User Guide

Beetle microfluidic system

Microfluidics Innovation Center

Contents

Introduction

Instrument description

The BEETLE is made of a box device with N gas outlets and N flow sensors. The USB and power supply connection ports can be found on the back of the device, as well as the switch button. On each pump channel, there is a space on the front for the flow sensor (connected either magnetically or through USB-C).

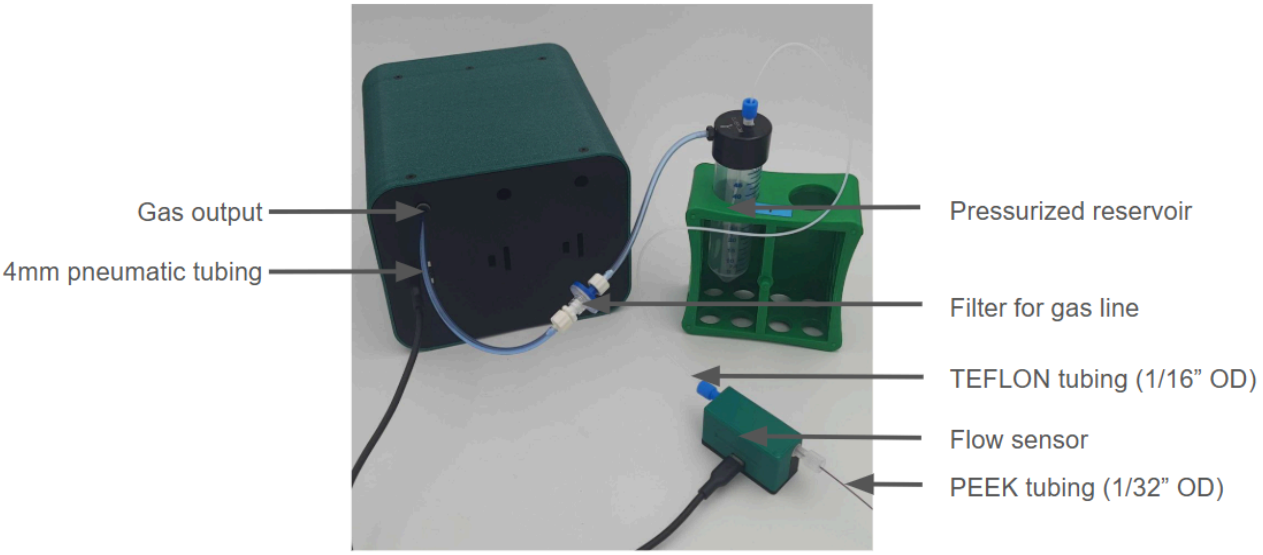


Figure 1. *BEETLE microfluidic system with one pump channel connected to a reservoir and a flow sensor.*

Technical Specifications

Performances	Pressure range	Depending on the model: BEETLE200 **0 - 200 mbar** BEETLE2000 **0 - 2 bar**
	Pressure stability	Depending on the model: BEETLE200 **0.5 mbar** BEETLE2000 **5 mbar**
Electrical	Input voltage range	100V to 240V

	AC supply frequency	50 Hz to 60Hz
	Power supply voltage	18-24V DC
	Max current consumption	2A peak
	Power consumption (max)	36W
	Connection type	USB-C to USB-A
Mechanical specifications	Fluidic connectors	Reservoir cap: Standard 1/4-28 UNF, flat-bottom SLF3S-0600F or LG16-0431: Standard 1/4-28 UNF, flat-bottom LG16-0150: UNF 6-40 coned port
	Operating temperature	10 - 100°C
	Operating Humidity	Flow sensors: Compatible with CO2 incubator Non autoclavable Beetle device: Non compatible with CO2 incubator
	Dimensions (without connectors)	22 cm x 15 cm x 14 cm
	Weight	1,7 kg
Software	Computer specifications	USB 2.0 port, Intel Pentium II 500 MHz, 1 Go Hard Disk space, Windows 10 and newer, 32/64 bit.
	Provided software	Dedicated Software Interface

Product package contents

Before setting up your BEETLE MICROFLUIDIC SYSTEM, please check the package contents to verify that you have received the items below:

1. One main **BEETLE device** with N pump channels.

2. **N pump channels**. Each pump channel is supplied with a reservoir cap, a semi-integrated flow sensor, a USB-C to USB-C cable and a piece of resistance tubing.

3. One 24V power supply

4. One USB-A to USB-C cable

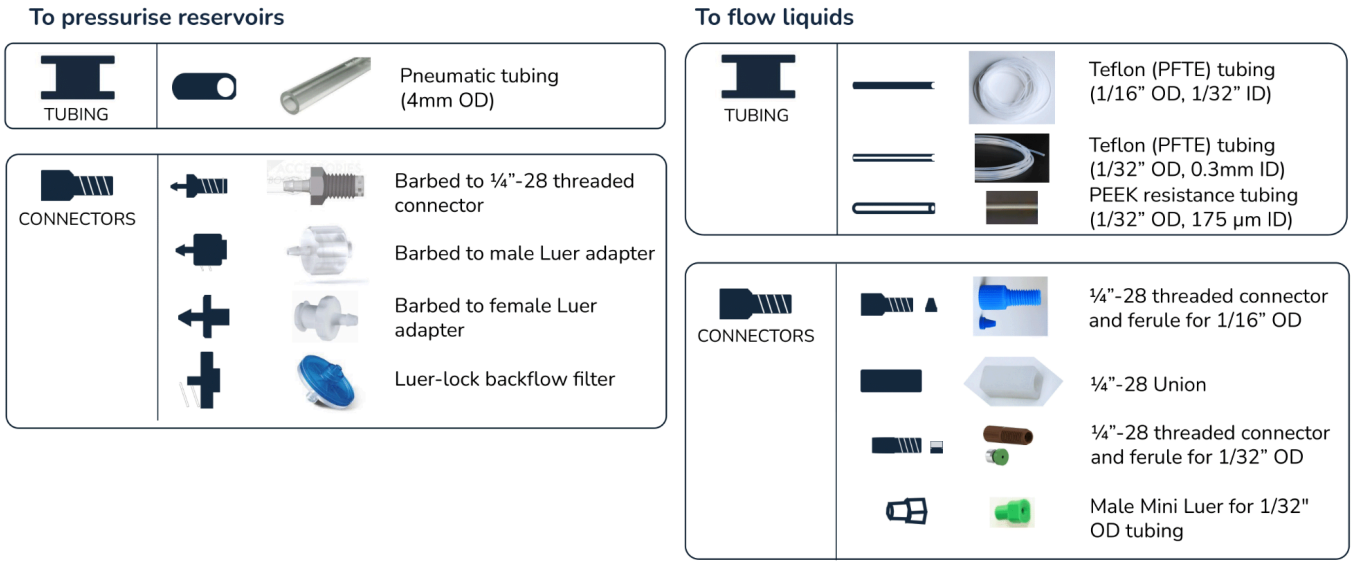
In addition to the above items, the user should have the necessary fluidic accessories, tubings and fittings to connect the inlets/outlets to the rest of the setup (purchased separately).

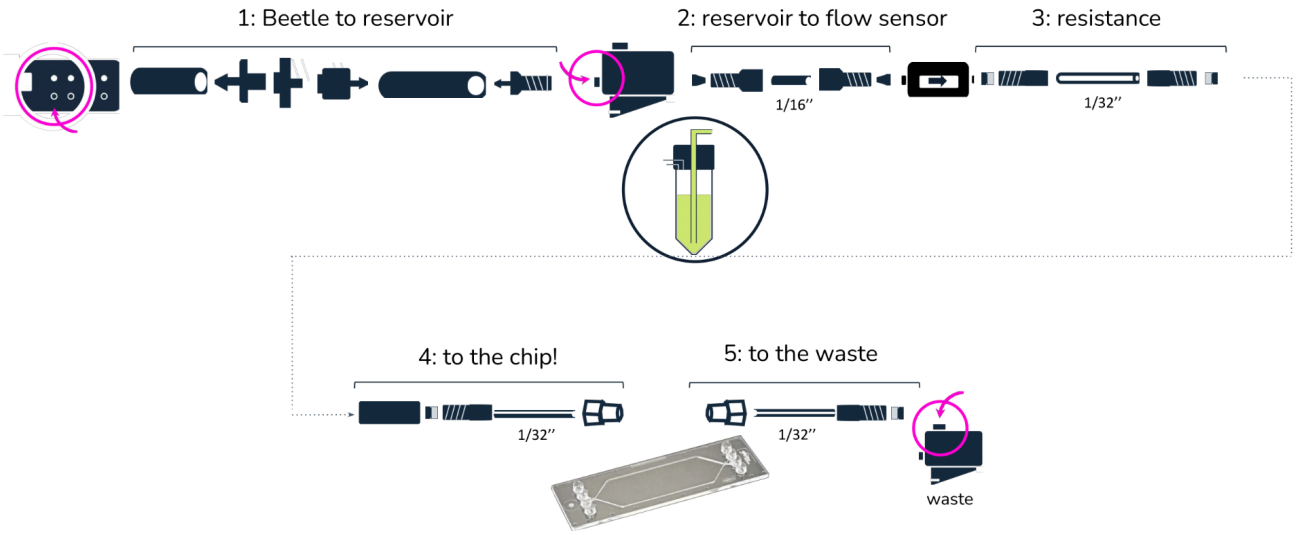
Installation & use

In order to use the BEETLE MICROFLUIDIC SYSTEM, the device must be connected to the fluidic setup and to the computer.

Fluidic connections

For fluidic connections, please find below the dedicated schematics illustrating an example of set-up to connect a mini-luer connection chip (here Fluidic 845 Rhombic Chamber from Chipshop for reference):

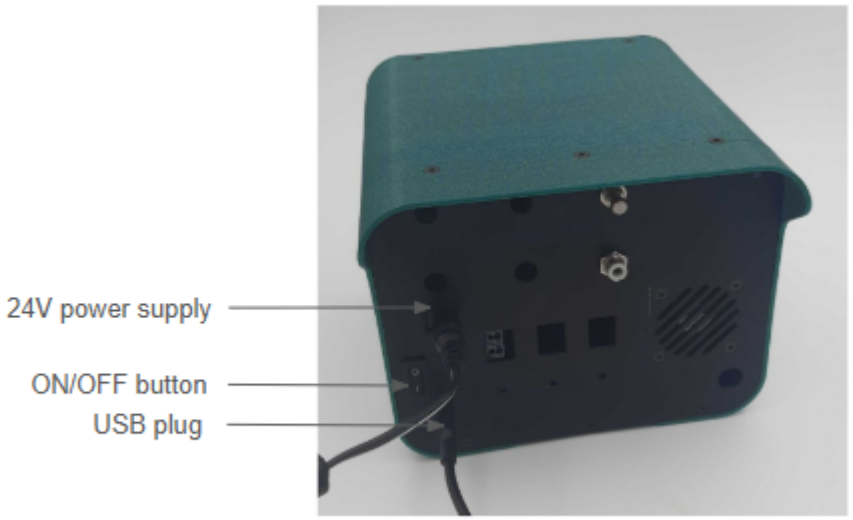




Fluidic 845 Rhombic Chamber
Chip eP1 for example

Electrical connections

BEETLE MICROFLUIDIC SYSTEM should be connected to the computer with a **USBa-USBc cable** and to the **power supply** (24V, 1.5A) by the back of the unit. There is a **switch button** on the back to turn the device on.



BACK OF THE BEETLE - Electrical and USB connections

Software

The following section details, in instructional format, the use of the BEETLE custom Software.

The BEETLE Software is compatible with Windows 10 and Windows 11. Open the software by double-clicking on the icon. You will see the window below open.

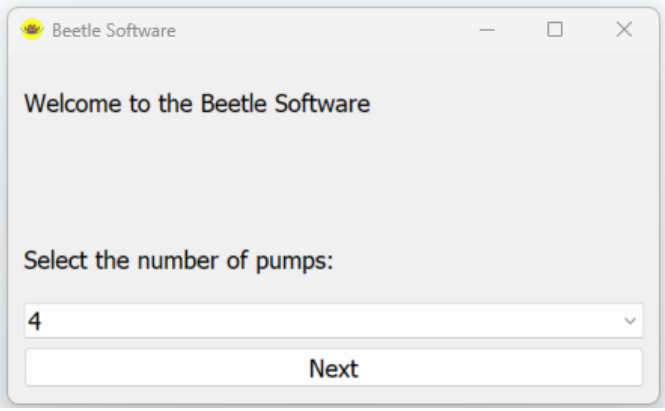


Figure 3. *Pop-up window to select the number of pump channels in the BEETLE software*

Select the number of pump channels you have, and click “Next”. The control window will appear. It has all the control features on the left panel (connection, control of pressure and flow, data acquisition, sequence creation) and a graph on the right panel (Figure 4).

Ensure the BEETLE is connected via the provided USB cable to your PC. Once the physical connections are made, you may click the “Select port” button on the interface. You will be asked to select the USB com port of the BEETLE. Once you selected the USB com port, click the “Connect Beetle” button to establish communication. Once communication is established, the interface will appear as below (if it is not the case, refer to section Tips and tricks). Here is the description of the different features of the software, corresponding to the labels on the below image:

1. This button starts communication with the device.
2. This controls and monitors the first pump module. You can select the control mode (between pressure and flow rate control) and the target value, and visualize the pressure of the pump and the flow rate measured by the flow sensor.
3. This central display is a live-updated graph of the measure over time.
4. This section allows the control of the graph parameters. Changes are effective after clicking on the reset button. The minimum sampling time is 0.1s.
5. This section allows the acquisition and saving of data at the user defined data acquisition sampling time. The minimum sampling time is 0.01s and can not be changed once the acquisition has started.

When clicking the “Start acquisition” button in the interface, you will be prompted to select a location and name of the log file. Once a location and name are chosen and saved, you will find a CSV format file in the designated location, which will be logged with data constantly until you stop it. In order to finish data logging, you must click the “Stop acquisition” button found in place of the “Start acquisition” button in the interface. The CSV format file created may be opened in the preferred method of the user.

NOTE: your computer entering sleep mode may interrupt data acquisition. Please disable your computer’s sleep mode if long term data acquisition is required.

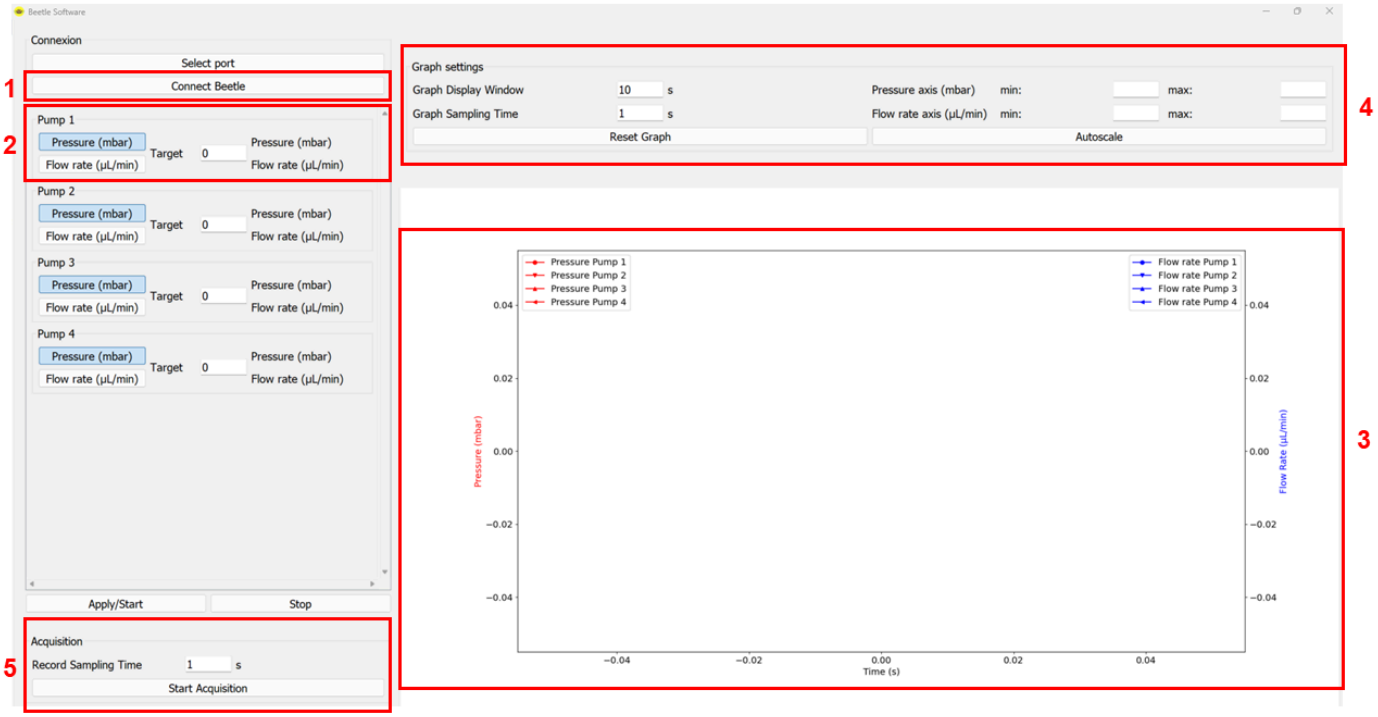


Figure 4. *Beetle software with 4 pump channels. The numbered elements allow for 1. Connection / disconnection, 2. Control and monitoring of one pump module, 3. Live visualization, 4. Changing graph parameters and 6. Data acquisition.*

Tips & tricks - Recommendations

Cleaning Procedure

It is recommended that the flow sensor is cleaned after each use, especially if being placed in storage for a significant amount of time after a flow experiment. Depending on the working fluid being used, the flow sensor may be cleaned by flushing one or a combination of the following liquids:

- Pure, deionized water
- Pure isopropanol
- Pure ethanol
- Hellmanex® III 2% v/v in water solution (especially if working with biological media)

Regardless of the cleaning liquids applied, the BEETTLE sensor should be stored dry. Thus flushing the flow sensor with air should be done after any liquid cleaning step.

Troubleshooting

If the software does not properly establish communication with the BEETLE:
Try turning off the power button, disconnecting the USB cable, disconnecting the power cable, waiting 5 seconds, reconnecting the power cable, reconnecting the USB cable, and turning on the power button. If the software does not establish communication after 3 tries, contact us.

Customer Support

In case there are still some questions and you would like further clarification, please don't hesitate to let us know by email at innovation@microfluidic.fr. We are always happy to help.

Acknowledgements

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