Kern

Performance Synthesizer

Version 1.2

http://www.fullbucket.de/music

VST is a trademark of Steinberg Media Technologies GmbH
Windows is a registered trademark of Microsoft Corporation
The Audio Units logo is a trademark of Apple Computer, Inc.
AAX is a trademarks of Avid Technology, Inc.

Table of Contents

Introduction

Kern is a software synthesizer plug-in for Microsoft Windows and Apple macOS designed to run with and to be fully controlled by MIDI keyboard controllers. It is written in native C++ code for high performance and extremely low CPU consumption. The main features are:

- Streamlined to be used with MIDI keyboard controllers; all parameters can be controlled by MIDI CC
- MIDI Learn
- Two alternative user panels
- 32 voices polyphony
- Two band-limited oscillators including Hard Sync
- 4-pole zero-delay feedback lowpass filter (two types)
- Two envelopes, one LFO
- Chorus effect
- Double precision audio processing
- Plug-in supports Windows and macOS (32 bit and 64 bit)

Kern is based on the **iPlug2** framework maintained by **Oli Larkin and the iPlug2 team**. Big thanks, guys!!! Without your work it would not have been possible to create a resizable *Kern* user interface.

To resize the plug-in you just grab the yellow triangle at the bottom right of the window and drag it. You can save the current window size using the menu entry "Save Window Size" in the *Options Menu* or by right-clicking somewhere into an empty space of *Kern*'s panel.

If you have trouble with the standard version of *Kern*, please grab the (sound-wise identical) "N" version of the plug-in which is based on the original **iPlug** framework.

Acknowledgments

- **Oli Larkin** and the **iPlug2** team.
- **Alberto Rodriguez** (albertodream) for designing the factory presets 32 to 62.

Why Kern?

Ask yourself:

- Do you have a MIDI controller with all those shiny sliders, knobs, and buttons?
- Do you feel the urge to use it to twiddle the parameters of your favorite (software) synth?
- Do you get frustrated because moving a knob here changes a knob there, but the mapping seems not to be intuitive?
- Or maybe the parameter you want to access isn't even mapped?
- And, to even increase frustration, do you remember the good old days when synthesizers had exactly one dedicated slider/knob/button for each parameter?

If your answer is always “No” then ask yourself:

- Do you want a light-weight, easy-to-use, CPU-friendly, cool sounding synth?

If it is “No” again then *Kern* may be not the right thing for you.

… but now you know why I created *Kern*. Together with my V-Machine (which is grateful for CPU-friendly plug-ins!) I have a fully controllable stand-alone synthesizer that does not need a PC.

Of course there are drawbacks: Since today's MIDI master keyboards typically do not have more than 30 hardware controls I had to limit the number of *Kern*'s parameters to (what I believe – you may have a different opinion here, that's OK –) the minimum of what is absolutely required. That is why *Kern* is named “Kern” which is German for “core”.

User Interface

Two alternative user panels (“views”) are available: The standard (“traditional”) view is in line with the architecture of subtractive synthesizers while the second view reflects the typical layout of the sliders, knobs, and buttons of today's MIDI hardware controllers. If you own a Novation Impulse (like I do) or a similar machine you will find the latter view very helpful since it visually maps the hardware controls to *Kern*'s parameters.

You can switch between the views via the *Options* menu or via the *Switch View* button (only available on the standard view).

Kern's standard view

Kern's alternative view

Sound Engine

Oscillators

Kern has two band-limited oscillators that can create *Sawtooth* or *Square* waves; the waveform has to be selected for both oscillators together. Oscillator 2 can be transposed by ±24 notes and detuned by ±1 note. Furthermore, it is possible to hard-synchronize Oscillator 2 to Oscillator 1.

The frequency of the oscillators can be modulated either by the LFO or the filter envelope (positively or negatively). If Hard Sync is activated, only Oscillator 2 will be modulated to produce the classic rich harmonic "Sync" spectra we all love. Apart from that, frequency modulation of both oscillators by the LFO ("Vibrato") can always be applied via the modulation wheel. Portamento is on board, too.

Finally, it is possible to switch *Kern* into monophonic mode (e.g. for lead and/or bass sounds). By default the envelopes are *single triggered* meaning that they are not restarted when playing *legato* (also known as "Minimoog mode"). However you can change the trigger mode to *multiple* using the context menu that opens when you click on the *Mono* switch.

Filter and Amp

The filter is based on a (attention: buzz words!) *Zero-Delay Feedback* design and provides two modes: *Smooth,* a 4-pole lowpass with moderate non-linearities and potential self-oscillation, and *Dirty*, a punchy 2-pole lowpass with potential but no self-oscillation. *Cutoff* and *Resonance* of course are editable.

The cutoff frequency of the filter can be modulated simultaneously and both positively or negatively by four sources: filter envelope, LFO, key track, and velocity.

The amplifier just offers *Volume* and *Velocity* parameters; the latter controls the influence of the velocity to the output volume.

LFO and Envelopes

The LFO offers three waveforms: *Triangle*, *Square*, and *S/H* (random); its' speed rate ranges from 0 to 100 Hz.

The filter envelope is a simplified ADS generator: The *Decay* parameter controls both Decay and Release rates together while *Sustain* can only be switched on or off. The amplifier envelope is similar with the exception that here *Release* can be controlled independently from the Decay rate.

Chorus

The Chorus can be switched on or off. Furthermore it is possible to set the speed rates of the two triangle-shaped LFOs modulating the Chorus as well as the modulation depth.

Performance Controls

Program Menu

If you know my other plug-ins then there will be no surprises: To select one of the 64 patches just click on the program number, and edit its' name by clicking in the text field.

Options Menu

When clicking on the *Options* button, a context menu opens with these options:

Copy Program	Copy current program to internal clipboard
Paste Program	Paste internal clipboard to current program
Init Program	Initialize the current program
Load Program	Load a program file containing a patch to the *Kern*'s current program
Save Program	Save the *Kern*'s current program to a program file
Load Bank	Load a bank file containing 64 patches into the *Kern*
Save Bank	Save the *Kern*'s 64 patches to a bank file
Select Startup Bank	Select the bank file that should always be loaded when the *Kern* is started
Load Startup Bank	Load the Startup bank file; can also be used to check what the current Startup bank is
Unselect Startup Bank	Unselect the current Startup bank
Default Path for Program Files	Sets the default path for program and bank files
MIDI Thru	Set globally if MIDI data sent to *Kern* should be sent through to its MIDI output (stored in configuration file)
Ignore Program Change	Set globally if MIDI Program Change data sent to *Kern* should be ignored (stored in configuration file)
Reload Configuration	Reload *Kern's* configuration file
Save Configuration	Save *Kern's* configuration file
Check Online for Update	When connected to the Internet, this function will check if a newer version of the *Kern* is available at fullbucket.de
Switch View	Switches between the views (see section *User Interface*)
Visit fullbucket.de	Open fullbucket.de in your standard browser

The kern.ini Configuration File

Kern is able to read some settings from a configuration file (`kern.ini`). The exact location of this file depends on your operating system and will be displayed when you click on “Reload” or “Save Configuration”.

MIDI Control Change Messages

All parameters of the *Kern* can be controlled by MIDI controllers, or more precise: Each MIDI controller (except *Modulation Wheel* and *Sustain Pedal*) can control one of *Kern*'s parameters. The mapping is defined in the `kern.ini` for example like this:

```
[MIDI Control]
CC41 = 12 # Filter Cutoff
CC42 = 13 # Filter Resonance
CC43 = 21 # Filter Env Attack
CC44 = 22 # Filter Env Decay
CC45 = 24 # Amp Env. Attack
CC46 = 25 # Amp Env. Decay
CC47 = 27 # Amp Env. Release
...
```

The syntax is straight forward:

```
CC<controller number> = <parameter ID>
```

Given the above example, controller 41 directly controls the overall *Filter Cutoff* parameter, controller 42 the *Filter Resonance* etc. As you can see, comments are introduced by the Pound sign (#); they are here just for description purposes and completely optional.

The *parameter ID* of one of the *Kern*'s parameters is given in the section *Parameters* below. Note that the *controller number* can run from 0 to 119, with the exception of 1 (*Modulation Wheel*) and 64 (*Sustain Pedal*); the latter two are simply ignored.

Of course, instead of editing the controller/parameter assignments in `kern.ini` with a text editor it is much easier to use the *MIDI Learn* function and save the configuration (see sections *MIDI Learn* and *Options Menu*).

MIDI Learn

Every parameter of *Kern* can be controlled by one MIDI controller. If you want to change the assignment of MIDI controller (CC; *MIDI Control Change*) to *Kern* parameter the *MIDI Learn* function comes in quite handy: Just click the *MIDI Learn* button on *Kern*'s control panel (caption turns red) and wiggle both the MIDI controller and the parameter you want to assign (you can abort *MIDI Learn* by clicking the red button). To save the controller assignments use “Save Configuration” in the *Options* menu.

Parameters

Oscillators

parameter	ID	description
Mono	1	Switches between polyphonic and monophonic mode (*Single* or *Multiple Trigger*)
Master Tune	4	Master tune (hidden parameter)
Wave	5	Selects the waveform (*Sawtooth* or *Square*)
P.Bend	2	Pitch Bend range (in notes)
Porta	3	Portamento time
FM	6	Frequency modulation depth
FM Src.	7	Frequency modulation source
Trans.	8	Oscillator 2 transpose (in notes)
Tune	9	Oscillator 2 tuning
Sync	10	Oscillator 2 Hard Sync

Filter

parameter	ID	description
Cutoff	12	Cutoff frequency
Reso.	13	Resonance
Mode	11	Filter mode (*Smooth* or *Dirty*)
Env	14	Cutoff frequency modulation by filter envelope
LFO	15	Cutoff frequency modulation by LFO
Key	16	Cutoff frequency modulation by note number
Velocity	17	Cutoff frequency modulation by velocity
Attack	21	Attack time of filter envelope
Decay	22	Decay/Release time of filter envelope
Sustain	23	Sustain of filter envelope (*Off* or *On*)

LFO

parameter	ID	description
Rate	19	Rate of the LFO (0 to 100Hz)
Wave	20	Waveform (*Triangle*, *Square*, *S/H*)

Amplifier

parameter	ID	description
Attack	24	Attack time of amplifier envelope
Decay	25	Decay time of amplifier envelope
Release	27	Release time of amplifier envelope
Sustain	26	Sustain of filter amplifier (*Off* or *On*)
Volume	0	Master volume
Velocity	18	Velocity amount

Chorus

parameter	ID	description
Enable	28	Chorus on/off
Rate 1	29	Rate of first Chorus LFO
Rate 2	30	Rate of second Chorus LFO
Depth	31	Depth of Chorus modulation

Frequently Asked Questions

How do I install the Kern *(Windows 32 bit version)?*

Just copy the files `kern.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the *Kern* VST2 plug-in the next time you start it.

How do I install Kern *(Windows VST2 64 bit version)?*

Just copy the file `kern64.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the *Kern* VST2 plug-in the next time you start it.

Note: You may have to remove any existing (32 bit) `kern.dll` from your VST2 plug-in folder or else your DAW may screw the versions up…

How do I install Kern *(Windows VST3 64 bit version)?*

Just copy the files `kern.vst3` from the ZIP archive you have downloaded to your system's or favorite DAW's VST3 plug-in folder. Your DAW should automatically register the *Kern* VST3 plug-in the next time you start it.

How do I install the Kern *(Windows AAX 64 bit version)?*

Copy the file `kern_AAX_installer.exe` from the ZIP archive you have downloaded to any of your system's folder and run it. Your AAX-enabled DAW (Pro Tools etc.) should automatically register the *Kern* AAX plug-in the next time you start it.

How do I install Kern *(Mac)?*

Locate the downloaded PKG package file in Finder (!) and do a right- or control-click on it. In the context menu, click on “Open”. You will be asked if you really want to install the package because it comes from an “unidentified developer” (me ☺). Click “OK” and follow the installation instructions.

What is the plug-in ID of Kern*?*

The ID is **`kern`**.

I spent a lot of time customizing the MIDI controller/parameter assignments. Can I save these assignments?

Yes, by using “Save Configuration” in the *Options* menu (see section *Options Menu*).

How do I know if a new version of the Kern *is available?*

When connected to the Internet, open the Options menu (see section *Options Menu*) by clicking the disk icon and select the entry “Check Online for Updates”. If a new version of the *Kern* is available on fullbucket.de the respective information will be shown in a message box.