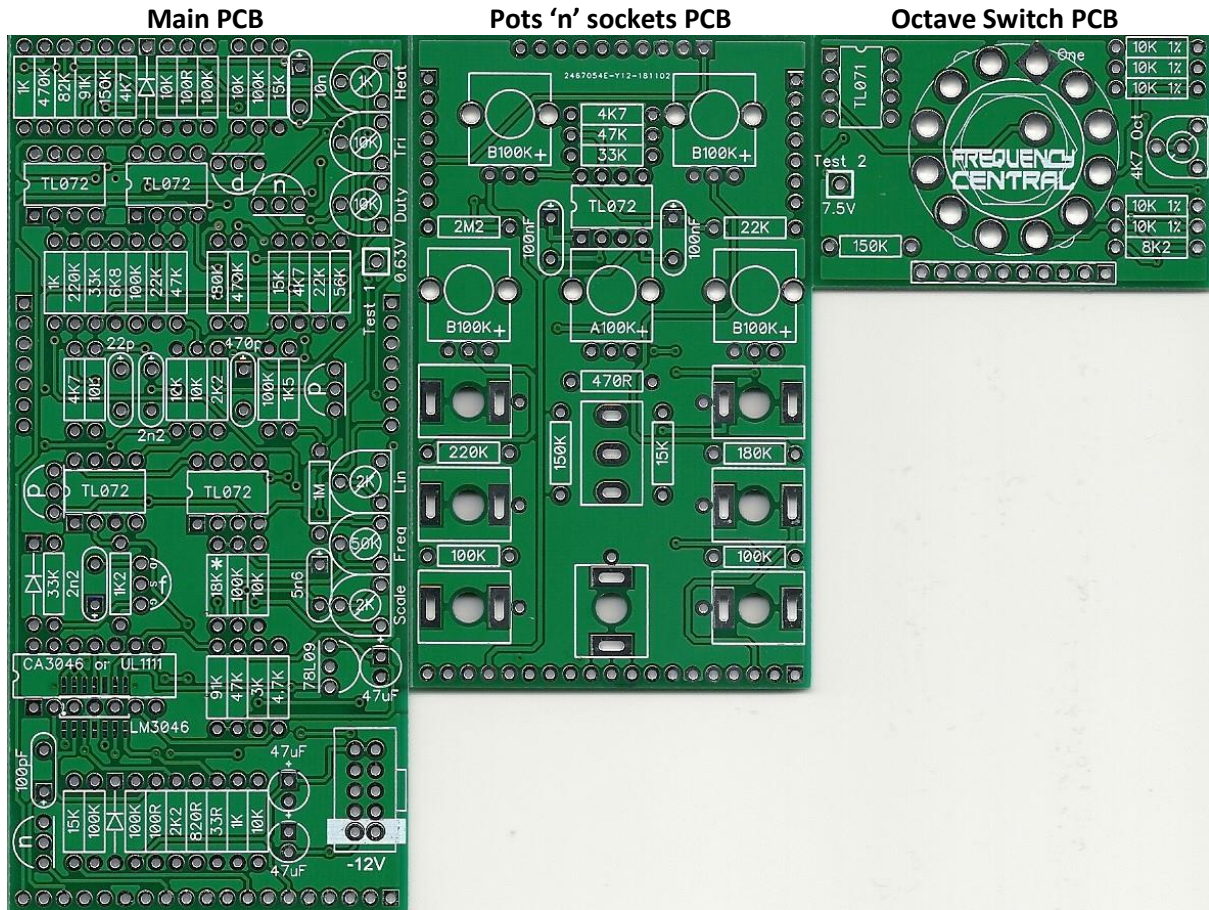# FREQUENCY CENTRAL

Build documentation for:

XVCO TWO

Based on the Roland System 100M VCO, with onboard FM/PWM LFO borrowed from the MC202.

Main PCB   **Pots 'n' sockets PCB**   **Octave Switch PCB**

XVCO TWO features a 3 PCB set:
- Main PCB
- Pots 'n' sockets PCB
- Octave switch PCB

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.
f: This signifies 2N5485 FETs. 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.

Bill of Materials			
33R	22pF x 1	**CA3046***	B100K x 2
100R x 2	100pF x 1		
470R	470pF x 1	TL071 x 1	A100K x 1
820R	2.2nF x 2	TL072 x 5	(or this)****
1K x 3	5.6nF x 1	BC547 x 2	
1k2	10nF x 1	BC557 x 3	B100K x 2
1k5	100nF x 2	2N5485 x 1	(or these)****
2k2 x 2	47uF x 3	78L09 x 1	
3K		1N4148 x 3	1K trimmer x 1
4K7 x 5			2K trimmer x 2*
6K8		14 pin IC socket x 1	4K7 trimmer
8K2		8 pin IC socket x 6	10K trimmer x 2
10K x 7			50K trimmer x 1
10K 1% x 5*			
15K x 4			Rotary switch
18K**			
22K x 3			SPDT toggle x 1
33K x 3			
47K x 3			3.5mm socket x 7
56K			
82K			SPDT switch
91K x 2			
100K x 9			Male 40 pin header
150K x 3			Female 40 pin header
180K x 2			10 pin box header
220K x 2			
470K x 2			Big knob
1M			Little knob x 2
2M2			
All resistors ¼ watt metal film.			

* 10K 1% x 5 These are the five matched resistors for the octave switch voltage divider ladder. They don't have to be 10K exactly, they just have to be matched to each other, so for example if they are all 9.98K that's fine. Grab a bunch of 10K resistors, measure each one, make little piles of 10k, 9.99K, 9.98K etc. Before long one of the piles will have five resistors in it, that's your matched set! Should only take 5 minutes.

** 18K This is the resistor, which along with the Scale trimmer, sets the 1V/octave trim. Marked with an asterisk on the PCB.

*** CA3046 can still be got for some suppliers such as Banzai, Das Musikding, Small Bear and some reputable Ebay sellers. http://dsmcz.com/prestashop/en/ sell UL1111 for only £1.53, they are functionally identical to CA3046. Alfa Rpar will shortly be releasing a CA3046 clone. The PCB also includes pads for SMD LM3046.

**** I prefer the Song Heui tall trimmers because they have a longer shaft and a white notch.

Main PCB assembly

1. Solder all resistors. Tip – don't get 100R and 100K mixed up.

2. Solder all IC sockets

3. Solder all non-electrolytic capacitors

4. Solder all transistors

5. Solder all trimmers

6. Solder the power header – if you're using box type, observe correct polarity

7. Solder all electrolytic capacitors

8. Cut male headers to size and solder them into place. Make sure that they stick out of the bottom of the PCB.
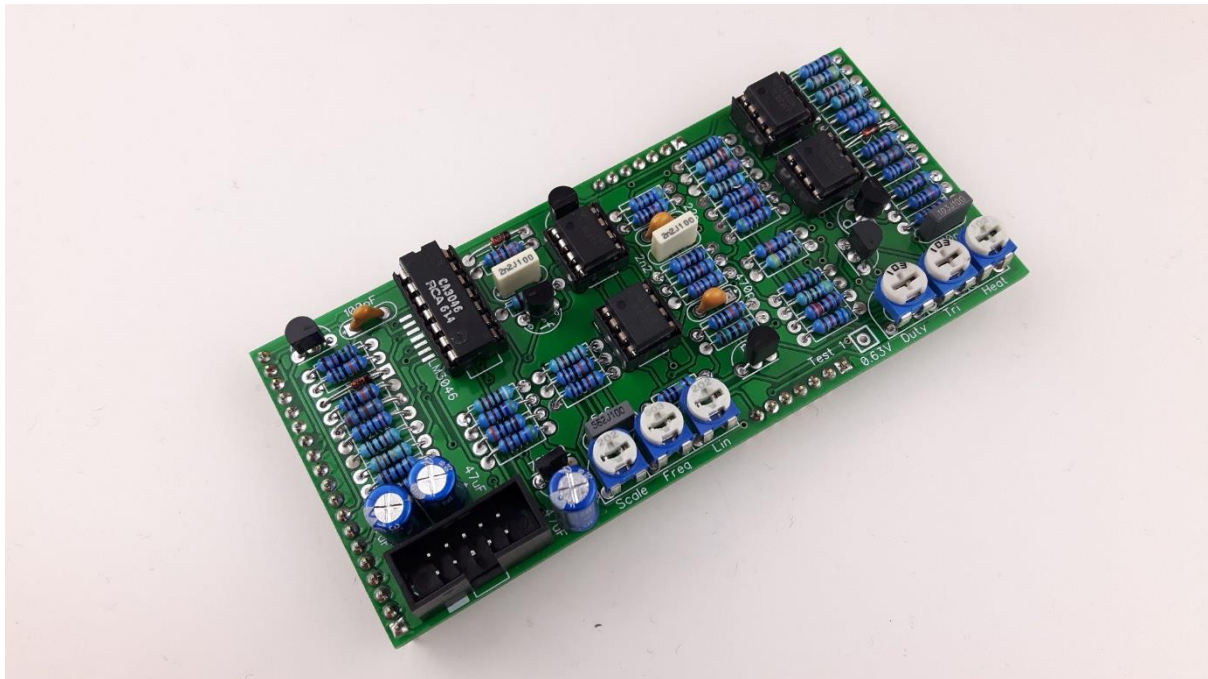
Pots 'n' sockets PCB

1. Solder all resistors

2. Solder the IC socket

3. Solder the two capacitors

4. Place the two metal shaft pots and the switch on the PCB, and fold over the mounting tabs of the pots at the rear of the PCB, then place the panel over them. This will assure that they are correctly positioned. Flip the whole lot over and solder the pots into place.

5. Place all sockets on the PCB, making sure the ground tabs line up with the PCB's ground pads, then place the panel over them. This will assure that the sockets are correctly positioned. Flip the whole lot over and solder the sockets into place. Don't forget to ground the sockets to the PCB using cut off resistor legs.

6. Place the three plastic shaft pots on the PCB, fold over their mounting tabs at the rear of the PCB, then place the panel over them. This will assure that they are correctly positioned. Flip the whole lot over and solder the pots into place.

7. Cut **three female** headers to size and solder them into place. Make sure that they stick out of the bottom of the PCB. **See photo below.**

8. Cut **one male** header to size and solder it in place. Make sure it sticks out of the bottom of the PCB. **See photo below.**
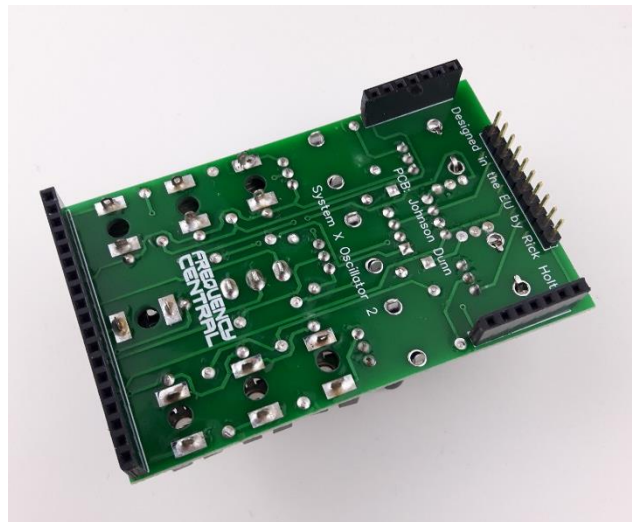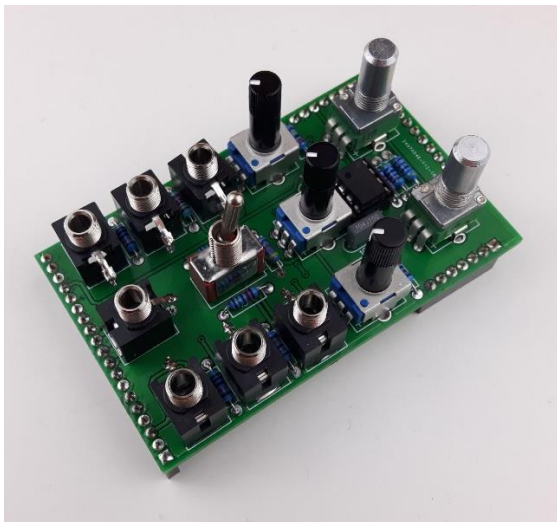
Octave Switch PCB

1. Solder all resistors (see note in BOM section about matching the 10K resistors)

2. Solder the IC socket

3. Solder the trimmer

4. Solder the 1P12T rotary switch. Once you have soldered it in place, snip of the tabs on the solder side of the PCB, this will stop it fouling on the Main PCB once fully assembled.

Final Assembly

1. Mount the Pots 'n' sockets PCB onto the panel. Tighten all mounting nuts.

2. So, the 1P12T rotary switch needs to be adjusted to be a 1P6T rotary switch. Remove the mounting nut and the washer, below them you will find another washer with a small flange at 90°, the inner part of the switch has a number of slots, drop the flange into the slot marked 6, then waggle the switch to make sure you're getting 6 positions.

3. Mount 1P12T rotary switch onto the panel, making sure the relevant padsalso pass through the male header of the Pots 'n' sockets PCB. Tighten the nut. Solder the Octave Switch PCB to the Pots 'n' sockets PCB via the male header. **See photo.**

4. Plug the Main PCB into the Pots 'n' sockets PCB
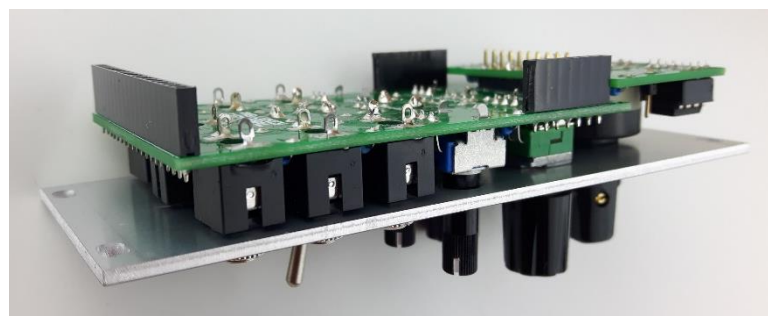
Calibration

- **1K Heat:** Power up the module and adjust this trimmer until you get a reading of 0.63V at **Test 1** next to the Duty trimmer.

- **10K Tri:** This sets up the triangle wave symmetry. As this VCO is sawcore, there is always going to be a very slight spike at the trough of the triangle, that's just science! However, you can use this trimmer to minimise the spike. Optimal position should be pretty close to the centre of the trimmer.

- **10K Duty:** This sets the duty cycle of the square wave, should be just about spot on with the trimmer in the mid position, as I carefully chose associated resistor values to make it so.

- **2K2 Lin:** High end trim. There is a set-up procedure for this in the Roland service manual (pages 5 and 6 of this PDF). It requires the use of a 'scope and a precision reference oscillator. I've built a fair few of these by now, and I've found it tracks very well over 6-7 octaves even before using Roland's set-up procedure for high end trim – if you have a good ear and some patience.

- **50K Freq:** Sets up the initial frequency of the VCO. Optimal should be close to the mid position of the trimmer, but you may adjust to taste.

- **2K Scale:** This trimmer sets the 1V/oct tracking of the VCO, and it's really worth spending some time to get it right. On first power up, the VCO should already be pretty close to 1V/oct with the trimmer in it's mid position, as I carefully chose associated resistor values to make it so. To set it closer, play two notes an octave apart and adjust until it sounds spot on. Then play two notes two octaves apart, and adjust still further until it sounds spot on. If you have a frequency counter, still better!

- **4K7 Octave:** Set the octave switch to it's highest position and adjust trimmer until you get a reading of 7.5V at **Test 2** on the octave rotary switch daughter board.

<div align="right">RDH 22/11/18</div>

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