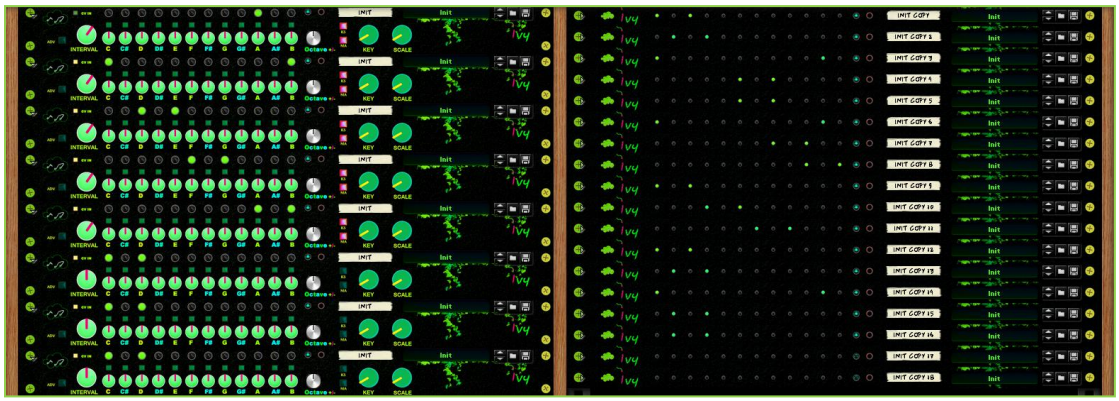
-IVY : NOTE CV HARMONIZER-

by Rainwaves

Rack Extension User Guide

Document version 1.0 released 06/10/2017



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INTRODUCTION

Ivy Note CV Harmonizer is an Instrument/Utility type Rack Extension plugin, developed by Rainwaves. You can use Ivy as software plugin in Reason versions 7 and up.

WHAT IS A HARMONIZER?

A harmonizer is a device which typically receives a musical input signal, and outputs that same signal plus a newly created signal which musically harmonizes with the former signal.

Typically harmonizer effects include a key sync feature, which ensures that the generated harmonizing signal only plays notes in a specified musical key. This is a standard which ensures that a harmonizer device can follow certain musical rules, which are discussed in further detail in the music theory section featured in this user guide.

The fundamental aim of a harmonizer is to provide the musician with the ability to play more notes simultaneously with more ease. A harmonizer can for example allow the musician to perform more complex musical parts or sounds than those which are physically possible to play without a harmonizer,. In a simpler case, a harmonizer can be used to make a difficult musical part 'easier to play'.

Harmonizing is an effect often commonly found in devices such as guitar harmonizer pedals. Guitar effects must harmonize real-world audio signals by using pitch detection and a somewhat 'artificial' means of creating a harmonizing signal. Unlike a guitar effects pedal, **Ivy - Note CV Harmonizer** is a device for synthesizing musically harmonic CV signals, which may then be routed to any Reason instrument device to generate audio.

Ivys intended use is to generate a musical harmony to accompany an existing melody, or to generate more interesting musical parts from a real-time note input such as a MIDI keyboard. Ivy may also be used as an aid to learning about music theory, or as a practice tool for keyboard skills.

Ivy listens to the notes you play, and creates a new set of notes to harmonize with the original notes.

Both the notes you send to Ivy (lead melody part), and the harmonzing note part generated by Ivy can be distributed individually to other Reason devices (such as synthesizers, samplers, or arpreggiators) via CV outputs.

Ivy is used in conjunction with other Reason Instrument devices. The way Ivy works can be thought of as being similar to the 'Player' type devices featured in Reason versions 9 and up. A key difference between Ivy and Player device is that Ivy distributes notes to other instruments via control voltage (CV), whereas Players send notes via a different protocol. Fortunately, the vast majority of Reason and Rack Extension instruments are equipped with '**Gate**' and '**Note**' **CV** inputs to ensure compatibility with note CV utility devices, such as Ivy. As a bonus, Ivy is able to save space in the Reason rack, by distributing both lead melody CV and harmony to separate Reason devices, whereas Players may only distribute notes to one Instrument device that they are linked to at a time.

GETTING STARTED

You can get started using Ivy in a number of ways. The fastest method is to create a combinator, and load one of Ivys preset combinator instrument patches. This will load a new combinator (which behaves like a synthesizer) into the Reason rack.

1) Create a new combinator by right clicking in an empty space inside the Reason rack, and select Create>Utilities>Combinator

2) Click the 'Browse patch' button on the newly created combinator

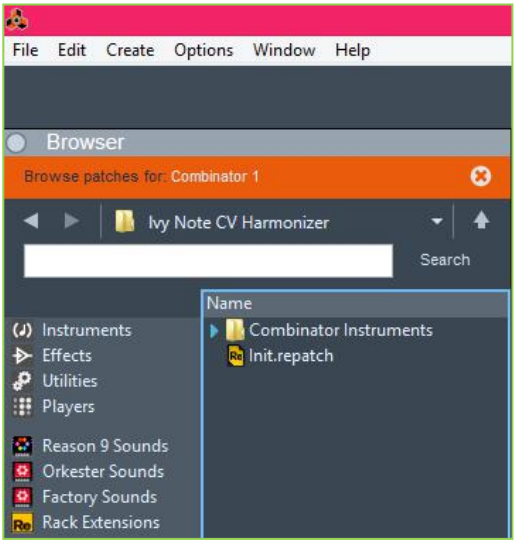
3) Load one of Ivy's preset patches from Reason's browser window

If you play some notes into the newly loaded combinator, you should hear some sound. If you do, you're good to go! If you don't, you may also need to connect your combinator to a new mix channel...

The following more tedious method ensures everything will be set up correctly:

1) Right click inside an empty space in the Reason rack, and select Create>Instruments>Rainwaves>Ivy Note CV Harmonizer. A new instance of Ivy will be created in the Rack.

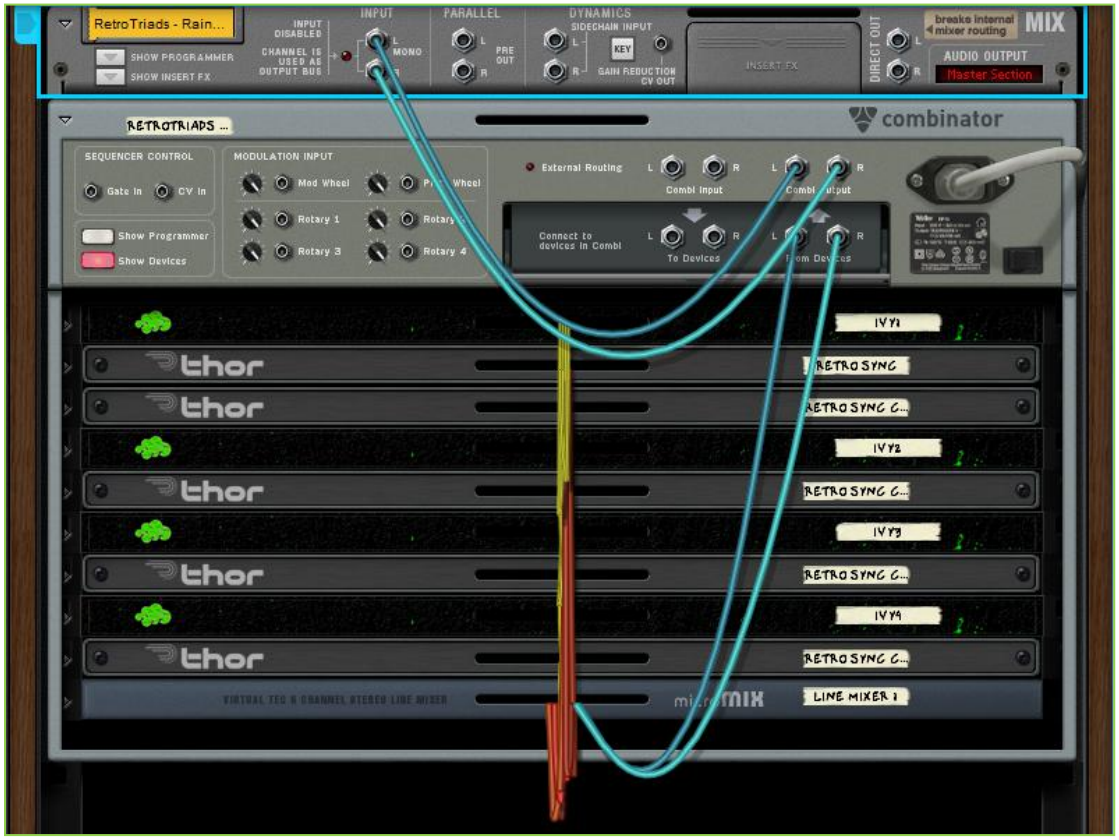
2) Use Ivys patch browser to select one of the included combinator instrument patches. You can find these patches by navigating to the 'Rack Extensions' folder in Reason's browser window.



Once you have chosen a patch inside the ‘Combinator Instruments folder, select ‘load’. You should now have a combinator in the rack instead of just an Ivy device.

3) Right click in the rack, select Create>Utilities>Reason Devices>Mix Chanel. This will create a new empty mix channel in the rack.

4) Press the ‘tab’ key on your computer keyboard to flip to the rear view of the rack. Connect the audio outputs of the combinator you created in step 2 to the audio inputs of the mix channel you created in step 3 with patch cords. Your patch cord routing should look like this:



5) Play some notes into the combinator. You’re good to go! Read on for details of Ivy’s controls and features…

CONTROLS AND FEATURES

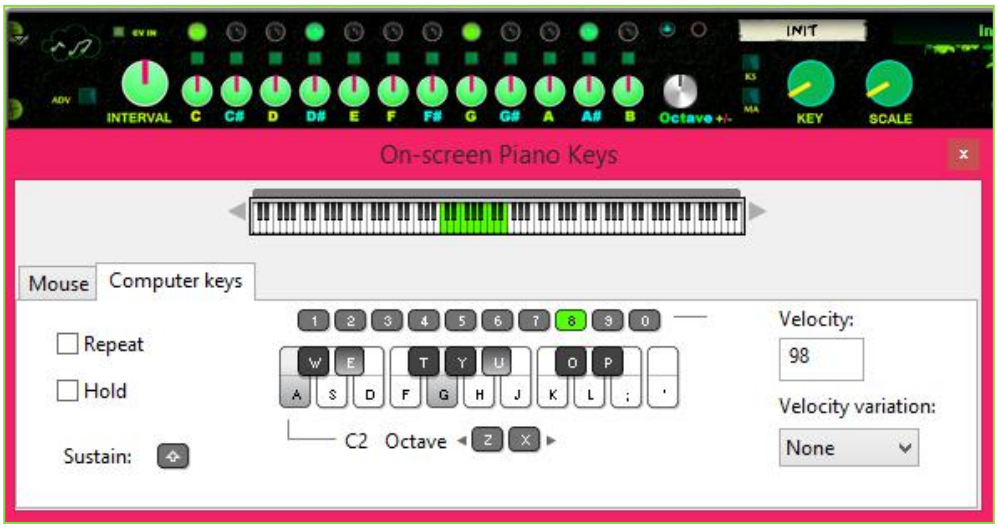
Note On Lamp

This lamp remains lit whenever Ivy is receiving any sustained note(s).

Chromatic Note On Lamp Display

These twelve note on lamps are used to identify which musical notes are currently being sustained. It can be extremely helpful to pay attention to these indicators when using the advanced interval controls and note mute switches.

You can see below how Ivy detects each individual note quickly, by using the On-screen Piano Keys in Reason. Note that in the image presented, the keys pressed down on the QWERTY keyboard correspond to specific note on lamps on Ivys GUI (those which are lit).



Mute Notes (12x Toggle Switches)

These switches simply block their respective musical notes at the input stage. This note blocking occurs BEFORE the harmony processing, which also prevents a harmony being generated from any muted notes received at the input.

Interval (Rotary)

This control is the most critical to understand in order to properly utilize the functionality of Ivy. The setting of this control determines the harmonizing interval to be applied to any notes received by Ivy.

Highlighting the rotary using a mouse cursor reveals a tooltip showing the current state of the control. The harmonizing interval determined by this rotary can be both an ascending or descending interval.

If the Key Sync toggle switch is set to disabled, this control offers an unrestricted (chromatic) range of interval settings. The available interval settings in 'Free' (un-synced) state are as follows: Unison, Minor 2nd, Major 2nd, Minor 3rd, Major 3rd, Perfect 4th, Diminished 5th, Perfect 5th, Minor 6th, Major 6th, Minor 7th, Major 7th, and Octave.

If the Key Sync toggle switch is set to enabled, this control offers a limited (diatonic)range of intervals. Each degree of the rotary in this case relates to each degree of the scale implied by the 'Key' and 'Scale' rotary settings.

Advanced Mode (Toggle Switch)

When this switch is enabled, the twelve advanced interval rotaries become active, allowing the user to set a unique harmonizing interval for each of the twelve musical notes. This disables the functions of the basic interval rotary.

Advanced Interval (12x Rotaries)

When advanced mode is enabled, these rotaries are used to select a unique harmonizing interval for each of the twelve musical notes - C, C#, D, D#, E, F, F#, G, G#, A, A#, B - whenever any of these notes are received as an input to Ivy.

For e.g, if Ivy receives the note ‘C’, the advanced interval rotary control which is furthest to the left would be used to set the harmonizing interval that Ivy will generate for this note, as well as any subsequent ‘C’ notes (of any octave) received as an input to Ivy. If Ivy then receives the note ‘A#’, the advanced interval rotary second furthest to the right would be required to set the harmonizing interval for this and any subsequent ‘A#’ notes.

Octave (Rotary)

The octave control shifts the octave (up or down) of all harmonizing notes generated by Ivy. This effectively changes the octave of every interval control simultaneously. Only the respective note outputs of the harmony CV Gate/Note pairs are affected by this control.

Key (Rotary)

Sets the root note of the scale to be used with the ‘Key Sync’ and ‘Mute Accidentals’ functionality.

Highlighting the rotary using a mouse cursor reveals a tooltip showing the current state of the control. The twelve states of this rotary are: C, C#, D, D#, E, F, F#, G, G#, A, A#, B.

Scale (Rotary)

The scale rotary allows the user to select a scale derived from the *major modes*. In conjunction with the ‘Key’ rotary, these set the scale to be used by the ‘Key Sync’ feature, as well as the ‘Mute Accidentals’ feature when either feature is enabled.

In most simple cases the user will not need to alter the scale rotary from the default (Ionian). Using the ‘Key’ rotary, whilst the ‘Scale’ rotary is set to Ionian, is to select the major key being used by Ivy. Setting the ‘Scale’ rotary to ‘Aeolian’ means the key setting will be minor instead of major.

Key Sync (Toggle Switch)

If the Key Sync toggle switch is set to disabled, Ivys interval controls offer an unrestricted (chromatic) range of interval settings.

If the Key Sync toggle switch is set to enabled, Ivys interval controls offer a limited (diatonic) range of intervals.

The musical scale which is used to determine Ivys available interval settings whilst the Key Sync toggle switch is enabled is controlled by both the 'Key' and 'Scale' rotaries.

Mute Accidentals (Toggle Switch)

When the Mute Accidentals toggle switch is enabled, Ivy filters out any notes in the input that are not in the selected key. This function can be active even when the Key Sync toggle switch is disabled.

An 'accidental', in music theory, is any note that is used in piece of music which does NOT belong to the key of the music.

Clear (Momentary Button)

Flushes Ivys note buffers, effectively resetting all notes to an off state.

Flashes red to indicate that buffers have been cleared.

This feature was originally used during the development of Ivy as a way of quickly releasing 'stuck notes' while testing Ivy. Whilst it is not to be expected that Ivy should encounter any problems causing its note functionality to stop responding properly, this secret button may just save the day under those circumstances.

The clear button was made automatable due to it being an effective means of 'ducking' all notes. This could be used or indeed abused…

Patch Browser

Allows saving and loading of both Ivy patches and combinator patches.
!TIP! Note that when loading combinator patches from Ivys patch browser, a Mix channel is required for the audio output of the combinator which is not automatically created. Loading Ivys combinator patches from a combinator patch browser typically speeds up work-flow in this regard.

--CV OUTPUTS--

Harmony CV Outputs

There are two pairs of harmony CV outputs (Gate/Note Pair 1 + Gate/Note Pair 2), both of which output the harmonizing notes generated by Ivy. At least one of these CV output Gate/Note pairs should be connected to the Gate/Note inputs of an arbitrary Reason instrument for Ivy to function properly.

Note that Gate/Note pairs 1 + 2 output identical CV signals i.e. Gate 1 and Gate 2 outputs are identical, and Note 1 and Note 2 outputs are identical.

CV Thru

This pair of Gate/Note output connections are used to output the same notes that Ivy receives at the input stage. This effectively is CV THRU, but its output can potentially be altered by enabling Ivys Note Mute switches and/or Mute Accidentals switch to filter out notes.

In the majority of combinator patches using Ivy, these outputs act like the lead melody output, with the harmony Gate/Note pair directly below acting as the harmony of the lead melody.

Connecting Ivy to Reason Devices

Ivy can be connected to one or several instruments simultaneously, depending on the intended use. In a majority of cases, it is expected that users will require Ivy be connected to at least two instrument devices. By its definition, 'harmony' is created when the relationship between two or more simultaneously sounding musical notes are played together. It is therefore logical to assume that where Ivy is used to generate musical harmonies, the user will wish to listen to two different sets of notes at once. Using Ivy to distribute both of these sets of notes (lead melody and harmony) to separate instruments is not only beneficial in keeping your project tidy and easy to follow, but actually can extend the functionality of the Reason rack significantly.

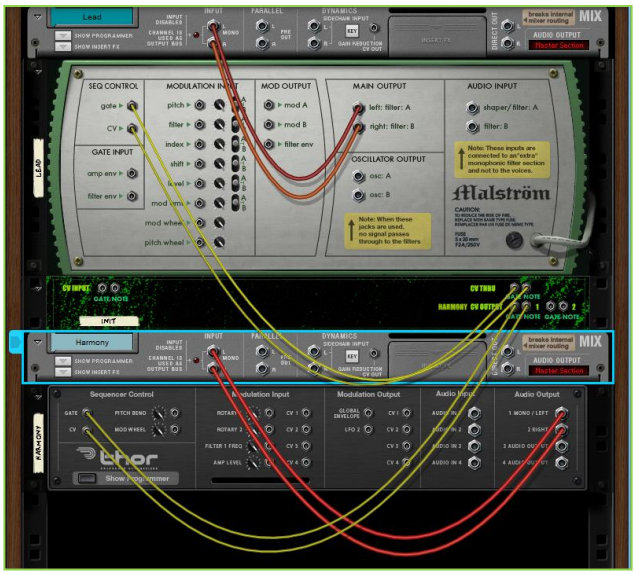
Ivys CV outputs are designed to allow for the routing of lead melody and harmony to separate Reason devices and/or Rack Extensions, unlike Players, which may only be used to distribute notes to one Reason instrument at a time. This means that in some cases Ivy should be connected to one other instrument device, and in others it should be connected to several instrument devices.

Connecting Ivy to Multiple Instrument Devices

1) Create any two instrument devices (e.g. Subtractor, Malstrom, Thor, NN-XT etc.) in the rack. Rename the first instrument 'Lead'. Rename the second instrument 'Harmony'.

2) Connect Ivys CV THRU Gate/Note output pair to the CV Gate/Note inputs of the first instrument.

3) Connect Ivys Harmony CV Gate/Note outputs to the CV Gate/Note inputs of the second instrument. Your device routing should look like this:



Why Use Multiple Instruments with Ivy?

Ivy distributes its input notes and its harmony generated from the note input via separate CV output connections. In many cases it is expected that users will require two instrument devices two connect to Ivy. This will largely depend on the specific needs of the user. In any case, this functionality is intended to allow for extended functionality in the Reason rack. In particular, users can now experiment with multi-timbral variance in polyphonic musical parts, by using Ivy to distribute notes to several instruments at once, where those instruments are creating differing sounds. Aside from the advantages of multi-timbral harmony, it may also be useful to use multiple instrument devices with Ivy due to some Reason instrument patches being monophonic leads. Monophonic synthesizer patches can only play a single note at a time, so in order to have these patches harmonize

with each other, it is necessary to create several instances of those devices. Whilst it is possible to merely increase the number of polyphonic voices available on most Reason synthesizers, this in turn affects monophonic note re-triggering behaviours, in some cases.

Connecting Ivy to a Single Instrument Device

In some cases, it will only be necessary to connect Ivy to a single instrument. Two logical reasons for doing this are suggested…

The first would be a scenario where the user wishes to use Ivy to generate a harmony, and send those harmony notes to an instrument device in the rack. If the lead melody notes being sent to Ivy are already being played by another instrument in Reason, it would be unnecessary to use Ivy to redistribute those notes to another instrument; the result would be two instruments playing the same set of notes, and one instrument playing the harmony notes.

The second reason one might wish to connect Ivy to only one device would be to use Ivys CV Thru output only. Although at first this may appear to be pointless, Ivys 'Mute Note' switches and 'Mute Accidentals' features actively affect the CV THRU output signal, therefore Ivy could be utilized as a CV note filter if only the CV Thru outputs are used.

--CV INPUTS--

Standard CV Input Gate/Note pair. Can be used as a way of sending notes to Ivy.

!IMPORTANT! - Ivy will only receive notes from this input if the 'CV In' toggle switch on the front panel is enabled. This also disables any other note sources.

CV In (Toggle Switch)

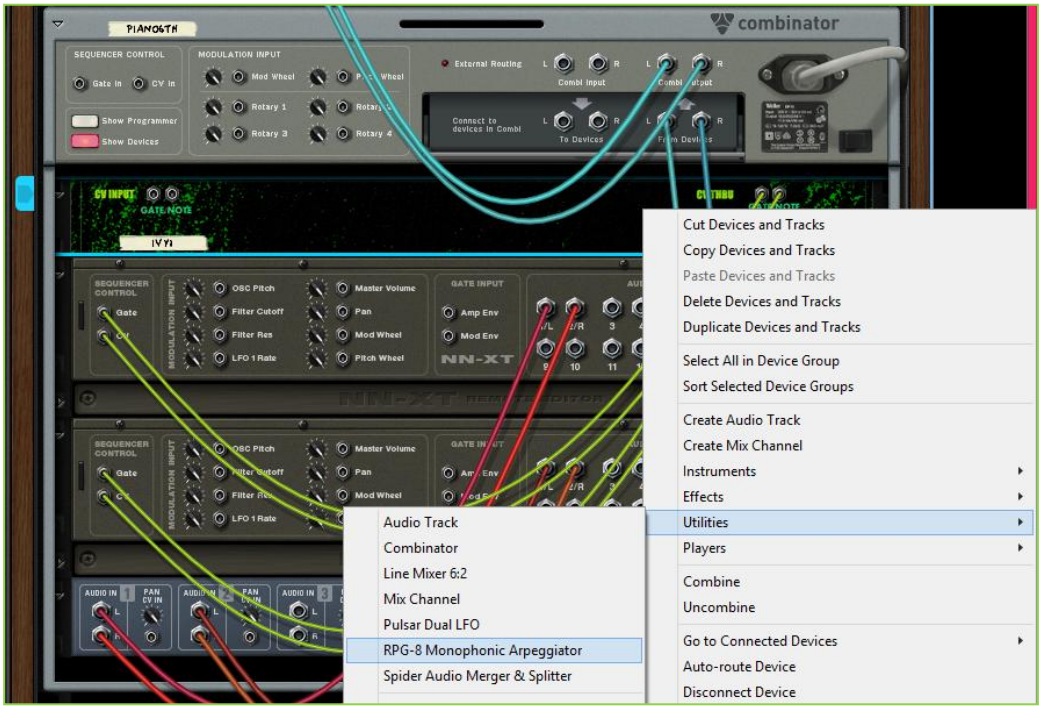
This switch effectively selects the note input source for Ivy. If disabled, Ivy receives notes from the Reason sequencer, the on screen piano, combinators, and MIDI controllers. If enabled, Ivy receives notes from the Gate/Note CV input pair, found on the rear panel of the device.

Adding Players to Ivy

Ivy is formatted as an Instrument type device in Reason. This allows Ivy to receive notes from Player devices in Reason. To add a Player device simply click on Ivy to select it (a light blue border box appears around the selected device), then right click on Ivy, and select Create>Players>[PLAYER DEVICE OF YOUR CHOICE].

Using Other Note CV devices with Ivy

CV Input devices such as Reasons RPG-8 Monophonic Arpeggiator can automatically connect to Ivys CV inputs. To add a device such as RPG-8, click on Ivy in the Reason rack to select it, then select Create>Utilities>RPG-8 Monophonic Arpeggiator.



You should now see two patch cords appear in Ivys note CV inputs, that are connected to RPG-8s note CV outputs. If this does not happen automatically, or if you are attempting to use another Rack Extension instead of an RPG-8, you may need to add these patch cords manually. The routing should look like this :

BUILDING COMBINATORS

A method for building basic combinator patch featuring Ivy is as follows. As an example we will build the 'Piano 6th' combinator patch, which is included in Ivy's default patch library.

Firstly it is necessarily to create some devices in the rack. As a tip, it is a good idea to hold the 'shift' key when creating new devices (hold the key when clicking the device name in the Create menu). This will ensure that the newly created device does not automatically connect to any other devices in the same rack space. ***This tutorial will be easier to follow if you don't have to unplug anything that you didn't set up yourself!***

So let's create the devices we need. This will include two arbitrary instrument devices, a line mixer, a mix channel, and an Ivy Note CV harmonizer.

1) Right click inside the Reason rack to open the menu, and create a new instrument of your choice by selecting Create>Instruments>[INSTRUMENT OF YOUR CHOICE]. For this example, let's assume we have chosen an NN-XT Advanced Sampler.

2)Repeat step 1, with a second instrument of your choice. You may still choose the same instrument as you chose before. Again for the example, let's assume we have created a second NN-XT.

3) Next, create an Ivy by right clicking in the rack and selecting Create>Instruments>Rainwaves>Ivy Note CV Harmonizer.

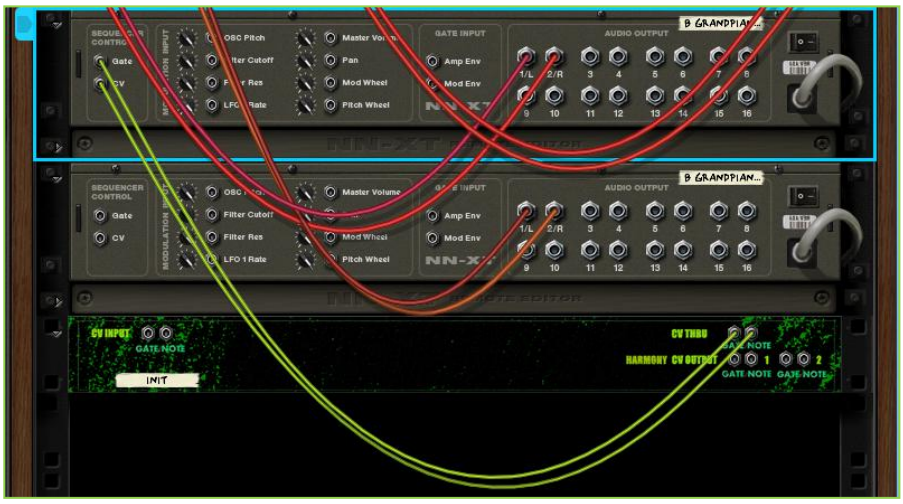
4)Create a line mixer and a mix channel. Both the line mixer and mix channel devices can be found in the menu under Create>Utilities>Reason Devices.

Now we have the devices we need, let's connect them up:

5) Press the 'Tab' key to flip the Reason rack to rear panel view. Connect the stereo outputs from the two NN-XTs (or your own instrument devices of choice) to the first two line mixer channels.

6) Connect the stereo output of the line mixer to the inputs of the mix channel.

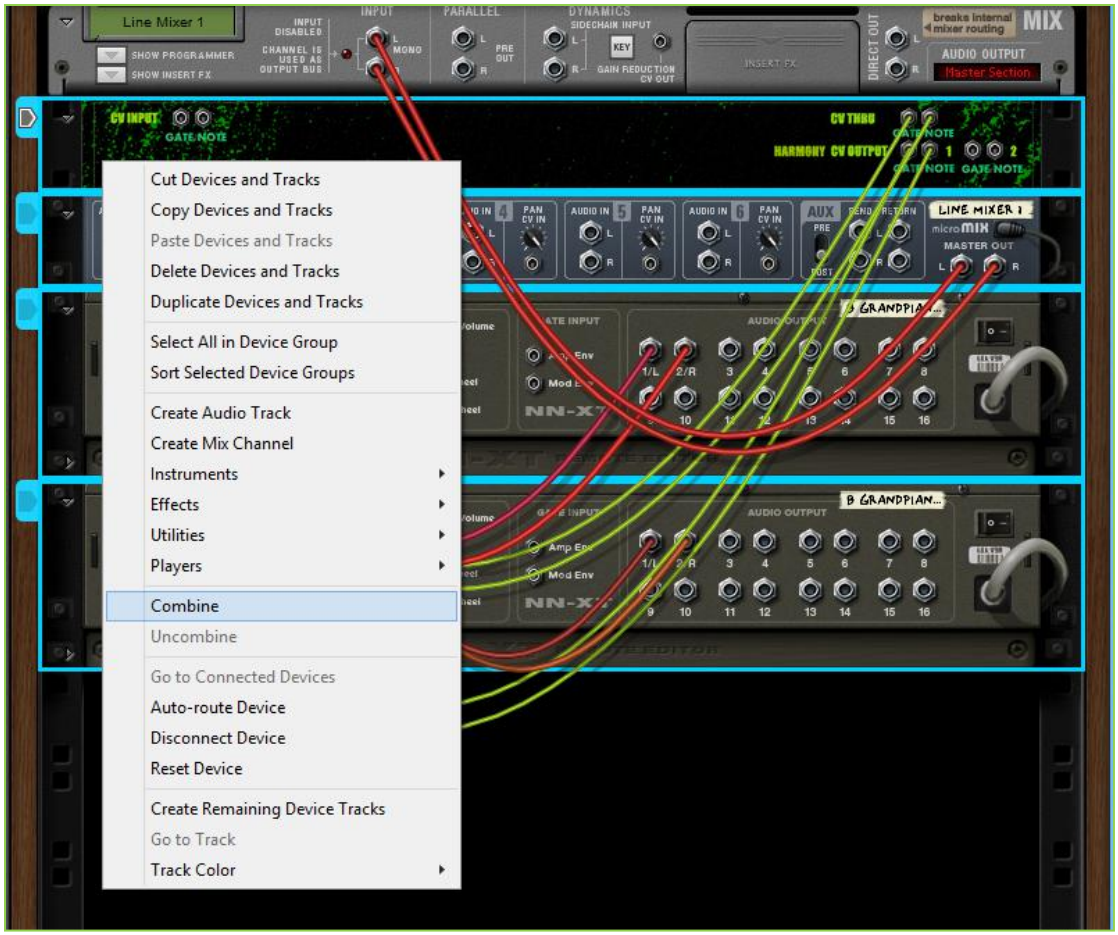
7) Connect the CV THRU gate and note outputs of the Ivy to the gate and note inputs of the first NN-XT.



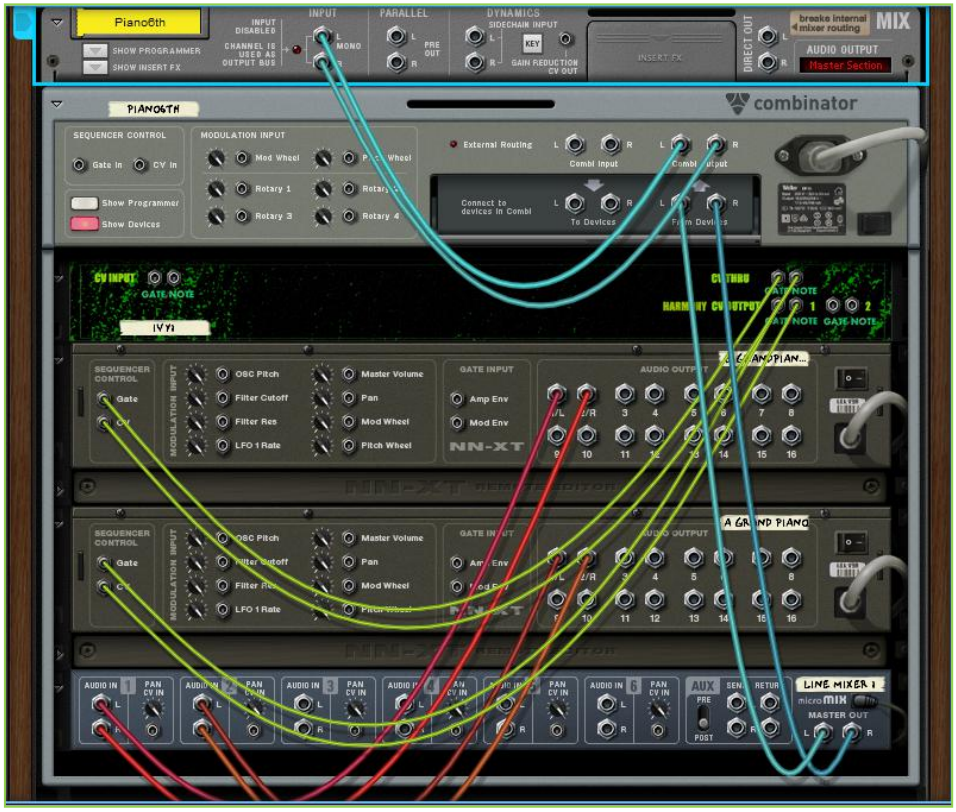
8) Connect the Harmony CV gate and note outputs of the Ivy to the gate and note inputs of the second NN-XT. Note that Ivy has two sets of Harmony gate/note outputs. Both pairs output identical CV signals to one another. In this example we will use the first pair for the sake of obsessive neatness…

Now we have our devices chained together correctly, they should look like this. You can of course stack your devices in any order you prefer.

9) Now we have to combine our devices. This is easily done. Press and keep holding the ‘ctrl’ key down and click once on both NN-XTs, the line mixer, and the Ivy Rack Extension. Once all the devices are selected, right click on any of the devices, and select ‘Combine’ from the menu. This will place all of our selected devices inside a new combinator.



The routing of all our devices should now look like this:



10) Press the 'tab' key to flip the Reason rack back to front panel view. Your combinator device should now look something like this:

11) It's very important to be aware of how notes are being distributed among our devices. If we play some notes into our new combinator, in most cases we will want the combinator to send notes to the Ivy device, and then subsequently, the Ivy sends two different sets of notes to the two different NXXTs respectively. In many cases when building combinators, the combinator will automatically be set up by Reason to send notes to every instrument type device that it contains. To ensure this is not happening in our patch, click 'Show Programmer' on the combinator. Each device inside the combinator is shown in a list. Simply ensure that the 'Receive Notes' checkbox is only ticked for Ivy, and is left blank for both NXXTs.

12) Navigate to the Ivy device inside the combinator. Enable the Key Sync toggle switch, and then set the large interval rotary to '+6th'. This means that the second NN-XT will now receive notes that are a 6th above the original notes being played. Ensuring that our combinator device is the active input device, try playing some notes. ***If you can hear a harmonizing piano, mission accomplished!***

You can spend some time using the combinator programmer to set up the combinator rotaries or buttons. In this example patch, we have mapped Rotary 1 to the Ivy's Key rotary, Rotary 2 to Ivy's Scale rotary, Rotary 3 to Line mixer channel 1's pan (which is our lead melody pan), and Rotary 4 to Line mixer channel 2's pan (which is our harmony pan).

The finished patch should look something like this:

!TIP! Try changing the patch on an NN-XT to create multi-timbral harmonies! The preset Piano 6th patch included in Ivys patch bank uses different piano patches on each NN-XT device.

AUTOMATION

All of Ivys controls are can be automated in the Reason sequencer, with the exception of the CV In toggle switch. Simply right click on the control you wish to automate, and select 'edit automation' from the menu that appears. This will create a new automation lane in the Reason sequencer for the control.

!TIP! Automating interval controls re-triggers new notes!

MIDI CC REFERENCE

All of the 'Interval' rotaries on Ivys user interface are switchable between 'synced' and 'free' states via the 'Key Sync toggle switch. As such these states have their own independent mappings. When creating automation for Ivys 'Interval' rotaries, it is helpful to remember that if the 'Key Sync' state of Ivy is changed, this will effectively disable automation of the rotary. The solution is simply to create a second automation lane for the new state of the control.

[14] = Interval Rotary (Synced)
[15] = Interval Rotary (Free)
[16] = Advanced Interval Rotary C (Synced)
[17] = Advanced Interval Rotary C# (Synced)
[18] = Advanced Interval Rotary D (Synced)
[19] = Advanced Interval Rotary D# (Synced)
[20] = Advanced Interval Rotary E (Synced)
[21] = Advanced Interval Rotary F (Synced)
[22] = Advanced Interval Rotary F# (Synced)
[23] = Advanced Interval Rotary G (Synced)
[24] = Advanced Interval Rotary G# (Synced)
[25] = Advanced Interval Rotary A (Synced)
[26] = Advanced Interval Rotary A# (Synced)
[27] = Advanced Interval Rotary B (Synced)

[39] = Advanced Interval Rotary C (Free)
[40] = Advanced Interval Rotary C# (Free)
[41] = Advanced Interval Rotary D (Free)
[42] = Advanced Interval Rotary D# (Free)
[43] = Advanced Interval Rotary E (Free)
[44] = Advanced Interval Rotary F (Free)
[45] = Advanced Interval Rotary F# (Free)
[46] = Advanced Interval Rotary G (Free)
[47] = Advanced Interval Rotary G# (Free)
[48] = Advanced Interval Rotary A (Free)
[49] = Advanced Interval Rotary A# (Free)
[50] = Advanced Interval Rotary B (Free)
[51] = Advanced Mode Toggle Switch
[52] = Clear [NOT INTENDED FOR USE WITH MIDI CC]
[53] = Key Sync Toggle Switch
[54] = Key Rotary
[55] = Scale Rotary
[56] = Mute Accidentals Toggle Switch
[57] = Mute Notes Toggle Switch C
[58] = Mute Notes Toggle Switch C#
[59] = Mute Notes Toggle Switch D
[60] = Mute Notes Toggle Switch D#
[61] = Mute Notes Toggle Switch E
[62] = Mute Notes Toggle Switch F
[63] = Mute Notes Toggle Switch F#
[64] = [UNUSED]
[65] = Mute Notes Toggle Switch G
[66] = Mute Notes Toggle Switch G#
[67] = Mute Notes Toggle Switch A
[68] = Mute Notes Toggle Switch A#
[69] = Mute Notes Toggle Switch B
[70] = Octave Rotary

POLYPHONY

Ivy works with both monophonic and polyphonic note inputs. In the latter case, Ivy exhibits minor polyphonic limitations in accordance with Reason's control voltage (CV) standard. Fully polyphonic note information cannot be transmitted via control voltage, meaning that when several notes are sustained when sending notes via the CV protocol, none of the sustaining notes can be re-triggered until either a new note is triggered, or the sustained notes are all released.

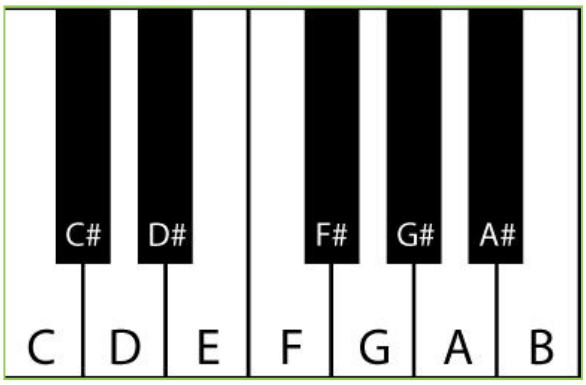
When receiving notes directly as opposed to the CV Inputs on Ivys rear panel, the polyphonic behaviour is more effective in preventing dropped notes, though this difference may be negligible.

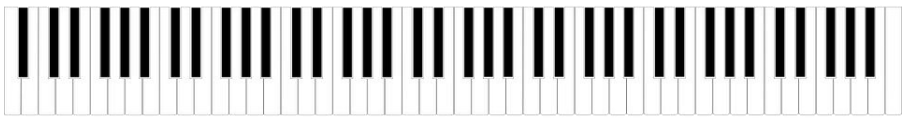
MUSIC THEORY FOR IVY

As many Reason users may be unfamiliar with music theory concepts, some basic terminology which is essential to understand in order to properly utilize Ivys functionality is explained here.

Notes

In Western music theory there are twelve notes in total. These are C, C#, D, D#, E, F, F#, G, G#, A, A#, B. On physical pianos or keyboard based instruments, these twelve notes are represented as a sequence of white and black keys, that is then repeated some number of octaves across the range of the keyboard.





Semi-tone

A semi-tone is the name given to a distance in pitch of one note. For example, clicking on a MIDI note in the Reason sequencer reveals the properties of that note at the top of the sequencer. By changing the pitch of the note by one step (either up or down), that note is being shifted up or down by one semi-tone.

Tone

A tone is the name given to a distance in pitch of two notes. It is simply the distance in pitch that its double the size of a semi-tone.

Octave

An octave is the name given to a distance in pitch of twelve notes. An octave is equivalent to twelve semi-tones, or six tones.

An octave is also the name given to the result of doubling or halving a frequency.

By shifting a note by one octave, the new note is the same as the previous note in terms of it's name, for e.g. by shifting the note 'A' by one octave, the new note will also be called 'A'. Assuming the frequency of the first note 'A 'is 440Hz, by shifting this note upwards by one octave, the new note 'A' will have a frequency of 880Hz. Likewise, by shifting the 440Hz note 'A' downwards by one octave, the new note 'A' will have a frequency of 220Hz.

Key

A musical key is simply a collection of notes that are used in a piece of music. An example of a key is C Major. The key of C Major includes the notes C,D,E,F,G,A, and B. These notes happen to be all the white keys on standard musical keyboards.

Note that in some contextual cases, this manual also uses the word 'key' to signify the physical keys on piano and keyboard based musical instruments.

Accidental

An 'accidental' in music theory is any note that is played in a piece of music which does NOT belong to the key of that piece of music. If for e.g. a piece of music is written in the key of C Major, then that piece would use the notes C,D,E,F,G,A, and B; these notes are said to 'belong' to the key.

The remaining notes that exist are C#,D#,F#,G#, and A#. Incidentally, these notes are all the black keys on standard musical keyboards. If any of these notes were to be played in our piece of music, they would be considered 'accidentals'.

Accidentals are relevant to using Ivy, because when Ivy is synced to a musical key, accidentals can be automatically blocked by enabling the 'Mute Accidentals' toggle switch.

Scale

A scale is a linear sequence of musical notes (usually the notes of a musical key played in order). There are literally thousands of scales that exist, however, the majority of music uses a small number of popular scales, such as the **major scale** (also known as Ionian mode), and the **natrual minor scale** (also known as Aeolian mode).

The major scale based on any given '**root note**' has the formula (**+T,+T,+S,+T,+T,+T,+S**), where 'T' means 'Tone', and 'S' means 'Semi-tone'. For example, if the root note for this scale was 'C', the

scale would be called 'the **C major scale**', and would have the notes C,D,E,F,G,A,B; the scale would also end on the note 'C' (an octave higher than the first note/root note of the scale). Breaking this down a little further, by starting on the root note 'C', we first move up by one tone (according to the formula), which gives us the note 'D'. Remember that a 'tone' means a shift by two notes, so we are moving from 'C' to 'C#', and then from 'C#' to 'D' in order to make a leap of one tone. Next we move up a tone from 'D' to 'E'. Next our formula specifies that we must move up to our next note by a semi-tone. We therefore step up from 'E' to 'F'. **(*Now is probably a good time to mention - there is no such note as E# or E sharp! Same goes for B# - NO SUCH THING! Yeah, music theory is kinda weird…*)**

By continuing to follow the above formula, we eventually produce all the notes of the C major scale. The final semi-tone shift in the formula moves us from 'B' to 'C'.

Interval

Intervals are perhaps the most important concept to understand, in order to using the Ivy - Note CV Harmonizer. In music theory, an interval is a special name for the distance (in pitch) between two notes. There are two types of intervals: they are **harmonic intervals** (two notes played simultaneously), and **melodic intervals**(two notes played one after the other). Ivy is designed to create harmonic intervals. A harmonic interval can simply be thought of as a ***two note chord***.

Intervals have special names. An example of an interval is the '***major 2nd'***; this is equivalent to a distance of 2 semi-tones. This means that for example, by playing the note 'C' and the note 'D' simultaneously, we are playing a major 2nd interval. The **'minor 2nd'** is also the name given to an interval, which is equivalent to a distance in pitch of 1 semi-tone. Try not to worry too much about the special names used to describe intervals; **just remember that any interval can simply be thought of as a distance in pitch between two notes, described by an arbitrary number of semi-tones.**

A full list of the intervals used by Ivy are as follows:

Unison = No difference in pitch; two voices playing the same note)
Minor 2nd = 1 semi-tone
Major 2nd = 2 semi-tones
Minor 3rd = 3 semi-tones
Major 3rd = 4 semi-tones
Perfect 4th = 5 semi-tones
Augmented 4th/Diminished 5th = 6 semi-tones
Perfect 5th = 7 semi-tones
Minor 6th = 8 semi-tones
Major 6th = 9 semi-tones
Minor 7th = 10 semi-tones
Major 7th = 11 semi-tones
Octave = 12 semi-tones

Hovering over Ivy's Interval rotary controls reveals the current interval state for that control. So, whatever setting you choose on the interval control will generate a note which is a certain number of semi-tones apart from the input note. Using the advanced interval rotaries allows the user to select a unique harmonizing interval for each of the twelve musical notes.

Unison

Unison is the name given to two or several musical voices playing the same pitch. It is also the name given to the musical interval which has no pitch difference. The proper musical term for this interval is 'Perfect Unison'. Ivy's 'Interval' rotary controls are set to 'Unison' by default, meaning the

harmony CV outputs and the lead line (CV Thru) outputs are identical in this state.

Harmony

Harmony is the name given to two or more musical voices which are playing different notes, but where the pitches of those notes are musically significant ratios of one another.

Modes

Modes are the permutations of a scale. For example, the seven modes of the C Major scale, which uses the seven notes C,D,E,F,G,A,B are:

C Ionian = C,D,E,F,G,A,B
D Dorian = D,E,F,G,A,B,C
E Phrygian = E,F,G,A,B,C,D
F Lydian = F,G,A,B,C,D,E
G Mixolydian =G,A,B,C,D,E,F
A Aeolian = A,B,C,D,E,F,G
B Locrian = B,C,D,E,F,G,A

It can be seen that each of the modes is merely the same scale merely in a different starting order. It is also worthwhile to note that this shows how the major scale (Ionian mode) can share exactly the same notes as a minor scale (Aeolian) mode. In this example, C Ionian (C major) shares the same collection of notes as A Aeolian (A natural minor). This is a musical concept known as '**relative major**' and '**relative minor**' keys. The relative minor key of C major is A minor, and the relative major key of A minor is C major. The relative minor key of a major key is simply calculated by subtracting three semi-tones from the root note of the major key. In this example, we have descended in notes from 'C', to 'B', to 'A#', to 'A'.

The theory of using modes in music is slightly more abstract than the other concepts covered in this short music theory guide, and is definitely beyond the scope of a user manual. That said, it's really nothing to worry about.

If you are unsure, it's best to leave Ivy's 'Scale' rotary control (which allows the user to select one of these modes) set to the default which is Ionian (The major scale), and use the 'Key' rotary to select the root note for the major key you want to be in.

AKNOWLEDGEMENTS

A special thank you goes out to Matt at LabOne Recordings.

Special thanks are also owed to Chip, Paul Brooks, and Stu Gorman at WCS.

A final special thank you goes out to Dr David Moore of GCU.

Thanks to Jennie Stephenson for drawing up the Rainwaves logo designs.

Thank you to the Propellerhead team for all the hard work on the RE format.

A shout out to all the RE devs helping out on the boards.

Thank you to all the Ivy beta testers and patch designers.

Until next time, **stay tuned…**
(no pun intended)