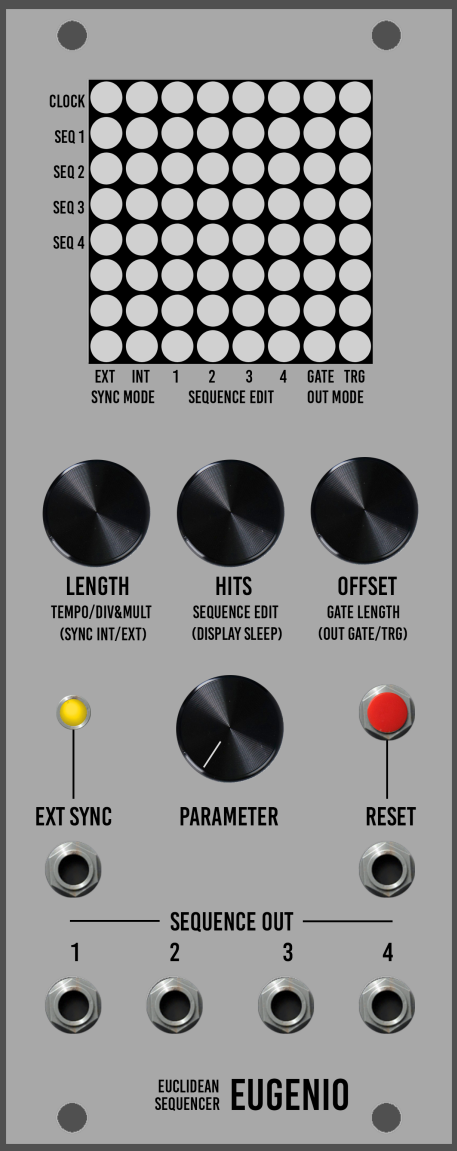


Eugenio

Euclidean sequencer

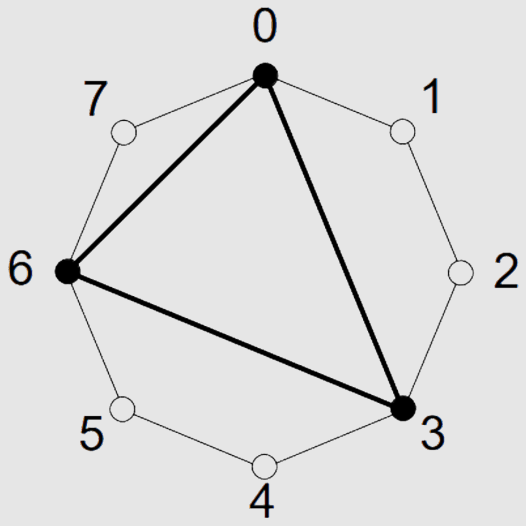
User manual

About Eugenio

Eugenio is a 4-channel euclidean sequencer.

The term *euclidean* referred to rhythmic sequences means essentially that hits and pauses are distributed as evenly as possible along the sequence, and this can be done using an algorithm from Euclid's *Elements*[1].

For example, take a cyclic sequence with a **LENGTH** of 8 beats, and distribute 3 **HITS** (solid) along the sequence, leaving 8-3=5 pauses (hollow).



With the **LENGTH**, number of **HITS** and an **OFFSET** with respect to the sequence start, we can define every euclidean sequence. Eugenio can define 4 different sequences and output them separately.

Eugenio has a number of extra features:

- **external/internal clock** options
- external **clock divider/multiplier**
- **trigger and gate output** modes, with adjustable gate length for each channel
- **reset** button and external input

[1] Godfried Touissant, The Euclidean Algorithm Generates Traditional Musical Rhythms

Assembly and installation

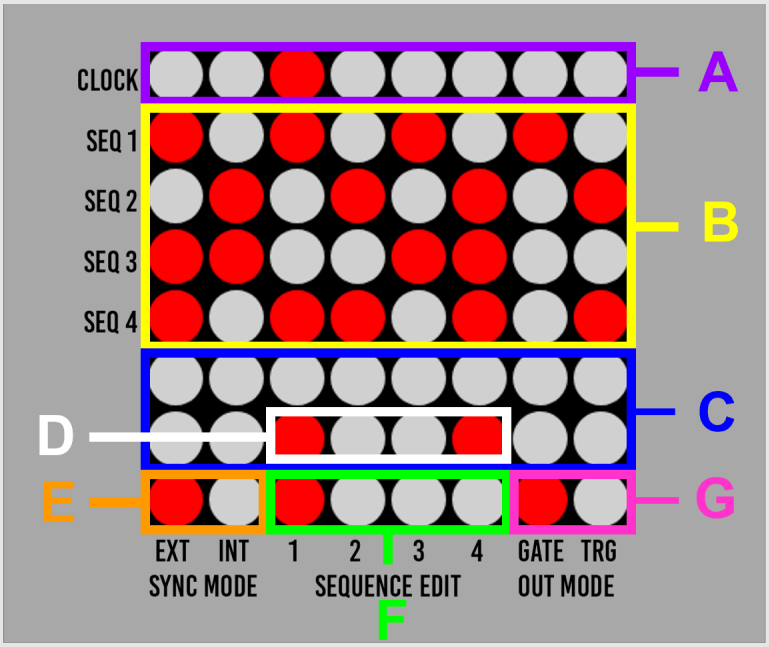
If you are starting from the empty PCB, you can find the BoM and component placement drawings in Appendix.
A MAX7221 LED controller is recommended for minimum noise, but a MAX7219 will also work.

Eugenio uses a 2x8 pin power connector and requires only a +5V supply voltage, which is provided either by the onboard regulator from the +12V rail, or directly from the +5V rail.

Using the **+12V power supply rail** with a current draw of **35 mA** is the default option. The regulated +5V is provided by the onboard L7805 voltage regulator. In this configuration jumper J9 is open and J10 is closed.

Using the **+5V power supply rail** with a current draw of **30 mA** is the alternative option. In this case, you have to configure the jumpers J9 closed and J10 open when building the module. You may avoid placing the L7805 regulator.

Display



The first 5 rows of the 8x8 dot matrix are arranged as a timeline view of the sequences, turning *page* every 8 clock steps.
In the first row **[A]**, a single dot advances every clock cycle, indicating the current step. The 4 rows **[B]** indicate the hits (on) and pauses (off) of the 4 sequences. The column below the clock dot shows the current steps of the 4 sequences. After the clock reaches the end of the row, it restarts from the beginning, and the *page* below turns, showing the next 8 steps of each sequence.
Note that all sequences are cyclic, so if they have different lengths, the phasing between the 4 sequences will change over time.

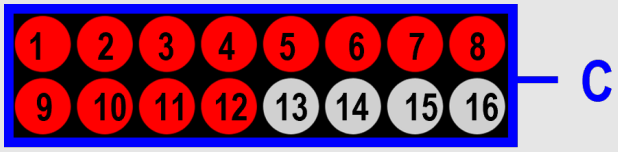
The two rows **[C]** are used as a multi-function display. By default, the four dots **[D]** give a visual indication of the output status of the 4 channels, illuminating when the corresponding output is high.
When editing a specific parameter, section **[C]** displays the parameters being edited, as explained in the next sections.

The last row is used to display the active sync mode (external/internal) **[E]**, the sequence being currently edited **[F]**, the active output mode (gate/trigger) **[G]**.

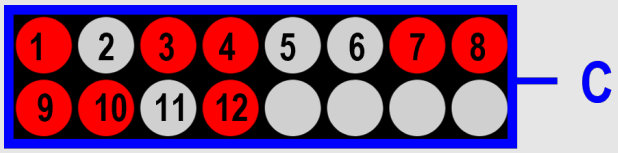
If you don't want the display to distract you, long pressing the **HITS** knob will put it to sleep (he module will continue to work, you just won't see it!).
Long press the same knob again to wake up the display.

Sequence edit

Pressing the **HITS** knob will change the current sequence (the sequence selected for editing), which is shown on the display **[F]**. Turning the **LENGTH**, **HITS**, or **OFFSET** knob will change the corresponding parameter of the current sequence. When editing the **LENGTH**, the display **[C]** shows the sequence length (min 1, max 16 dots).



When editing the number of **HITS**, or the **OFFSET**, the display **[C]** shows the whole sequence (hits on, pauses off).

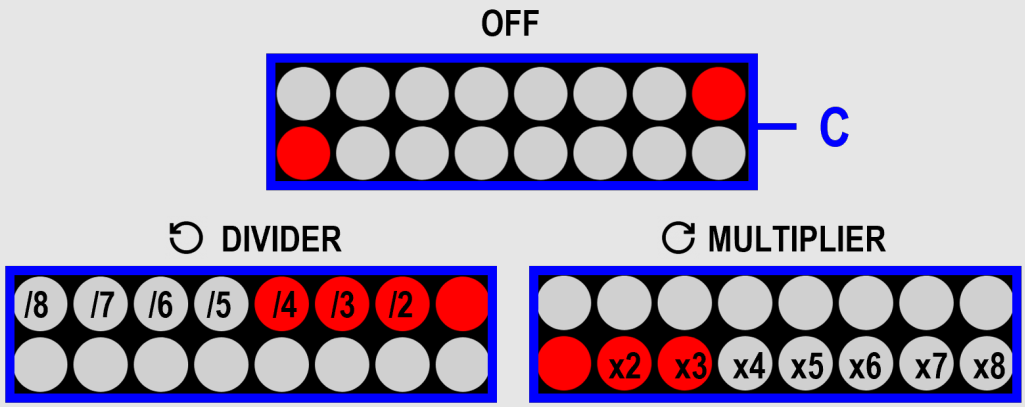


External/internal sync

Long press the **LENGTH** knob to switch between external and internal sync modes. The active mode is shown on the display **[E]**.

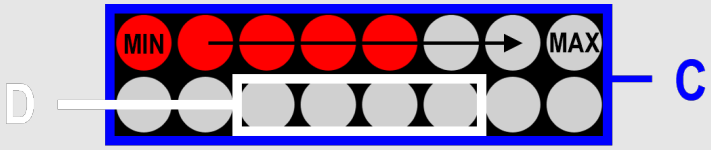
When **external sync** is active and the **EXT** dot on the display **[E]** is steady, the clock follows the signal applied to the **EXT SYNC** input.

Pressing the **LENGTH** knob will enter the **clock divider/multiplier** mode.
The sequence clock tempo can be synced from **1/8** to **8** times the **EXT SYNC** signal tempo, turning the **PARAMETER** knob. The clock divider/multiplier status is shown on the display **[C]**.



If the clock divider/multiplier is active, the EXT dot on the display **[E]** will blink at the speed of the sequence clock.

When **internal sync** is active, the clock is generated internally, and the tempo can be adjusted by pressing the **LENGTH** knob and then turning the **PARAMETER** knob. An indication of the current internal clock tempo will be visible on the display **[C]**.



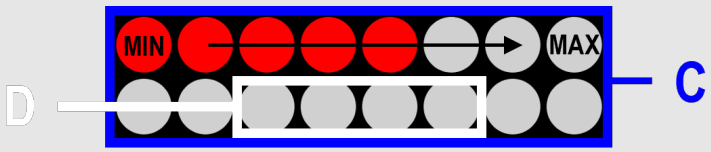
Note that the tempo is varied (almost) continuously, even if the visual indication has obviously a resolution of only 8 dots.

Gate/trigger output

Long press the **OFFSET** knob to switch between gate and trigger output modes. The active mode is shown on the display **[G]**.

When in **trigger mode**, each sequence outputs the hits as trigger signals (10ms).

When in **gate mode**, gate length is adjustable for each of the 4 sequences. Pressing the **OFFSET** knob will enter the gate adjustment mode for the current sequence. The current gate length is shown on the display **[C]**. Turning the **PARAMETER** knob will change the gate length.



Note that gate mode is equivalent to trigger mode when the gate length is set to the minimum for all sequences.

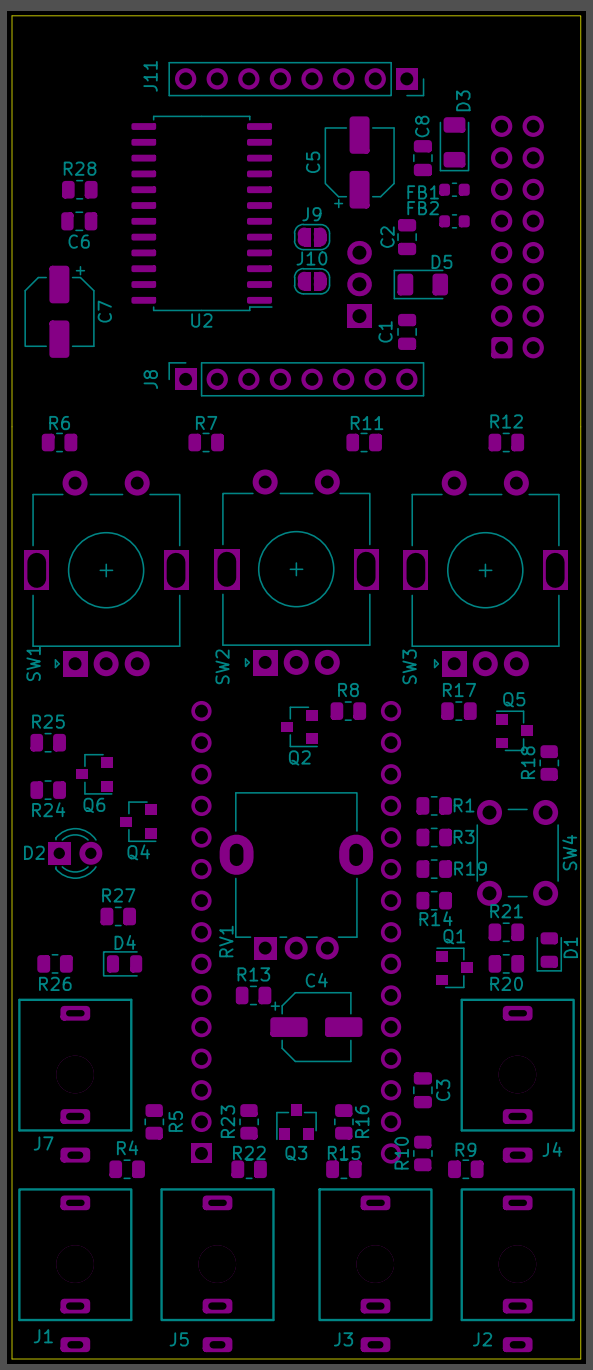
Reset

When the signal applied to the **RESET** input is high, all 4 sequences restart from their first step.
The same effect can be achieved manually by pressing the **RESET** button.

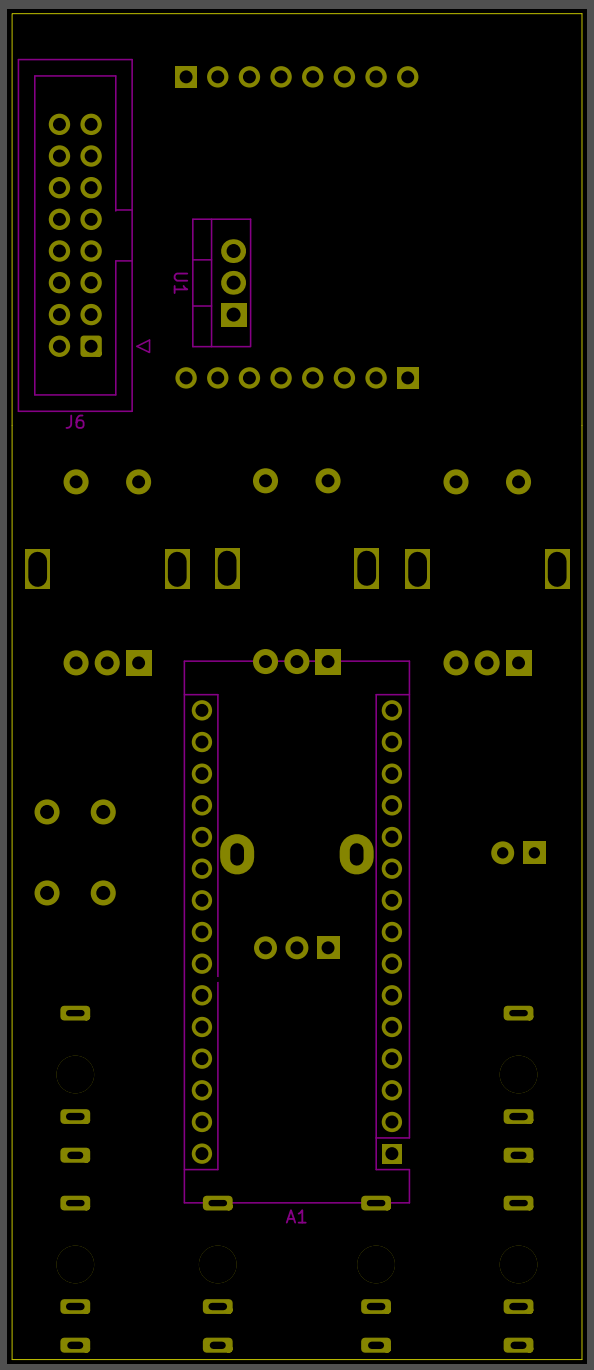
Appendix: Bill of Materials

Qty	Reference(s)	Value	Footprint
1	A1	ARDUINO NANO	Arduino Nano Module
2	C1, C8	1uF	Capacitor SMD 0805
3	C2, C3, C6	100nF	Capacitor SMD 0805
3	C4, C5, C7	10uF	Capacitor SMD Elec 5x4.5
2	D1, D4	1N4148	Diode SMD 0805
1	D2	LED	LED THT 3.0mm
2	D3, D5	1N4007	Diode SMD 1206
2	FB1, FB2	FERRITE	Ferrite Bead SMD 0603
1	J1	OUT 1	Thonkiconn Jack
1	J2	OUT 4	Thonkiconn Jack
1	J3	OUT 3	Thonkiconn Jack
1	J4	RESET IN	Thonkiconn Jack
1	J5	OUT 2	Thonkiconn Jack
1	J6	POWER CONN	Pin header 2x8
1	J7	CLOCK IN	Thonkiconn Jack
1	J8	DISP CONN 2	Pin socket 1x8
1	J9	JP 5V	Solder Jumper
1	J10	JP 12V	Solder Jumper
1	J11	DISP CONN 1	Pin socket 1x8
6	Q1, Q2, Q3, Q4, Q5, Q6	MMBT3904	Transistor SMD SOT-23
17	R1, R3, R5, R6, R7, R8, R10, R11, R12, R13, R14, R16, R17, R18, R19, R23, R25	10K	Resistor SMD 0805
5	R4, R9, R15, R22, R24	1K	Resistor SMD 0805
2	R20, R26	100K	Resistor SMD 0805
2	R21, R27	1M	Resistor SMD 0805
1	R28	470K	Resistor SMD 0805
1	RV1	10K	Potentiometer THT Single Vertical
1	SW1	EC11 (LENGTH)	Rotary Encoder Alps EC11 Switch Vertical
1	SW2	EC11 (HITS)	Rotary Encoder Alps EC11 Switch Vertical
1	SW3	EC11 (OFFSET)	Rotary Encoder Alps EC11 Switch Vertical
1	SW4	RESET BUTTON	Button Switch THT 6mm
1	U1	L7805	Voltage Regulator THT TO-220
1	U2	MAX7219/MAX7221	Led Controller SMD SOP-24

Appendix: Component placement



Front



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Appendix: Schematic