INSTRUO | SPECIALIST SYNTHESIZERS

Seashell

a new analogue workflow

Hybrid Desktop Synth

User Manual

Contents

Description

Instruō Seashell introduces a new way of working with analogue synth voices.

A compact semi-modular system, pairing hands-on hardware with expansive control and configuration through dedicated software. Seashell offers seamless integration of Instruō hardware into existing workflows for professional sound design, music production, and live performance.

Features

- Two sawtooth-core analogue voltage-controlled oscillators
- Analogue voltage-controlled wavefolder
- Resonant voltage-controlled low-pass filter
- Internal waveform routing to filter and wavefolder inputs
- Parallel modular level outputs
- Internal analogue cross FM modulation bus
- CV inputs for self-patching and external modulation
- Stereo line level/headphone output driver
- On-board DSP effects
- TRS MIDI input
- User-definable external CV input and output
- USB-C connectivity for audio/MIDI integration to DAW
- VST3/Software control interface expansion
- High resolution (14Bit) digital control over analogue circuitry
- Customisable scale transposition engine
- Total recall of digitially-controlled analogue parameters
- Internal LFO modulation sources
- Multi-function envelope generator
- Stereo diffusion effect
- 4x4 modulation matrix mixer with hardware macro control
- MIDI learn functionality

Desktop Synth Operation

1. Power Seashell with the included power adaptor.
2. Connect Seashell's **Stereo Line Level/Headphone Output** to a monitoring system.

Optional -

3. Connect Seashell to a computer using the included USB-C cable.
4. Open the Seashell Controller stand-alone application.

TRS MIDI Operation

1. Power Seashell with the included power adaptor.
2. Connect Seashell's **Stereo Line Level/Headphone Output** to a monitoring system.
3. Insert the included TRS MIDI (Type A) adaptor to the TRS MIDI Input and connect a MIDI Controller.

Optional -

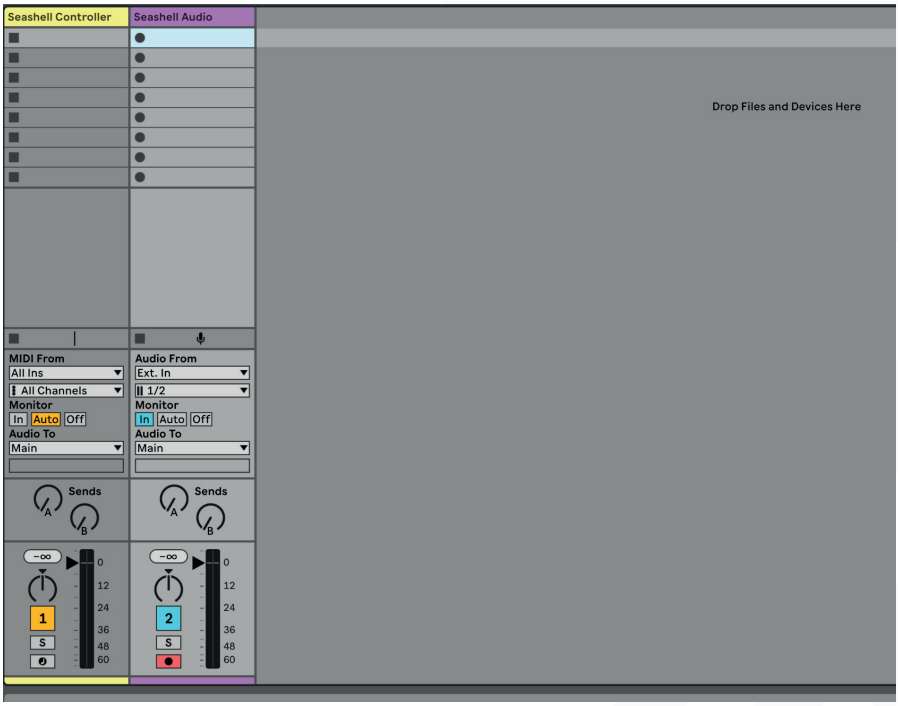
4. Connect Seashell to a computer using the included USB-C cable.
5. Open the Seashell Controller stand-alone application.

Integrated DAW Operation

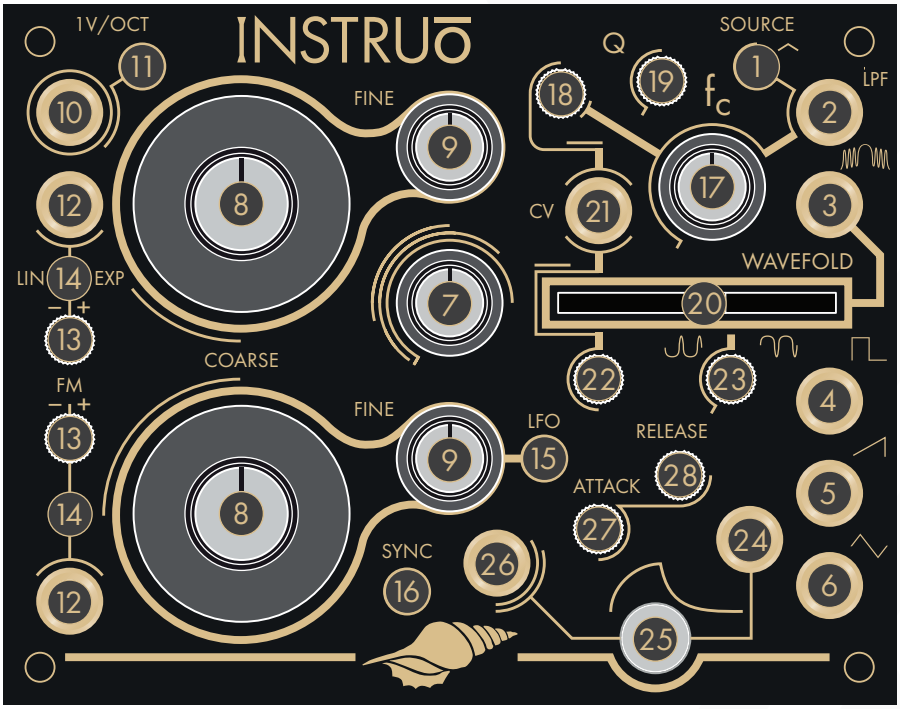
1. Power Seashell with the included power adaptor.
2. Connect Seashell to a computer using the included USB-C cable.
3. Open a VST3 compatible DAW, like Ableton Live, FL Studio, Bitwig Studio, Reaper, or Cubase/Nuendo, etc. or the standalone desktop app.
4. Set Seashell as the audio input device in your DAW's preferences.

5. Create a MIDI track to host the Seashell Controller VST3 plugin and record MIDI data.

6. Create an audio track to monitor/record Seashell.



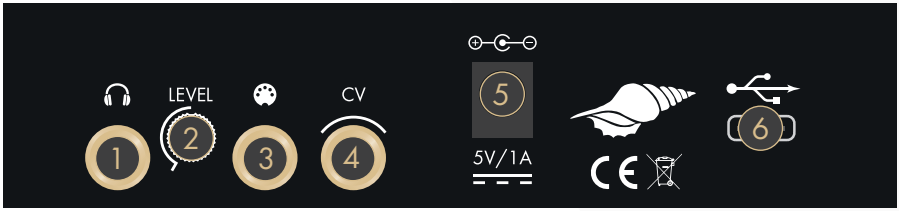
Seashell / sē'shĕl"/ compound noun: Sea (environment) vast body of waves; Shell (architecture) ornate outer structure, (computing) user interface for entering control commands.



Key

1. Source / Shift Button
2. Low-Pass Filter Output (LPF)
3. Osc 1 Fold Ouput
4. Osc 2 Pulse Output
5. Osc 2 Sawtooth Output
6. Osc 2 Triangle Output
7. Macro Knob
8. Coarse Knobs
9. Fine Knobs
10. 1V/Oct Input
11. 1V/Oct Button
12. FM Inputs
13. FM Attenuverters
14. Lin/Exp Toggles
15. LF Button
16. Sync Button
17. Freq Knob (fc)
18. Freq CV Attenuator
19. Resonance Knob (Q)
20. Fold Slider
21. Freq/Fold CV Input
22. Fold CV Attenuator
23. Analogue Symmetry Modulation Attenuator
24. Envelope Output
25. Gate/Trigger Button
26. Gate/Trigger Input
27. Attack Knob
28. Release Knob

Back Panel



Key

1. Stereo Line Level/Headphone Output
2. Level Knob
3. TRS MIDI Input
4. Assignable CV Input
5. DC Power Input
6. USB-C Port

Seashell Controller

Key

1. Extend Button
2. Osc 1 Wavefold Button
3. Osc 1 Sawtooth Button
4. Osc 2 Pulse Button
5. Osc 2 Sawtooth Button
6. Diffuse Knob
7. Level Knob
8. Osc 1 & 2 Freq Knobs
9. 1V/Oct Buttons
10. Transpose Buttons
11. Transposition Keyboard Buttons
12. LF Button
13. Sync Buttons
14. Freq Knob
15. Key Track Knob
16. Sine Button
17. Sawtooth Button
18. Fold Knob
19. Bias Knob
20. Animate Knob (Fold)
21. Animate Button
22. Pulse Width Slider
23. Animate Knob (PWM)
24. AR Button
25. ADSR Button
26. Cycle Button
27. Linear Button
28. Logarithmic/Exponential Button
29. Manual Trigger Button
30. Voltage Trigger Button
31. MIDI Trigger Button
32. Attack Knob
33. Decay Knob
34. Sustain Knob
35. Release Knob
36. Gate > VCA Button
37. Reset LFO Button

38. Gate-Stalled LFO Button
39. One-Shot LFO Buton
40. Manual Trigger Button
41. Voltage Trigger Button
42. MIDI Trigger Button
43. Unipolar Positive Button
44. Bipolar Button
45. Rate Knob
46. Hz Button
47. Tempo Sync Button
48. Macro Knob
49. Source Slot
50. Modulation Node
51. Destination Slot
52. Reset Button

Back Panel

The back panel of Seashell includes various operational controls, inputs, and outputs.

Stereo Line Level/Headphone Output: Outputs to a stereo line level signal adaptor or headphones. The included stereo splitter adaptor can be used to split the stereo 3.5mm TRS output to two ¼" inch TS mono outputs.

Level Knob: Sets the volume of the **Stereo Line Level/ Headphone Output.**

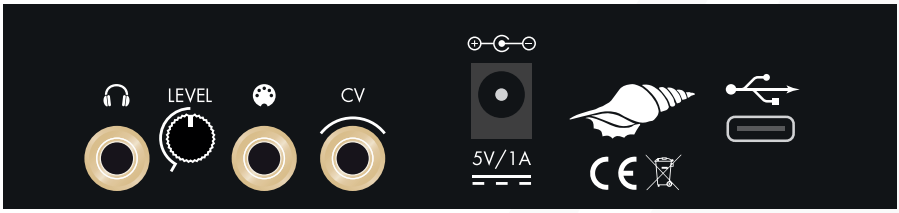
TRS MIDI Input: Receives MIDI information via the included TRS MIDI (Type A) adaptor.

Assignable CV Input: Allows for external control voltage input to parameters in the software.

DC Power Input: Powers Seashell via the included AC/DC adaptor.

- 5V/1A / Centre-Negative

USB-C Port: Class compliant USB Audio and MIDI for direct integration with DAWs.



Digital & Analogue Control

Seashell has a myriad of functions that support flexible synthesis and sound design techniques. Many of these functions are digitally read so that they can be controlled by either the hardware, the software, or both. Certain functions are analogue only and do not have a software control.

Digital Controls	Analogue Controls
Coarse Knobs	Fine Knobs
Macro Knob	FM Attenuverters
Freq Knob	Lin/Exp Toggles
Fold Slider	Freq CV Attenuator
Attack Knob	Fold CV Attenuator
Release Knob	Resonance Knob
Gate/Trigger Button	Analogue Symmetry Modulation Attenuator
Source/Shift Button	
1V/Oct Button	
LF Button	
Sync Button	
Level Knob	

Standard & Extended Modes

The software can be set to one of two modes: Standard Mode or Extended Mode. Standard Mode displays all parameters available on the hardware, along with additional software-only settings. Extended Mode includes everything in Standard Mode, plus additional modulation features such as the digital LFO and the modulation matrix.

Switching between Standard Mode and Extended Mode can be done on both the hardware and the software.

- To switch between modes on the hardware, press and hold the **Source/Shift Button** and then tap the **Sync Button**.
- To switch between layouts in the software, press the **Extend Button** at the top right corner of the software window.

Waveform Generation & Outputs

Seashell is a complex synthesis environment consisting of two analog sawtooth-core oscillators configured with the ability to influence each other. Although many waveforms are available between the two oscillators, some have dedicated modular level outputs while others are used exclusively for internal modulation and/or processing.
For example, the wavefolder can receive either the sine or sawtooth waveform of Oscillator 1.

The sine waveform of Oscillator 1 is also normalled to modulate the frequency of Oscillator 2, and vice versa. Despite the absence of dedicated hardware outputs for all waveforms, these internal waveforms play a pivotal role in Seashell's synthesis and sound design capabilities.

The selected waveforms from both oscillators can be mixed through the low-pass filter and routed to both the **Low-Pass Filter Output** and the **Stereo Line Level/Headphone Output**

Oscillator 1 Generated Waveform:

Sine (wavefolder/modulation)
Sawtooth (wavefolder)

Oscillator 2 Generated Waveform:

Pulse
Sawtooth
Triangle
Sine (modulation)

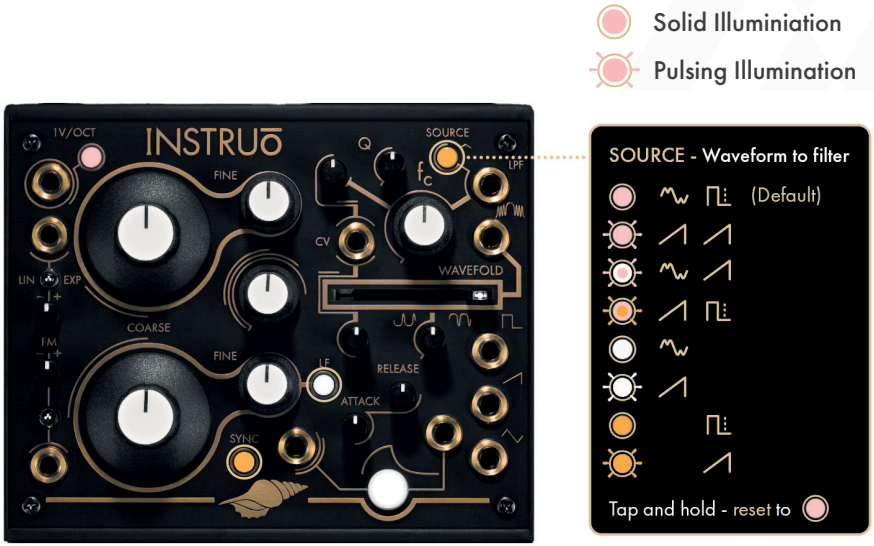
Outputs

Source/Shift Button: Selects the waveform(s) routed through the **Low-Pass Filter** to the **Stereo Line Level/Headphone Output**. It also serves as a shift button to access advanced features (See the Advanced Features section for more information).

- Hardware selection of waveforms will be reflected in the waveform selection buttons in the software.

Colour-coding:

- Oscillator 1 selections are indicated by white illumination and Oscillator 2 selections are indicated by amber illumination.
- Primary waveforms are indicated by solid illumination, secondary waveforms are indicated by pulsing illumination.



In the software there are four waveform buttons that are used to make waveform selections.

Wavefold Button: Routes the wavefold waveform of Oscillator 1 to the input of the low-pass filter.

Sawtooth Button: Routes the sawtooth waveform of Oscillator 1 to the input of the low-pass filter.

Pulse Button: Routes the pulse waveform of Oscillator 2 to the input of the low-pass filter.

Sawtooth Button: Routes the sawtooth waveform of Oscillator 2 to the input of the low-pass filter.

Low-Pass Filter Output (LPF): Low-pass filter output that contains either the selected Oscillator 1 waveform, the selected Oscillator 2 waveform, or a mix of both oscillator's selected waveforms (See the Low-Pass Filter section for more information).

Osc 1 Fold Output: Wavefolder output of Oscillator 1 (See the Wavefolder section for more information).

- Either the sine waveform or sawtooth waveform of Oscillator 1 can be processed by the wavefolder. Waveform selection can be made in the software.
- An external waveform can be summed at the wavefolder input through the **FM Input** of Oscillator 1 with an amount set by **Analogue Symmetry Modulation Knob**.
    - By default, this sine waveform of Oscillator 2 is normalled to the **Analogue Symmetry Modulation Knob** through the **FM Input** of Oscillator 1.

Osc 2 Pulse Output: Pulse waveform output of Oscillator 2.

- The pulse width of the pulse waveform can be set in the software (See the Pulse Width Modulation section for more information).

Osc 2 Sawtooth Output: Sawtooth waveform output of Oscillator 2.

Osc 2 Triangle Output: Triangle waveform output of Oscillator 2.

Macro Knob: Multifunctional hardware control that either sets the amount of spatial diffusion applied to the signal present at the **Stereo Line Level/Headphone Output** in Standard Mode or sets the global depth of modulation for all modulation matrix routings in Extended Mode.

In Standard Mode

- Turning the knob clockwise increases the amount of spatial diffusion.
- Turning the knob anticlockwise decreases the amount of spatial diffusion.

In Extended Mode

- Turning the knob clockwise increases the scaling of the multipliers defined at the **Modulation Nodes**.
- Turning the knob anticlockwise decreases the scaling of the multipliers defined at the **Modulation Nodes**.
- This functionality can be disabled on a per-node basis by right-clicking the selected node and engaging the **Lock**, changing it to a fixed state.
- In Extended Mode, pressing and holding the **Source/Shift Button** and then turning the **Macro Knob** sets the amount of spatial diffusion

Diffuse Knob: Sets the amount of spatial diffusion applied to the output.

- Turning the knob clockwise increases the amount of spatial diffusion.
- Turning the knob anticlockwise decreases the amount of spatial diffusion.
- This is a digital control that is present in the software, but can also be controlled via the **Macro Knob** in Standard Mode.

Level Knob: Sets the overall output amplitude.

- Turning the knob clockwise increases the overall output amplitude.
- Turning the knob anticlockwise decreases the overall output amplitude.
- This is a digital control that is only present in the software.

Frequency

The frequency of both oscillators can be controlled through either the hardware or the software. On the hardware, this is done using both the **Coarse** and **Fine Knobs** and/or via external control voltage.

Coarse Knob: Sets the fundamental frequency, determining the pitch of the respective oscillator.

- Turning the knobs clockwise increases the frequency.
- Turning the knobs anticlockwise decreases the frequency.
- These are digital controls that are present on the hardware and in the software.

Fine Knob: Sets the fundamental frequency, adjusting the pitch of the respective oscillator in relation to the values set by the **Coarse Knobs**. The range of the **Fine Knobs** is -/+1 semi-tone and is curated to function as a "detune" control.

- Turning the knob clockwise increases the frequency.
- Turning the knob anticlockwise decreases the frequency.
- These are analogue controls that are only present on the hardware.

Although the software does not include **Fine Knobs**, the **Coarse Knobs** are linked to the **Osc 1 Freq** and **Osc 2 Freq Knobs**. Middle C is achieved by setting both the **Coarse** and **Fine Knobs** to their center positions with no external control voltage. The octave range controlled by the **Coarse Knobs** and the **Freq Knobs** around middle C can be defined in the software settings. The default range is ±5 octaves, but any value between 1 and 6 octaves above and below middle C can be set.

Pitch Tracking

Pitch tracking is accessible to both oscillators through either the hardware or the software.

1V/Oct Input: Bipolar control voltage input that is calibrated to 1 volt per octave.

- This input can be electrically routed to either or both oscillators
- Control voltages are summed with other frequency definitions, including the **Coarse** and **Fine Knobs**, the **FM Inputs** and MIDI messages via USB-C/TRS MIDI.
- This is an analogue input that is only present on the hardware.

1V/Oct Button: Defines pitch tracking assignment to either or both oscillators. When enabled, the assigned oscillators' pitch will be influenced by incoming control voltage connected to the **1V/Oct Input** and MIDI messages via USB-C/TRS MIDI. Although the hardware button cycles between available enabled states, discrete oscillator assignment can also be done with the **1V/Oct Buttons** in the software.

Oscillator 1 Pitch Tracking: Pitch tracking of Oscillator 1.

- This is indicated by white illumination of the **1V/Oct Button** on the hardware as well as illumination of the **1V/Oct Button (1)** in the software.
- This is a digital control that is present on the hardware and in the software.

Oscillator 2 Pitch Tracking: Pitch tracking of Oscillator 2.

- This is indicated by amber illumination of the **1V/Oct Button** on the hardware as well as illumination of the **1V/Oct Button (2)** in the software.
- This is a digital control that is present on the hardware and in the software.

Dual Oscillator Pitch Tracking: Pitch tracking of both oscillators.

- This is indicated by mixed white/amber illumination of the **1V/Oct Button** on the hardware as well as illumination of **1V/Oct Buttons (1) and (2)** in the software.
- This is a digital control that is present on the hardware and in the software.

Disabled Pitch Tracking: Disabled pitch tracking.

- Press and hold the **1V/Oct Button** on the hardware or deselect **1V/Oct Buttons (1) and (2)** in the software to disable pitch tracking of both oscillators.
- This is indicated by an unilluminated **1V/Oct Button** on the hardware as well as no illumination of the **1V/Oct Buttons (1) and (2)** in the software.
- This is a digital control that is present on the hardware and in the software.

Transposition

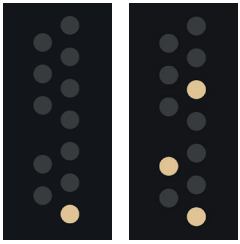
Oscillator pitches can be transposed by quantised semitone intervals.

Transpose Button (1): Enables transposition for Oscillator 1.

- This is indicated by illumination of the **Transpose Button (1)** in the software.
- Press and hold the **Source/Shift Button** and then press the **1V/Oct Button** on the hardware to cycle between transposition states.
- Press and hold the **Source/Shift Button** and then hold the **1V/Oct Button** on the hardware to disable transposition states for both oscillators.
- This is a digital control that is present on the hardware and in the software.

Transpose Button (2): Enables transposition for Oscillator 2.

- This is indicated by illumination of the **Transpose Button (2)** in the software.
- Press and hold the **Source/Shift Button** and then press the **1V/Oct Button** on the hardware to cycle between transposition states.
- Press and hold the **Source/Shift Button** and then hold the **1V/Oct Button** on the hardware to disable transposition states for both oscillators.
- This is a digital control that is present on the hardware and in the software.



Transposition Keyboard Buttons: Enables and disables chromatic intervals to the programmed pitch transposition scale available to oscillators with transposition enabled.

- This transposition offset is defined by the **Osc 1** and **Osc 2 Freq Knobs**.
- This is a digital control that is only present in the software.

Frequency Modulation

Both linear and exponential frequency modulation (FM) are accessible to each oscillator. With nothing patched, circular FM can be achieved through internal connections. External control voltage can also be patched to either oscillator to influence their frequencies. This allows the frequency of one oscillator to be modulated by the frequency, waveform, and amplitude of another oscillator. By default, the sine waveform of Oscillator 1 is normalled to the **FM Input** of Oscillator 2 and scaled by Oscillator 1's **FM Attenuverter**. Similarly, the sine waveform of Oscillator 2 is normalled to the **FM Input** of Oscillator 1 and scaled by Oscillator 2's **FM Attenuverter**. Connecting an external signal to an **FM Input** breaks the normalled connection of the respective oscillator. As these are purely analogue functions, all FM routing and attenuversion settings are controlled directly from the hardware. Additional amplitude scaling can be accessed and controlled in the software via the modulation matrix. **Cross Modulation Depth** as a modulation matrix destination simultaneously controls the modulation amplitude with a pair of internal VCAs.

Lin/Exp Toggles: Enables and disables frequency modulation of the respective oscillator as well as defines the response curves of the **FM Inputs** to either linear or exponential.

- If the toggle is set to its centre position, frequency modulation is disabled.
- If the toggle is set to its left position, the FM signal is connected with linear scaling.
- If the toggle is set to its right position, the FM signal is connected with exponential scaling.
- These are analogue controls that are only present on the hardware.

FM Inputs: Bipolar control voltage inputs for the frequency parameter.

- Control voltages are scaled by the **FM Attenuverters** and summed with other frequency control signals, including the **Coarse** and **Fine Knobs**, and any pitch tracking information received by the **1V/Octave Input** and/or via USB-C/TRS MIDI.
- These are analogue inputs that are only present on the hardware.
- Further modulation depth control can be accessed in software via the modulation matrix.

FM Attenuverters: Sets the depth and polarity of modulation applied to the frequency parameters of the respective oscillators by scaling and/or inverting the control voltage signals present at the **FM Inputs** when a **Lin/Exp Toggle** is in either its left or right position.

- Turning the knob clockwise from its centre position increases the depth of modulation.
- Turning the knob anticlockwise from its centre position increases the depth of modulation with inverted polarity.
- No modulation is applied when the knob is at its centre position.
- These are analogue controls that are only present on the hardware.
- Further modulation depth control can be accessed in software via the modulation matrix.

Low-Frequency Oscillation

Oscillator 2 can be set to a low-frequency range, allowing it to act as a modulation source rather than an audio source. This functionality is accessible through either the hardware or the software.

LF Button: Sets the frequency range of Oscillator 2 to LFO range.

- LFO range of Oscillator 2 is indicated by white illumination of the **LF Button** on the hardware as well as illumination of the **LF Button** in the software.
- This is a digital control that is present on the hardware and in the software.

NOTE: When the **LF Button** is enabled, a clicking sound may be heard form the **Low-Pass Filter Output** and/or the **Stereo Line Level/ Headphone Output**. This is because Oscillator 2 is set to low frequency range and is still routed to the low-pass filter. Disable Oscillator 2's waveform to eliminate the clicking sound when the **LF Button** is enabled.

Hard Synchronisation

Hard synchronisation of Oscillator 1 to Oscillator 2 is available through either the hardware or the software. When any of the three Sync Modes are enabled, the rising edge of Oscillator 2's pulse waveform resets the waveform phase of Oscillator 1.

Sync Button(s): Selects from the three Sync Modes, as well as disabling synchronisation.

Sync: Activates hard synchronisation between the two oscillators, with Oscillator 2 synchronising Oscillator 1.

- Pressing the second **Sync Button** (straight line) in the software will also enable synchronisation.
- This is indicated by white illumination of the **Sync Button** on the hardware and illumination of the **Sync Button** in the software.

½ Sync: Activates hard synchronisation between the two oscillators, with Oscillator 2 synchronising Oscillator 1 at half the frequency of Oscillator 2's fundamental frequency (one octave lower).

- Pressing the third **½ Sync Button** (single chevron) in the software will also enable ½ sub-synchronisation.
- This is indicated by amber illumination of the **Sync Button** on the hardware and illumination of the **½ Sync Button** in the software.

¼ Sync: Activates hard synchronisation between the two oscillators, with Oscillator 2 synchronising Oscillator 1 at a quarter of the frequency of Oscillator 2's fundamental frequency (two octaves lower).

- Pressing the fourth **¼ Sync Button** (double chevron) in the software will also enable ¼ synchronisation.
- This is indicated by mixed white/amber illumination of the **Sync Button** on the hardware and illumination of the **¼ Sync Button** in the software.

Disable Sync: If any synchronisation is enabled, press and hold the **Sync Button** on the hardware to disable synchronisation. Pressing the top **Disable Sync Button** (dotted line) in the software will also disable synchronisation.

- This is indicated by an unilluminated **Sync Button** on the hardware and an illuminated **Disable Sync Button** in the software.
- This is a digital control that is present on the hardware and in the software.

Waveform Modification

Seashell offers three methods to modify waveforms: low-pass filtering, wavefolding, and pulse width modulation, each of which alters the timbre of the final output signal. Low-pass filtering reduces the amplitude of higher harmonics in the harmonic spectrum, wavefolding introduces additional harmonics through a form of complex waveshaping distortion that inverts the clipped portions of the waveform back through its own amplitude, and pulse width modulation affects the presence or absence of harmonic overtones in relation to the duty cycle of the pulse waveform.

Low-Pass Filter

The filter is a -12 dB/octave (2-pole) resonant low-pass filter, allowing for the adjustment of both the cutoff frequency – the point at which the amplitude of harmonics is reduced by -3 dB – and the resonance, which controls the emphasis placed on the cutoff frequency. It also includes keyboard tracking, a method of adjusting the cutoff frequency in relation to the pitch tracking information received by the oscillator. It's important to note that the filter cutoff **Freq Knob** is accessible through the hardware and the software, the **Key Track Knob** is only accessible in the software, and the **Resonance Knob** is only accessible on the hardware

Freq Knob (fc): Sets the cutoff frequency of the low-pass filter.

- Turning the knob clockwise increases the cutoff frequency.
- Turning the knob anticlockwise decreases the cutoff frequency.
- This is a digital control that is present on the hardware and in the software.

Freq/Fold CV Input: Bipolar control voltage input for the cutoff frequency and wavefold amount parameters.

- The **Envelope Output** is normalled to the **Freq/Fold CV Input**.
- Control voltages are scaled by the filter cutoff **Freq CV** and **Fold CV Attenuators** and summed with the cutoff frequency and wavefold amount parameters.
- This is an analogue input that is only present on the hardware.

Freq CV Attenuator: Sets the depth of modulation applied to the cutoff frequency of the low-pass filter by scaling the control voltage signals present at the **Freq/Fold CV Input**.

- Turning the knob clockwise increases the depth of modulation.
- Turning the knob anticlockwise decreases the depth of modulation.
- This is an analogue control that is only present on the hardware.

Resonance (Q): Sets the resonance of the low-pass filter.

- Turning the knob clockwise increases the resonance.
- Turning the knob anticlockwise decreases the resonance.
- This is an analogue control that is only present on the hardware.

Key Track Knob: Sets the amount of cutoff frequency offset applied following any pitch tracking information received via USB-C/TRS MIDI.

- Turning the knob clockwise from its centre position increases the amount of key tracking.
- Turning the knob anticlockwise from its centre position increases the amount of key tracking with inverted polarity.
- No key tracking is applied when the knob is at its centre position.
- This is a digital control that is only present in the software.

Wavefolder

Wavefolding is a type of distortion. Unlike other forms of distortion that simply clip the waveform, wavefolding inverts the clipped portions of the waveform back through its own amplitude, generating rich harmonic spectra even from very simple sound sources.

Sine Button: Routes the sine waveform of Oscillator 1 through the Wavefolder.

- This is a digital control that is only present in the software.

Sawtooth Button: Routes the sawtooth waveform of Oscillator 1 through the Wavefolder.

- This is a digital control that is only present in the software.

Fold Slider/Knob: Sets the amount of wavefolding applied to the selected waveform of Oscillator 1. Although the control is a slider on the hardware, its identical control in the software is a knob.

- Moving the slider to the right or turning the knob clockwise increases the amount of wavefolding.
- Moving the slider to the left or turning the knob anticlockwise decreases the amount of wavefolding.
- This is a digital control that is present on the hardware and in the software

Freq/Fold CV Input: Bipolar control voltage inputs for the filter cutoff frequency and wavefold amount parameters.

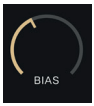
- The **Envelope Output** is normalled to the **Freq/Fold CV Input**.
- Control voltages are scaled by the **Freq CV** and **Fold CV Attenuators** and summed with the cutoff frequency and wavefold amount parameters.
- This is an analogue input that is only present on the hardware.

Fold CV Attenuator: Sets the depth of modulation applied to the fold amount of the wavefolder by scaling the control voltage signals present at the **Freq/Fold CV Input**.

- Turning the knob clockwise increases the depth of modulation.
- Turning the knob anticlockwise decreases the depth of modulation.
- This is an analogue control that is only present on the hardware.

Analogue Symmetry Modulation Attenuator: Sets the summing amplitude of a branch of the modulation signal received at Oscillator 1's **FM Input** to the wavefolder's input.

- By default, Oscillator 2's sine waveform is normalled to Oscillator 1's **FM Input**.
- Turning the knob clockwise increases the summing amount.
- Turning the knob anticlockwise decreases the summing amount.
- This is an analogue control that is only present on the hardware.



Bias Knob: Sets the amount of DC offset applied to the selected waveform of Oscillator 1 prior to wavefolding. This allows the top of the waveform to be folded asymmetrically to the bottom of the waveform.

- Turning the knob clockwise increases the amount of DC offset applied to the wavefolded waveform.
- Turning the knob anticlockwise decreases the amount of DC offset applied to the wavefolded waveform.
- This is a digital control that is only present in the software.

Animate Button: Enables internal fixed-rate triangle waveform LFO modulation for the wavefold amount of Oscillator 1 and the pulse width modulation amount of Oscillator 2.

- Press and hold the **Source/Shift Button** and then press the **LF Button** on the hardware unit to enable and disable **Animate**.
- This is a digital control that is present on the hardware and in the software.

Animate Knob (Fold): Sets the amount of internal fixed-rate triangle waveform LFO modulation applied to the wavefold amount of Oscillator 1.

- Turning the knob clockwise increases the depth of modulation.
- Turning the knob anticlockwise decreases the depth of modulation.
- The is a digital control that is only present in the software.

Pulse Width Modulation

Pulse width modulation (PWM) dynamically changes the width of a pulse waveform, shifting its harmonic energy and producing interesting timbral variations. It can be used for waveform animation, pseudo-chorusing, and can even create the perception of pitch-shifting—though the actual pitch remains unchanged.

Pulse Width Slider: Sets the width of the pulse waveform of Oscillator 2.

- Setting the slider in the centre forces the pulse waveform to be a symmetrical square waveform.
- Moving the slider right increases the width of the positive portion of the waveform and decreases the width of the negative portion of the waveform.
- Moving the slider left increases the width of the negative portion of the waveform and decreases the width of the positive portion of the waveform.
- This is a digital control that is only present in the software.

Animate Button: Enables internal fixed-rate triangle waveform LFO modulation for the wavefold amount of Oscillator 1 and the pulse width modulation amount of Oscillator 2.

- Press and hold the **Source/Shift Button** and then press the **LF Button** on the hardware unit to enable and disable **Animate**.
- This is a digital control that is present on the hardware and in the software.

Animate Knob (PWM): Sets the amount of internal fixed-rate triangle waveform LFO modulation applied to the pulse width of the pulse waveform of Oscillator 2.

- Turning the knob clockwise increases the depth of modulation.
- Turning the knob anticlockwise decreases the depth of modulation.
- The is a digital control that is only present in the software.

Envelope Generator

The envelope generator is a modulation source that controls both the cutoff frequency of the low-pass filter and the amount of wavefolding applied to the selected waveform of Oscillator 1. In addition, it can be used to modulate other parameters via its hardware **Envelope Output** and internally via the **Modulation Matrix**.

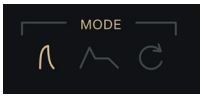
Envelope Modes

There are three Envelope Modes – AR Mode, ADSR Mode, and Cycling AR Mode. Envelope Modes can be set on the hardware and in the software.

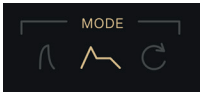
To cycle between the Envelope Modes on the hardware, press and hold the **Source/Shift Button** and then press the **Gate/Trigger Button**.

- AR Mode is indicated by a white illumination of the **Gate/Trigger Button**. This sets the envelope generator to be a two-stage AR envelope generator.
- ADSR Mode is indicated by an amber illumination of the **Gate/Trigger Button**. This sets the envelope generator to be a four-stage ADSR envelope generator. In this mode, the **Release Knob** on the hardware controls both the **Decay Knob** and the **Release Knob** in the software. These settings can be adjusted separately by manually controlling them in the software.
- Cycling AR Mode is indicated by a mixed white/amber illumination of the **Gate/Trigger Button**. This sets the envelope generator to be a cycling AR envelope generator.

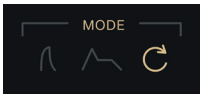
To set the Envelope Mode in the software, press the **AR Button**, the **ADSR Button**, or **Cycle Button**.



AR Button: Sets the envelope generator to be a two-stage AR envelope generator.



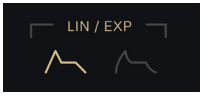
ADSR Button: Sets the envelope generator to be a four-stage ADSR envelope generator. In this mode, the **Release Knob** on the hardware controls both the **Decay Knob** and the **Release Knob** in the software.



Cycle Button: Sets the envelope generator to be a Cycling AR envelope generator.

Envelope Response Curve

The envelope generator can be set to either a linear response curve or a logarithmic/exponential response curve.



Linear Button: Sets the envelope generator to have linear attack, decay, and release stages.

- This is a digital control that is only present in the software.

Logarithmic/Exponential Button: Sets the envelope generator to have a logarithmic attack stage and exponential decay and release stages.

- This is a digital control that is only present in the software.

Envelope Trigger Modes

The envelope generator can be triggered in several ways: via the **Gate/Trig Button**, the **Gate/Trigger Input**, USB-C/TRS MIDI, or any combination of the three sources.

Manual Trigger Button: Determines how the envelope generator responds to the **Gate/Trigger Button**. When enabled, pressing the **Gate/Trigger Button** activates the envelope generator. If the envelope generator is set to ADSR Mode and a the **Gate/Trigger Button** is pressed, then the envelope generator will sustain for the duration of the button press.

- This is a digital control that is only present in the software.

Voltage Trigger Button: Determines how the envelope generator responds to the **Gate/Trigger Input**. When enabled, sending a gate or trigger signal to the **Gate/Trigger Input** activates the envelope generator. If the envelope generator is set to ADSR Mode and a gate signal is received, then the envelope generator will sustain for the duration of the gate signal.

- This is a digital control that is only present in the software.

MIDI Trigger Button: Determines how the envelope generator responds to MIDI information. When enabled, a MIDI Note-On message activates the envelope generator. If the envelope generator is set to ADSR Mode, then the envelope generator will sustain until a MIDI Note-Off Message is received.

- This is a digital control that is only present in the software.

Envelope Generator Parameters

Envelope Output: Envelope generator output.

- The **Envelope Output** signal is normalled to the **Freq/Fold CV Input** and is scaled by both the **Freq CV Attenuator** and the **Fold CV Attenuator.**
- This output can be used to access the analogue envelope signal for use in patching to other devices compatible with control voltage.
- This output can be configured as a variable analogue CV output via the modulation matrix (See the Modulation Matrix Destinations section for more information).

Gate/Trigger Button: Manually triggers the envelope generator.

- Press and hold the **Source/Shift Button** and then press the **Gate/Trigger Button** on the hardware to cycle between Envelope Modes.
- Press and hold the **Source/Shift Button** and then press and hold the **Gate/Trigger Button** on the hardware to enable/disable the internal digital VCA applied at the **Stereo Line Level/Headphone Output**.
- This is an analogue control that is only present in the hardware.

Gate/Trigger Input: Externally triggers the envelope generator with a connected gate or trigger signal.

- This is an analogue input that is only present on the hardware.

Attack Knob: Sets the attack time of the envelope generator.

- Moving the knob clockwise increases the attack time.
- Moving the knob anticlockwise decreases the attack time.
- This is a digital control that is present on the hardware and in the software.

Decay Knob: Sets the decay time of the envelope generator.

- The **Decay Knob** is only accessible if the Envelope Mode is set to ADSR.
- Moving the knob clockwise increases the decay time.
- Moving the knob anticlockwise decreases the decay time.
- If the Envelope Mode is set to ADSR, the **Release Knob** on the hardware controls both the **Decay Knob** and the **Release Knob** in the software. These settings can be adjusted separately by manually controlling them in the software.
- This is a digital control that is only present in the software.

Sustain Knob: Sets the sustain level of the envelope generator.

- The **Sustain Knob** is only accessible if the Envelope Mode is set to ADSR.
- Moving the knob clockwise increases the sustain level.
- Moving the knob anticlockwise decreases the sustain level.
- This is a digital control that is only present in the software.

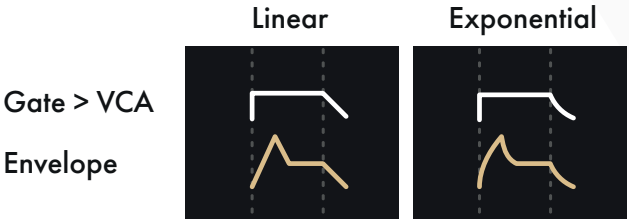
Release Knob: Sets the release time of the envelope generator.

- Moving the knob clockwise increases the release time.
- Moving the knob anticlockwise decreases the release time.
- If the Envelope Mode is set to ADSR, the **Release Knob** on the hardware controls both the **Decay Knob** and the **Release Knob** in the software. These settings can be adjusted separately by manually controlling them in the software.
- This is a digital control that is present on the hardware and in the software.

Digital VCA

An internal digital VCA can be applied to the signal at the **Stereo Line Level/Headphone Output**. This can be enabled through both the hardware and the software.

It is important to note that the digital VCA is not opened by the envelope generator itself, but rather by a gate, trigger, or MIDI Note-On/Note-Off message received by the envelope generator with the release time applied at its ending.



To enable the digital VCA on the hardware, press and hold the **Source/Shift Button**, then press and hold the **Gate/Trigger Button**. When enabled, the **Gate/Trigger Button** will pulse with the colour of the selected Envelope Mode. To disable the digital VCA, repeat the same action.

To enable and disable the digital VCA in the software, press the **Gate > VCA Button**. This is indicated in the software by illumination of the **Gate > VCA Button**.

Gate > VCA Button: Enables the digital VCA applied to the signal present at the **Stereo Line Level/Headphone Output**.

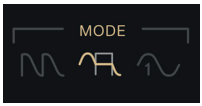
Digital LFO & Modulation Matrix

Seashell's Extended Mode provides access to the digital LFO and modulation matrix, both of which greatly expand the modulation capabilities of Seashell.

Digital LFO Parameters

Reset LFO Button: Sets the digital LFO to reset with each gate signal, trigger signal, or MIDI Note-On message.

- This is a digital control that is only present in the software.
- Press and hold the **Source/Shift Button**, then the **LF Button**, and then tap the **Gate/Trigger Button** on the hardware unit to set the LFO's rate via tap tempo.



Gate-Stalled LFO Button: Sets the digital LFO to stall with each gate signal, trigger signal or MIDI Note-On message.

- This is a digital control that is only present in the software.
- Press and hold the **Source/Shift Button**, then press the **LF Button**, and then tap the **Gate/Trigger Button** on the hardware unit to set the LFO's rate to a tap tempo.

One-Shot LFO Button: Sets the digital LFO to oscillate one cycle per gate signal, trigger signal, or MIDI Note-On message.

- This is a digital control that is only present in the software.
- Press and hold the **Source/Shift Button**, then press the **LF Button**, and then tap the **Gate/Trigger Button** on the hardware unit to set the LFO's rate to a tap tempo.

Unipolar Positive Button: Sets the digital LFO's waveform to be positive only with a 0V to 5V range.

- This is a digital control that is only present in the software.

Bipolar Button: Sets the digital LFO to have both positive and negative portions of the waveform with a ±5V range.

- This is a digital control that is only present in the software.

Rate Knob: Sets the frequency of the digital LFO.

- This is a digital control that is only present in software.

Hz Button: Sets the digital LFO's rate to frequency values in hertz.

- This is a digital control that is only present in the software.

Tempo Sync Button: Sets the digital LFO's rate to beat divisions/multiplications of the DAW's tempo.

- This is a digital control that is only present in the software.

Digital LFO Trigger Modes

The digital LFO can be triggered in several ways: via the **Gate/Trig Button**, the **Gate/Trigger Input**, USB-C/TRS MIDI, or any combination.

Manual Trigger Button: Determines how the digital LFO responds to the **Gate/Trigger Button**. When enabled, pressing the **Gate/Trigger Button** activates the set LFO Mode behaviour.

- This is a digital control that is only present in the software.

Voltage Trigger Button: Determines how the LFO responds to the **Gate/Trigger Input**. When enabled, sending a gate or trigger signal to the **Gate/Trigger Input** of the hardware unit activates the set LFO Mode behaviour.

- This is a digital control that is only present in the software.

MIDI Trigger Button: Determines how the LFO responds to MIDI information. When enabled, a MIDI Note-On message activates the set LFO Mode behaviour.

- This is a digital control that is only present in the software.

Modulation Matrix

Macro Knob: Sets the scaling of the multipliers defined at the **Modulation Nodes**.

- The hardware **Macro Knob** will control the software **Macro Knob** if in **Extended Mode**.

Source Slot: Selects the modulation source within the modulation matrix.

Modulation Node: Sets the depth of modulation between the source and destination.

- The **Modulation Node's** value can be changed to a fix state by right-clicking the **Modulation Node** and selecting and engaging **Lock**. This decouples it from the **Macro Knob's** functionality.

Destination Slot: Selects the modulation destination within the modulation matrix.

Reset Button: Resets all modulation matrix routings.

Modulation Matrix Sources

None: No modulation source selected.

Offset: Defines a set DC offset value as a constant modulation source.

CV Input: Defines the **Assignable CV Input** on the back panel as a modulation input.

Envelope: Defines the envelope generator as a modulation source to be used for modulation routings.

Envelope End of Cycle: Defines envelope generators EOC as a trigger source.

Gate/Trigger Input: Defines the signals present at the **Gate/Trigger Input** to be a gate or trigger source.

Gate/Trigger Button: Defines the **Gate/Trigger Button** to be a gate or trigger source.

LFO: Defines the digital LFO as a modulation source.

- Random
- Sine
- Triangle
- Square
- Sawtooth

MIDI: Defines various MIDI channel voice messages as modulation sources.

- Velocity
- Pressure
- Pitch
- Note-On

MIDI CC: Defines various MIDI continuous controller messages as modulation sources.

- 0-127

Modulation Matrix Destinations

None: No modulation destination selected.

VCA Level: Defines the amplitude of the VCA as a modulation destination.

Diffuse Amount: Defines the amount of spatial diffusion as a modulation destination.

CV Out: Redefines the Envelope Output as a variable analogue CV output.

Pulse Width: Defines the pulse width of Oscillator 2's pulse waveform as a modulation destination.

Filter Frequency: Defines the cutoff frequency of the low-pass filter as a modulation destination.

- This operates in parallel to the normalled envelope signal present at the **Freq/Fold CV Input**.

Cross Modulation Depth: Defines additional amplitude scaling of the FM signals as a modulation destination.

Wavefold Amount: Defines the wavefold amount as a modulation destination.

- This operates in parallel to the normalled envelope signal present at the **Freq/Fold CV Input**.

Wavefold Bias: Defines the wavefold bias amount as a modulation destination.

1V/Oct Routing: Defines various pitch-related parameters as modulation destinations

- The routing of the pitch control follows the pitch tracking assignment.
- Detune
  - Reduced range of pitch modulation.
- Frequency
  - Full range of pitch modulation.
- Transpose
  - Chromatically-quantised pitch modulation (according to the custom tranpsosition scale).

Osc 1: Defines various pitch-related parameters of Oscillator 1 as modulation destinations.

- The routing of the pitch control follows the pitch tracking assignment.
- Detune
  - Reduced range of pitch modulation.
- Frequency
  - Full range of pitch modulation.
- Transpose
  - Chromatically-quantised pitch modulation (according to the custom tranpsosition scale).

Osc 2: Defines various pitch-related parameters of Oscillator 2 as modulation destinations.

- The routing of the pitch control follows the pitch tracking assignment.
- Detune
  - Reduced range of pitch modulation.
- Frequency
  - Full range of pitch modulation.
- Transpose
  - Chromatically-quantised pitch modulation (according to the custom tranpsosition scale).

Envelope: Defines various envelope generator parameters as modulation destinations.

- Trigger
- Attack
- Decay
- Sustain
- Release

LFO: Defines various LFO parameters as modulation destinations.

- Rate
- Sync

Software Control Bar

The software's control bar includes options for preset management, layout selection, MIDI options, and settings.

Save Button: Captures and saves settings as presets.

Load Button: Loads presets.

Previous Preset Button: Loads the previous preset in the preset menu.

Next Preset Button: Loads the next preset in the preset menu.

Preset Menu: Displays and loads all presets.

Extend Button: Displays advanced LFO and modulation matrix features.

- Press and hold the **Source/Shift Button** and then hold the **Sync Button** on the hardware unit to expand and collapse the advanced LFO and modulation matrix features.

MIDI Learn Button: Allows for MIDI mapping of parameters over the TRS MIDI connection.

Settings Button: Displays the Global Settings, MIDI Mappings, Tooltips, and Hardware and Software Version Numbers.

Settings

The settings menu includes global attributes that can be set for Seashell.

MIDI Channel Menu: Selects the MIDI input channel for receiving data.

MIDI Pitch Bend Menu: Selects the amount of semitones that are available via MIDI pitch bend.

Octave Range Menu: Sets the amount of octaves that are available via the **Coarse Knobs** on the hardware and the **Osc 1** and **Osc 2 Freq Knobs** in the software.

Tap Tempo Menu: Enables and disabled the ability to calculate a digital LFO rate from a clock signal present to the **Gate/Trig Input** when the **Source/Shift Button** and the **LF Button** are held.

Envelope Retrigger Menu: Determines whether or not the envelope generator retriggers with subsequent gate/trigger signals.

Monitoring Mix Crossfader: The crossfader balances between DAW monitoring and direct input monitoring. When fully left, only the DAW audio is heard at full volume. When fully right, only direct Seashell audio is heard at full volume. By default, the crossfader is set fully right at 100%.

- Press and hold the **Source/Shift Button**, then turn the **Level Knob** on the hardware to set the **Monitoring Mix Crossfader**.

Advanced Feature Button Combinations

This is a list of the various advanced hardware features that are accessible via button combinations mentioned throughout the manual.

Shift+Click

- Fine tune software parameter values in the software.

Extended Mode

- Press and hold the **Source/Shift Button** and then tap the **Sync Button** on the hardware to expand and collapse the advanced LFO and modulation matrix features.

Diffusion in Extended Mode

- Press and hold the **Source/Shift Button** and then turn the **Macro Knob** to set the amount of spatial diffusion

Transpose Buttons

- Press and hold the **Source/Shift Button** and then press the **1V/Oct Button** on the hardware to cycle between transposition states.
- Press and hold the **Source/Shift Button** and then hold the **1V/Oct Button** on the hardware to disable transposition states for both oscillators.

Animate Button

- Press and hold the **Source/Shift Button** and then press the **LF Button** on the hardware to enable and disable **Animate**.
- Press and hold the **Source/Shift Button** then tap and hold the **LF Button** to reset the animatable parameters (pulse width and wavefold bias) to their default position.

Envelope Modes

- Press and hold the **Source/Shift Button** and then press the **Gate/Trigger Button** on the hardware to cycle between Envelope Modes.

Digital VCA

- Press and hold the **Source/Shift Button** and then hold the **Gate/Trigger Button** on the hardware to enable and disable the digital VCA.

Tap Tempo LFO

- Press and hold the **Source/Shift Button**, then press and hold the **LF Button**, then tap the **Gate/Trigger Button** on the hardware to set the LFO's rate to a tap tempo. If Tap Tempo is enabled and the **Source/Shift Button** and **LF Button** are held, a clock signal at the **Gate/Trig Input** will set the tap tempo.

Monitor Mix Crossfader

- Press and hold the **Source/Shift Button**, then turn the **Volume Knob** on the hardware to set the **Monitoring Mix Crossfader**.

Default Waveforms

- Tap and hold the **Source/Shift Button** to reset to the default waveforms (Wavefold and Pulse).

Firmware Update

To update the firmware, connect Seashell to a computer via the USB-C port. Then press and hold the **Source/Shift Button** and the **Sync Button** while powering via the DC Power Input. Seashell will appear on the computer as an external disk. Drag the most recent .uf2 file to Seashell. Seashell will automatically update the firmware, eject itself from the computer, and power on in normal operation.

Initialise

With Seashell powered on, press and hold the **1V/Oct Button**, **Source/Shift Button**, **Gate/Trigger Button**, and the **Sync Button** for several seconds. The **Fold Slider** will flash, indicating that the initialisation is complete.

An initialisation will reset all digital parameters:

- Sets Standard Mode
- Sets all software controls to match their hardware equivalents
- Set mixed waveforms of Oscillator 1 Fold and Oscillator 2 Pulse
- Routes sine waveform of Oscillator 1 to wavefolder
- Sets Bias to 0%
- Sets pulse width of Oscillator 2 to 50%
- Sets Oscillator 2 to audio-rate
- Enables Animate
- Set Animate depths to 50%
- Disables synchronisation
- Enables 1V/Octave pitch tracking for both oscillators
- Disables Transposition for both oscillators
- Disables all LFO Trigger inputs
- Disables LF mode
- Sets LFO rate to 0.5Hz
- Enable all Envelope Trigger Modes
- Enables all Envelope Trigger Inputs
- Sets AR Mode
- Sets logarithmic/exponential envelope response curve
- Enables internal digital VCA
- Sets Monitor Mix to 100%,
- Sets Level to 100%

Factory Reset

With Seashell powered on, press and hold the **1V/Oct Button**, **Source/Shift Button**, **Gate/Trigger Button**, **Sync Button**, and the **LF Button** for several seconds. The **Fold Slider** will flash, indicating that the factory reset is complete.

A factory reset sets the above with addition of the following parameters:

- Sets Tranposition to octaves
- Sets Coarse Knobs range to +/- 5 octaves
- Sets pitch bend range to +/- 2 semitones
- Enables Tap Tempo Jack
- Enables Envelope Retrigger
- Resets Matrix
- Resets MIDI Map

CE This device meets the requirements of the following standards: EN55032, EN55103-2, EN61000-3-2, EN61000-3-3, EN62311.