GASERA

FTIR accessory: PA101

Photoacoustic
gas analysis module

PA101
PHOTOACOUSTIC
DETECTOR

Sensitivity and low volume

The PA101 measures low concentrations from very **low gas volumes**. **High sensitivity** is obtained by utilizing the patented **cantilever based optical microphone** technology.

Linearity

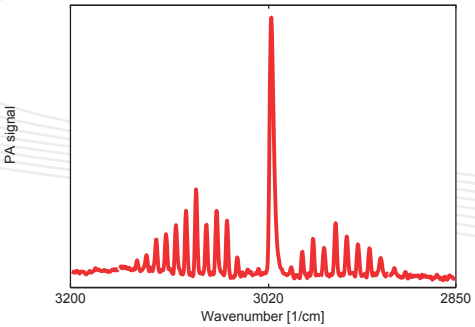
The photoacoustic signal, unlike the conventional infrared detector output, is **highly linear** in a very **wide dynamic range** because new photoacoustic technology allows the use of short absorption path length without losing sensitivity. Wide linearity range allows the efficient subtraction of unwanted signals, such as water. Generally water vapor occurs in much higher amounts in gas mixtures than the analyte gas and it is usually very difficult to subtract using conventional detection.

Reliable concentration monitoring

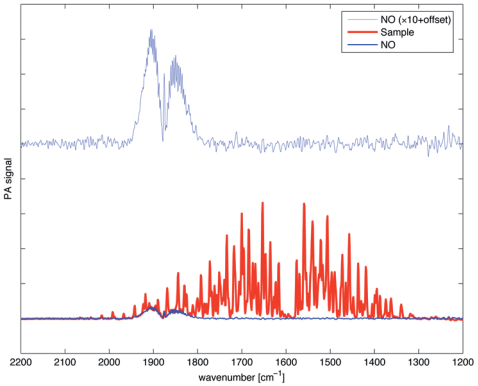
Absorption is measured directly with photoacoustic technique. This makes the measurement **free of drift**. It is the key factor for the **unbeatable stability** and reliability without frequent background measurement. Unlike in conventional transmission technique, interferometer instabilities do not show as large drifts in the photoacoustic spectra.

Applications

- Low sample volume applications:
  - Headspace analysis
  - Analysis of synthesis processes
  - Analysis of decomposition processes
  - Outgassing of materials
- Wet gases
- Measurements requiring high dynamic range

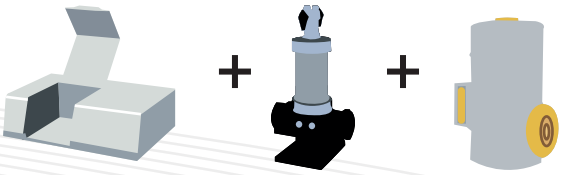


Infrared spectrum of the 3000 cm^{-1} band of 100 ppm methane, measured from 10 ml gas volume, 2 cm^{-1} resolution, 100 scans with 2.5 kHz FTIR mirror speed.



A spectrum of 90 ppm nitric monoxide measured in the presence of water vapor (red) and the same spectrum after the subtraction of water spectrum (blue). The subtracted water spectrum was measured from laboratory air and the fit was made with simple linear substitution (2 cm^{-1} resolution, 100 scans with 2.5 kHz mirror speed).

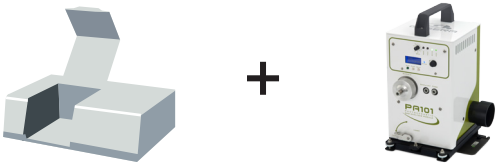
Conventional FTIR gas measurement system



FTIR | White cell | Detector

- large gas volume
- non-linear
- limited dynamic range
- frequent background measurement

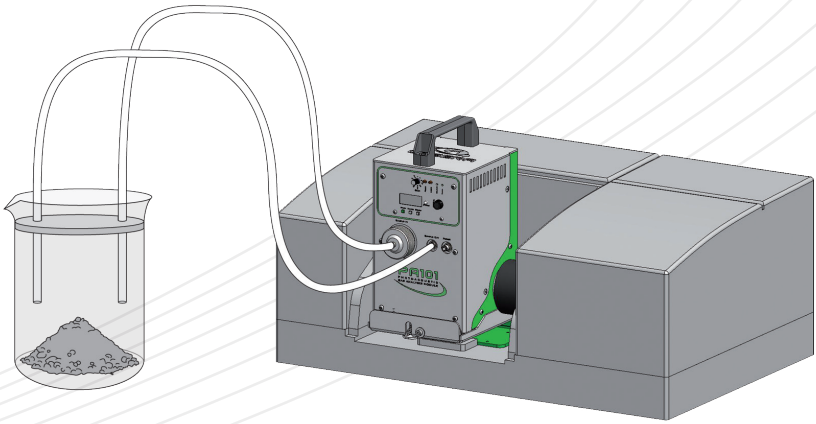
Gasera photoacoustic system



FTIR | Photoacoustic gas analysis module

- low gas volume
- highly linear
- wide dynamic range
- background measurement only once

The PA101 replaces the conventional long path gas cell and the IR detector.



Setup for headspace photoacoustic gas analysis.

PA101
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Features

- Photoacoustic detector with cantilever enhanced optical microphone
- Virtual zero-background measurement principle. Background drift of the FTIR instrument does not influence noticeably to the photoacoustic background.
- Total gas volume of the system is low, approx. 30 ml
- A simple user interface with a display and buttons. The gas exchange procedure is user configurable. The gas exchange can be started manually with a press of a button or the instrument can be programmed to do it automatically using timer or an external trigger.
- Three gas connections in the front. The sample gas has two connections, one for input and one for output. The input is equipped with a particle filter. The purge input is for the IR beam path purging.
- Temperature stabilized gold coated gas cell with user selectable temperature from room temp. to 50 °C
- Patented ultra-sensitive optical microphone based on a MEMS cantilever sensor coupled with a laser interferometer to measure microscopic movement of the cantilever sensor.
- Complies with the following standards or other standardization documents under the Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC: EN 61326-1:2005, EN 61010-1: 2001
- 12 months warranty

Technical specifications

- Materials in contact with gas:
  - FPM, FKM (o-ring seals, solenoid valve seals)
  - PS, EPDM (gas pump)
  - Resin (solenoid valves)
  - Stainless steel (solenoid valves, tube connectors)
  - IR-window (BaF2, KBr, etc.)
  - Readout window (SiO2)
  - Nickel (gas exchange unit block, tube connector)
  - PTFE (tubes, particle filters)
  - PP (particle filters)
- Dimensions: 16,5 cm W x 29,0 cm H x 16,5 cm D (6,5 in W x 11,4 in H x 6,5 in D)
- Weight: 6,0 kg
- Total internal gas volume: 30 ml
- Operational conditions:
  - Temperature range: 0 °C – +45 °C
  - Humidity range: Below 90% RH, non-condensing
  - Pressure range: Ambient level
  - Dust/water resistance: IP20 (IEC 529)
  - Shock/vibration endurance: Vibrations can affect the measurement results
  - Acoustical level: Loud sounds can affect to the measurement results
- Storage conditions:
  - Temperature range: 0 °C - +60 °C
- Sample gas conditions:
  - Temperature: Below the gas cell temperature and non-condensing
  - Pressure: 300 mbar – 1500 mbar
  - Moisture: Non-condensing at sample temperature
  - Gas flow with bypass flow: approx. 1 liters/minute
  - Particulates size < 1 µm
- Gas connections:
  - Push-in connector for 6/4 mm tubing
- Electrical connections:
  - Power supply unit:
  - Input voltage: 100 - 240 Vac, 50 - 60 Hz
  - Input power max: 30W
  - Analog outputs:
  - Output connectors: BNC
  - Output signal voltage span: ± 3.3 V
  - Output signal frequency band: Low pass filtered, 0-10kHz
  - Output load: >2k resistive
  - Trigger I/O:
  - CMOS compatible input
  - Open collector output
  - Triggering sequence programmable
- Measurement specifications:
  - Detection limit: Gas dependent. Typically in the sub-ppm region.
  - Optical path length: 80 mm at optical axis
  - Repeatability: < 1 % of measured value in operational conditions at the calibration concentration
  - Temperature stability: Ambient temperature change within the operational temperature range will not cause drift
  - Recommended FTIR scan speed: 0.16 cm/s or less (2.5 kHz HeNe frequency)
- Fits to following FTIRs:
  - Bruker Tensor and Vertex series
  - Thermo Nicolet 6700/8700, Nexus series, iS10 and iS50
  - Perkin-Elmer Frontier, Spectrum One, Spectrum 100
  - Varian/Bio-Rad 3000/4000/6000/7000
  - Agilent/Varian 640/660/670/680
  - Jasco FT/IR-4000/6000
  - Shimadzu IRAffinity-1 /IRPrestige-21

  The list is continuously growing, ask for other models

Sales package content

- Gasera PA101 photoacoustic FTIR accessory
- Required cables and parts for connecting to a specified FTIR instrument
- Power supply unit
- User Manual
- Storage case

Gasera Ltd. reserves the right to change specifications without notice.

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