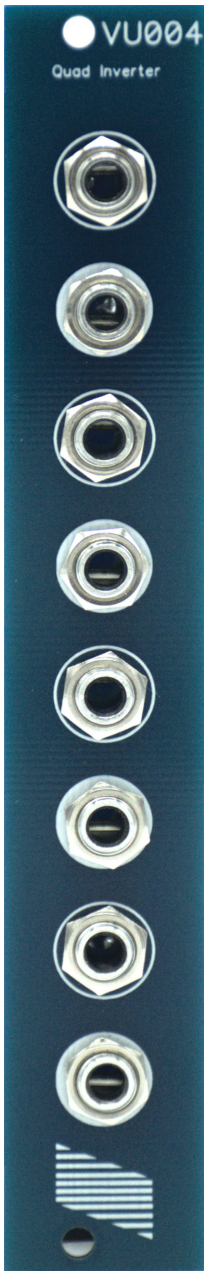
VU004
Quad Inverter
User/Build Guide



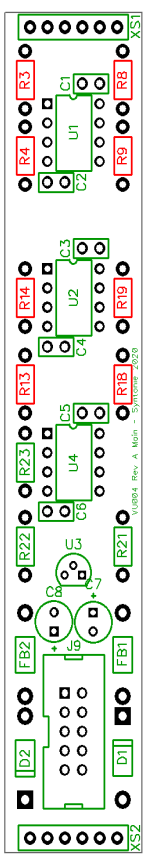
VU004 is a quad signal inverter, it will invert the signal at the input while keeping it between 0V and 1V. Since most CV inputs on LZX modules features attenuverters, it's more intented to be used to invert a signal just before the encoder for example, freeing a Cadet Processor if only inversion is needed.

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

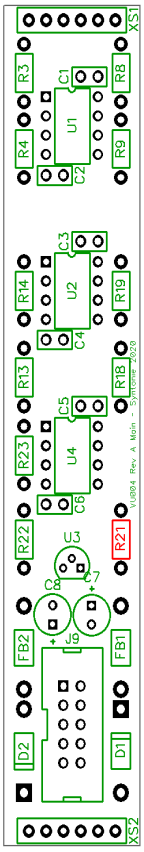
– 4HP
– 17mA +12V
– 17mA -12V
– 0mA +5V
– 40mm deep

Mainboard build

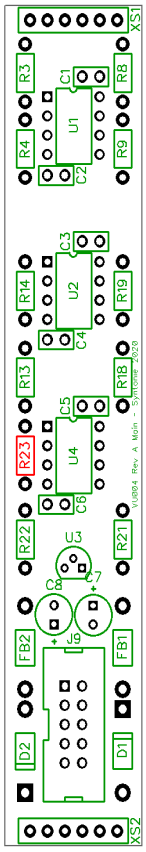
Resistors



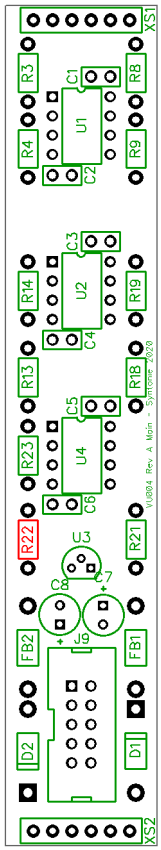
1k



4.99k



10k

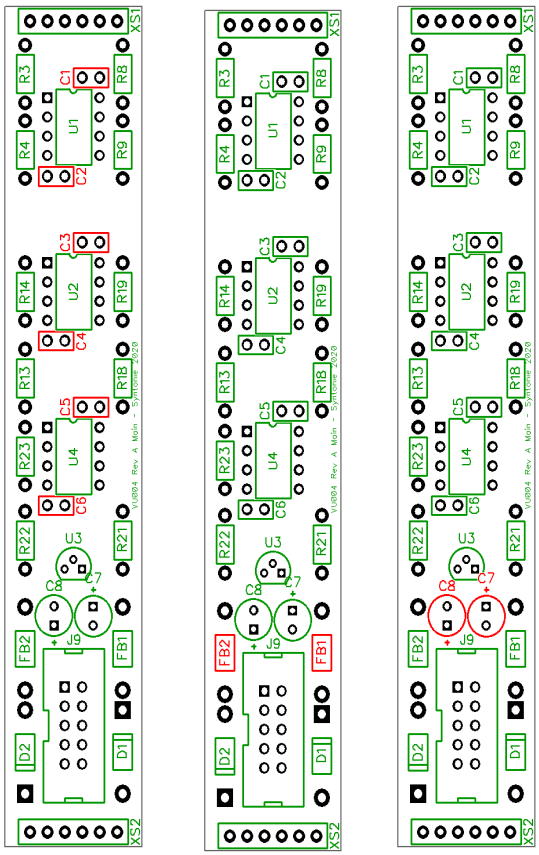


24.9k

1k : R3, R4, R8, R9, R13, R14, R18, R19
4.99k : R21
10k : R23
24.9k : R22

Mainboard build

Capacitors/Ferrites



100nF Ferrites 10uF

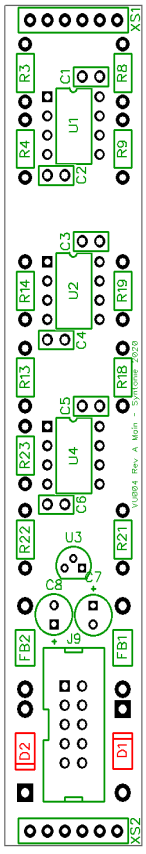
100nF : C1, C2, C3, C4, C5, C6
Ferrites : FB1, FB2
10uF : C7, C8

10uF capacitors are polarized, make sur to make the longer leg/positive side of the capacitor match the + marked/square pad on the board (note that C17 + sign is a bit merged with J7).

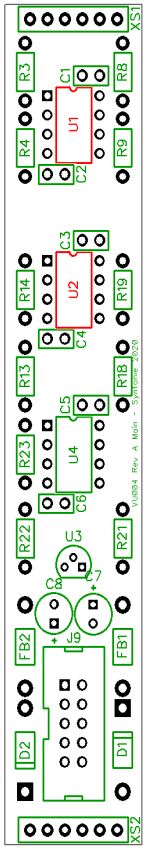
100nF capacitors and ferrites are not polarized, can fit either way.

Mainboard build

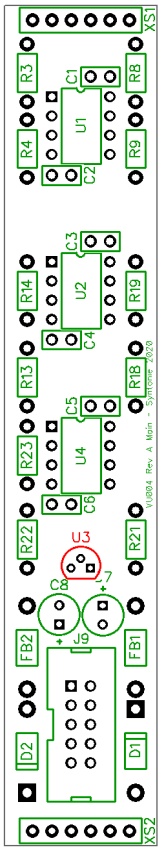
Semiconductors



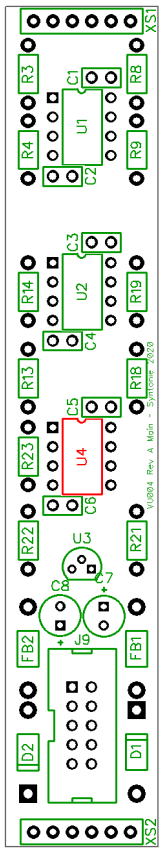
1N4001



LM6172



TL431



TL072

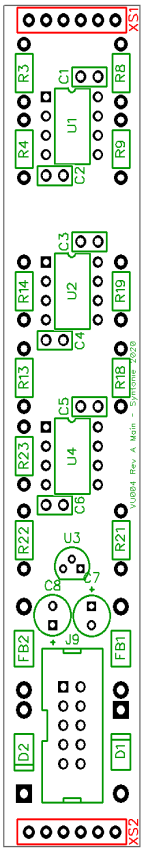
1N4001 : D1, D2
LM6172 : U1, U2
TL431 : U3
TL072 : U4

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

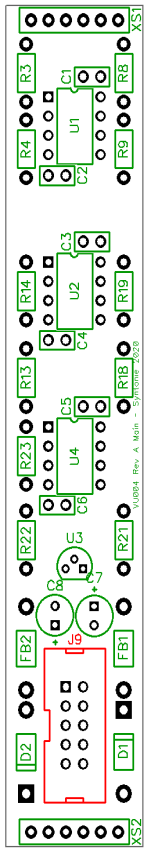
The kit include sockets for the ICs, you can use it or not, both have pro and cons, the socket allow to remove the chip easily, which can be useful for troubleshooting, however it can add unwanted capacitance on the IC pins.

Mainboard build

Connectors



6pin male



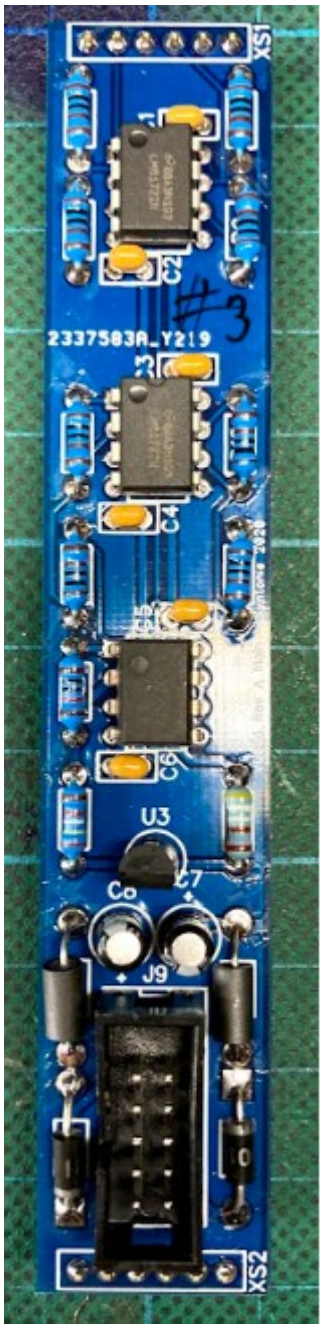
10pin IDC

XS1, XS2 : 6pin male connector
J9 : 10pin power header

XS1 and XS2 longer pins should be on the solder side of the board, and soldered from the component side.

Mind the orientation of J9, the notch on the connector should match with the footprint on the circuit board.

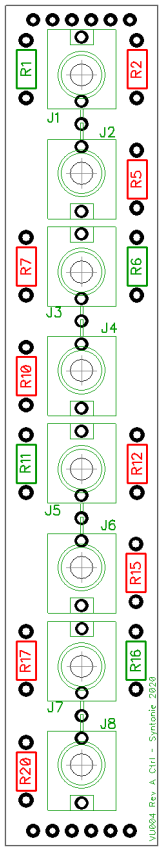
Mainboard build



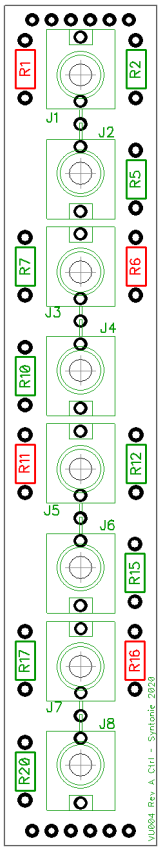
This is how the board should look once all the components are populated. Let's move on to the Control Board.

Controlboard build

Resistors



499R

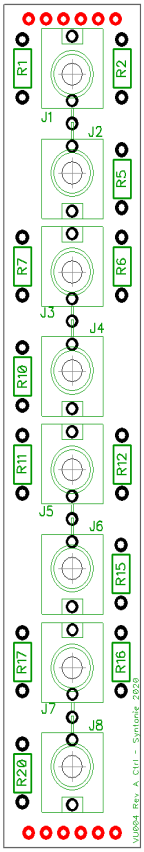


100k

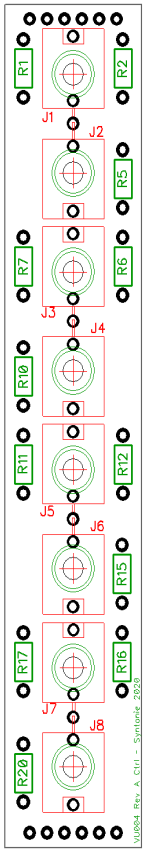
R2, R5, R7, R10, R12, R15, R17, R20 : 499R
R1, R6, R11, R16 : 100k

Controlboard build

Connectors



6pin female



PJ398SM

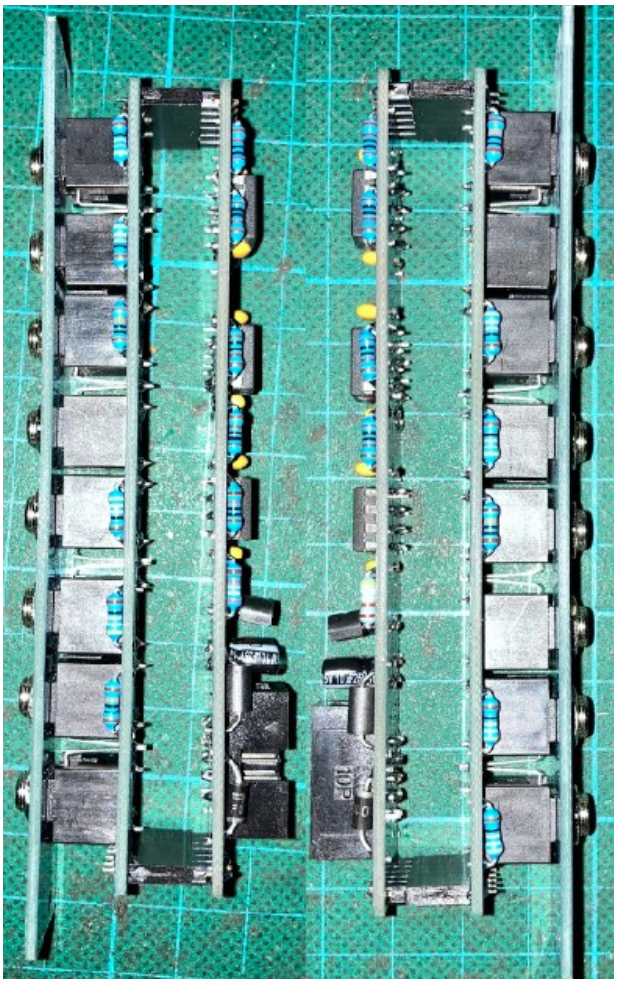
XS1, XS2 : 6pin female connector
J1, J2, J3, J4, J5, J6, J7, J8 : PJ398SM

XS1 and XS2 are soldered on the opposite side of the jacks

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.

The front panel is fitted using the 3.5mm jack nuts. After connecting the control board to the mainboard, you can test the module by sending a signal to the first jack (1st inverter input) and then see if you get the proper inverted signal at the second jack (1st inverter output)

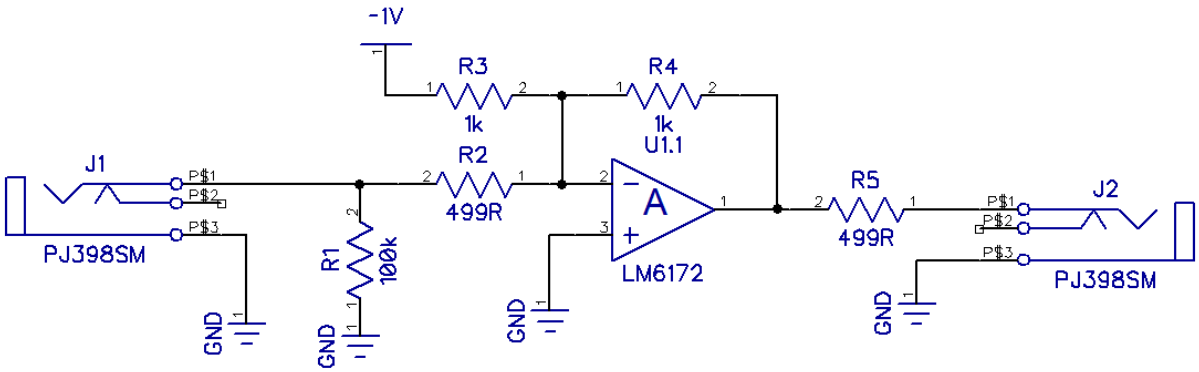
If the connectors between the mainboard and controlboardboard feel a little loose, bending both the legs and box headers a bit outward of the boards will help.



This how the boards look like when assembled together.

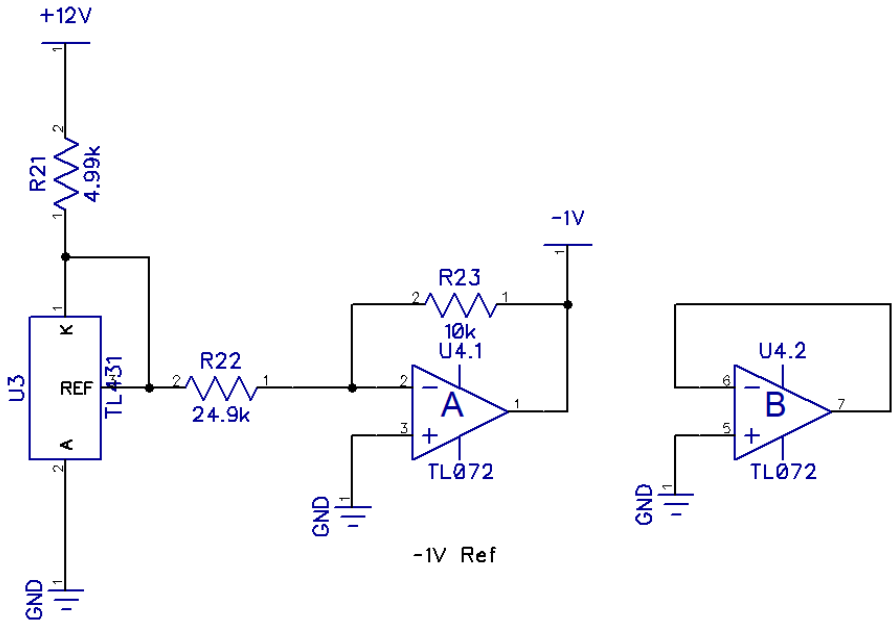
About the circuit :

Since the circuit is on two boards and quad, here is a simplified version of the schematic for 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 an inverting amplifier with unity gain, a -1V offset is added to get the inverted signal between 0 and 1V (without this offset, the inverted signal would evolve between 0 and -1V).
R5 is a 499ohm output termination resistor, as per LZX standard.

-1V reference generation :



R21 is a 4.99k resistor that set the current reference for U3.
U3 is set as a 2.5V voltage reference.
U4.1 and associated resistor form an inverter amplifier with a gain of -0.4 (2.5V → -1V).
U4.2 is unused and terminated accordingly.

Revisions log :

- **Rev A** : initial release
- **Rev B** : adds 11mm spacers

References :

- LZX Reference Designs
https://github.com/lzxindustries/lzxdocs/blob/master/Reference%20Designs/LZX%20Interface%20Examples%20RevA.pdf