SPACE BRAIN CIRCUITS

DarkSky-4

USER MANUAL

TABLE OF CONTENTS

GETTING STARTED

Safety Instructions

Before using DarkSky-4, it is important to read and understand the user manual. This will help you understand how to properly use and maintain the device, as well as avoid any potential hazards.

DarkSky-4 should be kept away from water and moisture, which can damage the internal components of the device, and in some cases cause electrical shock.

DarkSky-4 should be kept away from heat sources such as heaters, stoves, and direct sunlight. Heat can cause damage to the internal components of the unit, and in rare cases fire.

When you are not using DarkSky-4, unplug it from the electrical outlet. This will help reduce the risk of electrical shock or damage to the device.

When combined with an amplifier or headphones, DarkSky-4 has the potential to generate sounds that can be loud enough to cause hearing damage or damage to equipment if not used properly. Therefore, it is important to exercise caution when turning on the unit and adjusting the volume levels. It is recommended to start with the volume set to a low level and gradually increase it to a comfortable listening level.

Power Supply Requirements

When using this device, it is important to ensure that a 12V DC power adapter is used with a minimum current output of 1000mA. Using an adapter with a lower rating may result in the device not functioning correctly. Please double check your power supply prior to turning on the device.

Tips on verifying you have the correct power supply:

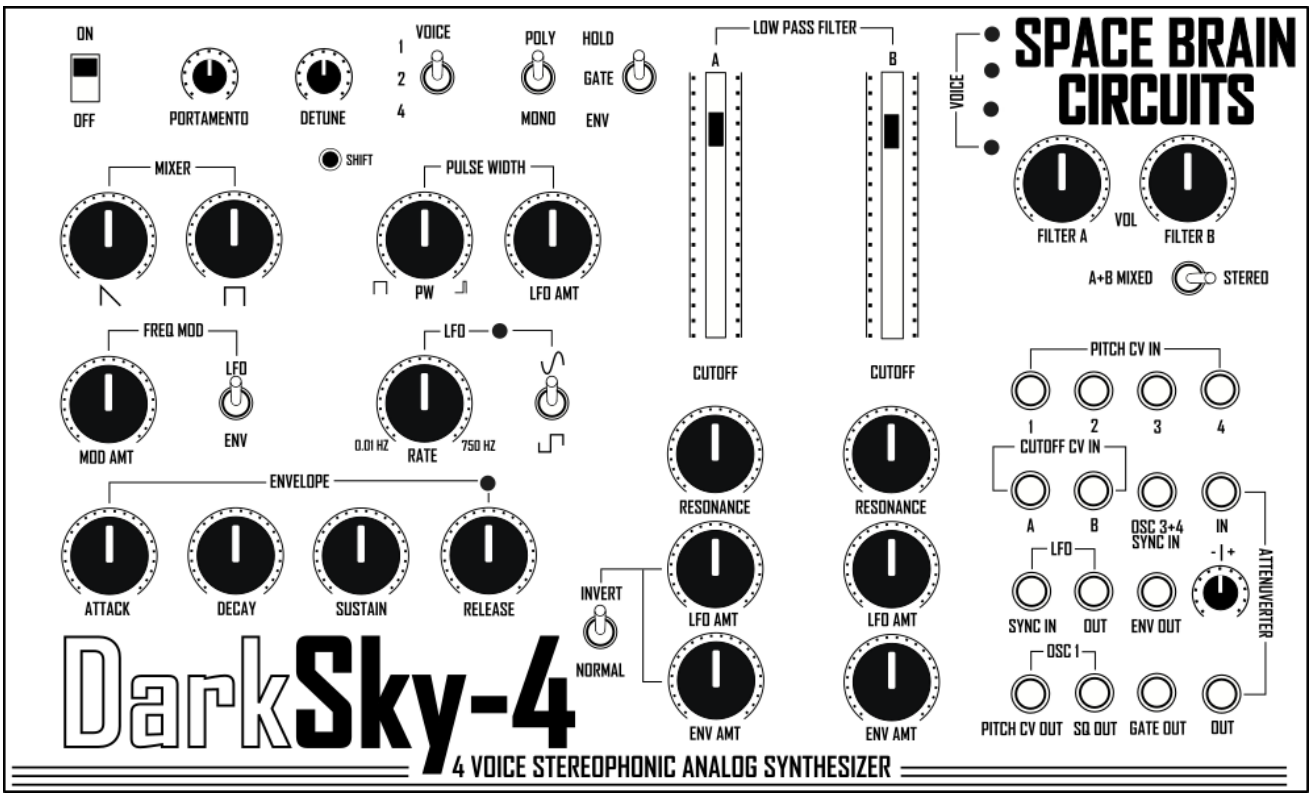
- Look on the back of the power adapter wall wart or power brick.
- The output must be in DC, designated by "DC" or the universal DC symbol: ⎓
    a. Example: INPUT: AC100V-240V, OUTPUT DC12V 1A
    b. Example: INPUT: 100V-240V AC, OUTPUT 12V⎓1A
- Verify the polarity of the power adapter is center positive as shown below.

Notice how the + symbol is connected to the inner circle.

- Make sure the barrel adapter is the standard 2.1mm barrel as designated on the power supply packaging. When plugging the adapter into DarkSky-4, the power supply barrel should have a snug fit.

About this synth

DarkSky-4 is a 4 voice stereophonic analog synthesizer. The synthesizer consists of 4 independent oscillators that can be played monophonically, paraphonically or polyphonically. Each oscillator is equipped with a dedicated VCA and Envelope, which allows for better musicality and the ability to sound each note as it is pressed. Each oscillator contains a sawtooth and square wave, which can be mixed to generate various timbres and sounds. The square waveform can be gradually adjusted from a square waveform to a narrow pulse width waveform to further expand the sonic characteristics of the oscillators. The synthesizer also features two 24dB low pass filters with dedicated controls for cutoff frequency and resonance peak. DarkSky-4 provides several ways to add modulation to the audio signal, including frequency modulation, pulse width modulation, and filter modulation. The unit was designed to create a more expansive soundscape for studio and performance settings. The filter adjustments, along with filter modulation, provide a wide range of stereo effects when in stereo mode. Additionally, the semi-modular patch bay can be used to further modulate multiple sources of controls.



Basic Setup and Connections

Main | Phones

Stereo Mode: ¼ inch TRS Jack for Filter A
A+B Mixed: ¼ inch TRS Jack for Filter A and B

Out B

¼ inch TRS Jack for Filter B

Midi In

Midi Cable connected to Midi Out.

Midi Out

Midi Cable for sending Midi data to external devices.

Audio In

An input for external audio signals that is directed to the mixer section.

FW Update

USB Mini Jack for upgrading firmware.

Fine Tune

Master tuning for DarkSky-4.

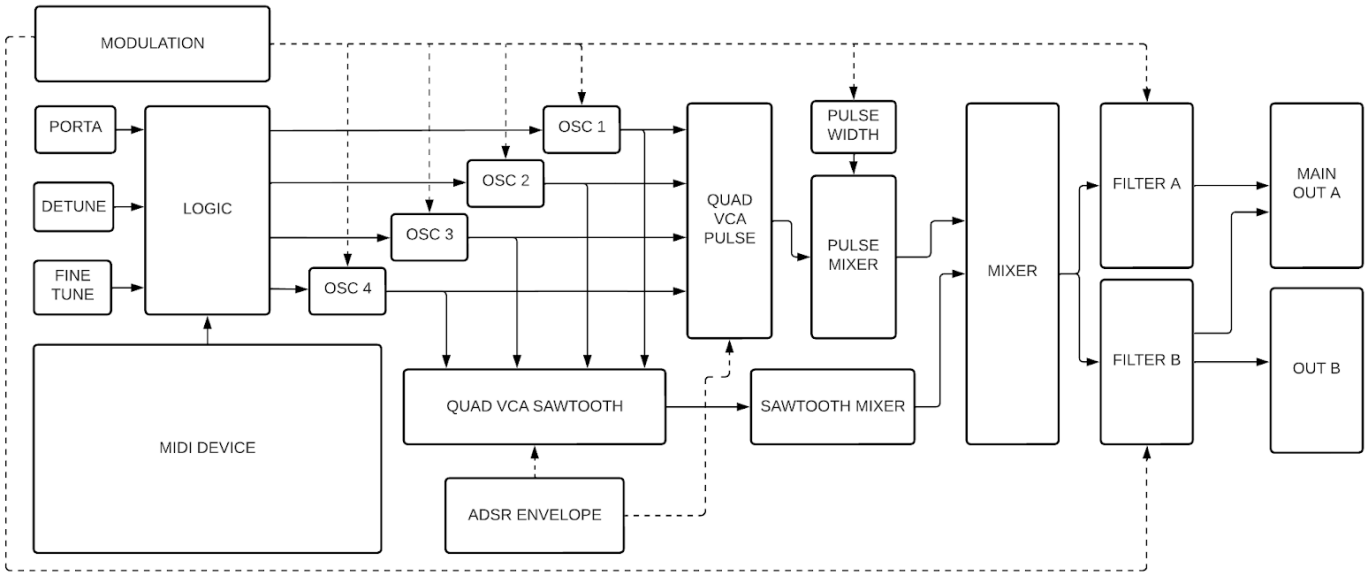
Power Supply

DC Jack for 12V DC power source.

For more information, please see **Power Supply Requirements** section.

Signal Flow

DarkSky-4 is an analog synthesizer that features a signal flow that is unconventional. Rather than the typical oscillator → filter → VCA signal flow that is found in most synthesizers. DarkSky-4 runs all signals first into a VCA to act as a gatekeeper for any notes that are played. This allows greater flexibility when playing polyphonically since each of these notes has a dedicated ADSR and Envelope. After the VCA section, a duplicate of the signal is created and sent to the two parallel 24dB filters as shown below. This creates a scenario where the user is allowed the ability to play 100% polyphonic prior to the filters. The filter can then be modified to allow for stereo filter control.

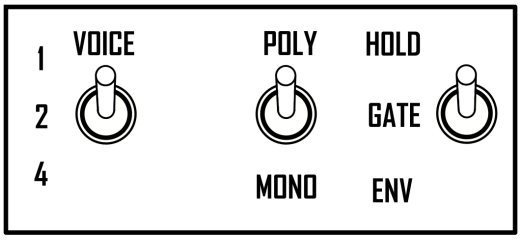


DarkSky-4 is designed and manufactured using the Sound Semiconductor chipsets. DarkSky-4 uses SSI12131 VCO chips for all oscillators, SSI2164 VCA chips for all Voltage Controlled Amplifiers, and SSI2144 (Fatkeys™) for filters A and B.

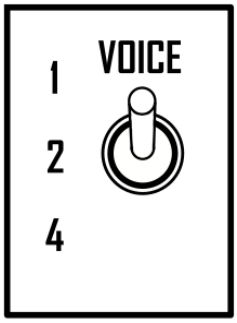
OPERATIONS

Modes

DarkSky-4 can be utilized in a variety of different configuration settings. The logical operation of the synthesizer can be controlled by the following modes, with each controlling a different aspect of the synthesizer.

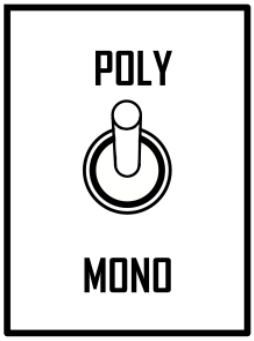


Voice Mode



The **VOICE** Mode on DarkSky-4 controls the number of oscillators used when a note or multiple notes are played. DarkSky-4 allows the ability to choose between **1**, **2**, or **4** oscillators when playing in either **POLY** or **MONO** mode, as explained below.

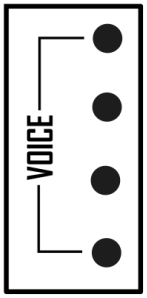
Polyphony Mode



The **POLYPHONY** mode in DarkSky-4 refers to the capability to produce multiple notes simultaneously. In **POLY** mode, DarkSky-4 can play multiple notes at the same time, allowing for the creation of chords and harmonies. When in this mode, each oscillator is assigned a dedicated VCA for each note played. This allows for a much more natural type of play, similar to a piano. In **MONO** mode, the synthesizer can only play one note at a time, making it ideal for lead or legato playing.

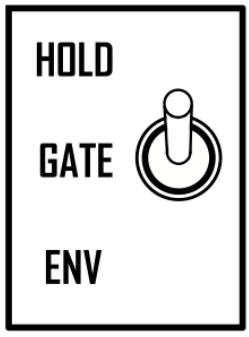
The mode is directly related to the number of voices selected, as shown above. If the **VOICE** setting is set to **1 Voice**, DarkSky-4 is restricted to playing a single note at a time, regardless of the POLYPHONY setting. If the **VOICE** setting is set to **2 Voices**, DarkSky-4 is capable of playing two-note chords when operating in **POLY** mode. When switching to **MONO** mode, the two oscillators will be played in unison. Likewise, when the

VOICE setting is set to **4 Voices**, DarkSky-4 is capable of producing four-note chords in **POLY** mode and four-note unison in **MONO** mode.



By observing the **VOICE LED** section, you can visually confirm the **POLYPHONY** mode and Number of **VOICES** selected. When operating in **POLY** mode, an LED will illuminate for each note of the chord as it is played. If the number of notes played exceeds the maximum number of voices allowed, DarkSky-4 will begin to override the notes in the order in which they were pressed. You may notice that the LEDs indicate that each voice is played in a manner that avoids repeating a single LED back-to-back. This is by design and allows the synthesizer to ensure that each note is allowed to release, instead of being overridden by the next key press. However, this functionality may be changed by using the **SHIFT** button. Furthermore, when in **MONO** mode, the LEDs will also indicate the number of oscillators being used with each key press.

VCA Mode

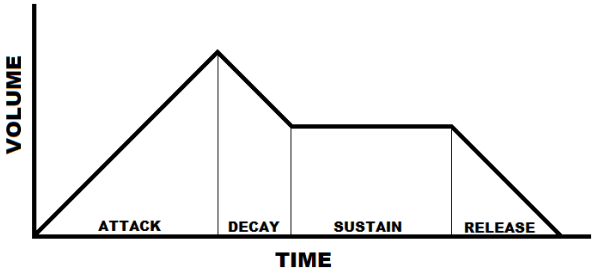


The **VCA** mode on DarkSky-4 allows for the control of the Voltage Controlled Amplifier's behavior. The Voltage Controlled Amplifier, commonly abbreviated to VCA, is used in synthesizers to control the volume level of an oscillator.

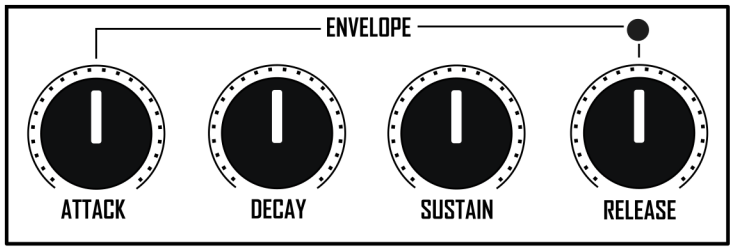
The VCA Mode on DarkSky-4 contains three selectable options. When the **VCA** mode is set to **HOLD**, the sound for each voice is set at maximum volume level regardless if a note is being held or not. When the VCA mode is set to **GATE**, the sound level will be at maximum volume when a note is held, ignoring any Envelope **ATTACK** specified by the **ADSR** section. After the note is released, the VCA will follow the Envelope **RELEASE** when fading from maximum level to silence. Lastly, when the VCA mode is set to **ENV**, the VCA will be controlled by the **ADSR** Envelope. See **Envelope** section for more information.

Envelope

An ADSR envelope is used to control the volume level of an oscillator and how it changes over time. ADSR stands for Attack, Decay, Sustain, and Release, which are the four stages that make up the envelope as shown on the diagram to the right.



The **ATTACK** stage determines how quickly the sound reaches its maximum level when a note is first played. The **DECAY** stage controls how quickly the sound drops to a lower sustain level after the attack. The **SUSTAIN** stage determines the level at which the sound will be held as long as the note is held down. Finally, the **RELEASE** stage controls how quickly the sound fades out after the note is released.

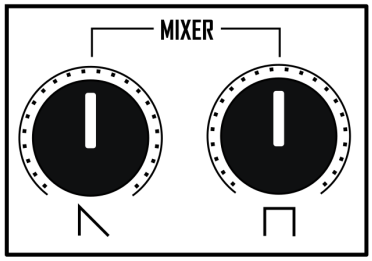


The **ENVELOPE** control on DarkSky-4 allows the ability to change each of these parameters as described above. The **ENVELOPE** will control the volume level for each oscillator when the VCA mode is set to **ENV**. Additionally, the **ENVELOPE** will also control the modulation envelopes on both the **FREQ MOD** as well as the **LOW PASS FILTER**. The modulation envelope will trigger on the first note pressed after all notes have been released. However, this behavior can also be adjusted by use of the **SHIFT** function. The LED as shown on this section will also indicate usage when using the modulation for various aspects of the synthesizer.

Additionally, the sustain amount is also controlled by both the **VELOCITY** of a key press, as well as the **AFTERTOUCH**.

Note: the sensitivity of the **VELOCITY** and **AFTERTOUCH** may be adjusted by **SYSEX** messages. See **SYSEX** section for more information.

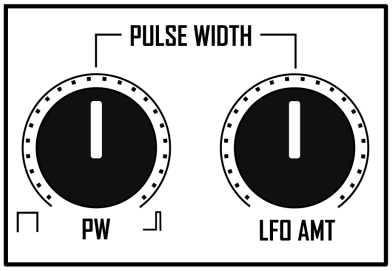
Mixer



Each oscillator on DarkSky-4, contains a sawtooth waveform and a square waveform. When a note(s) is played, a VCA allows a signal to pass from both the sawtooth and square waveforms of each oscillator. These signals, which are identical in magnitude, are sent to the **Mixer** section which allows the user to control how much of each waveform exists in the overall signal. By various positions of these controls, you can create a 100% square waveform, 100% sawtooth waveform, or a mix of both of these waveforms, as shown in the diagram. Although only two waveform controls exist in the mixer section, you can further

adjust the sound of the square waveform by adjusting the **Pulse Width** as described in the next section.

Pulse Width

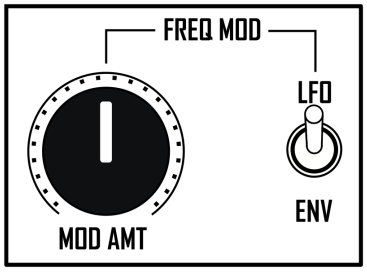


The **Pulse Width** section allows the user to further modify the sound of the square waveform by adjusting the **Duty Cycle** or **Pulse Width** of the waveform. On DarkSky-4, this is done by changing the **PW** control in the Pulse Width section. The **Duty Cycle** is defined as the ratio of time the signal is in the "ON" or "OFF" state. For example, a 50% duty cycle is considered a square waveform, because the amount of "ON" time is 50% of the duration of the total period of the waveform. By adjusting the **PW** control, the Duty Cycle can be changed from a standard Square waveform (50% Duty Cycle) to a Narrow Pulse waveform (10% Duty Cycle), and anything in between.

Note: The Pulse Width section will only affect the square waveform in the mixer section.

One very popular use of Pulse Width is **Pulse Width Modulation**. On DarkSky-4, **Pulse Width Modulation** is available by adjusting the **LFO AMT** control. Although changing the Duty Cycle of the waveform by use of the **PW** control is very useful, there may be times where the user would want to adjust this waveform automatically without having to manually turn the **PW** control. By turning up the **LFO AMT** control, the LFO section will begin to control the Duty Cycle automatically, as if the **PW** control was being adjusted. When turned completely to the left, the pulse width is unaffected by the LFO**.** When turned completely to the right, the maximum amount of LFO modulation will affect the **Pulse Width** of the waveform.

Freq Mod

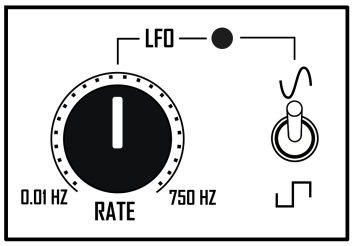


The **Freq Mod** section gives DarkSky-4 the ability to add **Frequency Modulation** to a chosen sound. Frequency Modulation is an important aspect of synthesis, and allows the player to add vibrato or frequency changes to the pitch of the oscillators. The **MOD AMT** control will direct the amount of modulation present in the sound. When the **MOD AMT** is turned completely to the left, the pitch of the oscillators will be unaffected. When turned completely to the right, the full modulation amount will affect the pitch of the oscillators, creating dramatic pitch changes.

The type of modulation is also selectable by the **LFO | ENV** toggle as shown on the right of the diagram. When set to **LFO**, the **LFO** section will be routed to the pitch of each oscillator. This setting is ideal when wanting a vibrato type sound, or to the extreme, a UFO style effect. When **ENV** is selected, the ADSR envelope generator will control the pitch of each oscillator. This setting is more fitting for futuristic or 80's percussive sounds such as those found on drum machine synthesizer modules.

Note: When on LFO, the Midi Controller Modulation wheel also has the ability to change the amount of modulation affecting the pitch of the oscillators.

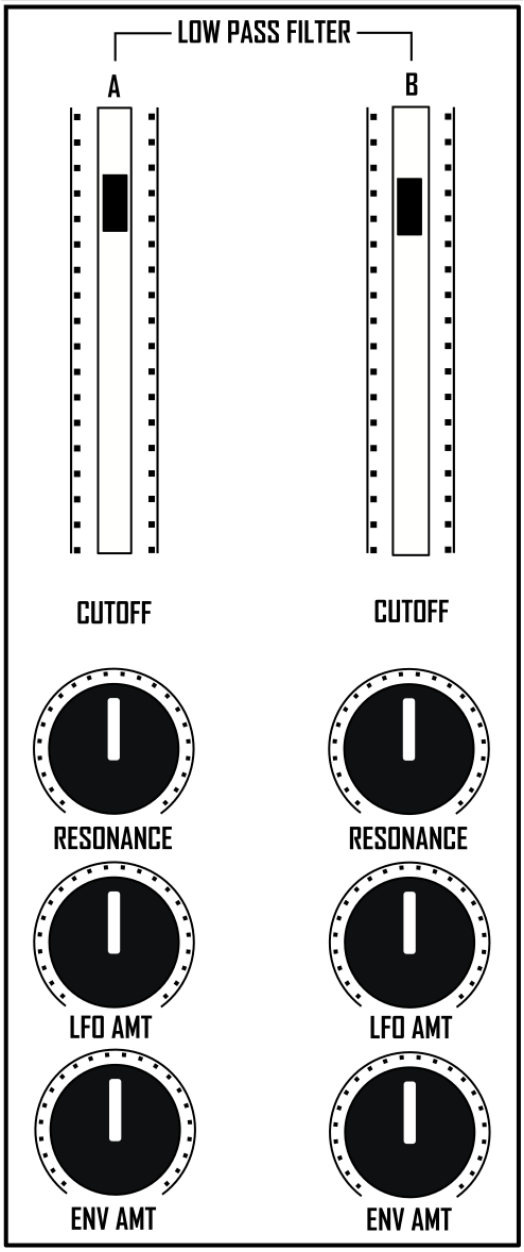
LFO



The **LFO** section controls the Low Frequency Oscillator frequency and waveform of the LFO being routed to various locations throughout DarkSky-4. The **RATE** control allows the LFO signal to vary between subsonic and audio level frequency ranges. When the **RATE** control is turned completely to the left (0.01 HZ), the frequency will be ultra slow and will take approximately ~10 seconds before the LFO will oscillate a full cycle. This is great when needing the oscillator to perform slow filter sweeps or oscillator pitch changes. When the **RATE** control is turned completely to the right, the LFO will operate fast enough to be heard audibly. When introducing this modulation source to other areas of the DarkSky-4, a gentle or extreme distortion will be apparent, depending on the amount of LFO introduced to a particular section. Additionally, the waveform of the LFO is selectable by the toggle on the right of the diagram. The LED will help the user visualize the rate and waveform selected.

Note: The Midi Controller Modulation wheel has the ability to change the amount of LFO signal affecting various sections of DarkSky-4. When the modulation wheel is adjusted, the LED will dim depending on the position of the modulation wheel.

Low Pass Filter



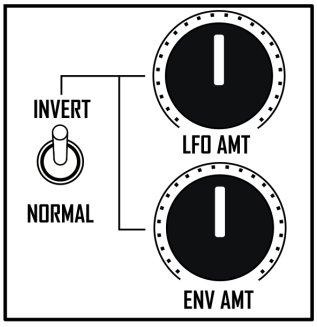
DarkSky-4 includes two parallel 24dB **LOW PASS FILTER** modules. After the signals are mixed in the **MIXER** section, the sum of the signals is duplicated and fed into **FILTER A** and **FILTER B**.

A low pass filter is an electronic circuit that allows low-frequency signals to pass through it while attenuating or blocking high-frequency signals. The cutoff frequency of the filter determines the point where the filter begins to attenuate the high-frequency signals. This adjustment is controlled by the **CUTOFF** sliders as shown in the diagram.

RESONANCE is also available per each filter on DarkSky-4. Resonance is a characteristic of filters, where there is a peak in the frequency response curve at the cutoff frequency. This peak is known as the resonance peak and can result in a boost in the amplitude of signals near the cutoff frequency, which creates a nasal, or wet type of sound.

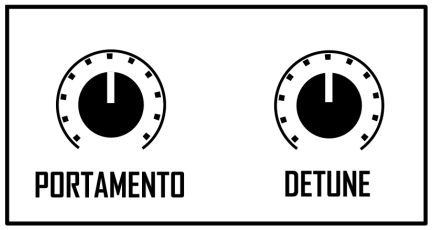
*Note: By boosting the **RESONANCE** while the **CUTOFF** sliders are at a maximum, the oscillators will begin to have a sizzly or static sound.*

Both Filters also include an **LFO AMT** and **ENV AMT** control for each filter. These controls allow modulation to the **CUTOFF** of each filter by the LFO signal or ADSR Envelope.



Furthermore, the modulation sources can be normalized or inverted using the **INVERT | NORMAL** switch. Inverting these signals will result in modulation that is opposite to the behavior of **FILTER B**. This feature can create complex panning effects, which will be elaborated on in the **STEREO** section.

Portamento & Detune



The oscillators on DarkSky-4 can be further controlled using the **PORTAMENTO** and **DETUNE** section.

Portamento is a musical term that refers to a sliding effect between two or more pitches. Turning the **PORTAMENTO** control completely to the right will result in the maximum time it takes for a note to slide from one note to the next.

DETUNE is a feature on DarkSky-4 that allows the user to slightly adjust the pitch of one or more oscillators, creating a thicker and richer sound. The amount of detuning can be adjusted using the **DETUNE** control on DarkSky-4. If the **DETUNE** control is turned completely to the left, there will be no detuning and no beating effect will be present in the sound.

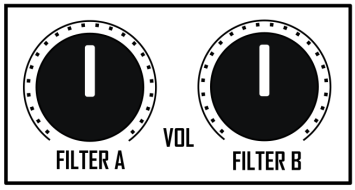
Stereo | A+B Mixed

DarkSky-4 can be operated in two different modes, **STEREO** and **A+B Mixed**. Depending on which mode is selected, this defines the destination of Filters A and B.

STEREO mode routes **FILTER A** to **MAIN | PHONES** and **FILTER B** to **OUT B**. By connecting **MAIN |PHONES** and **OUT B** to separate speakers or audio channels, DarkSky-4 will produce interesting stereo movement when making subtle adjustments to the **LOW PASS FILTER** section. Additionally, the **INVERT** switch will introduce panning or fading between channels when adding LFO or envelope modulation.

A+B MIXED routes **FILTER A** and **FILTER B** to **MAIN | PHONES** when requiring a single channel or mono output.

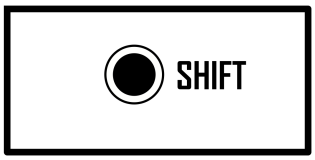
Output



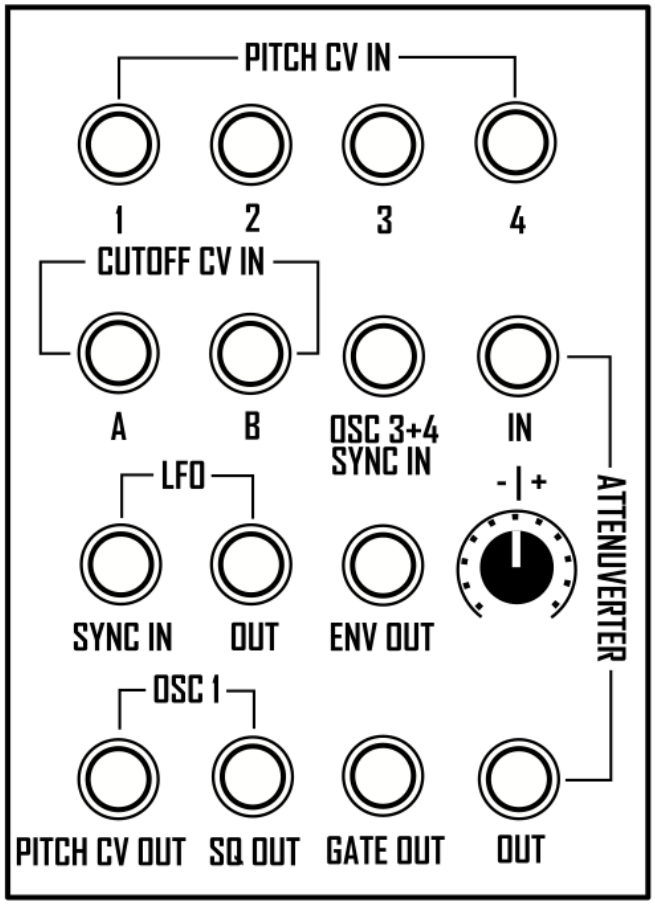
The OUTPUT section controls the volume output from **FILTER A** and **FILTER B**.

Shift

The shift button gives the user access to hidden settings. By holding the Shift button, and pressing a key, adjustments may be made to the operational behavior of DarkSky-4. See **Shift Functions** for more information.



Patchbay



Additional modifications may be added to the DarkSky-4 sound by patchbay. This semi-modular matrix can be used to route alternative CV sources to various aspects of the synthesizer. **PITCH CV IN** will control each oscillator's pitch designated by the oscillator number. **CUTOFF CV IN** will control the cutoff amount for Filter A and Filter B. **OSC 3+4 SYNC IN** will hard sync oscillators 3 and 4 when receiving audio level signals. An onboard **ATTENUVERTER** is available for processing AC signals and DC voltages. The **LFO** section includes **SYNC IN** and **OUT**. **SYNC IN** will restart the LFO when receiving a 5V pulse. The LFO signal at the **OUT** jack is determined by the waveform toggle. **ENV OUT** is the modulation envelope that can be routed to other sources. **OSC1 PITCH CV OUT** and **SQ OUT** is also available for controlling other CV enabled gear, and **SQ OUT** is specifically designed to be routed to the **OSC 3+4 SYNC IN** which gives the ability to create hard sync sounds. **GATE OUT** is a 5V pulse that can be used to control other gear or used to reset the LFO Signal by the **SYNC IN**.

CUSTOMIZATION

Global Settings

All sysex files are located on github at https://github.com/spacebraincircuits. The following list is subject to change based on future firmware updates.

Calibration

See **Tuning & Calibration**.

Set EEPROM

Resets DarkSky-4 back to factory default settings. Note: DarkSky-4 must be calibrated after this operation.

Midi Channel In

Sets DarkSky-4 Midi In Channel. (Default: 1)

Midi Channel Out

Sets DarkSky-4 Midi Out Channel. (Default: 1)

Pitch Bend Up

Sets the pitch bend up range for the pitch bend wheel. (Default: 2 semitones)

Pitch Bend Down

Sets the pitch bend down range for the pitch bend wheel. (Default: 2 semitones)

Modulation Midi CC

Sets the Modulation control message for attenuating the LFO signal. (Default: Mod Wheel)

Detune Sensitivity

Sets the Detune sensitivity for the Detune control. (Default: 2)

Aftertouch Sensitivity

Sets the Aftertouch sensitivity for aftertouch messages. (Default: 2)

Velocity Sensitivity

Sets the Velocity sensitivity for velocity messages. (Default: 0)

Poly Chain

Sets the DarkSky-4 behavior when more notes than the active Voice (1, 2 or 4) are pressed while in POLY mode.

Poly Chain: Poly Chain mode permits the connection of an extra synthesizer to DarkSky-4, thereby enabling it to be utilized as a supplementary oscillator(s) to generate more voices. This is achieved by connecting the Midi Out jack of DarkSky-4 to the Midi In of another, and enabling the Poly Chain mode by either sysex message or Shift function. When in this mode, all additional notes will be sent to the Midi Out jack as opposed to overwriting the last note played.

Midi Out (Default): All notes played will be duplicated and sent back out to the Midi Out jack. When in this mode, each additional note will override the last when playing more notes than the active Voice setting.

Round Robin

Sets the DarkSky-4 behavior on the order of oscillators utilized when in POLY mode.

Round Robin (Default): Round Robin is a feature that allows for more natural and varied playback of the oscillators. By enabling this feature, DarkSky-4 will behave as a 100% polyphonic instrument prior to the filters. As each note is pressed, the oscillator will increment to the “next available” oscillator.

Linear: The oscillators will be reset back to Oscillator 1 on the first note pressed. This is preferable when utilizing hard sync and more consistency when using the patchbay.

Envelope Reset | Normal

Sets the DarkSky-4 behavior on triggering the Modulation envelope.

Envelope Normal (Default): The first note pressed will trigger the modulation envelope.
Envelope Reset: Each note pressed will retrigger the modulation envelope.

Detune | Drift

Sets the DarkSky-4 behavior of the Detune control.

Drift: The oscillators will drift in and out of tune based on the amount set by the detune control.
Detune (Default): The oscillators may be detuned by the amount set by the detune control.

Fixed Gate | Gate

Sets the DarkSky-4 behavior of the Gate Out jack.

Fixed Gate: The GATE OUT output jack will continuously be at 5V DC.
Gate (Default): The GATE OUT output jack will output 5V DC when the first note is pressed, and 0V DC when all notes are released.

Shift Functions

By using the shift button, the user can quickly access global settings. By holding the Shift button, and pressing a key, adjustments may be made to the operational behavior of DarkSky-4. These are subject to change across firmware versions.

Shift-A: Toggles the Midi Out jack between **Poly Chain** and **Midi Out** mode (Default).
Shift-B: Toggles between **Round Robin** (Default) and **Linear** mode.
Shift-C: Enables calibration procedures. (See **Tuning & Calibration**).
Shift-D: Resets DarkSky-4 back to default settings.
Shift-E: Toggles between modes Envelope Reset and Envelope Normal.
Shift-F: Toggles between **Detune** (Default) and **Drift** mode.
Shift-G: Toggles between **Fixed Gate** and **Gate** (Default) mode.

Firmware Upgrades

Firmware updates will be available by mini USB connection. See **Firmware Manual**.

TUNING & CALIBRATION

In order to keep DarkSky-4 in perfect tune, the occasional calibration may be necessary. This is a completely automated procedure that requires approximately 5 minutes for a full calibration. Simply press Shift-C to start the calibration procedures. DarkSky-4 will begin to calibrate each oscillator, indicated by the Voice LED section. If the volume level is up, you will notice some strange sounds, however this is completely normal and necessary for the unit to check and perfect the tuning of each oscillator.

IMPORTANT: Wait 15 minutes after powering on DarkSky-4 before beginning the calibration process. When Calibrating, the following controls must be set as shown below.

WARRANTY

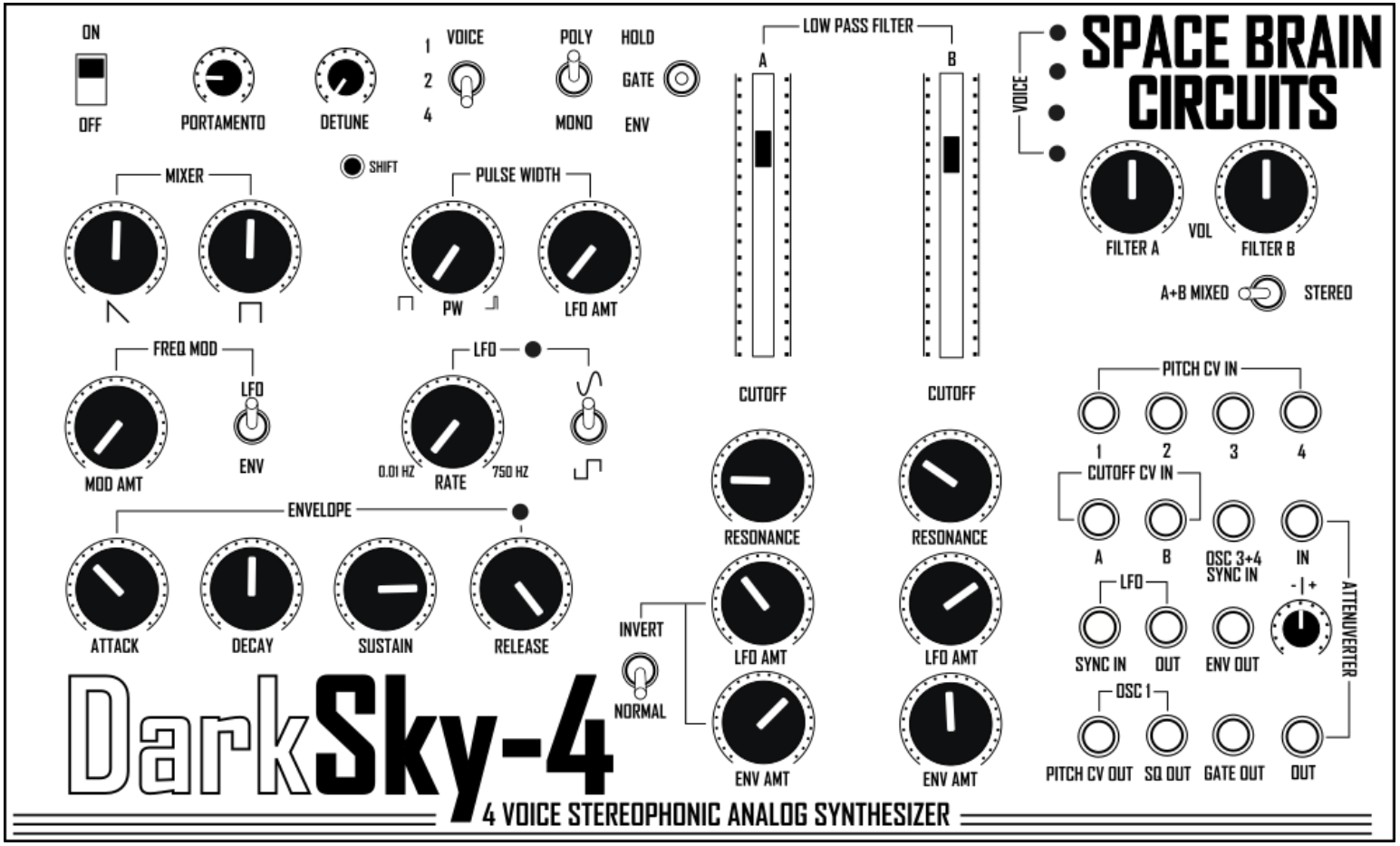
Space Brain Circuits guarantees that its products are free from any material or workmanship defects at the time of shipment. The Warranty Period commences on the date of purchase and lasts for one year. Within this period, any defective products will be repaired or replaced upon return to the factory with proper authorization from Space Brain Circuits. This warranty specifically covers defects that are determined by Space Brain Circuits to be unrelated to user actions or faults.

In situations where repairs are necessary due to the fault of the user, Space Brain Circuits will provide repair services as agreed upon by Space Brain Circuits and purchaser.

PATCHBOOK

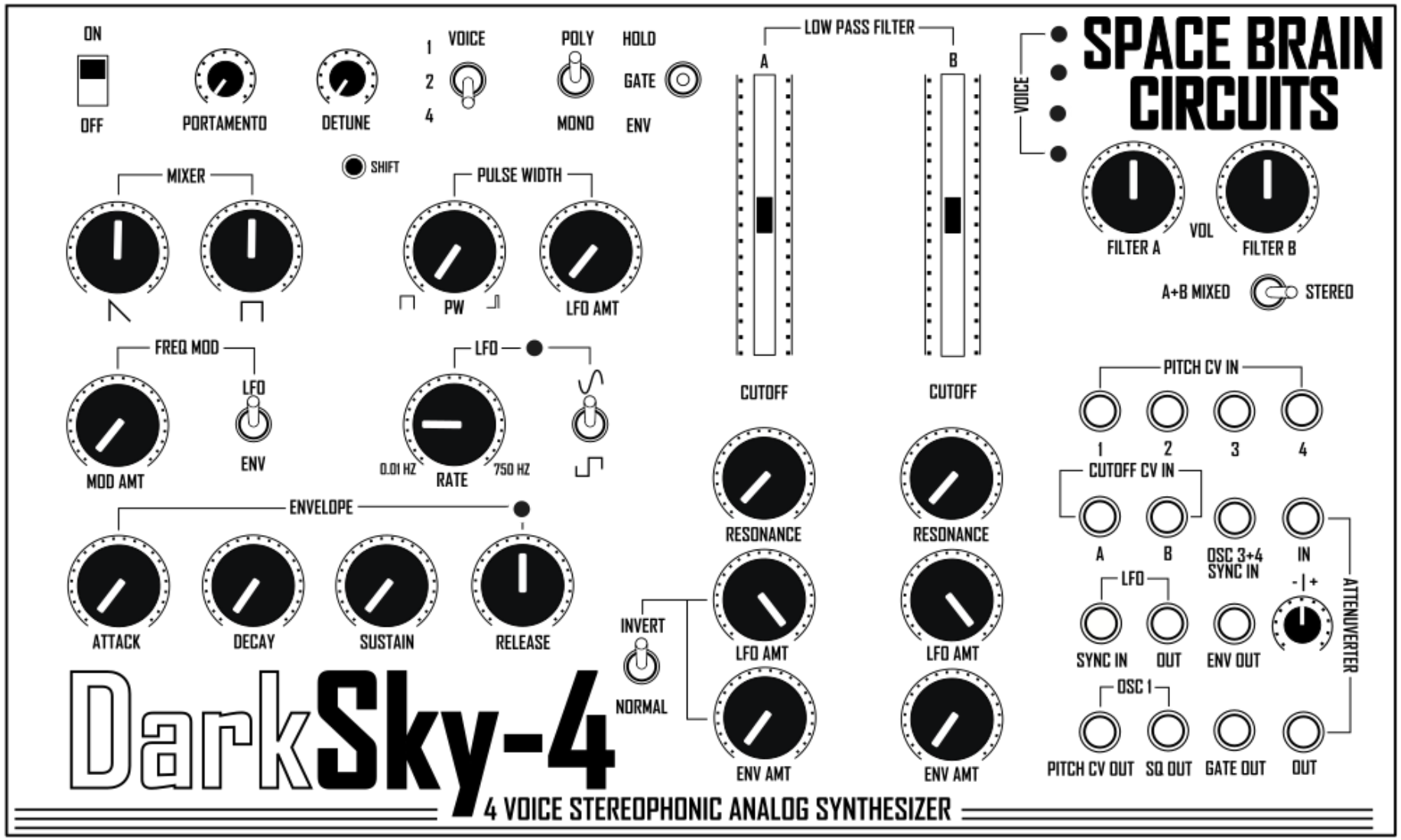
Here are some presets to try out! Pay special attention to the included notes on the following pages. Although each preset diagram has a specific location for each control, feel free to adjust the controls as you explore DarkSky-4 to find new sounds!

WAVEY CHORDS



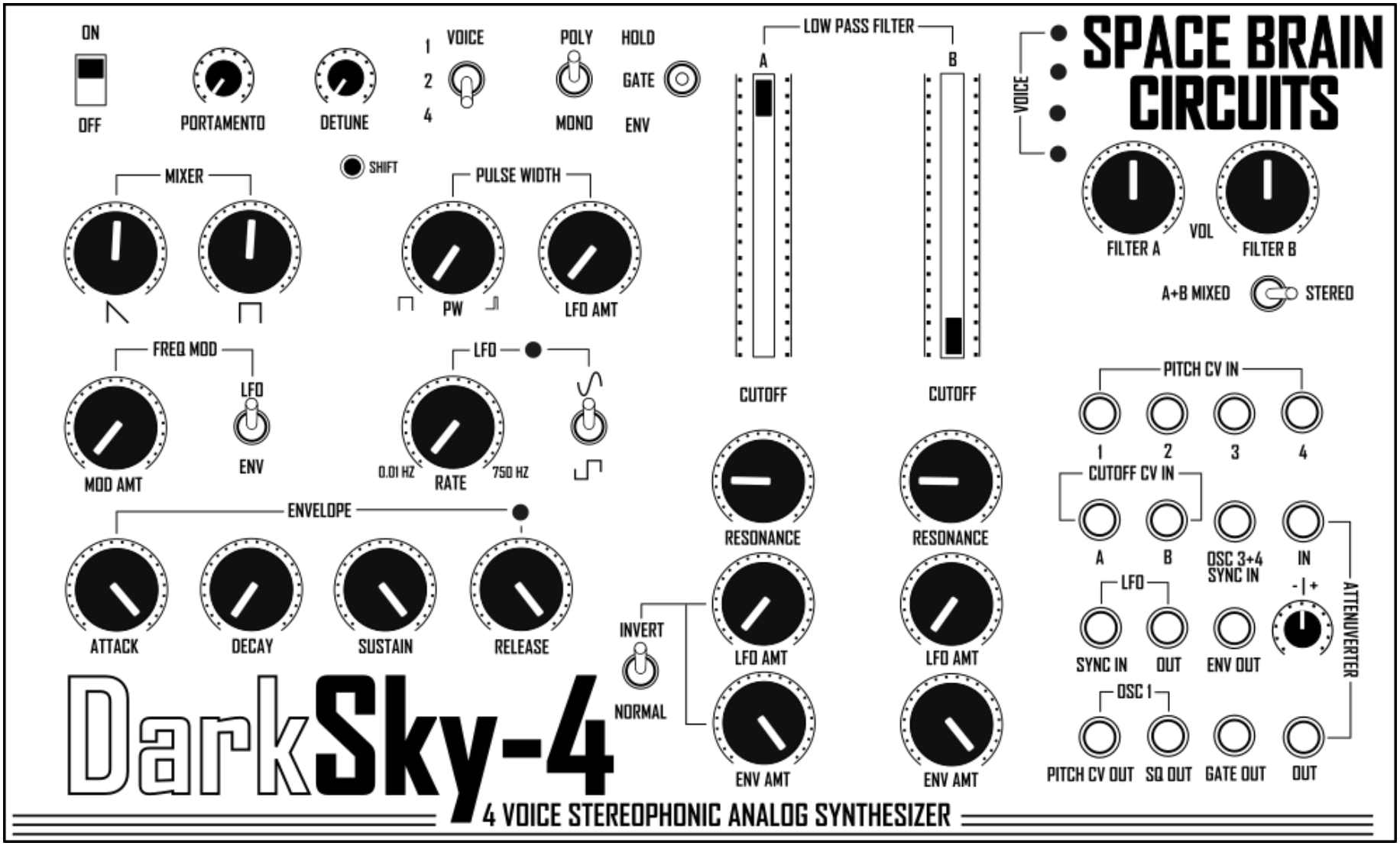
STEREO PING PONG

If not using headphones, make sure to route MAIN | PHONES and OUT B to separate channels and pan LEFT and RIGHT.

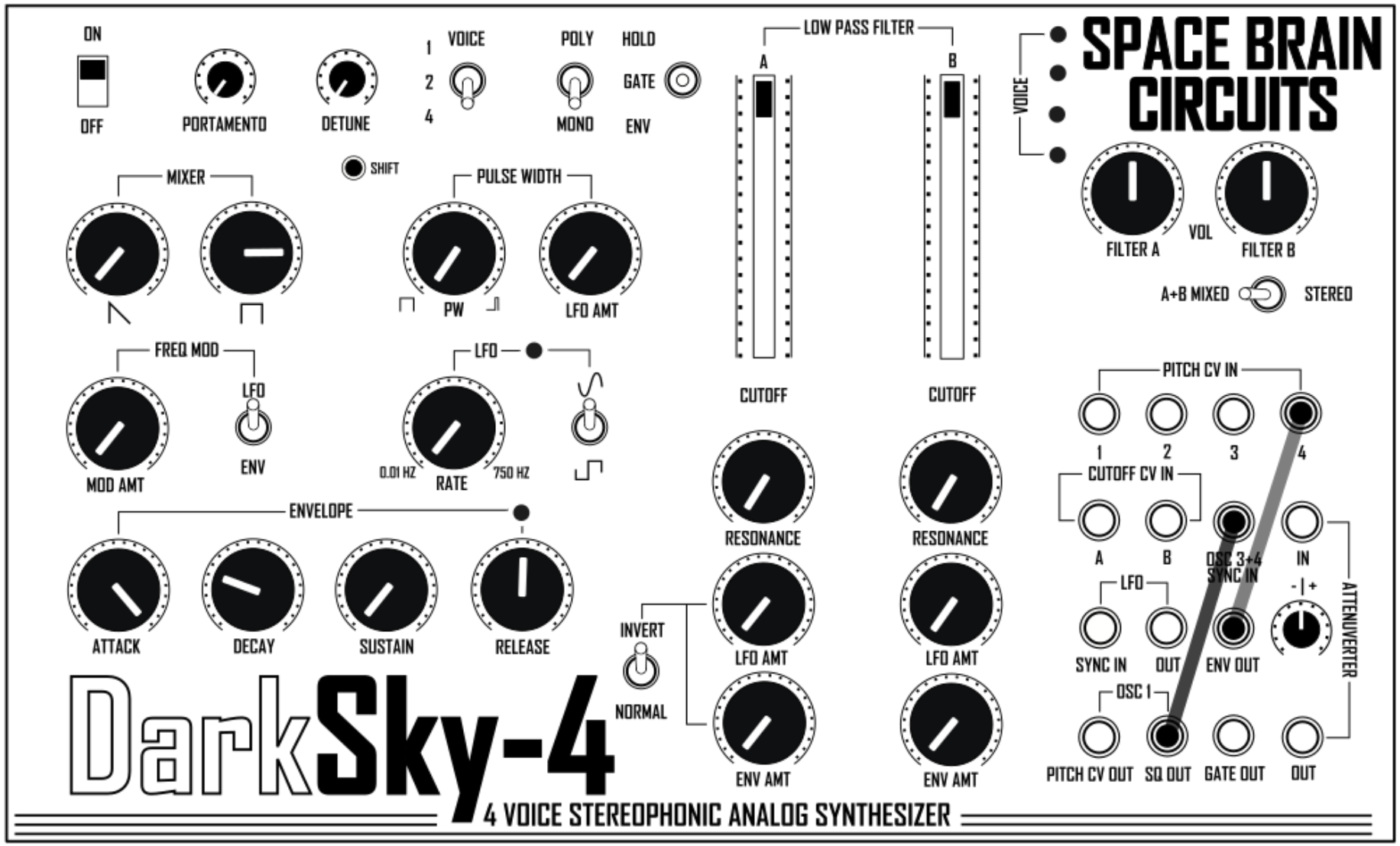


STEREO PAN

If not using headphones, make sure to route MAIN | PHONES and OUT B to separate channels and pan LEFT and RIGHT.



HARD SYNC


ON
OFF
PORTAMENTO
DETUNE
1
2
4
VOICE
POLY
MONO
HOLD
GATE
ENV
LOW PASS FILTER
A
B
VOICE
SPACE BRAIN CIRCUITS
FILTER A
VOL
FILTER B
A+B MIXED
STEREO
SHIFT
MIXER
PULSE WIDTH
PW
LFO AMT
FREQ MOD
LFO
MOD AMT
ENV
LFO
0.01 HZ
RATE
750 HZ
CUTOFF
CUTOFF
PITCH CV IN
1
2
3
4
CUTOFF CV IN
A
B
OSC 3+4 SYNC IN
IN
LFO
SYNC IN
OUT
ENV OUT
ATTENUVERTER
ENVELOPE
ATTACK
DECAY
SUSTAIN
RELEASE
RESONANCE
RESONANCE
INVERT
NORMAL
LFO AMT
LFO AMT
ENV AMT
ENV AMT
OSC 1
PITCH CV OUT
SQ OUT
GATE OUT
OUT
DarkSky-4
4 VOICE STEREOPHONIC ANALOG SYNTHESIZER

OCTAVE SAW

Rotate the Attenuverter control to adjust the pitch of oscillator 1. Rotate slowly to the left to find the sub octave.