State Machine V1.2 – User Guide
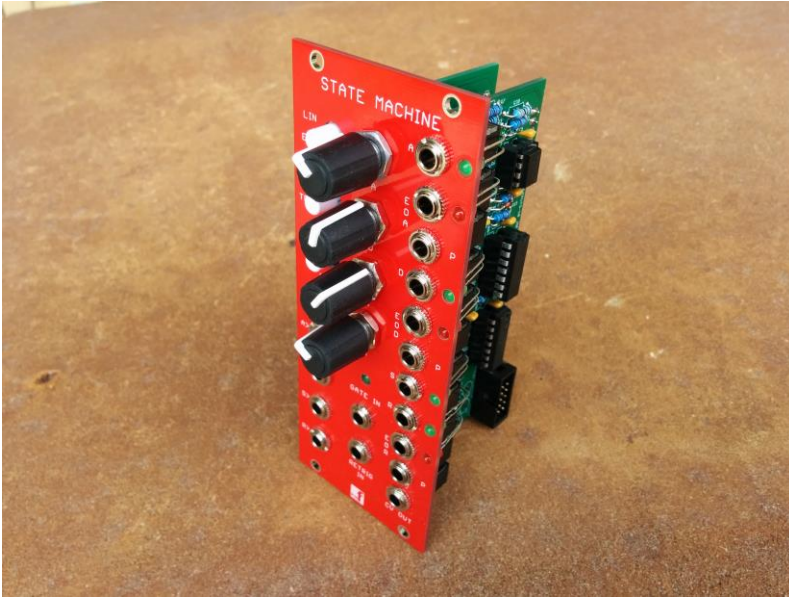
The module is designed for a monophonic Analog synthesizer.

The module is designed and sized for **Eurorack** systems. You will need a 16-10 pin **Eurorack** power ribbon connector with –12/0/+12 which is connected to a synth power supply.

Calibrating the State Machine

If you bought PCBs or a kit, you should only need to calibrate the unit once. If you bought a pre-built and tested unit, you can skip this section.

There are two calibrations. For both calibrations, start with the following:

1. Power up the module.

2. Attach -ve probe of multimeter set to the 20V range (or an oscilloscope) to the GND of a patch cord or other accessible signal ground.

3. Attach the +Ve probe of the multimeter (or an oscilloscope) to the signal pin of a patch cord plugged into the CV out jack of the State Machine.

4. Set pots ATTACK to between 50% and maximum, DECAY, RELEASE and SUSTAIN to minimum.

5. Plug a GATE signal (from a keyboard or other gate source) into the GATE input.

Attack Peak

1. R32 (ATTACK PEAK) determines the maximum voltage that the ATTACK will reach before beginning the DECAY time.

2. Turn the trimmer R32 fully counterclockwise by turning up to 25 times or until you hear the click of the end stop, then turn it 10 turns clockwise. The following steps will then need to be repeated until the CV output rises to the desired ATTACK PEAK level and then immediately starts to decay:-

   a. generate and maintain a GATE signal by pressing and holding a key on the keyboard,

   b. measure the CV OUT signal. It should rise (ATTACK) to a maximum value and may start to decay. The objective here is to get the signal to decay immediately the attack reaches 10V.

   c. while holding the key down, adjust R32 until the CV OUT signal switches to decay mode when it reaches 10V, maybe 3 or 4 turns either way.

   d. If the voltage is high, turn the trimmer clockwise until the voltage gets to around 10v and then fine tune it. If it is too low, attack will not reach maximum before decay starts, too high and the attack wil be slow to turn around to the decay or it will not turn around at all but remain high.

   e. release the GATE signal (key) and allow CV OUT to reach 0, and repeat the exercise

3. Repeat until the signal at CV OUT reaches an ATTACK PEAK of 10V and then immediately starts to decay.

MAXIMUM SUSTAIN

1. Turn the SUSTAIN control to MAX.

2. Press and hold a key until it attacks, decays and then reaches the sustain level and continue holding.

3. Turn R30 (MAXIMUM SUSTAIN) trimmer in either direction until the voltage meaured is +10V

4. Now when VR3 (SUSTAIN LEVEL) is set to maximum, there will be no DECAY time. You can play with this setting if you want different behavior.

Operation

The Envelope Out jack will in general be used to control a VCA or filter in response to the ADSR curve generated during the time that a GATE signal is applied to the GATE jack.
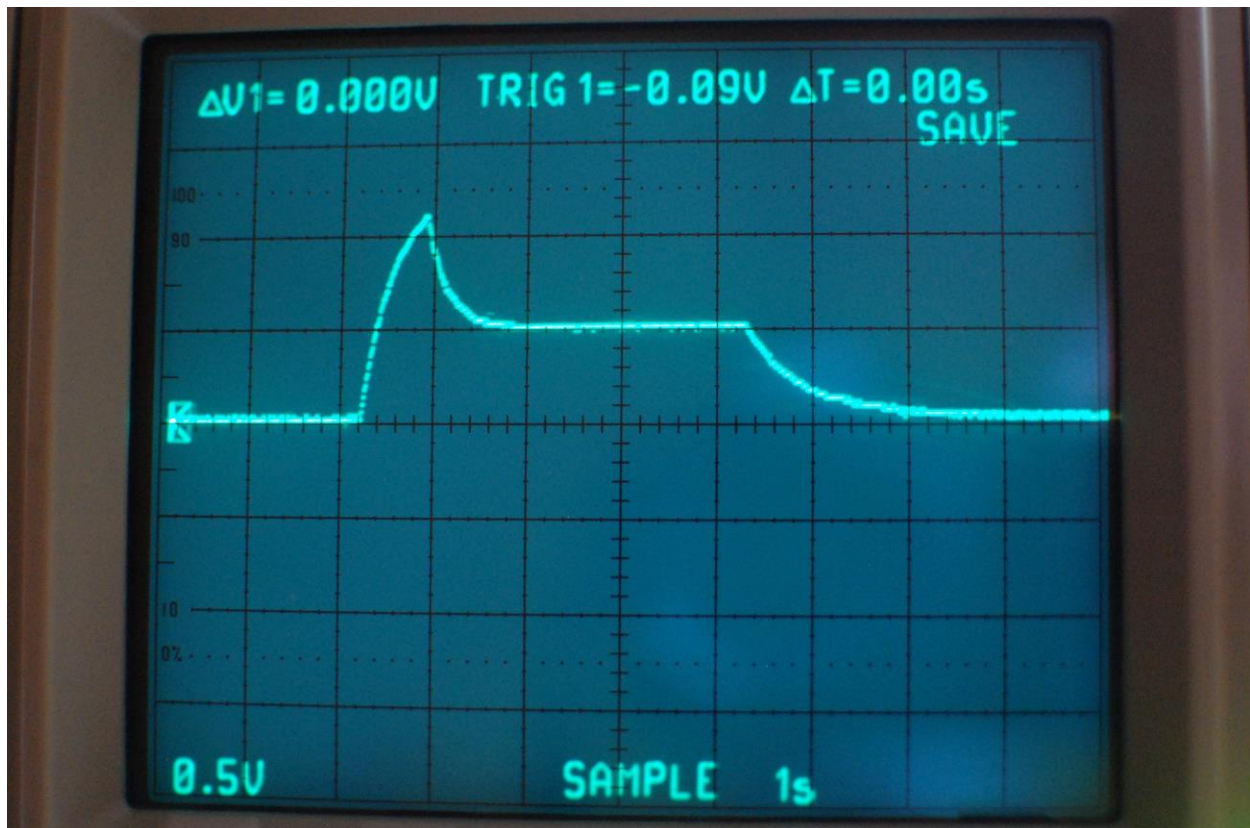
Controls

1. Gate In
2. Retrig In
   For keyboard controller with retrigger output, this will reset the envelope to the attack phase.
3. > A, > D, > S, > R
   CVs for ADSR sections. Standard 0 to 10V but small negative voltages will shorten the A,D and R times. Negative S will produce a sustain level below 0V.
4. Linear/Exponential
   Linear will shorten the envelope as well as change the shape.
5. Gate/Trig
   Gate: When gate held, envelope follows ADS stages. When gate released, R stage begins.
   Trig: When positive edge of gate signal, envelope starts A stage. The envelope continues with the R stage if the gate is released. If the gate is held, the ADS stages will be followed until the gate is released, in which case the R stage is entered immediately.
6. Loop
   Gate/Trig must be on Trig. Press Loop to start self-cycle/LFO mode. Cycle will start/stop/change shape depending on settings of ADSR. There is no sustain in loop mode if there is no "held" key. The curve follows AR only.
   If a key is held down the A and D curves are followed.
7. Envelope CV out
8. State outputs
   A - On when attacking
   EOA - positive edge of gate signal resets to 0, goes high at end of A.
   EOA (P) - short pulse only at start of EOA
   D - On when decaying
   EOD - resets to 0 when rising attack signal hits sustain level, goes high at end of D.
   EOD (P) - short pulse only at start of EOD
   S - On when sustaining
   R - On when releasing
   EOR - positive edge of gate signal resets to 0, goes high at end of R.
   EOR (P) - short pulse only at start of EOR.
9. EOD or EOR cycle
   Set Gate/Trig to Trig. Patch EOD into Gate. A and R change shape, S changes base voltage.

Set Gate/Trig to Trig. Patch EOR into Gate. A and R change shape. CV covers 0-10V.

There is no sustain in this mode because there is no "held" key. The curve follows AR only.

10. Notes:
    a. If the gate is released before the sustain level is reached, R starts immediately and the EOD will not open until the level reaches the sustan level.
    b. If sustain is set to 0 there will be no EOD output.
    c. To self-cycle with EOD, must have sustain above 0
    d. To self-cycle with EOR, sustain can be at 0.