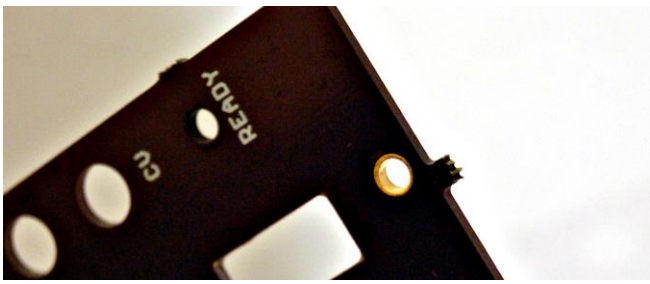
Saw v1.0 – Assembly Guide

Thank you for purchasing this module! This is an average build with easy soldering. Some of the pads are quite small and you will need a chisel tip or screwdriver tip soldering iron and the skill to solder these tiny joints.

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.
Follow the parts lists, these instructions and the PCB silkscreen text to build the module.
The module consists of 1 PCB board and a front panel.
You may need to clean up the board edges with wire cutters and/or a file to remove the remains of the tabs from the fabrication process. This is particularly important for the edges containing the jacks. These edges will need to mate flush with the front panel.
You must follow the order of assembly as described below since some components will be soldered underneath other components.

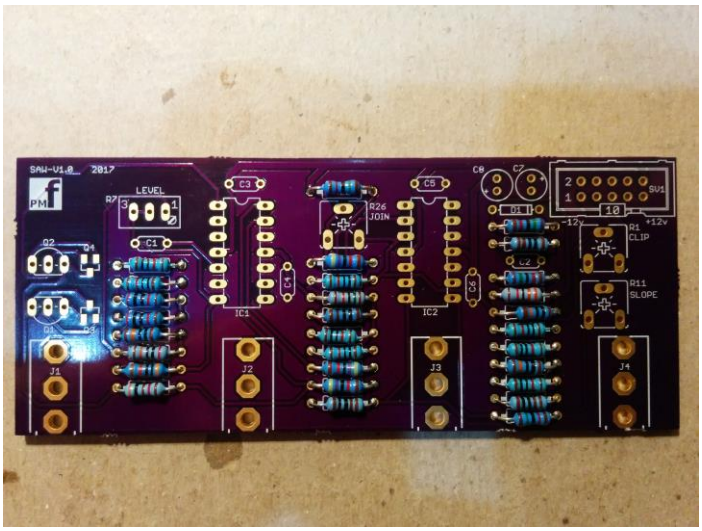
Constructing the board

1. Clean board edges with wire cutters and/or file to remove the manufacturing tabs.



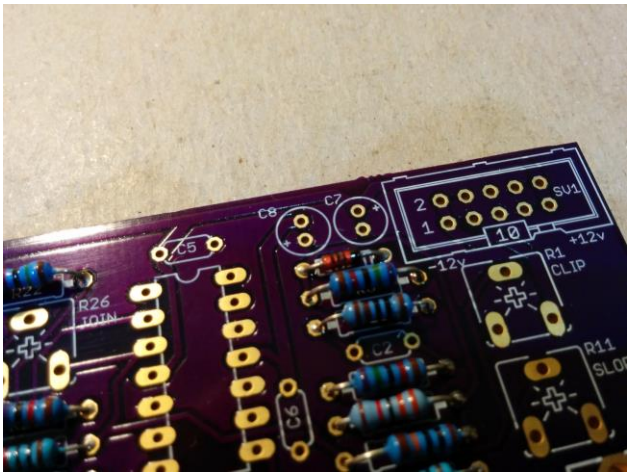
2. Resistors

Install the flat resistors on the TOP of the board. Solder and clip the leads.



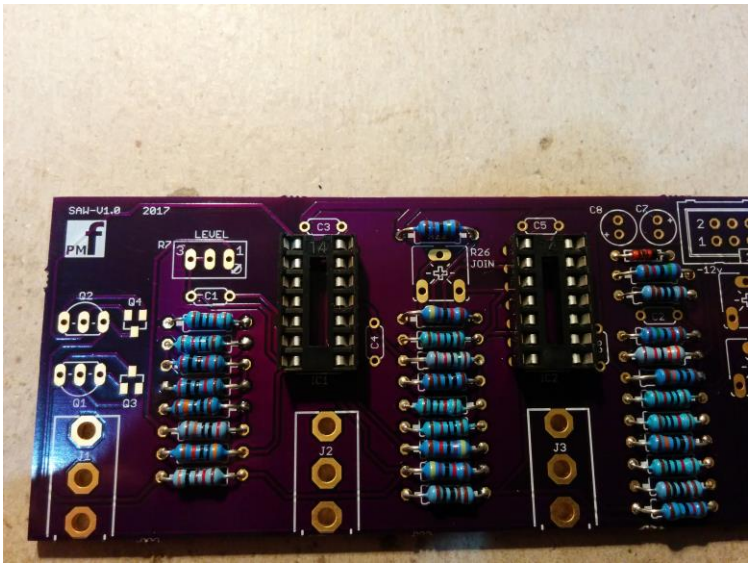
3. Diode

   Install the diode on the TOP of the board. These are polarized components. Align the stripe on the diode with the stripe marked on the board. Solder and clip the leads.



4. IC Sockets

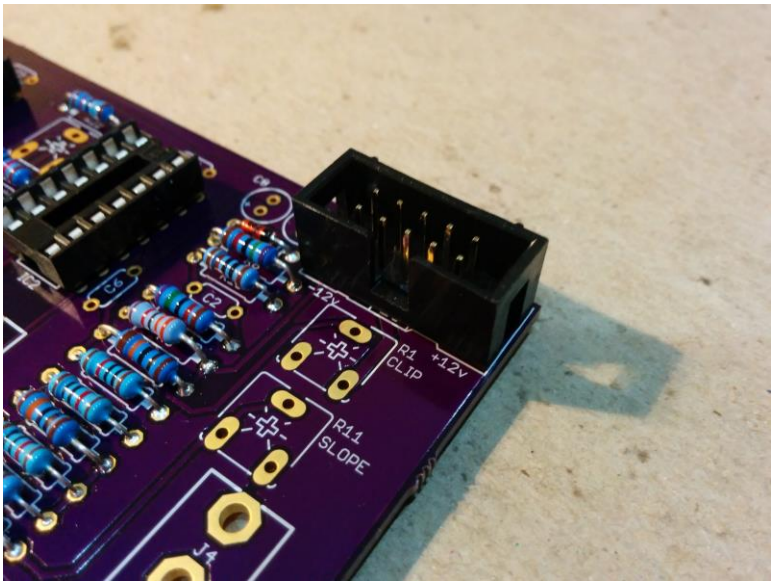
   Install the sockets on the TOP of the board. Observe the notch or mark on the sockets and align with the notch or mark on the board. Solder.



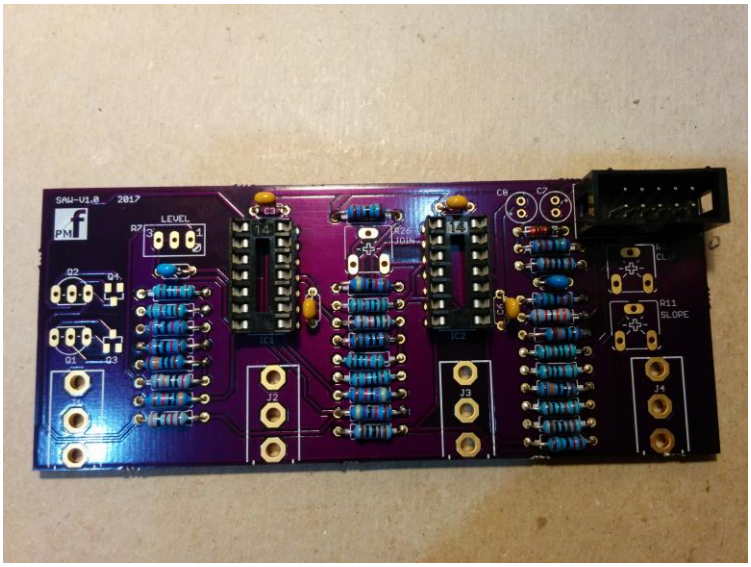
5. Power socket

   Install the 10 pin power socket on the TOP of the board. This must be installed with the correct orientation or the module will be damaged when the power is connected.

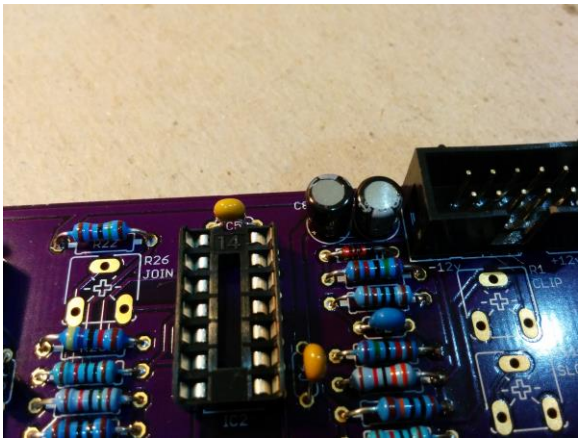
   The cut-out in the socket should face the jacks, aligning the cut-out with the "10" marking on the board as shown in the photo. Solder on the underside.



6. Ceramic/film/polypropylene capacitors
   Install the ceramic/film capacitors on the TOP of the board. The 220 pf polypropylenes are recommended for C17 and C20. Solder and clip the leads.

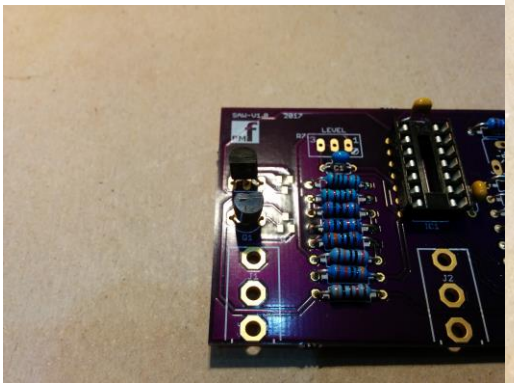


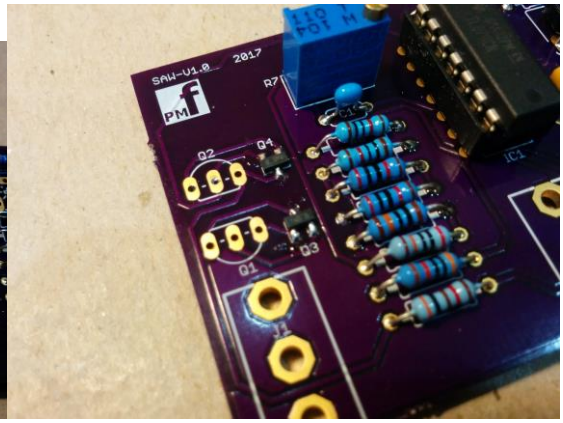
7. Electrolytic capacitors
   Install these on the TOP. Make sure you orient these capacitors correctly. The longer lead and/or the lead marked with a + needs to be inserted into the hole that has the "+" marking near it. Leads marked with "-" go in the board hole WITHOUT the "+". Solder and clip the leads.



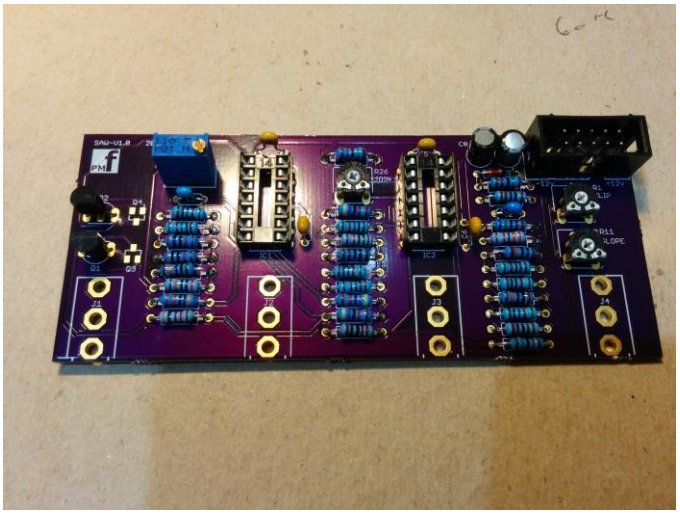
8. Transistors

   Select SMD OR through hole transistors. The board has footprints for both packages. DO NOT INSTALL both SMD transistors and through hole transistors.
   Install the transistors on the TOP of the board. These are polarized components. Align the outline with the outline on the board. Solder (and clip the leads if using through hole components).

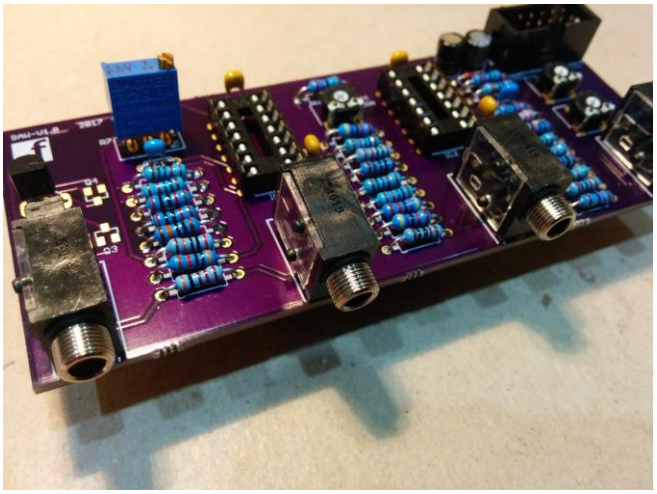




9. Trimmer resistors
   Populate the trimmer pots on the PCB. Make sure the multi turn trimmer is oriented so that the screw is above the circle on the silk screen.



10. 3.5mm Jack Sockets
    Install jacks on the top. Tack one pin only with solder. These will be finalized later. Please ensure they are on the CORRECT SIDE OF THE BOARD.



11. Alignment
    1. Place the front panel over the board so that the 3.5mm jacks align with the holes in the panel. The panel will fit either way up BUT is important that it ONLY be installed so that the panel title "SAW" at the top of the panel is at the same end of the PCB as the label "SAW-V1.x" and the PMF logo on the PCB. This ensures that the input jacks and the output jacks are in the correct place. See photo.

    2. Put nuts on the jacks and FULLY TIGTEN all of them. Do not overtighten!
    3. Now fully solder all the pins of the jacks.
    4. If you cut off the ends of the pins of the jacks, near to the solder joint, the module will be easier to fit into your rack close to other modules.

12. Do not install the ICs until the voltage tests are complete.
13. If you do not trust all your soldering and connections, carry out the voltage tests below before installing the ICs

Voltage tests

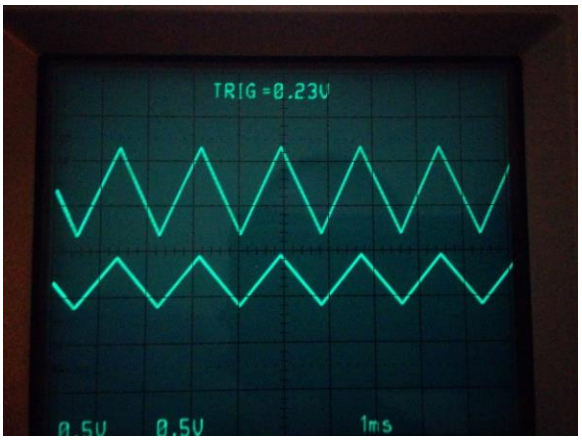
1. You do not have to do these tests if you are completely happy with your soldering and are sure there are no bridges or incorrectly placed components. However, these tests will ensure that the correct power supplies are sent to the IC pins to ensure they will not be damaged on power up.
2. Plug in the power supply and connect the –VE probe of a multimeter (set to the 20V DC range) to one of the GROUND pins of the jacks. The GROUND pin is nearest to the edge of the board.
3. Check the voltage at the following points on the board:
    a. At IC1 pin 4 approx = +12V
    b. At IC1 pin 11 approx = -12V
    c. At IC1 pin 3, 10, 12 = 0V
    d. At IC2 pin 4 approx = +12V
    e. At IC2 pin 11 approx = -12V
    f. At IC2 pin 3, 10, 12 = 0V
4. If any of these tests fail to match the readings given, you should check the components and soldering before progressing

Final Assembly

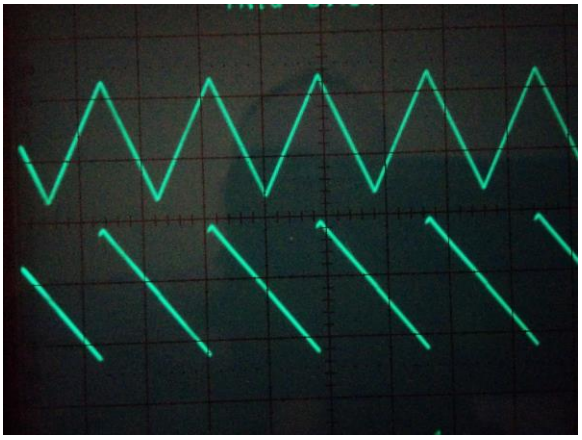
1. Place the ICs in place by aligning the notch with the notch graphic on the PCB Silk Screen and notch on the sockets.

Calibrating the Ramp and Saw Wave circuit

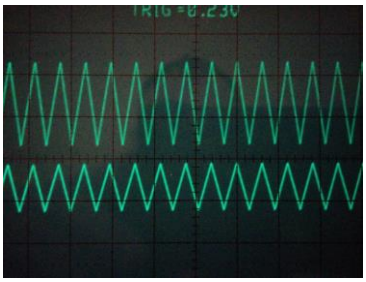
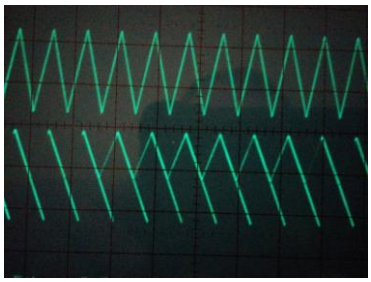
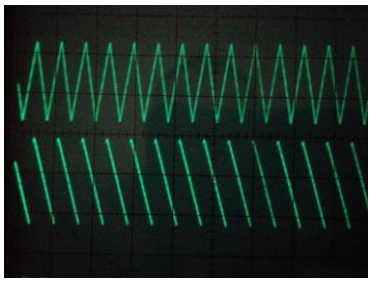
1. Turn trimmer R7 LEVEL fully CCW. This will be between 12 and 25 turns.
2. Turn trimmer R26 JOIN fully CCW.
3. Feed a triangle wave of about 400Hz from a VCO into the TRIANGLE IN jack of the Saw Module.
4. Monitor the output of the saw wave (the first output jack) on an oscilloscope. You should see a triangle wave of half the amplitude of the input triangle wave.



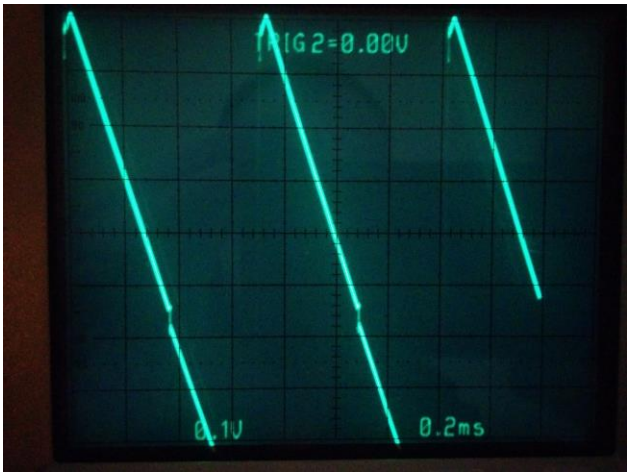
5. Turn R7 LEVEL CW until the triangle wave displayed flips into a saw wave.



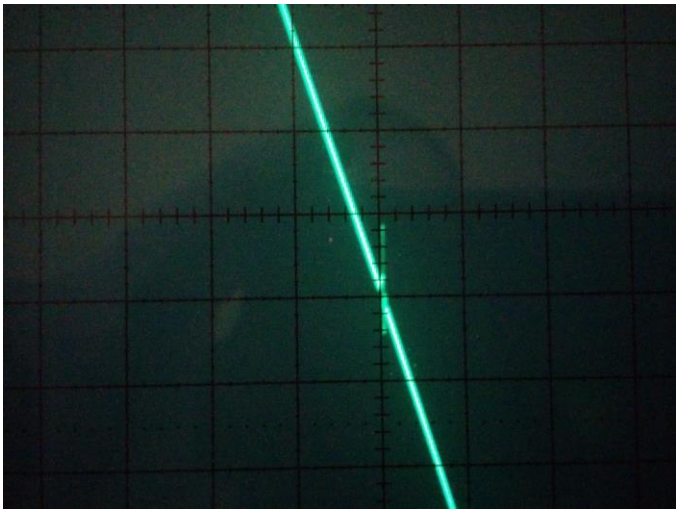
6. Now increase the frequency of the VCO to the desired maximum frequency that will be used. The saw wave will turn back into a high frequency triangle wave again.
7. Continue to turn R7 LEVEL until the triangle flips into a saw wave again. As you approach this point, you will see the wave oscilating between a triangle and a saw. The objective is to obtain a stable saw wave up to the maximum useable frequency. If you go too far CW with R7 you will begin to see an increase in the size of the triangular peak of the saw wave. The idea is to minimize this while achieving the highest usable frequency.

8. Now, reduce the frequency and turn up the horizontal and vertical sweep of the oscilloscope until you can observe the center of one wave cycle, which will have a gap in it.

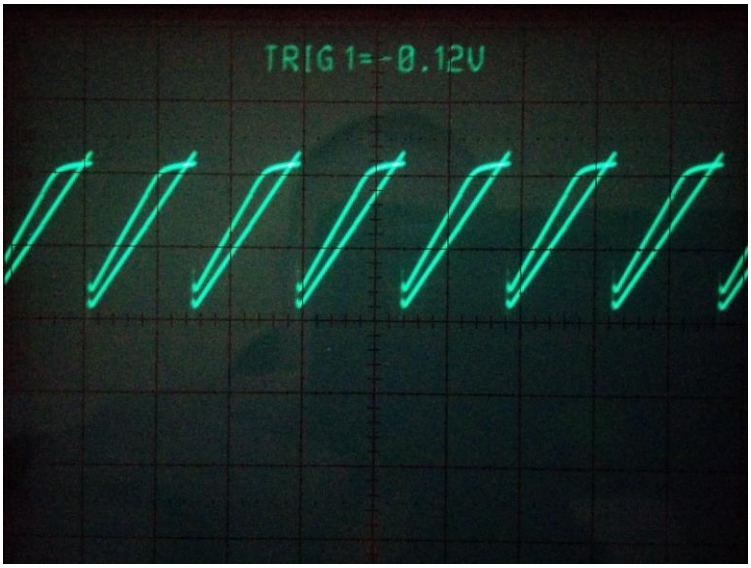


9. Slowly turn R26 CW until the part of the waveform above the gap and the part of the waveform below the gap are in line. You probably won't close the gap but there should be a smooth transition between the top and bottom of the wave.

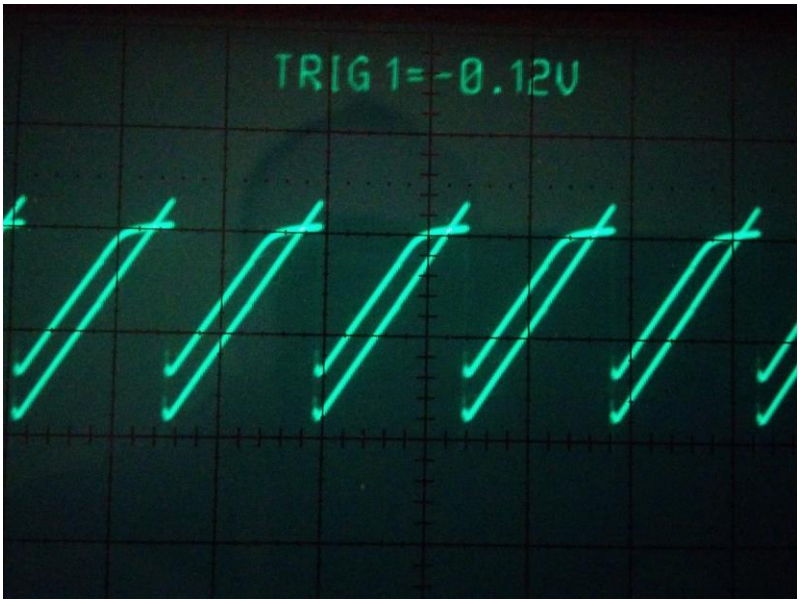


Calibrating the Spaced Saw wave

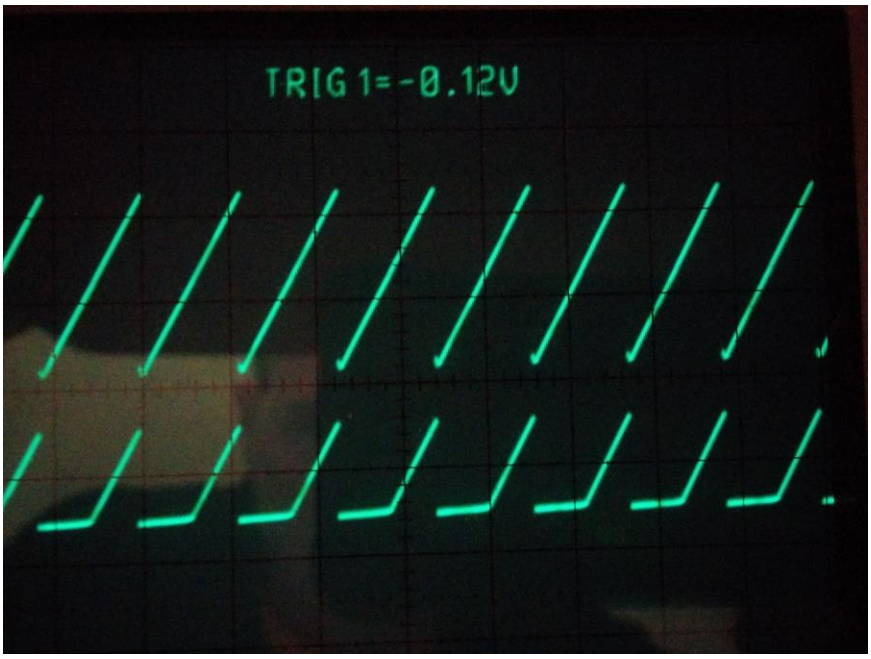
1. Turn trimmer R11 SLOPE fully CCW.
2. Turn trimmer R1 CLIP fully CCW.
3. Feed a triangle wave of about 400Hz from a VCO into the TRIANGLE IN jack of the Saw Module.
1. Monitor the output of the ramp wave (the second output jack) on trace 1 of an oscilloscope. You should see a saw wave.
2. Monitor the output of the stepped ramp wave (the bottom output jack) on trace 2 of the oscilloscope. Arrange the position of the scope traces so that the horizontal and vertical scales are the same.



3. Turn trimmer R11 SLOPE CW until the slope of the spaced ramp wave is exactly the same as the ramp wave. You can superimpose the waveforms to make this comparison easier.



4. Turn trimmer R1 CLIP CW until the desired amount of spacing is achieved. This adjustment determines the sharpness of the waveform which affects the tonal quality. The adjustment is a matter of taste, however aiming for a peak amplitude of about 3V is a good starting point for a listening test.


TRIG 1=-0.12V