



USER MANUAL

OLI LARKIN 2014-2019



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Figure 1: The VirtualCZ User Interface

1 | Introduction

VirtualCZ is an emulation of the synthesis engine from the CASIO CZ range of synthesisers that were produced in the 1980s. It also functions as an editor for those synthesisers, since it can save, load and transmit CZ System Exclusive (SYSEX) data. VirtualCZ offers many enhancements and extra features to increase the possibilities and improve usability.

The CZ series are digital synths that use a technique known as Phase Distortion - a close relative of Frequency Modulation (FM) made popular by Yamaha's DX series. Unlike FM synthesis, CASIO's Phase Distortion method is very simple to control. Dramatic changes in the audio spectrum can be created by manipulating one parameter. This has a similar effect to changing the filter cutoff frequency in subtractive synthesis, although there is no filter in Phase Distortion synthesis. The CZ synths were some of the first affordable polyphonic synthesisers, but were valued for their unique sound above anything else. They are capable of producing interesting synth string, brass and pad sounds as well as great bells, metallic percussion and synth bass. Many people fondly remember the CZ synths and they have become retro-classics that are highly sought after. They were used on classic techno, house, rave and synth-pop records in the late 80s and early 90s and lots of artists still use them today for their unique sounds. Sadly many of the hardware units are in a bad state or are malfunctioning in one way or another after 30 years of life.

With VirtualCZ we have tried to bring the classic CZ sound and feel into the modern Digital Audio Workstation (DAW) workflow, and make a convenient editor for those musicians who have the real thing. Whether you are a software fan or a hardware fan, we hope you enjoy VirtualCZ!

Oli Larkin.

1.1 Key Features

- Recreates the unique Phase Distortion synthesis engine of CZ synthesisers
- Two CZ-Style PD oscillators per voice (each has eight wave shapes, which can be different for alternate cycles)
- Six loopable envelopes per voice
- Switch envelopes between easy-to-use ADSR and more powerful eight-stage MSEG modes
- Tempo syncable LFO for vibrato, with 7 shapes
- 32 voice polyphonic/mono/legato modes
- Unison and detuning effects
- Ring Modulation and Noise Modulation
- Vintage stereo chorus/ensemble effect (two different algorithms)
- Easy to use interface: all key synthesis functions accessible on the front panel
- Works as a SYSEX editor/librarian for hardware as well as an emulation (access thousands of patches online)

- Available in VST2, VST3, AU, AAX plug-in formats and Stand-alone app (.app/.exe)
- Built-in preset browser
- Import/export presets for all plug-in formats
- Micro-tuning and MIDI scaling functionality
- Polyphonic and Channel aftertouch support

1.2 System Requirements

VirtualCZ has been tested in the majority of compatible plug-in hosting digital audio software for Windows and Mac OSX.

Mac

- OSX Mavericks (10.9) or higher
- 64bit VST 2.4, VST 3, AAX or Audio Unit host
- Pro Tools 11.02+ for AAX
- Minimum Intel i5 CPU and 4GB ram or more recommended

Windows

- Windows XP, Vista, 7 or 8
- 32bit or 64bit VST 2.4, VST 3 or AAX host
- Pro Tools 10.36+ or Pro Tools 11.02+ for AAX
- Minimum Intel i5 CPU and 4GB ram or more recommended

1.3 Installation

Mac

On the Mac platform VirtualCZ is distributed as a *.dmg* disk image named something like **VirtualCZ-v1.0.0-mac.dmg** (depending on the version number). Double click the *.dmg* file to mount the disk image. You should then see the contents of the disk image in the OSX Finder. Double click the icon labelled **VirtualCZ Installer.pkg** to install the plug-in and click "Continue" to go through the various stages of the install. You will be presented with the "readme" and EULA which you will need to agree to. If you wish to perform a custom install in order to save hard disk space (for example, by only installing one plug-in format), you can click the "Customise" button on the "Installation Type" page. You are required to install the "VST3 Presets" and the manual even if you don't intend to use the VST3 version of the plug-in, since these are also used by the other plug-in formats. You will be required to enter an administrator password in order to install VirtualCZ.

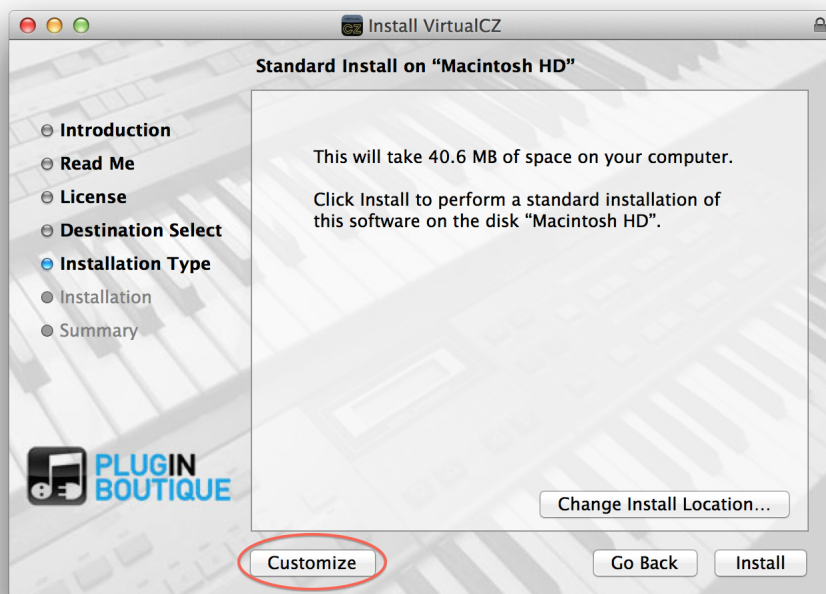


Figure 1.1: Mac Standard Installation

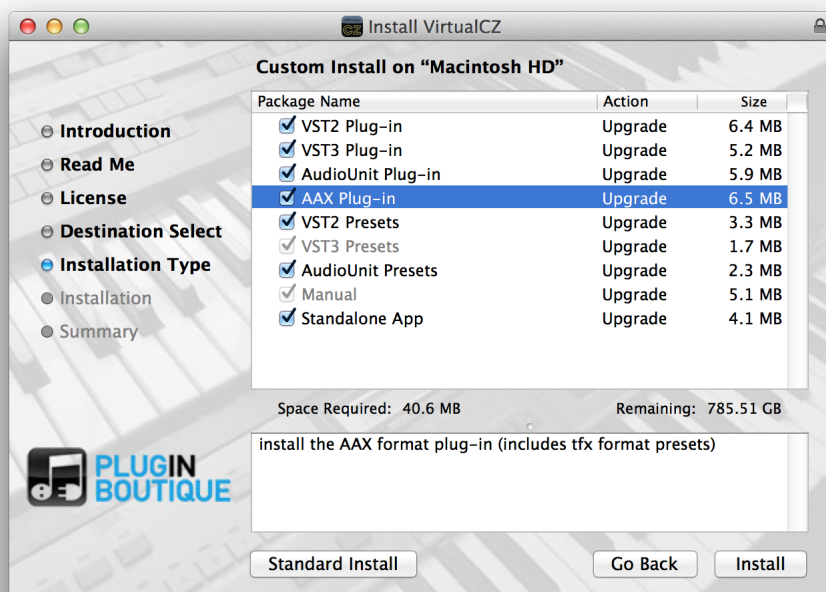


Figure 1.2: Mac Custom Installation

Windows

On the Windows platform VirtualCZ is distributed as a *.zip* file named something like **VirtualCZ-v1.0.0-win.zip** (depending on the version number). You should extract the contents of the *.zip* file to somewhere convenient on your hard drive and then launch **VirtualCZ Installer.exe** by double clicking it in Windows Explorer. You can then proceed through the installer stages by pressing the next button. You will need to accept the End User License Agreement. On Windows, VST2 plug-ins can go in different locations and the installer will ask you to confirm where you want to put those files. It will try and obtain the correct location from the Windows registry, but pay attention because sometimes the registry value is incorrect or missing and you could end up installing the plug-in to the wrong folder. In this case it won't show up in your VST2 host/DAW! The installer will give you the option to install both the 32-bit and 64-bit plug-in versions on a 64-bit OS, and you should be careful not to install the 64bit *.dll* file to the 32bit VST2 plug-ins folder and *vice versa*.

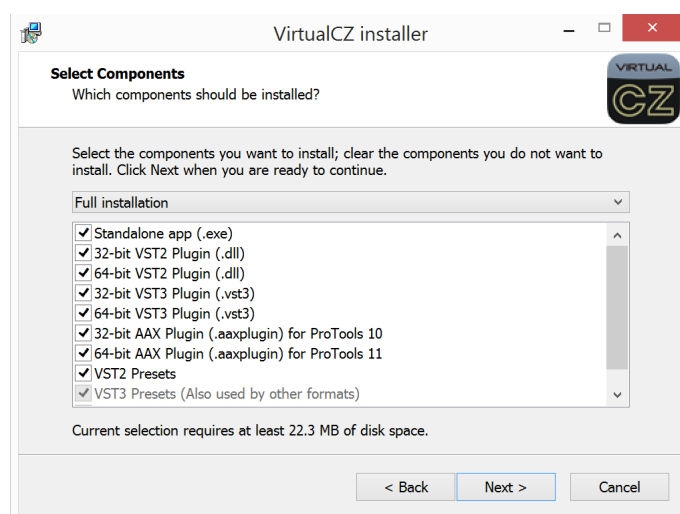


Figure 1.3: Windows Installation

1.3.1 Registering the Plug-in

If you previously installed the demo version of VirtualCZ you should download the full version from your.pluginboutique.com account and install it using the above instructions. Once you've installed it, you will need to launch it and input the serial number in order to register it. To get your serial number, visit your.pluginboutique.com account and locate the product section that lists your personal serial number for VirtualCZ. Your VirtualCZ Serial Number will look like this:

```
START|Your Name|your@email.com|XXXX-XXXX-XXXX-XXXX|END
```

Click the copy button (see Figure 1.4) to copy the serial number to the clipboard or select the whole serial number including the words START and END and copy to the clipboard with CTRL-C/COMMAND-C. You can then launch the plug-in or stand-alone app and paste the serial in, just by clicking the box that says *"Thanks for purchasing VirtualCZ!..."*. The box should change colour as you move your mouse over it to indicate that you can click it. If it doesn't, make sure the plug-in window has focus, by clicking the title bar.

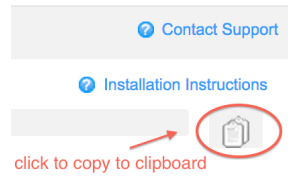


Figure 1.4: Copy your serial number by clicking the clipboard icon in [your pluginboutique.com account](#)

1.3.2 Installing for Multiple Users

Normally when you paste your serial number into VirtualCZ it will authorize the plug-in for a single user on the computer. This will be suitable for the vast majority of machines. If you wish to register the plug-in for all user accounts on the computer (for example in a classroom setting) you can either register it using each user account or you can manually move the file `key.txt` to the following locations:

Mac

```
MOVE ~/Music/VirtualCZ/key.txt  
TO /Library/Application Support/VirtualCZ/key.txt
```

Windows

```
MOVE %LocalAppData%\VirtualCZ\key.txt  
TO %ProgramData%\VirtualCZ\key.txt
```

1.3.3 Uninstalling

Mac To uninstall VirtualCZ on OSX, you should manually remove the plug-ins from the various plug-in folders. Delete your registration by removing

```
~/Music/VirtualCZ/key.txt
```

Windows On Windows you can run the VirtualCZ uninstaller. You can find a shortcut to it in the Start Menu or by searching on the Start Screen (Windows 8). Delete your registration by removing

```
%LocalAppData%\VirtualCZ\key.txt
```


2 | Getting Started - Using Presets

VirtualCZ comes with a library of over 200 presets specially developed for the plug-in. Patches designed for the CZ hardware synths can be imported into the plug-in, providing they are in a suitable SYSEX format.

The controls for managing presets are at the very top of the plug-in's user interface. You can get started just going through them with the Next Preset button (arrow pointing right) (See Figure 2.1).



Figure 2.1: The Preset Controls Section

2.1 Factory Presets

The five banks that come with VirtualCZ are as follows:

- Bank A - 64 presets by Oli Larkin
- Bank B - 64 new presets by Don Solaris
- Bank C - 64 presets originally designed for the CZ-1 by Don Solaris
- Bank D - 64 presets by Scott AbstractCats
- Bank E - A further 30 new presets by Don Solaris

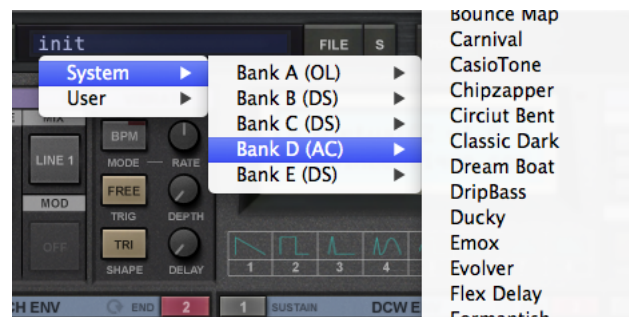


Figure 2.2: Clicking the patch name to bring up the .vstpreset browser

By default VirtualCZ will use its own .vstpreset browser (see below), but if you want you can turn this off and just use the preset browsing options in your DAW since the factory presets are supplied in different file formats for each plug-in format (.fxp/.fxb for the VST2 plug-in, .vstpreset for VST3 plug-in, .aupreset for Audio Unit plug-in and .tfx for the AAX plug-in). This means that preset management can be handled via the host's mechanisms if you so wish. If you only use one plug-in format this might be the best option for you. For instance if you are using the Audio Unit version of the plug-in in Logic you can save and load .aupreset format files via Logic. DAWs will often provide an integrated preset browser that appears when you insert the plug-in on a track, which can be a convenient way to manage your presets in a consistent manner.

2.2 About Banks of Presets

Only the VST2 version of VirtualCZ has a notion of a "bank" of presets so extra options are available for dealing with banks in that version. You can save and load *.fxb* (VST2 bank) files that contain 64 presets and when you save a project in the DAW containing the VST2 version of VirtualCZ it saves the state of all the 64 presets. Certain bank-related preset controls are disabled by default in the other versions. If you want to use banks of presets with the VST2 version, it is recommended you turn the *.vstpreset* browser off.

Support for banks of presets also means that you can import a SYSEX file that contains multiple presets directly into the VST2 version of the plug-in. In other formats, you will be prompted to extract individual *.syx* files first if the SYSEX file you are trying to load contains multiple patches.

2.3 VirtualCZ Preset Browser Mode

You can enable/disable the *.vstpreset* browser by clicking the "FILE" button and clicking the "Use *.vstpreset* browser" entry so that it shows a tick. This is a global preference that means that the preset controls in VirtualCZ will allow you to browse VST3 format presets on your computer's hard drive in the designated locations for system (factory) and user presets.

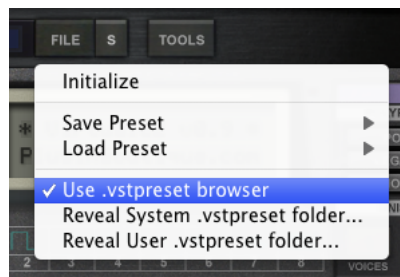


Figure 2.3: Enabling/Disabling *.vstpreset* browser

The VST3 *.vstpreset* locations are as follows:

Mac

System:

`/Library/Audio/Audio/Presets/Plugin Boutique/VirtualCZ`

User:

`~/Library/Audio/Audio/Presets/Plugin Boutique/VirtualCZ`

Windows

System:

`%ProgramData%\VST3 Presets\Plugin Boutique\VirtualCZ`

User:

`%UserProfile%\Documents\VST3 Presets\Plugin Boutique\VirtualCZ`

You can place your own presets in these locations, and they will show up in the preset browser menu. There are entries in the "FILE" menu that will reveal these locations in the

OSX Finder/Windows explorer. You may require administrator privileges in order to place presets in the system *.vstpreset* folder.

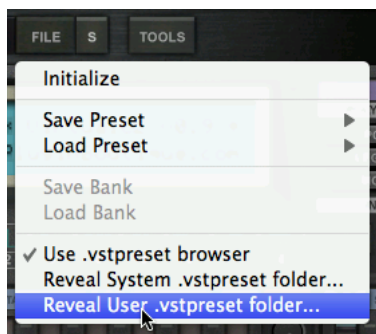


Figure 2.4: Opening the user/system *.vstpreset* folders in OSX Finder or Windows Explorer

2.4 Creating Presets

If you want to start from scratch, VirtualCZ has a feature to initialize the state of the plugin. Click the "FILE" button and select "Initialize".

2.5 Naming Presets

VirtualCZ supports multiple preset formats and can cope with CZ-1 SYSEX, so the plug-in has a place to store the name of the patch. You can edit this by SHIFT clicking the blue part of the preset controls. This is what will be sent to a CZ-1 (the only CZ to support patch names) if you send it the SYSEX. When dealing with *.vstpresets* in the *.vstpreset* browser, it is the file name that is listed - so that would usually match the name you had given the patch.



Figure 2.5: Renaming a patch after SHIFT clicking

2.6 Saving Presets

There are a couple of different options for saving presets depending on what version of the plug-in you are running.

With *.vstpreset* Browser on

Clicking the "S" button (see figure 2.6) is the quickest way to store a *.vstpreset*. You are advised to store your *.vstpresets* in the user *.vstpreset* folder, but you can put it elsewhere. It must be in the system or user *.vstpreset* folders if you wish to see it in the *.vstpreset* browser.

With *.vstpreset* Browser off

In the VST2 version of VirtualCZ, when the *.vstpreset* browser is not enabled, pressing "S" will save the current preset in the VST2 bank. This way you can go through all 64 presets,

tweaking and pressing "S". Then using the "Save Bank..." options you can export all 64 presets in the bank to the other formats of preset. The preset controls will be disabled in VST3, AU and AAX.

2.7 Sharing/Converting Presets

If you wish to export the current state of the plug-in to a file format compatible with another plug-in format, you can use the options in the "Save preset..." submenu of the "FILE" menu. Likewise you can load in various formats with the "Load preset..." sub-menu.

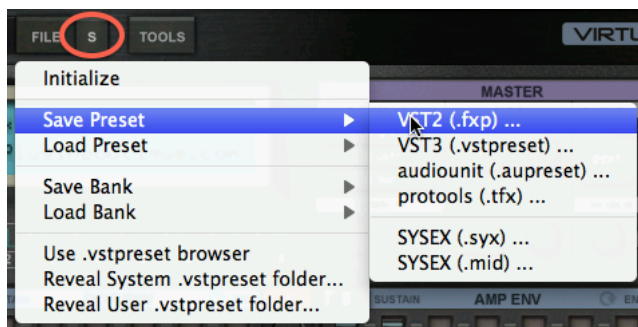


Figure 2.6: Save the current state to a particular preset or SYSEX file

Importing Patches from SYSEX files

One of the features that differentiates the various CZ hardware synths is the number of presets that they can store. The flagship model, the CZ-1 was capable of storing 64 user presets, the CZ-5000/CZ-3000 could store 32 user presets and the CZ-1000/CZ-101 could store 16 user presets (as well as 16 factory presets that could not be changed). This means that SYSEX files that you want to load may contain a single preset, or they may contain multiple presets.

Since the VST2 plug-in format supports banks of presets, the VST2 version of VirtualCZ will allow you to import up to 64 presets from a single .syx or .mid file. The other formats will first ask if you want to extract the individual sounds as .syx files. Choose a folder to extract them to and then load the individual .syx files one at a time.

3 | Control/Parameter Reference

This section describes the various controls/parameters of VirtualCZ in detail. The controls are described section by section. For most of the controls the automation parameters that they link to are also grouped similarly and depending on your plug-in host you may have to navigate to a particular group to automate that parameter.

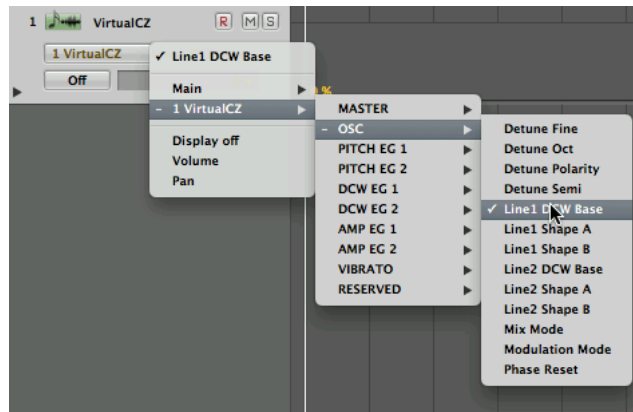


Figure 3.1: Audio Unit parameters are organized into sections

3.1 Notes about the controls

Before we look at the various groups of controls it is worth discussing some common features.

Tool Tips

Hover your mouse over a control to bring up a tooltip with some helpful information about what the control does.

Mouse Behaviours

All the controls on the VirtualCZ user interface use similar mouse and keyboard behaviours to operate them.

- ALT-CLICK or DOUBLE-CLICK a control to reset it to its default value
- SHIFT-CLICK a control to enter a precise numerical value via the keyboard
- Hold down SHIFT while dragging a control to reduce the speed of value changes and to set it more precisely
- OPTION-CLICK or RIGHT-CLICK a control to bring up MIDI Learn options.
- In a VST3 host such as Steinberg Cubase or Presonus Studio One, OPTION-CLICK or RIGHT-CLICK will also allow you to create a host context menu for that parameter.
- In the AAX version of VirtualCZ, you can use standard Pro Tools commands such as CTRL-ALT-CMD/CTRL-ALT-START-CLICK in order to bring up the Pro Tools automation dialog.

LCD Readouts and Conversions

When you move a parameter the parameter name and value will be displayed in the LCD. Since VirtualCZ is an editor for CASIO CZ hardware, as well as an emulation, certain controls must retain their original units, in order that they transfer to the hardware and that editing is intuitive. This means that some controls have ranges or units that are uncommon in modern virtual instruments (for instance, the MSEG envelope rates are set in units of 0-99, rather than in time in milliseconds). Where it makes sense, VirtualCZ will display a conversion on the LCD to more logical units.

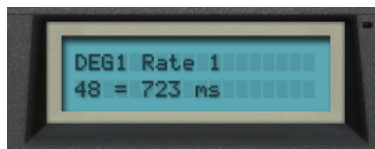


Figure 3.2: VirtualCZ's LCD displaying the CZ style rate in 0-99 units and a conversion to milliseconds

Parameter Locks

When browsing presets, often we'd like certain aspects of the patch to stay the same. For instance, if we have customised the scaling of MIDI velocity or aftertouch messages to match a particular MIDI keyboard, we may not want that to change when the preset changes. VirtualCZ features several lock toggles that will protect certain parameters in the event of a new preset being loaded. The states of the locks are not saved when you store a DAW project or save a preset.

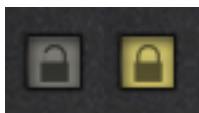


Figure 3.3: Locking parameters

Copying Values, Randomising and Resetting

The various grouped "sections" of controls in VirtualCZ can be reset, randomised and modified via some special options. If you mouse-over the title of a section it should flash to indicate that you can click it. If you click the title, a menu will give you various options that will apply only to the controls that belong to that section. Areas, such as the EG headings allow you to copy and paste the values of one EG to another.



Figure 3.4: The areas where you can click to copy/reset/randomise a section's controls



Figure 3.5: Click on the Env Line heading to copy/randomise/reset that Line's EG controls



Figure 3.6: Click on the individual EG headings to bring up a menu to randomise/reset/copy/paste the values

3.2 MASTER Section

The master section contains controls that affect the overall behaviour of a patch and controls for "special" effects such as chorus, unison and panning.



Figure 3.7: The MASTER Section

Polyphony Mode

The Poly Mode parameter can be switched between poly, legato and mono modes. Legato mode is a monophonic mode - when a key is held and another key is pressed, the synth's envelopes are not re-triggered. Both mono mode and legato mode are lowest note priority. Polyphonic mode supports a maximum of 32 notes of polyphony.

Unison Voices

When Poly Mode is set to mono or legato, the Unison Voices parameter is enabled and allows a choice of between one and eight voices of unison. If you send a MIDI note-on message to VirtualCZ it will cause multiple voices to play at the same pitch, which can be a useful way of fattening a lead or bass sound.

Unison Detune

When Poly mode is set to mono or legato and the Unison Voices parameter is set higher than 1, the Unison Detune parameter will detune the stacked unison voices.

Portamento Time

When set to zero, no portamento is applied and when a new key is pressed the oscillators will receive the new pitch immediately. When this parameter is greater than zero the oscillators will take time to reach the new pitch. Portamento in VirtualCZ is of the constant time variety, so it always takes the same amount of time for the pitch to get to the desired pitch, regardless of the distance between the start and end pitch.

Bend Range

This parameter controls the range (in semitones) of pitch deviation caused by MIDI pitch bend messages.

Master Tune

By default VirtualCZ is tuned to concert A = 440Hz. If you wish to adjust the master tuning this parameter will let you raise or lower it by up to 100 cents. This tuning shift will work even if you have customised the tuning table to something other than the default 12 TET.



Figure 3.8: The Chorus and Pan Width controls

Pan Width

The Pan Width parameter introduces stereo panning in order to create a wider stereo image. The parameter has a different effect depending on the setting of the Poly Mode parameter. When Poly Mode is set to Polyphonic, if Pan Width is greater than zero, a random pan position is applied to each voice. The higher the Pan Width, the wider the spatialization. If the Pan Width parameter is at 100% it is possible that a voice could be panned completely left or completely right. When Poly Mode is in either of the monophonic settings and the Unison Voices parameter is greater than 1, the Pan Width controls the spread of the voices playing in unison across the stereo image.

Chorus Depth

Several of the CZ hardware synths featured an analogue stereo chorus section. VirtualCZ features an emulation of this and this control sets the strength of the chorus effect.

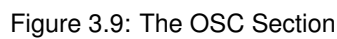
Chorus Mode

Click the word "CHORUS" to switch chorus mode. There are two stereo chorus algorithms in VirtualCZ. The first (Chorus Mode A) is the default and is a quite clear sounding chorus modelled on the Roland Dimension D. The second algorithm (Chorus Mode B) is a more lo-fi modelled on the Chorus/Ensemble effect that was in the CZ synths.

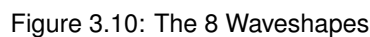
Master Volume

Controls the overall volume of the synth. If you ever find the output of VirtualCZ is pushing your DAW's meters into the red, you can decrease the volume here.

This section allows adjustment of the oscillator settings for the two CZ "Lines" including the way they are mixed, detuned and modulated.



For each Line there are two enumerated list parameters that affect the wave shape; one for each alternating cycle produced by the Line's oscillator. The shape's name describes the resulting waveform when the DCW (the amount of phase distortion) is at it's maximum. On the user interface there is a third control that is not represented by a parameter that allows you to quickly set both of the Line's shape parameters to the same value. This control is accessed by clicking directly between the Line's Shape A and Shape B controls (see Figure 3.11).



No.	Waveform	Description
1	Saw	Sine wave moving to sawtooth at max DCW
2	Square	Sine wave moving to square at max DCW
3	Pulse	Sine wave moving to impulse at max DCW
4	DbISine	Sine wave moving to double sine
5	SawPulse	Sine wave moving to saw/pulse hybrid
6	Reso1	Hard-synced sine wave with sawtooth envelope
7	Reso2	Hard-synced sine wave with triangle envelope
8	Reso3	Hard-synced sine wave with trapezoid envelope

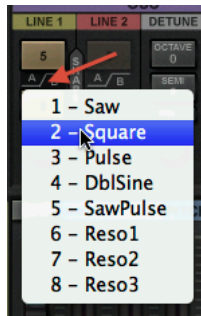


Figure 3.11: Clicking in-between the shape buttons to set both shapes at once

Line DCW Base

This parameter, which doesn't exist on the CZ hardware, allows the setting of a base-value for the DCW amount, and is the closest equivalent to a filter-cutoff control on a subtractive synth. If you wish to invert the DCW Envelope for a Line you can set the to the maximum (100%) and set the DCW Envelope depth to a negative value.

Mix Mode

The Mix Mode parameter chooses whether you have one or both of the CZ lines engaged.

Mix Mode Setting	Description
Line1	Line 1 on its own
Line2	Line 2 on its own
Line1 + Line1'	Line 1 and a detuned version of itself
Line1 + Line2	Line 1 and Line 2 at the same time

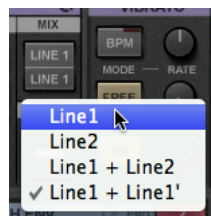


Figure 3.12: Line Mix Mode menu

Detune Polarity

This is a simple switch parameter that determines if the detune settings for the second line (in Mix Modes Line1 + Line1' / Line1 + Line2) should be positive or negative.

Detune Oct

The number of octaves to detune the second line by between 0 and 3.

Detune Semi

The number of semitones to detune the second line by between 0 and 11.

Detune Fine

This is a fine detune for the second line and can be used to create interesting beating and chorusing effects. Like the CASIO hardware, the increments for fine tune are a 60th of a semitone, rather than the more conventional cents (100th of a semitone) often used when detuning. If you look in the VirtualCZ LCD it shows a conversion to cents as you change the parameter.



Figure 3.13: Line detune settings

Modulation Mode

The Modulation Mode, which is enabled when two lines are engaged (i.e. Mix Modes Line1 + Line1' or Line1 + Line2), can be set to either Ring (the output of Line 2 or Line1' is Ring Modulated with the output of Line 1), or Noise (the pitch of Line 2 is modulated by a noise/random function). Ring Modulation is good for creating inharmonic tones, such as bells and metallic percussion, whereas noise is good for special FX sounds.

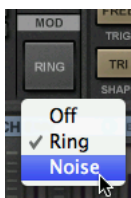


Figure 3.14: Line Modulation Mode menu

Phase Reset

The oscillator Phase Reset parameter, which is not found on the CZ hardware, is only really relevant for the monophonic unison modes. When phase reset is on, the oscillators will start at the same position in the waveform when a note is played. When multiple voices are in unison and detuned this means that the same pattern of phasing and beating effects is repeated each time a note is triggered. This can be desirable for tight bass and lead sounds, but sometimes a more mellow unison is preferable, in which case the oscillator phase reset can be disabled.

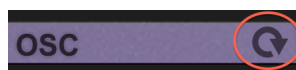


Figure 3.15: Phase Reset toggle switch

3.4 ENV (Envelope Generators) Section

One of the most powerful features of the CZ synths is the six 8 stage envelope generators (EGs), which allow complex modulations with stages that can either be extremely quick or extremely slow, or somewhere in between. Setting the parameters for 8-stage multi-segment (MSEG) envelopes can be confusing and time consuming even for the most adept sound designers, so VirtualCZ provides an option to switch all the envelopes to the more familiar ADSR type, as found on most analogue synthesisers. Since there are six EGs per voice, each with very similar settings, the following descriptions are generic.



Figure 3.16: ENV Section: Line 2 Amp Envelope controls in MSEG Mode and ADSR Mode

EG Mode

This switch, which is located in the bottom right hand corner of the plug-in's user interface, will allow you to choose between MSEG and ADSR modes, and will show/hide the controls that correspond to the currently selected mode. It's important to understand that the plugin makes no attempt to "convert" between one envelope type and the other - the parameters are independent and if you tweak ADSR settings and switch to MSEG your sound will be different - naturally.

Depth (PITCH and DCW EGs)

On the PITCH and DCW envelopes, the EG Depth parameter is bi-polar and it can range from +/- 84 semitones and +/- 100%, so that the effect of the envelope can be inverted and scaled. This parameter did not exist on the original CZ hardware, so when sending SYSEX messages you should probably set it to the maximum value if you want the sound to be similar.

Level (AMP EG)

On the AMP EGs, there is a Level parameter to control the overall volume of each line, which corresponds to the Line Level on the CZ-1 hardware. Like the hardware, there are 16 values that range between 0 and 15.

Velocity

This parameter controls the amount that MIDI note-on velocity influences the envelope. If the parameter is set to zero, then the velocity will have no effect on the envelope depth. Like the hardware, there are 16 values that range between 0 and 15.

Key Follow (DCW and AMP EGs only)

On the DCW and AMP EGs a Key Follow parameter sets the amount of influence the pitch played has on the envelope. For the DCW EG the depth of the envelope is modified. This can be important, for instance, when emulating the sound of acoustic instruments, where you might want to roll off the DCW amount the higher the pitch in order to emulate a varying spectrum across the keyboard range. For the AMP EG, the Key Follow parameter modifies the rate of the envelope, where higher values mean that higher pitches have faster rates i.e. they notes are shortened. Like the hardware, there are 10 possible values that range between 0 and 9.

Rate Controls (MSEG Env Mode only)

The rate controls set the speed of each envelope segment, using the same 0-99 range as the CZ hardware. The higher the rate, the faster the envelope segment. Rate increases clockwise, so the fastest envelope setting is all the way to the right.

Level Controls (MSEG Env Mode only)

The level controls set the level of each envelope segment, using the same 0-99 range as the CZ hardware.

Sustain Step (MSEG Env Mode only)

You can choose between "off" or steps 1-7 to say where in the MSEG envelope the progression should stop whilst a key is held down. If the End Step is lower than the Sustain Step, then the Sustain Step has no effect.

End Step (MSEG Env Mode only)

This is the point at which the envelope ends and can be set between 2 and 8. Redundant Rate/Level controls will be greyed out if this parameter is changed.

Loop Enable (MSEG Env Mode only)

A loop option, not found on the CZ hardware. If the Sustain Step is not set to "off" the envelope will loop all the stages up to the Sustain Step, then return to the beginning. On release it will continue with the rest of the envelope.

Attack (ADSR Env Mode only)

This sets the attack time in Milliseconds/Seconds.

Decay (ADSR Env Mode only)

This sets the decay time in Milliseconds/Seconds.

Sustain (ADSR Env Mode only)

This sets the sustain level (a percentage of the maximum envelope level).

Release (ADSR Env Mode only)

This sets the release time in Milliseconds/Seconds.

3.5 VIBRATO Section (LFO)

Like the CZ hardware synths VirtualCZ has one Low Frequency Oscillator (LFO), which is assigned to vibrato. The LFO in VirtualCZ is more flexible than the hardware - it has more waveforms and can be synchronised to the DAW's tempo.



Figure 3.17: The VIBRATO Section

Vibrato Rate Mode / Vibrato Rate

The Vibrato Rate Mode parameter determines whether the Vibrato Rate is set with a (BPM) beat based division or a (Free) rate in the range 0-99 like on the CASIO hardware. SHIFT-CLICK the rate knob when Vibrato Rate Mode is set to BPM to bring up a menu of all the options (see figure 3.18).

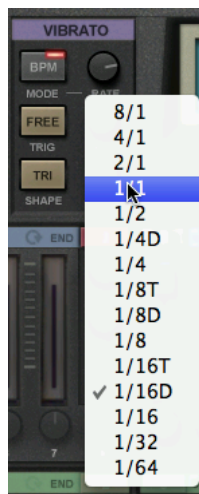


Figure 3.18: SHIFT-CLICK the Vibrato Rate menu

Vibrato Depth

This sets the depth of the Vibrato modulation in CZ units of 0-99. The LCD readout shows the equivalent in semitones (maximum 12 semitones/1 octave).

Vibrato Trig Mode

The Vibrato Trig Mode parameter determines whether the LFO's phase is aligned with the DAW's timeline. If you want to produce precisely repeatable results you can set this to "Host Sync" rather than "Free".

Vibrato Shape

VirtualCZ has 7 different vibrato LFO waveforms, *versus* 4 on the CZ hardware. They are as follows:

No.	Waveform	Available on real CZ?
1	Sine	NO
2	Square	YES
3	Triangle	YES
4	RampUp	YES
5	RampDown	YES
6	SAH (Sample & Hold)	NO
7	Noise (Interpolated Sample & Hold)	NO

When transferring a patch via SYSEX that uses a waveform not on the hardware it will be set to Triangle.

Vibrato Delay

This is a fade-in time on the Vibrato when a note is trigger. Unlike the CZ hardware it is a gradual fade in, rather than purely a delay, however, the units are 0-99 like on the hardware.

3.6 SCALING Section

Because MIDI keyboards often have very different responses and players play keyboard in different ways, VirtualCZ contains a scaling section where incoming velocity and aftertouch values can be remapped to new ones.

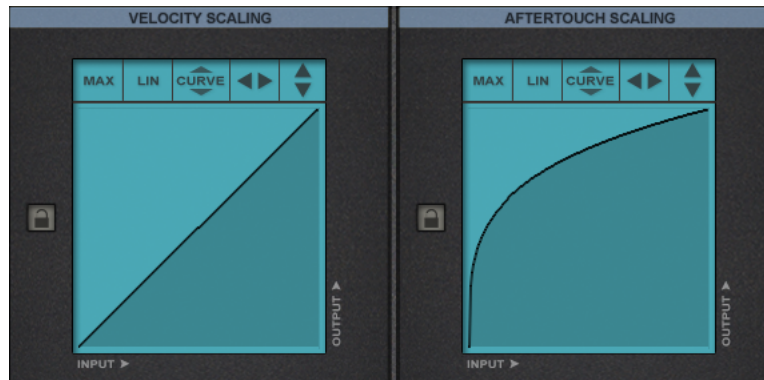


Figure 3.19: The SCALING Section

For both velocity and aftertouch there is a two dimensional table where you can draw a mapping curve by clicking and dragging with the mouse. Input level is on the X axis and output is on the Y axis. In order to draw straight line segments you can hold down SHIFT and click the start and end points of your line. You can also use the MAX button to remove all velocity influence and set all values to maximum and the LIN button to revert to the default linear mapping. A CURVE button can be used to make a variable curvature in the mapping; to use it click and drag up or down. You can also click and hold the LEFT/RIGHT/UP/DOWN arrows in order to shift the entire mapping.

It's worth noting that these scaling settings will have no effect if none of the envelope generators have been set to respond to velocity.



Figure 3.20: Aftertouch Mode and Routing controls

Aftertouch Mode

VirtualCZ supports both channel pressure and polyphonic aftertouch, but not both at the same time. You can choose which is enabled here.

Aftertouch Routings

The modulation from the aftertouch can be routed to LFO (Vibrato) Depth, Volume (AMP) or DCW.

3.7 Miscellaneous Controls

LCD Backlight Colour

By clicking the VirtualCZ LCD, you can bring up a menu to choose one of three backlight colours. The LCD backlight colour is a global preference.

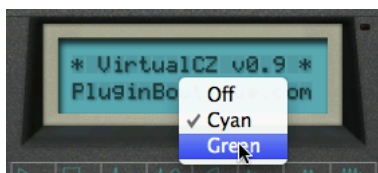


Figure 3.21: Setting the LCD Backlight Colour

Panic Button and MIDI Activity LED

VirtualCZ has a MIDI activity LED that will flash whenever a MIDI note is received. You can also click it to reset all the voices in case of one getting stuck.

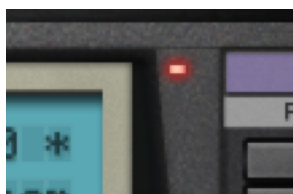


Figure 3.22: The LED to show MIDI activity doubles up as a PANIC! button

4 | Using VirtualCZ as a SYSEX Editor

VirtualCZ can send patches to the CASIO CZ synths (CZ-1, CZ-101, CZ-1000, CZ-3000, CZ-5000). At this stage the CZ-230s is not supported.

The CZ synths use SYSEX dumps, which means the entire state of the synth is sent in one go. This means it is not possible to send SYSEX messages to automate a single parameter. Sending SYSEX from a computer to an old synthesizer can often be unreliable due to various factors. Many USB MIDI interface drivers are poor quality and will have problems with the significant amounts of data required by SYSEX. We recommend you use a high quality MIDI interface and avoid sending SYSEX at the same time as other MIDI data.

The "TOOLS" button at the top of the plug-in's interface is where you can perform SYSEX sending commands (see Figure 4.1). You can SHIFT-CLICK the "TOOLS" button to send SYSEX, as well as using the "Send SYSEX" item on the popup menu.

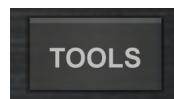


Figure 4.1: The TOOLS button/menu. SHIFT-CLICK to send SYSEX

There is also an option to automatically send SYSEX when a parameter is changed in the plug-in (see Figure 4.2). This will send a SYSEX message every second if a parameter has changed. This means that when you choose a preset in VirtualCZ or alter any control the patch will get transferred to the hardware. Since the message is a SYSEX dump sent every second, this is not suitable for automating parameters in real-time, and you are recommended to turn it off during playback in your DAW and only use it during the process of editing your CZ patch.

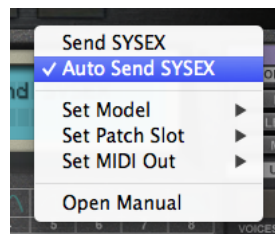


Figure 4.2: Send SYSEX and Auto Send SYSEX

Host MIDI or Direct MIDI out?

Many audio plug-in hosts (e.g. DAWs) do not handle SYSEX messages well (if at all), so VirtualCZ features its own direct MIDI output that can bypass the host's MIDI settings, although by default the MIDI output will be routed to "Host MIDI" (see Figure 4.3). This is a global setting, with the assumption that if you have a CASIO CZ hardware synth you leave it connected to a particular MIDI port, and whatever DAW you use it will send to the synth, without having to configure the DAW's MIDI settings each time. On Windows, you will probably need to make sure that the DAW is not also trying to use the same MIDI device and disable it in the DAW preferences if so. VirtualCZ will give you an error message if it can't open the MIDI device. The MIDI output in VirtualCZ is a global setting, so it is only designed to work with a single CZ synth at a time. If it is not possible to assign VirtualCZ its own MIDI device, or if you have multiple CZ synths you want to work with, then you should

use the "Host MIDI" setting and a DAW that supports SYSEX coming from plug-ins. In this situation, you will need to consult your DAW's documentation to route the MIDI output from the VirtualCZ to a hardware MIDI output.



Figure 4.3: Choosing the MIDI output

Steps to send SYSEX

The first thing to do when sending SYSEX is to make sure you have a MIDI cable going from the MIDI output of your MIDI Interface to the MIDI input of the CZ hardware. You can test the connection by sending a MIDI note message from your DAW to the hardware. You will need to choose your CZ model (see Figure 4.4) and choose the patch slot destination (see Figure 4.6). The CZ model is a global setting.

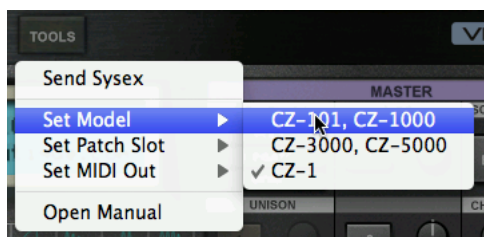


Figure 4.4: Choosing the CZ Model

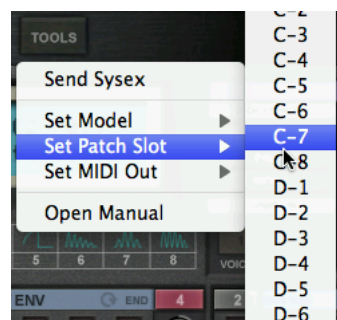


Figure 4.5: Choosing the Patch Slot

Below are the steps to follow for the various CZ hardware models. **Red** text indicates something that you do in VirtualCZ and **blue** text indicates something that you do on the CZ hardware.

CZ-101 / CZ-1000

- **Set Model To "CZ-101, CZ-1000"** in Tools->Set Model
- **Choose one of the 16 patch slots** in Tools->Set Patch Slot -> 1 to 16
- **Make sure "PROTECT" is switched to "OFF"** on the back of the synth
- **Make sure COMPARE/RECALL is not illuminated**
- **Select the "Internal" memory on the CZ-101, CZ-1000 that you wish to send to (e.g. Internal No.1)**

- Select Tools-> Send SYSEX
-

CZ-3000 / CZ-5000

- Set Model To "CZ-3000, CZ-5000" in Tools->Set Model
 - Choose one of the 32 patch slots in Tools->Set Patch Slot -> A1 to D8
 - Make sure "PROTECT" is switched to "OFF" on the back of the CZ-3000 / CZ-5000
 - Make sure COMPARE/RECALL is not illuminated
 - Select the MEMORY on the CZ-3000 / CZ-5000 that you wish to send to (e.g. MEMORY A-1 to D8)
 - Select Tools-> Send SYSEX
-

CZ-1

- Set Model To "CZ-1" in Tools->Set Model
- Choose one of the 64 patch slots in Tools->Set Patch Slot -> A1 to H8
- Make sure "PROTECT" is switched to "OFF" on the back of the CZ-1
- Make sure SYSEX is enabled on the CZ-1
 - Press the button labelled "MIDI" to the immediate left of the LCD, to view MIDI options
 - Press the page down button (labelled "DOWN") to change to the second page of MIDI options
 - Press the value up button (with an upwards arrow on it) so that the LCD shows "SYSTEM EXCLUSIVE TONE DATA=ENA"
- Select the MEMORY BANK on the CZ-1 that you wish to send to (e.g. MEMORY A-1 to H8)
- Select Tools-> Send SYSEX

Requesting patches From CZ Synths

VirtualCZ 1.1 adds functionality to allow the software to request SYSEX patches from the CZ hardware, one at a time. In order to do this, make sure the MIDI input/output in the TOOLS menu are routed to the CZ hardware - choose "Set MIDI Output.." in VirtualCZ and select the port on your MIDI interface that is connected to your CZ's MIDI input socket, then choose "Set MIDI Input..." and choose the port on your MIDI interface that is connected to your CZ MIDI output socket. Once you have your MIDI connections routed, you can follow these steps to pull a sysex patch from the hardware, into the software. Please note, that if you want to save this patch, you will then have to export it into a particular format.

- Set Model in Tools->Set Model, to choose your CZ model
- Make sure "PROTECT" is switched to "OFF" on the back of the CZ hardware
- Make sure COMPARE/RECALL is not illuminated, if your device has that button
- Make sure SOLO is not enabled, if your device has that button
- If connected to a CZ-1, make sure SYSEX is enabled, see above
- Request one of the patches on the hardware device in Tools-> Request SYSEX -> (different CZ models will show different options)

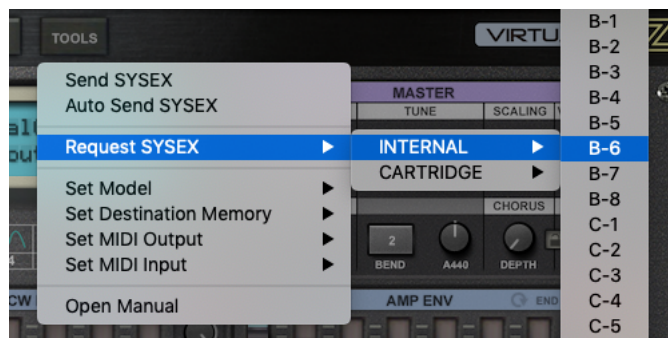


Figure 4.6: Requesting patch B-6 from a CZ-1

Hardware vs Plug-in

Below is a list of differences between the VirtualCZ emulation and the CASIO CZ hardware. The plug-in has been modelled without any insider knowledge of the CZ synthesiser firmware, so it has not been possible to make a 100% accurate mapping of parameters to the synthesis engine, which can sometimes show when directly comparing a patch on VirtualCZ with the same patch on a real CZ. More often than not, a slight tweaking of the envelope controls or velocity influence settings in VirtualCZ can help match sound from the hardware more precisely.

VirtualCZ new features ...

- Front panel controls for the majority of synth parameters
- UNISON (up to 8 voices) mode with detune amount
- Random panning of each note in polyphonic mode
- Stereo spread of voices in in unison mode
- MSEG (8-stage) Envelope generator can be looped
- Base DCW amount for each oscillator, which can be used like a "filter cutoff" parameter
- Envelope depth controls that can be positive or negative for PITCH and DCW envelopes
- Envelopes can be switched to ADSR style instead of MSEG (8-stage)
- Micro-tonal tuning support
- LFO can be synchronised to DAW tempo
- 7 Vibrato LFO shapes (vs 4 on the hardware)
- No restriction on combinations of Oscillator wave shapes
- 32 voice polyphony with both lines on (CZ-1 had 8 voices, CZ-101 had 4 voices)
- Modulation wheel controls the depth of Vibrato and is independent of the Vibrato Depth control

Hardware CZ features that are not in VirtualCZ ...

- no "Operation Memory" (OP-MEM) modes as found on the CZ-1
- VirtualCZ does not feature "Tone Mix" or "Key Split" modes. These can be implemented more flexibly by making multiple copies of the plug-in within the DAW
- VirtualCZ is mono-timbral (use multiple instances for multiple sounds)
- No "Glide" as found on the CZ-3000, CZ-5000 and CZ-1

5 | Using Tuning Tables

For users interested in micro-tonal music, VirtualCZ allows you to detune each MIDI note. It would be very laborious to do this manually, so it supports importing custom tunings via the popular *.tun* tuning table format. The tuning table is stored per patch and the lock can be enabled to stop new presets overwriting it.

Using *.tun* Files

The *.tun* format specifies a base frequency and a list of tuning offsets from the base frequency in cents for each pitch on the keyboard (there are 1200 cents in one octave). Click the LOAD button to select a *.tun* file. Click the RESET button to get back to 12 tone equal temperament.

You can find *.tun* files and resources on the internet:

- [About the *.tun* tuning table format](#)
- [Scala to *.tun* converter](#)
- [.tun generator](#)

Manually Adjusting Tuning

You can type in a base frequency and the tuning offsets in cents for each MIDI key manually. Clicking in the squares to the left of the tuning table box chooses the octave that is displayed on the keys/notes in the middle. The exact tuning can be specified in the text entry boxes adjacent to the keys. Sending a MIDI Note-On message to VirtualCZ (e.g. by playing a key on your MIDI keyboard) the display should highlight the corresponding octave/key in the tuning interface to help you find the correct place (see Figure 5.1). You can also click one of the 12 keys in the middle of the tuning table to trigger a MIDI note for that key and audition any tuning changes.

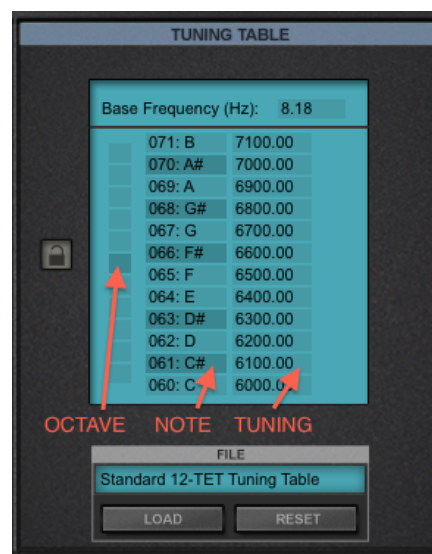


Figure 5.1: Tuning Table

6 | Stand-alone Application

When using the Stand-alone version of VirtualCZ, you need to specify what audio and MIDI devices to use. You can change these settings in the applications preferences, which is accessible from the application menu on OSX or the File menu on Windows. The choices are remembered when you close VirtualCZ, but if your devices change (for instance if you disconnect your audio interface), you may need to adjust the settings, because VirtualCZ will revert to the default audio interface, as specified by the operating system. When using the Stand-alone Application to send SYSEX, your MIDI output must be chosen inside the application preferences window.

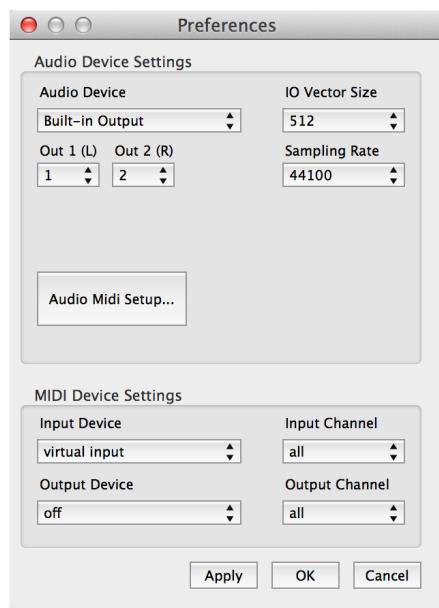


Figure 6.1: App Preferences Dialog on OSX

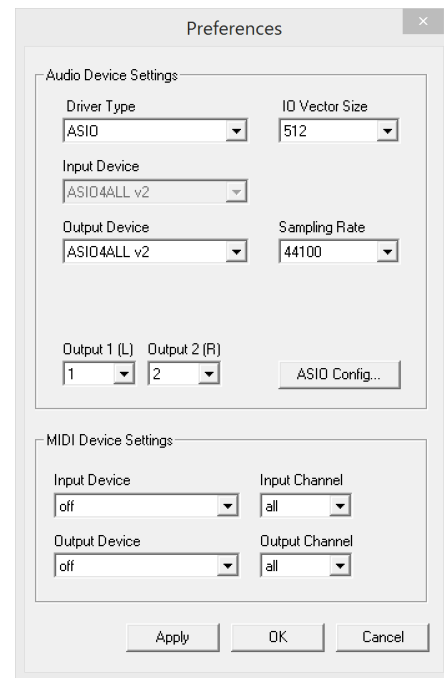


Figure 6.2: App Preferences Dialog on Windows

Driver Type (Windows Only)

Select the kind of audio driver to use (DirectSound or ASIO). ASIO will allow lower latencies. If you don't have an ASIO driver, you may be able to use [ASIO4ALL](#).

Input/Output Device

The physical device used for IO.

Out 1 (L) / Out2 (R)

The physical channels used for audio output (they must be consecutive).

IO Vector Size

The audio hardware buffer size. Increase this setting if you experience audio glitches (higher settings results in higher latency but less CPU usage).

Sampling Rate

VirtualCZ supports sample rates up to 192kHz if your audio interface supports it. Higher sampling rates mean better sound quality and lower latency, but result in more CPU usage.

AudioMidi Setup / ASIO Control Panel

This button will launch the OSX AudioMidi Setup app or your audio interface driver's ASIO control panel on Windows.

MIDI Input Device

Choose the MIDI input device. On OSX you can choose "virtual input" to create an IAC (inter application communication) driver that will appear as a midi output in other OSX software.

MIDI Input Channel

Filter the incoming MIDI messages to only use the specified channel.

MIDI Output Device

Choose the MIDI output device.

MIDI Output Channel

Filter the incoming MIDI messages to only use the specified channel.

7 | Host Notes

This section contains information regarding using VirtualCZ in specific plug-in host applications. As a general note for hosts that support multiple plug-in formats - it's best just to stick to one format and not switch between them or use two formats in one DAW project. Since VirtualCZ works as both a 32 bit (x86) and 64bit (x64) plug-in, you should never need to "bridge" it with a bit-bridge plug-in. Use the 32 bit version in a 32 bit DAW and use the 64 bit version in a 64bit DAW.

ImageLine FLStudio

Although FLStudio supports both VST3 and VST2, we recommend you use the VST2 version of VirtualCZ in FLStudio, because the FLStudio VST3 wrapper has some GUI focus issues with VirtualCZ.

Avid Pro Tools

In Pro Tools, VirtualCZ should respect the conventions for mouse behaviours, and when you automate a parameter it should be highlighted in the plug-in GUI.

Ableton Live

On Mac OSX, Ableton Live supports both VST2 and Audio Unit plug-in formats. You can use either. One advantage of using the VST2 version is that your project will transfer to a Windows machine running Live (Windows does not support Audio Unit plug-ins). One advantage of using the Audio Unit version is that VirtualCZ's *.aupreset* preset files are indexed and browsable in Ableton Live's browser.

Ableton Live does not support SYSEX internally, so you must use the direct MIDI output if you wish to send SYSEX to CZ Hardware.

Steinberg Cubase/Nuendo

Steinberg hosts will only show the VST3 version of VirtualCZ if you have both the VST2 and VST3 versions installed. VST3 is the preferred format for VirtualCZ in Steinberg hosts, since you can use the DAW's *.vstpreset* browser and some nice features such as right-clicking parameters to bring up a contextual menu where you can add the parameter to the automated parameter list.

8 | Further Reading

There is a vast amount of information on the internet about the CASIO CZ series and about phase distortion synthesis in general. Here are a few links to some of the best sites:

- [Electric Druid - "Phase Distortion Synthesis - How it Works"](#)
- [PAUL WIFFEN: Synth School, Part 3: Digital Synthesis \(FM, PD VPM\)](#)
- [Michael Rickard's CASIO CZ site](#)
- [Tomás Mulcahy's CASIO CZ site](#)
- [CASIO CZ youtube channel](#)
- [GForce Software Synth Archive: CASIO CZ-101](#)
- [archive.org CASIO Synth Manual Collection](#)
- [CZsynth Yahoo group](#)
- [cosmosynthesizer.de \[GERMAN\]](#)

9 | Support Info

You will be sent an email when VirtualCZ is updated, and it is recommended that you update to the most recent version as and when a new version is released.

Contacting Support

If you experience a problem with VirtualCZ, the first thing to do is to login to [your pluginboutique.com](https://www.pluginboutique.com) account to check for a new version, which may fix the issue. If there is no new version, you can contact support via email support@pluginboutique.com

When you email support it will help if you can provide the following information to help us solve your issue as quickly as possible:

You can check the plug-in format, version number and whether you are using a 32 bit or 64 bit version on the about page by clicking the VirtualCZ or PIB logo in the top corners of the interface.

- What is the VirtualCZ version number?
e.g. v1.0.0
- What plug-in format were you using?
e.g. VST2, VST3, Audio Unit, AAX or Stand-alone app
- What platform did you notice the bug on?
e.g. Windows XP, Windows 7 x64, OSX 10.8
- Please describe the spec of the machine you are using
e.g. i5 3Ghz, 4GB RAM / MacBookPro i5 2010 8GB RAM
- What is the name and version of your plug-in host?
e.g. Logic 9, Cubase 6.5, FLStudio 11
- Were you using the 32 bit or 64 bit version of the plug-in?
e.g. 32 bit
- If your issue relates to using VirtualCZ with CASIO hardware, which CZ model were you using?
e.g. CZ-101, CZ-1
- ... and what MIDI interface were you using?
e.g. MOTU 828 MkII
- Is the issue repeatable?
Can you make it happen again by following the same steps?

Feature Requests and Feedback

If you like VirtualCZ we'd really appreciate your feedback. You can rate the plug-in at www.pluginboutique.com and review it on sites such as www.kvraudio.com.

If you have a feature request or a suggestion for future versions of the plug-in please [contact the developer](#).

10 | Credits and Acknowledgements

VirtualCZ is designed and developed by Oli Larkin
<http://www.olilarkin.co.uk>

Graphics by Phillipe Decuyper
<http://www.eareckon.com>

Sound Bank A, by Oli Larkin

Sound Bank B, C and E by Don Solaris
<http://www.donsolaris.com/>

Sound Bank D by Scott AbstractCats
<http://abstractcats.org/>

Manual by Oli Larkin, typeset with \LaTeX

Thanks:

- [CASIO](#) and the engineers who made the awesome CZ series in the first place
- [Michael Rickard](#) for his extensive work on decoding the CASIO SYSEX format
- Justin Frankel and John Schwartz at [Cockos](#) for developing the WDL/IPlug C++ library
- [Jez Wells](#) for Matlab tips
- [Theo Niessink](#) for contributions to WDL/IPlug
- [Gary Scavone](#) for making RTAudio and RTMidi used in the App
- Jack and Ben for the lending of the CZs
- VirtualCZ beta testers

11 | Glossary

ADSR Attack-Decay-Sustain-Release envelope generator.

DAW Digital Audio Workstation.

GUI Graphical User Interface.

MSEG Multi Segment Envelope Generator - an 8-Stage envelope generator. More powerful than an ADSR but more confusing too.

Phase Distortion A type of sound synthesis first used in the CASIO CZ series synthesisers, involving waveshaping of a phasor to distort a sine wave into various other waveforms.

phasor A name given to a basic oscillator that is used to generate a periodic ramp to drive a wavetable oscillator.

SYSEX MIDI System Exclusive message - a special type of MIDI message often used to transfer sound patches between devices.

waveshaping Waveshaping is the name for a process whereby an input signal is processed by a stateless function, in order to change the value at the output, for a given input. This is typically used in audio effects to emulate non-linearities that cause distortion, but in the case of the CZ waveshaping is applied to the phasor part of the oscillator in order to change the way that the stored wavetable is read.

wavetable A stored waveform (e.g sine wave), in the synthesiser/computer memory. Often used as an efficient way to calculate things like sine waves that are slow using other methods.

12 | License

VirtualCZ End User License Agreement

VirtualCZ (the Software) is developed by Oli Larkin (the Developer), under license for exclusive distribution to Plugin Boutique Ltd, (the Distributor).

Caveat

By installing the Software you agree to use it at your own risk. Neither the Developer or the Distributor can be held responsible for any damages caused as a result of its use.

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