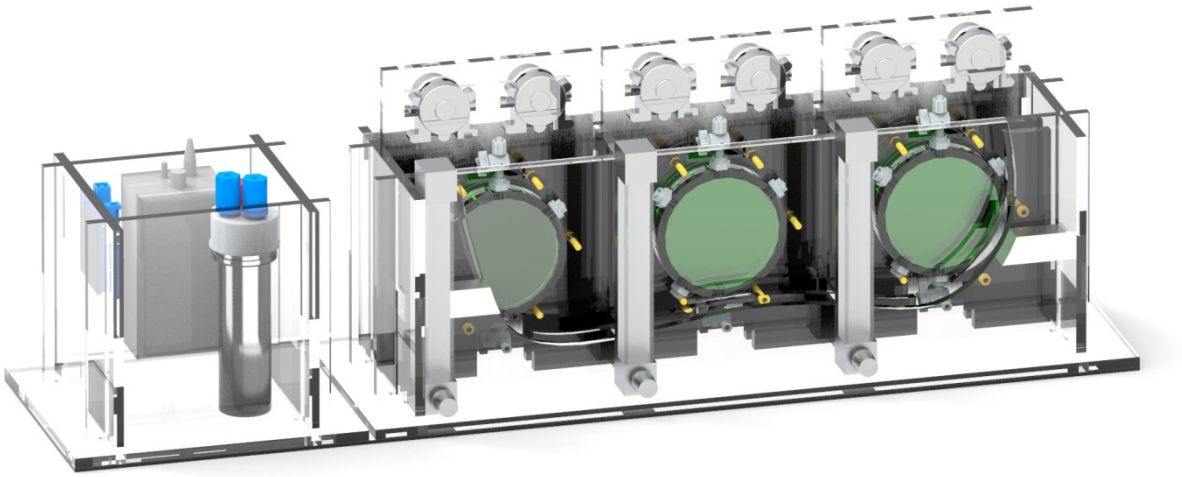


Pumps (openPBR)

Step by Step tutorial

The pumping system of the openPBR can be used for the turbidostatic/chemo static mode and to fill and empty the cultivation vessels. They are controlled by 6 N-Channel MOSFET at 5V provided by a LM317 voltage converter. The cut outs on the back wall on the openPBR are optimized to hold the pumps without any screws.

Partlist:

- 6x DC 6V Peristaltic pump 13,99 Euro

https://www.amazon.de/Acogedor-Peristaltik-Peristaltische-Fl%C3%BCssigkeiten-Dosierzus%C3%A4tze/dp/B07HHT7CD1/ref=sr_1_12?__mk_de_DE=%C3%85M%C3%85%C5%BD%C3%95%C3%91&keywords=peristaltic+pump&qid=1571504324&sr=8-12

- 6x N-Channel MOSFET 0,67 Euro

https://www.reichelt.de/mosfet-n-ch-60v-50a-110w-0-018r-to220-stp55nf06-p257486.html?r=1

- 1x Aluminum cool bloc 0,83 Euro

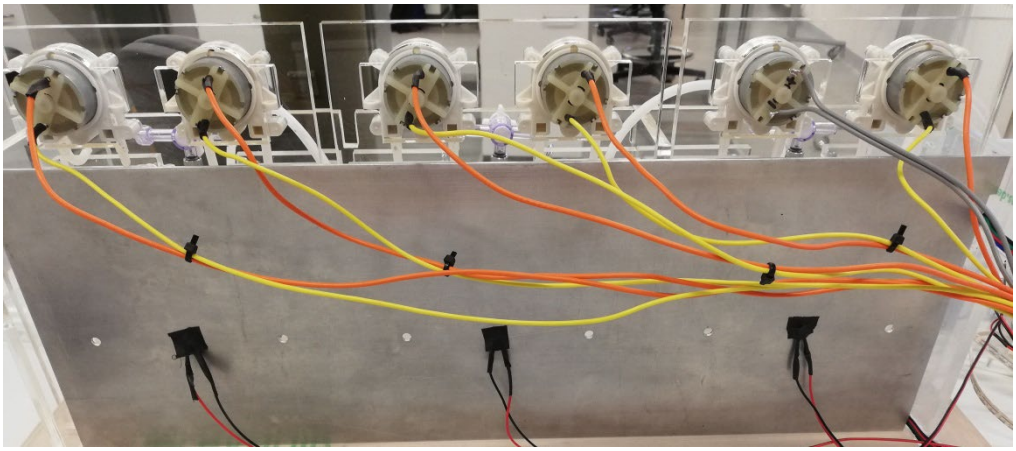
https://www.reichelt.de/kuehlkoerper-25-mm-alu-60-k-w-sot-32-to-220-sk-12-25-sa-32-p227995.html?&trstct=pos_0

- 1x LM317 voltage converter 0,25 Euro

https://www.reichelt.de/spannungsregler-einstellbar-1-2-37-v-to-220-lm-317-220-p10458.html?r=1

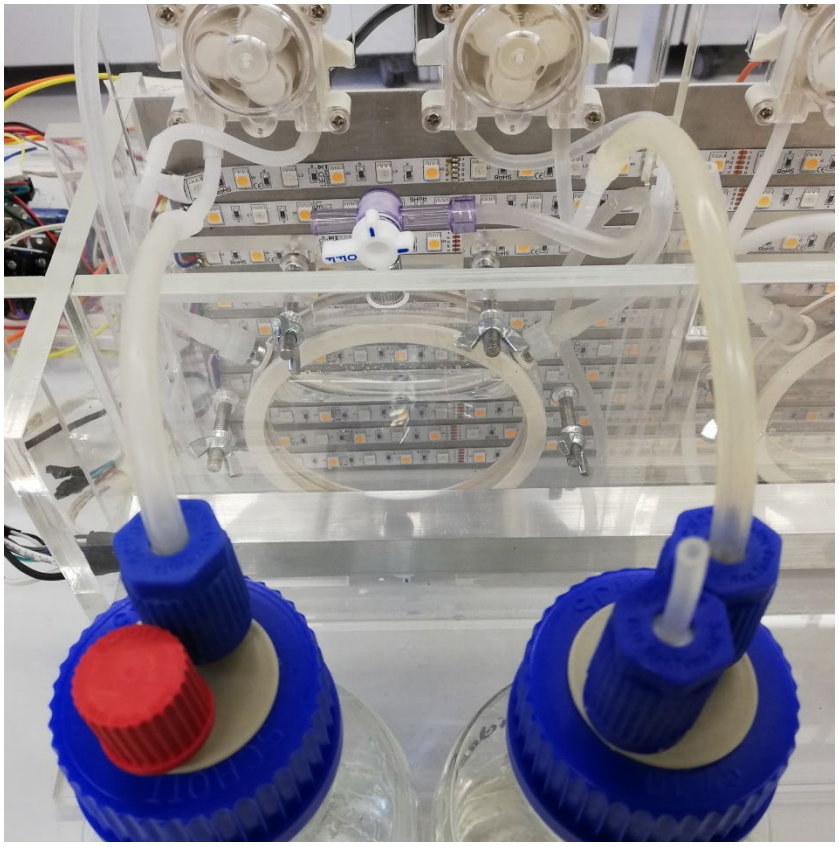
Total: 89,04

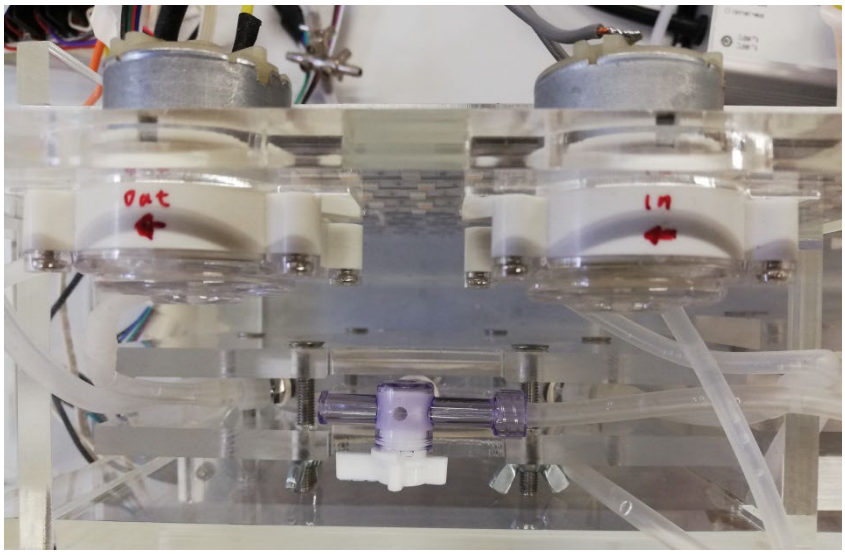
Solder cables to the pumps and put them into the pump holder holes in the back wall of the openPBR.



Turbidostatic/Chemo static mode:

To hold the cell density in the cultivation vessel, the Open PBR measures the cell density and controls the pumping to stay in turbidostatic conditions. On a given density one pump is pumping out media/cell culture and the second pump pumps in new media.



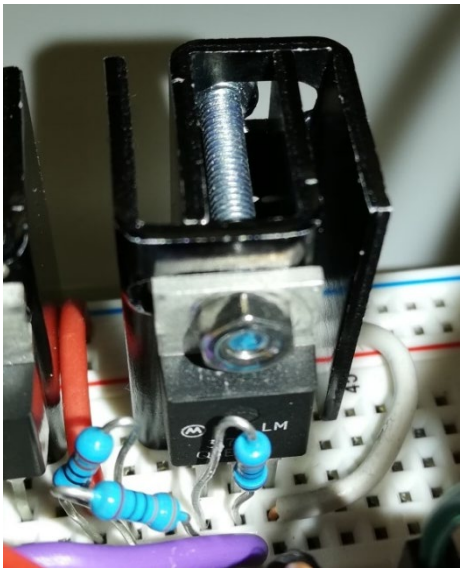


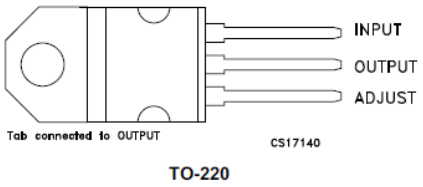
Electronics:

The LM317 voltage converter

- The LM317 is converting the 12V from the network adapter of the openPBR LED-panel to 5V for the pumps. You can control the voltage output of the LM317 by resistors on the ADJUST pin. To reduce the voltage from 12V to 5V you need one 1k ohm and one 330 ohm resistor. Be careful the LM317 can get very hot so it is recommended to attach a proper cooling bloc.

- Connect INPUT to 12V(+) white cable.
- Connect on 330 ohm resistor from ADJUST to OUTPUT.
- Connect one 330 ohm and one 1kohm resistor in row to the 12V (-).
- Connect a cable (violet) to the lane you want to have 5V (+) on.



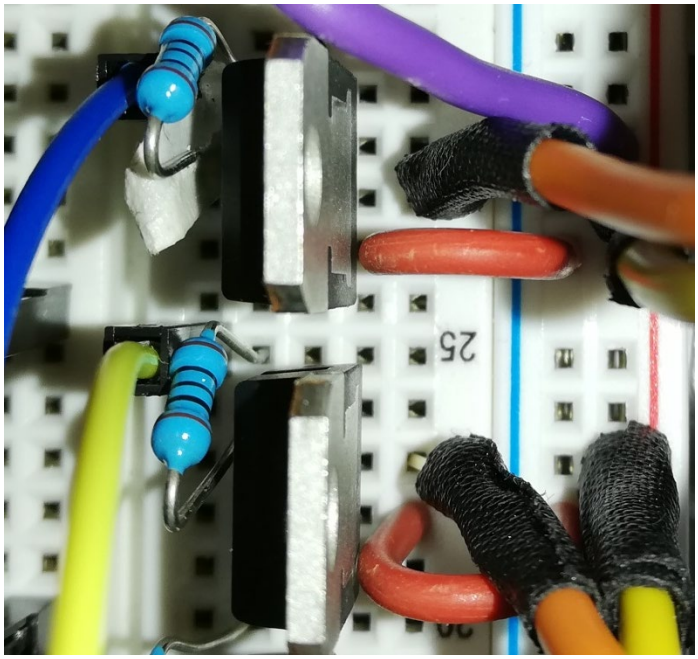


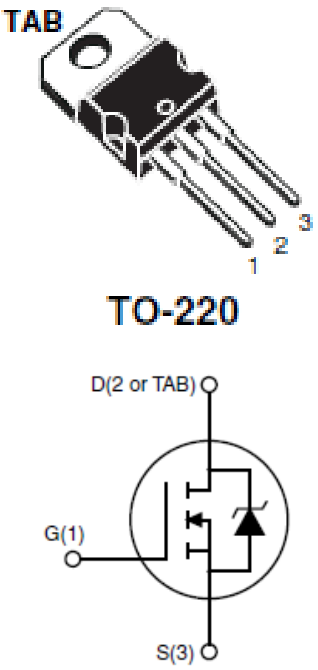
TO-220

More information to the LM317 you can find here:
http://www.learningaboutelectronics.com/Articles/LM317-resistor-and-voltage-calculator.php#answer1

N-Chanel MOSFET

- Connect G (Gate) with a 100 ohm resistor to your Arduino digital pins according to the position of the pump e.g. Left (Out/In), Middle (Out/In), Right (Out/In). Here blue and yellow cable.
- Connect S (Source) to ground (-).
- Connect D (Drain) to each (-) of your pump.
- Connect the 5V (+) of each pump to the 5V lane of the LM317.





The complete wiring and circuit diagram of the openPBR you find in: DIY Manual on GitHub

The software to control the pumps you find in the openPBR_control software.