

# MFCS™ -EZ

## Microfluidic Flow Control System



User Manual

**MFCS™-EZ**



Version 8A\_Feb 2021

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## **WARRANTY TERMS:**

### **Fluigent**

#### **What This Warranty Covers**

This warranty is granted by Fluigent and applies in all countries.

Your Fluigent product is guaranteed for one year from the date of delivery at your laboratory against defects in materials and workmanship.

If found to be defective within the warranty period, your Fluigent product will be repaired or replaced free of charge.

#### **What This Warranty Does Not Cover**

This warranty does not cover routine maintenance, or damage resulting from the failure to maintain the product in accordance with instructions provided by Fluigent. This warranty also does not cover damage that arises from accidental or intentional misuse or abuse, alteration or customization, or repaired by unauthorized persons.

#### **How to Get Service**

If something goes wrong, contact the Fluigent dealer from whom you purchased your product. Arrange a mutually convenient time for Fluigent service representative to discuss over the problem and find a solution to fix the issue. Will be favored any remote repairs, but in case more actions need to be taken, the system will come back to Fluigent offices (for no additional cost, only if it is under warranty).

#### **The MFCS™-EZ warranty conditions are:**

- Do never open MFCS™-EZ cover box
- Do not apply a higher inlet pressure than the value advised by Fluigent and written on the nameplate
- Do not use oil pump
- Do not use any corrosive or toxic gas
- Use a dry and clean gas
- Do not use other cables than cables provided by Fluigent
- Prevent foreign objects or liquids from entering the MFCS™-EZ
- Connect the power cord to an AC outlet of the correct voltage
- Do not place the product in an unstable location, place the unit in a location with a level surface and a strong and stable support
- Do not treat the MFCS™-EZ in order to clean it (autoclave)
- Do not apply any electricity voltage on the MFCS™-EZ
- Respect the temperature compatibility (from 5°C to 50°C)
- Do not block the fan (on MFCS™-EZ high pressure)
- Do not enter liquids inside the MFCS™-EZ

For specific use, please contact our Support team at [\*\*support@fluigent.com\*\*](mailto:support@fluigent.com)

### **PRECAUTIONS:**

- Do never open MFCS™-EZ cover box. Refer all servicing to after-sales service department.
- Prevent foreign objects or liquids from entering the MFCS™-EZ;  
This may cause a short-circuit failure or other malfunction  
Failing to respect this advice would:
  - Expose you to direct current/voltage in case the device is under voltage which may lead to severe damages
  - Void device's warranty
  - Discharge our company from any liability regarding physical or device damages
- Connect the power cord to an AC outlet of the correct voltage
- Do not place the product in an unstable location, place the unit in a location with a level surface and a strong and stable support

# **1. Introduction**

The brand-new **Microfluidic Flow Control System** MFCS™-EZ is a unique pressure-based flow controller for microfluidics and nanofluidics applications (microchannels, nanochannels, capillaries, lab on chip...).

It allows a stable and pulsation free flow with short response times down to 40 ms\* and settling times as low as 100ms\*\*. The MFCS™-EZ series also enable the control of several independent channels (up to 4) at the same time. The user-friendly software platform provided with the MFCS™-EZ systems allows you to create scripts for complex flow patterns or dynamic coupling (see the dedicated user manuals).

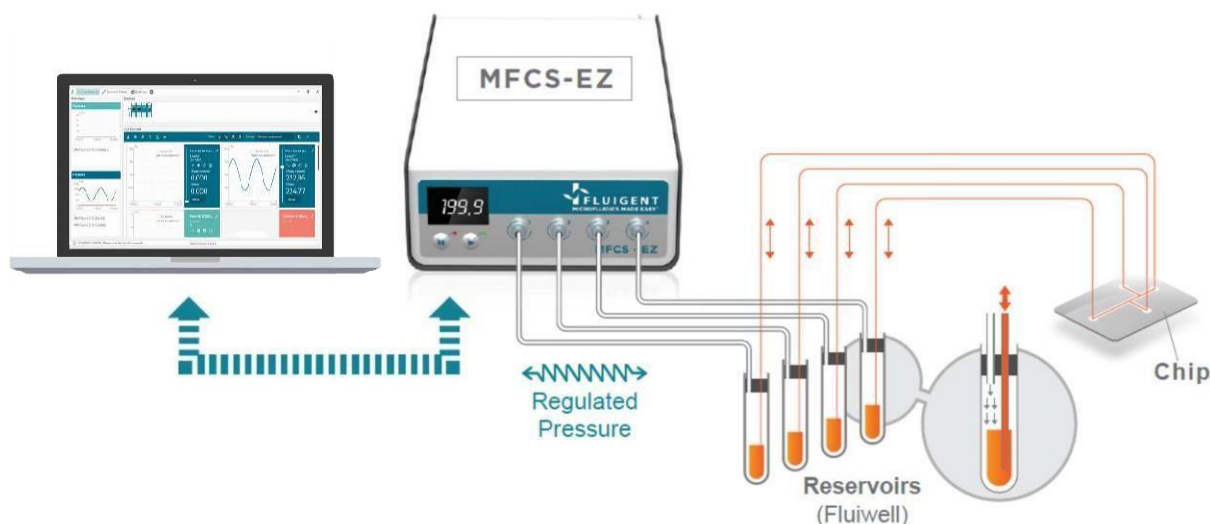
This user manual will show you how to install and use the MFCS™-EZ for your daily work. It will describe how to connect it to all the equipments.

\* Depends on the user PC operating system and configuration

\*\* Output volume dependent

## 2. General information

### 2.1 General functioning



The MFCS™-EZ series enable the flow actuation of fluids by pressure regulation. The principle is based on the pneumatic pressurization of reservoirs (external reservoirs as well as disposable cartridges or integrated wells) containing the liquids to be injected in the microfluidic systems.

The original pneumatic path combined with a very fast regulation algorithm has been developed to deliver regulated pressure from a pressure source. The principle of pressure actuation in microfluidic systems is shown in the figure above and the benefits of this technology are listed below.

The principle of pressure actuation is described hereafter:

- 1: Output pressures are controlled thanks to the software OxyGEN™.
- 2: The pressure actuators immediately and automatically provide the requested pressures with very high stability thanks to a feedback loop.
- 3: Connecting the pressure outputs to airtight reservoirs provides precise and smooth control of the sample flow into the microfluidic device.

### 2.2 Different MFCS™

- **MFCS™ - EZ**










Maximum of 4 pressure channels.

Different types of MFCS™-EZ depending on the pressure ranges are available. You can mix together different pressure ranges :

- low pressure MFCS™-EZ
- negative pressure MFCS™-EZ
- high pressure MFCS™-EZ

The appropriate ring and connector are displayed in the table below.

Pressure range (mbar)	25	69	345	1000	2000	25	69	345	800	7000
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MFCSTM-EZ	low pressure					negative pressure				high pressure
Ring										NA
Connector	Female luer lock									4mm instant-connector










- **MFCSTM - EX**

System with **8** pressure channels.

Different types of MFCSTM-EX depending on the pressure ranges are available. You can mix together different pressure ranges :

- low pressure MFCSTM-EZ
- negative pressure MFCSTM-EZ
- high pressure MFCSTM-EZ

The appropriate ring and connector are displayed in the table below.

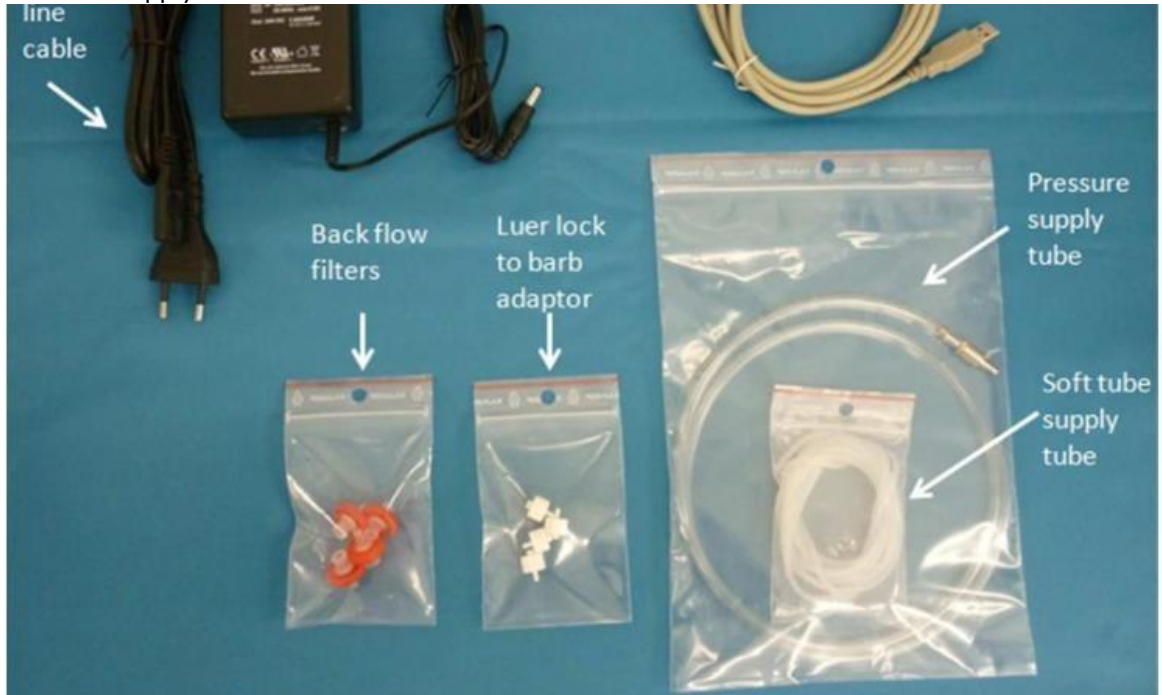
Pressure range (mbar)	25	69	345	1000	2000	25	69	345	800	7000
MFCSTM-EX	low pressure					negative pressure				high pressure
Ring										NA
Connector	Female luer lock									4mm instant-connector



### 3. **Package content**

The MFCST™-EZ package contains the following items:

- One MFCST™-EZ unit
- A power supply and a power line cable
- A USB cable
- A pneumatic connection kit (luer to barb adaptors, soft tube, back flow filters)
- This user manual
- Pressure supply tube



If any part is missing or damaged, please contact your local dealer or Fluigent immediately ([support@fluigent.com](mailto:support@fluigent.com)).



#### 4. **MFCST<sup>TM</sup>-EZ description**



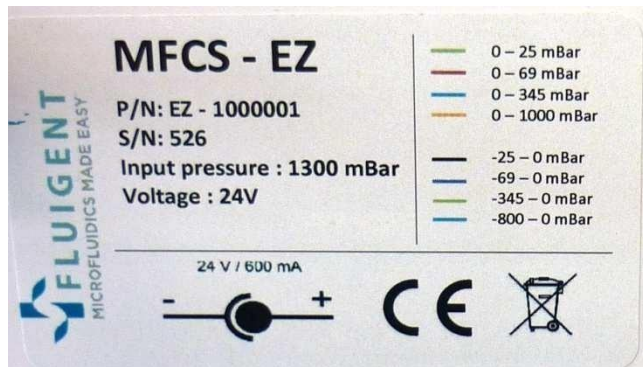
##### **Front plate description**

1. Inlet pressure value display
2. Pause button with its associated red led (idle mode)
3. Play button with its associated green led (active mode)
4. Pressure outlets\*



##### **Back plate description**

1. Inlet pressure connector
2. On/Off switch
3. Power supply inlet connector
4. USB connector
5. Nameplate



##### **Nameplate description**

**P/N:** MFCST<sup>TM</sup>-EZ product number

**S/N:** MFCST<sup>TM</sup>-EZ serial number

**Inlet pressure:** Nominal pressure at which the MFCST<sup>TM</sup>-EZ must be used.

**Voltage:** Power supply voltage (VCC)

\*Two types of connectors are provided depending on the type of MFCST<sup>TM</sup>-EZ. Low and negative pressure MFCST<sup>TM</sup>-EZ use Female luer lock connectors. High pressure MFCST<sup>TM</sup>-EZ (100 psi) uses 4mm O.D instant-connector.

## 5. Connections

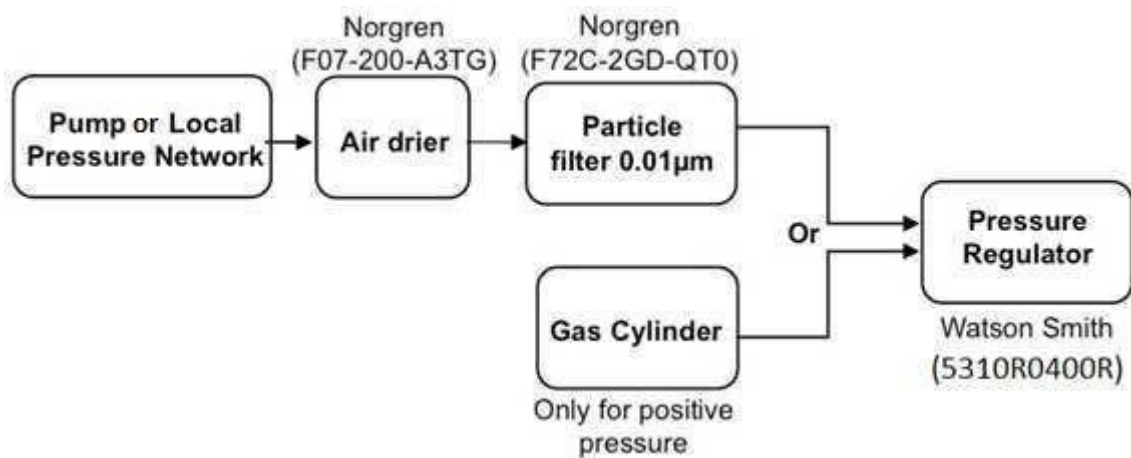
### 5.1 Pressure connection requirements

Using the MFCS™-EZ requires the following materials:

A pneumatic pressure source:

- Dry and non corrosive (use an air drier)
- Dust and oil free
- with a pressure regulator to tune the input pressure value
- 0.01 µm filtered

The pressure range of the pump should suit your MFCS™-EZ input pressure



NOTE: This scheme represents a typical positive pressure network. For negative pressure network example, see §5.1.4.

### 5.1.1 Pump kit



Whether indicated with an arrow or with some “in” and “out”, each item composing the pressure pump kit must show its air inlet and outlet. Make sure to connect the pneumatic network in the order as shown in the following pictures so that the MFCST<sup>™</sup>-EZ is properly fed with pressure.



The pressure pump kit is composed (in standard) with a manual pressure regulator, an air drier and 5m of tubing.

It is recommended to have these items in between your pressure network and your MFCST<sup>™</sup>-EZ if you fear the pressure network is not stable and dry enough.



The “pressure in” side of the manual pressure regulator is indicated with a white dot.



The air flow direction of the air drier is indicated with an arrow.

### 5.1.2 Positive pressure pump



The pump (ref 11156001 or 12305001) is a positive pressure pump providing a maximum pressure of 4Bar. It is usually used with low pressure MFCST<sup>TM</sup>-EZ.

100PSI (7Bar) positive pressure pump can also be ordered upon request.



The one-liter buffer tank ensures a stable airflow within the pressure network and comes along with the positive pressure pump.

Overall pressure network



**Warning** : Fluigent advise you to put the positive pressure pump on the floor and the MFCST<sup>TM</sup>-EZ on a table. The height difference between the positive pressure pump and the MFCST<sup>TM</sup>-EZ will prevent water flows to the MFCST<sup>TM</sup>-EZ.

### 5.1.3 Optional particle filter



The “pressure in” side of the particle filter (ref. 10001001) is indicated with a little arrow on the filter’s bottom side. This filter must be used when the pressurized air contains dirty particles likely to damage the MFCST<sup>™</sup>-EZ.



This filter sometimes needs to be triggered in order to let the air in. Proceed as follow if needed:

- Turn pressure ON.
- Block with your finger for five seconds the white plastic hose’s outlet.
- Release.
- Pressure now passes through.

If not, please contact FLUIGENT support team.



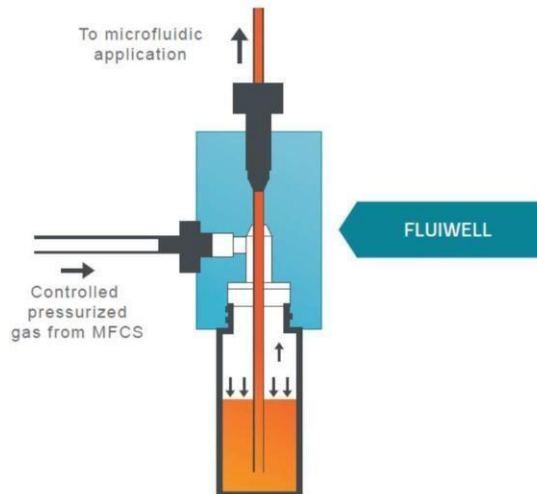
#### 5.1.4 Negative pressure pump



The negative pressure network does not need any special filter. We recommend using the pump (ref. EACVACPUMP). Its pressure outlet must be connected directly to the MFCS™-EZ pressure inlet without anything in between.

## 5.2 Reservoir connection

### 5.2.1 Fluiwell

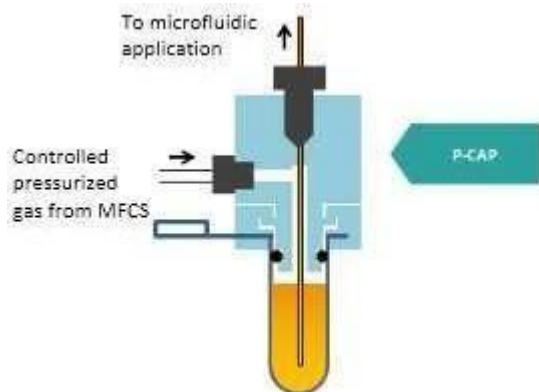


The Fluiwell is a microfluidic accessory enabling a precise pressurization of the samples into disposable vials (different volumes available) to be injected in the microfluidic system.

It is a fluidic interface between the MFCS™-EZ and your microfluidic system (see the picture).

The different FLUIWELL are listed further in a table.

### 5.2.2 P-Cap



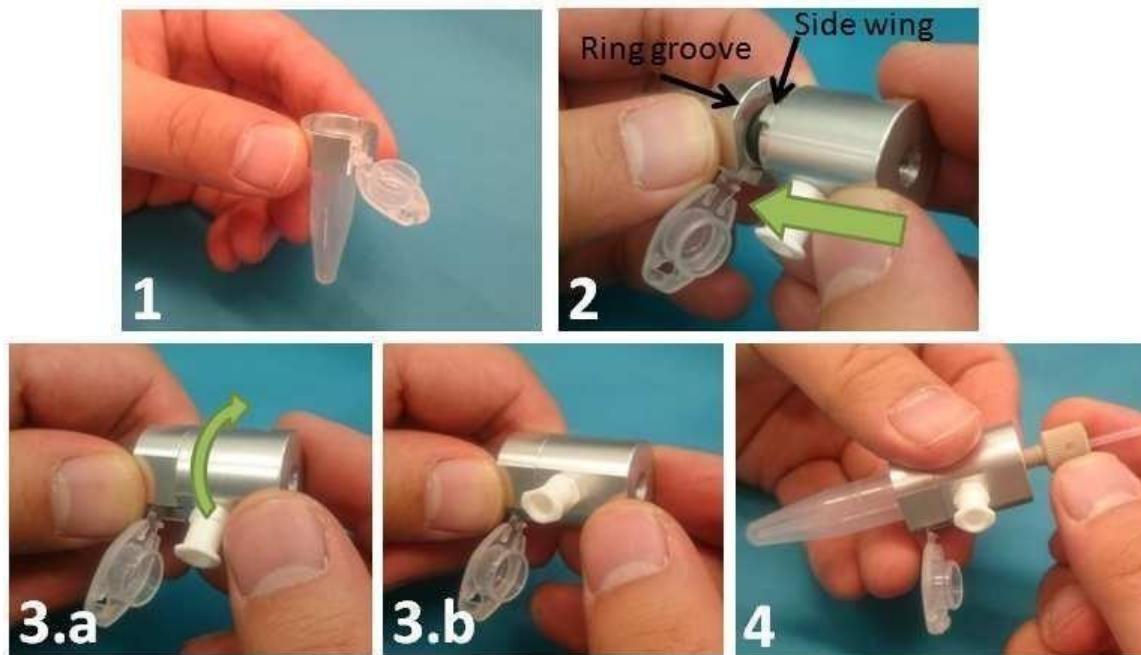
In complement to the Fluiwell, the P-Cap is a two-part pressurization system that enables quick and easy injection of liquid.

It is adapted to common low volume vials such as 1.5 ml or 2 ml Eppendorf tubes.



List of P-Cap elements, including the cap and the ring

The image below explains how to use a P-Cap.



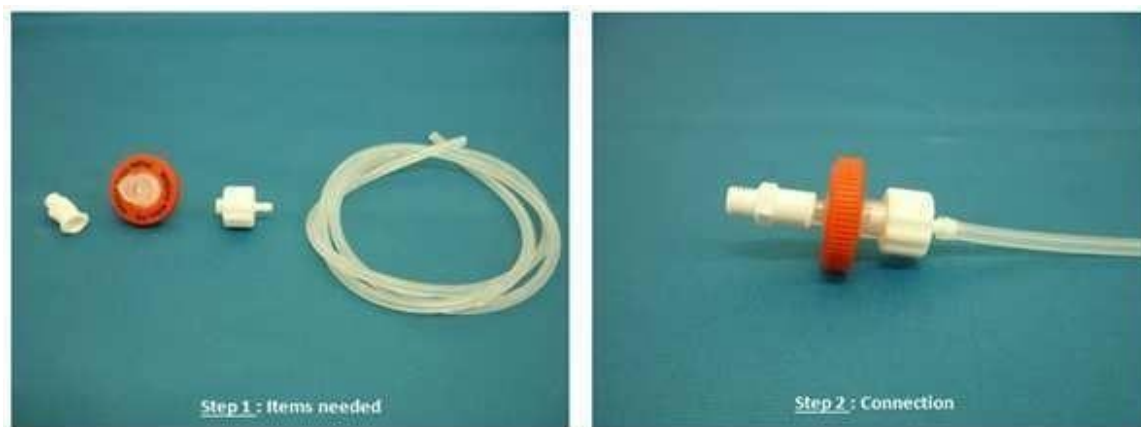
- 1) Place the ring around the tube. Make sure the cap attached to the tube fits into the groove.
- 2) Insert the cap in the ring by fitting the cap's side wings in the ring grooves.
- 3) Turn the cap while firmly holding the ring for the side wings to slide inside the cap (3.a). The faces of the ring and the cap should be well aligned (3.b).
- 4) The P-Cap is locked and ready for tube insertion.

Note: If you want to change the o-Ring, please be careful not to damage the Cap which can cause leakage: Fluigent strongly advises you to use a hard plastic rather than a metallic tube.

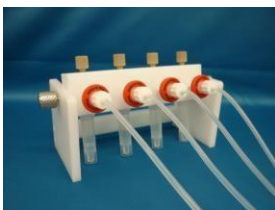



## 5.2.3 With Female luer lock connector (MFCST<sup>TM</sup>-EZ low and negative pressure)

### 5.2.3.1 For customers having Fluiwell or P-Cap

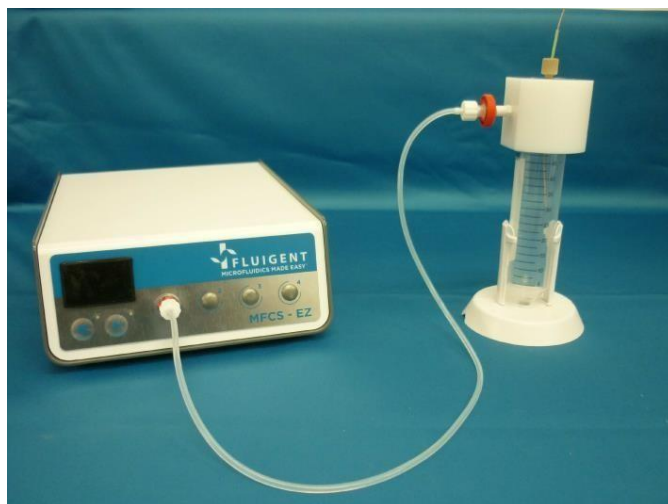
To connect the MFCST<sup>TM</sup>-EZ to your Fluiwell or your P-Cap, you will need Fluiwell white connector, back flow filter, luer lock to barb adaptor and soft tube, as shown on the picture below:





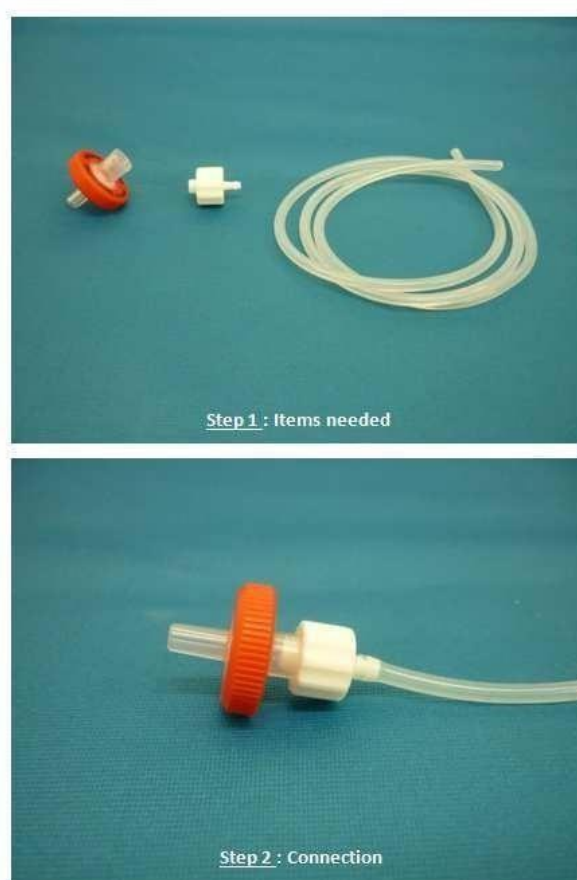
Reservoir volume	FLUIWELL	Connector
		Low/Negative pressure
0.5-2 mL		
15 mL		
50 mL		

The picture below shows how to connect a MFCS™-EZ to the Fluiwell (example with a Fluiwell 1C 50 mL low pressure).



### 5.2.3.2 For customers without Fluiwell

To connect the MFCS™-EZ to your setup (chip, for example), you will need back flow filter, luer lock to barb adaptor and soft tube, as shown on the picture below:



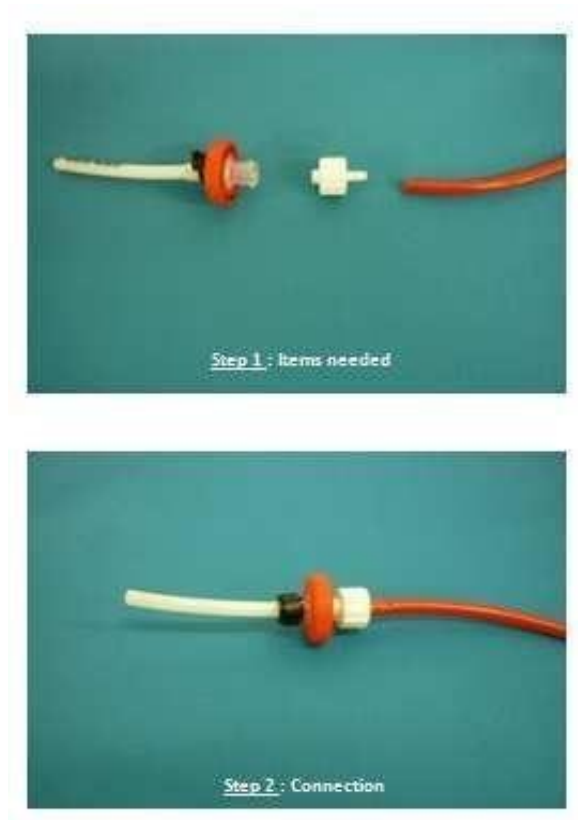
The picture below shows how to plug a back flow filter to the MFCS™-EZ.



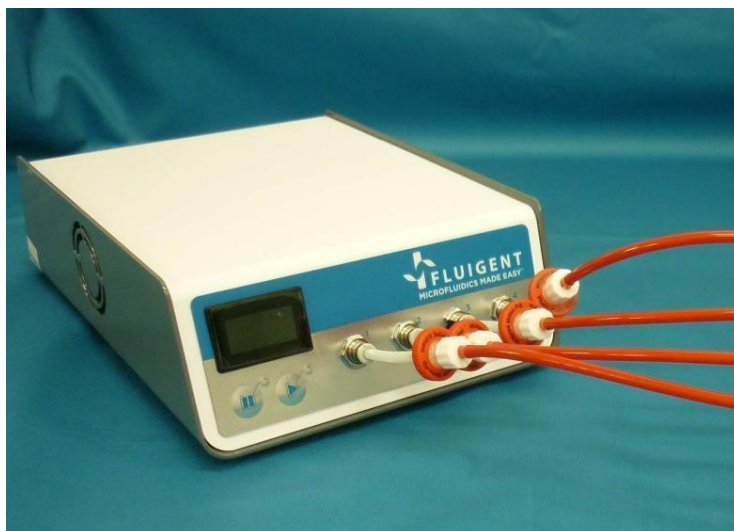
### 5.2.4 With 4mm instant- connector (MFCS™-EZ high pressure)

The picture below shows the type of instant-connector that should be screwed on the Fluiwell or P-Cap using a High-Pressure MFCST™-EZ.

To connect the MFCST™-EZ (high pressure) to your set-up, you will need the back flow filter system provided by Fluigent, luer lock to barb adaptor and pneumatic tubing, as shown on the picture below :



The picture below shows how to plug a back flow filter to the MFCST™-EZ (high pressure).



## 6. **Turn on the MFCS™-EZ**

The power supply\* as well as the USB connections are shown in the picture here below:



Once the pressure supply, power supply and the USB cable are connected to the computer turned on, switch ON the MFCS™-EZ: the red led must turn red. The connection between the computer and the MFCS™-EZ is well established. The MFCS™-EZ is in "idle mode". In the "idle mode" no pressure enters the MFCS™-EZ.

Upon pressing the "play" button, the MFCS™-EZ gets in "active mode" and the pressure is allowed into the MFCS™-EZ. Set the inlet pressure at the value advised at the back on the nameplate of the MFCS™-EZ.

The MFCS™-EZ is ready. Please check the OxyGEN user manual for software installation.

### Notice:

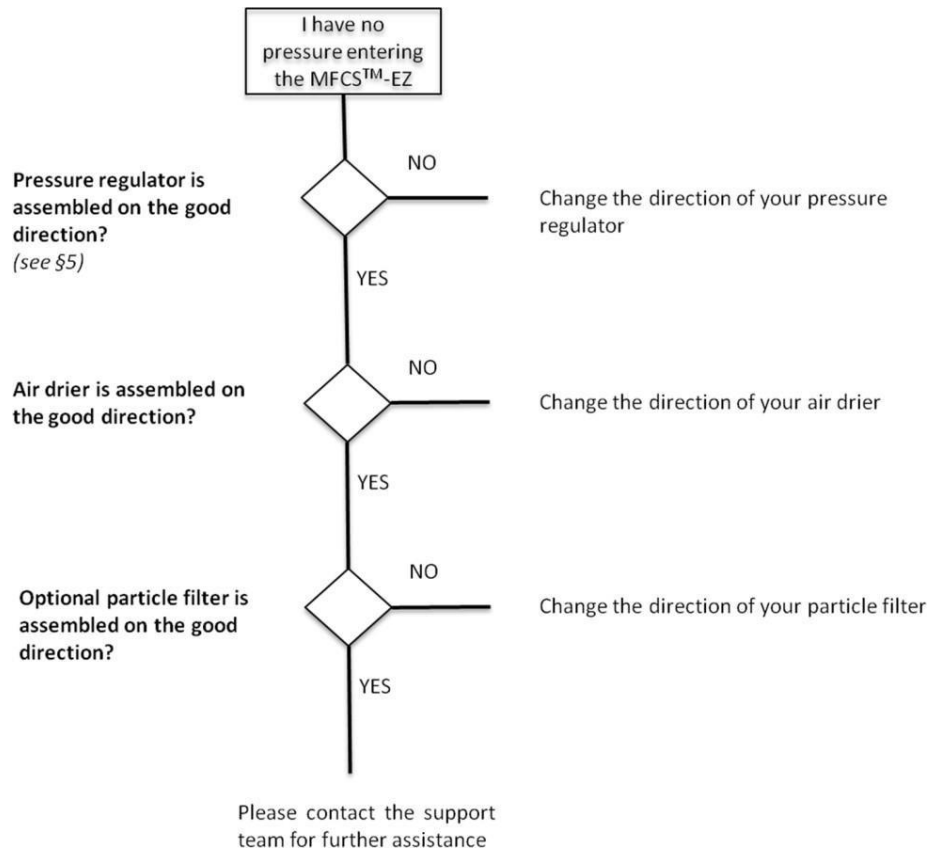
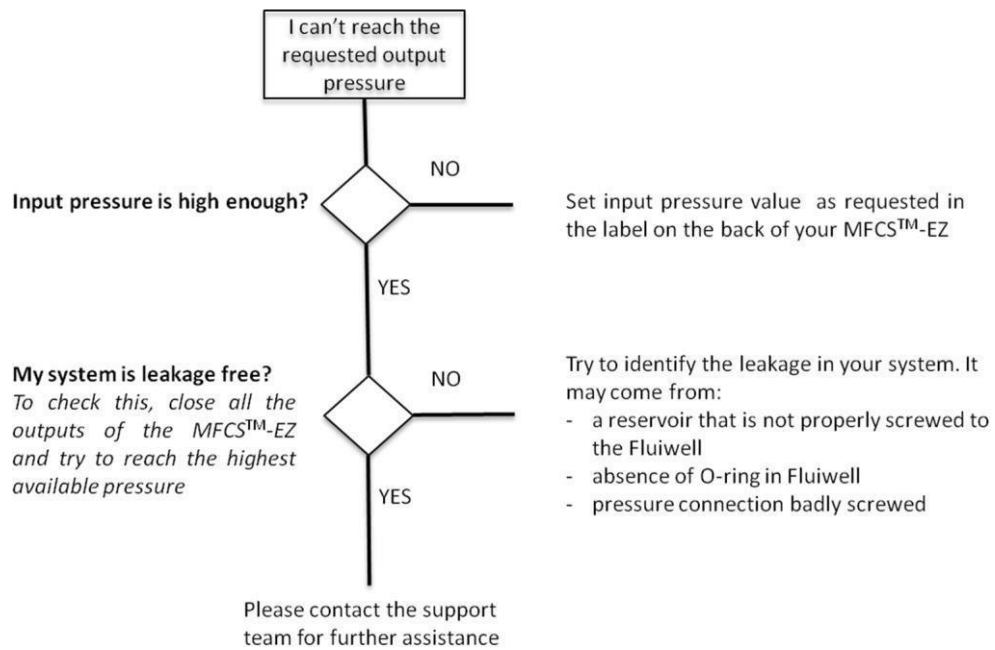
In case of inlet overpressure, the safety valve inside the MFCS™-EZ will trigger\*\*. The green and red led will show this status by blinking alternatively. In order to return to the "active mode", decrease the input pressure, press the "play" button and set the input pressure in accordance with the value advised on the nameplate of the MFCS™-EZ.

\*Make sure you received the appropriate power cord as per your country of origin.

\*\*See the Frequently Asked Question section

## 7. Frequently Asked Questions

Symptom	Potential problem	Solution
MFCST <sup>TM</sup> -EZ does not turn on	a) No power supply b) Power cord disconnected c) Wrong power supply	a) Check power supply b) Check connections between MFCST <sup>TM</sup> -EZ and power supply c) Check power supply is well 24V DC provided by Fluigent
Red led does not turn on	a) USB is disconnected b) Computer is in sleep mode or turned off c) USB hub is not adapted <i>Bandwidth provided by a host or powered hub must be:            Full speed: 12 Mbps. (Shielded cable)            Low speed 1.5 Mbps. (Non-Shielded))</i>	a) Check USB b) Get computer in normal mode c) Change USB hub
Green & Red LEDs alternatively blink	Inlet pressure is too high	Set inlet pressure as advised on the nameplate of MFCST <sup>TM</sup> -EZ (NB: variations must not exceed +/- 5%)
Nothing displayed on the LCD	a) Wrong power b) supply LCD is faulty	a) Check power supply is well 24V DC provided by Fluigent b) Contact the support team
ON/OFF switch does not work	a) No power supply b) Power cord c) disconnected Wrong d) power supply ON/OFF switch faulty	a) Check power supply b) Check connections between MFCST <sup>TM</sup> -EZ and power supply c) Check power supply is well 24V DC provided by Fluigent d) Contact the support team
Abnormal pressure drops/variations when using the MFCST <sup>TM</sup> -EZ i.e Inlet pressure is not stable.	a) Pressure source may not be stable enough b) On a vacuum MFCST <sup>TM</sup> -EZ, potential air leak on your setup.	a) Use a pressure regulator as advised in §5. b) Look for and fix the leak



## 8. Specifications

	<b>MFCST<sup>TM</sup>-EZ</b>
Pressure sensor resolution	0.03 % full scale
Pressure stability	< 0.1% CV (on measured values)
Response time	Down to 40 ms (depending on user PC operating system and configuration)
Settling time	Down to 100 ms (output volume dependent)
Pressurizing gas	Non corrosive or explosive gas (pressurized air recommended or N <sub>2</sub> , AR, CO <sub>2</sub> )
Size	16 x 23 x 6.5 cm <sup>3</sup> (6.3 x 9 x inch <sup>3</sup> )
Weight	2.0 kg (4.4 lbs)



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