

# Gas dosing for bacterial growth



Application note A050-FP02-0716A



- ◆ Yoghurt
- ◆ Wine

**Bacteria are single-celled micro-organisms with their size in the micron range. Already for ages, bacteria have been used in the preparation of fermented foods and drinks, such as yoghurt and wine.**

Bacteria are the workhorses in the modern field of biotechnology, where they are employed to produce chemically, pharmaceutically or biologically active substances as antibodies or insulin. Bioreactors form their artificial habitat. In this controlled environment, that needs to be conditioned with respect to temperature, dosing of gases and liquids and pH value, these bacteria can grow. In a search for better mass flow equipment a manufacturer of bioreactors came in contact with Bronkhorst. A few years ago they developed a new, small type of bioreactor with a volume of 500 ml, and they needed matching gas dosing equipment. It was the start of a fruitful cooperation.



Fermentor

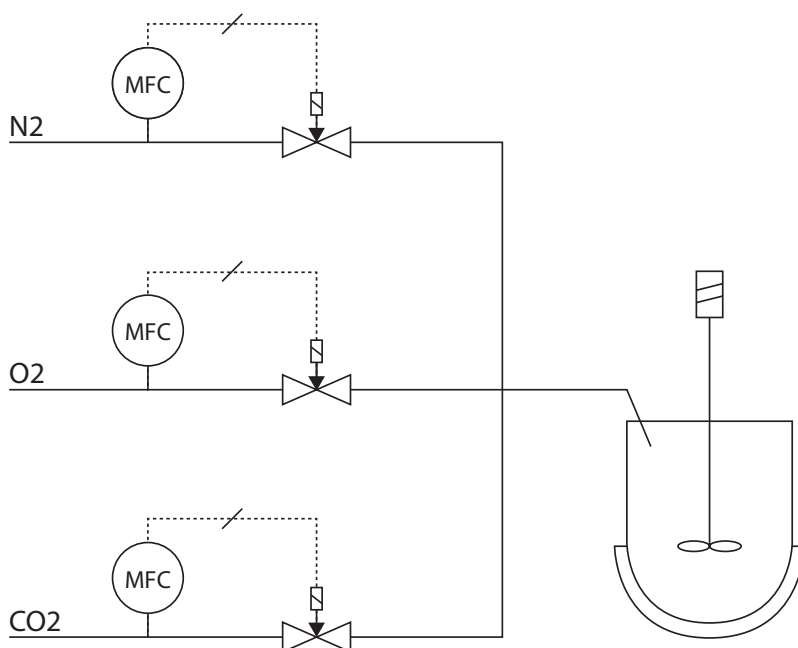
## Application requirements

Accurately and reproducibly dosing of gases as oxygen or carbon dioxide to bioreactors is essential to control bacterial growth rate. Moreover, for easy scaling-up, a full range of dosing equipment should be available, and these should be mutually interchangeable.

### Important topics

- ◆ Reproducibility and reliability
- ◆ Full range
- ◆ Mutually interchangeable, easy to scale up

## Process solution



Flow scheme

The small bioreactor system has the size of a personal computer housing, with a reactor vessel of 500 ml and all kinds of sensors. For this system they needed small mass flow controllers: for low flows, but also compact. To this end Bronkhorst supplied the IQ+ Flow mass flow controller for one channel, or a package called IQM3 for three channels, to dose gases such as oxygen, nitrogen, carbon monoxide or carbon dioxide into the reactor. With IQM3 three gases can be dosed simultaneously, each in the range between 10 and 1500 ml per minute.

For this small bioreactor application, a dosing accuracy of max.  $\pm 3\%$  is required, and the IQ+ Flow series deliver with an accuracy of  $\pm 2\%$ . In addition to that: the bioreactor uses a standard recipe of gases for bacteria to grow, and the composition of the recipe should be the same - within specifications - as the previous one, so reproducibility is even more important.

Bronkhorst is able to serve the entire biotechnology production range: from lab scale (1 l/min) with IQ+/IQM3, via intermediate scale (10 l/min) with EL-FLOW Select, to full production scale (200 l/min). Upscaling to another device with larger flow is easy, as all these devices use the ModBus communication protocol, so they all speak the same language. The cooperation started with small devices but nowadays ... ►

... Bronkhorst flow devices are also incorporated in the bioreactors of intermediate and full production scale of the manufacturer.



## Recommended Products



### IQ+ FLOW

Conventional mass flow and pressure meters and controllers have needed a footprint of 1.5". Now Bronkhorst High-Tech has developed the IQ+FLOW® mass flow sensor. Bronkhorst has been able to halve the footprint dimension to 0.75", thereby realizing the ultra compact flow and pressure meters and controllers.

- ◆ Flow ranges from 0,2...10 ml/min up to 0,1...5 l/min (Full Scale values)
- ◆ Very stable Zero, due to the thermally balanced chip-sensor
- ◆ Compact assembly ensures space efficiency
- ◆ Economical solution, low cost of ownership
- ◆ Fast response, down to 300 msec
- ◆ Analog and digital (RS232 or RS485) communication



### EL-FLOW Select

EL-FLOW® Select Series Mass Flow Meters/Controllers are thermal mass flow meters of modular construction with a 'laboratory style' pc-board housing. Control valves can either be integrally or separately mounted, to measure and control gas flows from lowest range 0,014...0,7 ml/min up to highest range 8...1670 l/min.

- ◆ High accuracy (standard 0,5% Rd plus 0,1% FS)
- ◆ Rangeability in digital mode up to 1:187,5
- ◆ Fast response (down to 500 msec), excellent repeatability
- ◆ Optional Multi-Gas / Multi-Range functionality: freely programmable ranges and gas types
- ◆ Pressure ratings 64 / 100 bar (Multi-Gas / Multi-Range functionality up to 10 bar)
- ◆ Compact, modular construction



### IN-FLOW

IN-FLOW Select Series Mass Flow Meters/Controllers are thermal, bypass-type, mass flow meters of modular construction with a 'industrial style' pc-board housing. Control valves can either be integrally or separately mounted, to measure and control gas flows from lowest range 0,014 ... 0,7 ml/min up to highest range 8 ... 1670 l/min

- ◆ High accuracy (standard 0,5% of Rd plus 0,1% of FS)
- ◆ Rangeability in digital mode up to 187,5 : 1
- ◆ Optional Multi-Gas / Multi-Range functionality: freely programmable ranges and gas types
- ◆ Pressure rating 64 / 100 bar (Multi-Gas / Multi-Range functionality)
- ◆ Rugged, weatherproof housing
- ◆ Analog or digital communication (RS232 or fieldbus interface)



### MASS-STREAM

The MASS-STREAM™ covers flow ranges from 0.01 ... 0.2 l/min up to 100 ... 5000 l/min (Air), and follows M+W Instruments' strategy of widely standardised product ranges. The instruments have IP65 protection as a standard and are operated with a main-board with all functions for accurate flow measurement and control.

- ◆ Useable for virtually every kind of gases
- ◆ Compact and robust IP65 design
- ◆ Very low pressure drop
- ◆ Measurement without moving parts
- ◆ Less sensitivity to humidity or dirt
- ◆ No inlet pipes needed
- ◆ Optional with integrated TFT display
- ◆ Maintenance-free

## Contact information



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FP: Food, Beverage & Pharma  
02: Biotechnology - Lab

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