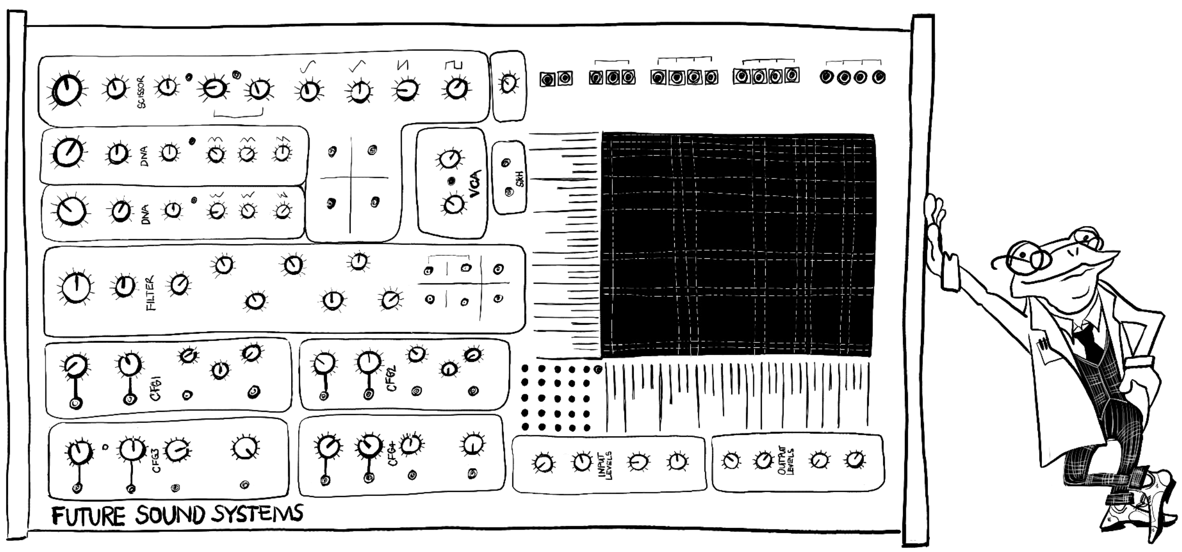

FUTURE SOUND SYSTEMS CRIC

Electronic Music Synthesiser **User Manual**

November 2024

V1.0

www.futuresoundsystems.co.uk

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Foreword

Thank you for purchasing the Future Sound Systems Cric Electronic Music Synthesiser.

This instrument is the culmination of over a decade's worth of tinkering, testing, exploration of and curiosity in all aspects of analogue sound synthesis. We hope to have brought together the most pertinent, useful and unusual tools, in a way which allows your creative expression to flourish.

We have also tried to present something novel to a well-explored area of music making technology. We hope that you enjoy our take, and that this instrument gives you many moments of joy and satisfaction.

If you would like to get in touch with us for any reason, our latest contact information can be found on our website: www.futuresoundsystems.co.uk

At time of writing our address is:

Future Sound Systems, Princess House, Princess Street, Bristol, BS2 0RR

Safety Information

Disclaimer: Future Sound Systems have taken all possible steps to ensure that the information given here is both correct and complete. In no event can Future Sound Systems accept any liability or responsibility for any loss or damage to the owner of the equipment, any third party, or any equipment which may result from use of this manual or the equipment which it describes. The information provided in this document may be modified at any time without prior warning. Specifications and appearance may differ from those listed and illustrated.

Instructions: Read, keep and follow these instructions, and heed any warnings. Do not use this apparatus with water. Clean the apparatus only with a dry cloth. Do not install the apparatus near any heat sources such as radiators, heat registers or grilles, stoves, or other appliances (including amplifiers) that produce heat. Do not defeat the safety purpose of the polarised or grounding-type plug. A polarised plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus. Only use attachments/accessories specified by Future Sound Systems. If and when a cart is used to move or store this apparatus, use caution when moving the cart/apparatus combination to avoid injury from tip-over. Unplug this apparatus during lightning storms or when unused for long periods of time. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped. No naked flames, such as lighted candles, should be placed on or in the surroundings of the apparatus.

Warning: Excessive sound pressure levels from earphones and headphones can cause hearing damage and/or loss.

Caution: To reduce the risk of electric shock, do not remove cover or back. No user-servicable parts inside. Refer servicing to qualified personnel.

Warning: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

Caution: The normal operation of this product may be affected by a strong electrostatic discharge (ESD). In the event of this happening, please reset the unit by removing and then replugging the DC power cable. Normal operation should then return.

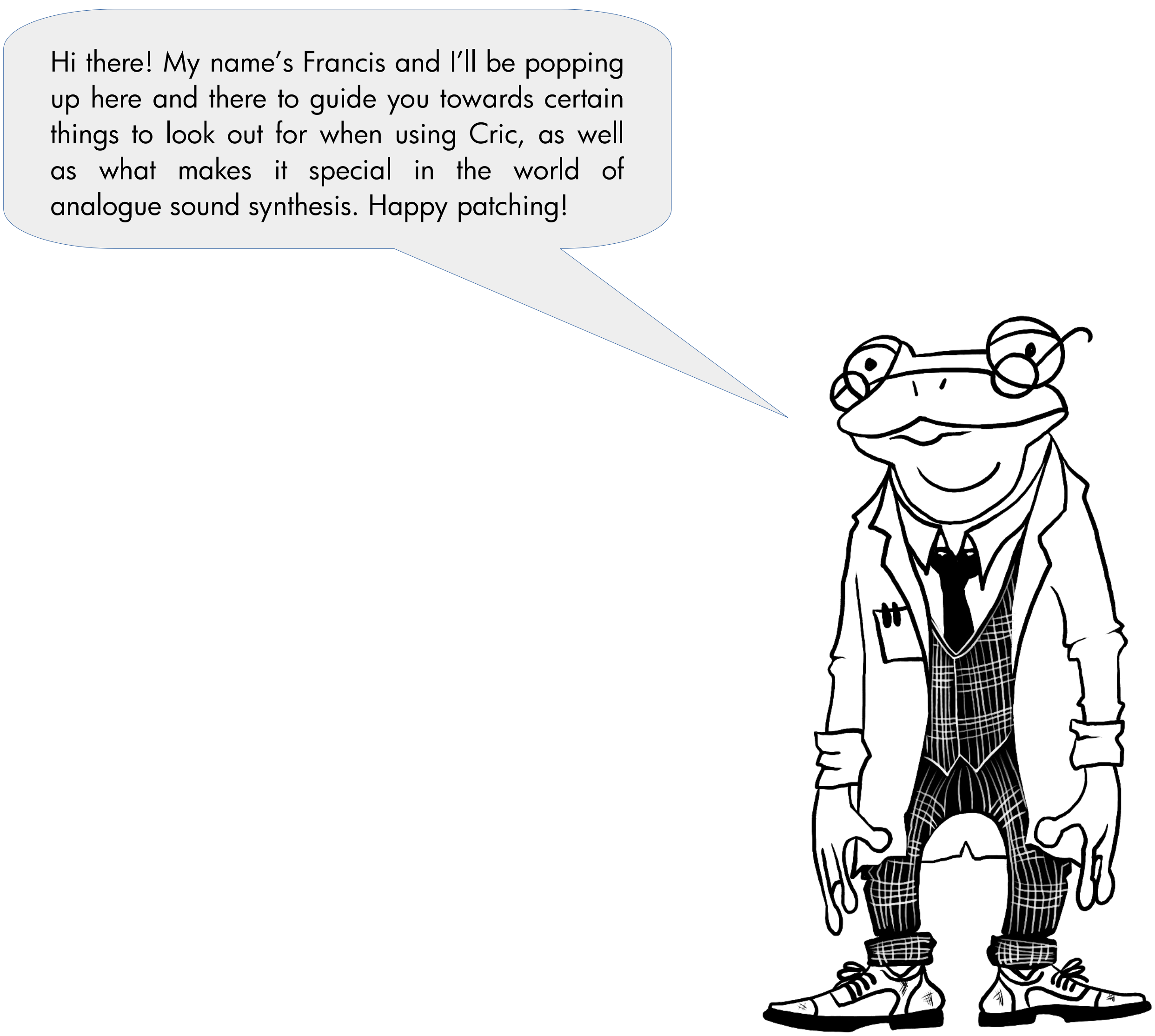
RoHS Notice: This apparatus conforms, where applicable, to the European Union's Directive 2002/95/EC on Restrictions of Hazardous Substances (RoHS) as well as the following sections of California law which refer to RoHS, namely sections 25214.10, 25214.10.2, and 58012, Health and Safety Code; Section 42475.2, Public Resources Code.

Introduction

Cric is an analogue patchable synthesiser, designed to showcase our approach and attitude towards subtractive sound synthesis. It is not a clone or derivative of a pre-existing musical instrument, nor is it simply our Eurorack modules cased up in a box.

Whilst some of the Cric's functionality descends directly from our experience in designing modular synthesiser components, it has been designed as a fully fledged, standalone instrument, which can easily be introduced into an existing electronic music studio.

As well as a functional user manual, we hope that this document will lead you to discover new ideas and opportunities within sound synthesis as a whole. Cric was designed this way, so it only makes sense that the manual should be written in a similar vein.

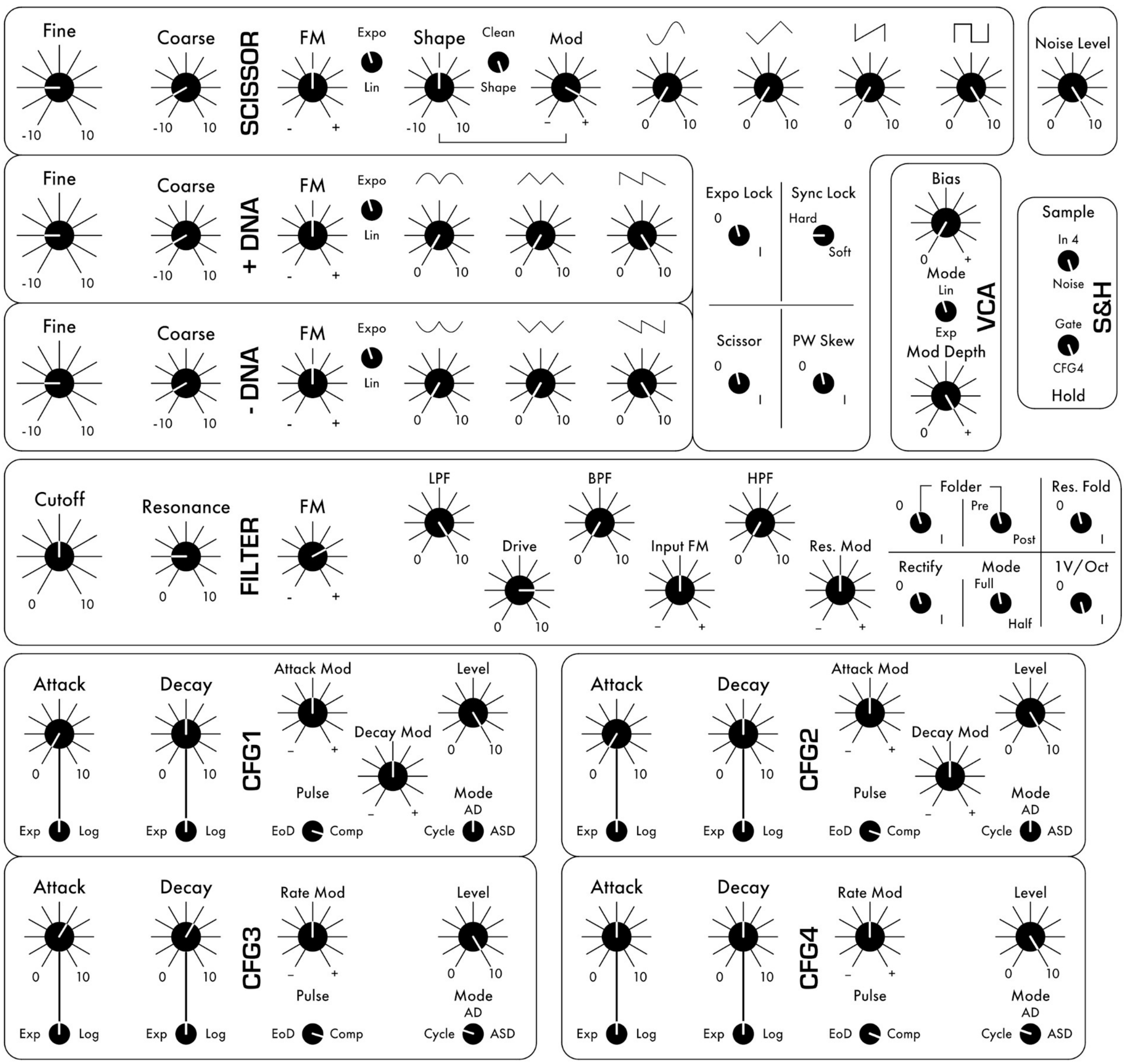


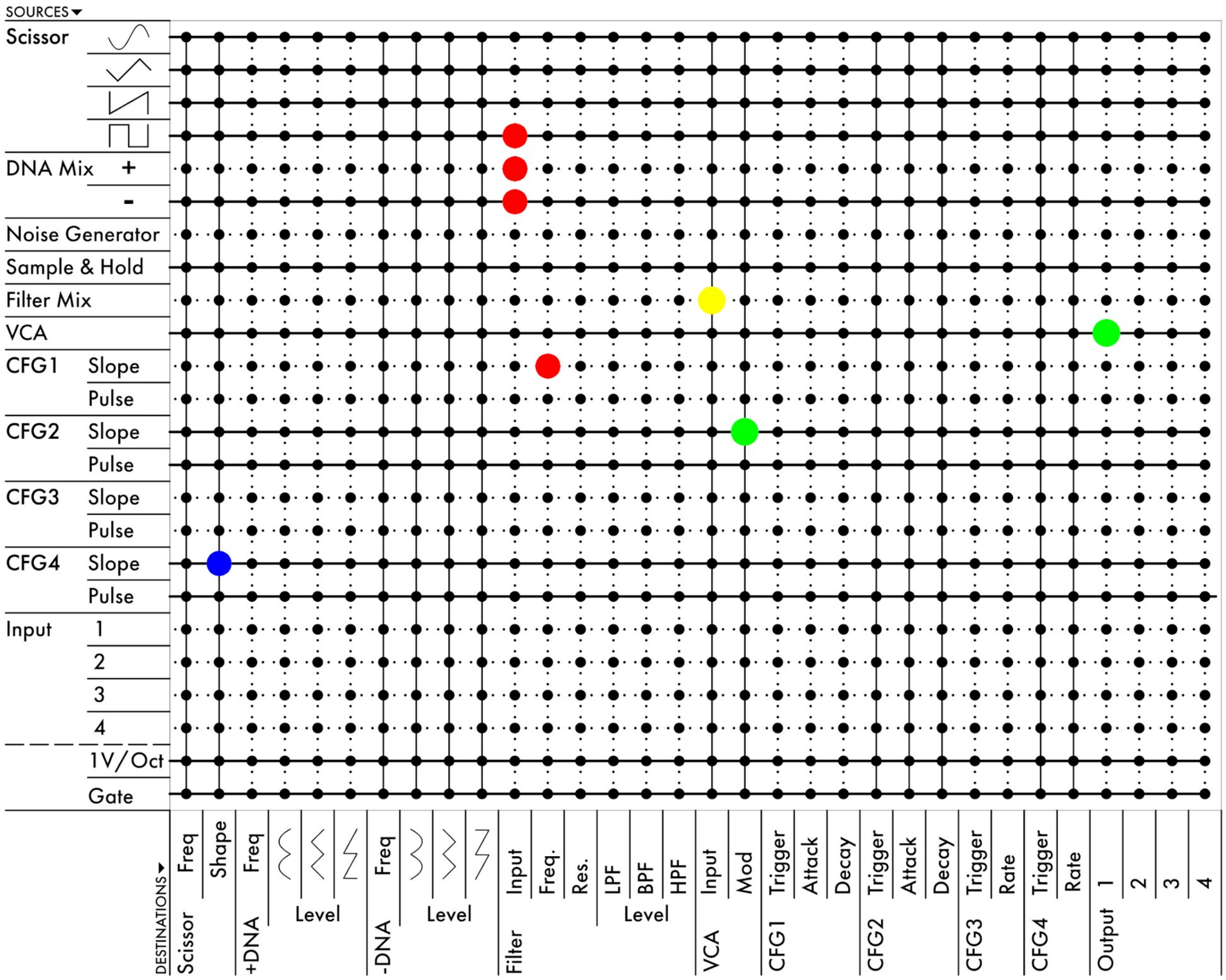
Quick Start

As a first patch, the below settings and matrix connections will produce a three-VCO-unison style configuration, using the low-pass filter in a clean mode to give a somewhat classic sound. Note that CFG1 is set as a filter envelope and CFG2 opens and closes the VCA. CFG4, meanwhile, is set to cycle, acting as a triangular LFO on the Scissor oscillator’s shape (pulsewidth, in this patch).

Connect a 1V/Oct source to the global 1V/Oct input, and a gate source to the global Gate input. Note that you do not need to route these inputs to destinations on the matrix - these sources are presented on the matrix for modulating other destinations.

Please note that the pins used can be of any colour. Tune the oscillators and start playing!





Why not try adding further variation to this patch by routing the Sample & Hold source to the Filter Frequency destination on the matrix? Flip the S&H Hold switch to Gate, and now the Filter's cut-off frequency will be randomly shifted on each key press. The range of this modulation can be controlled by adjusting the Noise Level.

There's no need to stop there, either:

CFG3 is completely free.

The Decay (and Attack) times of CFG1 and 2 can be modulated for variable note "shapes".

Why not use the Filter state VCAs and free up the independent VCA? Re-route CFG2's Slope source to the LPF Level and turn the LPF control down. The independent VCA could now be used to modulate the level of a signal according to an external source, for example, such as keyboard velocity. In this case, patch the keyboard velocity CV source to an external input - Input 3 is a good one - route Input 3 to the VCA Mod destination, route CFG2's Slope to the VCA Input destination, then use the VCA source as a velocity-controlled slope from CFG2. In this patch, be sure to reroute the Filter Mix to Output 1.

Elements of the Instrument

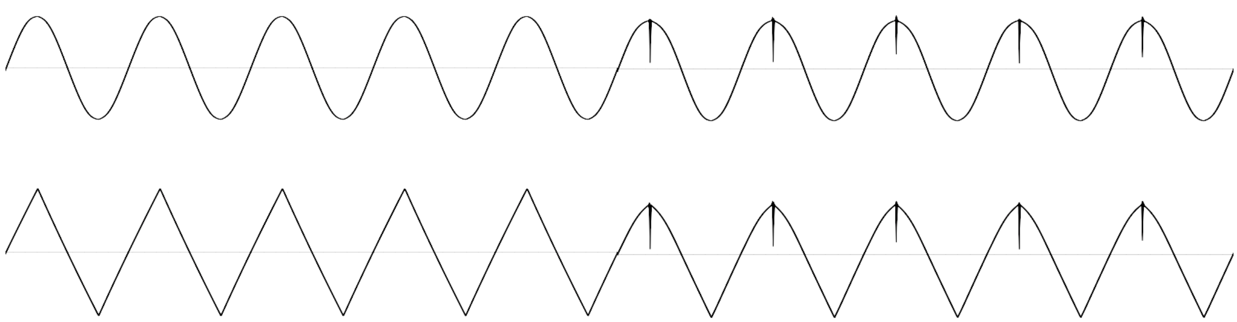
Oscillators

Cric features three voltage-controlled oscillators (*VCO*) and a white noise source as its primary sound generators. Each of the three VCOs is slightly different, for reasons that will be explained below, and are referred to as the Scissor, Positive DNA (*+DNA*) and Negative DNA (*-DNA*). The assemblage is derived from our Recombination Engine concept, where the three VCOs can be used as individual, discrete tone sources, or as a system for generating unusual waveshapes and harmonic structures.

Scissor

Let’s begin with the Scissor oscillator. This is the more traditional of the three oscillators, as all of its waveforms are bipolar in output, meaning that they will oscillate between positive and negative voltage in a single oscillation. The Scissor oscillator outputs four waveshapes - sine, triangle, sawtooth and pulse. Each of these waveshapes has its own output source present on the pin matrix, as well as an attenuator which controls the level of the signal at the source.

The Scissor oscillator also features a Shape control, which varies the pulse-width (or duty cycle) of the pulse output, as well as the harmonic content of the sine and triangle outputs when the Shape switch is turned on. It’s worth noting that, when the Shape switch is turned to Clean, the sine and triangle waveshapes are kept as harmonically “pure” as possible. Turning the Shape switch on implements a “dirtier” triangle and sine waveshaper circuit, as found in our Cyclical Engine module, which gives these waveshapes a glitch at the peak of their waveforms. This sound is reminiscent of “classic” analogue oscillators where the waveshaping circuitry was less than perfect. A modulation destination for the Shape control is present on the matrix.



The sine and triangle traces on the left display the Scissor’s outputs in Clean mode, whilst those on the right display the outputs in Shape mode. Note the notches at the peaks of these waveforms.

DNA

The Positive DNA oscillator is rather different from the Scissor. Firstly, only positively-rectified-sine, triangle and sawtooth waveforms are produced by the +DNA VCO. Each of the three waveforms then pass through an exponential-law VCA, before being summed together at the DNA Mix source rows of the matrix. The VCA attributed to each waveform can be opened and closed by the control on the front panel, by the Scissor oscillator via the Scissor switch, and by modulation sources routed to the waveform level destination columns on the pin matrix.

The Negative DNA oscillator is almost identical to its Positive counterpart. However, the waveforms cycle between zero and a negative voltage per cycle.

Oscillator Modes

Expo Lock

This switch sends the exponential frequency bus of the Scissor oscillator to control the two DNA oscillators. In other words, the DNA oscillators will now track the pitch of the Scissor oscillator, sans any *linear* Frequency Modulation assigned to the Scissor oscillator.

With Expo Lock enabled, the two DNA oscillators will sound an octave above the Scissor oscillator when the Fine and Coarse frequency controls of the DNA oscillators are set to around 12 o'clock.

> Are your DNA oscillators tracking an external pitch controller strangely? It's likely that Expo Lock is enabled whilst all oscillators are under the control of the global 1V/Oct pitch input. In doing this, the pitch control is doubled up on the DNA oscillators (resulting in a 0.5V/Oct pitch law). Try routing the pitch controller to the Scissor frequency input instead.

Sync Lock

This switch routes pulse outputs of the Scissor oscillator to reset, or sync, the DNA oscillators. Note that the Positive DNA oscillator is reset on the positive-going edge of the Scissor's pulse, whilst the Negative DNA oscillator is reset on the negative-going edge. The timing relationship of the sync between the DNA oscillators can be adjusted using the Scissor's shape control (i.e. pulsewidth).

Note that three positions are available on the Sync Lock switch - hard, soft and off in the middle position. Hard sync forces the DNA oscillators to be reset to 0° of each waveform's cycle. Soft sync, meanwhile, will reverse the direction of the oscillator's triangle core, but only when activated in the last 180° of the waveform's cycle. For both the sinusoidal and triangular waveforms, the direction of the waveform does indeed appear to reverse direction around at the moment of sync. The sawtooth, meanwhile, is reset but only to an inverted amount of its then-current displacement from the midpoint of its cycle at the moment of sync. This results in a "rougher", more unstable sound than hard sync.

Scissor

The Scissor switch enables the wave-splicing technique as found on our Recombination Engine module. Here, pulse waves are sent to the amplitude-modulation buses of the DNA oscillators' VCAs. This results in the DNA waveforms being "turned on and off" by the Scissor pulse - the Positive DNA oscillator is switched on by the positive-going portion of the Scissor's pulse, whilst the Negative DNA oscillator is switched on by the negative-going portion.

With this switch enabled, the waveform levels of the DNA oscillators should be set to 12 o'clock for even wave-splicing. At maximum level, the waveforms are not modulated by the Scissor at all, but instead flow through the open VCAs connected to each waveform. At minimum level, the waveform is fully muted. Modulating the DNA waveform levels via the Matrix gives control over this range of wave-splicing.

With Expo Lock, Sync Lock and Scissor enabled, try setting a chosen waveform level of the two DNA oscillators to 12 o'clock. Now sum the two DNA Mix sources to a single output destination, and listen to this output. With the Fine and Coarse controls of the DNA oscillators also set to 12 o'clock, a bipolar version of the chosen waveform should be heard. This can then be altered, recombination style, by adjusting the frequency and levels of the DNA oscillators, as well as the shape of the Scissor oscillator.

PW Skew

This switch assigns the Shape modulation bus of the Scissor oscillator to the frequency of the Positive and Negative DNA oscillators. However, the bus is inverted going to the Negative DNA oscillator, so that frequency is skewed in an opposing manner between the two DNA oscillators. When the Shape control of the Scissor oscillator is turned towards the minimum, the positive portion of the Scissor's pulse wave's duty cycle is extended, and the negative portion is shortened. As the positive portion "grows", the frequency of the Positive DNA is increased whilst that of the Negative DNA is decreased. The opposite happens when the Shape control is turned towards the maximum.

Whilst this may not make much sense when the oscillators are working in "normal" modes, the PW Skew becomes an intriguing effect with Sync Lock and/or Scissor enabled. With the DNA oscillators synchronised to the Scissor and PW Skew enabled, modulating the Shape control produces an array of vocal and formant-type timbres when the two DNA oscillators are summed together. This is due to the harmonic structure of these tones now featuring two distinct peaks, the frequency of which change depending on the resultant DNA frequencies.

Filter

Cric's filter is an 18dB/octave state-variable filter based on our Timbral Sculptor design. Like the DNA oscillators, the low-pass, band-pass and high-pass states each feature their own exponential-law VCA, to control the mix of states present at the Filter Mix source. The level of each state can then be controlled from the front panel or modulated by patching signals into these destination channels.

Within the filter, there are several "nonlinear" circuits that can be inserted into the resonance chain to extend the palette of behaviours achievable by the filter. The first is a simple wavefolding circuit, based upon R. Lockhart Jr.'s transistorised design, which aggressively distorts the resonance network. This converts the Resonance level into more of a growl than a squeal. Use with caution.

The second nonlinear circuit is an active rectifier, which can be switched between full-wave and half-wave rectification. This has the effect of boosting the resonance, but can also drastically change the characteristics of the Lockhart wavefolder.

There is a second wavefolder present in the filter section, which can be placed in series either before or after the filter. This folder is more complex than the Lockhart circuit, and can fold incoming waveforms four times before "flattening out". The amount of folding is amplitude dependent, so is therefore controllable via the Drive control when set to pre-filter, and then by the overall level of the filter states when set to post-filter.

The Input FM control in the filter section allows for the cut-off frequency of the filter to be modulated by the audio present at the filter section's input (pre-wavefolder if applicable). This feature stems from the behaviour of certain analogue filters which are subtly frequency modulated by their signal inputs when driven relatively hard. In Cric's filter, this can be taken to the extreme, with full range frequency modulation available at either end of the Input FM attenuverter.

Cyclical Function Generators

Cric features four Cyclical Function Generators (CFGs) which are designed to carry out the synthesiser's modulation duties. Inspired by the "West Coast" function generator designs of the 1970s, each CFG features:

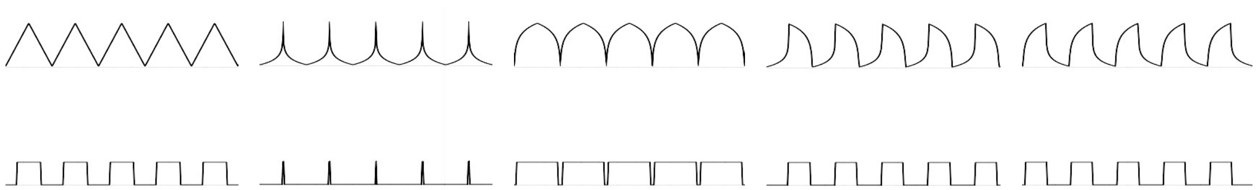
- an Attack and Decay stage
- different shape modes for the two stages (linear, exponential or logarithmic)
- modulation over slope time (either for each stage independently as per CFG 1 and 2, or globally as per CFG 3 and 4)
- a pulse output, switchable between an End of Decay pulse or a Comparator output which goes high when the CFG slope is above 50% of its total range
- a Level attenuator for each CFG's Slope output
- three modes of operation - cycling, attack/decay and attack/sustain/decay

The CFG has been designed to cover a wide time range for both attack and decay stages, with their minimum times resulting in an oscillation around 3.6kHz up to their maximum times of more than quarter of an hour (>5 minutes for attack, >11 minutes for decay) for a single cycle.

Unlike most traditional envelope generators, the CFGs will not retrigger when in their attack stage. Instead, the peak of the function must be reached before it can be retriggered, therefore meaning that the CFGs *will* retrigger in their decay stage. This means that a CFG can be used as a frequency divider, particularly if the Decay is set to zero, when triggered from a source with a set frequency.

To prevent a CFG from being (re)triggered by the global Gate input, plug a dummy jack or cable into the corresponding CFG Trigger input. This is most helpful when using a CFG for slow, cycling modulation.

Both Attack and Decay stages can have their shapes changed independently between linear, exponential or logarithmic slopes. The exponential and logarithmic laws are approximated, and were tuned in the design stage for an appropriate "feel" when it comes to synthesis and sound design. Some example slopes, as well as their corresponding Comp pulse outputs, can be seen below:



Linear A + D *Exp A + D* *Log A + D* *Exp A, Log D* *Log A, Exp D*

The Pulse source derived from each CFG can be switched between End of Decay (EoD) or Comp. In EoD mode, a brief trigger is sent as soon as the Decay stage has completed. This can be used to chain several CFGs together in a sequential fashion. Meanwhile, in Comp mode, a comparator sends a pulse which is high as long as the Slope is above the midpoint of its range, and low when it is beneath this midpoint. With Attack and Decay set to produce a perfectly triangular slope, a 50:50 square wave will be presented in Comp mode.

The modulation attenuverters follow the law that, for a positive voltage source at the corresponding destination, negative settings (anti-clockwise from 12 o'clock) reduce the stage times and positive settings (clockwise from 12 o'clock) extend the stage times. For CFG 3 and 4, the Rate destination sends modulation to both Attack and Decay controls simultaneously.

Sample and Hold

Cric features a sample and hold, the output of which can be found as a source in the routing matrix. Both the sample and hold signals are assigned via the two switches in the S&H section. The sample signal can be switched between noise (as is typical in many synthesisers) or Input 4, allowing the user to patch any signal into the S&H. The same is true of the hold signal also, which is switchable between the Pulse output of CFG4, or the global Gate input.

The Hold circuitry operates well into the audio range so that the S&H can be used for downsampling effects. CFG4's shortest cycle can trigger the S&H at 3.6kHz, but a higher frequency, positive-going source can be routed to the Gate input with a minijack patch cable. Just be sure to plug dummy cables into the CFG Trigger inputs!

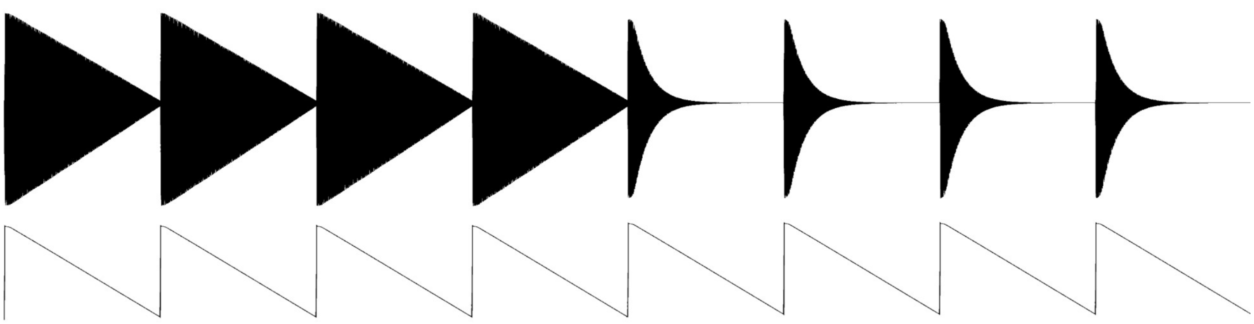
VCA

Cric's stand-alone voltage-controlled amplifier (VCA) can be used for a multitude of different applications. It should be noted that, whilst there are exponential-law VCAs attached to the two DNA oscillators and the Filter section, it can still be useful to use this stand-alone VCA as a "master" VCA at the end of a patch, particularly if mimicking the behaviour of standard subtractive synthesiser structures.

The VCA is also DC-coupled, meaning that any control signals can be used as a signal input to the VCA. This is very useful when the depth of a modulation source needs to be automated.

The VCA Bias control provides a fixed level at the VCA control bus. Without any incoming modulation, this acts as a level or volume control. The Mod Depth control provides an attenuator for the modulation routed to the VCA Mod destination bus on the matrix.

The control law of the VCA can be switched between Linear and Exponential modes. This alters the relationship between the incoming control and the loudness of the signal through the VCA. The difference between Linear and Exponential modes is perhaps most easily understood by observing the figure below.



The top trace displays the VCA's audio output, whilst the bottom shows the VCA's control bus. The first four ramps have the VCA set to Linear mode, whilst the last four have the VCA set to Exponential mode.

The VCA can be used as a gain stage. This is achieved by routing the VCA's output source back into its own input destination. This sets up a feedback loop, adding gain to the VCA circuit. Beware that too much gain will send the VCA's output to either the positive or negative rail, thus "swamping" the output. Plenty of overdrive and saturation effects can be achieved before this occurs, however.

Inputs and Outputs

Cric has 4 input and 4 output buses each with attenuator controls below the Matrix. These are available on the rear panel through ¼” unbalanced TS jacks for the inputs and ¼” balanced TRS jacks for the outputs, or on the front panel via ⅛” unbalanced TS minijacks for easy connection to Eurorack gear. The rear mounted, ¼” jack line outputs are electronically balanced by THAT line driver integrated circuits.

Please note that the input minijacks are normalled to the ¼” jack inputs. Therefore, plugging a minijack into an input will override the connection made on the rear of the unit via the corresponding ¼” input.

All minijacks are unbalanced and the Output minijacks are connected to the Output destinations from the pin matrix before the balancing circuits. Therefore, please expect a possible, brief interruption of signal when connecting and disconnecting jacks from the ⅛” outputs whilst listening to the ¼” balanced outputs.

By default, the inputs and outputs are not connected to any other element of Cric, so in order to get any signal in or out of the instrument you need to route signals from or to them using the Matrix.

Microphone Input

The XLR microphone input is normalled to Input 1 via the ¼” jack on the rear panel of Cric. The microphone input features a low noise, low distortion THAT microphone amplifier with a maximum gain of 60dB. The minimum gain is 12dB. The gain control is on the rear of the instrument.

When a jack is connected to either the ¼” TS jack or minijack for input 1, the XLR is disconnected and therefore no longer available. You can either use Input 1 as a microphone input *or* a line level input via a jack, not both.

Headphone Output

The headphone output is hardwired to Output 1. This can be used for listening purposes, i.e. listening to Cric without the need for monitor speakers, or even for cueing signals (such as external signals or internal patches) before adding them to a patch.

Acknowledgements

Many thanks to Signal Sounds for their support, guidance and distribution through the design and release of Cric.

The excellent illustrations you have seen in this user manual are by Ruth Ingamells. You can find more of her work via @ruth_i_art and www.ruthiart.com.

Housing design and fabrication is carried out by Grawart of Lublin, Poland. Cric's endcheeks are fabricated by Mirrl Ltd of Glasgow, Scotland.

FSS is eternally grateful for the pioneering work of designers and brands such as Robert A. Moog; Donald Buchla (and associates); Peter Zinovieff, Tristram Cary, David Cockerell and alumni at EMS; Alan R. Pearlman and alumni at ARP; Serge Tcherepnin, Korg Inc., Dave Rossum, Neil Johnson, Sound Semiconductor Inc., Ken Stone, Ray Wilson and many others. Cric, like many other products on the market, would not exist without the work from those aforementioned.

We would also like to extend our gratitude to our collaborators, colleagues and friends who have shaped Cric along its design journey. They include Roy Gwinn, Chris Carter, Daniel Miller, Sam Granger at EMC Testing Services Ltd., Luke Knott, Neil Arthur, Paul Whittington, Russell Haswell and Nik Void.

The design and assembly processes of Cric have imbibed the works of The Conet Project, Battery Operated Orchestra, Page 94, glues, Sluta Leta, Autechre, Nancy Drone, Why We Bleep, Gary Numan, Severed Heads, Adam Curtis, Nine Inch Nails, Gang of Four, Farmers Manual, Tom Ellard, Adult., AFX, Nik Void, Joni Mitchell, Bob Dylan, David Bowie, Mission of Burma, Pan Sonic, to be continued…