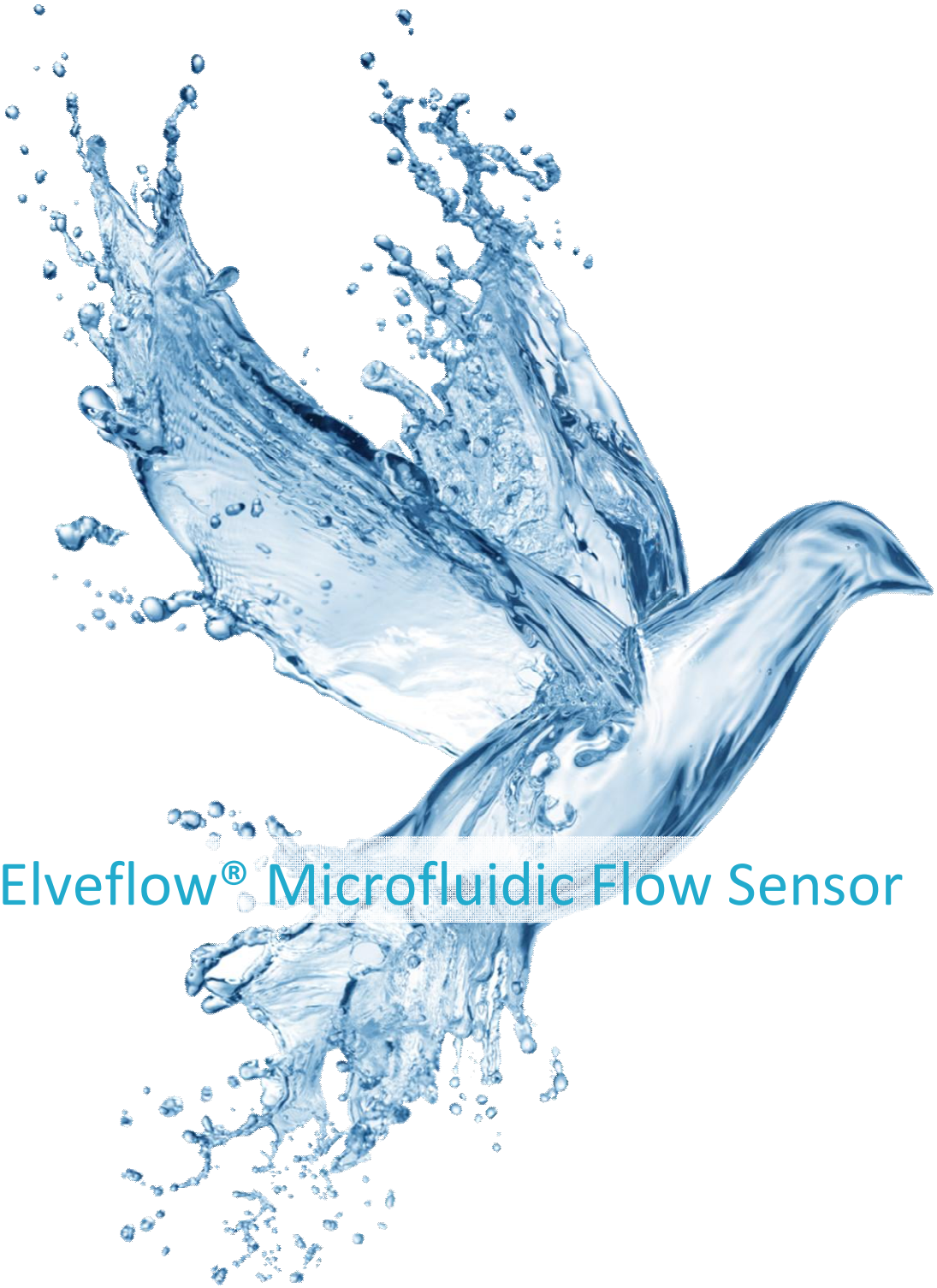


Elveflow® Microfluidic Flow Sensor

USER GUIDE

January 2015

ELVEFLOW
PLUG & PLAY MICROFLUIDICS

READ THIS MANUAL CAREFULLY BEFORE USING THE FLOW SENSOR

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

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

Important Flow Sensor safety notices:

1. **Do not use chemicals which are incompatible** with PEEK and glass (quartz for sensors #1, #2 and #3; borosilicate for sensors #4 and #5).

2. **No solids**should enter the flow sensor.

3. If possible, **filter the media** using a filter with pore size < 5 µm, especially for flow sensors #1 and #2.

4. **Do not exceed the maximum pressure** that can be applied to a flow sensor. Check the dedicated section for the pressure limits of each flow sensor model.

5. Always **clean the flow sensor** before storing it. Follow the recommended cleaning protocol in this user guide.

6. **Do not let media dry in the flow sensor capillary.**

7. Always store the sensor with its **protective cap**.

IF THESE CONDITIONS ARE NOT MET, THE USER IS 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.

Contents

Description

The Elveflow® microfluidic flow sensors are designed to monitor flow rates in different ranges for a wide variety of demanding microfluidic applications.

The Elveflow® Flow Sensor is monitored by a computer through and interfacing device such as an Elveflow® Flow Reader, or one of the Elveflow® pressure regulators, using the Elveflow® Smart Interface that allows you to perform real-time creation, monitoring and modificationson complex flow rate profiles such as sine, square, triangle, ramp, pulse or sawtooth.

Last but not least, the Elveflow® Smart Interface allows recording and exporting the data generated by all the Elveflow® instruments connected and involved in your experiment.

Principle

The flow sensor working principle is based on locally heating the fluid and measuring its temperature through a glass capillary. This mechanism is very sensitive to surface quality. Therefore, deposits on the capillary wall can reduce heat transfer for both heating and temperature measurements and lead to a measurement deviation and/or an offset. Cleaning flow sensors after use ensures their longevity and measurement quality.

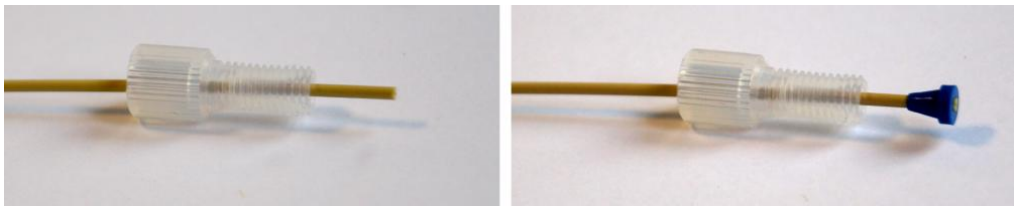
Setup and use

The Elveflow Flow Sensors have “in” and “out” markings which indicate the flow direction. Thus,“in” is generally connected to a reservoir, while “out” is connected to a microfluidic chip.

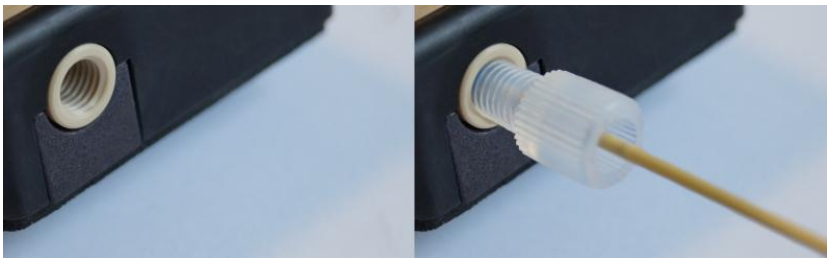
The flow sensors can read flow in both directions. A positive value indicates that the fluid is flowing from “in” to “out”, and a negative value indicates flow in the opposite direction, i.e., from “out” to “in”.

Microfluidic connections

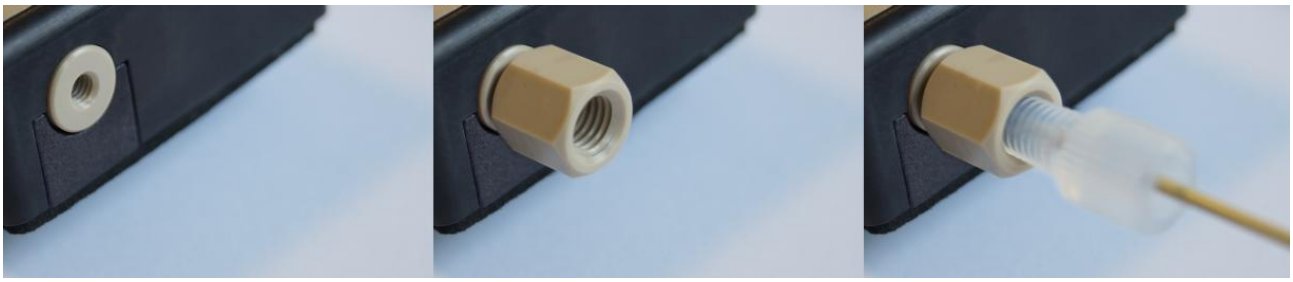
1. Place the tubing in a 1/16 1/4-28 flangeless nut then position the ferrule on the tip of the tubing. Note that this last step may be difficult, since the ferrule is designed so that a maximum sealing is achieved. Once inserted, the tubing must be at the same level as the flat face of the ferrule.



2. a) For a flow sensor with 1/4-28 female connectors, screw the flangeless nut directly into the connector.



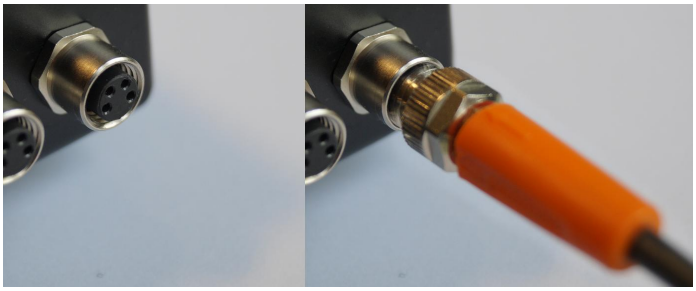
b) For a flow sensor with UNF 6-40 connectors first screw the UNF 6-40 – 1/4-28 adapter to the flow sensor, then screw the flangeless nut to the adapter.



Electronic connections

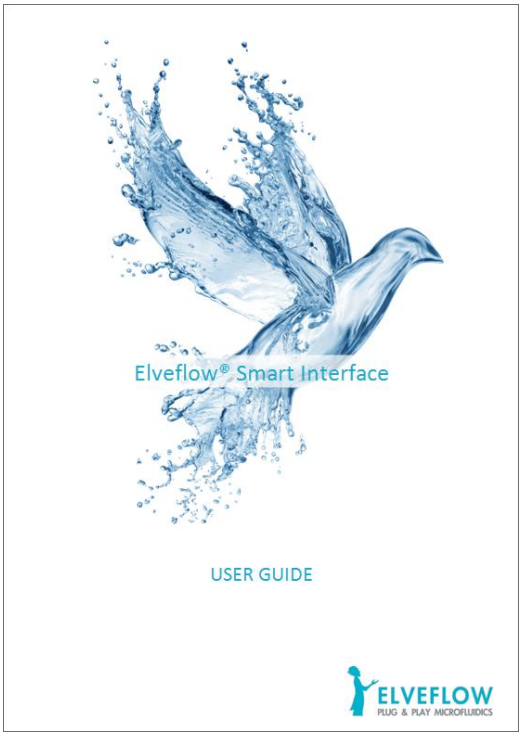
1. Connect the female part of the cable to the male connector of the flow sensor.

2. Connect the male part of the cable to the female connector on your instrument.



Using the Elveflow Smart Interface

The Elveflow® Smart Interface's main features and options are **covered by a specific guide**.Please refer to this guide for a detailed description.



You will also find dedicated user guides for:

- The instruments of the Elveflow product line;
- Accessories for microfluidics (reservoirs, flow restrictors, etc.).

Cleaning and storing

Cleaning the flow sensor after use is mandatory in order to prevent solid depositions in its capillary. These depositions may cause an increase in hydrodynamic resistance, false measurements and eventually render the flow sensor unusable.

The flow sensor is cleaned by simply pushing fluids through its capillary.**Never insert any solids in the capillary**, e.g. plastic or metallic sticks, in order to clean the flow sensor. You risk scratching the glass capillary and permanently damaging the flow sensor.

Cleaning protocols

The following protocols are general examples. Add washing steps according to the substances used during the experiment. Before washing the flow sensor with any substance, its **chemical compatibility with the wetted materials must be checked** (see technical data section).

When cleaning the flow sensor after flowing substances with additives, such as salts or surfactants, start by flowing the substance without any additive.

Always finish by the standard protocol below. Isopropyl alcohol is a very volatile solvent and does not leave any residues, as opposed to water and acetone.

Standard cleaning protocol

- 1 mL of acetone;
- 1 mL of isopropyl alcohol;
- 30 s of air flushingto dry the sensor.

Example of cleaning protocol for PBS-BSA

- 5 mL of deionized water;
- 5 mL of 1M acetic acid + 10% SDS;
- 1 mL of acetone;
- 1 mL of isopropyl alcohol;
- 30 s of air flushing to dry the sensor.

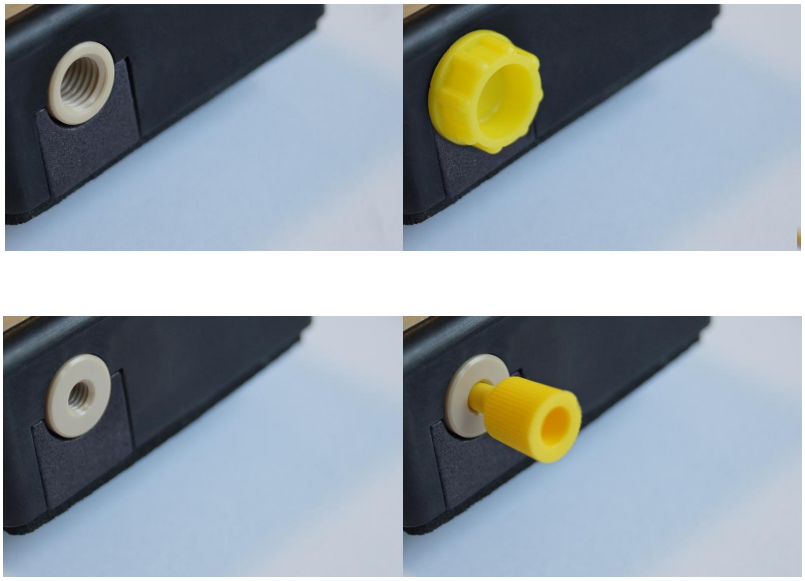
Example of cleaning protocol for fluorinated oil with surfactant

- 5 mL of fluorinated oil;
- 1 mL of acetone;
- 1 mL of isopropyl alcohol;
- 30 s of air flushing to dry the sensor.

Storing conditions

Always dry the flow sensor with clean, dry air before storing it.

Remove the microfluidic connectors and tubing and **connect the caps** to prevent dirt and dust from entering the capillary.



Supplementary information

Conditions of use

Terms and conditions of use

We strongly believe in the intrinsic quality of our microfluidic instruments line and we hope that you will be pleased with your purchase. However, in the unlikely event that you should receive damaged or incorrect goods in your delivery, please notify us within 7 days of receipt.
You will be offered the option of a refund or an exchange (provided the goods are in stock).
You may be asked to return goods for inspection. In this case we will refund the shipping fees.
Should the damaged or incorrect item be no longer available, you will be given the option of a refund.
Please note that goods that become damaged or broken after 7 days of receipt cannot be returned.

Unwanted items

If for any reason you do not wish to keep your purchase and would like a store credit, then please notify us within 7 days of receipt.
We cannot accept unwanted returns that have been opened, used or damaged by the customer.
For unwanted goods, we allow up to 14 days for the return of goods. We will only issue a credit upon receipt of all returned goods.
Please note that we are unable to refund your costs in returning unwanted goods or the delivery costs of sending the goods to you in the first place.

Cancellations
If you wish to cancel your order please email us immediately: contact@elveflow.com.

Privacy Policy
Customer details remain private and confidential and will not be released to a third party unless required to do so by law.
We use the information we collect about you to process orders, to provide a more personalized shopping experience and, if you request it, to notify you about new products, special offers or other information that may be of interest to you. We do not sell or pass on any personal information to any other Companies or Organizations.

Payments & Procedures
Payment from private customers must be paid for in advance of shipment.Trade orders from registered companies or organizations can be invoiced. Payment is due strictly within 30 days of the invoice date.

Products & Prices
Please note that some goods may vary in style, color or detail from the image shown.We reserve the right to change prices at any time.

Transport and storage

Be careful not to harm or shake Elveflow products while moving Elveflow® products must not be transported when plugged. Store products in standard conditions in an adapted box (typically the one used to send you the product).
Humidity and temperature must not exceed those of the specifications.

Exclusive remedies

The remedies provided herein are the customer's sole and exclusive remedies. Elveflow® shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Safety Information

THE FOLLOWING GENERAL SAFETY PRECAUTIONS MUST BE FOLLOWED DURING ALL PHASES OF OPERATION, SERVICE, AND REPAIR OF THIS INSTRUMENT. FAILURE TO COMPLY WITH THESE PRECAUTIONS OR WITH SPECIFIC WARNINGS ELSEWHERE IN THIS MANUAL VIOLATES SAFETY STANDARDS OF DESIGN, MANUFACTURE, AND INTENDED USE OF THE INSTRUMENT. ELVESYS ASSUMES NO LIABILITY FOR THE CUSTOMER'S FAILURE TO COMPLY WITH THESE REQUIREMENTS.

Important advices

Elveflow products are for research use only.
No solid should enter into the flow sensor otherwise this would void the warranty.
Please take the required action to ensure that these conditions are met and maintained.

Conditions of use

This instrument is intended for indoor use. It is designed to operate at a maximum relative humidity of 60% and at altitudes of up to 2000 meters. Operating temperature range is +10°C to 50°C.

Do not operate in wet/damp conditions: to avoid electric shock, do not operate this product in wet or damp conditions.

Do not operate in an explosive environment: do not operate the equipment in the presence of explosive or flammable gases or fumes.

Warning: Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. The protective features of this product may be impaired if it is used in a manner not specified in the operating instructions. Before installing, handling, using or servicing this product, please consult the data sheet and user manual.

Failure to comply with these instructions could result in death or serious injury. If the buyer shall purchase or use Elveflow® products for any unintended or unauthorized application, the buyer shall defend, indemnify and hold harmless Elveflow® and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if Elveflow® is allegedly negligent with respect to the design or the manufacture of the product.

Pressurized Equipment

Care must be taken when the Elveflow pump is pressurised to ensure that the instrument is not damaged in any way.

Protection

Safety glasses and labcoat should be worn at all times when using an elveflow pressure pump due to the use of pressurised equipment. This is particularly important when hazardous liquids are used.

Electrictity advices

Use Elveflow® instruments with the provided power unit only. Maintenance should only be attempted by qualified Elveflow® personnel. Removal of the back panel may invalidate any warranty.

Before applying power: verify that the line voltage matches the product's input voltage requirements and the correct fuse is installed. Use only the specified line cord for this product and make sure the line cord is certified for the country of use.

Fuses: only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short circuited fuse holders. To do so could cause a shock or fire hazard.

Keep away from live circuits: operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed.

To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

ESD precautions: the inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

Maintenance advices

Maintenance should only be attempted by qualified Elveflow® personnel.

Removal of the back panel may invalidate any warranty.

Do not service or adjust alone:do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do not substitute parts or modify instrument: because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument.

Return the instrument to an Elveflow® Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Instruments which appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified Elveflow® personnel.

CE compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Electromagnetic Compatibility

COUNCIL DIRECTIVE 89/336/EEC of 3 May 1989

This directive has been amended by the following Council Directives:

1. 92/59/eec of 29 June 1992 (General Product Safety)

2. 93/68/eec of 22 July 1993 (CE Marking directive)

3. 99/5/ec: Directive of Radio Equipment & Telecommunications Terminal Equipment (R&TTE).

Warranty

ELVEFLOW is a brand of ELVESYS Innovation Center.

The ELVESYS hardware products are warranted against defects in material and workmanship for a period of one year from date of delivery. ELVESYS software and firmware products, that are designated by ELVESYS for use with a hardware product and when properly installed on that product, are warranted not to fail to execute their programming instructions due to defects in material and workmanship for a period of 60 days from date of delivery. During the warranty period ELVESYS will, either repair or replace products that prove to be defective. ELVESYS does not warrant that the operation for the software, firmware or hardware shall be uninterrupted or error free. For warranty service, this product must be returned to a service facility designated by ELVESYS. Customer shall prepay shipping charges (and shall pay all duty and taxes) for products returned to ELVESYS for warranty service. Except for products returned to a Customer from another country, ELVESYS shall pay for return of products to the Customer.

ELVESYS does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer's applications by customer's technical experts. Recommended parameters can and do vary in different applications. ELVESYS reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

Limitation of warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance.