SERGE
Ring Modulator 2017
(RING) for Eurorack

The 2017 RING is an improved version of the late Serge Ring Modulator (R9), designed by Serge himself for Random*Source in 2017, more than 40 years after the launch of the Serge Modular system.

To quote the Serge 1983 catalogue:

"*Our new RING MODULATOR (RING) is a brand new design which incorporates greatly improved specifications . Features include the following:*

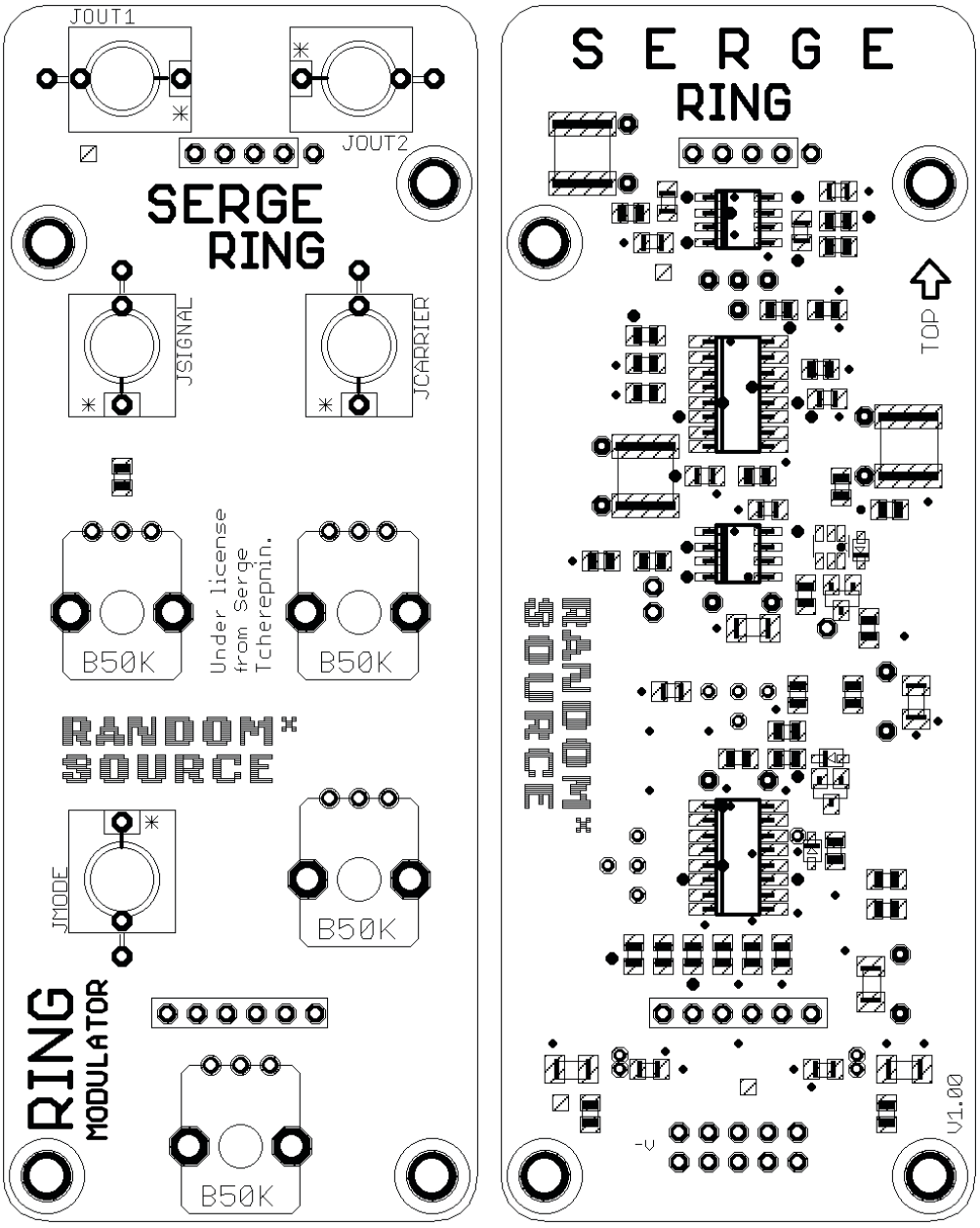
- *A VERY CLEAN SOUND down to very low signal levels (unlike conventional modulators where distortion increases at low levels) .*
- *80 dbs OF CARRIER SIGNAL REJECTION.*
- *INAUDIBLE NOISE OUTPUT .*
- *NO SQUELCH CIRCUIT IS REQUIRED due to the low noise therefore annoying signal dropouts and "pumping" effects are totally absent.*
- *INTERNAL WAVESHAPING OF CARRIER to add to modulation effects.*
- *The sum total of these design improvements is a Ring Modulator capable of treating the most subtle acoustical signals, without the coloration typically associated with even the best previously available ring modulators.*

The versatility of the Serge Ring Modulator is enhanced by the added feature of voltage and manual control of the entire spectrum of modulation possible: from zero modulation (i.e. the original, un-treated input signal) through amplitude modulation to full ring modulation. This allows many shadings of effect, manual or automatic with voltage controls. The ability to control the Carrier level manually and through voltage control allows the output to be level controlled, as well. -Through the use of an internal signal processor for the Carrier, additional effects can be produced by waveform modification of the carrier signal. When the module is set to full Ring Modulation from the lower knob or voltage control, the output signal contains the sum and

difference frequencies of the Signal Input and the Carrier Input. If both signals are pure sine waves (only one frequency component), the output will be a composite signal consisting two frequency components: the sum and the difference frequency of the Signal and Carrier. If the Carrier level is increased beyond the mid-position, then the carrier waveform will become slightly rounded, and new frequency components will be produced. Each of these new components will also modulate with the Signal input to produce a sum and difference frequency, and the output signal will become richer in harmonics. This effect. is unique to the Serge Ring Modulator, and allows another dimension in timbral modification.

The Random*Source version of the RING for Euro is a licensed and authorized implementation of the new original Serge design.

The Random*Source RING kit consists of a front panel and a pcb set with all SMT parts preinstalled. A couple of through-hole parts (mostly capacitors) have to be installed (1uF caps only if not already installed in SMT!).



Please note:

- The RING requires careful calibration for best results. A 2-channel oscilloscope is higly recommended, if not required.
- The module requires a couple of larger capacitors (10uF and 4.7uF) and provides footprints for WIMA film caps. You should be able to substitute other types (e.g. bipolar electrolytics for audio use), however, these are untested.
- If the main pcb already includes 3 large SMT capacitors in (1uF, black and silver cubes) - most likely this is the case -, you do not need to install any 1uF capacitors in through-hole - i.e. you can leave the corresponding 1uF through-hole footprints empty.
- Use antistatic precaution - try to avoid touching the SMT parts.
- Board is designed to be powered by a +/-12V stabilized PSU only. (+/-15V is untested).

Bill of Materials

Capacitors (min. 35V, 5mm lead spacing)

3	10uF	FILM / PET, 5mm	WIMA MKS2B051001N00JSSD (5% recommended)
1	4.7uF	FILM / PET, 5mm	WIMA MKS2 or similar, 5% recommended
3	1uF	FILM / PET, 5mm	WIMA MKS2 or similar - ONLY IF NOT ALREADY INSTALLED IN SMT!

Trimmpots

1	1k	Multiturn	e.g. Bourns 3296Y-1-102LF or Vishay T93YB102KT20
1	100k	Multiturn	e.g. Bourns 3296Y-1-104LF or Vishay
1	100k	Single-Turn	e.g. Bourns 3362P-1-104LF or whatever fits)

Misc

1	Euro Power header		MTA-100 power connector, Reichelt: WSL 10G
5	Thonkiconn Jacks		3.5mm Jack Sockets (PJ301M-12) from Thonk
4	Potentionmeter 50k	linear (B50K)	Alpha 9mm vertical pcb mount available from Thonk, Tayda, Mouser ... B100K should also work
1	Resistor 22k or 24k	OPTIONAL to adjust the taper of the MODE pot	Can be either TH (0207) or SMT (0805, 1206)
1	SIL header 6pol		pin connectors, linking main pcb to component pcb - using precision strips allows to break off pieces as needed
1	SIL header 5pol or 4pol (check markings if using 4pol)		
4	Spacers + 8 matching screws (M3)		10mm or whatever matches the SIL headers / connectors

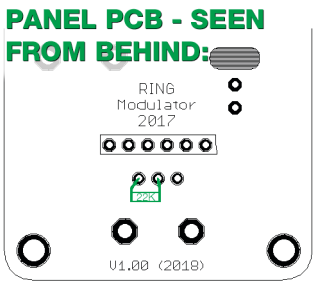
Building

This is simply a suggestion - you might find a different workflow more practical:

1. **Use a side-cutter to separate main pcb and component pcb.**
2. **Solder the power connector and other through-hole parts to the main pcb.**
3. **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 Thonkiconn jacks and 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. **Carefully mount the panel 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 and pots to the panel to make sure of that.**
7. **Once everything is nicely in place, solder the pots and jacks (while the front panel is attached). Make sure you don‘t spill any solder on the SMT parts.**
8. **Mount the main pcb again and fasten it using the spacers.**
9. **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.**
10. **You should be ready to calibrate and go :-)**

Optional: MODE knob taper adjustment

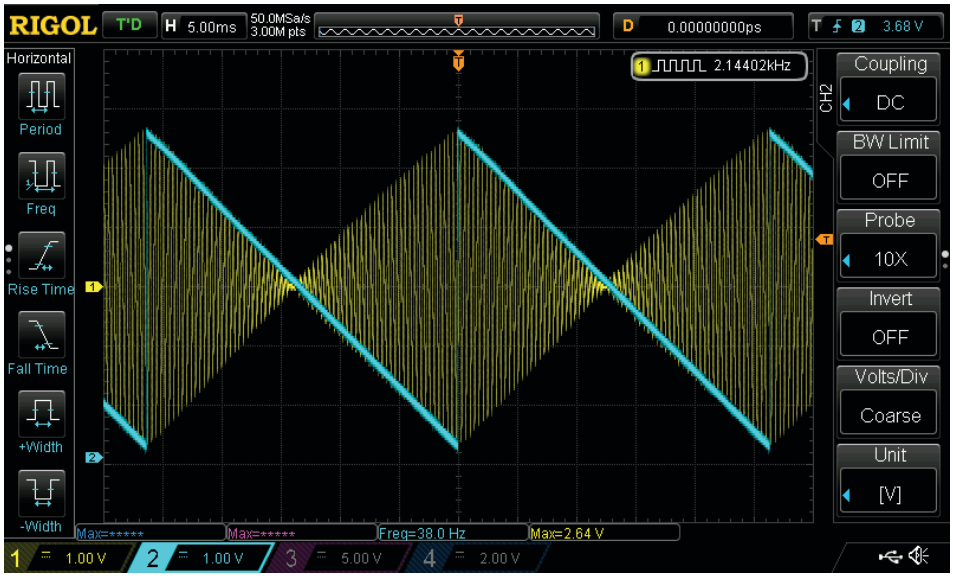
You might notice that depending on calibration the spot where the MODE knob reaches exactly the AM position (before fading to Ring modulation) is slightly before the center of the knob. This does not affect the function in any way - in particular not the VC MODE behavior) -, however, if that is the case and it bothers you, you can adjust the knob curve (taper) by soldering a resistor (22k or 24k for a B50K pot should work) between the wiper of the MODE pot and the GND pin like this:



Calibration

Feed a 5V pp signal into SIGNAL (e.g. Triangle or SAW from a DSG) and another 5V pp signal into CARRIER. The SIGNAL should be in the audio range, but not too fast, as waveforms may change otherwise, 1-2 kHz should do it. The signal into CARRIER should be slower, for instance around 50 Hz. Turn both attenuators fully CW. **Use a scope to see both the CARRIER signal as well as the OUTPUT** (using either output - they are identical).

(A) Set MODE fully CW and adjust the three trimmers so that **the OUTPUT has no DC offset and shows a nice symmetry like this:**



You will notice that this is an iterative process - the top trimmer controls the vertical (DC) offset, however, the other two trimmers kind of act like a joystick, shifting the balance of the output waveform. Don't expect to get a perfect result at once! Also, vary the frequencies of the incoming signals to see if there are any changes in the waveforms of the incoming signals. The bottom trimmer kind of tilts / rotates the waveform - this is where you should (carefully start). You will most likely have to revisit the DC offset trimmer after changing the others. Try a different waveform for CARRIER, too. Here's the SINE OUT of a Serge NTO:

(B) Turn the MODE knob to center position (AM). When feeding a was wave into the CARRIER, you should be able to get a beautiful amplitude modulated OUTPUT like this:

Beware that the singal and carrier level going in will affect the symmetry - a DSG mk2 will show an increase of amplitude when either Rise or Fall is very steep (towards the ends of the knob ranges) - the module is designed to work with 0-5V / 5V pp levels going in (i.e. standard Serge signal levels) - thanks to the input attenuators any “hotter” signal levels should be no problem, however, for calibration it is recommended to use a 5V signal and have th attenuators opened all the way.

At minimum position (CCW), the module has no effect, letting only the SIGNAL pass through. Moving towards center position it seamlessly blends to amplitude modulation (AM) where it starts to move towards ring modulation - full CW will deliver full ring modultion as shown in (A).

Tips and Tricks

- **Traditionally sine waves are considered best for ring modulation (as they have no harmonic overtones), however, try saw or square / pulse waves for interesting, rich results.**
- **A DSG mk2 is a great partner as it allows to go up to about 12kHz and provides various outputs. Try combining the RING with FM on the DSG for amazing effects.**
- **You can feed a negative voltage as Mode CV, i.e. bipolar signals work as well - turn the MODE knob up for this as the negative CV acts as if you turned the MODE knob down.**
- **Try running one of the input signals through a waveshaper (e.g. Serge VCM or TWS) for interesting effects, especially if you feed two signals that are almost identical in frequency - that can generate very slow, complex morphing sounds.**

Last edited on 18. March 2018, 10:20 PM