



Macropod Variable Bandwidth VCF User's Manual - 4U
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Hello and thank you for using the Macropod Variable Bandwidth VCF for 4U modular. We hope you will find its tones most pleasing!

Technical Specifications (4U, Loudest Warning standard)

Width: 2"

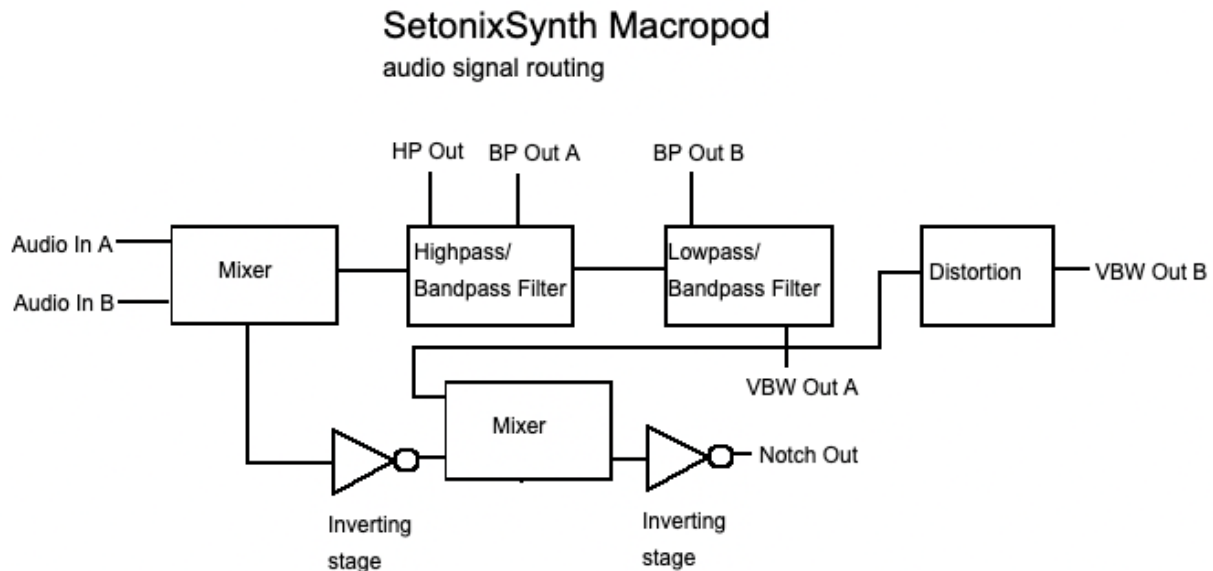
Depth: 25mm

Peak Current Draw: 48mA @ +12V, 48mA @ -12V

1. Connecting your Macropod

Connect a power cable to the MTA-156 header at the top of the Macropod pcb. The +12V side of the connector must be aligned with the silkscreen indicator that says "+12V" for proper use. This module is reverse diode protected, but it is still not recommended that you plug it in backwards to see what happens.

2. Theory of Operation



Macropod signal routing, simplified

This module uses the AS3350 Dual VCF chip, a reissue of the CEM3350 designed by Doug Curtis and used in a few 80s synthesizers. This is our second design using this IC, coming after the Marsupial Dual VCF for Eurorack. While that design highlights the chip's rich sound and resonant characteristics, the Macropod leverages its versatility to create a space-friendly and highly-functional Variable Bandwidth VCF with several features previously excluded from the two best-known filters of this type (the Serge VCF2 and Buchla 291): Resonance control, onboard Notch output, and a "squared-off" distorted output.

In this design, a two-channel audio mixer sums Audio In A and Audio In B and routes the mix to half of the chip, which is configured in High Pass/Band Pass mode. These two outputs are directly accessible. The High Pass output is then routed to the input of the chip's other half, configured as a Low Pass/Band Pass

filter. This filter's Low Pass output creates our Variable Bandwidth A output via the master Bandwidth control, which introduces an inverted voltage to both filters to control their distance from the center Cutoff (e.g. a positive voltage input to the Bandwidth CV jack will simultaneously increase the cutoff frequency of the Low Pass Filter section and decrease the cutoff frequency of the High Pass Filter section in equal amounts).

This filter takes the concept further, however! In traditional filtering, summing a phase-inverted Band Pass signal with the filter input creates a Notch filter, and the concept works well with this filter's Variable Bandwidth output. In this case, the inverted input is summed with the regular Variable Bandwidth A output and then the mix is inverted again; this nominally produces a Notch output which is in phase with the input.

We also added a transistor-based switching circuit through which the Variable Bandwidth A signal is routed, which creates the Variable Bandwidth B output. This output is lovely for creating electric guitar or bowed cello sounds, or can approximate the sound of Pulse-Width Modulation in some configurations. This function was inspired by the lovely aggressive sounds of the bottom section of the Serge Wave Multipliers module, though with a different circuit.

3. Summary of Functions

Cutoff: Sets the central frequency of the filter relative to the cutoffs of each filter section.

Bandwidth: Manual control of the Bandwidth of Variable Bandwidth A and B where CW = greater bandwidth up to approx. 12 octaves at Maximum setting.

Freq Atten: Attenuverter for the Frequency CV input, where center = 0 Modulation, CCW = Inverse modulation and CW = Regular modulation.

BW CV Atten: Attenuverter for the Bandwidth CV input, where center = 0 Modulation, CCW = Inverse modulation and CW = Regular modulation.

Freq CV: Input for Cutoff Frequency CV. Amount is controlled by the knob labeled "Freq Atten."

BW CV: Input for Bandwidth CV. Amount is controlled by the knob labeled "BW CV Atten."

1V/Oct ↑: Un-attenuated CV input which controls the cutoff of the High Pass filter section.

1V/Oct ↓: Un-attenuated CV input which controls the cutoff of the High Pass filter section.

Audio In A: Audio Input with gain controllable via the "In A Gain" knob up to 1.5x gain. Audio from this input is mixed with Audio In B after gain processing and before the filter stages.

In A Gain: Controls the Gain of Audio In A up to 1.5x the original gain. Ideal for feedback patching.

Audio In B: Unity-gain Audio input. Audio from this input is mixed with Audio In B before filter stages.

HP Out: 12dB/Oct High Pass Filter output. The cutoff of this output is controlled by the master Cutoff Frequency, Bandwidth, and 1V/Oct ↑ controls.

Resonance: Controls the Resonance/Q setting of both filters simultaneously.

BP Out A: Output of the first Band Pass Filter. The central frequency of this filter output is the same as HP Out and Bandwidth can not be varied.

BP Out B: Output of the second Band Pass Filter. The central frequency of this filter output is the same as the Low Pass Filter which forms the final stage of the Variable Bandwidth A output, and can be controlled directly via the 1V/Oct ↓ control input.

Notch Out: Output of the Notch Pass Filter, produced by summing the Variable Bandwidth A output with the inverted Audio input post-Mixer section. This output will cancel the phase of frequencies within the bandwidth of the Variable Bandwidth A output effectively with Resonance turned fully CCW, while boosting those frequencies more and more as Resonance setting is increased.

VBW Out A: Output for the Low Pass Filter, which is filtering the output of the other filter section's High Pass Filter to form a filter topology with Variable Bandwidth. Use this output for "clean" processing of the input signal.

VBW Out B: Created by routing Variable Bandwidth Out A through a single-transistor clipping stage with AC Coupled output. The base of the transistor needs approximately 0.7V input to activate, so lower Bandwidth or Cutoff frequency settings which produce a quiet output may cause this output to "mute" until the voltage threshold is reached.

4. Calibration

Calibration of the Macropod is simple and should be done by ear. Patch a triangle-wave VCO within the audible frequency range (probably 1kHz or so is best) into "Audio In B" and turn the Resonance control fully CW. Monitor VBW Out A and adjust the rear trimpot until maximum Resonance doesn't cause self-oscillation (added frequencies besides the input). However, if you like the way the self-oscillation sounds, turn up the trimmer and go with it!

5. Patch Ideas

"Extra-Grit Variable Bandwidth"

Patch Input Audio to "Audio In B" and patch VBW Out A to "Audio In A", then monitor a different output of the filter. Use "In A Gain" to add an adjustable amount of distortion to the input signal pre-filter.

"Extra Resonance"

Patch BP A or BP B outputs into "Audio In A" and input signal to "Audio In B". Use the "In A Gain" control to dial in extra resonance of a flavor dependent on the output used for feedback.

"Heavy Metal Guitar"

Turn the Bandwidth control fully CCW and send any waveform to any audio input. Send an envelope or gate pulse to BW CV and Attenuate to taste. Monitor VBW Out B to create a chunky, palm-muted like sound.

These are but three patch ideas, and a thorough exploration of the Macropod can surely yield many more.