unfiltered audio

YOKO

BAND-SPLITTER

OPERATIONS MANUAL

Congratulations on your purchase of a new Yoko Multiband Splitter. Yoko is the essential tool for creating unique multiband effects. With its uniquely neutral frequency response and intuitive controls, Yoko produces unparalleled splitting results while reducing operator fatigue. Yoko: Multiband Everything™.

As with all audio equipment, proper operation and maintenance play a vital role in the performance of your Yoko. It is, therefore, extremely important to read and understand this operations manual before mixing with your Yoko.

Before using your Yoko for the first time, please call toll free [redacted] to receive very valuable training over the phone.

I. Using Yoko

After installing Yoko in your rack and ensuring proper wiring, set the low-mid and mid-high cutoffs ("low" and "high" cutoffs for short) to whatever the corresponding frequency ranges you want to divide your signal into. For example with the low cutoff set to 300Hz and the high cutoff set to 7000Hz, the low output will contain everything around 300Hz and below, the high output will contain everything around 7000Hz and above, and the mid output will contain everything in between.

As a general rule of thumb, the high cutoff should remain even with or above the low cutoff. There is nothing inherently "bad" about crossing them however, and indeed very interesting effects can be created by doing so. As the low cutoff rises above the high cutoff the mid band will shrink and eventually disappear entirely. The amount of slope separating each frequency band also becomes unpredictable. None the less, the system as a whole will still have a flat frequency response distributed between the high and low bands.

The possibilities for multiband effects are as diverse as they are interesting. Send each band into its own distortion while modulating the cutoff frequencies to create otherwise impossible composite timbres. Use separate compression on each band to place it perfectly within a mix. Put reverb on only the lowest or highest part of a signal to create surreal sonic images. Apply separate delay times to different parts of a signal, creating the effect of a low-resolution spectral delay, et cetera.

Another common use is to turn the high cutoff all the way up only using the low and mid band, putting Yoko in 2-band "bass effect" mode. Or if more than three bands are needed, multiple Yokos can be stacked in series, creating 5, 7, 9 or more separate frequency ranges. Yoko's uses are increased with each effect you add to your studio.

II. Audio Configuration

Audio is received through the stereo left and right inputs. The signal is then split into low, mid, and high bands, each with their own respective outputs.

The final "Sum" output is a sum of the three split signals. Because of Yoko's "flat sum" design, if the low, mid, and high outputs are each set to 0.0 dB gain, the summed signal will sound identical to the input (all-passed). The sum output can be very useful when soloing certain bands or experimenting with various cutoff and amplitude levels. It also allows Yoko to function as a flat-sum, 3-band, CV-controllable equalizer.

III. Solo Buttons

The individual frequency bands can be soloed or muted in various combinations through the use of 3 solo buttons on Yoko's face.

If no solo button is selected, Yoko will perform normally, allowing each frequency band to pass through. If one or more solo buttons are selected, Yoko will output the soloed frequency bands and mute the rest.

IV. Slope

The amount of "slope" or the speed of the transition between frequency bands comes in three settings. These correspond to the steepness of the filters performing the splits and are measured in decibels per octave at the cutoff frequency.

smooth 

steep!

A setting of 24 dB/octave creates a smooth, seamless transition between each section. A setting of 72 dB/octave creates extremely abrupt splits, useful for special effects and exaggerated modulation.

V. CV Control

Yoko's CV control is mapped to allow the maximum possible range of control for any knob configuration.

a. Gain Knobs

For the gain knobs, positive or negative CV input is scaled to add or subtract the amount needed to reach the maximum or minimum knob value. For instance if the knob is set to 0.7 (normalized), then adding positive 0.0 to 1.0 CV will add 0.0 to 0.3 to value, as if turning the knob between 0.7 and 1.0.

Inputing negative CV from 0.0 to 1.0 will subtract from 0.0 to 0.7, as if turning the knob between 0.7 and 0.0. In short you can always set the knob to maximum by inputting full positive CV and to minimum by inputting full negative CV. Inputing zero CV will leave the knob value unchanged.

b. Cutoff Frequency Knobs

Yoko's cutoff frequencies are a little more complicated in order to prevent the low and high cutoffs from crossing one another during CV modulation.

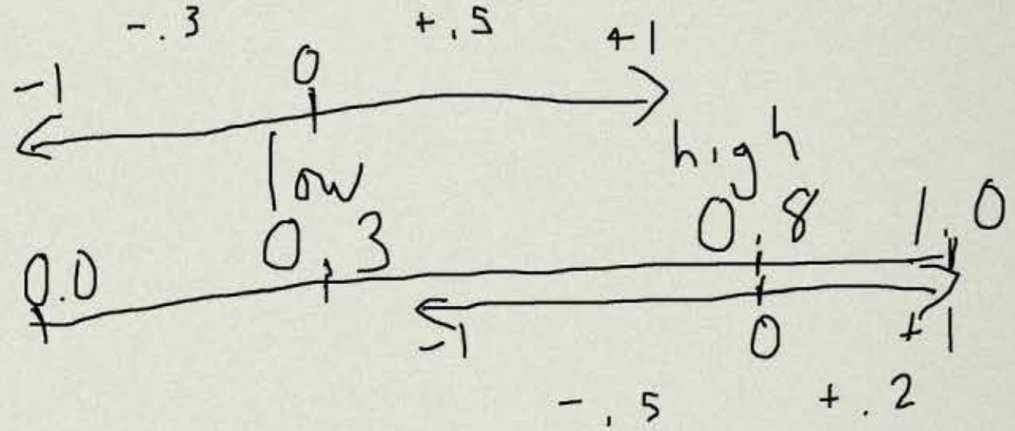
If the low cutoff knob is set to 0.3 (normalized) and the high is set to 0.8, putting positive CV on the low will add 0.0 to 0.5, making it touch but not go over the high cutoff (0.8). Negative CV will subtract 0.0 to 0.3.

The high cutoff is the same, but in the opposite direction. With the low cutoff set to 0.3 and the high cutoff set to 0.8, negative CV input into the high cutoff will subtract 0.0 to 0.5 (making it hit but not cross the low cutoff) and positive CV will add 0.0 to 0.2.

Things get a bit tricky if you're putting positive CV into the low cutoff and negative CV into the high cutoff at the same time, because they could overlap after the CV values were calculated. To prevent this, during each frame Yoko first calculates the low and high post-CV targets and before applying them, acts as is they each push each other back based on the amount they overlap. For example, with these same settings (0.3 and 0.8) putting full positive into the low cutoff should push it up to 0.8 and putting full negative CV into the high cutoff should push it down to 0.3. This creates an overlap of 0.5. Yoko determines this overlap ahead of time and subtracts half of it from the lower and adds half to the upper, putting them both at 0.55 and preventing them from crossing.

c. Trim

Trimming the CV input with the trim knob will cause the incoming CV to be multiplied according to a set ratio. For instance, if the trim knob is set to half (63), a CV input of 1.0 will be "trimmed" to 0.5.



VI. Technical Concerns

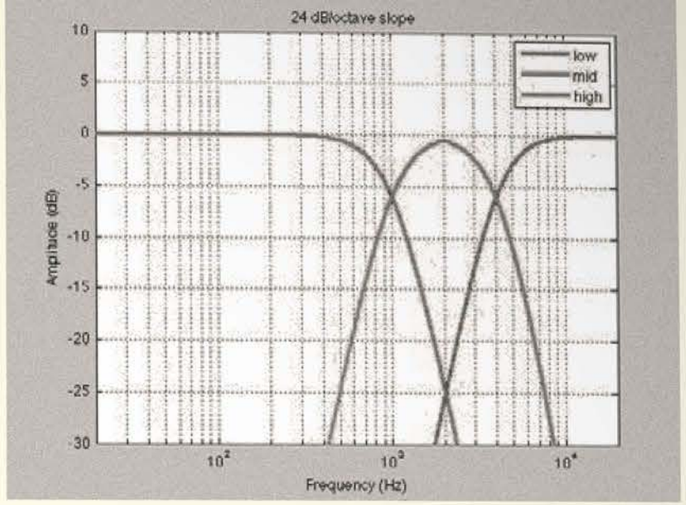
Splitting of the signal into three separate frequency bands is done using a hierarchical Linkwitz-Riley (also called "Butterworth Squared") crossover technique. Linkwitz-Riley filters have the unique property of a flat sum when added in complimentary low-pass/high-pass pairs.

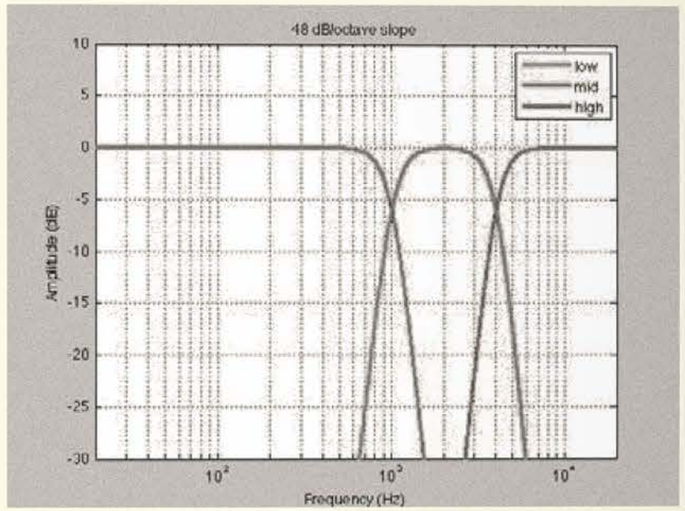
Splits are made by first sending the input signal through a low-pass and high-pass filter, each set to the low cutoff frequency, resulting in two bands. The high output band is then sent through another set of low-pass and high-pass filters, each set to the high cutoff frequency. The low output from the first split is sent through a final all-pass filter making it phase neutral in relation to the higher two bands and ensuring a flat frequency response of the system as a whole.

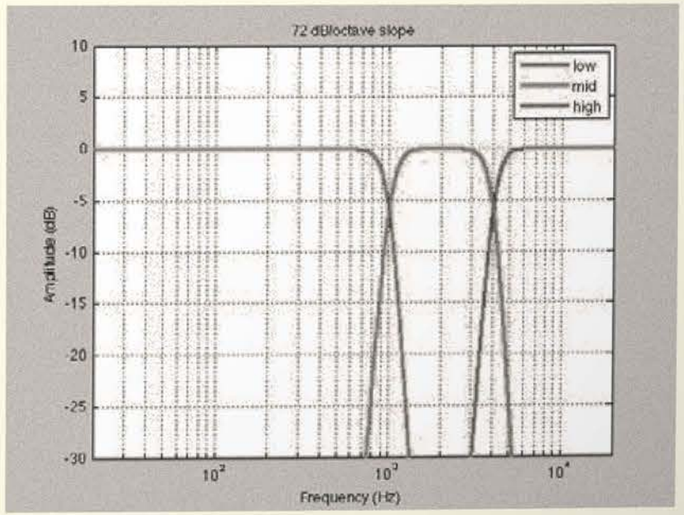
Signal Path

a. Slope

24 dB, 48 dB, and 72 dB/octave slopes are created by 4th, 8th, and 12th-order Linkwitz-Riley crossover networks.







VII. Credits

Your Yoko experience is brought to you by the three audio scientists at Unfiltered Audio:

Joshua Dickinson
Michael Hetrick
Ryan McGee

Manufactured in Santa Barbara, California, USA.