



MOB OF EMUS

Polyfunctional
Harmonic Sextet

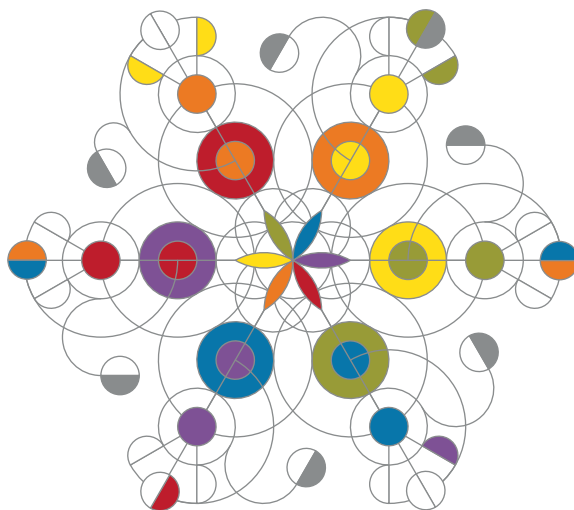
Operation Manual

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1. Introduction



Thanks for purchasing the Rossum Electro-Music Mob of Emus Polyfunctional Harmonic Sextet. This manual will give you the information you need to get the most out of Mob of Emus. The manual assumes you already have a basic understanding of synthesis and synthesizers. If you're just starting out, there are a number of good reference and tutorial resources available to get you up to speed. One that we highly recommend is:

Power Tools for Synthesizer Programming
(2nd Edition)

By Jim Aikin

Published by Hal Leonard

HL00131064

Another great source of information is Chris Meyer's Learning Modular:

<https://learningmodular.com>

Support

In the unlikely event that you have a problem with your Panharmonium, tell us about it here:

<http://www.rossum-electro.com/support/support-request-form/>

...and we'll get you sorted out.

If you have any questions, comments, or just want to say "Hi!," you can always get in touch here:

<http://www.rossum-electro.com/about-2/contact-us/>

...and we'll get back to you.

Happy music making!

2. Module Installation

As you will have no doubt noticed, the rear of Mob of Emus is a circuit board with exposed parts and connections. When handling Panharmonium, it's best that you hold it by the edges of the front panel or circuit board. It's not particularly easy to blow up, but why take chances?

More specifically, the biggest risk (to the extent that there's a risk), is damage by static electricity. Particularly on dry, cold days (or if you've just shuffled across your shag carpet in fuzzy slippers), make a point of touching the metal panel first, before touching any other part of the module.

While all Rossum Electro-Music modules are protected against reverse polarity damage, both to your module and your system, care should still be taken to connect the power cable correctly. (For more detail on our unique protection method, check out Dave's discussion of Circuit Protection in Chapter 17.)

Plug the included 16-pin connector into the header on the rear of the module such that the red stripe on the cable (the -12V side) is on the same end of the header as the "Red Stripe (-12V)" text on the PCB.

Mob of Emus requires, at most, 140mA of +12V and 30mA of -12V.

We have included both M3 and M2.5 (for vector rails) mounting screws. Use what fits your system.

If rack rash is of concern to you, use the included nylon washers when mounting Mob of Emus in your case.

3. Overview



What is Mob of Emus?

Mob of Emus is a flexible music and sound design tool that gives you an extensive collection of multi-channel synthesis functions in a mere 16HP.

Mob of Emus provides up to six channels of oscillators, noise sources, cyclical and 1-shot modulators (including LFOs, envelopes, and various other shapes), sample and hold waves, slow random modulators, triggers, rhythm patterns, and quantization (of both internal and external signals) in pretty much any combination (well, any combination of six channels, anyway).

In addition to being able to independently program the function of each individual channel, Mob of Emus' Hex mode provides a macro control layer that allows you to control all of its channels simultaneously (while maintaining the relationships of each channel's independent programming).

What's more, Mob of Emus' "harmonic" control structure makes it extremely easy to combine its oscillators into rich additive timbres, to combine its LFOs into stacked harmonic low frequency modulation waves, and to create modulation sources and triggers with intricate polyrhythmic patterns.

With an external trigger input, six CV inputs that can operate in six different control modes, six independent outputs, and an assignable mix output, Mob of Emus can operate as the heart of an almost unlimited variety of patches.

And while Mob of Emus' interface is, by necessity, rather dense (given all it does), its eight real-time controls have been designed to give you immediate hands-on access to a channel's (or all six channels') key parameters, inviting (and rewarding) exploration and improvisation.

Finally, Mob of Emus provides 12 preset locations to save your favorite creations.

Read on for all the details.

4. Basic Functionality

Before we jump into individual functions in detail, let's take a quick look at Mob of Emus' structural organization.

Tap/Trig Button and Jack



The **Tap/Trig** button lets you set the frequency of Mob of Emus' Hex Mode frequency parameter or simultaneously trigger all six of its channels.

The associated jack can function in three different modes, either setting the Hex Mode frequency in response to incoming signals, triggering all six channels, or doing both simultaneously (the default setting).

Hex Button



The **Hex** button toggles Hex Mode on and off. The associated LED will indicate its state. It can also select or deselect all of the channels, toggle the LED channel output viewer, and latch or unlatch a selected Option Mode.

CV Inputs

The six CV inputs accept signals in the range of $\pm 5V$ and operate in one of 6 modes. They are:



MULTI For use in Hex Mode, each input affects all six channels simultaneously. Each input's target parameter is labeled on the panel (i.e., Frequency, Wave, Phase, Harmonic Gain, Variation, and Quantization).

FREQ The inputs independently control the frequency of all six channels.

TRIG The inputs independently trigger the individual channels.

GAIN The inputs independently control the output amplitude of individual channels.

WAVE The inputs independently control the wave shape of individual channels.

QUANT Mob of Emus will quantize external signals patched to the CV inputs using the scale selected by the Quantization parameter.

Real-Time Controls



The real-time controls function in a primary mode (labeled in black) and in one or two Option modes (labeled in blue). Functions labeled in orange are active in Hex Mode only.

H.GAIN/MIX Sets channel level in dB, from -infinity to 0.

Option 1: Include or remove a channel from the MIX output.

VARIATION/WARP Sets the probability that a channel will ratchet or drop a step.

QUANT/RND/DC Selects the scale that a channel's output will be quantized to.

Option 1: Add random frequency variation to a channel's output.

Option 2: Add a DC offset (+/- 12 semitones) to a channel's output.

In Hex Mode:

Unless noted, Options 1 and 2 are the same as individual mode.

FREQ/FINE/SEMI Offsets all channels' frequencies.

OCTAVE/2X Offsets all channels' octaves.

WAVE/ENV/PAT Selects all channels' waveshapes or enables the individual channels' waveshapes.

PHASE/SYNC/1S Offsets all channels' phase settings.

Option 1: Enables hard sync for channels 2–6, with channel 1 as master.

Option 2: Sets all channels to 1-shot mode.

HARM#/SERIES Sets the number of channels playing (from 1 to 6).

Option 1: Selects a preset harmonic series, setting the frequency multipliers of all 6 oscillators simultaneously.

H.GAIN/MIX Sets "Harmonic Gain."

Option 1: Sets Mix Output attenuation.

VARIATION/WARP Offsets the probability that all channels will ratchet or drop a step.

Option 1: Warps each channel's frequency in the style of a frequency shifter. Provides a rich chorusing effect just slightly clockwise from the 12 o'clock position. At full CCW, all channels swarm to the frequency of channel 1.

In individual channel mode:

FREQ/FINE/SEMI Sets a channel's frequency over a range of +/- 2 octaves.

Option 1: Fine tune.

Option 2: Constrain to semitones.

OCTAVE/2X Sets a channel's octave over a range of +/- 5 octaves.

Option 1: Doubles range to +/- 10 octaves.

WAVE/ENV/PAT Selects a channel's waveshape.

Option 1: Selects from a second bank of shapes, including envelopes.

Option 2: Selects from a third bank of shapes, including rhythm patterns.

PHASE/SYNC/1S Sets a channel's phase offset, from 0–360 degrees.

Option 1: Enables hard sync, with channel 1 as master.

Option 2: Sets a channel to 1-shot mode.

HARM#/SERIES Sets a frequency multiplier of 1 to 16.

Option 1: Sets a frequency multiplier of 17 to 32.

QUANT/RND/DC Selects the scale for the Mix output quantizer.

Option 1: Adds random frequency variation to all channels' outputs.

Option 2: Adds a DC offset (+/- 12 semitones) to the Mix output.

Mixed Mode

When Hex mode is enabled and one or more channels are selected, all parameter edits will affect the selected channels, not the Hex layer. However, Mob of Emus will continue to apply the Hex layer offsets and modifications, allowing you to make edits to the individual channels while hearing the Hex Mode offsets.

Channel Selectors and LEDs



The channel selector buttons are used to select channels for editing, to manually trigger individual channels, and to solo or mute individual channels.

The LEDs indicate the channels selected for editing as well as displaying triggers. When OPTION is held or latched, the LEDs act as a graphical output level viewer.

When editing HARM/SERIES, HARM#, OCTAVE, QUANT, SEMI, or DC, the LEDs (along with the Preset LEDs and the HEX LED) will display the current pot value as a temporary LED meter.

Outputs



Six individual channel outputs and a summed Mix output.

NOTE: You'll notice that the individual channels are labeled with #1 at the bottom and #6 at the top. Given Mob of Emus' various "harmonic" functions, it makes sense to treat the channels as harmonics, with the lower frequencies at the bottom and the progressively higher frequencies towards the top. Of course, you can set channel frequencies to anything you like, but if you're using the "harmonic" functions, maintaining the bottom-to-top organization will tend to make things conceptually clearer.

IMPORTANT NOTE: In order to ensure precisely accurate CVs, the impedance of Mob of Emus' outputs is less than 1 Ohm. Because of this, the outputs will not directly drive headphones. If you would like to monitor Mob of Emus' outputs

when used at audio frequencies, first patch it into an audio processing module like a VCA, output module, filter, etc., and then monitor it there.

Preset/CV Mode Selectors



Lets you load or save one of 12 presets. Double-click and hold OPTION and click to select

the CV Input Mode.

Power Down Behavior

Upon power down (including accidental removal of power or a power failure), the state of the module is saved and reloaded the next time the module is powered up.

5. Make Some Noise!

The quickest way to hear some of what Mob of Emus can do is to check out the Presets that come pre-loaded from the factory. Refer to **Chapter 16** for details about the intended effect of each preset.

Select a preset by clicking or double-clicking the desired button in the Preset section. To load Preset 1–6, click the appropriate button. The associated LED will light. To select 7–12, double-click the desired button. The associated LED will flash. Click the button again to deselect the preset.

Once you've selected a preset, either monitor the outputs (if it's an audio preset) or patch the outputs to modulation inputs on additional modules (as suggested for the preset in Chapter 16). In either case, try adjusting some parameters and see what happens.



A TIP: *If you start playing with a preset and get lost to the point that you're not sure what's going on (not that that's necessarily a bad thing), try deselecting the preset and then selecting it again to get back to its initial state.*

When you've played for a while, read the rest of this manual. You'll be glad you did.


6. Tap/Trig Button & Jack


The **Tap/Trig** button and its associated jack let you set the Hex Mode frequency or trigger all six channels simultaneously (or, depending on the jack mode, both). The **Tap/Trig** button also offers the ability to set the frequencies of selected individual channels.

Tap/Trig Button



Sequentially clicking the **Tap/Trig** button while in Hex Mode (with no individual channels selected) will set the Hex Mode Frequency parameter. Mob of Emus will average the period between your clicks to derive the frequency. You can think of this as a real-time “tap tempo” function.

 **NOTE:** If you are not in Hex Mode, clicking the button will have no effect on Hex Mode frequency (but will set the frequency of any selected channels — see the next note).

 **THE NEXT NOTE:** Whether you are in Hex mode or not, if any channels are selected for editing, sequentially clicking the **Tap/Trig** button will set the frequencies of those selected channels. Selecting channels sequentially and clicking the **Tap/Trig** button for each is a quick way to set up the frequencies of the different channels

Holding down the Option button and then clicking the Tap/Trig button will execute a hex trigger, simultaneously triggering all six channels (but see below for a discussion of “trigger” vs. “phase reset”).

 **NOTE:** As described in **Chapter 8**, latching any of the Option Modes will allow you execute the hex trigger simply by clicking the **Tap/Trig** button.

The **Tap/Trig** button, in combination with the Option button, is also used to set the mode of the **Tap/Trig** jack, as described below.

Tap/Trig Jack



The **Tap/Trig** jack can accept a wide range of clock frequencies and can function in one of three modes:

- > **Frequency + Trigger Mode:** In this mode, the jack functions like the **Tap/Trig** button to set the Hex Mode Frequency. In addition, it will generate a hex trigger on every clock pulse. This is the default mode and is the best technique for syncing to an external clock and ensuring that all of Mob of Emus’ channels remain phase synchronized.
- > **Frequency Mode:** In this mode, the jack functions like the **Tap/Trig** button to set the Hex Mode Frequency, but does not generate a hex trigger on every clock pulse. This is useful when you want to define a tempo, but do not necessarily require that all channels be resynchronized on every trigger.
- > **Trigger Mode:** In this mode, a hex trigger is generated whenever the incoming CV exceeds 1.7V, but the Hex Frequency is not affected. This mode is useful when you want to trigger events via an external trigger source (a trigger sequencer, for example) without affecting the overall tempo.

Setting the Tap/Trig Jack Mode

To select the **Tap/Trig** jack mode, hold the Tap button for 1 second to display the current selected mode on the **Preset** and **Channel Selector** LEDs. The bottom row of Preset LEDs and the **Channel 1, 2, and 3** LEDs will strobe towards the **Option** button to remind you that that’s the button you click to select the mode.

Clicking the **Option** button cycles between the three choices. The LED indication for each mode is as follows:

Frequency + Trigger Mode:

Preset 1 LED + Channel **4**, **5**, and **6** LEDs

Frequency Mode: **Preset 1** LED only.

Trigger Mode: Channel **4**, **5**, and **6** LEDs


Trigger vs Phase Reset


As far as Mob of Emus is concerned, triggering a channel and resetting the phase of a channel are essentially the same thing. In each case, a channel's wave instantly resets to its beginning and plays from there.

The main difference lies in whether the wave is in 1-Shot Mode or is a continuing cyclical wave.

If in 1-Shot Mode (as would be typical of an envelope shape), upon receipt of a trigger, the shape would play once and then stop until it receives another trigger, at which time it plays once again.

If a cyclical wave (as would be typical of the traditional synth waveforms or the rhythm patterns), the wave is repeating continuously. When it receives a trigger it will do an instant phase reset, that is, it will jump to the beginning of its shape and continue playing from there.

 **A NOTE:** *Of course, there is nothing keeping you from turning an envelope into a cyclical wave or a sawtooth into a 1-Shot, in which case you'll be triggering a single cycle of the sawtooth and resetting the phase of the repeating envelope.*

 **A TIP:** *One use of a phase reset is if you've set up a polyrhythmic texture or drone where the separate channels drift apart over a period of time. Doing a phase reset of all the channels at once will resync them to their beginnings and restart the polyrhythmic pattern.*

7. Real-Time Controls


The real-time controls give you immediate access to all of a channel's key parameters (or the key parameters of all of the channels in Hex Mode).

Before we get into the individual controls, here are some things to keep in mind:


Option Modes




Most of the controls operate in a primary mode, labeled on the panel in black, and one or two Option modes, labeled in blue. Option modes are accessed (for Option 2) and then turning the control.

 **A NOTE:** Clicking the Hex button while an Option mode is active latches the Option mode. That is, you can release the Option button and Option mode continues to be active, letting you adjust multiple Option mode parameters without having to hold down the Option button.

When an Option mode is latched, clicking the Hex button unlatches it, returning the module to primary mode.


 **ANOTHER NOTE:** While an Option mode is latched, clicking the Option button cycles sequentially through the three modes: Option 1 to Option 2 to primary.

When in Option 1 mode (either by holding the Option button or when latched), the Hex LED blinks at 4 Hz to indicate that. When in Option 2 mode, the LED blinks at 8 Hz.

 **YET ANOTHER NOTE:** As described elsewhere in this manual, clicking and holding, or double-clicking and holding the Option button enables a number of other functions. Latching an Option mode latches the ability to execute those functions as well. Specifically:

When Option 1 is latched, the Channel Output Viewer is active and clicking a Channel Selection button triggers or resets the phase of that channel.

When Option 2 is latched, the Preset buttons function as CV Mode Selector buttons.

 **AND YET ANOTHER NOTE:** Some of the controls do not have a dedicated Option 2 function. In those cases, their Option 1 function will also be available when Option 2 is selected. In the detailed descriptions that follow, those functions appear in parentheses.

Knob Behavior

When switching between channels for programming, you will often find that a knob's current position doesn't match the value of its parameter in the newly selected channel. As long as you don't adjust the position of the knob, the parameter in the newly selected channel will not be affected. However, as soon as you do move the knob, the parameter will change to the knob's physical position.

Hex Mode

When in Hex Mode, the real-time controls, in most cases, affect their parameters in all six channels. However, there are a few instances where certain functions are only available when in Hex mode. These are indicated on the panel with orange labels.

Channel Frequency Range

It's important to remember that a channel's initial frequency (before any CV control) is defined by the product of four of the real-time parameters: Frequency, Octave, Harmonic #, and Variation. In Hex Mode, Frequency and Octave can be further offset by their Hex Mode parameters. And, of

course, a Frequency CV can expand the range by another +/-5 octaves.

The initial frequency of a channel with all parameters and modifiers set to 0 is 2Hz. (Which, if you're programming rhythmic modulation, is exactly 120BPM.)

Making use of all the available parameters and modifiers, maximum frequency range is approximately as follows:

Lowest: 36.4 hours per cycle.

Highest: >23,148 Hz (amplitude is 0 above that)

Exploration

In selecting Mob of Emus' real-time controls, it was our goal to encourage experimentation and exploration. Particularly when it comes to additive harmonic synthesis and polyrhythmic modulation patterns, we encourage you set up a basic patch and then play with the various harmonic parameters (Harmonic #, Harmonic Series, Harmonic Gain, etc.) as well as the Variation and Random parameters. These make it extremely easy to quickly audition a huge variety of options, potentially leading to the discovery of rich sounds and intricate rhythmic patterns you might never otherwise have imagined.

So, now on to the controls.

FREQ/FINE/SEMI



This control sets a channel's frequency relative to the selected octave.



NOTE: The frequency can be further modified by the Harmonic # or Harmonic Series parameter.

In Individual Mode:

Primary: Sets a channel's frequency over a range of +/- 2 octaves.

Option 1: Allows fine tuning of the channel's frequency.

Option 2: Sets the channel's tuning to semitones.

In Hex Mode:

Primary: Offsets the frequencies of all channels over a range of +/- 2 octaves.

Option 1: Offsets the fine tuning of the frequencies of all channels

Option 2: Offsets the tuning of all channels in semitone steps.

OCTAVE/2X



As is obvious from its name, this control sets a channel's octave. In combination with the frequency control, this is where you will typically define a channel as an audio channel or a modulation source (keeping in mind, of course, that an audio rate signal can also be a modulation source).

In Individual Mode:

Primary: Sets a channel's octave over a range of +/- 5 octaves

Option 1: Doubles the range to +/- 10 octaves.

Option 2: (Doubles the range to +/- 10 octaves.)

In Hex Mode:

Primary: Offsets all channels' octaves over a range of +/- 5 octaves

Option 1: Doubles the offset range to +/- 10 octaves.

Option 2: (Doubles the offset range to +/- 10 octaves.)

WAVE/ENV/PAT



This control lets you select a channel's waveshape. There are three banks of 9 shapes to choose from.

IMPORTANT NOTE: When using a CV to control the waveshape, the CV selection is limited to the currently selected bank. That is, a CV will not jump from one bank to another.

A RELATED IMPORTANT NOTE: Within each bank, a CV can only be used to access the first 8 waves, as the ninth wave in each bank is different enough from the other 8 that you wouldn't want to inadvertently choose it. So, within Bank 1, a CV will not select Sample & Hold. Within Bank 2, a CV will not select Smoothed Random Voltage, and within Bank 3, a CV will not select Filtered Noise.

If you have manually selected any of the three ninth waves, CV modulation does nothing.

AND YET ANOTHER IMPORTANT NOTE: The traditional waveforms in Bank 1 are anti-aliased, allowing them to be transposed cleanly over an extremely wide range. The remainder of waveforms are intended primarily for modulation purposes and are not anti-aliased. However, there is no reason you can't use them at audio rates as well. Just keep in mind that, depending on the range you use them in, artifacts may result. That may or may not be a good thing.

In Individual Mode:

Primary: Selects a channel's waveshape from Bank 1

Option 1: Selects a channel's waveshape from Bank 2

Option 2: Selects a channel's waveshape from Bank 3

In Hex Mode:

Primary: Selects the waveshape of all channels from Bank 1

Option 1: Selects the waveshape of all channels from Bank 2

Option 2: Selects the waveshape of all channels from Bank 3

Bank 1 (labeled on the panel)

Standard waveforms, useful both as audio oscillators and LFOs.

- 1 Ø (Null)*
- 2 Sine
- 3 Triangle
- 4 Ascending Sawtooth
- 5 Descending Sawtooth
- 6 Square (50% Pulse)
- 7 25% Pulse
- 8 12.5% Pulse
- 9 Sample & Hold**

* In Hex Mode, the Ø setting allows the individual channels' wave selections to be in effect. In Individual Mode, it maps to the Sine shape.

** The Sample & Hold wave is generated from an internal random source.

Bank 2

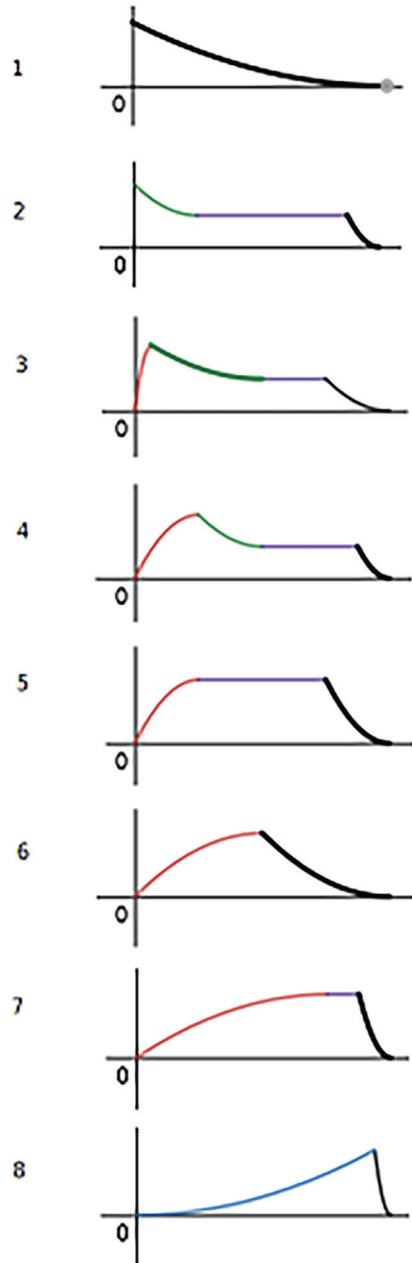
Envelopes and smoothed random output voltage.

The durations of the envelope segments (attack, decay, sustain, release) are quantized to multiples of 1/16th of the channel frequency, making them particularly applicable to rhythmically synced patterns.



NOTE: The envelopes have a voltage range of 0-5V.

The Smoothed Random output is the Sample and Hold oscillator followed by a tunable low pass filter. The low pass filter cutoff frequency is determined as a function of the channel's frequency in order to produce a smoothly varying random output voltage. Stacking Smoothed Random oscillators at different frequencies and amplitudes can produce "fractal" random shapes at the Mix output, much like the Perlin noise that is used in the video domain to synthesize natural looking landscapes.




#9 Smoothed Random

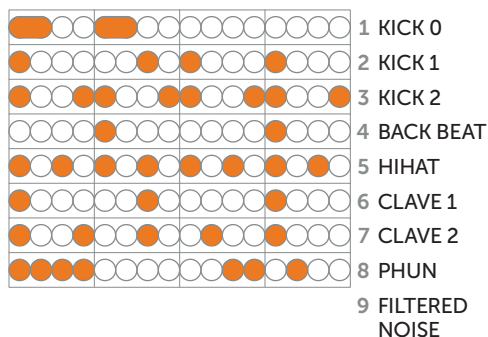
Bank 3

Rhythm Patterns and Filtered Noise

The rhythm patterns are 16 step micro-sequences that can be useful in setting up a basic drum/rhythm pattern. In the diagram below, each step represents 1/16th of the frequency period of the channel. For the purpose of these patterns, it may be useful to think of one frequency period as 4 quarter notes, with each step representing a 16th note.

 **NOTE:** The two gates in Kick 0 are stretched to 8th notes.


The Filtered Noise output is a white noise source followed by a tunable low pass filter. The low pass filter cutoff frequency is determined as a function of the channel's frequency. Useful both as an audio source and a modulation source, the noise color will be white with a channel's frequency (and octave) cranked all the way up, red/brown at low frequencies, and various shades of mauve in between. Again, stacking can produce interesting results.




PHASE/SYNC/1S




This control allows you set a channel's phase offset, from 0-360 degrees, to enable hard sync with Channel 1 as the master, and set a channel to 1-Shot mode.

 **A NOTE:** When setting Phase, there are small dead zones at 90 degrees, 180 degrees, and 270 degrees to make it easy to set up quadrature LFOs.

 **IMPORTANT NOTE:** Options 1 & 2 are essentially two-position switches. In each case, rotating the knob counterclockwise from 12 o'clock turns the function off, while turning it clockwise from 12 o'clock turns it on. The specific position doesn't matter, as long as it's either to the right or left of 12 o'clock.

In 1-shot mode, upon being triggered, the wave will play once and stop until triggered again. Cyclical waves will play for one cycle. Filtered Noise and Smoothed Random Voltage will play for one frequency period.

 **NOTE:** When Filtered Noise is in 1-Shot Mode, the Phase control will set the delay until onset. When Sample & Hold and Smoothed Random Voltage is in 1-Shot Mode, Phase will control the delay until update.

In Individual Mode:

Primary: Sets a channel's phase offset, from 0-360 degrees.

Option 1: Enables hard sync, with Channel 1 as the master.

Option 2: Sets a channel to 1-Shot mode.

In Hex Mode:

Primary: Offsets all channels' phase settings.

Option 1: Enables hard sync for Channels 2-6 with Channel 1 as the master.

Option 2: Sets all channels to 1-shot mode.

HARM#/SERIES



This is the primary control for quickly setting up the various harmonic relationships of the channels.

This control makes it easy to set up rich timbres when using the channels as oscillators for additive synthesis and to create complex polyrhythms when using the channels as cyclical modulation sources.


In Individual Mode, The Harmonic Number parameter is a frequency multiplier that sets the channel's frequency to one of the frequencies in the harmonic series. A value of 1 results in the channel's current frequency, which could be thought of as the "fundamental." Higher numbers set frequency relationships relative to that fundamental that follow the classic harmonic series.

If you're creating polyrhythmic modulations, this conversion table from harmonic number to musical note value may be useful. Note that it assumes Harmonic #1 is a whole note.

Harmonic Number to Note Value

- 1: Whole note
- 2: Half note
- 3: Half note triplet (3 over 2)
- 4: Quarter note
- 5: Quarter note quintuplet (5 over 4)
- 6: Quarter note triplet (3 over 2)
- 7: Quarter note septuplet (7 over 4)
- 8: 8th note
- 9: 8th note nontuplet (9 over 8)
- 10: 8th note quintuplet (5 over 4)
- 11: 8th note 11tuplet (11 over 8)
- 12: 8th note triplet (3 over 2)
- 13: 8th 13tuplet (13 over 8)
- 14: 8th note septuplet (7 over 4)
- 15: 8th note 15tuplet (15 over 8)
- 16: 16th note
- 17: 16th note 17tuplet (17 over 16)
- 18: 16th note nontuplet (9 over 8)
- 19: 16th note 19tuplet (19 over 16)
- 20: 16th note quintuplet (5 over 4)

- 21: 16th note 21tuplet (21 over 16)
- 22: 16th note 11tuplet (11 over 8)
- 23: 16th note 23tuplet (23 over 16)
- 24: 16th note triplet (3 over 2)
- 25: 16th note 25tuplet (25 over 16)
- 26: 16th note 13tuplet (13 over 8)
- 27: 16th note 27tuplet (27 over 16)
- 28: 16th note septuplet (7 over 4)
- 29: 16th note 29tuplet (29 over 16)
- 30: 16th note 15tuplet (15 over 8)
- 31: 16th note 31tuplet (31 over 16)
- 32: 32nd note

 **A TIP:** Whether for audio or modulation, start by setting all six channels to the same frequency. Then set the harmonic number of each channel to create the desired harmonic relationships.

In Hex Mode, Harmonic Number has a different meaning. There it selects the number of channels playing, from 1 to 6.

Also in Hex Mode, the Option 1 function lets you select from 15 pre-programmed harmonic series, instantly assigning each channel to the appropriate harmonic number.

In Individual Mode:

Primary: Sets a channel's frequency multiplier from 1 to 16

Option 1: Sets a channel's frequency multiplier from 17 to 32

Option 2: (Sets a channel's frequency multiplier from 17 to 32)

In Hex Mode:

Primary: Sets the number of channels playing (from 1 to 6). Channels are silenced starting with Channel 6 and moving down until only Channel 1 remains. The Mix output will auto-scale amplitudes with the number of channels playing, to keep the mix near the nominal output level.

Option 1: Selects a preset harmonic series, setting the frequency multipliers of all 6 oscillators simultaneously.

Option 2: (Selects a preset harmonic series, setting the frequency multipliers of all 6 oscillators simultaneously.).

Hex Mode Harmonic Series

- 1 Unison {1,1,1,1,1,1}
- 2 All {1,2,3,4,5,6}

Rhythms

- 3 Powers of 2 4/4 Rhythm {1,2,4,8,16,32}
- 4 12/8 Rhythm {1,2,4,6,8,12}
- 5 3/4 Rhythm {1,2,3,4,6,8}
- 6 3+5 Rhythm {1,2,3,5,6,10}

Odd

- 7 Odd {1,3,5,7,9,11}
- 8 Fave Odd {1,5,9,11,15,19}
- 9 Fibonacci {1,2,3,5,8,13}

Non-harmonic

- 10 Bar 1 {9/9,25/9,49/9,81/9,121/9,169/9}
squares of odd numbers
- 11 Bar 2 {1, 4.4375, 8.6975, 14.3775, 21.4775,
29.9975}
- 12 Bell {1,2,2.4,3,4,5}
- 13 Kettle Drum {1,1.17647,1.77647,1.97647,2.34
117,2.45882}

Scales

- 14 Hexatonic Major {C,D,E,F,G,A}
(1 ... 1.68179)
- 15 Hexatonic Minor {C,D,Eb,F,G,Bb}
(1 ... 1.78179)
- 16 Not Currently Used

H.GAIN/MIX



In Individual Mode, this control lets you set levels for the individual channels and also controls whether a particular channel appears in the Mix output.

In Hex Mode, the primary function is "Harmonic Gain" (that's why only the "H" is orange on the panel.) Harmonic Gain lets you control the balance of the six channels. At full clockwise, all six channels will play at their individually programmed levels. As you turn the knob counterclockwise from there, variable slope attenuation will be applied: more for the higher numbered oscillators and less for the lower numbered oscillators. At full counterclockwise, only Channel 1 will be audible.

In Individual Mode:

Primary: Sets a channel's Level

Option 1: Includes or removes a channel from the Mix output.

Option 2: (Includes or removes a channel from the Mix output.)



NOTE: Like the previously described Sync and 1-Shot functions, Option 1 is a two position switch. Rotating the knob counterclockwise from 12 o'clock removes the selected channel(s) from the Mix output. Turning it clockwise from 12 o'clock causes the channel(s) to appear at the Mix output. Again, the specific knob position doesn't matter, as long as it's either to the right or left of 12 o'clock.

In Hex Mode:

Primary: Controls Harmonic Gain

Option 1: Sets the attenuation of the Mix output

Option 2: (Sets the attenuation of the Mix output)

VARIATION/WARP



The Variation function lets you set the percentage probability that, for each frequency period, a channel's frequency will either ratchet (be doubled) or dropped (divided by 2).

Turning the knob clockwise from 12 o'clock increases the probability of ratcheting. The farther you turn it, the greater the probability a step will ratchet. At full clockwise, the percentage probability is 100%, essentially doubling the channel's programmed frequency.

Turning the knob counterclockwise from 12 o'clock increases the probability of dropping. The farther you turn it, the greater the probability a step will drop. At full counterclockwise, the percentage probability is 100%, essentially halving the channel's programmed frequency.


In Hex Mode, Option 1 controls the Warp function. Warp bends the individual channel frequencies in the style of a frequency shifter. With conventional frequency adjustment, the harmonic relationships between a sound's spectral elements are preserved. So, while the pitch changes, each individual harmonic element maintains its relative relationship to the rest of the harmonic elements. As a result, the timbre of the sound remains generally constant as the overall pitch changes.


With warping, each harmonic element (i.e., channel) is shifted individually, producing a variety of clangorous, swarming textures.

When the knob is at 12 o'clock, there is no warping. As the knob is turned clockwise, the channels are spread apart, with the odd-numbered channels being shifted lower and the even-numbered channels being shifted higher.

 **NOTE:** The range from 12 o'clock clockwise to 1:30 is specifically designed to provide a chorus effect.

As the knob is turned counterclockwise from 12 o'clock, the channels are shifted closer together, until, at full counterclockwise, the frequencies swarm to the frequency of Channel #1.

 **A TIP:** A Warp setting just to the right of center provides nice chorus-style detuning.

 **NOTE:** There is a small dead zone at 12 o'clock to make it easy to set to no warping.

In Individual Mode:

Primary: Sets the probability that a channel will ratchet or drop a step.

Option 1: Applies the Warp algorithm to any selected channels.

Option 2: (Applies the Warp algorithm to any selected channels.)

In Hex Mode:

Primary: Offsets the probability that all channels will ratchet or drop a step.

Option 1: Sets the amount and direction of warping.

Option 2: (Sets the amount and direction of warping.)

QUANT/RND/DC



The Quantization function lets you select from a variety of preprogrammed scales used to quantize the output of the individual channels or the Mix output.

The Random function adds random frequency variation to a channel's output on a perfrequency period basis. The farther clockwise you turn the knob, the more of the random signal is applied to the frequency.

NOTE: *The Individual Mode randomization amount and the Hex Mode randomization amount sum together, so you can get double the amount of randomization by turning them both up to maximum.*

The DC function adds a DC offset of +/- 12 semitones (quantized to semitones) to a channel's output (Individual Mode) or the Mix output (Hex Mode). It's useful for quickly transposing one or more channels or the entire Mix output. It is also useful to set the root note for the quantizer.

IMPORTANT NOTE: *It's important to differentiate between this Quantization function, which quantizes the outputs of Mob of Emus' internal channels, and the Quantization CV Input mode, which quantizes external signals patched to the CV inputs. When in Quantization CV Input mode, the scales and DC offsets selected here affect the external quantizer and the quantized signals replace the internal channels. See **Chapter 10** for details.*

Quantizer Scales

- 1 Off
- 2 Chromatic (12 steps)
- 3 Major (7 steps) (C D E F G A B)
- 4 Major Pentatonic (5 steps) (C D E G A)
- 5 Major Triad (3 steps) (C E G)
- 6 Major 7 (4 steps) (C E G B)
- 7 Minor 9 (4 steps) : (C Eb G [^]D : taller than an octave, so doubles back)
- 8 Minor Triad (3 steps) (C Eb G)
- 9 Minor Pentatonic (5 steps) (C Eb F G Bb)
- 10 Japanese (kumoi-joshi) (5 steps) : (C D Eb G A) also functions as minor 6
- 11 Harmonic Minor (7 steps) (C D Eb F G Ab B)
- 12 Sus4add9 close voicing (4 steps) (C D F G)
- 13 Dominant 7 (4 steps) (D F G B)
- 14 Diminished Hexatonic (6 steps) (C D Eb Gb Ab Bbb)
- 15 Whole Tone (6 steps) (C D E F# G# A#)
- 16 Sus4add9 open voicing (4 steps) (C G [^]D [^]F : taller than an octave, so doubles back)

In Individual Mode:

Primary: Selects the scale that a channel's output will be quantized to.

Option 1: Adds random frequency variation to a channel's output.

Option 2: Add a DC offset (+/- 12 semitones, quantized) to a channel's output.

In Hex Mode:

Primary: Selects the scale for the Mix output quantizer.

Option 1: Adds random frequency variation to all channel's outputs.

Option 2: Adds a DC offset (+/- 12 semitones, quantized) to the Mix output.

Mixed Mode

When Hex mode is enabled and one or more channels are selected, all parameter edits will affect the selected channels, not the Hex layer. However, Mob of Emus will continue to apply the Hex layer offsets and modifications, allowing you to make edits to the individual channels while hearing the Hex Mode offsets.

8. Hex Mode



Hex Mode provides a macro control layer that allows you to control all of Mob of Emus' channels simultaneously (while, in most cases, maintaining the relationships of each channel's independent programming).

The **Hex** button toggles Hex Mode on and off. The associated LED lights steadily to indicate Hex Mode is active.



NOTE: *While one of the Options Modes is latched on, the LED instead flashes to indicate that. When an Option Mode is unlatched, the LED will return to indicating the Hex Mode state.*

While in Hex Mode, the real-time controls will **offset** the individual channels' values for the following parameters (adding or subtracting from them as appropriate):

Frequency

Octave

Phase

Variation

DC Offset

While in Hex Mode, the real-time controls will **override** the individual channels' values for the following parameters:

Wave (unless "Ø" is selected)

Harmonic Series (sets all channels' Harmonic #)

Mixed Mode

When Hex mode is enabled **and** one or more channels are selected, all parameter edits will affect the selected channels, not the Hex layer. However, Mob of Emus will continue to apply the Hex layer offsets and modifications, allowing you to make edits to the individual channels while hearing the effects of the Hex Mode offsets.

Additional Hex Button functions

The Hex button is also used for the following functions:

Select or deselect all channels Double-click the Hex button to select all six channels. If all channels are selected, double-clicking the Hex button will deselect all of them.

Toggle Output Viewer Clicking and briefly holding the Hex button will toggle the Channel Selection LEDs Output Viewer on and off.

Latch Option Mode Clicking the Hex button while an Option Mode is momentarily selected will latch the Option Mode on.

Unlatch Option Mode Clicking the Hex button while an Option Mode is latched will unlatch the Option Mode.

9. Channel Selectors and LEDs




The Channel Selector buttons are used to select channels for editing, to manually trigger individual channels, and to solo or mute individual channels. The LEDs indicate the channels selected for editing as well as displaying triggers. When Option is held or latched, the LEDs act as a graphical Output Level Viewer.

When editing HARM/SERIES, HARM#, OCTAVE 2X, QUANT, SEMI, or DC, the LEDs (along with the Preset LEDs and the Hex LED) will display the current pot value as a temporary LED meter (see the end of this chapter for details).


Channel Selection

Clicking a Channel Selector button will select the channel for programming.


The associated LED will light steadily to indicate that. Clicking the Channel Selector button of an already selected channel will deselect it and the associated LED will extinguish.

 **NOTE:** Multiple channels can be selected at one time. In that case, any parameter adjustments will affect all of the selected channels identically.

Clicking and holding a Channel Selector button will select that channel and deselect any other selected channels.

 **NOTE:** If the channel whose button you click and hold is already selected, it will remain selected and all other channels will be deselected.

You can also double-click the **Hex** button to select all six channels. If all channels are selected, double-clicking the **Hex** button will deselect all of them.

 **NOTE:** In Individual Mode, if no channels are selected, adjusting any of the real-time controls will have no effect. To alert you to that state (and hopefully avoid the impression that something's broken), turning a knob when no channels are selected will result in a 1/2 second "chase" of the Channel Selector LEDs.

Channel Soloing and Muting

Much like the channels on a mixer, Mob of Emus' channels can be soloed and muted. Here's how:

Solo Double-click a channel's Channel Selector button to solo it. The associated LED will alternate between dim and bright to indicate the soloed state.

If a channel is already soloed, double-clicking will unsolo and deselect it.

Double-clicking and holding a channel's Channel Selector button will solo it and unsolo and deselect any other soloed channels.

Mute Triple-click a channel's Channel Selector button to mute it. The associated LED will dim to indicate the muted state.


If a channel is already muted, triple-clicking will unmute it and deselect it.

Triple-clicking and holding a channel's Channel Selector button will mute it and unmute and deselect any other muted channels.

Channel Output Viewer

Clicking and holding the **Option** button will cause the Channel Selector LEDs to display the output voltages of the six channels as long as the Option button is held or latched.

Alternatively, clicking and briefly holding the **Hex** button will directly latch on the Output Viewer. Briefly holding **Hex** again, or clicking the **Option** button will dismiss it.


 **NOTE:** *If you'd rather not see the Output Viewer, there are a couple of options:*

> Upon pressing the Option button, press and hold the Hex button until the display goes off. The Option Mode will be latched without the display.

> Upon pressing the Option button, either turn a knob or latch the Option Mode within 2/3 of second.

Triggering Individual Channels

Holding the Option button and clicking a channel's Channel Selector button will trigger that channel (if it's in 1-Shot Mode) or reset its phase (if it's a cyclical wave).

 **NOTE:** *If you latch Option 1 Mode, you can trigger channels by simply clicking their buttons without the need for holding the Option button. Great for "playing" the channels one-handed.*

Trigger Indication

A channel's LED will flash at full brightness to indicate the receipt of a trigger, whether manually generated by the click a button, or by the receipt of a signal at the TAP/TRIG jack or at a CV input in Trigger CV Mode.

 **NOTE:** *If the LED Output Viewer is active, the trigger indications will be superimposed over the top of it.*

Pot Value Meter

Most of Mob of Emus' parameters can be set by ear. However, for ease in setting functions that involve selecting discrete values or choosing from menu selections, the Channel Selector LEDs, in combination with the Preset LEDs and the Hex LED, will act as a temporary value indicator.

The parameters that provide the indicator are:

Harmonic # (in Individual and Hex Modes)

Harmonic Series

Octave 2X

Quantization

Semitone

DC Offset

Whenever you adjust the knob for any of the above parameters, the LEDs change to pot value display mode. When you stop turning the knob they revert to their previous state.

Here's how it works:

> The Channel Selector LEDs display the ones digit. Since there're only six of them, 7, 8, and 9 are represented by wrapping around at the top. So:

```
1. * - - - -
2. - * - - -
3. - - * - -
4. - - - * -
5. - - - - *
6. - - - - - *
7. - - - - * *
8. - - - * * *
9. - - * * * *
```

> One Preset LED will light (for values greater than 9) to indicate the 10s digit. (So 10 is Preset 1 and no Channel Selector LEDs, 23 is Preset 2 and Channel 3 LED, etc.)

> The Hex LED lights to indicate a negative sign (for Octave 2X and DC Offset).

10. CV Inputs



Mob of Emus provides 6 assignable CV inputs. The inputs accept CVs in the range of $\pm 5V$.

NOTE: Inputting CVs above or below that range won't hurt the module, but they'll be clipped to the $\pm 5V$ values for purposes of modulation.

The CV inputs can function in one of six input modes. You can select the desired mode (or just check which mode is currently selected) by double-clicking and holding the Option button. The Preset LEDs will chase to draw your attention. The LED for the currently selected mode will light steadily. To select a new mode, click the appropriate Preset button.



The modes are:

MULTI For use in Hex Mode, each CV input controls a particular parameter of all six channels simultaneously. The destination parameters for each input are as labeled on the panel (i.e., Quantization, Variation, Harmonic Gain, Phase, Wave, and Frequency).

FREQ Allows you to independently control the frequency of the individual channels.

TRIG Allows you to independently trigger (if in 1-Shot Mode) or reset the phase (if cyclical) of the individual channels.

GAIN Allows you to independently control the output amplitude of the individual channels.

IMPORTANT NOTE: When Gain Mode is selected, the output of each channel will be 0V when no CV signal is present. I.e., there will be no output from a channel until a positive CV is applied to the channel's CV input.

WAVE Allows you to independently control the wave shape of the individual channels.

QUANT Converts Mob of Emus to a six channel pass-through quantizer! Allows you to quantize up to six external signals patched to the CV inputs.

The scales used for quantization purposes are the ones assigned to the individual channels using the real-time Quantization parameter.

The quantizer also reflects the Individual Mode DC Offset and Gain parameters, so you can transpose the incoming signals as well as scale them.

If Hex Mode is active, the function also reflects the Hex Mode Quantization, DC Offset, Harmonic Gain, and Mix parameters.


The selected CV Mode is stored with the saved presets.

11. Outputs




Mob of Emus provides 6 individual channel outputs and a summed Mix output.

Nominal output levels are $\pm 5V$, although the Mix output may be somewhat lower, depending on how the waves sum and phase against one another. All of the outputs will provide a maximum of $\pm 10V$ before clipping occurs.

 **IMPORTANT NOTE:** *In order to ensure precisely accurate CVs, the impedance of Mob of Emus' outputs is less than 1 Ohm. Because of this, the outputs will not directly drive headphones. If you would like to monitor Mob of Emus' outputs when used at audio frequencies, first patch it into an audio processing module like a VCA, output module, filter, etc., and then monitor it there.*

Individual channels can be included or excluded from the Mix output using the Individual Mode Mix control.

The output level of the Mix output can be attenuated using the Hex Mode Mix control.

 **NOTE:** *You'll notice that the individual channels are labeled with #1 at the bottom and #6 at the top. Given Mob of Emus' various "harmonic" functions, it makes sense to treat the channels as harmonics, with the lower frequencies at the bottom and the progressively higher frequencies towards the top. Of course, you can set channel frequencies to anything you like, but if you're using the "harmonic" functions, maintaining the bottom-to-top organization will tend to make things conceptually clearer.*

12. Presets




Mob of Emus allows you to store 12 **Presets** in memory for easy recall.

A **Preset** is a snapshot of the module's settings and includes:

- Pot values
- Hex Mode
- CV Input Mode
- Tap/Trig Jack Mode
- Channel Selection, Solo, and Mute states
- Output Viewer state
- Option Latch state

Presets may be backed up to and restored from WAV files (individually or en masse) as described in **Chapter 14**.

 **NOTE:** *Mob of Emus comes from the factory preprogrammed with 12 presets as described in **Chapter 16**. Our assumption is that once you become familiar with Mob of Emus, you'll save your own creations over them. However, if you think you might want to use some of them in the future, you can simply save some or all of them to WAV archives and reload them as needed (as described in **Chapter 14**).*


Loading Presets


To load **Preset 1–6**, click the appropriate button. The associated LED will light.

Click the button again to deselect the Preset. The LED will extinguish.

To load **Preset 7–12**, double-click the desired button. The associated LED will flash.

Click the button again to deselect the Preset. The LED will extinguish. (It's not necessary to double-click it to deselect, but that will work too.)

 **IMPORTANT NOTE:** *When you recall a preset, it's likely that the values of the various parameters will no longer match the physical positions of their corresponding controls. However, adjusting any of the controls (either physically or via a CV) will cause the associated parameter to immediately change to the parameter's new value.*

 **ANOTHER NOTE:** *When you deselect a preset, Mob of Emus reverts to the parameter values of the physical controls.*

Saving Presets

To save the current **Preset** to a memory location, click and hold (for **Preset 1–6**) or double-click and hold (for **Preset 7–12**) the desired button for three seconds until the associated LED flashes to indicate that it's been saved.

Modified but Unsaved Presets

If you recall a preset and then change any parameters, the **Preset** LED will slowly pulse to indicate that the preset currently has unsaved changes. You can either resave the preset to incorporate the new value(s) or deselect and reselect the preset to reload it with the original values (i.e., your unsaved changes will be lost). If a modified preset is deselected without saving, it will default to its original values when next selected.

13. Updating Software

Mob of Emus provides the ability to update its operating software via a WAV file. The latest version of software will always be available at the Downloads tab of the Mob of Emus web page:

http://www.rossum-electro.com/products/mob_of_emus

Checking your Software Version

To check the software version currently in your Mob of Emus, use the Display Software Revision utility:

- > Press and hold **Tap** + **Hex** + **Option** and (while continuing to hold them) click the **Preset 1** button.
- > While holding **Tap** + **Hex** + **Option**, the software revision number will be displayed on the Preset and Channel Selector LEDs. The major revision number will be displayed on the Preset LEDs and the minor revision number on the Channel Selector LEDs. So, for example, if current software is v1.3, the Preset 1 LED and the Channel Selector 3 LED would be lit.

If the version in your module matches the latest version on the web site, you're good to go. If not, you can update to the latest version as follows.



How to Update Software

1. Patch your audio file player into the **6/ FREQ** CV input.
2. Hold the **HEX** button and the **Channel 5** button as you power up your system.
The **Channel 1** and **Preset 1** LEDs will be lit, and the **HEX** LED will be off.
3. Press the **OPTION** button to proceed:
4. Play the audio file containing the Mob of Emus software (see the Hints for Playing Back WAV Files below). The **Preset 1–3** LEDs will show the input audio signal VU: **P1** is too low. **P1** and **P2** is better. **All three** is best. Once a file sync marker is detected the **Channel 2** LED will light and the remaining channel LEDs will light in sequence to show load progress. If a successful load occurs, all 6 LEDs will be lit.
5. Press the **OPTION** button to reboot using the new software.

If an error occurs, all Channel LEDs will go off, the **HEX** LED will light, and the **P4–P6** LEDs indicate the type of error. Press the Option button to try again. If it still isn't successful, get in touch and we'll work it out.

NOTE: If the update fails, your module will still be okay. It will just continue to function with the version of software it was running prior to the update attempt.

Here are the possible error codes (which you will hopefully never need to refer to):

P4	P5	P6	ERROR
Off	Off	On	Bad Pulse
Off	On	Off	Bad Sync
Off	On	On	Unexpected End
On	Off	Off	Bad Checksum
On	Off	On	File Type
On	On	Off	Flash Write Error
On	On	On	Program Transfer Error



Hints for Playing Back WAV Files

The basic requirements for successful WAV file playback for software updates is that the file should be played back at the highest possible level without distortion. As long as it doesn't distort, the hotter the better.

We've had good luck playing WAV files directly from a computer (but see the warnings below) as well as smartphones and tablets. In theory, any device that will play a WAV file without distorting the data should work.

However, here are some caveats:

- > If you are streaming the file directly from the web, be sure that your data rate is sufficient to keep up. If necessary, wait until the file has been completely buffered before starting playback.
 - > If you are playing the file from a computer or phone, quit Facebook, your email client, and any other software that produces audio. Any other audio injected into the stream will cause the transfer to fail.
 - > If you're using a smartphone, temporarily placing it in Airplane Mode will prevent any incoming call or message notifications from interfering with playback.
 - > We have found that Safari on the Mac plays the file in a way that often keeps it from being successfully recognized and decoded. If you are using Safari, we recommend downloading the WAV file to your computer and playing the file from the local copy using Quicktime Player.
- > In fact, if you are having **any** problem streaming the file, downloading the file locally and playing it from there is a good alternative.
 - > If you do get an unsuccessful transfer (e.g., the level was too low, your computer generated extraneous audio, etc.), you can just correct the problem and try again. However, we've found that rather than just playing the file again from the beginning, it's usually advisable to close the file, reopen it, and then start playback.

14. Utilities

Mob of Emus offers a variety of utility functions, including the ability to archive and restore saved Presets as WAV files.

To access the utility functions, press and hold **Tap** + **Hex** + **Option**. All of the LEDs will "chase" to let you know you are ready to select a utility function. While continuing to hold **Tap** + **Hex** + **Option**, press one of the **Preset** or **Channel Selector** buttons to select the desired utility.

The available utilities are:

Via the Preset Buttons

1. Display Software Revision Number
2. Set Default Parameter Values
3. Unused
4. Backup all User Data
5. Restore all User Data
6. Transfer Menu

Via the Channel Selector Buttons

6. Unused
5. Unused
4. Unused
3. Toggle Buchla Mode
2. Calibrate ADCs
1. Calibrate DACs



Here are the details:

Utilities Accessed via the Preset Buttons

Preset 1: Display software version. While holding **Tap + Hex + Option**, the software revision number will be displayed on the Preset and Channel Selector LEDs. The major revision number will be displayed on the Preset LEDs and the minor revision number on the Channel Selector LEDs. So, for example, if current software is v1.3, the Preset 1 LED and the Channel Selector 3 LED would be lit.

Preset 2: Set Default Parameter Values.

Press and hold the **Preset 2** button for at least 2/3 of a second to set all of the current panel parameters to their default values. The Channel Selector LEDs will strobe once from 6 to 1 to indicate the values have been set.

Below are the default values that will be set:

Hex Mode: On
CV Input Mode: Multi
All Channel Selectors: Off
Tap/Trig Jack Mode: Frequency + Trigger

Individual channels:

Frequency: 0
Octave: 0
Wave: Sine
Phase Offset: 0
Harmonic Number: Each channel is set from Series #3 (powers of 2: 1,2,4,8,16,32)
Gain: 0dB
Variation: 0 (i.e., None)
Quantize: 0 (i.e., Off)
Mix: On
Hard Sync: Off
1-Shot Mode: Off
Random: Off
DC Offset: 0

Hex Mode layer

Same as above, except:

Harmonic Number: 6 (i.e., all six channels playing)

Harmonic Series: Series #3 (Powers of 2)


Harmonic Gain: -6dB

Mix Gain: -0dB

Preset 4: Back up all Presets to a WAV file.


This function allows you to back up all of your stored Presets to a WAV file, which can later be restored using Function 5 below.


Here's how:

1. Patch Mob of Emus' **Mix Output** to the input of your WAV recorder. We've found that a regular Eurorack patch cord works fine.
-  **IMPORTANT:** *Your recording device must record uncompressed WAV data. Do not use an MP3 recorder.*
2. Press and hold **Tap + Hex + Option** and then the **Preset 4** button. The **Preset 4** and **Hex** LEDs will flash. (If you need to change your mind at this point, press the **Hex** button to return to normal operation.)
 3. Press the **Preset 4** button again to proceed. The **Preset 4** LED will flash rapidly and a tone will appear at the **Mix Output** that you can use to adjust the recording level on your WAV recorder.
 4. Start recording on your WAV recorder.
 5. Press the **Preset 4** button to transmit the data. While transmitting, the **Channel Selector** LEDs will act as a progress indicator. The six LEDs will light in sequence as the data is loaded. (The transfer may take a minute or so, so be patient for the LEDs to light.)
 6. When the transfer is complete, the six **Channel Selector** LEDs will be lit and the **Preset 4** and **Hex** LEDs will flash. Stop your WAV recorder and press either the **Hex** or the **Preset 4** button to return to normal operation.

Button 5: Restore all Presets from a WAV file. This function allows you to restore all of your saved Presets from a WAV file. This file might be an archive you previously recorded, a file from some other user sharing his or her presets, or a download from our web site containing the factory example Presets (which you may have overwritten but want back).


Here's how:

 **NOTE:** Before starting, be sure to check out the *"Hints for Playing Back WAV Files"* in the previous chapter.

 **ANOTHER NOTE:** This function will overwrite (i.e., delete) all of the Presets in your module. So be careful. You may want to archive your current contents using Function 4 above before doing this, just in case you change your mind about whether or not you might want them later.


1. Patch the output of your WAV player to the **FREQ/6** CV Input. Again, a regular Eurorack patch cord works fine.
2. Enter the Restore function by pressing and holding **Tap + Hex + Option** and then the **Preset 5** button. The **Preset 5** and **Hex** LEDs will flash. (If you need to change your mind at this point, press the **Hex** button to return to normal operation.)
3. Press the **Preset 5** button again to proceed. **Channel Selector** LEDs 1 and 2 will light and the **Preset 5** LED will double-flash to indicate Mob of Emus is waiting for audio.
4. Play the audio backup WAV file. The **Channel Selector** LEDs will act as a progress indicator. The six LEDs will light in sequence as the data is loaded. (Again, the transfer may take a while, so be patient for the LEDs to light.)
5. If all goes well, the user data will be received and all six LEDs will be lit. Press **Hex** to return to normal operation.

If the transfer wasn't successful, an error code will be displayed in the Channel Selector LEDs. Press **Hex** to return to normal operation. If you continue to have a problem, get in touch via our web site (<http://www.rossum-electro.com/support/supportrequest-form/>) and we'll get it handled.

 **IMPORTANT NOTE:** If the transfer wasn't successful (e.g., the received data was corrupt, damaged, or not understood), Mob of Emus' current **Presets** will remain intact, and will not be erased or overwritten.

Preset 6: Transfer Menu. This function allows you to save and restore individual Presets to and from WAV files. It's ideal for exchanging individual content with others or archiving only selected Presets.

The actual process of saving and restoring is very similar to the mass archiving and restoring described above.

 **IMPORTANT NOTE:** When individual Presets are saved, their button location is not saved with them. This allows you to load a saved Preset into any button location you prefer.

Here's how:

1. Press and hold **Tap + Hex + Option** and then the **Preset 6** button to enter the Transfer Menu. The **Preset** buttons will "chase" and the **Hex** button will flash. You will then have the following options:

Click a **Preset** button to transmit one of Preset 1–6.

Double-click a **Preset** button to transmit one of Preset 7–12.

Click and hold a **Preset** button for 3 seconds to receive one of Preset 1–6.

Double-click and hold a **Preset** button for 3 seconds to receive one of Preset 7–12.

Click the **Hex** button to exit the Transfer Menu.

To transmit a preset:

2. Patch Mob of Emus' **Mix** Output to the input of your WAV recorder.
3. Start recording on your WAV recorder. (Again, your recording device must record uncompressed WAV data. Do **not** use an MP3 recorder.)
4. Click (for Presets 1-6) or double-click (for Presets 7-12) the appropriate button to immediately send the data for that Preset to your WAV recorder.
5. Once the data has been sent, Mob of Emus returns to "chase" mode to give you the opportunity to save (or load) additional Presets.
6. When finished, press the **Hex** button to rerun to normal operation.

To load a preset from a WAV file:

2. Patch the output of your WAV player to the **FREQ/6** CV Input.
3. Click and hold for three seconds (for Presets 1-6) or double-click and hold for three seconds (for Presets 7-12) the appropriate button to choose the destination for the restored Preset. **Channel Selector** LEDs 1 & 2 will light and the **Preset 6** LED and the Hex LED will flash. (If you need to change your mind at this point, press the **Hex** button to return to normal operation.)
4. Click the **Preset 6** button.
5. Play the audio.
6. The **Channel Selector** LEDs will act as a progress indicator. The six LEDs will light in sequence as the data is loaded.
7. If the transfer is successful, Mob of Emus will return to the Transfer Menu for additional actions. When finished, press the **Hex** button to rerun to normal operation.

8. If the transfer wasn't successful, an error code will be displayed in the **Channel Selector** LEDs. Press **Hex** to return to normal operation. If you continue to have a problem, get in touch via our web site (<http://www.rossum-electro.com/support/supportrequest-form/>) and we'll get it handled.

Utilities Accessed via the Channel Selector Buttons

These functions are intended for calibration and test during the manufacturing process, and as such, it's highly unlikely you'll ever need to interact with them. But here they are for reference.

Channel 3: Enable Buchla Mode. Press the Channel 3 button to toggle Buchla Mode on and off.

With Buchla mode enabled, all inputs and outputs conform to a 1.2V/octave specification. With Buchla mode disabled, all inputs and outputs conform to a 1V/octave specification.

While holding the **Channel 3** button, the current state is displayed as follows:

Normal Mode: **Preset 1** LED lit and no **Channel Selector** LEDs lit (i.e., 1.0 V/Oct)

Buchla Mode: **Preset 1** LED lit and **Channel Selector 2** LED lit (i.e., 1.2 V/Oct)

Channel 2: Calibrate ADCs

Channel 1: Calibrate DACs

These functions are used during initial module calibration and, barring any unforeseen problems, you should never have to interact with them. Unless you like living dangerously (or we have instructed you to do something here as part of diagnosing a problem), you would be best advised not to fool around with these. Seriously.

15. Button Function Reference

For quick reference, here are guides to Mob of Emus' various button functions. They are also available on the Quick Start Guide that accompanied your module. You might want to keep them near your system until they become second nature to you.

HEX BUTTON



CLICK: Toggle Hex Mode

DOUBLE-CLICK: Select/deselect all harmonics

CLICK AND HOLD: Toggle Output Viewer

CLICK WHILE AN OPTION MODE IS MOMENTARILY SELECTED: Latch Option Mode

CLICK WHILE AN OPTION MODE IS LATCHED: Unlatches Option Mode

CHANNEL SELECTOR BUTTONS



CLICK: Select for programming. Deselect if already selected

DOUBLE-CLICK: Solo. Unsolo and deselect if already soloed

TRIPLE-CLICK: Mute. Unmute if already muted

CLICK AND HOLD: Select, and deselect any others

DOUBLE-CLICK AND HOLD: Solo, and unsolo and deselect any others

TRIPLE-CLICK AND HOLD: Mute, and unmute and deselect any others

HOLD OPTION AND CLICK: Trigger the channel

TAP BUTTON



CLICK REPEATEDLY: Define frequency (I.e., like Tap Tempo)

HOLD OPTION AND CLICK: Trigger all 6 channels

HOLD FOR AT LEAST 1 SECOND AND CLICK OPTION: Select TAP/TRIG jack mode

PRESET BUTTONS



CLICK: Load or deselect (if selected) preset 1–6

DOUBLE-CLICK: Load or deselect (if selected) preset 7–12

CLICK AND HOLD FOR AT LEAST 3 SECONDS: Save to preset 1–6

DOUBLE-CLICK AND HOLD FOR AT LEAST 3 SECONDS:

Save to preset 7–12

DOUBLE-CLICK AND HOLD OPTION FOR 1 SECOND (LEDS WILL

CHASE) AND CLICK A BUTTON: Select CV input mode

OPTION BUTTON (cross reference)



CLICK AND HOLD: Momentarily engage Option Mode 1

DOUBLE-CLICK AND HOLD: Momentarily engage Option Mode 2

CLICK AND HOLD + HEX: Latch Option Mode 1

DOUBLE-CLICK AND HOLD + HEX: Latch Option Mode 2

CLICK AND HOLD: Clear latched mode

CLICK WHILE AN OPTION MODE IS LATCHED: Cycle through Option Modes

CLICK AND HOLD + TAP: Trigger all channels

CLICK AND HOLD + CHANNEL 1–6: Trigger individual channel

DOUBLE-CLICK AND HOLD FOR 1 SECOND + PRESET 1–6: Set CV Input mode

CLICK AND HOLD: Display Output Viewer (while held)

DOUBLE-CLICK AND HOLD: Display Output Viewer (while held)

HOLD TAP FOR 1 SECOND AND CLICK OPTION: Select TAP/TRIG jack mode

16. Factory Presets

To help you get started, we've created some presets for you to play around with. Check them out, mess with the various parameters, and see (and hear) what happens.

1. Audio: Warp This is a stack of oscillators in Warp mode. Listen to the **Mix** output.

- > Hold the **Option** button and adjust the **Variation/Warp** knob. Interesting points will be found near (but not quite at) the full counterclockwise position and either side of 12 o'clock for some nice chorusing.
- > Hold **Option** and adjust the **Harm#/Series** knob to try various harmonic series.
- > Adjust the **Freq** knob or patch a 1V/Oct CV into the **6/Freq** input.

2. Audio: Saw Swarm Six sawtooth oscillators with the CV input mode set to **Freq**. Listen to the **Mix** output.

- > Patch CVs to each CV input to individually control the frequency of each oscillator.
- > Use the Warp function to control the swarm.
- > Change the CV mode to Multi and use the Mix output to use the preset as a fat super saw oscillator.

3. Modulation: Frog Talk Multiple summed modulation waves. Patch the Mix output to the exponential frequency CV input of an oscillator.

- > Adjust **Freq** and **Octave** to control the overall rate of modulation.
- > Adjust **H.Gain** to control the density of modulation
- > Patch the individual channels elsewhere in your system for additional modulations.

4. Rhythm: 4/4 Drums with Variation

Rhythmic trigger patterns using the patterns in Wave Bank 3 and the Variation function. Patch individual outs to trigger inputs of audio sources. Channel 1 is low drum, Channel 2 next higher, to highest on Channel 6.

- > Adjust Variation to either side of 12 o'clock and listen to its effect.
- > Select individual channels and change their pattern (within Wave Bank 3) or their Harmonic # to vary the polyrhythmic patterns.

5. Modulation: Mutant Talk Multiple summed modulation waves. The Mix output is quantized to a minor 9th arpeggio. Patch the Mix output to the 1V/Oct frequency CV input of an oscillator.

- > Adjust **Freq**, **Octave**, **Wave**, **H.Gain**, and **Quantize** to modify the generated patterns.

6. Modulation: Square Stack Multiple square wave LFOs. Patch the Mix output to the exponential frequency CV input of an oscillator.

- > Adjust **Phase** and **H.Gain** and note the pattern variations.
- > Patch the individual outputs to various modulation inputs on one or multiple modules.

The next six presets can also serve as templates for quickly setting up your own patches using various functions.

- 7. Audio: Additive Oscillator** Six sine oscillators using Harmonic Series 8, Fave Odd. Listen to the **Mix** output.
- > Adjust **H.Gain** to control the levels of the harmonics.
 - > Adjust **Wave** to create different timbres.
 - > Select different **Harmonic Series** to create other varieties of different timbres
 - > Adjust **Warp** to modify the relationships of the harmonics.
 - > Route an external triggered envelope to the H.Gain CV input to modify the intensity of the harmonics in realtime.
- 8. Mixed: Quadrature Waves** Channels 1 through 4 have their phases set 90 degrees apart in a quadrature relationship. Use the individual outs at low frequency for quadrature modulation. Adjust **Frequency**, **Octave**, and **Wave** as desired.
- > Patch to multiple VCAs for quad panning.
 - > Patch to multiple filters for quad timbre modulation.
 - > Adjust frequency to audio range and listen to the Mix output. Adjust **H.Gain** to modify timbre.
- 9. Modulation: Hex Envelopes** Six envelopes, all in 1-Shot Mode. CV inputs in **Trig Mode**. Slower envelopes at the bottom and faster ones towards the top. Option Mode 1 is latched so that you can use the **Channel Selector** buttons one-handed to manually trigger individual channels. Patch external triggers into the CV inputs. Patch the individual outputs to the modulation inputs of other modules as desired.
- > Use the **Freq** and **Octave** controls to scale all of the envelope times simultaneously.

- 10. Rhythm: 4/4 Drums Template** This is a template for setting up a basic 4/4 drum or rhythm pattern (with just a slight bit of positive **Variation**). Hard sync is enabled on Channels 2–6. Patch the individual outs to the trigger inputs of your audio source(s). Choose a kick drum type sound for Channel 1, a snare type for Channel 2, etc.
- > Repeatedly click the **Tap/Trig** button to set your tempo.
 - > Use the **Octave** knob to halve or double your tempo.
 - > Adjust the Hex Mode **Variation** setting or the **Variation** settings of individual channels.
- 11. Modulation: Quantized Stacked Arpeggio** Stacked triangle waves (except Smoothed Random on Channel 3 for a little variety) quantized to a major pentatonic scale at the Mix output. Patch the Mix output to an oscillator's 1V/Oct CV input.
- > Adjust **H.Gain** to control the density of the arpeggio.
 - > Adjust Hex **Quant** to change the notes of the arpeggio
 - > Vary the **Wave**, **Freq**, and **Mix** output level to suit your particular application.

12. Template: External Quantizer CV input mode is set to **Quant**. Each channel (and the Mix output) is set to a different scale:

- 1: Pentatonic
- 2: Major Triad
- 3: Maj7
- 4: Major
- 5: Sus4add9
- 6: Sus4add9 open voicing
- Mix: Pentatonic

- > Patch external modulation signals into the six CV inputs. Patch the individual outputs and/or the Mix output into the modulation inputs of other modules.
- > Change any channel's scale by selecting it and adjusting the **Quant** control.
- > Change all of the channels to the same scale simultaneously by adjusting the Hex Mode **Quant** parameter.
- > Transpose a channel's output with the **DC** control.
- > Adjust **H.Gain** to vary the ranges simultaneously.
- > Use the quantizer on an audio signal for a variety of lo-fi sounds.

17. From Dave's Lab

Circuit Protection

Eurorack suffers from the problem of power connector reversal. When 10 pin connectors are used, mis-insertion results in a swap of +12V and -12 V, and protection is easily accomplished using various techniques such as series diodes.

But more systems are providing the +5V supply and thus use the full 16 pin connector. When this is reversed, a diode-protected module is still safe, but the six connected ground pins in the module will short together the system's +5V and +12V supplies, potentially damaging the power supply and any modules that use +5V.

To prevent this, Rossum Electro-Music modules deviate from the standard Eurorack power connector by leaving power connector pins 9 and 10 open, rather than connecting them to ground. When plugged in backwards, this leaves the system +12V supply disconnected. Since ground is still supplied by four pins as well the chassis and any patch cords connected to the module, the dropping of these two pins has no measurable effect on circuit performance, but it means that if a Rossum Electro module is accidentally plugged in backwards, no stress is placed on the +5V supply or modules

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