

# Octave Shifter 2 Audio Unit

## User Manual

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# Preface

## About this manual

You are reading the Octave Shifter 2 Audio Unit user manual, which covers installation and usage of the Octave Shifter 2 software effect. After reading this manual you will be able to use the software in a variety of Audio Unit hosts and know the purpose of each of the Audio Unit's processing parameters.

To obtain the latest revision of the Octave Shifter 2 user manual, please visit the Audiowish website at <http://www.audiowish.com>. You will find an up-to-date version of the manual in PDF format ready for download.

The manual you are reading now was last modified on October 3, 2007. For a brief overview of revisions, consult the "[Revision History](#)" section of this manual.

## About Audiowish

Audiowish is a young software company dedicated to developing high quality Audio Unit sound effects. Thanks to our enthusiasm and continued interest in providing robust tools for musicians, producers and sound engineers we're able to offer exciting products at very low prices.

Audiowish started in 2006 under the Forever For Now umbrella and became a dedicated effort in the third quarter of 2007.

For the latest news and software updates, visit the Audiowish website at <http://www.audiowish.com>.

# Octave Shifter 2 Audio Unit

## Introduction

Octave Shifter 2 is a real-time<sup>1</sup> pitch shifting effect for Apple's Audio Unit architecture.

By leveraging existing technologies like CoreAudio, AltiVec and SSE<sup>2</sup>, Octave Shifter 2 offers a unique audio experience. Key features of the Audio Unit include:

- real-time, low latency processing for live performances
- high precision post-processing for studio quality results
- four full octaves of pitch adjustment
- continuous pitch change, enables automation of pitch parameter

Additionally, Octave Shifter 2 makes use of the industry standard generic Cocoa and Carbon graphical interface views for Audio Units offering a seamless integration into host applications like Logic (Pro), Garageband and AU Lab.

## System requirements

To use the Octave Shifter 2 Audio Unit, you will need at least the following configuration:

- Apple Macintosh computer with a PowerPC G4 or G5 or Intel processor<sup>3</sup>
- Mac OS X Tiger (10.4) or higher<sup>4</sup>
- 5 Mb of free disk space<sup>5</sup>
- Audio Unit version 2 host software

Almost all existing Apple G5 and Intel computers will conform to these requirements and should have no problems running the Octave Shifter 2 Audio Unit.

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<sup>1</sup> In this manual *real-time* refers to internal processing latencies lower than 2 milliseconds.

<sup>2</sup> AltiVec will only be used on PowerPC-based computers, SSE will only be used on Intel-based computers.

<sup>3</sup> Octave Shifter 2 is packaged as a Universal Binary – it performs equally well on PowerPC and Intel based computers.

<sup>4</sup> Although Octave Shifter 2 has not been extensively tested on Mac OS X Leopard (10.5) yet, initial user reports indicate no problems on the platform.

<sup>5</sup> Disk space requirement is estimated, actual required disk space may vary.

# Using Octave Shifter 2

## Installation

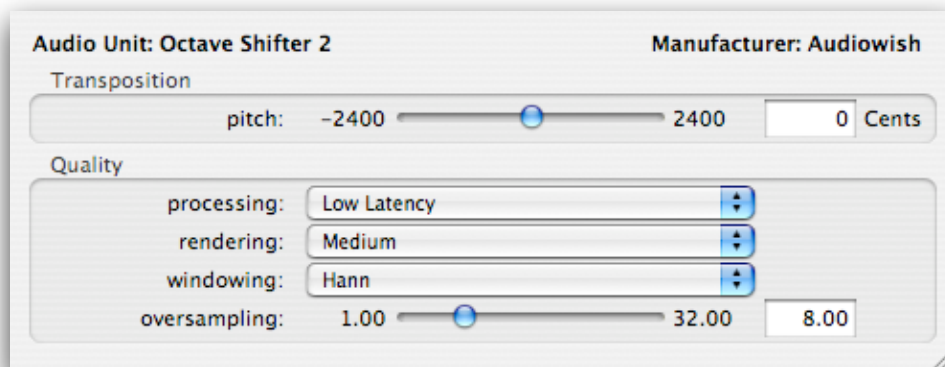
To install the Octave Shifter 2 Audio Unit on your computer, drag the “OctaveShifter.component” file from the disk image to the “Install (All users)” folder link in the disk image.

If you want to make sure you performed the installation correctly, refer to the “[Octave Shifter 2 does not show up in host software](#)” section in the troubleshooting chapter.

## Basic usage

Octave Shifter 2 is an Audio Unit effect, not a stand alone application. You will need an Audio Unit version 2 compliant host application<sup>6</sup> to be able to use Octave Shifter 2 in your effects chain. Please refer to your host software’s manual on how to add Audio Unit effects to your projects.

In this manual we’ll look at Octave Shifter 2 in Apple’s AU Lab host application, using the generic Cocoa interface, or *view*:



*Octave Shifter 2 generic Cocoa view in AU Lab.*

Like other Audio Units, you can adjust Octave Shifter 2’s processing settings by manipulating the on-screen parameters using your mouse or keyboard.

The main purpose of Octave Shifter 2 is to shift the pitch of an incoming audio signal. Now, try to move the “pitch” slider in the “Transposition” group while audio is being routed through Octave Shifter 2. Notice how the frequency of the sound is being adjusted in real-time.

Congratulations! By moving the “pitch” slider you have learned how to use Octave Shifter 2 for basic pitch shifting. Read the next chapters for advanced usage scenarios and parameters to get the most out of Octave Shifter 2.

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<sup>6</sup> Popular Audio Unit host applications are Logic (Pro), Garageband and AU Lab. You can find more Audio Unit host software on Apple’s Mac OS X Downloads page at <http://www.apple.com/downloads/macosx/>.

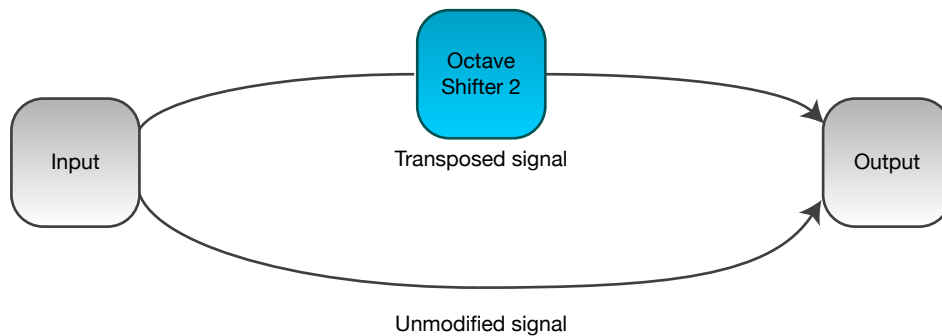
# Usage Examples

## Introduction

Octave Shifter 2 can be used for more than simple pitch shifting of an incoming audio signal. This chapter provides three examples in which Octave Shifter 2 is integrated into an audio effects chain. Be creative and explore the possibilities!

## Dubbing

Octave Shifter 2 can be used to add an extra, transposed layer to a solo or lick by adding it to a bus parallel to the input signal. This diagram shows how to set up your effects chain:

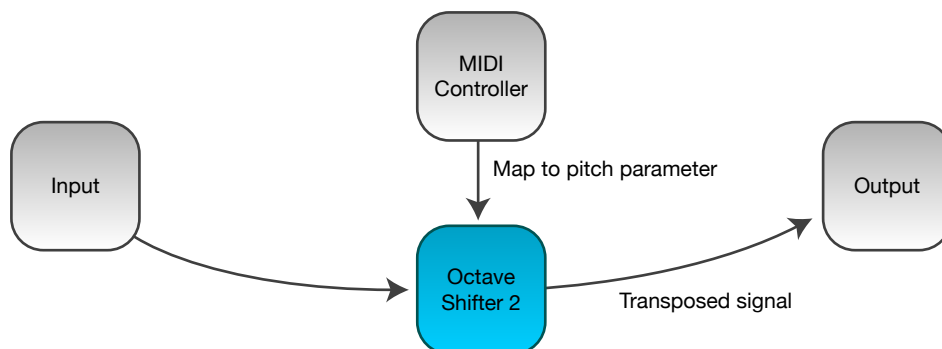


*Effects chain for dubbing with Octave Shifter 2.*

Set the Octave Shifter 2 pitch parameter to values like 700 or -500 to transpose the input signal to its perfect fifth, up seven semitones or down five semitones. Adjust the mix of both the unmodified and transposed signal to find a sound you like.

## Whammy<sup>7</sup>

A lot of great guitarists use an interactive pitch shifting effect when performing live. Octave Shifter 2 lets you recreate a Whammy sound by mapping a MIDI controller to its pitch parameter, like this:



*Effects chain for combining Octave Shifter 2 with a MIDI controller to recreate a Whammy.*

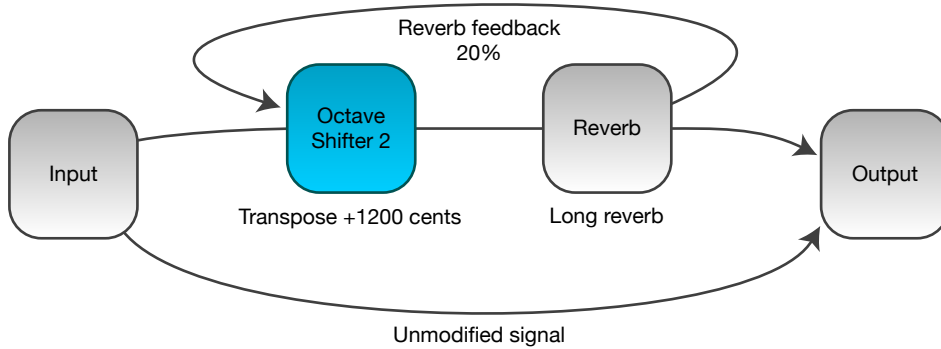
For example, map a MIDI expression pedal to a 0 ... 1200 pitch parameter range to be able to shift your instrument's sound up one octave by using the pedal.

<sup>7</sup> Whammy is a registered trademark of DigiTech, a Harman International company.

## Crystal harmonizer

Using Octave Shifter 2 you can simulate a high pitched shimmering synthesizer sound while playing chords or arpeggios on your instrument. You will need to add Octave Shifter 2 on a parallel bus feeding its signal into a reverb effect which feeds back its wet signal to Octave Shifter 2.

This diagram shows the effects chain for this set up:



*Effects chain for the crystal harmonizer using Octave Shifter 2.*

Now, when playing your instrument you will notice that the combination of Octave Shifter 2 and the reverb effect will add an extra voice to your performance which slowly tracks the chords of the song.

It may take some practice to get used to this set up, but the results are well worth it.

# Audio Unit Parameters

## Overview

Octave Shifter 2 offers the following parameters for controlling the audio processing. The following table lists individual parameters, their group, range, default value and unit of measurement. An elaborate description of each parameter is included below the table.

Group	Parameter	Range	Default	Unit
Transposition	Pitch	-2400 ... +2400	0	Cents
Quality	Processing	Low Latency or High Precision	Low Latency	
	Rendering	Minimum, Low, Medium, High and Maximum	Medium	
	Windowing	Blackman, Cosine, Hamming, Hann and Sine	Hann	
	Oversampling	1 ... 32	8	Times

## Transposition group

### Pitch

Controls the interval of the pitch shift relative to the original audio signal. The pitch shift is defined in cents, a logarithmic measure for musical intervals<sup>8</sup>. For regular musical performances in the 12 TET scale, semitones are 100 cents apart, adding up to 1200 for a full octave interval.

Octave Shifter 2 supports pitch shifts of minus two octaves (-2400 cents) to plus two octaves (+2400 cents) and everything in between. For example, if you wish to pitch shift an audio signal up five semitones, use a value of +500 cents.

## Quality group

### Processing

Choose between Octave Shifter 2's low latency or high precision processing modes. The low latency mode uses less than half of the processing load of the high precision mode, enabling you to explore very low latency responses during live performances or studio monitoring<sup>9</sup>.

For post-processing tracks in a studio recording where latency is not an issue, select the high precision mode for high fidelity results.

### Rendering

Controls the resolution of Octave Shifter 2's advanced audio analysis and synthesis steps. Choose one of the predefined quality settings ranging from Minimum to Maximum to find a balance between sound quality and processing load.

<sup>8</sup> See the Wikipedia entry on cents for detailed information, at [http://en.wikipedia.org/wiki/Cent\\_%28music%29](http://en.wikipedia.org/wiki/Cent_%28music%29).

<sup>9</sup> Low latency processing in Octave Shifter 2 can be combined with the Audio Unit host application settings to decrease overall latency even more. Refer to your host application's manual to explore this option.

Lower rendering qualities will decrease processing load (and thus – latency), but will also degrade the sound quality of the output signal. The **Medium** rendering quality offers a solid balance and it is advised not to change this parameter unless absolutely necessary.

*Technical note: the rendering quality parameter maps to the internal logarithmic size of the Fourier transformation. The quality to sample-count mapping is Minimum – 512, Low – 1024, Medium – 2048, High – 4096 and Maximum – 8192 samples.*

### Windowing

Controls the sound character of the pitch shifted sound<sup>10</sup>. Octave Shifter 2 offers five different windowing functions, each of which is suited for a variety of input signals. The default **Hann** windowing function is a solid choice for almost all input signals and offers a noise-free and serene output.

Use the **Blackman** windowing function to emphasize frequency peaks in the input signal. Both the **Cosine** and **Sine** functions offer a louder body in the sound, with a bit of a cold touch. The **Hamming** windowing function tends to emphasize higher frequencies.

The choice of a windowing function does not influence the processing load.

### Oversampling

Controls the overall quality of Octave Shifter 2's processing by smoothing out the synthesis step. Raising the oversampling will audibly boost the quality of the output signal at a significant increase of the processing load.

Use the oversampling parameter with caution as excessively high values will result in pops and clicks in the output signal. Values between 8 and 16 offer a good tradeoff between sound quality and processing load.

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<sup>10</sup> An analysis of windowing functions is available on Wikipedia, at [http://en.wikipedia.org/wiki/Window\\_Function](http://en.wikipedia.org/wiki/Window_Function).

# Troubleshooting

## Octave Shifter 2 does not show up in host software

If you did not follow the installation instructions in this manual, please read and follow the “[Installation](#)” section first.

Octave Shifter 2 not showing up in your Audio Unit compatible host software can have multiple causes. Please follow the following steps to make sure your computer is set up correctly:

- Verify that your host software supports version 2 Audio Units<sup>11</sup>
- Make sure that “OctaveShifter.component” is installed correctly by double clicking the “Install (All users)” link in the disk image and checking if it is listed there
- Use Apple’s “auval” tool<sup>12</sup> to verify the Audio Unit is working correctly, open up the Terminal application and copy and paste the following command:

```
auval -v aafx shft Awsh
```

Press the Enter key to execute this command. Please send the output of this command to [frank@audiowish.com](mailto:frank@audiowish.com) for further troubleshooting the problem.

## Audible pops and clicks

Pops and clicks are usually the results of one of three causes:

- Verify that the original, incoming audio signal does not contain pops or clicks – Octave Shifter 2 will only shift the pitch of the incoming signal and won’t correct imperfections
- Using Activity Monitor, verify your computer’s CPU usage for spikes or constant high load<sup>13</sup> – if the Audio Unit host application cannot process its audio signals within a short amount of time it will generate a pop or click
- Check the parameters in the “[Quality Group](#)” of Octave Shifter 2 and try to lower the “[Oversampling](#)” and “[Rendering](#)” parameters to reduce processing load

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<sup>11</sup> Consult your application’s manual, documentation or contact the manufacturer of the software.

<sup>12</sup> If your system does not have the “auval” utility installed (indicated by a “command not found” message) you can get it as part of the Xcode suite. Consult Apple’s developer website, <http://developer.apple.com>, on how to obtain Xcode.

<sup>13</sup> On multi-processor or multi-core systems like a Dual or Quad G5 system or Intel Core Duo, check for spikes or high load on single processors or cores.

# Known Issues

## Parameter groups not shown in Carbon interface

The generic Carbon Audio Unit interface provided by Apple does not support parameter groups for Audio Units. There is currently no known workaround, but Octave Shifter 2 will perform normally despite the minor graphical differences compared to the Cocoa interface.

# Version History

Date	Version	Remarks
October 2, 2007	2.1	Migrated to Audiowish.
May 4, 2007	2.1	Implemented gapless changing of quality parameters, improved synthesis sound quality and usability.
April 17, 2007	2.0	Initial release of the Octave Shifter 2 Audio Unit.

# Acknowledgments

## Stephan M. Bernsee

The Octave Shifter 2 Audio Unit builds on the work and tutorials written by Stephan M. Bernsee, posted on his website called DSP Dimension<sup>14</sup>. Thanks to Stephan for answering questions and explaining audio concepts.

## Philippe Gruchet

Philippe Gruchet, author of Open Tuning<sup>15</sup>, has offered a lot of suggestions, ideas and testing on the PowerPC platform. Thanks to Philippe for all communications and efforts which have helped make Octave Shifter 2 what it is today.

## The Apple CoreAudio Team

The Apple CoreAudio Team has been very supportive and helpful while developing the Octave Shifter 2 Audio Unit and related products. Special thanks to Michael Hopkins and William Stewart for answering a multitude of questions and helping debug code.

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<sup>14</sup> See <http://www.dspdimension.com> for Stephan M. Bernsee's tutorials and examples.

<sup>15</sup> See <http://www.open-tuning.com> for more information on Philippe Gruchet's Open Tuning software.

# Revision History

Date	Remarks
October 3, 2007	Current document revision.
October 2, 2007	Adapted the manual for the migration to Audiowish.
May 5, 2007	Table formatting update, updated " <a href="#">Parameter Overview</a> ".
May 4, 2007	Updated " <a href="#">Acknowledgments</a> ", " <a href="#">Version History</a> " sections and screenshot.
May 2, 2007	Updated " <a href="#">Parameter Overview</a> ".
April 17, 2007	Added " <a href="#">Usage Examples</a> " chapter with a Dubbing, Whammy and Crystal Harmonizer example. Fixed " <a href="#">Acknowledgments</a> " headings.
April 16, 2007	Updated interface screenshot, installation instructions and troubleshooting.
April 13, 2007	Added default values to the parameter overview, fixed interface screenshot and added the " <a href="#">Version History</a> " chapter.
April 12, 2007	Fixed minor typos and small corrections.
April 11, 2007	Initial draft for internal use.