

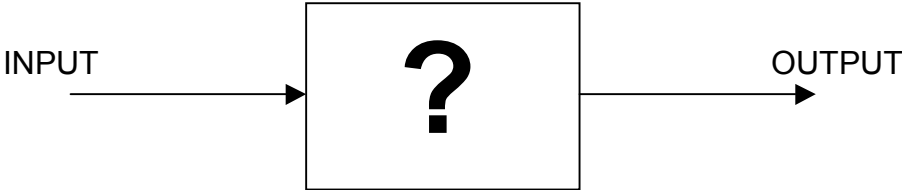
EQUALISATION

An equaliser (or EQ) is a device that allows us to alter the tonal balance of relative frequency ranges in a signal. These were originally invented to compensate for the loss of low and high frequencies when a sound was sent down a telephone line, hence the name.

Studio equalisers perform the same function as the 'bass and treble' or 'graphic equalisers' found on domestic 'hi-fi' sound systems but are higher quality and/or more precise. Also in the studio world we can apply EQ to individual sounds as well as, if desired, the overall mix.

Many circuit designs and permutations have been tried over the years, most studio units today fall into the categories discussed here.

Let us initially consider these 'processors' as unknowns and examine their 'gain' characteristic (i.e. how the output alters relative to the input) as the frequency varies.



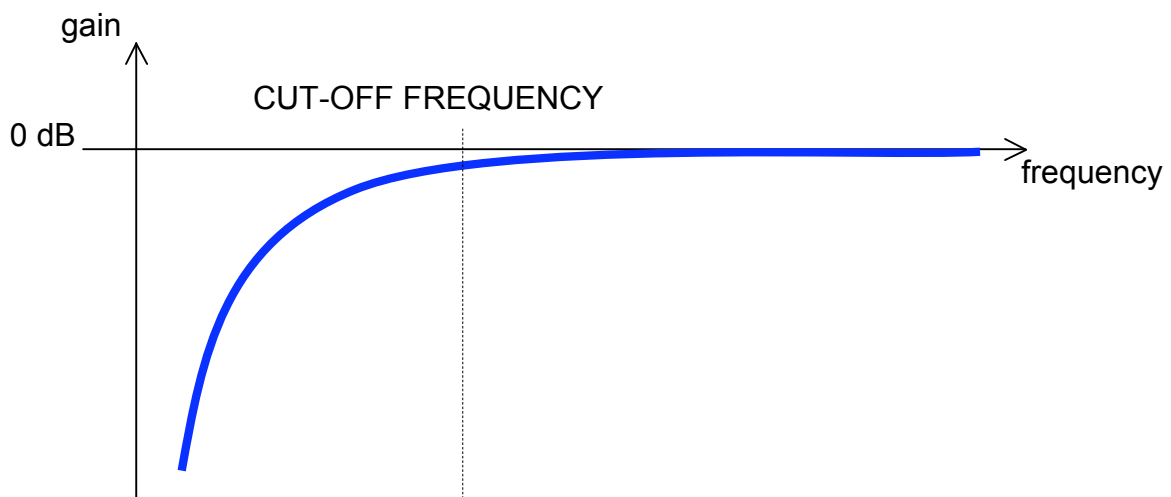
$$\text{GAIN (frequency dependent)} = \frac{\text{OUTPUT}}{\text{INPUT}}$$

Filters

These are normally 'passive' designs, meaning that they do not need a power supply (not requiring the energy to amplify) as they only reduce (or attenuate) portions of the signal.

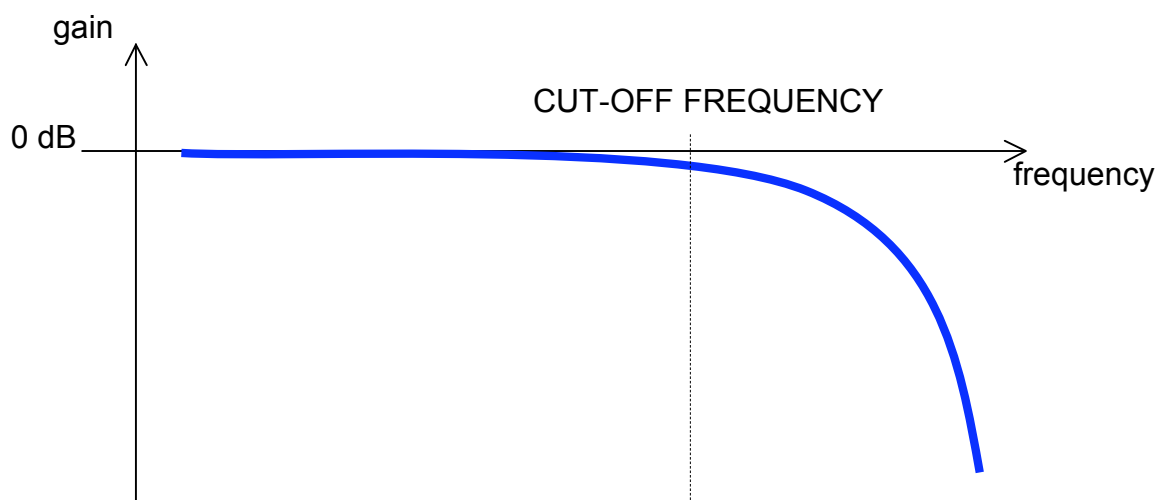
Common Filter types:

HIGH PASS FILTER



At high frequencies sound passes from input to output unaffected (referred to as 'unity gain' or 0 dB), but for lower frequencies the signal suffers increasing attenuation.

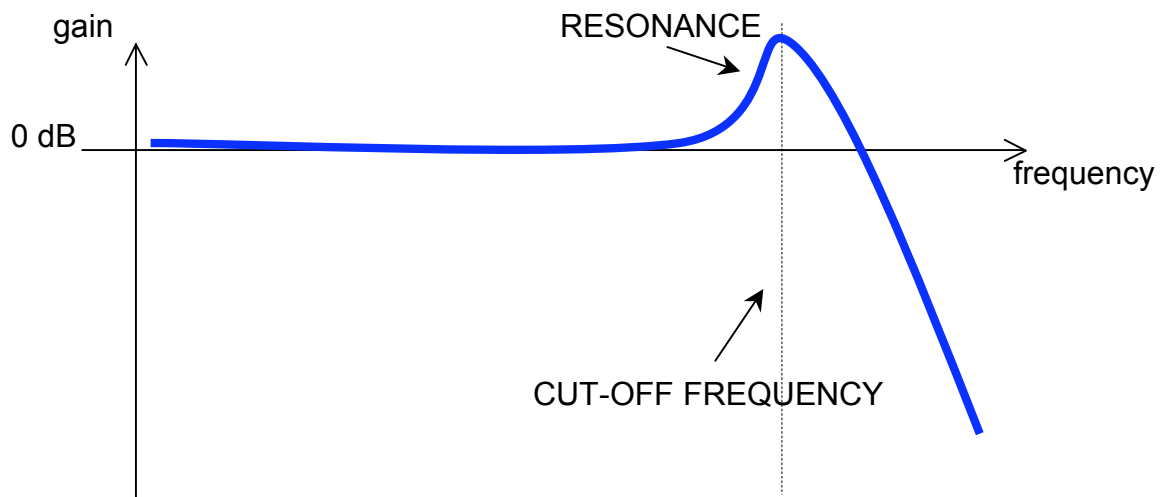
LOW PASS FILTER



This time at low frequencies sound passes from input to output unaltered (i.e. 'unity gain', 0 dB), but as the frequency raises the signal suffers increasing attenuation.

The variable parameter in both these cases is the **cut-off frequency**, and this type of EQ is considered to be good for general sound shaping with minimal side effects.

A particular type of low pass filter is worth mentioning as it's widely used as such in synthesiser design, and has become a popular studio processing tool for the extreme (often evolving) filtering effects. By feeding some of the output back to the input, the filter can be sent into **resonance** producing an exaggerated peak in the response around the cut-off frequency.



Please note all curve shapes are approximate representations

Other Filter types:

BAND PASS FILTER

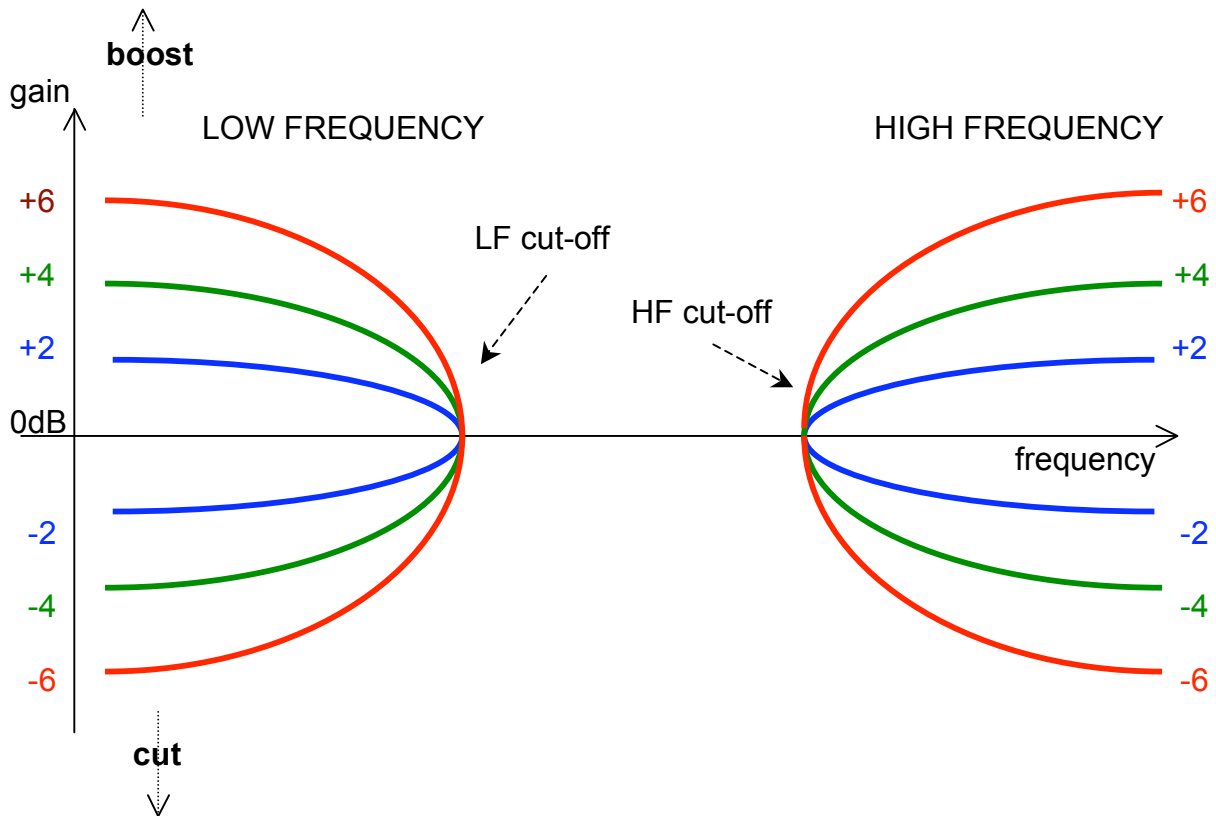
This is the combination of LPF and HPF where the former cut-off frequency is higher than the latter, allowing only a band of frequencies to pass.

BAND STOP FILTER

Similar to above but the LPF cut-off is now lower than the HPF's, producing an attenuated band between them.

SHELVING EQ

Typical 'bass' and 'treble' controls are based on this configuration, though studio units not only have a **boost/cut** control (usually with a 0 dB centre detent) but also allow the adjustment of **cut-off frequency**.



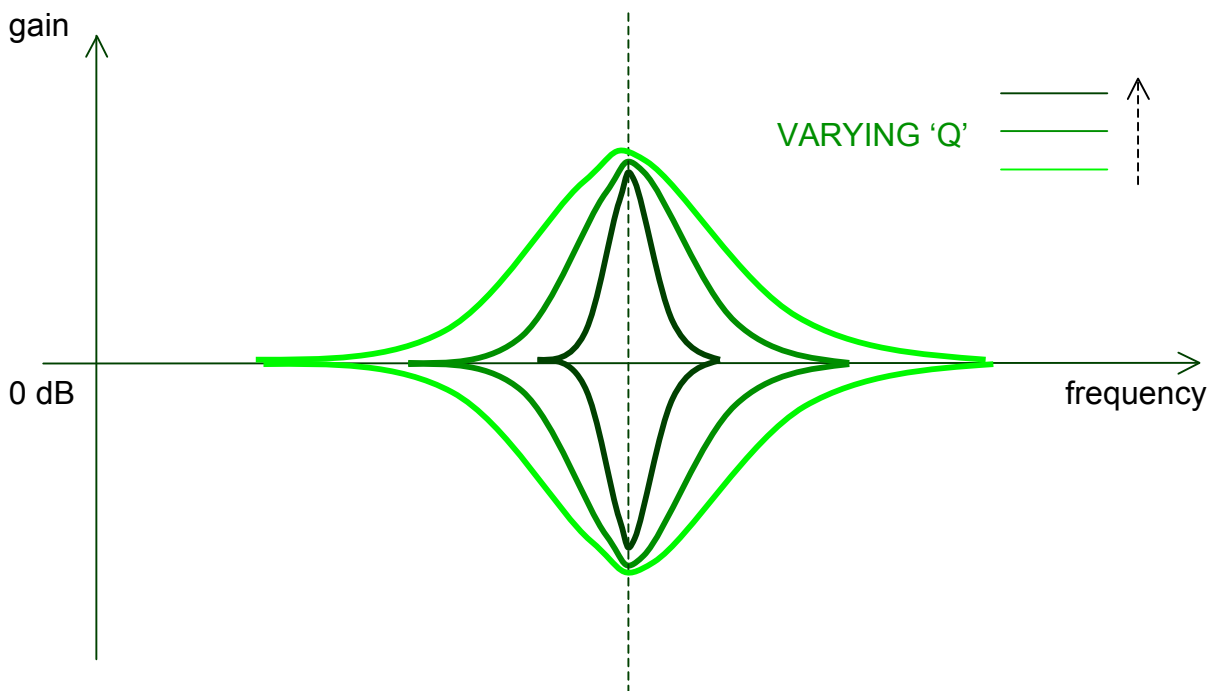
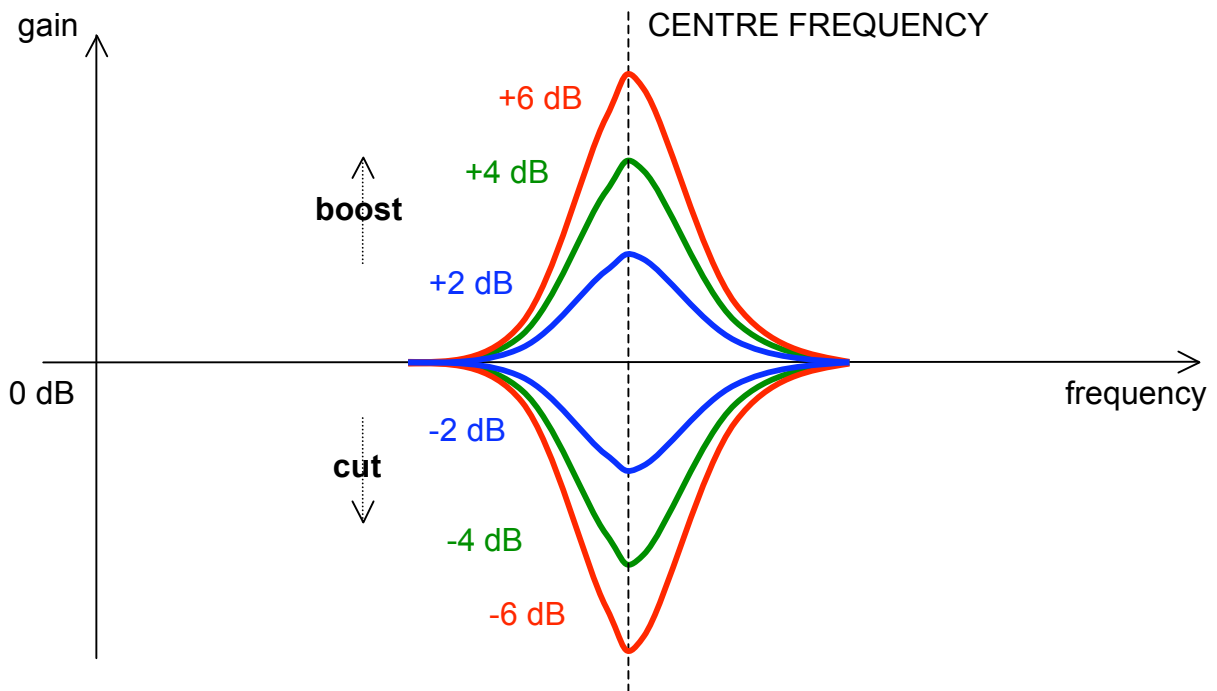
This type of EQ, like filtering, is useful for fairly general shaping of the spectrum extremes, but adds flexibility and is considered to offer reasonably 'natural' sounding results.

PARAMETRIC EQ

These units can be used for mid-band modifications as well as more 'surgical' alterations as each band has **boost/cut**, **centre frequency** and '**Q**' controls.

The '**Q**' is the relationship of the width of the band to the height, the larger the Q the more narrow the band. Practically low Q bands sound more natural and high Q bands tend to exhibit a more processed sound, which can be useful as an effect or for precise cuts.

On smaller mixers the mid-band EQ section(s) is often **sweep EQ**, i.e. has a fixed '**Q**'.



Practical Issues in the use of EQ

As has been mentioned already, the way an EQ is applied can influence the quality of the end result. In practice cuts, wider band adjustments and minimal boosts tend to produce a less obviously EQ'd sound.

Note that in analogue designs not only do the levels vary when applying EQ but also the **relative phase** of the harmonics in the altered band. This means that minute additional (as acoustic sounds already contain component phase relationships) timing differences are introduced to the different frequency areas of the signal. How these change (and how much) depends on circuit design and component quality, the 'natural' or 'musical' nature of the unit's sound is significantly attributed to this (sought after vintage units come into this category).

Minimum or Linear phase designs (found more in mastering studios) sound more 'neutral' or 'transparent', the advent of digital technology has advanced the practicality of this type of unit.

SO WHERE DO I START WITH EQ SETTINGS?

Here is a common practical method:

- **Listen to the sound to be processed and try to identify the frequency area requiring adjustment (either exaggerated or minimised)**
- **Boost a parametric band about 8-10 dB (taking care that the signal does not push the channel or mix-bus into overload)**
- **With a middle setting of 'Q', sweep the centre frequency control until the required area is found**
- **Now re-adjust the gain control for the desired (hopefully more tasteful) boost or cut, also resetting the 'Q' as necessary.**

Further Investigation

NOW you should put 'Equalisers' into your favourite search engine, read any article you find, absorb any more practical tips you come across **AND (most important)** try/test the application of EQ in your music.