USER'S
MANUAL

MICROFLUIDICS
AUTOMATION
TOOL
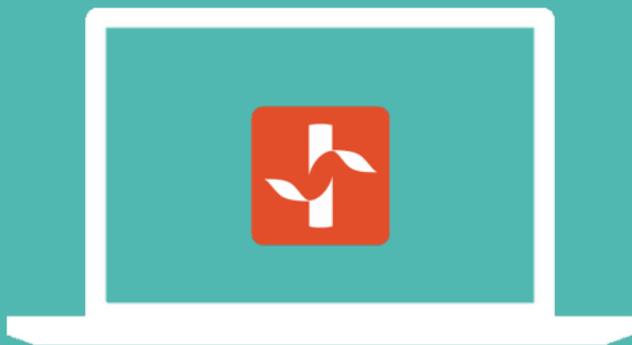
FLUIGENT

INTRODUCTION

The Fluigent Microfluidic Automation Tool (or MAT) is a software solution for automating microfluidic based protocols. Built on a user friendly graphic interface, the MAT allows scientists to create protocols using the Fluigent LineUP™, ESS™, MFCS™ and FRP™ Series instruments as well as OEM PX. The MAT allows one to:

- Automate complex protocols with up to sixteen (16) pressure systems (LineUp™ series, MFCS™ series, PX controller)
- Monitor or control up to 16 flow sensors (FLOW UNIT)
- Program valve actuation timing of ESS valves (M-SWITCH™, 2-SWITCH™ and L-SWITCH™).

This User Manual describes how to use MAT 20 for day-to-day work. It explains all of the software's functionalities that will control the flow, pressure and valves in microsystem(s). After reading this you will be able to make the most of the Microfluidics Automation Tool performance and features.

SYSTEM REQUIREMENTS

This installation requires one of the following Microsoft operating systems:

Windows 7 (32 and 64 bits)
Windows 8 (32 and 64 bits)
Windows 10 (32 and 64 bits)

Installation requires the MSI (Windows Installer) Engine to be installed on the computer.

The Microfluidics Automation Tool software requires:

A minimum of 512 MB of RAM (2GB recommended)
Minimum processor Intel Pentium 1.6 GHz
Minimum screen size 1024 x 768

INSTALLATION INSTRUCTIONS

Before installing the Microfluidics Automation Tool software, **log on as Administrator or as a user with Administrator privileges.**

Administrator privileges are necessary as the program modifies the configuration registry of your system. Complete the following steps to install the Microfluidics Automation Tool software:

1. Plug in the Microfluidics Automation Tool USB key. If the installer does not launch automatically, navigate into the USB key files using
Windows Explorer and launch the setup.exe file from the Microfluidics Automation Tool software.

2. The installation wizard guides one through the necessary steps to install the Microfluidics Automation Tool software. One can go back and change values where appropriate by clicking the Back button. One can exit the setup where appropriate by clicking Cancel.

3. Once the installation is complete, click Finish.

MAT USER'S MANUAL

HOW TO START

Material Needed

Microfluidics Automation Tool software can be launched without any instruments connected. If a new device is connected, the software must be relaunched to detect it.

The supported products are listed below:

- **LineUP™ Link** module with at least one **Push-Pull** or **Flow EZ™** module, one **SWITCH EZ** microfluidic valve controller or one **P-SWITCH** pneumatic valve controller. Optionally, a **FLOW UNIT** can be connected to each Push-Pull or Flow EZ™ modules for flow-rate monitoring.

- **MFCS™ series** pressure controllers (MFCS™-EZ or MFCS™-EX)

- **ESS** microfluidics valves (**2-SWITCH™**, **M-SWITCH™**, **L-SWITCH™**) connected to PC using a **SWITCHBOARD** or **LineUp™ SWITCH EZ** with a **LineUp™ LINK**. They can also be triggered with TTL signal.

- Flow-rate platform with at least one **FLOW UNIT** connected to a **Flowboard**

- **PX** pressure controller (OEM instrument)

> Note: each **LineUP™ LINK** module drives two configurable **TTL ports** allowing for external instruments synchronization.

Starting MAT

Click on the MAT shortcut on your desktop to launch Microfluidics Automation Tool. The following splash screen should appear as the application loads.

MAT INTERFACE

1	Settings menu	for setting general parameters
2	Instrument window	displays connected/simulated instruments
3	Function block window	list of functions for the selected instrument
4	Toolbox	with general function blocks and loops
5	Toolbar	contains protocol management related features
6	Protocol editing area	drag & drop function blocks here to manage protocol
7	Status bar	displays information status

Settings menu

The settings icons allow one to change general parameters and access to software and system information.

1. Select and choose the units of measurement.

Flow-rate can be in μL/min, nL/min, mL/min, mL/h or μL/h
Volume can be in μL, nL or mL
Pressure can be in mbar, PSI or KPa

2. Switch the software from offline mode for simulation to online mode.

3. Open the help menu to access to:
Software and system information
Contacts and support information
Third-party.
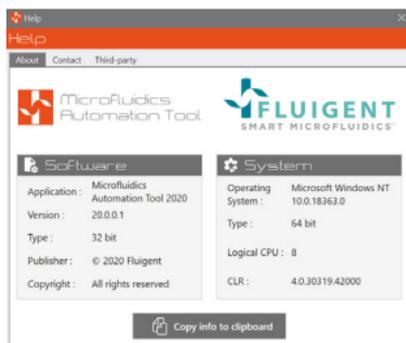
4. Open a settings panel to change the working directory and landing page preferences.

Instruments Window
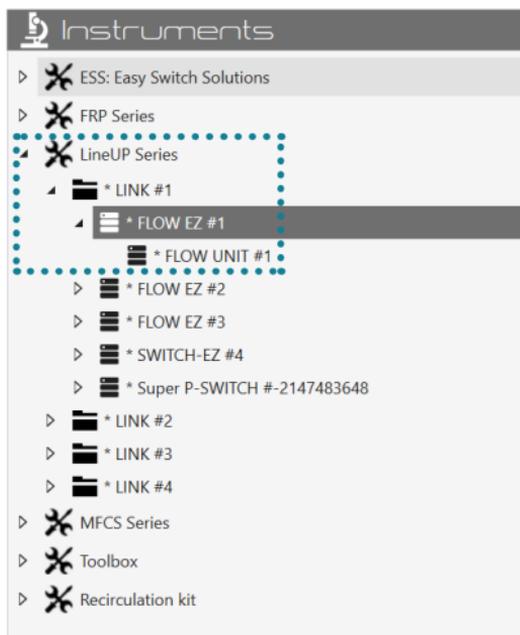
Connected instruments are listed by category. Here is an example of what the window looks like when a **LineUp™ Flow EZ** is connected to a **LineUp™ LINK** to the PC. A **FLOW UNIT** is also connected to the Flow EZ to allow for flow rate control.

As shown on the picture below, clicking on one instrument will list all available functions (for this instrument) in the function block area.
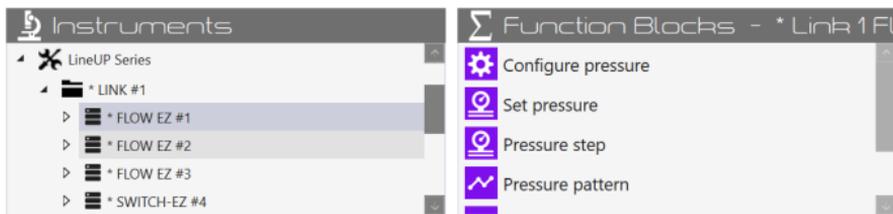
FUNCTION BLOCKS

The list of functions in this window changes depending on the instrument the user has selected in the Instruments window. The function blocks have to be dragged and dropped on the Protocol editing area.
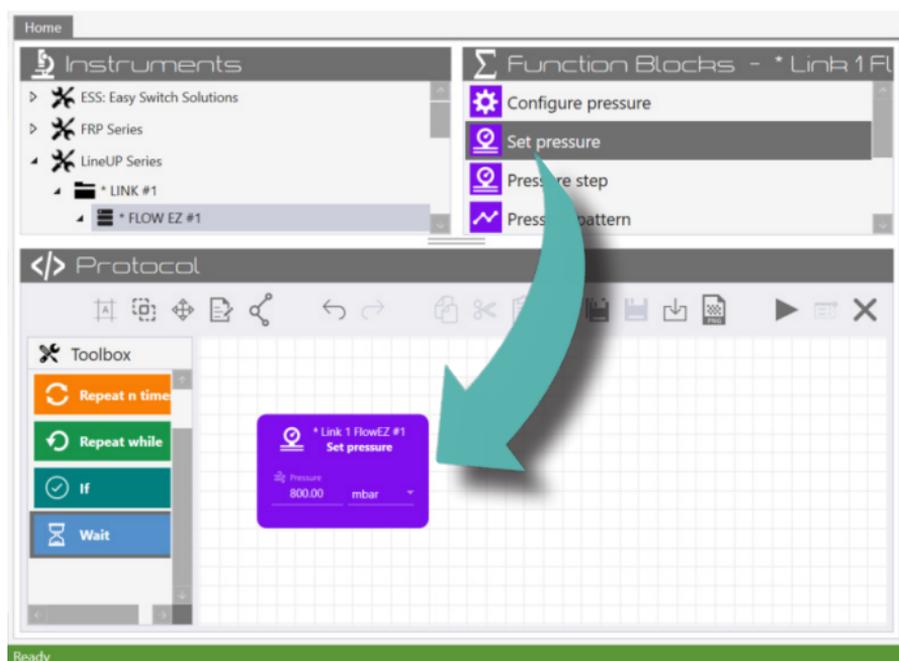
In the Protocol editing area, the user can set the functions value. For example, in the picture above, in the "Set pressure" function, the user can enter the pressure value to be applied by the Flow EZ™ #1. Value and unit can be changed directly on the block.

ESS™ SERIES FUNCTION BLOCKS

The **EASY SWITCH SOLUTIONS™** series consists of a collection of three complementary bidirectional valves, connected to the computer via the **SWITCHBOARD** or the **LineUp™ SWITCH EZ**.
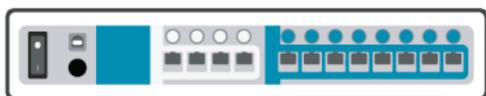
SWITCHBOARD

LineUp™ SWITCH EZ
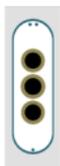
The **2-SWITCH™** is a 3-port/2-way bidirectional valve.
  Use "**Toggle position**" to switch from a position to another
  Use "**Set position**" to choose position 1 or position 2

* SB 1 2-SWITCH #1
Toggle position

* SB 1 2-SWITCH #1
Set position

Position1

Position1

Position2

The **L-SWITCH™** is a 6-port/2-position bidirectional valve used for injection or fluid recirculation

   Use "**Toggle position**" to switch from a position to another

   Use "**Set position**" to choose position 1 or position 2

The **M-SWITCH™** is a 11-port/10-way bidirectional valve.

   Use "**Configure**" to select the direction of rotation. The valve can rotate in clockwise, anticlockwise or using the shortest path.

   Use "**Set position**" to choose the position between 1 and 10. The user enters the port number in the block.

LineUp™ series function blocks

The **LineUp™ series** is a range of module for pressure-based flow rate control (**Flow EZ™**, **Push-Pull**), pneumatic valve actuation (**P-SWITCH**) and microfluidic valve actuation (**SWITCH EZ**). They are connected to the PC using the **LineUp™ LINK**.

LineUp™ series modules

LINK   **Flow EZ**   **Push-Pull**   **P-SWITCH**   **SWITCH EZ**

The **LineUp™ LINK** connects the **LineUp™ series** modules to the computer using USB communication or serial port communication (**LineUp LINK™ COM)**. It can also control two TTL signals.
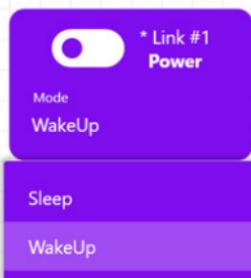
Use "**Power**" to either turn the module and whole LineUp™ chain in *sleep mode* or on the contrary to put the LINK in operation mode and turn ON the connected modules (and ESS™ microfluidic valves if a SWITCH EZ is combined)
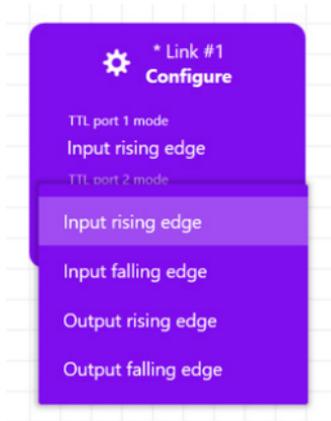
Use "**Configure**" to configure the two TTL ports of the Link module. 4 configurations are available for each TTL port:

> Input rising edge,
> Input falling edge,
> Output rising edge,
> Output falling edge.

Use "**Trigger**" to activate the configured signal on the selected TTL port.
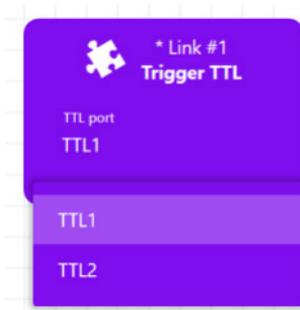
FUNCTION BLOCKS

The **LineUp™ Flow EZ** and **LineUp™ Push-Pull** are free-standing flow controllers that regulate pressure. With those modules, five functions are available:

1. Configure pressure
2. Set pressure
3. Pressure step
4. Pressure pattern
5. Stop pressure pattern

Additional functions for flow rate management instead of pressure are also available if a **FLOW UNIT** is connected to a LineUp™ controller. (See *Flow-rate function blocks* section)

Use "**Configure pressure**" to:

- Set the minimum and maximum pressure limit that will ever be applied to the system. This may prove useful to protect the system

- Set the way of setting pressure either "Fast" or "Smooth"
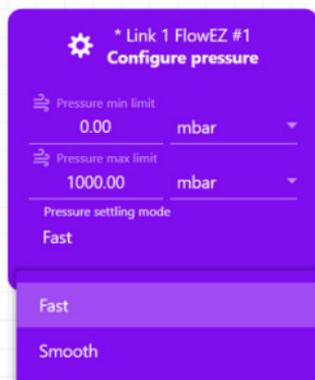
Use "**Set pressure**" to set the pressure value. The user can also choose the pressure unit (mbar, PSI or KPa)

Use "**Pressure step**" to increase or decrease the pressure value by a specified pressure step. The user enters a positive or negative value in the block and pressure will adjust consequently.

Note: This function can be very useful to perform pressure ramps when used within a "**Repeat n times**" function (see in *Toolbox* section).

Use "**Pressure sine wave**" to perform pressure sine profiles.

It allows for pressure offset, pressure amplitude, signal period, different pattern shapes (sine, square, triangle, sawtooth) and number of periods configuration. The user can set those parameters in the block or import a custom profile from a .csv file by choosing *Custom* in pattern section.

Note: When importing pattern from a table in a .csv file, the units applied on the block will be the ones set within the setting menu. No conversion will be done if the units are changed after the import.

FUNCTION BLOCKS

Use "**Stop pressure pattern**" to stop the application of a previous pressure pattern block.

> * Link 1 FlowEZ #1
> **Stop pressure pattern**

> When a "Pressure sine wave" block is used, the Flow EZ or Push-Pull will apply the pressure pattern for the number of periods set in the block. To apply a pressure pattern for a specific amount of time or to stop it midway, use a type of configuration as shown below.

> * Link 1 FlowEZ #1
> **Pressure pattern**
>
> 3490
>
> 2710   05s
>
> Pattern
> Sine
> Offset
> 3100.00   mbar
> Amplitude
> 780.00   mbar
> Period
> 50ms
> Points number   Repetitions
> 100   999999999

> **Wait**
> Enter your comment
> Period
> 02m30s

> * Link 1 FlowEZ #1
> **Stop pressure pattern**
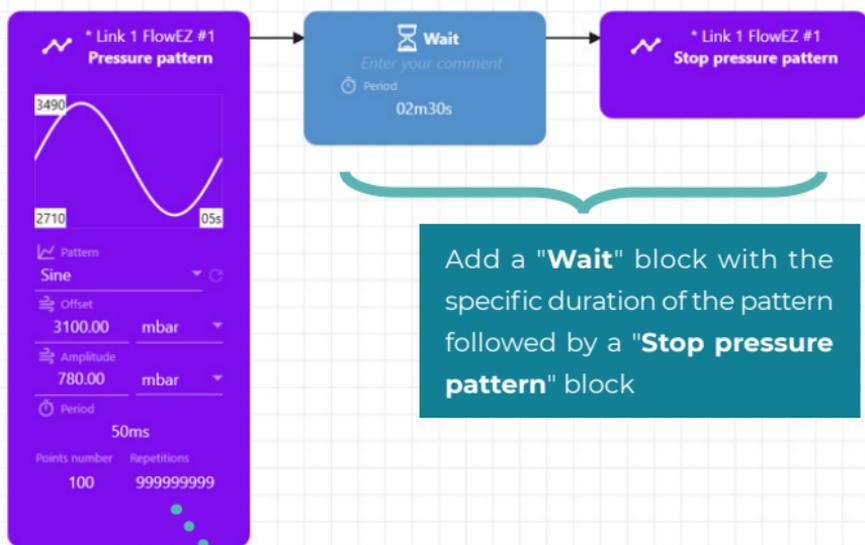
Add a "**Wait**" block with the specific duration of the pattern followed by a "**Stop pressure pattern**" block

Enter a high number of repetitions to avoid pattern stop before the desired amount of time.

The **LineUp™ P-SWITCH** is a pneumatic valve controller. By providing two pressure sources (any vacuum or pressure from -800 to + 2000 mbar), each module is able to deliver one of the two provided pressures through 8 independent outlets. The module allows for automation of any pneumatic or quake valve actation.

MAT allows the user to set the pressure outputs for the P-SWITCH module. Use "**Set all**" to switch all 8 outlets to P1 or P2 which represent the two pressure/vacuum sources.

- Right click any output to change its source.

- Left click on P1 or P2 to change all pressure output orders to the respective source.
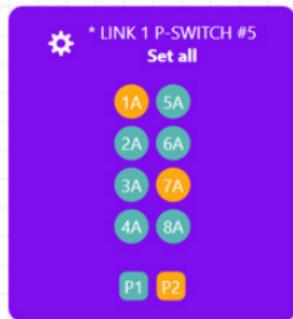
When MAT detects more than one P-SWITCH module in the LineUp™ chain, each module has its own "**Set all**". There is also a new option of a single super instrument.
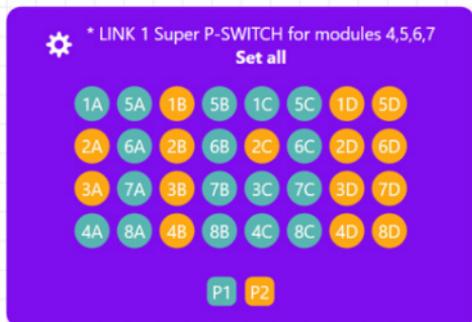
With 4 P-SWITCH modules combined, a super instrument be created by MAT, and a 32 valves "**Set all**" block will be available. The valves are still broken into the 4x8 blocks of a standard P-SWITCH.

FUNCTION BLOCKS

One can chain "**Set all**" blocks with "**Wait**" blocks to create a sequence of pressure steps. Alternatively, MAT offers a specific "**Sequence**" block.

Use "**Sequence**" to download a picture of the system/chip and drag & drop bullets as marks. The block allows to create several steps with specific durations to toggle the outlets. Each step can be seen as a "**Set all**" block followed by a "**Wait**" block

1	Add step for adding a new step after the selected one
2	Delete step to erase the selected step from the sequence
3	Duplicate step to copy and paste a step after the selected one
4	Import picture to download a picture of the chip/system and add marks
5	Step name to configure the name of the selected step
6	Duration to set the duration of the pressure step (in seconds, ms or min)
7	Valve commutation configuration choose the valve positions of a step

In case MAT detects more than one P-SWITCH module in the LineUP™ chain, they are still accessible independently. Each module has its own "**Sequence**", but also as a single super instrument.
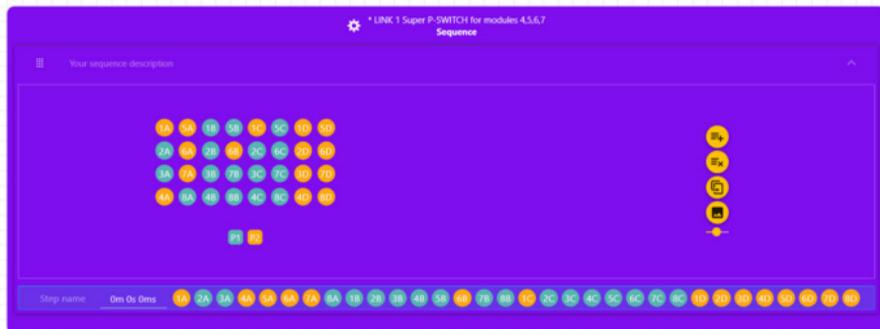
The **LineUp™ SWITCH EZ** is a microfluidic valve controller allowing one to automate valves actuation timing. Use ESS™ function blocks to control these valves.
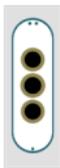
2-SWITCH™   **L-SWITCH™**   **M-SWITCH™**

For information about 2-SWITCH™ L-SWITCH™ and M-SWITCH™ control, please refer to the dedicated section *ESS™ series function blocks*.

Flow rate function blocks

If one wishes to work with flow-rate, a flowmeter (**FLOW UNIT**) must be added in the fluidic path and connected to either a **Flow EZ™** / **Push-Pull** or a **Flowboard**. The **LineUp™ Flow EZ** and **LineUp™ Push-Pull** have a dedicated port to plug the FLOW UNIT and allow for PC detection through the **LineUp™ LINK**.

To use the FLOW UNIT independently from the LineUp™ series, with another pressure controller such as **MFCS™ series** system for example, the FLOW UNIT must be connected to the PC using a **Flowboard**.

Once a FLOW UNIT is connected to the PC and detected by the MAT, it can be coupled with any pressure channel .

The **FLOW UNIT** allows for flow-rate operation when connected to a **LineUp™ Flow EZ**, **LineUp™ Push-Pull** or **Flowboard**.

Use "**Configure**" to:

- Set the connected FLOW UNIT calibration table:
  - Water or IPA calibration

- Set flow rate custom scale factors

- Set the maximum flow rate limit while using direct flow-control

- Set the flow sense (direction)
  - Nominal: flow follows the FLOW UNIT arrow
  - Inverse: flow goes against the FLOW UNIT arrow

Use "**Set flow-rate**" to set the flow-rate value. The user can also choose the unit and select which pressure channel will be coupled with the FLOW UNIT.
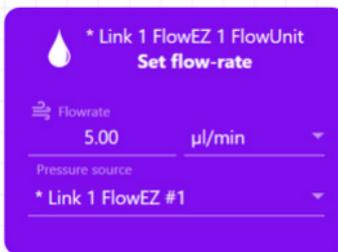
FUNCTION BLOCKS

Use "**Flow-rate step**" to increase or decrease the flow-rate value by a specified flow rate step. The user enters a positive or negative value in the block and flow rate will adjust consequently.

Note: This function can be very useful to perform flow rate ramps when used within a "**Repeat n times**" function (see in *Toolbox* section).

Use "**Flow-rate sine wave**" to perform flow-rate sine profiles.
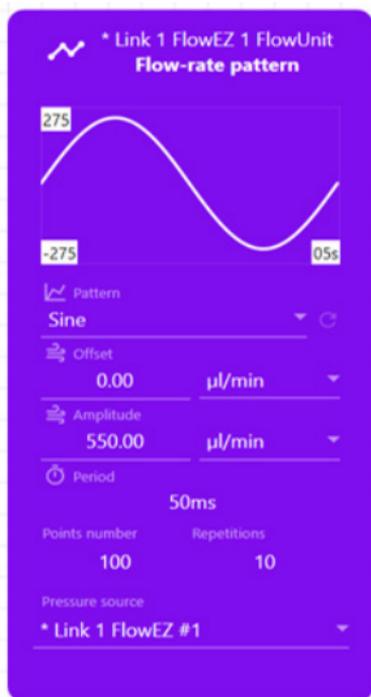
It allows for flow-rate offset, flow-rateamplitude, signal period, different pattern shapes (sine, square, triangle, sawtooth) and number of periods configuration. The user can set those parameters in the block or import a custom profile from a .csv file by choosing *Custom* in pattern section.

Note: When importing pattern from a table in a .csv file, the units applied on the block will be the ones set within the setting menu. No conversion will be done if the units are changed after the import.

Use "**Stop flow-rate pattern**" to stop the application of a previous flow-rate pattern block.

When a "Flow-rate sine wave" block is used, the Flow EZ™ or Push-Pull will apply the flow pattern for the number of periods set in the block. To apply a flow rate pattern for a specific amount of time or to stop it midway , use a type of configuration as shown below.
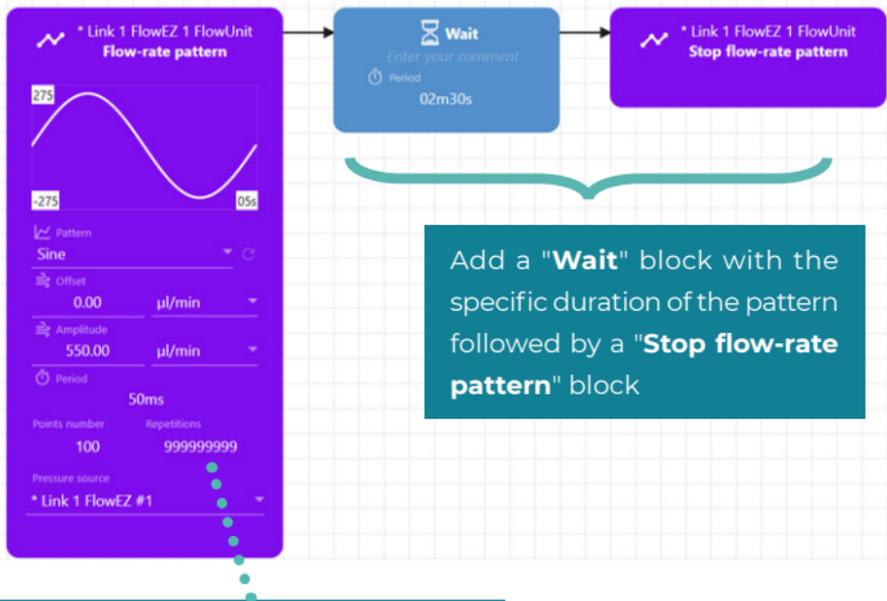
Add a "**Wait**" block with the specific duration of the pattern followed by a "**Stop flow-rate pattern**" block

Enter a high number of repetitions to avoid pattern stop before the desired amount of time.

FUNCTION BLOCKS

When a **FLOW UNIT** is connected to a LineUp™ pressure controller, the user has the possibility to inject a specific volume.

Use "**Flow-rate volume injection**" to:

Set the flow rate and wait for the specified volume to pass through the connected FLOW UNIT.
Flow rate will be set to zero once the volume has been injected.
This function is suitable for precise injections and pipetting protocols.

Use "**Pressure volume injection**" to:

Set the pressure and wait for the specified volume to pass through the connected FLOW UNIT.
Pressure will be set to zero once the volume has been injected.
This function is suitable for precise injections and pipetting protocols. The user sets the volume to be injected.

Note: The "Pressure volume injection" block is available in the list of function blocks associated to the LineUp Flow EZ™ or LineUp™ Push-Pull instruments. However a FLOW UNIT is required for the system to determine the amount of volume dispensed into the system

Obsolete blocks

Obsolete blocks appear in their original color, but lighter. One can still use protocols you wrote with previous MAT versions, even though they contain such obsolete blocks. Obsolete blocks are not available anymore when writing new protocols.
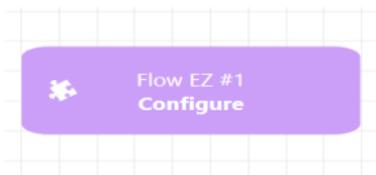
Obsolete block which can be replaced with "Configure pressure" and "Configure flow-rate" blocks

Below is a list of obsolete function blocks:

Name	Version	Comment
Flow EZ "Configure" function block	17.1.0.0	Split into two separated function blocks: Configure pressure Configure flow-rate
Flow EZ "Flow step" function block	17.2.0.2	Replaced by a new "Flow-rate step" block

MFCS™ SERIES AND FRP FUNCTION BLOCKS

Function blocks available on **MFCS** channels and Flow-Rate Platform (Flowboard and FLOW UNIT) instruments cover all the features used by **LineUp Flow EZ™** and **LineUp™ Push-Pull** instruments' function blocks. Pressure related function blocks are available when selecting a MFCS channel, while flow-rate related function blocks are available when selecting a FRP instrument.
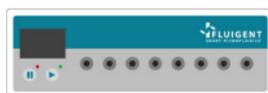
MFCS™-EZ   **MFCS™-EX**   **Flow-Rate Platform**

MFCS sampling rate: MFCS pressure control rate is 100ms. By default, MAT sample period is 50ms. If using MFCS instruments only, one may want to change MAT's sampling period by editing *<install folder>/MicrofluidicsAutomationTool.exe.config* file as in the following screenshot.

```
<setting name="ReadPoolingMs" serializeAs="String">
  <value>100</value>
</setting>
```

Legacy refurbished Flowell Series "FLOW UNIT" instruments are limited to 55µL/min and do not have IPA calibration table

The following table lists all function blocks and their attached instrument

Function block name	LineUp™ block equivalent	Instrument attached to	Specific parameters
Configure pressure	Configure pressure	MFCS channel	Response mode feedback coefficient: - defaults to 5 - ranges from 1 to 100 The higher the faster response is. May cause instability when set too high
Set pressure	Set pressure	MFCS channel	-
Pressure step	Pressure step	MFCS channel	-
Pressure sine wave	Pressure sine wave	MFCS channel	-
Purge	None	MFCS Flex / P-OEM	Purge state: ON/OFF This block allows the activation/deactivation of the purge feature
Configure flow-rate	Configure flow-rate	Flow-rate platform	-
Set flow-rate	Set flow-rate	Flow-rate platform	Pressure source Drop down list of associable MFCS channels This parameter allows to choose which MFCS channel is used for tubing pressurization
Flow-rate step	Flow-rate step	Flow-rate platform	Pressure source (see description above)
Flow-rate sine wave	Flow-rate sine wave	Flow-rate platform	Pressure source (see description above)
Flow-rate volume injection	Flow-rate volume injection	Flow-rate platform	Pressure source (see description above)

Recirculation kit function blocks

A recirculation kit allows to recirculate liquid from one reservoir to another and vice-versa while ensuring a constant and unidirectional flowrate in your system. This kit is composed of individual instruments and when the correct setup is made the recirculation functions can be used.

Recirculation kit's components

Component	LineUp™ configuration	MFCS™ configuration
Pressure source number 1	LineUp Flow EZ™	MFCS channel
Pressure source number 2	LineUp Flow EZ™	MFCS channel
Valve number 1	2-SWITCH™	2-SWITCH™
Valve number 2	2-SWITCH™	2-SWITCH™
Flow rate control	FLOW UNIT connected to a Flow EZ™	FLOW UNIT connected to a Flowboard

How to create, edit and delete recircultation kit

A recirculation kit can be composed by using the kit creation window:

- Right-click the recirculation kit plugin (in the instrument section),
- Select "Create" in the contextual menu,
- Name and assemble the kit according to available components
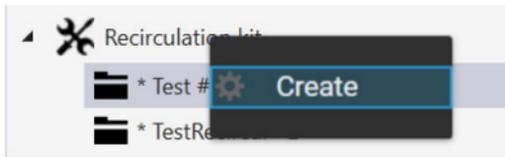
Once the creation windows appears, select all required components and hit the "*Create*" button.
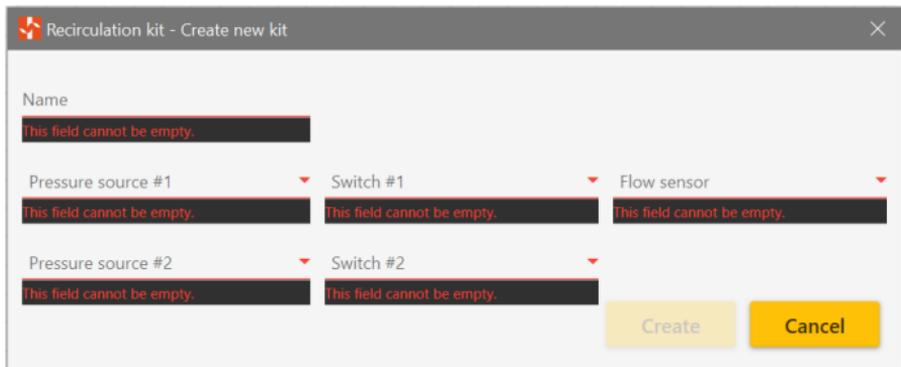
The newly created kit will be listed under the recirculation kit plugin and its function blocks should appear on the right-hand side when selected.
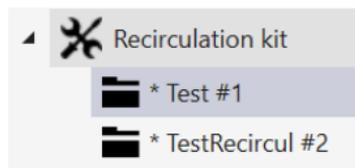
FUNCTION BLOCKS

A recirculation kit can have its name or components edited by right clicking it and selecting "*Edit*". A window, similar in shape and content to the "Creation window" will be displayed and allow the user to actually edit the kit. Once the edit is complete, the user can validate or cancel the edit. A recirculation kit can be deleted by right-clicking it and selecting "*Delete*".
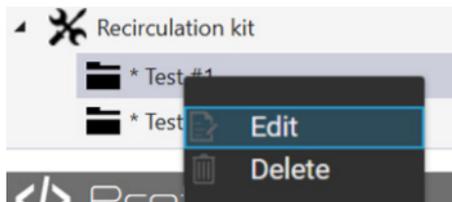
▌Recirculation kit's function blocks:
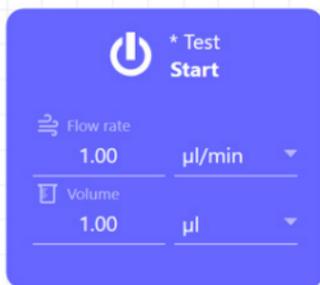
Use "**Start**" to start the recirculation and specify:

▌Flow-rate order
Volume per recirculation phase

The "*Start*" block can also be used to restart the recirculation after a "*Pause*"
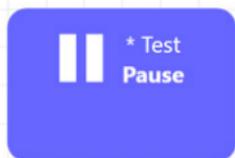
Use "**Pause**" to pause a previously started recirculation.

Use "**Resume**" to resume a previously paused recirculation.
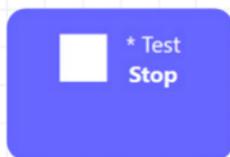
Use "**Stop**" to stop a previously started recirculation. If a recirculation is restarted after a "*Stop*" block it will start as a new one, not resume it.

TOOLBOX

The toolbox is located bottom left of the Home view. It contains two loops, a conditional structure and a wait function. Additionally there is a grouping function to organize protocols as for the Function Blocks, the user has to drag and drop the blocks to the protocol editing area.
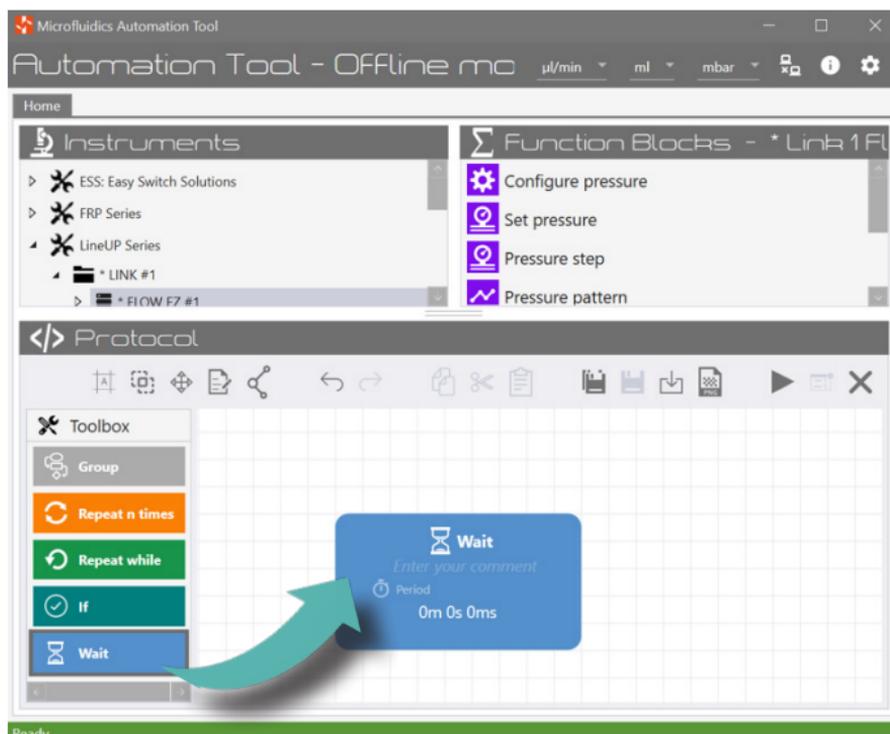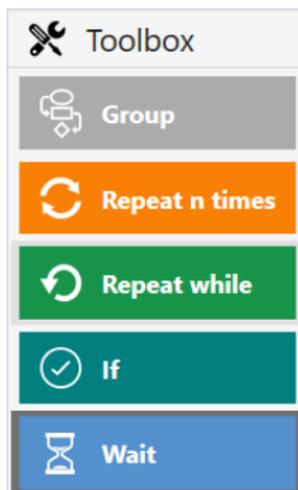
Repeat "n" times

The protocol inside this loop will be repeated "n" times. The user enters the iteration number and drags and drops function blocks to be repeated inside the loop square.

1	**Number of iterations** indicate a value or use the arrows
2	**Comment section** name the loop or add a specific comment
3	**Loop area** drag & drop function blocks inside the area to loop

In the example below, by repeating 5 times a pressure increase of 10 mbar, the user performs a pressure ramp. The "*Wait*" function allows controlling ramps speed of 50ms

Repeat while

The protocol inside this loop will be repeated while a condition is true. The condition has four parts:

1	Function to be watched i.e "Read Flow Rate" on the "Flow EZ #1"	4	Comment section name the loop or add a specific comment
2	The condition operator equal, greater, less, greater or equal, less or equal,	5	Loop area drag & drop function blocks inside the area to loop
3	The condition value i.e 100 µL/min, 245 mbar, valve position 2		

In the example above, the loop is set to repeat an increase pressure operation of 10 mbar step every 50 ms while the flow-rate on the Flow EZ #1 is lower than 100µL/min.

If (condition structure)

The protocol inside the "If" structure is executed only if a specified condition is fulfilled. This condition is selected in the "to execute if" list. The conditions proposed are related to the connected instruments. For example, below, we will set a pressure (purple function block inside the loop square) if the M-Switch 1 position is 3. If not, the protocol will proceed to the next step.
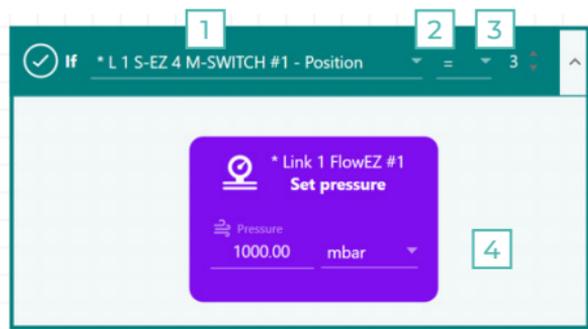
1	Condition i.e position of a M-SWITCH™ is checked	3	The condition value i.e position has to be set on number 3
2	The condition operator equal, greater, less, greater or equal, less or equal	4	Loop area drag & drop function blocks to execute inside the area

Wait

Wait function allows a pause for an amount of time set by the user.
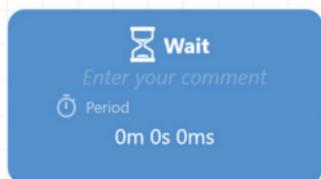
The "*Wait*" block is often used after another function block in order to apply this one during a certain period of time. As an example a "*Set pressure*" block followed by a "*Wait*" block allow to apply the set pressure during the time indicated into the "*Wait*" block.
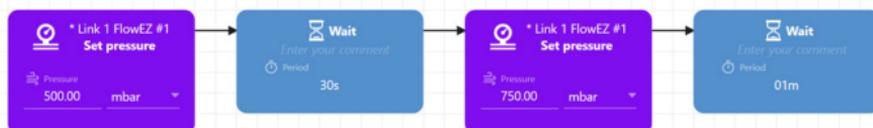
Group container (comments)

The "Group" container groups several blocks together, allowing the user to set a comment in its header.

PROTOCOL AREA

To start creating a protocol, the user drags and drops the desired function blocks and has to link them in chronological way. One can use the *Toolbar* to interact with the protocol editing area, and drag & drop functions from the *Function blocks* section or from the *Toolbox*

1	**Toolbar** list of tools to interact with the editing area (described on next page)
2	**Toolbox** Common function blocks to drag & drop into the editing area
3	**Editing area** to create the protocol by linking the function blocks together
4	**Linking arrow** to wire and organize which block will be executed after another
5	**Anchor point** can be the starting or finishing point of an arrow to order blocks
6	**Resize point** to resize some blocks and organise the protocol sheet

Toolbar

This toolbar interacts with the protocol editor, each function has a tooltip to guide.

1	Arrange the diagram automatically
2	Clean up the diagram to align every block properly
3	Center all protocol elements
4	Details to display a window on the right side to add comments
5	Wire diagram blocks automatically
6	Undo to cancel the previous action (shortcut to Ctrl+Z)
7	Redo to retrieve the previous cancelled action (shortcut to Ctrl+Y)
8	Copy to copy the selected elements(s) (shortcut to Ctrl+C)
9	Cut to cut the selected elements(s) (shortcut to Ctrl+X)
10	Paste to paste/duplicate the copied/cut elements(s) (shortcut to Ctrl+V)
11	Save as
12	Save
13	Load a saved protocol
14	Export to export blocks as png picture which can be imported back in area
15	Start the protocol to launch the current protocol and open the dashboard view
16	Open execution window to switch on the dashboard view after first launch
17	Close file to go back on a new sheet

Editing a protocol

The user drags and drops desired function blocks and must link them in chronological order. Click on a block to see the anchor points then drag an arrow from a block to another's anchor point.
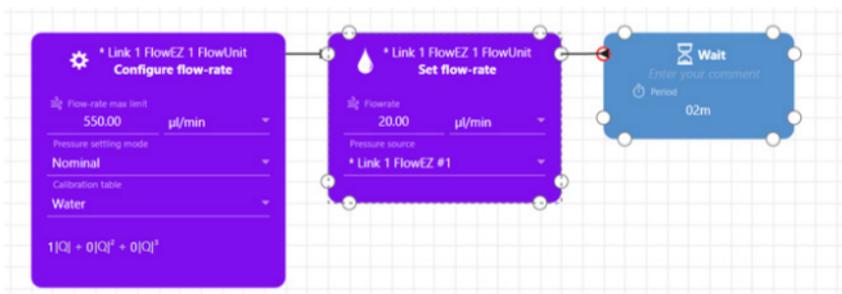
When using loops, the user has to drag and drop the function blocks inside the loop. The loop block can be wired to other blocks in the same way two function blocks would be.

To start executing a protocol, the user has to click on the *Start* button in the toolbar. A new tab (the dashboard see p.42) will appear to show the operations, flow-rates and pressures.

Note : When exiting the Software, pressure values will be reset to 0. Make sure to save the protocol before closing MAT.

Keyboard shortcuts

The following table lists keyboard shortcuts of the Microfluidics Automation Tool Software protocol area:

Keyboard shortcut	Description
Ctrl + C	Copy the selection
Ctrl + X	Cut the selection
Ctrl + V	Paste copied/cut elements
Ctrl + Z	Undo the last action
Ctrl + Y	Redo the last action
Ctrl + mouse wheel	Zoom in / Zoom out

DASHBOARD VIEW

When finished editing the protocol, click on the *Start* button; the protocol will start and the Dashboard view will be displayed.
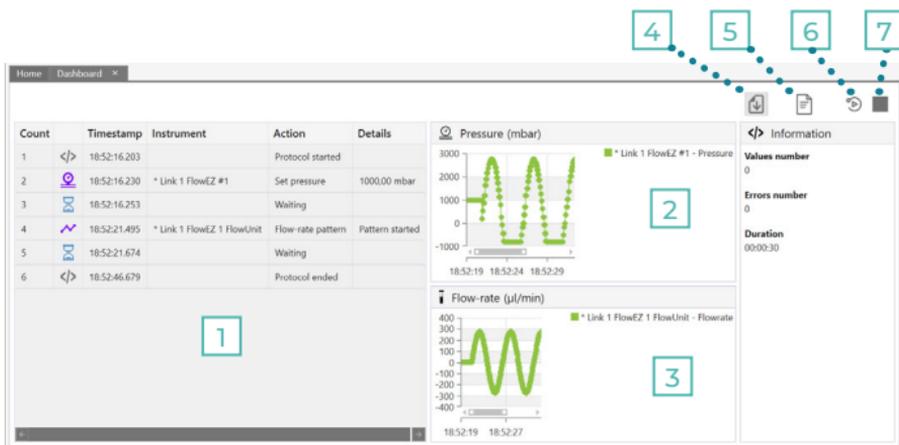
#	Name	Description
1	**Execution list**	to know the steps of execution of the protocol
2	**Pressure graph**	to view the pressure value variation during the protocol*
3	**Flow rate graph**	to view the flow rate variation during the protocol*
4	**Auto scroll**	allows the execution list to scroll automatically to the last step
5	**Data log folder**	MAT logs all pressures and flow rates in a dated .csv file
6	**Replay/Pause**	allows to pause and relaunch the protocol
7	**Stop**	end the protocol
8	**Information**	displays information (i.e the duration of the step)

*Note: by default, charts do not display latest values. Set scroll bars to the right to have charts show latest values.

MAT UPDATES

MAT 17.1.0.0 INTRODUCED DIRECT FOW CONTROL

Pressure control provides very smooth flow-rates and provides for rapid settling times. However, the physical parameter users generally want to monitor and to control is the flow-rate. Indeed, flow-rate is related to fluid speed in the channel, the hydrodynamic resistance, and viscosity. A certain pressure can lead to different flow-rates in two different microfluidic channels depending on the variables.

During an experiment, liquid levels in the reservoir change leading to modifications of the hydrostatic resistance. In a long-term procedure, a constant pressure can lead to slow flow-rate changes. Direct Flow Control is an algorithm which adjusts the pressure in the reservoir to reach the desired flow-rate and maintain it over long time period protocols. A "classic" algorithm would need the user to adjust some parameters in order to fit his/her set-up. Direct Flow Control does it automatically for extended ease of use and, of course, with the best performance. DFC is only available for the LineUp™ Flow EZ and Push-Pull with a FLOW UNIT connected to it and using A-i-O or MAT software.

MAT 17.2.0.4 INTRODUCED SUPPORT FOR MFCS™ AND FRP SERIES

MFCS™ pressure controllers were previously not supported. It is now possible to drive them using MAT 17.2.0. Each MFCS channel is visible, configurable and can be driven to output pressure to the microfluidic system. In addition, MAT 17.2.0 also supports FRP series; i.e. one can now connect a Flowboard hardware and monitor any FLOW UNIT that is connected to it, thus dramatically increasing the number of flow measurement channels the software can monitor. Both supports were added in order to allow the use of direct flow control algorithm (see update 17.1.0.0) with a MFCS™ channel and a FLOW UNIT connected to a Flowboard. An association between a flow channel and a pressure channel can be made in order to control the flow going through the flow channel.
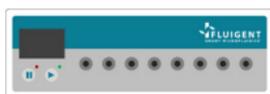
MFCS™-EZ   **MFCS™-EX**   **Flow-Rate Platform**

MAT 19.0.0.1 INTRODUCED SUPPORT FOR PX SERIES

Fluigent has released a new OEM product line in 2019. The PX-series consist in a set of three single channel pressure controllers, ranging from -800 mBar to 2000 mBar. Microfluidics Automation Tool allows protocol design including all PX controller connected through USB.

PX controller

MAT 19.0.1.3 INTRODUCED SUPPORT FOR RECIRCULATION KIT

Fluigent research and development has been working on a microfluidic recirculation module, that can be used with MFCS™ series or LineUP™ series. This module allows long term experiments requiring flow recirculation within a chip, without having to manually refill any of the reservoirs.

Microfluidics Automation Tools 19.0.1.3 allows one to create a new instrument, namely a recirculation kit, that associates components together and display new functions blocks for this kit.

MAT 20.0.0.0 INTRODUCED SUPPORT FOR P-SWITCH AND SWITCH EZ

The LineUP™ P-SWITCH is a pneumatic valve controller. By providing two pressure sources (any vacuum or pressure from -800 to + 2000 mbar), each module is able to deliver one of the two provided pressures through 8 independent outlets. The module allows for automation of any pneumatic or quake valve actation.

P-SWITCH

The SWITCH EZ is a microfluidic valve controller allowing one to automate valves timing. The module has no specific block in MAT, it connects the ESS™ valves to the PC.

SWITCH EZ

MAT 20.0.0.0 allows the user to specify units on each block. The "*Set pressure*" block for example, now allows the user to select KPa, mbar or PSI. MAT 20.0.0.0 also allows the user to define times pressure switch sequences.

MAT 20.0.0.0 introduces direct block display which makes protocols easier to edit and to read.

TECHNICAL SUPPORT

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Fluigent

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**VERSION
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