Modularity = Flexibility Modular Micro-technology for Process Control

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In the era of globalisation and a steadily growing world population, an increasing worldwide energy demand is inevitable. Current studies show that the global primary energy consumption will increase dramatically by 2030 and that a 45% increase in energy usage is to be expected, in developing countries alone. Rising energy costs will be a consequence of this, which both general consumers and plant operators will have to deal with. Optimised process control can make a significant contribution in reducing energy use, reducing costs and therefore maximising profits.

In areas in which gas quality plays a primary role, process control can be positively influenced by the use of a process gas chromatograph (PGC). The choice of the right gas analysis system, taking into consideration the specific conditions and requirements, is just as crucial at this point as the examination of the costs incurred over the entire operational life. Investments which at first seem advantageous can prove to be real cost drivers in the long-term.

The quality control of process gases is, in itself, a highly complex process and requires the analysis of numerous components in order to maintain operator specifications. Amongst other variables, this includes; the measurement of various hydrocarbon chains, the calculation of the density, the Wobbe index, the calorific values, the measurement of the moisture, hydrogen sulphide, oxygen content and the hydrocarbon dew point.

Generally this requires several different types of analysers from a variety of manufacturers, of which each has to be integrated into an analyser shelter or cabinet. In principle, a safety cabinet is necessary in order to protect the devices from environmental influences such as ambient temperature and humidity. Many operators are familiar with the problem of protective housings which are typically located far from the sampling points due to their size. The result is high logistical effort, also caused by the necessary maintenance intervals, leading automatically to significant added costs for the user.

The newly developed compact gas analysis system from BARTEC BENKE allows an installation close to the process and combines, due to its modular design, different analysis equipment, reflecting the customer's needs.

In terms of process control, the operator benefits from short cycle times, high availability and significantly lower (re)calibration requirements compared to classic PGCs. The costs of acquisition and operation are reduced, also due to the low carrier gas consumption. Multiple service and maintenance contracts are also a thing of the past.

The design of the gas analysis system consists of a variety of freely combinable modules, in a customised package suitable for use in potentially explosive areas of zone 1 IIC T4. Depending on the process, the operator can add up to five additional optional modules to the base module, which is integrated into an Ex p enclosure.

The base module is a Micro-GC with a packed column, designed for the measurement of permanent gases such as; nitrogen, hydrogen, carbon dioxide and short-chain hydrocarbon compounds from C_1 to C_3. The Micro-GC is based fully on the Micro technology and consists of an injector, which injects pre-programmed samples into the carrier gas stream and a thermal conductivity detector (TCD).

If the product specifications also require the measurement of long-chain hydrocarbons from C_4 to C_9, the user has the option of adding a second Micro-GC to the gas analysis system. This module is largely identical to the base module, but the measurement is performed with a capillary column.

With another optional module the moisture in a gas stream can be measured within a dew point temperature range from -80°C to +20°C with a precision of ± 1K. It is composed of an evaluation unit and a sensor, with no cross-sensitivity to hydrocarbons, methanol and glycol in the sample. The module determines the moisture based on the patented fibre-optic method. The connection with the dew point and the moisture content is calculated in conformity to DIN EN ISO 18453.

If the operator needs to identify the hydrocarbon dew point, this can be performed by adding another sensor, which determines the results based on a modified form of the chilled mirror method. The sensor uses the same evaluation unit as the moisture module, thus contributing to the compactness of the overall system.

In addition the determination of the hydrogen sulphide and oxygen concentration is often a minimum requirement for operators for reasons of safety, but it also serves for process control.

To measure the hydrogen sulphide content even for trace quantities, a module based on UV resonance absorption spectrometry (UV-RAS) is available, which provides the most accurate measurement and covers a measuring range from 0 to 100 Vol%. As an alternative there is an electrochemical module available, allowing differentiable measurement ranges from 0 to 100 ppm or higher concentrations if needed.

An electrochemical module is also available for determining oxygen concentration, which can cover a variety of partial measurement ranges within a bandwidth from 0 up to 10,000 ppm, depending on customer requirements. Taking into account customer-specific requirements, the use of a paramagnetic module is also possible for determining the oxygen content.

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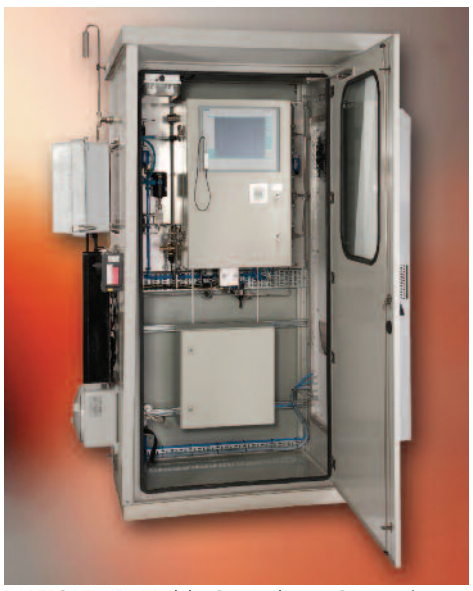
The modular gas analysis system comes as standard in every configuration with integrated software for calculating; the calorific values, density and the Wobbe index, in accordance with the ISO 6976 and ASTM D3588 standards.

In order to be able to install the modular gas analyser close to the sampling point, BARTEC BENKE offers optional complete system integration, including an air-conditioned protective cabinet for outdoor installation. The operator can therefore ensure that environmental influences such as temperature and humidity have no influence on the measurements. The system can also be equipped with a temperature-controlled gas bottle supply station and a customised sample preconditioning system. Communication interfaces such as Modbus allow simple operation and remote monitoring of the results; allowing the operator to receive a complete system solution from a single provider.

This complete system offers users even more advantages over classic PGCs. It is possible to install the complete analysis system in the immediate proximity of the sampling point, potential measurement errors which could arise from dead volumes and temperature influences are reduced. In addition the modular design significantly reduces service efforts, downtime, and maintenance costs. The requirements for a necessary infrastructure are minimised because the Micro-GC with a carrier gas consumption of maximum 1 ml/min, uses less than one tenth of what classic PGCs do. Gas bottles do not have to be exchanged as often as previously or smaller bottles can be used, reducing logistical and personnel expenses significantly. The pre-programmed software can also perform the calibration automatically. The ratio of energy consumption by the Modular Gas Analyser to the classic PGC averages 1 to 3, also contributing to cost reductions.

The market demands for modular gas analysis systems vary, depending on the area of use. Some applications, such as natural gas processing facilities, require modules for the analysis of short and long-chain hydrocarbon compounds and for determining the moisture and hydrogen sulphide content and also the hydrocarbon dew point. Other applications, in turn, require fewer modules.

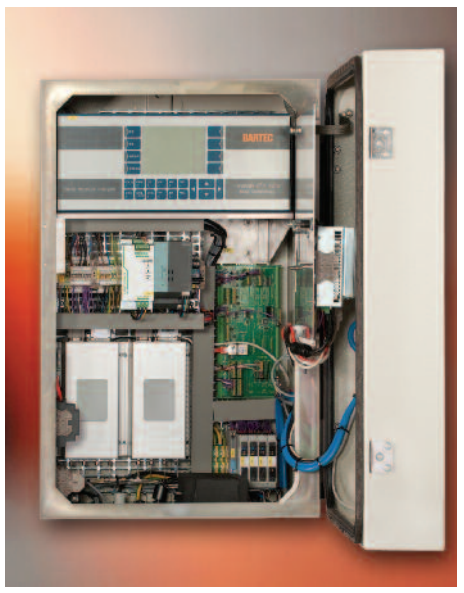


BARTEC BENKE's Modular Gas Analyzer MGA-nano in an air-conditioned protective cabinet

A further application is found in petroleum refineries, for example, where both refinery gases and recycle gases appear. The typical composition of recycle gas consists primarily of hydrogen and impurities, composed of; methane, ethane, propane, butane, other hydrocarbon compounds, water and air. The components must be measured or controlled so that the recycle gas is always within the specified tolerance for hydrogen content. For these applications, the gas analysis system is typically offered with the base Micro-GC module, second Micro-GC, hydrogen sulphide module and moisture module.

Considering the increasing scarcity of resources, the requirement for an alternative gas source has arisen in recent times. Today gases released by microorganisms in landfills are used to drive gas engines and gas turbines, which generate electricity and heat. Landfill gas typically consists of 60% methane and 40% CO_2. The values for quality and process control are crucial for further use. For this application, the monitoring of the moisture, hydrogen sulphide and oxygen content are imperative to operators, along with the base Micro-GC module. These measurements are also frequently required in biogas treatment plants.

For the first time operators of facilities in which gas processes must be monitored or controlled have an alternative to classic PGCs. The Modular Gas Analyser MGA-nano meets customer needs for user-specific, modular system solutions which can be installed close to the process and offer long-term cost savings.



Ex p enclosure with integrated Micro-GC modules, evaluation unit for moisture/HCDT determination and IPC