



Q10

Paragraphic Equalizer

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Chapter 1 - About Q10

Our challenge in designing Q10 was to develop an equalizer that gave excellent sonic performance and ease of use, but we also wanted to build in enhancements and facilities that would be impractical, if not impossible, to implement in the analog realm. The Q10 also provides a visual representation of the EQ curve that you can adjust by 'dragging' the curve itself so you don't have to rely on conventional controls. However, if you know what EQ settings you want, you can simply enter the numerical values to achieve the same result.

A traditional parametric equalizer might incorporate three or four bands of equalization, Q10 provides up to 10 bands of equalization per channel, configurable as either two independent mono equalizers or as a precisely ganged stereo equalizer. Use just what you need for the job. Each of the 10 bands can be true parametric, high/low shelves, or high/low pass (cut) filters, and to ensure optimum fidelity, each is noise-shaped for the best possible signal-to-noise ratio.

New 88.2/96khz support for native

If you are using Q10 in a native application which supports the higher sampling rates, the Q10 now supports these sampling rates, although the frequency scale does not change to show these frequencies. Therefore, if you are using a shelf or bell that would normally have "dropped" near the window edge, now the filter shape will continue onward toward the now-higher Nyquist!

Q10 component plug-ins

You can select just the audio processing you need and use only the power necessary to do the job. Use only as many bands of EQ as you need for efficient use of your platform's processing capabilities. The WaveShell makes the most of your system.

Depending on your platform, the Q10 has several plug-in components in the menu. You can select up to 10 mono or stereo EQ bands ; each plug-in is appropriately named for the number of bands, i.e., Q4, Q10. When being used in Native applications, if you don't have a band turned on, the CPU is not being used. In the case of DSP systems (such as TDM), then you should select the number of bands that best fits your needs in order to conserve processing power.

Factory Presets

These presets will show up in all components, and each requires different numbers of bands to work. The Preset name has a small number in brackets (<4>) at the end to show how many bands are needed.

Example:

if you see **SuperNotch (-46dB) <4>** in the menu,

it says you need at least 4 bands to use this 46dB deep notch filter.

Setup library

A wide selection of configurations are available in the Setup Library providing instant access to complex filters, which may be used as they are or modified for specific applications. Categories of Setups include Multimedia, PseudoStereo, Band-limiting, Pre/De-emphasis, Plateau filters, Tilt filters, Crossovers, Harmonic combs (hum removal), and so on. The Library includes comprehensive printed documentation which offers practical hints and insights into the use of each setup in the Library, as well as historical and practical use of equalization. We suggest that power users read it and enjoy! It was written by the late Michael Gerzon and has many amazing and powerful hints. We didn't edit or revise the Setup Guide document, so some of the examples and materials may refer to Sound Designer II, the editor Michael used to create the setups.

Most of the Setups are user-adjustable and applications include corrective applications, such as hum or hiss reduction, as well as creative effects such as AM radio or telephone simulation, pseudo-stereo, comb filtering and so on. There are also several utility filter configurations including brickwall crossover filters and other special equalizer characteristics.

Chapter 2 - Using Q10

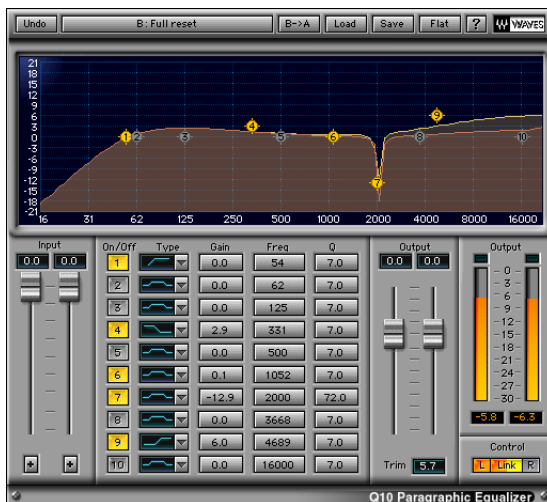
This chapter gives a quick overview of how to use the Q10.

For complete information on using the interface of Q10 and any Waves plug-in, read the **WaveSystem Manual**. Some of the aspects of these controls *unique to Q10* are discussed in this chapter.

In brief, parameters may be entered either from the keyboard or by using the mouse as a slider, and direct control over the EQ curve is possible by using the mouse to 'drag' points on the curve directly.

Color graphing

Q10's display comprises a single window which makes use of color to present the maximum amount of information in an easy to understand manner. Because both left and right audio channels are displayed in a single window, the left and right equalization curves are represented by blue and red lines respectively, and for those few using mono monitors in 1-bit mode, the left channel is represented by the darker gray line, while the right is represented by the lighter gray line.

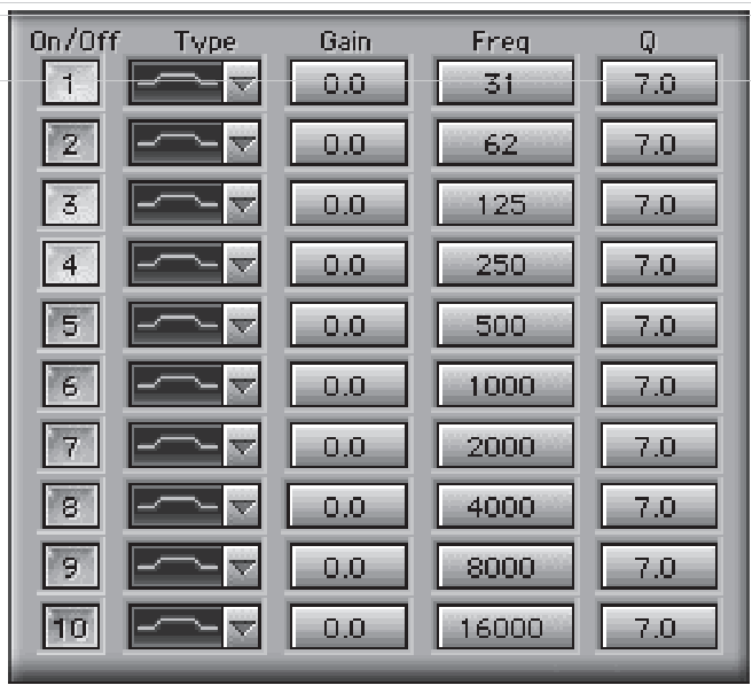


The Equalizer

Each of the 10 bands of EQ provided by Q10 has exactly the same controls and the same parameter range. The only difference is in the default frequency values.

The parameter values indicated in the small Value Windows may be changed either via the

keyboard or using the mouse. See the **WaveSystem Manual** for general details about using the controls. Exceptions specific to Q10 are discussed later in this chapter.



On/Off	Type	Gain	Freq	Q
1		0.0	31	7.0
2		0.0	62	7.0
3		0.0	125	7.0
4		0.0	250	7.0
5		0.0	500	7.0
6		0.0	1000	7.0
7		0.0	2000	7.0
8		0.0	4000	7.0
9		0.0	8000	7.0
10		0.0	16000	7.0

Value Windows of the Q10

Q Control

The area beneath the frequency curve window is a table with Value Windows for Frequency, Gain and Q for each of the 10 equalizer bands, along with the band's filter type and In/Out button. The right hand column Value Windows show the Q value which corresponds to the width of the frequency range for that band. The higher the Q setting, the narrow the band of frequencies that is affected.

About Q

Q is a way of expressing the frequency width of a filter in relation to the center frequency of the filter band and may be represented by the mathematical relationship: F_c/F_w (center frequency divided by frequency width at the traditional '-3dB point', both in Hertz). For example, a Q of 2.0 at 1,000Hz gives a bandwidth of 500Hz (1000Hz divided by 2).

In the Q10, the filter design adopts a constant bandwidth rather than constant Q approach which means that the literal interpretation of Q is only strictly applicable at maximum boost setting. At other gain settings, the

width of the ‘bell’ is kept nominally the same as at maximum boost, not because we want to be awkward, but because we feel that this approach makes the control of the equalizer more intuitive and more musical. In the Q10, when using small boosts and cuts, the Q value shown is approximately 5.5 times greater than the traditional engineering definition of Q. However, the basic principle of Q still applies; the higher the value of Q, the sharper the filter and the narrower the range of frequencies that is affected.

For typical EQ applications, Q values of between 0.5 and 6 are typical, but for specialist applications, for example, notching out specific frequencies (such as hum), much higher values of Q (up to 100) may be used. Figure 2 shows examples of both high and low Q settings. Note that because Q10 uses a variable Q filter topography, for most small boost/cut uses, these typical ‘engineering’ Q values of 0.5 to 6 would be shown as approximately 2.7 to 33 Q in the Q10.

Freq

The frequency control (Freq) Value Window displays the center frequency for each band when bell or bandpass mode is selected. When in low/high pass or low/high shelf modes, the Freq parameter controls the corner frequency of the filter. Traditionally, the corner frequency of a filter is defined by its -3dB point, but in the Q10, this is only strictly true at the maximum boost setting. At other gain settings, the constant bandwidth filter design maintains a nominal Q which is roughly the same as at maximum boost.

The Frequency control values are adjustable in one-sixteenth-tone steps (96 steps per octave), rounded to the closest integer. The left/right arrow keys may be used to step the selected Freq value in one-sixteenth-tone increments.

Gain

Gain may be adjusted in the range -18.0 to +18.0 dB, in increments of 0.1 dB via the Gain Value Windows or by ‘dragging’ the EQ curve. The displayed frequency response graph shows a range of +/- 21 dB.

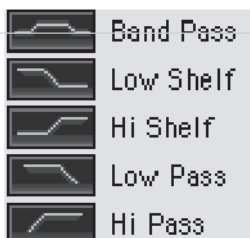
Dual axis control

When setting up an equalizer, many engineers will adjust the Q or frequency with one hand while varying the gain with the other. Q10 goes one better by allowing the user to employ both the Y and X movements of the mouse to access two sets of parameters simultaneously, using just one hand. Selecting either the Frequency or Q of any band links that parameter to horizontal movements of the mouse while Gain is changed by vertical movements. Any change in parameter value will be reflected in the shape of the resulting EQ curve, and similarly, any adjustments made by dragging points on the curve will cause the Value Windows to change accordingly.

When adjusting the EQ curve directly, the X axis controls Frequency (Freq) by default while the vertical or Y-axis movement of the mouse adjusts the gain. Holding down the keyboard Option button at any time switches control from frequency to Q (PCs use the Alt key). Option-clicking on the band marker will not reset the values; option-clicking on a *value window* such as Gain or Freq will reset it to its default value.

Filter type

The FilterType Value Window, selects the type, or mode, of filter used for each band. The selected Type is indicated by means of an icon representing the filter curve.



The default Type is the Bell or bandpass filter which is used to provide parametric equalization or to construct notch filters. Clicking on the Type icon will step through the filters in the following order: Parametric (Bell), Low shelf, High shelf, Low pass, High pass. You can also option-click on the filter type button to see a popup menu for direct selection.

In/out button



Band In/Out buttons

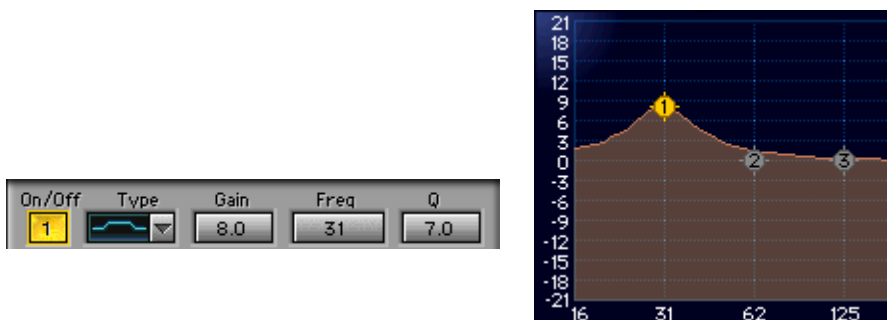
To the left of the Type button is the In/Out (on/off) button for each band. Clicking on the In/Out button causes the button to 'light up' and the filter band number to the left of each button turns red when the corresponding band is selected for adjustment. This makes it easy to determine which band (or group of bands) has been selected, especially when the band markers are in close proximity to each other, as is often the case when using the Setup Library or tweaking a complex filter.

If a point on the filter curve is selected with the mouse, the band number beside the In/Out button turns red. This makes it easy to determine which band is being adjusted in complex setups. The number turns red whether the band is switched In or Out. Note that when a filter band is bypassed, moving the filter's 'handle' on the frequency display will have no effect on the shape of the frequency curve until the filter is switched back in.

How to use the EQ controls

Perhaps the most intuitive way to adjust the equalizer is simply to use the mouse to modify the EQ curve display. Not only does Q10 allow you to control single bands using the mouse, it is also possible to select multiple bands for simultaneous adjustment when necessary. You may take control of a band with the mouse and use the two axes of movement to change either the Freq and Gain or the Q and Gain simultaneously. You may also bypass single bands or selected groups of bands. Please read the WaveSystem Manual for complete details of the controls.

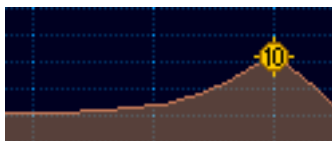
The following example will help you to get the feel of setting up the filters by using the Value Windows and the mouse. Select a suitable section of audio, then click on the Preview button if appropriate for the host application, or pass audio through the system if the host application permits real-time control. If you are using Preview mode, you should now hear your short selection of audio looping continuously. The maximum length of the loop is usually determined by the amount of computer RAM available to the host application in which Q10 is running. Where real-time processing is supported, you will be able to adjust Q10 as the audio plays through normally. See your host application manual for details.



Band 10, showing +8.0dB Gain, controlled from Value Window

- First, click the In button of Band 10, the highest frequency band; the In button is located at the lower edge of the screen. It will turn red, indicating that this band is now switched in. Note also that a Band Marker has appeared on the flat line of the frequency curve graph .
- Click and hold on the Gain value for this band, and slowly move the mouse forward ('up' in the y-axis) until you have introduced around 8dB of gain. You should hear now hear the result of this high frequency boost, and you will notice that the Band Marker moves as you change the parameter value. When you release the mouse button, the graph will be redrawn and you'll see the EQ curve change shape to reflect the actual response curve being created by your settings. The Band Marker is at the top-center of the bell curve you have created and represents the center frequency (Freq) of this band.
- Now click and hold the Q control for the same band, and slowly move the mouse to the left (to control Q, you move the mouse horizontally) so that the Q value gets larger and the filter response becomes narrower. Set the Q to about 10.0. Again notice that the shape of the filter bell curve changes once you release the mouse button.
- Click and hold on the Freq control for this band, and slowly move the mouse back and forth, from left to right, and you'll hear the center frequency of the filter change. (Remember, to control Freq, move the mouse horizontally).

Direct graphic control



- Click and hold on the Band 10's Marker in the equalization graph and drag it up and down using up/down mouse movements to change the Gain value. Without releasing the mouse button, move the mouse from left to right and notice that the Freq value changes accordingly. If you like, you can move the mouse diagonally and change both Frequency and Gain values simultaneously.
- To change Q with horizontal mouse movement, hold the keyboard Option(Alt) key down while moving the mouse. Vertical movement will still change the Gain of the selected band, but horizontal movement will now control Q. Note that when modifying parameters, the mouse movements are the same in the Frequency graph as they are in the Value Windows, and because the Band Marker moves in the same direction as the mouse, you can think of the action simply as dragging the Band Marker.
- Multiple bands may be selected and manipulated simultaneously by holding down the Shift key as you select the Band Markers you wish to control, or by drag-selecting a group.
- Bands may be 'toggled' In and Out by a clicking on a Band Marker while holding down the Command key (PCs just doubleclick the band marker).

Being able to control the values of a band directly from the graph is a powerful advantage as it allows you to set up the EQ by feel rather than by numbers. Bear in mind that small EQ changes can make a significant difference to the way something sounds, so don't feel obliged to make use of the Q10's full range unless you really need it!

More control options

- Change the filter type by using an Option-Command-click on the Band Marker (PC doesn't support this).
- 'Lock' into one parameter without changing the other by holding the Control key down while moving the mouse. For instance, either before or after clicking on a Band Marker, press the Control key down. Then, move the mouse to adjust Freq without changing the Gain. Release the Control key. Then, press it again, and this time move the mouse to adjust the Gain without changing the Freq.

Note that direct keyboard control can only be used if supported by the host application or platform. Some platforms will not support all keyboard commands, and most digital sequencers don't allow use of the keyboard at all by plug-ins. Check your host application manual, plus any Read Me files about your host that came with your Waves package.

For platforms that do support keyboard commands, here is a summary of the Q10 commands (some are unique to Q10, all others are covered in the **WaveSystem Manual**).

In the graph, on any Band Marker(s):

option (alt)-click	to control Freq and Q.
click	to select a band (or any Value Window), and <i>drag</i> to control Freq and Gain.

*Note: You can press the Option key at any time to control Q without having to click again.
Release the Option key and control returns to Gain.*

control-click	to adjust only one parameter. (The first move becomes the active one.)
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*Note: You can press the control key at any time to activate the parameter lockout.
Then, release to allow changing of both.*

command-click	to toggle band in/out.
shift-click	to select or de-select a band
option-command	to toggle filter type

Arrow Keys

To adjust any selected value(s) by small increments, use the arrow keys. (Note: The increment for each value is smaller than what will be displayed, so it may take several keypresses to see the value change on-screen.)

Left/right arrows control Freq or Q, and up/down arrows control gain. Pressing an arrow key once will change the selected value(s) by the smallest possible increment. Press and hold for continuous change.

Clicking on filter type buttons:

option(alt)-click	to see popup menu of filter types for direct selection.
click	to toggle through the filter types

Chapter 3 - Internal clipping

To copy/paste selected buttons, grab markers, etc.

Select the controls you want to copy (shift-click, drag-select, etc.)

Press the letter 'c' to copy the selected value(s).

Press the letter 'v' to paste the selected value(s).

Undo is active for any accidental paste action.

If you have a band selected in the graph (a Band Marker) and you press 'c', all three parameters (Gain, Freq, and Q) are copied. All three can be pasted to another band, even in the alternate setup (for example, copied from a band in Setup A and pasted into a band in Setup B). Multiple bands can be copied and pasted simultaneously. They are copied in order and do not have to be contiguous. For example, you could also copy from bands 1, 2, and 3, then paste to bands 4, 7, and 9, respectively.

***Note:* It is possible to copy/paste from any control to any other control, which may yield unexpected results (such as pasting a Q value into an input fader). If you try this, be aware that what is actually pasted is an internal value and not the visible numerical value. The internal value is scaled for each control's range.**

Under certain circumstances, internal clipping can occur. With high level files (already normalized, or with high peaks), several situations can occur that may cause peaks that did not exist in the unequalized signal. This is true even for filters that have no gain, such as a high-pass filter, or for filters with a cut. The VU meters are output meters and will not show this internal clipping. To show this kind of clipping, meters would be needed between each band of the equalizer. Therefore, if you are using a soundfile with high levels (either normalized or very near 0 dbFS), just reduce the Input Faders 3 to 6 dB to allow for internal peaks.