

Operation manual

Monofilter

v 4.0

NUGEN Audio

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Introduction

The NUGEN Audio Monofilter is designed for the control of stereo width and phase correlation in the low frequencies of the audio spectrum. We have paid particular attention to the practical application of the processes, allowing for optimisation at all stages of the recording process, tracking, mixing and mastering.

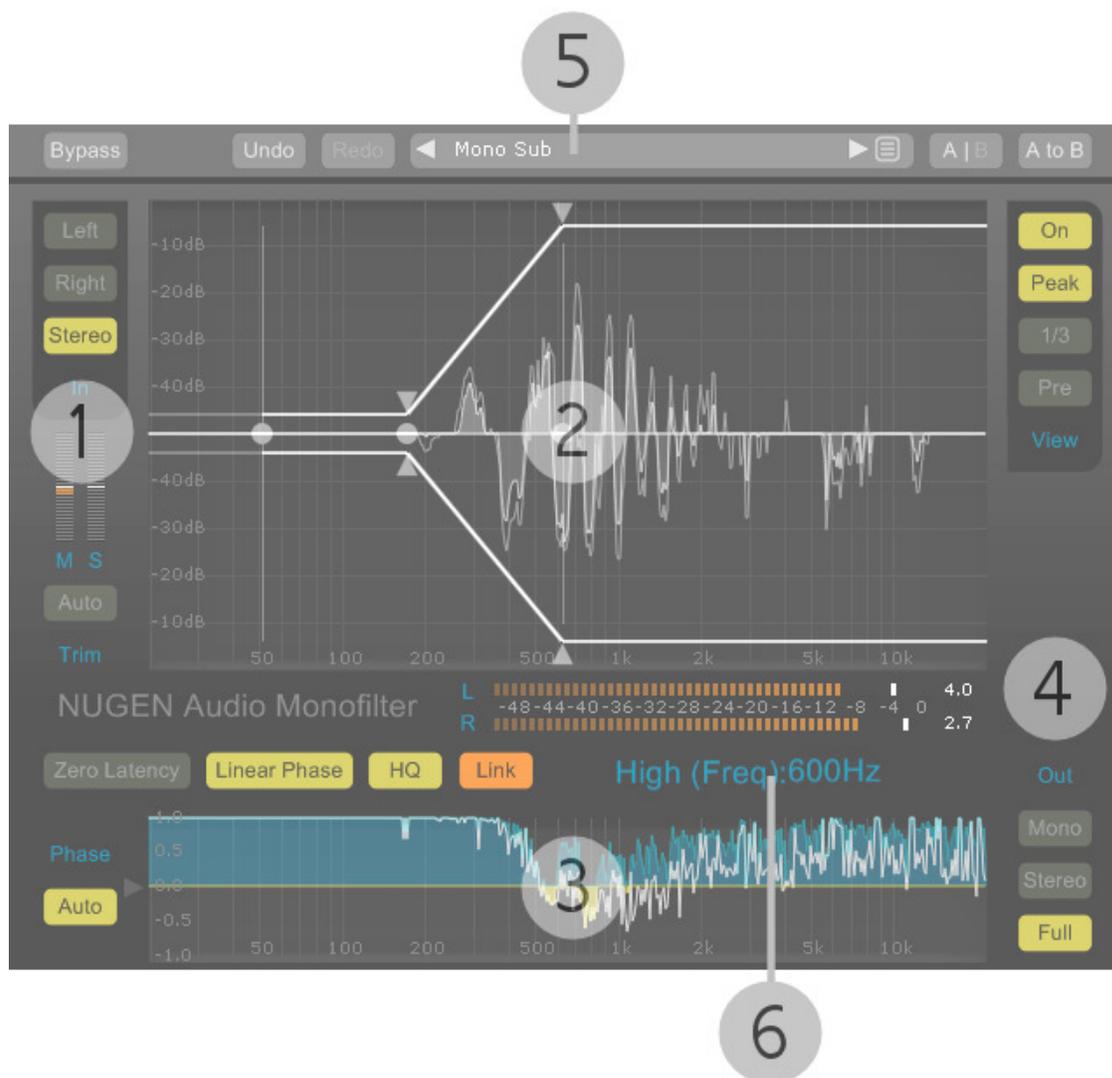
Monofilter allows for rapid and intuitive low frequency correction without unwanted artefacts, allowing the user to quickly centre the LF power distribution toward and below localisation frequencies, leaving stereo perception intact whilst increasing the definition and focus of the lower frequency ranges.

Monofilter uses high quality filter algorithms, optimised for audio transparency, simply delivering the results of the process without generated coloration. The interface has also been designed for transparent operation, removing the link between control and control function with visual representation of many controls in graphical format.

Optional visual analysis is also available, showing the stereo spread and phase correlation relative to frequency, allowing for frequency conscious adjustment without the needs to refer to a separate analysis plug-in.

Controls

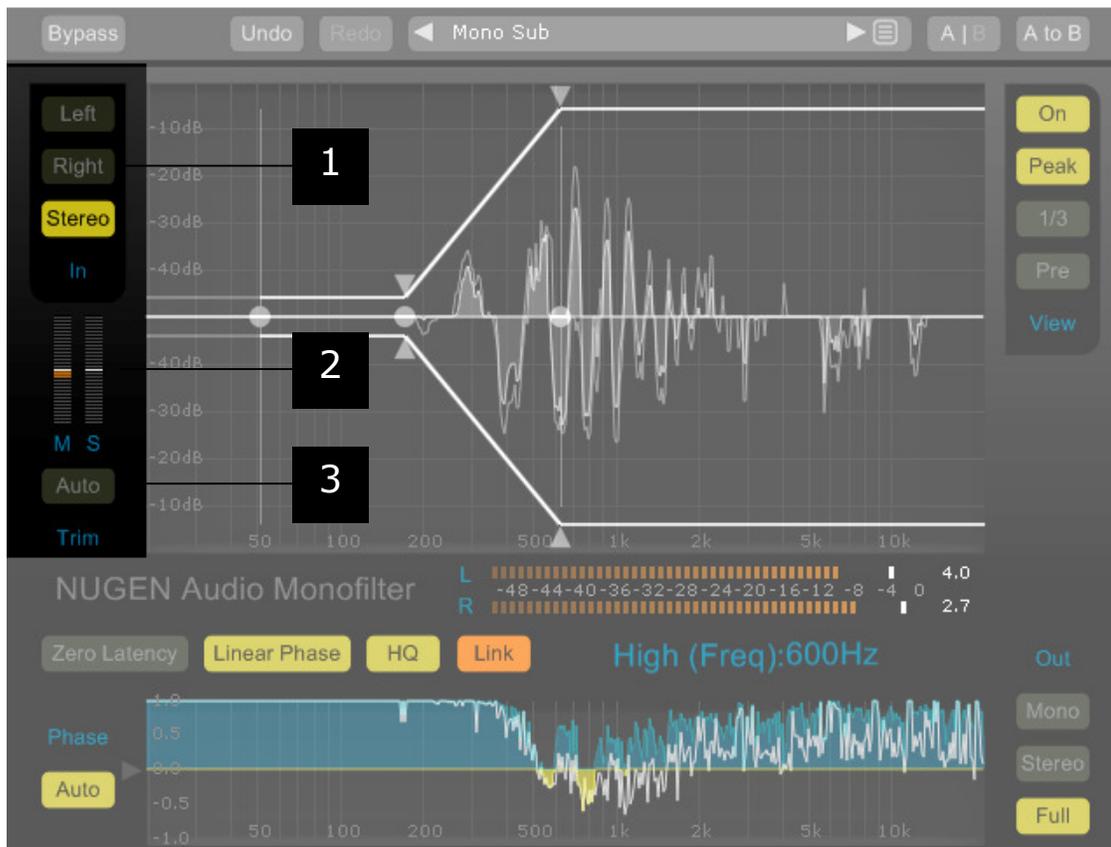
The controls are grouped into several distinct zones, to aid intuitive operation (see diagram below).



- 1 Input control zone
- 2 Monofilter process control and stereo differential spectrum analysis
- 3 Phase correlation adjustment and correlation by frequency meter
- 4 Output control zone
- 5 Utility control zone
- 6 Parameter value display window

1. Input control zone

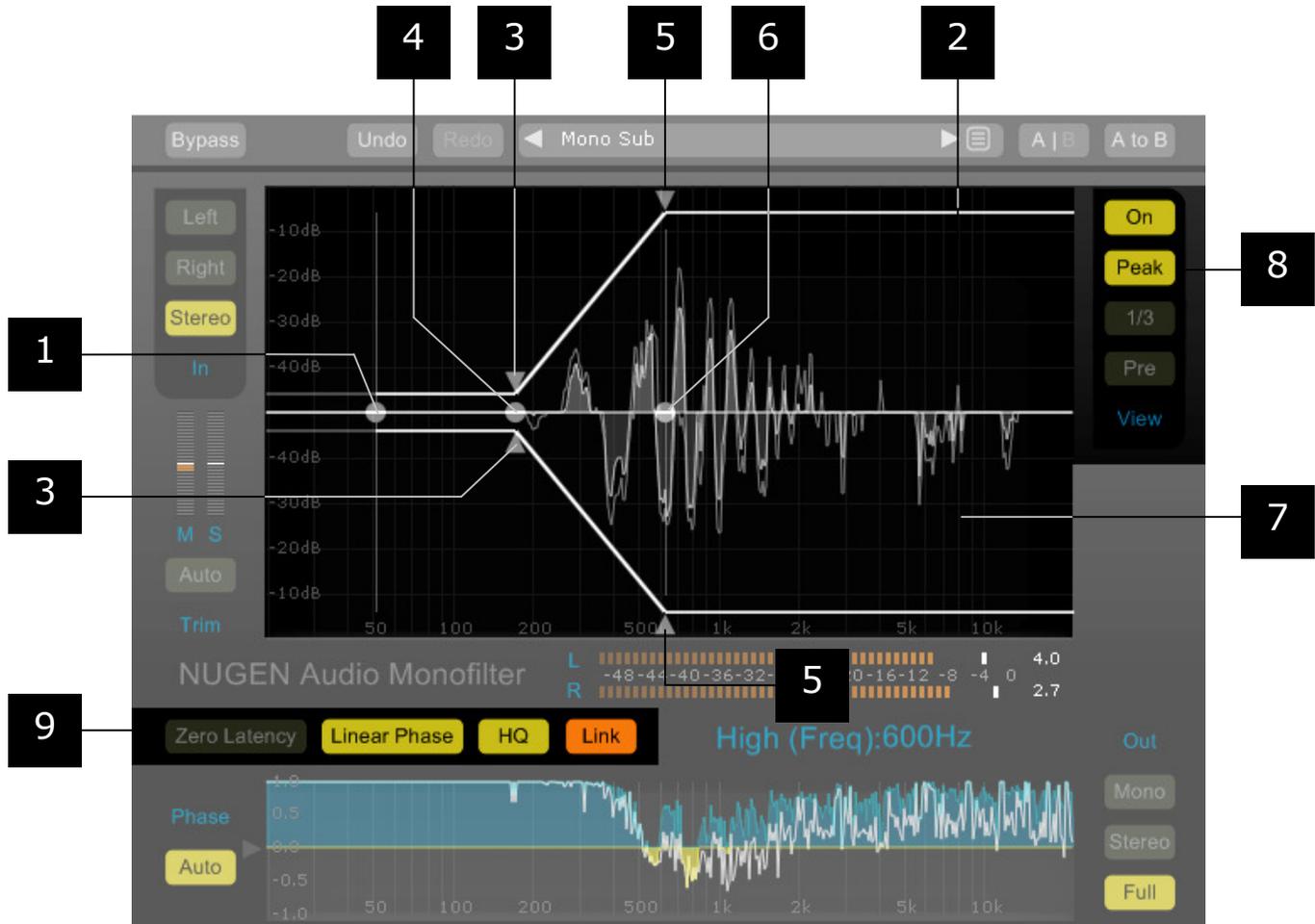
This section provides controls for adjustment of the source audio signal prior to and within the main Monofilter process, allowing the user to optimise the signal path both in terms of level and channel source.



- 1 **Process source select.** This control determines which channel/s is used to provide the source audio for the Monofilter process. The three options Left|Right|Stereo are mutually exclusive.
- 2 **Input trim.** Click and drag to boost or attenuate the Monofilter processed signal level 'M' or the remaining stereo signal 'S'.
- 3 **Trim Audio.** Select 'Auto' to have Monofilter compare the input and output levels and automatically adjust the level to maintain consistency.

2. Monofilter Process & Stereo Analysis

This section provides controls for adjustment of the main Monofilter processing algorithm. The main screen shows the stereo width control envelope with several control points along with optional stereo differential audio analysis.



- 1 **HPF cut-off frequency.** This control determines the cut-off frequency of the High Pass Filter. Drag left and right to increase or lower the value. Dragging all the way to the left will turn off the filter.
- 2 **Stereo Width Envelope.** This line indicates the stereo width envelope applied by the processing and is adjusted by moving the envelope control points [3,4,5,6]
- 3 **Low (Width).** This parameter determines the amount the stereo field is narrowed at and below the low frequency control point [3], from Mono at the minimum to unchanged (stereo) at the maximum i.e. The value determines the level of width reduction achieved at the low frequency control point. Dragging vertically reduces or increases the stereo width possible within the signal at this point.

- 4 **Low (Frequency).** This control point adjusts the lower frequency node of the Monofilter algorithm envelope [2]; this determines the frequency of the low width parameter. Drag horizontally to adjust to the required frequency.
- 5 **High (Width).** This parameter determines the amount the stereo field is narrowed at and above the high frequency control point [5], from mono at the minimum to unchanged (stereo) at the maximum i.e. The value determines the level of width reduction achieved at the high frequency control point. Dragging vertically reduces or increases the stereo width possible within the signal at this point.
- 6 **High (Frequency).** This control point adjusts the upper frequency node of the Monofilter algorithm envelope [2]; this determines the frequency of the high width parameter. Drag horizontally to adjust to the required frequency.
- 7 **Graphical Display.** This area shows the stereo width envelope [2] and associated control points. The optional audio analysis gives a graphical representation of the stereo spread in the output against frequency - the wider the stereo spread the larger the deviation (Left - Up, Right - Down) from the straight line as represented by a mono signal.
- 8 **Display Options.** The display options affect both the stereo spectrum analysis view and the correlation by frequency view. The 'On' control toggles the audio analysis display on and off. 'Peak' toggles the peak envelope display on and off. The '1/3' control toggles between full range analysis and a 1/3 octave banded view. The 'Pre' control toggles the display between Pre and Post the Monofilter process.
- 9 **Algorithm Settings.** This section determines the type of filter Monofilter process uses. 'Zero Latency' is a zero latency algorithm designed for use when immediate audio throughput is required. 'Linear Phase' is a transparent option, with a slight process latency. This is the suggested option for mixing and mastering. The 'HQ' option switches in a higher definition process, at the expense of increased CPU usage and latency in the case of the Linear Phase filter. The 'Link' control links the filter settings of all Monofilter instances with the setting activated. This allows for rapid switching between different algorithms e.g. if zero latency operation is temporarily required during a mixing session.

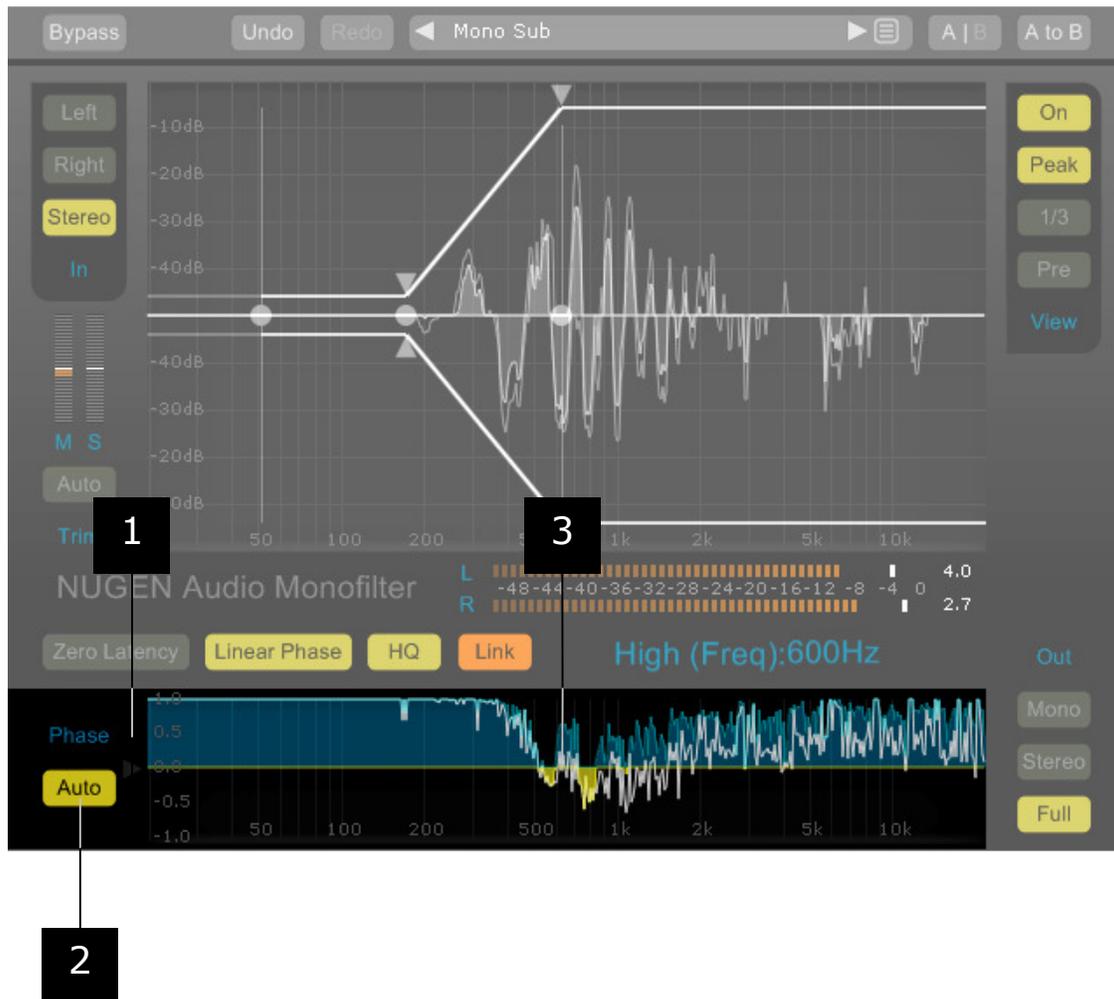
Note: When HQ mode is selected or deselected or the process algorithm is changed, the VST host will need to recalculate the Plug-in Delay Compensation[◇]. If the mode is changed during playback, this can lead to a glitch in the sound output, depending upon the VST host, computer spec and other plug-ins in use at the time. To avoid accidental interruption of playback, the default setting will only allow the mode to be changed when audio playback is stopped.

To disable this safety setting click the plug-in title to open the 'options panel' and set the HQ mode safety switch to off.

[◇] This is required because HQ mode/linear phase algorithm uses a different fft kernel size in order to achieve the high level of precision this feature requires.

3. Phase correlation control and analysis

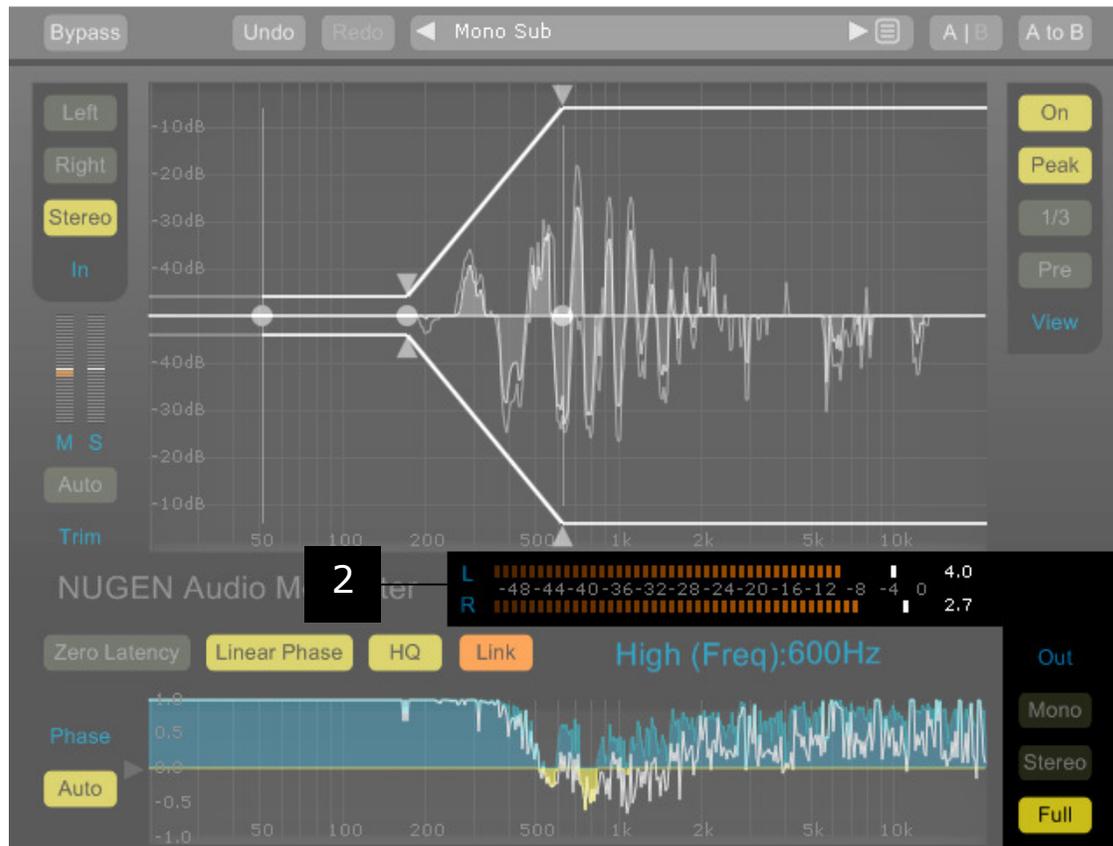
This section provides controls for adjustment of the phase correlation of the Left and Right input, along side analysis showing correlation by frequency.



- 1 **Phase Shift.** This control adjusts the relative phase of the stereo audio L and R signal to be adjusted by the Monofilter algorithm. The control is not available if the LF source select control is set to a mono input.
- 2 **Auto phase.** Select this option to have Monofilter compare the correlation of the incoming signal and adjust for maximum correlation automatically. The auto phase option is not available in Zero Latency mode.
- 3 **Correlation by frequency meter.** The meter shows the correlation by frequency of the signal pre, or post the Monofilter process, as determined by the Pre/Post control in the View section.

4. Output control

This section provides controls for adjustment of the phase correlation of the Left and Right input, along side analysis showing correlation by frequency.



- 1 **Output mode.** Useful for fine-tuning the threshold frequency by ear. 'Mono' will mute stereo frequencies. 'Stereo' mutes mono frequencies. 'Full' returns the output to the full frequency range.
- 2 **Output Level Meter.** Shows output level, with peak hold indicators and margin. If a digital 'over' is detected, the margin will show a red 'clip' indicator. Click to re-set.

5. Utility controls

Monofilter supports a number of standard utility controls. These may be duplicated in some instances within the host DAW, however the controls within the plug-in will operate 'in place' to provide seamless audio performance.



- 1 **Preset Browser.** Click to open preset browser window to select presets from list. Use arrows to move through presets in order.
- 2 **Bypass.** In-place bypass mode, preserving PDC to avoid re-lock issues.
- 3 **Undo.** Unlimited session undo.
- 4 **Redo.** Unlimited session redo.
- 5 **A|B.** Switch between temporary session A and B memories to compare two sets of settings.

General Functions

- Holding down control (Ctrl) and clicking a control will return the control to the default position (Win) or double click a control (OSX).
- Holding down shift whilst moving a control will allow fine adjustment to be made.

Practical Application

Monofilter is a versatile effect that has many practical applications, both in the studio and during live recording and performance. Below are some suggestions to help you get the most from your plugin.

Guiding principles.

- 1 Low frequencies are generally considered to be 'omni-directional' i.e. The ear has difficulty in telling which direction they come from. Stereo information in these frequencies is largely redundant, and can often contribute to a lack of clarity and focus in the mix. Below 80Hz it is more or less impossible to determine direction using level difference. In practical listening environments, this value may well be much higher.
- 2 Different playback systems and mediums have different requirements and low frequency ranges. If the intended playback medium is known, then mixes can be adjusted to make full use of the available headroom and optimised to take into account the low frequency handling available. This can be summarised in two main areas, the frequency range of the system and the crossover point (if any) at which balanced power handling and phase consistency become advantageous. The table below gives some indication of likely ranges.

System	Guide to min. Frequency	LF crossover point
Laptop	200Hz	N/A
Standard TV	90Hz	N/A
Computer Game 2.1 system	50Hz	200Hz
Average Hi-Fi	50Hz	80-150Hz
Good Hi-Fi	35Hz	80-120Hz
Home Theatre	35Hz	80-160Hz
Club PA	20Hz	90-250Hz
Vinyl		70-150Hz

- 3 In general, natural sounding audio is phase coherent in the lower frequencies, and as a result, we tend to perceive phase inconsistencies as 'weak', 'hollow' or 'flat'. As soon as recorded audio is in the studio however, the chances of introducing such artefacts are high. Adding stereo FX processing and using multiple mic. set-ups immediately bring the issue into play.
- 4 Bass frequencies are difficult, high-energy sounds for speakers to produce; this energy is best shared between the speakers. Sharing the load between speakers and amplifiers allows the system to work within optimal ranges, providing clearer audio reproduction.
- 5 When mastering tracks for vinyl, stereo sounds and phase differences in the bass frequencies are best avoided, as this can cause severe problems for the cutting plant and may result in your master being rejected.

Choosing the Algorithm

Monofilter has three separate modes of operation, zero latency, linear phase and linear phase HQ, each with it's own characteristics. The optimum algorithm setting is dependent upon the task at hand. Below are some guidelines to help with algorithm selection.

- Live (Zero Latency)

In live contexts, low latency is essential. Low CPU use is also a benefit, as to ensure a system always performs smoothly it is best to avoid stressing the system with a high processor load.

Key benefits:

- Even power distribution, avoiding stressing the playback system and keeping demand within optimum range
- Sharper, more focussed low end
- The ability to reduce the width of hard-panned effects (eg. Stereo delay). With getting on for a third of the audience having an experience dominated by a single speaker stack (right or left), hard panned sounds can lead to situations where an entire section of the soundstage can be inaudible. Reducing the width of these sounds brings the entire listening experience to all sections of the audience.

- Mixing (Linear Phase)

When mixing, a 'transparent' sound is great for 'gluing' sounds together without upsetting the overall colour of a sound. Latency and CPU are less of an issue as the system is in a more controlled environment. As the overall sound is a layering of many tracks and groups, standard linear phase mode is usually sufficient unless extremely sharp transitions are required at very low frequencies.

Key benefits:

- Sharper, more focussed low end
- Linear phase 'transparent' filtering
- Low CPU use

- Mastering (Linear Phase HQ)

In a mastering context quality and precise definition are the over-riding concerns. CPU and latency issues are less important. Maximum control, definition and transparency are achieved by using Monofilter in linear phase HQ mode. The HQ mode does result in a higher CPU overhead, which can be mitigated by choosing larger buffer sizes in the audio driver set-up options.

Key benefits:

- Sharper, more focussed low end
- Linear phase 'transparent' filtering
- Very high precision algorithm

- Summary Table

Application*	Priority			Setting
	Low latency	Low CPU	High Precision	
Live Recording (DAW monitoring)	High	High	Low	Zero Latency
Mixing Recording (Hardware monitoring)	Med	Med	Med	Linear Phase
Mastering	Low	Low	High	LP HQ

* The 'link' control can be used to switch all instances of Monofilter to the same algorithm simultaneously. This can be useful when unforeseen overdubs are called for etc.

The Presets. These are intended to be used as 'quick start points' when approaching a mix, sub mix or individual track. They are by no means exhaustive and should be treated as an introduction to the parameters and possibilities rather than a 'how to' guide. When working through these examples it is important to bear in mind that the end result and settings required will depend heavily upon the source material.

Stereo Spectrum Analysis. The graphical display in Monofilter can be used as a Stereo differential spectrum analyser. Setting the Width Controls to maximum width, the HPF to off, and leaving the other controls in their default positions (you can achieve this quickly and simply by selecting the preset 'Analyser') will set up the plugin in analysis mode. The incoming sound is not affected, but is analysed for stereo content, which is then displayed visually.

The display shows frequency (20Hz – 20Khz) horizontally against stereo spread (dB) vertically. Left displacement at any given frequency is represented above the 0dB line and Right displacement below.

The lower analysis window shows correlation against frequency. A correlation in the positive region toward +1 will result in 'solid' sounding audio. 0 is uncorrelated material and values from 0 to -1 (anti-correlation) can result in phasing and phase cancelation where certain frequencies are reduced or cancel out entirely.

If you are unfamiliar with the incoming audio material, or wish to visually check frequencies that are difficult to determine, this mode is a good place to begin. Before you start making any adjustments to the sound, visual analysis can quickly highlight areas of concern, or conversely, give you a good indication that little treatment is needed.

Centering the bass where stereo FX are used. Applying stereo effects to liven or enrich a sound can work wonders in the mid and high frequencies, but often muddies up the bottom end. Using Monofilter you can add stereo effects and still retain a solid centre in the bass frequencies, by reducing the width below the point at which stereo nature of the effect has ceased to make significant impact.

Correcting phase issues. Some stereo effects use phase shifting to create the desired sound. This can cause cancellations and superpositions of certain frequencies when the channels are forced back to mono. Using the Phase control you can adjust the phase of the L and R components being summed below the threshold frequency to correct any phase imbalance. If the input signal has a dynamic phase shift, the auto button can be engaged to automatically analyse and track the shift, adjusting for maximum phase alignment.

Making a frequency split. Monofilter has a very transparent, high performance crossover filter which can be used to split an audio signal into two frequency bands for individual processing. This can be achieved using two instances as follows: Split the audio into two streams (using groups/duplicate audio tracks etc.) and use two identical instances of Monofilter, one on each signal. Select the 'Mono' output button on one instance for the low frequency mono information and the 'Stereo' output button on the other for the stereo information above the threshold frequency.

During Live Recording and Performance. When working with live material, giving attention to taming the unpredictable and treating the PA with respect can bring real benefits. Using Monofilter to ensure that the subs (and even the bass frequencies in general) are centred in the mix can help share the load between over worked amplifiers and speakers as well as providing a sharper level of clarity in the bottom end. Where a more subtle approach would be of benefit, Monofilter can be used with individual problem instruments and groups (toms/laptop performers/DJ's/keyboard players using global delay etc.)

Taking care for vinyl. Vinyl has difficulty reproducing stereo information in the low frequencies. Wide stereo frequencies in the bass can cause the needle to jump upon playback, so the track has to be cut at a lower level to compensate. It also difficult for the lathe to cut this information accurately. To quote a vinyl mastering specialist:

"The moral for engineers is: If you are looking for hot levels or long sides, don't pan instruments like drums and percussion hard left and right. Keep the bass and bass drum in the center, and keep everything in phase. An out of phase snare or bass drum can wreak havoc. Use an oscilloscope if possible!"*

"I always tell clients, especially dance artists, 'Mono your bass.' Staging is a big problem for vinyl cutting. I've run into situations where producers try to do stereo kick drums, and they think they're fattening them up by moving one a couple of milliseconds, which only knocks it out of phase and results in less bass. And it's almost impossible to cut. We can do things to try to mono the low end, but usually it requires a remix. When something's out of phase, it tries to pull the cutting head two different ways, and then the cut just collapses. Phasing causes the cancellation of frequencies, and the cutting head can't process that, so you lose your groove, which causes a skip." **

With Monofiter you can centre the bass and adjust the phase ensuring that your recordings are properly prepared for vinyl pressing.

'Panning' Bass. Panning bass sounds is usually something best avoided as off-centre high energy in the low frequencies can present more problems than it resolves. However, using Monofilter a sound may be panned and the low frequencies present in say a bass guitar track, can be centred using the Monofilter process, the higher frequencies (i.e. much of the attack component) can be moved in the stereo field without the usual problems of the attending lows, giving the impression that the bass part has been panned, when really it is only the high, directional information carrying frequencies that have been moved.

Choosing the algorithm setting

Reporting a problem.

If you encounter a problem with any of NUGEN Audio's products, please let us know, to help us improve them.

Please email NUGEN Audio at **support@nugenaudio.com** giving a clear explanation of the problem. Please state how frequently you've experienced the problem. If there are any particular steps you need to go through to see the problem, please detail these. Also, please give details of the VST Host you are using, including version number (e.g.- Ableton Live 8.0.1).

Please also state your operating system, and the rough specs for your machine (e.g.- CPU speed, RAM) - in Windows XP you can get this information by right-clicking "My Computer" and selecting properties.

Please be patient with any problems you may experience, particularly with products at a beta stage of release. At NUGEN Audio we take problems with our software seriously, and will endeavour to correct them as quickly as possible.

Version History.

4.0 Initial release

[†] Live is a trademark of Ableton AG

[‡] Cubase, Steinberg, and VST are registered trademarks of Steinberg Media Technologies AG

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* <http://www.urpressing.com/tips.html>

** Pete Lyman, Vinyl Mastering Engineer in Electronic Musician magazine