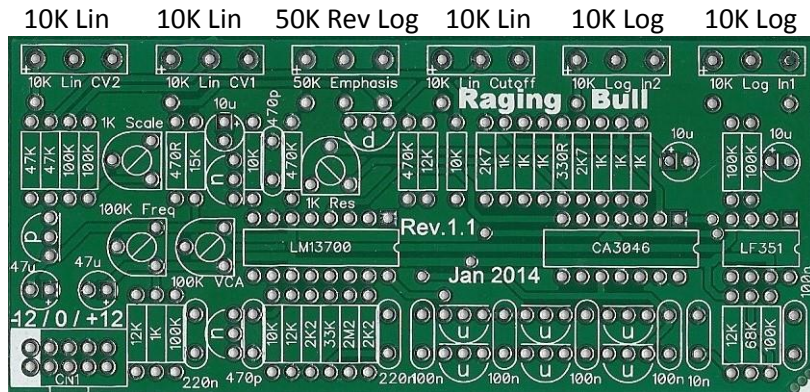# FREQUENCY CENTRAL

Build documentation for:

RAGING BULL

Based on the legendary Moog Taurus Mk I VCF and VCA.

Key to PCB screen print:

n: This signifies NPN BC547 transistors. Note the correct pinout as shown by the half circles.
p: This signifies PNP BC557 transistors. Note the correct pinout as shown by the half circles.

The PCB shows the correct orientation for BC547/BC557. Other transistor types can be used (eg 2N3904/2N3906), but please observe the correct pinout.

Please observe the correct polarity of the electrolytic capacitors.

Gnd: ground connection between PCB and all sockets
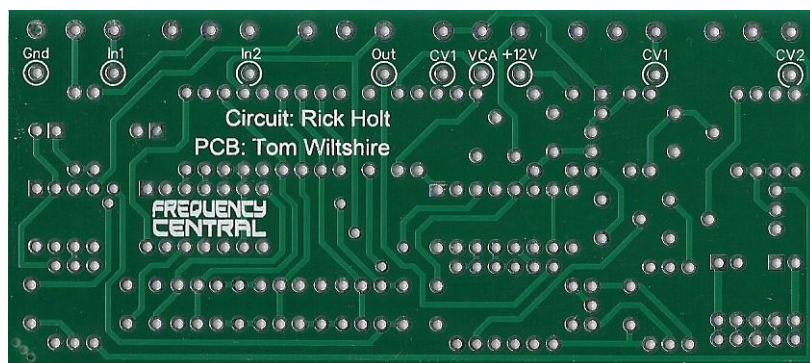**In 1:** wire to Audio1 socket
In 2: wire to Audio2 socket
Out: wire to output socket
CV1, VCA, +12V: wire to VCA CV source select switch
CV1: wire to CV1 socket
CV2: wire to CV2 socket

Bill of Materials

330R x 1	470pF x 2	CA3046	10K Lin x 3
470R x 1	10nF x 1	LF351	10K Log x 2
1K x 7	100nF x 5	LM13700	50K Rev log x 1*
2K2 x 2	220nF x 2	BC547 x 8	
2K7 x 2	10uF electrolytic x 3	BC557 x 2	All pots are Alpha
10K x 3	47uF electrolytic x 2		16mm
12K x 4			
15K x 1			1K trimmer x 2
33K x 1			100K trimmer x 2
47K x 2			
68K x 1			SPDT toggle x 1
100K x 6			
470K x 2			
2M2 x 1			

*The Taurus used a 50K log slider mounted backwards, thus making it reverse log. At a push, you can use Lin or Log, but Rev Log will give the most useful taper.

Tip #1 - don't mix up the 2K2 and 2M2
Tip #2 - don't mix up the 470R and 470K

A big part of the sound of the Taurus was the way in which the VCF interfaced with the VCA, so on Raging Bull the VCA is always in the audio path. A toggle switch allows you to select 'always open' or CV control of the VCA from CV input 1.
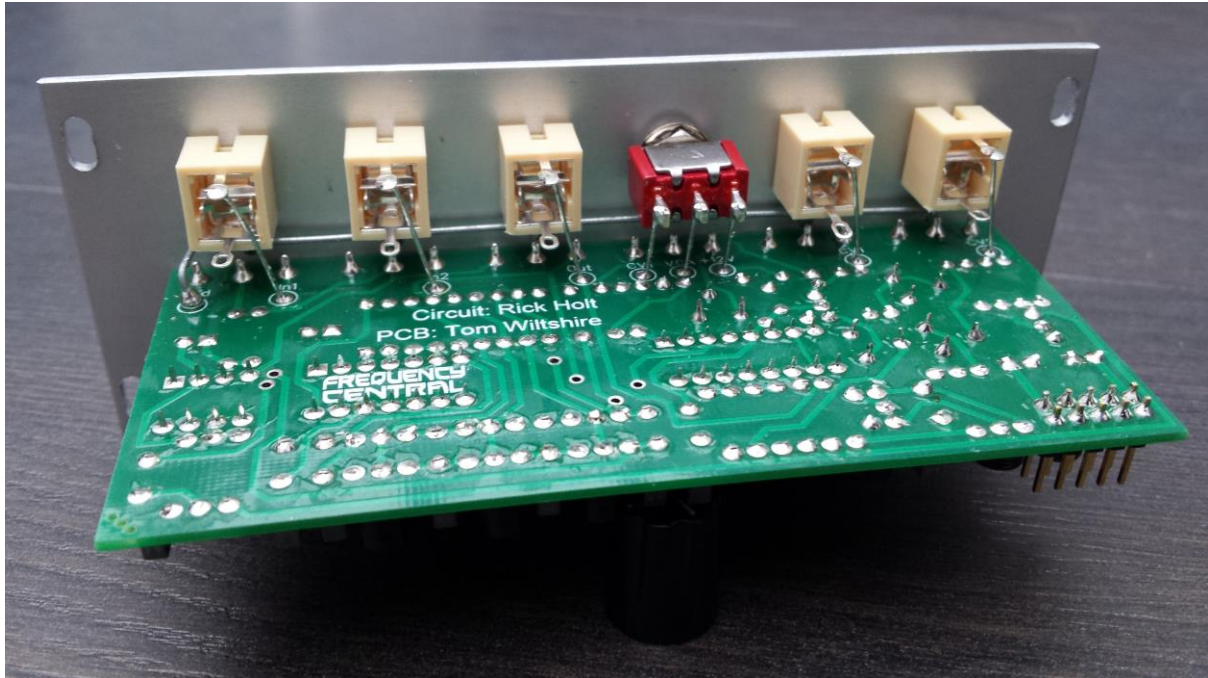
Calibration
1. **VCA trimmer:** flick the toggle switch down, send a nice snappy ADSR into CV1 input. Adjust Bias trimmer to sweet spot, ie there is no DC thump. The chances are that that the sweet spot is around the mid position.
2. **Scale trimmer:** turn Emphasis all the way to self oscillation. Patch a 1V/oct source into CV input 2, with the attenuator fully clockwise. Play octaves and adjust the Scale trimmer until they are spot on.
3. **Freq trimmer:** you want to tweak this so that the filter is fully open when the Cutoff pot is fully clockwise.
4. **Res trimmer:** you can adjust exactly where the Emphasis knob starts to self oscillate. If in doubt, leave this trimmer in it's mid position.

Underside of the PCB showing:
- Ground bus between sockets and PCB
- Connections between inputs/output and PCB
- VCA source select switch connections

I use solid core for all of the above.