AO2000 Series
Modular Continuous Gas Analyzers

The integrated analyzer system solution



Innovative modular analyzer technology – The AO2000 series

The measurement of a large number of different gas components, at low concentrations, places exacting demands on your continuous gas analysis systems.

At ABB, we offer you solutions that meet and exceed those demands, with flexible systems designed to provide optimum results at very competitive prices.

With our AO2000 series, ABB is the right partner for you.



The AO2000 series offers:

- Simple, operator-friendly analyzer systems
- Turnkey installations for problem-free operations from the very start
- Reliable, low-maintenance and performance-tested systems

The AO2000 series' analyzers combine advanced technologies with 75 years of experience in processing and environmental analysis. They are the innovative solution for the demands of today and the challenges of tomorrow.
Being tailored to satisfy the requirements of various industries, the AO2000 series can be used in almost every form of production and has proven itself in the toughest processing environments:

- Refineries, petrochemicals, chemicals and synthetics
- Air separators and pure gas production
- Pharmaceuticals, food and beverages
- Metals, minerals, pulp and paper
- Power generation
- Environmental technology

The AO2000 series is based on an integrated system concept and it excels the performance standards of conventional analyzers. Thanks to the advanced features built into all AO2000 analyzers, comprehensive multi-component analytical systems can now be expanded to meet new requirements cost-effectively and efficiently.

Unrivalled economy

With the AO2000 series, you can also reduce the overall costs of your analyzer technology, while at the same time increasing the availability of your systems.

- Cost-effective operation, service and maintenance over the entire life cycle
- Lower training and documentation expenses

Environmental protection, process optimization, quality assurance and cost reduction – these are the key issues for today's processing industries.

Integrated system solutions – for added flexibility

Standardized modules can now be adapted to your measuring tasks and combined to systems tailored to your individual requirements. And all of these assemblies are designed to integrate flexibly with each other – from analyzer modules to housings, from displays to control units and from power supplies to sample conditioning. In its basic version, the AO2000 system consists of a central processing unit and an analyzer module.

"Packaging" that fits right in

Three system housings are available: a 19" slide-in version for cabinet installation, a wall mounted housing and an explosion-protected design. And all these housings can be purged for the measurement of toxic or corrosive gases.



Multi-analyzer systems

In its most extensive version, an AO2000 multi-analyzer system consists of four analyzer modules and it can measure six different components. Communication takes place via its internal system bus. Other locally installed system components for the conditioning of sample gas, such as sample gas feeding units and coolers, can also be integrated. All the modules are operated by the central processing unit – and the analyzer module can even be installed up to 350 m away.

Integrated control and monitoring

State-of-the-art processor technology with high performance and rapid signal processing is used for sophisticated calculations, such as cross-sensitivity correction and auto-calibration. This innovation therefore eliminates the need for additional external logic controllers.

Simple, user-friendly operation

The control unit is ergonomically designed, with an illuminated, easy to read display.

- Simultaneous display of up to six sample components
- Clear status and maintenance messages
- Operation menus with online help
- 10 languages are available
- Operator controls can be customized

Reliable and powerful

All our analyzers have been designed with user requirements in mind and are built for the toughest industrial conditions. Their convincing features include:

- Measurements of even low level, trace values
- Calibration without test gas cylinders
- Easy-to-service construction
- Standardized electrical and pneumatic connections
- Proven measuring technology with minimized maintenance
- Corrosion-proof housings made from coated stainless steel
- High quality construction with a long service life

Always the right analyzer for the job. Whatever the measuring task!

The AO2000 series offers analyzer modules using various measurement principles which are suitable for practically any processing task, including:

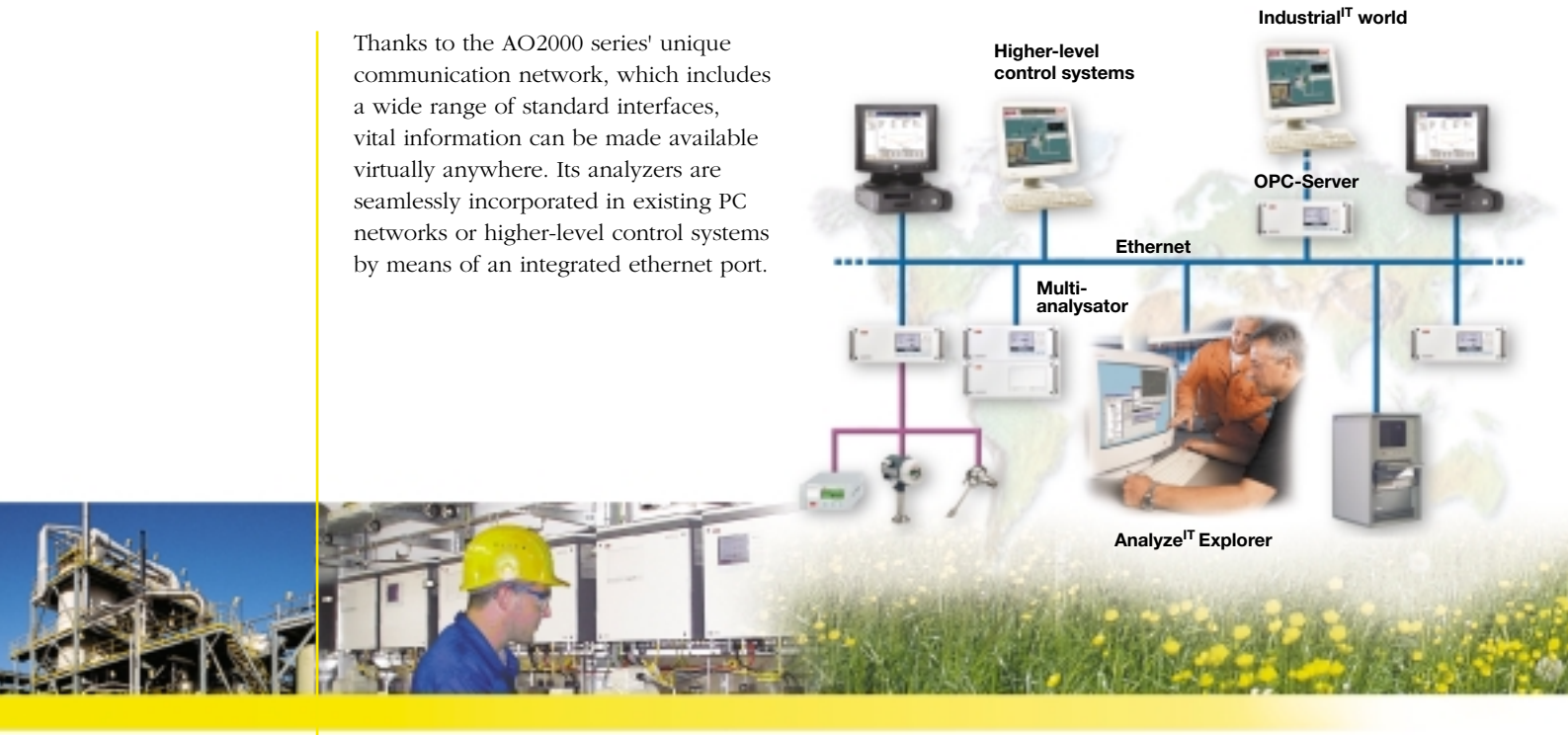
- Infrared analyzer modules
- Process photometers
- Thermal conductivity analyzer modules
- Oxygen analyzer modules
- Flame ionization detectors
- Laser analyzer modules

Ready for the future

To upgrade your analytical capabilities, new modules and functions can now be easily integrated in your existing system. Even older "Advance Optima" analyzers can now be upgraded to a state-of-the-art system by simply exchanging a few modules.

Unlimited communications – information anywhere

Thanks to the AO2000 series' unique communication network, which includes a wide range of standard interfaces, vital information can be made available virtually anywhere. Its analyzers are seamlessly incorporated in existing PC networks or higher-level control systems by means of an integrated ethernet port.



Improved operating functions such as remote control of the analyzer, effective asset management as well as the installation of new software versions from a central maintenance computer, are now also possible. And advanced software tools are available too. Naturally, today's commonly used fieldbus systems are supported by the system as well as the traditional 4…20 mA analog outputs.

- **Ethernet port** with TCP/IP protocol for direct integration into existing PC networks or control systems
- **OPC interface** for direct integration into centralized process control equipment
- **Profibus-DP/PA interface** for the direct coupling of a fieldbus
- **Modbus connection,** serial port, also for Windows applications

- Complete remote control of the analyzer
- Asset management for centralized maintenance
- Facility wide – as well as worldwide access

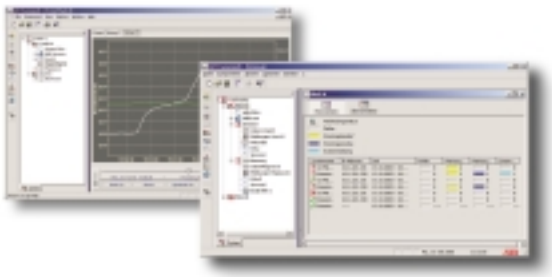
Integration with the Industrial^IT world

To further increase your system's productivity, Industrial^IT certified analyzers can be seamlessly integrated with the complete range of ABB products and automation systems. And to ensure the seamless integration of your instrument documentation, "Aspect Objects" are also provided.

Asset management facility wide

The asset management software "Analyze^IT Explorer" permits centralized maintenance of all analyzers and systems via the Ethernet – as well as worldwide via an Intranet connection.

- Increased system availability through rapid trouble-shooting and diagnosis
- Reduced costs through planned predictive maintenance



Improving safety for people, facilities and the environment

Safety concept for flammable and toxic sampling components

A sophisticated safety concept which is built into the AO2000 series ensures the impermeability of its measuring system. Minimized purging volumes and superior EEx nAC (nonincendive) protection even permits the installation of these modules in hazardous Zone 2 or Division 2 areas.

In addition, an innovative 24-7 alarm system has also been integrated, which can send messages to maintenance personnel via the standard network, as well as by e-mail or SMS.



Explosion protection

The AO2000 series with all its associated safety engineering assemblies is certified for operation in hazardous Zone 1, Zone 2 and Class I Division 2 designated areas.

The AO2060 category's 2G analyzers are available in an explosion-proof version. And the AO2040 central processing unit with overpressure purging can be installed either directly in a Zone 1 area or in a non-hazardous area via an extended system bus.

The designs for operation in Zone 2 (known as Class I and Division 2 in the USA and Canada respectively) do not require additional case purging. All the assemblies have been tested to ensure that they are nonincendive.

Quality assurance

ABB fulfills all ISO 9001 quality guidelines.
All development and production processes are monitored.

International certifications

- In Germany, for emission monitoring pursuant to the 13th and 17th German Federal Regulation on Immissions and Air Purity
- In Great Britain, certified to MCERT
- ATEX-certified for Category II 2G, II 3G
- Certified for measurement of flammable gases in Zone 2
- In Japan, certified according to the JIIS
- In the USA, meets EPA requirements
- CSA-certified for use in Class I, Division 2 areas
- In Germany, certified for quality assurance systems in production sites
- Additional certificates are available on request







Infrared analyzer module

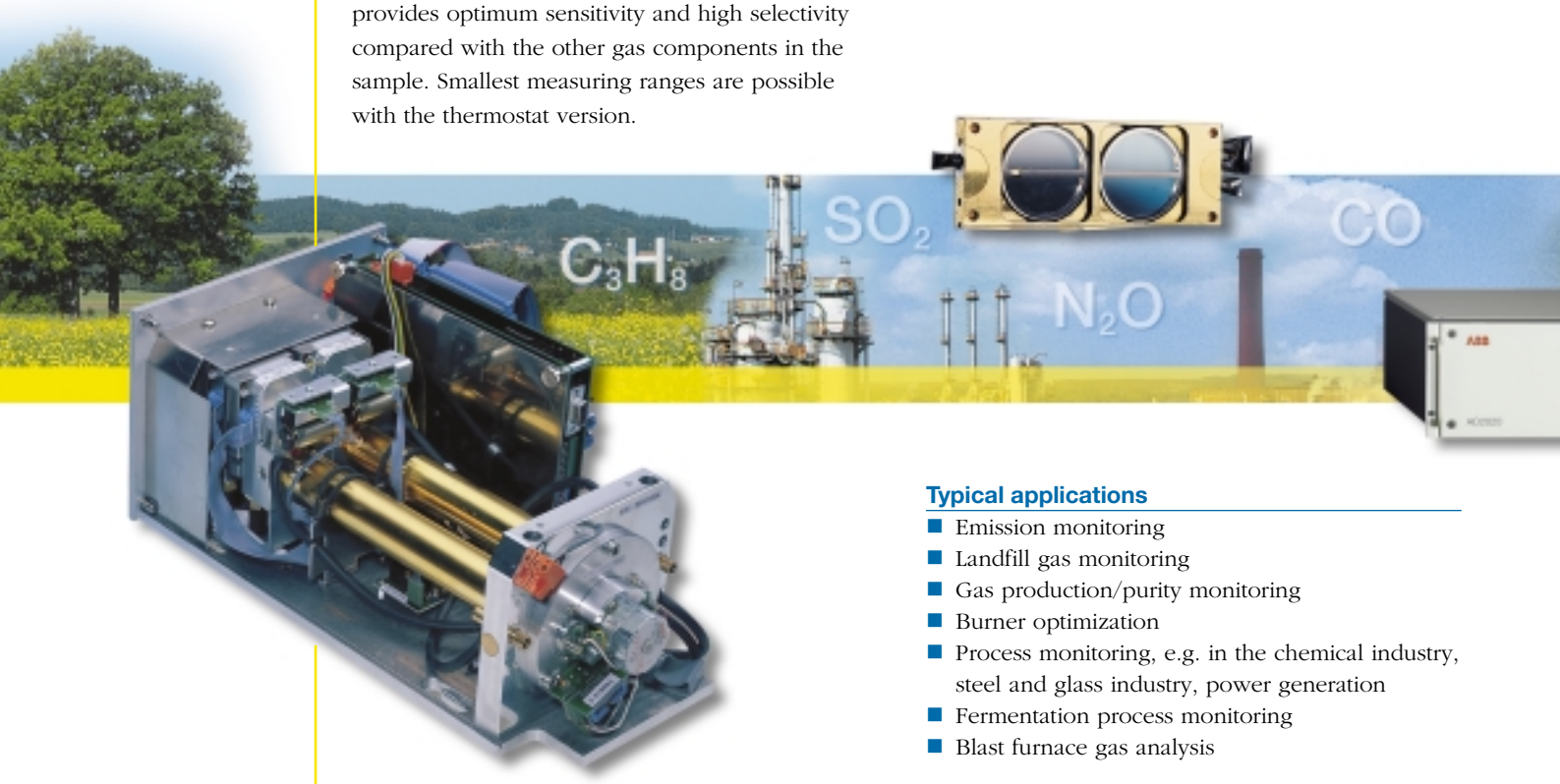
Uras14

The continuous NDIR industrial photometer can selectively measure concentrations of up to four sample components.

The analyzer features gas-filled opto-pneumatic detectors. Detector filling corresponds to the gas being measured. This means that the detector provides optimum sensitivity and high selectivity compared with the other gas components in the sample. Smallest measuring ranges are possible with the thermostat version.

Gas-filled calibration cells substitute expensive test gas bottles. With an optional electro-chemical sensor cell, oxygen can be measured in the same device.

For corrosive and toxic processes or use with flammable gases, a special safety cell is available whose windows can be purged. Purging is monitored internally.



Measurement principle

Non-dispersive infrared absorption in the λ = 2.5...8 µm wavelength range.

Typical applications

- Emission monitoring
- Landfill gas monitoring
- Gas production/purity monitoring
- Burner optimization
- Process monitoring, e.g. in the chemical industry, steel and glass industry, power generation
- Fermentation process monitoring
- Blast furnace gas analysis

Sample components – smallest measuring ranges (examples)

- CO 0...10 ppm
- CO_2 0...5 ppm
- NO 0...150 ppm
- SO_2 0...25 ppm
- N_2O 0...20 ppm
- CH_4 0...50 ppm
- C_3H_8 0...50 ppm
- C_2H_4 0...300 ppm
- R 134 0...50 ppm

Calibration

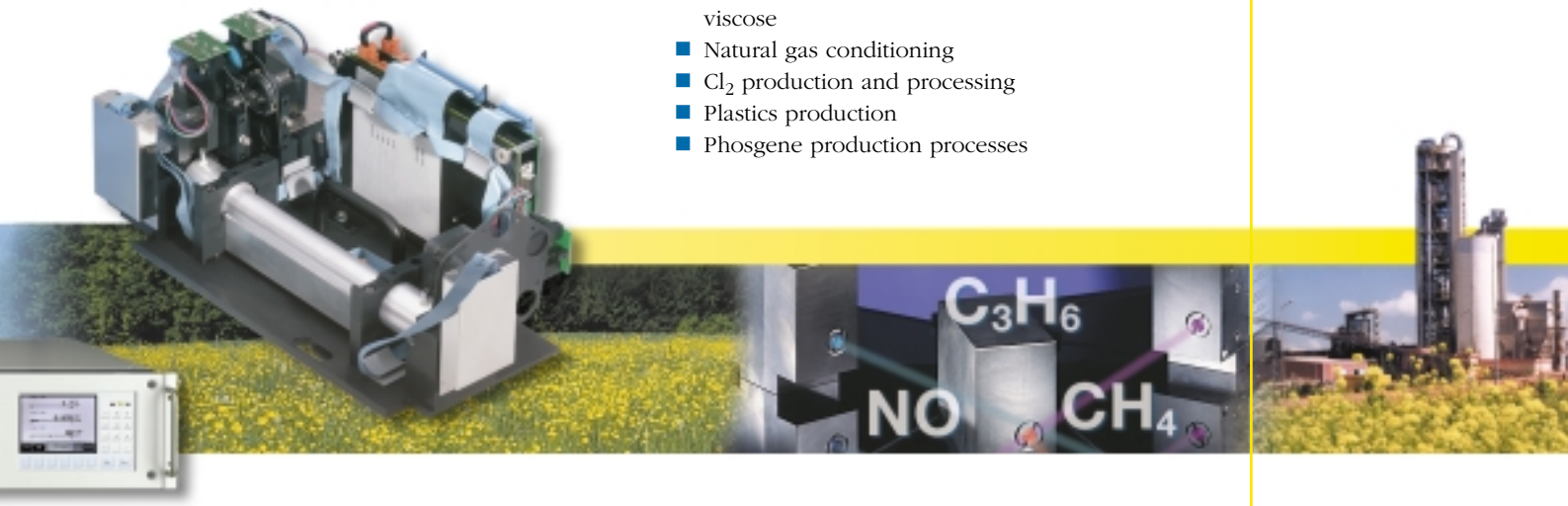
- Zero- and end-point calibration with calibration cells or test gas mixture
- Automatic calibration by means of internal control

Limas11

The Limas11 is a process photometer which is easily configured to meet individual process measurement requirements.

Typical applications

- Burner optimization
- Control of DeNOx installations
- Emission monitoring of FCC furnaces
- Nitric acid production
- Cement production
- Purity measurement in the chemical industry
- Production and processing of cellulose and viscose
- Natural gas conditioning
- Cl_2 production and processing
- Plastics production
- Phosgene production processes



The measuring principle is particularly reliable because of its high stability which is based on the four-beam signal processing principle. As a result, the Limas11 is unaffected by contamination in the cells. A high degree of selectivity is provided by using interference and gas filters as well as optimum selection of measured wavelength and reference wavelength. This allows electronic cross sensitivity correction.

The Limas11 is also the economical and simple solution for the measurement of flammable, corrosive and toxic samples, also in the hazardous zone 2. The new safety concept makes this possible by using a cell of high-grade steel. The sample gas path is made completely of high-grade steel and hermetically sealed. In order to meet increased safety standards, the cell windows can be purged and the purging monitored by means of built-in sensors.

Measurement principle

Process photometer for measuring gas filter correlation or wavelength comparison

- in ultraviolet and visible spectrum range λ = 200...600 nm (Limas11UV, Limas11HW) and
- in infrared spectrum range λ = 2.5...10 µm (Limas11IR)

Sample components – smallest measuring ranges (examples)

Limas11UV

NO	0…10 ppm
SO_2	0…25 ppm
NO_2	0…125 ppm
H_2S	0…25 ppm
Cl_2	0…125 ppm
CS_2	0…50 ppm
COS	0…250 ppm

Limas11HW

NO	0…25 ppm
NO_2	0…40 ppm
NH_3	0…25 ppm

Limas11IR

CO	0…500 ppm
CO_2	0…150 ppm
HCl	0…2,500 ppm
CH_4	0…1,000 ppm
C_2H_2	0…1,250 ppm
C_2H_4	0…1,500 ppm
C_2H_6	0…250 ppm
C_3H_6	0…500 ppm
C_3H_8	0…150 ppm
C_4H_{10}	0…250 ppm

Measuring ranges

- 1 to 4 ranges per sample component
- Largest measurement Ranges: 0...100 Vol.-% or 0 Vol.-% to saturation or 0 Vol.-% to LEL
- Measurement ranges freely adjustable within a range ratio of 1:20 relative to the factory-set reference measuring range
- Electronic zero-point suppression, max. suppression ratio of 1:10

Thermal conductivity analyzer modules

Caldos15

The Caldos15 is designed for highly corrosive applications. The measuring cell with its glass-coated resistor is especially resistant to corrosive gases. With Caldos15 pressure correction is not required. The measurement signal is completely independent of the sample gas pressure – whether negative or positive.

Caldos17

Smallest measuring ranges and fast measurements are characteristic of Caldos17 thanks to its silicon sensor. In addition, the micro-structure of the sensor gives the Caldos17 a particularly short T_{90} response time. Measuring ranges can be selected freely. An exceptionally long-term stability of the end point permits Caldos17 the single-point calibration with only one gas.



Typical applications

- Chlorine production
- Analysis of SO_2 in metal roasting plant off-gas
- Ammonia dissociation

Sample components – smallest measuring ranges (examples)

H_2 in N_2 or air	0…0.5 Vol.-%
SO_2 in N_2 or air	0…1.5 Vol.-%
H_2 in Cl_2	0…0.5 Vol.-%

Calibration

- Zero-point calibration with sample component-free process gas or substitute gas
- End-point calibration with process gas having a known sample gas concentration or with substitute gas

Measurement principle

The analyzer modules' measuring principle is based on the differences in thermal conductivity between gases. Individual gas components are quantitatively analyzed in a binary or quasi-binary mixture based on their thermal conductivity.

Typical applications

- Hydrogen purity measurement
- Turbo generator monitoring
- Inert gas monitoring
- LEL monitoring

Sample components – smallest measuring ranges (examples)

Ar in O_2	0...2 Vol.-%
H_2 in Ar	0...0.25 Vol.-%
H_2 in N_2 or air	0...0.3 Vol.-%
CH_4 in N_2 or air	0...2 Vol.-%
Ar in N_2	97.5...100 Vol.-%
He in N_2	97...100 Vol.-%

Calibration

- Zero-point calibration with sample component-free process gas or substitute gas
- End-point calibration with process gas having a known sample gas concentration or with substitute gas
- Simplified calibration with standard gas avoids the need for separate zero- and end-point calibration with test gases
- Automatic calibration by means of internal control

Dynamic response

- $T_{90} \leq 2$ s

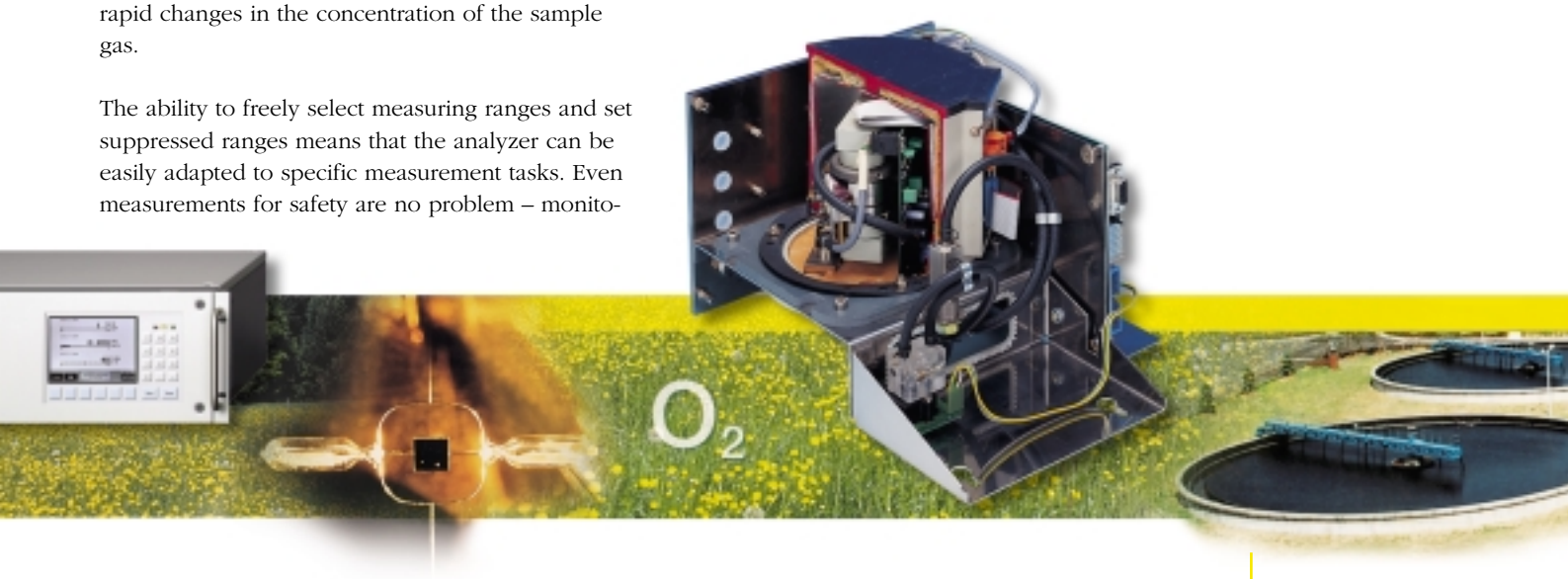
Magnos106

The Magnos106 is based on the magneto-mechanical measuring principle. Thanks to the short T_{90} time, the Magnos106 is also suitable for measuring rapid changes in the concentration of the sample gas.

The ability to freely select measuring ranges and set suppressed ranges means that the analyzer can be easily adapted to specific measurement tasks. Even measurements for safety are no problem – monitoring the sample flow rate through the measuring chamber always ensures that the current oxygen concentration is being measured. Calibration of the zero-point is only required once a month using air or nitrogen.

Measurement principle

The measuring method of this analyzer module is based on the specific paramagnetic behavior of oxygen.



Typical applications

- Oxygen purity measurement
- Air separation plants
- Biogas monitoring
- Process gas monitoring
- Emission monitoring

Sample components

- O_2

Measuring ranges

- Smallest measuring range: 0...1 Vol.-% O_2
- Largest measuring range: 0...100 Vol.-% O_2
- Measuring range suppression max. 1:100, e.g. 99...100 Vol.-% O_2

Calibration

- Zero- and end-point calibration with nitrogen and air or test gas mixtures
- Single-point calibration with ambient air
- Automatic calibration via built-in pneumatic module or external valves

Magnos17

The Magnos17 is based on the thermomagnetical measuring principle. The robust measuring cell means that the Magnos17 is especially resistant to vibrations and shocks.

Typical applications

- Flue gas analysis
- Metal roasting plant off-gas analysis
- Cement flue gas analysis

Sample components

- O_2 in flue gas or nitrogen

Measuring ranges

- Smallest measuring range: 0...3 Vol.-% O_2
- Largest measuring range: 0...100 Vol.-% O_2

Calibration

- Zero-point calibration with oxygen-free process gas or substitute gas
- End-point calibration with process gas having a known oxygen concentration or with substitute gas
- Automatic calibration via built-in pneumatic module or external valves

Flame ionization detectors

MultiFID14

The Multi-FID14 is a flame ionization detector which measures the total content of organic carbon in the sample gas. For this purpose organic substances are ionized in a hydrogen flame. The current of these ions is proportional to the organic carbon content. The analyzer is heated up to 200 °C and can be directly connected to a heated sample gas line. Thus no cold spots occur at any point. The Multi-FID14 features self-monitoring, fault detection, logging and messaging functions. An automatic reset is also possible after fault correction.

MultiFID14 NMHC

The Multi-FID14 NMHC is a flame ionization detector which measures the total contents of organic carbon with and without methane in the sample gas (NMHC = non-methane hydrocarbon). Via an internal solenoid valve, the sample gas is conducted through a catalyst in which all hydrocarbons are combusted into CO_2 and H_2O without methane. Thus only the methane content is measured. Then the sample gas is supplied directly to the detector leaving out the catalyst. The methane-free hydrocarbon concentration derived from the difference can be displayed.



Typical applications

- Emission monitoring
- Process monitoring
- Measurement of volatile hydrocarbons (VOC) in water
- Purity measurements of O_2, N_2 and argon

Sample components

- Hydrocarbons

Measuring ranges

- Smallest measuring range: 0...10 mg org. C/m³
- Largest measuring range: 0...100,000 mg org. C/m³
- Measuring range switching: manual; optionally external or automatic control

Calibration

- Zero-point calibration with air or nitrogen
- Sensitivity calibration with propane or another hydrocarbon in air or nitrogen
- Automatic calibration via built-in zero gas and test gas valves

Typical applications

- Emission monitoring
- Process monitoring
- Also for applications in which there is no O_2 or H_2O

Sample components

- Hydrocarbons
- Methane
- Hydrocarbons without methane

Measuring ranges

- Smallest measuring range: 0...10 mg org. C/m³
- Largest measuring range: 0...5,000 mg org. C/m³

Calibration

- Zero-point calibration with air or nitrogen
- Sensitivity calibration with propane or another hydrocarbon in air or nitrogen
- Automatic calibration via built-in zero gas and test gas valves
- Efficiency testing of catalyst with test gas C_3H_8 and CH_4 in N_2

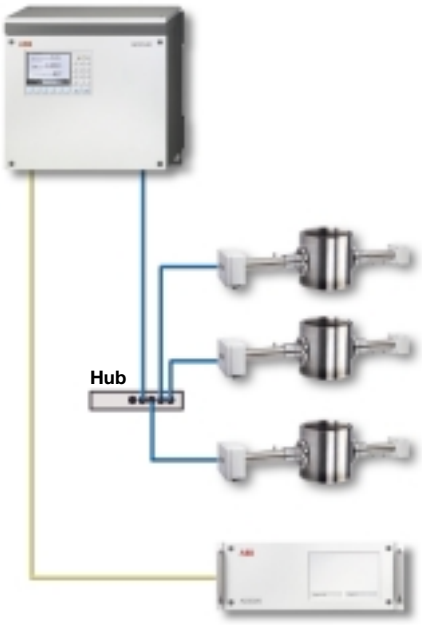
LS25

The LS25 laser analyzer selectively measures the concentration of up to two sample components. The laser operates according to the principle of single-line spectroscopy. For measurement purposes a single absorption line is selected from the gas to be measured in the near infrared spectral range, at which no cross-sensitivity from other gases occurs. The absorption line is scanned and the receiver located opposite detects the absorption caused by the sample gas and calculates the gas concentration from this.

The laser analyzer module consists of a transmission and receiver unit which can be used on ducts with a diameter of 0.5...6 m. Depending on the application, process pressures of 10 bar and temperatures up to 1500 °C can be achieved.



Multianalyzer systems allow the combination of up to four analyzer modules from the product range.



Typical applications

- Emission monitoring
- Combustion control
- Process monitoring and analysis in the chemical industry, steel and iron manufacture, power industry and glass manufacture.
- Control of DeNOx installations

Sample components – smallest measuring ranges (examples)

- O_2 0...1 Vol.-%, 10 bar, 1,500 °C
- CO 0…3,000 mg/m³, 3 bar, 1,500 °C
- CO_2 0...3,000 mg/m³
- HCl 0...7 mg/m³
- H_2S 0...300 mg/m³
- NH_3 0...10 mg/m³
- H_2O 0...3 mg/m³ low levels
- H_2O 0...1 Vol.-% high levels

Calibration

- Calibration takes place either via a built-in flow cell or a separate calibrating cell.

Analyzer technology is our strength



ABB is one of the leading international companies in the field of analyzer technology. Thanks to decades of experience, we can develop innovative instruments and systems to meet your company's indivi-dual requirements.

And with a distribution network covering over 40 countries, ABB's know-how is available to you – worldwide.

Naturally, after any purchase after-sales services are just as important to you, as they are to us. That's why we offer you a broad spectrum of specialized services, such as: continuous maintenance, analyzer system modifications and troubleshooting etc. We'll be pleased to put together an individual service package for you.

ABB is your partner: From consulting to project planning, from system-installation to after-sales service.

Tradition and innovation

More than 75 years of experience in the development and production of analyzers as well as regular contacts with our customers are the basis for our innovative solutions, which have always been the market leader. Under the brand name "Hartmann & Braun", our products for the continuous measurement of processing gases have gained an outstanding international reputation and represent the leading edge of technology. Since then, analyzers with the names Uras, Limas, Caldos and Magnos have enjoyed worldwide acclaim and stand for the highest efficiency. Today, more than 30,000 of these analyzers have been installed throughout the world - in almost every industry.

2003	**AO2000 series, the integrated analyzer system**
2002	**ACF-NT,** the successful solution for emission measurements **EL6010** analyzers for hazardous areas
2001	**EasyLine** analyzers, high-quality measuring technology for simple applications
1999	**Limas11,** unique UV/IR photometer
1998	**ABB acquires Hartmann & Braun**
1996	First asset management tools for Ethernet connections
1996	**Advance Optima**, the first modular analyzer system
1988	**Uras10,** with calibration cells which replaced test gas cylinders
1986	**Magnos 6/7, Caldos 5/7,** digital microprocessors replace analog electronics
1980	**Radas*** UV analyzer, new measurement methods for gas analyzers
1970	**Fidas**** flame ionization detector
1950	**Uras, Magnos and Limas** capture the market
1938	CO-, CO_2 analyzer
1929	**First CO_2-analyzer for combustion,** basis for the subsequent Caldos
1901	Foundation of Hartmann & Braun AG

* today Limas11UV ** today MultiFID14

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ABB continuously optimizes its products, therefore the technical data in this document is subject to change.

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