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**O7A Harpex Upsampler Plugin**  
**v2.4.0**

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# 1 Introduction

The O7A Harpex Upsampler Plugin converts first order ambisonic audio streams into seventh order ambisonic (O7A) audio streams suitable for use with other O7A plugins. The algorithm used is an "active" one which estimates the sound directions in the first order material and uses that to synthesise seventh order material.

Various forms of first order ambisonics have been used since the 1970s. These typically use four audio channels to carry a 3D audio scene, which gives rather less spatial detail than modern third order ambisonics, let alone the seventh order that this plugin produces. First order ambisonics has the advantage that a number of commercial "A-Format" or "B-Format" microphones are available for recording.

There are ways to convert first order material to O7A other than by use of this plugin. It is often okay simply to mix first order material directly into the first four channels of an O7A stream, although a little processing can help (e.g. with the O7A Injector - First Order plugin from the Blue Ripple Sound O7A Upmixers library) and it is important to check you are using compatible formats. However, these approaches will not typically produce imaging that is as sharp spatially as that produced using the Harpex algorithm.

In general we recommend the use of O7A streams primary for research purposes, or in studios with high-end modern hardware. **The CPU load generated by the O7A plugins can be very high and may not be suitable for use on standard studio computer systems.** Third order (O3A) streams are an alternative. These carry enough spatial detail for most practical applications and present a much lighter processing load. Many O3A plugins run roughly four or sixteen times faster than their O7A equivalents.

## 1.1 Compatibility

O7A streams require audio busses with at least 64 channels, which (at the time of writing) most Digital Audio Workstations (DAWs) cannot handle. Some are limited at 2 channel stereo and many are limited at the 8 channels used for 7.1 surround mixes. **The O7A plugins will not work correctly with these DAWs**, which may even crash. In general, Reaper or Pro Tools Ultimate (version 2023.6 or later) are good options.

### 1.1.1 AAX

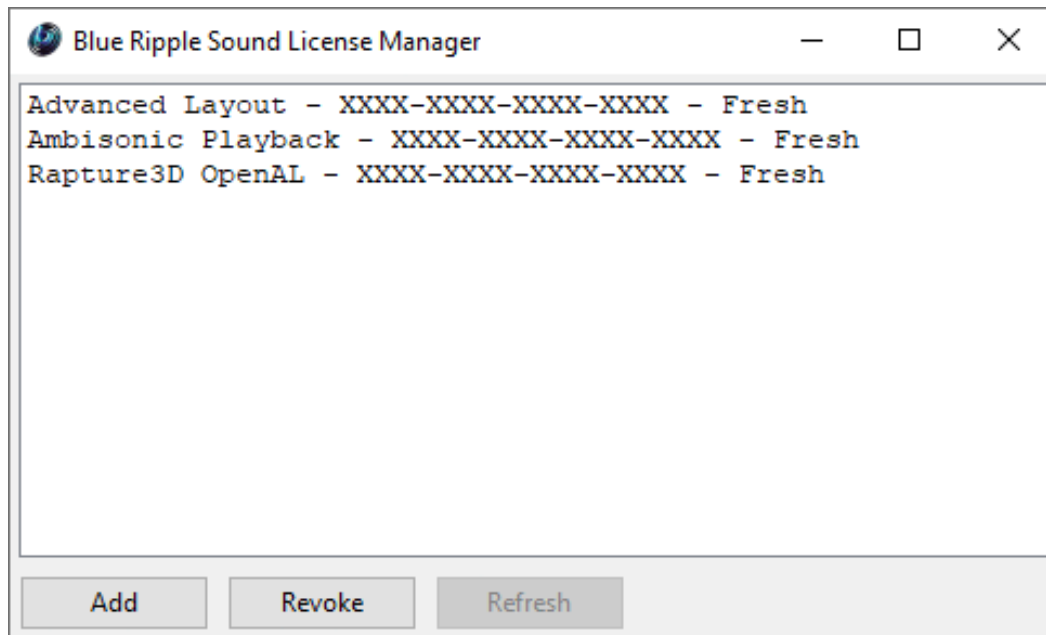
This plugin is compatible with [Pro Tools](#) Ultimate version 2023.6 or later. Pro Tools keeps careful track of exactly what stem formats are present on tracks and busses; this is a powerful feature which helps avoid mistakes and helps ensure plugins are used in the right places.

### 1.1.2 VST2

Most VST2-compatible DAWs (such as [Reaper](#)) have a plugin "path", which is a list of directories which will be searched for VST2 plugins. You may need to change this path to point at the location of the plugins, or move the plugins there. By default, these plugins are installed into `/Library/Audio/Plug-Ins/VST` on macOS. Various directories may be used on Windows, but `C:\Program Files\Steinberg\VST2` is not uncommon.

## 1.2 The License Manager

The Blue Ripple Sound License Manager application can be used to move license keys around between computers.



The application is generally available in the Start Menu on Windows, and in your installation directory, which is typically:

- C:\Program Files\Blue Ripple Sound\ on Windows, and
- /Applications/Blue Ripple Sound/ on macOS.

License keys can be removed from a computer using the 'Revoke' button and added with 'Add'. If data is not 'Fresh' this probably indicates a network connectivity issue, in which case the 'Refresh' button may be used. Generally, licenses are refreshed automatically.

## 1.3 Technical Requirements

### 1.3.1 Operating System

Supported versions of Microsoft Windows are 10 or 11, 64bit Intel.

Supported versions of Apple macOS are 10.14 to 13.5, 64bit Intel or Apple Silicon.

### 1.3.2 VST Host

**This plugin does not work with all VST 2 hosts.** One reason for this is that the plugin needs large numbers of channels on its input or output busses.

### 1.3.3 AAX Host

The AAX plugin requires **Pro Tools Ultimate version 2023.6** or later.

### 1.3.4 PC Hardware

Please check your PC meets the following requirements:

- Intel Core i7 CPU or better, or Apple Silicon.
- 400MB of free disk space.

### 1.3.5 Permissions

You'll need administrator permissions while installing on Windows. The software probably won't install properly using a "restricted" account.

### 1.3.6 Internet Connection Required

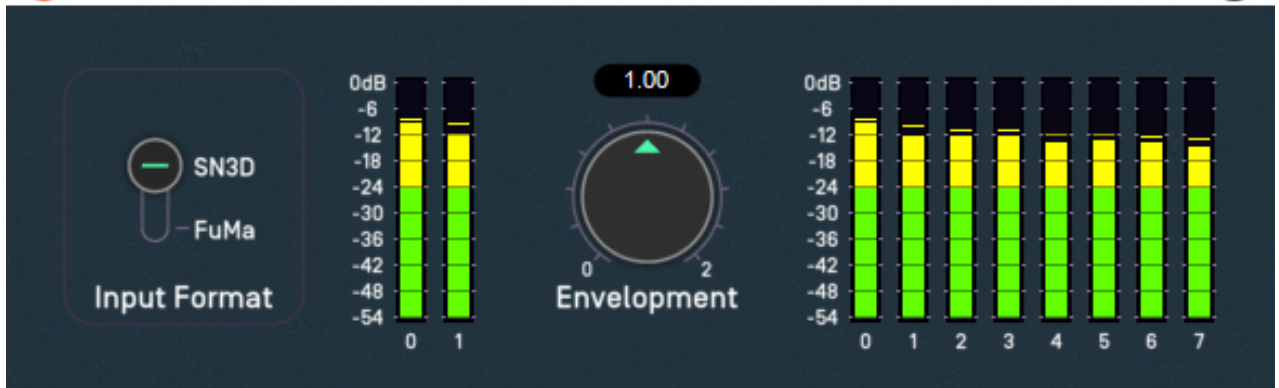
This software requires an Internet Connection for license activation and verification.

Successful license verification isn't required every time you use the software, but it is needed during installation and needs to succeed once every couple of weeks to keep the license fresh.

The license can be "revoked" to remove it from one machine so it can be moved on to another. You should also do this if you're updating your system in case the machine appears to have changed identity.

# 2 O7A Harpex Upsampler

O7A Harpex Upsampler



## 2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

## 2.2 Audio

	Channels	Content
Input	4	First order B-Format ambisonics (SN3D/ACN O1A or FuMa, switchable)
Output	64	O7A

## 2.3 Controls

- Envelopment
- Format

## 2.4 Description

This plugin takes classic four channel first order B-Format and converts it to seventh order (O7A).

In general when we refer to B-Format we are referring to 64 channel seventh order ambisonic (O7A) B-Format, but this plugin is an exception. The first order ambisonic B-Format we are talking about here is less detailed and only uses four channels. The plugin supports two first order input formats, SN3D and FuMa. Please check which you have and set the switch accordingly.

The plugin does *not* perform conversion from A-Format to B-Format. If your microphone produces ambisonic A-Format, you will need to use software specific to your microphone to convert to B-Format before using this plugin.

The plugin uses the Harpex algorithm to estimate the original directions of sounds and then uses those directions to synthesise seventh order material. For more information about Harpex, see <http://www.harpex.net>.

## 2.5 Meters

Meters are shown on screen to show the average energy content within each of the ambisonic orders present. The meter on the left shows the zero and first order content of the input to the plugin and the meter on the right shows the zero to seventh order content of the output. Metering uses the same methodology as the O7A Meter plugin from the Blue Ripple Sound O7A Core library.

In a typical mix, the two input meters should have roughly the same level, as should the eight output meters. If this is not the case, this probably indicates unusual content in the input mix, which may be for valid reasons but is more typically due to the choice of A/B filter used to convert from A- to B-Format. In these cases, you may want to set the envelopment control to something other than 1.

## 2.6 Warning: CPU Load

This plugin is particularly demanding in terms of CPU load, even in comparison to other O7A plugins. Please use it with care.

## 2.7 Controls

### 2.7.1 Control: Envelopment

The envelopment control allows control over how enveloping or diffuse the output of the plugin is. The control ranges from 0 (for a sharp image) to 2 (for a diffuse image). A value of 1 is normally recommended.

### 2.7.2 Control: Format

The input format describes the first order ambisonics that is being fed into this plugin. Setting this incorrectly will give bad results. The options are:

- "SN3D" (in the ACN channel ordering) is the format used by the O1A, O3A and O7A plugins. It is used by some recent first order microphones and is sometimes known as "AmbiX".
- First order "FuMa" is the same as classic WXYZ B-Format, which dates back to the 1970's. It was used in versions of these plugins prior to version 2.0 and some hardware and software uses it, including a number of 3D microphones. FuMa is only defined up to third order.