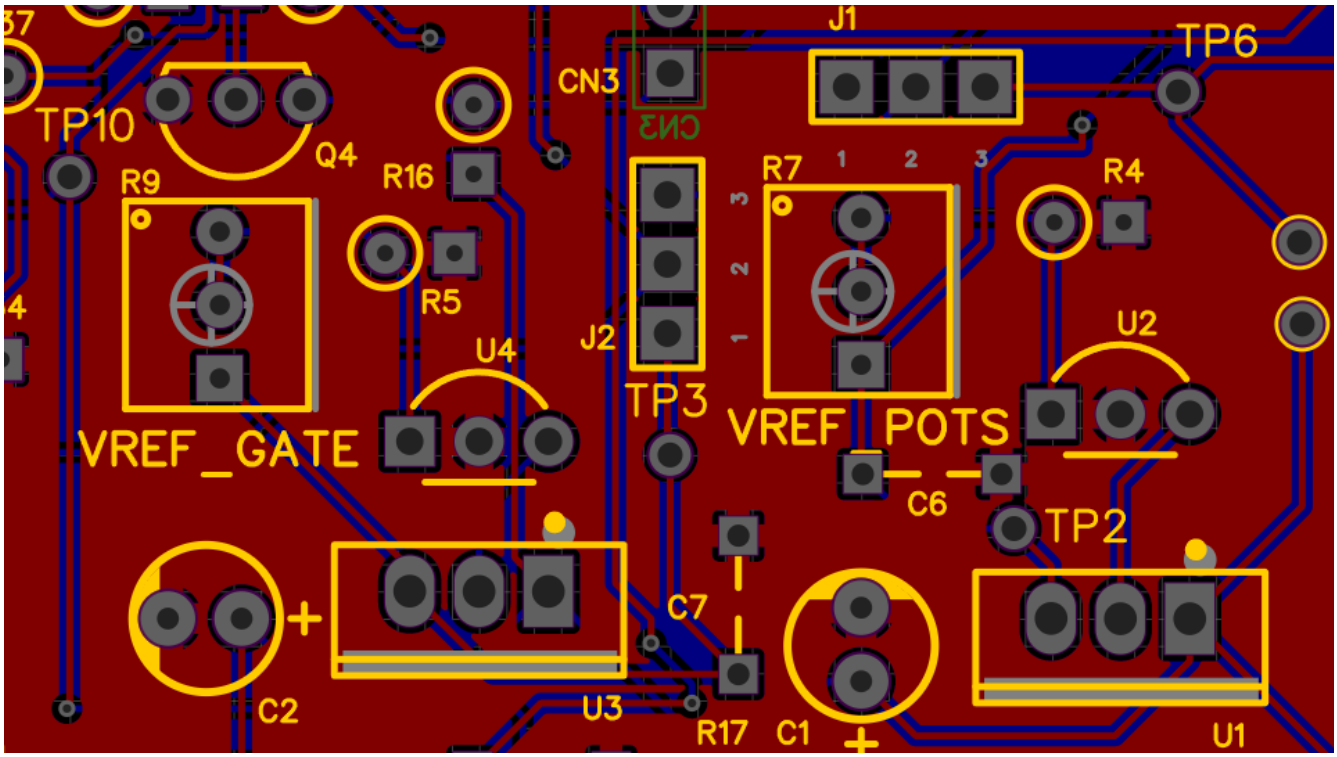
Reset

The reset input will respond to a rising pulse. It will reset the sequencers to their begin step. The push button does the same. See also the paragraph **immediate changes**.

Calibration

VREF_GATE determines the output voltage of the gate outputs when in a HIGH state. You can set it via R9, a 10 turn trimmer pot and measure it on TP3 on the pcb, see picture below. Set it to the max value you want the gate to have. Most times 5V should be sufficient, but some devices like a 2600 need a voltage higher than 5 Volts. In my setup 8 Volts worked nicely. Your mileage may vary.

VREF_POTS determines the range of the V/Oct output. You can set it via R7, a 10 turn trimmer pot and measure it at TP2 and go up to 10V if you like, but the closer you get to 12V the more sensitive it will be to voltage variations of the power supply. We advise to choose 7V. Note that the pots will then span 7 octaves, which should be ample. We advise to not choose a much higher maximum voltage because the higher the voltage the more difficult it will be to select a note value. Connect the CV outputs via a quantizer to a VCO to make life a bit easier.



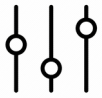
Troubleshooting

No Sound

Turn the PWM value up. The duty cycle of the CV-gate and Noise-Gate might be too short to have an audible effect. Check the quick start section and make sure you're setup corresponds.

If that does not help, check the +12V power supply. Its voltage should not be lower than 11.6 Volt DC.

Symbols table

Main V/Oct output or main V/Oct range potentiometer	
Second V/Oct output or V/Oct range potentiometer. The output is a copy of the main signal output. It can e.g. be used for key tracking a filter.	
Gate out for the CV signal	
Gate out for the noise signal	
Midi in	
Noise out or LED that signals Noise Mode	
Filter for snare out. Shallow Low Pass (turn counter clockwise) and High Pass filter (turn clockwise).	
function button	

mode button	
run/pause button	
PWM potentiometer Set the duty cycle of the CV and Noise gate between 1% and 90%	
Reset input / button, will restart both sequencers at their starting points on the rising edge of a block signal	
Clock input for applying an external clock signal. Will respond to the rising edge of a clock signal.	
Led signaling ratcheting ON/OFF Not implemented (yet).	
Led signalling chance The led will light up whenever the odds are in favour of outputting a CV-gate.	
+ button 1: to forward the sequencer one step when setting potentiometers for tuning 2: to accept changes made to the CV or noise patterns