
# Vario two.

## Liquid & Gas Analyzer

Product Brochure

VARIOLYTICS

Making the invisible visible.

# Vario two. | Liquid & Gas Analyzer

## Overview

The Vario two. is the world's first mass spectrometer that can measure simultaneously from the liquid and gas phases. Simultaneous measurement from the liquid and gas dramatically increases the benefits of mass spectrometry relative to the initial cost. The combined liquid and gas measurement is patented by Variolytics and is not offered by any other supplier. The liquid and gas analyzer is particularly used for fermentation monitoring and bioprocess engineering, but optimizes any process where parallel measurements from the liquid and gas phases are required.

## Advantages of the Vario two.

**1 GAS & LIQUID**

First simultaneous measurements from the gas & liquid phases using a mass spectrometer

**2 SENSITIVE**

High detection sensitivity from the low ppb to the 100% range

**3 MULTIPARAMETER**

Measures all volatile components simultaneously and without delay

**4 MULTIPLEXING**

Designed to measure from multiple sources simultaneously

### What is MIMS Technology?

Membrane inlet mass spectrometry (MIMS) was invented about 50 years ago in order to introduce samples to a mass spectrometer. The goal was to monitor concentrations of gases and volatile organic compounds (VOCs) in a biological process without disturbing it and with no sample preparation.[1]

1 Nier et al. (2015). The Encyclopedia of Mass Spectrometry: Volume 9: Historical Perspectives Part A: The Development of Mass Spectrometry. Elsevier Science.



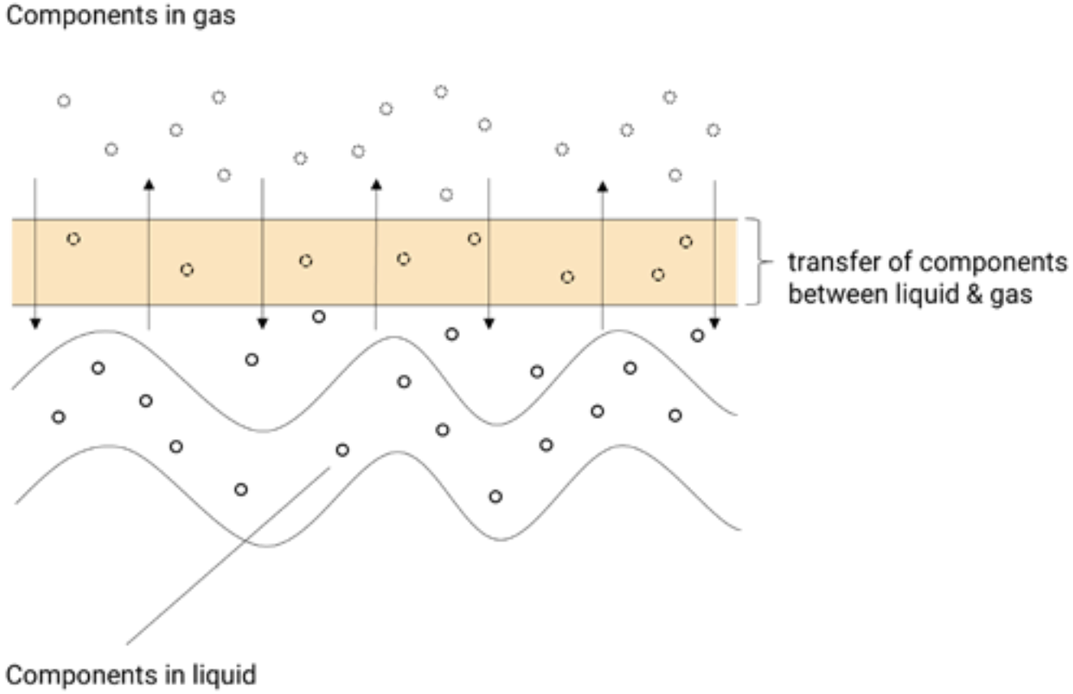
# Patented Inlet System

## Liquid & Gas

The patented inlet system enables simultaneous measurements from the gas and liquid phases. The membrane module contains a membrane at whose interface all volatile components in a liquid are continuously transferred through the membrane into a vacuum. From the gas flow in the vacuum, a small fraction of molecules is transferred to a high vacuum and measured in this way. (Patent: DE102015208250A1, EP3292563A1, disclosure date Nov. 10, 2016).

## The Key to Improving Processes

Our sensor determines precise transfer rates of components between gases and liquids.



# The Perfect Membrane Inlet for your Measuring Task

## Variolytics inlets

The Variolytics membrane inlets allow stable multi-parameter measurements from the liquid. The membrane module contains a hydro- and organophobic membrane. At the interface of the membrane, volatile components present in the liquid are continuously transferred through the membrane into a vacuum. Then these parameters are measured directly in the mass spectrometer. The membrane inlets are easily autoclavable and can be easily replaced if necessary.

### Flow Cell

- ✓ Bypass from the reaction site to the flow cell
- ✓ No probes need to be inserted directly into the process (no disturbance by measuring)
- ✓ Can influence measurement purposefully for ex. by setting a specific temperature

### In-Situ Sensor

- ✓ Measuring directly in the process, does not need a bypass
- ✓ Faster response times than the flow cell & no time delay in measurements
- ✓ Particularly suitable for measuring dissolved gas concentrations



# Latest Software Architecture

## Ideal for problem-free process integration

Tired of outdated software? So are we! The Vario two. offers a software architecture that can be easily integrated into control systems or with other hardware via the MQTT interface. A modern user interface and smart functions make it easy to use. Automated rotans even allow “stand-alone” operation for continuous measurements.

## Practical hardware

# Technical Specifications

| | Specifications |
|---|---|
| **Measuring speed** | 4 ms / amu |
| **Measuring range** | 100 ppb -- 100% |
| **Mass ranges** | 0,5 to 100, 200, 300 and 512 amu possible |
| **Dimensions** | approx. 433 x 526 x 518 mm (W x H x D) |
| **Weight** | ~ 60 kg |
| **Inlets** | Membrane flow cell, in-situ sensor<br>(temperature adjustable from 4°C to 94°C) |
| **Ion source** | Gas-tight cross beam electron impact ion source |
| **Electrical connection** | 230 V/AC, 50 Hz, 8 A; Power consumption <1.2 kVA |
| **Calibration interval** | Automatic or manual |
| **Sample intake** | Automated and continuous via integrated peristaltic pump |
| **Mass filter** | Hyperbolic quadrupole mass filter for better filter performance |
| **Software** | IPI-QMS System- and User-Software<br>• System settings permanently stored in the hardware for reproducible measurement data<br>• Auto tuning for RF adjustment enables optima & energy efficient operation<br>• User-friendly visualization between total ion current of the associated spectra and individual ion traces<br>• Export to third party software such as Chromstar 7 SCPA & OpenChrom |



# Application Areas

## Perfect for integration into the process

Variolytics offers a variety of powerful, flexible and ready-to-use analytical solutions. Our focus is especially on the selection and integration of measurement technology into the process so that the measurement data can be used online. For us, the application is in the foreground.

- Wastewater Monitoring
- Fermentation Control
- Gas Analysis
- Catalysis Monitoring
- Pollutant Analysis
- Food Analysis

# Application Sheet

## Measuring CO2 simultaneously in the Gas & Liquid Phases

**Measurement**
$CO_2$

**Sector**
Many Applications

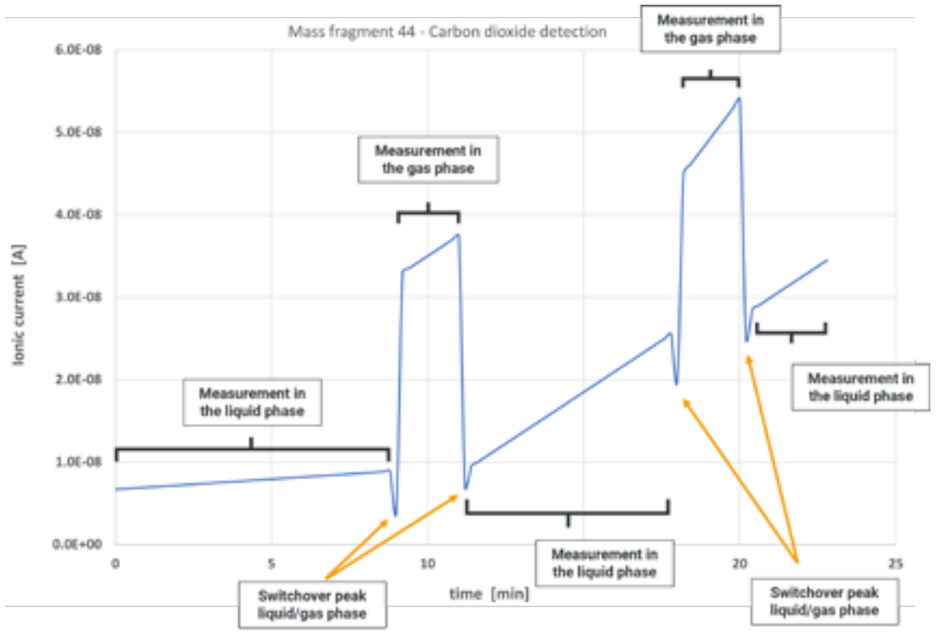
**Device**
Vario two.

**Inlet**
in-situ sensor

### Measurement Task

$CO_2$ is expelled by adding hydrochloric acid to an aqueous Sodium-hydrogen-carbonate solution. Data is evened out because the signal in the liquid phase is noisy due to the $CO_2$ bubbles that are formed. There is difference in the slopes due to slow and fast adding of the hydrochloric acid solution.

**$NaHCO_3$ (aq) + HCl-Lsg. (aq) –> NaCl (aq) + $CO_2$ + $H_2O$**




### Conclusion

Some of the $CO_2$ dissolves in the water and can be detected using an inline probe. Part of the $CO_2$ outgasses from the solution and can be detected in the gas phase.The Vario two. enables measurements from the liquid and gas phases simultaneously.

# Variolytics

## About us

Variolytics is a leading service provider in the field of real-time analytics. With our measuring instruments and our consulting services, we enable industrial customers to map their processes more accurately and to control them better.

Through our close cooperation with research institutes, we are always up to date with the latest measurement methods in the fields of chemistry & biotechnology, process industry, as well as environment & water analysis. It is our ambition to transfer new measurement methods into industrial applications in order to always offer our customers the best measurement technology.

## Supported by

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