USER MANUAL

SYNTHI V

ARTURIA®

YOUR EXPERIENCE • YOUR SOUND

Special Thanks

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Thank you for purchasing Synthi V!

This manual covers the features and operation of **Arturia's Synthi V**, the latest in a long line of incredibly realistic software instruments.

Be sure to register your software as soon as possible! When you purchased Synthi V you were sent a serial number and an unlock code by e-mail. These are required during the online registration process.

Special Messages

Specifications Subject to Change: The information contained in this manual is believed to be correct at the time of printing. However, Arturia reserves the right to change or modify any of the specifications without notice or obligation to update the hardware that has been purchased.

IMPORTANT: The software, when used in combination with an amplifier, headphones or speakers, may be able to produce sound levels that could cause permanent hearing loss. DO NOT operate for long periods of time at a high level or at a level that is uncomfortable.

If you encounter any hearing loss or ringing in the ears, you should consult an audiologist.

Introduction

Congratulations on your purchase of Arturia's Synthi V!

For nearly 20 years, ARTURIA has been receiving acclaim from reviewers and end users alike for designing state-of-the art software emulations of the venerable analog synthesizers of the past. From the Modular V (2004), to Origin (2010), to the Matrix 12 (2015), the Synclavier V (2016) and the Buchla Easel V (2018) our passion for synthesizers and sonic purity has given demanding musicians the best software instruments for professional audio production.

Arturia has a passion for excellence and accuracy. This led us to conduct an extensive analysis of every aspect of the EMS Synthi AKS hardware and its electrical circuits, even modeling the changes in behavior over the course of time. Not only have we faithfully modeled the sound and behavior of this unique instrument, we have added a variety of useful features that were unimaginable in the days the original Synthi AKS hardware was being manufactured.

Synthi V runs both as a standalone instrument on Windows and macOS and as a plug-in in all major formats inside your DAW. It has easy MIDI learn functionality for hands-on control of most parameters, and as a plug-in also allows parameter automation for greater creative control.

In short, ARTURIA Synthi V is the culmination of decades of experience in recreating the most iconic synthesizers of the past. We hope using it will bring excitement and joy to your music making!

The Arturia team

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1. WELCOME

1.1. The story of EMS

Electronic Music Studios (EMS) was a UK based synthesizer manufacturer founded by Dr. Peter Zinovieff, Tristram Cary and David Cockerell in 1969. Zinovieff was an eccentric man with an intense interest computing. He was also a man with the means to acquire not one but *two* 12-bit computers for use in his home recording studio. Owning two computers may not be remarkable today but in the 1960s it was virtually unheard of for an individual to have a private computer. At that time, one would need to visit a university or military facility to even *see* a computer and the opportunity to use one to explore a personal interest in music-making would be all but impossible. The costs of such machines were astronomical and so they were commissioned and immediately put to work on "important" problems of the day! When taking inflation into account, each of Zinovieff's "low-cost" PDP8 machines would cost approximately $150,000 USD in today's (2019) money, and this does not include all of the additional equipment required to build and run an electronic music studio.

Besides being an eccentric man with means and an interest in exploring the musical applications of computers, Zinovieff was also a man with a network of very talented people. Many of these people would go on to become distinguished engineers, composers and professors in their own right. Zinovieff partnered with co-founders Tristram Cary (composer) and David Cockerell (engineer) to launch EMS and build many innovative, idiosyncratic and exciting musical instruments over the next decade.

The company eventually faced financial difficulties and folded in 1979, but not before releasing some of the most iconic and beloved synthesizers of all time, including the VCS 3, Synthi A, Synthi AKS and Synthi 100 among others.

1.1.1. About the Synthi AKS

In May 1971, EMS released a synthesizer called the Synthi A. In March 1972, the company followed up with the Synthi AKS, which was a Synthi A with a built-in keyboard sequencer ("KS"). The Synthi A and AKS featured a similar design to the earlier (and more expensive) VCS 3. The portability and relatively low cost made it a popular synthesizer among enthusiasts that could not afford the more costly options such as the MiniMoog.

While popular, it should be noted that the Synthi A (and Synthi AKS) did have its share of detractors. Some reviewers and experts wrote it off as being a toy with unstable oscillators or not reliable enough for "serious" use. In response to this, EMS made a now famous print advertisement called "Every Band Needs a Synthi". In it, the ad casually mentions "Every band needs a Synthi. Some bands already have one. Pink Floyd. The Who. Yes. Family. King Crimson. Curved Air. Led Zeppelin. Jethro Tull. Roxy Music. Hawkwind. Moody Blues. Fleetwood Mac. Three Dog Night. Sly and the Family Stone. Tonto's Expanding Headband... to name a few." This ad seemed to speak to the pioneering, fearless and unapologetic character of the company. This was a company that was not afraid of highly original, slightly unusual and sometimes annoying approaches to problem solving like the (brilliant) Pin Matrix or the (slightly confusing) Envelope Shaper. This pioneering spirit spoke to the hearts of many musicians and we believe this is why EMS products continue to be held in such high regard.

Perhaps the clearest indicator of the desirability of EMS synthesizers is the fact that–at the time of writing–well-maintained vintage Synthi AKS models have been sold online for close to $20,000 USD! A truly staggering amount of money for nearly 50 year old technology.

1.1.2. About the Pin Matrix

One of the most recognizable features of the Synthi A/AKS and other EMS synthesizers is the Pin Matrix.

The Pin Matrix allowed EMS to solve the problem of manufacturing a modular synthesizer in a compact, portable form factor without the cost and visual clutter created by patch cables. By concentrating all the input and output jacks into a tightly packed grid, it was no longer necessary to place input and output jacks all over the front panel. This not only improved the ergonomics (knobs are not covered by cables and are easier to reach) but also meant that the system could be made small enough to fit into a suitcase!

While the synthesizer has a relatively small number of modules (oscillators, filters, envelope, etc.), the ability to freely patch these modules together gives users an extraordinarily diverse range of sounds from filtered basic waveforms to fantastically complex alien soundscapes.

1.2. Arturia's secret ingredient: TAE®

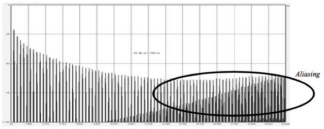
TAE® (True Analog Emulation) is Arturia's technology for emulating the analog circuits used in vintage synthesizers. TAE®'s software algorithms result in spot-on emulation of analog hardware. This is why Synthi V offers an unparalleled quality of sound, as do all of Arturia's virtual synthesizers.

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

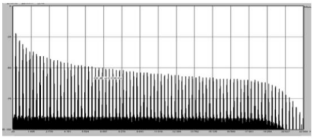
1.2.1. Aliasing-free oscillators

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

TAE® enables the creation of oscillators that are completely free of aliasing in all contexts (PWM, FM...) and does so without any CPU cost.



Linear frequency spectrum of a current well-known software synthesizer

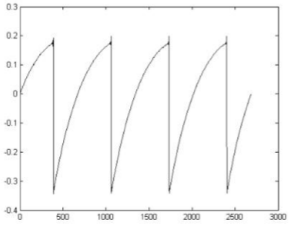


Linear frequency spectrum of an oscillator modeled with TAE®

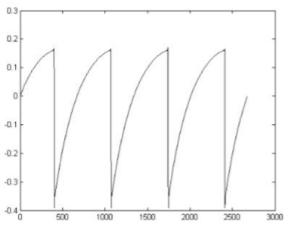
1.2.2. A better reproduction of analog oscillator waveforms

The waveforms produced by the oscillators in analog synthesizers are affected by the presence of a capacitor in the circuits. The discharge of such capacitors 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.

Directly Below is a plot of a waveform from one of the hardware instruments that Arturia has emulated, followed by one generated by Arturia's TAE®. As you can see, the waveforms are quite similar and both are 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®

1.2.3. Additional factors

Analog oscillators in vintage hardware were often unstable in their operation. Their waveforms differed slightly from one period to another and the starting point for each period (in Trigger mode) could vary due to changes in temperature and other environmental conditions. These stability "problems" were, in fact, largely responsible for the beloved "warm" sound of many synthesizers! TAE® accurately reproduces the inherent instability of vintage oscillators, resulting in a fatter and "bigger" sound that captures the magic of vintage synths.

1.3. Arturia's Version of the EMS Synthi AKS

Synthi V closely mimics the original Synthi AKS hardware and it has all the features that make the Synthi AKS such a unique and beloved instrument. However, we did not blindly emulate all features without regard to modern day considerations. In some cases, we have removed functions that do not make sense in a software context. In other cases, we have added modern functionalities that greatly increase the usability and sonic potential of the original instrument. We have done this as tastefully as possible to maintain the sound and experience of using the original instrument.

Omitted are:

- The control section along the top of the instrument with various inputs, ouputs and VU meter. This section is not necessary as all audio inputs, outputs and metering are handled by your audio interface and/or music software.
- The Input Level module for bringing in external modulation sources. This is no longer necessary since MIDI CC can be used to automate nearly any parameter in the plugin.
- The "Prestopatch" programmer card slot; it has no purpose here as patches can now be stored on the computer.

Added functions:

- A quantize switch for all oscillators modules, enabling you to easily "snap" oscilators to the nearest note on the chromatic scale
- Sync between first two oscillators.
- A Sample and Hold module complete with Sync and Slew Limiter functions.
- Up to four voice polyphony
- MIDI-assign function to easily assign on-screen parameters to the controls on your MIDI controller
- An "Advanced Features" section with many powerful modern features including:
    - Five mult-stage envelopes that can be mapped to nearly any parameter of the plugin
    - The ability to use MIDI velocity, mod. wheel, and aftertouch as modulation sources
    - A 32-step step sequencer
    - A syncable LFO
    - Group (macro-level) control over modulations
    - Advanced Joystick controls letting you "animate" movements
    - An elaborate effects section with flexible routing and 10 powerful effects (reverb, chorus, phaser, etc.)

♪: There's one other major difference which may not seem like a big deal to you, but which is a major shift for users of vintage Synthi AKS hardware: you can save your creations as presets! For purists this is a horrible option, as each performance should be unique and unrepeatable. When you're done performing you dismantle your patch and the next day you start over with a fresh mind and a fresh Synthi V. This helps keep your sound design skills sharp! Composers and sound designers, on the other hand, will welcome the save option; they can now build a library of their most creative moments and instantly load those moments into a composition. Of course, how you use Synthi V is completely up to you!

2. ACTIVATION AND FIRST START

Synthi V works on computers equipped with Windows 7 or later and macOS 10.10 or later. You can use the instrument in standalone mode or as an Audio Units, AAX, VST2 or VST3 instrument inside your Digital Audio Workstation (DAW) software.

2.1. Activate the Synthi V license

Once Synthi V has been installed, the next step is to activate your license for the instrument. This is a simple process that is done through a separate program called the Arturia Software Center.

2.1.1. The Arturia Software Center (ASC)

If you have not already installed the ASC, you can do so by going here: Arturia Updates & Manuals.

Look for the Arturia Software Center at the top of the page, and then download the version of the installer that you need for your system (macOS or Windows).

Once the software is installed:

- Launch the Arturia Software Center (ASC)
- Log into your Arturia account
- Scroll down to the My Products section of the ASC
- Click the Activate button and follow the instructions

That's it!

2.2. Synthi V as a plug-in

Synthi V comes in VST, Audio Units (AU) and AAX plug-in formats for use in all major DAW software such as Ableton, Cubase, Logic, Pro Tools and so on. When using Synthi V as a plugin, all audio and MIDI routing as well as buffer size settings are handled by the host music software. Please refer to your host music software's documentation if you have any questions about loading or using plugins.

Note that when you load Synthi V as a plug-in instrument inside your host software, its interface and settings work the same way as in standalone mode, with a few small differences:

- Synthi V will synchronize to your DAW's host tempo/bpm rate, when tempo is a factor
- You can automate numerous parameters using your DAW's automation system
- You can use more than one instance of Synthi V in a DAW project (in standalone mode you can only launch one instance of Synthi V)
- You can run the output of Synthi V through any additional audio effects available to your DAW such as delay, chorus, filters, etc.
- You can route Synthi V's audio outputs more creatively inside your DAW using the DAW's own audio routing system.

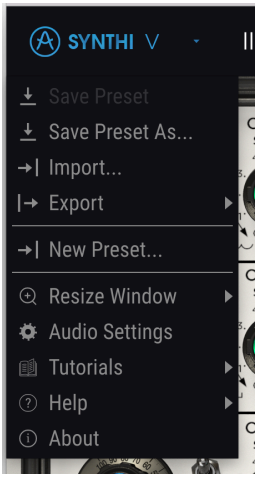
2.3. Initial setup for Standalone Use

If you would like to use Synthi V in standalone mode, you will need to set up your instrument and ensure that MIDI and audio signals are flowing properly through the software. You generally only need to do this one time unless you make major changes to your computer. The setup process is largely the same on both Windows and macOS computers but for the sake of clarity, we'll cover Windows and macOS separately.

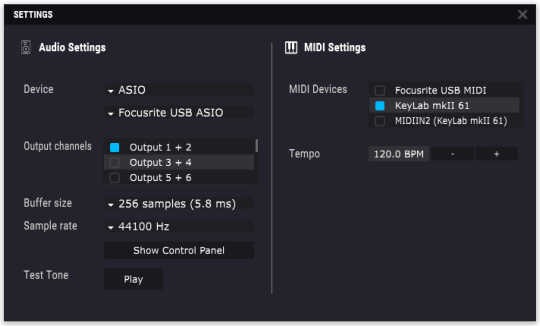
> !: This section only applies to readers that plan to use Synthi V in standalone mode. If you are only going to use Synthi V as a plugin inside a host music software, you can safely ignore this section (your host music software handles these things).

2.3.1. Windows Users: Audio and MIDI settings

At the top left of Synthi V is a pull-down menu. Click it to reveal the following:



Select **Audio Settings** to bring up the following window (note that this menu is only available when using Synthi V in Standalone mode):



The Audio MIDI Settings in Windows

Starting from the top we have the following options:

- **Device** selects which audio driver and device will handle the playback of Synthi V. This can be your computer's internal driver like Windows Audio, or an ASIO driver. The name of your hardware interface may appear in the field below depending on your selection.

- **Output Channels** lets you select which of the available outputs will be used to route audio out. If your selected device only has two outputs, then only two options will appear here; If your device has more than two outputs, then 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 larger buffer means a lower CPU load as the computer has longer periods of time to process commands and fewer interruptions, but this can result in a noticeable latency between keypress and hearing a result (an obvious problem when playing an instrument). A smaller buffer means lower latency between pressing a key and hearing the note, but a higher strain on your CPU. A fast, modern computer should easily be able to operate at low sample buffer sizes (256 or 128) without audio glitches. However, if you do hear clicks, pops and or artifacts, try increasing the buffer size until you have smooth playback without any glitches. The latency time is displayed in milliseconds on the right-hand side of this menu.

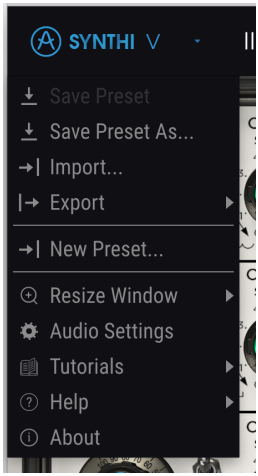
- The **Sample Rate** menu lets you set the sample rate at which audio is sent out of the instrument. The options listed here will depend on the capability of your audio interface hardware.

> ♪: Virtually all audio hardware can operate at 44.1 or 48 kHz which is perfectly fine in most applications, including Synthi V. Higher sample rates place greater loads on the CPU so we recommend staying at 44.1 or 48 kHz unless you have a specific requirements to work at high sample rates.

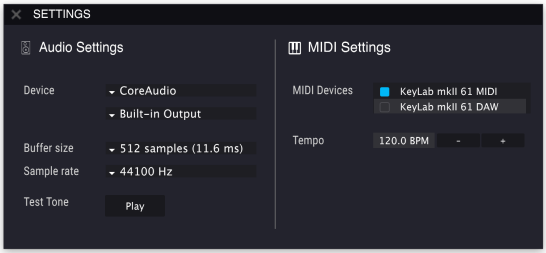
- The **Show Control Panel** button will jump to the system control panel for whatever audio device is selected.
- **Play Test Tone** plays a simple test tone to help you to troubleshoot audio issues. You can use this feature to confirm if the instrument is routed correctly through your audio interface and audio is playing back where you expect to hear it (your speakers or headphones, for example).
- **Tempo** lets you set the tempo of the Synthi sequencer. When using Synthi inside a host music software as a plugin, the instrument gets tempo information from your host software.
- Your connected MIDI devices will appear in the **MIDI Devices** area. Note that this is only displayed if MIDI devices are present on your computer. Click the check box to accept MIDI data from the device you want to use to trigger the instrument. Note that you can select more than one MIDI device if you wish to play Synthi V from multiple controllers.

2.3.2. MacOS Users: Audio and MIDI settings

At the top left of Synthi V is a pull-down menu. Click it to reveal the following:



Select Audio Settings to bring up the following window (note that this menu is only available when using Synthi V in Standalone mode):



Audio midi settings in macOS

Starting from the top we have the following options:

- **Device** selects which audio driver and device will handle the playback of Synthi V. This can be macOS's own CoreAudio driver or an ASIO driver. The name of your hardware interface may appear in this field. Below the device selection is a second pull-down menu that lists the available outputs the selected device. If your selected device has only two outputs, only two will appear as options; If your device has than two outputs, you can select a specific pair that you would like to use with Synthi V.
- The **Buffer Size** menu lets you select the size of the audio buffer your computer uses to calculate sound.

> ♪: A larger buffer means a lower CPU load as the computer has longer periods of time to process commands and fewer interruptions, but this can result in a noticeable latency between keypress and hearing a result (an obvious problem when playing an instrument). A smaller buffer means lower latency between pressing a key and hearing the note, but a higher strain on your CPU. A fast, modern computer should easily be able to operate at low sample buffer sizes (256 or 128) without audio glitches. However, if you do hear clicks, pops and or artifacts, try increasing the buffer size until you have smooth playback without any glitches. The latency time is displayed in milliseconds 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 listed here will depend on the capability of your audio interface hardware.

> ♪: Virtually all audio hardware can operate at 44.1 or 48 kHz which is perfectly fine in most applications, including Synthi V. Higher sample rates place greater loads on the CPU so we recommend staying at 44.1 or 48 kHz unless you have a specific requirements to work at high sample rates.

- **Play Test Tone** plays a simple test tone to help you to troubleshoot audio issues. You can use this feature to confirm if the instrument is routed correctly through your audio interface and audio is playing back where you expect to hear it (your speakers or headphones, for example).
- **Tempo** lets you set the tempo of the Synthi sequencer. When using Synthi inside a host music software as a plugin, the instrument gets tempo information from your host software.
- Any connected MIDI devices will appear in the **MIDI Devices** area. Note that this is only displayed if MIDI devices are present on your computer. Click the check box to accept MIDI data from the device you want to use to trigger the instrument. Note that you can select more than one MIDI device if you wish to play Synthi V from multiple controllers.

2.4. Taking Synthi V for a test drive!

Now that you have Synthi V up and running, let's take it for a quick test drive!

If you haven't done so already, launch Synthi V as a plugin or as a standalone instrument. If you have a MIDI controller set up, use it to play some notes on Synthi V. If not, use your mouse to play the on-screen keyboard.

The Left and Right arrows at the top of the instrument let you step through all of Synthi V's available presets. Try playing a few and when you find one that you like, try adjusting some of the other on-screen controls to see how it affects the sound. For example, the Joystick will always be mapped for the factory presets, so try moving that to see how it affects the timbre of your preset. The Filter Oscillator and Envelope Shaper are used in most patches, so feel free to adjust those as well.

Play freely and don't worry about changing any presets. Nothing is saved unless you specifically save a preset (described later in this User Guide), so there is no chance of messing up any of Synthi V's factory presets.

If you are familiar with how the Pin Matrix works or have used the EMS Synthi hardware in the past feel free to go deeper. Try modifying one of the presets by changing the routing. You can add pins by clicking on open points in the matrix. To remove a pin, right-click it. If you're feeling really adventurous, try removing all pins and creating a new sound from scratch!

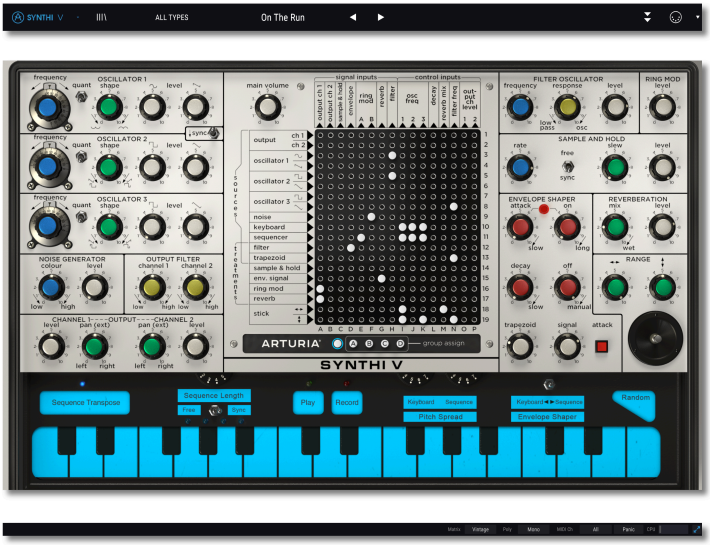
At this point, we can wrap up the installation and test drive. We hope you have gotten off to a smooth start. The rest of this guide will help you work your way through all of the Synthi V features on a section-by-section basis. By the time you reach the end, we hope you'll understand all of Synthi V's features and will be using the instrument to create fantastic music!

3. THE USER INTERFACE

Don't be fooled by its compact size and fun appearance, Synthi V is actually a powerhouse synth! It is packed with many modules for generating and shaping sounds and the incredibly flexible routing matrix lets you arrange those modules in countless ways. We are certain that there is enough in here to keep sound design enthusiasts entertained for a long time!

In this chapter we'll start with an overview of the Synthi V user interface. This will give you an idea of how the instrument is organized and where to find things. The point here is to establish how the interface is composed at a high level. We'll dive deeper into the main panel explain every module in detail in the next chapter.

3.1. High-Level Overview



Synthi V is neatly subdivided into three sections as shown in the illustration above.

- **The Toolbar (top):** This is where you handle administrative tasks such as saving, loading and browsing presets, editing various setup and configuration parameters, adjusting MIDI mappings and accessing advanced features of Synthi V. We will go over the Toolbar in the next section of this chapter.

- **The Panel (middle):** Here is where you will likely spend most of your time when working with Synthi V. It contains a detailed reproduction of the Synthi A panel complete with knobs, switches, indicator lights, joystick and–of course–the pin routing matrix. At the bottom of the Panel, you will find the "KS" (Keyboard Sequencer) virtual keyboard. We will go over the Panel it in the next chapter of this guide and the Keyboard Sequencer is covered in the following chapter.

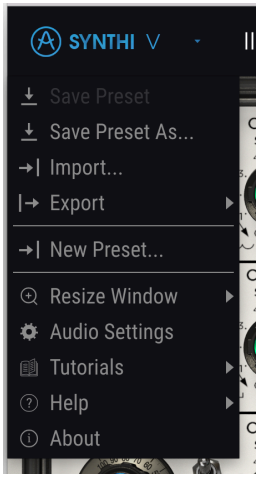
- **The Lower Toolbar:** This section provides quick access to a number of important parameters and useful bits of information such as CPU usage, polyphony mode and your selected MIDI channel. We will go over the Lower Toolbar at the end of this chapter.

3.2. The Toolbar

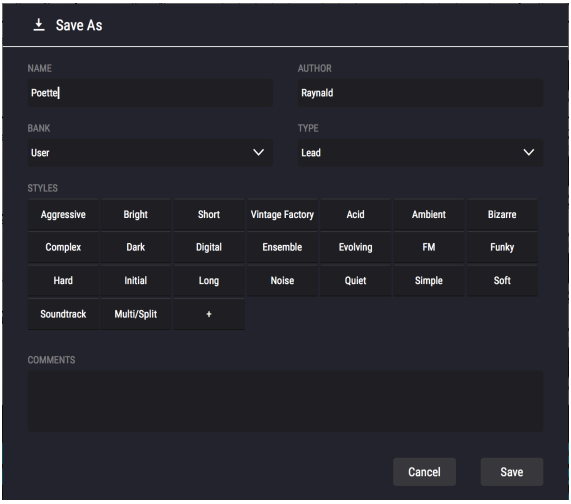
The toolbar that runs along the top of the instrument provides access to many useful features including the Synthi V menu, preset browsing features, access to Synthi V's "advanced" mode, various MIDI mapping features.

3.2.1. The Synthi V menu

Clicking the Synthi V box at the top-left corner opens a pull-down menu (shown directly below) and lets you access nine important features.



- **Save:** This option will overwrite the currently loaded preset with any changes you have made. If you would like to save the current preset under a different name, use the "Save As..." option below.
- **Save As...** This lets you save your preset under a different name. Clicking this option reveals a window where you can name your preset and enter information about it.



♪: Arturia's powerful browsing system lets you save much more than just a preset name. For example, you can enter the Author's name, select a Bank and Type, select tags that describe the sound, and even create your own Bank, Type, and Characteristics. This information can be read by the preset browser and is useful for searching the presets banks later. You can even enter freeform text comments in the Comments field, which is handy for providing a more detailed description of a sound. This can help you remember a sound or to provide context to other Synthi V users with which you are collaborating.

- **Import Preset:** This command lets you import a preset file, which can be either a single preset or an entire bank of presets.
- **Export Menu:** You can export presets in two ways: as a single preset or as a bank.
    - Export Preset: Exporting a single preset is handy when you want to share a preset with someone else. The default path to these files will appear in the "save" window, but you can create a folder at another location if you like. The saved preset can be reloaded using the *Import Preset* menu option.
    - Export Bank: This option can be used to export an entire bank of sounds from the instrument, which is useful for backing up or sharing presets. Saved banks can be reloaded using the *Import Preset* menu option.
- **New Preset:** This option creates a new preset with default settings on all parameters. It is a good place to start if you would like to create a new sound from scratch.
- **Resize Window:** The Synthi V window can be resized from 50% to 200% of its original size without any visual artifacts. On a smaller screen such as a laptop you may wish 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 smaller controls can be easier to see at higher magnification levels.

- **Audio Settings: (only available in Standalone mode)** Here you manage the way the instrument transmits audio and receives MIDI. See the section Audio and MIDI settings for more information about this topic.

> !: The Audio Settings menu is only available in when using Synthi V in Standalone mode. When using Synthi V as a plugin, the host software handles all of the parameters in this menu including audio and MIDI routing, buffer size settings, and more.

- **Tutorials:** Synthi V comes with tutorials that walk you through different features of the instrument. Select one of the tutorials to get step-by-step descriptions of how to make the most of the Synthi V features.
- **Help:** This section provides handy links to the Synthi V User Guide and the Synthi V Frequently Asked Questions page on Arturia's website. Note that accessing these pages will require an Internet connection.
- **About:** Here you can view the Synthi V software version and developer credits. Click the About window again to close it.

3.2.2. Browsing Presets

Synthi V comes packed with lots of great-sounding factory presets and we hope you'll create many more of your own custom presets. To help you search through large numbers of presets, we have a powerful preset browser with a number of features to help you find sounds quickly.

The browsing features of the Toolbar (shown above) include the following:

- The **Preset Browser** (on the left) opens and closes the preset browser. This is covered in detail in the next section of this guide
- The **Preset Filter** (set to "All Types" in the image above) helps you narrow down your selection. For example, you can narrow your search to only include presets tagged with *Keys*, *Lead*, or *Pads* so that you can find those sounds more quickly. To use this feature, click this section to open a pull-down menu and select any preset from the various categories ("Keys" "Lead" "Pads" etc.) This will load that preset and set the filter to only show you other sound tagged. You can now use the Preset Name or Arrow Icons to step through the filtered options. To reset the filter and show you all options, open the menu and select any preset from the "ALL TYPES" menu.
- The **Preset Name** is listed next in the toolbar ("Poette" in the image above). Clicking on the name reveals a pull-down menu with other available presets. Click on any name to load that preset or click away from the menu to close it.
- The **Arrow icons** to select the previous or next preset in the filtered list. This is the same as clicking on the preset name and selecting the next option in the list, but does it in only one click.

> ♪: The Previous and Next arrows can be MIDI mapped. This means you can use buttons on your MIDI Controller to easily step through the available presets without having to use the mouse at all.

3.2.3. Accessing Synthi's Advanced Features

Synthi V is not just a very accurate emulation of the classic EMS Synthi hardware. It actually contains many modern and powerful features that today's music makers will find very useful. Since many of these advanced features would look out of place on a vintage synthesizer like the Synthi, we have chosen to hide the modern touches away in the Advanced Features section. This way, if you want the authentic sound and feeling of using a vintage Synthi, you can have it using just the front panel control. If you need some powerful modern functions (like multistage envelopes, step sequencer, powerful studio effects and more), no problem—you can have that with just one click!

The downward facing double-arrows on the right side of the Toolbar open Synthi V's Advanced Features section. This section is covered in detail in the Advanced Features section of this guide.

3.2.4. MIDI Features

At the far right of the Toolbar, there are two MIDI-related options: A MIDI connector icon that switches MIDI Learn mode on and off, and a MIDI Controller Configuration menu. Both of these topics are covered in depth later in this chapter.

3.3. The Lower Toolbar

The Lower Toolbar runs along the bottom of the Synthi V user interface and provides quick access to several important parameters and useful bits of information.

- **Parameter Name:** As you move the mouse over various on-screen controls of Synthi V, the name of the parameter will be listed here. The current value of the control is listed in a tooltip that appears next to the control.
- **Matrix:** This parameter determines the operation of the Pin Matrix. In *Modern* mode, the pin matrix transfers signals perfectly as it theoretically should. In *Vintage* mode, the matrix behaves like the actual Synthi hardware, where crosstalk and signal loss occurred between neighboring pins on matrix rows or columns.

♪: Vintage mode gives users the full Synthi "hardware" experience, complete with the crosstalk and signal loss issues of the original hardware. However, you are more interested in sonic results and less interested a vintage synthesizing experience, you might consider leaving this parameter set to *Modern*. Doing so will mean the instrument will deliver more of the expected behavior and fewer surprises. Of course, you can switch back and forth and see which option you like more on any given preset!

- **Poly:** This parameter determines the polyphony mode of Synthi V. When set to *Mono*, Synthi V becomes a monophonic synthesizer. When set to *Poly 2*, *Poly 3* or *Poly 4*, the instrument becomes a two, three or four voice polyphonic synthesizer.
- **MIDI Ch:** This window 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).

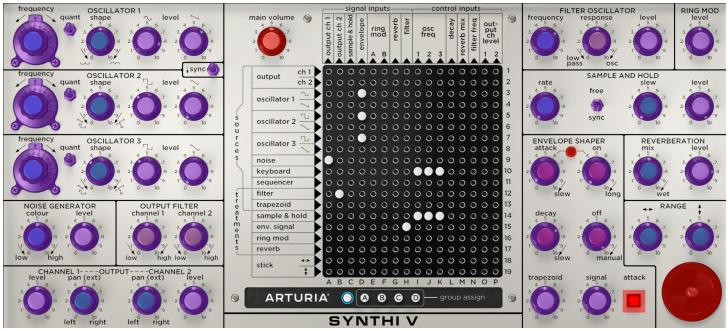
♪: By default, Synthi V will receive MIDI data on all 16 MIDI channels. You can change this by selecting a specific channel in the lower toolbar. You will need to do this if, for example, you want to use an external controller to use a number of instances of Synthi V.

- **Panic Button:** Press the Panic button to reset all MIDI signals in the event of "stuck" notes or other issues.
- **CPU Meter:** The CPU meter is used to monitor how much of your computer's CPU is being used by the instrument.

!: If the CPU meter is high, you may hear clicks, pops and other audible glitches in playback. In this case, consider increasing the audio buffer size setting. This is found under Audio Settings when working in Standalone Mode or in your host music software's preferences menu.

3.4. MIDI Learn and Configuration

The MIDI plug icon at the far right side of the Toolbar places Synthi V in "MIDI learn" mode. In this mode, all MIDI-assignable parameters are shown highlighted and you can map physical controls (on your MIDI Controller) to those on-screen controls inside the instrument. A typical example might be to map a real expression pedal to the Master Volume control, or a physical knob on the MIDI controller to the Frequency knob of the Filter Oscillator module.



MIDI Learn mode

Notice in the image above that some of the assignable controls appear in red whereas others are in purple. Purple controls are unassigned whereas red ones have already been assigned to an external MIDI control.

3.4.1. Assigning / Un-assigning controls

When MIDI Learn mode is switched on, click on any purple control to select it. Then turn a knob, move a slider or push a button on your MIDI controller. Your selected on-screen control will change from purple to red, indicating that a link has been made between your hardware control and the on-screen software parameter.

> !: Pitch Bend is a reserved MIDI controller that cannot be assigned to other controls.

A popup window appears providing additional information and various adjustable parameters about the newly "learned" connection.

Midi Control Setup

3.4.2. Min / Max value sliders

By default, a hardware control will span the entire range of the on-screen control (i.e., from 0 to 100%). The minimum and maximum value sliders let you restrict the range something other than 0%-100%. For example you may want the Master Gain to be controllable via hardware from 30% to 90%. To do this, set *Min* 0.30 and *Max* to 0.90. Your on-screen control will now be limited and the volume cannot go below 30% or above 90% no matter how the physical control is set. This is very useful for making sure you cannot accidentally make the sound too quiet or too loud when performing.

3.4.3. Relative control option

In the MIDI Control Setup box, there is a checkbox labelled "Is Relative". Check this box if your hardware MIDI control is sending "relative" MIDI messages. Leave this box unchecked if the MIDI controller is sending out "absolute" messages (this is the more common behavior).

A "relative" change instructs the receiving device to increase or decrease its current value. The receiving device (Synthi V in this case) interprets this command as "increase/decrease your current value." This type of control is often implemented on "endless" or "360 degree" knobs that do not have hard stops at the ends of their range. The advantage of this is that physical knobs always remain in sync with on-screen controls. However, not all hardware devices support this mode of operation which is why both options are available in Synthi V.

> ♪: There are two common types of messages when working with MIDI knobs: Absolute and Relative. Absolute positioning sends the exact position of the knob as a specific numerical value (i.e., "Set value to 54, 55, 56, etc.") when you turn the knob on your hardware controller. This is the most common implementation and is almost always used when using potentiometer knobs with "hard" stops at the ends. One downside to this implementation is that if you change presets, your physical knob and on-screen control will be "out of sync" with each other and turning the physical control can cause the on-screen control to suddenly jump to that position.

3.4.4. Unassigning or "un-learning" a MIDI mapping

Click the *Unassign* button to disconnect or "un-learn" the MIDI mapping of an on-screen control.

3.4.5. MIDI controller configuration

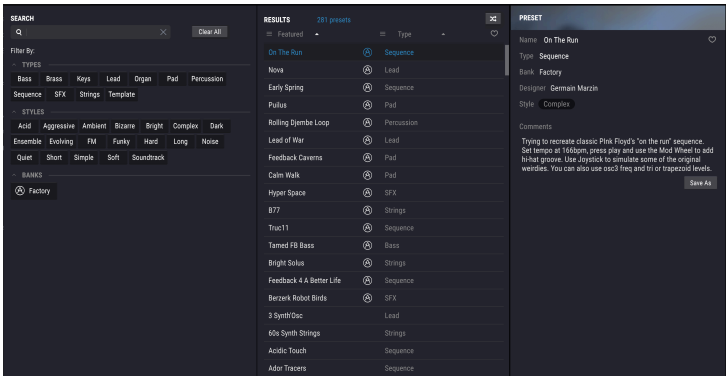
MIDI controller configuration

The small downward facing arrow at the right edge of the toolbar lets you manage different setups of MIDI mappings for controlling Synthi V. For example, if you have multiple hardware controllers (small "live performance" keyboard, large "studio" keyboard, pad based controller, etc.), you can create a profile for each of them one time and then quickly load it here. This saves you from having to redo the MIDI mapping assignments from scratch each time you swap hardware.

Once you have created a profile, you can save, delete, import or export it using the options in this menu.

Your MIDI Mapping profiles are listed at the bottom of this pull-down menu and the currently active profile has a checkmark next to it.

3.5. The Preset Browser in Detail



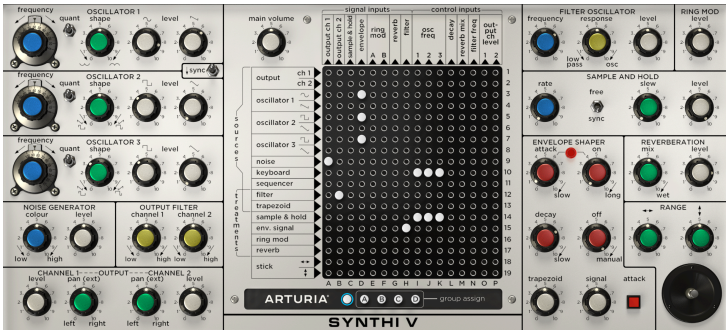
The Preset Browser (shown above) is where you can search through all of the presets to Synthi V. Open the Preset Browser by clicking the library symbol on the toolbar. To close the Preset Browser and return to the main screen, click the "X" that appears in the Toolbar.

To narrow down the presets and help you find the preset sounds you want, you can enter keywords in the search bar or click any of the available tags on the left column of the browser.

The results of your search are listed in the middle column. You can easily audition any displayed preset by clicking on it and playing a connected MIDI keyboard. You can sort the list results in various ways by clicking the column headers directly above the preset names. If you're feeling spontaneous, click the Random button at the top right to randomly select one preset from the results list. This is a fun and quick way to audition sounds without having to step through the list one-by-one.

Details about the currently selected preset are listed in the right column. If you really like a preset, click the heart icon at the top-right corner to tag that preset as a favorite. Click the heart icon again to un-like the preset. Options for saving or deleting patches are listed at the bottom of this column.

> ♪: Factory presets cannot be modified, deleted or overwritten. Only "User" (user generated) presets can be deleted, overwritten or saved under a different name. This is done by using the "Delete" "Save" or "Save As" buttons at the bottom of the right column. If you have modified a Factory preset and would like to save it, you must save your modified preset under a different name (only the "Save As" option appears in this case since you cannot delete or overwrite factory sounds).

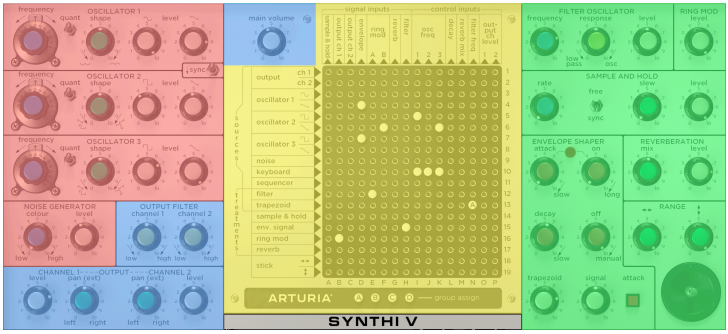


4.1. Ways to look at things

At first sight, some users may feel overwhelmed by the front panel of Synthi V, but there is nothing to fear! The original Synthi AKS hardware features a *brilliantly* laid out front panel that groups sections in clear, intuitive ways. Every feature is its own box with all accompanying controls placed nearby. Controls are clearly labeled and the knobs are even color-coded to help you gain an intuitive sense of what everything does. The pin matrix in the middle may seem imposing but it is actually very simple once you know how to use it. It gives you the incredible flexibility of a modular synth in a compact form factor without having to deal with a big mess of patch cables.

Let's take a look at the things in detail.

4.1.1. Visual Chunking



Front panel with color overlay

If you look at the Synthi front panel, you'll see that the synthesizer is actually composed of 12 different sections or "modules" plus the Pin Matrix. Black lines on the panel separate each module into its own box and the function of each box is identified in ALL CAPS at the top of each box.

To further help users, similar modules are physically grouped together. Take a look at the illustration above with its color overlay. You'll notice that sound sources (in red) are clustered together at the top-left of the instrument. Sound Modifiers (in green) are grouped together on the right. The pin matrix (yellow) is front and center as it's arguably the most important part of the synth. And finally, the output section (in blue) is on the bottom left. The only exception is the Main Volume knob, which we have placed at the top left of the pin-matrix due to space constraints.

4.1.2. Color Coded Knobs

Most people immediately notice the colorful knobs on the front panel of Synthi V. While these colors give Synthi V a fun appearance, there is actually more to them than just fun-factor. Look closely and you'll realize the colors map to specific kinds of controls. Some users find that over time, they develop an intuitive feel of what each color does and this makes their sound design process more intuitive and less analytical.

4.1.2.1. Blue Knobs:

These knobs always map to some kind of frequency-related control. With oscillators, blue knobs set the pitch. With the Sample and Hold, it sets the LFO rate. With the Noise Generator module, it determines whether the noise is low or high frequency in character. In all cases, blue knobs map to some parameter involving pitch or frequency.

4.1.2.2. White Knobs:

White knobs always control an output level. Turning this knob fully counter-clockwise will effectively mute that output. Turning the knob all the way up will result in the maximum possible output for the module.

> ♪: Be careful when turning modules all the way up as doing so may cause the module's output to overload the input of the next module in your voice path. This may not be a bad thing and can actually result in a nicely overloaded or distorted final sound. However, if your output is sounding unexpectedly distorted, check that the output knobs in your voice path are not turned up too high.

4.1.2.3. Green Knobs:

Green knobs are secondary functions of a module. For example, the green knob sets the wave shape of each oscillator. In the joystick section, the green knobs determine the range of the X and Y outputs. In the Sample and Hold section, the green knob sets the slew rate. While the specific function may vary from module to module, you can be sure that a green knob will always control a secondary function.

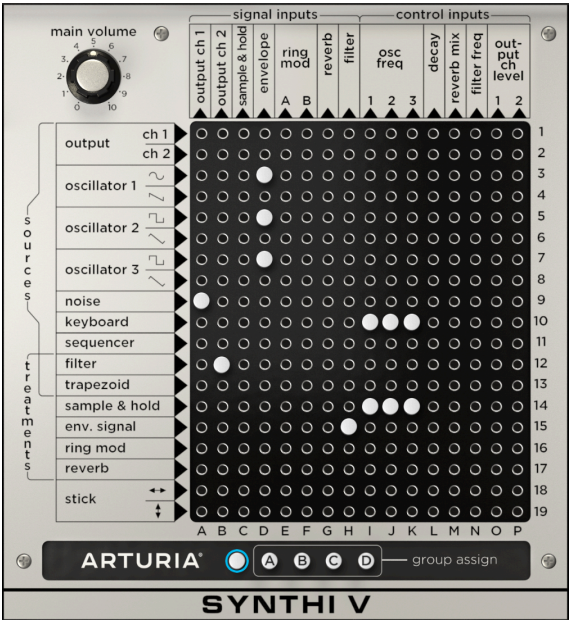
4.1.2.4. Yellow Knobs:

These knobs are like Green knobs except they apply specifically to filtering functions.

4.1.2.5. Red Knobs:

Red Knobs control envelope-related functions. Envelopes are used to control various parameters over time and are covered later in this manual.

4.2. The Pin Matrix



The Synthi's pin matrix is a brilliant piece of engineering! It gives you the massive power and flexibility of a modular synthesizer without the mess of cables or the massive size (the Synthi AKS was originally built into a small briefcase!) All you need is small plugs ("pins") to connect modules together. We will discuss the function of each module later in this chapter, but first let's first discuss how to use the matrix.

4.2.1. Making Basic Connections

Using the Pin Matrix simple. All of the sources (i.e., inputs of the matrix) are listed vertically along the left edge and all of the destinations (outputs of the matrix) are listed along the top. To connect a source to a destination, simply find where they intersect and click to place a pin to connect the two. To remove a pin, just right-click it.

There are 304 closely-spaced patch points on Synthi V, so to help you avoid placing a pin the wrong location, the row and column labels are highlighted when your mouse pointer hovers over the matrix.

The source rows are listed by number (1-19) and the destination columns are listed by letter (A through P). Synthi users commonly described patches in shorthand by simply referencing pin locations. For example, in the illustration above pins must be placed in locations "I1O", "J1O" and "K1O" in order to connect the keyboard source (row 10) three Oscillator Frequency destinations (columns I, J and K).

4.2.2. Sources and Destinations in detail

If you look closely, you may have noticed that there are two categories listed along the left edge of the matrix: **Sources** and **Treatments**. "Sources" is EMS' way of describing the output of modules that produce audible signals on their own. "Treatments" is their way of describing modules that must first be fed with a signal before producing their own output. Note that there are exceptions to this rule and some treatment modules (Filter and Trapezoid, for example) are able to produce sounds of their own under certain condition. These exceptions are sometimes exploited by sound design enthusiasts to great effect, and we will discuss this later in the manual.

The same thing is true of the Destinations (along the top of the matrix). Here you see that are subdivided into two categories: **Signal Inputs** and **Control Inputs**. Signal Inputs expect to connect to audible signal sources while Control Inputs generally expect to connect to control signals. Again, there are exceptions to this rule that sound designers use to great effect.

There is no "wrong" way to use the Synthi V software so feel free to experiment. However, do exercise some caution as the results may be loud and/or unexpected!

4.2.2.1. Sources (Sources and Treatments):

- **Output 1, 2** – The master output of Synthi V can be brought back into the synth to create wild feedback paths.

> !: Feedback paths can be loud and sometimes unpredictable. Please exercise caution when bringing these signals back into the Synthi V so you don't damage your hearing or your speakers!

- **Oscillator 1, 2, 3** – These are the outputs of the Synthi V's three oscillator modules. The pin matrix has two rows for each oscillator since each oscillator simultaneously produces two wave shapes.
- **Noise** – This is the output of the noise module.
- **Keyboard** – This is the control voltage output of the Synthi V keyboard.
- **Sequencer** – This is the control voltage output of the keyboard sequencer. Note that this output is different from the Keyboard (directly above) or the Step Sequencer described later in the advanced features.
- **Filter** – This is the output of the Filter Oscillator module.
- **Trapezoid** – This is the control voltage output of the Envelope Shaper module. You can connect this to control inputs of other modules to automate them with the Envelope Shaper. Note that this is the control signal from the Envelope Shaper, not the processed audio (see "Env. Signal" below for that).

> ♪: While the Trapezoid is technically a control voltage and isn't intended to be used as a sound source, some sound designer use Trapezoid in their audible signal path anyway as it adds a "boom" and/or "tick" to the beginning of a sound and gives the overall sound a sharper attack. Experiment and see if you like the sound!

- **Sample & Hold** – This is the control voltage output of the sample and hold module.
- **Env. Signal** – This is the audio output of the Envelope Shaper module. Sound sources that are processed by the Envelope Shaper appear here. Note that the envelope shaper has a separate control voltage output that is described above (see "Trapezoid").
- **Ring. Mod** – This is the output of the Ring Modulator module.
- **Reverb** – This is the output of the Spring Reverb module.
- **Stick (X and Y)** – These are the outputs for the Joystick module. Each axis of the joystick (X and Y) has a separate output.

4.2.2.2. Destinations:

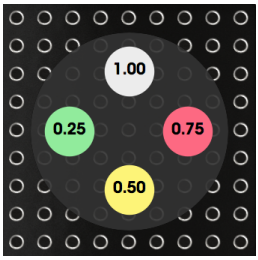
- **Sample & Hold** – This is the sampling input of the Sample & Hold module.
- **Output Ch. 1-2** – These two columns connect to the Left and Right channels of Synthi's Output section.
- **Envelope** – This is the audio input for the Envelope Shaper.
- **Ring Mod A, B** – These two columns connect to the A and B inputs of the Ring Modulator Module.
- **Reverb** – This is the input of the Synthi V's spring reverb module.
- **Filter** – This is the audio input for the Filter Oscillator module.
- **Osc Freq 1-3** – These three columns are the control (pitch) inputs for the Synthi V's three oscillators.
- **Decay** – This is the control signal input for the decay time of the envelope shaper.
- **Reverb Mix** – This is the control signal input for the dry/wet amount of the reverb module.
- **Filter Freq** – This is the control signal input for the cutoff frequency of the Filter oscillator module.
- **Output Ch. 1-2 Level** – These are the control signal inputs for the amplitude levels of the output section.

4.2.3. Advanced Connections

4.2.3.1. Attenuator Pins

A left-click places a white pin on the matrix. This pin sends 100% of the source's signal to the destination. This is the default behavior because in many cases, this is what you want. However, there may be cases you may want to send an attenuated signal to the destination. On the original Synthi AKS hardware, this was done with different colored pins that offered various amounts of attenuation. We have maintained that concept in the Synthi V software.

Click-and-hold any existing pin (or empty pin location) to reveal four different variations of pins, as shown below.



By Dragging the mouse up, right, down or left before releasing, you will place 100%, 75%, 50% or 25% signal strength pins. If a pin already exists at a location, you can click-and-hold that pin to access this menu and change its color.

♪: Attenuator pins are particularly useful when working with control signals. For example, if you are sending the output of the Sample and Hold module to *multiple* different destinations, you may not want to send that signal at full strength to all of the destinations. Turning the level knob of the Sample and Hold module (see below) would attenuate the output signal and would affect all receiving modules equally, which is not helpful. The solution to this problem is the attenuator pins. By using different colored pins, you can send full strength modulation (100%) to one destination but attenuated copies of the same signal (75%, 50% or 25%) to other destinations.

4.2.3.2. Group Assign Pins

At the bottom of Synthi's matrix, you will notice five selectable pins. The leftmost pin is unlabeled whereas the four remaining "group assign" pins are labeled A, B, C and D. You can select any of these pins by clicking on them and the currently selected pin is outlined.

The currently outlined pin will be placed when you click on the matrix. For example, if the unlabeled pin is selected, you will place an unlabeled white pin at your selected location; if one of the groups pins is selected, you will place a pin with that group's marking ("A" "B" "C" or "D") on the top of the pin.

Group Assign pins are special because they not only connect source to the destination, but allow you to have group-level "macro" controls over all similarly marked pins. This group-level control is done through the "Modulation" section in the Advanced Features menu of Synthi V. This is described in detail later in the manual but the quick summary is that groups allow you to do two important things:

1. Adjust groups of connections using one master control (i.e., providing "macro" control over multiple connections)
2. Bring in a variety of new control sources that are not available on the original Synthi AKS hardware including: keyboard aftertouch, velocity, mod wheel, an extra tempo-synchronized LFO and even a step-sequencer.

ℹ♪: Group assign pins can be attenuated and given different colors using the same process described in the previous section of this guide.

4.3. The Modules

Modules are the circuits where audio and control signals are generated, processed and sent out of Synthi V. To help simplify things, let's break it down into three groups: Sound Sources, Modifiers, and the Output Section.

4.3.1. Sound Sources

Sound sources are modules that generate the raw sounds that can then be processed by other modules. Synthi V has four of them: three oscillators and a noise generator.

ℹ♪: It is technically possible to use the Filter Oscillator module as a fourth oscillator using the old synthesis trick of "playing" the filter's self-oscillation (we will explain how to do this in the Filter Oscillator description later in the guide). However, we don't count the filter as a source since that is not its intended purpose and the oscillator it creates is limited in its functionality.

4.3.1.1. Oscillators

Synthi V has three oscillators with small variations in features and capabilities to give users more sonic options.

	Frequency Range	Wave Shapes
Oscillator 1	0.600-16,750 Hz	Sine & Saw
Oscillator 2	0.600-16,750 Hz	Square & Triangle
Oscillator 3	0.015-500 Hz	Square & Triangle

♪: Any of Synthi V's oscillators can technically be used as a Low Frequency Oscillator (LFO) control source, but Oscillator 3 is particularly well suited to this task due to its lower minimum frequency limit and reduced total frequency range. The reduced total frequency range is an advantage since this makes it easier to dial in a very specific frequency, which is often necessary when working with LFOs.

The Oscillator controls are as follows:

- **Frequency:** Sets the frequency of the oscillator. The ranges are listed in the table above.
- **Quant:** This switch engages and disengages note quantization. When quantization is engaged (the switch in the up position), the oscillator's Frequency knob automatically "snaps" to the nearest semitone. If quantization is left off, the oscillator's Frequency knob will sweep smoothly between notes.
- **Shape:** This knob changes the shape of the output waveform by adjusting its symmetry. This provides a very wide variety of timbres for users beyond the basic sine, saw, square and triangle wave shapes offered by the oscillators.

♪: The Shape knob has no effect on Oscillator 1's Sawtooth output. This is normal.

- **Sync:** Synchronizes the second oscillator to the first to produce a classic "hard sync" sound. This means the second oscillator immediately restarts itself any time the first oscillator completes a cycle, regardless of where the second oscillator is in its own cycle. The resulting "hard-sync" sound is very rich in harmonics and always stays in tune with the pitch of the first oscillator.

> ♪: When sync is enabled, sweeping the second oscillator's Frequency knob will provide a variety of complex and interesting tones. For an even more adventurous tones that "move" try using an LFO, envelope or other control source to modulate the second oscillator's frequency automatically!

- **Level:** Sets the output level of the oscillator. There are two knobs here since each oscillator simultaneously outputs two wave shapes to the Pin Matrix. The shape of the output is drawn above the knob and also in the Pin Matrix.

4.3.1.2. Noise Generator

This module creates filtered noise that can be used by itself as audio or in conjunction with other modules like the Sample and Hold (described below).

- **Colour:** Determines the character of the noise being produced. The default "5" position produces neutral broadband noise. Turning the knob clockwise shifts the tone more toward "bright" white noise; turning the knob counter-clockwise shifts the tone more toward a "warmer" pink noise.
- **Level:** Sets the output level of the Noise Generator module.

4.3.2. Modifiers

Synthi V has six different sound modifiers. These are modules that process an incoming sound directly or generate control voltages that you can then use to control other modules.

4.3.2.1. Filter Oscillator

The filter oscillator is a filter low-pass/band-pass diode ladder filter. This filter is similar to the transistor ladder design patented by Robert Moog in 1969 but EMS uses diodes instead of transistors. Synthi A's filter sounded similar to the beloved Moog design but had a less linear, less predictable and less refined sound. Users have commonly described this filter as having a "wild" and "squelchy" sound.

Due to its self-oscillating design, this filter can also act as an oscillator using a special trick. This is described below.

> ♪: Fans of the iconic Roland TB-303 may find the Synthi Filter Oscillator sound to be strangely familiar. This is because Roland implemented a similar diode ladder design in that product.

Filter Oscillator controls are as follows:

- **Frequency:** Sets the cutoff frequency of the Filter Oscillator module.
- **Response:** This knob adjusts the "Q" (sometimes called "resonance") of the filter.

Response Setting	Resulting Sound
0-5	At low settings, the filter produces a gentle high frequency rolloff with little or no "peaking" at the cutoff frequency. This is a classic low-pass filter sound.
5-7	At medium settings, the filter has a slightly more "aggressive" sound and acts more like a band-pass due to its pronounced bump at the cutoff frequency and natural reduction in low frequencies.
7-10	At high settings (approx. 7-10) the filter begins to self-oscillate and outputs a whistling tone even if nothing is being played through the filter. Any sound that is passing through the filter will likely gain an aggressive, distorted and heavily filtered sound due to the strong peaking at the cutoff frequency.

- **Level:** Sets the output level of the Filter Oscillator module.

> ♪: When the response is set to high settings (7-10) and no sound is played though the filter, the module self-oscillates and outputs a quite pure sine tone. The pitch of this tone can be set by the Filter Oscillator's Frequency knob. It is possible to "play" the resulting oscillation by connecting the keyboard source to to the Filter Freq. destination in the Pin Matrix. However–just like with the real Synthi AKS hardware–the pitch of the oscillator will drift as you play notes further away from the tuned frequency. It should be clear that this special "oscillator" is quite limited in its capabilities. It has pitch tracking limitations, can only output sine tones and does not have quantization, shaping or sync capabilities. Still, in cases when a fourth oscillator is really needed, this is a great trick to know!

4.3.2.2. Ring Mod

Ring Modulation is a simple effect where two audio sources (labeled "A" and "B" on the Pin Matrix) are multiplied together. This effect tends to work best when one (or both) of the inputs have simpler waveforms without complex harmonics, but feel free to experiment! Note that this module requires audio signals to be connected to *both* inputs, otherwise it outputs silence.

> ♪: As you experiment with ring modulation, you may come across very familiar-sounding bell-like and sci-fi sounds. That is because many radio, film and television programs used ring modulation to achieve otherworldly tones and voices. The best example of this is probably the voice of the Daleks in the wildly popular BBC television series Doctor Who in 1963!

Level: Sets the output level of the Ring Mod module.

4.3.2.3. Sample and Hold

This is a module that was not originally available on the Synthi AKS hardware, but we have chosen to add it in to the Synthi V software instrument because it is a fantastically useful module for sound designers and it is period correct (i.e., the effect was available at the time when EMS was manufacturing the original Synthi AKS hardware).

This effect works by periodically "sampling" any incoming signal (audio or control) and holding that value as a steady control output until the next sample is taken. The output is a control signal can then be used to control parameters on any of the modules in Synthi V.

♪: A popular use of Sample and Hold is to connect a noise source to the sampling input and to connect the Sample and Hold's output (i.e., the "held" control signal) to an oscillator's frequency input. This creates the classic "computing machine" sound from old sci-fi films.

Rate: Sets the sampling frequency of the module. This knob's settings can be synchronized to your DAW software's tempo though the Sync switch.

Sync: When this switch is set to "sync" the Rate knob is synchronized to the tempo of your DAW and the Rate value is displayed in bars and beats. If Sync is set to "free", then the Rate value is shown in Hertz.

Slew: This knob sets the speed at which the circuit transitions from one sampled level to another. When set to "0", the transitions will be instantaneous. Abrupt shifts will often result in ticks and pops due to the speed at which the transition takes place (this is normal and expected behavior). Turning this knob up slows down the transitions and will result in smoother transitions, but with softened "edges." Turning this knob up even more can result in what some musicians call "squishy" or "rubbery" transitions! This knob has a lot of sound design potential and there is no "right" or "wrong" way to use it, so experiment and have fun!

Level: Sets the output level of the Sample and Hold module.

4.3.2.4. Envelope Shaper

The original Synthi AKS hardware features a unique envelope generator that was different from the ones offered by other synthesizers manufacturers at the time. Whereas most synthesizers like the MiniMoog had ADSR (attack, decay, sustain and release) controls, the Synthi Envelope Shaper module has Attack, On, Decay and Off and it was possible to "loop" the Synthi's envelope. This was—and still is—somewhat unusual, but it opens up some very interesting sound design possibilities.

Attack: This knob sets the onset ("attack") time of the triggered envelope. "O" will be virtually instantaneous whereas slow settings will need over one second to reach maximum output levels.

On: After the attack stage is completed, the output is held at its maximum value for a period determined by this knob. This knob is sometimes described as a "hold" function since it holds the attack value.

> ♪: An indicator lamp shows when the Attack and On stages are active. This light switches off when the envelope generator has moved to the Decay stage.

Decay: The decay stage is similar to the "Release" stage of most other synthesizers. It determines how quickly the envelope fades away when a key or other trigger source is released. "O" will be a virtually instantaneous stop whereas slow settings will need well over 10 seconds to release. Note that adjusting this value will affect the overall length of the envelope and you may wish to make adjustments to the Attack, On and Off settings to compensate.

Off: The Off knob sets a timer for an automatic re-triggering circuit within the Envelope shaper. When this knob is set to its highest settings ("7-10" or "Manual"), the delay time becomes infinite and therefore the circuit never automatically retriggers. As the knob value is reduced, the delay time is reduced and the circuit will retrigger more and more frequently.

♪: One of the more odd (and delightful) features of the Synthi is its ability to "loop" its own envelope. This idiosyncratic feature has confused many users expecting to see traditional (non-looping) envelopes with the usual "ADSR" controls. However, those users that have taken the time to understand this feature have ended up describing it as one of Synthi's most interesting and idiosyncratic features.

Trapezoid (Output Level): Sets the output level for the control voltage envelope being created by this module. This output appears as the "Trapezoid" source row in the Pin Matrix.

Signal (Output Level): Sets the output level of the audio signal being processed by module. This output appears as the "Env. Signal" source row in the Pin Matrix.

Attack (Switch): This switch manually triggers the envelope. As long as this switch is held down, the envelope will stay in its "On" phase.

4.3.2.5. Reverberation

The EMS Synthi A hardware featured a spring reverb tank inside. This tank was an important contributor to the overall Synthi sound and has been carefully modeled in the Synthi V.

Mix: This knob lets you blend the "dry" incoming signal with the "wet" reverberant signal coming back from the spring reverb tank. In theory, setting this knob to "0" should result in a 100% dry signal (no reverberation heard at all) while setting this to "10" will result in a 100% wet signal (only the reverberation is heard). A "5" setting provides a 50/50 mix of dry and wet sounds. Since Synthi V is modeled on the actual analog hardware, the separation is not perfect and some "wet" or "dry" signal is heard even if the knob is set to 100% dry or 100% wet. We have done this to maintain the sound and experience of using the original hardware.

♪: The Mix knob can be controlled by other modules by using the "Reverb Mix" destination on the Pin Matrix.

Level: Sets the output level of the Reverberation module.

4.3.2.6. The Joystick

Few things conjure fun more than a joystick! You see them on video game controllers, arcade machines, giant excavators and cranes, airplanes and—of course—the Synthi synthesizer!

Beyond the simple fun factor, a joystick is a great control to have on a synthesizer because it gives you easy control over two parameters in one place. For example, on Synthi V you might map the X axis to filter frequency and the Y axis to reverb mix so that you can simultaneously control them with only one hand leaving your other hand free to manipulate other controls. Besides freeing up one hand, a joystick opens up new avenues of gestural expression that are difficult (and much less intuitive) using separate knobs.

♪: Like most on-screen controls, the Joystick can be mapped to a hardware controller using MIDI Assign functionality. We recommend doing this if possible to get the full joystick experience!

Range Knobs (X and Y-axis): These knobs scale the X and Y outputs of the joystick. You can think of these knobs as being like volume controls for the joystick's outputs. When a knob is set to the maximum "10" value, the joystick outputs its control signals at full power and a receiving module reacts strongly to the signal. In cases where you would like the effect of the joystick to be less pronounced, turn down one (or both) of these knobs

Joystick: The Synthi V joystick outputs control voltages on two axis (X and Y). These outputs appear as sources "Stick X" and "Stick Y" in the Pin Matrix. Connecting these sources to one or more destinations lets you control the destinations with the joystick.

4.3.3. Output Section

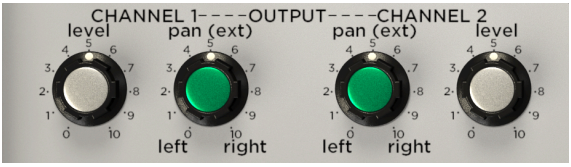
The output section is the last stop for your signal before it leaves Synthi V. This tends to be an overlooked part of the Synthi V as users often associate it with simple volume and pan controls, but don't be fooled! Even at this late stage in the signal path, you can still be creative with modulate-able Level knobs and two sweet-sounding filters!

4.3.3.1. Output Filter

The Output Filter module includes two filters that combine low-pass and high-pass filtering into one knob. This allows you to do some final sound "sweetening" to your signal before it leaves the Synthi.

Channel 1-2: The knob's default position ("5") lets your signals pass through the filter unaffected. Turning a knob counter-clockwise increasingly low-pass filters the sound (i.e., high frequencies are cut while low frequencies are let through). Turning a knob clockwise has the opposite effect: low frequencies are cut and high frequencies are let through.

4.3.3.2. Output Level and Pan



Pan: Sets the panning position of its corresponding channel, from hard left to hard right.

Level: Sets the output level of its corresponding channel.

> !: Note that these Level knobs can be controlled by other modules through the "Output Ch. 1-2" destinations in the Pin Matrix. If these pins are being used in the Pin Matrix, then these knobs may still be passing audio even though they appear to be turned down. For this reason we have included a true "master" volume control knob, which is described immediately below.

4.3.3.3. Master Volume Knob

The main volume control knob controls (you guessed it!) the master output volume of the Synthi V. Even though Synthi has Level knobs in the Output module, we felt it was important to include a Main Volume knob for two reasons:

1. It is practical to have one knob to control the output instead of two separate level knobs in the Output Module.
2. The Level knobs in the Output module can be modulated by control voltages from other sources. This means those Level knobs can still be letting sounds through even if they appear to be turned down. By contrast, the Main Volume knob described here cannot be modulated and provides a simple control that always works as users expect.

5. THE KEYBOARD SEQUENCER

Synthi V's Keyboard Sequencer

5.1. History

Digital music sequencing is quite commonplace today and nearly all hardware sequencers depend on microprocessors and other digital technologies to record and playback notes. This was not always the case. In 1972 when the Synthi AKS was launched, EMS were among the very first pioneers of digital sequencing.

To provide some perspective: Most sequencers in the early 197Os used purely analog technology and gave users 4, 8 or perhaps 16 discrete steps to program. The Synthi AKS digital sequencer was different in that it allowed users to record short performances like a tape recorder and the system was able to capture up to 256 separate events. Users could then loop, overdub and manipulate their performances in various ways. This kind of power and flexibility became more prevalent in the 198Os with the introduction of MIDI but the fact that EMS was doing it in 1972 is proof of their immense forward-looking abilities.

It should be emphasized that this was pioneering technology and it may seem crude by modern standards. It doesn't have the refinements and editing capabilities of modern sequencers and our closely modeled software emulation reflects this. That said, working within the confines of this sequencer can produce surprising and delightful results and we hope you will take the time to really explore it!

5.2. Keyboard Sequencer features

The Synthi V sequencer contains the following features:

5.2.1. The Keyboard

The on-screen keyboard can be "played" with a mouse and also responds to incoming MIDI note data (active notes are illuminated). If Poly mode (in the Lower Toolbar) is set to "mono" then the keyboard is monophonic just like the original Synthi AKS. If Poly mode is set to "Poly 4" then this keyboard can play up to four notes.

5.2.2. Sequence Transpose

This button engages and disengages sequence transposition. When switched on, the light above the button is illuminated and any note that you play will transpose the recorded sequence. The transposition amount is the interval between your played note and first note played. When Sequence Transpose is switched off, the light is no longer illuminated and the sequence returns to its original recorded pitch.

♪: This button can be automated using the MIDI Learn functionality. Doing so makes it easy to quickly transpose sequences "on the fly" with your MIDI controller during a live performance.

5.2.3. Sequence Synchronization

This switch determines the synchronization source of the sequencer. When set to *Sync,* the sequencer locks to the tempo of your host music software or Synthi V's internal tempo when using the standalone version. When set to *Free*, the sequencer runs freely according to its internal clock. The rate of the sequence is set by the Sequence Length knob.

5.2.4. Sequence Length

This knob sets the length of the sequence. If Sequence Synchronization parameter (above) is set to *Free*, this parameter ranges from 0-10 (minimum to maximum); if Sequence Synchronization is set to *Sync*, this length is displayed in bars.

♪: Arturia has chosen to maintain the original "Sequence Length" labeling used by EMS, however he term "length" can be a bit confusing to some modern users, since the length of the sequencer is always 256 events. This knob sets the overall length of time required to play the sequence and it does so by adjusting the speed at which the sequence plays back. Playing faster through the sequence results in a shorter sequence. Some users may have an easier time conceptualizing this by thinking about this knob as a "playback speed" control for a recorded sequence.

5.2.5. Play

This button starts and stops playback of the sequencer. A stopped sequence always restarts playback from the beginning of a sequence. If recording is enabled and you press this play button, the recorder stops recording but the sequencer continues playback without interruption.

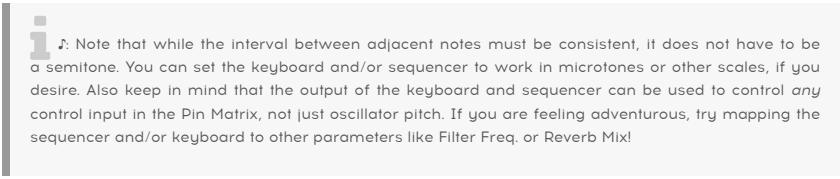
♪: There are four lights next to the Sequencer Length knob and give you visual feedback of where you are in a sequence. These lights move left to right any time the sequencer is recording or playing back.

5.2.6. Record

This button lets you record a sequence. If you press this button when playback is stopped, any existing sequence in memory is cleared and the recorder is "armed" but recording does not start until you play the first note on the keyboard or the host software triggers a note (when Sequencer Sync mode is active). If you press this button while a sequence is playing, the sequence continues to play and the recorder enters "overdub" mode, letting you add more notes on top of the current sequence. In all cases, the recorder "loops" when it reaches the end of the sequence and continues recording in overdub mode.

5.2.7. Pitch Spread Knobs

The Pitch Spread knobs determine the pitch interval (or "spread") between notes. This section includes two knobs, *Realtime* and *Sequence*. The Realtime knob determines spread between notes of the keyboard as it is played (i.e., in realtime). The Sequence knob determines the spread of notes in a recorded sequence. Having the ability to adjust these two ranges independently giving you access to some quite unusual sounds.



♪: Note that while the interval between adjacent notes must be consistent, it does not have to be a semitone. You can set the keyboard and/or sequencer to work in microtones or other scales, if you desire. Also keep in mind that the output of the keyboard and sequencer can be used to control *any* control input in the Pin Matrix, not just oscillator pitch. If you are feeling adventurous, try mapping the sequencer and/or keyboard to other parameters like Filter Freq. or Reverb Mix!

5.2.8. Envelope Shaper Switch

This is a three-position switch that determines whether the Envelope Shaper module is triggered by the sequencer only (switch set to left position), the keyboard only (right position), or both the sequencer and the keyboard (center position).

5.2.9. Random Switch

This button generates a random voltage on the keyboard. It is a fun and spontaneous way of generating random control voltages.

♪: Keep in mind that voltages generated by the Random button can be recorded into the Synthi V sequencer.

5.3. Summary

The Synthi AKS hardware featured a powerful (for its time) and unusual digital sequencer. We have modeled Synthi V's sequencer as faithfully as possible on that original hardware. Some users will find it fun and intuitive whereas others may find it limited and confusing by modern standards. As you explore, keep in mind that this pioneering sequencer was created in the early 1970s, long before best practices were established on how sequencers should work. While it may have idiosyncrasies, we hope that you will take the time to really explore it so that you can unlock its maximum musical potential.

6. MIDI AUTOMATION

The original Synthi A and AKS synthesizers were launched in the early 197Os, more than a decade before the introduction of the MIDI protocol in 1983. This means the Synthi hardware was unable to benefit from all the good things brought about by MIDI.

Fortunately things are different with Synthi V. The software fully supports the MIDI protocol and this is how the instrument receives information from your host music software about what note to play, how long and with what velocity. The support for MIDI is not limited to basic commands like note-on, note-off and velocity. As with all Arturia software instruments, the MIDI support goes deep into the core of the instrument and you can use MIDI Continuous Control ("CC") messages to automate nearly *any* parameter within Synthi V. This opens up entirely new avenues of creative expression.

It's important to note that each host music software (Ableton Live, Logic, Cubase, etc.) implements MIDI automation in its own way and it is impossible for us to provide step-by-step instructions for each host. Therefore, what we will do here is cover the general idea of MIDI CC control and show what it can do in one DAW (Ableton Live). If you are not already familiar with MIDI automation for your host software, please refer to your software's documentation to learn more.

6.1. What is MIDI CC?

To sum it up in one sentence: MIDI CC is like Voltage Control for the digital age.

The original Synthi hardware had many limitations. While some of its knobs were voltage controllable (like oscillator pitch or filter cutoff), many controls were not. For example, none of the white Level knobs could be voltage controlled. This means the only way to change those knobs would be to physically turn them by hand, which may not be possible if you are already using your hands to play the instrument!

Synthi V changes all that. Nearly every parameter in Synthi V can be "voltage controlled", not with actual voltages but with MIDI CC commands. Nearly every control on Synthi V (knobs, buttons, etc.) has a unique CC number associated with it and by sending CC data to that number, you can "automate" (i.e., push, turn or move) that control.

This is incredibly powerful. It means you are no longer limited to what you can turn by hand or control through the Pin Matrix. You can control Synthi remotely even if you don't see the user interface in front of you. You can even compose complex automation routines in the timeline of your music software and have these changes happen automatically and with perfect repeatability. It is like having dozens of extra hands to precisely turn knobs exactly as you want without making any mistakes.

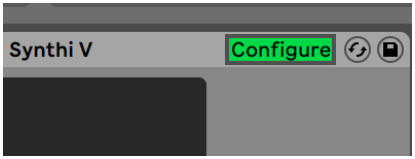
What's even better is that modern host applications do not even require you to look up cryptic CC numbers for every control you want to manipulate. Most host applications automatically detect and spell out, in plain English, what every CC number controls. Some applications like Ableton Live go even further and let you simply click on an on-screen control to select it without ever having to know anything about CC values at all.

6.2. Selecting knobs to automate with CC

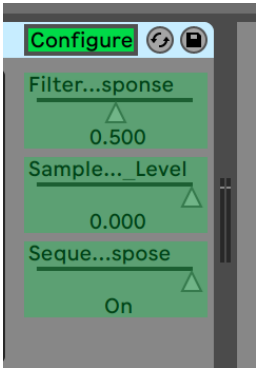
If you want to control Synthi knobs from Ableton Live, you will need to do the following:

- Drag a copy of the Synthi V plugin to an empty MIDI track.

- Click on the downward arrow to unfold the device parameters.



- Click on "Configure" button. The Synthi V panel will now open and any control that you click inside Synthi V will be added to the configuration window (just below the configure button).

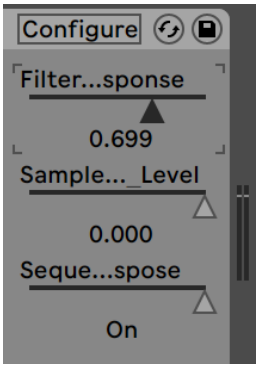


- When you are done selecting controls that you would like to automate, click the "Configure" button again to exit the configuration mode.

6.3. Controlling knobs with CC

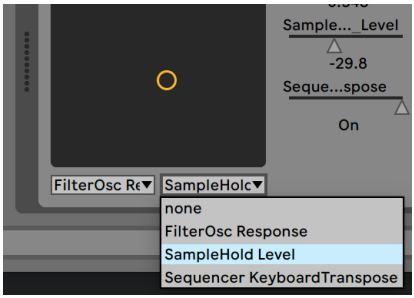
In the preceding section, we selected knobs that we want to control with Ableton Live. In this section, we will show you three ways to control your selected parameters.

6.3.1. Method 1: Direct Control



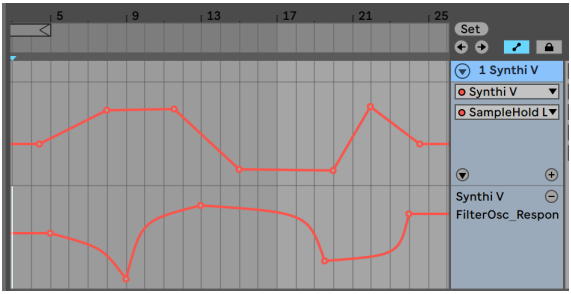
The simplest method is to simply click and drag a slider to change it. You can do this even if the Synthi V window is closed or buried behind other windows. This is a convenient way of remotely controlling important Synthi parameters directly from Live without having to look at the Synthi V user interface.

6.3.2. Method 2: Assign to XY Pad

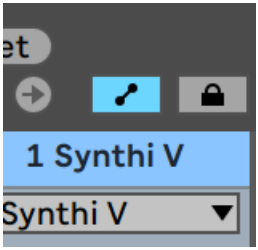


Another way to control one or two selected parameters with CC is to assign them to the XY Pad. This is done by opening the pull-down menu and selecting any of the controls that you made available in the previous section of this guide. Now you can control your chosen parameters simultaneously by click-dragging the circle.

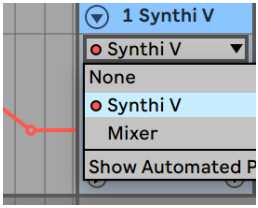
6.3.3. Method 3: Automating MIDI CC in a timeline



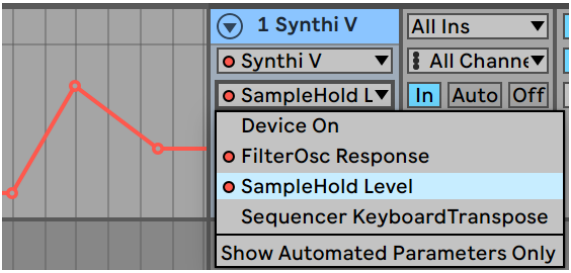
Imagine being able to make precise automated adjustments the attack time, reverb size or any number of other parameters as your song plays through its different sections (verse, chorus, bridge, for example). MIDI CC makes it possible and you can do this through Ableton's track automation features:



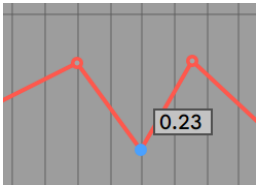
- Click the Automation Mode icon (to the left of the Lock icon) to view the track's automation lanes.



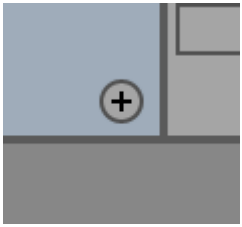
- Select the Synthi V from the top pull-down menu.



- Select one of the options from the bottom pull-down menu. These are the options that you selected in previous section of this user guide.



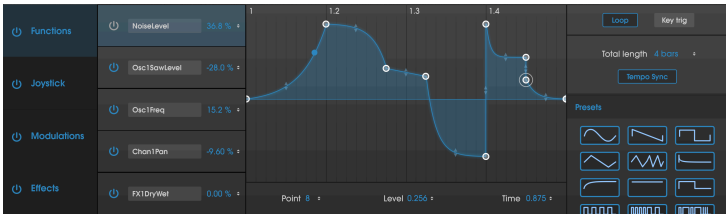
- Click on the line to add breakpoints and drag points to position them in time. As Ableton Live plays you will see the associated knob animating and reacting to what you have drawn in the automation lane.



- If you would like to control more than one parameter in a track, you can do so clicking the "+" icon to add more automation lanes to a track.

7. ADVANCED FEATURES

7.1. Overview

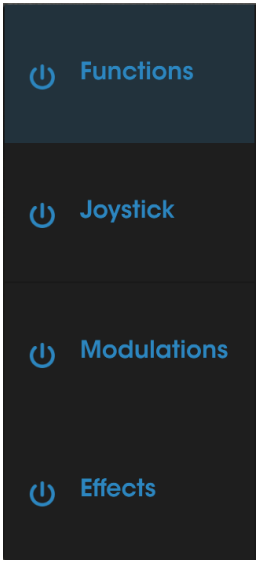


Things have come a long way since 1971 when EMS launched the Synthi A. We now have technologies that musicians from the 1970s could only dream about and these technologies are actively driving music-making forward. Take the envelope generator as one small example. This was initially a simple device with primitive attack, hold and decay parameters. Today it has evolved into a complex multi-stage device that lets you freely draw and manipulate envelopes on-screen with a mouse! The level of control, precision and repeatability offered today would be unimaginable to an engineer from the 1970s. This is just one example, but all other areas of electronic music instruments have evolved just like the envelope generator. Musical expectations are much higher now.

At Arturia, we are not content to simply model a classic synthesizer with astounding accuracy and leave it at that. We want to make powerful instruments that are relevant to the music makers of today. We try to do this in a way that is tasteful and honors the sound and legacy of original instrument and this is why we hide the advanced features of the Synthi V in a mode that you only see *if* you want to go further. This way, if you just want to get the classic Synthi AKS experience—without all the modern touches—you can have that by default. However, if you are ready to access the state-of-the-art features under the hood, just click the double arrows at the top-right of the screen.

Open Mode Button

7.2. Navigating the Advanced Features

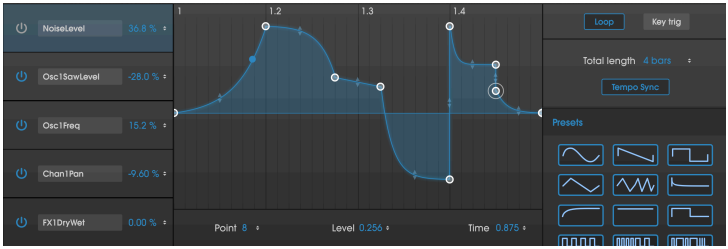


Section Headers

Synthi V's advanced features are separated into four sections as shown on the left of Open Mode interface: **Functions**, **Joystick**, **Groups Mod**, and **Effects**. Click any of these section headers to reveal its features. The currently shown header is highlighted. The **Power** buttons next to each header act as a global on/off switch for all of the features contained within that section.

> ♪: Being able to temporarily switch sections off can be helpful during sound design as it can help you focus on one area (functions, for example) without being distracted by the sound from another (effects).

7.3. Functions



The Functions Tab

The Functions section lets you generate up to five highly complex envelopes that you can then assign to nearly any parameter of Synthi V.

Select any of the five envelopes by clicking on their boxes on the left side of the screen. Envelopes can be switched on and off using the **Power** buttons. Select the destination of each envelope by clicking on the **Destination** menu ("None" by default), selecting one of the available categories and finally the specific parameter within that category.

Once you have selected a destination, you can set the **Modulation Amount** (i.e., strength of envelope's modulation) by click-dragging the percentage. Note that modulation is bipolar and the effect of an envelope on its destination can be set from 100% to -100%.

In the middle of the screen is the visual display of the envelope. Envelopes are required to have two fixed points at the start and end of the display in the zero position, but you are otherwise free to create complex shapes up to *16* points in total! To add a new point, click anywhere in the display area. To remove a point you have created, simply right-click it. To move a point, click-drag the point.

The **Point**, **Level** and **Time** parameters at the bottom of the display show numerical values for a selected point (indicated by a white halo). These parameters indicate the selected point (1 to 16), its level (from 0 to 1), and its position in the timeline (from 0 to 1). You can edit these numbers numerically by click-dragging them.

By default, a linear path is drawn between points. However, the small translucent arrows (located halfway between two points) can be dragged up or down to add a curve to the connecting segment. Being able to set exact curvature really opens up a world of sound design possibilities over simple linear paths.

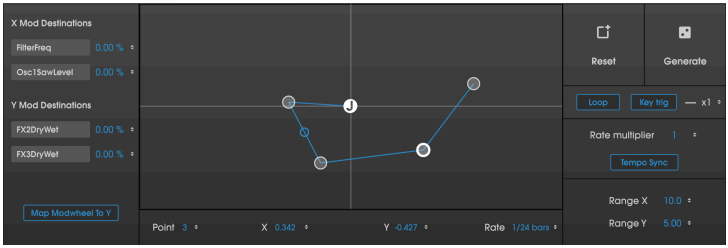
The section on the right displays various parameters pertaining to the displayed envelope. **Loop** switches envelope looping on and off. **Key Tri** switches key triggering on and off (i.e., when this is switched on, new notes re-trigger the envelope; when key triggering is switched off, the envelope runs freely regardless of what is being played).

The **Total Length** parameter determines how long it will take for the envelope to play fully. If **Sync** is switched on, playback speed is synchronized to the tempo of your DAW (or Synthi V's internal tempo when working in standalone mode) and the Total Length value is displayed in bars. If Sync is switched off, then the Total Length is shown in seconds.

Finally, the **Presets** section on the lower right lets you select from a variety of commonly used envelope shapes. Click on any shape to load it to the currently selected envelope slot. Once a preset is loaded into the visual display in the center, you can modify it like any other envelope.

We hope these advanced envelopes will provide a massive boost to the classic Envelope Shaper on the Synthi V front panel and will keep modern sound designers thoroughly satisfied!

7.4. Joystick



The Joystick Tab

The Joystick on the front panel of Synthi V is a very simple two-axis design modeled on the Synthi AKS hardware. The only other Joystick-related controls on the front panel are two Range knobs that scale the X and Y axes from 0 (no effect) to 10 (maximum effect). The Joystick section in the advanced menu brings the front-panel Joystick to life with some powerful animation features.

If you move the joystick on the front panel, you will see the "J" circle moving around the X/Y display of the Joystick section. That is because the Joystick and this section are linked. The "J" circle is the starting point of a modulation path. Left-clicking anywhere in the X/Y section will add points (up to eight) and create a path through which the joystick will "move" when you play a note on the keyboard. Right-clicking a point will remove it (you can remove all points except the "J"). This is quite similar to how an envelope can "move" control a like a knob, except the X/Y display controls two outputs (the Joystick's X and Y outputs).

Each axis of the joystick can modulate up to two destinations. Select the destinations by clicking on the **Destination** menu ("None" by default), selecting one of the available categories and finally the specific parameter within that category. Once you have selected a destination, you can set the **Modulation Amount** (i.e., strength of envelope's modulation) by click-dragging the percentage. Note that modulation is bipolar and the effect of an envelope on its destination can be set from 100% to -100%.

Finally, we have a **Map Modwheel to Y** button. When this button is active, the modwheel controls the Joystick's Y-axis. If this button is switched off, then the modwheel will not control the Joystick's Y-axis.

This may sound complex when explained in text, but in practice it is actually quite simple and intuitive. Just add some points, play some notes and you'll see how easy it is to add life and movement to an otherwise static sound! Notice that you can always still play with the Joystick in realtime but now you have complex pre-programmed movements too.

You can click-drag the **Point**, **X** and **Y** controls along the bottom to select and move points numerically if you like. The **Rate** control determines the speed at which the animation moves from one point to the next. Note that each segment can have a different rate setting.

The **Reset** button clears the path while the **Generate** button generates a random number of points, in random locations with random rate settings. This is a fun and spontaneous way to generate variations of a sound quickly.

The **Loop** button engages looping, such that the joystick replays the movement when it reaches the last point. The **KeyTrig** button switches key triggering on and off (i.e., new notes re-trigger the movement when this is switched on; the movement runs freely when KeyTrig is switched off). The **ReTrig Multiple** (x1-8) repeats the movement up to eight times before stopping.

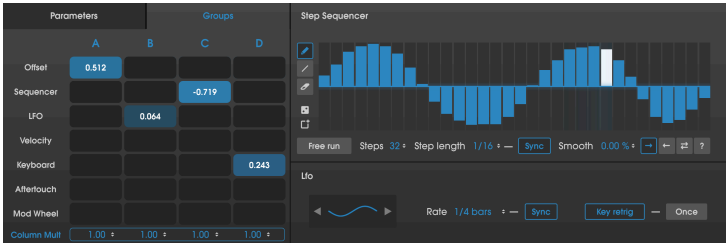
♪: Note that the ReTrig Multiple functionality is only available when Loop is switched off. When looping is switched on, the ReTrig Multiple parameter is greyed out. This is because loop function does essentially the same thing as the ReTrig Multiple, except it does so infinitely.

If **Tempo Sync** is switched on, playback speed of the Joystick is synchronized to the tempo of your DAW and all Rate values are displayed in bars. If Sync is switched off, then all Rate values are shown in seconds. The **Rate Multiplier** provides a global speed control for joystick movement. This is handy control for when you increase the movement without manually edit every point.

Range X and **Range Y** are the same as the control knobs on the front panel and let you restrict the range of the X and or Y outputs. You can change these values by click-dragging them up or down. As you change these values, you will see the corresponding knob on the front panel change.

Again, this extended Joystick functionality may seem complex but it is quite intuitive on you spend a bit of time with it. We hope users will find exciting and expressive uses for it!

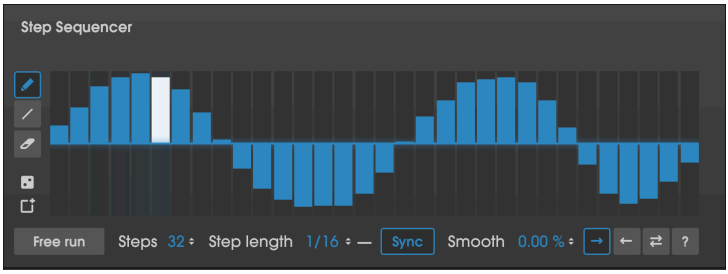
7.5. Modulations



The Groups Mod Tab

The Modulations section brings some desired modern features and extra flexibility to the Synthi V. Here you will find a Step Sequencer, an LFO (low frequency oscillator), a modulation matrix and group modulation controls. Let's discuss each section separately.

7.5.1. Step Sequencer



A step sequencer is a classic synthesis tool that outputs control voltages in discrete steps. These changes in voltage levels are often–but not always–synchronized to the tempo of a song and are used to rhythmically modulate various parameters in a synth. For example, you may choose to subdivide a four bar phrase into 32 steps, assign values to each step and send the step sequencer's output to the cutoff input of the Synthi V's Filter Oscillator. This will result in rhythmic "stair step" changes to your sound created by the filter. This is a good way of adding movement and motion to a static sound.

To create a sequence, simply click (or click and drag) in the sequencer area. The default **Pencil** tool lets you draw steps freely with your mouse. The **Line** tool creates smooth, linear progressions as you click-drag the mouse. The **Eraser** tool lets you delete steps.

> ♪: To save time, you can delete a step by right-clicking it even if the Pencil or Line tool is still selected. This means you don't have to select the eraser tool each time you wish to delete a step.

The **Random** button (just below the Eraser tool) generates random values for each step. The **Reset** button (trashcan icon) clears the pattern.

By default, Synthi V's Step Sequencer is synchronized to the transport controls of your DAW (or Synthi V's internal tempo when working in standalone mode). However, if **Free Run** is switched on, the step sequencer is decoupled from the DAW transport and runs freely. This means the step sequencer can be in a different position each time you start playback in your DAW, resulting in unpredictable but sometimes wonderful results.

Steps determines the number of steps in the sequence, from 1 to 32.

> ♪: To create fascinating polyrhythms, try setting Steps to odd or not-cleanly-divisible values. The musical results will be much less repetitive as the Step Sequencer will loop in unpredictable plates!

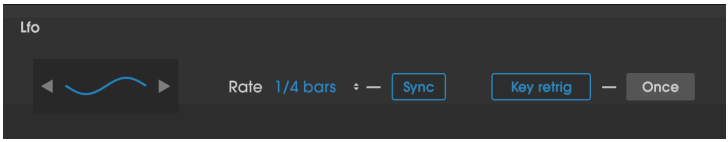
Step Length determines the length of each step in the sequence. If **Sync** is switched on, the sequencer is synchronized to the tempo of your DAW (or Synthi V's internal tempo when used in standalone mode) and Step Length values are displayed in bars. If Sync is switched off, sequencer values are displayed in seconds.

The **Smooth** parameter lets you add gradual transition (portamento) between the steps. This parameter ranges from 0% ("hard" instantaneous changes) to 100% (slower "gliding" transitions between steps).

The arrows on the bottom right determine the motion of the Step Sequencer. **Forward** plays the sequence left-to-right in a loop. **Backward** plays right-to-left in a loop. **Ping-Pong** plays the sequence forward and then backward in a loop (i.e., in a four step sequence, it will play 1-2-3-4-4-3-2-1-1-2... and so on). **Random** (displayed on-screen as a "?") picks steps randomly in the sequence.

This Step Sequencer's output appears on the second row of the Parameter and Group Modulation Matrix tabs (see below) and can be assigned to any of the available outputs. This is covered in detail below.

7.5.2. LFO



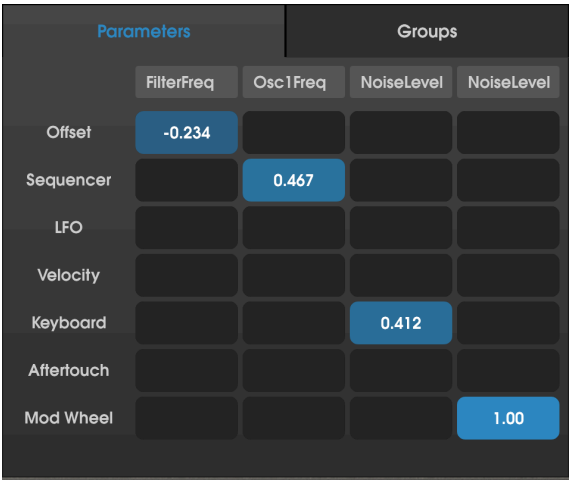
One area in which the original Synthi AKS may be lacking is low frequency oscillators. Only Synthi's third oscillator will work at very low frequencies and it is not easily possible to synchronize this oscillator to the tempo of a song. Not to worry! The LFO in the Group Mod section is here to help with the modern touches that today's music makers expect to see in a synth.

Lfo lets you select the shape of the modulation and the **Rate** setting sets the oscillation speed of the LFO. If **Sync** is switched on, the LFO's speed is synchronized to the tempo of your DAW (or Synthi V's internal tempo when working in standalone mode) and the Rate value is displayed in bars and beats. If Sync is switched off, then the Rate value is shown in Hertz.

When **Key Retrig** is active each new note retriggers the LFO. If it is switched off, the LFO runs freely and is not retriggered when new notes are played. When the **Once** button is active, the LFO stops after one oscillation (it effectively acts like an envelope). If the Once button is left inactive (its default state) then the LFO loops and continues to oscillate. Note that the Once button is only available when Key Retrig is active.

This LFO's output appears on the third row of the Parameter and Group Modulation Matrix tabs (see below) and can be assigned to any of the available options. This is covered in detail below.

7.5.3. Parameters Tab



The Parameters Tab features a powerful modulation matrix. This modulation matrix is a lot like the Pin Matrix on the Synthi V's front panel but it lets you connect Synthi V's advanced features (i.e., things not available on the original Synthi hardware or the Synthi V front panel) to nearly *any* destination within Synthi V.

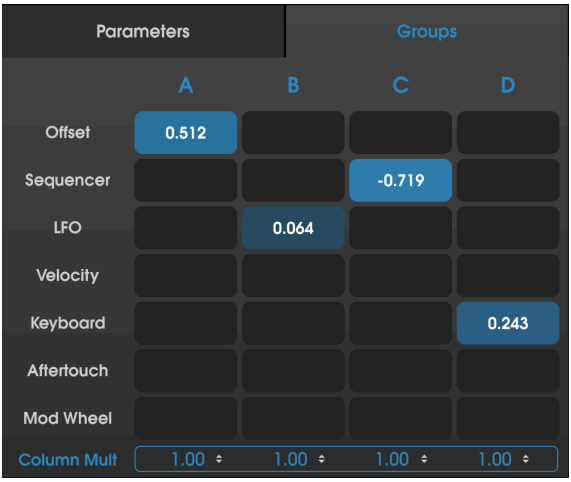
The inputs of this matrix are listed in a column on the left and the destinations are listed in a row along the top ("None" by default). You can select a destination by clicking on the box at the top of each column and choosing from any of the available options.

You can connect any input to any destination (or multiple destinations) by click-dragging on the square where the input and output intersect. Unlike the pin matrix on the front panel, modulations in this matrix can be positive or negative and can be dialed in with high precision (-1.000 to +1.000 in increments of .001). To eliminate a connection, simply double-click it.

> ♪: You can right-click and drag parameters in the matrix to enter values with very high precision. This can be very handy when fine-tuning your sound design.

Let's take a look at a common use case: As you design sounds, you may find that you want to map keyboard velocity to the filter cutoff, so that as you strike the keys harder on your MIDI controller, Synthi V's output become brighter. To do this, first select the destination by clicking on one of the boxes at the top of each column and selecting Filter > FilterFreq from the menu that appears. Set the filter to about "5". Next, find the box in the modulation matrix where the Keyboard Row and the FilterFreq column intersect. Click-drag this box up and down as you play notes of varying velocity. You should now be able to hear the effect of velocity on the filter cutoff.

7.5.4. Groups Tab



The Groups Tab features a modulation matrix just like the one described in the Parameters Tab above. However, this tab's matrix is designed specifically to work with the special Group Assign pins on the front panel of the Synthi V. This gives you powerful group-level control of connections on the Synthi V front panel (i.e., adjusting several pins on the front panel matrix with one convenient "macro" control).

The inputs of the group modulation matrix are listed in the column on the left and the outputs are listed in a row along the top (**A**, **B**, **C**, and **D**). The matrix on this tab works exactly the same way as the matrix on the Parameters tab, so please see the previous section if you are not sure how to use it.

The outputs of the modulation matrix on this tab can be temporarily muted by clicking the A, B, C, and D letters along the top. If a letter is dimmed, that output is muted.

At the bottom of the matrix, you will see a scaling control for the entire column. This ranges from -1.000 to 1.000 and can be used to scale all of the modulations in a column with one convenient control.

The outputs of this group modulation matrix appear on Synthi V's front panel through special pins labeled "A", "B", "C", and "D". By using one of these special pins on Synthi V's front panel, you not only make the usual connection on the front panel, you also add in any modulation that is happening on that pin on the Groups Mod function page.

For example, if you have made a number of connections on the pin matrix on Synthi V's front panel but you realize it would be nice to modulate all of those connections using only one control, select one of the group pins (A, B, C, or D) and click on any of the existing pins to assign them to that group. Now all you have to do is to adjust that group's "Offset" value in the Groups tab and you will modify all of those connections at once. You can even use the Mod Wheel or Aftertouch inputs if you would like to "play" the strength of those connections in realtime. You can even attach the LFO and/or Step Sequencer to a group to create additional "movement" in the otherwise static connection.

This section is incredibly useful and brings both power and ease-of-use to the original Synthi hardware. We hope end users will get good use out of it!

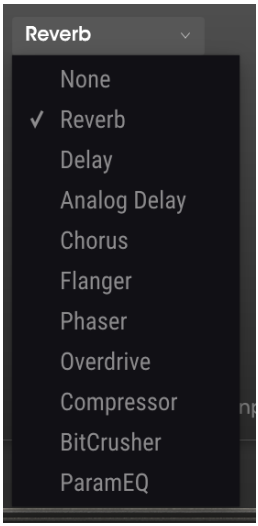
7.6. The Effects

7.6.1. Why use effects at all?

The way we think about effects has changed since the 1970s. In earlier times, effects were not considered an essential part of the synthesis process and were used sparingly. Today, effects are a vital component of a sound, and their importance, in some ways, even supersedes that of oscillators and other sound generators. Why? We believe it's because effects are really effective at adding expression and emotion to raw sounds. We expect that effects will continue to be a source of inspiration and innovation in music and this is why we revive classic effects and modernize them with 21st century touches.

7.6.2. Selecting an effect

Synthi V includes 10 powerful effects that can be arranged serially or in parallel. To start using and editing the effects, click the Effects section in Advanced mode. Here you will see three effect slots. Each slot has its own **Power** switch to enable and disable its effect and a pull-down menu to select the effect that you would like to use.



List of Synthi V effects

Each slot also has a **Wet/Dry** slider that controls the percentage of the original signal that passes through to the output. Moving this all the way to Dry will bypass that effect. Finally, the **Serial** and **Parallel** Arrows at the right side of the screen let you decide if you want the effects to be arranged serially or in parallel. In Serial mode, Synthi V's output goes from one effect to the next in succession; In parallel mode, Synthi V's output goes into all three effects at the same time and the output of the three effects are then mixed together.

> ♪: All effect parameters are MIDI-assignable, which means you use the MIDI "learn" function to map effect parameters to hardware controls on an external USB MIDI device. This is covered in the MIDI Learn assignment section of this guide.

7.6.3. Each effect in detail

Each of the effects has its own unique controls and indicators. We will discuss each effect separately below.

7.6.3.1. Reverb

This effect simulates the reverberant sound of a room or large space by creating a large number of filtered echoes that fade or "decay" over time. You can greatly affect the character of the reverberant sound by adjusting knobs controlling delay, filter and various other parameters.

The Reverb Effect

The controls are:

- **Damping:** Controls the "brightness" of the sound by attenuating high frequency content of the reverberant echoes. Low settings will provide very little damping and will result in a bright sound; high settings will filter much of the high frequencies and will result in a duller sound.
- **MS Mix:** This knob controls the "stereo width" of the reverberation. Low settings will sound monophonic whereas high settings will have a wide, expansive stereo sound field.
- **Predelay:** Sets the amount of time before the input signal is affected by the reverb. Adjusting this parameter can affect the sense of space.
- **Decay:** Sets how much time it takes for reverberant echoes to fade away.
- **Size:** Controls the size of the reverberant space. Low settings result in smaller sounding rooms whereas high settings sound like massive halls and chambers. Use this knob in conjunction with the Predelay to achieve a variety of different sonic spaces.
- **Input LP Freq:** This is a low pass filter that can be used to remove some of the high frequency tones that can make reverberation sound "sizzle-y" or unnaturally bright. This filtering happens on the input signal before the reverberation takes place. Use this knob in conjunction with the Input HP Freq knob to dial in clear reverberations.
- **Input HP Freq:** This is a high pass filter that can be used to remove some of the low frequency tones that can make reverberation sound "muddy" indistinct and washed out. This filtering happens on the input signal before the reverberation takes place. Use this knob in conjunction with the Input LP Frequency to dial in clear reverberations.

7.6.3.2. Delay

A delay can increase the spaciousness of a sound without making the sound "swim" the way some reverbs do. It can also be used as a rhythmic counterpoint to accentuate a groove. This delay repeats the input signal and creates an "echo", giving it more space and depth. The Time dial offers a range of settings from 2 milliseconds to two seconds (2000 ms).

♪: This is a modern "digital" delay that provides clear, precise echoes that are common in modern delay effects. If you would like a warmer and more modulated delay sound, see the Analog Delay effect below.

The Delay Effect

The controls are:

- **Delay Time:** Sets the length of the delay. Turning the dial clockwise increases the delay time; turning in the opposite direction shortens it. Values here are shown in either bars or milliseconds, depending on how Sync is set (see below).
- **Sync:** Locks the delay to the current tempo of the DAW (or Synthi V's internal tempo when using the standalone version). When Sync is switched on, Delay Time is displayed in Bars. If Sync is deactivated, Delay Time is shown in milliseconds.
- **Rate Synced Type:** Sets the timing of the delays from Binary, Ternary (Triplet) or Dotted. This parameter is only active when Sync is engaged (it does nothing when Sync is switched off).
- **Width:** This knob controls the "stereo width" of the delay. Low settings will sound monophonic whereas high settings will have a wide, expansive stereo sound field.
- **Ping Pong:** Hard-pans alternating delays left and right, so that they "bounce" from left to right.
- **Feedback:** Determines how much of the Delay's output is fed back into its own inputs. Higher settings mean that the delay will be heard for a longer period of time before fading out.

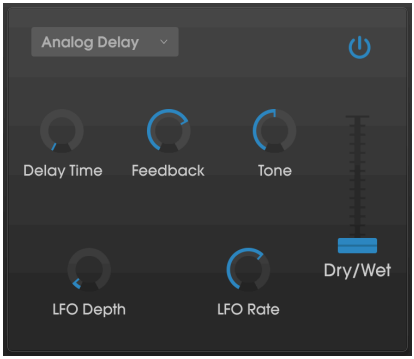
♪: Setting Feedback to its maximum amount will mean that a signal is looped infinitely and never fades out. This effectively turns the Delay into a looper!

- **HP Freq:** This is a high pass filter that can be used to remove some of the low frequency tones that can make the delay sound "muddy" indistinct and washed out. This filtering happens on the input signal before the delay takes place. Use this knob in conjunction with the LP Frequency to dial in clear delays.
- **LP Freq:** This is a low pass filter that can be used to remove some of the high frequency tones that can make delay sound unnaturally bright. This filtering happens on the input signal before the delay takes place. Use this knob in conjunction with the HP Freq knob to dial in clear delays.

7.6.3.3. Analog Delay

Analog Delay is an effect like the Delay module (described above) but with a more of a vintage "analog" sound due to its LFO modulation and filtered feedback.

> ♪: This delay provides a classic "analog" delay sound with warm modulated delays. If you would like a more modern delay sound with a crisp, precise sound try the Delay module instead (see above).



The Analog Delay Effect

The controls are:

- **Delay Time:** Sets the length of the delay in milliseconds.
- **Feedback:** Determines how much of the Analog Delay's output is fed back into its own inputs. Higher settings mean that the delay will be heard for a longer period of time before fading out.

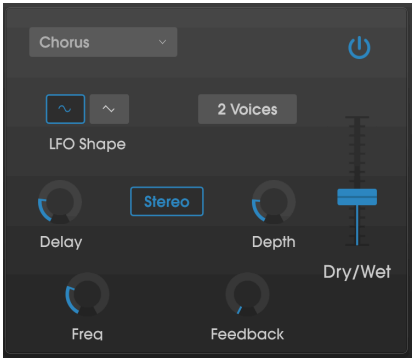
> ♪: Setting Feedback to its maximum amount will mean that a signal is looped infinitely and never fades out. This effectively turns the Delay into a looper!

- **Tone:** Increases or decreases the high frequency content in the feedback, resulting in brighter or duller delayed sound.
- **LFO Depth:** Sets the strength of the LFO's modulation on the feedback pitch. Low settings can be very subtle whereas high settings can sound quite extreme
- **LFO Rate:** Sets the speed at which the LFO modulates the feedback pitch.

7.6.3.4. Chorus

A chorus module recreates the sound of multiple takes of an instrument being combined in a mix. The effect works by duplicating the incoming signal, delaying one side while using an LFO to slowly modulate the delay time and mixing the delayed signal back with the original sound. To make the choral sound more rich and lush, the signal can be duplicated multiple times and modulated by separate LFOs.

♪: The chorus effect is very similar to the Flanger effect (see below) except chorus delay times tend to be longer (0.6ms minimum for this effect) which results in a subtle and pleasing choral effect.



The Chorus Effect

The controls are:

- **LFO Shape**: Selects the shape of the LFO used to modulate the delayed voices.
- **Voices:** Sets the number of duplicated voices in the chorus effect, from one to three voices.
- **Delay:** Sets delay time for the chorus effect.
- **Stereo Mode:** The output of the chorus can be set to stereo for a wider and more modern sound or mono for a more vintage sound.
- **Depth**: Sets the strength of the LFO's modulation on the delayed signal, from very subtle to quite extreme.
- **Freq:** Adjust the speed of the chorus by setting the LFO rate.
- **Feedback:** Determines how much of the Chorus output is fed back into its own input.

7.6.3.5. Flanger

The Flanger effect is similar in principle to the Chorus effect above, except that the delay time tends to be much shorter (as low as 0.001ms in the case of the effect). The extremely short delay time produces a "comb filter" effect that sweeps up and down through the harmonics of the original signal.

The Flanger Effect

Flanging can create both subtle and extreme effects, depending on the Frequency and Depth of the modulation. With higher Depth settings you will begin to hear changes to the pitch of the sound. This is how the circuits in an analog flanger work, and we have taken care to recreate these conditions in our software.

The controls for the effect are:

- **Shape:** Selects the shape of the LFO used to modulate the delayed voices.
- **Polarity:** This determines whether the feedback polarity will be positive or negative. This can provide smoother or harsher flanging effect depending on your other settings, so experiment with positive and negative settings to see what works best for your track.
- **Stereo:** The output of the flanger can be set to stereo for a wider and more modern sound or mono for a move vintage sound.
- **Freq:** Sets the LFO's modulation rate for the minimum delay time.
- **Min Delay:** Sets a minimum limit for the delay time, which can be useful for controlling the flanger's harmonic content.
- **Depth:** Sets the strength of the LFO's modulation. This is set to "max out" at less than 100% to limit runaway feedback.
- **Feedback:** Determines how much of the flanger's output is fed back into its own input.
- **LP Freq:** Sets the lowpass cutoff frequency for the flanger. Frequencies above this are not flanged.
- **HP Freq:** Sets the highpass cutoff frequency for the flanger effect. Frequencies below this are not flanged.

7.6.3.6. Phaser

Phase shifting is a sweeping effect that was first popularized in the 1960s. It adds motion and a swirling character to the sound. It works by splitting the incoming signal, changing the phase of one side, and recombining it with the unaffected signal. This creates a notch-comb filter which can be swept through the frequency spectrum, causing the signature "whooshing" sound of the phase shifter. This particular phaser is a stereo model with tempo synchronization.

The Phaser Effect

The controls are:

- **LFO Rate:** Sets the speed of the LFO. If tempo synchronization is enabled (see below), this parameter is displayed in bars. If synchronization is disabled, the Rate parameter is displayed in Hz.
- **Sync:** Locks the phaser's LFO to the current tempo of the DAW.
- **Rate Synced:** Sets the timing of the delays from Binary, Ternary (Triplet) or Dotted. This parameter is only active when Sync is engaged (it does nothing when Sync is switched off).
- **LFO Amount:** Sets the strength of the LFO's modulation.
- **LFO Shape:** Sets the wave shape of the modulating LFO
- **Frequency:** Sets the center frequency at which the phaser affects the incoming signal
- **Feedback:** Effectively controls the amount of phaser resonance. Look out! Higher settings can make the filtering effect very pronounced.
- **N Poles**: Sets the number of poles used in the sweeping filter. Low settings will have a gentler sound whereas high settings will have a more pronounced sound.
- **Stereo:** Sets the stereo width of the effect, from mono to maximum stereo (hard left to hard right).

7.6.3.7. Overdrive

Will add gain to a signal causing it to clip and distort. This introduces new harmonics that add a harsh edge to sounds. This is similar to an overdrive pedal for a guitar.

The Overdrive Effect

The controls are:

- **Drive:** Sets the overdrive amount.
- **Tone:** Brightens the sound and adds a harsher edge through a high frequency shelving filter.
- **Level:** Sets the output level of the overdrive. This allows you to compensate for increased output caused by the drive.

7.6.3.8. Compressor

At its core, a compressor is simply a device that is used to maintain a consistent level of sound. You can think of it as a very fast manual control that turns down the volume when the input is too loud and raises it again when the loud parts have passed. Over the decades, audio engineers have found many creative uses for compressors beyond simply evening out loudness levels. For example, many mix engineers use compressors to bring an increased sense of power and excitement to a single track or an overall mix.

The Compressor

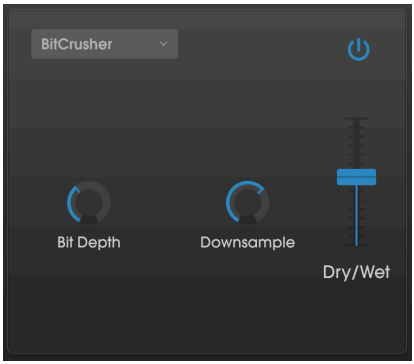
If you are using a compressor in a chain of effects, the compressor can keep the attack transients of a sound from overloading the input of the next effect. It can also re-contour a sound that naturally decays quickly so that it has a longer sustain. Drums are often compressed to add "punch". Compression is also routinely added to radio and television audio levels to keep them within a certain volume range.

The controls are:

- **Makeup:** Switches the compressor's automatic make-up gain feature on and off. This feature compensates for the natural reduction in output loudless as the compressor brings down peaks.
- **Attack:** Sets the speed with which the compression will react to an incoming signal. Short attack times mean the compressor will immediately affect an incoming signal. Longer attack times allow momentary peaks to slip through before the compressor has a chance to affect on the signal. In some cases this can be desirable as it allows a signal to maintain some of its natural "attack" transients before it starts working.
- **Release:** Sets the release time of the compressor. Generally, this is set such that the output of the compressor sounds natural and transparent. However, many contemporary artists deliberately choose to set this to more extreme values in order to achieve "pumping" and "breathing" artifacts. Go ahead and experiment—maybe you'll stumble upon a sound you love!
- **Threshold:** Sets the loudness level above which the compressor will begin to work. The compressor ignores signals that fall below the threshold.
- **Input Gain:** Adds gain to the signal before the start of the compression process.
- **Ratio:** The compressor ratio determines the amount of compression that will be applied once the threshold is reached. For example, if the ratio is set to 2:1, signals exceeding the threshold by 2 db will be allowed to increase by only 1 dB. An 8 dB increase will be reduced to a 4 dB increase, and so on.
- **Output Gain:** Controls the final output level of the compressor.

7.6.3.9. BitCrusher

Arturia instruments generate very high fidelity sounds, however, in some scenarios you may prefer a gritty lo-fi sound. The BitCrusher effect can really help make this happen! It adds nasty digital distortion by intentionally reducing the bit depth and sampling rate of incoming signals.



The BitCrusher Effect

To explore this effect, start by setting the Bit Depth and Downsample dials to the minimum settings. Then gradually turn each dial up to reduce the bit depth and sampling rate of the incoming signal. Each knob has a different degrading effect and you can experiment with different settings to find the perfect blend of sonic destruction for your sound!

The controls are:

- **Bit Depth:** Reduces the resolution of your sound (i.e., the number of bits used to render an output) as this knob is turned up. There is no reduction at the minimum setting and extremely reduction at the maximum setting.
- **Downsample:** Resamples the already bit-reduced signal (set by the Bit Depth knob). As you turn up this knob, your incoming signal will be re-sampled at lower and lower frequencies, increasingly destroying the fidelity of the pure sound.

7.6.3.10. ParamEQ

ParamEQ is a powerful five-band parametric equalizer with low and high frequency shelving controls. You can use it to create tight "surgical" boosts and cuts to specific frequencies or to provide a broadband frequency shaping to set the overall tone of your instrument.

The ParamEQ Effect

The ParamEQ filter features five tabs just below the graphical display. Each tab controls one of the five frequency bands in the filter (a low shelf, a high shelf and three "peak" filters). To edit a band, click its corresponding tab and adjust its controls. The blue line shows the overall contour of the EQ.

The controls are as follows:

- **Freq:** Sets the cutoff frequency of the selected filter.
- **Gain:** Sets the boost or cut amount for the selected filter.
- **Q:** Sets the "Q" or sharpness of the selected filter. Low-Q settings result in broadband boosting or cutting of a sound whereas high-Q settings provide sharper and more localized boosts and cuts.

ℹ♪: You can also edit the ParamEQ by click-dragging any of the circles on the graphical display. This method lets you set the filter cutoff frequency and gain amount, but you will still need to adjust the Q value using the knob.

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