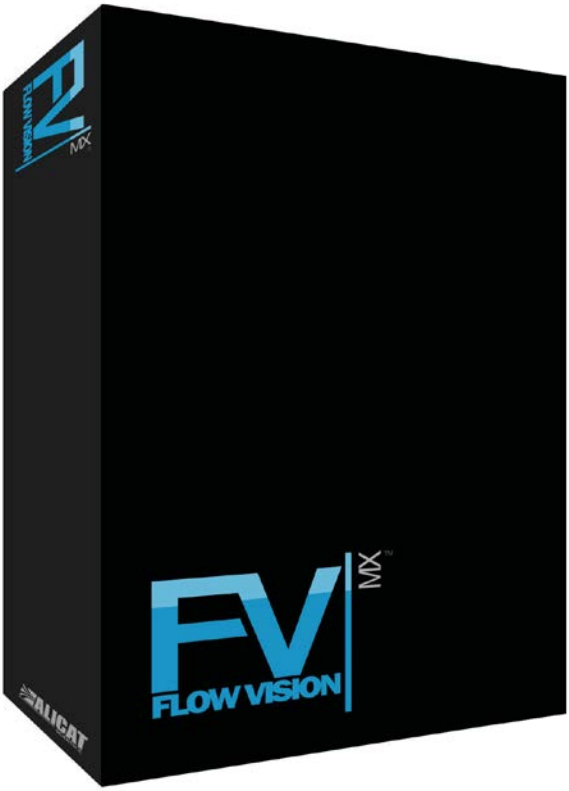


Flow Vision™ | MX

Gas Blending Station

Welcome to Flow Vision™ Gas Blending Station

Flow Vision™ MX is a graphical software package that aides in the process of mixing gases. Currently, up to six Alicat Scientific, Inc. mass flow controllers are supported.

System Requirements

Supported Operating Systems: Microsoft Windows Vista, Windows 7, Windows 8/8.1, Windows 10

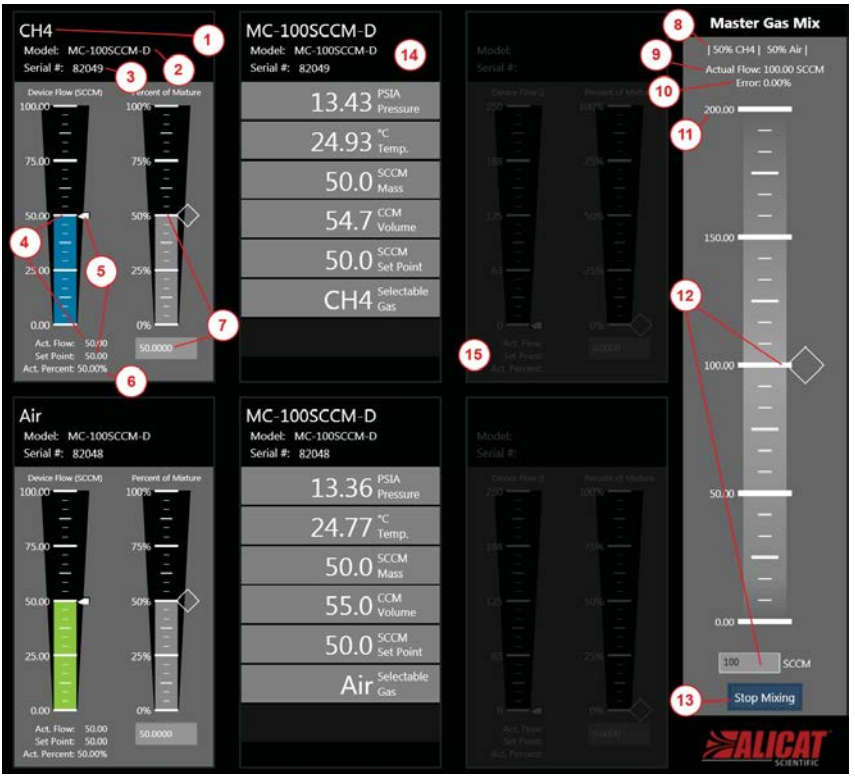
- **Software:** Microsoft®.NET Framework Version 4.5.2
  (A copy of Microsoft® .NET Framework can be downloaded at: https://www.microsoft.com/en-us/download/details.aspx?id=42642)

Hard Disk: Up to 10 MB of available space may be required for installation. Data logs may require additional space.

Hardware: Available COM port, at least one Alicat Scientific, Inc. mass flow controller

Display: Minimum of 860 x 860

Overview

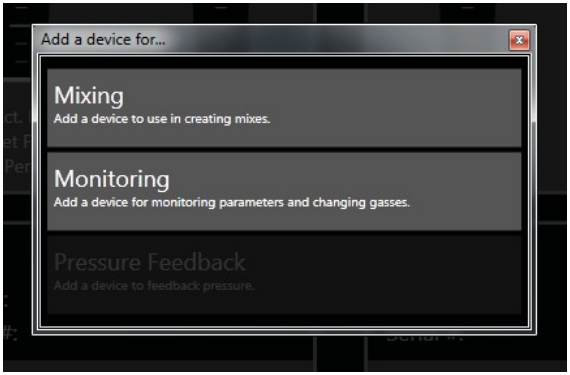


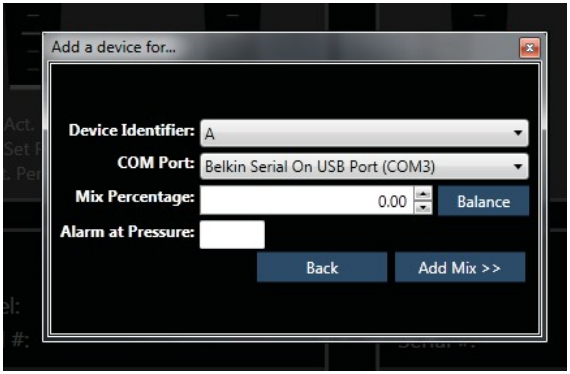
1. *Device Gas*: The gas that the target device is set to flow.
2. *Device Model Number*: The model number of the target device.
3. *Device Serial Number*: The serial number of the target device.
4. *Actual Mass Flow*: The current mass flow measurement of the target device.
5. *Device Set-Point*: The current set-point (target flow) of the target device.
6. *Actual Percent*: The actual concentration percentage of the gas that the target device is flowing. This will vary with the actual flow of all devices.
7. *Target Percent*: The target concentration of the gas in the overall blend.
8. *Blend Composition*: The makeup of the final gas blend.
9. *Actual Total Flow*: The total flow of the final gas blend.
10. *Error*: The flow error in terms of the target flow.
11. *Maximum Flow*: The maximum flow rate that can be reached.
12. T*arget Blend Flow Rate*: The target rate of flow for the blend.
13. *Start/Stop Mixing Button*: Button to start/stop the mixing process.
14. *Monitored Device:* A device that is monitored during the mixing process.
15. *Empty Location:* An empty location that is available for mix components or monitored devices.

Creating a Blend

If you are not mixing, double click any of the six empty mix component locations.

If you are already mixing, select ***File > New Blend*** from the menu to create a new, empty blend. Any existing blend information will be removed from the application. Double click any of the six empty mix component locations.





Select **Mixing** to add a device that will be used for gas mixing. Enter the following information:

Device Identifier: The alphabetic identifier of the device you wish to use.

COM Port: The RS232 port that the device is connected to.

Mix Percentage: The percentage of the final gas mix that this device will contribute. This can be changed later.

Alarm at Pressure: If the pressure drops below this level Flow Vision™ MX will generate an alarm.

Click the **"Add Mix"** button to continue.

Flow Vision™ MX will search for a mass flow controller using the selected parameters.

If the device is found, it will be added to the current mix.

Blending Gases

Adjusting Concentrations

The concentration of each gas in the overall mix can be adjusted.

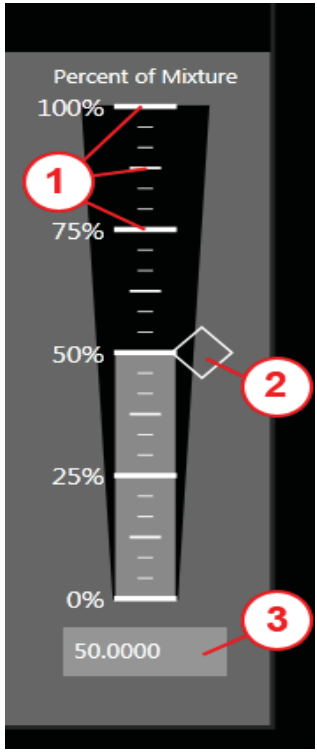
The gauge is split into tick marks for visual measurement of the flow (**1**).

The indicator on the right of the gauge will match the percentage of the mixture (**2**).

The percentage of the mixture can be edited directly in the box under the gauge (**3**).

Mixing cannot begin until the total of all concentrations reaches 100%.

When this occurs, the ***"Start Mixing"*** button is enabled.



Devices that are at zero percent will not be represented in the final blend readings.

Controlling these devices outside of Flow Vision™ MX will create inaccurate blend readings.

Changing Flow Rates

When the total of all concentrations reaches 100%, the ***"Start Mixing"*** button becomes enabled.

Clicking this button will start the mixing process.

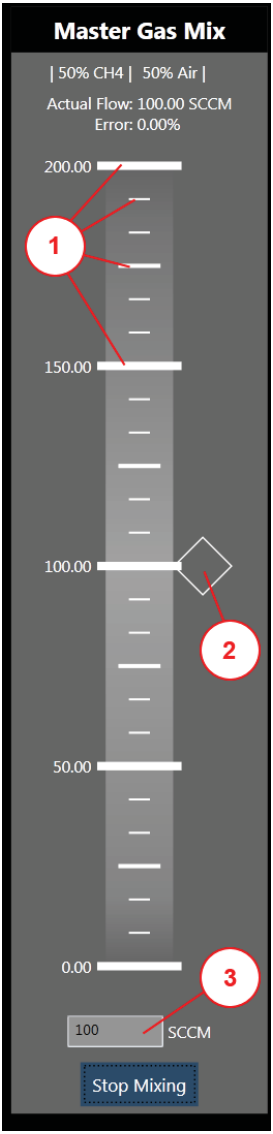
The total flow of your gas blend can be changed adjusted.

The gauge is split into tick marks for visual measurement of the flow (**1**).

The indicator on the right of the gauge (**2**) will match the total flow of the mixture.

The total flow value can be edited directly in the box under the gauge (**3**).

To stop the mixing process, click the ***"Stop Mixing"*** button. All device set-points will be set to zero and the gas flow will cease.



Removing Components

To remove a component, **left-click** on the arrow in the top right of the item and select remove.

Components cannot be removed while blending.

Saving a Blend

Begin by selecting ***File > Save Blend*** from the menu.

You will be prompted for a location on disc to store your blend.

Enter a file name and click the ***"Save"*** button.

Blends are stored using the .fvb extension in XML format and can be modified using a text editor.

Loading a Blend

Choose ***File > Load Blend*** from the menu to launch the open file dialog.

Navigate to the desired blend file (.fvb) and click the ***"Open"*** button.

The stored blend will be loaded, overwriting any existing blends.

Loading Recent Blends

Recent blends are added to the menu under **File > Recent Blends**. Selecting the blend name will load it into Flow Vision™ MX.

Data Acquisition

Flow Vision™ MX allows you to capture the data returned by the devices while mixing. To enable data acquisition, select **File > Data Acquisition > Start** from the menu or press the **Ctrl + Q** keys.

To view the log files, select **File > Data Acquisition > View Folder** from the menu. Logs are stored with the date and time that the acquisition was started in the file name.

Changing Flow Units

By default, all flow readings in Flow Vision™ MX are in **SLPM**.

The units can be changed by selecting the desired units from the ***Edit > Flow Units*** menu.

Changing Decimal Places

By default, all flow readings are shown to two decimal places.

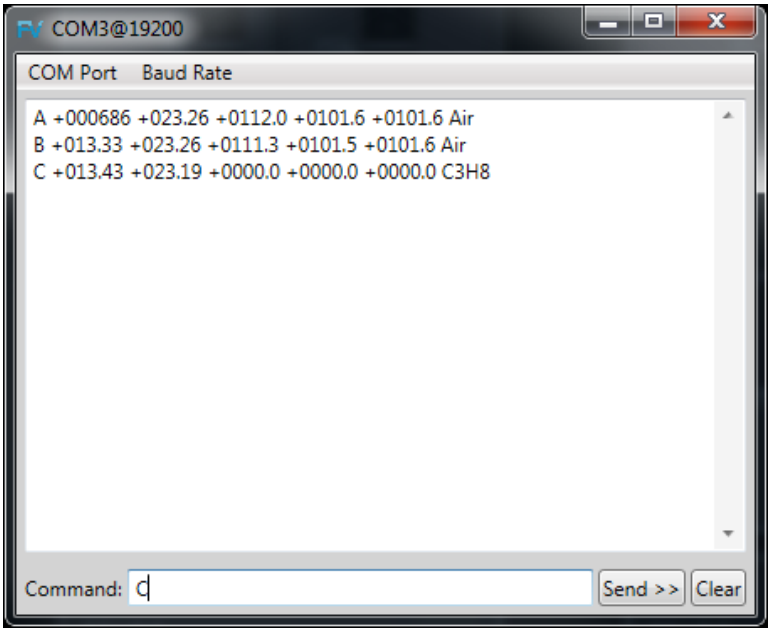
Decimals can be increased or decreased using the ***Edit > Decimals*** menu.

Increasing the decimal places will not increase the resolution of the devices.

Using the Terminal

The terminal allows for basic RS-232 communication with your Alicat Scientific™ devices while gases are being mixed.

To launch the terminal, select ***View > Terminal*** from the main menu.



Select a valid port from the ***COM Port*** menu to begin communications.

Commands are entered into the box at the bottom of the terminal.

Send a command by clicking the ***"Send"*** button.

For more information on the standard Alicat Scientific™ command set or RS-232 communications, please see the operating manual for your device.

Monitoring a Device

The device monitoring functionality allows you to interact with a device that may not be part of your current gas blend. Devices that are part of your blend may also be monitored.

To add a device, double click any empty mix component location. Select **Monitoring** to add a device that will be used for monitoring. Enter the following information:

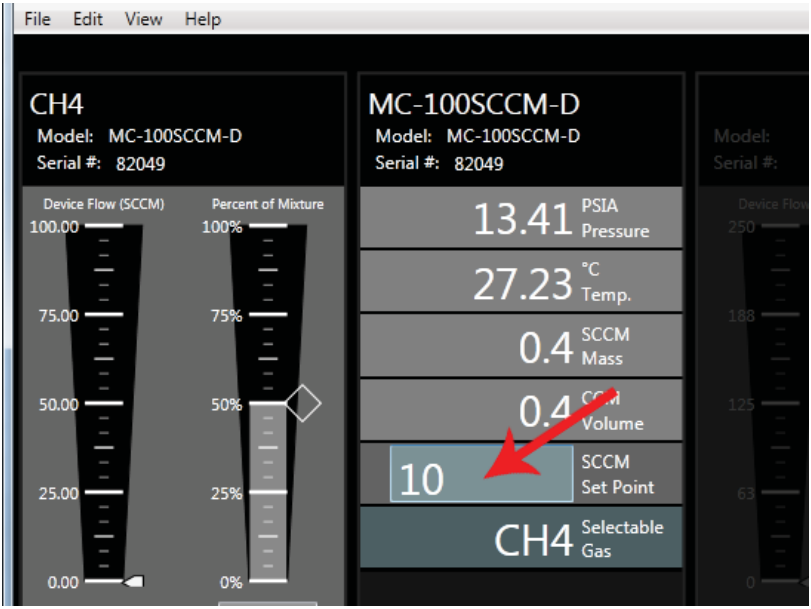
Device Identifier: The alphabetic identifier of the device you wish to use.

COM Port: The RS-232 port that the device is connected to.

Click the **"Add Device"** button to continue.

Flow Vision™ MX will search for a device using the selected parameters. If the device is found, it will be added to the current mix.

Changing the Set-Point



The set-point on a monitored controller can be changed by clicking on the current set-point value. The field will become editable. Type in the desired set-point and press the **Enter** key. If the set-point is valid, it will be changed on the device.

Set-points cannot be changed while mixing.

Changing the Gas

To change the gas of a monitored device, click on the current gas value.

Then select the desired gas from the list of available gases.

The gas cannot be changed while mixing.

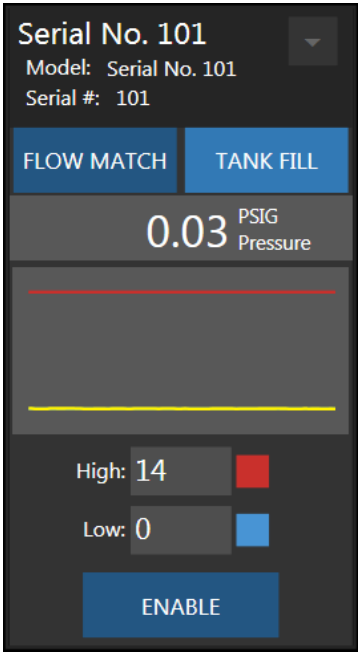
The selected gas should match the actual gas being flowed.

If the gases do not match, flow readings will be inaccurate.

Pressure Limiting

The pressure limiting feature of Flow Vision MX allows you to automatically stop mixing when a monitored pressure exceeds a set value. When pressure surpasses your preset limit, Flow Vision MX closes the valves on the mixing devices. When pressure drops below a low limit, mixing resumes.

Overview



1. Visual High Limit: A visual representation of the high limit. If the current pressure exceeds this, mixing will stop.

2. Visual Low Limit: A visual representation of the low limit. If the current pressure falls below this limit, mixing will resume.

3. Visual Current Pressure: A visual representation of the current monitored pressure.

4. Current Pressure: The current monitored pressure.

5. High Limit: An interactive representation of the high limit.

6. Low Limit: An interactive representation of the low limit.

7. Enable/Disable: Allows you to enable and disable the limit.

Adding a Pressure Limit

Double click any of the six locations in the application. Select **"Pressure Control"** from the list of available options. Enter the following information:

Device Identifier: The alphabetic identifier of the device that will be used to monitor pressure.

COM Port: The RS-232 port that the device that will be used to monitor pressure is connected to.

Click the **"Add Device"** button to continue. The pressure limiting view will be added to the application.

Flow Vision MX will search for a device using the selected parameters. If the device is found, it will be added to the current mix.

Real Time Pressure Feedback

Real time pressure feedback allows Flow Vision MX to control the flow of your gas mix based on a desired pressure. The application uses a control algorithm to adjust the flow of mix in real time to maintain pressure.

To add a pressure feedback device, double click any empty mix component location. Select **“Pressure Control”** to add the device that will be used monitor pressure. Enter the following information:

Device Identifier: The alphabetic identifier of the device you wish to use.

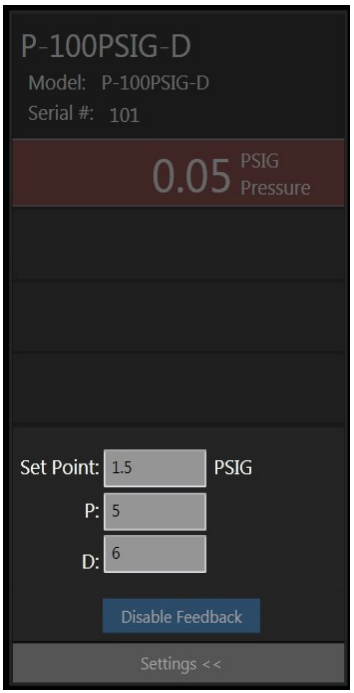
COM Port: The RS-232 port that the device is connected to.

Set-Point: The pressure that you would like to maintain, in the device’s pressure units.

Click the **“Add Device”** button to continue.

Flow Vision MX will search for a device using the selected parameters. If the device is found, it will be added to the current mix.

Tuning Pressure Feedback



Flow Vision MX uses a modified PID control algorithm to maintain pressure at a set-point.

The proportional (**P**) and derivative (**D**) terms can be adjusted by opening the **Settings** menu and changing the appropriate values.

For more information on PID control and tuning, please see http://en.wikipedia.org/wiki/PID_controller.

While mixing with pressure feedback, Flow Vision will control the output of your mix.

If you would like to disable this behavior, press the **“Disable Feedback”** button under the **Settings** menu.

Gas Viscosity, Density and Compressibility:

#	Gas		Absolute Viscosity* 25°C	Density ** 25°C 14.696PSIA	Compressibility 25°C 14.696PSIA
0	Air	Air	184.918	1.1840	0.9997
1	Argon	Ar	225.593	1.6339	0.9994
2	Methane	CH4	111.852	0.6569	0.9982
3	Carbon Monoxide	CO	176.473	1.1453	0.9997
4	Carbon Dioxide	CO2	149.332	1.8080	0.9949
5	Ethane	C2H6	93.540	1.2385	0.9924
6	Hydrogen	H2	89.153	0.08235	1.0006
7	Helium	He	198.457	0.16353	1.0005
8	Nitrogen	N2	178.120	1.1453	0.9998
9	Nitrous Oxide	N2O	148.456	1.8088	0.9946
10	Neon	Ne	311.149	0.8246	1.0005
11	Oxygen	O2	204.591	1.3088	0.9994
12	Propane	C3H8	81.458	1.8316	0.9841
13	normal-Butane	n-C4H10	74.052	2.4494	0.9699
14	Acetylene	C2H2	104.448	1.0720	0.9928
15	Ethylene	C2H4	103.177	1.1533	0.9943
16	iso-Butane	i-C4H10	74.988	2.4403	0.9728
17	Krypton	Kr	251.342	3.4274	0.9994
18	Xenon	Xe	229.785	5.3954	0.9947
19	Sulfur Hexafluoride	SF6	153.532	6.0380	0.9887

#	Gas		Absolute Viscosity* 25°C	Density ** 25°C 14.696PSIA	Compressibility 25°C 14.696PSIA
20	75%Ar / 25% CO2	C-25	205.615	1.6766	0.9987
21	90% Ar / 10% CO2	C-10	217.529	1.6509	0.9991
22	92% Ar / 8% CO2	C-8	219.134	1.6475	0.9992
23	98% Ar / 2% CO2	C-2	223.973	1.6373	0.9993
24	75% CO2 / 25% Ar	C-75	167.451	1.7634	0.9966
25	75% Ar / 25% He	A-75	230.998	1.2660	0.9997
26	75% He / 25% Ar	A-25	234.306	0.5306	1.0002
27	90% He / 7.5% Ar / 2.5% CO2 Helistar® A1025	A1025	214.840	0.3146	1.0003
28	90% Ar / 8% CO2 / 2% O2 Stargon® CS	Star29	218.817	1.6410	0.9992
29	95% Ar / 5% CH4	P-5	223.483	1.5850	0.9993

*in micropoise (1 Poise = gram / (cm) (sec)) **Grams/Liter
Reference: NIST REFPROP 7 Database

Flow Conversions:

SCFM	1.00	=	28.3160	SLPM	SLPM	100.00	=	3.5316	SCFM
SCFH	1.00	=	0.4719	SLPM	SLPM	100.00	=	211.9093	SCFH
SCIM	100.00	=	1.6390	SLPM	SLPM	1.00	=	61.0128	SCIM
SCIH	1000.00	=	0.2732	SLPM	SLPM	1.00	=	3660.7688	SCIH