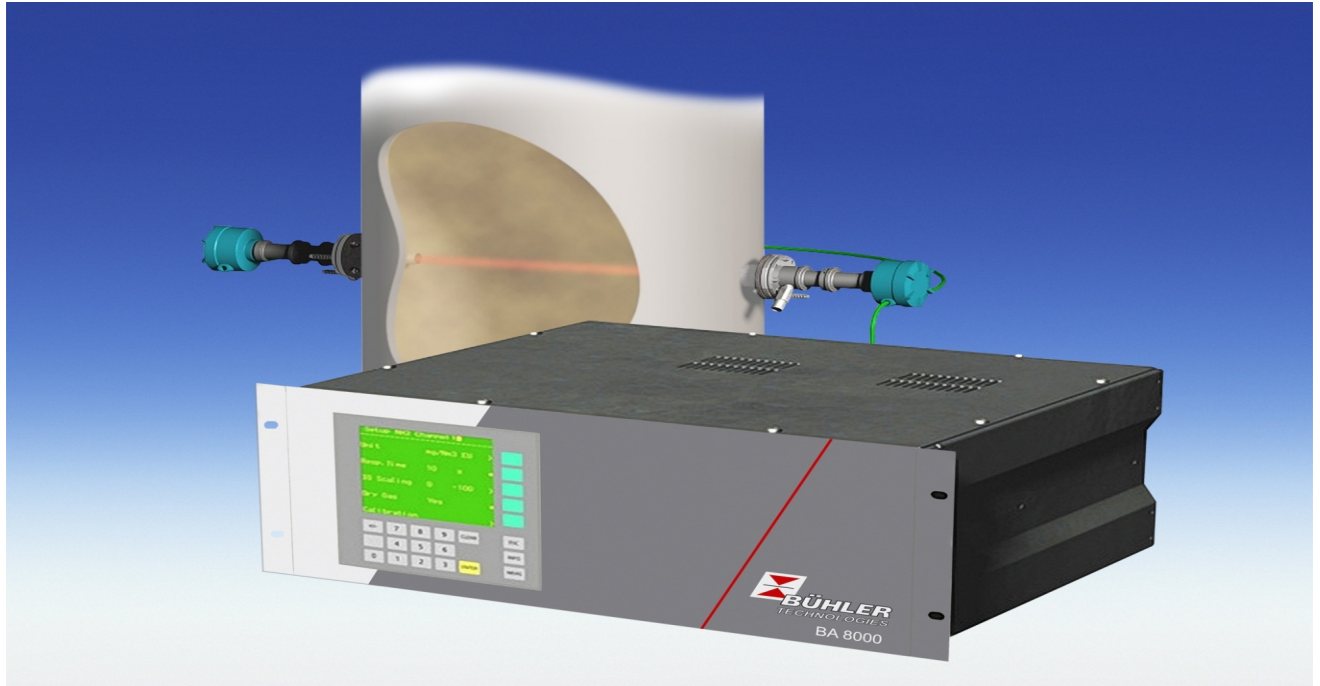


Diode Laser In-situ Gas Analyzer BA 8000



When sampling reactive or highly corrosive gases, the in-situ measurement technique is the preferred approach. It solves many sampling and analytical problems inherent in difficult applications. The BA 8000 In-situ Gas Analyzer, is designed to meet the most difficult gas measurement challenges.

Based on state-of-the-art tunable diode laser technology, the Model BA 8000 analyzer is suitable for a wide range of critical processes and delivers accurate measurements within seconds. Thus, the Model BA 8000 opens opportunities for process gas analysis which have never been feasible or economical in the past.

This analyzer currently allows highly selective measurement of O₂, NH₃, HCl, HF, H₂O, CO, CO₂. A maintenance-free reference gas cell, integrated into the analyzer, eliminates the need for field calibration. Remote scanning and diagnostics is accomplished with the built-in ethernet interface.

- **High selectivity**
- **Real time measurement**
- **Compact design**
- **Low maintenance**
- **Rugged design**
- **Drift-free long term operation**
- **Hot/wet measurement**
- **Resistant to toxic, corrosive and explosive gas mixtures**
- **Easy to install**
- **Up to three measurement points per parameter**

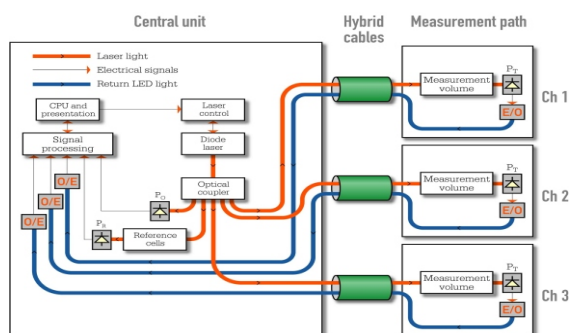
Operating principle

BA 8000 employs single-line molecular absorption spectroscopy. A diode laser emits a beam of near infrared light which is transmitted through the process gas by an emitter and detected by a receiver. The wavelength of the beam is tuned to a gas-specific absorption line. This single absorption line is continuously scanned with a very high spectral resolution. The molecular line is then analyzed in terms of absorption strength and line shape.

In some cases, two components can be measured simultaneously. This is the case if their absorption lines are so close to each other that they can be detected within the laser spectrum by one single scan (for example water and ammonia). Furthermore, in some applications, the gas temperature can be measured from the absorbance of two characteristic lines of the same molecule measured at the same time.

Possible combinations are:

- oxygen (O_2) - temperature
- hydrogen fluoride (HF) - water vapor (H_2O)
- hydrogen chloride/HCl - water vapor (H_2O)
- ammonia (NH_3) - water vapor (H_2O) and
- carbon monoxide (CO) - carbon dioxide (CO_2).



Central Unit

The central unit is available as a 19"-rack mount unit and provides a large LCD display with background illumination for simultaneous display of measurement results and system status. The contrast is adjustable. The menu-guided configuration and diagnostics take place through an easy-to-clean soft key touch pad. All instructions are displayed in plain text. One central unit is able to communicate with up to three pairs of sensors. Each channel provides 2 analog inputs for process temperature and pressure and 2 analog outputs for gas concentration(s) or gas temperature and concentration. In addition, each channel has 6 programmable binary inputs for signaling faults and maintenance requests from external temperature and/or pressure transducers or sensor purging failure, plus 6 programmable relay outputs to provide signals for error messages, maintenance requests, system alert, and high/low range alarms.

An Ethernet (T-Base-10) serial port connects to a network and allows remote diagnostics and maintenance.

Modular Design

The complete analyzer system consists of the central unit mounted within a 19" steel housing and a pair of sensors which include the emitter and the receiver unit. Sensors and central unit will be connected through hybrid cables, which are a specially designed combination of glass-fiber and twisted wires. The sensors of the **BA 8000** will be flanged directly to the process line or stack. The in situ analyzer delivers accurate real time analysis, even in process gas temperature up to 2700 °F. Furthermore, it features an integrated, maintenance-free self calibration and has the capability to connect 3 pairs of sensors with only one central unit. Optional intrinsically safe versions according to *ATEX II 1G D T135°C EEx ia IIC T4* are available.

The modular design plus the features mentioned above make the **BA 8000** the appropriate analyzer for applications in power plants, waste treatment plants, chemical and petrochemical plants, and others. Whether required for DeNOx optimization, process control, emission monitoring or quality assurance, the **BA 8000** provides the most economical solution for your critical process gas analysis.



BA 8000, sensor

Sensors

The in-situ cross duct sensors are configured as transmitter and receiver unit, connected through a special hybrid sensor cable with a maximum length of 3300 feet. Adjustable DN65/PN16 or ANSI 4"/150 lb flanges allow connection to the process line and an easy alignment of the sensors. To prevent blinding of the beam channels at the process site, purging of the channels is highly recommended. Configurable purge ports at the site of the process and the sensor allow purging with instrument air, steam, nitrogen or any other suitable purging medium. For potential cleaning of windows and/or the measurement path, the sensors are equipped with an easy-lock system. All wetted parts are made of stainless steel. Special materials such as Hastelloy or synthetics (PP) and ceramics are available. While the standard sensor's protection class is IP 65, sensors for hazardous areas in accordance to *ATEX II 1GD EEx ia IIC T4* can be provided.

Sensors especially designed to meet requirements of corrosive applications, such as monitoring moisture in chlorine, are also available as extractive systems, if the process or onsite conditions do not allow connection of sensors directly to the process line.

Calibration

The stability of the spectrometer is continuously monitored by a reference path providing a reference measurement cell usually filled with the component of interest providing continuous self-calibration.

For applications requiring field calibration due to regulatory requirements, special calibration sets are available. These sets consist of a number of reference cells with certain gas concentrations and can be easily connected to the central unit. A flowing calibration gas option is also available.

Influences on the measurement

The BA 8000 can analyze gas streams in both, the transverse or the longitudinal direction of the process gas flow. It may be necessary in some applications to locate the measurement in a bypass channel parallel to the main stream. In such cases, special conditioning of the process gas such as drying or dust removal is usually not required.

Dust load

By applying a dynamic background correction, measurements can be carried out under dust loading up to approx. 44 gr/ft³ without any negative impact. The dynamic background correction compensates the gas absorption line and the inherent background. Dust load influences the maximum path length: the higher the dust load the shorter the possible path length.

Typical applications

- **Process optimization**
- **DeNOx-Optimization**
- **Combustion processes**
- **Emission control**
- **Filter optimization**
- **Process control**
- **Measurements in corrosive and toxic gases**
- **Quality control**
- **Product drying**

Temperature

The influence of temperature on the strength of the adsorption line is compensated with a correction factor. If the process temperature is fluctuating, an external temperature signal is used to correct the influence of the temperature on the observed line intensity.

At very high process temperatures, the detector may need protection by an optical bandpass filter to prevent saturation by the strong background radiation

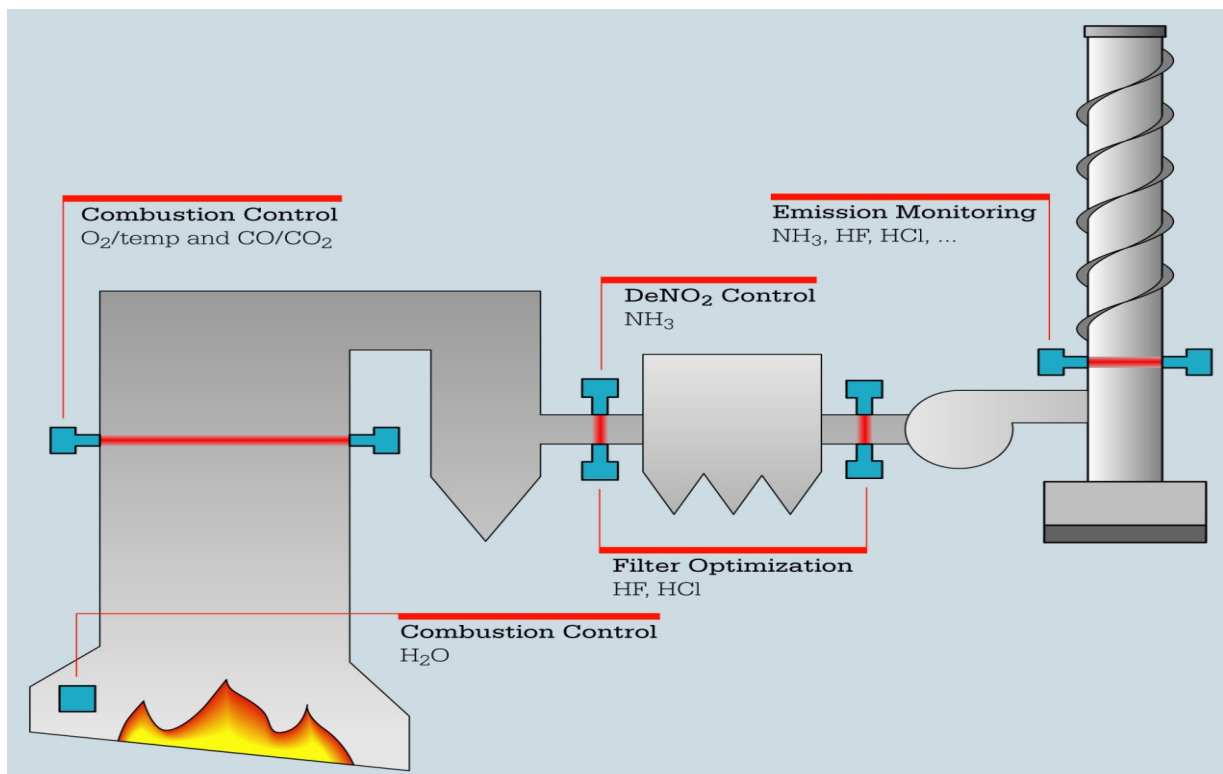
Pressure

Gas pressure can affect the line shape of the molecular absorption line. In cases where the algorithm usually employed is not sufficient, an external pressure signal is used to provide compensation, including the density effect.

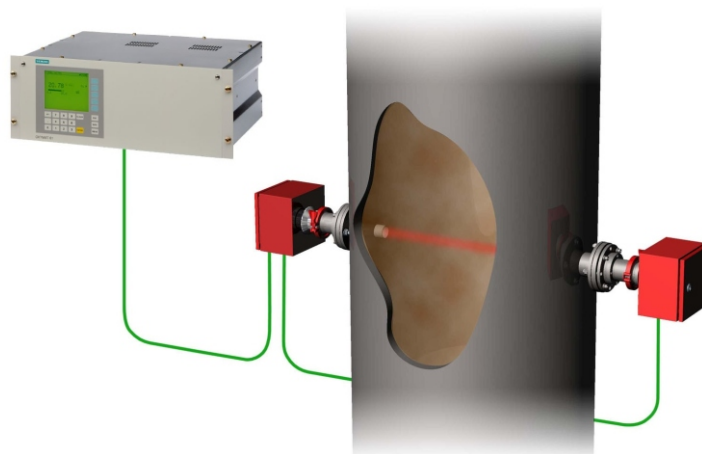
Optical path length

According to physical principles, the path length influences the accuracy of the final measurement. In addition, there is further influence due to the thickness of the mixing zones between the purging media and the process gas. In typical in situ installations with long path lengths (several meters), the influence of the purge gas on the effective path length is negligible.

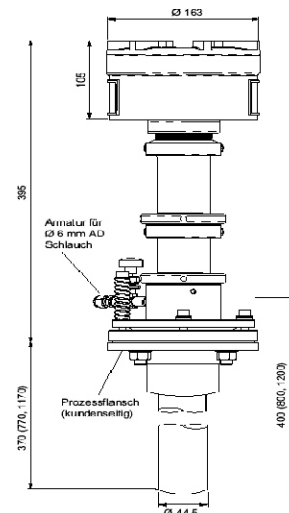
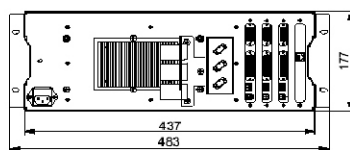
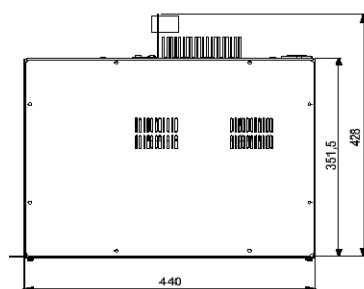
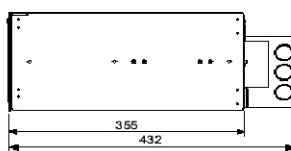
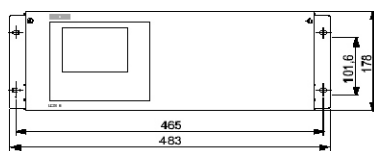
Typical Applications



Example of use in combustion processes



Technical Specification Analyser Ranges internal settable Detection limit (20 °C, 1000 hPa, 1 m path length) dependent on gas composition: HF: 0.1 vpm HCl: 0.2 vpm NH ₃ : 0.3 vpm H ₂ O: 0.3 vpm O ₂ : 500 vpm CO: 200 vpm CO ₂ : 200 vpm Lowest recommended range (20 °C, 1000 hPa, 1 m path length) dependent on gas composition: HF: 0 ... 2 vpm HCl: 0 ... 10 vpm NH ₃ : 0 ... 10 vpm H ₂ O: 0 ... 10 vpm In combination with HF, HCl, NH ₃ 0 ... 5 Vol% O ₂ : 0 ... 1 Vol% CO: 0 ... 1 Vol% CO ₂ : 0 ... 1 Vol% Highest recommended range (20 °C, 1000 hPa, 1 m path length or less) dependent on gas composition: HF: 0 ... 10 Vol% HCl: 0 ... 25 Vol% NH ₃ : 0 ... 100 Vol% H ₂ O: 0 ... 100 Vol% O ₂ : 0 ... 100 Vol% CO: 0 ... 100 Vol% CO ₂ : 0 ... 100 Vol% Depending on the application and specific analyser configuration, the measurement ranges have to be specified. Please contact Bühler Technologies to clarify application if ranges required are 200 times lower than the recommended bottom range.		Time response Warm-Up time at 20 °C environment approx. 15 min. Response time (T90) < 1 s Electrical response 0.3 (selectable), typically 1 ... 3 s Dead time < 1 s Response better than 3 s, dependant on application Integration 1 to 100 s, selectable Performance Output signal noise 2% of reading Precision < 2% - < 5% of reading, application dependant Drift negligible Linearity drift < 1% of reading Influencing variables Environmental temperature < 1%/10 K of reading Environmental pressure < 1%/50 hPa Sample gas pressure < 2% alteration of reading at pressure change of 50 hPa Power supply < 1% at alteration of output signal by ± 10% Tip < 1% for non horizontal mounting
		Utilities Power 100 to 240 V AC 50-60 Hz, Consumption 50 W EMV in accordance to EN 61326 and NAMUR NE21 standard Electrical safety in accordance to EN 61010-1, overload class II Fuses 100 ... 240 V: 2.5T/250 Input / Output Channels 1 ... 3, optional Analog output 2, 4 ... 20 mA, potential free, max. load 750Ω Analog input 2, designed for 4 ... 20 mA Binary outputs 6, relays contacts, user configurable, AC/DC 24 V/1 A, potential free Binary inputs 6, designed for 24 V, potential free, configurable
General Concentration units vpm, Vol%, mg/Nm ³ (EU/US) Display Digital display of concentration (5 digits floating point presentation) Laser-protection Class 1, no risk for eyes Laser power application specific Certificates CE-mark, ATEX Linearity better than 1% Accuracy better than 2% for values above LDL		Design (19" control unit) Protection class IP20 in accordance to EN 60529 Dimensions 177x440x380 mm Weight approx. 13 kg Ambient conditions Temperature range +5 ... +45 °C in operation, -40 ... +70 °C for transport and storage Humidity < 85% RH, non condensing Pressure 700 ... 1200 hPa, for higher alterations of pressure than ± 50 hPa in relation to 1013 hPa atmospheric pressure please contact Bühler Technologies



BA 8000 Central unit, Dimensions in mm

BA 8000 Sensor, Dimensions in mm