



MAGIC SMOKE ELECTRONICS

CIRCUIT CHANGES

Based on our own prototypes and a great deal of help from FOS (Friend Of Smoke) Dave Brown, a few minor changes were made to the TH-301 circuit for Rev 02. You'll see a list of the new components on the Parts List, and the changes have also been marked on the schematic that comes with this documentation package:

- 1) R20 Changed from 4.7k to 10k. This helps reduce the "pip" at the peaks of the Sine wave.
- 2) R57 Changed from 100k to 255k. This change is OPTIONAL. Normally, the Coarse Tune control has no effect in the extreme ends of the pot travel (only the middle 50% or so of travel actually changes the LFO frequency). The Coarse Tune control was designed with this extra range to allow you to offset other control voltages that might be connected to the TH-301, and is normal in a modular setup. However, some people don't like the "dead areas." In this case, change R57 to 255k, and add R79 (8.06k, although feel free to use another more common value close to 8k). If you want to keep the original design, keep R57 at 100k and put in a jumper for R79.
- 3) R78 added from the base of Q3 to Ground. Helps eliminate some false triggering that occurred.
- 4) R79 Added along with change to R57 (see item 2 above).
- 5) C18b Added as the Low Range Timing cap. This includes adding a Range Switch (at connector SW4). C18 now becomes the High Range Timing Cap.
- 6) C24 Added to minimize glitch in Triangle and Sine waves.
- 7) D15 Added to protect to protect Q4 from negative spikes.

FREQUENCY INDICATOR LED

There are several different options for D12 (the Frequency Indicator LED). You can use a single LED, although this will only display half of the output wave. If you use a bipolar LED or two standard LEDs, you'll get a display that shows both the positive and negative halves of the output wave. The wiring for the different LED options is shown in the Connector Wiring document.

CALIBRATION / TUNING

First, set the LFO frequency to about 10Hz and adjust the Symmetry (R64) and Offset (R67) of the Triangle wave. There will be some interaction between these controls, so you may have to go back and forth a few times. Next adjust the Sine Distortion (R65) for best symmetry and offset on the Sine wave, and then adjust the Ramp Connect (R66) for a nice smooth Ramp waveform. Note: when you first fire up the TH-301, you may have to toggle the Delay Select switch (S1) to get an output. This is especially likely if you have the Fine or Coarse frequency controls near the ends of their travel. Flip the switch from "Gate" to "Footswitch" to see an output. Leave the switch in the Footswitch position while calibrating and tuning the circuit.

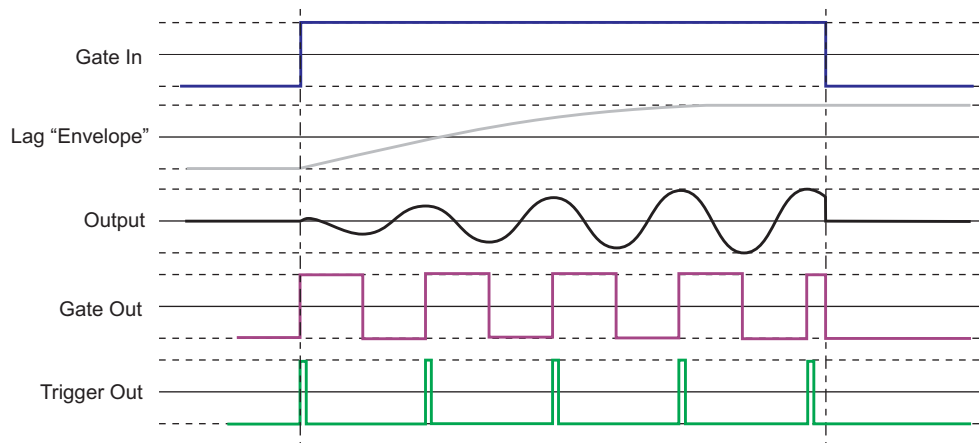
The tuning procedure is courtesy of Dave Brown: "The last adjustment is the Volts/Octave trim (R1). Let the LFO run for a few minutes so that the circuit temperature can stabilize. I used my keyboard as the voltage reference and disconnected the coarse and fine controls so 0 volts input would have 0 volts on R1. That way I could measure the base LFO frequency at 0 volts and adjust the trimmer for 2X that frequency with a 1 volt input. Then I checked and adjusted the trimmer for 4X the frequency with 2 volts, and 8X the frequency with 3 volts. This adjustment is more difficult with the Fine and Coarse controls in the circuit as the trimmer then adjusts both the upper and lower frequencies."



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USING THE TH-301

The TH-301 has several features that set it apart from a standard LFO. The most unusual features are the Delay and Lag functions. When the Delay Select switch is set to Gate and the TH-301 is triggered at the Gate input, the output level is set to zero and rises back up to maximum at a rate set by the Lag control. The maximum Lag Time is about 2.5 seconds. This allows the classic “delayed vibrato” effect to be achieved without using an external VCA and Envelope Generator. Note that the output lag can also be triggered with a normally open footswitch (with the Delay Select switch set to Footswitch, of course). The Gate input also discharges the main timing capacitor, and performs a reset or sync function. The Sync input can also be used to reset the main timing cap without using the Lag or Delay functions.



The Delay function behaves like a Gate Delay. When the Delay Select switch is set to Delay and the TH-301 is triggered at the Delay Trigger input, the Lag cycle described above will happen after the delay time has passed. This allows for an ever wider range of effects, as the output will begin to rise only after the delay. The maximum delay time is about 5 seconds. Note that the Gate and Trigger outputs are held low until the delay time period is over. The Delay Trigger also performs a reset on the timing capacitor, causing the output waveforms to reset and sync to the trigger pulse.

