SERGE Smooth & Stepped Generator (SSG) for Eurorack

The Serge Smooth & Stepped Generator (SSG) is an essential part of the Serge system. According to the 1979 catalogue, “it is a complex multi-functional module which can be patch programmed to provide various slew and sample functions.

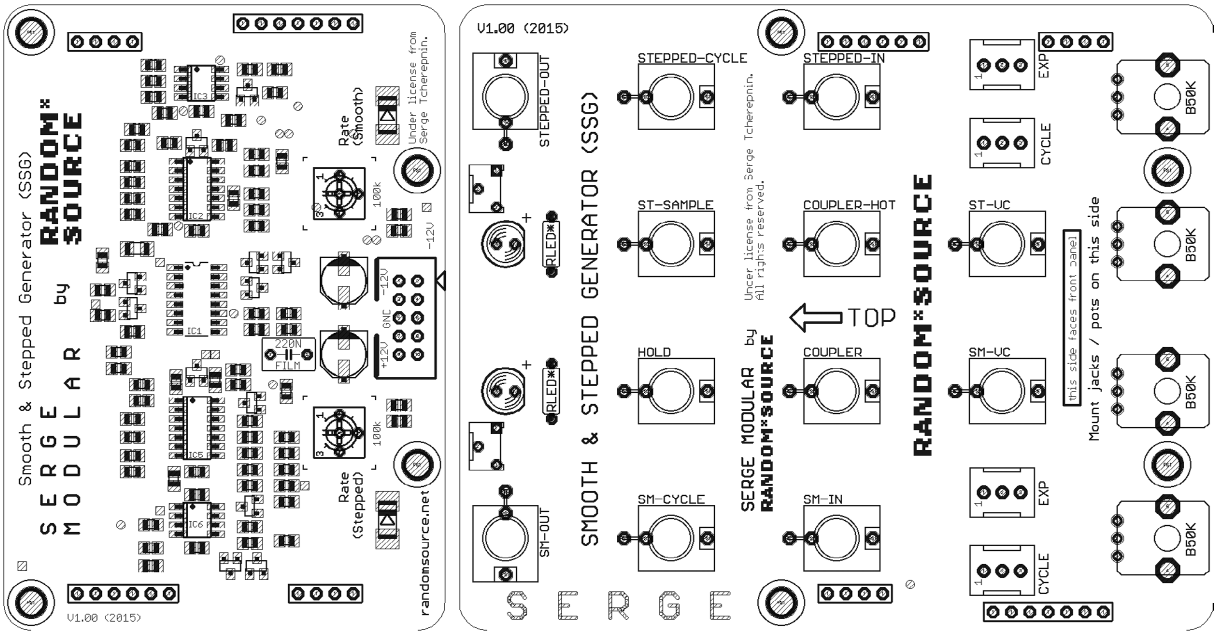
The Smooth section will place a postitve and negative slew on input voltage transitions for lag effects, voltage controlled portamento and for low frequency filter applications.” In Cycle-mode (cycle jack patched to the input), the Smooth side “will oscillate yielding a voltage controlled traiangle wave LFO. A high level into the HOLD input will enable the Smooth Function to be used as a track-and-hold circuit with voltage controlled slew rate.

The Stepped funtion can be used as a sample-and-hold with voltage controlled slew rate limiting. In Cycle mode, a pulse applied to the Sample input will generate complex staircase waveforms for control voltage applications and for use as audio signals.

The Coupler is an internal comparator which compares the output levels of the Smooth and the Stepped Generators. This output is useful for generating complex control voltages or random voltages.

The Random*Source version of the Smooth & Stepped Generator for Euro is a licensed and authorized adaption of the original Serge design that provides an increased audio range of the Smooth Generator and a bipolar (“hot”) Coupler output in addition to the regular (unipolar) Coupler output.

The Random*Source SSG kit consists of a front panel, 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:

- The SSG is a unique and complex module - it takes years to discover its secrets, so give it some time and don't expect to understand everything at once - it's highly rewarding.
- The front panel is color (screen) printed. **Do not use strong cleaning liquids, solvents, acid, ethanol, detergents etc. to clean the front panel** as that could solve/harm the paint. A damp cloth should be sufficient if you need to clean it.
- The "**Expo**" switch is equivalent of patching the output of each side into the input, making the slopes exponential. Depending on the signals and settings, this can stop the Cycle mode, especially the VC pot at full CCW (minimum) position will do so. In such case turning off the Expo switch and moving the pots a bit should bring the module back to life (Cycle).
- The **updated version of the panel pcb** provides an option to use 3-position switches (ON - OFF - ON) for the Expo switches (this is marked on the pcb "ON - OFF - ON"): this allows to get exponential curves by either injecting the output signal pre (UP) or post (DOWN) VC potentiometer. In UP position, the VC knob fades from linear to exponantial, also, running an external signal into the VC input may have a different effect depending on whether the switch is UP or DOWN. This is a (recommended!) option - you can also use a ON - OFF switch but you lose the UP magic...
- Orientation of the main pcb: **power header is at the bottom** (when looking at the module upright, e.g. in a rack), RED STRIPE (-12V) should be on the right hand side then.
- **Use antistatic precaution** when handling the SSG pcb - don't touch the small SMD parts and ICs with your hands.

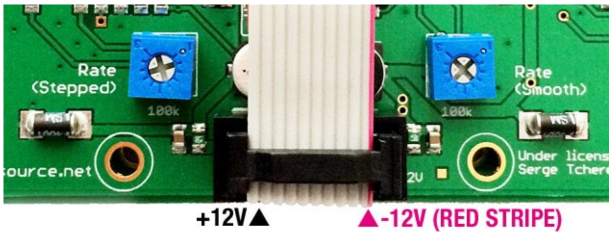
- Only very few parts have to be soldered in: trimpots, 1 Film cap, pin stripes to connect the main pcb to the component pcb, power header (see picture above).
- LEDs: The LED symbol **on the first version** of the pcb is correct, but the **"+" sign for the LEDs on the panel pcb is incorrect**! Anode (long leg) has to be on top - see picture below. **LED brightness** can be controlled by **either** the **trimmers** on the front panel pcb **or** the **resistors** ("RLED*") on the component pcb - **do not install both**(!). It is **essential to use low current (max 2mA) LED**s - **otherwise the LED action might affect the operation of the module** (depending on brightness and color). Use at least 100-130mcd or ultrabright LEDs (60°) plus a **trimpot of (only) 2k or (or a 2k resistor) for (fairly) bright LEDs (**100-150mcd). If you use ultra-bright LEDs, a 5k trimmer might make sense, higher values for the trimpot are probably not needed (but work also).

Bill of Materials

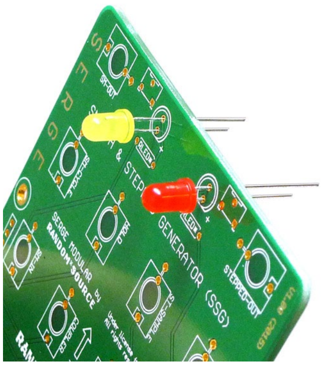
Trimmers			
2	100k	Rate Stepped, Rate Smooth	Trimpot (Bourns 3362P, Vishay T73YP104KT20 or anything that matches the footprint). See calibration info below.
2	2K or more	LED brightness (instead of RLED resistors)	Trimpot (Bourns 3362P or Vishay T73YP202KT20 or anything that matches the footprint) to adjust the LED brightness. Pick value depending on LED (see text).
Resistors			
2	(2k*)	RLED*	Pick according to LEDs and desired brightness if not using trimpots.
Capacitors			
1	220n		Film (Wima MKS-2-5 or similar) or C0G
Misc			
2	LED 5mm	low current (max) 2 mA	pick color to suit LED lens - be careful, the + marking on the pcb v1.00 is incorrect - see below.
2	LED lens 5mm		VCC, Mouser 593-3000R (red), 593-3000A (amber) ...
2	Switches SPDT ON - OFF	Cycle	Sub-Miniature Switch, e.g. Mountain Switch (Mouser: 108-0042-EVX)
2	Switches SPDT ON - OFF - ON*	Expo *3-positions only if indicated on panel pcb!	Sub-Miniature Switch, e.g. Mountain Switch 3 positions: Mouser: 108-0044-EVX
	or ON - OFF	ON - OFF works for all versions!	2 positions: Mouser: 108-0042-EVX
1	Euro Power header		MTA-100 power connector, Reichelt: WSL 10G
2	SIL header 4pol		pin connectors/headers, linking main pcb to component pcb - using precision strips allows to break off pieces as needed
1	SIL header 6pol		
1	SIL header 7pol		
12	Thonkiconn Jacks		3.5mm Jack Sockets (PJ301M-12) from Thonk
4	Potentionmeter 50k	linear (B50K)	Alpha 9mm vertical pcb mount available from Thonk, Tayda

Power Connector

The module is designed to be powered using a standard Eurorack 10-pin DIP header (pinout +12V / GND / GND / GND / -12V with the **red stripe on the cable indicating the -12V side**). Depending on the headers used on the pcb, the markings indicating -12V may be blocked, so **be careful about the direction**:



LED Orientation



Please be careful about the type and orientation of the LEDs:

The **LED Symbol on the pcb v1.00 is correct** (flat side = cathode = short leg towards the bottom), however, **the + marking is incorrect** - the **anode (long leg) has to be towards the top as shown in the picture** on the left.

On newer versions of the pcb this has been fixed.

Building

1. Use a side-cutter to separate main pcb and component pcb.

2. Main pcb and component pcb are to be connected through precision DIP socket and pins. It is recommended to use the pins on the main pcb (facing down, soldered from above) and the pin sockets on the component pcb (standing up, soldered from the front panel side). Break or cut off the pieces you need and stick them together so that main pcb and component pcb form a nice sandwich (don‘t solder yet). Check that you didn‘t leave out any pins / holes and that the sockets are all on the same side (component pcb). Solder all the pins in while keeping the sandwich together - this avoids any misalignments.

3. **Carefully** separate the sandwich - if you used precision sockets, this may not to too easy - they stick together nicely (giving a good connection).

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

5. Attach any screws / spacers if desired to the component pcb (this gets more difficult once the component pcb is connected to the front panel).

6. 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.

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

8. Solder the trimpots, the cap and the power header onto the main pcb.

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. You should be ready to go now :-)

Calibration

There's one trimmer for each side that - among other things - determins the range covered by the RATE potentiometers. The most efficient way for the Smooth Generator seems to be:

1. Turn on Cycle mode and turn up the RATE pot to maximum.

2. Try to increase the speed / frequency of the cycle using the trimpot. From a certain point on, the trimmer will not have any effect on the speed / frequency any more. Turn back the trimmer to find the spot where it is about to slow down the cycle. Keep the trimmer right at the point where the speed is still maximum.

For the Stepped Generator the procedure is basically the same, but you have to run a (high frequency) pulse wave into the SAMPLE jack (the Stepped side doen't cycle without a pulse into SAMPLE). Observe the output (using an oscilloscope if possible). As on the Smooth side, adjust the trimmer for the spot where the speed is still as fast as possible. If you turn back the RATE pots to minimum, the CYCLE should now be very slow on each side.

If you installed trimpots for **LED brightness** on the component pcb, adjust them according to taste.

First Steps

The SSG is a complex, highly versatile module which allows for a wide range of uses and abuses both in the audio and CV range, so it may require some time and experimenting to familiarize oneself with it - don't expect the module to reveal its secrets and power in a few minutes after you first power it up. Here are some very basic ideas to start with:

1. Turn on the **Cycle switch** on the Smooth side - this is equivalent to patching the Cycle jack into the **Input** - the Smooth side then produces a triangle wave from about 0V to 4 to 5 V (depending on frequncy), the LED should indicate that. The **Rate** pot determines the frequency of the cycle / output - the range is very wide, going from below 1 Hz (depending on calibration above, possibly far below 1 Hz) to appr. 4 kHz. The **Cycle jack** provides a corresponding Pulse wave output.

2. Turn on the **Cycle switch** on the Stepped side as well. Unlike the Smooth side, the Stepped side will not generate an output in Cycle mode (=LED stays dark) unless a Puls wave is fed into the **Sample** jack. Patch a pulse wave - e.g. the **Cycle** output of the Smooth side - into the **Sample** jack to bring the stepped side to life. The stepped side is essentially a sample-and-hold circuit, the **Rate** knob determines how long each step is at the Stepped output. Changing the frequency of the pulse going into the **Sample** input and/or changing the **Rate** affects the output.

3. The Smooth Side can be used as a **Lowpass filter**. Feed an audio signal (e.g. a saw or pulse wave from an oscillator) into the **In jack** (Cycle switch turned off) and listen to the signal coming from the **Smooth out** while you turn the **Rate knob**. At maxium position (full CW) the signal should sound pretty much unfiltered, turning the Rate down (counterclockwise) the harmonics get filtered / smoothed out, at minimum position the signal will disappear altogether.

4. Using the VC input jack in the same setup as before, this filter effect can be used to achieve the effect of a **Lowpass Gate / VCA**. Send an CV envelope (e.g. from a DUSG or an Extended ADSR module) into the VC jack and turn the VC knob sufficiently high. Tune the Rate pot to a position so that the output is silent when no CV is applied but clearly audible when the envelope is high. This causes a VCA effect, but the envelope not only determines the amplitude, but also the amount of filtering applied (like a lowpass gate).

Power Consumption

Power consumption: <=30mA @ +12V and <=30mA @ -12V
Module width: 18HP, depth: < 35 mm

(Version 13 May 2016)

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