



OPERATION MANUAL

SEQ-S & SEQ-ST

Linear Phase Spline 'Match & Morph' EQ



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Introduction

Note: This manual covers both SEQ-S (full surround plug-in) and SEQ-ST (stereo version). The only difference between the two versions is the surround capability of SEQ-S. In general, SEQ-S is referred to and illustrated with screen shots, and where surround functionality is discussed, this is not available in SEQ-ST. Other operational aspects are the same for both versions.

NUGEN Audio SEQ-S is a high resolution, linear phase spline and match EQ delivering powerful sonic sculpting and EQ matching up to 7.1 (SEQ-ST is stereo only), with stereo mid-side operation and automated spectrum analysis. A direct-draw interface and detailed spectrum analysis make it easy to quickly identify and specifically fine-tune your audio. Couple this with EQ matching via sonic fingerprinting and you have some unique possibilities.

SEQ-S is suitable for high-end audio production, including mastering and post production.

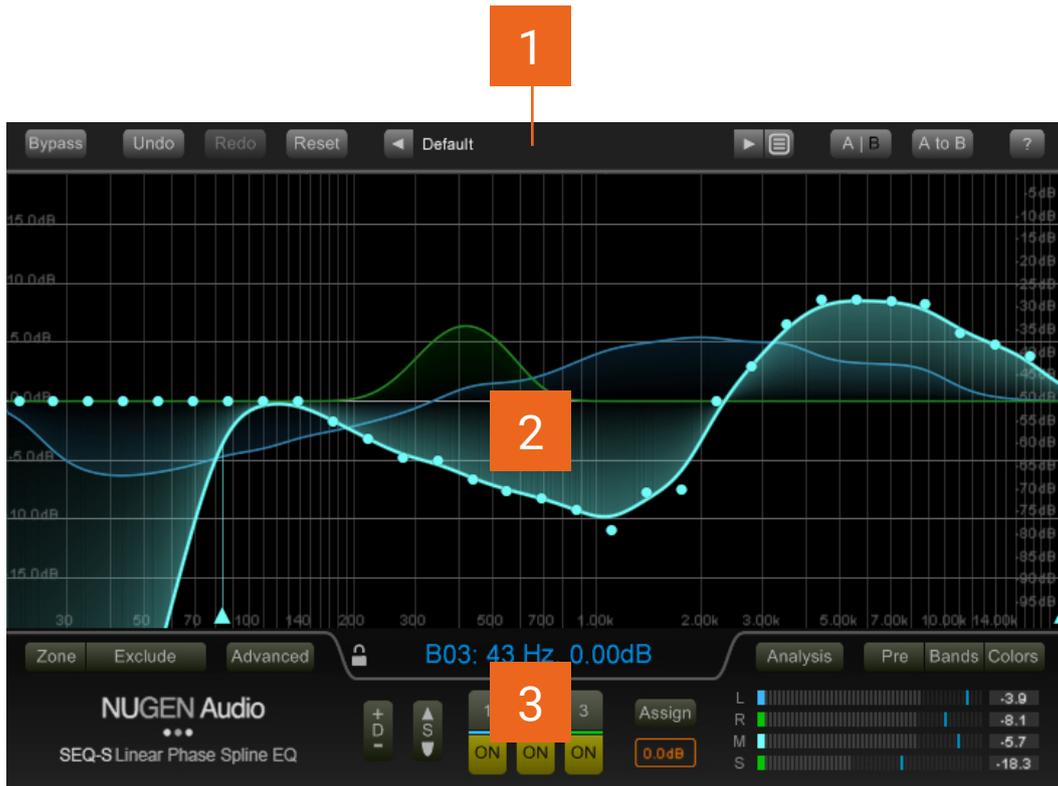
Unlike most digital EQ's, SEQ-S is linear phase. This means the the phase shift is linear across the frequency spectrum, resulting in a natural sounding EQ change, and producing minimal phase artefacts.

Traditional EQ algorithms employ a mathematical technique known as IIR (Infinite Impulse Response). Whilst this provides low CPU usage and is relatively simple from a mathematical point of view, there is an important side effect known as Phase Warping. Digital EQ utilising the classic IIR approach distorts the relationship between frequency and phase.

The computational algorithm employed in SEQ-S is based upon the FFT (Fast Fourier Transform). This is a much more involved process, transforming the audio data into the frequency domain, before applying frequency related computations and then transforming back into the temporal domain. The advantage of this process is that the frequency and temporal relationship remains intact – linear phase transformation. The benefit of this method is that the linear phase adjustments sound clearer, it is possible to create a much more transparent EQ using this technology. Phase Warping also affects the clarity of transients, as it causes Phase Smearing. Linear Phase calculations avoid this limitation, producing a sharper audio image.

Interface - General Layout

The SEQ-S interface is designed to facilitate intuitive operation by allowing many parameters to be accessed directly from the main 'direct-draw' window, with ancillary controls of related functionality grouped together to aid selection.



- 1 Utility controls
- 2 Graphical readout and direct-draw zone
- 3 Processing and control options

Utility Controls



- 1 **Bypass.** This button bypasses the effect 'in-place'. This allows for direct A | B comparisons to be made with and without the effect, without altering any other processing in the chain.
- 2 **Undo | Redo.** Unlimited session undo and redo commands allowing the user to step back and forward through processing modifications.
- 3 **Reset.** Global plug-in reset button, instantly resetting the EQ to initial 'blank' settings.
- 4 **Preset browser.** Use the arrow buttons to step sequentially through the presets or click the end control to open the preset menu to select from a list. Double click the name to re-name session presets.
- 5 **A | B and A to B (B to A).** These controls switch data between the 'A' and 'B' memories for direct comparisons between two different sets of EQ envelopes. The A|B control toggles between the A and B memories (current active memory highlighted). The A to B (B to A) button transfers current settings to the memory indicated, ie. From A to B or vice versa.
- 6 **?** Opens the 'About' page, with access to credits, de-authorisation options and the product manual (if installed).

Main Display and Direct-draw Zone

This section shows the EQ envelopes and spectrum analysis of the input and output signals. The graph shows frequency (horizontally) against dB (vertically). It is possible to draw the eq curve required directly from this window, and adjust a number of additional controls. The view can be zoomed by drag-clicking the vertical and horizontal scales to examine an area of interest in greater detail.



- 1 **Control point.** SEQ-S utilises a spline curve to determine the overall EQ to be applied to the audio. This is a 'line of best fit' between a number of consecutive control points. The desired EQ shape is simply 'drawn' in using click-drag. The control points will jump into place and the spline forms to join them in a smooth EQ transition.
- 2 **EQ envelope.** The outlined shaded zone represents the EQ envelopes being applied to the audio, showing boost (above the 0dB axis) and cut (below the 0dB axis). This, rather than the position of the individual control points [1], best shows the effect of the EQ. EQ envelopes can be applied to individual channels or to groups of channels allowing rapid overall EQ adjustment and specific detailed correction as required. It is possible to utilise up to three EQ curves simultaneously.

- 3 **Zone controls.** The zone controls are activated using the Zone button (see below). When active they can be used to 'lock' the control points outside (or within the upper and lower controls. This is useful for adjusting the EQ in a tight frequency range without accidentally affecting control points outside. The zone can also be used to apply match EQ, curve reset and invert functions to a specific range of control points.
- 4 **Spectrum Analysis.** Spectrum analysis can be activated using the Analysis button (see below). When active, a spectrum analyser will show the input/output signal, colour coded for each active band. Note, the left-hand frequency scale matches the scale for the EQ envelope. The dB scale for the analyser is shown on the right hand side when the analyser is active.
- 5 **Low Pass Filter.** The triangle represents the cut-off point of the LPF. The cutoff point can be dragged left/right. If the filter is dragged all the way to the right hand side it will be de-activated.
- 6 **High Pass Filter.** The triangle represents the cut-off point of the HPF. The cutoff point can be dragged left/right. If the filter is dragged all the way to the left hand side it will be de-activated.
- 7* **dB scale zoom and scroll zone.** Click and drag in this area to zoom in/out and scroll the frequency scale of the display. Can be reset to defaults using control/command click.
- 8* **Frequency zoom zone.** Click and drag in this area to zoom in/out and scroll the dB scale of the display. Can be reset to defaults using control/command click.

*The scroll/zoom setting can be locked to avoid accidental changes, or to make accessing control points close to the zone boundaries easier by clicking the padlock icon in the parameter readout area (see below).

Processing and Control Options

This section contains additional controls for accessing, assigning and modifying the EQ envelopes. The controls in this section are also used to determine the information shown in the main display zone.



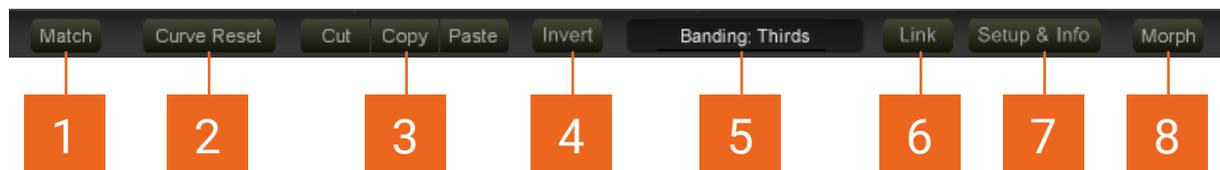
- 1 Parameter Readout.** This area displays the value of parameters as they are adjusted, allowing specific values to be dialled in if required and confirming the settings of any controls modified.
- 2 EQ envelope selectors.** SEQ-S has three EQ envelopes available. Each envelope may be assigned to a single, or combination of input channels. To modify an envelope, select the number of the envelope you wish to modify in the main display by clicking the corresponding number (1, 2 or 3). Each envelope can be toggled On/Off by using the 'On' button below
- 3 Envelope assign.** This button is used to bring up the envelope assign window. This window shows the available input channels and shows which channel is assigned to which envelope. The options available will depend upon the type of track the plug-in is operating upon (mono, stereo, 5.1 etc.)

1	L	R	M	S
2	L	R	M	S
3	L	R	M	S

In this example, envelope 1 has been assigned to the Left input channel, envelope 2 to the Right and envelope 3 is unassigned.

- 4 **Envelope smoothing.** The envelope smoothing control determines the 'sharpness' of the spline curve envelope. Higher values give a smoother curve, lower values make the curve more angular. This function affects all envelopes.
- 5 **Depth.** Controls the overall EQ envelope depth. This function is applied only to the active envelopes and can be re-applied if required.
- 6 **Zone.** The Zone button activates the zone controls (see above). When active they can be used to 'lock' the control points outside (or within if the 'exclude option is active) the upper and lower controls. This is useful for adjusting the EQ in a tight frequency range without accidentally affecting control points outside. The zone can also be used to apply match EQ, curve reset, cut/copy/paste and invert functions to a specific range of control points.
- 7 **Analysis.** Activates the spectrum analysis view (see above).
- 8 **Pre.** Toggles spectrum analysis pre/post processing.
Bands. Toggles between raw data and banded spectrum analysis. When banding is selected, the analysis will reflect the control point position banding as selected in the advanced options (see below).
Colours. The colours option opens the colour selection window. It is possible to choose the colours of the EQ Curves, level meter and level meter peaks.
- 9 **Level meters.** The level meters show the audio output levels, with peak hold and margin levels. If a peak clip is detected the margin background will turn red. Click to reset. The meter layout will reflect the channels available to the plug-in, depending upon the type of track it is operating upon (stereo, 5.1 etc.)
- 10 **Output Trim.** Applies a dB offset to the output for gain optimisation purposes. Click drag up and down to increase/decrease the value, or double click to enter a number directly.
- 11 **Advanced.** This button shows/hides the advanced controls [12], giving access to the match EQ section and additional specialised controls.
- 12 **Advanced controls tool bar** (see below).

Advanced Controls (Including Match EQ and EQ Morph)



- 1 **Match.** Initiates the match EQ (see section 6 below). Clicking the Match control starts the process by, opening a new set of options.
- 2 **Curve reset.** Clicking this control will reset all the control points on the currently selected EQ curve envelope. The curve reset can be used in conjunction with the zone control to reset a specific section of the curve.
- 3 **Cut | Copy | Paste.** These utility controls can be used to cut, copy and paste the current control point positions to and from the clipboard. When used in conjunction with the zone control (see above) these controls can be used on a specific section of the EQ curve envelope. Switching between the active curve envelope allows the transfer of node information from one EQ curve envelope to another.
- 4 **Invert.** Inverts the active EQ curve envelope (can be used in conjunction with the zone control).
- 5 **Banding.** The banding option is used to determine the frequency position of the control points in the EQ curve envelope. Click in this area to choose from a drop down menu.

Thirds Splits the frequency range into equal 1/3 octave bands.

Sixths Splits the frequency range into equal 1/6 octave bands.

Chromatic Sets the nodes at chromatic intervals.

Bark Arranges the bands according to the Bark scale. This is a psycho-acoustically derived scale that splits the frequency range into bands according to how well the ear can differentiate the frequencies i.e. The bands narrow where the ear is more sensitive and broaden where distinction is harder to define.

Mel As with the Bark scale above, with with a slightly different curve.

Bark Thirds As the bark Scale, but with twice the number of curves.

- 6 Link.** This option links the 'Quality Setting' of multiple instances of SEQ-S together. See 'Setup and process info' below.
- 7 Setup & info.** This button opens up the Set-up and processing information window.

Resolution. The resolution setting is used to set SEQ-S to the most suitable for the application at hand. This setting can be unique to this instance, or linked to the other instances of SEQ-S, to allow global switching of the resolution across all other linked instances by changing the setting on only one (see Link above).

The Resolution setting governs overall CPU and latency trade-offs and has several possible states as shown in the table below.

Resolution	FFT Size*	Suggested Application
Minimum	512	Mixing
Low 1/2	1024/2048	Mixing
General	4096	Mixing/Mixdown
High	8192	Mixdown/Mastering
Maximum	16384	Mastering

*When M/S processing is active alongside L/R processing, the FFT size is shared between two FFT algorithms.

Changing FFT sample size affects the resolution of the EQ. The larger the sample block, the better the resolution of the algorithm. This is particularly important for low frequencies, as generally speaking, the FFT analysis gives greater resolution, the higher the frequency. This does not change what the EQ 'does' or how it sounds exactly, but allows for sharper changes in the EQ curve envelope. If you need high resolution, particularly in the low frequencies, you should employ a higher FFT size. NB. You should also switch the nodes available to 'chromatic' banding if you are using High or maximum settings to gain maximum benefit from the increased resolution.

Dither. The SEQ-S internal calculations are performed with 64-bit floating point accuracy. Depending upon your DAW, it is highly likely that the output from SEQ-S will be truncated to a lower bit-depth. There are several options for how this should be handled, either with or without dither. Note: This is not the same as using a 64-bit or 32-bit DAW/version of the plug-in.

Invert gain cap. This is a safety setting which prevents the EQ 'Invert' button from introducing extremely high gain settings.

- 6 Morph.** Engages the morph EQ function. This function switched SEQ-S into 'morph mode' allowing two EQ states to be morphed from one to the other.

Match EQ

Match EQ is used to 'match' the EQ spectrum of a source section of audio with a target piece. In the match process, SEQ-S uses frequency templates. A frequency template is formed by analysing a section of audio over time. An 'average' of the frequencies present in the audio is then built up, which can be thought of as a frequency 'fingerprint' for this section of audio.

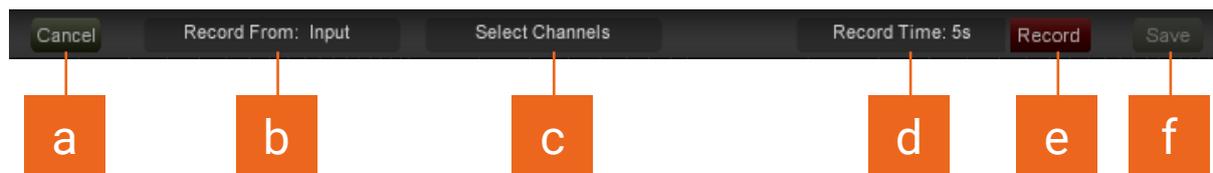
Match EQ can be used in several different situations, and can be highly effective if suitable source material is chosen. With individual instruments, the 'vintage' or 'feel' of one take can be applied to another. Different takes from individual sessions can be matched, even if the recording set-up differs from the original. These techniques can also be applied to dialog recordings and audio restoration. It is even possible to apply match EQ to entire tracks, harmonising differing program content using the depth control to govern the 'strength' of the effect or applying the feel of one track to another.

In order to successfully generate a match EQ curve, SEQ-S uses two templates. A source template to 'match from', generated from the audio you wish to transfer the sonic properties from, and a template of the audio to be modified to 'apply to'. SEQ-S then uses these two templates to produce a match EQ envelope which can be applied to your audio to 'match' it with the original source.

Clicking the Match control in the advanced options controls bar (see section 5 above) starts the process for choosing these two templates, opening a new set of options.



- 1 Cancel.** Cancels the match operation and returns to the advanced controls interface.
- 2 Match From.** Choose the source template to match from. This is the template from the audio you wish to 'transfer', 'clone' or 'copy' from. You can either;
 - **Current Source snapshot.** If you have a current template already in the SEQ-S temporary memory, choose this to recall.
 - **Record a new snapshot.** As an alternative to using a preset template, you can also record your own template. To do this you will need a copy of the audio you wish to 'sample' in the same sequence as the plug-in. Once the option to record a new template is selected, you a set of controls will be available.



- a** **Cancel.** Cancels the template recording and returns to the main Match EQ interface above.
 - b** **Record From.** This chooses the input source for the recording. Choose from 'self', which is the audio currently routed through the plug-in, from one of the NUGEN Audio Send plug-ins if available, which can be used as a side chain to route audio from another source into SEQ-S. For information on how to use the NUGEN Audio Send plug-in, see separate instruction manual.
 - c** **Select Channels.** By default, this will be set to Avg: LR. Clicking this option opens a window which will allow a selection of input channels to be chosen. The plug-in can then be set to use the Maximum, Minimum or Average value between the selected channels for the template data.
 - d** **Record Time.** This value determines how long SEQ-S will listen to the input to perform the template recording. Click-drag up/down to change the value, double click to type in a value directly
 - e** **Record.** Click to begin recording from the chosen input. To stop recording before the record time has elapsed, click Stop. Once finished, the recorded template will be shown in the main display.
 - f** **Save.** Saves the current data-set and returns to the main Match EQ interface.
- 3** **Apply to.** Choose the template for the audio you wish to match to. This is usually a template taken from the audio currently routed through SEQ-S ie. A template of the audio you wish to match to a previous recording.
- Record a new template.** Choose this option if you wish to conform your track to a template of another piece of audio. The process for recording the template for the audio you wish to match to the original source template is exactly as described above.
- Use empty snapshot.** This is a special case use. It is possible to use match EQ to create very specific space in a complex mix where traditional EQ would be just too cumbersome.

If for example, you would like to create space for an acoustic guitar within a heavy keyboard part, but wish to keep as much of the original keyboard sound intact as possible, record the spectrum of the guitar at the Match from template, and select 'Use empty snapshot' as the Apply To template. When the match curve is produced, it is automatically inverted to turn the resulting curve 'upside down'. You can now use the depth control to adjust the strength of the curve until the guitar sits neatly into the delicate space made using the match EQ. With care this technique can be used to create very complex and transparent 'notches' that could not be achieved with traditional EQ techniques.

- 4 Match.** Choose which curve the match will be sent to and click Match. This will perform the match calculation, close the match interface and load the Match EQ curve envelope to the selected target (1, 2 or 3). **Note this will overwrite any EQ present on this EQ envelope.**

Tip: To achieve the most tonal detail possible within the match process, it is advisable to first roughly match the loudness of the source and target audio to avoid losing resolution by generating large dB offsets.

Note: The match process is designed to preserve the maximum tonal detail possible at the expense of a possible level change. If an undesirable level change is generated, this can be compensated for within the SEQ-S by adjusting the Output Trim control (see 'Processing and Control Options' above)

EQ Morphing

The EQ Morphing functionality of SEQ-S is designed to allow a smooth transition over time between two EQ filter states. This feature can be used to produce creative filter sweeps, sophisticated tremolo & auto-pan effects, for audio transitions matching scene changes or for adding a temporal dimension to the match EQ process when moving from one environment to another.

The morph function uses the two EQ memories 'A' and 'B' as the basis for operation, enabling a transition between these two states over time.

Clicking the Morph control in the advanced options controls bar (see section 5 above) opens a new set of options for controlling the morphing behaviour between the two EQ memories A and B.



1 Timebase. Two time bases are available.

Seconds allows entry of the overall transition time to be entered as a specific value. This is useful for syncing transitions to picture and other content not directly related to a musical score.

The **BPM** setting will automatically detect the BPM setting of the DAW/NLE project session as a basis for calculating transition time. An additional scaling factor can then be applied to further subdivide or multiply the transition time as a proportion of a tempo-locked bar.

2 Transition type.

Single will perform a 'one shot' morph from one state to another.

Return performs a morph from the current state and back again.

Loop morphs between A and B and back, continuously.

3 Play. Starts a morph. If the time base is set to seconds, this will engage immediately. If BPM is selected, the morph process will begin at the start of the next relevant tempo block.

4 A | B and Progress bar. The A and B buttons are used to determine which set of EQ envelopes is currently being edited. Click the appropriate button to edit the desired envelope set. The progress bar shows the progress of the morph between A and B states. This is also reflected dynamically in the main graphical display.

5 Pass filters. There are several possible modes for pass filters.

Off. Turns off the pass filters when morph mode is engaged.

Static. This mode performs a 'cross-fade' between different pass filter positions. This mode generates a relatively subtle shift, from one state to the other and is useful for opening up or closing in the overall sound without obviously drawing attention to the process used.

Dynamic. The dynamic mode morphs the cut-off frequency of the pass filter between two different positions and can be used to create more dramatic filtersweep effects.

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.

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 rightclicking "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

- 1.0 Initial release
- 1.1 Changes to empty snapshot match EQ implemented.
Scroll/zoom lock option added.
EQ dB range extended to +/- 60dB, dB safety cap introduced.
- 1.2 New filter-morph mode added.
Preset handling system updated.
- 1.3 Added resizable interface.

