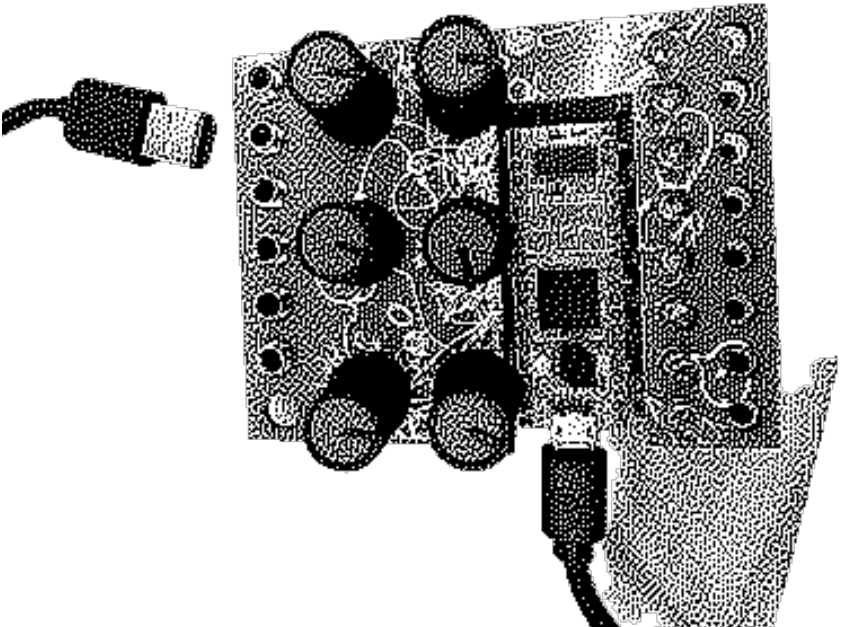
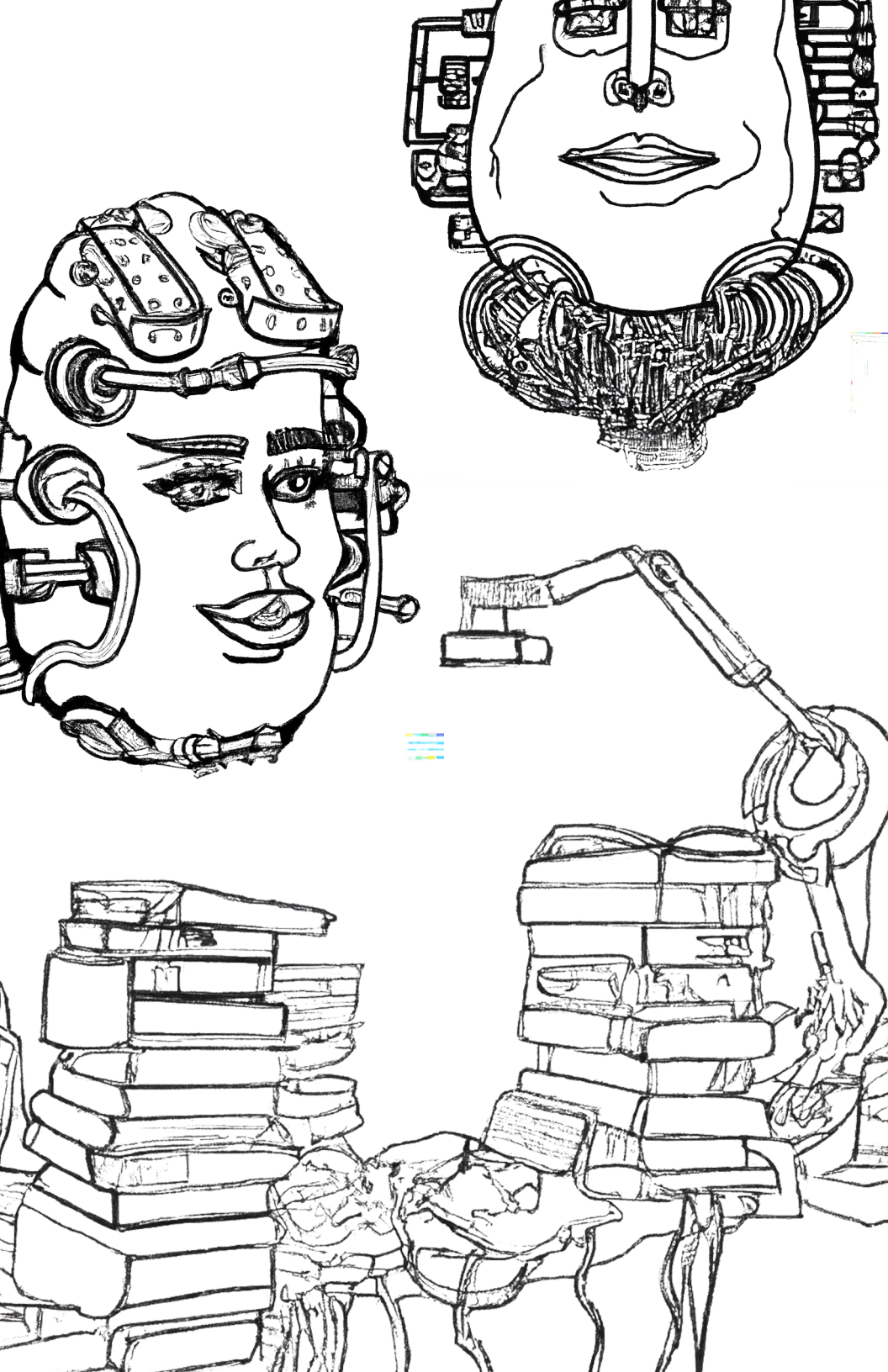
OPERATING MANUAL FOR CCAM EARTH





The same Professor Challenger who made the Earth scream with his pain machine, as described by Arthur Conan Doyle, gave a lecture after mixing several textbooks on geology and biology in a fashion befitting his simian disposition. He explained that the Earth—the Deterritorialized, the Glacial, the giant Molecule—is a body without organs. This body without organs is permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities, by mad or transitory particles.
- Deleuze and Guattari, ATP #4 (1980)

The music of Alice Coltrane and Sun Ra, of Underground Resistance and George Russell, of Tricky and Martina, comes from the Outer Side. It alienates itself from the human; it arrives from the future. Alien Music is a synthetic recombinator, an applied art technology for amplifying the rates of becoming alien. Optimize the ratios of excentricity. Synthesize yourself."
- Kodwo Eshun, More Brilliant Than the Sun

Futurhythmachines turn the extended capability of machines into super sensory powers.
- Kodwo Eshun, More Brilliant Than the Sun (1998)

Welcome to Earth.

EARTH is a nascent hardware-software ecosystem for DIY and community embeded music making.

Recent developments have made it inexpensive to manufacture repogrammable integrated circuits (ICs, colloquially chips) that can run sound synthesis algorithms at audio rate. What that means: we are entering an age where you can design your own sonic palettes and instruments and upload them onto mobile, screenless hardware.

At the same time, the manufacture of ICs are extremely energy-inefficient. It’s not difficult to imagine this contributing to the seemingly endless faucets of e-waste moving towards our landfill and oceans. New media art must think and act permacomputationally.

CCAM developed the EARTH module to encourage reusability of these incredibly powerful processors, as well as the open sharing of sound synthesis algorithms between musicians and technologists.

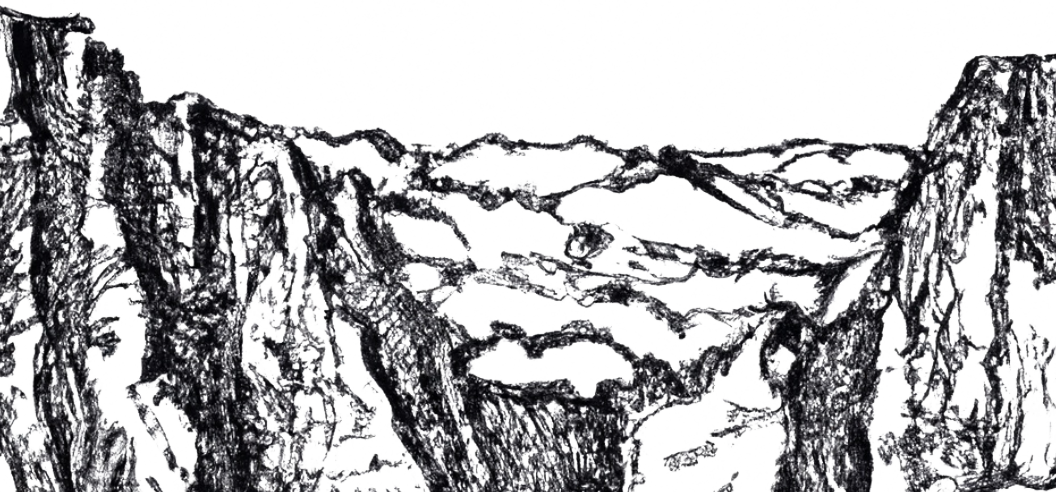
EARTH is built on a microcontroller using

one of these chips called Daisy Seed made by Electrosmith. It runs at audio rate (up to 96kHz) at high-quality bitrates. Nothing comes on the seed; it needs software written in C++, Arduino, and Max/MSP (gen~).

This zine details 3 initial software profiles for the EARTH designed by Juan Flores and myself. These patches were inspired by Chicago House Music as part of CCAM's FUTURHYTHM MACHINES:: Chicago House event at Watershed Art & Ecology.

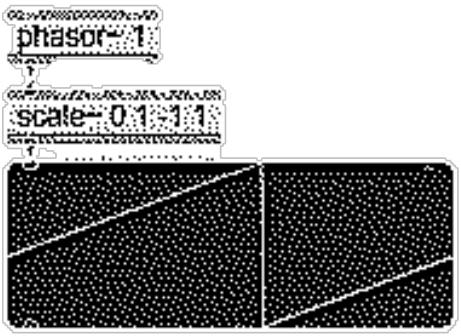
We hope to develop infrastructure for further sharing, encouraging people to share their own software for the concretized EARTH module. Through workshops, collaborative learning, and artistic production and presentation, we hope to build a community of artists, musicians, and technologists with different strengths, aspirations, and backgrounds.

- Garrett Laroy Johnson, CCAM lead
  May 2024, Chicago IL



Control Voltage

An important principle for linking together EARTH modules is “Control Voltage”. By using software to program different patterns, the Daisy microcontroller can output varying voltages. EARTH can also receive voltages via a 3.5mm patch cable “mono” aud cable).



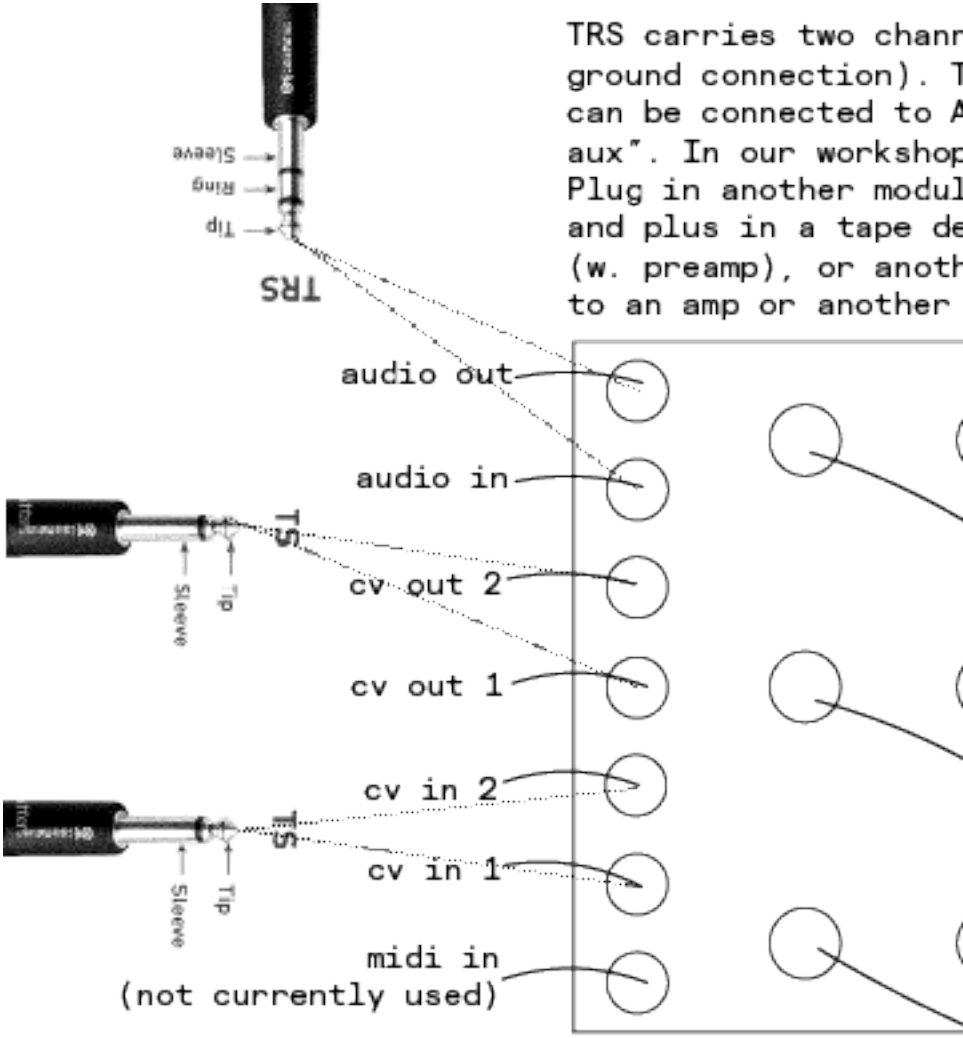
In these instruments explored in this workshop, *Control Voltage* is used to communicate the *clock pulse or tempo*, so that modules can be synchronized in time.

This is only the very beginning. Check out the visualization of the “ramp” signal to the left. Imagine we have made some machine to connect this to an automatic door; behind the door is a room with a speaker. When the signal rises, the door opens; when it falls, the door shuts again. Now consider how this would affect the sound to us in the other room; the sound would would gradually become brighter and clearer as the door opened, and suddenly darker and more muffled.

What we have imaged is a *low-frequency oscillator (LFO)* that controls the frequency of a filter modulating a sound source. If we imagine changing how fast the door opens and closes, we change the frequency of the LFO. If we imagine the door smoothly opening and closing, we change the waveform of the LFO. In hardware synthesis, these are questions of *control voltage*.

This is just one example affecting the timbre of sound. These decisions are musical ones. Changing these parameters of time creates musical dynamism that is pleasing to the ear, curious to the mind, and moving to the body. Or, not -- that's where musicianship comes in!

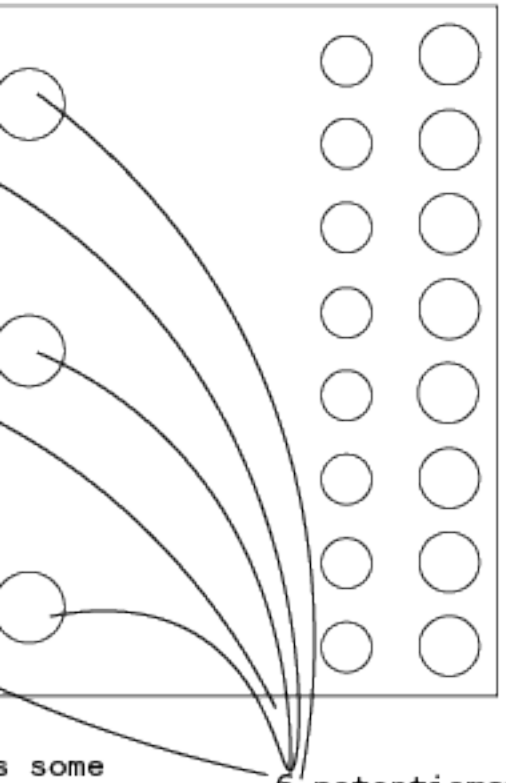
This "control voltage" approach to working with sound is widespread in electronic music production and performance and takes on other forms in other approaches (such as DAWs like Logic, Live, or GarageBand).



TRS carries two chann
ground connection). T
can be connected to A
aux". In our worksho
Plug in another modul
and plus in a tape de
(w. preamp), or anoth
to an amp or another

TS carries Control Voltage, a signal that carries
information from one module to another module to
some element of synthesis. NOTE: BE CAREFUL NOT T
INPUTS AND OUTPUTS (e.g. output to output). This
likely damage the microcontroller. EARTH is set u
and receive voltages up to 3v3. NOTE: DON'T PATCH
FROM COMMERCIAL SYNTHS unless you've ensured they
and not higher, otherwise you'll damage the circu

nels of signal (plus a
This is used for AUDIO and
AUDIO IN or OUT. AKA "the
, these are braided cables.
le (or make some other code
eck, a microphone or guitar
ner sound source. Send out
module.



8 LEDs [light-emitting diodes]. We can send out from Daisy Seed different values. Sometimes you will find they give you some idea of what's going on with the buttons.

8 buttons or switches. These provide a brief pulse into the Daisy, that can be used to turn something on or off, or change some control.

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control
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up to send
H VOLTAGES
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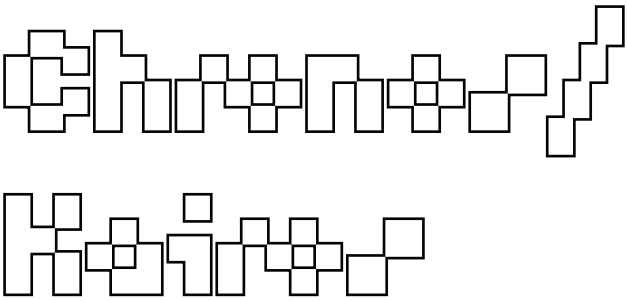
6 potentiometers (or knobs). These are mapped to different parameters of the instrument. These provide instantaneous control to performers in live performance.



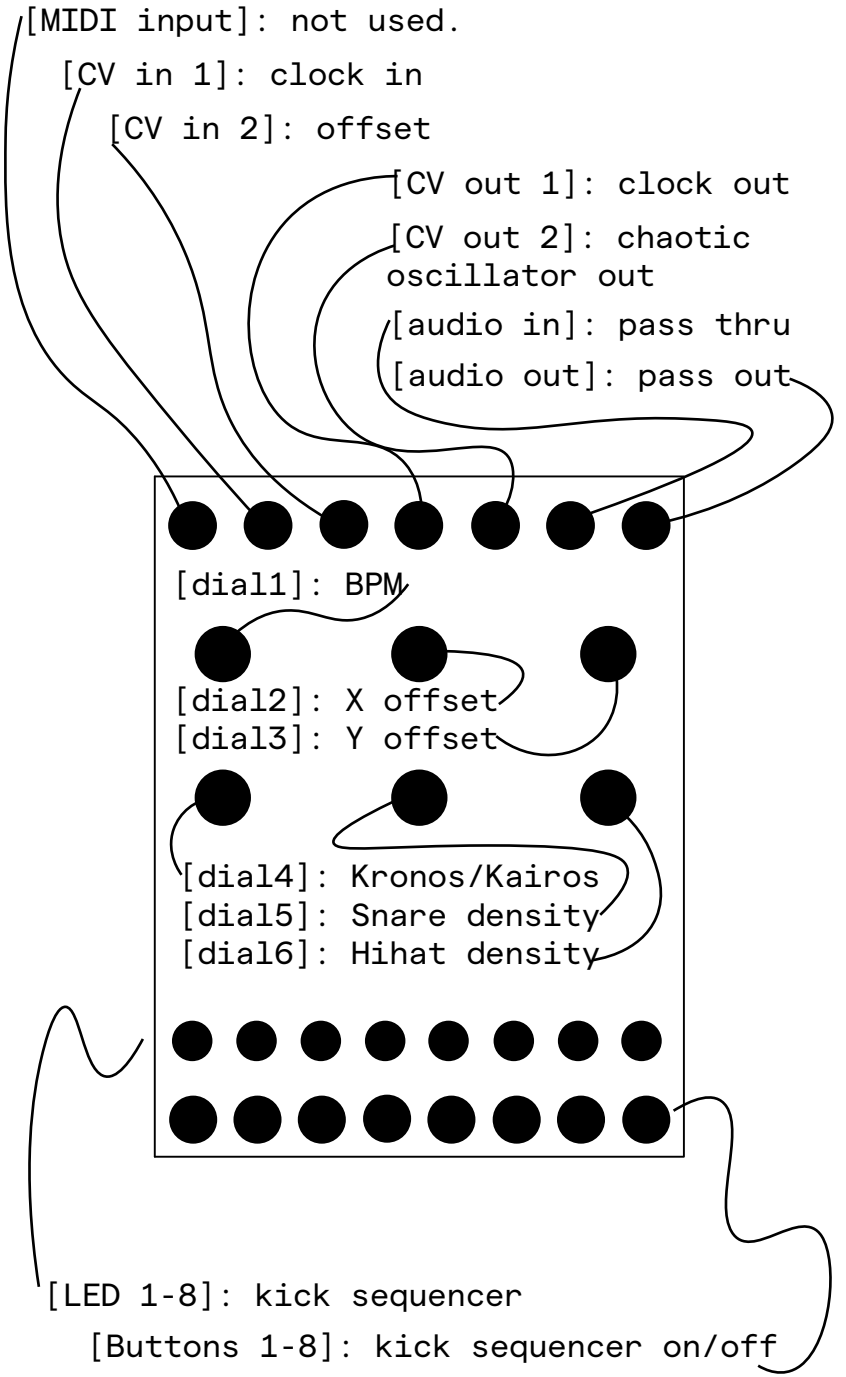
In Greek, there are two words for time.

Chronos speaks to mechanically and quantitavely measured and regulated time, such as clock time, metronimic time, physics time, or perhaps capitalist time.

Kairos refers to the felt-experience of time, which may intensify, flow, stall. It speaks to a sense of “know-when”, related to musical or comedic timing, for instance.

We borrow from philosophical meme to name this module as it is not only “a drum machine”. It is also a time-keeping machine, which can bend time between strict metronimic time and a more “humanized time”, where the pulse is modulated by a chaotic oscillator. This clock signal can be send out to other modules.

The drum output is a lo-fi three piece kick, snare, and highhat. The sequence of the snares and highhats are generative; you can adjust the density of each voice and offset the sequence to find syncopations.


[MIDI input]: not used.
[CV in 1]: clock in
[CV in 2]: offset
[CV out 1]: clock out
[CV out 2]: chaotic oscillator out
[audio in]: pass thru
[audio out]: pass out
[dial1]: BPM
[dial2]: X offset
[dial3]: Y offset
[dial4]: Kronos/Kairos
[dial5]: Snare density
[dial6]: Hihat density
[LED 1-8]: kick sequencer
[Buttons 1-8]: kick sequencer on/off

pocket calculator

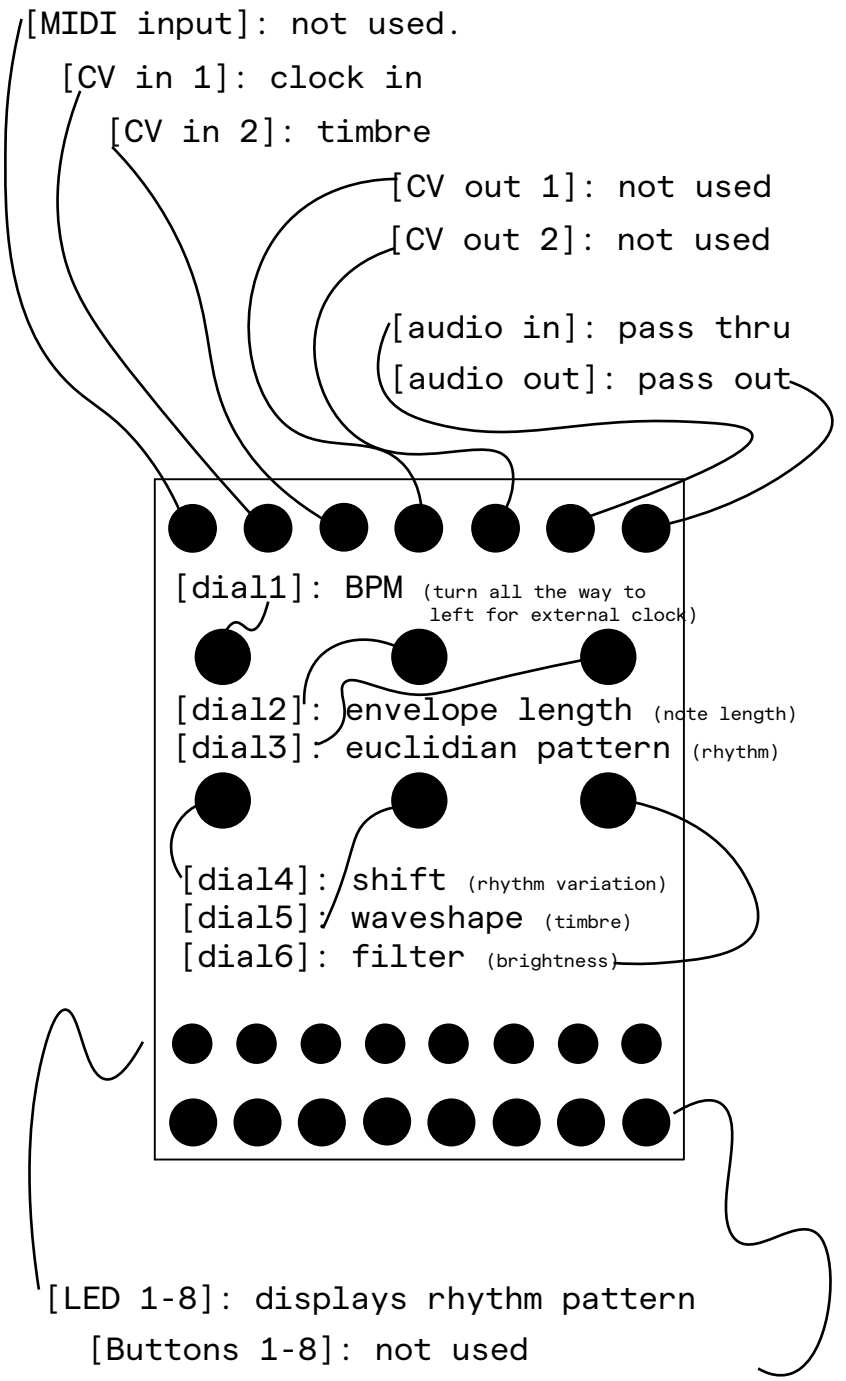
For drummers and bass players in a rhythm section, playing in the “the pocket” refers to the occupation of a temporal territory (a sweet spot), a resonance across time sometimes called a “groove”.

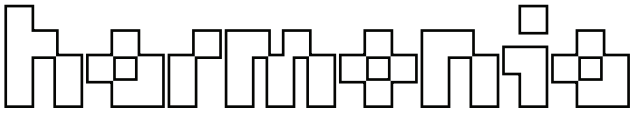
In math, a pocket calculator is a technical device that computes arithmetic, functions, and other mathematical problems. It also fits in your pocket.

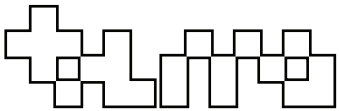
It is not clear that “the pocket” can be calculated, but what if it could?

Pocket calculator is a bassline generator. It uses a technique called a shift register to arrange notes. It employs something called a Euclidean sequencer (named for the geometer) to generate rhythmic patterns as if they were sides of a shape.

Plug the clock out of KRONOS/KAIROS into CV 1 to sync modules. More mappings to come!


[MIDI input]: not used.
[CV in 1]: clock in
[CV in 2]: timbre
[CV out 1]: not used
[CV out 2]: not used
[audio in]: pass thru
[audio out]: pass out
[dial1]: BPM (turn all the way to left for external clock)
[dial2]: envelope length (note length)
[dial3]: euclidian pattern (rhythm)
[dial4]: shift (rhythm variation)
[dial5]: waveshape (timbre)
[dial6]: filter (brightness)
[LED 1-8]: displays rhythm pattern
[Buttons 1-8]: not used



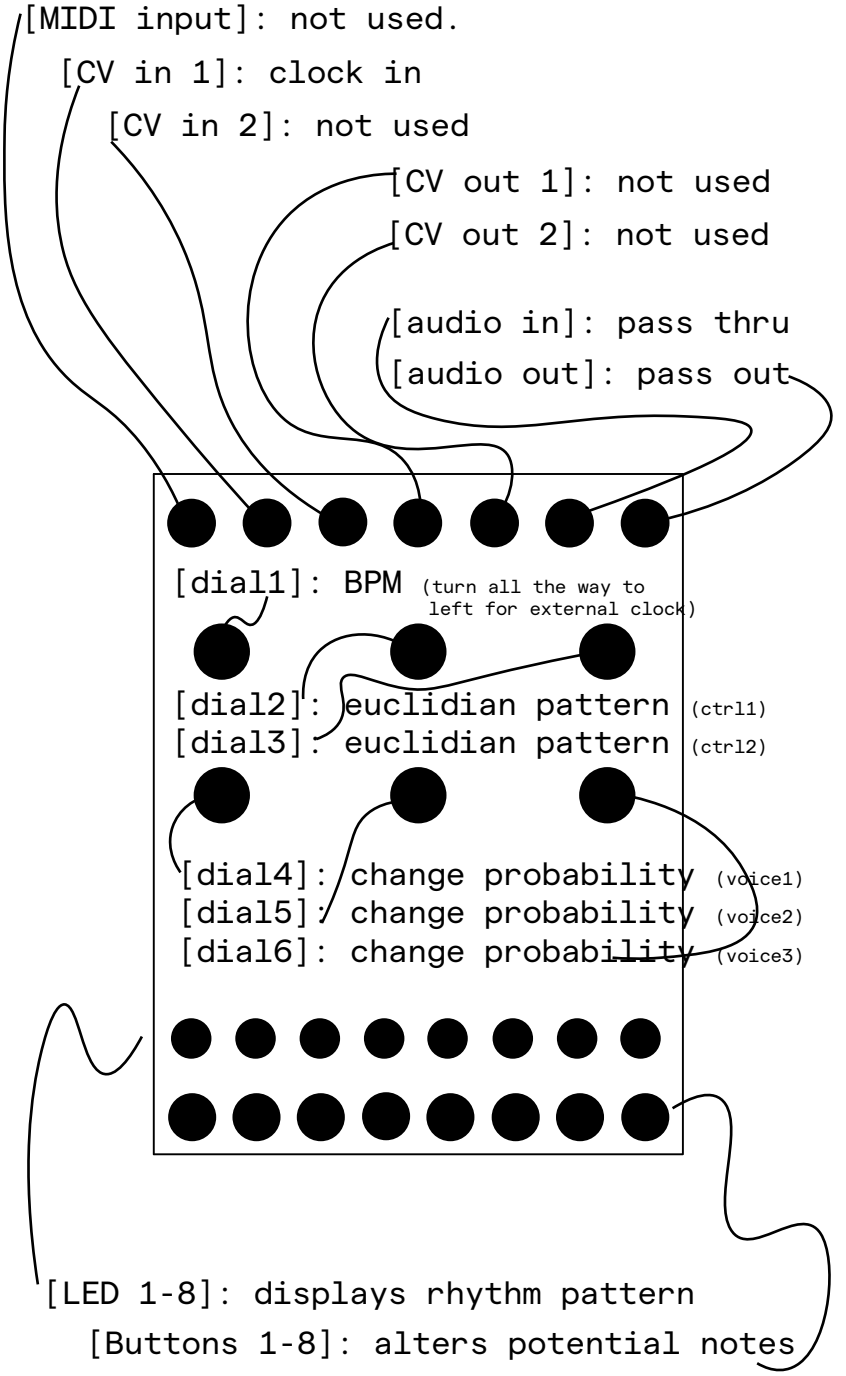


Harmonia Mundi, the name of a 20th-century jazz and classical record label, translates to the “harmony of the world”. The name gestures towards another concept: “musica univeralis”, or the music of the spheres (planets). It was believe that movements of celestial bodies oscillated at deep, low frequencies and resonated in harmony at “pure” musical intervals.

We know now that the fundamental “order” of the universe is anything but “pure” or neatly ordered. What if, instead of gesturing to a grandiose, rational abstraction, we asked: what are the disjunctive harmonies of the earth?

This patch employs a 3-voice shift register that shifts at the end of each musical bar. The bottom row of knobs controls the probability each voice will change (left or right, less probability, center: high probability). Top left knob controls BPM (can also patch in clock).

The top center and top right knob vary the rhythmic pattern of our “harmonic machine”.


[MIDI input]: not used.
[CV in 1]: clock in
[CV in 2]: not used
[CV out 1]: not used
[CV out 2]: not used
[audio in]: pass thru
[audio out]: pass out
[dial1]: BPM (turn all the way to left for external clock)
[dial2]: euclidian pattern (ctrl1)
[dial3]: euclidian pattern (ctrl2)
[dial4]: change probability (voice1)
[dial5]: change probability (voice2)
[dial6]: change probability (voice3)
[LED 1-8]: displays rhythm pattern
[Buttons 1-8]: alters potential notes

5.11.24 @ Watershed Art & Ecology, Chicago IL

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More at https://ccam.world

CENTER FOR
CONCRETE
AND ABSTRACT
MACHINES