



## VAYU Meter

The first non-contact, real-time, continuous biomonitoring system for pharma and biotech with unparalleled precision

# VAYU Meter

The solution for continuous, real-time, non-invasive biomonitoring for pharmaceutical and biotech production

## Better Process Understanding

Optimizing pharma yield during fermentation processes – knowing how to control growth processes, when to add nutrients, change fermentation conditions and terminate the process – is extremely challenging. Incorrect timing may result in waste of resources and lower profits.

Better process understanding and control are key enablers in fermentation process optimization to achieve increased yield and shortened culture duration.

Monitoring and control of the production stage with the VAYU Meter can establish a database of the fermentation pattern. The optimum duration of the production stage can then be set.

## VAYU Meter: Improved Culture Performance

VAYU Meter enables pharmaceutical companies to monitor and control fermentation-based drug production processes with extreme accuracy, continuously and in real time.

VAYU Meter monitors, records and analyzes CO<sub>2</sub> metabolic gas concentrations produced during the respiration and growth of living cells.

Continuous, automatic measurements via proprietary IR absorption allow in-situ detection of metabolic gases without interrupting the process for invasive sampling.

The demonstrated accuracy of the VAYU Meter measurements qualifies it as a control tool that can improve culture performance, when used as a key decision driver for managing culture dynamic.



VAYU Meter installed via Neumo  
Bioconnect interface



3D Sketch of the VAYU Meter  
with Disposable Unit

## Advantages of VAYU Meter Process Control unit

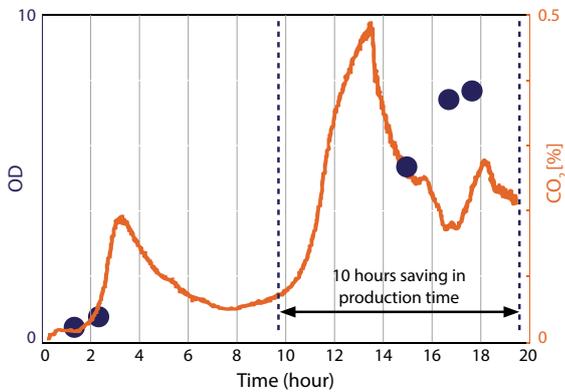
### Operational customer benefit

- Online monitoring in real time, continuously
- Non-invasive
- Easy installation on the exhaust system of the fermenter
- Defined media-touch interface (Bio Control)

### Business impact of optimized R&D and production processes with the VAYU Meter:

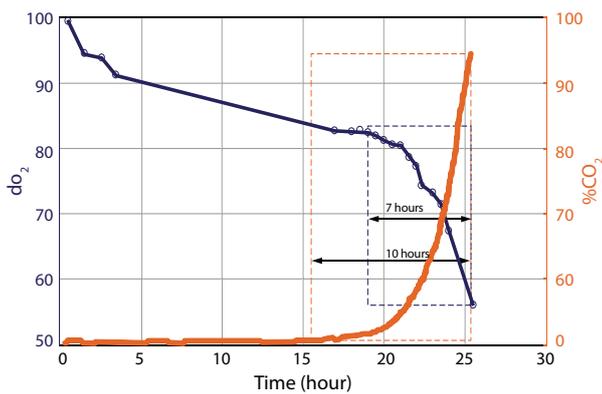
- Increase yield up to 40%
- Shorter R&D protocol establishments
- Reduce time to market
- Reduce production cost
- Improve process reproducibility
- Optimize overall plant efficiency

# High Resolution of VAYU Meter CO<sub>2</sub> Monitoring is Superior to Other Measurement Methods



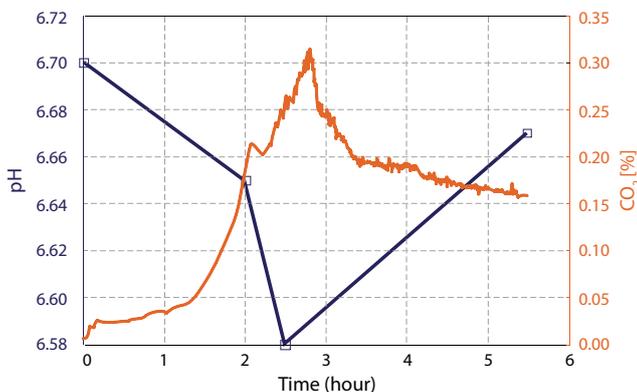
## VAYU Meter continuous measurement provides more insightful information than discrete optical density measurement

VAYU Sense's online and continuous monitoring of bacteria growth, shown in red, is more precise than traditional optical density measurements, shown in blue. In this case, VAYU Meter data shows that the recombinant protein production process was completed 8 hours after seeding, while the harvesting was not done until 18 hours after seeding. In this example, this means redundant fermenter time and lower yields.



## VAYU Meter CO<sub>2</sub> measurements boast a resolution 63 times higher than dO<sub>2</sub>

VAYU Meter's sensitive and high-resolution CO<sub>2</sub> monitoring, shown in red, enables early detection of cell growth, around 3 hours earlier when compared to dO<sub>2</sub> measurements, shown in blue. In the above measurement, dO<sub>2</sub> level changed – during the log phase – by a factor of ~1.6 greater than during the lag phase, while the change of CO<sub>2</sub> concentration was more than 100 times larger between log and lag phases.



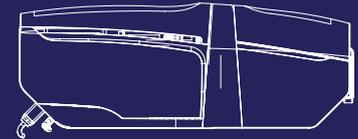
## VAYU Meter is shown to correlate to pH measurement

pH measurement, shown in blue, is a recognized method that is routinely used for controlling fermentation processes and it correlates with cell growth. In this case, the results measured with the VAYU Meter shown in red correlate with pH.

# Technical Specifications VAYU Meter

## Technical Specifications

1. Mounting / Placement:
  - a. Inline process use: mounting via NEUMO GmbH dedicated connector
  - b. Disposable use: placement on any flat platform
2. Communication Interfaces: LAN, USB, Analog input/output 4-20 mAmp
3. Dimensions / Weight:
  - a. Inline process use: 32cm / 33cm / 22cm (L/W/H), ~ 9 kg
  - b. Disposable use: 54cm / 33cm / 22cm (L/W/H), ~ 12 kg
4. Power: 220VAC / 150W
5. Environmental:
  - a. Storage: IP65, 10-35 [°C], 20%-90% humidity
  - b. Operational: IP65, 10-35 [°C], 20%-70% humidity
6. Applicable standards:
  - IEC / EN61010-1 3rd Ed
  - IEC 60529: 2001 / EN 60529: 1991 + A1: 2000
  - Laser safety: IEC / EN 60825-1: 2007



a. Inline process use

b. Disposable use

## VAYU Meter is a powerful device with two different interface options

### Large-scale fermenters (NEUMO housing):

- Various sizes according to the customer need
- Pipe connections to the fermenter:
  - DIN 11866 Line A,B,C. ASME BPE. - DN 25-65 (1"-3")
- Media-bearing materials:
  - 1.4435 / 1.4404 – Factory acceptance certificate
  - DIN EN 10204 3.1
- Media-coated glass is Borosilicate glass –
  - Factory acceptance certificate
  - DIN EN 10204 3.1
- O-rings: EPDM – FDA, USP Class VI
- Pressure stage: PN 16 – TÜV approval
- Temperature: -10 to +200 °C

### R&D, disposable fermenters, small-scale fermenters (Disposable Unit):

- Stationed on table / shelf
- Disposable tube connected to the exhaust tube of small-scale fermenter or/and disposable fermenter
- Enable / Disable air pump option
- Very easy installation

## How it Works



### Measure

A dedicated light source emits infrared light to measure new growth from the fermenter/container via the gases produced by the biological material. No calibration is needed.



### Record

Real-time results that correlate with biomass are measured and recorded continuously. These can be viewed on the control unit as well as on any mobile device.



### Optimize

Better process understanding enables the operator to intervene in the process to optimize yield and throughput.

## Strong partnership

**VAYU Sense AG** has developed and is bringing to market an innovative biological detection technology. VAYU Meter allows identification of extremely subtle fluctuations in gaseous concentrations at unprecedented parts-per-million sensitivity. Its ability to measure these processes accurately in real time will positively impact a wide range of industries.

**NEUMO GmbH+Co.KG** is a technology leader in fittings, assemblies, containers and equipment made of stainless steel and special materials, which are used for fluid handling in the pharmaceutical, biotechnology, chemical, semiconductor and solar industries. This family managed company, firmly rooted in its local region, is the breeding ground for the NEUMO Ehrenberg Group, with a workforce of more than 1,900 worldwide. NEUMO is the international distribution partner of VAYU Sense.

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