Supplementary Materials: Fully-Programmable, Low-Cost, "Do-It-Yourself" Pressure Source for General Purpose Use in the Microfluidic Laboratory

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1. Experimental Setup for the Pressure Pump Characterization

The experimental setup to investigate the characteristics of the pressure pumps is given in Figure S1. A detailed fabrication design of the microfluidic chip, used as load, is given in Figure S2. The chip design holds three identical fluid channels, which consist of an inlet a hydraulic resistance in form of a meander channel and an outlet. During the experiments three different hydraulic resistances were used. In order to realize the three different resistances the fluidic channels of the chip given in Figure S2 were connected in series. For the smallest resistance one channel was used, for the middle-sized resistance 2 channels were connected and for the highest resistance all three channels were bridged in series.

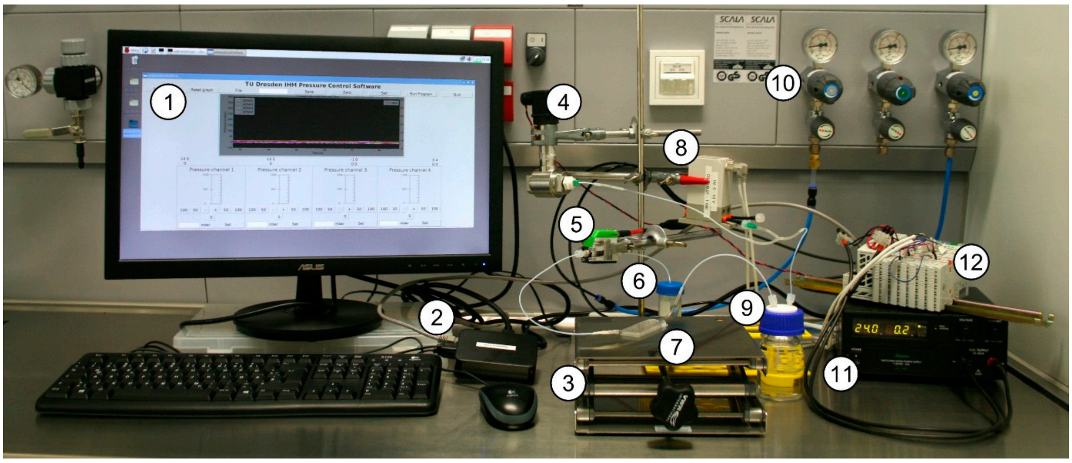
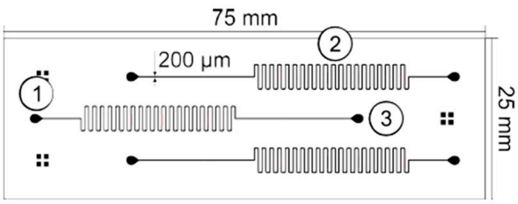


Figure S1. Experimental setup for pressure source (with load). (1) Software GUI; (2) Computer; (3) Stage, (4) Pressure sensor; (5) Flow sensor; (6) Waste; (7) Microfluidic system; (8) Pressure controller; (9) Fluid reservoir; (10) External supply; (11) Voltage source; (12) Fieldbus system.



Master Flow layer
Channel height: 100 µm
Substrate size: Glass substrate with a length of 75 mm and a width of 25 mm

Microfluidic Chip
PDMS 10 : 1

Flow layer
PDMS with a thickness of 4 mm

Cover layer
Glass substrate with a thickness of 1 mm

Joining of layers
Oxygen Plasma for 2 min at 50 W

Figure S2. Design of the microfluidic chip. (1) Inlet; (2) Hydraulic resistance in form of a meander channel (width: 200 µm/length; 200 mm); (3) Outlet.

2. Experimental Setup for Water-in-Oil Droplet Generation

The experimental setup applying the DIY pump to a water-in-oil droplet generation as given in Figure S3. A detailed fabrication design of the microfluidic chip used for droplet generation is given in Figure S4. The chip design holds 2 inlets accordingly for the dispersive (water) and the continuous phase (mineral oil with 3 wt % surface detergent). Each inlet follows a meander channel as hydraulic resistance. The droplet generation takes place at flow focusing device where the two phases join together (Figure S4(5)). The wide channel (Figure S4(6)) functions as droplet reservoir to hold the generated droplets. The fluidic structures are concluded with an outlet.

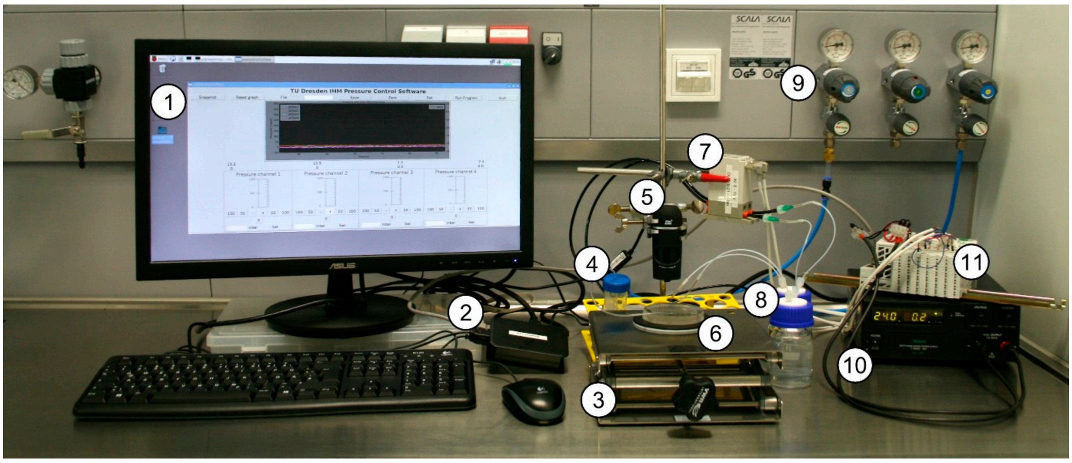


Figure S3. Experimental setup for droplet generation. (1) Software GUI; (2) Computer; (3) Stage; (4) Waste; (5) Microscope; (6) Microfluidic system; (7) Pressure controller; (8) Fluid reservoirs; (9) External supply; (10) Voltage source; (11) Fieldbus system.

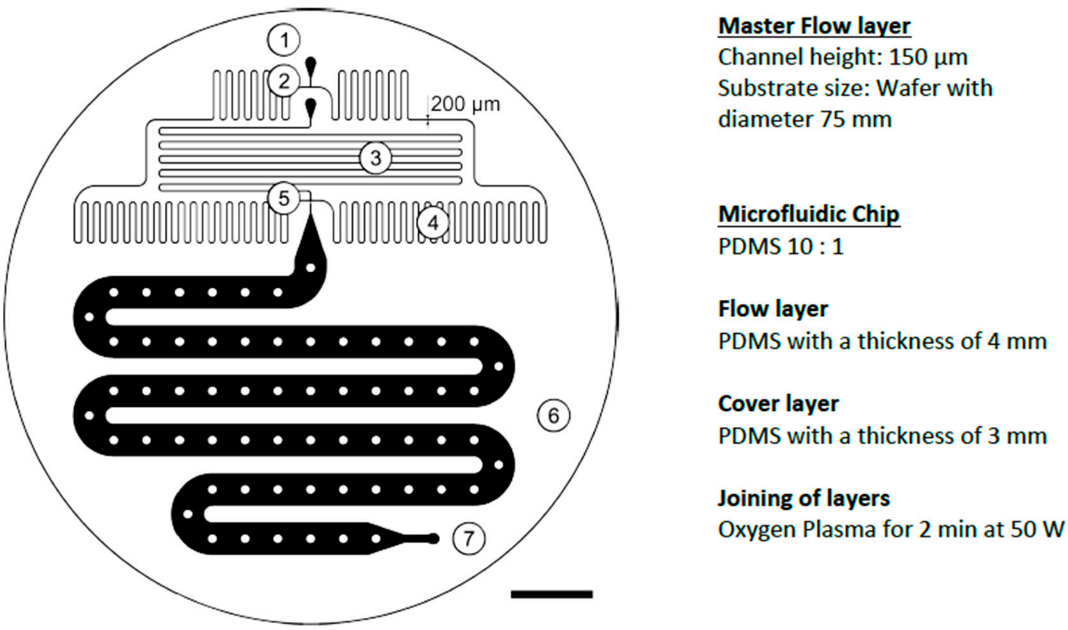


Figure S4. Design of the microfluidic droplet chip. (1) Inlet continuous phase; (2) Inlet dispersive phase; (3) hydraulic pre-resistor dispersive phase; (4) hydraulic pre-resistor continuous phase; (5) Flow focusing device; (6) Droplet reservoir channel; (7) Outlet, (Scale bar = 10 mm).