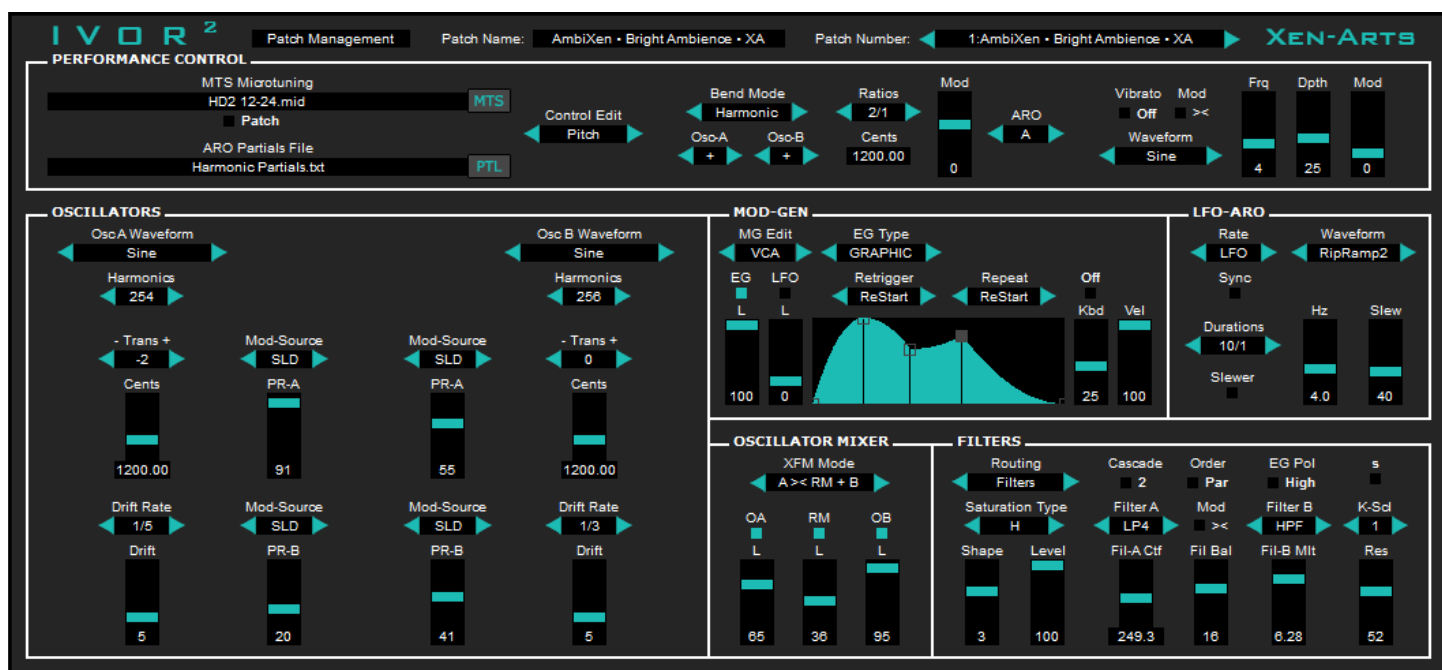


XEN-ARTS

presents

MICROTONAL VIRTUAL ANALOG SYNTHESIZER 2



A SUBTRACTIVE, FM, XFM & RM SYNTHESIS VSTI FEATURING MTS FULL KEYBOARD MICROTUNING

Instruction Manual

IVOR2 • Manual • Table of Contents

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IVOR2

The Microtonal Virtual Analog Synthesizer

Foreword from Xen-Arts

Xen-Arts is very excited to present **IVOR2**, a significant evolution and refinement of the original Ivor microtonal virtual analog synthesizer design.

Introduced in this iteration are a new set of standard features that will be implemented in future updates to the other Xen-Arts instruments, as well as some new ones that are unique to this instrument and its particular type of oscillators:

MOD-GEN

A **MOD-GEN** is essentially a generalized hybrid **Modulation Source Generator**, which includes an envelope generator that can be switched between an **ADSR** or a **Graphic Envelope Generator**, and an **LFO** that can be switched to run at audio-rate: the **ARO**. The **IVOR2 VSTi** features eight total **MOD-GEN** of this type, which are used for modulating the **Phase** or **Pulse-Width Modulation (PWM)** of each oscillator waveform, the range of **Phase & PWM**, **Crossfade Modulation (XFM)**, **Filters**, **VCA** and **Pitch**.

A powerful synthesis feature of the **IVOR2 VSTi**, is that when the **MOD-GEN LFOs** are switched to the **ARO** mode, they are capable of generating additional sideband spectra in the signal, resulting in complex, expressive and evolving timbres. Additionally, the frequency ratios of each **ARO** may be configured by loading a **Partials File (TXT)**, which enables basic tuning and timbre correlations of the generated sideband spectra, especially where sine-waves are being used as the modulating waveform.

Oscillator A & B Pitch Modulation Polarity

All pitch-modulation sources may be configured so that the pitch of each oscillator can be modulated in a common direction and polarity, or the signals inverted for modulation in opposite directions, as well as switched to a static setting without modulation when, for example, using the MIDI Pitch Wheel Controller. When the modulation control signals are inverted, the phase of the modulation sources routed to each oscillator's pitch is effectively at 180°.

Each of the below pitch modulation sources may be configured to modulate the pitch of the two oscillators in either a common direction and polarity (0° phase), or otherwise, in opposite (phase inverted 180°) directions:

- Pitch Bend Controller
- Mod-Wheel Vibrato
- Pitch Mod-Gen
- Harmonic Mod-Gen

Crossfade Modulation (XFM)

Crossfade Modulation itself is a common feature of contemporary synthesizers, however, this instrument enables a unique variant of the technique: partials-file controlled audio-rate modulation between two oscillator sources using a dedicated **MOD-GEN**, which is capable of generating intonation-related sideband spectra, thereby creating interesting sonic relationships between the microtuning and timbre of the instrument, and especially in the most simple **XFM** case scenario of using sinewaves with different pitch transposition offsets.

Phase & Pulse-Width Modulation with MOD-GEN

Unique to **IVOR2** are the new and extremely versatile **Phase & PWM Sliders** and **MOD-GEN** routing options that replace the single control in the original version. Each oscillator has a pair of these range sliders, which can be set to fixed values, and **MOD-GEN** source routing selectors that can optionally override the sliders and their targets modulated with dedicated **MOD-GEN**.

In more typical synthesizer Phase and PWM modulation scenarios, the range of the modulation is set to fixed values. With **IVOR2** the range can be fixed, or alternatively modulated by a **MOD-GEN** to create a huge variety of real-time timbral variations, sweeping notching effects, as well as **FM** timbres when running the **LFO** in a partials-file controlled audio-rate modulation (**ARO**) mode.

With these new phase and pulse-width modulation features, the **IVOR2 VSTi** opens myriad new and exciting realms of microtonal and xenharmonic sound-design possibility.

Jacky Ligon
Xen-Arts
2016

IVOR2 **The Microtonal Virtual Analog Synthesizer** **by Xen-Arts**

IVOR2 is a two-oscillator subtractive, FM, XFM and RM synthesizer that features full-controller MIDI Pitch Microtuning using MTS (MIDI Tuning Standard), where any MIDI Note Number can be freely microtuned to any desired pitch across the MIDI range, thereby enabling musicians and composers to explore the vast expressive possibilities of composing music with alternative intonation systems.

IVOR2 is a microtonal sound-designer's virtual analog synthesizer with a carefully designed ergonomic workflow for quickly creating powerful sounding and musically useful timbres.

IVOR2 excels at making categories of timbres that include bass, distortion, keys, pads, broken, weird, leads and other analog synthesis types of sounds.

IVOR2 is an educational tool for learning about subtractive sound synthesis and musical instrument intonation (microtuning and xen-harmonics).

IVOR2 embodies a design philosophy of simplicity for microtonal music sound-design:

- A knob-less design primarily featuring slider controls, which enables intuitive direct control with a computer mouse
- A dedicated control signal system mapped to the most important synthesis functions
- Settings are made by typing values into fields, dropdown lists, left-and-right arrows, switches and sliders
- Enables musicians to specify precise microtonal pitch-bend settings
- Features arbitrary microtonal oscillator transposition settings
- MIDI-CC modulation of harmonics enables dynamically playing harmonics of the fundamental pitch

Features

Oscillator Section

- Two Oscillators with 22 Waveforms
- Microtonal, Cents-Based Oscillator Transposition
- Per-Oscillator Analog Pitch Drift Emulator
- Phase & Pulse-Width Modulation (PWM) Range Sliders

Mod-Gen Section

- Nine dedicated Modulation Generators (MOD-GEN), featuring an ADSR and Graphic Envelope Generator, and an LFO that can be switched to run at Audio-Rate, which are for modulating Phase (FM), Pulse-Width, XFM, Pitch, Filters and Amplitude (VCA)
- MIDI-CC-to-Harmonics Modulation enables oscillators to dynamically sound harmonics of the fundamental pitch

Oscillator Mixer Section

- Oscillator Mixer for setting relative oscillator volumes, Cross-Fade Modulation (XFM) and Ring Modulator (RM)
- Cross-Fade Modulation (XFM) Mode with six directional options for cross-fading between the two oscillators, including Sum (XFM bypass)

Filter Section

- Pre-Filter Saturation Stage with 20 Saturation Types
- Two Independent Filters with Six Filter Types: LP4, LP2, HPF, BPF, BRF, APF
- One and Two Stage Filter Cascade
- Parallel and serial order routing
- Unipolar and Bipolar Filter Modulation Modes

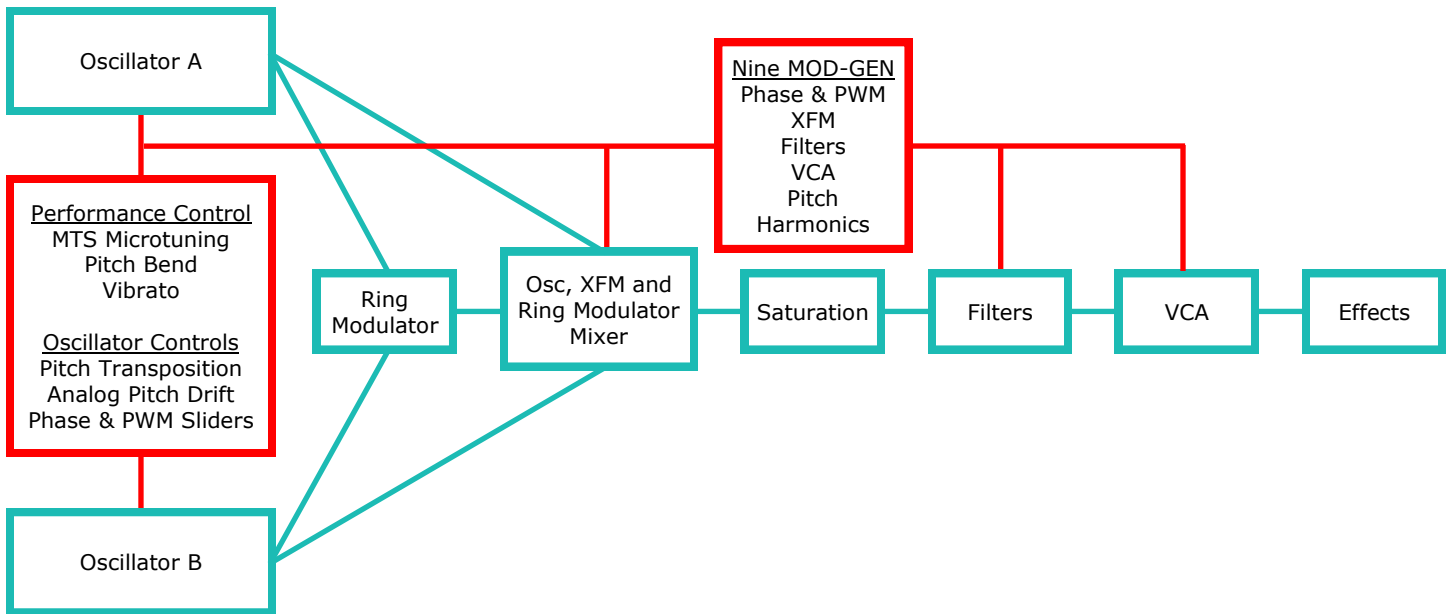
Performance Control

- Full controller MIDI Pitch Microtuning with MTS (MIDI Tuning Standard)
- MTS support for both Single Note and Bulk Dump: Loads MTS microtuning format files internally and receives MTS externally
- Patch (per-patch) and Global Microtuning (static microtuning for all patches)
- Microtunings can be loaded from any directory on hard drives or storage devices connected to the PC
- Partial file loader for patch-level partial retuning of MOD-GEN Audio-Rate Oscillators
- Modulation Effects include Chorus and two Phaser types
- MIDI: 12 Note Polyphonic, Monophonic Legato Mode, Monophonic Portamento, Microtonal Pitch Bend, Vibrato
- Ensemble: Tone Filters, Stereo Ensemble
- Delay: Stereo Delay effect

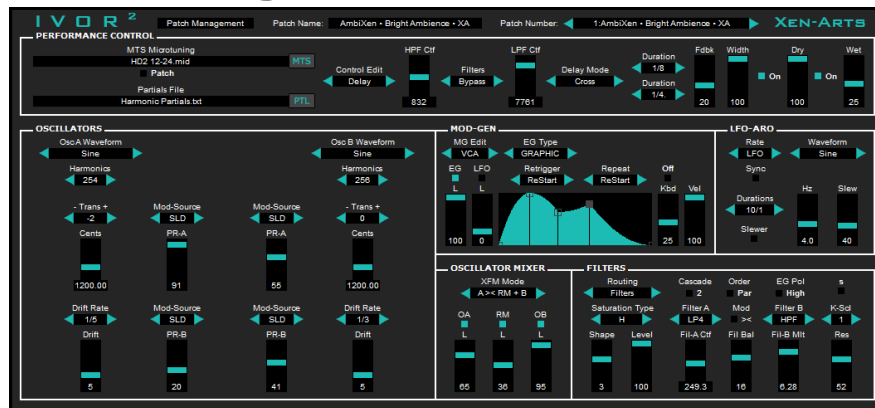
Content

- 118 Factory Patches by Xen-Arts and Sevish
- 148 MTS Microtunings
- 91 Partial TXT Files for Audio-Rate Oscillator Modulation
- Instruction Manual

IVOR2 • SIGNAL FLOW BLOCK DIAGRAM



Blue = Audio Signal Flow Red = Modulation Sources



IVOR2 • SYSTEM REQUIREMENTS

System Requirements

OS: IVOR2 is a 32-bit VSTi for Windows (XP or higher) and Ubuntu Linux 15.04 (bridged with Airwave VST-bridge).

<https://github.com/phantom-code/airwave>

Windows x64: This instrument can be bridged for use on Windows x64 with jBridge.

<https://jstuff.wordpress.com/jbridge/>

Host DAW: The VSTi was rigorously tested in Reaper, Cubase, Ableton Live, Bitwig Studio and FL Studio and is known to work without problems in these hosts.

MTS Microtuning Creation: Install and use Scala to create your own custom microtunings for this instrument.

<http://www.huygens-fokker.org/scala/downloads.html>

MIDI Controller: Requires the use of an external MIDI Controller such as a USB Halberstadt keyboard (standard 12-tone keyboard), a Generalized Keyboard such as the Axis-64 from C-Thru Music, the Opal Chameleon available from The Shape Of Music, the Starr Labs Microzone U-648, U-990, or any of the vast range of commercially available MIDI controllers.

End User: Basic knowledge and experience with the subtractive and FM synthesis methods are assumed for the use of this instrument and manual.

Installation

Extract the entire contents of the archive to your VST directory. This will place the VST DLL and all of the dependent files for the plugin in the required place and will ensure the correct operation of all the synthesis features. It is suggested for Windows 7 users to install the plugin into a directory other than Program Files (x86) due to UAC, since it must be able to write to its install directory.

IVOR2 • PATCH MANAGEMENT



IVOR2 Patch Management functions.

Use the Patch Management features at the top of the VSTi to load, create and store your instrument patches and banks.

Click the **Patch Management** button to access patch **Copy**, **Load** and **Save** options:

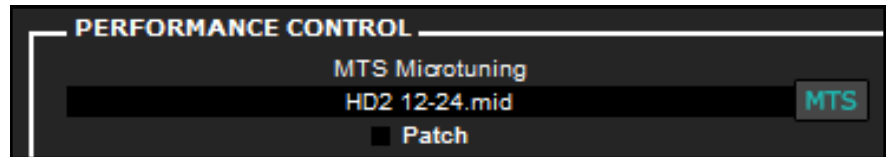
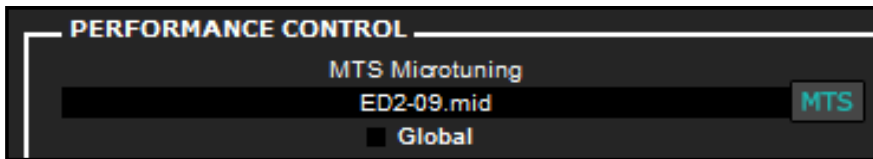
- Copy patches to a single location or to a range of patches with the **Copy Patch** menu option.
- Load an FXP single instrument patch file with the **Load Inst** menu option.
- Save an FXP single instrument patch file with the **Save Inst** menu option.
- Load an FXB bank file that can contain up to 128 patches with the **Load Bank** menu option.
- Save an FXB bank file that can contain up to 128 patches with the **Save Bank** menu option.

Type a new name for the current patch into the **Patch Name** field when designing custom timbres.

Select from the available 128 patches stored in the current bank by clicking the **Patch Number** drop-down menu, or alternatively use the left and right arrow buttons found to the right of the menu to step through the available patches in a bank.

Any changes made to the currently selected patch are automatically saved with that patch number.

IVOR2 • PERFORMANCE CONTROL • Microtuning & ARO Partial File



IVOR2 can load both a **Global** and **Patch** level MTS microtuning.

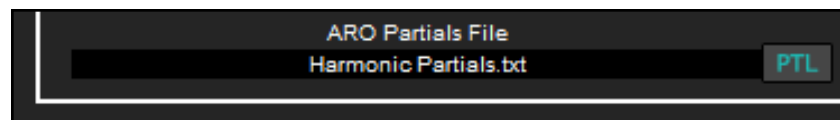
PERFORMANCE CONTROL • Microtuning

The **IVOR2** VSTi enables musicians to load both a **Global MTS Microtuning** as well as a **Patch MTS Microtuning**. The **Global** MTS Microtuning will stay loaded even on patch changes and can be used to play in a constant tuning while previewing the patches in a bank. The **Patch** MTS Microtuning, however, is saved at the patch level and is restored whenever a patch with an associated microtuning is opened. Load the desired Global and Patch MTS Microtuning files by clicking the **MTS** button.

Choose to play the current patch with either the loaded **Global** or **Patch** MTS Microtuning by configuring the selector beneath the **MTS** file loader.

Note: The default selection of MTS microtunings saved with the VSTi have the 1/1 of the tuning on MIDI Note C 60 with a Reference Pitch of 261.626 Hertz.

An important feature of all Xen-Arts VSTi is that they enable musicians and composers to load, and make music with, MTS microtunings that are stored in any directories on their computers. This includes connected external drives and USB storage devices.



The ARO Partial File loader in the Performance Control section.

PERFORMANCE CONTROL • ARO Partial File • Audio-Rate Oscillators (ARO)

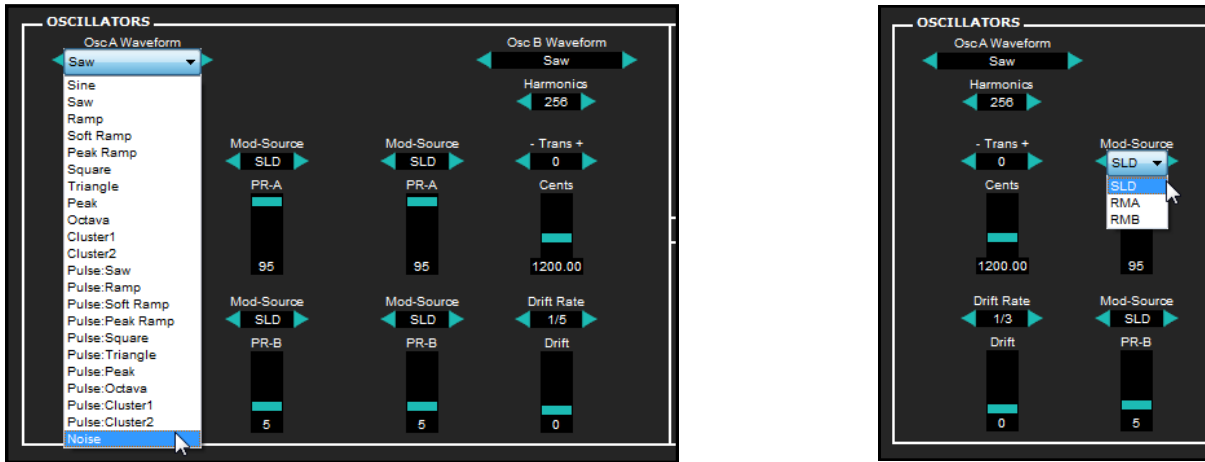
Among the distinguishing features of this instrument is the ability to retune the **Audio-Rate Oscillators (ARO)** found in the **MOD-GEN** section) to user-specified partials values by loading **Partials Files (TXT)** into the instrument using the **ARO Partial File** loader found in the top left area of the **Performance Control** section.

A **Partials File**, in the context of this instrument, is a text (**TXT**) file containing an index of 32 frequency ratios. Each line of a **Partials File** retunes a partial to a mathematically precise frequency ratio relative to the incoming fundamental pitch. The incoming fundamental pitches around which partial frequency ratios are offset, are determined by the **MIDI Note** being played on one's controller, as well as the intonation system (**microtuning**) being used.

ARO Partial Files are patch-specific, and the currently loaded one determines the available intervals and partials tuning of the **ARO** for the selected patch. For **ARO Partial Files** to be used with an **ARO**, the respective **LFO** must both be switched to the **ARO** mode, as well as its **Trans Mode (Transposition Mode)** set to **Partials**. When configured in this way, the user can directly specify the pitch offsets for each **ARO** according to the partials (frequency ratios) available in the loaded **ARO Partial File**.

A small library of partials files are included with the VSTi, but users may freely create their own using **Windows Notepad**. Type or paste your own ratio values into Notepad, where each of 32 lines contains a single frequency ratio value. **Set the TXT file properties to 'Read Only' in order to preserve their contents and formatting, and save them into the plugin content directory of this instrument.**

IVOR2 • OSCILLATORS



IVOR2 oscillators have 22 waveforms as well as range and routing controls for phase and pulse-width modulation.

OSCILLATORS • Oscillator Waveforms

There are two oscillators, A and B, with identical features. Select the waveform of the oscillators using the **Osc A Waveform** or **Osc B Waveform** dropdown list or left and right arrows.

There are 22 waveforms available. The first 11 are basic synthesis waveforms:

1. Sine
2. Saw
3. Ramp
4. Soft Ramp
5. Peak Ramp
6. Square
7. Triangle
8. Peak
9. Octava
10. Cluster1
11. Cluster2

These 11 waveforms may be subjected to **Phase Modulation** using dedicated **Modulation Generators** found in the **MOD-GEN** section: **PMA** and **PMB**.

Waveforms 12 through 21 have a Pulse prefix:

12. Pulse: Saw
13. Pulse: Ramp
14. Pulse: Soft Ramp
15. Pulse: Peak Ramp
16. Pulse: Square
17. Pulse: Triangle
18. Pulse: Peak
19. Pulse: Octava
20. Pulse: Cluster1
21. Pulse: Cluster2

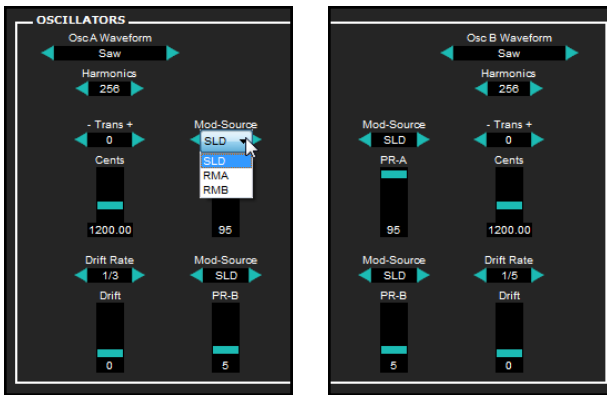
These waveforms may be subjected to **Pulse Width Modulation** using dedicated **Modulation Generators** found in the **MOD-GEN** section: **PMA** and **PMB**.

A final waveform is available:

22. Noise

The noise waveform has no specific pitch and may be used to synthesize percussion oriented sounds, as a Ring Modulation source, or may be blended with the above pitched waveforms to create breathy or blown types of sounds.

IVOR2 • OSCILLATORS



IVOR2 oscillators have independent range and routing controls for phase and pulse-width modulation.

OSCILLATORS • Basic Oscillator Functions

Specify the number of harmonics for each oscillator using the **Harmonics** selector. The range is from 1 to 256 harmonics. Obviously, with the most simple waveform - a sinewave - only one harmonic is sounded: the fundamental pitch, so setting a higher harmonic number for a sinewave will still be limited to sounding only the fundamental partial tone.

Arbitrary pitch transpositions of the oscillators may be set by using the respective **Cents** sliders (which permits typing and pasting values into its field) and using the - **Trans +** selector. The range of transposition is ± 16 times the value specified in the **Cents** field beneath the slider.

Drift Rate: Controls **Rate of Analogue Drift**. Simulates the small voltage variances of analogue synths causing pitch drifting over time. **Drift** slider: Controls the depth of the Analogue Drift.

OSCILLATORS • Phase & Pulse-Width Modulation Controls

Each of the oscillators has a pair of independent sliders and modulation routing controls for **Phase** and **Pulse-Width Modulation**: a **Mod-Source (Modulation Source)** selector, and range sliders labeled **PR-A** and **PR-B**.

Use the **Mod-Source** selectors to specify the behavior of the **Phase** and **Pulse-Width Modulation** for each oscillator:

SLD

With the **Mod-Source** selector in the **SLD** mode, either of the **PR-A** and **PR-B** range sliders are **activated** and may be used for setting **static modulation range boundaries** for **Phase** and **Pulse-Width Modulation**.

RMA

With the **Mod-Source** selector in the **RMA** mode, either of the **PR-A** and **PR-B** range sliders are **deactivated** and the **range modulation boundaries** for **Phase** and **Pulse-Width Modulation** are controlled by a dedicated **Modulation-Generator** found in the **MOD-GEN** section, which may be configured by choosing the **RMA** page using the **MG-Edit** selector.

RMB

With the **Mod-Source** selector in the **RMB** mode, either of the **PR-A** and **PR-B** range sliders are **deactivated** and the **range modulation boundaries** for **Phase** and **Pulse-Width Modulation** are controlled by a dedicated **Modulation-Generator** found in the **MOD-GEN** section, which may be configured by choosing the **RMB** page using the **MG-Edit** selector.

The range for the **PR-A** and **PR-B** sliders is from 0 to 100. Specify static **Minimum** and **Maximum** range values for phase or pulse-width modulation by typing a value into the lower field, or by adjusting the slider.

Phase (FM) and Pulse Width Modulation can be utilized to create complex and evolving timbres. When modulated at slower **LFO** rates, the effect can be similar to chorusing, while modulation at audio-rates can create complex sidebands in the composite signal. **Pulse Width Modulation** can progressively add or remove harmonics from the oscillator waveforms. An in depth discussion of Phase and Pulse Width Modulation is outside of the scope of this brief manual. It is suggested to read these two articles as an introduction to these important synthesis concepts:

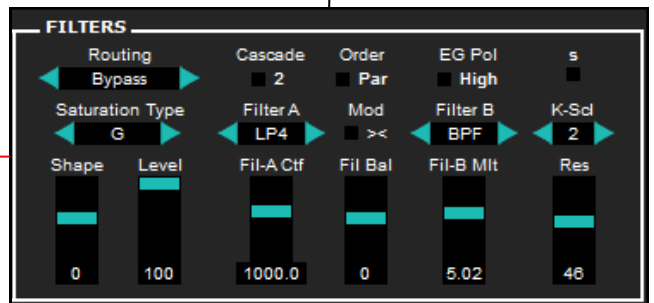
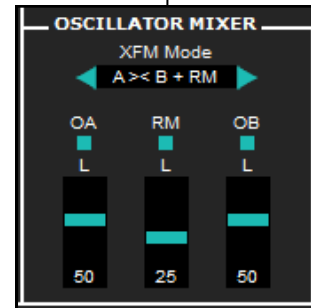
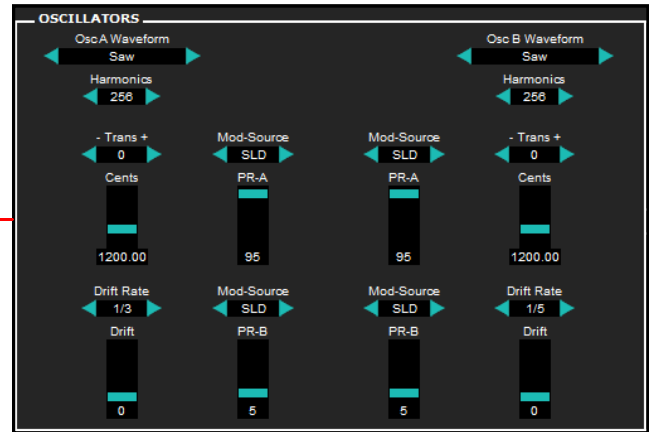
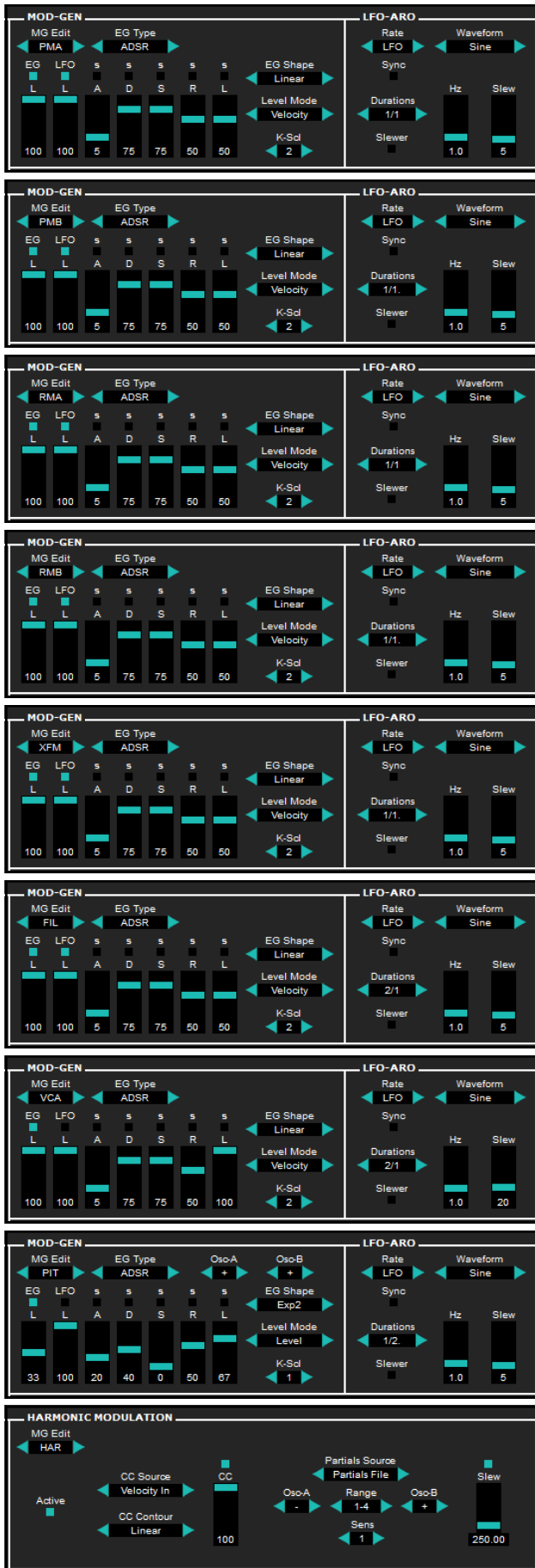
Synth Secrets, Part 12: An Introduction to Frequency Modulation

<http://www.soundonsound.com/sos/apr00/articles/synthsecrets.htm>

Synth Secrets, Synthesizing Strings - PWM & String Sounds

<http://www.soundonsound.com/sos/Mar03/articles/synthsecrets47.asp>

IVOR2 • MOD-GEN Overview



VCA

To Performance Control FX

A **MOD-GEN** is a Modulation Source Generator that includes an ADSR or Graphic Envelope Generator, and an LFO that can be switched to run at audio-rate: the ARO. The IVOR2 VSTi features eight total MOD-GEN of this type:

- PMA:** Osc-A Phase & PWM
- PMB:** Osc-B Phase & PWM
- RMA:** Phase & PWM Range Modulation
- RMB:** Phase & PWM Range Modulation
- XFM:** Crossfade Modulation
- FIL:** Filter Modulation
- VCA:** Amplitude Modulation
- PIT:** Pitch Modulation

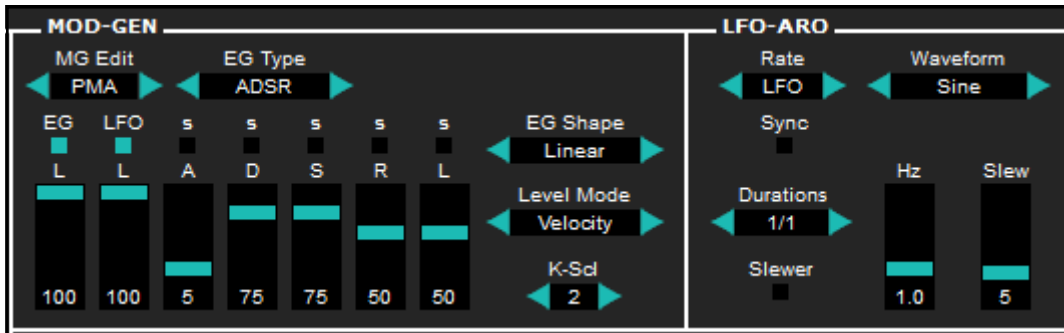
There is also an additional MIDI CC controlled MOD-GEN:
HAR: Harmonic Modulation

Red = Modulation Signal Paths
 Black = Audio Signal Paths

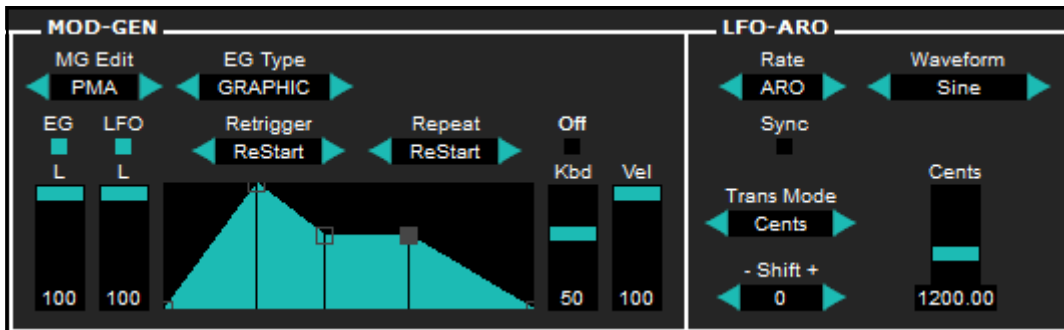
IVOR2 • MOD-GEN Overview

It will be informative in detailing the more complex functions and interactions between the various sections of the **IVOR2** VSTi, to offer an initial overview of a single **MOD-GEN** in isolation, since they are integral to the operation of the instrument at practically every stage of its sound-generation, and all share common features.

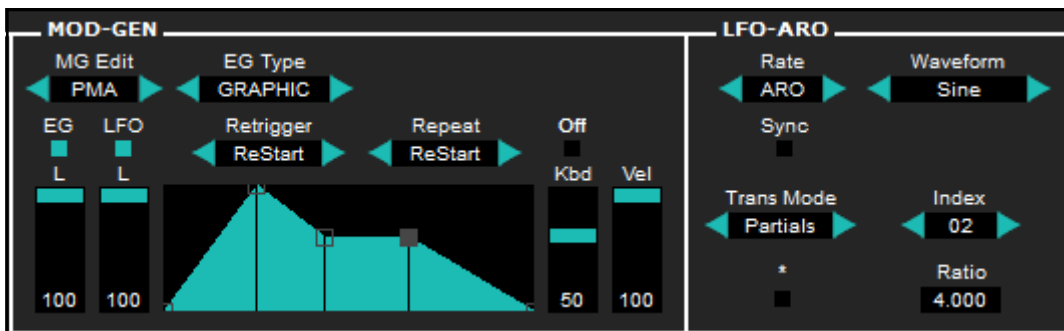
A **MOD-GEN** is essentially a **Modulation Source Generator** that includes an **ADSR** or **Graphic Envelope Generator**, and an **LFO** that can be switched to run at audio-rate: the **ARO**. The **IVOR2 VSTi** features nine total **MOD-GEN** of this type.



Pictured here is a single MOD-GEN Envelope Generator (EG) switched to the ADSR EG Type. On the right, the LFO-ARO section is switched to LFO.



The same MOD-GEN with its EG switched to display the controls for its Graphic EG. On the right, the LFO-ARO is switched to ARO, with its rate controlled with a Cents transposition value relative to the incoming MIDI pitch.

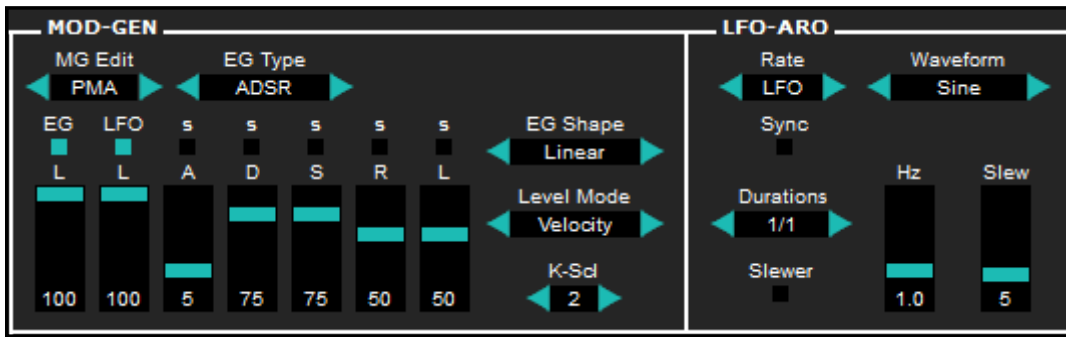


The same MOD-GEN with its EG switched to display the controls for its Graphic EG. On the right, the LFO-ARO is switched to ARO, with its rate controlled by the loaded partials file offset.

The **Modulation Generators (MOD-GEN)** have **LFOs** that can be switched to run at **Audio-Rate**. These **MOD-GEN** are used for modulating the **Phase** or **Pulse-Width Modulation (PWM)** of each oscillator waveform, the range of **Phase & PWM**, **Crossfade Modulation (XFM)**, **Filters**, **VCA** and **Pitch**.

A powerful synthesis feature of the **IVOR2** VSTi, is that when **LFOs** are switched to the **ARO** mode, they are capable of generating additional sideband spectra in the signal, resulting in complex, expressive and evolving timbres. Additionally, the frequency ratios of each **ARO** may be configured by loading a **Partials File (TXT)**, which enables basic tuning and timbre correlations of the generated sideband spectra, especially where sine-waves are being used as the modulating waveform.

IVOR2 • MOD-GEN Overview



Switch between the different **MOD-GEN** control panels using the **MG Edit** selector.

Directly below the **MG Edit** selector is a simple mixer for the **EG** and **LFO** which is always visible. The mixer includes activator switches for the enabling or disabling the **EG** and **LFO**, and sliders, labeled **L**, for mixing their relative levels.

Please note that when both the EG and LFO are active, the EG modulates the level of the LFO.

The **MOD-GEN** includes an **ADSR** style **Envelope Generator** with keyboard tracking features, selectable with the **EG Type** selector.

A = Attack, D = Decay, S = Sustain, R = Release and L = Level

Set the **ADSR** timings for the **EG** using the provided sliders, or otherwise type timing values into the fields beneath them. Range is 0-100 max.

Above each **ADSR** slider there is a three position selector for configuring the behavior of linear keyboard tracking for each stage of the envelope generator. In the '**s**' position, keyboard tracking is disabled and the stage is controlled entirely by the slider alone. When set to '+', playing lower on the MIDI controller will shorten the time of the envelope stage, while playing higher will lengthen it. Conversely, when the selector is set to '-', playing lower on the MIDI controller will lengthen the time of the envelope stage, while playing higher will shorten it.

Use the **K-Scl** selector to scale the linear keyboard tracking. This operates in direct relation to, and in interaction with, the settings made to the keyboard tracking selector for each of the envelope stages, and enables the user to find the best balance and tracking behavior for the ADSR across the MIDI range.

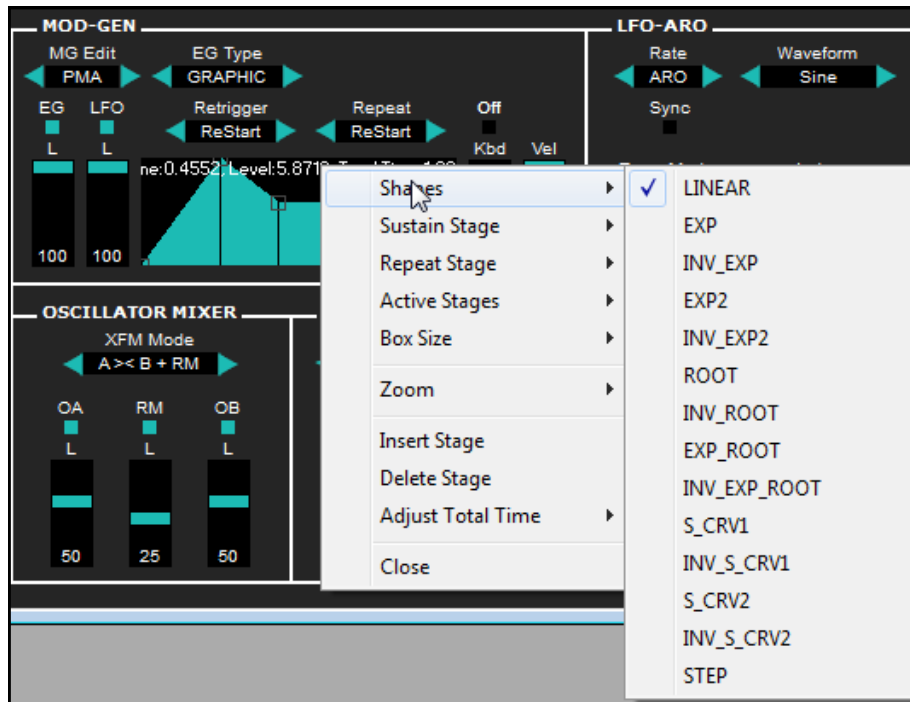
Specify the shape of the **EG** control signal using the **EG Shape** selectors. **Linear** is the EG standard mode, while the other shapes radically change the timing and rate of the EG control signal, which can be useful for synthesizing plucked-string-like timbres and percussive sounds.

Use the **Level** mode selector to switch between the two level modes, which also determines the behavior of the **Level** slider:

Velocity - In this mode the **Level** slider sets the depth of **MIDI Velocity** amplitude modulation, enabling dynamic performance volume control. Softer play on the MIDI controller will sound quieter, while greater force of play will be louder.

Level - In this mode the overall amplitude is set with the **L** slider and the EG does not respond to MIDI Velocity.

IVOR2 • MOD-GEN Overview



Graphic Envelope Generators

Use the **Graphic EG Type** when fine modulation control is required for the particular timbre and musical application. The Graphic EG option offers:

- 8 Stage Looping Envelope Generators
- Retriggering Modes
- Repeat Modes
- Velocity Modulation Level
- Keyboard Tracking

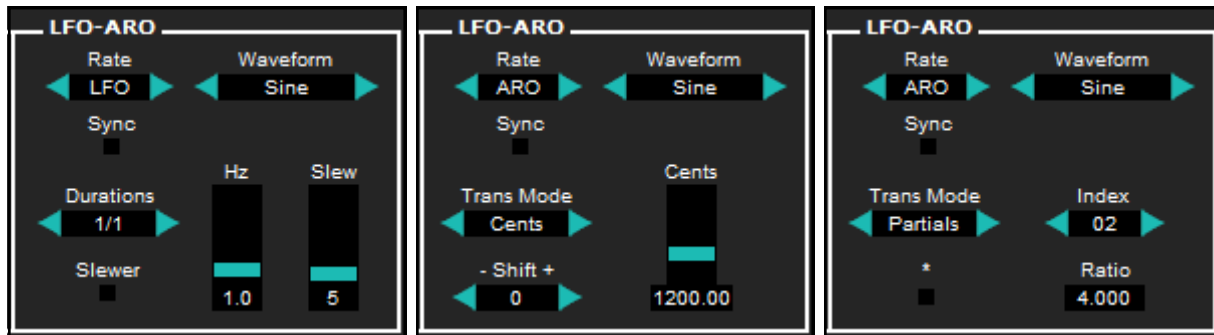
Use the **Retrigger Mode** to either **Restart** the EG from the beginning with each MIDI Note On, or with **PickUp** selected, with each new MIDI Note On, the EG will resume at the position from the last MIDI Note Off. Click and drag the **boxes** in the **EG Display** to adjust the **time** for each stage of the Envelope Generator. Clicking inside the **EG Display** causes a menu of options to appear for creating custom modulation settings.

Choose from the available **Shapes** to create custom modulation contours for each stage of the EG. Using the **Sustain Stage** menu, specify which stage of the EG will produce sustain when a MIDI Note is held. Using the **Repeat Stage** menu, the stage at which the EG will repeat (or loop) as a MIDI Note is held may be configured. Use the **Active Stages** menu to set the number of stages for the EG. Up to 8 stages may be configured for complex modulations. Stages may be added or removed using **Insert** or **Delete Stage**.

Using the **Adjust Total Time** menu, the EG time may be scaled from 10 to 1000%. Use the **Vel Lvl** (Velocity Level) slider to specify the depth of interaction between MIDI Key Velocity and the EG. Use the **Kbd** (Keyboard Level) slider and the **Activator Switch** (Keyboard Tracking) button to make settings for the depth and polarity of the EG keyboard tracking (keyboard tracking behavior is linear): **Off** disables keyboard tracking of the EG, **` + '** causes the EG time to scale positive as higher MIDI Notes are played and **` - '** increases the time of the EG as lower MIDI Notes are played.

Note: A typical **ADSR** can be configured with an **EG** by setting the **Active Stages** to **4** and the **Sustain Stage** to **3**.

IVOR2 • MOD-GEN Overview



The two different modes in the LFO-ARO section. With the LFO switched to run at audio-rate (ARO), frequency ratio offsets can be specified using the Trans Mode (Transposition Mode) in either Cents, or otherwise by frequency ratios available in the currently loaded Partials File.

Switch between the **LFO** and **ARO** (Audio Rate Oscillator) functions using the **Rate** selector.

Choose the waveform for LFO-ARO modulation using the **Waveform** selector.

Choose whether or not to sync the **LFO** waveform to each **MIDI Note-On** using the **Sync** activator button. Leave this off for pad-type sounds for a continuously evolving modulation effect, and on for timbres that use the LFO as a kind of periodic envelope generator, where one needs the LFO waveform to consistently start at the beginning of the wave cycle.

Use the **Durations** selector to choose from either **Hertz** (the first choice in the list), which enables using the **LFO Hz** slider to specify the frequency of the LFO, or otherwise host synchronized standard musical durations ranging from 128/1 to 1/128.

Activate or deactivate the slewer using the **Slewer** activator button. When activated, specify the slew rate in milliseconds using the **Slew** slider. Range is 0 to 250 ms. The Slewer enables smoothing the transitions of certain waveforms.

Switch between the **LFO** and **ARO** (Audio Rate Oscillator) functions using the **Rate** selector. With the LFO running at audio-rate, the pitch is controlled by the **MIDI-to-CV** and the loaded **MTS Microtuning** file; transforming the LFO into a pitch-accurate microtonal-controlled oscillator, which is in turn capable of introducing intonation related sideband spectra into the composite synthesizer signal.

Choose the waveform for LFO-ARO modulation using the **Waveform** selector. Select whether or not to sync the **LFO** waveform to each **MIDI Note-On** using the **Sync** activator button. Leave this off for a free-running **ARO**, and on where one needs the LFO waveform to consistently start at the beginning of the wave cycle.

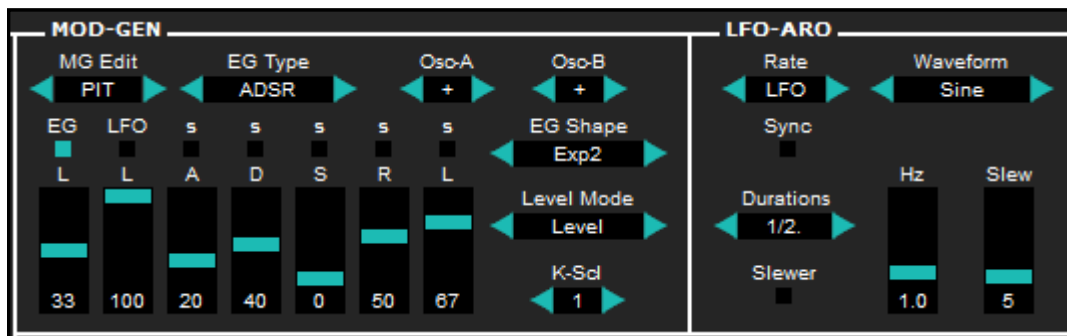
Use the **Trans Mode** selector to switch between the two different **ARO** transposition modes: **Cents** and **Partials**. In the **Cents** mode, the transposition interval is specified in cents using the **Cents** slider. Cents transposition offsets are made using the **- Shift +** selector. Range is from -16 to 16.

In the **Partials** transposition mode, transposition offsets are quantized to the loaded **Partials File**. Use the **Index** selector to set the degree of transposition.

Choose to Multiply ***** or Divide **/** the fundamental pitch of the ARO by the selected frequency ratio using the **Partials */** button.

Now that we have reviewed the functions of a single **MOD-GEN** in isolation, let's continue with exploring them together in the context of how they integrate and interact with the two oscillators.

IVOR2 • MOD-GEN Overview



The PIT (Pitch) MOD-GEN

As previously mentioned, a **MOD-GEN** is a Modulation Source Generator that includes an ADSR or Graphic Envelope Generator, and an LFO that can be switched to run at audio-rate: the ARO. The IVOR2 VSTi features eight total MOD-GEN of this type. Below is a more detailed overview of how they are used in this instrument:

PMA: Osc-A Phase & PWM

For Oscillator-A Phase (FM) and Pulse-Width Modulation (PWM).

PMB: Osc-B Phase & PWM

For Oscillator-B Phase (FM) and Pulse-Width Modulation (PWM).

RMA: Phase & PWM Range Modulation

Used for Phase & PWM Range Modulation and may be freely assigned as a modulation source using any of the Mod-Source selectors found in the Oscillators section.

RMB: Phase & PWM Range Modulation

Used for Phase & PWM Range Modulation and may be freely assigned as a modulation source using any of the Mod-Source selectors found in the Oscillators section.

XFM: Crossfade Modulation

Used for Crossfade Modulation (XFM) in the Oscillator Mixer section. This MOD-GEN is activated when the XFM Mode selector is using any of the modes other than Sum.

FIL: Filter Modulation

Used for modulating the filters found in the Filters section.

VCA: Amplitude Modulation

Used for modulating the amplitude of the VCA, which is the final stage of the sound-generation sections of the synthesizer before the signal is passed to the Performance Control effects section.

PIT: Pitch Modulation

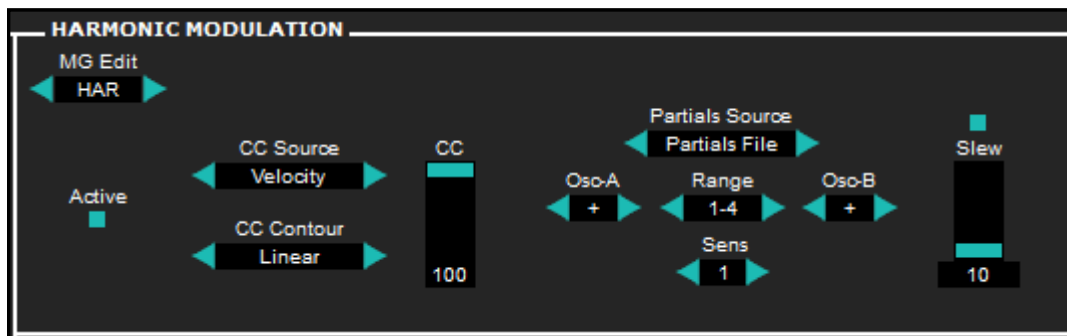
Pictured at the top of this page is the **PIT MOD-GEN**, used for modulating the pitch of the two oscillators. As one can see, there are two additional **Osc-A** and **Osc-B** selectors that make this particular MOD-GEN unique from the others described above. Options are **+**, **-** and **0**. **+** modulates the pitch in an upward direction, **-** in a downward direction, while **0** disables pitch modulation for an oscillator. This flexible functionality enables sound-designers to create myriad kinds of pitch-modulation effects, from plucks to large sweeping effects, with the noteworthy ability to modulate the pitch in a common direction, in opposite directions, disable modulation, or any combination of the above.

There is also an additional MIDI CC controlled MOD-GEN:

HAR: Harmonic Modulation

Used for dynamic MIDI CC controlled sounding of harmonics of the fundamental pitch of the instrument, which will be described in greater detail on the following page.

IVOR2 • MOD-GEN Overview



The HAR (Harmonic Modulation) MOD-GEN

HAR: Harmonic Modulation

This VSTi has a unique feature found only in **Xen-Arts** instruments: **MIDI CC** controlled **Harmonic Modulation**, which enables musicians to dynamically break out harmonics of the fundamental pitch in a manner similar to acoustic instruments such as winds and strings, where force from a MIDI Continuous Controller directly controls the harmonic level.

The **HAR (Harmonic Modulation) MOD-GEN** is designed specifically to be used for this type of dynamic MIDI CC controlled sounding of harmonics of the fundamental pitch of the instrument. Activate or deactivate this MOD-GEN using its **Active** switch.

Where past implementations of this concept were limited to **MIDI Velocity** only, this new iteration of **IVOR2** introduces a more deeply refined implementation of the feature, which enables users to select from a wider range of MIDI CC source options. Select from the available MIDI CC sources that will be used to modulate the harmonics using the **CC Source** selector. Options are: **Velocity**, **Aftertouch**, **Bender**, **Mod-Wheel**, **Breath** and **Expression**.

Configure the **MIDI CC** response curves using the **CC Contour** selector options.

Set the depth of the **MIDI CC** modulation using the **CC** slider.

Choose the harmonic structure that will determine the intervals that are sounded by the **MIDI CC** modulation using the **Partials Source** selector. Options are **Harmonics** and **Partials File**.

When the **Partials Source** selector is set to **Harmonics**, integer multiples of the fundamental pitch are sounded when the **Osc-A** and **Osc-B** sign selectors are in the **+** mode, while **Subharmonics** of the fundamental pitch are sounded when they are in the **-** mode. When the **Osc-A** and **Osc-B** sign selectors are in the **0** mode, harmonic modulation is disabled for the respective oscillator.

This flexible functionality enables sound-designers to create myriad kinds of harmonic-modulation effects, with the noteworthy ability to modulate the pitch in a common direction, in opposite directions, disable modulation, or any combination of the above.

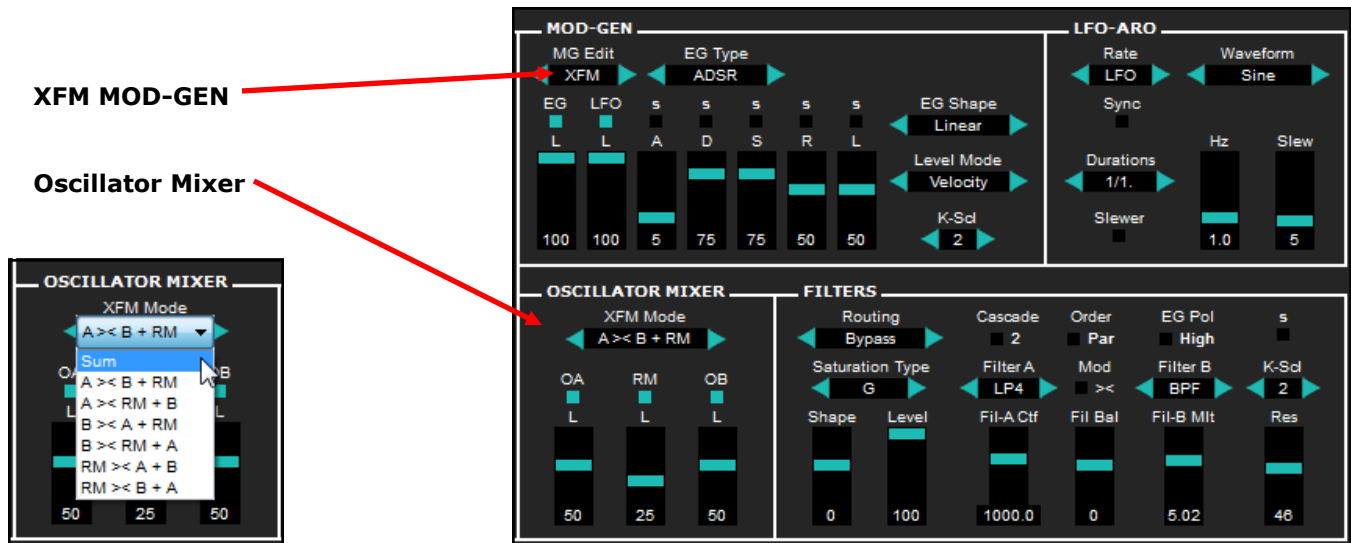
When the **Partials Source** selector is set to **Partials File**, the intervals that will be sounded during harmonic modulation are determined by the loaded **Partials File** in the **Performance Control** section. In this scenario, the **Range** numbers indicate the **Index** value stored in the **Partials File (TXT)**, thereby enabling musicians and composers the ability to specify any kind of partials structure including harmonic series, or otherwise nonharmonic partials.

Set the harmonic range using the **Range** selector. Options are harmonics **1-2**, **1-4**, **1-8** and **1-16**.

Set the sensitivity response of MIDI Velocity for harmonic modulation using the **Sens** selector. Options are **1**, **2** and **3**. A lower setting sets the sensitivity such that lighter force is required to break out higher harmonics, while higher settings require stronger force on the MIDI controller.

Activate or deactivate the Slew with the **Slew** button. Use the **Slew** slider to specify the slew rate in milliseconds. This can be used for creating short pitch glides that smooth the transitions of the harmonic modulation, or alternatively large pitch sweeps, where this **MOD-GEN** is being used for more special-effects categories of sound-design. Range is from **0** to **5000 ms**.

IVOR2 • OSCILLATOR MIXER



The Oscillator Mixer combines signals from Oscillators A and B with the post-oscillator Ring Modulator and also features XFM (Cross-Fade Modulation). The modulation source for XFM is with its dedicated XFM MOD-GEN

What follows is an overview of the **Oscillator Mixer** functions, which is where the oscillator signals are summed together before being routed to the **Filters** and **VCA**. The **Oscillator Mixer** is able to mix the relative levels of signals from the oscillators, but also includes a post-oscillator **RM (Ring Modulator)** that can be used to synthesize sum and difference tone spectra from the two oscillator input sources. Additionally, this is where the **XFM (Cross-Fade Modulation)** synthesis feature is found, which enables smoothly cross-fading between the two oscillator signals, or otherwise modulating them at audio-rate with its own dedicated **XFM MOD-GEN**.

As above, the **Oscillator Mixer** section provides a simple mixer for setting the relative volume balance between **Oscillators A** and **B**. This section also includes a basic **Ring-Modulator**, into which both Oscillators A and B are routed, and which is treated here as another discrete signal that can be mixed with the oscillators for creating complex composite waveforms. Extraordinarily rich and evolving timbres can be created with the ring-modulator, especially when cross-fade modulating of Oscillators A and B with the **XFM MOD-GEN**.

Activate or deactivate the mixer channels for **Oscillator A**, the **Ring-Modulator** and **Oscillator B** using the appropriate **OA**, **RM** and **OB** selectors. Set the relative volume levels of Oscillator A, the Ring-Modulator and Oscillator B using the **OA**, **RM** and **OB** sliders.

Ring Modulation is a signal processing technique in which two signals are multiplied and the resulting waveform contains both the sum and difference frequencies of the two source signals. It is important to note that even when Oscillators A and B have been turned off, they are still internally routed into the ring-modulator. This enables making timbres in which only the RM signal is sounded, while Oscillators A and B are in the Off position.

Use the **XFM Mode** selector to specify the Cross-Fade Mode for Oscillators A & B and the Ring Modulator. Options are:

Sum: Oscillators A & B, and the Ring Modulator, are Summed together and X-Fade Modulation is disabled.

A><B + RM: Osc-A X-Fades with Osc-B, while RM is sustained.

A><RM + B: Osc-A X-Fades with RM, while Osc-B is sustained.

B><A + RM: Osc-A X-Fades with Osc-B, while RM is sustained.

B><RM + A: Osc-B X-Fades with RM, while Osc-A is sustained.

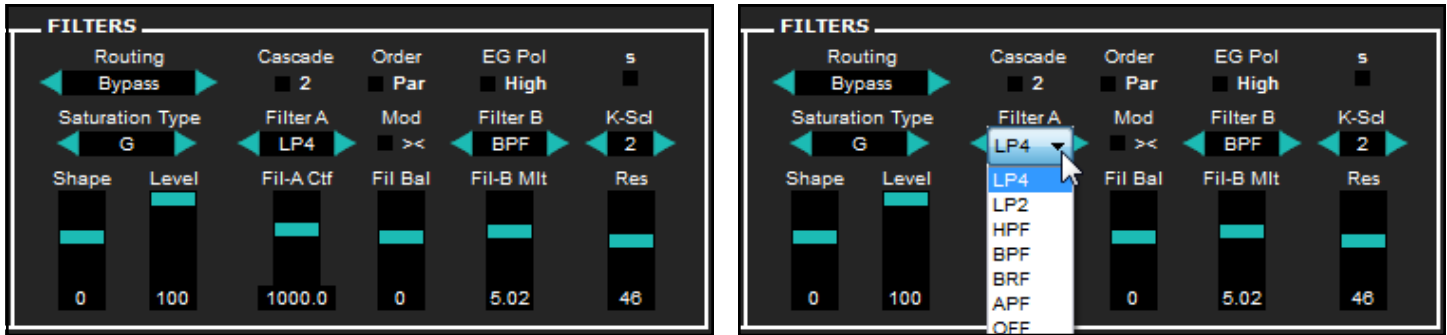
RM><A + B: RM X-Fades with Osc-A, while Osc-B is sustained.

RM><B + A: RM X-Fades with Osc-B, while Osc-A is sustained.

The XFM Mode in the Oscillator Mixer can be modulated with its own dedicated XFM MOD-GEN. For XFM to be activated, the XFM MOD-GEN must also be activated, and the XFM Mode set to any of the above options other than Sum.

When performing XFM at audio-rate using the dedicated XFM MOD-GEN ARO, new sideband spectra are generated and are added to the composite signal in this section of the synthesizer.

IVOR2 • FILTERS



The Filters section features a saturation stage followed by two filters with six filter types.

This section features a pre-filter saturation stage followed by two filters. Configure the way the Oscillator signals are processed by the filter section using the **Routing** selectors. The options are:

Bypass: In this mode the source signals bypass the saturation and filters entirely. **Filters:** The source signals are passed through the filters only and the saturation stage is bypassed. **Sat + Filters:** The source signals are passed through both the Saturation stage and Filters.

Using the **Saturation Type** selectors, select from the available 20 different saturation types, each of which imparts a unique quality of saturation, from subtle wave-shaping to extreme distortions. Use the **Shape** slider to change the wave-shaping and tone quality of the saturation. Control the relative wet and dry balance between the unprocessed source signals and the saturation effect using the **Level** slider. Lower settings let more of the unprocessed signal pass through, while when set to 100%, the source signals are fully processed by the saturation stage.

Use the **Cascade** selector to switch between (1) a single filter for filters A and B, and (2) two filters in series for each filter. Switch between **Parallel** and **Serial** filter routing using the **Order** selector. **Par:** Both Filters run in parallel. **Ser:** Routes Filter A through Filter B in series.

There are two filters with six different filter types. Select from the filter types using the **Filter A** and **Filter B** selectors. When the **Cascade** selector is set to **1**, the available filter responses are as follows:

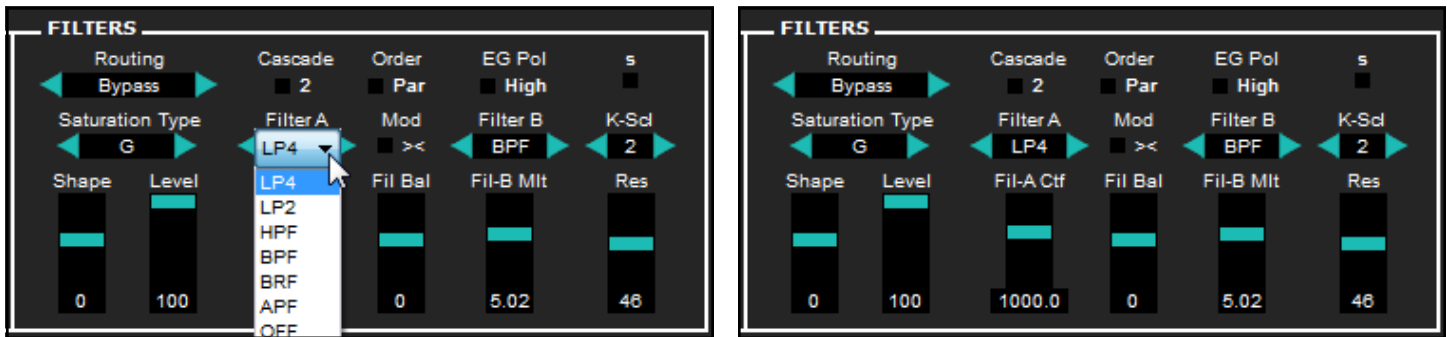
- **LP4:** 4-Pole, 24 dB per octave, Low-Pass Filter with a saturation stage and aggressive resonance, which sounds similar to a Moog style filter.
- **LP2:** 2-Pole, 12 dB per octave, Low-Pass Filter.
- **HPF:** 2-Pole, 12 dB per octave, High-Pass Filter.
- **BPF:** 1-Pole, 6 dB per octave, Band-Pass Filter.
- **BRF:** 1-Pole, 6 dB per octave, Band-Reject Filter.
- **APF:** 2-Pole, 12 dB per octave, All-Pass Filter.
- **OFF:** Disable the filter.

When the **Cascade** selector is set to **2**, then the filter responses for filters A and B are effectively doubled.

Set of the cutoff frequency for **Filter A** using the **Fil A Ctf** slider. The range is 35 Hz to 8 kHz. The cutoff frequency of **Filter B** is specified as a multiple of the **Filter A** cutoff frequency using the **Fil B Mlt** slider. Range is from 1 to 8 times the setting for the Filter A cutoff frequency. For instance, if the cutoff frequency of Filter A is set to 100 Hz, and the Fil B Mlt slider is set to a value of 3, then the cutoff frequency of Filter B is 300 Hz.

Use the **Fil Bal** slider to set the relative balance between Filter A and Filter B. Negative values balance towards Filter A, while positive ones toward Filter B. This enables creating unique and complex composite filter sounds. A setting of 0 creates an equal balance between the filters.

IVOR2 • FILTERS



The Filters section features a saturation stage followed by two filters with six filter types.

Set the Resonance level using the **Res** slider. When the **Keyboard Tracking Selector** (found directly above the **K-Scl** selector) is in the **s** position, keyboard tracking is disabled and filter resonance is controlled entirely by the slider alone. When set to **+**, playing lower on the MIDI controller will lower the resonance, while playing higher will raise it. Conversely, when the selector is set to **-**, playing lower on the MIDI controller will raise the resonance, while playing higher will lower it.

Use the **K-Scl** selector to scale the linear keyboard tracking of the resonance. This operates in direct relation to, and in interaction with, the settings made to the **Keyboard Tracking Selector** above, and enables the user to find the best balance and tracking behavior for filter resonance across the MIDI range. The range is from 0 to 3 and at the lowest value, the resonance tracking is linear in relationship to the keyboard position, while higher values increase the response.

The **MOD-GEN** signals used for modulating the **cutoff frequencies** of **Filter A** and **Filter B** may be set to a common 0° phase, or inverted so that the phase is at 180°. Use the **Mod** switch to change between these two modes:

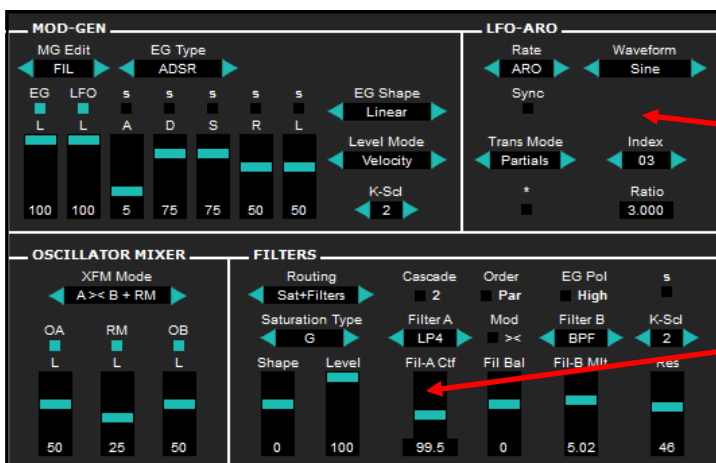
0° Phase Modulation Mode = >>

This modulation mode causes the modulation signals to modulate the cutoff frequencies of Filter A and Filter B in a common direction.

180° Phase Inverted Modulation Mode = ><

This modulation mode inverts the modulation signals 180°, which modulates the cutoff frequencies of Filter A and Filter B in opposite directions. This modulation mode for the filters is capable of creating some extraordinary filtered synthesizer sounds.

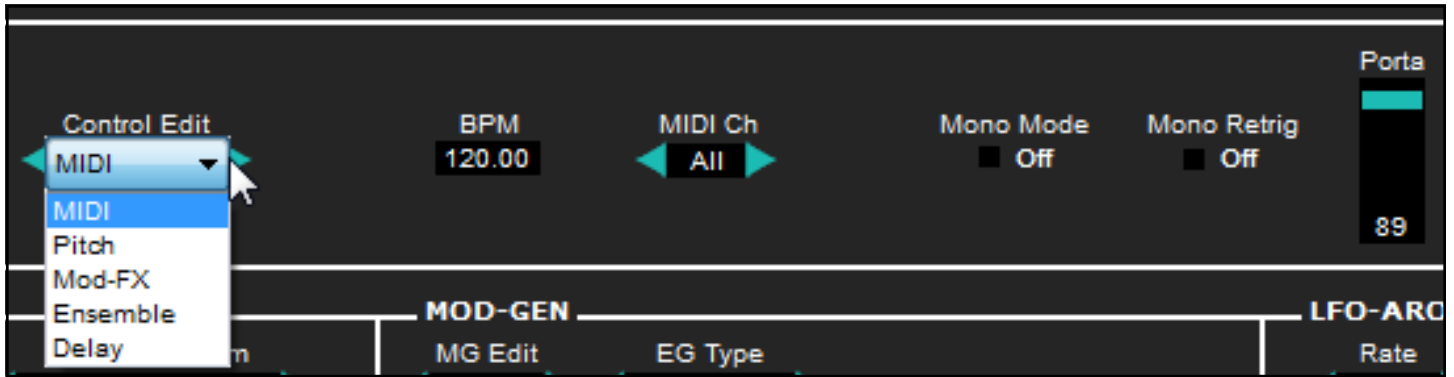
Among the most compelling sound-design techniques with this instrument, is the potential for audio-rate modulation (**ARO**) of the filter cutoff frequency using the dedicated **FIL MOD-GEN**, which is capable of creating a vast range of musically useful resonant effects. Here too it becomes possible to tune the **ARO** using the **ARO Partial Files** that can be loaded into the instrument in the **Performance Control** section, which can be used to generate intonation related sideband spectra and resonator effects.



The **FIL MOD-GEN LFO** is switched to **ARO** mode and pitch offsets are controlled by the loaded partials file.

The **Filter Cutoff Frequency** is modulated at audio-rate, producing intonation related sideband spectra.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The MIDI page of Control Edit options in the Performance Control section.

There are five pages of **Control Edit** options in the **Performance Control** section: **MIDI**, **Pitch**, **Mod-FX**, **Ensemble** and **Delay**. Switch between these pages using the **Control Edit** selector.

PERFORMANCE CONTROL • Control Edit • MIDI

The **BPM** display reports the tempo of the host DAW.

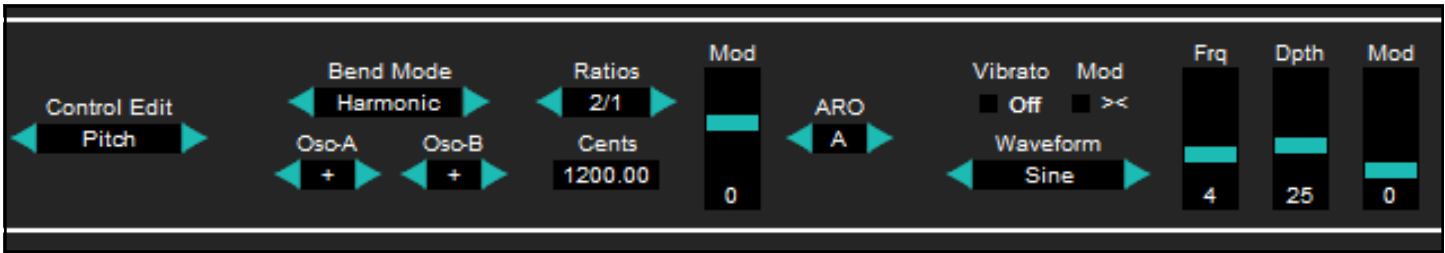
Use the **MIDI Ch** selectors or drop-down list to choose the MIDI reception channels All or 1-16.

Activate or deactivate **Monophonic Mode** with the **Mono Mode** selector. While in **Mono Mode** the synthesizer will only be capable of playing one note at a time, which is useful for bass and single note melodic lines and leads.

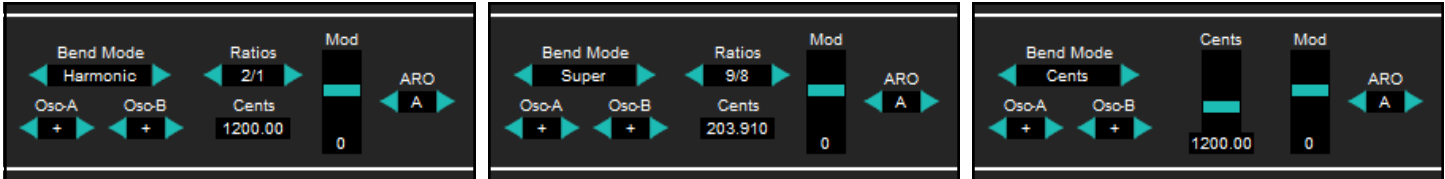
Activate or deactivate **Mono Retrigger** using the selector. Enabling **Mono Retrigger** while the synthesizer is in **Mono Mode** causes **Envelope Generators** to be retriggered with each note-on. Leave this in the Off position to play smooth mono-legato passages.

The **Portamento** feature is activated when the **Mono Mode** switch is set to the On position. Set the portamento glide time using the **Porta** slider

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Pitch page of Control Edit in the Performance Control section.



The Pitch page features three different Bend Mode options for MIDI Pitch-Wheel control: **Harmonic**, **Super** and **Cents**, as well as functions for **Vibrato**.

PERFORMANCE CONTROL • Control Edit • Pitch

IVOR2 has one of the most powerful and flexible **MIDI Pitch Wheel (or Joystick)** control systems available in virtual instruments. Choose between the three **Bend Modes** using the **Bend Mode** selector:

Harmonic: Set the MIDI Pitch-Bend controller to bend by **Harmonic-Series** ratios with the **Ratios** selector. Options are 2/1, 3/1, 4/1, 5/1, 6/1, 7/1 and 8/1.

Super: Set the MIDI Pitch-Bend controller to bend by **Superparticular Ratios** (intervals lying between members of the harmonic series) with the **Ratios** selector. Options are 2/1 to 32/31.

Cents – This mode enables musicians to type a pitch bend value into the slider control expressed in **Cents**. The maximum range is 4800 cents, which is four full octaves. This unique feature enables musicians to precisely specify arbitrary microtonal pitch bend values as needed for any imaginable intonation system.

Underneath the **Bend Mode Selector** are selectors for **Osc-A** and **Osc-B**, with options of **+**, **-** and **0**. **+** bends the pitch positively when the MIDI Pitch-Bend controller is moved, **-** bends it negatively, while **0** bypasses the pitch-bender. This feature enables bending both oscillators in the same direction, in opposite directions, bypassing the pitch-bender, or any combination of the above.

Use the **ARO** selector to specify which of the **Osc-A** or **Osc-B** bend-direction controls will be used for active **ARO** (the **Audio-Rate Oscillators** found in each of the **MOD-GEN**). Options are: **A** (ARO pitch bends in the direction set for Oscillator-A), **B** (ARO pitch bends in the direction set for Oscillator-B) and **Off** (ARO pitch-bend is disabled).

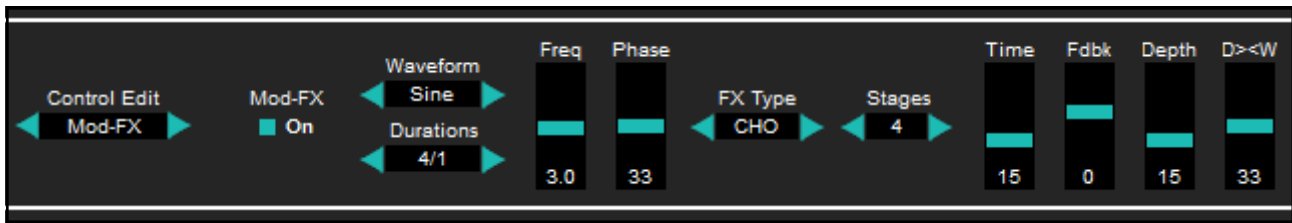
Activate or deactivate **Vibrato** using the **On/Off** selector. Choose from the available **vibrato waveforms** using the **Waveform** selector. Set the modulation polarity using the **Mod** selector. **>>** configures vibrato to modulate the pitch of the oscillators in the same direction (0° phase), while the **><** setting will cause the vibrato to modulate the pitch of each oscillator in opposite directions (180° phase inversion), thereby creating vibrato-controlled detuning effects.

Set the **vibrato rate** in Hertz using the **Frq** slider.

Set the **depth of vibrato** using the **Dpth** slider.

Vibrato is by default mapped to the **MIDI Modulation** controller. Movements of the **Mod-Wheel** on an attached MIDI controller will move the **Mod** slider. It is possible to map this parameter to other MIDI Continuous Controllers if needed.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Mod-FX page of Control Edit options in the Performance Control section.
In the above image the Chorus FX Type is selected for the current patch.

PERFORMANCE CONTROL • Control Edit • Mod-FX

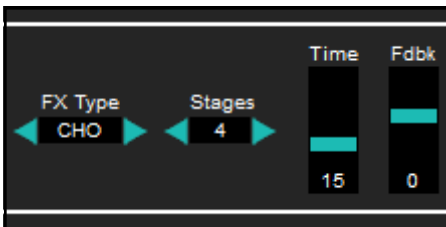
The **Mod-FX** (Modulation Effects) page is actually made up of three different effects processors in one compact space: **Chorus**, **Phaser 1** and **Phaser 2**. Switch between these three effects by using the **FX Type** selector.

Chorus is an effect that is created with multiple LFO modulated delay lines, where each of the LFO waveforms can be set to modulate with a different phase. Chorus is capable of making, for instance, ensemble detuning effects.

Phaser (or Phase Shifting) is also an LFO modulated effect that is typically created with multiple phase-shifted allpass filters. The input signal is notched by the filters as they are slowly swept across a wide frequency range. The effect can create sounds that can remind of pulse-width modulation on an analog synthesizer, or perhaps parallel filter modulation effects, although it is a unique effect unto itself.

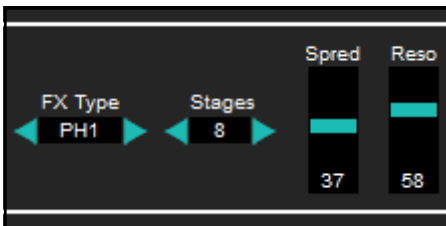
Notice that when changing between the three different effects, some control labels change to reflect the unique settings for the selected FX Type, while the other controls are universal and are applied to all of the effects.

The controls that change according to the selected **FX Type** are as follows:



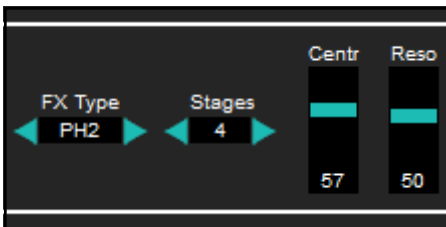
CHO • Chorus

When the **FX Type** is set to **CHO**, the **Chorus** effect is activated, and its unique controls for **Stages**, **Time** and **Feedback** are visible.



PH1 • Phaser 1

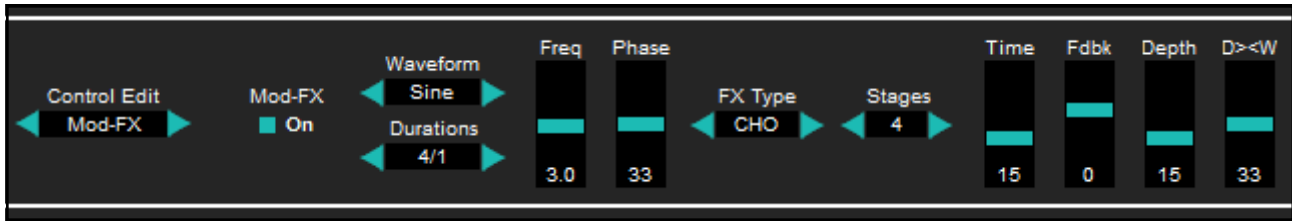
When the **FX Type** is set to **PH1**, the **Phaser 1** effect is activated, and its unique controls for **Stages**, **Spread** and **Reso** (Resonance) are visible.



PH2 • Phaser 2

When the **FX Type** is set to **PH2**, the **Phaser 2** effect is activated, and its unique controls for **Stages**, **Center** and **Reso** (Resonance) are visible.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Mod-FX page of Control Edit in the Performance Control section.
In the above image the Chorus FX Type is selected for the current patch.

PERFORMANCE CONTROL • Control Edit • Mod-FX • Chorus

CHO • Chorus

When the **FX Type** is set to **CHO**, the **Chorus** effect is activated, and its unique controls for **Stages**, **Time** and **Feedback** are visible.

As before mentioned, **Chorus** is an effect that is created with multiple LFO modulated delay lines (called here Stages) with short time delays, where each of the LFO waveforms can be set to modulate with a different phase. These modulated delay line Stages (independent voices in the Chorus) are mixed with the dry input signal, which creates the characteristic ensemble effect that we typically associate with chorus.

A related effect is called Flanging. The difference between Flanging and Chorus is a matter of the delay times of the modulated delay lines:

- Flanging delay times are typically within an approximate boundary of 0-20 ms. Flanging also incorporates higher level Feedback settings to get that characteristic notched sweeping sound.
- Chorus delay times are typically within an approximate boundary of 20-60 ms. Chorus will usually have lower, or no, Feedback settings.

The Chorus effect in this VSTi is extremely versatile and can operate within a range of 0-100 ms, making it possible to create myriad fine gradations of Flanging and Chorus sounds.

Activate or deactivate the Modulation Effect using the **Mod-FX On-Off** button.

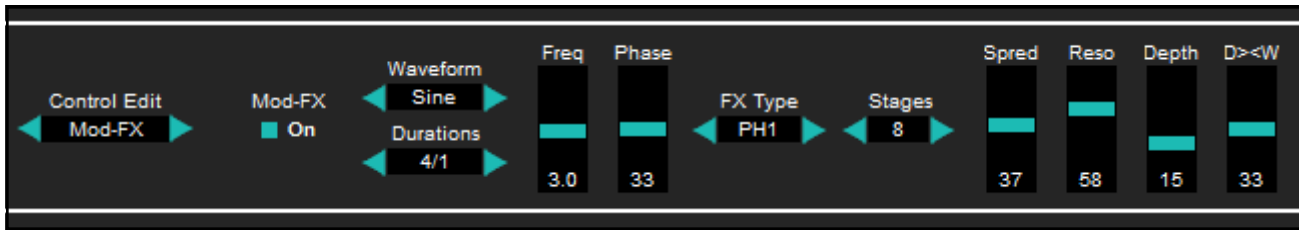
Select the waveform for the LFO using the **Waveform** selector. Options are **Sine**, **Tri**, **Peak**, **Dip**, **Hump** and **Noise**, each of which imparts a unique modulation character to the selected **FX-Type**.

Select the musical duration period for the selected LFO waveform using the **Durations** selector. The first option available in the list of choices is **Hertz**, and when this is selected, the rate of the LFO is set manually using the **LFO Freq** slider within a range of **.001-10 Hz**. When any of the other musical duration options are selected, the LFO operates in a mode in which it is synced to the host DAW tempo.

Use the **Phase** slider to change the phase relationships of the four internal LFOs that are used to modulate each **Stage** of the selected effect. Changing these phase relationships creates a corresponding change to the sonic character of the modulation, as well as the overall timbre of the oscillator signal.

Use the **Stages** selector to specify the number of available stages that will be modulated by the LFO. Chorus has from 1 to 4 Stages. Set the delay time in milliseconds using the **Time** slider. The **Time** range is from 0 to 100 ms. Set the feedback level using the **Feedback** slider. The feedback range is from **-100 to 100** and the extremes of high and low feedback settings will produce a sound that is more characteristic of **Flanging**, while lower, or no, feedback settings are typical of **Chorus**. Set the depth at which the LFO will modulate the selected effect using the **Depth** slider. This is an important setting for creating a useful blend and fusion between the dry oscillator signal and the wet processed one. Balance the levels between the dry oscillator signal and the processed effect signal using the **D><W** slider. At a setting of 50 there is an equal mix of dry signal with the effect, at 0 all Dry, at 100 all Effect. This is also a critical setting for creating a musically useful blend between the dry and effects signals.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The **Mod-FX** page of **Control Edit** in the **Performance Control** section.
In the above image the **Phaser 1** FX Type is selected for the current patch.

PERFORMANCE CONTROL • Control Edit • Mod-FX • Phaser 1

PH1 • Phaser 1

When the **FX Type** is set to **PH1**, the **Phaser 1** effect is activated, and its unique controls for **Stages**, **Spread** and **Resonance** (Resonance) are visible.

As before mentioned, **Phaser** (or Phase Shifting) is also an LFO modulated effect that is typically created with multiple phase-shifted allpass filters. The input signal is mixed with the filter modulated signal which creates notched frequency effects as they are slowly swept across a wide frequency range. The effect can create sounds that can remind of pulse-width modulation on an analog synthesizer, or perhaps parallel filter modulation effects, although it is a unique effect unto itself. Phase Shifting effects typically work best on sustained bright timbres with lots of upper partials.

The **Phaser 1** effect in this VSTi is based on LFO modulated allpass filters and can have from 1 up to 32 stages.

Activate or deactivate the Modulation Effect using the **Mod-FX On-Off** button.

Select the waveform for the LFO using the **Waveform** selector. Options are **Sine**, **Tri**, **Peak**, **Dip**, **Hump** and **Noise**, each of which imparts a unique modulation character to the selected **FX-Type**.

Select the musical duration period for the selected LFO waveform using the **Durations** selector. The first option available in the list of choices is **Hertz**, and when this is selected, the rate of the LFO is set manually using the **LFO Freq** slider within a range of **.001-10 Hz**. When any of the other musical duration options are selected, the LFO operates in a mode in which it is synced to the host DAW tempo.

Use the **Phase** slider to change the phase relationships of the four internal LFOs that are used to modulate each **Stage** of the selected effect. Changing these phase relationships creates a corresponding change to the sonic character of the modulation, as well as the overall timbre of the oscillator signal.

Use the **Stages** selector to specify the number of available stages that will be modulated by the LFO. **Phaser 1** has from **1 to 32 Stages**.

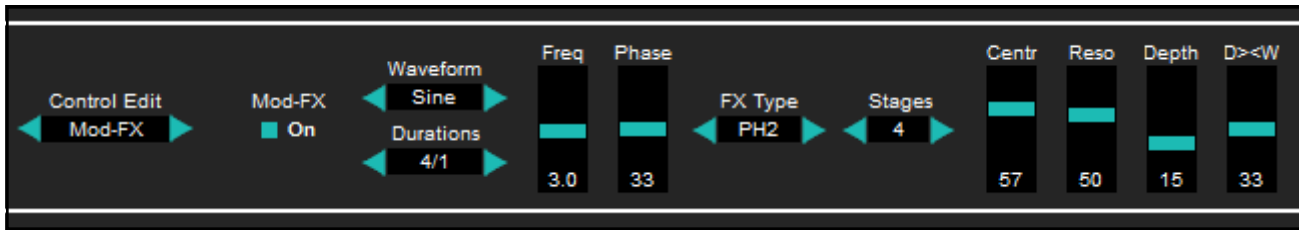
Set the spacing between the **Phaser Stages** using the **Spread** slider.

Set the resonance level using the **Reso** slider.

Set the depth at which the LFO will modulate the selected effect using the **Depth** slider. This is an important setting for creating a useful blend and fusion between the dry oscillator signal and the wet processed one.

Balance the levels between the dry oscillator signal and the processed effect signal using the **D><W** slider. At a setting of 50 there is an equal mix of dry signal with the effect, at 0 all Dry, at 100 all Effect. This is also a critical setting for creating a musically useful blend between the dry and effects signals.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Mod-FX page of Control Edit in the Performance Control section.
In the above image the Phaser 2 FX Type is selected for the current patch.

PERFORMANCE CONTROL • Control Edit • Mod-FX • Phaser 2

PH2 • Phaser 2

When the **FX Type** is set to **PH2**, the **Phaser 2** effect is activated, and its unique controls for **Stages**, **Center** and **Reson** (Resonance) are visible.

As before mentioned, **Phaser** (or Phase Shifting) is also an LFO modulated effect that is typically created with multiple phase-shifted allpass filters, however, the unique character of the **Phaser 2** effect is based on the use of LFO modulated state variable filters and can have from 1 up to 4 stages.

The input signal is mixed with the filter modulated signal which creates notched frequency effects as they are slowly swept across a wide frequency range. The effect can create sounds that can remind of pulse-width modulation on an analog synthesizer, or perhaps parallel filter modulation effects, although it is a unique effect unto itself. Phase Shifting effects typically work best on sustained bright timbres with lots of upper partials.

Activate or deactivate the Modulation Effect using the **Mod-FX On-Off** button.

Select the waveform for the LFO using the **Waveform** selector. Options are **Sine**, **Tri**, **Peak**, **Dip**, **Hump** and **Noise**, each of which imparts a unique modulation character to the selected **FX-Type**.

Select the musical duration period for the selected LFO waveform using the **Durations** selector. The first option available in the list of choices is **Hertz**, and when this is selected, the rate of the LFO is set manually using the **LFO Freq** slider within a range of **.001-10 Hz**. When any of the other musical duration options are selected, the LFO operates in a mode in which it is synced to the host DAW tempo.

Use the **Phase** slider to change the phase relationships of the four internal LFOs that are used to modulate each **Stage** of the selected effect. Changing these phase relationships creates a corresponding change to the sonic character of the modulation, as well as the overall timbre of the oscillator signal.

Use the **Stages** selector to specify the number of available stages that will be modulated by the LFO. **Phaser 2** has from **1 to 4 Stages**.

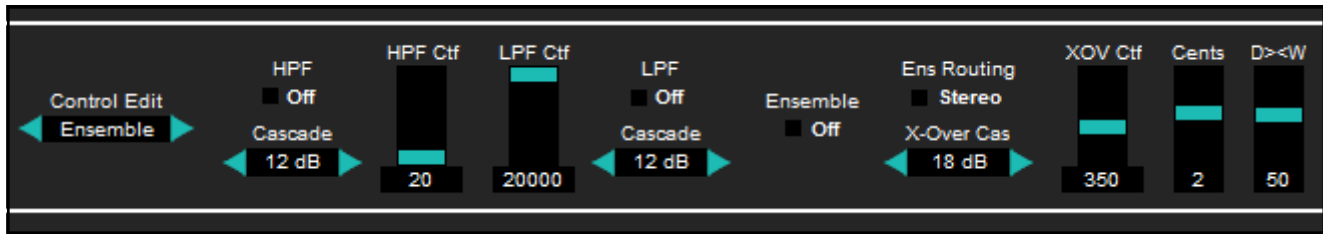
Set the center around which the LFO will modulate the filters using the **Center** slider, which is useful for dialing in the sweet spot of the effect.

Set the resonance level using the **Reso** slider. Higher values can produce a deeper notched and ringing effect.

Set the depth at which the LFO will modulate the selected effect using the **Depth** slider. This is an important setting for creating a useful blend and fusion between the dry oscillator signal and the wet processed one.

Balance the levels between the dry oscillator signal and the processed effect signal using the **D><W** slider. At a setting of 50 there is an equal mix of dry signal with the effect, at 0 all Dry, at 100 all Effect. This is also a critical setting for creating a musically useful blend between the dry and effects signals.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Ensemble page of Control Edit options in the Performance Control section.

PERFORMANCE CONTROL • Control Edit • Ensemble

The **Ensemble** page of the **Control Edit** options features a tone-control filter stage with a High-Pass Filter (**HPF**) and Low-Pass Filter (**LPF**) cascade that precedes the **Ensemble** effect.

The **High-Pass Filter (HPF)** can be used for filtering lower frequency content in the signal. Activate or deactivate the **HPF** using its **On/Off** selector. Configure the filter contour with the **Cascade** selector. The range is from 6 dB to 48 dB per octave. Set the cutoff frequency of the **HPF** using the **HPF Ctf** slider. The range of the frequency slider is from 20 Hz to 20 kHz.

The **Low-Pass Filter (LPF)** can be used for filtering high frequency content in the signal and is placed in series following the **HPF**. Activate or deactivate the **LPF** using its **On/Off** selector. Configure the filter contour with the **Cascade** selector. The range is from 6 dB to 48 dB per octave. Set the cutoff frequency of the **LPF** using the **LPF Ctf** slider. The range of the frequency slider is from 20 Hz to 20 kHz.

Activate or deactivate the **Ensemble** effect using the selector. This is a four-voice ensemble detuning effect that can be used to make waveforms more rich sounding by playing copies of the sound at different closely spaced intervals.

Choose to place the four voices of the **Ensemble** effect in either a stereo arrangement, or otherwise collapse all of them to mono using the **Ens Routing** options.

The **Ensemble** effect has a **crossover filter** that passes frequencies in the synthesizer signal above the filter cutoff which are then processed by the four-voice stereo (or mono) Ensemble effect, while frequencies beneath the cutoff frequency are not processed and are in heard mono.

Set the filter response of the crossover filter using the **X-Over Filter** selectors. The options are:

6 dB - 6 dB per octave Low-Pass and High Pass filters.

12 dB - 12 dB per octave Low-Pass and High Pass filters.

18 dB - 18 dB per octave Low-Pass and High Pass filters.

24 dB - 24 dB per octave Low-Pass and High Pass filters.

Bypass - In the Bypass mode, the crossover filter is disabled and the full frequency range of the synthesizer signal is processed by the Ensemble effect.

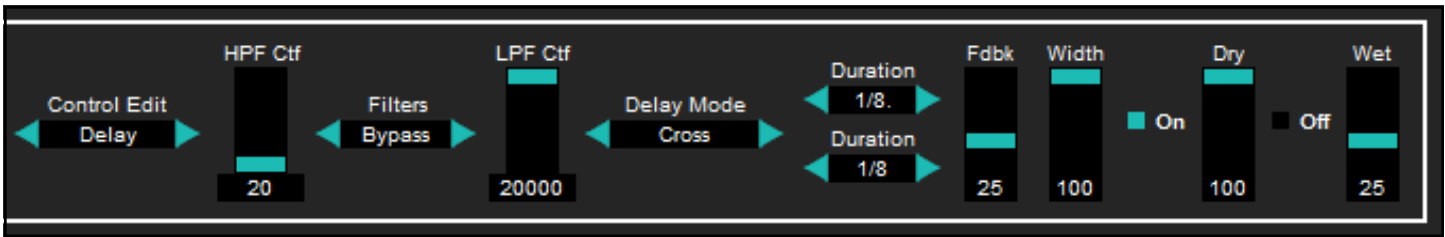
Set the **cutoff crossover frequency** in Hz of the **X-Over Filter** using the **Cutoff** slider. This can radically transform and shape the sound of the synthesizer in quite musically useful ways.

Set the depth of detuning of the **Ensemble** effect using the **Cents Dt** slider. The maximum range is -/+ 55 cents.

Set the **dry-to-wet balance** of the **Ensemble** effect using the **D><W** slider. Values below 50 have less of the effect, while greater than 50 makes the effect more pronounced. It is often a good idea to allow some of the dry signal to pass through by keeping the slider in the middle range, as the dry synth sound is also a 'voice' in the effect.

Special Note: Xen-Arts cares about protecting musician's audio gear and has added to the Ensemble section of this VSTi a steep low-cut filter. This hidden filter attenuates extremely low frequencies that are typically beneath the reproducible range of most consumer monitors and headphones.

IVOR2 • PERFORMANCE CONTROL • CONTROL EDIT PAGES



The Delay page of Control Edit options in the Performance Control section.

PERFORMANCE CONTROL • Control Edit • Delay

The **Delay** page of the **Control Edit** options features a tone-control filter stage with a High-Pass Filter (**HPF**) and Low-Pass Filter (**LPF**) cascade that precedes the stereo **Delay** effect.

Activate or deactivate the tone-control filters, or configure the filter contour with the **Filters** selector. Options include **Bypass** (tone-control filters for the Delay section are disabled), or filter cascade ranges from 6 dB to 24 dB per octave.

The **High-Pass Filter (HPF)** can be used for filtering lower frequency content in the signal. Set the cut-off frequency of the **HPF** using the **HPF Ctf** slider. The range of the frequency slider is from 20 Hz to 20 kHz.

The **Low-Pass Filter (LPF)** can be used for filtering high frequency content in the signal and is placed in series following the **HPF**. Set the cutoff frequency of the **LPF** using the **LPF Ctf** slider. The range of the frequency slider is from 20 Hz to 20 kHz.

Use the **Delay Mode** selector to specify the type of delay. Options are **Normal** (independent left and right delay channels) and **Cross** (cross-feedback: the first echo is swapped over L>R, R>L).

Specify the host-synced delay durations using the two **Duration** selectors. The range of musical durations is from 1/128 to 128/1, including dotted, triplet, quintuplet and septuplet values.

Set the level of feedback using the **Fdbk** slider. Adjust the stereo delay width using the **Width** slider.

Activate the **Dry** and **Wet** levels using their respective **On/Off** selectors. Set the relative **Dry** and **Wet** volume levels using the respective sliders.

IVOR2 • MIDI AUTOMATION

A large number of automation targets for this instrument are exposed to the host DAW - with logically labeled naming conventions - making it easy and intuitive to map automation controls to the synthesizer parameters. After reading through this manual it should be easily apparent what sections and parameters the exposed automation targets control.

IVOR2 • CONTENT

FACTORY PATCHES • MICROTUNINGS & PARTIALS LIBRARY

Included with this instrument is the following content:

- **118 Factory Patches by Xen-Arts and Sevish**
- **148 MTS Microtunings**
- **91 Partial Text Files for Audio-Rate Oscillator Modulation**
- **Instruction Manual**

Within the installation folder for this VSTi, one will find the below TXT file:

Xen-Arts VSTi Microtuning & Partial Library Documentation.txt

This documentation contains information about all of the microtunings and partials file content in a single, concise and easy to read format. Categories of microtunings include:

Equal Temperaments

Bohlen-Pierce

ED2: Equal divisions of harmonic 2

ED3: Equal divisions of harmonic 3

ED4: Equal divisions of harmonic 4

Just Intonation

HD2: Harmonic divisions of 2

HD3: Harmonic divisions of 3

HD4: Harmonic divisions of 4

SD2: Subharmonic divisions of 2

SD3: Subharmonic divisions of 3

SD4: Subharmonic divisions of 4

Non-Octave

Wendy Carlos - Alpha (78.0 Cents)

Wendy Carlos - Beta (63.8 Cents)

Wendy Carlos - Gamma (35.1 Cents)

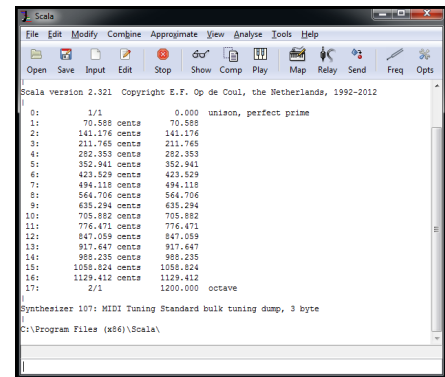
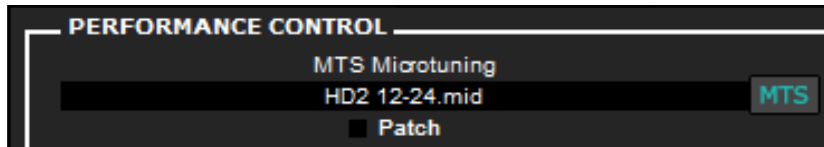
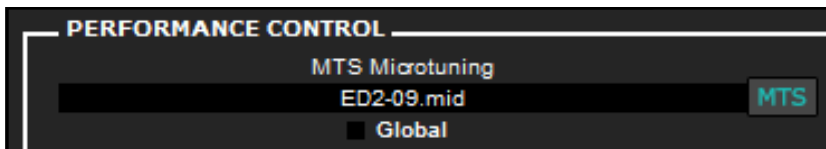
There is also a TXT file list of the factory patch bank included:

IVOR2 Patch List.txt

The factory bank has been saved in its entirety within the plugin content folder:

IVOR2 Factory Bank.fxb

IVOR2 • MICROTUNINGS • SCALA: CREATING MTS MICROTUNING FILES



Create MTS microtuning files for this VSTi with the popular Scala microtuning software application developed by Manuel Op de Coul.

MTS is the **MIDI Tuning Standard**, which is a kind of MIDI System Exclusive (SYSEX) that is able to do full keyboard microtunings in the same way that the popular TUN format can, although there are distinct advantages over these kinds of fixed tuning-table formats, such as the ability to retune ensembles of MTS-enabled VSTi from a single track in a DAW by transmitting the MTS to a number of VSTi instrument tracks simultaneously.

MTS files can be created in **Scala** in the same way that TUN files are, with the variation of setting the synth type to a different number (107).

MTS is really just a MIDI file, with a file extension of MID, and this kind of file is basically 'played' into, or transmitted, to the synth. In this VSTi, the transmission of the MTS file can be done internally using the MTS file open dialogs, or it can receive MTS externally by playing it from a track in your DAW and routing the MIDI to the VSTi track.

To create MTS files in Scala:

1. Open Scala.
2. Using the menus File/New/Scale or Ctrl+N, open the Input Current Scale dialog to create a new scale. Paste or type your tuning values into the Pitches field and click OK. Obviously, there are a number of ways to create tunings, such as opening SCL files from the Scala archive, or using the other File/New options.
3. To see your scale, type Show then press Enter, or press the Show button on the toolbar, or even press F6 on your keyboard.
4. To set Scala to create the MTS (Synthesizer 107: MIDI Tuning Standard bulk tuning dump, 3 byte), type 'set synth 107' into the command line at the bottom of the program and press Enter. Alternatively, click the Opts button on the toolbar to display the User Options dialog. Click the Synth button on the left to switch the dialog to the Synth options. Under Synthesizer Tuning Options, choose Tuning Model: "107: MIDI Tuning Standard bulk tuning dump."
5. On the File menu choose Export Synth Tuning, or press Shift+Ctrl+T, to open the export dialog (Curiously, this dialog is titled Select MIDI File To Save).
6. Use the Places navigation pane on the left to navigate to a directory where you wish to save your MTS file. Type a file name at the bottom with the file extension MID, such as '5-tet.mid'. Press OK.

Now you have saved an MTS file that can be opened by this VSTi.

Scala: <http://www.huygens-fokker.org/scala/>

Please note that the microtunings included with this VSTi have the 1/1 mapped to C.60 @ 261.625565 Hz.

IVOR2 • Notes & Tips

Polyphony in this VSTi

It is useful to understand how polyphonic voices are generated and processed in this VSTi in order to design patches that fit with a given musical context.

MIDI Input coming from a **MIDI Controller** is routed to an internal **MIDI-to-CV**. When multiple notes are played on the controller, new voices are cloned in the instrument, each of which can make up the held notes of chords. This instrument is **12-Note Polyphonic**, which means that up to 12 simultaneous voices may be sounded before the internal voice allocation system begins to silence the first held voices in round-robin order.

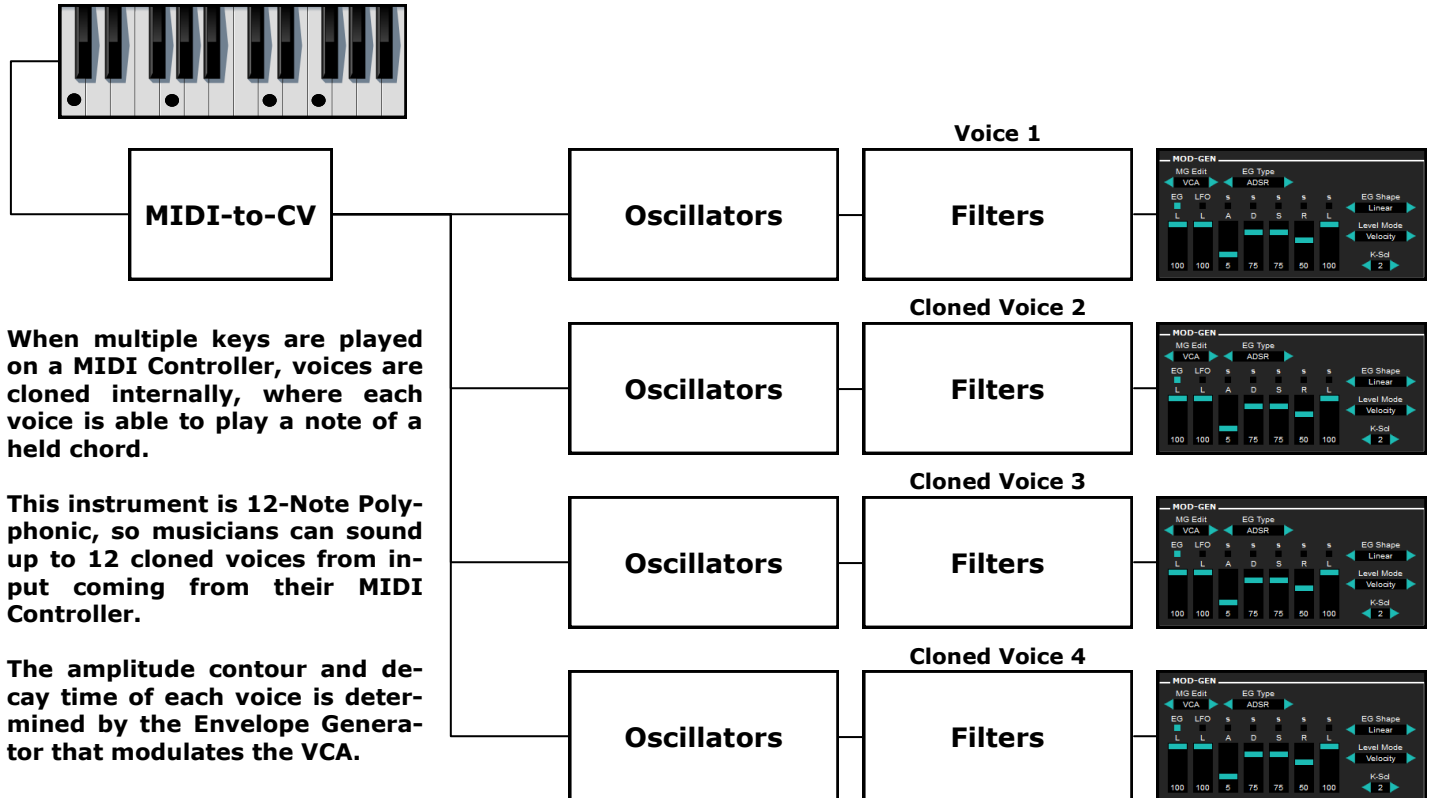
Important Concepts Regarding Polyphonic Voices In This VSTi:

The decay time and overall volume contour of these cloned voices are determined by the modulation source that controls the **VCA**, such as an **ADSR** or **Graphic Envelope Generator**.

The **VCA** is the final amplification stage of the synthesizer. Following **MIDI Note-Off** messages coming from the **MIDI Controller**, which occur when keys held down on controller are released, the **VCA Envelope Generator Release Stage** will fade to zero, and it is at this point that sounding synthesizer voices are suspended. When synthesizer voices are suspended, they are effectively silenced and use no further CPU.

It is advisable to set **Envelope Generator Release Times** according to the musical context at hand. For example, shorter release times for dense and rapidly performed polyphonic passages, while longer release times may be used for sustaining timbres playing more slow musical parts, such as in the case of pads.

With this practice in mind, it becomes possible to tailor envelope-generator times to the musical performance gestures, and thereby avoid scenarios where the maximum number of voices is exceeded, which causes the internal voice allocation system to begin silencing voices.



A visualization of cloned synthesizer voices, generated from a four-note chord played on an external MIDI Controller.

More information about Polyphony in this VSTi continues on the following page.

IVOR2 • Notes & Tips

Polyphony in this VSTi (continued from the previous page):

As mentioned on the previous page, the decay time and overall volume contour of the synthesizer voices are determined by the amplitude modulation-source that controls the **VCA**, such as an **ADSR** or **Graphic Envelope Generator**. Following **MIDI Note-Off** messages coming from the **MIDI Controller**, which occur when keys held down on controller are released, the **VCA Envelope Generator Release Stage** will fade to zero, and it is at this point that sounding synthesizer voices are suspended.

Critical to grasping the behavior of synthesizer voices in this instrument is understanding how different **Envelope Generator** types can modulate the amplitude of the **VCA**, and thereby suspend polyphonic voices under a huge variety of musical performance conditions:

ADSR Envelope Generator Modulating the VCA

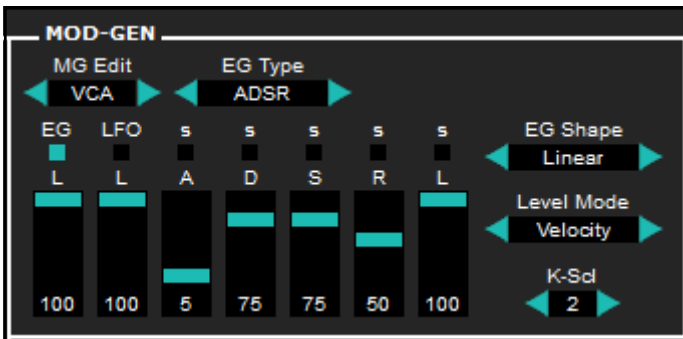
The **Release Stage** of an **ADSR Envelope Generator** has a maximum time of about 10 seconds. When the **Release Stage** of the **ADSR** fades to zero, sounding synthesizer voices are suspended.

Graphic Envelope Generator Modulating the VCA

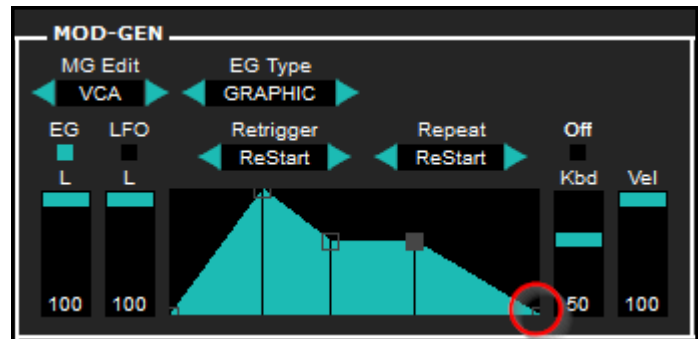
In contrast, a **Graphic Envelope Generator** offers a far wider range of amplitude modulation options, from extremely short percussive envelopes, to **infinite sustain**. When the final **Release Stage Node** of the **Graphic Envelope Generator** is set to **zero** (the lowest possible setting), **voices in the synthesizer are suspended when the control signal generated by the envelope reaches the zero value at its terminating Release Stage Node**.

However, when the final **Release Stage Node** of the **Graphic Envelope Generator** is set to a value that is **greater than zero**, **voices will sustain infinitely**, which is an option for sound-designers wishing to create drone-based patches that will infinitely sustain after **MIDI Notes** are played from the **MIDI Controller**. **In such sound-design scenarios, it is critical to understand that infinitely sustaining patches which feature a VCA Graphic EG with its final Release Stage Node set to a value greater than zero, can only be silenced by switching to another patch or to the ADSR EG type.**

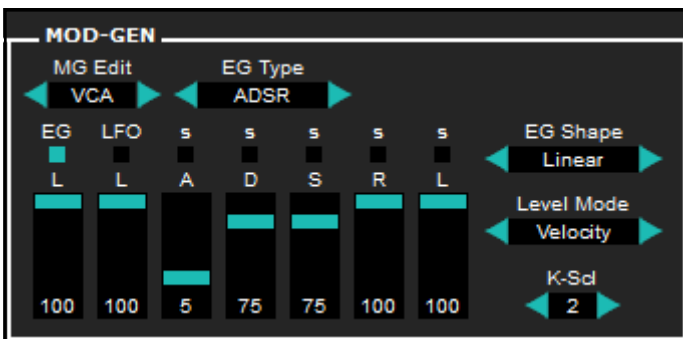
Generally speaking, for patches intended to be used for **melody** and **harmony** performance, it is best to have the final node of the **Graphic EG** set to zero (its lowest value), so that the amplitude contour of the timbre fades out and suspends the voices like a typical musical instrument following **MIDI Note-Off** messages.



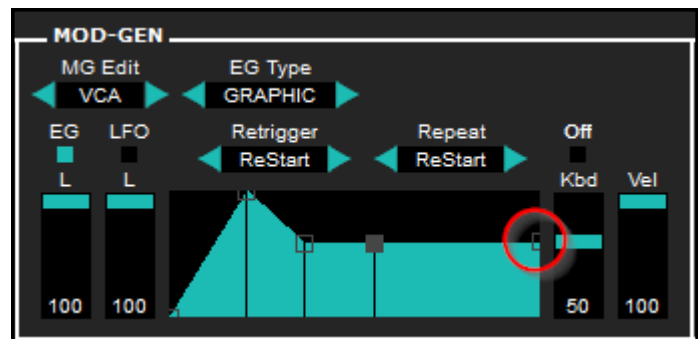
Release time is approximately 5 seconds when configured as above, after which voices are suspended.



The synthesizer voices are suspended when the Graphic EG reaches the final Release Stage Node with a zero value following MIDI Note-Off messages.



Release time is approximately 10 seconds when configured as above, after which voices are suspended.



Synthesizer voices will sustain infinitely when the VCA Graphic EG Release Stage Node is set to a value greater than zero, as pictured above.

IVOR2 • Notes & Tips

Bass and Distortion Timbres

IVOR2 was originally conceived as a bass and distortion synthesizer capable of creating deep basses and heavy distorted guitar-like timbres. The key features that are involved in creating these kinds of distortion patches are the Pitch Envelope Generator and Phase and Pulse Width Modulation LFO found in the Oscillator Modulation section, as well as the Saturation stage found in the Filters section. Emulation of guitar-like sounds relies heavily on being able to synthesize the plucked attack and the PEG with its many control Shapes makes this possible. The Analog Pitch Drift feature also contributes to this kind of sound by emulating the random micro-fluctuations of pitch observable in many analog, acoustic and electro-acoustic musical instruments.

Polyrhythmic LFO

Using the Low Frequency Oscillators found in the MOD-GEN sections, makes it possible to create myriad kinds of polyrhythmic transformations to the timbre of the instrument. Setting each LFO to different durations is capable of creating incredibly complex and sonically alluring rhythmic timbral effects that can be synced to the musician's host DAW.

Microtunings

In designing the patch bank for this synth no attempt has been made to assign specific microtunings to all patches. The choice of what microtunings to use - or whether to use them at all - is left entirely to musician's and composer's choice.

It was not the design goal for this synthesizer to try to feature a comprehensive selection of microtunings and only a very basic set are included as factory defaults, and these should be regarded as starting points for further investigation. In this case too, the creation and exploration of custom microtunings is left to the discretion of musicians. Microtonal and xenharmonic music - and musical instrument intonation in general - is a vast topic and a field in which one should anticipate working with lots of different intonations and spending a significant number of years to understand and master the use of alternative intonation systems in one's music.

Microtonal Pitch Bends

One of the powerful features of this synthesizer is the ability for musicians and composers to precisely specify the pitch-bend range in cents. While there are many possible applications for this functionality, one use for this is to configure a pitch bend range that lies directly between a single step of an equal temperament.

For example, in the case of 8 tone equal temperament, we know that the tuning is made up of equal step sizes of 150 cents. To set a pitch bend range at 1/2 of this step size, we can type in 75 cents into the pitch bend cents field, and with the Bend Selector in the Cents mode, when we bend the pitch wheel of the MIDI controller we are able to precisely play pitches that lie between the steps of 8-TET, which, are in fact, notes found in the next highest multiple of this temperament: 16-TET. So in effect we are able to move the pitch wheel to precisely play notes from a higher multiple of a given equal-temperament, and with this same kind of logic, we can examine any microtuning to determine what would be other musically useful settings for expressive microtonal pitch-bends that are contextual to a given intonational setting.

MIDI CC Modulation of Harmonics

Musicians and composers who are familiar with playing acoustic instruments such as winds and strings will appreciate the expressive ability to sound harmonics of the fundamental pitch by over-blowing or plucking at harmonic nodes. The IVOR2 VSTi has a completely unique feature that enables direct modulation of the harmonic (and subharmonic) series using MIDI Velocity, where, when activated, increased force on the controller can be used to break out higher harmonics, which are in effect, integer multiples of the fundamental frequency of the sounding waveform. As previously explained in the MOD-GEN section of this manual, the range options are from 1-2, 1-4, 1-8 and 1-16 harmonics. The interaction between the sensitivity setting and the range of harmonics can be easily configured by musicians to fit with the requirements of a particular musical or performance scenario.

IVOR2 • Notes and Tips

Microtonal Oscillator Transposition

In addition to the microtonal pitch bend functions, this VSTi also features the ability to precisely configure transposition offsets of the oscillators in terms of cents, which enables musicians to directly specify any arbitrary transposition values as required by particular musical and intonation settings. The range is a maximum of 4800 cents, or four octaves.

While most synthesizers and samplers force musicians to use octaves, semitone steps of 12 tone equal temperament and cents, the IVOR2 VSTi enables musicians to easily make oscillator transposition settings that fit with any intonational context required by the music at hand. This is especially useful for musical composition scenarios in which the intonation system does not repeat at an exact interval of 2/1 @ 1200 cents, and there are many beautiful microtunings of this nature, such as Bohlen-Pierce, and the wonderful Wendy Carlos, Alpha, Beta and Gamma, all of which are included as default microtunings in this instrument.

Oscillators A and B feature versatile transposition controls enabling musicians to directly specify precise pitch offsets as required by particular musical settings.

Cents – Enables musicians to type in any desired offset value into the provided **Cents** field, then using the **- Shift +** selector, transpose the oscillators between -16 to 16 times the specified value. For instance, typing 1200 cents into the Cents field and shifting -1, will lower the pitch of the oscillator 1 octave. Conversely, shifting to 1 will raise the pitch of the oscillator 1 octave.

This unique transposition feature enables microtonal musicians and composers to transpose the pitch of the instrument to any interval required, and can be very useful where the period (or repeat-ratio) of the microtuning may be something other than the typical 2/1 of 1200 cents, such as in a scenario where one is composing with non-octave tunings and might need to transpose the instrument to a non-octave period.

The flexibility of the **Cents** transposition mode becomes more apparent when working with intonation systems which do not repeat at an interval of an octave (2/1 @ 1200 cents), such as the above mentioned **Bohlen-Pierce** microtuning, which instead has a repeat value of 3/1 @ 1901.955 cents. To transpose the VSTi by the period of the Bohlen-Pierce temperament, type or paste **1901.955** into the Cents field. The Bohlen-Pierce temperament MTS Microtuning File and Partial Files are included with this instrument for musicians to explore this fascinating non-octave microtuning.

Worth mentioning as well are three other rather famous microtonal tunings discovered by Wendy Carlos which feature both narrow and wide 'pseudo-octaves':

Alpha (78.00 Cents Equal Temperament)

Degree 15, Lower Pseudo-Octave: 1170.00 cents

Degree 16, Upper Pseudo-Octave: 1248.00 cents

Beta (63.80 Cents Equal Temperament)

Degree 19, Lower Pseudo-Octave: 1148.40 cents

Degree 20, Upper Pseudo-Octave: 1212.20 cents

Gamma (35.10 Cents Equal Temperament)

Degree 34, Lower Pseudo-Octave: 1193.40 cents

Degree 35, Upper Pseudo-Octave: 1228.50 cents

These pseudo-octaves, or any other interval offsets can easily be achieved with the IVOR2 cents transposition features.

Xen-Articles • Microtuning Virtual Instruments

A series of potentially helpful articles about microtuning virtual instruments is available on the Xen-Arts web:

xen-arts.net/xen-articles

IVOR2 • ACKNOWLEDGEMENTS

The release of the **IVOR2 VSTi** has been an effort involving a number of creative musicians, composers and programmers from around the world:

Concept, construction, GUI, and this user manual, by **Jacky Ligon • Xen-Arts • xen-arts.net**

The 118 patches included in the **IVOR2** factory patch bank were a collaborative effort programmed by **Xen-Arts** and **Sevish**.

Very special thanks goes out to all of the musicians, composers, educators and researchers involved in our beta-testing, documentation and sound-design group, who by volunteering their time and invaluable insights into matters related to microtuning, sound-synthesis, microtonal and xenharmonic music composition, have made this a far better instrument.

Beta-testing, documentation and sound-design:
Sean Archibald • Sevish • sevish.com

Beta-testing and documentation:
Brian Ginsburg • brianginsburg.com
Tony Dubshot • dubbhism.org
Justin Curfman • feedingfingers.net
Warren Burt • warrenburt.com
Hardy Slicer • soundcloud.com/hardyslicer

This instrument was created in the **SynthEdit** environment from developer **Jeff McClintock**. The highest possible level of gratitude goes out to Jeff for implementing **MTS (MIDI Tuning Standard)** in SynthEdit; the ultimate microtonal tuning format.

Jeff McClintock • SynthEdit • synthedit.com

This instrument features 3rd party SynthEdit modules developed by **Chris Kerry, David Haupt** and **EVM**.

Design consultant, microtonal software developer: **X. J. Scott • Microtonal Software • microtonalsoftware.com**

The **MTS** microtunings included with this synthesizer were created using the **Scala** application developed by **Manuel Op de Coul**. Many thanks goes out to Manuel for his decades long support of microtonal musicians and composers and for offering his application as freeware.

Manuel Op de Coul • Scala • huygens-fokker.org/scala

Enormous inspiration for this instrument was derived from the work of **John Chowning** and **William Sethares**.

John Chowning • ccrma.stanford.edu/people/john-chowning

William Sethares • Relating Tuning and Timbre • sethares.engr.wisc.edu/consemi.html

Harmonics consultants: **Kraig Grady** and **John Chalmers**

Thanks goes out also to the many helpful members of the **SynthEdit** Users group for helping to make this instrument a reality.

This VSTi is a gift to musicians and composers who are interested in exploring the vast expressive possibilities of alternative intonation systems in their music.

This instrument is dedicated to the memory of **Ivor Darreg**.

End User License Agreement

By downloading, installing and using this software, you understand and agree to the following:

This instrument is offered as freeware as a way to inspire musicians and composers to experiment with software synthesis techniques and alternative musical instrument intonation systems (microtonal and xenharmonic music).

The instrument can be used in any kind of musical production, commercial or otherwise, completely free of charge.

Selling this VSTi is not permitted.

Distributing this VSTi in any manner without prior permission is not permitted.

Xen-Arts assumes no responsibility for any kind of damages resulting from the use of this software.

The exploration of alternative intonation systems, xenharmonic and microtonal music is largely about a quest for aesthetic beauty and expression, and one might hope that through simple acts of gifting, such as the gifting of this software to musicians, composers and researchers completely free-of-charge, that it might inspire others to do the same.

If you make microtonal or xenharmonic music with this VSTi, consider sharing your work with other people, including the developer, who would greatly appreciate getting to hear any music created with this instrument.

Music is an expression and celebration of life, in which the creative cycle is completed when it is shared with others.