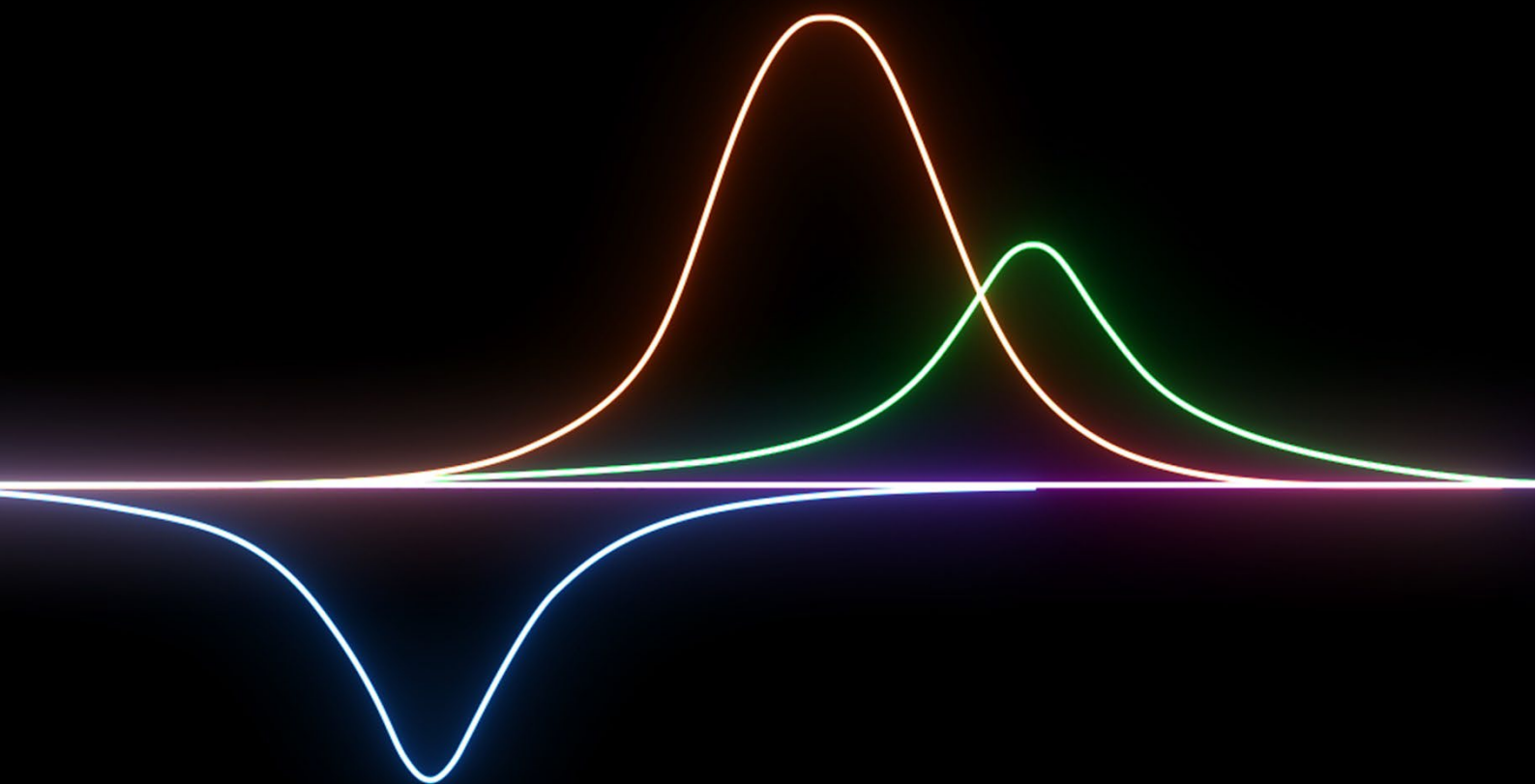


Kirchhoff-EQ

User manual



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Chapter 1 Introduction

Kirchhoff-EQ is a feature-rich 32-band parametric equalizer featuring:

- High-quality sound from refined design and high precision processing.
- A Large set of filter types including vintage hardware models.
- In depth flexible dynamic functions, allowing for separate detect and effect frequency bands.

The versions released/updated after October 2022 feature Plugin Alliance licensing toolbar. A Plugin Alliance account is required when you purchase or start a trial for Kirchhoff-EQ.

Minimum System Requirements:

- Intel or AMD CPU with SSE 4.1 support, Apple chip.
- MacOS 10.9, Windows 7.
- 4GB RAM, 100 MB disk space.

Note: Logic Pro 9 is not supported, please use Logic Pro X or higher.

If you would like to report bugs, send feature requests, or need any technical support, please contact us by sending a mail to: support@threebodytech.com. We will read every email and respond as soon as possible.

Chapter 2 Installation

Plugin Alliance Licensing System

Kirchhoff-EQ use Plugin Alliance's proprietary licensing system that is completely software based. No hardware license dongle, special drivers, or serial numbers are required to run Kirchhoff-EQ. Everything is handled from within the software product. All of your licenses are stored in a single file located on your computer or USB flash drive. This file must be updated whenever you buy or start a trial for Kirchhoff-EQ.

We offer both online and offline activation. We highly recommend using online activation. It is the fastest and easiest process. Activation requires you to have a current Plugin Alliance account. If you don't already have one, you can [create an account on Plugin Alliance's website](#) for free.

License Types

Plugin Alliance licensing system includes different types of licenses that come with related restrictions on their use.

A **full license** unlocks a plugin for an unlimited amount of time. You get a full license whenever you purchase Kirchhoff-EQ. These licenses can be activated on up to 3 devices. If you want to use more devices, you can purchase additional licenses to add 3 more devices with each license.

A **trial license** allows you to try a product for 14 days. Trial licenses are free of charge and fully-functional, so you can use all the features of the plugin. A trial license can be activated on up to 99 devices, but it will only be active for 14 days after the first activation.

Lease licenses are licenses which are valid for a specific period of time. The duration of your validity period depends on the product you have purchased and is usually shown as a countdown value in the lower toolbar of the plugin. If you have extended this period, e.g. through a purchase, you may need to re-activate to refresh your license file. This will extend the activation period so you can continue using the plugin. Subscription licenses are Lease licenses. Subscription payments are handled automatically by Plugin Alliance's system. However, you will need to re-activate the plugin according to your subscription period.

You may also have an **NFR license** in your account. These licenses are given out with certain promotions. They may have an expiration date or be unlimited and they cannot be transferred.

Standalone Installers

Kirchhoff-EQ have standalone installers available. You can find these installers on the product page on Three-Body Technology or Plugin Alliance websites, or on the [Manage Registered Plugins](#) page in your Plugin Alliance account. The same installer allows you to start a trial or use a full license that you have already purchased. We offer separate installers for each platform: Windows, MacOS.

After you have downloaded the installer for your platform, you can run it to select the plugin formats that you want to install (VST2, VST3, AAX, or AU). The format you need depends on the digital audio workstation (DAW) that you are using. If you are unsure of which format your DAW requires, refer to the DAW software documentation.

Plugin Alliance Installation Manager

Kirchhoff-EQ is available to download via Plugin Alliance Installation Manager. In Plugin Alliance Installation Manager, you can select Kirchhoff-EQ in the formats you need and install it directly on your computer-based audio workstation, or transfer to a dedicated offline machine.

To begin, download the Installation Manager for your system (MacOS or Windows) from the [Installation Manager page on Plugin Alliance's website](#). Then extract the zip file and drag the resulting app to your Applications folder (MacOS) or Program Files folder (Windows).

If you want to install Kirchhoff-EQ on an offline computer, you can still use the Installation Manager. See the instructions below.

Online Installation

If your audio workstation has an internet connection, use Plugin Alliance Installation Manager on that computer and select the *Download/Install* installation type in the sidebar.

You can type "Kirchhoff" in the search bar to find Kirchhoff-EQ and filter the plugin formats that you want to install (64-bit VST2, VST3, AAX, or AU). This will also determine which formats are downloaded and installed.

Select Kirchhoff-EQ and click the *Download & Install* button at the bottom right. When the download is complete, click the *Install* button and Kirchhoff-EQ will be available to use in any DAW that supports the formats you selected.

Offline Installation on a Computer

To install Kirchhoff-EQ on a computer without an internet connection, you will first need access to an internet-connected computer to download and create an installation package. On the online computer, run Plugin Alliance Installation Manager and select the *Download/Export* option in the sidebar. The platform options will appear: Mac or Windows 64-bit. Select the platform of your offline device.

You can type "Kirchhoff" in the search bar to find Kirchhoff-EQ and filter the plugin formats that you want to install (64-bit VST2, VST3, AAX, or AU). This will also determine which formats are downloaded and installed.

Select Kirchhoff-EQ and click the *Download & Export* button at the bottom right. When the download is complete, click the *Save As* button to choose a removable drive on which to save the install package. It will be named *Installer.pabundle* by default, but you can rename it to keep multiple packages organized. Also be sure to copy Plugin Alliance Installation Manager app to your removable drive, as you will also need that app to install the package.

With a copy of Plugin Alliance Installation Manager app and your installer package, take the removable drive to your offline computer. Copy the Installation Manager to your Applications folder (MacOS) or Program Files folder (Windows), then run it. In the sidebar, select the *Import/Install* option, then click the *Import* button on the lower right and select the install package. The Installation Manager will verify the package and an *Install* button will appear if the file is loaded and ready to go. Click the button to install Kirchhoff-EQ on your offline device.

Chapter 3 Activation

After you have installed Kirchhoff-EQ, start your digital audio workstation (DAW) software. Most DAWs will wait until you instantiate a new plugin in a session before starting the activation process. In Pro Tools, a new plugin will produce the activation window during the plugin scan at startup. Pro Tools will incorrectly report that a plugin is invalid if you don't complete the activation process at startup.



Figure 1: Kirchhoff-EQ Window Before Activation

Click on the *Activation Required* text in the Kirchhoff-EQ window to open the activation window. You will see a drop-down menu that lets you choose which device to activate. Your options will be your computer or any connected USB drives (see USB Activation below). Selecting *Activate all my licenses* will activate your system on all the available, valid licenses in your Plugin Alliance account. If there were any problems with the activation, a message will describe the reason (such as not having enough available machines on the license).

Because all Plugin Alliance plugins use the same license file, there is no need to reactivate the same plugin in different DAWs. For example, if you activate Kirchhoff-EQ in Pro Tools, it will also be active in Logic, as long as you are logged in to the same user account on the same computer or using the same USB flash drive.

In addition, if you log in to a different Plugin Alliance account when activating Kirchhoff-EQ, this will replace your license file. Only the plugins that are active in this new account can be used.

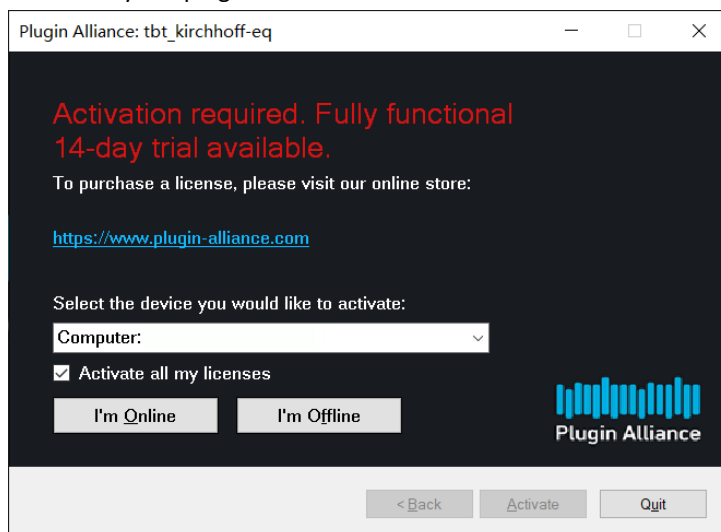


Figure 2: Activation Window

Online Activation

If you chose *I'm online* in the activation window, you can enter your Plugin Alliance account email address and password to connect to the server and get the current version of your license file automatically. The account you use here is the same one that you use to log in to Plugin Alliance's website.

You can choose to save your log in by selecting the *Save password* checkbox (Fig. 3). Your log in details are encrypted for security and can be used to activate new Plugin Alliance products in the future without having to re-enter your log in data every time.

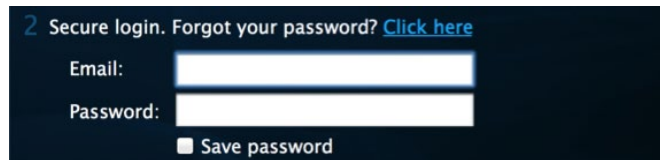


Figure 3: Saving your Log In Information

Kirchhoff-EQ will be activated if you have a valid license; otherwise, if you have not started a trial before, you will have the option to start one. The 14-day trial period starts as soon as you activate the plugin.

First-time Offline Activation

If your audio computer is not online, the Kirchhoff-EQ activation must be done manually via another computer with internet access. Then, you can copy your license file from the online computer to the offline one.

In this case, choose *I'm offline* in the activation window. Choose *Save to file* and save the text file (Fig. 4), named *machine_id.txt* on a removable drive. Now take the drive to your online computer and connect it.

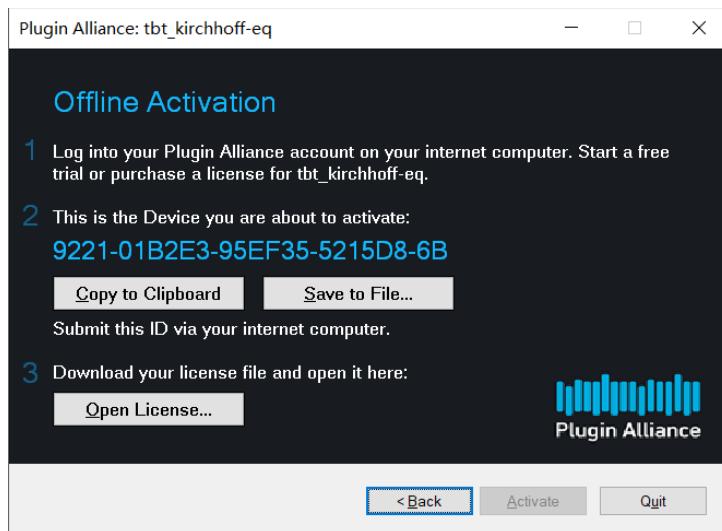


Figure 4: Offline Activation

Log in to your Plugin Alliance account and make sure you have an active license for Kirchhoff-EQ. If you want to start a trial for Kirchhoff-EQ for the first time, go to [Plugin Alliance's Create Offline License page](#), select Kirchhoff-EQ, and click *Create License*. Visit [Plugin Alliance's Manage Devices page](#), upload the *machine_id.txt* file in the *Activate New Device* section (Fig. 5), and click *Activate*. Download the license file from the *Download License File* section at the bottom of the Manage Devices page to your removable drive (Fig. 6). Take the drive back to your offline computer.



Figure 5: Device Activation Section

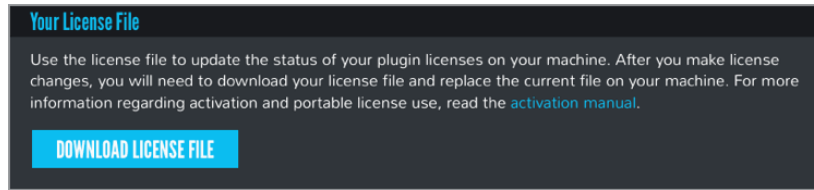


Figure 6: License File Download

In the Kirchoff-EQ activation window, click *Open license* and choose the *pa.license* file from your removable drive (Fig. 4). Finally, click *Activate* and Kirchoff-EQ will be available to start using.

Offline Activation for Existing Devices

Each offline computer only needs to be registered once in your Plugin Alliance account. To activate Kirchoff-EQ on a device that is already registered, you can begin on the online computer and skip copying the *machine_id.txt* file.

To activate one plugin, go to [Plugin Alliance's Manage Registered Plugins page](#) in your account. Select Kirchoff-EQ, and then select your computer in the drop-down menu under *Activate Existing Device* and click *Activate* (Fig. 7). Download the license file from the *Download License File* section at the bottom of the page and save it on a removable drive (Fig. 6). Take the drive to your offline computer.

To activate all your plugins at once, you can use the *Manage Devices* page instead (Fig. 7). Download the license file from the *Download License File* section at the bottom of the page and save it on a removable drive (Fig. 6). Take the drive back to your offline computer.

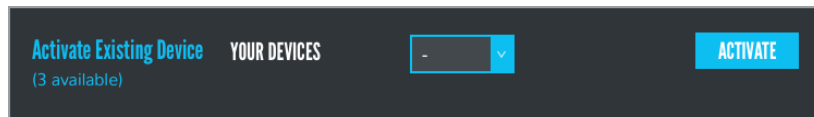


Figure 7: Activate an Existing Device

On the offline computer, open the Kirchoff-EQ activation window, click *I'm offline*, then *Open license* and choose the *pa.license* file from your removable drive (Fig. 4). Finally, click *Activate* and your plugins will be available to start using.

USB Activation

Kirchoff-EQ is portable when you activate it using an ordinary USB flash drive. With this flash drive, you can run Kirchoff-EQ on any computer without the need for the computer to be activated. This is especially useful for front-of-house engineers on tour, or engineers who travel to different studios frequently. We highly recommend activating a USB flash drive via an online computer.

Insert the flash drive and make sure that it is mounted in your file system. On an online computer with Kirchoff-EQ installed, open it in your DAW. Open the activation window by clicking the key icon at the bottom right if it's not open already. Select your flash drive in the drop-down menu under *Select the device you would like to activate*, then click *I'm online*. Enter your Plugin Alliance account email address and password. The account you use here is the same one that you use to log in to Plugin Alliance's website. Click *Activate* to connect to the server and save the current version of your license file to your flash drive. Now Kirchoff-EQ can be used on any computer just by plugging in this flash drive.

Some very old flash drives are unsupported and will not appear in your device drop-down. If your USB flash drive is among the unsupported models, please switch to a newer drive.

Deactivation

Each of your full license can be active on 3 devices at once. It is available to move your licenses from a machine you no longer use to a new one. You can also reclaim a license from a computer or flash

drive that is lost or broken. All of your license data is stored on Plugin Alliance's servers, so no need to worry about losing a license on a crashed hard drive.

Log in to your Plugin Alliance account and go to [Manage Devices](#). In the *Activated Devices* section, find the name of the device that you want to reclaim, then click the *Deactivate* button. Trial licenses cannot be reclaimed, but they come with 99 available machines.

Since your license data is stored remotely, there is no need to deactivate a computer or flash drive when you reformat it. Plugin Alliance licensing system will recognize the same machine ID as long as there were no other hardware changes and reuse the existing activation for the device.

Due to the way Windows generates the machine ID, certain hardware modifications may change your computer's machine ID. If this happens, you can use the process above to deactivate the old machine ID, then activate the new one using online or offline activation as needed. You may also consider using USB Activation instead if this happens often on your Windows PC.

Please note that you cannot reclaim the same plugin license from more than seven different machines, but if the same machine is deactivated more than once, it will not be counted again. So if you frequently need to move your licenses to new computers, please consider using a flash drive as one of your three devices (see USB Activation).

Plugin Licensing Toolbar

Kirchhoff-EQ have a Plugin Alliance toolbar (Fig. 8) below the user interface, giving you access to some basic plugin information, described below.



Figure 8: Plugin Licensing Toolbar

PA Logo

Clicking on the Plugin Alliance logo takes you to the Plugin Alliance website via your web browser if your computer is online.

License Type

The center of the toolbar shows the type of license you are running. Licenses with an expiration date will show the number of days until they expire.

\$ Icon

If you have a trial or financed license for Kirchhoff-EQ, the dollar sign icon will take you to Plugin Alliance's website, where you can purchase a full license or make your next payment.

Key Icon

The key icon opens the activation window, allowing you to refresh your license file with device changes you made on Plugin Alliance's website, activate a newly purchased or extended trial, or activate a flash drive connected to your computer.

? Icon

The question mark icon contains a context menu that links to the product page and downloads section on Plugin Alliance's website.

Contact [Plugin Alliance Tech Support](#) for assistance regarding installation or activation problems and questions.

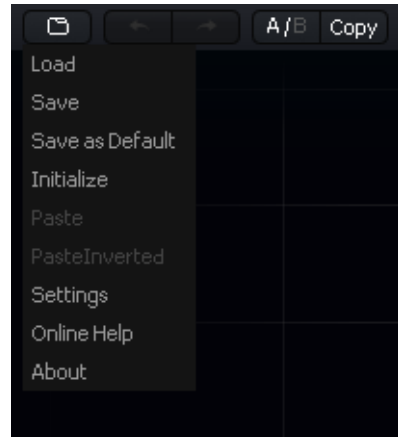
Chapter 4 User Interface

Top Bar

Save/Load/Initialize

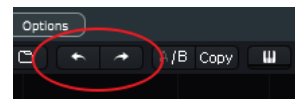
Click on the leftmost folder button to show this pop-up menu:

- Load: load a previously saved plugin state.
- Save: save current plugin state to a file.
- Save as Default: save current plugin state as default.
- Initialize: reset current plugin state to default.
- Paste: paste copied band.
- Paste Inverted: paste copied band inversely.
- Settings: open settings menu.
- Online Help: open User Manual online.
- About: this page shows serial number and software version.



Undo/Redo

These two buttons can undo/redo changes on plugin. Please note that operations in settings page are not affected.



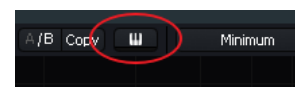
A/B Switch

You can use this function to rapidly switch between two states. For example, if you have made a preset and suddenly feel that another way might also applicable, you can switch between these two states quickly and listen their differences.

The "Copy" button would synchronize current state to the other one. If you are in A state, clicking this button would copy A state to B, and vice versa.

Keyboard

Clicking on this button will show/hide a keyboard on bottom of plugin UI, on which band frequencies can be set on integral pitches.



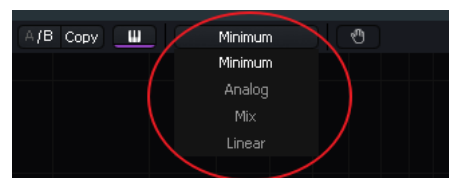
Phase Mode Selection

Phase modes are essential for equalizers, but it's hard to describe it simply and clearly. This part would introduce the phase modes of Kirchhoff-EQ in detail.

Click on this button will show phase modes of Kirchhoff-EQ, which are:

Minimum-Phase Mode

This phase mode will have lowest latency among all possible modes. Observing the processing on an impulse, latency is zero.



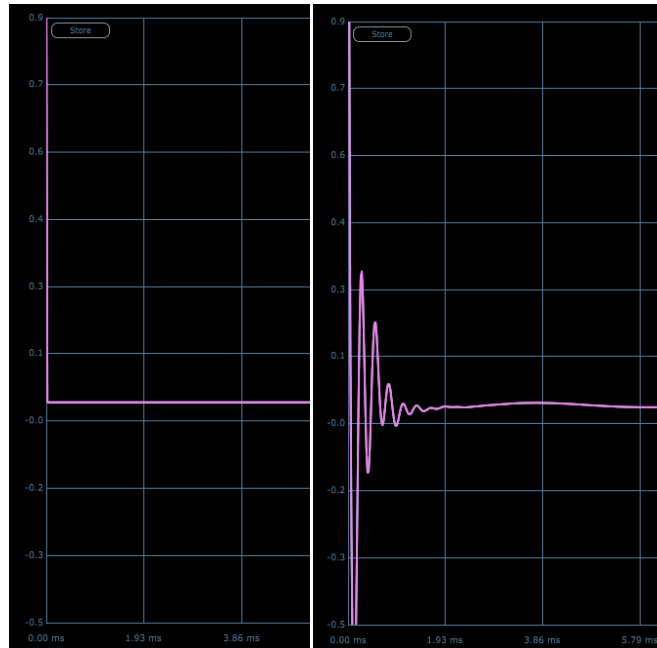


Figure 9: Input and output signal of minimum-phase mode.

Minimum-Phase is suitable on most scenarios.

Analogue Prototype Mode

Generally, every type of digital filter has its corresponding analogue prototype. You can imagine the concept of "analogue prototype" as what an ideal filter behaves like at an infinite sample rate. It is obvious that the sample rate is limited in the digital world, thus there are differences between the digital implementation and its analogue prototype. The Analogue Prototype Simulation is to compensate the difference on amplitude and phase at the expense of processor intensity and latency.



Figure 10: The difference on spectrum between minimum-phase and analogue prototype.

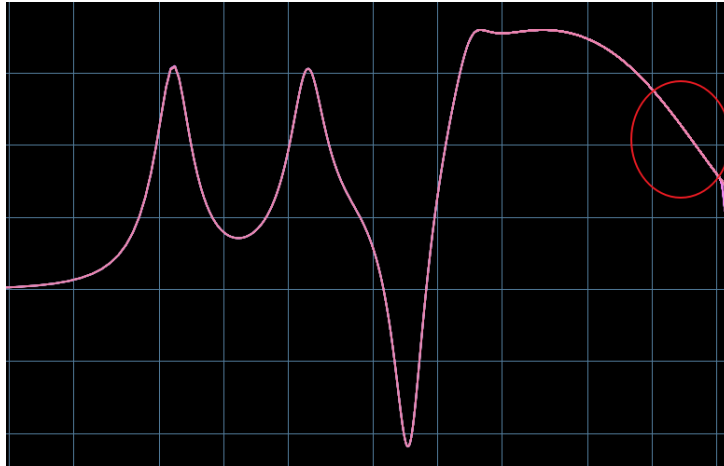


Figure 11: Adjust on spectrum by analogue mode.

When Analogue mode is selected, the amplitude and phase will both be compensated, but it would induce a latency of 63 sample points. The difference can be observed by the change on an impulse:

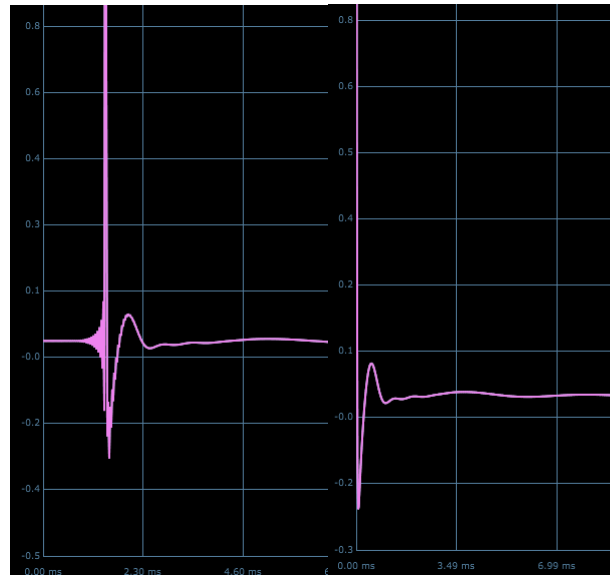


Figure 12: Analogue phase mode vs. minimum phase mode.

Linear-Phase Mode

As its name, this mode won't change the phase of input signal. The image below shows that the phase response of minimum-phase mode is distorted, while linear-phase mode is straight line.

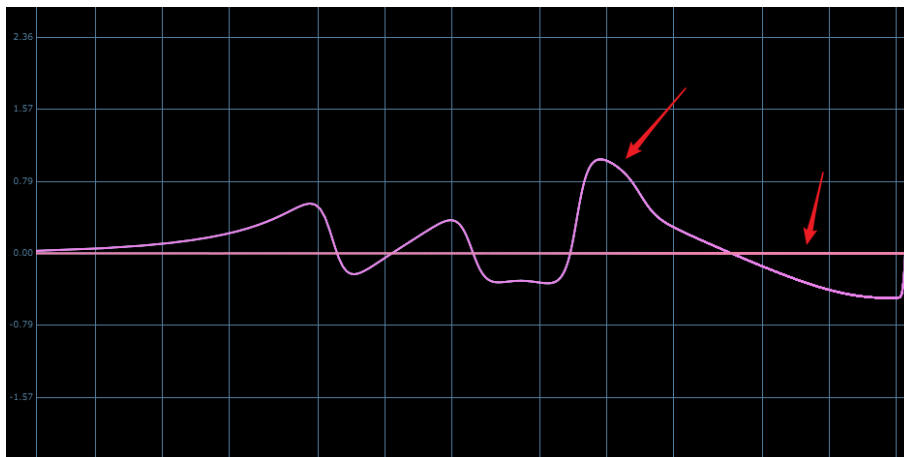


Figure 13: Phase response of minimum phase mode and linear phase mode.

You might ask: As phases are important and it's possible that phases aren't changed, why we do not always use this mode?

The linear-phase mode has three major issues:

- extremely long latency;
- pre-ring;
- high computing consumption.

Firstly, let us discuss on the first two issues. The linear-phase mode is implemented by introducing extra latency to make the impulse response symmetric:

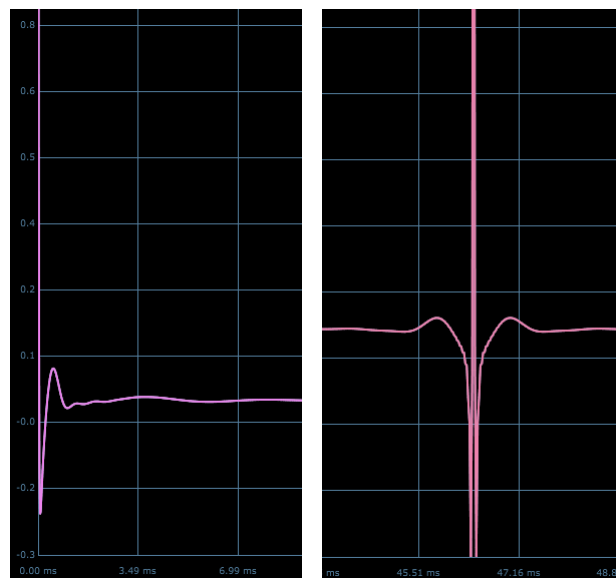


Figure 14: non-symmetric minimum-phase mode and symmetric linear-phase mode

The front half part of the symmetric impulse response is what we called "pre-ring", that makes a "fade-in" sound before the impulse. This would usually cause audible artifacts. In some circumstances, the pre-ring is not large and can be ignored. Sometimes however it is significant and would impact the sound quality, especially in percussion.

Please note that there's no silver bullet: though linear-phase mode has pre-ring, minimum-phase mode changes the phase. Thus linear-phase mode is still advantageous in some situations.

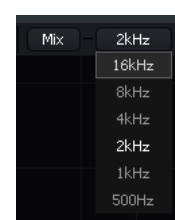
Kirchhoff-EQ implements linear-phase mode via FIR convolution, and the convolve length can be adjusted. A longer convolution will have better resolution and is closer to the original analog model, this will have a longer latency and higher CPU consumption. The allowed quality options are:

- Low: 4095-point FIR
- Medium: 8191-point FIR
- High: 16383-point FIR
- Very High: 32767-point FIR
- Extreme: 65535-point FIR



Mixed Phase Mode

The minimum- and linear-phase modes have their own pros and cons. Some mixing engineers prefer to use minimum-phase on low frequencies while using linear-phase on high frequencies. This is the problem mixed phase mode works to solve. In this mode, the phases are gradually changed on different frequencies.

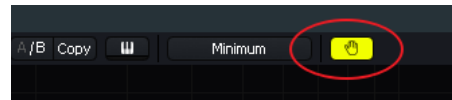


The boundary frequency between minimum- and linear-phase can be selected in menu. Please note that a boundary with a lower frequency would result in longer latency.

Spectrum Dragging

Though EQ adjustment is relied on ears, not eyes, sometimes we still need to aim on a specific frequency, such as neutralizing a high-frequency ringing. Manually doing such work is hard. However, you can use spectrum dragging that automatically finds the precise peak frequency from approximate mouse pointing.

Clicking on the "hand" button or right-double-click on the spectrum panel will turn on spectrum dragging mode. The spectrum panel will be rendered "freeze": each frame will be accumulated upon entering this mode to calculate frequency peaks.



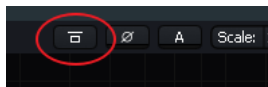
By putting the mouse cursor on spectrum nearby peaks will be marked red.

You may find that some frequency points cannot be selected, this is due to the limit of the peak determine algorithm, or it is not sharp enough.

When you find the expected frequency, hold the left mouse button and drag upward/downward, a bell type EQ band will be created at this frequency, and spectrum dragging mode would be exited.

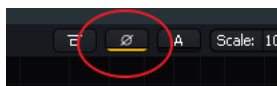
If you want to exit spectrum dragging mode without creating new bands, you may click on the "hand" button or right-double-click on spectrum panel again.

Bypass



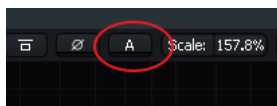
Enabling this will bypass all processing of this plugin.

Phase Invert



Enabling this will invert phase.

Auto Gain



Click this button to turn on/off automatic volume compensation. In this mode, Kirchhoff-EQ would make compensation on gain according to current EQ curve to ensure total volume is generally unchanged.

A fully precise gain compensation must consider the content of input audio. For example, you made a high-pass filter at 10 kHz, there should be positive compensation as it reduces volume on low frequencies. But if the input audio is a pure sine wave at 20 kHz, there's actually nothing cut thus no compensation is needed at all.

As it is impossible to interpret the content of input audio, like most equalizers, Kirchhoff-EQ performs compensation by estimate which is not 100% correct, but it should work fine in most situations.

If you are not sure whether to enable automatic volume compensation, imagine the following scenes: sometimes we want to adjust the tone only and focus on tonal change. We should then turn on auto

gain to avoid illusions of total volume change. But when mixing, we want to focus on balancing tracks and want to observe the effect of change on a specific frequency. At this time, the auto gain should be turned off.

Global Scaling

You can drag this button to scale the gains of all bands globally.

Global scaling is sometimes very useful. For instance, we may make many edits to refine the EQ, but the customer says "hey! you have adjusted the equalizer too much". Reducing gains one by one band is tedious. Instead, you can change all the bands' gain at once using this function.



Spectrum Settings

Click on "FFT" button to open spectrum settings panel. In this panel, you can adjust spectrum display settings.

- Resolution: frequency resolution. Higher resolution results in more detailed spectrum but would reduce sensitivity to transients.
- Speed: update speed.
- Range: amplitude range in decibels.
- Tilt: from the physics aspect, the same amplitude of low and high-frequency oscillations should display with same height in spectrum. But for human ear, high-frequency sounds are heard more loudly than low frequencies. To adjust this difference, we provide this option to have different weights on different frequencies. Please note that the weighting only affects display, but not on the actual sound.
- Show spectrum: whether to show spectrum of input and/or output audio.



117-bit Ultra-High Precision

The internal processing of Kirchhoff-EQ uses 64-bits double precision, but you can choose to have precision higher than 64-bits. When this function is on, inner processing would use 117-bit precision, and doubles CPU workload.



16-bits, 24-bits, 32-bits, 64-bits, and now we have 117-bits. Why the higher precision? A 16-bit CD-quality is good enough? Unfortunately, not enough for equalizers. Let me describe the underlying: in computational science, the crucial thing is not error itself, but accumulation of error. Imagine a flying spaceship with a navigation system that accumulates 1 cm of error per second. Though 1 cm seems small, it would be 2.5 kilometers after 3 days! Similarly, the IIR-based equalizers have recursion calculations, in which errors are accumulated to future results.

The essential way to solve this is to use higher precision. When we start to design Kirchhoff-EQ, we choose 64-bits and it's impossible to use a lower precision. You may ask that since there are 64-bits, can we simply combine into 128 bits? It's not that simple: the 64-bits calculation is supported by CPU hardware which is very fast, while high precision is software simulated that is much slower. We have searched for a long time to find approaches that achieve higher precision with acceptable CPU consumption. We have found "Double-Double" that uses hardware 64-bits and some mathematics techniques to achieve ultra-high 117-bits precision.

So, what does it sounds like? Most times 64-bits are enough, and the improvements of 117-bits are subtle for to people. In our comparative tests, sometimes the effect of 117-bits is significant. Sometimes not perceivable, so it relates to the processed audio content. It's hard to clarify in which specific scenario this mode is required. However, since it is simple to turn it on and off, you can simply make your own comparisons.

2x Oversampling

When an effect plugin is expected to have better sound quality, it is a common operation to have 2x or higher oversampling during inner processing. The primary benefit is to avoid aliasing at high frequency. Kirchhoff provides the function of oversampling at 2x.

Click on the "2x" button to turn on/off oversampling.



It's uncommon to have an oversampling function in an equalizer that is not simulating a real analog hardware. This is because linear equalizers theoretically have no distortions and no need for oversampling. The reason that Kirchhoff-EQ provides oversampling is: it is not a simple static EQ and it has dynamic functions. These types of effects, such as compressor, limiter and noise gate, have a common procedure that applies a modulation curve to the audio amplitude. These procedures would spawn harmonic distortions, and this is the reason we include 2x oversampling.

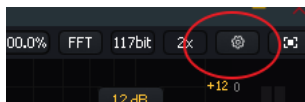
Even if dynamic functions are not on, oversampling could improve the frequency distribution of quantization noise caused by precision limit. As a result, even working as a regular static EQ, turning on 2x oversampling would still result in sonic improvements.

The 2x oversampling will significantly increase CPU workload and induces some latency. This latency is notified to host DAW and is generally compensated automatically.

You may have a question: since 2x oversampling would result in improved sound, why don't we keep it on all the time? The first reason is oversampling and down-back requires anti-aliasing filters which is indeed a low-pass filter near half sample rate, which would filter out contents at very high frequency. The second reason is oversampling will cause latency (linear-phase oversampling) or phase distortion (minimum-phase oversampling). As a result, oversampling will **always** change the sound even if no equalization is applied! This is inevitable.

We suggest that you can turn on/off the oversampling function and make comparative tests to decide which option best suits your needs.

Settings



Click on this gear button to change some global settings like modifier keys. Please note that settings are global: once you changed it from one plugin instance, all newly created instances will be affected.

Full Screen



Click this button to make Kirchhoff-EQ occupy whole screen.

Decibel Range

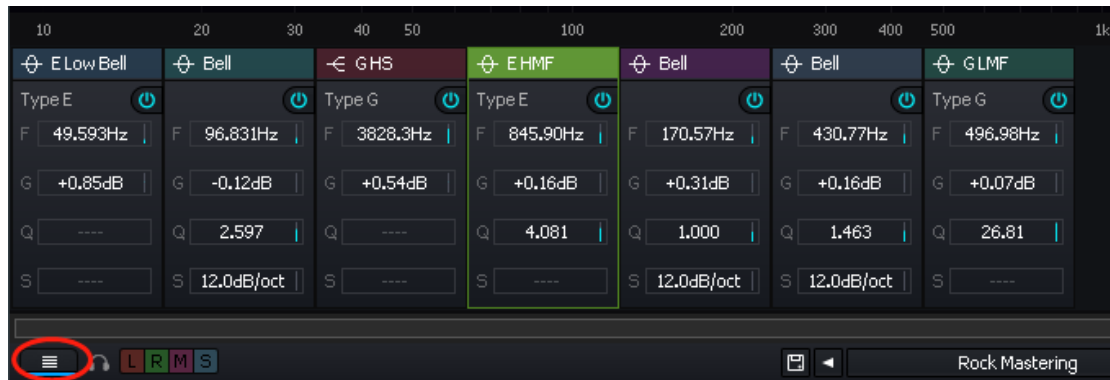


You can adjust the decibel range of EQ response curve in this menu.

When doing mixing, you may want to adjust EQ at wide range, and you may choose 12-18dB. When doing mastering, you may need more accurate adjustment at a narrower range and 3-6dB would be more suitable.

Bottom Bar

Band List



Click the first button on the left to open/close band list, which can help you to check and adjust the basic parameters of every band.

Each item in band list is related to one band. The filter type with icon is shown on the top. Click or use mouse wheel on the icon to change the filter type.

Use the power button to disable/enable the band. Adjust the F, G, Q, S values to control Freq, Gain, Q, Slope/Shape respectively. The grayed out "----" means the parameter is unavailable and cannot be adjusted. If multiple bands were selected, adjustment would change the parameters of all selected bands.

Left click on any place in the band list except the mentioned operational area to select the item/band. Ctrl/Command/Shift + left-click to select multiple items/bands. Left click and drag an item to arrange the order. Right-click to open the menu where you can select "Types" to change the filter type of selected band(s), select "Sort" to sort all items by frequency or filter type, select "Remove" to delete selected band(s). Double-click on an item to create a new item on the right with the same parameters. Double click on the right of all items to create a new band with default parameters.

Left/Right/Middle/Side Channel Monitoring

Click *L/R/M/S* button to switch monitoring between left/right/middle/side channel. It can help you to monitor single channel.

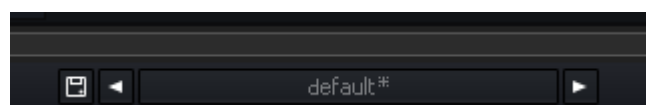


After one of them is clicked, the headphone icon will keep blinking to remind that you are on monitoring mode.

Please note that monitoring mode is not a plugin parameter, so its status will not be saved by host. It goes off while the plugin interface is closed.

Preset Selector

Preset selector located on the middle of bottom bar. There are some basic presets in Kirchhoff-EQ. You can also save and load more user-defined defaults. Any preset saved in our folder extension could be loaded by preset selector.



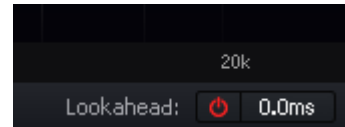
Click on the button with the name of preset to open a menu showing every loadable preset. Click on the arrows on the left or right to switch the presets in order.

Click on the save icon on the left to open a menu with “save”, “save as default” and “override”. Select “save” to save the current state as a new preset. Select “save as default” to save the current state as the state when opening Kirchhoff-EQ. Select “override” to override the selected preset with current state.

When a new preset is selected, the name would be shown white on the button. Once you make any change, the name would turn gray and be marked with “*”.

Lookahead

Click the *Lookahead* power switch on the right of bottom bar to turn the function on. There will be a 20ms latency when *lookahead* is on. The value of *lookahead* can be adjusted on the right.



Attack is a necessary parameter in most dynamic effects like Compressor and Kirchhoff-EQ. High *attack* makes transient getting too much, and low *attack* causes distortion. *Lookahead* gives signal a short latency, allows detection activating the stage of *attack* before the process. It helps avoiding problems that may be caused by the value of *attack*.

As above, turning *Lookahead* on brings a short latency which may affect to latency compensation of hosts. So, we set a switch for *Lookahead*. When it's on, Kirchhoff-EQ has a 20ms latency. When it's off, *Lookahead* doesn't cause any latency.

The value of *Lookahead* can be adjusted by dragging/mouse wheel or inputting a value between 0-20ms. Please note that in case hosts refresh latency compensation too frequently (which may make some hosts crash), *Lookahead* always have a 20ms latency, even if the value was set as 0ms.

Tip: If you are not sure about the value of *Lookahead* you need, you can choose not to enable it, or adjust it to a value nears *attack* and feel the change of transient.

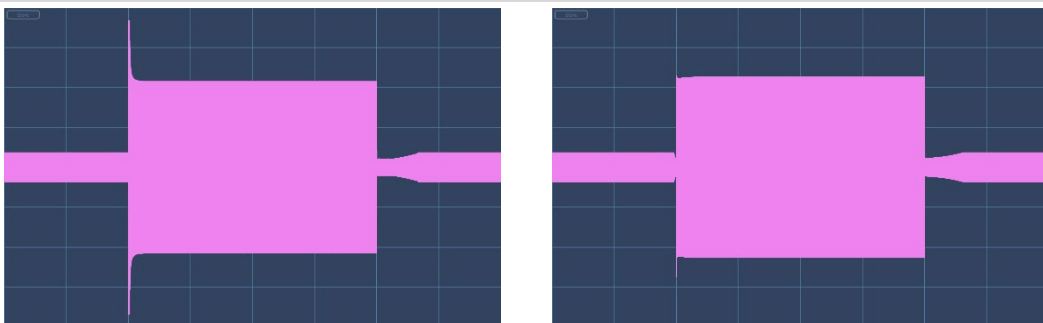


Figure 1: Lookahead off (left) and Lookahead on (right)

Stereo Width Control

A simple stereo expanded function that helps you to adjust the width of output audio. This parameter controls stereo width by altering ratio between Mid and Side. When it's 100%, Mid and Side have the same volume; when it's 0%, we have only Mid and no Side; when it's 200%, we have only Side and no Mid.



Side Channel Volume Control

The volume of side channel could be adjusted here between +12 dB and -inf dB. Not everyone likes changing the ratio between Mid and Side, so we added this control for adjusting Side's volume individually.



Spectrum Panel

Spectrum Panel Operations

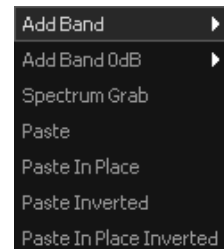
Double-click or Ctrl/Command + left-click to add a new band. You can also drag from spectrum to add a band. Drag on empty area to select multiple bands. Double-right-click on empty area to enable spectrum dragging (with default setting).



As the figure above, L/R/M/S mark is shown beside frequency point when the band is set on Left/Right/Mid/Side mode. The frequency point is available to drag. Bands on Left/Right/Mid/Side mode has curves in different color that help you to identify.

With default setting, Ctrl/Command + right-click on empty area of spectrum panel to open the menu. If you turned “double-right-click enables spectrum grab” off, it can also be opened by single right-click.

- Add Band: add a band of a specific type.
- Add Band 0dB: add a band of a specific type on 0dB.
- Spectrum Grab: turn on spectrum dragging mode.
- Paste: paste the copied band at the location where the cursor is.
- Paste In Place: paste the copied band at its original location.
- Paste Inverted: paste the copied band inversely at the location where the cursor is.
- Paste In Place Inverted: paste the copied band inversely at its original location.

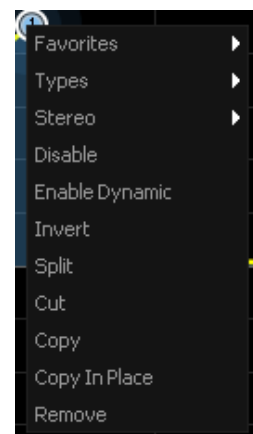


Band Operations

Left-click on frequency point to select the band. Ctrl/Command + left-click to select multiple bands or unselect a band. Double-click to bypass a band. Ctrl/Command + right-click on frequency point to delete the band (with default setting).

Single right-click on frequency point to open the band control menu.

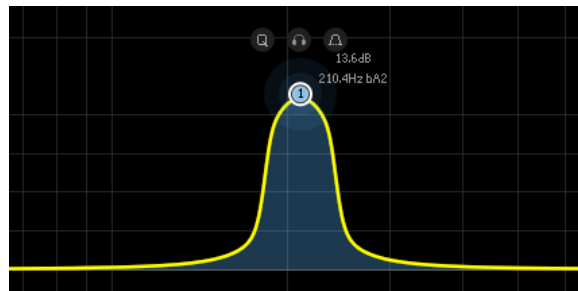
- Types: change type of selected band(s).
- Stereo: change stereo mode of selected band(s).
- Disable: bypass selected band(s).
- Invert: invert selected band(s).
- Split: split band(s) on Left/Right or Mid/Side mode to 2 bands; add new band(s) on opposite channel for band(s) on other modes.



- Cut: cut selected band(s).
- Copy: copy selected band(s).
- Remove: remove selected band(s).
- Favorites*: If *show my favorite types in band control menu* option was enabled in Favorite Settings (refer to Chapter 7), the Favorites folder containing the filter types you added will be shown at the top of the band control menu for you to change the type of selected band(s) conveniently.

Band Floating Window

When floating window is turned on in settings, there are three icons above the handle of selected band, on which you could adjust Q value, monitoring and slope.



- Dragging on the bell icon on the right will adjust filter slope, it has same function to the Slope knob in lower control band.
- Dragging on the "Q" icon on the left will adjust filter Q value, it has same function to the Q knob in lower control band.
- Click and hold mouse down on the headphone icon on center to turn on monitoring of the selected band until releasing the mouse. When monitoring is on, you can still drag the handle to find a suitable position.
- Ctrl/Command + click on the headphone icon on center to turn on/off monitoring of the selected band.

Band Control Panel

When there are bands selected, the band control panel will be shown at lower left.

- Bypass button: disable/enable selected band.
- Headphone button: turn on/off monitoring selected band.
- Remove button: delete selected band.
- Left/Right arrow button: switch selected band by number.
- Filter type button: click to show the menu of all EQ band types. You can select in the menu or use mouse wheel on the button to switch between the filter types of similar shape.
- Stereo mode button: click to show the menu of all stereo modes. Refer to "EQ with Pan".
- L/R or M/S slider: drag to adjust the rate of L/R or M/S. Refer to "EQ with Pan".
- Freq knob: drag or use mouse wheel to adjust the frequency of selected band. You can also input the value in the text box manually.
- Gain knob: drag or use mouse wheel to adjust the gain of selected band. You can also input the value in the text box manually. It would be locked if current type has no gain parameter.
- Q knob: drag or use mouse wheel to adjust the Q value of selected band. You can also input the value in the text box manually. It would be locked if current type has no Q parameter.

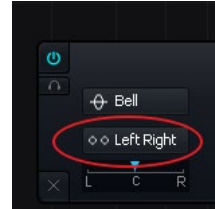


- Slope/Shape knob: drag or use mouse wheel to adjust the slope or shape according to current type. You can also input the value in the text box manually. It would be locked if current type has neither slope nor shape parameter.
- D button: click to turn on dynamic EQ mode and show the dynamic panel. Refer to Chapter 6.

EQ with Pan

This button allows you to adjust how you work with stereo sounds for each individual filter band.

- Left Right: process left and right channels at one time. In this mode, the pan slider below adjusts the "position" of sound.
- Left: process left channel only.
- Right: process right channel only.
- Mid Side: middle-side mode. In this mode, the pan slider below adjusts the amount of effect taken in middle and side parts.
- Mid: process middle channel only.
- Side: process side channel only.



Dynamic Panel

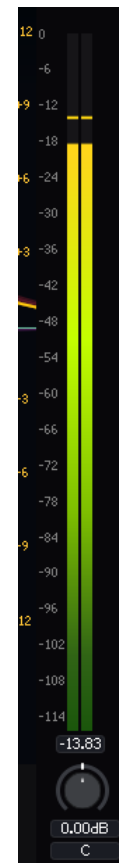


Click on D button to turn on dynamic EQ mode and dynamic panel will be shown. Refer to Chapter 6 for operation manual.

Output Penal

Output Panel Operations

Drag the round knob on the bottom to adjust the output gain. Drag the circle knob to adjust output pan. Double-click on a knob to reset the value (by default). Double-click on the text box of gain or pan to input the value manually.



Chapter 5 EQ Band Types

Common Types

- Bell: bell-like type, the shape can be adjusted by and slope.
- Low Shelf: increase/decrease low frequency, the shape can be adjusted by slope.
- High Shelf: just like low shelf but adjusts to high frequency.
- Tilt Shelf: increase low frequency and decrease high frequency or vice versa, the shape can be adjusted by slope.
- Flat Top: a bell-like type with "flat" top, the shape can be adjusted by slope.
- Flat Tilt: change whole spectrum in a straight line.
- Low Pass: passes only low frequency and filter out all high frequency, the shape can be adjusted by slope.
- High Pass: just like low pass but in inverse.
- Band Pass: only passes around a frequency, the shape can be adjusted by slope.
- Notch: inverse of band pass, only rejects around a frequency.
- Sword: bell-like but with sharp top, best suited to work with sharp resonances.

Misc Types

- Brickwall LP: Brickwall low pass filter with the sharpest cutoff frequency.
- Brickwall HP: Brickwall high pass filter with the sharpest cutoff frequency.
- Allpass L and Allpass H: Allpass filter passes all frequencies equally in gain, but changes the phase relationship among various frequencies. There will not be any visual changes in amplitude spectrum.

Allpass types are not always featured in EQs because phase changes are not sensitive to human ears. But they could be very useful in some scenes, such as mixing multiple mic tracks.

Please be careful when using allpass filters. Transients could be "smashed" or "blurred" because of the massive phase changes.

Please note that under Linear-Phase Mode (as its name, it won't change the phase of input signal), the Allpass types won't cause any effects.

"L" and "H" meant Low and High. When "Allpass L" is selected, the phase of 0Hz will keep unchanged and phase of high frequencies will change according to Q and slope. When "Allpass H" is selected, the phase of 22kHz will keep unchanged and phase of low frequencies will change according to Q and slope.

"Q" means how steep the phase changes near frequencies. High "Q" will cause great phase wrap near the frequency.

"Slope" means the "order" of the filter, high slope will cause even more phase chaos.

Vintage Modelling Types

All of these filter types are Inspired by vintage hardware (but do not contain the non-linear part of their effects).

Some of the hardware contains an intrinsic low- or high-pass effect due to their own in/out buffering. This effect is not considered, and we only focus on the equalizer part of them.

Unlike the originals, all these types have smooth adjustable frequency.

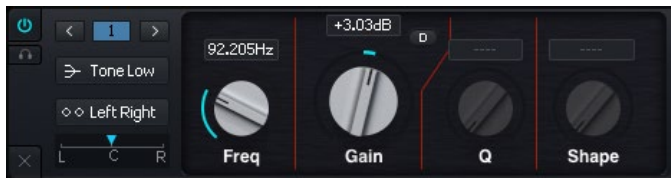
Birt N

Inspired by a very famous British hardware EQ. We modified the circuit modelling to have adjustable Q value in its bell type.



- BritN HP: high pass type.
- BritN LS: low pass type.
- BritN Bell: bell type with adjustable Q value.
- BritN HS: high shelf type.

Tone Stack



Inspired by a very classic low/high shelf EQ. We decoupled the filters model to allow low and high shelf parts to be individually adjustable.

- Tone Low: low shelf type. Note that if you select this type, the high frequency would have reduced due to circuit modelling.
- Tone High: high shelf type.

Vintage Tube



Inspired by three classic tube EQ.

- VT HP: high pass type.
- VT LP: low pass type.
- VT LS: low shelf type. It has sunk middle frequency when adjusting Q value, which is same with its hardware counterpart.
- VT Boost: bell type at high frequency. This type could only raise gain but cannot reduce, which is same with its hardware counterpart.
- VT Atten: high frequency reduce type.
- VT LMF: bell type at middle-low frequency.
- VT HMF: bell type at middle-high frequency.

Console E



Inspired by a classic EQ hardware. You may notice that the shape of LMF and HMF types are similar. They are both bell types and are indeed similar, but with slightly different sound, and we modelled them individually. Due to our decouple-modelled frequency points, you can apply LMF to high frequencies and HMF to low frequencies.

- E HP: high pass type.
- E LP: low pass type.
- E LS: low shelf type.
- E HS: high shelf type.
- E LMF: middle-low frequency bell type.
- E HMF: middle-high frequency bell type.
- E Low Bell: low frequency bell type, Q value not adjustable.
- E High Bell: high frequency bell type, Q value not adjustable.

Console G



Inspired by a very classic EQ hardware. Though looks similar with Console E, they have different sounds.

EQ 250



Inspired by a very classic EQ hardware. You may notice that the shape of its low shelf and high shelf are very different from common ones.

Blue



Inspired by an EQ hardware with very good sound quality. Gain can only be raised but cannot be reduced.

Please note that raising EQ may affect overall volume in some hardware. We normalized this kind of effect, avoiding the volume being raised with high frequencies.

Meanwhile, there are much hardware have the dB value which is not 100% accurate. For example, sometimes raising 3dB of frequency response on scale actually makes it increased 3.5dB. We also normalized the deviations as much as possible.

Chapter 6 Dynamic EQ

In Kirchhoff-EQ, all filter types can use dynamic functions except lowpass, highpass, bandpass and notch because these have no "gain" parameter to dynamically adjust.

Click the "D" button to turn on dynamic EQ mode, click again to turn it off. If selected filter type does not have dynamic function, the "D" button will be hidden.



When dynamic mode is on, the dynamic panel will be shown:

Threshold

In this panel, you can adjust the thresholds of the dynamic function. Different from simple compressor effects, the dynamic function of Kirchhoff-EQ is rich and complete. You can see *Below* and *Above* sub-panels and the *Threshold* knob at center.

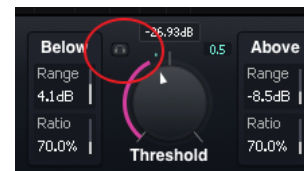


The threshold works like common dynamic effects. Through it you can tell Kirchhoff-EQ to what extent the sound is above/below the line.

When input volume is below threshold, the parameters in *Below* panel will be used; and when input volume is above threshold, the parameters in *Above* panel will be used. This is similar with a 2-way compressor/expander effect.

When current volume is lower than the threshold, the gain of current filter band is affected by the *Range* and *Ratio* parameters in the *Below* panel. For instance, if current volume is 3 decibels lower than threshold, and the *Below* panel has range of +6 dB and ratio of 50%, the gain would increase $3 \times 0.5 = 1.5$ db. and if the *Below* panel has range of -6 dB and ratio of 50%, the gain would decrease $3 \times 0.5 = 1.5$ db. If current volume is 3 decibels lower than threshold, and the *Below* panel has range of +1 dB and ratio of 50%, the gain would increase $\min(3 \times 0.5, 1) = 1$ db.

When current volume is higher than threshold, the gain of current filter band is affected by the *Range* and *Ratio* parameters in the *Above* panel. If current volume is 3 decibels higher than threshold, and the *Above* panel has range of +6 dB and ratio of 50%, the gain would increase $3 \times 0.5 = 1.5$ db. And if the *Above* panel has range of -6 dB and ratio of 50%, the gain would decrease $3 \times 0.5 = 1.5$ db. If the *Above* panel has range of +1 dB and ratio of 50%, the gain would increase $\min(3 \times 0.5, 1) = 1$ db.



Click the headphone icon besides Threshold knob to monitor the changes of sound.

The *Attack* and *Release* parameters are similar with common compressor effects: they control the speed of the volume envelope.

Click "*Below*" button to turn on/off the settings in *Below* panel.

Click "*Above*" button to turn on/off the settings in *Above* panel.



Detect/Relative Double Envelope Detection

Different from common dynamic effects, Kirchhoff-EQ detects envelope using a method we called "Double Envelope Detection".

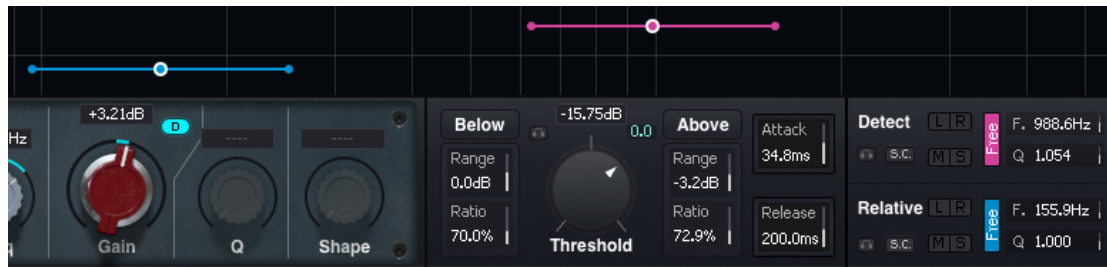
Let us imagine a simple case: if we are playing sound with 12 decibels around 1000 Hz, you may think "Oh it's too much! We should reduce at 1000 Hz." But we should also consider the overall volume of the audio. If the whole sound has a volume of 100 dB, you won't feel 1000 Hz is too much, but would think that it's too low. That is why "Double Envelope Detection" is so important: not only to detect the volume of current frequency bands, but also the volume of whole sound. The criterion to determine whether volume is high or low is its relative composition, not its absolute value.

As so, there are two panels laying in parallel, the upper *Detect* panel means the frequency band to detect, and the lower *Relative* panel means where to take the reference volume.



In default, the *Detect* will detect the envelope of current band's frequency and Q value, while *Relative* detects the whole audio. If you turn on their *Free* mode, you could manually adjust the frequency bands they use.

When *Free* mode is on, you can drag on the pink and blue lines to adjust their working frequency and Q value, or adjust on F and Q sliders directly.



We can have more choices in *Free* mode. A useful case is to detect sibilants: the simplest rule is to determine the high-frequency volume and consider all parts with a high level of high-frequency content as sibilants. But this is not always correct. A better way is to choose those parts with more high frequency and less low frequency, which more accurate. This can be achieved by setting *Detect* to high frequency, and *Relative* to low frequency.

“Detect” and “Relative” can be set as Sidechains by clicking “S.C.” button. You can set “Relative” to sidechain and leave “detect” and vice versa.

This value increases the ratio of transient envelope detection. When it becomes 100%, only transients are detected, making envelope detection work like a transient shaper.



Through the rightmost *Relative* percentage value, you can have balanced between relative- and absolute- envelope detection. When *Relative* values are 0%, the dynamic detection would degrade to common absolute envelope detection, and the *Relative* panel would virtually take no effect. When *Relative* value is 100%, the envelope is fully calculated from the volume relative ratio. The default value of this percentage is 80% that is a mix of 80% relative envelope detection and 20% absolute envelope detection.

We have *L*, *R*, *M* and *S* buttons on the right side of “Detect” and “Relative”, which refer to left, right, middle and side channel detection respectively. They provide 5 options in total:

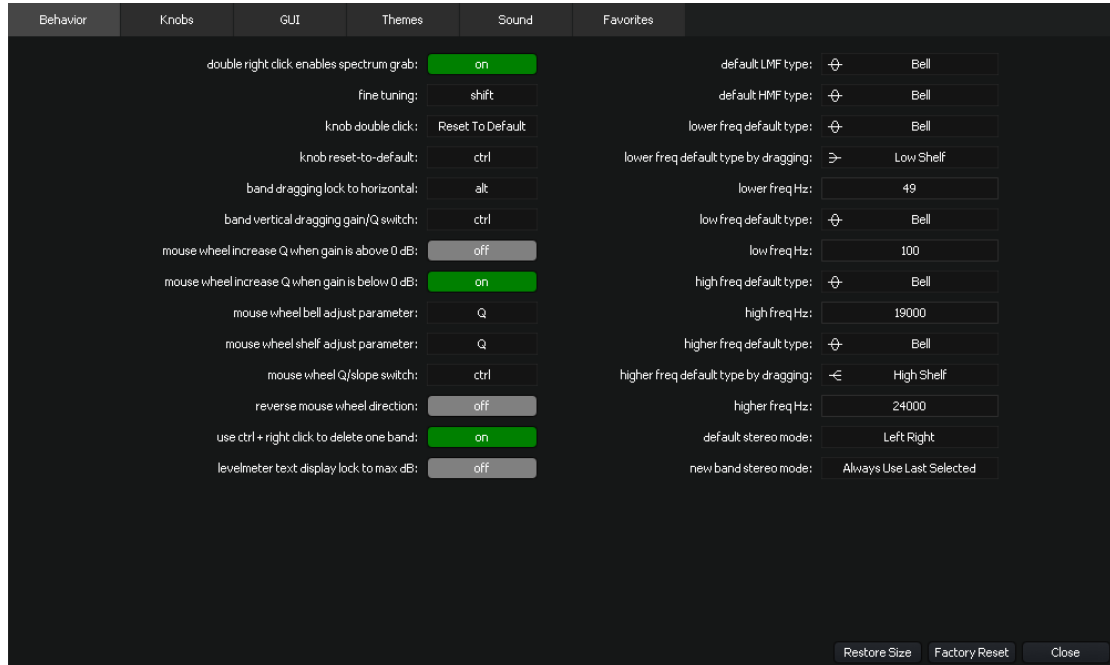
- Not enable any: detect overall volume of all channels.
- Enable L: detect left channel’s volume only.
- Enable R: detect right channel’s volume only.
- Enable M: detect mid channel’s volume only.
- Enable S: detect side channel’s volume only.



With these options, we can easily achieve various commonly used compression processes, such as a “mid-side compression”. For example, when we need to compress the low frequencies of both mid and side channels by detecting mid channel’s volume only, we can create a low shelf, then enable its *M*. If we need to compress the side channel by detecting the volume of itself, we can create a dynamic band on side channel and enable its *S*.

Chapter 7 Settings

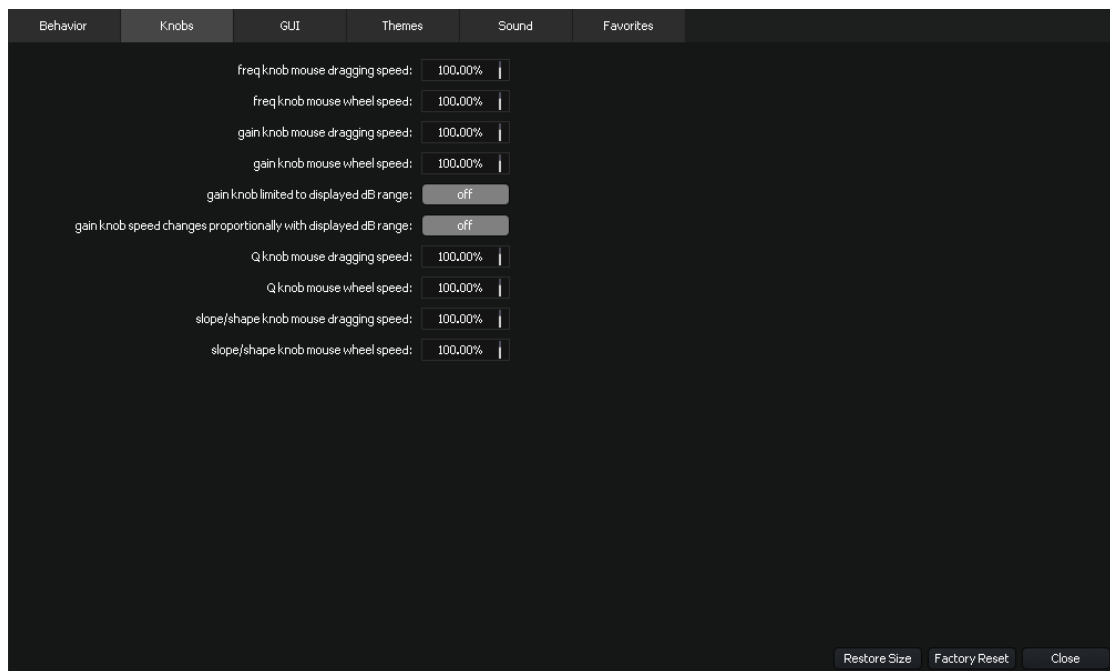
Behavior Settings



- double right click enables spectrum grab: Ctrl/Command + right-click to open the menu on spectrum panel when this setting is turned on.
- Fine tuning
- Knob double click
- Knob reset-to-default
- Band dragging lock to horizontal
- Band vertical dragging gain/Q switch
- Mouse wheel increase Q when gain is above 0 dB
- Mouse wheel increase Q when gain is below 0 dB
- Mouse wheel bell adjust parameter
- Mouse wheel shelf adjust parameter
- Mouse wheel Q/slope switch
- Reverse mouse wheel direction
- Use ctrl/command + right click to delete one band
- Level meter lock max dB display
- Default LMF type
- Default HMF type
- Lower freq default type
- Lower freq default type by dragging
- Lower freq Hz
- Low freq default type
- Low freq Hz
- High freq default type
- High freq Hz
- Higher freq default type

- Higher freq default type by dragging
- Higher freq Hz
- Default stereo mode
- New band stereo mode: set the rule of stereo mode selection when adding new bands.
 - Always use last selected: always use the stereo mode that was selected for the last band, unless you are creating the first band in a project.
 - By selection: if there is selected band, use the same stereo mode; if there is no selected band, use default stereo mode.
 - Always use default

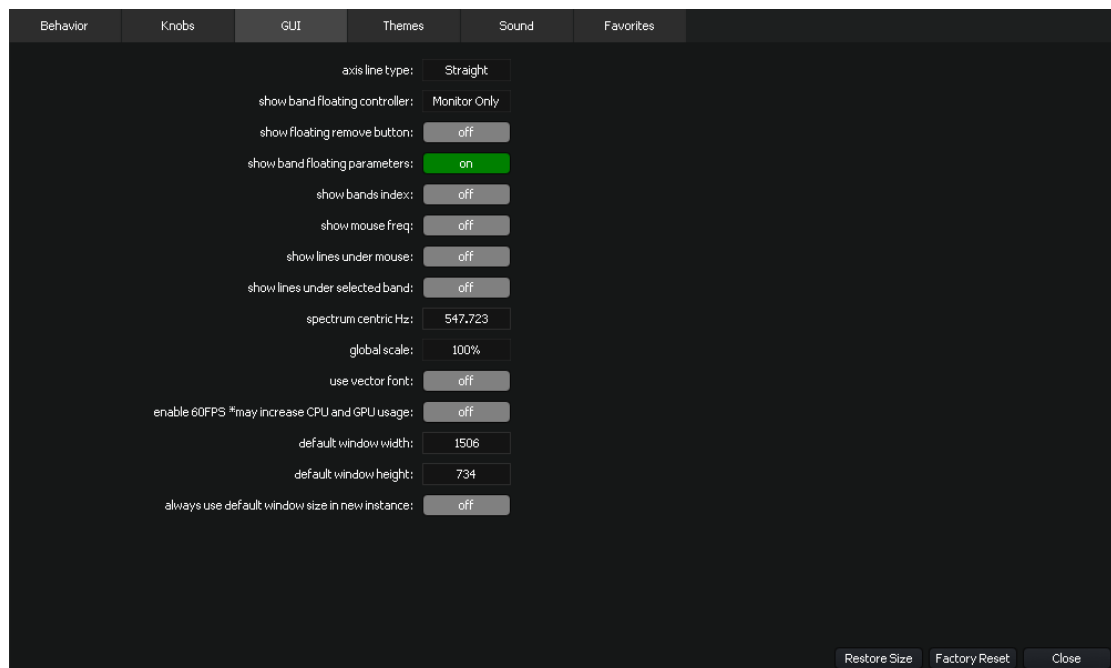
Knobs Settings



Mouse dragging and mouse wheel speed on frequency, gain, Q and slope knobs could be adjusted respectively here.

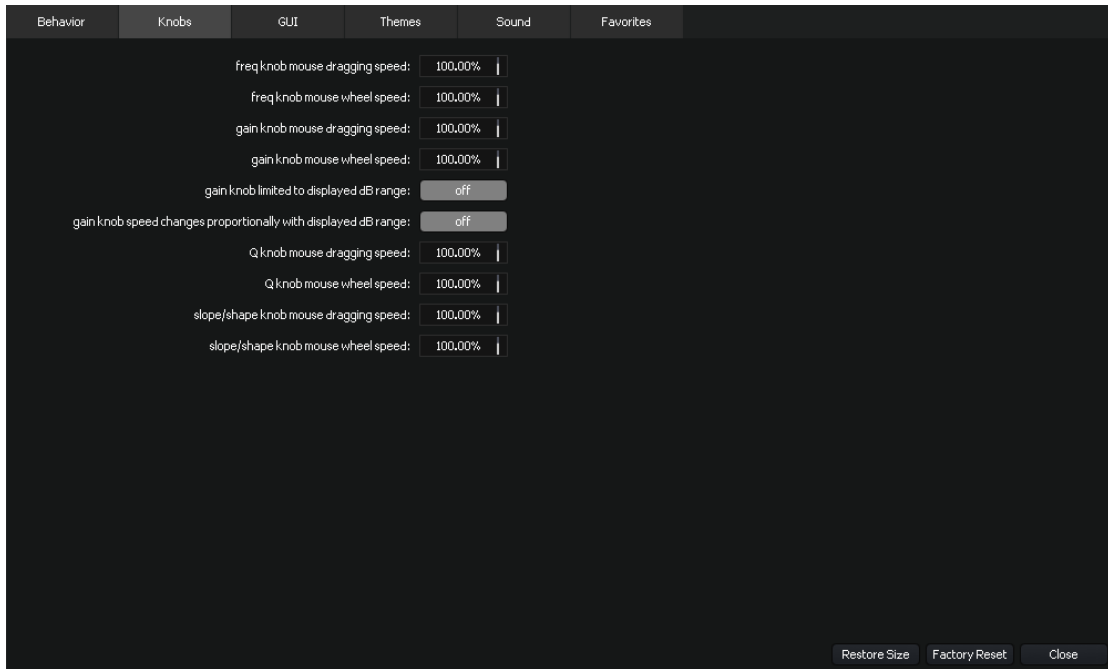
You can set whether to limit the adjustable range of gain knob by displayed dB range on spectrum panel, and whether to change gain knob speed proportionally with displayed dB range on spectrum panel.

GUI Settings



- axis line type
- show band point controller
- show floating remove button
- show band floating parameters
- show bands index
- show mouse freq
- show lines under mouse
- show lines under selected band
- show selected band freq
- spectrum centric Hz
- restore default spectrum centric Hz
- global scale
- use vector font
- enable 60FPS *may increase CPU and GPU usage
- default window width
- default window height
- always use default window size in new instance

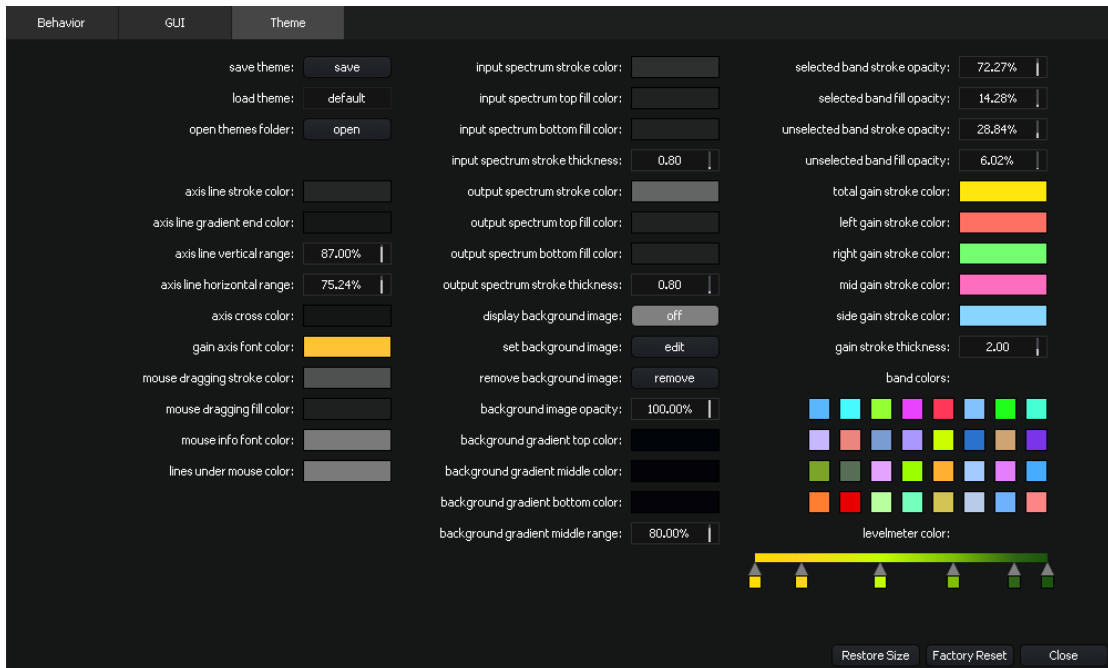
Knobs Settings



Mouse dragging and mouse wheel speed on frequency, gain, Q and slope knobs could be adjusted respectively here.

You can set whether to limit the adjustable range of gain knob by displayed dB range on spectrum panel, and whether to change gain knob speed proportionally with displayed dB range on spectrum panel.

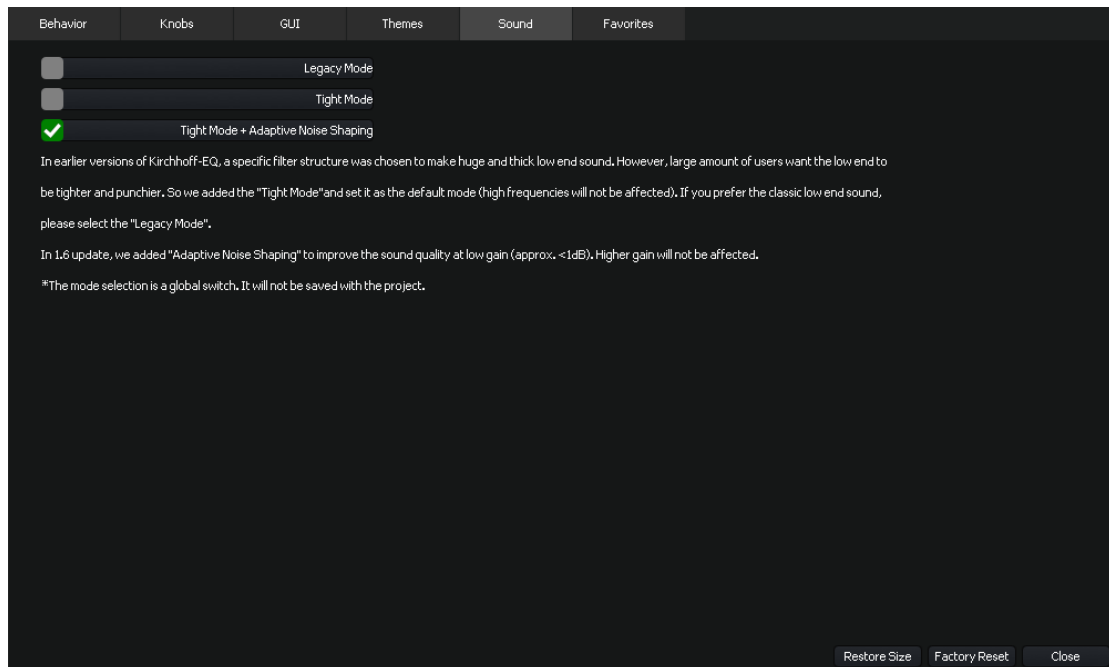
Themes Settings



Kirchhoff-EQ have multiple preset themes for you to choose. You can also customize the themes and save them as theme files. The files can be loaded anytime to change the current theme.

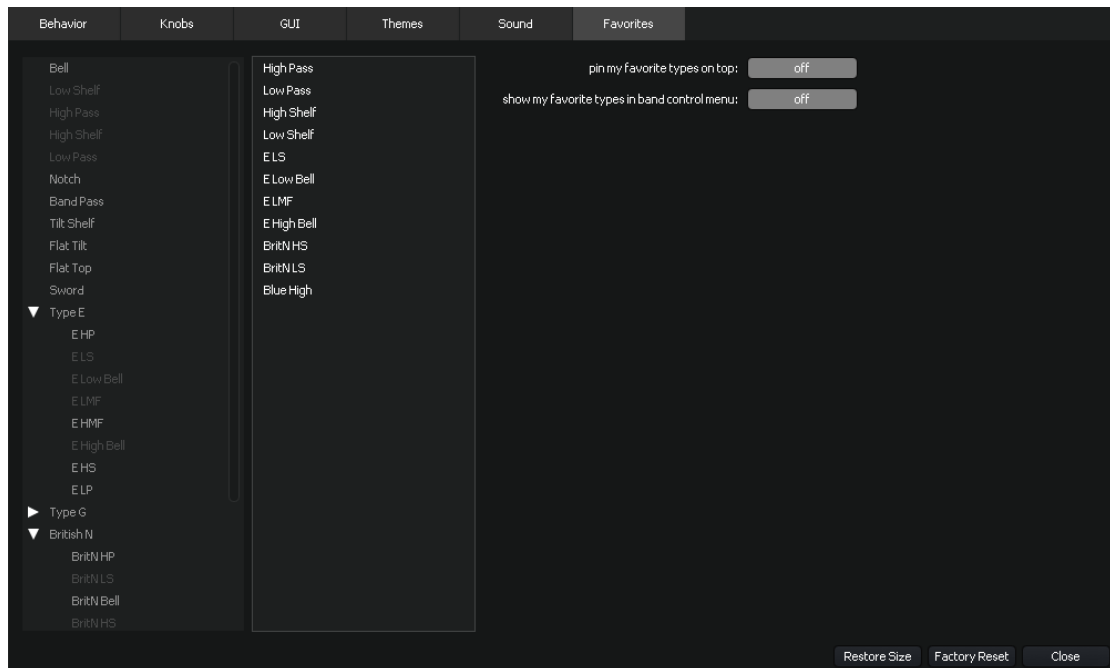
Kirchhoff-EQ provides highly customizable options. Nearly all adjustments can be applied to the current interface instantly. If there is any option that hard to understand, try to adjust it and see what's happening on the interface.

Sound Settings



- Legacy Mode: the sound mode for early versions of Kirchhoff-EQ. A specific filter structure was chosen to make a huge and thick low-end sound.
- Tight Mode: use the new sound mode for Minimum-Phase Mode, Analogue Prototype Mode, and Mixed Phase Mode, to produce a tighter and punchier low end (high frequencies will not be affected).
- Tight Mode + Adaptive Noise Shaping: in addition to Tight Mode, use "Adaptive Noise Shaping" to improve the sound quality at low gain (approx. $\pm 1\text{dB}$). Higher gain will not be affected.

Favorites Settings



Commonly used filter types could be added to your favorites. There will be a folder named “Favorites” in the filter type selecting menu after any filter type was added. The folder would be on bottom of the menu by default, or you could change the setting to pin it on top of the menu. You can set to show favorites in band control menu as a sibling menu with “Types”.

Chapter 8 Credits

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Dear Users
Our friends and family

Thanks for the measurement software @Plugindoctor

Kirchhoff-EQ User Manual

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