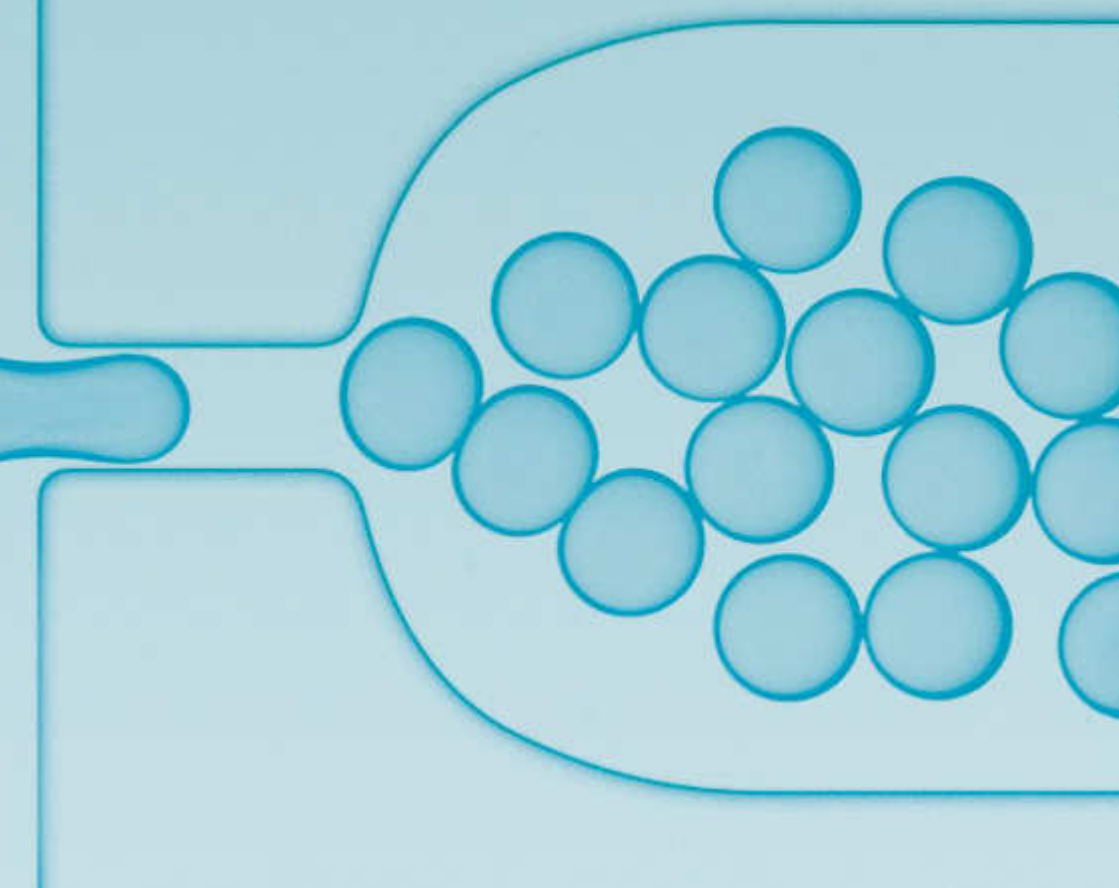
FLUIGENT

SMART MICROFLUIDICS™

PRODUCT CATALOG



CONTENT

COMPANY OVERVIEW

Blue: Fluigent facilities *Orange: Local partners and distributors*

Fluigent develops, manufactures, commercializes and supports innovative fluid handling solutions for a variety of rapidly growing applications where fluid control is critical.

Since 2005 we have delivered more than 2,500 Fluigent systems. These include the MFCS™-EZ (Microfluidic Flow Control System), the FRP (Flow-Rate Platform) and the ESS™ (Easy Switch Solutions™).

Today, building on our field experience and a broad range of applications and we have more than 400 scientific publications citing our products and their performance.

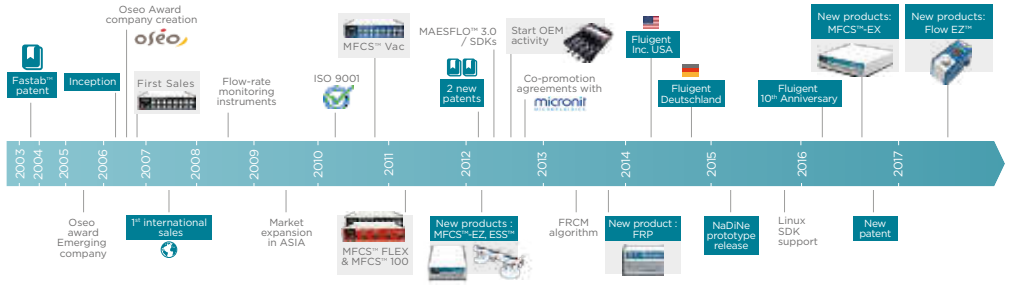
We strive to provide "Smart Microfluidic" solutions. Our modular system architecture enables our customers to save time from cumbersome engineering fluidic developments (such as re-designing and re-developing electronic and software interfaces for each new set-up). As an example, it is possible to add/ remove switch units on the fluidic paths within few minutes' time, and immediately start operating the new set-up.

TEAM AND FACILITIES

In addition to our Paris area headquarters, we have 2 local subsidiaries to be closer to our customers:

FLUIGENT GmbH in Jena, Germany for our Northern and Eastern European customers, and FLUIGENT INC. in Boston, USA for our American customers. We also rely on a trained network of partners worldwide for the other regions.

HISTORY



In 2003 Jean-Louis Viovy and his team at Institut Curie where facing issues with flow stabilization on a microfluidic experiment for DNA analysis. Stability and equilibration time of syringe pumps made the experiments long, tedious and not very reproducible. Thus, they came with the idea of using pressure instead of syringe pumps to drive the flow in the microfluidic devices. They developed and patented a unique way of delivering pressure which resulted in a very fast and stable flow in microfluidic chips: our disruptive technology. Experimental time dropped down from one hour to few seconds.

In 2005 Fluigent was founded and was the first to commercialize pressure based flow control instruments for microfluidics: MFCS™ instruments including our disruptive technology. Since its inception Fluigent has then developed new instruments for microfluidic applications with the goal to make microfluidic easy and accessible to the largest number of labs for various applications.

FLUIGENT IS THE LEADER IN MICROFLUIDIC CONTROL:

- **Over 12 years' expertise in microfluidics with an excellent record for quality, performance and customer support.**
- **Expertise: fluidic, automation, mechanical knowhow and experience**
- **3 subsidiaries and 12 trained distributing partners worldwide**
- **More than 500 customers in more than 40 countries**
- **An industrial partner for OEM solutions**

FLUIGENT
SMART MICROFLUIDICS™

2. PRODUCTS AND SOFTWARE

FLOW EZ™

The most advanced flow controller

EASY TO USE :
JUST DIAL IN SET PRESSURE

BEST PERFORMANCE AVAILABLE

USE WITH OR WITHOUT PC

EXPANDABLE BY THE USER

ENGINEERED FOR MICROFLUIDICS LAB BENCH

BENEFITS

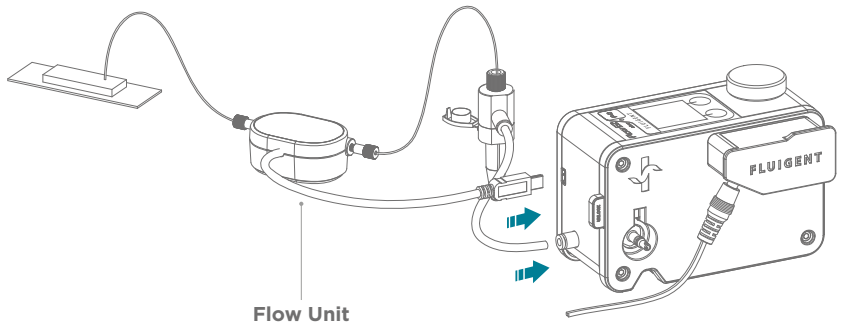
- **Local control with intuitive dial:** directly dial in pressure set points
- **Live control & monitoring:** digital screen with intuitive menu
- **Expandable design:** additional modules are plug and play
- **Add a FLOW UNIT directly** to measure flow-rate
- **Low gas consumption**

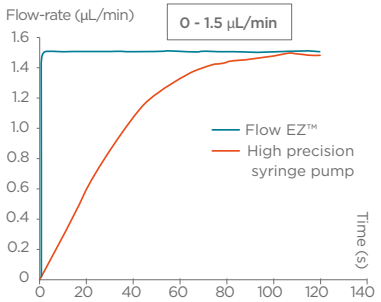
APPLICATIONS

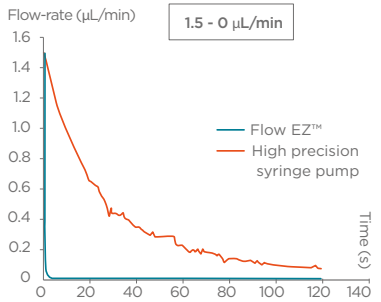
- Cell encapsulation
- OOAC
- Flow Cytometry
- Digital PCR
- Droplet Manipulation
- LOAC
- High-throughput screening
- Cell Sorting

LineUP™

Our new LineUP™ product range is the next generation of microfluidic systems. Besides this Flow EZ™ module, a Link (see p. 32) can connect the modules to a computer or any other external instrument, and an Adapt module is available to connect Flow EZ™ modules with different pressure ranges without the need of additional pressure sources.







Features	FLUIGENT Flow EZ™	Other Pressure-Based Solutions	Syringe Pumps
Free standing (no PC needed)	✓	×	~
Modular and stackable	✓	×	~
Very short response time	✓	~	×
Pulseless flow	✓	✓	×
Control & monitor display	✓	~	~
Very low gas consumption	✓	×	NA
Compact	✓	~	×

Same pressure ranges than our MFCS™ Series. Specifications upon request.

~ : Feature not available for all brands

MFCS™-EZ

Microfluidic Flow Control System EZ

FAST INSTALLATION

EASY TO USE

AUTOMATION CAPABILITIES

FAST AND STABLE

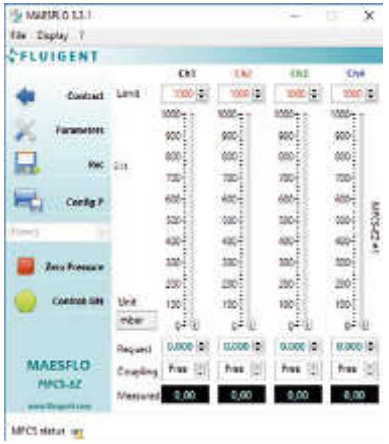
FIELD PROVEN TECHNOLOGY

BENEFITS

- **Get started instantaneously** and focus on your science
- **Get results** faster
- **Save space** with a compact flow controller
- **Save time** and let the MFCS™-EZ take care of your set-up for you

SOFTWARE

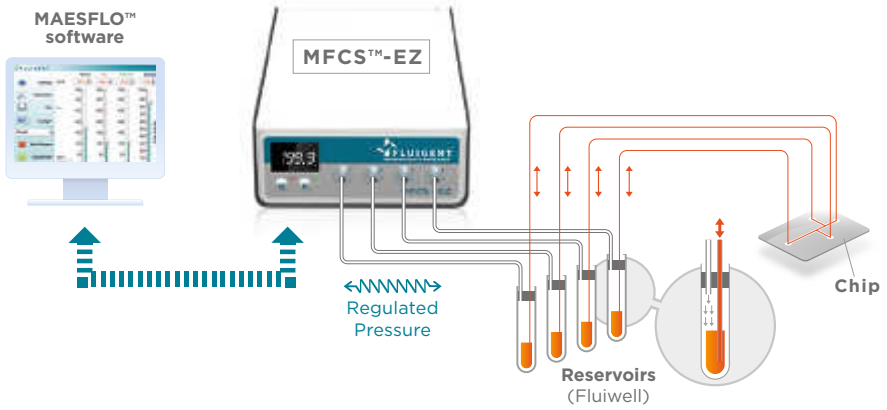
- MAESFLO™ (p.34)
- Flow Rate Control Module (FRCM) (p.34)
- Script Module (p.37)
- Software Development Kit (SDK) (p.39)



APPLICATIONS

- Droplets
- Lab on Chip
- Organ on chip
- Cell handling
- Bead manipulation
- Volume control

PNEUMATIC TECHNOLOGY



Pressure ranges	0-25 mbar	0-69 mbar	0-345 mbar	0-800 mbar	0-1000 mbar	0-2000 mbar	0-7000 mbar
Positive Pressure	✓	✓	✓	-	✓	✓	✓
Negative Pressure	✓	✓	✓	✓	-	-	-
Excellent Output Pressure Stability	Highly monodispersed droplet size - No oscillation						
Fast System Settling Time	No transitory regime - Reagent savings - Stop-flows						
Pressuring gas	Non corrosive or explosive gas (air, N_2, Ar, O_2, ...). No contamination between the MFCS™-EZ and the solutions and between the solutions						
Size Weight	16 x 23 x 6.5 cm^3 (6.3 x 9 x 2.5 $inch^3$) 2.0 kg (4.4 lbs) - Compact controller						
Output connectors	Female Luerlock						4mm OD tube connectors
Volumes	Wide range of volume can be controlled No compromise between volume and stability						
Flexibility	Any mix of pressure ranges is available, even on one MFCS™-EZ Highly customizable						

MFCS™-EX

Microfluidic Flow Control System EX

8 CHANNELS OF PRESSURE CONTROL

COMPACT

ECONOMICAL

COMPATIBLE WITH MAESFLO™

ALLOW POSITIVE OR NEGATIVE PRESSURES*

ONLY ONE SOURCE OF PRESSURE & ELECTRICITY

BENEFITS

- **User-friendly interface** with effective data visualization
- **Fast control & regulation**
- **Instantaneous pressure** and flow-rate monitoring (only with FRP)
- **Script module included** to fully automate your microfluidic experiments
- **Data recording**
- **Coupling tool** between pressure channels
- **Pressure limit option** to prevent from any damage on chips
- **Customization** available (name, unit, ...)
- **Ability to log** pressure configuration

APPLICATIONS

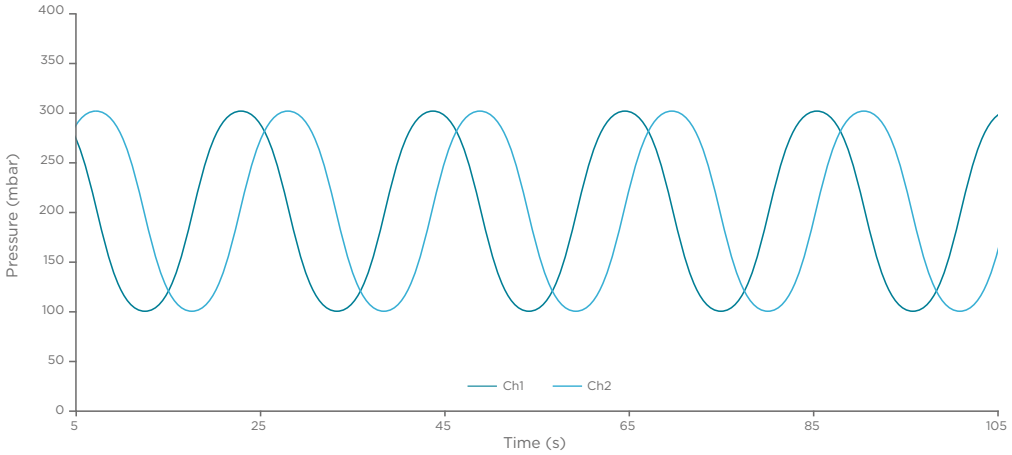
- **Organ-On-Chip**
- **Lab-On-Chip**
- **Droplets**
- **Cell handling**
- **Bead manipulation**
- **Volume control: injection of a selected volume in your chip**

SOFTWARE

The standard version of MAESFLO™ (p.34) is included with any MFCS™ ensuring an independent and precise control of the pressures inside your microfluidic system and monitoring of the pressures and the flow-rates (only available with the FRP) of up to 16 different channels.

* Allow positive or negative pressures on a single channel on request

PRODUCTS AND SOFTWARE | PRESSURE CONTROLLERS



Sinus protocol - Real time measured values on 2 different channels simultaneously (1 chip)

Pressure ranges	0-25 mbar	0-69 mbar	0-345 mbar	0-800 mbar	0-1000 mbar	0-2000 mbar	0-7000 mbar
Positive Pressure	✓	✓	✓	-	✓	✓	✓
Negative Pressure	✓	✓	✓	✓	-	-	-
Excellent Output Pressure Stability	Highly monodispersed droplet size - No oscillation						
Fast System Settling Time	No transitory regime - Reagent savings - Stop-flows						
Pressuring gas	Non corrosive or explosive gas (air, N_2, Ar, O_2, ...). No contamination between the MFCS™-EX and the solutions and between the solutions						
Size Weight	25 x 23 x 5.5 cm^3 (9.8 x 9 x 2 $inch^3$) 3.0 kg (6.6 lbs) - Compact controller						
Output connectors	Female Luerlock						4mm OD tube connectors
Volumes	Wide range of volume can be controlled No compromise between volume and stability						
Flexibility	Any mix of pressure ranges is available, even on one MFCS™-EX Highly customizable						

FLOW UNIT

High-precision individual flow sensors

COMPATIBLE WITH ANY FLOW CONTROLLER

EASY TO SET UP AND USE

HIGH PRECISION

TUNABLE TO YOUR LIQUIDS

BENEFITS

- **Usable with any flow control system** when you need it
- **Get the best precision** for various flow-rate ranges
- **Tune your measurements** for a variety of liquids
- **Adapt the Flow-Rate Platform** to one's application

APPLICATIONS

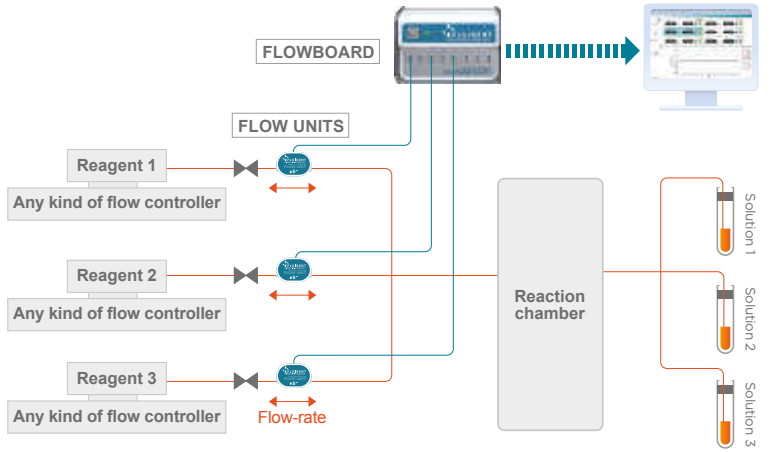
- **Droplets**
- **Cell analysis**
- **Organ-on-a-chip**
- **Cell culture**
- **Biological applications**
- **Rheology studies**
- **Chemical synthesis**
- **Kinetic studies**
- **Volume control**

SOFTWARE

The Flow-Rate Platform is designed to work with the Flow-Rate Platform Soft-Front Panel (FRP-SFP, p.35), adaptable with any flow controller.

The FRP-SFP enables recording measured values and graphic display of data.

When using our Flow EZ™ one can also monitor the measured flow-rates directly within the A-i-O software. When using our MFCS™ one can also monitor the meaured flow-rates directly within MAESFLO™ software.



FLOW UNIT	XS	S		M		L		XL
Sensor inner diameter	25 µm	150 µm		430 µm		1.0 mm		1.8 mm
Maximum pressure	200 bar	200 bar		100 bar		12 bar		5 bar
Wetted materials	PEEK & Quartz Glass	PEEK & Quartz Glass		PEEK & Borosilicate Glass		PEEK & Borosilicate Glass		PEEK & Borosili-cate Glass
Calibrated Media	Water	Water	IPA	Water	IPA	Water	IPA	Water
Range	0±1.5 µL/min	0±7 µL /min	0±70 µL /min	0±80 µL /min	0±500 µL/min	0±1 mL /min	0±10 mL /min	0±5 mL/ min
Accuracy (m.v. = measured value) Accuracy also applies to negative values	10% m.v. above 75 nL/min	5% m.v. above 0.42 µL/ min	20% m.v. above 4.2 µL/ min	5% m.v. above 2.4 µL/ min	20% m.v. above 25 µL/ min	5% m.v. above 0.04 mL/ min	20% m.v. above 0.5 mL/ min	5% m.v. above 0.2 mL/min
	7.5 nL/min below 75 nL/min	21 nL/min below 0.42 µL/ min	210 nL/min below 4.2 µL/min	0.12 µL/ min below 2.4 µL/ min	5 µL/min below 25 µL/ min	1.5 µL/min below 0.04 mL/ min	100 µL/ min below 0.5 mL/ min	10 µL/min below 0,2 mL/min
Repeatability (m.v. = measured value) Repeatability also applies to negative values	<1% m.v. above 90 nL/min	0.5% m.v. above 0.7 µL/ min	1% m.v. above 0.7 µL/ min	0.5% m.v. above 1.4 µL/ min	1% m.v. above 25 µL/ min	0.5% m.v. above 0.04 mL/ min	1% m.v. above 0.5 mL/ min	0.5% m.v. above 0.2 mL/min
	0.9 nL/min below 90 nL/min	3.5 nL/min below 0.7 µL/ min	7 nL/min below 0.7 µL/ min	8 nL/min below 1.4 µL/ min	0.25 µL/ min below 25 µL/min	0.2 µL/min below 0.04 mL/ min	5 µL/min below 0.5 mL/ min	1 µL/min below 0,2 mL/min

FRCM

Flow-Rate Control Module

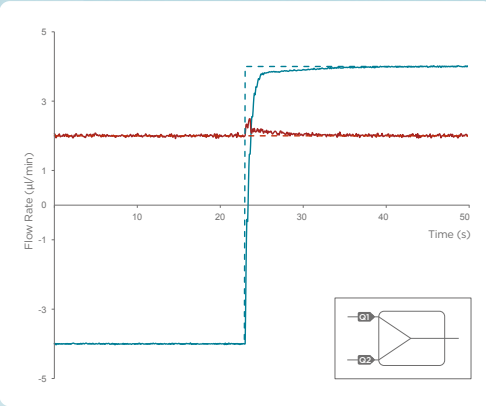
SHORT SETTLING TIME

AUTOMATIC PRESSURE ADJUSTMENT

EXCELLENT ACCURACY AND STABILITY

PRESSURE OR FLOW-RATE CONTROL

HIGH REPRODUCIBILITY



Fluigent has developed an innovative solution to simultaneously control multiple flow-rate channels using its Fluigent MFCS™ pressure controller. The FRCM can be used in one's experiment with the MFCS™-EZ and FRP for controlling simultaneous multiple flow-rate channels (both pressures and flow-rates) with excellent responsiveness and stability even in complex fluidic networks with cross talk between channels.

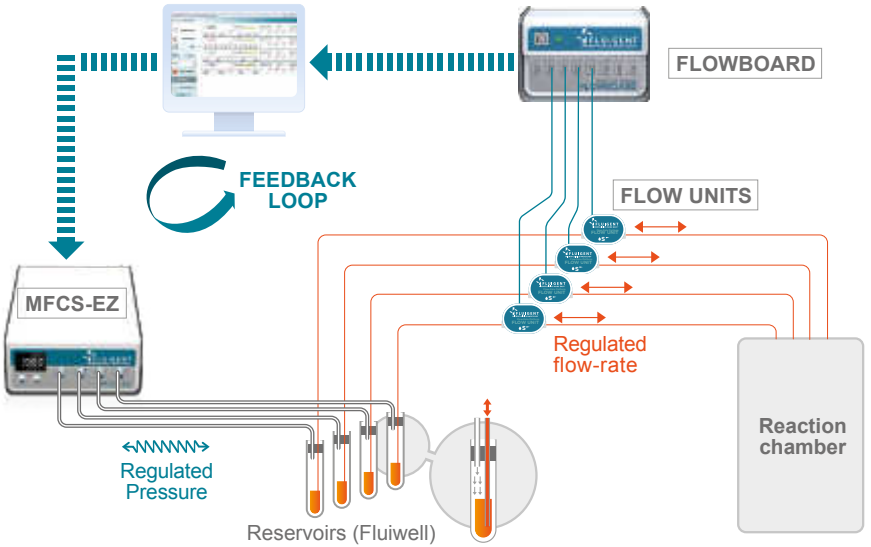
BENEFITS

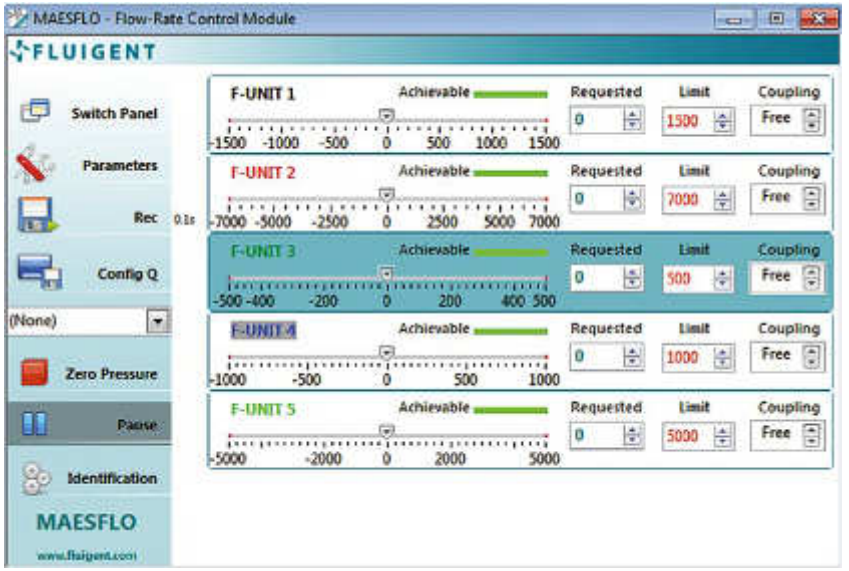
- **Predict and automatically adjust pressure**
- **Short settling time**
- **Excellent flow stability** even for long time experiments
- **Multi flow-rate channel regulation**

APPLICATIONS

- **Droplet generation**
- **Sample pretreatment**
- **Kinetic measurements**
- **Chip quality control**
- **Lab-on-a-chip**
- **Organ-on-a-chip**
- **Beads manipulation**
- **Cell handling**

PATENTED TECHNOLOGY





ESS™ PLATFORM

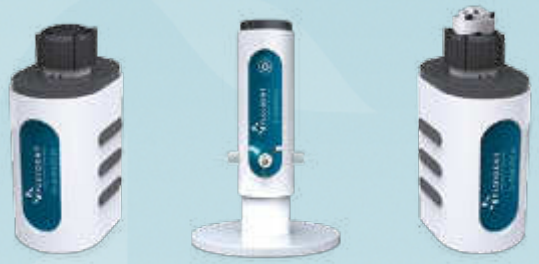
Easy Switch Solutions™

SHORT RESPONSE TIME

LOW INTERNAL VOLUME

BIDIRECTIONAL FLOW

BIOCOMPATIBLE MATERIALS



BENEFITS

- **Simplify chip design**
- **Save time** by automating most complex experiment
- **Keep full sample integrity**
- **Reduce the benchtop footprint of the set-up** while optimizing performance
- **Save money** by reducing reagent and sample consumption
- **Check and monitor the experiment** in real time

SOFTWARE (P.36)

- Ability to record and log the positions of all devices during the experiment, with different data sampling rates.
- Save a set of positions as a configuration that can be reused whenever needed.
- Modular display of devices: every 2-SWITCH™, L-SWITCH™ or M-SWITCH™ control can be undocked and displayed in an individual and repositionable compact window.

APPLICATIONS

- **Full set-up automation**
- **Sequential injections**
- **Time saving**
- **Highly calibrated volume injection**
- **TTL synchronization**

SWITCHBOARD

COMMUNICATION PLATFORM

The SWITCHBOARD hosts up to four M-SWITCH™ or L-SWITCH™ and eight 2-SWITCH™ as well as provides them power. It is also the link between the connected valves and the controlling ESS™ software. Additionally, the SWITCHBOARD is compatible with TTL signals and has the capability to take specific actions automatically in response to an external trigger or to the status of its connected valves.

This hardware-based electronic solution gives the SWITCHBOARD the fastest reaction time and the best reliability comparing to other solutions in the market. It guarantees the tightest synchronization and the success of your experiments.

2-SWITCH™

3-port / 2-way bidirectional valve

- 3-port / 2-way valve
- Chemical & biological compatibility
- Low internal volume (12µL)
- No dead volume
- External fittings
- No heating
- Use as a stand-alone system or software controlled (full automation)
- Fast response time: 20ms
- Easy identification of the positions with indicator lights

L-SWITCH™

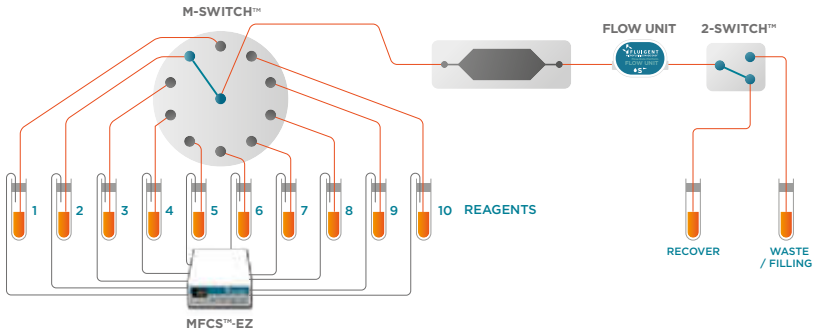
6-port / 2-positions bidirectional valve

- 6-port / 2-position valve
- Switching different fluids controlled by our ESS™ Control software
- Chemical & biological compatibility (wetted materials: PEEK)
- Low port-to-port volume (660nL)
- No dead volume
- External fittings
- Software controlled / Full automation
- Port-to-port switching time: 100ms
- Injection and switching modes
- Compatible with sample injection loop from 5µL to 100µL

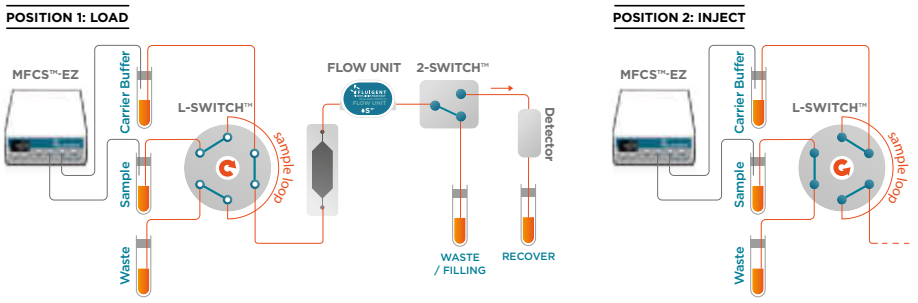
M-SWITCH™

11-port / 10-way bidirectional valve

- 11-port / 10-way valve
- Bidirectional 11-port / 10-way valve for injection or selection of up to 10 different fluids controlled by our ESS™
- Chemical & biological compatibility (wetted materials: custom polymer RPC 7)
- Low internal volume (11.6µL)
- No dead volume
- Integrated fittings
- Software controlled / Full automation
- Port-to-port switching time: 280ms



Sequential injections with 2-Switch™ and M-Switch™



Controlled volume injection with L-switch™

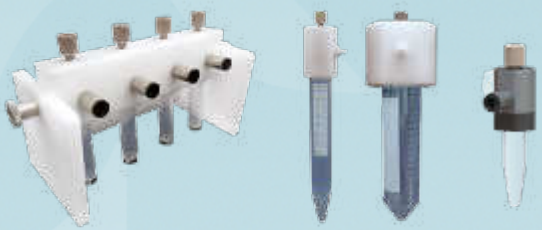
FLUIWELL & P-CAP

Fluiwell 1C-15, Fluiwell 1C-50, Fluiwell 4C, P-CAP

AUTOCLAVABLE

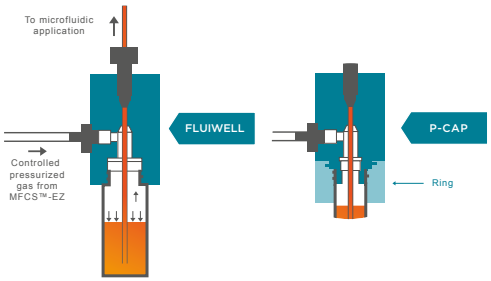
COMPATIBLE WITH A LARGE RANGE OF TUBING

LARGE RANGE OF RESERVOIRS AVAILABLE



BENEFITS

- **Autoclavable** - for sterile systems
- **Use of different types of tubing** compatible with your own samples
- **Suitable for long term experiments**
- **Flow control for simple or complex applications** with a unique product
- **Made of Delrin** (Fluiwell) **and Aluminium** (P-CAP)
- **Compatible with any tubing with** 1/16 inch outer diameter
- **Different size reservoirs available**
- **Independently pressurized channels**



Type of FLUIWELL	FLUIWELL-4C	FLUIWELL-1C		P-Cap
Maximum volume of pressurized liquid	from 0.5 ml to 2 ml	15 ml	50 ml	from 1,5 ml to 2 ml
FLUIWELL size (W x L x H mm^{v})	130 x 60 x 60	25 x 30 x 36	40 x 40 x 50	26 x 18 x 16
FLUIWELL weight	190 g	20 g	92 g	15 g
Fluid connectors	10-32 coned UNF female fittings			
No wetted material	Only disposable material are wetted			
Type of reservoirs (disposable)*	Simport (Micrew Series)	Greiner	Corning	Eppendorf

Other options available - please contact us.

ELECTROWELL

Specifically designed for pressurization

PRESSURE / FLOW-RATE AND VOLTAGE CONTROL

CE APPROVED

CAN BE STERILIZED

COMPATIBLE WITH ANY TUBING MATERIAL

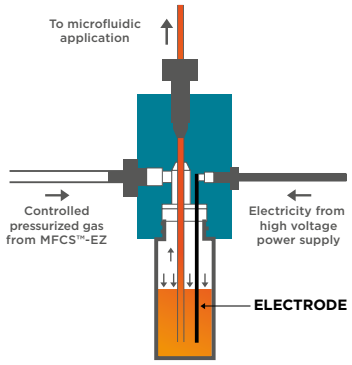
Characteristics	Value
Maximum Voltage	5 000 V
Acceptable electrodes material	Pt, Au, Ag... Easy to change
Acceptable electrodes diameter	ø 100 to 500 µm
Electrical Connection	High Voltage banana ø 4mm plugs
Wetted parts	Reservoir (disposable), electrode
Weight	500 g
Size (W x L x H mm^3)	118 x 126 x 43
Fluid connectors	10-32 UNF female fittings
Cable available (plug type)	Shielded 4 mm banana plug or high voltage SHV
Number of independent channels	4
Reservoirs	4 vials from 500 µl to 2 ml
Type of reservoirs (disposable)	Simport (Micrew Series)

APPLICATIONS

- **Electrophoretic flow**
- **Electric field inside a microchannel**
- **Electroosmotic flow**
- **Poiseuille flow control**

BENEFITS

- **Autoclavable**
- **Use of different types of tubing** compatible with your own samples
- **Suitable for long term experiments**
- **Flow control for simple or complex applications** with a unique product
- **Made of Delrin**
- **Compatible with any tubing** of 1/16 inch outer diameter
- **Different size reservoirs available**
- **Independently pressurized channels**



TUBING & FITTING KITS

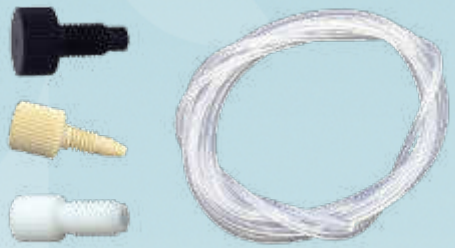
Fluigent Microfluidic Tubing and Fitting Kits are a quick and easy way for your work be done with every Fluigent product.

SPECIALLY OPTIMIZED FOR FLUIGENT PRODUCTS

FLUIDIC AND PNEUMATIC

TUBING AND FITTING

DESIGNED FOR YOUR SET-UPS



DROPLET KIT

The Droplet Kit is designed to be used with the Droplet Starter Pack, with any Flow EZ™ pressure channel and FLOW UNITS model.

- 3 x EZ Drop chips, with 3 patterns each
- 2m Tubing (250 ID ; 1/32"OD)
- 2 x Sleeves

FLOW EZ™ SUPPLY KIT

The Flow EZ™ Supply Kit is designed to be used with any Flow EZ™ pressure channel.

- Power supply (24VDC)
- Power supply to Sub-D adaptor
- Pneumatic inlet tubing
- Pneumatic inlet smart connector

MFCS™ KITS

The MFCS™-EZ High Pressure Kit is especially designed to be used with any MFCS™-EZ with any high-pressure channel, especially the 7bar pressure range.

- MFCS-HP Red Plug (x4)
- MFCS-HP Back-flow Filters (x4)
- High Pressure Tubing (4x40cm) OD: 4mm, ID: 2.5mm

The MFCS™-EZ Low Pressure Kit is especially designed to be used with any MFCS™-EZ with any low-pressure channel from 25mbar to 2000mbar ranges and from -800mbar to -25mbar ranges.

- MFCS-LP Male Luer Connector, 1.6mm (x4)
- MFCS-LP White Cap (x4)
- MFCS-LP Back flow Filters (x4)
- Tygon Tubing (2m) OD: 3mm, ID: 1mm

FRP KITS

The FRP Low Flow-Rate Kit is especially designed to be used with low flow-rate FLOW UNITS, XS, S and M.

- Adaptor PEEK 1/16'' to 1/32'' OD Tubing (x1)
- LQ Flow Unit Connector for 1/32'' OD Tubing (x2)
- Green sleeve 1/16'' OD, 0.33'' ID x 1.6' (x1)
- Blue PEEK Tubing 1/32'' OD x 0.010'''' ID (1m)

The FRP High Flow-Rate Kit is especially designed to be used with high flow-rate FLOW UNIT L .

- HQ Flow Unit Connector 1/4-28 Flat-Bottom for 1/16'' OD Tubing (x2)
- Ferule for HQ Flow Unit (x4)
- FEP Tubing 1/16'' OD x 0.020 ID (1m)

The FRP High Flow-Rate Kit XL is especially designed to be used with high flow-rate FLOW UNIT XL.

- HQ Flow Unit connector 1/4-28 Flat-Bottom for 1/16" OD tubing (x2)
- Ferrule for HQ Flow Unit (x4)
- FEP Tubing 1/16" OD x 0.020" ID (1m)
- Union Tezfel™ with .030 thru hole (x1)
- PEEK Tubing Natual 1/16" OD x 0.055" ID (10cm)

ESS™ KITS

The ESS™ 2-SWITCH™ Kit is designed to help our customers to daily use our 2- SWITCH™.

- 2-SWITCH™ Plug Delrin® - 10-32 Flat Bottom (x1)
- 2-SWITCH™ Ferrule 1/16″ (x12)
- 2-SWITCH™ Teflon Connector (x6)
- FEP Tubing 1/16″ OD x .010″ ID (1m)

The ESS™ L-SWITCH™ Kit is designed to help our customers to daily use our L-SWITCH™.

- L-SWITCH™ Plug Delrin 10-32 Coned Blue (x2)
- L-SWITCH™ 10-32 to Female Luer Connector (x2)
- FEP Tubing 1/16″ OD x 0.020″ ID (1m)
- L-SWITCH™ Fitting 10-32 Coned, for 1/16″ OD Tubing

The ESS™ M-SWITCH™ Kit is designed to help our customers to daily use our M-SWITCH™.

- M-SWITCH™ Ferrule 1/16″ (x20)
- M-SWITCH™ Plug (x10)
- FEP Tubing 1/16″ OD x 0.10″ ID (1m)

FLUIWELL KITS

The Fluiwell-1C15 Kit is designed for use with our Fluiwell-1C, with reservoirs of 15mL.

- Fluiwell Fitting 10-32 Coned, for 1/16″ OD Tubing (x2)
- Fluiwell-4C Seals (x1)
- FEP Tubing 1/16″ OD x 0.020″ ID (1m)

The Fluiwell-1C50 Kit is designed for use with our Fluiwell-1C, with reservoirs of 50mL.

- Fluiwell Fitting 10-32 Coned, for 1/16″ OD Tubing (x2)
- Fluiwell-4C Seal (x1)
- FEP Tubing 1/16″ OD x 0.020″ ID (1m)

The Fluiwell-4C Kit is designed for use with the Fluiwell-4C, with reservoirs up to 2mL.

- Fluiwell Fitting 10-32 Coned, for 1/16″ OD Tubing (x4)
- Fluiwell-4C Seals (x4)
- FEP Tubing 1/16″ OD x 0.020″ ID (1m)

DROPLET STARTER PACK

Get started within minutes

NEW

COST EFFECTIVE SOLUTION

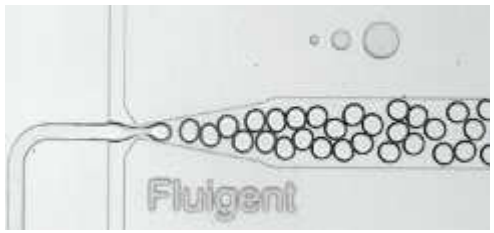
EASY TO USE WITH HIGH PERFORMANCE

NO COMPLEX CONNECTORS

FROM 20 TO 100µm DROPLETS AND UP TO 1200 HZ

BENEFITS

- **Most simple droplet generation kit**
- **Highly monodispersed droplets** (with CV < 2%)
- **From 15µm to 100µm diameter droplets**
- **Up to 1200 Hz**
- **Integrated resistance** to avoid back-flows and limit external perturbations
- **Quality monitoring** with a specific QR code per chip
- **Datasheet with frequency-size abacus and phase diagram included**



INCLUDES:

- 2 Flow EZ™ for pressure-driven injection
- 2 Flow UNIT for flow-rate control
- 2 P-CAP 2mL (reservoirs)
- 1 Droplet Kit (see p.22)
  - 3 EZ Drop chips (with 3 microfluidic droplet generators each)
  - 2m 1/32″ tubing
  - 2 green sleeves
- All tubing fittings and accessories:
  - Flow EZ™ Supply kit
  - 2 LQ Kit
  - 2 P-CAP Kit
  - Tube Cutter

FULLY INTEGRATED SOLUTION

Cell Culture Platform

RECIRCULATION LOOP FOR UNIDIRECTIONAL STABLE FLUID CIRCULATION

INPUT & OUTPUT FLUID SELECTION FOR FLEXIBILITY

FLOW-RATE / VOLUME CONTROL TO REDUCE CONSUMPTION OF EXPENSIVE REAGENTS

EASY ACCESS TO ALL FLUIDIC PARTS

SUITABLE FOR INCUBATOR EXPERIMENTS

TTL PORTS INTEGRATED

Cell culture / Cell encapsulation

Fluigent has the capability to design and manufacture customized integrated platforms for specific applications and needs, thanks to detailed product design and application engineering capabilities. Proprietary pneumatic and electronic designs enable us to adapt the product design to each customer's need without relying on fixed, pre-packaged external solutions. OEM Customization expertise uses Fluigent proprietary technologies.

BENEFITS

- **Detailed product design and manufacturing capabilities**
- **Proprietary pneumatic and electronic design,** enabling us to adapt the product design to each customer's need without relying on fixed, pre-packaged external solutions
- **Over 12 years expertise in microfluidics**
- **OEM Customization expertise** using Fluigent proprietary technologies

EXAMPLE OF SPECIFICATIONS

- **Dimensions: 25cm x 26cm x 15cm³**
- **Power supply: 24V**
- **Maximum outlet pressure 2.4bar**

PRODUCTS AND SOFTWARE | ENGINEERED SYSTEMS

OOAC

Organ-on-a-Chip

LONG TERM CELL CULTURE UNDER PERFUSION

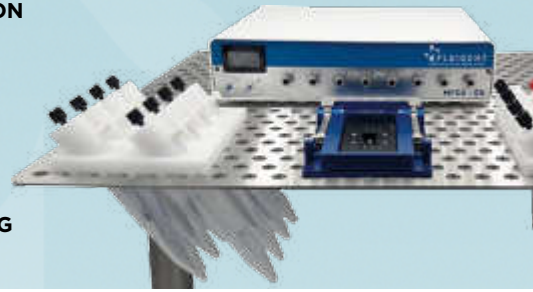
AIR/LIQUID OR LIQUID/LIQUID INTERFACES

PHYSIOLOGICAL SHEAR STRESS

CELL CO-CULTURE

MEDIUM RECIRCULATION

AUTOMATED MICRODOSING/MICROSAMPLING



Fluigent has partnered with Micronit to design a compact perfusion culture platform for a wide range of applications including: organ-on-chip, cell biology, tissue engineering, biomechanics, and toxicology.

APPLICATIONS

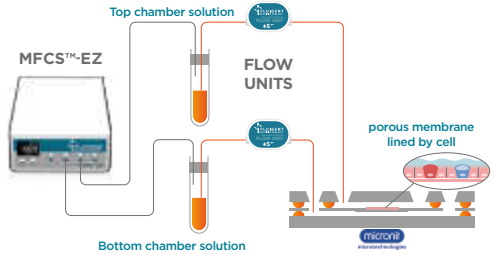
- **Microphysiological systems/Organ-on-chip**
- **Trans-membrane invasion assay**
- **Drug discovery/screening**
- **Hypoxia/hyperoxia in cell culture**

SPECIFICATIONS

- **From 10nL/min to 5mL/min**
- **1 MFCS™-EX, 16 15mL Fluiwells, 8 possible FLOW UNITS, tubing**
- **4 Resealable chips, 4 soft membranes, 1 chip holder**
- **Dimensions of 1 platform: 45 x 45 x 28 cm³**
- **Weight: 5kg**
- **Power Supply: 24V**

BENEFITS

- **Excellent long-term flow stability:** over 1 month
- **Wide controlled flow rate range:** from 10nL to 5mL/min
- **Independent monitoring of each flow chamber**
- **Precise control of oxygen level**
- **Programmable flow-rate profile**
- **Protocol automation:** sequential injections/ periodic sampling/recirculation
- **Fits in classic incubator**
- **Scalable:** up to 4 chips per chip holder



Resealable glass chip divided in 2 distinct flow chambers by a porous membrane

BUBBLE TRAP KIT

Catch them all

EFFICIENT BUBBLE REMOVAL UP TO 5ML/MIN

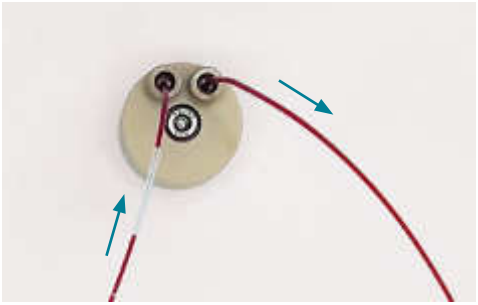
ROBUST DESIGN (PVC / PTFE)

COST EFFECTIVE SOLUTION

NO VACUUM LINE NEEDED

INCLUDES:

- Fluigent Bubble Trap
- 2 disposable membranes
- 2 Fittings 1/4-28 Flat-Bottom for 1/16" OD Tubing
- 2 ferrules
- FEP Tubing 1/16" OD x 0.020 ID



Gas bubbles present in a liquid sample are a common problem encountered in numerous microfluidic experiments, and their removal in the sample of interest is quite often a major challenge for microfluidicists. Indeed, gas bubbles circulating through a microfluidic system can damage equipment or the biological sample of interest and cause experimental errors :

- **Bubbles can cause experimental errors** to sensors, and lead to unrepeatable experiments when entering into a microfluidic chip.
- **Bubbles inside a biological reactor often increases shear stress**, induces cytotoxicity, as cells membranes will stretch under the force of the liquid-air interface.
- **Bubbles present inside a sample can also lead to pipetting and sampling errors**.

FLPG

Fluigent Low Pressure Generator

PRESSURE PUMP

AIR TANK AND DRYER

MANUAL MANOMETER

PRESSURE SENSOR & DISPLAY

The Fluigent Low Pressure Generator is the perfect tool for those who need a pressure source with all accessories included and integrated.

SPECIFICATIONS

- Dimensions: 25cm x 26cm x 15cm³
- Power supply: 24V
- Maximum outlet pressure 2.4bar

BENEFITS

- **Low vibrations:** easy to work with
- **Low noise (around 50dB):** suitable for a closed lab with no pressure supply
- **Fittings already adapted to our MFCS™ and Flow EZ™:** fast and easy connections
- **Outlet pressure display to monitor your pressure controller inlet pressure**
- **Only one power supply needed**
- **Can provide 1bar of pressure for up to 4 pressure channels** (other configurations possible)

FOOT SWITCH

HAND-FREE OPERATIONS

AUTOMATE ADDITIONAL FUNCTIONS

CONNECTION TO COMPUTER WITH USB PORT

PRESSURE CONFIGURATION SWITCH

IDEAL FOR WORK UNDER A MICROSCOPE

OEM & ODM

Original Equipement & Design Manufacture

EASY HARDWARE INTEGRATION

SOFTWARE INTEGRATION TOOLS

VOLUME / SERIES MANUFACTURING CAPABILITIES

HIGH CUSTOMIZATION

SPECIFIC PRODUCT DESIGNING DEVELOPMENTS

FIELD PROVEN TECHNOLOGY

COMPACTNESS

ISO-9001 PROCESSES

All microfluidic instruments developed by Fluigent are available as OEM products. In order to help you focus on your applications and your microfluidic devices we have developed a range of OEM products for flow control and fluid handling in microfluidic and nanofluidic applications. Our OEM products can easily be integrated in more complex instruments. All our OEM products and solutions come with a Software Development Kit (SDK).

BENEFITS & FEATURES

- **Obtain a stable flow**
- **Control droplet size**
- **Provide high resolution, fine tuning of pressure or flow-rate profile**
- **Control both flow-rate and pressure**
- **Have a short response time**
- **Have a reliable and versatile software**
- **Stop the flow**
- **Run long time experiments**
- **Avoid cross contamination**
- **Compact**
- **Reproducible results**
- **Automatable**
- **Easy to use and integrate**
- **Modular**
- **Customizable**
- **Robust with low maintenance**
- **Economical**

INDUSTRIAL REFERENCES

- **Early diagnosis instruments**
- **Digital PCR manufacturer**
- **Blood analyzer**
- **Flow cytometer**
- **Cell culture provider**
- **Pharmaceutical high-throughput screening**
- **Phenotyping & genotyping maker**

PRODUCTS AND SOFTWARE | OEM & ODM

We offer a complete OEM product line with our standard OEM products and our solutions to co-develop specific solutions to best suit industrial needs:

- Flow management solutions
- Pressure measurement & control solutions
- Flow-rate measurement and control solutions
- Flow switching solutions
- Pressure generators
- Other components may be available depending on requirements
- Specific developments can be discussed on requests (mechanics, fluidics, electronics, software, communication protocols, ...)
- Integration of exernal components such as specific sensors or valves can be made

DEVELOPMENT PROCESS

- **Building blocks assembly**
- **Testing**
- **Proof of concept**
- **Final User specification requirements**

ALL-IN-ONE SOFTWARE (A-i-O)

One software for all your work

INTUITIVE USER INTERFACE

COMPLETE USER XP DESIGN

20MS SAMPLE RATE

16 INDIVIDUAL CHANNEL DISPLAY

LOW PC MEMORY USAGE

NEW

BENEFITS & FEATURES

- **Customizable user** interface
- **Live monitoring** and control
- **Windows 7 and higher support** (32bits & 64bits)
- **Pressure control and monitoring**
- **From pressure to flow-rate control in one click**
- **Pressure and flow-rate limit per channel**
- **20ms data logging** in format compatible with Excel
- **Pressure and flow-rate configuration saving**
- **Detachable single channel views** for screen spacing optimization

RELATED PRODUCTS

- **Flow EZ™**
- **FLOW UNIT connected to a Flow EZ™**
- **Link**

MICROFLUIDIC AUTOMATION TOOL (MAT)

For experiment automation

SINE WAVES, RAMPS & CUSTOM FLOW PROFILES

DRAG AND DROP USER INTERFACE

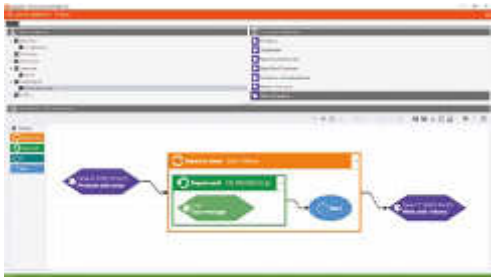
INCLUDED DATALOGGER

OFFLINE DESIGN AVAILABLE

TTL SYNCHRONIZATION

NEW

The Microfluidic Automation Tool allows an easy design of protocols for complete automated experiements. It includes a wide range of operations and loops such as "do...while", "repeat n times". Automation of experiments provides high repeatability, avoids human related errors and allows gain of time for researchers.



BENEFITS & FEATURES

- **Specific flow profile design** (sine waves, ramps, triangles, squares, ...)
- **Controlled volume injections**
- **Easy full automation** of complex protocols
- **Long-time duration experiments** (up to several days)
- **Automated detection** of connected instruments

LINK MODULE

FOR LINEUP™ SERIES

- **Communication port to your PC**
- **Hot plug and play**
- **BNC ports for TTL synchronization**
- **On/off button for the whole line of Flow EZ™**
- **Size: 79 x 97 x 55 mm**
- **Weight: 212g**
- **24 VDC power supply**

RELATED PRODUCTS

- **Flow EZ™**
- **FLOW UNIT connected to a Flow EZ™**
- **Link**

MAESFLO™

For the microfluidic controller MFCS™

PRESSURE CONTROL & MEASUREMENT

FLOW-RATE MONITORING

MS EXCEL COMPATIBILITY

CONFIGURATION SAVE

Fluigent MAESFLO™ offers a single software environment to take full advantage of the best in class pressure-driven flow controller (MFCS™-EZ) and the latest Fluigent Flow-Rate measurement system, (the Flow-Rate Platform FRP). With a user-friendly interface, the user can customize the environment to be as close as possible to ones needs.

BENEFITS & FEATURES

- **Control and measurement of pressure** (up to 16 channels)
- **Flow-rate monitoring** (up to 16 channels)
- Ability to **change pressure and /or flow-rate units**
- **Set a maximum pressure limit per channel**
- Data logging in format **compatible with MS Excel**
- **Link several pressure channels**
- **Save pressure configurations and reuse them** (drop down menu/shortcut key)
- **Measure the volume** dispensed through your system

RELATED PRODUCTS

- **MFCS™-EZ**
- **MFCS™-EX**
- **FRP**
- **FRCM**

FRP-SFP

For Flow-Rate monitoring

EASY TO SET-UP AND USE

HIGH PRECISION

UP TO 16 FLOW UNITS

CUSTOMIZABLE

Used with a Flow-Rate Platform (at least one FLOWBOARD and one FLOW UNIT), the MAESFLO™ and A-i-O software provide a quick and user-friendly view of up to sixteen (16) FLOW UNITS. For those who need to use our Flow Rate Platform without MFCS™-EZ, you can use our FRP-SFP software. Many features have been integrated to enable to the customization of the FRP-SFP to specific needs and simplify daily use of the FRP.

BENEFITS & FEATURES

- **Flow-rate monitoring**
- **Flow-rate data logging in format compatible with Microsoft Excel**
- **Volume monitoring**
- **Digital and graphic display**

RELATED PRODUCTS

- **FLOW UNIT**
- **FLOWBOARD**

FLOWBOARD

COMMUNICATION HUB

A hub managing the communication between FLUIGENT software and up to 8 FLOW UNITS of any ranges and calibration. Computer connection and power supply with a single USB plug.

Flowboard	Specifications
Imput	5V ⎓ 100 mA
Size	114 x 102 x 70 mm (lengh x width x height)
Weight	478 g

ESS™ CONTROL

Easy Switch Solutions™

FULL SET-UP AUTOMATION

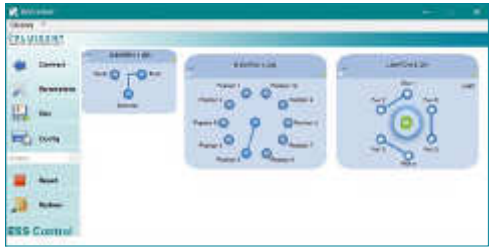
PERFORM SEQUENTIAL INJECTIONS

PERFORMANCE OPTIMIZATION

HIGHLY CALIBRATED VOLUME INJECTION

TTL SYNCHRONIZATION

The ESS™ Control enables on-time visualization of valve positions when you use the ESS™ (Easy Switch Solutions™) as well as the full automation of any scripts and protocols (thanks to the Script Module).



BENEFITS & FEATURES

- **Each control shows the current active position**
- **Easily change the 2-SWITCH™, L-SWITCH™ and M-SWITCH™ positions** by clicking on the corresponding port on the control
- **The interface is adjusted to the device configuration** by displaying controls for each one of the 2-SWITCH™, L-SWITCH™ and M-SWITCH™ connected to the SWITCHBOARD
- **Name custom settings:** possibility to save custom names for all devices as well as all fluidic ports
- **Possibility to record and log the positions of all devices during the experiment,** with different possible sampling rates
- **Ability to save a set of positions** as a configuration that can be reused whenever needed
- **Modular display of your devices:** the main window can be contracted, and every 2-SWITCH™, M-SWITCH™ or L-SWITCH™ control can be undocked and displayed in an individual and repositionable compact window.
- **Choose the direction of rotation of the M-SWITCH™ devices** (clockwise/anti-clockwise/the shortest)

RELATED PRODUCTS

- **M-SWITCH™**
- **2-SWITCH™**
- **L-SWITCH™**

SCRIPT MODULE

For experiments automations

CREATE COMPLEX FLOW PROFILES

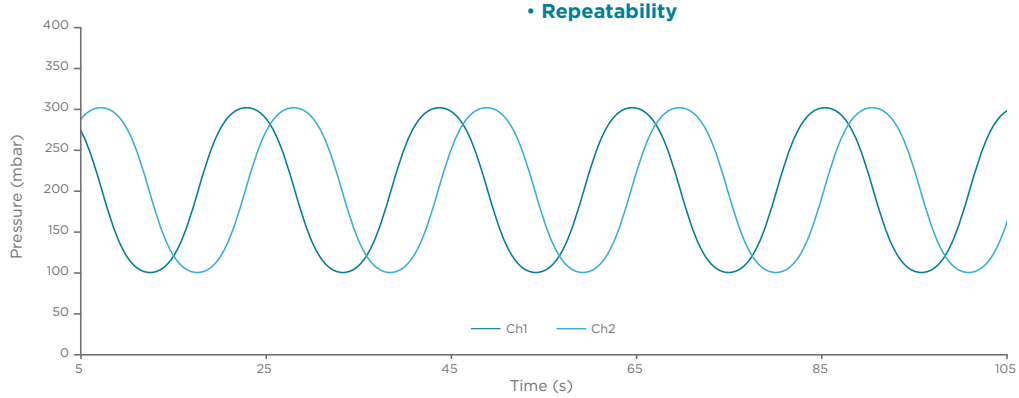
AUTOMATE TIMED FUNCTIONS

EASY TO USE

The Script Module is compatible with any Fluigent microfluidic instrument for flow control and fluid handling: MFCS™ (Microfluidic Flow Control System) series, FRP, FRCM (Flow-Rate Control Module), and ESS™ (Easy Switch Solution).

BENEFITS & FEATURES

- **Pressure and volume control** MFCS™ series, FRCM, flow-rate, valve position (ESS™)
- **Full automation** of even the most complex experiments
- **Long time duration experiment even more** (up to several days)
- **Create and run complex flow profiles** (sine, triangle, ramp, etc.)
- **"On time" control of the script and indication of time sequence** (duration of each command)
- **Automatic detection of protocol errors** thanks to the debugger within the Script
- **Repeatability**



Sinus protocol - Real time measured values on 2 different channels simultaneously (1 chip)

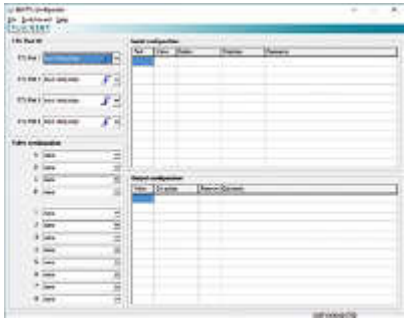
TTL

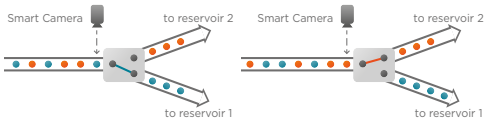
Hardware synchronization with the ESS™ Platform

SEND START/STOP SIGNAL

SYNCHRONIZATION

HARDWARE COMMUNICATION





Example of application : droplet sorting

BENEFITS & FEATURES

- **4 independent TTL ports**
- **Input port or/ Output port (user defined)**
- **Hardware configuration**
- **Rising or falling edges**
- **Individual setting of each port**

APPLICATIONS

- **Start recording camera when switching**
- **Start/Stop fluorescence detection/recording**
- **Cell sorting**
- **Drug screening**
- **Process automation**

SWITCHBOARD

COMMUNICATION PLATFORM

The SWITCHBOARD hosts up to 4 M-SWITCH™ and/or L-SWITCH™ and 8 2-SWITCH™ and provides them power supply. The SWITCHBOARD is also the link between the connected valves and the controlling software ESS™ Control.

SDK

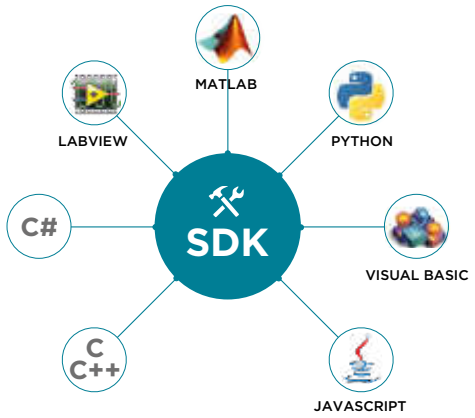
Software Development Kit

EASE OF INSTALLATION

EASE OF USE

FLEXIBILITY TO SPECIFIC NEEDS

The Fluigent Toolkit includes full integration of devices interfaces within LabVIEW and MATLAB. This includes palettes, built-in error codes and application builder integration and detailed help for LabVIEW, and start button shortcut, automated path, function browser entries, deployment tool integration and detailed help for MATLAB. Examples in C, C++, LabVIEW, MATLAB, Python, Visual Basic and Javascript are also provided as starting points for rapid application development and system integration.



COMPATIBILITY

- **Windows10** (32 and 64 bits)
- **Windows8** (32 and 64 bits)
- **Windows Seven** (32 and 64 bits)
- **Windows Vista** (32 and 64 bits)
- **Windows XP Service Pack 3**
- **Linux OS** (Rapsbian, Ubuntu, Debian, Scientific Linux)

PROGRAMMING LANGUAGES AVAILABLE

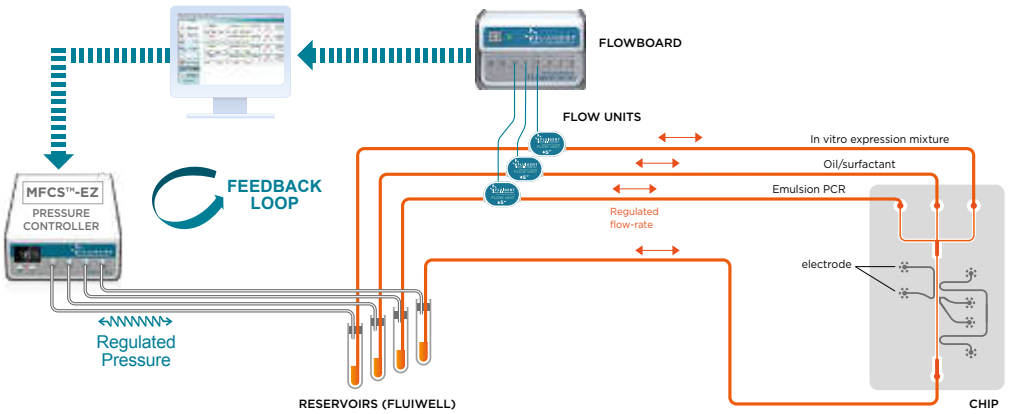
- **LabVIEW**
- **MATLAB**
- **C / C++**
- **C#**
- **Python**
- **JavaScript**
- **Visual Basic**

RELATED PRODUCTS

- **MFCS™-EZ**
- **ESS™**
- **FRP**
- **OEM**
- **FRCM**

3. APPLICATION AND SERVICES

HIGH-THROUGHPUT CELL DNA SCREENING USING DIGITAL PCR



The use of water-in-oil droplets in microfluidics in high-throughput screening is rapidly gaining acceptance. The main application areas currently involve screening cells as well as genetic material for various mutations or activity. Here the aim is to isolate single DNA molecules and analyze the enzymes and proteins resulting from their expression.

MATERIAL

- 1 MFCS™-EZ
- 1 FLOWBOARD
- 3 FLOW UNITS
- 1 FLUIWELL 4C
- Fluigent software
- FRCM

APPLICATIONS

- Cell DNA screening
- Digital PCR
- Sequencial fluid injection
- Pulse-free flow delivery
- Automated rare cells capture and labelling

PROTOCOL

There were several steps to the study:

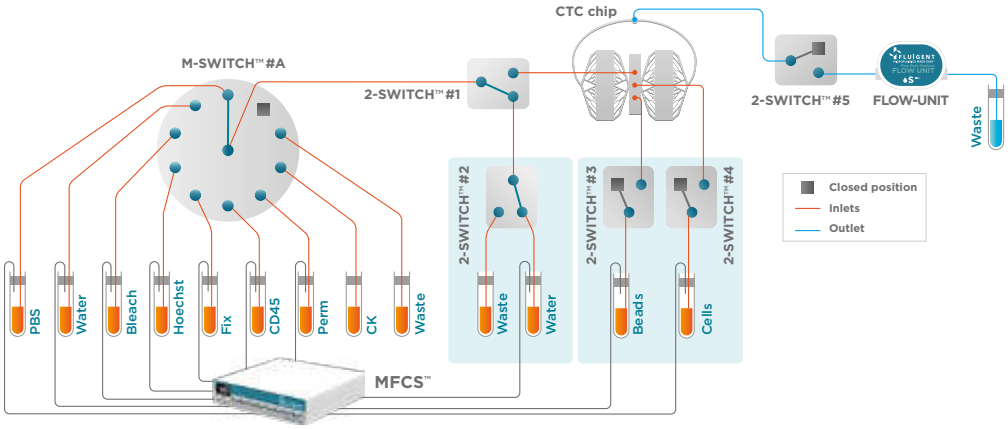
First, two separate emulsions were generated. The first one encapsulated an aqueous- phase of PCR and DNA mixture in an organic continuous phase on a dedicated chip. The second emulsion was generated encapsulating an aqueous-phase IVT (In Vitro Transcription) mixture in the same organic phase.

Lastly, both emulsions were then fused into one droplet at a time to control which DNA sequence is translated at the end of the process.

For these studies, it is very important that the droplets are generated at the correct frequency, and at uniform size. That's where the use of the MFCS™-EZ is critical with the generation of very stable flows and the accurate control of the different phases.

The MFCS™-EZ, Fluigent pressure controller, controlled by software, allows to create your two emulsions. The Flow Units allows one to control the flow-rates during the experiment.

AUTOMATED RARE CELLS CAPTURE AND LABELLING



Because CTCs detection and labelling need a very precise and smooth flow control, Fluigent MFCS™ associated with the Flow-Rate Control Module and the ESS™ platform, was the designated choice to be able to efficiently control the flows of all the solutions and samples.

MATERIAL

- 1 MFCS™-EZ
- 1 FLOWBOARD
- 3 FLOW UNITS
- 1 FLUIWELL 4C
- Fluigent software

APPLICATIONS

- Cell DNA screening
- Digital PCR
- Sequencial fluid injection
- Pulse-free flow delivery
- Automated rare cells capture and labelling

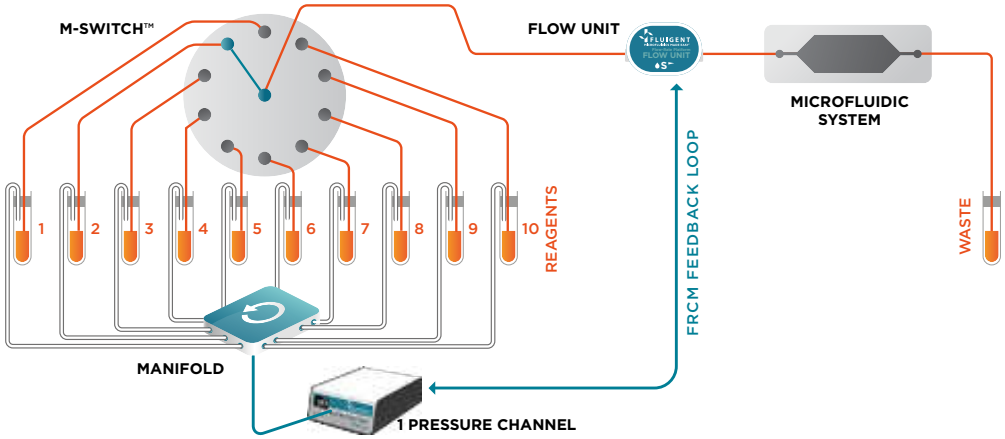
PROTOCOL

Circulating Tumor Cells (CTCs) are tumoral cells originating from a primary tumor. They transiently circulate in the blood stream until they stop in specific organs to seed metastases. Metastases are involved in most cancer deaths and often develop characteristics which make them resistant to treatments that were efficient on the primary tumors. In this context, being able to study these CTCs represents several assets such as to monitor over time the disease progression as well as to develop the best-suited therapeutic strategies.

Several methods have been studied to capture and detect CTCs. They usually include a large number of steps (injection of several different samples, buffers, etc.) and can last several hours.

This application note describes the automation of a 5-hour CTC capture and detection method including the precise volume control of more than 10 different solutions.

SEQUENTIAL FLUID INJECTION & DELIVERY WITH PULSE-FREE FLOW



MATERIAL

- 1 MFCS™-EZ
- 1 M-SWITCH™
- 1 FLOW UNIT
- 1 FRCM (Flow Rate Control Module)
- 1 manifold
- Fluigent software

APPLICATIONS

- Impedance spectroscopy for cell and particle counting
- Sequential fluid injection
- Delivery with pulse-free flow
- Automated rare cells capture and labelling

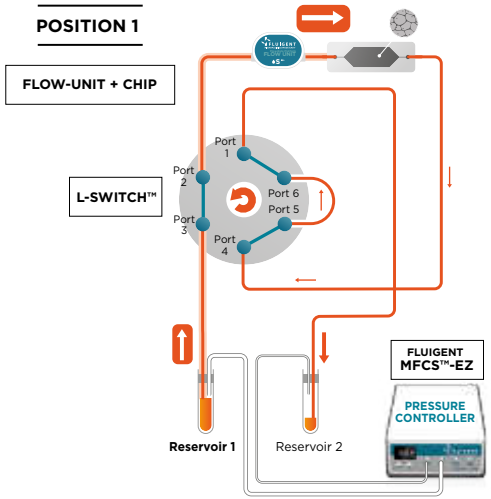
Many microfluidic applications require switching between multiple solutions (such as samples or buffers) while maintaining a constant flow-rate during the course of their experiment.

In this application, one MFCS™-EZ pressure channel is connected via a manifold to ten separate vials containing different aqueous solutions..

BENEFITS

- High repeatability
- Stability and responsiveness
- Pressure and flow-rate multiplexing
- Set-up optimization
- Cost optimization
- Uses minimal bench space
- Automation

FLUID RECIRCULATION FOR CELL PERFUSION WITH REDUCED SHEAR STRESS



Many microfluidic applications require expensive solutions to be injected at a controlled flow-rate into a microfluidic system, such as cell cultures, PCR processes, cell injections 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 for recirculation between the two vials while maintaining a continuous unidirectional flow-rate within the cell culture chamber.

BENEFITS

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

MATERIAL

- 1 MFCS™-EZ
- 1 L-SWITCH™
- 1 FLOW UNIT
- Fluigent software

APPLICATIONS

- Sequential fluid injection
- Delivery with
- Pulse-free flow
- Digital PCR
- Automated rare cells capture and labelling
- Cell DNA screening

PUBLICATIONS

DROPLETS

A microfluidic chip integrated with droplet generation, pairing, trapping, merging, mixing and releasing

Xiaoming Chen and Carolyn L. Ren, Royal Society of Chemistry, 2017

Developing a microfluidic chip with multiple functions is highly demanded for practical applications, such as chemical analysis, diagnostics, particles synthesis and drug screening. This work demonstrates a microfluidic chip integrated with a series of functions including droplet generation, pairing, trapping, merging, mixing and releasing, and controlled entirely by liquid flow involving no electrodes, magnets or any other moving parts. This chip design is capable of trapping and merging droplets with different content on demand allowing the precise control of reaction time and eliminates the need for droplet synchronization of frequency, spacing or velocity. A compact model is developed to establish a set of design criterion. Experiments demonstrate that fast mixing in the merged droplets can be realized within several seconds benefiting from the flow fluctuation induced by droplets coming or leaving the trapping region. Additionally, it allows a concentration gradient of a reagent to be established. Finally, this design is applied to screen drug compounds that inhibit the tau-peptide aggregation, a phenomenon related to neurodegenerative disorders.

Octanol-assisted liposome assembly on chip

S. Deshpande, Y. Caspi, Anna E.C. Meijering & C. Dekker, Nature Communication, 2016

Millifluidics as a simple tool to optimize droplet networks: Case study on drop traffic in a bifurcated loop

William S.Wang, Siva A. Vanapalli, Biomicrofluidics, 2014

LAB-ON-A-CHIP

Thermal-Responsive Anisotropic Wetting Microstructures for Manipulation of Fluids in Microfluidics

Nianzuo Yu, Shuli Wang, Yongshun Liu, Peihong Xue, Peng Ge, Jingjie Nan, Shunsheng Ye, Wendong Liu, Junhu Zhang and Bai Yang, Langmuir, 2016

We show morphology-patterned stripes modified by thermal-responsive polymer for smartly guiding flow motion of fluid in chips. With a two-step modification process, we fabricated PNIPAAm-modified Si stripes on silicon slides, which were employed as substrates for fluid manipulation in microchannels. When the system temperature switches between above and below the lower critical solution temperature (LCST) of PNIPAAm, the wettability of the substrates also switches between strong anisotropy and weak anisotropy, which resulted in anisotropic (even unidirectional) flow and isotropic flow behavior of liquid in microchannels. The thermal-responsive flow motion of fluid in the chip is influenced by the applied pressure, the thickness of PNIPAAm, and dimension of the microchannels. Moreover, we measured the feasible applied pressure scopes under different structure factors. Because of the excellent reversibility and quick switching speed, the chip could be used as a thermal-responsive microvalve. Through tuning the system temperature and adding the assistant gas, we realized successive “valve” function. We believe that the practical and simple chip could be widely utilized in medical detection, immunodetection, protein analysis, and cell cultures.

Low-cost multilevel microchannel lab on chip: DF-1000 series dry film photoresist as a promising enabler

R. Courson, S. Cargou, V. Conedera et al., RSC Advances, 2014

More than 400 peer-reviewed publications citing our microfluidic instruments since 2006.

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https://www.fluigent.com/applications/publications/

CELLS & PARTICLES

Asymmetric division of contractile domains couples cell positioning and fate specification

Jean-Léon Maître, Hervé Turlier, Rukshala Illukkumbura, Björn Eismann, Ritsuya Niwayama, François Nédélec & Takashi Hiiragi, Nature, 2016

During pre-implantation development, the mammalian embryo self-organizes into the blastocyst, which consists of an epithelial layer encapsulating the inner-cell mass (ICM) giving rise to all embryonic tissues1. In mice, oriented cell division, apicobasal polarity and actomyosin contractility are thought to contribute to the formation of the ICM2, 3, 4, 5. However, how these processes work together remains unclear. Here we show that asymmetric segregation of the apical domain generates blastomeres with different contractilities, which triggers their sorting into inner and outer positions. Three-dimensional physical modelling of embryo morphogenesis reveals that cells internalize only when differences in surface contractility exceed a predictable threshold. We validate this prediction using biophysical measurements, and successfully redirect cell sorting within the developing blastocyst using maternal myosin (Myh9)-knockout chimaeric embryos. Finally, we find that loss of contractility causes blastomeres to show ICM-like markers, regardless of their position. In particular, contractility controls Yap subcellular localization6, raising the possibility that mechanosensing occurs during blastocyst lineage specification. We conclude that contractility couples the positioning and fate specification of blastomeres. We propose that this ensures the robust self-organization of blastomeres into the blastocyst, which confers remarkable regulative capacities to mammalian embryos.

Clogging transition induced by self filtration in a slit pore

B. Dersoir, A. B. Schofield and H. Tabuteau, Soft Matter, 2017

A microfluidic device for characterizing nuclear deformations

Andrew C. Hodgson, Christophe M. Verstreken, Cynthia L. Fisher, Ulrich F. Keyser, Stefano Pagliara and Kevin J. Chalut, Lab Chip, 2017

ACTUATION & CONTROL

Growth of bubbles on a solid surface in response to a pressure reduction

Jiang Li, Haosheng Chen, Weizheng Zhou et al., Langmuir, 2014

Experimental optimization of a passive planar rhombic micromixer with obstacles for effective mixing in a short channel length

Iwona Bernacka-Wojcik, Susana Ribeiro, Pawel Jerzy Wojcik et al., RSC Advances, 2014

Characterizing the Deformation of the Polydimethylsiloxane (PDMS) Membrane for Microfluidic System through Image Processing

X. Qian, W. Zhang, C. Peng, X. Liu, Q. Yu, K. Ni and X. Wang, Micromachines, 2016

CUSTOMER SUPPORT SERVICES

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At Fluigent, we understand that a non-functioning system means time lost in the lab. Fluigent customer support team is dedicated to performing timely, cost effective repairs. Our goal is to have your device back in working order as soon as possible. Besides, our experts are here to advise you on any questions you may have on the use of our products within your setups.

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SPECIFICATIONS

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- **Our expertise is at your service with microfluidic tips**
- **Downloadable user manuals and software**

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INTELLECTUAL PROPERTY

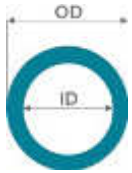
Fluigent's patented pneumatic and flow-rate control technologies are unique. Our product design and manufacturing activities far exceed simple assembly process. We have proprietary pneumatic and electronic design, enabling us to finely tailor the product design to each customer's need without relying on fixed pre- package external solutions. This allows us to be more flexible to your specific needs in terms of customization and integration of your device.

TIPS

Working in a microfluidic environment almost automatically means using fittings and tubing, to connect your microfluidic device or your Lab-on-a-chip to the various elements of your microfluidic circuit: your reagents reservoirs, your flow control device (such as a peristaltic pump, a syringe pump, or Fluigent's MFCS™ and Flow EZ™ pressure controller), possibly also valves, filters, back pressure regulators... Tubing enables you to link the various elements of your microfluidic circuit, and fittings are the small but significant parts that will enable you to attach, adapt or adjust the tubing to these elements, while ensuring tight connections. Tubing and sleeves are defined by several parameters: diameters, length and material.

DIAMETER

Inner diameter (often abbreviated as "ID" in parts catalogs): diameter of the fluidic path where fluid flows. The inner section times the length of the tubing gives you the internal volume of the tubing. The inner diameter plays a significant role in the resistivity brought by the tubing: the smaller it is, the more resistant the tubing will be.



LENGTH

Usually the tubing is made as short as possible to have smaller internal volumes. It is also a parameter that takes part in the resistivity of the tubing.
NB: in order to get clean interface and prevent any clogging or collapsing of the fluidic path, all tubing should be cut with specifically designed cutters.

MATERIALS

A wide range of materials are available for the same ID / OD combination. The material should be selected according to the nature of the reagents flowing through the tubing. Be careful to check the chemical compatibility of the tubing material before installing the tubing on your application. Some of the most common materials for microfluidic tubing include:

- **PEEK** (Polyetheretherketone): very good chemical resistance and biocompatibility, low non- specific adsorption. Rigid and opaque. For low and high-pressure applications. Very small internal diameters available.
- **PTFE** (Polytetrafluoroethylene, equivalent to the brand name Teflon®): chemically inert, nontoxic, non-porous, excellent stress-resistance. Flexible and transparent. Mostly for low- pressure applications.
- **FEP** (Fluorinated ethylene-propylene): same family as PTFE, inert to most chemicals and good biocompatibility. Flexible and transparent. Mostly for low-pressure applications (no higher than 7 bar).
- **ETFE** (Ethylene tetrafluoroethylene): same family as PTFE and FEP but more rigid and better- suited to higher pressure applications.
- **Fused silica** (high-purity glass): for capillary tubing, exists with external diameters smaller than 1/32" (360 µm OD, 510 µm OD...). NB: this type of tubing must be cut with ceramic cutters to get clean inlet and outlet.

4. OTHERS

NOTES

NOTES

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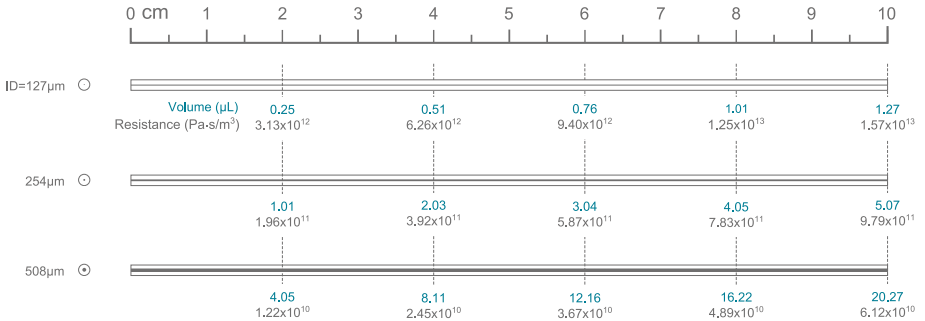
VOLUME AND RESISTANCE FOR FLUIDIC TUBING WITH DIFFERENT ID (INNER DIAMETER)

Place your tubing on the page for a quick reference



※ values for illustrative purpose only

OD (OUTER DIAMETER) IDENTIFICATION

●	•
1/16” (1.6mm)	**1/32”** (0.8mm)

UNITS CONVERSIONS

1 bar = 14.5 psi	1 mbar = 1.45 X 10-2 psi	1 inch = 2.54 cm
1 psi = 6.90 X 10-2 bar	1 psi = 68.95 mbar	1 cm = 0.39 inch

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