

# USER MANUAL

# mini V

**ARTURIA®**  
YOUR EXPERIENCE • YOUR SOUND

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# Table of Contents

1	INTRODUCTION .....	6
1.1	History of the original instrument .....	6
1.2	Arturia's secret ingredient: TAE® .....	10
1.2.1	Aliasing-free oscillators .....	10
1.2.2	A better reproduction of analog oscillator waveforms.....	11
1.2.3	Direct Filter Circuit Modeling .....	12
2	ACTIVATION AND FIRST START .....	14
2.1	Register and Activate.....	14
2.2	Initial setup .....	14
2.2.1	Audio and MIDI settings: Windows.....	14
2.2.2	Audio and MIDI settings: Mac OS X .....	17
2.2.3	Using Mini V in plug-in mode .....	18
3	USER INTERFACE .....	19
3.1	The virtual keyboard .....	19
3.2	Toolbar.....	19
3.2.1	Save Preset .....	19
3.2.2	Save Preset As.....	20
3.2.3	Import preset .....	20
3.2.4	Export preset.....	21
3.2.5	Resize window options .....	21
3.2.6	Audio settings .....	22
3.2.7	Preset browser overview .....	22
3.2.8	Open and Close Advanced section .....	23
3.2.9	MIDI Learn assignment .....	23
3.2.9.1	Assigning / unassigning controls.....	24
3.2.9.2	Min / Max value sliders.....	24
3.2.9.3	Relative control option.....	25
3.2.9.4	Reserved MIDI CC numbers .....	25
3.2.10	MIDI controller configuration.....	26
3.2.11	The lower toolbar.....	26
3.2.11.1	Current control Value.....	26
3.2.11.2	MIDI Channel setting.....	26
3.2.11.3	Panic button and CPU meter .....	27
3.2.11.4	Play mode.....	27
3.2.11.5	Maximum Polyphony.....	27
3.3	The Preset Browser.....	28
3.3.1	Searching presets .....	29
3.3.2	Using tags as a filter.....	29
3.3.3	The Preset Info section.....	30
3.3.4	Preset selection: other methods.....	31
3.3.4.1	Selecting a preset by its Type .....	32

3.3.5	Playlists .....	32
3.3.5.1	Add a playlist.....	33
3.3.5.2	Add a preset.....	33
3.3.5.3	Re-order the presets .....	33
3.3.5.4	Remove a preset .....	33
3.3.5.5	Delete a playlist.....	34
3.4	The synthesizer panels .....	34
3.4.1	Overview of the "Classic" mode .....	35
3.4.2	The "Extended" mode.....	36
3.4.2.1	The modulation matrix .....	36
3.4.2.2	The LFO .....	37
3.4.2.3	The arpeggiator section .....	37
3.4.2.4	The effects section.....	37
4	THE SYNTHESIZER .....	39
4.1	The oscillators .....	40
4.2	The mixer .....	42
4.3	The filter and its envelope.....	43
4.4	The output volume and its envelope .....	44
4.5	The polyphonic mode, the playing modes.....	45
4.6	The pitch bend and modulation wheels .....	48
4.7	The Motion Recorder .....	48
4.7.1	The Motion Recorder activation/deactivation .....	49
4.7.2	Playing recorded Motion curves.....	49
4.7.3	Quantizing a motion curve .....	49
4.7.4	Setting the modulation amount of a motion curve .....	50
4.7.5	The parameters available for the Motion Recorder.....	51
4.7.6	Editing a motion curve .....	52
4.7.6.1	The Edit tools.....	52
4.7.6.2	The Curve Editor screen .....	53
4.8	The vocal filter.....	54
4.9	The low frequency generator .....	56
4.10	The modulation matrix .....	57
4.11	The arpeggiator.....	59
4.12	The chorus and stereo delay .....	60
5	THE BASICS OF SUBTRACTIVE SYNTHESIS .....	61
5.1	The three main elements .....	61
5.1.1	The oscillator, or VCO.....	61
5.1.1.1	Triangle .....	62
5.1.1.2	Sawtooth .....	63
5.1.1.3	Square.....	63
5.1.1.4	Pulse Width Modulation .....	64
5.1.1.5	Synchronization .....	64
5.1.1.6	Frequency modulation .....	65

5.1.2	The noise module .....	66
5.1.3	The Mixer.....	66
5.1.4	The filter or VCF.....	66
5.1.4.1	The cut-off frequency.....	67
5.1.4.2	The resonance.....	67
5.1.5	The amplifier or VCA.....	68
5.2	Other modules .....	69
5.2.1	The keyboard.....	69
5.2.2	The envelope generator .....	70
5.2.3	The low frequency oscillator .....	70
6	A FEW ELEMENTS IN SOUND DESIGN.....	73
6.1	Subtractive synthesis.....	73
6.1.1	A simple bass sound .....	73
6.1.2	A 3 oscillators lead sound.....	76
6.1.3	A polyphonic accompaniment.....	77
6.2	The modulation matrix.....	79
6.2.1	Using the arpeggiator .....	81
6.3	The effects of the Mini V.....	82
6.3.1	The stereo chorus.....	83
6.3.2	The stereo delay .....	84
7	END USER LICENSE AGREEMENT .....	87

# 1 INTRODUCTION

Thank you for purchasing our virtual synthesizer, Mini V! We are certain it will give you many hours of inspiration and enjoyment.

Mini V is one of the pillars of our extensive family of instruments that recreate hard-to-find classic keyboards and synths. In addition to bringing the authentic sound of this essential instrument to your music, we have added some 21<sup>st</sup> century features that were never available in the original!

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## 1.1 History of the original instrument

*“Mind you, neither of us had any idea where this was leading”<sup>1</sup>*

Robert A. Moog was born in May 1934 in New York. With a passion for music (he took piano lessons for 12 years), he was introduced to electronics by his father, an engineer. During his adolescence he discovered the Thereminvox plan, invented during the 1930's by a Russian engineer, Leon Theremin (or more exactly Lev Sergeivitch Termen). Seduced by this instrument with its never before heard sounds, he began to produce his own models and founded his own company in 1954.

Frequenting musical professionals, and in particular electronic and concrete music, Bob Moog realized that there was a real demand for electronic instruments of a higher quality.

One of the first clients to come to Robert Moog, the professor of music Herbert A. Deutsch, asked him to listen to a song he had composed. Bob Moog is immediately convinced and they decided to associate their work. Their co-operation produced the first voltage controlled oscillator (VCO).

In 1964, the first prototype of a synthesizer designed by Bob Moog was produced. It was a modular system with a voltage controlled filter (VCF), an envelope generator, a white noise generator, a trigger and two keyboards each with a generator module (sawtooth, triangle and square) as well as a voltage controlled amplifier module (VCA).

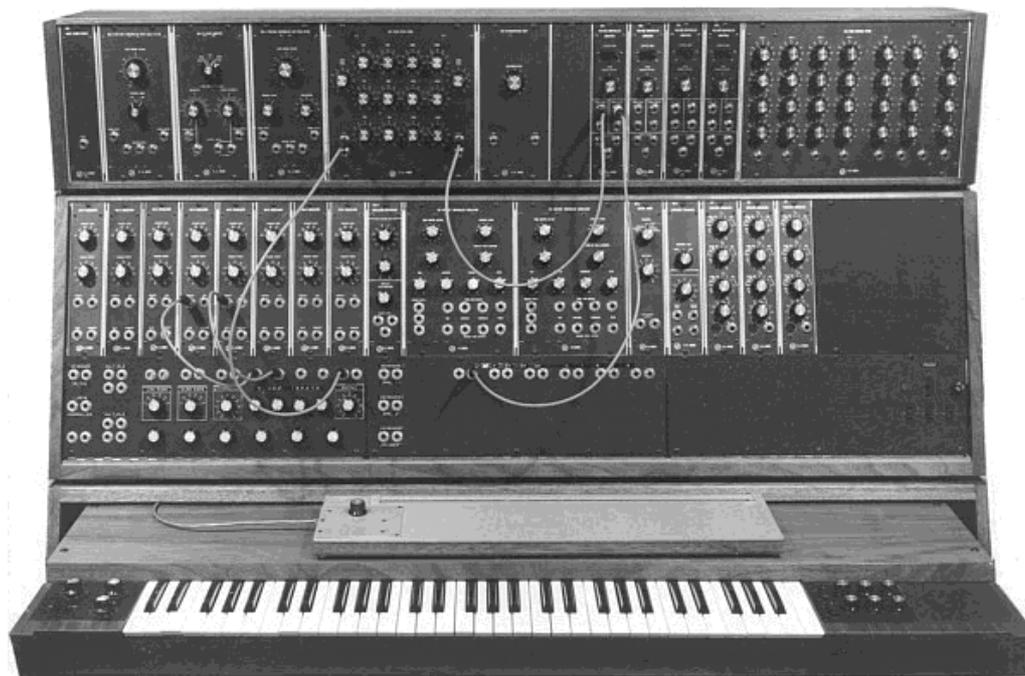
A second prototype, grouping those new modules all together, was built during summer 1964 and shown at the AES (Audio Engineering Society) autumn show, where Bob Moog took advantage of an unused stand. In 1965, upon the success encountered at this show, he decided to release the 900 series for sale.

In 1967, Bob Moog decided to release different machines, each with a certain number of modules. This marked the birth of modular systems I, II and III. In 1968 worldwide recognition came with the success of “Switched-On Bach” by W. Carlos.

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<sup>1</sup> : Bob Moog, quoted by Mark Vail, in his book *Vintage Synthesizers* © Miller Freeman 1993

This album, where classical music is played on a synthesizer of the brand, sold over one million copies and won 3 Grammy awards.



*The modular system III (1967)  
Courtesy of Roger Luther, MoogArchives.com*

Success grew, and big groups like Tangerine Dream, the Beatles and the Rolling Stones would also become modular system owners.

In 1969, the company which at that time had around 40 employees was building up to 3 modulators per week and the order book was always full. The modular synthesizer series had 5 years of high sales, and sold around 200 models in the United States<sup>2</sup>.

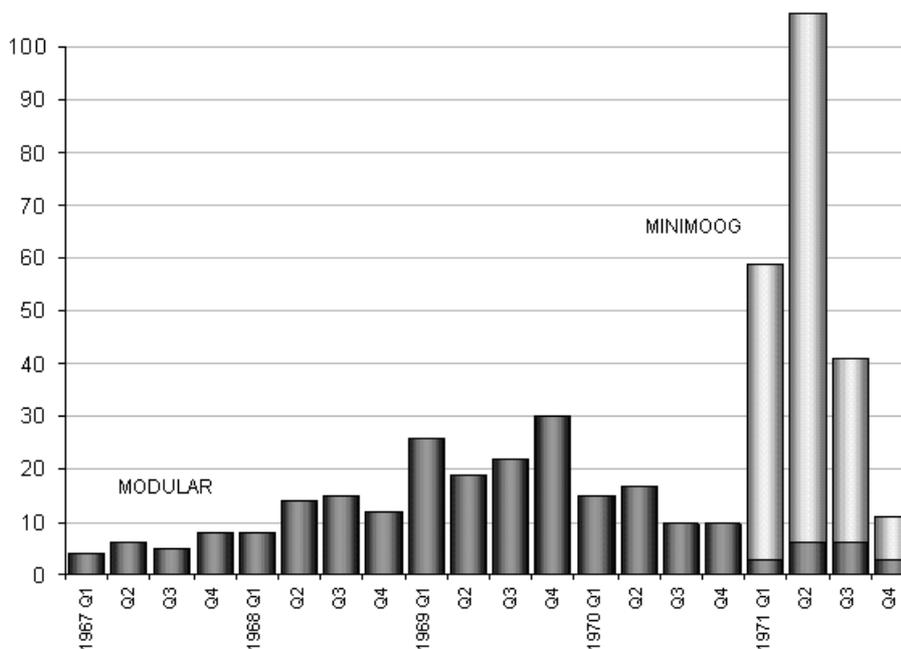
However, the sales would rapidly decrease, because the gigantic proportions of modular units put a damper on the interest of most musicians and also prevents the instrument from entering most *music shops*, and therefore from being known. Furthermore, a serious competitor, ARP, has just arrived on the market.

In the same time, Bob Moog received requests for a more compact instrument that could be transported more easily, directed more to stage than studio. With the help of an engineer from Berkeley, Jim Scott, and the advice from numerous musicians he was about to create another legendary synthesizer: its famous 1971 monosynth...

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<sup>2</sup> : In 2003, Arturia has released a software emulation of the famous modular synthesizers designed by Bob Moog under the name of Modular V.

"Here it is! A compact, moderately priced electronic music synthesizer designed for live performance." This is the way this new synthesizer is introduced on the very first promotional brochure, in the midst of 1971. The monophonic synthesizer required several months of research and development and 4 prototypes, before leading to the commercial model. More than 12,000 units were sold until 1981. They were quite far from the 10 modular units per month that the company produced in the late 60's.



Bob Moog's synthesizers sales figures - 1967-1971  
 Courtesy of Roger Luther, MoogArchives.com

The very first prototype was called Model A. Three other versions, B, C and D, followed. This last model is the final and most common incarnation of this synthesizer and the only one that was put into production in large numbers. The choice of wood rather than plastic for the cabinet prevailed from the beginning, simply because Robert Moog preferred to follow the advice of musician friends, rather than drawings coming from its industrial engineers. The Model D was first introduced at the NAMM convention in June 1971. It was the company's first exposure to the music instruments industry - and the industry's first exposure to synthesizers. The reception is rather cold as, according Robert Moog himself, "Most dealers didn't know what to make of a musical instrument with words like Oscillator Bank and Filter printed on the front panel".



*Bob Moog's monosynth, Model A (prototype)  
Courtesy of Roger Luther, MoogArchives.com*



*Model D  
Courtesy of Roger Luther, MoogArchives.com*

The iconic monosynth knew an unparalleled success during the 1970's. Artists and bands like Tangerine Dream, Kraftwerk, Depeche Mode, Keith Emerson, Jean-Michel Jarre, Klaus Schulze, and Rick Wakeman used the synthesizer, notably for the typical sound and its very warm quality, which is excellent for basses and lead sounds.

After the production stopped in 1981, there had been during the 1990 decade, several failed attempts to restart production of the 1971 monosynth. With the arrival of computer music technologies, it has been very often mimicked as a virtual instrument, with little success. Arturia Mini V is the latest avatar, and thanks to the TAE® technology, we dare to think it is probably the most accurate emulation of this cornerstone of analogic synthesis available on the market.

## 1.2 Arturia's secret ingredient: TAE®

TAE® (True Analog Emulation) is Arturia's outstanding technology dedicated to the digital reproduction of the analog circuits used in vintage synthesizers.

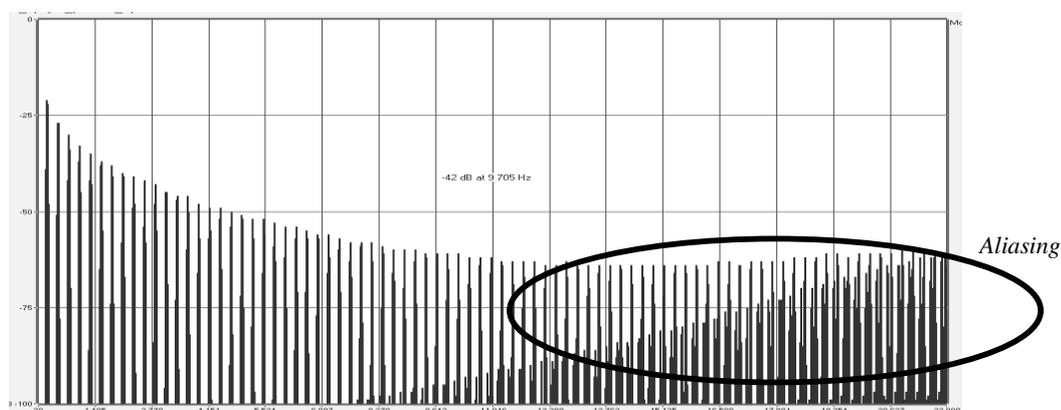
TAE®'s software algorithms result in spot-on emulation of analog hardware. This is why Matrix-12 V offers an unparalleled quality of sound, as do all of Arturia's virtual synthesizers.

TAE® combines three major advances in the domain of synthesis:

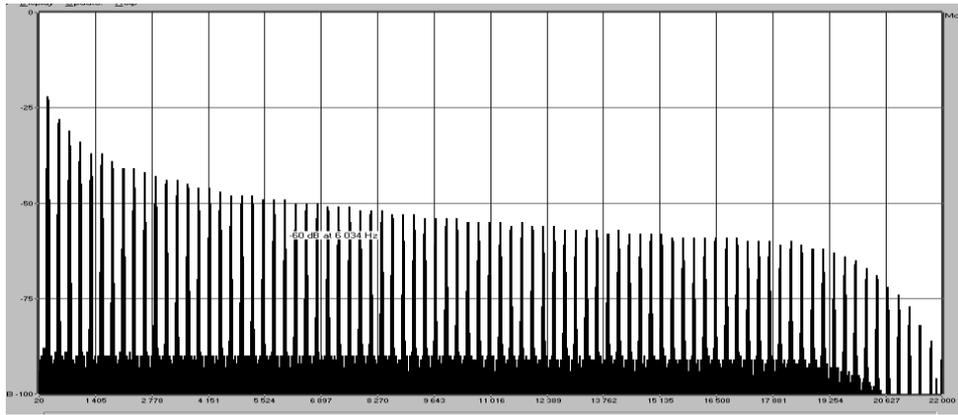
### 1.2.1 Aliasing-free oscillators

Standard digital synthesizers produce aliasing in high frequencies, especially when using Pulse Width Modulation (PWM) or Frequency Modulation (FM).

TAE® enables the generation of oscillators which are completely free of aliasing in all contexts (PWM, FM...), and at no extra CPU cost.



*Linear frequency spectrum of a current well-known software synthesizer*

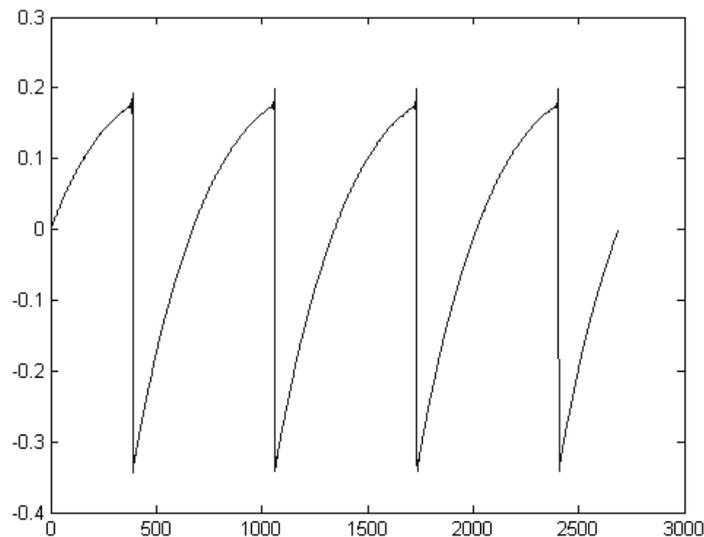


*Linear frequency spectrum of an oscillator modeled with TAE®*

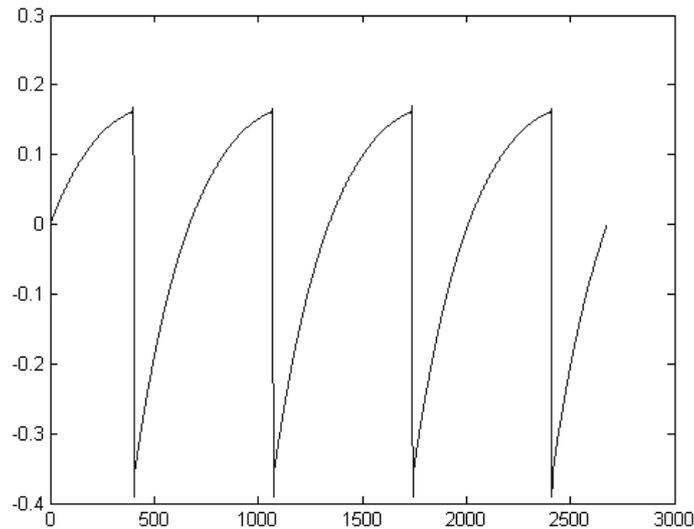
### 1.2.2 A better reproduction of analog oscillator waveforms

The waveforms produced by the oscillators in analog synthesizers are affected by the presence of a capacitor in the circuits. The discharge of a capacitor results in a slight 'bend' in the original waveform (most notably for sawtooth, triangular and square waveforms). TAE® reproduces the result of this capacitor discharge in software.

Below is the analysis of a waveform from one of the five original instruments Arturia's software emulates, followed by one made by TAE®. They are both equally deformed by the low-pass and high-pass filtering.



*Temporal representation of the "sawtooth" waveform of a hardware synthesizer*



*Temporal representation of a "sawtooth" waveform reproduced by TAE®*

What's more, the hardware analog oscillators were unstable. In fact, their waveforms vary slightly from one period to another. If we add to this the fact that the starting point for each period (in Trigger mode) can vary with the temperature and other environmental conditions, we see why vintage synthesizers have such a typical sound.

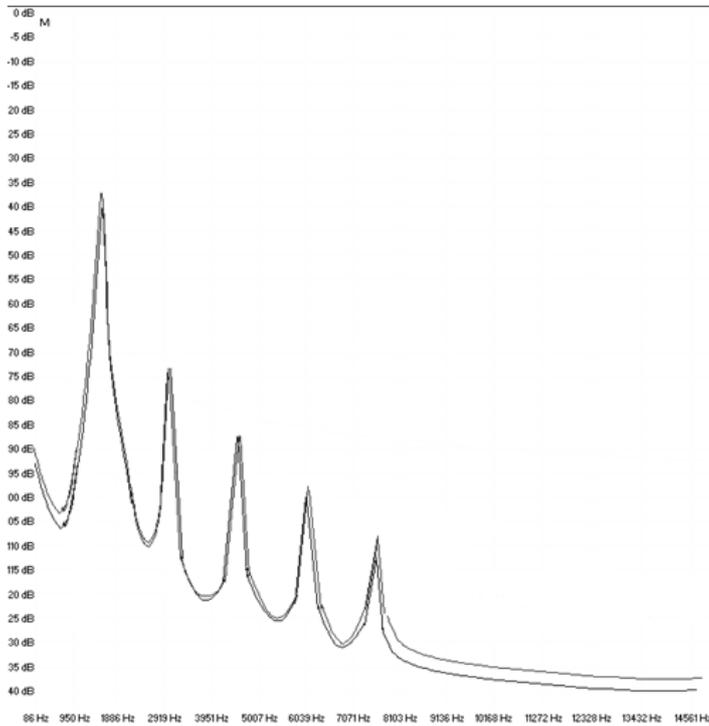
TAE® reproduces the instability of oscillators, resulting in a fatter and "bigger" sound.

### 1.2.3 Direct Filter Circuit Modeling

Due to advances in computer processing power, TAE® can now employ direct filter modeling techniques to achieve unprecedented accuracy in the emulation of a hardware synthesizer's filter. By modeling the operation of the individual hardware components of the filter circuit, the warm nuances synonymous with analog sounds are recreated.

The following graph shows a single example of direct circuit modeling in action. The peaks represent the generation of harmonics at multiples of the resonant frequency when a particular filter is in self oscillation mode. These harmonics are characteristic of hardware synthesizer filters and are due to the non-linear behavior inherent to their analog circuitry. Anomalies such as these add to the richness and warmth of the sound produced by the filter.

But you'll notice there are two lines on the graph: Those are the superimposed frequency domain plots for both one of Arturia's virtual instruments and the hardware filter being emulated. They are practically indistinguishable, both on the graph and to the human ear. The direct recreation of this analog circuitry causes the same characteristics of the sound to be present, thus giving the user a truly analog sound.



*Comparison of harmonics generated by the filter circuits in self-oscillation of TAE® and a hardware synthesizer*

So here's the bottom line: when you bring together a bunch of music lovers who also have a deep understanding of the characteristics of electronic circuits, you wind up with Arturia. And Arturia now offers you our most impressive software model yet, the Matrix-12 V.

We take great satisfaction in knowing this great synthesizer will help you explore previously unknown musical territory.

## 2 ACTIVATION AND FIRST START

### 2.1 Register and Activate

Mini V works on computers equipped with Windows 7 or later and Mac OS X 10.8 or later. You can use the stand-alone version or use Mini V as an Audio Units, AAX, VST2 or VST3 instrument.



Once Mini V has been installed, the next step is to register the software.

The registration process will require you to enter the serial number and the unlock code you received with the product.

In order to proceed, go to this web page and follow the instructions:

<http://www.arturia.com/register>

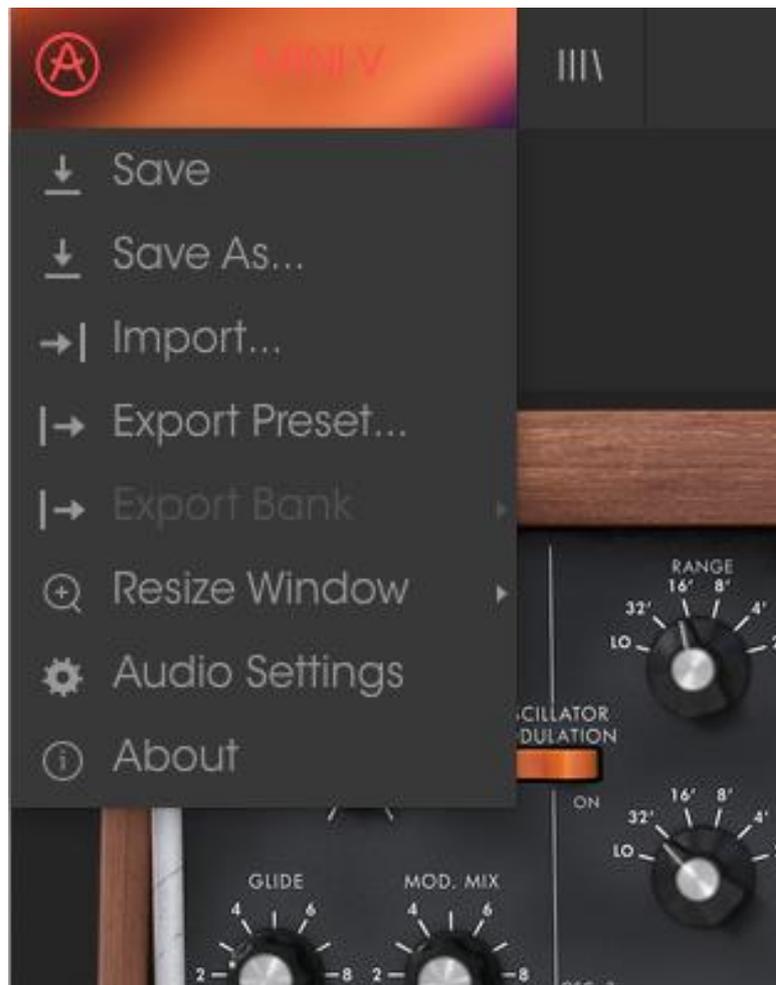
Note: If you don't have an Arturia account yet, you will need to create one. The process is quick, but it does require that you can access your email address during the registration process.

Once you have acquired an Arturia account you will be able to register the product.

### 2.2 Initial setup

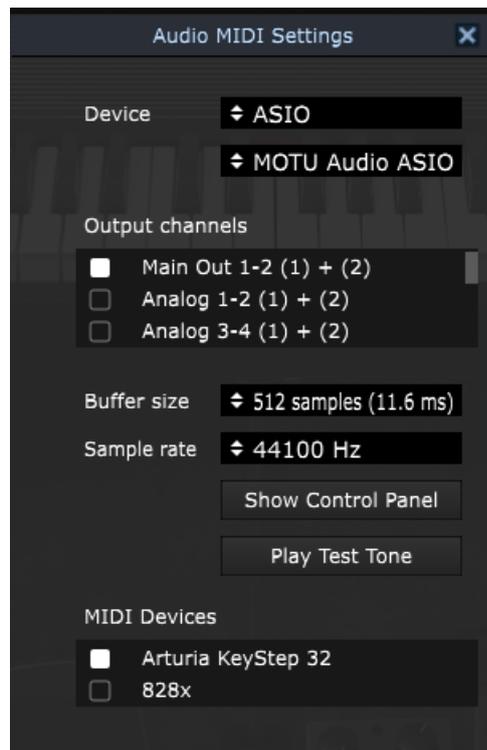
#### 2.2.1 Audio and MIDI settings: Windows

At the top left of the Mini V application is a pull-down menu. It contains various setup options. Initially you will need to go to the menu and choose the Audio Settings option to get sound and MIDI flowing in and out.



*Mini V main menu*

You will then see the Audio MIDI settings window. This works in the same way on both Windows and Mac OS X, although the names of the devices available to you will depend on the hardware you are using.



*Audio and MIDI settings window*

Starting from the top you have the following options:

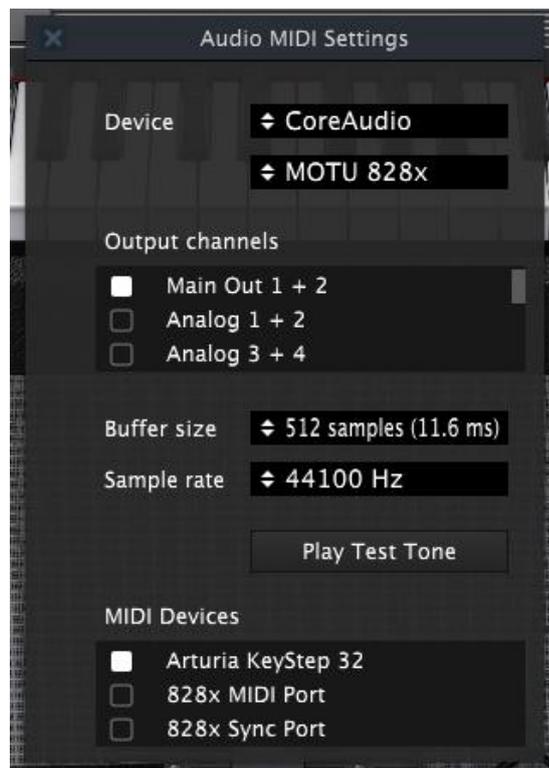
- **Device** lets you choose which audio driver you want to use to route sound out of the instrument. This might be your computer's own driver like Windows Audio, or an ASIO driver. The name of your hardware interface may appear in this field.
- **Output Channels** lets you select which of the available outputs will be used to route audio out. If you only have two outputs, only two will appear as options. If you have more than two you can select a specific pair of outputs.
- The **Buffer Size** menu lets you select the size of the audio buffer your computer uses to calculate sound. A smaller buffer means lower latency between pressing a key and hearing the note. A larger buffer means a lower CPU load as the computer has more time to think, but can result in a small latency. Find the optimum buffer size for your system. A fast, modern computer should easily be able to operate at 256 or 128 sample buffer size without creating pops or clicks in the sound. If you are getting clicks, try raising the buffer a little. The latency is displayed on the right hand side of this menu.
- The **Sample Rate** menu lets you set the sample rate at which audio is sent out of the instrument. The options here will depend on the capability of your audio interface hardware though even most computers' own hardware can operate at up to 48kHz which is perfectly fine. Higher sample rates use more CPU power so unless you have a good reason to go up to 96kHz, then 44.1k or 48k is usually fine. The **Show Control Panel**

button will jump to the system control panel for whatever audio device is selected.

- **Play Test Tone** helps you to troubleshoot audio issues by confirming whether sound can be heard through the correct device.
- Your connected MIDI devices will appear in the **MIDI Devices** area. Click the check box to accept MIDI from the device you want to use to trigger the instrument. In standalone mode, Mini V listens for all MIDI channels so there's no need to specify a channel. You can specify more than one MIDI device at once.

## 2.2.2 Audio and MIDI settings: Mac OS X

The process is very similar to initial setup for Windows and the menu is accessed in the same way. The difference is that OS X uses CoreAudio to handle audio routing and the audio device selection is made in the second dropdown menu. Apart from that, the options work the same way as described in the Windows section.



## 2.2.3 Using Mini V in plug-in mode



Mini V comes in VST, AU and AAX plug-in formats for use in all major DAW software such as Cubase, Logic, Pro Tools and so on. You can load it as a plug-in instrument and its interface and settings work the same way as in standalone mode, with a couple of differences.

- You can automate numerous parameters using your DAW's automation system.
- You can use more than one instance of Mini V in a DAW project. In standalone mode you can only use one at once.
- You can route Mini V's audio outputs more creatively inside your DAW using the DAW's own audio routing system.

## 3 USER INTERFACE

Mini V is packed with great features, and in this chapter we'll make sure you know what each one does. We think you'll be amazed by the huge range of sounds that can be made with this instrument.

And while Mini V is very flexible, there's nothing complicated about it. That will always be the main focus of every Arturia product: to unleash your creativity while remaining easy to use.

### 3.1 The virtual keyboard

The virtual keyboard allows you to play a sound without the need for an external MIDI device. Simply click on a virtual key to hear the currently selected sound. You can also drag the cursor across the keys to hear a glissando.

Clicking near the front edge of the key results in a higher velocity note; clicking near the back of the key produces a soft velocity.



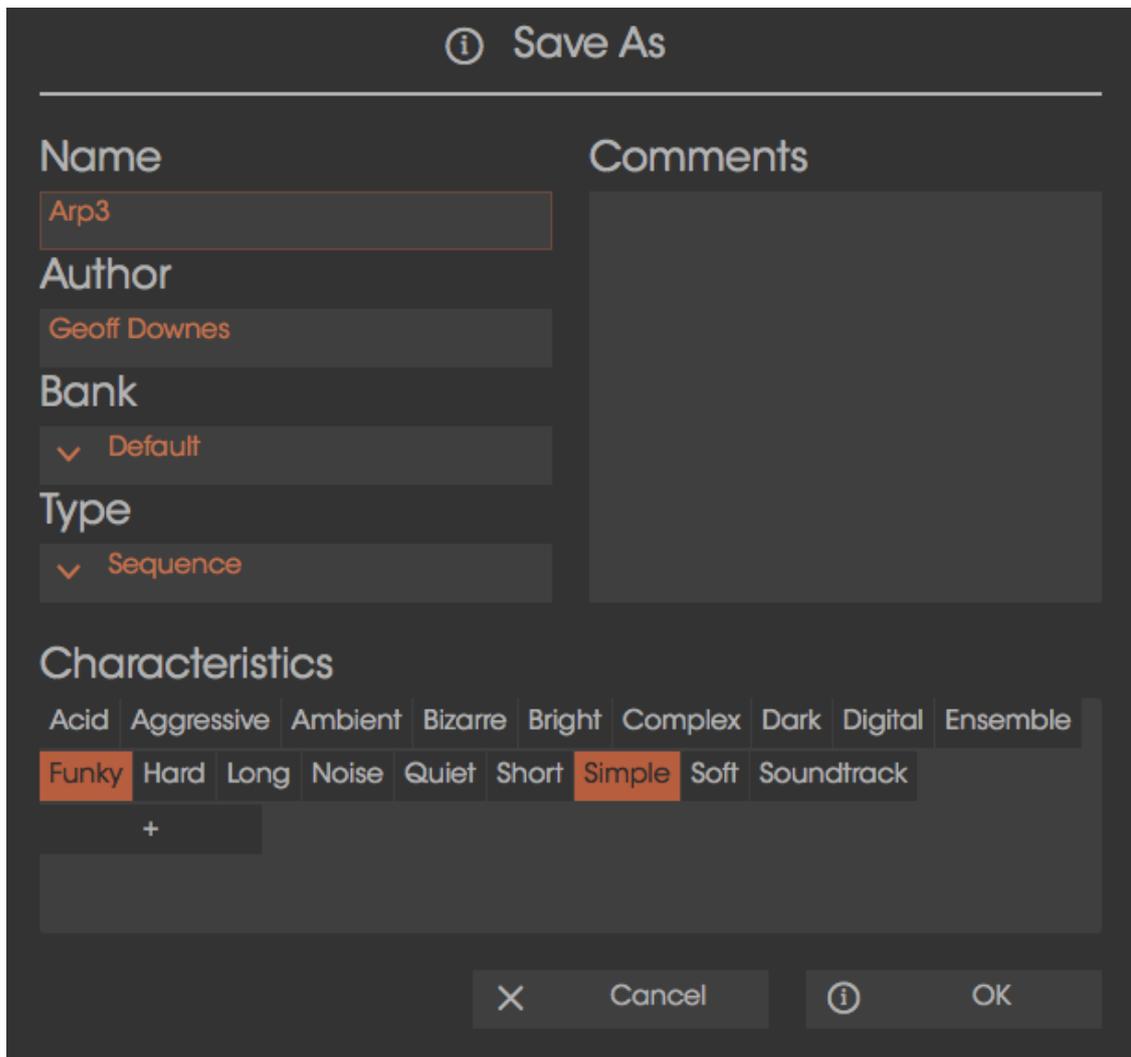
*Mini V keyboard*

### 3.2 Toolbar

The toolbar that runs along the top edge of the instrument both in standalone and plug-in mode provides access to many useful features. Let's look at them in detail. The first seven of these options can be found by clicking on the Mini V section at the very top left hand corner of the instrument window.

#### 3.2.1 Save Preset

The first option lets you save a preset. If you select this you are presented with a window where you can enter information about the preset. In addition to naming it you can enter the author name, select a bank and type and select some tags that describe the sound. This information can be read by the preset browser and is useful for searching the preset banks later. You can also enter freeform text comments in the Comments field, which is handy for providing a more detailed description.



*The Save Preset window*

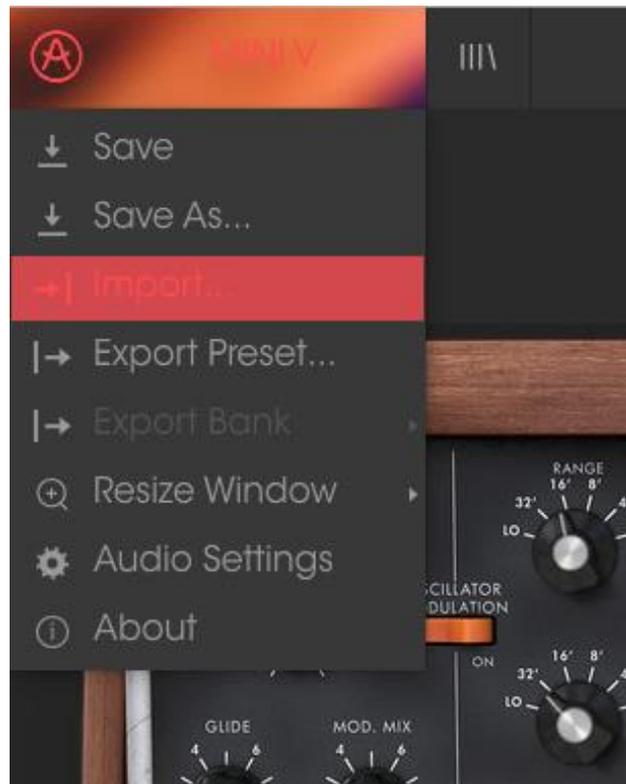
### 3.2.2 Save Preset As...

This works in the same way as the Save command, but lets you save a copy of the preset instead of saving over the original. It's useful for creating variations on patches but still keeping individual copies of each one.

### 3.2.3 Import preset

This command lets you import a preset file, which can be either a single preset or an entire bank of presets. Both types are stored in the .minix format.

After selecting this option, the default path to these files will appear in the window, but you can navigate to whichever folder you are using.

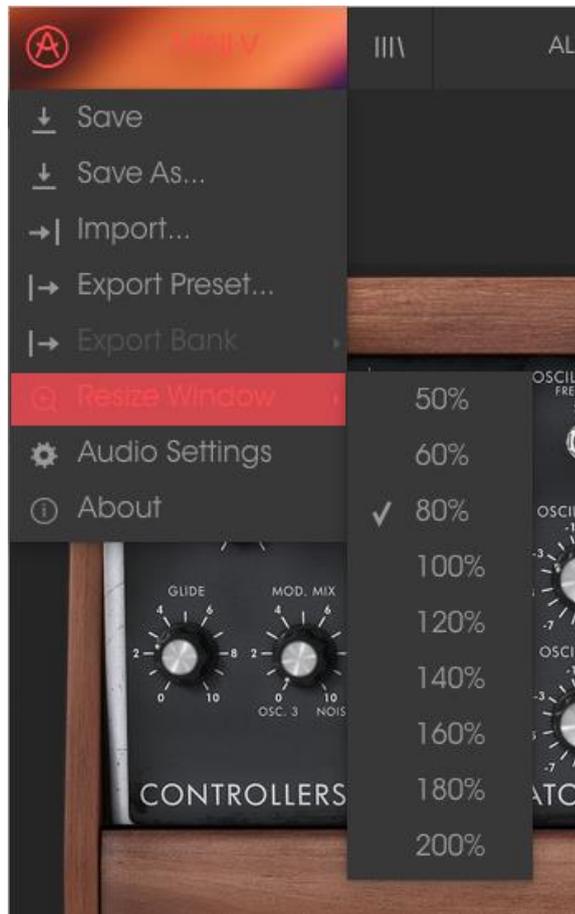


### 3.2.4 Export preset

You can export and share a single preset using this command. The default path to these files will appear in the window, but you can create a folder at another location if you like.

### 3.2.5 Resize window options

The Mini V window can be resized from 60% to 200% of its original size without any visual artifacts. On a smaller screen such as a laptop you might want to reduce the interface size so it doesn't dominate the display. On a larger screen or a second monitor you can increase the size to get a better view of the controls. The controls work the same at any zoom level but the smaller ones can be harder to see at the smaller magnification values.



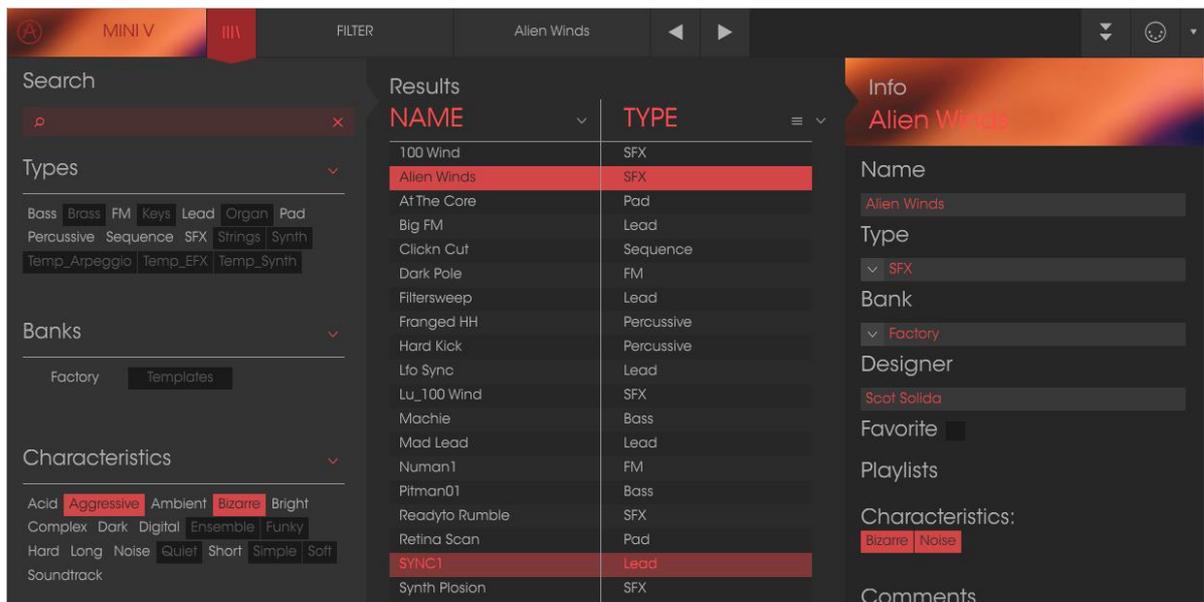
*The Resize Window menu*

### 3.2.6 Audio settings

Here you manage the way the instrument transmits sound and receives MIDI. See section 2.2 of the manual for full details on this.

### 3.2.7 Preset browser overview

The Preset browser is invoked by clicking the toolbar button that has four vertical lines. See section 3.3 of the manual for full details on this. The Filter, name field and left / right arrows in the toolbar all assist with preset selection.



The Preset Browser

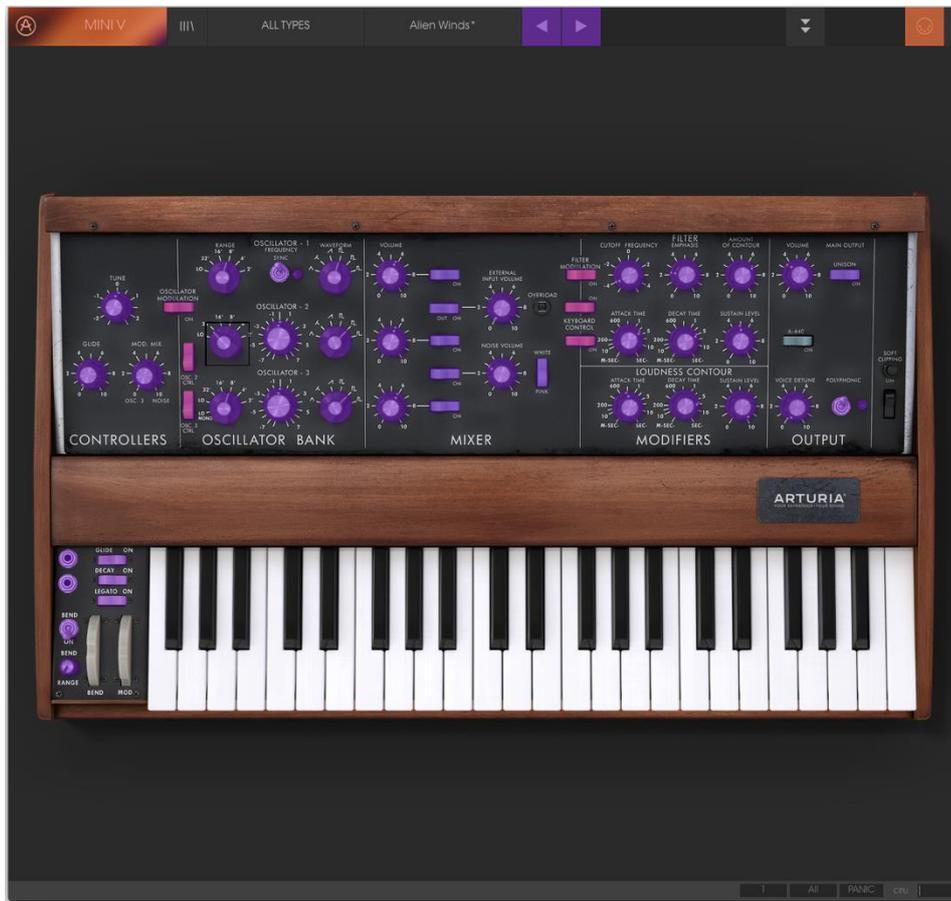
### 3.2.8 Open and Close Advanced section

The Advanced section can be revealed by clicking on the button with the two downward arrows at the right of the toolbar. This lets you access the more advanced features of the instrument like. Click this button once to reveal the advanced section of the instrument and again to hide it. You can also click on the frame of the instrument to open and close it.



### 3.2.9 MIDI Learn assignment

The MIDI plug icon at the far right side of the toolbar places the instrument into MIDI learn mode. Parameters that can be assigned to MIDI controls will be shown in purple, and the idea is that you map physical buttons, knobs, faders or pedals from hardware MIDI controllers to specific destinations inside the instrument. A typical example might be to map a real expression pedal to the virtual volume pedal, or buttons on a controller to the effect switches so you can change the sound from your hardware keyboard.



*MIDI Learn mode*

### 3.2.9.1 Assigning / unassigning controls

If you click on a purple area you'll put that control into learning mode. Move a physical knob or fader and the target goes red, indicating that a link has been made between the hardware control and the software parameter. There's a popup window that displays which two things are being linked and a button to unassign the two from each other.



*Filter cutoff frequency selected and assigned*

### 3.2.9.2 Min / Max value sliders

There are also minimum and maximum value sliders that you can use to restrict the parameter change range to something other than 0%-100%. For example,

you might want the filter cut-off be controllable via hardware from 30% to 90%. If you made this setting (Min set to 0.30 and Max set to 0.90) your physical knob would be unable to alter the volume lower than 30% or higher than 90%, no matter how far you turned it. This is very useful for making sure you can't accidentally make the sound too quiet or too loud when performing.

In the case of switches which only have two positions (on or off), those would normally be assigned to buttons on your controller. But it is possible to toggle those with a fader or other control if you like.

### 3.2.9.3 *Relative control option*

The final option in this window is a button labelled "Is Relative". It is optimized for use with a specific type of control: one which sends only a few values to indicate the direction and speed at which a knob is turning, as opposed to sending a full range of values in a linear fashion (0-127, for example).

To be specific, a "relative" knob will send values 61-63 when turned in a negative direction and values 65-67 when turned in a positive direction. The turn speed determines the parameter response. Refer to the documentation of your hardware controller to see if it has this capability. If so, be sure to switch this parameter on when setting up its MIDI assignments.

When configured this way, movements of the physical control (usually a knob) will change the software parameter by starting at its current setting, rather than being an "absolute" control and snapping it to some other value as soon as you start to move it.

This can be a great feature when controlling things like volume, filter, or effect controls, since you won't usually want them to jump massively out of their current setting as soon as you start to modify them.

### 3.2.9.4 *Reserved MIDI CC numbers*

Certain MIDI Continuous Controller (MIDI CC) numbers are reserved and cannot be reassigned to other controls. These are:

- Pitch Bend
- Ctrl Mod Wheel (CC #1)
- AfterTouch
- Ctrl Sustain On/Off (CC #64)
- Ctrl All Notes Off (CC #123)
- Ctrl Omni Mode Off (CC #124)
- Ctrl Omni Mode On (CC #125)
- Ctrl Poly Mode Off (CC #126)
- Ctrl Poly Mode On (CC #127)

All other MIDI CC numbers may be used to control any assignable parameter in Mini V.

### 3.2.10 MIDI controller configuration

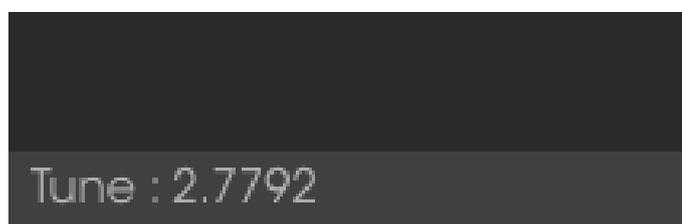
There's a small arrow at the far right hand side of the toolbar that deals with MIDI controller configurations. This allows you to manage the different sets of MIDI maps you may have set up for controlling the instrument's parameters from MIDI hardware. You can copy the current MIDI assignment setup or delete it, import a configuration file or export the currently active one. This is a quick way to set up different hardware MIDI keyboards or controllers with Mini V without having to build all the assignments from scratch each time you swap hardware.



### 3.2.11 The lower toolbar

#### 3.2.11.1 Current control Value

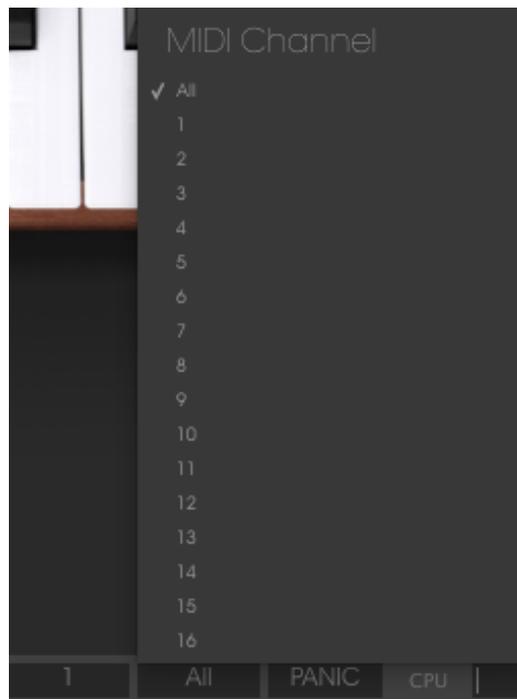
At the left hand side of the lower toolbar you will see a readout showing the value or state of whatever control you are modifying. It will also display the current value of a parameter without editing it: just hover the cursor over the related control and the value will appear as pictured below.



*Displaying the current control's value*

#### 3.2.11.2 MIDI Channel setting

At the right hand side of the lower toolbar are three small windows. The first one on the left indicates the current MIDI Channel setting. Click on it and it will expand to show the full range of values you can select (All, 1-16).



#### 3.2.11.3 *Panic button and CPU meter*

The Panic button can be pressed to reset all MIDI signals in the event of stuck notes or other issues. The Panic button is also MIDI-assignable.

The CPU meter is used to monitor how much of your computer's CPU is being used by the instrument.



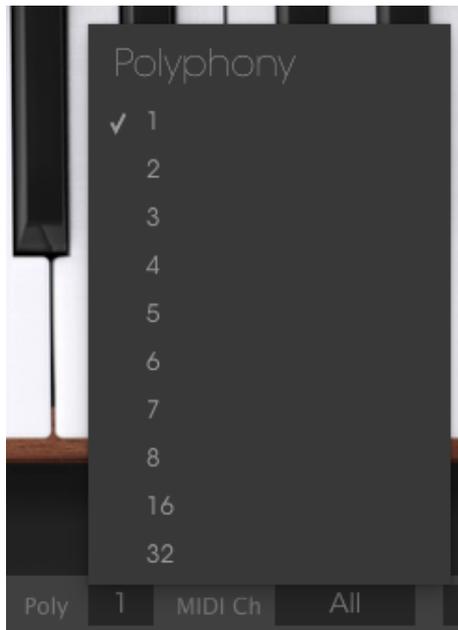
#### 3.2.11.4 *Play mode*

The play mode allows to select which note is heard when several keys are pushed simultaneously while the Mini V is in monophonic mode.

In “Low” mode we will hear the lowest note, in “High” mode the highest note, and in “Last” mode the last note played on the keyboard.

#### 3.2.11.5 *Maximum Polyphony*

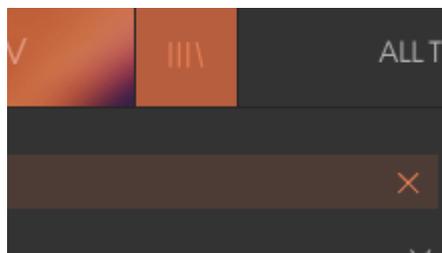
By clicking this button, you will be able to adjust the upper limit for the number of voices played the Mini V. It can be set from 1 to 32. Having lower setting will result in less CPU being used. Setting the number too low can create situation where the voices cut off and create unnatural sustains. The key is to find a balance that you and your computer can both live with.



### 3.3 The Preset Browser

The preset browser is how you search, load and manage sounds in Mini V. It has a couple of different views but they all access the same banks of presets.

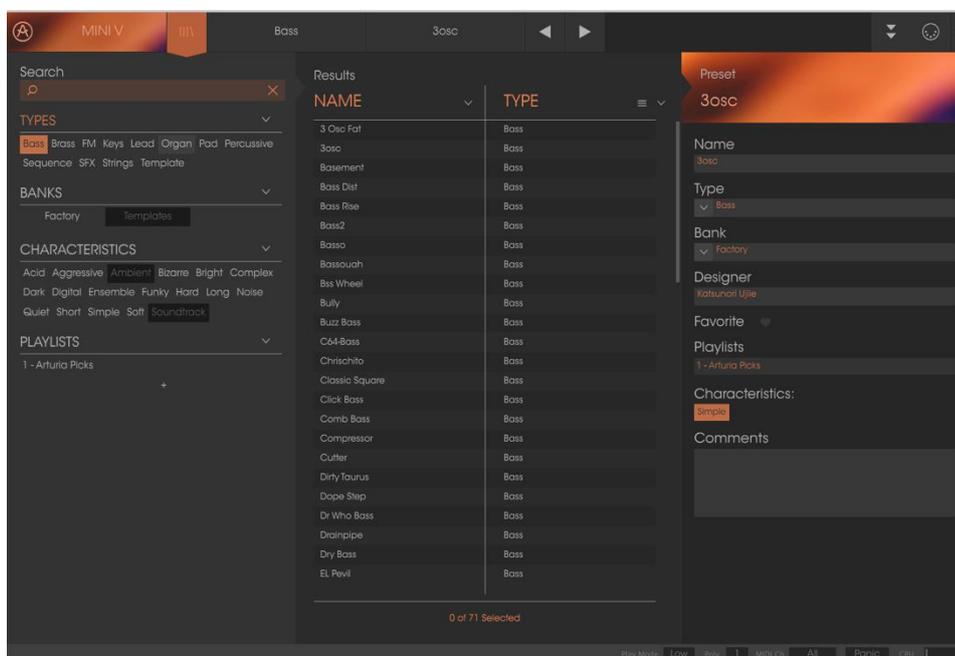
To access the search view, click on the browser button (the icon looks a bit like books on a library shelf).



*The Preset Browser button*

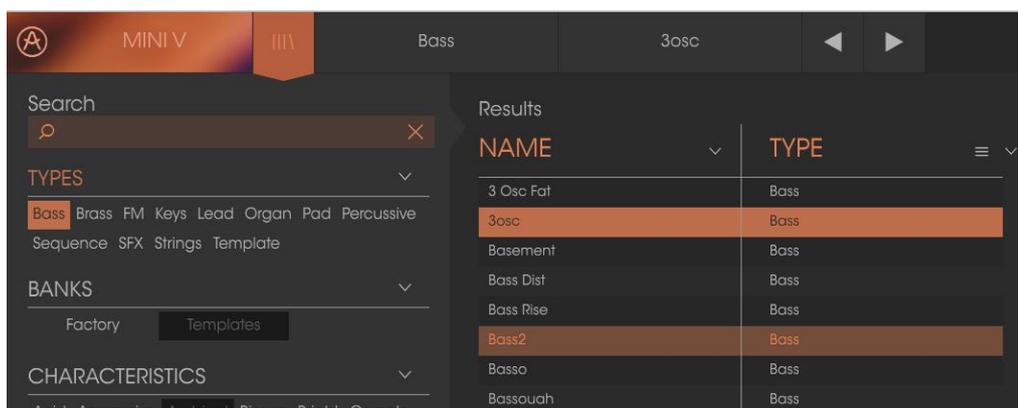
### 3.3.1 Searching presets

The Search screen has a number of sections. By clicking on the Search field at the top left you can quickly enter any search term to filter the preset list by patch name. The Results column is updated to show the results of your search. Press the X button in the search field to clear the search.



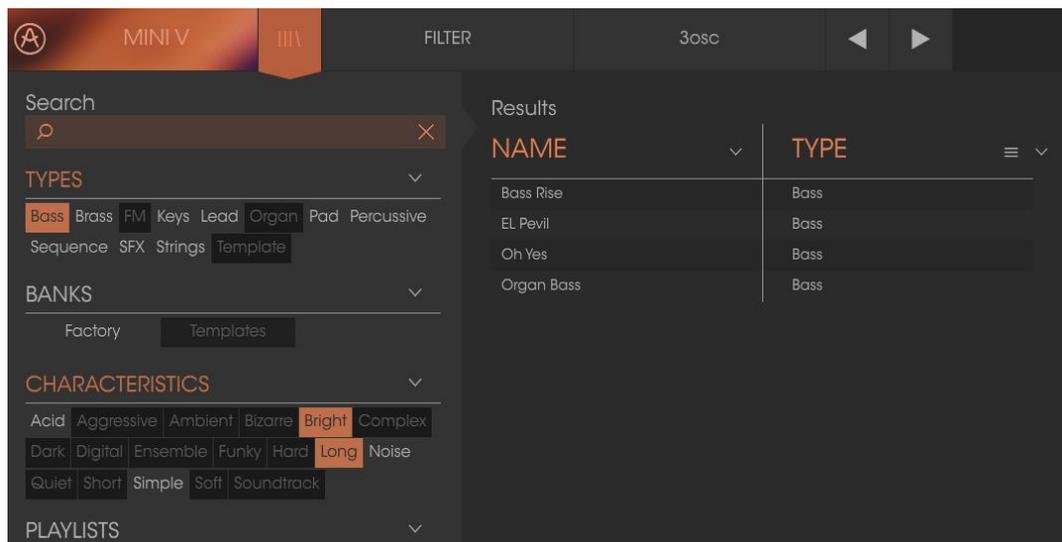
### 3.3.2 Using tags as a filter

You can also search using different tags. Clicking on a Type field shows only presets that match that tag. The tag fields can be shown or hidden by using the small down arrow buttons in their title fields. Results columns can be sorted by clicking the same arrow button in their own section.

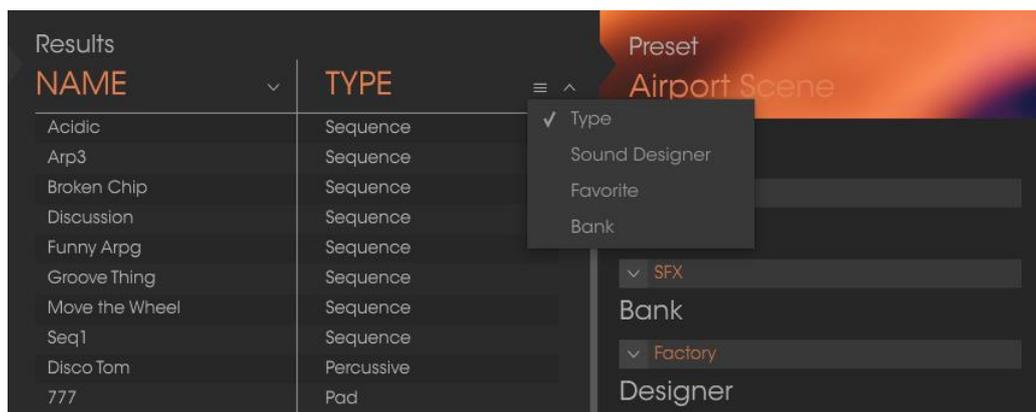


You can use multiple search fields to perform narrower searches. So by entering a text search and also specifying type, bank and characteristics options you could see only the presets that match those exact criteria. Deselect any tag in any area to remove that criteria and widen the search without having to go

back and start again. Using “Ctrl + click” (Windows) or “Cmd + click” (Mac) will allow you to select multiple elements in the same area.



The second Results column can be switched to show Type, Sound Designer, Favorite or Bank tags depending on how you like to search. Click on its options menu button just next to its sort arrow.

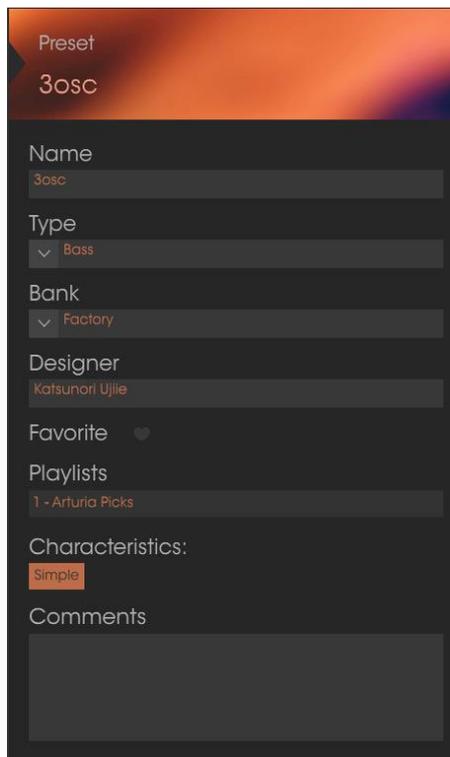


### 3.3.3 The Preset Info section

The Info column on the right of the search field shows you information about any preset. The information for User presets may be changed here: Name, Type, Favorite, etc.

However, if you want to alter the information for a Factory preset you must first use the Save As command to re-save it as a User preset. After this the Info section will gain Edit and Delete buttons at the bottom of the window.

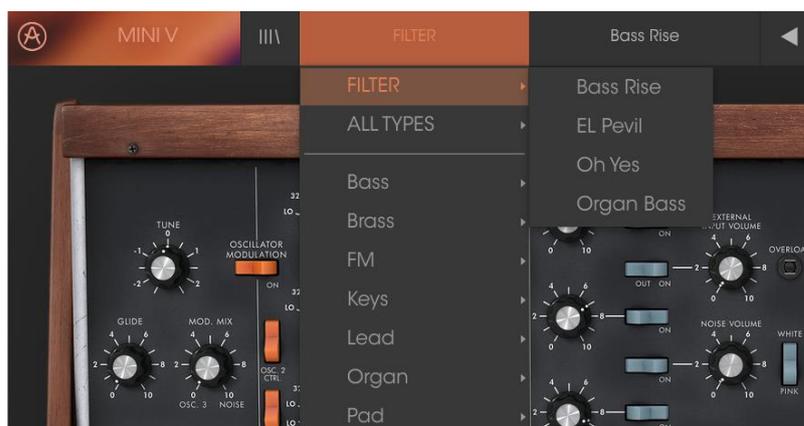
Click Edit and then make the desired changes, either by typing in one of the fields or by using a pull-down menu to change the Bank or Type. You can even add new Characteristics by clicking the + sign at the end of that list. Click Save when you are done.



### 3.3.4 Preset selection: other methods

The pull-down menu to the right of the Search menu provides a different way to select presets. The first option in this menu is called Filter, and it will display the presets that fit the search terms you used in the Search field. So if you searched for “Love” in the main search area, the results of that search will appear here.

Similarly, if you previously selected a Type in the Search field you would see the results of that search in this area instead.



Filter results may differ based on Search criteria

Selecting the All Types option in the pull-down menu will bypass the Search criteria and show the entire list of presets.

The Categories below the line also ignore the Search criteria and display the presets based on their Type.



#### 3.3.4.1 Selecting a preset by its Type

Clicking on the name field in the center of the toolbar will show you a list of all available presets. The list will also take into account any selections you have made in the Search field. So if you have pre-selected a Characteristic such as "Funky" this shortcut menu will only show you presets that match that tag.

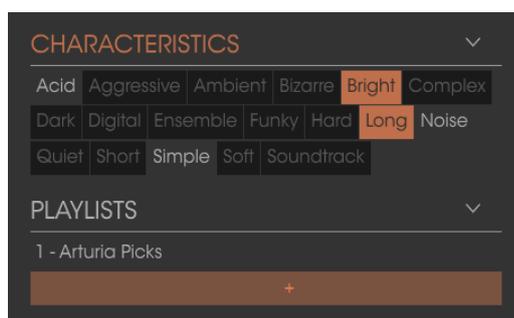
The left and right arrows in the toolbar cycle up and down through the preset list: either the full list, or the filtered list that resulted from the use of one or more search terms.

### 3.3.5 Playlists

In the lower left corner of the Preset Browser window is a feature titled Playlists. This is used to collect presets into different groups for different purposes, such as a set list for a particular performance or a batch of presets related to a particular studio project.

### 3.3.5.1 Add a playlist

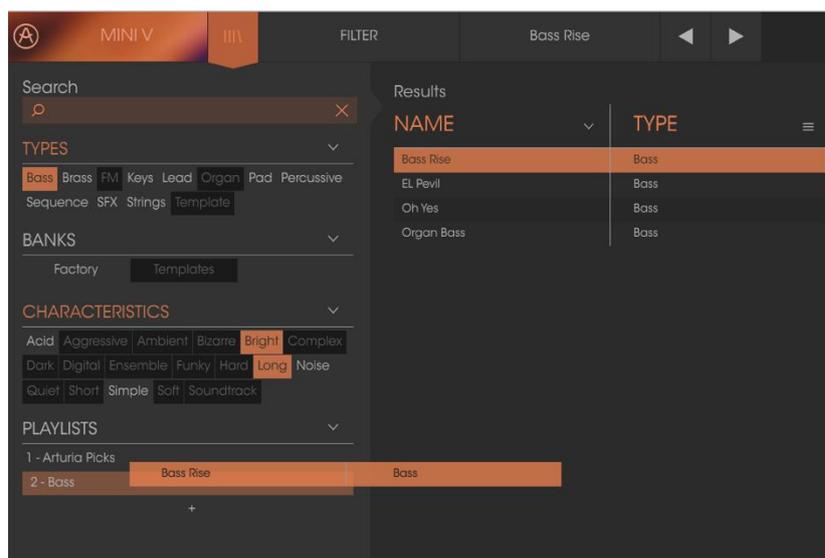
To create a playlist, click the plus sign at the bottom:



Give the playlist a name and it will appear in the Playlists menu. You can rename the playlist at any time; just click the pencil icon at the end of its row.

### 3.3.5.2 Add a preset

You can use all of the options in the Search window to locate the presets you want to have in your playlist. Once you have found the right preset, click and drag it onto the playlist name.



Click and drag from the Search Results list onto one of the playlists. To view the contents of a playlist, click on the playlist name.

### 3.3.5.3 Re-order the presets

Presets may be reorganized within a playlist. For example, to move a preset from slot 2 to slot 4, drag and drop the preset to the desired location.

This will move the preset into the new location.

### 3.3.5.4 Remove a preset

To delete a preset from a playlist, click the x at the end of the preset row.

Click the X to remove a preset from a playlist

### 3.3.5.5 Delete a playlist

To delete a playlist, click the x directly to the right of the playlist name.

Click the X to delete a playlist

## 3.4 The synthesizer panels

The Mini V offers two panels:

The “**Classic**” mode allows using the original configuration of the original model. Some additional features: the oscillator 2 can be synchronized to the oscillator1, the oscillator 2 can be disconnected to the keyboard following circuit, poly/mono/unison switches have also been added.



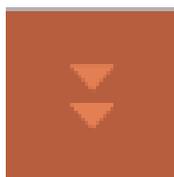
*The Classic mode (same as the original)*

The “**Extended**” interface gives access to a motion recorder, a vocal filter, a LFO, a modulation matrix, an arpeggiator and two effects. These different functions will enrich the basic settings of the Mini V.



*The panel of the “Extended” mode*

- ▶ To access the “Extended” mode, click on the wooden crosspiece situated above the synthesis settings or on the “Open” button on the right of the toolbar.
- ▶ To return to the “Classic” mode, simply click again on the wooden crosspiece or on the “Close” button.



*Opening the extension panel*

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To use the Mini V exactly like the original model, you must also deactivate the chorus and delay effects and switch off the polyphony toggle in the output section.

---

### 3.4.1 Overview of the “Classic” mode

The “Classic” mode holds 50 synthesis settings, which will allow you to conceive an infinite variety of sounds. The knobs and switches associated to these parameters are found regrouped on the panel above the keyboard.

These parameters are composed of:

**3 oscillators** (VCO) which deliver the base audio signal thanks to 6 wave forms (triangle, sawtooth 1 and 2, square, rectangle 1 and 2) and manage the height of the sound (the frequency). The third can also be used as a modulator when its signal is directed to the filter or oscillators.

A **Mixer** allows you to mix the signals coming from the oscillators or the noise module.

A **low-pass 24dB** resonant filter

An **ADS** envelope modulating the low-pass filters

**1 amplifier** (VCA) allowing the amplification of the signal coming from the filter to direct it to the stereo output.

An **ADS** envelope modulating the signal going through the amplifier.



*The synthesis parameters*

### 3.4.2 The “Extended” mode

When the Mini V is at the “Extended” position, you access an extension panel to the parameters of synthesis. It is displayed in the form of a modulation matrix, a Low Frequency Oscillator (LFO) which was brought in be substituted for oscillator 3 which was being used to this effect. An arpeggiator, a chorus and stereo delay complete this extension.

#### 3.4.2.1 The modulation matrix

The modulation matrix multiplies the possibilities for editing sound when compared to the original instrument. You can choose 8 sources (sub osc., envelopes, etc.) to modulate 8 destinations (freq. Osc., freq. VCF, etc.).

The choice of source and destination is done via the LCD displays. The matrix offers 15 sources of modulation and 35 destinations (compared to 2 on the original!).



*The modulation matrix*

### 3.4.2.2 The LFO



On the original synthesizer (equivalent to the “Classic” mode), oscillator3 can be set to the low frequency (“Lo” position in the range) to be used in LFO mode. This removed the possibility of using 3 simultaneous oscillators as well as a slow modulation on the filter cut-off frequency for example.

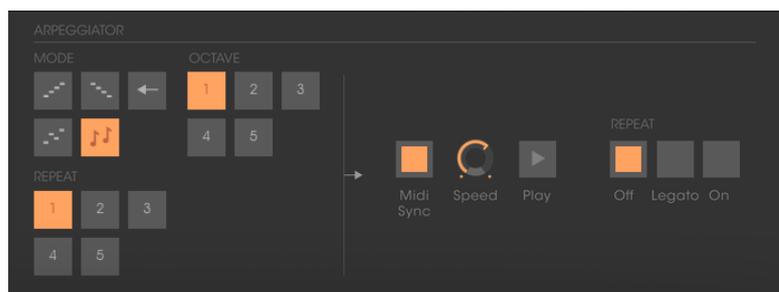
With the added LFO module added in the panel of the “Extended” mode, you can keep the 3<sup>rd</sup> oscillator as a base for sound and add an additional source of modulation to be used on one of the 35 available locations.

### 3.4.2.3 The arpeggiator section

The “Arpeggiator” section lets you easily create an arpeggio from a chord played on the keyboard.

An arpeggio is a series of single notes of the same length that spell out a chord, and play one after the other.

Arpeggiator settings are available on the right of the modulation matrix.



*The arpeggiator*

### 3.4.2.4 The effects section

The effects section lets you add chorus or delay to your sound.

#### **The chorus:**

The Chorus effect enables to double and slightly detune your sound in order to make it deeper and livelier. 3 types of stereo chorus are available.



*The chorus*

**The delay:**

The delay effect adds stereo echoes to the sound.

It has independent settings for the speed and the number of echoes on the right and left sides. It is also possible to create a great number of rhythmic combinations between the echoes. The speed of the delay can also be synchronized with the MIDI tempo.



*Settings of the delay effect*

## 4 THE SYNTHESIZER

When it is set to “Classic” mode, the Mini V remains very close to the original synthesizer. It is composed of two parts, one containing the synthesis parameters, the other being the keyboard and the modulation wheels. The synthesis panel is separated into several sub-groups, corresponding to the usual modules for subtractive synthesis: Oscillators, Mixer, Filter and Envelopes.



*View of the Mini V in “Classic” mode*

By clicking on the “Open” button of the toolbar or the upper wooden bar, the Mini V will open and reveal the extension panel. The effects, an arpeggiator and a modulation matrix are contained here.



View of the Mini V in “Extended” mode

## 4.1 The oscillators

The Mini V has three independent oscillators which can be found in the “Oscillator Bank” section in the synthesis panel.



## Oscillators

Each of these oscillators can produce different waveforms which are selected using the knob on the right. The first two generate, from left to right, a triangle, an asymmetric triangle, an ascending sawtooth, a square, asymmetric square and impulse. The third oscillator replaces the asymmetric triangle with a descending sawtooth. By right clicking on these selectors, it is possible to adjust the impulse width of certain waveforms: square, rectangular, impulse, triangle and asymmetric triangle. If the waveform is again modified, the impulse width will go back to its default value.

The choice of range for these oscillators can be set with "Range" knobs on the left. From the left to right are the positions: Low, 32, 16, 8, 4, and 2, the third oscillator adds the "LowMono" position at the extreme left.

The "Low" position corresponds to a very low frequency mode, the position "LowMono" on the third oscillator adds a monophonic function. In this mode, the oscillator will generate the same signal irrespective of the note played, unlike the "Low" mode where it generates a different signal for each of the notes in polyphonic mode.

The other positions of this knob correspond to the range, the 8 position being the position without transposition, positions 4 and 2, respectively 1 and 2 octaves above, positions 16 and 32 respectively 1 and 2 octaves below.

Oscillators 2 and 3 can equally be fine-tuned with the central "Frequency" knob. By left-clicking with the mouse on the knob, the setting is done by semi-tone, by up or down an octave, while when right-clicked, it is possible to tune it in a continuous manner, by more or less a semi-tone. By double clicking on this knob, it is possible to set it to its default value, which is to say tuned.

- The “**Sync**” switch synchronizes oscillator 2 with oscillator 1. In this position, it is the tuning of oscillator 1 which will be evident while oscillator 2 will bring and modify the harmonics heard.
- The “**Osc. 2 Control**” switch allows to activate and deactivate the command of oscillator 2 by the keyboard.
- The “**Osc. 3 Control**” switch is for activating and deactivating the command of oscillator 3 by the keyboard.
- The “**Oscillator Modulation**” switch modulates oscillators 1,2 and 3 via oscillator 3 with an amplitude depending on the modulation wheel. If we don't want to have oscillator 3 modulate itself, we need to deactivate the switch.

## 4.2 The mixer

The section situated on the right of the “Oscillator Bank” sub-group mixes the different signals available before applying the filtering.



*Mixer*

There are five sound sources available: the three oscillators, a noise generator and external audio in. The level of the three oscillators is set with each of the “Volume” knobs, the external signal level with the “External Input Volume” knob, the noise level with the “Noise Volume” knob. The five vertically aligned switches allow the quick deactivation of a given sound source, while the “White/Pink” switch selects a white or pink noise.

When the “Overload” indicator lights up, this indicates an overload of the external audio in.

The mixer possesses two modes of functioning, with or without the emulation of the overload circuit. In the first case, the sound signals are not modified regardless of their level. In the second, the overload circuit limits the amplitude and thus allows a modification of the tone typical of the original model.

The mixer mode change is done with the “Soft Clipping” switch on the extreme right of the synthesis panel.

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It should be noted that the emulation of the overload circuit is heavy on calculation power, and using it should be avoided with heavy polyphony or unison.

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*Activation of the overload circuit (soft clipping)*

The switch corresponding to the external signal has three positions. The first disconnects this input from the mixer. The second position connects the output of the Mini V to the mixer. This allows, thanks to the particular distortion brought by the overload circuit, to obtain a typical sound. The third connects the external input to the mixer.

### 4.3 The filter and its envelope

The result of the mixing of different sources of sound is directed towards a resonant filter with a slope of 24dB per octave.



*Filter parameters*

The “Cutoff frequency” knob sets the cut-off frequency. The “Emphasis” knob sets the level of resonance and “Amount of Contour” the action of the envelope generator associated to the filter.

It should be noted that this filter auto-oscillates, which is to say that when the resonance is set to the maximum, the filter generates a signal close to sinusoid even in the absence of an input signal. Nonetheless, a weak noise signal as filter input

brings us a little closer to the results obtained with the original synthesizer. In fact, electronics can never guarantee a perfect zero level to the filter input as is the case with a virtual reproduction.



*Envelope generator associated to the filter*

The envelope generator associated to the filter can be adjusted with the “Attack Time” knob for the attack time, and the “Decay Time” knob for the decay time, and the “Sustain Level” knob for the level of sustain.

Unlike other envelope generators, there is no separate setting for the time to return to zero. This time is the same as the decay time but can be activated or deactivated with the “decay” switch situated on the left of the keyboard. When it is deactivated, the return time to zero for the generator is practically zero.

The two “Keyboard control” switches allow the use of a key follow at the filter cut-off frequency.

When they are set to the “OFF” position, no key follow is connected.

When the first is “ON”, the key follow allows the modification of the cut-off frequency by a major third for an octave.

When the second is “ON”, the key follow is of a fifth for an octave, and when both are “ON”, the filter cut-off frequency exactly follows the keyboard. It should be noted the pivot note is F0.

A supplementary key follow can be connected with the modulation matrix. These two key follows combine. The key follow connected by the modulation matrix has a maximum slope of two octaves, which can be set with the amount knob of the matrix.

When a key follow is connected, the cut-off frequency is equally influenced by portamento, when it is active.

#### **4.4 The output volume and its envelope**

The output level of the Mini V is managed by a voltage controlled amplifier (VCA) where the setting changes are made with the “Volume” knob in the “Output” group of the synthesis panel.



*Setting the output level*

This VCA is also controlled by an envelope generator which is set in the same manner as the envelope generator associated to the filter.



*Parameters of the envelope generator associated to the VCA*

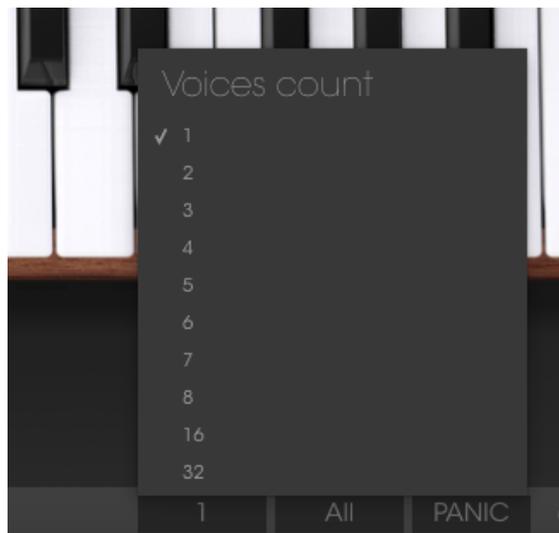
This envelope generator is set with the “Attack Time” knobs for the attack time, and the “Decay Time” knob for the decay time, and the “Sustain Level” knob for the level of sustain. The management of the return to zero is identical to the envelope generator associated to the filter.

When the decay time knob is set to the maximum, the notes are held indefinitely.

## **4.5 The polyphonic mode, the playing modes**

The original model was a monophonic synthesizer. The Mini V offers the possibilities of polyphonic playing where the number of voices can be set from 2 to 32 with the “Voices” menu.

The “**Unison**” switch: lets you to play all of the voices at the same time. The “Voice detune” knob lightly detunes each of the polyphonic voices.



*Number of polyphonic voices*

The “**Polyphonic**” switch: activates or deactivates the polyphonic playing mode. When deactivated, the Mini V is in monophonic mode. When more than one note is played on the keyboard, the note that will be heard depends on the mode of playing selected in the “playing mode” menu.



*Polyphonic and unison*

In “Low” mode we will hear the lowest note, in “High” mode the highest note, and in “Last” mode the last note played on the keyboard.

In the two first modes, when the note is released, we will hear the lowest note (or respectively the highest) without triggering the envelopes. In the last mode, the envelopes are always active.

It is possible to prevent the triggering of envelopes with the “Legato” switch which is on the left of the keyboard.



*Activation of the Legato mode*

The original synthesizer uses the “Low” playing mode when the “Legato” mode is activated.

The notes played on the keyboard directly command the frequency of the oscillators. Nevertheless, it is possible for this frequency to move slowly from one note to the next. This function, called portamento, is activated with the “Glide” switch on the left of the keyboard.



*Activation of the portamento*

The “Glide” knob: sets the time taken to reach the note played.



*Setting the portamento time*

The “Glide” switch: activates or deactivates the glide. It can be controlled by a foot switch pedal. In this case you must click on the jack on the left.

The same is true for the “Decay” switch activating the time for the return to zero of the envelopes.



*Activating the portamento and return to zero of the envelopes by pedal*

When none of the jacks are connected, eventual pedal commands act on the notes sustain.

## 4.6 The pitch bend and modulation wheels

On the left of the keyboard we find two wheels, one for modifying the oscillator frequency, the other for varying the amplitude of the modulation brought by the third oscillator, either on the oscillator frequency, or the filter cut-off frequency.

When the modulation wheel is at zero, the window displays “no modulation”. This means that it is not possible to modulate the value given by this wheel with the modulation matrix (see underneath).

On the left of the bend wheel we find a “BEND” switch and a “RANGE” potentiometer.

The “BEND” switch is used to disconnect the bend wheel from the frequency of the oscillators. We can thus, through the modulation matrix, use the bend wheel to modify a parameter of synthesis, without modifying the frequency of the oscillator.

The “RANGE” potentiometer sets the amplitude of the bend wheel, more or less four octaves per semi-tone.



*Setting the bend wheel*

## 4.7 The Motion Recorder

The Motion Recorder allows recording in real time some parameters motions on the fly. Four dedicated tracks containing each one parameter motion are available.

Those recording curves can be quantized to a MIDI tempo or not.

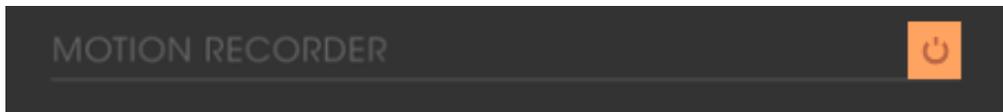
The different motion curves can also be “manually” modified thanks to a dedicated edition interface including drawing tools (pen, rubber, curve, lines...)



*The Motion Recorder main interface*

#### 4.7.1 The Motion Recorder activation/deactivation

To activate the Motion Recorder, just click on the activation button situated on the motion recorder interface. (This button is now highlighted)



*The activation button*

To deactivate the Motion Recorder, just click on the activation button (This button is now extinct).

#### 4.7.2 Playing recorded Motion curves

To hear the complete motion curve, you have to hold a note (or a chord) on your MIDI keyboard or on your MIDI sequencer.

Play one (or several) note(s) on your MIDI keyboard to read the motion curve(s).

To stop the curve playing, you can deactivate the modulation destination by selecting the "OFF" option in the automation track.

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The motion automation curves are re-triggered each time a note will be played. Finally, they can be equivalent to "super envelopes" that are drawn by the user!

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#### 4.7.3 Quantizing a motion curve

The Motion Recorder allows you to quantize a recorded motion curve in relation to the internal Mini V tempo or to a host MIDI tempo.

Click on the "Quantize" menu, situated under the Motion Recorder main screen and select the quantization factor you wish on the dedicated menu.



#### 4.7.5 The parameters available for the Motion Recorder

The parameters available as modulation destinations for the Motion Recorder are:

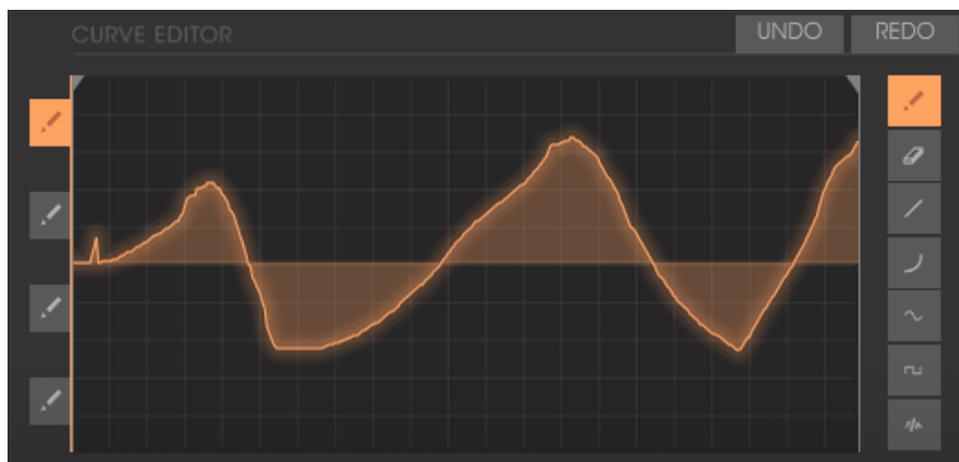
- VCO1 FM.....Coarse frequency of oscillator 1
- VCO1 PWM .....Pulse width of oscillator 1
- VCO1 AM .....Output level of oscillator 1 (available in the Mixer)
- VCO2 FM.....Coarse frequency of oscillator 2
- VCO2 PWM .....Pulse width of oscillator 2
- VCO2 AM .....Output level of oscillator 2 (available in the Mixer)
- VCO3 FM.....Coarse frequency of oscillator 3
- VCO3 PWM .....Pulse width of oscillator 3
- VCO3 AM.....Output level of oscillator 3 (available in the Mixer)
- VCO12 FM .....Coarse frequency of oscillators 1 and 2
- VCO123 FM .....Coarse frequency of oscillators 1, 2 and 3
- VCO12 PWM ...Pulse width of oscillators 1 and 2
- VCO123 PWM .Pulse width of oscillators 1, 2 and 3
- VCO12 AM .....Output level of oscillators 1 and 2
- CutOff.....Filter cut-off frequency
- Emphasis .....Level of filter resonance
- EG VCF lev.....Amount of filter envelope
- EG VCA lev.....Amount of amplifier envelope
- Glide .....Portamento time
- MixMod .....Balance between oscillator 3 and noise
- Mod.Wheel.....Amount of internal modulations only (oscillator and filter)
- VCA AM .....VCA output level
- LFO FM .....LFO speed
- LFO AM.....LFO amplitude
- Noise AM.....Output level of noise generator (available in the Mixer)
- Ext. AM.....Level of the audio external input (available in the Mixer)
- Pan Mod .....Panoramic
- Vocal Filter X ...Vocal Filter X movement
- Vocal Filter Y ...Vocal Filter Y movement
- Off.....No modulation destination



Choose a modulation destination

#### 4.7.6 Editing a motion curve

You can edit in real-time your motion curves thanks to the dedicated “CURVE EDITOR” interface. This editor includes an ensemble of tools which will help you to draw or erase a part or the whole of the selected curve.



The “CURVE EDITOR” interface

Let's take a look on the “Curve Editor” interface:

##### 4.7.6.1 The Edit tools

- Drawing tool .....Tool for drawing a freehand curve.
- Eraser tool.....Tool for erasing an existing curve.

- Line tool .....Tool for drawing a straight line.
- Curve tool .....Tool for drawing an exponential curve.
- Noise tool.....Tool for adding noise to an existing curve.
- Sine tool .....Tool for drawing a sinusoid.
- Square tool.....Tool for drawing a square curve.



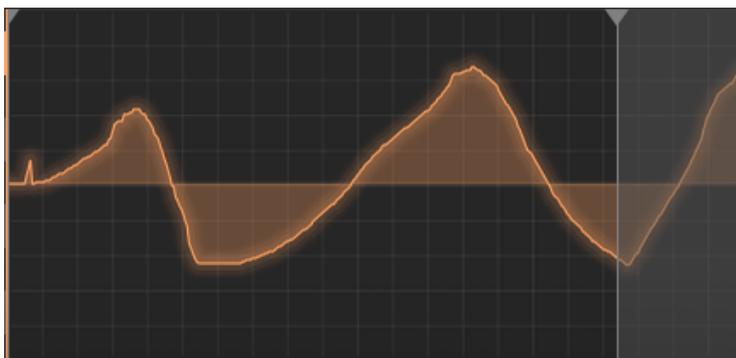
*The Curve Editor tools*

#### 4.7.6.2 *The Curve Editor screen*

The Curve Editor screen allows you to edit a recorded curve or to draw a new curve from scratch.

To open the Motion Recorder screen editor, click on the middle of. A new bigger screen is now opened showing the current motion curve.

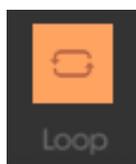
Two locator bars determine the input and output loop points of a recorded curve.



*Place the right locator*

To place a locator, click on the left top arrow (for the input point) or on the right top arrow (output point) and drag it from left to right to choose the desired input or output points of the loop.

Click on the “Loop” interrupter to validate the loop mode.



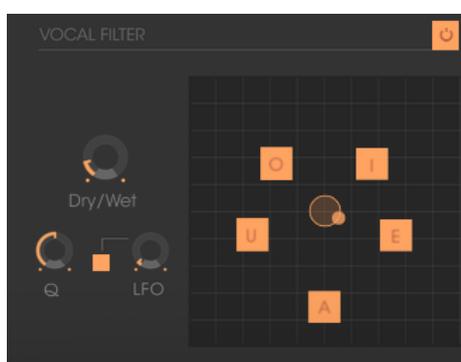
*Click on the “Loop” interrupter*

If you have chosen a quantization factor (1/8 for example), the locators will move by steps through this quantization factor.

## 4.8 The vocal filter

The Vocal Filter is a formant filter which can be applied to the output signal of the Mini V or to an external audio signal.

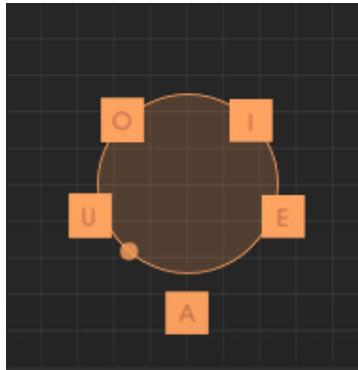
The main interface of the Vocal filter, located on the central TV style screen, shows an ensemble of five vowels (A, E, I, O and U).



*The main interface of the Vocal Filter*

The Vocal Filter frequency can be set in real time:

Manually by moving the red ball cursor between five vowels or moving the vowels letters by dragging them on the screen surface of the Vocal filter.

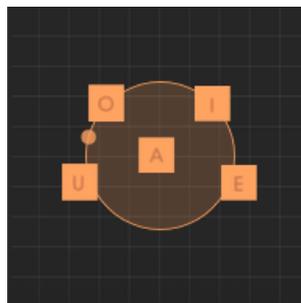


*Manually moving the ball cursor*

An LFO is also available to make an automation of the cursor movements.

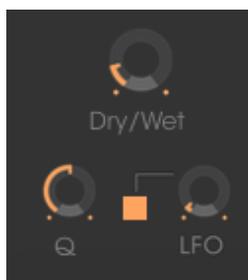
You can set the radius amplitude of the LFO by clicking on the ball cursor and moving it out of its central initial place. This action will set the width of the circle of the ball movements.

It's also possible to re-arrange the order of the five vowels on the screen space. To do this, simply click on one of the 5 letters and drag it on the place you wish on the screen. Those changes will introduce some interesting variations when you will modulate your five filters manually or with the LFO.



*Re-arrange the order of the vowels*

On the bottom of the main screen, three potentiometers and a button allow setting additional parameters as follow.



*The Vocal Filter parameters*

From left to right:

- Gain .....Sets the balance between the dry signal coming from the Mini V (or from an external audio source) and the vocal filter signal.
- Q .....Sets the band width of the 5 band pass filters of the Vocal Filter. At the right top, it result a very thin audio signal close to a whistle sound.
- LFO .....Sets the rate of the Vocal Filter LFO
-  button .....Start or stops the LFO activity

## 4.9 The low frequency generator

The Mini V brings a new module which allows the generation of a very low frequency to modulate any off the synthesis parameters. It is situated in the extension panel which appears the Mini V is in open position.



*Low frequency generator*

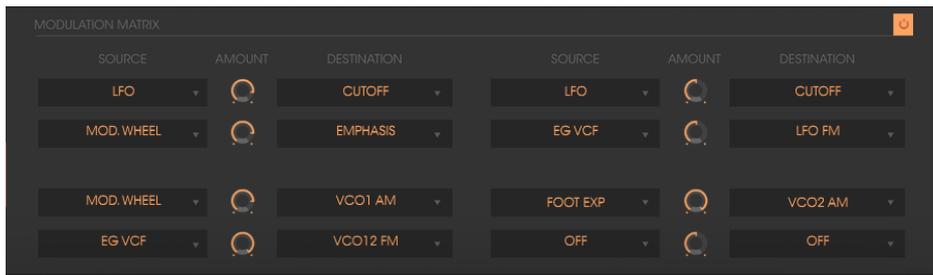
- “Rate” knob.....Sets the frequency, the “Waves” knob selects the waveform,
- “Midi Sync” switch Synchronize the frequency of the generator to the tempo of the host application.

- Waveforms.....Sinus, descending sawtooth, ascending sawtooth, square, noise, random, triangle.

The modulation destinations for the LFO generator are selected exclusively through the Modulation Matrix (see below).

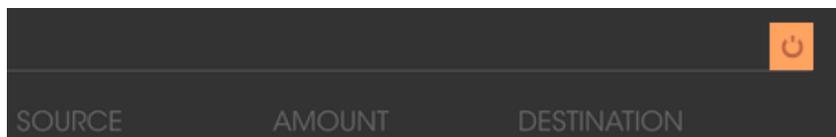
## 4.10 The modulation matrix

The Mini V increases the original possibilities of modulation thanks to the presence of the modulation matrix in the extension panel. This panel appears when the Mini V is in open position.



*Modulation matrix*

This matrix can be activated or deactivated with the selector in the top-right corner of the modulation matrix interface.



*Activation of the modulation matrix*

The matrix allows 8 modulation connections. To activate a connection, select a source of modulation by clicking in the “source” zone, next select a parameter to modulate in the “destination” zone, and set the rate of modulation with the “Amount” knob.

The sources of modulation are:

- VCO3.....Output of oscillator 3
- EG VCF.....Filter envelope output
- EG VCA.....VCA envelope output
- P.Bend.....Pitch Bend wheel
- ModWheel .....Modulation wheel
- AfterTouch.....Polyphonic aftertouch / Channel pressure

- FootExp .....Expression pedal
- Velocity.....Velocity
- LFO .....LFO output
- Kbd Follow.....Key follow output
- Ext. In .....External input signal
- VCA out.....VCA output signal
- Voice Num .....Gives a different fixed modulation value for each voice number (voice) played
- Triggered SH1 .....Fixed random modulation value for each note played
- Triggered SH2 .....Fixed random modulation value for each note played
- Off .....No source of modulation

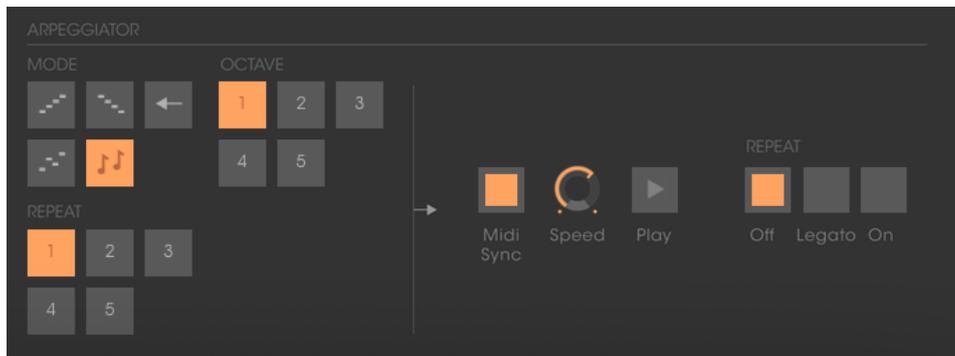
The parameters that can be modulated are:

- VCO1 FM .....Frequency of oscillator 1
- VCO1 PWM .....Impulse width of oscillator 1
- VCO1 AM .....Output level of oscillator 1
- VCO2 FM .....Frequency of oscillator 2
- VCO2 PWM .....Impulse width of oscillator 2
- VCO2 AM .....Output level of oscillator 2
- VCO3 FM .....Frequency of oscillator 3
- VCO3 PWM .....Impulse width of oscillator 3
- VCO3 AM .....Output level of oscillator 3
- Noise AM .....Output level of noise generator
- Ext. AM .....Level of the audio external input
- CutOff .....Filter cut-off frequency
- Emphasis.....Level of filter resonance
- EG VCF Att. ....Attack time of filter envelope
- EG VCF Dec.....Decay time of filter envelope
- EG VCF Sus.....Sustain level of VCA envelope
- EG VCF Lev .....Output level of VCA envelope
- EG VCA Att. ....Attack time of VCA envelope
- EG VCA Dec.....Decay time of VCA envelope
- EG VCA Sus.....Sustain level of VCA envelope
- EG VCA Lev .....Output level of VCA envelope

- Glide.....Portamento time
- MixMod .....Level of mixing between oscillator 3 and the noise
- Mod.Wheel .....Level of the modulation wheel
- VCA AM.....VCA output level
- LFO FM .....VCA speed
- LFO AM .....Level of LFO output
- Osc1-2 FM.....Frequency of oscillators 1 and 2
- Osc1-2-3 FM .....Frequency of oscillators 1, 2 and 3
- Osc1-2 PWM .....Modulation of the impulse width of oscillators 1 and 2
- Osc1-2-3 PWM .....Modulation of the impulse width of oscillators 1, 2 and 3
- Osc1-2 AM.....Modulation of the amplitude of oscillators 1 and 2
- Pan.....Modulation of the output panoramic
- Vocal Filter X.....Modulation of Vocal Filter X movement
- Vocal Filter Y .....Modulation of Vocal Filter Y movement
- Off .....No destination of modulation

## 4.11 The arpeggiator

Situated in the Mini V extension panel which appears when in “Extended” mode, the arpeggiator allows for each note the activation of an arpeggio.



*Arpeggiator*

The “**Speed**” knob sets the speed of the arpeggio.

The “**Midi Sync**” switch lets you synchronize delay return time with the host application.

The “**Play**” switch triggers the arpeggiator which, when a note is played, activates the notes one after the other, and stops when there are no more active notes on the keyboard.

The three state “**Off/Hold/Mem**” switch lets you choose the arpeggiator mode: In “Mem” position, the notes played on the keyboard are memorized. To stop the memorization, place the switch to “Off” mode.

To stop the chaining of the notes, you must stop the arpeggiator with the “Play” position.

In the “Hold” position, the notes played on the keyboard remain present until a new note (or group of notes) is played.

As long as a note remains active on the keyboard, all of the notes played are memorized.

The “Mode” selector is used to choose the arpeggio mode: ascending, descending, return, random, and in the order of appearance of the notes.

The “Octave” selector is used to choose the number of octaves that the arpeggiator cover for each cycle. The “Repeat” selector is used to choose the number of cycles repeated for each octave.

## 4.12 The chorus and stereo delay

In the Mini V extension panel which appears when it is in open position, we find two effects, chorus and stereo delay.



*Chorus and stereo delay*

The chorus has three knobs: “Rate” “Depth” and “Dry/Wet” which respectively set the speed, the depth and the relationship between the original signal and the modified signal. The “type” buttons allow the selection of chorus types, from the simplest to the deepest.

The delay contains two knobs “Time Left” and “Time Right”, respectively for setting the time for the left channel and the right channel, two knobs “FeedB. Left” and “FeedB. Right” respectively setting the feedback of channels left and right, and finally a “Dry/Wet” knob which sets the relationship between the original signal and the modified signal.

The “Midi Sync” switch lets you synchronize delay return time to the tempo of the host application.

## 5 THE BASICS OF SUBTRACTIVE SYNTHESIS

Of all forms of sound synthesis, subtractive synthesis is one of the oldest and still certainly one of the most employed today. It is this method that was developed toward the end of the 60's on analog synthesizers like the Bob Moog's ones, ARP, Yamaha, Buchla, Oberheim, Sequential Circuits (Prophet series), Roland, Korg (MS and PS series) and many others. This concept of synthesis is still used on most current digital synthesizers, complementing sample reading or wave tables, which progressively replaced the analog oscillators of the first synthesizers in the 80's. The 1971 Bob Moog's monosynth, or even your own Mini V, is among the best illustrations of the enormous possibilities of subtractive synthesis.

### 5.1 The three main elements

#### 5.1.1 The oscillator, or VCO

The oscillator (**Voltage Controlled Oscillator**) is the starting module (with the noise module which is often classed among the oscillators) for the creation of a sound on an analog system.

It will generate the initial sound signal. We can think of the oscillator like a violin string that once stroked or plucked, vibrates to create its sound.



*The oscillator settings*

The main oscillator settings are:

- The **pitch**, determined by the oscillation frequency. You can set the frequency of the oscillator with 2 controllers: first, the "RANGE" selector which determines the fundamental frequency – it is expressed in feet: Low, 32, 16, 8, 4, 2; the highest number (32) brings the deepest tone, inversely, the smallest number (2) brings the highest

tone. Secondly, the detune setting ("FREQUENCY") lets you tune the oscillator more precisely.

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On the Mini V, the "RANGE" and "FREQUENCY" buttons are placed in the "OSCILLATOR BANK" panel.

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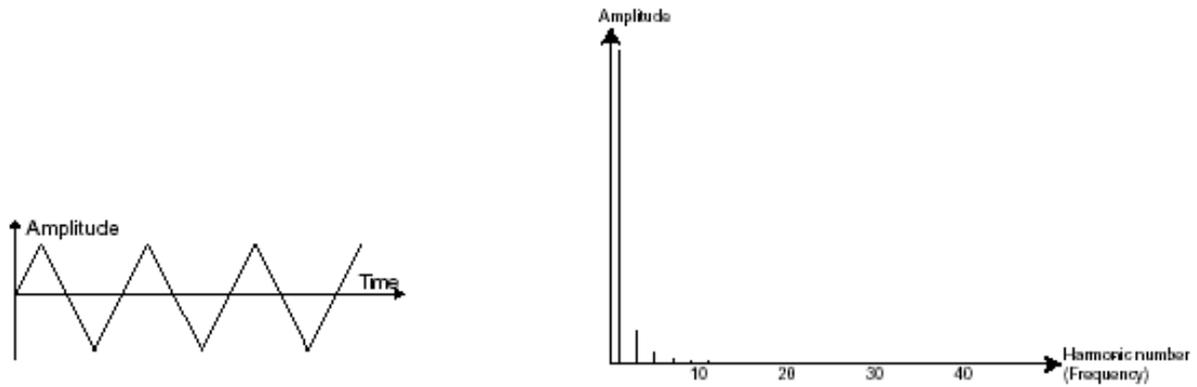
- The **waveform**, which determines the harmonic richness of the audio signal. On the Mini V, 6 waveforms are available:
  - triangle
  - saw-triangle
  - sawtooth
  - square (duty cycle: 48%)
  - wide rectangular (duty cycle: 29%)
  - narrow rectangular (duty cycle: 17%)



*The Mini V waveforms*

#### 5.1.1.1 Triangle

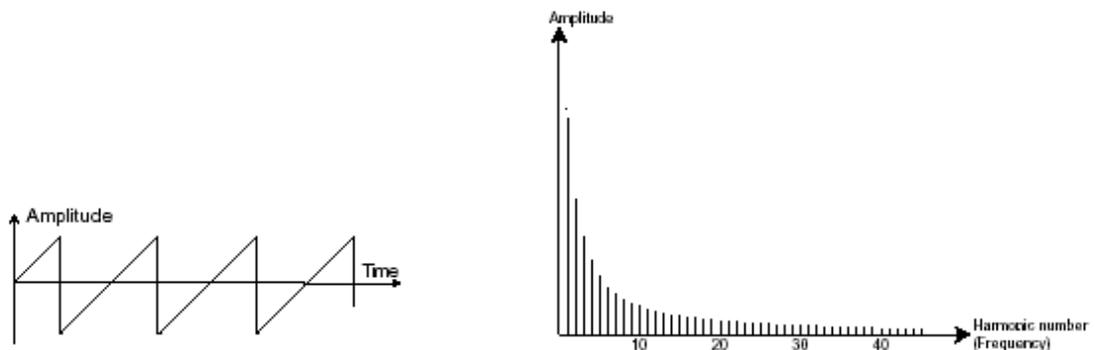
The **triangle** can be considered like a very filtered (and soft) square signal. It is very low in harmonics (odd only) and will be very useful for creating sub basses, flute sounds, etc.



*Time and spectral representations of the **triangle** waveform*

### 5.1.1.2 Sawtooth

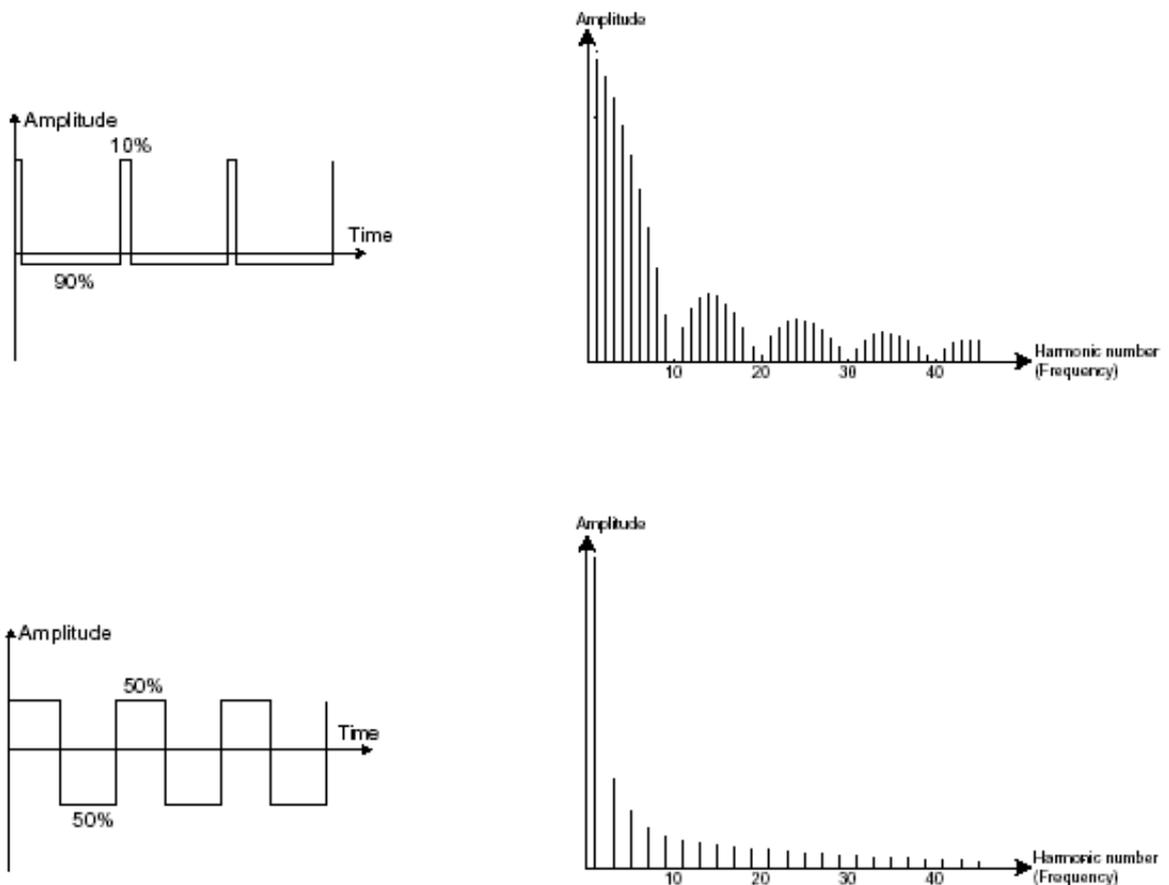
The **saw tooth** presents the richest audio signal of the 4 waveforms (it contains all of the harmonics at decreasing volume levels in high frequencies). Its sound is ideal for brass sounds, percussive bass sounds or rich accompaniments.



*Time and spectral representations of the **sawtooth** waveform*

### 5.1.1.3 Square

The **square** possesses a more “hollow” sound than the sawtooth (it only contains odd harmonics) but none the less, its rich sound (notably in low frequencies) can be used for sub-bass sounds that will come out well in the mix (the square oscillator is often set an octave below that of the sawtooth), wood sounds (clarinet, if the square signal is a little filtered), etc.



Time and spectral representations of the **pulse** (top) and **square** (bottom) waveforms

---

The original synthesizer proposed 3 types of square waveforms (square – 50%, wide rectangle – 25% and narrow rectangle – 10%). This choice allowed compensation for the missing PWM setting. The Mini V offers these 3 waveforms but includes also the pulse width modulation.

---

#### 5.1.1.4 Pulse Width Modulation

The **PWM** (**P**ulse **W**idth **M**odulation) is a setting that allows you to modify the duty cycle of the square waveform. This can be done through a modulation only (with an envelope or a LFO). This pulse width variation translates to a spectrum modification, resembling a waveform change.

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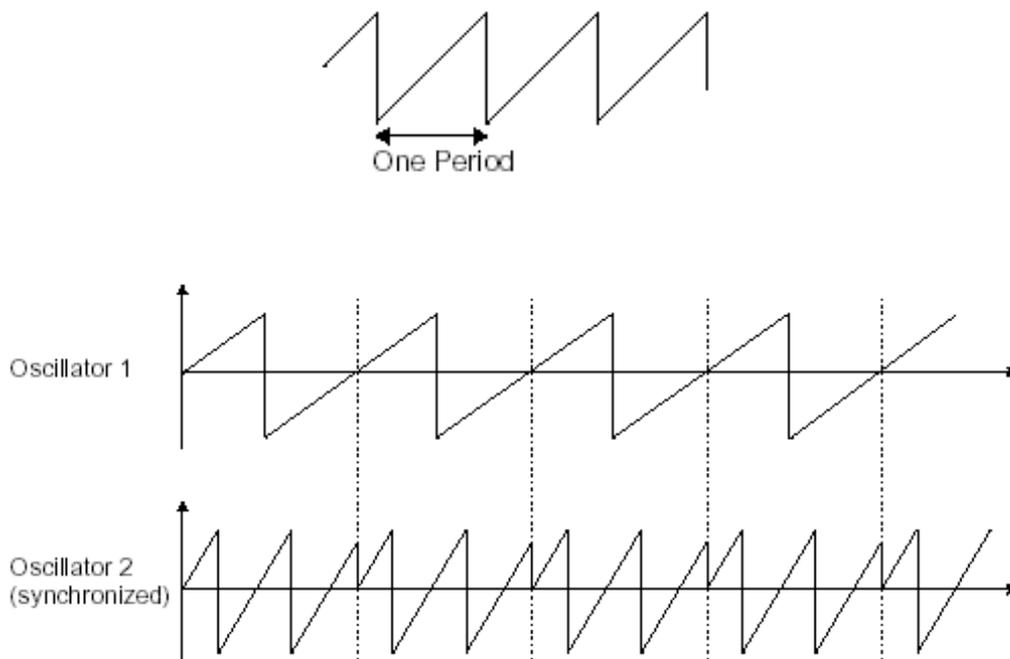
Unlike classic analog synthesizers, the Mini V lets you change the impulse width not only for the square waveform but also for the triangle. This brings a large number of additional sound possibilities to compliment the base signal.

---

#### 5.1.1.5 Synchronization

The **synchronization** of an oscillator with another creates more complex waveforms. If for example, you synchronize oscillator2 with oscillator1, oscillator2 will restart a new period every time the first oscillator completes a

period, even if oscillator2 has not completed a complete period (this signifies that it is not tuned to the same tonality!) The more you tune oscillator2 upwards, the more you will encounter composite waveforms.

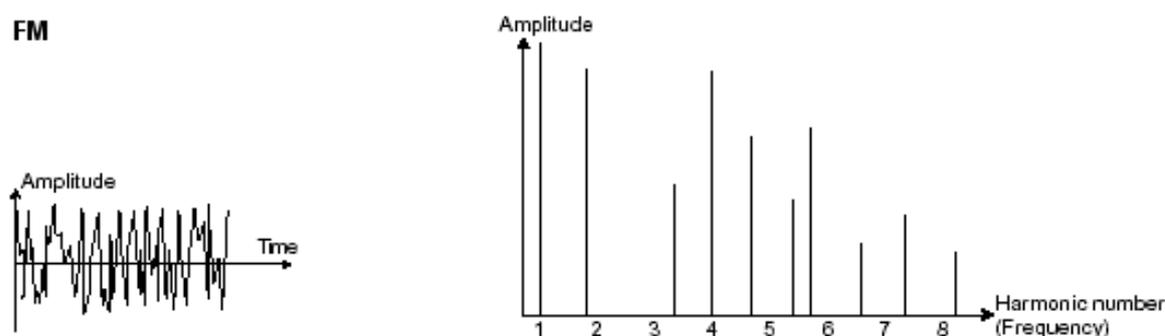


In the above image, oscillator2 is synchronized with the first and tuned to double the tonality. The resulting waveform is unique in that it cannot be created by standard synthesis techniques such as layering or filtering.

#### 5.1.1.6 Frequency modulation

A **frequency modulation (FM)** can be created between 2 oscillators by connecting the audio output from a first sinusoidal oscillator to the modulation input of a second oscillator. On the Mini V, if you turn the modulation rate ring, you will obtain a sound richer in harmonics. If you introduce a square or sawtooth signal, the result can be quickly distorted... but interesting for inharmonic sonorities like bell sounds or special effects for example.

#### FM



*Time and spectral representations of a frequency modulation*

### 5.1.2 The noise module

The noise signal spectrum has all frequencies at an equal volume level, often referred to as “white noise”. For this reason, the noise module is used to create different noises like the imitation of wind or special effects. White noise is the richest of noises. Pink noise is also regularly present on synthesizers. It is less rich in the high frequencies than white noise.

Also note that the audio output of noise can also be used as a modulation signal (especially when strongly filtered) to create random cyclic variations.

On pre-cabled synthesizers, the noise module is either integrated into the oscillator (its audio output being placed to compliment the waveform outputs), or within the mixer directing the signals towards the filter.

---

On the Mini V, you will find the noise generator amongst the settings in the mixer panel. A switch allows you to choose between the white and the pink noise.

---



*The noise generator set on the mixer*

### 5.1.3 The Mixer

The audio signal generated from an oscillator is generally directed to a module filter (VCF). It will be first useful to individually set the volume of each oscillator, external audio source or noise, thanks to the “Mixer”.

The external audio signal could be, for instance, a recorded vocal track or a drums loop.

### 5.1.4 The filter or VCF

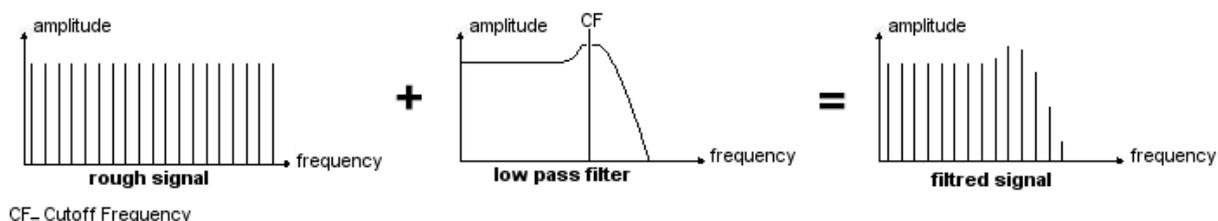
The audio signal generated by an oscillator (the waveform) is next generally directed to a filter module (**Voltage Controlled Filter**). It is this module that we use to control the sound by filtering (by subtraction, which explains the name given to this type of synthesis) the harmonics situated around a cut-off

frequency. It can be considered to be a sophisticated equalizer that reduces, depending on the case, the high or low frequencies of a sound.

#### 5.1.4.1 The cut-off frequency

The removal of undesirable frequencies at the cut-off frequency is not done suddenly but progressively, depending on the filtering slope. This filtering slope is expressed in decibels per octave (or dB/Oct). The filters used in classic analog synthesizers have 24 dB/Oct or 12 dB/Oct slopes.

The Mini V offers 1 type of slope: 24 dB/Oct slope.

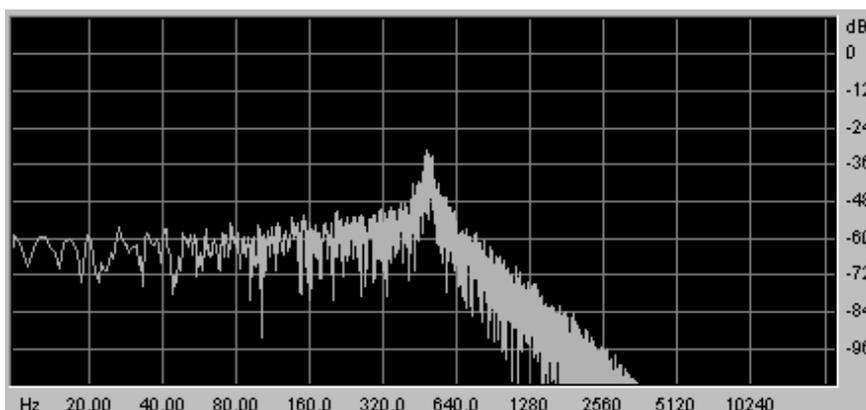


*Spectral representation of a **rough** then **24dB LP filtered** signal*

On the Mini V, you have access to one type of filtering.

The low-pass filter (LPF) progressively removes high frequencies above the assigned frequency limit (the cut-off frequency) and allows the sound below the cut-off to pass through unchanged. Depending on the setting we will hear the sound becoming more or less “brilliant”, more or less “dampened”.

This is the type of filtering that you will find more than often on synthesizers that use subtractive synthesis. It can be found on most of the recent analog and digital synthesizers.



*Spectrum of a noise signal proceed with a low-pass filter*

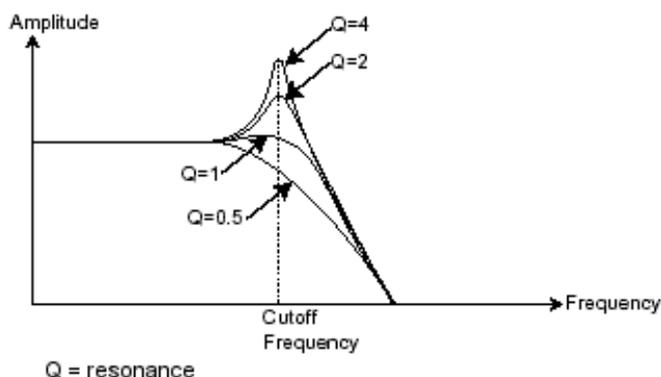
#### 5.1.4.2 The resonance

A second setting to compliment the cut-off frequency: the resonance. You will also find it called “Emphasis” or “Q” – for Quality of filtering.

The resonance amplifies frequencies close to the cut-off frequency. The other frequencies remaining are either unchanged (below the cut-off frequency) or reduced (above the cut-off frequency).

On the Mini V, you can increase the rate of resonance through the “emphasis” knob.

When you increase the resonance, the filter becomes more selective, the cut-off frequency is amplified, and the sound begins to “whistle”.



With a high resonance level, the filter will begin to produce a sound close to a sine waveform. At this stage, the use of a key follow is very important as you can create a melody by tuning the cut-off frequency of the filter with the frequency of the oscillators.



*The filter settings of the Mini V*

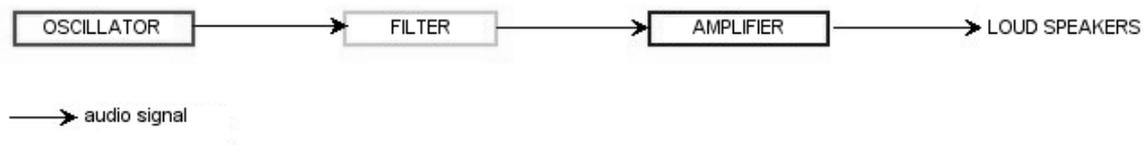
### 5.1.5 The amplifier or VCA

The amplifier (**Voltage Controlled Amplifier**) receives the audio signal coming from the filter to be adjusted before the volume is sent to the speakers.



*The Mini V VCA*

In conclusion, here is a diagram that should help you to understand the composition of a basic sound:



*Basic audio path in analog synthesis*

## 5.2 Other modules

### 5.2.1 The keyboard

If we stop here, the sound that you will obtain will be uniform, without life and without an end!! The oscillator delivers a sound signal (the audio output of a waveform) of a fixed pitch in a continuous manner. In the diagram above, the only way to stop this quickly unpleasant sound is to lower the filter cut-off frequency so that it becomes more and more damp until it finally disappears; or simpler yet, lower the volume of the amplifier!

To start and stop the sound, and this at the tone that we require, we use a keyboard that is connected both to the VCA through a gate and to the frequency of the oscillators. This will “play” the sound as soon as a key is pressed, and mute it when released. Of course, this connection is made through MIDI (it replaces the “gate” type of connections on analog synthesizers, which trigger the note when a key is pressed and stop it when released).

The key position provides a control voltage that tells the oscillator what pitch level to play when the gate opens.

---

If you don't have a MIDI keyboard, you can also play on the virtual keyboard of the Mini V to audition sounds while editing voices on your computer.

---

### 5.2.2 The envelope generator

The envelope generator, connected to the amplifier, is used to "sculpt" the volume of the sound when we press a key on the keyboard and ends after the note is released.

The most common modules developed use 4 settings that we can vary:

- The **Attack** is the sound that the sound will take to reach its maximum volume once we have pressed a key on the keyboard.
- The **Decay** (fall) is the time that the sound will take to diminish after the attack portion is complete.
- The **Sustain** (hold) is the maximum volume level that the sound will reach after the decay is complete.
- The **Release** is the time that the sound will take to fade once the key has been released.

---

The two envelopes of the Mini V (Contour) contain only 3 parameters: **Attack**, **Decay** and **Sustain**. You can get the **Release** thanks to the "Decay" button located on top of the modulation wheels. The release time is thus identical to the decay time of the envelope.

---



*The Mini V ADS(R) envelope*

### 5.2.3 The low frequency oscillator

The LFO (*Low Frequency Oscillator* – or *LFO on the Mini V*) possesses more or less the same characteristics of the classic oscillator but it only produces frequencies lower than 20 Hz. In other words, you won't hear the pitch of its sound.

It will create a cyclic modulation on the setting to which it is connected.

For example:

- If the sine waveform of an LFO modulates the volume of an amplifier, the sound will increase in volume then disappear in a varying manner following the speed (the frequency) of this LFO. This will produce a **tremolo** effect.

- A sine waveform on an LFO modulating the frequency of an oscillator would produce a **vibrato** effect.
- With an LFO sinusoid wave modulating the cut-off frequency of a slightly resonant low-pass filter, you will obtain a “**wah wah**” effect.

---

The original model does not contain any dedicated LFO. You can use the third oscillator in low frequency (“Lo” position of the “Range” selector) to modulate the filter and oscillators’ frequency.

The signal of the third oscillator can be mixed with the noise signal to create some random modulations.

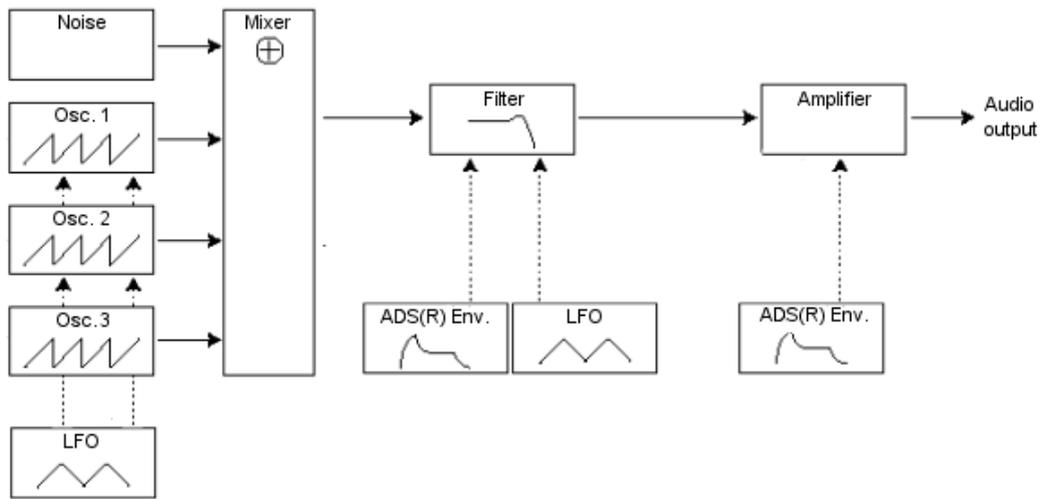
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*The LFO module of the Mini V*

Now to finish, here is the diagram of a complete synthesis voice on the Mini V containing:

- 3 oscillators (VCO)
- 1 noise module
- 1 mixer (mixing of the 3 VCO and the noise generator)
- 1 low-pass filter (VCF)
- 1 amplifier (VCA)
- 2 envelopes (one for the filter and the other for the VCA)
- 1 LFO



*A complete Mini V synthesis voice*

## 6 A FEW ELEMENTS IN SOUND DESIGN

Here is a series of examples designed to guide you through the creation of a sound and a sequence. They are classed in order of difficulty going from the easiest to the most difficult and are organized into 3 parts:

- The first part will help you to grasp subtractive sound synthesis. You will start with the most basic patch (make a VCO oscillator “sound” in an output VCA amp), to finish by touching on the programming of a richer sound (several oscillators, the filter, the frequency modulation of the filter and oscillators).
- The second will help you to use the modulation matrix
- Finally, the third part will teach you to use the arpeggiator and the effects.

### 6.1 Subtractive synthesis

#### 6.1.1 A simple bass sound

To begin we will see how to program a bass sound. As we saw in chapter 3 (Quick Start), the Mini V uses 3 oscillators. We will only use the first for this example. It will be composed of:

- An oscillator
- A low pass filter (Filter)
- An output VCA (Output)
- The envelope corresponding to the filter
- The envelope corresponding to the output amplifier (Loudness Contour)

You will thus obtain a base patch for subtractive synthesis.

- ▶ Choose the preset “Blank” in the “Templates” bank. This preset does not produce sound yet! Don’t worry, this is normal.

The following image shows the different knob positions:



So as to hear the sound, click on the first of the 5 blue “Mixer” switches. This activates the signal coming from the first oscillator.



You will notice that the sound is particularly linear and without life.

The sawtooth signal from the first oscillator goes through a filter where the cut-off frequency is set to the maximum.

This minimalist configuration will let you easily perform some simple experiments with this basic sound.

Start by changing the waveform of this oscillator to appreciate some of the tones it can produce.



*Change the waveform of oscillator 1*

Progressively lower the cut-off frequency of the low pass filter. The sound becomes more and more “damp”.



*Lower the cut-off frequency of the low pass filter*

Change the range of the oscillator with the “range” knob (as a default it is set to 8'). In this case, lower it to 16'.



*Change the range of oscillator1*

Increase the decay time for the filter envelope (“Decay”) to a value somewhere around 400ms so that the cut-off frequency progressively decays when you press a key.

You will thus obtain a simple yet efficient bass sound.



*Increase the decay time for the filter envelope*

You can now save your sound by clicking on the “Save As” situated on the left of the toolbar. It will be useful as a base template for programming lots of other sounds.

### 6.1.2 A 3 oscillators lead sound

Keeping the current sound and we will now go a little further and create a rich lead sound.

It will be composed of:

- 3 oscillators
- A low-pass filter (Filter)
- An output VCA (Output)
- The envelope corresponding to the filter
- The envelope corresponding to the output amplifier (Loudness Contour)

Start by again increasing the “Decay” time for the filter envelope so as to prolong the fall of the cut-off frequency. By using a value somewhere around 2000ms, the sound will seem “brighter”.

So as to hear the sound from the 2 other oscillators, click on the 3<sup>rd</sup> and 5<sup>th</sup> blue “Mixer” switches.

Change the range of oscillator 3 with the “range” switch. Set it to 4’ for example.

The sound takes another form. Don’t hesitate in changing the waveforms of the three oscillators to hear the different tones that result. You can also change the volume of these oscillators to create a different balance.

Now change the coarse tone of oscillator 3 to give it another tone. For this, click on the central knob with the left mouse button and turn it gently to the right until you reach the value “7 semi tone”.



*Change the coarse tone of oscillator3*

Lightly detune oscillator 2 from the two others by turning this same knob with the right mouse button. The sound will begin to “move” slightly and sound “warmer”.

If you want a sound that is even “fatter”, click on the “Unison” switch which brings all of the polyphonic voices to the same note. Lightly detune each of the polyphonic voices with the “Voice detune” knob (“Output” section).

Here is how, in a few seconds, to transform a simple base sound into the kind of powerful lead preset that made the 1971 Bob Moog’s monosynth so famous.

Save the preset with the “Save As” button in the toolbar.

### 6.1.3 A polyphonic accompaniment

Unlike the original synthesizer which offered just a monophonic playing (one note at a time), the Mini V allows you to play chords with the “Polyphonic” playing mode located in the “Output” module on the right of the synthesizer.

Let’s see how to create a powerful evolving accompaniment.



*The “Polyphonic” mode*

This preset will be composed of:

- 2 oscillators
- A low-pass filter (Filter)
- An output VCA (Output)
- The envelope corresponding to the filter
- The envelope corresponding to the output amplifier (Loudness Contour)
- Oscillator3 in low frequency modulating the filter cut-off frequency

Take the preset “2 Osc Octave” in the “Templates” bank. This sound is already composed of 2 active oscillators which you will use as a base sound.

Place the “Range” of oscillator2 to 8’ so that the 2 oscillators play in unison.

Slightly detune this same oscillator to obtain a richer sound: turn the central knob to the right or left with a left click; take for example the value “fine tune” 10%.

Lower the filter cut-off frequency to make the sound less “bright”. Take for example a value of -2.00 - 256.96 Hz.

Increase the amplitude envelope attack time (“Loudness Contour”) to around 4000ms. Set the “Decay” time to around 700ms.



*Increase the amplitude envelope attack time*

Do the same with the filter envelope.

Place the “Range” knob of oscillator3 to Low mono (the last position on the left). It will oscillate in low frequencies (like a LFO)

Lower the tuning to -48 (-4 octaves) by turning the central knob to the left with a left click on the mouse. This oscillator will not produce audible sound (if only light “clicks” marking the oscillation cycle), it will be used to modulate the filter cut-off frequency.

Click on the “Filter Modulation” switch to activate the filter cut-off frequency modulation by oscillator3.



*Click on the Filter Modulation switch*

Raise the modulation wheel to maximum to set the modulation frequency.



*Raise the value of the modulation wheel*

You will obtain a rich accompaniment sound.

## 6.2 The modulation matrix

We will discover a few of the many additions to the Mini V: the modulation matrix, the LFO and the velocity.

For this, let's again use the preset "Attack Long" in the "Templates" bank. This preset offers an ideal starting point for an accompaniment sound (the amplitude envelope is already calibrated for this type of use).

It will be composed of:

- 2 oscillators
- 1 lightly resonant low-pass filter
- 1 output VCA
- The filter and VCA envelopes are active
- Oscillator 3 modulates the 2 other oscillators for a vibrato effect brought by the action of the modulation wheel.

The modulation matrix will be active for:

- A modulation of the cut-off frequency by the velocity
- A modulation of the width of the oscillator2 square by the LFO

To begin, lower the filter cut-off frequency to around "-4.46: 44.00 Hz". This will make the different modulations easier to hear.



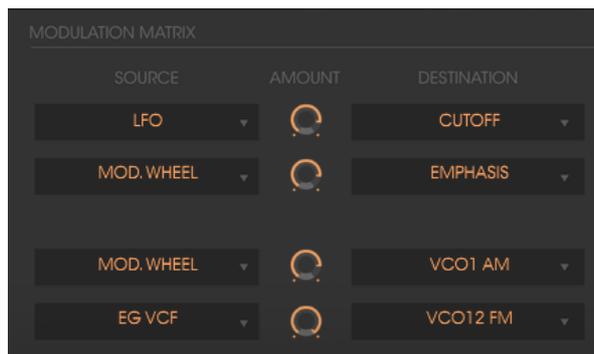
*Lower the filter cut-off frequency*

Start by activating the modulation matrix by hitting the on/off button on the top-right corner. Then choose the first source of modulation by clicking on the display on the left of the first line: "LFO" (for **L**ow **F**requency **O**scillator)



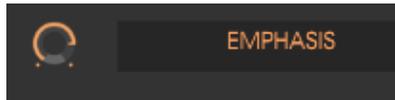
*Choice of source*

Do the same thing for the first destination by clicking on the display situated on the right of the first line: choose "VCO2 PWM" (square width of oscillator2).



*Choice of destination*

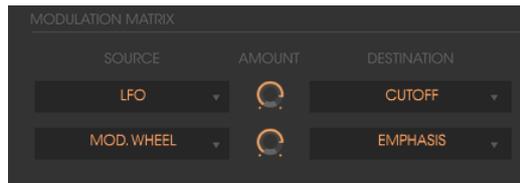
Increase the rate of modulation by turning the "Amount" knob between the two displays. Place it at a value of 0.0480. The square width of oscillator2 lightly varies in a manner so as to create a detuning between the 2 oscillators.



Turn the “Amount” knob

For the 2<sup>nd</sup> source of modulation, choose the “Velocity” to modulate the filter “Cutoff”.

Turn the “Amount” knob to a value of **0.31**.



The velocity to modulate the “Cutoff”

Place the “Range” knob of oscillator3 to Low mono (the last position on the left). It will oscillate in low frequencies (like a LFO)

Lower the tuning to -48 ( -4 octaves) by turning the central knob to the left with a left click on the mouse. This oscillator will not produce audible sound (if only light “clicks” marking the oscillation cycle), it will be used to modulate the filter cut-off frequency.

Now, click on the Filter Modulation to activate the filter cut-off frequency modulation by oscillator3.

Finally, increase the value of the modulation wheel to set the rate of modulation on the frequency of modulation.

By varying the force of playing on the keys of your MIDI keyboard (velocity), the filter cut-off frequency is varied with each note.

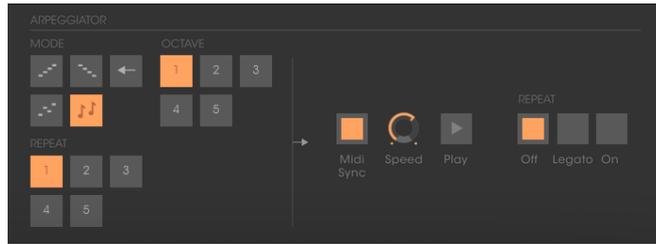
The 3 examples that we have just seen will give you the basics necessary in order to delve a little deeper. Try other settings. The possibilities for synthesis are numerous.

### 6.2.1 Using the arpeggiator

Now let's see how to program and play the arpeggiator by using the sound from the previous section 8.1.2.

First let's lower the Attack time of the amplitude envelope in the “Loudness contour” section.

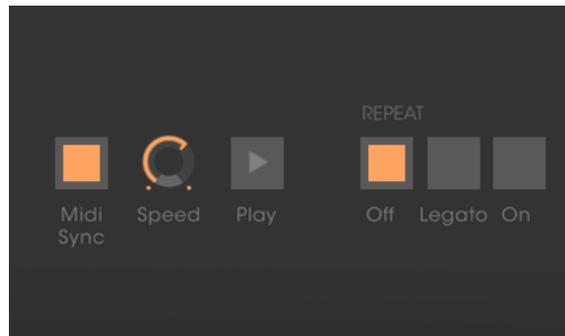
Click on the arpeggiator “Play” button and increase the “speed” parameter.



*Click on the "Play" button*

Play a chord between C4 and C6, the notes will be played one after the other in the order in which you have placed them. (it is possible to changing the playing order by clicking on the linear "mode" knob)

If you want, it is possible to keep the chord continuous by clicking on the "Hold" switch. Two types of playing are available in this mode: "Hold" (central position) lets you add notes to an existing chord and "Memory" (low position) allows the change of chord type freely.



*The "Memory" position*

To remove one or several notes or add notes without keeping them in the arpeggio, click again on the "Hold" switch to set it to "Off" position (to the top) and play the note to be removed.

To remove one or several notes, click again on the "Hold" and play the note to be removed.

It is now possible to simultaneously play (or record) a bass part on the first octave of your keyboard, accompaniments on the 2 following octaves all while having an arpeggio which develops on the latter two.

### **6.3 The effects of the Mini V**

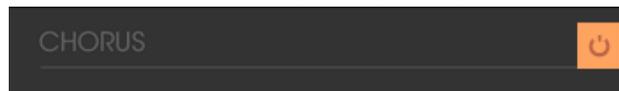
The Mini V offers two additional effects letting you add another color and more space to your sound.



*The Chorus and Delay effects*

### 6.3.1 The stereo chorus

For this example, take the sound of the accompaniments from the previous paragraph 8.1.3. Add chorus by clicking on the button on the right of the chorus section.



Add chorus

Chorus is used to create an effect of doubling the sound, which gives more width and “thickness”. If you accentuate the intensity of the effect you will obtain a very detuned sound.

---

The speed of modulation can be set with the “Rate” knob, the amplitude with the “Depth” knob and the mixing between the initial sound and the effect with the “Dry/Wet” knob.

The 3 “Type” buttons choose between the 3 types of chorus: simple, medium, complex.

---

To clearly hear the different depths of modulation, simply increase the value of the “Depth” knob. The higher the value, the more detuned the sound becomes! For a classic chorus, use minimal values (around 0.16)



*The “Depth” parameter*

Set the modulation speed by turning the “Rate” knob. The faster the speed, the faster the detuning. Here again, use values situated around 0.50 Hz if you wish to have a slight detuning.



*The “Chorus Rate” knob*

Place the “Dry/Wet” knob to the center (Dry:50.00%, Wet: 50.00%) to obtain a balance between the gain applied to the signal without effect (“Dry”) and the setting of the gain applied to the treated signal (“Wet”).



*The “Dry/Wet” knob*

### 6.3.2 The stereo delay

This module allows you to repeat the incoming signal in an independent manner for the left and right tracks so as to create stereo echo.

---

The speed of repetition is set for the left and the right with the “Time left & right” knobs, the number of repetitions heard can be set with the “Feedback Left &

Right” knobs and the mixing between the initial sound and the treated sound with the “Dry/Wet” knob.

---

To set the time between the repetitions of the left track turn the “Time Left” knob.

Do the same thing with the “Time Right” knob for the right track.



The “Time Left” knob

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To obtain a stereo effect, it is important that the two time settings (Time Left & Right) have different values.

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A 2 position “MIDI Sync” switch synchronizes the repetition time with the tempo of the host application. This will help to quickly find the appropriate timing for each side. Try for example the values “Tempo” (synchronized to a crotchet) for the left and “Tempo 1.5” (synchronized to a dotted crotchet) for the right side.



*Synchronization of delay to MIDI tempo*

Now set the number of repetitions for both sides by turning the “Feedback Left & Right” knobs.



### *The “Feedback Left” setting*

To finish, as for the chorus effect, place the “Dry/Wet” knob to the center (Dry:50.00%, Wet: 50.00%). You will obtain a balance between the gain setting applied to the signal without effect (“Dry”) and the gain setting applied to the treated signal (“Wet”).

These different examples, as you will have noticed, presented different levels of difficulty. We hope that they will have allowed you to see a few of the possibilities offered by the Mini V. But don't hesitate to try your own settings, this is the best way to progress and have more originality.

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