



MCQ Instruments
GAS BLENDER 100 Series
User Manual - Revision 3.0

ESSENTIAL INSTRUCTION

Read carefully before proceeding!

MCQ Instruments tests its products to meet many national and international standards. For these instruments are sophisticated technical products, proper install, use and maintenance are required to ensure their right functioning. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining MCQ products.

ESD (Electrostatic Discharge)



CAUTION!

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation and other handling of circuit boards or devices.

Handling procedures:

- **Power to unit must be removed.**
- **Personnel must be grounded, via a wrist strap or other safe, suitable means before any circuit card or other internal device is installed, removed or adjusted.**
- **Printed circuit cards must be transported in a conductive container. Board must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.**

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Section 1 ABOUT THIS GUIDE

1.1 INTRODUCTION

This guide is your operative manual for the MCQ Gas Blender 100 Series, an instrument created for gas mixing solutions. With the MCQ Gas Blender 100 Series you can:

- **Operate with Dynamic Gas Mixtures with an immediate response time** – the MCQ Gas Blender 100 Series allows you to work with any desired Gas Mixture composed by non-aggressive gases. The Gas Blender works with three-channels, designed for dynamically three different gases mixtures preparations. The MCQ Gas Mixture Creator provided with the instrument gives you an easy and quick way to set and control the gas mixture parameters, allowing you to change the mixture composition with a single channel response time for change of setpoint value of 50 ms.
- **Operate with Microflows** – with a working lower limit of 0.01 sccm and with 1% of accuracy of the setpoint for each channel, the MCQ Gas Blender 100 Series is the ideal instrument for any microflow based applications. The standard working range is 0.01-200 for each channel (total flow: 0.01-600 sccm). Depending on the user request, custom settings with an extended working range up to 500 sccm for each channel (total flow: 0.01-1500 sccm) can be made.
- **Save room with the “Lab in a box” solution** - instead of multi-channel solutions using mass flow controller and external units for power supply and readout, MCQ Instruments offers a three-channels solution in a compact box (Lab in a Box).
- **Operate with your own PC** - the MCQ Gas Blender 100 Series has a 2.0 USB port for an easy and quick connection with you PC. You don't need any external control unit since the MCQ Gas Mixture Creator, included in the package, guarantees a full control over the instrument.
- **Operate with High Diluted Gas Mixtures** - (*Function for future use. At the moment not active*). Through a 485 BUS different Gas Blenders can be connected together allowing user to control up to 64 different devices. The RS485 connection can be used to create a cascade of gas blenders in order to obtain gas mixtures with strong dilution factors.

MCQ Gas Blender 100 Series is also equipped with push-in technology-based inlet and outlet tube fittings. The Gas Blender can operate at 12/36 V AC/DC and up to 25 psi pressure.

1.2 USING THIS GUIDE

The guide describes the features, installation, and initial configuration of the MCQ Gas Blender 100 Series. The guide is intended for both first-time and experienced computer network users who want to install and use the MCQ Gas Blender 100 Series. If you are working with a Gas Blender for the first time, it is possible you may make mistakes. We have tried to identify the likely errors you may make and have provided hints and tips to help you recover from error situations.

1.3 DEFINITIONS USED IN THIS GUIDE

The following terms are used frequently in this guide. They are presented here with their definitions for your information:

- **Setpoint** - The command or control signal supplied to a flow controller is called its setpoint. The controller will maintain the flow at this value.
- **Full scale** - The highest flow that an instrument will meter within its specified accuracy. It is often possible for an instrument to measure a flow beyond its full scale value, but the accuracy of this measurement may be outside of published specification.
- **Purge** - The MCQ Gas Blender 100 Series is supplied with the ability to open the valve far beyond the full scale position to allow them to be cleaned. This is usually accomplished by blowing clean, dry nitrogen through the instrument. When the valve is opened to this cleaning position, it is said to be in the Purge mode.
- **Sccm** - Standard Cubic Centimeters per Minute. It's a common flow measurement unit most used in the flow meters/controllers field that indicates how many standard cubic centimeters of gas flow by a stationary point in one minute (1 sccm = 0,001 L/minute).

e.g.

Using Sccm	Using mL per Minute	Using Litres per Minute
Channel 1 = 200 sccm	Channel 1 = 200 mL/min	Channel 1 = 0,2 L/min
Channel 2 = 200 sccm	Channel 2 = 200 mL/min	Channel 2 = 0,2 L/min
Channel 3 = 200 sccm	Channel 3 = 200 mL/min	Channel 3 = 0,2 L/min
Mixture flow = 600 sccm	Mixture flow = 600 mL/min	Mixture flow = 0,6 L/min

- **Non-aggressive gases** - MCQ Instruments refers to non-aggressive gases indicating all the gases for which the long time use does not involve a potential risk of instrument damage. A complete list of non-aggressive gases, compatible with the instrument, is provided in Appendix A (see page 37).

- **Gas mixture** - A gas mixture (or gas solution) is a homogeneous mixture composed of two or more gaseous substances. In such a mixture, one or more solutes gases are dissolved in another substance, known as solvent gas. What tells the solute from the solvent is the quantity ratio. In case of a two component gas mixture, the solvent gas is the component present in the greatest amount.
- **Channels** - The MCQ Gas Blender 100 Series works controlling three separate modules, one per each gas in use. MCQ Instruments refers to these modules as Channels. Gas Blender's *Channel 1* is designed for working with the solvent gas, while *Channel 2* and *Channel 3* are designed for the solutes gases. This instrumental configuration can be changed through the MCQ Mixture Creator.
- **Push-in connectors** – All the MCQ Gas Blender 100 Series inlets and the outlet are equipped with this kind of connectors that: provide a fast and easy way to connect the tubes (6 mm diameter) with the instrument, secure a strong locking mechanism and prevent accidental disconnects (for a complete list of compatible tubes check Appendix B, page 37).
- **BUS RS485** – (*Function for future use. At the moment not active*). The BUS RS485 is a serial communication method for computers and devices. RS485 is currently a widely used communication interface in data acquisition and control applications where multiple nodes communicate with each other. Up to 64 gas blenders cascade can be made through the RS485 port to obtain High Diluted Gas Mixtures.

Section 2 GETTING STARTED

2.1 INTRODUCTION

This chapter provides instructions for the installation of the Gas Blender.

- **Before you begin the installation**
- **What's in the package?**

2.2 BEFORE YOU BEGIN THE INSTALLATION

Before installing the instrument, ensure that the installation site conforms to the specific operating parameters recorded on this instrument's User Manual. This is critical because each instrument is configured for a specific application range. Please review the gas or gases, the mounting orientation, the maximum flow range(s), the inlet and the outlet pressure(s) and the operating temperature(s) and all the other parameters listed in the Appendix C (page 37). The line pressure should not exceed 2.0 bar (optimal pressure setting around 1.0 bar). The temperature range for a proper working is 15-45 °C at standard conditions (100 kPa ambient pressure and 30-50% relative humidity). If your application exceeds any of these parameters, contact your MCQ Sales Agent before installation. You may also contact the MCQ Technical Support Center.

REFERENCES:

Phone: +39 06.48.47.90

FAX: +39 06.99.33.15.98

E-mail: support@mcqinst.com

2.3 WHAT'S IN THE PACKAGE?

Before you install the Gas Blender, check the contents of the box against the packed contents check list below. If any of the items have been damaged in transit or are missing, please contact the MCQ Instruments dealer from whom the equipment was purchased.

- Gas Blender 100 Series unit
- Power adapter and power cord
- USB Cable – Type A to B
- 4 x Check valves
- 4x6mm Øtubes of 50cm length
- MCQ Instruments Gas Mixture Creator Installation disk
- Calibration certificate
- User Manual

Section 3 INSTALLING THE GAS BLENDER

3.1 INTRODUCTION

In this release of the MCQ Gas Blender 100 Series, we have provided this User Manual to assist in your setting up the instrument and getting started. This chapter provides more information on the process for your assistance:

- **Gas Blender features**
- **Pre-installation check list**
- **Gas Blender 100 Series hardware installation**
- **Gas Blender 100 Series software installation**
- **Gas Blender 100 Series console connection**

3.2 FEATURES

This section provides a quick hardware setup procedure for the Gas Blender. Follow the steps below to learn more about setting up your instrument:

Front Panel Features

Below is a representation of the front panel (Fig. 1). Familiarizing yourself with the connections will help in properly setting up your Gas Blender.



Fig 1

- **GAS 1** - Gas inserts connected with the airflow sensor of Channel 1, specifically calibrated for your chosen gas (solvent gas).
- **GAS 2** - Gas inserts connected with the airflow sensor of Channel 2, specifically calibrated for your chosen gas (solute gas).
- **GAS 3** - Gas inserts connected with the airflow sensor of Channel 3, specifically calibrated for your chosen gas (solute gas).
- **OUT** - Outlet of the gas mixture dynamically obtained.
- **POWER LED** - This LED indicates the Gas Blender working status. In case of properly working, this LED will flash red after you power on the instrument

Rear Panel Features

Below is a representation of the rear panel (Fig. 2). Familiarizing yourself with the connections will help in properly setting up your Gas Blender.

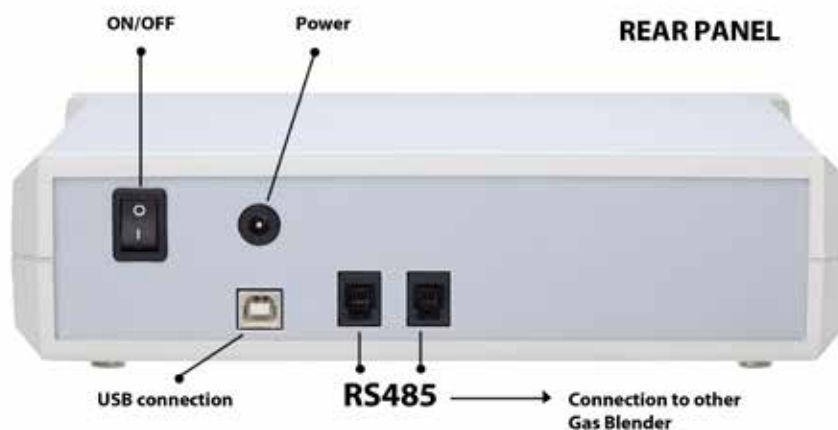


Fig 2

- **ON/OFF SWITCH** – This button controls the Gas Blender power supply.
- **POWER INLET** – The power port attaches to an external power supply included in your package. The other end of the power supply cable connects to a CEE 7/4 electrical socket.
- **USB PORT** – This 2.0 USB port connects the Gas Blender with you PC allowing a full control over the instrument with the MCQ Gas Mixture Creator bundled with product.
- **RS485 PORTS** – *(Function for future use. At the moment not active)*. Via these BUS RS 485 ports, a cascade of up to 64 Gas Blender devices can be created.

3.3 DIRECTIVES APPLIED

2004/108/EC Electromagnetic compatibility 2006/95/EC Low voltage equipment

3.4 STANDARDS APPLIED

EN 61010 Electrical safety
EN 61326-1 e 55011 Electromagnetic compatibility

3.5 PRE-INSTALLATION CHECK LIST

The steps below provide you a quick procedure that must be followed for a proper instrument installation:

- 1. Double-check that gas to be measured are compatible with the instrument.** MCQ Gas Blender 100 Series Modules are compatible with non-aggressive gases. A complete list of non-aggressive gases, compatible with the instrument, is provided in Appendix A (see page 37). In case you need to work with gases not listed in Appendix A, please contact the MCQ Instruments Support Center before operate. The use of inappropriate gases can cause an instrument failure.
- 2. The use of appropriate tubes is strongly recommended for the right functioning of the instrument.** MCQ Gas Blender Series 100 instruments are equipped with female inlet and outlet push-in connectors, designed for tubes with an external diameter of 6 mm. MCQ provides 4 x 6mm diameter tubes to connect the instruments inlets and outlet to the check valves (also provided in the package). The tubes required for valve-cylinder connections are not provided. In case you may need further help for this kind of installation, check the Compatible Tubes List in the Appendix B (see page 37), where you can find some connection solutions suggested by MCQ.
- 3. No need for pipes installation.** Because the flow controllers set up a laminar flow condition within the flow body, no straight runs of pipe are required upstream or downstream of the controller.
- 4. This instrument has internal filters.** The MCQ Gas Blender 100 Series has internal filters near the inlets. These filters themselves provide a proper working of the instrument. However the installation of additional external filters is allowed.
- 5. The instrument has specific power supply requirements.** 16-36 V, min 1,5 A. A power adapter working in the adequate range is provided in the package.
- 6. Do not locate the instrument in areas subject to sudden temperature changes, excessive moisture or near equipment radiating significant amount of heats. Moreover be sure to allow adequate space for cable connectors and wiring.**

3.6 GAS BLENDER 100 SERIES HARDWARE INSTALLATION — —

CAUTION!

Before connecting the gas through the equipment, please verify that the gas pressure is compatible with the instruments specifications (see the Appendix C, page 37).

This section provides a simple step-to-step method for a quick and safe installation of the Gas Blender.

1. **Gas cylinders** - Close the cylinder's main valve. Take a 6 mm external diameter tube and proceed connecting it to the cylinder pressure regulator. For a safe connection a specific rubber holder adapter is usually required (Fig. 3). This procedure must be repeated for each gas cylinder in use.

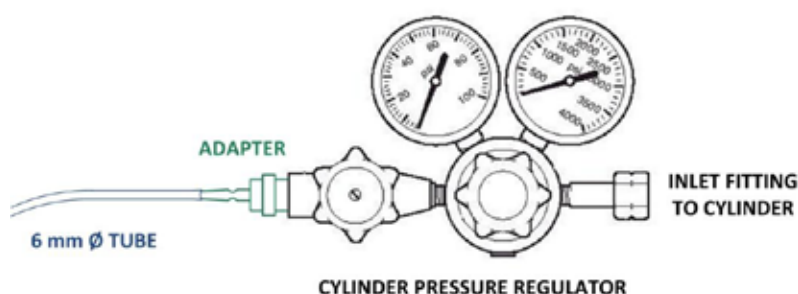


Fig 3

2. **Check valves** - Install the Check valves (provided in the package) along the gas line for each of the gas source in use. In order to do so, take the free end of the tube previously connected to the pressure regulator and insert it in the check valve through the push-in connector. Check valves allow the gas to flow through them in only one direction. Therefore the check valves must be installed in the direction of flow sense, i.e. from the cylinder to the Gas blender (Fig. 4). In case of different valves type use, please contact the MCQ support center.

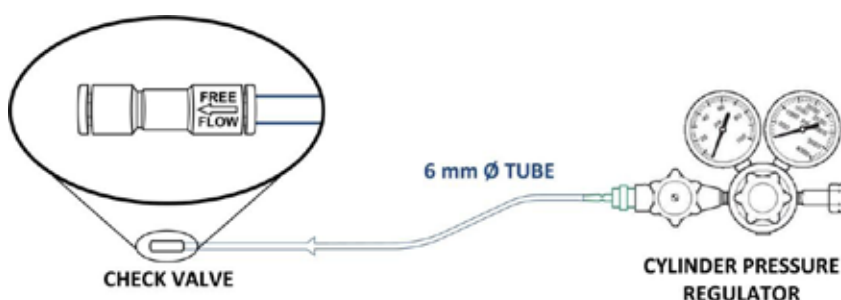


Fig 4

- 3. Gas Blender Inlets** - Check valves must be positioned at a distance of 50 cm from the Gas Blender inlets to secure a proper working of the instrument. For this purpose three 6mm diameter tubes 50 cm long are provided in the package. Take the 50 cm long tube and connect one end with the check valve. Then connect the other end to the instrument dedicated inlet positioned in the Gas Blender front panel (Fig. 5). This procedure must be repeated for each gas cylinder in use. *Note: Channel 1 is designed for the solvent gas.*

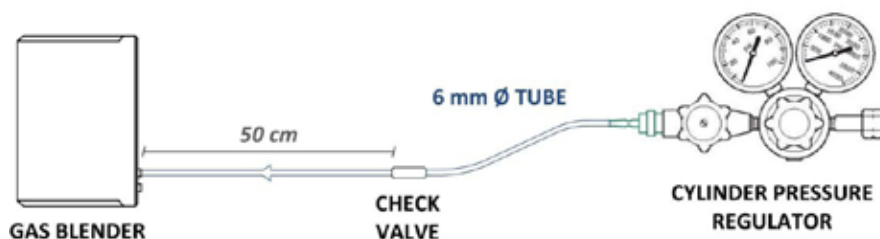


Fig 5

- 4. Gas Blender Outlet** - Another check valve must be positioned at a distance of 50 cm from the Gas Blender outlet to secure a proper working of the instrument. Take the 50 cm long tube and connect one end with the check valve (pay attention: the check valve must always be installed in the direction of flow sense), then connect the other end to your system, as shown in the pictures below (Fig. 6).

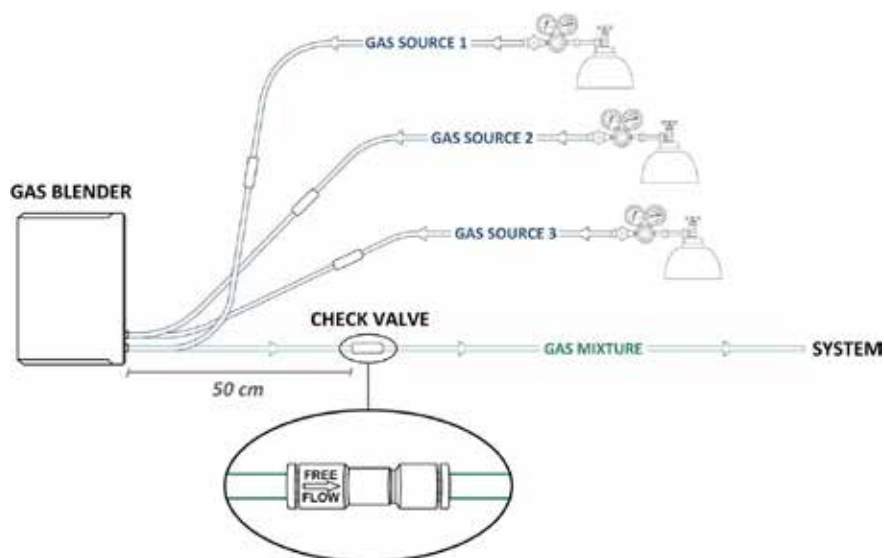


Fig 6

- 5. Power** - Connect the bundled power supply unit to the back dedicated plug of the instrument. Make sure the power plug is connected securely to the instrument. Then, plug the unit into an electrical outlet.
- 6. Console** - Connect the Gas Blender to your PC with the USB cable (provided with the instrument).

3.7 GAS BLENDER 100 SERIES SOFTWARE INSTALLATION — —

Gas Mixture Creator

BEFORE YOU BEGIN: //

Gas Mixture Creator compatibility

The MCQ Gas Mixture Creator is compatible with the following Microsoft Operative Systems:

- **Windows® XP Home edition with Service Pack 3 or more**
- **Windows® XP Professional with Service Pack 3 or more**
- **Windows® Vista**
- **Windows® 7**
- **Windows® 8**
- **Windows® 8.1**

BEFORE YOU BEGIN: //

NET Framework 3.5 installation required

In order to use the MCQ Gas Mixture Creator, the Microsoft .NET Framework 3.5 (or higher) must be installed on your computer. Visit the Microsoft official website, download and install the .NET Framework 3.5 (or higher) version. Installing the .NET Framework libraries will let you work with the Gas Mixture Creator and with all the software designed for the .NET Framework platform.

Gas Mixture Creator Software installation

The MCQ Gas Mixture Creator is a unique and fundamental tool provided by MCQ Instruments for the Gas Blender 100 Series control.

In order to install the software put the MCQ Instruments Gas Mixture Creator Installation USB (provided in the package) in your USB port, navigate to the USB directory, double click on it and then follow the simple installation steps. (Fig. 7-8-9)

	ISSetupPrerequisites	13/05/2015 15:59	File folder	
	0x0409.ini	23/03/2010 15:44	Configuration sett...	22 KB
	Autorun.inf	22/02/2015 17:05	Setup Information	1 KB
	Data1.cab	22/02/2015 15:03	WinZip File	9.109 KB
	Gas Mixture Creator PRO.msi	22/02/2015 15:03	Windows Installer ...	924 KB
	setup.exe	22/02/2015 15:03	Application	1.442 KB
	Setup.ini	22/02/2015 15:03	Configuration sett...	6 KB

Fig. 7

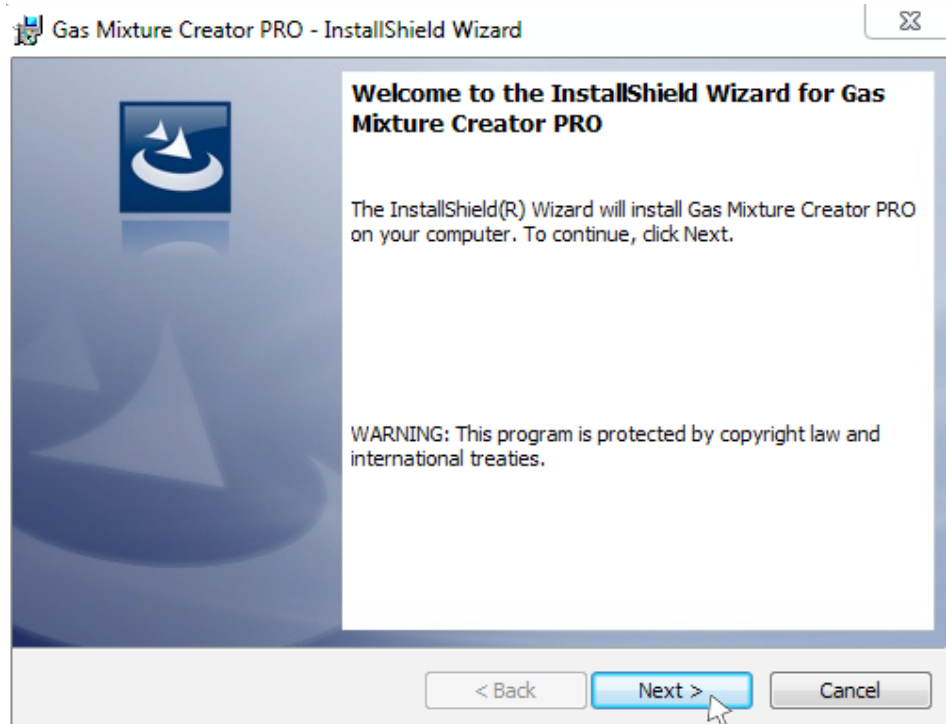


Fig. 8

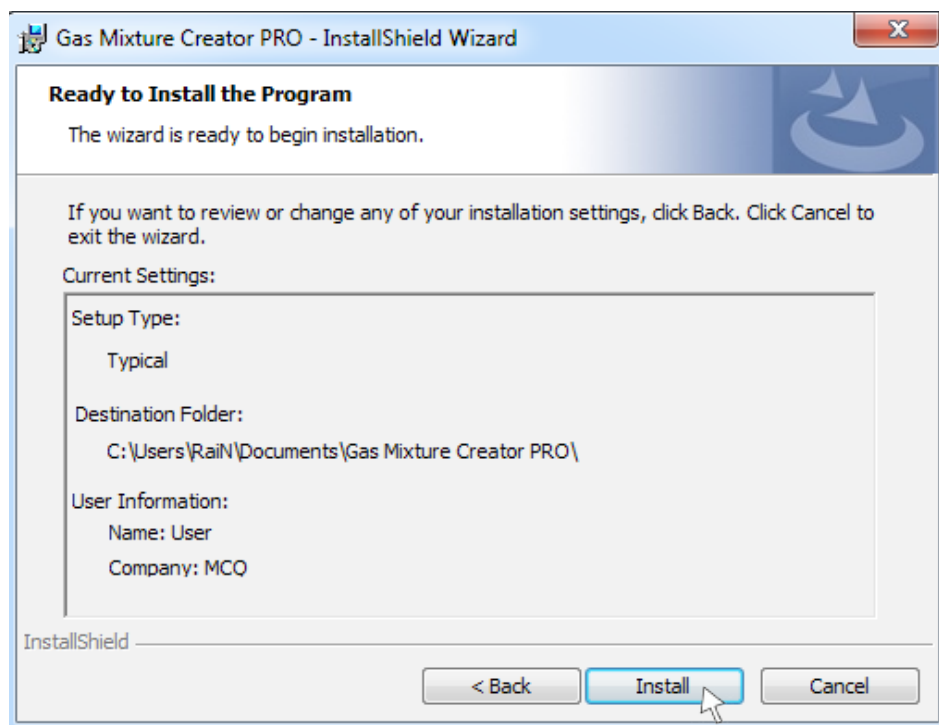


Fig. 9

3.8 GAS BLENDER 100 SERIES CONSOLE CONNECTION - - -

After the MCQ Gas Mixture Creator installation, you will find two icons (Fig. 10) on your desktop.

In order to do so, follow the simple a step-to-step guide (optimized for *Windows 7* users) provided in this section.

Click on “MCQUSBDriver” to install the instruments driver

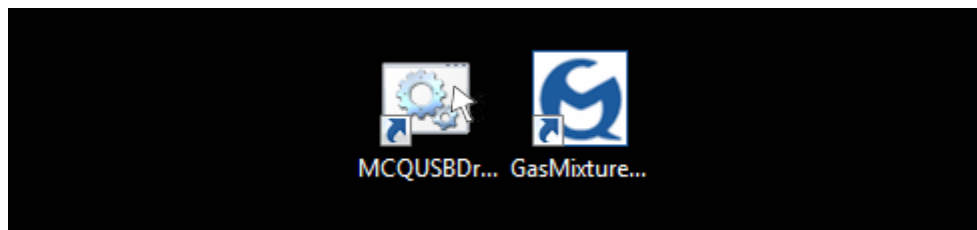


Fig. 10

and follow the procedure clicking on “next” button. (Fig. 11)

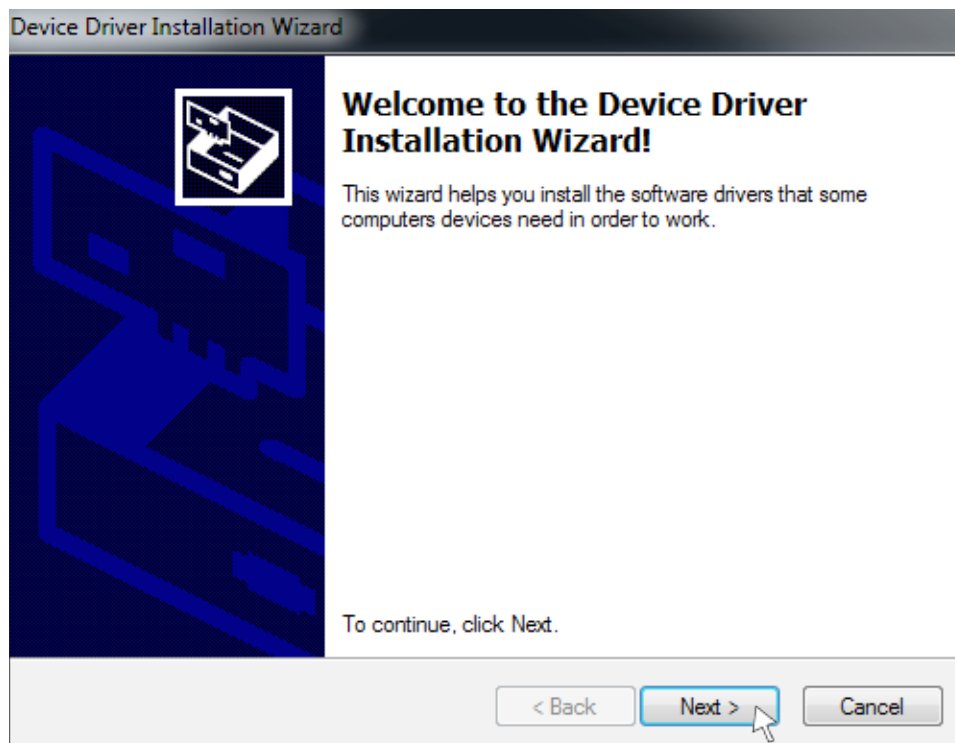


Fig. 11

Then click on “install” (Fig. 12)

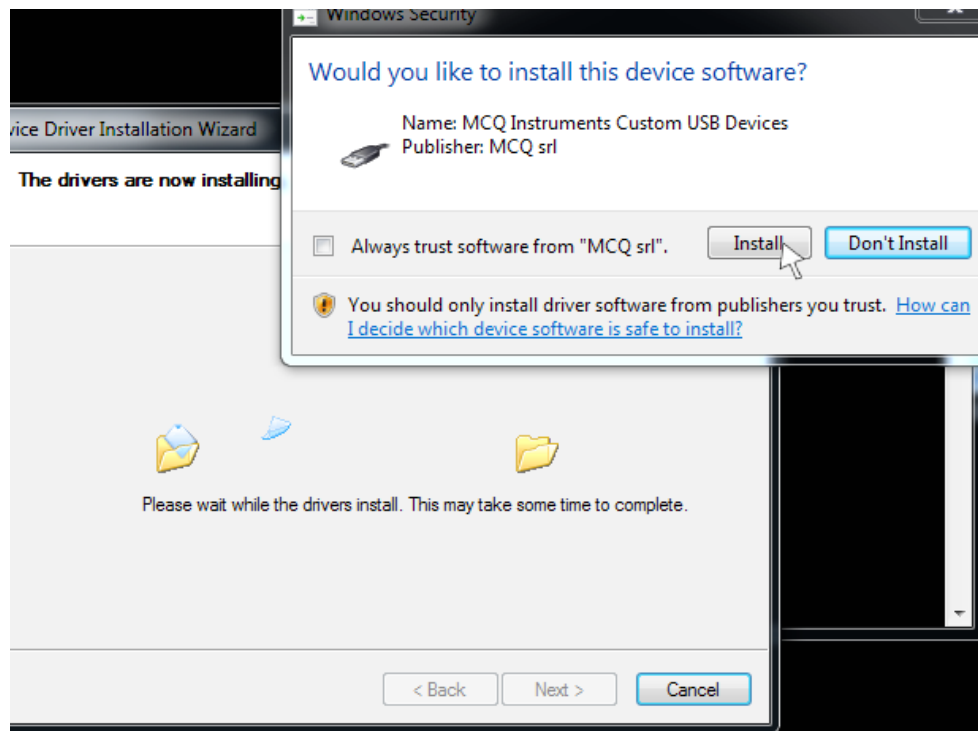


Fig. 12

A new pop-up “Installing device driver software” (Fig. 13) will be displayed on your desktop and automatically in few second it will change in “MCQ Gas Blender 100 Series”. (Fig. 14)

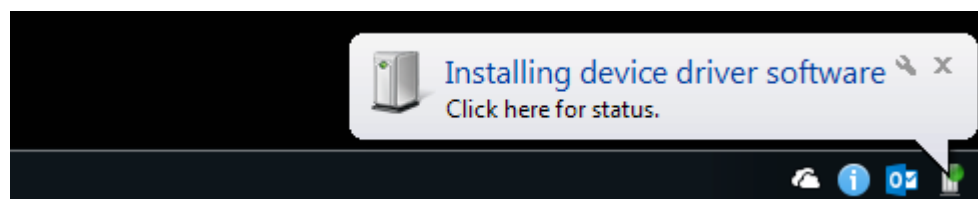


Fig. 13

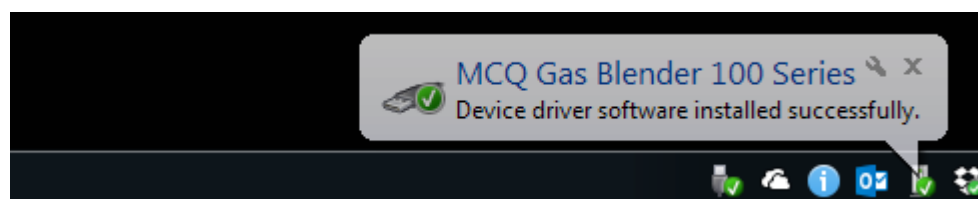


Fig. 14

After the MCQ Gas Mixture Creator installation the Gas Blender must be connected to your console.

- **Power Supply** - Connect the bundled power supply unit to the back dedicated plug of the instrument, then turn on the instrument.
- **USB** - Connect the instrument to your console via the USB cable provided in the package. After this operation, you can use the instrument and the Gas Mixture Creator Software.

Section 4 USING THE MCQ GAS MIXTURE CREATOR

4.1 INTRODUCTION

MCQ Gas Mixture Creator is a user-friendly tool that provides a complete control over the MCQ Gas Blender 100 Series. In this section a simple and quick guide to the MCQ Gas Mixture Creator software is provided.

- **Gas Mixture Creator Configuration**
- **Gas Mixture Creator Features**

4.2 GAS MIXTURE CREATOR CONFIGURATION

The operations described below must be performed after the hardware installation (see the “**Installing the MCQ Gas Blender 100 Series**” section). Working with the Gas Blender requires the configuration of the software instrument connection. The following steps will guide you through the configuration path of the Gas Mixture Creator software.

1. Launch the software double-clicking on the **MCQ Gas Mixture Creator’s** shortcut icon located on your desktop. (Fig. 15)



Fig. 15

2. After the launch, the *Gas Mixture Creator’s* start screen will be displayed as shown in the example below. (Fig. 16)



Fig. 16

3. In case you have not done it before, connect the instrument to your PC with the USB cable provided in the package. The serial number of the Gas Blender in use will be displayed in the button "**Device**". (Fig. 17)



Fig. 17

INSTALLATION COMPLETE

Your MCQ Gas Blender 100 Series is now ready to work!

The instrument settings are configured following your desired customization so you can skip points 4-8 and directly proceed to the next section (**Gas Mixture Creator Features**). For further customization or to change the default settings, keep reading the description below.

4. Click in the **Gas Settings** icon to access the Gas Mixture Creator Setup Panel. (Fig. 18) Once in the panel you can choose between three different sections for the management of the instrument gas sources: **Channels** and **Gas Settings**, **Gas Properties Table** and **Custom Cylinder**.

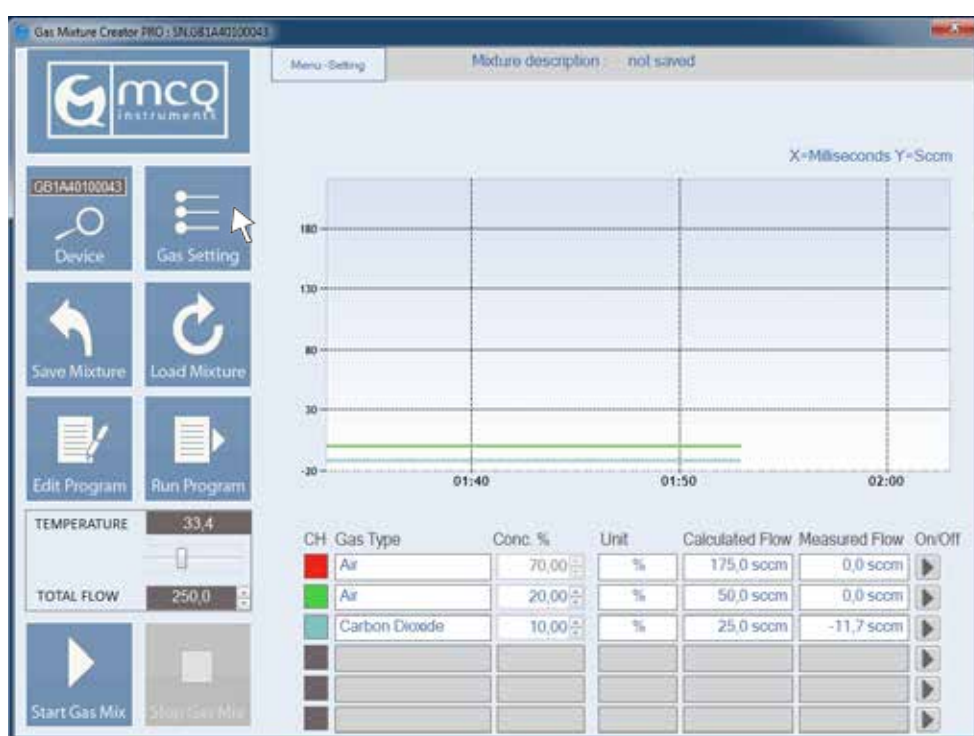


Fig. 18

5. You can also open the panel "**Gas Settings**" clicking on "**Menu Setting**" in the upper side of the software. (Fig. 19)

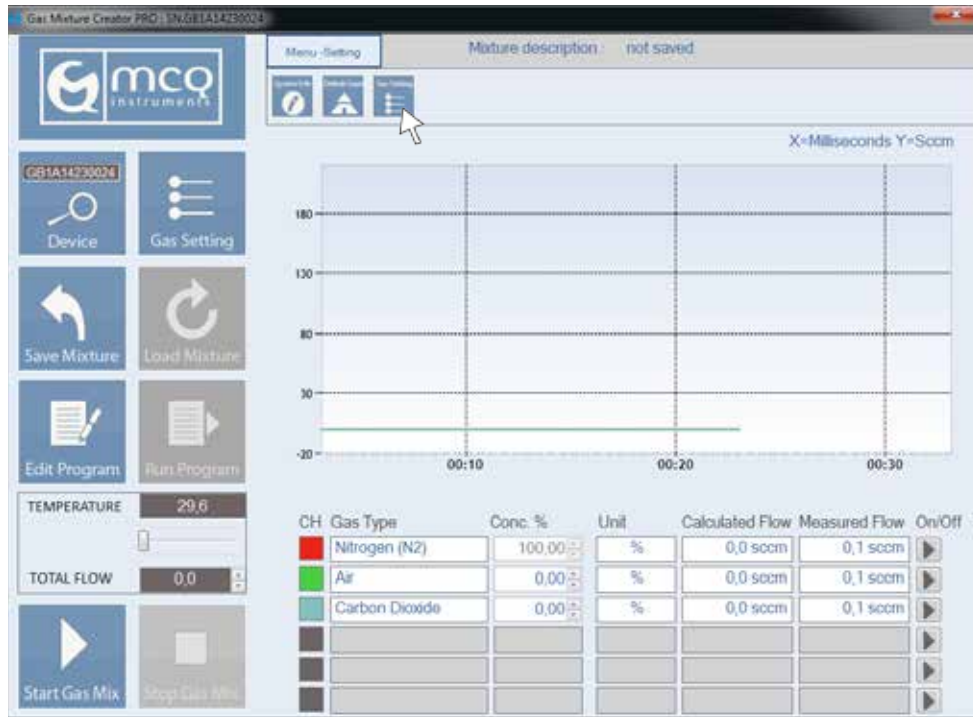


Fig. 19

Channels and Gas Settings

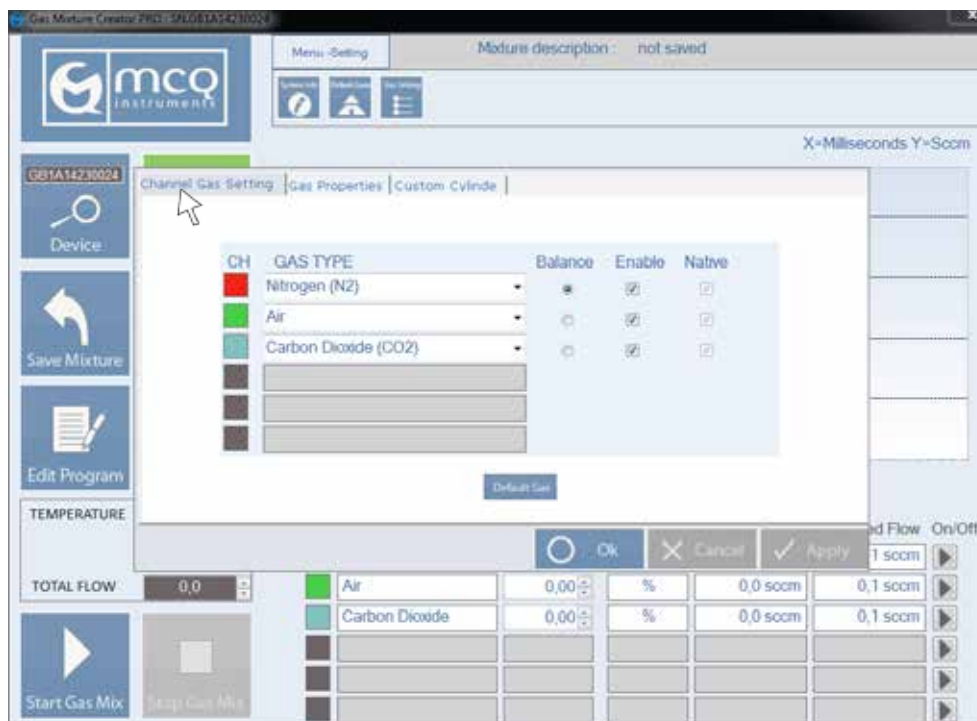


Fig. 20

(Fig. 20) Adjustable parameters (going from left to right):

- **CH** - Indicates the color assigned to each channel. The colors refer to the Gas Blender modules (*Channel 1* controls module 1, *Channel 2* controls module 2 and so on) and therefore cannot be changed.

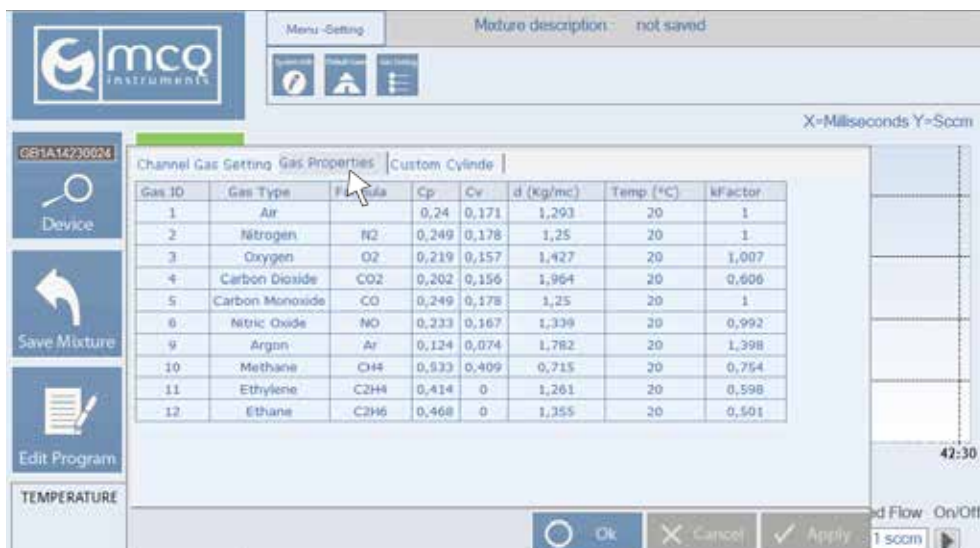
- **Gas Type** - Allows the user to set the gas source type currently in use for each channel. The Gas Blender channels are calibrated by MCQ Instruments according to the user specific request. The software automatically detects the gas type calibration for each channel and displays the corresponding gas type in the pull-down menu as default. The gas type for which each channel has been calibrated is marked by a double star (**).

NOTE: A channel calibrated for a specific gas can still be used to work with another gas type. In case, for example, you need to work with Methane in a channel calibrated for Oxygen, just select "Methane" in the channel pull-down menu list. The channel calibration curve will be automatically adjusted to work with the new selected gas type. Nevertheless the adjustment process is just a mathematical calculation that can determine a small measure accuracy loss.

- **Balance** - Allows the user to set the balance gas (solvent gas) over the available channel list. The balance gas is assigned to the *Channel 1* as default.
- **Enable** - Allows the user to manage up to six different channels. As you are using an MCQ Gas Blender 100 Series, only three channels have been set as enable while the other three are blocked as default. You can enable more channels (e.g. in case you are using a different MCQ Gas Blender model) or block them (e.g. in case you need to work with less than 3 channels) using the check marks and the related ballot boxes.

Gas Properties Table

In this table (Fig. 21) the basic information about a wide variety of gas types commonly used for lab experiments are gathered. The **K factor**, calculated from each gas C_p , C_v , density and temperature values, is also provided. The K factor is used by the software to mathematically adjust the channel calibration curve in case you need to work with gases the channels have not been calibrated for.



Gas ID	Gas Type	Formula	Cp	Cv	d (Kg/mc)	Temp (°C)	kFactor
1	Air		0,24	0,171	1,293	20	1
2	Nitrogen	N2	0,249	0,178	1,25	20	1
3	Oxygen	O2	0,219	0,157	1,427	20	1,007
4	Carbon Dioxide	CO2	0,202	0,156	1,964	20	0,606
5	Carbon Monoxide	CO	0,249	0,178	1,25	20	1
6	Nitric Oxide	NO	0,233	0,167	1,339	20	0,992
9	Argon	Ar	0,124	0,074	1,782	20	1,398
10	Methane	CH4	0,533	0,409	0,715	20	0,754
11	Ethylene	C2H4	0,414	0	1,261	20	0,598
12	Ethane	C2H6	0,468	0	1,355	20	0,501

Fig. 21

Custom Cylinder (Only available in the .PRO Version)



Fig. 22

With this function, you can create your own cylinder composition and maximize the accuracy of the instrument. **Custom cylinder** function allows you to create a no-pure gas cylinder and to calculate the correct K-Factor. After chosen the name of your own cylinder you can set the main component and the percentage in %, ppm or ppb of the minor gases and visualize the calculated K-Factor.

Adjustable parameters (going from up to down):

- **ID100,101,102** – Here (Fig. 23) you can indicate the name you will choose for your custom cylinder.

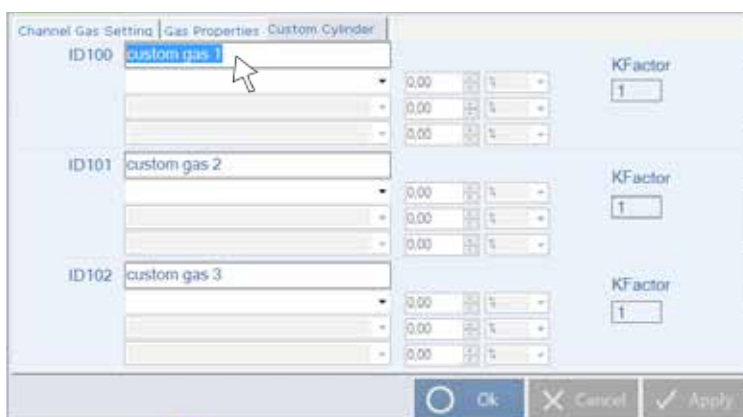


Fig. 23

- **Pull Down Gas Menu** – Here (Fig. 24) you can indicate the gas type you will choose for your custom cylinder.

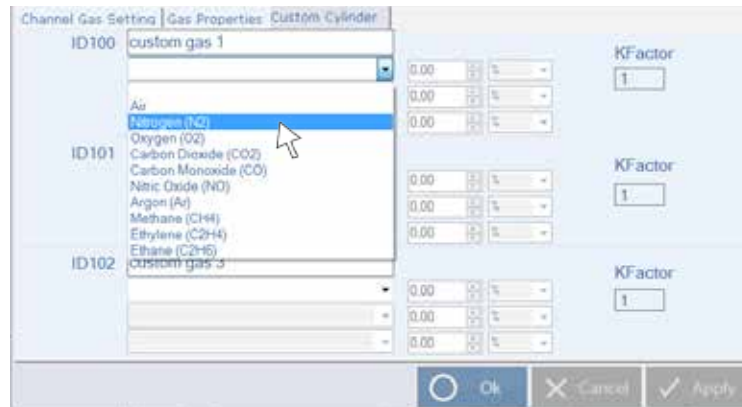


Fig. 24

- **Concentration and Unit** – Here (Fig. 25) you can indicate the concentration you need for each component and the measure unit (ppb, ppm or %).

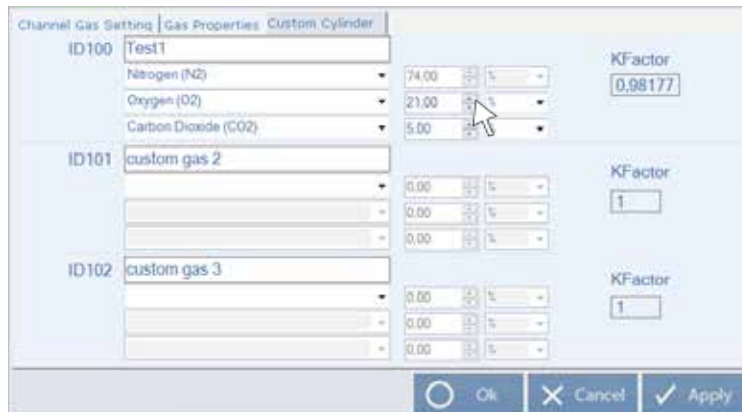


Fig. 25

Once you have chosen the percentage for each component a new k-factor is calculated then click Apply to save the created Custom Cylinder. (Fig.26)

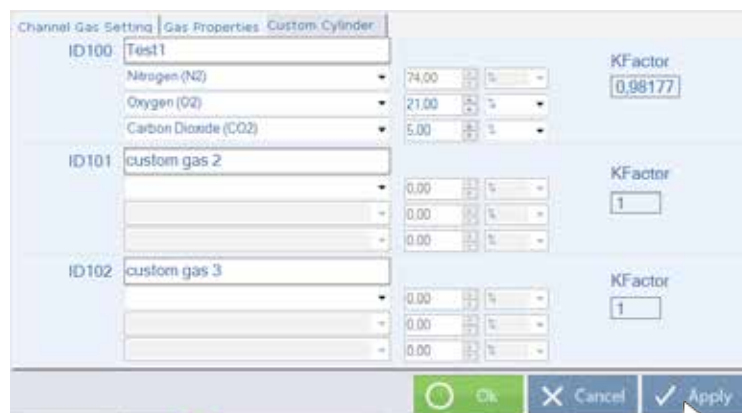


Fig. 26

You can select your created custom cylinder in the panel “**Channel gas setting**” by select the Custom gas you have previously created (i.e. TEST1). (Fig. 27)

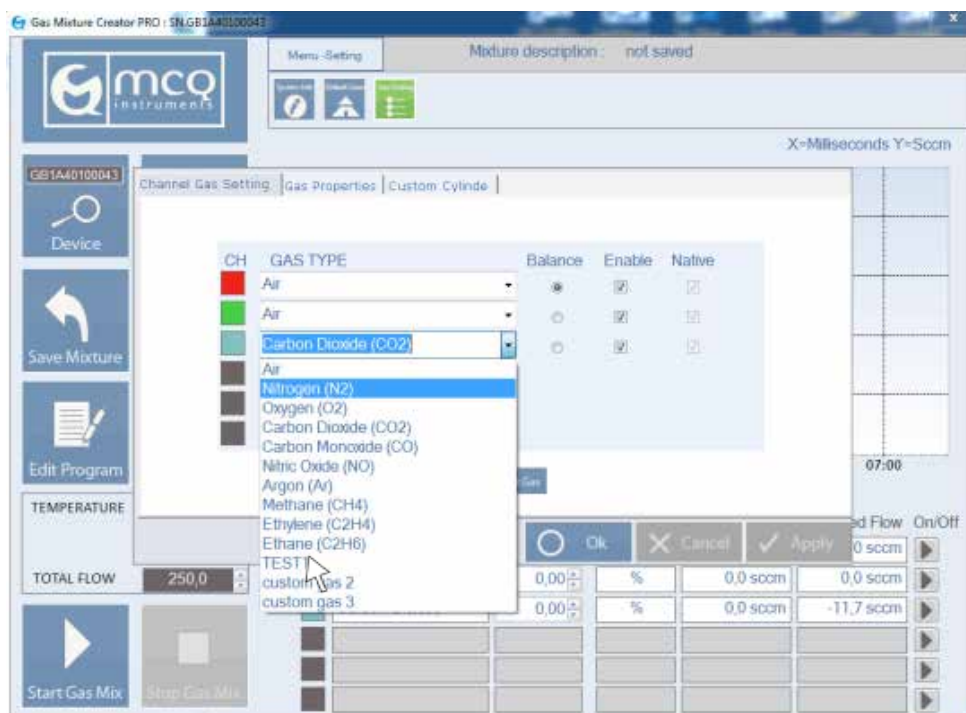


Fig. 27

6. Go back to the **Channels** and **Gas Settings** section and click on the **APPLY** button to make your adjustments effective. Moreover the panel commands allow you save and store you desired instrument configurations in case you may need to recall them for future applications.
7. The Gas Blender 100 Series allow you to work with dynamic gas mixture. Nevertheless the frequent use of a specific mixture (i.e. a specific instrument configuration) may be required. (Fig. 28) Use the **Save Mixture** command to store your desired mixture configuration in the instrument memory and the **Load Mixture** command to recall it whenever you need it. The Saved mixture will be automatically reloaded at each instrument start-up.

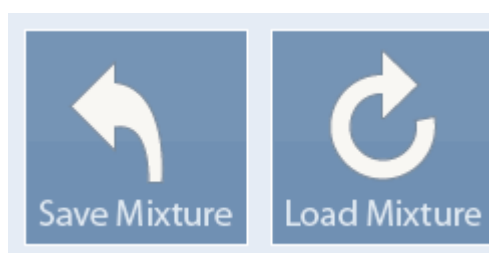


Fig. 28

8. Click on the **System Info** button (Fig. 29) to access the Gas Mixture Creator Info panel. The panel is divided in three sections: **General Info**, where basic hardware information about the instrument is provided; **Modules Info**, where basic hardware information and configuration settings of each module is provided; **Device Software**, where basic information about the software itself is provided.

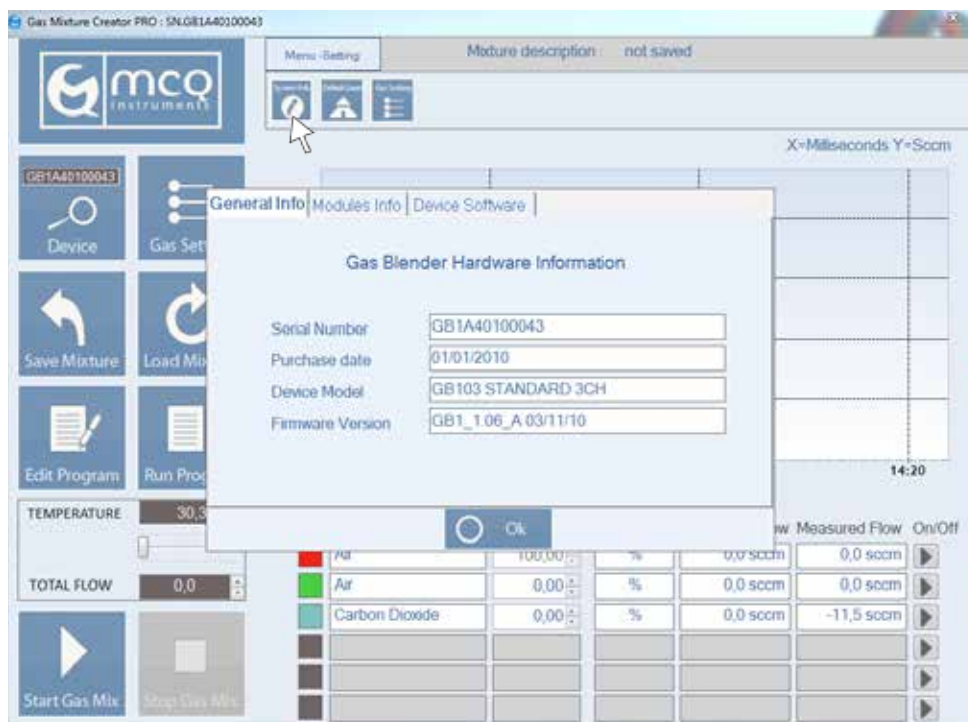


Fig. 29

4.3 GAS MIXTURE CREATOR EDIT – RUN PROGRAM — — —

(Only available in the .PRO Version)

In this menu, you can create, save and load your automatic mixture program.

Set the percentage of each channel, the total flow of the mixture and the time work (h, min, s). You can add, delete, copy and paste all the lines you need. Once the program will be created you can choose to save it in an external file and to recall it when you need it.

1. Launch the “**Edit – Run program**” clicking on the MCQ Gas Mixture Creator’s icon named “**Edit Program**”. (Fig. 30)

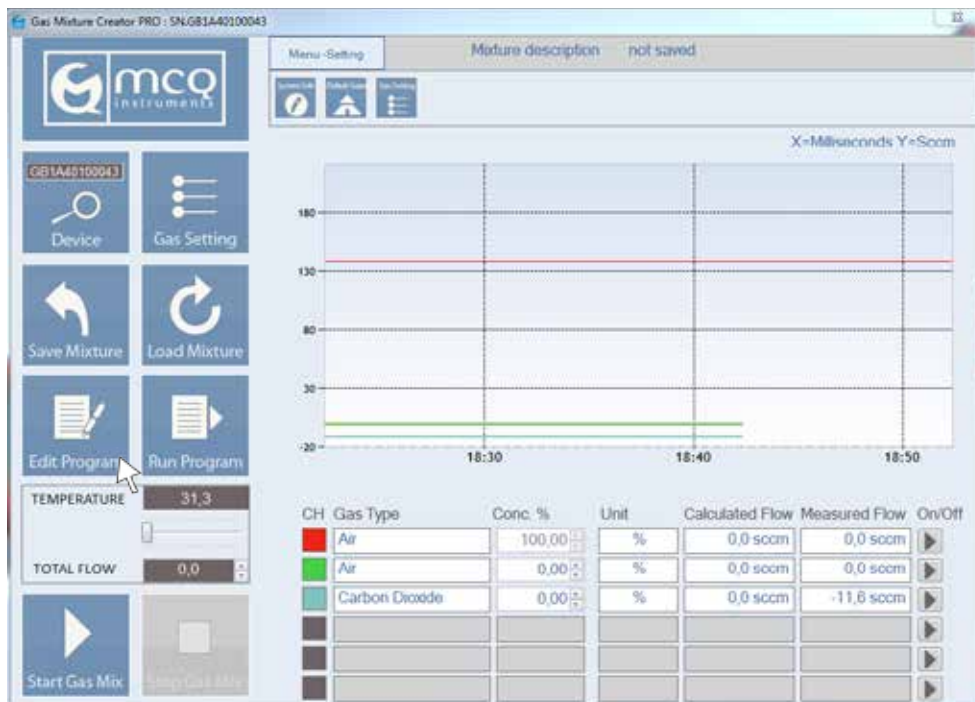


Fig. 30

2. After the launch, the “**Edit – Run Program**” start screen will be displayed as shown in the example below. (Fig. 31)

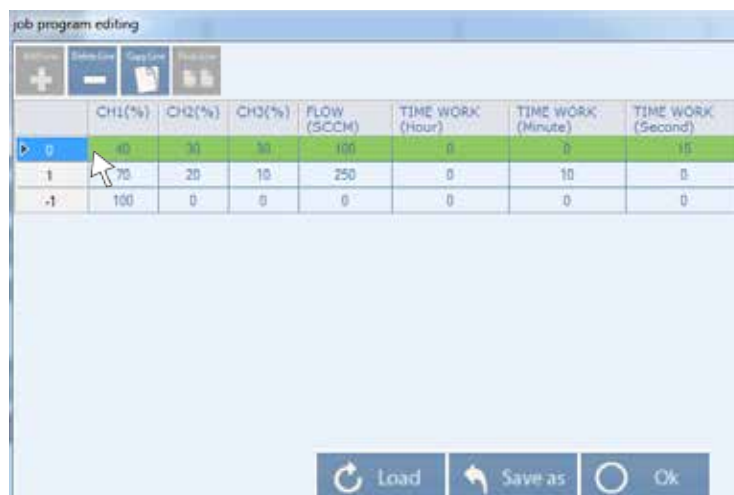


Fig. 31

Adjustable parameters (going from left to right):

- **CH (%)** - Indicates the percentage of gas assigned to each channel. The numbers refer to the Gas Blender modules (*Channel 1* controls module 1, *Channel 2* controls module 2 and so on) and therefore cannot be changed.
- **Flow (sccm)** – Indicates the Flow in sccm you want to set for the total mixture.
- **Add Line** – Allows you to add a new line for a new mixture
- **Delete Line** – Allows you to delete a created line
- **Copy/Past Line** – Allows you to Copy and/or Past one or more created lines.

Note: New lines could be added only once you have inserted all the parameters for the previous lines: Percentage for each channel, Total Flow and Time Work. Without this parameters a new line can't be added, copy or pasted.

3. Once you have created your “program job” you can **save** it in an external file with your desired name (i.e. TEST123). (Fig. 32)

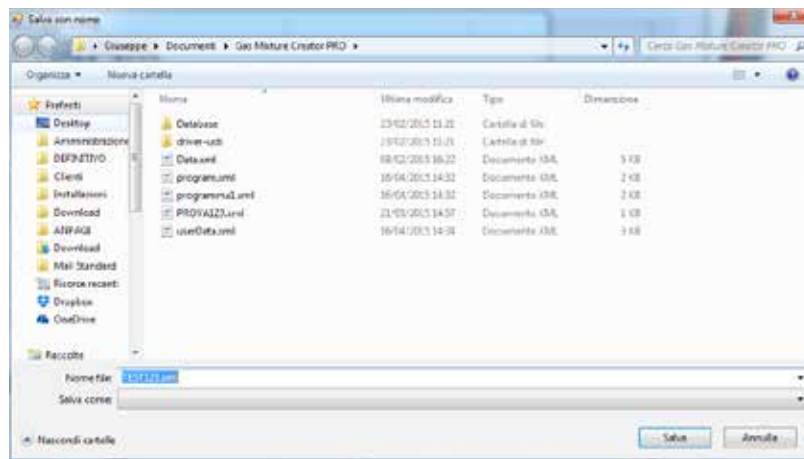


Fig. 32

4. If you have previously created your programs and you want to recall it, click on the button “**Load**”. Select the folder you have created to save your program, double clicking on your desired program and open it. (Fig. 33)

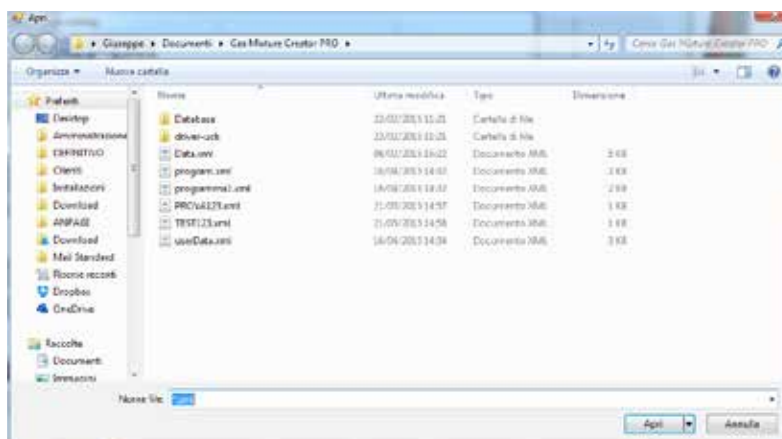


Fig. 33

- To RUN your created program, once you have load it, click on the button "**Load Program**" in the main screen of the software. A confirmation windows will be open and then click "**yes**". (Fig. 34)

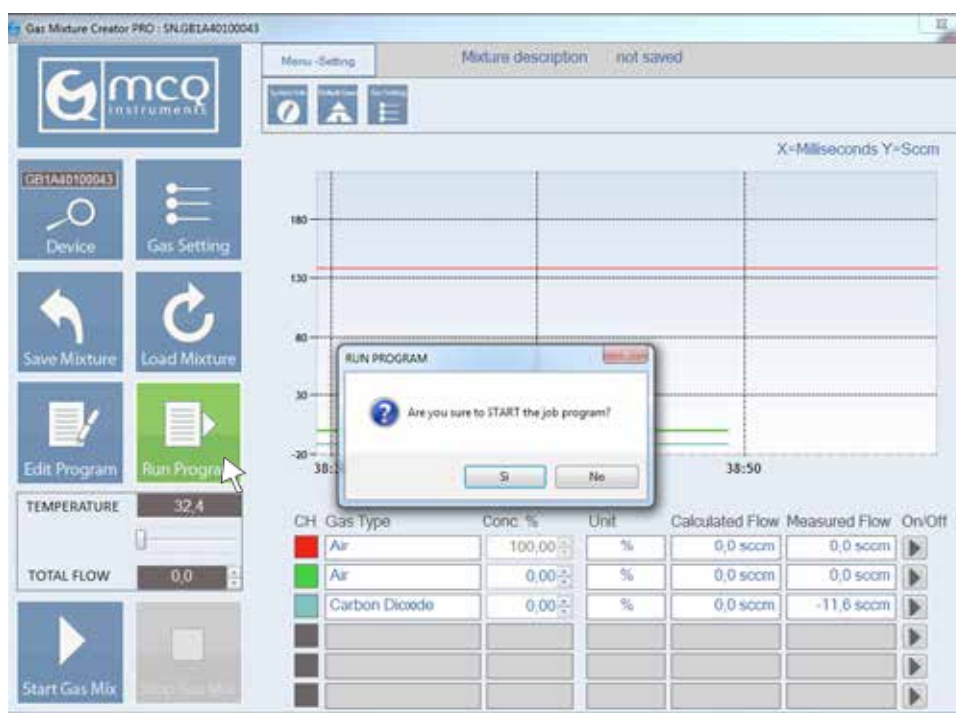


Fig. 34

- If a program will be activated, the icon "**Run Program**" change its color in **orange** (Fig. 35) and you can control the steps you have memorized in the upper part of the main window.

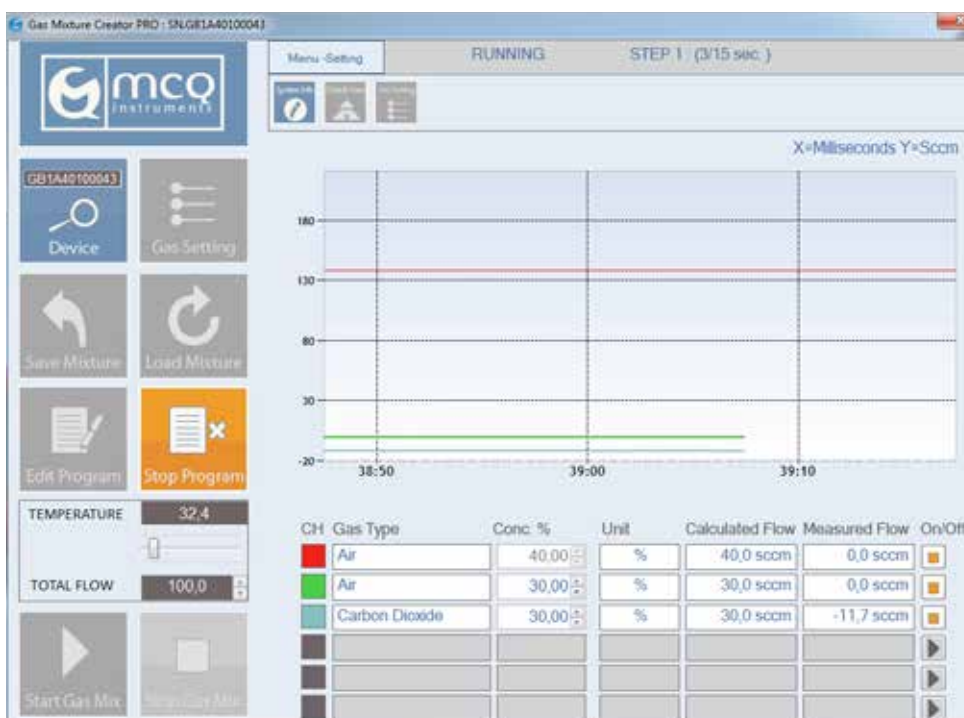


Fig. 35

4.4 GAS MIXTURE CREATOR FEATURES

In this section the Gas Mixture Creator main features and the basic commands are shown. The picture below shows the Gas Mixture Creator main screen divide in three sections: **Monitoring Section**, **Gas Mixture Control** and **Channels Control**.



Fig. 36a

Monitoring Section

The monitoring section provides an array of real time information about the Gas Blender working status. As shown in the picture below (Fig. 36) this section has been divided in 2 subsections:



Fig. 36

1. **System Temperature Display** – Shows the Gas Blender internal temperature, measured inside the instrument box (unit of measure = °C).
2. **Flow Rate Plot** – Shows the flow rate vs. time trend for each channel. Values are plotted in sccm (y axis) vs. milliseconds (x axis).

Gas Mixture Control

This section provides the user the gas mixture flow rate control commands. As shown in the picture below (Fig. 37), this control section allows the user access to the following commands:



Fig. 37

- 1. Mixture Flow Rate Digital Regulation** – Allows the user to set the gas mixture total flow rate (u.m. = sccm). The mixture flow rate is the sum of the single channels flow rates. Since the single channel working range is 0.01-200 sccm, the working range for the gas mixture is 0.01-600 sccm. The mixture flow rate max value depends on the channels flow rate regulation and cannot exceed the sum of the single channels outcome.

e.g.

The three channels have been regulated to supply the same amount of gas flow. Since each channel max flow rate value is 200 sccm, the mixture max available outcome is 600 sccm (Case A). Using the digital mixture flow rate regulation the user sets 300 sccm as the total outcome. The software automatically adjusts the single channels flow rate to obtain 300 sccm as a sum of them. The single channel flow rate for each channel is then set to 100 sccm (Case B).

Case A

Mixture max outcome = 600 sccm

Channel 1 = 200 sccm

Channel 2 = 200 sccm

Channel 3 = 200 sccm

Case B

Mixture max outcome = 300 sccm

Channel 1 = 100 sccm

Channel 2 = 100 sccm

Channel 3 = 100 sccm

- 2. Mixture Flow Rate Analog Regulation** – By slide the grey knob the user can set the gas mixture total flow rate percentage. The functioning principle of the knob is the same of the digital regulation, with the exception that the gas mixture flow rate max value is displayed as a percentage.

e.g.

Working with the same conditions as before, in Case A the user sets the total mixture flow rate at 100%, obtaining 600 sccm of mixture outcome; in Case B the user sets the total mixture flow rate at 50%, obtaining 300 sccm of mixture outcome.

Case A**Mixture total flow rate = 100%**

Mixture max outcome = 600 sccm

Channel 1 = 200 sccm

Channel 2 = 200 sccm

Channel 3 = 200 sccm

Case B**Mixture total flow rate = 50%**

Mixture max outcome = 300 sccm

Channel 1 = 100 sccm

Channel 2 = 100 sccm

Channel 3 = 100 sccm

3. **Mixing commands** – The **Start Gas Mix** and the **Stop Flow** buttons give the user the control over the gas supply.

Channel Control

This section provides the user the basic information and the channels flow rate control commands for each channel (Fig. 38).

CH	Gas Type	Conc. %	Unit	Calculated Flow	Measured Flow	On/Off
1	Air	100,00	%	0,0 sccm	0,0 sccm	▶
2	Air	0,00	%	0,0 sccm	0,0 sccm	▶
3	Carbon Dioxide	0,00	%	0,0 sccm	-11,5 sccm	▶
4						▶
5						▶
6						▶

Fig. 38

- **Gas Type Display** – Indicates the gas type assigned to each channel. The *Channel 1* is assigned to the solvent gas as default, while the *Channel 2* and *Channel 3* are assigned to the solute gases. These settings can be changed in **Gas Mixture Creator Setup Panel**.
- **Concentration & Unit Regulation** – Allow the user the set the desired flow rate for each channel. The flow rates are displayed in percent unit. The *Channel 1* concentration value cannot be directly changed by the user, while the *Channel 2* and *Channel 3* concentration values can be adjusted by using the small arrows or directly typing the desired amount in the related boxes. Increasing a solute gas concentration will involve a consequently decrease in the solvent gas concentration. For that reason the flow rate concentration value for *Channel 1* is automatically adjusted by the software, so that the sum of the three channels concentration is always set at 100%.

e.g.

Case A. As shown in the picture above the *Channel 2* (Carbon Dioxide) concentration is set at 35.00%, while the *Channel 3* (Oxygen) concentration is set at 20.00%. The *Channel 1* concentration is then automatically adjusted at 45.00% ($45+35+20=100$).

Case B. The *Channel 2* concentration is then decreased to 15.00% while the *Channel 3* concentration is increased up to 25.00%. The

Channel 1 concentration is then automatically adjusted at 60.00% (60+15+25=100).

Case A

Channel 1 concentration = 45.00%

Channel 2 concentration = 35.00%

Channel 3 concentration = 20.00%

Channels concentration sum = 100.00%

Case B

Channel 1 concentration = 60.00%

Channel 2 concentration = 15.00%

Channel 3 concentration = 25.00%

Channels concentration sum = 100.00%

- **Calculated Flow Display** – Indicates the flow rate (u.m. = sccm) set for each channel. Once the user has selected the desired flow rate concentration for each channel and the desired total flow outcome (whose control is located in the **Gas Mixture Creator Setup Panel**) these values are automatically calculated by the software.
- **Measured Flow Display** – Indicates the flow rate (u.m. = sccm) measured by the instrument for each channel. The MCQ Gas Blender 100 Series works with 0.1% of tolerance threshold between the calculated and the measure flow rate value for each channel.
- **On/Off Display** – Indicates the status for each channel. Four different statuses are available for the channels:



CHANNEL STOPPED

At the software start up all the channels are stopped. While in this status the channels don't erogate gas.



STOP CHANNEL

*Once you have clicked on the **Start Gas Mix** button the channels are activated and you can see this icon. Clicking on the icon the specific channel pass in the stopped status.*



START CHANNEL

Clicking on the icon the specific channel pass in play status.

Section 5 MAINTENANCE REQUIREMENTS

5.1 INTRODUCTION

This section will provide the general guide lines for the proper maintenance of the Gas Blender 100 Series and its external components. This section is divided in the following 3 areas:

- **Gas Blender maintenance**
- **External Tubes maintenance**
- **Check Valve maintenance**

5.2 GAS BLENDER MAINTENANCE

The MCQ secures the proper functioning of the Gas Blender 100 series without the need of any specific routine maintenance. In case of improper working, all the MCQ products must be maintained, cleaned, and repaired only through the MCQ Support Center.

MCQ reminds you that the calibration of each channel is considered expired after 1 year. MCQ doesn't secure 1% of accuracy for a channel with an expired calibration. Please contact the MCQ Support Center for the annual calibration service.

5.3 EXTERNAL TUBES MAINTENANCE

The polyurethane tubes provided with the instruments don't require any routine maintenance. In case of switch between different working gasses, MCQ suggest a small purge (5-10 minutes with pure nitrogen) in order to clean any possible gas trace from the tubes.

5.4 CHECK VALVES MAINTENANCE

The check valves bundled with the instrument are SMC AKH-06 Check Valves. The SMC itself does not suggest any specific maintenance for this kind of product. The following specification are provided by SMC:

Proof Pressure	<i>15 bar</i>
Operating Pressure Range	<i>-1 bar to 10 bar</i>
Cracking Pressure	<i>0,05 bar</i>
Ambient Temperature and Operating Gas Temperature	<i>-5°C to 60°C</i>
Applicable Tubing Materials	<i>Nylon, Polyurethane</i>

Section 6 WARRANTY TERMS AND CONDITIONS

Introduction

The following terms and conditions shall discipline the warranty recognized by the manufacturer on "Gas Blender serie 100" and/or any other product sold by MCQ s.r.l. in addition to the clauses, terms and conditions contained in the individual contracts, without any exception, offers and acceptances of orders, invoices and/or any other negotiation papers and documents.

Subject

MCQ s.r.l. ensures that its hardware product is free from defects in material and workmanship occurring under normal use of the product. In the event that defects listed in the previous paragraph occur within the warranty period and the buyer submits a valid notice, MCQ s.r.l. shall replace or repair the product, at its sole discretion, prior technical assessment of the actual existence of the alleged defect. If the warranty grantor opts for replacing the product, MCQ s.r.l., at its sole discretion, shall deliver to the buyer either a new product or a functionally equivalent product. In case of replacement option, the property of the product replaced shall pass to MCQ s.r.l.

Warranty Period

The warranty set forth in paragraph 2 shall remain valid for a period of one year from the date of purchase. In order to ascertain the period indicated in the previous paragraph, it shall be considered the original invoice date, in which must be clearly stated date of purchase, model and serial number of the product for which is requested assistance under warranty.

Exclusions and limitations

A) MCQ s.r.l. shall not guarantee for:

- Uninterrupted operation;
- Uninterrupted or error-free operation of the product;

Product repair and/or replacement, as provided under this warranty, do not involve the extension or renewal of its starting date. Both repair and replacement, performed by virtue of this warranty as described in item 2, can also be realized using parts or units not identical but functionally equivalent to that of the product subject to repair or replacement. This warranty shall not be extended to cases other than defects in materials and production. This warranty shall not be recognized at any rate, and therefore not applied and expressly excluded, where defects complained and found result from damage, misuse, tampering, negligence or neglect, alterations or repairs performed by unauthorized people. In particular, but not limited to, this warranty shall not be recognized in case of defects or damages arising from:

- Using product under conditions other than usual;
- Using product under environmental conditions other than those listed in the user manual;
- Misuse and/or improper and/or unauthorized use other than that provided in the user manual;
- Performing, in general, any alteration and/or change to the product;
- Performing incorrect and/or improper maintenance;
- Performing incorrect controls and/or any improper operation;
- Performing an improper and/or inadequate calibration, and not executed and/or authorized by MCQ s.r.l.;

- Performing an improper and/or inadequate calibration, and/or executed with gases other than those specified in the user manual;
- Performing an improper or inadequate removal and/or intervention on the product, and not executed and/or authorized by MCQ s.r.l.;
- Repairs and/or opening of the product performed by people not authorized by MCQ s.r.l.;
- Abuse or misuse, including but not limited to, the inability to use the product for common purposes or in accordance with provisions listed in the instructions for use and maintenance provided by MCQ s.r.l.
- Using product together with accessories not approved by the MCQ s.r.l. as suitable and/or compatible with it.
- Malfunction of the product arising from incorrect installation or use not conform to technical or safety standards currently in force, or made in violation of instructions contained in the user manual;
- Accidents, natural disasters and/or any other external cause, however not controlled by MCQ s.r.l., even if caused by lightning, water, fire, riots and improper ventilation.
- Moisture, liquid and any infiltration including those of beverages and/or food;
- Normal and/or natural wear and tear;
- Shipment of the product for whatever reason and purpose;

This warranty shall not be recognized at any rate, and therefore not applied and expressly excluded, in case of inspections, maintenance, repair and replacement of parts resulting from natural wear and tear.

- B) The information in this document constitutes the sole and exclusive warranty provided and recognized by MCQ s.r.l. and replaces and excludes any other expressed and/or implied, oral and/or written applicable warranty and/or general condition. It shall be in particular considered unrecognized and excluded, for implicit or explicit defects including, but not limited to, warranties of marketability, satisfactory quality, suitability for use and specific purposes. Subject to any limit provided by law applicable to sales of the product and validity of any specific legislation protecting consumers.
- C) In no event, MCQ s.r.l. can be and shall be liable for any direct, special, indirect or related damage arising and/or related and/or carried forward to any defect in the product, even if under warranty solved, as well as for any breach of warranty and/or any other agreement and/or arrangement and/or obligation, even if recognized and/or recognizable by law. In the exemption referred to in the preceding paragraph shall be considered including, but not limited to, damages resulting from loss of annual turnover, loss of anticipated or immediate revenue (including loss of profits arising out of contract), loss of liquidity, lost of savings, loss of business, loss of opportunity, loss of goodwill, damage to the image, loss and/or damage and/or alteration of data, any other damages even indirect and/or consequential and/or otherwise related, including equipment replacement costs and property in general, costs of recovery and/or programming and/or reproducing any program or data stored. In no event, MCQ s.r.l. shall still be held liable for any amount above the purchase price of the product under warranty and actually paid by the buyer. Subject to any limit provided by law applicable to sales of the product and validity of any specific legislation protecting consumers.

Request intervention under warranty

- A) To request warranty, the buyer shall promptly send an intervention application by e-mail at support@mcqinst.com, enclosing the form No. 1 to this document completed in its entirety.
- B) Under the provisions of the preceding paragraph, M.C.Q. s.r.l. shall consider and decide, in the time and manners deemed appropriate, about a possible return of the product.
- C) If a return of the product is deemed necessary, the buyer shall received by M.C.Q. the RMA (Return Materials Authorization) form as attached No. 2 to this document.
- D) The buyer shall promptly complete the RMA form and return it to MCQ s.r.l.
- E) Executing all specific information provided by MCQ s.r.l., the buyer shall be required to return the product, using the same carrier who performed the initial delivery of the same good, anticipating all costs, taking care to prepare all the necessary customs documentation required by the legislation of the sending nation and fulfilling any other incumbent may be required to perform the shipment.
- F) Received the product on time and in the manner deemed most appropriate for the specific case, MCQ s.r.l. shall perform and verify the existence of the claimed defect and possible causes that produced it.
- G) Once checks referred to in paragraph F shall ascertain the validity of the warranty coverage, M.C.Q. s.r.l. shall:
 - repair and/or replace and/or recondition the product, choosing, at its sole discretion, the solution deemed most appropriate;
 - return the product to the buyer, claiming the cost of shipping;
 - reimburse the buyer of any shipment cost sustained in advance for the product return;
- H) In the event, checks referred to in paragraph F shall not ascertain the validity of the warranty coverage, MCQ s.r.l. shall:
 - formulate a repair estimate showing an effective date;
 - communicate the estimate to the buyer.

The buyer, within the period of validity of the estimate, shall reply sending an e-mail at support@mcqinst.com, expressly declaring its approval of the estimate received or, alternatively, a request to return the product without performing no intervention on it, remaining in this case at its charge any shipping expenses. Both in case of acceptance of the estimate and request for a product return, all shipping costs shall be borne by the buyer. In case of no acknowledgment of the buyer within six months from the estimate receipt, the product shall be retained by MCQ s.r.l. becoming a property of the same company. The purchase and use of the product by the buyer shall be expressly subject to acceptance of the warranty set forth herein.

APPENDIX - A

GAS MEDIA COMPATIBILITY

The MCQ Gas Blender 100 Series incorporates components made of non-reactive material that are compatible with a wide variety of gaseous media. This Appendix provides a list of non-aggressive gases compatible with the instrument.

Gas Media	MCQ Gas Blender 100 Series
<i>Air</i>	●
<i>Nitrogen</i>	●
<i>Oxygen</i>	●
<i>Argon</i>	●
<i>Natural Gas</i>	●
<i>Nitrous Oxide</i>	●
<i>Anesthetic Gasses</i>	N/A
<i>Carbon Dioxide</i>	●
<i>Nitric Oxide</i>	Dry Gas Only
<i>Sulfur Oxide</i>	Dry Gas Only
<i>Water Vapor</i>	Non-condensing
<i>Ammonia Gas</i>	Dry Gas Only, <0,1%
<i>Chlorine Gas</i>	<0,1%
<i>Hydrogen Sulfide</i>	<0,1%

APPENDIX - B

COMPATIBLE TUBES LIST

This appendix provides you a list of tube compatible with the MCQ Gas Blender 100 series. For your laboratory applications involving the Gas Blender the following type of tube can be used:

- **Soft Polyurethane**
- **Fluorinated Ethylene Propylene (FEP)**
- **Stainless Steel**

The MCQ Gas Blender 100 Series utilizes soft polyurethane tubes for both internal and external connections.

APPENDIX - C

PERFORMANCE SPECIFICATIONS

In this appendix the Gas Blender 100 Series internal and external working specifications are listed. Use this performance specifications in order to ensure a safe and proper use of the Gas Blender. MCQ is not responsible for any instrument damage caused by an inappropriate use of the instrument itself.

<i>Accuracy</i> (For each Channel)	N2, 20°C, 101.325 kPa (1 atm)	
	5 - 100% FS	1% of set point
	< 5% FS	0,2% of FS
<i>Repeatability</i>	0,16% of reading	
<i>Response Time for change of SetPoint</i> (For each Channel)	50 ms	
<i>Power Supply</i>	16 - 36 V DC - min 1,5A	
<i>Operating Pressure for Inlet Gasses</i>	Max 25 psi	
<i>Operating Internal Temperature Range</i>	0 to 50° C	

EXTERNAL SPECIFICATIONS

<i>Operating External Temperature Range</i>	-25 to 85° C
<i>Optimal External Pressure</i>	100 kPa (1 bar)
<i>Optimal External Humidity</i>	30 to 50% relative humidity

APPENDIX - D

OPERATING SPECIFICATIONS

In this appendix the Gas Blender 100 Series operating specifications are listed. These specification must be followed to ensure the proper use of the Gas Blender. MCQ is not responsible for any instrument damage caused by an inappropriate use of the instrument itself.

<i>Mass Flow Rates</i>	0,01 - 500 mL/min (standard) 0,01 - 200 mL/min (on request)
<i>Total Mixture Flow Rate</i>	Up to 1,5 L/min
<i>Gasses</i>	N2, O2, CO2, CH4, Air (additional gases supported on request)
<i>Communication</i>	USB PC interface. (*)RS 485 BUS with open proprietary protocol. (*)To be Implemented
<i>Output Channel</i>	0 - 5 V, Max 80 mA
<i>Fittings</i>	Push-in fittings for 6-4mm O.D. Tubes. Other on request.
<i>Inlet Gas Channel</i>	3 inputs
<i>Outlet Gas Channel</i>	1 output of mixed gas
<i>User Interface</i>	Gas mixing software. 1 LED signal interface

STATEMENTS



COMPANY

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CONTACTS

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- **E-mail:** support@mcqinst.com