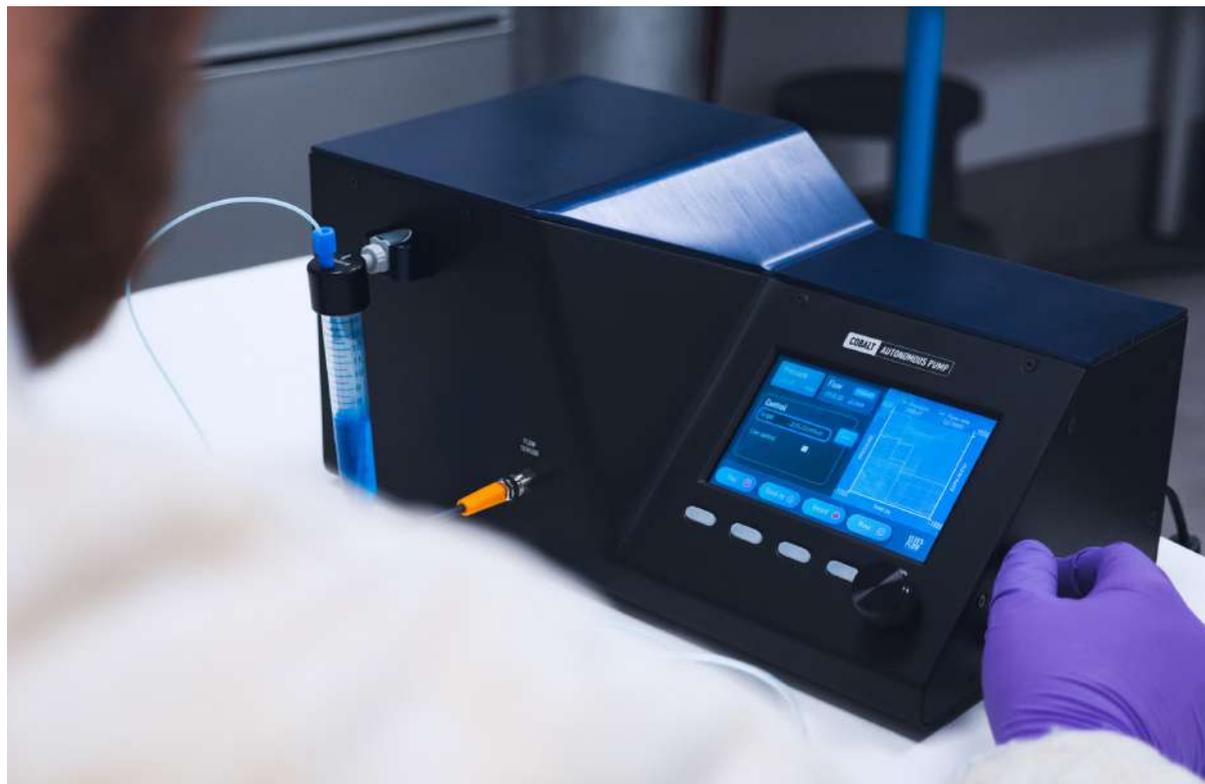


COBALT

AUTONOMOUS MICROFLUIDIC PUMP



User Guide

DOCUMENT REF : UGCOB-220428

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.



READ THIS MANUAL CAREFULLY BEFORE USING THE INSTRUMENT

This manual must be read by any person who is or will be responsible for using, maintaining or repairing the Cobalt Microfluidic Pump.

Due to the continual development of the product, the content of this manual may not correspond to the updated version of the product. Therefore, we retain the right to make alterations without prior notification.

Important Cobalt safety notices:

1. The Cobalt must be used in a clean and dry environment with up to 80% relative humidity.
2. The Cobalt requires a 24 V DC input voltage, so make sure you use the right power cord.
3. For both the user's and the instrument's safety, do not use the instrument in connection with substances that could emit toxic or corrosive fumes, such as acids or alkalis.
4. We advise plugging a back flow filter to the Cobalt outlet to prevent liquids or solids from entering the device. Neither liquids nor solids should get into the Cobalt.
5. Disconnect your sample reservoir from the instrument after each experiment to prevent backflow from the reservoir into the instrument.
6. Working with systems or equipment containing liquids or gases under pressure can entail risks, especially if containing corrosive, toxic, or explosive liquids (or even water).
7. Be aware that the reservoirs are not designed to withstand high pressure. Thus, Elvesys can not guarantee the integrity and strength of the provided reservoirs (for any type: Eppendorf, Falcon, glass, etc) beyond atmospheric pressure.
8. It is the user's responsibility to take the necessary precautions and wear protective equipment to minimize the risks and prevent damage by the use of any dangerous substances.

IF THESE CONDITIONS ARE NOT MET, THE USER MAY BE EXPOSED TO DANGEROUS SITUATIONS AND THE INSTRUMENT CAN UNDERGO PERMANENT DAMAGE. ELVESYS AND ITS PARTNERS CANNOT BE HELD RESPONSIBLE FOR ANY DAMAGE RELATED TO THE INCORRECT USE OF THE INSTRUMENTS.

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Introduction

The Elveflow® pressure control instruments are designed to generate stable and pulseless flow with a short response time for a wide variety of demanding microfluidic applications.

The Elveflow® Cobalt Autonomous Pump offers superior fluidic performances compared to microfluidic syringe or peristaltic pumps. It delivers the smoothest flow with the highest accuracy because no moving mechanical part is used in the pressure generation process.

The Elveflow® Cobalt instrument is an autonomous device containing a friendly user interface with an embedded software. Thus, it does not require a computer to run a set of typical microfluidic tasks. It is ready to use from the moment it is powered on.

Additionally, the Cobalt® computer software allows you to control advanced tasks - such as real-time creation, monitoring, and modifications of complex pressure and flow rate profiles (like sine, square, triangle, ramp, pulse, or sawtooth) - via computer using a USB connection.

Last but not least, the Elveflow® software also allows recording and exporting data generated by any Elveflow® instrument connected to your experiment.



Main Features & Benefits

- Portable Microfluidic Pump.
- Two pressure ranges available: 0 to 2000 mbar or -700 to 1000 mbar.
- Standalone Unit:
 - integrated and optimized pressure or vacuum source,
 - embedded software control.
- Two operating modes: pressure control or flow control.
- Automation through custom waveform design.

Principle

The pressure controller pressurizes a tank - such as an Eppendorf, a Falcon, or a bottle - containing the sample. The content from the tank is then smoothly and quasi-instantly injected into a microfluidic chip.

The tank is pressurized (resp. depressurized) relative to the atmospheric pressure via one port that is connected to the output of the pressure controller. The second port of the reservoir serves as the reservoir outlet (resp. inlet).

A tubing plunged into the liquid allows the liquid to go out (resp.. inside) of the reservoir once it is pressurized (resp. depressurized).

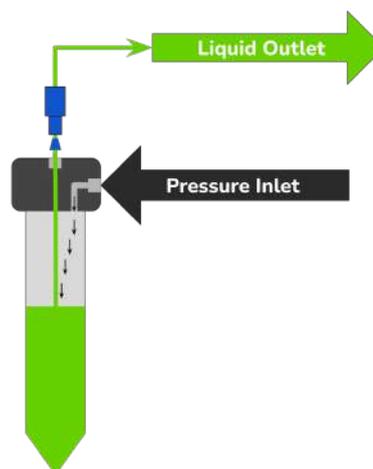


Figure: working principle of a two port pressurized reservoir.



Picture of a reservoir with a pressurized cap and pneumatic tubing.

Technical Specifications

Main specifications

The table summarizes the main specifications of the Cobalt controller. To guarantee quality & performance, all of our instruments are tested and calibrated independently (response time, stability, repeatability, etc) after being assembled, and all test results recorded.

	Cobalt	Cobalt DUAL
PNEUMATICS		
Type of pressure	Positive	Positive & negative
Pressure range (1)	0 to 2000 mbar (0 to 29 psi)	-700 to 1000 mbar (-10 to 14 psi)
Minimum pressure increment	Embedded software (1 mbar) Computer software (100 µbar)	
Pressure stability (2)	100 µbar	
Electronic response time	Embedded software: down to 10 ms Computer software: down to 100 ms (3)	
Settling time (4)	Down to 75 ms	Down to 105 ms
Pressure Source	No pressure source needed (integrated)	No pressure & vacuum source needed (integrated)
FLOW CONTROL		
Flow sensor compatibility	Possible to pair 1 flow sensor from the Elveflow MFS series (MFS2, 3, 4, 5)	
Flow rates (5)	MFS2: 0 to 7 µl/min MFS3: 0 to 80 µl/min MFS4: 0 to 1000 µl/min MFS5: 0 to 5000µl/min	
Minimum flow rate increment	Embedded software: 0.05µL/min to 1µL/min Computer software 0.01µL/min	
Flow sensor calibration	User-friendly automated sensor calibration module	
Liquid compatibility	Non contact Any aqueous or organic solvent, oil, or biological sample solution	

Non-contractual information may be changed without notice

- (1) Max pressure value might vary by +/- 2.5%.
- (2) Pressure stability (standard deviation) is measured over 60s, 1 minute after the setpoint is reached.
- (3) Depending on your computer's operating system.
- (4) Volume dependent – Measurement done on 12 mL reservoir for a set point from 100 to 200 mbar.
- (5) Indicative, please refer to the MFS documentation for detailed specifications.

	Cobalt	Cobalt DUAL
CONTROL & MONITORING		
User interfaces	Embedded software on Cobalt Cobalt computer software (Windows) on PC	
Cobalt computer software added functionalities	Custom profile: design, upload, download Recording data: download	
Record frequency range	Embedded software: 1-5-10Hz Computer software: 0-100Hz	
Maximum recording time	Embedded software: up to 6000 sec depending on recording frequency Computer software: unlimited	
OTHER		
Power consumption	36 W (100 V to 240 V - 50 Hz to 60 Hz)	
Case dimensions	328 x 235 x 168 mm (l x w x h)	
Weight	3.3 kg	4.1 kg
Output connectors	Quick Connect	

Non-contractual information may be changed without notice.

Instrument description

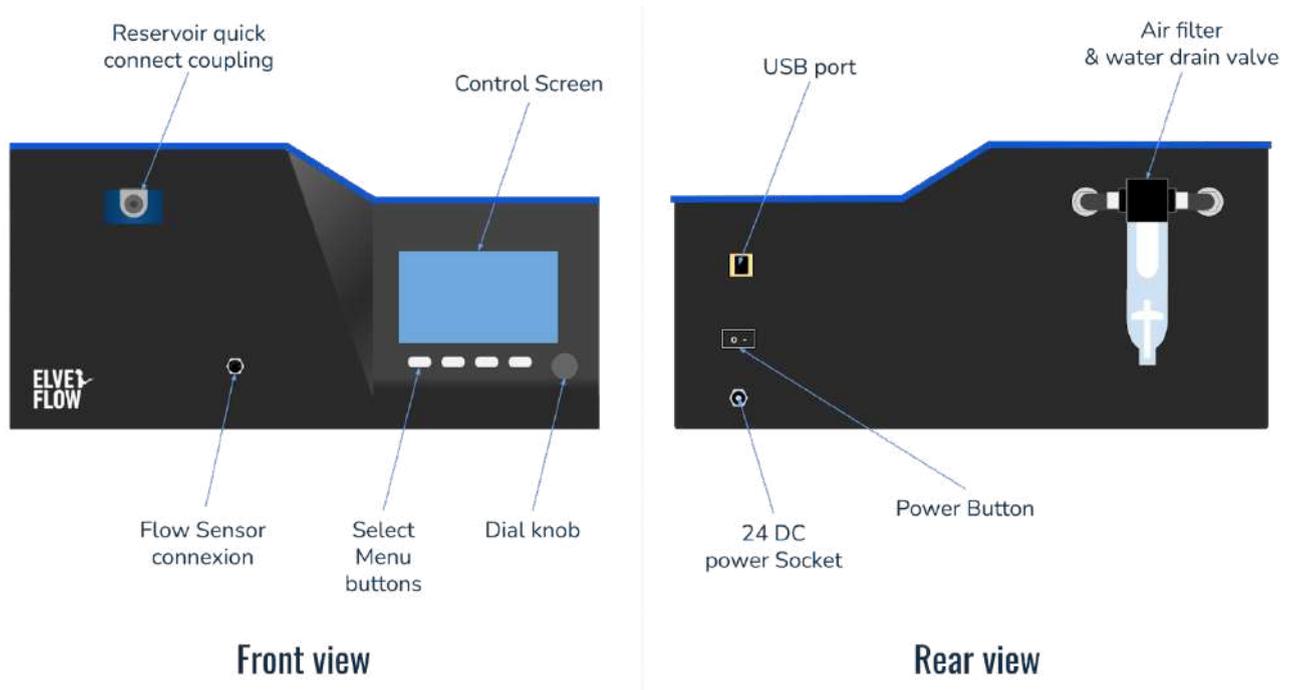


Figure: overview of the Cobalt autonomous pump.

About the water drain valve

The Cobalt unit pumps air into a tank where the air accumulates, increasing the pressure inside. Because the air is taken from the surroundings (known as “atmospheric air”), it contains water vapor. Once pressurized, water vapor condenses into water droplets and accumulates at the bottom of the drain. Failure to drain this moisture may lead to rust and degradation of the tank and other internal components of the Cobalt pump.

Thus, draining the Cobalt unit is a mandatory maintenance routine.

The good news is that the drain function makes draining moisture easy and quick.

You can access this function by:

- Standalone operation: access the drain via the “drain” function in the “Device settings”.
- Computer control operation: access the drain via the “drain” function in the “Maintenance” tab.



We advise checking regularly the amount of water collected into the drain.

We recommend purging the Cobalt pump as a maintenance procedure every 1-2 days of use.

When using the instrument all day long, a significant amount of water may accumulate and sit at the bottom of the filter. In this case, we advise draining it after every use.

If the Air filter fills up (water above the white plastic seal inside), contact your sales contact point immediately (and cc “contact@elveflow.com”) for rapid diagnosis and remote solution.

Product package contents

Before setting up your Cobalt, check the package contents to make sure you have received all the items below:

Cobalt unit and companion accessories

1. the Cobalt instrument;
2. a USB cable;
3. a power supply unit;
4. a USB flash drive containing the Elveflow® dedicated control software and the user guides;
5. a reservoir kit with its QuickConnect and pressurized cap;
6. a backflow filter.

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

Optional Accessories

You may have ordered some additional items such as:

- flow sensor units;
- additional reservoir kits;
- bubble removers;
- additional tubing.

Please check that you have received all the ordered components.



Helpful information. If any parts are missing or damaged, please get in touch with Elveflow support immediately through customer@elveflow.com.

Installation & Use

Setting up the Cobalt

The Cobalt unit has been designed to ease the installation of the fluidic setup. Hence, minimal plugs, fittings and tubings are required to quickly start using the system.

Electrical connections

A 24 DC power supply cable is provided with the system.

A USB cable must be connected to a computer to use the Cobalt computer software for advanced configuration. However, the unit can also be fully controlled using the Cobalt instrument embedded software.

Once the power supply is plugged, the installation can be completed by connecting the reservoirs using the QuickConnect plugs.

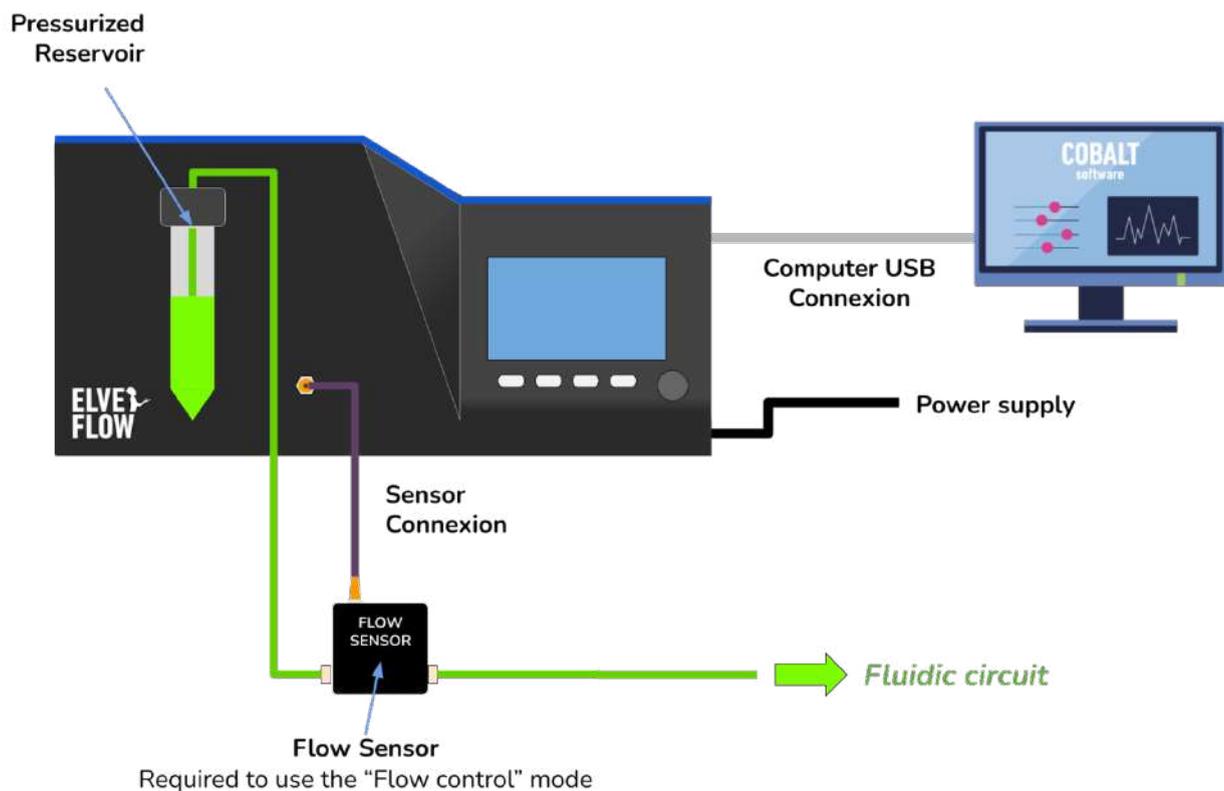


Figure: a typical Cobalt setup using the Cobalt unit - a reservoir, a computer, and a flow sensor.



Do not use an alternative power supply. This may lead to safety issues and system damage.
The water drain valve should remain connected to the rear face of the Cobalt at all times.

Pneumatic connections: Reservoirs & QuickConnect

Reservoir range

The Cobalt units are compatible with our reservoir kit series. Elveflow provides a wide range of autoclavable microfluidic adapters, allowing them to be used with different reservoir tubes (XS, 1.5mL; S, 15mL; M, 50mL; L, 100mL and 150mL) in microfluidic systems using standard 1/4"-28 to 1/16" OD fittings interfaced with the Cobalt units.



Quick Connect Fittings

Our reservoir kit series can be easily plugged to the Cobalt unit using QuickConnect fittings.



Backflow filters

We recommend using backflow filters to protect your equipment from water entering the Cobalt. These filters use a hydrophobic membrane to repel water from the surface and pores of the membrane, preventing water from getting inside your device. See how to connect the backflow filter at the end of this document (ppednix 1: Backflow filters).



Direct reservoir connection (XS, 1.5mL; S, 15mL; and M, 50mL reservoirs)

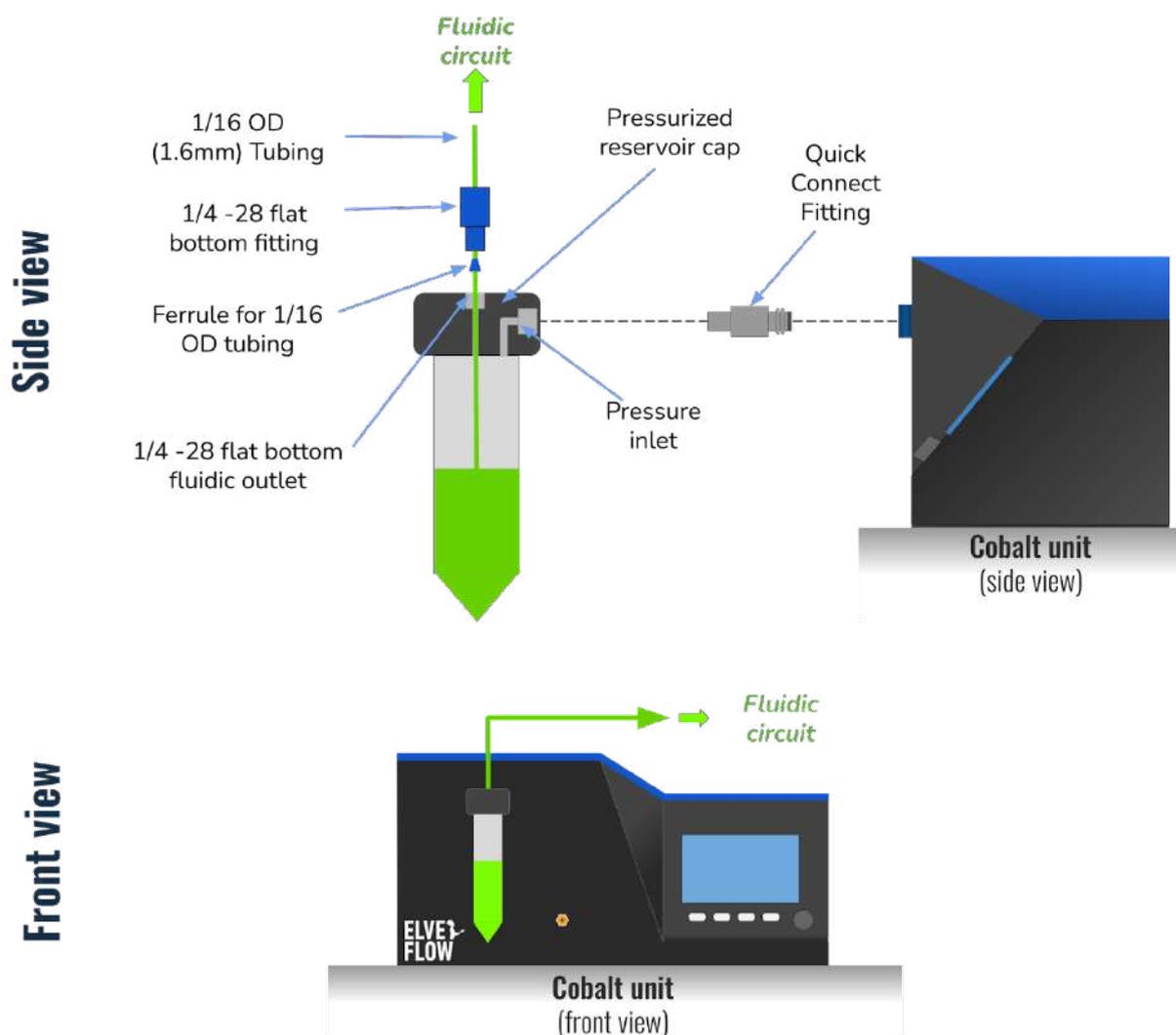


Figure: Direct connection of small reservoirs to the COBALT pump (XS, 1.5mL; S, 15mL; M, 50mL).

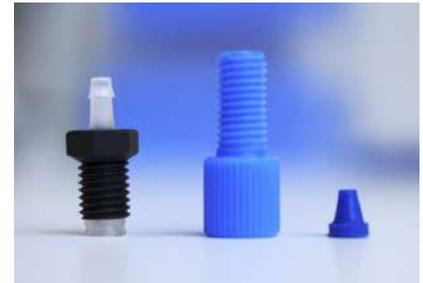


Deported 100mL reservoirs (L)

The standard laboratory 100 mL bottles are equipped with specific caps allowing for pressurization and flow control. To use these reservoirs with your Cobalt, place them on a flat surface under the pressure outlet (e.g. benchtop).

The Reservoir Kit shall be connected to the Cobalt unit using:

1. 1/16 OD (1.6mm) tubing
2. 1/4 -28 flat bottom fitting with ferrules for 1/16 OD (1.6mm) tubing
3. L cap for pressurized reservoir
4. Male Luer Integral Lock to 3/32" OD Barb
5. Pneumatic 4mm OD Tubing
6. 1/4"-28 Union, threaded
7. QuickConnect fitting



Deported reservoir connection (L, 100mL and 150mL reservoirs)

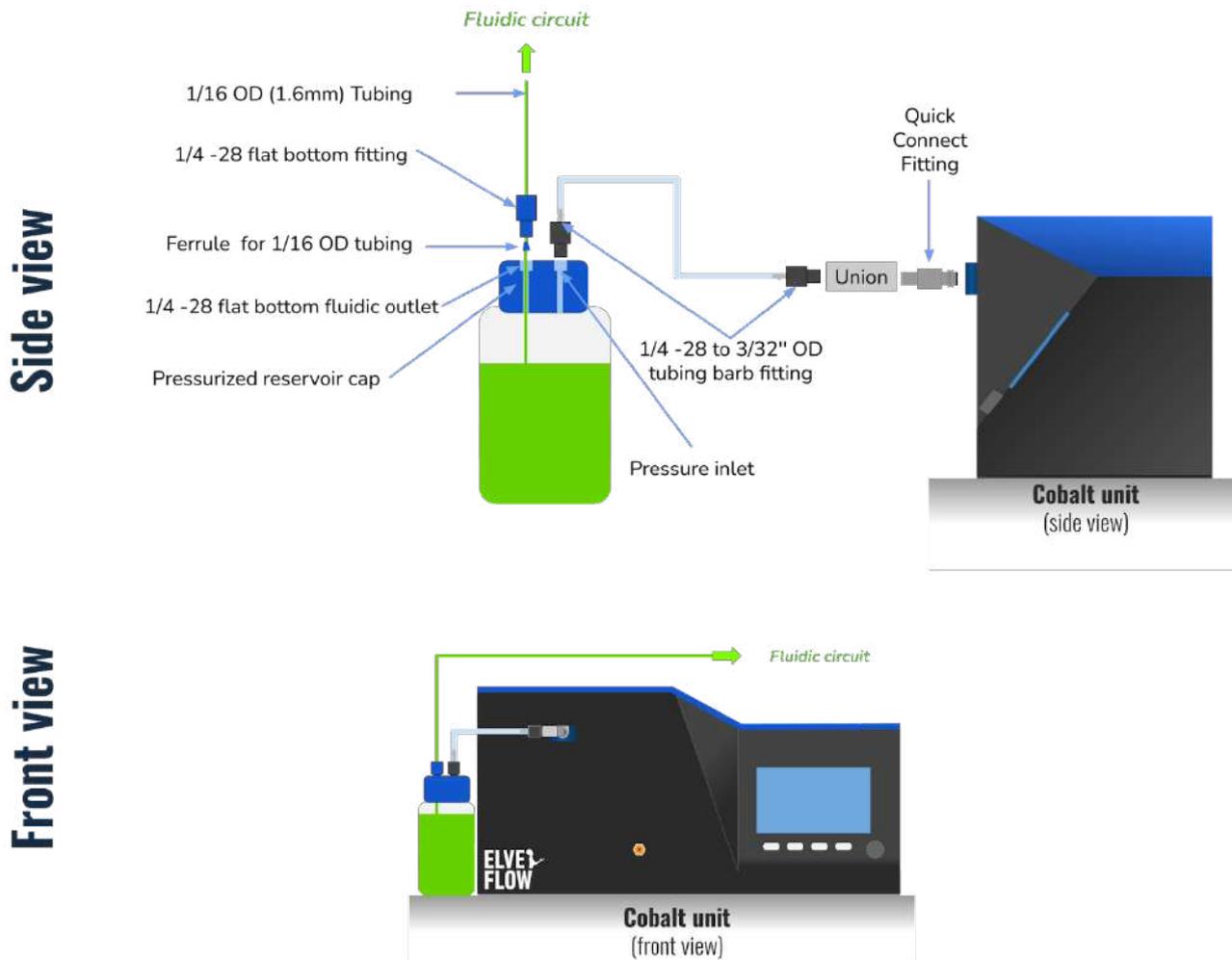


Figure: Deported connection of large reservoirs to the COBALT pump (L, 100mL and 150mL).

User Interfaces

The Cobalt is a standalone unit with its own embedded software. In addition to the simple and intuitive instrument software and interface, a computer software was developed to carry out additional functions.



Cobalt software refers to the software stored in the Cobalt unit and controlled by the Cobalt buttons and dial.

Cobalt computer software refers to the software installed on a computer and controlled via USB connection.

Cobalt Embedded Software

The Cobalt unit can be fully controlled through its embedded software. Whether you wish to control pressure or flow rate, it has never been so easy to monitor the parameters and fine tune your experiments.

The Cobalt embedded software has been simplified through:

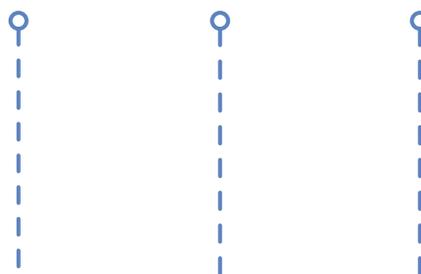
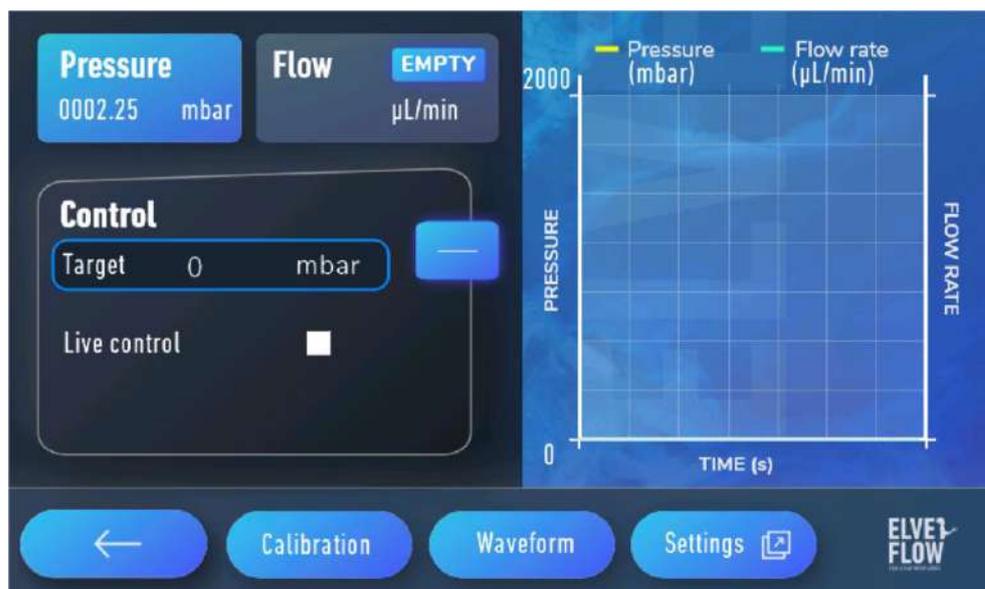
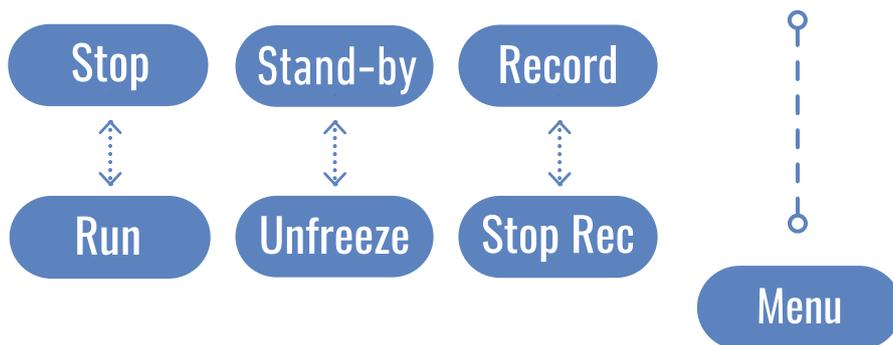
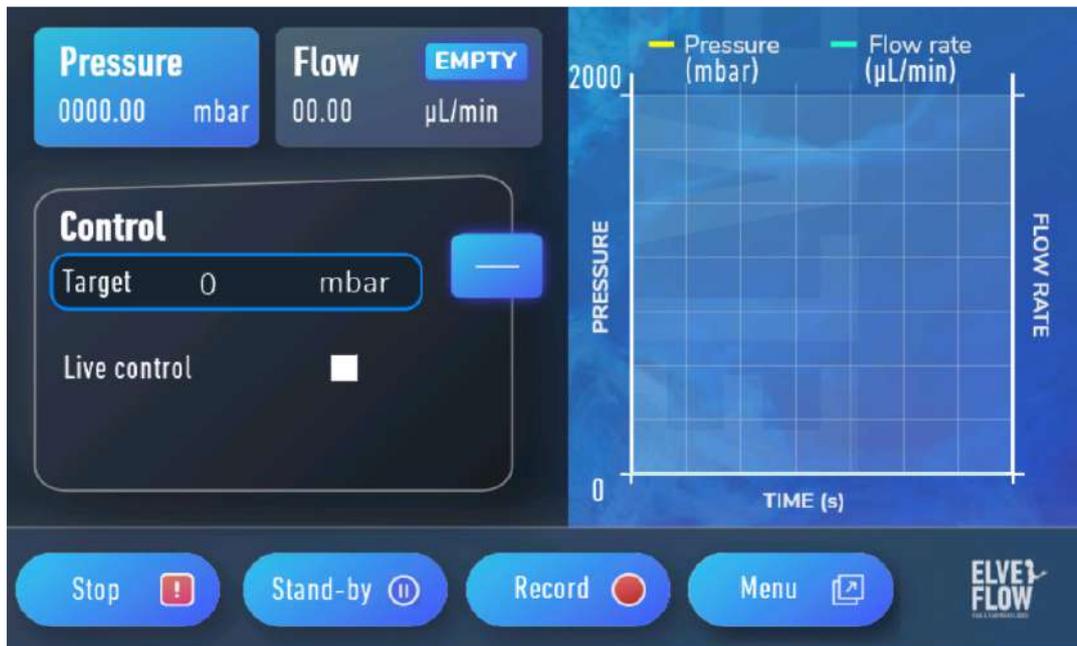
- 4 buttons allowing to activate/deactivate functions or enter in sub-menus.
- 1 dial knob for changing/selecting parameters **when rotated or clicked**.



Figure: Overview of the Cobalt embedded software. The rotating dial knob can be used to select a specific field and modify values, while the action buttons can be used to navigate through the software and select functions.

User interface structure :

Main window



Device



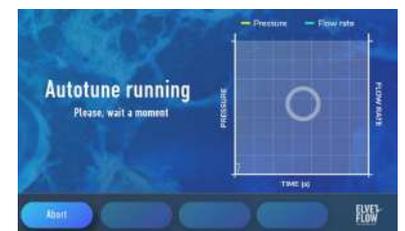
REC settings



Settings Control



Autotune



Internal calib



Settings



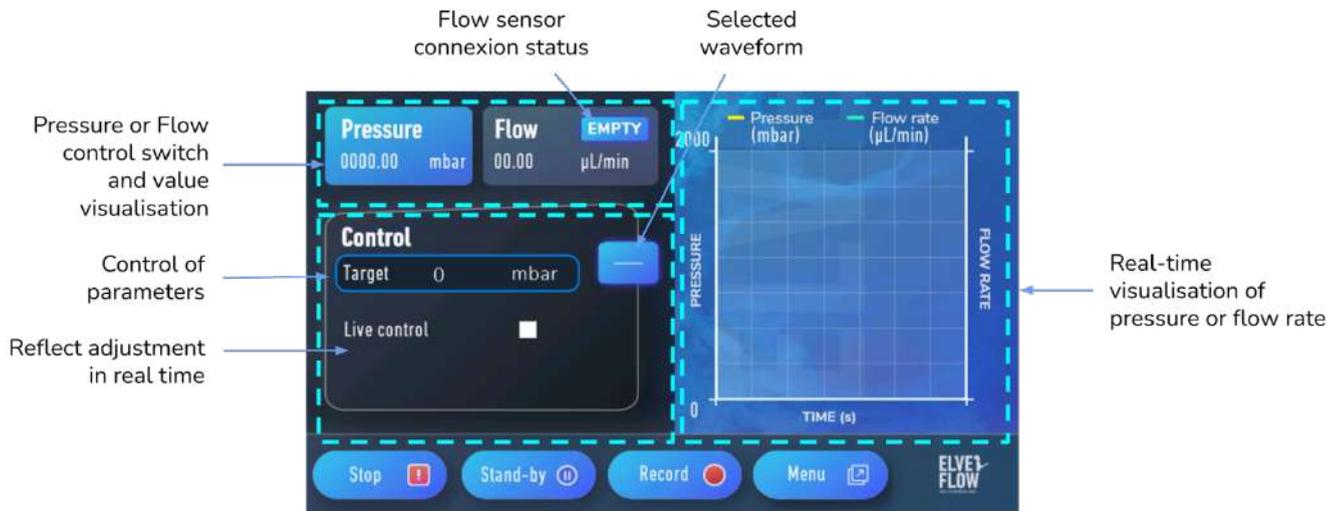
Waveform

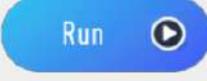
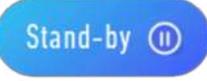
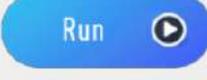


Calibration



Main window



Button	Function when pressed
	Switch to live control to select a new target value. There is no need to validate the new target by pressing the knob. The value is directly applied to the target, allowing you to fine tune your experiment in real time.
	Sets the regulator to 0 mbar (this value of 0 mbar is precisely defined during calibration).
	Starts the pressure regulation, resuming the last pressure target.
	Allows modification of parameters without stopping the ongoing pressure/flow rate regulation.
	Loads and applies the new set of parameters when in Stand-by mode.
	Starts recording the pressure and flow rate measurements. Recorded settings can be changed in settings => Record.
	Stops recording and saves the data in slot (check record settings to change slot number and other parameters).

Switching between pressure and flow rate control



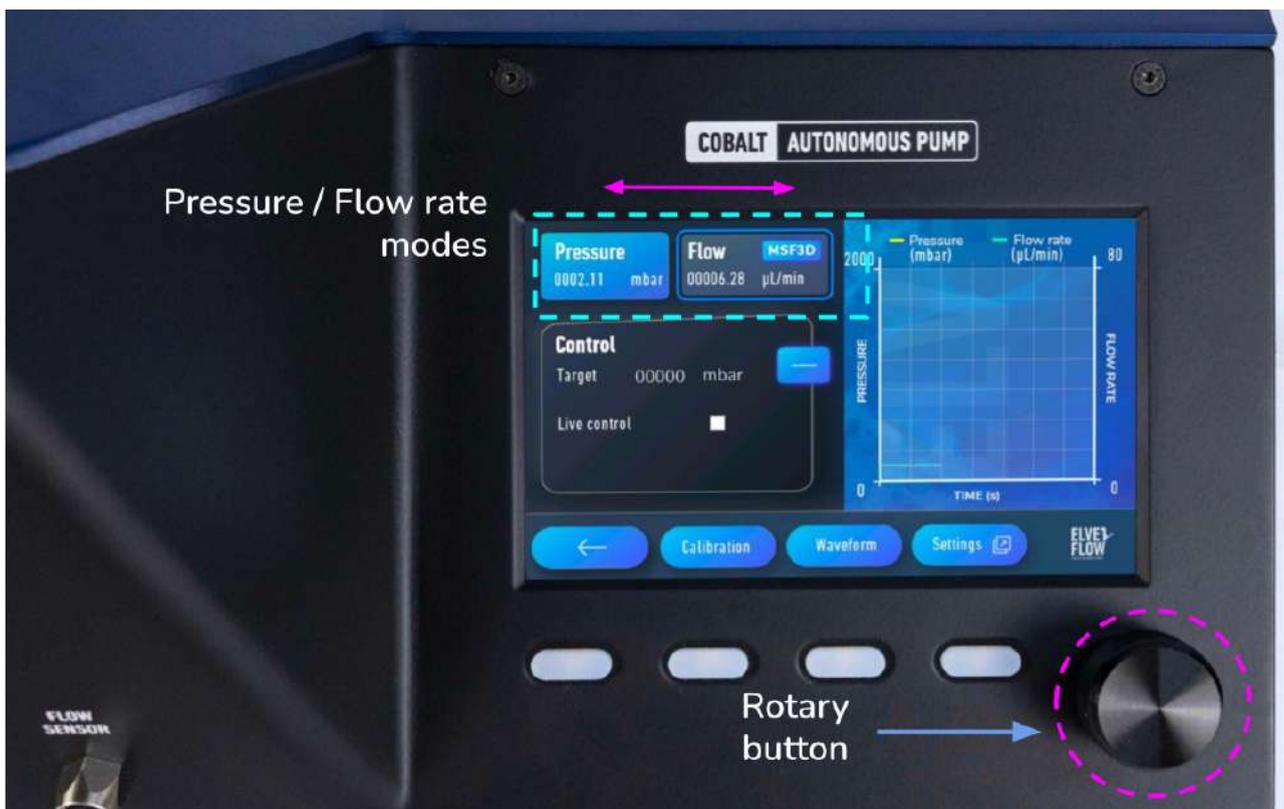
Helpful information. The Cobalt can be controlled by setting pressure values or by flow rate values (provided a flow sensor is connected to the device).

To switch from the “Pressure” mode to the “Flow rate” mode, follow the steps below (note that you will only be able to select the “Flow” mode if a flow sensor is connected).

1. Select the “Pressure” or “Flow” mode using the rotary button from the *Main window*.

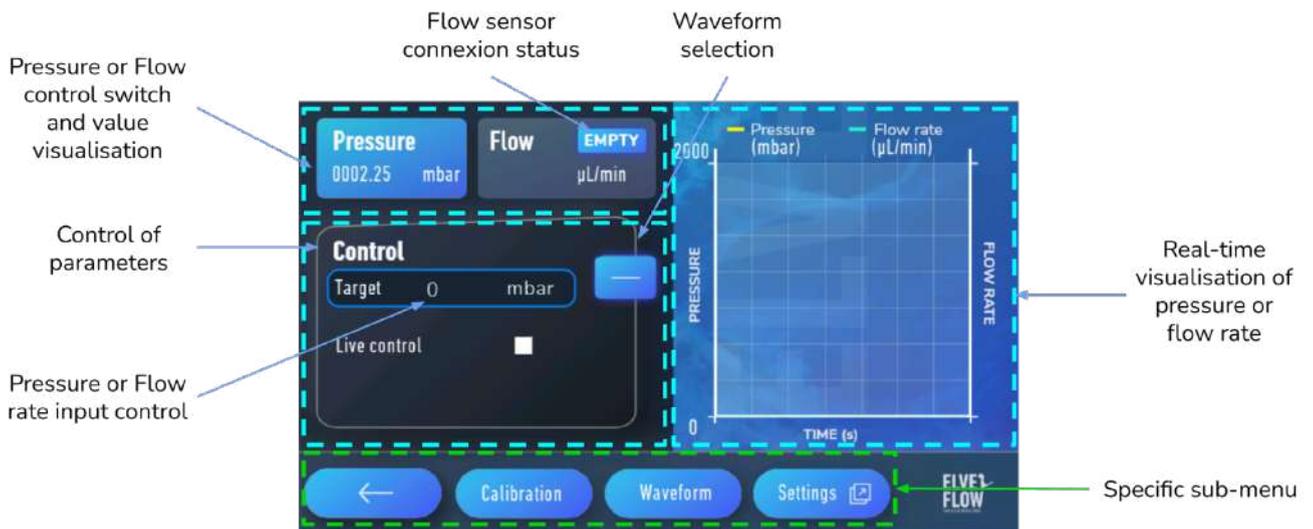
2. Press the rotary button to validate your choice.

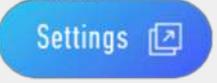
NB: your choice once validated will be highlighted in blue as the “Pressure” mode is in this example.



Menu window

Pressing the “Menu” button on the Main window opens a sub-menu with three choices: “Calibration”, “Waveform” and “Settings”. Each sub-choice leads to a specific window, detailed in the following sections.

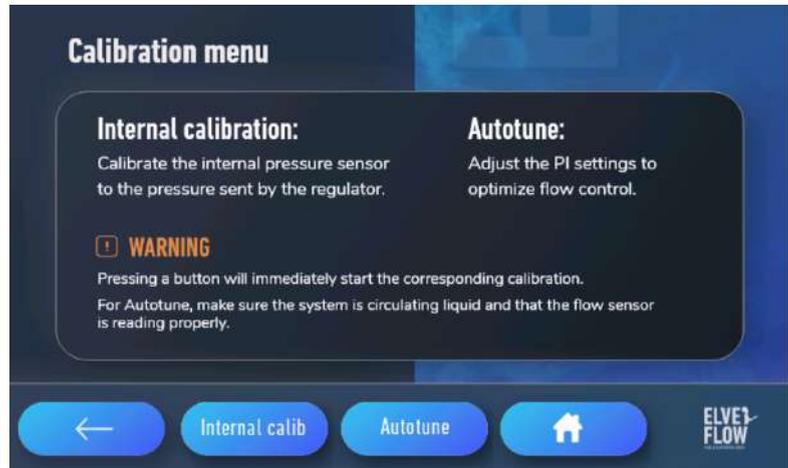


Button	Function when pressed
	Back to the Main window.
	Access to the Calibration window to calibrate the internal sensor or the flow control parameters.
	Access to the Waveform window to select control waveforms.
	Access to the Settings window.

Calibration

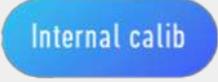
From the “Menu window”, you can access the “Calibration window”. The “Calibration window” is an intermediate window to choose from two types of calibrations:

1. “Internal calibration” refers to the internal calibration of the pressure regulator.
2. “Autotune” refers to the calibration of the flow rate control parameters.



This intermediate Calibration window warns you that pressing one or the other button will immediately start the corresponding calibration.

Since the Autotune adjusts the PI parameters using the Flow Sensor feedback loop control, the flow path must be properly connected before starting the Autotune calibration. For calibration, make sure that the liquid flows through the whole path.

Button	Function when pressed
	Back to the Menu window.
	Launch the internal pressure regulator calibration process.
	Launch the automatic flow control parameters tuning.
	Return to the main page.

1. Internal pressure calibration

This calibration is fully automated and only requires you to sit down and enjoy your favorite hot drink, or any other activity, as it takes around 5 minutes. It allows calibration of the internal pressure sensor readings.

Button	Window	Function when pressed
	Internal calibration window.	Stop the ongoing calibration.



We recommend performing this calibration on a daily basis.

2. Auto-tuning of the flow rate control mode

A key principle of pressure-driven flow control is explained here. In order to achieve proper flow rate control, one must ensure that:

- the flow restriction of the circuit matches the targeted flow rate range, and
- the software PI parameters (namely Proportional, Integral) governing the electronic feedback loop control of the flow rate are appropriate.



[Additional information available.](#)

For a simple and easy explanation of this key aspect, you can watch the following video:

- ▶ [What is a microfluidic pressure-driven flow controller?](#)

The Autotune function enables the Cobalt to quickly and accurately implement flow control by adjusting the pressure output.

Flow control requires a connected MFS flow sensor. The Cobalt unit automatically recognizes the MFS and its flow rate range. The Autotune consists in (i) scanning the flow depending on the pressure input and (ii) adjusting the PI parameters to optimize both response time and flow rate stability.

You may wish to personalize the PI parameters to e.g. optimize the response time of your setup or, alternatively, get the most stable flow rate. This can be done by adjusting the PI parameters through the Cobalt computer software. The selected parameters can then be loaded into the Cobalt and used without the computer.



MFS flow sensor required. The Autotune calibration can only be performed if a digital MFS flow sensor is connected to the Cobalt unit.

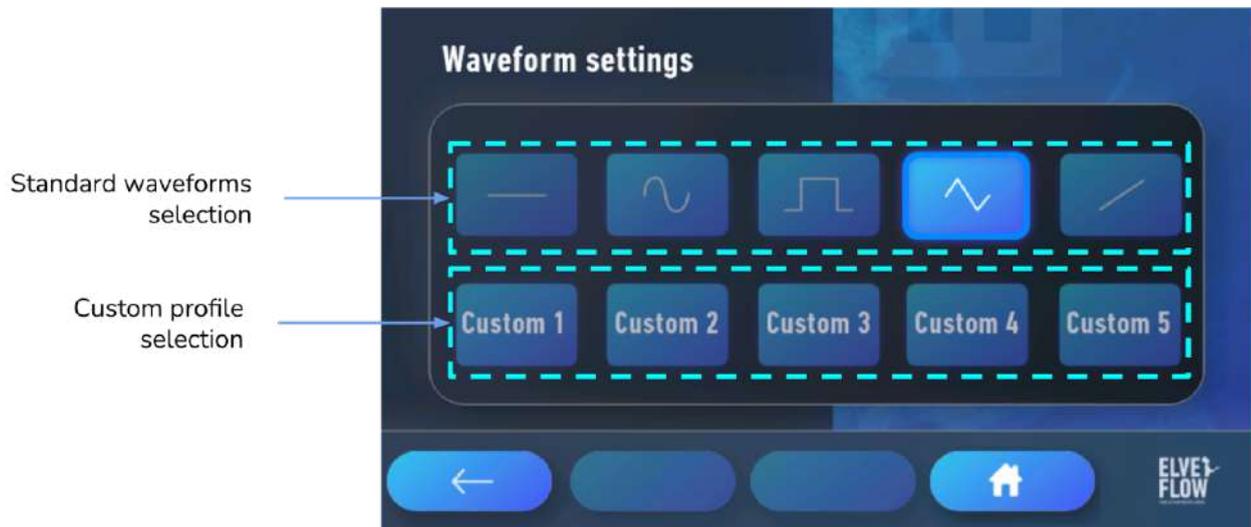
We recommend performing this Autotune step for each modification of the fluidic circuit.

Waveform window: selecting a control waveform

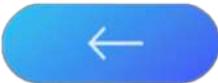
From the “Menu window”, you can access the “Waveform window”. Using the rotary button you can then select a standard waveform or select a custom profile.

After selecting a standard waveform, you can modify specific parameters through the “Main window” in the “Control parameters” zone.

A custom profile has to be designed using the Cobalt computer software. Refer to the dedicated section of this User Guide to generate, save, and load your custom profiles. You can load up to 5 custom profiles from the computer to the COB unit. Once loaded, you can access and select one of them through this Waveform window.

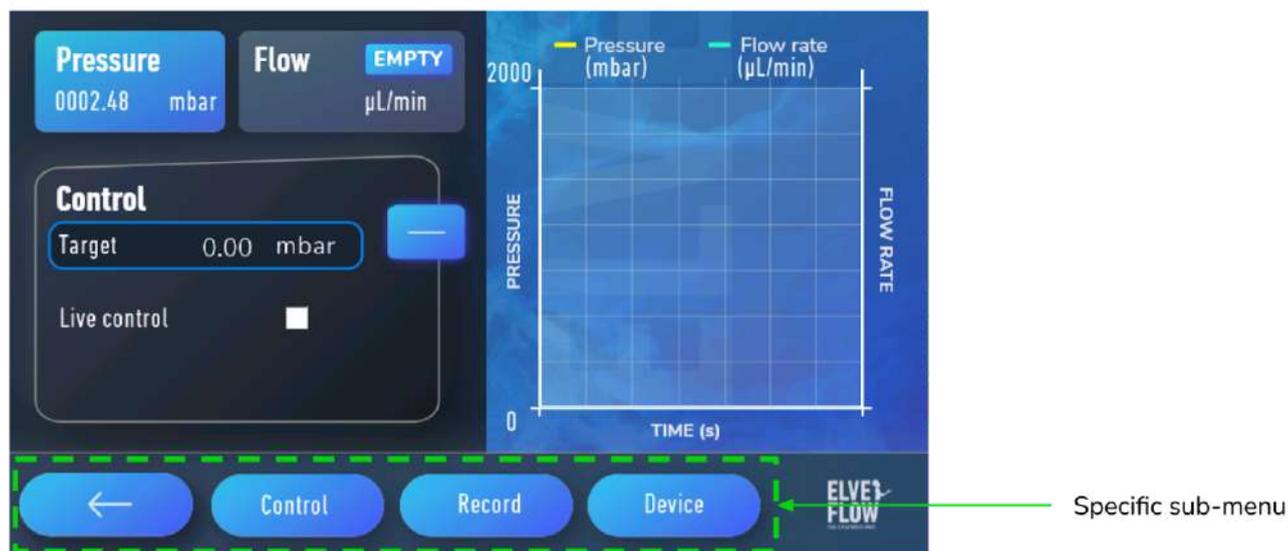


Use the Rotary button to navigate and select waveforms and custom profiles.

Button	Function when pressed
	Back to the Menu window (in which you can access and modify the parameters of the waveform selected).
	Back to the Main window.

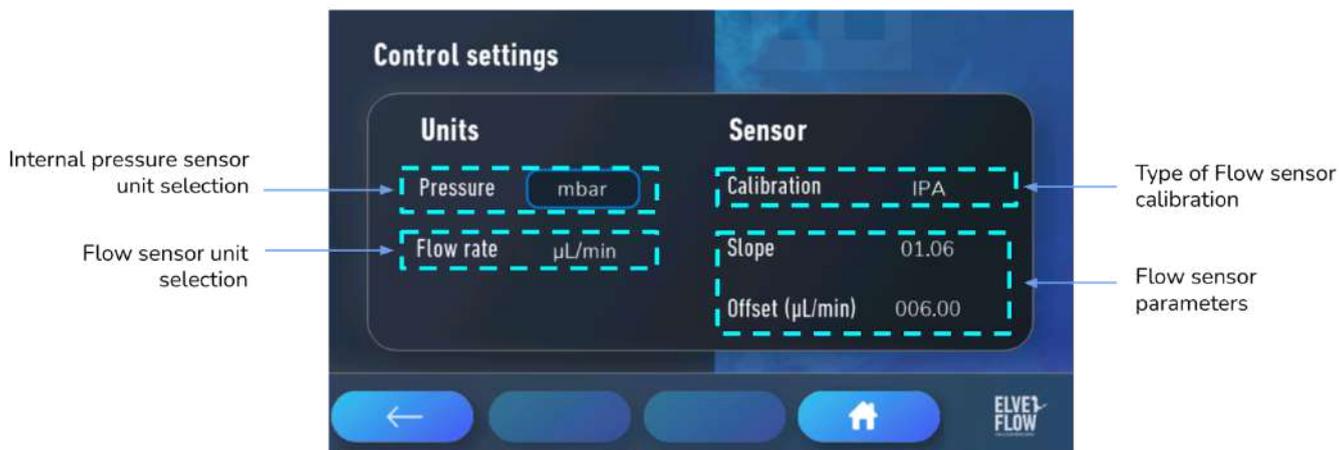
Settings window

Pressing the “Settings” button on the “Menu window” opens a sub-menu with three choices: “Sensors”, “REC settings”, and “Device”. Each sub-choice leads to a specific window, detailed in the following sections.



Button	Function when pressed
	Back to the Menu window.
	Access to the Sensors settings.
	Access to the recording settings.
	Access to the Cobalt device personalisation.

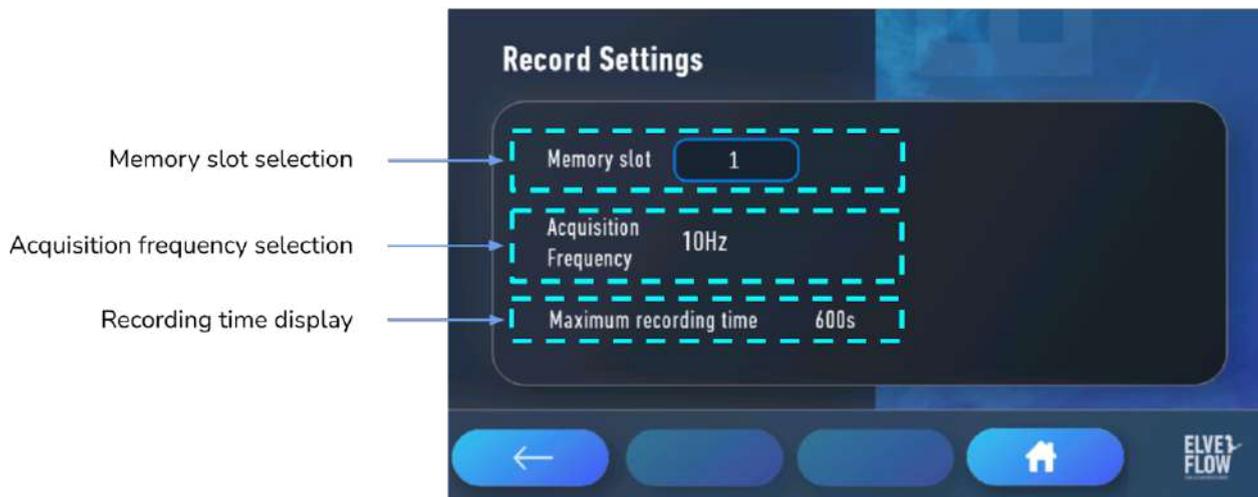
Control settings



Using this settings window, you can select and change the:

- Pressure and flow rate units.
- In case you connect an MFS sensor:
 - Type of calibration: Water or IPA
 - Calibration curve: slope and offset between real and measured values
 - Flow displayed = Flow measured*Slope + Offset
 - Any change in the sensor parameters will be saved in the MFS sensor itself

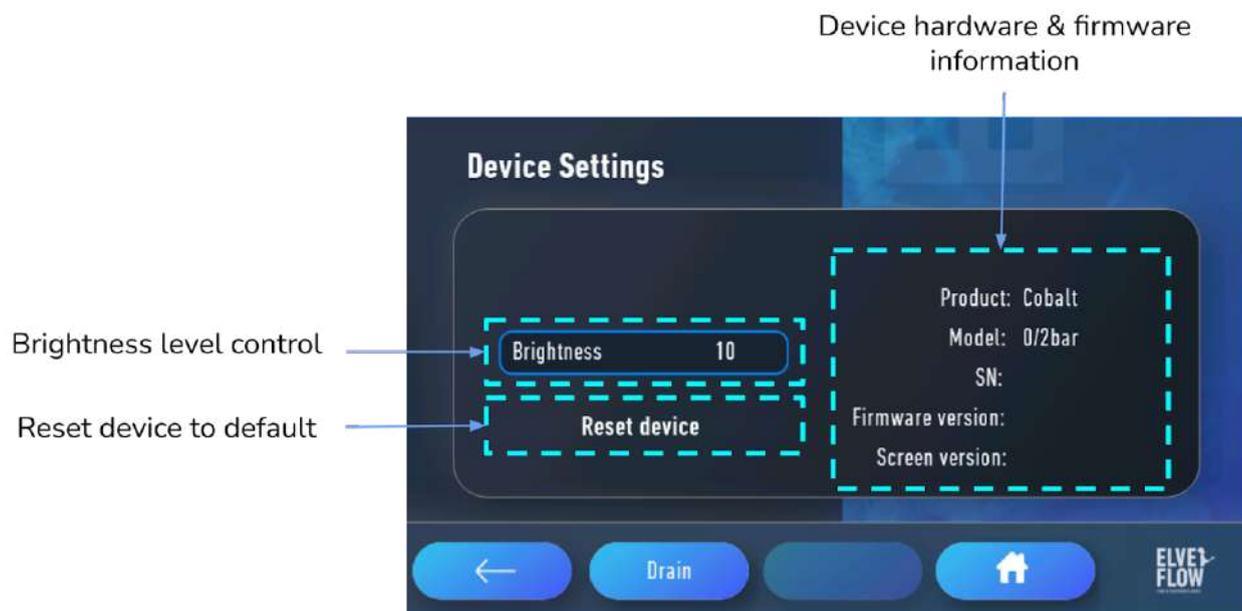
Record settings



Using this settings window, you can select and change the:

- Saved data memory slot: there are 10 slots available. Once all 10 slots are used, the most recent recording will overwrite the oldest one. Thus, be aware not to lose important data when saving new ones. Saved data can be loaded on a computer using the Cobalt computer software.
- Acquisition frequency: you can choose between 3 acquisition frequencies that allow 3 different maximum recording times: the higher the acquisition frequency, the shorter the maximum recording time.
 - 1Hz allows recordings up to 6000 seconds (i.e. 100 minutes)
 - 5Hz allows recordings up to 1200 seconds (i.e. 20 minutes)
 - 10Hz allows recordings up to 600 seconds (i.e. 10 minutes)

Device settings



Through the device settings you can perform the following actions:

- Change the brightness of the screen.
- Reset the device to default settings.
- Drain the instrument from any accumulated water.

Cobalt Computer Software

Minimum computer requirements

The instructions displayed in this guide are based on features proposed by Cobalt_V1.01.01 and later releases. Be sure your Cobalt computer software version is up to date before implementing the solutions described in this guide. See ASI download link below. Using the Cobalt computer software requires complying with the following minimum computer configuration.

Cobalt_V1.01.01 or later versions:

- 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.

Software Installation

1. Plug the Elveflow® USB flash drive into your computer, or download the latest version from Elveflow website.
2. Open the Elveflow® folder.
3. Locate the Cobalt software zip file (e.g. Cobalt_V1_01_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.



The instructions displayed in this guide are based on features proposed by Cobalt V1.01.00 and later releases. Be sure your Cobalt version is up to date before implementing the solutions described in this guide.

Do not install Cobalt directly from the Zip file or directly from the USB key as this is likely to cause issues. Always copy the Cobalt.zip source to your computer and unzip it before launching the installation process.



The Cobalt's latest stable version can be downloaded from the Elveflow website.

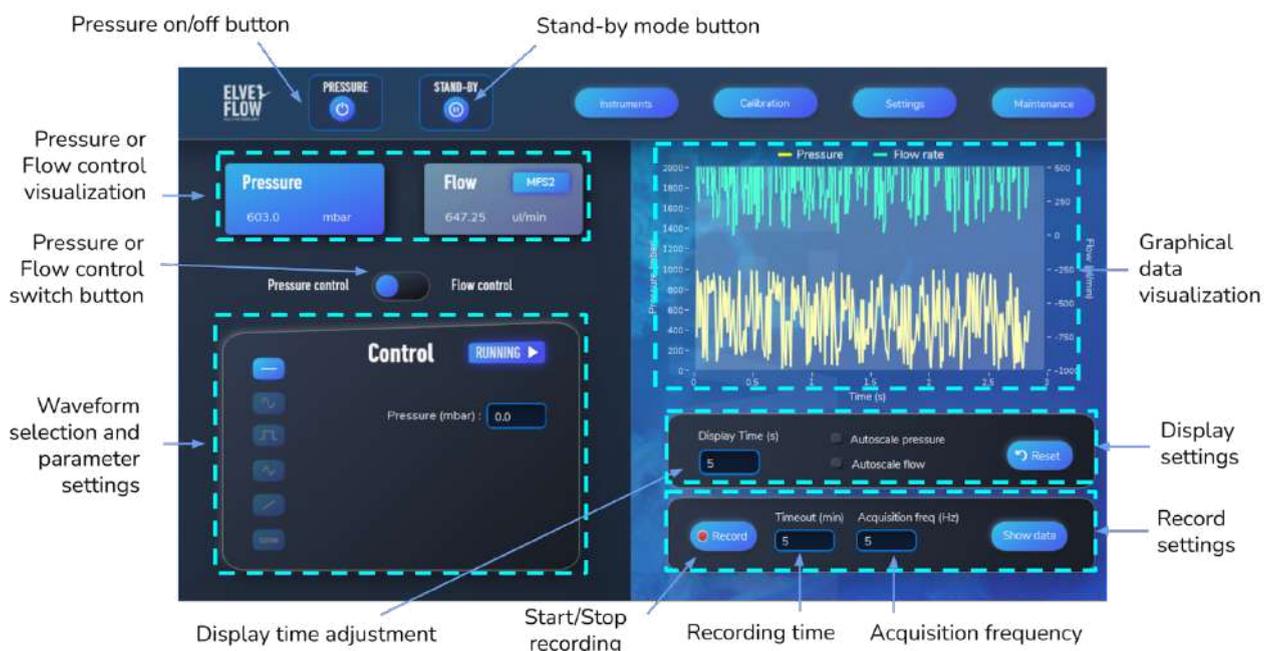
Main window

The main window gives you access to all the real-time data visualization (pressure and/or flow rate) and their adjustments.



The Cobalt computer software allows control of several Cobalt units. Each new Cobalt should be initialized through the “New Cobalt initialization” button.

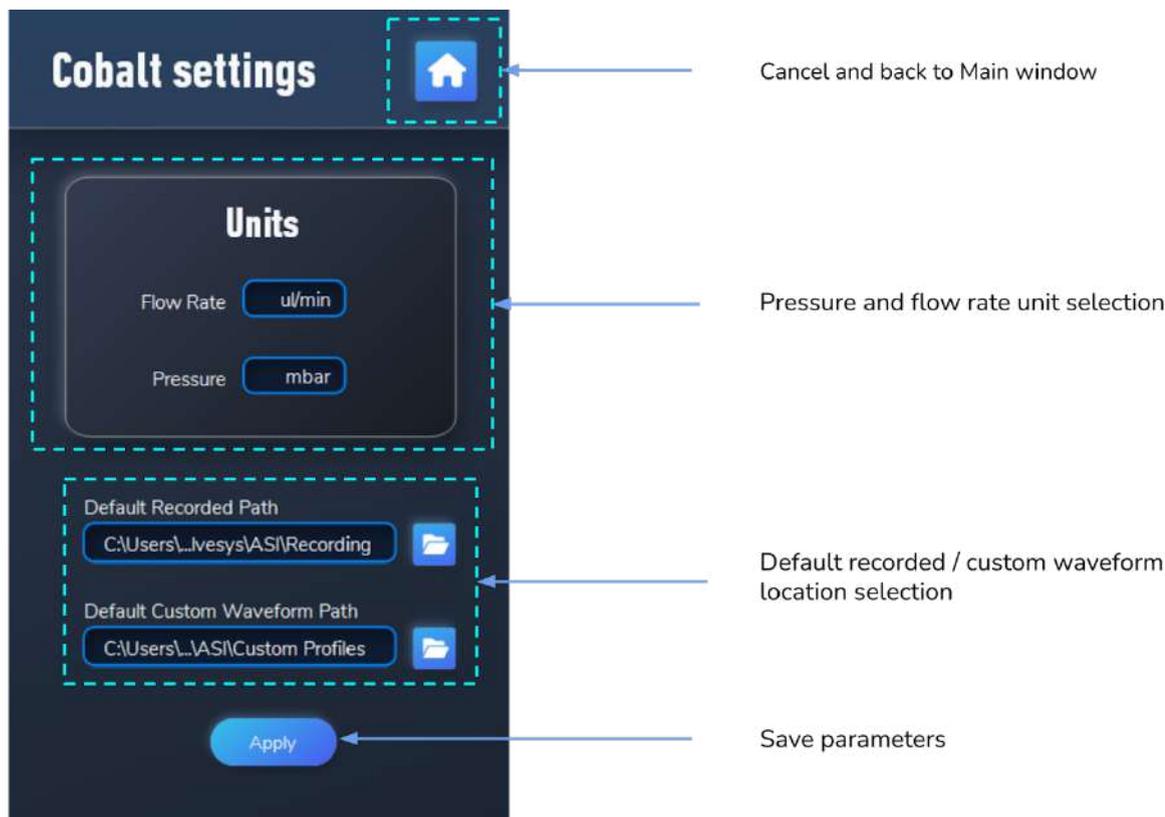
Further settings such as *General settings* or *Waveform settings* are available and introduced in the next sections.

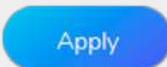


Button	Name	Description
	Pressure on/off button	Starts or stops pressure regulation.
	Stand-by mode	Allows modification of parameters <i>without</i> stopping the ongoing pressure regulation.
	Instruments	Manages the instrument internal data and MFS.
	Settings	Access to General Cobalt settings and flow sensor settings.
	Calibration	Access to the internal pressure sensor calibration.
	Maintenance	Get in touch with Elveflow support and use the Drain function to remove the water accumulated in the drain.
	Visualization	Management and visualization of recorded data.
	Empty graph	Clears the graphical data from the visualization area.
	Start/Stop recording	Start/Stop recording the current running configuration.

Settings window

From the Settings window you can access two tabs: the general device settings and the data access paths.



Button	Name	Description
	Cancel/back to main menu	Close the current window and return to the main window. To save any parameter changes, make sure you click on "apply" before that.
	Default file paths	Select the default file path for Recorded data and waveforms.
	Apply	Allows saving modified parameters and going back to the main window.

Calibration window

Similarly to what can be found in the Cobalt embedded software, the “Calibration window” opens access to two types of calibrations:

1. “Pressure calibration” refers to the internal calibration of the Cobalt pressure regulator.
2. “PID and Autotune” refers to the calibration of the flow rate control parameters.

The screenshot shows the 'Calibration' window with a dark blue background. At the top left is the title 'Calibration' and a home icon. Below this are two main sections:

- Pressure Calibration:** Contains the text 'Calibrate the internal pressure sensor to the pressure sent by the regulator.' and a blue 'Start' button.
- PID & Autotune:** Contains the text 'Adjust the PI settings to optimize flow control. Make sure the system is circulating liquid and that the flow sensor is reading properly.' and a blue 'Autotune' button.

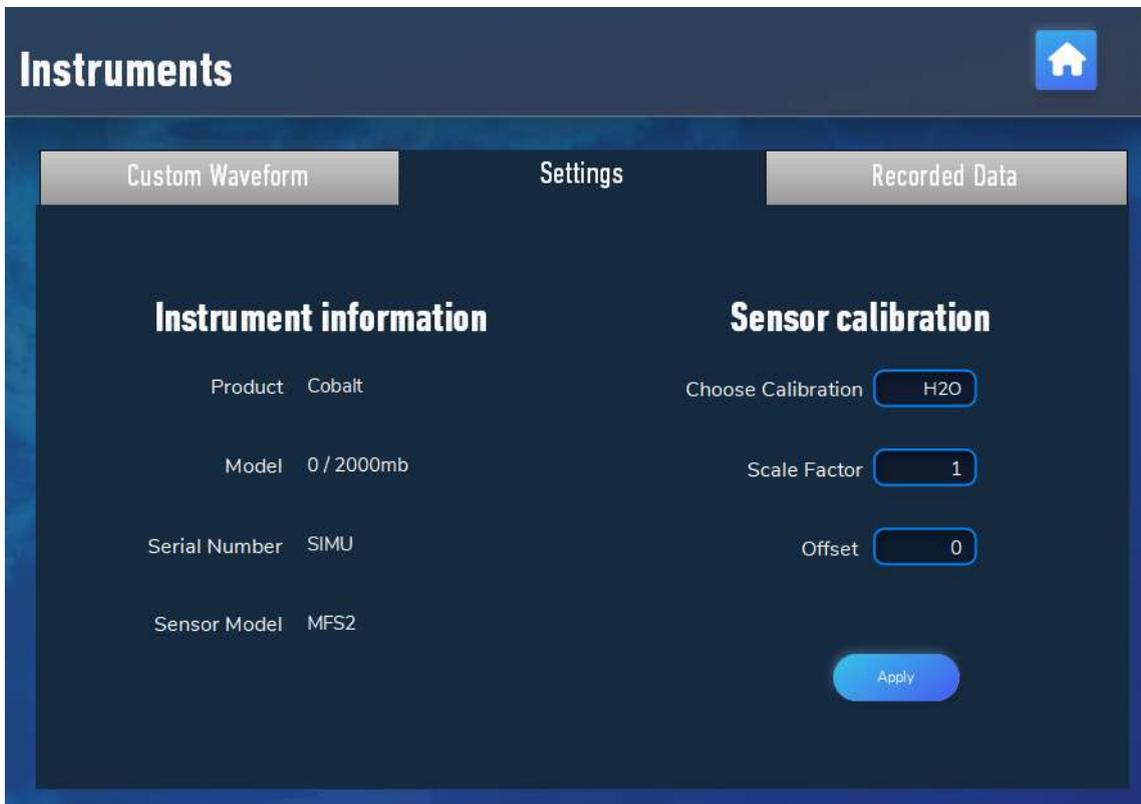
Under the 'PID & Autotune' section, there are two sub-sections:

- Responsiveness:** Features a vertical slider between 'FAST' (top) and 'SLOW' (bottom). The 'FAST' position shows a high-frequency oscillating waveform, and the 'SLOW' position shows a lower-frequency oscillating waveform. Below the slider is a 'P' parameter input field with the value '0'.
- Stability:** Features a vertical slider between 'SMOOTH' (top) and 'SHARP' (bottom). The 'SMOOTH' position shows a smooth, low-frequency curve, and the 'SHARP' position shows a high-frequency oscillating waveform. Below the slider is an 'I' parameter input field with the value '0'.

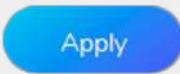
Instruments window

This window is about the Cobalt device, and has 3 tabs: “Settings”, “Recorded data”, and “Custom waveform”.

Settings

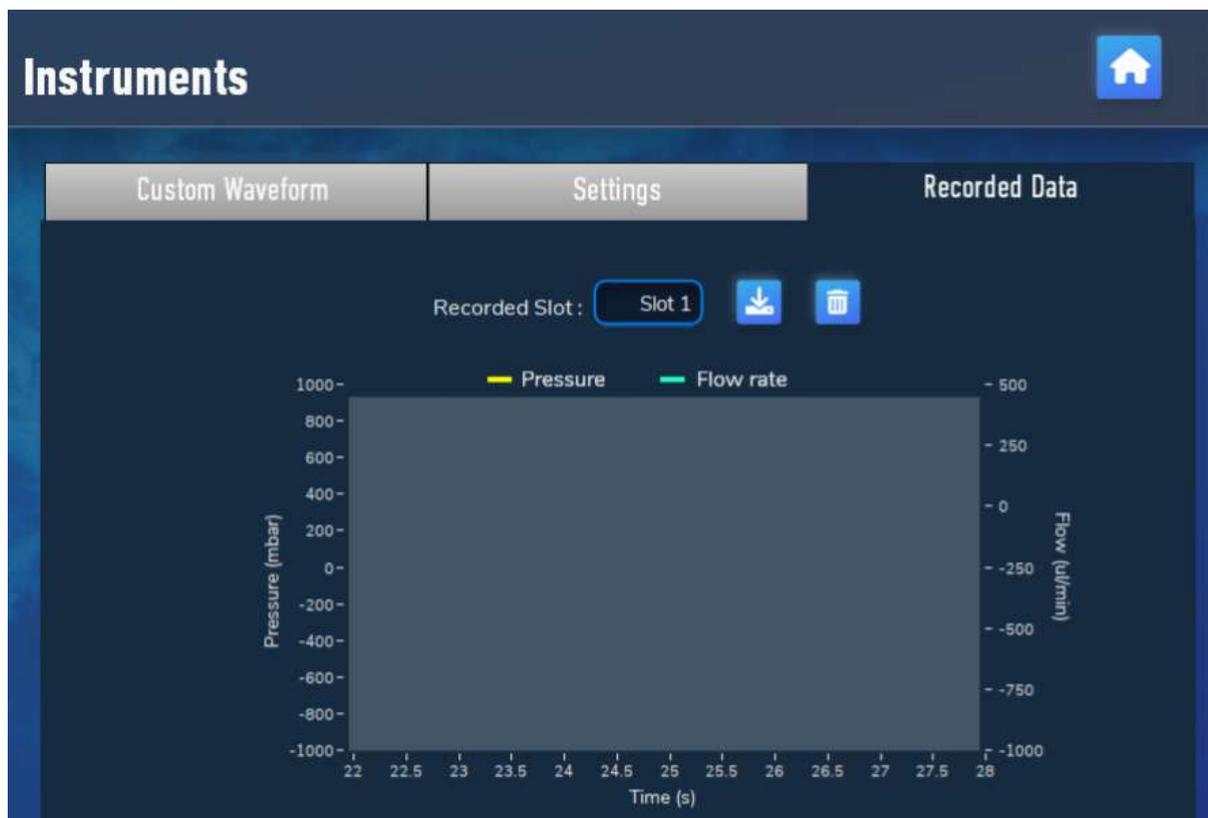


On this window you can access general information about your Cobalt unit (name, model, serial number, sensor connected). You can also check the current sensor parameters (Calibration, Scale Factor, and Offset) and apply new ones if required.

Button	Name	Description
	Cancel/back to main menu	Close the current window and return to the main window. To save any parameter changes, make sure you click on “apply” before that.
	Apply	Allows saving modified parameters and going back to the Main window.

Recorded data

This tab displays the recorded data from the Cobalt (when used autonomously) and allows it to be exported.

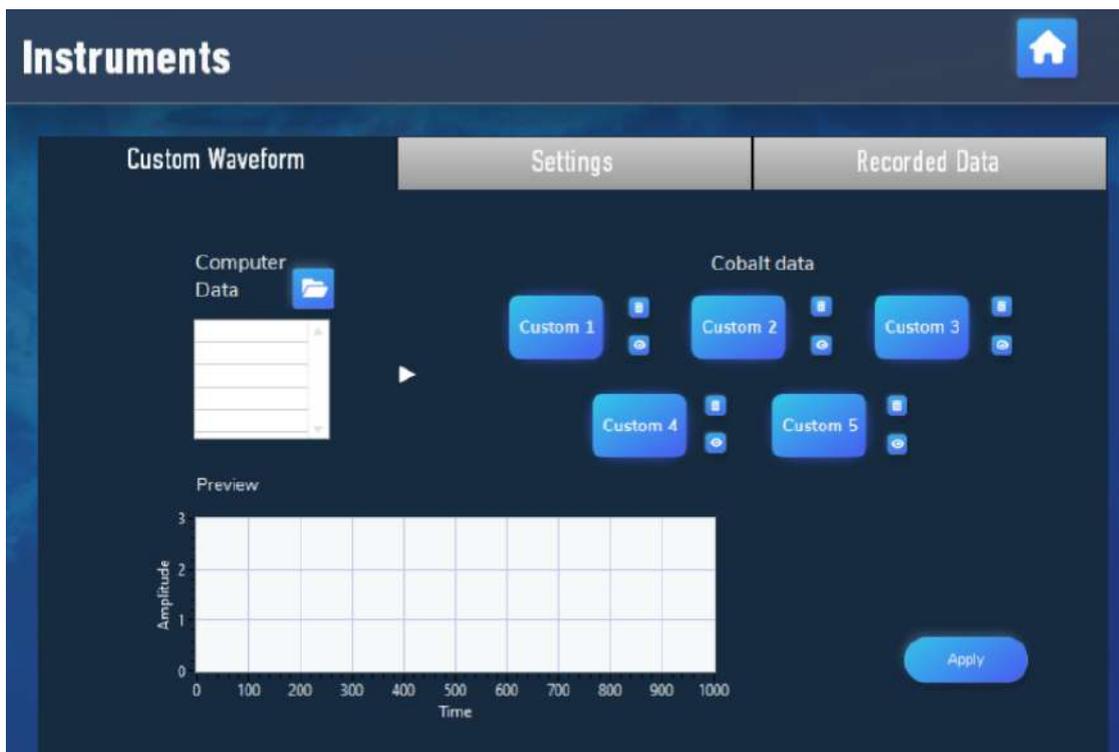


Button	Name	Description
	Recorded slot	Scrolling list of the slots from the Cobalt.
	Export	Exports data from the selected slot.
	Delete	Clear the slot.
	Back to main menu	Back to the Main window.

Custom waveform

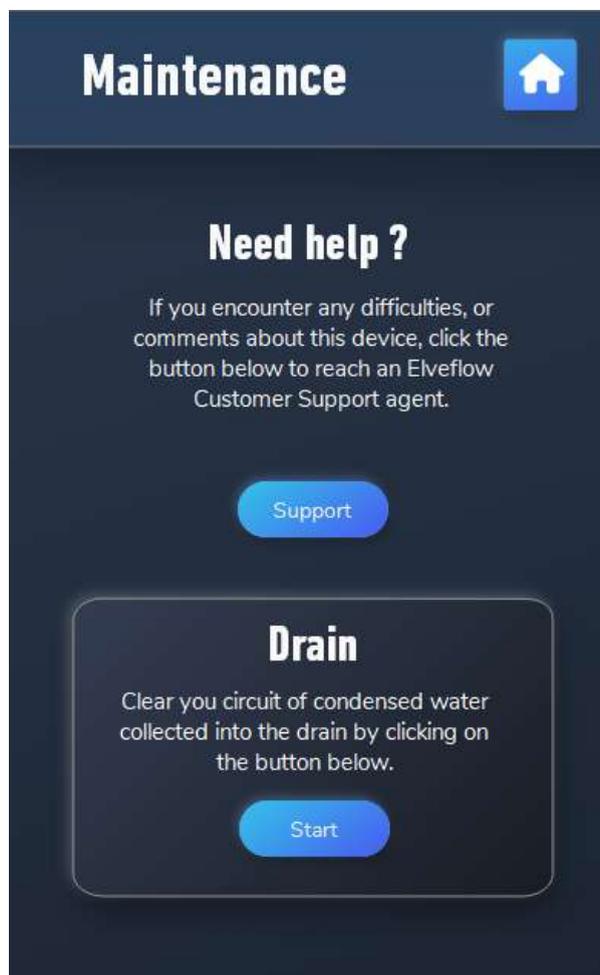
From this window, you can load, edit, or remove up to 5 custom profiles in the internal Cobalt memory. The custom profiles should be created using an excel sheet.

The “Computer data” shows the list of custom waveforms in the designated folder (path defined in general settings: default custom profile path). The “Cobalt data” shows the list of custom waveforms in the embedded memory of the Cobalt. Simply drag and drop a computer data file into a Cobalt data file slot to load a waveform into the Cobalt pump.



Button	Name	Description
	Open folder	Opens the designated folder (path defined in general settings: default custom profile path).
	Preview	Click this button to preview a custom waveform file.
	Delete from Cobalt	Deletes the custom waveform from the Cobalt internal memory.
	Apply	Allows saving new slot assignments and going back to the main window.
	Cancel/back to main menu	Close the current window and return to the main window. To save any parameter changes, make sure you click on “apply” before that.

Maintenance

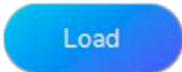


Button	Name	Description
	Go to support	Click the Support button to reach an Elveflow Customer Support agent (requires internet connection).
	Start drain	Get rid of the condensed water accumulated in the drain.
	Back to main menu	Back to the Main window.

Show data

Enable visualization of the recorded data.



Button	Name	Description
	Open windows navigation	Searches for the file to load.
	Load and display	Loads the file and displays it on the graph.
	Back to main menu	Back to the Main window.

Cobalt Embedded Software and Computer Software Comparison

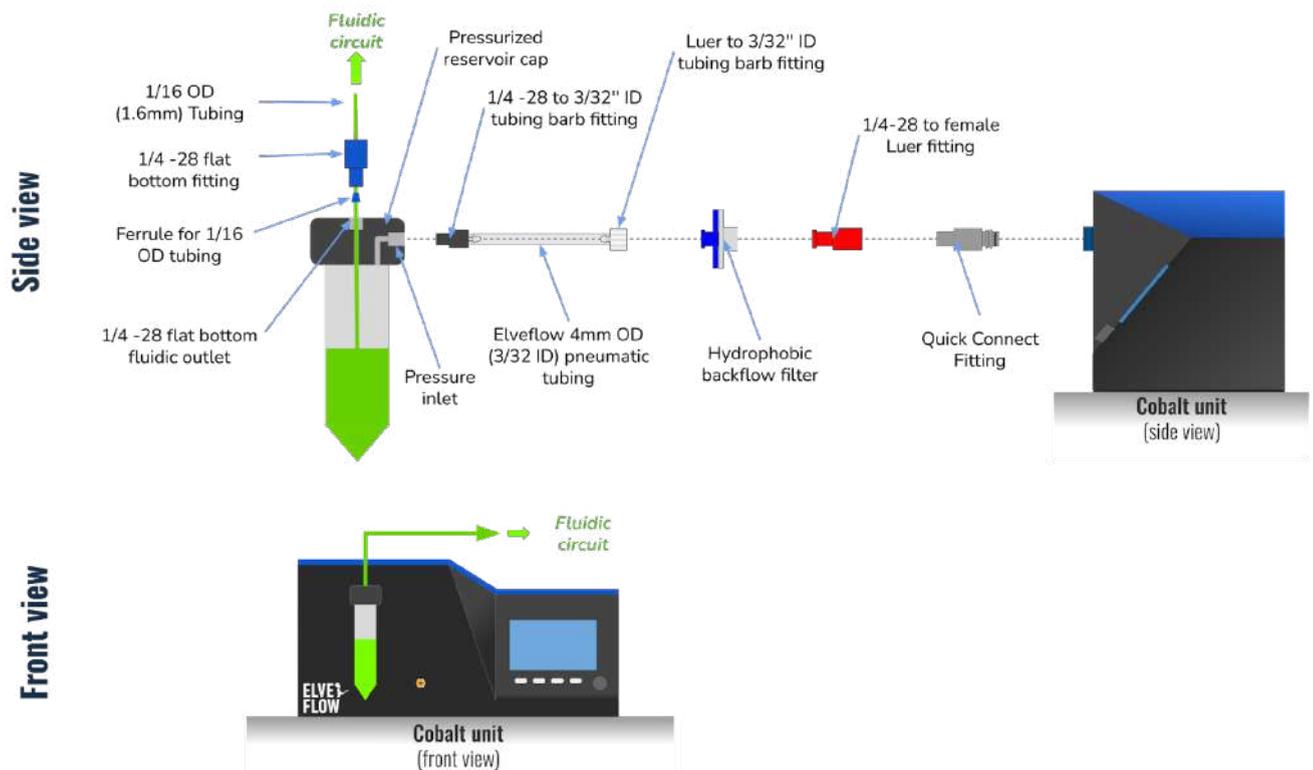
The following table summarizes the features of the embedded software versus the computer software.

	Cobalt Embedded Software	Cobalt Computer Software
Pressure control	✓	✓
Flow control	✓	✓
Internal calibration	✓	✓
Autotune	✓	✓
Manual PI parameter adjustment	-	✓
Auto sensor detection	✓	✓
Record data: start-stop	✓	✓
Record data: configure	✓	✓
Record data: download	-	✓
Custom waveform: design	-	✓
Custom waveform: upload	-	✓
Custom waveform: run	✓	✓
Error messages	✓	✓
Stop mode	✓	✓
Stand-by mode	✓	✓
Remote control via USB connection	-	✓
Graph display management	-	✓

Appendix: Backflow filters

We recommend using a backflow filter to prevent water entering the Cobalt. This is particularly important when using the Cobalt DUAL in aspiration mode. During aspiration mode, the tank may quickly overfill and the excess liquid may enter and damage the instrument.

Backflow filters are made of a hydrophobic Teflon membrane that repels water, preventing it from getting inside your device. It is important to note that although hydrophobicity works well with aqueous solutions, other solutions (such as ethanol) may modify the wetting capacity of the membrane, reducing its efficiency. We recommend that the user be aware of the solutions used, their influence in the circuit and on the Teflon membrane of the filter.



We recommend using a backflow filter in cases where liquid reflux may occur. In particular, when using Cobalt DUAL (and when vacuum mode is used).

We recommend that the user be aware of the solutions used to guarantee the backflow filter efficiency and maintain the proper functioning of the Cobalt.



The elements required to install a backflow filter on the Cobalt unit are available in the **Kit fittings Starter Pack COBALT**. In case you miss an element or need further assistance, don't hesitate to contact us on customer@elveflow.com.

Troubleshooting

Embedded software error codes and recommended actions

Number	Description	Meaning / Action
3	Calibration was a success	No action required.
4	Autotune was a success	No action required.
5	Pneumatic Leak: please check setup	Check and secure every connection to fix the leak.
6	Setup changed: Please run autotune again	Run autotune again.
7	Pneumatic error: maximum pressure not reached	The internal pressure pump is degrading, or there is an internal pneumatic leak. Please contact customer service .
8	Pneumatic error: minimum pressure not reached	The internal vacuum pump is degrading, or there is an internal pneumatic leak. Please contact customer service .
9	Calibration error: internal sensor does not match real pressure	There is likely an internal pneumatic leak. Please contact customer service .
10	Autotune error: not enough microfluidic resistance	Add some resistance (see the MFS user guide).
11	Autotune error: too much microfluidic resistance	Adapt the resistance (see the MFS user guide).
12	Autotune error: microfluidic resistance not linear enough	The flow sensor requires cleaning. Check your setup and retry the Autotune.
13	Autotune error: probable leaks	Check and secure every flow connection to fix the leak.
14	Autotune error: bad PID parameters estimation	A flow perturbation may have occurred during the autotune. Check your setup and retry the Autotune.
15	Autotune error: no flow sensor connected	Connect a Flow Sensor to tune your flow parameters.
16	Filter warning: Please check filter and run drain mode	Eliminate the water accumulated in the drain filter.

Customer support

You are welcome to browse through the Elveflow Support Portal accessible online anytime (<https://support.elveflow.com/support/solutions>). We provide extensive guidance on how to use our product line so most of the answers you're looking for can be found there. In case you have other questions or need further assistance, don't hesitate to let us know by emailing us at customer@elveflow.com.



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

To readily assist you, please provide with:

- The serial number of the Elveflow device(s) used (Instrument, Sensors).
- The error message number, if applicable.
- Some pictures or movies of your setup and your issue. [WeTransfer](#) is perfect to easily send us large files.

We are always happy to help ❤️

Linked products



[MFS Flow Sensors](#)

Microfluidic Flow Rate Sensor using thermal time-of-flight technology. 5 sensors covering water flow rates from 0.07 to 5000 $\mu\text{L}/\text{min}$.



[Microfluidic Bubble Trap](#)

Bubbles are a typical issue encountered in microfluidic setups, so using an in-line bubble trap before your sample will ensure smooth experiments and reliable results.



[Microfluidic Reservoirs](#)

Benefit from microfluidic adapters for eppendorf ©, falcon © tubes, or gl45 threaded glassware.



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