Build documentation for:

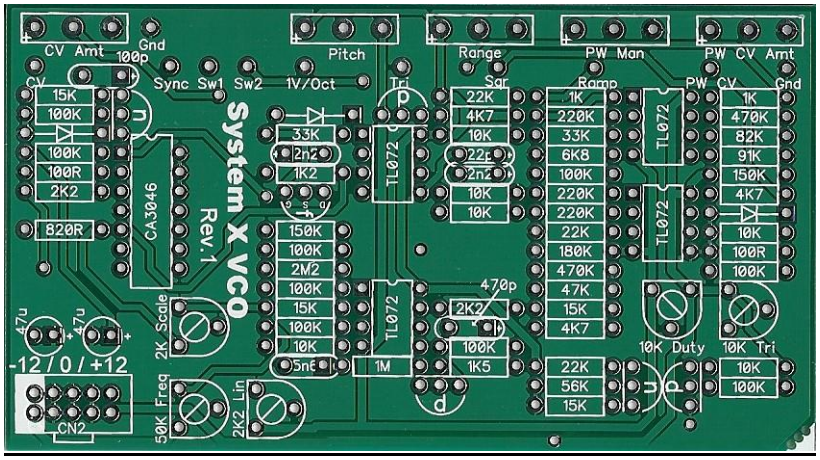
SYSTEM X OSCILLATOR

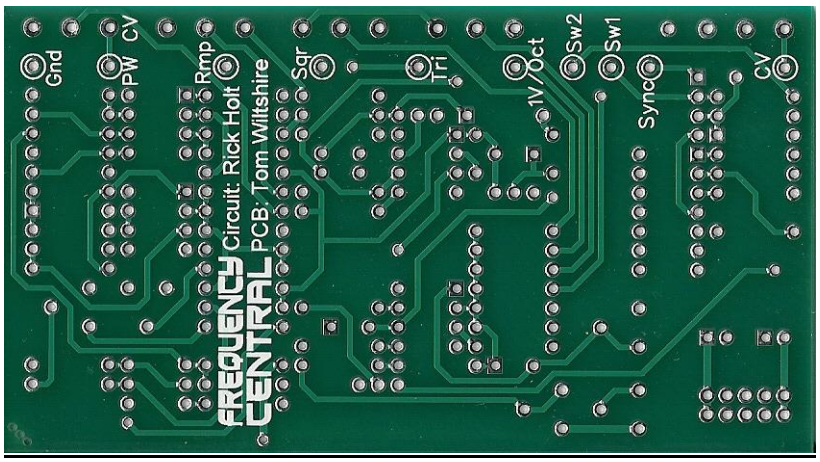
Based on the Roland System 100M VCO

FREQUENCY CENTRAL

Rev 1 / July 2013

B100K B100K B100K B100K B100K





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 FET. Note the correct pinout as shown by the half circles.
Gnd: Ground

Please observe the correct polarity of the 3 diodes and 2 electrolytic capacitors. The lower value capacitors are non-polarised.

The PCB shows the correct orientation for BC547/BC557/2N5485. Other transistor types can be used (eg 2N3904/2N3906/BF245), but please observe the correct pinout.

Trimmers

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.

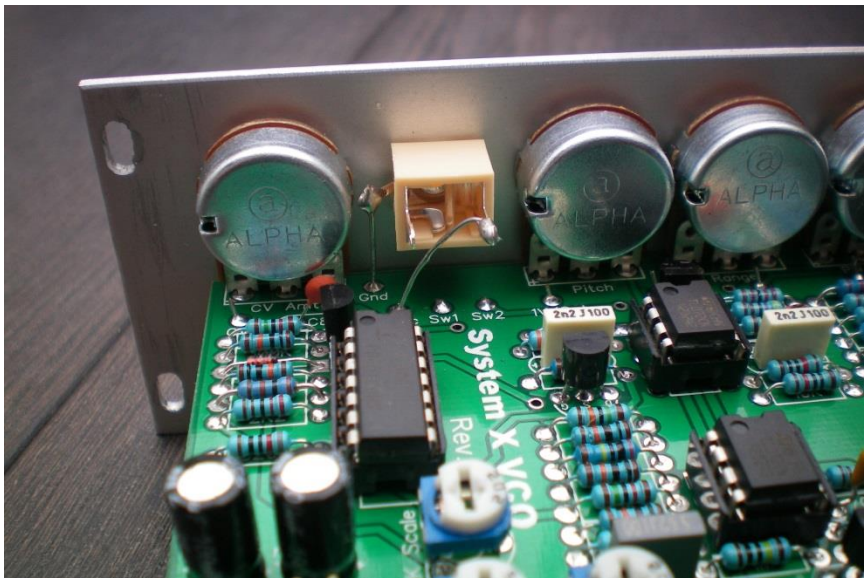
2K Scale: This trimmer sets the 1V/oct tracking of the VCO, and it's really worth spending some time to get it right. On first power up, the VCO should already be pretty close to 1V/oct with the trimmer in it's mid position, as I carefully chose associated resistor values to make it so. To set it closer, 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!

Another handy tip for scaling the oscillators…if you have a MIDI/CV interface and a MIDI keyboard or sound module, you can set them up both on the same channel and use the MIDI sound module as a reference - you're looking to reduce the beating to a bare minimum. I've used my Juno 60 for this job before.

Bill of materials

100R (Ohm) x 2 820R (Ohm) x 1 1K x 2 1K2 x 1 1K5 x 1 2K2 x 2 4K7 x 3 6K8 x 1 10K x 6 15K x 4 22K x 3 33K x 2 47K x 1 56K x 1 82K x 1 91K x 1 100K x 9 150K x 2 180K x 1 220K x 3 470K x 2 1M x 1 2M2 x 1	22pF x 1 100pF x 1 470pF x 1 2.2nF x 2 5.6nF x 1 47uF (electrolytic) x 2	CA3046 x 1 TL072 x 4 BC547 (NPN) x 2 BC557 (PNP) x 3 2N5485 (FET) x 1 1N4148 x 3	B100K x 5 All pots are 16mm Alpha. SPDT toggle x 1 2K trimmer x 2* 10K trimmer x 2 50K trimmer x 1 All trimmers are 6mm (Tayda) *on the PCB one trimmer is marked as 2K2, but as it's configured as a voltage divider there's no harm using a 2K instead.

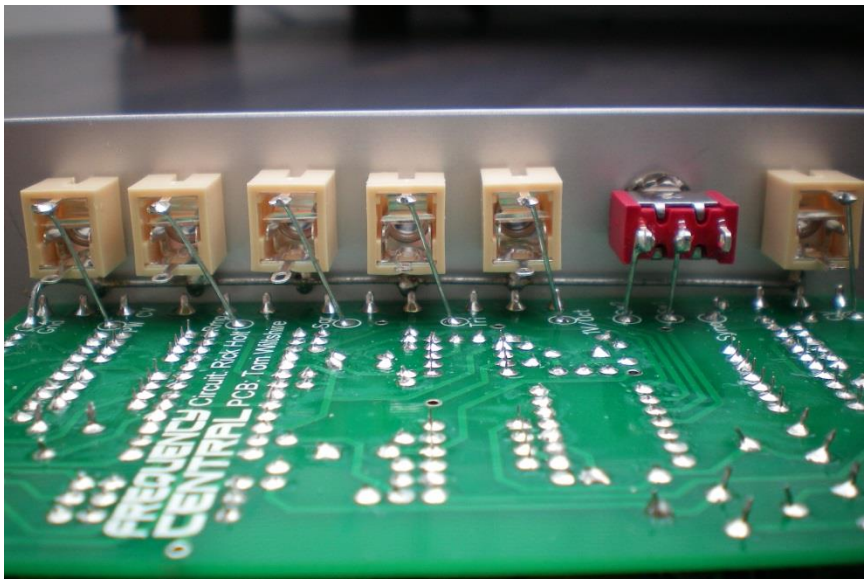
Detail showing Sync input socket wiring and ground connection:

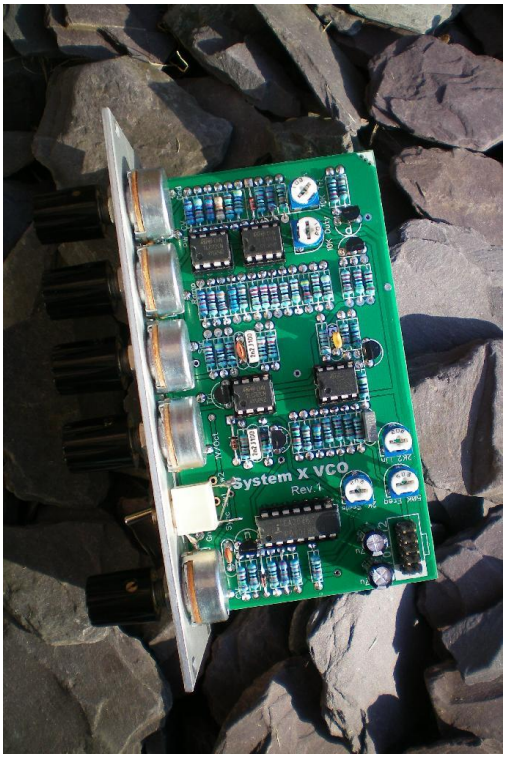


Underside of the PCB showing:

- Ground bus between sockets and PCB
- Connections between inputs/outputs and PCB
- Sync switch wiring

I use solid core for all of the above.





RDH 24th July 2013

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

Extracts from Roland's service manual on the following two pages below.

ADJUSTMENT

For M-180 and M-181, see pp. 16-17.

M-110 VCO-VCF-VCA **M-112** 2VCO

The following precautions should be kept in mind before starting adjustment on M-180 and M-181.

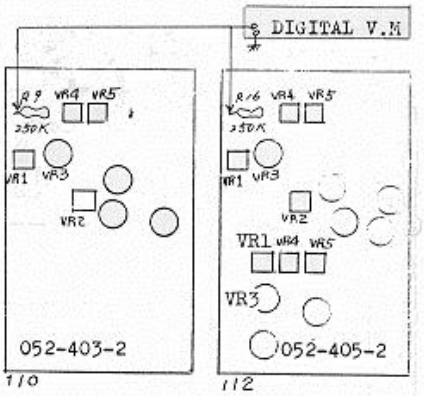
Leave the test and testing equipments turned on for 20-30 minutes as a warmup period.

Keep room at a normal and constant operating temperature.

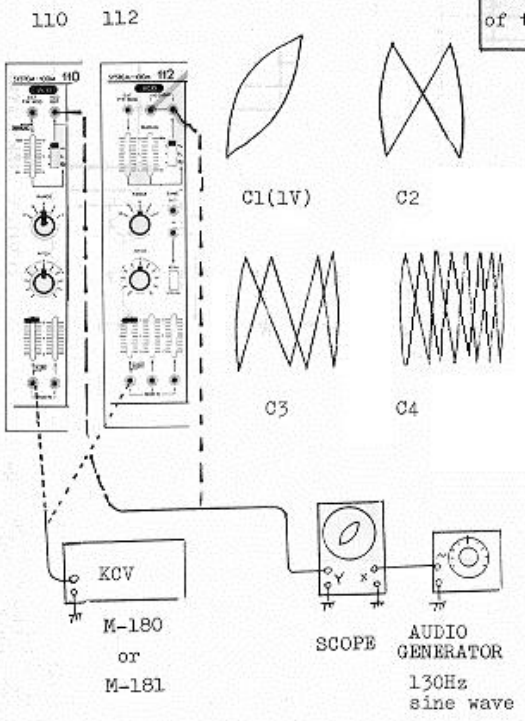
Check keyboard KCV or reference voltage for 1V/oct (±1mV).

VCO

(1) - RANGE - coarse



Trimpot designations are independent of those on circuit diagrams.



Connect digital voltmeter to R9 or R16 lead.

1. Set VR1 around its midpoint.
2. Adjust VR2 for 10V reading.

(2) - WIDTH. FREQUENCY -

Set VR3 and VR4 around the midpoint.

1. While pressing 1V key (M-180 C2 key with TRANSPOSE set in L; M-181 C1 key), adjust VR4 for 1:1 Lissajous (WIDTH).
2. With 2V key holding down, adjust VR5 for motionless waveform.
3. Repeat steps 1 and 2 until waveforms stand still.
   Tolerance at 2V key: cycle/5s (0.2Hz).
4. Pressing 5V key, lock Lissajous with VR3. (LINEARITY) (M-180: C4, TRANSPOSE H)

Turning VR3 will affect previous adjustments in this section. Repeat from step 1.

Tolerance: 1Hz at 4V key.

(3) - RANGE - fine

Keep 1V key pressed down.

While continuously rotating RANGE knob across full travel range, adjust VR1 for the least detune at every RANGE setting.

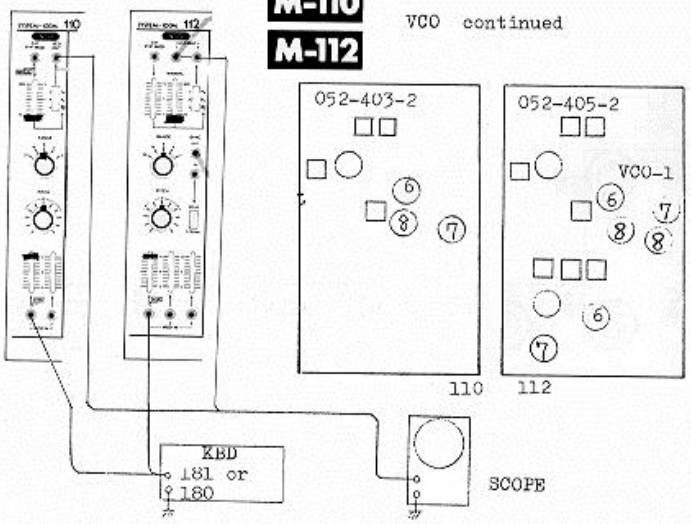
KEY DESIGNATION

M-181

M-180

M-110
M-112

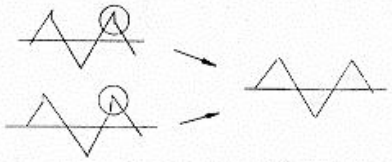
VCO continued



(4) - TRIANGULAR -

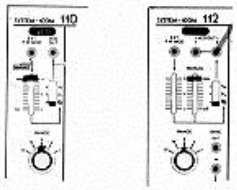
VCO OUT switch: ∧∨ .

With 2V key holding down, adjust VR6 for straightness.



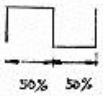
(5) - RECTANGULAR -

Set OUT switch to ⊓.



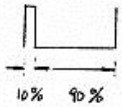
Set MANUAL to 50% (0).

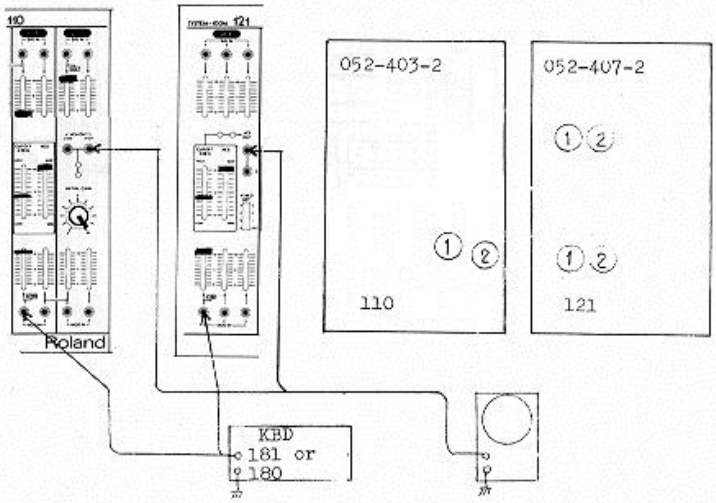
While pressing 2V key, adjust VR7 for 50% duty ratio.



Set MANUAL to MIN (10).

While pressing 2V key, adjust VR8 for 10% duty ratio.

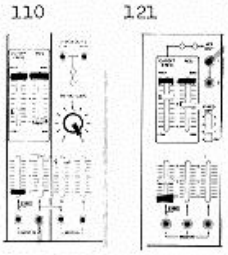




M-110 VCO-VCF-VCA **M-121** 2VCF

VCF

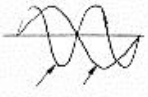
(2) - FREQUENCY -

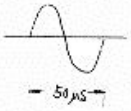


(1) - WIDTH -

Make sure that VCF oscillates when RES knob is set around 7-8th line.

While quickly playing 2V and 3V keys alternately, adjust VR1 for waveforms 1:2 in frequency.





Adjust VR2 for 20kHz (50us).