

PRODUCT BROCHURE

MAX300-BIO

Bioreactor/Fermentation Mass Spectrometer



Fast Response

Process Control

Stable Measurement

- Quantitative analysis of individual contaminants
- PPT detection limits
- Analysis time in seconds
- Multiport sample systems for total site monitoring
- Precision & accuracy for safety and regulatory reporting
- Minimal maintenance required

Introducing the MAX300-BIO

Know Your Process

Mass spectrometry is a powerful tool for bioreactor monitoring. Changes to the headspace composition in a fermentor or bioreactor provide crucial insight into cellular health and production efficiency. This makes the fast, accurate analysis of the gases flowing out of the reactor essential for real-time process control. The continuous measurement of these streams enables the determination of critical process parameters, like the Respiratory Quotient, without endangering sterility within the vessel. The MAX300-BIO™ uses cutting edge quadrupole mass spectrometer technology to quantify bioreactor gases from multiple reactors within the facility and reports the data to the control system in real-time.

Based on decades of proven performance in bioreactor applications, and thousands of process control installations worldwide, Extrel® process mass spectrometers provide the stability and precision of a laboratory-grade analytical instrument in a rugged platform optimized for continuous operation in demanding manufacturing environments.

Bioreactor and Fermentation Process Gas Analyzer Features:

- Measures CO₂, O₂, N₂, H₂O, alcohols, contaminants, and more
- Samples without risk of contamination
- Calculates control parameters in real-time (e.g. Respiratory Quotient)
- Provides flow and mass balance data
- Multiport sample systems for up to 80+ reactors
- High precision and accuracy for optimal process automation
- Low maintenance, utilities and calibration required
- Complete method scale-up
- Lab, Pilot, Production

Industrial Bioreactors are used worldwide to produce pharmaceutical, fuel, food and biomass products.

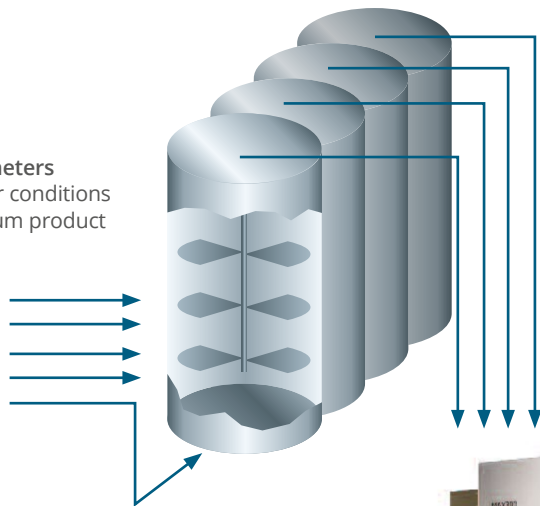
- Biofuels
- Ethanol
- Pharmaceutical Products
- Enzymes
- Antibiotics
- Steroids
- Vitamins
- Biomass
- Biopolymers
- Alcoholic Beverages
- Bread Products
- Waste Treatment



Max300-Bio: Gas Analysis For Bioreactor Process Control

Critical Control Parameters
Tight control of reactor conditions is required for maximum product quality and yield.

- Temperature
- Dissolved oxygen
- pH
- Agitation speed
- Aeration rate



Rapid Data Delivery

The programmed analysis routine measures each sample point in seconds, and instantly transmits critical information about process conditions directly to the plant's automated control system.

Transmission options:

- TCP/IP
- 2 Wire Serial
- 4 Wire Serial
- Analog
- Fiber Optic (single mode/multi-mode)



Total Plant Control with a Single Analyzer

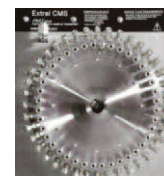
The sample inlet system of the MAX300-BIO can be configured with a number of zero-dead-volume multipoint valve options. (Stainless steel enclosure option shown).

Sample Pressure Range:

- 0.015 – 2.5 bar

Number of sample streams:

- 16, 31, 40, 80+



The 80 port MAX300 FASTvalve

For larger installations, the FASTvalve sample system can maintain continuous flow from up to 80 sample points and be heated up to 120°C.

Extrel's MAX300-BIO LG™ offers a compact alternative for monitoring bioreactors and fermentation from a benchtop installation.



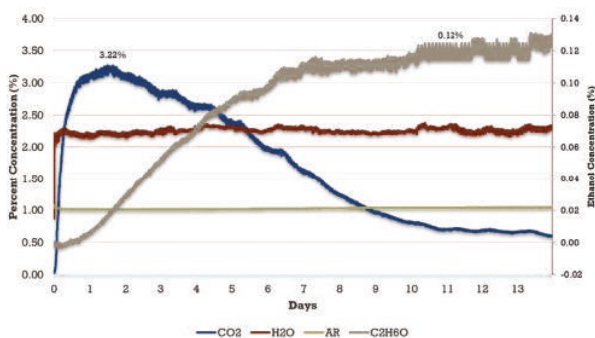
Analytical Flexibility for Laboratory Sampling

A production control MAX300 can also analyze lab and pilot scale bioreactors without stopping the industrial monitoring sequence, even if the smaller reactors are testing a new process with different gases and measurement ranges.



The MAX300-BIO Provides Real-time Process Control

Accurate off-gas analysis tells the control loop exactly what is happening inside each reactor without the risks involved with probes or manual sampling.



Gases Measured: CO₂, O₂, N₂, H₂O, argon, ethanol, methanol, formaldehyde, others

Calculated Control Loop Inputs

Using the effluent composition, the MAX300-BIO calculates the key indicators of organism health and process efficiency:

- Carbon Dioxide Evolution Rate (CER)
- Oxygen Uptake Rate (OUR)
- Respiratory Quotient (RQ)
- Total Gas Flow
- Total Mass Balance
- Liquid Concentrations in the vessel
- Batch Quality – Analysis of minor ppm/ppb level components such as formaldehyde, methanol, acetic acid, etc.

$$RQ = \frac{CER}{OUR} = \frac{\left(CO_{2\ out} * \frac{N_{2\ in}}{N_{2\ out}} \right) - CO_{2\ in}}{O_{2\ in} - \left(O_{2\ out} * \frac{N_{2\ in}}{N_{2\ out}} \right)}$$

FAST, ACCURATE, EFFICIENT

System Highlights

Detectable compounds:

Any gas or vapor sample

Detection range:

100% – 10 ppb standard, 10 ppb with the electron multiplier option*

Number of sample streams:

16, 31, 40, 80+

Analysis rate:

<0.4 seconds per component

Number of components: Unlimited

Number of analysis routines: Unlimited

Number of user configurable data tags:

Unlimited

Analysis precision:

<0.25% relative standard deviation**

Stability:

<0.5% relative standard deviation over 30 days**

Dual filaments:

One active and one spare with automatic switchover

Maintenance: Typically two PMs per year

Manual or fully-automated calibration and validation

Mass range options: 1-250, 300, or 500 amu

19 mm high-transmission quadrupole filter

* Documented on trace benzene in air.

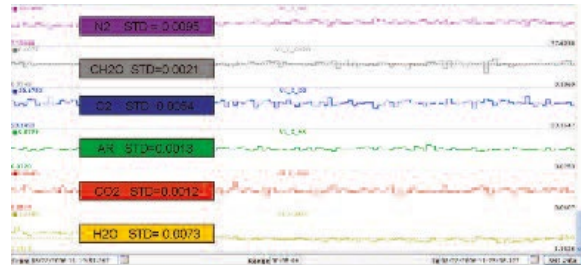
** Based on the analysis of 1% argon.

Low Maintenance, Easy to Use

The Questor5 software that drives the MAX300-BIO measures all sample points in a fully customizable sequence for site-specific, automated production control. The intuitive web-based interface allows the user to check instrument status, review data, or run a validation sequence from anywhere on the plant network, while maintaining government and industry security standards for login and electronic record keeping (21 CFR 11).

Combining the power of Questor5 with industrial-grade hardware, the MAX300-BIO is a 24-7 bioreactor monitor with a documented uptime >98%.

Faster data means better control. The MAX300-BIO is an analytical platform with the speed necessary to provide real-time process data on up to 80+ reactors within the facility, and the sensitivity to measure trace contaminants in the final product.



Simultaneously trend high precision measurements of bulk components and ppm-level contaminants with the easy-to-use Questor5 control software.

Extrel



Extrel's 19 mm quadrupole next to a common 6 mm filter. The larger device provides greater ion transmission for unparalleled sensitivity and signal stability.



The MAX300-BIO disposable, plug-and-play ionizer eliminates the cleaning requirement. It includes dual filaments: one active and one spare.

MAX300-BIO System Specifications

Power Supply Options:

- 120 VAC, 50/60 Hz, Two 15 Amp circuits
- 230 VAC, 50/60 Hz, One 20 Amp circuit

Power Consumption:

- Nominal 2500 Watts
- Startup 2750 Watts
- Heat Load: 2500 Watts (8500 BTU/Hr)

Weight:

- Standard Enclosure: 420 lbs (190 kg)
- ATEX Enclosure: 560 lbs (254 kg)
- Optional cart: 40 lbs (18 kg)

Ambient Requirements:

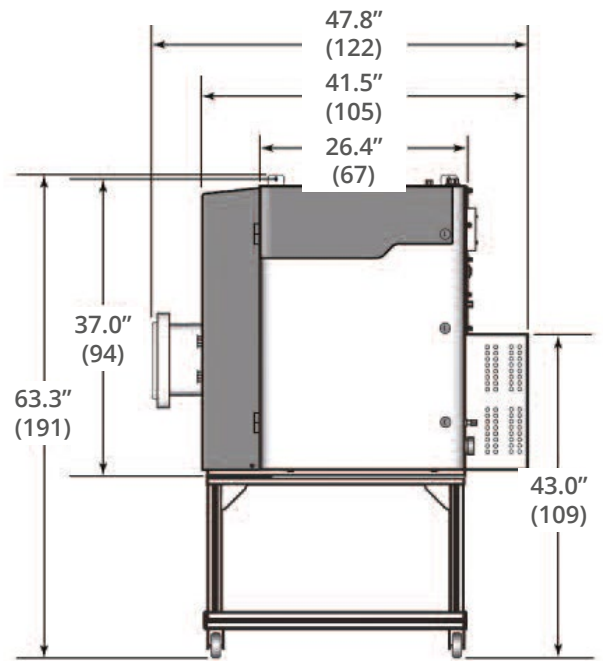
- Temperature: -4°F to 120°F (-20°C to 49°C)
- With A/C, cold start $\geq 54^\circ\text{F}$ (12°C)
- Area Classification Options:
 - General Purpose
 - Class 1, Division 2 Groups B, C, D, T3
 - Class 1, Division 1 Groups B, C, D, T3
 - ATEX Zone 1 or Zone 2, Group II B +H2, T4

Additional Utilities:

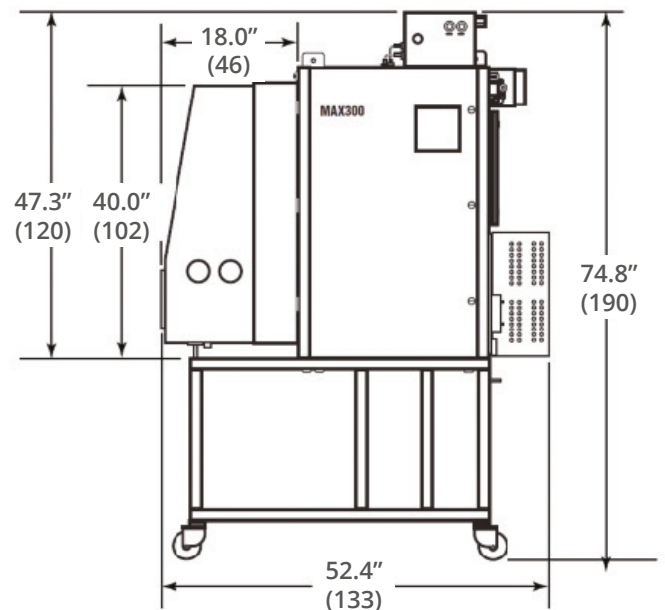
- Purge gas (for hazardous area installations)
- Base calibration requirement: 2 gas bottles

Data System and Communications:

- System control interface options: Ethernet, RS-422 4-wire
- Login security levels: Administrator, User, Viewer
- External communications:
 - Ethernet, Modbus serial, digital I/O, analog I/O, OPC



MAX300-BIO standard enclosure dimensions with A/C and Cart



MAX300-BIO ATEX enclosure dimensions with A/C and Cart

Dimensions shown in inches [cm]

Exceptional Worldwide Service and Support

For over 50 years, Extrel has been committed to providing the highest quality support services for the thousands of instruments installed worldwide. Factory trained and certified personnel offer industry-leading support to Extrel customers at every stage of the environmental monitoring application.

PREMIUM INSIGHTS – GAIN REAL-TIME INSIGHT INTO YOUR PROCESS

Process Insights' products and solutions deliver innovative and differentiated analysis and measurement solutions and technologies that add high value to our customers and protect the environment.

Our commitment is to deliver smart and affordable innovation that optimizes process, improves safety, and transforms our world.

CENTERS OF EXCELLENCE

PROVIDING PROVEN SOLUTIONS FROM A GLOBAL TECHNOLOGY LEADER

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