Tasty Chips

Integral (INT-ə-grəl)

Dual True-Stereo Reverb Convolution Pedal
Deep-Dive & Expanded Manual by Jon Stubbs

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Introduction

Tasty Chips is a modular synthesizer manufacturer in the Netherlands. In 2023, they released a pedal version of their convolution reverb called **Integral**. After my new Integral arrived, I started exploring its sounds, features,

 and functions. Through reading their excellent manual, and some friendly emails with Joeri Braams at Tasty Chips I've gained a general understanding of the Integral; and have discovered some useful secrets.

This PDF is a detailed exploration of this device, along with some helpful context. This document provides: an overview, background, a feature-comparison with a competing product, detailed instructions, and a few tricks. Some portions of this PDF were copied or paraphrased from factory manual, which contains more details about the internal signal path, trouble-shooting, credits, and support options. Through this writing, I have gained a greater understanding, but I also think this will help current and potential owners to understand the capabilities of this exquisite device.

Because convolution-- particularly with regard to reverb--is still not widely understood by the pedal-buying public, this first section provides an overview of the convolution process and how it is used.

Convolution Overview

Convolution is an audio effect process, where the sonic signature of a fixed audio file is imposed in a specific way onto a second audio signal. This "signature" audio file is called an impulse response (IR). An IR could theoretically be any audio file, but in practice, it is a sonic snapshot of a space or some other audio-shaping process. The second audio input signal could be a recorded track, or, in the case of Integral, a live stereo input signal. Convolution does heavy computing to imprint the IR onto every sample of the input audio, making it sound as if it as occurred within that space or run through that process. Compared to other cross-modulation processes like AM, FM, Vocoding, or side-chaining, convolution can provide a more rich, natural, and musical result. The ability of convolution to emulate everything from speakers, to resonators, to massive reverberant spaces is uncanny.

Impulse Responses (IR's)

When recording an impulse response, there are two ways to "activate" the space, speaker, object, device, or process. Usually, the goal is to capture a neutral, full-spectrum sonic event that has been changed by the process.

The first method is to directly record a burst of noise like a starter pistol or a balloon pop. The resulting recording is trimmed to start at the precise moment of the burst and end after signal dies out. That resulting audio is the IR, ready to use.

The second method involves feeding a sine-wave tone that is swept from 20Hz to 20,000Hz (i.e., across the full audio spectrum) into a loudspeaker that is carefully positioned in the space; or feeding that sine-sweep thru a device or process. The resulting sound is recorded via microphones in the space, or from the direct outputs of the process. That reverberant or otherwise processed recording must then undergo another process which time-aligns all the frequencies of the sweep to the same zero-start-time --essentially making it a noise burst but with a reliably balanced frequency spectrum. Listening to the raw IR of an ambient space gives a general idea what the signal will sound like in that space. An IR from a speaker cab sounds like a click, so its effect on an input signal is more difficult to predict.

Theoretically, any audio file could be used as an IR, so there are infinite otherworldly realms waiting to be discovered.

In Use

For a typical reverb scenario, we might start by downloading an IR that is a stereo recording of a starter pistol fired in a massive industrial space, We then load that IR into a reverb convolution processor, and feed a mic signal to the input. Now that microphone signal is gloriously bathed in that reverb, as if it is existing in that space.

Another scenario is speaker emulation, specifically for electric guitar and bass guitar combo amps and speaker cabinets. Because the sine-sweep was sent through some combination of amp, speaker cabinet, and room, and was captured by a specific microphone; thus all the elements of that signal path contribute to the final processed IR. Guitarists and bassists will then place the speaker cab convolution after their digital amp simulation to create a more realistic sound.

Speaker/"Cab" IRs are very short (~20ms), which requires far less computing power than long reverb IRs. When IR's are this short, the convolution process ends up working more like static EQ, imposing a very specific spectral shape on the input. This type of speaker cabinet convolution processor is often referred to as an "IR Loader". The lower processing demands, and large guitar pedal market make IR loaders fairly common.

What Convolution Can and Can't Do

Convolution does some things very well, but some processes won't translate as expected. Convolution is most convincing when the space/object/speaker/device/process is linear; i.e., it behaves the same way regardless of signal volume. Dynamic processes like distortion, compression, or an envelope filter won't directly translate. The convolution will do something, but probably won't resemble the original process. Also, convolution can't reproduce pitch, modulation, or spectral effects that change over time, or change along with an input's pitch. Again, it will do something but might not be an effective simulation of the original process.

Software & Hardware

Convolution for reverb has existed since the early 2000s. The original flagship convolution reverb software was and still is Altiverb, developed by AudioEase in the Netherlands. They put convolution reverb on the map. Both Apple's Logic and MainStage include Space Designer, as well as a dedicated Impulse Response Utility (for creating new IRs). Other convolution software includes: WaveArts Convology XT (freeware, with paid IR libraries), AudioThing Fog Convolver, Avid TL Space, and Waves IR 1.

Because long reverb IR's require significant processing power, affordable hardware convolution devices for reverb have been rare. Speaker cabinet convolvers (IR loaders) are popular with guitarists and bassists, and are far more common.

In 2014, a company called Logidy released the first convolution reverb pedal called EPSi. It was subsequently discontinued, with nothing to take its place for years.

In 2019, Tasty Chips in the Netherlands started building convolution reverb hardware in Eurorack synth modules called ECR-1, then the ECR+.

In 2020, the Australian company Poly Effects unveiled their effect pedal Digit, and its sister product Beebo. These devices have undergone some shifts in name, firmware & function, but in their various incarnations, they've included a convolution reverb as one of the available modules within them.

In 2023, Tasty Chips released Integral, a dual true-stereo convolution reverb in an effect pedal format. Later in 2023, Poly Effects released their dedicated convolution reverb pedal called Verbs.

Comparison: Verbs vs Integral

As of this writing (early 2024), Poly Effects Verbs and Tasty Chips Integral are the two main choices for convolution reverb in a pedal. Both products have bundled IR collections built into the firmware, including real spaces, hardware reverbs, and special effects. Some of differences in features will have more weight depending on each user's individual needs. Here is a basic comparison of their features:

Poly Effects Verbs	Tasty Chips Integral
1 true-stereo convolution engine	**2 true-stereo convolution engines**
Shallow feature-set & learning curve	Deeper feature set & learning curve
8 user slots for IRs	**Access unlimited IRs directly from USB stick**
No raw IR play/audition feature	Dedicated button to audition raw or processed IR
Maximum IR Length is not documented (40 sec ?),	Maximum IR Length= 23 seconds
File Format: .wav 48K 24 bit	Reads wav, .aif, .flac, (at various rates & bit-depths): Internal processing 48K/32-bit, output 48K/24-bit.
Values shown as LED status & ladders low-info, viewable while standing	1" x 1" 128x128 pixel color display (waveform & text) high-info, not viewable while standing

Routing options:
  * True Stereo
  * Mono-in / Mono-out
  *** NO mono-in / stereo-out option**
	Routing options:
	  * True Stereo
	  * Mono out (via L and/or R out with width at zero)
	  *** Mono-in / Stereo-out**

MIDI in for remote parameter & preset change	**No MIDI in**
MIDI in for CC of settings	Expression pedal input
12 bit slider resolution (scan rate not documented)	10 bit knob resolution, 50Hz scan rate
Dry thru always direct/analog wet latency not documented	Dry options include direct/analog wet latency less than 5 ms
clipping indication not documented	Internal level clipping indicator
Settings:	Settings (stored with preset):
Pre-delay	Pre-delay
Wet-level	Wet-level
	Dry-level
High-Pass Filter	High-Pass Filter
Spread ("Smoosh")	IR Pitch (+/- 2 octaves)
Bypass button	A/B Bypass buttons
Crescendo/Hold	Long-sustain available via 2nd convolver
	Width (via Mid/Side)
	Balance between A & B Convolvers
	Start offset for IRs
	Attack & Release ramp/env
	Two independent 4-band full parametric EQ

Integral: Hardware Overview

As a **dual** true-stereo convolution pedal, Integral can load two IR files, one into each of its two convolution engines (A & B). Files can be mono, normal stereo, or quad-true-stereo, with lengths up to 23 seconds. This means you can load everything from short cab IR's all the way up to massive reverberant spaces, and everything in between. The two convolution engines run in parallel, with an adjustable level balance between them. Footswitches A & B allow you to enable both, either, or neither.

Integral's internal processing has a resolution of 32-bits at 48 kHz.The output DAC is 24 bits at 48kHz. Signal-to-noise is 96 dB. The latency is less than 5ms. In short, the audio fidelity is excellent.
The sound is clean with no distortion or coloration. The analog dry thru (in DIRECT mode) is clean with zero latency.

TS jacks on the back include L/mono and R inputs, and L and R stereo outputs. Mono from one or both output jacks is available by setting the width knob to zero. A push-button on the right side sets the input level for both inputs to either instrument level (button out) or line level (button in). Also, on the right side is the DC 9V power input, which requires a minimum 500mA, and accepts either a tip-positive or a tip-negative connector. There is no dedicated power switch.

IMPORTANT: Wait a minimum of 10 seconds between powering Integral off & back on.

On the left side is an input for a standard TRS expression pedal with a linear-sweep potentiometer, and a resistance of at least 10 kOhms. Also on the left side is USB port-- which is recessed
6 mm deep into the chassis. The USB port opening is 8.85 mm X 16 mm. Not all USB sticks will fit into this recessed opening. USB sticks or USB-microSD adapters must be formatted in FAT, ExFat, or Linux Ext filesystems.

The overall dimensions are 12.2 cm L x 9.7 cm W x 5.4 cm H. (4.81" L x 3.82" W x 2.13" H).

On top:

SELECT push-encoder

6 parameter knobs,

2 buttons (SHIFT and PLAY)

2 footswitches (A & B)

1" x 1"   128×128 pixel LCD color display.

New features and fixes have and will continue be added to the pedal via firmware updates to further enhance Integral's already robust feature-set and workflow.

Display

The main display shows the name and length of the currently loaded IR. The displayed IR length is replaced with any changing parameter and its value. The IR's waveform display is in a logarithmic scale so the lower amplitude tails are easier to see. Changes to POSITION, ATTACK and RELEASE are displayed as envelope lines overlaid onto the waveform.

You can only view and edit one of the two convolvers at a time. An A or B on the display shows which one is in the foreground. To bring the other convolver to the foreground, press the SELECT push-encoder. Tapping either footswitch A or B enables or bypasses that convolver bringing it to the foreground.

With convolution and EQ, it is possible for signals to clip internally. This is indicated by a "C" in the display next to the A/B status. Clipping may be corrected by either adjusting the level feeding the input, or by adjusting some combination of the Wet level, the HPF, or the EQ.

If you turn the SELECT encoder, you will enter the file chooser view; which starts in the "SAMPLE" section; showing a full list of all the internal IR's and all the IR's on the USB stick; displaying 13 items at a time. Pressing SELECT exits the file chooser with the highlighted IR now loaded into the foreground convolver. While still in the file chooser, press and hold the SELECT push-encoder for one second, to switch to the PRESETS tab, where you can view and load any of the presets you have stored onto the USB stick.

From the main display, if you hold SHIFT while pressing the SELECT push-encoder, you will enter the system menu display. From here you have access to GLOBAL SETTINGS, PRESET SETTINGS, EQUALIZER A, and EQUALIZER B. All these menus have an EXIT option on the screen. Turn the SELECT knob to highlight EXIT, and press SELECT to exit back out one level, ultimately returning to the main display.

All these display modes and features are described in greater detail below.

Loading Impulse Responses

You can load two IR files into the Integral; one into convolver A, and a second into convolver B. On the main screen, either of the two convolvers (A or B) is in the foreground, while the other convolver runs in the background. The foreground convolver's IR name & waveform image are displayed, as well as either the IR length, or the value of the most recently changed parameter. The parameter knobs only control the foreground convolver. To switch the other convolver to the foreground, press the SELECT push-encoder. Pressing either footswitch A or B enables/bypasses that convolver, and brings its convolver to the foreground.

From the main display, when you turn the SELECT knob, you enter the file chooser view. Though the IR files may be stored in folders (one level deep), they are shown in one long list, and they are grouped according to their folders. With the SHIFT button active, turning the SELECT knob one step advances you to the next folder. Use of folders is essential if you have many IR's on your USB stick.

In the file chooser, the enable/bypass state of A & B are retained. If the foreground convolver is enabled, as you turn the SELECT encoder and highlight different IR files, they are loaded into the enabled foreground convolver, allowing you to play through the IR without exiting the file chooser; and if the foreground convolver is bypassed, you won't hear the pre-loaded IR. If the background convolver is enabled, you will continue to hear that convolver while in the file chooser. Pressing SELECT exits the file chooser with the highlighted IR file loaded into the foreground convolver. If AUTO-EXIT is ON, the currently highlighted IR will be automatically loaded into the foreground convolver. There is no cancel or exit option, so to revert, you must highlight the previously loaded IR.

In both the main display and the file chooser, the PLAY button plays current IR as a loop; and with SHIFT active, it plays the processed IR-- i.e., with the position, pitch, attack/release settings of the foreground convolver applied to it.

Tasty Chips have included a variety of fun and useful IR's from a variety of sources via openairllib.net (via creative commons, CC BY-SA 3.0). If you have a USB stick or USB-SD adapter inserted, then you can scroll past all the INTERNAL IR's/folders, to your USB content. The 2nd line of the screen will then switch from "INTERNAL/folder-name" to "USB0/folder-name", and you will now see the IR's on your USB stick. You can organize your own IR's into folders one level deep (--nested folders and their contents will not be seen by Integral's file system). The foreground/destination convolver (A or B) is shown to the left of the file-path.

Integral loads user IR's that are in .wav, .aif, and .flac format, in all common rates & bit-depths. The internal processing resolution is 32 bits at 48K, and Integral will use files with up to 32 bits without bit-truncating. IR's at 48K match Integral's native rate and will load more quickly.

The Integral can record impulse responses directly from the inputs (in 32-float at 48K) and save them to the USB stick. See Recording/Saving Impulse Responses

Loading Presets

An Integral preset file includes the file-paths for the IR selections for both convolvers A and B; as well as all the knob/parameter settings, all values from the PRESET SETTINGS menu, and all the settings for both 4-band equalizers. Note: The IR files are not contained in the preset, only the file-paths.

From the file chooser view, press and hold the SELECT push-encoder for one second to switch to the PRESETS tab. A list of all the presets that are saved/stored on your USB stick will be displayed. Integral doesn't ship with any internal presets, so loading presets is only possible if you have saved them yourself, or acquired them from a 3rd party. If you have not saved any, it will exit to the main display. In the PRESETS tab, nothing is automatically loaded, so the previously loaded (current) preset continues to function in the background. Your stored presets can be organized in folders (you must access the USB stick on your computer to manage those preset files and folders). You can step through folders of presets using the SHIFT button as you can with the IR files in the SAMPLE tab. See Saving Presets.

Physical Controls

The knobs/potentiometers have 10 bit resolution (1024 values) and a ~50 Hz refresh rate. The knobs control only the foreground convolver (A or B, not both). Pressing SELECT or the A/B footswitches toggles the foreground convolver between A/B. Knobs will retain their set values regardless of physical position)-- [See the PICKUPS section of GLOBAL SETTINGS]. The top panel controls include:

KNOB/BUTTON	NORMAL FUNCTION	SHIFT FUNCTION [⇧]
Width	Stereo Width (via Mid/Side processing)	IR Pitch (+/- 2 oct, scaled to +/- 1.000)
Xfade	Balance between A & B convolvers	Slew Time (smooths audio transitions between iterations of (recomputed) IRs
Predelay	Predelay Time (up to 2 sec)	High pass filter 12 dB/oct, 20Hz-20KHz
Position	IR start offset	
Release	Release Time (ramp duration/slant)	Attack time (ramp duration/slant)
Wet	Wet level	Dry level
Encoder Push	Switch A/B (Hold to select presets)	System menu
Encoder Turn	Prev/Next for impulses, presets, list items	Prev/Next folder
Play Button	Preview foreground convolver's raw IR as loop	Preview foreground convolver's processed IR (position, pitch, attack/release)
Footswitch A	Convolver A: Enable/Bypass, Foreground	Record/Stop
Footswitch B	Convolver B Enable/Bypass, Foreground	Hold to save preset

Width uses mid-side processing to control the stereo spread; from mono at zero, normal stereo at 12-noon, and widened at maximum.

The **Slew** time (SHIFT + X-Fade) adjusts the crossfading time as the IR is recomputed, or after loading a new IR, or changing some parameters. Short slew settings are more responsive, but choppier sounding, longer slew times reduce glitching with IR loads and parameter changes.

Changing the **Position** or **Attack** may result in a lower volume if the convolver uses a quieter section of an IR. Integral automatically uses normalization after applying the position or envelope settings. Each time the position or envelope is changed the convolver recomputes and restarts.This can be smoothed by increasing Slew time. Lines are overlaid onto the waveform display to show their expected behavior.

The **Release** setting behaves like a synthesizer's "decay" setting, in that it always starts directly after the attack portion of the envelope. The release can be set to fade the IR more quickly, but as the release extends further than the length than the IR, the ramp angle levels out, and with the release set at at max, the IR plays as is. A line is overlaid on the display to show the behavior.

Play and SHIFT-Play work the same in the main display and the file chooser when in the IR ("SAMPLES") tab. The file chooser does not pre-load presets, so PLAY will ignore the currently highlighted preset, and play the last loaded IR, including what was highlighted while in the SAMPLE tab.

IMPORTANT: The knob positions for: Pre-Delay (0), X-Fade (mid), Wet (max), Attack (0)/Release (max) will significantly impact the sound. For a neutral starting point, set to the positions shown in parenthesis.

System Menu

To enter the system menu, you must always press and hold SHIFT then press SELECT (regardless of the DIRECT SHIFT setting).

The display lists: GLOBAL SETTINGS, PRESET SETTINGS, EQUALIZER A, EQUALIZER B, and EXIT.

NOTE: Within the menus, the actions of the SELECT push-encoder may vary as you highlight and select menu items, step through the available options, and confirm choices.

Global Settings

These general settings control the overall behavior of the Integral. They are stored when the global settings menu is exited, and recalled when the Integral boots up.

- DIRECT SHIFT: chooses SHIFT button behavior
   ON = momentary (press and hold manually), or
   OFF = latch (button presses toggle between shift & off)
   The OFF selection is helpful for one-handed operation.
   NOTES: Accessing SYSTEM MENU always requires holding SHIFT while pressing encoder.
        In firmware 3.0, there is a known bug where Integral "forgets" the shift state
        when exiting the file chooser, or waking the display from sleep, in which case
        the SHIFT button is still on but not lit. The workaround is to press SHIFT twice.

- AUTO EXIT:
   ON = Exits the file chooser after 4 seconds (auto-loads currently highlighted IR).
   OFF = Press Select knob to exit the file chooser with currently highlighted IR loaded.
   NOTE: There is no way to exit the file chooser without loading the currently highlighted IR
     (there is no option cancel or exit and revert to the previously loaded IR).
   There is no cancel or exit option from the PRESETS list, but you can switch back to the "SAMPLE" tab by
   holding the SELECT button down for one second before selecting an IR and exiting.

- PICKUPS: The active value of a parameter may not match the knob's physical position. This may be the case if
   you have loaded a preset, or SHIFTED to the secondary function, or changed the foreground convolver. This
   setting determines the behavior of the knob as it adjusted from different active value.
   ON = holds the stored value as the knob is turned, until the knob crosses (picks up) the stored value. This
   prevents sudden parameter value changes. A lock icon is shown, along with the stored ("null") value of the
   knob/parameter.
   OFF = As soon as a knob is turned, the number will suddenly jump from the stored value to the value
   reflected by the knob's actual position.

- SCREENSAVER: Sets the screensaver time: 0 seconds, 30 seconds, 2 minutes, or 5 minutes.
   After this time the display will turn to black, and wake up when any control action is taken.
   TIP: Press SHIFT to wake the display without an action, this also corrects the SHIFT button's LED state.

- WAVE CONTRAST: Adjusts the display contrast of the impulse waveform visualization from 1 - 4,
    to compensate for lighting conditions and display variance.

- REC MODE: selects the method to trigger IR recording.
   SHIFT = SHIFT + Footswitch A to start recording,
   DBL TAP = Double-tap Footswitch A to start the recording
   NOTE: In both cases, a single tap of Footswitch A stops the recording.

- SAVE AND EXIT: The global settings are stored when the menu is exited

Preset Settings

The values in the PRESET SETTINGS are contained in stored presets, and effect the current preset. These are stored when a preset is saved, and they are replaced when a different preset is loaded. The last saved preset is reloaded upon booting.

- DRY MODE: Determines how dry input signal is routed through the internal signal path.

    MIX: dry signal is digitized, and is controllable via dry level knob,
        in bypass the digital dry signal is heard

    DIRECT: Analog dry-thru, no latency, no dry level control.

    KILL: Eliminates the dry signal regardless of enabled/bypassed state.
      This is useful for when Integral is in a parallel path, or send/return configuration.

- EXP MAP: Assigns the expression pedal to either the A or B convolver, or both.

- EXP CONTROL: Assigns which parameter the expression pedal controls.
        POS: Position
        WET: Wet level
        XFD: X-fade (balance between A & B)
        PIT: Pitch

    NOTES: XFD is global, so the EXP MAP setting is ignored.
    With EXP MAP is set to NONE, the expression pedal is unassigned.

- RENAME PRESET: This replaces the current preset.
                    To copy a preset, save the preset again, changing the name.

- DELETE PRESET: This cannot be undone.

    Note: RENAME & DELETE are only available when a preset is loaded.

- EXIT: Exit to the system menu.

Equalizers A/B

Integral has a separate 4 band equalizers for each of convolver A & B. These EQ settings can be stored/recalled with a preset.

- HPF (this is the same high pass filter that is also accessed from the main screen)

- 1-4 selects each band for settings/adjustment

- Mode: LOWSHELF, HIGHSHELF, LOWPASS, BELL (peak/notch).

- Lower 3 knobs control FREQ, GAIN (level), QFAC (bandwidth), RESO depending on mode.

- EXIT to leave the EQ page and return to system menu.

Saving Presets

Integral allows you to save/load presets to/from a connected USB stick. The saved preset includes the current IR (the IR's file name/path is stored, not the actual IR file), as well as all the parameter settings, the preset settings (from the settings menu) and all EQ settings- for **BOTH** A & B convolvers. This allows you to quickly recall a live configuration with two different reverbs and all your preferred settings.

To save, hold SHIFT and press the right footswitch for one second. Follow the onscreen prompts to name and save the preset. Presets cannot be saved internally, so if no USB stick is recognized, the right footswitch LED will flash two times and the display will indicate that the store failed.

Tip: The presets on the USB stick can be organized into folders one level deep (no nested folders). The presets themselves can be edited on a computer by opening the .prst files in a plain text editor. The parameters and values are clearly shown, however, the range, resolution, and scale of the parameter values is not documented in the factory manual. It is not clear whether specific values, that are not available via the knobs can be typed in instead.

Recording/Saving Impulse Responses

To record your own IR, activate the A footswitch according to your preferred method GLOBAL SETTINGS (SHIFT + Footswitch A, or double-tap Footswitch A). During recording, all convolution is paused, as you monitor the dry input. Press footswitch A again to stop recording (or it will automatically stop after 20 seconds). You can now use the recording as you would any IR.

When a USB stick is inserted, you can store the recording by holding SHIFT and pressing the right footswitch. Follow the screen prompts to name and save the recording/IR. It must be saved to a USB stick, and cannot be saved internally. If no USB stick is present, the right footswitch LED will flash twice and the screen will show "STORE FAILED".

**IMPORTANT:** Be sure to allow the save function to finish before disconnecting power.

True Stereo Impulse Responses

True Stereo IR's have 4 channels, with two separate stereo IR's- one for each of the Left & Right inputs. Integral routes audio this way:

Left Input	/ Left Out	(Channel 1)
	\ Right Out	(Channel 2)
Right Input	/ Left Out	(Channel 3)
	\ Right Out	(Channel 4)

If you have True Stereo IRs in the form of two separate stereo files, (one for left input, and the other for right input), you can use the free Audacity audio editor to combine them into a single "quad" file.

1. In Audacity Preferences, Audio Settings, Quality, set Project and Default rates to 48K, and Default Sample Format to 24 or 32 bits (depending on your source file).
    In the Quality section's SRC (sample rate converter), choose Best Quality, set Dither to none.

2. Drag the two stereo files into the blank Audacity window, making sure the tracks for left input are first, above the right's stereo channels.

3. Choose "Export Audio..." from the file menu. Choose the .wav format, and 48000 Hz rate; and for Export Range confirm that Entire Project is selected.

4. For Channels, choose "Custom mapping" and click the Configure button to confirm the 1-to-1 wiring.
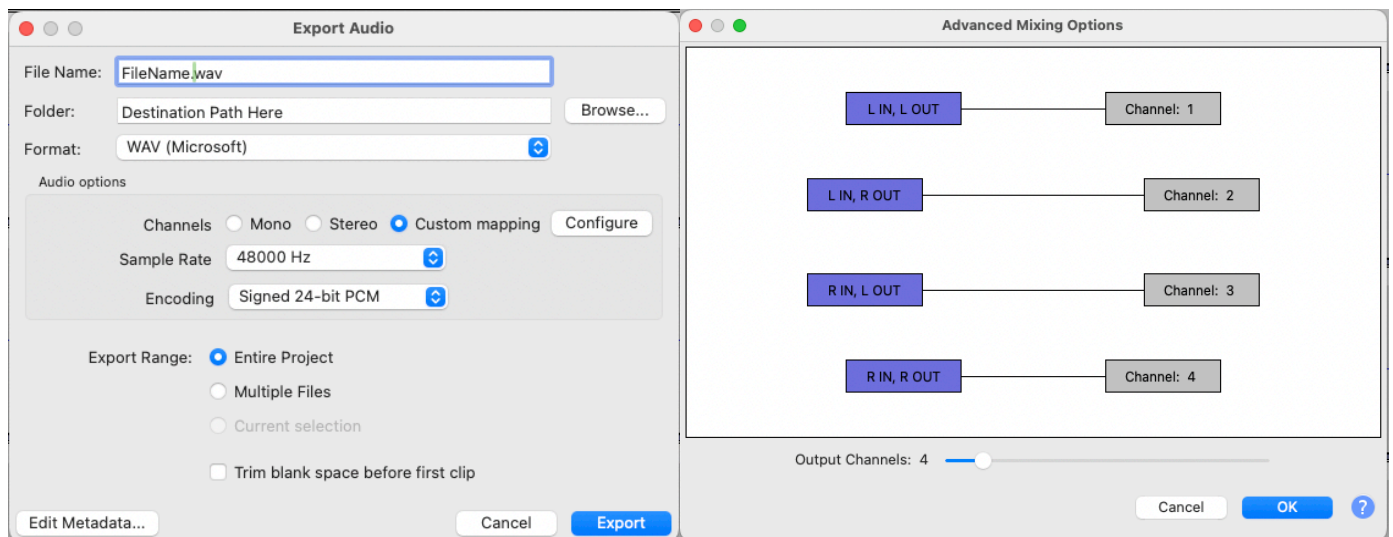
Trick #1: Four Stereo Convolvers

We can take advantage of the True-Stereo routing, and actually get **FOUR** normal-stereo reverbs out of Integral at one time. This might be useful with a parallel path or send effect (100% wet, no dry signal) configuration. There are a few setup conditions for this:

1. Rather than using the two inputs as a stereo pair, we can think of the Left input as "Input 1" and the Right input as "Input 2", and we would think of the 4 reverbs as: "A1, A2, B1, B2".

2. As a send or parallel path effect, we would need to turn off the dry input by going to PRESET SETTINGS, and setting the dry mode to KILL.

3. Meanwhile on the computer, we need to combine two different stereo IR's into one quad file, using Audacity. It won't matter if the stereo files are of different length. Audacity will extend the length of the shorter stereo file to match that of the longer one. (See the Audacity directions in the previous section for exporting quad audio.)

There are limitations to how the relative levels of the four reverbs can be adjusted. This will require a little extra planning.

Integral has no internal level control for the L & R inputs, so you must set the levels from the sending device. The balance you set between the two signals entering Input 1 (L) vs Input 2 (R), will be the same for both convolvers A and B. You can adjust the wet levels of A and B independently, but A1 and A2 are linked, and B1 & B2 are linked.

It may be helpful to think of this as a table with 4 adjustable legs, where the four reverbs (A1, A2, B1, B2) are the corners of the table. The height of any of the four corners is the relative level of that reverb.

You can adjust the rear legs as a pair (via Send 1), and the front legs as a pair (via Send 2).

The left side's legs as a pair can be adjusted with the wet level from Convolver A, likewise for right side's legs via the wet level of Convolver B. Independent control of individual legs, or diagonal pairs isn't possible.

Let's say we want four reverbs: a spring, a plate, a room and a cathedral, all with normal stereo (2-channel) IR files. You start by using Audacity to combine the spring & plate into one quad IR (as shown in the previous section) with the spring on channels 1 & 2, and the plate on 3 & 4. Audacity will set the quad file's length to that of the longer IR pair. We'll call this file "Mechanicals". You do the same with the Room and Cathedral IR's, merging them into a quad file which we'll call "RealSpaces".

We'll then load the Mechanicals IR into Convolver A, and the RealSpaces IR into Convolver B.

Now, let's connect SEND 1 and SEND 2 from our mixer into inputs L & R respectively. Now, SEND 1 feeds both the Spring on A, and the Room on B, and SEND 2 feeds both the Plate on A and the Cathedral on B. By adjusting the SEND amounts from the mixer, we can control the relative levels of Spring+Room (on send 1), and Plate+Cathedral (on send 2). Using Integral's WET and/or X-FADE controls we can adjust the balance between the Mechanicals (on A) and the RealSpaces (on B).
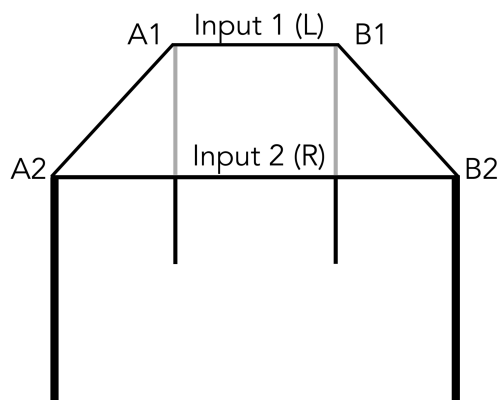
Trick #2: Audio Loop Recorder/Player

The IR audition button plays the audio of any audio up to 23 seconds (whether it is an IR or not) as a loop. When the DRY MODE is set to DIRECT, you can load or record an audio loop (e.g., drum loop, or chord accompaniment, ambient drone, etc.). When you press the play button, it will loop, and you can play along via your dry sound. Note: The effect of the other convolver will not be heard. If you use SHIFT + PLAY, the processed IR will play/loop with the position, pitch, attack/release settings applied.

Trick #3: Adjustable Stereo Delay

Integral (and convolution generally) can recreate most non-modulated delay effects very effectively. The IR of a delay is essentially a tick of audio for each delay tap. So you could theoretically construct any delay pattern from scratch. If you want a vintage or tape type sound, you could start with an IR from an actual unit, then edit to taste.

For an adjustable single-tap, stereo delay, put an IR with a single delay tap on the left channel in A, and a right tap IR in B. You can now use the PRE-DELAY knob for A & B to either adjust the delay time for each. Alternatively, you could add silence before the tick(s) and use POSITION to shorten the delay time. If you place the tick (tap) at the end of an otherwise silent audio file, you can make the IR as long as the maximum delay time that you would want (up to 23 seconds!), however, there's no need to make the IR longer than you need, as the POSITION setting becomes less precise with longer IR lengths.

Document Version 1.0, April 13, 2024

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