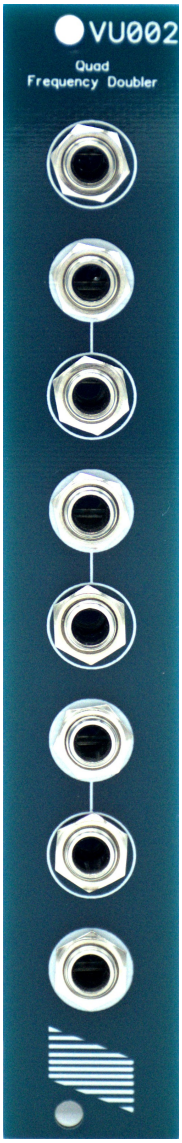
VU002
Quad Frequency Doubler
User/Build Guide



VU002 is a quad frequency doubler or full-wave rectifier (in the same way as a linear power supply works, where AC is rectified and filtered to produce DC). Each of the 4 stage can :

- convert a ramp/saw to triangle
- multiply a triangle signal by a factor of 2
- multiply a sine signal by a factor of 2 (output sine is glitched)
- process a video signal for solarization effect

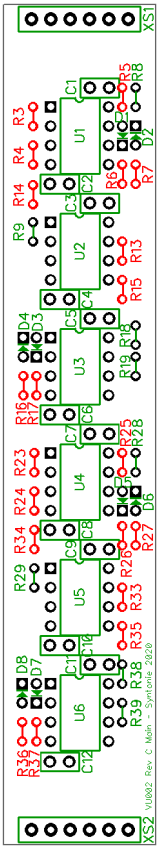
The 4 stages are chained together to multiply the signal at the input of the first stage by 16. Switching jacks allow to break the connection between each stage to use them individually.

Inputs: 0-1V, 100kohms
Outputs: 0-1V, 499 ohms

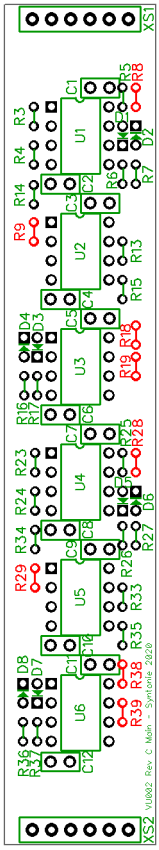
– 4HP
– 38mA +12V
– 37mA -12V
– 0mA +5V
– 50mm deep

Mainboard build

Resistors



1k



2k

1k : R3, R4, R5, R6, R7, R13, R14, R15, R16, R17, R23, R24, R25, R26, R27, R33, R34, R35, R36, R37
2k : R8, R9, R18, R19, R28, R29, R38, R39

As you may have noticed, the resistors needs to be mounted vertically. Bend one of the lead along the body of the resistor, as close as possible (as another board will be mounted above this one).

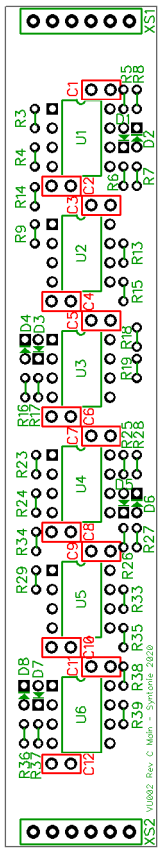
A good practice is to mount two resistors that are next to each horizontally head to tail, to avoid a short between the leads.

Another good thing to do is to place a few resistor and solder them instead of placing all of them and solder, as there will be a lot of leads crossing each other.

Check the picture at the end of this section to see how the resistors are mounted.

Mainboard build

Capacitors

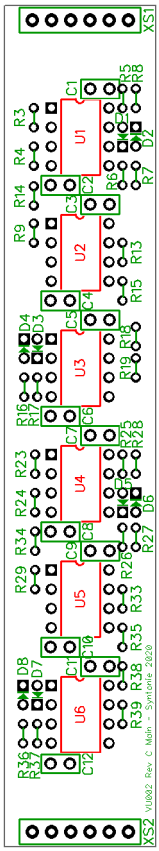


100nF

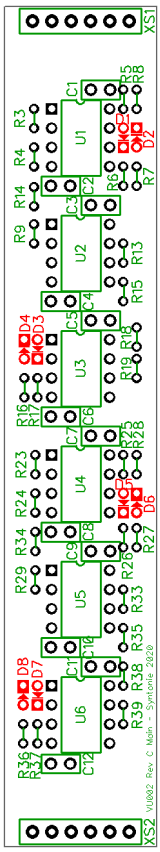
100nF : C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12

Mainboard build

Semiconductors



LM6172



1N5711

LM6172 : U1, U2, U3, U4, U5, U6
1N5711 : D1, D2, D3, D4, D5, D6, D7, D8

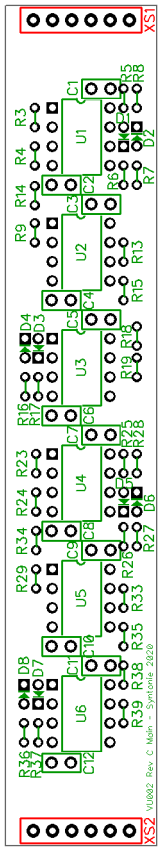
Diodes are polarized, make sure that the ring on the diode matches with the square pad on the circuit board. As for the resistors, the diodes needs to be mounted vertically by bending one of the lead along the body of the diode. Same as before, head to tail to avoid shorting.

LM6172 is polarized, make sure that then notch on the chip matches the notch on the circuit board.

The kit include sockets for the ICs, you can use it or not, both have pro and cons, the socket allow to remove the chip easily, which can be useful for troubleshooting, however it can add unwanted capacitance on the IC pins.

Mainboard build

Connectors

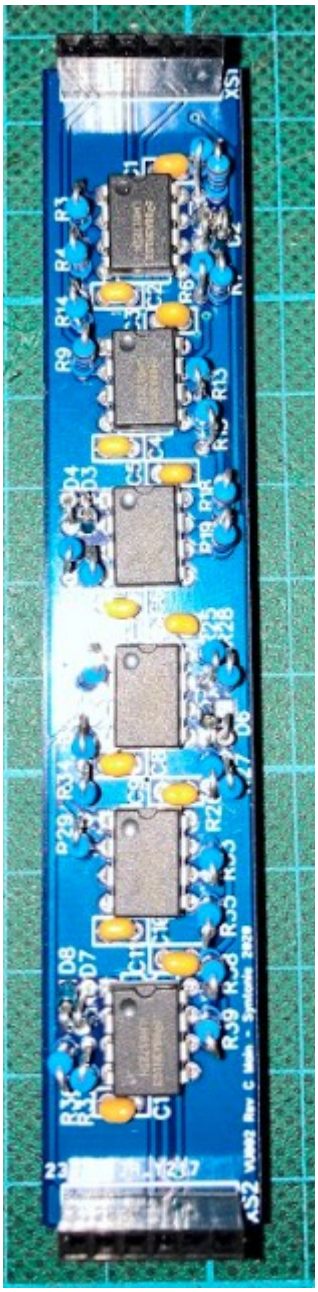


6 pin stackable connectors

XS1, XS2 : 6pin stackable connector

The box header (female plastic part) needs to be mounted on the component side, and the long pins on the solder side.

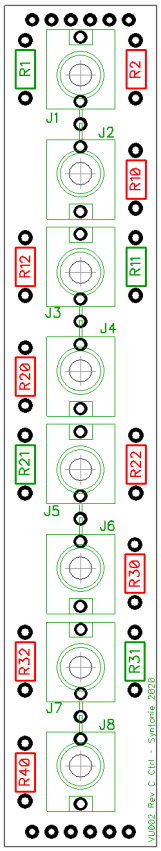
Mainboard build



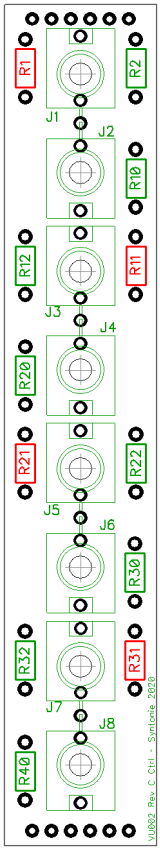
This is how the board should look once all the components are populated. Notice that the resistors and diodes are mounted head to tail. The connectors are soldered on the solder side of the board.

Controlboard build

Resistors



499R

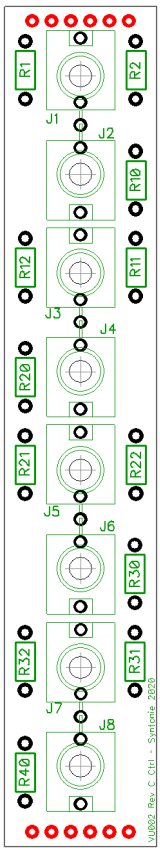


100k

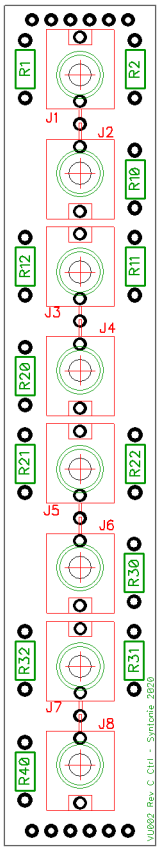
499R : R2, R10, R12, R20, R22, R30, R32, R40
100k : R1, R11, R21, R31

Controlboard build

Connectors



6pin female



PJ398SM

XS1, XS2 : 6pin female connector
J1, J2, J3, J4, J5, J6, J7, J8 : PJ398SM

The 6pin connectors needs to be mounted with the box header on the solder side, pins are soldered on the component side.

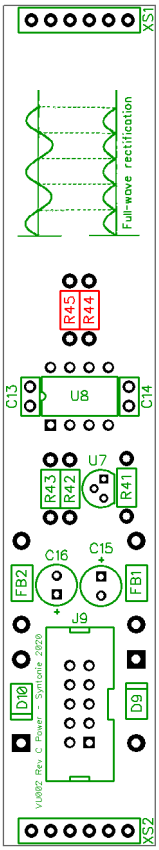
The jacks are sharing a ground hold to save space, so it's better to insert J1 and J2 before soldering them, and so on.

Controlboard build

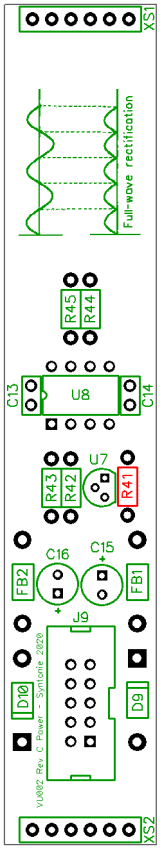
Now that the controlboard is done, let's move on to the power board. You can try fitting the controlboard to the mainboard now, but don't push the connectors all the way down yet, as it's a bit hard to disconnect afterwards.

Powerboard build

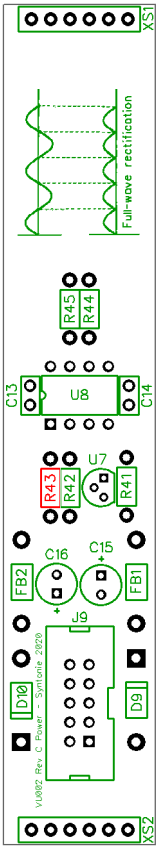
Resistors



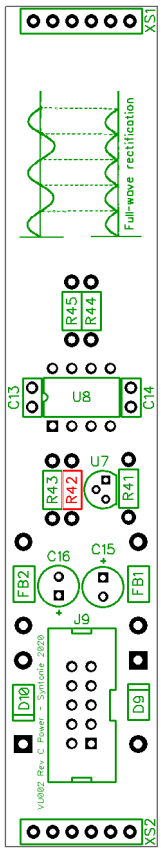
1k



4.99k



10k

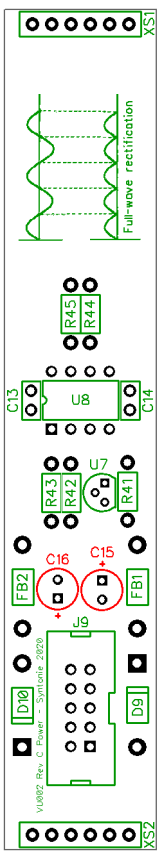


24.9k

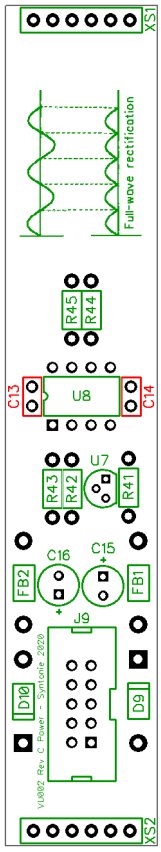
1k : R44, R45
4.99k : R41
10k : R43
24.9k : R42

Powerboard build

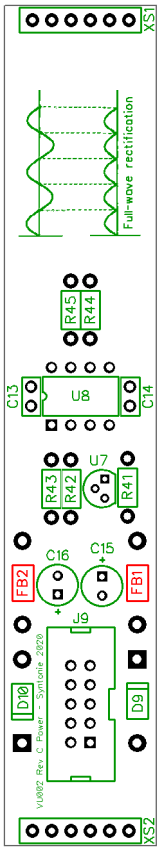
Capacitors/Ferrites



10uF



100nf



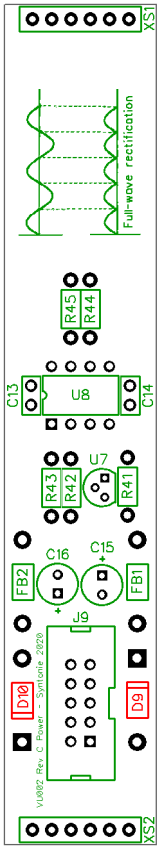
Ferrites

10uF : C15, C16
100nF : C13, C14
Ferrites : FB1, FB2

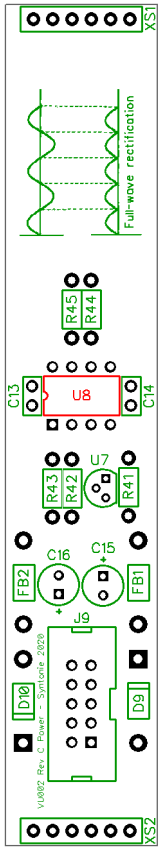
Note that the 10uF capacitors are polarized, the longer lead needs to match the square pad/plus sign on the circuit board.

Powerboard build

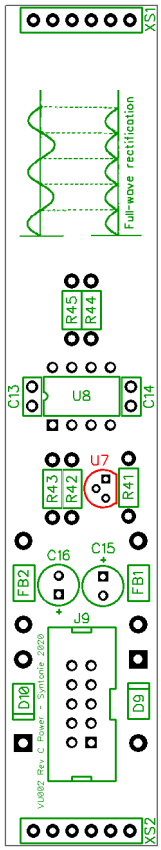
Semiconductors



1N4001



TL072



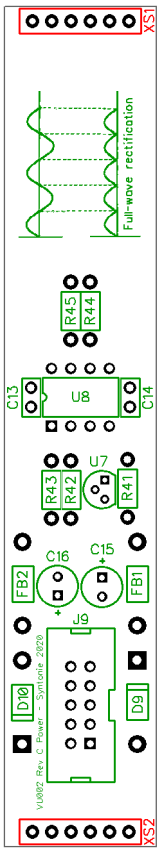
TL431

1N4001 : D9, D10
TL072 : U8
TL431 : U7

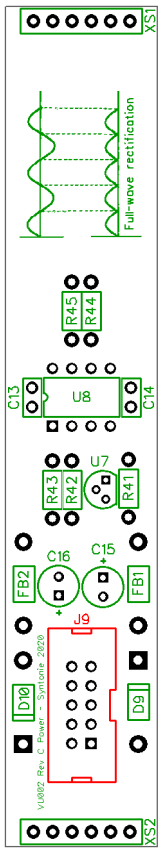
Diodes are polarized, make sure that the ring on the diode matches with the line on the circuit board.
TL072 is polarized, make sure that then notch on the chip matches the notch on the circuit board.
TL431 is polarized, make the flat side of the component match the straight line on the circuit board

Powerboard build

Connectors



6pin male



10pin IDC

XS1, XS2 : 6pin male connector
J9 : 10pin IDC connector

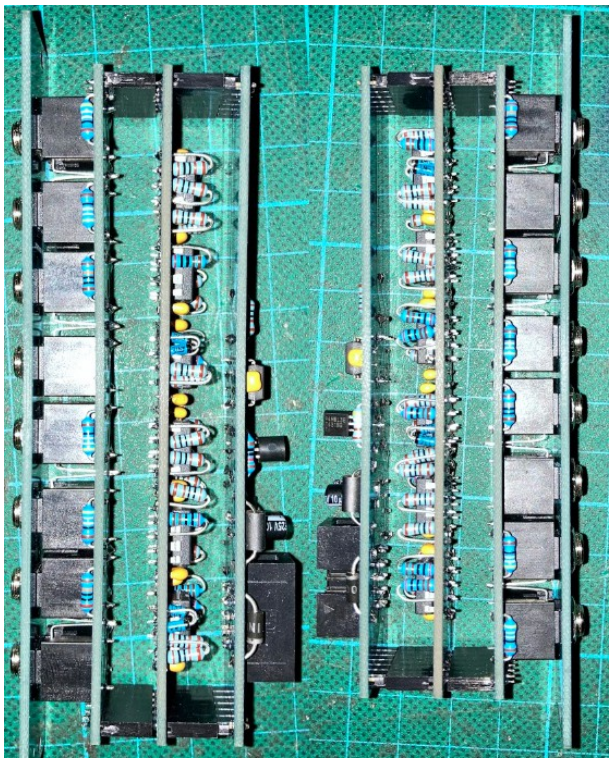
XS1 and XS2 long pins should be on the solder side of the board, and solder on the component side.
Make sure that the notch on the IDC connector matches the notch on the circuit board.

Powerboard build

Now that all three boards are built, they can be connected together (again, don't push the control board and mainboard fully yet). You can fit the panel to test that the module is working properly. To do so, input a signal in the top jack (ramp or triangle) and check that the frequency is multiplied at each outputs, and you can also test each stage individually to check that all inputs are working correctly.

You can now push the controlboard and mainboard fully, if the boards are not perfectly parallel, you can bend the legs of the connector a bit so you can fit it completly (may require a bit of force).

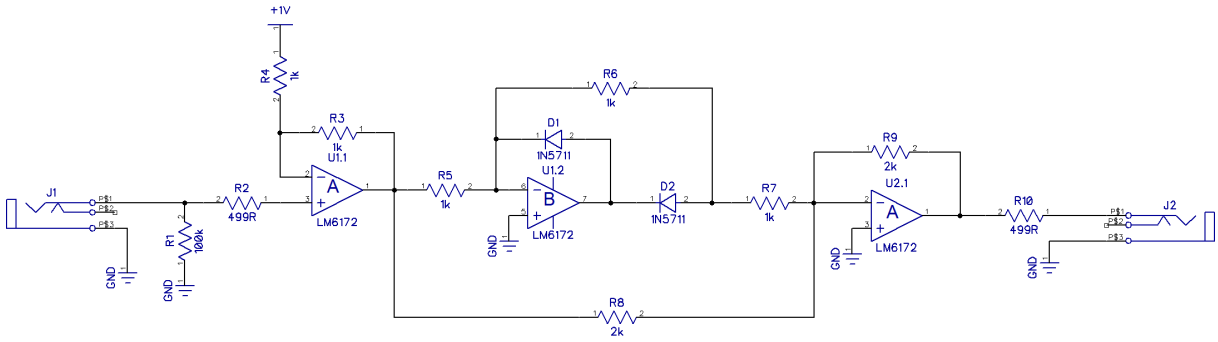
If the connectors between the mainboard and powerboard feel a little loose, bending both the pins and box headers a bit outward of the boards will help.



This is how it looks once all the boards are assembled together.

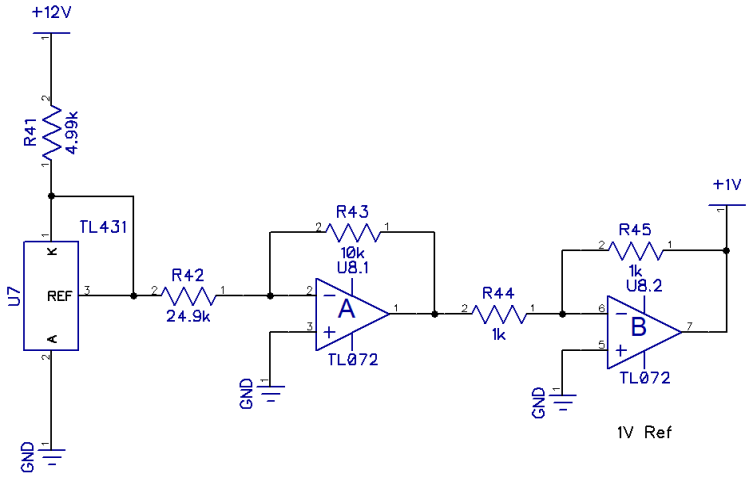
About the circuit :

Since the schematic can be a bit hard to read because of the circuit being on three boards and quad, here is a simplified view of one stage :



R1 is a 100k input termination resistor, as per LZX standard.
R2 is a 499ohm resistor, help reducing settling time as per LM6172 datasheet recommendation.
U1.1 is a non-inverting amplifier with a gain of 2 and -2V offset, so the 0-1V signal at the input becomes -1V/+1V at the output of the op-amp.
U1.2 with associated diodes and resistor achieve a half wave rectification.
U2.1 sums the half wave rectified signal with the input signal, resulting in full wave rectification.
R10 is a 499ohm output termination resistor, as per LZX standard.

1V reference generation :



R41 is a 4.99k resistor that set the current reference for U7.
U7 is set as a 2.5V voltage reference.
U8.1 and associated resistor form an inverter amplifier with a gain of -0.4 (2.5V → -1V).
U8.2 and associated resistor form a unity gain inverter amplifier (-1V → 1V)