# !THE NEST - REALM OF SOUND

## 1] Understanding Sound and Synthesis Fundamentals

In this lesson, we will delve into the fundamental principles of sound and synthesis, uncovering the underlying language of sonic expression. We will explore how sound serves as a universal language that connects individuals and transcends boundaries.

### Sound is a Universal Language

Sound has the remarkable ability to transcend cultural, linguistic, and geographical barriers. It is a language that speaks to our emotions, evokes memories, and stirs our souls. In the Utopian vision of Lost Chameleon, sound becomes a powerful tool for fostering understanding, empathy, and a sense of unity among people.

Imagine a symphony playing in a concert hall, where people from diverse backgrounds gather to listen and be moved by the same piece of music. In that moment, differences disappear, and a profound connection is forged through the shared experience of sound. This is the transformative power of sound as a universal language.

### The Nature of Sound Waves

To understand sound, we must explore its foundational elements. Sound waves are created when an object vibrates, causing molecules in the surrounding medium (such as air, water, or solids) to compress and expand. These vibrations propagate through the medium in the form of waves, eventually reaching our ears and being perceived as sound.

Key characteristics of sound waves include frequency, amplitude, and waveform. Frequency determines the pitch of the sound, with higher frequencies corresponding to higher pitches and lower frequencies to lower pitches. Amplitude represents the intensity or loudness of the sound, while waveform describes the shape of the wave, influencing its timbre or tone color.

### Frequencies:

Frequencies are fundamental to understanding the pitch of a sound. They determine whether a sound is perceived as high or low. Frequency is measured in Hertz (Hz), which represents the number of cycles or vibrations per second. Here are a few key concepts related to frequencies:

**Pitch:**
Pitch refers to the perceived highness or lowness of a sound. Higher frequencies correspond to higher pitches, while lower frequencies correspond to lower pitches. For example, a high-pitched sound like a bird's chirp has a higher frequency compared to a low-pitched sound like a bass drum.

**Octaves:**
Octaves are intervals between two frequencies where the higher frequency is exactly twice the value of the lower frequency. Moving up one octave doubles the frequency, resulting in a sound that sounds higher but retains the same tonal characteristics. Understanding octaves allows us to work with harmonic relationships between sounds and create musical structures.

**Frequency Range:**
The range of human hearing typically spans from about 20 Hz to 20,000 Hz (20 kHz). Different animals and sound systems may have different frequency ranges. In sound design, it's important to consider the intended playback system and the frequency range it can reproduce accurately.
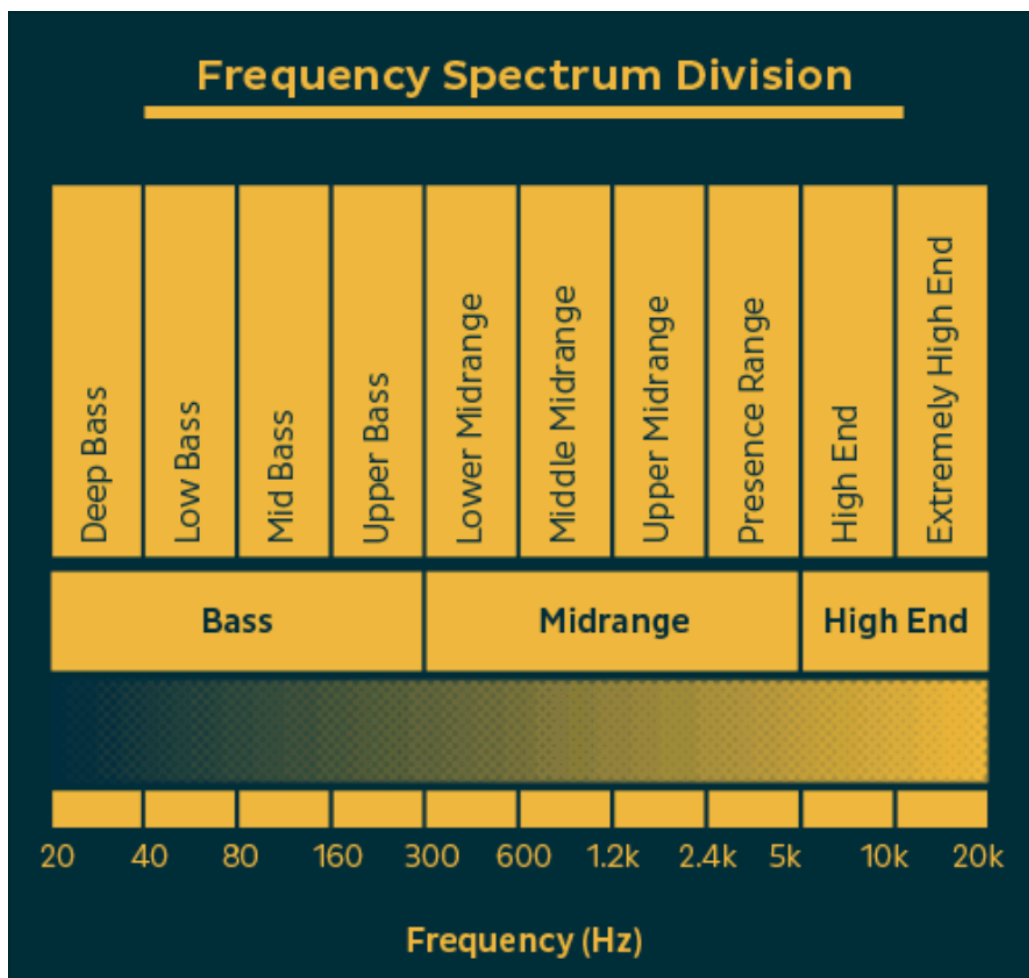


## Waveforms:
Waveforms describe the shape or pattern of a sound wave. They play a crucial

role in defining the timbre or tone color of a sound. Different waveforms produce distinct sonic characteristics. Here are some commonly encountered waveforms:
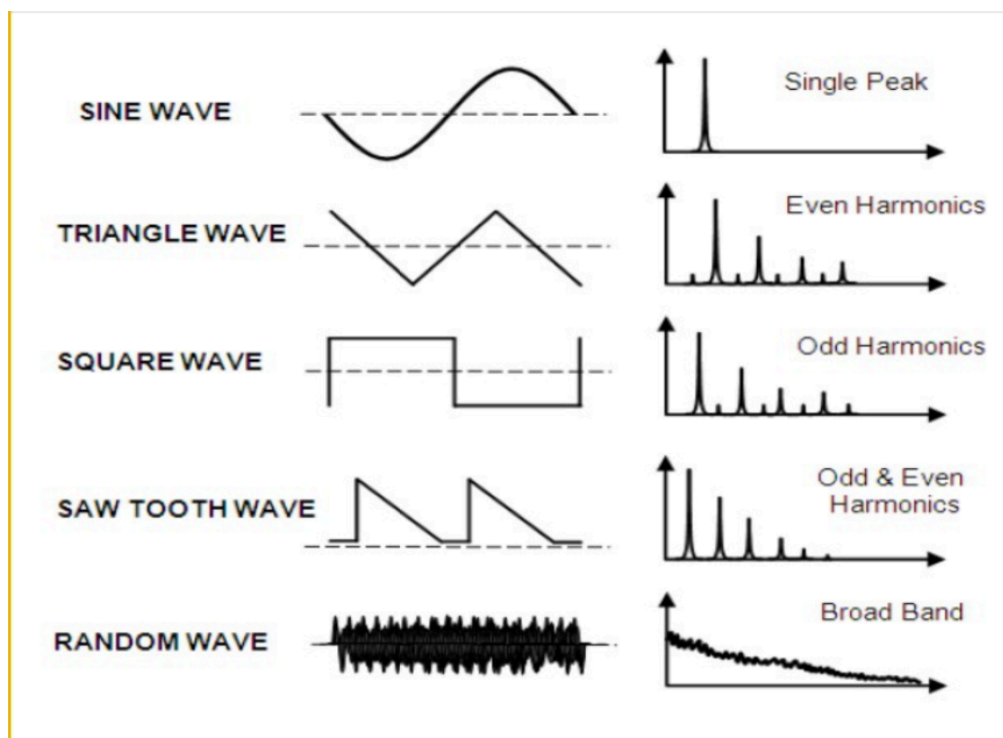


## Sine Wave:
A sine wave is the simplest waveform, representing a pure and smooth tone with no harmonics. It has a smooth, rounded shape and produces a clear, mellow sound. Sine waves are often used as reference tones or as a basis for creating other waveforms.

## Triangle Wave:
A triangle wave has a triangular shape, with gradual slopes going up and down. It contains a series of harmonics but has a softer and less bright character compared to sawtooth and square waves. Triangle waves are versatile and can be used for creating various sound textures and instruments.

## Square Wave:
A square wave has a characteristic square-shaped waveform, alternating between two discrete levels—high and low. It consists of odd harmonics, producing a hollow, nasal, or reedy sound. Square waves are often used in creating bass sounds, plucks, and percussive tones.

## Sawtooth Wave:
A sawtooth wave has a linear rise and a rapid fall, resembling the shape of a saw blade. It contains a rich set of harmonics, producing a bright and buzzy sound. Sawtooth waves are commonly used in creating lead sounds, pads, and brass-like timbres.

## Pulse Wave:

A pulse wave is similar to a square wave but allows for variable duty cycle, which determines the width of the high and low portions of the waveform. By adjusting the duty cycle, we can shape the timbral qualities of the sound, ranging from narrow and buzzy to broader and softer.

Understanding waveforms allows us to manipulate the tonal characteristics and timbre of a sound. By selecting different waveforms, adjusting their harmonic content, and combining them creatively, we can create a wide range of unique and expressive sounds in our sound design explorations.

In the realm of sound design, frequencies and waveforms serve as the building blocks for crafting captivating and evocative sonic experiences. By mastering their properties and understanding how they interact, we gain the tools to shape the emotional impact and tonal qualities of our sounds.

## Introduction to Synthesis

Synthesis is the art of creating and manipulating sound through electronic means. It allows us to sculpt and shape sound waves to generate unique and expressive sonic landscapes.

There are various methods of synthesis, each offering distinct approaches to sound creation.

**Subtractive Synthesis:**
Subtractive synthesis is a widely used method that involves starting with a rich, harmonically complex waveform and then filtering out specific frequencies to shape the desired sound. Here's how it works:

**Oscillators:**
Subtractive synthesis typically utilizes oscillators that generate waveforms such as sawtooth, square, triangle, or pulse waves. These waveforms contain multiple harmonics, which contribute to the sound's timbral qualities.

**Filters:**
Filters are used to remove or attenuate specific frequencies from the sound generated by the oscillators. Common filter types include low-pass, high-pass, band-pass, and notch filters. By adjusting the cutoff frequency and resonance parameters, you can sculpt the timbre of the sound.

**Envelopes:**
Envelopes control how various sound parameters change over time. In subtractive synthesis, envelopes are commonly used to shape the amplitude (volume) and filter parameters of the sound. The most common envelopes are the ADSR (Attack, Decay, Sustain, Release) envelopes.

Subtractive synthesis allows for a wide range of sound design possibilities. By

combining different waveforms, filter settings, and envelope shapes, you can create rich and expressive sounds, from punchy basses to lush pads and screaming leads.

## Additive Synthesis:
Additive synthesis takes a different approach by combining multiple sine waves, which are the simplest and purest waveforms, to build complex sounds from simpler components.

Here's how it works:

### Harmonic Series:
Each sine wave used in additive synthesis represents a harmonic or partial of the sound. The fundamental frequency represents the base pitch, and additional sine waves are added at integer multiples of the fundamental frequency.

### Amplitude Control:
Each sine wave's amplitude can be individually adjusted to shape the overall timbre of the sound. By controlling the amplitudes of different harmonics, you can create intricate and evolving textures.

Additive synthesis offers great flexibility in creating unique and complex timbres. By precisely controlling the amplitude and frequency of individual harmonics, you can craft sounds with rich harmonic content and subtle nuances.

## Frequency Modulation (FM) Synthesis:
FM synthesis creates timbral variations by modulating the frequency of one waveform, known as the carrier wave, with another waveform, called the modulator wave.

Here's how it works:

### Carrier and Modulator:
The carrier waveform is typically a sine wave, while the modulator waveform can be a sine wave or a more complex waveform. The modulator wave's frequency affects the frequency of the carrier wave, resulting in harmonic or inharmonic sidebands.

### Modulation Index:
The modulation index controls the depth and complexity of the frequency modulation effect. Higher modulation index values create more complex and dissonant sounds, while lower values produce subtle variations.

FM synthesis is known for its ability to generate a wide range of metallic, bell-like, and evolving timbres. By experimenting with different modulation ratios,

waveforms, and modulation indices, you can achieve unique and expressive sounds.

## Wavetable Synthesis:
Wavetable synthesis involves using a series of pre-recorded waveforms, known as wavetables, that can be scanned and interpolated to produce evolving and dynamic sounds.

Here's how it works:

### Wavetables:
A wavetable contains multiple individual waveforms arranged sequentially. As the playback position progresses through the wavetable, different waveforms are interpolated to create complex timbral variations.

### Scanning and Modulation:
Wavetable synthesis allows you to scan through the wavetable at different speeds and directions, creating evolving textures. Additionally, modulation sources can be used to modulate the position in the wavetable, adding further movement and expression to the sound.

### Interpolation:
During wavetable scanning, interpolation is used to smoothly transition between individual waveforms. This ensures seamless transitions and avoids audible artifacts.

Wavetable synthesis offers a versatile approach to sound design, allowing for the creation of evolving pads, intricate textures, and morphing sounds. By manipulating the scanning speed, direction, and modulation sources, you can craft dynamic and evolving timbres.

Each method of synthesis - subtractive, additive, frequency modulation, and wavetable synthesis - brings its unique characteristics and sonic possibilities to sound design

## The Building Blocks of Synthesis
In order to create and manipulate sound using a synthesizer like Xfer Serum, we need to understand its basic components. Oscillators are the sound generators that produce waveforms, serving as the building blocks of our sonic palette. Filters shape the frequency content of the sound, allowing us to remove or emphasize specific frequencies. Envelopes control the evolution of sound over time, shaping its attack, decay, sustain, and release. Modulators introduce movement and modulation to various parameters, adding depth and expressiveness to our sounds.

Throughout this lesson, we will explore these components in detail, understanding their functions and how they interact to shape the sonic

characteristics of a sound. We will also dive into practical demonstrations using Xfer Serum, where you will learn to manipulate oscillators, apply filters, shape envelopes, and use modulators to create your own unique sounds.

By understanding the fundamentals of sound and synthesis, we lay a strong foundation for our journey into the realm of sound design. As we embrace the ideology of Lost Chameleon's Utopian philosophy, we will harness the transformative power of sound and unleash our creativity to sculpt new sonic landscapes that transcend boundaries and captivate listeners.

# 2] SERUM 101



## Introduction:
Welcome to the world of Serum, a remarkable VST plugin developed by Xfer Records. Serum has garnered immense popularity among sound designers and producers worldwide for its unparalleled versatility and expansive set of features. It has become a go-to tool for those seeking to push the boundaries of sound design and create captivating sonic landscapes.

## History & Impact on Electronic Music:

Serum emerged onto the music production scene as a game-changer, revolutionizing the way we shape and sculpt sound. It was conceived by Steve Duda, a visionary music producer and programmer, renowned for his innovative contributions to the electronic music industry. With its release in 2014, Serum quickly gained recognition for its remarkable capabilities and forward-thinking design.



Serum's impact on the electronic dance music landscape has been profound. Its unparalleled versatility and rich sonic palette have made it an indispensable tool for producers across various genres. From the pulsating basslines of future bass and dubstep to the soaring leads of trance and progressive house, Serum has left an indelible mark on the sonic landscapes of countless tracks and live performances.

**Your favorite tool:**
With Serum, you have at your fingertips an extraordinary palette of sounds and a vast array of tools to shape and mold them into your unique creations. Whether you're an aspiring producer, a seasoned sound designer, or an adventurous musician, Serum opens up a world of endless sonic possibilities.

What sets Serum apart is its intuitive interface and the depth of its capabilities. It combines the power of wavetable synthesis, versatile modulation options, and a comprehensive set of effects to provide you with complete control over every aspect of sound design. From creating lush pads and evolving textures to crafting aggressive basslines and intricate leads, Serum empowers you to bring your sonic visions to life.

Throughout this course, we will dive deep into the various aspects of Serum and unravel its secrets. We will explore its interface, examine its features, and unlock the techniques that will elevate your sound design skills. By the end of this journey, you will possess the knowledge and confidence to harness the full potential of Serum and embark on your own sonic adventures.

## Where do I download Serum?
If you don't already have Serum, here are two options for obtaining it:

1. **Direct from Xfer:** You can purchase Serum directly from Xfer Records' website for $189 USD. They also offer a free demo version, although it has a 15-minute time limit.
   serum

2. **Splice Rent-to-Own:** Another option is to use Splice's Rent-to-Own program. For $9.99 USD per month, you can access Serum. Once you've paid the full price, you own the plugin for life.

## INTERFACE
Let's begin our exploration of Serum's interface by acquainting ourselves with its user-friendly layout. The main menu serves as our gateway to Serum's various features and functions, allowing us to navigate through its powerful capabilities effortlessly.



In Serum, the interface is divided into four main tabs:
OSC, FX, MATRIX, and GLOBAL

Each tab provides specific functionalities for sound creation and manipulation. Let's take a closer look at each of these tabs:

# OSC (Oscillators)



The OSC tab is where the magic begins. It allows you to generate and manipulate the core elements of your sound. Within this tab, you'll find:

- Oscillators A and B: These generate the primary waveforms for your sound.
- Noise Oscillator: It adds texture and randomness to your sound.
- Sub Oscillator: It provides additional depth and richness by generating a sub-frequency waveform.
- Filter: This shapes the frequency content of your sound.
- Envelopes: They control the volume and modulation over time.
- LFOs (Low-Frequency Oscillators): These create cyclic modulation effects for various parameters.
- Macros: These allow you to control multiple parameters simultaneously with a single knob.
- Voicing: It determines the number of voices and how they are spread in stereo.
- Keyboard: It displays the virtual keyboard for playing and testing your sounds.

I'll cover these in depth throughout the lesson moving on!

**FX (Effects)**

The FX tab is where you can enhance and process your sound with a range of effects. Some of the effects available in this tab include:

- Hyper/Dimension: It adds stereo width and dimensionality.
- Distortion: This introduces grit, warmth, and harmonics.
- Flanger, Phaser, and Chorus: These create modulation-based effects.
- Compressor: It controls the dynamic range of your sound.
- Delay: This produces echoes and rhythmic repeats.
- Reverb: It adds depth and space to your sound.
- Filter (another one): This is an additional filter option.
- EQ: It allows you to shape the frequency response of your sound.

## MATRIX (Modulation Matrix)
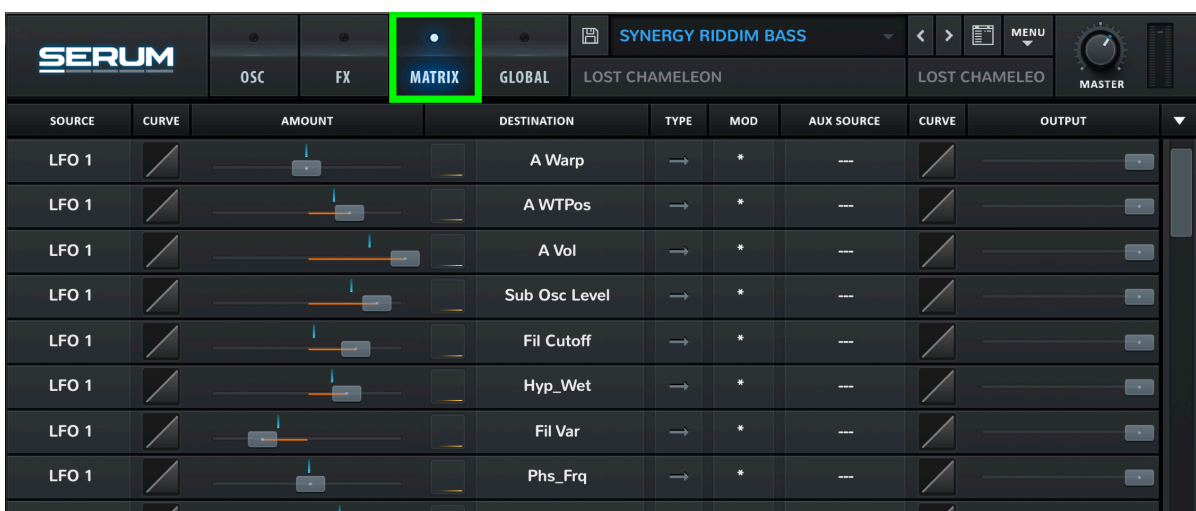


The MATRIX tab displays all the modulation sources and destinations in a matrix-like interface. Modulation adds movement and variation to your sounds. While we won't delve into this section right now, it offers the flexibility to assign and control various parameters over time.

## GLOBAL (Global Settings)
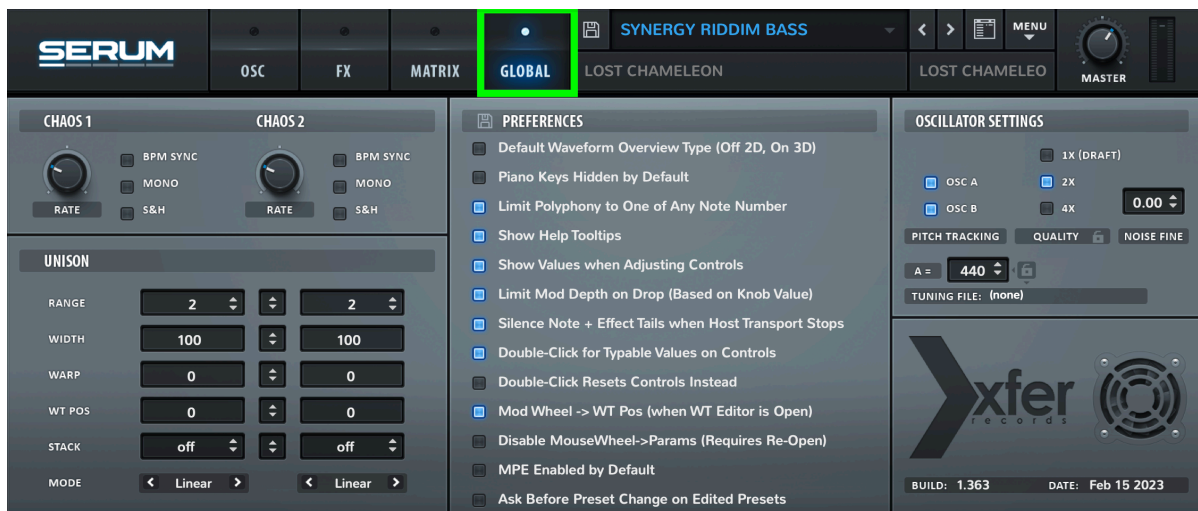


The GLOBAL tab offers various optional features and settings that affect the overall behavior of Serum. Here, you can adjust parameters such as oscillator quality, chaos oscillators, and more. The GLOBAL section provides advanced options that can be explored at a later stage of your learning journey.

✨Bonus tip - How to evolve Serum like a Pokemon:

### View Tab:

Located on the top left, disguised as the SERUM logo, the View menu offers customization options to tailor Serum's interface according to your preferences. You can adjust the zoom level, toggle between different display modes, and even change the skin, ensuring a workspace that suits your needs.

What?
SERUM is evolving!



Congratuations! Your SERUM has evolved
into the LOST CHAMELEON skin!

Serum evolved like a Pokemon,

Pretty cool right?

wait, you want this super cool Serum Skin you say?

Here's a free download!

# Oscillators: The Sound Architects

Oscillators are the fundamental building blocks of sound in Serum. They generate the initial waveforms that shape the character and timbre of your sounds. Let's delve into the world of oscillators and explore their capabilities within Serum.

**Primary Sound Generators**

The oscillators in Serum serve as the primary sound generators. They are responsible for producing the raw waveforms that form the basis of your sounds. By manipulating the parameters within the oscillators, you can create a vast array of sonic textures and tones.

## Oscillator Types

Serum offers a variety of oscillator types, each with its own unique characteristics and sound possibilities. These include:

**Analog Oscillators**:

These emulate the warm, rich, and organic sounds of traditional analog synthesizers. They deliver classic waveforms such as sine, triangle, sawtooth, and square.

**Digital Oscillators**:
These generate precise, complex, and digital waveforms, expanding the sonic palette with unique timbres. They include digital waveforms like digital noise, FM (Frequency Modulation), and more.

**Wavetable Oscillators**:
Wavetable oscillators revolutionize sound design by allowing you to morph between different pre-recorded waveforms seamlessly. This opens up a world of dynamic and evolving sounds, making Serum particularly versatile.

## Warping and Modulation

One of the powerful features of Serum's oscillators is the ability to warp and modulate waveforms. You can apply various algorithms and techniques to manipulate the waveform shape, resulting in intricate and complex timbres. This includes techniques like wave folding, FM synthesis, and phase distortion, among others.
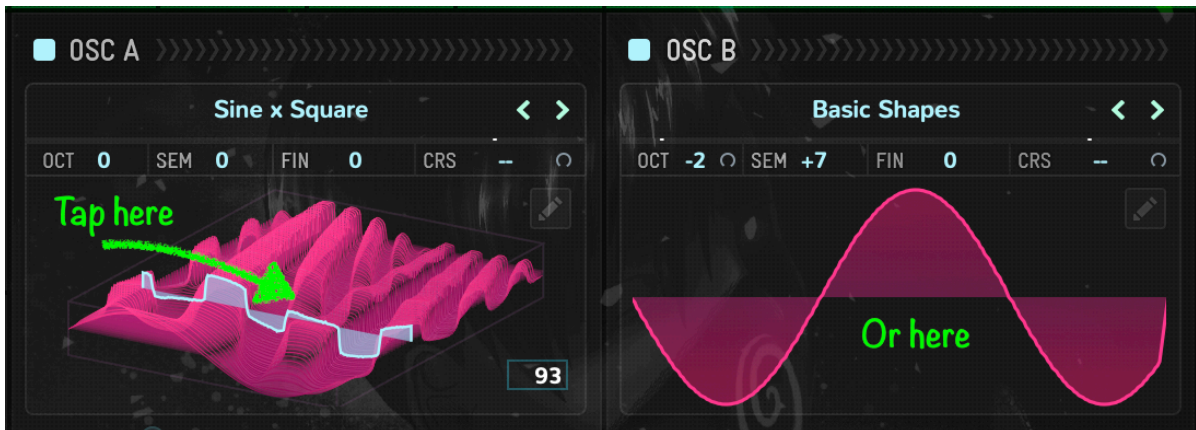
Parameters and Controls
Within each oscillator, you have a range of parameters at your disposal to shape the sound to your liking:
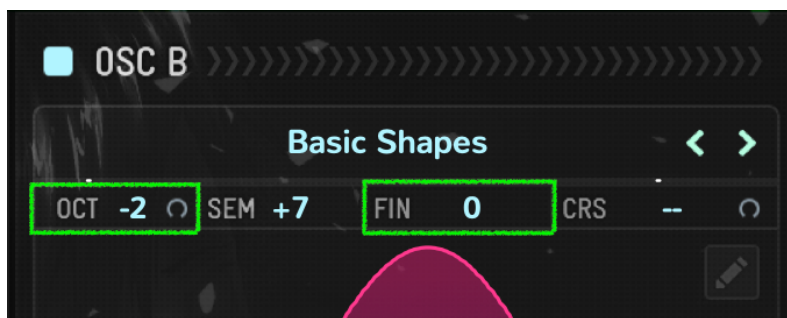
**Waveforms**:
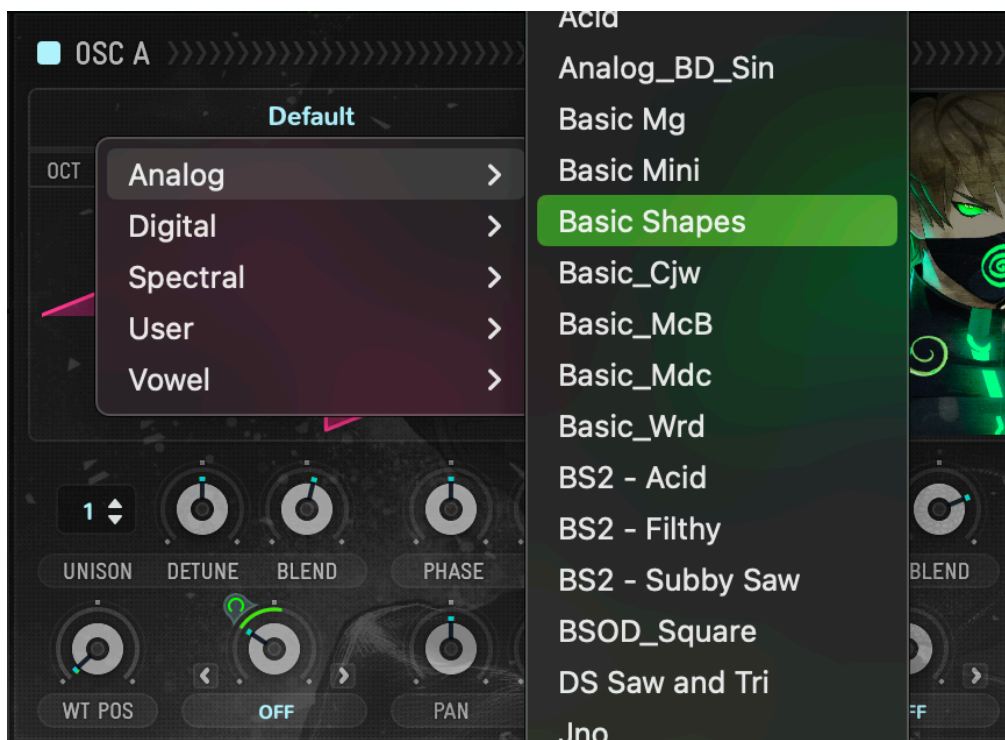
Select the desired waveform shape for each oscillator, such as sine, triangle, sawtooth, square, and more.



*Toggle between 2d and 3d by clicking on the waveform.*

**Octave & Fine-tuning**



Octave and fine-tuning controls allow you to adjust the pitch of the oscillator. Octave controls shift the sound up or down in octaves, while fine-tuning enables finer adjustments to achieve the desired pitch accuracy.

**Phase and Random Knobs:**

Controlling Time Relationships

Within the oscillator section of Serum, you'll find two additional knobs that provide control over how the oscillators relate to each other in time: the Phase and Random knobs. While not essential for sound creation, these knobs offer interesting possibilities for shaping your sounds. Let's explore them in detail:

## Random Knob:

The Random knob, represented by the "RAND" label, adjusts the degree of randomness in the starting position of the oscillator across its cycle. When set to higher values, the oscillator's starting point becomes more random, emulating the unpredictable nature of analog synthesizers. This randomness adds a touch of organic variation to your sound, as it won't always start at the same position.

## Phase Knob:

The Phase knob determines the central starting point for each oscillator. Its impact on the sound depends on the setting of the Random knob. When the Random knob is set to maximum, the Phase knob's effect is negligible, as the phase is always randomized. However, when the Random knob is dialed down, the phase begins to center around the specified starting point.

Why is this useful? In scenarios where you're dealing with low-frequency sounds, such as sub-bass frequencies, it's crucial to avoid phase cancellation caused by clashing waveforms. By aligning the phases of your oscillators, you can enhance the impact and clarity of your sound. Adjusting the Phase knob allows you to precisely control the phase relationship between oscillators, ensuring they start at the specified point.

## Warping and Advanced Oscillator Techniques

Serum goes beyond traditional oscillators by offering advanced features like warping.
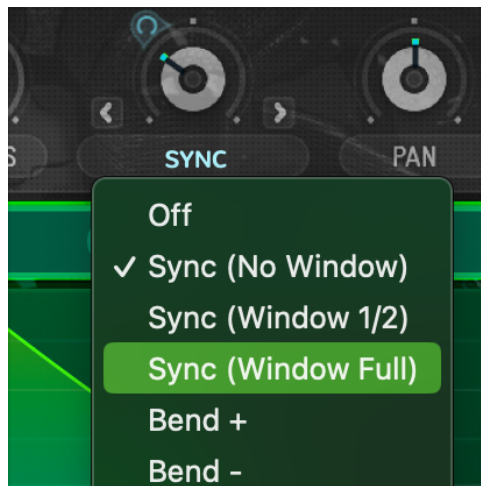
Warping allows you to modulate and transform the waveform in unique ways, resulting in complex and evolving sounds. Experimenting with different warp modes, including FM (Frequency Modulation), AM (Amplitude Modulation), and more, unlocks a world of sonic exploration.

**Sub Oscillator:**

## Adding Depth and Consistency
In addition to OSC A and OSC B, Serum offers a Sub Oscillator to enhance your sound design capabilities. The Sub Oscillator is a simplified oscillator designed to output basic shapes and plays a crucial role in creating a consistent and powerful sub-bass foundation. Here's what you need to know about it:



1. Waveform Selection:
The Sub Oscillator provides a selection of basic waveforms to choose from, including Sine, Rounded Rectangle, Triangle, Saw, Square, and Pulse. These waveforms are intentionally simple to ensure a clean and focused low-frequency output. When layering the sub oscillator with other sounds, it's recommended to opt for the simplest waveform that complements your desired bass tone. Sine, triangle, and rounded rectangle waveforms are popular choices for creating deep and impactful basses.

2. Direct Out Switch:
The Sub Oscillator features a "Direct Out" switch, which bypasses any

processing or filtering applied to other oscillators. By enabling this switch, the sub oscillator's output remains unaltered, ensuring maximum impact in the low-end frequencies. This direct signal path is particularly useful when you want to prioritize the sub-bass presence without additional modulation or effects.

3. Additional Controls:
The Sub Oscillator provides a few standard options to refine your sub-bass sound. The "Octave" control allows you to adjust the pitch of the sub oscillator, ensuring it fits harmoniously within the desired bass range. The "Level" knob enables you to balance the volume level of the sub oscillator relative to other oscillators, maintaining a cohesive and well-balanced sound. Additionally, the "Pan" knob can be used to position the sub-bass sound in the stereo field, allowing for creative spatial effects or stereo enhancement if desired.

✨ *Super Pro Tip:*
*An effective technique is to layer the sub oscillator under your existing sound to reinforce the low-frequency presence. Blend the sub oscillator to taste, finding the right balance that adds depth and weight to your sound without overpowering the other elements.*

## Noise Oscillator: Adding Texture and Character

The Noise Oscillator in Serum is a powerful tool that goes beyond the conventional white/pink noise generators found in other synthesizers. Instead of generating noise from scratch, Serum's Noise Oscillator utilizes noise samples, opening up endless possibilities for sound design.
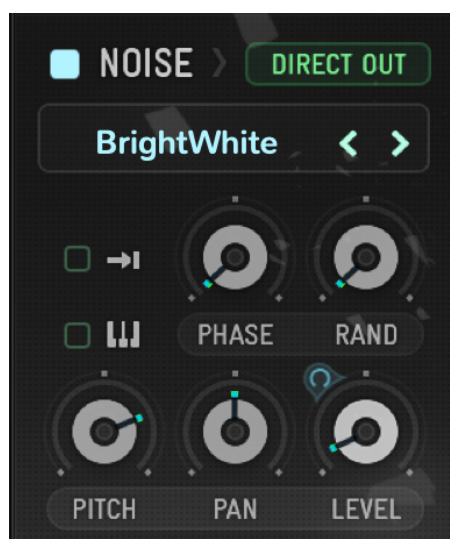


Here's what makes it remarkable:

### Diverse Sound Sources:
Unlike traditional noise generators, Serum's Noise Oscillator allows you to use

various sound sources to create noise. This means you can load samples ranging from foley recordings and synth samples to percussive elements.

Producers often experiment by loading vocal samples into the noise oscillator, transforming them into unique basses or leads. The preset noise options cover a wide range, including attacks for layering into plucks, hardware-sampled noises, and other intriguing samples.



## Flexibility and Control:

By dragging in any audio file onto the noise oscillator, you can expand your sound palette even further. This flexibility lets you incorporate your own samples, giving you the freedom to create entirely unique and personalized noise textures. The Pitch knob allows you to adjust the pitch of the loaded

sample in semitones, providing additional control over the tonality of the noise. For fine pitch adjustments, you can access the Global section.

## Essential Controls:

The Noise Oscillator features essential controls that mirror the standard oscillators. The Phase and Random (RAND) knobs affect how the noise oscillator behaves in relation to the other oscillators in terms of timing and randomness. The Pan and Level knobs allow you to position the noise in the stereo field and adjust its volume relative to other elements in your sound.

## Special Functions:

Serum's Noise Oscillator offers two additional switches for added functionality. The One Shot Mode switch stops the noise sample from looping, making it ideal for one-off attack sounds that don't require sustained repetition. On the other hand, the Keyboard Tracking switch enables the noise's pitch to follow the MIDI notes being played. This is particularly useful for creating tonal noises or utilizing melodic samples in your sound design.

Experiment and Explore:
Now it's time to put the Noise Oscillator to work! Layering a noise sample under your existing sound can add depth and character. Blend it to taste and explore the FM Noise OSC warping option to see how it interacts with your other oscillators. The Noise Oscillator in Serum empowers you to unleash your creativity and push the boundaries of sound design.

# Filters: Sculpting Your Sound

In Serum, filters play a crucial role in shaping and coloring your sounds. Let's explore the filters in-depth:

## Main Filter:

Located on the OSC page, the main filter is your go-to for sound manipulation. Its visual interface provides intuitive control over your sound.
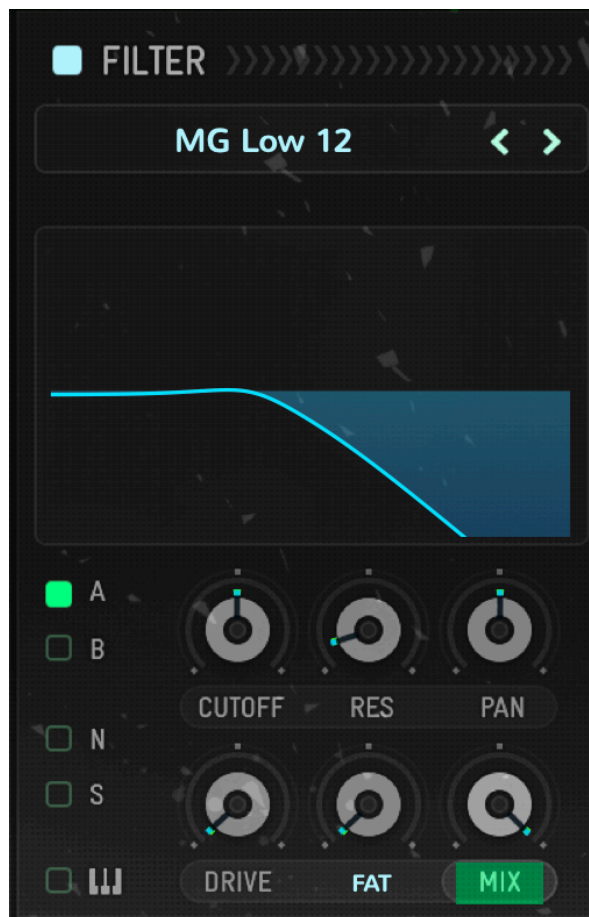
Key features include:

1. **Cutoff:**
Adjust the frequency where the filter starts attenuating.

2. **Resonance:**
Enhance frequencies near the cutoff for added emphasis.

3. **Pan:**
Create stereo width by independently adjusting the cutoff for the left and right channels.

4. **Drive:**
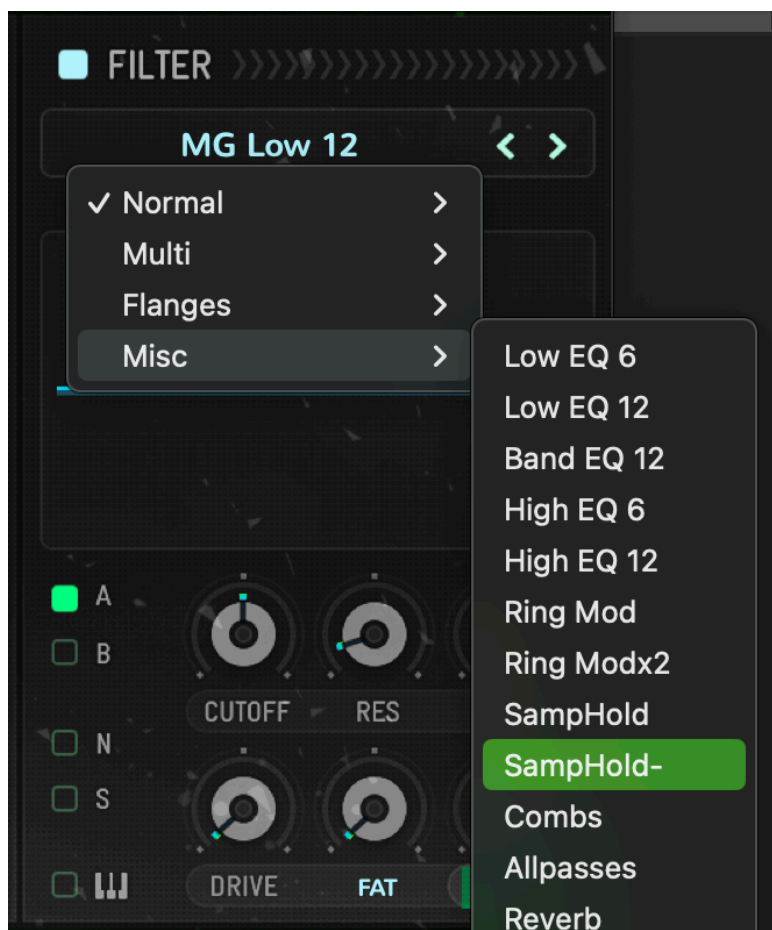Add distortion and saturation to the filtered signal.

5. **FAT:**
Behavior varies with the selected filter type, offering additional tonal control.

6. **Mix/Level:**
Balance the mix between the filtered and unfiltered signal.

**Filter Types:**
Serum offers a diverse range of filter types, each with its own unique sonic character:

**1. Normal Types:**
Traditional filter curves such as low pass, high pass, band pass, notch, and peak filters. These shape the sound with different slopes and characteristics.

**2. Multi Types:**
Combine multiple filters into a unified filter, allowing for complex tonal sculpting and modulation possibilities.

**3. Flanges Types:**
Explore comb filters, phasers, and flangers for intriguing flanger-like effects. Adjusting cutoff and resonance yields captivating results.

**4. Misc Types:**
Unconventional filter options, including reverb and comb filters, provide limitless creative potential.

✨ *Super Pro tip:*
*Experimentation is key. Adjust the cutoff and resonance parameters to find the perfect balance and sonic character for your sound.*
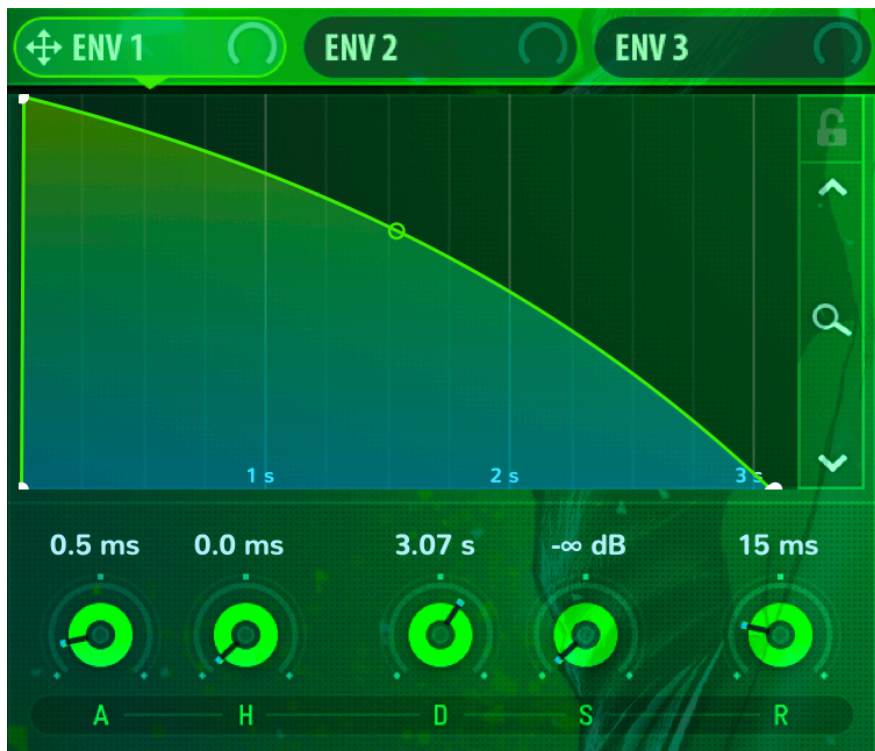
## **Modulation:** Unleash Dynamic Sound Control

Serum's modulation system empowers you to infuse your sounds with movement, expression, and vitality. Let's dive into the world of modulation:



Modulation Sources:

**Envelopes:**



Serum offers three envelopes, each using the classic ADSR (Attack, Decay, Sustain, Release) structure to shape your sound precisely. Envelopes are triggered when a new note is played. The parameters available for modulation in envelopes include:

- Attack: Controls the time it takes for the sound to reach its maximum level.

- Decay: Sets the time it takes for the sound to decay from the peak level to the sustain level.

- Sustain: Determines the level at which the sound remains after the decay phase.

- Release: Adjusts the time it takes for the sound to fade out after releasing the note.

Envelopes provide precise control over the dynamics and contour of your sound. Additionally, Envelope 1 is dedicated to controlling the overall volume of your patch, while Envelope 2 and 3 can shape other aspects of your sound in unique ways.

## LFOs (Low-Frequency Oscillators):

Serum takes LFOs to the next level by allowing you to draw or load any curve as a modulation source. This feature provides incredible



control over your sound, enabling you to create patches that cut through the mix with precision. The parameters available for modulation in LFOs include:

- Rate: Adjusts the speed at which the LFO cycles.

- BPM Sync: Syncs the LFO rate to the tempo of your DAW.

- Mode: Offers three modes for LFO behavior:

- Env: Behaves like a custom-shaped envelope, cycling through once for each note.

- Trig: Triggers the LFO when a note is played.

- Off: Keeps the LFO running continuously as long as the DAW is playing.

## Macros:
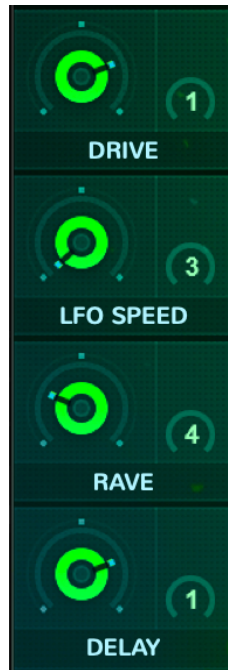


Macros are powerful yet underutilized controllers in Serum that can add a human and organic feel to your sounds. They allow you to modulate multiple parameters simultaneously using a single knob. The parameters available for modulation via Macros include:

- Assignments: Drag and drop to assign multiple destinations to a Macro knob.

- Automation: Automate the Macro knob within your DAW to create dynamic variations.

Macros provide a flexible and intuitive way to control and shape your sound, allowing for real-time performance and automation possibilities.

## Modulation Matrix:
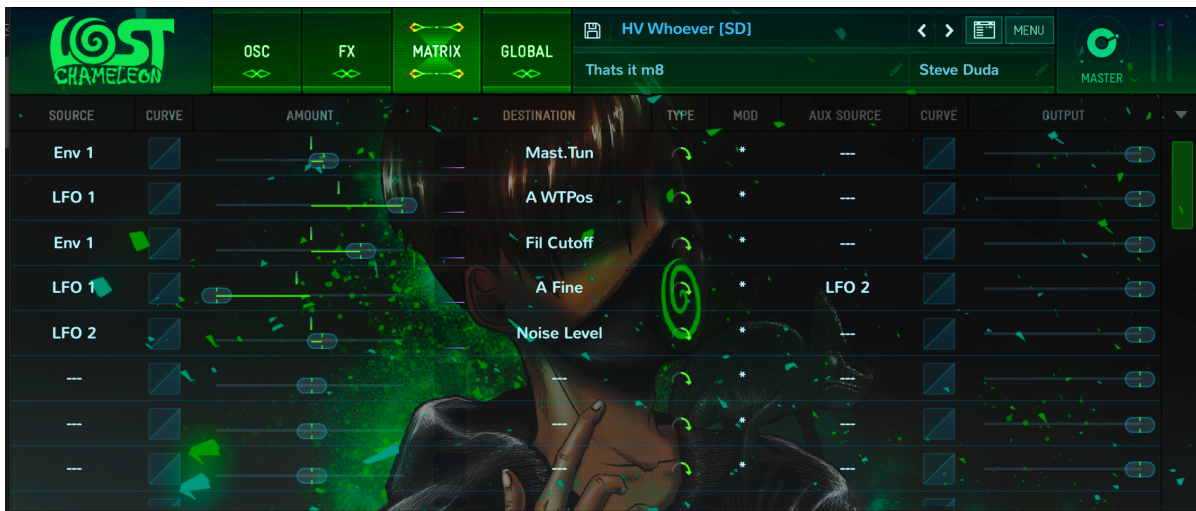
The modulation matrix in Serum provides an overview of the modulation sources and their corresponding destinations. It allows you to create complex modulation routings and fine-tune the modulation behavior. The parameters available in the modulation matrix include:

**Amount:**
Controls the modulation strength or depth.

**Response Curve:**
Adjusts the shape of the modulation curve for a more gradual or sudden effect.

**Polarity/Type:**
Determines the modulation's direction and behavior (unipolar or bipolar).

**Auxiliary Modulation Source:**
Adds an additional modulation source to the destination.

The modulation matrix offers a visual representation of the modulation relationships within your patch, allowing for easy management and adjustment of modulation assignments.
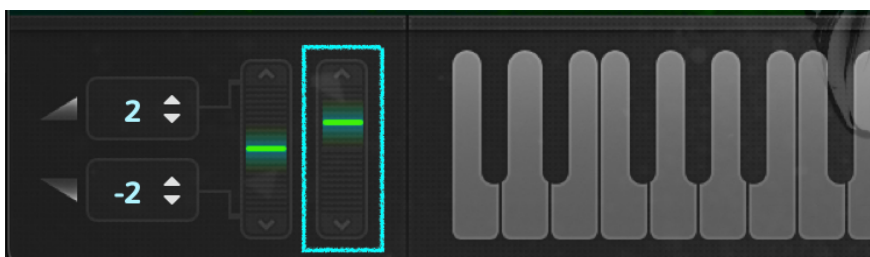
**Aux Source:**
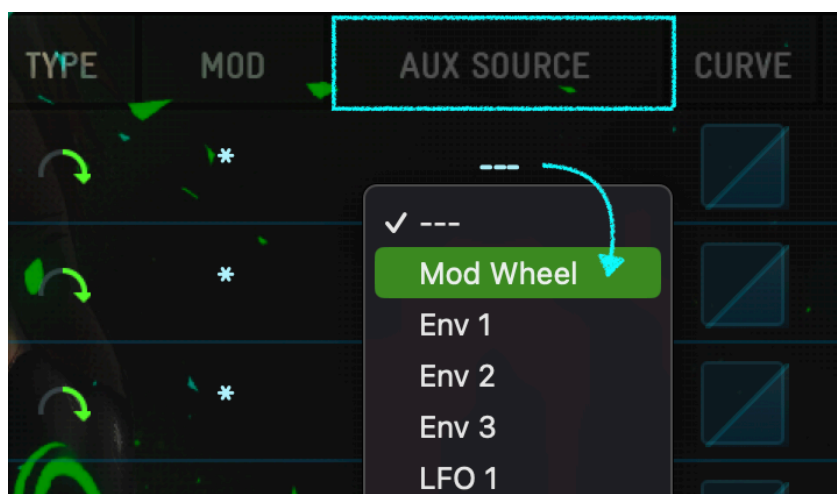
The concept of an auxiliary source in Serum is useful for controlling the modulation amount of a specific parameter over time. By assigning an auxiliary source, such as a Macro, you can fade the modulation in and out, providing dynamic control and versatility.

**Mod Wheel:**

The Mod Wheel, is a performa



nce control found on many MIDI controllers and synthesizers. It allows you to modulate various parameters in real-time, including pitch.

In Serum, the Mod Wheel can be assigned to control different parameters related to pitch modulation. The specific assignments may vary depending on the preset or patch you are using. Typically, the Mod Wheel is mapped to parameters such as vibrato depth, pitch modulation intensity, or filter cutoff modulation.

To use the Mod Wheel, you need to have a MIDI controller that has a Mod Wheel or a software-based MIDI controller. Simply move the Mod Wheel on your controller, and Serum will respond accordingly based on the assigned modulation parameters.
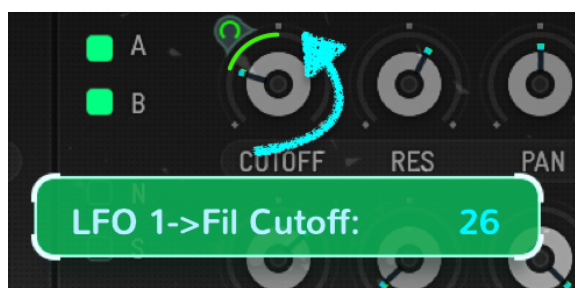
## Modulation Destinations:

With Serum, you can modulate various parameters to add depth and movement to your sound. Here are some popular modulation destinations:

- Oscillator Parameters: Modulate parameters like pitch, wavetable position, and level to introduce dynamic timbral shifts and harmonic variations.

- Filter Cutoff: Add expressive sweeps and filter movements by assigning modulation sources to control the cutoff frequency of the filters.

- Effects: Inject movement and variation into effects parameters like delay time, reverb size, or phaser rate to create evolving textures and spatial effects.

## Assigning and Adjusting Modulation:

To assign modulation in Serum, simply click on a parameter and drag it to a modulation source.



You can then adjust the modulation amount using the modulation depth control associated with the parameter.



Fine-tune the modulation by adjusting the modulation source's rate, shape, or other relevant parameters.

Experiment with different modulation combinations and amounts to achieve the desired sound. Modulation provides a powerful tool for breathing life into your

sounds and making them truly expressive.

## FX: Elevate Your Sound with Effects Mastery

In Serum, the FX section is a powerful arsenal of effects that allows you to shape and transform your sounds with depth, texture, and character. Let's delve deeper into each effect module and explore their respective parameters, signal flow, and routing options.

### 1. Hyper/Dimension:

The Hyper effect consists of two parts:



Hyper and Dimension. Hyper adds detuning to the sound by duplicating it at different pitches. The detune control adjusts the amount of pitch difference, while the rate determines the speed at which the pitches change. This effect widens the sound, adding a sense of width and thickness.

Dimension serves as a short delay/reverb effect, providing an immediate yet controlled echo. It creates a sense of space around the sound without cluttering up the mix. You can adjust the size and decay parameters to tailor the reverberation characteristics to your liking.

### 2. Distortion:



Serum's distortion section is a versatile tool for adding grit and saturation to your sounds. It offers various distortion algorithms, ranging from subtle warmth (tube, soft clip, tape saturation) to more aggressive options (sine shaper, diode). Experiment with different distortion types to add harmonics and create unique timbres. The pre-filter and post-filter options allow you to shape the sound before and after applying distortion, providing better control over the tonal balance.

### 3. Flanger:
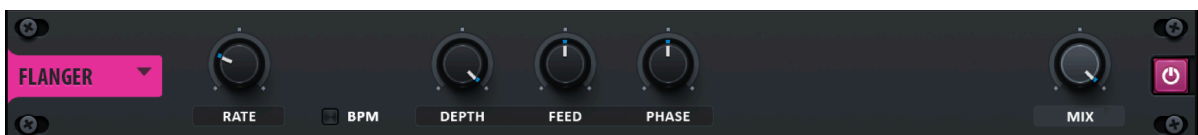


The flanger effect introduces metallic-like textures and sweeping motion to

your sounds. By adjusting the rate, depth, and feedback parameters, you can create swirling and sweeping effects. In Serum, if you set the flanger rate to 0Hz, you can manually control the LFO depth using the depth knob. This feature gives you more precise control over the flanging effect.

## 4. Phaser:



Similar to the flanger, the phaser effect adds movement to your sounds. It creates a sweeping, phasing effect by modulating the phase of the audio signal. Adjusting the rate, depth, and feedback parameters allows you to achieve different phasing characteristics. Placing the phaser effect before intense distortion can result in unique and powerful bass and lead sounds.

## 5. Chorus:



The chorus effect adds depth and richness to your sounds. It creates the illusion of multiple voices by modulating the audio signal with slight delays and pitch variations. Adjusting the rate, depth, and feedback parameters allows you to control the chorus effect's intensity. Use the LPF/HPF control to shape the wet signal and blend it to your taste. You can push the boundaries of the chorus effect to create experimental textures and effects.

## 6. Delay:



The delay effect provides standard delay functionality, allowing you to create echoes and rhythmic patterns. In Serum, you have control over parameters such as feedback, left and right delay time, linking options, and BPM synchronization. The "Tap -> Delay" option is a unique feature that sets the left delay to a "pre-delay" and the right delay to the actual delay time, creating a gap before the delay starts. This can be useful for creating rhythmic effects or emphasizing specific elements in your sound. The filter option allows you to shape the frequency content of the delayed signal, ensuring it sits well in the mix.

## 7. Compressor:

The compressor is a crucial tool for controlling dynamics and adding punch to your sounds. Serum's compressor offers a special "Multiband" mode that applies an OTT-like compression preset, enhancing the character of your sound. You can adjust parameters such as threshold, ratio, attack, release, and gain to shape the dynamics of your sound. Placing the compressor at the end of your effects chain can help tame wild sounds and ensure a more controlled output.

## 8. Reverb:



Serum's built-in reverb effect servesas a versatile tool for adding spatial depth and ambience to your sounds. While it may not provide the most authentic and rich reverb sound, it offers practical sound design capabilities.

The reverb module in Serum includes two modes: Plate and Hall. The Plate mode delivers a more two-dimensional reverb sound with a slightly metallic texture, which works well for leads and basses, adding a sense of space and dimension. The Hall algorithm provides a three-dimensional reverb sound, ideal for creating spacious environments for pads and plucks.

You have control over several parameters in the reverb module. The pre-delay knob introduces a gap between the dry signal and the onset of the reverberation, creating a sense of distance. The damp control allows you to soften the high-frequency content of the reverb, reducing any potential sharpness. The width knob adjusts the stereo spread of the reverb, enhancing the stereo image of your sounds.

Additionally, the decay parameter determines the length of the reverb tail, influencing the overall duration of the reverberation. The spin and spin depth parameters add a chorus-like modulation to the reverb tail, imparting richness and thickness. These modulation options help create evolving and atmospheric reverb textures.

Furthermore, the reverb module provides high cut and low cut controls, allowing you to shape the frequency response of the reverb tail. These controls enable you to tailor the reverb's tonal characteristics and ensure it fits harmoniously within your mix.

## 9. EQ:

Serum includes a simple two-band EQ module, which can be used for sound shaping or as an additional filtering tool. The EQ provides options for shelving, cutting, or bell-shaped frequency adjustments at both ends of the spectrum. You can control the gain and bandwidth for each band, enabling precise frequency sculpting.

## 10. Filter:



While we have covered the filter section previously, it's worth mentioning that Serum includes a second filter module within the FX section. This filter module offers the same range of filter types as the main filter section but lacks the graphical interface for visual representation. You can use this additional filter module to further shape your sound and add complexity to your patches.

Signal Flow and Routing Options:
In Serum, the FX modules can be arranged and connected in any order you desire, similar to adding plugins within a digital audio workstation (DAW). This flexibility allows for creative sound design possibilities. You can enable or disable individual FX modules as needed, ensuring they don't occupy unnecessary space or processing power.

To apply effects to your sound, you can simply drag and drop the FX modules onto the FX rack in the desired order. Each module has its own set of parameters that you can tweak to achieve the desired sonic outcome. By experimenting with different effect combinations and parameter settings, you can sculpt and transform your sounds to suit your artistic vision.

The FX modules can be further modulated and controlled using Serum's modulation system. You can assign modulation sources, such as envelopes, LFOs, or macros, to various FX parameters, allowing for dynamic and evolving effects.

## Global Settings in Serum:
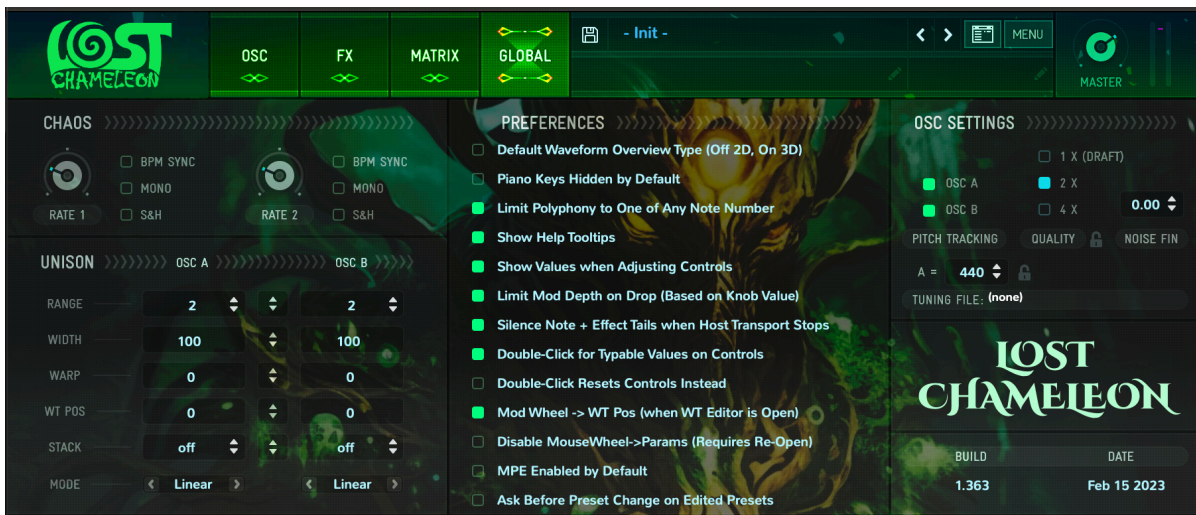
In addition to the main sound-shaping features, Serum also has some additional settings that affect how the plugin behaves and sounds overall. These settings can be adjusted to customize your experience and optimize Serum's performance. Let's take a closer look at these settings:

## Unison:



Unison is a feature that makes your sounds bigger and thicker by layering multiple voices. It's like having several copies of the sound playing simultaneously. You can control how many voices are stacked together and how much they're detuned. More voices and detuning create a wider and richer sound. Unison is commonly used for creating massive leads, lush pads, and fat chords that fill up the stereo field.

## Oversampling:

Oversampling is like adding extra detail to the sound. It makes the audio quality better by processing it at a higher resolution internally. Think of it as taking a high-resolution photo compared to a low-resolution one. With oversampling, Serum can reduce distortion and make the sound clearer and smoother.

However, keep in mind that higher oversampling settings require more computer power (CPU).
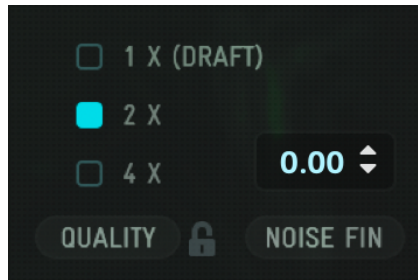


=You can choose from different quality options based on your needs. If you're working on a complex project and your computer can handle it, you might prefer higher quality settings for better sound accuracy.

## Global Tuning:
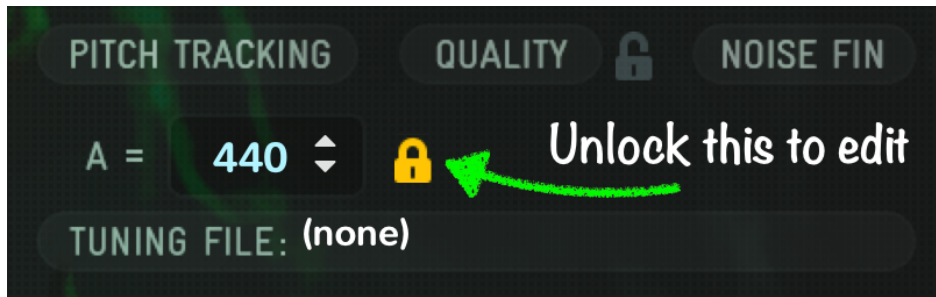


Global tuning allows you to adjust the overall pitch of Serum. It's like tuning all the sounds in Serum to match the desired key or to create unique musical effects. You can change the pitch by tiny increments called cents. This feature is helpful when you want to make sure Serum plays in tune with other instruments in your composition or when you want to experiment with unconventional pitch relationships.

*Speaking of changing the Tune..*

## Pitch Bend:
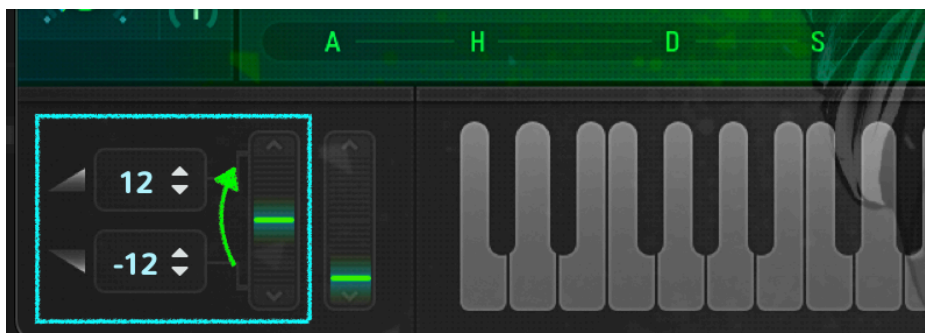


The Pitch Bend feature in Serum allows you to dynamically bend the pitch of a note while playing or performing. You can find the Pitch Bend control at the bottom left corner of the interface. It is represented by a horizontal lever-shaped icon.

When you move the Pitch Bend lever upward or downward, it introduces a

smooth pitch modulation effect. By default, the Pitch Bend range is set to 2 semitones up and 2 semitones down, but you can adjust the range according to your preference. To change the Pitch Bend range, simply click and drag the numbers above the Pitch Bend control.

To use the Pitch Bend, simply press a key or play a note and then manipulate the Pitch Bend lever to bend the pitch up or down. This feature adds expressive and dynamic control over the pitch of your sounds, allowing you to create slides, glides, and other pitch-based effects.

## Pitch Controls
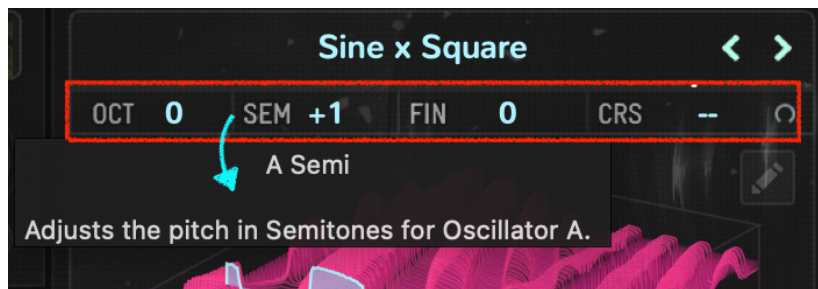


In Serum, you can adjust the pitch of each oscillator individually by using the coarse and fine tuning controls. These controls can be found in the oscillator section of the main interface. Coarse tuning adjusts the pitch in semitone increments, while fine tuning allows for more precise adjustments in cents.

## Voicing
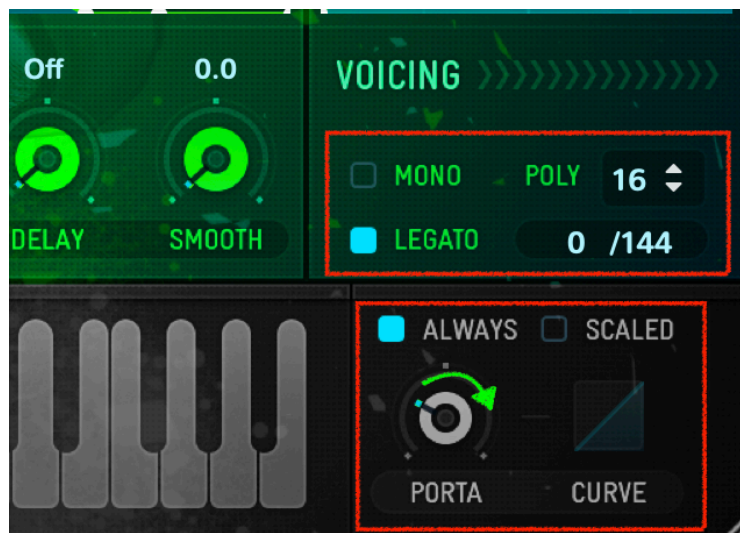


**Polyphony:**
Polyphony refers to the number of voices or notes Serum can play at the same time. The polyphony setting determines how many voices can be played simultaneously. For example, if you set it to monophonic, only one note can play at a time, while polyphonic modes allow multiple notes to sound simultaneously. This setting is important when working with chords or playing

complex melodies. If you reach the polyphony limit, some notes may get cut off to make room for new ones.

### Portamento
Portamento is a pitch bending effect that creates a smooth glide between two or more notes. In Serum, you can enable portamento by clicking the "Glide" button in the voicing section of the interface. You can adjust the portamento time using the "Time" knob.

### Mono and Legato Modes
When working with monophonic sounds, you can enable the "Mono" mode in the voicing section to ensure that only one note can be played at a time. In addition, you can enable the "Legato" mode to create a smooth transition between notes, even when playing overlapping notes.

*Damn that was a-lot! Let's wrap this up.*

# Recap
In this Serum 101 lesson, we explored the key features and functionalities of the Serum synthesizer. Let's recap the main points covered:

1. **Serum Interface:**
We discussed the layout and organization of the Serum interface, including the oscillator section, filter section, modulation matrix, effects, and global/master settings.

2. **Oscillators:**
We learned about the different oscillator types, waveforms, and parameters available in Serum, allowing for rich and diverse sound generation.

3. **Filters:**
We explored the various filter types and their parameters, enabling precise control over the timbre and character of your sounds.

4. **Modulation:** We delved into the modulation capabilities of Serum, including envelopes, LFOs, and macros, which provide motion, dynamics, and expression to your sounds.

5. **Effects**:
We discussed the powerful effects section in Serum, covering modules such as reverb, delay, distortion, and more, and their respective parameters. We also touched on the signal flow and routing options for applying effects within Serum.

6. **Global and Master Settings:**
We explained additional settings that affect the overall behavior and

performance of Serum, such as oversampling, quality settings, global tuning, master tuning, unison, and polyphony settings.

7. **Pitch Altering Features:**
We explored features like Portamento, Mono, Legato, Pitch Bend, and Mod Wheel, which allow for pitch control, glide effects, and expressive modulation in real-time.



## Final Message

Woop-woop! Congratulations on completing Serum 101! Mastering Serum unlocks a world of creative possibilities. And you know what? Some of your best sounds will happen by accident, so don't be afraid to make mistakes. Learn the technical terms like a professional, then break them as an artist.

Wishing you endless inspiration,

Lost Chameleon