USER MANUAL

Buchla Easel V

ARTURIA®

YOUR EXPERIENCE • YOUR SOUND

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Thank you for purchasing Buchla Easel V!

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

Be sure to register your software as soon as possible! When you purchased Buchla Easel 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 Buchla Easel V!

Since the late 1990s, the French company ARTURIA has received acclaim from players and reviewers alike for designing state-of-the art software emulations of the venerable analog synthesizers from the 1960s to the 1980s. From the Modular V, back in 2004, to Origin, a modular system of a new generation that we introduced in 2010: , to the Matrix 12 released in 2015 and the Synclavier V, released in 2016, our passion for synthesizers and sonic purity has given demanding musicians the best software instruments for professional audio production.

The ARTURIA Buchla Easel V is the culmination of over a decade of experience in recreating the most iconic synthesizers of the past.

Arturia has a passion for excellence and accuracy. This led us to conduct an extensive analysis of every aspect of the Buchla Easel 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 slew of features that were unimaginable in the days the Buchla Easel was being manufactured.

Buchla Easel 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.

The Arturia team

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1. WELCOME

1.1. Don Buchla and the Easel

The Buchla Easel is a unique and colorful instrument. It was conceived and designed by a unique and colorful man: Don Buchla. Throughout his life he refused to wear matching socks. In 1965 the composers of the San Francisco Tape Music Center asked Don to build an electronic musical instrument for live performances and recording. As a result he built the first voltage controlled synthesizer: he called it the Buchla Electric Music Box. He disliked the word synthesizer, which to him suggested a synthetic imitation of existing sounds.

Until that moment creating electronic music was a privilege for composers with access to a studio with tape recorders and, with luck, some oscillators. An oscillator is an electronic circuit that well...oscillates and thus makes a tone. The early oscillators had just one dial, which when it was turned would change the pitch. A well-equipped studio like the Fonologico Studio in Milan had the staggering amount of 12 oscillators. You guessed it, one for each note in the musical scale.

What made Don Buchla's design special was that he created an oscillator that could be "played" with voltages. Instead of the composer turning a dial, the dial could now be "turned" by a voltage, and because voltages can change a dial much faster than a composer, this was the start of a whole new era in music. It was also the start of what we now call the West Coast style of Electronic Music.

Having an oscillator that responds to Voltages (VCO) is a first step; now you need a second oscillator that can create the kind of slow voltages needed to control the main oscillator: an LFO. Buchla called it a Modulating Oscillator. One thing led to another and by the end of 1966 Buchla had the beginning of a system that would, in the years to come, evolve into the Buchla Easel.

The idea to use slow voltages to control an Oscillator came from Robert Moog who lived in the Eastern parts of the US. He designed several new voltage controlled modules such as a Voltage Controlled Filter (VCF), a Voltage Controlled Envelope Generator and a Voltage controlled Amplifier (VCA). An envelope generator is capable of creating a more complex flowing voltage that allows you to mimic the sound contour of an instrument.

He was also the first to combine all of these modules into one design that has become the basic structure of almost every synthesizer. Moog favored filters to shape sound and he added a keyboard which made the instrument very popular. His style of combining modules is now known as East Coast Synthesis.

1.1.1. The Birth of the Easel

The Easel was one of the first of what we now call semi modular synthesizers. The reason modular synthesizers are so successful is that they offer a composer/performer an unlimited number of options for creating sound. The perfect modular synthesizer contains a well-balanced number of modules that complement each other's functionality. The Easel and the Minimoog are good examples of this. Don Buchla and Robert Moog, the engineer who created the Minimoog, each combined a number of sound modules in ways that made their instrument unique and different from all others.

On the keyboard of the original Buchla Easel it says "The Electric Music Box". Nobody seems to use that name. It's more popularly known by its nickname "The Easel". "Easel" probably refers to painter's easel. A painter uses the easel to support the canvas on which he creates his paintings. The easel is the perfect support to hold the canvas on which you create your sound paintings. Anyway, it sounds much better than "Touch Activated Voltage Source model 218".

Buchla for a long time flatly refused to add a keyboard to his instruments. To him the synthesizer had to be a tool for experimental music and experimental performers. A keyboard would be an invitation to play conventional scales and make conventional music. He wanted his instruments to be used for a new, experimental kind of music. For years and years he stubbornly continued to develop alternative controllers such as ribbon controllers and touch sensitive keys.

Finally in 1972 he gave in and created the Easel with a keyboard. Yet... the keyboard of the Easel was something special. Buchla infused it with much of the knowledge he now had about making controllers; it was solid; the keys did not move but were touch-sensitive, and could produce accurate and reproducible pressure output, tactile feedback, and voltage controlled portamento.

He also took the opportunity to include a much improved oscillator that he dubbed "The Complex Oscillator". It was developed with computer aided simulation studies. It now had become a sound source capable of generating complex audio waveforms.

1.1.2. The interface of the original Buchla Easel

It is difficult to believe that an instrument consisting of only 12 to 15 fairly simple modules can generate so many different sounds. It is because our mind has difficulty understanding that when you combine many simple options, the number of ways you can combine these options grows exponentially.

The Easel was special in other respects, as it had Buchla's own version of a filter called a Dual Lo Pass Gate. The thing that makes a Lo Pass Gate unique is that it contains vactrols. A vactrol is a combination of a light sensitive resistor and light source. When the light source (usually a LED) emits more light the resistor will reduce the current that flows through it. Buchla was one the first engineers to apply this effect in musical ways.

The Easel also had a unique patching system. If you create a patch on a modular Moog or Eurorack system the sliders and dials will soon disappear behind a spaghetti forest of wires. Wires that come from places that you don't remember and go to places that you don't remember either.

How different on the Easel: all patch points are concentrated on the lower half of the machine. Most connections can be done by using shorting bars, and connecting modules that are further apart can be made using stackable cables, but the sliders and dials will always remain clearly visible.

Another thing that made the Buchla Easel a system ahead of its time was the generous use of color coding for patch points and related modules. The Easel is indeed a colorful machine made by a colorful man.

1.2. Arturia's secret ingredient: TAE®

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

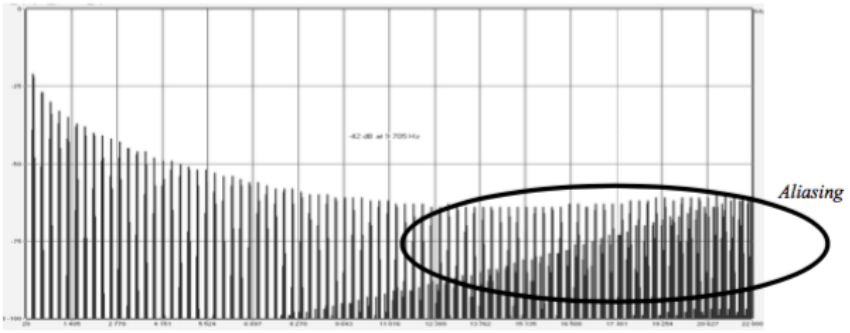
TAE®'s software algorithms result in spot-on emulation of analog hardware. This is why Buchla Easel V offers an unparalleled quality of sound, as do all of Arturia's virtual synthesizers.

TAE® combines major advances in the domain of synthesis:

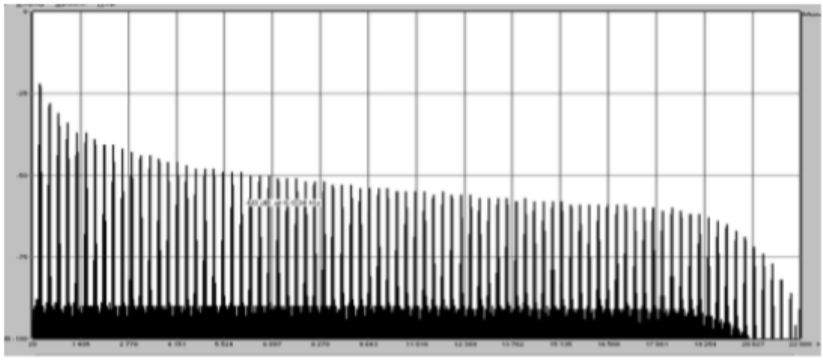
1.2.1. Aliasing-free oscillators

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

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



Linear frequency spectrum of a current well-known software synthesizer

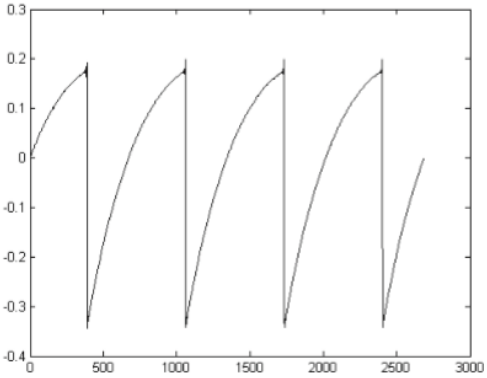


Linear frequency spectrum of an oscillator modeled with TAE®

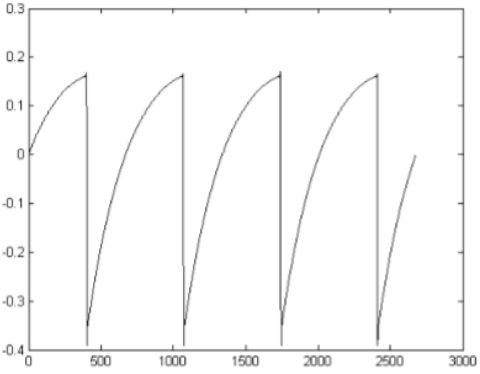
1.2.2. A better reproduction of analog oscillator waveforms

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

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



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



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

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

1.3. Arturia's Version of the Buchla Easel

Buchla Easel V closely mimics the original Easel. It has all the features that make the Easel such a unique instrument. Yet we would like to think that we improved the original in several ways, by removing functions that make no sense in a software version and adding functions that are only possible in software:

Omitted are:

- The control section at the top of the instrument
- The programmer card of the original; it has no function, as patches can now be stored on the computer
- The remote local switch has been removed
- The Audio outputs, as audio feeds directly into your DAW
- The Inverter's From Card and To Card connectors
- The Pre-amp's To Card connector
- Headphones and output level; all monitoring can be done on the sound port of your computer or the output of your interface

Added functions:

- A quantize switch in both oscillators which enables you to quantize them to the chromatic scale
- A noise generator and a feedback generator in the Pre-amp section
- Four voice polyphony
- A self-trigger mode to the Envelope Generator, which turns it into an elaborate LFO
- MIDI-assignable parameter control
- Patchable velocity, wheel, and keyboard follow voltages
- The Right Hand: a 32-step polyphonic sequencer with preset voltage source transpose
- The Left Hand: five complex Function Generators to create your own voltage curves
- The Gravity Universe: a Voltage Control lab based on game physics
- An elaborate dual effects section with assignable effects
- User configurable response of the Lo Pass Gates

♪: There's one other major difference which may not seem like a big deal to you, but which is a major shift for some people in the Buchla world: you can save your creations in presets! For purists this is a horrible option, 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 Easel. Composers, on the other hand, will welcome the save option; they can now build a library of their most creative moments and merge those moments into a brilliant composition.

2. ACTIVATION & FIRST START

Buchla Easel V works on computers equipped with Windows 7 or later and macOS 10.10 or later. You can use the stand-alone version or use Buchla Easel V as an Audio Units, AAX, VST2 or VST3 instrument.

2.1. Activate the Buchla Easel V license

Once Buchla Easel V has been installed, the next step is to activate your license for the software.

This is a simple process that involves a different software program: the Arturia Software Center.

2.1.1. The Arturia Software Center (ASC)

If you have not already installed the ASC, go to this web page:

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).

Follow the installation instructions and then:

- 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

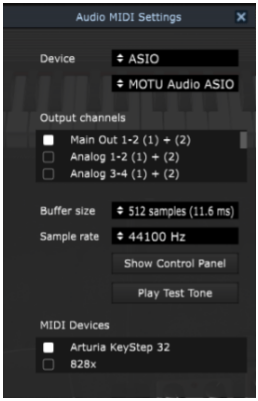
That's all there is to it!

2.2. Initial setup

2.2.1. Audio and MIDI settings: Windows

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

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



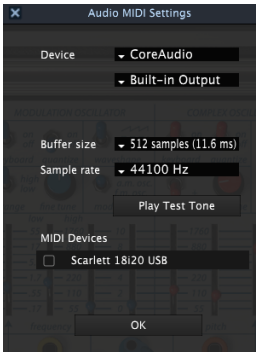
The Audio MIDI Settings in Windows

Starting from the top you have the following options:

- **Device** lets you choose which audio driver you want to use to route sound out of the instrument. This might be your computer's own driver like Windows Audio, or an ASIO driver. The name of your hardware interface may appear in this field
- **Output Channels** Lets you select which of the available outputs will be used to route audio out. If you only have two outputs, only two will appear as options. If you have more than two you can select a specific pair of outputs.
- The **Buffer Size** menu lets you select the size of the audio buffer your computer uses to calculate sound. A smaller buffer means lower latency between pressing a key and hearing the note. A larger buffer means a lower CPU load as the computer has more time to think, but can result in a small latency. Find the optimum buffer size for your system. A fast, modern computer should easily be able to operate at 256 or 128 sample buffer size without creating pops or clicks in the sound. If you are getting clicks, try raising the buffer a little. The latency is displayed on the right hand side of this menu.
- The **Sample Rate** menu lets you set the sample rate at which audio is sent out of the instrument. The options here will depend on the capability of your audio interface hardware though even most computers' own hardware can operate at up to 48kHz which is perfectly fine. Higher sample rates use more CPU power so unless you have a good reason to go up to 96kHz, then 44.1k or 48k is usually fine.
- The **Show Control Panel** button will jump to the system control panel for whatever audio device is selected.
- **Play Test Tone** helps you to troubleshoot audio issues by confirming whether sound can be heard through the correct device.
- Your connected MIDI devices will appear in the **MIDI Devices** area. Click the check box to accept MIDI from the device you want to use to trigger the instrument. In standalone mode, Buchla Easel V listens for all MIDI channels so there's no need to specify a channel. You can specify more than one MIDI device at once.

2.2.2. Audio and MIDI settings: macOS

OS X uses CoreAudio to handle audio routing and the audio device selection is made in the second dropdown menu. At the top left of the Buchla Easel V application is a pull-down menu. It contains various setup options. Initially you will need to go to this menu and choose the Audio Settings option to get MIDI flowing in and sound flowing out.



Audio midi settings in macOS

Starting from the top you have the following options:

- **Device** lets you choose which audio driver you want to use to route sound out of the instrument. This might be your computer's own driver like Windows Audio, or an ASIO driver. The name of your hardware interface may appear in this field.
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- Your connected MIDI devices will appear in the **MIDI Devices** area. Click the check box to accept MIDI from the device you want to use to trigger the instrument. In standalone mode, Buchla Easel V listens for all MIDI channels so there's no need to specify a channel. You can specify more than one MIDI device at once.

2.2.3. Buchla Easel V as a plug-in

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

- the instrument will now 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 Buchla Easel V in a DAW project. In standalone mode you can only use one at once
- any additional audio effects your DAW has available may be used to process the sound, including delay, chorus, filters, etc.
- you can route audio through the Buchla Easel V using the Pre-amp
- you can route Buchla Easel V's audio outputs more creatively inside your DAW using the DAW's own audio routing system.

2.3. QuickStart: A basic patch

Please load the default factory preset. This ensures that you have all knobs and sliders in the correct starting position. The volume dial in the Output Section should be at about twelve o'clock.

> When you start Buchla Easel V and load the default preset that comes with the factory presets you'll notice that we have pre-patched the Envelope Generator into Gate 1 of the Dual Lo Pass Gate. This is a helpful gesture to get you started. What it does, is to open the Lo Pass Gate when you click on a key on the Buchla Easel V keyboard or press a key on an external keyboard. If we hadn't you would not hear any sound, which is rather frustrating when you're starting to learn something.

The output of the Complex Oscillator is by default routed through Lo Pass Gate 1. If that gate is closed you will not hear any sound so let's open it up; move slider level 1 of the Dual Lo Pass Gate to 2. Press a note on your controller or virtual keyboard. You should now hear the Complex Oscillator humming away.

To change the waveshape of the Complex Oscillator move the timbre slider up and down. Make certain the waveform dial above the timbre slider is at minimum. That way you will get the maximum effect of the timbre modulation. The timbre switch allows you to select different waveforms.

Modulating the timbre of the Complex Oscillator

2.3.1. Jumping octaves

Let's see if we can use the Sequential Voltage Source [p.58] to move the pitch of the Complex Oscillator [p.38] an octave up and down.

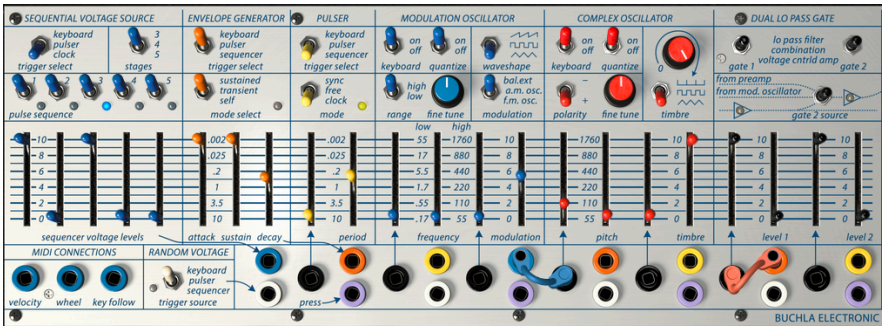
To accomplish this we have to make a connection between the Sequential Voltage Source and the Complex Oscillator. Connections like this are made on the patch board below the sliders. The original Easel used shorting bars to connect nearby patch points. Buchla Easel V uses virtual cables that you can stretch to any length and fold back to their point of origin to discard them. As soon as you start to "pull" a new patch cord from a patch output you will see a tiny circle inside patch points that can accept a connection. It also works the other way around; click on an input patch point to see from which outputs it will accept a connection.

The outputs on the patch board are color coded; the blue output are Sequential Voltage Source outputs. All black patch points are input points. Make a connection by drawing a patch cable from the blue Sequential Voltage Source output (under modulation) to the black input patch point of the Complex Oscillator.

> For more information about patching and the patch board refer to chapter 4 [p.31]

Now set the modulation cv input slider of the Complex Oscillator (above the the black input patch point) to 110.

Set the number of steps on the Sequential Voltage Source [p.58] to 3. Set the first step to 10 using the slider, the second step 0 and the third step to 10. The switch above the sequencer slider should be in the "Clock" position. If it isn't, the sequencer will not step through its steps. Now press any key on the keyboard. If you made the adjustment carefully the result should now be an octave jump.



Jumping octaves

To make this a bit more interesting move your attention to the Envelope Generator. You'll find it to the right of the Sequential Voltage Source.

Set the switch above it to "Sequencer". The Sequential Voltage Source will now trigger the Envelope, which in turn sends its output to Gate 1, where it will control the level of Gate 1. Try moving the sliders of the Envelope Generator [p.54] to get a feel for what an envelope generator does. To hear this even better, lower the speed of Clock (where it says "clock rate") to slow down the rate Sequential Voltage Source.

3. USER INTERFACE

Buchla Easel V is packed with great features and in this chapter we'll take a tour and show you what it is capable of. We think you'll be amazed by the huge range of sounds that can be made with this instrument.

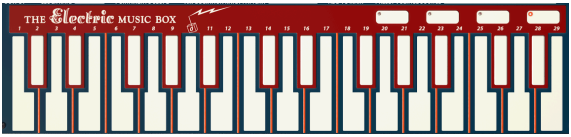
Buchla Easel V is very flexible. That will always be the main focus of every Arturia product: to unleash your creativity while remaining easy to use.

3.1. The Panel

The Panel is a detailed reproduction of the original Easel panel. The Panel contains all the modules you need to create audio and control voltage signals. We have made a few changes to the original user interface. We'd like to think it improves the Buchla Easel V user experience. We will have a detailed look at the new Panel [p.31] in another chapter.

3.2. Virtual keyboard

The virtual keyboard allows you to play a sound without the need for an external MIDI device. Simply click on a virtual key to hear the currently selected preset.



The Virtual Keyboard

3.3. The Toolbar

The toolbar that runs along the top edge of the instrument provides access to many useful features. The first seven of these features can be accessed by clicking on the Buchla Easel V section at the very top left hand corner of the instrument window.

We'll go through each of these functions in the following sections.

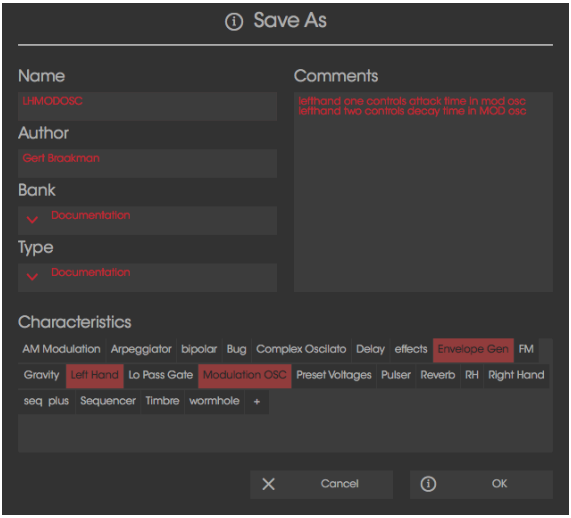
3.3.1. Save Preset

This option will overwrite the active preset with any changes you have made, so if you want to keep the source preset also, use the Save As option instead. See the next section for information about this.

3.3.2. Save Preset As...

If you select this option you are presented with a window where you can enter information about the preset. In addition to naming it you can enter the Author name, select a Bank and Type, 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 preset banks later.

You can also enter freeform text comments in the Comments field, which is handy for providing a more detailed description.



Save as Preset

3.3.3. Import Preset

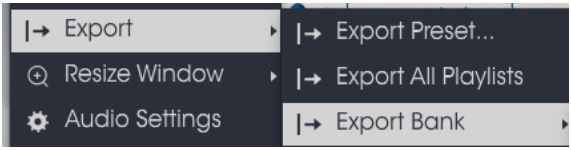
This command lets you import a preset file, which can be either a single preset or an entire bank of presets. Both types are stored in .mex format.

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

3.3.4. Export Menu

You can export presets in a number of ways; as a single preset and a bank or as a playlist.

- Export Single 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 with 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.
- Export All Playlists: This is an option you could use to prepare for a performance. It also allows you to transfer your playlists to another computer.



Export a bank of presets

3.3.5. Resize Window options

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

The Resize Window menu

3.3.6. Audio Settings

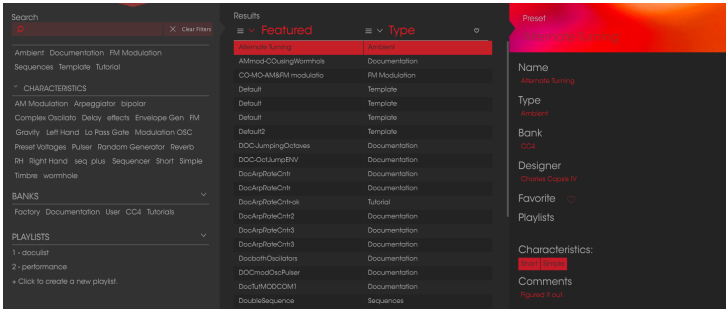
Here you manage the way the instrument transmits sound and receives MIDI. See the section Audio and MIDI settings [p.10] for full details on this.

3.3.7. About

In this window you can view the Buchla-Easel V software version and developer credits. Click on the About window to close it.

3.3.8. Preset browser overview

The Preset browser [p.24] can be openened by clicking the library symbol on the toolbar. The filter, name field and left / right arrows in the toolbar all assist with preset selection.



The Preset Browser

3.3.9. Browse with MIDI controller

At the bottom of the Preset browser window on the left side is a field labeled Browse with MIDI Controller. It will configure Buchla Easel V to work with an Arturia controller so you can browse the preset search results without having to map any controllers to those functions.

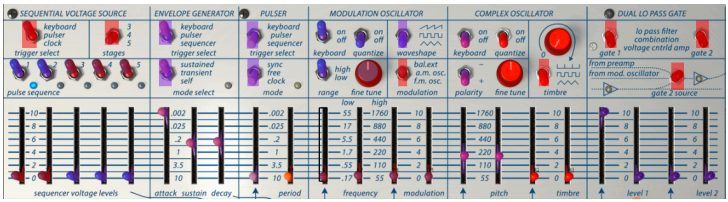
Click the menu to select the Arturia controller you are using.

> The way browsing the presets is implemented will depend on the controller you use. Please refer to the documentation of your controller for details.

If you want to disable this feature, select None.

3.4. MIDI Learn assignment

The MIDI plug icon at the far right side of the toolbar places the instrument in MIDI learn mode. MIDI-assignable parameters will be shown in purple, which means you can map physical controls to those destinations inside the instrument. A typical example might be to map a real expression pedal to the Master Volume control, or buttons on a controller to the Preset selection arrows so you can change the preset from your hardware keyboard.



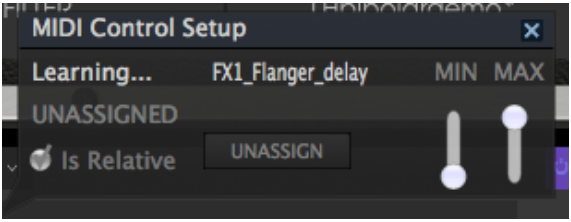
MIDI Learn mode - top section

In the image above one of the parameter dials is red. That means it has already been assigned to an external MIDI control. It can be reassigned, though.

> Remember that you can also assign the Preset Forward and Backward arrows to an external control.

3.4.1. Assigning / un-assigning controls

If you click on a purple area you'll put that control into learning mode. Move a physical dial, fader, or button and the target goes red, indicating that a link has been made between the hardware control and the software parameter. There's a popup window that displays which two things are being linked and an un-assign button that will disconnect the two.



Midi Control Setup

3.4.2. Min / Max value sliders

There are also minimum and maximum value sliders that you can use to restrict the parameter change range to something other than 0%-100%. For example you might want the Master Gain to be controllable via hardware from 30% to 90%. If you made this setting (Min set to 0.30 and Max set to 0.90) your physical dial would be unable to alter the volume lower than 30% or higher than 90%, no matter how far you turned it. This is very useful for making sure you can't accidentally make the sound too quiet or too loud when performing.

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

3.4.3. Relative control option

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

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

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

This can be a great feature when controlling things like volume, filter, or effect controls, since you won't usually want them to jump noticeably from their current setting when they are modified.

> Pitch Bend, Mod Wheel and Aftertouch are reserved MIDI controllers that cannot be assigned to other controls.

3.5. MIDI controller configuration

There's a small arrow at the far right hand side of the toolbar that deals with MIDI controller configurations. This allows you to manage the different sets of MIDI maps you may have set up for controlling the instrument's parameters from MIDI hardware. You can copy the current MIDI assignment setup or delete it, import a configuration file or export the currently active one.

This is a quick way to set up different hardware MIDI keyboards or controllers with Buchla Easel V without having to build all the assignments from scratch each time you swap hardware.

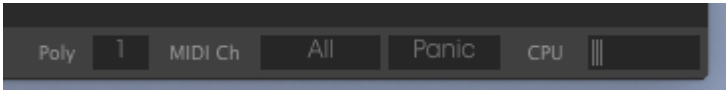
MIDI controller configuration

Note the check mark next to one of the controller names: that indicates that the Beatstep Pro configuration is currently active.

3.6. The lower toolbar

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

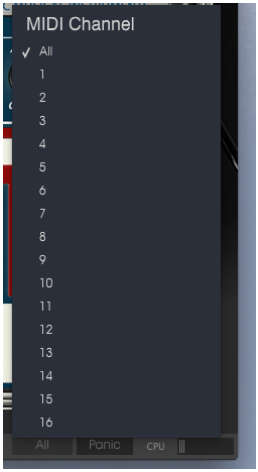
At the right hand side of the lower toolbar are several small windows and buttons. These are very important features, so let's take a closer look at them.



The lower toolbar

3.6.1. MIDI Channel setting

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).



MIDI Channel selection

By default Buchla Easel V will receive MIDI data on all 16 MIDI channels. You can change this by selecting a specific channel in the lower toolbar at the bottom of the screen. This can come in handy you want to use an external controller to use a number of instances of Buchla Easel V.

3.6.2. Panic button

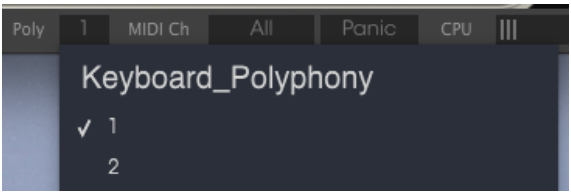
The Panic button can be pressed to reset all MIDI signals in the event of stuck notes or other issues.

3.6.3. CPU meter

The CPU meter is used to monitor how much of your computer's CPU is being used by the instrument. If you stress your computer too much, the performance of your computer may suffer.

3.6.4. Maximum Polyphony

By clicking this button, you will be able to adjust the upper limit for the number of voices played by the Buchla Easel V. It can be set from 1 to 4.



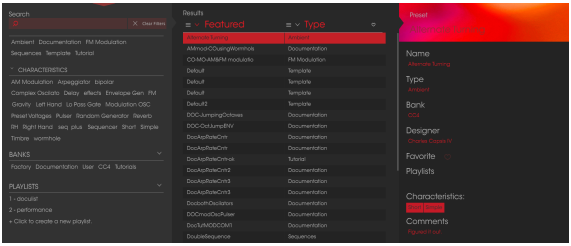
Polyphony settings

A lower setting will result in less CPU being used. Setting the number too high can create situation where the voices cut off and create unnatural sustains. The key is to find a balance that is acceptable for both you and your computer.

> The polyphony setting is MIDI assignable!

3.7. The Preset browser

The preset browser enables you to search, load and manage sounds in Buchla Easel V. It has a couple of different views but they all access the same banks of presets. You access the preset browser by clicking on the library symbol next to the Arturia logo.



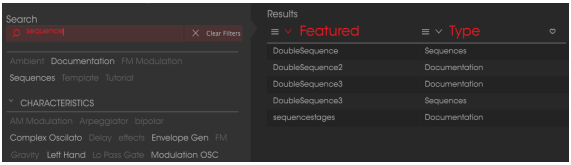
The Preset Browser button

The Tag category window in which the charateristics of a preset are listed may be collapsed and expanded using the symbol preceding it.

Tag window collapsed

3.7.1. Searching presets

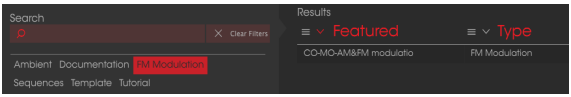
The Search screen has a number of sections. By clicking on the Search field at the top left you can quickly enter any search term to filter the preset list by patch name. The Results column is updated to show the results of your search. Press the Clear Filters button in the search field to clear the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



Using the filter to search for presets

3.7.2. Using tags as a filter

You can also search using different tags. So for example by clicking on the Documentation option in the Types field you can show only presets that match that tag. The tag fields can be shown or hidden by using the small down arrow buttons in their title fields. Results columns can be sorted by clicking the same arrow button in their own section.



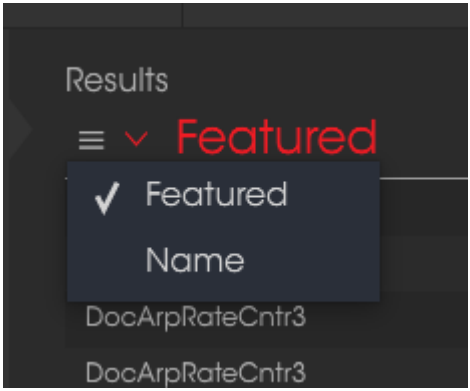
Using tags to search for presets

You can select multiple fields to perform narrower searches. So by entering a text search and also specifying Type, Bank and Characteristics options you could see only the presets that match those exact criteria. Deselect any tag in any area to remove that criteria and widen the search without having to go back and start again.

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

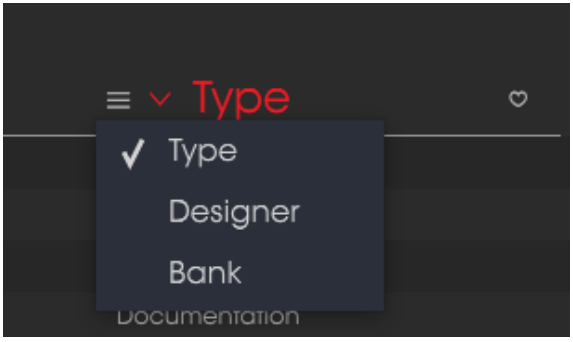
3.7.3. Search Results window

Click the options menu button in the first Results column to specify whether you want to view the presets by Featured or by Name. Click the sort arrow to reverse the alphabetical order.



Selecting featured results

Similarly, click the options menu button in the second Results column to order its display results by Type, Sound Designer, or Bank tags. Click the sort arrow to reverse the alphabetical order.



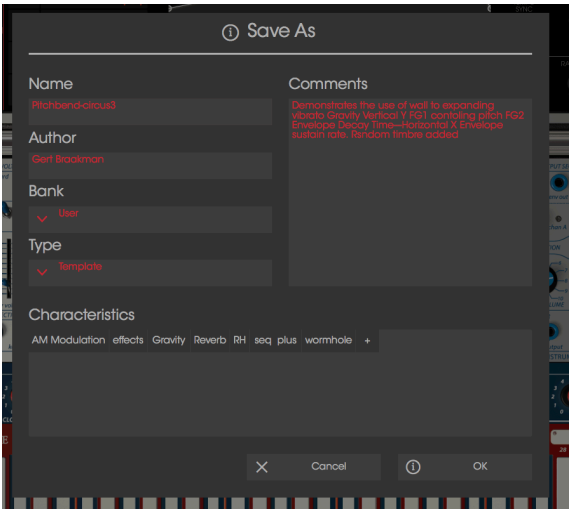
Selecting results by type

3.7.4. The Preset Info section

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

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

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



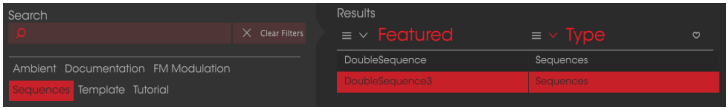
Preset Characteristics

3.7.5. Preset selection: other methods

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

3.7.5.1. Selecting a Preset by type

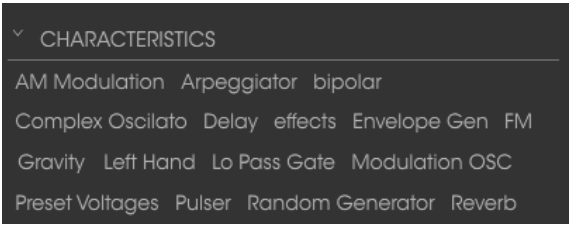
Similarly, if you previously selected Type: Keys and Characteristics: Ambient in the Search field you would see the results of that search in this area instead.



Selecting a preset by type

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

The Categories below the line also ignore the search criteria and display the presets based on their Type: Bass, Funk, Guitar, and so on.



Selecting a preset by its characteristics

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

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

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

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

3.8. Playlists

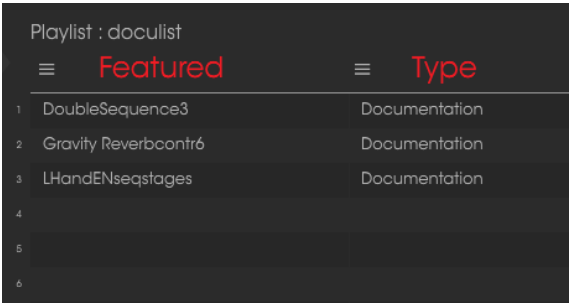
In the lower left corner of the Preset Browser window is a feature titled Playlists. This is used to collect presets into different groups for different purposes, such as a set list for a particular performance or a batch of presets related to a particular studio project.

3.8.1. Add a playlist

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

3.8.2. Add a preset

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



playlist example

To view the contents of a playlist, click on the playlist name.

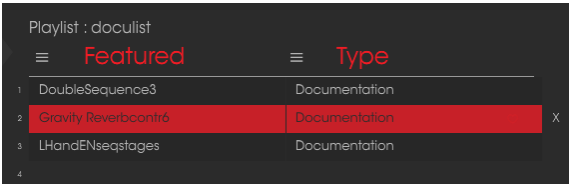
3.8.3. Re-order the presets

Presets may be reorganized within a playlist. For example, to move a preset from slot 1 to slot 3, drag and drop the preset to the desired location.

This will cause the other presets to be bumped up in the list to accommodate the new location of the preset being moved.

3.8.4. Remove a preset

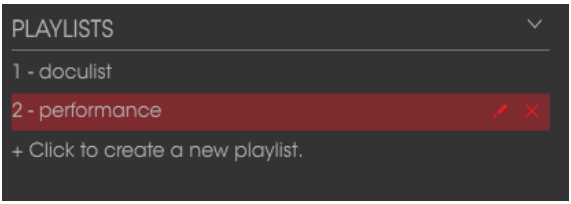
To delete a preset from a playlist, select the preset and click the "x" at the end of the preset row.



Click "X" to remove a preset from a playlist

3.8.5. Delete a playlist

To delete an entire playlist, click the x at the end of the playlist row. This will only delete the playlist, it will not delete any of the presets inside the playlist.

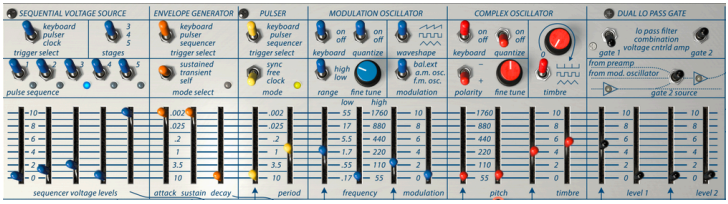


Deleting a playlist

4. THE BUCHLA EASEL V PANEL

The Panel of Arturia's software version of Buchla Easel is very similar to that of the original Easel. After firing up the original Easel the preferred practice was to wait five minutes to allow the oscillators to warm up and stabilize. You're of course welcome to do that with the software version to honor this tradition, but it will not make any difference for the oscillators.

At first glance the Buchla Easel V main panel can be quite intimidating; a strange and random collection of sliders, switches and dials. On closer look there is very carefully designed order in the chaos...



Mirrored design in the Panel

The original Easel was designed in the San Francisco area in the '60s. At the highpoint of the Hippie era Zen and all things Japanese deeply influenced ideas about design; everything had to be clear and symmetric.

Why are the sliders that control the main oscillator next to it and the sliders that control the Modulation Oscillator so far removed from it? It all makes sense if the layout is folded. It's a mirrored design. When you look at the layout with this thought in mind suddenly the chaos starts to make sense. The same is true of the in- and outputs on the patchboard in the row below the sliders.

Origami design of the patch bay

The black patch points are inputs, the others are all outputs. Some outputs are below and others above the black input. Again....if you were to fold this layout horizontally in the middle, you have a perfect symmetry; a valley with the black input in the bottom of the valley and the outputs on the high edges.

The signal will always flow from the high edges into the valley below. Holding this image in mind helps you visualise the direction in which the voltages flow and makes patching faster.

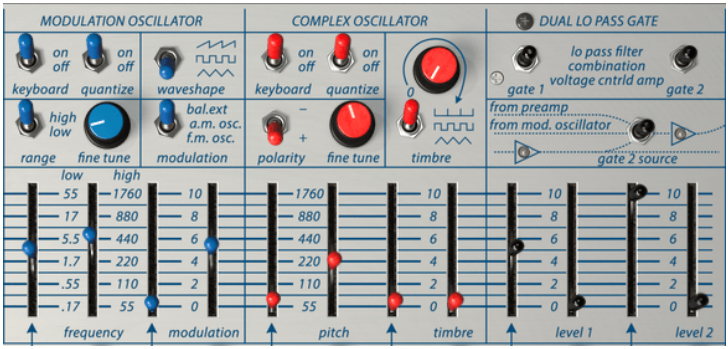
Buchla created this interface with the performer in mind; the sliders are all laid out in pairs; one for your left hand, one for your right hand. For example, the sliders that control the Complex Oscillator are actually two pairs; one pair for the pitch and one to control timbre.

The slider for the right hand controls pitch and the slider for the left hand controls the amount of external control voltage that comes in. The same with the timbre sliders, one for the right hand to control the timbre manually and one for the left hand to control the amount of external control voltage.

The onscreen keyboard of the Easel V does not have the pressure sensitivity options that the hardware version has. How can we maintain these performance qualities in a software version of the Easel? If only you had a pair of virtual hands! Well now you do! More about the Easel V Virtual Hands later.... [p.73]

4.1. Ways to look at things

On the right half of the panel you'll find the modules that deal with audio: The Complex Oscillator, the Dual Lo Pass Gate, the Output Section, the Reverb, Master Volume and the Pre-amp.



Panel audio section

The remaining sections of the panel are all about generating, mixing and patching control voltages. Control voltages are very slow waves in the sub audio range; you cannot hear them but they play an important role in shaping the sound in the audio range.

4.1.1. Function Rows

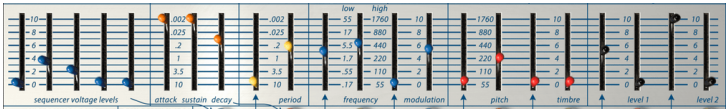
Another way to look at the layout is to divide the panel in rows from top to bottom. The top contains mainly switches and some dials. It's aptly called the switchboard. The switches allow you define how the modules in the row below it will behave. You operate them by left-clicking on them with the mouse. A threeway switch needs three mouse clicks to select all positions.

The Pulser for instance is a simple module that (you guessed it) generates Pulses that can do all sorts of magical things. Using the switches you can tell the Pulser where to send its pulses and whether it can "pulse away" in free running mode or pulse in tandem with the internal clock.

Switches row

The second row contains mostly sliders. Some allow you to control a module manually, while others let you define the strength; the force with which a control voltage controls a module.

Some sliders may seem confusing; they don't work as expected. As an example; you probably know that an envelope generator controls the attack and decay of a sound. If you raise the slider of the attack of an envelope generator on any standard synthesizer, such as a Minimoog or Korg, the attack will be slower and longer when you raise the slider.



Sliders row

Not so on the Buchla. It's short when it's high and long when it's low! So to make the attack longer you have to lower the slider.

The same for all other sliders in the time domain: *high is fast, low is slow.* A perfect mantra to repeat before going to sleep.

The patch bay

The third row is the patchboard where you connect the various modules using patch cords.

The Bottom row contains the touch-sensitive keyboard and a number of dials that each add a specific voltage to the keyboard output.

The Keyboard voltage control strip

The octave switch adds or subtracts voltage from the keyboard, which results in lower or higher keyboard voltages. We'll have an in-depth look at the keyboard and its voltage output mixer in the Keyboard Section [p.66].

4.1.2. Color coding

The last and probably most revealing way to look at the Buchla Easel V panel is its color coding. It is consistent throughout:

Black patch points are inputs; all others are outputs.

It means you can apply voltage control to:

- Gate 1 level
- Gate 2 level
- Complex Oscillator timbre
- Complex Oscillator pitch
- Modulation Oscillator frequency
- Modulation Oscillator range
- Pulser
- Inverter
- Keyboard inputs

The colored patch points are all outputs.

- Blue outputs: Midi and Sequencer voltages (The blue outputs in the Output Section on the right are an exception)
- Orange outputs: Envelope voltages
- Purple outputs: Keyboard pressure
- White: Random Voltage
- Yellow: Pulser triggers

4.1.3. The Patch Bay

Several copies of every output are available in the patch bay. The yellow Pulser output for instance is available three times. The voltages flowing out of these three outputs are identical.

> It's a stroke of genius to locate all of the patch points below the sliders; the cords you use to connect patch points will never get in the way. It's a major improvement over the Moog and Eurorack environments where patching will create a jungle of spaghetti patch cords which totally obscure the modules behind them.

Patch bay plus Inverter

The original Easel uses shorting bars to connect nearby patch points. Buchla Easel V uses virtual cables that you can stretch to any length and fold back to their point of origin to discard them. You can also drag the end of the patch cable to an empty spot on the instrument panel to remove the cable. That's sometimes faster than dragging it back to its point of origin.

As soon as you start to "pull" a new patch cord from a patch output you will see a tiny circle inside patch points that can accept a connection. It also works the other way around; click on an input patch point to see from which outputs it will accept a connection. This is a great learning and inspiration tool that helps you to understand which input accepts a particular output signal. Just grab a patch cord at the output and observe in which input patch points circles appear. Buchla Easel V has a major advantage over the original Easel here, where often in the heat of the performance you would plug a cable in a patch point where it did absolutely nothing.

There are some limits here:

- You cannot patch two cords into an input patch point.
- You can "pull" a maximum of three cords from an output patch point.

Some patch points are available outside the patchbay:

The pulse output next to the clock pulse output enables you to control any CV input by pressing a note on the keyboard. You could for example patch this pulse output to the pitch CV input of the Complex Oscillator. With gate 1 opened you'll make pitch change, only when your finger holds a note.

In a similar way the output of the Preset Voltage Source is available to patch to any CV input.

4.2. Making Connections

4.2.1. The Art Of Creating Control Voltages

Control voltages are to a Buchla Easel V performer what colors and lines are to a painter. To quote Todd Barton, an expert on all things Buchla Easel; "Your performance is only as good as your ability to create complex and beautiful control voltages. This is the art of the Easel and it must be mastered just as on any other instrument". The way you create control voltages is what makes you unique as an analog performer/composer. Easel V will offer you plenty of opportunities to create a personal style.

In addition to the control voltages you create using the Panel modules there are Virtual Hand extensions [p.73] that enable you to do many things that are not possible on the standard Easel. But first.....let's explore some of the more basic ways to create control voltages on Buchla Easel V.

4.2.2. Control Voltages

There are several kinds of control voltages:

- **Triggers** are very short voltage spikes. They are used to start an envelope generator or a sequencer. Clocks generate triggers...
- **A gate** is somewhat longer: its purpose is to keep something going, like the hold stage of an envelope generator. Keyboards generate a gate when you press and hold a key.
- **A waveform** is a voltage that can have any duration; it usually cycles from high to low and vice versa. On the Buchla Easel, the Modulation Oscillator creates slow voltage control waveforms in the low position. The Envelope Generator and the Sequential Voltage Source will create a multi stage control voltage.

The heartbeat of every analog system is the clock. Clocks are simple-minded things; all they do is send out pulses/triggers and they do that very well. You can set their tempo manually or sync it to an external clock whose tempo enters Buchla Easel V via MIDI. Clocks are essential to create rhythmic movement in your sound designs. The other voltage controlled tools all depend on a trigger from the clock to do something. The Envelope Generator is always waiting for a trigger pulse to start its envelope voltage; the Sequential Voltage Source will only move to the next step if it receives a trigger. The Clock in the keyboard section is an important source for triggers.

The Pulser is a second source of triggers. It is more advanced than the keyboard clock. It can sync to an external MIDI source, to the keyboard clock or run in free mode independent of other clocks.

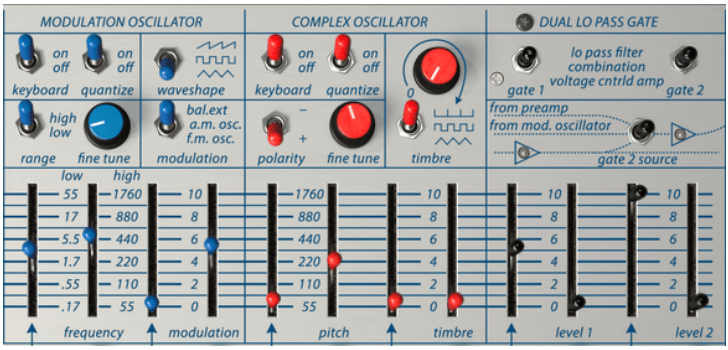
To make things easier for a performer there are a number of hardwired connections that enable you to select the trigger source for the Pulser: the Keyboard, the Sequential Voltage Source or its internal source. The Envelope Generator, the Random Voltage Source and the Sequential Voltage Source also have switches that you can set to determine what will trigger the module.

Lastly the Envelope Generator can be used as clock. In standard mode it will create a string of three voltages: attack, hold and decay. When you set the times for each of these voltages very short and switch it to self-trigger mode the Envelope Generator will cycle very quickly through its stages and become a clock that can be used to control other modules.

Many modules on Buchla Easel V have control inputs that allow you to control them using a trigger, a gate, or a waveform. For example, the speed of the Pulser can be voltage-controlled using the black input patch point in the patch area below it. Its pulses/triggers are available in the patch area where you can use them to trigger all sources that accept a modulation input. In a similar way the Sequential Voltage Source, the Envelope Generator, the Keyboard and the Random Voltage Generator can be patched to the input points in the patch bay and control other modules.

5. THE AUDIO SECTION

On the right half of the panel you'll find all modules that deal with sound in the audio range. The Complex Oscillator and the Modulation Oscillator are both capable of generating a number different waveforms. The function of the Dual Lo Pass Gate is to amplify these signals or to filter them.



Panel audio section

5.1. The Complex oscillator

The Complex Oscillator is the main sound source of Buchla Easel V. It can be tuned with the frequency/pitch fader over five octaves. The frequencies are listed in the column next to the slider. This frequency listing can be helpful when tuning the oscillator to the Modulation Oscillator or an external oscillator. The fine tune dial allows you to change the frequency over a small range.

The Complex Oscillator depends on wave folding and modulation to add harmonics to its waveform rather than subtracting harmonics with a filter as is customary in East Coast synthesis. By moving the timbre slider you change the harmonic content of the wave of the Complex Oscillator using a technique called wave folding. Wave folding is a form of wave shaping. Wave shaping applies a function to a wave to change its harmonic content. Wave folding is an advanced form of waveshaping in which the peak of a wave is cut off and folded back onto itself in a series of folds. It is a technique also found in the Arturia Brute series synthesizers.

The Complex Oscillator

When experimenting with sounds and timbres the keyboard switch is usually in the "off" position. You'll only set it to "on" when you want to create melodies and arpeggios or use the transposition options of the keyboard.

Next to the keyboard switch is the quantize switch. When the switch is set to "on", quantizing is active. If you then move the pitch slider, all pitches are quantized to notes on the chromatic scale. The quantize function is available on both oscillators.

> Quantize can not be applied on the Modulation Oscillator when the Modulation Oscillator range is set to "low".

With the timbre dial you blend a wave folded sine waveform with either a impulse train, a square or a triangle. The switch below the timbre dial selects the wave the sine wave will transform into. The timbre slider determines the amount of wave folding applied to the wave. When waves are folded/multiplied this way the resulting waves have a very rich harmonic content.

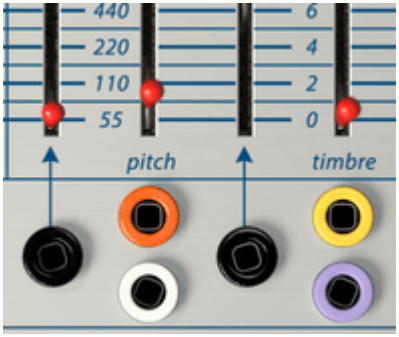
5.1.1. Modulation inputs

The Complex Oscillator responds in a very strict way to incoming control voltages. Next to the red pitch slider you'll see a frequency table labeled from 55 to 1760. If you want to generate pitches in the standard pitch range set the slider to 440 hz. On the left of the pitch table the numbers are a good indication for creating input voltages.

The sliders come in pairs: the right slider enables you to set the frequency of the oscillator and the left slider controls the control voltage flowing in through the black input patch point below it.

Sliders come in pairs

The patch points below the Complex Oscillator allow you to modulate frequency and timbre using control voltages.

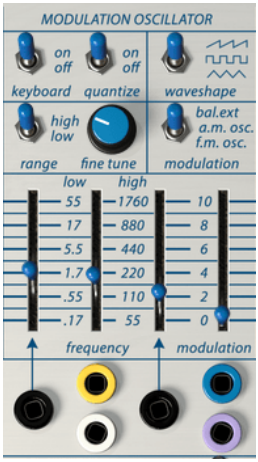


Patch entry points for the Complex Oscillator

When you modulate the timbre of the Complex Oscillator with the Envelope Generator or a similar cyclic signal, the modulation will start at the point you've set with the manual slider, move up from there and return to that starting point when the envelope reaches the end of its stages. Interesting effects can be achieved by inverting the polarity of the incoming control signals by using the Inverter in the Output Section. Instead of going up from the level set by the manual slider the pitch will go down first and then rise back up.

5.2. The Modulation Oscillator

The Modulation Oscillator is a dual function oscillator capable of generating voltages in both the low and high frequency range. In the low range you can use it as a control source, in the high range as an audio oscillator. The output of the Modulation Oscillator is routed to Channel B in the Output Section through Lo Pass Gate 2. If you hear no sound check the volume of channel B.



The Modulation Oscillator

With the keyboard switch you select whether the Modulation Oscillator will or will not track the keyboard.

When the keyboard switch is active, the range is set to high and the quantize switch is on, the frequency slider is quantized to notes. The fine tune dial then allows you to reach all pitch values in between.

The high/low switch enables you to select whether the Modulation Oscillator will function as an LFO (low frequency oscillator) or an audio oscillator. The Modulation Oscillator can generate sawtooth, square and triangle waves. The waveshape switch selects them.

You can set the Modulation control switch to either target the external input signal, perform Amplitude Modulation (AM) on the Complex Oscillator or perform Frequency modulation (FM) on the Complex Oscillator.

To hear the difference between FM and AM set the modulation slider midway, the switch in the FM or AM position and move the frequency slider of the Modulation Oscillator up. FM and AM both have a very distinct sound that you've probably heard a thousand times before without realizing what is was. When one oscillator modulates another in this way additional frequencies called sideband frequencies will appear.

Again the sliders come in pairs. The slider above the black input patch point allows you set the amount by which the frequency is modulated. The sibling slider is used to set a floor level.

5.2.1. Modulation options

The Modulation Oscillator is hardwired to the Complex Oscillator. There is no need to create a patch connection between them, the connection is made internally. If you want to use the Modulation Oscillator to modulate other units on Buchla Easel V you have to draw a patch cord from the "mod cv out" in the Output Section to a destination.

The Modulation Oscillator: slider and switch

The Modulation Oscillator has a modulation slider instead of a timbre slider. Using this slider you can modulate the Complex Oscillator in different ways.

The modulation switch above the slider allows you to select the modulation type:

- In the bal.ext position you'll hear the "natural" sound of the Modulation Oscillator as long as you do not connect any external source here. If you do, the Modulation Oscillator will become a Balanced or Ring modulator. Ring Modulation is a very specific kind of modulation in which two frequencies collide. Let's call them A and B. As a result you will hear the summed output of A and B (A+B) and the subtracted output of A and B (A-B). Ring modulation is often used to produce bell-like sounds.
- In Frequency Modulation one oscillator (the modulator), modulates the frequency of a second oscillator (the carrier). This process produces additional sideband frequencies around the original frequency of the carrier. Normally the end result is not very spectacular when using only two oscillators. Interesting things can happen when this simple form of frequency modulation is combined with timbre modulation of the Complex Oscillator. In the FM position the Modulation Oscillator will change the waveform of the Complex Oscillator. This form of FM is called static FM. The moment you start modulating the pitch of one of the two oscillators you move into the area of dynamic FM.

> When you start experimenting with FM modulation it is a good idea to use relatively simple waveforms like triangle or sawtooth. When simple waveforms modulate each other it is easier to hear what happens in the sidebands that result from the modulation.

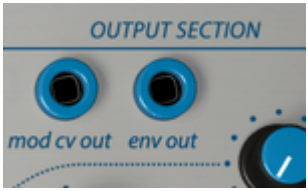
- Amplitude Modulation is different from FM in that instead of the frequency the amplitude (volume) of the second oscillator (the carrier) is modulated. In the AM position the Modulation Oscillator will modulate the Amplitude (the volume/loudness) of the Complex Oscillator. In AM the frequencies of the modulating oscillator add to and subtract from the frequencies of the carrier oscillator (in this case the Complex Oscillator). In an AM modulated signal you will hear new pitches arising in the sidebands. When tuned and tracked properly, static, moving pitch intervals will occur.

5.2.2. The Modulation Oscillator as an LFO

When you set the Modulation Oscillator range switch to the low position, very different things will happen. To hear the difference set the mod switch in the FM position and turn up the frequency slider. The frequency of the Complex Oscillator will now change. You can set the modulation range from .17 to 55. If you set the modulation slider to 2 and the frequency slider to about 5.5 you'll recognize the effect immediately; it's vibrato.

The Modulation Oscillator as an LFO

When you set the modulation switch to AM the Modulation Oscillator will change the amplitude (volume) of the Complex Oscillator, an effect known as tremolo.



Modulation Control Voltage output

The combined control voltage output of the Modulation Oscillator is available in the "mod cv out" patch point of the Output Section.

An LFO is a powerful tool that can be applied in many situations. A few examples: applied to the Pulser it will change the length of the Pulser period. This can be useful when creating a control chain: Modulation Oscillator>Pulser>Sequencial Voltage Source>Complex Oscillator.

When you patch the low frequency output to the timbre input of the Complex Oscillator the result is a very pleasant "morphing" waveform. You're of course welcome to make it unpleasant if that is more to your liking. Experiment with different wave shapes of the Complex Oscillator. What happens is that the original simple waveform of the Complex Oscillator is folded into itself, thus creating complex waveforms.

5.2.3. Tutorial: Modulation Oscillator and Complex Oscillator

The Modulation Oscillator can modulate the Complex Oscillator in a number of ways:

As an audio oscillator it can:

- modulate the Complex Oscillator using AM and FM
- modulate the timbre of the Complex Oscillator (which is another type of waveform modulation)

As a low frequency oscillator (LFO) it can:

- modulate the pitch of the Complex Oscillator
- modulate the timbre of the Complex Oscillator
- modulate the volume of the Complex Oscillator by means of the "mod cv out" in the Output Section. This last option is specific for Buchla Easel V.

Let's have a closer look at some of these modulation routings.

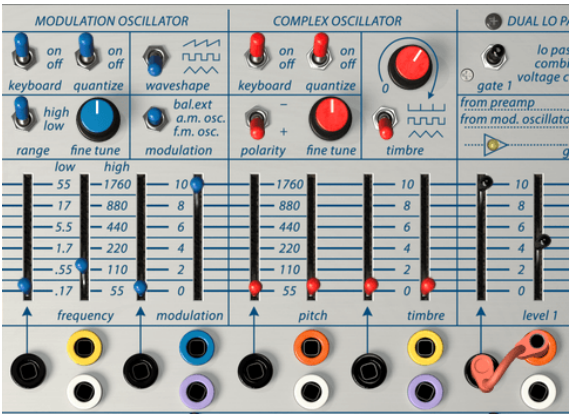
5.2.4. AM and FM modulation

Start by loading the Default preset.

The first thing on our to-do list is to make the Complex Oscillator audible:

- Move the Level 1 slider in the Dual Lo Pass Gate to about 5
- Set the pitch of Complex Oscillator to 110
- Set the keyboard switch of the Modulation Oscillator to "off".
- Set the Modulation Oscillator modulation switch to "a.m. osc." This will enable the Modulation Oscillator to control the Amplitude (volume) of the Complex Oscillator.
- Set the modulation slider of Modulation Oscillator to maximum. This maximizes the amount of modulation we will use to modulate the Complex Oscillator.

Now slowly move the pitch slider of the Modulation Oscillator up. You will hear all sorts of interesting effects while moving the slider up when the frequencies of the two Oscillators go in and out of sync.



Modulating the Complex Oscillator

It's interesting to note here that the position of the quantize switches of both the Modulation Oscillator and the Complex Oscillator will make for a different experience. When quantize is "on" on both oscillators they will sync with greater ease.

Try different waveforms of the Modulation Oscillator and note their effect on the Complex Oscillator.

Now switch to FM and try different waveforms, pitches and modulation amounts of the Modulation Oscillator.

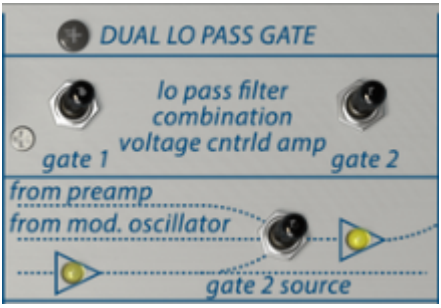
5.3. The Dual Lo Pass Gate

If you have a background in Eurorack modular synthesizers or in Moog style synthesizers, the Dual Lo Pass Gate is somewhat difficult to understand. Is it a filter? A VCA? How can it be both?

A Lo Pass Gate is basically a low pass filter with a gentle slope. In its default state it is closed completely; no sound can go through. You need an external control voltage to open it up. In case of Buchla Easel V this voltage can come from the Pulser or the Envelope Generator. This signal flow gives the Lo Pass Gate a unique sound signature; brighter when loud and darker when soft. It has more the characteristics of a filter than a VCA. The other thing that makes Lo Pass Gates unique is that they contain vactrols. A vactrol is a combination of a light-sensitive resistor and light source. When the light source (usually a LED) emits more light the resistor will reduce the current that flows through it. Buchla was one of the first engineers to apply this effect in musical ways. Vactrols respond to pulses in a unique way; when receiving a pulse-like voltage they ring. That property makes them ideal for percussive effects. In addition, they have a very natural decay.

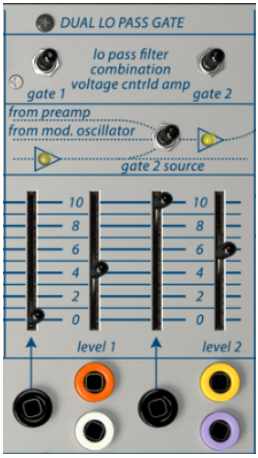
> No two vactrols are alike, they all sound slightly different. In the early days owners of Buchla equipment would often have several Lo Pass Gates and use each one in a different situation because of their individual qualities.

The Dual Low Pass Gate is a multifunction unit. It is both a Voltage Controlled Amplifier (VCA) and a Voltage Controlled Filter (VCF).



Dual Low Pass Gate switches and routing

The two gates function separately. You control what they do with the function switch in the top row. Two LEDs in the row below it will light up when a signal passes through the gate; one for each channel.



The Dual Low Pass Gate

The diagram below the switches explains how the signal flows through the gates. By default the output of the Complex Oscillator will always pass through Gate 1. Gate 2 has three settings: the gate switch determines whether the gate will process external sounds that enter Buchla Easel V in the Pre-amp section, signals from the Modulation Oscillator or the Complex Oscillator.

When the switch is in the low position, the two gates work in series. The middle setting where each gate controls its own Oscillator is probably the setting you will use most.

Again the sliders come in pairs; there's a manual slider that enables you to set the floor of the signal and a CV-in slider that determines the level of the control voltage flowing in through the black input patch point.

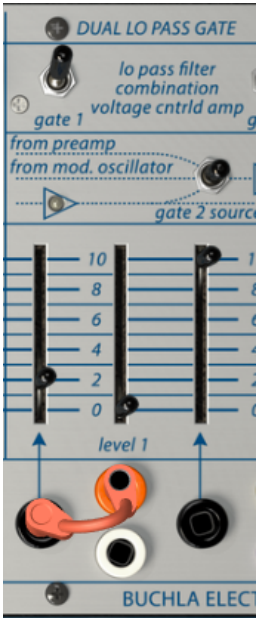
To hear the output of the Lo Pass Gates turn up the volume dials of Channel A and B in the Output Section. The signal is inverted between Low Pass Gate 1 and Low Pass Gate 2, so when using a mix of both, some phase cancellation occurs. You can use this to your advantage to create specific effects.

> *Note:* The response type of the Low Pass Gates can be adjusted in the Effects Section [p.98]

5.3.1. Filter Mode

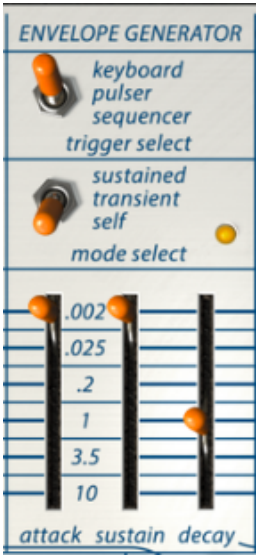
In filter mode the level slider controls the cut-off frequency of the incoming signal. It's a 12 dB filter, which means that it filters with an intensity of 12 dB (decibels) per octave. There are many types of filters that each have their own characteristic; a 24 dB filter will cut off frequencies with a much steeper slope. 12 dB is considered a gentle form of filtering. The LEDs will give you a fairly good idea of the intensity of the filtering process.

When lowering the manual filter slider the high frequency content of the sound will become less and less until in the end only the fundamental frequency of the sound remains. To hear this effect it's best to select a sound with many overtones such as a sawtooth. To really get the most out of the filtering process you have to control its cut-off frequency with a control voltage.



The Dual Low Pass Gate as a filter

In the example above we control the Dual Lo Pass Filter with the Envelope Generator.



Settings for the Envelope Generator

The Decay of the Envelope Generator is set to about one second. Experiment with the Control Voltage input slider of Gate 1 to hear the filter opening up.

5.3.2. VCA Mode

In VCA mode the Lo Pass Gate will amplify the incoming signal when fed with a control voltage. It's needed at this stage because the signal coming from the Complex Oscillator and the Modulation Oscillator is imperceptibly low and needs to be raised to line level. You can do this manually by raising the level slider, but a more interesting way is to control the level with a voltage. Hence the name Voltage Controlled Amplifier. The VCA can be controlled with many different sources: the Envelope Generator, the Pulser, the Sequencial Voltage Source and many other sources.

5.3.3. Combination Mode

The two functions of the Lo Pass Gate can be combined. The effect is a distinctly different sound, the effect of which is most audible when the level is controlled by a voltage. The Pulser is an obvious choice if you want to create drum-like sounds.

5.3.4. Tutorial: Oscillator routing

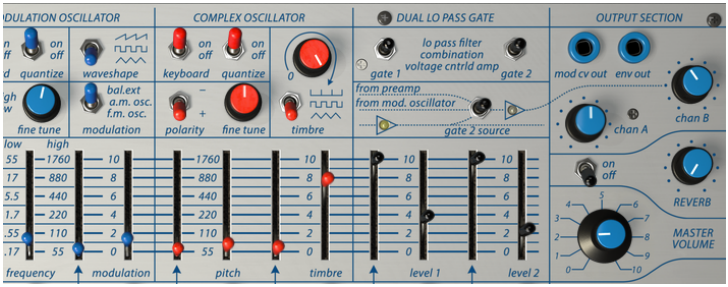
> Please load the default factory preset before starting this tutorial.

By default each oscillator on the Buchla Easel V is assigned to its own gate; the Complex Oscillator to Gate 1 and the Modulation Oscillator to Gate 2. In the row above the gate sliders, the switch should be in the "from mod. osc" position, the middle position.

Make certain the dials in the Output Section for channel A and B are both in the middle position.

Set the frequency of the Modulation Oscillator to 11O. In the default patch the Modulation Oscillator is always in the audio range. Now when you raise levels 1 and 2 of the Dual Lo Pass Gate you will hear both oscillators. To get a feel for how they sound try different levels, pitches and waveshapes.

Your patch should now look like this:

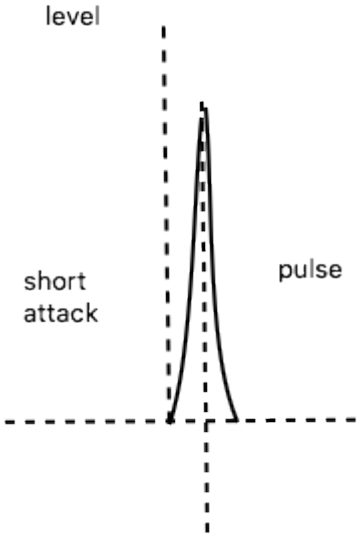


Both oscillators routed through the Lo Pass Gate

6. THE VOLTAGE CONTROL SECTION

6.1. The Pulser

Every analog environment needs one or more sources that creates triggers and gates. Triggers are very short ramp pulses, usually a few milliseconds long. A gate is longer, anywhere from a few milliseconds to several seconds. When you hold down a key on your keyboard you create a gate. And if you hold it down for several days your gate will be listed in the Guinness book of records.



Percussive attack and decay generated by a short period of the Pulser

Triggers and gates are needed to start other modules in Buchla Easel V; the Envelope Generator will create an envelope when it receives a trigger and the Sequential Voltage source will go one step further in its (short) five step life cycle after receiving a trigger from the Pulser.

6.1.1. Switches, dials and sliders

The Pulser can be triggered by the Keyboard, the Sequencial Voltage Source or run in Self-trigger mode. When triggered by the Keyboard, it behaves as mentioned before, the voltage will stay high for as long as you touch the keyboard (you can let go now) then decays as the note is released. It's referred to as a HR (Hold-Release) envelope.

The Pulser

In Buchla Easel V the Pulser will be triggered anytime it is set to Self mode.

The mode switch enables you to set the trigger source of the Pulser. In Self trigger mode (the middle position) it is free running and will generate the pulses you set with period slider. Pulses can range from .002 second to 10 full seconds.

> ♪: Again, remember: on the Easel "high is fast and low is slow".

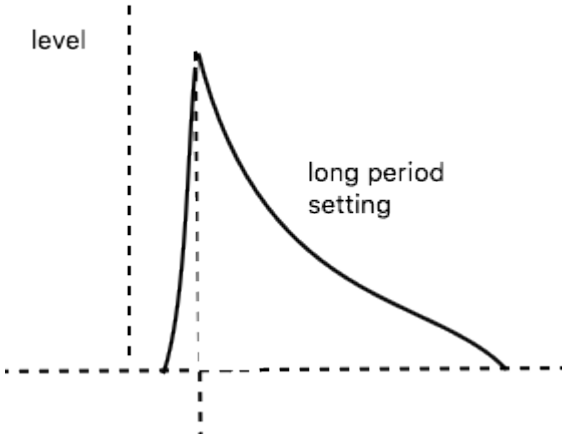
The Mode switch has three settings:

- Sync: The Pulser rate will be synchronized to the host tempo. Rates go from .002 second to 10 full seconds or from 4 bars to 1/128th when using the Left Hand/ Gravity module.
- Free: The regular Pulser mode. No synchronization.
- Clock: The Pulser is re-triggered with each clock pulse. How it will re-trigger will depend on the setting of the "trigger select" switch. If you hold a note and the Pulser is in keyboard trigger select mode, the Pulser will not re-trigger.

The left slider determines how a control voltage will influence the speed of the Pulser. The control voltage input will accept input from all control voltage generating modules on Buchla Easel V.

Pulser "long" decay setting

The Pulser is an excellent tool for creating percussion-type envelopes. By lengthening the Period of the Pulser you can create longer decays.



6.1.2. Tutorial: Patching the Pulser

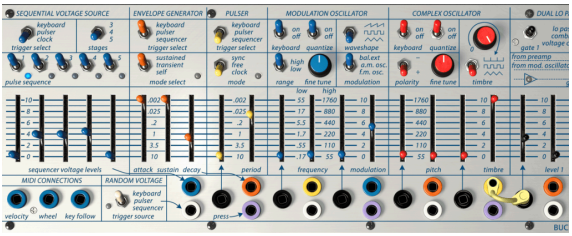
One very popular use of the Pulser on the original Easel was to control the rate of the Pulser with a pressure voltage. The keyboard registered how much of your finger was in contact with the keyboard. More contact would result in more pressure voltage.

To achieve this with the Buchla Easel V you can patch the "press cv" output to the Pulser cv in and use a keyboard controller with aftertouch capabilities.

The on-screen keyboard of the Buchla Easel V cannot be used to generate pressure voltage, but there are many fascinating alternatives: the Envelope Generator, the Modulation Oscillator, and the Virtual Hands. More about the Virtual Hands [p.73] in a later chapter.

6.1.3. The Pulser as an AD envelope generator

The Pulser is capable of generating sharp percussive envelopes. In the example below we have patched the Pulser in Gate 1 of the Dual Lo Pass Gate. To make this possible you must first remove the envelope patch cable which is by default connected to control input 1 of the Dual Lo Pass Gate. Drag a cable from the yellow pulser output to the control input of Dual Low Pass Gate. Now move the period slider of the Pulser up. You should now hear very short percussive attacks. Lower the speed of the Clock ("clock rate") to hear the pulses more clearly.



Pulser as an AD envelope generator

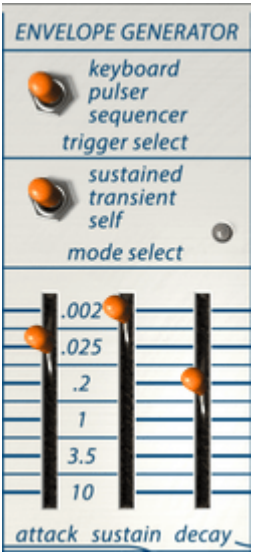
By carefully adjusting the control voltage input level of the Dual Lo Pass Gate and the period slider of the Pulser you can create a variety of envelope lengths.

6.2. The Envelope Generator

The Envelope Generator is one of the basic building blocks of Buchla Easel V. It enables you to shape the overall loudness of a tone or the timbre of a sound. It's a sound sculpting tool. It can be patched to all inputs that accept a control voltage. The voltage output of the Envelope Generator is available from the orange patch points in the patchbay.

6.2.1. Switches, dials and sliders

In a similar way as the Pulser you can define what triggers it with the flip of a switch; the trigger select switch will determine which source will start the envelope cycle: the Keyboard, the Pulser or the Sequential Voltage Source.



The Envelope Generator

With the Mode select switch you set how the Envelope Generator behaves. In sustained mode the sustain stage will remain high as long as you press a key on the (external) keyboard. In transient mode it will cycle uninterrupted through all three stages. In self mode it will cycle continuously through its stages and become an LFO capable of generating complex control signals.

The sliders set the duration of each stage.

6.2.2. What does an envelope generator do?

Traditional instruments have a very specific envelope (and timbre) that make it possible to recognize them immediately. An organ attains full volume instantly, remains high for as long as a key is depressed and decays very quickly. A piano has a slower attack and a longer decay. A string section will reach full volume gradually and the volume mostly fades gradually as well. Buchla considered his instrument a tool to go beyond these traditional envelopes and was always keen to hear innovative new ways to combine envelopes and timbre.

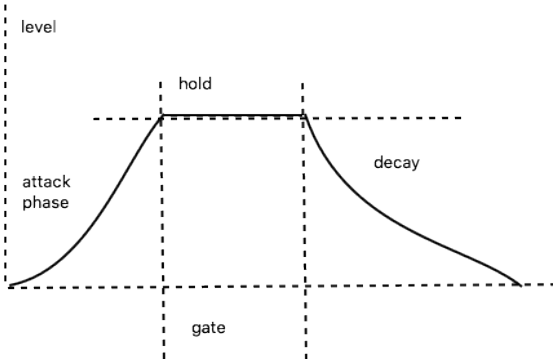


Diagram of envelope stages

The Envelope Generator of Buchla Easel V has three stages: attack, sustain and decay. Technically speaking it is an AHD envelope because the sustain stage can be held indefinitely when the Envelope Generator is used in conjunction with the keyboard.

6.2.3. Attack (rise)

In the attack stage of the envelope cycle the sound rises to its maximum, either slow or fast depending on the position of the Attack slider. Again, remember; "high is fast and slow is low". If you forget about this here this Easel quirk can be very confusing. You could set the slider in the low position expecting to hear a fast attack, but nothing will happen. Always start in the "high" position and then lower the slider. The time bar in the middle refers to both the duration of the attack stage and of the sustain stage.

6.2.4. Sustain (hold)

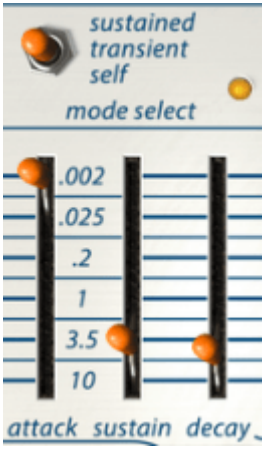
The sustain stage starts when the attack stage is finished. The actual time of the sustain will depend on the setting of the mode switch above it. In sustained mode the sustain time is the grand total of the time set with the slider and the time you hold a key on the keyboard, either on a connected MIDI keyboard or in the Virtual Hands section [p.73] of Buchla Easel V.

In transient mode, the sustain will last as long as defined with the slider. This mode is often used when emulating drum-type sounds, where the sound needs to have a short fixed decay.

6.2.5. Decay (fall)

The decay slider sets the time needed for the sound to go from maximum to zero.

> If you set sustain and decay both to very long times the sustain stage can seem to last indefinitely. This a quirk of the original Easel that we have faithfully reproduced.

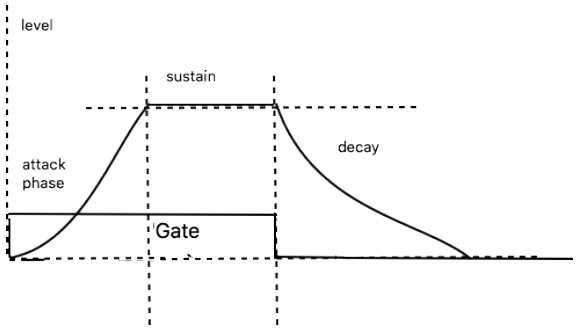


Overlapping sustain and decay times (not a good idea)

The trigger select switch enables you to select how the Envelope Generator will be triggered: by the Keyboard, the Pulser or the Sequential Voltage Source. When using the factory default preset the switch is set to Keyboard and the envelope is patched into Lo Pass Gate 1.

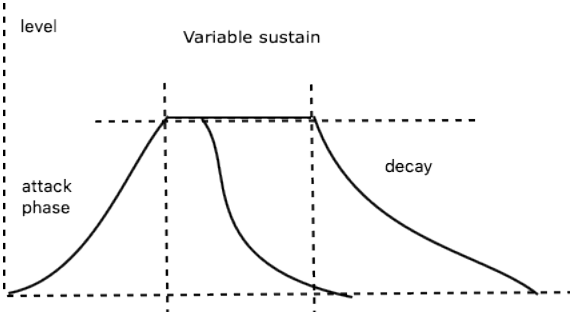
The Envelope Generator can function in three ways: in sustained mode, in transient mode and in self-trigger mode.

In sustained mode the Envelope Generator will always cycle through the attack/sustain/decay stages even when the gate is very short and stops during the attack stage.



Sustained Mode

In transient mode the duration of sustain phase will be determined by the setting of the sustain slider. The length of the gate is irrelevant.



Transient Mode

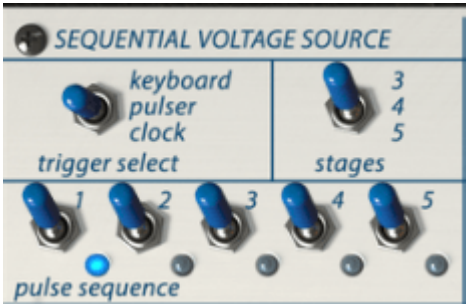
6.3. The Sequential Voltage Source

In many ways the Sequential Voltage Source or Sequencer for short is one the most fun parts of the Buchla Easel V. Buchla named it Sequential Voltage source on purpose. Not because he liked posh sounding names but because he wanted to emphasize that it can be used for more than pretty little melodic sequences. It steps through voltage levels, voltages that you can apply to control other modules.

> It's easy to forget the Sequential Voltage Source can also be a live performance tool. With careful practice you can adjust the sliders while the sequencer is running. When it's running very slow you can follow along with each step and change the voltage of the step that is currently playing to create glissando and pitch bend effects.

6.3.1. Switches, dials and sliders

The Trigger select switch enables you to choose how the Sequential Voltage Source will be triggered, by the keyboard, the Pulser or the clock. Each trigger mode will have a different effect. When triggered by the keyboard, the Sequencer will advance one step and then wait for the next trigger to arrive.



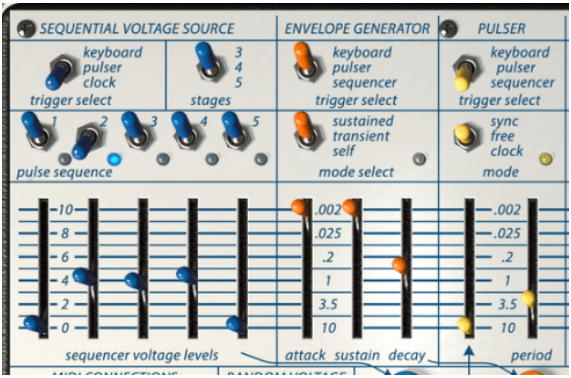
The switches of the Sequential Voltage Source

When set to Pulser, the Pulser period slider will determine the speed with which the Sequencer steps through its stages.

If set to the system clock the Sequential Voltage Source will run at clock speed. The clock itself can be set to sync with external (MIDI) clock signals. This enables you to sync Buchla Easel V to the clock speed of your DAW or the clock of external MIDI sources.

The "stages" switch allows you to set the number of steps of the Sequential Voltage Source, three, four or five. The five and three step options make it possible to go beyond the standard four beat patterns. If you try to confuse the Sequential Voltage Source by switching from 5 steps to 3 steps while on the step 4, it will go to step 5 then return to step 1 and loop between steps 1 and 3.

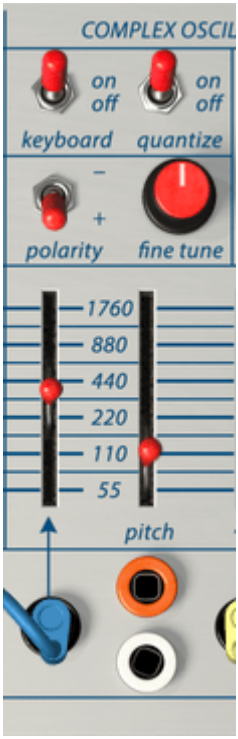
The step switches allow you to switch how certain steps are triggered. This creates interesting rhythmic options. If you combine this with controlling the step speed of the Sequential Voltage Source as in the example below, it opens the door to some very complex rhythmic variation. It doesn't stop there; unlike the hardware Easel, Buchla Easel V has three MIDI inputs all of which you can use to control the speed of the sequences if you patch them in the Pulser voltage input and set the Sequential Voltage Source trigger select to "Pulser".



The Sequential Voltage Source triggered by the Pulser

The sliders of the Sequential Voltage Source allow you to set the voltage level that is output by each step. To quickly calibrate the sequencer to octave steps, set a step to 10 and patch the blue sequencer out to the black Complex Oscillator input and set pitch on the Complex Oscillator to 110. The 220, 440 and 880 marks will give you access to higher octaves.

Here's a simple patch to create pitches with the Sequential Voltage Source:



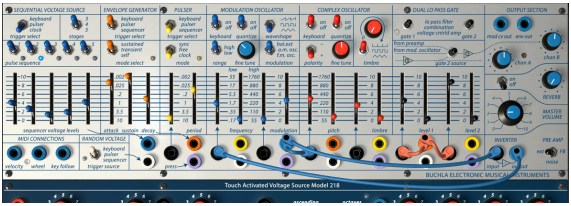
How to create pitches with the Sequential Voltage Source

As stated above, it is important to see the Sequential Voltage Source as a general voltage control tool. You can use it to create changing timbre states or to change the speed of the Pulser, the slope of portamento or as a stepped LFO when controlling the Lo Pass Gates.

When the Sequential Voltage Source is set to receive its triggers from the Pulser many things can happen. If for example you patch the Envelope Generator to control the speed of the Pulser as demonstrated in the Pulser Chapter [p.50] you can vary the speed of the Sequential Voltage Source in lots of fun ways. Try setting the attack of the sequencer to 3.5, the sustain to .002 and the decay to about .2.

6.3.2. Tutorial: Inverted control of the Oscillators

The usefulness of the Sequential Voltage Source can be doubled by feeding it into the Inverter in the Output Section. By doing so you invert the voltage of the steps. High steps will be low and vice versa. Imagine what happen when you feed the Complex Oscillator with the standard voltage output of the Sequential Voltage Source and the Modulation Oscillator with the inverted version of the steps; you'll have two melodies mirroring each other.



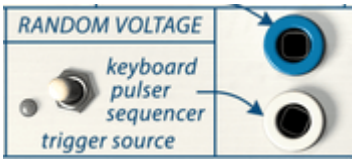
Inverted control of the oscillators

This preset may look a bit complex at first sight, but it's not... The output of Sequential Voltage Source is split in two parts; one controls the Complex Oscillator, the other part is inverted and controls the Modulation Oscillator. The Envelope is triggered by the Sequential Voltage Source and controls the levels of Gate 1 and 2.

6.4. The Random Voltage Generator

Looks can be deceiving. Behind this unobtrusive, modest-looking module there's a world of thought and musical ideas. In the early '50s composers wanted to move away from predictable melodies and embraced randomness as a source of inspiration. In itself the idea isn't new; Mozart, in 18th century, devised a musical game in which you could combine melodies by throwing dice into a two-voice waltz.

Buchla was fond of random sounds and voltages. His most famous random module is the Source of Uncertainty. (He also enjoyed making up original names.) The Buchla Easel V Random Voltage Generator is a very simple version of this module, and it does one thing only; it creates random voltages.



The Random Voltage Generator

A random voltage generator usually has a built-in noise source that covers the whole spectrum of sound from high to low. It will sample this noise and store the sampled voltage. Whenever it receives a trigger it will release the stored voltage and take a new sample. It can be triggered in a number of ways: by the keyboard, a virtual hand, the Pulser or the Sequencer. Its output is available at four (!) locations in the patchbay. This fact alone shows how important Don Buchla considered random voltages to be. For comparison; the sequencer only has two (!) output points on the patchbay.

> The four random output patchpoints on the patchbay each output a unique random voltage. If you want to apply an identical random voltage you must draw copies from one patch point.

When fed into an oscillator in small amounts, it will add some grit to the sound, same with the timbre. In higher doses it generates the well known and often used random pitch sound that was so popular in 1960 SF movies.

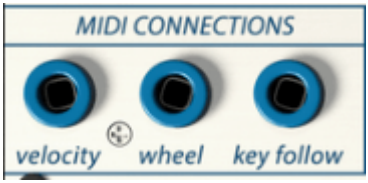
Here again it is fun to use the Inverter to create an inverse version of the random voltages. If you patch the original voltage in Gate 1 and the inverted version in Gate 2, the volume of the two channels will alternate in unpredictable ways. Don't forget to turn up the volume of channel B. If there is still no sound check whether the Gate 2 source switch is in the middle position.

7. MIDI CONNECTIONS

When you draw notes in the editor of your DAW you are, without knowing it, creating MIDI data. With each note you create a note-on message, a gate message, a note-off message and a velocity value. The velocity value imitates how strong a note is struck on the MIDI keyboard. In the note editor it becomes an abstract value that tells the DAW or an external synth about the volume of the note. Velocity values (as most values in MIDI) are in the range 0-127.

7.1. MIDI CC# values

MIDI serves another purpose, when you move a dial a slider or the pitch bend wheel on your synthesizer you generate a stream of control data that can be understood by other MIDI devices. Buchla Easel V is no exception here, whenever you move a slider or a dial you'll send MIDI CC# values to your DAW. It also works the other way, whatever you do on your controller or in your DAW can be understood by Buchla Easel V. The MIDI connections section on Buchla Easel V is where these values enter the Buchla Easel V.



The MIDI connections section

7.2. MIDI streams

At the Velocity Output all velocity values from your DAW or external controller arrive. For the Buchla Easel V to understand these values its MIDI channel must match the MIDI channel that your controller or your DAW sends. By default Buchla Easel V will receive MIDI data on all 16 MIDI channels. You can change this by selecting a specific channel in the lower toolbar at the bottom of the screen.

> This comes in handy you want to use an external controller to use a number of instances of Buchla Easel V. You could for example create two different sequences on the Beatstep Pro and set sequencer 1 to control an instance of Buchla Easel V set to receive on channel 1 and sequencer 2 set to channel 2, to control a second instance of Buchla Easel V set to receive on MIDI channel 2.

From the Wheel Output you can patch the output of the modulation wheel on your controller to any of the black input patch points.

Patching the Key Follow out to an oscillator enables you track the pitch of an external keyboard. You could use this to open the Lo Pass Gates; higher notes will then open the Lo Pass Gates further creating a brighter sound.

7.3. MIDI and VST

The original Easel had many limitations; the stages of the Envelope Generator could not be voltage controlled. To change the amount of reverb you have to move a dial. The VST version of the Easel changes all that, every parameter of Buchla Easel V can be "voltage controlled", not with voltages but with MIDI data streams. When you know the CC# of a dial, a slider or switch you can change its value from the DAW or using an external controller. Fortunately you don't have lookup the CC# of every slider or dial to control it, Buchla Easel V, the DAW and the Controller will help you with that.

7.3.1. Buchla Easel V and your DAW

When you start up Buchla Easel V in Ableton or similar DAW you're in for a big surprise. Nearly every parameter of Buchla Easel V can be controlled with CC# values. You would expect to be able to control sliders and dials but the plugin version of Buchla Easel V also allows you to control switches on the panel even if they are three way switches, that in itself creates an astounding array of options.

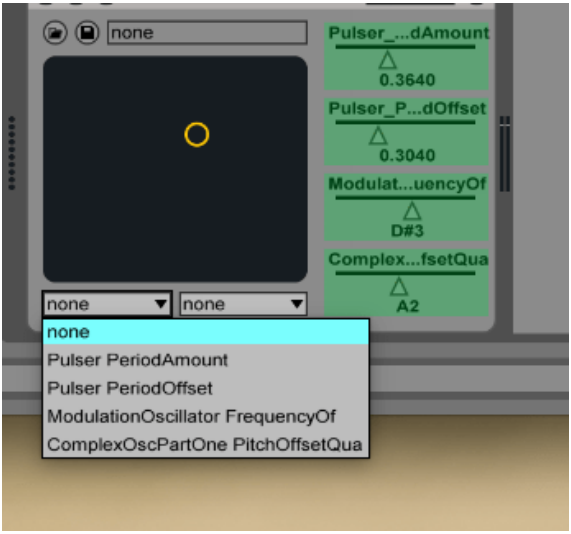
Each time you start your DAW, it will read the content of your plugin directory. On the Mac that is the Library/Audio directory. Depending on what you have installed at startup you will find copies of the Buchla Easel V plugin in the /Components and in the VST and VST3 directories.

If you want to control Buchla Easel V sliders and dials from Ableton you will have to tell Ableton how to control them:

- Drag a copy of Buchla Easel V from the VST panel to an empty MIDI track.

- Click on the downward arrow to open the configuration screen.
- Click on "Configure" to be able to add parameters to the panel.

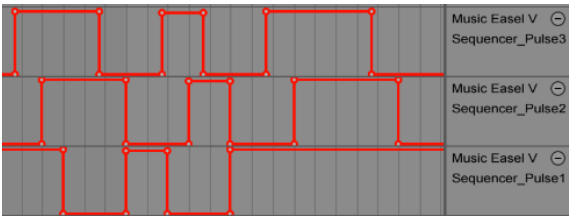
The Buchla Easel V panel will now open. When you now move sliders and dials they will be added to the configuration window.



Buchla Easel V parameters defined for cross modulation

This is an attractive option if you are performance oriented, you can now assign two Buchla Easel V parameters in the control assignment window of Ableton and cross modulate them.

Another intriguing option is to create parameter tracks in the arrangement view of Ableton. Imagine being able to slide all five Sequencer sliders simultaneously or turn Sequencer steps on off in an Ableton control lane.



Parameter tracks in Ableton's arrangement view

> It does not stop there, if you have some proficiency with the MAX4Live (M4L) programming language you can create Max patches that store groups of switch settings, sliders settings etc. and recall them together.

7.3.2. Parameter control using external controllers.

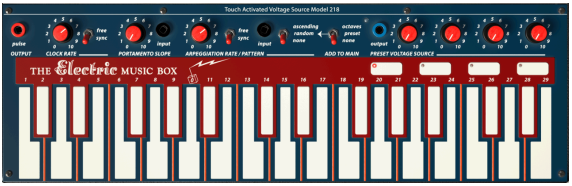
The BeatStep Pro and the BeatStep are perfect controllers for Buchla Easel V. Their control modes enable you to control nearly every slider, dial or switch on Buchla Easel V. The velocity values you programmed in the BeatStep sequences are available at the MIDI output on the control panel, as are wheel movement and the key follow voltage. It also works the other way around; knob and slider movements on Buchla Easel V can be recorded in your DAW.

It is possible to use Buchla Easel V to control your modular Eurorack setup. It has an unexpected advantage: if you want to couple a hardware Easel to your modular system you need a (usually) expensive interface that translates the Easel control voltage "language" to the Modular environment. With Buchla Easel V that problem does not exist. But there is another problem you are faced with, your average audio/MIDI interface is not designed to handle control voltages. It handles audio signals in the range of 20 to 96 kHz very well, but it doesn't like signals in the 0 to 20 hz range. Most audio interfaces are AC-coupled devices that consider control voltages hum; something that needs to be removed. If you want to send control voltages from Buchla Easel V directly to your modular setup you need a DC-coupled audio interface.

8. THE KEYBOARD SECTION

The original Easel had a touch capacitive keyboard of 29 keys. The keys would generate a gate when held down, a pitch control voltage and a pressure control voltage. To generate a pressure voltage you would place your finger on a key and then gradually put more of the skin of your finger on the key. The keyboard was very responsive and would ever register the touch of your nail.

The original Easel is very much a performance instrument, the sliders are laid out in pairs, one for the left hand, one for right hand. The expressiveness of the original keyboard is lost in a software emulation because you cannot create expressive voltages as on the original touch capacitive keyboard. The solution to this the Arturia team came up with is absolutely brilliant. They gave you, the composer/performer a pair of virtual hands. The virtual hand section of Buchla Easel V catapults this instrument in a whole new class and opens a world of creative options.



The Keyboard

> **Note:** If your controller has channel aftertouch or poly aftertouch capability, a pressure Control Voltage is generated, which is available at the purple outputs of the patch bay.

Above the keyboard you'll find the keyboard control voltage strip: a number of dials, inputs and outputs that enable you to use the keyboard as a control voltage source. The Clock generates pulses, portamento and allows you slew the voltage between two keys. There's an arpeggiator, an octave switch and a preset voltage source. We'll cover all these in more detail below.

The Keyboard voltage control strip

The best way to understand the keyboard control voltage strip is to see it as a voltage mixer/processor. The keyboard itself is already a voltage control source; each key generates a voltage. The 29 keys will generate 29 stepped voltages from low to high. How these voltages will affect a destination will depend on the position of the input slider of the module you want to control with it.

The voltage you have "programmed" in the four preset voltage pads is added to the voltage output of the keys. The same with the octave switch which will add one volt for every increase in octave, and the arpeggiator that will cycle between the voltages of the keys you hold.

8.1. The Clock

The Clock is a central unifying force in Buchla Easel V. In a similar way as the biological clock in our body to which all organs in the body synchronize, the modules in Buchla Easel V can be synchronized to the Clock thus creating a coherent rhythmic environment.

The Clock generates a periodic pulse. It is the main trigger source of Buchla Easel V. On startup it is in sync mode; it will follow the Clock tempo of your DAW or external controller. The Clock follows the song position pointer; stops when a MIDI stop is received and starts with a MIDI start.

The Clock

The more common use for the Clock is to trigger the Sequential Voltage Source and the Pulser. On the Sequential Voltage Source you can set "Clock" as a trigger source. In the Pulser you set the switch as a mode.

In "Free" mode the Clock will run independently. It will no longer track external MIDI tempo messages and will ignore Start and Stop Messages.

To know which input accepts this pulse output, grab a patchcord at the output and look for the input patch points in which the square changes into a circle.

8.2. Portamento

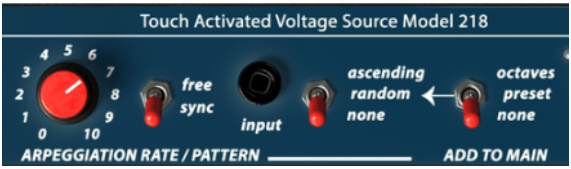
When you play the keyboard the pitch will change abruptly from one key to the next. The portamento dial allows you "ease" that transition. Instead of an immediate change of pitch, the pitch can be made to change gradually. The Portamento dial slews the voltage generated by the keyboard after the arpeggiator.

Portamento

The slew rate can be regulated with the dial and control voltage input. It is the speed of change that is under voltage control. You could for example patch a random voltage in this input to randomize the amount of portamento or patch a sequential or preset voltage in this output to achieve an ever changing portamento effect.

8.3. The Arpeggiator

The arpeggiator plays the notes held on the keyboard in ascending order or in random order. The rate is defined by the rate dial and control voltage input. A switch allows for MIDI Sync. In this mode, the arpeggiator rates (incl. control voltage input) will be quantized.



The Arpeggiator

Unless you are a supersonic mouse virtuoso, you will need an external keyboard to use the arpeggio. The note you hold down on the keyboard will be alternated in ways that can be defined using the arpeggiator switches.

The switches to the right of the arpeggiator allow you to select different arpeggio patterns. The switches work in series. You start by selecting a setting on the right most switch: octaves, presets or none. In Octave mode the arpeggios will spread over multiple octaves. In preset mode the arpeggiator will take the current voltages of the preset pads and add them to its output. In "none" mode the output of the switch is neutral.

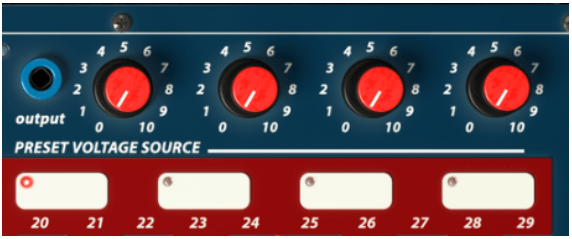
The switch to the left of that determines "the walk" of the Arpeggiator, ascending, random or none (neutral). Combining the settings of these two switches allows for many variations.

When in sync mode and moving the Arpeggio dial keep an eye on the tooltip in the lower toolbar below the keyboard. It will display the tempo value in tempo divisions. It shows you how the arpeggiator is currently synced to the clock.

The control voltage input enables you to control the speed of the arpeggiator. An interesting aplication of this is to control the speed of the Pulser in free mode.

8.4. The Preset Voltage Sources

The four preset voltage sources on the keyboard are used to offset the voltage that is generated by the keyboard. They can generate octaves or use the preset values defined by the dials. There is an output available to send this voltage to other destinations.



The four Preset Voltage Sources

The original Easel had only three pads. The new Easel and Buchla Easel V have four. There are many performance situations in which the Preset Pads can add an interesting twist to an improvisation.

In addition to the obvious choice of changing pitch you can also use it to control the speed of the Pulser/Sequential Voltage Source. Because you can set the voltage of a pad in real time using the dials you can use these dials in the same way as sliders to control destinations directly. Just patch the output of the Preset voltage source in an input on the patch board and control any destination. You now have two manual controls to control that destination: the manual slider and the preset dial.

You can also choose to set certain starting voltages for each pad and then introduce these voltages during a performance. Use this to transpose the voltage of the arpeggiator to predefined intervals.

Output of the Preset Voltage source added to Complex Oscillator

In the above patch the values stored in the Preset Voltage Source are sent to the Complex Oscillator, where they control its pitch.

9. THE OUTPUT SECTION

In the Output Section you'll find everything to do with connecting Buchla Easel V sound sources to the outside world.

9.1. Control Voltage Outputs

The Modulation Oscillator is hardwired to the Complex Oscillator. There is no need to create a patch connection between them, the connection is made internally. For most situations that is an elegant solution. In Buchla Easel V the control voltage of the Modulation Oscillator is available here at this output patch point. If you want to use the Modulation Oscillator to modulate other units on Buchla Easel V you can now draw a patch cord from the "mod cv out" in the Output Section to a destination.

The Env Out is not an additional control voltage output of the Envelope Generator as you might think, but of the Envelope Follower that is part of the Pre-amp. Refer to Pre-amp [p.71] for a more detailed explanation.

9.2. Channels

The Channel A and B dials set the final level of sound that leaves the two gates of the Dual Lo Pass Gate. Channel A is the usually the output for the Complex oscillator, Channel B for the Modulation Oscillator. The actual output will depend on the settings of the switches in the source mixer to the left of it; Channel B can carry either the sound of the Modulation Oscillator, the output of the Pre-amp or the summed (out of phase) output of Gates 1 and 2.

9.3. Reverb

In the days of the original Easel, digital reverbs were either unavailable or outrageously expensive. So of most the synthesizers manufactured in the sixties and early seventies (think EMS Synthi) had spring reverbs. A spring reverb is a very simple device; you connect the sound source to the start of a metal spring and pick it up at the end of the spring. Spring reverbs have a characteristic sound that has become the trademark of that era. The original Easel had three springs, later versions four. Buchla Easel V of course has no springs and emulates them in the digital domain. There is another important difference in Buchla Easel V: the reverb times can be controlled using Function Generators or Gravity "voltages". Refer to the Left Hand and Gravity sections [p.86] for details.

The reverb dial allows you to mix dry and wet signal. The on/off switch allows you to quicky turn off reverb. As it is under CC# control, you could use this as a performance tool.

9.4. Master Volume

The Master Volume dial controls the output of Buchla Easel V after the reverb has been mixed in. Remember that in the VST version of Buchla Easel V the master volume can be controlled using CC# values.

9.5. Pre-Amp

The Pre-amp can have three functions: Envelope Follower, Noise Source or Feedback Source. Select a function by click-dragging vertically over the switch.

9.5.1. The Envelope Follower

In the early days of electronic music it had a reputation of being sterile. In fact it often was. The only way to shape the loudness of the sound was using a envelope generator. Composers and performers started looking for alternative ways to create interesting amplitudes. The envelope follower was the answer to their prayers. An envelope follower registers the loudness/amplitude of an incoming signal and creates a control voltage contour that is an exact match of that signal.

The Envelope Follower in the Pre-amp is capable of generating very detailed control voltages. Try to patch it into the timbre input or have it control the level of Gate 1. If your input signal is a repeating drum sound the Easel will follow along. Using your voice to control the level or the pitch of the Modulation Oscillator could also yield interesting results.

The output of the Envelope follower is available at the "Env Out" patch point.

9.5.2. Making Noise

The original Easel had no noise source. We've added it in Buchla Easel V. Noise is just the thing you need to create percussive-type sounds or to create atmospheric soundscapes. You can achieve a similar effect when using the Random Generator in small doses but it is not the same thing.

You can find it in the middle position of the Pre-amp switch. To hear it, draw a patch cord from the Env Out in the top of the Output Section to the control voltage input of the Complex Oscillator and turn up the control voltage slider. You'll hear a shaky oscillator tone; that's what noise does.

9.5.3. Feedback

Last but not least is the Feedback option. In the patch below we will create a feedback loop using the Modulation Oscillator. We will feedback the output of channel B to itself:

- Start by selecting the default preset.
- Set Gate 2 on the Dual Lo Pass Gate to VCA.
- Switch the Gate 2 source on the Dual Lo Pass Gate to Pre-amp.
- Raise Gate 2 level to max.
- Set the Pre-amp mode switch in the Output Section to feedback.
- Set chan A dial to minimum (we don't want to hear the Complex Oscillator).
- Raise channel B dial slowly; at around 7 you should hear some feedback.

Once you have some feedback going experiment with modulation amount on the Modulation Oscillator to create different timbres.

!: When experimenting with feedback it is always a good idea to keep your hands on the volume dial as Feedback tends to go out of control very soon. Be delicate and alert!

9.6. The Inverter

The Inverter circuit takes a control voltage input and inverts it at unity gain. When you patch a rising voltage into the Inverter it will be inverted to a proportionally-equal falling voltage. If the angle of the incoming voltage is steep the inverted falling voltage will be steep. In other words the voltage is inverted. It's not a coincidence that the Inverter is right next to the Pre-amp. Patching the output of the Pre-amp into the inverter can lead to endless hours of musical delight.

10. THE BUCHLA EASEL V UNIVERSE

Things have changed a lot since the introduction of the first Easel. The envelope generator for example, over the years developed from a simple device with an attack, a sustain and decay into a complex multi stage device with repeatable decay stages and voltage controlled attack, sustain, decay and release stages.

Buchla Easel V again pushes the envelope of voltage control which the introduction of the Gravity Universe in with control voltages are replaced by novel forms of control such as control curves and gravity forces.

10.1. Overview

One of the limitations of the original Easel is that it has only seven control voltage destinations; the black input patch points in the patch bay. The Buchla Easel V Universe goes far beyond that. It has three additional ways to create "control voltages":

- The Left Hand section which is about creating complex control voltage curves
- The Right Hand section is a sequencer that enables you to generate polyphonic sequences
- The Gravity section, a universe with projectiles that collide and interact with Planets, Repellers and Walls. It's an astoundingly novel way to create control voltages.

The three sections share a control panel. In the control panel you can enable and disable each section and mix the signals generated in the three sections. The sections offer advanced control options, that can be summed to control modules on the Buchla Easel V main panel.

> When working in one of the sections it is good practice to keep the others switched off. While in the proccess of creating voltages it's important to only hear the section you are working in.

The section menu

10.2. Working in a section

When you click on a section header, the header will turn red and its edit window will appear. To enable the section click on the on/off button in the top right.

The exception to the rule is the Effects section, which cannot be turned on or off. It contains two parralel effects slots that you can fill with any of ten different effects. You enable or disable these slots by clicking on the on/off symbol in the upper right corner of the effect.

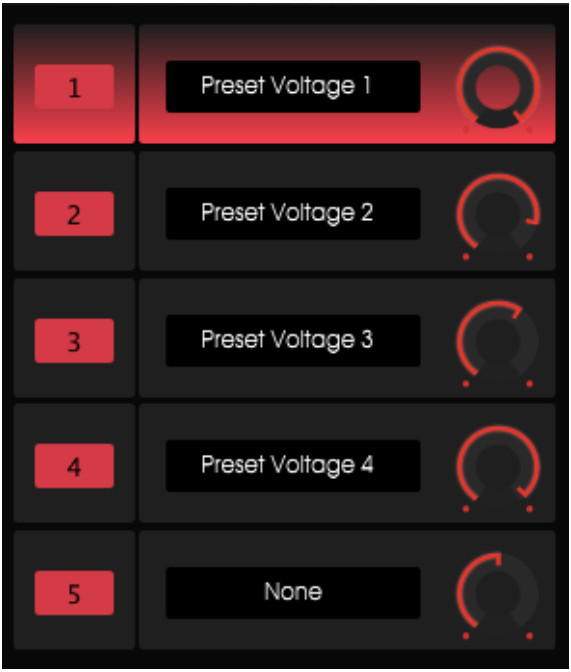
Buchla Easel V will enable you to create an incredible complex soundscape. It has so many advanced ways to create control voltages and so many ways to connect sources and destinations that even the most experienced sound designer will be amazed.

> **Tip:** The power of the Gravity section combined with that of the Left- and Right hand sections will allow you to create endless combinations. You may sometimes find yourself lost. To find your way in this maze of options retrace your tracks. The red on/off switches will be lifesavers. When lost, switch off all sections and restart them one by one.

10.3. ADVANCED MODE: The Left Hand

When the Left Hand screen opens you'll see five Function Generator slots. By default the first slot is active and running. To deactivate it click on the number of the slot. It will turn black indicating that it is now inactive. Click again to reactivate it. By activating and deactivating slots you also mix the control voltages that are generated by them.

> There are of course no control voltages in the digital domain; we emulate them in software



Preset Voltages Generator mixer

The on/off option allows you to experiment with different combinations of active slots.

The dial to the right of the slot name controls the amount of "voltage" that the Function Generator will send to the destination.

10.3.1. The Function Generator

In a Function Generator you create a curve that you can use to control almost all of the modules on the Panel of Buchla Easel V in ways that are not possible in the hardware Easel.

10.3.1.1. Connection to destinations

When you click on a slot its background will turn red, indicating that the curve in the slot can be edited and the destination screen opens.

Available destinations

In this screen you link to destinations and their parameters. Please notice the white line dividing the screen in two halves. The top half lists the available main destinations, the bottom half the sub parameters of the destination that can be targeted.

Click on a destination in the top window and the available parameters will appear in the lower half of the window. Every destination has a specific range of parameters you can control.

For an overview of all available destinations please refer to the Overview of Routing Destinations [p.109]

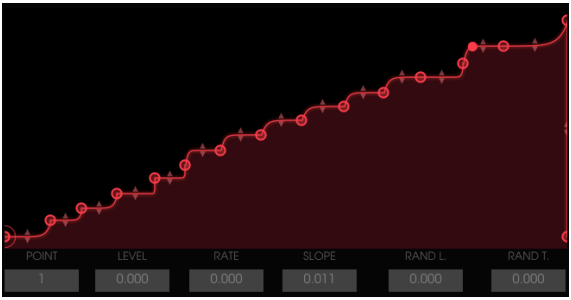
Selecting the main destination and one of its parameters is a simple matter of clicking on them. Once you have made your choice click on "close" to finalize your choice. The name of the destination will now appear in the name strip of the slot and the Voltage Envelope Window will open.

10.3.2. The Voltage Preset Window

This is the edit window in which you create your Preset Voltages. A Preset Voltage consists of a string of Vectors. Don't let the term Vector scare you: a vector is a force that moves with a specific speed and direction. Some vectors will move in a straight line while others will be curved. You can have a force that moves in a "V" shape or in an upside down pattern.

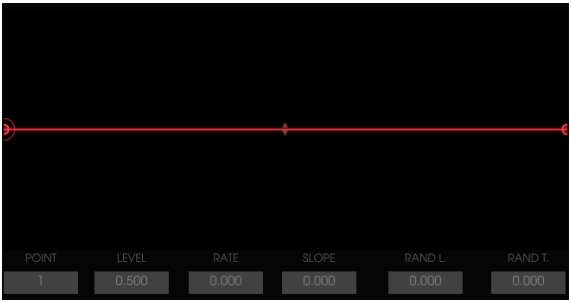
> ♪: Music is all about creating vector strings. The way a blues guitarist bend his strings is a vector. It's a very controlled force that defines his personal style as a guitar player. You'll find vectors in the vocal phrases of Indian music or in the complex and refined string bending techniques of a sitar player. In Western music this form of phrasing is called melisma.

The Function Generator is a perfect tool to create complex vector strings that you cannot make any other way. In Buchla Easel V we refer to a vector string as a curve.



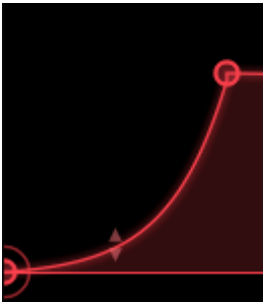
A complex vector string

In its initial state the voltage envelope window has three points: start- , middle- and end point. The start- and end points cannot be moved, they are stuck to the outer horizons.

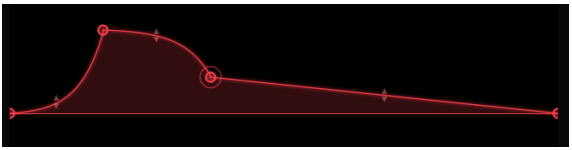


Initial state of the Voltage Envelope Window

Click somewhere in the middle of the line to create a new point. This midpoint can be dragged to any position in the window. By dragging it you alter the envelope curves to the right and left of it. To further control a curve grab the little triangle arrow symbol in the middle of a line and drag it vertically.



The two stage envelope you created can now can be expanded to a three stage by clicking anywhere on the line or outside it. Again this point can be dragged to any position in between the previous and next point. To remove a point right-click it.



Three stage envelope

When you drag a point the data associated with it will appear in the little display windows below the voltage envelope window.

Once you have defined a number of points you can begin to edit the details of each point. Select the point you want to edit by dragging vertically in the little point window in the lower left of the Voltage Envelope Window. A little circle will indicate which point is active and can be edited.

- Level: will change the amplitude of the current point
- Rate: will change the speed with which the level of the "voltage" changes between this point and the next. It's effect is bi-directional; dragging this value will also change the rate of change between this point and the previous point
- Slope: will change the properties of the envelope curve between this point and the next
- Rand L: random level; will add a random amount to the level.
- Rand R: random rate; will add a random amount to the rate.

The Random knob in the humanize section will be effective only if you have set "RAND L" and "RAND R" values for points. You set the Random value by choosing a point and changing the RAND L/T values by sliding your cursor up/down directly in the RAND L/T combo box. After that you can add a general randomness multiplier with the Random dial.

The Random function is a multiplier on all the randomness parameters in a Function Generator. At 0, no randomness is calculated. At 1, the actual randomness function is calculated. The default randomness is 1.

10.3.2.1. Applying curves

Once you've created a curve you may want to experiment by applying it to different destinations; what effect does this curve have when I apply it to the envelope decay instead of oscillator pitch?

Changing your mind is easy, open the Function Generator destination menu by clicking on the destination name you have currently defined and choose an alternate destination.

> The Reset option will clear the destinations you have selected but keep the curve you create intact.

10.3.3. Trigger Modes

In the mode section you determine the behavior of the Function Generators:

- In ONCE mode a Function Generator will run its trajectory once and then stop. If it receives a trigger somewhere along its path it will restart from the beginning.
- In LOOP mode a Function Generator will loop continuously only to restart when it receives a trigger while looping.
- In RUN mode a Function Generator will loop freely and not respond to any trigger, but will follow the song position pointer in the DAW.

10.3.4. Rate

By default the Rate of a Function Generator is not synced to any clock. In this mode Rate can vary from 0.1Hz to 20Hz.

When the Tempo Sync button is active, a Function Generator will respond to MIDI start events. A Function Generator will then reset every time a MIDI start event is received. Its tempo will sync to the external MIDI clock.

10.3.5. Humanize

The random dial is a humanize function. It will add a certain degree of randomness to the notes. While moving the dial keep an eye on the value displayed in the lower left of the Buchla Easel V window; when at zero, the notes will not be randomized.

The Random knob will be effective only if you set "RAND L" and "RAND R" values for points. So first you have to choose any point and change the RAND L/T values by sliding your cursor up/down directly in the RAND L/T combo box. After that you can add a general randomness multiplicator with the Random dial.

You can experiment like this :

On a flat unipolar line with only first and last default points:

- Create a curve with one or two points and select the Complex Oscillator pitch as destination
- Apply a positive amount of modulation to the Complex Oscillator pitch with the "amount" dial
- Select point 1 and set RAND L value at 1.000
- Set Random knob at max, and mode to "LOOP".

Now play and hold a note; each time the function is retriggered, you'll hear differences. If from there you set the Random knob to min, no modulation will be heard.

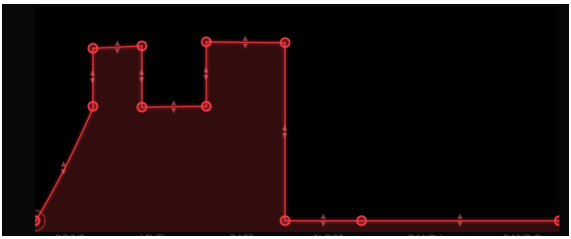
- Set RAND L values for point 1 at 0
- Add a point to your curve, and move it up vertically. If you like, create a classic ramp-up shape
- Select this new point (which is now point 2) and set Rand T(R) value at 1.000. Set the Random knob to max.

Again play and hold a note; each time the function is retriggered, you'll hear differences.

> The Random function is a multiplier on all the randomness parameters in the Function Generator. At 0, no randomness is calculated. At 1, the actual randomness function is calculated. The default randomness is 1.

10.3.5.1. The Smooth Function

The Smooth Function takes the sharp edges of the function you've created. In the Buchla world this was called an integrator. In West Coast synthesis this function is referred to as a Slew Limiter or a Lag Processor.



The smooth function

Note The Smooth parameter adds low-pass filtering to the amplitude variations. At 0, no smoothing is applied. At maximum, it should take about 300 ms to go from one value to another in response to a ramp. The Default setting is 0 ms.

10.3.5.2. Bipolar curves

There will many situations in which you need a bipolar curve. You want to move a pitch up from its present frequency and the move it down to below its current frequency and finally rest it on the frequency it started. By default the curves you create in a Function Generator work this way; they are bipolar.

10.4. ADVANCED MODE: The Right Hand

The golden rule in Electronic Music is: "You can never have too many sequencers." By interlocking several sequencers you can make soundscapes that move in perfect synchronicity. The Right Hand is a polyphonic 32-step sequencer with an extra flavor; in addition to polyphonic control of the Buchla Easel V voices it also allows you to use the Preset Pads on the Buchla keyboard to transpose the 32 sequence steps individually.

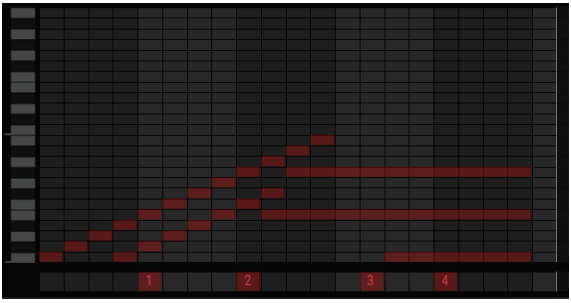
10.4.1. Setting the length of the sequence

As a rule you start by setting the length of the sequence by dragging the vertical end bar to the left. This will reduce the number of steps in quantized amounts.

10.4.2. Editing note information

The keyboard grid in the column on the left will guide you when placing pitches on the grid. You enter a note by left-clicking on a location in the grid. You remove it with a right click of your mouse. Once created you can move a note to any position on the grid by grabbing it in the middle and dragging it to a new location.

The duration of a note can be extended by hovering over the right half of it until the cursor changes to an extend symbol. You can drag a note out to any desired length. Extending and shortening a note always happens in quantized steps. In similar way you can move the startpoint of a note by hovering over the left half of a note and moving the startpoint to the right. This will of course only work if the note is longer than one grid position. The grid will allow you to create chords by stacking multiple notes, this will only have an effect if you have set the polyphony setting to two or more.



A sequence transposed by the Preset Voltage Sources on the Keyboard

If you click & hold somewhere in the bottom lane of the sequencer and drag the cursor up, numbers will appear from 1 to 4. These refer to the four presets on the keyboard. The voltages from the selected preset will be added to the voltage defined in the steps above it. If there are no preset voltages selected in the locations to the right of it, the voltage level of current preset will be maintained until the sequencer reaches a new preset voltage source change. The preset voltage source is monophonic, setting a value for a step clears the previous active voltage source until the next change.

If you enjoy exploring complexity you could modulate the voltages of the preset pads while they are modulating the RH sequences. To do so, go to the Left hand, select Function Generator 1 and in the routing window select the keyboard (=RH) to modulate Preset voltage 1.

> **Note** Being observant, you have probably noticed that it is not possible to edit individual velocities in the Right Hand Sequencer. If you want to apply velocity variations to the sequence, the way to go is modulate the level of the Dual Lo Pass Gates with the Pulser, the Envelope Generator, or a Preset Voltage of the Left Hand.

10.4.3. Right Hand Sequencer Modes

The sequencer can be in one of the following three modes:

- ONCE: The sequencer will play once every time a new note is triggered and will run as long as the note is held. The lowest C corresponds to the note that is played (last note priority). When all notes off are received, the notes contained in the sequencer are stopped.
- LOOP: The Sequencer will loop continuously and restart when it receives a trigger while looping.
- RUN: The Sequencer will loop freely and not respond to any trigger and will follow the song position pointer of the DAW.

The speed of the sequencer can be set in two ways: when the Tempo Sync button is off the sequencer is running in free mode. When Tempo Sync is on, the rate syncs proportionally to the external MIDI clock and can sync ratios varying from 4 bars to 1/128.

10.4.4. Gate length

The humanize function will add randomness to the gate length. Each note you enter in the Right Hand Sequencer will be triggered and shaped by the Envelope Generator. If the Envelope Generator is in Sustained mode you can vary the length of the gate time of each note with the Gate Length dial. The value selected here will be added to the sustain time of the Envelope Generator. When the Envelope Generator is in transient mode this dial will have no effect.

The gate length dial allows you to set the gate duration of all notes in the grid simultaneously. The gate length can be varied from 0.01-0.99.

Gate length and Randomize Functions

!: If a note consists of several tied steps The Gate Length and Gate Random functions will only affect the last step of the note.

The Gate Random dial will randomly vary the Gate Length time set with the Gate Length dial.

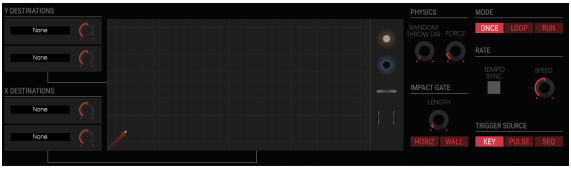
To summarize: with the Gate Length function you can add sustain time to sustain already defined in the Envelope Generator. The Random dial will randomize the amount of sustain added with the Gate Length dial.

Another fascinating way to control the gate length of the notes in the Right Hand sequencer is with a Left Hand Preset Voltage. If you sync both Hands to the Keyboard clock you can draw a Preset Voltage curve that selectively shortens the gate of certain sequencer steps.

10.5. ADVANCED MODE: The Gravity Universe

We all know what gravity is. Gravity is omnipresent in games. It was around 1935 when the first pinball machines were introduced in arcade halls. Their rise to fame started when in 1947 the flipper was invented and you no longer had to tilt the machine to get the ball rolling.

Gravity can also be used to create "control voltages" and that is exactly what we've done in the Gravity Universe of Buchla Easel V; it is filled with projectiles that collide and interact with Planets, Repellers and Walls. As you will discover in the next few pages it's an astoundingly novel way to create forces that move, swirl and bounce. Forces that can then be applied to oscillators and amplifiers. Game physics applied to music.....



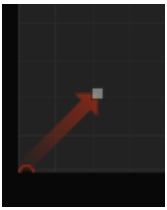
The Gravity Section

Gravity is the third section on the left. As with the Left and Right Hand you can enable/disable it by clicking on the little red dot in the top right corner. Center stage is the Gravity world itself, this is where you launch projectiles that will bounce off the horizon walls and will collide with objects placed in it. The Universe is XY mapped and a rectangle with twice as many pixels in the X axis as in the Y axis. The X axis is scaled from 0 to 20 and the Y axis from 0 to 10.

> In the Real Universe the horizon is everywhere. Whether you look up or down the horizon is what you see in front of you. In Buchla Easel V we call the edges of the Universe the Horizon.

10.5.1. The Launcher

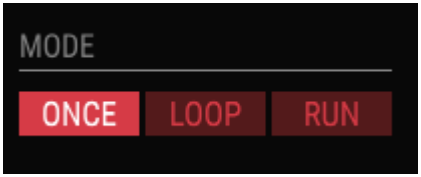
The upward pointing arrow in the lower left corner of the Gravity Universe is the Launcher. It will launch a projectile when you press a key on your (external) keyboard. The projectile will stay alive as long as you keep the key down. It can also be triggered by the Pulser or the Sequencer. You can select a trigger source in the lower right half of the screen.



The Launcher

When a projectile hits the horizon of the Gravity Universe it will not lose any energy. In other words it has a perfect elastic collision, its kinetic energy will be preserved.

In the top right section of the screen, in the "once, loop, run" menu, you select whether the launcher will launch once, loop or run continuously.



Gravity Mode options

When set to loop, the speed dial below this menu takes on an important role, as it will determine the period the projectile will stay alive. Try setting the speed dial to about 0.30. While turning the dial keep an eye on the data display window in the lower half of the screen. At about 0.30 the projectile should stay alive for about two seconds before being re-triggered.

10.5.1.1. Controlling direction and force of the Launcher

The direction and the force with which the projectile will be launched can be set with the mouse, by dragging over the end point of the launcher. The white dot in the endpoint will change to a square, which you can drag in all directions. This enables you set the size of the projectile and to align it with the vertical or horizontal axis. The Launcher is, as you may have understood by now, in the center of a Cartesian plane. The Launcher can launch a force vertically in the "Y" direction, horizontally in the "X" direction and anywhere in between. A very small launcher will have little force and its force will move more slowly. This is important to remember when you direct its force towards a Repeller.

10.5.1.2. Randomizing direction

By default the launcher will launch the projectile at an angle consistent with its direction. When you involve the "Random Throw Dir" dial you can vary this direction randomly. The force dial next to it will play an important role when, after being launched, the force meets Planets and Walls. The length dial will set the duration of the trigger when the force meets a Wall or an Object.

10.5.2. Modulation destinations

X and Y are modulation destinations. When you launch the projectile in its default direction; the upper right corner under an angle of 45 degrees, the resulting force will be an equal mix between X and Y. Move the projectile in the direction of the horizontal floor and you have a force in which X dominates. Align the projectile with the Y axis and you have a force that is one hundred percent Y.

10.5.2.1. Selecting Destinations

In the destination section to the left of the Gravity screen you set the destinations of the force created by the Launcher. The process of selecting a destination is similar to that of selecting destinations for the Function Generators.

When you click on a slot its background will turn red, indicating that content of the slot can be edited and the destination screen opens.

The available destinations

If these destinations look familiar to you...they are identical to the ones in the Left Hand destination select screen.

Again this is where you link the gravity force to destinations and their parameters.

> ♪: Please notice the white line dividing the screen in two halves. The top half lists the available main destinations, the bottom half the sub parameters that can be controlled.

Click on a destination in the top window and the available parameters will appear in the lower half of the window. Every destination has a specific range of parameters you can control.

Selecting the main destination and one of its parameters is a simple matter of clicking on them. Once you have made your choice click on "close" to finalize your choice. The name of the destination will now appear in the name strip of the slot.

> While you have the destination select window open you can not make edits in the dials visible on the screen. First close the destination window with either "none" to ignore your selection or "close" to affirm it.

10.5.3. The Objects

You can add objects in the Universe by dragging and dropping them from the objects repository into the Universe. Each object will act differently when the force of the projectile hits it.

You remove an object from the Universe by dragging it back to the object repository.

The objects

There a four types of objects, Repellers [p.90], Planets [p.91], Walls [p.92] and Wormholes [p.93]. There are four instances of every object available.

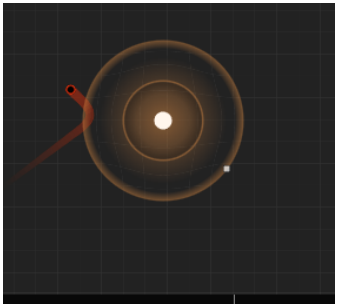
10.5.3.1. Moving an object

Once it is present in the Universe you can move an object by dragging its center point. An object can be moved all the way to the boundaries of the Universe. Part of the object may end up outside of the Universe, this should not be a problem as long as you can grab its center you will be able to move it around.

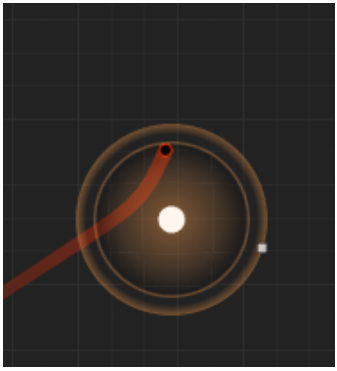
10.5.3.2. Repellers

A Repeller generates a repulsive Gravity field around its center. This gravity field will repel any force directed at it. The ring around the Repeller defines the action radius of the Repeller, inside the ring the gravitational repelling force will become active. Dragging the white dot on the outer ring outwards will increase the boundary of the Gravity field linearly and will modify both the distance of the field and the intensity of the gravitational force.

The Repeller is sensitive to the force directed towards it. If you launch a force at it with the projectile being small and weak, the force cannot penetrate the outer hull of the Repeller.

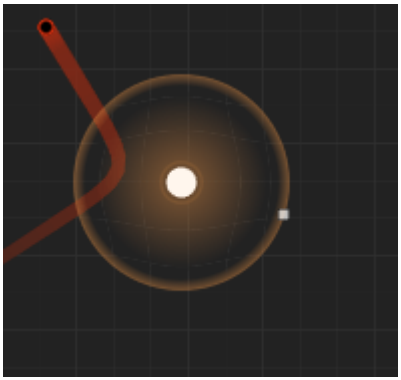


Launcher force and repelling power



The effect of increased force

If you increase the power of the Launcher the projectile will penetrate the hull and may be able to approach the center of the Repeller. The size of the ring surrounding the Repeller and the force you defined in Physics will determine where and under which angle the projectile will be repelled.

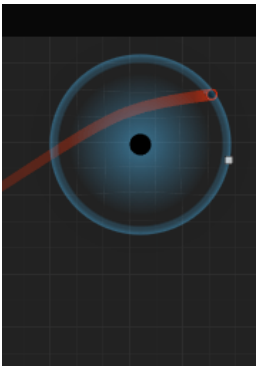


Effect of maximum repulsion

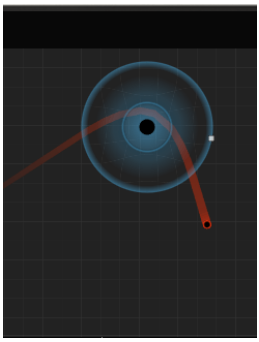
If you are used to understanding these things in formula terms: the intensity of the repelling strength is A / d(projectile, planet center)2 where A is defined by dragging the boundary/ intensity of the force.

10.5.3.3. Planets

A Planet is the opposite of a Repeller, instead of repelling a force it will attract a force and bend its direction around its core. As with the Repeller the ring around the Planet defines the action radius of the Planet, inside the ring the gravitational repelling force will become active. How much it will bend the approaching projectile around its core will depend upon the setting of the Force dial in the Physics section.



Minimum gravitational force applied



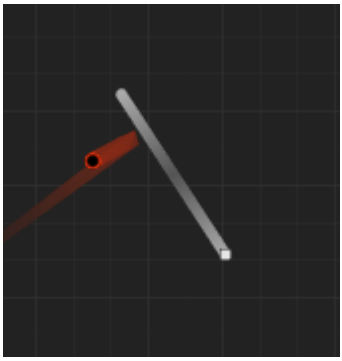
Maximum gravitational force applied

You can place a maximum of four planets in your Universe.

A Planet generates a Gravity field around its center. As with the Repeller you can drag the white dot on the outer ring outwards thereby increasing the boundary of the Gravity field and the intensity of the gravitational force. The gravitational force always points at the center of the planet. Expressed in a formula, the intensity is : A / d(projectile, planet center)2 where A is defined by dragging the boundary/intensity of the force.

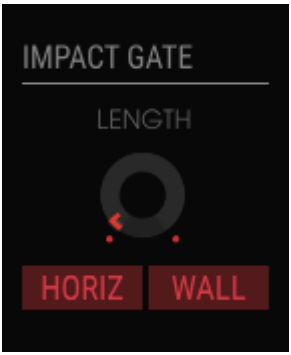
10.5.3.4. Walls

A Wall is a rectangular object with a width of 0.2 and a corner radius of 0.1 (the small edges are half circles). It's a magic baton that you use to constrict the movement of the forces you release with the projectile. It's a very flexible object, you change its size by grabbing the corner with the little white rectangle. The same point can be used to change the orientation of the Wall. To move it to another position grab its center and drag...



Gravity: projectile bouncing off wall

A Wall can either be active or passive. A passive Wall will only bounce the force back. An active Wall will emit a trigger when hit by a projectile.

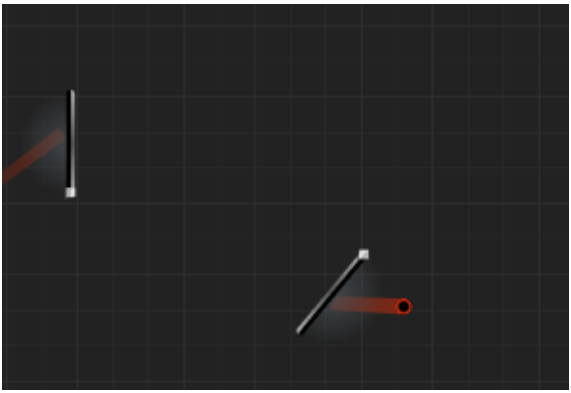


Activating triggers in the Impact Gate section

You can alternate between active and passive states with the Wall toggle switch in the impact gate section next to the Universe.

10.5.3.5. Wormholes

A Wormhole works exactly as we learned to expect in SciFi. You enter on one side and are transported to the side within the blink of an eye. As in SciFi these Wormholes work both ways. If you try to cheat and approach a point from the back, where there's no magic glow you will be repelled.



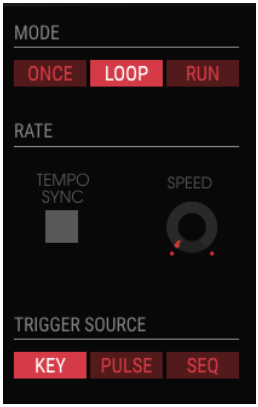
The only known to exist recording of the exact moment a projectile moves through a wormhole

You can place the entrance point and exit point independently anywhere in your Universe. They do not have to be parallel to each other. If you look very carefully you'll notice that there is a mysterious blue pulsing glow on the entrance point. If your forces enter at that point, the force will be transmitted by a teleporter to the exit point and will resume its course with the same trajectory it entered: if it entered at 45° it will exit at 135°.

10.5.4. Mode

Here you decide how long the projectile will stay alive. In "ONCE" mode it will stay alive as long as you keep a key on the (internal or external) keyboard down. When you let go the projectile dies.

♪: It's important to understand that the final behavior of the Projectile is the result of the settings in both the Mode and Rate sections.



trigger modes

In LOOP mode the projectile is re-triggered periodically. The Loop Rate and Tempo Sync toggle set the period of the loop. When un-synced the loop can range from 0.025 Hz to 0.5 Hz. When synced to an external clock, the loop goes from 1 to 8 bars.

- LOOP: The Loop is reset when a MIDI Start event is received.
- RUN: The projectile is never resets, it happily lives its simple projectile life.

10.5.5. Rate

The tempo sync button will sync the Launcher to MIDI Start events. The Projectile position is reset. In loop mode the projectile position will also reset when a MIDI Start event is received.

10.5.6. Trigger Source

The projectile is launched when a trigger is received. The trigger source is selected in the Trigger Source section menu.

- KEY: the Keyboard will launch the projectile
- PULSER: the Pulser will launch the projectile
- SEQ: the Sequencial Voltage Source will launch the projectile

10.5.7. Impact Gate

In the Impact gate you can choose what kind of triggers will be generated when the projectile collides with either the horizon of the Universe and/or the objects.

This is also the location where you set the length of the generated gates using the Length dial. Gate values can range from 5ms to 4s. The default value is 20ms.

The Impact gates interact with the gates generated by the keyboard. If a key on the keyboard is pressed down, the Impact Gate will register this and generate a gate off/gate on signal. The duration between the gate off and gate on should be somewhere between 2-4ms regardless of the tempo. In this case, the Length dial has no effect.

10.5.8. Physics

Both Repellers and Planets will have a gravitational effect on the projectile. A Repeller will reject the approaching projectile, a Planet will attract it. Once the projectile is inside the action radius of either Repeller or Planet this gravitational effect will become active.

- Force is a multiplier on the attraction / repulsion value of the Planets / Repellers. It does not modify the action radius, only the force inside that radius. The values go from 0 to 8; the default value is 1.
- Random direction adds a "slewed S&H" random variation to the direction vector of the Launcher. The rate and slew of the S&H and the amplitude of the angular change increase when the Random Direction is increased. In other words when you increase the random throw value the Launcher will become more and more unpredictable.

10.5.9. Gravity Modulation Tutorial

To initiate the projectile, set the mode to "run". Now point the projectile upward in such a way that it is almost parallel to the Y axis. Now click on the "HORIZ" button ("horiz" is shorthand for horizon). When this button is active it will cause a trigger each time the projectile hits one of the horizons.

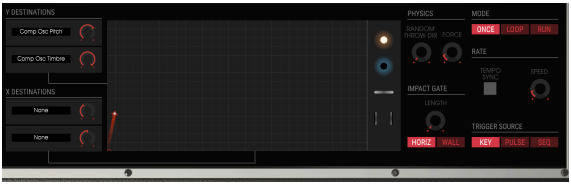
Set Rate/SPEED to 1, Trigger Source to "Key", Impact to "HORIZ" and Length to about 0.3. Length determines the length of the gate of the generated note.

When you now press a key on your keyboard the Projectile will launch in an almost vertical direction. For as long as you keep it depressed it will bounce repeatedly and slowly move to the right. The Vertical movement is a Y force, the horizontal displacement an X force. You'll hear a "beep" every time the force hits one of the horizons.

You're now ready for the fun part. Let's add one or more Y destinations: click on the first Y destination slot and select the pitch of the Complex Oscillator as destination. We still hear nothing; there is one more thing left to do: we have to set the amount of modulation we want to exert on the pitch. Do this by turning the modulation dial (next to the slot label) slightly to the right.

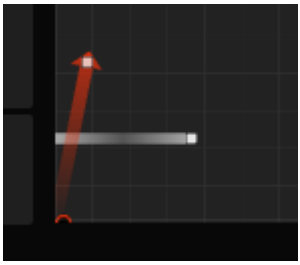
You should now hear the pitch moving up and down every time the projectile hits one of the horizons.

As there is still one slot left for an X-based modulation, we could use it to modulate the timbre of the Complex Oscillator; select Complex Oscillator timbre in the second X slot and dial in a value with the modulation amount dial. To hear the maximum effect, set the timbre dial and the timbre slider to zero.



Using Walls

It takes a long time for the projectile to reach the top horizon, so let's take a Wall from the repository and place it horizontally in the course of the Launcher.



Limitations

Now press a key and hear how the Wall limits the pitch. A trigger is generated every time the projectile hits the bottom horizon. When you activate the Wall button in the Impact Gate an additional trigger will be generated when the projectile hits the Wall.

The moment of impact

By adding more objects you can create an endless variety of voltage control.

10.6. ADVANCED MODE: The Effects

The way we think about effects has changed significantly during the last few decades. Effects were once seen as similar to a sauce added to a meal: not too much, as it bad for your health. They were not considered an essential part of the synthesis process. Today effects are a vital component of every mix, and their importance in some ways even supersedes that of oscillators and other sound generators. Why? Because there is much to gain in this area. In the next few years they will continue to be a source of innovation in music. At Arturia we're in the process of expanding the options of existing effects and reviving a number of older, "retro" effects, bringing them into the 21st century using advanced digital emulation techniques.

10.6.1. Effects Overview

Buchla Easel V provides up to two simultaneous effects, including distortion effects, delays, equalizer, filters, and reverb. To start using or editing the effects, click the FX tab in Advanced mode.

The effects screen consists of two parts. In the top part you select an effect in one of the two effects slots. In the lower half you can adjust the responsiveness of the Lo Pass Gates

As explained in the Dual Lo Pass Gate [p.46] chapter, the thing that makes Lo Pass Gates unique is that they contain vactrols. No two vactrols are alike; they all sound slightly different. In the early days owners of Buchla equipment would often have several Lo Pass Gates and use each one in a different situation because of their individual qualities. In the Gate Response section you can create your own unique sound by defining how the vactrols in the Lo Pass Gates respond to a signal passing through them.

Gate Response

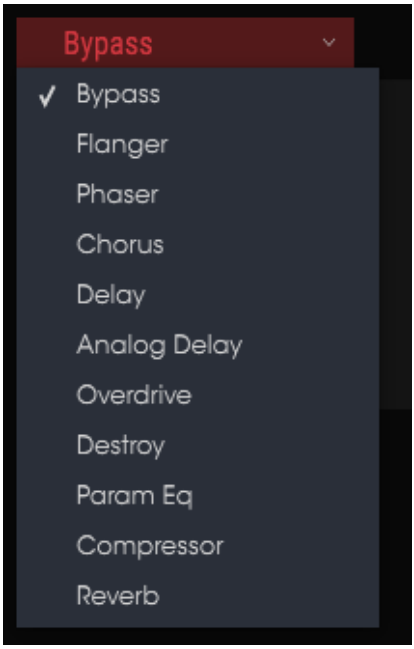
The three Gate response settings enable you to set the characteristics of the Vactrols in the Lo Pass Gates; from "FAST" for sharper percussive types of attack and decay to "SLOW" for a softer attack and a more gradual decay. The Pulser Gate setting determines whether the Pulser has a gate behavior (hold/release) or a trigger behavior (release only).

10.6.2. Selecting an effect

When you first open the Effects section the effects are in bypass mode; nothing is active.

There are two effect slots. You activate a slot by clicking the on/off switch in the top right corner.

Make a selection in the menu and the corresponding FX module will appear in the effects panel, either on the left or the right, depending on the window you choose.



List of effects

> When you change an effect control the numerical value for the parameter is displayed in the lower tool bar on the left side of the application window.

The Wet/Dry dial controls the percentage of the original signal that passes through to the output. Moving this all the way to Dry will remove that FX from the output.

One more thing: All FX parameters are MIDI-assignable, which means they "learn" the controllers on your external USB MIDI device. Refer to the section MIDI Learn assignment [p.20] for more information.

Now open the effects menu and select one of the ten effects. Each effect has a number of dials specific to that effect.

10.6.3. Flanger

A flanging effect is created by combining two identical signals, delaying one of the signals by a small amount, and then modulating the delay time. The recombined output produces a sound that sweeps up through the harmonics of the original signal and back down. This produces a swept "comb filter" effect.

The Flanger effect

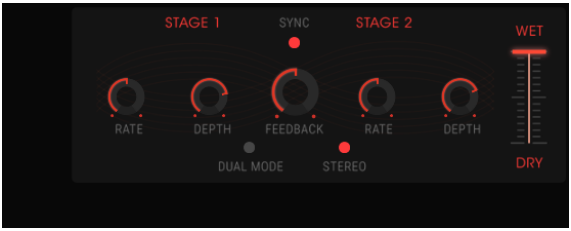
Flanging can create both subtle and extreme effects, depending on the Rate and Depth of the modulation. With higher Depth settings you will begin to hear changes to the pitch of the sound. This is how the circuits in an analog flanger work, and we have taken care to recreate these conditions.

The controls for the effect are:

- Delay: Sets the delay time, which changes the harmonic content.
- Depth: Sets the modulation depth. This is set to "max out" at less than 100% to limit runaway feedback.
- Rate: Sets the modulation rate for the delay time.
- Feedback: Adds positive or negative feedback for a harsher or "ringing" sound. Double-click this control or set it to the 12:00 position for zero feedback.

10.6.4. 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. The sweep is caused when the phase of the affected half is modulated by an oscillator, with the frequency determined by the Rate control. The Depth dial sets the amplitude for the action of the filtering, while Feedback amplifies certain harmonics.



The Phaser effect

This particular phaser is a two-stage phaser. The two stages can operate independently or in sync with each other.

The following parameters are available independently for both Stage 1 and Stage 2:

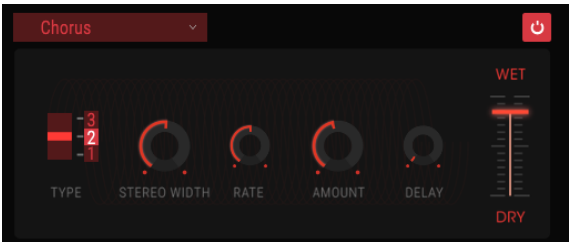
- Rate: Sets the speed of the phaser.
- Depth: Sets the depth of the phaser activity.
- Feedback: Controls the amount of phaser resonance.

Stages 1 and 2 share these parameters:

- Sync: Locks both stages to the current tempo of the DAW and/or the rate of the delay. (These are the only two FX modules with a Sync button.)
- Mode: "Single" means Stage 1 is on the left side and Stage 2 is on the right. With "Dual" both stages process both sides; the Phaser output is mono.
- Stereo: Pans the two phasers in the stereo field.

10.6.5. Chorus

A Chorus effect is similar to a flanger in that it splits the signal, delays one side, varies the delay time gradually, and mixes a number of copies back together. The difference is that the length of the delay time is longer than that of a flanger, which results in a more subtle but still very interesting effect. A chorus module recreates the sound of multiple takes of an instrument being combined in a mix.



The Chorus effect

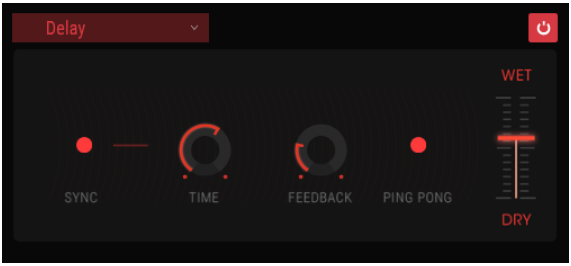
The speed of the effect is set by the Chorus Rate dial, while its depth and width are controlled by the Amount and Delay dials, respectively. The resulting "frequency blur" is different for the left and right halves of the signal, which allows us to derive a stereo signal from a mono signal. The difference between the two halves then can be set with the Stereo width, with the speed of the left-right rotation under the control of the Stereo rate dial. The Wet/Dry control sets the ratio between the input signal and the treated signal, while the Type switch selects between three different chorus models: simple, medium, and complex.

The controls are:

- Type: select one of three chorus types.
- Stereo Width: controls the width of the stereo effect.
- Stereo Rate: sets the speed of the stereo effect.
- Chorus Rate: adjusts the speed of the chorus.
- Amount: Controls the depth of the chorus.
- Delay: Sets the amount of delay applied to the input signal.
- Wet/Dry: Changes the balance between the input signal and processed signal.

10.6.6. 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 digital delay repeats the input signal and creates an "echo", giving it more space and depth. The Time dial offers a range of settings from 9 milliseconds to almost one full second (999 ms).



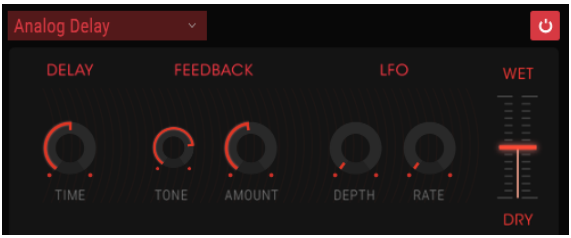
The Delay effect

The controls:

- Sync: Locks the delay to the current tempo of the DAW and/or the rate of the Phaser. (These are the only two FX modules with a Sync button.)
- Link: Makes the delay mono, after which the top row of Time and Feedback controls are used to adjust the effect.
- Time: Turning the dial clockwise increases the delay time; turning in the opposite direction shortens it.
- Feedback: Adjusts the Feedback amount. Larger values cause the delay to be heard longer.
- Ping Pong: Hard-pans the effected signals so they "bounce" from left to right.
- Damping: Higher settings will roll off the high-frequency content of the delayed signal more quickly.
- Wet/Dry: Sets the ratio between the original (dry) and modified (wet) signals.

10.6.7. Analog Delay

A simple LFO-controlled delay.



The Analog Delay effect

The controls are:

- Delay time: Sets the time distance between original and delayed signal.
- Feedback tone: Increases or decreases the high frequency content in the feedback.
- Feedback amount: Sets the amount of feedback. When fully clockwise the feedback will take a long time to die out.
- LFO Depth: Will cause a slight pitch variation.
- LFO Rate: Sets the speed of the pitch variation.

10.6.8. Overdrive

Will add gain to a signal causing it to clip and distort. It introduces new harmonics that add a harsh edge to sounds.

The Overdrive effect

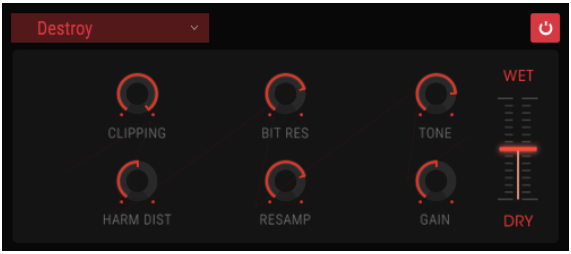
The controls are:

- Drive: Sets the overdrive amount.
- Tone: Increases the high frequency of the sound, adding a harsher edge.
- Output: Sets the general level of the overdrive. Allows you to compensate for increased amplitude caused by the drive.

10.6.9. Destroy

The Destroy effect will literally take your sound apart. The sound of Buchla Easel V is usually generated in 32-bit quality, though the actual bitrate is determined by the sound quality setting of your DAW. By reducing the number of bits used to express the sound, details will gradually disappear.

To explore the sound alterations of this effect start by setting the tone, bit reduction and resample dial to maximum. Then gradually turn the dial counter-clockwise. This will reduce the bitrate, making the sound more and more indistinct. Combined with the resample option, you can deconstruct/destroy the source sound even further.



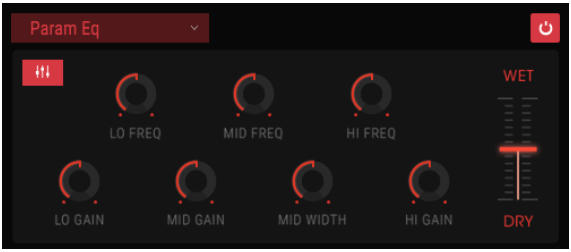
The Destroy effect

The controls are:

- Clipping: Sets the level where clipping will occur. Clipping is a process where the peaks in a signal are cut off. The waves are mutilated, which causes a very distinct kind of distortion.
- Harm Dist: Alters the harmonic content of an input signal by distorting the harmonic balance of the overtones contained in the signal.
- Bit Res: Reduces the resolution; i.e., the number of bits used to render the input signal.
- Resample: Resamples the already bit-reduced signal. At lower settings this will destroy the coherence of the input signal.
- Tone: Decreases the high frequency content in the signal.
- Gain: Allows you to compensate for the loss or gain in amplitude caused by the resample and bit-crushing operations.

10.6.10. EQ4

The Eq4 is a three-band Equalizer. An equalizer selectively amplifies or attenuates frequencies in the frequency spectrum.



EQ4

The controls are:

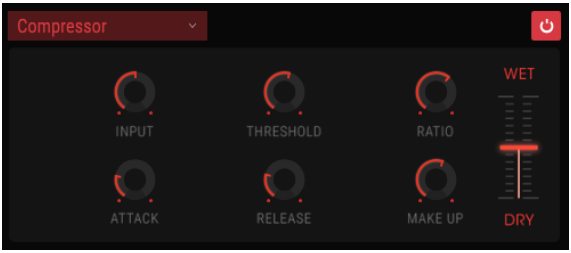
- Lo Freq: Decreases or increases the low frequency band.
- Mid Freq: Decreases or increases the mid frequencies.
- High Freq: Decreases or increases the high frequencies.

As our ears are most sensitive to timbre changes in the mid frequency range, the EQ enables you to set the width of the midrange attenuation or amplification.

- Lo Gain: Decreases or increases the gain of the low frequency band.
- Mid Gain: Decreases or increases the mid frequencies gain.
- Mid Width: Sets the width of the mid frequency band.
- Hi Gain: Decreases or increases the gain of the high frequency band.

10.6.11. Compressor

A compressor is generally used to help maintain a consistent level of sound, though there are many other ways to use one. You could think of it as a very fast manual control that turns down the volume when it becomes too loud and raises it when too soft.



The Compressor

If, for example, you are using effects in a chain, it can keep the attack transients of a sound from overloading the input of the next effect. It can also help a sound which would normally decay quickly not to fade away as quickly. 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.

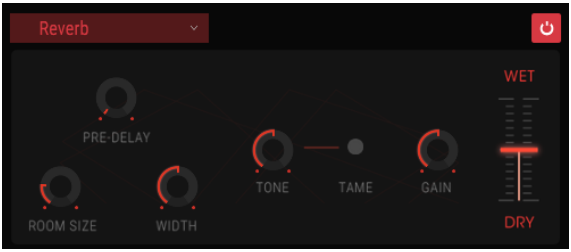
The Attack and Release control the response time of Compressor by defining how quickly the compressor reacts to input-level changes. Longer attack times could allow fast peaks to slip through.

The controls are:

- Threshold: Sets the level where the compression will kick in.
- Attack: Sets the speed with which the compression will kick in.
- 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.
- Release: Sets the release curve of the compressor.
- Output Gain: Controls the final output level of the compressor.

10.6.12. Reverb

A Reverb effect creates a large number of echoes that gradually fade or "decay". It simulates how the input would sound in a room or a large space.



The Reverb

The controls are:

- Pre-delay: Sets the amount of time before the input signal is affected by the reverb.
- Room Size: Controls the size of the room: counter-clockwise is smaller, clockwise is larger.
- Width: Adjusts the reverb from mono to an increasingly wide stereo space.
- Tone: Knob positions to the left roll off high frequencies; knob positions to the right scoop out low frequencies.
- Tame button: A movable band pass filter; reduces low- and high end.
- Gain: Controls the output level of the reverb.
- Wet / Dry mix: controls the balance between the input signal and the effected signal for this effect.

11. OVERVIEW OF ROUTING DESTINATIONS

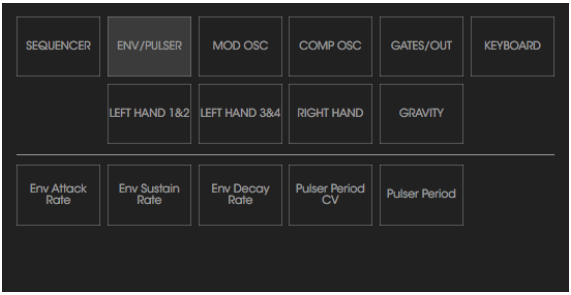
The Left Hand Section and the Gravity Section of Buchla Easel V offer the composer and performer novel ways of control. The control voltages you create in the Left Hand and in the Gravity Universe can be routed to a number of predefined destinations.

The parameter section screen shared by both sections is divided in two halves. In the upper half you select the main destination, in the lower half one of the properties of that destination.

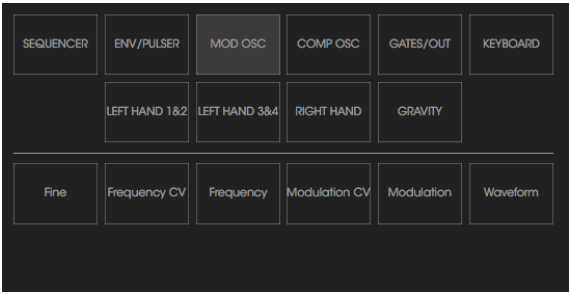
Selecting the main destination and one of its parameters is a simple matter of clicking on them. Once you have made your choice, click "Close" to finalise your choice. The name of the destination will now appear in the name strip of the slot and the Voltage Envelope Window will open.

Below you will find an overview of the main routing destinations on Buchla Easel V.

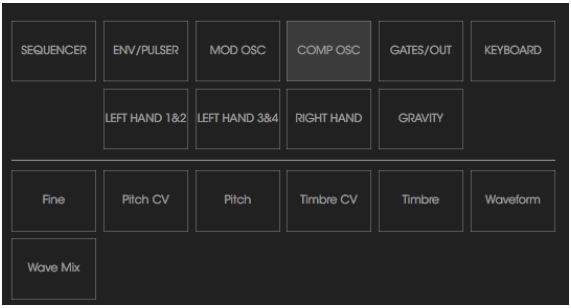
Routing options to the Sequential Voltage Source



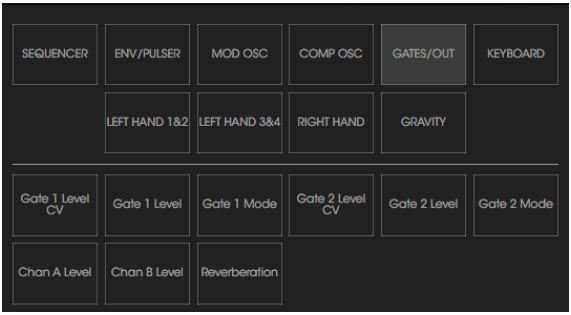
Routing options to the Envelope Generator and the Pulser



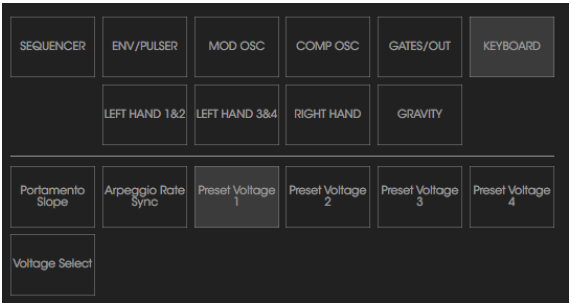
Routing options to the Modulation Oscillator



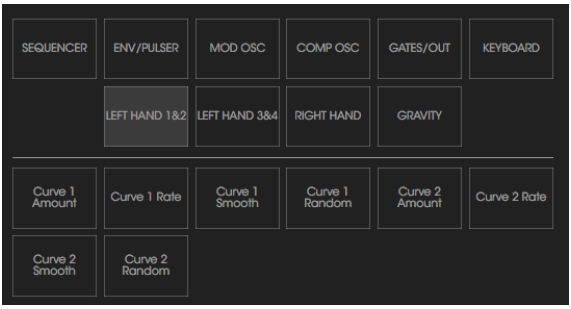
Routing options to the Complex Oscillator



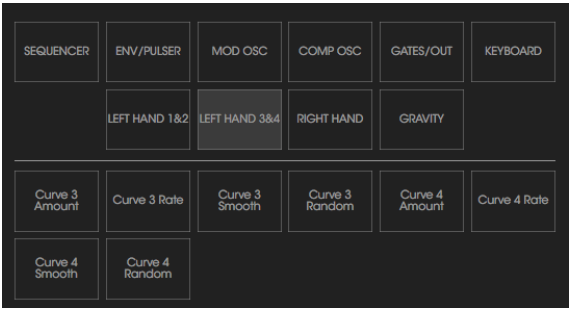
Routing options to Gate 1, Gate 2 and the Output Section



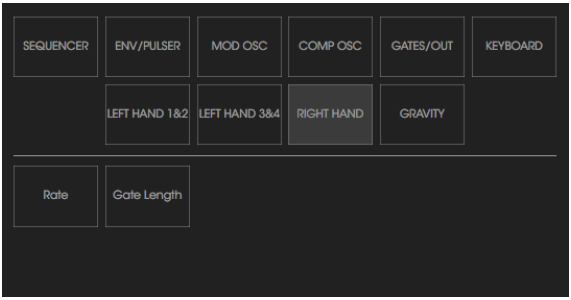
Routing options to the Keyboard



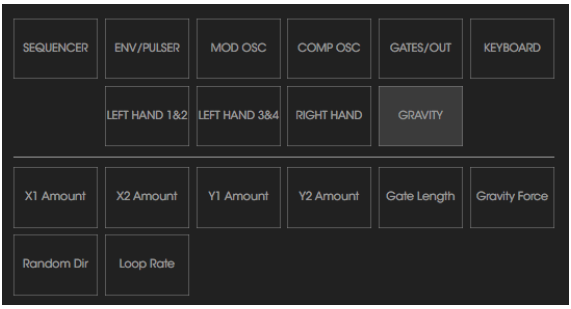
Routing options to the Left Hand 1 and 2 Function Generators



Routing options to the Left Hand 3 and 4 Function Generators



Routing options to the Right Hand



Routing options to the Gravity Universe

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