
ABB MEASUREMENT & ANALYTICS

FT-IR solutions for laboratory and process gas phase measurements

R&D, QA/QC, process optimization
and air monitoring



Measurement made easy

The need for gas phase measurements spans many industries. It includes characterization and identification of gas streams for regulatory emission compliance, industrial hygiene and process or quality control.

Designed with the concerns of the industry needs, the MB3000-CH90 and MBGAS-3000CH are the ideal solutions for multi-gas component analysis.

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FT-IR technology for multi-component gas analysis

— 01 Example of ABB MBGAS-3000CH calibration performance for process chemical leak detection. Quantification of metal carbonyl (upper, LOD: 0.6 ppb) in the presence of carbon monoxide (lower, LOD: 0.14 ppm).

Industry needs

There is a wide variety of choices for gas sensors and analyzers. Key features to look for when implementing an efficient gas analysis solution are:

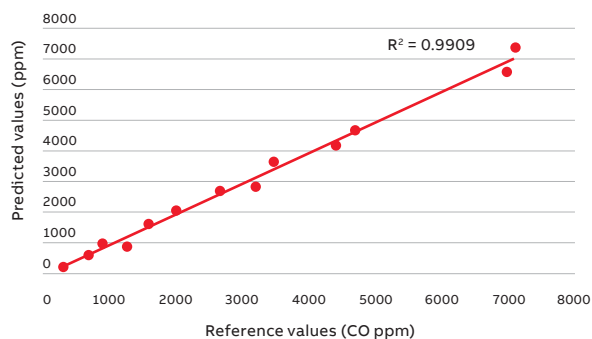
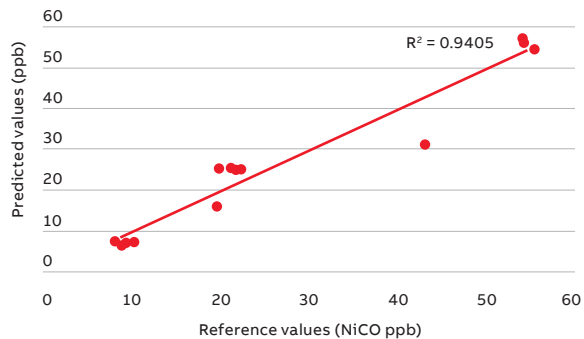
- Sensitivity
- Long term reliability
- Robustness with respect to interferences and false positives
- Robustness with respect to chemical deactivation or poisoning.
- Effective diagnostic capability for early alerts

Fourier-Transform Infra-Red (FT-IR) gas analyzers combine those attributes and are ideally suited for the analysis of multi-component gases by a single instrument, specifically where interferences can compromise the results. Examples of such situations are:

- 1) Analysis of a specific gas component in the presence of high concentrations of other gases, for example moisture.
- 2) Analysis of samples containing multiple gases which would induce cross-sensitivity.

The gas molecules that are routinely measured by FT-IR are organic compounds (CyRx), silane compounds (SixXyRz), inorganic acids, amines (NHRx) and many more. It should be noted that homonuclear diatomic molecules (e.g. H₂, N₂, O₂) and noble gases (e.g. He, Ne) do not absorb infrared radiation and cannot be measured with FT-IR analyzers.

Thanks to stringent manufacturing specifications combined with patented interferometer design and signal processing techniques, ABB MB Series analyzers exhibit best-in-class analytical performance and are suited for industrial applications in laboratory or process conditions. The MB3000-CH90 Laboratory Gas Analyzer and MBGAS-3000CH Process Gas Analyzer can measure both high and low concentrations, down to parts per billion in some cases.



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Dedicated offering for laboratory applications

MB3000-CH90 laboratory gas analyzer

The MB3000-CH90 provides fast and accurate gas measurements in a user-friendly environment. The Horizon software enables the use of commercial or personalized spectral libraries for unknown gas identification and the heatable gas cell can be tuned for either long or short pathlength applications.

ABB's tight manufacturing tolerances and specifications for analyzer-to-analyzer matching permit laboratory development of calibrations which are routinely transferred to ABB process instruments.

Typical applications of the MB3000-CH90 are found in both R&D and QA/QC laboratories, for example checking gas purity, controlling gas mixing and composition or performing unknown components speciation. The MB3000-CH90 is also used for fast off-line analysis of grab samples obtained from airborne or process gases.



MB3000-CH90 laboratory gas analyzer

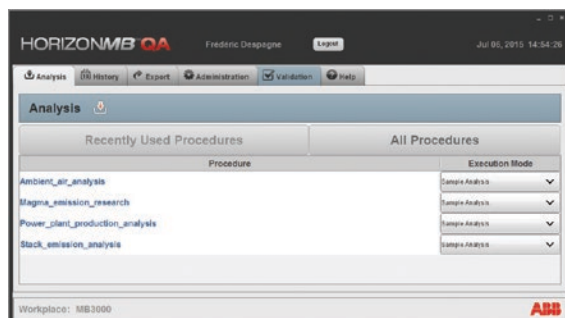
- 01 Horizon QA operator interface for routine analysis
- 02 Horizon Library spectral search engine

MB3000-CH90 features

The MB3000-CH90 Laboratory Gas Analyzer is designed to offer a unique combination of sensitivity, robustness and simplicity. An innovative and unique interferometer design is at the core of the instrument. This latest advancement in interferometer technology is extremely modular and compact and is combined with a patented 24-bit sampling algorithm for optimal dynamic range. The permanently aligned optics with a Jacquinot stop in the interferometer output beam ensure an accurate and stable line shape as well as wavelength and resolution stability.

As result, the MB3000-CH90 offers an outstanding spectroscopic performance enabling ppb level gas analyzes with a standard DTGS detector. In addition, the analyzer can also be fitted with an optional and hot-swappable liquid nitrogen-cooled MCT detector for applications requiring higher sensitivity or measurement speed.

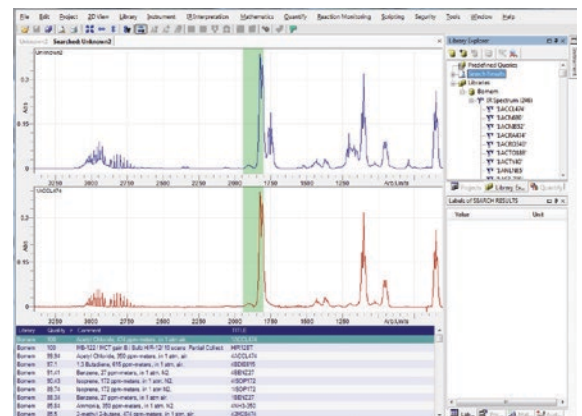
While the exceptional stability of the double-pivot interferometer principle ensures reproducible data, the permanently aligned optics do not require re-alignment and the interferometer has a lifetime warranty. The MB3000-CH90 is also an instrument with minimal cost-of-ownership: the pre-aligned source module with electronic stabilization does not require replacement for 10 years, and the diode laser-based metrology module does not require any scheduled maintenance. These unique features are combined with an extensive instrument built-in health monitoring program.



Whether operating in QA/QC, analytical development, R&D or formulation laboratories, scientists and engineers enjoy the ease of use of the MB3000-CH90. The heated gas cell was developed by ABB and specifically optimized to match the instrument optics and provide maximum sensitivity. It is placed in a universal sampling compartment and can be easily swapped and replaced by other infrared sampling accessories, such as an ATR cell or a microscope. This makes the MB3000-CH90 a very flexible and versatile tool for any laboratory.

The MB3000-CH90 includes by default the software module Horizon FTIR for spectral acquisitions, display and management. Several optional modules can be added to perform specific tasks:

- Horizon Quantify: development of chemometrics models for quantitative applications
- Horizon Library: spectral library search engine
- Horizon IR Interpretation: automated identification of functional groups in infrared spectra
- Horizon RX: customisable dashboard interface for real-time chemical reaction monitoring
- Horizon QA: operator interface for routine sample analysis
- Horizon Security: activation of electronic record security features for operations in 21CFR Part11-compliant environment
- Horizon Scripting: creation of custom routines and functions



Dedicated offering for process applications

MBGAS-3000CH process gas analyzer

The MBGAS-3000CH enables real-time monitoring of continuous gas processes for capacity increase. The instrument will not drift, therefore end-users can be assured that changes displayed on the control chart are real. The MBGAS-3000CH reliably provides precise and stable measurements which enable effective process control for increased capacity and improved quality.

Real-time applications of MBGAS-3000CH for process gas monitoring include reaction headspace monitoring, regulatory emissions control, chemical process optimisation and gas contamination monitoring. Ambient air monitoring and real-time detection of harmful vapors in chemical plants is another important application well suited to FT-IR technology. The instrument can detect toxic chemicals at low concentration in ambient air to ensure plant personnel safety. Interfacing the MBGAS-3000CH with a PLC-controlled sample stream manifold allows to monitor multiple sampling points -up to 64- with a single instrument. This approach provides a cost-effective solution for applications such as vent monitoring, gas scrubber inlet and outlet monitoring, leak detection, confined space air quality, indoor/outdoor air monitoring and compliance to local safety and environmental requirements.



MBGAS-3000CH process gas analyzer

MBGAS-3000CH features

The MBGAS-3000CH is designed for continuous 24/7 operation without need for operator intervention. A comprehensive health monitoring program runs continuously in the background to ensure that all measurements are correct at any time. Efficient optics of the MBGAS-3000CH provide an excellent signal-to-noise performance, so that the detector does not require cooling for extra-sensitivity.

This greatly enhances the reliability and simplicity of the FT-IR measurement compared with process analyzers that require liquid nitrogen-cooled or Stirling-cooled detectors. Furthermore, all optical components are non-hygroscopic therefore avoiding moisture damage, eliminating the need for desiccant and reducing maintenance requirements.

The MBGAS-3000CH FT-IR process analyzer offers significant advantages over alternative technologies for analysis in process gas streams. Measurements are performed in real-time and multiple gas components can be measured simultaneously, with no requirement for carrier or reference gases. Installation is straightforward with minimal sample handling system.

The MBGAS-3000CH is used with the FTSW100 process software specifically designed by ABB to meet the rigorous requirements of industrial process environments. FTSW100 offers several communication options for information exchange with plant control systems, thus providing the flexibility and functionality that are a trademark of ABB process analyzers.

Compared with other analytical techniques for process gas measurements, the use of the MBGAS-3000CH leads to an overall reduction in maintenance cost as carrier gases and test gases are not required for analyzer operation. Multiple-point measurements can be performed with the addition of a sample manifold greatly reducing the analysis cost per sample point. Preventative maintenance is simple and is typically only required every 3 years, eliminating the need for on-site expertise.



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01 ABB MB Series heated
gas cell: process version
(left) and laboratory
version (right).

ABB MB Series gas cell features

A specifically designed proprietary gas cell that captures ABB's extensive experience with gas monitoring is provided with the MB3000-CH90 and MBGAS-3000CH analyzers. Calibrations performed on an ABB gas analyzer (laboratory or process) can therefore easily be transferred to other ABB analyzers.

The cell has 1-liter volume and can be heated up to 200°C. It is mounted horizontally to minimize contamination associated with particles settling on optical components. The cell has an aluminum body with highly corrosion resistant gold plated mirrors (proprietary coating). The windows are made of barium fluoride (BaF₂).

The MB Series gas cell is provided with two path length options (only one path length can be selected and set at factory):

- 3.20 meter for low level analysis (ppm to ppb)
- 0.36 meter for percent level application



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Specification

Feature	MB3000-CH90 (Laboratory)	MBGAS-3000CH (Process)
Spectral range	800-5000 cm ⁻¹	800-5000 cm ⁻¹
Unapodized resolution	< 0.7 cm ⁻¹	< 0.7 cm ⁻¹
Apodized resolution	1 - 64 cm ⁻¹	1 - 64 cm ⁻¹
Detector	DTGS (Option: Liquid nitrogen-cooled MCT)	DTGS
Signal sampling	24-bit ADC	24-bit ADC
Controller	PC controller	PC controlled (Option: rack-mounted controller)
Gas cell	1-liter gas cell, path length 3.20m or 0.36m, resistant mirrors, aluminum body, heatable up to 200°C, ¼-inch Swagelok™ tubing connector	1-liter gas cell, path length 3.20m or 0.36m, resistant mirrors, aluminum body, heatable up to 200°C, ¼-inch Swagelok™ tubing connector
Beamsplitter material	ZnSe (non-hygroscopic)	ZnSe (non-hygroscopic)
Interferometer	Patented high throughput double pivot mechanism	Patented high throughput double pivot mechanism
Purging	Optical path fully purgeable	Optical path fully purgeable
Source	Ceramic Glowbar with electronic stabilization, 10 years average life time	Ceramic Glowbar with electronic stabilization, 4 years average life time
Metrology	Solid-state laser (no scheduled maintenance required)	Solid-state laser (no scheduled maintenance required)
Data communication	Ethernet port (10/100 Mbps)	Ethernet port (10/100 Mbps)
Enclosure	Aluminum casting with integral handles	IP50 modular arrangement with gas cell module, interferometer module and electronic box module
Mount options	Table top	Brackets for wall mount, rack mount or tray mount
Dimensions	43.5 cm (W) x 37 cm (H) x 28 cm (D)	46 cm (W) X 85 cm (H) X 27 cm (D) excluding gas cell insulated enclosure (in wall mount orientation)
Weight	24 kg	35 kg
Power supply	Input voltage: 100 to 240 VAC ±10%, 50 to 60 Hz ± 3 Hz	Input voltage: 100 to 240 VAC ±10%, 50 to 60 Hz ± 3 Hz
Power consumption	65 W (for analyzer only)	550 W at power-up and 200 W during operation
Operating temperature	+10°C to +35°C	+5°C to +40°C
Operating relative humidity	5% to 80% non-condensing	0% to 95% non-condensing
Regulatory certification and compliance	TÜV (electrical safety), CE	TÜV (electrical safety), CE
Short-term stability	< 0.09% transmission between consecutive 1-mn measurements @ 4 cm ⁻¹	< 0.09% transmission between consecutive 1-mn measurements @ 4 cm ⁻¹
Temperature stability	< 1% /°C	< 1% /°C
Frequency repeatability @ 1918 cm ⁻¹	< 0.001 cm ⁻¹	< 0.001 cm ⁻¹
Frequency accuracy @ 1918 cm ⁻¹	< 0.06 cm ⁻¹	< 0.06 cm ⁻¹
Software	Horizon FTIR (other modules available as options)	FTSW100

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