1U LFO – Build Guide

In this build guide I'm going to assume that you have some basic proficiency in building PCB/panel kits. If this is the very first module you're building, I can highly recommend https://learn.adafruit.com/adafruit-guide-excellent-soldering

The build difficulty is of this module is average.

It's all through hole components, but the tight spacing and standing resistors can be challenging. It can be built using the most basic equipment.

- Soldering Iron – I use and can highly recommend the Hakko FX-888D
- Side cutters
- Needle nose pliers (I personally use an 8mm/10mm pipe wrench for pots and Thonkiconn nuts)
- Helping hand (sometimes called third hand) to hold your PCB's – not required, but nice to have.
- A Multimeter to verify component values and check for shorts.

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Bill of materials

Name	Designator	Type	Quantity
10uF	C1,C2	Low profile electrolytic, like UPW1E100MDD	2
33uF	C3	Low profile electrolytic, like ECE-A1CKA330	1
100nF	C4,C5	MLCC / ceramic 5mm lead spacing	2
Male	H1,H3	40 PIN 2.54MM single row header	2
Female	H2,H4	Tayda A-1303 or similar	2
TL072	IC1	DIP8	1
LED-TH-3mm	LED1	Any 3mm led you like	1
8 pin IC socket	optional	8 pin IC socket. Tayda A-857 or similar	1
2N3904	Q1	TO-92 2N3904 (BC547 will work but mind orientation)	1
470R	R1, R2	1/4W 1% resistor	2
10K	R10	1/4W 1% resistor	1
22K	R12	1/4W 1% resistor	1
8K2	R13	1/4W 1% resistor	1
4K7*	R3	1/4W 1% resistor	1
220K	R4	1/4W 1% resistor	1
15K	R5,R8,R11,R14	1/4W 1% resistor	4
100K	R6,R7,R9	1/4W 1% resistor	3
B250K	RATE	T18 ALPHA 9MM	1
Thonkiconn	SQR,TRI	PJ-301M	2
10 pin header	U2	boxed header, angled header, or 2x5 pin. Tayda A-2939 or similar	1
Knob		Pick your favorite knob. Davies 1900h or smaller will work.	1

Sources I use:

https://www.thonk.co.uk/   Potentiometers, knobs, Thonkiconn, rare parts

https://www.taydaelectronics.com/   Resistors, generic components, IC sockets

https://www.tme.eu/nl/en/   Wima film caps, trim pots, IC's (cheaper than Mouser)

https://eu.mouser.com/   Has almost everything except the Thonk items.

https://electricdruid.net/   Rare IC's, vactrols, Electric Druid PIC's

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Soldering standing resistors

- Bend one of the legs 180 degrees in a smooth curved radius.
- Make sure the body + bent leg don't exceed ~9mm height when standing up to avoid shorts with the controls pcb.
- The silkscreen circle indicates where the resistor body goes. The hole next to the gap in the silkscreen circle will take the bare bent leg.
- Solder the bare leg from the top of the pcb to hold it in place. → make sure to not apply too much pressure with the soldering iron to prevent knocking over the resistor.
- After all standing resistors are placed with one leg soldered, flip the board and solder the other legs.
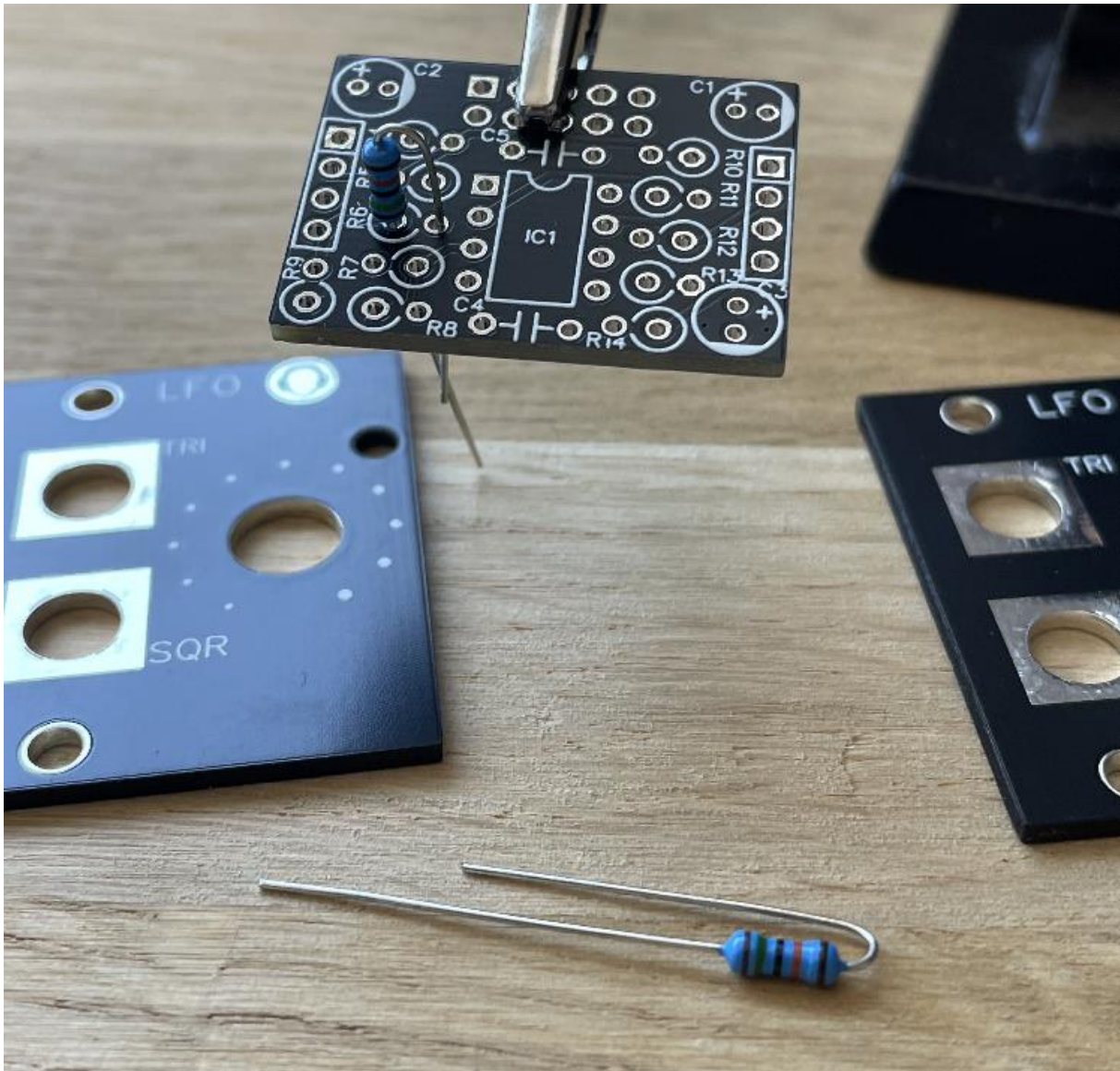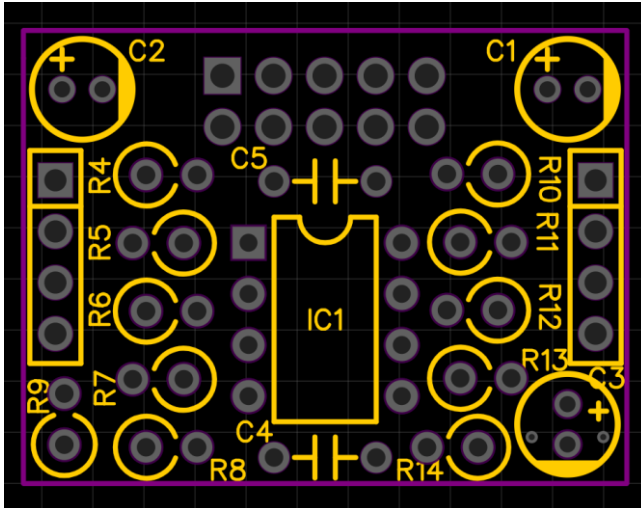

Quincas - Synth DIY Guy uses this same technique.

If my explanation is not clear, just watch some of his video's on the Erica Synths diy series. Even if you got this, I highly recommend his video's for anyone interested in building DIY modules.

Synth DIY Guy - Erica Synths Bassline

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Main PCB

Install the IC socket → Watch the orientation!

- Use the front panel to hold the socket in place while flipping the PCB. Solder in place.

Now it's time for the standing resistors. For these it makes sense to work from the inside outwards.

- Install   R6 (100K), R12 (22K)   solder bare leg from above
- Install   R5 (15K), R11 (15K)   solder bare leg from above
- Install   R7 (100K), R13 (8K2)   solder bare leg from above
- Install   R4(220K), R10 (10K)   solder bare leg from above
- Install   R9 (100K), R8 (15K), R14 (15K)   solder bare leg from above
- Flip the board and solder the legs on the body side.
- Trim all the legs with a cutter and touch up your soldering where necessary.

Install the ceramic caps. You can solder these from the top.

- 100nF   C3, C4

Install the electrolytic caps → Watch the orientation!

- 10uF   C1, C2
- 33uF   C3   If you can't find a small 33uF place it on the back of the pcb.

Bend the legs a little outwards to hold them in place while flipping the PCB to solder it from the other side.

Install the IDC 10 pin header on the bottom side of the PCB. → Make 100% sure you do this right. It's very hard to unsolder these without destroying the board.

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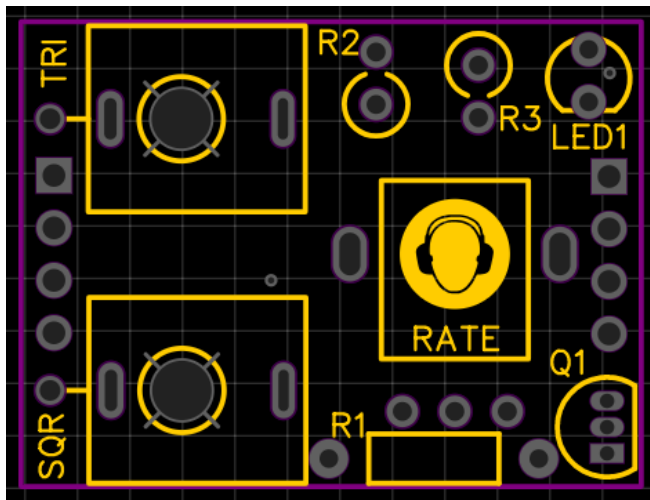
Controls PCB

First install and solder all the flat resistor on the board.

- R1(470R)

Install the standing resistors. → use the same strategy as on the main pcb.

- R2(470R), R3(4K7*)   *use your favorite LED current limiting resistor value.

Install the 2n3904 (or equivalent) transistor.

- Bend the outer legs a bit to hold it in place while flipping the board.
- Solder from below.

Install the LED, mind the orientation. The flat side on the LED should match the flat side on the silkscreen should → but don't solder yet!

Place the potentiometer, but don't solder yet. → any* value between 100K and 1M will do.

*Higher resistance will give you slower oscillations, but the resolution on the knob suffers a bit. I find a B250K pot to have the best balance between slow and having decent control.

Install the 2 Thonkiconn jacks → but don't solder yet!

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Now take the front panel and tighten the nuts on the Thonkiconn and potentiometer to secure the front panel in place. Make sure they don't rotate under the force. Everything should align up nicely without tension.

Flip the whole thing over and make sure everything still lines up. Make sure the LED is in the hole in the front panel.

Solder all controls pcb components in place. → double check if nothing moved when done.
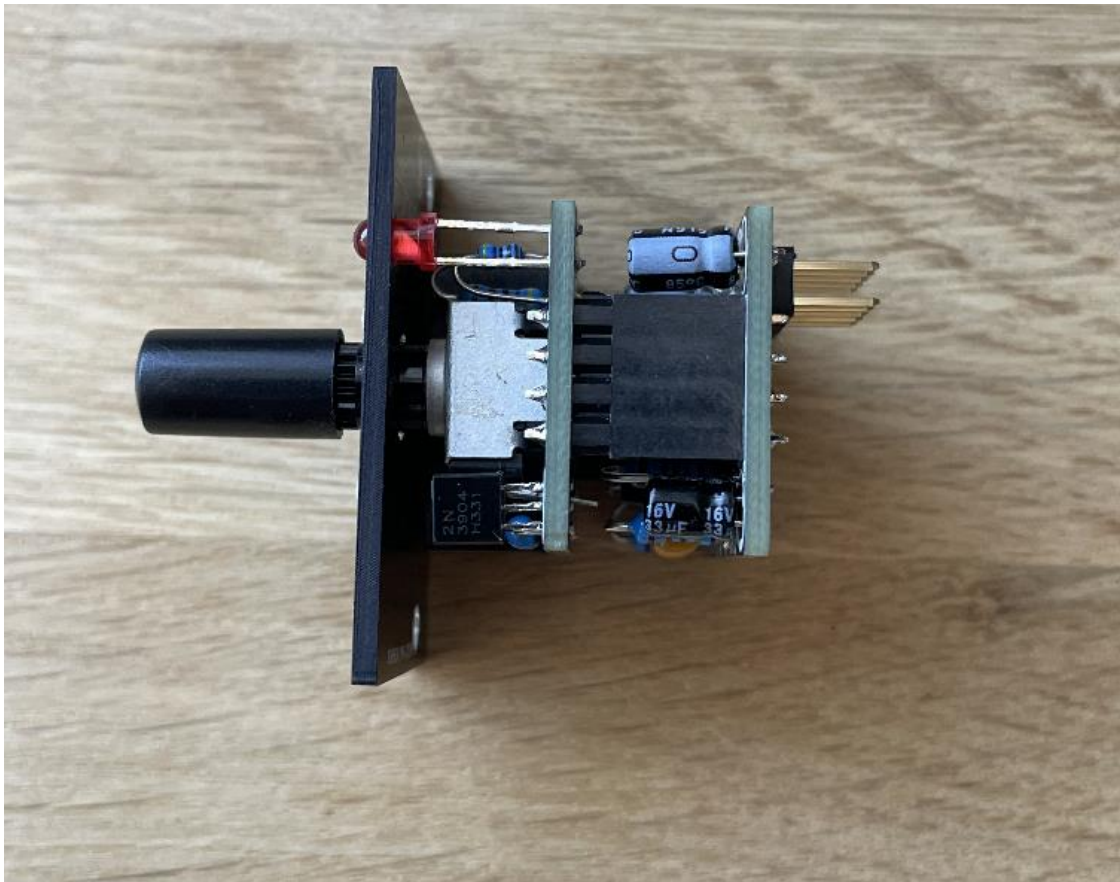
Building the sandwich

There are multiple ways to do this, but this is my preferred method.

Start with the front panel still flat on the table.

Assemble the pin headers together.

Make sure that when you install the header assemblies, you build in some safety (poka yoke) measure to be able to never accidentally install the boards in the wrong orientation.

- One of the sides should have female header on the bottom
- One of the sides should have male header on the bottom

Now place the main board on top with the power header on your side. All text should be oriented the same. If not, one of the boards is placed wrong.

Solder one pin on both headers.

Flip the sandwich on its side, like in the picture. Make sure it's all aligned neatly and flat.

Solder all the pins on the headers on the visible side.

Rotate the board and do the same for that side.

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This is an example of Poka Yoke* (loosely translated as idiot-proof) when it comes to the headers.

By alternating the header orientations there is no chance to accidentally assembling the boards in the wrong orientation and potentially damaging components or the power supply.

*For true safety by design I should have offset the placement of the headers. This way there would be a real physical barrier to prevent accidental wrong orientation. Even if the builder doesn't follow the instructions.

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Power-up & calibration

Before you power up the module, do a continuity test to check for shorts.

- Set your multimeter to resistance.
- Measure the resistance between +12V and ground, -12V and ground, and between the two power inputs. There can be some fluctuations due to the capacitors, but there should never be any shorts. → If you find a short, check your soldering.
- Remove the back PCB
- Connect your power cable → watch the orientation. The red stripe on the cable should match the stripe / -12V label on the pcb.
- Use your multimeter in the volts setting.
- Verify that the pin 8 receives +12V and pin 4 receives -12V.
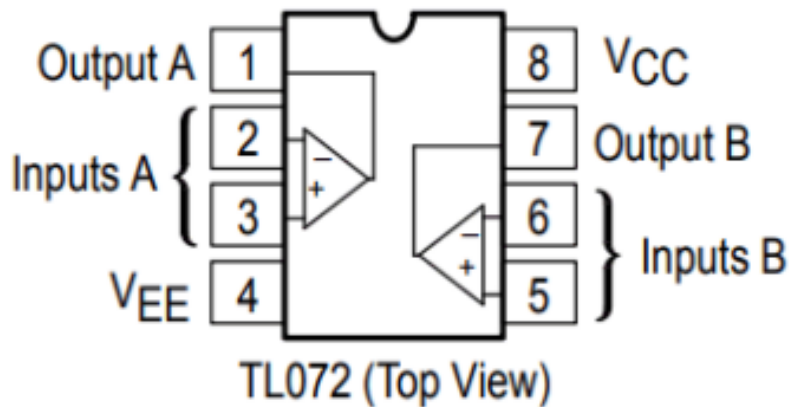
- Remove the power
- Install the TL072 IC → watch the orientation. The notch should line up with the notch in the socket and silkscreen.
- Reassemble the pcb sandwich.

No calibration required. Your new module is ready to use.

I'm always happy to see if anyone would actually build my modules.

If you finish this and feel like it, tag me on Instagram:

@my_modular_journey or use the hashtag #mymodularjourney so I can see your build.