M111 Sample & Hold

FUNCTION DESCRIPTION

The M111 Sample & Hold is a control voltage generator not unlike a keyboard or sequential controller, but with important differences in its method of voltage output selection. Like the M109 Sequential Controller, the M111 Sample & Hold has a clock oscillator which determines the speed of its output operation. This clock oscillator can be bypassed by introducing Gate pulses to the EXT CLOCK INPUT of the module. With nothing connected to this input the sampling speed can be set by the CLOCK RATE potentiometer at the top of the module.

The second section of the M111 module, the sample section, selects the instantaneous voltage which appears at the S&H INPUT jack and holds that voltage as a DC output until the next clock pulse. An internal PINK NOISE generator always feed the S&H INPUT jack with fast ever changing voltages. This noise signal can be bypassed by connecting an external CV signal to this jack.

The final sampled DC voltage go thru a third section which introduces an adjustable delay or "LAG" on it by the mean of potentiometer OUTPUT LAG. This creates a PORTAMENTO like effect on the S&H OUTPUT jack.

Musical Application

One of the most familiar sounds in popular electronic music is the "pseudo" sequencer sound {or computer sound} created by the sample and hold module running at a regular clock speed while sampling au audio input like white or pink noise. This same patch can be used to control the filter or amplifier for varied timbre or dynamic changes.

In addition to the internal clock oscillator, external sources can be introduced to vary the time between samples. Complex rhythmic sequences can be obtained from multiple oscillators mixed together, keyboard, or sequencer gate outputs.

Varied musical intervals, other than random samples can be achieved by using different waveforms from control oscillators, sequencers, or external audio sources.

The circuit description

A big part of this circuit is derived from the famous MOTM 101 Noise Generator/S&H module. But many components have been changed to better suit this new version.

The core of the M111 Sample & Hold circuit is based on the LF398(U3) S&H IC. This IC has all it's needed to sample incoming +/-15v voltage (pin3), charge and keep the sampled voltage on an external cap (pin6). The sampling take place on every rising edge pulse at CLK IN (pin8). The sampling pulses come from a TLC555(U6) (pin3) configured as astable oscillator. Its frequency rate can be varied from 0.5 to 20Hz (fixed 30msec. rising pulses) using P3 "RATE" potentiometer.
By default U6 output is wired to EXT CLOCK INPUT jack J3 but get disconnected on any introduction of an external clock source. This external clock source can be from +/-15vp max but the clock trigger takes place at 1.36v threshold point through pin3 of TL072(U4A). The +/-15v amplified pulses feed another TLC555(U5) through C21 to get a narrower pulse at pin3. This final pulse is used to sample the incoming S&H INPUT voltages to LF398(U3) pin8.
LF398(U3) S&H raw output is then unity gain buffered by U2A then passed through a first order low pass filter (P2,R14,C18) to get an adjustable "LAG" effect on the S&H output voltage. It is then buffered by U4B to J2 S&H final output.

By default the incoming S&H signal comes from an internal PINK noise generator. The complete PINK noise is generated by first using 2 x 1N5240B Zener diodes (D2,D3) avalanche effect, then amplifying the thin amount of WHITE noise at C11 using 2 consecutive TL072 sections(U1) then going through a specific low pass amplified array (R3,C7,R6,C10) to get a rounded version of PINK noise at U2B(pin7). This signal is connected by default to S&H INPUT jack J1 but get disconnected on any introduction of an external signal source.
Since both Zener diodes needs some times to get a "stabilized" voltage at power up across C11(3.3uf) there is a need to "clamp down" the largely waving voltage for a small period of time.. This is the job of C6,D1,R2,R1,Q1. The 2N3819(Q1) JFET shorts U1A feedback loop at power up to help keep the PINK noise output quiet until the Zener's voltage is DC stable and reliable.

P1 LEVEL adjust the amount of signal to be sampled by U3.

Adjustments and trimmings:

The following is the only adjustment procedure:

-Connect an accurate true rms AC voltmeter between GND and U2 pin7.

-Adjust VR1 (noise gain adjust) to get a signal around 1.3vrms AC.
On the scope this signal is a PINK noise signal at around 10vpp.

-All needed trimmings done !

October, 2021
Jean-Pierre Desrochers
ArcEnSon

ELECTRONIC SPECIFICATIONS

POWER CONNECTOR PIN ASSIGNMENTS

1	-15V
2	A GND
3	A GND
4	+15V
5	D GND
6	+5V

Panel Size: Single width 2.125”w x 8.75”h.

Controls:

CLOCK RATE pot span: 0.5 to 20Hz
Internal Clock pulse width: positive 30msec.
EXT CLOCK INPUT: Rising pulse +2vp min.

INPUT LEVEL impedance: 100k +/-20%
S&H INPUT ext signal: -15v to +15v max

OUTPUT LAG pot span: 0.5 to 400msec.
S&H OUTPUT signal: -5v to +5v max

All input impedances: 100k +/-5%
All output impedances: 1000ohms, nom.

Power:
+15V @ 16mA,
-15V @ 16mA,
+5V @ 6mA.

ArcEnSon