



MAESFLO™

User Manual

for version 3.3.X



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FLUIGENT

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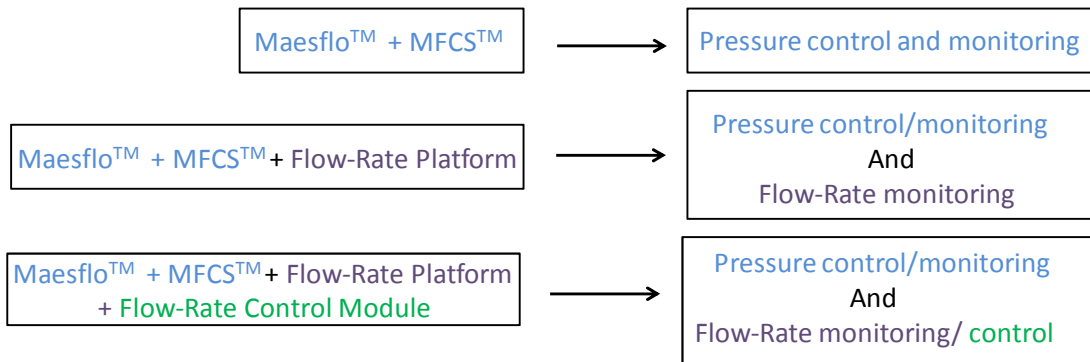


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1. Introduction

The MAESFLO™ software is a software solution for microfluidic flow control. Used with the MFCS™-EZ and the MFCS™ pressure actuators, the MAESFLO™ provides a quick, stable and accurate control of up to sixteen (16) pressure channels. By adding the Flow-Rate Platform, flow-rate measurement solution, the MAESFLO™ enables high resolution monitoring of up to sixteen (16) flow-rates in your microsystem(s). Combining the MFCS™-EZ or the MFCS™ and the Flow-Rate Platform performances with a new algorithm (Flow-Rate Control Module), the MAESFLO™ has become the solution for providing accurate and fast flow-rate control. Now the MAESFLO™ gives you the option to precisely and smoothly control microfluidic flows by pressure orders, flow-rate orders or both of them while keeping benefits of pressure actuation.



The MAESFLO™ user manual describes how to use the MAESFLO™ for your day-to-day work. It describes all the MAESFLO™ functionalities that will help you to perfectly control your microsystem(s). Explanations about the Flow-Rate Control Module operating principle are provided as well as answers to frequently asked questions. You will then be able to make the most of the MAESFLO™ performances and features.



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2. System Requirements

This installation requires one of the following Microsoft operating systems:

- Windows XP Service Pack 3
- Windows Vista x86
- Windows Vista x64
- Windows 7 x86
- Windows 7 x64
- Windows 8 x86
- Windows 8 x64

This installation requires that version 3.1 of the MSI (Windows Installer) Engine is installed on your computer. If you do not have MSI 3.1 or later, the installer updates the engine automatically and might require that you restart your computer.

The MAESFLO™ software requires:

- A minimum of 512 Mo of RAM (2Go recommended)
- Minimum processor Intel Pentium 1.6 GHz
- Minimum screen size 800 x 600

3. Installation Instructions

Before installing the MAESFLO™ software, **log on as Administrator or as a user with Administrator privileges**. The MAESFLO™ software setup program must have Administrator privileges because the program modifies the configuration registry of your system. Complete the following steps to install the MAESFLO™ software:

1. Plug your MAESFLO™ USB key. The installer launches if your USB key plays data automatically. If the installer does not launch automatically, navigate into the USB key files using Windows Explorer and launch the setup.exe file from your MAESFLO™ software USB key.
2. The installation wizard guides you through the necessary steps to install the MAESFLO™ software. You can go back and change values where appropriate by clicking the **Back** button. You can exit the setup where appropriate by clicking **Cancel**.
3. When the installation is complete, click **Finish**.



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4. How to start

4.1 Material needed for pressure control

The FLUIGENT devices below are needed for starting the MAESFLO™ software. All the devices must be connected to your computer.

- At least one (1) MFCS™-EZ or one (1) MFCS™. Up to four (4) MFCS™-EZ or (1) MFCS™ and (1) MFCS™-EZ or two (2) MFCS™ can be used.
- Optional: up to sixteen (16) FLOW UNIT can be used for flow-rate monitoring (up to two (2) FLOWBOARD).

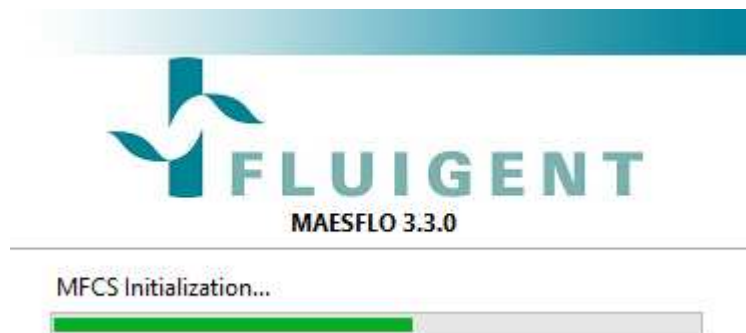
4.2 Material needed for Flow-Rate Control Module

The FLUIGENT devices below are needed for starting the Flow-Rate Control Module. All the devices must be connected to your computer.

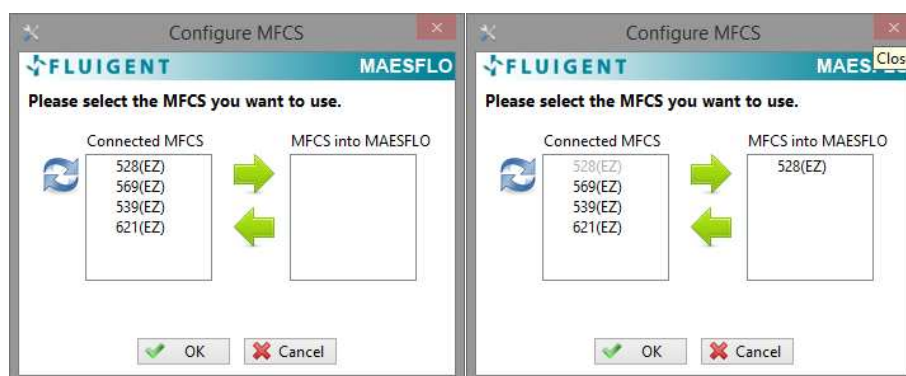
- At least one (1) MFCS™-EZ or one (1) MFCS™. Up to four (4) MFCS™-EZ or (1) MFCS™ and (1) MFCS™-EZ or two (2) MFCS™ can be used with the Flow-Rate Control Module.
- At least one (1) FLOW UNIT connected to one (1) FLOWBOARD. Up to two (2) FLOWBOARD can be used with the Flow-Rate Control Module (up to sixteen (16) FLOW UNIT).
- A dongle key supplied by FLUIGENT.

4.3 Starting MAESFLO™

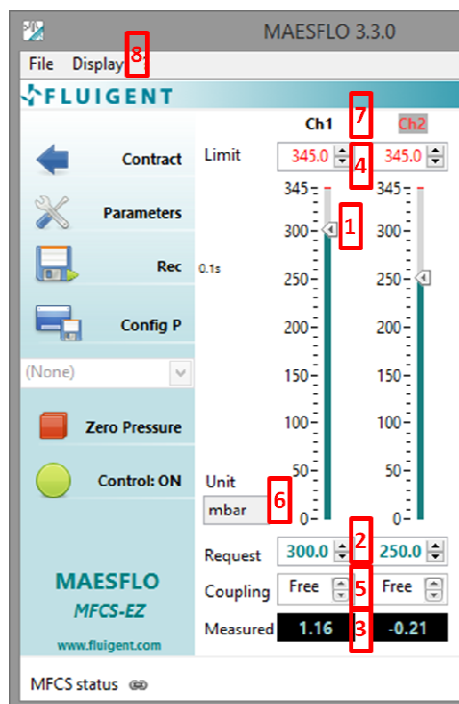
Click on the MAESFLO™ shortcut on your desktop to launch the MAESFLO™ with pressure control features.



The MFCS™ or MFCS™-EZ connected to the computer will be automatically detected. To refresh, click on the blue arrows. You will be asked to select the MFCS™ or the MFCS™-EZ you want to use.



5. MAESFLO™ Pressure Control panel (expanded)



*: Requires Flow-Rate Platform

** : Requires FRCM Dongle

The Pressure Control panel provides you with the following functionalities:

1. **Vertical pointer slide.**

Slide the pointer to change or adjust the requested pressure on the given channel.

2. **Manual pressure control.**

Directly enter the requested pressure on the given channel. See *Configurations (MAESFLO™ parameters dialog)* for navigation keyboard shortcuts to control the pressure order.

3. **Measured pressure.**

Display the current pressure on the given channel.

4. **Limit.**

Set the maximum pressure on a given channel if necessary for your experiment

5. **Channel coupling.**

Easily link the channel pressure settings between several channels by selecting the appropriate coupling label in the drop down menu.

When channels are coupled with “A+”, increasing/decreasing the pressure of one channel will increase/decrease the pressure of the other(s) channel(s) of the same amount.

When two channels are coupled with “A-”, increasing the pressure of one channel will decrease the pressure of the other channel of the same amount.

6. **Unit selection.**

Select the pressure unit you want to use from the drop down menu (mbar, psi and Pa).

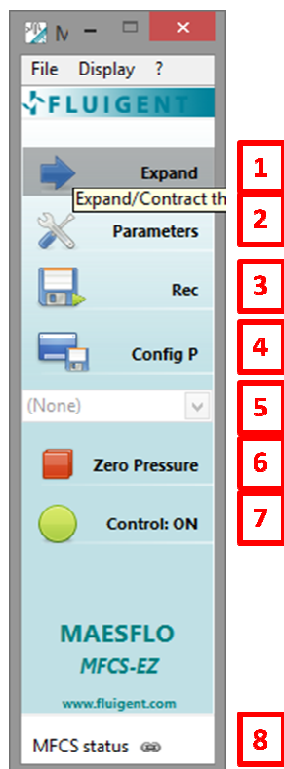
7. **Channel naming.**

Right-click to change the channel names.

8. **Display options.**

Select from the drop down menu additional windows (pressure graph (cf. section 8), Flow-Rate Platform panel*(cf. section 9), flow-rate graph*(cf. section 8), Flow-Rate Control Module**(cf. section 13)) you want to display.

6. MAESFLO™ Pressure Control panel (contracted)



1. Contract/Expand main window.

Let you contract or expand the main window so that you can respectively, trim the panel to the menu and access to the entire panel.

2. Access to MAESFLO™ parameters.

See *MAESFLO™ parameters dialog* for more details.

3. Recording.

Log the set pressures, measured pressures, and measured flow-rates* at a given sampling rate. See *Record (MAESFLO™ parameters dialog)* for more details.

4. Configurations.

Save the current pressure configuration of the different channels (by clicking on the “Config P” button).

5. Configuration list.

Select the configuration you want to apply.

6. Zero pressure.

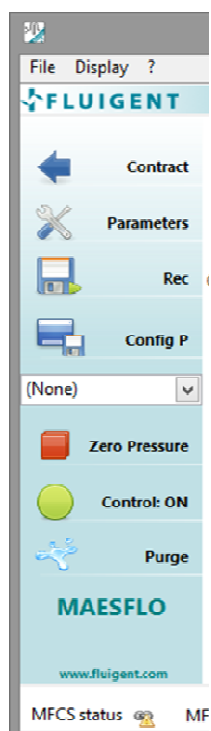
Set all pressure channels to zero. Pressing “Escape” key will also set all pressures to zero.

7. Control (ON/OFF).

When control is set to OFF, no new order is sent to the MFCS™-EZ or MFCS™ but the monitoring and recording are still working. When control is set to ON orders are transmitted to the MFCS™-EZ or MFCS™.

8. MFCS status.

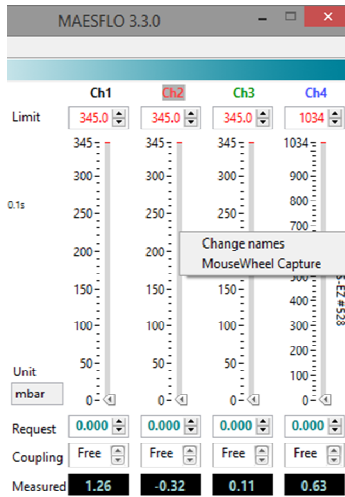
Display the current connection status of the MFCS™-EZ or MFCS™.



When using only MFCS™ (without any MFCS™-EZ), the purge button will be available.

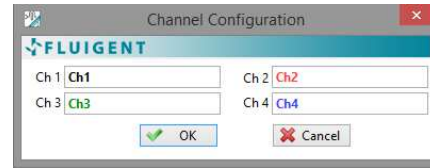
Purge

Set maximum pressure available in channel 1. The maximum pressure available corresponds to the pressure value displayed in the front panel of the MFCS™.



Pressure Panel:

By right-clicking on pressure channels, you can change the name of pressure channels.



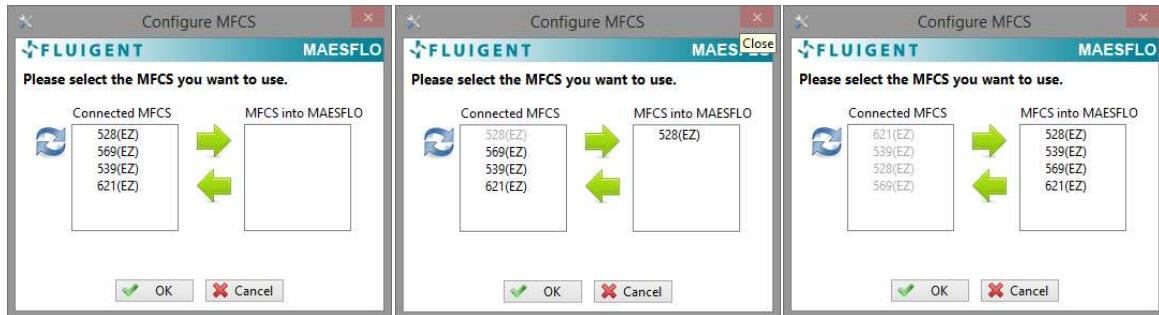
Note: The mousewheel capture function is explained in section 11.

7. Working with several MFCS™ and MFCS™-EZ

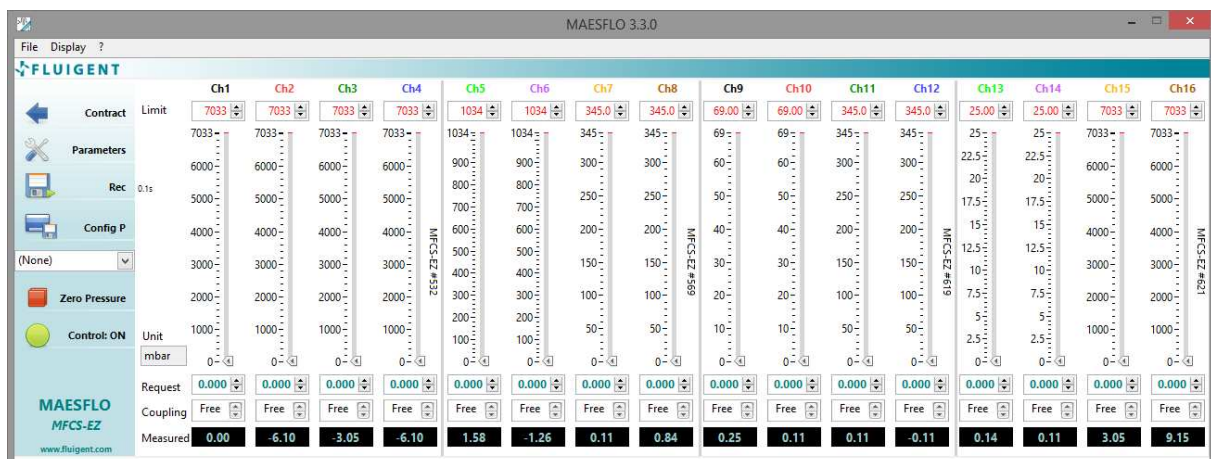
It is possible to control up to four (4) MFCS™-EZ or one (1) MFCS™-EZ and one (1) MFCS™ or two (2) MFCS™ with MAESFLO™.

You can then control up to 16 pressure channels and mix control of positive and negative pressure (EZ) and/or control of low and high pressure.

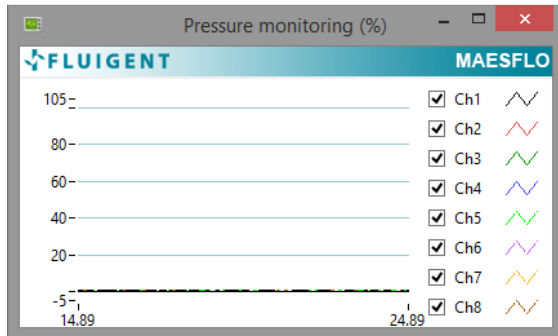
When several MFCS™-EZ or MFCS™ are connected to the same computer you are asked to choose which pressure actuator you want to control with MAESFLO™ (example below with 4 MFCS™-EZ).



All pressure channels of all the MFCS™-EZ are then displayed in the main control window.



8. Graphs Display

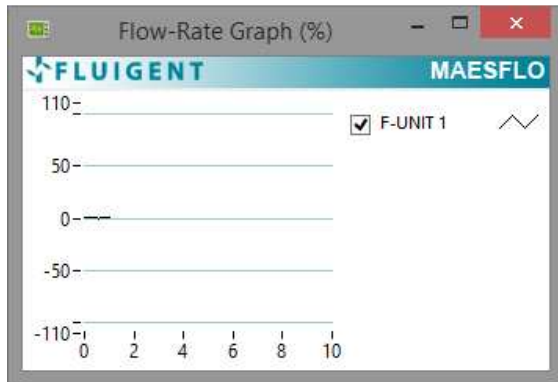


Pressure Graph window:

Display pressure measurements of the different channels in % of full scale.

This window can be rescaled.

You can choose which pressure channel you want to display by clicking on the corresponding box.



Flow-rate Graph* window:

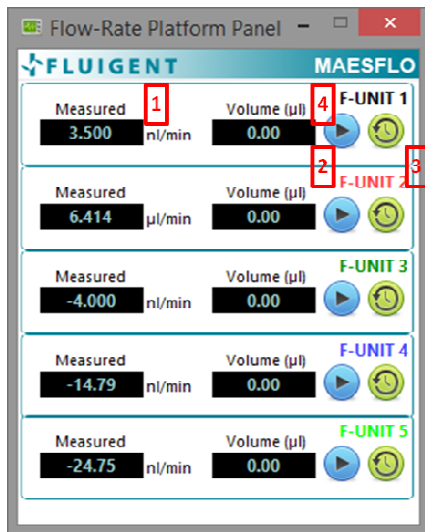
Display flow-rate measurements of the different channels in % of full scale.

This window can be rescaled.

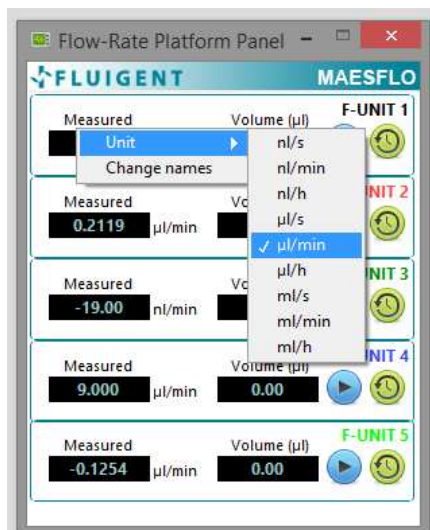
You can choose which flow-rate channel you want to display by clicking on the corresponding box.

*: Requires Flow-Rate Platform

9. Flow-Rate Platform panel*

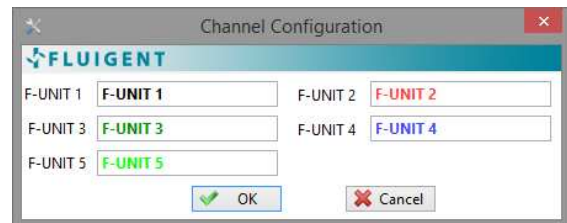


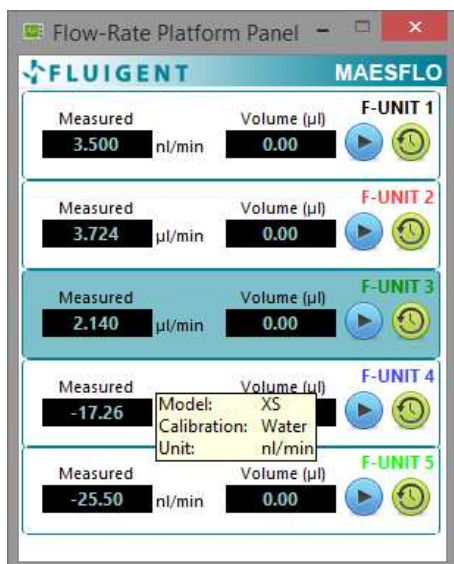
- Flow-rate Platform Panel* :**
1. Flow-rate measurement.
 2. Start/stop volume measurement.
 3. Reset volume measurement.
 4. Volume measurement.



*: Requires Flow-Rate Platform

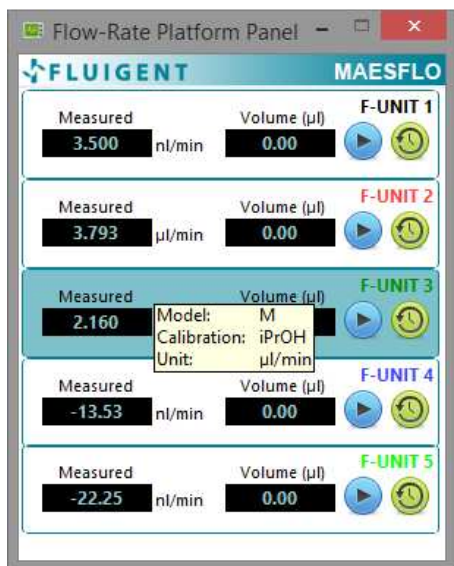
By right-clicking, you can change the name of the FLOW UNIT and change the unit.





Tool tips display as you hover your mouse pointer over the various elements.

You will find information on the Model (**XS**), Calibration (**Water**) and Unit (**nl/min**) regarding the selected FLOW UNIT.



In this other example, the Model is **M**, the Calibration is **Isopropyl Alcohol** and the Unit **µl/min** for the FLOW UNIT 3.

If the calibration for FLOW UNIT S, M and L is fixed to be Isopropyl Alcohol, the channel is highlighted in blue (cf FLOW UNIT 3). If the calibration used is water, the channel is highlighted in white (cf other FLOW UNIT).

The explanations related to the dual calibration of FLOW UNIT are given in the Flow-Rate Platform user manual.



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10. List of keyboard shortcuts

The following table lists keyboard shortcuts in the MAESFLO™ software:

Keyboard Shortcut	Description
Navigating the MAESFLO™ Software	
Tab	Navigate through the controls or indicators.
Shift-Tab	Navigate backward through the controls or indicators.
Ctrl-S	Save the current configuration.
Ctrl-O	Open a configuration file.
Ctrl-Q	Quit MAESFLO™.
Ctrl-H	Display the context help window.
Escape	Set all pressure channels to 0.
Alt-F4	Close the current closable window (if done from the MAESFLO™ main panel it will act as the Ctrl-Q shortcut).
Navigating the “Requested pressure” when the focus is inside the Pressure control panel	
Right/Left arrow	Navigates through the « Requested pressure » controls from a channel to another.
Up/Down arrow	Increase/Decrease of a small amount the value when focused.
Page up/down	Increase/Decrease of a larger amount the value when focused.
Navigating the configuration	
F1 to F9	See <i>Configurations (MAESFLO™ parameters dialog)</i>



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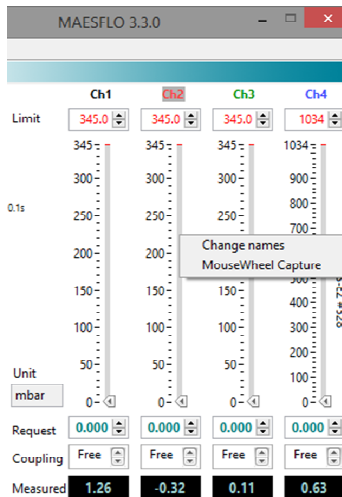
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11. MouseWheel Capture addon

The MouseWheel Capture addon allows you to take control of the pressure channel from the mouse wheel.

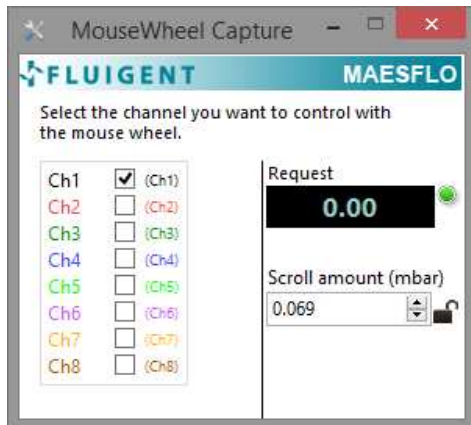
You need to select the Pressure channel you want to control then you will be able to increment/decrement the pressure order with the mouse wheel.

The MouseWheel Capture dialog should be active and your mouse pointer within the window bounds to run the capture.



Pressure Panel:

By right-clicking on pressure channels, you can have access to the MouseWheel Capture dialog.



MouseWheel Capture:

This window appears when clicking on MouseWheel Capture menu item.

You can choose the pressure channel you want to control by directly clicking on the corresponding box or using the Tab shortcut.

Once the channel is selected and only when the MouseWheel Capture window is active and your mouse pointer is within this window (see the green indicator), you are able to change the pressure value while moving the mouse wheel.

You can choose the Scroll Amount in mbar (the minimal scroll amount is 0.02% of the pressure range of the selected channel).

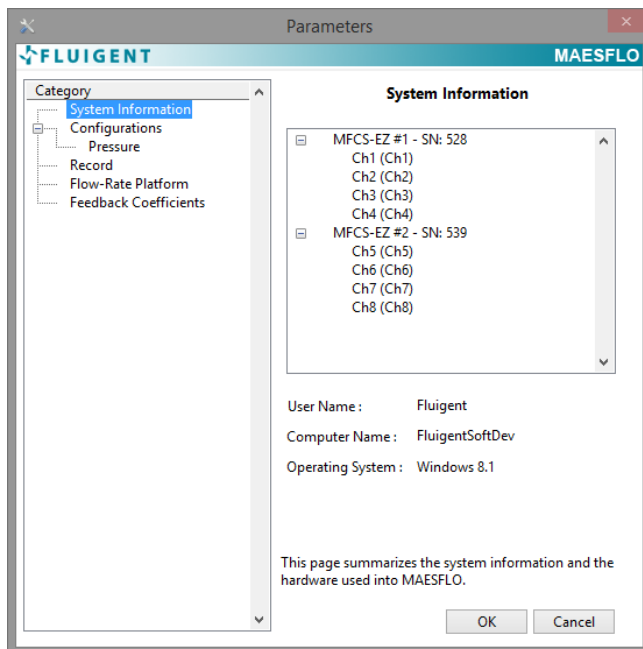
12. MAESFLO™ parameters dialog box

Select **Parameters** to display this dialog box.

Use this dialog box to set MAESFLO™ parameters. You can customize the appearance and operating mode of MAESFLO™ and add devices to MAESFLO™ software.

- **Category:** List the parameter options to customize the appearance and operating mode of MAESFLO™. Select an option in the Category list box to display the parameter options in the dialog box.
- **System Information:** Information on your hardware used into MAESFLO™.
- **Configurations:** Set options for configuration files.
- **Record:** Set options for log files.
- **Flow-Rate Platform:** Add FLOWBOARD and FLOW-UNIT devices to MAESFLO™ software.
- **Flow Rate Control Module:** Control the flow-rates in your microfluidic system.
- **Feedback coefficients:** Set options for pressure feedback coefficients.

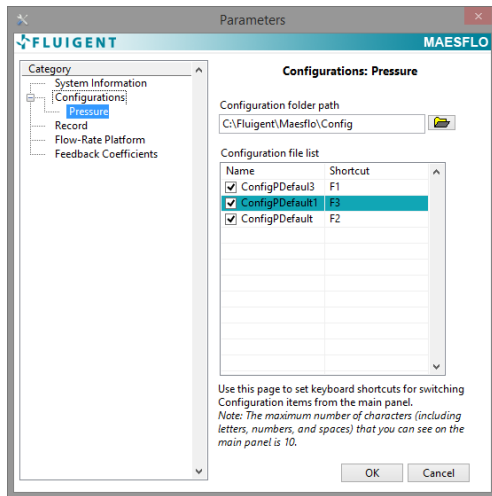
12.1 System Information (MAESFLO™ parameters dialog box)



Summary of hardware used into MAESFLO™ software:

- MFCS™ or MFCS™-EZ
- FLOWBOARD
- FLOW UNIT

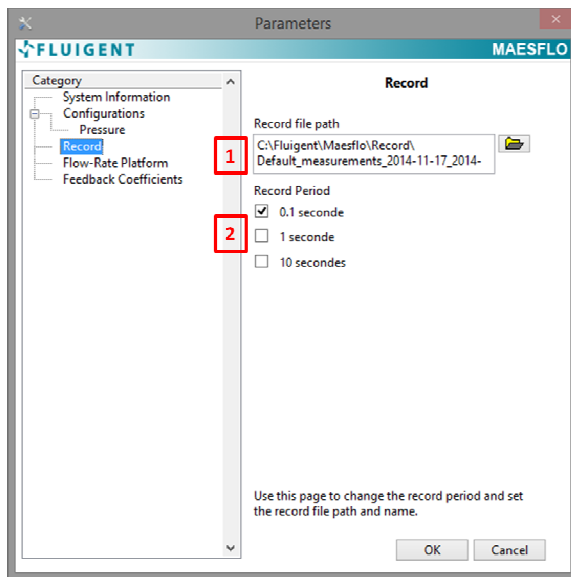
12.2 Configurations : Pressure (MAESFLO™ parameters dialog)



Configurations are a snapshot of a pressure set point. You can name your different configurations, create shortcuts and choose to display them or not in the drop-down menu of the main panel.

- 1. Folder path:** You can choose the path for the directory containing your configurations. Default path is C:\Fluigent\Maesflo\Config.
- 2. Name:** Display the configuration name of the configuration saved in the Folder path directory. Ticking a configuration will display it in the drop-down menu of the main screen.
- 3. Shortcut:** You can set and use shortcuts (with F1 to F9 keys) for direct access to configurations.

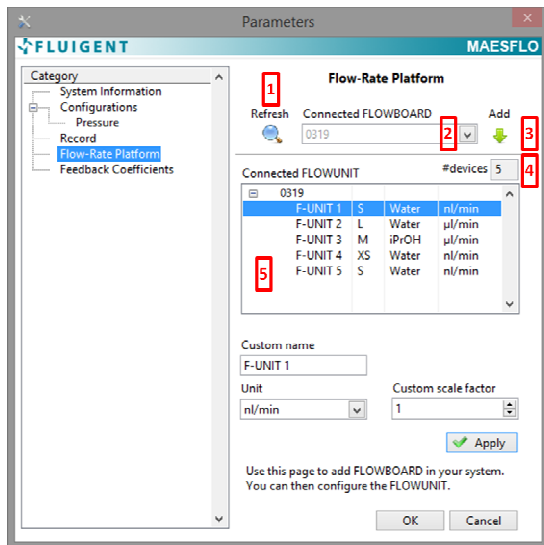
12.3 Record (MAESFLO™ parameters dialog)



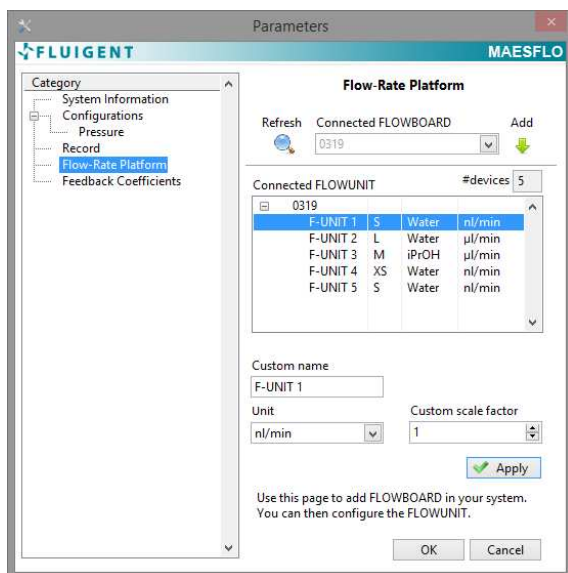
You can log pressure orders, measured pressures and flow-rates of your experiments at anytime.

- 1. Record file path:** You can choose the path of the log file location. Default path is C:\Fluigent\Maesflo\Record\.
- 2. Record period:** You can choose the sampling rate between three preset values. This sampling period is indicated on the main panel (expanded version).

12.4 Flow-Rate Platform (MAESFLO™ parameters dialog)

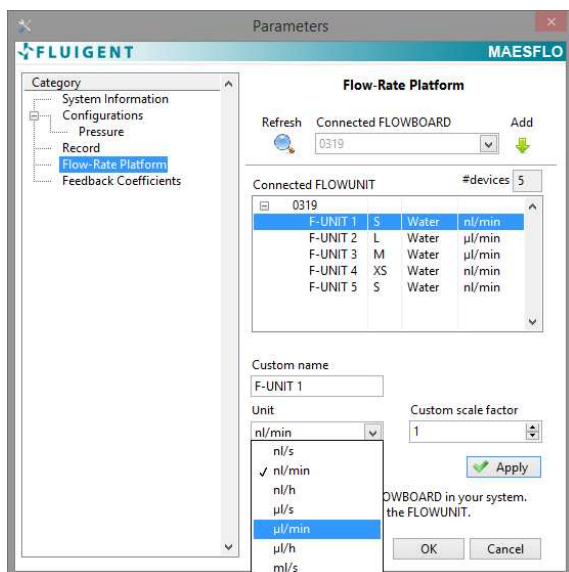


1. Launch the automatic detection of connected FLOWBOARD (the serial number is indicated).
2. Display the list of connected FLOWBOARD. You can select up to 2 FLOWBOARD at the same time.
3. Add FLOWBOARD and update FLOW UNIT.
4. Display the number of connected FLOW UNIT (from all FLOWBOARD).
5. Display information on FLOW UNIT (Name, Range, Calibration, Unit).



When clicking on the green arrow, it displays all the FLOW UNIT connected to the selected FLOWBOARD (here FLOWBOARD with the serial number 0319). It can take several seconds to load the information. The different FLOW UNIT are identified through their position on the FLOWBOARD (port 1 to port 16). The default settings are displayed.

If you want to change the settings, first select a FLOW UNIT.

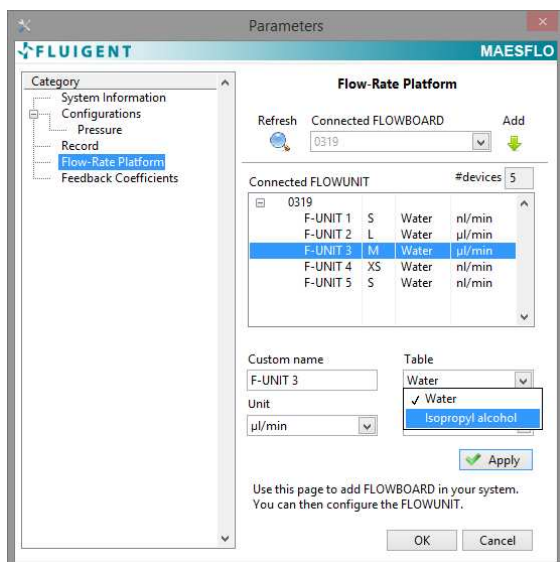


When a FLOW UNIT XS/XL is selected, you are able to:

- add a custom name (the name will be loaded in all the different panels and graphs)
- change the unit
- add a scale factor (see the Flow-Rate Platform user manual for explanations)

Note 1: the scale factor 0 is not allowed

Note 2: click on the “Apply” button to save the new settings for each FLOW UNIT



When a FLOW UNIT S/M/L is selected, you are able to:

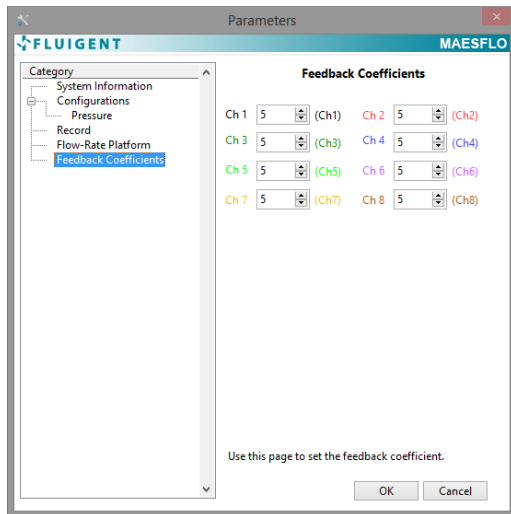
- add a custom name (the name will be loaded in all the different panels and graphs)
- change the unit
- add a scale factor (see the Flow-Rate Platform user manual for explanations)
- change the calibration: choose between Water and Isopropyl alcohol calibrations (see the Flow-Rate Platform user manual for explanations).

Note: the scale factor 0 is not allowed

Note 2: click on the “Apply” button to save the new settings for each FLOW UNIT

When all the FLOWBOARD and FLOW UNIT are displayed, do not forget to click on “OK”. It will launch and/or update the Flow-Rate Platform Panel (see §9).

12.5 Feedback coefficients (MAESFLO™ parameters dialog)



With this parameter you can set the pressure response shape. The factory default value is 5.

Response mode:

If the feedback coefficient is higher than 5 the response is faster but you can also have overpressure and instability.

If the feedback coefficient is lower than 5 the response is more stable without overpressure but it will lead to a slower response.

Note: It's highly recommended not to change the default value. The MFCS™ and MFCS™-EZ have been optimized by Fluigent experts and should provide you with the best compromise between stability and fast response.

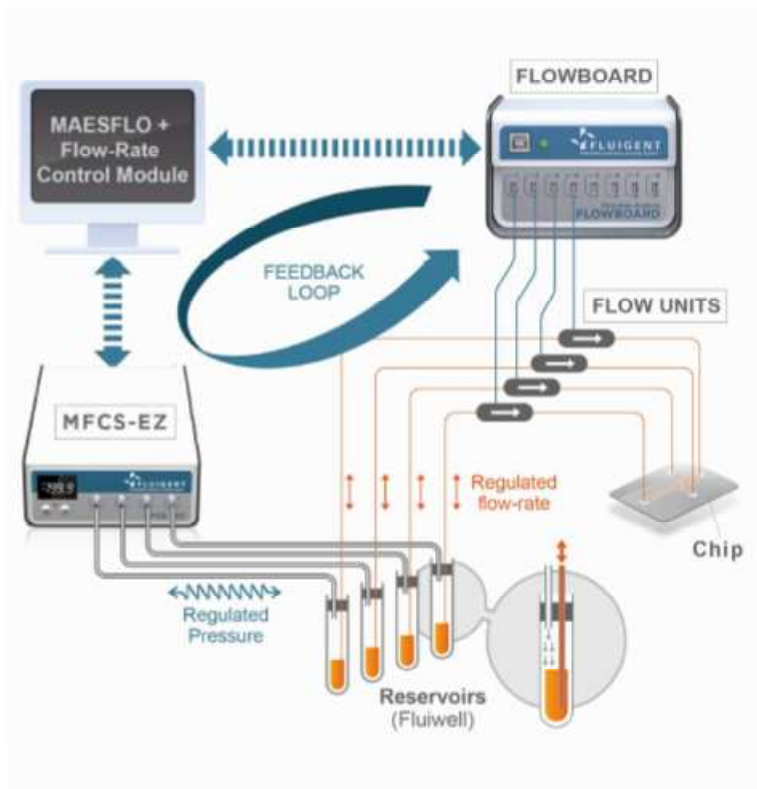
Please contact us for more information: support@fluigent.com

13. Flow-Rate Control Module: Operating principle

The Flow-Rate Control Module uses pressure actuation to control flow-rates. As shown in the figure below, applying pressure in the suitable FLUIWELL™ reservoirs creates a liquid flow through your microsystem. As both pressure and flow-rate are measured by the MFCS™-EZ or the MFCS™ and the Flow-Rate Platform, the Flow-Rate Control Module is able to automatically adjust pressure(s) to reach the flow-rate set-point(s). This operating principle enables to control flow-rates even in complex microsystems made up of coupled channels. The Flow-Rate Control Module may be used with up to sixteen (16) pressure channels and sixteen (16) flow-rate channels. Combining with MFCS™-EZ or MFCS™, and the Flow-Rate Platform, this solution provides fast, stable and precise flow-rate control.

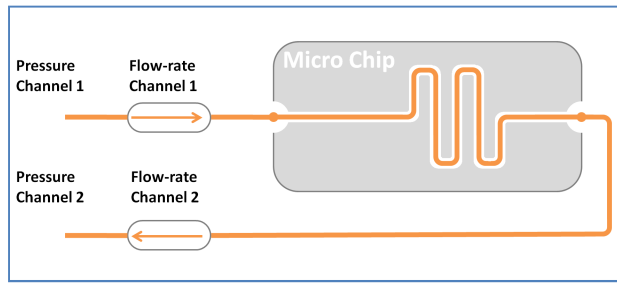
To perform flow-rate control by pressure actuation, the Flow-Rate Control Module needs to create a model containing the relations between pressures and flow-rates. This is done thanks to the **identification step**. This step must be successfully achieved to access flow-rate control features. Besides, the flow-rate control performances are impacted by the flow-rate measurements relevance and the pressure channel selected. Once the model is computed, it is used in the regulation mode (or flow-rate control mode) to provide the target flow-rates with the pressure actuators. During the experiment, the model is continuously computed to check any variation and adapt its response (in a certain range).

All these points will be discussed below and we will give you some practical examples and advices to make the most of the Flow-Rate Control Module performances.



13.1 Pressure for flow-rate control

The choice of the pressure channels used for the flow-rate control has a key impact on the Flow-Rate Control Module performances. In this part, we will introduce the pressure channel and pressure range selection.



The figure on the left describes a simple microfluidic set-up. The input is connected to the pressure and flow-rate channels 1. The output is connected to the pressure and flow-rate channels 2. A "positive" flow-rate is given by the arrow direction on the left scheme for each flow-rate channel.

We will describe the Flow-Rate Module Control behavior in two different cases:

Case 1: Only the pressure channel 1 is controlled by the Flow-Rate Control Module. In this case the Flow-Rate Control Module will only provide positive flow-rates. To obtain negative flow-rates, the pressure in channel 2 has to be increased. As this pressure has not been selected for the Flow-Rate Control Module, you have to increase the pressure manually. Then, the Flow-Rate Control Module will be able to reach negative flow-rates.

Case 2: The pressure channels 1 and 2 are both controlled by the Flow-Rate Control Module. In this case, the Flow-Rate Control Module will automatically adapt the pressure of both pressure channels to provide positive and negative flow-rates. You do not have to adapt any pressure value.

The choice of the pressure channels used by the Flow-Rate Control Module directly impacts the reachable flow-rate range. You will be asked to choose the pressure channels during the identification step. FLUIGENT advises you to select all the pressure channels in this step. You may be able to modify them in the *Parameter* panel after the identification while performing your experiment.

Please be also aware that the pressure range of the pressure channel directly impacts the reachable flow-rate range. Increasing (*decreasing*) the pressure range will increase (*decrease*) the reachable flow-rate range. In the MAESFLO™ software the **Pressure limit** (Pressure Control panel) is used to limit the maximum pressure provided on the selected channel. This control may be used for safety reasons such as microchip integrity. The limit is however taken into account by the Flow-Rate Control Module and may reduce the reachable flow-rate range.

13.2 Reachable flow-rate

The Flow-Rate Control Module always displays if a requested flow-rate order can be reached. Information is provided thanks to the **Reachable** indicator on the Flow-Rate Control panel. As previously said, the reachable flow-rate range directly depends on the pressure channels controlled by the Flow-Rate Control Module and the pressure range of these channels. However, some flow-rate orders may not be reached due to another limitation called "contradictory orders".

In the figure above, a contradictory order occurs when two different flow-rate orders are requested for the two flow-rate channels. These channels are indeed linked by the following physical constraint: as the flow-rate channels are associated with the same microfluidic channel, the flow-rates are always equal for both flow-rate channels. So in this case, reaching two different flow-rate orders is physically impossible.

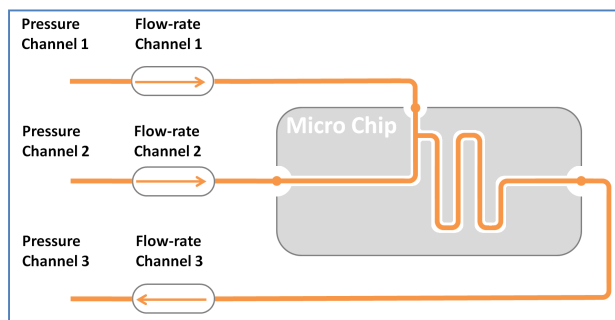
When a flow-rate order is not reachable, the Flow-Rate Control Module will reach the closest flow-rate achievable from the flow-rate order.

13.3 Flow-rate priority

The Flow-Rate Control Module introduces the flow-rate priority concept. Four priority levels are available for each flow-rate channel:

- High:** the Flow-Rate Control Module will always try to match the flow-rate orders of these channels.
- Medium:** the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the high priority channels are matched.
- Low:** the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the medium priority channels are matched.
- None:** these channels are only monitored.

The flow-rate priority directly impacts the reachable flow-rates. The Flow-Rate Control Module tries to match simultaneously all the flow-rate orders incoming from flow-rate channels with the same priority level. If for any reason, one of them is not reachable, they all will be considered as “not reachable”. Then, the Flow-Rate Control Module will try to provide the closest flow-rate from each order.



The figure on the left describes a microfluidic set-up. The inputs are connected to the pressure and flow-rate channels 1 and 2. The output is connected to the pressure and flow-rate channels 3. A "positive" flow-rate is given by the arrow direction on the left scheme for each flow-rate channel.

Let's assume that the user chooses the same priority level for all the channels (*high*) and asked the following flow-rate orders:

- +20 $\mu\text{L}/\text{min}$ for the flow-rate channel 1
- +20 $\mu\text{L}/\text{min}$ for the flow-rate channel 2
- +20 $\mu\text{L}/\text{min}$ for the flow-rate channel 3

Let's assume that all orders are individually reachable. The orders on the flow-rate channels 1 and 2 are contradictory orders regarding to the order on channel 3. All the orders will be displayed as “not reachable”. None of them will be matched.

Using the priority level partition may avoid this behavior. In the same example, let's assume that the user only modifies the flow-rate priorities while keeping the same orders:

- Flow-rate channel 1: High
- Flow-rate channel 2: Medium
- Flow-rate channel 3: Medium

The flow-rate order of the channel 1 will be reached first without taking into account the other orders with lower priority. After this flow-rate order has been reached, the Flow-Rate Control Module will try to reach the orders with a *Medium* priority. As the “contradictory order” still remains, the orders of the channels 2 and 3 will still be displayed as “not reachable”. With the same system, adapting the priority levels enables to reach flow-rate orders previously displayed as “not reachable”.

Now, let's assume that the user modifies again the flow-rate priorities while keeping the same orders:

- Flow-rate channel 1: High
- Flow-rate channel 2: Medium
- Flow-rate channel 3: Low

The flow-rate order of the channel 1 will be reached as previously. Then the Flow-Rate Control Module will reach the order of the channel 2. Finally, it will try to match the order of the channel #3. As the “contradictory order” still remains, this last order cannot be reached. It will be the only one displayed as “not reachable”.

This example points out how to use the flow-rate priority concept. With the same system, a suitable priority partition enables to reach flow-rate orders that may initially be displayed as “not reachable”. However, you have to keep in mind that, whatever the priority given, if a flow-rate order cannot physically be reached (due to pressure range or contradictory order) it will always be displayed as “not reachable”.

13.4 Identification step

The purpose of the identification step is to learn about the relation between applied pressure(s) and measured flow-rate(s) in your microsystem. To perform this step, you will be asked to choose the pressure channels used for the flow-rate control and to ensure that the flow-rate sensors are in a non saturated state.

The Flow-Rate Control Module will only take into account the selected pressure channels during the identification. It means that a pressure channel which has not been selected cannot be used for the flow-rate control. If you want to use a pressure channel not selected during the identification, you have to perform a new identification process. The pressure channels that were selected during the identification may be used for the flow-rate control or for the pressure control. That is why FLUIGENT advises you to select all the pressure channels available during the Identification step.

The identification quality depends on the flow-rate measurement suitability. Any flow-rate sensor saturation decreases the identification quality and increases its duration. The Flow-Rate Control Module takes into account all the flow-rate sensor measurements. That is why you will be able to control any flow-rate channel in the Flow-Rate Control panel, even those not selected during the identification step.

The results of the identification can be saved. If the user wants to use previous identification results, he needs to load the corresponding identification file. The identification result is linked to the FLUIGENT devices used to perform it and of course the connected microsystem. The software will deny the loading of an identification result if there is any difference in the devices used (number of MFCSTM-EZ and/or MFCSTM, number of FLOWBOARD, number of pressure channels and FLOW-UNIT, range of pressure channels or FLOW-UNIT). The flow-rate control performances will also decline if the connected microsystem highly differs from the microsystem used during the identification.



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14. Identification wizard

14.1 Overview

The Flow-Rate Control Module uses pressure(s) to control flow-rate(s). This working principle provides a fast, precise and stable flow-rate control. However it needs to determine the relations between applied pressure(s) and measured flow-rate(s). This step is done thanks to the **identification wizard**. **You must complete the wizard before using the flow-rate control.**

The **identification wizard** provides three (3) different ways to perform the identification step:

1. Create a new system setup: to perform a new identification result. The wizard will guide you step by step through the identification process. FLUIGENT advises this option for new users or for complex systems.
2. Load an existing system setup: to load a previous identification result.
3. Enter manually the parameters (advanced user): to perform a new identification result. The user will directly input the identification data and perform the identification himself. This option is the quickest to perform a new identification result. FLUIGENT advises it for advanced users only.

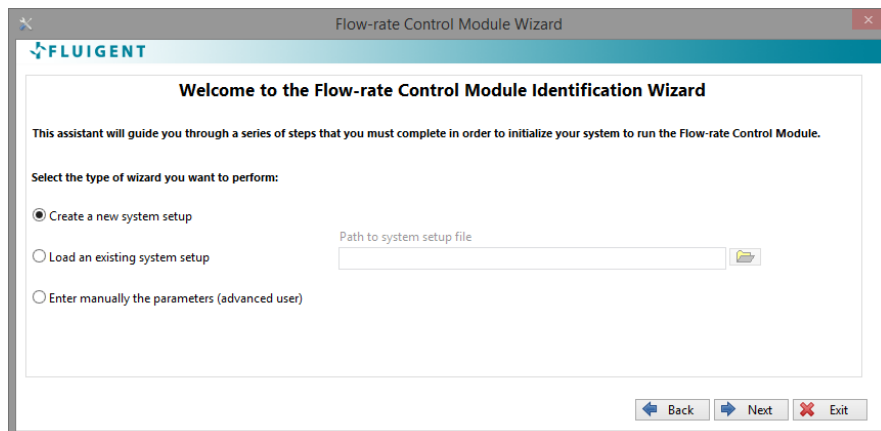


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14.2 Create a new system setup

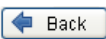
Step 1: Welcome Page

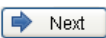



1. Select the option Create a new system set-up on the Wizard Welcome page.
2. The **Next** button is now available. Click on it to pursue the process.

Common Buttons Description

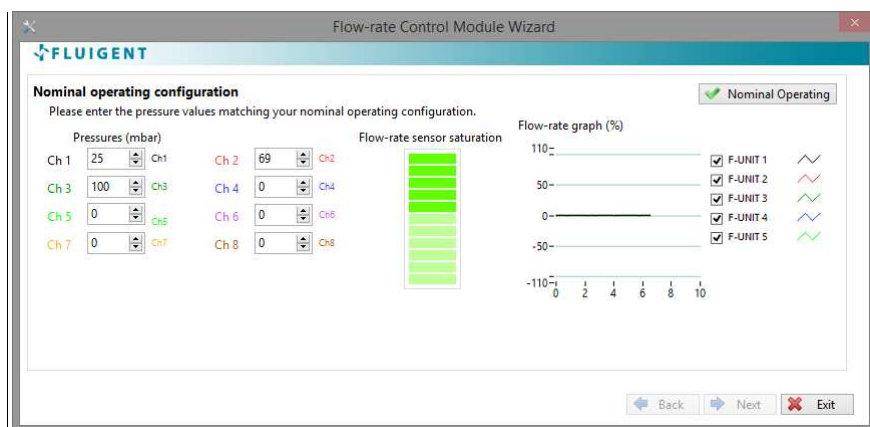
The following buttons are displayed through the entire identification process. They will not be described again, even if they appear in the next steps.

 **Back:** Get back to the previous step. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Next:** Pursue the identification process. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Exit:** Quit the identification wizard. This button is always available. Clicking on the top right Exit button will lead to the same action. Beware that clicking on this button during the first launch of the identification wizard will close the Flow-Rate Control Module and force you to get back to the MAESFLO™ Pressure Control panel.

Step 2: Nominal operating configuration



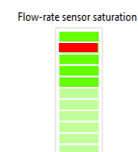
The purpose of this step is to define the nominal operating configuration of your microsystem.

1. Enter the nominal operating pressure for each pressure channel thanks to the dedicated Pressure buttons.
2. Monitor on the **Flow-rate graph** the current flow-rates and check that all the **Flow-rate sensor saturation** indicators are green. Then click on the **Nominal Operating** button when the flow-rates match your nominal operating configuration.
3. The **Next** button is now available. Click on it to pursue the identification process.

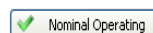
Buttons description

Ch 1 25

Pressures: These buttons enable to change the applied pressure in each pressure channel of the MFCS™-EZ or MFCS™. Input the requested pressure for the selected channel. By clicking on the up and down arrows, you can increase or decrease the pressure order with a step of one (1) mbar. The pressure unit is “mbar”.



Flow sensor saturation: These indicators inform you if any flow-rate sensor is saturated. A saturated sensor is represented by a red indicator, otherwise the indicator is green (the light green indicators stand for the unaffected FLOWBOARD ports)



Nominal Operating: Click on this button when your microsystem is in the nominal operating configuration. This button is only available when all the **Flow-rate sensor saturation** indicators are green.

Flow-rate Graph: Provide continuous monitoring for all the flow-rate channels.

Frequently Asked Questions (see §18.2)

Why can I not apply the maximal pressure allowed by a pressure channel?

Am I obliged to set a pressure value for all the pressure channels?

Why is the Nominal Operating button disabled?

What is a nominal operating configuration?

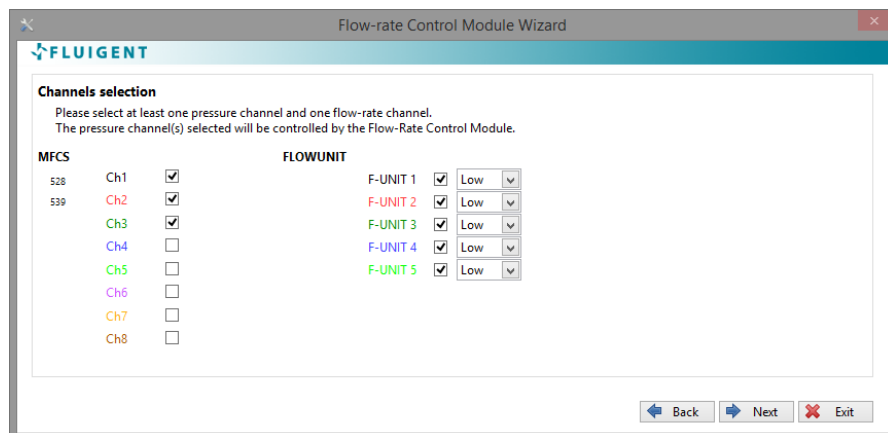
How do I stop sensor saturation?



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Step 3: Channels selection

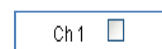


The purpose of this step is to define the pressure channels that will be used to control flow-rates. In this step, you will also choose the flow-rate channels you want to control and define the flow-rate priorities.

1. Select the pressure channels that will be used to control the flow-rates. FLUIGENT advises you to select every pressure channels.
2. Select the flow-rate channels you want to control and the channel priority (*Low, Medium, or High*).
3. Click on the **Next** button.

Beware that the **Next** button is only available after selecting at least one (1) pressure channel and one (1) flow-rate channel with its priority.

Buttons description



Pressure channel: Select the pressure channels used to control the flow-rates.



Flow-rate channel: Select the flow-rate channels you want to control and their priority. Three (3) priority levels are available:

- High:* the Flow-Rate Control Module will always try to match the flow-rate orders of these channels.
- Medium:* the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the high-priority channels are matched.
- Low:* the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the medium-priority channels are matched.

Frequently Asked Questions (see § 18.2)

Will I be allowed to modify the flow-rate priority later?

What does “pressure channels for flow-rate control” mean?

Will I be allowed to modify the selected pressure channels later?

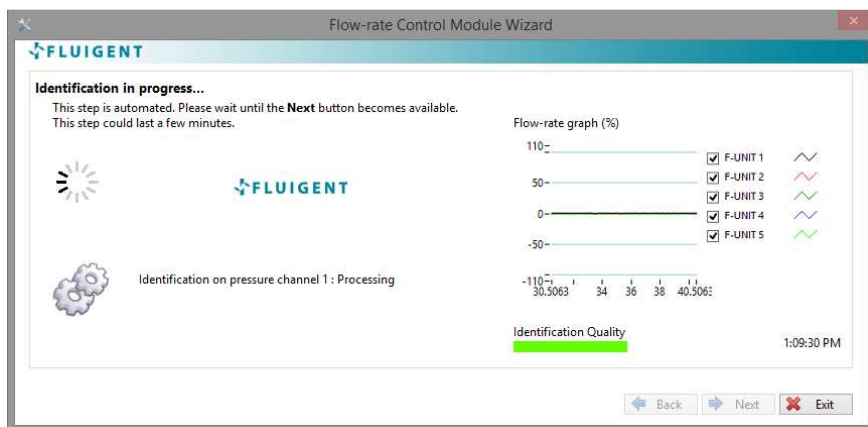
How do I choose the pressure channels?



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Step 4: Identification

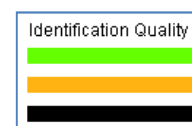


This is an automatic step. During this step, the Flow-Rate Control Module determines the relations between the selected pressure channels and all the flow-rate channels. This is achieved by automatic pressure variations on the pressure channel selected in *Step 3: Channels selection*.

As the flow-rates will fluctuate during this step, the **Flow-rate Graph** provides a flow-rate monitoring of all the channels. The **identification quality** indicator provides a continuous overview of the identification quality.

This step lasts a few minutes. The duration increases with the number of pressure channels selected in the previous step. You can stop the process by clicking on the **Exit** button. In this case, the identification process is **not completed** and cannot be applied in the Flow-Rate Control Module.

Buttons description



- Green (High):** The Flow-Rate Control Module will control your microsystem with optimal performances.
- Orange (Medium):** You can use the Flow-Rate Control Module. The performances will be sufficient enough to control your microsystem.
- Black (Low):** FLUIGENT advises you to restart the identification process.

User message: This indicator provides information about the process and potential error messages.

Frequently Asked Questions (see § 18.2)

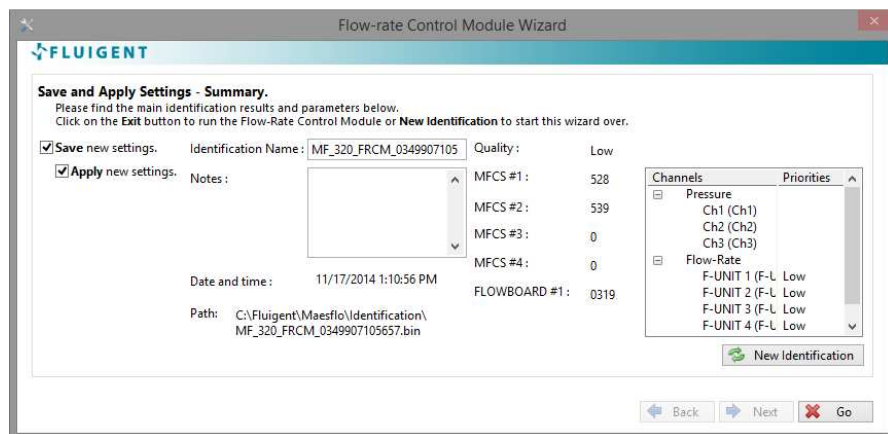
[How do I improve the identification quality?](#)

[Why does the automatic identification stop with an error message?](#)

[How can I do to avoid backflows in my microsystem\(s\)?](#)

[Does the identification step consume liquids?](#)

Step 5: Save and apply settings



This is the final step of the identification process. To complete the identification process and start using the flow-rate control, please:

1. Select **Save new settings** if you want to save the identification result on a dedicated file.
2. Select **Apply new settings** if you want to use the Flow-Rate Control Module with the new identification result.
3. Click on the **Go** button to start the flow-rate control.

A quick summary is available containing:

- The identification quality.
- The serial number of the MFCS™-EZ or MFCS™ and FLOWBOARD™ used.
- The name of pressure and flow-rate channels.
- The flow-rate channel priorities.

If you do not want to save or apply the identification result just created, please:

- Click on **New Identification** button to get back to the Welcome page without saving or applying the current result.

Buttons description



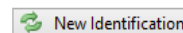
Save: Save the identification result on a dedicated file.



Apply: Apply the identification result to the Flow-Rate Control Module. This button is available after selecting the **Save** button.



Go: Finish the identification process and validate your choices.



New Identification: Get back to the Welcome Page without saving or applying the identification result. Your previous Flow-Rate Control Module configuration (identification result, parameter) are maintained.

Identification name: Rename the identification result as wanted. It will help you to quickly recognize the identification files.

Notes: Input some personal notes regarding this identification.

Path: Shows where the file is saved on your computer

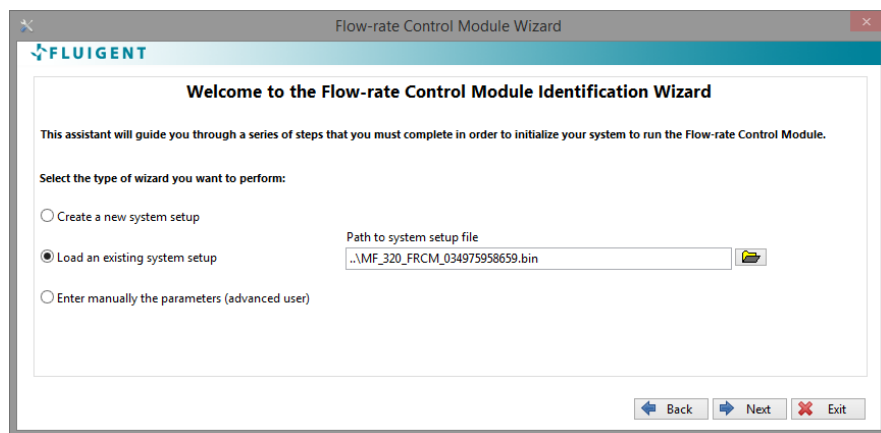


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14.3 Load an existing system setup


Step 1: Welcome Page





1. Select the option Load an existing system setup on the Wizard Welcome page.
2. The **Path** button is now available. Click on it to select the identification file you want to load.
3. Click on the Next button to pursue.

Common Buttons Description


The following buttons are displayed through the entire identification process. They will not be described again, even if they appear in the next steps.

 **Back:** Get back to the previous step. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Next:** Pursue the identification process. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Exit:** Quit the identification wizard. This button is always available. Clicking on the top right Exit button will lead to the same action. Beware that clicking on this button during the first launch of the identification wizard will close the Flow-Rate Control Module and force you to get back to the MAESFLO™ Pressure Control panel.

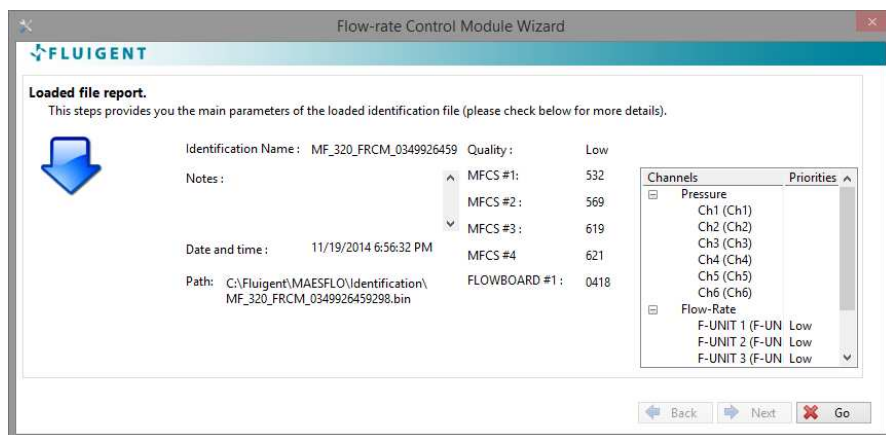
Button Description

 **File Path:** Select the identification file that you want to load. The default path is `C:\Fluigent\Maesflo\Identification`. All identification files are saved in this folder by the software.

Frequently Asked Questions (see § 18.3)

I do not recognize the identification file names.

Step 2: Loading file report



This step analyzes the identification file and informs you whether you can apply it with the current FLUIGENT connected devices. A quick summary of the identification file is available, containing:

- The name you chose for the identification.
- The note you wrote.
- The identification quality.
- The serial number of MFCS™-EZ or MFCS™ and FLOWBOARD used.
- The name of pressure and flow-rate channels.
- The flow-rate channel priorities.

If the selected identification matches the FLUIGENT connected devices, please click on the **Go** Button to apply the identification result and start using the flow-control.

If the selected identification does not match the FLUIGENT connected devices, please restart the process. The software provides you with more details about the reasons of the failure (**Details** section).

Frequently Asked Questions (see § 18.3)

Why can I not load a previous identification file?

I can load a previous identification file but the flow-rate control performances are deteriorated.

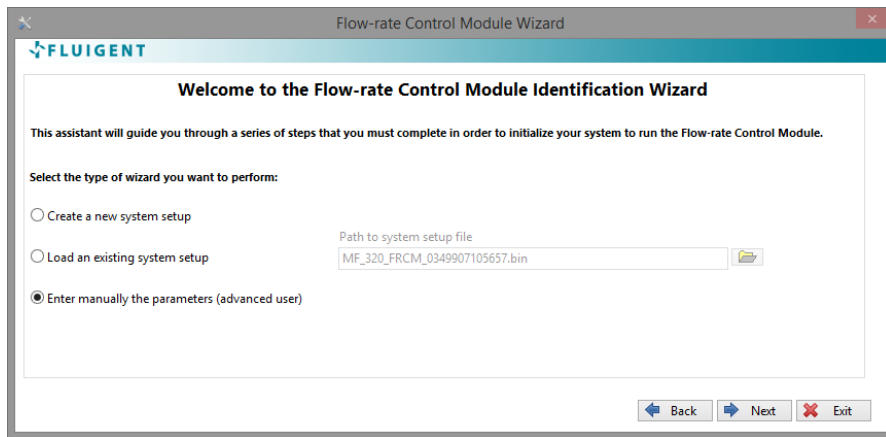


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14.4 Enter manually the parameters (Advanced user)

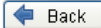
Step 1: Welcome page

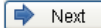


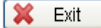
1. Select the option *Enter manually the parameters (advanced user)* on the Wizard Welcome page.
2. The **Next** button is now available. Click on it to pursue.

Common Buttons Description

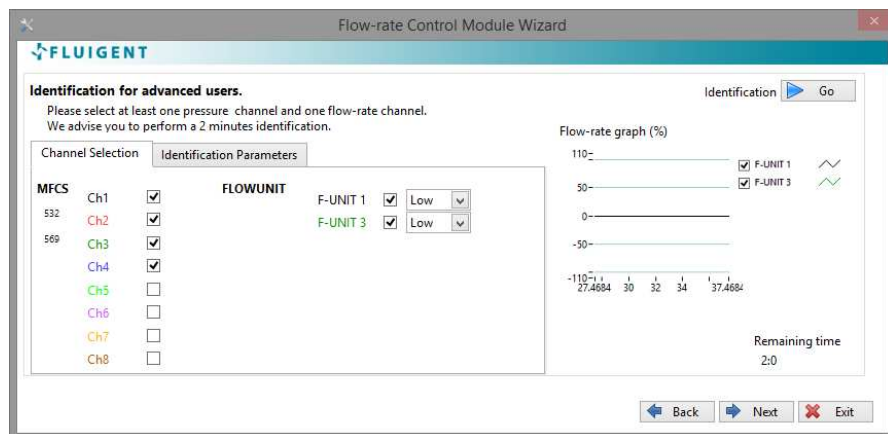
The following buttons are displayed through the entire identification process. They will not be described again, even if they appear in the next steps.

 **Back:** Get back to the previous step. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Next:** Pursue the identification process. This button may require specific user actions or specifications to be available. These requirements will be described when needed.

 **Exit:** Quit the identification wizard. This button is always available. Clicking on the top right Exit button will lead to the same action. Beware that clicking on this button during the first launch of the identification wizard will close the Flow-Rate Control Module and force you to get back to the MAESFLO™ Pressure Control panel.

Step 2: Identification for advanced user (Channels selection)

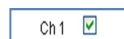


The purpose of this step is to define the pressure channels that will be used to control flow-rates. In this step, you will also choose the flow-rate channels you want to control and define the flow-rate priorities. All the actions and buttons described here are available on the *Channel Selection* tab.

1. Select the pressure channels that will be used to control flow-rates.
2. Select the flow-rate channels you want to control and the priority of each flow-rate channel (*Low*, *Medium* or *High*).

Beware that the **Next** button is only available after you selected at least one (1) pressure channel and one (1) flow-rate channel with its priority.

Buttons description



Pressure channel: Select the pressure channels used to control the flow-rates.



Flow-rate channel: Select the flow-rate channels you want to control and their priority. Three (3) priority levels are available:

- High:* the Flow-rate Control Module will always try to match the flow-rate orders of these channels.
- Medium:* the Flow-rate Control Module will try to match the flow-rate orders of these channels if the orders of the high-priority channels are matched.
- Low:* the Flow-rate Control Module will try to match the flow-rate orders of these channels if the orders of the medium-priority channels are matched.

Frequently Asked Questions (see § 18.4)

Will I be allowed to modify the flow-rate priority later?

What does “pressure channels for flow-rate control” mean?

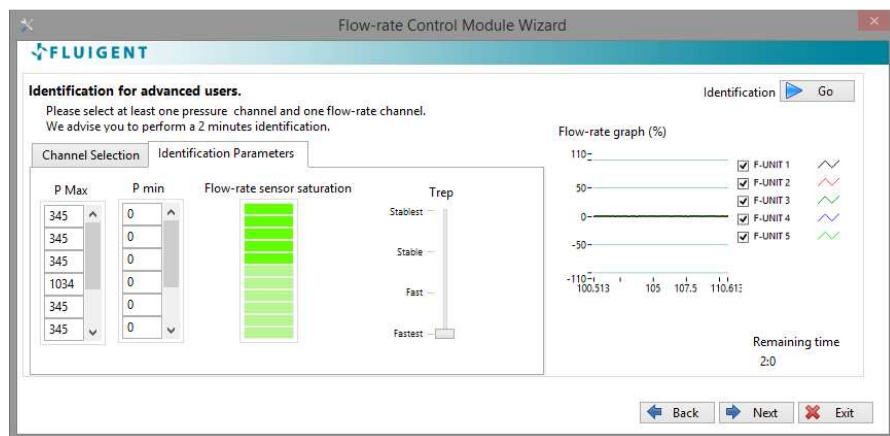
Will I be allowed to modify the selected pressure channels later?



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Step 2: Identification for advanced user (Identification parameters)

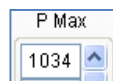


The purpose of this step is to define all the identification parameters before starting the identification run. All the buttons and actions described here are available on the *Identification Parameters* tab.

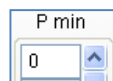
- With the **P max** button, enter the maximal pressure that will be applied during the identification step for the selected channel.
- With the **P min** button, enter the minimal pressure that will be applied during the identification step for the selected channel.
- With the **Response time** slider, select the pressure variation speed that will be applied during the identification step.
- Click on the **Identification Go/Pause** button to start the identification run. This button is only available after you selected at least one (1) pressure channel and one (1) flow-rate channel with its priority.

FLUIGENT advises you to select ΔP ($P_{max} - P_{min}$) greater than 20% of the maximal pressure available.

Buttons description



Pmax: Select the maximal pressure that will be applied during the identification run for the selected channel. The pressure order unit is mbar. The **Pmax** values cannot be inferior to the **Pmin** values of the same channel. This button is an array: the first row corresponds to the first pressure channel, etc..



Pmin: Select the minimal pressure that will be applied during the identification run for the selected channel. The pressure order unit is mbar. The **Pmin** values cannot be superior to the **Pmax** values of the same channel. This button is an array: the first row corresponds to the first pressure channel, etc..

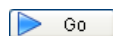
Flow-rate sensor saturation



Flow sensor saturation: These indicators inform you if any flow-rate sensor is saturated. A saturated sensor is represented by a red indicator, otherwise the indicator is green (the light green indicators stand for the unaffected FLOWBOARD ports).



Pressure response time (Trep): This slider modifies the speed of the pressure variation. It leads to reduce the flow-rate overshoots due to air bubbles. The modification impacts all the pressure channels.



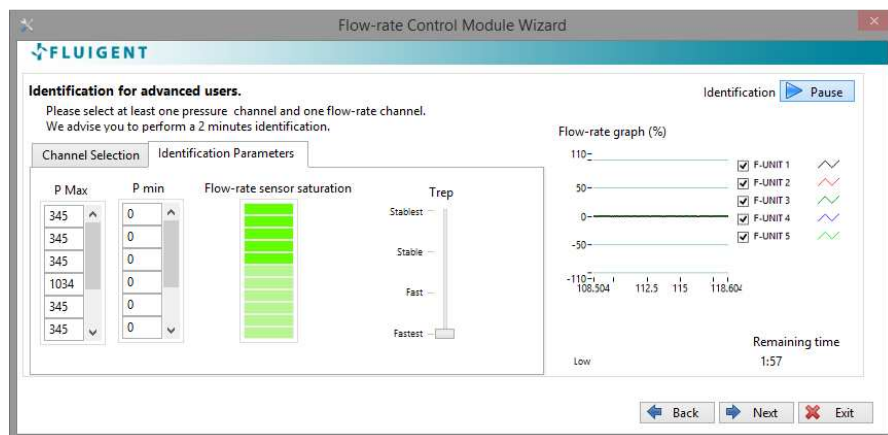
Identification Go/Pause: By clicking on it you can start or stop the identification run. You can pause the identification for as long as you want and then restart it.

Frequently Asked Questions (see § 18.4)

How do I choose the Pmax and Pmin values?

When do I stop the identification?

Step 2: Identification for advanced user (Identification run)



Next button. You also can stop and restart the identification run at any time by clicking on the **Identification Go/Pause** button.

During this step, the Flow-Rate Control Module will apply pressure orders simultaneously on all the pressure channels you have selected before. During the run, please:

- Check the **Flow-rate sensor saturation** indicators: **they have to stay green.**
- All the parameters described before on the *Channel Selection* and *Identification Parameters* tab are available. Do not hesitate to modify them to keep the **Flow sensor saturation** indicators green.
- Check the **Identification quality** indication (high, medium, low) to have a feedback on the identification run.
- Click on the **Next** button when the identification quality is good enough for you (after 2 minutes). This will end the identification run. FLUIGENT advises you to obtain at least a *Medium* identification quality.

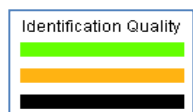
The **Flow-rate graph** provides you with continuous monitoring of the flow-rates. Please be aware that you can end the run at any moment by clicking on the



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Button description



Identification quality: This indicator provides an estimation of the identification quality at the end of the identification run (after 2 minutes). Three (3) colors, linked to quality levels, may be displayed.

- Green (High):** The Flow-Rate Control Module will control your microsystem with optimal performances.
- Orange (Medium):** You can use the Flow-Rate Control Module. The performances will be good enough to control your microsystem.
- Black (Low):** FLUIGENT advises you to restart the identification process.

Frequently Asked Questions (see § 18.4)

[Why does the Flow sensor saturation need to stay green?](#)

[How do I avoid flow sensor saturation?](#)

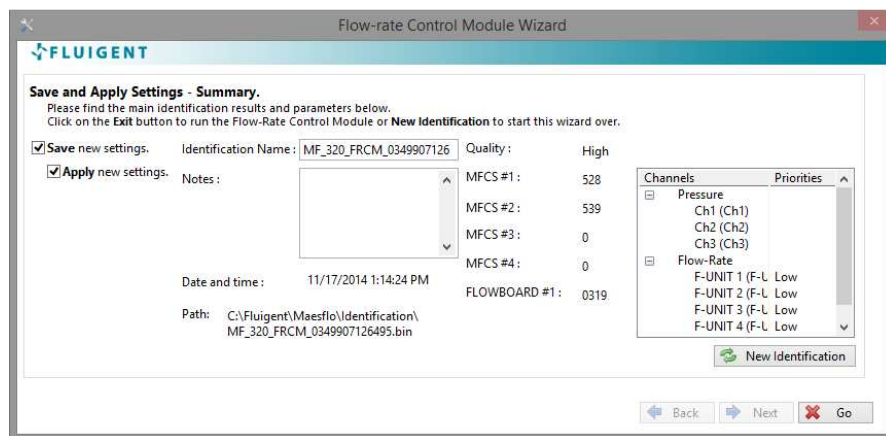
[Does the identification step consume liquids?*](#)



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Step 3: Save and apply settings



This is the final step of the identification process. To complete the identification process and start using the flow-rate control, please:

1. Select **Save new settings** if you want to save the identification result on a dedicated file.
2. Select **Apply new settings** if you want to use the Flow-Rate Control Module with the new identification result.
3. Click on the **GO** button to start the flow-rate control.

A quick summary is available containing:

- The identification quality.
- The serial number of the MFCSTM-EZ or MFCSTM and FLOWBOARD used.
- The name of pressure and flow-rate channels.
- The flow-rate channel priorities.

If you do not want to save or apply the identification result just created, please:

- Click on **New Identification** button to get back to the Welcome page without saving or applying the current result.

Buttons description



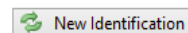
Save: Save the identification result on a dedicated file.



Apply: Apply the identification result to the Flow-Rate Control Module. This button is available after selecting the **Save** button.



Go: Finish the identification process and validate your choices.



New Identification: Get back to the Welcome Page without saving or applying the identification result. Your previous Flow-Rate Control Module configuration (identification result, parameter) are maintained.

Identification name: Rename the identification result as wanted. It will help you to quickly recognize the identification files.

Notes: Input some personal notes regarding this identification.

Path: Shows where the file is saved on your computer



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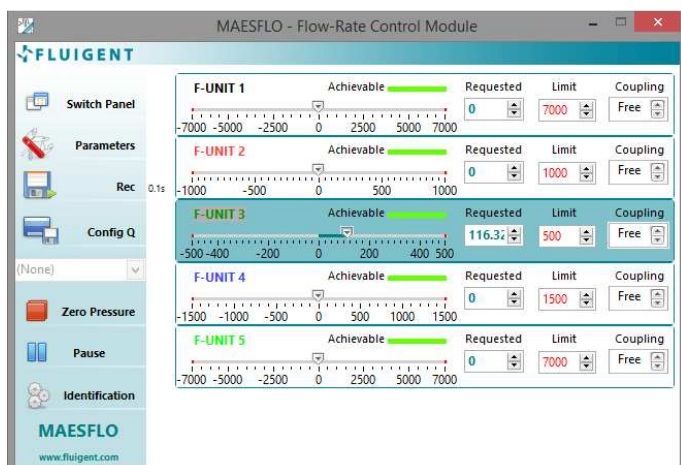
15. MAESFLO™ Flow-Rate Control panel

15.1 Overview

The following panel provides you with all the flow-rate control features. Thanks to it, you will be able to control the flows through your microsystem by flow-rate orders.

In this section, we will start by describing the buttons dedicated to the flow-rate control. We will finish this section by describing the functionalities shared by the MAESFLO™ Pressure Control panel and the MAESFLO™ Flow-Rate Control panel. So you will be totally aware of all the flow control solutions for your microsystem.

15.2 Panel description



The Flow-Rate Control panel provides the following functionalities:

- Apply flow-rate orders.
- Limit the maximum and minimum flow-rates.
- Flow-rate channel coupling.
- Inform about the achievability of the flow-rate orders.
- Inform about the calibration used for the FLOW UNIT
- Modify the flow-rate unit.
- Modify the flow-rate channel name.
- Modify the flow-rate channel priority.
- Get to the Parameters window.
- Get to the Pressure Control panel.
- Record data.
- Create flow-rate order configurations.
- Apply flow-rate order configurations.
- Set all pressures to zero (emergency stop).
- Stop (Pause) or run the flow-rate-control.
- Get to the identification wizard.
- Visualize the tables used with the FLOW-UNIT.

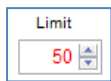
15.3 Buttons description



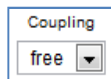
Flow-rate slider: Modify the flow-rate order on the selected channel quickly by sliding the pointer. The slider range is the range of the flow-rate sensor currently connected.



Flow-rate control: Input the requested flow-rate order for the selected channel. By clicking on the up and down arrows, you can increase or decrease the order with a step of one (1) flow-rate unit.

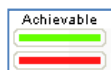


Flow-rate limit: This button allows you to limit the maximal and minimal flow-rate orders for the selected channel. You can use it as a safety button. For example, enter a value of “15” will limit the flow-rate orders between “+15 and -15”. By clicking on the up and down arrows, you can increase or decrease the limit with a step of one (1) flow-rate unit.



Coupling channel: Easily link the flow-rate channel settings between several channels by selecting the appropriate coupling label in the drop down menu. Two or more channels are coupled when the same coupling label is displayed for the selected channels.

When channels are coupled with “C+” or “D+” label, increasing (*decreasing*) the flow-rate order of one (1) channel will increase (*decrease*) the flow-rate order of the other(s) channel(s) of the same amount. When channels are coupled with “C-” or “D-” label, increasing (*decreasing*) the flow-rate order of one (1) channel will decrease (*increase*) the flow-rate order of the other(s) channel(s) of the same amount.



Flow-rate achievability: This indicator informs you continuously on the achievability of the flow-rate order for the selected channel. The green color means that the flow-rate order will be reached by the Flow-Rate Control Solution. The red color means that the flow-rate order cannot be reached by the Flow-Rate Control Solution. In this case, the Flow-Rate Control Module will reach the closest flow-rate achievable from your order. See more details at § 13.2.



Switch Panel: Click on it for a direct access to the Pressure Control panel.



Parameters: Click on it for a direct access to the Parameters panel.



Record: Click on it to record the pressure and flow-rate measurements of all the pressure and flow-rate channels. The pressure orders are also recorded. Click on it again will stop the record. The record period is shown on the right side of this button. This button provides the same features than the **Record** button in the Pressure Control panel. See more details at §12.3.



Config Q: Click on it to save the current flow-rate orders of all the flow-rate channels. The configuration is saved on a dedicated file (default path: C:\Fluigent\Maesflo\ConfigQ). The saved configuration will be available in the **Apply Config Q** button. See more details at § 16.1.

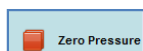


Apply Config Q: This button provides a drop-down menu containing all the flow-rate configurations previously saved in the *configuration folder* and selected in the *Parameters/Flow-Rate* panel (see at §16.1). By selecting the desired configuration, the saved flow-rate orders will instantaneously and simultaneously be applied to all the flow-rate channels. So you can use this feature to quickly switch from one configuration to another corresponding, for example, to different working modes. Please note that shortcut is not available for flow-rate configurations (only for pressure configurations).



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Zero pressure: Click on it to instantaneously apply a zero pressure order on all the pressure channels. You can use this button as an emergency stop. By clicking on it, the flow-rate control is stopped: your flow-rate orders are not taken into account by the software. Click on the **Pause** button to restart the flow-rate control.



Run/Pause: Click on it to run/stop the flow-rate control. When the flow-rate control is stopped, the Pause button background color is blue, otherwise it is grey. When the flow-rate control is stopped, all the flow-rate order changes are not taken into account until you click again on the Run button. So you can modify the flow-rate orders of each channel, corresponding to another working mode of your microsystem for example, and apply them simultaneously by clicking again on the button. When the flow-rate control is stopped, all the pressure channels are available even those used by the Flow-Rate Control Module. See more details about the Pressure Control and Flow-Rate Control Module interactions at § 0.

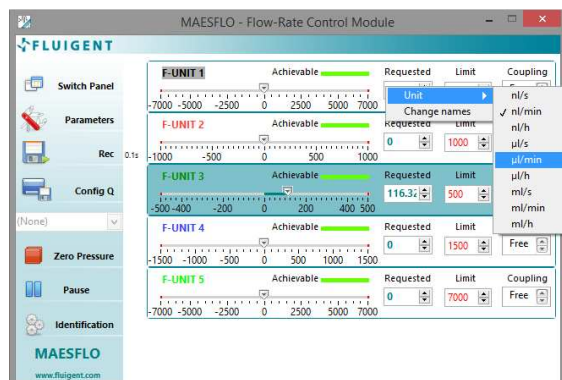


Identification: Click on it for a direct access to the identification wizard. See more details at §14.

Frequently Asked Questions (see §18.5)

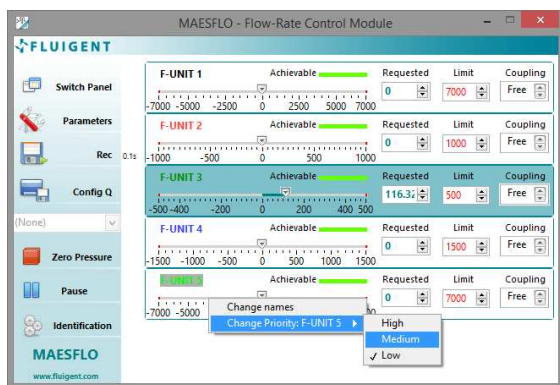
Why right after an identification , when I click on the button run the order of flow-rate is not taken into account?

15.4 Right click controls



Right-clicking on any **other button** displays two hidden controls:

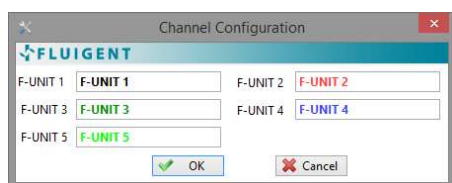
- Modify flow-rate channel names.
- Modify selected flow-rate channel unit.



Right-clicking on any **Flow-rate slider** displays two hidden controls:

- Modify flow-rate channel names.
- Modify selected flow-rate channel priority.

Change flow-rate channel names



1. Click on *Change Names* in the popping menu (here opposite window appears).
2. Change the flow-rate channel names as wanted.
3. Click on the **OK** button to apply your modifications.
4. Click on the **Cancel** button to get back to the previous names.

Your modifications will be taken into account in all the MAESFLO™ software.

Change priority:

1. Click on *Change Priority* in the popping menu.
2. Select the priority for the related flow-rate channel. Three (3) priority levels are available:
 - High:* the Flow-Rate Control Module will always try to match the flow-rate orders of these channels.
 - Medium:* the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the high-priority channels are matched.
 - Low:* the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the medium-priority channels are matched.

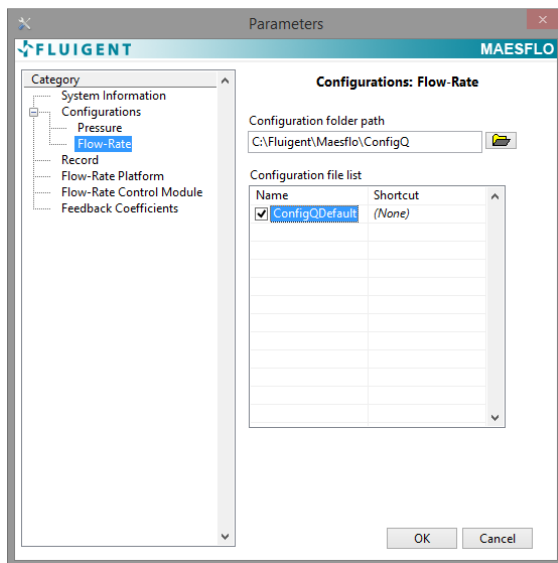
16. MAESFLO™ parameters dialog box for Flow-Rate Control Module

The Parameters panel enables to check, create or modify the following parameters:

- Flow-rate configurations.
- Flow-rate channel priority.
- Pressure channel used for the MAESFLO™ Flow-Rate Control Module.
- The pressure response time.
- The identification files (saved results of a previous identification process).

Click on the **Parameters** button from the Flow-Rate Control panel or from the Pressure Control panel to display the Parameters panel.

16.1 Flow-rate configurations



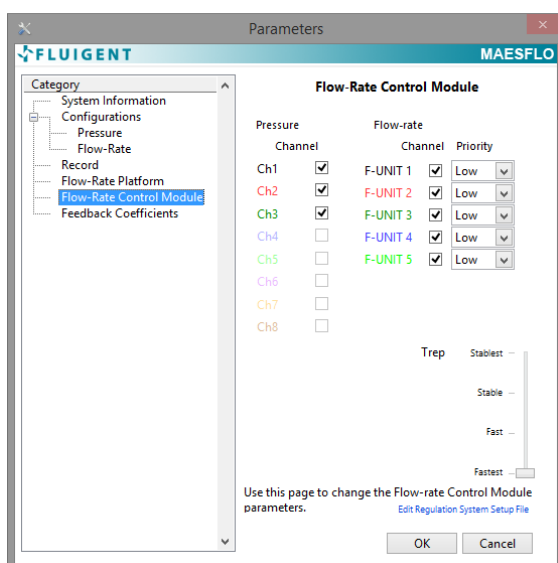
Select the *Configurations/Flow-rate* category to access the panel opposite.

The *Configuration file list* displays the saved configurations in the folder specified in the *Configuration folder path*. The default folder path is *C:\Fluigent\Maesflo\ConfigQ*.

Select the desired configurations in the *Configuration folder list* to make them available in the **Apply Config Q** button (see at §15.3).

Apply your choices by clicking on the **OK** button. Clicking on the **Cancel** button will cancel all the changes you have made.

16.2 Flow-Rate Control Module



Select the *Flow-Rate Control Module* category to access the panel opposite.

This panel provides an overview on the main parameters used by the Flow-Rate Control Module. It enables to check or modify the following parameters:

- Pressure channels used by the Flow-Rate Control Module.
- Flow-rate channels controlled.
- Priority of the flow-rate channels.
- Pressure response time.

Apply your choices by clicking on the **OK** button. Clicking on the **Cancel** button will cancel all the changes you have made.

Pressure Channels used by Flow-Rate Control Module

Channel	
Ch1	<input checked="" type="checkbox"/>
Ch2	<input checked="" type="checkbox"/>
Ch3	<input checked="" type="checkbox"/>
Ch4	<input checked="" type="checkbox"/>

This button displays the following information for all the pressure channels:

- Pressure channels used during the identification process.
- Pressure channels currently used by the Flow-Rate Control Module to control the flow-rate channels.
- Pressure channels used during the identification process but currently used for pressure control.
- Pressure channels dedicated to the pressure control.

The pressure channels used during the identification process are displayed as “not grayed”. For these pressure channels you can decide to:

- Use them for flow-rate control. In this case, the pressure of these channels will be controlled and automatically adjusted by the Flow-Rate Control Module to reach the flow-rate orders. These pressure channels are displayed as “selected”.
- Use them for pressure control. In this case, you can modify the pressure orders by yourself in the Pressure Control panel. These pressure channels are displayed as “unselected”. These pressure channels will stay available for being used for flow-rate control.

The pressure channels dedicated to pressure control are those not used during the identification process. They appear “grayed” (see the channel 2 in the example above). You cannot use them for flow-rate control.

Please see more details at §13.1 .

Frequently Asked Questions

Why are some pressure channels grayed in the *Parameters/Flow-Rate Control Module* panel?

How do I choose the pressure channels used for the flow-rate control?

Flow-rate channel and priority

Channel	Priority
F-UNIT 1	<input checked="" type="checkbox"/> Low
F-UNIT 2	<input checked="" type="checkbox"/> Low
F-UNIT 3	<input checked="" type="checkbox"/> Low
F-UNIT 4	<input checked="" type="checkbox"/> Low
F-UNIT 5	<input checked="" type="checkbox"/> Low

This button displays the current controlled flow-rate channels and their priority. The number of channels depends of the number of flow-rate sensors currently connected.

To obtain a monitored flow-rate channel, unselect the related **Channel** button. Its priority is automatically changed to *None*. All its related controls and indicators on the Flow-Rate Control Module panel will be disabled and grayed.

To add a new controlled flow-rate channel, select the related **Channel** button. Then choose which priority you want to apply for this channel. Three (3) priority levels are available:

- High:** the Flow-Rate Control Module will always try to match the flow-rate orders of these channels.
- Medium:** the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the high priority channel are matched.
- Low:** the Flow-Rate Control Module will try to match the flow-rate orders of these channels if the orders of the medium priority channel are matched.
- (None:** the channel is only monitored)

To modify the priority of a controlled flow-rate channel, please just change the priority level on the related **Priority** button.



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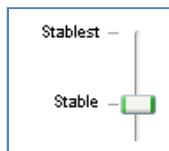
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Frequently Asked Questions

Why should I change the flow-rate channel priority?

Can I use flow-rate channels for flow-rate control even if I have not selected them during the identification process?

Pressure response time



This button displays the current pressure response. By default, this value is set to *Stable*.

Increasing the response time will lead to more stable flow-rates while the delay to reach a new flow-rate order will increase. Increasing the response time also limits the flow-rate overshoots which may appear in a micro system with air bubbles. The changes are applied **for all the pressure channels**.

Four (4) labels, corresponding to different pressure response time are available:

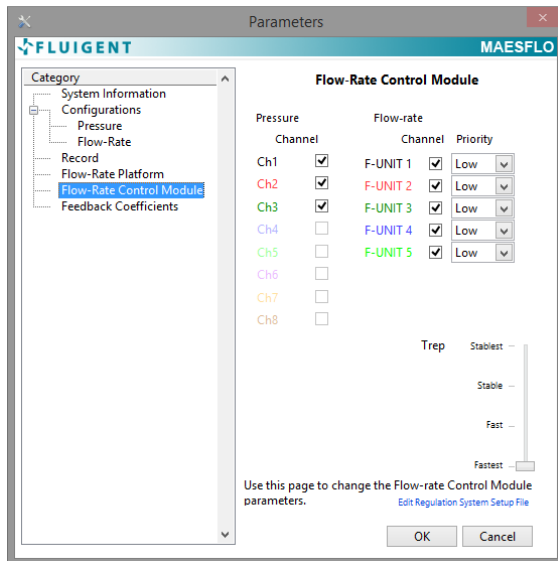
- *Fastest*: the pressure order is reached thanks to the highest MFCS™ or MFCS™-EZ response time.
- *Fast*: the pressure order is reached in approximately 1 second.
- *Stable*: the pressure order is reached in approximately 3 seconds.
- *Stablest*: the pressure order is reached in approximately 5 seconds.

Frequently Asked Questions

Why should I change the pressure response time?

Why is the pressure variation so slow?

16.3 Identification File Viewer



This parameters panel displays all the identification file features. It will help you to choose the appropriate file for loading.

To access this parameters panel, please:

1. Get to the *Parameters/Flow-rate Control Module* category.
2. Click on the [Edit Regulation System Setup File](#) link (on the bottom right of the panel).

The next window is now available. The *File List* displays all the identification files saved in the *C:\Fluigent\Maesflo\Identification* folder. If you saved an identification file in another folder, it will not be displayed in this list.

Select the identification file you want to check for loading on the *File List*. For each identification file, the following data are given:

- **Identification name:** the name you chose for the identification file during the *Save and Apply* step of the identification wizard.
- **Notes:** the notes you wrote for the identification file during the *Save and Apply* step of the identification wizard.
- **Date and time:** Date and time of the identification file creation.
- **Path:** path of the selected identification file.
- **Identification quality:** FLUIGENT advises you to use identification with at least a Medium quality.
- **Serial number** of the MFCS™-EZ or MFCS™ used during the identification process (up to 4 MFCS™-EZ, or 2 MFCS™, or 1 MFCS™ and 1 MFCS™-EZ).
- **Serial number** of the FLOWBOARD used during the Identification process (up to 2 FLOWBOARD).
- **Channels data:** number and name of pressure channel(s) and flow-rate channel(s) used during the identification process. The flow-rate channel priority is also displayed.
- **Details:** details about the reason why you cannot load the identification file selected (if happening). The main reasons are:
 1. Different number of pressure channels and /or flow-rate channels.
 2. Different ranges of the pressure channels and/or flow-rate channels.
 3. The loaded file was generated for an older version of Maesflo.

Flow-rate Control Module Identification File Viewer

Flow-rate Control Module Identification File Viewer

File List

- MF_320_FRCM_03498030
- MF_320_FRCM_03499071
- MF_320_FRCM_03499071
- MF_320_FRCM_03499071
- MF_320_FRCM_03499264
- MF_320_FRCM_03499340
- MF_320_FRCM_03499343
- MF_320_FRCM_03499344
- MF_320_FRCM_03499404
- 5869889
- MF_320_FRCM_03499407
- MF_320_FRCM_03499408**
- MF_320_FRCM_03499411
- MF_320_FRCM_03499426

Identification Name : MF_320_FRCM_0349940827 Quality : Low

Notes :

Date and time : 11/21/2014 10:51:11 AM MFCS #1: 532

Path: C:\Fluigent\Maesflo\ Identification\ MF_320_FRCM_0349940827 158.bin MFCS #2: MFCS #3: MFCS #4: FLOWBOARD 1: 0426 FLOWBOARD 2:

Channels	Priorities
Pressure	
Ch1 (Ch1)	
Ch4 (Ch4)	
Flow-Rate	
F-UNIT 1 (F-L)	Low

Details: The loaded file does not match with the connected hardware for the following reasons:
-The number of pressure channels does not match.

Flow-rate Control Module Identification File Viewer

Flow-rate Control Module Identification File Viewer

File List

- MF_320_FRCM_03498030
- MF_320_FRCM_03499071
- MF_320_FRCM_03499071
- MF_320_FRCM_03499071**

Identification Name : MF_320_FRCM_0349907149 Quality : Low

Notes :

Date and time : 11/17/2014 1:18:15 PM MFCS #1: 528

Path: C:\Fluigent\Maesflo\ Identification\ MF_320_FRCM_0349907149 542.bin MFCS #2: 539 MFCS #3: MFCS #4: FLOWBOARD 1: 0319 FLOWBOARD 2:

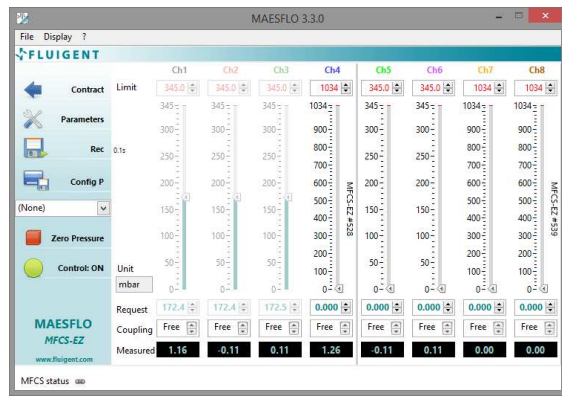
Channels	Priorities
Pressure	
Ch1 (Ch1)	
Ch2 (Ch2)	
Ch3 (Ch3)	
Flow-Rate	
F-UNIT 1 (F-L)	Low
F-UNIT 2 (F-L)	Low
F-UNIT 3 (F-L)	Low
F-UNIT 4 (F-L)	Low



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17. Flow-Rate Control Module and Pressure Control interactions



The MAESFLO™ Pressure Control provides a direct control of the MFCS™-EZ or MFCS™ pressure channels. The MAESFLO™ Flow-Rate Control Module provides flow-rate control by automatically adjusting pressure orders. This principle leads to physical and software interactions that will be described below.

Pressure orders

The pressure channels used for the flow-rate control are grayed in the Pressure Control panel when the flow-rate control is running. So you cannot change the pressure order for these channels.

By clicking on the **Pause** button of the Flow-Rate Control panel, the flow-rate control is temporarily stopped. All pressure channels are now available for modification: you can change the pressure orders of all channels.

Pressure limit

The pressure limits inputted in the Pressure Control panel are taken into account by the Flow-Rate Control Module. It will adapt the pressures of the selected channels to reach the flow-rate orders in the range defined by the pressure limit.

By clicking on the **Pause** button of the Flow-Rate Control panel, the flow-rate control is temporarily stopped. All pressure channels are now available for modification: you can change the pressure limit of all channels.

Configurations

You can use the saved pressure configurations while the Flow-Rate Control Module is running. The configurations will not be applied to the pressure channels controlled by the Flow-Rate Control Module. The Flow-Rate Control Module will still control these channels as usual.

Pressure response time

The pressure response time can be modified in the *Parameters/Flow-Rate Control Module* panel. The value selected will be applied to all the pressure channels when the flow-rate control is running.

Zero Pressure, Parameters and Record

These three (3) buttons are displayed on the Pressure Control panel and the Flow-Rate Control panel. They lead to the exact same features.

18. Frequently asked questions

18.1 How to start

All the FLUIGENT devices needed are connected to my computer but the *Flow-Rate Control Module* option is still disabled.

Please make sure that the FLOWBOARD and FLOW UNIT are selected by the MAESFLO™ software. To be sure that the elements are selected, try to display the **Flow-rate Graph window** or the **Flow-rate Platform Panel** by clicking on the **Display menu**. If these options are disabled, you have to select FLOWBOARD and FLOW UNIT. To select a FLOWBOARD, please follow the instruction at **§Erreur ! Source du renvoi introuvable.**

After checking the FLOWBOARD and FLOW UNIT connection, if the *Flow-Rate Control Module* option remains disabled, please check your dongle key connection and restart the MAESFLO™.

Please make sure that a Dongle is connected to the computer.

18.2 Create a new system setup

Why can I not apply the maximal pressure allowed by a pressure channel?

The **identification wizard** takes into account the pressure limit you specified for each pressure channel in the MAESFLO™ (see at §0). Please check or modify these limits.

Am I forced to set a pressure value for all the pressure channels?

No, please only modify the pressure channels you need to match the nominal operating configuration of your micro system. If the required configuration is “zero pressure” for all pressure channels, the software will also be able to deal with it.

Why is the **Nominal Operating** button disabled?

This button is only available when all the **Flow-rate sensor saturation** indicators are green.

What is a nominal operating configuration?

A nominal operating configuration is a flow-rate and/or pressure configuration usually used in your microsystem.

How do I stop sensor saturation?

Modify the pressure values of the pressure channels. Usually, by decreasing the pressure value you will be able to stop a flow-rate sensor saturation. Modify first the pressure channels which have a major impact on the flow-rate channel currently saturated.

Will I be allowed to modify the flow-rate priority later?

Yes you will. This step only configures the MAESFLO™ with your current choices. After completing the wizard, you will be able to change the priorities.

What does “pressure channels for flow-rate control” mean?

It means that the selected pressure channels will be automatically adjusted by the software to provide the requested flow-rates. You will not be able to modify the pressure of these channels yourself. You can control all the other pressure channels (not selected in this step) with the Pressure Control panel.

Will I be allowed to modify the selected pressure channels later?

Yes but you will not be allowed to add new pressure channels for flow-rate control. A new identification process is required in this case.

How do I choose the pressure channels?

The selected pressures should be connected to the flow-rate channels regarding the microfluidic design of your setup. It means that a pressure modification leads to a flow-rate modification. If you cannot define these



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relations, please select all the pressure channels available. The Flow-Rate Control Module is able to figure out all the relations between pressure and flow-rate channels.

How do I improve the identification quality?

You can improve the quality by avoiding transitory phenomena in your system during the identification (bubble, clogging, liquid leaks, valve actuating, etc...).

Why does the automatic identification stop with an error message?

The software stops the identification if too many flow-rate sensor saturations occurred.

To limit saturations, try to avoid air bubbles in your microsystem. Bubbles in a micro system may lead to flow-rate overshoots when a new pressure order is applied. The bigger the bubble is, the higher the flow-rate overshoot may be.

Please also be sure that the flow sensor ranges and the pressure channel ranges are suitable for your microsystem. If a flow sensor saturates when you applied less than 20% of the maximum pressure available, the ranges are not suitable for your microsystem.

How can I avoid backflows in my microsystem(s)?

To be able to guide the flows during the identification step and avoid backflows for example, enter manually the parameters (advanced user).

Does the identification step consume liquids?

In the identification step, pressures will be applied and consequently liquids will flow inside your microfluidic system. It means that this identification step will consume some liquids. If you do not want to use your samples (delicate and/or costly) you can make the identification with model samples (with characteristics close to your real sample). After the completion of the identification step, you fill your reservoirs with your real sample, load the identification file and then perform your experiment.

18.3 Load an existing system setup

I do not recognize the identification file names.

Please be aware that the identification file name differs from the identification name you inputted during the *Save and apply setting* step. The identification file name is indeed automatically created by the MAESFLO™. Please use the identification file viewer for concordance between identification file name and the identification name you wrote (see at §16.3).

Why am I not allowed to load a previous identification file?

The software cannot apply a previous identification if the FLUIGENT devices connected do not exactly match those used during the creation of the identification file. The **Details** section gives you more information about the reasons why a file has not been loaded.

The following parameters must be the same:

- Number of MFCS™-EZ (or MFCS™) and FLOWBOARD.
- Number and range of pressure channels.
- Number and range of flow-rate sensors.

I can load a previous identification file but the flow-rate control performances are deteriorated.

The Flow-Rate Control Module guaranties you that the FLUIGENT connected devices match the previous used during the creation of the identification file. You must be aware that the performances depend on the microsystem and how you set it up.

For example, if the microsystem currently used is different than the system used to create the identification file (other chip design), the regulation performances may be deteriorated.

If you use the same microsystem but connect the pressure channels (or flow-rate channels) a different way, the performances may not be good enough. It means that the pressure and flow-rate channels must be connected to the same input/output.



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18.4 Enter manually the parameters (advanced user)

Will I be allowed to modify the flow-rate priority later?

Yes you will. This step only configures the MAESFLO™ with your current choices. After completing the wizard, you will be able to change the priorities and also control the flow-rate channels with an initial *None* priority.

What does “pressure channels for flow-rate control” mean?

It means that the selected pressure channels will be automatically adjusted by the software to provide the wanted flow-rates. You will not be able to modify the pressure of these channels all by yourself. You can control all the other pressure channels (not selected in this step) with the Pressure Control panel.

Will I be allowed to modify the selected pressure channels later?

Yes but you will not be allowed to add new pressure channels for flow-rate control. A new identification process is required in this case.

How do I choose the Pmax and Pmin values?

They deeply depend on your micro system but they need to reach two requirements:

1. They must not lead to any flow sensor saturation.
2. They must not be equal. FLUIGENT advises you to select ΔP (Pmax-Pmin) greater than 20% of the maximal pressure available.

By settling the appropriate pressures (Pmax and Pmin), you will be able to guide your flows as wanted during the identification step (for example, you will be able to avoid backflows if required).

When do I stop the identification run?

You are allowed to stop the identification when you want. FLUIGENT advises you to go to the next step only if the identification quality is at least *Medium* (*High* would be best). However, the identification run typically lasts two (2) or three (3) minutes. If the identification quality do not reach a *Medium* or *High* quality after 5 minutes, stop the identification run. Then, try to adapt your system to avoid saturations and/or transitory phenomena.

Why does the Flow-rate sensor saturation need to stay green?

Any flow sensor saturation reduces the identification quality, even on unselected flow-rate channel. By avoiding flow sensor saturation, you increase the identification quality and decrease the duration needed to obtain the best performances.

How do I stop a flow-rate sensor saturation?

1. Change the values of the **Pmin** and **Pmax** buttons. Generally, reducing the ΔP (Pmax-Pmin) highly limits the flow sensor saturation. Check which sensor is saturating and modify first the pressure value of the pressure channels which seem to impact the flow sensor most.
2. Increase the **Flow-rate response time** slider will help you to limit the transitory saturation due to the bubbles.
3. Please also be sure that the flow sensor ranges and the pressure channel ranges are suitable for your microsystem. If a flow sensor saturates when you applied less than 20% of the maximum pressure available, the ranges are not suitable for your microsystem. Please do not hesitate to contact FLUIGENT, we will suggest you a dedicated solution for your set-up.

Does the identification step consume liquids?

In the identification step, pressures will be applied and consequently liquids will flow inside your microfluidic system. It means that this identification step will consume some liquids. If you do not want to use your samples (delicate and/or costly) you can make the identification with model samples (with characteristics close to your real sample). After the completion of the identification step, you fill your reservoirs with your real sample, load the identification file and then perform your experiment.



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18.5 MAESFLO™ Parameters dialog for Flow-Rate Control Module

Why right after an identification, when I click on the button run the order of flow-rate is not taken into account?

Right after each identification, it's necessary to change the order of flow-rate (0 if it's the first identification, the previous value if it's the 2nd one or more) for at least one channel if you want it to be taken into account.

Why are some pressure channels grayed in the Parameters/Flow-Rate Control Module panel?

The grayed pressure channels are those only available for the pressure control. These channels have not been selected during the identification step. The Flow-Rate Control Module is not able to use them for flow-rate control. If you want to use these channels with the Flow-Rate Control Module, please process a new identification.

How do I choose the pressure channels used for the flow-rate control?

The selected pressure should be connected to the flow-rate channels regarding the microfluidic design of your setup. It means that a pressure modification leads to a flow-rate modification. If you cannot define these relations, please select all the pressure channels available. The Flow-Rate Control Module is able to figure out all the relation between pressure and flow-rate channels.

Why should I change the flow-rate channel priority?

Adapting the flow-rate priorities may enable you to enlarge the reachable flow-rate range. Please see at §13.3 for further information.

Can I use flow-rate channels for flow-rate control even if I did not select them during the identification process?

Yes, you can. The Flow-Rate Control Module figures out the relation between selected pressure channels (during the identification wizard) and **all** flow-rate channels. The selection of flow-rate channels during the identification wizard only configures the Flow-Rate Control Module with your initial choice. You are able to control a flow-rate channel initially configured with a *None* priority when you want.

Why should I change the pressure response time?

Reducing the pressure response time leads to reduce the flow-rate overshoots that may appear during the identification process or while the Flow-Rate Control is running. It may be used to increase the identification quality and/or leads to a more stable flow-rate control. Any pressure response modification is applied to all the pressure channels even those not used by the Flow-Rate Control Module.

Why is the pressure variation so slow?

Please check the pressure response time value and decrease it to obtain the wanted response time.



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