

X-EQ™

User Guide

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1. Introduction

Thank you for purchasing the X-EQ plug-in for the SSL Duende platform. X-EQ is a versatile and comprehensive mastering grade parametric EQ plug-in built from the ground up for Duende. It has an unprecedented clarity, smoothness, and excellent high-frequency response.

The use of innovative coefficient generation and innovative processing design provides superior performance that surpasses analogue EQ in both artistic freedom and sound quality. This plug-in may well provide all the different EQ options you will ever need.

A total of 10 EQ bands are provided, split into dedicated HP and LP filters, LF and HF shelves and 6 bell bands. A Parallel EQ mode is also provided which recreates the characteristic sound of an old parallel passive PEQ circuit built with inductors and capacitors.

In addition to this, different filter types are provided independently for each of the 10 bands. The HP and LP filters have 5 different topologies available, the 6 bell bands each offer 9 different characteristic shapes and the LF and HF shelving filters offer variable Q. Together these cover the vast majority of EQ styles currently popular amongst professional users, including some legacy styles which are renowned for their artistic capability and some unique designs only possible in the digital domain.

Liberated from any analogue style control legacy, the X-EQ graphical user interface will especially appeal to people who like to see what they are hearing. The fully interactive EQ display shows the exact filter shapes and resulting curves of the different EQ bands, and a real-time spectrum analyser allows you to see the effect of your EQ settings on the overall frequency spectrum of the sound source. Extensive control options include dragable EQ nodes, traditional mouse parameter control and exact numerical entry.

The plug-in is available in both mono and stereo instances in VST, AU and RTAS formats making it compatible with virtually all audio software currently available on both PC and Mac.

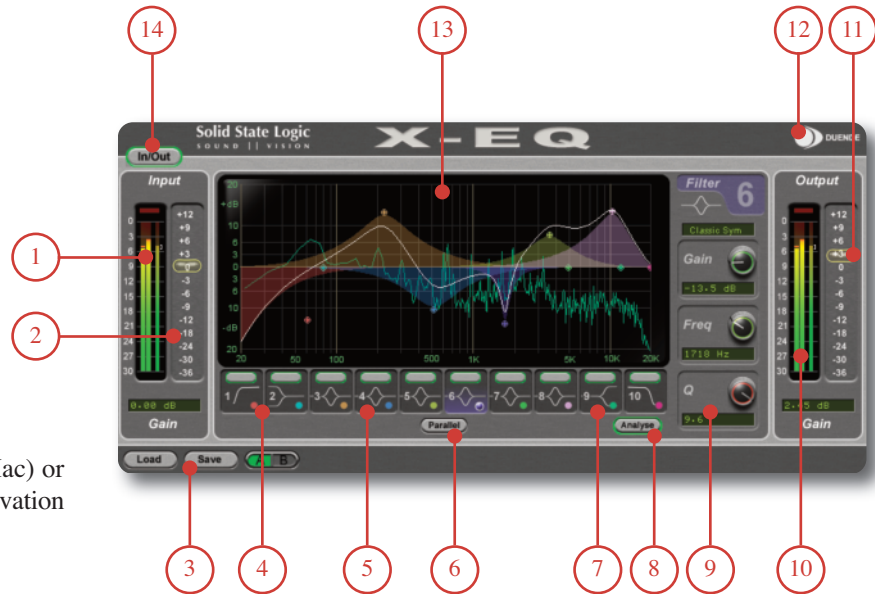
As with other Duende plug-ins, X-EQ is capable of operating at 44.1, 48, 88.2 and 96kHz sampling rates, where a mono instance at 44.1/48kHz occupies 1 Duende processing slot. This figure is doubled for stereo use and doubled again for 88.2/96kHz operation.

Key Features

- 10 band fully parametric high quality digital EQ
- A total of 16 different filter types: 5 different cut filters, 9 bell shapes, shelving filters and a parallel mode
- Extensive control options including dragable EQ graph nodes, mouse wheel adjustment and numerical data entry
- Extremely low noise and low non-linear distortion filter algorithms resulting in the residual THD+N significantly lower than 24-bit quantisation noise
- Comprehensive stereo/mono peak (*with clip-hold*), RMS and dynamic history metering at input and output
- Different bell filter types are all normalised to look identical at +6dB boost allowing for quick comparison between filter types
- Proprietary preset management functions providing compatibility between all major DAW platforms
- A/B functionality for easy comparison of any two settings
- Individual band bypass
- Global soft latency free bypass
- Real-time FFT Analyser showing the result of the EQ processing on the audio spectrum
- Superb mastering grade audio quality delivered by Duende's 40-bit floating point engine
- Preset library based on settings used by some of the worlds top mixing engineers

X-EQ Graphical User Interface

- 1 Stereo/mono input meter
- 2 Input gain control
- 3 Preset Management buttons
- 4 HP filter and LF shelf bands
- 5 6 independent bell shape bands
- 6 Parallel mode button
- 7 LP filter and HF shelf bands
- 8 FFT analyser on/off
- 9 Band control section
- 10 Stereo/mono output meter
- 11 Output level control
- 12 Duende logo – Command + click (Mac) or Ctrl + click (PC) here for Product Activation
- 13 Graphical EQ display with analyser
- 14 Latency free plug-in bypass



2. System Requirements

Apple Macintosh

- SSL Duende running V2.2 software and firmware
- PowerPC G4/G5 or Intel 1.0GHz or higher
- 512Mb RAM (*1Gb recommended*)
- Mac OS X (*Version 10.4.10 or higher*)
- 60Mb of free hard disk space
- Audio Units, VST or RTAS* compatible host application
- 17" or larger colour monitor with screen resolution of 1024 x 768 or higher recommended
- Internet Connection
(*for product registration and software updates*)

Windows/PC

- SSL Duende running V2.2 software and firmware
- Minimum of Intel Pentium IV 1.0GHz or equivalent
- 512Mb RAM (*1Gb recommended*)
- Windows XP
- 80Mb of free hard disk space
- Approved VST or RTAS* compatible host application
- 17" or larger colour monitor with screen resolution of 1024 x 768 or higher recommended
- Internet Connection
(*for product registration and software updates*)

Plug-in formats

VST and RTAS* versions are provided for use under Windows XP on the PC platform

VST, AU and RTAS* formats are provided in a universal binary format for Intel based and PowerPC Macs.

As with other Duende plug-ins, X-EQ will take one 'slot' at 44.1/48kHz in mono. Please see the Duende manual for more information on DSP resource management.

* RTAS support is provided by the included FXpansion VST-RTAS wrapper: www.fxansion.com

3. Installation & Authorisation

A time limited trial version of X-EQ will be installed during the Duende V2.2 software update. This allows X-EQ to be run in evaluation mode, which means the plug-in can be used with full functionality until a certain number of samples of audio have been processed. At 48kHz this gives approximately 10 hours of continuous use for either stereo or mono plug-ins. At the point where 10 minutes of the evaluation period remains, the countdown timer will turn red. Once the timer reaches '0h 0m 0s' the sample count has been reached and the plug-in will cease to process audio.

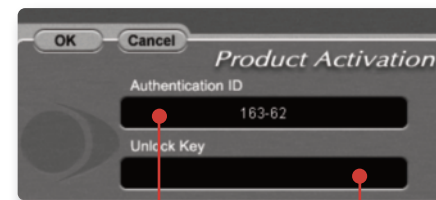
If you wish to continue using X-EQ after this period, you can purchase the full version from <http://solid-state-logic.locotalk.com>. Once the authorisation procedure has been completed, you will have an unrestricted version of X-EQ.

To obtain an authorised version of X-EQ please do the following:

1. Navigate to <http://solid-state-logic.locotalk.com> and log in to your SSL account. If you do not already have an account, please create one.
2. Under the '**SSL Products and Admin**' section, proceed to the Online Shop.
3. Add X-EQ to your cart and confirm your identity in the next step.

4. In step 3 you will be asked to enter your Authentication ID. This is found in the X-EQ Production Activation box. Command + click (*Mac*) or Ctrl + click (*PC*) on the Duende logo in the X-EQ GUI to open this box.
5. If your Duende hardware is not already registered you will be asked to register it here.
6. Enter your payment details, your order will be completed and you will be provided with the Unlock Key.
7. Return to the Product Activation box and enter the Unlock Key – X-EQ is now authorised for unlimited use.

Please note that X-EQ will only run on the particular Duende hardware for which it is authorised



Authentication ID

Unlock Key

4. Some History

4.1 An Audio Engineer's Best Friend

The equaliser is the oldest and the most popular sound processing tool. From the earliest days, its main function has been to correct or enhance sound by boosting or cutting certain frequency ranges. Engineers have developed countless equalisers for over 50 years and some of them became legendary and were considered bench marks. The most popular type of EQ in recording and post-production studios is the parametric equaliser or PEQ. It offers maximal flexibility due to direct access to all relevant filter parameters. Properly used the PEQ is a very powerful tool and the best friend of every sound engineer in the battle for perfect sound. If misused, it can be the greatest enemy of any recording.

4.2 The Best of the Analogue and Digital Worlds

X-EQ is a creative equalising tool combining the best of both the analogue and digital worlds. We recreated the most legendary analogue equalisers and added a few experimental characteristics only possible in the digital domain. By using proprietary filter algorithms, we have achieved a huge dynamic range as well as extremely low noise and distortion level, and thus unparalleled sound purity; impossible with any analogue circuitry.

4.3 Analogue Parametric EQ Modelling

In today's era of digital audio workstations, hundreds of software parametric equalisers are available. Many of them are intended to be "THE best sounding equaliser ever". The truth is that only few of them are recognised and adored by the experts. You may ask why one equaliser sounds great while another does not. This question is almost as old as the equaliser itself and still is not completely answered. On the one hand there are some obvious rules which must be followed when designing a good sounding PEQ, on the other hand some never really proven esoteric claims driven by marketing departments or self-nominated audio evangelists. Especially treasured analogue equalisers are considered by some people as being absolutely unique and unmatched by any 'dirty' digital equaliser. The truth is that with a properly designed, fully parametric analytic EQ every amplitude and phase characteristic of any other equaliser setup can be recreated. Of course, the contribution of distortions to the specific sound of a particular analogue equaliser caused by the respective electronics has to be considered. If the distortions are 'good', they may make certain applications sound better. Usually however, 'bad' non linear distortions and other deficiencies like limited dynamic range are surely not responsible for a 'magic' sound. Therefore our policy in digital PEQ design has always been to make the equaliser

filters as precise and clean as possible. For controlled generation of distortions we recommend using enhancers or any other specialised processors with proper built-in anti-aliasing technology.

4.4 Non- Linear Phase EQ

Phase shift in equipment is probably one of the most misunderstood topics in audio. Phase shifts often get blamed for anything that is not classed as typical distortion. The reality is that *all* analogue EQs produce a deviation from linear phase which is specifically related to the shape of the EQ curve, and it is precisely these phase changes which produce the required gain reductions. This is a very natural process which can be found in the audio characteristics of rooms, materials and elsewhere.

Though it is not possible for us to detect phase in isolation, the phase shift of an EQ can often be the cause of the ‘magical’ sound of that device once the EQ’d signal is added back into the mix. For example, the Duende channel EQ derived from the SSL analogue consoles – plenty of phase shift and plenty of magic!

In contrast, a linear-phase EQ delays all frequencies by the same amount. This can only be achieved in the digital domain by using special techniques. While this process is very

effective in certain situations (eg. ‘surgically’ removing troublesome frequencies), it should not be considered as a superior tool for the majority of EQ tasks.

Linear phase equalisers have become popular over the past few years due to the proliferation of powerful digital processors. We decided not to go down that route with X-EQ and we think you’ll agree with that decision. Maybe linear phase EQ is something we will explore in the future but... who knows? An equaliser not only changes the relative frequency balance of a signal but also its phase. If you EQ a sound until it sounds right or natural, then the chances are that you are EQing to make it sound in phase with the rest of the mix. We need say no more on this subject.

4.5 Parallel Passive EQ

Parallel EQ exhibits quite different sonic properties to the familiar serial parametric EQ. We are generally used to hearing the effect of one EQ band superimposed on another, as opposed to the band interaction inherent to a parallel EQ. Because the bands are placed in a parallel configuration, phase cancellations and re-enforcements happen which is not always obvious when first encountered.

Passive EQ is something that is found in old equaliser units and is generally known for its transparent and natural sound, but has some problems associated with it. However, in the digital domain these shortcomings do not have such an influence.

A passive EQ does not have any gain elements, but can still have controls to seemingly boost frequencies as well as cut. What actually happens is that the entire signal is cut by an amount, but the frequencies which are apparently 'boosted' are simply not cut as much. Therefore the unit must attenuate either the input, the output, or both to allow enough headroom. Unfortunately in the analogue domain, a 20dB reduction in signal level produces a 20dB increase in the noise floor. Luckily, in the digital domain with a 40-bit floating point DSP, these issues do not remain.

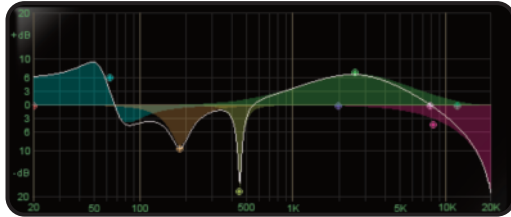
In X-EQ – when the '**parallel**' button is engaged – you are presented with a parallel passive EQ model which the original designers of these devices could only have dreamed of. The noise floor can be disregarded due to the huge resolution allowed by Duende.

You may find yourself entering this mode more and more as you become familiar with the sonic signature. Larger gain changes are possible without colouration, and boost starts to become something that is useable to a significant degree in a digital EQ!

Parallel EQ does however exhibit asymmetry in its boost and cut characteristics. But this is not such a bad thing as most engineers would agree that boost is best done with low (*wide*) Q values and cut with a higher (*narrower*) Q.

5. Operational Overview

5.1 Graphical EQ Display



When you click on any of the EQ band nodes on the display the corresponding band parameters will be shown in the Band Control section on the right. These can be adjusted with the mouse cursor, scroll wheel or numerically using the keyboard. The colour of the node corresponds to the colour on the Band Section and the Band Selector.

Mouse Operations in Graphical Display

Click and hold on any bell or shelf node to move it in two dimensions simultaneously:

- Gain Mouse drag Up/Down
- Freq Mouse drag Left/Right

When moving the LP and HP filter nodes:

- Order Mouse drag Up/Down
- Freq Mouse drag Left/Right

5.2 Control Options in Band Control and Input/Output Sections

Move the mouse cursor either up/down or in a circular movement over a knob to adjust its parameter value. The exact nature of the movement you need to make to change a knob value is dictated by your DAW.

The scroll wheel can also be set to alter parameter values here.

Press **'Shift'** whilst scrolling for increased resolution.

Command + Click (*Mac*) or Ctrl + Click (*PC*) on a knob to reset it to its default value.



Exact numerical entry is possible by double clicking on the value box.

The input and output sliders function in the same manner as knobs, allowing you to move with mouse cursor, scroll (*with shift as fine adjust*) and reset using modifier keys.

Exact numerical entry is possible for any value by double clicking on the value box.

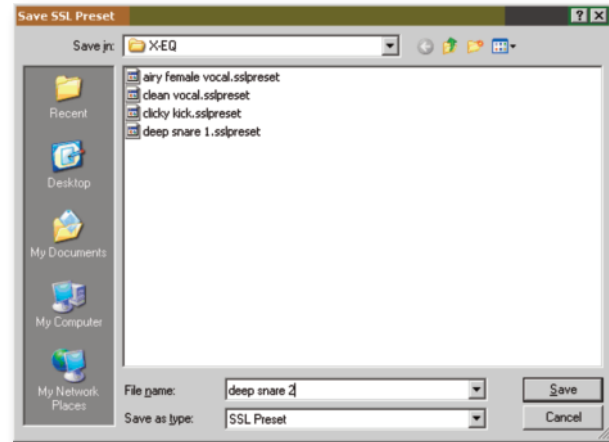
Band Gain can be entered upto a resolution of 0.1dB, and frequency, Q and input/output gain values to one decimal place.



5.3 Save, Load and A/B Functionality



Permanent preset storage and retrieval can be carried out by using the Load and Save buttons. Because the .sslpreset files used by X-EQ use a standardised file interchange format they are fully platform and software independent meaning any stored setting or collection of presets can be easily transferred between workstations. This includes Intel and PowerPC Macintoshes, Windows XP and Vista (32-bit) PCs, and any compatible audio software including Cubase, Nuendo, Logic, Pro Tools, Live! and Sonar amongst others. Stereo and mono presets are also fully compatible.



Clicking the '**Load**' button with the left mouse button will bring up a standard Mac OSX or Windows dialogue box asking you to choose a file to load

The '**Save**' button behaves in the same manner, and when clicked will ask you to choose a destination to store the file.

It is suggested that X-EQ presets are stored in the '**SSL Presets**' directory created during install in the '**Solid State Logic**' folder.

Alternatively, you may wish to store the presets in a sub-directory within your project folder.

A/B functionality, providing two different memory locations, is included for easy comparison of any two settings. When the plug-in is instantiated memory location A is selected by default, as shown left. Pressing the A/B toggle button will move to memory location B which allows you to set up a completely independent EQ curve. Pressing the A/B button again will return to A. You may wish to use this function to compare two very similar settings or to keep a 'maybe' setting in reserve if your current one does not work out.

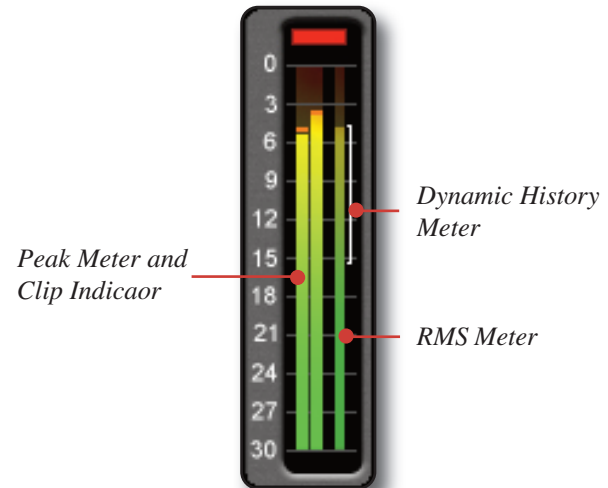
You may wish to copy one memory location to another so it becomes the starting point for a different setting you may wish to explore.

Example: To copy from location A to location B:

1. Save the preset to a temporary location on your hard disk whilst in location A
2. Toggle to location B
3. Load the stored preset

5.4 Meters

The X-EQ input and output meter displays are, in fact, three meters in one. They offer various ways to easily read the Peak and RMS levels of a signal over time, and the '*dynamic history*' meter allows you to see at a glance how the amplitude has been changing over the past second or so. A 30dB range from 0dB FS downwards gives ample information about the amplitude of the signal.



Peak Meter and Clip Indicator

The wide meter bar to the left is a responsive peak meter which allows you to observe the exact input level at any point in time. A red clip light at the top of the meters indicates that three consecutive samples are at maximum which is taken to mean that the input is higher than 0dB FS and is therefore clipping. It will stay illuminated for 1 second following clip detection, after which it will automatically clear. It can also be cleared at any point with a mouse click.

Dynamic History Meter

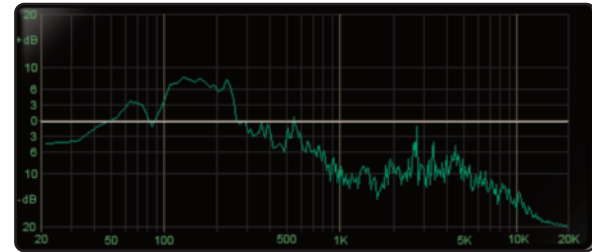
The thin white bracket on the far right of the meter gives an indication of the recent dynamic range of a signal. The top of the bracket measures the most recent peak level of the signal, where as the bottom of the line shows the smallest peak to have happened recently. If the bracket is long it indicates that the signal has a large swing in dynamic range and if it is short the range is small. If the top and bottom points of the bracket are quickly moving around, it can be assumed that the dynamic range is quickly changing, which could be interpreted as an ‘energetic’ signal.

RMS Meter

The thinner bar to the right of this shows the RMS (*average*) level. This is useful in graphically judging the ‘loudness’ of the signal and when used in conjunction with the peak meter can give a good idea of the peak to RMS ratio (*crest factor*) of the signal.

5.5 FFT Spectrum Analyser

A real-time FFT analyser engine reports the amplitude of all frequencies at any moment in time. As the analyser is placed post-EQ, you can see what effect the processing has on the frequency spectrum. The Spectrum Analyser makes it easy to spot an offending frequency that needs attenuating, or a range of frequencies that require boost.



The analyser graphic can be turned off and on with the ‘Analyse’ button.

5.6 Automation

Every X-EQ plug-in parameter can be automated as long as parameter automation is supported by the host application. The method for recording and editing automation varies from host to host. For specific instructions on using automation with your host, consult the host application’s documentation.

5.7 Global Bypass

Because Duende plug-ins cause a noticeable latency at higher host buffer settings, the bypass button provided by the DAW can cause an undesirable shift in time. For this reason a latency-free global bypass (*In/Out*) button is included. When this is engaged the audio is still passed to and from Duende, but is unchanged as all X-EQ processing (*including input and output gains*) are bypassed. This gives a smooth, glitch free bypass function and we recommend that you use this method every time.

5.8 X-EQ Band Parameters and Control Range

| Band | Gain | Frequency | Q |
|------------|-------|---------------|---------------------------|
| HP Filter | n/a | 20Hz – 1020Hz | 0 – 48dB/oct in 6dB steps |
| Low Shelf | ±20dB | 20Hz – 1020Hz | 0.3 – 10.3 |
| Midband 1 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| Midband 2 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| Midband 3 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| Midband 4 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| Midband 5 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| Midband 6 | ±20dB | 20Hz – 20kHz | 0.3 – 10.3 |
| High Shelf | ±20dB | 500Hz – 20kHz | 0.3 – 10.3 |
| LP Filter | n/a | 500Hz – 20kHz | 0 – 48dB/oct in 6dB steps |

6. X-EQ Filter Types

6.1 Bell Filters

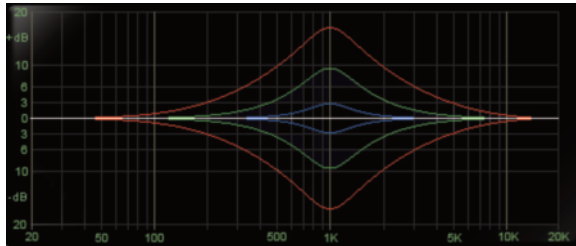
Q Definitions

P – 3dB – Classical definition that means Q is measured 3dB below peak for boost or 3dB above peak for cut.

0 – 3dB – Definition used for bells in some US products, the bandwidth for Q calculation is measured 3dB below 0dB line for cut or 3dB above for boost. Q in both definitions correct only for +6dB boost/cut.

P/2 – New “musical” definition based on the bandwidth measurement in the middle of a bell filter, between peak and 0dB line.

Normalisation – All 12 equalisers are normalised to have exactly the same bell shape for +6dB boost.



Asymmetrical

Often features in older equalisers. Boost as above but much narrower cut characteristic.

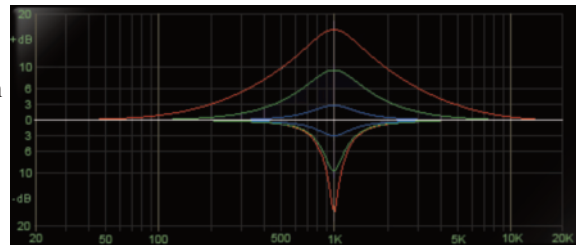
P – 3dB boost

0 – 3dB (x2) cut

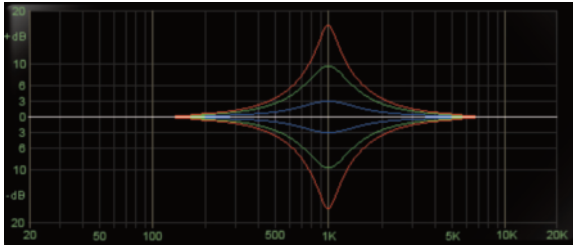
Classic Symmetrical

The most popular parametric EQ shape used in various mixing consoles and outboard gear. Almost constant Q characteristic.

P – 3dB



Classic



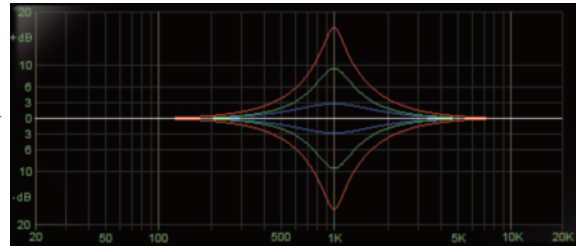
Proportional 1

Proportional equalisers are recognised as being more ‘musical’ than Constant Q. The bells are wider below +6dB and narrower above +6dB (or -6dB for cut).

Proportional 2

Like Proportional 1 but with larger changes below and above +6dB peak (or -6dB for cut).

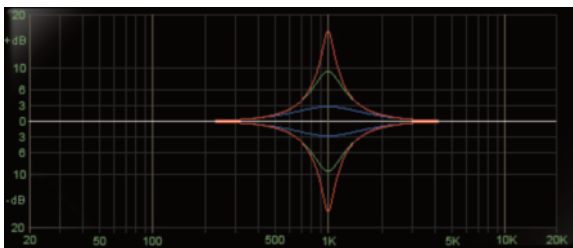
P -3dB

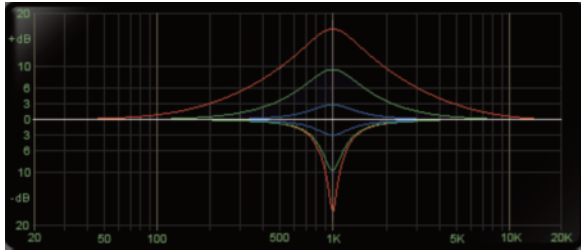


Proportional 3

Like Proportional 1 but with extra widened bells between 0 and +3dB (or -3dB for cut).

P - 3dB

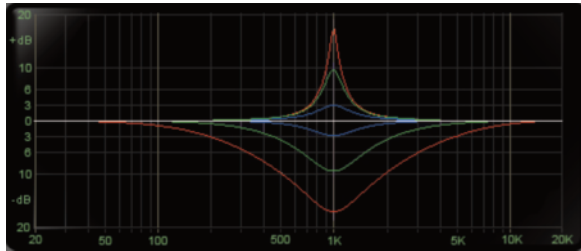




Constant Q Asymmetrical

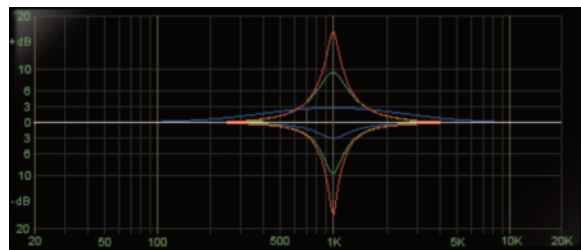
Used in some US products and mixers. The boost characteristics are defined according to 0 – 3dB formula. Extra widened between –3dB and 0dB.

P – 3dB boost, 0 – 3dB cut



Constant Q Asymmetrical Reverse

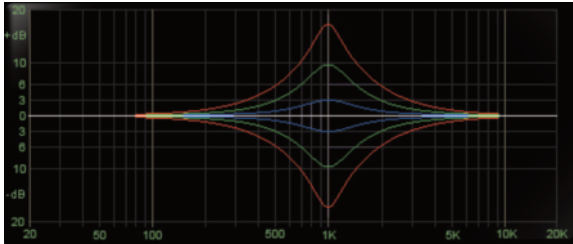
Exactly like above but with mirrored boost and cut characteristics.



Constant Q Invert

Both boost and cut characteristics are both defined according to 0 – 3dB formula.

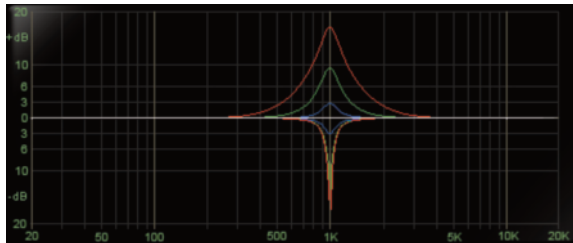
0 – 3dB



Constant Q New

Defined Q is always perfectly maintained independent of bell gain (also below 6dB). In terms of P – 3dB definition of this equaliser can be classified as proportional.

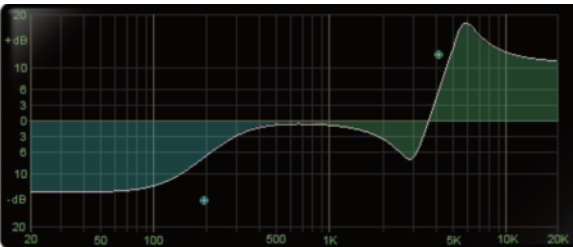
$P/2$



Parallel

Recreates the passive LC parallel equaliser with all its advantages (sound) and disadvantages (band interaction, asymmetry). As found in graphic equalisers.

3dB boost, 0 – 3dB (x2) cut

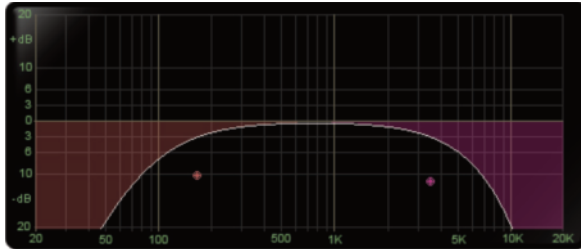


6.2 Shelving Filters

Low and High shelves

Q value is used to control overshoot characteristic. On the left is the Low shelf filter with a low Q value, on the right the High shelf filter exhibits overshoot with a large Q value.

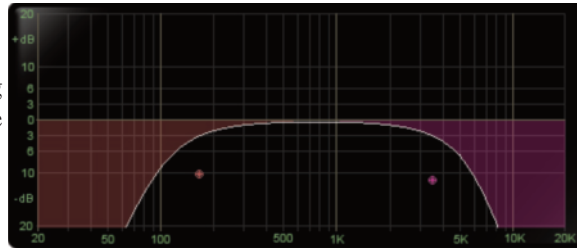
6.3 Cut Filters



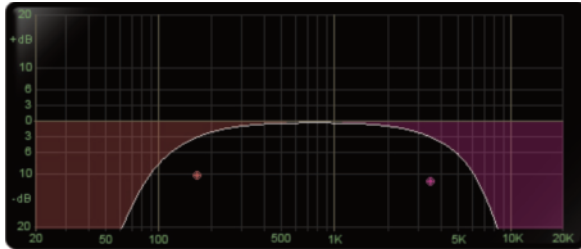
Phase behaviour leads to no overshoot or ringing resulting from a sudden transition between signal levels. The drawback is a sluggish roll-off rate.

Critical

“Critical Damped” filters simulate a chain of passive analogue RC (for high-cut) and CR (for low-cut) stages fixing a behaviour similar to a series of RC elements in vintage analogue equipment.

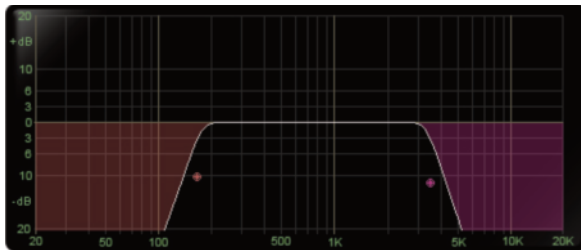


Bessel
Linear



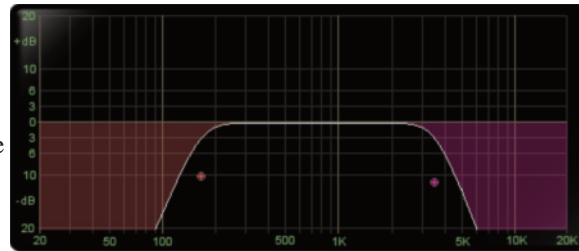
Butterworth

Characterised by having a maximally flat magnitude response, i.e, no amplitude ripple in the passband.



Gaussian

No ringing or overshoot in the time domain, but slow roll-off in the frequency domain.

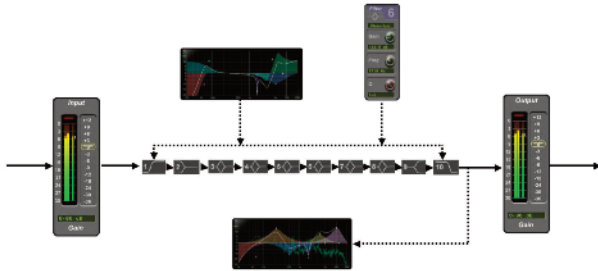


Chebyshev

Characterised by having an equiripple magnitude response, meaning the magnitude increases and decreases regularly from DC to the cutoff frequency.

7. X-EQ Signal Flow

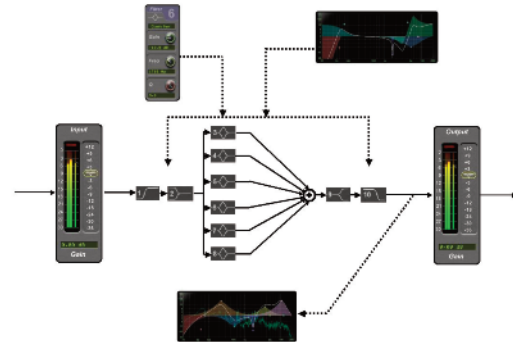
7.1 Serial Mode



In serial (default) filter mode, the input signal is initially amplified or attenuated using the input gain slider and then passed to the input meter. It then enters the serial filter chain, has processing applied, and is then passed to the output stage, again with level control and metering.

The Band Control section and Interactive EQ graph are both used to control the band parameters. As the signal leaves the filter chain, it is also fed to the analyser which derives a graphical display.

7.2 Parallel Mode



When the Parallel button is engaged, the six bell bands are arranged in an alternative manner. As in serial mode, the signal is fed to the input stage, into the high pass filter and then onto the low shelf filter. The signal is then fed to all six bands simultaneously, processed and then summed back together. Finally, again as in the serial mode, the signal is passed to the high shelf filter, high pass filter and into the output stage.

8. Application Tips

As said earlier, the equaliser is probably the oldest and the most popular sound processing tool. Parametric EQ (PEQ) in particular offers maximal flexibility due to direct access to all relevant filter parameters. Properly used, the PEQ is a very powerful tool and the best friend of every sound engineer in the battle for perfect sound but if misused, it can be the greatest enemy of any recording! There is no universal formula stating how to properly use the PEQ as every new recording or mixing session is unique. Here we present only a few universal guidelines which are valid for the majority of situations. For further directions see the respective literature, ask experienced colleagues and be creative. You may also wish to look at the Duende tutorials, available for download from our website here:

<http://www.solid-state-logic.com/resources/tutorials/duende>

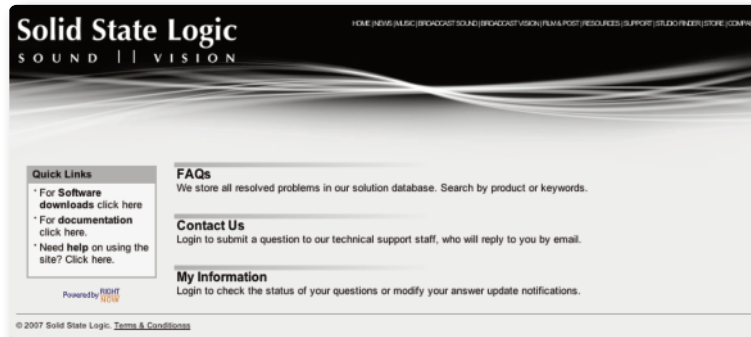
- Do not exaggerate with boosting. It is much better to concentrate on a proper recording setup than to rely on extreme EQ corrections. Use good mics, placed in just the right spot. Equalisers are a lot more effective taking away things in the signal than replacing what was never there. If the sound is not good without EQ, then you will never end up with a perfect sound using it.
- For sound enhancement use moderate Q values. High Q is always associated with a strong phase shift that can negatively influence the sound, especially if more instruments are recorded on the same track. Remember that when you use an equaliser to boost or cut a certain part of sound at the adjusted centre frequency, you are also boosting or cutting frequencies nearby.
- Your tracks may sound great when soloed but that doesn't mean that they will still be great in the context of your mix. Mixing a multitrack recording is like solving a complicated puzzle or creating a great painting. Every part (*instrument or voice*) has to have its proper place in the overall sound image. Change the settings in small increments. Use the In/Out bypass button regularly to flip back and forth between the equalised and unprocessed sound. Always equalise tracks in the context of the rest of the mix to avoid sonic conflicts.
- Be aware that boosting the gain of a frequency region can cause signal clipping at the output of the sound card. Therefore, use the X-EQ output slider to compensate for this before the signal enters the DAW channel.

9. X-EQ Support

9.1 Support FAQs

To access the latest support information on Duende, please visit our online support site. The information there is kept up to date by our support staff to make sure all information is accurate. All information is available to you 24/7.

URL: <http://solid-state-logic-en.custhelp.com>



If you can't find your answer or a solution to your issue, you can submit a question on the site to our support staff for resolution.

X-EQ was developed by Solid State Logic in collaboration with DSP software house Algorithmix.





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