

Gas Mixing System GMS150

Instruction Manual



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1. List of Equipment

Carefully unpack the carton, which contains:

- **Gas Mixing System GMS 150**
- **Cables and Connectors**
- **This Operation Manual** (*on a CD or a printed version*)
- **Optional Accessories** (*according to your specific order*)

Note:

If any item is missing, please, contact the manufacturer. Also check the carton for any visible external damage. If you find any damage, notify the carrier and the manufacturer immediately. The carton and all packing materials should be retained for inspection by the carrier or insurer.

For customer support, please write to: support@psi.cz

2. General Information

GMS 150 can produce precise mixtures of up to 4 different gasses. The flows of the individual input gases are measured by thermal mass flow meters and adjusted by integrated mass flow controllers. Before the exit connector, the gas mixture is thoroughly homogenized. The input and output gas connectors are of Prestolok type allowing fast and secure connection to a variety of tubes.

The GMS 150 mass flow meters and controllers can operate gas flows ranging from ml_n/min to tens of l_n/min. Typically, the controllers of GMS 150 operate in the lowest range 0-8 ml_n/min and in the highest range 0-2500 ml_n/min. GMS 150 is typically used to control flow of air, carbon dioxide, and nitrogen. Additional gases like nitrogen dioxide, carbon monoxide, methane, ammonia and others can also be added to simulate various technological mixtures or smokestack gasses.

The standard GMS 150 version includes 2 channels:

Channel 1 controls air or N₂ flow to a maximum of 2000 ml_n/min

Channel 2 controls CO₂ flow to a maximum of 40 ml_n/min

The GMS 150 can be used as a stand-alone instrument or in a system with the Photobioreactor FMT 150. It can be controlled locally from its front panel. The user can define the required gas mixture either by setting the flows of the individual gasses (e.g., 980 ml_n/min of N₂ and 20 ml_n/min of CO₂) or by setting the required relative composition of the gas mixture (2% CO₂) and the mixture gas flow (1000 ml_n/min).

3. Technical Specification

Measuring Principle:

Thermal mass flow measurement

Accuracy (Incl. Linearity):

$\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS ($\pm 1\%$ FS for ranges 3...5 ml_n/min; $\pm 2\%$ FS for ranges < 3 ml_n/min)

Turndown:

1:187

Repeatability:

< 0,2% Rd

Control Stability:

< $\pm 0,1\%$ FS (typical for 1 l_n/min N₂)

Settling Time:

1...2 seconds

Warm-Up Time:

30 min for optimum accuracy, 2 min for accuracy $\pm 2\%$ FS

Temperature Sensitivity:

zero: < 0,05% FS/°C; span: < 0,05% FS/°C

Pressure Sensitivity:

0,1%/bar typical N₂

Attitude Sensitivity:

max. error at 90° off horizontal 0,2% at 1 bar, typical N₂

Input Pressure:

3 bar

Operating Temperature:

15...50 °C

Input / Output Connectors:

Parker Prestolok (6 mm)

Seals:

Viton

Display:

8 x 21 characters LC display

Dimensions:

37 cm x 28 cm x 15 cm

Weight:

7 kg

4. Safety Precautions

THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY DAMAGE DUE TO IMPROPER OR INCOMPETENT OPERATION.

THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY DAMAGE DUE TO GAS LEAK FROM ANY AUXILIARY UNITS (GAS CONTAINERS, DEFECTIVE VALVES, ETC.).

BEFORE OPERATING THE GMS 150 READ THE FOLLOWING INSTRUCTIONS AND WARNING CAREFULLY:

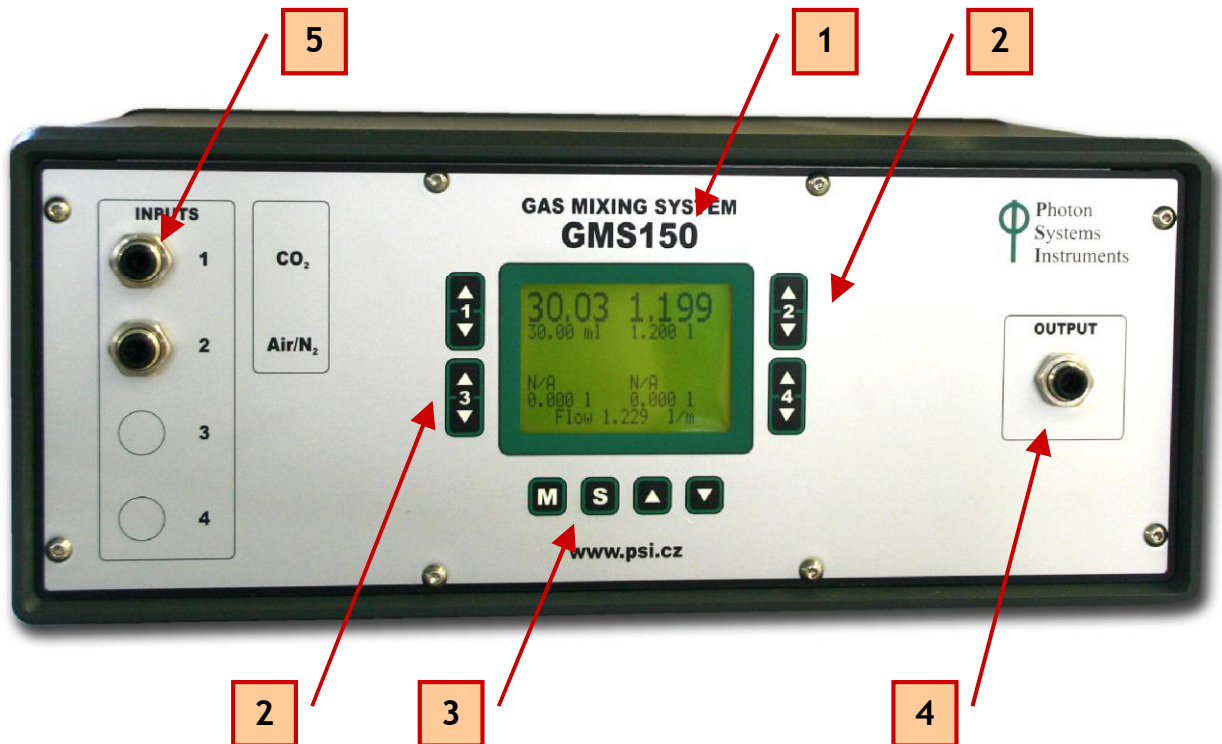
- **To operate a gas handling equipment, you should be trained in its proper use or be under competent supervision.**
- **The device is primarily intended to mix CO₂, N₂ and air. Mixing of other gasses must be always consulted with manufacturer!**
- **Pressure regulator must be always used when connecting the GMS 150 with the gas tank! Never connect the gas tank directly to the GMS 150!**
- **Gas input pressure cannot exceed 3 bar!**
- **Do not subject the regulator to an inlet pressure greater than is recommended!**
- **Input gas must be free of oil, water or any other foreign substances!**
- **If working in wet conditions, dehumidifier must be used so as to prevent condensation of water in tubes and the system.**
- **Follow the basic safety rules for work with CO₂ and other hazardous gases!**
- **Never heat or expose a gas tank or gas handling equipment to temperatures above 50°C (120°F)!**

GENERAL ELECTRICAL SAFETY GUIDELINES:

- Connect all peripheral units when the device is switched off!
- First connect all peripheral units (pumps, control valves), then switch on the device.
- Routinely check the devices and their wiring.
- Replace worn or damaged cords immediately.
- Use electrical extension cords wisely and do not overload them.
- Place the devices on a flat and firm surface. Keep them away from wet floors and counters.
- Avoid touching the device, socket outlet or switch if your hands are wet.
- Do not perform any alterations to the electrical part of the devices or its components.

5. Physical Features

FRONT PANEL:



[1] – Display.

[2] – Four “UP/DOWN” keys. Each “UP/DOWN” key controls one particular valve (more on valve control in Chapter 6.1. – Display & Control Screen).

[3] – Four control keys for the device setting (more on device setting in Chapter 6.2. - Setting Screen).

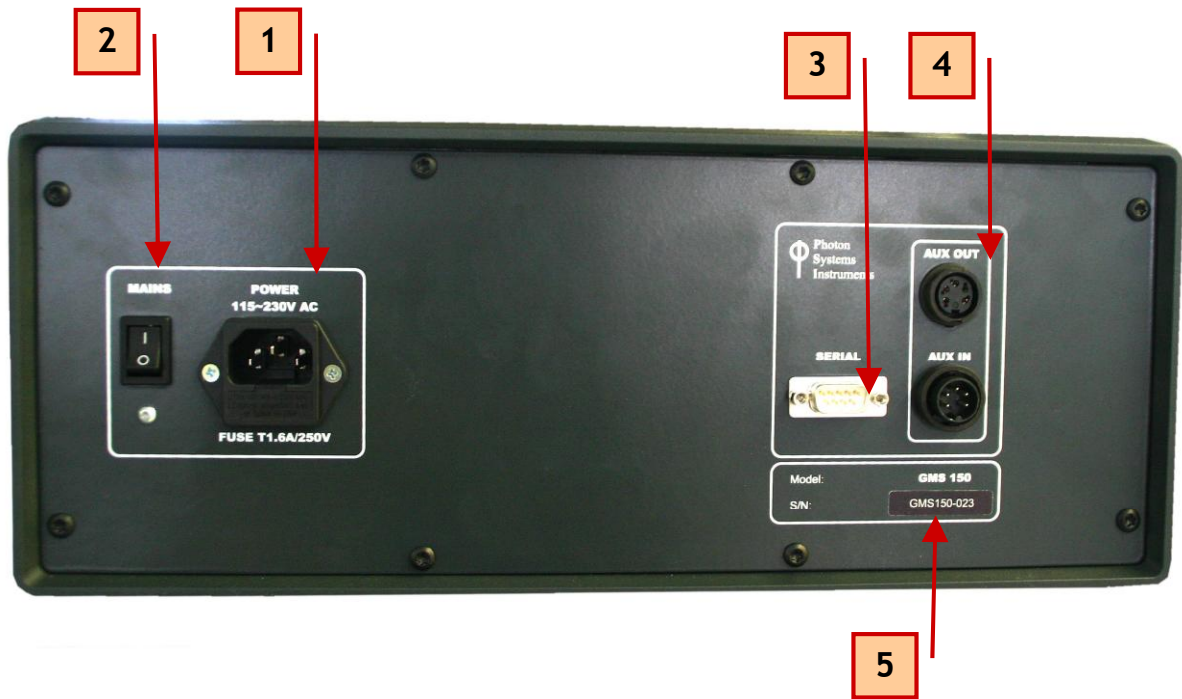
[4] – Gas output.

[5] – Two gas inputs. When switched on, the device detects and displays automatically all connected valves.

CO₂ input is connected to valve 1.

Air/N₂ input is connected valves 2 and 3.

REAR PANEL:



- [1] – Power connector.
- [2] – ON/OFF Mains switch.
- [3] – Serial connector.
- [4] – I2C connectors (IN, OUT).
- [5] – Device serial number.

6. Operation

The device is operated and controlled via two different screens (modes) of the digital display:

1. **Display & Control Screen**
2. **Setting Screen**

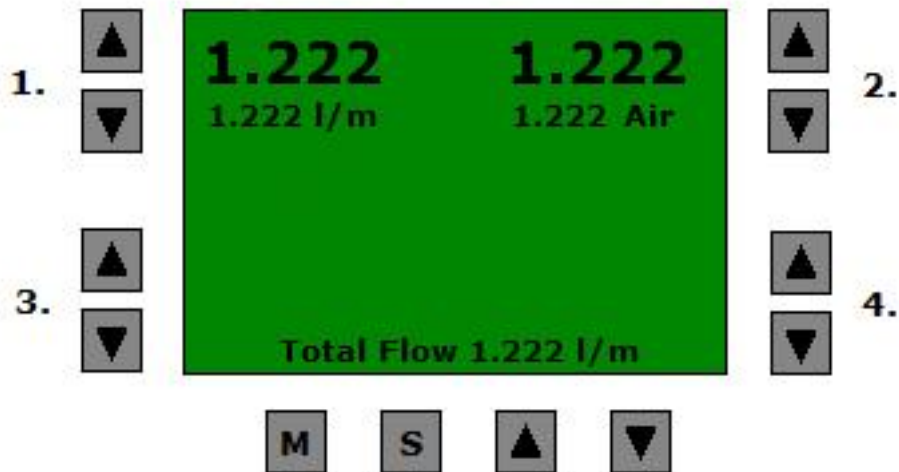
To change between these two screens (modes):

- Use the “S” key (below the digital display) to jump from the **Display & Control Screen** to the **Setting Screen**.
- Use the “M” key (below the digital display) to return from the **Setting Screen** to the **Display & Control Screen**.

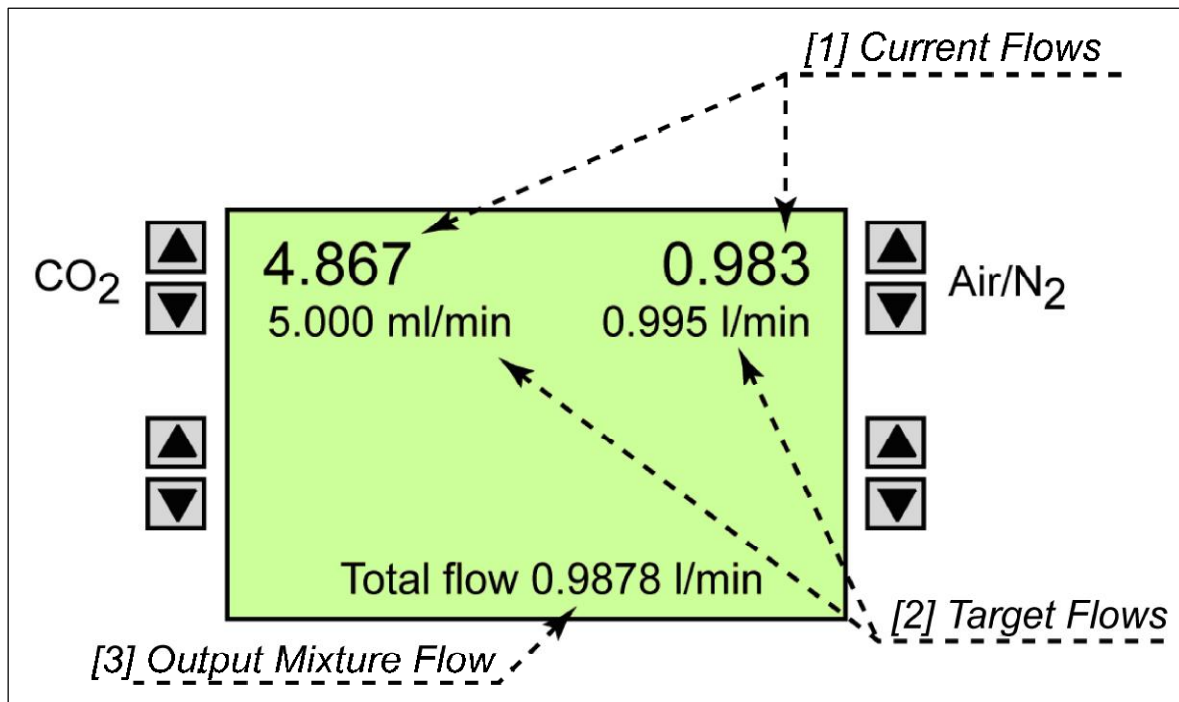


6.1. Display & Control Screen

- Use the “S” key (below the digital display) to jump from the **Display & Control Screen** to the **Setting Screen**.
- Use the “M” key (below the digital display) to return from the **Setting Screen** to the **Display & Control Screen**.
- The Display & Control Screen shows the actual, current gas flow as well as the target flow values for each installed valve. These values can be displayed either in **absolute gas flow units** or in **relative units** by the ration that specifies relative contents in the output gas mixture.
- The **absolute** or **relative units** can be selected in the Setting Screen → Mode Option (see page 16 of this manual).
- The target values for the single valves are set by four “UP/DOWN” keys situated at both sides of the screen. The keys are used to change actual gas flow in corresponding valves (UP/DOWN = add/subtract). The keys are numbered 1 – 4 (see the picture below).



(A) Display with Absolute Flow Units



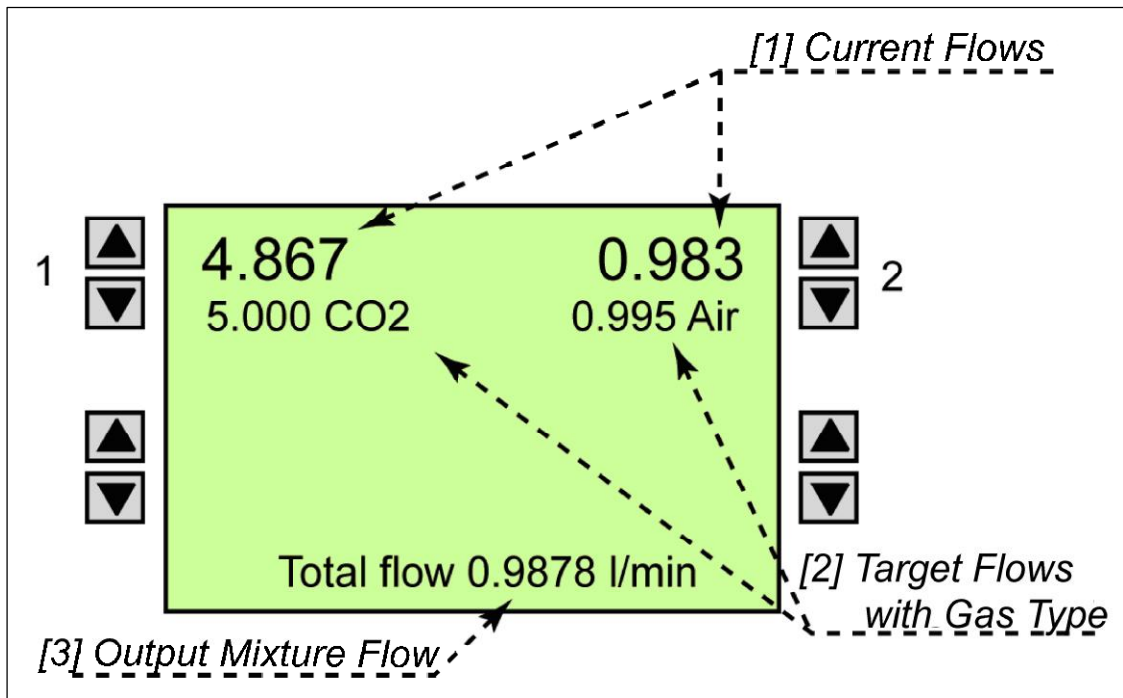
[1] – Current Flows

- The current, actual flow values will be blinking if different from the target value [2] for more than “*Tol*”. “*Tol*” is the default or user-defined tolerance (its value can be set in the Setting Screen → Warn Option).

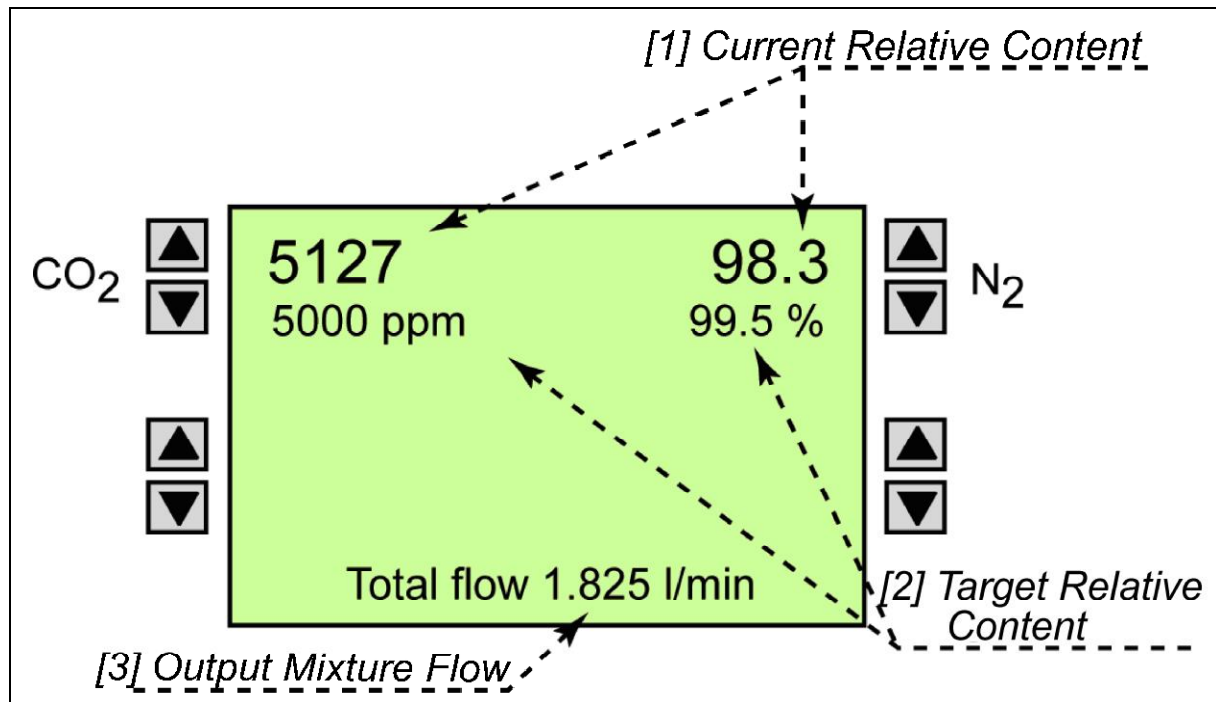
[2] – Target Flows

- The target flow value can be adjusted by using the corresponding “UP/DOWN” key. The maximum setting range is limited by used valve. The accuracy of the valve control decreases towards low flow levels.
- The absolute gas flow units are either liters per minute (l/min) or milliliters per minute (ml/min).
- In some Gas Mixing Units, the valve control keys on the front panel are not labeled with the particular gas type. Instead, labels Valve 1-4 are used and gas type can be shown on display (see the picture below). Displaying the gas type can be achieved through the Setting Screen → Gases → ValveX (more in Chapter 6.2.).

Warning: The mass flow meters are calibrated for a particular gas type. The reading may be incorrect if another gas is used.



(B) Display with Relative Gas Content Units



[1] – Current Relative Content

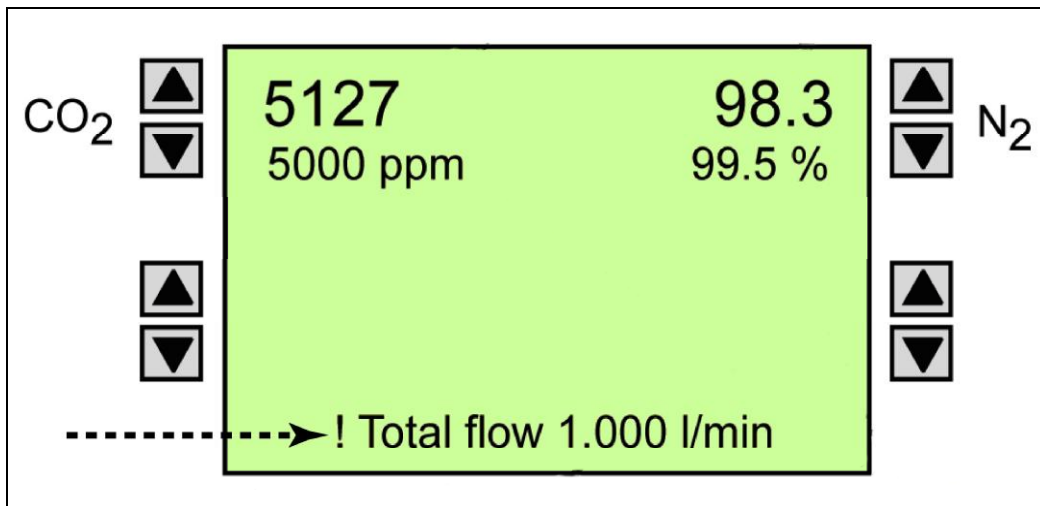
- The actual relative gas content value will be blinking if different from the target value [2] for more than “Tol”. “Tol” is the default or user-defined tolerance (its value can be set in the Setting Screen → Warn Option).

[2] – Target Relative Content

- The target relative gas content value can be adjusted by using the corresponding “UP/DOWN” key. The accuracy of the valve control decreases towards low flow levels.
- The relative gas content units are either parts per million (ppm) or percents (%).
- In some Gas Mixing Units, the valve control keys on the front panel are not labeled with the particular gas type. Instead, labels Valve 1-4 are used and the gas type can be shown on display (see the above picture). Displaying the gas type can be achieved through the Setting Screen → Gases Option → ValveX (more in Chapter 6.2.). **Warning:** The mass flow meters are calibrated for a particular gas type. The reading may be incorrect if another gas is used.

[3] – Output Mixture Flow

- The total flow of the gas mixture is determined by the instrument so that the relative gas content is adjusted with a maximum accuracy. The user can opt for another target gas mixture flow using the Setting Screen → Σ Flow Option. **Be aware that in this case optimal gas mixing precision cannot be granted!** If this alternative selected, the total flow label is preceded by an exclamation mark (see the picture below).



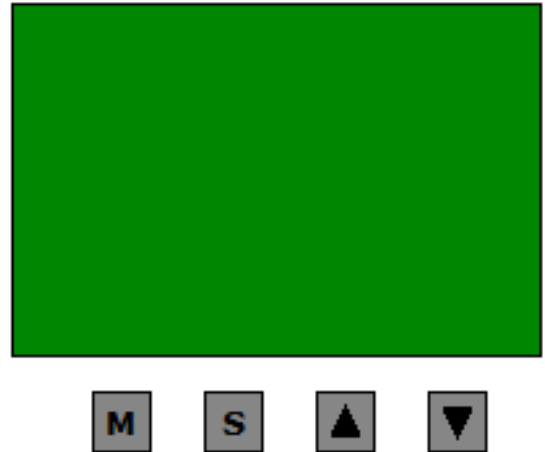
Important remarks:

The relative content of CO₂ in the output mixture is set as described above when mixed with N₂. However, when CO₂ is added to air that contains, for example, 380 ppm of CO₂, the target value is added to the offset of 380 ppm. The offset CO₂ concentration in the air can vary depending on the air source and, also, some of the air sources can have changing CO₂ content, e.g., during the day and night.

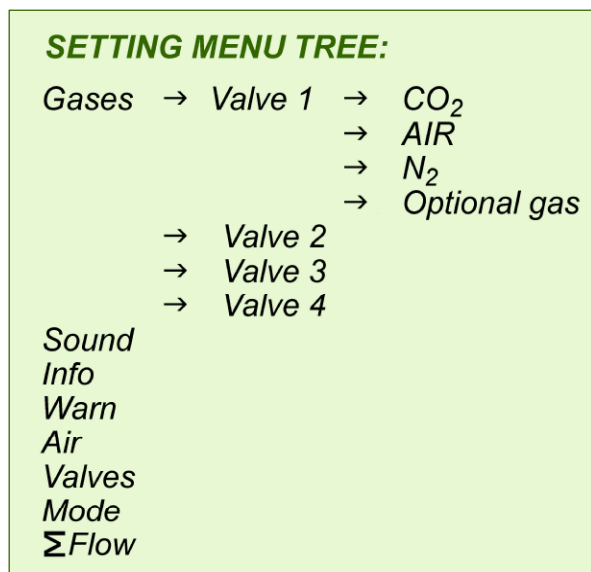
The correction for the CO₂ concentration in the air can also be done automatically by the GMS 150 provided that the user specifies the local CO₂ level in the Setting Screen → Air Option.

6.2. Setting Screen

- Use the “**S**” key (below the digital display) to jump from the **Display & Control Screen** to the **Setting Screen**.
- Use the “**M**” key (below the digital display) to return from the **Setting Screen** to the **Display & Control Screen**.
- **The Setting Screen** is operated by the “**M**”, “**S**” and “**UP/DOWN**” keys situated below the screen (see the picture below).
- “**M**” key: Use it to move back in the menu tree or to exit.
- “**S**” key: Use it to move forth in the menu tree or to save the selected value (parameter).
- “**UP/DOWN**” key: Use it to attain the desired value (add/subtract) or to move up/down in the menu tree.



EXPLANATION OF THE SETTING MENU:



Gases > ValveX

Use this option to change the gas type for valve 2 (AIR or N₂).

Warning: The mass flow meters are calibrated for a particular gas type. The reading may be incorrect if other gas is used.

Sound

Use this option to turn On/Off the beeping sound.

Info

This option specifies the firmware number and date, device name, and device serial number.

Warn

Use this option to set tolerance range (tolerated difference between the target and actual values). Use “UP/DOWN” key to set the required value.

Air

Use this option to specify the CO₂ concentration in local air. Use “UP/DOWN” key to set the required air volume.

Valves

This option displays information on the installed valves (serial number, status, valve type).

Mode

Use this option to switch between the display of **Absolute** Flow Units and the display of **Relative** Gas Content Units. Use “UP/DOWN” key to jump between the two modes.

ΣFlow

This option is active only when the relative gas mixture units are used. It serves to modify the total output flow of the gas mixture. Use “UP/DOWN” key to set the desired value in liters/minute. The setting is cancelled whenever the user resets the relative mixture composition in the Display & Control Screen. Upon any such change, the instrument resumes a gas mixture flow rate that yields the highest precision for given relative concentrations.

7. Statement of Limited Warranty

- This Limited Warranty applies only to the Gas Mixing System GMS 150. It is valid one year from the date of shipment.
- If at any time within this warranty period the instrument does not function as warranted, return it and the manufacturer will repair or replace it at no charge. The customer is responsible for shipping and insurance charges (for the full product value) to PSI. The manufacturer is responsible for shipping and insurance on return of the instrument to the customer.
- No warranty will apply to any instrument that has been (i) modified, altered, or repaired by persons unauthorized by the manufacturer; (ii) subjected to misuse, negligence, or accident; (iii) connected, installed, adjusted, or used otherwise than in accordance with the instructions supplied by the manufacturer.
- The warranty is return-to-base only, and does not include on-site repair charges such as labor, travel, or other expenses associated with the repair or installation of replacement parts at the customer's site.
- The manufacturer repairs or replaces faulty instruments as quickly as possible; the maximum time is one month.
- The manufacturer will keep spare parts or their adequate substitutes for a period of at least five years.
- Returned instruments must be packaged sufficiently so as not to assume any transit damage. If damage is caused due to insufficient packaging, the instrument will be treated as an out-of-warranty repair and charged as such.
- PSI also offers out-of-warranty repairs. These are usually returned to the customer on a cash-on-delivery basis.
- *Wear & Tear Items* (such as sealing, tubing, padding, etc.) are excluded from this warranty. The term *Wear & Tear* denotes the damage that naturally and inevitably occurs as a result of normal use or aging even when an item is used competently and with care and proper maintenance.

For customer support, please write to: support@psi.cz

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