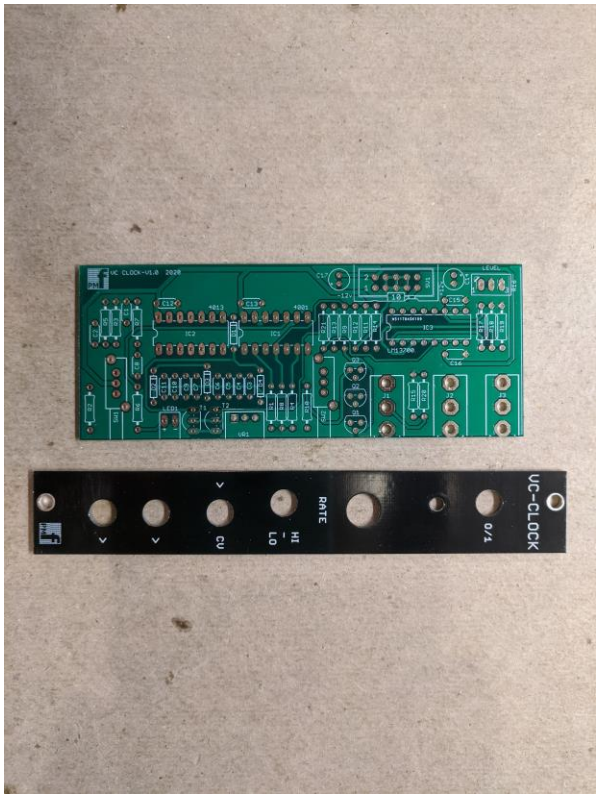
Voltage controlled Clock v1.0 – Assembly Guide

Thank you for purchasing this module! This is an easy build with some precision integrated circuits. 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.



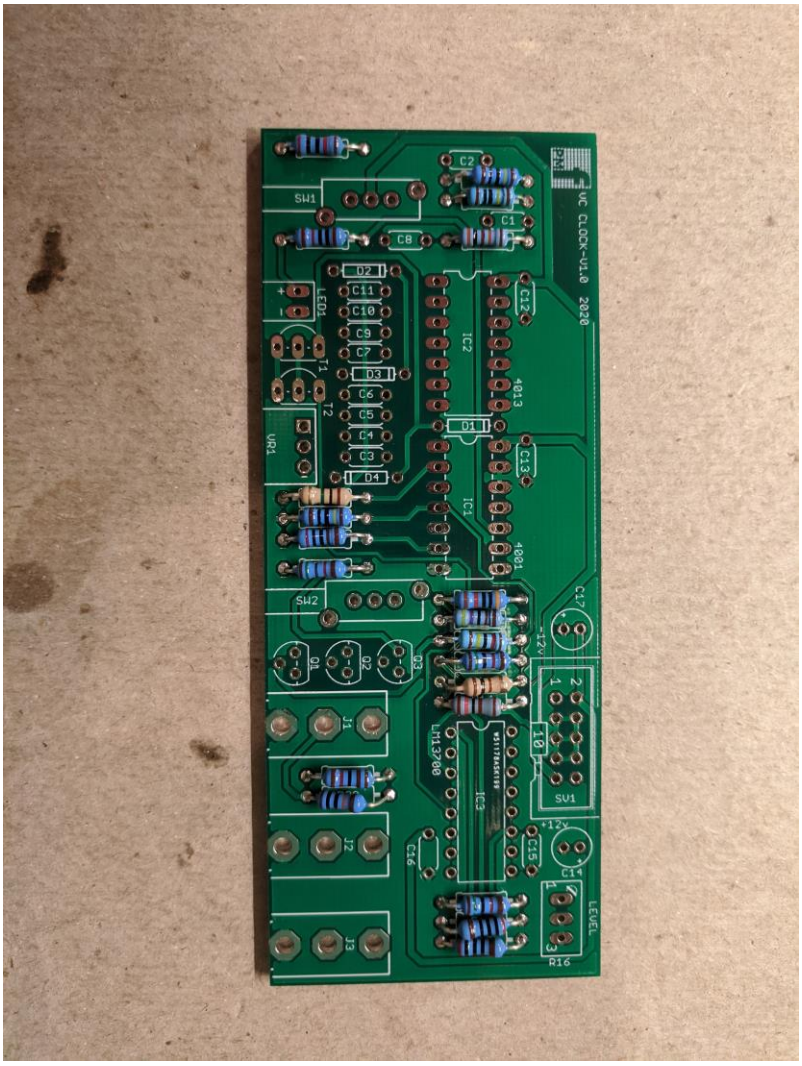
The module is designed and sized for **Eurorack** systems. You will need a 16-10 pin eurorack power ribbon connector with –12/0/+12 which is connected to a synth power supply.
Follow the parts lists, these instructions and the PCB silkscreen text to build the module.
The module consists of 1 PCB board and a front panel.
You must follow the order of assembly as described below since some components will be soldered underneath other components.

Constructing the board

1. Resistors

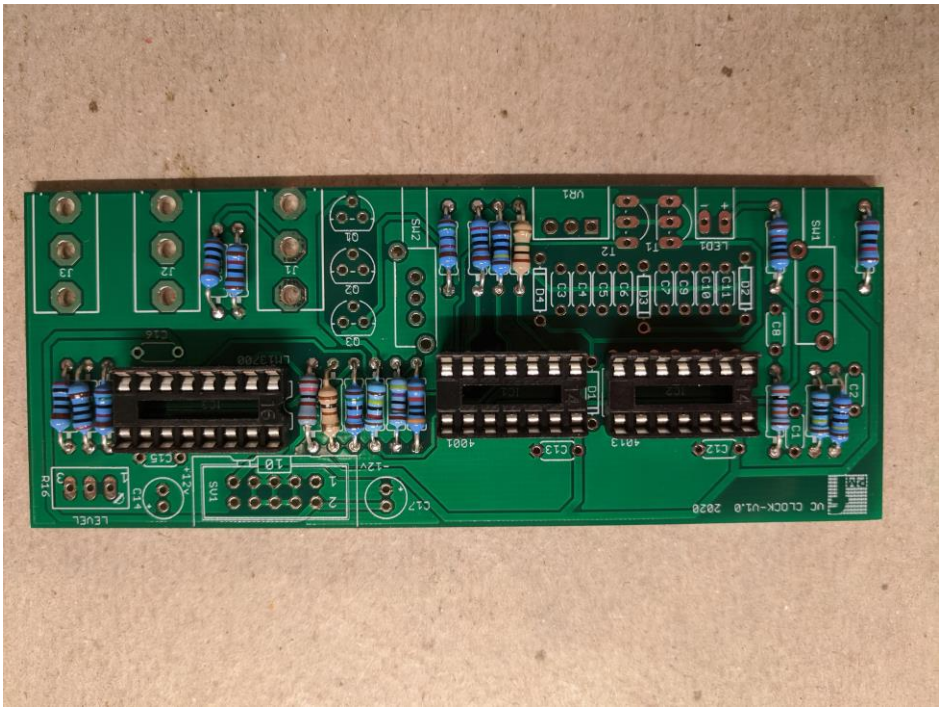
   See the appendix for options before proceeding.

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



2. IC Sockets

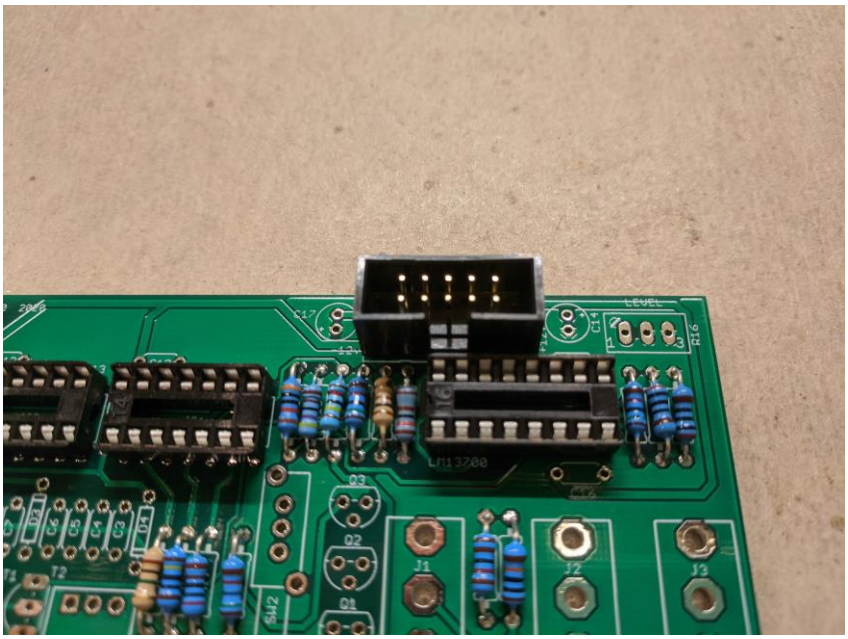
   Now Install the sockets on the TOP of the board. Observe the notch or mark on the sockets and align with the notch or mark on the board. Solder.



3. 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.

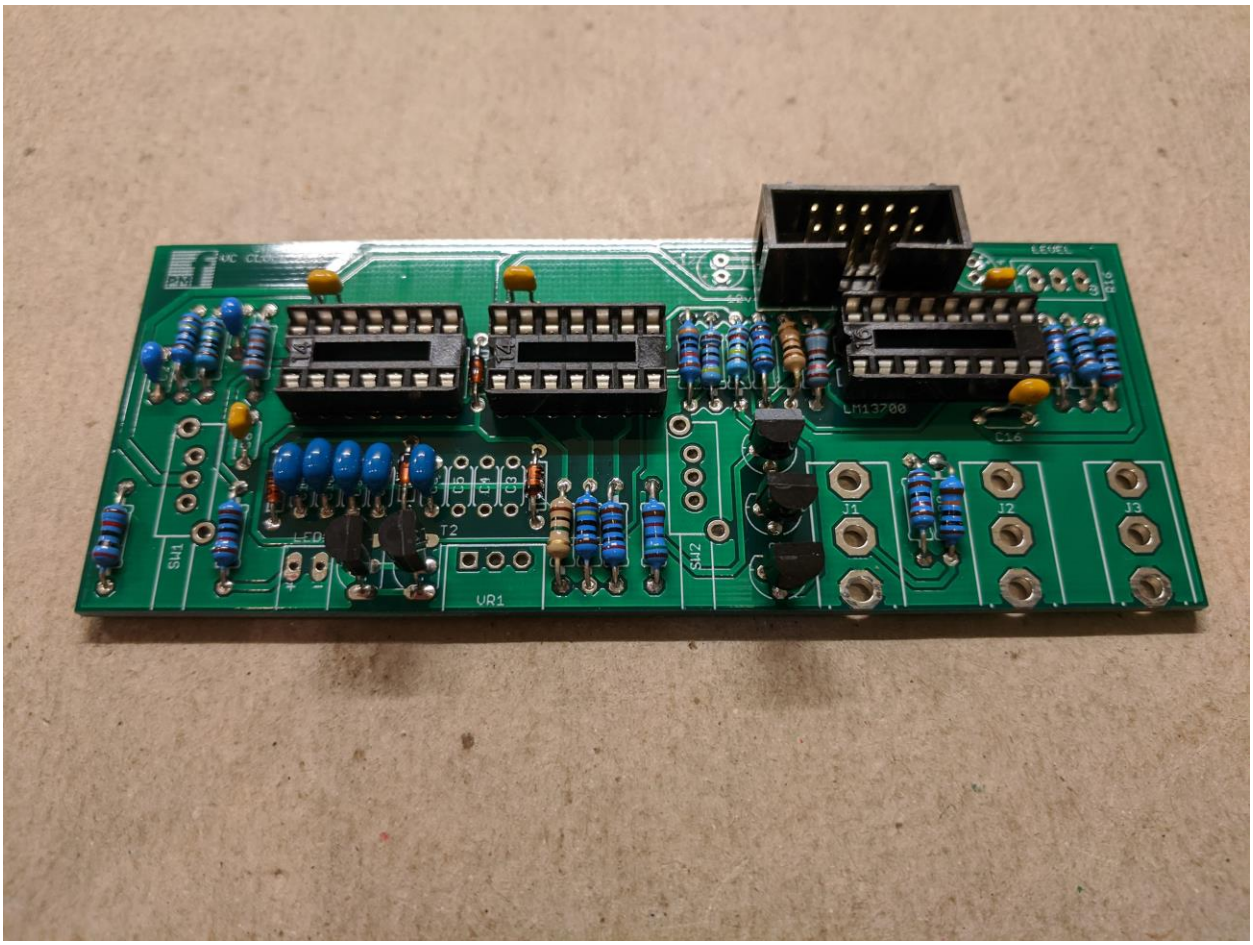
   The cut-out in the socket should face the jacks, aligning the cut-out with the "10" marking on the board as shown in the photo. Solder on the underside.



4. Ceramic/film/polypropylene capacitors

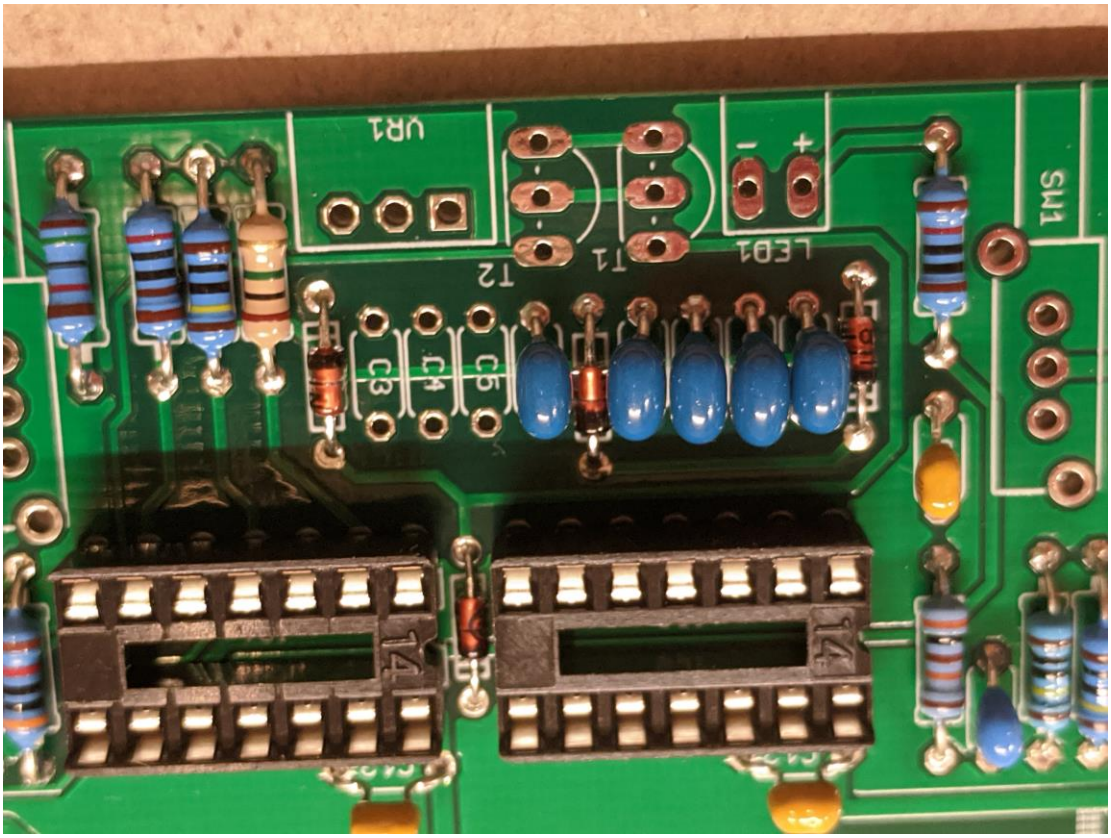
   With the capacitor values suggested in the BOM, the approximate clock frequencies are:

HI: 1.35 Hz to 68 Hz
LO: 0.1 Hz to 6 Hz
DO NOT INSTALL C3, C4, C5. See the appendix for options before proceeding.
Install the ceramic/film capacitors on the TOP of the board. Solder and clip the leads. The photo shows one 3.3uF capacitor in bank 1 and four 10uF capacitors in bank 2 to make 40uF.

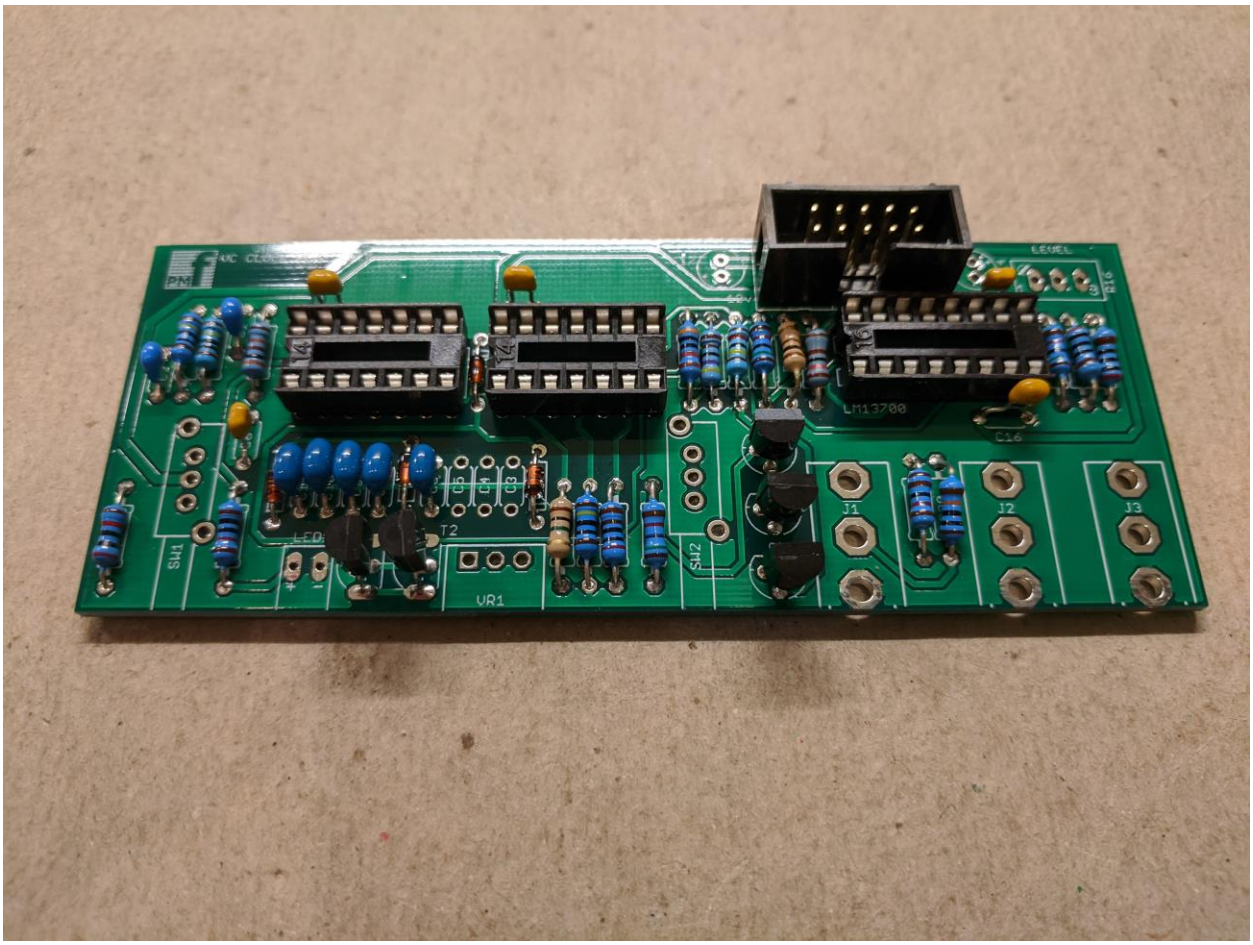


5. Diodes

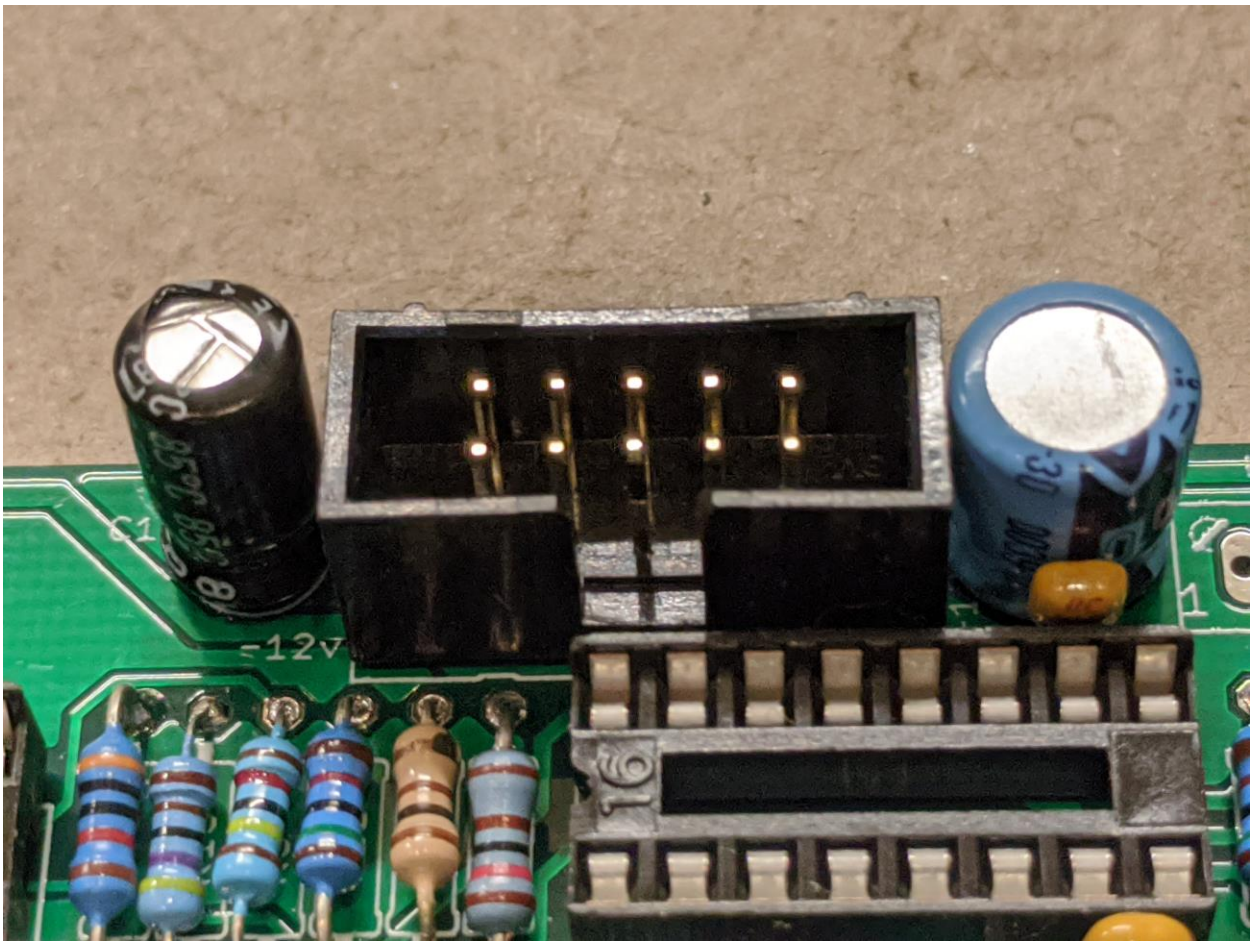
Install the diodes on the TOP of the board. These are polarized components. Align the stripe on the diode with the stripe marked on the board. Solder and clip the leads.



6. Transistors
   Install the transistors on the TOP of the board. These are polarized components. Align the outline with the outline on the board. Do not mix up the 2N3904s and the 2N3906s. The 2N3906s are labeled T1 and T2.
   They should be raised off the board surface slightly and at the same height. Solder and clip the leads.

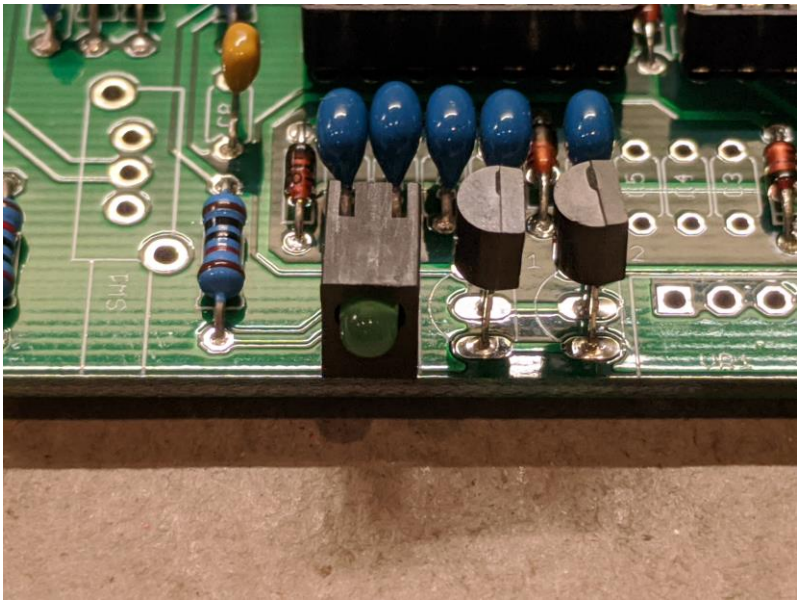


7. Electrolytic capacitors
   Install these on the TOP. Make sure you orient these capacitors correctly. The longer lead and/or the lead marked with a + needs to be inserted into the hole that has the “+” marking near it. Leads marked with “-“ go in the board hole WITHOUT the “+”. Solder and clip the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



8. Trimmer resistor
   DO NOT INSTALL R16 unless you are modifying the standard design according to the appendix.

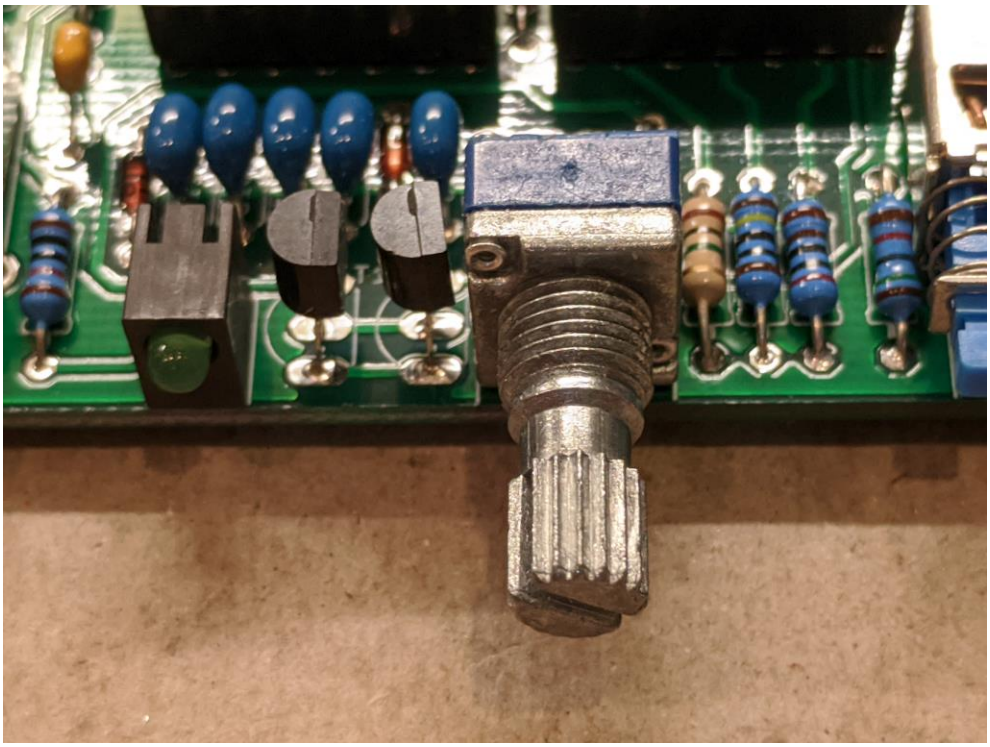
9. LED
   Install the LED on the TOP of the board and solder on the underside. The LED should face the edge of the board.



10. Potentiometer

    If the pot has positioning lugs on the front, cut these off with a sharp pair of flush cutting pliers. The front of the pot (where the shaft protrudes) needs to be flat.

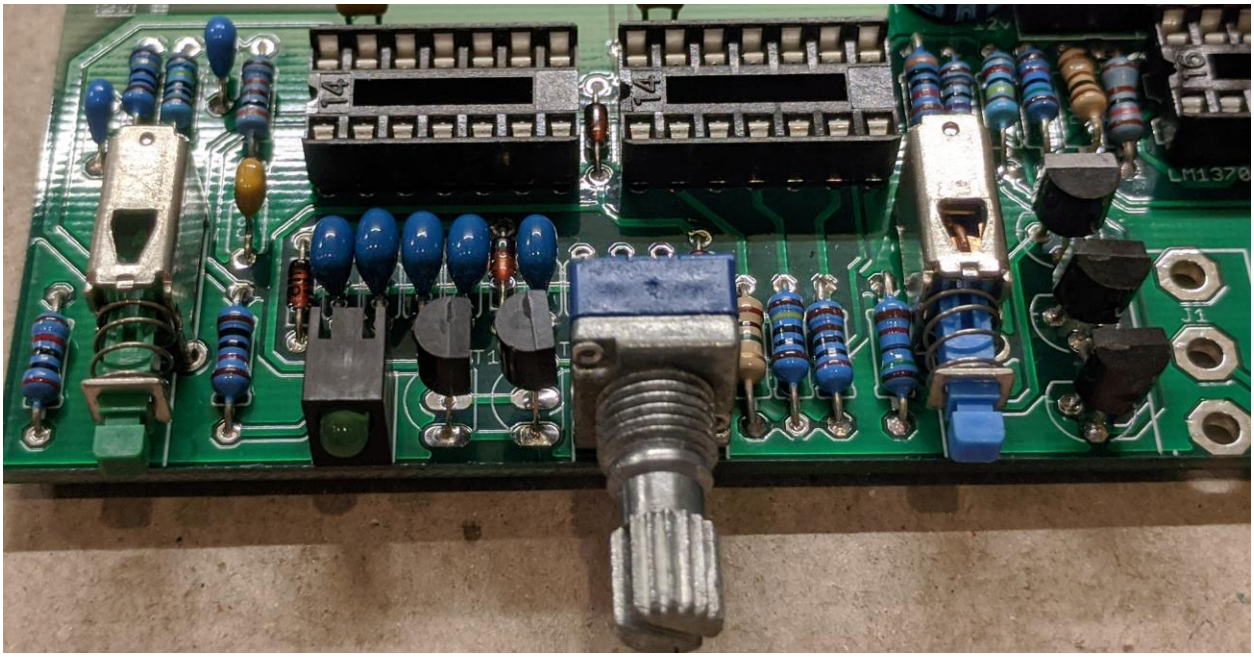
    Tack one pin only with solder. This will be finalized later. Please ensure it is on the CORRECT SIDE OF THE BOARD.



11. Switches

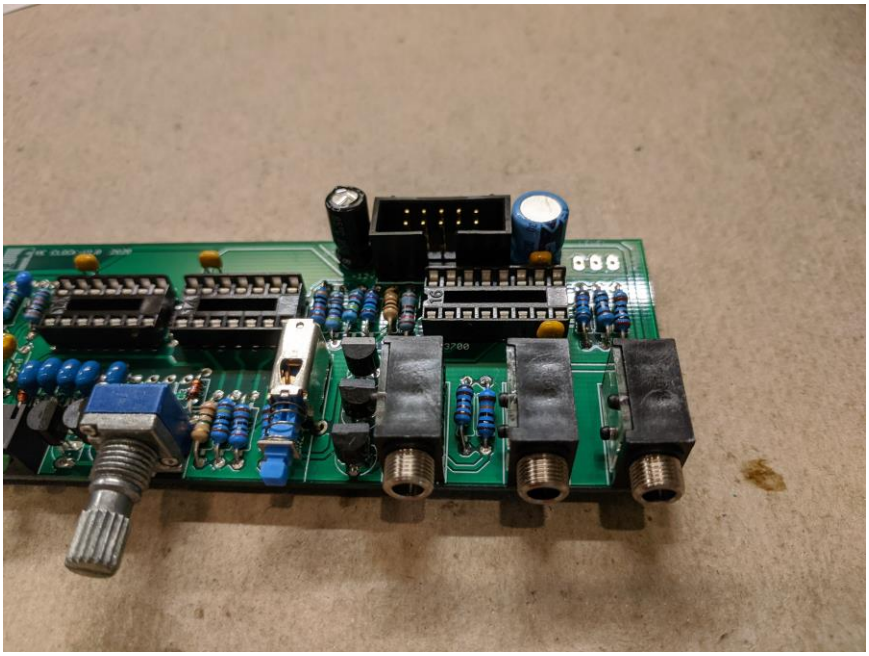
    The locking switch is for the range HI/LO and the momentary switch is for the start/stop.

Tack one pin of the switches, align with the front panel, then solder all the remaining pins and the locating lugs.



12. 3.5mm Jack Sockets

    Tack one pin of each only with solder. These will be finalized later. Please ensure they are on the CORRECT SIDE OF THE BOARD.



13. Alignment
    1. Place a washer over pot shaft.
    2. Place the front panel over the board so that the pots and 3.5mm jacks align with the holes in the panel.
    3. Put nuts on the jacks and pots and FULLY TIGTEN all of them. Do not overtighten!

4. Now fully solder as many pins as you can reach of each jack and pot.
5. Remove the front panel and solder all the remaining pins on the jacks and pots.
6. 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.

14. 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 14 approx = +12V
    b. At IC1 pin 7, 12, 13 = 0V

    c. At IC2 pin 14 approx = +12V
    d. At IC2 pin 3, 5, 7, 8, 10 = 0V

    e. At IC3 pin 11 approx = +12V
    f. At IC3 pin 6 = -12V
    g. At IC3 pin 1 approx = +12V
    h. At IC3 pins 3, 4, 5 = 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.
2. Install the knob.
3. Put the caps on the switches by pushing each cap until it clicks.


VC-CLOCK
0/1
HI
LO
CV

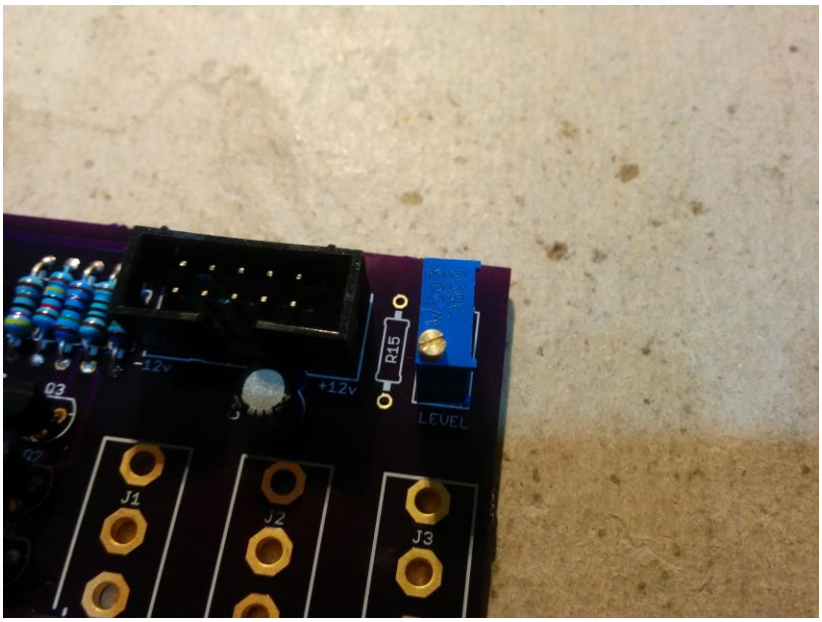
Appendix 1: Build options

Pulse level:

R14, R15 and/or trimmer R16 set the clock output pulse voltage level. The following options are suggested:

- **STANDARD BUILD**: 10V pulse: R14 = 1.2K, R15 = 11k, R16 OMITTED
- 5V pulse: R14 = 1.8K, R15 = 1.5k, R16 OMITTED
- VARIABLE PULSE LEVEL: R14 = 1.5k, R15 OMITTED, R16 = 50k Trimmer

Remember to add the trimmer to your parts order if you are installing this option.
If you are using R16, install it and then R15 SHOULD NOT BE INSTALLED. Make sure the multi turn trimmer is oriented so that the screw is above the circle on the silk screen.



Range:

C3-C6 set the HI range of the clock and C7-C11 set the LO range of the clock. Each range is determined by a bank of parallel capacitors equivalent to C(HI) and C(LO).
The clock values can be determined by entering different values for C in the range calculation spreadsheet inclued in the documentation link.
Simply enter capacitor values in column A to find clock frequencies in columns D-E
For more extensive customization you can change the values of R1 and VR1.
The spreadsheet uses the following formula:
F = 1/2.2*(R4 +VR1)*C in Megohms and microFarads. F (freqency) is the inverse of the clock period.
You can use one ar more of the capacitors in each bank to obtain the equivalent values required
With the capacitor values suggested in the BOM, the approximate clock frequencies are:

HI: 1.35 Hz to 68 Hz
LO: 0.1 Hz to 6 Hz

Calibrating the output voltage

If you have installed R16, connect the power supply and adjust the clock to a high frequency. Monitor the output of the clock on an oscilloscope.
Alternatively, use a multimeter with the voltage set to a DC range that will read about 0-12V. Set the clock to a slow speed if using a multimeter.
Adjust the trimmer until the desired voltage for the clock is achieved.