DIY Assembly Manual

for the LPZW.modules PO-Series Adapter

Version 1.1

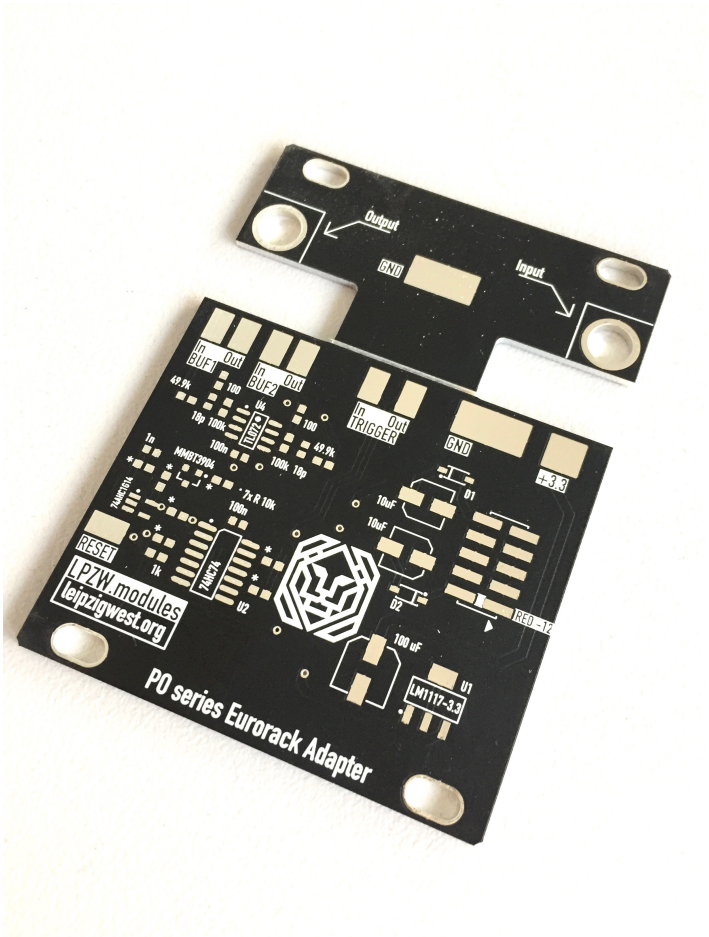
Introduction

The LPZW.module PO-Series Adapter has five functions:

- hold the PO in your Eurorack
- supply power to the PO from bus-power
- route the I/O 3.5mm jacks to the front
- divide incoming 16th-note clock to a 8th-note clock used by the PO
- safeguard against higher trigger voltages than the PO accepts
- amplify the output signal times 2

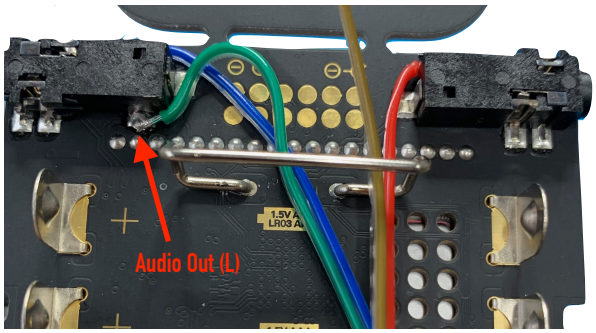
It is up to you to decide which of those functions you want to use. Read this manual carefully and completely first and decide for yourself.

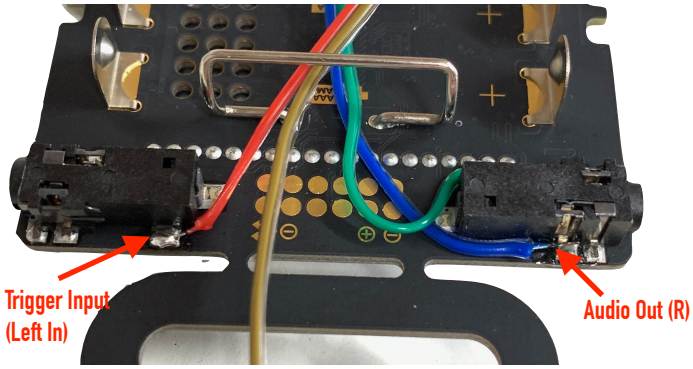
Content



Assembly step-by-step

Step 1: Solder wires to the PO's 3.5mm jacks. This is easier without the adapter in place. The top part of the adapter will sit tightly next to the pads of those jacks, so be careful not to solder on their sides but on top of the pins:

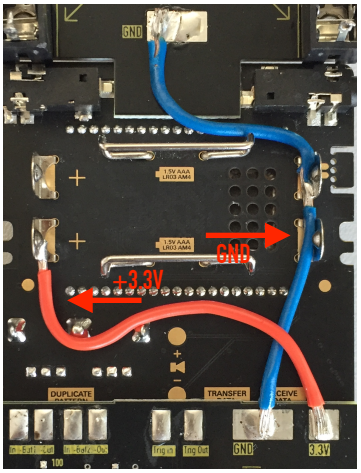




Step 2: Break the adapter into the top and bottom piece. There is a notch so this is easy and you shouldn't need to much force to do it.

Step 3: Attach the adapter to the PO with the adapter's blank side towards the back side of the PO. There is a line on the bottom part that marks the alignment for the PO and the handle is marked on the top part. Try first before you permanently attach it!
You can use thin double sided tape if you want to be able to remove the adapter in the future or you can use super glue, which is a more solid solution for transport.
Please align in your rack before committing to glue otherwise you might run into problems with lipped rails.

Step 4: Wire the GND from the bottom part to the top part and also to the negative pole battery clip. Make sure to use the correct one since the two batteries are in series, so only one of the clips is actually GND.
It is easier to remove solder from the clip than from the pad under the clip. So if you want to be able to remove the adapter, try soldering this cable to the clip.



Step 5: Connect 3.3V to the positive clip. Again: only one clip is correct!

You can do step 4&5 after the other cables to hold those down a bit better. (see finished photo below)

Step 6: connect the wire from the PO input jack left channel to the Trig Out pad of the adapter.

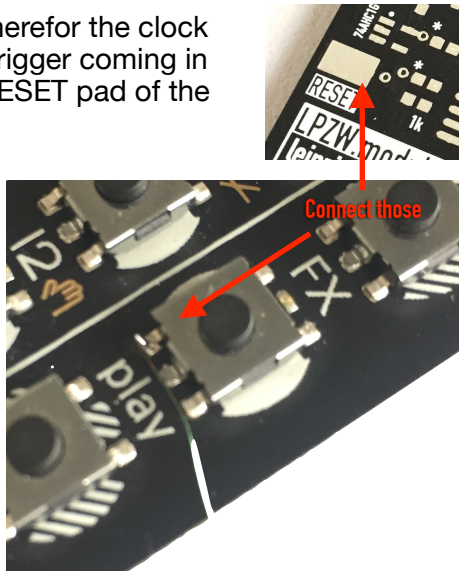
Step 7: connect the Trig In pad to the new input jacks tip connector.

Step 8 (optional): if you want to use the mono audio thru feature of the PO, connect the ring connector of the new stereo input jack to the right channel of the PO input jack directly.

Step 9: connect left and right output of the PO to the Buf1 and Buf2 In of the adapter.
You could also connect the output jacks to each other directly if you do not want to use the buffer.

Step 10: connect the Buf1 and Buf2 Out to the tip and ring of the new output jack. Try to route left to the tip and right to the ring pin of the new output.

Step 11: the PO only recognises the rising edge of the clock, therefor the clock divider needs a reset. Only so the PO starts with the first 16th trigger coming in after a restart. Connect the "play" button of your PO with the RESET pad of the adapter's clock divider.
THIS IS THE ONLY WIRE THAT WILL WRAP AROUND TO THE FRONT OF THE MODULE! There should be some thin enamelled wire in your kit for this!
Consider fixing it with tape or glue. If you use very thin wire you can wrap around right there, the gap between two modules in Eurorack is usually way wider. Alternatively you can route thru the cutout in display area of the PO.



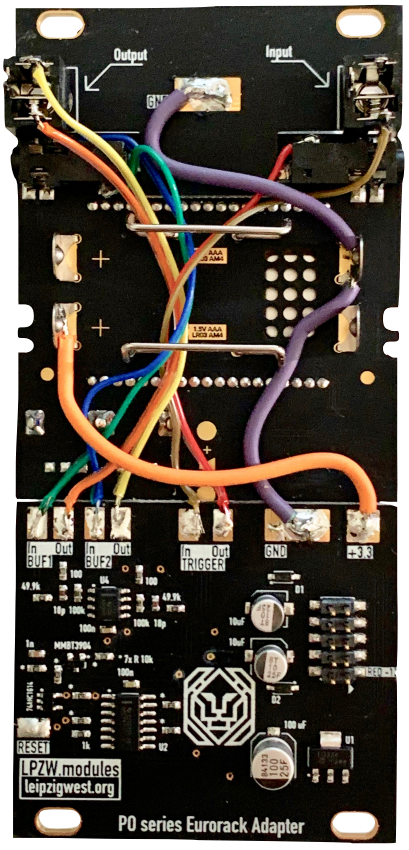
For advance DIYers: You can also connect this point to a NPN transistor pulling towards GND, with its base over 10k connected to some sort of external reset pulse (probably some inverter needed - I have not done this yet).

Step 12: Stick some non-conducting ca. 3.5mm thick round thing (we supply nylon screws) into the PO's I/O jacks to break the normaled conditions. (GND to the input; speaker to the output).

An M3 nylon screw might now be too thin to break the internal switching contact of the jack. Wrap one or two layers of electrical tape around the screw to make it a bit thicker if that is the case with your PO!
We started supplying M3.5 nylon screws to counter that problem.
Cut off the head of the nylon screw with your side cutter pliers.

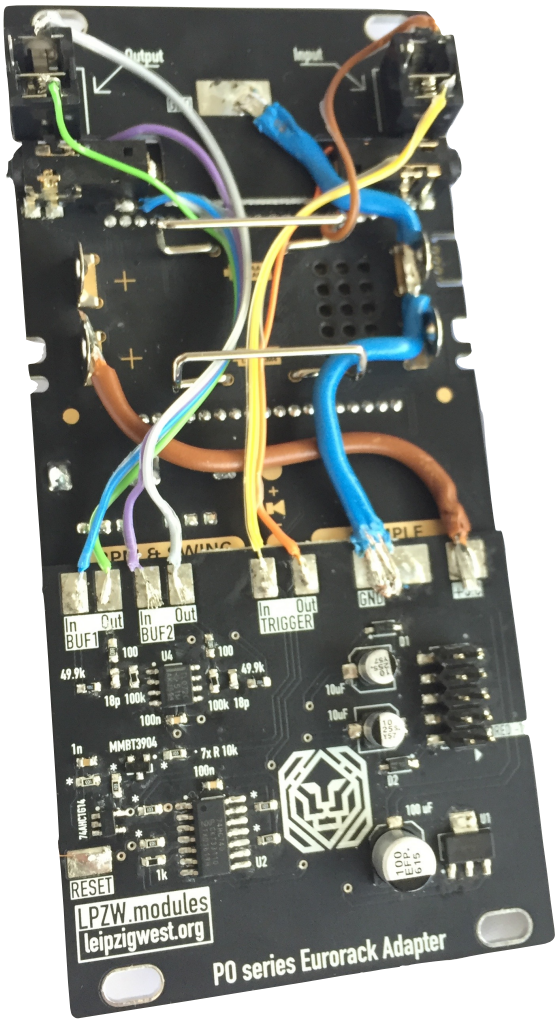
Step 13: connect the PO-Adapter to your Eurorack. Make sure you align the red line with the marking on the adapter and the bus boards -12V!

Step 14: set the PO to sync mode SY2 (recommended) or SY4.



COLOR SCHEME IN THIS PIC —>
FROM PO LEFT TIP OUTPUT TO BUFFER1 IN
FROM PO LEFT RING OUTPUT TO BUFFER2 IN
FROM BUFFER1 OUT TO MODULE OUT TIP
FROM BUFFER2 OUT TO MODULE OUT RING
FROM MODULE INPUT TO CLOCK DIVIDER IN
FROM CLOCK DIVIDER OUT TO PO INPUT TIP

PO-33 converted for audio and trigger input:



Sampling is possible thru the ring contact of a 3.5mm TRS jack. You need and external Y-cable and use mode SY4. Modular levels might be a bit hot so attenuate them for distortion free sampling.

Remarks regarding clocking the PO series

The PO series clock on the rising edge of a 1/8th note clock. Our clock divider divides a more common 16th note clock to a 1/8th note clock.
The POs seem to calculate the distance between the clock pulses for the intermediate steps. This works accurately down to approximately 50BPM. This means you can clock the PO with half speed in standard BPM ranges without artefacts.
When you go below that (clock at quarter notes) or want to send single triggers with larger interval, the PO will asynchronously step an intermediate 16th note further. This will give you a polyrhythmic structure that we strongly encourage to explore!

Remarks regarding the PO32/33/35

For those PO you need to take care to preserve its upload/sampling capabilities. Which is actually not that difficult. there is only one thing you need to decide: do you want to use the mic or the audio input jack for sound upload? (You can also create your own circuitry there with a switch and an attenuator etc.)

If you want to use the mic - connect the right channel pin and its normaling pin on the PO-32's input jack.
If you want to use the audio input use the right channel from the stereo input jack of the adapter and connect it directly to the PO.
In any case you have to use sync mode SY4 on the PO and stop the clock while uploading data or sampling!

Remarks regarding saving of patterns

The PO series saves edited patterns only when it goes to standby mode. Since the normal use case would have been that you have batteries in there you would not even notice that it doesn't happen before. So you have to remember to leave your Eurorack powered until the LEDs of the PO go off otherwise you will loose your last edits.

Direct quote from the Teenage Engineering website:

> auto power off (a.p.o)
> the unit auto powers off after 5 minutes of inactivity. in this state all patterns and settings will be saved, leaving only the LCD lit. this state draws very little power so there is no need to remove batteries. if there is a cable connected in the line in, the unit will auto power off after 60 minutes of inactivity.
> press any key to wake the unit after sleep.

Since our mod makes use of a faux external jack and routes the input to the front, the waiting time is indeed quite long. My PO-32 took ca. 30 minutes to go to sleep.

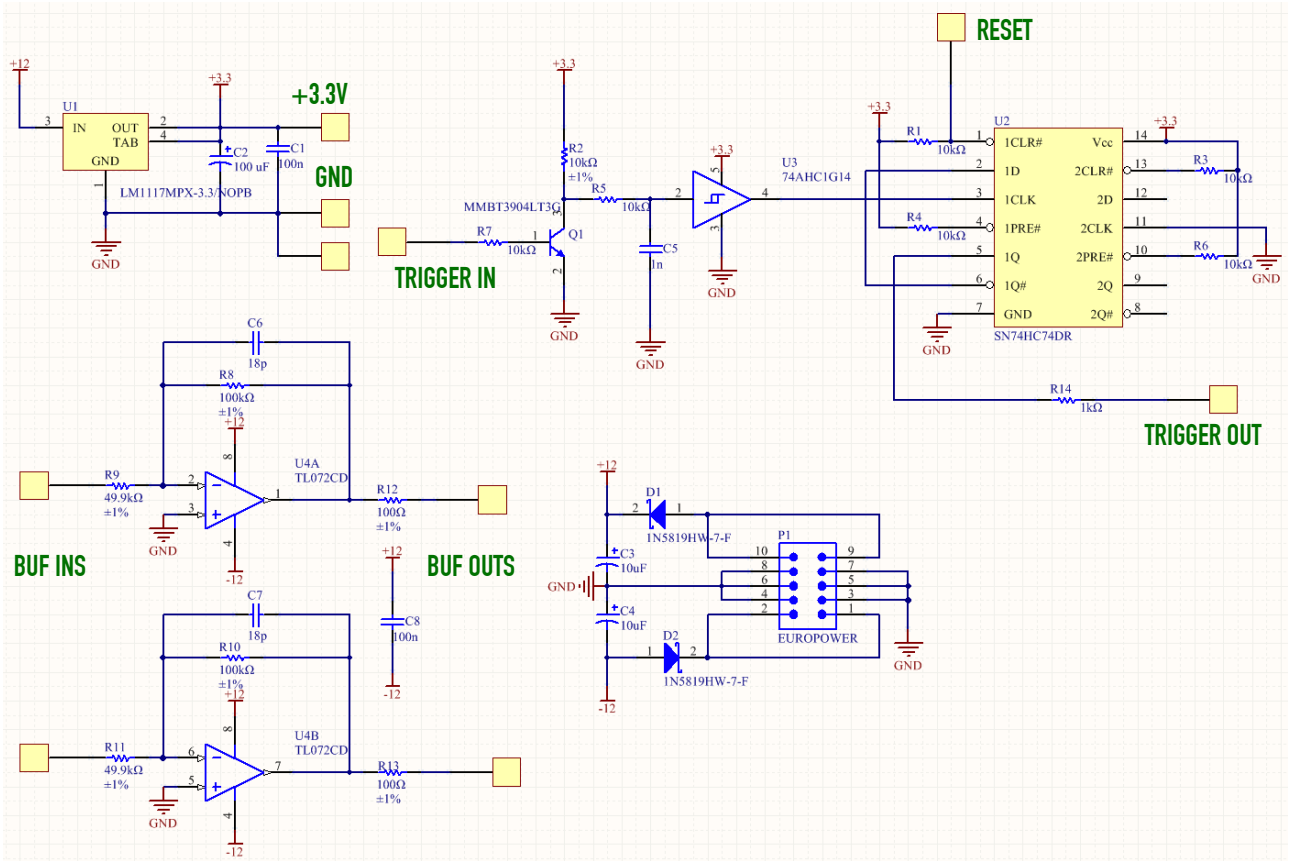
If you are totally unsatisfied with this behaviour, you can do the following things to shorten the waiting time:
Use a normaled mono jack like the Knobicon and connect the normaled connector tap from the PO and extend it to the Knobicons switching contact. This way you are able to remove the input cable in a way the PO will recognize.
If you absolutely need the stereo input (for instance with the PO-32):
Find a stereo jack with switching contacts that fits in this area (and report back to me which) or drill a hole into the adapter in the area inside the PO's handle and install a micro switch that connects the two pins of the PO that would normally connect when you unplug the cable.

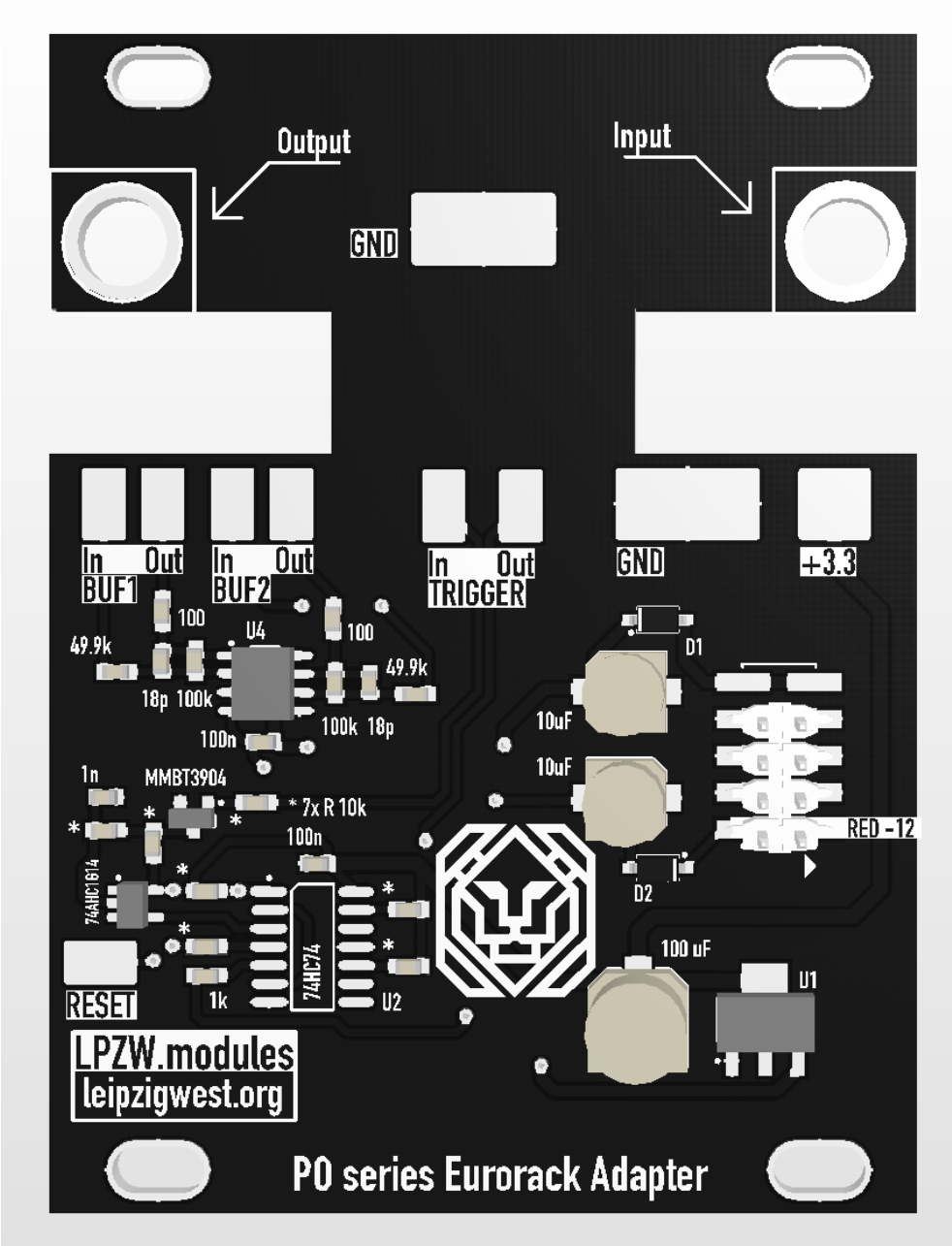
PCB assembly (only if bought blank)

BOM

- 100n - C1, C8 - CAP CER 16V 10% - X7R 0603
- 100 uF - C2 - 6.3mm x 5.4mm 100u/10-Volt Surface Mtg/Pkg Aluminum Electrolytic Cap
- 10uF - C3, C4 - Cap Aluminum Lytic 22uF 16V 20% (5 X 5.8mm) SMD 160mA 2000h
- 1n - C5 - CAP CER 16V 10% X7R 0603
- 18p - C6, C7 - CAP CER 16V 10% X7R 0603
- 1N5819HW - D1, D2 - 1.0 A Surface Mount Schottky Barrier Rectifier, 40 V, -65 to 125 degC, 2-Pin SOD-123 Package
- 2x5 Pin header SMD - P1 - Conn.; Rect/PCB; Header; 10 Pos. SMT; 2-Row
- MMBT3904LT3G - Q1- General Purpose Transistor, NPN Silicon, 3-Pin SOT-23
- 10kΩ - R1, R2, R3, R4, R5, R6, R7 - RES SMD 10K OHM 0.5% 1/10W 0603
- 100kΩ - R8, R10 - RES SMD 100K OHM 0.5% 1/10W 0603
- 49.9kΩ - R9, R11 - RES SMD 49.9K OHM 0.5% 1/10W 0603
- 100Ω - R12, R13 - RES SMD 100 OHM 0.1% 1/10W 0603
- 1kΩ - R14 - RES SMD 1K OHM 0.1% 1/10W 0603
- LM1117MPX-3.3/NOPB - U1 - 800mA Low-Dropout Linear Regulator, 4-pin SOT-223
- SN74HC74DR - U2 - IC:DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS
- 74AHC1G14 - U3 - MC74VHC1G14 Series 2 to 5.5 V Single Schmitt-Trigger Inverter - SOT-23
- TL072CD - U4 - Dual Low-Noise JFET-Input General-Purpose Operational Amplifier, 8-pin SOIC
- 2x Thonk PJ301CM - Stereo 3.5mm jacks or Knobicons or Thonkicons (do this to your needs, read the remarks)

Schematic


RESET
+3.3V
GND
TRIGGER IN
TRIGGER OUT
BUF INS
BUF OUTS
U1
LM1117MPX-3.3/NOPB
U2
SN74HC74DR
U3
74AHC1G14
Q1
MMBT3904LT3G
U4A
TL072CD
U4B
TL072CD
D1
1N5819HW-7-F
D2
1N5819HW-7-F
P1
EUROPOWER


Output
Input
GND
In Out
BUF1
In Out
BUF2
In Out
TRIGGER
GND
+3.3
100
49.9k
U4
100
49.9k
18p 100k
100k 18p
100n
D1
10uF
10uF
1n
MMBT3904
* 7x R 10k
100n
74AHC1G14
74HC74
D2
RED - 12
100 uF
U1
RESET
1k
U2
LPZW.modules
leipzigwest.org
PO series Eurorack Adapter

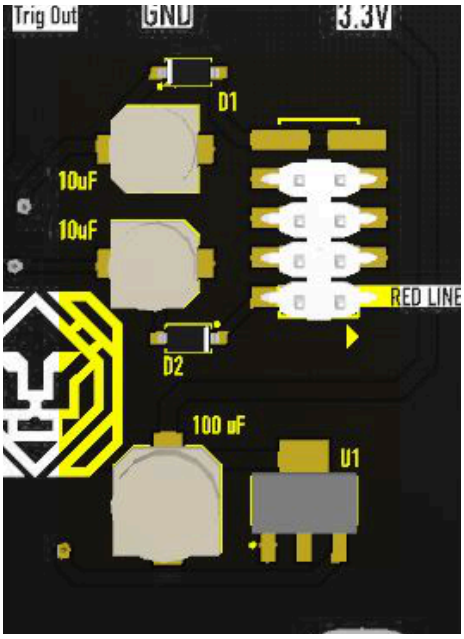
Component placement

U1: LM1117MPX-3.3
U2: 74HC74 (CMOS!)
U3: 74HC1G14 (CMOS!)
U4: TL072
Q1: MMBT3904
D1, D2: 1N5819HW

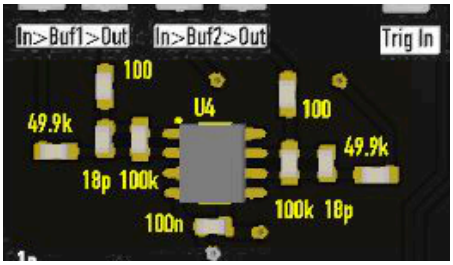
Resistors marked with an asterisk are 10k (7x)
The rest is printed in values on the PCB

Steps

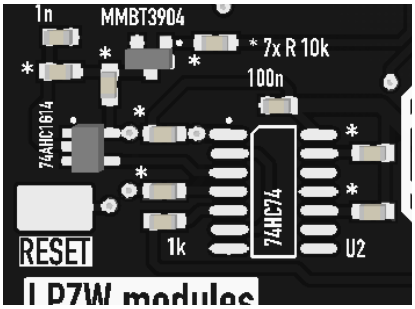
1. Populate all the parts for power supply.
   Connect to your bus power and check if the output is 3.3V



2. Populate all the buffer parts. (You could check if there is a DC on the buffer outputs - it should be DC free)
   If you have a signal generator and an oscilloscope you can check the inverting buffers for correct output. The input should not exceed +/- 5.5V.
   The output is twice the amplitude and inverted.
   If you find a gain of 2 not good enough change the ratio of the 49.9k and 100k resistors to your liking.



3. Populate the clock divider parts. All resistors marked with asterisk are 10k.



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Thanks to the crowd on Muffwiggler Forum for the support and motivation!

If you find faults or inconsistency in the manual's steps or unbearable grammar mistakes, please contact info@leipzigwest.org. It is my first manual of this kind.