G-6E
Dynamics Processing Control GUI

Technical Documentation

Wheatstone Corporation
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Chapter Contents

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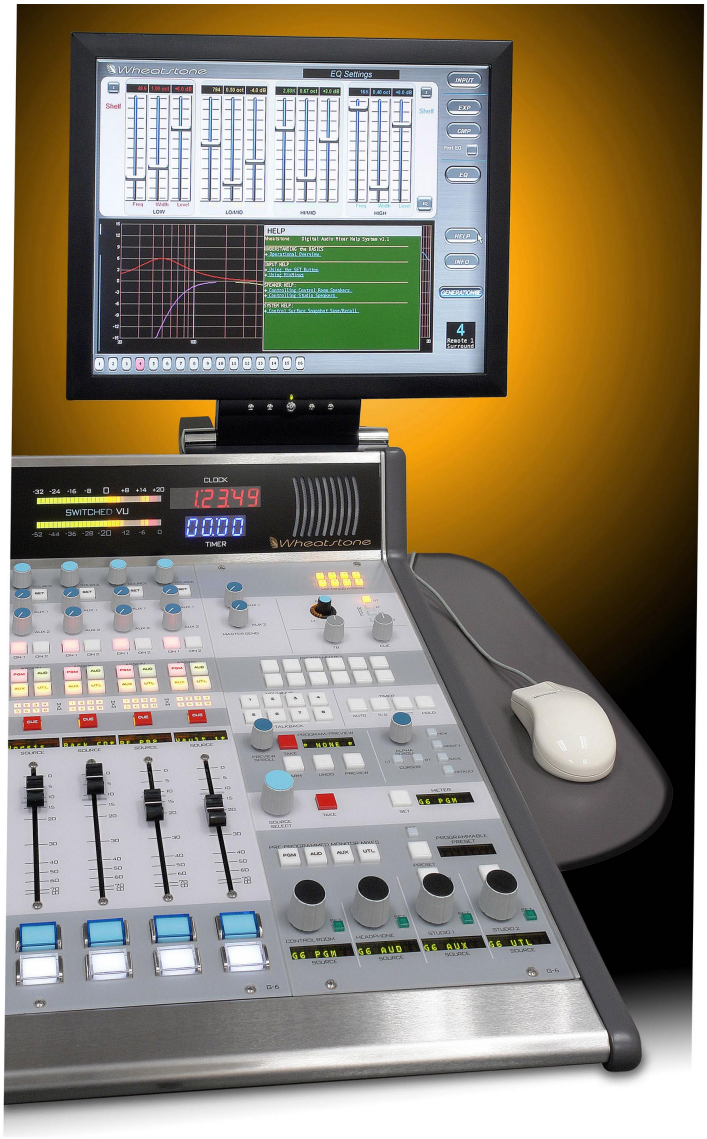
Getting Started

The G-6 control surface is supplied with a custom Graphical User Interface (GUI) program, intended to be straightforward in use, controlling and displaying the 4-Band Parametric EQ, Expansion/Compression, and Input settings.



Connecting the G-6 and the GUI

The G-6 should be installed, powered-up, and verified to be operating normally. Plug in the flat panel monitor display (user supplied) and mouse to the DB-15 “MONITOR” and DB-9 “MOUSE” connectors on the control surface’s rear panel.

Using the GUI

Multiple processing screens allow full control of 4-Band Parametric Equalizer, Expansion/Compression, and Input settings. Each screen has a Title Bar, a Control Area, the Dynamics Displays, the Side Bar buttons, and the Channel buttons. First choose the channel by clicking the appropriate button on the bottom of the monitor display. Alternatively, you can press the desired channel's SET button to bring that channel's settings up on the screen. Clicking a Side Bar button on the right side of the monitor display brings the respective management screen (its name shown in the title bar window) and gains access to the controls for that portion of the signal processing.

To operate the controls and faders in the Control Area, click on the control, and slide the mouse to move the control - up increases the control's indicated position, down decreases it.

Visually, the most important element on the main screen, dominating the lower half of it, is a large graphical display; the standard audio frequency of 20Hz – 20kHz is ranged in logarithmic form across this graph with gradations at salient frequencies. The vertical axis scale range is -15dB - +15dB, with gradations every 3dB.

Input Settings

This screen shows input gain control, polarity, and filter settings.

Gain Control

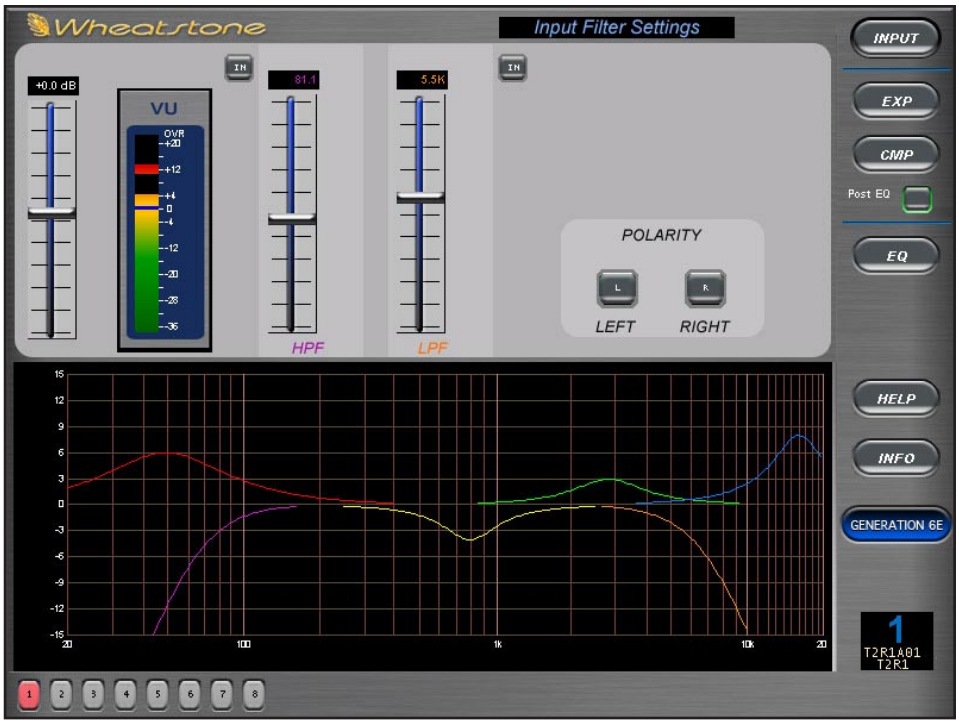
Adjusts input signal gain between -18.0dB - +12.0dB to compensate for:

(+) inadequate incoming level on a source,

(-) depression of input signal to retain headroom if large amounts of equalizer boost is incurred.

VU Meter

The level meter is a dual-indicating peak-over-average, with peaks riding as a lone “dot” over a solid bar-graphed average. An “Over” indication is at the top of the input level bargraph.



Filter

HPF (High-Pass Filter) - This is a 24dB/octave variable high-pass filter with Butterworth characteristics, tunable between 16.1Hz and 500Hz, and with a separate in/out switch ("HPF IN" switch, near the top of the screen and to the left of the HPF slider control). The relatively high order of filter is necessary to allow definite and decisive removal of unwanted low-frequency artifacts (air-conditioning rumble, line hum, traffic, or footstep impacts) with minimal effect on the required program.

Note: Butterworth Filters typically yield excellent flatness, no ripple in the pass band, and a rounded amplitude response near the cutoff frequency.

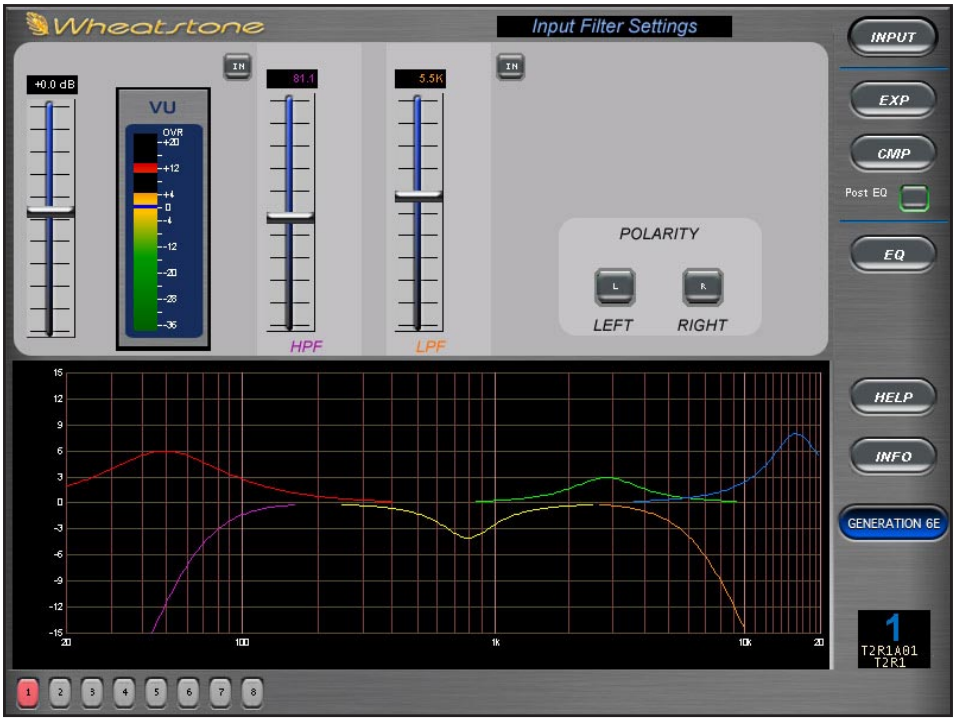
LPF (Low-Pass Filter) - This is a 24dB/octave variable low-pass filter with Butterworth characteristics, tunable between 1KHz and 20.2KHz, and with a separate in/out switch ("LPF IN" switch, to the right of the LPF slider). This filter is used to remove unwanted high frequency artifacts (noise, squeaks, etc.) with minimal effect on the required program.

Polarity

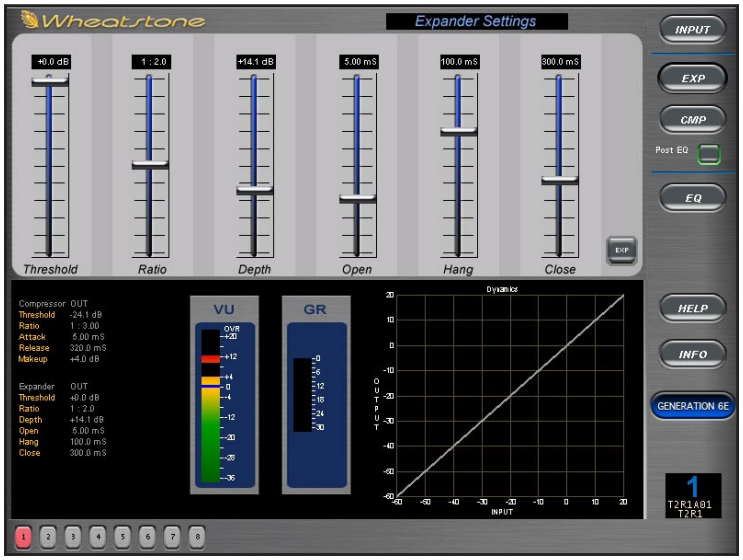
A pair of buttons, one for left and one for right, are provided to cause the reversal of absolute phase of the signal path, in case there is an inadvertent reversal elsewhere in the signal chain of which the G-6 is a part.

Frequency-Domain Graph

A Fast-Fourier Transform (FFT) based real-time spectral analysis of the selected input signal.



Expander Settings



An expander is a useful tool for reducing unwanted background noises. These could be variously air-conditioning rumble or noise, background conversation, phone-line noises, recording hiss, etc. It is also useful for reducing the inevitable general increase in background noise of some recorded material when subject to heavy compression. A common usage in live sound is to effectively turn a microphone off when not being talked/sung into, so as to reduce corruption of a mix or reduce the chances of feedback with an unwanted open microphone.

The expander is slightly counter-intuitive when first encountered, in that unlike nearly any other processing element it is active - i.e. working, attenuating away the input signal - when the input signal is at its quietest, at or below the threshold. If the expander is on, there will be gain reduction when no signal is present. The gain-reduction reduces as the threshold is approached, and there is none above the threshold.

The controls are:

EXP — A switch that allows the expander to be enabled and disabled.

THRESHOLD (-60.0dB - 0.0dB) — Below which the automatic attenuation starts to take effect.

RATIO (1:1.0 - 1:5.0) — Being the proportion of how many dB the input signal is attenuated for every dB it drops below the threshold. 1:3 indicates 18dB loss for 6dB drop in input signal level.

DEPTH (0.0dB - 40.0dB) — The maximum amount the expander is permitted to reduce the input signal level.

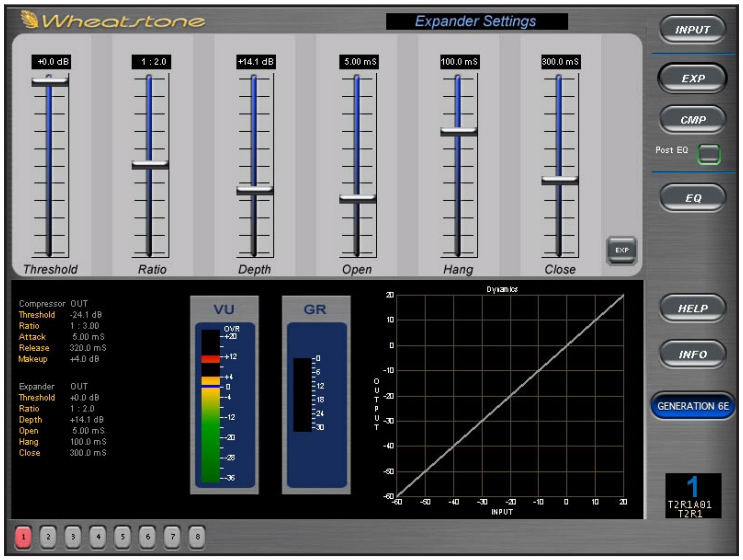
OPEN (1.00mS - 100.0mS) — The time-constant of the rate at which the expander un-attenuates, or opens; sometimes called “attack”.

HANG (0.00mS - 1.000S) — An adjustable period of time the expander remains open without attenuating, before starting to close. Handy to keep the expander open during, say, speech inter-syllables or other short pauses, without having to resort to excessively long...

CLOSE (50.0mS - 3.000S) — ... close times, being the rate at which the expander attenuates away the input signal once below the threshold.

An input/output plot, a graphical representation of the relationships between threshold, ratio, and depth, is on the Expander Control screen of the GUI; it is a handy visual aid.

Almost always, the trick is to set the threshold of the expander - below which it starts to attenuate away the input signal - high enough to capture the noise, but not too high as to snatch at the lower levels of the desired parts of the program material. That can sound really irritating.



Sometimes the gain reduction is required to be subtle so as not to draw attention to the fact that the expander is in operation; under these conditions shallow expansion ratios, such as 1:1.5 or 1:2 are preferred, as are restricted depth - 6dB, or 10dB, is plenty and makes a substantial subjective improvement to the noise.

These, too, are the kind of settings used for another application of an expander: effectively shortening an excessively long room reverberation time, or an instrument's ring-out that is overly persistent. In these cases the threshold is set somewhat higher, well up into the desired audio levels - in this way the attenuation becomes part of the overall sound, but the gentle ratio prevents a sense of anything "odd" happening. Again, relatively shallow depths of 12dB or so are plenty to achieve the desired effect.

More aggressive expansion, or "gating", is accomplished with steep ratios (1:3, 1:5) and with shorter open and close times than for "unobtrusive". It is still best not to go overboard with depth - even just 14dB, 20dB tops, is enough to make a signal "disappear" in the context of a mix; the whole gating sound, especially surprisingly its opening, is less obvious with shallower depth. Sometimes the "Surprise!" element is required, though, for effect.

Compressor Settings

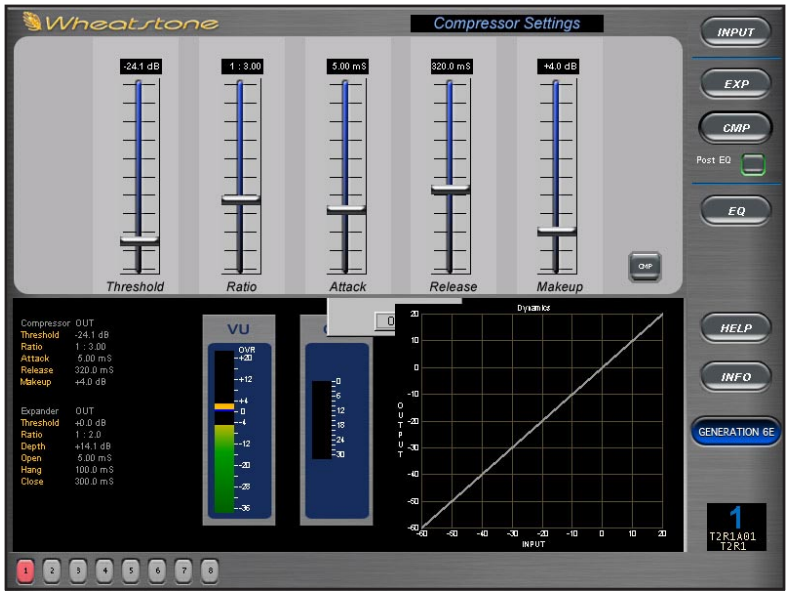
The compressor algorithm used in the G-6 is designed to:

- prevent really ghastly noises from being achieved too easily;

- allow smooth, inaudible, and unobtrusive level control on uneven sources;

- be able to act as a peak limiter for inadvertent overload control;

- enable deep effects if required.



The G-6 compressor section is a compound of many diverse dynamics elements.

The level detector is a pseudo-RMS averaging type with its own symmetrical-in-time attack-and-release characteristic adjustable between 0.1mS and 330mS ("Attack" control). At the slower end of its range, by itself it achieves a nouveau-classic "dbx" style syllabic-rate level control. As the time-constant is shortened, it becomes progressively shorter in relation to the lower audio frequencies themselves; the effect is to turn the detector into more of a peak-level detector, necessary for limiting or wilder effects. A secondary effect at intermediate to fast attack-times is that low frequencies are peak sensed while high frequencies are average sensed resulting in an effective high-frequency bias (up to as much as 6dB differential) which helps to mitigate the detrimental limiting effect of the resulting audio seeming "bottom heavy" normal to most compressors.

While the overall gain-reduction scheme is "feed-forward", the heart of the detector stage itself is a feedback limiter; this allows for this carefully-contrived loosely-damped servo-loop to permit far more interesting dynamic effects than the analytically perfect but deathly boring deterministic classic feed-forward detection schemes typically afford.

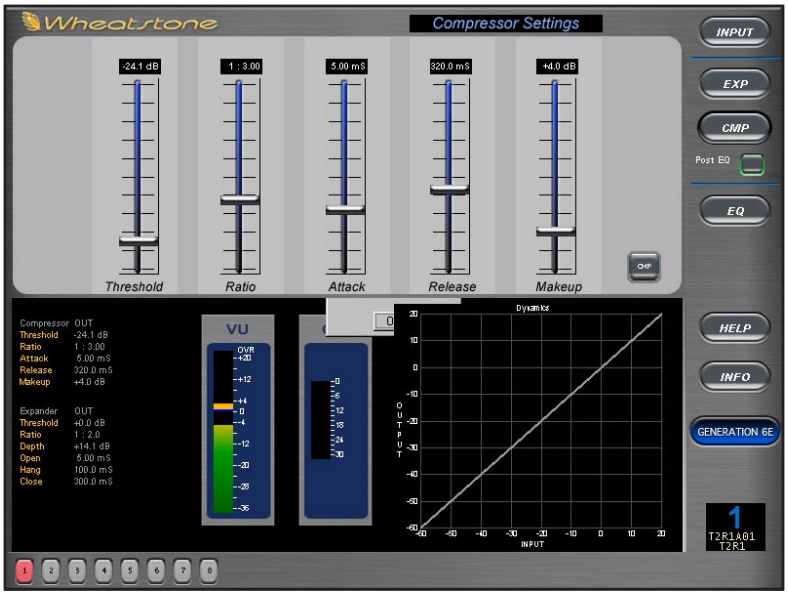
The compressor is "soft-knee", meaning the compression ratio increases slowly with increasing applied level, greatly easing the sonic transition into full compression; it helps avoid the "snatching" and "pumping" at threshold that many "hard-knee" dynamics units exhibit.

A full range of controls is available over the compressor's behavior:

CMP — A switch that allows the compressor to be enabled and disabled.

POST EQ — Determines whether the compressor is effectively inserted after the equalizer or before the equalizer. In general, pre-EQ is a better option on pre-processed program material while post-EQ allows the excesses of a "raw" source signal to be tamed prior to exciting the dynamics.

THRESHOLD (-30.0dB - +10.0dB) — Threshold, the level above which gain reduction is applied.



RATIO (1:1.00 - 1:20.0) — The proportion by which a signal exceeding the threshold is reduced in level. "1:3" means that a change in signal level above the threshold by 15dB will be reduced to only a 5dB change in level.

ATTACK (0.10mS - 330.0Ms) — How quickly the compressor responds to a signal exceeding the threshold.

RELEASE (50.0mS - 3.000 S) — The speed with which the compressor recovers as the exciting input signal reduces or disappears.

MAKEUP (0.0dB - 20.0 dB) — When fairly deep compression is invoked (large gain reduction) it can be necessary to increase the compressor's output level back up to nominal system signal level; up to 20dB of output gain is available to allow this.

AGC

The AGC is an additional sidechain operating in conjunction with the compressor; generally the AGC has much slower integration times for attack and release, so that it responds more to the medium or long-term energy of the program material in a given band, rather than more typically energetic actions of the compressor.

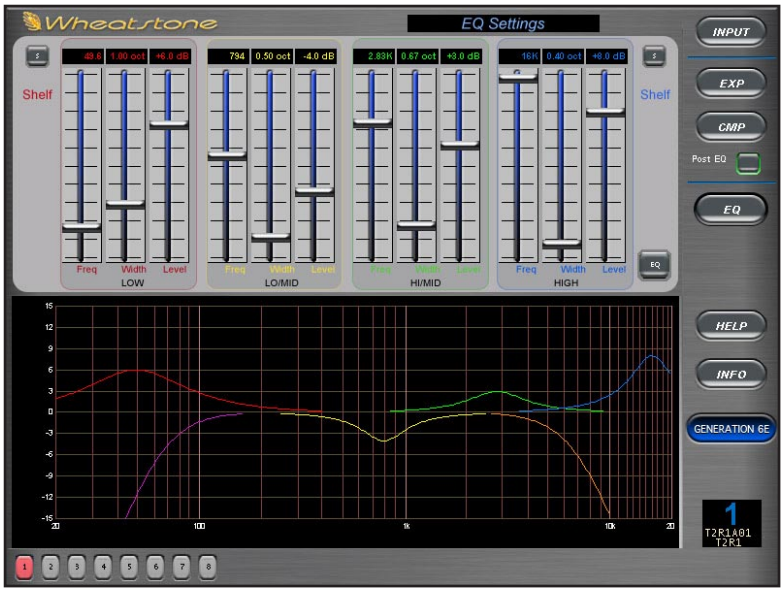
The AGC action rides "underneath" the compressor; depending on the time-constant settings and character of the program material, the AGC can follow the average long term level changes and create a gain-reduction "bed" some 12dB to 6dB under the compression gain-reduction peaks. The AGC rides the general level, the compressor processing for effect takes place on a consistently controlled signal.

On sudden application of an input signal, the faster compressor's attack captures the onslaught, with the AGC eventually catching up. On release, the effect is identical to the much-vaunted "two-slope release" of classic compressor units such as the Audio and Design F760xrs and Joemeek SC2. On departure or reduction of the input signal the usually faster

compressor release predominates until its gain-reduction contribution falls below that of the AGC, whose much slower release rate takes over. A big advantage of the compounded processes is that on normal program material, the compressor does not have to "move as far" to capture signal peaks, so reducing the "snatching" which can occur at deep compression onset.

For most purposes the combination AGC/compression is the most transparent; if the intention is wild effect, deriving all the gain-reduction from the compressor alone is probably better.

EQ Settings



The EQ system consists of a four-band parametric EQ with low band and high band PEAK/SHELF switching, plus variable frequency high and low pass filters. As any of the controls are adjusted, a real time graphic display shows the resulting frequency response curves.

Reasonably conventional parametric sections are employed, with +/-14dB lift and cut capability, centre-frequency sweepable over the range of 16.1Hz to 20.2kHz, and a filter sharpness (Width) sweepable between 0.2 and 3.0 octaves. The LOW and HIGH bands also have a shelving function. The entire EQ is switchable in or out ("EQ" switch). The composite effect of any EQ adjustments is shown in the frequency-domain graph.

Low and High Shelving

The high and low "shelving" EQ sections are designed to correct for real or subjective lack in low or high frequency energy in the program material.

The low shelver at the lower end of its range will enable specific kick-drum or bass guitar elements of a source to be balanced with respect to the rest of the source; at higher frequency settings it acts progressively more as a conventional "bass" control.

Similarly, at lower frequency settings the high shelver acts as a conventional "treble" control; as the frequency is raised the effect is confined to progressively higher frequencies allowing "sizzle" or "sparkle" to be (re)introduced without adding the harshness that a corresponding rise in high-mid frequencies would introduce.

At mid-point frequency settings the shelvers reasonably emulate the classic "Baxandall" style tone control, noted for its ease in rapid correction of tonal imbalance.

INFO and HELP Screens

Clicking the INFO and HELP buttons will display windows:

INFO — the technical information about the surface's software versions and connection status to its companion rack MT link, Ethernet link, and automation interface.

HELP — the top level of built in user help system.

To close those windows click again on the INFO and HELP buttons.