BMC15 Quad Mix/VCA
Last edited April 13 2024
This documentation covers PCB version 4.1 (w/SMD footprint for 13700) and version 3.1 (w/through hole footprint for 13700).

This module contains 4 VCA circuits normalled into a 4 channel mixer. VCAs can be used individually and their outputs are automatically removed from the mixer. Each VCA has an attenuator for CV, when no CV is input a +5V supply is normalled in, so it can be used as a 4 channel mixer without having to use external voltage sources.

PCB Changes in REV 4.1:
1. Changed resistor value in CV reject circuit for easier calibration.

REVISION 4 Documentation here.

1. Parts List

Semiconductors:

Name	Quantity	Notes
LM13700	2	SOIC Package for Rev 4.1 board, DIP package for Rev 3.1
TL074	2	
TL072	1	
2N3906	4	
7805	1	For Rev 4.1 use 78L05 TO-92 package, for Rev 3.1 use TO-220 package
1n4148	4	

Resistors:

Name	Quantity	Notes
10 ohm	6	5mm package
470 ohm	4	On Rev 3.1 board some are marked as 10 ohm, see page 8
1K ohm	4	
10K ohm	4	
47K	1	
100K	30	On Rev 3.1 board some are marked as 4.7K, see page 8
330K	4	
B100k trimpot	8	
B100k Pot	5	16mm PCB Mounted

Capacitors

Name	Quantity	Notes
10pf	4	ceramic 2.5mm lead spacing
.1uf	10	" "
10uf	2	electrolytic

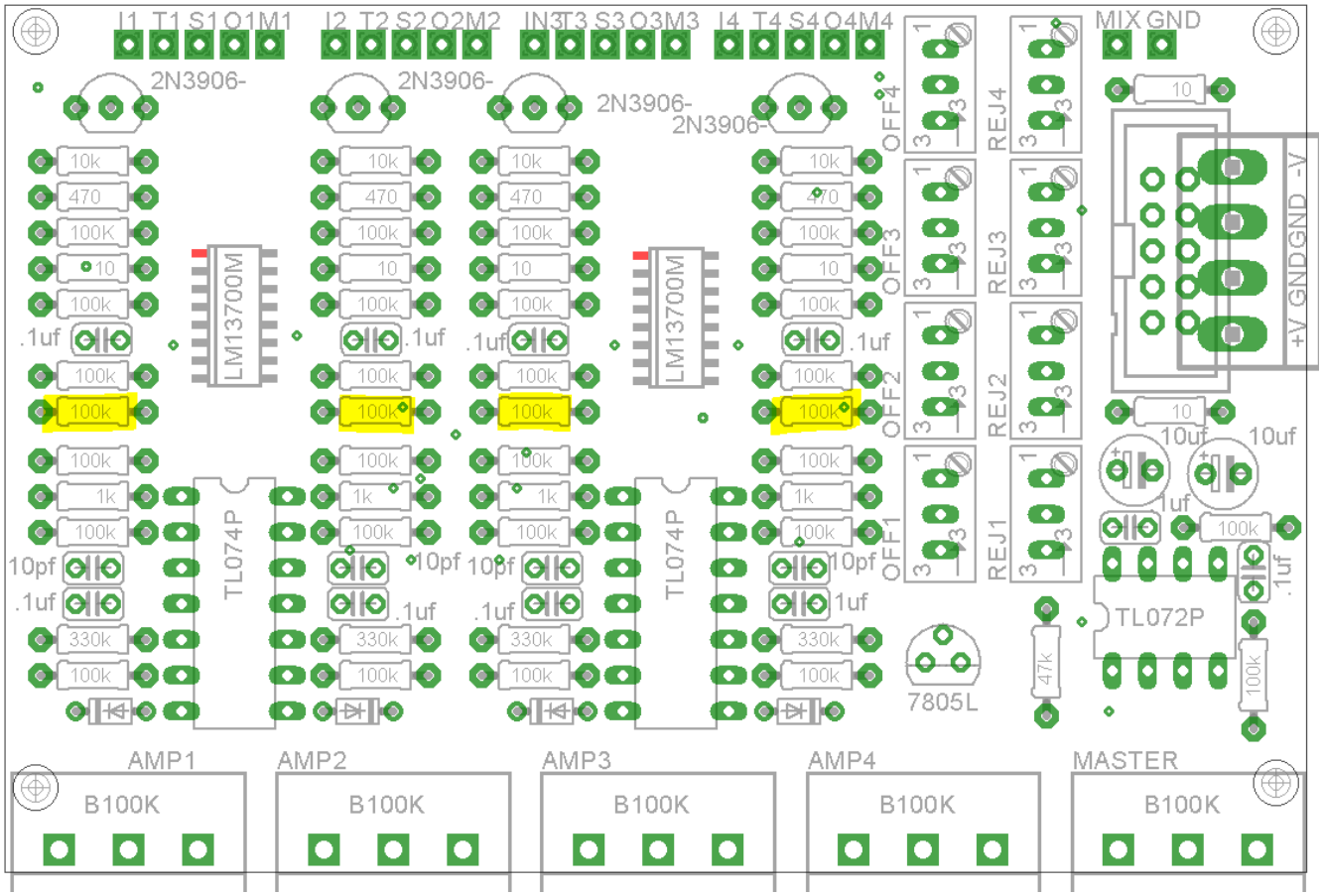
Connecters

Name	Quantity	Notes
DIP8	1	Socket
DIP14	2	Socket
DIP16	2	Socket (Rev 3.1 board only)
Power Connecter	1	MOTM or Eurorack
Switching jacks	13	

2.Board Layout/Wiring Instructions:

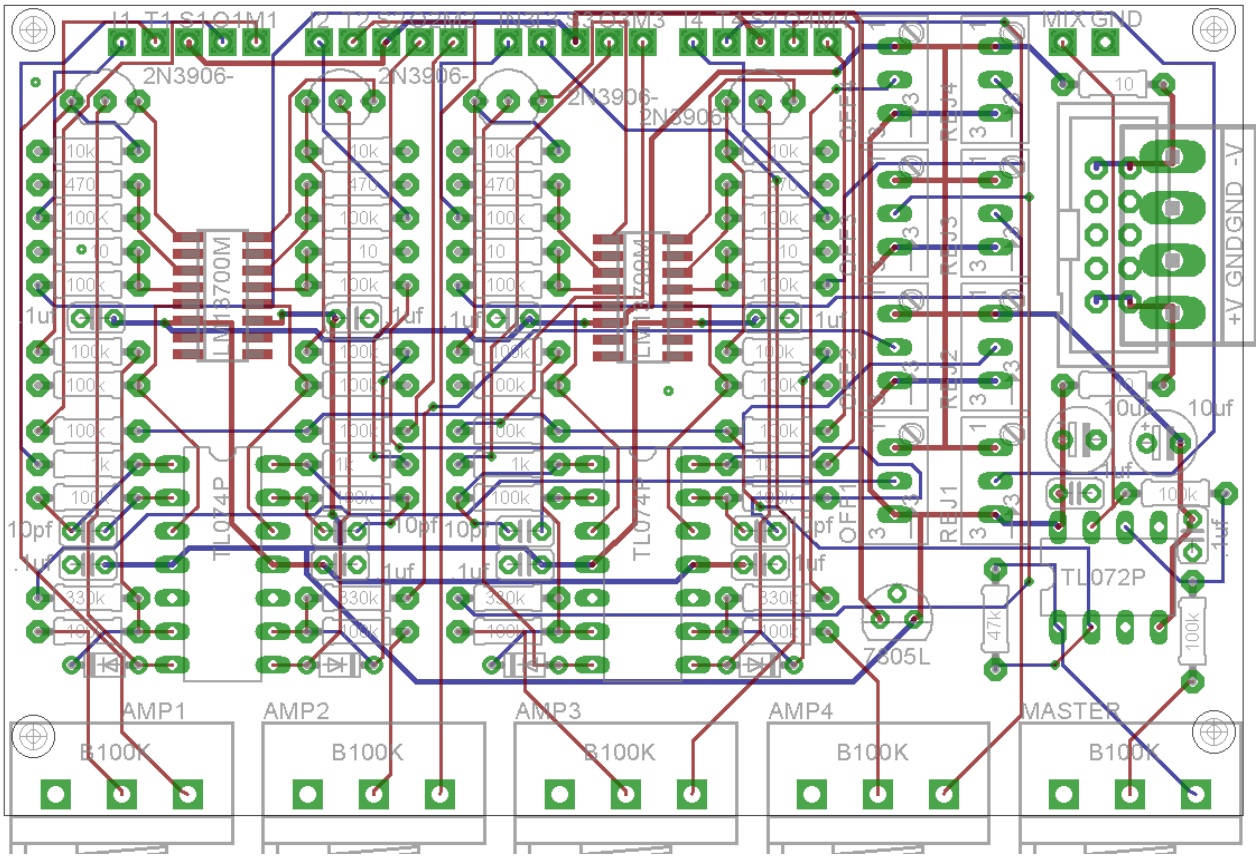
Each channel has 5 wires to be connected.
I should be connected to the tip of the input jack
T should be connected to the tip of the CV jack
S should be connected to the switch of the CV Jack
O should be connected to the tip of the output jack
M should be connected to the switch of the output jack
MIX should be connected to the tip of the mix output jack

To reduce gain to less than 1, replace yellow highlighted resistors with 47K
Pin 1 of the LM13700 is marked in red.



The board's dimensions are 3 and 5/8" by 2 and 3/8" (93mm x 62mm). The pots are spaced at 3/4" distance. The mounting holes are 3 1/2" x 2 1/8" (89mm x 53mm).

To aid in troubleshooting, here is a rendering of the PCB with traces:

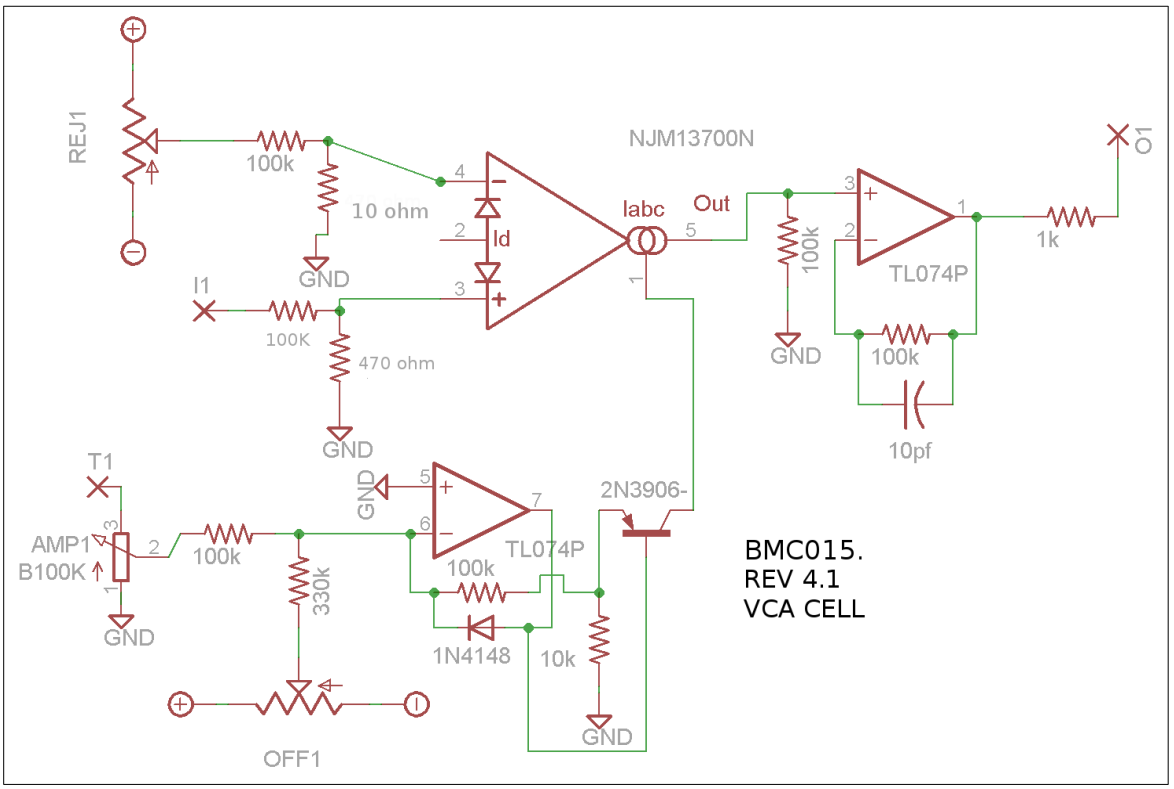


3. Set up.
Each channel has two trimpots that need to be adjusted.

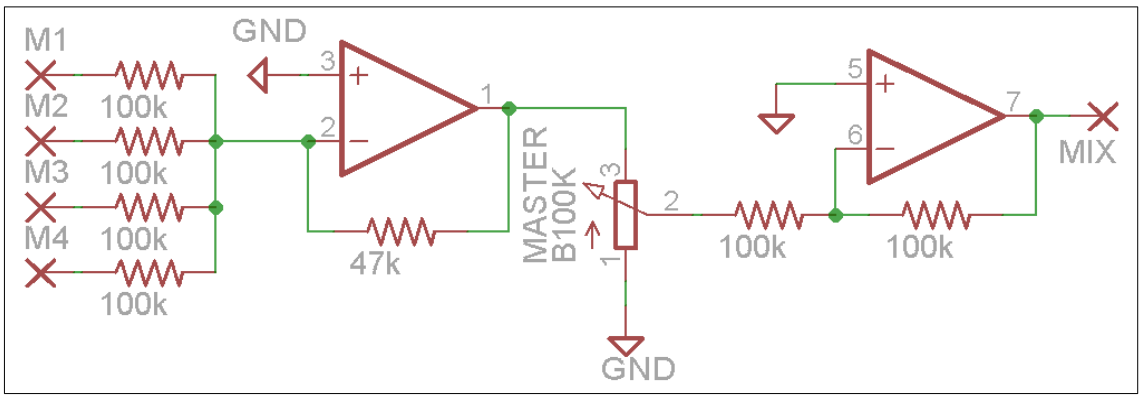
1.Input a square wave from a VCO into the CV jack of a channel and nothing into the input jack. Turn the knob for that channel all the way up. Adjust the "Reject" pot for that channel until you hear the square wave the least.

2.With nothing plugged into the CV jack and a square wave plugged into the input, turn the knob for the channel all the way down. Then adjust the "Offset" trimpot for that channel until you hear nothing.

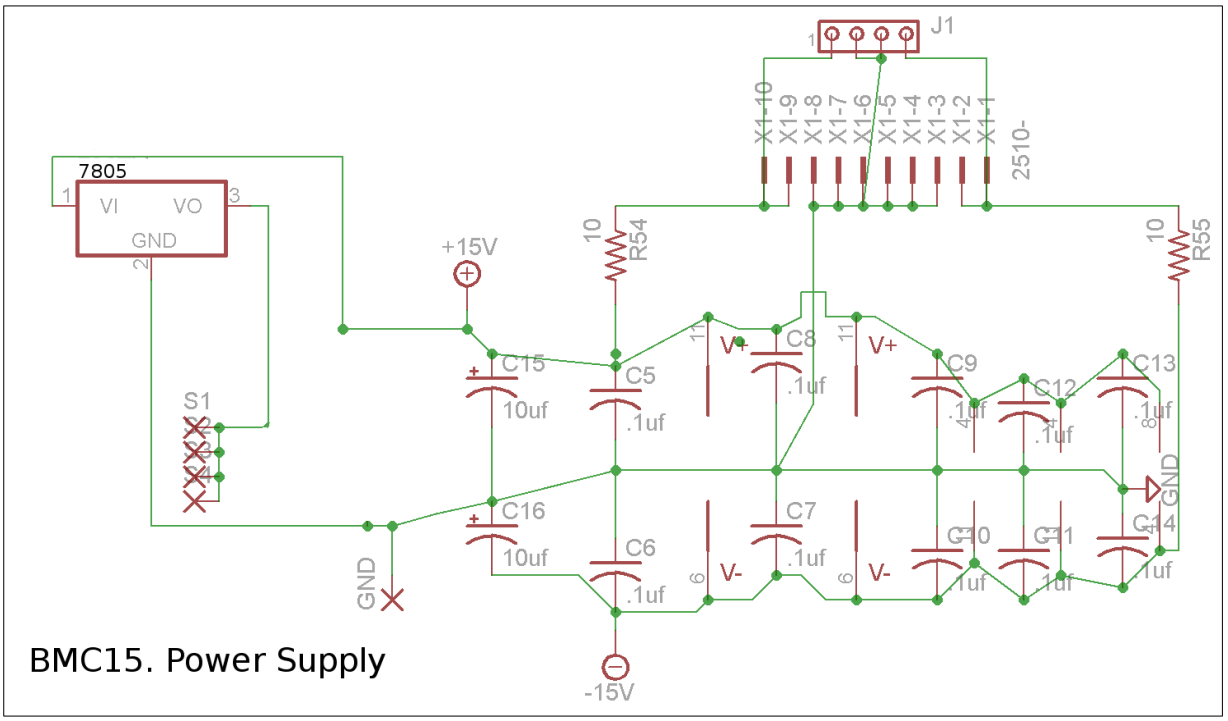
4.Schematics



This section is repeated 4 times, once for each VCA. This topology is a modified version of Thomas Henry's VCA-1 topology available here: http://www.birthofasynth.com/Thomas_Henry/Pages/VCA-1.html (that page also has a link to Magic Smoke where you can buy Thomas Henry's books, which are a great resource for learning about how synthesizers work and I recommend them to anyone reading this.) The most obvious differences between this circuit and the Thomas Henry circuit are a lack of input stage and use of a non-inverting gain stage after the OTA. The cell has gain of a little over 2 using the components shown. To reduce the gain to a little more than 1 replace the 100K attached to pin 3 of the op amp to a 47K, or attach another 100K in parallel with the 100K.

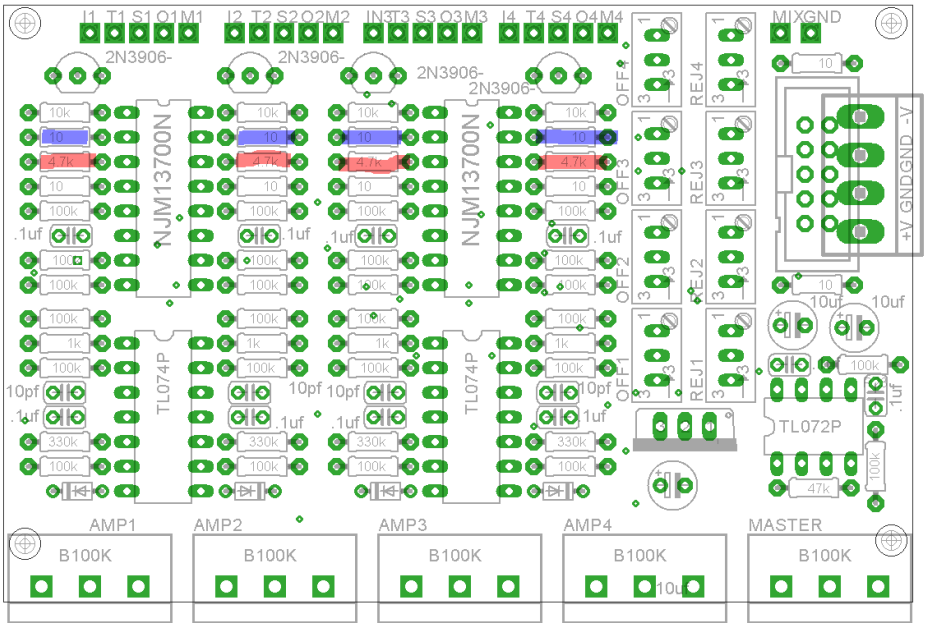


The mixer section just consists of an inverting gain stage that mixes the outputs, an attenuating potentiometer and a unity gain inverting stage.



Finally we see the power supply. On the top are the power connecters. The 10 ohm resistors are used to filter out power supply noise. On the left is a 7805 voltage regulator, this is used to provide a steady 5v reference for normalizing to the CV attenuaters when no input is present. The rest of the schematic just shows the power rails connecting to the ICs supply pins and decoupling caps.

5.Using 3.1PCB with Rev 4.1 values.



Refer to the image above to show which parts to replace
Blue 10 ohm resistors should be replaced with 470 ohm resistors
RED 470K ohms become 100K ohms

Below is an image of the 3.1 board with traces to aid in troubleshooting