Cairn Zodiac-6

– Modulation is free!

VSTi Software Synthesizer

User Manual

v1.0

Welcome!

The Cairn Zodiac-6 is a fairly traditional subtractive, polyphonic virtual analog synthesizer with some additional gadgets like frequency and ring modulation. It is constructed using Jeff McClintock's SynthEdit modular synth-building kit, with some additional modules developed by David Haupt.

"Do we really need yet another such synthesizer?" You may well ask! But look at it this way:

- It's free.

- You never know, perhaps you'll fall in love with one of the presets.

- It has an unusually straight-forward yet flexible approach to modulation control, and is particularly well suited for keyboard controllers sporting Channel Aftertouch.

- Due to the classic layout, it's a perfect tool for newcomers to learn basic subtractive synthesis without quickly getting limited by a lack of programming options.
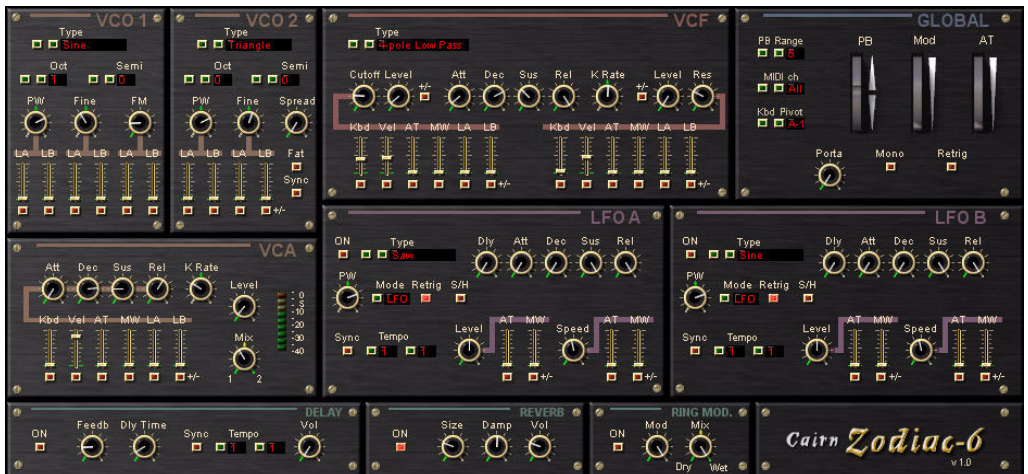
Features

Global

- Polyphonic synthesizer - 6 voices
- Mono / Poly mode switch
- Portamento and pitch bend controls
- Retrigger mode switch
- MIDI receive channel control (1-16 or ALL)

2 LFOs

- Can also serve as noise generators or spare monophonic envelopes
- On / Off switch
- Saw / Ramp / Tri / Sin / PWM / White Noise / Pink Noise Waveforms
- Pulse width control
- LFO DADSR envelope (Delay/Attack/Decay/Sustain/Release)
- Sample&Hold mode
- Manual or tempo synced frequency
- LFO wave – free running or re-triggered at envelope start
- Amplitude (Level) and frequency (Speed) controls, with modulation possible by Modwheel and Channel Aftertouch

2 VCOs

- Saw / Ramp / Tri / Sin / Pulse / White Noise / Pink Noise waveforms
- Pitch adjustable - +/- 2 octaves plus fine tune
- Pulse width, pitch and FM modulation possible by LFOs
- VCO 1 can modulate frequency of VCO 2
- VCO 2 can be synced to VCO 1
- VCO 2 "Fat mode" = a total of 3+1 oscillators / voice
- Ring Modulation

1 VCA

- VCA ADSR Envelope with keyboard rate scaling
- Overall level and VCO1 / VCO2 mix controls
- Overall level modulation possible by Modwheel / Channel Aftertouch / Velocity / Keyboard scaling / LFOs

1 VCF

- Filter type options: 2-pole Lowpass / 4-pole Lowpass / 2-pole Bandpass / 4-pole Bandpass / 1-pole Highpass
- Cutoff / Resonance ADSR Envelope with keyboard rate scaling and overall level control
- Cutoff modulation possible by Modwheel / Channel Aftertouch / Velocity / Keyboard scaling / LFOs
- Resonance modulation possible by Modwheel / Channel Aftertouch / Velocity / Keyboard scaling / LFOs

On-Board Effects

- Delay (manual tempo or host synced)
- Reverb

The User Interface

Knobs

You can determine how each knob works by looking at the coloured notches on the knob's scale:

Anti-clockwise stop: 0%
Clockwise stop: +100%

12 o'clock: 0%
Clockwise stop: + 100%
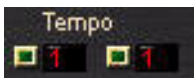Anti-clockwise stop: - 100%

12 o'clock: 50% 1, 50% 2
Fully clockwise: 0% 1, 100% 2
Fully anti-clockwise: 100%1, 0% 2

Buttons

There are three types of button controls:

Down/Up Selector: Pushing the buttons scrolls through the list of possible values for the display. Left button=down, right button=up.

Cycle selector: Pushing the button cycles through the list of possible values for the display.

Toggle button: Pushing the button toggles it between the on and off states. When the red LED lights, the function is activated.

Modulator Controls

It is mainly these gadgets that set the Zodic-6 apart from other synths of its kind, visually as well as functionally: The **Modulator Controls**. You may think of them as mixer faders that control the amount of modulation provided by a certain modulation source to a certain synthesizer function. They all look and work the same. Here are the six Modulator Controls that affect the Pulse Width, pitch tuning and frequency modulation of VCO 1:

Note the coloured bands going from the synthesizer controls to the Modulator Control labels – these show the synthesizer function affected by each modulator control.

The small toggle button beneath each Modulator Control is an **Inverter Button** – *not* an on/off button! When activated, the modulator signal is inverted so that it subtracts rather than adds to the signal. This means the zero position for a Modulator Control is *always* at the bottom, never mid-way through fader travel, making it much easier to adjust the amount of modulation.

The labels are abbreviated for obvious reasons, and here are the six types you will come across:

LA / LB

LFO A and LFO B. Whatever you have instructed LFO A and LFO B to do, they will do in proportion to the LA / LB Modulator Control settings.

Kbd

Keyboard follow modulation: The higher up the MIDI keyboard (or, the higher the note pitch played through the sequencer), the more modulation will be applied. Unless, of course, you activate the inverter button which makes the control do exactly the opposite...

The most common use is probably moving the filter cutoff frequency to a higher value for higher notes, but it can be lots of fun in other ways too!

The exact effect of the keyboard follow modulator also depends on the setting of the **Kbd Pivot** control (see the *"Globals"* chapter).

Vel

Keyboard velocity modulation: The faster (harder) you hit the keyboard keys, the greater the effect.

Note that even soft keystrokes will add to the modulation – meaning that in most cases, when you activate velocity modulation, you need to decrease the corresponding synthesizer control setting a little to maintain the overall balance.

AT

Channel aftertouch modulation: This feature usually requires access to a MIDI keyboard controller providing channel aftertouch data, but we have graciously provided you with an extra modwheel on the Zodiac-6 as an alternative means to provide the aftertouch signal (see the *"Globals"* chapter).

Channel aftertouch is often used for things like swelling the sound of wind and bowed instruments, or providing a manually controlled filter sweep for a pad sound.

MW

The Good Old Modulation Wheel, found on most synthesizers since the seventies.

Patch Management.

The Zodiac-6 memory bank has room for 128 patches. The first 65 are used for preset patches, and the remaining are set to an "Init" pattern useful when creating your own patches from scratch.

The Zodiac-6 has no built-in interface for saving, loading, copying, renaming, or moving patches around. How this is done will depend entirely on how your host program's VSTi implementation handles VST bank (.fxb) and program (.fxp) files.

The VCOs

The two VCOs are almost identical, apart from the fact that they play different roles when using Frequency Modulation or Oscillator Sync.

Type

Use the small buttons to the left of the LCD to change the type of waveform generated. The available types are:

- Sine
- Triangular
- Pulse (= variable width square wave)
- Saw
- Ramp (=inverted saw)
- White Noise
- Pink Noise

Oct / Semi

Use the small buttons to the left of the LCD to change the pitch of the sound in octaves and semitones, respectively.

PW

Adjusts the pulse width of the Pulse waveform (and doesn't work with anything else). Can be also be modulated by the LFOs.

Fine

Finetunes the pitch of the oscillator. Most often used to detune the two oscillators slightly for a fatter sound.

The pitch can also be modulated by the LFOs, but note that the effect of the LFOs is far greater than that of the Fine knob: You can reach up to an octave of pitch shift using LFO modulation. For subtler pitch-shifting you will probably need to decrease both the Modulator Control here *and* the Level control of the LFO itself.

FM

Lets the frequency of VCO 1 modulate the frequency of VCO 2, which can produce bell-like sounds as well as "digitally distorted" sounds. Can be also be modulated by the LFOs.

Fat / Spread

Want a fatter sound? Press the Fat button! This adds two exact copies of VCO 2 to the mix. The two copies can be detuned around the VCO 2 main frequency by means of the Spread knob.

Mainly intended for use with monophonic patches. In poly mode, this obviously produces as many as 12 extra oscillators, which adds up to a huge CPU load.

Sync

Syncs the waveform of VCO 2 to VCO 1, meaning the waveform of VCO 2 will start over whenever the waveform of VCO 1 does. The results vary wildly with the kind of waveforms used. Often used to produce a more "gnarly" sound. Note that the overall pitch in Sync mode is totally dependent on the VCO 1 settings.
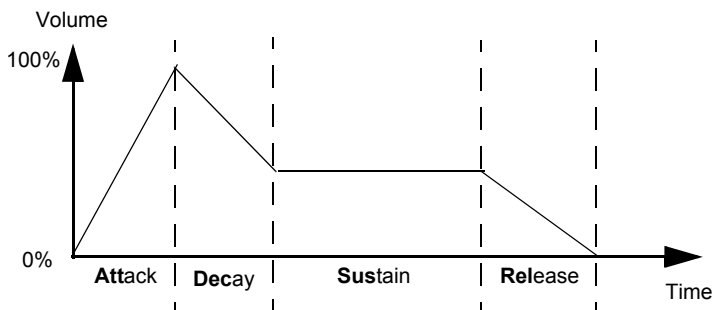
The VCA

The VCA determines the overall volume of the sound generated by the VCOs.

Att / Dec / Sus / Rel

These controls change the relative volume level over time:

Although not immediately obvious, note that the Sustain control is actually a volume control, whereas the other are time controls, deciding the time it takes for the volume to go from zero to max to sustain and back to zero again.

The same way of controlling the development of the sound over time is also used in the VCF and LFO sections of the synthesizer, and is commonly referred to as an **Envelope**.

K Rate

The Keyboard Rate control adjusts the overall time it takes to run though the envelope depending on keyboard (note) pitch. Turning the control anti-clockwise shortens the envelope the higher up on the keyboard you get. This mimics the behaviour of, for example, plucked string instruments where the decay times are shorter for the shorter strings.

The exact effect of the K Rate control also depends on the setting of the "Kbd Pivot" control (see the **Globals** chapter).

Level

Controls the overall output level from the VCOs to the VCF.

Mix

Controls the VCO 1 / VCO 2 signal mix. To produce "pure" FM and Oscillator Sync sounds, be sure to turn this knob all the way to the right (= VCO 2 output only), since the output of VCO 1 is then only used to modulate the waveform of VCO 2.

Output Level Meter

This meter actually shows the output level of the entire Zodiac-6 signal chain, but is placed here since the main controls for the volume level are the **Level** and **1<-->2** Mix knobs located here.

The VCF

The VCF shapes the sound by eliminating unwanted frequencies.

Type

- **Off** – if the VCF is not needed, set it to this position to save on CPU.
- **LP2** – a 2-pole lowpass filter (12dB / octave).
- **LP4** – a 4-pole lowpass filter (24dB / octave).
- **BP2** – a 2-pole bandpass filter (12 db / octave).
- **BP4** – a 4-pole bandpass filter (24 db / octave).
- **HP1** – a 1-pole highpass filter (6 dB / octave).

Note: The 4-pole filters consume significantly more CPU than the other types.

Cutoff

Controls the filter cutoff or band pass frequency. Can be modulated by all modulation sources and the VCF envelope (see below).

Res

Resonance: Controls the amount of emphasis given to the frequency just at the filter cutoff point. Can be modulated by all modulation sources and the VCF envelope (see below).

Att / Dec / Sus / Rel / K Rate

Provides an envelope control for the cutoff and resonance.

A "working" envelope consumes CPU. If you don't need to use the envelope, set all its control knobs to the minimum position. Never set a longer release (Rel) than you actually need.

Level

The amount of influence on the Cutoff and Resonance is determined by the respective **Level** knobs. There is also an inverter button next to each level knob to invert the effects of the envelope.

The LFOs

Apart from performing traditional "LFO tasks", each LFO can also operate as a noise generator, or you can use just the envelope to control other things like VCO pitch.

The two LFOs are identical. Here, we only describe the controls of one of them :)

On switch

If you don't need an LFO, switch it off by deactivating the On switch. This saves CPU. For an LFO in use, the LED on this button should be lit.

Type

These are the LFO waveforms available:

- Sine
- Triangle
- Pulse (= variable width square wave)
- Saw
- Ramp (=inverted saw)
- White Noise – Converts the LFO into a White Noise generator
- Pink Noise – Converts the LFO into a Pink Noise generator

PW

Adjusts the pulse width of the Pulse waveform (and doesn't work with anything else).

Mode

The standard mode is **LFO**, which makes the LFO behave in the traditional way: The amplitude of the LFO wave is modulated by the LFO envelope.

The **ENV** mode is short for "just use the envelope": It sends a full-on signal to the envelope instead, which means the LFO envelope can be directly used to modulate things like the VCO pitch which has no envelope of its own. In this mode all LFO knobs and settings, apart from the envelope and level controls, become inactive.

Note: Keep in mind that unlike VCA and VCF envelopes, the LFO envelopes are monophonic. See Dly/Att/Dec/Sus/Rel below.

S/H

When used together with the White Noise waveform, activating the **S/H** (Sample and Hold) button makes the LFO output a random-level signal. The rate of change in the output signal is controlled by the Speed knob or the Tempo control (see below).

Retrig

When activated, the LFO will always start at the beginning of its waveform whenever the envelope is restarted (see Dly/Att/Dec/Sus/Rel below). Deactivate when you want the LFO to be "free running" in relation to the envelope.

Sync

When activated, this button disables the Speed control, and locks the LFO to the host tempo using the Tempo control (see below).

Tempo

Adjusts the tempo of the LFO operation based on the current host tempo. The the leftmost display controls the beat count, the rightmost is the note value.

Dly / Att / Dec / Sus / Rel

Provides an envelope for the LFO. Note the extra Dly (Delay) control, which adds an initial delay to the LFO envelope before the attack phase. This comes in handy when you don't want a string sound vibrato to start fading in right away, for example.

Unlike other envelopes that are triggered by each note played, the effect of the LFO needs to be synchronized over all voices to produced the desired result (for example when playing pads modulated by Sample & Hold). Therefore, they are "monophonic": Even with Retrig activated, the LFO envelope and waveform only restarts after a period of all voices in the off state.

Without the envelope in operation, the LFO will not produce any output at all. This means that if even you'd like to control the LFO modulation level manually, you should still set the envelop Sustain knob to maximum, then modify the LFO amplitude using the Level control and Level modulator controls. See below.

Note: A "working" envelope consumes CPU power. Never set a longer Release time than you actually need.

Level

This controls the overall LFO modulation level. Maximum LFO output may make the individual LFO Modulation Controls in other sections hard to fine-tune, so often you want to set the LFO output to a moderate value using this knob.

The level can be modulated using channel aftertouch and modwheel. To modulate the level entirely by the modwheel, set the Level knob to minimum and push up the Mod Modulation Control. (And you also need the LFO Sustain to be set as discussed above.)

Speed

Controls LFO speed. Can be modulated by channel aftertouch and modwheel. Only works when **Sync** is disabled.

Global

The Global controls have nothing to do with the sound generation, but how the synth is controlled.

PB Wheel

Click and drag with the mouse to input pitch bend controller data.

Mod Wheel

Click and drag with the mouse to input modwheel controller data.

AT Wheel

Click and drag with the mouse to input channel aftertouch controller data.

PB Range

Controls the pitch bend wheel range. Value is in semitones.

MIDI Ch

Controls the MIDI receive channel. When set to All, the Zodiac-6 will use all MIDI data received regardless of channel.

This is the only value that is not saved for each patch, but must always be changed manually.

Kbd Pivot

Determines the point at which the keyboard follow modulation and keyboard rate controls have zero influence. Lower notes will have negative influence, higher notes positive influence.
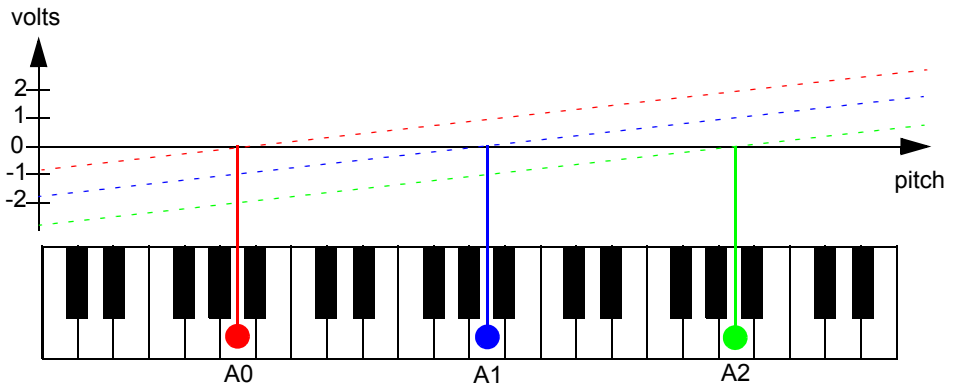
Porta

Determines the time it takes to "slide" between notes when playing legato. Mainly used in mono mode.

Mono Mode

When activated, only one note at a time can be played. Apart from saving vast amounts of CPU, this facilitates legato playing.

Retrig

Decides whether to restart the VCA envelope for each note played in mono mode (when playing legato).

Delay

On

Activate to enable the Delay effect.

Feedb

Controls the amount of delay feedback.

Dly Time

Sets the delay time when Sync is not activated.

Sync

When activated, this button disables the Dly Time control, and locks the delay to the host tempo using the Tempo control (see below).

Tempo

Adjusts the tempo of the LFO operation based on the current host tempo. The the leftmost display controls the beat count, the rightmost controls the note value.

Vol

Sets the delay effect volume. Since this is a send effect, it just adds the effect signal to the original signal which is always played at full volume.

This is quite a simple delay effect. You are advised to try using an external delay effects unit if the sound of this one is not to your liking.

Reverb

On

Activate to enable the Reverb effect.

Size

Sets the size of the reverberation space.

Damp

Controls how much the higher frequencies of the reverb should be dampened.

Vol

Sets the reverb effect volume. Since this is a send effect, it just adds the effect signal to the original signal which is always played at full volume.

This is quite a simple reverb effect. You are advised to try using an external reverb effects unit if the sound of this one is not to your liking.

Ring Modulator

This "effect" is actually embedded in the sound generation architecture and in some ways more akin to FM and oscillator sync, but shown here as a "separate effect" nonetheless. It multiplies part of the oscillator output signal with itself and can produce metallic and disharmonic sounds, especially when used with clean waveforms like sine and triangle.

On

Activate to enable the Ring Modulation effect.

Mod

The amount of ring modulation applied.

Mix

Unlike the other effects, the Ring Modulator will mix the levels of the original signal and the modulated signal. Fully clockwise means only the modulated signal will be heard. Fully anti-clockwise means only the clean signal will be heard (at which point you should deactivate the effect since you no longer use it!).

Preset Patches

The presets are sorted according to type or intended use:

BAS   Bass sounds
BEL   Bell-like sounds
BRS   Brass and woodwinds
KEY   Keyboard sounds
LED   Synth lead sounds
ORG   Organ sounds
PAD   Synth pad sounds
PRC   Percussion sounds
SEQ   Synth sounds for fast sequencing / arpeggiator use
STG   Bowed and plucked string sounds
SYN   Synth sounds

The signature in parenthesis denotes the patch programmer:

(PE)   **Per Thulin**
(SO)   **Sola**

Reading through the following descriptions of some of the patches may give you a few hints on how to use the features of the Zodiac-6.

BEL FM Belles

A pure FM bell sound. Can anyone say "DX"?

BRS Synth Brass

This patch shows how the LFO can be used as a noise generator. LFO A applies some white noise modulating the pitch of the oscillators, adding a disharmonic element to the brass sound in the attack phase.

KEY Electro Grand

A sound akin to the electric baby grand. Some FM as well as ring modulation is applied to add "two types of metallic" to the sound. The VCA uses keyboard rate scaling to shorten the release of high notes.

ORG Organ

A standard tonewheel organ sound based on pure sine waves. Some Frequency Modulation (FM) puts a little grit into the sound, making it slightly more Hammondesque.

A lot of keyboard follow modulation is applied to the VCF cutoff frequency. Without this, the sound would all but disappear in the upper octaves, and it would certainly not sound gritty enough.

Without modulation applied, most of the "drifting" is due to the detuned oscillators. The modwheel applies vibrato depth and also speeds up the vibrato (through the LFO A Level and Modwheel Modulator controls).

A bit of aftertouch modulation on the VCA envelope makes the aftertouch work as a swell pedal, increasing the volume when applied.

PAD PWM Organ Pad

This sound uses pulse width modulation to produce a "drifting" quality to the sound. LFO A is used to vary the pulse width i different directions for VCO 1 and VCO 2 (note the inverted effect of the LFO on VCO 2).

PAD Wait For It

This patch demonstrates the use of LFO B in "envelope" mode. After an initial delay, it sends the pitch of VCO 1 up an octave, and then lets it gradually fall back down, producing the whistling effect thanks to the filter resonance settings.

PRC Mallets

This is a xylorimba, or something. A minimal attack/decay period in the VCF envelope helps produce the initial mallet strike sound. Some FM helps make the patch sound just that little bit sharper and more brilliant.

PRC Reel Drums

This steel drum pad shows off the ringmod effect at its best. The only other thing needed to bring you straight to the Bahamas was offsetting one of the oscillators 7 semitones...!

STG Drifting Strings

A straight-forward string ensemble sound, using slightly detuned sawtooth waveforms. Modwheel opens the filter, aftertouch swells the sound. It also uses the VCO 2 "Fat" option to add 2 more oscillators to the sound.

SYN S/H Pipe

This one shows how to set up an LFO in Sample & Hold (S/H) mode. Some reverb is added to emphasize the "clicks" produced by the radically changing LFO level affecting the filter – This pipe is leaking, and it's dripping something onto the concrete floor! Let's hope it's water...

SYN Cygnus

This patch toys with the filter resonance, keeping the filter just on the border of self oscillation. (If you want to make the bird scream, just push the modwheel a bit for more LFO.)

Note that a bit of negative keyboard follow is applied to the filter resonance, just to counterbalance the resonance settings for high notes.

SYN Manual Sync

With both LFOs working at different speeds, some interesting rhythmic effects can be achieved.

SYN Res Pulse

A quite unusual way of using the LFO envelope. This patch clearly demonstrates how the LFO only retriggers after all notes have been off: Try playing legato, and the initial flutter on each note does not appear. Lift off for a while, and there it is again.

SYN Going Up

Here, an inverted VCF envelope is responsible for both the initial "key click" and the filter opening up when a key is released.