Electronic Supplementary Informations

FOMSy: 3D-Printed Flexible Open-Source Microfluidic System and Flow Synthesis of PET-Tracer

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3D printer setup

Two 3D printers were used for this work. 3D-printed parts out of PLA (polylactic acid) and PETG (polyethylene terephthalate glycol-modified) were printed on an X-CF Pro from Qidi. 3D-printed parts out of PEEK (Polyetheretherketone) were printed on an Apium P220 from Apium Additive Technologies GmbH.

Software: All parts were designed with Autodesk Inventor Professional 2022. After modeling, the files were exported as STL files and sliced with the software simplify3D.

PEEK parts: The parts out of PEEK were printed with Apium PEEK 4000 Natural filament with an Apium P220 3D printer. The filament roll was dried in a vacuum oven at 80 °C and 50 mbar overnight to ensure proper drying of the PEEK.

Print speed = 25 mm/s

Extrusion width: 0.40 mm

Extrusion multiplier = 0.90

Nozzle temp. = 480 °C

Bed temperature = 130 °C, glass plate coated with DimaFix pen with a brim of 24 perimeters

Layer height: 0.1 mm

PLA parts: PLA 1.75 mm from Janbex was used on the Qidi X-CF Pro 3D printer.

The following settings were used:

Print speed = 60 mm/s

Extrusion multiplier = 1.00

Nozzle temp. = 200 °C

Bed temperature = 60 °C, printed on a flexible metal PEI sheet, coated with DimaFix Spray or pen.

Layer height: 0.2 mm – 0.3 mm

PETG parts: PETG 1.75 mm from Fiberlogy was used on the Qidi X-CF Pro 3D printer. The filament roll was stored in a sealed box with silica gel bags inside to ensure proper drying of the PETG.

The following settings were used:

Print speed = 60 mm/s

Extrusion multiplier = 1.00

Nozzle temp. = 230 °C

Bed temperature = 80 °C, printed on a flexible metal PEI sheet, coated with DimaFix Spray or pen.

Layer height: 0.2 mm (if a part was printed with 0.3 mm layer height, it is indicated in the parts list)

The STP and STL files of all printed parts can be found in the zip file "Data Files" in the supplementary information. For more information also see our previous publications. [1], [2]

Dual syringe pump

All 3D-printed parts were printed in PLA (black) and PETG (bordeaux red). The exploded-view CAD drawing of the syringe pump can be found in **Figure S1,** the single parts in **Figure S2,** and the full parts list in **Table S1**.

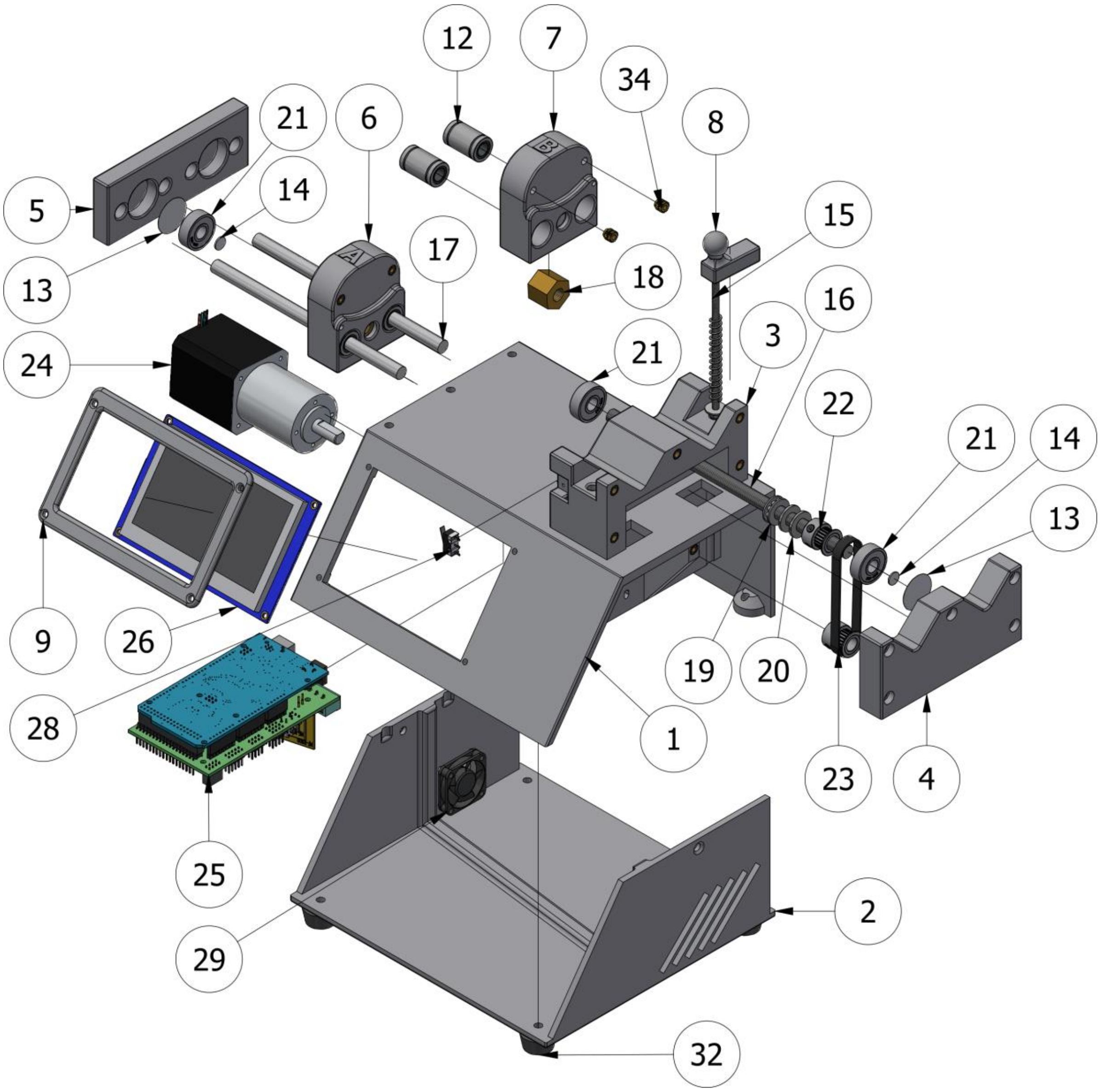


Figure S1: Exploded-view CAD drawings of the syringe pump.

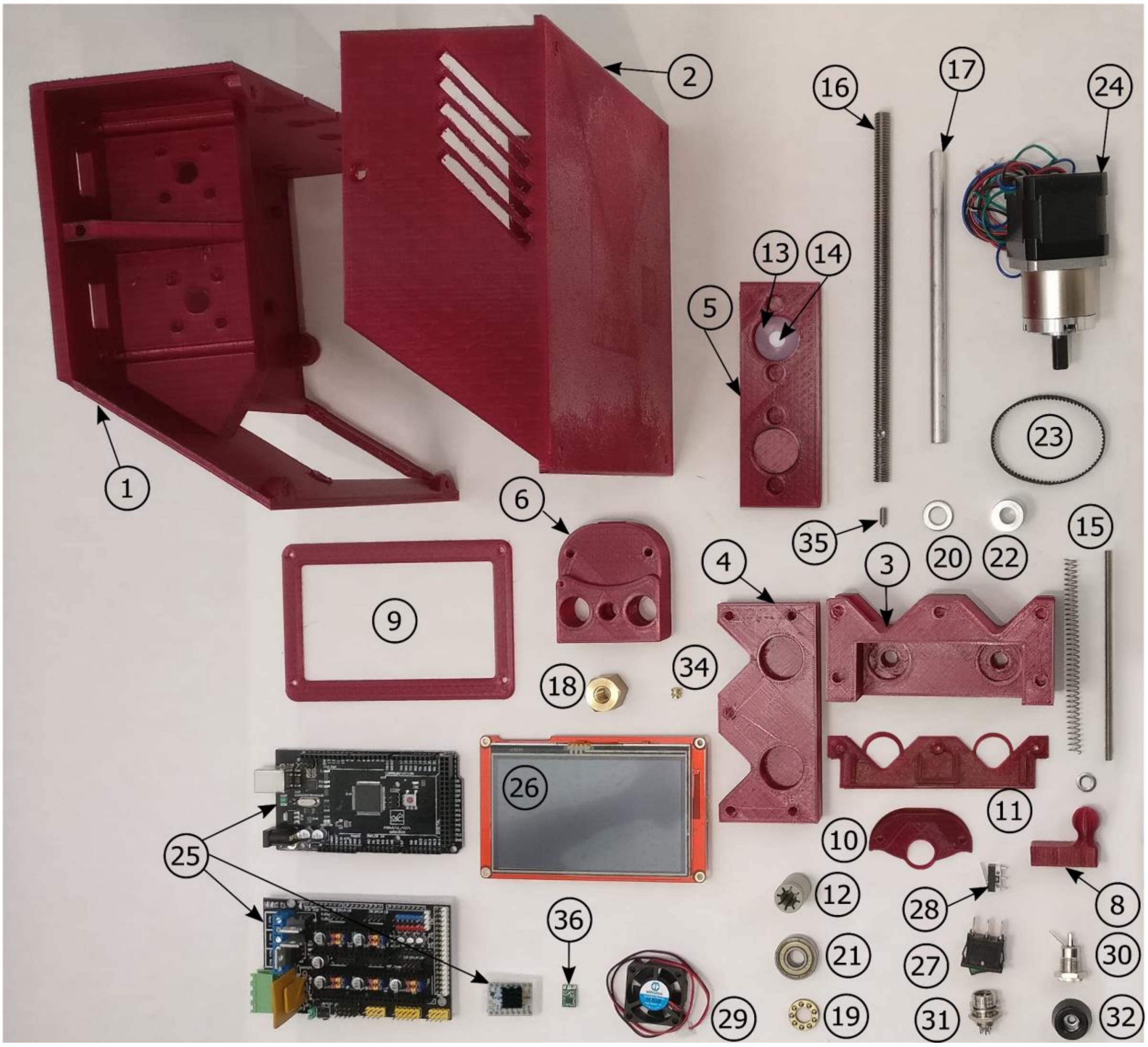


Figure S2: All 3D-printed, mechanical, and electronic parts with numbers.

Table S1: Parts list for the syringe pump. The screws and nuts that are needed for mounting each part are given in brackets.

Quant.	Part	Source	No.
1	Main pump body (printed with 0.3 mm layer height)	3D-printed	1
1	Bottom part (printed with 0.3 mm layer height)	3D-printed	2
1	Syringe holding block	3D-printed	3
1	Front plate	3D-printed	4
1	End plate	3D-printed	5
1	Carrier block A	3D-printed	6
1	Carrier block B	3D-printed	7
1	Syringe clamp	3D-printed	8
1	Display frame	3D-printed	9

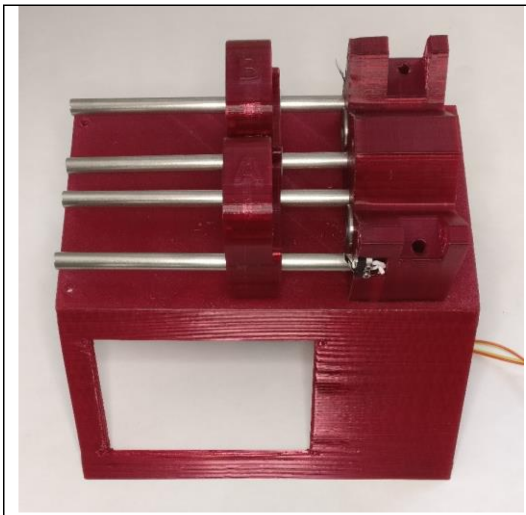
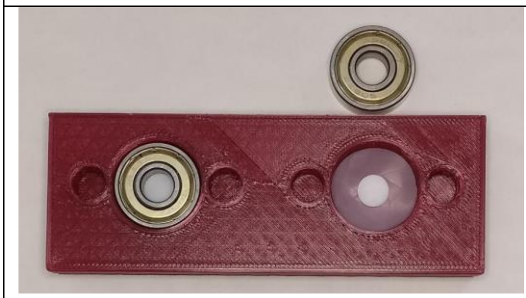
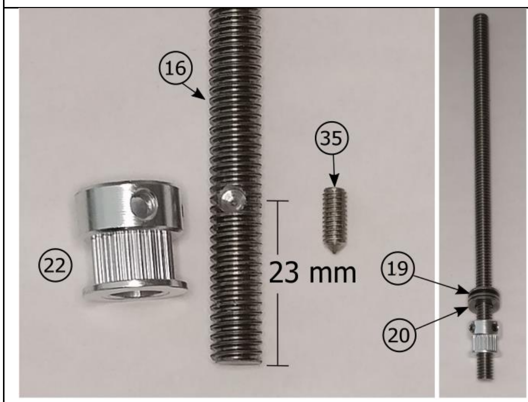
Quant.	**Part**	**Source**	**No.**
2	Syringe retainer back	3D-printed	10
1	Syringe retainer front	3D-printed	11
4	RJ4JP-01-08 drylin® R - bearing 8mm	Amazon	12
4	PTFE washer (22 mm × 0,1 mm)	In-house workshop	13
4	PTFE washer (8 mm × 2 mm)	In-house workshop	14
2	M4 Threaded rod	In-house workshop	15.1
2	compression spring 45 × 7 mm × 0.6 mm	In-house workshop	15.2
2	M4 locknut and washer, 12 mm	In-house workshop	15.3
2	Trapezoidal thread spindle, Tr8 × 1.5 × 185 mm	HFB-Gewindetechnik	16
4	Round rod, stainless steel, 8 × 145 mm	In-house workshop	17
2	Hexagon nut, Tr8 × 1.5	HFB-Gewindetechnik	18
2	Thrust bearing, F8-16M 8 × 16 × 5mm	Amazon	19
4	Washer 8×16×15mm	In-house workshop	20
6	Ball bearing 608RS	Amazon	21
4	GT2 timing pulley, 8 mm bore, 20 teeth, for 6 mm belt	Amazon	22
F4	GT2 closed loop timing belt, 6 mm, 158 mm	Amazon	23
2	Nema 17 Stepper Motor Bipolar L=40mm w/ Gear Ratio 27:1 Planetary Gearbox	stepperonline	24
1	HIMALAYA basic MEGA 2560	Eckstein GmbH	25.1
1	Ramps 1.4 controller	Eckstein GmbH	25.2
3	TMC2208 V1.2 stepper motor driver	Eckstein GmbH	25.3
1	Nextion NX4827T043 Display	Antratek Electronics	26
1	Rocker switch, 3-Pin	Eckstein GmbH	27
2	Pololu mini snap-action switch with 13.5mm lever	Eckstein GmbH	28
1	Cooling fan (30 × 30 × 10 mm), 5 V	Amazon	29
1	DC-socket 2.1/5.5mm	Reichelt elektronik GmbH & Co. KG	30
1	GX12 aviation socket, Pins 5 or 6 (+ aviation plug on the cable)	Amazon	31
4	Rubber feet, 20 × 9 mm	Amazon	32
	Threaded inserts M4 × 8 or M4 × 6	Amazon	33
	Threaded inserts M3 × 6	Amazon	34
2	Grub screw, M4 ×10 mm (ISO 4027)	In-house workshop	35
1	Pololu 5V Step-Up/Step-Down Voltage Regulator S9V11F5	Eckstein GmbH	36
	Hex Socket Head Cap Screws (ISO 4762), various sizes	In-house workshop	37

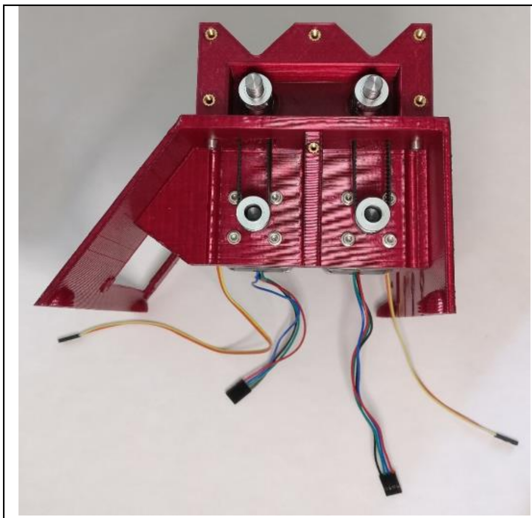
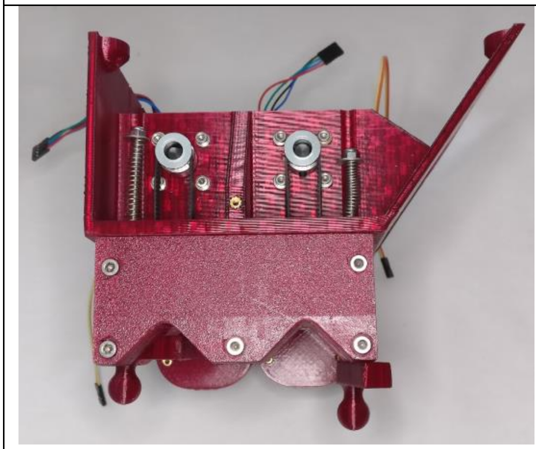
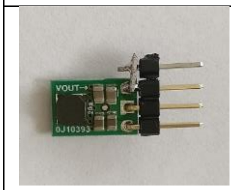
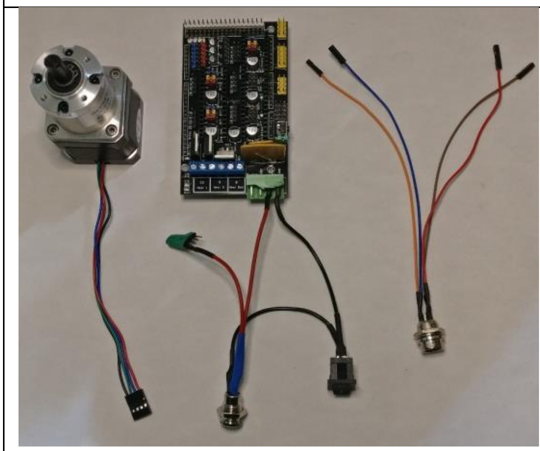
Quant.	Part	Source	No.
	Hexagon socket countersunk screws (ISO 10642), various sizes	In-house workshop	38
1	Single output power supply 12 V, 3 A	Reichelt elektronik GmbH & Co. KG	39
	jumper wire cables, female to female	Eckstein GmbH	

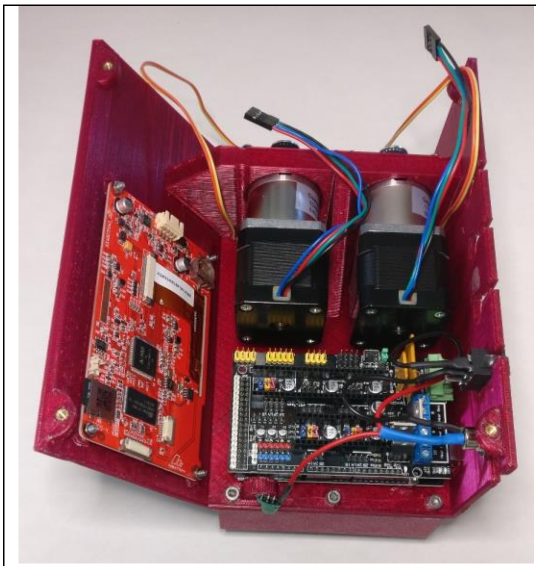
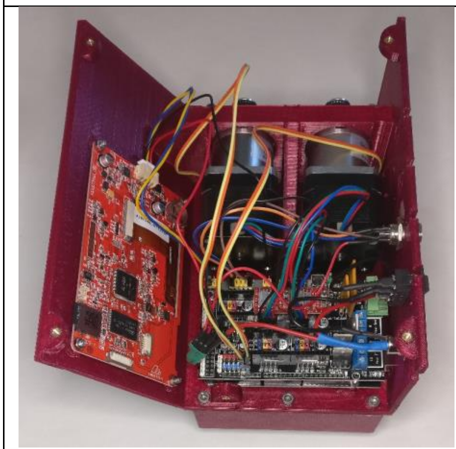
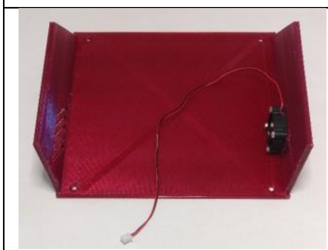
Detailed step-by-step assembly instruction

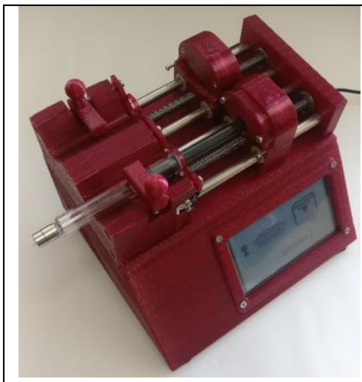
In the following, a detailed assembly instruction with example photos is given. Together with the exploded CAD view, it should be possible to assemble the pump without using special tools. A bench drill with a vise is recommended in step 11 to drill an accurate hole.

	 **Step 1**: All Threaded inserts (33 and 34) were inserted using a soldering iron **Step 2**: The two core wires for the end switch were pulled through the main pump body (1) and the syringe holding block (3). **Step 3**: The syringe holding block (3) was screwed (M4 head cap screws) on the main pump body (1).
	**Step 4**: The linear bearing (12) and the nut (18) were inserted into the carrier blocks A and B (6 and 7). *Care should be taken that the round rod (17) runs without friction through the linear bearing! If not, increase the hole size of the carrier block.*

	**Step 5**: The end switches (28) were soldered to the wires and attached to the syringe holding block. **Step 6**: The round rod (17) and two ball bearings (21) were inserted into the syringe holding block (3). **Step 7**: The two carrier blocks A and B (6 and 7) were slid in the round rods.
	**Step 8**: The two 22 mm PTFE washers (13) and the two ball bearings (21) were inserted in the end plate (5). **Step 9**: The two 8 mm PTFE washers (14) were inserted into the two ball bearings (21).
	**Step 10**: The end plate (5) was screwed (M4 head cap screws) to the main pump body (1). *Care should be taken that the carrier blocks move without friction!*
	**Step 11**: A hole (4mm) was drilled halfway through the trapezium thread spindle (16) with a distance of 23 mm from center to end *(bench drill with a vise is recommended)*. **Step 12**: The timing pulley (22) was screwed to the threaded spindle with a grub screw (35). **Step 13**: Two washers (20) and the thrust bearing (19) were attached (total thickness of 8mm).

	**Step 14**: The spindles from step 13 were inserted. *Make sure that the spindle can be rotated without much resistance!* **Step 15**: The gear stepper motors (24) were loosely attached (M3 head cap screws with washers) to the main pump body (1). **Step 16**: The timing pulleys (22) and the timing belts (23) were attached. The timing belts were put under tension and the motors and pulleys were tightened firmly.
	**Step 17**: The front plate (4) was screwed (M4 head cap screws) to the pump. **Step 18**: The M4 threaded rods (15.1) were screwed into the syringe clamps (8) and inserted through the holes. **Step 19**: The compression spring (15.2) was inserted and fixed with the washer and lock nut.
	**Step 20 (optional)**: A second 5 V output was soldered to the Voltage Regulator (36). *This could be used to supply power to the sensor module if no motorized BPR is used! If a separate power supply on the sensor module is used, do not connect power from pump to sensor!*
	**Step 21**: The cables of the motors were shortened and connected to a 4-pin plug (black – green – blue – red). **Step 22**: Cables were soldered (see figure S3) to the components (27, 30, 31, 36). The 12 V (+ and -) input cable was soldered directly to the RAMPS controller (25.2) *The voltage regulator (36) should be encased in heat shrink tubing to prevent accidental electrical contact with other parts.*

	**Step 23**: The Arduino Mega (25.1) was screwed (M3 head cap screws) to the Main pump body (1). **Step 24**: The electronic part from step 22 was attached to the main pump body. The RAMPS controller (25.2) was plugged on the Arduino. **Step 25**: The Nextion display (26) was screwed (M3 countersunk screws with M3 nuts) with the display frame (9) to the main pump body.
	**Step 26**: The TMC2208 stepper motor drivers (25.3) were plugged on the RAMPS (Jumper to MS2, middle position). **Step 27**: The wires were connected as described in Figure S3.
	**Step 28**: The cooling fan was screwed (M3 countersunk screws with M3 nuts) to the bottom part (2)
	**Step 29**: The bottom part (2) with the rubber feet (32) was screwed (M3 countersunk and head cap screws) to the main pump body (1). **PLA version of the pump:** 



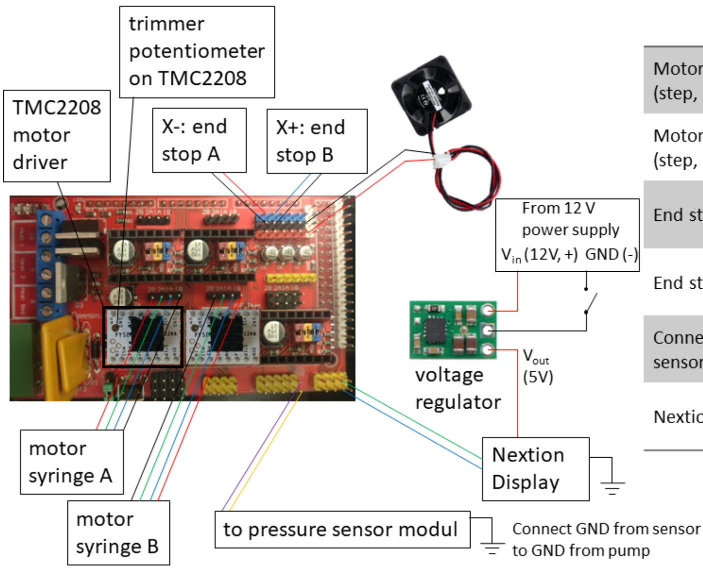
Optional: Syringe retainers (10 and 11) can be used to hold the syringes in place when drawing up a solution into the syringe using the motors.

The syringe retainers must be adjusted for each syringe itself so that it fits optimally (change hole diameter and thickness).

The uploaded retainers are optimized for a Hamilton 5 mL Gastight Syringe Model 1005

Electronic setup of the pump

For controlling the motors of the pump an Arduino Mega 2560 was used with a RAMPS 1.4 controller shield attached. TMC2208 stepper motor driver was connected to the RAPMS controller at X and Y positions and the jumper settings were set to 1/4 microsteps (jumper on MS2, middle position). The current limiting was adjusted on the TMC2208 stepper motor driver to around 2.4 A with the integrated trimmer potentiometer (1.2 V). For a constant voltage of 5 V for the Nextion Display, a Pololu S9V11F5 5 V Step-Up/Step-Down Voltage Regulator was used. The RAMPS controller was connected to a standard 12 V DC, 3 A power supply over a rocker switch, and a DC socket. The detailed assignment of the electronics is shown in **Figure S3**. All electronic parts were connected using standard female-to-female or female-to-male jumper wires.



	PIN Arduino	PIN RAMPS
Motor Syringe A (step, dir, enable)	A0, A1, 38	2B, 2A, 1A, 1B on Motor X
Motor Syringe B (step, dir, enable)	A6, A7, A2	2B, 2A, 1A, 1B on Motor Y
End stop switch A	2, GND	X+ end stop, GND
End stop switch B	3, GND	X- end stop. GND
Connection to pressure sensor module	A11, A12, GND	A11, A12, GND
Nextion Display (TX, RX)	50, 51	50, 51

Figure S3: Wiring diagram of the Arduino with PIN assignment.

Programming with Arduino and Nextion software: The software was written on the open-source Arduino software (Ver. 1.8.15) and the Nextion Editor (Ver. 1.63.3.). The codes can be downloaded from the supplementary files. In the software, five Hamilton gastight syringes and five disposable syringes were implemented. The diameters of these syringes were taken from the corresponding company's website. Detailed Information (company, diameter, accuracy) can be found in **Table S2**. For changing the syringes to other predefined syringes, the Nextion code on pages "syA" and "syB" has to be edited. The text in the buttons b0 – b9 could be changed to the corresponding value in the attribute window (change txt). The diameter of new syringes has to be edited in the event window. An example is given here:

Old syringe	New syringe	Changes
n1.val=4 t13.txt="69" main.t5.txt="Plastic 1"	n1.val=6 t13.txt="12" main.t5.txt="Metal 1"	The diameter was changed from 4.69 mm to 6.12 mm. The name, which appears on the main page, was changed from Plastic 1 to Metal 1.

Accuracy test of the syringe pump: Each kind of pre-programmed syringes were tested with typical flow rates for continuous flow reactions. Distilled water was dispensed at room temperature for 1 to 10 min and the measured weight was compared to the theoretical weight.

Table S2: Accuracy test of the pre-programmed syringes.

Volume	**Syringe**	**Flow rate [µL/min]**	**Time [min]**	**Weight [g]**	**Deviation [%]**
1 mL	HSW NORM-JECT®	100	5	0.498	0.08
		50	10	0.497	0.29
		10	20	0.197	1.52
		5	30	0.147	1.78
		1	50	0.048	3.47

Volume	Syringe	Flow rate [µL/min]	Time [min]	Weight [g]	Deviation [%]
2 mL	BD Discardit II	200 100 20 10 2	5 10 20 30 50	0.995 0.995 0.397 0.295 0.098	0.27 0.30 0.42 1.54 2.09
5 mL	BD Discardit II	500 250 50 25 5	5 10 20 30 50	2.474 2.481 0.993 0.737 0.243	0.81 0.50 0.44 1.56 2.53
10 mL	HSW NORM-JECT®	1000 500 100 50 10	5 10 20 30 50	4.970 4.961 1.987 1.474 0.488	0.34 0.53 0.40 1.48 2.18
20 mL	BD Discardit II	2000 1000 200 100 20	5 10 20 30 50	9.897 9.913 3.972 2.928 0.973	0.78 0.62 0.46 2.21 2.49
0.1 mL	Hamilton Gastight 1710	10 5 1 0.5 0.1	5 10 20 30 50	0.049 0.049 0.019 0.014 0.005	0.04 0.45 0.85 5.26 10.71
0.25 mL	Hamilton Gastight 1725	25 12.5 2.5 1.25 0.25	5 10 20 30 50	0.125 0.124 0.049 0.036 0.012	0.04 0.20 2.73 2.94 5.55

Volume	Syringe	Flow rate [µL/min]	Time [min]	Weight [g]	Deviation [%]
1 mL	Hamilton Gastight 1001	100	5	0.498	0.00
		50	10	0.498	0.10
		10	20	0.197	1.26
		5	30	0.147	1.54
		1	50	0.048	4.01
2.5 mL	Hamilton Gastight 1002	250	5	1.245	0.06
		125	10	1.245	0.08
		25	20	0.498	0.12
		12.5	30	0.373	0.26
		2.5	50	0.123	1.51
5 mL	Hamilton Gastight 1005	500	5	2.475	0.67
		250	10	2.480	0.44
		50	20	0.993	0.31
		25	30	0.737	1.46
		5	50	0.243	2.35
10 mL	Hamilton Gastight 1010	1000	5	4.970	0.24
		500	10	4.961	0.43
		100	20	1.970	1.16
		50	30	1.475	1.32
		10	50	0.488	2.01
25 mL	Hamilton Gastight 1025	2500	5	12.397	0.47
		1250	10	12.413	0.34
		250	20	4.971	0.22
		125	30	3.728	0.24
		25	50	1.221	2.01

Table S3: Accuracy test of the pre-programmed syringes at 5 bar (PETG system).

Volume	Syringe	Flow rate [µL/min]	Time [min]	Weight [g]	Deviation [%]
1 mL	Hamilton Gastight 1001	50 5	10 30	0.493 0.146	1.16 2.30
10 mL	Hamilton Gastight 1010	1000 100	5 20	4.965 1.968	0.35 1.27

Table S4: Accuracy test of the pre-programmed syringes at 5 bar (PLA system).

Volume	Syringe	Flow rate [µL/min]	Time [min]	Weight [g]	Deviation [%]
1 mL	Hamilton Gastight 1001	50 5	10 30	0.494 0.146	0.96 2.16
10 mL	Hamilton Gastight 1010	1000 100	5 20	4.961 1.969	0.42 1.22

Pressure Sensor

The case for the electronic component was printed in PETG (bordeaux red). For our applications, the solvent touching part No. 40 was printed out of PEEK, but other materials such as PP or PVDF are also possible. The exploded-view CAD drawing of the pressure sensor case and the sensor can be found in **Figure S4,** and the part numbers can be found in **Table S5**.

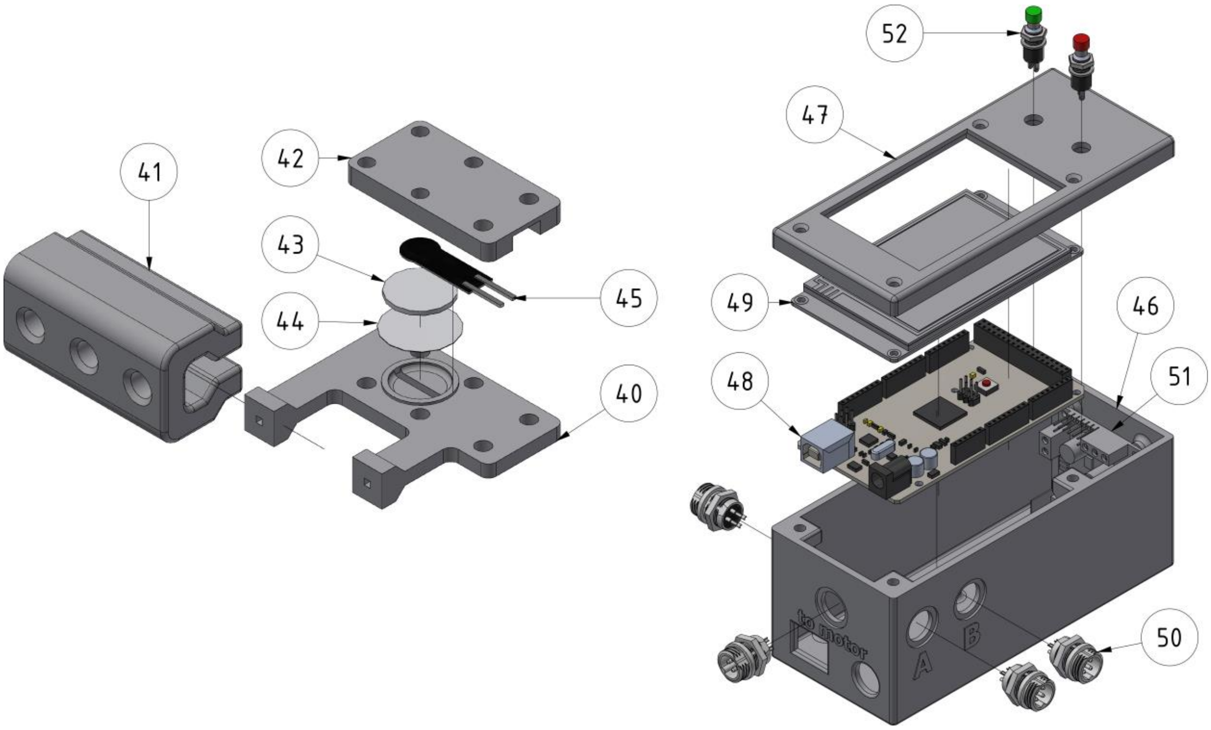


Figure S4: Exploded-view CAD drawings of pressure sensor and case.

As described in our latest publication,[2] the flat side of the sensor, on which the flat bottom 1/4”-28 fitting is pressed, was sanded with 220 – 1500 grit abrasive paper to ensure a smooth surface and a leakproof connection. The ring, upon which the septum is placed, was sanded the same way.

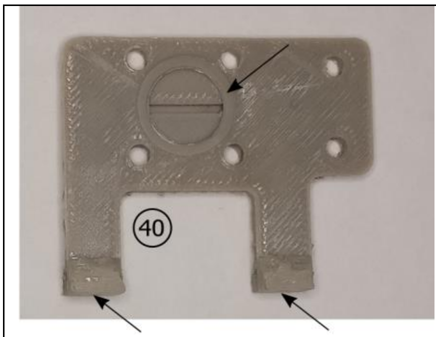
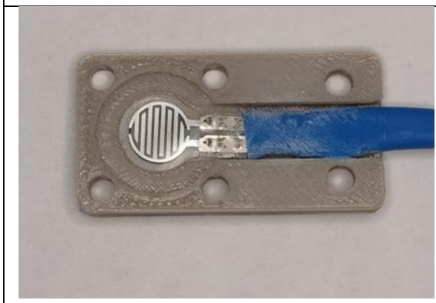
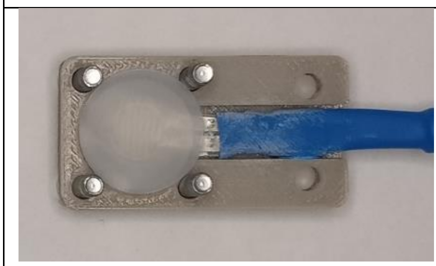
Table S5: Part list for the sensor case and the sensor. The screws and nuts that are needed for mounting each part are given in brackets.

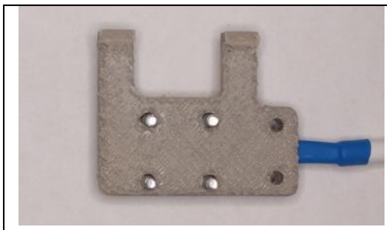
Quant.	Parts Sensor and case	Source	No.
1	Pressure sensor main body (printed with 0.1 mm layer height)	3D-printed	40
1	Guide rail	3D-printed	41
1	Pressure sensor lid	3D-printed	42
1	Silicone disc, 14 mm diameter, 1 mm thickness	In-house workshop	43
1	PTFE disc, 16 mm diameter, 0.1 mm thickness	In-house workshop	44
1	Force sensing resistor, 0 – 10 kg, 9 × 0.25 mm	Amazon	45
1	Electronic case	3D-printed	46
1	Electronic case lid	3D-printed	47
1	HIMALAYA basic MEGA 2560	Eckstein GmbH	48
1	Nextion NX4832T035 Display	Antratek Electronics	49

Quant.	Parts Sensor and case	Source	No.
3	GX12 aviation socket, Pins 5 or 6 (+ aviation plug on the cable)	Amazon	50
1	L298N Motor Drive Controller	Amazon	51
2	Push button switch, 6 mm hat diameter	Amazon	52
	jumper wire cables, female to female	Eckstein GmbH	53
1	Optional: pressure gauge holder	3D-printed	54
1	Optional: manometer Cl 2.5 from WIKA with an O-Ring 10 × 2.5 mm	WIKA	55

Detailed step-by-step assembly instruction

In the following, a detailed assembly instruction with example photos is given. Together with the exploded CAD view, it should be possible to assemble the pressure sensor without using special tools.

	**Step 1**: The flat sides (marked with an arrow) of the pressure sensor main body (40) were sanded with 220 – 1500 grit abrasive paper to ensure a smooth surface.
	**Step 2**: The force sensing resistor (44) was soldered to a two-core wire and sealed with heat shrink tubing. **Step 3**: The force sensing resistor (44) was glued in the pressure sensor lid (42) on the hose with super glue. *Do not use superglue under the sensor plate!*
	**Step 4**: The silicone disc (43) was inserted
	**Step 5**: The M3 head cap screws and the PTFE disc (44) were inserted.

	**Step 6**: The pressure sensor main body (40) was carefully applied to the prepared pressure sensor lid (step 5) without shifting the silicone disc and screwed on it (M3 nuts and washers).

Back pressure regulator (BPR)

The exploded-view CAD drawing of two variations of the BPR can be found in **Figure S5** and the part numbers can be found in **Table S6**. The STP and STL files of all printed parts can also be found in the supplementary download file. As for the pressure sensor, the flat side and the ring in the middle of the BPR were sanded with 220 – 1500 grit abrasive paper to ensure a smooth surface and a leakproof connection. For our applications, the solvent touching part No. 56 was printed out of PEEK, but other materials such as PP or PVDF are also possible.

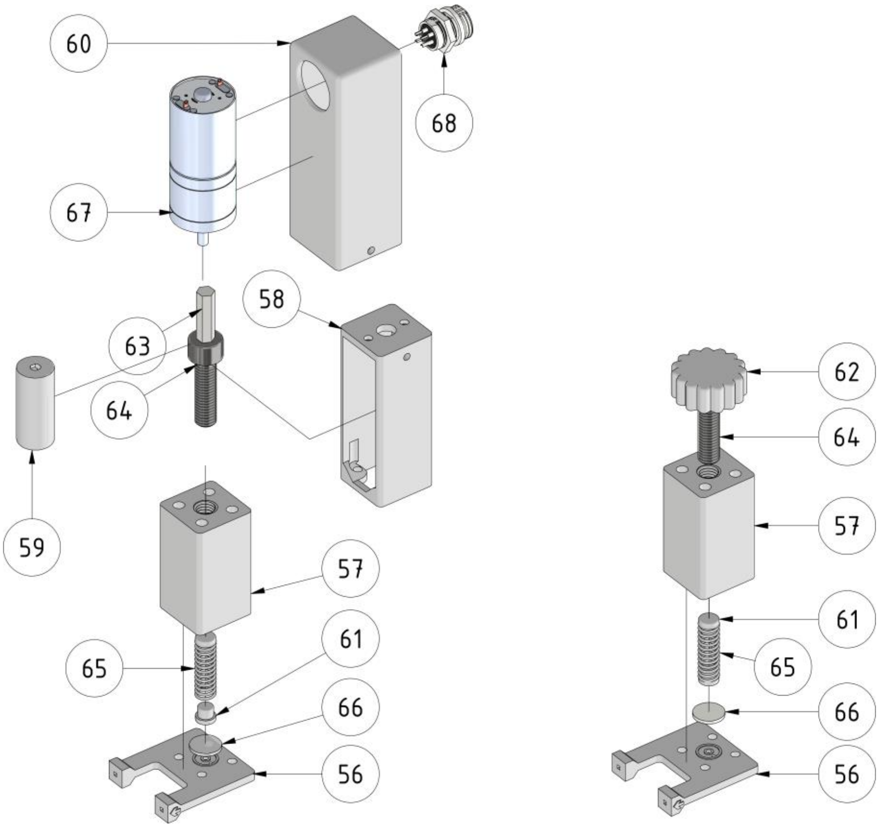


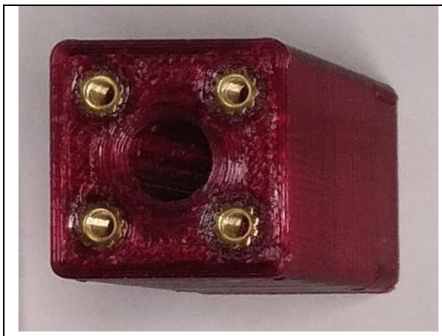
Figure S5: Exploded-view CAD drawings of the motor-controlled BPR and the manual-controlled BPR.

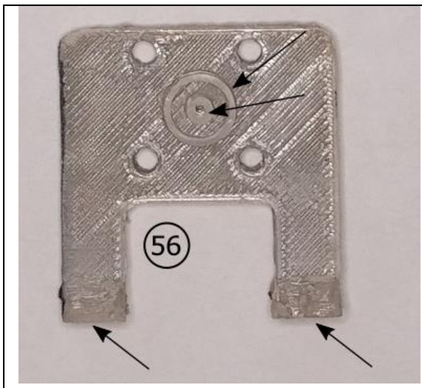
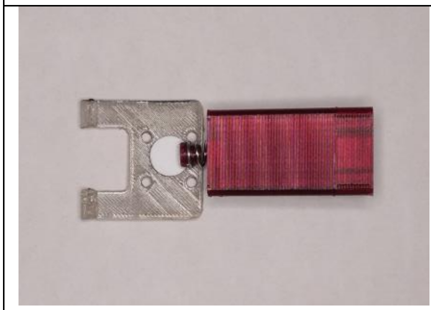
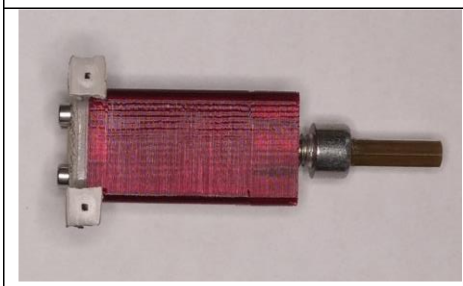
Table S6 Parts list for the BPRs

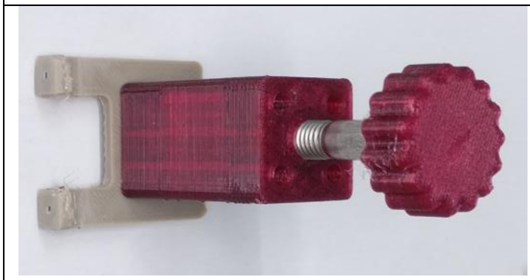
Quant.	Parts spring pressured BPR	Source	No.
1	BPR Main body (printed with 0.1 mm layer height)	3D-printed	56
1	BPR top part	3D-printed	57
1	Motor mount	3D-printed	58
1	Motor shaft coupler	3D-printed	59
1	Motor cover	3D-printed	60
2	Spring cap	3D-printed	61
1	M8 press-fit head	3D-printed	62
1	6 mm hexagonal rod (25 mm)	In-house workshop	63
1	Cheese head screw with hexagon socket, M8 × 30 mm)	In-house workshop	64
1	Spring 1.0 × 8 × 25 mm	IVO Industriebedarf	65
1	Septum 12 mm, PTFE red/Silicone white, 1 mm thickness	Sigma-Aldrich	66
1	12 V DC gear motor, 25mm, 10 rpm	Amazon	67
1	GX12 aviation socket, Pins 5 or 6 (+ aviation plug on the cable)	Amazon	68

Detailed step-by-step assembly of the motor-controlled BPR

In the following, a detailed assembly instruction with example photos is given. Together with the exploded CAD view, it should be possible to assemble the pressure sensor without using special tools.

	**Step 1**: All threaded inserts (M6, Pos. 34) were inserted into the BPR top part (57) using a soldering iron

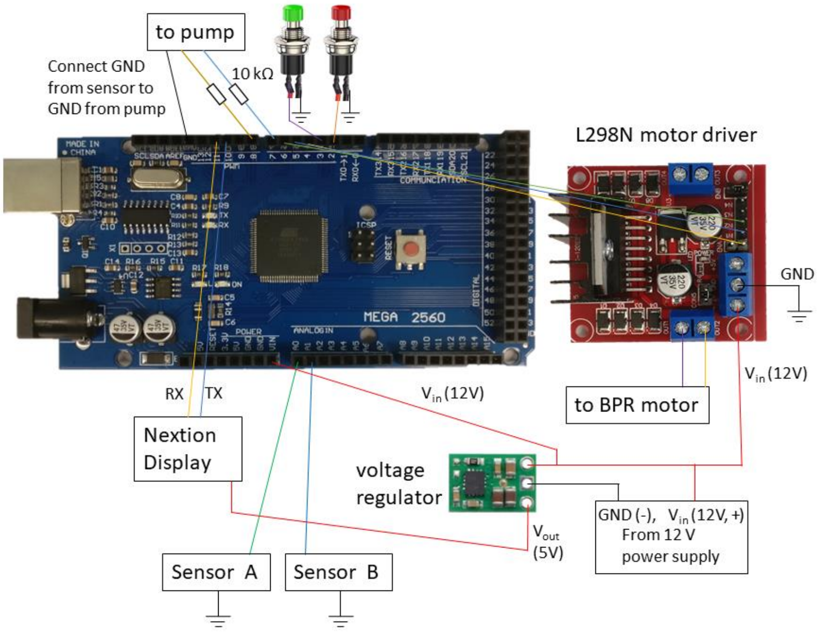
	**Step 2**: The flat sides (marked with an arrow) of the BPR main body (56) were sanded with 220 – 1500 grit abrasive paper to ensure a smooth surface.
	**Step 3:** Spring caps (61) were inserted into the spring (65).
	**Step 4**: The Septum (66) was inserted. Red side (PTFE) facing to the bottom part, white side facing (silicone) to the spring cap **Step 5:** The spring with caps from step 3 was inserted**.**
	**Step 6**: The BPR main body (56) was carefully applied to the prepared BPR top part (57) without shifting the septum and screwed on it (M3 nuts and washers).
	**Step 7**: The hexagonal rod (63) was glued into the cheese head screw with hexagon socket, M8 × 30 mm (64) using super glue.
	**Step 8**: The prepared M8 screw from step 7 was screwed into the BPR top part from step 6. Prior retapping of the thread with an M8 tap may be necessary.

	**Step 9**: The aviation socket (68) was soldered to the gear motor (67). **Step 10**: The gear motor (67) was screwed to the motor mount (58) and the motor shaft coupler was inserted (with M4 × 6 threaded insert and an M4 grub screw).
	**Step 11**: The prepared motor mount from step 9 was screwed to the BPR top part from step 8. **Step 12**: the motor cover was screwed to the motor mount and the aviation socket was fixed to the motor cover through the hole.
	To assemble the manually controlled BPR, follow steps 1 - 6. Instead of gluing the hexagonal rod onto the M8 screw, press the M8 press-fit head (62) into the screw using a vise.

Electronic setup of the sensor and BPR

For controlling the pressure sensor an Arduino Mega 2560 was used. The motor of the BPR was controlled with an L298N motor drive controller using 12 V from the power source. For a constant voltage of 5 V for the Nextion Display, a step-up/step-down voltage regulator was used. The Arduino was connected directly to a standard 12 V DC, 3 A power supply. The L298N and the voltage regulator were connected to 12 V using the V_{in} pin from the Arduino Mega. The detailed assignment of the electronics is shown in **Figure S6**. All electronic parts were connected using standard female-to-female or female-to-male jumper wires.

For the connector cables between the components, two core wires with aviation plugs were used. To ensure correct signal transmission from the sensor to the pump, 10 kΩ resistors were placed behind pins 7 and 8 respectively.



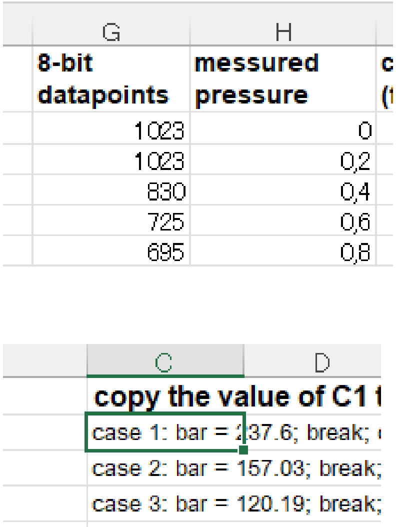
	PIN Arduino
To BPR motor control (en, in1, in2)	4, 5, 6
To press button (red, green)	2, 3
Sensor A	A0, GND
Sensor B	A1, GND
To pump (sensor A, sensor B, GND)	7, 8 (+ 10 kΩ resistor each), GND
Nextion Display (TX, RX)	10, 11

Figure S6: Wiring diagram of the pressure sensor and BPR with PIN assignment.

Calibration of the pressure sensor

For the calibration of the pressure sensor, the sensor was connected to a manometer (Cl 2.5 from WIKA (6 bar). The Arduino Mega has an 8-bit analog-to-digital converter (1024 data points) that is used with the force-sensing resistor. 20 datapoints, ranging from 0.5 to 6 bar, were measured and the protocol from Kenji Ohgane[3] was used to perform a sigmoid plotting of the data points. The excel table, which can be used for individual calibration, can also be found as a supplementary file.

	**Step 1**: The assembled sensor was connected to any external pressure sensor using the guide rail (41) with 1/4-28 flat-bottom fitting (IDEX H&S XP-230) and 1/16'' ETFE tubing. Here, we use the pressure gauge holder (54) with a monometer (Cl 2.5 from WIKA) (55) sealed by an O-ring. The cable from the sensor was connected to the electronic case (sensor A/B). **Step 2**: Pressurize the system from 0 to 6 bar and collect approx. 20 corresponding data points (from 0 to 1024) **Step 3:** Open the solver excel file and follow the steps in the excel file to bring the data points to the Arduino (the excel file can be found in the supporting information)



Step 4: Follow the instructions in the excel file:
(1) Paste the 8-bit data points and the measured pressure into columns G and H.
(2) Start Excel Solver (Tools > Solver)
(3) Set "Target cell" to "B7" (Sum of squared residuals).
(4) Click "Solve" to perform the fitting.
(5) Close the solver window and check the graph to see if the calculated curve fitted well.
(6) go to sheet "switch case - one line"
(7) copy the value of C1 to the Arduino software (line 364 for sensor A, line 372 for sensor B). Make sure to have "." as a decimal separator

Notes and references

[1] Neumaier JM, Madani A, Klein T, Ziegler T (2019) Low-budget 3D-printed equipment for continuous flow reactions. Beilstein J. Org. Chem. 15:558–566. https://doi.org/10.3762/bjoc.15.50

[2] Menzel F, Klein T, Ziegler T, Neumaier JM (2020) 3D-printed PEEK reactors and development of a complete continuous flow system for chemical synthesis. React. Chem. Eng. 5:1300-1310. https://doi.org/10.1039/D0RE00206B

[3] Ohgane K (2019) Sigmoid fitting in Excel (Excel Solver Add-In), protocols.io, https://doi.org/10.17504/protocols.io.78ihrue