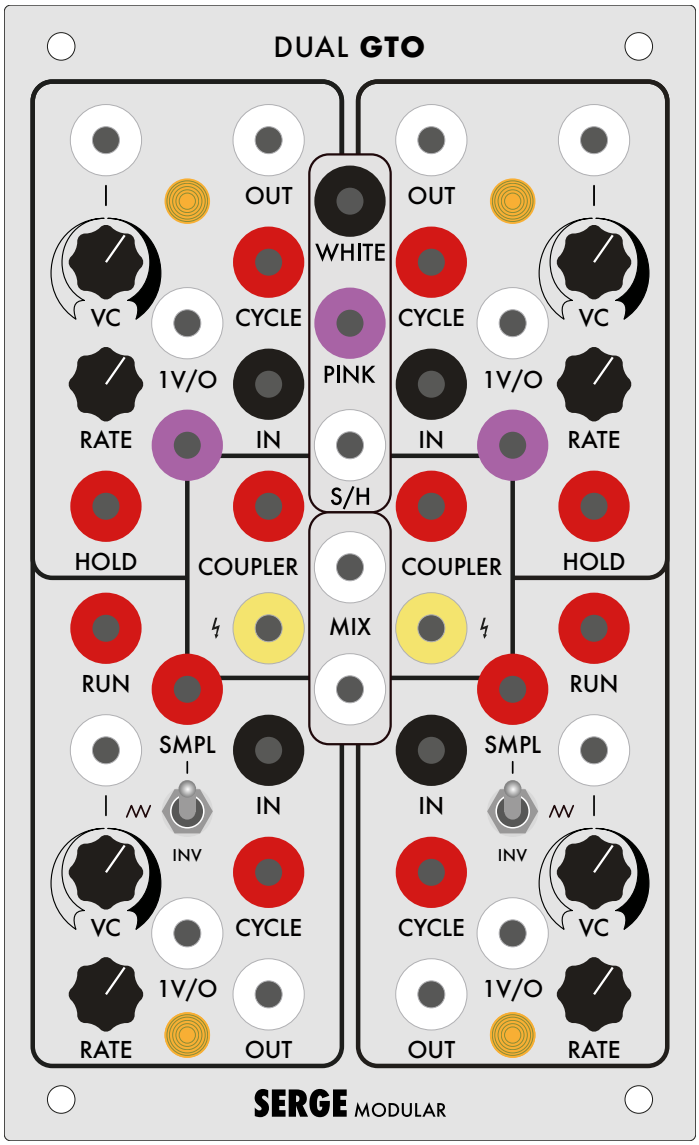
SERGE

DUAL GTO

NOISE



USER MANUAL

V1.0

RANDOM*SOURCE

DUAL GTO

DUAL GTO

Installation

Always turn the eurorack case off and unplug the power cord before plugging or unplugging any eurorack power cable. Do not touch any electrical terminals when attaching any eurorack power (bus board) cables.

The Serge Dual GTO is an electronic music module requiring 50mA of +12VDC and 50 mA of -12VDC regulated voltages and an appropriate power connector to operate.

POWER YOUR SYSTEM OFF before installing the module. Please use the power cable provided to connect the small end of the power cable to the module. Carefully install and secure the module in your boat. Power on, and flip the CYCLE switches to the DOWN position, SMPL to the CENTER position. You should see an LED flashing for each channel. If either side seems constantly ON or OFF, turn the RATE knob to the center position or slightly below to see each side cycling. Your module should be ready to go now :-)

Please beware: Powering the module on anything more (or less) than +/-12V is not recommended and may damage the module. Feeding any of the inputs (or outputs) with voltages outside a +/-12V range may damage the module. This type of damage is not covered under warranty.

Overview

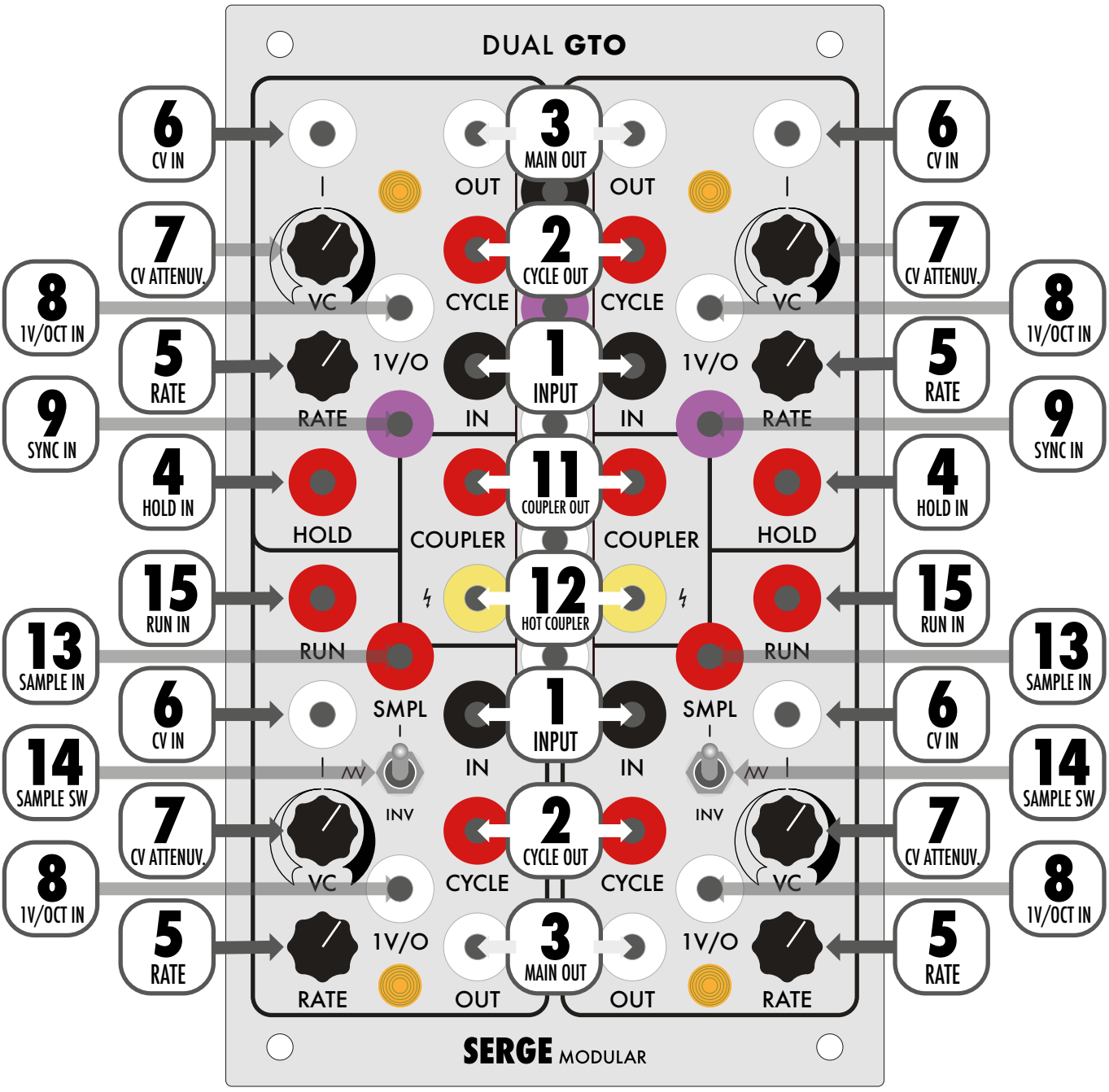
The Serge GTO is an evolution of the famous Serge Smooth & Stepped Generator. As its predecessor, it has two sides, that are not identical, but differ in some aspects. The top section was traditionally the “Smooth Side” while the bottom section was the “Stepped Side”. In the GTO, however, the bottom section can to some extent - in particular when the SMPL switch (14) is in CENTER position - behave like a “smooth” side.

The GTO is a dual “lag and hold” device that can be quite a few things, depending on how you use it. It can be patched as a slew, portamento, oscillator, LFO, metallizer, triggered staircase generator, subharmonic generator/ divider, VCA, lowpass-gate, sample and hold, track and hold, set of comparators, trigger delay, one-shot, envelope follower, quadrature function generator, “bit-crusher” and much more.

What’s new? What’s different?

The Dual GTO comprises 2 identical GTOs plus a Serge Noise and a Mixer that provides the sum of the two top sections and of the two bottom sections. The Serge GTO is not just an improved SSG, but almost a complete redesign with the focus on stability, precision and speed. Each GTO section has a **temperature-compensated 1V/Oct** input for use as an oscillator with a **frequency range of up to 20kHz** (top) and **8kHz** (bottom). Each section tracks over 5 or 6 octaves. The lower sides offer 3 different Sample modes plus a RUN input that vastly extend the track-and-hold possibilities of the classic SSG.

Dual GTO - Basic Operation



Top section(s) /// SMOOTH mode

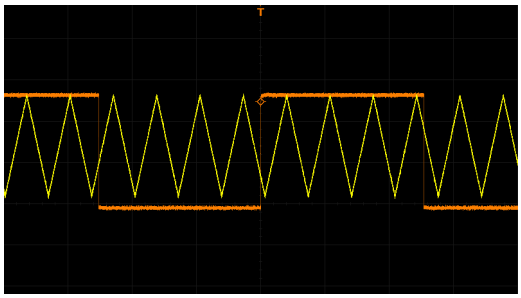
In **CYCLE mode** (CYCLE OUT connected to IN), the OUT produces a nice triangle wave. The RATE knob controls an enormous **frequency range of appr. 26s/CYCLE to appr. 20(!) kHz**.

In **INPUT mode** (CYCLE mode is off), the OUT follows the IN as quickly as the RATE parameter allows. A high at the HOLD input will freeze the OUTPUT.

Bottom sections /// STEPPED mode (and more)

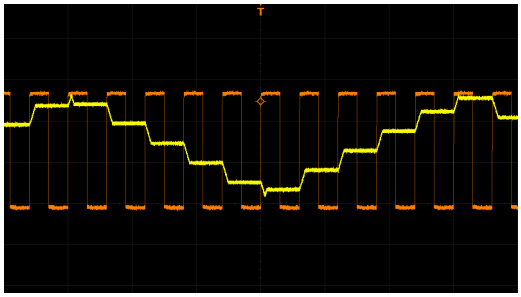
The bottom sections also have a **CYCLE mode** (CYCLE OUT connected to IN). However, the OUT depends on the Sample (SMPL) input and the corresponding MODE switch as well as on the RUN input:

- **Smooth Mode**: Set the SMPL switch to center to let the bottom section run freely - both the SMPL input and the RUN input are ignored. The Stepped side now pretends to be “smooth”, producing a triangle wave at the OUT. The RATE knob controls a **frequency range of >1min/CYCLE to 8 kHz**.

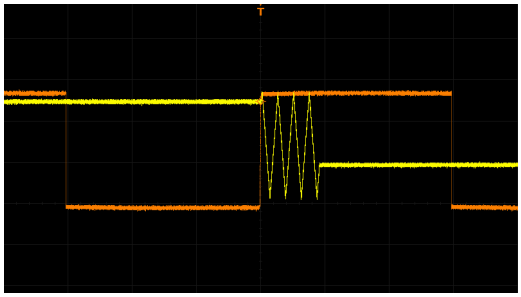


A PULSE wave (orange) into SMPL or RUN does not affect the Cycle.

- **Sample Mode**: When the SMPL switch is up, the GTO moves (cycles) only for a very short period of time when a pulse wave triggers the SMPL input - irrespective of the pulse length:



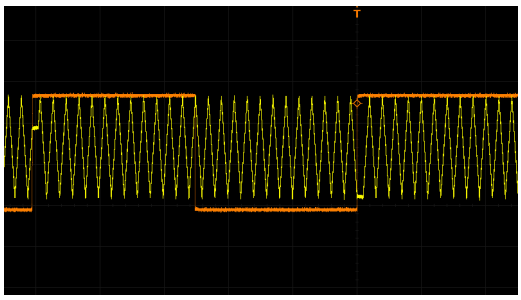
A PULSE wave (orange) into SMPL allows the GTO to run for a moment before being frozen again.



If the RATE is very fast, the few full cycles can occur before being frozen again.

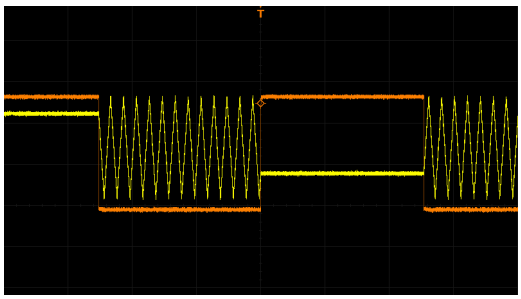
The moment in which the waveform can run freely is fixed in length (about 0.5ms) - this **limits the maximum speed the SMPL input can digest - if the clock signal is faster that about 2.2kHz, no more triggering occurs** and the waveform goes flat (i.e. the CYCLE dies).

- **INV Mode**: When the SMPL switch is down, the SMPL input works exactly the other way around: the GTO is free except for that small moment when the trigger occurs:



The CYCLE is held for a brief moment.

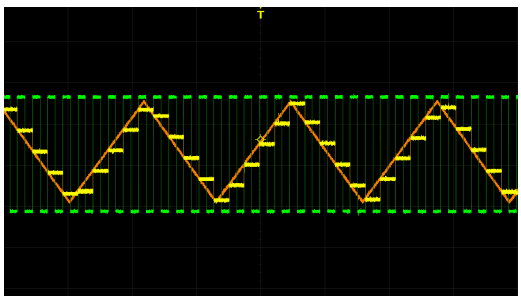
- **RUN Mode**: If all of this is not flexible enough for you, the RUN input comes into play. Here, the GTO runs freely while the signal is high and is held when the signal is low, i.e. the duty cycle of the pulse signal determines the ratio of running to stopping. The RUN mode gives you essentially a SMOOTH mode with HOLD:



The CYCLE is running as long as RUN is low.

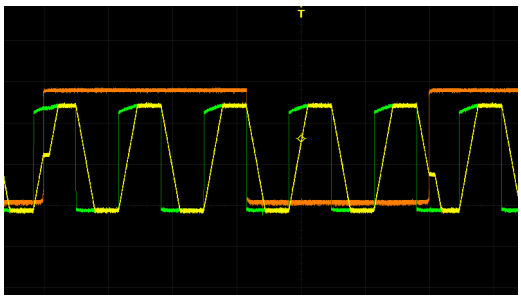
In **INPUT mode** (CYCLE mode is off), the OUT of the bottom section of the GTO tries to follow the IN as quickly as the RATE parameter allows, with the restraints set by the SMPL mode.

- If the SMPL switch is in center position, SMPLE in and RUN are ignored, the bottom section is in **SMOOTH MODE** (without a HOLD).
- **Sample Mode**: When the SMPL switch is up, the GTO moves only for a very short period of time when a pulse wave triggers the SMPL input - irrespective of the pulse length.



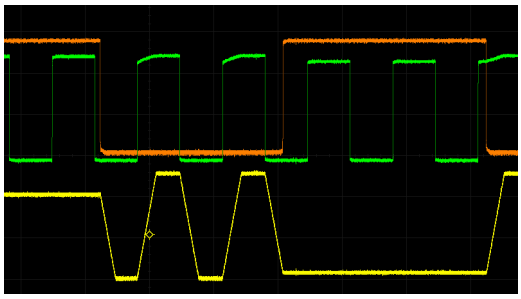
High clock rate into SMPL (green) and a fast RATE creates quantizing / aliasing / bitcrushing (yellow) of the input signal (orange).

- **INV Mode**: When the SMPL switch is down, OUT is almost like in SMOOTH MODE, but the SMPL input halts the signal for a very short moment:



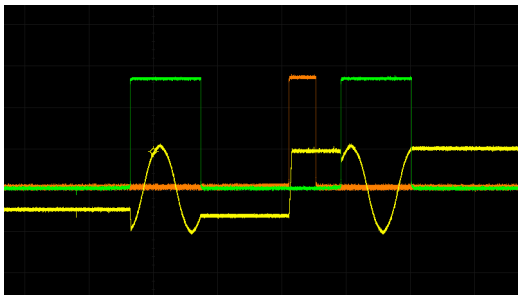
Note the tiny step in the OUT (yellow) whenever SMPL IN goes high (orange). Green is the IN signal.

- **RUN Mode**: Here again the signal is frozen as long as the RUN input is high - the GTO acts like the top section (SMOOTH MODE with HOLD):

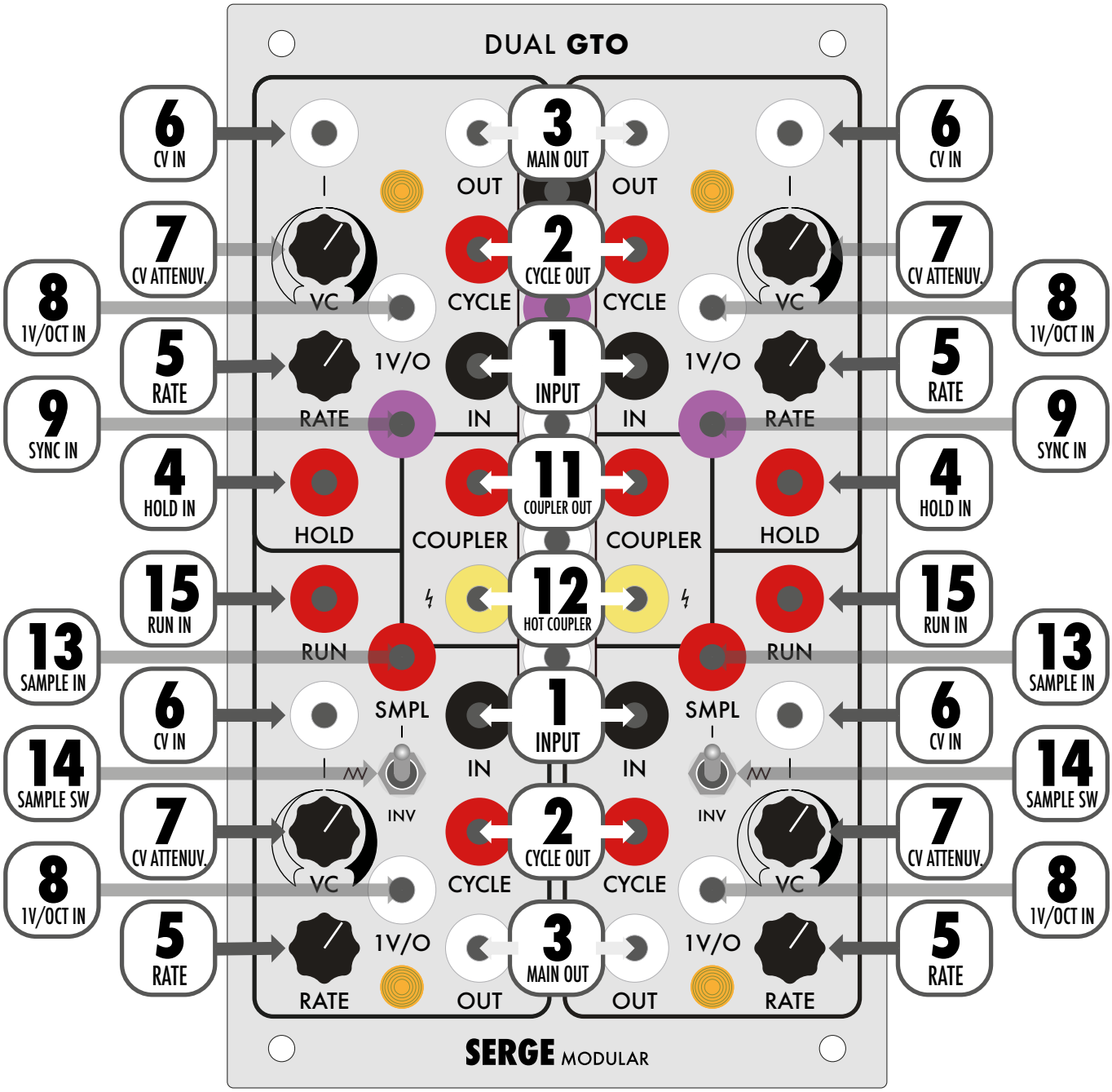


GTO (yellow) acts as in SMOOTH mode, RUN (orange) acts like HOLD.

Please note that RUN and SMPLE IN can be combined for even more complex waveforms and modulations:



GTO output (yellow) as affected by RUN (green) and SMPL (orange).



1V/Oct Input (#8)

Each side of the GTO can be used as an audio source/oscillator (in SMOOTH MODE) and has an additional CV input that has been calibrated to follow the 1V/Oct standard. Both sides are **temperature compensated** and **track 5 octaves or more (up to 2 kHz or above)**.

Sync Input (#9)

As you'd expect, the SYNC input causes the waveform (CYCLE) to restart. In the audio range, this gives you a typical Sync effect, however, the SYNC also works far below audio in the CV range and allows you to reset the GTO as an LFO.

The Coupler (#11, #12)

The COUPLER is an internal comparator comparing the outputs of both side.

Whenever the bottom section is HIGHER in voltage than the top section, the output of the COUPLER goes HI. Otherwise the output is LO. The COUPLER has two outputs, one of which switches between 0V and +12V, the other switching between -12V and +12V. This is useful for generating complex control voltages and for patching a random voltage generator. In fact, the Random Voltage Generator module is a Smooth & Stepped Generator internally patched to function exclusively as such. Note that a Noise Source is needed for use of the GTO as a random voltage generator. The red COUPLER OUT (**11**) is 0 to 5V, the black ("hot", **12**) one goes rail to rail (roughly -12V to +12V i.e. 24V pp). **Please be careful when using the black Coupler**, e.g. when routing to a ADC converter or similar.

GTO - First Steps

The GTO 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. Patch the Smooth side of the GTO to cycle by connecting the **Cycle** jack into the **Input**. The Smooth side then produces a triangle wave from about 0V to 5 V (amplitude slightly depends on frequency), 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 to appr. 4 kHz. The **Cycle jack** provides a corresponding Pulse wave output.

2. Set the Stepped side to cycle as well by patching Cycle to IN (or turning on the **Cycle switch** in the eurorack module). Unlike the Smooth side, the Stepped side will not generate an output in Cycle mode (=LED stays dark or seems frozen) 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 maximum 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.

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).

4. Try whatever you can think of and try not to distinguish between CV and audio - while originally the SSG was primarily for control voltages, very interesting results can be found by going into audio range.

Serge Noise Source

The Noise Source generates both **white** and **pink** noise waveforms.

The **S/H Source** output produces the necessary input for a sample and hold function to produce equi-probable random voltages, similar to a 1/F distribution function. This signal is requred to patch the GTO as a Random Voltage Generator (RVG):

Random Voltage Generator (RVG) Patch

The Random Voltage Generator is the patched version of the generator in the classic Random Source module. The GTO needs a special random signal to make that work: the S/H SOURCE. Simply patch:

- S/H SOURCE ➡ STEPPED IN
- COUPLER (hot) ➡ SAMPLE (STEPPED)
- COUPLER (hot) ➡ SMOOTH IN

The Smooth random voltages are available at SMOOTH OUT, the stepped ones are at STEPPED OUT, and random pulses are available at the COUPLER.

With the Stepped (bottom) RATE knob at maximum, varying the RATE knob of the Smooth section changes the rate of BOTH the Smooth and Stepped random voltages. Varying the RATE of the Stepped side changes the amplitude of your Smooth and Stepped random voltages ... so turning the Stepped RATE knob down reduces the amplitude of the signal at the OUT jacks.

Of course, the Smooth RATE and the Stepped RATE can be voltage-controlled, too.

Please note that the RVG was meant as a CV generator, working at sub-autio frequencies. When you turn the (top) RATE up, you can reach (low) audfio rates, too (up to about 300-400Hz), however, the signal will then max out and turn into a (clean) triangle wave - and should go back to random when you turn the rate down again.

Utility Mixer

The Dual GTO also contains a small mixer section in the middle. The top MIX OUT provides the SUM of the two top main OUTs. Similarly, the bottom MIX OUT adds the two bottom (stepped) OUTs. As the Dual GTO can be used as 4 oscillators, these 2 Mix outputs can be used as funnel the signals into two busses for further processing.

Serge GTO - Patch Ideas

Sync'd VCO

Using both sides combined as one tracking oscillator.

- CYLCE both sides of the GTO.
- Set SMPL switch to center ("free").
- Keyboard 1V/OCT ➡ left and right 1V/OCT of the GTO.
- Adjust the RATE of the top section to tune the top section to be one octave (or 2 octaves, or 5 semitones or ...) higher than the bottom section.
- Right CYCLE out ➡ left SYNC input.
- Listen to left OUT or red COUPLER.

Metallizing VCA

Use a PCO or NTO (or another GTO) as a sound source, the bottom section of GTO as filter / VCA, however, scrambled by the left GTO:

- SAW (or PULSE, TRI) ➡ GTO bottom section IN.
- CYLCE top section of GTO
- CYCLE out (left) ➡ RUN on the right
- Keyboard 1V/OCT ➡ PCO 1V/OCT and left GTO 1V/OCT
- Keyboard GATE OUT ➡ ExtADSR (or DSG) for Envelope
- ExtADSR OUT ➡ VC RATE of right GTO, VC RATE attenuverter fully CW
- right GTO: Rate knob at about 40%

Variations:

1. SYNC: Send PULSE OUT of PCO to GTO SYNC input.
2. (b) Send 2nd output of PCO to 1V/Oct of right GTO
3. (c) Send envelope from ExtADRS also to VC-RATE of GTO (left), VC-RATE attenuverter near center.

Geometric Waveshapes:

- Send a SAW wave from a PCO or NTO or DSG ➡ GTO top section SYNC and ➡ GTO bottom section SMPL.
- Keyboard 1V/OCT ➡ PCO 1V/OCT and left GTO 1V/OCT
- CYLCE top section of GTO
- Do not CYLCE bottom section of GTO

- CYCLE out (left) ➡ IN on the right
- Set SMPL switch to SMPL (top)
- RED Coupler ➡ RUN on the right
- Keyboard GATE OUT ➡ ExtADSR (or DSG) for Envelope
- ExtADSR OUT ➡ VC RATE of right GTO, VC RATE attenuverter fully CW
- Right GTO: Rate knob at about 50%
- Listen to right GTO OUT.

SYNC FM

- CYLCE both sides of the GTO.
- Set SMPL switch to Cycle (center) or INV
- Right OUT ➡ left VC RATE (RATE attenuverter set to about 2 p.m.)
- Keyboard 1V/OCT ➡ both left and right 1V/OCT (but don't expect the patch to track!)
- Right CYCLE out ➡ SYNC

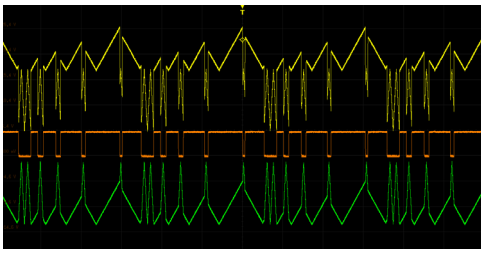
Variations:

- Send left GATE OUT to RUN and set SMPL switch to SMPL or INV

SYNC DRONE

Again, using both sides combined as one massive oscillator.

- CYLCE both sides of the GTO.
- Left CYCLE ➡ RUN
- Right CYCLE out ➡ SYNC
- Right CYCLE out ➡ right VC RATE
- Set SMPL switch down ("INV").
- Keyboard 1V/OCT ➡ left and right 1V/OCT of the GTO.
- Adjust the RATE of the top section to tune the top section to be one octave (or 2 octaves, or 5 semitones or ...) higher than the bottom section.
- Send ADSR or LFO to left VC RATE with VC RATE knob close to center.
- Alternatively, send black COUPLER to left VC RATE with VC RATE knob close to center.
- Use right RATE knob to adjust pitch.
- Listen to left OUT (green) or red COUPLER (orange) - yellow wave is a mix of left OUT and COUPLER:



DUAL GTO Patches

These patches use both sides of the Dual GTO, here named A and B for convenience.

Double SYNC:

- CYCLE both top sections (SMOOTH).
- B: CYCLE out (left) ➡ A: SYNC In
- A: CYCLE out (left) ➡ B: 1V/Oct
- Option: A (going SAW instead of TRI): CYCLE out (left) ➡ A: CV IN, CV-Attenuverter close to center
- Play with RATE knobs on A and B.

SSG mk2 + Noise patch #2

- CYLCE top section of GTO
- Coupler (normal) ➡ Stepped RUN and ➡ Smooth SYNC
- Keyboard ➡ 1V/Oct input
- SH/SRC ➡ Stepped IN

Listen to whatever output ;-)

Dual GTO Critters

Patch **each** side as a Random Voltage Generator (RVG):

- S/H SOURCE ➡ STEPPED IN
- COUPLER (hot) ➡ SAMPLE (STEPPED)
- COUPLER (hot) ➡ SMOOTH IN

Then add interaction between the sides:

- Send left Smooth out to right Smooth CV.
- Send right (normal) Coupler to left ???
- Send right Stepped out to left 1V/Oct for computer music
- Variation: Send pink Noise to any free CV input or 1V/Oct.

Listen to the Smooth (top) outputs.

(Version 21. July 2023, 3:35 PM)