FLUIGENT
SMART MICROFLUIDICS™

UNIDIRECTIONAL & STABLE FLUID RECIRCULATION

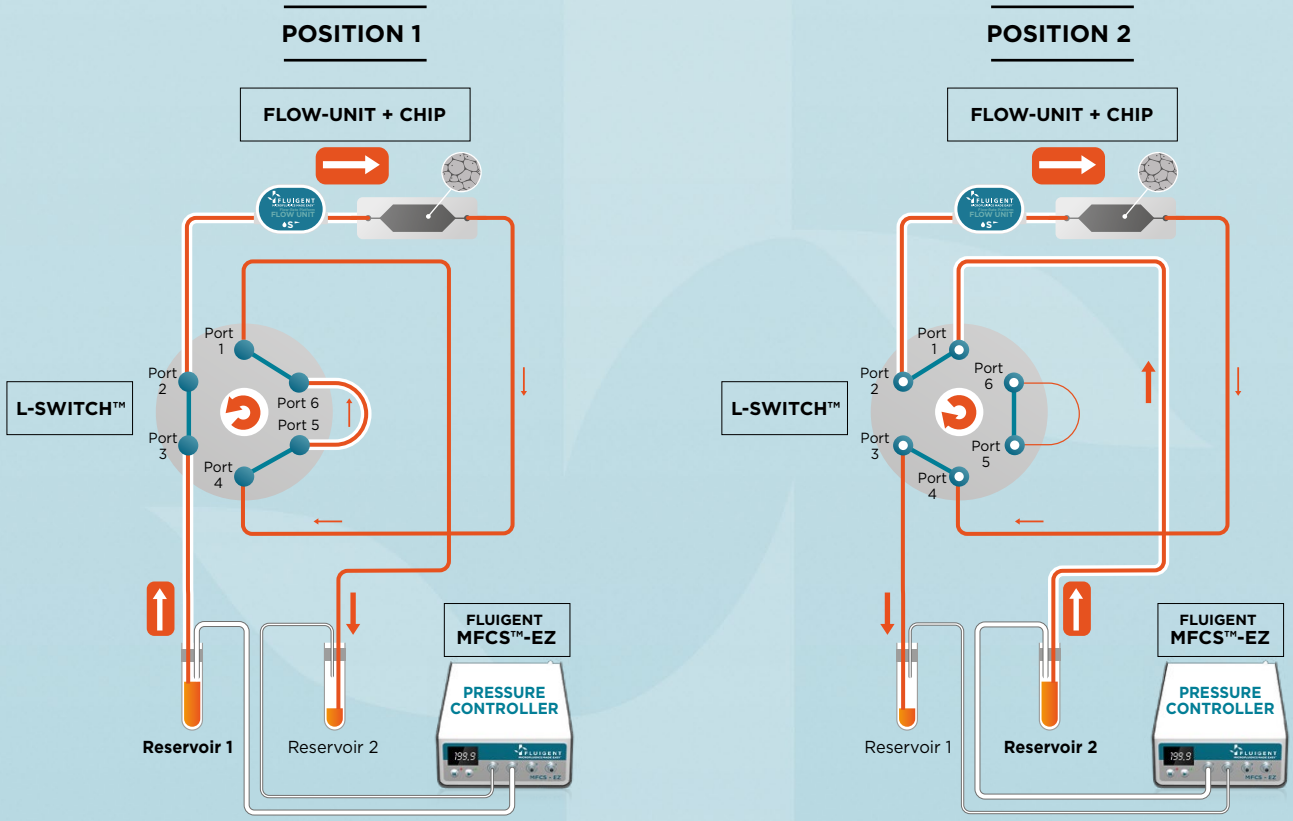

Figure 1: Diagram of the two fluidic paths during the long-term experiment. The fluid always goes in the same direction within the chip.

BENEFITS

- Small buffer volume
- Controlled shear stress
- Long-term experiments
- High stability
- Flexible automation
- Pressure and/or flow-rate control and limit

APPLICATIONS

- Cell culture
- *In vitro* modeling
- Blood circulation study
- Perfusion
- Biochemical synthesis

INTRODUCTION

Many microfluidic applications require expensive buffers to be injected at a controlled flow-rate into a microfluidic system, such as cell cultures, PCR processes or simulation of blood capillaries with a controlled minimal mechanical stress.

In this application, two MFCS™-EZ pressure channels are connected to two vials containing a physiological buffer for instance. The use of the L-SWITCH™ and ESS™ Control software allows back and forth flow between the two vials while maintaining a continuous unidirectional flow-rate within the cell culture chamber.

This allows an efficient recirculation system as it can reinject the same small volume of buffer during hours into one chamber. This highly reduces buffer costs while maintaining a controlled shear stress onto your cell culture.

MATERIALS

- MFCS™-EZ, 2 channels at 345 mbar full scale
- 2 Fluiwells filled in with water
- L-SWITCH™, SWITCHBOARD, Script Module
- FEP tubing with an ID of 500 microns
- FLOW UNIT M, calibrated for water over the range of 60 nL/min to 80 µL/min

METHODS

The experiment was run under the following conditions:

- Set the L-SWITCH™ on Position #1
- Set the flow-rate to 10 µL/min
- Set the L-SWITCH™ on Position #2 while switching pressure channels used on the MFCS™-EZ
- Automatically switch from one position to the other one every 1h40min via the Script Module
- Save flow rate profile by the MAESFLO™ software, and analyze in Excel.

The goal was to study the stability of the flow-rate during a long-term recirculation experiment using our L-SWITCH™. It is important in this type of set-up to be able to switch from one vial to the other and vice-versa without modifying the shear stress in a media on cells for instance. Furthermore, one needs to notice that only a small amount a fluid is needed for a long period of time, which is critical when using expensive buffer.

RESULTS

For this experiment we used only 1mL of distilled water. This volume was injected within the system at a flow-rate of 10.0µL/min. The switching steps occurred after 1h40min and the whole experiment lasted 60h. This means that the effective volume of the experiment was 36mL. We hence divided by a factor 36 the volume needed for a simple unidirectional circulation just by using our L-SWITCH™.

CONCLUSION

The Fluigent Automation Tool, when combined with flow control, allows the automated recirculation of a minimum amount of reagents or buffer for a long period of time.

Total volume used	Total injected volume	Experiment duration
1 mL	36 mL	60 h