MS GAS -100

Compact bench-top gas analyzer with mass spectrometry detection **MS GAS-100** is designed for complex analyses of gases and volatiles including isotopes, solvents and volatile organics.

Mass analyses of volatiles are performed using mass spectrometer PrismaPlusTM QMG 220 M1 based on open or closed ion source with electron impact, two independent filaments and single quadruple mass analyzer with variable mass ranges of 1-100, 1-200 and 1-300 amu. Two types of detectors are available for the system:
- **Farraday detector** with sensitivity lower than 10 ppm and
- **Secondary electron multiplier (SEM) detector** with sensitivity lower than 100 ppb.

The exceptional sensitivity of MS GAS-100 is conditioned by a highly effective vacuum pumping system, additional heating element integrated in a vacuum chamber and a unique water trapping module.
The effective high vacuum can be reached owing to the tuned cooperation of two pumps, the backup diaphragm pump MVP 015 and turbo-molecular pump HiPace 80 SplitFlow. Thermostated heating element performs vacuum chamber baking for clean-up of undesirable impurities inside the mass spectrometer. Finally, electronically controlled Stirling cooler ensures highly efficient suppression of water molecules background and significantly enhances ion source lifetime. This unique freezing system allows continuous weeks-long operation. Moreover temperature of water trap can be defined by user and it enables to monitor special volatile species (e.g. ethanol).
The integral part of MS GAS-100 is a modular inlet port. It supports interchangeable permeable membrane probe or needle valve inlets. Membrane probe inlet allows small levels of the dissolved species to pass through it; this type of inlet is suitable for liquid samples as well as for analysis in gaseous environments. Needle valve inlet is designed for direct measurements of volatiles in gaseous samples.
MS GAS-100 is equipped with a high vacuum pressure sensor to determine total pressure in vacuum chamber and inlet pressure sensor to ensure mass spectrometer protection.

Intuitive operation of the device is available via integrated touch screen monitor. It supports manual mode with possibility to set temperature of heating/cooling system and opening/closing inlet, split-flow and safety valves. Supplementary, programmed automatic functions facilitate routine measurements by predefined sequence of actions including valve operation based on signal from pressure sensors. Mass spectrometer tuning and acquisition of measured data are performed via software Quadera which enables also writing special, user defined protocols tailored for analyses of desired species.

APPLICATIONS

MS GAS-100 analyzer is intended for numerous applications in biotechnology and bioenergetics:

- Photosynthesis and respiration (CO_2, O_2)
- Nitrogen fixing species (N_2, ethylene)
- Biofuels (H_2, ethanol, hydrocarbons)
- Photorespiration with labeled $^{18}O_2$

- Isotopic distribution analysis

TYPICAL ANALYSIS EXAMPLES:

- Air and water pollution (environmental studies)
- Gas pollutants (CH_4, H_2S, NO_x, SO_2, CS_2, CO, …)
- Volatile organics, solvents (benzene, toluene, acetone, …)

KEY FEATURES

- Measurement of gas exchange states in gaseous and liquid samples
- Long-term measurements of multiple gases and volatile species by a single device
- Accurate, sensitive and rapid measurements
- Membrane based inlet or needle valve inlet for atmospheric measurements and/or special gaseous and liquid applications
- Compact design with modular inlet structures and multiple interface options for gas exchange analysis on whole plant level or on cell suspensions
- Highly efficient removal of water molecules by Stirling cooler water trap for significant enhancement of ion source lifetime
- User friendly software interface based on Quadera software
- Numerous applications for biotechnology of plants, alga, yeasts, bacteria and others, for biochemical methods, environmental analysis and many other related fields

TECHNICAL SPECIFICATIONS

- **Measurement principles:**

Online measurements of gases, volatile organics and/or solvents

- **Mass analyzer:**
  Residual gas analyzer (RGA) PrismaPlus (Pfeiffer Vacuum, Asslar, Germany)
  Mass range available: 1-100 amu, 1-200 amu, 1-300 amu
- **Ion source :**
  Open or closed version
  Two independent filaments (material: yttriated iridium)
  Electron impact
- **Detectors:**
  Response time < 20 seconds
  Farraday …… sensitivity < 10 ppm
  Secondary electron multiplier (SEM) ……. sensitivity < 100 ppb
- **Vacuum system:**
  Turbomolecular pump HiPace 80 SplitFlow (Pfeiffer Vacuum, Asslar, Germany)
  Diaphragm backing pump MVP 015 (Pfeiffer Vacuum, Asslar, Germany)

- **Inlet options:**
  Membrane probe (PDMS default)
  Needle valve
- **Heating system:**
  Thermostat heating element 100 W - maximal attainable temperature 90 °C
- **Cooling system:**
  Integrated cooler water freezing trap - minimal attainable temperature -80 °C
  Electronic control
- **Pressure sensors:**
  High vacuum pressure sensor for measurement of total pressure in mass spec chamber
  Inlet pressure sensor for protection of mass spectrometer
- **Integrated touch screen:**
  System control and actual readings
- **BIOS:**
  Upgradeable firmware
- **Communication port:**
  Ethernet TCP/IP
- **External PC:**
  Notebook with software Quadera for mass spectrometer tuning and acquisition of measured data
- **Dimensions:**
  54.5 x 72 x 45.5 cm
- **Total weight:**
  65 kg
- **Electrical**:
  110 - 230 V AC

REFERENCES

- Zavřel T., Knoop H., Steuer R. *et al. (*2016): Bioresour Technol 202: 142–151. DOI: 10.1016/j.biortech.2015.11.062