Tobinski

HARMONIC TIMING GENERATOR

USER MANUAL

Note: This manual is currently being updated.
Please check back later for the final version.

The Tobinski Harmonic Timing Generator (HTG) is an analogue oscillator with a frequency multiplier section connected to 3 voltage controlled switches.

It can be used with the Tobinski Sequencer as the reference clock source to drive each of the 4 sequences at different rates. It features Start, Stop and Step controls for the analogue oscillator and it can be synced to other sequencers using the CV inputs.

It can also be used with the Tobinski Interpolating Scanner as a harmonic oscillator using an internal ribbon cable connection. The output of which is converted into sine waves within the scanner for a smoother tone!

Outputs for Tringle and Square waves of the oscillator are available but the main output is a falling ramp sawtooth that is used to drive the multiplier section.

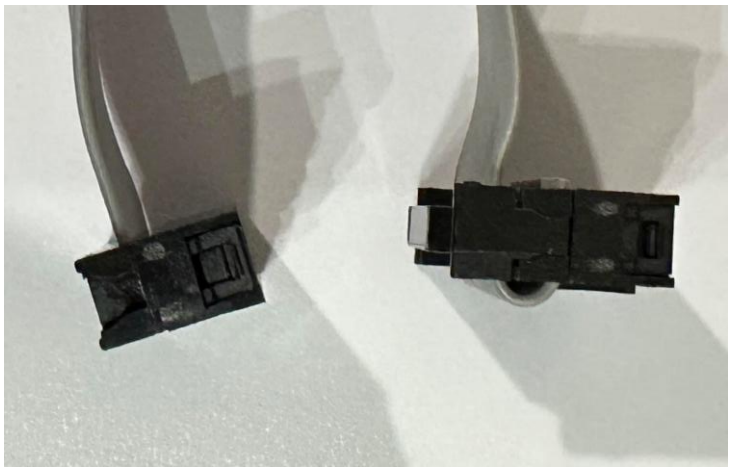
The multiplier section produces falling ramp sawtooth multiplied frequencies of x1, x2, x3 etc... up to x8 but it can also be re-routed using patch cables to produce higher multiplied frequencies. These falling ramp sawtooth wave shapes are necessary to drive the sequencer slide control correctly when used as the reference clock source.

The available multipliers are x2 (4 available), x3, x5 and x7, so it can be routed to produce say 2 x 7 = 14 x base frequency. It should be noted that this is all analogue circuitry and noise will start to affect the accuracy at higher multiplier values.

The multiplier section can be used independently of the internal oscillator by connecting an external +-5V saw tooth into the REF. IN input. It can also be used other waveforms such as triangle or sine waves which not only sound nice at audio frequencies but can produce interesting rhythms when used to clock the sequencer.

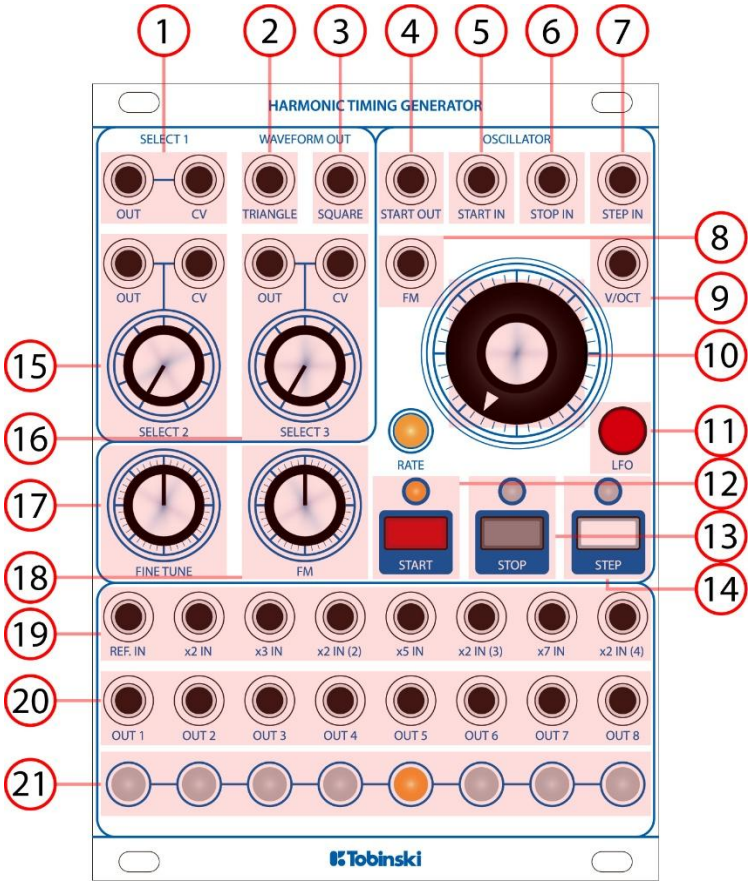
The Step control can be used with a pulse from another sequencer as a sync input and careful adjustment of the oscillator frequency so it matches with the incoming pulse. The Step control also it to be used as a burst generator.

IMPORTANT – PLEASE USE THE SUPPLIED POWER CABLE ONLY



The cable on the left is the supplied power cable that doesn't have a strain relief attached.

The cable on the right has a strain relief and is longer which will cause the power header to be damaged as it will push the power header shroud back and possibly damage the components on the PCB when the module is inserted into the rack.



1. SELECT 1 output and CV (0V to 5V) input. Selects one of the 8 outputs of the multiplier section. The manual selection or offset for the CV is selected via the pushbutton switches at the bottom of the module.
2. TRIANGLE wave (+-5V) oscillator output.
3. SQUARE wave (+-5V) oscillator output.
4. START OUT (+5V Pulse) output. Produces a +5v pulse whenever the START button is pressed or the START IN CV input transitions from low to high.
5. START IN (+5V) CV input to start the oscillator.
6. STOP IN (+5V) CV input to stop the oscillator running.
7. STEP IN (0V to 5V positive edge triggered) CV input. Produces one cycle of the oscillator. Used to sync to external sequencers or for burst generation triggering.
8. FM input.
9. V/OCT CV input for connection to keyboards or sequencers etc.
10. Frequency control.
11. LFO button.
12. START button, starts the oscillator running.
13. STOP button, stops the oscillator.
14. STEP button, produces one cycle of the oscillator when pressed.
15. SELECT 2 output and CV (0V to 5V) input plus manual control. Selects one of the 8 outputs of the multiplier section.

16. SELECT 3 output and CV (0V to 5V) input. Selects one of the 8 outputs of the multiplier section.
17. FINE TUNE control for the oscillator.
18. FM bipolar attenuverter for the FM input.
19. Multiplier inputs.
    - REF. IN – Normalled to the oscillator Saw wave output.
    - x2 IN – Normalled to REF.IN (Saw wave). Produces x2 frequency.
    - x3 IN – Normalled to REF. IN (Saw wave). Produces x3 frequency.
    - x2 IN(2) – Normalled to OUT 2. Produces x2 frequency.
    - x5 IN – Normalled to REF. IN (Saw wave). Produces x5 frequency.
    - x2 IN(3) – Normalled to OUT 3. Produces x2 frequency.
    - x7 IN – Normalled to REF. IN (Saw wave). Produces x7 frequency.
    - x2 IN(4) – Normalled to OUT 4. Produces x2 frequency.
20. Outputs for the multiplier section.
21. Manual switch selection for Select 1. Can be used to select any of the multiplier frequency outputs quickly for live use.

All inputs are tolerant of full modular +-12V signals.

Harmonic Timing Generator

Width 18HP

Depth (internal from panel) = 27mm

-12V @ 176mA

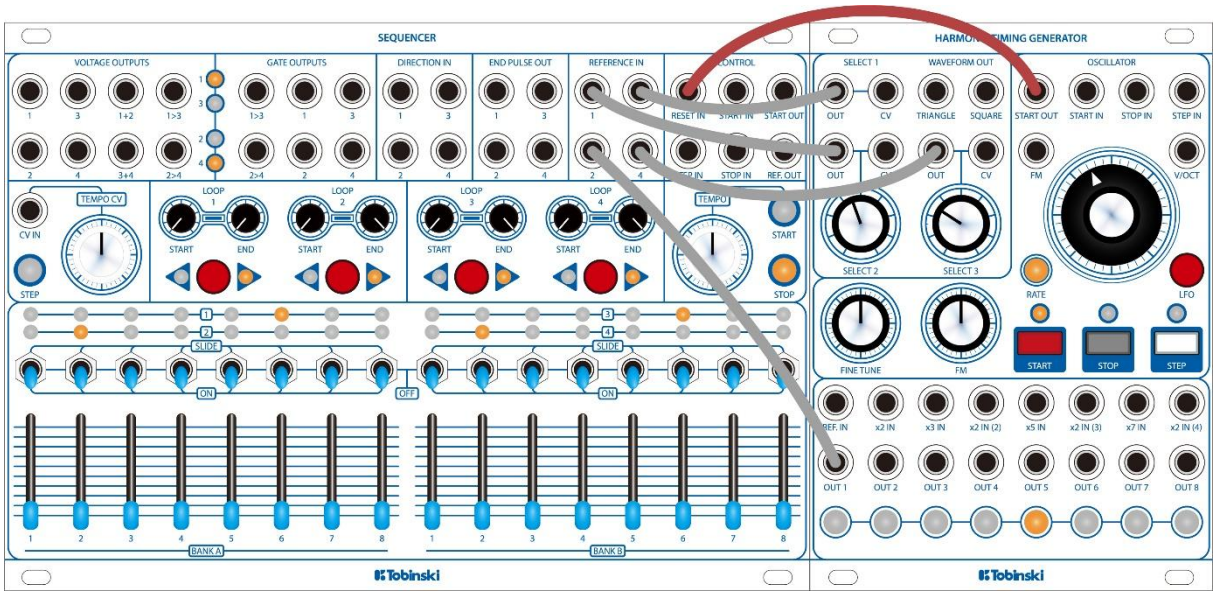
+12V @ 235mA

+5V @ 20mA

HTG AS A CLOCK SOURCE FOR THE SEQUENCER- EXAMPLE PATCHES AND TIPS

The following examples use the HTG as a clock source for the sequencer and require the HTG to be in LFO MODE so the LFO button should be depressed. As well as reducing the HTG frequency, the LFO button engages filtering on all of the multiplied outputs and SELECT outputs which is required to ensure the sequencer advances properly without skipping steps.

HTG CLOCK SOURCE FOR THE SEQUENCER



The first patch shows the HTG being used as the clock source for all 4 channels of the Sequencer module.

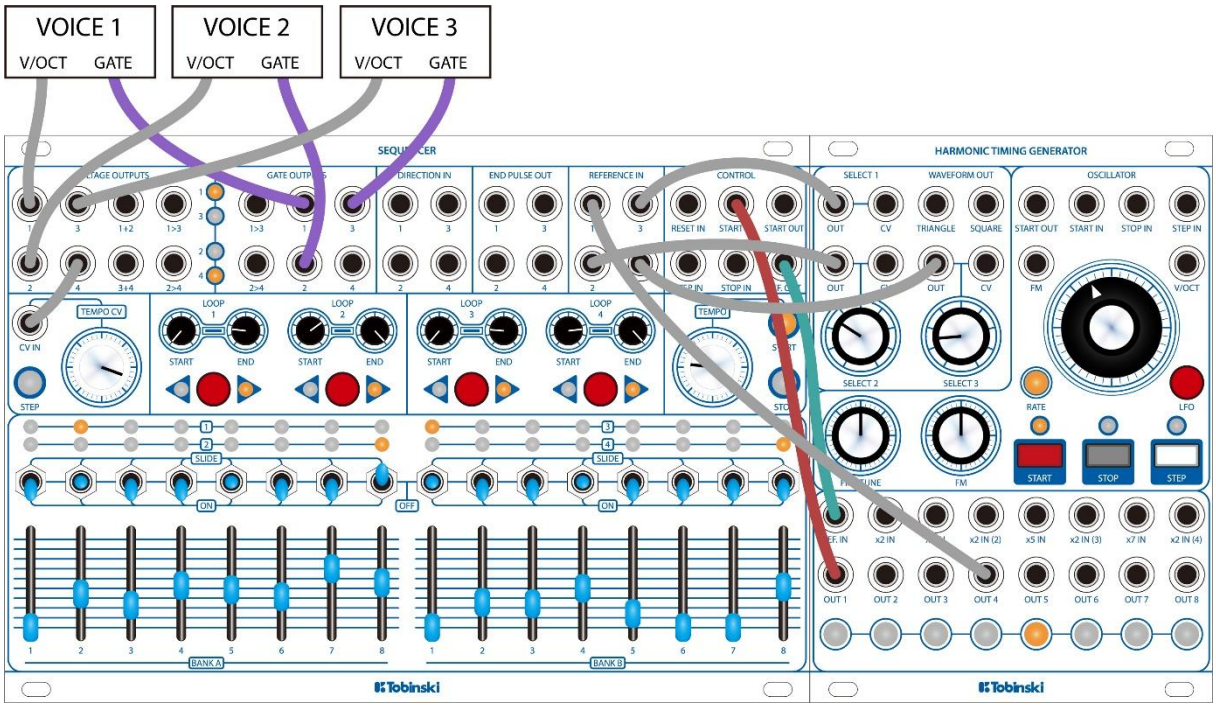
The red cable is used to ensure all sequencers start from step 1 when the HTG START button is pressed.

SELECT 1, 2 and 3 can be controlled manually or via CV for some more intricate dynamic timing.

As shown the settings will produce polyrhythms of 1/4, 3/4, 4/4 and 5/4 so it might sound a bit confusing but setting some switches on the Sequencer to off and adjusting the loop lengths can produce something a little more sensible.

Of course there's no need to have all 4 sequencers running at the same time or at different time signatures but this is just an example of what can be done.

SEQUENCER SWING POLYRHYTHM



This patch uses the Sequencer REF.OUT as the source for the HTG multiplier section. In this way, the TEMPO CV can be modulated using 1 channel of the sequencer to create a swing time and the multiplied clocks can be used to create polyrhythms with a more human feel for the other Sequencer channels that are sent the synth voices.

The above example was tested using simple sine waves and low pass gates for percussive type sounds.

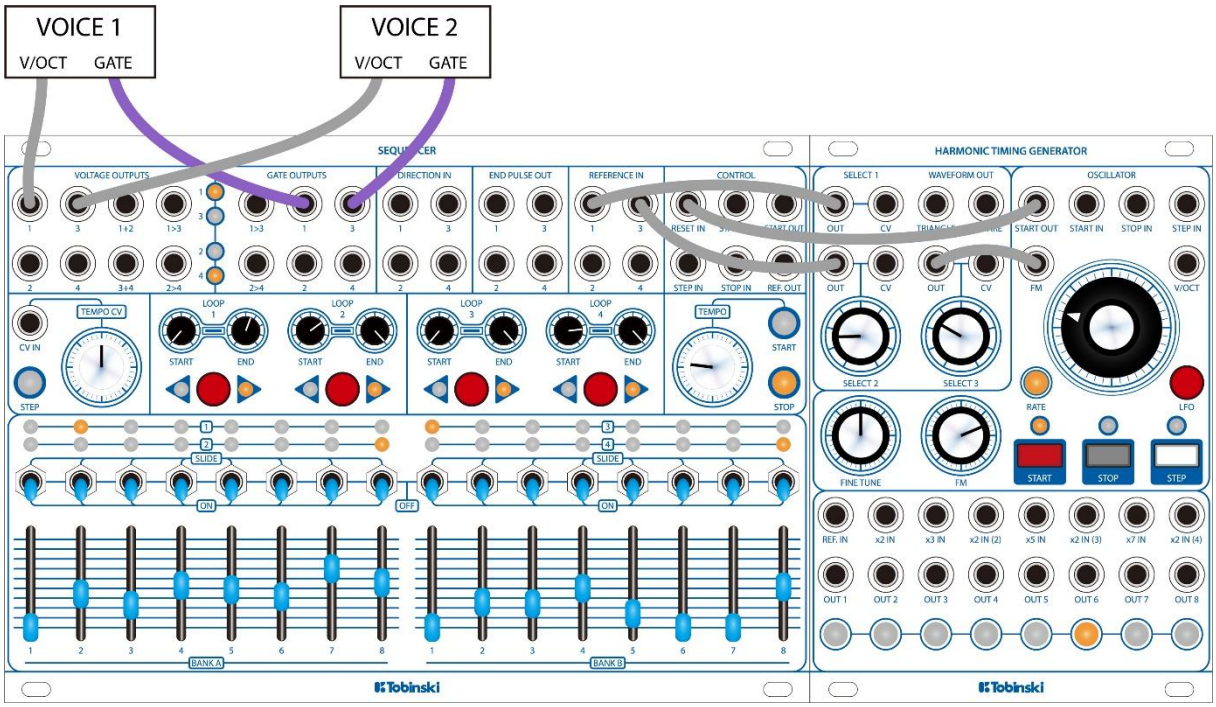
- Patch Sequencer VOLTAGE OUTS and GATE OUTS for channels 1, 2 and 3 to 3 voices (The test example used sine waves and percussive low pass gates), and set the LOOP START/END and sliders plus switches as shown.
- Patch Sequencer VOLTAGE OUT 4 into Sequencer TEMPO CV input and set the LOOP START/END and sliders plus switches as shown.
- Set the TEMPO CV and TEMPO controls on the sequencer as shown.
- Patch Sequencer REF.OUT (green cable) into the HTG REF.IN. This is the input to the multiplier section of the HTG allowing it to be used independently of the HTG internal oscillator.
- Patch HTG OUT 1 (red cable) to the Sequencer START IN. This ensures the sequencer will set to loop start whenever the sequencer clock goes high, keeping everything in sync.
- Patch the HTG OUT 4 to the Sequencer REFERENCE 1 IN.
- Patch the HTG SELECT 1 OUT to the Sequencer REFERENCE 3 IN and select x5 on the HTG bottom row of selector buttons.

- Patch the HTG SELECT 2 OUT to the Sequencer REFERENCE 2 IN and select x3 on the HTG SELECT 2 manual control.
- Patch the HTG SELECT 3 OUT to the Sequencer REFERENCE 4 IN and select x2 on the HTG SELECT 3 manual control.

Obviously there are many things you can do to vary the patterns including, reversing the direction, changing the loop lengths, changing the ON/OFF/SLIDE switches, changing HTG multiplier settings etc.

One interesting thing to try is taking one of the spare multiplier outs at the bottom of the HTG and use it either directly or through an attenuator then into one of the HTG SELECT CV inputs. This gives interesting variations along the manual control which acts as an offset to the incoming CV.

HTG SWING TIMING



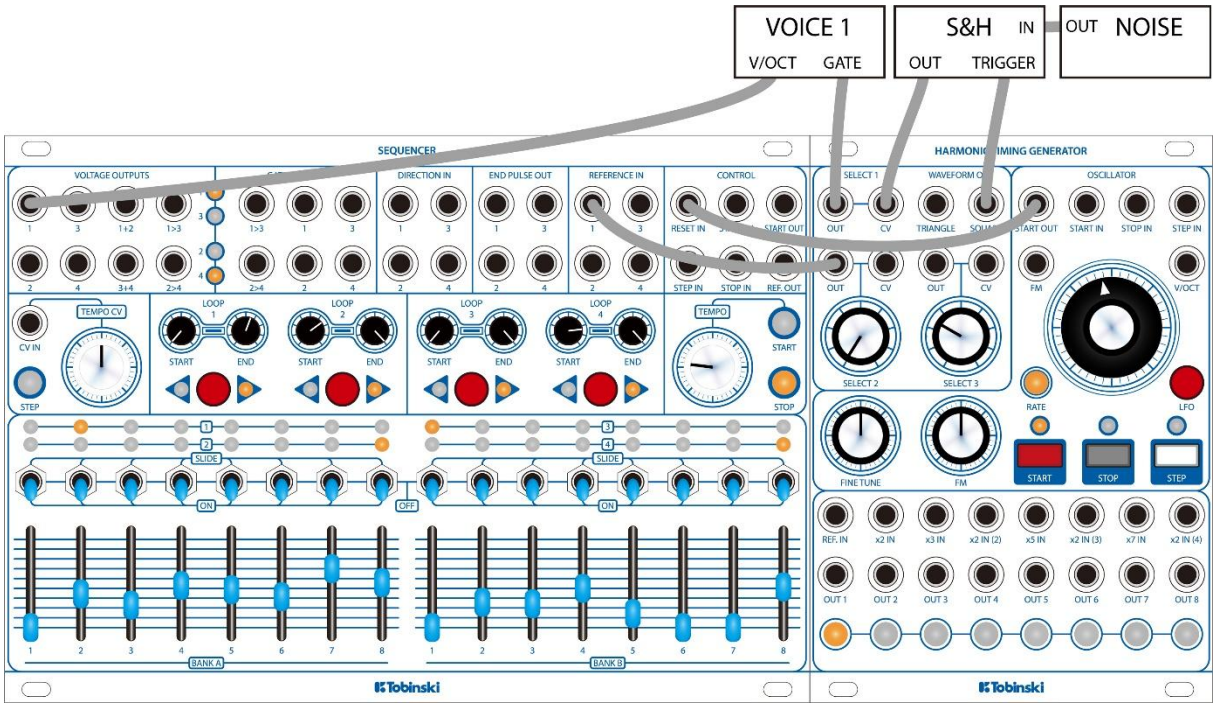
This example shows how the HTG FM input can be internally routed to produce swing timing. The settings as shown are for triplet swing but it can be adapted for normal quarter note or 8th note etc.

- Patch Sequencer VOLTAGE OUTS and GATE OUTS for channels 1 and 3 to 2 voices.
- Patch HTG SELECT 1 to Sequencer REFERENCE IN 1 and select the x6 button.
- Patch HTG SELECT 2 to Sequencer REFERENCE IN 3 and set to x2 on the manual control.
- Patch HTG SELECT 3 to HTG FM input and set to x3 on the manual control.
- Press START on the HTG.
- Set the HTG FM control as shown to produce a swing triplet feel to the rhythm. The FM control is bipolar and can also be set the other way to either push or pull the rhythm for a different type of swing feel.

The technique used to produce the swing timing is done using a falling ramp that is half the speed of the reference clock signal. So the tempo either increases or decreases with the falling ramp (depending on the FM control setting) which will either push or pull the double time reference clock used to trigger the sequencer.

If you want to use quarter notes for the swing timing then set select 3 to x2 and set select 1 buttons to x4.

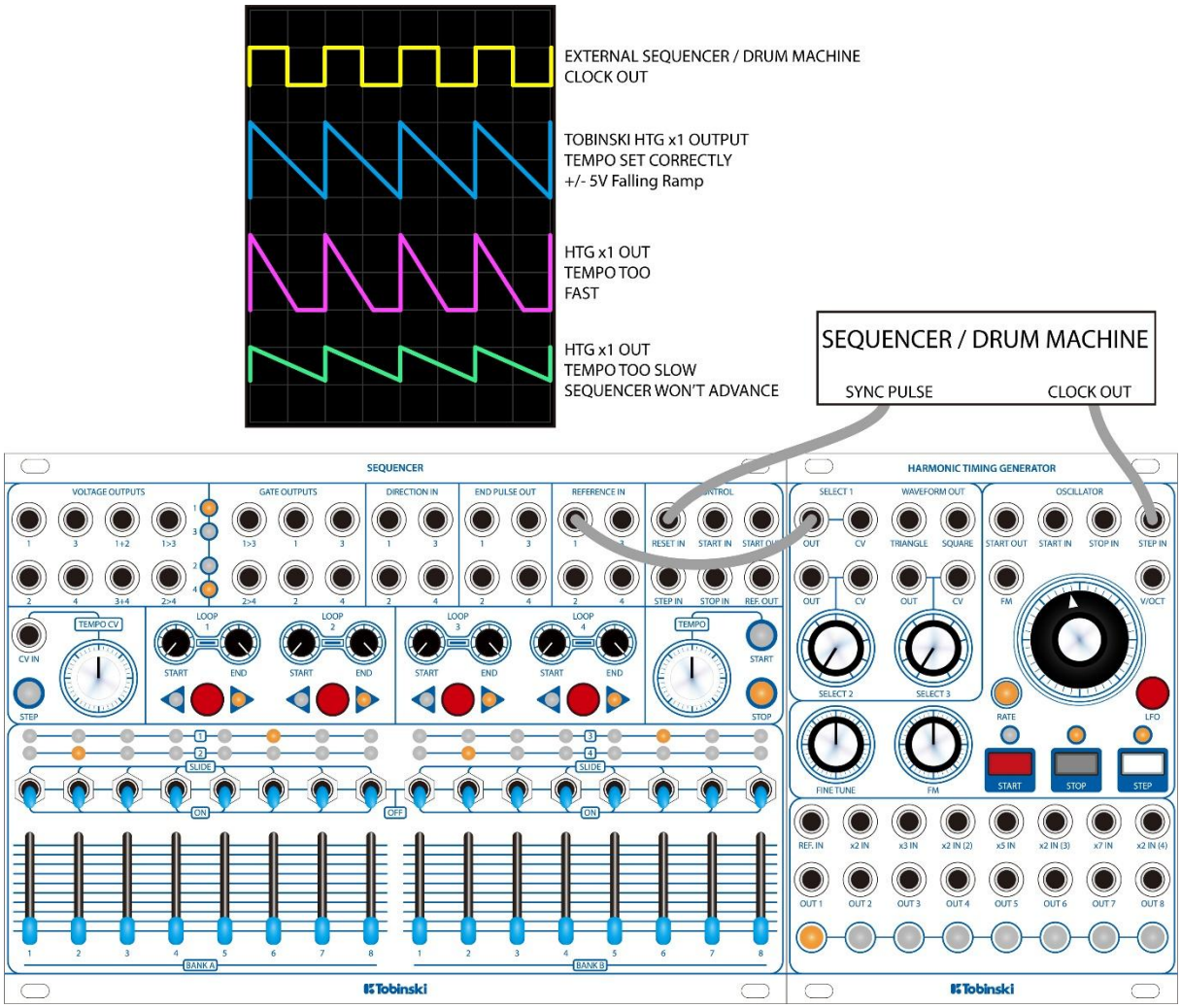
HTG RATCHETING



This patch uses the HTG to clock the sequencer with one channel and trigger the envelope with another. A sample and hold is used to CV control the envelope trigger clock to produce random multiples of the clock for ratcheting effects.

- Patch Sequencer VOLTAGE OUT 1 to the V/OCT input of a voice and HTG SELECT 1 OUT to the GATE IN of the voice.
- Patch HTG SELECT 2 OUT to the Sequencer REFERENCE IN 1 and set the HTG manual control to x1.
- Patch the HTG SQUARE output to a S&H (sample and hold) TRIGGER input and patch the S&H output to the HTG SELECT 1 CV input.
- Patch a NOISE source to the S&H input.
- Select x1 on the HTG SELECT 1 buttons.
- Press START on the HTG.
- Using an attenuator on the S&H output is useful to limit the range of the CV into the HTG SELECT 1 CV input so the ratcheting is more musical.
- The SELECT 1 buttons can also be used to add manual offsets for faster ratcheting.

HTG SYNC TO EXTERNAL SEQUENCER OR DRUM MACHINE



This patch shows the connections for synchronising to an external sequencer or drum machine using the RESET and STEP inputs of the sequencer. The VOLTAGE and GATE connections have been left out of the above diagram for the sake of clarity.

The CLOCK OUT of the external source is connected to the STEP input of the HTG so it fires one cycle of the HTG falling ramp every time the leading edge of the external clock goes high.

The SYNC PULSE of the external source is connected to the RESET input of the sequencer so that it resets to step 1 every time the sync pulse goes high.

The falling ramp generated by the HTG is sent to the Tobinski sequencer that uses the leading edge (sharp low to high transition) to advance the sequencer steps and the falling ramp to control the SLIDE and GATE time.

In order to generate the correct SLIDE and GATE times, the Frequency (large knob) control and the FINE TUNE control on the HTG can be used so that it matches the clock of the external source.

The Scope diagram in the top left shows the clock output of the external sequencer or drum machine in yellow (as shown it is a +5V square wave but it can be anything up to +-12V and the duty cycle can be long or short).

The blue trace shows the HTG x1 OUTPUT. This is how the waveform looks when the frequency of the HTG is matched to the external clock. In this state the multiplied frequencies of the HTG should be in sync also. However it should be noted that the higher multiplied frequencies might be slightly out as small variations between the incoming clock and the HTG frequency cause larger variations in the higher multiplied frequencies of the HTG.

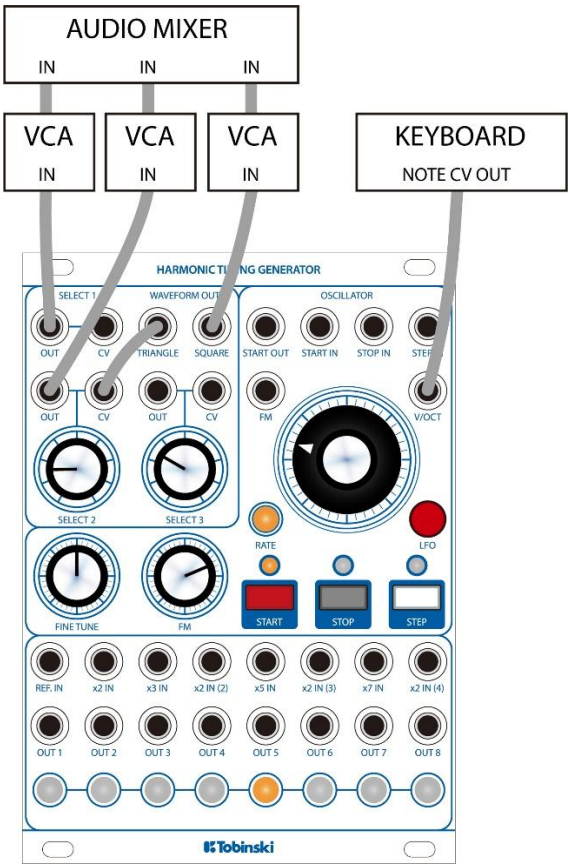
The pink trace shows the x1 OUTPUT when the frequency is too high. This will make the SLIDE and GATE times of the sequencer shorter and also make the multiplied frequency outputs of the HTG occur faster and out of sync.

The green trace show the x1 output when the frequency is too low. As the frequency controls of the HTG are decreased the SLIDE and GATE times get longer but there is a point where the HTG signal no longer passes 0V so the leading edge is not capable to advance the sequencer. As before if the frequency of the HTG is too low the multiplied frequencies will be out of sync but this time they will take longer to occur.

HTG HARMONIC OSCILLATOR- EXAMPLE PATCHES AND TIPS

When the HTG is used as an audio rate oscillator the LFO button should not be pressed in as the filtering will reduce the output amplitude at audio rate frequencies.

HTG AUDIO OSCILLATOR



This example patch shows a few different connections for using the HTG as an audio rate oscillator. The VCAs are all controlled by an envelope(s) triggered from the sequencer or keyboard (not shown in the above diagram for the sake of clarity). The input for the left VCA in the example has been taken from the HTG SELECT 1 OUT for easier selection of harmonics but it could also be taken directly from the OUT 1 to OUT 8 jack sockets at the bottom of the module.

- Patch a keyboard or sequencer into the HTG V/OCT input.
- Patch the HTG SELECT 1 OUT into a VCA.
- Patch HTG SELECT 2 OUT into another VCA.
- Patch HTG SQUARE output into another VCA.
- Patch HTG TRIANGLE output into the HTG SELECT 2 CV input. This can go through and attenuator first for more control over the timbre.
- Patch all the VCA outputs into a mixer then into the audio out of the system.

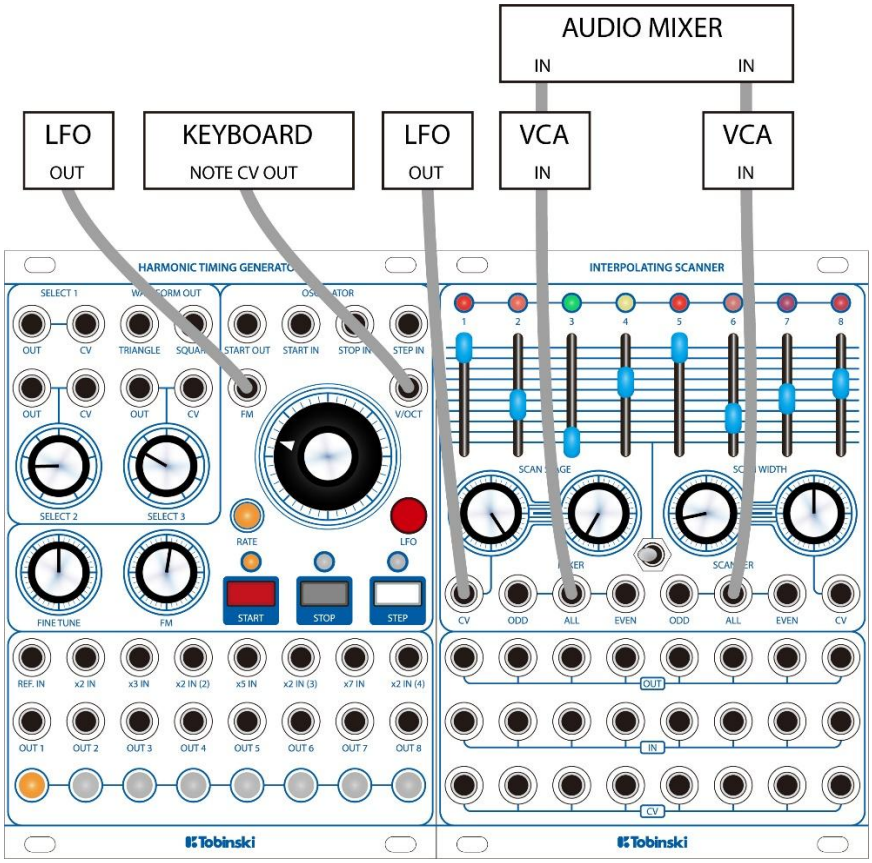
- Press HTG START and play some notes on the keyboard or sequencer.
- Use the mixer to listen each of the VCAs and mix the different timbres.

The SQUARE output can be used to provide a solid reference of the fundamental frequency, while the SELECT 1 buttons on the bottom can be used to quickly change between each of the harmonics to add various overtones.

The SELECT 2 out using the TRIANGLE output as a CV source adds extra textures to the oscillator output. The SELECT 2 manual control can then be used to add an offset for tonal variations.

HTG + INTERPOLATING SCANNER- HARMONIC OSCILLATOR

When paired with the Tobinski Interpolating Scanner, the HTG multiplied outputs (1 to 8) are sent to the Interpolating Scanner via an internal ribbon cable connection where they are converted to sine waves before being sent to the VCA and scanner sections of the Interpolating Scanner.

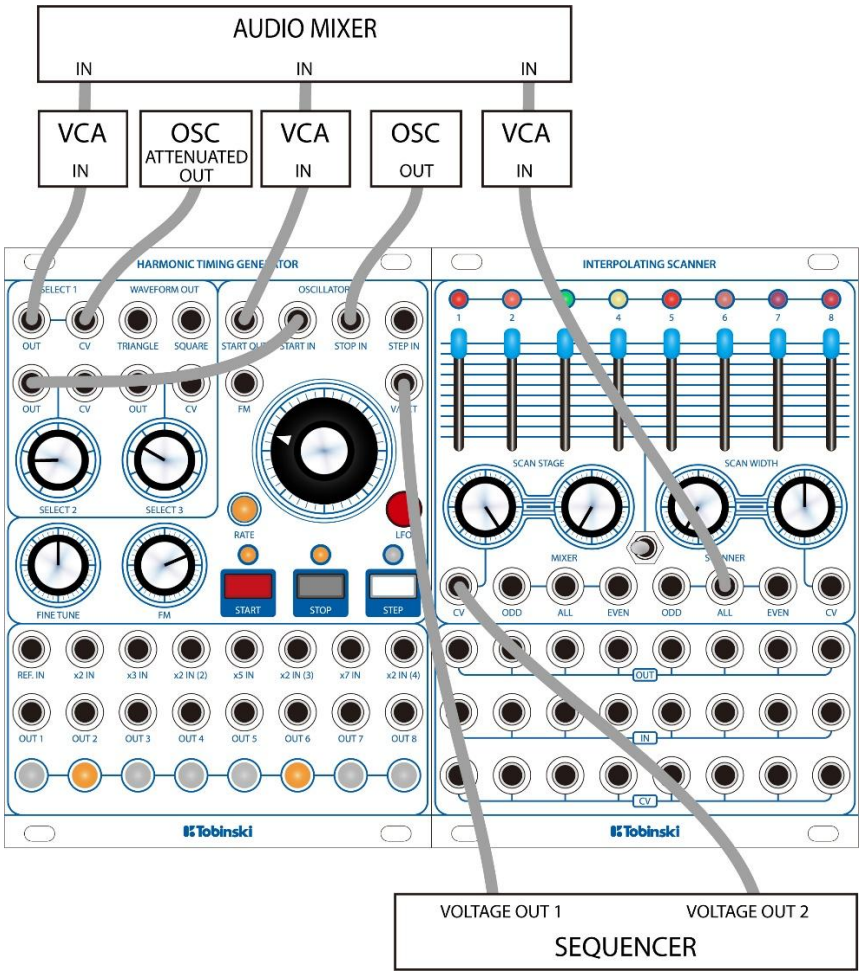


This patch shows a basic idea of how the HTG plus Interpolating Scanner can be used to create a harmonic oscillator similar to draw bar organs using the Interpolating Scanner MIXER ALL output with the addition of the SCANNER ALL output and an LFO to add a scanned harmonic output.

The LFO going into the HTG FM input can be used to add a slight vibrato to the sound using the FM bipolar control for a more classic organ type sound.

The sliders on the Interpolating Scanner can be used to pick out various overtones much like a drawbar organ.

HTG + INTERPOLATING SCANNER- MULTI-TIMBRAL OSCILLATOR



This patch example makes use of the SELECT 1 OUT, START OUT and Interpolating Scanner to create a multi-timbral oscillator that contains many different tonal characteristics.

It also uses 2 external oscillators as CV sources for the HTG SELECT 1 CV and HTG STOP IN that can either be just set to a particular frequency or played with a keyboard or sequencer etc to create different tonal variations.

The VCAs in the above patch were all controlled with one envelope triggered by the sequencer but you could try different envelopes or LFOs controlling each VCA.

- Patch a keyboard or sequencer to the HTG V/OCT input.
- Patch a keyboard, sequencer or LFO to the Interpolating Scanner SCAN STAGE CV input and turn up the CV control.
- Patch the HTG SELECT 1 OUT into a VCA.
- Patch an external oscillator into the HTG SELECT 1 CV input. Using an attenuator on the oscillator output before going to the HTG gives more control over the tonal range that can be achieved. Also using a square wave as the modulation source is nice as it alternates between 2 harmonics on the HTG. The SELECT 1 buttons can be used to add an offset to the CV for more tonal variations.

- Patch the HTG SELECT 2 OUT to the HTG START IN and patch the HTG START OUT to another VCA. Changing the SELECT 2 manual control gives some interesting tonal results. The SELECT 2 CV could also be used for more dynamic variations.
- Patch an external oscillator to the HTG STOP IN. This works well with a square wave input but any waveform will work.
- Patch the Interpolating Scanner SCANNER ALL output to another VCA.

The 3 VCAs can be monitored in turn to hear what's happening at each of the different outputs then mixed to find a nice balance of the different textures.

HTG CALIBRATION AND TEST PROCEDURE

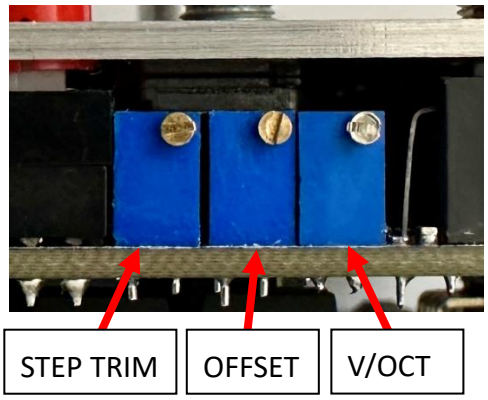
To calibrate and test the HTG you will need an oscilloscope, a CV source that can produce accurate octave voltages like a keyboard or midi to CV module, an LFO or oscillator and a trim pot adjuster.

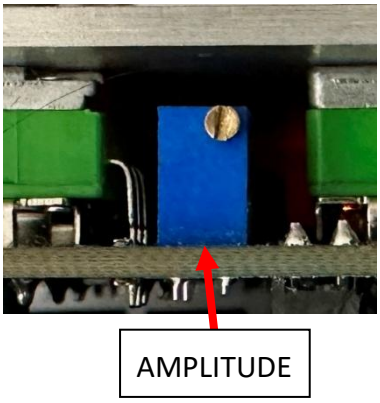
Due to the analogue nature of the circuits it is advisable to let the HTG warm up for 10 to 20 minutes before starting the calibration procedure.

The HTG was mainly designed as a timing generator for the sequencer so it has some circuitry to enable the START and STOP controls in the core of the oscillator design. Although it can function adequately as an audio rate oscillator it should be noted that the V/OCT only has accurate tracking over a 4 or 5 octave range and above this the notes tend to go a little sharp.

It should also be noted that due to the nature of the analogue components, some of the higher harmonics will not be 100% accurate waveforms.

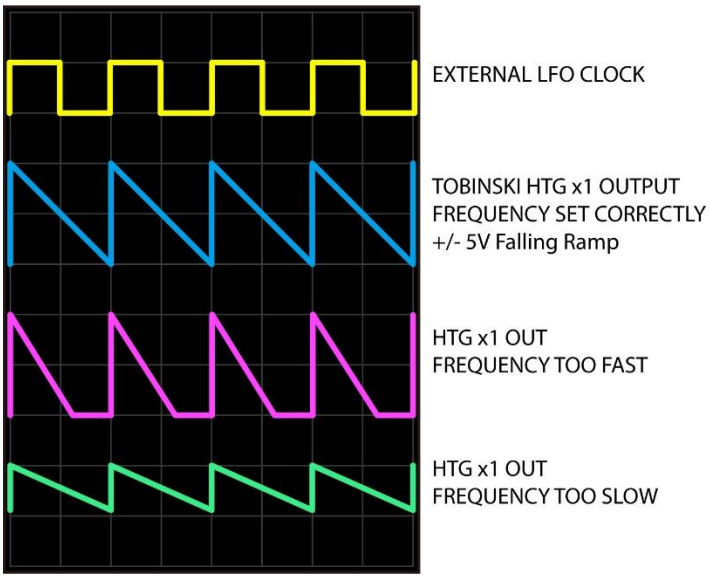
Calibrate the HTG.





1. Connect the SELECT 1 OUT to an oscilloscope and press the OUT 1 select button so the x1 output is selected.
2. Connect the SQUARE out of the HTG to the oscilloscope second channel if you have one available and set the scope so that it uses this signal to sync the scope to.
3. Start the HTG by pressing the START button.
4. Adjust the OFFSET trim pot so the falling ramp is centred around 0V.
5. Adjust the AMPLITUDE trim pot so the falling ramp is going from +5V down to -5V.

6. Select the OUT 7 button (x7 output) on the the HTG and adjust the oscilloscope so you can see the waveform clearly.
7. Fine tune the OFFSET and AMPLITUDE trimpots so the waveform looks as much like a series of falling ramp waveforms as possible. There might be some slight differences in the amplitudes of each of the falling ramp waves but this is expected and part of the nature of the analogue circuits. As long as they look more or less even and have a peak to peak voltage of around +5V to -5V. If you can monitor the audio of the output that is also quite handy as you should be able to here when the signal is purest sounding.
8. Connect an LFO square wave into the HTG STEP input and ensure the HTG STOP button is pressed and the HTG LFO button is pressed (LFO MODE ON).
9. The HTG should produce 1 cycle of the falling ramp every time the LFO pulse goes high. The amplitude of the HTG cycle can be adjusted using the STEP TRIM trimpot so the cycle goes from around +5V to -5V. Note that the frequency of the HTG also has to be adjusted so it is about the same as the LFO.



10. Connect the HTG SQUARE output to a tuner.
11. Connect the CV out from a keyboard to the HTG V/OCT input.
12. Make sure the LFO button is not pressed in and the HTG START button is pressed.
13. Play a C6 note on the keyboard and tune the HTG using the panel frequency controls so it reads C6 on the tuner.
14. Play a C2 on the keyboard and note the difference in pitch.
15. Keep alternating between the C6 and C2 notes on the keyboard and adjust the V/OCT trimmer so the difference between the 2 notes observed on the tuner is 4 octaves. It doesn't matter if the notes observed on the tuner drift away from C, as long as the interval is 4 octaves.