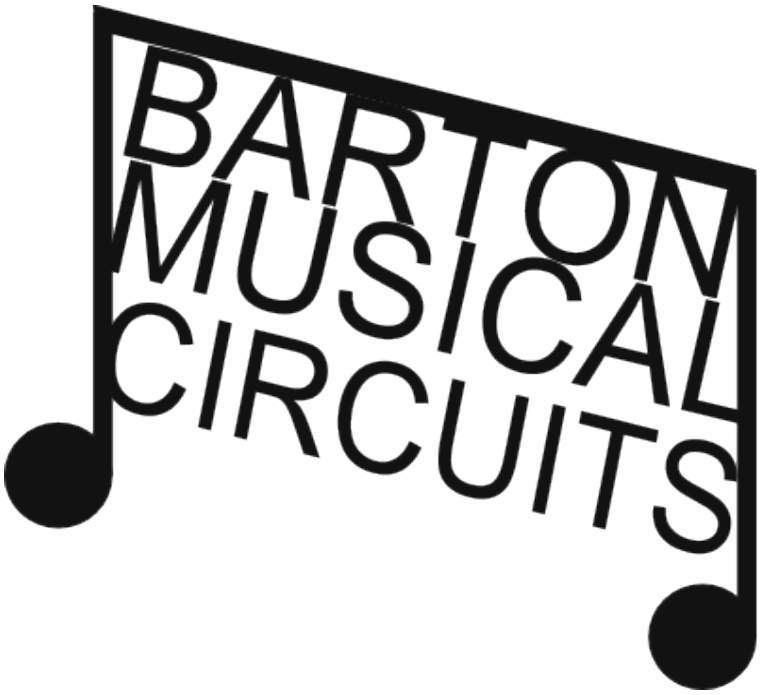


BMC091. 10 Band Equalizer

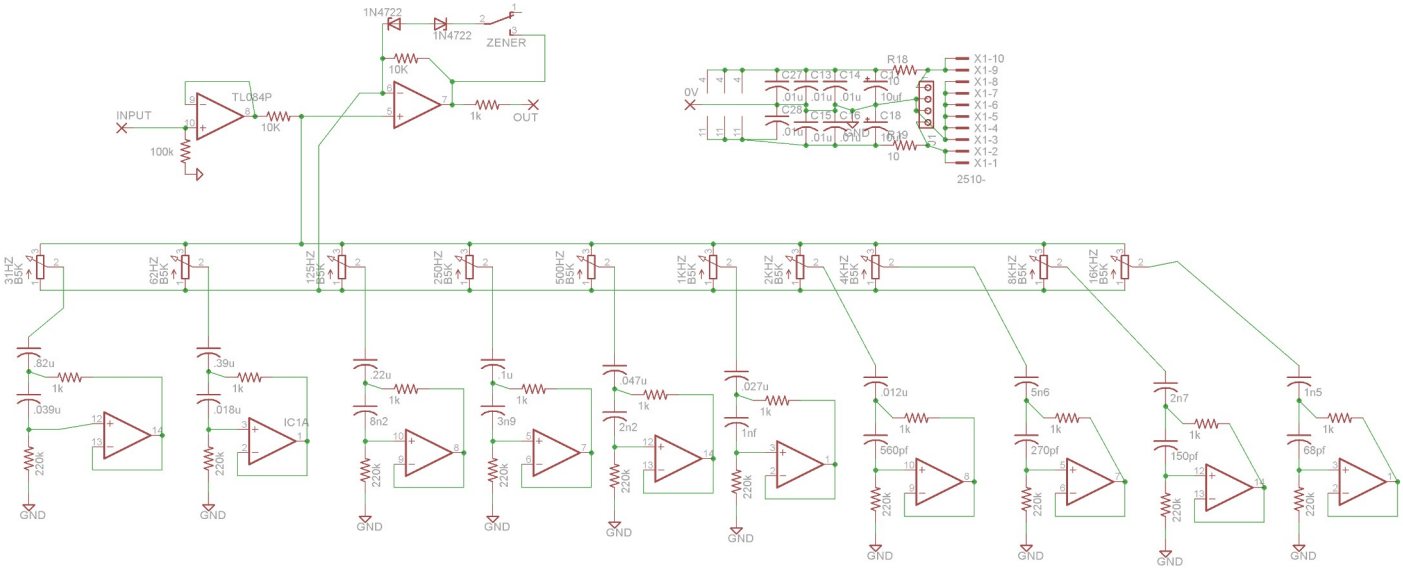
If you have any questions, or need help trouble shooting, please e-mail
Michael@Bartonmusicalcircuits.com

UPDATE: Typo on board, the part labeled “1N4722” should be a “1N4733”

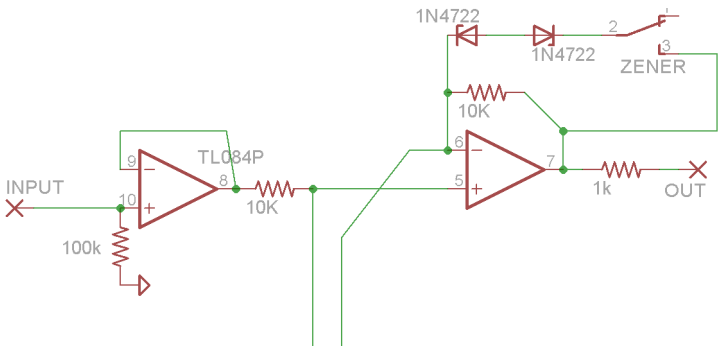
I. What it Does

This module is a 10-band equalizer, or fixed bandpass filter bank. Center frequencies are spaced one octave apart each ranging from 31hz to 16khz, and have 12 decibels of cut or boost per bank. The equalizer features a toggle to engage zener diodes in the output section to help limit the output to the +/-5V range that's normal for modular synths. This also provides harmonic distortion and creates a "saturation" effect.

II. Schematic

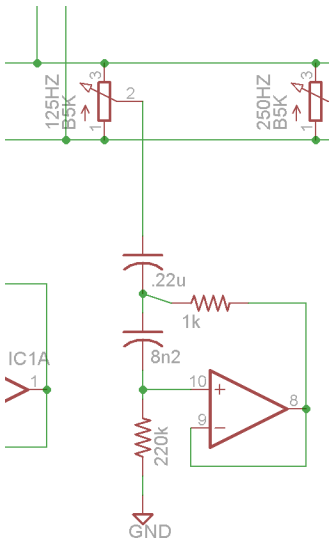


Above is the full schematic for this project for reference. There is a simple In/Out section and then repeating filter sections.



Above is the In/Out section. Audio is input and then sent to an op-amp buffer, the output of the buffer is then sent to the non-inverting input of the output op-amp, as well as to an outside lug of the filter pots. The output op-amp has a 10K resistor in it's feedback path as well as a pair of back to back zener diodes that can be switched in our out with a toggle. The negative input of the op-amp connects to the other outside lug of the filter pots.

If you ignore the connections to the filters, this circuit would simply be a non-inverting amplifier with a gain of ~1, and when the filter knobs are all at center this is how the circuit acts. But when a filter knob is turned clockwise, it increases the resistance to the non-inverting input of the output op-amp and decreases resistance to the inverting input. This creates an increase of that frequency on the output as the negative feedback is reduced at that frequency and there's less filtering at the positive input. When the knob is turned the other way, the opposite happens. More of the frequency is filtered out before it gets to the output op-amp and negative feedback at that frequncy is increased at the inverting input.



Above is the closeup of a filter section. Each filter section uses the same resistor values, but different capacitor sections. The wiper of each pot connects to a large capacitor that connects to a 1K resistor and a smaller cap. The smaller cap connects to a 220K resistor and then to an op-amp wired as a buffer. This arrangement is used to simulate an inductor as would have been used in older equalization circuits.

III Construction
A.PARTS LIST

SEMICONDUCTORS

Name/Value	QTY	Notes
TL084	3	14 pin DIP package. Will work with other op-amps, but I had better response in the upper frequency bands using the 84
1N4733 Zener Diode	2	Typo on PCB, marked as 1N4722! Other Zener diodes of voltage around 5V will work like 1N4732

RESISTORS

Name/Value	QTY	Notes
10 ohms	2	All resistors 1/4W metal film except potentiometers
1K	11	
10K	2	
100K	1	
220K	10	
B5K PC Mounted Pot	10	9mm parallel mount. Like these

CAPACITORS

Name/Value	QTY	Notes
68pf	1	Ceramic Disc
150pf	1	Ceramic Disc
270pf	1	Ceramic Disc

560pf	1	Ceramic Disc
0.01uf	6	Ceramic Disc
1nf	1	Film cap
1.5nf	1	Film cap
2.2nf	1	Film cap
2.7nf	1	Film cap
3.9nf	1	Film cap
5.6nf	1	Film cap
8.2nf	1	Film cap
0.012uf	1	Film cap
0.018uf	1	Film cap
0.027uf	1	Film cap
0.039uf	1	Film cap
0.047uf	1	Film cap
0.1uf	1	Film cap
0.22uf	1	Film cap
0.39uf	1	Film cap
0.82uf	1	Film cap
10uf	2	Electrolytic cap

OTHER

Name/Value	QTY	Notes
SPDT Toggle	1	
14 pin DIP socket	3	
Power connecter	1	MOTM or Eurorack style
Jacks	2	

B. THE BOARD

The PCB is 95mm x 47mm. Vertically the pots are spaced 20.32mm apart and horizontally they're spaced 31.75mm apart.

When building the module, it's recommended to solder all components to the top of the board (resistors, capacitors, etc) and then solder just one lug of each pot/switch on the other side. Then after affixing the PCB to the panel, finish soldering the toggle and pots.

Wiring for this project is simple enough that no diagram should be necessary. Wirepads should be wired as follows
Connect 0V to the sleeve of the input jack.
Connect INPUT to the tip of the input jack.
Connect OUT to the tip of the output jack.

Below is an image of the PCB with traces to use when troubleshooting, and below is a close up of the wiring.