

BioPAT® Fundalux

Online Measurement
of Turbidity
and Total Biomass



Benefits

- Designed for use in R&D, as well as in pilot- and production-scale
- Monitoring cell growth in bacterial fermentation and mammalian cell cultures
- Online triggering of control loops for advanced automated fermentation

Product Information

BioPAT® Fundalux is an absorption-based photometric probe that uses light from 840 nm to 910 nm to measure the turbidity in bioreactors and fermenters. A precisely defined and constant LED light beam passes through the process medium from either side of the gap on the probe's shaft. Its hermetically sealed photodiode detects attenuation of light intensity, which is caused when light is absorbed by cellular mass, dissolved compounds and insoluble material. The 180° constant direct beam optical path lengths (OPL) allow maximum utilization of LED light intensity. The changes in detected light intensity are caused by different degrees of absorption by materials in the medium, which is described by the Beer-Lambert law.

This states that the logarithm of the transmission loss is proportional to the concentration of a substance. In addition, as BioPAT® Fundalux operates according to the transmittance principle in the range, it is not affected by color changes in the cultivation medium. As a result, the probe measures the concentration of total biomass accurately and constantly throughout a process based on the respective medium properties.

Measurement Range

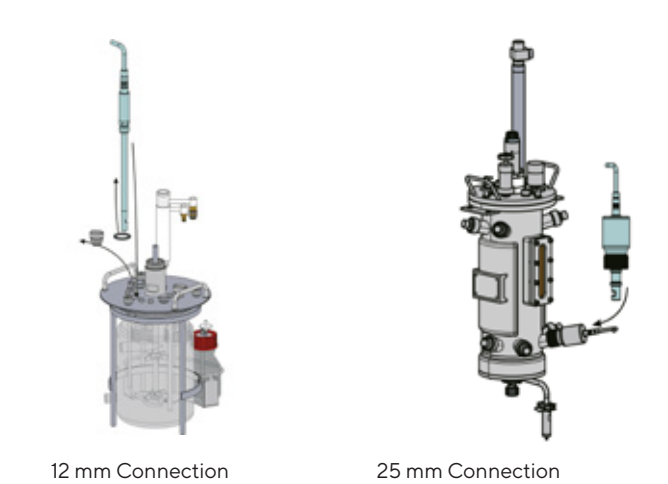
Optical Path Length [mm]	Measuring Range* Concentration Units	Measuring Range* OD 590 600	Measuring Range* g/L WCW
10	0 – 0.5 to 4	0 to 250	0 to 180
5	0 – 0.5 to 5	0 to 325	0 to 250
1	0 – 0.5 to 6	0 to 450	0 to 300

*based on calculations from reference cell line

Vessel Installation and Size Selection

The BioPAT® Fundalux probe can easiliy be installed into the bioreactor vessel by using an available port of the appropriate thread size. The head plate, O-ring and tightened probe thread create a sterile barrier in order to prevent contamination after sterilization.

The serial cable connects to the post-sterilization probe connector (push-pull type) utilizes a single analog port on the DCU tower.

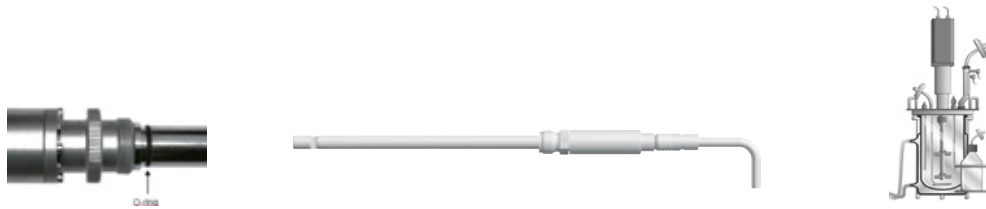


12 mm Probe connection
 PG13.5 thread on head plate
 Bevelled top installation is recommended; no entrapped gas at top of port; product drains off the windows; easy insertion | removal of sensor; good cleaning.

25 mm Probe connectiononnection
 Standard 25 mm ingold port side entry
 Horizontal installation is recommended; no entrapped gas at top of port; product drains off the windows; easy insertion | removal of sensor; good cleaning

12 and 25 mm Probe Connection
 OPL opening angled away from center of the bioreactor to minimize the interference from aeration.

The range of Univessel® and bioreactor volumes can be investigated by selecting the appropriate length of the BioPAT® Fundalux probe to ensure that the OPL window is fully submerged during cultivation.

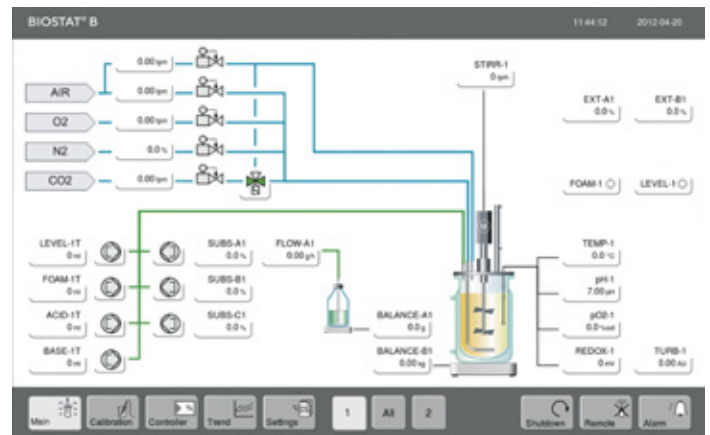


Order Number	Probe Connection [mm]	Optical Path Length [mm]	Insertion Length [mm]	Applicable Vessel
BPF1L10	12	10	120	1L Univessel®
BPF1L05	12	5	115	1L Univessel®
BPF1L01	12	1	111	1L Univessel®
BPF2L10	12	10	225	2L Univessel®
BPF2L05	12	5	220	2L Univessel®
BPF2L01	12	1	216	2L Univessel®
BPF5L10	12	10	325	5 & 10L Univessel®
BPF5L05	12	5	320	5 & 10L Univessel®
BPF5L01	12	1	316	5 & 10L Univessel®
BB-8846604	25	10	45	> 5L steel vessel
BPFSS05	25	5	40	> 5L steel vessel
BPFSS01	25	1	36	> 5L steel vessel

Calibration

Zero-point calibration is performed on the DCU controller prior to inoculation in the culture media when all physical parameters are stable and ready for growth.

Functional testing can be carried out by the Sartorius local service representative at the annual preventative maintenance session. In the unlikely event that any readings deviate from the probe's technical specifications, the probe needs to be returned to Sartorius for repair and recalibration.



Automation and Integration

The measured data can be transferred via the serial connection established with the local DCU controller. The CU output is conveniently displayed on the DCU visual display in real time. The optimal sampling frequency and time can be adjusted to best suit your bioprocessing parameters and data requirements. This data can then be transferred to our SCADA software: BioPAT® MFCS where real-time responses can be initiated and, by effect, create automated control loops that adjust the process toward a desired set point. These control loops will significantly improve your process by reducing operator sampling inconsistencies and free up user time for other tasks. Further to that, automated calculations can be implemented in BioPAT® MFCS | Win to convert CU output into other process measuring parameters such as OD and g/L.

Supply and Service

All components are supplied and maintained by Sartorius. Therefore, we ensure that all hardware and software components are delivered ready to use. In addition, any future preventive maintenance calls will be covered by a single Sartorius point of contact, eliminating conflicts of interest and extended fermenter downtime.

The integrated BioPAT® Fundalux turbidity sensor that ensures all the various component parts, including power supply are protected by the probe design and the control tower housing. This reduces footprint, minimizes cabling and cuts down on power supply socket needs.

Technical Data

Specifications

	BioPAT® Fundalux 12 mm	BioPAT® Fundalux 25 mm
Measurement principle	Single-channel absorption of light	
Detector	Single silicon photodiode (sealed)	
Measurement wavelength	840 – 910 nm	
Measuring range	0 to 6 CU	
Optical path length	Choice of 1 mm, 5 mm and 10 mm	
Calibration	CU specific to cell line	
Light source	Hybrid LED (sealed) 5.4 V DC, 100 mA; typical lifetime 10 years	
Protection	IP68	IP65


Process adaptations		
Material	Liquid-contacted parts AISI 316 L stainless steel (German standard 1.4435) dF < 1%, BN2 Surface: electropolished Ra < 0.4 µm AISI 316 Ti stainless steel housing (German standard 1.4571)	
Port connection	Fermenter head plates Diameter: 12 mm Thread: Armored pipe thread, PG 13.5	OSP25-GS60 (similar Ingold port) Nominal length: 30 mm and 60 mm Diameter: 25 mm Thread G1-1/4 in. ISO 228/1
Port gasket	O-ring 11.00 + 3.00 mm EPDM (FDS USP Class VI)	O-ring 18.64 + 3.53 mm EPDM (FDS USP Class VI)
Insertion depth	110 mm + OPL 215 mm + OPL 315 mm + OPL	35 mm + OPL
Optical path window	Sapphire (sealed)	
Process temperature	Constant 5 – 50°C	Constant 5 – 65°C
Process pressure	Pressure free (+/- 0.5 bar)	10 mbar to 10 bar
Sterilization conditions	Sterilization must be performed outside the process, and the probe needs to be disconnected from the power source Max. temperature: 135°C for 60-minute cycle time	In situ sterilization by SIP at 135°C for up to a 60-minute cycle once a day
Temperature ranges for operation and storage	Operation: 0°C – 40°C (32°F – 104°F)	Transportation: -20°C – +70°C (-4°F – +158°F)
Connections		
Cable length	Standard: 2 m (3, 5, 10 m available)	Standard: 3 m (2, 5, 10 m available)
Cable material	Non-metallic sheathed cable with finely stranded copper conductor; PVC insulation (-40°C – +70°C, +40°F – +158°F)	
Cable weights	Probe cable: 0.5 kg 10 m	
Certificates		
Certificates	ISO 9001:2008, CE	

Germany

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