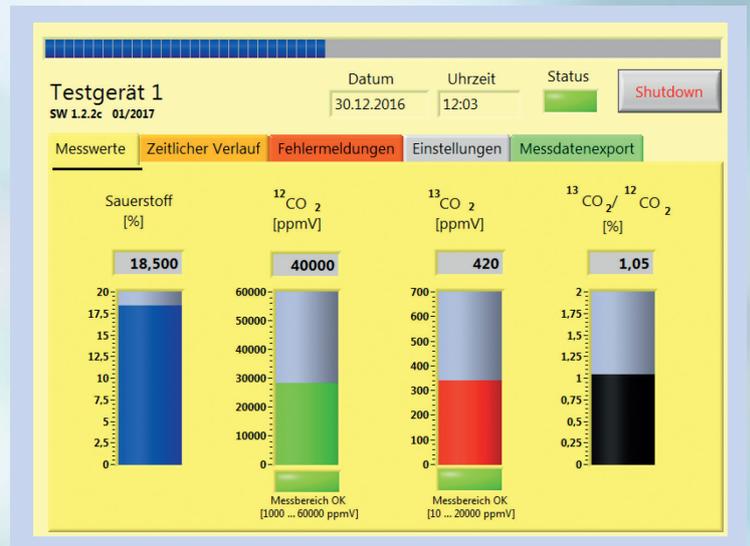


GAS-MED GAS ANALYZER

Precise optical respiratory gas analysis for pharmaceutical and diagnostic applications in veterinary and human medicine

Product highlights:

- ▷ Continuous measurement of $^{12}\text{CO}_2$, $^{13}\text{CO}_2$ and O_2 in the exhaled air of patients (successfully tested on animal models / mouse intensive care units)
- ▷ Minimal sample gas volume (approx. 1ml) required
- ▷ High measurement speed (30 s measurement interval)
- ▷ Intuitive and straightforward user interface and optional data storage (locally or network based)
- ▷ No further operating resources other than the supply voltage required



Main display of the touch screen with all relevant measured values



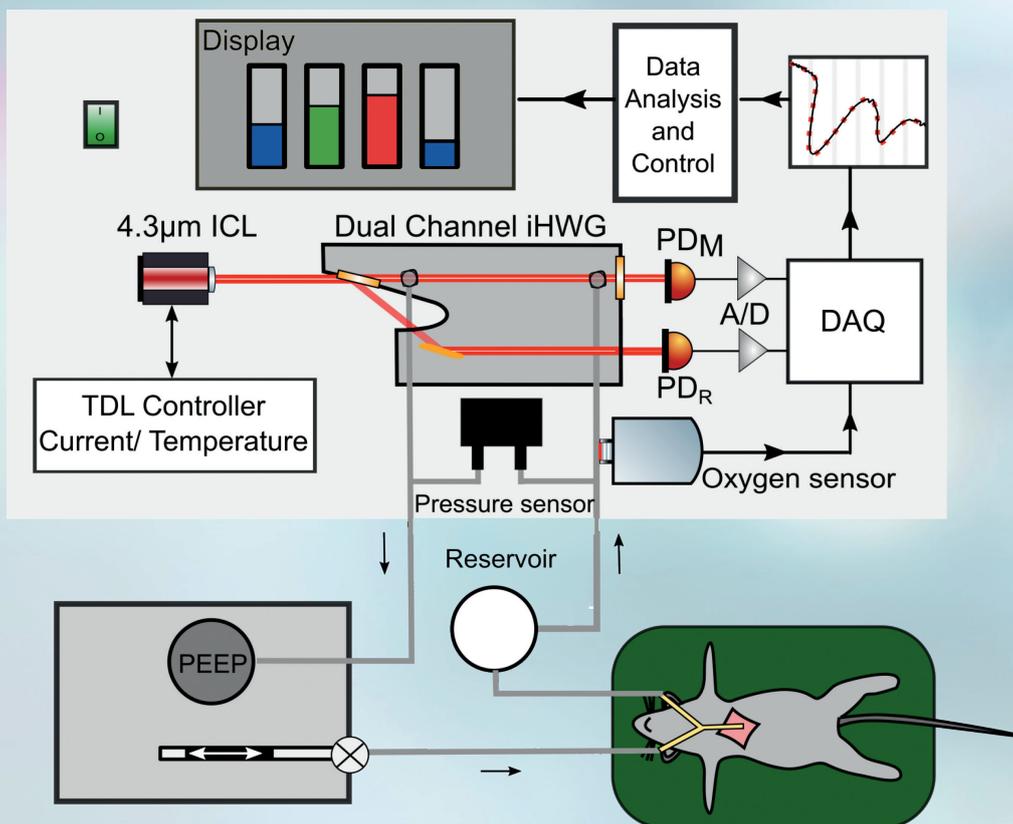
GAS-MED Unit: 19" Model for Table or Rack Mounting



GAS-MED GAS ANALYZER

Important Product Features

- ▷ Innovative, highly selective and precise respiratory gas sensor for the diagnosis and therapy monitoring of various diseases on the basis of the respiratory gas composition / isotope concentrations
- ▷ Reliable and durable optical respiratory gas analysis in the infrared spectral range (IR)
- ▷ Continuous measurement of $^{12}\text{CO}_2$, $^{13}\text{CO}_2$ and O_2 in the exhaled air of patients (successfully tested on animal models / mouse intensive care units)
- ▷ Adaptable to other respiratory gases, for example, volatile biomarkers (demonstrated on acetone as an example)
- ▷ Minimal sample gas volume (approx. 1 ml) required
- ▷ High sample throughput (continuous measurement in the flow), no pretreatment processes required
- ▷ High measurement speed (30 s measurement interval)
- ▷ Very good detection limits in the ppmV range
- ▷ Intuitive and straightforward user interface and optional data storage (locally or on a network resource)
- ▷ Compact and robust overall design (19" housing)
- ▷ No further operating resources other than the supply voltage required



Functional diagram of the GAS-MED gas analyzer and the artificial respiration in a mouse intensive care unit with illustrated gas flow and beam path in the unit

Successful field tests in a mouse intensive care unit at the University Hospital in Ulm

The device has been successfully tested in a mouse intensive care unit at the Institute of Anaesthesiological Pathophysiology and Process Development at the Ulm University Hospital. There, the system proved itself on mechanically ventilated mice on the mouse intensive care unit through its compactness, robust design, measurement speed and ease of use with high sensitivity and selectivity. The measured values were validated with the aid of a mass spectrometer. The correlation was $R^2=0.995$. (ICLs in the ICU: Advanced Photonic Sensors based on Interband Cascade Lasers for Real-time Mouse Breath Analysis, ACS Sens. 2018, 3, 9, 1743–1749, 2018

<https://doi.org/10.1021/acssensors.8b00477>

S ANALYZER

GAS-MED GAS ANALYZER

Product Description

The air that a living being breathes out consists mainly out of nitrogen, oxygen, carbon dioxide and water vapour. Further constituents with very low concentrations are e.g. volatile organic compounds (VOCs). The composition of the gas mixture allows conclusions to be drawn about the vital condition of the body and the metabolization of medical products. This is especially the case when, for example, isotope-labelled medication is administered and these isotopes can be subsequently selectively measured in the breath.

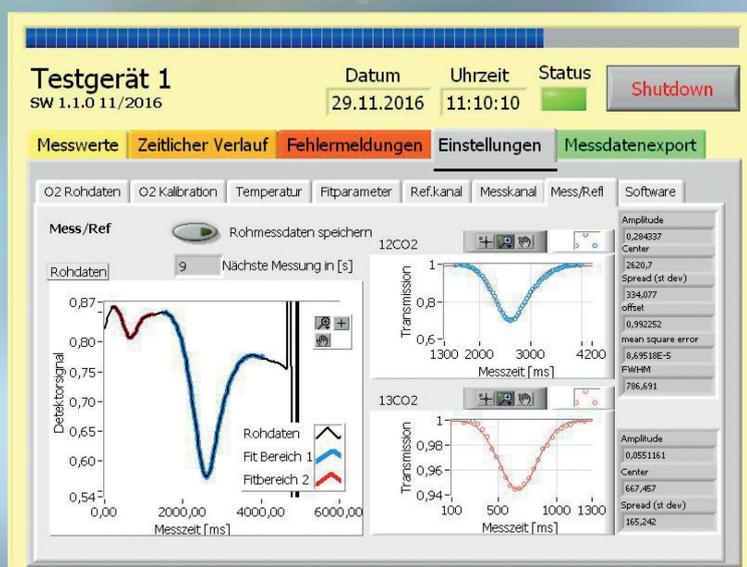
The GAS-MED gas analyzer is a laser spectrometer that can selectively and sensitively measure the gas absorption of various molecules and their isotopes in the infrared spectral range (for example, $^{12}\text{CO}_2$ and $^{13}\text{CO}_2$). The non-IR

active oxygen is determined by an integrated opto-chemical sensor from the company TecSense. Based on an optical hollow waveguide, the miniaturized gas measurement cell enables a minimal sample volume of just one millilitre.

The measurement takes place with a constant flow rate without further gas treatment or change to the sample gas. Thus, the device can, for example, be integrated without problems into the exhaust gas routing of an artificial respiration system. Subsequent analyses of the sample gas are not affected by this technology. Through the simple replacement of the laser and the associated software configuration, the unit can be adapted to any IR-absorbing gas.

Application Areas

- ▷ Clinical and pharmaceutical fundamental research, for example, use in animal models / mouse intensive care units.
- ▷ Through the isotope-selective measurement of CO_2 , the metabolization of ^{13}C -labelled medications can be analyzed.
- ▷ Human medical diagnostics (for example, on new-born baby wards and the diagnosis and therapy monitoring of various diseases)
- ▷ Compliance tests – verification that test subjects taking part in studies have actually taken the medication.



Detailed view of the measured data and the numerical analysis: Isotope-specific absorption lines

The GAS-MED gas analyzer has been developed on the basis of the Research Project FKZ 13N13084 (2014-2019) supported by the German Federal Ministry of Education and Research (BMBF).

The technical support was provided by the project executing organisation, VDI Technologiezentrum GmbH (Düsseldorf).

The successful development of the GAS-MED was accomplished thanks to the outstanding cooperation with the project partners:

- Institut für Analytische und Bioanalytische Chemie der Universität Ulm
- Nanosystems and Technologies GmbH (Gerbrunn)
- JOANNEUM RESEARCH Forschungsgesellschaft mbH (Graz, Österreich)
- TecSense GmbH (Grambach, Österreich)

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About the company

OptoPrecision GmbH from Bremen specializes in the development, design and manufacture of daylight-independent camera and video monitoring systems as well as laser and LED light sources for maritime, official and industrial applications. As a medium-sized group of companies, we employ a highly qualified team of approx. 60 employees. From the development, via the design, manufacture and software programming, almost all activities are carried out in-house.



CONTACT

OptoPrecision GmbH | Auf der Höhe 15 | 28357 Bremen | Germany
Telephone: +49 421 94961-31 | E-Mail: analytics@optoprecision.de