STO



Limited WARRANTY:
Make Noise warrants this product to be free of defects in materials or construction for a period of one year from the date of purchase (proof of purchase/invoice required).

Malfunction resulting from wrong power supply voltages, backwards power cable connection, abuse of the product or any other causes determined by Make Noise to be the fault of the user are not covered by this warranty, and normal service rates will apply.

During the warranty period, any defective products will be repaired or replaced, at the option of Make Noise, on a return-to-Make Noise basis, with the customer paying the transit cost to Make Noise.
Please contact Make Noise for Return To Manufacturer Authorization.

Make Noise implies and accepts no responsibility for harm to person or apparatus caused through operation of this product.

Please contact technical@makenoisemusic.com with any questions, needs & comments, otherwise...
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http://www.makenoisemusic.com

THANK YOU

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Test Subjects: Rob Lowe, Joseph Raglani

Installation:

The Make Noise STO is an electronic signal generator requiring 30mA of +12V and 30ma of -12V regulated power and properly formatted distribution receptacle to operate. It is designed to be used within the euro format modular synthesizer system.

Go to http://www.doepfer.de/a100_man/a100t_e.htm for the details of this format.

To install, find 8HP of space in your euro-rack synthesizer system, confirm proper installation of included power cable on backside of module (see picture below), plug the 16pin end power cable into the euro-rack style power distribution board, minding the polarity so that the RED stripe on the cable is oriented to the NEGATIVE 12 volt supply line. This is USUALLY at the bottom.

Please refer to your case manufacturers' specifications for location of the negative supply.



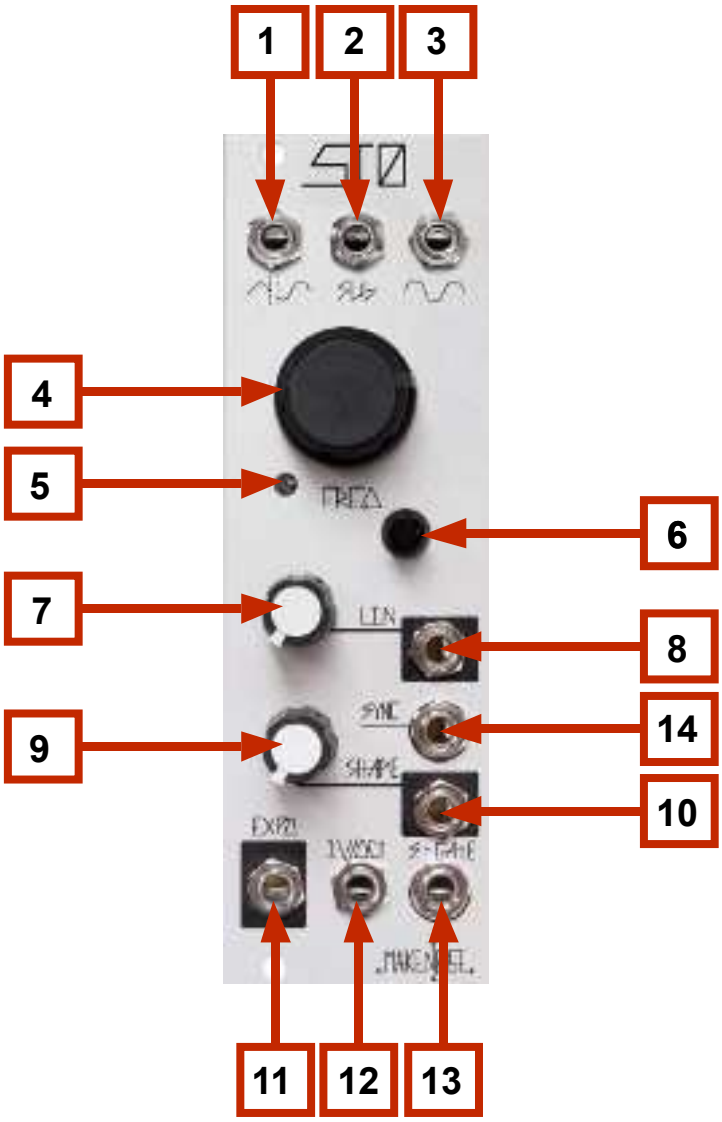
Proper installation of included power cable on module.
Please note the RED BAND.

Overview:

The STO is a compact Voltage Controlled Oscillator designed for generating SINE waves, Variable wave-Shapes, Sub-Octaves, Oscillator SYNC and Linear FM in the analog domain. The Sub-Timbral Oscillator is the more subtle and melodic friend to the DPO's complex harmonic lattice. The STO will yield harmonically rich textures through the use of Hard Sync, Linear FM and Variable Shape, but this VCO seems destined for melody.

The STO uses a Triangle Core and has outputs for SINE, SUB and Variable Shape. The SINE is shaped from the Triangle using the same circuit used on the DPO. The Sub-Oscillator has its own gate input that lets the user turn it on/ off at will. The Variable SHAPE ripples both Even and Odd Harmonics resulting subtle timbral shifts where the fundamental frequency is never masked. When combined with the Sub-Oscillator output (at the input of the MMG, for example) this makes for a rich, strong melodic voice.

The STO is a 100% analog musical instrument that is not suitable for laboratory use.



STO Panel Controls

1. Variable Shape Waveform OUT: 10Vpp
2. Sub-Oscillator OUT: 12Vpp
3. Sine Waveform OUT: 10Vpp
4. Coarse Tune panel control: 9 octave range 8hz-4khz
5. 1V/ Octave Scale Trimmer (see calibration procedure)
6. Fine Tune panel control: +/-2.5 semi-tone range
7. Linear FM Level: uni-polar attenuator for Linear FM input
8. Linear FM INput: AC coupled, 10V range
9. Variable SHAPE: Ripples Even and Odd harmonics. With nothing patched to Variable SHAPE CV IN, works as standard panel control. With Signal Patched to Variable SHAPE CV IN, works as an attenuator for that signal.
10. Variable SHAPE CV IN: Direct Coupled uni-polar control signal input, range 0V to +8V
11. Expo INput: Exponential frequency control input. Bi-polar, 10V range
12. 1V/ Octave control INput: bi-polar pitch control, optimal range +/-5V
13. S-Gate: Resets and turns Sub-Oscillator ON at Gate HIGH, turns OFF at Gate LOW. Just about any signal that exceeds 1V will work here.

14 SYNC: Resets Oscillator Core. Just about any 10Vpp audio rate signal will work here.

The WAVEFORM OUTPUTS

There are three wave shapes that are derived from the oscillator core. These signals are all roughly 10V peak to peak and centered around 0V (bi-polar).

The SINE wave is derived from the TRIANGLE core of the oscillator and is provided as an output because it is great for blending with signals of greater harmonic content in order to strengthen the fundamental. The SINE shape has almost no harmonics, so it is also a good starting point for creating complex FM sounds because the sidebands introduced through FM will not be obscured by harmonics present in the signals utilized.

The Variable SHAPE is a unique waveform that is derived from the SINE. It is more harmonically rich then the SINE, but the fundamental frequency is still very strong. The Variable SHAPE will carry the harmonics and sidebands introduced through Hard SYNC and FM with greater presence then the SINE shape. The end result is that the it will be more aggressive signal when using Hard SYNC or FM. The Variable SHAPE is also excellent for patching Subtractive synthesis sounds.

The Sub-Oscillator is a stepped rectangular shape derived from the comparator on the core of the STO and will be affected by SYNC patches as well as the EXPO, Linear FM and 1V/Octave inputs and controls. The sound is similar to a Square wave, but it is one octave below the frequency of the Variable SHAPE and SINE waveforms making it very pleasant to combine with these signals. It will thinken the sound and provide more harmonics for filters such as the MMG to work upon.

Control INPUTS

There are several control inputs on the STO, all of which conform to the system wide standards. Just about any control or audio signals will be effective in some way at these inputs.

The EXPO CV INput is similar to the 1V/ Octave Input and in fact could be used for adding a second sequence (combining two sequences) or transposing a sequence patched to the 1V/Octave input. It is also highly useful for sweeping the Frequency of the STO to animate SYNC sounds or percussion patches. If wild textures are desired, the EXPO input could be used to implement Exponential FM. When using for modulation be sure to patch a VCA such as the Optomix in series before the EXPO CV IN as there is no attenuator associate with this input.

The 1V/Octave INput is typically used for controlling the Pitch of the STO from a sequencer, CV Keyboard or Midi to CV convertor. It could also be used for all of the functions described above in the EXPO CV IN paragraph. When using for modulation be sure to patch a VCA such as the Optomix in series before the EXPO CV IN as there is no attenuator associate with this input.

The S-Gate input will turn ON, OFF and Reset the Sub-Oscillator. Just about any signal will work as a gate at this input. There is just two states, Sub ON and Sub OFF. Additionally, the Sub will reset at the onset of the gate HIGH state (Sub ON). This input is useful for animating the Sub-Oscillator, allowing it to have rythymic or percussive patterns not associate with the other outputs of the STO. If more narrow signal is used at this input, such as SAW from VCO A onn the DPO, it is possible to create sync type sound in the Sub-Oscillator while the other outputs, SINE and Variable SHAPE, are not affected.

The Linear FM input and associated attenuator is described below in the FM, SYNC and Variable SHAPE section.
The SYNC input is described below in the FM, SYNC and Variable SHAPE section.
The Variable SHAPE input and associated attenuator is described below in the FM, SYNC and Variable SHAPE section.

FM, SYNC and Variable SHAPE:

The STO is capable of generating harmonically rich waveforms. This is accomplished through the modulation of the Variable SHAPE, FM and Oscillator SYNC.

Linear and EXPO FM

Frequency Modulation super-imposes the frequency of one oscillator upon another. The result is that the oscillator that is FM'd will carry the modulating oscillator's pitch information in the form of harmonics. Linear FM attempts to preserve the base frequency of the carrier oscillator allowing for harmonically rich waveforms to be generated while still being able to track the 1V/ Octave scale properly. The Linear FM input is AC coupled and has a Level control. As you increase the Level, the Amplitude of the signal Frequency Modulating the STO is increased and the resulting signals at all outputs of the STO will become increasingly more complex. At greater than 80% Level, the Linear FM bus goes into overdrive and the STO will not track accurately.

Exponential FM is also possible with the STO by patching your modulating oscillator tot he EXPO input. You will want to patch a VCA such as the Optomix in series before the EXPO input on the STO to allow for Dynamic FM (voltage control over the FM Index). Exponenital FM is much deeper and more complex then Linear FM, however it will severely change the base frequency of the oscillator core and therefore the STO will no longer track the 1V/ Octave scale properly. Exponential FM is highly useful when you require complex signals but you do not require proper tracking, for example, if you are programming percussion sounds.

Oscillator SYNC

SYNC patches will introduce strong harmonics to all of the outputs on the STO. Sync uses a modulation method where the core of the STO is made to conform to that of an external VCO. Once SYNC'd the STO core will restart its period at each cycle of the external VCO signal, so they will have the same base frequency. Additional harmonics are achieved when the STO Frequency is HIGHER then that of the external VCO to which it is SYNC'd. In a SYNC patch, the timbre of the STO may be altered by varying it’s frequency against that of the Master Frequency as set by the external VCO signal. Slow sweeping modulation of the STO core Frequency, such as an envelope or LFO patched to the EXPO IN, will result in sweeping of harmonics. The best results are achieved by setting the external VCO to a base frequency of at least at least 100hz (around A2) and sweeping the STO Frequency from 100hz up!

SYNC has the advantage of tracking much more reliably then Linear FM, however the sound is much more aggressive.

Variable SHAPE

This circuit is unique to the STO. It gently ripples both Even and Odd harmonics, while always maintaining a strong fundamental. At 0% the Variable SHAPE output is a SINE shape and at 100% it is a glitched triangle. Although it is well capable of audio rate modulation, it is best served by slower modulations such as logarithmic envelopes and LFOs from MATHS and/ or FUNCTION and Smooth Random Voltages from the Wogglebug. When modulated and combined with the Sub-Oscillator (at the inputs of the MMG or Optomix) this output will create a very strong voice for melodic sequencing.

Patch Ideas:

The Sub Timbral Voice:

Patch Variable SHAPE output to AC input of MMG. Patch Sub-Osc output to DC input of MMG. Set STO Freq to around Noon. Set MMG input attenuator to 60%, MMG Freq to 0%, MMG Q to 40% and Mode to LP. Patch slow LFO logarithmic from MATHS to SHAPE CV IN on STO and set SHAPE attenuator to about 60%. Patch sequencer or keyboard CV to 1V/ Octave input on STO. Patch sequencer or keyboard gate to envelope generator such as MATHS or FUNCTION, programmed for fast Rise Time, Slow Fall Time and Exponential shape. Patch this exponential envelope to the FREQ 2 CV IN on MMG. Monitor MMG Output.

Analog Bass Drum:

Patch SINE to Optomix CH. 1 Signal IN. Patch Gate from René or other sequencer to Linear FM IN and Optomix CH. 1 Strike IN. Set Linear FM amount to 50% and Frequency panel control to roughly 9 o' clock. Set Optomix CH. 1 Damp and Control panel controls to full Counter Clock-Wise. Monitor Optomix CH. 1 Signal OUT. Adjusting the Linear FM amount, Frequency setting and DAMP settings will allow you to create many different Bass Drum sounds. Adding Expo FM from another VCO will expand the possibilities.

Transposition/Superimposition

Patch a sequence such as from Rene to the STO's 1v/oct input. Patch another sequence of a different speed, or control voltage from a keyboard, to the Expo input. The two sequences will be "added" together for transposition. Variations would include: clocking the transposing sequence at an odd division of the master clock, resulting in long periods between exact repetitions; deriving the transposing sequence from the master sequence via sample and hold; tuning a square wave LFO to +/- 1v for double octave leaps.

Dual Sync

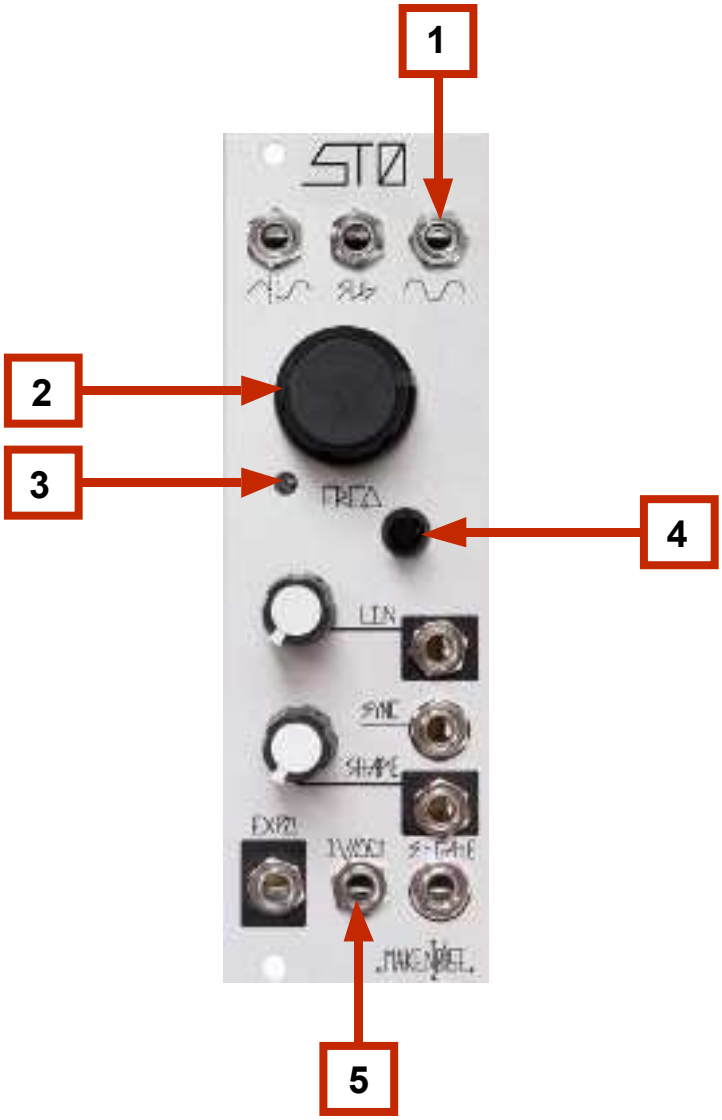
Patch an audio-rate square or sawtooth wave to the STO's S-Gate input, and another to the Sync input. The SUB output will be "pseudo-synced" to a different frequency from the Sine and Variable outs. If the sync sources are related, such as from two sides of a DPO with Following engaged, so will be the STO's outputs.

Key Tracking

Mult the control voltage in the 1v/oct input to the SHAPE CV input, and take output from Variable wave Out. This will result in higher pitches having more harmonic content, similar to keyboard tracking on a low-pass filter.

Bassline

Patch a low-frequency square wave (or EOR/EOC gate from cycling Function or MATHS) to the S-Gate input, and take output from SUB Out. Mult the square wave to the Clock input of a sequencer, and patch the sequencer's output to the STO 1v/oct input. Adjust square wave pulse width (or MATHS/Function Rise/Fall times) to change the length of "notes."



Calibrating the STO

Requires small flat head screw driver or trimmer tool, tuned reference signal, oscilloscope.

NOTE: if you plan to use the STO with another VCO or Synth in your system (even another STO or Make Noise DPO), it is a good idea to use that VCO/Synth for your reference signal, assuming it is calibrated to your satisfaction. The same is true of the quantizer or MIDI to CV interface. Use the unit within your system. If you use one, a digital midi controlled soft synth is also a nice reference signal and note generator. Be certain the reference is not processed in any way by effects or filters or any other processes.

1V/ Octave Scale

Trim for 1V/ Octave Scaling (3) are accessed from the front of the module so that user need not remove the module from the system to calibrate 1V/ Octave Scaling. Calibrate the STO while installed in the system in which it will be utilized.

1.Monitor STO SINE (1).

2. Patch quantizer or MIDI to CV interface to 1V/ Octave INput (5).

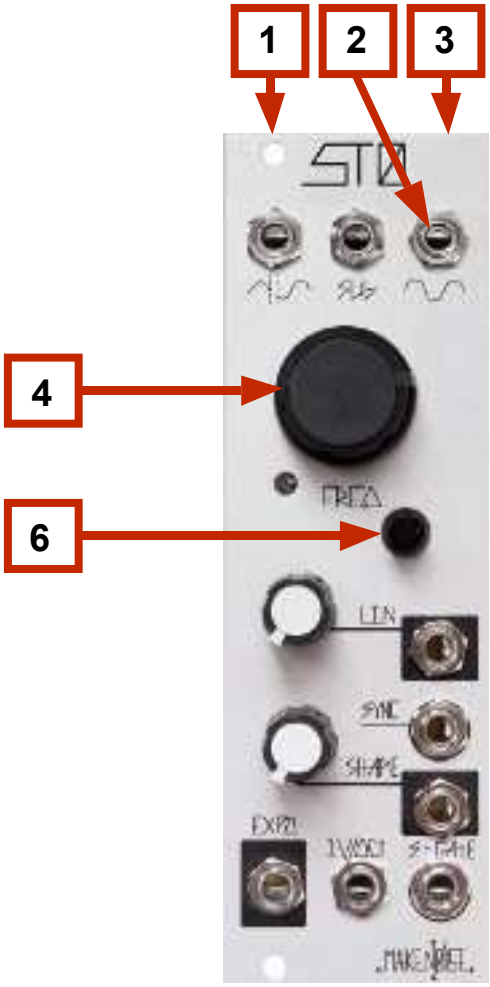
3. Patch this same quantizer or MIDI to CV signal to the reference oscillator and monitor together with the STO SINE. If using digital/soft synth for reference, just pass midi note to MIDI to CV interface connected to STO.

3. Send note C6 to the both DPO VCO B and your reference oscillator, and adjust the FREQ (2) and FINE TUNE (4) Panel Controls so the STO pitch matches that of the reference**.**

4. Send note C3 to the both STO and your reference oscillator, and adjust the 1V/Octave Trimmer (3) on the STO so the pitch matches that of the reference.

5. Repeat steps 3 and 4 until satisfaction or exhaustion is achieved.

6. Check across 4 or 5 octaves and adjust if necessary. The STO will track musically. Expect variance across 4 octaves. Get the tuning so it is useful to you, and move on to making noise.



STO SINE Shape and Amplitude

Trims for SINE shape (1) and Amplitude (3) are accessed through the top side of the module. Take care in lifting the top half of the module out of case for calibration.

1.Monitor the SINE (3) from the VCO to be calibrated. If possible view the signal on an oscilloscope and/ or spectrum analyzer as well.
2. Set VCO to be calibrated near to frequency of C4 (4).
3. Set oscilloscope for 2V/ div. by 2ms/ div. (skip to step 4. if no oscilloscope will be used).
4. Trim SINE Shape (1) for least amount of audible harmonics (skip to step 5 if using oscilloscope).
5. If using an oscilloscope or spectrum analyzer adjust so the SINE shape is pure as possible, meaning both the top and bottom arches are smooth, rounded and glitch free, and harmonics are minimized.
6. Amplitude is adjusted by trim 3. Amplitude should be set using oscilloscope for measurement, to roughly 10.5V peak to peak.

Expect some small amount of harmonics in the SINE shape. Trim to satisfaction and then go make noise!