ELVE FLOW
PLUG & PLAY MICROFLUIDICS

OB1 MK4

PRESSURE AND VACUUM CONTROLLER

User Guide

DOCUMENT REF: UGOB1-220920

SYMBOLS USED IN THIS DOCUMENT

IMPORTANT INFORMATION. Disregarding this information could increase the risk of damage to the equipment, the risk of personal injuries, and influence your user experience.

HELPFUL INFORMATION. This information facilitates the use of the instrument and contributes to its optimal performance.

ADDITIONAL INFORMATION IS available on the internet or from your Elveflow representative.

Please read this document carefully before starting any experiment.

Important OB1 Pressure controller safety notices:

1. **The OB1 must be used in a clean and dry environment** with up to 80% relative humidity and in a ventilated room.
2. **Use a power supply with the correct voltage.** The OB1 requires a 24V DC input voltage. Use only the 24V DC power supply provided.
3. **The maximum input pressure must be between 1.5 and 10bar**. Do not connect the instrument to a pressure source greater than 10bar.
4. **The OB1 must be used exclusively with non-explosive, neutral, dry, dust- and oil-free, and particle-filtered gases at a minimum particle size of 5µm.** The OB1 can't be used with pure oxygen or in any other fire-risk situation.
5. **Use a particle/humidity filter between the pressure source and the OB1**. Please refer to ISO 8573-1, cl. 3 for detailed information.
6. **Use particle/anti-backflow filters with a pore size of at least 5µm** to avoid particles or liquid entering the instrument.
7. **Never use a GL45 cap when using an 8bar regulator, use our high pressure rated reservoirs.** This pressure level can be dangerous in some circumstances and must be handled with care. Always use reservoirs and tubings suitable for the pressure you are working with.
8. For the safety of the user and the instrument, **do not use the instrument in connection with substances that may emit toxic or corrosive fumes, such as acids or alkalis.**
9. **No liquids or solids should enter the OB1.**
10. **Disconnect your sample reservoir from the instrument after each experiment** to prevent backflow from the reservoir into the instrument.
11. **The reservoirs should not be placed at a higher level than the OB1 pressure channels** to prevent backflow from the reservoir into the instrument.
12. **Turn off or close your pressure source (gas cylinder) after each experiment** because the OB1 valves are in an open state when turned off.
13. **Close the pressure outlets with the Push-in locks when not using the OB1** to prevent any contaminants from entering the instrument.
14. **For best performance, allow the OB1 to warm up and stabilize for at least 15 minutes** before starting any experiment

If the conditions listed above are not met, the user is exposed to dangerous situations, and the instrument can undergo permanent damage. Elveflow and its partners cannot be held responsible for any damage related to the incorrect use of the instruments.

General Advice

Read the user documentation in full to avoid common mistakes and learn the fundamental principles involved in your experiments.
Summarize or abbreviate the details given in this manual using outlines, flowcharts, or diagrams.
Visualize and write down all the steps so you clearly outline the procedure.
Optimize your learning curve. Once you understand the phenomena at play, your possible actions, and their effects, do not hesitate to practice it with a "test and learn" mindset to improve proficiency over time.

Additional information:

The OB1 unboxing video shows the elements provided in a typical customer parcel to assist you with the basic installation steps. It is important to note that the **OB1 unboxing video** provides only a general overview and may not describe all the items in your unique parcel. For more specific details, refer to the User Guide. You can find the video on our YouTube Page.

The Flow Control Tuning instructions cover all the steps users should follow to control the flow using a typical Elveflow setup (OB1, reservoirs, and an MFS flow sensor). More information on resistance and PID tuning can be found in the MFS User Guide.

Table of contents

1. Introduction

The Elveflow OB1 Mark 4 (OB1 Mk4) is the fourth generation of our unique **pressure-driven flow control technology** for microfluidics. It offers precise and pulseless flow control and has a response time of down to 35ms.

The OB1 allows controlling output pressure from -900mbar to 8000mbar in up to 4 independent channels for various advanced microfluidic applications. It uses a gas or vacuum input pressure to flow liquid from a hermetic liquid tank to your microfluidic device.

The device's control is achieved through the ESI software – a single and intuitive software that allows the automation of complex and long-lasting experiments. Additionally, the ESI software allows for real-time creation, monitoring, and modification of complex flow rate profiles such as sinusoidal, square, triangle, ramp, pulse, or homemade profiles. The Elveflow Software Development Kit allows you to control the OB1 MK4 through your own code and covers third parties instruments and sensors.

Main features and benefits

- Piezoelectric technology
- Pressure and vacuum control
- Fast settling and response time
- High flow stability and pulseless flow
- Flow control tuning
- Customizable and upgradable: 1 Module, up to four channels, 5 pressure ranges available
- Software automation

Principle

The pressure controller pressurizes the reservoir containing the liquid to flow (Fig 1). This action generates a pressure differential between the inlet and the outlet, so the liquid is moved smoothly and quasi-instantly into the microfluidic chip. Thus, controlling the input gas pressure of the tank allows controlling the liquid that flows out of the tank.

For more information, check our YouTube video:

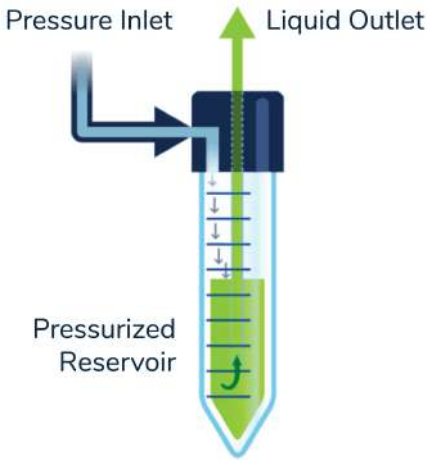


Fig 1. *Principle of pressure-driven fluid motion.*

2. Technical specifications and design

Technical specifications

The table below summarizes the main specifications of the Elveflow® OB1 MK4 pressure controller. To guarantee the device's high quality and premium performance, all our instruments undergo a quality control test and are checked for malfunction or damage before leaving our production center.
All the pressure values are expressed relative to the atmospheric pressure.

CHANNEL PRESSURE RANGE	**0 to 200 mbar*** (0 to 2.9 psi)	**0 to 2,000 mbar *** (0 to 29 psi)	**0 to 8,000 mbar *** (0 to 116 psi)	**-900 to 1,000 mbar *** (-13 to 14.5 psi)	**-900 to 6,000 mbar *** (-13 to 87 psi)
PNEUMATICS					
Pressure stability (1)	**0.015 % FS** 30 µbar (0.0004 psi	**0.005 % FS** 100 µbar (0.0014 psi)	**0.006% FS** 500 µbar (0.007 psi)	-900 to 500 mbar: **0.005 % FS** 100 µbar (0.0014 psi) 500 to 1,000 mbar: **0.007 % FS** 150 µbar (0.0021 psi)	-900 to 2,000 mbar: **0.005 % FS** 350 µbar (0.05 psi) 2,000 to 6,000 mbar: **0.007 % FS** 525 µbar (0.076 psi)
Response time (2)	< 10 ms				
Settling time (3)	down to 50 ms				
Minimum pressure increment	**0.006 % FS** 12 µbar - 0.00017 psI	**0.006 % FS** 120 µbar - 0.0017 psi	**0.006 % FS** 480 µbar - 0.007 psi	**0.0064 % FS** 120 µbar - 0.0017 psi	**0.0061 % FS** 420 µbar - 0.006 psi
Number of independent channel outlets	From 1 to 4 any pressure range mix configuration possible				
Output pneumatic connector	4mm push-in				
Pressure supply	**1.5 bar (or Max pressure + 0.5 bar) to 10 bar** non corrosive, non explosive, dry and oil-free gases, e.g. air, argon, N2, CO2, ... Compatible with gas line, compressor or gas canister Input connector: 6mm push-in				
Input vacuum (4)	/			Any value from -0.7 to -1 bar Compatible with vacuum pump or vacuum line	
FLOW CONTROL					
Flow sensor compatibility	Compatible with the whole MFS and BFS range Monitoring and feedback loop flow control available				

Flow rates	From 0,1 µL/min to 500 mL/min (*indicative, please refer to the MFS and BFS series)*
Liquid Compatibility	Non contact pump Any aqueous, oil, or biological sample solution.
CONTROL & MONITORING	
Software control	Elveflow Smart Interface Windows 7, 8 and 10, both 32 and 64 bit versions supported
Software Development Kit	Librairies available: Matlab, Python, Labview, C++ Windows 7, 8 and 10, both 32 and 64 bit versions supported Serial/UHART communication protocol on request
Data management	Possibility to log and extract data (.csv): channel and sensor detailed information using ESI
Input profiles	Possibility to load profiles: ramp, sine, triangle, square or custom
Automation	Generate step-by-step sequences using the ESI built-in sequencer Load and save custom configurations (.csv)
Screen	LCD screen showing pressure and sensor from the channel
ELECTRICAL CONNECTION	
USB connection	USB B
Sensor connection	One M8-4 pins connecter available per channel Compatible with Elveflow sensors: MFS, MPS, MFP, MBD Custom analog sensor supply: 5-24V Custom analog sensor readout : 0-10V
TTL trigger	In and out available 0-5V
OTHER	
Power consumption	12 W (100 V to 240 V – 50 Hz to 60 Hz)
Casing dimensions (5)	(length x width x height): 240 x 223 x 80 mm
Weight	1.4 kg to 2.9 kg
Warranty	2 years

Non-contractual information, may be changed without notice

***Max pressure value might vary by +/- 2.5%**

(1) Pressure stability (standard deviation) measured over the full pressure range with an external high accuracy pressure sensor (Druck DPI150) (2) Time required to reach 5% of the setting point. Depends on the computer operating system (3) Time required to reach 95% of the set point. Volume dependent – Measurement was done on 12 mL reservoir for a set point from 0 to 200 mbar (4) A vacuum source is mandatory for calibration and use of dual channels even if the channels are to be used in pressure only (5) (length x width x height).

Design

Fig 2. *Front view of the OB1 Mark 4 pressure controller.*

You find the following elements in the front of the OB1:
- The Power button
- The LCD screen that displays basic information
- One to four pressure channels

It is essential to note that the values indicated on the OB1 screen are indicative. Thus, when setting the device (flow regulation, pressure setpoint, etc.), consider the values displayed on the software.
The OB1 can accommodate 1 to 4 independent pressure channels. Each channel consists of a sensor connection slot and a pressure outlet. Each pressure range is marked differently to facilitate their identification. Find the color code for each OB1 pressure outlet in the “OB1 hardware installation” section below.

Helpful information. If you purchased an OB1 containing only 1, 2, or 3 channels, the inactive channel(s) will be protected by a plug added during the fabrication of the device. Should you wish to add a new pressure channel, the instrument must be returned to the factory, where our experts can remove the plugs and install the new channel.
To add a pressure channel or replace an existing one, email us at customer@elveflow.com.

Software conversion of a pressure channel into a different one is not possible. It requires the installation of new components, and this must be performed at the Elveflow factory.

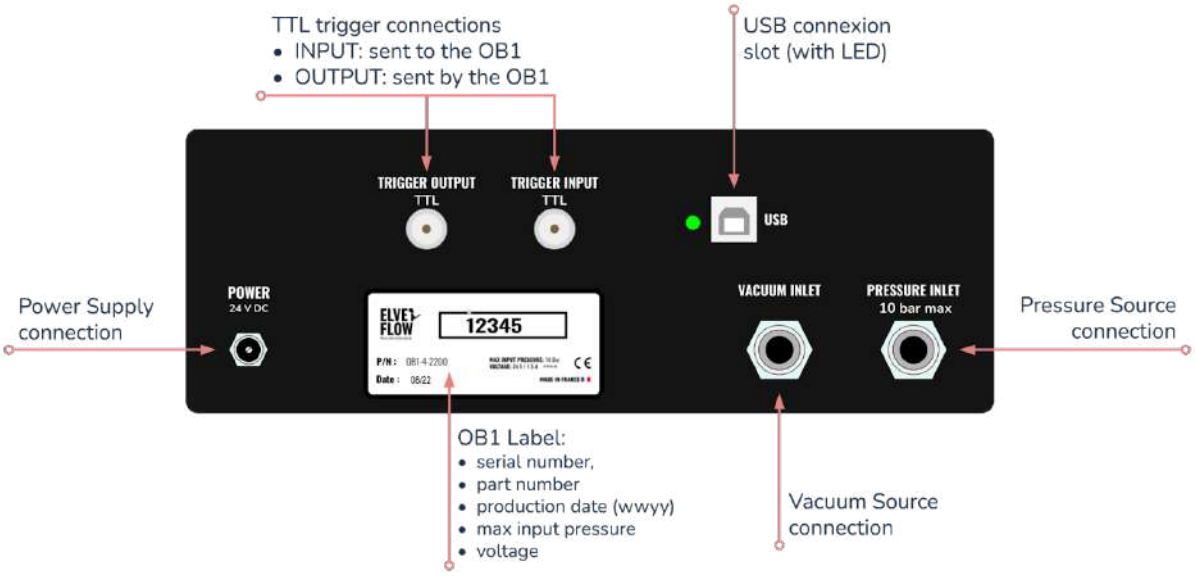


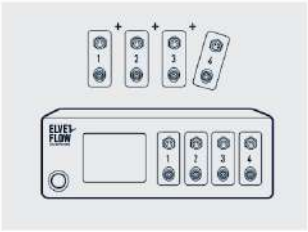
Fig 3. *Rear view of the OB1 Mark 4 pressure controller.*

You will find the following elements on the back of the OB1:

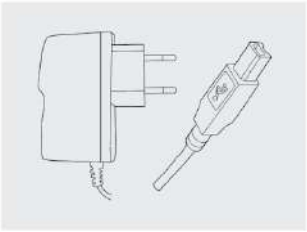
- The label that provides essential information, such as the device's serial number. This reference is required when requesting technical support.
- 2 TTL connections (triggers):
  - Input trigger: for signals sent to the OB1 from other devices.
  - Output trigger: for signals sent by the OB1 to other devices.
    - These two functions can be reached and used in the ESI sequencer. For more information, refer to the ESI User Guide.
- Inlets for connecting the pressure and vacuum sources.
  - Please note that these inlets use secure quick connections, which require pressing the outer ring while disconnecting the tubing or plug.
- The USB connection
  - a green LED light is switched on once the communication between the OB1 and the computer is established.
- Connection to the 24V power supply unit.

Product package content

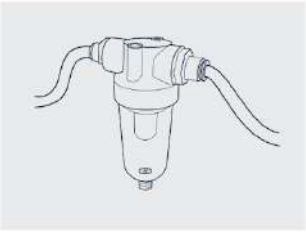
Before setting up your OB1, please check the package contents to ensure you received all the items below.
Each OB1 pressure controller includes the following:



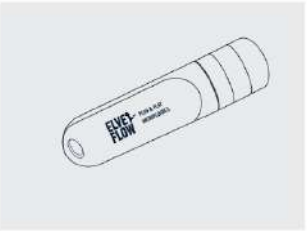
OB1 MK4
+ number of chosen channels



Power supply unit and USB cable



Particle/humidity filter



Elveflow Smart Interface software
ESI in the USB or downloaded from Elveflow

\+ Microfluidic fittings and connectors (OPTIONAL)

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

Defects or missing items:
Please report any defects or missing items **within one month** of your order receipt.

3. Required material checking

OB1 pressure requirements

The OB1 positive pressure channels require having a pressure source that meets and maintains the following specifications:

- dry and non-corrosive (use an air drier)
- no risk of fire and explosion (no oxygen)
- dust and oil-free
- output pressure between 1.5 and 10 bar

The Elveflow OB1 is generally used with an air compressor, but an airline or gas cylinders can also be used as a pressure source. The pressure source should be ON at a pressure value between 1.5 to 10 bar (at least equal or above the OB1 channel top range) anytime the OB1 is used, including during calibration. For a 2000 mbar pressure channel, the pressure source should deliver at least 2.5 bar.

OB1 vacuum requirements

Dual OB1 channels can be used with positive or negative (vacuum) pressure (i.e. -900 to 1000 mbar and -900 to 6000 mbar channels).

- Regarding the positive pressure range (i.e. 0 to 1000 mbar, 0 to 6000 mbar), follow the recommendations for positive channels found in the OB1 pressure requirements session above.
- Regarding negative (vacuum) pressure, using a vacuum pump with the lowest possible vacuum value is recommended since the vacuum pump defines the vacuum pressure range of the OB1. For instance, if the ultimate vacuum value delivered by the vacuum pump is -600 mbar, the OB1 dual channel (-900 to 1000 mbar) would be limited by this value, i.e., the possible reachable values would be -600 to 1000 mbar.

- **Pressure source should be set between 1.5 and 8 bar.**
- **There is no minimum recommended vacuum value.**
- **In the case of dual channel OB1, both pressure and vacuum sources must be switched on and connected to the OB1.**

Warning when using a dual regulator (regulator with vacuum):

- Start the ESI software *before* the vacuum pump and stop the vacuum pump *before* closing the software. When the software does not run, dual regulators are fully open to the vacuum side, which may result in backflow.
- A slight vacuum pressure around 0 mbar (0,2% of the channel range, i.e. approximately 4 mbar for a -900 to 1000 mbar channel and 14 mbar for a -900 to 6000 mbar channel) is considered normal. If this is an issue, you can use an opposite counterpressure or valves to block liquid motion and release the flow on demand with the ESI software.

Minimum computer requirements

The instructions presented in this document are based on the features proposed by the ESI V3.04.00 software and its latest versions. Thus, ensure that your ESI software is up to date before going through the proposed solutions (see the ESI download link below).

The minimum computer configuration requirements are:

- Windows 7 SP1 or later
- USB 2.0 port or faster
- 1 GB RAM
- 3.0 GHz Pentium 4
- 1 GB of free hard disk space

4. ESI Software installation

1. Plug the Elveflow® USB flash drive into the computer, or download the latest version from the Elveflow website.
2. Open the Elveflow® folder
3. Locate the ESI software zip file (e.g. ESI_V3_06_03.zip)
4. Copy the installation zip file to a location of your choice (e.g. desktop), and unzip the file
5. Run setup.exe and follow the instructions displayed by the installation assistant
6. When ready, restart your computer to finish the installation process

- **Ensure your ESI version is up to date before implementing the solutions described in this guide.**
- **The ESI software should not be installed directly from the Zip file or the USB key.**
- **Always copy the ESI.zip source to your computer, then unzip it before launching the installation process.**

Download the latest version of the Elveflow® Smart Interface anytime from the Elveflow website.
To facilitate access to the installation files, two links for the same file are provided. The mirror link is the same file hosted on another server, so you always have an accessible version 24/7.

5. OB1 Pressure controller installation

Connecting pressure and vacuum sources to the OB1

The compressor discussed in the following sections is the Jun-Air pressure pump usually provided by Elveflow. Please refer to the manufacturer's instructions if you're using different equipment. Alternatively, you can connect your OB1 to a gas cylinder or a local compressed air network (Fig 4).

The vacuum pump discussed in the following paragraphs is the LabTech, usually provided by Elveflow. Please refer to the manufacturer's instructions if you're using different equipment.

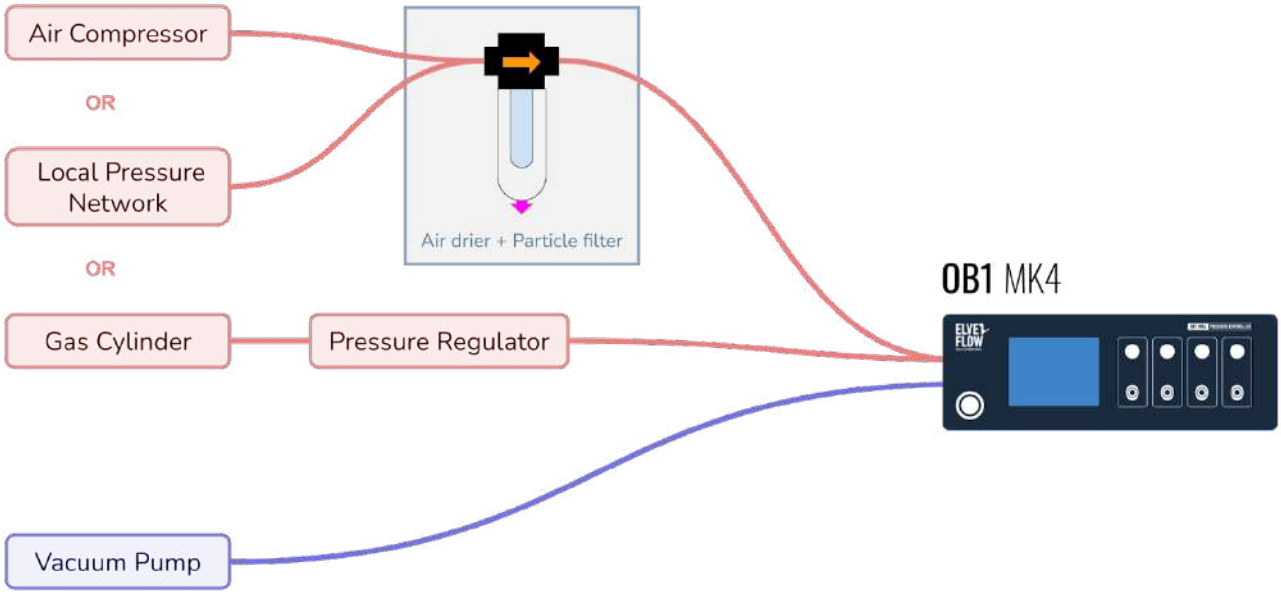


Fig 4 *Pressure (red) and vacuum (blue) sources connection possibilities to an OB1*

Pressure source: Jun-Air compressor installation

Jun-Air compressor installation details

Replace the red cap on the air intake tube with the intake filter (Fig 5.)

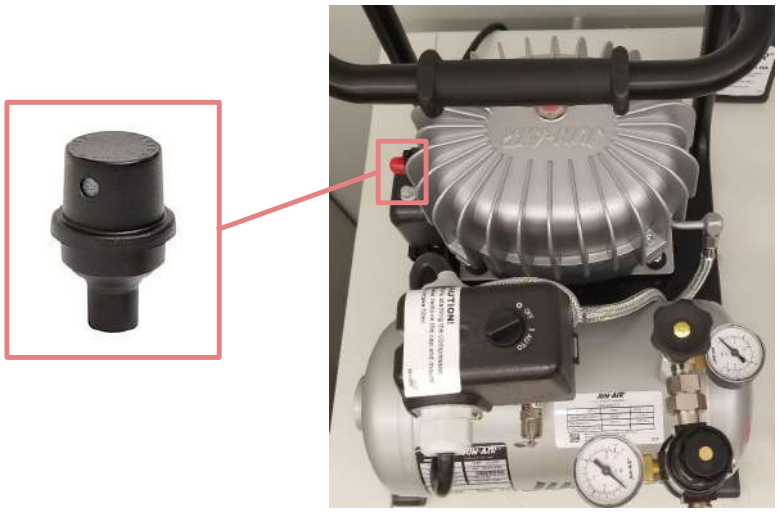


Fig 5 *Jun-Air air intake filter installation.*

The output filters and the toggle switch (Fig 6) should be installed before connecting to the OB1 with the 6 mm pneumatic tubing. It is not mandatory to mount both filters in series (Fig 7a) with the 6mm OD tube since using the 5 µm filter is enough (Fig 7b).

Fig 6. *Toggle switch.*

Fig 7 a. *Optional compressor output mounting (5µm + 0.01 µm filter).*

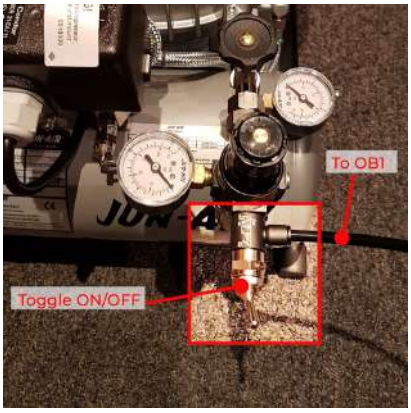


Fig 7 b. *Regular compressor output mounting.*

Setting the Jun-Air compressor output value between 1.5 to 8 bar (any OB1)

The supplied Jun-Air compressor is factory set to deliver up to 8 bar.
The filter cap allows you to set the output pressure as low as 1.5 mbar.
Once the valve is open (Fig 8a), the compressor is running and connected to the OB1. When the tank is filled with compressed air, the pump stops. You can then pull the cap upwards (Fig 8b) to be able to turn it and adjust the output value (Fig 8c). Then secure it again by putting it back in the low position(Fig 8d).

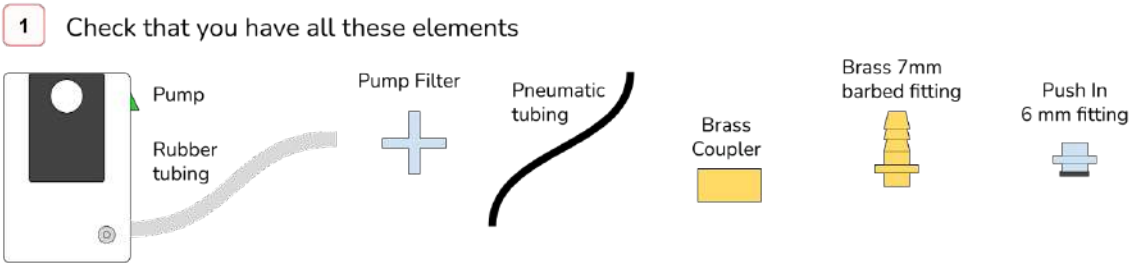
a  b  c  d 

Fig 8. *Setting the Jun-Air compressor pressure pump output value.*

Vacuum source: LabTech vacuum pump installation

LabTech vacuum pump installation details

The vacuum source is only required for the OB1 equipped with a dual regulator.
The vacuum pump kit includes an intake filter and rubber tubing (Fig 9). To use it, install the filter and connect 10 cm of the rubber tubing to the "suction" port in the back of the vacuum pump.



2 Cut the Vacuum pump rubber tubing

3 Assemble the elements, and connect the vacuum line to the OB1 vacuum inlet

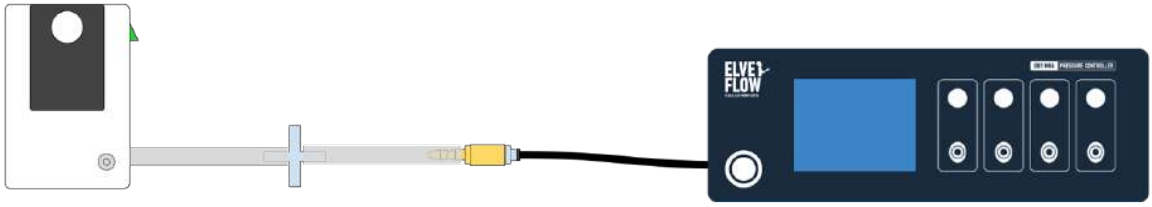


Fig 9. *Vacuum line assembly and connection to the OB1.*

Create the mounting (Fig 10d) by connecting the 7 mm barbed male straight tailpiece adapter threaded fitting (Fig 10a), the brass coupler (Fig 10b), and the pneumatic push-to-connect adapter for the 6 mm OD tubing (Fig 10c). Insert it into the pump rubber tubing and connect 6 mm OD pneumatic tubing to the vacuum inlet in the back of the OB1. The final mounting can be seen in Fig 10.

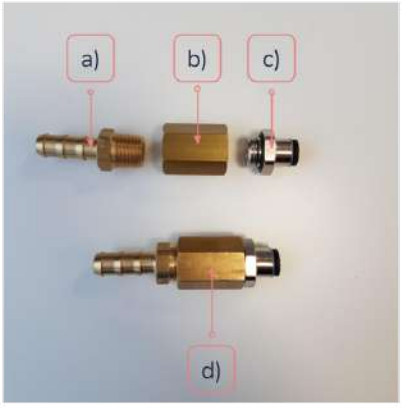


Fig 10. *Required elements to connect the vacuum pump tubing to the OB1 tubing.*

It is recommended to turn on the vacuum pump only when the software is running to prevent backflow from the reservoir into the OB1 regulator. Also, anti-backflow filters should be used on each outlet of the OB1 (see OB1 pressure outlets filter installation below).

A dual regulator should be connected to the pressure and vacuum source when in use. The OB1 dual regulator must be connected to a vacuum source to work properly, even when you only use positive pressure.

Elveflow Pressure & Vacuum Sources

In 2021, Elveflow introduced a new generation of oil-free pressure and vacuum sources to be used with the Elveflow OB1 pressure and flow controller. Because of their small footprint and reduced noise, they can be installed directly at the place of use.

Elveflow Pressure Source (EPS)

The Elveflow pressure source is a pressurized air source that provides compressed air to an OB1 with two 0-2 bar channels. The pressure source offers a steady pressure of 2000 mbar, making it the perfect companion for 0-200 mbar or 0-2000 mbar OB1 pressure regulators.

Elveflow Vacuum Source (EVS)

The Elveflow vacuum source is a vacuum pump that provides vacuum to an OB1 with two vacuum channels. The steady vacuum generation goes down to -850 mbar, making it the perfect companion for -900/1000 mbar -900/6000 mbar OB1 pressure regulators.

Connection to Elveflow OB1

The Elveflow Pressure Source and Elveflow Vacuum Source can be connected to the OB1 using the same pneumatic 6mm OD tubing (2 m) (Fig 11).

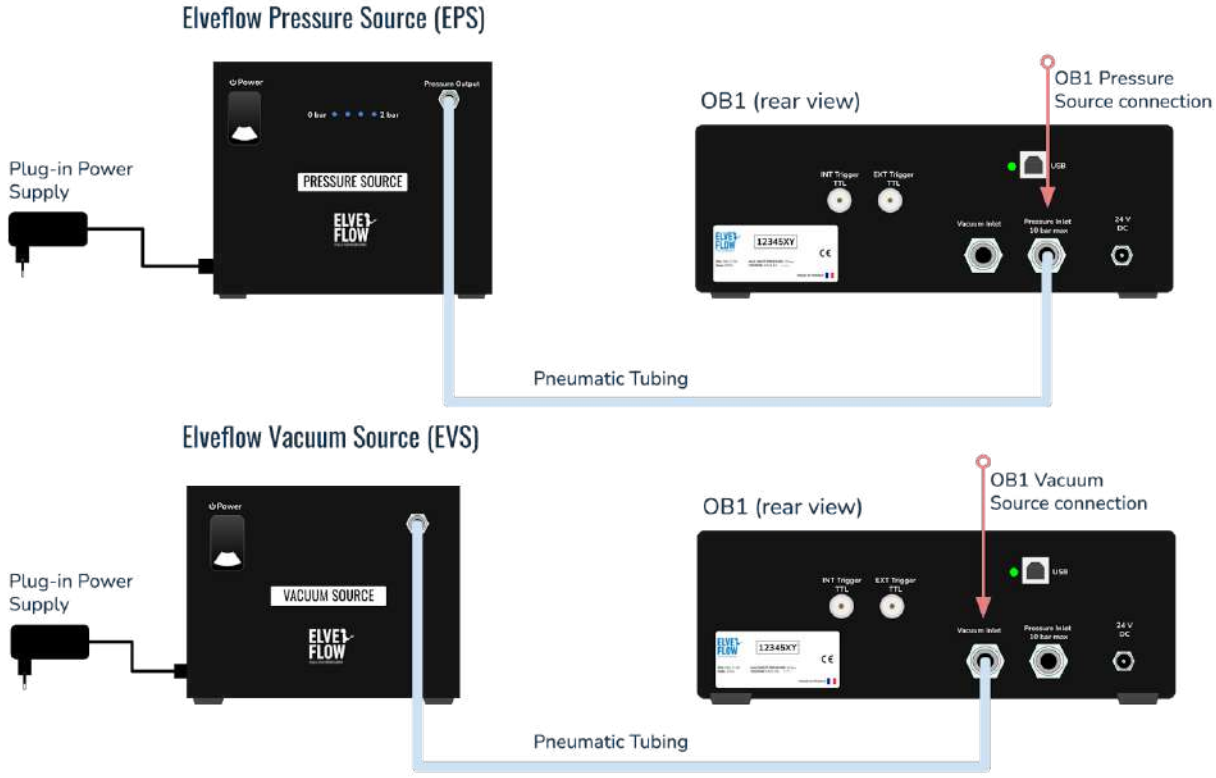


Fig 11. *Elveflow Pressure Source (top) and Elveflow Vacuum Source (bottom) connection to an Elveflow OB1 Pressure and Flow Controller*

Additional information:

The Elveflow Pressure & Vacuum Sources user guide is available 24/7 on the Elveflow Knowledge Base. We recommend that you read through this manual to learn about installation, operation and advanced functionality.

OB1 Installation

Once the pressure source (and vacuum, if applicable) is installed, you may connect them to your OB1 flow controller.

Keep the compressed air lines dry and clean

The OB1 technical specifications might vary depending on your particular system. Generally, the OB1 is described as a four-channel controller. Remember, however, that your controller might have 1,2,3 or 4 pressure outputs.

Condensed water and particles shorten the life of the OB1 pressure controller, cause significant maintenance costs, and may result in loss of productivity. The most effective way to eliminate condensed water and particles is to install an air dryer and filter at the compressor output. The air dryer should be mounted vertically, with the drain plug at the bottom and the side arrow of the cap towards the OB1 (Fig 12).

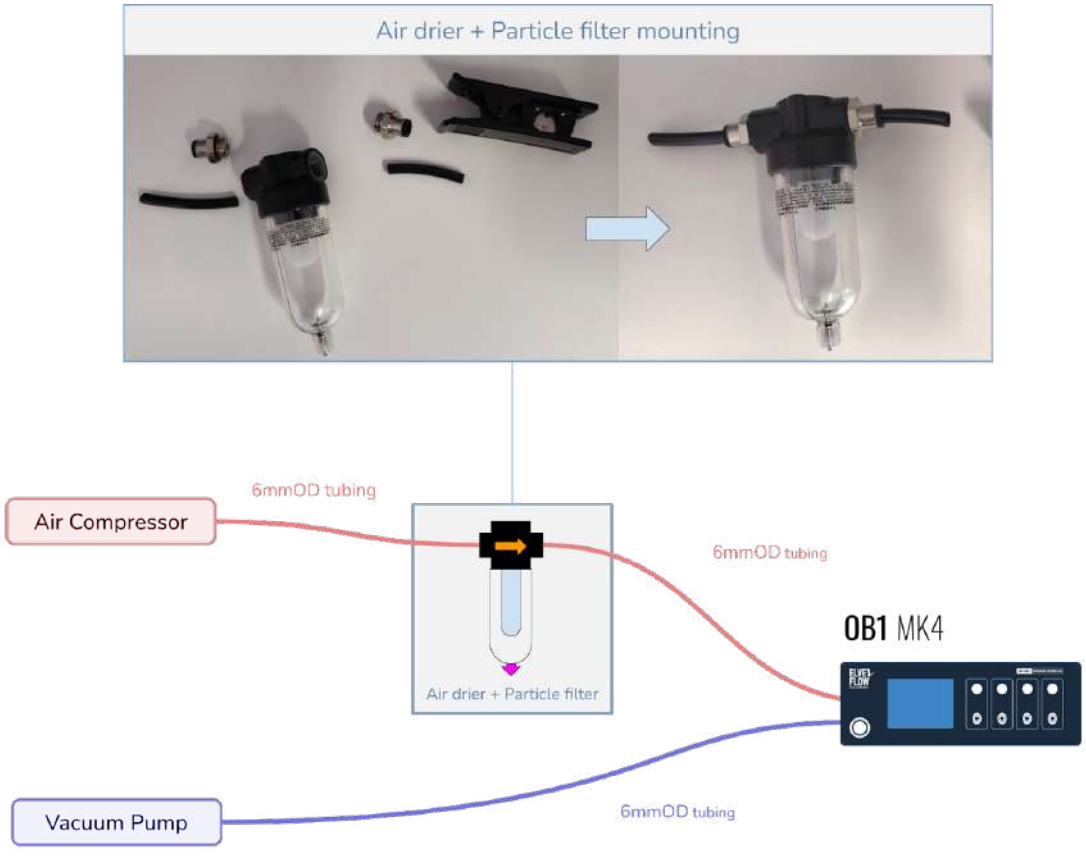


Fig 12. *Install an air dryer to keep water and particles out of the pneumatic circuit.*

Connect the pressure and vacuum sources to the OB1

Using 6 mm OD pneumatic tubing, connect the pressure and vacuum pump to the quick connect pressure and vacuum inlets (Fig 13) indicated by “pressure inlet” and “vacuum inlet” in the back of the OB1 device. Ensure the pressure source is connected to the “pressure inlet” and that your vacuum pump is connected to the “vacuum inlet”, if applicable.

To connect the 6 mm OD tubings to the OB1, insert the tube into the vacuum or pressure connector (Fig 14). To disconnect the pressure or the vacuum inlet, ensure that the pressure and vacuum sources are turned off, and the tubing is purged to the atmospheric pressure, then press the gray ring and pull the tubing.

As obvious as it may seem, always connect your pressure or vacuum source to the appropriate connector in the back of the OB1. Make sure the pressure source is connected to the “pressure inlet” and your vacuum pump is connected to the “vacuum inlet”, if applicable.

Fig 13. *OB1 quick connect fittings*

Fig 14. *How to disconnect OB1 quick connect fittings*

Important information. Always use an air filter on the pressure line connected to the OB1.
We advise replacing this filter whenever a performance decrease is observed and at least once a year. Contact customer@elveflow.com for details.

Do not use the OB1 with explosive or corrosive gases or liquids, as this would put the user at risk and damage the instrument. **Using Oxygen is not advised**.

Be careful to disconnect the OB1 quick-connect fittings correctly by pressing the outer ring while pulling out the element to disconnect (tubing or plug).

Install the anti-backflow filters to the OB1 outlets

Each OB1 pressure/vacuum outlet should be equipped with a filter to prevent the accidental flow of liquids in the instruments (backflows). Figure 15 illustrates our recommended filter installation.

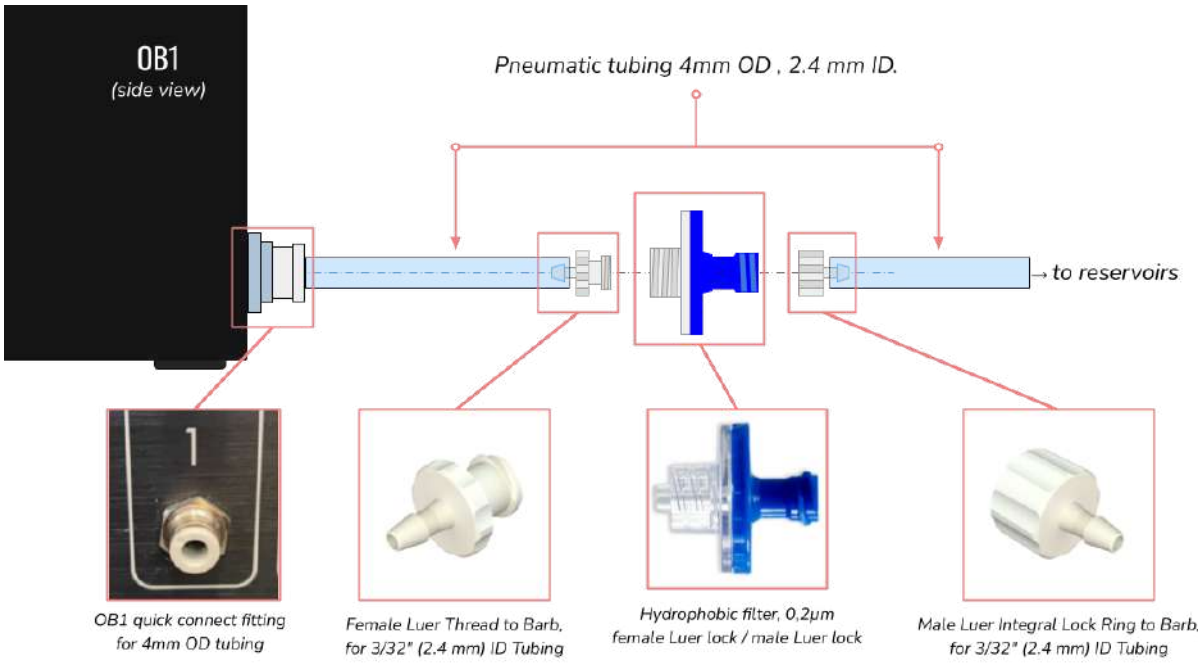


Fig 15. *How to install the anti-backflow filters to the OB1 outlets*

We recommend always using anti-backflow filters. The OB1 pressure regulators are sensitive to dust and corrosion inside, usually caused by backflow accidents. The warranty does not cover damages caused by backflow.

Connect the OB1 to the sample reservoirs

The OB1 channel outputs have quick-connect fittings. To install a quick-connect fitting, simply insert the 4 mm OD pneumatic tubing into the mouth of the fitting and push it through the ring until the tube reaches the bottom of the O-ring. The design is simple, but these fittings can create reliable and durable connections with a simple push.

To remove a quick-connect fitting, press on the fitting ring as you pull the tubing in the opposite direction. Applying pressure to the ring prevents it from reaching the top of the body, where the taper activates the ring's teeth. If you simply try to remove the tubing without pressing the fitting ring, the teeth will engage, and you will not be unable to extract the fitting. By pressing down on the collet, you are keeping the teeth from compressing around the piece of tubing, ensuring a safe disconnection.

If you struggle with a particularly stubborn quick-connect fitting, find an object you can use to leverage the pressure. For example, use a flat wrench key to press the ring as you pull the tubing out.

The different outputs of the OB1 are color coded. Each color corresponds to a specific pressure range (fig 16).

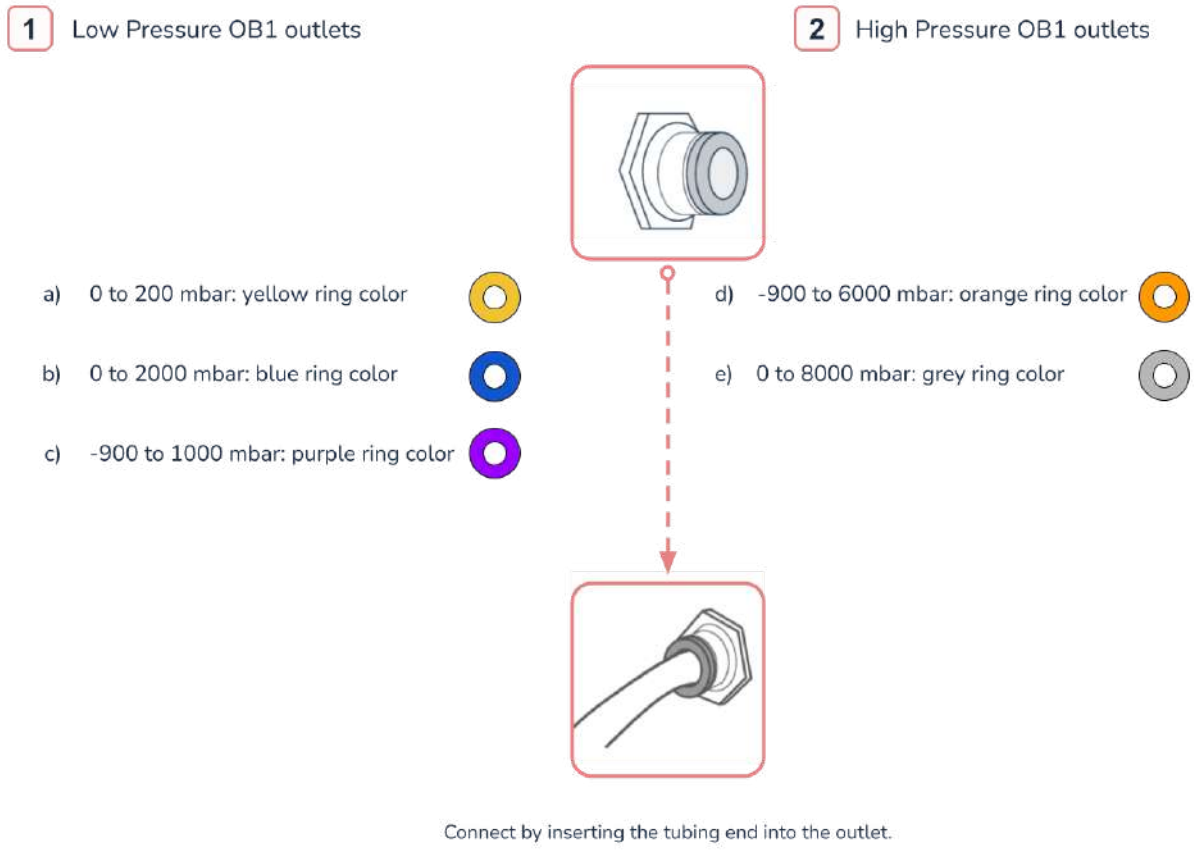


Fig 16. *The OB1 channels outlet and recommended connections. Channels type* ***a***, ***b***, *and* ***e*** *are "Positive channels", while channels type* ***c*** *and* ***d***, *work both with positive and negative pressures and are called "Dual channels".*

Fig 17. *How to disconnect push-to-connect high-pressure outlets.*

Do not try to disconnect push-to-connect fittings **without pressing the fitting outer ring**, as this may damage the fitting (Fig 17). **If additional force is required,** you may use a flat wrench to press the outer ring and facilitate the release.

Connect your OB1 to your computer and the power supply

Connect the instrument to the computer using the USB cable (“USB” marking). Once the USB cable is connected, the green LED turns on.

Next, plug the power adapter into the instrument (“24 V DC” marking), and connect the adapter to an electric socket (country-specific plug adapters provided).

Add your OB1 to the ESI software

You can download the ESI software 24/7 through the Elveflow Website.
You will find the software description and operation details in the ESI guide under the .zip archive downloaded with the software or in the support portal.

To add an OB1 not yet recognized by the software, click on ADD INSTRUMENT (Fig 18b).

In the New Instrument window, select the Instrument type and name it. You can use letters from A to Z (upper or lower cases), numbers from 0 to 9, and underscores. The instrument name should not contain any space.
Note that if more than one new instrument of the same type is connected to the computer, an instrument selector will appear at the top right corner (Fig 18a).

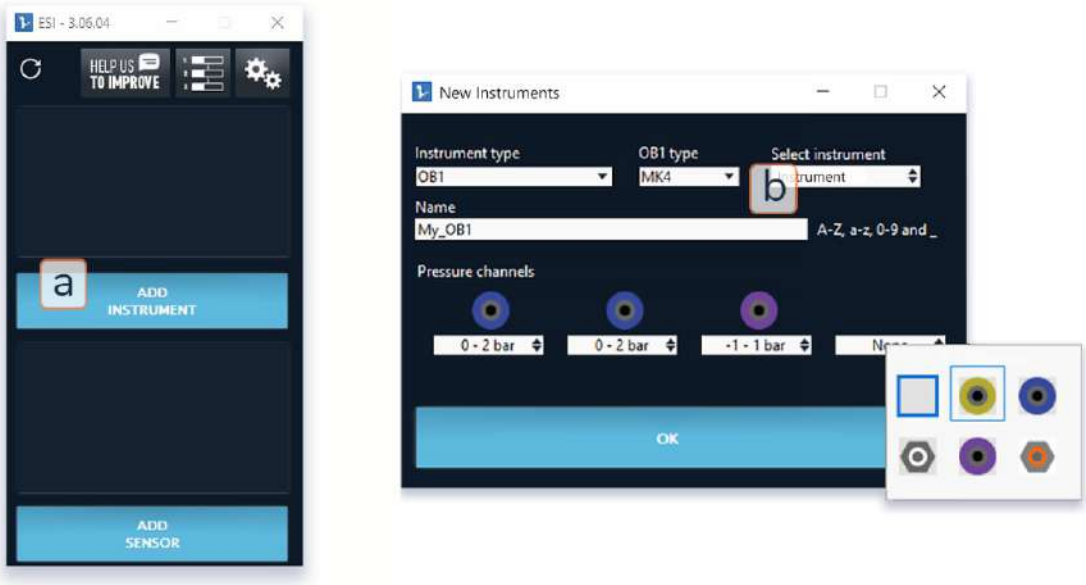


Fig 18. *Adding an OB1 in the ESI software.*

The configuration of your OB1 MK4 will be automatically detected.
If not, please contact Elveflow Support at customer@elveflow.com.

Click OK, and your new instrument will appear in the main window.

If you want to remove your OB1 from the devices list, click the “delete” red button in the ESI OB1 settings tab (Fig 19b)

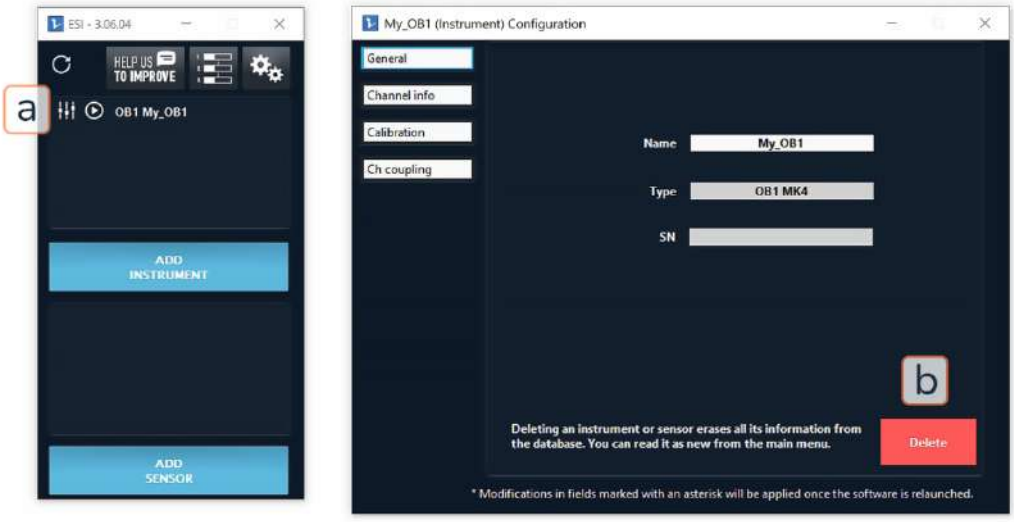


Fig 19. *Removing a device from the list.*

The OB1 channels configuration is predefined and can not be changed on the software. However, adding a new channel or replacing an existing one is possible. Contact Elveflow Customer Support for details at customer@elveflow.com.

If your OB1 has a dual regulator, start the vacuum pump only when the software is running and stop the vacuum pump before closing the software. When the software is not running, dual regulators are fully open on the vacuum side, which could cause a backflow of liquid into your OB1.

If you want to reset your device information (instrument or sensor) in the ESI, you must delete the device from the ESI device list and add it again later.

OB1 calibration in the ESI software

From the main window, open the instrument settings window and select the calibration tab (see Fig 20a and 20b). The third line of the instrument settings window indicates the current calibration in use (either the default or the last used calibration) (Fig 20c). Once all the pressure outlets have been closed (Fig 21*)*, press “Start Calibration” (Fig 20c). This process takes a few minutes and begins with the calibration of channels 1 and 2, then proceeds to the calibration of channels 3 and 4.

The ESI User Guide provides a detailed description of all the OB1 software settings.

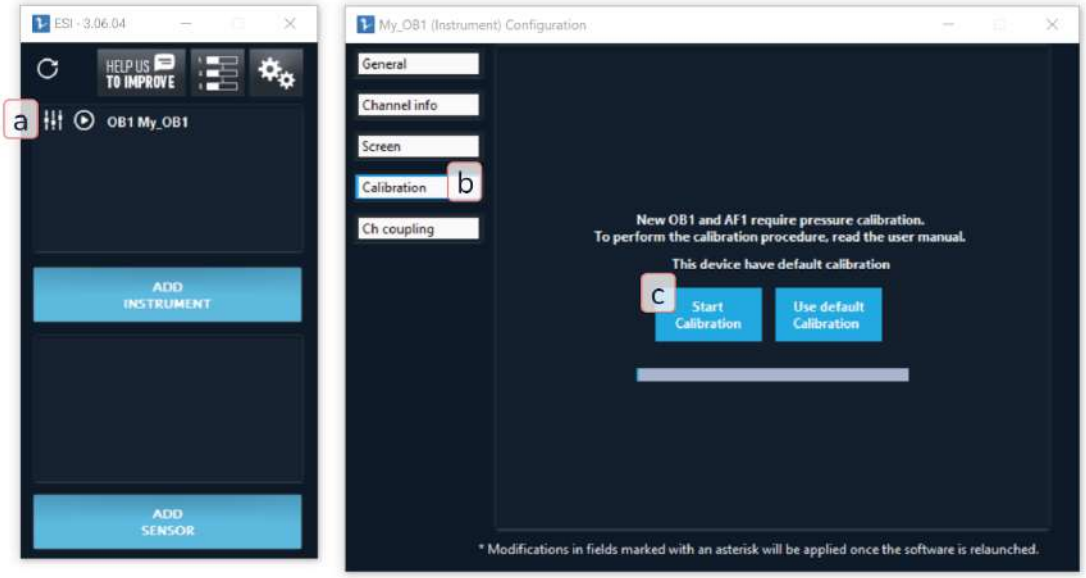


***Fig 20**. Quick and easy calibration of the OB1 is essential before use.*

Close the OB1 outlets during calibration. During the OB1 calibration, all pressure outlets must be closed with the appropriate push-in plugs (Fig 21), with no reservoir connected.

***Fig 21.** The OB1 push-in pressure outlet plug for the OB1 Mk4 pressure channels.*

For best performance, allow the OB1 to warm up and stabilize for at least 15 minutes before starting an experiment

Calibration is recommended:

- When connecting the instrument to a computer for the first time.
- Any time a pressure difference between the requested value and the measured value is observed. A pressure difference corresponding to 0.2% of the maximum channel range is considered acceptable (e.g., 4 mbar for a 0 to 2 bar OB1 channel).

Perform the experiments under the same conditions applied during the calibration (e.g. if OB1 calibration was performed with the vacuum and pressure sources switched ON, then the experiments should be performed with the vacuum and pressure sources ON as well).
Positive channels (see Fig 16) should be calibrated with the pressure pump open and ON, while any OB1 with a dual-channel requires both the pressure pump and vacuum pump to be open and turned ON during calibration.

Calibration should be performed according to the OB1 channel type.
Positive OB1 channels should be calibrated with the pressure pump open and switched ON (with the OB1 channel outlets closed and no sensor or reservoir connected).
Dual OB1 channels are designed to work with vacuum and pressure and, therefore, require both the pressure pump AND the vacuum pump to be open and turned ON during calibration (with the OB1 channel outlets closed and no sensor or reservoir connected).

6. Connecting the elements

The typical OB1 start setup

We advise starting with a simple and easy setup to master the installation steps (Fig 22). The setup can be incrementally complexified if required.

Prepare the following elements:

- 1 OB1
- 1 flow sensor (if applicable)
- 1 Reservoir filled with water (if applicable)
- Tubings (4 mm OD - 2.7 mm ID clear tubing for air pressure connections, and white PTFE 1/16" OD tubing for liquids)
- Flow resistance and a cutting tool (to make clean cuts). Each resistance is packed in an individual plastic bag with a resistance ID marked on each (e.g. 65 µm, 100 µm, and so forth)
- A microchip
- A waste reservoir
- A computer equipped with the Elveflow Smart Interface (ESI). The ESI latest version can be found here.

These elements should be connected according to the following schematic:

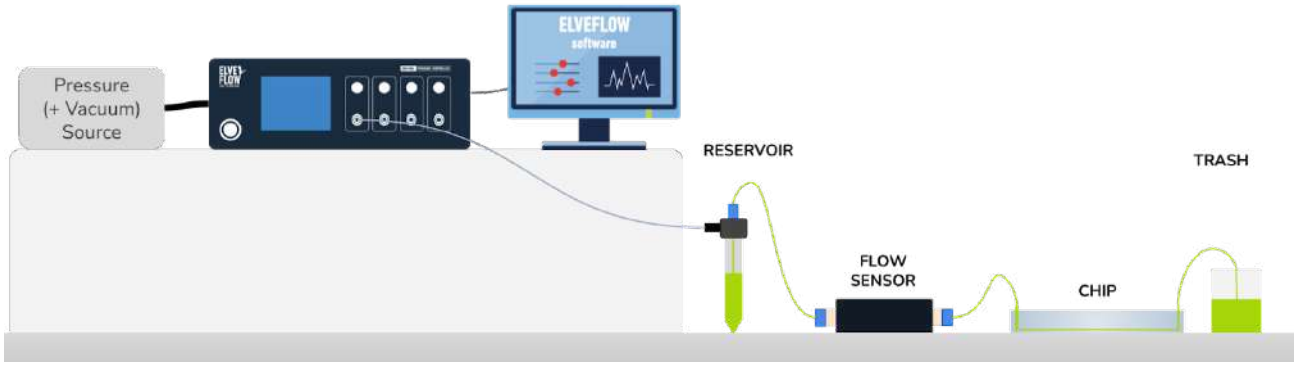


Fig 22. *Example of a simple setup.* We advise starting the setup this way to master the installation steps.

Expert tips:

- To minimize the risk of backflow, position the OB1 at the same level or higher as the other elements.
- The dip tube of your trash should be immersed in the liquid. Avoid drops dripping into the trash, as this may cause flow instability.

As a general rule, feel free to adjust the fitting's tightness using Teflon thread seal tape to avoid pressure or liquid leaks.

Connecting the reservoirs

Please refer to the user guide for pressurized reservoirs for the specific instructions on connecting the Elveflow® reservoirs (fig 23).

Use the following fittings to connect the reservoirs to your microfluidic setup:

- 1/4-28 Flat-Bottom fitting for 1/16" OD tubing.
- 1/4-28 UNF Bottom fitting to 3/32" (2.4 mm) ID tubing.

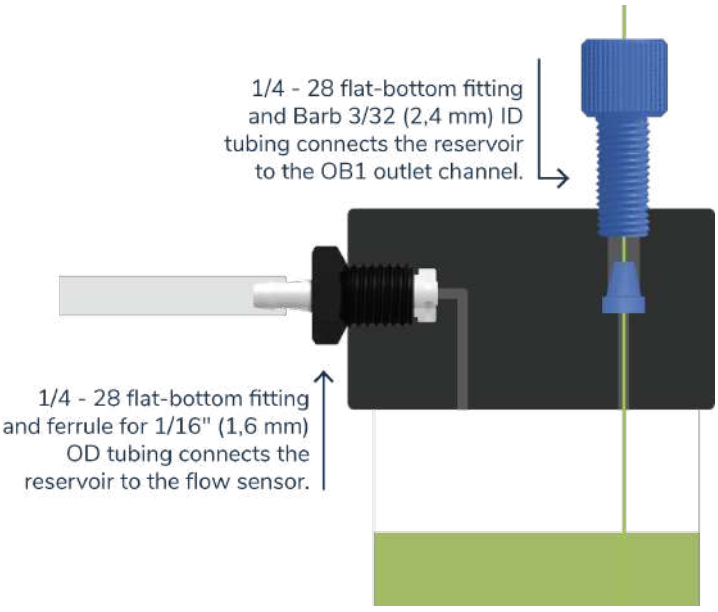


***Fig 23**. Cross-section of a 15ml reservoir with the fittings and tubings required to connect it to the pressure generator and flow sensor.*

Does your OB1 make a continuous noise? If so, you may have a pressure leak.
For an easy fix, look at the troubleshooting section ***Fix an OB1 continuous noise or a leak*.**

Connecting sensors

The OB1 Mk4 automatically detects when a digital sensor is connected to a sensor port. As soon as the sensor is connected, the OB1 screen will instantly start displaying the values of the connected sensors. To connect a sensor, plug the sensor cable into the sensor receiver port above an OB1 pressure outlet. We advise you to refer to the appropriate Elveflow sensor user guide and read it before starting any experiment. You can find the sensor user guides on the Elveflow Support Portal.

Browse through our Knowledge Base to find more information about our products.

7. Flow control tuning

Refer to the MFS User Guide available on the Elveflow Knowledge Base for detailed instructions on flow control regulation.

Additional information is available from Elveflow Customer Support. Contact us at customer@elveflow.com.

8. Preventive maintenance

Pressure and vacuum sources maintenance

Jun-Air compressor maintenance

Regular maintenance is required to ensure compressor performance and service time. Please read the Jun-Air 3-4 Pressure Pump User Manual in the Elveflow Documentation.
The Jun-Air compressor is a reliable device that can last many years when correctly handled, serviced, and periodically inspected per the manufacturer's instructions.

A detailed compressor user guide (original manufacturer's guide) is provided. We recommend you to read it and follow the manufacturer's recommendations for optimum use.

If applicable, the compressor filters (5 µm and 0.01 µm, Fig 24a) should be checked regularly and replaced at least once a year.

A yellowish liquid leak could be a sign of a compressor oil leak.
Depending on the location of the leak, follow the steps below:

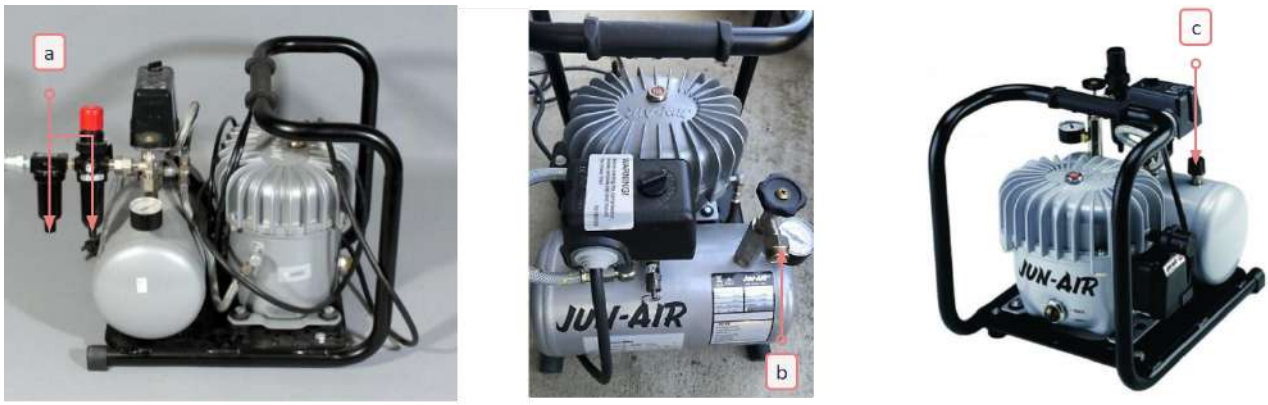


***Fig 24**. Compressor maintenance*

- A leak is most likely at the filter outlets (Fig 24a), which is an expected result of the automatic filter purge. You can use a device to collect the condensed water from the filter if you want.
- If the leak is located at the connections between the filters (Fig 24b), a Teflon thread seal tape. should be used to secure the connection.

Additional information is available at Elveflow Customer Support. If you notice a problem with your Jun-Air compressor or think it is not properly working, contact us at customer@elveflow.com for specific instructions on how to properly operate your system.

Although compressor maintenance is a safe operation, we recommend using personal protective equipment during the procedure (mask, glasses, gloves, and lab coat).

LabTech vacuum pump maintenance

This vacuum pump usually requires low maintenance. Still, if you notice a problem with your LabTech vacuum pump or think it is not working properly, contact us at customer@elveflow.com, for specific instructions on how to properly operate your system.

Using Elveflow Pressure sources

Replace the filter of the Elveflow Pressure sources (which also acts as an auto-drain) at least once a year. Contact Elveflow Support at customer@elveflow.com to get a quote for this replacement.

Using lab compressed air

When using a compressed air line or a gas cylinder, always use an air cleaner filter between your pressure source and your OB1 (Fig 11). Check this filter at the back of the OB1 (Fig 26a) regularly and drain the accumulated water by pressing the button at the bottom of the filter. Replace the air cleaner filter at least once a year.

OB1 controller maintenance

Check the air cleaner filter at the back of the OB1 (Fig 26a) regularly and drain the accumulated water by pressing the button at the bottom of the filter. Replace the air cleaner filter at least once a year.

Replace the Backflow filters at the front of the OB1 (Fig 26b) at least once a year or any time it gets into contact with some liquid.

***Fig 26**. OB1 maintenance: Replace the filters at least once a year.*

Additional information is available at Elveflow Customer Support. For more information on the OB1 maintenance, please contact customer@elveflow.com.

About using gas cylinders (N_2, CO_2, etc)

It is important to know that a small leak occurs within the OB1, even when switched off. If you use a gas bottle as a pressure source, the bottle should be closed after each use. Remember to ventilate the room.

Close the OB1 outlets during calibration. Ensure safety conditions are taken and maintained anytime using gas cylinders (e.g. CO2, Nitrogen).
Ventilate the room where the OB1 is used and close the gas bottle after each experiment to avoid excess gas consumption or gas concentration built-up in the experiment room.

9. OB1 troubleshooting guide

This section helps Elveflow users troubleshoot, diagnose, and resolve OB1-related issues. Before contacting our customer support, we recommend you go through the present user guide to provide a clear description of the issue encountered.

General recommendations

Before any diagnosis, please ensure that:

- The OB1 is connected to a power supply, switched on, and connected via the USB cable.
- The pressure and vacuum sources are well connected to the OB1. Ensure the compressor/vacuum hose is ON and connected to the appropriate inlet on the back of your OB1.
- The pressure or vacuum sources match the OB1 channel requirements.

ESI messages: causes and recommended actions

The instrument seems not to be connected to the power supply

This can happen when there is an issue in the electrical connection with the OB1 (this can also occur with other instruments).

Check the following:

- The power cable is correctly inserted into the OB1 socket.
- The Power Button on the front of the OB1 is switched ON.
- The USB Cable is correctly connected and not damaged. You may also try using another cable with the same specifications (Male USB A to Male USB B USB Cable, USB 2.0) to test it.

The instrument calibrated, - channel X: pressure too low (P out max = 1354 [1], normal P out max = 2000)

This means that the maximum pressure your OB1 channel can go to is not reached (1354 < 2000). However, your regulator should work properly from 0 to 1354 mbar.
Solution:

- Check the pressure source connected to the OB1. It might be because the inlet pressure is around 1354 mbar.
- If your pressure source is set to deliver a pressure above or equal to 2000mbar, then your OB1 channel may be defective. Contact Elveflow Customer Service for inspection and repair of your device.

[1] Values may vary depending on your settings and equipment.

Instrument Calibrated - Channel X: Couldn't go below -600 [1] mbar

This means that the minimum negative pressure (vacuum) your OB1 channel can reach is not reached. However, your regulator should work properly between -600 to 0 mbar.
Solution:

- Check the vacuum source connected to the OB1. This issue might happen because the inlet vacuum is around -600 mbar.
- In the case your pressure source is set to deliver a vacuum pressure compliant with the OB1 requirements, then your OB1 channel may be defective. Contact Elveflow Customer Service for the inspection and repair of your device.

Typical situations and how to proceed

Your OB1 is not recognized by the ESI software

The ESI software should automatically detect your OB1 configuration. If that does not occur, please contact Elveflow Support at customer@elveflow.com.

Your OB1 does not reach the min or max channel values

Please check the following:

- The connection between the pressure/vacuum source and the OB1: the pumps must be connected, open, and turned on.
- The input pressure connected to the OB1 is sufficient to use the regulators (e.g. you cannot reach 4 bar pressure if the inlet pressure is only 2 bar).
- Perform a new OB1 calibration and check that the channel output plugs are plugged correctly when calibration is running.

If the problem persists, contact Elveflow Support at customer@elveflow.com.

Water enters the OB1 channel

Water inside the channel can damage the instrument, and, in this case, the OB1 may need repair. Try to dry flooded regulators by applying high pressure for some time (typically a few hours). If the OB1 responds correctly, it is a sign that everything is fine. Otherwise, contact customer@elveflow.com for an inspection and repair of your device.
Remember to use anti-backflow filters on each output of the OB1 to prevent such situations.
If your OB1 has a dual regulator, start the vacuum pump only when the software is running. Also, only stop the vacuum pump before closing the software. Be aware that dual regulators are fully open on the vacuum side when the software is not running, which may cause a backflow of liquid into the OB1.

Your OB1 makes some noise

A transient noise is normal and should be expected when using the OB1 pressure regulator.
If the noise is continuous and abnormal, please check:

- If there is a leak in your microfluidic setup (pressure tubing from OB1 to the reservoir, reservoir pressure, or any liquid connections). See the details in the section "How to fix an OB1 continuous noise or a leakage" below.
- If the plugs are inserted correctly into each OB1 outlet before calibration and during the experiment.
- If a hissing noise is generated from the OB1, close the channel outlets with a plug and apply sudden pressure switches. For this purpose, use the square function of the OB1, for example, in the channel range extreme values for at least 30 seconds (e.g. 0 to 2000 mbar for a 2 bar channel). Use short periods, such as 1 second, for instance.

Your OB1 screen does not turn on or does not display anything

In most cases, you can continue using your OB1 through the ESI even if the display does not work. Still, contact customer@elveflow.com for the inspection and repair of your device.

Your OB1 shows random or unstable flow values

If that's the case, check the following:

- If you are using digital flow sensors, check if they are physically disconnected from your OB1 but still listed in the ESI. Ensure to remove any physically disconnected sensor from the ESI sensor list.
- If the flow resistance tuning was performed correctly (find details in the MFS user guide available in the Elveflow Knowledge Base. A correct flow resistance stabilizes the flow and greatly improves flow control.
- If your ESI software version is updated.

If the problem persists, contact Elveflow Support at customer@elveflow.com.

How to fix an OB1 continuous noise (pressure leak) or liquid leakage

An OB1 continuous noise is a clear sign of a pressure leak in your system (that the OB1 is continuously trying to compensate).

Leakage can cause valuable sample loss and decrease OB1 performance. Nobody wants that. The key to fittings holding pressure is the integrity of the sealing surfaces. The threaded fittings provided by Elveflow use a compression fitting principle.

Tubing is inserted into the end of the fitting and the ferrule, and the nut/screw is tightened, forcing the ferrule into the fitting receiving port. As the ferrule(s) moves axially into the fitting body, the body-angled shape radially compresses the end of the ferrule onto the outer diameter of the tubing. This radial compression creates a leak-tight seal between the fitting, ferrule, and tubing.

If you find a defective element, then it's a simple matter of replacing it, re-pressurizing your system, and going on with your experiment. As a general rule, feel free to adjust the fitting's tightness using Teflon thread seal tape to avoid pressure or liquid leaks

If you do not find the leakage source, follow these steps to try and identify the leak. You may start from the OB1 front pressure outlet. Check every component using the following method:

1. Check that every fitting or connector is tightened correctly.

2. Close the connection right after the element you want to check with a plug (e.g. calibration plug), your fingers or clamp the tubing if required. *You must close the system right after the element you're about to check to determine if it is defective.*
3. Apply a moderate pressure (e.g. 500 mbar), and check if the OB1 continuous noise is still present.
4. Apply a 0 mbar pressure, then:
    a. If you still hear a noise, use Teflon thred seal tape to adjust the tightness or replace the defective fitting. Usually, the small blue cone-like ferrule is the part that needs to be replaced. Still, it also happens that the fitting thread is sometimes damaged by ordinary handling (overtightening, bad installation). Replace the defective element, re-apply a 500 mbar pressure, and check for OB1 noise again. You should hear no noise now.
    b. If you heard no noise, proceed to the next fitting check and do so on the entire pressure line and flow path. Of course, repeat the process on every OB1 channel until the leak is fixed.

Add or replace a channel on your OB1

You can add a positive or dual (positive and negative) pressure channel on an existing OB1 instrument. The added channel can either replace a current channel or be installed on a free slot. Each OB1 can have up to 4 channels.
This procedure is called Instrument Upgrade. To do this, follow the steps below:

1. Contact Elveflow Support for a quote for your specific needs.
2. Elveflow Support will send instructions and arrange the free return of your OB1 to the Elveflow workshop.
3. Elveflow will perform the upgrade of your instrument upon receipt of a Purchase Order.
4. Elveflow will ship back the upgraded instrument to you.
5. Upon receiving it, update the instrument in the ESI software to reflect the changes made for future experiments.

The installation, tuning, and testing of the new channel must be performed by qualified Elveflow personnel. To request an upgrade, email an Elveflow Sales Representative at customer@elveflow.com, indicating your OB1 serial number (found on the back of your OB1) detailing your current configuration and the modification you need.
An inspection service will be performed when your instrument reaches the Elveflow offices.

If the upgrade request occurs within 1-month after the purchase, the operation will be performed free of charge.
If the upgrade request occurs beyond the 1-month after the purchase, Elveflow will send you a quote based on your needs.

The typical OB1 channel installation is a quick operation followed by a test on a test rig to ensure the upgraded OB1 meets Elveflow's high performance and quality standards. As soon as we ensure all is fine, we will ship the upgraded OB1 back to you.

10. Linked products

[Thermal flow rate sensor]
Microfluidic Flow Rate Sensor uses thermal time-of-flight technology to flow rates in micro-size channels.

[Laboratory pressure source]
Light & compact pressure source ideal to supply a microfluidic pressure regulator

[Microfluidic Reservoirs]
Microfluidic adapters for Eppendorf © , falcon © tubes, or gl45 threaded glassware.

11. Customer Support

You are welcome to browse through our online Elveflow Support Portal (https://support.elveflow.com/support/solutions). You will find extensive information and guidance regarding all our product lines. It is very likely that the answers you are looking for can be found there. In case you have further questions or need clarification, please don't hesitate to contact us at customer@elveflow.com.

Information required for troubleshooting

With the critical information readily available, the Elveflow Support team will be better able to help you.

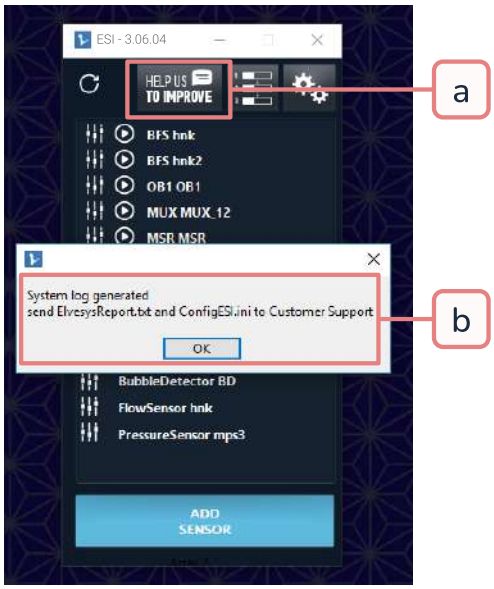
The essential troubleshooting elements are:

1. The serial number of the Elveflow device(s) (Sensors, Instrument).
2. The ESI Report and the ESI initialization file (see how to create an ESI report in the next section)
3. Screenshots of the error messages received, if applicable.
4. Pictures or movies of your setup and your issue. You can use WeTransfer to send us a big folder and files up to 2Go. Make sure to add the download link to your reply.

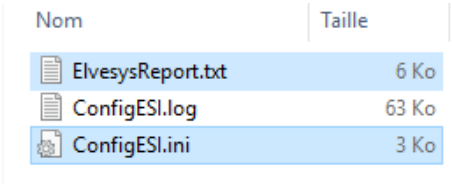
Generate and send ESI reports

1- Open ESI software

2- Click on "Help us to improve" (1) on the ESI main window to generate the report (2)



3- Click OK to open the ESI data folder. They are usually located in C: \ Users \ Public \ Documents \ Elvesys \ ESI \ data.



4- Add these 2 files to your email at customer@elveflow.com:

- ElvesysReport.txt
- ConfigESI.ini


ELVE
FLOW
PLUG & PLAY MICROFLUIDICS
Technical support
customer@elveflow.com
General information
customer@elveflow.com
+33(0).184.163.807
ELVESYS - Microfluidics innovation center
172 Rue de Charonne,
75011 Paris, FRANCE
www.elveflow.com
MAY THE FLOW BE WITH YOU