



# QUICK INDEX

**SETTINGS** (Page 9)

**PRESET MENU** (Page 10)

**VOLUME** (Page 8)

**VCO SECTION**  
VCO  
VCO-MOD  
(Page 17)

**PRESET MANAGER** (Page 10)

**VCF SECTION**  
VCF  
VCF-MOD  
(Page 21)

**GLIDE** (Page 19)

**CASCADE SECTION**  
CASCADE  
CASC-MOD  
(Page 13)

**LFO SECTION**  
LFO  
LFO-MOD  
(Page 20)

**KEYBOARD SECTION** (Page 26)

**ENVELOPE SECTION**  
ENV-1  
ENV-2  
(Page 23)

**DRIVE** (Page 16)

The image shows a detailed view of the Cascade synthesizer's control panel. At the top, the 'CASCADE' logo is on the left, and a 'Polar Express' preset name is in the center. To the right, there's a volume knob and a digital display showing '112 dB'. Below this are several sections: VCO-1 and VCO-2 with wave, shape, semi, cents, and mix controls; VCF with type, cut, and resonance controls; LFO with early, late, rate, wave, and phase controls; ENV-1 and ENV-2 with curve, attack, decay, sustain, release, and velocity controls; CASCADE with wet, render, dens, spread, size, gain, type, freeze, time, wind, and width controls; and CASC-MOD with LFO, ENV-2, and N.DEL controls. At the bottom, there's a keyboard interface with a 'DRIVE' knob and 'VOICES 1 / 4 SUSTAIN' indicator. Red arrows point from text labels to specific knobs and buttons in each section.

## INTRODUCING...

So you thought that everything that could be done in the field of synthesizers had been done already? Time to wake up from your hibernation. With Cascade we give you a completely new form of synthesis to play with, creating sounds you could never create before.

Cascade synthesis is based on a complex delay network that can densify a sound up to 5832 times. That doesn't mean however that a sound you create with cascade will per definition sound 'denser'. It can also be more lush and spacious, depending on the settings you choose. Play around a bit with the presets, and you will know what we mean. What makes Cascade really unique however is that a sound can develop over time, adding extra dimensions to it. And moreover: that you can select the most interesting part of this development process as the part you want to hear. The presets will give you a good idea of what Cascade is capable of. But don't let yourself be limited by our suggestions. Let your creativity flow, and create your own mysterious soundscapes, dense orchestral sounds, or otherworldly strings. Or something more 'industrial' or 'ambient' if that's what you are after.

THERE IS NO SUCH THING AS A NEW IDEA...

*By condensation successive events are transformed into the simultaneity of a spectrum. A succession of sounds as an input turns into a color of sound as an output. (Peter Ablinger, 1997)*

The making of Cascade was inspired by the work of Austrian composer Peter Ablinger. He experimented in the late 1980's with sound densification using 12 tape decks. Sound was recorded and played, recorded and played, and so on, until colored static noise itself was the result. In 1993-94 Peter Ablinger's concept of sound densification was refined by Peter Böhm, Wolfgang Musil (ELAK, University of Music and Performing Arts, Vienna) and Thomas Musil (IEM, Institute of Electronic Music and Acoustics, Graz). Thanks to the IRCAM Signal Processing Workstation (ISPW), that contained an at the time incredible powerful audio processor could for the first time sound densification be achieved in real time.

We took those early concepts to the next level: an actual synthesizer that can 'condense sounds in time'. The output of Cascade shows only a marginal resemblance to those revolutionary sound experiments though. The sound variation in a synthesizer however is far more subtle than the different sounds played by for example a violin. A synthesizer has no obvious 'successive events'. You must create them by skillfully adjusting the envelope or the LFO. Luckily our aim wasn't to replicate. Colored static noise wasn't really what we were after. What we wanted was to take this intriguing concept to the realm of synthesis to open up a complete new sonic territory. In our opinion it's precisely the subtlety that makes sound densification such an interesting addition to the modern sound repertoire. And of course, we couldn't resist the temptation to add 'a little spice', most importantly the possibility to modulate the cascade synthesis itself. This makes it possible to create sounds with a unique character. If you want to compare it to something anyway, we would say: a super fat chorus ensemble.

# INSTALLATION

Cascade comes in the form of a single installer for all available plugin formats: AAX, VST, and Audio Units.

## MAC OS X

1. If you have not already done so, please download and run the latest Cascade installer from [112dB.com/download](http://112dB.com/download). Double click the icon to mount it. A window similar to the one shown appears.

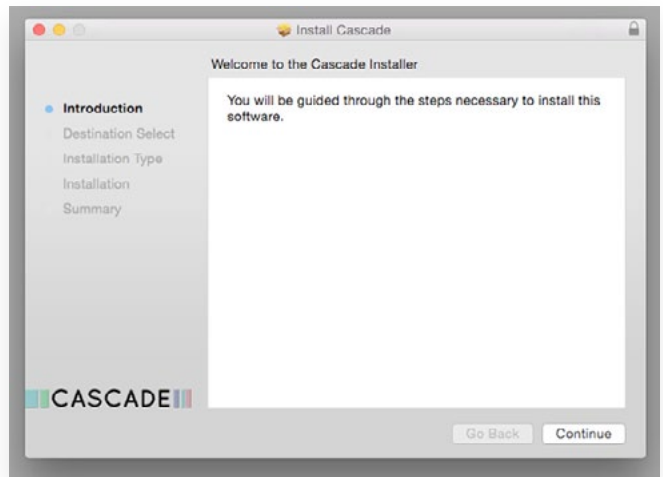
2. By default Cascade installs to your system drive. In general, it is not recommended to change this but if you have a compelling reason to do so, you may select a different disk during the installation setup. (step 2 "Destination Select")

3. The installer detects whether you already have VST, AU or AAX plugins on your system and selects the plugin formats it installs accordingly. If you wish you may override this choice and manually select your desired plugin formats during step 3 of the installation set up: "Installation Type".

4. You may be prompted for your Mac password to complete the installation.

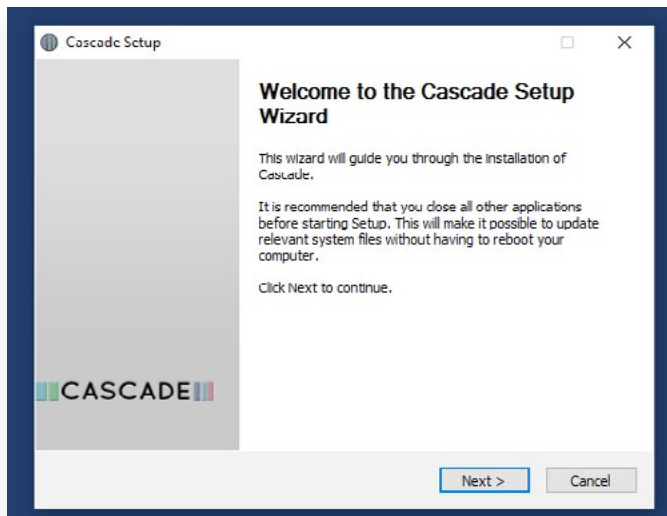
5. It is recommended to view the readme if this is a new installation or an update, as it may contain important last-minute information that was not available at the time of writing.

6. After the installation finishes you may safely eject the disk image.



## WINDOWS

1. If you have not already done so, please download and run the latest Cascade installer from [112dB.com/download](http://112dB.com/download). Double click the Cascade Installer to run the setup program .
2. The setup program detects whether you already have VST or AAX plugins on your system and selects the plugin formats it installs accordingly. If you wish you may override this choice and manually select your desired plugin formats during step 3 of the installation set up: "Components".
3. By default Cascade installs to \ Program Files\112dB\Cascade. In general, it is not recommended to change this but if you have a compelling reason to do so, either type in the desired directory in the Destination Folder box, or click on the Browse button and select the directory within which you would like Cascade installed.
4. If you opted to install the VST plugin, the Choose VST Location step is one you should pay attention to. The setup program should detect your default plugin folder, but you may prefer another directory for your plugins – particularly if you use multiple hosts – in which case you will need to manually direct the installer to the desired directory. The process for this is identical to that in the previous step.
5. The Start Menu Folder step is for convenience and for quick access to troubleshooting files (Windows 7 only). Currently, it points to the readme, the error log, the license agreement, this manual, and the uninstaller. It should be noted that all of these files are directly accessible in the Cascade program folder (wherever the installer was directed in Step 3). In addition the uninstaller for Cascade will be listed under Control Panel » Add/Remove Programs, so if you like to keep your start menu clean, you can safely select Do Not Create Shortcuts.
6. After Cascade installs, Setup is complete and you may click the Finish button. It is recommended to view the readme if this is a new installation or an update, as it may contain important last-minute information that was not available at the time of writing.



# AUTHORIZATION

With your purchase or demo download you should have received an email containing a keyfile (in the form of an XML-document). To authorize, save the keyfile to your computer, fire up your preferred host, and load Cascade. The plugin now notifies you: 'Authorization required'. Drag and drop your license file on this window to activate Cascade. Or alternatively select the checkbox 'locate license file'. Navigate to the folder where you saved the keyfile, select it, and click 'Open'. Cascade is now fully functional.

Please note that you need to be connected to the internet to install Cascade. Should you encounter any problems during the authorization process please contact our support staff via email at <support@112dB.com>. We will accommodate you as soon as humanly possible.

## FROM DEMO TO PERMANENT LICENSE

To upgrade your authorization from a time-limited demo to a purchased full license, first save the permanent XML license from your purchase confirmation email to your computer. To replace the demo license with the permanent license, open a Cascade plugin window in your favorite host. Click on the cogwheel icon at the top to open the Settings window. Check 'Reset Authorization'. Cascade will ask you to relaunch your host. After you have done so, open Cascade again. You will see a window that says: 'Authorization required'.

Drag and drop your license file on it to activate Cascade. Or alternatively check 'locate license file' in the window. Navigate to the folder where you saved the keyfile, select it, and click 'Open'.

## INSTALLING ON MULTIPLE COMPUTERS

You can use the Cascade keyfile to authorize the plugin multiple times. This way you can install and use the plugin on your studio setup, your home computer, and your travel notebook at the same time. We have built in one limitation though: the number of installs that can be done with one keyfile is restricted to 5 in 3 years. If you for some reason need more installs, simply request them by sending an email to <support@112dB.com> stating the reason for your request.

The Cascade interface has been designed to be as intuitive and easy to operate as possible. However, in the interest of innovation, some functions operate in ways that may be initially unfamiliar. This section will cover the less obvious aspects of the interface.

## TOOLTIPS

If you're lost, hovering over any item of the interface for approximately one second brings up a floating tooltip window with a brief description of that control's function. If you no longer wish to receive these tooltips you can disable this function. Uncheck 'show tooltips' in the Settings menu (the cogwheel at the top).



## NUMERICAL VALUE ENTRY

For maximal value control there is a small edit window below every knob that allows you to type in the desired value from the keyboard. Simply double-click on the window to edit the value.

## KEYBOARD ONLY

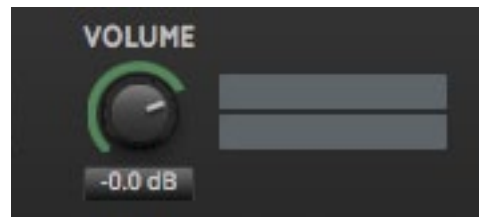
Clicking the keyboard icon in the header collapses Cascade: only the keyboard will be shown.

## RESET TO DEFAULT VALUE

<Ctrl>-clicking knobs and sliders will reset them to their default value. This is handy if you would like to undo some programming you have done.

## VOLUME

The volume knob at the top allows you to adjust the volume per preset.



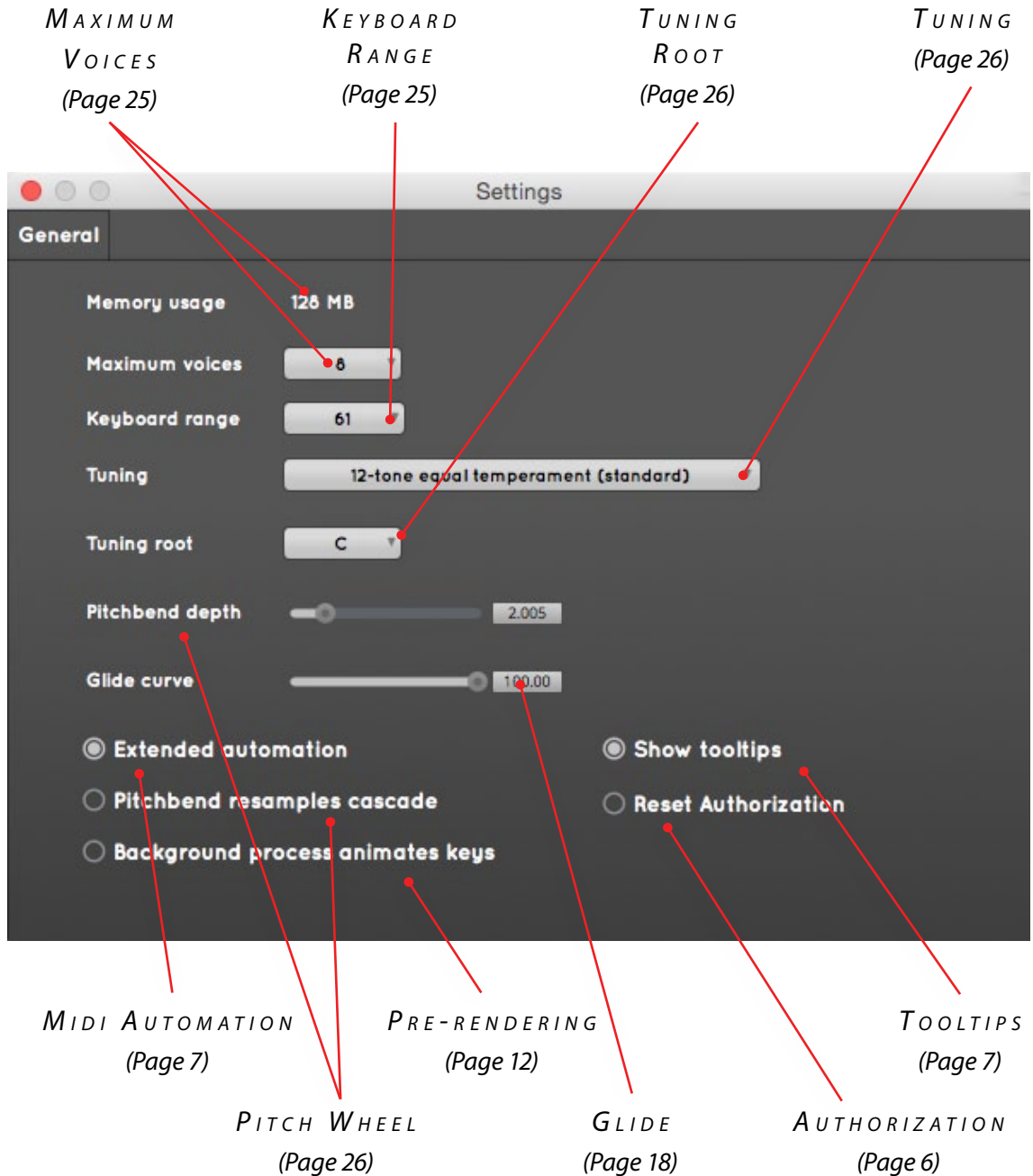
## MIDI AUTOMATION

You can turn on midi automation by selecting 'Extended automation' in the Settings Menu (the cog wheel at the top). Right-click on the knob you would like to automate, then turn the knob of the controller you'd like to move this knob with. Do you want to detach the knobs again? Right (ctrl)-click on the knob, and choose: 'Detach from midi automation'



# SETTINGS

Clicking on the cog wheel at the top will open the Settings Menu. Here you find global preferences or functions that you most likely will use only once or twice. They are explained in the different sections that are associated with it.



# PRESETS

If you are like us, the first thing you probably will do after you opened Cascade, is play around a bit with the presets. For quick access to presets there's the **preset menu**: a drop-down list of presets you can scroll through. Or alternatively use the arrows next to it to move one preset up or down. When you open Cascade for the first time the drop down menu will list our favorites: a selection we made from all presets available. A complete list of presets can be found in the



**preset manager** (the icon at the left of the drop-down menu)

At the left you see the preset folders, at the right the presets they contain. Click on the folder to see its contents. Double clicking a preset name will load the preset,

If you want to change the presets that will be shown in the preset menu, click on a specific folder. You will now see all the presets this folder contains in the drop down list. In other words: if you want to make a specific playlist that you would like to have quick access to, put all those presets in one folder.

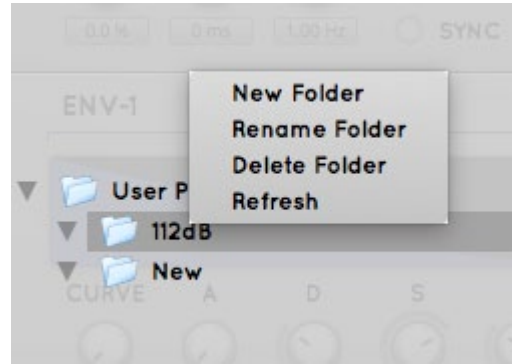
## ORGANIZING PRESETS

Right (ctrl)-clicking on the User Presets folder allows you to add new folders. These new folders you can organize any way you like. You can give them subfolders (**new folder**). Delete them again (**delete folder**). Or give them a different name (**rename folder**).

If you moved a folder on your hard drive, or added or delete some presets there, **refresh** will update the presets in the preset manager accordingly.

Want to move a preset to a different folder? Simply drag and drop the preset to the folder of your choosing.

If you want to change the location of your user preset folder on your hard drive, that's possible too. Right (ctrl)-click on the User Presets folder, and select '**change path**'.



## CREATING NEW PRESETS

Right (ctrl)- clicking on the User Presets folder allows you to add new folders. These new folders you can organize any way you like. You can give them subfolders (new folder). Delete them again (delete folder). Or give them a different name (rename folder).

If you moved a folder on your hard drive, or added or delete some presets there, refresh will update the presets in the preset manager accordingly.

Want to move a preset to a different folder? Simply drag and drop the preset to the folder of your choosing.

If you want to change the location of your user preset folder on your hard drive, that's possible too. Right (ctrl)-click on the User Presets folder, and select 'change path'.

## EXCHANGING PRESETS

You created a preset on another computer or want to use some presets that someone else created? No problem. Save the preset(s) in the folder User Presets. If you haven't changed the location of this folder, it can be found in /Documents/112dB/Cascade

Or if you just want to have a quick look at a preset, use 'open' in the preset menu, go to the place where you saved your presets, select a preset, and click 'open'. Note that you have to save the

preset to your User presets if you want it to show up again next time.

# THE SYNTHESIZER

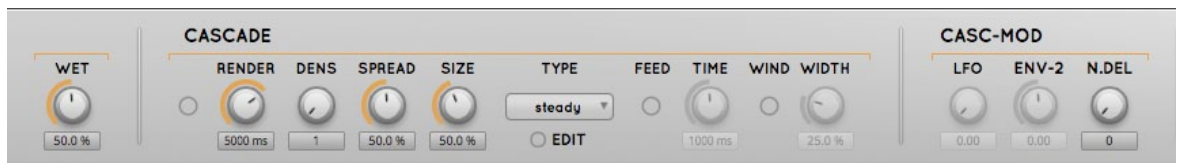
If you only look at the upper part of the Cascade synthesizer, there might seem nothing much new about it. Okay there are those two super fat oscillators, and some very nice sounding filters, but for most part it's just a basic subtractive synthesizer as you already know it. What makes Cascade really special however, is the Cascade section. This section gives you a complete new form of synthesis to play with. With a few knobs you can create a unique sound that you won't find in any other synthesizer.

## FUNDAMENTALS

The cascade sound is the result of the accumulation of an adjustable amount of delayed versions of the original sound. It's like a waterfall that comes down and splits on a rock, a cascade as it is called, and hence the name.

In the first cascade you get 8 signals. The second will give you  $8^2$  (64). In the last stage it will be  $8^4$  (4096). In other words: the sound will get exponentially more dense by adding the delays.

That doesn't mean that a sound will necessary sound 'denser', it can sound more spacious or 'fluffy' as well, depending on the settings you choose. You don't have to limit yourself to one type of synthesis: classic subtractive synthesis or cascade. It's possible to mix between them. You



will find that the best sounds usually contain a mix of both.

## PRE-RENDERING

The densification takes time to build up. And because the most interesting part of the sound is usually where it has developed to it's full potential, you would often like to skip the build-up process, or at least part of it. For this purpose Cascade has a pre-rendering option. By adjusting the pre-render time you can dive right into the interesting part. What this interesting part is? That's up to you. To find the right spot you need to experiment. Set the render time to zero. Listen to the build up time and jump to the point that you find most interesting. Estimate how much time it takes to get there and set the Render knob to that.

The rendering of the densification is done in a background process. The most recently played

notes are rendered first. So if you play the same note again, you will not have to wait for the process to finish, you can start right away. At the top you can see in the rendering bar how far the render process is. And if you turn on 'Background process animates keys' in the Settings Menu (the cog wheel at the top), you can see which keys already have been rendered (white means rendered, grey means rendering still in progress).

## PRE-RENDER AND MODULATION

The pre-render process won't take modulation into account, unless you specify so. Modulation will start, when the note starts. The LFO and Envelope2 however both have an 'early' knob that allows you to move the modulation into the pre-render phase. By doing this you don't have to wait for the modulation effect to build up. If you set the knob to 0% modulation won't be taken into account in the pre-render, 100% early means that the modulation starts when the rendering process starts. 50% means that the modulation starts halfway the pre-render time.

## THE CASCADE SECTION (CASC)

This is where all the action is. You probably need to play around a while with all the knobs to get the hang of it, but we promise you it will be worth while.

### WET (0%-100%)

The Wet knob allows you to mix the two methods of synthesis that the synthesizer provides. 100% wet means you hear only Cascade, 0% wet means you hear only the classic subtractive synthesizer. What the cascade synthesis does with the sound might not be completely intuitive. Especially since there are a lot of parameters you can tweak. So when you start to create a new sound with Cascade, we recommend to set the wet knob to 100%, to hear the changes that the different parameters produce best. Another useful trick is to set the density to 1. This makes it easier to distinguish what a specific Cascade function is doing to the sound.



If you don't use the cascade synthesis in a sound (Wet is set to 0%), it's recommended to turn Cascade off all together with the radio button at the left of the Cascade panel. That way no memory will be used up for calculations.



### RENDER (0ms-10.000ms)

Changes the pre-render time of the cascade synthesis. The pre-render time is the part of the build-up of the cascade effect that you won't hear. If you set it to 5000ms for example, you will skip 5 seconds of the build-up process.

## DENS (1-32)

With density you can change the amount of the densification. Or to be more precise: the amount of delays that are involved. The maximum amount is: 32 (all delays).

## SPREAD (0%-100%)

Distributes the signal between the left and right channel. This will make it sound more stereo. 0% will be mono, 100% will be full stereo.

## SIZE (10%-100%)

Sets the size of the cascade synthesis. This will modify the total length of the delays. All separate delay times in the network will scale proportionally.

## GAIN (0dB-6dB)

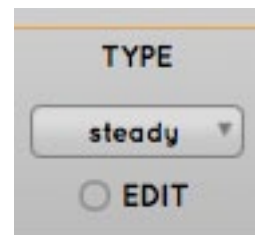


With the Gain knob you can adjust the volume of the Cascade synthesis ( the volume knob on top in contrast will change the volume of the entire output. This can be useful, because the volume of the the Cascade synthesis can be sometimes a bit unpredictable.



## TYPE

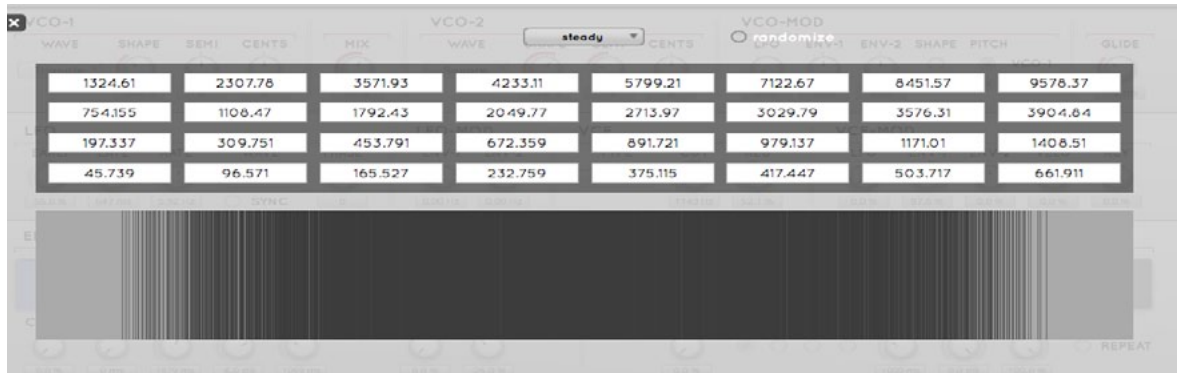
Cascade gives you 5 types of delay network models to choose from. There are 32 delay times per model, and the combination of these result in a very unique character. All models have one thing in common though, they are designed to distribute the sound continuously over time. The idea behind this is to get the least amount of additions and cancellation effects.



The difference between the models lies in the way the density is spread over the delay network. 'Steady' for example has rather long delay times in the first cascade stage and short delay times in the last stage. The delay times of 'fast-paced' are inverted so the sound will build up much

quicker.

Clicking on the 'Edit' toggle button will bring up a window that shows the delay network matrixes for the different type of models. The numbers in the matrix stand for the delay times.



CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
1324.61	2307.78	3571.93	4233.11	5799.21	7122.67	8451.57	9578.37
754.155	1108.47	1792.43	2049.77	2713.97	3029.79	3576.31	3904.84
197.337	309.751	453.791	672.359	891.721	979.137	1171.01	1408.51
45.739	96.571	165.527	232.759	375.115	417.447	503.717	661.911

The image below the matrix will give you an impression how the density is spread. You can even create your own delay network model, if you like. Simply type in your own delay times and save them as a new model. The 'randomize' radio button will randomize the current delay times. This is useful to create variations.

### FREEZE

If you turn Freeze on by selecting the radio button, it will freeze the sound for the time you set the 'Time' knob to. This gives you a sound loop with 100 percent feedback. You can use this function to build up resonating sounds.



### TIME

Sets the time of the feedback delay and the time of a windowed cycle.

### WIND

Wind stands for 'Windowed Mode'. It will add a Hanning envelope to the signal before it enters the Cascade. With the windowed mode you get less cancellation effects. The sound gets more granulated, and you will get kind of a pulse sound if you hold a key for a while.

### WIDTH (0-100%)

Sets the width of the Window. A small amount is a smaller window

## CASC-MOD

You can use the LFO and the envelopes not only to modulate the oscillators and the filters of the subtractive synthesizer, you can use them to modulate the Cascade synthesis as well. This will modulate the delay times. If feedback (freeze) is turned on, it will modulate the feedback loop as well.

Adding LFO modulation to the cascade process will give you some detuning and vibrato. It gives a slight Doppler effect as if you are riding a merry-go-round. While the delay gets shorter the tone will go up, while the delay will get longer, the tone will go down. Adding LFO gives the sound some movement. This is best used sparingly, 0.80 is usually more than enough. With Envelope-2 you can create pitch sweeps.



LFO (0%–100%)

Changes the amount of the LFO modulation of Cascade

ENV-2 (-100%–+100%)

Changes the amount of the ENV-2 modulation of Cascade

N.DEL (0–32)

N.DEL stands for number of delays. This knob makes it possible to modulate only the first part of the delays (for example the first 8 delays if you set it to 8). The other delays will be unaffected. A setting of 32 will modulate all delays. Be aware: modulating all delays will be very CPU hungry.

DRIVE (-100%–+100%)



A distortion effect that adds symmetric or asymmetric clipping sound output. Positive values add symmetric clipping and negative values add asymmetric clipping.

With the activation button you can turn the effect on or off. This gives you an easy way to compare the sound with and without the effect.



## THE OSCILLATOR SECTION (VCO)

VCO is shorthand for Voltage Controlled Oscillator. It is the part no synthesizer can do without, because it is the oscillator that produces the sound of the synthesizer. Which sound precisely depends on the waveform it produces. Cascade comes with two oscillators. With the cascade synthesis applied however, you can get the effect of many more.

If you choose a different waveform for each oscillator, you can mix waveforms together with the Mix knob. Another option: tune them differently from each other. This makes the sound fatter, or if you detune them in cents (100th of a semitone) it can add a swirling 'detuned' effect to the sound.

### WAVE

Cascade's oscillator gives you four common types of waveforms to choose from: Sine, Triangle, Square and Saw. As usual they are named after their shape.

**Sine Wave** – shaped like a sine wave, sort of an horizontal 'S'. This produces a mild, soft tone. It's the most purest tone that can be found, because it contains no harmonics.

**Saw Wave** - shaped like the teeth on a saw blade. It produces a bright, sharp tone.

**Triangle Wave** - shaped like a triangle. It sounds somewhere in between a saw wave and a sine wave. The tone is pure, a bit like a flute, and has a slightly 'hollow' character.

**Square Wave** - looks like a square. It produces a reedy, hollow sound.

But there's more than only waveforms to choose from. The next section of 'Wave' contains noises: White, Pink, Brown noise and Geiger and a single impulse: Dirac.

**Noise** can be used for sound effects, for example a sound that resembles surf on a beach or a rocket taking off, or to mimic percussive instruments such as cymbals or snare drums, which have high noise content in their frequency domain.

**White noise** means that all frequencies are equally loud. There's equal energy per hertz.

**Pink noise** is adapted to your hearing system. True white noise sounds like there is more treble than bass because the human ear interprets sound in terms of octaves, not in terms of absolute frequency. Pink noise has equal energy in all octaves of frequency. Most people perceive pink



noise as having the same apparent loudness at all frequencies.

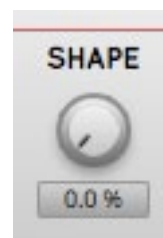
In **Brown noise** the low frequencies are louder. It's also known as 'drunkard's walk', because it sounds a bit like the wobbly path a drunkard would take.

**Geiger** is pulse noise: 1-bit noise. You can change the amount of pulses with the shape knob.

**Dirac** consists of a single impulse. It's added for sound design mostly, to hear the reflection of the cascade synthesis. A single impulse makes it possible to hear all reflections of the delay lines of cascade. This makes it easier to hear what cascade does to the sound.

#### SHAPE (0-100%)

Changes the shape of the currently selected waveform. Essentially this is a form of a phase compression, it tries to densify the phase. It gives the sound a little bit acceleration and creates more overtones. It's somewhat comparable with the sync feature some oscillators have. Shape can't be applied to the noise section. The only exception is Geiger. In this case Shape specifies the amount of pulses: it gives a crackly sound like that of a Geiger-teller.



#### SEMI (-24-+24)

Changes the pitch of the VCO in semitones (+24 is one octave higher than the original note, -24 is one octave lower)

#### CENTS (-100-+100)

Changes the pitch of the VCO in cents (100 cents = 1 semitone)

#### EARLY (0%-100%)

This knob is only useful if you employ cascade synthesis. It moves the start of the LFO modulation into the pre-render phase. This means you don't have to wait for the effect to build up. For a more detailed explanation, see the Cascade Section.

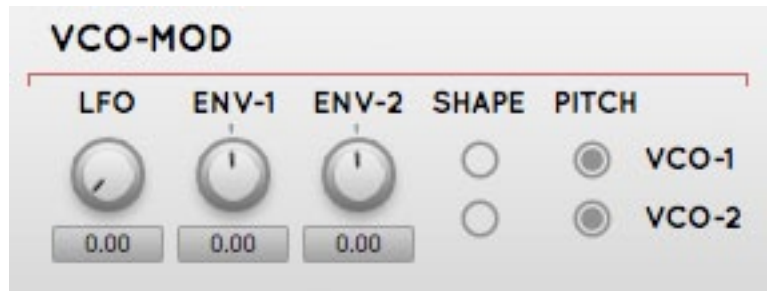


#### MIX (0%-100%)

Mixes the sound of both oscillators. 0% means you will hear only VCO-1, 100% means you will only hear VCO-2. 50% will give you an equal mix of both.

## VCO-MOD

You can modulate the shape of the oscillator, the pitch, or both. Or you can keep it simple and modulate the volume only. The amount of modulation is specified in semitones.



LFO (0-12)

Changes the LFO to pitch modulation in semitones

ENV-1 (-24-+24)

Changes Envelope-1 to pitch modulation in semitones

ENV-2 (-48-+48)

Changes Envelope-2 to pitch modulation in semitones



GLIDE (0-1000ms)

Sets the glide time. When you use 'Glide' a note slides to the next one on the scale, the time tells how slow or fast that slide will occur. Set it to 0 to turn glide off.

In the Settings menu (the cog wheel at the top) you can set the **glide curve** as well. With this function you can adjust glide to transition from linear (0%) to logarithmic (100%), comparable to the attack curve of the ADSR-envelope.

## THE LFO SECTION

LFO, or 'Low Frequency Oscillator' is a special kind of oscillator that oscillates at very low frequencies. It is used to modulate other parts of the synthesizer, such as the pitch of an oscillator, or the frequency of the filter. If you for example route an LFO to pitch, you get a vibrato. If you route it to the filter's cutoff frequency you get a wah-wah type of effect. Or at a very low rate it can give a gradual sensation of the sound becoming clearer or closer to the listener. The LFO can also be used for some interesting special effects, the 'rippling' sound effect you sometimes hear in movies is just one of the examples.

**EARLY**  
(0-100%)

This knob is only useful if you employ Cascade synthesis. It moves the LFO to

the pre-render process of the Cascade. This means you don't have to wait for the modulation effect to build up. The value is set as a percentage of the total render time. (For a more detailed explanation, see the Cascade Section.)



**LATE** (0-5000ms)

Sets the delay time before the LFO becomes active. It fades the LFO in, so to speak.

**RATE** (0Hz-99Hz)

This determines the frequency of the LFO—a higher rate will produce a more rapid oscillating effect. A slow rate is generally used for swells, a fast rate is more useful for trills or rapid flutters.

**WAVE**

The waveform determines the type of oscillating effect the LFO will create. You can choose between: **Triangle**, **Sine**, **Square**, **Saw** or **Exp** (Exponential). This last one is a sine like waveform with an exponential signal path that can be used for a more pronounced vibrato.

**PHASE** (0-360 DEGREES)

Phase adjusts where (within its cycle) the LFO waveform will be restarted whenever a note is played.

**SYNC** (ON/OFF)

Turning Sync on will sync the LFO's rate to the host's tempo.

You can set the amount with which the LFO affects its destination in the MOD sections of Cascade (VCO-MOD, VCF-MOD, CASC-MOD).

## LFO-MOD

You can modulate the LFO with the envelopes. You can use this to create for example bouncing effects, laser gun sounds or dubstep bass wobbles.

ENV-1 (-15 Hz-+15 Hz)

Sets the amount of frequency modulation of the LFO by ENV-1.

ENV-2 (-15 Hz-+15 Hz)

Sets the amount of frequency modulation of the LFO by ENV-2.



## THE FILTER SECTION (VCF)

The filter is responsible for sculpting the sound, diminishing some frequencies and accentuating others. You can see a filter as a volume control that is applied differently to different parts of the spectrum. For example, a filter might make low frequencies louder, while at the same time making high frequencies weaker. Such a filter would give a sound more bass and less treble.

In Cascade we use a OTA ladder filter, inspired on the ones that were used in the classic hardware synthesizers of the 70'ies. What makes this filter special is the Curtis chip emulation and possibility of self oscillation. In addition it's a multi mode ladder filter. Which means that you can choose from different types of filters: High Pass (HP), Low Pass (LP), and Band Pass (BP). The number (for example LP2) stands for the number of poles the filter has. Pole refers to the slope of the filter. It's another way of saying how many dB per octave a filter attenuates. A simple 1-pole filter has a slope of 6 dB per octave. A 2-pole has a slope of 12 dB per octave, and 4-pole 24 dB per octave. Because a band pass filter has two slopes, you have to divide the dB per octave with 2. In other words: a 4-pole band pass filter has a slope of 12 dB per octave at one side, and 12 dB per octave at the other side.

An LPBP-filter consists of 2 filters applied after each other, a low pass and a band pass. Which means that you get something in between. Both the high end of the spectrum and the low end will be attenuated, but high a bit more than low.

Note that filters won't do much on a sine wave, because it has no harmonics. If you cut part of the wave it's simply attenuated, it won't make any difference to the character of the sound.

## CUTOFF (16Hz-22.050Hz)

This parameter defines the cutoff frequency. Cutoff is the tipping point of the filter you could say. For a low pass filter it is the point from which the high will be cut off, for a high pass filter the point from which the low will be cut off, and for a band pass filter it's the middle of the band.

If a filter has a slope of 12dB/octave that means that one octave above the cutoff frequency, the sound is attenuated by 12 decibels. Two octaves above the cutoff frequency the sound is attenuated by 24dB, and so on. In subjective terms, a lower cutoff will generally make the sound softer, darker, duller, but also warmer.



## RES (0%-100%)

With Resonance you can boost frequencies around the cutoff frequency. This parameter is particularly useful when the cutoff is being altered dynamically (for example, by the filter envelope or the LFO), as it can produce effects that resemble vocal formants (such as 'wow' sounds), and it can also add 'edge' to filter sweeps for dramatic effect.

## VCF-MOD

You can modulate the filter with 5 types of control sources: LFO, ENV-1, ENV-2, VELO, and Key.

### LFO (0%-100%)

Sets the cutoff modulation amount by the LFO

### ENV-1 (-100%+100%)

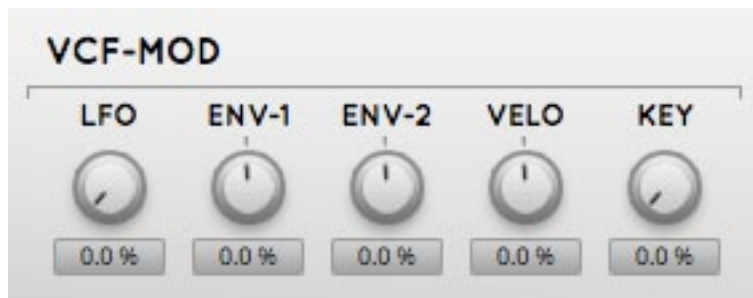
Sets the cutoff modulation amount by ENV-1

### ENV-2 (-100%+100%)

Sets the cutoff modulation amount by ENV-2

### VELO (-100%+100%)

Changes the cutoff modulation amount by the velocity: the velocity you play a key with will be added to or subtracted from the cutoff. If set on +100% the cutoff will go up if you play faster/louder. If set on -100% the cutoff will go down if you play faster/louder.



## KEY (0%–100%)

Key tracking enables you to use your keyboard as a modulation source. In Cascade key tracking is coupled to the filter. That means that the cutoff frequency of the filter changes with different keys. The higher the note you play, the more the filter with open up.



The percentage you set the knob to specifies how much influence the keys have on the filter. 0% means that the notes have no influence on the Cutoff frequency at all. 100% means maximum influence. Usually high notes sound brighter than low notes, but not too bright. So it pays off to experiment a bit to find the right spot. Please note: if the Cutoff frequency is already set to maximum key tracking has no effect.

Another nice thing of key tracking is that it enables you to make use of the self-oscillating property of the filter. If you set the key tracking to 100%, the Resonance to 100% as well, and the Cutoff somewhere in the middle, and make sure that oscillator 1 and 2 are off, you should be able to play a melody on the filter.

## THE ENVELOPE SECTION (ENV)

An envelope is used to give a sound a 'shape'. If you apply an envelope to the volume for example, you are able to make the sound for example slowly fade in and out when you press and hold a key. In Cascade envelopes can applied to the volume, the wave shaper and the pitch (VCO-MOD), the LFO, the filters (VCF-MOD) and to the cascade delay network (CASC-MOD).

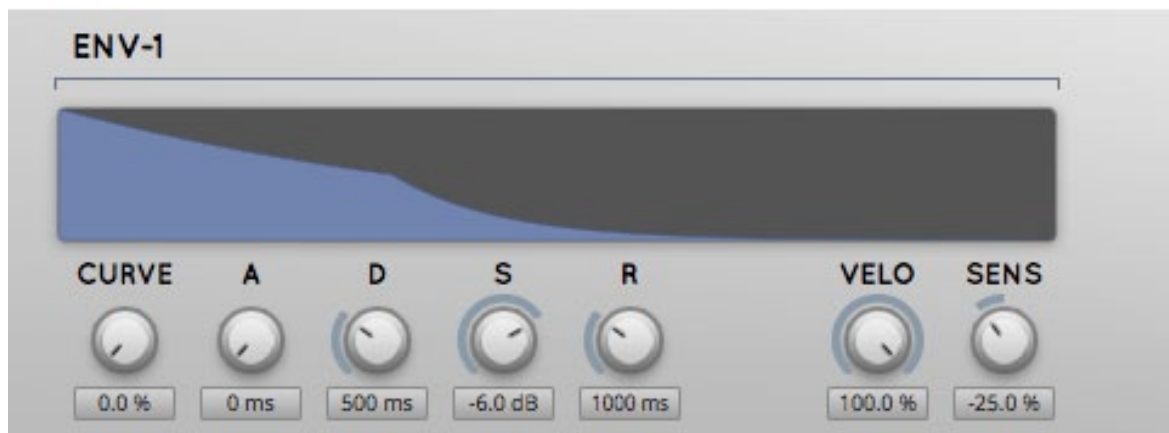
Cascade has two envelopes that both have a different mode of operation. Each one has his own merits.

ENV-1 resembles the envelope you will typically find in an analogue synth. It has an Attack, Decay, Sustain, and Release knob. With ENV-2 you can edit the envelope in four separate stages. For every stage you can set the time, level and curve.

Advantages: ADSR editing is more intuitive because it resembles the way in which the sound in traditional instruments is build up. With ADSR you can set a release level that will only kick in when a key is released, ENV-2 doesn't have a release stage. With ENV-2 on the other hand you can create an LFO type of effect. You can use it as an LFO with a complex waveform so to speak.

Another important difference is that ENV-1 will always modify the volume. Every sound will have an Attack, Decay, Sustain and Release that's specified by ENV-1. With ENV-2 you can modulate the oscillator, the filter and the cascade synthesis as you can with ENV-1, but not the volume.

## ENV-1



A = ATTACK (0-5000ms)

This parameter determines how long it takes for a sound to 'fade in'. A low setting will produce a very rapid attack. The sound plays at full blast straight away, like it does in percussive and plucked sounds. Higher settings will increase the amplitude gradually. The sound will slowly rise, like it does in strings, brass instruments, and pads.

D = DECAY (0-5000ms)

Determines how long it will take the sound to decrease in volume over time, beginning when the attack reaches the peak level. Sounds such as pizzicato strings have a very short decay, while sounds such as cymbal crashes have a long decay.

S = SUSTAIN (-INF dB-0dB)

When the decay reaches the level set by the sustain parameter, the level remains constant as long as the note is held—the perfect example of this is an organ, which will sustain indefinitely until the note is released.

R = RELEASE (0-10.000ms)

This parameter determines the time it takes for the sound to fade away completely once the note is released. It is somewhat comparable to a reverb at the end of your sound. When you set the release to zero, it will die away instantly. Set it to the max, and the sound will continue for 10 seconds after the note is released. To illustrate, an organ has a very rapid release rate, a piano has a moderate release rate, and a guitar has a long release (unless the string is muted).



## CURVE (0%–100%)

Curve enables you to change the attack curve. You can make it steeper or more slowly rising. 0% stands for a linear attack curve, the standard attack curve in synthesizers, 100% will give you an exponential attack curve. This will get you a sharper, snappier attack.

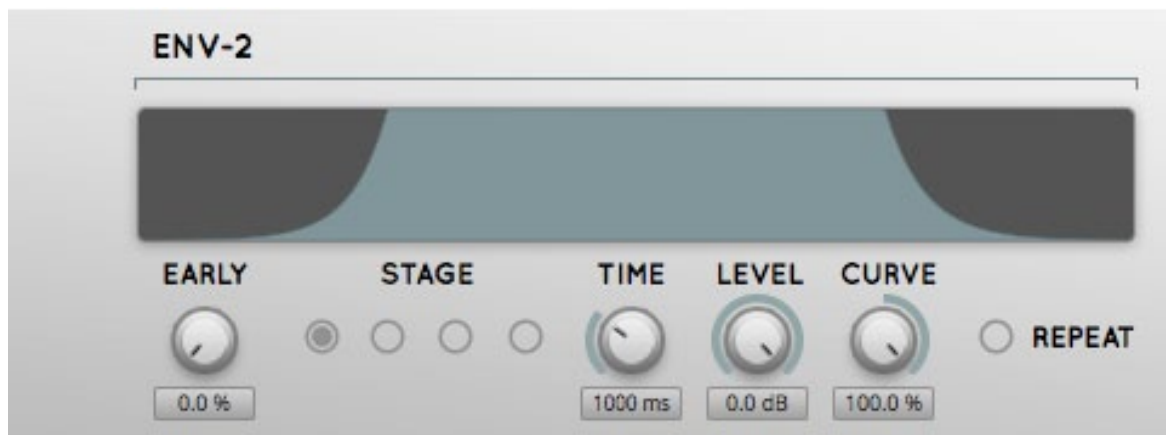
## VELO (0%–100%)

Changes the velocity amount: that is if and how much the envelope will respond to how fast a key is pressed. Set on 0%, a note you play will have the same loudness regardless how fast you press the key. Set on 100% a note will be louder when you press the key faster, and softer if you press the key slower, like on a piano.

## SENSE (-100%–+100%)

With Sense you can change the velocity sensitivity. The percentage specifies the curve of the velocity sensitivity. It goes from convex (-100%), to concave(+100%). Linear (0%) is the default. Convex will give you better control over louder notes, concave makes quiet notes more expressive. Which setting is best for you depends on your playing style, and the expressiveness of the keyboard you use.

## ENV-2



With Envelope 2 you can edit the envelope in 4 stages. You can set the time of the stage, the level that the sound will reach, and the curve with which it will reach that level.

## TIME (0–10.000ms)

Changes the time that the sound will take to reach its level of the current stage

LEVEL (INF dB-0dB)

Changes the level the sound will reach within the current stage.

CURVE (-100-100%)

Changes the curve the sound will take to reach its level.

REPEAT (ON/OFF)

Will repeat all stages once the last stage has been reached.

EARLY (0-100%)

This knob is only useful if you employ Cascade synthesis. It moves the envelope to the pre-render phase. This means you don't have to wait for the modulation effect to build up. For a more detailed explanation, see the Cascade Section.

## THE KEYBOARD SECTION

KEYBOARD RANGE

The default range for the keyboard in Cascade is 49 keys (4 octaves). You can change this to 61 (5 octaves), 88 (7+ octaves) or 25 (2 octaves) in the Settings menu (the cog wheel at the top). But please note: because more keys means more processing time for the cascade synthesis (read: a higher CPU load), we recommend that you only expand the keyboard range if strictly necessary.

MAXIMUM VOICES

Cascade has a maximum of 16 voices: the maximum amount of notes you will be able to hear at the same time is 16. However, by default the maximum is set to 8. You can change this in the Settings Menu (the cog wheel at the top).

Again there's the consideration of CPU load. More voices means more CPU, and if your machine is



a bit slow this could cause crackles or glitches. You can change the maximum amount of voices per preset as well. Type in the number in the box at the right of the keyboard. This way you can limit the amount of voices only for the presets that require a lot of CPU to begin with. In general that are the presets that make use of almost the full cascade (when Render is to the max, and the number of delays (N.DEL) is 16 or above).

In the Settings menu (the cog wheel at the top) you can see the memory usage associated with the keyboard range or maximum voices that you selected for the current preset.

## TUNING

Throughout history there have been suggested a lot of different tuning systems for keyboards. And if you are into that kind of stuff, you are lucky: you get a lot of systems to choose from in the Settings menu (the cog wheel at the top). However most people probably want to stick to the 12-tone equal temperament, the standard tuning system for synthesizers, or perhaps go for Werckmeister III (well-tempered) the standard for pianos.

## TUNING ROOT

In the modern 12-tone equal temperament tuning system all intervals are equally out of tune. Other tuning systems are designed to get specific intervals right that are deemed the most important. If you set the root key to C in such a system, the C Major scale will sound perfectly tuned, but D will sound completely out of tune.

## PITCH WHEEL

The pitch wheel allows you to move the pitch of a note up and down. You can bend the note a little bit, like you would do on a trumpet or with your own voice. Default value is two

semitones. That means you can go one semitone up, and one semi tone down. In the Settings menu (the cog wheel at the top) you can change this to another value, from 0 to



12 semitones.

The cascade synthesis reacts very slow to pitch changes due to the long delay times. For this reason 'pitch bend resamples cascade' in the Settings menu is turned on by default. This function allows pitch changes to become immediate, like you are used to in a synthesizer. Turning this setting off, however, can sometimes get some very nice results too. It makes it possible to use the pitch wheel for get very slow evolving glissando effects.

The radio buttons at the side of the pitch wheel are an extra service for if you are on the road and have no external keyboard available. The same applies to the sustain radio button.

# SYSTEM REQUIREMENTS

## OPERATING SYSTEM

- Windows 7, 8, or 10 (32 or 64-bit)
- Mac OS X 10.7 (Lion) / 10.8 (Mountain Lion) / 10.9 (Mavericks)/10.10 (Yosemite)/10.11 (El Capitan) (32 or 64 bit)

## HOSTS

Cascade is compatible with any host that understands the AAX, VST, and/or Audio Units protocol.

# UPDATES AND SUPPORT

Updates for Cascade will be made available at

<http://112dB.com/download>

For product support, questions, comments, feature suggestions, and anything you feel is worth sharing, please visit our forum at

<http://112dB.com/forum>

Alternately, for more individual product support you may contact our support staff by email at [support@112dB.com](mailto:support@112dB.com)

# CREDITS

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The Cascade synthesizer is inspired by a live electronic effect created by Wolfgang Musil for composer Peter Ablinger

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