

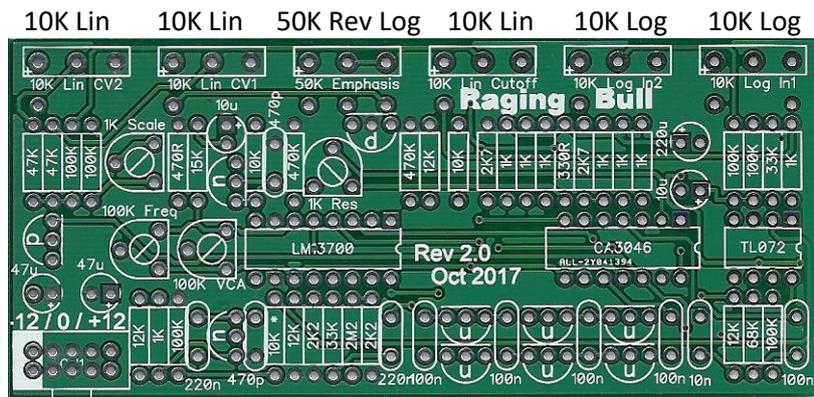
# FREQUENCY CENTRAL

Build documentation for:

## RAGING BULL 2.0

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

- Rev 2.0 PCB uses a TL072 instead of an LF351. The additional opamp stage is use to increase the output level of the module.
- There are also a couple more resistors (1K and 33K) and a 10uF capacitor is replaced with a 220uF capacitor.



### 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	<a href="#">470pF x 2</a>	CA3046 (or UL1111)	<a href="#">10K Lin x 3</a>
470R x 1	<a href="#">10nF x 1</a>	<a href="#">TL072</a>	<a href="#">10K Log x 2</a>
1K x 8	<a href="#">100nF x 5</a>	<a href="#">LM13700</a>	<a href="#">50K Rev log x 1</a>
2K2 x 2	<a href="#">220nF x 2</a>	<a href="#">BC547 x 8</a>	
2K7 x 2	<a href="#">10uF electrolytic x 2</a>	<a href="#">BC557 x 2</a>	<a href="#">1K trimmer x 2</a>
10K x 3	<a href="#">47uF electrolytic x 2</a>		<a href="#">100K trimmer x 2</a>
12K x 4	<a href="#">220uF electrolytic x 1</a>	<a href="#">8 pin socket</a>	
15K x 1		<a href="#">14 pin socket</a>	<a href="#">SPDT toggle x 1</a>
33K x 2		<a href="#">16 pin socket</a>	
47K x 2			<a href="#">3.5mm socket x 5</a>
68K x 1			
100K x 6			<a href="#">Knobs x 6</a>
470K x 2			
2M2 x 1			
<a href="#">All resistors ¼ watt metal film.</a>			

Suggested sources for CA3046: Banzai, Das Musikding, Small Bear, reputable Ebay sellers. Additionally, <http://dsmcz.com/prestashop/en/> sell UL1111 for only £1.53, they are functionally identical to CA3046.

- 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.

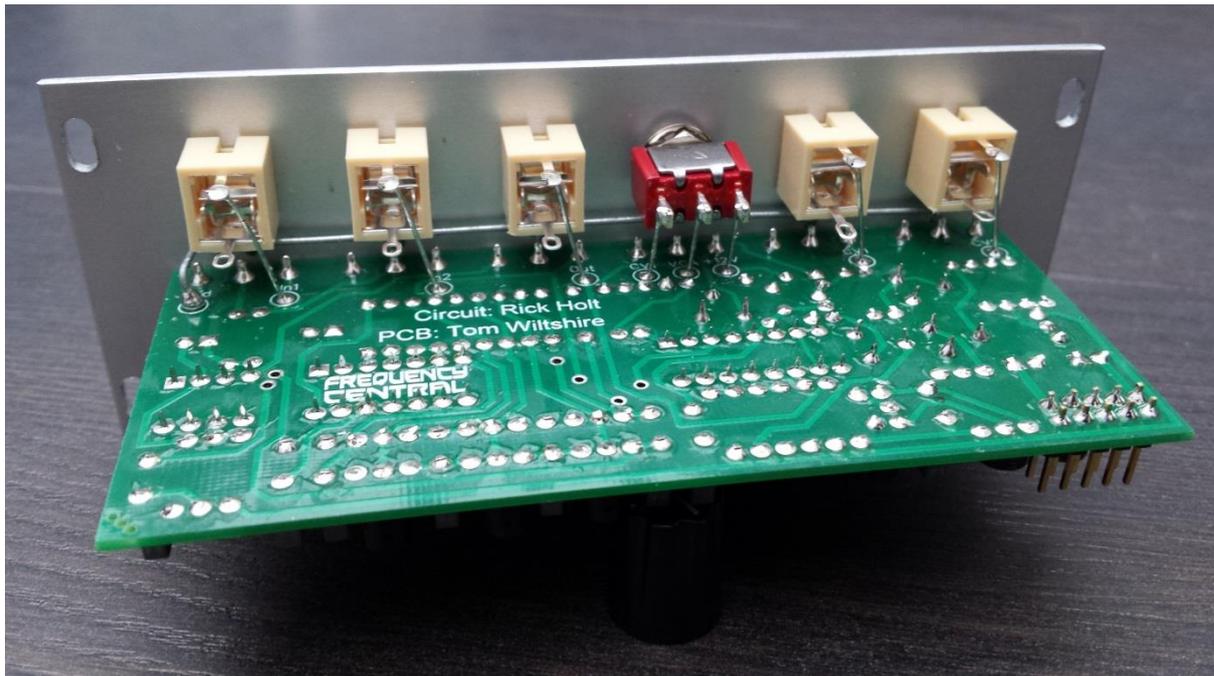
### Calibration

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.



RDH 07/03/18

<http://www.frequencycentral.co.uk/>