

ISSUE 10

WAVEFORM

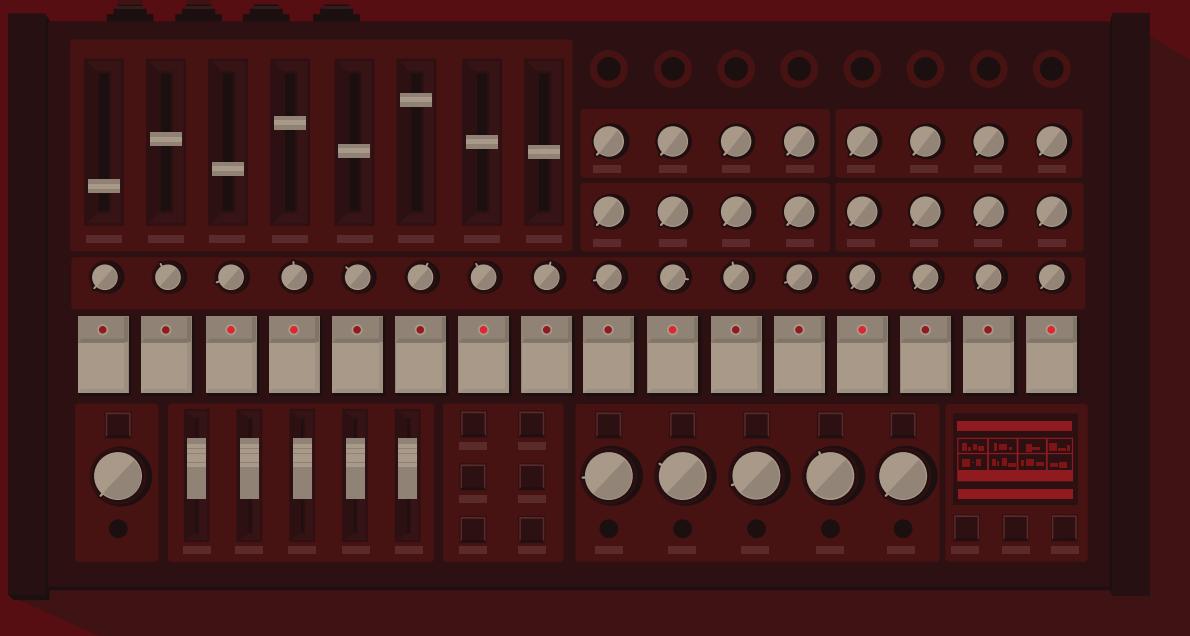
M A G A Z I N E

COSMOTRONIC

SCHLAPPI ENGINEERING

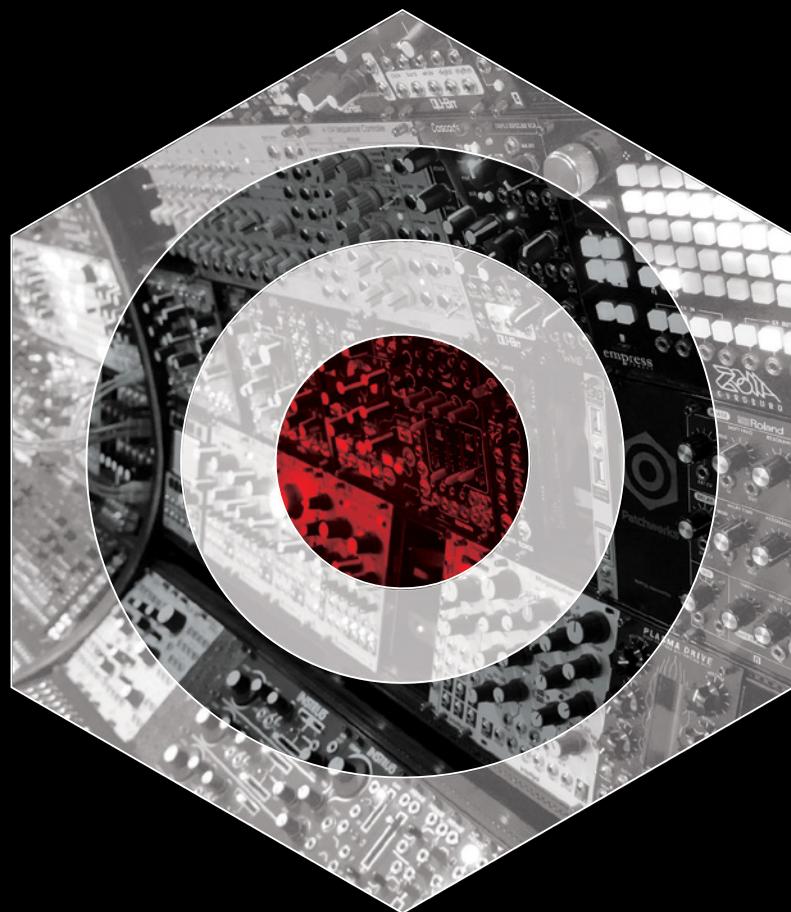
FIVE12

XAOC DEVICES



USA \$12.95
CANADA \$12.95

PLUG INTO PATCHWERKS



LOCATED AT 4129 STONE WAY N. IN SEATTLE

**OPEN DAILY 12-6 PM SUNDAY - WEDNESDAY, 12-7 PM THURSDAY - SATURDAY
AND ONLINE ANYTIME AT PATCHWERKS.COM**

FREE CONSULTATIONS AND EXPERT ADVICE
FAST, FREE SHIPPING FOR ORDERS \$75 OR MORE*
INSTANT FINANCING

*TO CONTINENTAL USA ADDRESSES

 Patchwerks



Shaped Dual EnvVCA

Dual EnvVCA

EnvVCA

WWW.4MSCOMPANY.COM

The **Shaped Dual EnvVCA** is a two-channel analog envelope generator with waveshapers and a stereo linear VCA. Unlike conventional analog envelope modules, the waveform of each envelope can be controlled with a slider or CV without changing the envelope timing. It has all the features of the Dual EnvVCA plus Shape controls, ASR Trigger mode, and dedicated linear outputs. 100% analog, 20HP. \$339

The **Dual EnvVCA** is a two-channel analog linear envelope generator with two fully independent low-noise exponential VCAs. It's two channels of the EnvVCA plus VCA CV inputs, output level knobs, offset knobs, and more. 100% analog, 16HP.

The **EnvVCA** is compact analog envelope generator with a built-in low-noise exponential VCA. With time ranges from 30 minutes to 10kHz, it can be used as an LFO, slew limiter, ASR/ADSR complex EG, audio-rate oscillator, audio or CV VCA, envelope follower, and general utility module. 100% analog, 8HP. \$159



**DUAL MODULATION WITH
WAVESHAPING & STEREO VCA**

**TWO ENVELOPES/LFOS
PERFECT FOR STEREO**

**ALL ANALOG ENVELOPE &
LFO WITH BUILT-IN VCA**

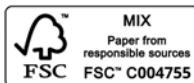
WAVEFORM

M A G A Z I N E

Editor in Chief - ELLISON WOLF
Publisher - SAM CHITTENDEN
Editor - EM MASLICH
Art Direction/Layout - ELLISON WOLF, SAM CHITTENDEN, EM MASLICH
Circulation/Customer Support - BARBARA JONES-FARADAY
Website - SAM CHITTENDEN Music Editor - TOM OJENDYK
Cover Image - SAM CHITTENDEN
WAVEFORM font is our own creation.

submissions/questions/subscription problems
contact@waveformmagazine.com
donate to help the cause
waveformmagazine.com/donate
patreon.com/waveformmagazine
to advertise or to sponsor an issue
ellison@waveformmagazine.com
subscribe online at www.waveformmagazine.com

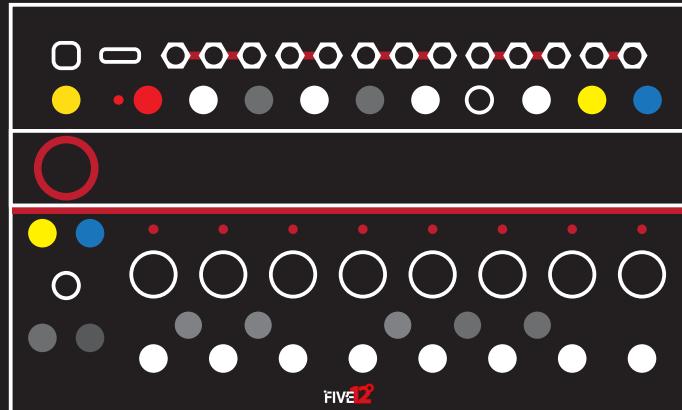
postmaster, reviews, music submissions:
Waveform Magazine
100 Crystal Rd.
Carbondale, CO 81623 USA
contact@waveformmagazine.com
For music reviews, links only please - no attachments.
Waveform is printed in the USA & published by
WAVEFORM MAGAZINE LLC All rights reserved



Vector Sequencer

A digital sequencer with an analog control format • Eight independent Parts • CV and MIDI • Monophonic, Chord & Drum Parts • Generative sequencing • Per-step Chance Ops Off-grid rate modes • Micro-timing • Sixteen sub-seqs for internal modulation • Assignable CV in for external mod • Comprehensive clocking & sync • Expander Module for additional CV • Presets • Playlists • Scenes

www.five12.com



ISSUE #10

TABLE OF CONTENTS

| | |
|-------------------------------------|---------|
| EDITOR'S LETTER..... | PAGE 6 |
| COSMOTRONIC..... | PAGE 8 |
| SCHLAPPI ENGINEERING..... | PAGE 16 |
| DIY SPOTLIGHT: GINKOSYNTHESSE | PAGE 24 |
| FIVE12 | PAGE 26 |
| XAOC DEVICES | PAGE 34 |
| GEAR REVIEWS | PAGE 42 |
| MUSIC REVIEWS | PAGE 74 |
| DAVID BATTINO'S "SYNTH HACKS" | PAGE 83 |
| SHOP TALK | PAGE 84 |



Multi Burst Env



Dual RVG



Tap Tempo LFO

WWW.AJHSYNTH.COM

CONTRIBUTORS

DAVID BATTINO'S DIY approach to music began at the Oberlin Conservatory in the days of quadraphonic tape loops. He's the founding editor of Music & Computers magazine and co-author of *The Art of Digital Music*.
batmosphere.com

EM MASLICH is an editor, artist, and musician. She plays a modified Fender Rhodes, drums, synths, and sings in the band Secretary. secretaryband.bandcamp.com

IAN RAPP likes hiking up Tuckerman's Ravine with his Husky, Sandor, and foraging for fennel. He is a graphic designer and music maker and composes under the name No Reliable Maps.

TOM OJENDYK likes music. He is co-owner of the Seattle, Washington record shop Hex Enduction, and also owns the record label Dirty Knobby.
discogs.com/seller/HexEnductionRecords/dirtyknobby.com

SAM CHITTENDEN is a designer, musician, and composer based in Colorado. He has some new music in the works under the alias Tuesday Adventure, but don't hold your breath awaiting a release.

ELLISON WOLF likes words, cold water swimming, foraging in his neighborhood, and making music. He plays in the band Secretary and makes terrible electronic music as RATACID.
secretaryband.com

JASON CZERYK is an avid synth collector, player, and builder. He designs psychedelic beverage coasters, binge watches "How-To" car repair videos, and does indoor Parkour to stay in shape. He lives near Atlanta with his wife, kids, and his two beloved Blue Healers; Indigo and Sharkskin.

WILLIAM STOKES is a writer and musician in three-piece avant-psych band Voka Gentle. He has written on music and music technology for *The Guardian*, *Sound On Sound*, *The Financial Times* and more. You can find his music at www.vokagentle.com



The DATA
by Mordax Systems

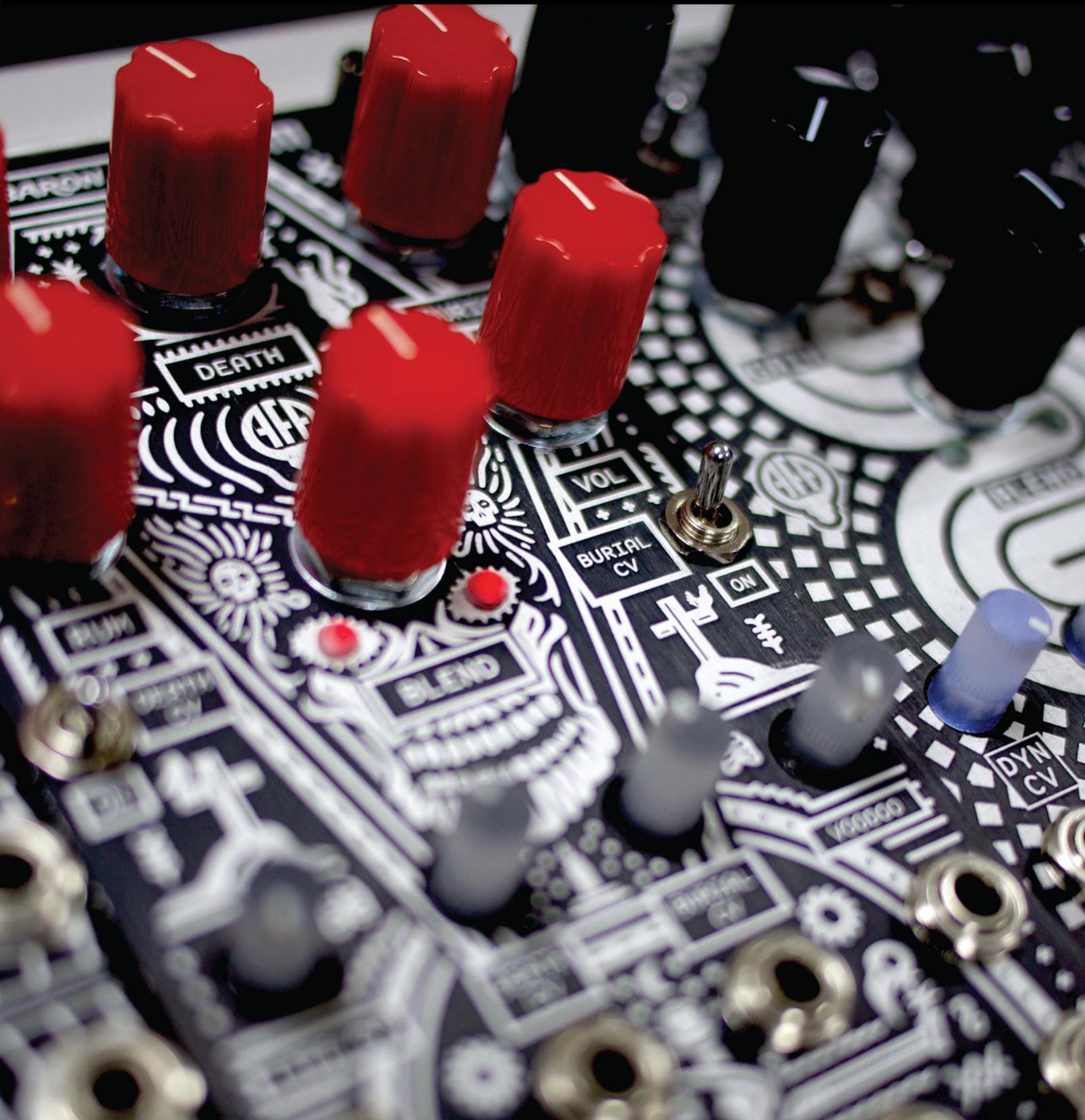
Available occasionally at
www.mordax.net
and retailers worldwide.

SUBTLETY IS THE ONLY SIN.

ANIMALFACTORYAMPS.COM



ANIMAL FACTORY
AMPLIFICATION



The past several months we've been traveling between cities throughout the United States quite a bit to spend time with family, and sometimes it's hard to tell the difference between one place and the next, especially if you're just driving through. There's not a lot of variation seen from the freeway, highway, or interstate and that makes it a challenge to remind yourself that you are, in fact, somewhere new, somewhere unique.

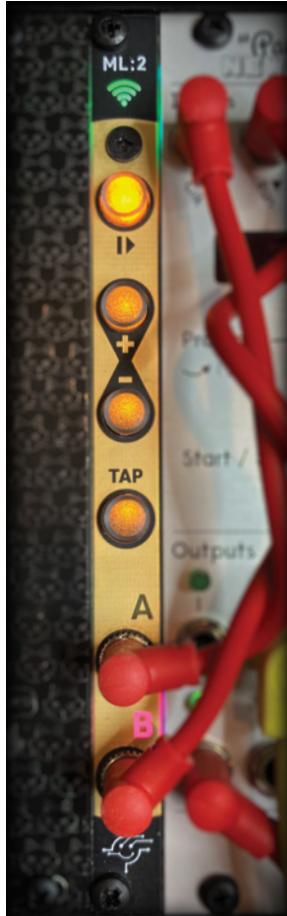
One thing I like to do when traveling is listen to the radio, local radio particular. It's typically there that I'll hear something that will cement a city or town in place in my mind, where a song or radio type of experience will stand out. In November I drove from Santa Fe to Atlanta—a twenty-hour trip—and was rewarded with some of the best and most unexpected local radio experiences imaginable. Starting with the UNM college radio station, where you might hear a local indie band right after a New Mexico rockabilly tune from the 1950s, to the religious AM radio station outside of Rudy, Arkansas that had more dead air between talking than I've ever experienced, where listeners would call in to wish their pets a happy birthday. That station was a definite highlight of the drive and I listened until there wasn't the faintest whisper of a signal left, until I was so out of range that I strained to decipher any tidbit of crumpled language through a nearly impenetrable wall of noise.

Listening to local radio stations has become one of my favorite things. You never exactly know what you'll hear

and in a world full of corporate automated radio stations this can be not only entertaining, but refreshing and restorative. Part of the reason is that I really only listen to the radio while in the car, never at home or on a walk or anywhere else; it's the only place where I'm a captive audience, one where I will pay attention to it, of course while paying attention to the road. This exploration of what's on the airwaves is something I look forward to when I know that I'll be driving any length of measurable distance, and in the U.S. there's a lot of measurable distances to be driven on a daily basis. I find myself driving everywhere, from the grocery store to the bank, to the gas station to the hardware store. Sometimes, after listening to a golf show or some hometown angler radio I find myself asking why I stayed with the stations I did when I'm not even invested in the topic? Mostly it's because they were awkward and imperfect, eclectic and interesting, and very human.

Synthesis and electronic music in most forms have a lot in common with this thinking; there aren't too many times after spending time in my studio, going to see a live performance, or talking with an artist or manufacturer that I don't feel inspired or energized, and sometimes completely surprised by a new sonic discovery. It's this surprise, this unknown, that has become such a rare and precious commodity to me, something that's become harder to find in today's world, something that I hold on to when I find it.

- Ellison, December 2022



Pamela's NEW Best Friend

*(also works
great with
any other
module
that has a
sync input)*

Meet ML:2, a 2 HP eurorack clock generator with Ableton Link integration.

Wirelessly synchronize your modular with Link devices including iOS music apps, DJ software and hardware, and a growing list of DAWs.

- Built-in 2.4 GHz WiFi
- Supports up to 24 PPQN clock output
- Adjustable shuffle/swing
- Gate output for DIN sync-style Run signal
- An easy to use web browser-based app for configuring and updating your ML:2



Learn more at
CircuitHappy.com





CONSTELLATION

8 channels of trigger / gate rhythm generation

8 euclidean patterns per channel each with clock division, burst, ratchet and probability

Combine multiple dense and sparse patterns with logic to arrive at complex and musical rhythms

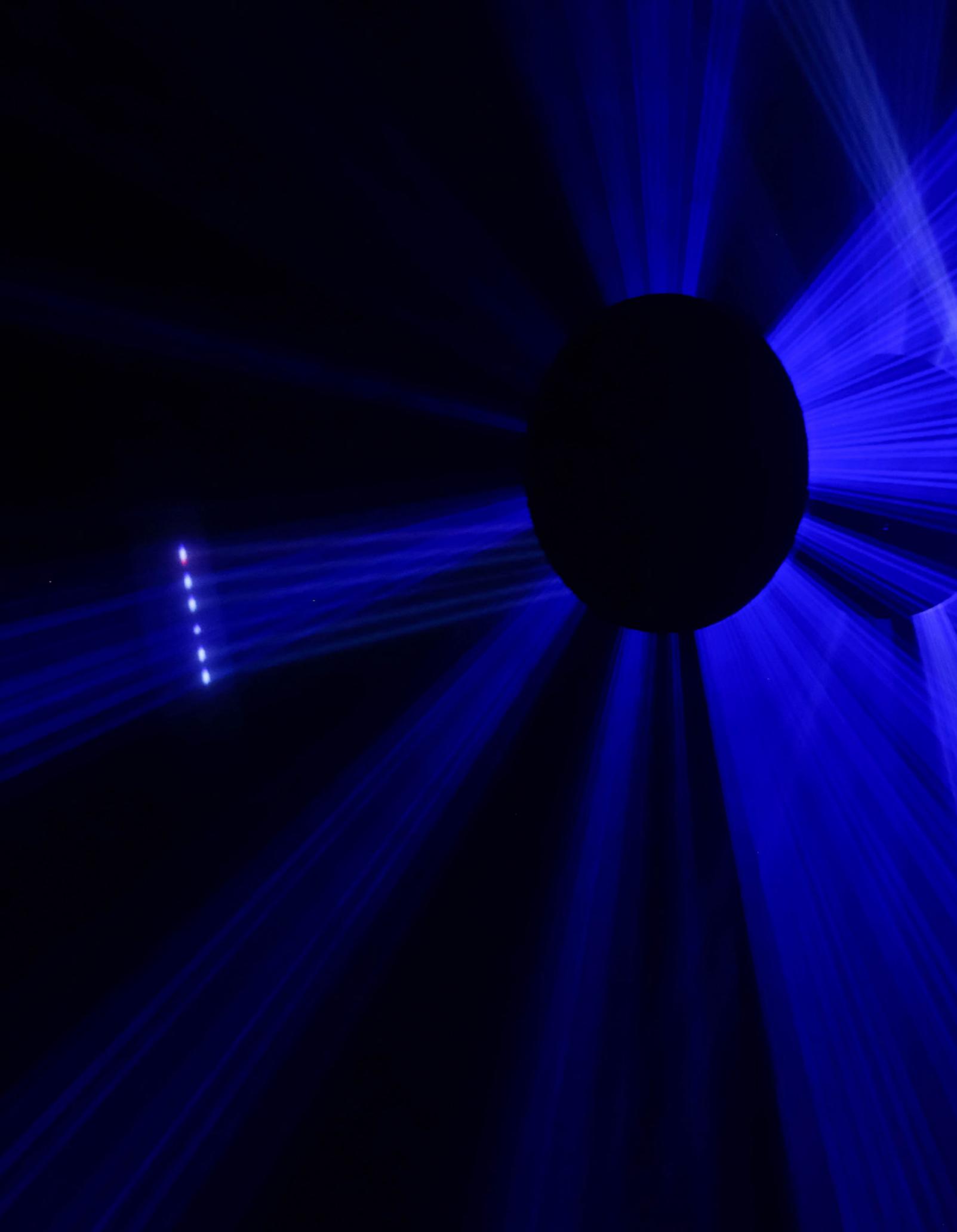
8 freely assignable CV inputs to modulate euclidean parameters for continuously evolving rhythmic movement

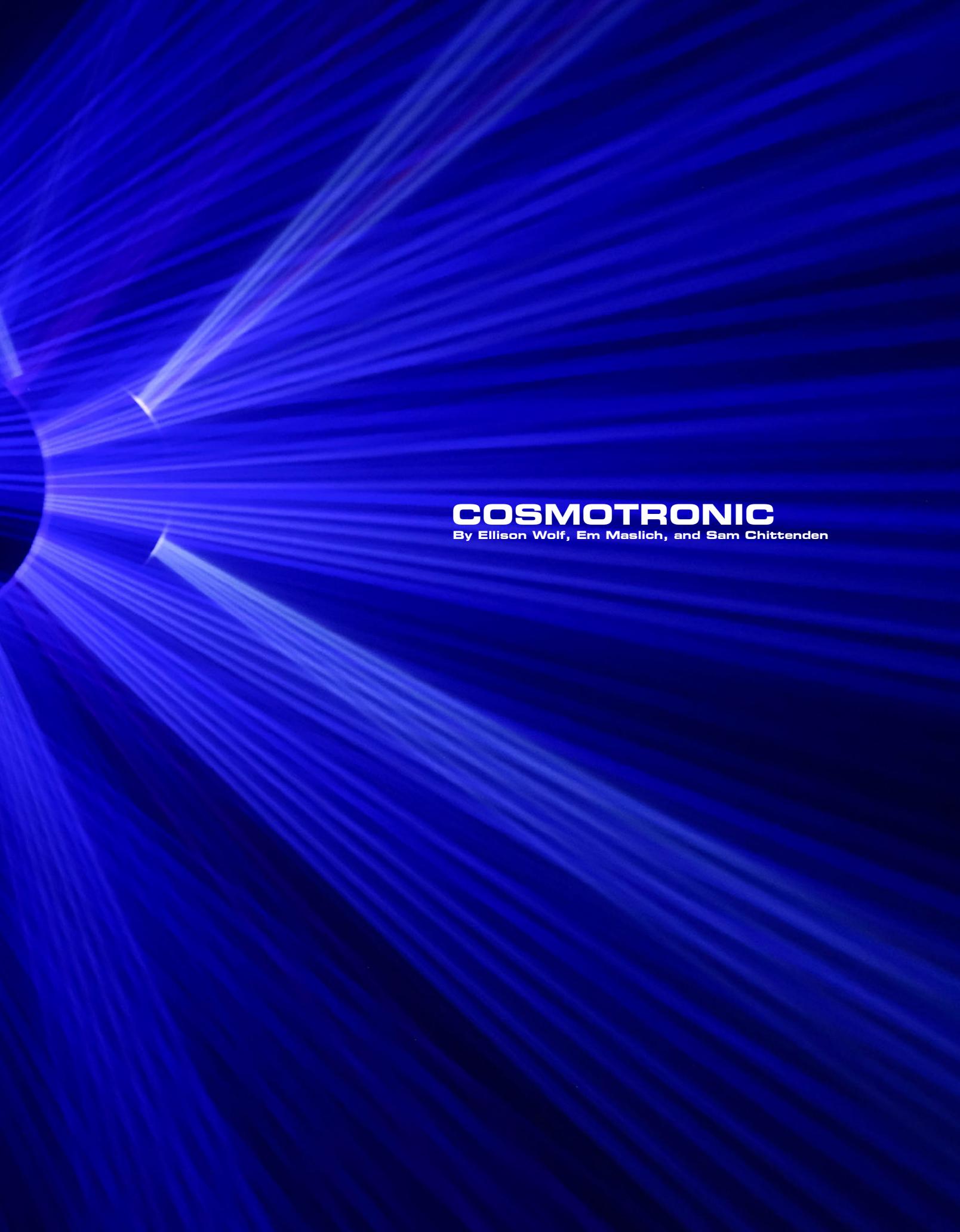
Save and load channel settings from up to 20 save slots per bank and up to 999 banks

Manually move between save slots as a performance technique in live mode

Robust internal and external clock options to synchronize tightly with all your other gear

find out more at acidraintech.com





COSMOTRONIC

By Ellison Wolf, Em Maslich, and Sam Chittenden



Previous page: *Hyperplanar1*, Matthijs Munnik.
This Page: **Matthijs Munnik, Luminial Installation.**
Following Page: **Cosmotronic HQ Workspace.**
Photos provided by Matthijs Munnik

Perception is a process, an intricate routing and organizing of sensory input, attention, experience, and history that lies somewhere between science and art. It is physical and psychological, and no matter how much we may feel it is true, how much we think we can rely on its consistencies, it can be changed. It is in those moments, perhaps just under the thresholds, where expansion is possible. Cosmotronic's Matthijs Munnik is interested in these spaces, those moments where we become aware of our perception, and how art can provide both a setting and challenge to the underpinnings of its architecture.

Inspired by artists such as Robert Irwin, James Turrell, and the Light and Space Movement, Munnik creates immersive works in light, color, and movement that explore sense and perception, and they are as technical as they are visually stunning. While studying art in the Hague, Munnik followed an innate curiosity that led from drawing to painting to kinetic light installations. An interest in new media art and circuit bending, as well as a need for hardware for an immersive installation, eventually brought Munnik into the world of modular synths. Carrying his influences and practices over, he began designing the all-analog modules that make up Cosmotronic.

Situated in a repurposed industrial building that houses artists of varying practices with workshops, woodshops, metal shops, and heavy machinery all around, Munnik's studio is rectangular in shape, with large windows that allow for light to flood

the space. At one end of the studio, well-tended plants sit above Munnik's electronics workbench and test station, as well as a prototype of an upcoming module and an all-Cosmotronic modular setup. Towards the middle of the studio, tools of every sort and shape sat cleanly put away in between a laser cutter and industrial worktables. Order is everywhere: Everything in its right place.

On the other end of the space, there is a small loft area, reached by climbing a precariously narrow stairway, where extremely detailed mechanized creations and luminescent artwork sit propped against walls. The mechanical guts of works in progress lay neatly in the actual loft space, itself not much bigger than an airport bathroom. My attention was immediately drawn to one of Munnik's light sculptures; two intricate patterned discs moving in a circular motion in opposite direction of one another, crossing and combining lines and shifting lights, the slow hum of finely tuned gears, the soundtrack to the hypnotic movement. As I stood staring, I felt something shift. All sound and motion blurred and my eyes and mind skittered as they tried to make sense of something they couldn't quite perceive, at that threshold that inspires Munnik's work and sensibility. As I became more immersed, the world was tuned out and my familiar ways of grounding—the sight of a horizon, physical touch, pattern recognition—had fallen away and left me. Space opened up. This is by design, this is intentional; this is Cosmotronic.



You learn the most from when it doesn't work and then you make it work.

Waveform: Your light sculptures are beautiful, evocative, and technical. How did you get started building those?

Matthijs Munnik: I was enrolled in the Art Science program at the Royal Academy of Art in the Hague, with a focus on audio-visual art. It's a really great program with just a few students and a lot of freedom, and it's where I developed my first light art and installation-based artworks. There were a lot of interesting classes and projects, mostly involving live audio-visual performances or installations and sound art projects, and you were free to do what you wanted. There were also classes on electronics, programming, and tools like MaxMSP.

Did you intend to study electronics there or was art your main focus?

At first, I was really into drawing and painting, then more into the new media, and then kinetic light installations. My graduation work was a piece called *Citadels*, an installation with colored stroboscopic lights; basically a whole space, totally white, with a big light field emitting stroboscopic patterns in all kinds of colors that had some kind of interference with your eyes, and it created these hallucination, fractal-like patterns.

There are definite crossover aspects of audio-visual, multi-sensory aspects in your art. When we met you at your studio

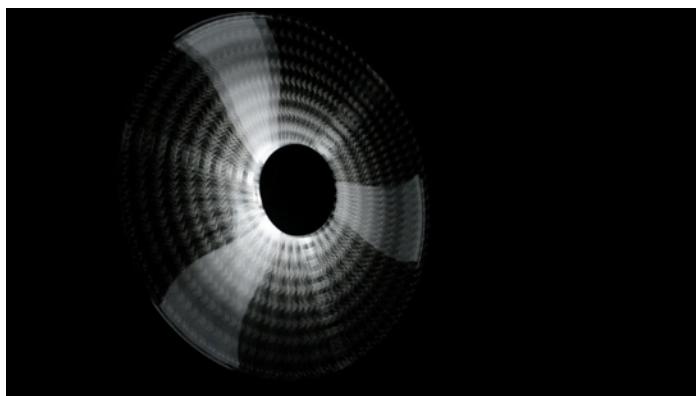
and looked at your work we talked a bit about psychology, psychoacoustics, and composer/artists like MaryAnne Amacher.

I listened to some of her pieces a few years ago, and it was a very interesting experience. In the 70s she began composing pieces on the Triadex Muse, a synthesizer developed by artificial intelligence pioneer Marvin Minsky. It's one of my favorite synth designs; very elegant and innovative, and it kind of looks like it was designed by Dieter Rams. My favorite part is the additional light unit that visualizes the sounds. The Triadex Muse was actually more of a sequencer than a synthesizer, but it did produce basic tones. When Amacher was playing around with it, she found that at high volumes certain loops of tones would create sounds within the ears themselves. These so-called "ear tones" or otoacoustics became the subject of these compositions. It was literally ear-piercingly loud, but very intense and beautiful in a way, and like nothing I had heard before. I find these kinds of sensations very interesting. It's like they exist at a kind of threshold of our perception. Audio-visual installations and performances can create immersive spaces focused on exploring this, it lets you set the environment to give your audience a new and shared experience.

Was that something that informed your art while you were studying at the Academy?



Yes, perception and perceiving your own perception have been the core theme of my work. Art can be a great way to create an environment for focused perception, maybe in a similar way to a deep listening session. In 2021 I worked with theater maker Boukje Schweigman and artist Cocky Eek on a theater piece called *Spectrum*. It was a specially designed cocoon-like space where you enter and stand on a kind of plank that very slowly folds back until you lie down facing the ceiling. Then the ceiling opens up, and a composition of light starts, with music made by Yannis Kyriakides. It was like a meditative journey of light and sound. This project came out of an earlier work I made called *Luminal*, a shadowless big room with all corners made completely round. You enter through a kind of portal and walk inside, and there are no shadows, only light gradients that slowly fade into each other. It can be a really emotional experience for some people to be completely immersed in color.



This immersive aspect sounds powerful. I can't think of any natural space, other than floating in a body of water or outer space where you can lose indications of where you exist in space. What other projects stand out from that time?

One of my first artworks was called *Microscopic Opera*. It was about the nematode called *C. elegans*, filmed with microscopes. They each had a genetic mutation that altered their movements. Five screens displayed the nematodes, and their movements were translated into singing voices. It's kind of a generative thing so that when they come in front [of the microscope] they perform.

Had you been interested in light art, electronics, and creating installations before going to the Academy?

Yeah, a little bit, but there was no place for me to learn. I was very interested in media art and was playing around with Arduinos and circuit bending, and making a lot of patches in MaxMSP. I had an idea for an immersive installation with stroboscopic light, and I needed to figure out the hardware to make it happen. There was a great electronics workshop at the Academy that helped me out, and that's where my interest in electronics started.

Where did it lead? What were you making?

First I was making small drivers for LED's, and then I became interested in guitar pedals. I liked that they were easy to make and you could build them, but I didn't play the guitar.

You didn't play the guitar at all?

No [laughs]. I was building the pedals and thought it was cool that they were modular in a way that you could change the order and do feedback stuff. I was doing that for a while, and then I bought a guitar and I was like, "Okay, I need to learn how to play this because I make guitar pedals."

So did you learn how to play?





I think of module design, the electronics design, as a kind of modular inside the module.

No, that never really happened. Jan Willem Hagenbeek from Ginko Synthese introduced me to modular, and that was actually what I was looking for, to skip the pedals and go to modular sound sources and synths. I started building some kits and some basic modules and it grew from there.

Just get rid of the need for the guitar altogether. Do you remember the first kit that you built?

Something by Bastl. A kick, I think.

It feels pretty good when you build something and it works, right?

Yeah, but it doesn't feel so good when it doesn't work, though you learn the most from when it doesn't work and then you make it work.

That's true. How did you transition from building kits to designing circuits?

I was on the train a lot going to Amsterdam because I was doing an art residency at Rijksakademie. I was doing circuit design and I just got more and more into it. It was a very gradual process, as with learning anything, but when I really get into something, I can work on it for a long time. After a while, I started to learn how to do simulations in LTspice on the computer. I learned a lot faster because you could try something on the simulation and see what happened, and then at the end of 2019 I released the Delta V, and the mixer [Cosmix] was after that. It was quite popular, and kind of took off and I thought, "Okay, this is a viable thing," so I put more energy into it.

So that's how Cosmotronic started? It was only three years from building that Bastl kick to releasing your first module?

I just get some kind of hyperfocus, and then I want to know all there is to know, and once I got it—how to read schematics, and all the values and circuit blocks in my head—then it was kind of easy. When looking at a schematic, it's just all these pieces and it starts to make sense, you can take different blocks and combine them. Once I understood all the blocks, it was similar to things I'd learned earlier, like programming or MaxMSP with patching.

Is the process of combining the blocks something that draws you to circuit design? What is it about electronics that appeals to you?

I'm really fascinated by electronics as a kind of visual language. Schematics are an elegant way of writing down these designs with almost no text. It's all images, really, from the schematic to the board layout, down to the silicon wafers, and to the output on the oscilloscope. That's what I find very satisfying about it. A populated board might not look interesting on the surface, but there's a kind of hidden world inside. All the signals are flowing from one place to the next. That's really the beauty of analog. What I find interesting in a modular setting is how so much complexity emerges once you introduce voltage-controlled modulation. I'm equally interested in all the waveforms and processing inside the module, and I think of module design, the electronics design, as a kind of modular inside the module.

How did that interest translate into something like the Delta?

I was always patching envelopes into a VCA as a voice and I



Page 12: *Citadels, Peradam, Common Structures, Hyperplanar 2*. Matthijs Munnik.

Previous page: All-Cosmotronic setup.
 This page: Messor, Peradam, Cosmix Pro.
 Photos provided by Matthijs Munnik

I like analog because there is a signal going all the way and it's modulated and transformed. It's still some tangible thing.

thought I would like a very small 10HP [module] to have all this functionality. I had the idea to normalize the input so it can be an envelope when you patch in audio, or with another signal, it becomes like a VCA. That solved the space issue; you have the VCA when you need it, but it's not in the way when it's not there.

What about the interface design, is there any sort of technique or ethos that you adhere to?

Designing the front panels and the electronics kind of go hand in hand. When you have figured out what your style is, then it becomes easier to design the next one because you already know the knobs and the sizes, the labeling...I usually design and prototype in LTspice and when I have a simulation working, I do a lot of sketches on ideas I might have, and sometimes after working on it for a while I might have a first draft of a module. From there I'll draw up the actual PCB with all the controls, with no constraint on size and functions, and then I'll do a couple of sketches to mock up a front panel for a specific size and I'll keep adding and removing controls until I'm happy with the form factor. There's always a balance between size, complexity, ergonomics, and cost. Adding one more function could make the module 4HP wider. I also want the combination and placement of knobs and jacks to be aesthetically pleasing and to make sense on a functional level. I feel what I think is right, what feels logical.

How do you think your background as a visual artist has influenced how you design modules, whether it's with the circuit design or the overall aesthetic of Cosmotronic?

I approach them similarly to an art project. It's a creative thing and I only design when I have some inspiration, some curiosity about how something works, or some idea of how I can do something different. I don't want to do the same thing, and that's why I like Eurorack: everyone is making something new; we're not all making the same module. There are, of course, similarities, but every module has some distinction or other feature or innovation.

You mentioned earlier that after the Delta you released

Cosmix. Do you typically have a planned progression for the things you want to make?

Not really. Of course, it's nice to have some system, so maybe I would like to do a filter, that feels like a logical thing, but I haven't had a good original idea for a filter yet. It just takes time. I put some thought into it and when it's done in my head, then I can make it really fast. Like with the [Peradam] distortion, I drew up the schematics for the initial version in two days because the idea of how to do it was already in my head. Of course, it takes a bit longer to fully flesh out the module.

What about something like the Vortex, which is obviously much more complex?

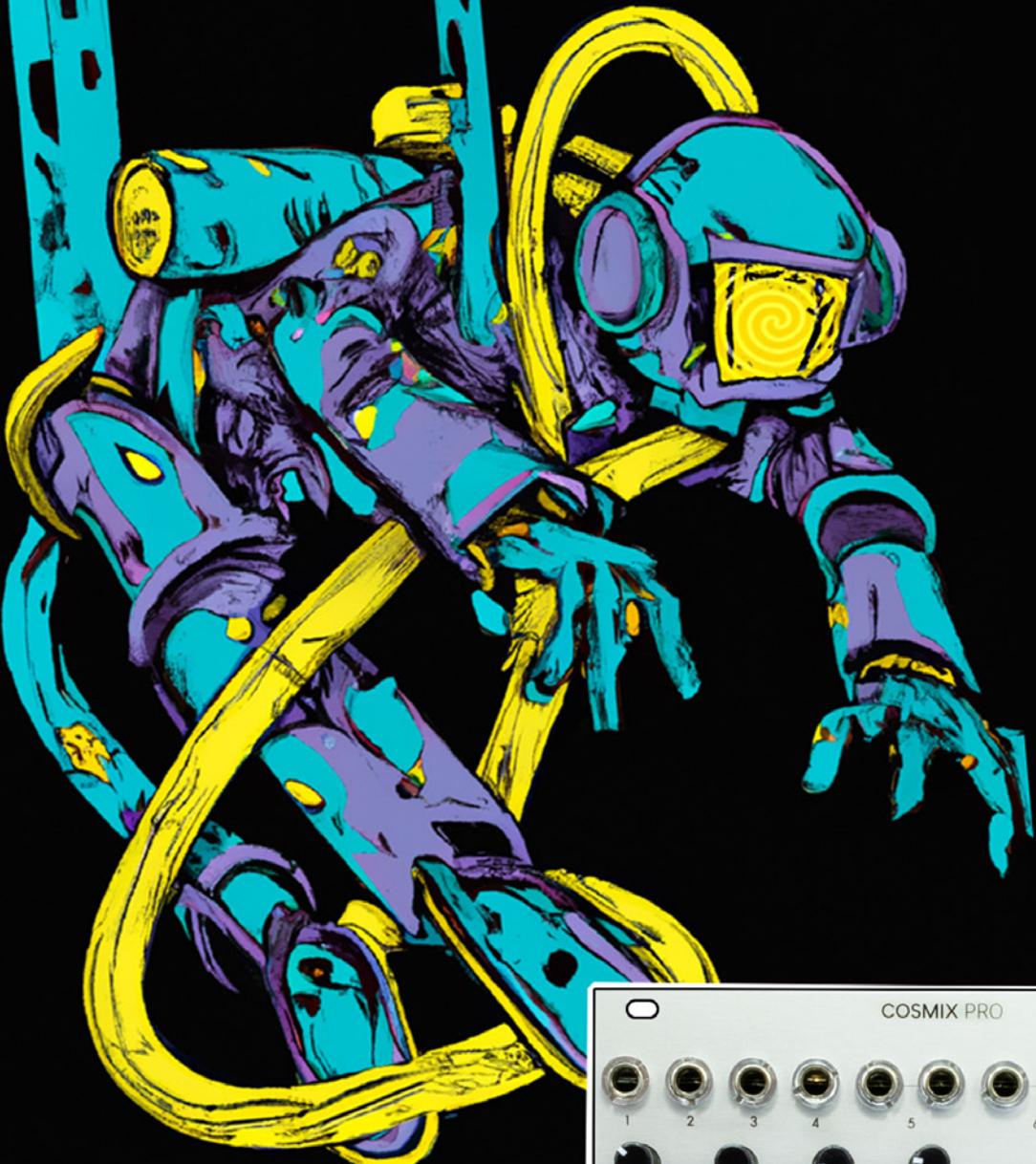
That took way too long—three years—because it was so many iterations and I was never happy, it was never good enough. Sometimes you put it away and work on things in parallel. Usually, I go back and think about a new concept over a longer period of time until I am happy with it. The Eurorack format is so tiny that it can quickly be too much and I like that modules can be a bit minimal.

Are you the only person that works for Cosmotronic? Do you do everything?

Yeah. I don't do the actual production, that's done by a local contract manufacturer, but I do everything else; the packaging, testing, ordering parts...I have a big parts inventory and to keep track of these 1000s of parts and all the reels...It's a headache.

Do you do the instructional videos for your modules as well?

Sometimes. I feel like I should be more on top of making Instagram posts or fixing the website...it's always things like that, that kind of slip behind. It's all a process. Because of all the details, wanting to make sure everything is right, and managing the production takes so much time, it's like full-time Cosmotronic. I want to re-organize my time so I spend more time on designing and not so much on the practical production. **Continued on p. 80**



COSMOTRONIC

COSMIX PRO



A man with short hair and a beard is focused on a large-scale artwork he is creating. He is wearing a dark t-shirt with a graphic design featuring the word "SICK" in large, stylized letters. He is leaning over a massive, sprawling collage that covers a significant portion of the floor and wall space. The artwork is composed of thousands of small, overlapping images, possibly Polaroids or printed photos, creating a dense, textured pattern. The man's hands are visible as he carefully places and arranges the individual pieces.

schlappi engineering

by Ellison Wolf and Sam Chittenden





Knowing what you want is vital, the very thing that can keep you going when the days, months, years take you in unexpected, even unwanted directions. Life may happen, may act upon you, but if you're lucky that idea, that knowing, will persist, sometimes quietly, sometimes with such noise and clammer that you can't ignore it any longer.

Originally from Phoenix, Arizona, Eric Schlappi spent his 20s living in Brooklyn, immersing himself in the city—and its noise—as much as possible and doing a variety of jobs while figuring out a way to make building synthesizers a reality. While he had been ruminating on the idea for years, the skills to carry out the dream weren't always at his disposal, so he decided to study electrical engineering in New York. After five years of school and getting his EE degree, another variety of jobs awaited, though again, none involved synth building. However, Schlappi's vision never waned and in 2018 Schlappi Engineering was born and his first module, Interstellar Radio was released. It was inevitable, as Schlappi explained, "This is not like a story that has a beginning, the only thing I've ever cared about were synthesizers."

Having recently spent time living in Grenoble, France, Schlappi is now back in the States and based in Portland, Oregon. Along with the recently released Three Body, Schlappi Engineering modules are situated uniquely in the Eurorack landscape, which is to say, there are no modules out there like them.

Waveform: What was your first synthesizer?

Eric Schlappi: My uncle gave me a Casio CZ100 and after that I got a Yamaha TX81Z, a Juno 106, and an old Waldorf Pulse.

How did you end up moving to Brooklyn? What were you doing there?

I went to school for audio and worked in a recording studio for a while as an engineer, but I didn't really make it past the internship stuff. If you want to be a recording engineer, you have to hustle to get clients and I got really disillusioned with the fact that it's not actually a technical career, that it's a people career. The best engineers do have skills with audio, but they also have the skills with people.

Did you feel like you weren't interested or you just didn't have those kinds of skills?

I just didn't want to hustle and have to go out and find bands to record. At the same time as I was working in the recording studio I was doing live sound at a company out of the Bronx. We did sound at smooth jazz dinner cruises on the Hudson, cultural events in the parks, weddings, graduations, corporate events, and other such things where we had to carry a soundsystem both in



There's usually this first stage where I want to accomplish this idea and the idea might be musical, but it might not be—it might just be theoretical.

and out. It was quite an experience. Fourteen hour days were common. That type of live sound is a huge amount of manual labor and makes it rather hard to enjoy music. I've done sound in rock clubs a few times and didn't find it much better. Somewhere between being a sound guy and the EE stuff I worked in several vintage synth shops in New York.

Fixing synths?

I did a lot of things. There was a year or two where I worked at a DJ shop, where we just repaired [Technics] SL-1200s all day. In Brooklyn there's enough DJs to just do that one thing, so I'd just fire through 1200s.

What would go wrong with those?

There are a few things, but the number one thing is just replacing the RCA cord, because for whatever reason [1200s] come with the RCA cord attached to them. Then, of course, the tonearms are very fragile, and we also did a lot of adding LEDs under the plate. At some point going back to school and doing math sounded a lot more attractive than carrying around speakers so I went to get my electrical engineering degree in Harlem at the City College of New York. When I went to engineering school, the plan was to build synthesizers, and I went to get my EE degree because I'd tried building synths but they didn't work. It was hard. I did all this work to get that engineering degree...

And you're fixing turntables. After finishing your EE degree what did you do?

I immediately left New York. I graduated when I was twenty-nine and I think that was the right age for me to stop living in a punk house in Brooklyn, though it still informs everything I do.

What do you mean?

For about ten years, when I started going back to school for engineering and had also been in Brooklyn long enough to have a social circle and be pretty familiar with the music scene, I went to

noise shows almost every night. I'd study until I couldn't handle it anymore, then go out. We would play music many nights a week in our apartment or walk down the hallway and catch a show on the same floor. Many of my roommates and neighbors were excellent musicians and I loved the constant jam sessions and just standing around in the hallways drinking terrible beer and surrounded by broken glass and spray paint fumes. It was constant sensory overload: Bicycling everywhere, hundreds of live shows, lots of punk rock bullshit, really steeped in late 00s DIY/noise aesthetic. I wouldn't want to go back to it, but I feel like I was really soaking a lot of things in, there was always something happening.

That sounds like a satisfactorily intense experience. Were you working on much of your own music at the time?

I didn't have too much time to work on my own stuff, but I finished a couple albums, both with a breakcore/industrial project, The Wretch, and my solo stuff [Negatek].

Did you ever perform while you were there?

Only a few times. The best band from every town in the US moves to New York as a fully established band, so it's not the place to get started, because you don't really get the space to develop what you're doing, but it is the place to see music. From there I moved to Tucson and I got a space, and that's when I started performing a lot. I got to be the noise guy from New York and to play the best shows.

What was your setup like in Tucson when you were doing noise shows?

It was almost always two monosynths and a drum machine or two. I would write simple songs and play the bassline on one and the lead line on the other and also be able to improvise or go into noisier territories. For most of that time it was an SH-101 and the Korg reissue Arp Odyssey with a Volca Beats for drums, but I did occasionally play dronier shows with less synths or bring out more synths or the modular. I started a Eurorack system shortly



Opening spread: Eric Schlappi performing at Basement State, 2022.
Photos taken from performance footage.

Page 18: Eric performing at PDX Synth Fest, 2020.

Page 19: Schlappi Engineering modules.

This Page: Eric in his office.

Following Page: Quitmyst Lamperage performing in France, 2022.

Page 22: Eric performing at Modular Day Barcelona, 2021.

Photos provided by Schlappi Engineering

I get up, I walk, maybe I actually play with the synthesizers, do some design, maybe I get to practice with my noise band in the evening. That's the shit.

after moving to Tucson and used it on recordings but wasn't really comfortable with it as a performance instrument until much later. I would also always bring out tube amps for each of my synths, which was a bit ridiculous but sounded great in those DIY venues and provided a sound more like the rock bands I would be playing with.

Did you utilize your EE degree when you got to Tucson in a music field? What types of jobs were you doing with your new degree?

The first thing I did was work in the defense industry in Tucson building test equipment. It was miserable. Most of the people there wanted to go to work and to know that they were going to have a job in five, ten, fifteen years, that they could just show up and then go home and watch TV. Fuck that. That's what I don't want... bringing your shit and putting in the microwave every day and eating it in your cubicle. That's the thing to avoid.

How long did you do that?

Three years. For most of those, I forgot that the goal was to build synthesizers. I was like, "This is my life now," but somewhere along the line I started building. During college the five year plan was to go to engineering school and then go build synths, but you spend five years doing lots of math and feel like you have to use it.

I think that's pretty understandable. How did your first module, Interstellar Radio, come about?

That came out of a weird circuit I did around 2016 when I was in the medical industry, after the defense industry. I worked doing freelance electrical engineering work for a startup which was reverse engineering large, high voltage, high current, medical equipment in order to sell retrofit replacement parts. One of the projects involved high voltage, like 30 kilovolts at 9000 amps, that happened in nanosecond pulses, like an EMP [electromagnetic

pulse]. Different parts of the system had to talk to each other without being electrically connected and I ran across some old circuits for a crude way to make an ADC. You take analog voltage and convert it into a high frequency pulse train. Once it's a pulse train you can send it over an optical cable and avoid the electrical connection, and then demodulate it back to the analog voltage. I was like, "What if I ran these two sides at different clock rates? What would it sound like?" This is one of the great things about analog, doing the sort of EE theory where you can make something that is relatively simple to design, but where unpacking the theory behind it can actually be quite complicated. In the case of the Interstellar Radio, I thought it would be like a bit crusher, but it's actually several layers of frequency modulation.

What were you designing Interstellar Radio to be?

The original intent was to use it more as a processor, but I always use it as a sound source. It's a little similar—in theory, not in the implementation—to how the 808 cymbals work. It's a whole bunch of really simple oscillators and they're effectively frequency modulating each other, and you get this white noise. In modeling, you think about what's happening when the cymbal gets hit and you try to model that, but then there's the perceptual side of things where what we're hearing sounds like a lot of white noise. There are a lot more harmonics than we can process. What if we just create all these harmonics? It's essentially four layers of frequency modulation that creates this broad spectrum of harmonics that are related to each other.

That relationship of the harmonics that you just described makes me think of the related phase outputs on your next module, the Angle Grinder. I feel like that release raised your profile, would you agree with that?

Yes. People like it, but I find it difficult to explain it because it isn't one thing, it's a big compromise between a bunch of different

ideas. It's a pretty good state variable filter. It's a pretty good analog oscillator. It does a unique form of distortion, and you can use it as a pretty good low frequency oscillator. Where it's really interesting is when you use it to modulate things while processing them while oscillating, and then it's something that both reacts to everything else in the patch and puts something else out. It's very difficult to explain and I never know how people are going to use it. The Angle Grinder is a weird one because I'd been really interested in the concept of quadrature oscillators, and they have lots of interesting uses. At the same time I was working my way through all of the classic synth circuits and realized how simple pulse width modulation is just a comparator. In a classic mono synth, the pulse width modulation circuit is a comparator with the triangle or the sine coming in one side and the external voltage coming in the other. Out of it you get this moving wave shape width—or the square wave variable width—



I forgot that the goal was to build synthesizers. I was like, “This is my life now.”

but actually that variable width is a form of phase modulation and doing pulse width modulation is a pretty complex effect. That was kind of the genesis of that idea and then it kind of kept evolving because I wanted to use it in my set.

Why did it keep evolving? Is that just simply part of your design process?

There's usually this first stage where I want to accomplish this idea and the idea might be musical, but it might not be—it might just be theoretical. It has to be useful in my case; it's not good enough to release something that's just a weird idea I had.

So that's your bar, if you can use it in a live setting?

It's actually a lot higher than that. It has to deserve a permanent part in the case. Both the 100 Grit and the Angle Grinder have stacked use cases.

You say that the Angle Grinder was a compromise between a few ideas. Was it the same thing with 100 Grit? That's a module with numerous uses to it as well.

With the 100 Grit I was really thinking about this certain form of distortion [found] on the RadioShack Moog, the MG-1. I have one of those, and I modified it with a pretty common modification where you take the headphone output, you run it into the filter input, and you get this insane feedback sound. I was like, “Where does the sound come from? What could be creating that sound?” So I breadboarded the filter, and ran that back to the input on my resonance. I was using the headphone jack, so I put the headphone amp in there, and it's this chip, an LM386, which is one of these dinosaur chips from the 70s. It turns out if you overdrive it, it sounds awesome. So that's the distortion circuit in the 100 Grit. The real focus there was to create this feedback sound that I heard, but I didn't want a whole module for this one sound, and so it sort of cross-pollinated with another

idea I'd been thinking about for a while, a cracklebox, because in a cracklebox you touch different pins of an IC to create awful sounds. I'd created them with PLL [Phase Lock Loop] chips, and once I realized that the special sauce—the sound that I cared about—was distorting the LM386, I was thinking that you can just touch the pins, so the touch points are the distortion chip. There's actually a second distortion chip that there's no output for, but I use for one of the normalized feedback paths. On that module, and I guess most of my modules, I got really obsessed with the idea that it should play in the system, but also by itself. Every control should do something, but it should be able to be used as this noise box without anything else. So there are a number of chips back there where their sole purpose is to provide another interesting feedback path. The coolest one on 100 Grit is on Input One, because I felt like it was too gnarly and I should kind of hide it. Most people are going to use Input One for audio, but at this point, I always put audio into Input Two, and use a little bit of Input One's feedback path, because that's a second distortion. So I had these two different things I was interested in, a cracklebox and this distortion feedback, and I was like, “Can we do them both at once?” That's two uses, but neither of those use cases deserve a permanent spot in the rack by themselves. In a synthesizer you don't always need a cracklebox or distortion, but then you bring in a version of the ladder filter and a VCA, and here are things you do always need. Some people try to create some instrument with their modular and then they leave it patched in that way. But for me, the best part is being able to unpatch it and create a different instrument. With these more basic building blocks it gives you more flexibility. I spent a lot of time actually making it as nice of a clean filter as I possibly could.

Schlappi Engineering modules are not necessarily known for their nice, clean sound, but even your newest module, Three Body, cleans up well. That's very thoughtful of you.

With the Three Body, what I'm personally doing with it is horrendous noise, but it should also be able to do extremely



phase and frequency has at least a surface level relation to the physics problem. Whether or not it actually gets to mathematical chaos, it is absolutely enough to create quite a lot of complexity. I love the point where a simple, easy to predict system tips over into, "I don't know what the hell is happening anymore!" just by adding a few feedback loops or points of cross modulation. It's even better when you can get a feel for how the system will be affected so you can play it as an instrument, even though it is always something different.

I hit that tipping point many times with the Three Body where I could predict how a parameter change would affect an output or another parameter, but only in the early stages of change. After a certain point all bets were off. You showed Three Body at trade shows for quite a while before it was released. What was the most difficult part in the design of that one?

The whole headache with temperature compensation and the exponential conversion. That's the hardest part of making an analog oscillator, generally. It turns out that even with digital you have to deal with temperature. It depends a bit on what ADC you use, but they need a reference voltage, they don't know what three volts is. They have a top and a bottom, and they assign however many bits, so if you're using the top ADC, you get 4096 values between zero and whatever your reference is, but most ADCs don't generate that reference so you have to pick a reference. It's just a reference voltage, but any reference voltage has a temperature component to it. If you change the top value,

You spend five years doing lots of math and feel like you have to use it.

clean sine waves. If you're saying that you can do FM, you should be able to do the clean bell tones, you should be able to track volts per octave, and it should be temperature compensated. A lot of people end up using it for the base functions by choosing certain controls and certain configurations. Even if you say it can do everything, there is going to be something that's going to be tabled, because it can be three decoupled oscillators freely, or you can use it as like a clock LFO or an FM toolkit, but the way it's normalized is for this freaky stereo noise, because that's what I care about.

You said it's kind of hard describing the Angle Grinder. What about the Three Body? How do you describe that?

It depends who I'm talking to. I do try to be considerate, I won't go too far with [the description], but I do try to judge people's comfort level. I am aware that my sounds are not for everybody.

Is there any connection from your Three Body to the three body problem in physics? It seems that it would make sense since you seem to enjoy feedback loops, and things where one thing is affecting another, which in turn affects the original thing, as well as your fondness for chaos in music in general.

Yes! I don't think the connection to the physics problem goes terribly deep, but three oscillators being able to affect each other's

you change the whole range and change your scaling, which is a huge problem in every part of electronics. Going digital doesn't get you away from it.

When you were envisioning making synthesizers back before engineering school, did you have an idea of what kind of synthesizers you wanted to make?

I was always obsessed with mono synths and my favorite was the Micromoog because you can frequency modulate the filter with the oscillator at audio rate. You set the filter to self-modulate and crank it up and it sounds amazing. With modular synths everyone can do this, but not very many vintage synths have this ability to untether the oscillator. I have quite a few monosynths, and I've always loved them, but I don't think many of the older polysynths are that great. I knew what I liked and in more recent times have been trying to figure out why I didn't like what I didn't like. I was an analog snob, but as an engineer the theory doesn't change, and anything you can do in analog you can do in digital. Anything you can do one of, you can do multiples of. I wanted to find out why these synths are better for me, keeping in mind that what gets me going is really complex audio rate modulation. Digital synths basically disable that to avoid aliasing, because as soon as you start modulating something you create harmonics that just go forever, and most of **Continued on p. 78**



SUPERBOOTH 23

11-13 MAY / FEZ-BERLIN
www.SUPERBOOTH.com

Steiner



DIY SPOTLIGHT: GINKOSYNTHES

BY WILLIAM STOKES

An electronic musician with a background in ecological architecture, Jan Willem Hagenbeek began making music on his parents' computer in 1992. Ten years of modding and circuit bending later, he began performing music live, and after another ten years, in 2012, Hagenbeek founded Ginkosynthese, whose name is loosely derived from the dutch name for a particular tree, but means nothing.

How did Ginkosynthese come about?

It just happened. I never wanted a synthesizer company. I was an architect and I always thought I would stay an architect, but I was playing electronic music and for that I made my own modules. In 2008 I needed an LFO, so I built one based on the LFO chip from Electric Druid. I was on a Dutch synthesizer forum and I asked if anybody wanted one, and I sold around 100 in the first month, which was a bit scary! Suddenly, I had to make them and get them all built, so I built 100 of these. I did everything by hand, and I still do. All the modules I ship out are basically DIY kits created and then built by myself. At a certain moment, it started to generate more income than architecture was and I realized

panels were printed anodized aluminum, I could add colors and let the factory produce the panels, but I missed that DIY feeling a bit. I started to make a few one-off panels and experimented with different techniques with how I could make my own. I made a panel in enamel for the Touch module, and the process of making it was as important for me as the result. It felt more like working on a piece of artwork than working on a product. I made a small Eurorack setup with modules designed especially for that, and those had panels dipped in acid with elements of copper to give them a beautiful patina. From that idea I made a small batch of 10 rusty Sampleslicers, with a hand-stamped print on it.

How did Magma come about?

One of the things I needed in my live set was a proper sounding mixer, so I made one about seven years ago in Eurorack format. The idea was to make a nine-channel mixer with nine faders and the option for bus compression, so I made a little compressor. I've used compressors quite a lot in my live setup, but not in my Eurorack setup. I had a Roland 303 running through a Roland optical compressor, and an optical compressor is a really slow,

I realized I just don't like drawing houses for people.

that I just don't like drawing houses for people and spending all their money. In architecture everything is about money and about organizing things, and a project takes ages. I was like, "If I make a company, I want to make something which I can design and can sell directly without spending more than one year on one project." I wanted to have more flexibility and to get more enjoyment from my work than I was getting from architecture.

How much of a relationship is there between architecture and synthesizers?

I think there's quite a lot. The thing is, sound very much dictates how you feel in a space. You can really create shapes and spaces with sound. For example, if I make a little ticking sound and I just add reverb, you will experience your environment differently than if you were to just hear the dry sound. I think music is like fluid architecture; it's changing, and you can also change your surroundings.

Tell me about some of your early modular designs—you even dipped some of your faceplates in acid!

When I started making my first modules I didn't know how to make proper front panels and that lack of knowledge kept me doing aluminum panels with black print for a while. As the

smooth curve, which is really nice, but for drums it's too slow. I wanted more aggressive compression for drums, so I started to experiment with all kinds of different things. I was working on a feedback loop with some diodes to limit the feedback, to remove the extremes and from there I realized that I could CV control it, so I started to work on a CV controllable diode bridge in a feedback loop, and from there I created the Magma. I realize that compression is not for everyone, and most people don't understand what it's doing when using compression for the first time. It can be really hard to understand the pure magic of it, if you've never touched a compressor before, but as soon as you understand it, it becomes a logical thing to process your sound with. I see Eurorack as a complete system that has evolved by the efforts of makers all together, so I build what I need in my setup and that means that my modules are made from my point of view when it comes to the system and focus on live performance without any menu-diving or submenus. The main thing for me is to have experimental patching and hands-on control going hand in hand. A module should always explain itself; you should be able to use it without reading a manual. Most important for me is that I can go on stage with my selection of modules and play a live set without any preparation and no pre-programmed sequencing!

BUILDING THE GINKOSYNTHESSE MAGMA COMPRESSOR

BY WILLIAM STOKES

I sit with an exploded DIY kit before me. The module in question is Magma, a diode compressor designed for quick, intuitive compression, particularly in a live situation. Immediately obvious about Magma is its rather excellent visual element and the genesis of its name: a large backlit glass orb that glows dynamically with red, orange and yellow [or, in the words of Ginkosynthese's website, "lights up like hot lava"] in tandem with its compression circuit. It's certainly the first time I've had a glass orb roll out of a DIY kit packaging, and the first indication that this is a compressor with character.

"The Magma makes compression creative and fun," promises Ginkosynthese, and while clinicians of dynamics processing may call that statement prosaic, it touches on an interesting and ongoing discussion in the world of Eurorack; about where an instrument ends and a piece of studio hardware begins. It's the first standalone compressor

I've had in my system, and many might resist the idea of allocating valuable rack

space to a module of this type. Stepping back, though, it's worth considering the importance we synthesists place on dynamics, with a litany of different envelopes and VCA designs out there, it's hardly a leap to incorporate compression into the workflow, particularly when it comes to sculpting sounds outside the realm of more conventional subtractive synthesis, such as samples or drum sounds.

The bill of parts here isn't too daunting: a single PCB and—aside from the aforementioned orb—a familiar lineup of parts. Five LEDs are included, correspondent to the various indicators on the Magma panel, along with knobs of various sizes, a button, a switch and four sockets. In many ways, this kit is a great introduction to soldering a selection of components, since there's a nice variety here while the PCB remains fairly spacious. Alongside Magma's sleek black faceplate, a rear plate is also included, as is—courtesy of Ginkosynthese's distributing partner Befaco—a nut-tightening tool.

The accompanying literature for Magma is concise, but does somewhat lean on an existing DIY knowledge base. The forty-strong bill of resistors, for example, offers a brief color-ring

That glowing orb...is also incredibly useful.

identification chart, but no more—it's down to you to get out the multimeter and measure them yourself. While I always appreciate it when resistor values are labeled [which doesn't feel like too much to ask, particularly since many DIY manufacturers already do this], it's always a good exercise to measure them yourself and is an important reminder not to expect too much spoon-feeding from a DIY kit. There is a second downloadable document showing a diagram of the PCB which lends a useful visual, as well as a Ginkosynthese-endorsed YouTube build tutorial, which I think is fair to count as part of Magma's instructional folder in this case.

Jan is a very responsive and helpful developer, and was more than happy to answer any questions I had about the build, no matter how trivial, basic, or pedantic. It's

one of the things we love about DIY culture and boutique Eurorack developers in general: no convoluted customer service forms here, just a direct line to the person who created the module in question and a mutual understanding that it's tough out there.

With the Magma built and mounted, it is a very pretty module with that glowing orb, which is also incredibly useful. Even as a simple gain circuit it sounds lovely, and can achieve some pleasant break up if desired. It's the kind of compressor that would feel just as at home in a 500-series rack, and it sounds like it, too. An audio side chain input with attenuator makes for some highly musical—and at times—highly experimental patching, and a simple envelope control [a switch toggles between fast or slow attack and a knob sets release time] harks back to the fixed-threshold compressors of yore, and there is a lone CV input with attenuator, for the compression level. This, paired with the audio side chain input—here called "Envelope"—render the Magma a wonderfully creative module that can lend some serious space and dynamic interplay into your patches, as well as sculpt individual sounds with finesse. Excellent stuff.



Above: Ginko Synthese Magma Diode Compressor
10HP, +12V = 62mA, -12V = 57mA
Photos: Provided by Ginko Synthese



A photograph of a roller coaster at night, illuminated by vibrant blue and purple lights against a dark background. The track curves through the night, with a train visible on one of the loops. The sky above is filled with numerous small, glowing stars.

Five12

By Ellison Wolf and Sam Chittenden



Previous page: **Manipulated selfie, 2022.**
Photo: James Coker; Design: Sam Chittenden

This page: **James Coker in Santa Fe, 2022.**

Following page: "The Octopus" prototype; The Vector and Jack Expander.
Photos: James Coker

I had the opportunity to spend the summer in Santa Fe, New Mexico last year. It was an unexpected and short-notice sort of offer, and I wondered about the hasty decision to act on it as I made my way out from Seattle. As the landscape began to change color and open up, I felt the apprehension shift into a different gear and I looked forward to going back to a place I hadn't been to for almost twenty-five years. I'd traveled through New Mexico in the late 90s, on my way out to Los Angeles, looking for abundant sunshine after living in Vermont for six years, but hadn't been back to the Land of Enchantment since, and couldn't really remember much about my time there, other than the blue of the sky, the orange of the earth, and how I had to spend ten days hunkered down in a monastery while waiting for my car to get fixed so I could continue on my way to California.

A few weeks after arriving, I ventured out to a synth meetup in Albuquerque. Hosted in the historic Albuquerque Press Club, I met James Coker of Five12 in the lobby and we wandered through a labyrinthian series of floors and rooms while chatting about New Mexico, synths, and Indian food—topics we both love. We were to hang out a few times over the summer; once while he did quad sound for a show at The Center for Contemporary Arts in Santa Fe, and twice over Indian food.

As the founder of Five12, it was Coker's need for his own live performances that led the development of the software sequencer Numerology, which in turn led to the Vector, an incredibly powerful sequencer for Eurorack. A thoroughly deep sequencer, its user base is as committed to it as much as Five12 is, and with Coker and his crew doing long deep dive videos about it, as well as being around on forums to answer questions, a community has sprung up around New Mexico.

Waveform: You've been in New Mexico for twenty-four years. Why did you initially come out here? Was there a specific reason or more of a general pull?

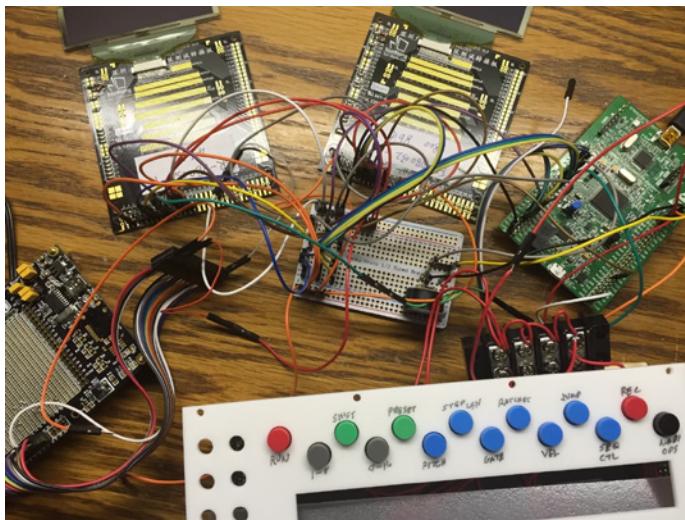
James Coker: Around '96 or '97, when I lived in Evanston, Illinois, I started getting into photography. I bought a view camera (an old-style camera with a bellows) and the manufacturer had this deal where you could call and find somebody in your area who knew how to use it. So I made the call and this guy said, "You really want this guy, Arthur [Lazar]." He was a photography teacher and he lived in Highland Park [Illinois], but it also turns out he was originally from Albuquerque. He actually grew up about two miles from where I live now and that was part of my entryway into coming out west to photograph.

Arthur was telling you that you should come out to New Mexico?

Yeah. At one point he got out a map and started marking up all kinds of places to photograph around the whole Four Corners area. I made a couple of trips out here, just driving around photographing Utah, Colorado, and New Mexico and I really got the bug. I had to come here. An interesting thing about New Mexico, is if you went to sleep and you woke up somewhere and had no idea where you really were, you would know you were here; there's no place like this anywhere else.

That's true. What were you doing at the time you decided to pack up and move?

I was working remotely for a startup out of San Francisco doing



That was the proof of concept—both for them and for me—that this was going to work.

Java programming. That's what allowed me to move out here. It was early on in the whole internet boom time.

You got your undergraduate degree at Northwestern, what were you studying there?

I started in physics and then for a while I was an English major, but I don't know if I was really serious about that. Eventually, it became computer science but it took three years to settle on that. I had a little 128k Mac when I got there and was learning to program on it. I got really into object-oriented programming early on, and I taught myself Smalltalk, which is one of the original object-oriented languages. I learned it and how to program at the same time, so it became second nature for me. I've been both lucky—and unlucky—in that I've never worked in big teams as a programmer, I've had to figure things out on my own. I'm very self-taught and that gives me my own weird perspective on things. I can choose what pieces to use and what pieces to leave out.

And after that you were at Stanford?

Yeah, I went for a masters in CS, but ended up taking some classes at CCRMA and I guess that's when I caught the music programming bug.

It seems you were open to a sort of organic trajectory and I wonder how you felt that helped you discover the art scene in New Mexico when you first arrived.

I wasn't out here for very long when there was a workshop in Santa Fe called *Techne and Eros* with Morton Sobotnick, Joan La Barbara, Steina and Woody Vasulka, and a few other folks. The physicist James Crutchfield was doing stuff with video feedback, and David Dunn was doing surround audio experiments in Reaktor and things with field recordings. Steina was using a program called Image/ine from STEIM to do real-time video

processing. That was a big breakthrough for me because I had been doing some music and some photography, but I'd never done video. Meeting Woody and Steina and seeing what Steina was doing was my entry point into doing video art. She is a violinist and would play the violin and there would be a camera on her and the violin sounds were used to manipulate the video. After that workshop, I sold my small DAT recorder and bought a mini-DV camcorder and started playing around with Image/ine. Two other video artists friends of Steina and Woody, Mariannah Amster and Frank Ragano, would go on to found Currents, which I have participated in a few times. [Ed. - Currents is a long running experimental sound/music event in Santa Fe].

Did your artistic focus shift from photography to video art at that time?

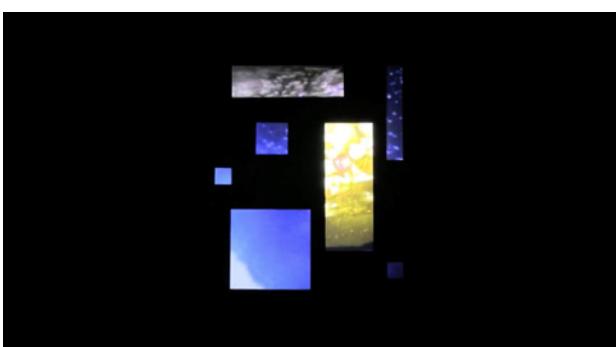
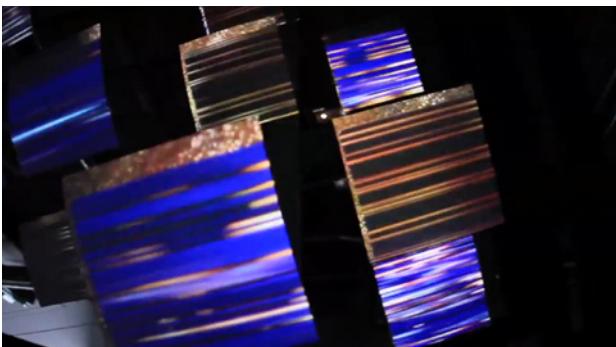
It seems to have gone in cycles. When I first moved out here, my creative output was very photography-oriented and I wasn't doing much music at the time. Then I started working in video, and then got back into music, often to go with video work. Music training and performance for me has always been sporadic and not always successful. I did piano lessons as a kid and that didn't really work out; I was in high school band and that was great, but then I was in band at Northwestern as an undergrad and that didn't really work out. For a while I was playing guitar, other times I was working with sequencers and synthesizers. Public performance was always stressful for me.

Is it still?

It's gotten better.

Do you think that's because you've done it more so you're more comfortable with it, or do you think it's because of the medium?

I think doing it regularly helps, but I think a lot of it is the



medium. If you're going to play an instrument, you have to be really comfortable playing and performing. That's something that's nice about synthesizers and modular, and particularly sequencing, because you can prepare much more ahead of time. The key for me was to be prepared enough and to practice repeatedly, just moving through it so that when you are there, it's all familiar, there are only a few things that are specific to timing or pressure.

There's obviously a rich history of the arts in New Mexico, how do you see the modular/electronic music scene situated within it?

The community has picked up remarkably in the last four or five years. One of the guys in Albuquerque, Anthony Ballo, started the Facebook group NMCV (New Mexico Control Voltage). I knew Chris [Meyer; Learning Modular, Alias Zone] and we would both go to the meetings. It was just at a community center over on the east side of town, and initially if we had five or six people it was a big meeting. Slowly it got bigger, but then everything shut down [due to Covid] and we started doing Zoom meetings online. The nice thing about that was that we could have people from out of town join our group. It was kind of amazing. When we could all get out again, we started meeting in Albuquerque at a place called the Press Club. We have been having both meetup type events and performances there and had good turnout, so we'll keep doing that. We also did an event in Santa Fe in March 2022 that was originally intended to be a kind of an installation performance with people playing spread out in different rooms, but it actually became so crowded that you couldn't hear from one room to the other and it turned into a little mini synth meet. It was great.

I know that you did a show in quad sound at the last Knobcon. Is that something that you recently got into?

When I first moved to Albuquerque, I was really interested in it. I had a quad setup in my studio at home, and it was fun, but then I moved away from it for quite a while. I'm not quite sure what was the catalyst exactly, but Chris and I both became interested in doing quad mixes last year after the folks at Currents invited us to play at the festival in June of 2022. Chris and I both modified our setups, but I ended up missing the Currents performance due to Covid. When the opportunity for the Knobcon show came up, we wanted to do it in surround as well and we encouraged anyone that was interested to also pursue a quad mix. Overall it seemed quite successful.

How difficult is it to adapt your live performance from a stereo to a quad setup?

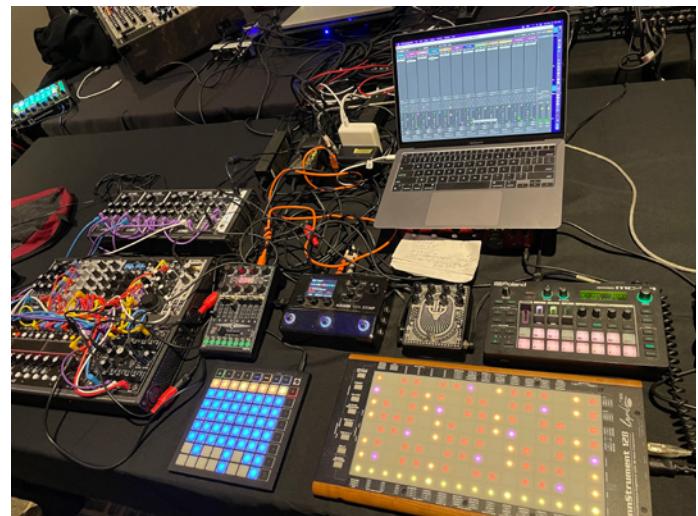
The big change is mixing on the computer. I'm using Numerology for it, which works fairly well. I was able to set up the quad panner fairly easily because there are lots of stereo buses; it's very easy to set up modulation. Also, there's a built-in controller object that's an XY pad, and I can take those values and then use the value of what's on the pad to control the panning. I can even modulate where that location is, so if I want to create a circular pan, I can do that. I had done some shows before on laptops so it's not new and scary, but it can sometimes be a little disappointing. I really enjoy

Page 30: Photo stills from video installations shown at *Currents* exhibitions: *Ocean/Dream*, 2008; *The Harbor Trees*, 2011; *Transmission*, 2012; *Transmission*, 2012; *Recognition*, 2014, all artwork by James Coker.

This Page: Knobcon 2022 live setup.

Page 32: Numerology screenshot.

Photos provided by James Coker



Once I had the design and knew what it would do, I had to do it.

working with just a hardware setup. There are ways you can build a surround mix using just hardware, it just becomes progressively harder and harder depending on what you want to do. As far as the instrumentation, I typically use three monophonic lines—one for bass, one main lead, and one alternate lead—and those go into the computer, and that's where I locate them in space and set up delays. For what I call my “rig”—which is the Linnstrument, the MC 101 and an HX Stomp for effects—that remains in stereo and sits in the front, though I maybe have an extra delay or an extra reverb in the back.

So it's typically more of the auxiliary components in a mix that get put in that 3D space?

Yeah, but there are no rules, we don't have to adhere to what something would be if it was natural to an acoustic space. I see working in surround as an extension of electronic music composition, a way to expand the soundstage around the listener. A lot of electronic music is experiential in the way that you listen to it, it's part of your environment, and listening in surround becomes a more personal experience than just sitting in a concert hall where everything is just in front of you.

You mentioned that you do your surround mixes in Numerology. What was the impetus for creating that program?

Some time in the late 90s, I met Suit & Tie Guy [Eric Williamson]. He was just starting to perform live and at some point we did a show in Peoria [Illinois]. It was random drum machines and a few other things, and it was all improvised. We didn't really know what we were doing, but we had a great time. We called the shows Numerology on the promo posters, and did two or three shows like that. A consistent issue with the performances was that we wanted to improvise and to be able to move quickly, but hardware sequencers at the time were crazy expensive. There were software options, but being a programmer I was never quite satisfied with whatever was available. I was constantly trying new

things and experimenting, and eventually just started writing my own software. After about seven or eight months, Numerology, version one was released.

Were you working on the program full time during that period?

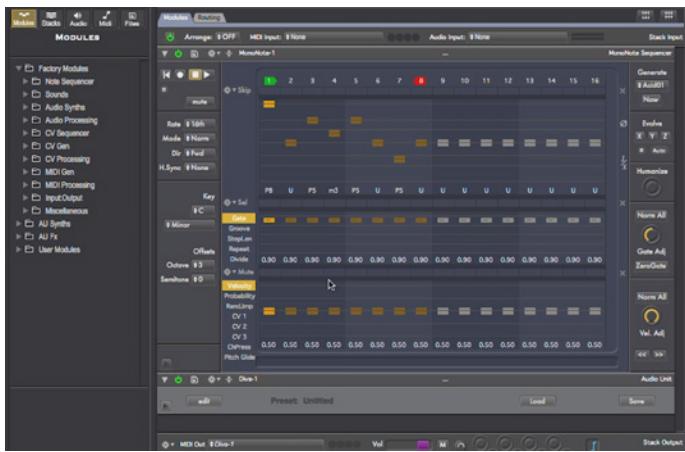
Yeah, but I didn't know what I was doing, I was iterating on a series of ideas. One of the key things was sequencers modulating other sequencers because that's a really powerful way to get something interesting going without having to do the math in your head. So I got version one out and people started buying it. Then I did version two, and that was a bit more elaborate. Version three had a lot more features, and that was a pretty big release for me; I eventually started to feel like I knew what I was doing.

For each release, did you start from the bottom up?

Version two was an expanded version one, but for version three I ended up rewriting a lot of things from scratch. The big change for version three was that I wanted to support ReWire and that meant the engine part of it had to be very separate from the UI. That's actually a very good restriction to have when you're writing music software, because the requirements you need for the music part are very different from what you need for the UI part. That took a while, but made for a much better product. Then I did version four and it was around that time that Eurorack started to take off.

What was your introduction into Eurorack? What prompted you to want to build the Vector?

Sometime after the first Numerology show I started buying modules. At the time—it was about twenty years ago—it was just Doepfer, Analog Systems, and Analog Solutions and during that time a lot of activity was on the plugins side, and I got pulled into that. People were gigging with laptops, doing video art on laptops, and I was doing video art that whole time on laptops,



You want it so that if you just poke around and read what's on the screen, you can eventually find it.

so it was very much this pendulum away from the hardware side. Eight years ago I started to really pay attention to what was going on with modules and I went to NAMM and some other shows and I saw sequencer modules that were interesting, but I thought that compared to what I could do on the computer... I'm a software developer, I'd built a software [sequencer] and I knew what I could do inside the hardware and had an idea of the features I wanted. I really wanted to do my own thing and I just had to reach a point where I became comfortable with the idea of doing the embedded programming for the hardware device, and then find the right collaborator, because I'm not a hardware designer. Eric had introduced me to his friend, Joe Grisso, who is a great engineer, and who offered to work with me, but it was another year after that before I was ready to actually start doing anything. I had to figure out how things worked, like what chip family to use, and how to take a program that's 25, 30 megabytes on the computer and squeeze it into 128 or 256 kilobytes.

You essentially had a thirteen year run up to figure out how to build the Vector, not a necessarily common trajectory.

I'm totally out of left field. A lot of hardware sequencers either come from the Moog side of things, where it's the eight-step dials, and it's all externally clocked and there's a very specific way you can use it; or it's more like the Roland digital drum thing or some other variation of hardware devices out of the 80s. After working on Numerology for several years, I had very clear ideas of how I liked to organize sequencing parameters and handle modulation and so forth, so when it came time to do the hardware design I had a fairly specific idea of how I wanted to approach it.

How much did the architecture of Numerology affect how the Vector operated?

It actually turned out that I was able to take a lot of the code straight out of Numerology, recompile it, make a few changes and have it work fairly well. The core sequencing algorithm is almost unchanged. The main difference was that I had a lot less space for

parameters, but the core engine [for the Vector] basically came from Numerology.

And then it's just kind of porting what you need to buttons and stuff...

Yeah, and that's also where the CV and MIDI as equal partners comes in. Another thing that I didn't like about a lot of the sequencing modules is that they were CV only. I wanted to be able to use gear that had MIDI, and so I wanted to have MIDI IO on the unit.

Once you knew that you were going to build this, did the ideas and formation for the Vector come quickly?

Some parts of Numerology lent themselves well for mapping to a hardware interface. There were parameters for pitch, gate, and velocity on each sequence step, and then the controls over the overall sequence. I wanted to have encoders beneath a display and then some buttons below that. I had assumed I was going to use a two-line by 80-character LCD, and then Joe turned me on to OLED displays. Of course I fell in love with the most expensive displays I could find, and needed two of them so I ended up using those displays with encoders below them. Then I made a little keyboard below that and put the edit mode buttons above the displays. Having an encoder to the left [called "Encoder Nine"] seemed like the thing to have as well and that left room for some navigation buttons. The design has turned out to be very durable in the sense that I've been able to expand things massively on the feature front without losing the basic workflow. I got lucky.

Using Vector never feels mysterious or tricky because you can always figure out how to do something pretty quickly. It might be a couple of button pushes or screen changes, but you can usually get where you want to go without needing to consult a manual. Was that a conscious decision to make it like that?

I tried to make it discoverable. You want it so that if you just poke around and read what's on the screen, you can eventually find it.

It's validation of your wanting to have a sequencer that speaks to everything rather than just being a Eurorack CV sequencer, in that it has a sort of a future-proof flexibility.

I tried to make it so the Vector integrates with other devices, whether it's LFOs, other sequencers, or drum machines. I don't think you can make one sequencer that would satisfy everybody, and it wasn't really intended to be a "do-everything-sequencer," but I did want it to have the flexibility to do the things that I am most interested in. I'm still working to fine tune parts of the UI to make them even just incrementally more intuitive.

Continued on p. 78



1U CATSNBANANAS

The Waveform 1U Cats N Bananas Eurorack/Banana Jack Format Jumbler Passive Module is 14HP and lets your Eurorack rig and your Banana Jack rig be friends. What could be better than that?



1U ATTENUATOR

The Waveform 1U Attenuator module is a 12HP dual passive attenuator utility.



1U BUFFERED MULT

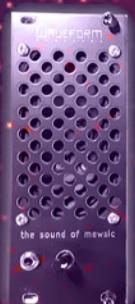
The Waveform 1U Buffered Mult is a simple build and a great way to add utility to any system.



1U RIBBON CONTROLLER

The Waveform 1U Ribbon Controller provides the same great functionality as our Catwalk version in a convenient 1U format. Meow you use it is up to your imagination!

WAVEFORM magazine



SOUND OF MEUSIC EURORACK SPEAKER

Waveform DIY Project #1. Faceplate is black with silver and is reversible for those who don't like cats. Hehheh. While the Sound of Meusic probably won't crumble the walls of your synth cave, we sourced a pretty decent sounding speaker—especially for the size/cost—and have been very happy with it so far.

STUFF



DIY EURORACK OSCILLOSCOPE

Easy to build, inexpensive Eurorack oscilloscope. The instructions on how to build this are detailed in Issue #2. Faceplate width is 14HP and is black matte with a copper color trace.

www.waveformmagazine.com/shop



NEW! ZORX 1U CV BUS | MORE INFO AT ZORXELECTRONICS.COM

ZORX

zorxelectronics.com





DEVICES

by Ellison Wolf and Sam Chittenden



We are really fanatical about modular and aware of pretty much every module on the market and every function.

The principle of form follows function worked from the assumption that something came into existence due to function, purpose, or need. A guiding tenet, one that shaped everything from architecture to automobiles to musical instruments, with far reaching and enduring impacts on things like usability, aesthetics, and overall design philosophies, the prevailing ideas favored the rational over aesthetic-based stylistic concerns. But form and function are amorphous concepts that can and have changed with perspective and time. Moreover, the distinctions between pure functionality and aesthetics are hard to uphold: Beauty can indeed be found in the functional; the functional has its own rhythm and design that can be pleasing.

In the case of early Eurorack modules, silver faceplates with black text were the de rigueur of the early years, and spoke to what was important at the time: the feature set, the functionality. Polish company Xaoc Devices [pronounced “chaos”] was born in 2011 from the imagination of graphic designers, Tomek Mirt and Marcin Łojek. Their backgrounds allowed them to utilize a different sense for balance, patterned design elements, and refined use of color, but they were also determined to make sure that the functionality met their standards, that form and function went hand in hand, that both elements upheld their end. Tomek

and Marcin—along with their engineer Maciek Bartkowiak—operate from an artist/engineer perspective, converging theory and sensibility into practice. Xaoc Devices has become one of the cornerstones of the Eurorack community. Modules such as Moskwa, Zadar, Batumi, Odessa, and Belgrad [among others] have become classics, and each new Xaoc Devices release finds an audience eagerly anticipating its arrival. With their strong aesthetic and interfaces that elevate the user experience it’s sometimes a marvel to realize that something as simple as a single red knob among a well-designed and laid-out faceplate can make a module stand out in a rig, and therefore make it more prone to being played and more apt to providing creative output; a true testament to their vision and partnership.

Waveform: How did you two meet?

Tomek Mirt: We met many years ago within the electronic underground industrial ambient scene and then we reunited about twelve years ago on Muff Wiggler [Ed. - now Mod Wiggler] because we discovered that we were both modular fanatics.

What was the modular scene like in Poland back then?



For the first time in my life, I felt that I made something that makes people happy.

TM: It was really tiny, almost nonexistent.

Marcin Łojek: Like four people or something. [Laughs] So we met again and it just clicked. We had ideas we wanted to do something with and I wanted to quit my day job finally.

So you started Xaoc. What was it like in the beginning?

TM: We had no idea what we were in for as our first years were quite far from stability. When we started the company, we were just two graphic designers; we could just do panels and logos and stuff like that. There was a huge amount of things that we needed to learn. We had some experience with DIY, but it wasn't enough, we needed an engineer.

ML: The first year was just trying to design the first product.

TM: We were bringing some ideas and it was just growing. It was Moskwa, Bytom, and Warna at the same time.

ML: We had a lot of ideas for the functionalities and features, but we were working from home, and our first engineer was living in another city most of the time... it was a mess. I'm not sure now how we even managed to assemble and test the first batch of modules, but it was fun. When we finally had an office we started to feel we were more like a serious company. We were extremely excited by everything that was happening, and constantly discussing new ideas, but it was difficult for us to make these ideas a reality; it was hard to finalize any project. We were working on Praga, and it was a big step forward for us, but the development was progressing at a very slow pace. Praga had become vaporware due to the time it took us to deliver it to the market after the official announcement. It took so long, because we didn't want to compromise on anything, but we knew that the delay would affect our image. One of our friends recommended Maciek, who is a synth aficionado, a modular addict, and was a postdoc at the Poznań University of Technology. He had a really big knowledge about DSP and circuitry.

TM: In the end it paid off because we were super strict about the quality of the design and the circuit, and people started to notice that. The modules are really sophisticated—sometimes it's even more sophisticated than it should be—and we are not taking any shortcuts with our designs. It's tricky, but I think we found a balance.

Were you both scared to leave your previous jobs in order to do this?

TM: I wasn't scared, but I never had any office job, I was always freelancing.

ML: I was so frustrated that I just wanted some excuse to leave. I loved graphic design, but the whole brand, the whole industry...I was really an anticapitalist kind of person and I was putting a lot of my work and effort to make people buy shit they didn't like and didn't need. When we started Xaoc, it was the opposite. I loved that we were getting a lot of feedback, that people loved our stuff, and they were happy. For the first time in my life, I felt that I made something that made people happy. It was a big, big change.

It looks like you've succeeded.

ML: Hopefully! [Laughs] I think more or less it was the same for the other companies, from enthusiasm in the hobby to something much more serious. Also, our families, even our parents are proud of what we have achieved. So for all of us, it was actually a life changer and the quality of our lives is much different. It gives us a lot of freedom, the freedom to create without any limitations and stress.

TM: We know that we are really lucky. With this company, it is easy to be enthusiastic.

It's interesting that you started the company with ideas about the way the modules should look and with ideas of function,



Page 40: Tomek, Marcin, Maciek, 2023.

Photo provided by Xaoc Devices.

Page 41: Odessa, Praga, Moskwa II.

Photos provided by Xaoc Devices.

This page: Tomek at Superbooth 2022.

Photo: Sam Chittenden

Next Page: Tomek and Marcin, Superbooth 2021.

Photo: Sam Chittenden

The variety of Eurorack is its beauty. It's not consistent, and it's not homogenous, but that's the point.

but that you had no way to carry out those ideas for the functions, the actual workings of the modules, and had to find somebody to carry all that out.

ML: It's because we are gearheads, fetishizing the gear we wanted and what would appeal to us.

TM: We are also coming from music underground, so it was natural for us. Like how you start playing music and you start some label to release your music. It was really natural for us to start the company. It's not like we didn't have any idea. I'm an industrial designer. We could design the product, but not the electronic circuit. We knew what was realistic and feasible.

The fact that you were both graphic designers explains why Xaoc has had such a strong visual aesthetic from the outset. Was the design element something you bonded over in the beginning?

TM: It was important in the beginning because most of the modular manufacturers were engineers. I think there was a small shift to designing a whole product, and I feel that we helped move it a bit.

ML: My impression is that our approach to aesthetics maybe inspired other manufacturers to pay more attention to this. After we introduced our products more manufacturers were caring about the front panel designs and the ergonomics.

We talk about how product design and aesthetics matter even more now. In the beginning, it was all about "What does it do?" and there's Sharpied-on text on the faceplate...it didn't really matter.

TM: Yes, it was smaller, more experimental. Now, it is really big so you need to show people something really interesting, something that will instantly grab them because there are hundreds of

modules. No one is really waiting for another one like ten years ago. Before, you'd show something really simple and everyone on Mod Wiggler was like, "I need this." Now we are showing a module that is really complex, DSP-based. The saturation is big now, the community is huge.

Who is on the design team for Xaoc modules now?

TM: The main core now is us and Maciek. During the design process, we are talking a lot.

ML: It's always a brainstorm.

TM: That is always the process and we are changing a lot during this. It's not like one of us is starting with a really finalized design and then we start the construction.

So after all these years, how do you find working together?

ML: I still have a lot of enthusiasm, even if not as much at the start. [In the beginning], we were on the phone for like two hours each day, talking and talking about modules, and pretty much nothing happened for a year. Finally it happened and it was a big success for us.

You must have been relieved!

TM: Yeah, it was a big relief, really, because we know that this is the way for us. The adventure, the fun is there, and you can't go back and do what someone is telling you, and there was really tons of enthusiasm for it in the whole community.

ML: The early Mod Wiggler community was kind of like a hardcore punk community; really ethical, caring about each other. Friendship and cooperation. To some extent it still is. Among those older manufacturers that we know and are friends with there's still a lot of cooperation, helping each other.



Tomek: You are a bit of a control freak.

TM: There was a lot of knowledge on the forum, it was really something totally unique.

How have you noticed that the industry has changed since you entered it?

ML: The demographics of modular users has changed a lot. Back then it was a cottage industry and everyone was contributing, even the users. I remember showing the preliminary designs on Mod Wiggler and people had some advice or questions. It was really a creative process that included the users. It's not like that anymore, because everyone is low profile. I think we helped some other manufacturers a lot, sharing our knowledge of manufacturing processes and our subcontractors and this and that. Just as other folks from the industry helped us somewhere in our journey—it was exactly as a family. For example, I remember the day that we had so much trouble delivering the Praga mixer because it was a much harder project than we expected. We had a lot of troubles and Scott [Jaeger] from Harvestman [now Industrial Music Electronics, Waveform Issue #2] asked, "Are you releasing Praga this summer, because I have a mixer and I can wait until you release your mixer?" Isn't that just sweet? I'm a total fan and I actually own pretty much everything he's done.

Marcin: Yes. That's the problem.

TM: He made the really big change, he brought digital technology to the modular scene.

ML: At the time everyone was like "Analog only, no digital." He was so bold. It was a really strong personality behind those modules.

TM: I think it was eye opening like, you can use all types of technology. It's not only analog and digital because you have this digital high-tech DSP stuff, and you have also this 8-bit digital, you have tubes in the analog realm and a thousand things in between. I think this a big strength of Eurorack, that you can find some really crazy ideas and they work well together with something totally different, you can mix everything as you like. We are really doing one product, it's just a synthesizer that someone will have as just one piece of gear, but there will be lots of different manufacturers that made this one synthesizer.

ML: The variety of Eurorack is its beauty. It's not consistent, and it's not homogenous, but that's the point. Your system is growing to your needs, and to your ideas.

Continued on p. 81

THE FUTURE IS MODULAR™



🌐 afrorack.org 📱 @afrorack

Talking with Maciek Bartkowiak, Xoac Devices engineer

Waveform: Marcin and Tomek described how you all come up with ideas in brainstorming sessions. How does this creative process work for you?

Maciek Bartkowiak: Every one of us has some ideas. Sometimes we need to wrap our heads around them, sometimes there's a heated discussion, sometimes there's just, "Oh, that's a great idea. Let's do it right now." Sometimes we have different views, different approaches to some ideas. There was one project that I was very enthusiastic about and after doing quite extensive work on the first prototype, Tomek said that he didn't want to go in that direction. I was really disappointed, but not mad. The thing is probably the difference between being an artist and being an engineer, thinking in terms of what can be done with technology and what is the goal for an artist. Sometimes at the very beginning, Marcin and Tomek would ask me if something is possible, and I would tell them, "No, this is impossible to do. I can't do this." Now I really try to never say this, because everything is possible. Mostly, that's the challenge, that some functionalities require a lot of circuitry.

They were saying that they were excited to find an engineer that was an artist as well, someone who understands both sides. Were you into synthesizers and music?

Yes, I was from very early years. I built my first sound device in primary school. My whole desk was covered with parts and boards, and I generated awful noises and my family complained about them. I graduated from university and did my PhD in signal processing so I have some background for serious projects. I had been working at the Politechnika Poznańska University [Poznań University of Technology] for twenty years and I have also some experience in developing algorithms and electronic circuits, and this translates well to what I can do right now with codes. After I did my PhD I started working in audio, in signal compression modeling, sinusoidal modeling. I participated in the development of MPEG-4 audio and extensions of it, so I even have some patents of mine in this domain, but it's not very musical, it's technical. But these tools are very essential in what I've done to make Odessa, which was based on ideas that I developed during research at the university.

How long have you been a XAOC?

Since 2012. I joined after they released Moskwa and during the development of Praga. We had a common friend who said that we absolutely must meet because we have very similar interests, but I was deeply bound up with the university and while I did some synthesizer stuff during the period, it was just a hobby.

Were you doing Eurorack?

No, I hadn't heard about Eurorack at the time. It was just standalone synthesizers with keyboards.

What did you think the first time you saw a Eurorack module?

I'd read about modular synthesizers, and had a rough idea that they were expensive and were absolutely inaccessible for an average person. Then I learned that there was something smaller, more accessible, made by many companies and Xaoc was one of them.

How do you enjoy working with Tomek and Marcin?

It's a dream job. It's absolutely fantastic. I enjoy every day going to work and expecting new things.

It must also be exciting to see your ideas be implemented into actual, marketable products that people buy and enjoy.

Yes, this is very rewarding. I didn't feel so rewarded when I worked at the university. I had some publications, some implementations in the industry, but I was never recognized. It was a bit depressing that my output felt so meaningless.

When you started down the path of a doctorate did you ever think at any point that you would be building synthesizers for a living?

Absolutely no. I was expecting that an academic career should be something to be proud of, something noble. But ultimately I didn't feel that.

Was it hard to give that idea of the career up?

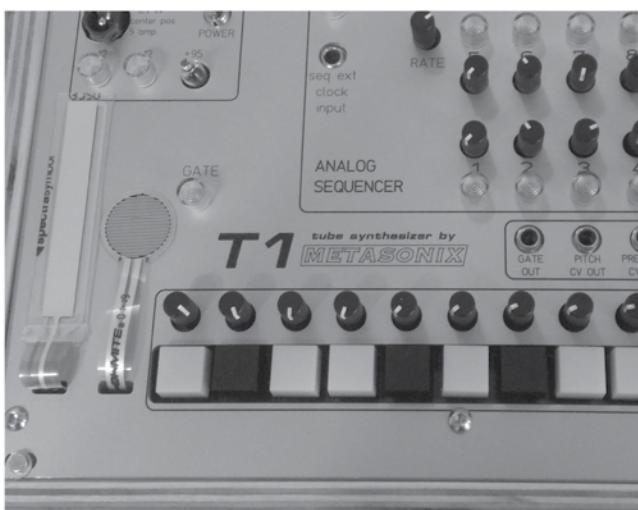
Yeah, it was a hard time. I had been considering it for a year, and I had my doubts because after twenty years of doing something, you just grow into it, but now I am never looking back.

FREE SCHEMATICS ALWAYS. AISYNTHESIS.COM. NO WIRING EVER. THE BEST KITS IN THE UNIVERSE. MODULES WITH WARRANTY, KITS, AND PCB/PANEL SETS. STEP BY STEP INSTRUCTIONS. FULL HOW TO BUILD VIDEOS. ARTICLES TO EXPLAIN ASPECTS OF DIY. FREE SCHEMATICS ALWAYS. NO WIRING EVER. THE BEST KITS IN THE UNIVERSE. MODULES WITH WARRANTY, KITS, AND PCB/PANEL SETS. STEP BY STEP INSTRUCTIONS. FULL HOW TO BUILD VIDEOS. ARTICLES TO EXPLAIN ASPECTS OF DIY. FREE SCHEMATICS ALWAYS. NO WIRING EVER. THE BEST KITS IN THE UNIVERSE. MODULES WITH WARRANTY, KITS, AND PCB/PANEL SETS. STEP BY STEP INSTRUCTIONS. FULL HOW TO BUILD VIDEOS. ARTICLES TO EXPLAIN ASPECTS OF DIY. FREE SCHEMATICS ALWAYS. NO WIRING EVER. THE BEST KITS IN THE UNIVERSE. MODULES WITH WARRANTY, KITS, AND PCB/PANEL SETS. STEP BY STEP INSTRUCTIONS. AISYNTHESIS.COM. FULL HOW TO BUILD VIDEOS. ARTICLES TO EXPLAIN ASPECTS OF



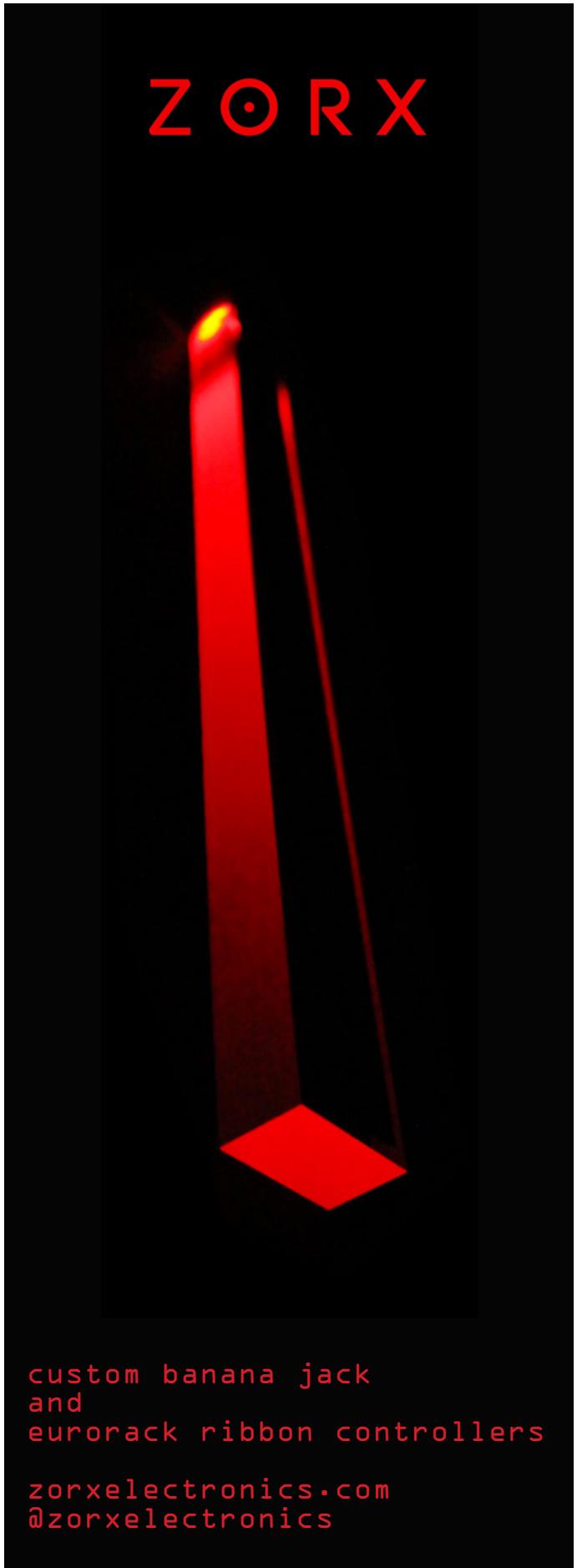
Synthesis

(flagship)



METASONIX

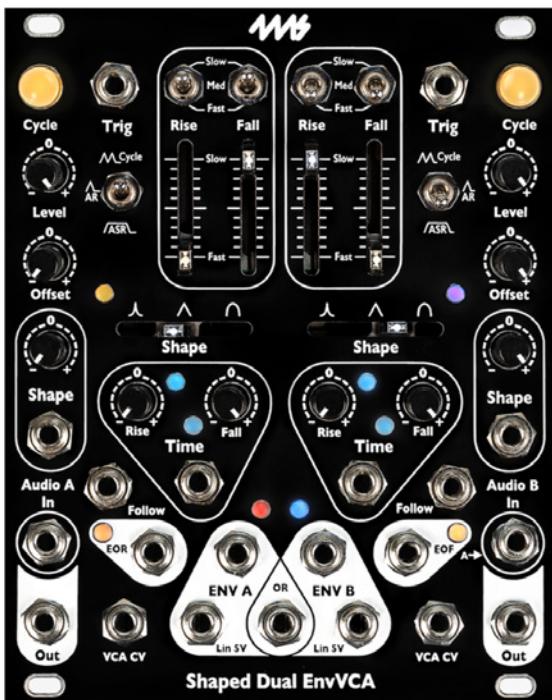
ZORX



custom banana jack
and
eurorack ribbon controllers
zorxelectronics.com
[@zorxelectronics](https://www.instagram.com/zorxelectronics)



GEAR REVIEWS



Shaped Dual EnvVCA 4ms

4mscompany.com

If you're a fan of envelopes, there's a pretty good chance—like 99.999%—that 4ms has what you need. With a lineup that includes their classic Pingable Envelope Generator [PEG] and the Mini PEG, their new line of envelope modules covers a lot of bases with the EnvVCA, Dual EnvVCA, and their Shaped Dual EnvVCA.

The Shaped Dual EnvVCA is indisput-

look with an elegant facade that makes for an intuitive tour around the landscape, especially when it comes to the ins and outs; inputs are framed in black, outputs in white. Easy peasy. The time range of the envelopes can go from a zippy 2.5kHz all the way down to a leisurely twenty minutes, and with so many input and output options for modulation, SDEnvVCA is be-

SDEnvVCA, is one of the most fun playgrounds for envelope shaping that I've come across.

ably the powerhouse of this group, with the most modulation options and opportunities. It's a two-channel 100% analog envelope generator and slew limiter, with an onboard DC-coupled stereo VCA, and full waveshaping capabilities. The SDEnvVCA sports 4ms' sleek new-ish black/white

beyond multi-function; it's multi-multi-functional. It can be an envelope follower, LFO, VCO, slew limiter, waveshaper, envelope generator, VCA [x2], and even sidechain processor due to its ducking capabilities. I'm certain I'll discover even more functions and uses as time goes on. The feature

that makes the SDEnvVCA so different from the other 4ms envelope modules is the ability to control the waveshape of each envelope via sliders or CV, all without affecting the timing of the envelope.

Since it's dual-channel, both CHANNEL A and B are nearly identical. There is a light up CYCLE pushbutton for triggering each channel by hand as well as a TRIG input. A three-position toggle switch determines the behavior of the envelope with CYCLING, an AR response, or an ASR behavior. I really love the inclusion of the ASR option, since the envelope will sustain as long as the input trigger/gate stays high; it brings in a totally different feel that's completely usable, and not as commonly found on other modules as the CYCLING and AR are. The RISE and FALL slider sections for each channel take center stage here, with LED faders that show the strength and duration of the shape at each stage, and SLOW, MED, and FAST rate toggles for each stage as well. You can really mix and match your rates here to get any feel imaginable, from short snappy percussive shapes, to sleepy, slowly evolving movement.

You can further sculpt the shape with the OFFSET and LEVEL pots and there is a SHAPE slider that can adjust the waveshapes from exponential, to linear, to logarithmic and every point in between. This can also be modulated with external CV, and there is an attenuverter for this as well. I like modulating the SHAPE with a slow moving sine wave to really hear the change taking place, but it was also fun to do with a fast moving square wave synched in time with a melody or kick drum in a patch to throw some accenting in there. Both the RISE and FALL rates can be controlled via a single shared CV input, with each phase having an attenuverter for further control of the shape. Since you can dial in positive or negative amounts of the CV for each, it opens up a lot of options in a small space, and there are LEDs that show the strength and polarity for each stage, which is helpful. The FOLLOW input, which almost gets lost amongst the flashier sections, allows for an input to do some slew limit-

ing and can be used for a ducking effect, envelope following, glide, and much more. Self-patching from one channel into the other makes for interesting modulation opportunities, and having an onboard way to duck/sidechain is pure modular gold, especially for clearing out percussive space in a dense patch.

As mentioned, there is a dual-stereo VCA that is normalled to each channel's outputted waveshape, but both can be used independently of what the rest of the module is doing, by patching in external CV. The input of VCA A is normalled into the input of VCA B, giving the ability to use both sides of the module with/for one audio input, though some really cool stereo action can happen if you cross-modulate or use a familial TRIG for both channels and use outputs from the same sound source for each VCA input. This is where SDEnvVCA really shines—with these fun, shaped stereo hits where there's some self-patching going on. The shapes and rhythms that you can get with just this one module and a sound source can be mesmerizing; it's where I spent most of my initial time, just bouncing around in stereo.

Aside from the VCA outs, there are two ENV outputs that output the waveshape of each channel, and an OR output that emits the highest voltage output of either ENV A or B at any given time. These outputs are directly affected by the LEVEL and OFF-SET controls; whereas the other two envelope outputs, the LIN 5V outputs, are not. There is also an end of rise [EOR] output on CHANNEL A's side, and an output for end of fall [EOF] on CHANNEL B's side. These are gate outputs that go high any time each respective feature is ending, and remain high until the next stage begins, as indicated by LEDs, and are great for triggering synched up events. With the module's controls and the CV modulation possibilities, it's almost like an Etch-a-Sketch for waveshaping, and while there are plenty of ways to get surprises here—so many places to patch CV [whether random or not]—it's the precision of this module

that I find most appealing. This is something that 4ms modules excel at overall: they've perfected the art of precision in

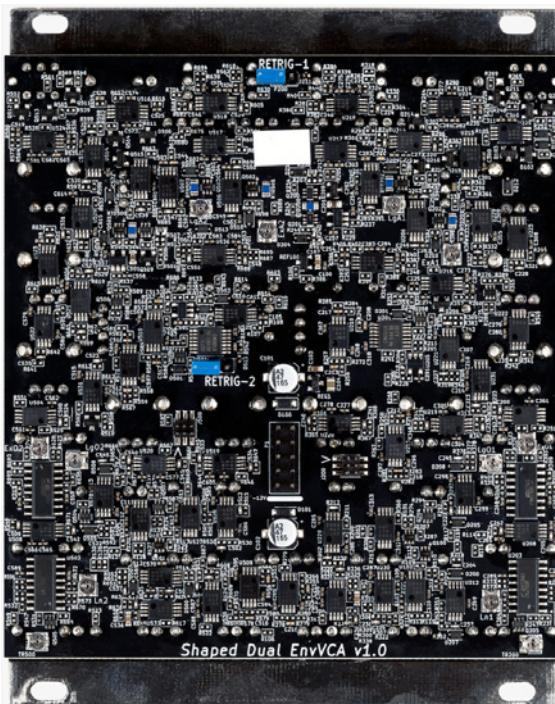
LEVEL control wasn't quite dead center, and there was in fact, some voltage creeping through into the output. What was I saying about precision? Exactly. It's the reason you can sculpt, shape, and skew waveshapes into so many different formations.

Not that I'm ever looking [I'm usually much too busy losing myself in some addictive patch], but I just can't find fault with anything 4ms puts out, and SDEnvVCA is one of the most fun playgrounds for envelope shaping that I've come across, and have been geeking out with it since putting it in my rack.

- Ellison Wolf

20 HP +12v 255mA -12v 230mA

Price: \$339

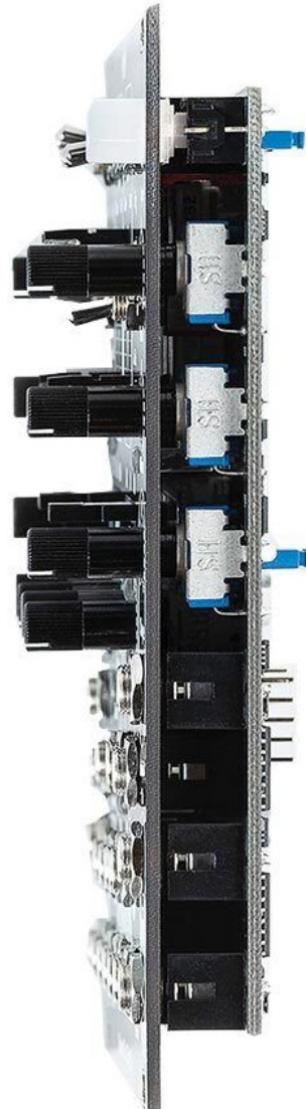


The resulting wave would stutter and lurch a bit like a rollercoaster; then go long on the incline with an extremely sudden drop.

their modules, which I've come to have a deep faith in.

One of my favorite things to do was to feed a synched up triangle wave into the SHAPE CV input with the RISE and FALL attenuators pointed full inwards and with the sliders even with each other and about halfway between fast and slow and on the medium setting with the SHAPE being in the exponential position so that the resulting wave would stutter and lurch a bit, like a rollercoaster; then go long on the incline with an extremely sudden drop before being more linear, more even keeled again. It's this aural anticipation that gets me and feels so satisfying.

Some of the controls, such as the LEVEL pot, are really touchy and there were times when I couldn't figure out why I was getting sound coming out of the VCA when I thought they should be slammed shut, letting audio squeak by. It was because the





TX-6 Field Mixer

Teenage Engineering

teenage.engineering

Having recently released their own beer as well as a set of singing wooden AI dolls [which I have yet to try, but love their look and sound], and a sleek work table, it's as impossible to predict what Swedish outfit Teenage Engineering are likely to release as it is to figure where they get their inspiration. Another perfect example is their tiny TX-6 Field Mixer. I would never have thought you could make a hardware mixer with this type of functionality in this size, and I'm not sure I would have thought there would be much point in doing so, but before I expound on what I think about the TX-6, let's get down to brass tacks as it's impossible to talk about TX-6 without instantly addressing the two most obvious talking points first: the size and the price. Yes, the TX-6 is small. Really small. Smaller than I'd imagined before I held it in my hand. And yes, it's pricey. All right. Now that we got those two subjects out of the way—though we'll talk a bit more about them later—we can dive into what it is, what it does, and what it does differently and/or better than other things that are bigger, different, and/or less expensive.

First, I really like the size. It's small, but also alluring and there's something about it that makes me want to hold it, to learn

it, and to use it. Call it GAS, call it stupid, call it whatever, but that's just how it is. Gear that is fun to use, that you want to use, will get used. TX-6 feels good in hand, like a good wrench, or a perfectly balanced chef's knife. My biggest concern with TX-6 was whether or not it would warrant the price and putting up with those tiny knobs, not that TE's preference for small knobs is surprising to me. I favorably reviewed their POM-400 modular back in Waveform, issue #8 and am accustomed to the contortion of fingers sometimes neces-

sary to tweak things like a filter cutoff or a step in sequence or whatever, and I've accepted this aspect of some of their devices. I've moved on, and I'm better for it. I guess.

Throughout my modular journey I've tried out numerous options for mixers; 4, 8, and 12-channel studio mixers, all types of Eurorack mixers, various DAW interfaces going into Ableton, and on and on. I've found that one mixer doesn't fit every situation and I was interested to see how well the TX-6 worked as a field mixer. I had some things that sort of worked when out in the field, but nothing that promised what the TX-6 offers, with its size, functions, and rechargeable battery. Some of the size issues with the TX-6 did have me feeling some trepidation, like the fact that the spacing between the inputs is so tight that you need to use cables that are on the slim side in order to use any inputs that are directly next to each other, and whether or not my shaky hands and fingers would be able to work the small knobs precisely. Make no mistake, those knobs are minuscule [think kabob skewer] and tucked together closely. Luckily, both of those issues turned out mostly fine and TX-6's functionality, versatility, fluidity, and sound quality had me forgetting those potential annoyances pretty quickly. Also, it's important to recognize that the small knobs, etc., aren't a design flaw, they are a design choice. There's a huge difference in meaning, and it's apparent that Teenage Engineering takes both choice and design in their products very seriously, something I'm grateful for. Is there anything within TX-6 that wasn't pored over to the nth degree? I don't think so.

The TX-6 is touted as a 6-channel field

It's as impossible to predict what Teenage Engineering are likely to release, as it is to figure where they get their inspiration.



mixer, but that's a bit like saying that a Swiss Army Knife is a knife. It's a field recorder, a mixer, a synth, a drum machine, instrument tuner, a sequencer, and much more. It supports MIDI, USB, and Bluetooth, and is battery-powered. It has built-in effects, controls that can be customized, and with some adapters can be turned into a 12-channel mixer. That's a lot of functionality for something that's roughly the size of a cassette tape.

First impressions count, and the TX-6 is a beautiful machine, reminding me of a well-made watch. Even when I unpackaged it, my mom [I was visiting the folks] commented that it looked like I was opening up fancy jewelry. The aluminum body is elegant and the small monochromatic screen works well, with the ability to read it from any angle, in any lighting condition, and with two modes [dark and light] to choose from to suit your tastes. The SELECT knob feels good, and along with the SHIFT button and other buttons make the menu system pretty easy to navigate. I found that while this is a deep machine, everything is usually at most two presses away, and finding my way around was pretty painless. Actually, the trickiest part was when I was trying to reconfigure the inputs from stereo to mono as I couldn't find any menus for this. It turns out that since I powered on the TX-6

with cables already patched into the inputs I inadvertently bypassed the input select menu. Un-patching and then re-patching the inputs automatically brought up the correct screen to configure each input to my liking, with the ability to choose between balanced mono, stereo, mono, or split mode. While most people may think of Teenage Engineering's design focus to be on the hardware end of things, thoughtful elements like this make the software aspect of TX-6 hold up its end of the bargain.

The six sliders feel great with the perfect amount of resistance, and the jacks feel solid as well. I'd read that some folks didn't feel the knobs were sturdy, but mine felt fine, and though close together, turned easily and controlled things nicely. Since the knobs are so close together it can be a problem for even the most nimble of us,

especially the knobs in the center of the mixer. The top and bottom row are mostly fine for average-sized fingers, but those middle row knobs...Fortunately you can customize all of the knobs for each track so that you can assign often-tweaked parameters to the top and bottom knobs and the less-used ones to the middle row, a decent enough workaround for that issue, though it still felt

like I was



My not abnormally large hand holding the TX-6.

Maybe I'm a sucker, maybe I'm drinking the Kool-Aid [or beer, in Teenage Engineering's case], or maybe TE has really hit on something.

bending a bit, trying to make it work as opposed to it just working. But it did work, so...

Cycling through the effects and track options is, again, intuitive and thoughtful and the effects sound great. The ability to dial in the desired amount per track of reverb or delay via EFX 1 is killer, and utility functions in EFX 2, like EQ, gain amount, and compression, are super handy. I especially like being able to use one knob to control both the HPF and the LPF, and the freeze function, distortion, and the tape head effects were fun and useful as well. I would love to see more tweakability and options for the reverb and delay effects, and an onboard LFO or two for use in auto-panning to get a little more dynamic movement would be nice as well, and if there's any way to use an input to handle incoming

patched in CV to route for panning, effects, etc...Perhaps we'll see some of that in future firmware updates as we've already seen two really nice updates for TX-6 since its release.

Patched up with all six inputs occupied and headphones in the main output, it was a little odd getting used to. I had to be mindful not to drag a patch cable with

my arm, potentially scooting it across the table and off the edge, leaving it dangling by the shorter of the cables. I mentioned it already, but it deserves mention again that TX-6 sounds great. With or without effects, the sound was pristine with no perceptible noise coming from the machine itself. Battery time was impressive as well, and even after four hours of continuous use it still held a 35% charge—a great sign for remote work.

I really didn't spend much time with TX-6 as a synth or drum machine, though it can be those; I have better instruments for those purposes and if I was out in the field and needed either, I'd come prepared with them. Still, the built

in synth/drum machine/sequencer was a surprise. I was really thinking it would be a total waste, and while it's probably not something that I'll be returning to often, it was fun to play around with for a bit, and I can see a few useful applications for it, especially with

the ability to either sequence the chosen sounds [tones or drum sounds] or play them individually. Overall though, TX-6 is a mixer/recorder and that's what it will be primarily used as in my world. Besides, you can turn almost any phone into either of those and then patch that into the TX-6, right?

There are a bevy of other functions within TX-6, like an instrument tuner, a DJ Tuner mode that lets you use TX-6 like a DJ mixer—which I'd love to see someone rock a house party with—and all sorts of MIDI, Bluetooth, USB, and sync settings for getting along with your other devices. TX-6 also lets you record and playback 48 kHz 24-bit pcm stereo wav files with a USB type-c flash drive. At first I thought it was a bit of a shame that it doesn't record to a micro SD **Continued on p. 73**



Three Body Triple FPGA Oscillator Schlappi Engineering schlappiengineering.com

I know that some folks are meticulous when it comes to how they arrange their patch cables. You've got those cutout wall hangers that look like combs with giant gaps and big teeth, DIY 3D-printed github CAD designs, Kickstartered gizmos that utilize the best [and worst] that technology has to offer, and on and on. Me? I have a drawer. It's a place where cables of all shapes, sizes, colors, widths, and types get thrown into at random, and while it's a pretty big drawer, it ain't pretty in there. It's the place where Knurlies disappear, where random company swag mingles with old NAMM tradeshow badges, and where stickers get so old and dehydrated that they

to dig deep in this drawer because of the new Schlappi Engineering Three Body, with its fourteen outputs and eighteen inputs that are available. That's a lot of cabling, and I've utilized every modulation input, and each output in order to attempt a glimpse at the full potential of this module. And that potential? It's vast.

The Three Body is an FPGA-based 30 HP digital three-oscillator behemoth of phasing and FMing goodgodness. At first glance it's quite intimidating, with knobs, switches, and jacks all over the place, but after a few deep breaths it's easy enough to settle in and find your way around, and not nearly as daunting as it may seem. With its

While the Three Body is unabashedly a digital module, its one-knob-per-functionality makes it feel like an analog device.

shriveled up and accrue a white sticker-backing border all the way around. Some of my cables are so lost in this drawer that they haven't seen the light of day for centuries, stuck in the darkness beneath the strata of more recently acquired cables.

Well, the core has been tapped, cable reliques unearthed, light brought forth. I've had

intuitive layout, it's easy to identify that all of three of the VCOs share similar traits with the center oscillator [VCO 2] being the focus with the outer VCOs [1 and 3] effecting this main one.

Each VCO has controls for COARSE/MULT, FM INDEX, and PHASE CV. VCOs 1 and 3 flank VCO 2 on each side [that

makes sense, right?!], and there are FINE DIV and PHASE INDEX controls that reside between each outer VCO and the VCO 2. Littered throughout are LEDs and toggles, which again, are symmetrical and consistent. Each VCO section has switches for TYPE [Free and Ratio], FM MODE [Exp and Lin], and RANGE [Hi/Mult and Low/Div]. There are so many combinations of switches that there are charts of the combinations on the quickstart guide, which reminded me of a Punnett square from my school biology days.

Most of the thirty two inputs and outputs are at the very bottom of the module, and this placement makes for pretty easy patching in what could have been a jungle. VCOs 1 and 3 have inputs for V/Oct/RATIO, PHASE, FM, FM INDEX, and SYNC, and VCO 2's section consists of those as well, but also has PHASE 1 and 2, and PHASE INDEX 1 and 2 CV inputs. Along with a TRANSPOSE input, that totals the eighteen inputs. Whew! As for the outputs, the VCOs 1 and 3 each get four outputs [sine, triangle, saw, and square], and VCO 2 has six, with an additional cosine and cosaw outputs totalling fourteen.

There's all sorts of normalization going on and the manual explains this well, but there's also text under some of the controls explaining what is being normalized. It's pretty great that you can patch into the TRANSPOSE input to control the pitch of all three VCOs at once, if desired, and while this normalization is somewhat expected, it's also a smart and efficient way that makes this module very versatile, and—dare I say—more compact and organized than it could have been. Not an easy task with all that's going on here.

Simply patching a sequence into any VCO's 1V/Oct input and patching from any of the outputs, lets you start twisting knobs and toggling toggles at random, enough to start your phase/FM explorations. While the Three Body is unabashedly a digital module, its one-knob-per-functionality makes it feel like an analog device so if you can stay on track, you can usually tell what's going on. There's nothing hidden here; what you see is what you get, and this is a really powerful concept in a really powerful module. It's not necessarily easy to wrap your head around what's going on once a patch becomes more complex, but the relationships between the three VCOs in and of itself is interesting to think about,

even without the normalization.

The Three Body can definitely get chaotic with many, many ways to do so. Near-infinite modulation opportunities can easily turn any output into a wall of noise, which makes it a great source for [weird] snare, percussive bursts, and creepy basslines, but conversely, the Three Body can get utterly beautiful tones, stunning even. The cleaner FM bell tones can sparkle, and through a snappy VCA with some reverb can leave a sonic imprint for days. I do find that when I want to go that route—to get something clean and beautiful—that it suits me to start off simply, like having all VCOs in Free mode and running off the same TRANSPOSE input—and to expand from there, especially if I'm shooting for something melodically coherent. That's really how I've run with this module in order to get the most out of it intellectually and musically; by slowly moving forward, methodically experimenting, and seeing where it can take me one step at a time. I might not remember right off the top of my head exactly how a certain combination of toggle settings will react to one another once a patch gets dense, but there's never a point

where I can't take a breath and know exactly what each toggle position means and what it controls.

The cosaw and cosine waves are 90 degrees out of phase with their non-co counterparts and in combination can give a phase-shifty sound if you're running 1V/Oct-synched VCO outputs in tandem, or even detuned in Free mode. The fourteen different waveform outputs give you an infinite variety of options for sounds and modulation, and you can route two different hard left and right and get all sorts of stereo fun. You can synch two of the VCOs by patching out of one into the others SYNCH input, while leaving the other VCO in Free mode, detuned however, to drone on and on. The Three Body is great as a drone. Slow LFOs patched in, slightly detuned VCOs...The ideas and options are endless, and when you start modulating one parameter of one of the VCOs that effects a parameter of another VCO you enter a maze in which every choice effects numerous things, including the choice it-

self, where you can never go back, perhaps the source of the name of the module. It's a feedback loop in real time, and it's a good thing that life isn't like that. Imagine taking a bite of a peppermint ice cream cone, and the next thing you know, just by sheer peculiarity of choice relationships, you suddenly find yourself riding Space Mountain at Disney Land. That happened to me once, but it was a long time ago. If you can untangle the web it would all make sense, there's a certain 5D logic somewhere, but the web is an impenetrable mass of sticky silken thread, so good luck with that. In that sense, the Three Body leads you surfing a never ending black hole, with clear views of a constantly changing world that you can view, but never quite reach and participate in, all due to one initial twist of the knob. I spent quite a bit of time trying to understand the Three Body's behavior and thinking about how changing one

mit that the Three Body helped me better understanding an annoying sibling. The Three Body can mend fences.

I was able to get some really inspiring tones out of the Three Body. On top of endless variations of noise as well as crystal clear bells, I found some excellent FM metallic alien reptile sounds that I really liked that were great for basslines, I got some peaky cat squeals by feeding an attenuated triangle wave into the 1V/Oct input of VCO 2 with the cosine out [though all of the outputs sounded equally as feline] with VCOs 2 and in Free mode, and VCO 1 in Ratio. Adding a little PHASE INDEX 1 to VCO 1 gave this patch a nice touch of FM-y grittiness. Those were two of my favorites that I'm able to somewhat describe, but there were many. Sometimes you'd have to go a bit down the line, like if you wanted to effect the PHASE CV on VCO 3 you could patch into that input, or instead, you could

patch into any of the inputs on VCO 1 as that's what the PHASE CV on VCO 3 is normalled to. It's a bit like chess, really; many moves ahead.

It helps to have a good grasp of FM synthesis and phase modulation, but even if you don't yet, the Three Body is

a great learning tool for that, and a truly excellent sound source and sound designing module. There's something very special and different about Eric Schlappi's approach to making modules, and using the Angle Grinder, Boundary, 100 Grit, and the Three Body [I haven't had a chance to dive deep into his other module, Interstellar Radio] all together and it becomes apparent just how unique and special the Schlappi Engineering vision and line of modules is. I'm a fan of all of Schlappi Engineering's modules, but the Three Body is becoming my favorite. Make room for it in your rack.

- Ellison Wolf
30 HP +12v 95mA -12v 50mA
Price: \$550

**WANT
SOMETHING
REVIEWED?**

EMAIL US AT
CONTACT@WAVEFORMMAGAZINE.COM



MiniMod Tap Tempo VC-LFO AJH Synth ajhsynth.com

While the tap-tempo function is what I was most interested in checking out on the well-named AJH Synths MiniMod Tap Tempo VC-LFO, this LFO is unlike any LFO I'd ever tried out before—and I've tried out many. Usually with LFO modules you get a few shapes to choose from, an input to CV the rate and/or synch, and a few bells and whistles, but the MMTTVC-LFO is like discovering craft beer after years of nothing but agro-corporate light beer. You wouldn't know it by looking at the module, as there's nothing particularly flashy about it or the whole AJH MiniMod line of modules for that matter. They are classic, timeless, confidently excellent. But what makes this module different from other LFOs?

First, rather than just a couple of waveforms, MMTTVC-LFO gives us sixteen, divided into two banks that are switch selectable [and CVable]. There are various parameters in which to modulate the waveforms; WF-TWIST [a PWM-like function over the LFO shapes], MULTIPLY [which changes the rate of the LFO from half to four times the speed], FREQ [which sets the rate of the LFO and is indicated by the LED above it with a range from 0.05Hz to 50kHz], and LEVEL, [which sets the amount of the applied LFO]. LEVEL runs through a dual VCA which controls the output of the two outputs on offer here; B OUT [bipolar], and U OUT [unipolar]. One of the things I love about AJH modules is that they usually have CV control over most of the important functions, and it's the same here. Everything is CV controllable, including the two banks, as you

can switch between BANKS 1 and 2 of the selected rotary switch position—provided the BANK toggle is in the up position—and also patch CV in to modulate between all of the available waveform shapes as well. So you can CV BANK to BANK and SHAPE to SHAPE. You can morph the LFO shapes with the WF-TWIST to make new shapes and get swelling modulated ratchets by using some CV to modulate the WF-TWIST and the LEVEL. Speaking of, the built in VCA is great to fade in/out of modulation using external CV—such as another LFO to modulate the modulation!—and also to attenuate the amount of the LFO modulation without needing to patch into another module; perfect for when you just want a small amount of modulation on a given parameter. When CV is patched in, the controls for each parameter become attenuators, doubling their functionality.

You can also patch in some clock to control the frequency and there's a CLOCK OUT that puts out a signal equal to that of the CLOCK IN and the MULTIPLY control. It's a great addition, especially since it's not just a duplicate of the CLOCK IN, as you can easily mult that somewhere else. It's also pretty cool that you can use the MULTIPLY as a clock divider [though, as mentioned, it only divides by half] and a clock multiplier to use for more modulation or clock/synch duties.

I was going crazy with testing out this module, and it's no understatement to say that it was a revelation. It's not just the changing of shapes—plenty of LFOs have random options, but the syncable modulation opportunities for every aspect of any given shape, whether it was a timing thing, a number of repeats crammed in a certain time space thing, or a PWM-ish thing, there are so many instances—like the switching between the two banks—that you just can't find anywhere else. LFO modulation has never been this fun—or this interesting. You can even self-patch to go bonkers with the shapes [and timing].

Like I said, the main reason I was initially excited to check out this module was due to its tap tempo feature as I kept thinking how cool it was going to be to synch up modulation on the fly with the avant-garde/improv/noise trio that I occasionally play in as a 4th-ish member, consisting of drums, bass, and screamcore vocals. We're constantly changing tempos, feel,

etc., and the changes are very random, with just a quick nod of the head by our drummer to signify an upcoming change, so you really have to be on your toes...and our tempoes. I'd already added a 4ms Taphographic Delay as well as tried out various tap tempo tremolo pedals for this outfit to try and keep up—if possible—but the idea of quickly and easily tapping and tempoing modulation had me way excited.

And so, after an ad hoc performance in front of four aural-fatigued friends who'd already heard more than their fair share of our version of noise, one of our attendees paid me the highest—and simultaneously, lowest—compliment by saying that our output of the day was, "Way more musical than normal," and "very nearly listenable." I was both perturbed and elated. Perturbed because our collective mindset isn't to create "listenable music," but rather push the outer limi...actually, I'm not really sure what we're trying to accomplish now that I think of it, as we've never discussed any sort of goals, musical or otherwise, so perhaps I shouldn't have been perturbed. I was also, however, elated because, I too sensed that we might have hit upon something, and personally, I felt like I'd turned a corner. Of course I say this somewhat in jest, but my other noisemates seemed to pick up on this as well, and genuinely seemed even more pleased than normal after we played. Perhaps I'll be a fourth wheel no longer [actually, four wheels are a good thing, right? More stable?], and will someday be a full-fledged member, making us a quartet. Only time will tell.

Either way, I almost wholeheartedly attribute this new, synched up musicality to the MMTTVC-LFO, which I had mulled into a Zorx 1U CV Bus that lets me attenuate and multiply a signal so that I had multiple variances of my synched up LFO modulation in various strengths and polarity going to numerous modules/parameters. I rocked that tap tempo all night long, modulating filter cutoffs, VCAs, various VCO parameters...and kept up with the 4/4s, 5/7s, 3/9s, 17/18ths and whatever else I couldn't mathematically tabulate that was being thrown at me with nods of the head.

This is a great module that I can't recommend enough. I would sure love to see an AJH MMTTVC-QLFO. Yes, Q For quad!

- Jason Czyeryk

12 HP +12v 35mA -12v 25mA

Price: \$299



Pandora Expert Sleepers expert-sleepers.co.uk

Continuing with their Cocteau Twins *Treasure* theme, Pandora is the latest all analog module from Expert Sleepers. It's obvious that the title of the song, the fifth track—hence the fifth module in this series—was an inspiration for the functionality of this module as Expert Sleepers Pandora really does open up a box of utility as it's a bandpass filter with manual and CV controls over the high and low frequency corners [Alpha for the LPF and Beta for the HPF], and a MOSFET transistor-based distortion processor with manual and CV control over the gain amount, which in effect can be used as a VCA as well. There's also control over filter feedback amount and a Mix control that can be modulated with CV.

Jumpers on the PCB allow the Mix to be configured to either have the halfway point of the control where the output is 50% wet and 50% dry, or to have the halfway point be 100% wet and 100% dry. It's an interesting detail and in the latter configuration when the control is below halfway the dry remains at 100% but the wet signal wet fades out when the control moves CCW. The opposite happens as the control moved from the halfway point to fully CW, with the wet signal being 100% and the dry fading out. This can be useful, such as when you bring the filter into the dry signal to dirty it up a bit, but want to retain the low and mid frequencies. I kept mine on the factory 50/50 setting throughout most of my initial testing. A Low/High switch controls the range of the filter response and a mono input and output round out Pando-

ra's features.

When I first racked up Pandora, I did it blindly without checking out the manual and didn't know exactly what it was. Granted, I was pretty clued in to most of it [Distortion, Mix, Feedback are all pretty easy to decipher] but I didn't know what the Alpha and Beta were for and so I just patched some CV into all of the CV inputs, an audio rate triangle wave into the Input, and twisted things around a bit. What I got was a pretty cool drone-y rhythm track. Tweaking the knobs a bit and I would lose the signal, distort it, get some squeals, etc., and it wasn't long before it was time to check the manual to get some secure footing.

After confirming that I was dealing with filtering of some sort in concerns with Alpha and Beta, I finally started to know what I was doing and started utilizing the bandpass functionality of Pandora. With a pretty tweaked static signal coming out of the Xaoc Devices' Sofia into Pandora and the bandpass with a pretty minimal thoroughfare for frequencies based in the middle of the frequency range, alternating LFOs between the CV ins of the two had my sound at the frequency cutoff for each end alternating between 80s video game lasers at the high end and bit-crushy mid-frequency kick drums at the low with a constant glitchy drone as the Gain was set at 2:00 and being fed a square wave. Minute adjustments of the knobs yielded completely different sounds and modulation affected audio lengths as well, as the modulation would veer off the cutoff and into audio purgatory. Tweaking the Feedback [even though it too was being modulated with a smooth random LFO] sounded like a dying capacitor the further CW I got. It was interesting working like this, and it struck me at how you can create really great rhythms via this method of modulating the Alpha and Beta simultaneously with various LFOs and envelopes.

One of the great uses for any tone-sculpting module is for parallel processing, and Pandora shined here, when I would mult a dry signal and blend the Pandora's signal with the original at my mixer. In the studio this is something I do a lot with mixed drum busses, and with bass when I want to add some girth to the bass at specific frequencies, but it isn't something I do so much in modular, but diving into it, and running the output of Pandora in this

manner through a modulated VCA, the drums would have Pandora's output mixed in along with the dry drum track to give some life, some humanity to the rhythm, adding some dynamics to this aspect of my patch. Again, this is something I sometimes lack—this changing of the rhythm—not in terms of beat, but sound. Sure, I'll do the filter sweep thing, or mute the kick or something at various times, but having the drums change tone via CV like this added a nice dimension, some variability to the drum sound, and made it less predictable. I then moved onto modulating the VCA at audio rate and it brought about some tinny ring-moddy highlights. Nasty stuff, really, and I had one instance of this using a mutated square wave output on Loralei—the Expert Sleepers VCO in this line of modules—and it was glitchy, fuzzy, busted up sounding...it was awesome. When I muted the Pandora processed track and only had the original dry signal at the mix out, I looked up and it was twenty minutes later and the sun had set. Is that a sign of something or what? Bring on the darkness, I say!

There are Vactrols used in Pandora that are in the filter section and it's interesting to find when tweaking or patching/unpatching CV into these, that the lag time of the circuit would sometimes take a second to re-calibrate. Sometimes the adjustments were very minute, so it could just be that it wasn't so much recalibrating as it was that I had ever so slightly moved the control to where it made a larger change than the movement would imply, and that's the thing with analog: you need to enjoy it in real time, in the moment, as change can occur quickly, at any time, and for any number of reasons. Like having clumsy fingers. You gotta appreciate it while it's there, staring you in the face.

There's a lot of interaction with the settings where tweaking one parameter slightly would go a long way, especially when it came to the distortion and feedback. Pandora can self-oscillate so there were times when my input signal would get buried under a wobbly self-oscillation and I'd have to back off the feedback a bit to regain some signal consciousness. It was really fun finding the sweet spots—of which I found a lot—in Pandora's box of tricks.

- Ian Rapp

8 HP +12v 69mA -12v 58mA

Price: \$199



Microcosm Hologram Electronics hologramelectronics.com

Microcosm, Knoxville-based Hologram's granular delay and looper pedal, is one of those pedals that can induce a little of a love at first sight reaction. It's a really nice looking thing with an off-white enclosure with flashes of pastel-ish rainbow colors and lights, and if you've heard it—and I'm sure you have, whether you realize it or not—and especially experimented with it, then you know how easy it is to churn out beautiful, interesting soundscapes and textures with it.

Microcosm can run in mono or stereo, has MIDI in and OUT, an assignable expression pedal input—which can also be used to CV control any of the main parameters—and a host of controls and features with which to tweak into the infinite. Its effects are divided into four styles with subsets for each that total eleven effects, switchable and selected by the pushbutton Preset Selector. All of this resides on the right side of the pedal, and the styles and [subsets] are as follows: MICROLOOP [Mosaic, Seq, Glide], GRANULES [Haze, Tunnel, Strum], GLITCH [Blocks, Interrupt, Arp], and MULTIDELAY [Pattern, Warp]. Each of the eleven effects also have four preset variations, so in total you have forty-four, not counting the sixteen saveable USER presets. All of the controls to tweak your sound are on the left side of the pedal; Activity, Shape, Filter, Mix, Time, Repeats, Space, and Loop Level. Each of these controls also has a secondary function reached by holding the Select/Shift button, also found on the left side of the pedal in the mini Tempo section of the pedal.

Microcosm is hypnotic to look at, with a four-color LED indicator light bar at the bottom of the pedal that signifies whether

the effects are on or off, what loop mode you're in, which effect preset you're in, etc. Truthfully, a screen would be more helpful in terms of information, and I could never remember exactly which subset of each effect I was in based on which color bar was illuminated, but it's way nicer to look at the colored bars than a screen, and I don't really think knowing which preset is which is all that important anyway. I just used my ears to determine what I wanted, felt like, etc., and for everything else the color bars were quite intuitive and helpful enough, and any other information is just a manual-reach away. I feel like this sort of menu display works well with a pedal that's obviously designed more for experimentation and feel than precision and in no way did the absence of a menu deter or hinder my enjoyment and creativity with Microcosm. Quite the opposite, actually.

A lot of the time I was experimenting with Microcosm I was pushing it, just seeing if I could hear the difference between one setting and another. For instance, there are four available reverbs to choose from and I would switch back and forth [hold Select/Shift and rotate the Space control] to see if I could hear the differences until I hit upon one that spoke to me in the moment. I can't say that I would be able to explain the differences as sometimes there would be so much going on, swirls of modulation and delay, and mostly it was more of a feeling than an understanding of change. Even so, that aspect of experimenting was fruitful and in line with the overall layout and feel of Microcosm. Most of the tones and sounds I uncovered were lush, deep, and evocative of the deep mysteries of space; it really excels at those types of sounds, something I was aware of beforehand, and it's really easy to get those beautiful types of textures. In that way you could almost see Microcosm as a one-trick-pony. Almost. Again, Microcosm sounds great, and if it was just a spacey effects box, if this was all you got, it would still be great, but there's also an onboard looper that can be used with or without the effects and before [Pre] or after [Post] the effects take place. This makes the looper really usable, really versatile, and really fun. I love recording a signal Pre-effects, so that I can tweak a recorded loop in real time, and I usually keep the looper set on Pre-mode for this purpose, though it's easy enough to switch back and forth between the two

options. The layout of the looper is familiar to anyone that has used a looper before with three momentary footswitches for looper control and the color bar supplying all of the needed information in terms of mode and the like. The leftmost switch [as well as the right-most] have main and secondary functions; TAP [Record/Play/Dub], HOLD [Stop/Erase], while the center switch engages/disengages Microcosm from your signal. You can even choose what Bypass mode you want [Buffered, Trails Mode, or True Bypass].

The looper part of Microcosm is really well done and super easy to use. Like the Tempo section there is a small light up section to select how you'd like the looper to function. As I mentioned, you can use it Pre or Post effects, and you can also quantize the loop to synch up with the Tempo function of the effects, copy loops, set the looper to be in Burst mode so that it records only as long as the Rec/Play/Dub button is pressed [really cool for super short "bursts" of signal looping], and you can reverse the loop playback. You can also change the loop playback speed on the fly by holding Shift and turning the Time control, which is quite fun.

I get the feeling that when most people think of Microcosm, it's the ambient/drone machine type of tendencies that come to mind, but I really love using the looper, both by itself and with the effects. It's as easy to use it to lock down ideas as it is to create never ending soundscapes. And in conjunction with the effects, and with a sixty-second recording length and endless overdubs, it succeeds very well as a sketch pad for ideas, a sound creation device, or perhaps a backdrop to a main melody line—a detailed pad of sorts. Since there are sixteen User assignable slots you're able to save any ideas or sounds you conjure and might want to recall as well. Sixteen might not sound like a lot, but I found it to be more than enough.

As mentioned earlier, Microcosm has an expression pedal input that can be used to CV any control on the pedal, which is what I used it for as I mainly used it with my modular setup, though I did plug in my guitar and played around with it in that capacity as well. There are a lot of possible MIDI implementations on offer, but I can't say that I wore out the MIDI IN and OUT ports. It's just not something I do a lot with pedals—using MIDI—but I wanted to

make mention of it because if using MIDI with pedals is your bag, and if you want to have that much control over Microcosm, if you want to use more extensive modulation to control, it's available, and you'll be right at home.

My biggest complaint about Microcosm, or pedals/modules of this type of nature [not that anything is exactly like Microcosm], is that they make everything sound amazing and interesting, that they're cooler than the music put in them. It sometimes feels a bit like cheating, like a magical topping that can go on even the shaggiest, soggiest, most flavorless of cakes, and make it delicious. Sometimes it can feel like the tool is doing more of the creative heavy lifting than I am and I wonder how much I've done in this music-making equation that is contributing to the overall wonders coming out of Microcosm. I mean, sure, I did procure the pedal, so that's something. And I did plug it in and throw some guitar/synth/noise into it, but if I'm being honest, Microcosm takes my noise and melodies and makes them awesome. I'm the side-kick here, the grasshopper.

It's possible to get something similar with a handful of other pedals, to have the same types of effects, options, and utilities at your fingertips that Microcosm has, though I doubt the workflow would be nearly this smooth. It reminds me a bit of how folks assemble modules to be like a Buchla Music Easel, a Minimoog, or an ARP 2600 or something. It might have the same options and components, it might even look somewhat the same, but the workflow, the interface, the magic isn't quite there. I feel the same about Microcosm, and you can indeed think of it as more than just a pedal, as an instrument in its own right.

While I'm not surprised at how great Microcosm is, I am surprised at how easy it is to use. It's really intuitive to grasp the operations of it, and it's all right there in front of you. Even with the alternate functions there was never a time when I couldn't figure out what to do, what was going on, or what to tweak. It's a beautiful pedal, and whether it sits on your pedalboard or your desktop, you'll have a hard time keeping your hands [and/or] feet off of it.

- Ellison Wolf

Price: \$459



Persephone Expert Sleepers expert-sleepers.co.uk

I'm a big fan of Expert Sleepers line of analog modules, and we reviewed three of them favorably [Beatrix, Lorelei, and Ivo] back in issue #7, and Pandora in this issue. They're well made, attractive, easy to read and navigate, and they do what they advertise quite well. Persephone was released a little after the initial three and I was happy to have it alongside the rest of the gang to check it out.

Persephone is a JFET based VCA, which rounds out the mixture of functions with the other three quite well. Really, a couple more modules [see the Pandora review in this issue] and Expert Sleepers will have a great analog system at their fingertips. Throw in a couple of Distings [or the Super Disting] and you've got all you need for a small, powerful system.

Like the other three modules in this particular ES lineup, Persephone is 100% analog in its signal and CV path, though it uses a digital logic chip for a sample and hold zero-crossing detection circuit, which I'll get into in a moment. At the top of the module are two CV Ins—one with a dedicated attenuator—and a summed output of the two, which is a great way to grab an extra modulation source to throw into your patch. You can never have enough modulation sources, especially those with unique and patch-related waveforms. Patching two somewhat slow moving LFOs into the CV Ins and using the summed CV out to modulate a filter cutoff while inputting a synced up melody line as Persephone's lone input—which was being fed into

the filter—brought some cool beat-savvy formant style sounds. Feeding the same summed CV Output into either of the FM inputs on Lorelei spat out some odd rising wiggles.

In the middle portion of the module are two mini-toggles, one for turning the Zero Cross Detection circuit on and off, and another to do the same with Asymmetry. The Asymmetry switch makes it so that the positive and negative parts of the input signal are affected differently by the VCA. I was never able to predict exactly what would happen with the switch engaged, but I could definitely hear the difference with it on or off, and overall, it's another way to alter your sound. In between the toggles is a Clip indicator LED that lights up when the output goes over $\pm 10V$.

The Zero Cross Detection is really what sets Persephone apart from the crowd. While there are plenty of VCAs out there, Persephone stands tall amongst the flock, and perhaps the biggest reason why is how it takes on a major issue that can sometimes be encountered with VCAs: the dreaded popping and clicking [that sounds like a breakdance move gone wrong] when a bipolar CV wave crosses the zero threshold. This is a common enough problem, and there have been times when I've had to embrace clicking in certain large patches I've created, when I had no viable patch options left to try and circumvent the problem, and decided that the clicking was just part of the patch, part of the special sauce. I wish I could say that it worked, that I was able to trick myself and put the clicking out of my mind, but I would be lying. VCA clicks [and pops and...] can, and usually do, drive me nuts, which is why I am so into Persephone. It utilizes a unique zero-crossing detector, a S&H circuit, that can end the pop/click nightmare when the CV/envelope is fast moving. This is huge. How many times have you wanted to pull your hair out standing in front of some amazing patch you've got going, and only able to hear some super annoying clicks? We've got the technology to fix this, right? Expert Sleepers does.

The bottom half of Persephone finds two inputs, one with a dedicated attenuator, that sums to one output with Pre and Post controls to sculpt the overall volume and tone of your signal/s at different stages of the signal chain. Various combinations yield different results and using the PRE

on top of just finding the right balance to make sure you do or don't overload the VCAs input, along with using Post to recalibrate the output level to taste you can get all manner of fattening and harshening up of your signal.

Running a kick through Persephone with nothing going in Input 2, and tweaking the Pre and Post knobs, I was able to get a pretty natural, acoustic sounding bass drum, albeit with a sort of 8-bit haze dragging on its tail. Changing the two output settings and fuzzy blow outs were happening. Even though I admitted to pulling hairs out due to VCA clicking, there were some moments with Persephone where I actually turned the Zero-Crossing circuit off because I liked the fast clicking, as it added to my sound a kind of a fuzzy, metallic girth that, while usually unpleasant for the most part, was in this instance a bit pleasing. I'm quite certain that the next time I play in a public park and want to annoy passersby, something I've unintentionally done before, I will be utilizing this, again... um...unintentionally. The zero-cross circuit really does clean the sound up quite well, and in the case of the kick drum going through, it was night and day. Circuit on, and it sounded full spectrum and like a good acoustic kick. Circuit off, and the low end was gone and so was most of the definition. It really highlighted how Persephone, apart from being used as a typical VCA, can also be utilized to sculpt sound.

Messing around with the Pre and Post controls is where you can really detail your sound, and I was able to go from some nice saturation to full on static-y chaos. There is also some interesting interplay between the Pre and Bias controls that can be had, which lets you really dial in when the VCA opens, the sound of the signal passing through, the strength of the opening, etc. The controls are nice and the ability to be precise with the amount of distortion is much appreciated, especially as this isn't always the case in a lot of modules. So many times with other distortion types of modules the slightest knob tweak can have your sound go from 0 to 100 with practically nothing in between, no range at all and a lot of dead space on the control. None of the ES modules in this line are like that. They're all really well done, everything works like it should, and there are no caveats to any of the functions or controls. I let a friend borrow a small rig to

get his feet wet in the modular landscape and I made sure to include these modules knowing I wouldn't have to explain anything about the modules themselves, just what synthesis is, what CV is, what V/Oct is, etc., and that they would serve him well. Indeed they did as he took the bait and dove in head first into the Eurorack rabbit hole.

Persephone has some really excellent features and might just well set the standard for how a VCA sounds and acts, and it makes it so that VCA pop/clickin' can be a thing of the past. Unless, of course, you like that sort of thing.

- Ian Rapp
8 HP +12v 36mA -12v 29mA
Price: \$189



LVX
Meris
meris.us

As I dove into Meris' LVX modular delay pedal I kept being reminded of *The Heart of Gold* from Douglas Adams' *Hitchhiker's Guide to the Galaxy*. In the novel, *The Heart of Gold* is the most advanced, powerful, and unique spaceship in the galaxy. It is powered by the "Infinite Improbability Drive," which allows it to perform feats of interstellar travel that include seemingly impossible jumps across both space and time, happy accidents, and results that are both a surprise and a delight. Like *The Heart of Gold*, Meris' LVX—with its brilliant white finish and retro-futuristic UI—is more than capable of transporting you through improbable spaces.

At its heart the LVX is a delay pedal, but in reality it is much, much more than that. Indeed, the amount of options and parameters available is staggering. Fortunately, the LVX is blessed with not one, but two excellent UI designs that make diving in and tweaking not only a breeze, but actu-

ally fun. The default graphical interface is a bubble-based affair with the category of the parameter [Delay, for example] surrounded by the various editable parameters [Time, Feedback, etc.] within that category. The second option is to switch to a text-based interface, wherein each of the LVX's knobs are assigned a parameter [per category screen]. I found the default graphic view entirely usable [though both versions are quite easy to use], but because of the depth and breadth of options available, I preferred the text based interface. In that view the parameters that are available—even if they are spread over a few pages—are more readily apparent, and the knob per parameter mapping makes things quick and intuitive.

Meris has borrowed some of the best bits from many of their other fantastic pedals and included them in some form, and the further I spelunked into the depths and possibilities available the more I came to realize the power that Meris has crammed in.

Along the back the LVX has ¼ inch jacks for stereo input and output, an expression pedal input [also ¼ inch], and five-pin DIN MIDI in and out. There is also a USB-C port for firmware updates and a standard 9v center-negative DC power input. On the face of the pedal along the bottom edge there are four foot switches that perform various functions such as loop control, preset selection, and tap-tempo. Above that, and centered around LVX's beautiful color screen, are the three main navigation controllers, C1, C2, and C3, along with four knobs dedicated [unless you are editing] to top level controls over Time, Feedback, Mod[ulation], and Mix. The C3 encoder is used to navigate through presets as well as through the different category pages while editing. C1 and C2 control two "favorite" parameters for each preset, both of which can be assigned as you see fit when editing a patch, allowing for quick access to parameters of your choice.

The LVX comes with 99 factory presets in 3 banks of 33 and I found the presets excellent. They range from straightforward to otherworldly and are a great way to get your head around the capabilities of the pedal. Out of the box the LVX will keep your ears busy with everything from multi-tap delays, envelope following pitch shifters, bit-crushed and filtered reverb trails, and more. On top of that it seems

that anything that gets fed into the LVX just sounds better coming out the other side, and whether you are going for an extreme change or something more subtle, this pedal will make magic.

When crafting your own sounds the LVX offers a stunning array of options, and if it wasn't so intuitive to navigate, this depth could easily be overwhelming. All of this can be broken down into a few categories, but since this is a "delay" pedal it makes sense to start with the delays. There are several different delay types to choose from: a clean and pristine digital version, a bucket brigade style, and a magnetic emulation. There are also six different delay structures which can add delay taps, filters to delay lines, reverse direction, and even a stereo port of Meris' own Polymoon algorithm.

If that amount of options isn't enough, then hold on to your space helmet because in addition to the delay parameters and types, the LVX has a further five categories of options to play with. First up is the dynamics section which gives access to both a compressor and limiter as well as Swell—an automatic volume swell that removes that attack of the signal—and a Diffusion parameter, which smears a series of short multitap delays for reverb-type effects. The LVX contains five different preamp models [six if you count the Volume Pedal parameter which is included in this part of the interface]; a tube model, a transistor based version with a focus on higher frequencies, an Op-Amp for a more broadly dispersed boost, an overdrive, and a bit-crusher, each with their own set of customizable settings.

Did you say filter? There are four different filter models onboard: a ladder filter [brought over from the Meris Enzo], a state-variable version [also from the Enzo], a comb filter, and a single-band parametric EQ. In the pitch-shifting category we have several models adapted from Meris' Hedra pedal: both a poly and a monophonic chromatic pitch shifter, a micro-tuned shifter, a harmonizer with two independent diatonic shifters [one for each channel], and a Lo-Fi pitch shifter that has been adapted from Meris' Ottobit Jr.

Last but not least there are seven different modulation effects including chorus, two different flanging effects, a cassette emulation with degradation controls, a ring modulator, a barber pole phaser effect, and a granular engine for stuttering and freez-

ing effects and evolving textures.

While all of those raw elements are impressive, what makes the LVX so powerful is the flexible nature of the signal path and the way in which different effect types can be placed in different parts of the signal chain. Each of the elements can be placed before or after the delays, in the feedback path, or applied to both the dry and the pre-effect signal. The looper also allows for elements to be placed in post-mix location. Additionally, each of the above elements are in stereo and can process the right and left signals independently. It's a lot to take in.

Oh, did I forget to mention that the LVX also has a suite of modulation controls? Yep. There are two independent LFOs, an envelope follower, a sample and hold, and a 16-step sequencer. All of these can be assigned to the various parameters available in the delay and effect categories. At the risk of sounding overwhelming, the LVX also features a capable sixty-second stereo looper, a tuner, and an extensive set of Global configuration options. If your set-up includes MIDI, the LVX has a comprehensive map of MIDI CC mappings for external control over the pedal's parameters, and it also has an expression pedal input which can be assigned for macro control over any of the same parameters as the internal modulators.

As I keep saying, the amount of options is utterly staggering, but the interface is so well thought out that the LVX is surprisingly never overwhelming to use. The flexibility of the signal routing is great and experimenting with differing placements can wildly affect the sound. The inclusion of a looper is a great feature and is easy to use, and apart from the fact that the LVX is an incredibly gorgeous delay pedal, the flexible nature of its architecture means you can apply its pre-amp models, dynamics processing, and pitch shifting independently of the delay line, turning the LVX into a kind of multi-effects pedal as well.

I honestly can't recommend the LVX enough. It's an incredible achievement from Meris and a pedal that deserves a serious look by any musician, regardless of the instrument you plan to run through it.

- Sam Chittenden

Price: \$599



Moogerfooger Effects Plug-ins Moog moogmusic.com

Moog's line of MoogerFooger pedals have always been a tweaker's delight. Great modulation options, excellent sound and build quality, and friendly ergonomics made these pedals perhaps the most well-known pedals ever designed for synthesists. I've been lucky enough to have spent time with a few different models throughout my musical life—the delay, the Freqbox, and the Clusterflux—and always enjoyed them. Since being discontinued a while back the prices for these pedals have been escalating, especially the 104M Delay [I had two of them!], to where a whole set of them would cost a king's ransom. Well, maybe not a king, a squire perhaps, but still, they're on the pricey side.

Well, hold on to [some of] those ducats because Moog has released all seven [plus a free MF-109S Saturator] as plug-ins, and they are just as fun as the hardware versions, and to these tinnitus-plagued ears, sound every bit as cool and magical.

The plug-in versions will automatically look familiar to anyone that's familiar with the pedals, they look the exact same. The wood sides, layout, text, etc., is spot on. But while there are limitations to any hardware device, the plug-ins have some features that didn't—and couldn't—make it onto the pedals, like attenuverters for each CV in, presets, and easy flexible routing. Add to this the fact that you can run multiple instances of any pedal on one track/signal, save and recall presets, have easy CV control from pedal to pedal over various parameters, can compare state settings, and have automation capability, and there is a

lot to like about these software versions.

This release and testing of the Moog plugs also coincided with me saying goodbye to Pro Tools after nearly 20 years as my main DAW [having tired of the subscription model, and making the switch over to Reaper], so it really felt like a fresh new environment in which to test these out. It was a certain kind of fun I hadn't experienced in a while behind a computer screen. While I do use my computer together with my modular to create music, I mostly used these as effects during editing/mixing, and I gotta say that they're a blast. Having been familiar with the pedals it was a seamless transition to using the new plug ins and after my initial jumping into the delay to see if it measured up to my memory of being one of my favorite delays [it did...why did I sell those???? Doh!] I wanted to check out the pedals that I never had the good fortune to have in my possession.

Going through the models was really nice, and I tried to think of a time that I was able to try them all out, and there wasn't one. Usually it was just one or two of the pedals at a time, so being able to spend time with pedals I'd never been able to try out like the MuRF and the Low Pass Filter was great. Finding my way around these two to understand the workflow and capabilities of the plug ins was flawless. It's easy to want to use all of the pedals all of the time—since you can—and I had to hold back a bit and think about what I was hoping to get and not just stack pedal on pedal, not that stacking pedal on pedal wasn't great!

Some things that you'd never find on the pedal version [or any pedal, really] are quite helpful, such as when you're using CV to control features, there is an illuminated line that highlights the circumference around knobs that animate, giving a nice visual indication of how much modulation is taking place. A similar thing happens with the virtual cable plugs in the CV area for each pedal, though I would have liked it all to be a little more visible, as it's a bit hard to see. I'm not going to pit the hardware vs. the software versions, but this is a nice feature, and definitely helpful when you're chugging along with multiple pedal instances going on. You can really get creative with the CV patching/routing from one pedal to another and it was nice to quickly and easily route CV around, trying out different modulation sources/destinations without having to rearrange

cables or the physical landscape of actual pedals. It made me realize the worth of the plug ins even if you had the pedals at your disposal; it'd be a great way to try out setups and variations in the virtual world before bringing it to the pedal board.

While the plug ins are individually great, it's with modulation and stacking one on top of another that they really show their worth as a whole. CVing the TIME on the 104 [Delay] with the LFO from the 102 [RingMod], modulating the LFO SWEEP of the 105 [MuRF] with the ENVELOPE from the 101 [Filter], and on and on, it's so easy to get lost in a warping of time, space, and audio.

These are a lot of fun, they sound great, allow for easy experimentation, and look great on the screen. A friend of mine has this rule when it comes to gear: if a piece of gear is "set and forget" and it has a good software equivalent, he'll choose the soft version. I can't say that I 100% agree with this; had I still had the 104Ms in my possession I'd be wary of letting them go again, but you sure won't be sacrificing or missing out on anything if you go this route with the Moog line. They software versions aren't cheap, but I think they're worth every shilling, and they're definitely more affordable than the pedals.

- Ellison Wolf

Price: \$249



Step 8
Joranalogue
joranalogue.com

Joranalogue's Step 8 has been kicking around on the scene in proto form for a bit and it's good to see it finally released into

the wild. At first glance, you'd be forgiven if you thought it was an 8-step sequencer with its light up LED faders looking similar to IME's Stillson Hammer, and while Step 8 can be a 1-8 step sequencer, as is usually the case for Joranalogue's line of modules, it's much more than that.

The core of Step 8 is an analogue 1-to-8 signal switch that goes through eight track or sample and hold stages. Step 8 has eight ANALOGUE OUTPUTS—one for each step—each with an attenuating LED slider. Each step also has a GATE OUT. There are two other outputs: STEP, which outputs a short trigger every time a new step event occurs, and SCAN. SCAN is sort of considered the main output as it outputs the currently active stage, compared to each step's ANALOGUE OUT.

There are a multitude of ways to shape Step 8's operation via its inputs. There's a signal IN, which sends +5V when nothing is patched in, and there are also inputs to control/modulate STEP, PAUSE, RESET, REVERSE, and STAGE. Most of these are pretty self explanatory, but the STAGE input is interesting in that each of the eight steps are divided equally by +5 volts, so that by doing some minor calculation you find that accessing a particular step is a multiplier of 0.625V [5V/eight steps = 0.625V], meaning that if you want to sequence or get to step one via the STAGE input, you would inject 0.625V into it, and if you wanted to get to step five, you would need 3.125V [5 x 0.625V]. Using random voltage for the STAGE input and you get a random sequencer. Conversely, you could use another module/s [offset with VCAs, or a CV sequencer] to access specific stages. It would be an interesting process, though I couldn't think of a good "real world" rationale for doing so, but I'm sure some tedious and highly detail-oriented patchers would find reasons I haven't thought of.

Along with CVing the steps, moving through the steps in sequence can of course also be done via the STEP input, or by pressing the button in the upper right corner. With all of the input controls and the ability to mute a step by positioning its slider all the way down, there are endless pattern variations to be had, whether it's to use Step 8 as a melodic controller or a modulation source. Or both at the same time. Like most traditional sequencers that have gate outputs you can do all sorts of cool

melodic/rhythmic variations, and I found that patching out of some ANALOGUE OUTS while doing so, and into various effects brought out cool pseudo-random highlights in a patch where [especially when going through the steps randomly] a ping of delay or reverb would pop out in surprising places, keeping the patch moving. You can do this with the STEP out too, to different effect. Actually STEP out is the triggering sibling of the SCAN out, and using both gives you a multitude of options for accents and modulation sources.

Finishing the controls on Step 8, the top of the module houses three toggle switches: CYCLE/SHIFT, SOLO/ALL, and TRACK/SMP. CYCLE/SHIFT functions as the mode selector in STEP 8 and switches [literally!] between cycling through the steps as you would in a traditional step-sequence or a sequential switch, where the input signal [or +5V if nothing is patched in] is moved to each successive output stage where it can be attenuated, or shifting all of the voltages to the right or left [if reversed] as a group, like a shift register. The SOLO/ALL switch selects if all of the analogue outputs will be active [ALL], or just the selected output [SOLO], with the LEDs on the sliders giving visual indication of that as well. Being able to toggle between these two settings is cool for a number of reasons, like when in SOLO mode and for various spatial percussive needs, or accenting or pinging something only on certain steps. You can always mix a few of the outputs together for multiple pings or accents on one CV input, like a filter ping or something, and this is a cool way to get really interesting timing/rhythmic accents and be able to tweak the level of the accent/ping.

The last switch is the TRACK/SMP toggle which selects how each stage behaves in relation to the input voltage. TRACK follows the input throughout the duration of each stage, and SMP samples the input with w 50 µs sampling rate.

You can get some really interesting behavior on Step 8. For instance, when I was patching a square wave into the REV using six steps [by patching step 7's GATE output into the RESET] you can get six steps moving forward, but the two skipped steps [7,8] will play when the sequence goes in reverse. You can do this, of course, in order—that is, to say, sequentially—by patching CV into the STEP input, or you

can do this randomly, with the skipped steps as something like mystery guest steps or hidden steps, by controlling the steps via CV into the STAGE input. Patching the SCAN output into a 1V/oct input on a VCO and you can create your own bespoke 1-8 stage S&H melody, constantly changed by tweaking the sliders and the step movement. Do this at a faster pace and it's something more akin to waveshaping, albeit with stepped behavior. You can also do all sorts of really cool rhythmic things as well by patching clock into the IN and the STEP and messing around with their rates along with the position of the sliders. I did this with Bastl Pizza's main output patched into the IN on Step 8 and turned Step 8 into a bassline generator, patching and unpatching to alter the step length at my whim. It was different than just a typical sequence because between steps the voltage would revert to the base [not bass!] tone being generated by Pizza and this gave it a really catchy bassline, but it did involve some extensive patching, using a square wave on the 1V/oct input on Pizza, coming from Pamela's New Workout with various tweaks to the level, clocking, skip percentage, etc. I also had to mult the clock to going into STEP on Step 8 to also use for a trigger in—in this case in Schlappi Engineering's Boundary—using the envelope output on that module to control the WORNG Vertex VCAs CV IN so that I didn't have clicks or pops going from step to step. Still, it made for a very cool, hands-on performance bassline controller with the ability to mute steps at will and change the volume at each step via the sliders. It was really interesting when I patched random voltage into the STAGE input of Step 8 along with having a clock at the STEP input. The STAGE CV was a division of the clock so it would randomly change up the order of the bassline, giving it some much needed variation, and the frequency of this was controllable as well.

The Step 8 manual has a handful of patch ideas to turn Step 8 into a clock divider, voltage mapper, etc., and it highlights where a lot of fun to be had with this module is in trying to come up with novel ways to use it, or to turn it into something it's not exactly made for. Step 8 is an interesting turn from Joranalogue. While most manufacturer's step-sequencers are flagship modules, Step 8 isn't quite that. Instead, it's a supremely clever and fun utility

module that fools you a bit and shows that you can't judge a module by its faceplate.

- Jason Czyeryk

16 HP +12v 110mA -12v 45mA

Price: \$350



SoftPop SP2

Bastl

bastl-instruments.com

The Softpop SP2 from Bastl is a visually and physically dense little brick of a synth. Much like Guy Pearce's tattooed body in *Memento*, every surface is covered in labels, notes, diagrams, and various bits of other information. Having a manual of sorts printed right on the unit does come in handy once you've familiarized yourself with the instrument, but it's really more of a cheat sheet, serving as quick reminders of all the key combinations and shift actions available. And there are a lot of key combinations and shift actions, most of which you are likely to forget several times. While dense, the front of the SP2 is laid out logically enough with a prominent set of six faders to control aspects of the oscillator, the filter, and the envelope. Above that are sliders for fine tuning the pitch, adjusting the resonance of the filter, and for timbral manipulation from "Soft" to "Pop"—smooth and classic when "Soft", through to hard-edged 8-bit style distorted mayhem at "Pop". On the left is the SP2's 8-step sequencer controls, on the right are level controls for both the output and input jacks, and a midi input, as well as buttons for manual trigger, a tap tempo, and play [all of which are utilized in various key combination functionality]. The top half contains the substantial array of patch points for the various modules of the Softpop SP2.

The basic architecture of the SP2 is that of a classic subtractive voice, a pulse wave into a filter into an envelope controlled

VCA, but there are also some interesting normalizations that immediately give the SP2 a very characterful, fun, and sometimes chaotic vibe.

The six main faders control the pitch, filter cutoff, and envelope in pairs. For the oscillator, the left slider is the pitch fader, working similarly to a coarse tune [although it is also the way in which you program in notes for the sequencer—more on that later]. It is combined with a pitch modulation slider that adjusts the level of input from either the signal at its dedicated input, or a normalled modulation source from a sample & hold circuit that is fed by the envelope. Next in line is the fader for the filter cutoff and its corresponding cutoff modulation fader [filter mod is normalled to the envelope]. The two right-hand faders control the rate and the shape of the AD envelope, respectively. The envelope can be cycled or manually triggered by a TRIG button or from a trigger at its patchbay input. In practice the interplay [sometimes subtle and sometimes extreme] between these six controls and the way in which the different normalizations play off each other give the SP2 a very organic and somewhat wild character. The faders lend a nice performability to the interface and really make experimenting with the Softpop SP2 fun even at an unpatched level. The filter sounds excellent and has a really nice aggressiveness when the resonance is cranked, the envelope is a nice and snappy exponential AD, and the continuous envelope shaping via the fader control makes moving from percussive strikes to an almost reversed feeling easy and fluid. When cycling, the envelope doubles as an LFO and also has a reverse input jack which will flip the attack and decay times as set by the slider, great for injecting some serious wonkiness.

After a recent firmware upgrade the SP2 now features a digital oscillator with a greatly expanded set of waveforms and timbral possibilities. Each waveform [selectable via the sequencer gate buttons] also has a unique set of waveshaping parameters that can be morphed by holding

down the SLIDE button and adjusting the fine-tune slider. Unfortunately, there is currently no CV control over the waveshaping parameters, but the SP2 can be set up so that the waveshaping is the default control for the fine-tune slider, and that option makes manual morphing much more manageable. One thing to note is that the SP2 has an internal scale quantizer that is applied to the combination of the pitch slider, the pitch MOD slider, and the pitch information from the sequencer. While the oscillator can be “unquantized,” it is still in stepped quarter-tone increments. The SP2 has eight default scales which can be easily edited to create custom scales for use with the sequencer. Speaking of sequencing, the Softpop SP2 has a surprisingly powerful sequencer on board. While it is limited to 8 steps, there are a few functional tricks up its sleeve that really open up its creative potential. Each 8-step pattern is stored in one of the eight slots in a bank, of which there can be eight. A pattern consists of gates, pitch, and slide information, and patterns can be selected in any order as well as chained together to form longer sequences. Additionally, the scale of the played patterns can be sequenced, as can various performance effects and the eight different playback modes. Programming a pattern can be done in real time by playing the sequence, holding down the record [PATTERN + SLIDE] buttons and moving the pitch fader or by manually entering pitches in a step edit mode. Gates can be toggled on or off and you can program in slides on a per note basis. Moving between different patterns in a bank is done by holding down the PATTERN button and tapping one of the eight gate buttons. To chain patterns, just hold down the PATTERN button and tap the gate buttons of the patterns you want to play [up to a maximum of 16 patterns or 128 steps] in the order you want them played. Once a series of patterns is chained and sounding good, you can mess with the play modes. SP2 features eight different playback patterns: forward and reverse, random 8-step, random while playing only the first four steps

of a pattern, as well as first and last four steps or first and last three steps of a pattern. Holding the PLAY button allows you to select between the different modes as well as chaining them together for longer and more varied sequences. There are also a set of temporary fill type effects. Ranging from tremolo and ratcheting effects to pitch, slew, and gate probability, each one can be engaged, combined, or chained together like the patterns and play modes.

If the thought of memorizing key combinations and shift functions has you backing slowly out of the room, I don't blame you. Sitting down with the SP2 the first time can be a bit harrowing, but there is a method to the madness [and a reason for the Leonard Shelby look]. After only a short time the logic of the functionality makes sense and you get the hang of navigating the various shift functionalities. Muscle memory will help a bit, but there is definitely a learning curve to access the synth's deeper functionality and utilizing it fluidly. That's not to say that the Softpop isn't accessible and fun straight out of the box. The recent digital oscillator upgrade adds a host of new and interesting waveforms that increase the SP2's repertoire of tones. The sliders are immediate, performable, and fun, and the normalled cross modulation sets the SP2 apart from its semi-modular peers and gives it loads of character by default. Even the jam-packed patchbay is well organized and easy to navigate. While I found the onboard sequencer a bit finicky to program pitches into, the sheer amount of fun and possibilities for new ideas that the various chainable patterns, effects, and play modes offer up more than make up for a bit of clunky step editing. Most importantly, with its wide range of tones—from classic subtractive beef to FM'd percussive hits to manic feedback to gonzo chirping filter trills—the Softpop SP2 just sounds great, rendering Bastl's second iteration of the Softpop semi-modular synth a wonderfully dense, extremely enjoyable, and great sounding little box.

- Sam Chittenden

Price: \$559

Want to advertise with Waveform?

drop us a line: contact@waveformmagazine.com



Mandrake
Malstrom Audio
malstromaudio.com

Netherland's Malstrom Audio is pretty new on the scene, but Daniel Mulder, the wizard behind the company's curtain, was also behind the now-defunct Livestock Electronics. When LE announced it was closing shop a few years ago, it was a sad day indeed, which is why it's so nice to have Daniel back amongst us as Livestock's sought after [and now hard to find] modules were unique and enjoyable.

Mandrake, Malstrom's new kick drum in their first round of releases [along with Arkan, a dual voltage processor], is beautiful. You'd think that since it's just black and white, it's no big deal, but maybe it's the white knobs, or the illuminated manual trigger LED button that lights up with the intensity of the kick [very cool!], but whatever the case is, it looks great.

Inspired by physical models and based off of an original design circuit—not a clone or copy of an 808, 909, or the like—Mandrake is made up of two sections, Hit and Body and has Techno and Dance in mind. On the left side of the module, Hit is

a resonating filter designed for standing out in a mix with Hit-Vol[ume] and Hit-Timbre controls, while the Body part is another resonating filter that features Saturation, Frequency, and Damping controls. Everything has CV inputs with a few of the parameters also including attenuators for precision control. Two sliders P-Dec[ay] and P-Mod[ulation] take up the center portion of the module with a Clean switch that removes low end rumble and has a frequency dip at 300Hz.

There's a Trigger input for triggering the sounds and it can also be AM'ed for some craziness that might not be so useful for getting the dance floor moving, but turns Mandrake into an interesting sound source. A 1V/Oct input can tune the kick to melodically sync up with a sequence, and also helps turn Mandrake into a bass synth of sorts. At the bottom there's an Accent switch that has a duality of functions. With the toggle up, the Accent/CV in triggers at Accent levels while the Trigger In is at a lower level, good for adding emphasis to certain hits. With the Accent switch down, it enables VCA control to adjust the volume of hits of the overall module, good for ducking or lowering the kick for various parts of tracks. Rounding out the features is a Res control for the main Frequency knob, a Shape toggle to switch between VCA types for the Body portion of the kick, a main Output, and an ENV output. It's interesting to use both outputs together; the main for your kick sound and the ENV to augment it a bit, patching into a VCA to stack sounds for sculpting a more complex kick. There's a small switch on the back of the PCB that lets you choose between the ENV out sending out a normal envelope, or a ducking envelope, which is a really cool option. I left it on the "Ducking" setting for most of the time as it's more useful to me that way, but I wish it could be on the front panel as it'd be something that I would definitely use both ways. I figure it's easier to just mult the Trigger input going into Mandrake and patch that into the trigger on another module to get an envelope, even if it doesn't share the same dynamics as the output.

Mandrake can be a very natural sounding kick, with a nice acoustic woody body and smooth resonating decay, just as much as it can be a quick, treble clicky beat that can cut through anything in a mix. There are various ways to alter the pitch and get

MANDRAKE

Kick Drum Synthesizer



down and tweak all the nitty gritty of your kick sound. By modulating the pitch it can get really wild and about as unnatural sounding as you can imagine, and with it all patched up you can essentially get an entire drum voice from the one module with accents, pitch changes, rhythmic variances, etc. Using a clock source, an LFO, and various envelopes, with a long decay on an envelope I was able to dial in some lagged hits for off-kilter rhythms, while easily accenting that by modulating the attack phase of the envelope. What started off as just checking out kick sounds quickly turned into a pretty complex patch, modulating the modulators that were modulating the parameters of Mandrake, and utilizing quite a few modules in the process. Throw in some Resonance and you can get a pretty good acid-trippy rhythm sequence going. Toss in some 1V/Oct and you can add even more melodic flavor, tuning the kick to the track. While Mandrake worked great as a solo-percussion module, it served me well as a drone-ish bass VCO, too, though I'm not sure I'd use it for that as I prefer other modules for that, like the Erica Synths Fusion VCO. Actually, paired up, the Fusion VCO and Mandrake meant I was in business. That was a really great combination.

With so many options to shape the sound, and CV ins in abundance, Mandrake is really versatile. Kick, toms, basslines, sound sculpting...there's a lot here, and it does a lot. In some instances it can take the place of three modules at once just by patching in CV, altering the tone, timbre, timing and decay throughout a rhythm. So much so that I feel that calling this a kick drum module is a bit of a misnomer as it really can be a whole beat machine by itself. There are a lot of kick modules to choose from, and Mandrake is towards the higher end of the spectrum, but I think it's money well spent. It's unique, well-built, sounds great, has a lot of tweaking and modulation opportunities, and I think one of the best interfaces and layout—it works very well in inviting you to lose hours to it. If you're looking for a really versatile kick module to craft a sound that's all your own, Mandrake is something you should take a look at.

- Ellison Wolf
14 HP +12v 130mA -12v 120mA
Price: \$399



FIL4 Timbral Sculptor Future Sound Systems futuresoundsystems.co.uk

Future Sound System's FIL4 Timbral Sculptor is one of those modules with stacked functions that give it a unique footprint. It's not just what's inside, but how everything can be routed, intertwined. In this case, it's a module broken up into three parts; a multi-mode FILTER, a VCA, and a TIMBRE section; however, thinking of the FIL4 in such basic ways really belies all it brings to the table. The FILTER section sports a three-pole 18dB/oct filter that can self-resonate when the RESONANCE is pushed hard and can track pretty well. There's also an AUDIO FM attenuverting control, which is inspired by the filter on the Korg35 chip that was the crux of the beloved MS-10 and early production MS-20 filters [later models switched to an OTA], with its ability to sound aggressive. Does it work? Can the FIL4 sound aggressive? Hellz yeah it can. There's also a Lockhart wavefolder in the resonance path to further warp your sound. If you're not familiar with a Lockhart wavefolder, don't distress; neither was I. It was designed by R. Lockhart Jr. who published the circuit design in the 70s and has been utilized by a few notable DIYers [namely Ken Stone] in various designs. Now that we have the small bit of synth design history out of the way we can talk about wave rectification. Why? Well, because the FIL4 has a rectification toggle to switch between half-wave rectification [HWR] and full-wave [FWR] to give more sonic options. I love the idea of rectification as it gets rid of that pesky negative voltage. There's already too much negativity in the world, right? Anyway,

it's an interesting way to manipulate your sound especially in relation to how the RESONANCE behaves.

One of the really cool things they've done with FIL4 is to give control over each of the three filter states; lowpass, high pass, and band pass with CV input and attenuator control of each VCA that's tied to it. There's also CV input and attenuverting control over RESONANCE and FREQUENCY, which has two inputs for more mass destruction.

The TIMBRE section is a West-Coast inspired wavefolder, which contrasts nicely with the East-Coast style FILTER section. It seems we can all get along, and the FIL4 proves this by not only housing these two [non] opposing ideologies, but by using them to great effect. There are a couple of unique aspects to this circuit as exemplified by the PRE/POST toggle which lets you assign where in the signal chain the TIMBRE section effects. If it's working the PRE, there's a DRIVE control to push the waveform into crunchy territory. If the TIMBRE section is working in the POST setting, it affects each of the three filter band's VCAs, and it's here where the DRIVE does the most damage, creating more harmonically rich textures the more you push it. Just flipping the PRE/POST switch into POST sent my signals into a frenzy, especially when modulation was patched into each of the three band's CV inputs. Set up like this and I got some pretty interesting modulation and spectral changes with some rhythmic irregularities [mostly coming from a random LFO into the HP CV in].

The final section is the VCA that can be used separately from the rest of FIL4, but can also be placed in front of or at the end of your signal, which is where it creates its magic.

With the three outputs—VCA, CHAIN OUT, and TIMBRE OUT—FIL4 also gives you a few related [or unrelated if the VCA is working independently] mixing options to do with what you want of your sound.

FIL4 is a really fun module with some great routing possibilities that set it apart from similar synth voice modules. While that last sentence might not sound super enticing, in real world practice it's very enticing. Once I had FIL4 all patched up with every CV receiving voltages and the outputs routed to various effects and my mixer, it was off to the races. While I changed

my inputs, trying out snare, full drums, bass lines, some ambient patches, and altered the rates of modulation to see what's what, I was impressed with the variation of sound I was able to get from just using the one module and some LFOs. To be fair, there were plenty of times when I was just wildly twisting knobs, unsure of how FIL4 was going to respond, especially so when I got out of a basic input/output mode and had the CV all patched up, but even just using the filter with the DRIVE and AUDIO FM, the sound sculpting was impressive. You do need to find the sweet spots as there were times that twisting one parameter put another out of its sweet spot, sometimes drastically changing the sound. I also suggest that if you get a tone/sound you like, you best hit record because it's not the type of module that's easy to recall any sounds on and you know...there ain't no presets on FIL4.

It helps to check out the signal diagram that's included in the manual as it gives a good visual of the signal entry points and how the VCA can be routed, etc. One thing I found confusing is that the FREQ CV1 input doesn't have any onboard attenuation, but FREQ CV2 does. This is slightly confusing because, while there is no control labeled "CV1," there is a "CV" control under the RESONANCE used to dial in the CV for the RESONANCE control when there is some patched in, which I kept thinking was the attenuator for CV1. It's not.

This is a great, versatile module that combines additive and subtractive synthesis techniques under one faceplate [who'd a thought?!], one that's going to get a ton of use in my rig. I totally dig the filter sound without even much else going on, and the DRIVE and AUDIO FM add so much along with the ability to control each of the filter's bands... From 8-bit arcade sounds, to additive grunge blasphemy, to warped laser guns, to bongo blips, there's a ton of fun to be had with FIL4.

- Ian Rapp
16 HP +12v 130mA -12v 110mA
Price: \$339

**WANT
SOMETHING
REVIEWED?
EMAIL US AT
CONTACT@WAVEFORMMAGAZINE.COM**



Mod Medusa Euclidean LFO Shakmat Modular shakmatmodular.com

In Greek mythology Medusa was a snake-haired woman whose visage turned those who looked at her to stone. By contrast, the Mod Medusa Euclidean LFO from Shakmat is a true beauty—albeit one that will seduce you with her many charms, yet still leave you to live out your years in your soft, human form.

While being billed as a Euclidean LFO there are more than just strictly Euclidean patterns available in the Mod Medusa, and it packs in a total of eight different tables of patterns derived from Shakmat's Knight's Gallop and White Gallop modules. The four output channels are congruent by default but can also be set to work independently with per-channel control over various parameters. Continuously morphable waveshaping can be applied to the signals and there are several performative controls over the patterns themselves.

Clocking in at a relatively slim 12hp the Mod Medusa boasts an intuitive and clean layout with well-labeled controls and smooth knobs, solid pots, and robust feeling jacks that give the module a premium feel. There are manual controls for pattern length [up to 16 steps long], pattern density, wave shape, and wave symmetry and there is an array of buttons surrounding the pattern length knob for tap tempo, waveform polarity, peak syncing [more on that later], a length/menu button for various shift functionality, and two shift buttons for nudging patterns left or right along the grid. To the left and right of the pattern density knob are two sets of 4 LEDs and a selection button. On the left is the selec-

tion for pattern tables as well as the clock divider settings, and on the right is a combination of correlation mode selection and the gate input function assignments. All inputs and outputs are along the bottom of the module, and in addition to the four outputs, there are inputs for clock, a VCA, reset, the assignable gate input, as well as for voltage control over the pattern length, pattern density, and waveform shape and symmetry.

While dense with options and deep in functionality, the Mod Medusa is quite easy to use and users of other Shakmat modules will find themselves right at home. Patch any or all of the four outputs to various destinations, clock the module externally, or use the tap tempo button to set an internal rate, select a pattern table, and away you go. The row of four LEDs along the top of the module provide excellent visual feedback for the activity of each output channel and exploring the interplay between the waveshaping and symmetry controls, the pattern length, and density is enough fodder for tons of patch experimentation.

The output sequences derived from Mod Medusa's eight pattern tables can be modified by four different correlated output modes: Main, Compute, Random, and Phase. While in the Main mode the output patterns for channels 2 through 4 are derived logically from channel 1. Compute mode associates channel 1 with channels 2 through 4 mathematically, with various multiplications and divisions based off of the pattern step length and sequence cycles. Random offers varying degrees of random variations across the second through fourth channels, and the Phase mode shifts each subsequent channel by the pattern length divided by four. In addition to the four correlated output modes Mod Medusa can be put into Independent mode in which the parameters of each channel can be individually set, though the CV inputs will only affect the settings of channel 1.

Sitting unobtrusively in the top half of the Mod Medusa are two features that really combine to enhance the flexibility and fun of the module; the Uni button and the P Sync button. The LFOs generated are bipolar by default but can be switched to be unipolar with the Uni button and I found this to be a very handy feature allowing for a lot of flexibility and variation for the modulation destinations. The peak

syncing feature of the Mod Medusa allows you to choose where the positive peaks of the generated waveforms will fall relative to the clock pulse. When P Sync is off, the beginning of the wave will line up with the clock. When engaged, the waveform peaks are synchronized with the clock. Playing around with P Sync in conjunction with the Shape and Symmetry controls is super interesting. With the clocked and correlated signals you are able to push and pull the generated rhythms while never going off the rails, and the interplay between peaks and troughs, waveshape, and wave symmetry is fantastic. Changing polarity and peak sync applies to all four channels when in Correlated mode, but when in Independent mode, each channel can have different polarity and peak sync status.

There is an assignable gate input that gives you access to several flavors of ratcheting as well as Track and Hold and One-Shot modes. Triggering a ratchet multiplies the cycle rate of the LFO by the selected ratio [x2, x3, x4, random, accelerando, and decelerando]. All pretty interesting, especially when coupled with the different waveshaping tools available on the module. Track and Hold lets the LFOs cycle normally when the gate is high and will hold when the gate is low and offers some really nice variations between the cycling modulation and the intermittent, but ever changing static voltage. One-Shot mode allows for channels to be cycling only while the gate is high, always dropping to 0v as opposed to the Track and Hold's held level. Finally, a VCA input allows for the external enveloping of the generated LFO signal outputs.

With all the functionality packed into 12hp there are inevitably key combos and shift functions, but the Mod Medusa [and Shakmat modules in general], strikes a solid balance between immediate usability and deep functionality. Will I ever remember what the different Assignable Gate options are? Probably not. Does that detract from the absolute blast that four channels of tempo-synced Euclidian patterned LFO modulation madness brings to the table? Definitely not. The module is incredibly performative and lends itself well to spontaneous patch experiments. As an intuitive and accessible way to quickly add movement and rhythmic interest to any patch it excelled. I really enjoyed using the outputs as AD envelopes, and because of the sharp trigger-like LFO shapes that can be

dialled in, it can even double as a percussive trigger pattern generator. Exploring the multitude of different relationships between the four outputs via the selectable modes give it a much wider ranging suite of rhythmic options than more typical Euclidian patterning, not to mention the ability to customize each channel's settings independently. The Mod Medusa manages to be both complex and straightforward, deep and intuitive, and above all highly musical.

- Sam Chittenden

12 HP +12v 55mA -12v 30mA

Price: \$275



Pizza BASTL Instruments bastl-instruments.com

Ever since I reviewed Bastl Instruments' Ikarie [Waveform, issue #6], it's been a filter I love—especially when I'm putting together an abbreviated rig for travel—due to its versatility, sound, and deep functionality, all of which is packed into a small, 8HP space. In the same vein, Pizza, Bastl's hot-from-the-oven digital FM and wave-shaping oscillator, contains the same type of compact versatility, also at 8 HP.

Pizza is laid out in a similar manner as Ikarie, with its combination of knobs, sliders, and buttons, and is unofficially broken down into sections; Pitch, FM, and the Shape Section, along with the inputs/outputs. Starting with the Pitch section at the top, the main visual draw is a medium-sized PITCH knob for controlling the main oscillator's pitch. On the right side of the PITCH knob is a button that determines how the PITCH knob controls the tuning, and toggles between OCTAVE

[+/- 4 octaves] and DETUNE modes. One of the things Bastl does so well is to use one knob for dual functionality by splitting the controller by the left and right sides. In the case of Pizza and the PITCH knob, when in DETUNE mode, turning the knob to the right detunes the OCT and RATIO oscillators exponentially, whereas turning the knob left of center detunes them linearly. If you long press the OCTAVE/DETUNE button, there's some flashing to denote a change in the controls, and you enter TUNE mode where you can fine tune the pitch with SEMI and FINE options. The whole top Pitch section controls all the three oscillators and it's very well done with the way that it's set up. This seemingly simple configuration [one button, one knob] is way more useful than it has any right to be, and makes it very versatile. Along with onboard assignable CV routing [more on that later], this little section offers up a lot of control.

Below the Pitch section is where the FM Section lies. A diagonal slider controls the frequencies of the modulating oscillators [the RATIO OSC on the left side of the slider and the OCT OSC on the right] with the slider crossfading between the two. You can patch some CV into the FM INDEX with an input in the bottom section for external CV control, and there's an attenuating INDEX MOD control to dial in the right amount, with center position at zero.

There are a couple of buttons that flank INDEX MOD that pertain to the modulation oscillators. The RATIO OSC's button lets you select between four frequency ratios for the RATIO OSC. These are pre-defined, but you can change them by long pressing the button to enter the RATIO SETTING mode and then you can change the ratio in a selected spot. There are seventeen ratios that correlate to various semitones [fifths, octaves, minor 7ths...] and the way this is done is pretty clever, allowing you to do some minor fraction [fine...ratio] creation. Yes, it involves some button presses and consulting the manual for all those who don't have photographic memories, but it's a really nice feature and not really much of a hassle, especially since it's not something that you'll be changing that often, most likely. The button on the right side, the OCT OSC button, switches the octave range from -1 to +2 octaves. You can really get a lot of mileage with just

these two top sections.

Pizza has a SHAPE section for the two modulation oscillators that has a slider control that goes from a pulse wave [hard left] to a sine [center] to a saw wave [hard right] with an external CV input and a [SHAPE] CTRL attenuverter for dialing in the desired amount of external CV. The WAVE/FOLD/RING button to the left of the slider selects between the three modes, determining what the SHAPE is correlating to. When experimenting with this, I had to pay close attention to what the overall settings for the module were, as just moving things around might not produce any changes. For example, when in WAVE mode, moving the SHAPE slider from left [square] to center [sine] to the right [saw] and then back and forth didn't do anything to the MAIN output sometimes, because...well, there needs to be some FM applied from the modulators to the MAIN oscillator via the FM INDEX slider. It seems simple enough, and it is, but it reinforces the point where you have to be present, do some thinking, some paying attention and perhaps a little sleuthing, and not just turn a bunch of knobs hoping for some amazing sounds to come out, though that happened a lot anyway! When the slider is towards the left, and FOLD is selected, Pizza applies a Buchla 259ish style of harmonic folding to the MAIN oscillator. When the slider is on the right side of center, the folding is polynomial based. When using CV, the position of the knobs or sliders matters a lot, as it can just modulate only one side of a controller [say, just the left side Buchla wavefolder in the SHAPE section], or a little of both sides. It's really quite genius, and if you use a square wave you can switch between the two halves of any control [depending on the position of the control and how much CV/what type [uni or bipolar] is being inputted] and get a lot of unique accents, changes, etc. Syncing a bunch of stuff up with some clocks and you can highlight a note or passage of a bass line, something I did with an ALM PNW, using a square wave to CV the SHAPE in this manner in order to accent one note of a six-note sequence. Here I dialed in a square wave at 8% [at 44 BPM, on /3] on PNW so only the one note would have a waveform change. You can do the same with percussion, and it's a pretty fun exercise to turn Pizza into a drum voice by patching CV into the var-

ious inputs all synced up. There aren't too many single modules that you can do this with that sound this good.

With RING selected you can use either the OCT OSC, the RATIO OSC, or an external modulator patched into the EXT in at the bottom to modulate the MAIN OSC. Again, you get a lot out of this seemingly simple setup, utilizing the options for each of the two modulation oscillators. So many sounds, so little time...

One of the greatest things about Pizza is the CTRL knob. By long pressing the WAVE/FOLD/RING selector button you can determine where to send the CTRL CV. This allows you to CV control almost any parameter via the CTRL knob or CV with just a few pushes of a button. While on its own CTRL offers from +/-6v, with, CV patched in the knob becomes an attenuverter for precision control. Even without any constant CV modulation, by just being old fashioned and using your hand to twist the knob, CTRL offers a lot of potential tweakability. CTRL is Pizza's special sauce and really elevates this module.

The bottom section of Pizza, the last piece of the pie so to speak, has all of its CV inputs; SYNC [which resets all of the oscillators phase], CTRL, INDEX, EXT [for using an external oscillator as a modulator], and V/OCT, as well as the three outputs; PULSE [outputs a pulse wave of the MAIN oscillator], MAIN, and OCT OSC. With the three outputs, you can stack sounds, mix and route in a ton of different ways, and make Pizza sound like a lot more than one module. Patched to the hilt with some random, unsynced LFOs on the ins, and all outs patched to various effects and panned L, R, and C, respectively [with the PULSE out muted and used for pan modulation of the effects], and you can get your crazy on. I think I've conjured sounds and soundscapes on Pizza that I'd never heard before, and that's saying something. Pizza even has a calibration mode to make sure you're in sync with your V/Oct source as well as a somewhat hidden bi-polar internal VCA via the CTRL control.

When it comes to incoming CV, remember that since each control is controlling two different parameters, that negative voltage will affect the left side of the control, and positive the right so that by using a bi-polar CV you can switch from, say, modulating the RATIO OSC to the OCT OSC with only one instance of CV. This is

pretty powerful, amazing really, and you can get wild with LFOs, audio rate modulation, or even audio itself. I patched in a sample of a Car Talk [who doesn't love Click and Clack?] radio part into the CV in for the FM INDEX and got pretty interesting, fuzzed out audio coming out. Actually, using Pizza as an FX unit, patching audio in the EXT, FM INDEX CV in, and/or the CTRL [while messing around with the destination settings for CTRL] brought some quite interesting results. I highly recommend checking this out.

Bastl has put in a lot of options on Pizza, and there's a lot to discover. Sure, when it came to the configurable RATIO settings I needed to consult the manual, but otherwise, it's all there right in front of you and there's a lot to play with. I have had a lot of fun experimenting with it, and teamed up with a module [like Pam's or the 4ms QCD] and a handful of LFOs, VCAs and envelopes, made for some darn good times. I would highly recommend taking a look at Pizza [and Ikarie], especially for anyone wanting to put together a small, powerful, and versatile system with plenty of options and patchability. Thin crust, deep dish, gourmet wood-fired, cafeteria style with ketchup, and now this...Bastl has risen like the perfectly rested dough to the occasion, and has given us all a new Pizza to love.

- Jason Czeryck

8 HP +12v 90mA -12v 20mA

Price: \$283



**The Mystic
Recovery Effects
recoveryeffects.com**

Recovery Effects' new offering, the Mystic, is a small semi-modular, experimental FM synth that encourages exploration with its droning and cross-modulating madness. Physically, the Mystic is a sandwich of three PCBs with open sides and exposed interior that's attractively done up in black and gold, with nice aesthetic touches such

as backlit sections of the top layer's corners. It features two operators, two modulators and an analog delay section with about a half a second of delay time. There is manual control via mini-pots over both operator oscillators, both modulation oscillators, the modulation rate [the single control influences the rate of both modulators] and over the delay time, feedback, and mix. A final pot is for volume control.

Above the manual knobs there are input jacks offering voltage control over both carrier and modulator frequencies as well as the modulation rate and delay time. The Mystic also has a large momentary switch button for opening and closing an internal VCA as well as a latching switch for drones, and droning is where the Mystic shines. The onboard delay is crunchy and dirty in a great way, and it's a blast to explore the interplay between the different carrier and modulator relationships. Blurring everything together with a bit of reverb and the Mystic comes alive in interesting and surprising ways. While the Mystic is Eurorack compatible your output will need to be boosted to play well with other modules, as CV in is fine at Eurorack levels but audio out from Mystic is at line level.

If you're looking for melodic fare, both carriers [at different times depending on the units parameter settings] will respond decently to pitch information, but the normalised cross modulation doesn't really lend itself to V/Oct tracking, which to be fair isn't really the point of the Mystic. Think bleepy bloopo noisy madness or crunchy, squealing insect arguments and you'll be right at the Mystic's sweetspot. There is some great percussive sample fodder to be found and drenching the out-

put in effects makes for interesting pad-like evolving sound beds and washy background textures. External modulation of the parameters is key and I got the best results when I modulated the hell out everything. Of course, the results are highly dependent on what you are feeding in, but unexpected and intriguing rhythms, timbres, and textures are only a few patch cables away.

I had a lot of fun with the Mystic, but I do wish that there were more onboard paths for feedback patching as the only output is the audio mix out. Having the ability to patch, say, the delay output, or one of the modulators back into the signal path could really open up the possibilities, and ditto if there were any touch points on the unit. It seems to me that those corners with the light up stars are screaming to be interactive. That said, if you like your drones noisy and your synths unpredictable, the Mystic charts a less complex, yet similar path to synths like the Make Noise Strega and SOMA's Lyra-8. While you definitely need to pair it with other hardware in order to get the most of it, the Mystic lives up to its billing as a fun and engaging, experimental desktop synth.

- Sam Chittenden

Price: \$279

(RECOVERY) EFFECTS AND DEVICES

The Mystic is a semi-modular desktop synth that makes ethereal voices swirl, echo, ascend, and plunge into an ever-changing, celestial, sonic playground.



With an FM synth at its core, The Mystic contains 2 operator voices, 2 modulators, and an analog style echo with 500ms of delay time. Generate colossal waves that ripple through the cosmos and make galaxies collide.

Watch the demo:
recoveryeffects.com



SF-1 SF1 Dual / Stereo Filter Weston Precision Audio
westonaudio.com

There's a lot to be said for what you name a child, pet, or business, and Weston Precision Audio has to be pretty confident about their technical ability to add that "Precision" in there. It's not just something you throw out there; you've got to own it. As it stands, this Portland, Oregon-based company more than lives up to the task. They've been offering impressive DIY projects [take a look at their PRO2021 Pro-One monosynth project] as well as completed modules for a bit, but up until now I've only been able to admire their modules from afar, never having been in close proximity to one. I'm happy to report that's now changed.

SF-1 is a really nice-looking thing; right out of the box I like the rounded PCB corners, if for no other reason than they look clean. It might seem arbitrary, but details like this, this design thoughtfulness for a seemingly small detail, might just perhaps

contribute to the “Precision” in their name. It’s always a bit fascinating to see what other people notice, what they deem worthy of facilitating awareness, attention, and/or change in, and you can tell how much love is put into SF-1. The overall build quality is great, as the module feels very solid and even the three-way switches—something I don’t normally pay much attention to—are sturdy and rise above the norm, reminding me of the switches found on some vintage drum machines. The black, gray, and yellow color scheme of the module is appealing and different, though not too much—it will still look as good in your dark and stormy all-black setup as it does mine—and the panel, while not flashy or overly design-y, looks good with nice, clear, and legible text and a pleasing mirrored horizontal symmetry.

As with most dual filters SF-1 can act as two separate filters—the Left side and the Right—with multiple simultaneous outputs. The Left side’s input is normalled to the input of the Right so that with one input you can get up to four related simultaneous outputs, and there’s a Link button whereupon you can control the both sides of the filter with just the Left controls.

Each side lets you select between a 2-pole [12dB per octave] or 4-pole setting [28dB per octave], and there are controls for Cutoff and Resonance with CV inputs for both [with the Cutoff CV input going through an attenuverter]. Input level controls for each side let you tame your signal, and can also add some grit, some overdrive to your signal when pushed. 1V/Oct inputs for both Left and Right are available and SF-1 self-oscillates quite easily and tracks well.

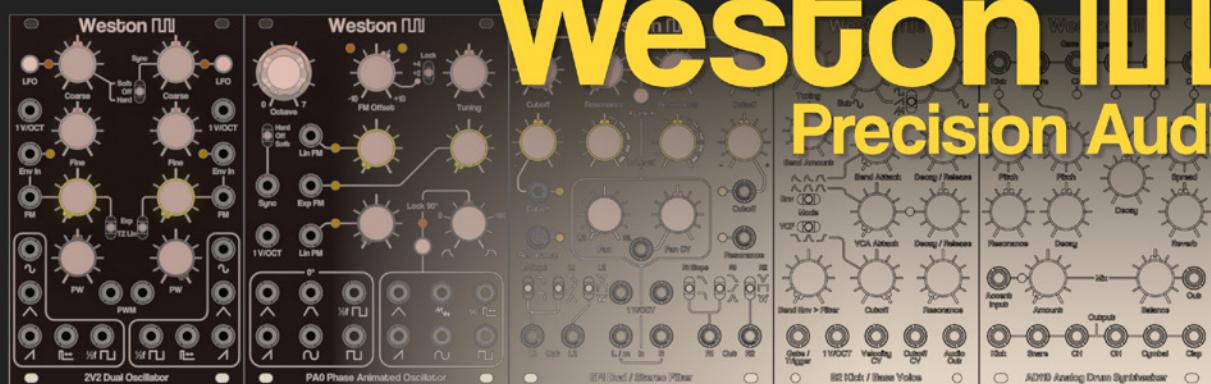
One of my favorite features on SF-1 is the inclusion of a dual VCA crossfade/panning circuit [with CV input], which integrates some interesting channel behavior and brings in stereo action to the module. On this control dead center means an even mix of both Left and Right channels at each output, and panning to the extremes isolates each channel into a respective output. When you start modulating this is when it becomes apparent how powerful this can be.

Another excellent feature, perhaps the most obvious one, is that SF-1 are the various simultaneous outputs and available filter types that each channel offers. The available filter shapes for

each are: Low Pass, High Pass, and Band Pass for L1 and R1 outputs, and Notch, All-Pass, and Phaser for L2 and R2 outputs. The first three options are pretty standard fare, and do exactly what you expect. The last three options, however, aren’t very common with modular filters, and I’m not sure I’ve ever used a notch filter—which filters out a specific, typically quite narrow, range of frequencies—or an All-Pass in modular before. I’ve used notch filters in studio recording and mixing to get rid of competitive frequencies or to clean up a sound or something, but never in a modular setting or live performance realm in real time. I always like when you’re able to use something that’s typically thought of as a utility, like a notch filter, in unique and interesting ways, and it’s cool that SF-1 lets you explore in this way. Running the output with the notch setting, and through a spectrum analyzer as I did with my beloved DATA, you can just twist and turn until you find something cool, and it’s a pretty fun exercise to correlate the sound with the frequencies lost and/or gained with each knob twist.

As cool as the Notch filter is, I have to give it up to the All-Pass. I didn’t even know what one was until I saw it on this module, and if you just patch out of it without any fanfare, it doesn’t sound like much. Well, that’s because it isn’t. The frequency boundaries are pretty extreme so that it just sounds like it’s letting all frequencies pass through it, hence the name. The fun—and I have to say, it is very fun—begins when you start modulating the Cutoff for each so that you get some phase modulation. Doing so on both sides while unlinked and with the Resonance cranked on both sides and introducing some panning into the mix and you’re really cooking. The movement of the sound was nothing short of spectacular.

Having just received a Schlappi Three Body I decided to patch up a simple melody line into it with some phase modulation dialed up in that module and then patched one sine wave output from a single channel of the Three Body into the Left input of SF-1 using the All-Pass output on both channels—panned hard left and right in my mixer—and with some modulation going into the Cutoff CV ins on both sides for some stereo dual phase modulation. I’m not sure what you’d call patching a phase mod-



ulated sound source into a phase modulating filter, but whatever you call it, it was pretty bonkers, and if I'd had a phase-phasing phaser that was really phasable who knows what would, or could, have happened. Maybe I would have entered a new dimension in time or space. Dunno.

Speaking of phase, the Phase setting is pretty fun as well, and can get very wobbly, especially if you unlink the two filters and move the cutoffs around to find your sweet spot.

I had to pry myself away from the L2 and R2 outputs to check out the more typical filter shapes that SF-1 has, the LPF, HPF, and BP. Those all sound nice and do what you'd expect, and at 24dB both the LPF and HPF can have a nice steppy growled whistle, and SF-1 definitely has some sweet spots.

SF-1 works great as your normal type filter, but start self-patching and it really becomes something special. Raspy overdriven broke up howls, stuttery whistles... it works really well to carve out some dirty bass, and being able to use a bandpass filter to hone in on some small-range tones while going through both sides is akin to a dual peak filter; it made me start thinking about trying to get some dual peak action going on, so I put the Resonance high to both sides so that each would self-oscillate and then muted a sequence into both 1V/Oct inputs on SF-1 as well as my VCO [Expert Sleepers Lorelei] and tuned the Cut-off on both sides of SF-1 so that they were harmonically adjacent to what Lorelei was putting out. Patching in two outputs from Lorelei into each Input of SF-1 and with just one output on SF-1 I was able to get three distinct tones, one of which I tuned to a sub-octave of the main tone. It wasn't quite chordal, there was no harmonic melding of the tones, but it sounded decent and was pretty interesting and usable.

Whether you utilize SF-1 as two filters for normal type duties or use it to sculpt your sound in more dramatic ways, you can't lose with SF-1. I'm into this filter in a heavy way and I highly recommend it. Those extra outputs and the CV crossfade/pan circuit is a bullseye, and if this is the kind of stuff that "Precision" means, well then bring on more of it.

- Ellison Wolf

18 HP +12v 120mA -12v 120mA

Price: \$350



Sofia
Xaoc Devices
xaocdevices.com

Superbooth 2022 was an interesting affair. Still heavily impacted by the pandemic, there was less traffic, both in terms of manufacturers and attendees; however, that in no way meant a dearth of interesting and exciting synths and modules being shown there. All of the new modules that Xaoc Devices presented were GAS-inducing, but Sofia, their new all analog VCO, was the one I had anticipated the most.

Sofia is based on a unique waveforming idea that centers around a core oscillator with two waveshaping sections called "ripple elements" that use time-domain components like density and decay to modulate the main core oscillator. According to Xaoc, this is a method employed by computer music that's called FOF [fonction d'onde formantique], a technique to create formant sounds, one that I'd never encountered before.

Every new cycle of the base tone creates a new pair of ripple elements, kind of like a pair of sidekick oscillators that interact with and contribute to the overall sound and changing of the main oscillator. The way Sofia operates is similar in some ways to a more traditional complex oscillator, but it's got three oscillating elements instead of the usual two.

Sofia is a great looking module with sliders and knobs of various sizes and shapes. It's got an intuitive layout with the MAIN oscillator's controls running down the center of the module and with each of the ripple element sections [A and B] on both sides. The main section consists of a large PITCH knob, which sports a two-octave

span, situated below a chicken head pointer knob for selecting the OCTAVE, that has an eight-octave range, one of those being an LFO. There's a PITCH CV V/OCT input to control the PITCH of the MAIN sine wave oscillator with external CV, and PITCH FM and GLOBAL FM inputs, both with attenuators. At the bottom are MAIN and FUNDAMENTAL outputs. On the left side of the OCTAVE knob is the ELEMENT MIX, which controls the mix between elements A and B—with the center position being equally mixed between the two ripple channels—that affect the MAIN oscillator. On the right of the OCTAVE control is the FUNDAMENTAL ELEMENT MIX, which determines how much the output of the ELEMENT MIX affects the MAIN oscillator. Fully CCW and you only hear the MAIN oscillator at the MAIN output, and fully CW and you only hear the mix of the ripples—no MAIN oscillator to be found. With a center position on both mix controls you will get an even mix of both the A and B ripples affecting the core oscillator, along with an even mix of the unaffected core oscillator and the ripple-affected core at the MAIN output.

Both ripple element sections are similarly laid out with controls for WARP and RATIO [both with CV inputs] and a DAMP CV input. RATIO and DAMP utilize light up slider attenuators for honing in on the desired amount. The RATIO controls how compacted the ripples are in relation to the fundamental tone, while the DAMP controls the decay rates of the ripples. The WARP control changes the ripples uniformity through each fundamental cycle of the wave.

Each element section also has a small switch to choose the core shape of the ripple for either a sine or square wave and switches for the RATIO and DAMP that determine whether or not those parameters are related to the fundamental period of the core oscillator, and if the ripple tracks the pitch or not. Each ripple element also has a pair of outputs: IMPULSE and A or B OUT. The IMPULSE outs give you the decay curve for each of the ripple elements to use for modulation, while the A or B outputs give you exactly what they advertise; the output of either ripple. One of the unique features of Sofia is that even though the MAIN output can look like all sorts of craziness, that it can have what seems to be a chaotic frequency cache, the frequencies

are in fact all harmonically related, which is one of the ways Sofia is not like a traditional complex oscillator.

I won't lie; it took me several passes through the manual to get a somewhat decent grasp of Sofia's features. It's not complicated in theory so much as I just didn't grasp the relationship [and functionality] of the WARP, RATIO, and DAMP functions right off the bat. Nonetheless, the studiousness I undertook to get a hold on Sofia was worth it. Even at its most basic, manipulating one of the ripples to hear the sounds Sofia can conjure up internally, was rewarding, with wonderful tones emanating from it. It's a superb sounding module and can/does have a metallic formant aesthetic, almost like a nasally filter sweep, which actually sounds way cooler than my description. Modulating the RATIO with any kind of LFO and you can hear Sofia whispering a hostile robot-y takeover ever so sweetly and with a smooth modulator this formant slant is really pronounced. Messing with the switches, with RATIO and DAMP in the off position, a square wave for the ripple [only working with A here], and an even mix of the A ripple and the core oscillator at the MAIN output, and the sequenced melody I had going sounded absolutely beautiful, one of the best oscillators I've ever heard. I put a little reverb on it and added some slow moving out of sync LFOs to the RATIO and DAMP and did some self-patching from IMPULSE B to the WARP A input, and remained really impressed.

Utilizing more complex modulation and teaming Sofia with Xao's excellent Koszalin frequency shifter [reviewed in Waveform, #9] and the Wrong Parallax filter, and doing some cross modulation, the resulting output became more predictably complex, more complicated. Whistling howling winds, bouncing ball fizzles, un-namable bonkersness, I got lost many times within the modulation. It's such a great sounding module, I realized I didn't want to obfuscate its beauty, only to enhance it to where I felt that having a light touch was best. Sofia can get nasty with the best of them, but there are plenty of modules in my rack that can get nasty, with very few of them that can sound as elegant and pleasing as Sofia. Let those other oscillators and sound sources run through various distortions, manglers, and souped up filters, Sofia needs none of that.

- Jason Czyeryk
24 HP +12v 90mA -12v 80mA
Price: \$490



Pony VCO Befaco befaco.org

Pony's are usually associated with twelve year-olds' birthday parties, Renaissance fairs, and petting zoos, and because of that, you might think that Befaco's minuscule new VCO [only 4HP!] would be kind of a beginner, entry level, cute little thing for newbs or something, a friendly way to ease the skittish into modular, but that's simply not the case. Not even close. Well, it *is* kind of cute—as well as a near marvel of PCB SMD layout—but this Pony is way more powerful than you might think at first glance.

Pony is an all-analog Buchla-inspired VCO with 10Vp-p Thru-Zero modulation [TZ-FM], a Timbre [wavefolding] control, four selectable waveshapes [sine, triangle, ramp, and square], and a built-in VCA. There's 1V/Oct tracking that has an eight-octave range, a Hard Sync input, a manual Frequency control, with a lone Output. With a selectable Range of four options [Full, Octave, Semitone [with a one-semitone span], and LFO] that affect the manual Frequency control, there are a lot of possibilities here. Patching in CV to the 1V/Oct overrides the Frequency, Octave, and Range controls.

I've always loved the Buchla style VCOs found on Music Easels and the newer Easel Command, with their sliding timbre control. It's sort of the West Coast version of the East Coast Filter Sweep, or perhaps

it's the other way around. Either way, I prefer the timbre slide over the filter sweep as there's a certain going-through-a-tunnel metallic electricity that comes from wavefolding, from seeing and hearing a wave collapse on itself, that is so satisfying, and Pony doesn't disappoint in this realm. Whether it's a sine, triangle, ramp, or square Pony folds with the best of them. FYI, when you're in square wave mode the Timbre control adjusts the wave's pulse width, and if you go to extremes with the Timbre slider while doing so, the voltage remains constant at about +5V at the top and -5V at the bottom with no change [unless you have CV patched in], which means no frequency, which means no sound! PWM fundamentals! Also, the Timbre CV input adds voltage to the position of the Timbre control, so how your patched-in CV affects the overall shape is dependent on the slider positioning.

Pony uses a Sound Semiconductor SSI2130 VCO as its core—a very stable chip—so for melodic purposes it works really well. Just for fun I ran Pony through the Mordax DATA's tuner and it was really stable, with hardly any pitch fluctuation while holding a note, no matter the wave-shape/form, and it was consistent every time my sequencer [Winter Modular's Eloquence in this case] jumped from note to note. There's really nothing like TZ-FM to create otherwise unobtainable tones in the analog realm, and again, Pony excels here as the Thru-Zero kept in tune quite well.

Pony sounds fantastic and I almost can't believe how much range, functionality, diversity of tone, and usability this small module offers up. Not to mention having an onboard VCA is totally handy; and using Pony as an LFO is completely worthwhile, very nearly a game changer if you're used to typical LFO offerings or just using some random voltage. And using Pony to audio rate FM another oscillator while being modulated to the hilt makes you realize why we're all in this to begin with. Pony might just be the most powerful 4HP VCO I've ever used, and definitely the most powerful pony I've come across. No need to wait until your next birthday to get yourself a Pony, it's available now in either a 3U or 1U format.

- Ellison Wolf
3U 4 HP +12v 32mA -12v 25mA
1U 24HP +12v 32mA -12v 25mA
Price: \$199



Rabbit Hole and Curiouser Apollo View Modular apolloviewmodular.com

Maybe this is best admitted in private, but I've never read the Lewis Carroll classic *Alice's Adventures in Wonderland*. I bring this up because Apollo View's Rabbit Hole makes reference to the Carroll book in a few ways, aside from just the name, and from what I'm guessing by my hazy knowledge of the book, it's an apt title.

Rabbit Hole is a module of many faces; it's a 16HP summing mixer, a dual VCA, a dual-filter tone control, and a saturation/distortion unit with an all analogue signal path. And it has a tube. Right smack dab in the middle. Were there tubes in Alice's Wonderland? If so, her adventures wouldn't have taken her very far if she's anything like the tube-loving music crowd. I mean, the first thing I did when I got this into my rack was blast some acid bass lines through it, going down a tubular-shaped rabbit hole, as with a big fat 12AU7 [OK, so not that big or fat] sticking out of it; Rabbit Hole is made to distort, right? Why else have that tube? But oh, how deep that journey to the center of the earth can go.

As it is, Rabbit Hole is well-named, as it provides a plethora of goodies—not just a pretty glowing tube—and going deep with it is a call to arms, an invitation to an investment of time and [head] space, where staying hydrated and bringing a reliable GPS tracker is advisable.

Rabbit Hole has an elegant aesthetic. The matte black faceplate lights up in a very cool way, with red LEDs glowing through PCB lookouts in a fun circular pattern that flashes in time with your input [setting dependent], and there is small, but legible

gold text throughout, which looks classy. There are solid knobs for the seven main parameters that encircle the tube, and mini-pots for the CV controls and main output. It even has those cool black circle nuts around all the jacks. Points!

There are two input channels [A and B] available, each with its own VCA, and you have the ability to add two [or more] channels via the expander, Curiouser. Curiouser is another two VCAs that can be chained together and summed, mixed in with the signals of Rabbit Hole, or used by itself for dual VCA implementation. What's cool is that you can add multiple Curiousers to have more channels, making this a potentially never-ending mixing set-up. I settled on just one expander, so four total channels [albeit with three outputs as the two on RH are summed].

Back to Rabbit Hole, there are GAIN controls for each input, and CV inputs for each of the channels VCAs as well, where the CV A is normalled into CV B. There's a solid-state DRIVE circuit that can clip the signal if hit hard enough, and of course, the tube circuit, where it can go from smooth and subtle to not-smooth or not-so-subtle. There's a TUBE control for the bias amount and an L8 toggle switch that determines the routing of pin 8 of the tube. This can change the sound and tonality in various ways, and overall it seemed to decrease the volume while cleaning up the sound a little, though it depended on my other settings. A tone circuit sees the signal split and go through both low-pass and high-pass [2 pole] filters to join back together where it routes through the TONE control that has a CV input and attenuverter—that blends between the two filters.

As if two tone shaping circuits weren't enough, there's also a diode LED clipping circuit, as signified with a mysteriously labeled "OWTH" toggle. OWTH stands for "Off With Their Heads," if that gives any indication of what to expect from it. There's also a MIX control to blend between the wet and dry signal, with a CV input and attenuverter as well. The feedback circuit, controlled by the FB knob—again, with a CV input and attenuverter—and an on/off FB toggle, finishes off the list of controls.

With a basic input, just a triangle wave running through Input A, Rabbit Hole is capable of bringing some nice tube saturation, as well as complete annihilation of your sound. One thing to note is that

all of the potentiometers are attenuverters, not just attenuators, and as such, the GAIN knobs are attenuverters, with what I found at times, to have a particular sweet spot in a pretty small range. Add to that the interactivity between the various stages and circuits and sometimes RH would go from self-oscillation to nasty distortion [nasty=good] with just a fraction of a knob twist. I wasn't really able to tweak with much predictability—not too surprising in a module with stacked distortion/feedback options—that's par for the course, but it really made it that much more obvious that this is an experimental hands-on module where you need to get dirty and do the work. A um...wonderland of sorts. And since many/most/all of the pots are dual functions, turning it to 11 might not be nearly as effective as turning it to -3, even if it's not quite as catchy to say in a quotable cult movie sort of way. If there's ever a modular synth version of Spinal Tap, maybe that'll be the line. Either way, even the output control is an attenuverter, so flipping it towards the negative can give you completely different sounding results than its positive voltage counterpart.

There's a lot you can do with Rabbit Hole and Curiouser. Processing drums to add some saturation or distortion, clean mixing of a melody line, using them as VCAs with character, or pitting the channels against each other using some alternating envelope/clocking techniques. You can even get some pretty nice self-oscillation going on and throw some sequenced voltage into the inputs for some brute force V/Oct melodic action. I've enjoyed my time experimenting with it and getting to know it. It's quite versatile and it was really fun running speech/audio through it as well. It sometimes took some fiddling to adjust things just so, you sort of have to muscle your way in there a bit, but the exercise will do you well, and it's a great escape while it lasts. Once you enter and set foot on this journey, it will make you curioser, and curioser, and curioser, and...

- Jason Czyeryk
Rabbit Hole

| | | |
|-------|------------|-----------|
| 16 HP | +12v 260mA | -12v 95mA |
|-------|------------|-----------|

Price: \$389

Curiouser

| | | |
|------|-----------|-----------|
| 6 HP | +12v 60mA | -12v 12mA |
|------|-----------|-----------|

Price: \$169



Eurorat
Funque Mod
funquemod.com

Truth be told, though I tell everyone that I'm from Kalamazoo, Michigan, I am in fact from Portage, Michigan, one town over from Kalamazoo. Why would I do this? Well, one town sounds funky and memorable, and the other... kinda sounds like it is. Growing up [ahem] in Kalamazoo there was a pretty great music scene and it's the birthplace of quite a few musical instrument companies, so when I got into music I scrimped until I could afford a Gibson Les Paul, which was originally made in Kalamazoo [the original building where they were made, with Gibson spelled out on the smokestack can still be seen near downtown—at least the last time I was there]. My strings? They were GHS Boomers from nearby Battle Creek. My

first distortion pedal? Well, if you know your music/geographic history, then you'll know that Pro Co, the makers of the famous RAT distortion pedal were also from Kalamazoo. If I could have procured a vintage Gibson tube amp I would have had a total hometown setup. Even my cables were local, again from Pro Co. Who would ever say I wasn't really from Kalamazoo with this setup? I was a homer through and through. I even had a "Yes, there really is a Kalamazoo" bumper sticker on my car. I was—and—remain a Kalamazooian. At least in heart and spirit.

Like most electric guitar players, I've had too many distortion, fuzz, buzz, overdrive, etc. pedals to name, but the RAT has always had a soft spot in my heart—being my first—even if it didn't always have a place on my pedal board.

Funque Mod's EuroRAT is a recreation of the beloved pedal in Eurorack form, from the circuit down to the 80s-ish styling on the front panel, so I was interested to see how the RAT sound as a whole would translate to modular, as sadly my RAT passed on many years ago, having drowned in a flooded basement, never to distort again. Not my fault.

Funque Mod designed the circuit as faithfully as they could and even dropped the +12 volts that Eurorack runs off of down to 9 volts before bringing it back up to modular level again. The controls are familiar to anyone who's ever seen a RAT: Distortion, Filter, and Volume. One input, one output, a tiny LED shining through the faceplate, and that's the grand tour. Nothing else to it.

The Eurorat has the RAT's sonic char-

acter down pretty well. For melody lines, bass lines, kick drum it sounded buzzy as it should, and pretty nice. I ran some other percussive elements as well and with everything cranked I got some nice droney buzz in the background. Actually, I wish I could have harnessed just the buzz, or separated it from the output somehow as it alone was also quite nice. I love me a good buzzy drone. I can see a lot of applications where using the Eurorat in a patch, whether as a main sculpting component or just to buzz up part of the rhythm or something, and I really liked using it with snare, to get some nasty sounds. Perhaps not particularly versatile, but the original RAT wasn't either, and that's kind of a hallmark of a classic. It's got distinction.

I do wish there was a bypass switch to go from distorted to clean [and vice versa], and all the better if this was CV'able. During testing I noticed that the Distortion knob had almost no effect from 12:00 to fully CCW, giving the Distortion a very narrow overall range of variance, and this was verified when I put it through my Mordax DATA's spectrograph to see if there were any added harmonics while I turned the knob in that range.

There are a lot of storied guitar pedals out there and it's nice to see the RAT get its due in modular format. While there's not a lot of nuance to the Eurorat, it's kind of a one trick pony...er RAT, it's a solid trick and if you're a fan of the RAT, you'll probably be a fan of the Eurorat, too.

- Ellison Wolf

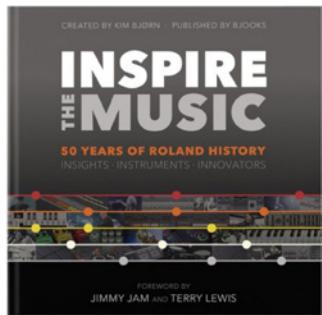
4 HP +12v 14mA -12v 1mA

Price: \$135

www.modularmoon.com

to the
MODULAR MOON
sound synthesis school & more
and back

Amsterdam Goa Mexico Moscow Santiago Tokyo



Inspire the Music: 50 years of Roland History; Patch & Tweak with Korg

Bjooks
bjooks.com

Bjooks has been on a roll of late, issuing beautiful manufacturer-spotlighted books on Roland and Korg, and they're as irresistible to any synth enthusiast as they are to fans of excellent design. Even if [dare I say] you aren't much into electronic music gear, Bjooks new *Inspire the Music: 50 years of Roland History* and *Patch & Tweak with Korg* [and their previously released *Patch & Tweak with Moog*] are hard to resist.

Inspire the Music: 50 years of Roland History details the ins and outs of the Japanese instrument maker, examining their incredible influence on popular [and less-popular!] music for the past half-decade. Let that sink in for a second...a half decade. Printed on certified eco-friendly paper and over 400 pages with beautiful photography and a well-heeled layout, *Inspire the Music* is as much a wonderful tribute to Roland as it is an eye-catching coffee table book.

While your brain [like mine] might be thinking 808s and Jupiters, *Inspire the Music* covers everything from those categories to everything else Roland has made including groove boxes, electric pianos, electronic drums, BOSS pedals, and so much more. I think I was assuming that this book would be about synths and drum machines only, but it's a very thorough his-

tory of the company. It's a beautiful, interesting, and informative look that includes over sixty articles, from their illustrious company history to the history of their design principles and production issues and techniques. It's fascinating to trace the evolution of some of their products, with insight from those who helped create them. On top of this, there are over ninety interviews with musicians and artists, and the genre span is impressive. It really has something for everyone and so many interesting stories and surprises. The interviews can be quite candid, and while they are Roland-centric, it never comes off like a Roland brochure. With a great foreword by Jimmy Jam and Terry Lewis, it's another great offering from Bjooks. It's impressively thorough and a great read.

Patch & Tweak with Korg is of personal interest as it was a MonoPoly that first got me into synths way back when. At 216 pages *Patch & Tweak with Korg* focuses on Korg's patchable models, their reissue ARPs, as well as Volcas, the SQ-1 and SQ-64 sequencers and a few others. This book has an intro written by Kitaro, whose input helped shape Korg's synths, and has been a lifelong user of the recently reissued MiniKorg-700S, and the rest of the interviews are quite varied. I found the Pete Townsend section to be really interesting, especially his philosophies on gear and songwriting, something that doesn't always get enough mention in gear-centric circles like the synth crowd oftentimes.

This book has a lot of tips/tricks on patching with the various patchable Korg/ARP reissue synths and there are quite a few helpful ideas included. This does have much more of a manual aspect than *Inspire the Music*, and I'm not sure if non-Korg owners will find it as interesting, but it does have a lot of pages dedicated to synth basics, so even non-Korgers [how dare they!] can still get a lot out of this book. Granted there is a lot for the newb, but there's still plenty for the expert, and there were some patching tips I learned about my ARP 2600M that I found in the pages here, though I'll let you discover whatever unknown functions you're unaware of for yourself as I don't want to give the plot of the book away! [Spoiler alert: there is no plot.]

The shelf with my Bjooks books is getting more crowded and prettier with each release and I can't wait to see what's next in

line. I've already made room.

- Ian Rapp

Price: \$75 *Inspire the Music: 50 years of Roland History*, \$45 *Patch & Tweak with Korg*



**C GF4 + C GF4e Expander
Sonocurrent**
sonocurrent.com

The C GF4 by Sonocurrent is a 12hp [18hp with an optional—but highly useful—C GF4e expander module] group fader and signal distributor. The module has four pairs of input and output jacks—one for each channel—grouped in its bottom half. There is also an input and output jack pair which serves as both CV control over the group level as well as outputting either an offset voltage [when the input is unpatched] or a pass through of the CV from the input jack. All five input jacks have corresponding attenuators surrounding the large group level knob and the inputs are normalled sequentially, meaning any signal patched into a channel input [from 1 to 3] will appear at subsequent inputs.

In use the C GF4 is very straightforward, intuitive, and dead useful, with its most obvious application being to use it as a macro controller over different modulation sources. Individual inputs can be tailored to their sweetspots with the per-channel attenuation, and then adjusted as a group while maintaining their relative levels. A simple concept but not one that is as quick or easy to patch up with separate modules. The C GF4 makes it a breeze to experiment with dynamic, patch-wide sweeps while sticking to the tailored levels of your individual modulation sources.

In a neat trick, the CV input for control over the master level will also pass through its input signal [which can be attenuated by a dedicated control] to the CV out. When left unpatched the C GF4 will output a static voltage at a level that corresponds to the group level control knob setting [from 0 to +5V]. Very handy for creating an additional static control voltage for something downstream in your patch or to achieve an attenuated copy of the input signal for separate but related modulation elsewhere.

The first input also has a +5v normalization that is also cascaded to the following inputs, so with nothing patched in the C GF4 can send up to 4 static offsets out to your system [and as always the global level can be both manually and voltage controlled]. Additionally, the second and fourth outputs can be inverted via manual switches.

The C GF4e expander adds an additional +5V offset controls for channels 1 and 3 as well as toggle switches and voltage controlled muting. The expander's mutes are triggered and remain active [muted] with any voltage above 2V and pair excellently with LFOs or envelopes for teasing interesting and unexpected rhythmic muting and unmuting of audio or modulation signals.

With all of the possibilities for assuming more control over modulation signals as well as the handy static offsets, the C GF4 really stands out as a utility module. With a solid build and premium feel, the C GF4 is another sneakily handy module from Sonocurrent, whose usefulness and clever design becomes more apparent the longer it is put to use. I find myself reaching for it whether I'm looking for performance control over audio, or macro control over multiple modulation sources, and I continue to discover new ways that it can serve any patch I'm working on.

- Sam Chittenden

C GF4
12 HP +12v 95mA
Price: \$195

C GF4e Expander
6 HP +12v 10mA
Price: \$95



Tannhäuser Gates Animal Factory Amplification animalfactoryamps.com

Taking a break from their distortion-device-making-operation, Animal Factory Amplification has released Tannhäuser Gates, their performance-y stereo mixer/VCA. This Blade Runner-referenced module contains four channels, each with a Pan control, Tilt EQ, Gain knob, Offset, attenuverting CV input for the VCA, an Audio Out, and a pushbutton Mute switch. For global type of controls, there is a main Volume, a Return volume control, stereo Send/Return, and a Master CV input for controlling all four channel's VCAs with one CV signal.

Tannhäuser Gates isn't your normal mixer. For starters, the dual-sided tilt EQ—something I'm a huge fan of—can attenuate either frequency end while boosting the other frequency side simultaneously. It's really great for bass boosting; not to leave out the treble, that too can be boosted while simultaneously attenuating the low end of your signal. You can really sculpt your sound in various ways with this; by normal attenuation or boosting of a signal's frequency, by multing a signal and mixing the same multed signal in two separate channels and boosting the highs in one channel and the lows in another, or just by cleaning up a muddy low end/taming highs on one channel, and not an entire mix.

The built-in VCA on each channel is also very useful, and each channel's VCA operates individually, with control over the Offset and CV amount, but it gets taken up a notch with the Master CV. That lets you control all four VCAs with only the

one CV input. Since the CV attenuverter lets you invert the CV signal, you can flip-flop the incoming Master CV, and if two channels are hard panned left and right, get some nice stereo imaging going on by having one channel's CV fully CW and the other fully CCW. You can also patch some fast moving audio CV in the Master CV and pan the channels hard and medium on both sides, using the CV attenuverters to get some alternating ring moddy madness. Add in some effects, namely reverb, and the potential for interesting—and sometimes maddening, depending on the CV rate—stereo panning/imaging atmosphere is immense.

Another feature that Tannhäuser Gates has that you don't find on a lot of Euro mixers is that each channel has its own independent Audio Out, with the signal also going to the main output. I like this as it furthers the ability to get some cool stereo effects by multing one channel and feeding both [or more] to TG and filtering/running it through a VCA/adding effects/etc. to one of the signals, but it also means you can't run a signal through Tannhäuser Gates and get the benefits of the VCA or EQ without it always going through the main output, and muting a channel also mutes the individual Audio Out, so there's no way to avoid the main output while still having the Audio Out pass signal.

The two main outputs, the Main Volume and Return volume that comes from the Left/Right Return, are interesting in that they work independently of each other and that the Return Volume isn't affected at all by the Main Volume, meaning you can turn down the Main all the way to get no sound coming out of the four channels themselves, but the Return volume still lets volume pass from the Send/Return buss. Not only is this cool for effects to mix with the Main volume, but this basically acts as two more inputs separate from the Main mixer—albeit without any controls except the Return volume control that gets fed to the main outputs. What makes this a bit strange is that even with both the Main and Return volumes all the way down, quite a bit of volume/voltage can still creep through both outputs depending on a few settings; i.e., the Offset and Gain. You can mitigate this on the Main volume by muting whatever channels necessary, or making sure that the Offset control is fully off for each channel; but if you do turn the

Offset all the way down on any channel, you won't get any signal going into the Main out at all since you're closing up the VCA for that channel, no matter what the Gain setting, which means that you actually need the Offset up a little in order to have anything come out of the Main output. I would have liked to see an overall Main volume control that also cuts the Return volume as if you do have a loop or another signal going into the Return inputs there's no way to cut sound from the whole module at once, to actually obtain full silence from the unit.

Tannhäuser Gates is built with expansion in mind, and on the back of the module you will find headers to chain up to four TGs together, creating a gated mixing community of sorts up to sixteen channels, which would be pretty amazing with all of the onboard VCAs/EQ/and stereo effects routing that would then be available. There are also headers for future expansion modules, which Animal Factory states will expand the functionality of the Tannhäuser Gates subdivision of your modular case, and knowing their idiosyncratic take on things, is an exciting prospect. Also found on the backside are DIP switches for adjusting to different levels of output.

I've mentioned a few of the peculiarities with Tannhäuser Gates, and I do have a few more desires for it. First, I wish the EQ trimmers were center detent to make it easier to tell if they're in the off position or not. I also wish that Channel 1's input was normalled to Channel 2's, and ditto for 3 and 4, so if you're going for some stereo experimentation you only need one input for two channels. Obviously not a big deal, but it'd be nice. I also wish there was CV control over panning for at least a couple of the channels to do some ping-ponging stereo stuff. Lastly, I wish that there was control over each channel's effect amount instead of just the entire four-channel output, though you can patch two mono effects instead of one stereo, and with some panning get somewhat close to that. I wouldn't be surprised to see some of these addressed in a future expander module, but that's just a guess.

Tannhäuser Gates is a really fun mixer. As it is, I wouldn't use it as my main end-of-rig mixer quite yet, and part of that is because I only have one—so only four channels—and I like to have more. Also, I need a headphone out so as not to drive

my fellow cohabitants/replicants stir crazy; however, with the expanders on the horizon, and maybe more Tannhäuser Gates in my future, all bets are off. Animal Factory Amplification always has interesting modules and pedals, and Tannhäuser Gates is yet another.

- Jason Czyeryk
20 HP +12v 146mA -12v 94mA
Price: \$375



Cosmix Pro Stereo Mixer Cosmotronic cosmotronic.nl

When Netherlands-based Cosmotronic came out with Vortex, their Through-Zero Complex Oscillator, it instantly drew my attention. It appealed to my love of absolute symmetry, and it had a no-nonsense design that was perfect in its simplicity with its black faceplate and use of blue LED underlighting creating a beautiful landscape with which to navigate its easily maneuverable and well laid out controls. Since then I've picked up a few more Cosmotronic modules [Messor, a stereo compressor, and Peradam, a side-chained distortion unit] and have really enjoyed them, excited for each new release.

Cosmix Pro is their latest, a high-quality performance mixer with four mono and two stereo channels with two Auxiliary sends and a return. It might seem a bit strange that they'd come out with a mixer as they already have the original Cosmix mixer, but Pro is a different beast as the original incorporated stereo dual band distortion and overdrive and Pro has done away with that and instead has the extra Aux channel, and is more of a studio utility

than a sound sculptor.

I love the look of Cosmix Pro as it retains the great layout that I've come to expect from Cosmotronic modules. There's a sort of global section on the right side of the module with left and right Main outputs, mono and stereo Send/Returns [Aux 1 and 2], and two CV inputs for panning channel's 5 and 6. There's also stereo LED meters and a main volume knob at the bottom of the module. The four mono channels each have controls for the amount of both Aux 1 and Aux 2 [yes!], as well as a pan knob, a nice backlit mute button, a slider for volume control, LED metering, and a switchable high pass filter. The stereo channels are similar but only have controls for Aux 2, not Aux 1, and have a switchable +18dB gain boost instead of the HPF switch so that you can easily bring non-modular gear up to level.

There are options on the back for chaining more than one Pro together, or even for chaining with the original Cosmix as well as places for future expanders. I'd love to see ¼ or XLR [or combo jacks] outputs as an option for expansion, but I do like the small footprint that the 3.5mm jacks take up, I just hate adapters as I'm always losing them. If it isn't screwed down in my rack, it'll find its way into a dark corner of a club or a trunk or something.

The biggest thing with any mixer is how it sounds, and Cosmix Pro sounds great. It's clean and clear, and there's plenty of headroom. I love the feel of the mutes—clickless and reliable—as well as easily viewed in any lighting situation, and one thing to note is that the mutes work when you release them—as opposed to when you touch them—which works particularly great in live applications. I also really like the design of the LED metering as usually you have a row of LEDs to denote level, but here it's a miniature meter, fluid in its design and implementation, and informative, yet taking up little space on the faceplate.

I really love this mixer. It doesn't have everything I'd like [XLR outs, headphone amp, more channels!], but those can be easily obtained and will hopefully be available in future expanders. It's a great mixer and it's going to be sticking around in my case and handling my mixing duties for the foreseeable future.

- Ellison Wolf
22 HP +12v 170mA -12v 170mA
Price: \$399



WF-1 Wavefolder + E-1 Expander DPW Design dpw.se

When we interviewed Dan Wahlbeck of DPW Design back in issue #8, he mentioned that after he released his Wavefolder module, WF-1, he didn't do any designing for six months afterwards because he was having so much fun with the WF-1. I figured there was a bit of hyperbole in that statement, but still it was a comment that stuck with me. I mean, wavefolders are fun, but six months? I dunno. It piqued my curiosity enough for me to grab one when I had the chance, aware that I couldn't get swept away for six months as I had other duties to attend to, but to see if the temptation to do so was there.

WF-1 has a nice, colorful, and somewhat playful design. There is a black faceplate with squiggly lines, both an attractive and informative visual that indicates signal flow. The white lines denote the clean signal, the yellow lines signify the modulation path, and the red lines are the output. Coupled with the multi-colored knobs on the module, and a sturdy build, there is something very alluring about WF-1 right away.

The module has two sides to it, a positive [P] side and a negative [N]. The P folds the positive side of the signal, and the N the negative. Both sides have a CV input with attenuverting control and bi-color green and red LEDs—which indicate the level and polarity of the signal—a 12ishV peak-to-peak positive/negative offset control, which sets the threshold where the folding starts, and at the bottom of the module—signified by the red knobs and labeled FoP and FoN—are output attenuverters for adding or subtracting a square-ish wave to the main output, also indicated with bi-color LEDs.

There is a mono input, inputs for both positive and negative CV control, a CLEAN input level control, and a MODulation amount level control. There is also a main OUT level control and three outputs: a main OUT, and two pulse wave outputs; one each for the positive and negative outputs that put out pulse waves when their respective wavefolders are folding, and are indicated by bi-color LEDs. If a pulse wave output is patched, that respective wave [FoP, FoN] is removed from the main OUT and those attenuverters determine the size/shape/polarity/strength of the outputted pulse wave.

There are two toggles; a SYM switch to choose either symmet-

rical or asymmetrical folding of the signal, and a LIM/0/DIST switch for adding either a soft-stepped limiter [LIM]—which can be driven by the CLEAN volume control—or a frequency dependent distortion and both the LIM and DIST can work with audio or control signals.

Wavefolders are really fun to experiment with, especially when hooked up to an oscilloscope, and WF-1 is no different. Messing around with a simple wave and just the positive side of WF-1 and patching the three outputs, as well as an undiluted input before going through the WF-1, and into my Mordax DATA, and you can see all of the interesting interplay that can happen between all of the available parameters. You mostly get a variation of a waveform that looks like Batman's head, but adding some of the FoP in the mix to this added more harmonics, and of course patching into the negative CV brought about more radical changes. Messing around with the SYM and adding LIM or DIST was a good way to add a some subtle distortion, while still using a sequenced sine wave and using the E-1 expander—included with the module—adds CV ability for the LIM/DIST toggle. For this to work the toggle needs to be in the center position, with each being CV'd independently. It would have been nice to not need the expander for this function as the expander is mostly empty space, but it opens up more functionality, especially in terms of accenting something in the time domain, whether rhythmically or melodically, and whether you're controlling an audio wave or modulation. A quick look at the underside of the WF-1 and you can understand the need for an expander: DPW uses durable, great feeling full-size pots and there is no more space for any-

- More than a normal wavefolder.
- Single or double sided folding. CV control of both sides.
- Rebuild the wave with squares produced in the folders or patch them out for further use.
- Multiple tweakable distortion types.
- Hard or soft clipping.
- CV control over crossover distortion, half or full wave rectification.
- Completely DC coupled for both audio and CV manipulation.

<http://dpw.se>

thing else under the faceplate.

Patching in more complex waveforms and WF-1 becomes a veritable funhouse mirror with much more zany and way less predictable waveforms at the main OUT. You do need to pay attention as it's possible that incoming modulation and the settings on WF-1 cancels itself out to where you're flatlining—dead—and it might require some math or sidekick detective skills, but that's actually part of the fun, this semi-educational aspect to WF-1. On the flipside you could just skip learnin' and stuff and just twist knobs and sh#t. That also works.

Using the Bastl Pizza as my oscillator and cross-patching between it and WF-1, patching the pulse outputs of the WF-1 into various CV ins on the Pizza, yielded some pretty bizarre results. From pulse-widthy tones to bitcrushing, to metallic swashbuckles, I was able to get a lot of variety. Having said that, I think I enjoyed WF-1 even more as a modulation source, to control the gain on a VCA or a filter cutoff, using WF-1 to output random envelopes for those duties. Controlling the FM Index on Pizza while at the same time using the positive pulse output of WF-1 to modulate the octave of Pizza, gave up some froggy formant basslines that were cool.

This is a really unique wavefolder. I was able to pull myself away from WF-1 so that I didn't spend six months entranced by it and was able to get other things done, but it wasn't as easy as you'd think.

- Jason Czyeryk

12 HP +12v 140mA -12v 140mA

Price: \$174 [expander included]

EP-1 Expander 2 HP, passive

Please support
our advertisers.
Tell them that
you saw them in
Waveform!



Ondes VCO
Therevox
therevox.com

The Ondes VCO by Therevox is a 14hp oscillator with classic vibes and a classy look. It's a recreation of the oscillator circuit found in the 1975 version of the Ondes Martenot, the enigmatic electronic instrument originally designed in 1928 by Maurice Martenot. Therevox used some of the original hand-drawn schematics when designing the Ondes, but added improvements for its port into the Eurorack format.

Aesthetically the Ondes has a vintage look about it with a powder coated, solid aluminum panel, robust feeling sliding switches and a large, smooth tuning knob. Unlike most Eurorack oscillators on the market today, instead of individual waveform outs the Ondes instead has 3 identical output jacks—a nod to the diffusers which were different styles of external speakers and resonators that provided differing tones and timbres depending on their construction that were typically used with original Ondes Martenots. Here, in the same spirit it allows for multiple output paths and separate signal processing. The Ondes VCO mixes its waveform internally via a series of switches which are arranged along the top half of the module. In the top row—in addition to 3 individual switches corresponding to the three output jacks—there are seven which toggle different waveforms in or out of the output mix, identified only by single letters or numbers on the panel but with full descriptions and titles in the simple but informative manual. The Tutti switch [labeled "T"] is a preset mixture of all the waveforms and is the only switch that when activated will override the other

switch settings. The remaining waveforms [when T is off] are Gambe—an asymmetrical square wave, Octaviant—a rectified sine wave, Nasillard—a narrow and fixed pulse wave, Creux—a soft clipped triangle, Onde—a fairly pure sine, and Petit Gambe—a low-pass filtered square wave. The Octaviant ["8"] and Petit Gambe [small capital "G"] each have a dedicated volume slider and associated VCA. The lower half of the module contains the output jacks, a fine tuning knob [with a range of about 1.5 octaves], and a four-position octave switch.

In practice, the Ondes VCO is somewhat of a macro oscillator and there are a certain amount of limitations inherent in the sound sculpting available. It's a manual affair when tweaking the tone of the oscillator as the only voltage control is over the mix level of the Octaviant and Petit Gambe waveforms. The other four are either on or off [and Tutti is a fixed preset] so adjusting the relative levels between each waveform is impossible. Despite its simplicity and the lack of extensive CV inputs the Ondes VCO is quite capable of producing beautiful and rich textures and timbres. The curated tone of the Tutti waveform has a nice buzz and some good weight behind it with plenty of harmonic fodder for filters to chew on. The Creux and Onde waves provide a nice solid bed of fundamental frequencies and more harmonics can be added to taste with the Octaviant and Petit Gambe sliders. Each waveform's dedicated VCA and slider allows for slowly evolving timbres or rhythmically punctuated harmonics to be added dynamically in the mix, and patching a noise source or another oscillator running at audio rate into either VCA circuit is a great way to get more aggressive and dirty tones.

Despite the relatively small amount of voltage control options, I like the Ondes VCO. The on-panel labeling of the included waveforms are a bit cryptic, and the lack of voltage control can be limiting, but the simple controls mean you're not going to get lost in this oscillator's cross patching possibilities and this allows you to focus more on the sound. While it is a somewhat limited palette, it offers up a nice range of classic timbres that makes it easy to reach for and lovely to listen to.

- Sam Chittenden

14 HP +12v 80mA

-12v 80mA

Price: \$355



ADDAC 809 Chain Router ADDAC System addacsystem.com

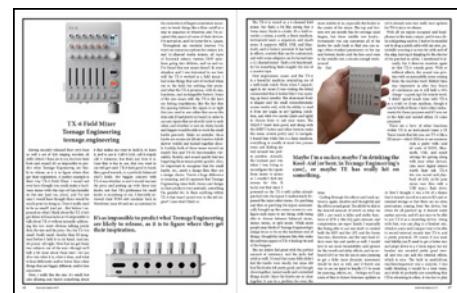
ADDAC's 809 Chain Router is one of those utility modules that you don't realize quite how cool and handy it is until you get your paws on it and put it in your system. While chain routing isn't the flashiest of utilities, 809 gives you the ability to easily route one signal six different ways by way of the input having two different send and return loops, A and B. These can be either run in series or parallel, or you can just use 809 as a switch to try out the two different paths separately and see which path fits your fancy. Want to try out one signal with two different reverbs and go back and forth without needing to patch/unpatch every time? Feeling unsure which delay is what you're looking for? 809 makes it easy to do this and find what you like, and this auditioning aspect is merely the starting point; It's the running of one path into the other and the ability to CV all of the path features that makes it so useful. Nicely illuminated soft switches for BYPASS, PARALLEL [if the effects are in series or

parallel], ORDER [A feeding into B, or B feeding into A as well as choosing A or B], AND DUAL/SINGLE [one path at the output or both] make this painless.

The ability to CV all of this is really what makes this module interesting. Using CV you can synch up effect switching, effects stage switching, path switching, or even complex oscillating; switching out complex or modulation oscillators and synching that up, too. One thing you can do is to use CV to scroll through all six of the pathway options, which can get really wild. Modulating this with an LFO is really interesting and I found that doing it slowly made it possible to not only hear the differences in the paths, but to also just intrinsically feel the changes without having to focus so much on it. Modulating any of the parameters at audio rate is a completely different story, and it mostly sounded AM'd and slightly ring-moddy, though still interesting enough at times. I felt like I had to try it out this way, you know, to be thorough and all, but it's not where 809's strengths are. Synced up/syncopated changes in the parameters is where it's at here, and 809 kills it in this way. It was cool to turn on/off a snare reverb in time, to switch from a delay feeding a reverb to a reverb feeding a delay in time, and to bypass it all every so often by using just a few related LFOs.

809 really does do double duty as both a chain figure pathway selector and an effect all unto itself, kind of the way a panner or crossfader can be; and whether you use 809 as a rhythmic accentuating effect or just to figure out the path you want for your signal so that you can hone in on the perfect patch, it's an incredibly useful module.

- Ian Rapp
6 HP +12v 80mA -12v 30mA
Price: \$165



Continued from page 45

card or internal storage so that there are no extra protrusions coming from the device, but when it's all patched up it doesn't really matter anyway. Along with that, you can plug in a headset mic, which is a nice and compact way to be able to record external sounds into TX-6, and is pretty practical. If you want real fidelity you'll need to get a better mic, but my headset mic sounded pretty good overall and you can add the internal effects to pretty it up, which is nice.

Sure, you can get any number of 6 [or 12 or 24 or...] channel mixers for a lot less money and bigger knobs, but as someone who's used mixers of all sorts for decades I can tell you it won't be nearly as much fun. Maybe I'm a sucker, maybe I'm drinking the Kool-Aid [or beer, in Teenage Engineering's case], or maybe TE has really hit on something oft-overlooked: a mixer that's functional and fun, portable and playable, tech-y and tactile. Paired with the OP-1 Field, some Pocket Operators, and an iPhone, laptop, or tablet, and you've got a fun, extremely powerful—and mostly portable—system. Whether you think the TX-6 is worth its weight in aluminum [x50??] is of course subjective, but make no mistake; the TX-6 is a serious—and seriously cool—piece of kit.

- Ian Rapp
Price: \$1199

WAVEFORM
10 ISSUES STRONG!

Don't miss an issue...

SUBSCRIBE!

Save 30% off the cover price
www.waveformmagazine.com/subscribe

ISSUE ONE • DALE DAVIS • VOLTAIC • APE • MOTORHEAD

ISSUE TWO • JEFF GLASS • DIGITAL REVOLUTION • THE GUITAR

ISSUE THREE • MICHAEL STipe • THE BEATLES • THE VELVET UNDERGROUND

ISSUE FOUR • THE COORS • THE ROLLING STONES • THE CURE

ISSUE FIVE • THE COORS • THE ROLLING STONES • THE CURE

ISSUE SIX • THE COORS • THE ROLLING STONES • THE CURE

ISSUE SEVEN • THE COORS • THE ROLLING STONES • THE CURE

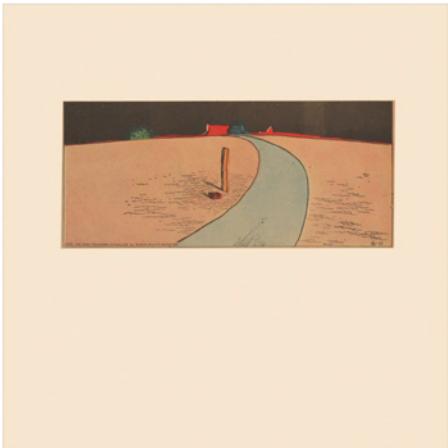
ISSUE EIGHT • THE COORS • THE ROLLING STONES • THE CURE

ISSUE NINE • THE COORS • THE ROLLING STONES • THE CURE

ISSUE TEN • THE COORS • THE ROLLING STONES • THE CURE

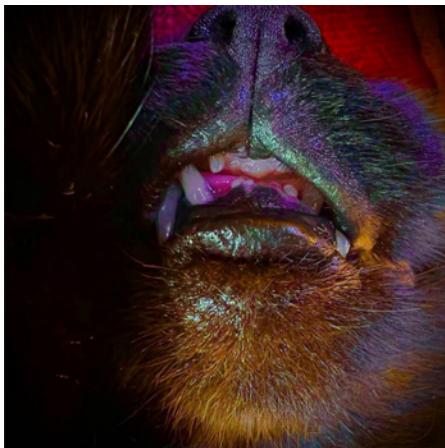


MUSIC REVIEWS



John Also Bennett
*Out there in the middle of
nowhere*
Pool Music

Using a 1940's Oahu laptop, a synth, and some field recordings, Bennett's latest release is a bare and haunting minimalist journey that utilizes slow-moving melodies on top of stark electronics. Motivated by a trip through the South Dakota badlands, Bennett successfully captures the feeling of the desolation of the terrain with the music, feeling vast and bewildering. *Out there in the middle of nowhere* requires patience, as Bennett allows for a lot of breathing room so reverberated notes can hover in space before getting lost. The pieces are mostly centered around creating an atmosphere and have an almost cinematic quality to them but everything is engaging and successfully captures the mood of the landscape. - Tom Ojendyk



Tim Held & Steven Jett
Kitty Safari
Mystery Circles

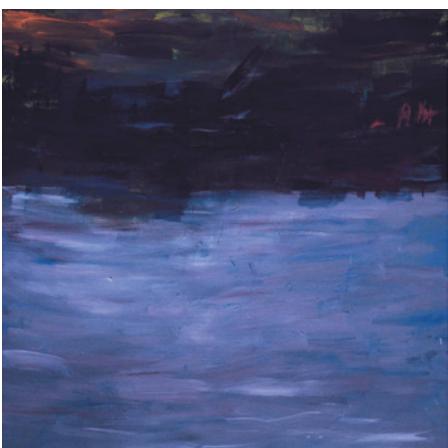
What do you get when you cross a pipe-organ builder with a podcaster with a penchant for costumes? Well, a lovely piano and modular album, of course! *Kitty Safari*, sees Steven Jett [the organ builder] and Tim Held [the podcaster, *Podular Modcast*] creating a beautiful and touching eight tracks spanning about forty minutes. With plenty of late-night piano meditations ripe with neo-classical moments, ambient flourishes, and toned down modular embellishments, *Kitty Safari* is more than the sum of the parts. The piano mostly sounds sad and serious with the background atmosphere acting as a stand-in for old family movies from times gone by, where the cellulose is nearly worn through, overplayed and decrepit in the parts where long-lost loved ones can still live on.

- Ellison Wolf



Meagan Jane Marron
Mast EP
Delusional Records

Previously releasing music under the name Cat Breath, Pacific Northwest synth wizard Marron's latest release is a two-song EP of clobbering dance music that's catchy as well as powerful. Produced using a Polyend Tracker, Eurorack modules, a MiniKorg 700fs, and other hardware and synths, the EP is hard-hitting techno with heavy beats and a dark industrial edge to it. The music is welcomingly aggressive with glitched out pulsating arpeggios on top of driving rhythms that work well either on the dance floor or in a dungeon. Both tracks have a bit of an 80s EBM vibe with the mix of repetitive and cool sequencer lines and dance beats, but they don't feel like throwbacks, as instead Meagan is able to inject a modern sense to them. Very cool. - Tom Ojendyk



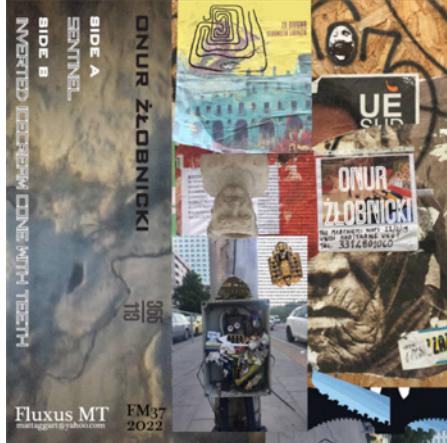
Mirt
Hiraeth

I made the stupid mistake of letting my nephew, who's getting into more experimental music [finally!], borrow a stack of records to check out, with Mirt's *Hiraeth* being one of them. It was stupid because when I got my records back I was informed that I wouldn't be getting this particular record returned to me. Ah well, who am I to deny the spreading of good music, the relocation of mind-expanding matter? Recorded during a 10-day quarantine, but adamantly stating, "It is not another pandemic album," *Hiraeth*'s ten tracks are indeed an interesting listen, bubbling with sounds and swirls, beating pulses, as well as hypnotic and almost-rhythms, with *Hiraeth* sometimes emerging on the edge of musical decipherability. The thing feels like a precious gem, a never-ending prism to get lost into, dissolving into color, making it that much harder to cede ownership of the LP. Some of the beats are really remarkable, especially on "Pangea." - Ian Rapp



Pole *Tempus* Mute

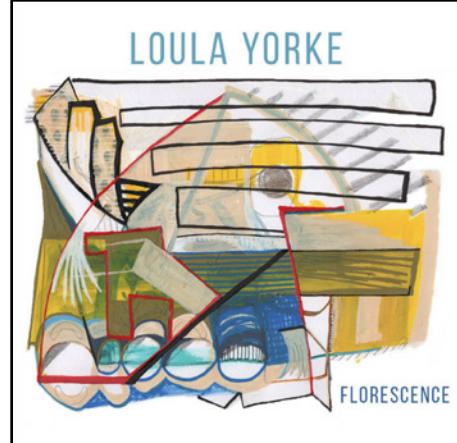
Following 2020's awesome *Fading*, Stefan Betke—aka Pole—is back with another fine album that fuses electronic, dub, jazz and ambient in a rich and compelling manner. The compositions are complex and unfold like a fractal with connected themes that are immersive, deep, and colorful. Betke's production is involved, clear, and uses space in a way that's similar to dub with a deep sense of mysteriousness and intrigue. All of the tracks have a unique feel to them but they also flow together cohesively and the album feels like a statement. Pole has been around for a while now and Betke's work has been remarkably consistent but also constantly forward-thinking. A very strong release and another welcome addition to the Pole catalog. - Tom Ojendyk



Onur Źłobnicki 355/113 Fluxus MT

Onur Źłobnicki is Keven Michael-Onur Kalaycioglu-Źłobnicki, also known as the man behind Zlob Modular. The two nearly twenty minute tracks were made with a combination of Eurorack modules, guitar pedals, and some algorithmically generated samples using Pure Data. Maybe it's the algorithm that's adding the sense of dystopian madness? Hard to tell. First track "Sentinel" ushers in a sinister drone, like a slowed down ship brushing the side of an iceberg, getting off easy until it gets forever trapped in a sheet of never-ending ice just moments later. "Inverted Icecream Cone with Teeth" is more of the same, and this would not be out of place being played in a sadistic dentist's office, perhaps the highest compliment I've ever given to a song.

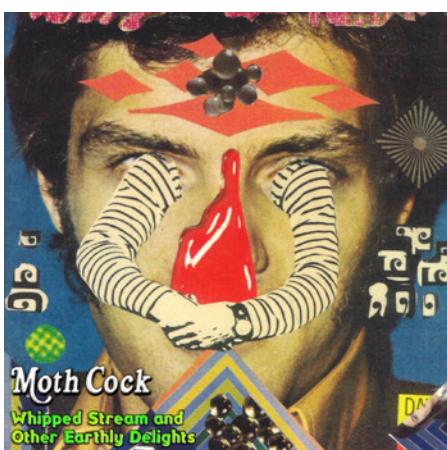
- Ian Rapp



Loula Yorke *Florescence* Tigerforce Records

Florescence is a fine collection of electronic improvisation jams from the UK-based synthesist Loula Yorke, whose music moves through various moods and themes but is constantly thoughtful, engaging, and rewarding. The album begins with "Silverweed," which has an almost aquatic feel to it and sounds like it could have been released on some rare 1970s library record. Other tracks like "Bastard Toadflax" and "Petty Whin" sound like 90s electronic jams with space-age rhythmic synth blasts that sound both retro and futuristic. The two longest tracks, both highlights, are saved for the end. "Sun Spurge" is a wonderful minimalist piece that slowly and blissfully moves around the intergalactic zone, and the last track "Aaron's Rod" is an intriguing experimental soundscape that's full of movement, ideas, and beauty.

- Tom Ojendyk



Moth Cock *Whipped Stream and Other Earthy Delights* Hausu Mountain

Ohio-based Moth Cock have been quite prolific since forming in the mid-2000s and their latest release might be their most ambitious one yet, comprising three hours of music stretched over a three-tape box set. Thankfully, the duo is in top form with their awesome mix of free improvisation and electric music. I might question the sanity of anyone who could sit through the entirety of this release due to its wide scope, and honestly, I think it works better when listening in parts because the pieces are easier to appreciate with fresh ears. The release begins with a gigantic 26-minute layered cosmic drone with sax and synths that shows how experimental music can be engaging and also cavernous. From there, the music goes from playful to bonkers to dark to beautiful and to everything in between. It's probably not possible to fully explain everything going on with this release but if you need to zone out for nearly half your work day, check out Moth Cock.

- Tom Ojendyk



Alias Zone Water Stories

According to Chris Meyer's Bandcamp page there was a twenty year gap between his first Alias Zone release, *Lucid Dream*, in 2001, and the follow up, *We Only Came to Dream*, released in 2021. Since then he's been on a tear, recording, releasing, and playing live at a rapid pace. I was fortunate enough to catch a quad performance in Santa Fe this past summer, and it was quite immersive. Meyer excels at a certain type of eastern influenced chilled-out music, replete with water swooshes, slow synth rises, spacious rhythms, and flute-onic melodies that reminds me a bit of Dead Can Dance and more recently a bit of Fever Ray. Created using a literal Pandora's Box [one of Meyers' modular synths' names] and other hard and soft synths and hand instruments, *Water Stories* is a relaxing, positive-vibed, soothing listen and the songs on it are studio versions of ones he's been playing out in the wild. - Ellison Wolf



Sarah Belle Reid & David Rosenboom Now

Ravello Records

This collaboration between two expert composers and performers is strongly avant-garde and highly immersive, full of radical experimentation. Rosenboom has been producing music since the 1970s and has worked with folks such as Anthony Braxton and Don Buchla, while Reid has been performing since the 2010s and has worked with Wadada Leo Smith, Charlie Haden, and Julia Holter. All in all, impressive resumés for both of the performers, so it's no surprise how well this collaboration works. The music is a great mix of electronics and instruments such as trumpets, flugelhorns, etc., and the compositions are abstract but not overbearing, complex yet welcoming. There is a lot going on so the pieces reveal themselves with each listen, and fans of experimental music will appreciate this release. - Tom Ojendy



Sam Gendel blueblue Leaving Records

Nobody can accuse LA-based Sam Gendel of not producing. According to his Bandcamp page the multi-instrumentalist had four full-length releases under his belt in 2022 [this was his fourth] alone. The fourteen tracks on *blueblue* correspond to a pattern in a traditional style of Japanese embroidery. It's a varied affair, sometimes invoking avant-garde jazz, sometimes a little 60s cinematic smoke noir, with instrumentation that feels lush, a bit broken and warpy at times, and overall very evocative. *blueblue* is definitely a great album to chill out to with all sorts of weavy, hypnotic interplay between the instruments, all played by Gendel except for the drums, which here I've got to give props to the stick man—Craig Weinrib's drumming is tight. - Ian Rapp



Todd Barton *below this time does not exist*

Todd Barton is indeed a master of the Buchla, and is perhaps best known for his use of it, but here, on his newest release, *below this time does not exist*, he is using not only Buchla, but Make Noise and Intellijel modules, among other tools. Unsurprisingly, it his mastery of sound movement and the space he deals out is typically sure-handed. There's definitely a 70s aesthetic at play here—more tones than tunes—yet Barton's explorations of sound and their travels is, as always, fresh. Whether it's the slow, drawn out bell-ish tones and metallic arcs on "collective delirium" or the elongated, stretched whale talk on "jump, fluctuate, materialize," there is an encompassing structure to the tones, themselves contained, trying to escape. Maybe that's the theme on *below*, time that's trapped, in this case not wanting to escape, but to contemplate. It's a bit of a sobering thought, isn't it? - Ian Rapp



Adriaan Swerts

One

Piano and Coffee Records

Adriaan Swerts is a Belgian-based neo-classical and ambient composer and his debut album *One*, is majestic and stunning in its minimalism, with piano, violin, harmonium, and various custom-made instruments. Swerts also utilizes nature field recordings which are then degraded via a reel-to-reel machine, thus giving the music a fragmented feel. The music is very solemn and melancholy, spacious and deeply personal, and the twelve compositions are diverse in sound, but all executed wonderfully with everything flowing together cohesively. While the music may initially seem sad, there are also strong feelings of hope and celebration in the mix, and Swerts has crafted a fine album that's perfect for the winter months. - Tom Ojendyk

Eight Questions with Adriaan Swerts

What was your musical upbringing like?

Both my parents are classical musicians and I felt like there wasn't much room for other music in the house when I was a kid. I learned to play the clarinet and the piano, though when I was fourteen my mom bought me my first synthesizer. Since then my musical horizons broadened and I haven't looked back.

How did you first discover ambient/electronic music?

My older brother would bring new music into the house when I first heard "Right Here, Right Now" from *You've Come A Long Way Baby* by Fatboy Slim it just totally blew my mind. That same year he introduced me to Air's *Moon Safari*, and it struck a chord. Their home-studio-producer-attitude had a profound influence on me. It meant that if you worked hard enough, you could make great and personal music in your own house.

The liner notes in your album make numerous mentions of an accident that happened to you. What happened?

When I was 18 years old I went on a high school field day with a high ropes course. Unfortunately, my climbing suit was not fastened properly and I fell. I had severe injuries and have had nerve pains and partial paralysis ever since. It quite drastically changed my life. From one day to the next I had to deal with all kinds of limitations of my body, but it also made me realize what truly matters in life; love, family, friends and enjoying the small things. I've been making music as a way to deal with my constant pain and it is also a big part of the mental healing process, of finding peace with the way things are now.

What was your artistic process with the field recordings and tape machines?

Apart from "Distant Overtones," which features an analog synthesizer, all of the other non-traditional sounds on *One* are natural sounds that I manipulated. I go for walks in nature and record sounds that I find interesting and edit these and use tape to degrade the quality. After this, I transform them into instruments with the computer and make music with them. By destroying the sounds with tape I can musically express what it feels like to live with a body that only partially does what you want it to.

What is it about turning noises in nature into musical sounds that resonates with you?

After I survived my accident I very much felt like I was seeing everything again for the first time. Learning to walk again was an arduous process and I tried to do this in nature as much as possible. When I am in nature I sort of feel a spiritual connection with everything. To express that feeling in my music and raise awareness for the effects of climate change on nature I started making recordings during my walks. When I get back home and compose music with these sounds I feel like I'm back in that place in nature and can continue to feel that connection.

You've made short videoclips for *One*. What was your motivation with these?

I made cymatic videoclips for each track on my album because I wanted to dive deeper into nature in my creative process. I was longing to make the vibrations of my music truly visible, not just an interpretation of them. I learned about the process of cymatics and it fascinated me that the natural phenomenon of sound actually generates visible symmetric geometric patterns in water. Some of these patterns that emerged looked like plants or flower-heads, so even on that invisible sonic level I found that connection between everything in nature.

What would you say is your main instrument?

Anything with piano-shaped keys. That can be a harmonium, synthesizer, piano, but also various MIDI-instruments via computer. Also, anything in the natural world that makes noise can be an instrument. That's what excites me the most.

***One* is very somber sounding. Would you consider yourself a sad person?**

Not really. I composed a lot of this music after my accident and after my grandfather died. Making music acts like an outlet for emotions like sadness that I otherwise don't easily express and that makes me feel better in my daily life because I've been able to give these feelings a place in my music. It's a kind of self-therapy.



Continued from page 22

these digital synths are running at pretty low sample rates. There are all sorts of tricks to avoid these harmonics, like band-limited waveforms and stuff. I feel like the original reason for wavetables is because if you wanted to create waveforms with cross modulation or phase and frequency modulation, you run into these problems where you need an extremely high sample rate because in digital, it's not the input or the output sample rate that's the problem, it's the internal sample rate. So if you have a discontinuity, like a sawtooth, or you modulate something and there's a really sharp rise like a sawtooth has, it technically has infinite harmonics, it instantly aliases. If you create something with infinite harmonics in a discrete environment, then the aliasing is in there and you can't get rid of it; it's not something you can filter out because it's aliased already, so people have all sorts of techniques to work around this. You carefully build your wave tables, maybe with additive techniques, and you get something that looks like a saw wave but it doesn't have infinite harmonics in it, maybe five or eight harmonics stacked on each other. A sine wave stacked on each other is close enough to a sawtooth—it looks like a sawtooth—and maybe it's fine if you're just listening to that sawtooth, because all the harmonics are below 20 kilohertz or something like that, but if you want to modulate it or use it in some other fashion, it's not enough. With wavetables, if you have these intrinsically band-limited waveforms you can get complex effects by basically fading between these.

So do you not like the digital workarounds? Do you not like the tricks?

No, I want to modulate the crap out of everything. The Three Body has an internal sample rate of 12.5 megahertz and that's close enough to infinity for a lot of this, so when answering the question

about why don't I like digital synths I think for the most part, the answer has been that they disabled the thing that I like the most because they have technical limitations they have to work around. Maybe they don't think that audio rate modulation is particularly musical, so they disable it, but modulating the Angle Grinder with another Angle Grinder sounds beautiful. With the Three Body, I'm able to add in a bunch of things that you can't really do in analog, like ratio-based phase modulation.

Now that you've been doing this for a bit, I'm guessing that you much prefer running your own company to working for someone else like a defense contractor or something?

When you're working for these larger companies in engineering, there's this Sisyphean aspect to it. You're given a task, you work on it, and then maybe it fits into the grand scheme or maybe it doesn't. Maybe funding gets stopped. Every little thing you do, you have to get six people to sign off on it. It takes six months to design a prototype, and you never finish anything.

There is a definite lack of satisfaction when you're repeatedly not seeing any completed results, but still doing a ton of work. Do you feel like your standard of life now is better than when you were working for other people?

My standard of living now is confusing. It's hard, because it involves a lot of self regulation. If you want to enjoy yourself, you have to be responsible for that. There are weeks where I get sort of miserable because I have all these things I need to do, and I'm trying to do it in a spare room. I'm overwhelmed. I can't decide which task is next. I'm just staying in that room and working all day long. That's not fun. Then there are other weeks where I get up, I walk, maybe I actually play with the synthesizers, do some design, maybe I get to practice with my noise band in the evening. That's the shit. But you have to figure out how to navigate your headspace so that you can do that. Me, I want to build synthesizers.

schlappiengineering.com



Five12

Continued from page 32

After working in the software world for so long, what was it like to have the first hardware machine that you could actually use, even in prototype form?

It was amazing. Joe had done some prototype designs, and there was this thing we called "the Octopus." It was a couple of prototype UI PCBs, an evaluation board for the CPU, a couple of adapter boards with the OLEDs attached, and then a little breadboard with dozens of wires coming out of it. It only did MIDI and the UI was super primitive, but it worked and I took that and a [Sequential] Tetra to Knobcon in 2017 and hooked them all up. It took about an hour to put together, and it was all spread out on the table, and was kind of like, "Don't push anything too hard!" It was fun. That December we got the first prototype to show at NAMM, and there was a problem with the OLED connector, the spec sheet was wrong, so we had to do a last-minute revision. Those showed up in early January, so I didn't actually have the prototype built for that first NAMM show until about two weeks before the show.

What was the reaction like to the Octopus?

I didn't show that one publicly. It was just in the hotel room, so I think four or five people saw it. Still, that was the proof of concept—both for them and for me—that this was going to work. One of the really difficult things to get your head around is this whole hardware versus software thing when making music. There's something special about having the hardware in front of you and being able to interact with it physically that makes it a musical experience as opposed to working on a computer, which is more of a work experience. I think it's harder to be creative in front of a screen than a keyboard, I don't care how many controllers you have. Professional musicians can do that, that's

their job, but for people that either aren't professional musicians or spend their days in front of computers, being able to set that aside and just work on a piece of hardware—even if it's much more feature limited—is a more gratifying experience. There's this interesting magic about having the button clicks and turning the knobs and seeing the changes.

So the Octopus was proof-of-concept. How did that translate into the first production run for the Vector? How many did you do?

We did 100 units on the first run. At the time I had no idea how it would sell. There was definitely a scary moment when I sent out several big orders for parts and all this money was going into the first production run. I already had one good-sized dealer order based on the prototypes, but you still didn't know what was going to happen. I don't have a manufacturing background, and you don't know what you don't know.

Were you overseeing the manufacturing?

By then we'd gone through four or five pre-production prototypes, so I knew how to build them. I did the through-hole parts and the physical assembly for probably the first 300 myself. It was interesting. It's one thing to make five of them. It's another to make fifty or 100.

That's a lot of time soldering and putting them together.

Yes, it is. I don't mind soldering, but putting the nuts on the expander...Eventually I got a 3D printer, and I started printing little tools to speed things up. That helped.

What about the expander? Did you have that in mind in the beginning?

No. At the first NAMM show it was just the Vector. The takeaway from that show was that I needed more IO and I wanted to have a USB A jack on it. I knew that a lot of small controllers are USB only, and the idea was that you could plug in a small controller to enter notes. It also meant that I would have the option of adding Launchpad support.

Why did you think you need more IO?

By then I knew we could do eight parts,

and we only had two CV ports on board. It was a little bit of myopia on my part not to recognize it sooner, and I wanted to have more MIDI IO as well.

Did you have the same kind of nerves demoing the Vector as you did when performing on it?

No, although the first SuperBooth [I attended] was interesting because there were a lot of people coming by doing videos. A couple of those, like Sonicstate and Ziv [Loopop]—who wasn't shooting video—were a little surreal and I got nervous.

This is now your full-time job, but what were you thinking when you started out? Did you just think it was kind of a cool thing that you could do, maybe sell a few?

Once I had the design and knew what it would do, I had to do it. If I'm only doing one module, this is the module I'm going to do. I'm not doing something that I'm not fully invested in.

Is there a significance to the name Five12?

Not really. When I picked it, I wanted something that was generic. I'm not particularly good at clever names, but I thought I'd pick something that was not a normal type of name. It's two to the power of nine, so it has a computer relevance to it, but it's just a number.

What about the Numerology name?

There is something to that. That name made perfect sense for me in terms of a sequencer, because you're working with different numbers all the time, specifically, integers: three, five, and seven, eight, and sixteen, and so forth. Of course, there's this whole mystical side. You look up numerology in the dictionary and you take numbers from someone and they all have certain meanings.

Are you still working on it Numerology?

It's been a few years since I finished Numerology version four, and after that I did the Vector. I'm excited about what's coming in Numerology 5, but it's taking forever as I'm rewriting the UI from scratch.

So you're working on a new version? I wonder what's going to make its way from Numerology version five into the Vector, and vice versa.

Certainly the things I have learned from the Vector are influencing the changes in Numerology 5.

The kind of a perennial question is, will the two tightly integrate at some point?

I don't know for sure. I have to let that happen organically. It's actually a tricky problem once you get into the details. There are really interesting benefits that come from flipping between the two. Each is an idea generator, and for me that happens both on the musical side and on the design side. Hardware design is tricky as you can't just add a button or knob after you start shipping, but there's a certain freedom in having that limitation, and it's one that has quite changed how I look at software design.

five12.com



NEED TO ADD A LITTLE SHINE TO YOUR STYLE?
GRAB A WAVEFORM ISSUE #10 T-SHIRT.
THESE LIMITED EDITION SHIRTS ARE ONLY AVAILABLE
FOR A SHORT TIME.
WAVEFORMMAGAZINE.COM/SHOP



Continued from page 14

That's a lot of work for one person.

Well, it's all things I enjoy. Burnout is always a challenge in any creative profession, and it's best to minimize stress as much as possible, but that's easier said than done. It's a balance, because if it's your passion and your hobby, and if you turn it into your job, then you need to find a new hobby.

Have you ever done any live music for your installations?

No, I haven't had it set up in real-time. I tried to do some generative patches, but it's hard to do really good generative patching. Sometimes I record a lot of sounds from the modular and then edit and arrange them later. I spend all my time in module design and electronics and don't put so much into making music. For me, I'm more interested in the way the signal flows than in making music with it.

What is it about signal flow that you find intriguing?

It's just kind of mysterious. I like analog because there is a signal going all the way through, and it's modulated and transformed. It's still some tangible thing. Digital is not so tangible, once it's crossed the AD converter it becomes math. The magic is a bit gone for me when it goes into the computer.

So do you only do analog?

Yeah. I love analog design. I am really fascinated by the relationship between the visual aspect of the waveforms and the way they sound. It's a very audio-visual thing for me, and sometimes, waveforms, weird-looking waveforms, create really good sound. I think with analog design, you have more freedom to design for character, like saturation or distortions, the coloring

and the timbre of the sounds.

You said that you don't play guitar, but would you describe yourself as musical?

No, I'm not musical. I don't really make any music myself, I just make the instruments. [laughs]. I know what instruments need because I talk a lot with people who use them. It's not like I don't understand what it needs to do, but it takes a lot of effort and practice to become a good musician, you need the drive for it.

That's one of the things about modular: you need a different kind of drive and expertise. You still need to put in a bunch of time, but It's not that you're trying to develop motor skills so much as you're trying to develop an understanding of the various types of theories and interactions.

The beauty—and the trouble—with modular is that you need to learn to play the instrument, but the instrument is in tiny pieces and it's always being rearranged, so you need to first design the instrument and there are so many options. It's a unique instrument, and it takes time to design it. I like that even if you don't know really what it does, but you just get in front of it and start patching, it's playful and immediate. You don't need to write a complex patch on paper before you start. Even if you are a beginner you can create sounds just by playing, and for experimental stuff, drones, or something, it's also great. I can patch some triggers and create some crazy soundscapes, and with the feedback loops you never really know what will happen.

What do you find more challenging: working in visual art or designing modules?

It's the same for me. My passion is in the modules and in the artwork. I've always really enjoyed the development and making something new.

Have you always been this focused and interested in art and design?

Ever since I was a kid I was into designing and making things. Building video games on the computer, drawing. I would play a video game and then I would immediately have some ideas about how I wanted to make a video game. That's how I was

doing things. I learned programming with a program called GameMaker where you could program little scripts and make some video games that only I played. I'm also interested in mechanical engineering and fabrication. I do a lot of hands-on building in the real world. That's what I like.

Have you combined your previous audio-visual light sculptures into any of your modules?

I was thinking of building some kind of light synthesizer or something like that, that would be interesting. I have ideas to bring some light pieces into synthesis. Ideally, it would be nice to combine the two practices.

Do you find it hard to manage your time between the two practices?

The problem is that I get very focused on something I find interesting, but then I also get bored quickly. I always have to find something. I manage it because now I don't fight it when I'm interested in something, I just go full force. In the arts, it's nice because if you have an interest in something you can turn it into a project and new work. It's the same with the modules. If I have an idea and then I just go fully forward.

cosmotronic.nl



Continued from page 39

Moskwa was one of your first modules and now you've got the Moskwa II. Why did you do a new version of that module?

ML: The Moskwa II is a kind of staple for the whole decade of our company. That's why we wanted to keep exactly the same form factor [as Moskwa I] but to contain much more features.

TM: For us, it is a bit iconic. It was quite a good product, but for today's standard it is

not enough. Moskwa was a feature-packed module ten years ago, and now it's almost a toy compared to modern sequencers. [Laughs] Moskwa II is doing really lots of crazy stuff that probably ten years ago would blow your mind.

How has your involvement changed the scene in Poland? Has the scene there grown at all?

ML: When we started we were so enthusiastic about the modules and Eurorack that we started a blog, a series of synth meetings, and concerts just to attract more people. There were a lot of people visiting us, and we didn't know them, but they were bringing their systems and other music equipment to our synth meets. It was growing so fast that we decided to step back because we didn't have much time anymore running the company. Now it's a lot of people.

How is it overall, having a Eurorack company that's based in Poland?

ML: There are advantages and, of course, shortcomings. The advantage is that a lot of things are much cheaper, so that helped us a lot. On the other hand, we are so far from the scene, from the community, that sometimes it is really hard for us to go to the events, to fly around the world to meet people. It is an effort. Still, we didn't feel like it was a big problem. Berlin is nearby and some dealers were interested in our first designs and really helped us initially, like Shawn [Cleary] from Analogue Haven, Schneidersladen and Escape From Noise. I think we were the first Eurorack company coming from Eastern Europe. Of course, now there's a lot of them, but back then I think it was only us.

Not that you've been around a while where do you draw your inspiration for new modules, new ideas, and new functionalities?

TM: There's really lots of different places where we find inspiration, especially when the ideas come from three different people. Sometimes it's something simple. For example, Maciek knows really well how analog to digital conversion works in hardware, but when I realized that you can change the control voltage into eight gate signals, it started this whole Leibniz [Binary] Subsystem, so there was this little

spark that came from nowhere. Then we started talking about the possibilities and Maciek was bringing lots of ideas how you can process in the digital domain. We were asking, "Is it possible to make another module from this idea?" Sometimes one of us has a general initial idea and the other one just adds to this and it starts some sequence, and another person is ending this. I think most of the inspiration is just from us talking together and exchanging some concepts, experiences, observations. It's also other products that influence us. You buy a module and you think it is really great and it would work well with something that is missing in the system, and you can make another module and it will be another brick to the bigger whole.

ML: We are really fanatic about modular and aware of pretty much every module on the market and every function. We have the big picture, what's in the market, and what is lacking in the market so we try to find some niche, some new idea, something against the grain. In our brainstorm sessions, one of us says, "Nobody would be using this because nobody needs that." The other one will be like, "I need that!" In the end, it is always, more or less, a success. I think the creative process is really good in our company.

TM: Sometimes even just playing a live show, it's like, "Oh, I should have some small thing." It is nice when you can just design it, but we need to be more responsible now.

What do you mean?

TM: For quite a long time all the risk was just on Marcin and me. If we made a stupid decision, we were the only ones to pay for such a mistake. Now, we employ people that put trust in our decisions. If a particular module doesn't sell well, we might not be able to recoup our costs. It is quite stressful. It definitely affects us, but can also be a problem for the whole team. After ten years our way of working has slowly become a daily routine. Not every day is an exciting adventure in the world of modular synth wonders, but on the other hand so many things are easier now.

Did you ever imagine that you would be at this point when you first met and were talking about modules together?

TM: It was really hard to imagine this.

ML: No, I'm a pessimist! When we started, we just made fifty units and that was a big number for us. It was normal in Eurorack at the time because most of the modules were made by someone just sitting around at home and soldering the modules on demand. We had shown the design on Mod Wiggler and elsewhere and we got an email from Analogue Haven saying, "I want to buy 300 of those." We were like, "That's crazy, but let's do it!"

I'm curious about the creative partnership between the two of you, if either of you had any kind of relationship like this before where you relied on another person to create in either the graphic design or maybe some kind of previous work?

ML: Probably, no. We have some meeting points in our lives, but we came from different backgrounds. Of course, we still argue a lot, but it's creative and brings something to each other. I think it's kind of a unity of opposites sometimes.

TM: As long as we can talk about everything together, it is great, and will only grow. There are some people that I have known for a long time, but this is really something different.

ML: We are maybe not talking to each other as much as we used to, but we still know each other well.

No more late-night two-hour phone calls?

TM: We just don't need to talk about this as much anymore because we have the same life almost. We spend most of the day together in our office.

ML: We needed to learn how to deal with each other because pretty much every person in the core of our company is totally different.

TM: We're so different. We know each other and can think a different way.

Would you say there's order in the chaos? [laughs]

TM: No, it's just pure chaos!

ML: We still operate as it was from the

start, and we want to grow a bit to step out of Eurorack with pedals, desktops, and [other] synthesizers. We don't want to kill the joy of running the company. Of course it's a hectic, chaotic, and sometimes a really stressful thing, but still we have fun doing this.

How does working on modules every day affect your artistic output?

ML: Tomek is releasing a lot of records; I'm kind of jealous. I don't have much stamina to do it anymore and I'm not so prolific, but sometimes I want to start a band again.

TM: I need to do music and I have to record an album every now and then. It's like a clock for me, a kind of a mechanism that divides my life into stages. Making modules affects my music, especially as I like to use our modules, and I wouldn't have such a huge system without Xaoc! Maybe it wouldn't be so modular oriented either.

ML: For me, it's like a kind of meditation. I don't actually have any need to release anything, as there's a ton of crap out already. For the first time in my life I actually own a decent home studio and a lot of equipment. I liked to sit around just noodling, but now it rather bores me to death. To clear my mind I ride my MTB to the forest.

TM: This is a good attitude, to not have this need to show someone.

ML: Well, I'm a bit of a coward and I think the opinion of others—or the lack of opinion—will somehow be hard to experience, but to be honest, I don't care anymore. I release music for my friends, paying for the vinyl pressing and this and that. I would love to release my own music, but it means that I will need to finish something.

TM: You are a bit of a control freak.

ML: Yes. That's the problem.

Would you say that even in terms of the business, the interaction between you two is somehow balanced? One is a self-characterized pessimist and a perfectionist, but it's countered with....

TM: I'm also a pessimist [laughs], but I call

myself a realist! It's like with the graphic design for our stuff, we started doing this together and Marcin is doing this really great, so usually it is just better when I am not distracting him and I can focus on other parts of the designing process.

ML: It's the process. Sometimes I'm stuck and Tomek has ideas. It's really good because I might be designing a panel for a month or something; it needs to be perfect! On the serious side, however, it pays off big time.

TM: A lot of time, I just have the idea that it's the time to finish the designing; it's enough, it's done. The graphics can get lost sometimes in a bunch of cables and things, but there is also the placement of the knobs, the size of it, which parameters you will do on the slider, which one on this big knob, the smaller knob. These are puzzles that you can improve on endlessly.

ML: Sometimes it's extremely hard to design it to be aesthetic and preserve the performability.

TM: This is really the problem of industrial design: that you have this PCB and there are some elements, some knobs that need to be close to some chip, for example, and you should leave this in some totally strange place, and it really doesn't fit any aesthetic project.

A lot of your designs seem to be very symmetrically minded.

ML: Actually, I hate that.

Really? You hate it? I find peace in symmetry.

ML: Our engineer makes fun of me because I'm making everything symmetrical, but for some reason in most cases, it's the only way that works. On our Belgrad filter there is a thing that looks like a bowtie or something and I noticed that two months after releasing the module.

I always thought Belgrad was so cool looking. In terms of names, you usually have a year like 1976 or 1969 and some city name. What's the idea behind that?

ML: Our "ideology" from the aesthetic side of things is that we are hinting to the communist era of consumer electronics—

what we remember from our childhood—but with a kind of retro look. We use only dates and names of cities from the times of the communist rule from the Eastern Bloc.

TM: In communist Poland, the radios and TVs were sometimes named after rivers, cities, and so it seemed a really good idea to name modules in the same manner.

You talked about stepping out of Eurorack a bit. Do you have plans to release anything different sometime soon?

ML: We have tons of ideas of different kinds, from really basic small instruments to advanced bigger ones, and also for pedals. Not necessary guitar pedals, but more targeted at the experimental crowd. I'm a guitarist, but I don't use pedals, but for electronic music, I love some crazy pedals. We want to develop some more things like that and we even thought about some acoustic things, new approaches to really old studio equipment like plate reverbs.

TM: We have some ideas that are really hard to put into a module. We're thinking of really different things and not just strictly electronic. It's fun to design something different.

xaocdevices.com



SYNTH HACKS #10

CASE THE MUSIC

BY DAVID BATTINO
BATMOSPHERE.COM

Live performance is back at last, which means it's a great time to grab a case or gig bag for your gear. Thinking outside the [cardboard] box and costly official cases can give you safety and style at an amazing price.



Fig. 2

This zippered headphone case has rigid sides and a plush lining that grips Velcro well. I added foam for extra protection for the Lemondrop screen.

Surplus stores and blowout sales are a great source for pouches with personality [see Figure 1]. I carry my Korg Kaossilator in a dollar-store CD wallet—I knew it would be a perfect match as soon as I saw the yellow color. A Casio electronic sax bag from the freebie bin holds my shakuhachi. A Wii Fit bag [40 cents!] covers my Arturia KeyStep, and a beer koozie protects my



Fig. 3

At 8.5 x 5 x 2.5 inches, this Vaultz pencil box fits Volcas like a glove—a glove with a flaming 3D monster eye. The Vaultz series starts at \$10 online.



Fig. 1

Bargain-bin bags make quick cases. Total cost of these four: \$1.40.

MidiPlus Miniengine, a nasty-sounding little GM module with a built-in battery and USB-MIDI input.

Figure 2 shows a compact rig I built to play on the bus. The soft-shell case from some broken headphones holds my 1010music Lemondrop, Korg Sound on Sound multitrack recorder, and a USB battery pack. Right-angle audio cables, including a colorful MyVolts CandyCord, make it all fit. I can play the Lemondrop from its touchscreen and record infinite overdubs on the SOS.

When I spotted the pencil case in Figure 3 at a back-to-school sale, I knew I needed its 3D lenticular dragon eye in my life. I'd planned to fill the box with DIY electronics, but discovered that adding two slices of foam made it an astonishingly snug fit for my Korg Volca Sample2. It's built like a mini road case to boot.

The Arturia KeyStep 37 [Figure 4] is a wonderful keyboard with a hard-to-cover skinny shape. Pondering what other gear is long and narrow, I hit on padded tripod cases. This one—\$15 on Amazon—is beautifully made with a sturdy zipper and an internal pocket for cables. Again, it fits perfectly. A case designed for the KeyStep would cost at least 3X more.

Sourcing your own cases offers benefits beyond price and personality. I've read that canny photographers pack their expensive camera gear in diaper bags — padded, leakproof, and the last thing a thief would want to steal.



Fig. 4

Armed with the dimensions of my Arturia KeyStep 37, I sought out long, skinny bags. This 24-inch padded tripod sack by Gazechimp [!] was just right.

SHOP TALK

SIGNAL SOUNDS

175 HOWARDS STREET

GLASGOW, SCOTLAND

WWW.SIGNALSOUNDS.COM

OWNERS - JASON BRUNTON & ALEKS JURCZEK

DATE SHOP OPENED - WEB STORE: 01/08/2016 PHYSICAL STORE: 01/05/2019

SPECIALIZATIONS - EURORACK, MOOG, BUCHLA & SERGE MODULAR SYNTHS, DESKTOP AND KEYBOARD
SYNTHS, AND A CURATED PICK OF MORE GENERAL MUSIC TECHNOLOGY

Waveform: Why did you open your shop?

Jason Brunton: It's a long, long story but the short version is that I had more than twenty five years of experience in making music, running a record label, collecting synths, and working in music retail. The opportunity came up for me to bring all of these separate strands together into one thing and to make a space that celebrated and explored the history and culture of electronic music as well as the hardware.

What were you doing before you opened your shop?

I was one of the owners of another music store here in Glasgow, Rubadub.

What is your idea of perfect happiness?

In work, it's when you realize that you've set off a spark of an idea in somebody's head or you've somehow got across a complex idea in a way that inspires that person to do something they've always wanted to do. Also, bringing the disparate strands of Glasgow's music community together.

What is your greatest extravagance?

Most of the synths and music gear I buy are not in "museum condition," but I did buy a beautifully restored E-Mu SP-12 Turbo two days before they announced they were re-issuing the SP-1200, so that was a bit of an extravagance.

How many employees do you have?

Three working in retail, one in dispatch, and one in wholesale.

What's the most challenging aspect of running your shop?

Being head of Marketing, Sales, Inventory Management, Purchasing, HR, Accounts, Cleaning, Website Development, and Retail all at the same time. Brexit and Covid didn't help much over the last few years either. :)

Favorite synth?

Roland Jupiter 6. It's part emotional attachment and part that it's just a brilliant instrument.

Is there anything unusual about the shop's history?

We are currently in a beautiful old building owned by an old family of tailors called Slaters, and are directly across the road from The Scotia, Glasgow's oldest pub [1792] where Billy Connolly used to drink in the 70s and 80s.

Which historical figure do you most identify with?

You know that dude in Greek mythology who had to roll a big massive boulder up a hill every day and then do the same thing the next day forever and ever? Him.

What are your plans for the future of the shop?

No moving around, just make what we have here better and more enjoyable to work and play in.

Who are your favorite writers?

JG Ballard, Robert Pirsig, Philip K Dick

Do you have musical projects that you're involved in?

Family and business stuff have made music making impossible for the last few years, but I'm hoping to get back into it and restart our record label, Iridite.

Dream synth setup?

I'm building it every day, it never ends.

Favorite synth artist?

Juan Atkins/Model 500

Which talent would you most like to have?

Better time management.

What's your favorite part about owning your shop?

I always wanted a space for synth weirdos to hang out. I'm a synth weirdo, so I built that place. Also, talking to other musicians from almost every country in the world and seeing what we have in common or learning about how things work in their local scene is fascinating.

Are there any local activities your shop hosts/organizes/is a part of?

There are some regular synth events in Glasgow and Edinburgh that we help out with on occasion, and we have a schedule of performance and educational events planned for our new showroom and events space in 2023.

Anything else you'd like to say? Now is the time.

Thanks to everyone who's been involved with the Signal Sounds story so far, on both sides of the fence.

Upgrade the nerve center of your studio with a unique piece from the maker of the world's finest handmade studio cases, paired with Eskatonic Modular hardware and power.



Eric Needham
WOODWORKS

Inspiration is in our grain.

needhamwoodworks.com

eskatonicmodular.com



