

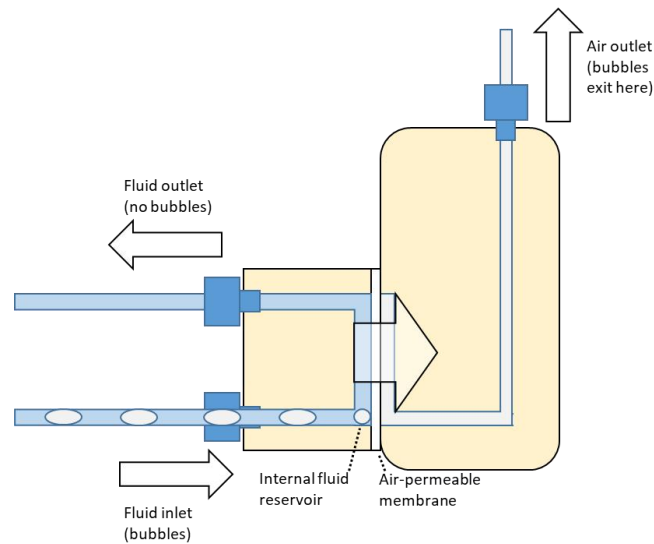
Bubble Trap User Guide



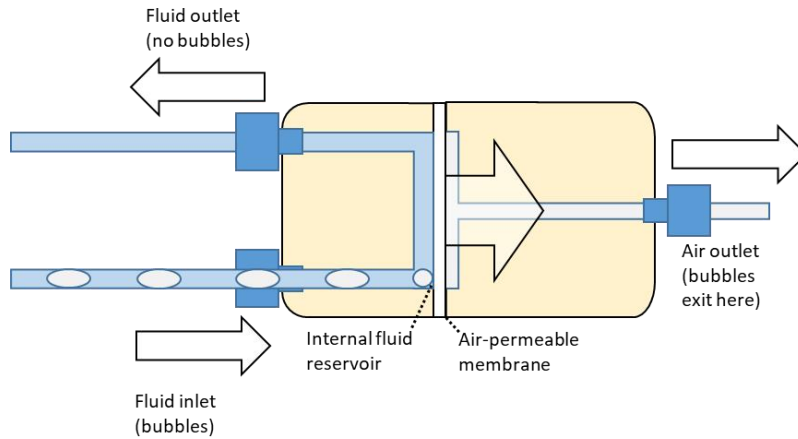
1. Introduction

PreciGenome's inline bubble trap is a device for removing air bubbles from fluidic solutions. Air bubbles can cause significant problems from abrupt changes in the microfluidic environment. These include variations in shear force or applied pressure. The trap uses a hydrophobic air-permeable membrane to remove bubbles with or without vacuum assistance, ensuring a uniform microfluidic environment.

2. Product Schematic EZ Mount Version



Standard Version

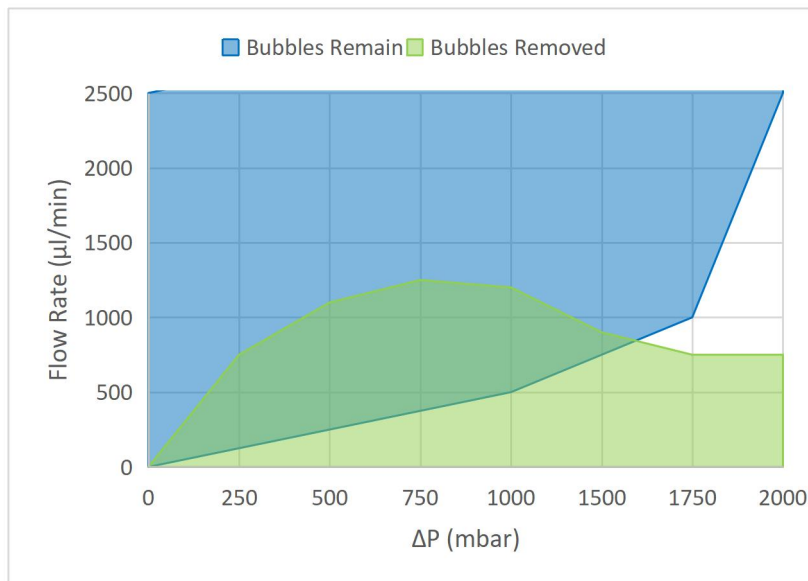


3. Product Specification

Name	Specifications		
Internal Volume (μ l)	25	95	300
Interface	1/4"-28		
Body Material	PEEK		
Membrane Material	10 μ m PTFE		
Max Differential Pressure	30 psi		
Max Liquid Flow Rate	60 ml/min		
Replaceable parts	Membrane		

All bubble trap models are available in both EZMount and standard versions.

4. Selection Guide



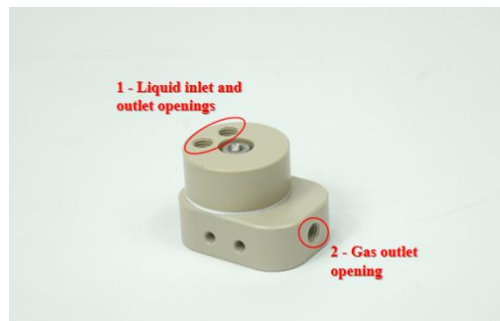
For flow rates above 5 ml/min, the 300 μ l bubble trap is recommended. 25 and 95 μ l bubble traps are recommended for lower flow rates. Though its dead volume is lower, the 25 μ l bubble trap will require adjustment of differential pressure to remain effective at removing bubbles. This will depend on the flow rate used with the bubble trap.

5. Installation Instructions

1. Insert the membrane between the two halves of the bubble trap with the marked face down¹ and smooth face up². Orientation is with the small half on top of the large.



2. Screw the two halves together to ensure a tight seal. Note the locations of the fluid inlet and outlet openings¹, as well as the gas outlet opening².

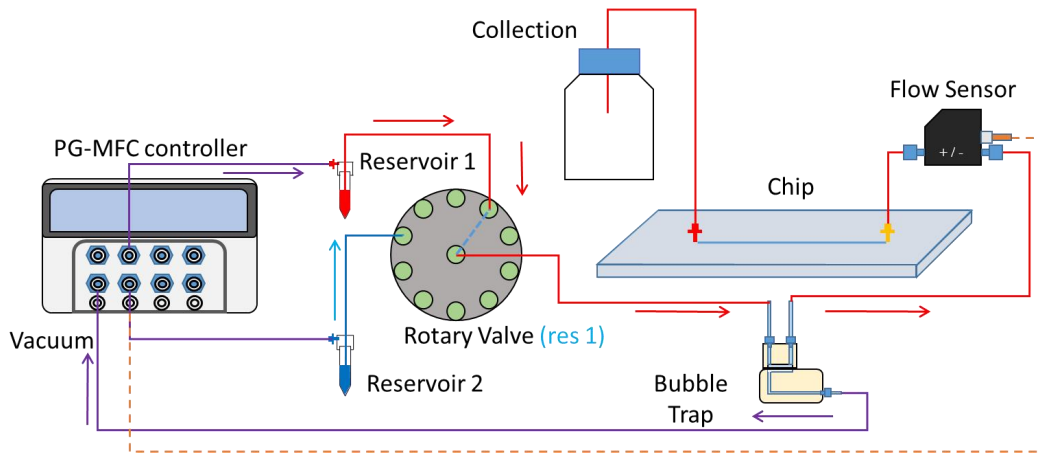


3. Connect the fluid inlet and outlet tubing to the bubble trap.
 - a) Both openings are interchangeable. The inlet will be determined only by which side is being pressurized.
4. Connect the bubble trap downstream of your reservoir(s) at the inlet, and connect to the next device (chip, liquid flow sensor etc.) at the outlet.
 - a) To enable active vacuum removal, connect the gas outlet to a vacuum source. This must be independent from the pressure source of your microfluidic setup.



6. Example Setup

Multi-Reagent Perfusion System



The bubble trap in this example is downstream of a rotary selection valve and upstream of a liquid flow sensor. Whichever reagent is pushed through the valve will have its bubbles removed before being sent to the flow sensor, ensuring uniform flow rate and stable pressure delivery. The bubble trap is also connected to a separate channel on the PG-MFC pressure controller to enable vacuum assistance.

7. Frequently Asked Questions

1. Why use PEEK instead of PVC for the bubble trap body?
 - a) PEEK has several appealing properties such as high abrasion resistance, low moisture absorption, high chemical resistance, low coefficient of friction, and excellent wear characteristics.
 - b) Unlike PVC, PEEK is autoclavable and suitable for most organic solvents.
2. What internal volume model should I use?
 - a) A smaller internal volume traps less liquid solution inside the bubble trap, improving solution usage efficiency. However, a larger internal volume can be considered for high flow rates as the lower volume will increase runtime.
3. What external mount system (standard or EZMount) should I use?
 - a) This depends on your mounting system. Our microfluidic mounts have holders which better support EZMount bubble traps.
4. What screw type is for mounting the bubble trap?
 - a) The mounting screws are M2. On the EZMount model, these are located on the side.
5. How to calculate vacuum pressure I can apply?
 - a) The max differential pressure of 30 psi means the difference between the inlet and vacuum pressure must be at most 30 psi. For example, with an inlet pressure of 17.5 psi, the vacuum must be no lower than -12.5 psi (i.e. -13 psi would be too low.)
6. How to improve de-gassing with the bubble trap?
 - a) A large pressure difference across the membrane will improve efficiency. It can be increased by applying vacuum, but should not be lower than -14.5 psi.
7. What is the bio and material compatibility of the bubble trap?
 - a) The bubble trap is fully compatible with living cells and aqueous fluids. While the trap materials are compatible with organic solvents, it is not recommended to use them with the trap. PTFE is hydrophobic and will not retain ethanol.
8. What is the bubble trap lifetime and required maintenance?
 - a) Membrane lifetime depends on the fluid used. Buffer solutions reduce lifetime compared to DI water, where the membrane can last several months or years.
 - b) Changing the membrane is highly recommended if different buffer solutions are to be used with the same setup.
 - c) Flushing the membrane with DI water is recommended in between use of buffer solution. 70% ethanol may also be used to ensure sterile conditions, but subsequent flushing with water is still necessary to remove traces.

8. Reference Papers using PreciGenome Bubble Traps

1. Ritt, Cody L., et al. "Thermodynamics of charge regulation during ion transport through silica nanochannels." *ACS nano* 16.9 (2022): 15249-15260.
2. Watson, Craig, et al. "Multiplexed microfluidic chip for cell co-culture." *Analyst* 147.23 (2022): 5409-5418.
3. Feng, Di, et al. "Phosphorylation of ACTN4 leads to podocyte vulnerability and proteinuric glomerulosclerosis." *Journal of the American Society of Nephrology: JASN* 31.7 (2020): 1479.