

Low gas volume & flow  
measurements made easier  
**Gas Endeavour**



 **BPC INSTRUMENTS**

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# Low gas volume and flow high accuracy and precision

## Measure gas volume and flow for a wide range of applications

The Gas Endeavour allows users to measure low gas volume and flow whenever there is a demand for accurate and precise measurements. This smart analytical instrument can be used for both research and industrial applications in animal nutrition studies, wastewater analyses, ethanol fermentation, hydrogen production, greenhouse gas emissions, evaluation of microbial communities and their activity and more.

## Significantly reduce your labour demands

The Gas Endeavour is a well-engineered analytical device, developed specifically for online measurements of low gas flows from any gas displacement process at laboratory scale. It is simple to use and easy to learn.

This automated analytical procedure significantly reduces labour demands when compared to many traditional methods or competitive solutions on the market.

## Standardise and compare results

The Gas Endeavour is a fully automatic analytical platform designed for the real-time monitoring of biological or non-biological batch processes generating or consuming low flows of either inert or slightly aggressive gases. The instrument provides for the standardisation of measurement procedures, data interpretation and reporting. This allows for data from different laboratories around the world to be easily compared, thus creating value above and beyond the high-quality results obtained from operating the Gas Endeavour.

## Get access to highly precise and accurate data

The real-time performance and outstanding features of the Gas Endeavour satisfy the highest demands for data accuracy and precision. This high-quality data can be used to extract important kinetic information, which in turn provides for a much better understanding of your process.

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15  
test lines

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2  
measuring resolutions

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Modular design for  
easy replacement and  
maintenance

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Continuous and  
simultaneous  
gas volume, flow,  
and composition  
analysis

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### Outstanding real-time performance

The Gas Endeavour is an efficient analytical instrument for conducting real-time assays in which gas is produced, having sampling, analysis, recording, and report generation fully integrated and automated. Its flexible design allows for gas consumption measurements as well.

The multi-channel analyser consisting of 15 parallel test vessels and the same number of gas flow meters attached to an embedded data acquisition system, allows for the real-time investigation of a high number of samples. This unique design makes the Gas Endeavour an extremely precise and accurate instrument, with a wide range of applications.

### Temperature and pressure compensation

The real-time temperature and pressure compensation feature of the Gas Endeavour ensures that the impact of measurement conditions can be minimised and data presentation is standardised.

The temperature and pressure are measured every time a flow cell opens, allowing the user to derive exact kinetic information compensated for any variation over time, while considering the vapour content of the gas. The normalised volumes are presented under dry conditions at 0 °C and 1 atm.

### Optional removal of gas over- or underestimation

The Gas Endeavour can be used to measure both total gas and/or the remaining gas after absorption of a part of the gas. For example, methane production can be measured when carbon dioxide is removed from the gas. When certain gases are absorbed and only a remaining gas is measured, an over- or underestimation of the gas production arises when the composition of the produced gas differs from the composition of the head space gas at the beginning of the test. The Gas Endeavour can calculate and remove this over- or underestimation, providing for more accurate and reliable data on measurements of gas production.

### Network-ready and easy access

The Gas Endeavour is designed to allow easy access from a remote location. Through the use of standard protocols and connections, the Gas Endeavour behaves like any other unit on an internal network, secured by a user definable password. All interactions with the software are conducted through a web browser using any computer. Thus, experiment monitoring can be carried out with any smartphone or tablet device.

The analytical capacity of Gas Endeavour can be easily expanded by connecting multiple instruments together with an Ethernet switch. With this feature, each Gas Endeavour can be operated alone or connected in parallel for analytical capacity expansion, entirely depending on user needs.

# Software for Gas Endeavour

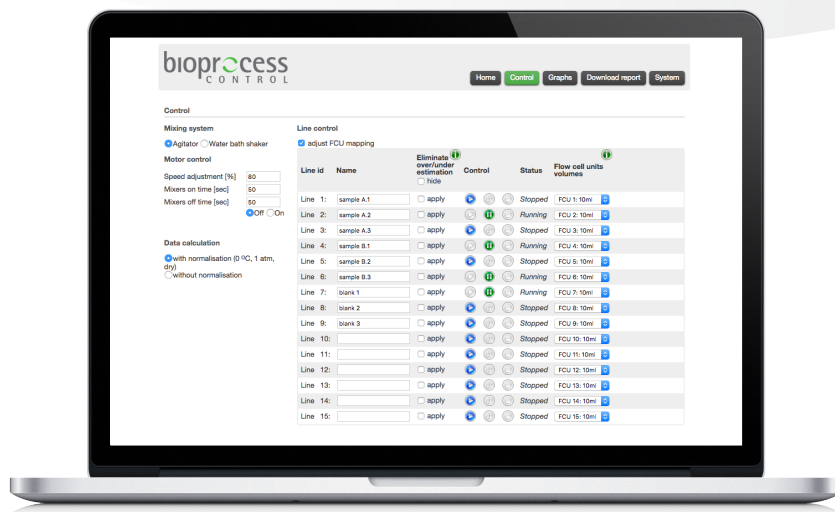
## A simple and intuitive software application

The Gas Endeavour software application has been specifically designed to be applicable for a wide range of batch tests where gas volume or gas flow needs to be measured with high demand on accuracy and precision. This application, which is easy to understand and navigate, allows users to set up an experiment, monitor its progress, and download results with little effort. Moreover, all data is in a standard format that allows for easy analysis. The software application is simply a natural extension of a universal hardware platform that has been designed for carrying out various batch tests where gas flow, volume, and composition measurements are important.

## Total control throughout an experiment

The Control feature of the Gas Endeavour software application allows users to control the status of each batch test in real-time during an experiment. For the system with our multifunctional agitation system, users can control the interval, speed, rotation directions, and on/off time of the mixing of reactors, to ensure each reactor is operated under optimum mass transfer conditions. Users can also easily start, pause, and stop data acquisition of an ongoing experiment at any time by means of a simple to use control feature, which also indicates the status of each test line at all times.

Overall, this allows users to have optimal control of all test vessels and batch experiments at all times with the simple click of a virtual button from the software user interface.



The Graph feature of the Gas Endeavour software application and embedded web server allows users to see their experiment in real-time and from any location. Users can easily monitor the accumulated gas volume and flow rate of each reactor in real-time by selecting and viewing only the one they wish to see.

Moreover, all values displayed are already adjusted for gas volumes normalised to 1 atmospheric pressure, 0 °C, and zero moisture content.

If a flush gas with a different gas composition from the produced gas is used to establish initial headspace gas conditions, the impact of the flush gas is also taken care of by the Gas Endeavour software application.

This flexibility and precision allows Gas Endeavour users to always know the status of an experiment, as well as keep an eye on the data being produced.

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Always have total control over your experiment at any time and any place

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An evolution in low gas volume and flow measurements

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# Wide user base and application areas

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## User base

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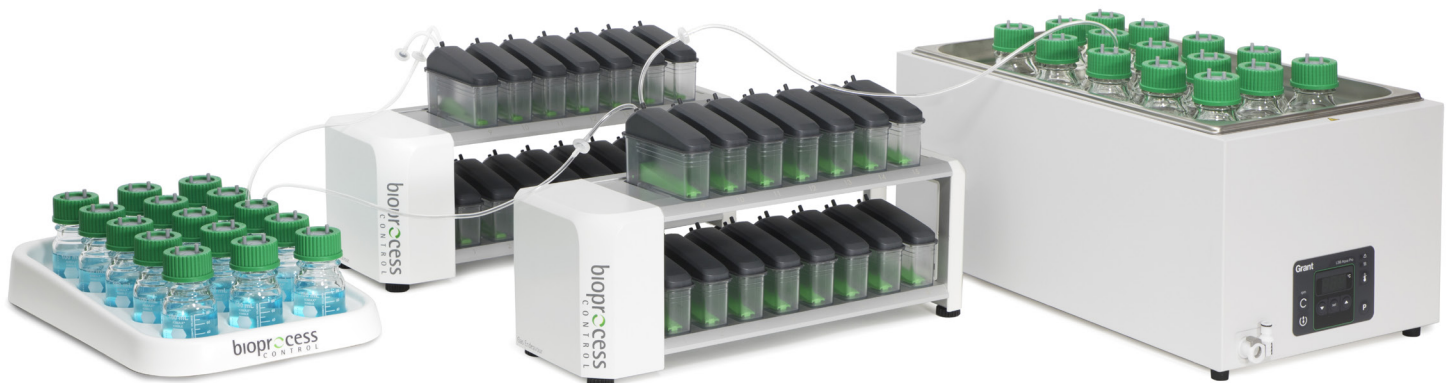
BPC's gas measurement equipment is currently used by academic scientists, public and private laboratories, energy producers, organic waste handlers, wastewater treatment plants, food producers, bio-ethanol producers, bio-hydrogen producers, microbiologists, prebiotic producers, and feed additive producers.

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## Application areas

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The Gas Endeavour can be used to conduct ruminant fermentation trials, feed additive studies, monogastric nutrition trials, biodegradability and compostability tests, greenhouse gas emission studies, silage studies, specific anammox activity tests, biochemical oxygen demand (BOD) analyses, aerobic and anaerobic respiration, and determining the dynamic profile of the target analysis.





## Technical specifications

### Sample incubation unit with mechanical agitation (option 1)

Maximum number of reactors per system: 15

Reactor material: glass

Reactor volume: 500 ml (standard), 1000 ml (optional)

Dimension: 59 x 34 x 28 cm

Temperature control: up to 95 °C (203 °F) (precision of 0.2 °C)

Mixing in the reactor: mechanical agitation (adjustable interval, speed and rotation directions), 10 to 200 rpm



### Sample incubation unit with shaking (option 2)

Maximum number of reactors per system: 15

Reactor material: glass

Standard reactor volume: 250 ml

Dimension: 59 x 34 x 28 cm

Dimension tray insert: 44 x 26 x 7 cm

Temperature control: up to 99 °C (210 °F) (precision of 0.1 °C)

Mixing in the reactor: shaking water bath, linear shaking motion, 20 to 200 rpm (depending on load)



### Gas absorption unit

Gas trap bottles: 15

Bottle material: glass

Bottle volume: 100 ml

Dimension of unit: 44 x 30 x 6 cm

Absorption liquid: depending on gas to be removed. For CO<sub>2</sub> removal: 3 M NaOH with pH indicator, 80 ml per bottle (not included)

Absorption efficiency: for CO<sub>2</sub> removal with NaOH: > 98%



### Flow meter array and DAQ unit

Single gas measurement: measurement for 15 test vessels in parallel

Double gas measurement (i.e. total gas and one specific gas component, such as methane): measurement for 7 test vessels in parallel

Measuring resolution: 2 ml or 9 ml

Detection capacity: up to 2.5 l cumulative gas per channel for each batch test with 2 ml flow cell; up to 12 l cumulative gas per channel for each batch test with 9 ml flow cell

Measuring range for instant gas flow rate: 2 to 24 ml/min for 2 ml flow cell; 9 to 110 ml/min for 9 ml flow cell

Integrated data acquisition (maximum capacity  $2 \times 10^4$  flow cell openings)

Built-in pressure and temperature sensor for real-time compensation

Dimension of unit: 51 x 26 x 17 cm

Housing: aluminium and plastic

Measuring precision:  $CV \leq 1\%$



### Software and System

- User friendly web-based software running on an embedded server, with no need of pre-installation on your pc, tablet, or smartphone
- Online real-time gas flow and volume display
- Automatic real-time pressure and temperature compensation
- Real-time gas flow and volume normalisation
- Algorithm to avoid over- or underestimation of gas flow and volume that may be introduced by flush gas during experiment setup
- Possibility of multiplexing, allowing for simultaneous analysis at different start-up times
- User friendly guidelines for experiment setup
- Online system logger for operational diagnosis
- Power supply: 12 V DC / 5 A (Flow cell array and DAQ unit), 24 V DC / 2.7 A (mechanical agitation)
- Usage: indoor



# BPC Instruments – smart instruments for smart people

BPC Instruments is a market leader in the area of low gas flow analytical instruments for biotechnology related applications. We invest in innovation and development of smart instruments that allow for more efficient, reliable and higher quality research and analysis, leading to significant reductions in time and labour. We ensure the highest product quality throughout our portfolio, and focus on being service minded and always meeting the needs of our customers.

The company's flagship products, AMPTS® and Gas Endeavour® has become the preferred analytical instrument around the world for conducting various anaerobic batch fermentation tests. BPC's product portfolio offers academic and industrial actors working with biogas, animal feed, wastewater, and other fields exciting products for low gas flow measurements, substrate analyses and process simulations.

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