SERGE
Wave Multipliers (VCM)

The legendary Serge Wave Multipliers (VCM) are a module - or rather 3 modules - designed to dynamically add new harmonically-related overtones to an input waveform. Accroding to the 1982 catalogue, they “alter the timbre in exciting new ways, producing interesting alternative forms of signal processing which are unique in the Serge Modular Music System. Since there are three entirely separate and different types of Wave Multipliers in this module, an enormously varied palette of new effects can be synthesized.”

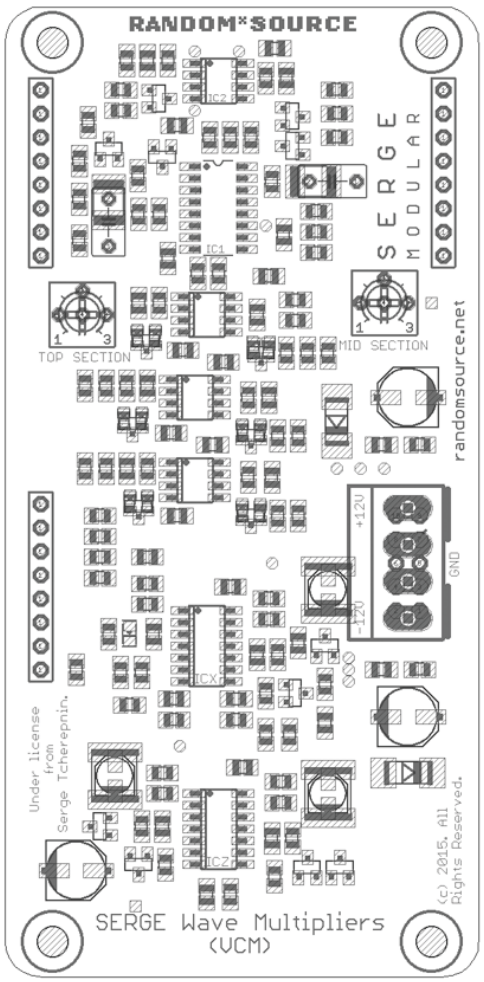
The **top section** offers two different modes, selected by a switch. In the “HI” position, the module functions to “square-up” an incoming signal, with a rounded flattening of the signal peaks, somewhat similar to overdriving a tube amplifier (with voltage control!). In “LO” mode, the module is a linear gain controlled VCA. This is useful for various functions such as amplitude modulation and for gating signals into the other sections.

The **middle section** generates a sweep of the odd harmonics (1, 3, 5, 7, 9, 11 and 13th) when a sine wave is applied to its input and the FOLD knob is turned up or a control voltage is swept from low to high. This effect is similar to overblowing a wind pipe closed at one end. A second input is included to allow two signals to be mixed before processing. This module can be used to explore timbral areas beyond the range of ring modulation.

The **bottom section** performs non-linear wavehaping known as full-wave rectification, but with sophisticated level-compensating conditioning as well. The circuit uses three full-wave rectifier sections linked in a very refined controllable format. Sweeping the VC input over its range will produce a smooth timbral transition using the even harmonics (second, fourth, and eighth). Many other partials are present in this basic sound, however, and the sonorities are very rich and varied. The white output is a “squared up” version of the black one, resembling an harmonically enhanced pulse width modulation.

The Random*Source Serge Wave Mulitpliers are a licensed adaption of the original Serge design, using best parts available today (e.g. Burr-Brown op-amps, C0G capacitors) for optimum audio performance.

The Random*Source VCM pcb kit consists of a main pcb that already contains most of the parts in surface-mount technology (SMT) and a component pcb serving as an interface to the front panel.



Please note:

- **Use antistatic precaution** when handling the main pcb - don't touch the SMD parts with your hands.
- Only very few parts have to be soldered in: 2 100K trimpots, pin strip headers to connect the main pcb to the component pcb as well as the power header (see picture above).
- The **main pcb is designed to sit upside-down**, so that all the SMT components are between the two pcbs - that means the **2 trimmers and the power header have to be soldered on the SMT side**.
- Orientation of the main pcb: **power header is on the left** (when looking at the back of the upright module), RED STRIPE (-12V) is marked on the pcb.

Bill of Materials

Trimmers

2	100k	Top section, Mid section	Trimpot (Bourns 3362P, Vishay T73YP104KT20 or anything that matches the footprint). See calibration info below.

Misc

1	Switch DPDT	HI / LO	Sub-Miniature Switch ON - ON, e.g. Mountain Switch (Mouser: 108-0043-EVX)
1	Power header		MTA-156 power connector, Mouser: 571-6404454
3	SIL header 8pol		pin connectors/headers, linking main pcb to component pcb - using precision strips allows to break off pieces as needed
7	Banana Jacks BLACK		Emerson-Johnson Thonk / Mouser: 530-108-0903-1 (black)
5	Banana Jacks WHITE	CV / unipolar	Emerson-Johnson Thonk / Mouser: 530-108-0910-1 (blue), 530-108-0901-1 (white)
3	Potentionmeter 50k (or 100k)	linear (B50K or B100K)	Alpha 9mm vertical pcb mount available from Thonk, Tayda

Power Connector

The module is designed to be powered using a standard MTA-156 header (pinout +12V / GND / GND / -12V with the **red stripe mark indicates the -12V side**).

DIY - Building the VCM

1. Mount the banana jacks onto the front panel.

2. Install the power header and the trimmers on the main pcb - **make sure they sit on the right side (not where the SMT parts are!)**.

3. Main pcb and component pcb are to be connected through precision DIP socket and pins. Add the spacers to the panel pcb and install the pin (SIL) headers so that the 2 pcbs form a nice sandwich. Pay attention to the direction the pcbs are facing - the SMT parts have to be inside the sandwich. It is recommended to have the **female headers on the panel pcb** and the pins on the main pcb.

4. If you have double-checked that the positioning is correct, solder the pins connecting the 2 pcbs.

5. Carefully seperate the 2 pcbs again and mount the pots onto the panel pcb. Pots should sit on the side facing the front panel (as marked on the board). Don‘t solder them in yet.

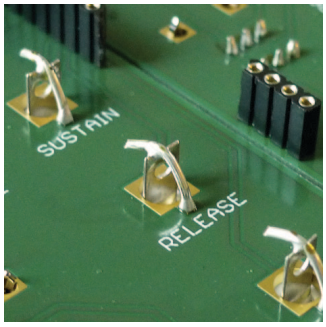
6. Mount the the pots and the switch onto the panel pcb. Pots should sit on the side facing the front panel (as marked on the board). Don‘t solder them in yet.

7. Carefully mount the component pcb (with the pots etc. inserted) onto the front panel. You may then have to wiggle each pot a bit to get the pots through. Make sure the threads of the pots go through completely and the pots sit right at the front panel. Screw the jacks, pots and switches to the the front panel to make sure of that.

8. Once everything is nicely in place, solder the pots, jacks und switch onto the component pcb (while the front panel is attached).

9. Solder the trimpots, and the power header onto the main pcb

10. Solder the banana jacks in. You can either solder them directly to the surrounding vias (ring round) or - which makes removing easier should you ever need to do that - by inserting a stiff (bare) wire into the little hole (via) and solder that wire to the top of the banana jack:



11. Mount the main pcb again and fasten it using the spacers.

12. Connect a power cord supplying +12V, GND, GND, -12V to the power-header on the main board and double check the direction of the power header before you turn power on. You should be ready to go now :-)

Calibration

Top and middle section each have a trimmer to adjust CV rejection. Calibration is easy:

TOP SECTION:

1. Set Switch to HIGH. Feed an audio signal into the CV input of the top section. Make sure the attenuator is at maximum position (CW) to let the signal through.

2. Using an oscilloscope or your ears, adjust the trimmer so that the output of that section shows the least amount of that input signal.

MIDDLE SECTION:

1. Feed an audio signal into the CV input of the middle section. Make sure the attenuator is at maximum position (CW) to let the signal through.

2. Using an oscilloscope or your ears, adjust the trimmer so that the output of that section shows the least amount of that input signal.

Power Consumption

Power consumption: <=45mA @ +12V and <=40mA @ -12V

(Version 16 December 2015)