

<sound|theory> G U L L F O S S

Operation Manual Soundtheory Gullfoss 1.11

Revision 1.3
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System Requirements

- macOS 10.9 or greater / Windows 7 or greater.
- Apple Silicon processor / Intel, AMD or compatible processor not older than 2008 and with support for SSE3.
- Graphics processor with support for OpenGL 3.2 or later.
- iLok License Manager for activation (dongle is not required).
- 64 bit plug-in host with support for AU, VST, VST3 or AAX Native.

Specifications

- Mono-to-mono or stereo-to-stereo processing. Stereo processing is compatible with M/S channels.
- Supported sample rates from 16 kHz to 384 kHz.
- Approximately 20ms of processing latency for Gullfoss and Gullfoss Master and 2ms for Gullfoss Live.
- Approximately 1000 auditory perception model updates per second.
- Approximately 300 equalizer updates per second.
- Artifact-free processing enabled by perception-aware equalization.
- Preservation of perceived loudness and dynamics.

Trademarks

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Acknowledgements

Gullfoss uses the **Eigen** C++ template library for linear algebra and the **KFR** C++ framework. The user interface graphics engine builds on the **Skia** framework.

Company

Soundtheory Ltd.

5 South Parade,
Summertown,
Oxford OX2 7JL,
United Kingdom

If you have any queries regarding Gullfoss or Soundtheory Ltd, please email: info@soundtheory.com

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INTRODUCTION

Thank you for choosing Gullfoss. At Soundtheory we are proud to provide you with the most advanced audio processing tool available to improve your sound and to make an audible difference.

By purchasing Gullfoss you are supporting our ongoing research and the development of future products that will simplify and improve the workflow of modern music production, while at the same time respecting the artist's intention and creative vision.

The principles employed by Gullfoss to improve your sound are the same as those used by your brain to adapt to poor listening situations. Our process is unique in this regard, because it bases its calculations on the information present in the signal and not some spectral power measure. This allows Gullfoss to make more details audible without forcing the signal into a predefined shape that makes everything sound alike. During this process, Gullfoss perfectly preserves the dynamic structure of the audio. By design, it won't introduce audible artifacts or degrade signal quality, even at the most extreme settings.

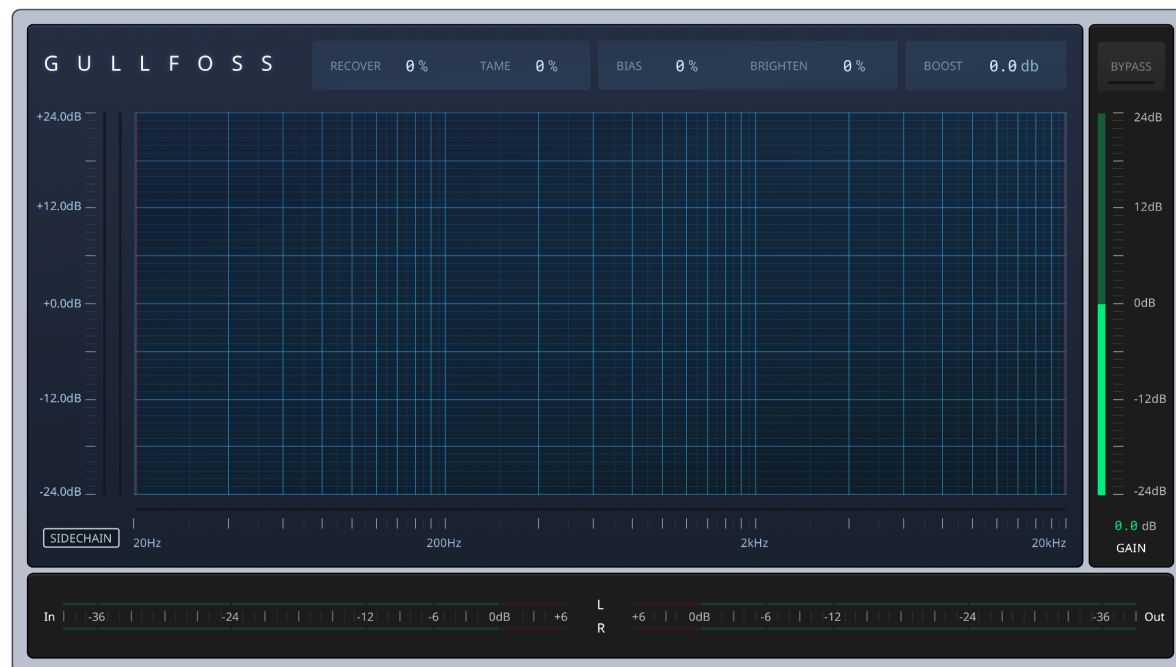
You can expect results that improve upon your recording's clarity and definition, as well as total balance and spatiality. You will find that many issues can be solved in a mix-down that would otherwise require access to the individual tracks. We have designed a very simple user-interface around these features, with a small number of parameters describing intuitive and natural concepts that allow you to improve your signal within seconds.

This manual provides a guide to the meaning and theoretical background of the individual parameters. It also discusses typical use-cases and strategies for getting the best out of Gullfoss.

Our team at Soundtheory wishes you a lot of fun making music and we sincerely hope you will enjoy our little contribution to it.

GETTING STARTED WITH GULLFOSS

When you first instantiate the plugin, all **five main parameters** at the top of the plugin window will be set to their default state of zero as depicted below. This is equivalent to a bypassed state where no processing occurs.



You can click and vertically drag up or down any of the main parameters to change the value. You can also **Alt+click** to alternate between zero and the previous value. This is useful for a quick A/B for any single parameter. You can also **Shift+drag** your cursor which allows for finer adjustments. When a parameter is highlighted, the up/down **arrow keys** on your keyboard may also be utilized to change the value with the smallest possible granularity. You also have the option to manually **type** an acceptable number followed by pressing the **enter** key.

Using the mouse **scroll wheel** or the **scroll gesture** on a trackpad, the parameters can also be changed. However, this method will not properly record **automation**, as the corresponding movements have no clear beginning and ending.

Recover & Tame

Recover and Tame are the two **primary** parameters of Gullfoss. These parameters **reveal masked** signal components which improves the clarity, detail, and spatiality of the signal. This can either be achieved by reducing the intensity of the components that are too **dominant** or by increasing the intensity of components that are **dominated** by others. **Recover** treats the dominated components while **Tame** treats the dominant components.



The range of the parameter values is between 0% and 200%.

Below you can see the effect of both Recover and Tame engaged at their respective maximum settings. The **EQ-graph** in the center of the plugin window accurately presents the current signal modification that is updated internally more than 300 times per second.

Please note that for both Recover and Tame the EQ boosts and cuts different frequency ranges. This combination of cutting and boosting preserves the original dynamics and **perceived loudness** of the input signal. This way you can always judge the output signal without being misled by a slightly different perceived loudness.

Bias & Brighten

Bias and Brighten are **secondary** parameters to Recover and Tame. They only have an effect if Recover or Tame are set to a non-zero value.



Before applying Tame and Recover to a signal, Gullfoss must decide how to **split** the range of audible frequencies into sections that need to be recovered and sections that need to be tamed. **Bias** controls this **classification** by either giving Recover more space when using a **positive** Bias value, or allowing Tame to control a larger frequency range with a **negative** Bias value. Recover and Tame then control by how much the respective ranges are affected.



Brighten tells the unmasking mechanism for Recover and Tame to prefer lower or higher frequencies. For example, if you have two **pure tones** of different frequency, and one is masking the other, then there is a whole **range** of possible balances that **uncover** the masked tone. A quiet higher frequency tone can be made **just loud enough** to stand out of the masking of the lower frequency tone. Or it can be so loud that it is quietened to **just not mask** the lower

frequency tone. Or anything in between. This range of possible unmasked outcomes can be parameterized by the resulting **perceived brightness**. Therefore, the brighten parameter gives you a very natural way to control the balance between low and high frequencies without affecting the **clarity** of the result. Negative values make the signal darker, whereas positive values make the signal brighter.

The range of both parameters is between -100% and +100%.

Boost

Just as with the perceived brightness of a signal, the balance between bass, middle, and treble frequencies is genre and context specific. The **Boost** parameter simulates the change of the **frequency balance** as perceived by human listeners when the sound volume is changed. This is reflected in the unit of Boost, which is **decibels**. The perceived loudness of the output signal is still preserved, even if you change the Boost parameter to change the perceived loudness frequency balance.



Increasing Boost will emphasize the **bass** frequencies of a signal while reducing the **mid** frequencies. Use this parameter to match the result to your taste and the intended listening situation.

Boost is a global parameter which can be used independently of the other parameters.

The range of this parameter is between -50dB and +50dB.

The meters

The parameters Recover, Tame, Bias and Brighten come with **meters** that light up when you highlight the corresponding parameter.

The **brightness** meter is located under the EQ graph and shows any deviation of the perceived brightness of the output from the perceived brightness of the input as a horizontal bar. Balancing this meter around its zero position, so that you can hardly see it, gives you an output that is equally bright as the input and therefore a good starting point for judging the effect of the unmasking without any bias.

The **Recover** and **Tame** meters are located left to the EQ graph and share the gain axis with it. The Recover meter only shows positive gains, the Tame meter only negative gains. They summarize the overall action taken by the Recover and Tame parameters and allow you to judge if your signal is processed more in one or the other direction.

The **Bias** meter is displayed left of the Recover and Tame meters. The Bias meter indicates whether Recover or Tame processes a larger **frequency range**. If the meter leans down towards the Tame side, then the tamed ranges are greater. The meter going up indicates that Recover is processing a larger frequency range.

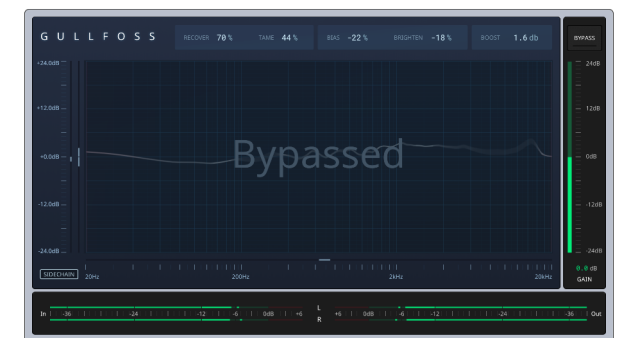
The input and output **peak level** meters are located below the EQ-graph and come with a peak-hold for levels greater than -12dBFS that can be reset by clicking the meter.

Gain & Bypass

Right of the EQ-graph Gullfoss displays the global output **Gain** control. While the processing performed by Gullfoss is compensated for perceived loudness, you may still find the gain control useful to keep the **peak level** matched or to correct for the loudness of a single relevant element in the mix.

For example, while your processed mix may be of the **same loudness** as the unprocessed mix, the lead vocal may have become slightly quieter in relation to other elements in the mix. The gain control can then be used to increase the total loudness, **restoring** the **perceived loudness** of the vocals within the mix.

The **Bypass** button is designed to be used as a tool for latency and loudness matched comparison between the processed and the unprocessed signal. The processing engine is **not** disabled when Bypass is engaged, so you won't see any reduction in the CPU load caused by Gullfoss.



You can **temporarily bypass all instances** of Gullfoss in your session by shift-clicking on the bypass button of any instance. The bypass button will blink with a **red indicator** and the EQ graph will display **“Session Bypassed”**. A second click on the bypass button will **restore** the previous bypass state for all instances.

The Main Display & Frequency Range Limiters

The way Gullfoss processes a signal can be compared to an equalizer that is continuously adjusted to improve the clarity of the signal at every moment. The basis for this adjustment is a highly advanced model of human **auditory perception** that allows Gullfoss to understand what your signal really sounds like and how it can be improved.



The main **equalizer graph** display provides you with real-time information about the processing that Gullfoss performs. You can use this graph to understand the **problems** that Gullfoss is trying to fix in your signal.

For example, if you observe that the frequencies above 4kHz are **consistently** lifted by around 6dB, then you can implement this as a change in your mix to improve the sound independently of Gullfoss.

Similarly, if you notice a very **strong** amount of low or high frequencies being lifted, this is usually indicative of the original audio not having very much information in these areas to begin with. In this and similar cases it can be helpful to tell Gullfoss to **disregard** certain frequency ranges during its unmasking calculations, because these ranges do not contain useful **audible information**.

For these cases, Gullfoss offers two **draggable** vertical bar controls inside the EQ-graph. These two range limiters **restrict** the action of **Tame** and **Recover** to frequencies **above** the first limiter and **below** the second limiter.

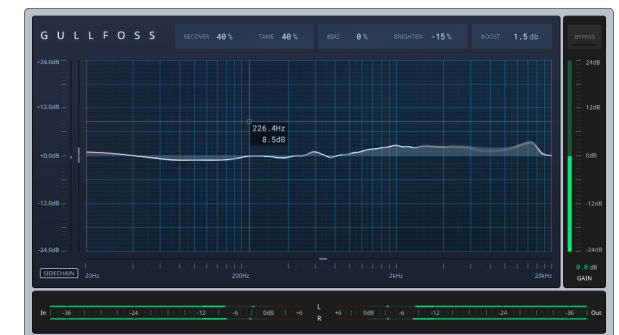
In the default order, the left frequency range limiter will **exclude** all

frequencies **below** it for unmasking and the right frequency range limiter will exclude all frequencies **above** it, leaving the frequency range between the limiters for processing. If you **reverse** the order of the two limiters you can **exclude** the frequency range **between** them from processing.

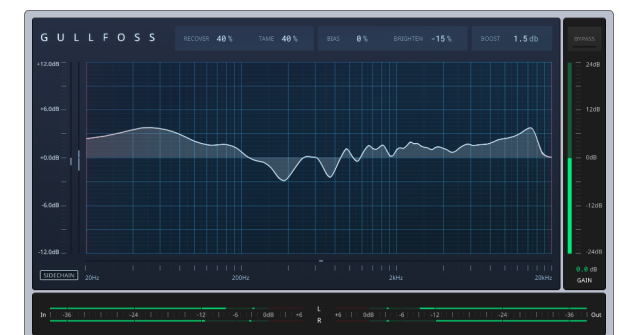
The **transition** between active processing and inactive processing is **smooth** and the strength of the processing is indicated by the **red shade** of the graph background. Even outside the processing frequency range you will find that the equalizer graph shows some processing. This is the result of any non-zero settings of the Boost parameter and the dynamic loudness compensation.

If the frequency range limiters are not visible, they can be dragged into the EQ-graph from the **edges** of the graph. Placing the mouse pointer over the edge makes the limiters visible.

Clicking and **dragging** in the equalizer graph **display** will reveal a small popup with information about the **frequency** and **gain** at the mouse pointer position. This makes it easy to **identify issues** in your mix as they keep getting processed by Gullfoss.



Using the **mouse wheel** or the **scroll gesture** on a track pad with the equalizer graph display changes the **gain scaling** of the graph. Dragging the vertical gain axis up or down has the same effect. **Clicking on the gain axis** changes the scaling by one step. The gain scaling setting is **not persistent** and will reset when the plugin is restored from a saved session.



Sidechain processing

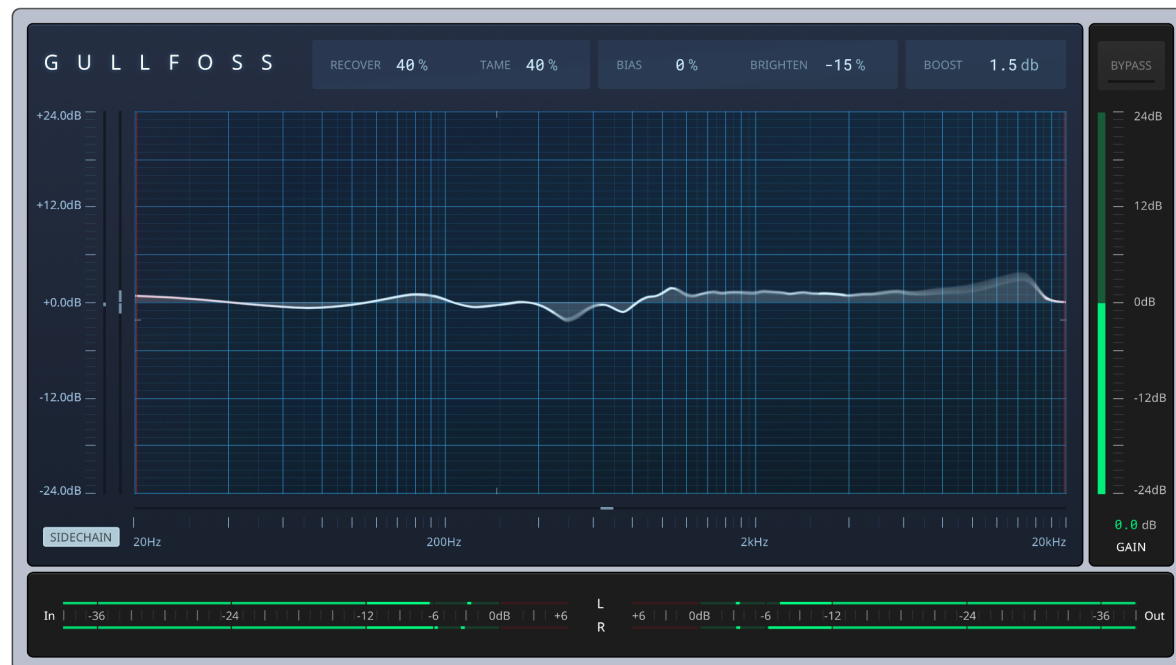
Starting with version 1.9.0, Gullfoss gains an **auxiliary sidechain input**. The signal fed into the sidechain can be routed to the **analyzer** section of Gullfoss while the signal on the main input will be processed by the **equalizer** responding to the sidechain input and routed to the main output.

There are two steps to enable sidechain processing. First, you must **connect** a signal to the sidechain inputs. This step is described in the documentation of your host software. Second, you need to tell Gullfoss to use the sidechain input as the signal source for the analyzer. The **sidechain button** in the bottom left corner of the main display facilitates this. It maps to a regular parameter and can be automated in your DAW.

Enabling the sidechain while there is no sidechain input connection from your DAW will either feed silence to the sidechain or the main input signal will be replicated on the sidechain, depending on how your DAW handles unconnected inputs.

make it sound like Gullfoss has been processing the sum of the stems. This technique requires driving the Gullfoss instances on each stem by the signal of the sum of the stems. Other uses of sidechain processing include creative **sound design** and **ducking** of signal content that interferes during a mix.

A word of **caution** when using sidechain processing: Gullfoss is very **sensitive** to timing differences between the main signal and the sidechain signal. Some DAW host applications do not properly **compensate for delay** between the main and the sidechain inputs of a plugin. Such a delay cannot be detected by Gullfoss and can result in a deviations from the expected result. In such a case we recommend checking and adjusting the delay between the inputs **manually**.



Sidechain processing can be useful in a number of situations. In particular, it enables you to render stems for **stem mastering** that

The Info Page

Clicking on the Gullfoss Logo in the top left corner reveals the **Info Page**. A **dialog** window that offers information about your Gullfoss version and options to **customize** its visual **appearance** as well as the **audio quality**.



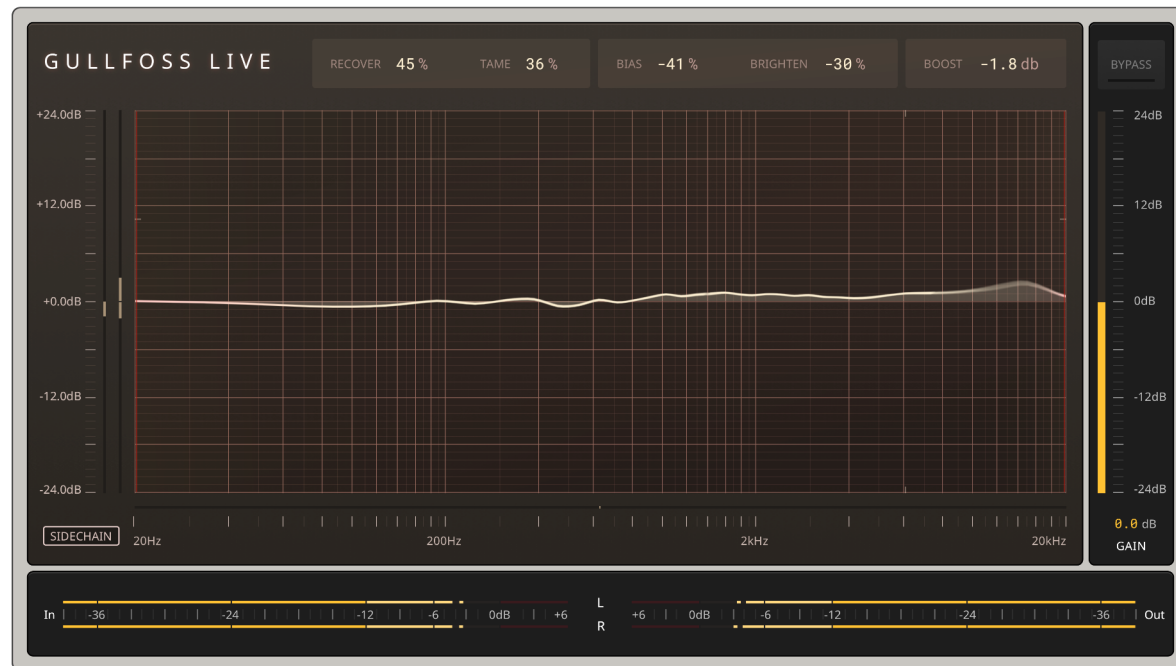
The first two settings control the plugin **window size** and the **refresh rate** of the equalizer graph. With version 1.9.1 we have also added the **default gain axis scaling** as a user preference. These settings are **global** and will only take effect when creating a **new instance** of the plugin. If you would like to update all existing instances with the new settings, please close and re-open your current project or **restart** your **host** application.

The **Huge** setting **doubles** the window size compared to the **Normal** setting. **Tiny** **halves** the window size. Please keep in mind that both window size and refresh rate have considerable impact on the **workload** of your graphics card. The default setting of Normal with a refresh rate of 30Hz will take up **eight** times **less** bandwidth than Huge with a 60Hz refresh and **eight** times **more** than Tiny at 15 Hz. That means there is a total GPU **bandwidth** factor of **96** between the lowest setting and the highest setting.

The **audio quality** controls are **per-instance** settings and take **immediate** effect when you **restart** the host **playback**. These settings are **stored** with the other plugin parameters, so that you can use a default **preset** to control their default values.

We have **optimized** the audio processing **quality** of Gullfoss to give you the best results, without adding any **artifacts** or creating any **distortion**. For most users, the **Normal** setting will be more than sufficient. The **Better** setting adds just a little safety margin on top and is a good choice for serious **mastering** work with the highest quality requirements. If you want to really go insane and squeeze even the last bit of quality out of Gullfoss, then **Best** is your setting. Be aware that the higher quality settings come with the price of a higher **CPU load**. Depending on your CPU architecture, expect up to **four times** the load from Best compared to Normal. Better is somewhere in between.

Gullfoss Live



quality settings on the settings page, Gullfoss Live has the **same user interface** and controls as Gullfoss and offers the same functionality.



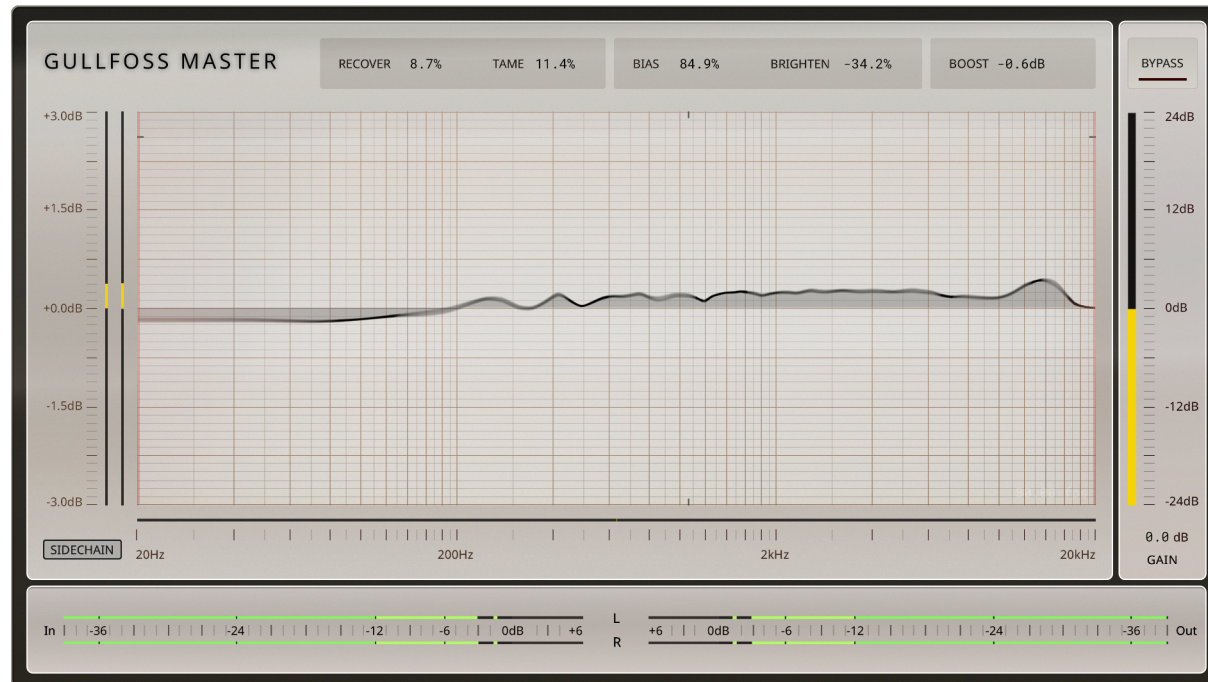
Gullfoss version 1.9.0 introduces **Gullfoss Live**, which is a special edition of Gullfoss that is optimized for **low latency** scenarios. Gullfoss requires knowledge of a **20 milliseconds** time-frame to make an EQ decision and therefore introduces a latency of around **21 milliseconds**. Gullfoss Live uses a set of trade-offs to reduce the latency to approximately **2 milliseconds**. This reduced latency comes together with a change of how the resulting signal will sound. Lower latency means that certain processing decisions cannot be made with full information about the signal content. In some situations Gullfoss Live has to try to predict the future. This mostly affects quick changes in the signal and may impact the ability to accurately process **percussive elements** separated from the rest of the signal.

We recommend that you try Gullfoss Live not just for low latency situations like tracking or live audio but that you also experiment with the **different sound character** compared to Gullfoss.

Gullfoss Live does not offer any processing quality settings. Quality has been **fixed internally** and is part of the low-latency trade-off. Other than the change of color scheme and the absence of the

Gullfoss Live is activated by the **same license** as Gullfoss. That means if you have a valid Gullfoss activation, Gullfoss Live will be available to you.

Gullfoss Master

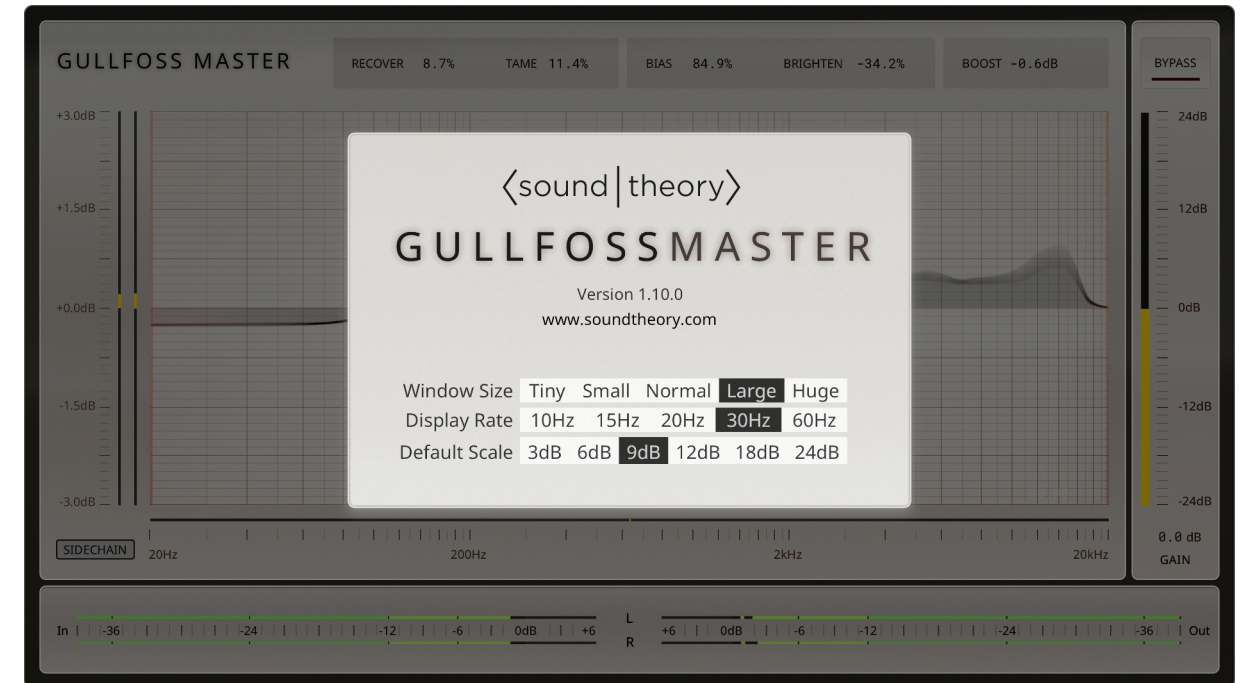


Gullfoss version 1.10.0 introduces **Gullfoss Master**, a special edition of Gullfoss that is optimized for the **highest possible quality** and an even **lower noise floor**. This also means that Gullfoss Master will have a **higher impact on your CPU** than the other editions. It comes with the same **21ms latency** as the standard edition.

We have also changed the auditory perception model to be **more precise**, especially for small equalization changes. The parameters also allow for a **finer control**, especially when you are using small adjustments. But you can also **Shift+drag** your cursor which allows for coarser adjustments.

Please note that because of the changes in the **auditory model** and the handling of the resulting equalization, taking a set of parameters from the other editions will produce **different results** with Gullfoss Master, so a direct comparison of settings is not meaningful.

Gullfoss Master does not come with quality options because the quality is internally already wired to the best possible.



Apart from the listed changes and a different visual appearance, Gullfoss Master has all the **same features**, functionality and user interface as Gullfoss and Gullfoss Live.

Gullfoss Master is activated by the **same license** as Gullfoss and Gullfoss Live. That means if you have a valid Gullfoss activation, Gullfoss Master will be available to you.