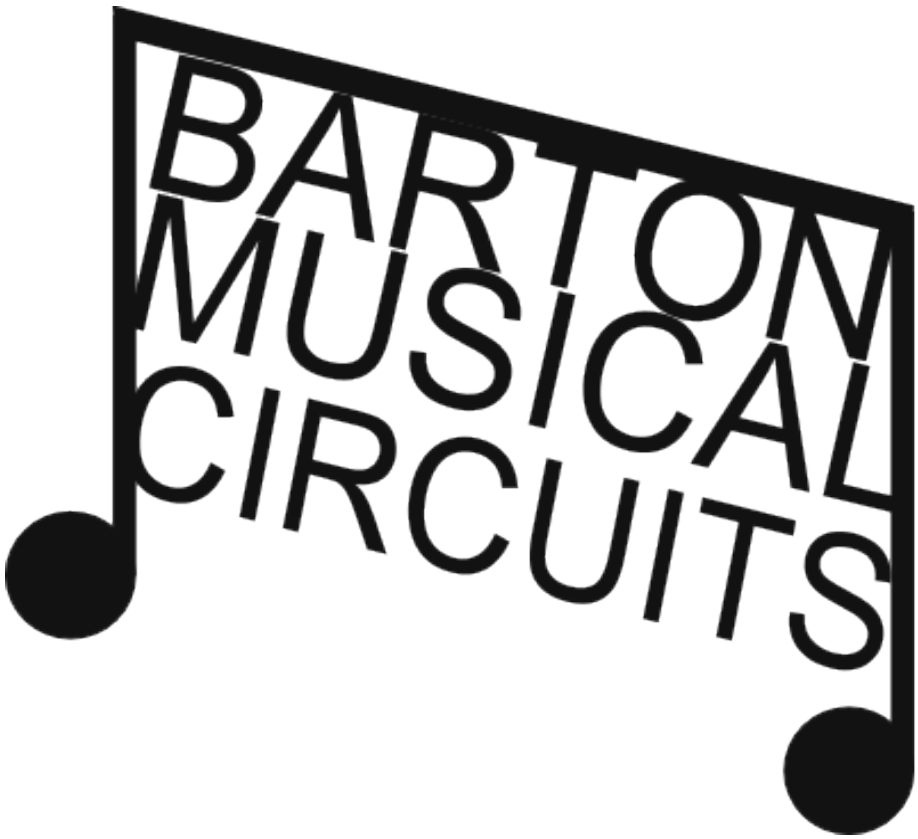

BMC 094. Trimmed Balanced Outs Build Documentation.

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III. Construction
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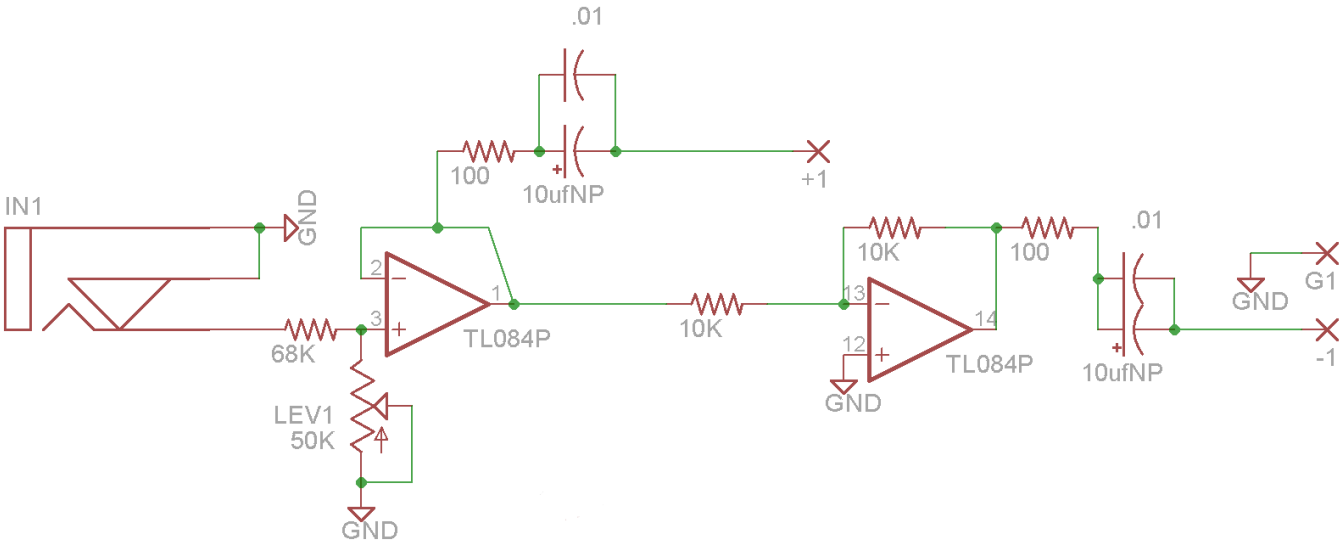
I. Using The Module.

This module is an alternative to BMC47 Balanced Outs. It is an 8 channel balanced outputs module with trimmer pots setting the output level and no output jacks on the front panel. This greatly reduces the amount of front panel space the module takes up, but requires careful planning with your overall modular system to use.

The PCB has two versions, one version has wirepads for the outputs so the module can be wired to output jacks on the back panel of the modular case and the other version has a DB-25 connector (Tascam pinout) so a single cable can connect all the outputs to your interface or mixer. I'm using it in my home studio with a Hosa DB25 to 8xFemale XLR snake to connect to my audio interface.

The PCB has attached Eurorack jacks, but also has a 15V style power connector and mounting holes so it can be used in other formats.



II. Schematic.

Above is the schematic for a single channel. This is repeated 8 times. This schematic shows wirepads for the outputs, on the DB-25 PCB these would instead connect to the appropriate pin of the connector.

Input signal is attenuated by a 68K resistor and 50K trimpot* forming a voltage divider. This attenuated signal is buffered by a TL084 op-amp and sent to the positive output through a 100 ohm resistor and a 10uf/.01uf capacitor pair in parallel with each other. The 10uf passes low frequencies easily and the .01uf helps it pass higher frequencies more efficiently.

The buffer also sends its signal to an inverting op-amp with it's gain set to -1 by a pair of 10K resistors. The inverter's output is sent to the negative output through the same network of 100 ohm resistor and .01 / 10uf capacitors.

The power connections aren't shown, but each TL084 has .01uf capacitors next to the power pins to help filter out high frequences in the power supplies, and the positive and negative power rails are filtered by a 10ohm/10uf passive low pass filter.

III. Construction

A. Parts List

Semiconductors

Value	Quantity	Notes
TL084	4	14 pin DIP.

Resistors

Value	Quantity	Notes
10 ohm	2	1/4W Metal film
100 ohm	16	
10K ohm	16	
68K ohm	8	
50K ohm Trimpot	8	3296W package. This value can be lowered to 10K if being connector to Mic pre-amp level inputs. This will make calibration easier.

Capacitors

Value	Quantity	Notes
.01uf ceramic	8	Cheap disc, value not critical
.01uf film	16	
10uf Non-polarized	16	Electrolytic. 16V rated, larger voltage rated caps may be too large to fit the board. Caps should be 5mm wide.
10uf polarized	2	

Other/Off Panel

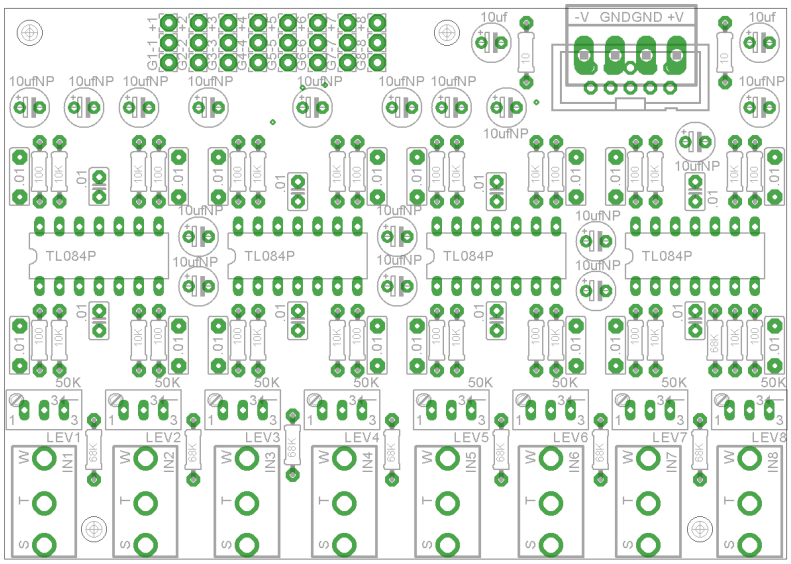
Value	Quantity	Notes
Power connecter	1	Eurorack or MOTM style
3.5mm Jacks	8	Like these
14 pin DIP Socket	4	
Female DB-25 Connector	1	Like this right angle, PC mount. Ignore for wirepad board
Output Jacks	8	XLR or ¼” stereo Jacks. Ignore for DB-25 Board.

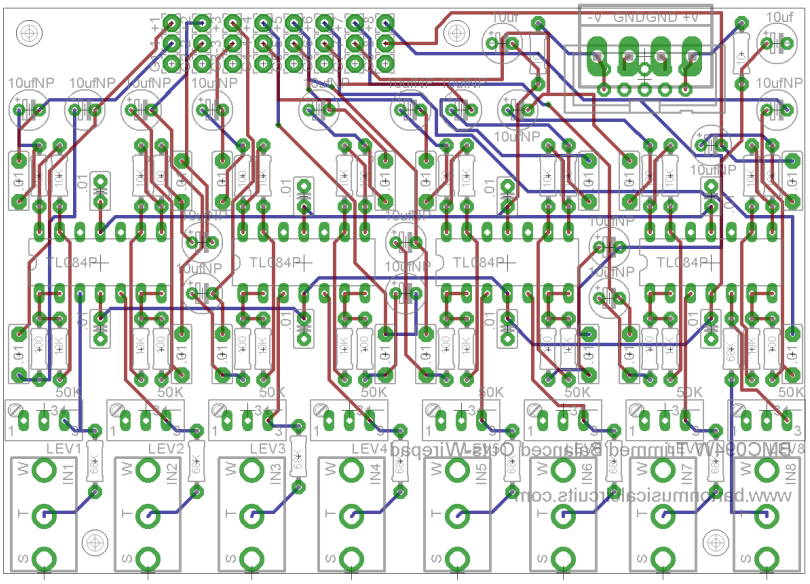
B. PCB Layout

Below are renderings of the PCBs. The rendering showing the traces does not show the ground fill plane, so assume any missing connection is a ground fill.

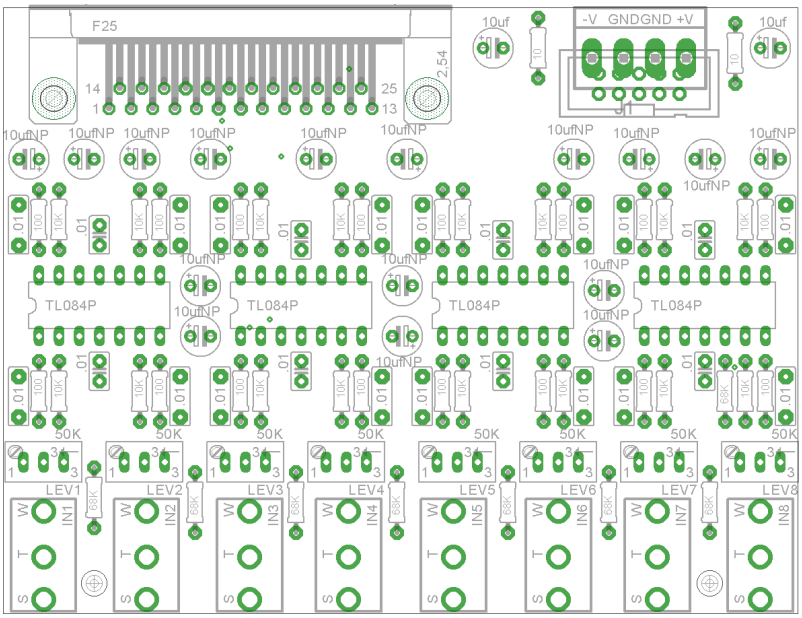
The DB25 PCB measures 100mm x 77mm and the wirepad board measures 100mm x 70mm. The jacks are spaced 13mm apart on both boards, and the mounting holes are 77.5mm apart.

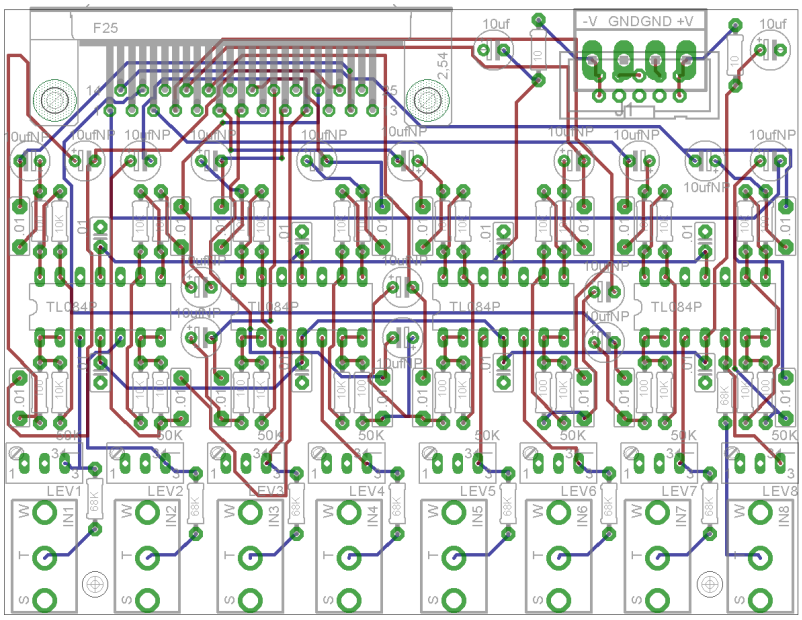
Wirepads PCB





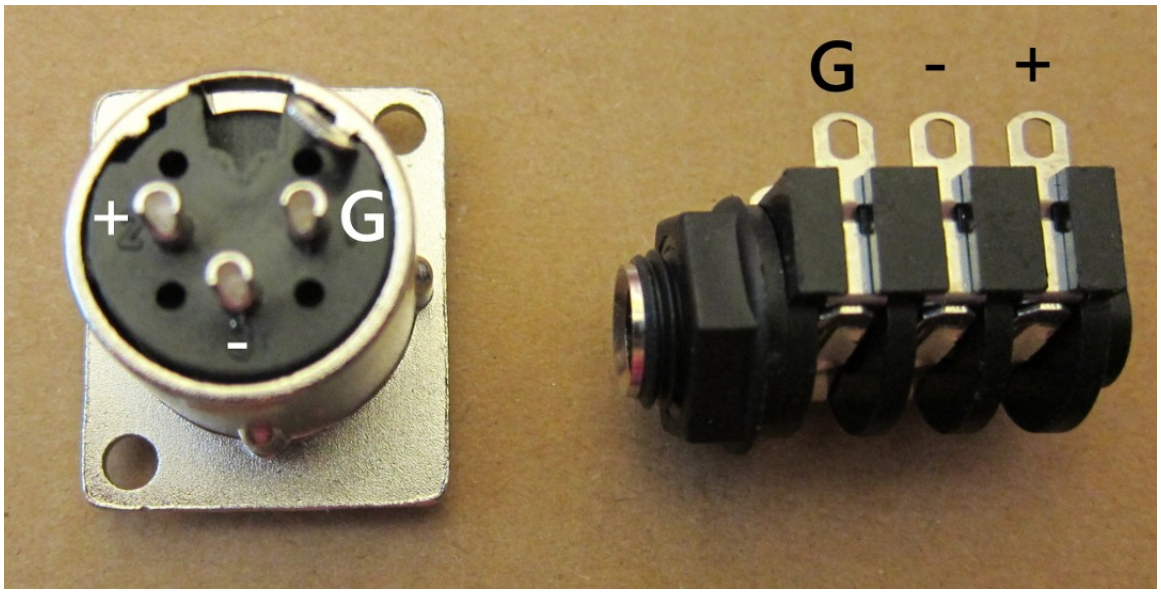
DB25 PCB





C. Wiring.
For the wirepads PCB, each channel has three connections marked G1, -1 and +1 (With "1" being replaced by other numbers for the remaining 7 channels). All G wirepads connect to ground, the – wirepads connect to negative outputs and + wirepads connect to positive outputs.

Below is a diagram of where to connect these wirepads on XLR and ¼" stereo jacks:



For short cable runs (less than a foot) you can use three regular non-shielded hookup wires to connect from the PCB to the jack and twist them tightly together. For longer runs, I'd suggest using shielded cables.

D. Calibration

Step 1. Create a patch that makes the loudest sound you possibly can with your modular system. For me, I output an analog drum through a 10 band EQ that was boosting every band.
Step 2. Patch this to channel 1 input of BMC84, connect output 1 to the first channel on your audio interface.
Step 3. Monitor the volume, either with your interface's built in monitoring or a DAW's input controls.
Step 4. Adjust the LEV1 trimpot until the very loud signal is not clipping the input of your interface.
Step 5. Replace the very loud patch with the output of a VCO. Make a note of what db level it's reaching on the monitoring. This will make it so calibrating the rest of the channels won't require hearing a loud annoying sound.
At this poitn, we have one channel calibrated, the next steps can be done two different ways.
Method 1, faster if slight differences in channel level aren't important:
Step 6. Patch the VCO signal into channel 2 input instead of channel 1. Connect output 2 to the second channel of your audio interface.
Step 7. Adjust the LEV2 trimpot until the db level is the same as it was on channel 1.
Step 8. Repeat Steps 6 and 7 for channels 3-8.

Method 2, better matching of channel output level:

Step 6.Patch the VCO into a buffer and send it to both channel 2 and channel 1 inputs on BMC84. In your DAW, invert the phase of channel 1. Connect output 2 to the second channel of your audio interface.
Step 7. Adjust the LEV2 trimpot until the out of phase signal in channel 1 and in phase signal from channel 2 cancel each other out. This is called a null.
Step 8. Move the patch cable going to channel 2 input over to channel 3. Connect output 3 to the third channel of the audio interface.
Step 9. Repeat steps 7 and 8 for channels 3-8.