

OEM OB1 Controller MK3+

Pressure Controller Custom

DOCUMENT REF: UGOB10EM-150721

USER GUIDE



Symbols used in this document



Important information. Disregarding this information could increase the risk of damage to the equipment, or the risk of personal injuries.



Helpful information. This information will facilitate the use of the instrument and/or contribute to its optimal performance.




Additional information is available on the internet or from your Elveflow representative.

Please read this document carefully before doing any experiment.



Important OB1 Pressure controller safety notices:

1. **The OB1 must be used in a clean and dry environment**, with up to 60% relative humidity, and in a ventilated room.
 2. **Use a power supply of the correct voltage.** The OB1 requires a 24 V DC input voltage. You can use the one provided (if requested) or use a 24V supply taking care of respecting the positive polarity.
- 
3. **The maximal input pressure must be between 1.5 and 10 bar.** Do not connect to a pressure source greater than 10 bar at the back of the instrument.
 4. **The OB1 must be used exclusively with neutral, dry, dust- and oil-free, and particle-filtered gases, at a minimum particle size of 5 µm.** 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 5 µm** to avoid inserting particles or liquid into the instrument.
 7. **When using an 8 bar regulator, do not use a glass reservoir.** This level of pressure can be dangerous in some circumstances and has to be handled accordingly. Use adapted reservoirs and tubing. Do not use standard glass reservoirs and tubing, as the 8 bar output pressure is beyond the kit's rated capacities.
 8. For the safety of both the user and the instrument, **do not use the instrument in connection with substances that could 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 to the instrument.
 11. **The reservoirs should not be put in a higher level than the OB1 pressure channels** to prevent backflow from the reservoir to the instrument.
 12. **Turn off or close your pressure source (gas cylinder) after each experiment**, because when turned off the OB1 valves are in an open state.
 13. **Close the pressure outlets with the Luer integral lock when not using the OB1** to prevent any contaminants from entering the instrument.

If the conditions listed here 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.



Important information. Working with systems or equipment containing liquids or gases under pressure can entail risks, especially with pressurized reservoirs containing corrosive, toxic, or explosive liquids and even with water.



See also:

1. **The Flow Control Tuning instructions:** is documentation that covers in detail the steps any user should follow to control the flow using a typical Elveflow setup (OB1, reservoirs, and an MFS flow sensor). More details on resistance and PID tuning could be found in the MFS User Guide.

Table of contents

1. Introduction	6
Main Features & Benefits	6
Principle	6
2. Technical Specifications & Design	7
Technical Specifications	7
Design	8
Product package contents	9
3. Required material checking	10
OB1 pressure requirements	10
Minimum computer requirements	10
4. ESI Software installation	10
5. OB1 pressure controller installation	12
Start with a simple setup	12
Connect the OB1 OEM to the pressure source.	12
General information	12
Compressor installation details	15
<i>Setting the compressor pressure output value between 1.5 to 8 bar (any OB1)</i>	15
<i>Setting the compressor output pressure for OB1 8 bar channels</i>	16
OB1 installation	17
General information	17
Installation of anti-backflow filters	19
Computer and Power supply connection	20
OB1 addition in the ESI software	20
OB1 calibration in the ESI software	22
6. Connection of additional elements	23
Connection of Reservoirs	23
Connection of Flow Sensors	23
7. Flow Control Tuning	24
8. Preventive maintenance	25
Pressure source maintenance	25
OB1 controller maintenance	26
About using gas cylinders (N2, CO2, etc...)	26
10. OB1 Troubleshooting Guide	27
General recommendation	27
Is the OB1 recognized by the ESI software?	27
Is it a calibration issue (pressure is too low, cannot reach min pressure)?	27
Can you reach maximum pressure?	27
Is your OB1 noisy?	27

Is your OB1 giving random pressure values, not responding correctly to pressure setpoint, or seems to be very unstable?	28
Did you disconnect any Digital Flow Sensor?	28
Fix an OB1 continuous noise, or a leak	28
Upgrading an OB1 and adding another channel to a unit.	29
The steps of an Elveflow Instrument Upgrade process	29
Refreshing your OB1 configuration in ESI, once your upgraded equipment is received.	30
11. Conclusion	31
12. Linked products	31
13. Customer Support	31

1. Introduction

The Elveflow OB1 MK3+ is based on a unique pressure-driven flow control technology suited to microfluidics. It offers precise and pulseless flow control for your system while having a response time down to 35 ms. The OB1 allows the control of the output pressure value of up to 4 independent channels, from -900 mbar up to 8000 mbar, for a wide variety of advanced microfluidic applications. It consists of using a gas input pressure within a hermetic liquid tank to flow liquid from the tank to your microfluidic device.

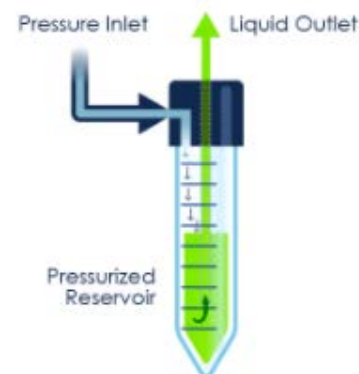
The control of the device is achieved by the means of the ESI software, a single and intuitive interface that allows the automation of the most complex and long-lasting experiments. Furthermore, the ESI software allows performing real-time creation, monitoring, and modifications of complex flow rate profiles such as sine, square, triangle, ramp, pulse, or sawtooth. The Elveflow Software Development Kit offers the possibility to control the OB1 MK3+ with your code and involve third parties instruments and sensors.

Main Features & Benefits

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

Principle

The pressure controller pressurizes a reservoir, containing the liquid to be injected. As a result, a pressure differential, between the pressure inlet and the liquid outlet, is generated and the liquid is injected smoothly and quasi-instantly into the microfluidic chip. Thus, controlling the input gas pressure of the tank will allow controlling the liquid that flows out of the tank. You can thus turn your system into a powerful syringe pump.



[For more information, check our YouTube video:](#)



2. Technical Specifications & Design

Technical Specifications

The table summarizes the main specifications of the Elveflow® OB1 MK3+ pressure controller. To provide high quality and premium performances, all of our instruments are QC tested and calibrated independently (response time, stability, repeatability...) after being assembled.

CHANNEL PRESSURE RANGE	0 to 200 mbar(1) (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)
Part Number *	OB1-C-1	OB1-C-2	OB1-C-3	OB1-C-4	OB1-C-5
Pressure stability (1)	0.005 % FS 10 µbar (0.00014 psi)	0.005 % FS 100 µbar (0.0014 psi)	0.006% FS 500 µbar (0.007 psi)	-900 to 500 mbar:	-900 to 2,000 mbar:
				0.005 % FS 100 µbar (0.0014 psi)	0.005 % FS 350 µbar (0.05 psi)
				500 to 1,000 mbar:	2,000 to 6,000 mbar:
				0.007 % FS 150 µbar (0.0021 psi)	0.007 % FS 525 µbar (0.076 psi)
Response time (2)	down to 9 ms				
Settling time (3)	down to 35 ms				
Minimum pressure increment	0.006 % FS 12.2 µbar - 0.00017 psi	0.006 % FS 122 µbar - 0.0017 psi	0.006 % FS 480 µbar - 0.007 psi	0.0064 % FS 122 µbar - 0.0017 psi	0.0061 % FS 420 µbar - 0.006 psi
Input pressure	1.5 bar - 10 bar non corrosive, non explosive, dry and oil-free gases, e.g. air, argon, N2, CO2, ...				
Input vacuum (4)	/			any value from 0 to -1 bar	
Liquid compatibility	no liquid should enter the OB1 any aqueous or organic solvent, oil or biological sample solution can be propelled				

Non-contractual information, may be changed without notice

POWER CONSUMPTION (maximum): 12 W **CASE DIMENSIONS** (length x width x height): 225 x 120 x 113 mm **WEIGHT**: 0.54 kg

(1) Pressure stability (standard deviation) measured over the full pressure range with an external high accuracy pressure sensor (Druck DPI150) (2) Depending on your computer operating system (3) Volume dependent – Measurement done on 12 mL reservoir for a set point from 0 to 200 mbar (4) The vacuum channels can be used without vacuum source if only positive pressures are desired. If no vacuum channels are present the Vacuum Input can be left open

* Part number OB1-C-0 corresponds to casing and electronics and embeds all the other part number OB1-C-X. (X corresponds to the pressure channel).

Other possible part numbers naming: OB1-OEM-XXXX with XXXX as the 4 channels configuration for the system. (e.g an OB1 OEM with 1x 0/2000 mbar channels would be OB1-OEM-2000)

Design

OB1 OEM front view

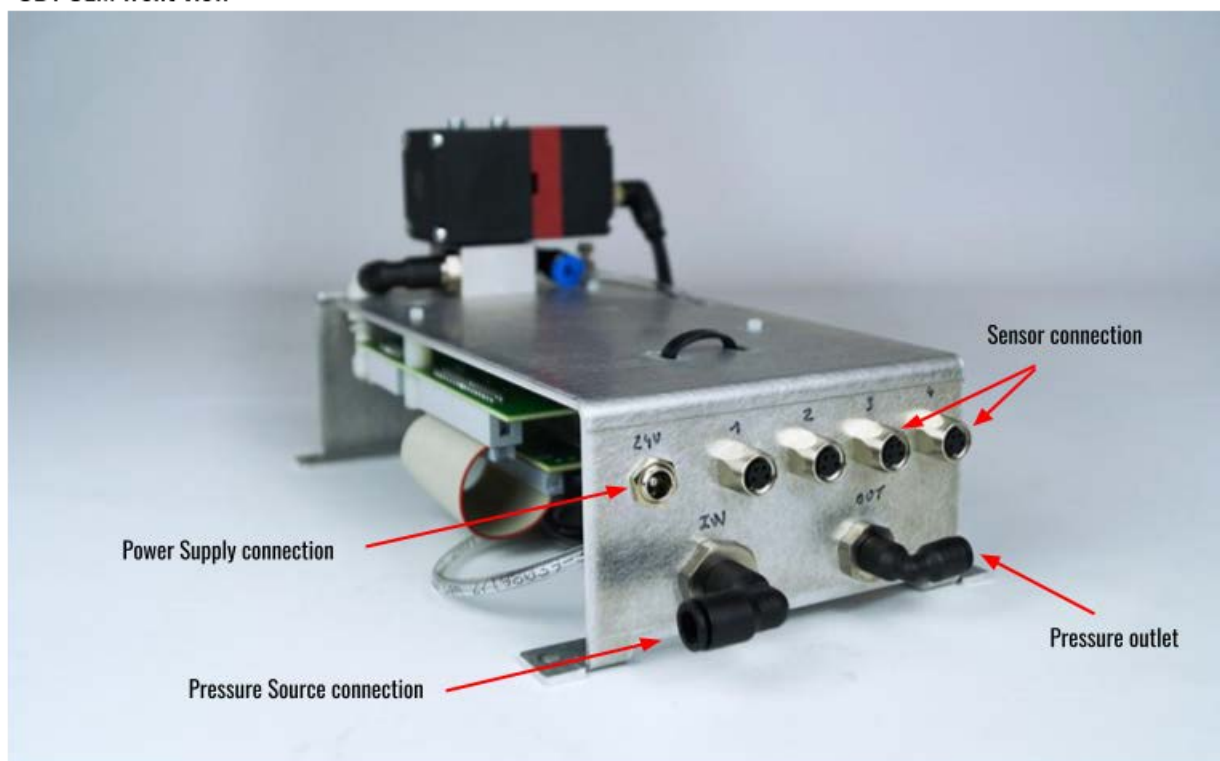


Fig 1. A front view of the OB1 OEM pressure controller.

On the front of OB1, we can find the following elements:

- Connection to the 24V power supply unit with positive polarity
- One pressure channel outlet.
- Four sensors connections for up to four microfluidic sensors
- Pressure inlet (maximum 10 bar).

Please note that these connections use secure quick connections which require pressing the outer ring while pulling out the element to disconnect (tubing, or plug).

This version of the OB1 OEM has one 0-2000 mbar pressure channel.



Helpful information. To add a pressure channel or replace an existing one, send an email to customer@elveflow.com and we'll proceed to the new pressure channel installation.

Software conversion of a pressure channel into a different one is not possible and requires new components installation performed at Elveflow factory.

OB1 OEM side view

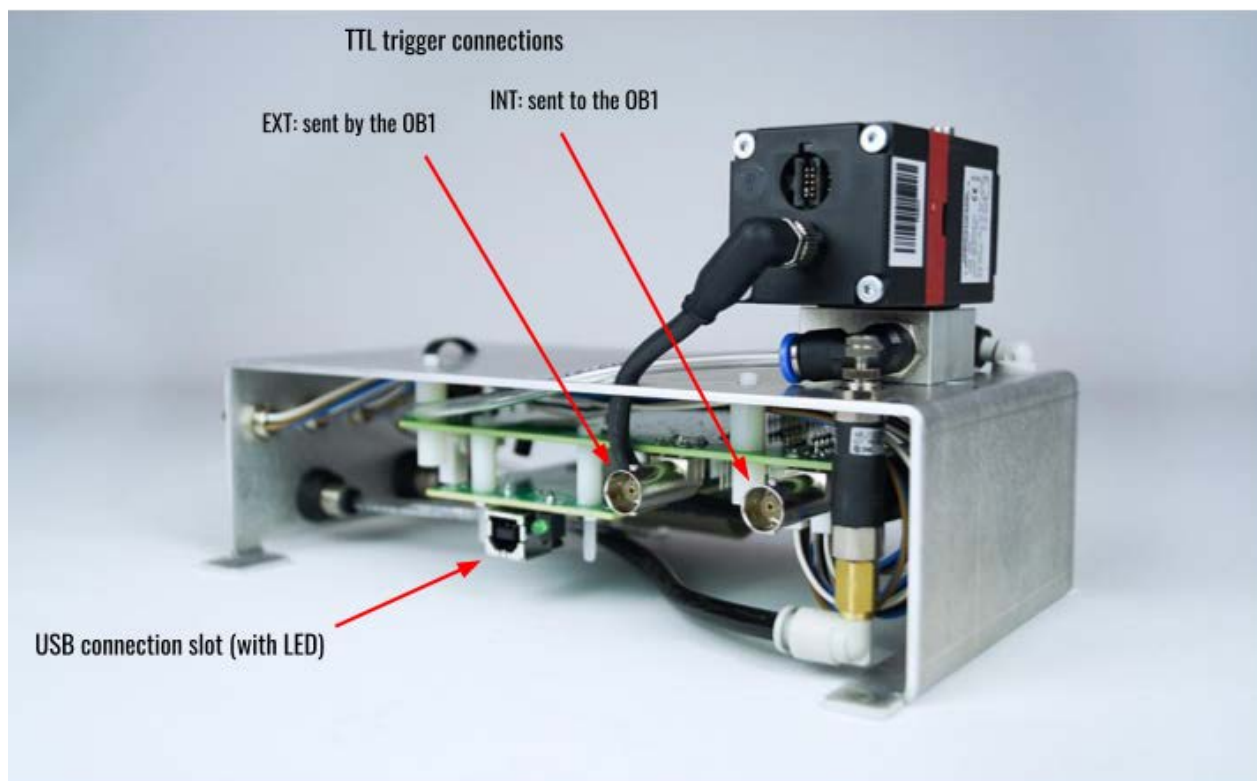


Fig 2. A side view of the OB1 OEM pressure controller.

On the side of the instrument, the following elements could be found:

- 2 TTL connections (triggers):
 - INT trigger: for signals sent to the OB1
 - EXT trigger: for signals sent by the OB1

These two functions can be reached and used in the ESI sequencer. For more information, refer to the ESI User Guide.

- The USB connection (a green LED is turned on once the communication is established between the computer and the OB1).

Product package contents

Before setting up your OB1, please check the package contents to make sure that you received all the items below:

Each OB1 pressure controller includes the following:

- OB1 Base MKIII+
- OB1 MKIII+ channels (Depends on the chosen configuration)
- Elveflow power supply unit (if requested) and USB cable
- Particle/humidity filter
- Elveflow Smart Interface software ESI in the USB, or [downloaded from Elveflow](https://support.elveflow.com/support/home).
- 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.

3. Required material checking

OB1 pressure requirements

OB1 positive pressure channels require having a pressure source with the following specifications met and maintained:

- 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 a compressor but can also be used with gas cylinders. Anytime the OB1 is used, including during calibration, the pressure source should be turned ON at a pressure value between 1.5 and 10 bar, and at least equal-to or above the OB1 channel top range. For a 2000 mbar pressure channel, the pressure source should deliver at least 2.5 bar.



- Pressure Source should be set between 1.5 and 8 bar,

Minimum computer requirements

The instructions presented in the present document are based on the features proposed by the ESI V3.04.00 software and its latest versions, so it should be made sure that the ESI software is up to date before going through with the proposed solutions (see the ESI download link below).

The minimum computer configuration requirements are:

- Window 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](https://support.elveflow.com/support/home).
2. Open the Elveflow® folder
3. Locate the ESI software zip file (e.g. ESI_V3_04_01.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 prompted, restart your computer to finish the installation process



- Be sure your ESI version is up to date before implementing the solutions displayed 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.



The latest version of the Elveflow® Smart Interface can be downloaded 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 that you always have an accessible version to work with, 24/7.



5. OB1 pressure controller installation

Start with a simple setup

Starting with a simple and easy setup is recommended to master the installation steps, then 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 (4mm OD - 2.7mm 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 resistance ID marked on it (e.g. 65µm, 100µm, etc...)
- A microchip
- A waste reservoir (trash)
- 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:

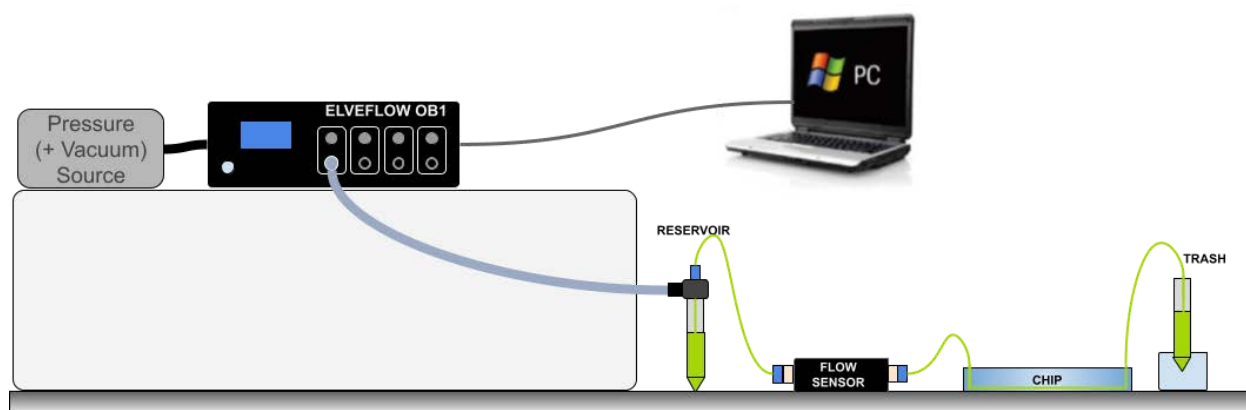


Fig 3. An example of a simple setup with which we advise to start.



Expert tips:

- To minimize the risk of a backflow, the OB1 should be positioned higher or at least at the same level as the other elements.
- The flow sensor should be laid flat on the setup bench
- The dip tube of your trash should be immersed into the liquid. Avoid drops dripping into the trash, this may cause flow instabilities.

Connect the OB1 OEM to the pressure source.

General information

The OB1 technical specifications might change depending on your system. As a general example, the OB1 is described as a four-channel controller, however, your controller might have 1,2,3 or 4 pressure outputs. The air dryer should be mounted vertically, with the drain plug at the bottom, and the side arrow of the cap oriented towards the OB1.

The compressor discussed below is the device provided by Elveflow. If you're using a different equipment, please refer to the manufacturer's instructions.

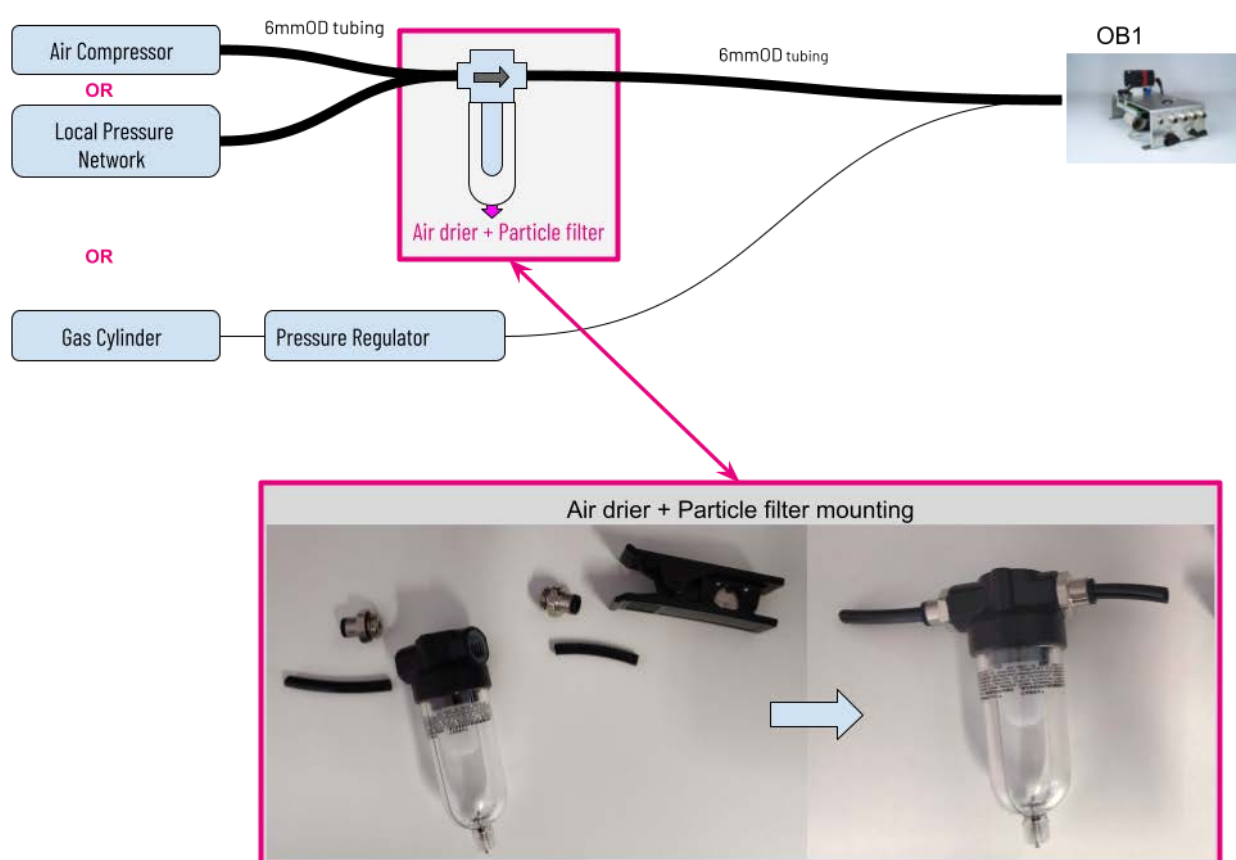


Fig 4. Suggested Pressure Source scheme



As a general rule, feel free to adjust the fitting's tightness using Teflon thread seal tape to prevent leaking.



Connect the pressure pump to the quick connect pressure, indicated by “Pressure Inlet” at the back of the OB1 device (fig 5) using 6mm OD pneumatic tubing.

To connect any 6 mm OD tubing to the OB1, just insert the tube in the pressure connector (Fig 6). To disconnect the pressure inlet, ensure that the pressure source is turned off and the tubing is purged to the atmospheric pressure), then, push the grey ring and pull tubing.



Fig 5. OB1 quick connect fittings

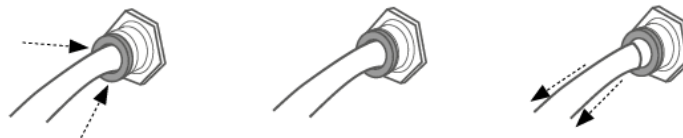


Fig 6. How to disconnect OB1 quick connect fittings

Please note that the OB1 high-pressure outlet (e.g. 8 bar outlet) also uses these quick connect fittings and requires pressing the outer ring while pulling out the element to disconnect (tubing, or plug).



The following steps describe how to set and connect a compressor to an OB1.
If you're using a gas cylinder, you can go directly to the step: [OB1 installation](#).



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 because 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).

Compressor installation details

If the Jun-Air compressor is used, details and preventive maintenance service instructions could be found in the datasheet "Jun-Air 3-4 Pressure Pump User Manual" provided with the Elveflow Documentation.

The output filters and the toggle switch (fig 7) should be installed to connect to the OB1 with the 6mm pneumatic black tubing. It is not mandatory to mount the 2 filters in series (Fig. 8A) with the 6mm OD tube, as using the 5µm filter is enough (Fig. 8 B).



Fig 7. Toggle switch



Fig 8 A. Optional compressor output mounting
(5µm + 0.01 µm filter)

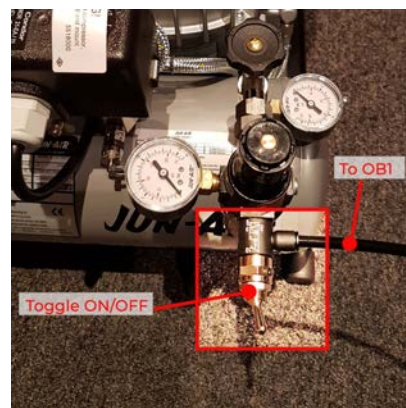


Fig 8 B. Regular compressor output mounting

Setting the compressor pressure output value between 1.5 to 8 bar (any OB1)

The filter cap allows you to set the output pressure (you can set this to 2 bar for example working with 200mbar channels, in any case, you have to adjust 1.5 bar minimum).

Once the valve is open (fig 9.1), the compressor is connected to OB1 and running, the tank must fill and then stop when filled. You can then pull the cap upwards (fig 9.2) to be able to turn it and adjust the output value (fig 9.3) . Then re-position it in the low position to secure it (fig 9.4).

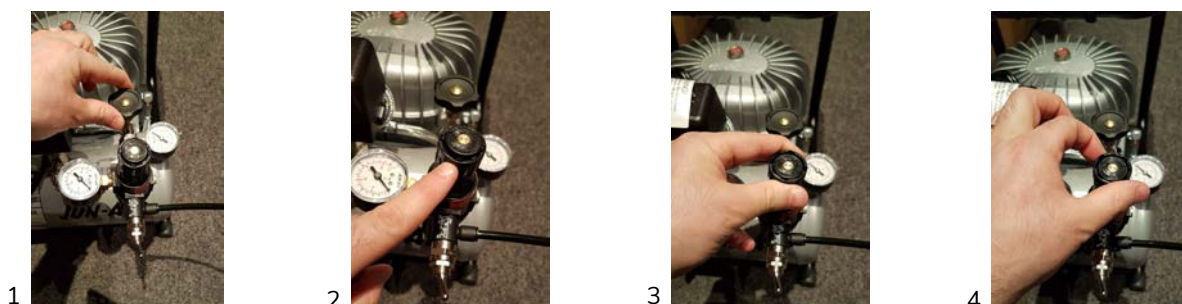


Fig 9 . Setting the Jun-Air compressor pressure pump output value

Setting the compressor output pressure for OB1 8 bar channels

By removing the pressure switch cover (Compressor Off), you will be able to access the screw "A" (see the figure 10 below). The maximum pressure of the compressor could be then adjusted by turning (screwing/unscrewing) this element. 4 to 5 turns are recommended to reach a maximum pressure ranging between 8 and 10 Bar.

The difference between the maximum and minimum pressure values provided by the compressor (2 Bar minimum) could be controlled using screw "B" (Fig.10).

Also to ensure good compressor performance, you need to replace the red cap on the air intake tube with the [intake filter](#). 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.

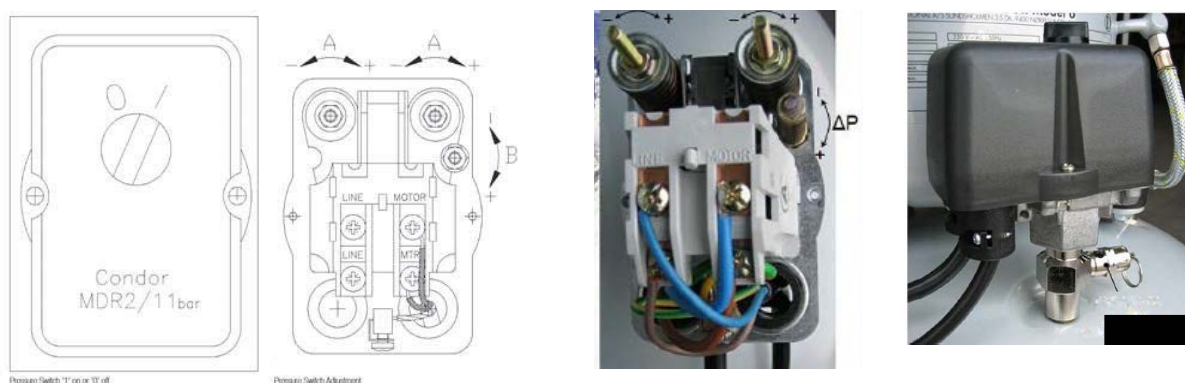


Fig 10 . Setting pressure output value between 8 to 10bar maximum

OB1 installation



Pictures shown below in the examples are from a regular OB1, but use of OB1 and OB1 OEM are similar.

General information

The OB1 pressure channels can have 2 types of connections:

- **Luer Lock** for low pressure channels i.e. 0 to 200 mbar, 0 to 2000 mbar, and -900 to 1000 mbar,
- and **Push-to-connect** for high pressure channels, i.e. -900 to 6000 mbar and 0 to 8000 mbar.
- Other connections could be installed on demand for particular uses.

For an easy set up of the OB1 pressure controller, the following steps should be followed:

- For the low pressure channels: connect the pressure outlets (on the front of the OB1) to the sample reservoirs using a male Luer-lock 3/32 OD barb fitting and flexible tubing (Fig. 13-1).
- For the high pressure channels: a 4 mm OD pneumatic push-to-connect tubing should be used to connect the pressure outlet (Fig. 13-2).

To disconnect a push-to-connect pressure fitting, press the outer ring while pulling the element to release (see steps 1 and 2 in Fig. 14). The same applies to the OB1 push-to-connect pressure inlets at the back of the OB1 and to the compressor push-to-connect fittings.

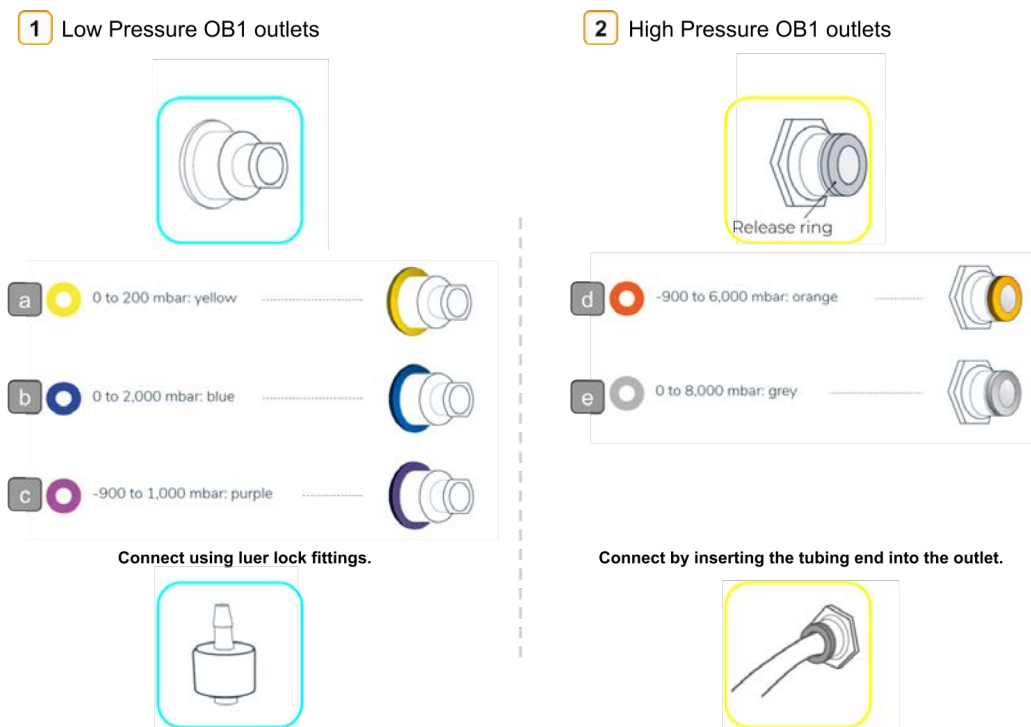


Fig 13. OB1 channels front outlet types and recommended connections.
Channels type **a**, **b**, and **e** are called "Positive channels", while channels type **c** and **d**, can work both with positive and negative pressures, and are called "Dual channels".

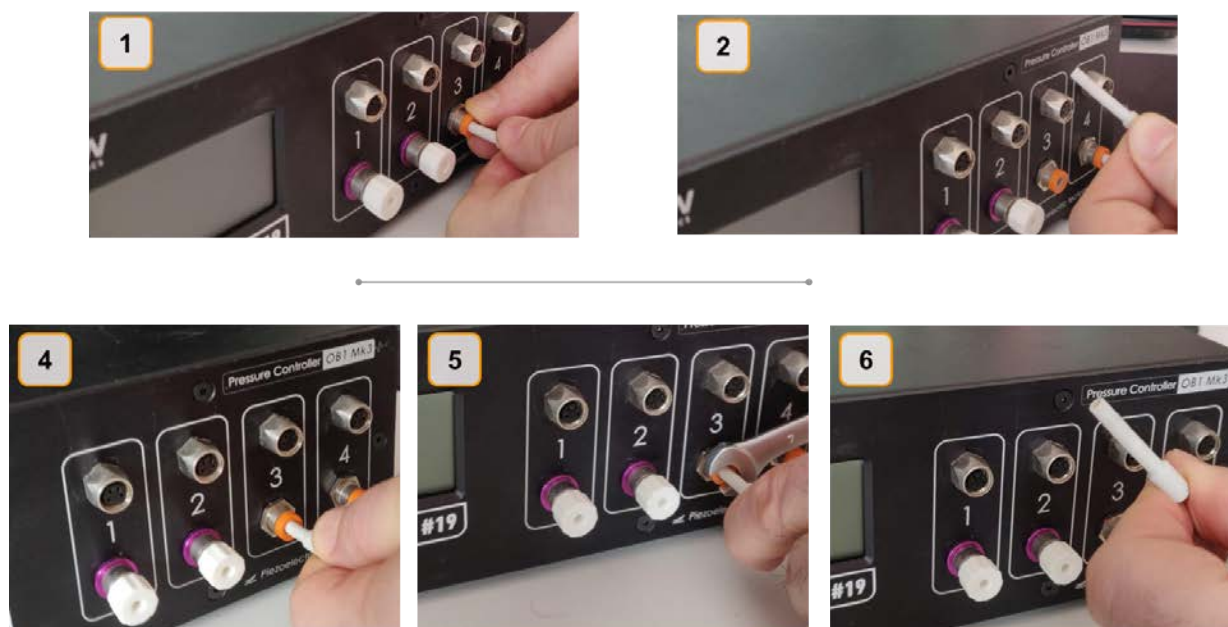


Fig 14. How to disconnect Push-to-connect High Pressure Outlets.



Do not try to disconnect push-to-connect fittings without pressing the fitting outer ring, this may damage the fitting. **If additional force is required**, you may use a flat wrench to press the outer ring and make the release easier (see 4, 5, 6 in Fig 14).

Installation of anti-backflow filters

Each OB1 pressure outlet should be equipped with a filter to prevent the accidental insertion of liquids in the instruments due to backflows. The figure below illustrates our recommended filter installation on both Luer Lock Low-Pressure Outlets and Push-to-connect High-Pressure Outlets using 4mm OD pneumatic tubing.

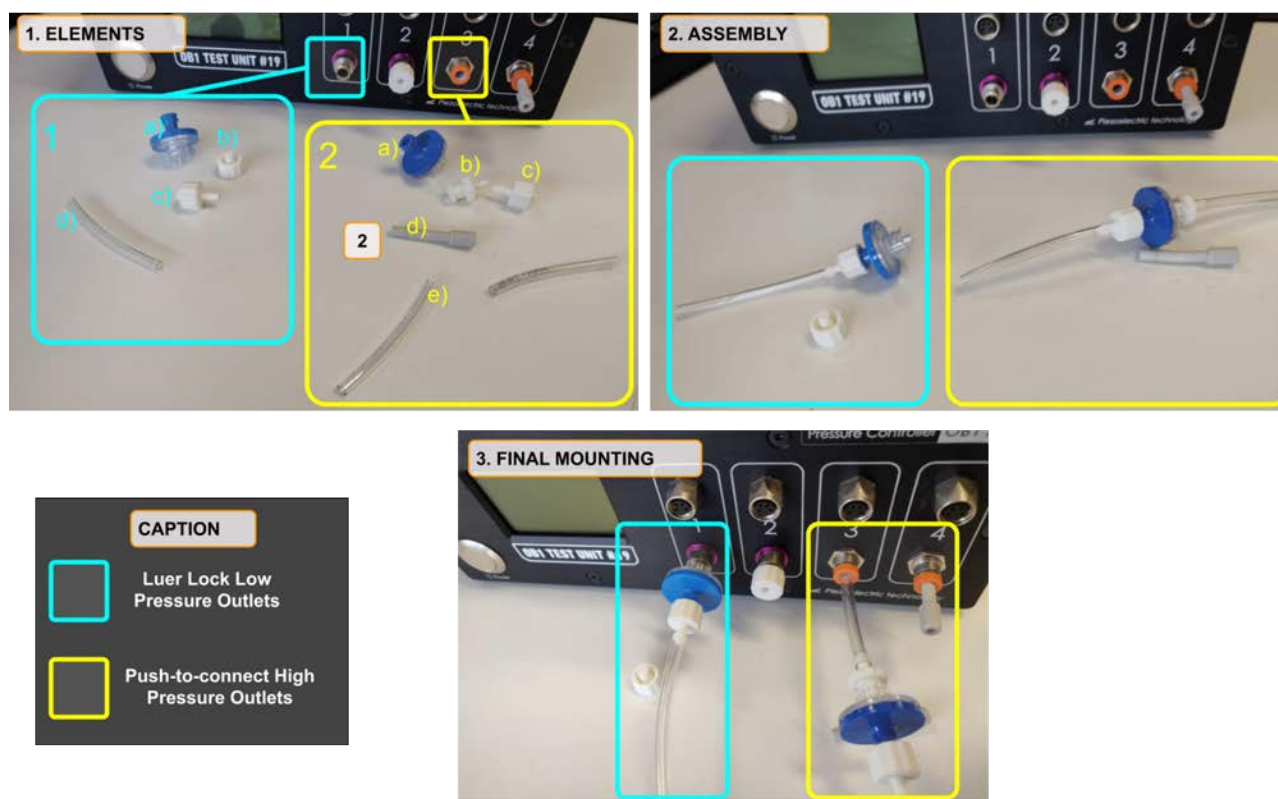


Fig 15. Anti backflow filter installation on Luer Lock Low-Pressure Outlets and Push-to-connect High-Pressure Outlets

- 1.a: hydrophobic filter, 0,2 μ female luer lock / male luer lock
- 1.b: Male Luer Integral Lock Ring Plug, Closed at Luer Tip
- 1.c: Male Luer Integral Lock Ring to Barb, 3/32" (2.4 mm) ID Tubing
- 1.d: Pneumatic tubing 4mm outer diameter, 2.4 mm inner diameter.

- 2.a: hydrophobic filter, 0,2 μ female luer lock / male luer lock
- 2.b: Female Luer Thread to Barb, 3/32" (2.4 mm) ID Tubing
- 2.c: Male Luer Integral Lock Ring to Barb, 3/32" (2.4 mm) ID Tubing
- 2.d: Push In Plug 4mm
- 2.e: Pneumatic tubing 4mm outer diameter, 2.4 mm inner diameter.



OB1 internal pressure regulators are sensitive to dust and corrosion, usually caused by backflow accidents. Damages caused by backflows are not covered by warranty.

Computer and Power supply connection

Connect the instrument to the computer using the USB cable. Once the USB cable is connected, the LED turns on. Then plug the provided power adapter to the instrument ("24 V DC" marking), and plug the adapter to an electric plug (country plug adapters provided).

OB1 addition in the ESI software

In order to add an OB1 that is not already recognized by the software, click on the ADD INSTRUMENT button.

In the New Instrument window, select the Instrument type and give it a Name. Allowed characters are letters from A to Z (both upper and 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.

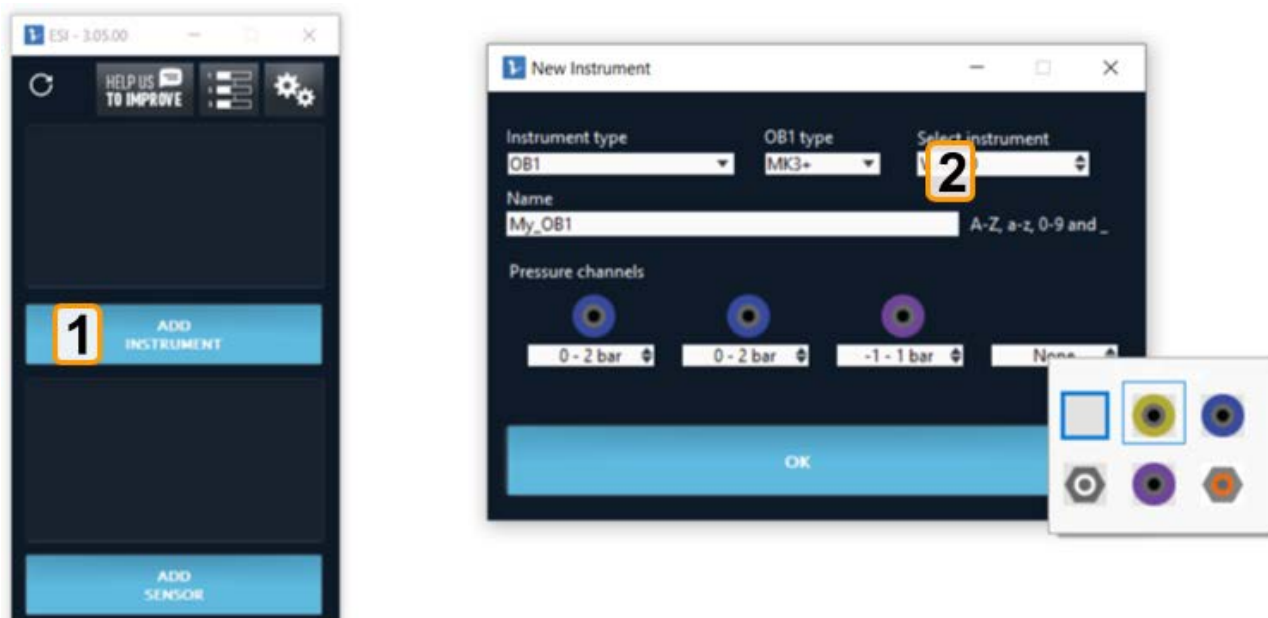


Fig 16. Adding an OB1 in the ESI software.

Once the OB1 is named, select the channel configuration according to the channels installed in your device:

- Select the Pressure range for each channel: 200 mbar, 2 bar, 8 bar, -1 to 1 bar, or -1 to 6 bar.



Fig 17. Select the OB1 channels in ESI.

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

Selecting a wrong OB1 channel type at this stage (e.g. 0-200 mbar instead of a 0-2000 mbar channel) will not allow an effective use of the OB1 device. To fix this, the OB1 should be deleted from the interface (click the “delete” red button in the ESI OB1 settings tabs) and then re-add it following the previously mentioned steps.

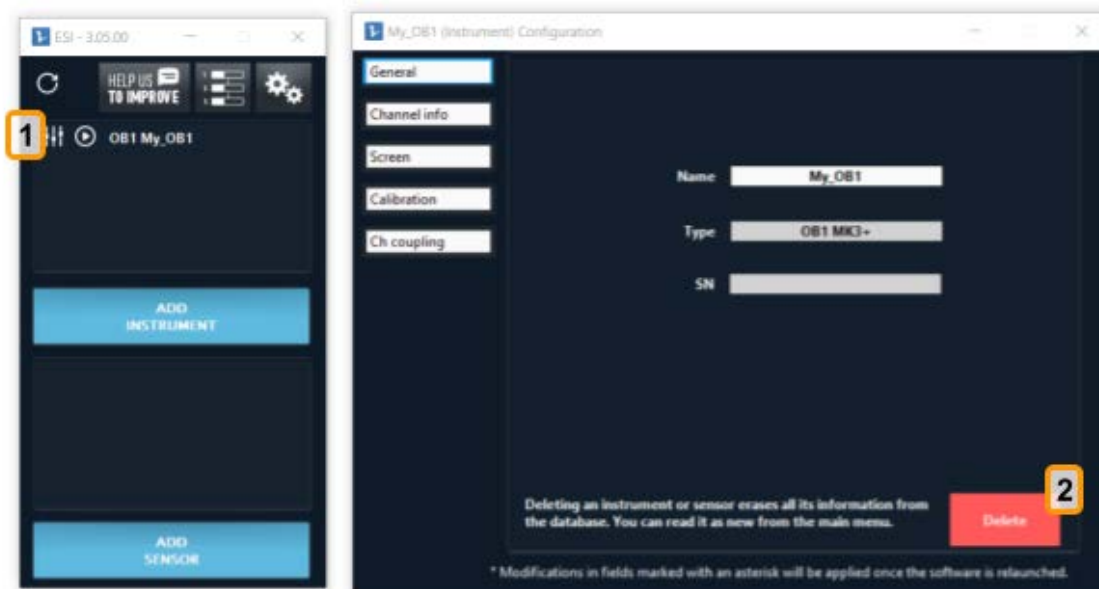


Fig 18. Removing a device from the list.



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

OB1 calibration in the ESI software

Open the instrument settings window and select the calibration tab. The third line indicates the current calibration in use (either default calibration or previously made calibration). Once all the pressure outlets have been closed (see Fig 19 below), press “Start Calibration”. This process takes a few minutes. A detailed description of all the available settings could be found in the ESI User Guide.

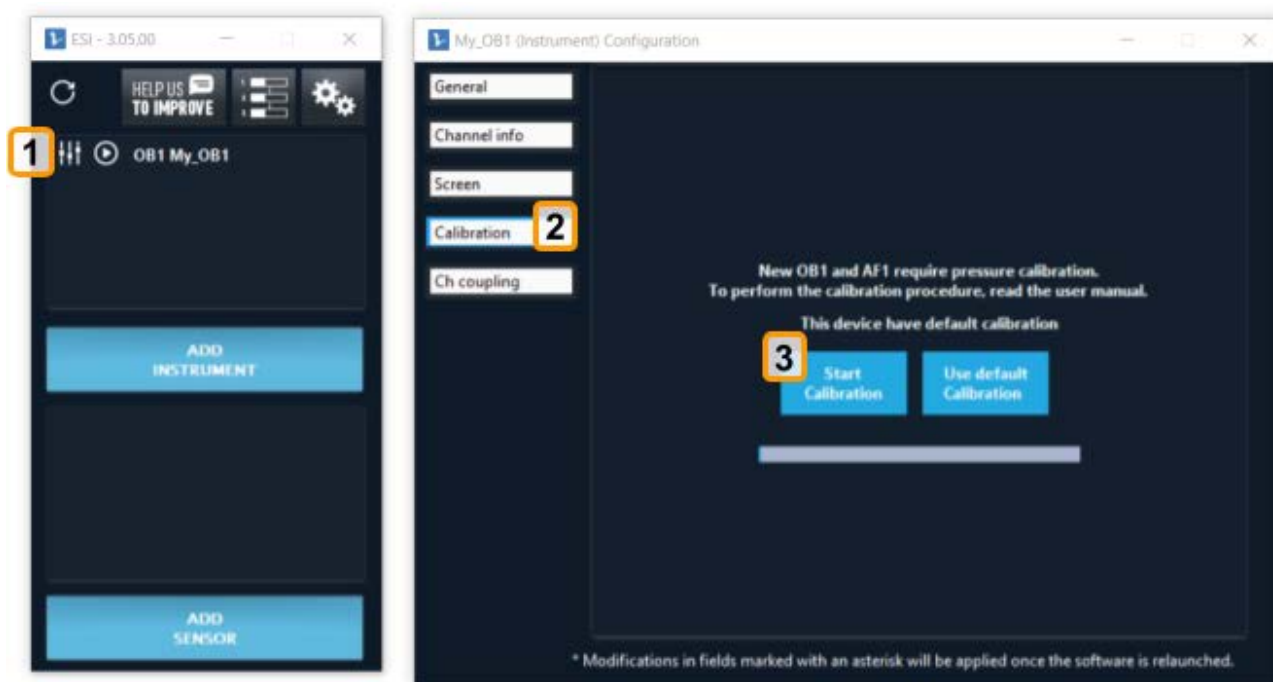


Fig 19. Quick and easy calibration of OB1 is essential prior to use.



Fig 20. OB1 pressure outlets plug for low-pressure channels (a) and high-pressure channels (b)



Close the OB1 outlets during calibration. During the OB1 calibration, all pressure outlets should be closed with the appropriate Luer Lock or Push-in fittings, with no sensor connected.



Calibration is recommended:

- When the instrument is connected to a computer for the first time.
- Any time a difference between the requested value and the measured value is observed. A few mbar difference is considered acceptable depending on the technical specifications of the OB1 channels.

6. Connection of additional elements

Connection of Reservoirs

The Elveflow® reservoirs connection instructions are covered by a specific guide (see the [user guide dedicated to reservoir connection](#)). Please refer to this guide for a detailed description.

The following fittings could be used to connect the reservoirs to the microfluidic setup:

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

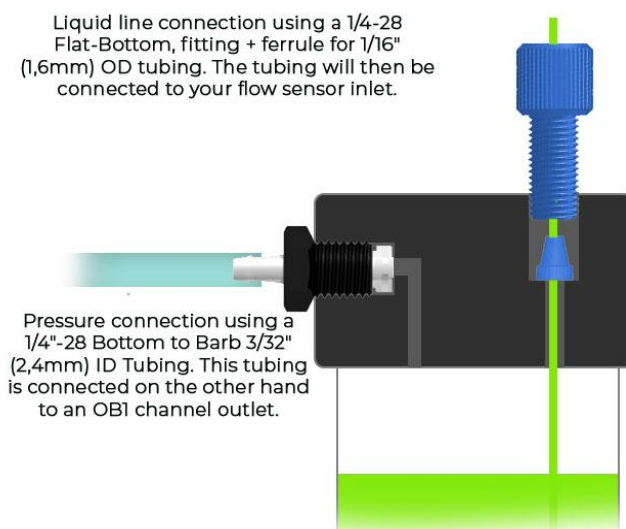


Fig 21. Fittings and tubings generally used to connect Elveflow reservoirs



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

Connection of Flow Sensors

The connection of the MFS flow sensor will be discussed in this section. If another sensor is used (e.g. BFS), please refer to the appropriate user guide. We also advise reading the MFS user guide.

The MFS4 and MFS5 sensors could be directly connected to the system using the blue 1/4-28 fittings for 1/16" OD tubing. For a flow sensor with UNF 6-40 connectors (i.e. MFS1, MFS2, and MFS3), first, screw the UNF 6-40 – 1/4"-28 adapter to the flow sensor, then screw the flangeless nut to the adapter.

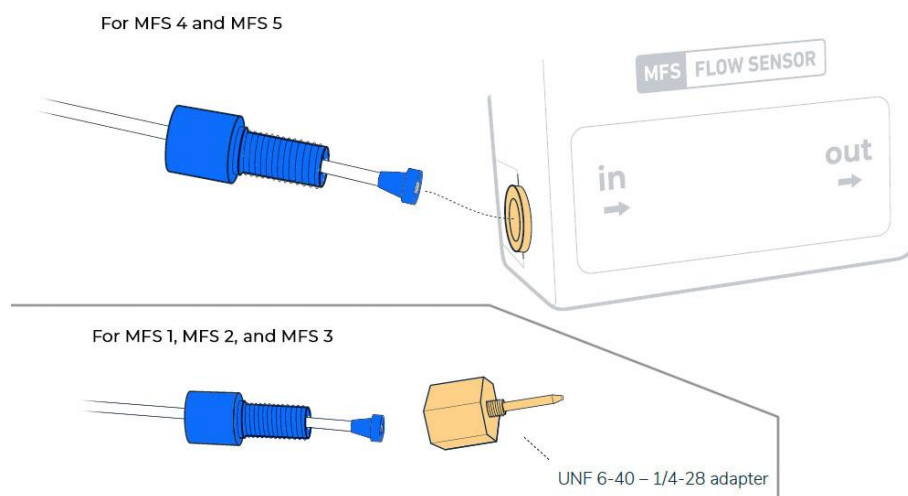


Fig 22. MFS sensors connection to the flow path

MFS connection tubing ID recommendations

For better measurement performance and accuracy, we recommend using tubing with internal diameter (ID) matching or higher than the ID of the MFS used. This is particularly critical for the MFS 5 (ID=1.8 mm).

Recommendations: 25 µm for the MFS 1; 150 µm for the MFS 2; 430 µm for the MFS 3; 1 mm for the MFS 4 ; 2 mm ID for the MFS 5.

Failure to meet this recommendation could negatively impact your flow control performance.

If you're having difficulties finding the right tubing for your sensor, contact us at customer@elveflow.com.

MFS sensor compatibility.

The digital version of the MFS sensor is only compatible with the OB1 version Mk3+ and above, while the analog version of the MFS sensor is compatible with all OB1 versions.

It is possible to upgrade the electronics of the OB1 old versions. For more information contact Elveflow Customer Support for details (customer@elveflow.com)

7. Flow Control Tuning

Detailed instructions on flow control regulation are covered in the MFS User Guide, and the Flow Control Guidelines.



Additional information is available from Elveflow Customer Support. For more information, contact us at customer@elveflow.com

8. Preventive maintenance

Pressure source maintenance

The compressor is a very reliable device that can last many years when correctly handled, serviced, and periodically inspected in accordance with the manufacturer's instructions.



A detailed compressor user guide (original manufacturer's guide) is provided. For optimum use, it is recommended to read it and to follow the instructions of the manufacturer.

The compressor filters (5µm and 0.01µm, if applicable, see Fig 18.1 below) should be checked regularly and replaced at least once a year.

A yellow-ish liquid leak could be a sign of a compressor oil leak.

Depending on the leak position, the following steps could be followed:



Fig 18. Compressor maintenance

- A leak could be expected at the filter outlets (Fig. 18.1) which is the result of the automatic filter purge. This should not be an issue, and a pipe could be connected to channel the condensate drain to a container. If the leak is located at the connections between the filters (Fig 18.2), [Teflon thread seal tape](#), should be used to secure the connection.



Additional information is available at the [Elveflow Customer Support](#). A dedicated compressor maintenance offer is available. For more information, contact us at customer@elveflow.com.

- Bleeding the compressor tank can also help if leaks are seen because if the tank fills with water over time (due to condensed air humidity accumulating), the filters will necessarily receive more water (water + oil) and will evacuate more of this mixture through the filter drains. The tank is purged by turning the purge valve (Fig 18.3). During the purging process, a mixture of air, water, and oil would be evacuated. It is recommended to connect a pipe and a waste container to the purging valve and to avoid standing near to the compressor during this process. The purging process is completed when no more liquids are coming out of the purging valve.
- A monthly check of the oil level of the compressor is recommended. At optimum conditions, the oil level should be at $\frac{3}{4}$ of the total volume. This oil could be purchased directly from the manufacturer. Feel free to contact us for more details.



Although the compressor maintenance is a safe operation, it is recommended to use personal protective equipment during this operation (mask, glasses, gloves, and lab coat).

OB1 controller maintenance

The air cleaner filter connected to the pressure inlet of the OB1 (see Fig 19.1 below) should be checked regularly to manually drain the condensate water by pressing the button located at the bottom of the filter if required. This element should be replaced at least once a year.

The Backflow filters connected on the output pressure of the OB1 (see Fig 19.2 below) should be replaced at least once a year.

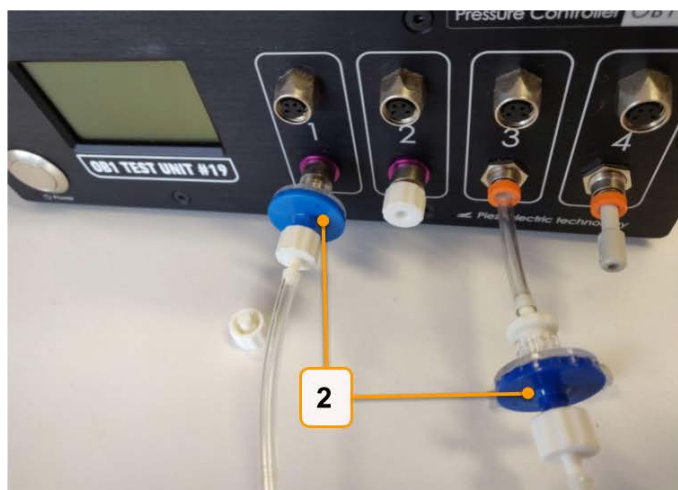


Fig 19. OB1 maintenance



Additional information is available at the [Elveflow Customer Support](https://support.elveflow.com/support/home). For more information on our OB1 maintenance offer, please contact customer@elveflow.com.

About using gas cylinders (N₂, CO₂, etc...)

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

10. OB1 Troubleshooting Guide

The purpose of this section is to help Elveflow users to troubleshoot, diagnose, and resolve OB1-related issues effectively. Before contacting our customer support team, it is recommended to go through the present user guide to provide us with a clear description of the OB1-related issue.

General recommendation

Before any diagnosis, please make sure that:

- The OB1 is powered, turned on, and connected via the USB cable.
- The pressure source is well connected to the OB1. Please check that the compressor is turned ON and connected to the appropriate inlet in the front panel of your OB1.
- The pressure source matches the OB1 channels requirements.

Is the OB1 recognized by the ESI software?

If not, please check the following:

- Try to reset the instrument using the front panel button (POWER).
- Launch NI-MAX, by typing NI MAX in the Windows menu and clicking on NI MAX software. It is recommended to send a screenshot of the window listing the connected devices with the rest of the information to the Elveflow support team.

Is it a calibration issue (pressure is too low, cannot reach min pressure)?

If yes, please check the following:

- The connection between the pressure source and the OB1: the pump must be connected, open, and turned on.
- The channel output plugs are screwed correctly when calibration is running.
- If the pressure source specifications match the OB1 channels requirements..

Can you reach maximum pressure?

If not, check the following:

- Did you get any liquid backflow? Check if you have any liquid that came back from the reservoir through the pressure tube and went to the channel pressure output. If it is the case, the OB1 may be damaged and may need to be repaired.
- Please adapt the input pressure source (back of the OB1, max pressure 10 bar) so that it delivers more pressure than the OB1 channel maximum pressure. Do not exceed 10 bar input pressure to prevent damaging the OB1 internal components.

Is your OB1 noisy?

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

- If there is no leak in your microfluidic setup (pressure tubing from OB1 to the reservoir, reservoir pressure, and liquid connections)
- That plugs are screwed correctly on each OB1 outlet before calibration and during your experiment.
- If a hissing noise is generated from the OB1, then please close the channel outlets with a plug and apply sudden pressure switches using for example the square function of the OB1. In this case, use the channel range

as extreme values of this function for at least 30 seconds (e.g. 0 to 2000 mbar if using a 2 bar channel), using a short period such as 1 second for example.

Is your OB1 giving random pressure values, not responding correctly to pressure setpoint, or seems to be very unstable?

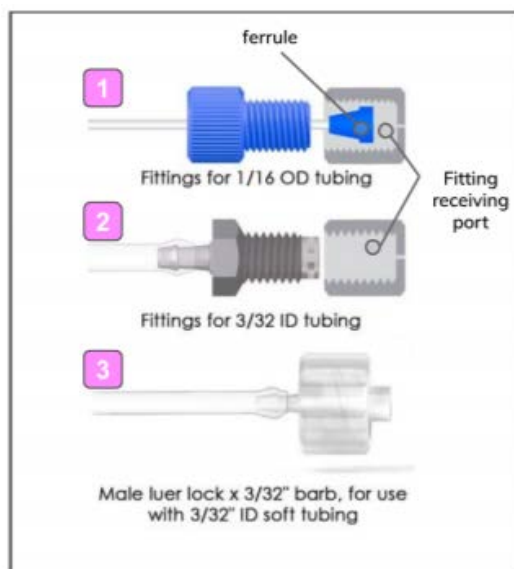
If yes, check the following:

- If you are using digital flow sensors, make sure that you have no digital flow sensor that is physically disconnected from your OB1 but still present in the list of sensors in the ESI. If it is the case, please remove from ESI any digital flow sensors that are not physically connected to the OB1.
- Update your ESI software version.

Did you disconnect any Digital Flow Sensor?

If you are using digital flow sensors, make sure that you have no digital flow sensor that is physically disconnected from your OB1, but still present in the software list of sensors in the ESI. If it is the case, please remove from ESI any digital flow sensors that are not physically connected to the OB1.

Fix an OB1 continuous noise, or a leak



The OB1 continuous noise can be disturbing. If at any moment, the OB1 makes a continuous noise, this is a certain sign that a leak is present in your system (that the OB1 is continuously trying to compensate).

Leaks 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 blue threaded fittings provided by Elveflow use a compression fitting.

Tubing is inserted into the end of the fitting and into 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's angled shape radially compresses the end of the ferrule onto the outer diameter of the tubing. It is this radial compression that creates the leak-tight seal between the fitting, ferrule, and tubing, and gives the compression fitting its name.

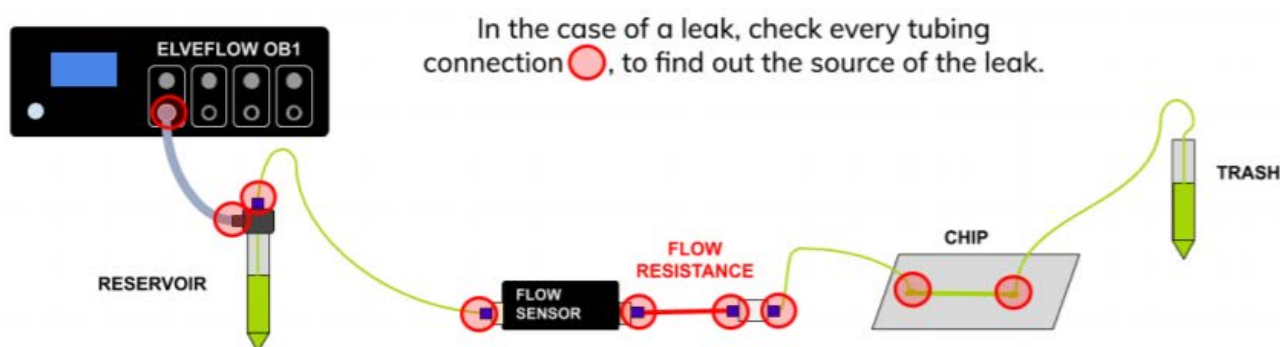
If you find a defective element, then it's a simple matter of replacing it, re-pressurizing your system, and going on your way. Unfortunately, not every leak is easily found, making it all the more

difficult to resolve a persistent problem. Here are some steps you can take to identify and fix a leak.

You may start from the OB1 front pressure outlet, then check every component, using the following method:

1. Close the connection right after the element you would like to check. Close it with either a plug (e.g. calibration plug), your fingers, or clamp the tubing if required. **You need to close the system right after the element you're about to check, to find out if it is defective.**
2. Apply a moderate pressure (e.g. 500mbar) pressure, check if any OB1 continuous noise can be heard.
3. Apply a 0mbar pressure, then:
 - a. If the noise was heard, replace the defective fitting. Usually, the small blue cone-like ferrule is the part that needs to be replaced, but it also happens that sometimes the fitting thread is damaged by ordinary handling (overtightening, bad installation) and needs to be replaced. Replace the defective element. Re-apply a 500mbar pressure and check for OB1 noise. No noise should be heard now.

- b. If no noise was heard, proceed to the next fitting check without removing the one that worked from your previous test, and do so on the entire pressure line and flow path, and, of course, on every OB1 channel until the leak is fixed.



Upgrading an OB1 and adding another channel to a unit.

It is possible to add any Positive or Dual (positive & negative pressure) channel on an existing OB1 chassis. This added channel can either replace an existing channel or be installed on a free slot.

The steps of an Elveflow Instrument Upgrade process

1. The User should contact Elveflow support to get a quote for this operation.
2. The User needs to fill & send back the spreadsheet file attached to send Elveflow the important information regarding this upgrade.
3. The User needs to fill & send back the contamination form so that Elveflow personnel can process your device.
4. The User needs to send back these documents to its Elveflow Sales contact person.
5. Elveflow will perform the upgrade of your instrument, upon receipt of a Purchase Order.
6. Elveflow will ship back the upgraded instrument to you.
7. The User needs to update the instrument in the ESI software to reflect the changes made in the instrument.



The installation, tuning, and testing of the new channel have to be performed by qualified Elveflow personnel. So to request such an upgrade, the first step is to send an email to an Elveflow Sales Representative at customer@elveflow.com, indicating your OB1 serial number (see on the back of your OB1), and detailing your current configuration, and the modification you would need.

When your instrument reaches the Elveflow offices, an inspection service will be performed.



If the upgrade request occurs within a 1 month delay following the purchase, the operation will be performed free of charge.

If the upgrade request occurs beyond a 1 month delay following the purchase, Elveflow will then send you a quote based on your needs.

The typical OB1 channel installation is a quick operation that will be followed by a performance test on a test rig, to ensure the upgraded OB1 meets Elveflow performance and quality standards.

The upgraded OB1 is then shipped back to the customer.

Refreshing your OB1 configuration in ESI, once your upgraded equipment is received.

Following the receipt of your modified instrument, it is important to change the OB1 configuration in the ESI software. Indeed you may have declared your OB1 as e.g. a 4x 200 mbar channel in the past, but you need ESI to reflect your upgraded OB1 configuration, e.g. 3x 200 mbar channel + 1x 2000 mbar channel.

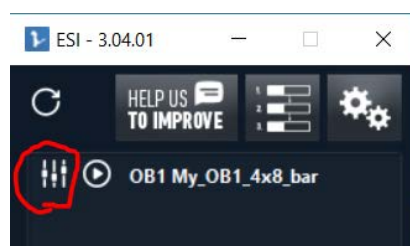
If you do not refresh your device configuration in ESI, you won't be able to use your new configuration.

Detection is not automatic, and new channel installation needs to be set in the software by the end-user.

You can just delete your OB1, shutdown and restart ESI, then re-add the OB1 in the ESI software.

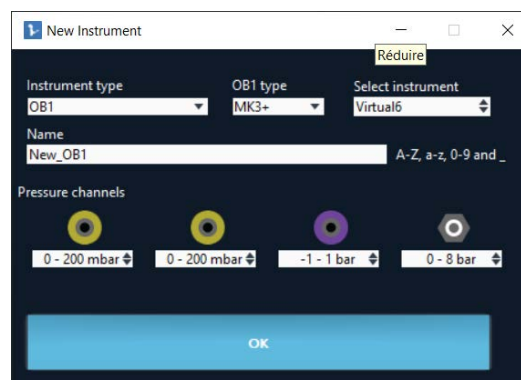
The steps required are below

1. Open the OB1 parameters



2. Delete your current OB1
3. Shutdown and restart ESI,
4. Re-add your OB1 accordingly

Your ESI initialization file will be updated.



11. Conclusion

Thank you for reading this guide!

You are now ready to use your Elveflow OB1 Pressure controller, and we wish you nothing but success!



As for every experiment, planification is key, and we recommend to plan and prepare each experiment in a careful, thorough manner before taking action - in a sort of 'measure twice, cut once' approach.



Important Reminder.

We advise reading this document and the ESI and MFS user guide carefully, and in full, before starting any experiment. Please contact customer@elveflow.com if you would like a copy of these documents.

12. Linked products



[Live Cell Perfusion Pack](#)

A liquid handling platform for cell-based experimentations



[OB1 MK3+ Pressure controller](#)

The most responsive and stable flow controller on the market



[Microfluidic Reservoirs](#)

microfluidic adapters for Eppendorf ©, falcon © tubes, or gl45 threaded glassware

13. Customer Support

You are welcome to browse through the Elveflow Support Portal accessible online anytime (<https://support.elveflow.com/support/solutions>). You can find lots of guidance on how to use our product line. It is most likely that the answers you're looking for are already here. In case there are still some questions and you'd like further clarification, please don't hesitate to let us know by email at customer@elveflow.com.



With critical context information readily at hand, Elveflow Support employees will be better prepared to help you.

The elements usually required are:

- the serial number of the Elveflow device(s) used (Sensors, Instrument)
- the ESI software initialization file located in C:\Users\Public\Documents\Elvesys\ESI\data. It is called either "ConfigESI.ini" or "ESI.ini", depending on your ESI version.
- the screenshots of the error messages received, if applicable.
- Some pictures, or movies of your setup and your issue. [WeTransfer](#) is perfect for easily sending us large files.

We are always happy to help ❤️