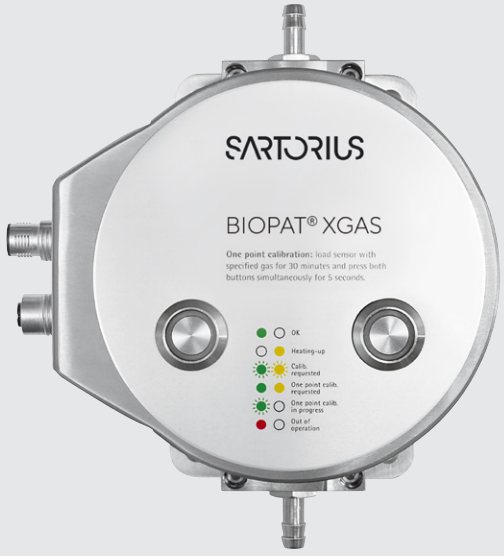
SARTORIUS

Product Datasheet

BioPAT® Xgas

Online Off-Gas Analysis for Monitoring and Controlling Bioprocesses



Benefits

- One-sensor determination of O_2 and CO_2
- Integration into Biostat® and BioPAT® MFCS
- Monitoring of metabolic processes
- Process and yield optimizing tool
- Compact design for flexible use
- Automatic moisture and pressure compensation

Product Information

The BioPAT® Xgas, can monitor exhaust gas from bioprocesses in real time. It is a dual oxygen-carbon dioxide sensor featuring automatic compensation of humidity and pressure. The oxygen concentration can be measured in a range of 1 – 50% and the carbon dioxide concentration in a range of 0 – 10%.

O_2 Sensor

The zirconium-dioxide sensor measures the oxygen concentration over a range of 1 to 50% with an accuracy of under 0.2% full scale over the whole measurement range with a ±3% reading on the value. The measurement principle requires the sensor temperature to be 580°C (1,076°F) and operates to specification for up to 15,000 hours (approx. 20 months) with less than 2% drift. The O_2 sensor requires a minimum of 0.1% oxygen during operation to avoid damage to the electrode cell. Therefore, sensor exposure to non-oxygen gas mixtures must be avoided.

CO_2 Sensor

The dual-wavelength infrared sensor detects the carbon dioxide concentration over a range of 0 to 10% with an accuracy of under 0.2% FS over the whole measurement range with a ±3% reading on the value. The robust sensor operates for up to 20,000 working hours (approx. 25 months) with less than 2% drift. As a non-standard, the sensor can be recalibrated to measure higher concentrations of CO_2 at a lower accuracy.

Dimensions and Exhaust Connection

The BioPAT® Xgas sensor has a compact footprint and a stainless steel housing (IP65) that connects to standard gas flow path adapters. This allows the sensor to be used at different maximum gas flow rates for each size of bioreactor. Sartorius Stedim will provide the appropriately sized flow path (¼" to 1¼") for each Biostat® application and arrange for mechanical and software installation. The system is mountable and can be integrated into the Sartorius Stedim bioreactor vessel exhaust line with either stainless steel piping or flexible tubing. This means a BioPAT® Xgas sensor is dedicated to a single cultivation vessel with an adjustable measurement frequency down to every 10 seconds. The BioPAT® Xgas sensor at a downward angle with respect to the inlet gas flow direction in order to minimize water collection in the measurement flow path.

Pressure and Humidity Sensor

As pressure and moisture levels affect the detected level of the O_2 and CO_2, these levels must be measured and compensated for. Internally, the BioPAT® Xgas has a piezoresistive silicon pressure sensor (0.8 to 1.3 bar, 11.6 – 18.85 psi) and a capacitive polymer humidity sensor (5 to 100% RH) sensor. These sensors account for, and compensate over, an exhaust gas temperature range of 15 to 40°C, or 59°F to 104°F.

Data Transfer

The sensor data can be transferred to the BioPAT® DCU as an analog signal (4 – 20 mA) or as a voltage signal (1 – 10 V). An OPC® interface to our SCADA software BioPAT® MFCS | Win allows digital data transfer. For either connection method, the data cables and digital conversion boxes are provided by Sartorius Stedim in a choice of integration packages, either for computers or for BioPAT® DCU.

BioPAT® DCU

The BioPAT® Xgas sensor readings are shown both on the visual display and on the batch record plot of BioPAT® MFCS as two separate output signals for O_2 and CO_2 exhaust percentages. A retrofit of an existing Biostat® will require a DCU configuration update and two available external input connections.

BioPAT® MFCS

Regardless of whether the sensor data comes from the BioPAT® DCU or is transferred by OPC® to BioPAT® MFCS, it is handled in the same way. The BioPAT® Xgas Vis software functions as the OPC® server, sending data to the BioPAT® MFCS | Win OPC® DA client for up to 12 sensors. Once the data is in BioPAT® MFCS, it can be used in conjunction with the data from the mass flow controllers and other Biostat® peripherals to calculate, plot and track the process metabolic and respiratory factors. These factors can be used to trigger actuators for automating gas-mixing strategies, adding feed or induction media to increase process yield and consistency.

Accessory Requirements

All power and data transfer cables are provided for the choice of connection method offered. The integrated feature for pressure and humidity compensation means no moisture traps, gas coolers or pumps are needed to operate the BioPAT® Xgas. For steam-in-place bioreactors (Biostat® C Plus and D-DCU), a pair of automated check values must be incorporated in the exhaust outlet set-up in order to prevent the sensor from being exposed to high-temperature steam during the sterilization cycle. To enhance the precision of metabolic calculation, mass flow controllers should be installed on the gas inlet lines. These controllers will allow optimal gassing settings and minimal fluctuation in DO control. The BioPAT® Xgas has its own M12 8-pin power supply allowing it to maintain the measuring temperature and prevent condensate formation inside the sensor housing. A base plate is included with every Univessel® BioPAT® Xgas enabling it to be wall mounted for ergonomic improvements.

Metabolic Calculations

The BioPAT® Xgas sensor monitors the concentration of oxygen and carbon dioxide online, allowing real-time measurement of key parameters, such as oxygen uptake rate (OUR), carbon dioxide evolution rate (CER) and respiratory quotient (RQ). Beyond this, oxygen and carbon dioxide measurements enable mass balances to be calculated and the oxygen transfer rate (OTR) to be determined directly. For in-depth details, please see the BioPAT® Xgas Metabolic Calculations data sheet available from Sartorius Stedim.

Calibration and Interface

The unit's status can be read and a one-point calibration carried out using the two push buttons located directly on the BioPAT® Xgas sensor. Annual service and factory recalibrations are recommended if the system is used for critical process control loops. The LEDs are color-coded, and a color-code chart is shown on the housing between the two manual input buttons. The exhaust O_2 and CO_2 sensor information can be obtained from the BioPAT® DCU or MFCS.

Technical Specifications

Concentration ranges[1]

0 – 10 vol% CO_2, 1 – 50 vol% O_2

O_2 Sensor Unit	
Measured gas	O_2
Measuring principle	Zirconium dioxide
Accuracy	< 0.2% FS[2] ± 3% Rdg[2] on value
Drift	< ± 2% value/year
Lifetime of sensor element	Approx. 15,000 operating hours
Temperature inside the sensor unit	580°C | 1076°F

CO_2 Sensor Unit	
Measured gas	CO_2
Measuring principle, infrared	Dual wavelengths
Accuracy	< 0.2% FS[2] ± 3% Rdg[2] on value
Drift	< ± 2% value/year
Lifetime of optical components	Approx. two years
Temperature inside the sensor unit	3°C | 5.4°F higher than process temperature

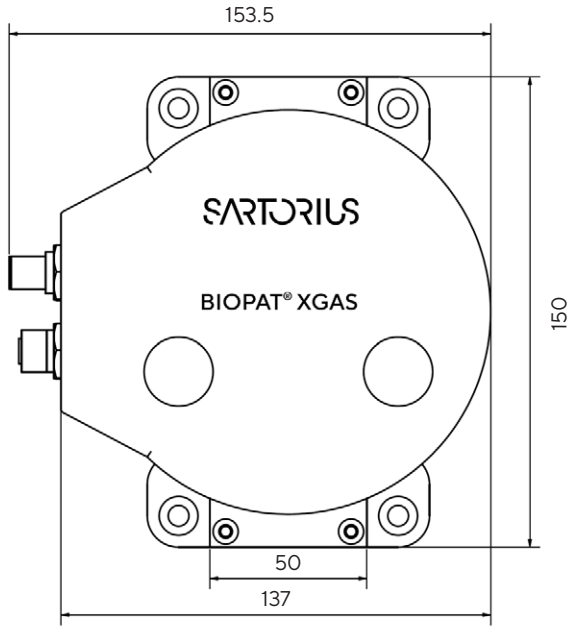
OPC® PC Connection Box	
Number of Serial Ports Connect directly using Telnet | SSH by port and IP address Connect with EasyPort menu by Telnet | SSH	1
Serial Port Interface	EIA232/422/485 on DB9M, RJ45, DB25M or DB25F
Serial Port Speeds	50 bps to 230 Kbps with customizable baud rate support
Parity	Odd, Even, Mark, Space, None
Local Console	Port RS232 on Serial Port
Power Supply	120 V AC (USA), 230V AC (International) Wall Power Adaptor included
Nominal Input	Voltage 12v DC
Weight	0.23 kg (0.5 lbs)
Dimensions	91 × 64 × 24 [mm], 3.6 × 2.5 × 0.92 [in] case dimensions not including mounting tabs, 91 × 89 × 24 [mm], 3.6 × 3.5 × 0.92 [in] includes mounting tabs

General	
Temperature range	15 – 40°C | 59°F – 104°F
Pressure range	0.8 – 1.3 bar | 11.6 – 18.85 psi absolute pressure
Operating humidity	5 – 100% RH, integrated humidity compensation
Housing, stainless steel	IP65 protection
Dimensions and weight	W × L × H = 170 × 150 × 120 mm (6.69" × 5.91" × 4.72")[3] | weight = 4 kg (8.82 lb)
Mechanical connection	4 mm – 1¼"[1]
Materials in contact with exhaust gas	Stainless steel, thermo-elastomer, sapphire, PTFE, polymer H.L., nitrile
Filters	PTFE, 0.22 µm; PTFE, 5 µm
Power supply	24V 1A
Storage conditions	0 – 60°C (32 – 140°F); 5 – 75% RH (non-condensing)

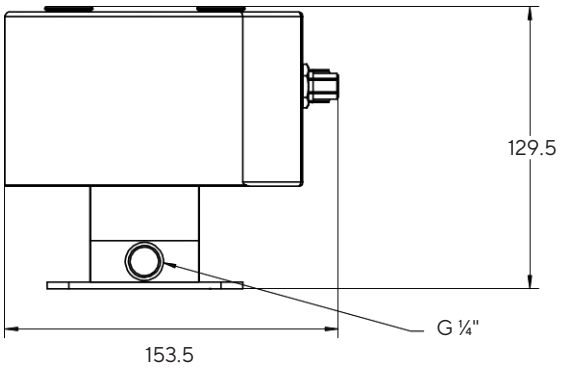
Electronic connections	
Power supply	8-pin M12, male
Output connection	8-pin M12, female
Electronic output	Active output, maximum 500 ohms with a 24 V power supply RS232, RS485 Modbus, 2 × 4 – 20 mA, USB, Modbus OPC® Server
Maintenance	One-point calibration with ambient air (0.04 vol % CO_2, 20.97 vol % O_2) once a month (other conditions possible); optional factory calibration once a year
CE/FCC/ICES	EN 61326-1:2006 | FCC 15:2009 Subpart 107/109, ICES-001:2006
Remarks	High concentration of NH_3 or O_3 could minimize the lifetime of the O_2 sensor element

[1] Expanded ranges on request
[2] FS = full scale, Rdg = measured accuracy
[3] Dependent on flow adapter

Technical Data



Isometric View



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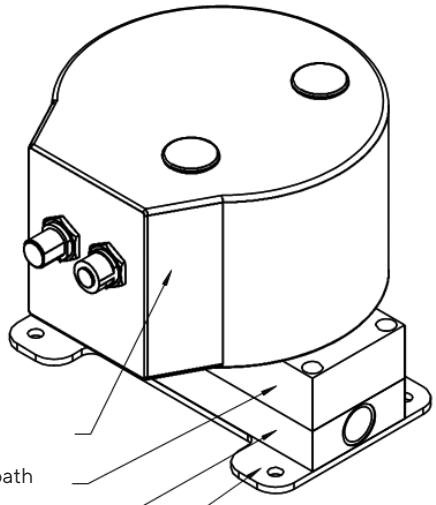

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