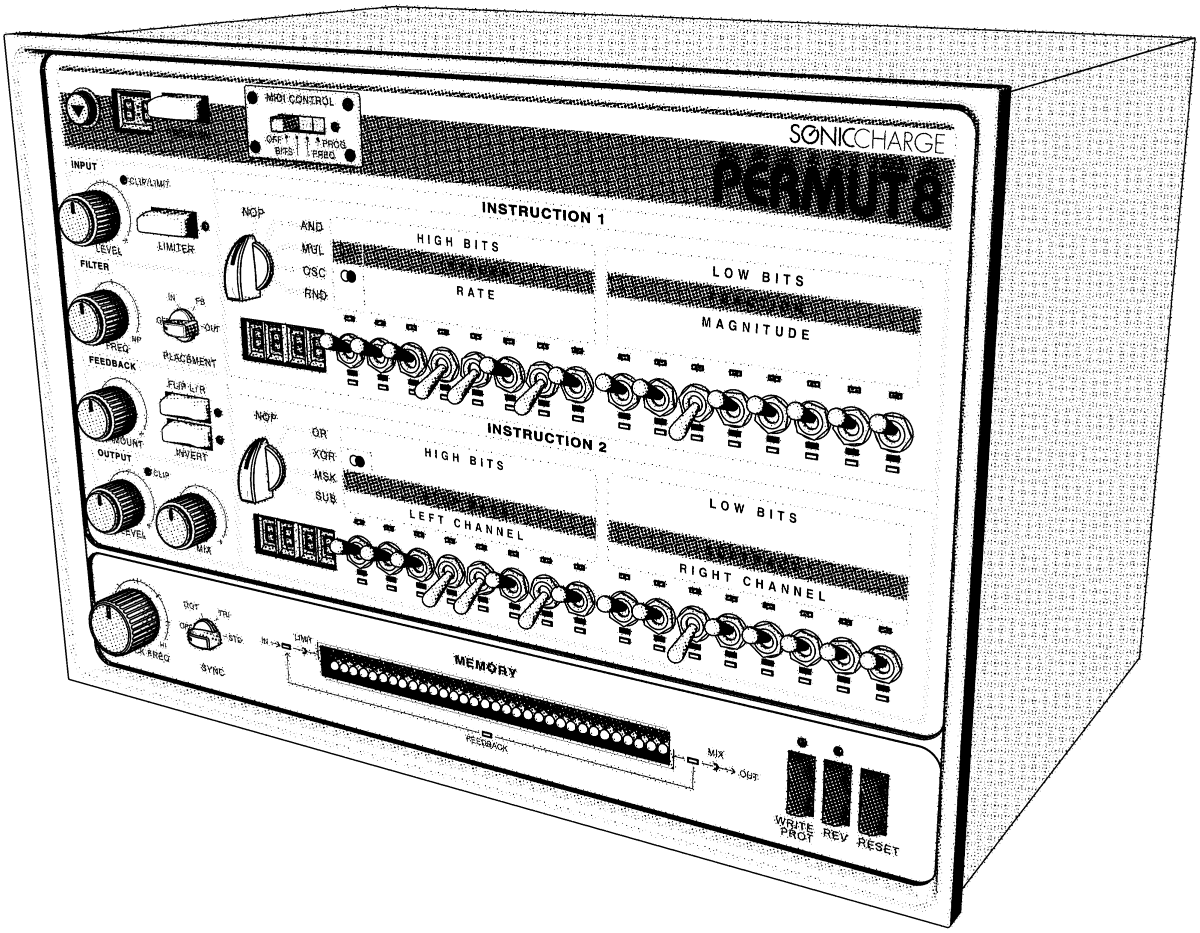
PERMUT8



USER GUIDE

- version 1.2.3 -

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INTRODUCTION

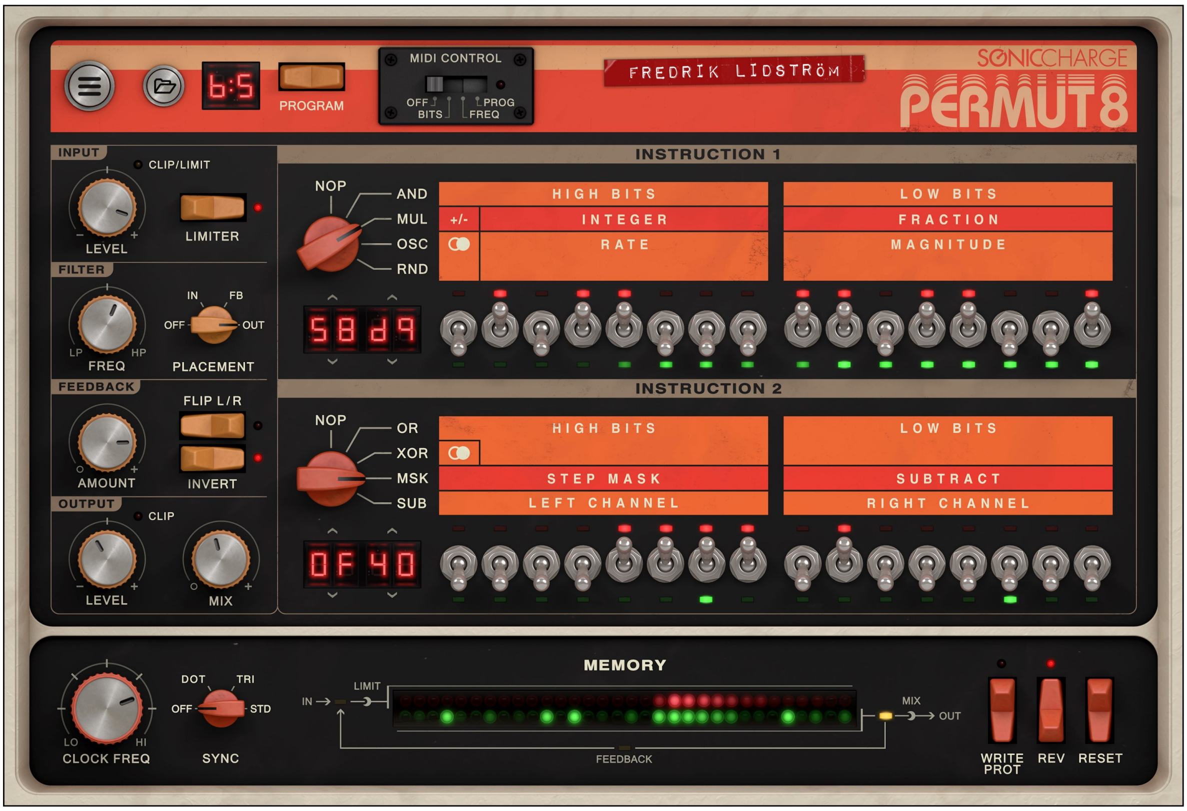
Permut8 is an effect plug-in that embraces the sounds of primitive digital signal processing hardware. It is programmable to produce a wide range of effects from traditional delays and flangers to beat-repeaters, bit-crushers, and yet unheard-of circuit-bent madness. At its core is a 12-bit digital delay with a variable sample rate from 0 to 352 kHz. The delay is controlled by a programmable processor with an assortment of operators, allowing you to create almost any type of effect you can imagine and many more that you can't. The input and output stages offer virtual analog components for saturation, limiting, and filtering. The output can be fed back into the input to create echoes, comb-filter effects, and never-ending chaos.

With Permut8, we have made a serious effort to make a plug-in that feels and sounds like a piece of physical, digital hardware, unlike your typical software effect. Permut8 can make aliasing noises that would make any Commodore 64 green with envy, but its aliasing differs from what you usually encounter in software DSP. For example, it is unrelated to the host sample rate, and you can tune it precisely with the "clock frequency" knob. Furthermore, the components that should not alias, e.g., the "analog" saturation, employ heavy-duty anti-aliasing techniques to avoid doing so.

The Permut8 user interface may seem a bit intimidating at first. Make no mistake, this is complex machinery at work, but it is also a product designed for experimentation and happy accidents. The best way to learn the plug-in is to dive right in and start flipping those switches at random and then read the reference section in this manual or turn to the built-in "Pop-up Help" for a better understanding of what is going on. On your journey to mastering this product, we are sure you will encounter many unexpected and rewarding results.

/ Magnus Lidström

User Interface

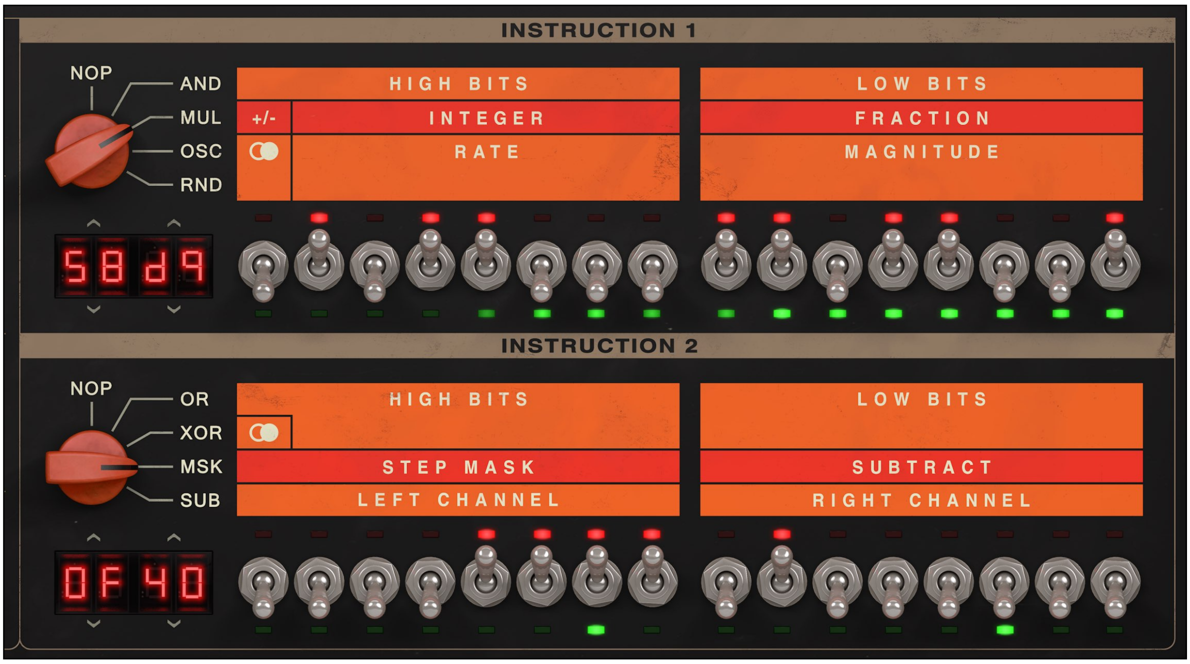


The heart of Permut8 is the 128 kilowords 12-bit delay-line memory, visualized by the LED array at the bottom of the user interface. The red dot shows incoming audio written to memory, i.e., the “write position”. The green dots represent playback positions for left and right outputs, i.e., the “read positions”. Use the two instructions to change and modulate the read positions with different “operators”. They are processed in order, i.e., instruction 1 is executed first, and instruction 2 is calculated based on instruction 1.

There are two eight-bit parameters per instruction, called “operands”. You can set individual “bits” of these parameters with the switches. If you set MIDI CONTROL to BITS, you can use MIDI keys to flip the bits. In most hosts, it is also possible to “automate” the switches. Shift-click and drag to set single bits more easily.

The current operand settings are also shown in “hexadecimal” format to the left of the switches. For your convenience, you can click and drag these displays to adjust the settings or click the small up and down arrows to increment and decrement one step at a time.

Operators



AND

The AND operator creates sudden jumps with the read position. It works by clearing selected bits in the read position data word. Turn on SYNC and flip the higher *(left-most)* bits to create beat-repeating effects. The middle bits generate granular "buffer underrun" effects, while the lowest bits can achieve "aliasing" like a bit-crusher effect.

MUL

MUL changes the rate of the read position in relation to the write position. In other words, it will change the pitch and speed of the input audio. The operand is a linear rate multiplier *(expressed in fixed-point notation with a sign bit)*.

Some examples:

0200 = double rate (1 octave up)
0100 = normal rate (no change)
0080 = half rate (1 octave down)
0000 = stop
8100 = reverse (leftmost switch flips the sign to reverse mode).

(Unlike a proper pitch shifter, there is no crossfading in Permut8*, which means there will be audible clicks as the read position and write positions meet.)*

OSC

OSC makes the read position swing backward and forward in a triangular motion. The results range from wobbly backward/forward effects to subtle pitch vibrato to extreme frequency modulation. You can achieve Flanger effects by turning up the FEEDBACK amount.

The high operand sets the oscillation rate, and the low operand sets the magnitude/depth of the modulation. Both follow exponential scales. The highest *(leftmost)* bit inverts the modulation of the right audio channel creating a wide stereo effect. A rate of 00 will freeze the oscillation and turn this operator into a fixed delay.

RND

Use RND to add a random sweeping motion to the read position, randomly modulating the pitch and speed. The high operand sets the rate, and the low operand sets the depth of the modulation. Both follow exponential scales. If you turn on the highest *(leftmost)* bit, a wide stereo effect is achieved by randomizing the right channel separately from the left.

At moderate rates and magnitudes, this operator adds subtle pitch modulation in the style of chorus effects. At extreme settings, it turns into white noise that follows the input level. A rate of 0 will effectively prevent the “sweeping” effect and make the read position hop to a random offset each time the write position completes a full cycle, resulting in a “sample-and-hold” modulation style.

(The pseudo-random number generator will generate the same sequence every time you flip the RESET switch.)

OR

The OR operator works like AND, but instead of clearing the selected bits, it sets them. As opposed to the AND operation, OR will “push” the read position in front of the write position. If you want to repeat the last section of a beat, OR is your friend.

> **DID YOU KNOW?** If you put Permut8 in REV mode, OR will work exactly like AND and vice versa..

XOR

XOR works on the bits of the read position data word *(similar to AND and OR)*. It inverts the operand bits, changing playback order in different ways. If you set all the bits to 1 *(FFFF),* the read position will move backward. If you leave the higher bits cleared, you will reverse short slices of audio, and if you set only the higher bits, the slices will play forwards but in reversed order. Flip the lowest bits to create ultra-nasty “aliasing” effects. The highest *(leftmost)* bit turns on a stereo effect that offsets the right channel against the left.

MSK

Use MSK to selectively “mask out” the result of instruction 1. This operator is most useful in SYNC mode. Each bit in the STEP MASK operand represents an eighth of the full “memory cycle”, i.e., if CLOCK FREQ is set to 1/1, each bit represents an eighth note. When a bit is zero *(switch is down)*, Instruction 1 is ignored. The SUBTRACT operand lets you delay the output signal. It uses the same exponential scale as SUB.

SUB

With the SUB operator, you subtract fixed amounts from the left and right channel's read positions, creating delays where the operands and the clock frequency define the exact time. The two operands follow exponential scales where values under 80 are typically used for tuning "comb filter" effects. If you hover the mouse over the hex displays, a pop-up hint will show the effective delay lengths as percentages of the full "memory cycle". E.g., if you enter STD SYNC mode and set the CLOCK FREQ to 1/1, F0F0 will create a delay of 1/2 bars.

If you put Permut8 in REV mode, the delay lengths become inverted. E.g., 00 will be exactly 100%. If you need a SUB operator for the first instruction, use OSC with a RATE of 0. If you want to control the delay length of both left and right channels from a single operand, use MSK with a STEP MASK of FF *(all bits set)*.

NOP

NOP is short for "No Operation" and does exactly that. Nothing. It is the bypass operator.

Memory Control

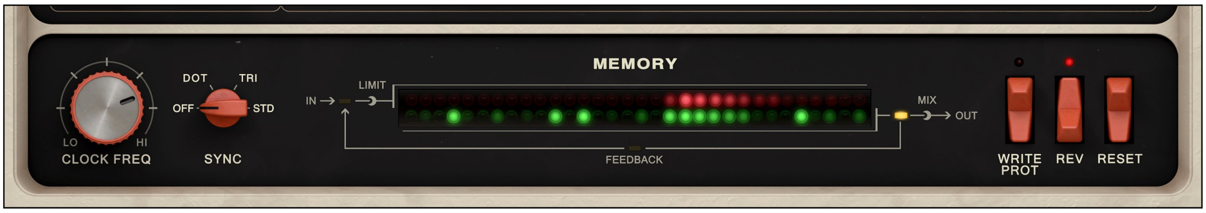
CLOCK FREQ

The CLOCK FREQ knob sets the running rate of the instructions. Changing the rate affects both the audio quality and the speed and delay times of the effects. The greater the frequency, the brighter and clearer the sound, but the maximum delay time will also be shorter. If SYNC is OFF, the clock frequency goes from 0 Hz *(full stop)* to 352.8 kHz. In other "synchronized" modes, the clock frequency adapts to the host tempo so that Permut8 will complete a full "memory cycle" in the chosen time signature and division.

If you shift-click CLOCK FREQ when SYNC is on, it will be turned OFF, and CLOCK FREQ will be positioned so that the tempo-synchronized rate is preserved. You can then fine-tune the frequency, e.g., for a delay that should be slightly out-of-sync.

MEMORY DISPLAY

The LED array is a visualization of the 128 kilowords 12-bit delay-line memory. The red dot shows incoming audio written to memory, i.e., the "write position". The green dots represent playback positions for left and right outputs, i.e., the "read positions".



Right-click the display to access a menu with functions to “bounce” the audio output of Permut8. You may either bounce the audio to a WAV file or back into the delay-line memory of Permut8. This function can be useful if you have frozen a nice loop with the WRITE PROTECT switch and want to export or mangle it further with the various Permut8 operators.

WRITE PROTECT

Enable WRITE PROTECT to “freeze” the memory content and create an infinite loop of whatever audio is currently in memory. You can still modify how the memory is played back, like changing programs and editing instructions. However, the INPUT and FEEDBACK controls will be of no use *(obviously)*, and the only FILTER PLACEMENT that will be useful is OUT.

“Write protected” memory content is even saved and loaded with your song file so that you can use Permut8 as a rudimentary loop player. If SYNC is OFF, clicking RESET will re-trigger the loop from the beginning.

REV

The REV switch makes the write- and read- positions move in reverse. This feature can be used to reverse short audio snippets in real time. After a full “memory cycle” has been completed, the audible effect of the reversal will be less noticeable *(or disappear entirely)* as the entire memory now contains reversed audio material. Notice, however, that the operators will function differently in REV mode.

RESET

If you flip the RESET switch, the memory is emptied *(if it is not “write protected”)*, and the read and write positions are reset. Notice that you should be able to “automate” this button in your host, just like any other button or knob.

Analog Section

INPUT LEVEL

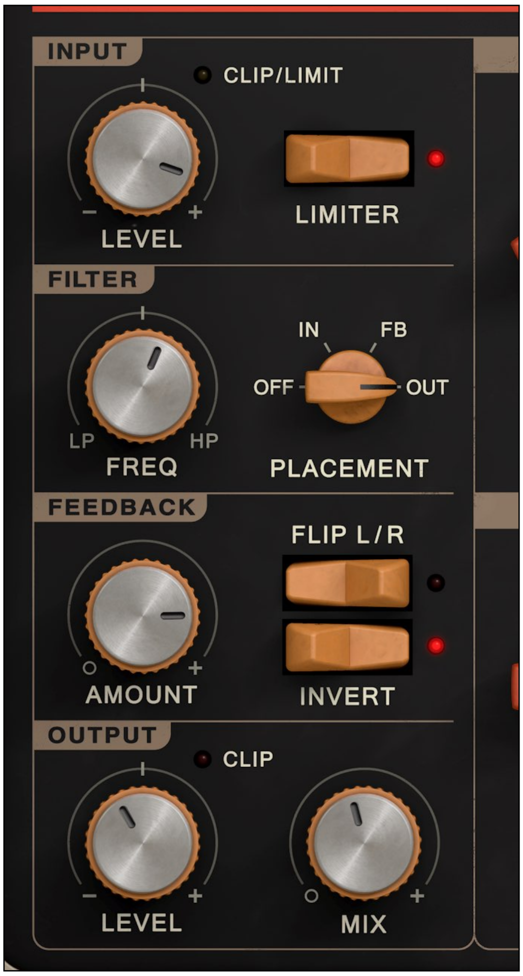
INPUT LEVEL is applied before anything else, including the soft clipper, the limiter, and the 12-bit sample data conversion. If you turn INPUT LEVEL very low, you will introduce a lot of quantization noise, i.e., “bit crushing” *(compensate with a high*

OUTPUT LEVEL). If you turn the level high, you will either get a lot of distortion or make the limiter work harder and obtain a more compact sound.

The soft clipping algorithm in Permut8 has very low aliasing, so you can use it as an analog distortion module. Turn up CLOCK FREQ to the maximum for the least amount of digital noise.

LIMITER

The LIMITER switch enables the built-in "brick-wall" limiter. The limiter has a fixed threshold and reaction time, but it is placed after the input gain adjustment. Thus the INPUT LEVEL will determine the amount of volume compression. The limiter is also placed inside the feedback loop, and with proper balancing of INPUT LEVEL and FEEDBACK AMOUNT, you can make the feedback signal "duck" when there is audio input *(creating a less busy sound)*. The filter is applied before the limiter if you turn FILTER PLACEMENT to IN. You can then tweak FILTER FREQ and MIX to compress only the low- or high-end of the audio signal.



FILTER FREQ

FILTER FREQ determines both the filter mode and its cutoff frequency. The left half of the knob puts the filter into lowpass mode while the right half puts it into highpass mode.

FILTER PLACEMENT

Turn the FILTER PLACEMENT dial to choose where in the signal chain you want to apply the filter. The OFF setting disables it entirely. The IN setting puts it before the soft clipper/limiter but still inside the feedback loop so that each successive iteration of the feedback signal will become increasingly filtered. The FB *("feedback")* setting places it on the feedback signal only, while OUT applies the filter to the final output *(as well as to the feedback)*. The different placement settings can make a big difference to the sound if you have a lot of digital distortion going on.

FEEDBACK AMOUNT

The FEEDBACK AMOUNT knob determines how much of the output signal is fed back into the input again.

FLIP L/R

With FLIP L/R, you can switch the left and right feedback channels so that for each iteration, the audio will bounce from left to right and vice versa.

INVERT

Turn the INVERT switch on for a 180 degrees phase inversion of the feedback signal. With very short delay times, this produces a totally different sound.

OUTPUT LEVEL

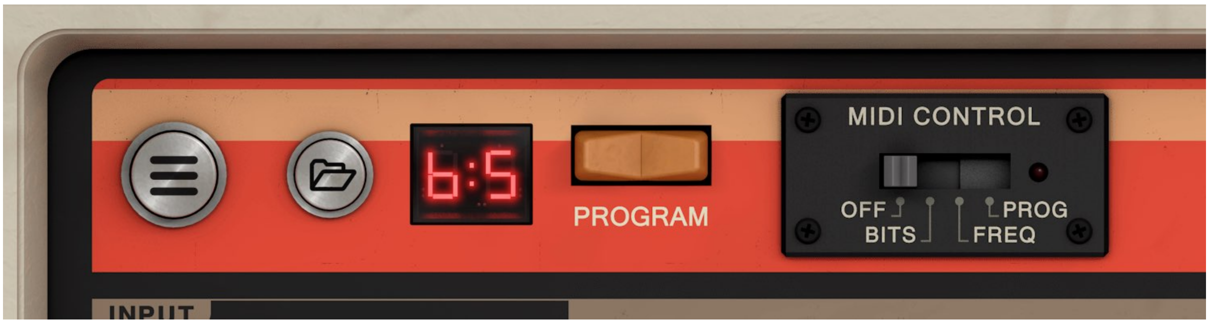
The OUTPUT LEVEL knob controls the final volume of the “wet” signal. There is a soft clipper on the output gain stage to give you that sweet saturated sound, just as there is on the input stage.

MIX

Use MIX to adjust the balance between the “dry” input and the “wet” processed sound. Because of the variable clock frequency technique in Permut8, the total input/output latency varies, and this cannot be compensated perfectly by the host. The MIX knob, on the other hand, makes perfect latency compensation even if the clock frequency changes. Therefore it is better to mix the dry/wet signals within Permut8 rather than mixing them in your host.

Programs

All the settings you see on the front panel constitute a Permut8 “program”, and Permut8 can have 30 such programs in memory at a time. You can instantly switch between these programs by clicking the program number display or the rocker switch next to it. You can also use “MIDI Program Change” messages to switch programs on the fly or put MIDI CONTROL in PROG mode and use MIDI keys.



The programs are numbered A0-A9, B0-B9, and C0-C9, but you can also give them names that are shown in a pop-up list when you click the program number display. If you do not name a program, a default name consisting of the “operator” and “operand” settings *(e.g., “[B0] and:4420 xor:0081”) is used*. Programs modified since they were last named are marked with a *.

The “Main Menu” button *(far left)* contains functions to undo/redo the last operation, load and save the entire “bank” *(all 30 programs)*, rename, copy and paste individual programs, randomize instructions, zoom the interface, and more.

(You can shift-click the main menu button to repeat the last chosen menu, which is especially useful for quickly performing multiple undo/redo or repeatedly randomizing the instructions .)

The “Open Bank” button *(right of the “Main Menu” button)* is a shortcut to the main menu item with the same name. It lets you load the entire “bank” *(all 30 programs)*.

If you save a Permut8 “bank”, a VST® .fxb, or an Audio Unit .aupreset, all 30 programs are saved in the file. When you create a new instance of Permut8, the most recently used programs will automatically load. *(You may disable this feature from the “Main Menu”.)*

Alternative Firmwares

Permut8 can be expanded with new functionality through so-called “alternative firmwares”. Alternative firmwares are pieces of computer code you load into Permut8 to extend or replace its signal processing algorithms. It can be a new type of operator or a completely new effect, e.g., a wave-shaper, a pitch-shifter, or even a speech synthesizer.

No complicated steps are necessary to "install" these firmwares. Just load these special Permut8 Bank files into the plug-in, automatically activating the new signal processing code.

The signal processing code is executed in a "virtual machine" inside Permut8, which is 100% "sandboxed". Bad firmware code cannot crash or freeze your plug-in host. Furthermore, the actual code is saved with the project in your DAW, meaning that you do not need to install or keep track of which version of a particular firmware you use for a specific project. It will just work. "Forever."

(The drawback to this solution is that it requires more CPU than running "native" code, but for many types of effects, the CPU hit is still moderate on a modern computer.)

When an alternative firmware is active, you can click on its "logo sticker" in the top right corner of the user interface for more info.

Please go to https://soniccharge.com/permut8 to check out our latest offering of Official Firmware Banks for registered customers.

MIDI Control

There are three ways to control Permut8 via MIDI *(provided that your host application allows routing MIDI to effects)*.

BITS

The BITS setting will let you toggle individual "operand bits" *(the 32 flip-flops under INSTRUCTION 1 and 2)* with MIDI keys.

FREQ

FREQ allows transposing effects with MIDI keys by adjusting the clock frequency up or down when keys are held. Note number 60 *(C3)* is the root key. While holding down a key, you can use the pitch bend, e.g., bend it down quickly for a "tape stop" effect.

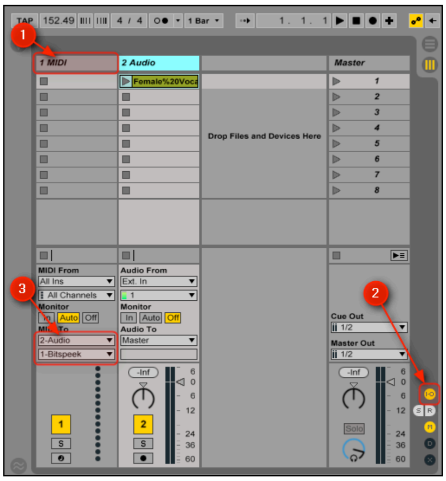
PROG

In PROG mode, you can switch between the 30 programs in memory using MIDI keys. Great for sequencing glitchy effect patterns. Click the program number display and check the pop-up list to see the assigned MIDI keys. *(You probably want to avoid "automating" parameters in this mode, as parameter changes are permanent and cannot be easily undone.)*

MIDI Routing in Popular Hosts

Here are a few quick instructions on how to set up MIDI routing in some popular hosts. The procedure is the same for Permut8 as for Bitspeek, used in the screen-shot examples.

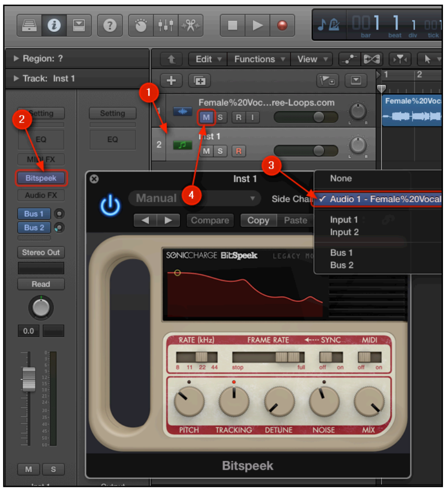
Ableton Live



(Add Permut8 to the effect chain on an audio or instrument track.)

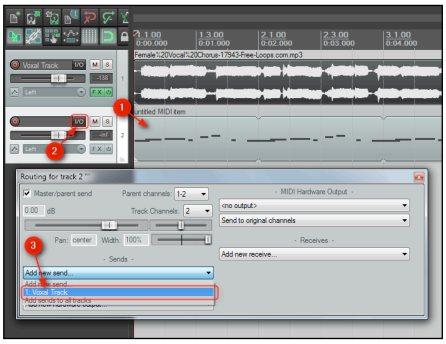
1. Create a MIDI track.
2. Bring up the I-O parameters if they are hidden.
3. Assign “MIDI To” to the audio track that contains Permut8 and make sure “MIDI To” is assigned to the Permut8 effect and nothing else.

Apple Logic Pro X



1. Create a new instrument track.
2. Click the “Plug-In” button and select Permut8 under MIDI-controlled Effects.
3. Select your audio track from the Side Chain menu in the top right corner of the plug-in window.
4. You can mute the audio track output since it is already passing through the instrument track.

Cockos Reaper



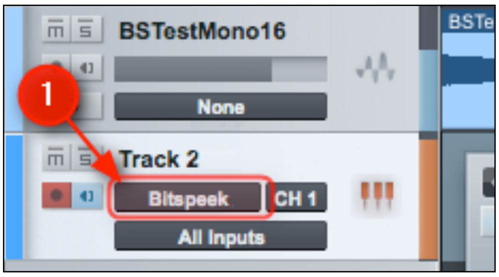
(Add Permut8 to the effect chain on an audio or instrument track.)

1. Insert a new track and then add a “New MIDI item”.
2. Click the “I/O” button for the MIDI track.
3. In the Routing window, choose “Add new send…” and select the track with the Permut8 effect you wish to control.

Steinberg Cubase

(Add Permut8 to the effect chain on an audio or instrument track.)

1. Create a new MIDI track.
2. Select Permut8 as the MIDI destination for the new track.



PreSonus Studio One

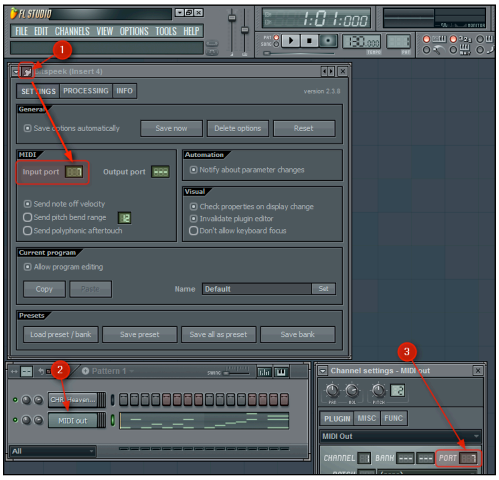
(Add Permut8 to the effect chain on an audio or instrument track.)

1. Add an Instrument track and select Permut8 as the destination for the new track.

Image-Line FL Studio

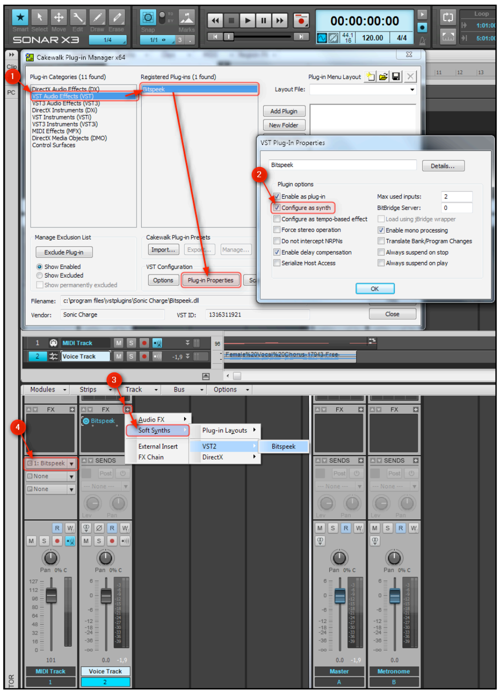
(Add Permut8 to the effect chain on an audio or instrument track.)

1. Select a free input port under the MIDI section in the plug-in settings.
2. Add a "MIDI Out" channel.
3. Select the same port number in the channel setting as you did for Permut8.

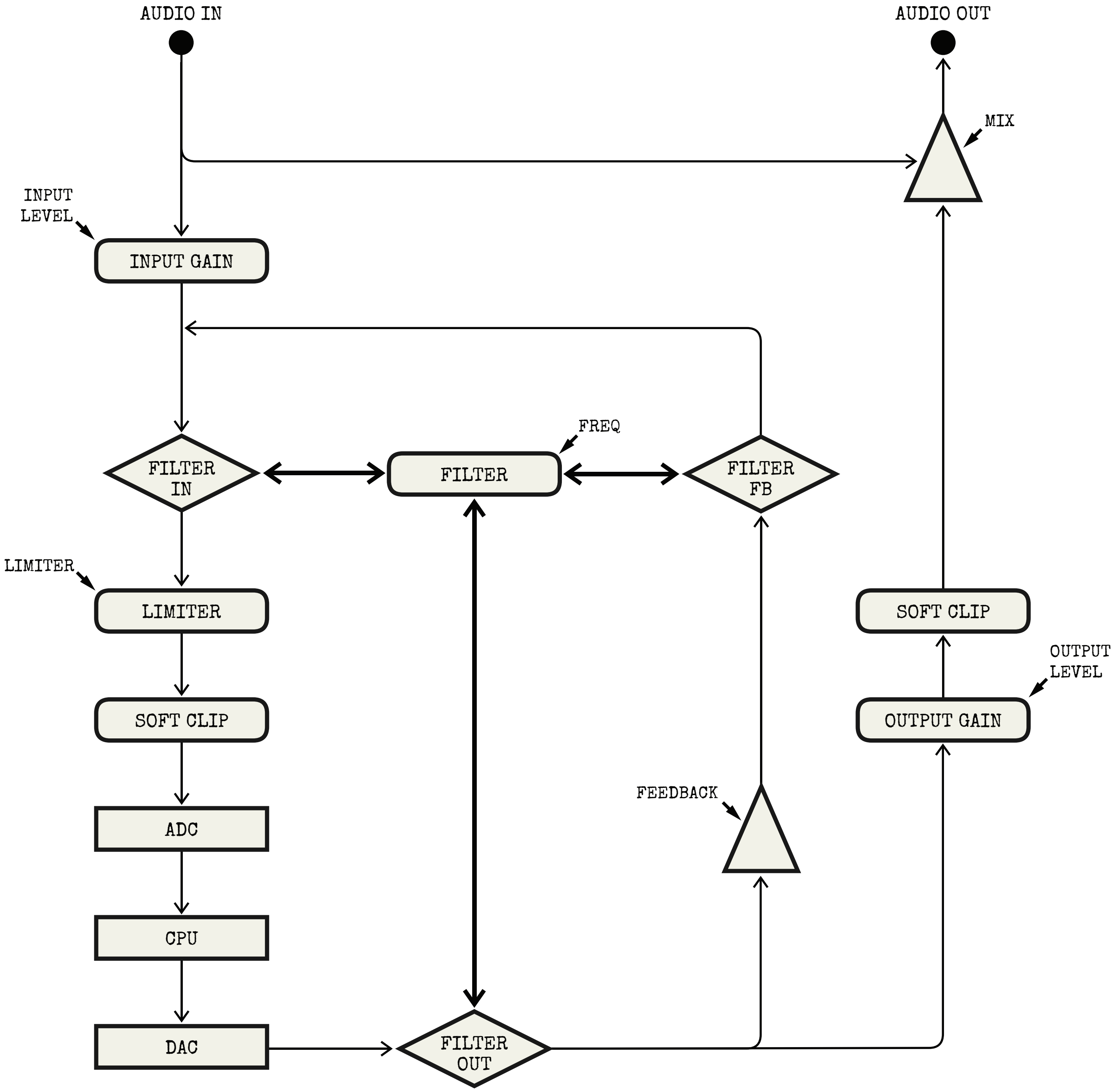


Cakewalk

1. Enter the Cakewalk Plug-in Manager, select Permut8, and click "Plug-in Properties".
2. Turn on "Configure as synth" and click OK. Permut8 should now show up under VST Instruments.
3. Insert Permut8 in the FX chain as a "Soft Synth" instead of an "Audio FX".
4. Insert a MIDI track and select Permut8 as output for the new track.



Signal Flow Chart



Requirements

The minimum requirements for installing and running Permut8 are:

- Microsoft Windows 7
  A host that supports 64-bit VST 2.4, or VST3 plug-ins
- macOS High Sierra (10.13)
  A host that supports 64-bit VST 2.4, VST3, or AudioUnit 2 plug-ins

Change History

Version 1.2.3 (2022-11-07)

- VST3 support.
- Increased resolution of graphic resources.
- *(Windows)* Deprecated 32-bit support.
- Bug and compatibility fixes.

Version 1.2.2 (2022-02-16)

- *(Mac)* Native support for Apple Silicon.
- Bug fixes, “under the hood” maintenance, and improvements.

Version 1.2.1 (2020-08-24)

- Added support for time-limited licensing.
- Made a workaround to handle a rare Windows problem generating a unique machine-id.
- Fixed a bug that prevented the zoom feature from working correctly in some hosts (e.g., Cakewalk)

Version 1.2 (2020-03-04)

- Scalable GUI and retina support.
- Improvements and bug fixes related to custom firmwares.
- New algorithm for the “system unique identifier” used for authorization. Hopefully, fixing the problem where the plug-in became unregistered spontaneously.
- Fixed a bug that could leave temporary files behind when saving and replacing files.
- *(Mac)* Solved a compatibility problem with DAWs that are built with recent Apple SDK’s, e.g., Cubase 10.5.
- *(Mac)* Notarized installer for Catalina.
- *(Mac)* New 64-bit compatible uninstaller.
- *(Mac)* “Go to folder” buttons in the file browser now work in Catalina.
- *(Mac)* 64-bit Audio Unit no longer depends on the “Component Manager”. This means you should not need to restart after installation.

- *(Mac)* Preferences and registration data are now shared with “sandboxed” DAWs like GarageBand *(meaning Authenticator works with these DAWs)*.
- *(Mac)* Fixed a problem where the preferences data could stay locked under certain conditions if the DAW crashed, requiring a full system restart.
- Lots of other minor bug and compatibility fixes.

Version 1.1 (2014-12-16)

- Improved support for alternative firmwares *(“logo stickers”, clickable tape for entering text, and more)*.
- Right-click the “memory display” allows you to “bounce” the Permut8 output to file or back into memory for further processing.
- Undo/redo support. Even changes to the delay memory buffer are undoable when the write-protect switch is on.
- Improved support *(in most hosts)* for keyboard input to the “tty terminal”.
- Open bank button. Because alternative firmwares are delivered as Permut8 bank files, and you want quick access to those.
- Open browsers now feature two buttons to take you to factory and user preset directories quickly.
- Right-click context-menu on knobs and sliders to set exact values with text.
- Fixed a bug with 0Hz clock rate (the left and right dry channels were delayed differently).
- Fixed a broken LED in the memory display.
- Chess.
- Supports Sonic Charge Authenticator for easier registration.
- Many minor bug fixes.

Credits and Contacts

Sonic Charge Permut8 v1.0 - v1.2.3 *(2012-2022)*

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zlib by Jean-loup Gailly and Mark Adler

VST PlugIn Technology by Steinberg

Audio Units SDK by Apple

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Sonic Charge website:

https://soniccharge.com

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