

LABORATORY BIOREACTORS

PRODUCT BROCHURE



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1L



5L



50L



100L



200L



600L



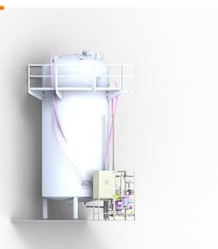
1000L



5000L



20000L



1. INTRODUCTION

Welcome to our innovative company, where we specialize in the design and manufacture of laboratory and pilot scale bioreactors. **Our state-of-the-art bioreactors are equipped with the latest technologies, including model-based control of fed-batch fermentation and a novel magnetic drive,** resulting in innovative solutions that meet up-to-date requirements.

At our laboratory, **we test our new bioreactor solutions through real fermentation processes to ensure their reliability and performance.** Our bioreactors have been designed to be easily adapted to a wide range of applications, and we manufacture laboratory bioreactors for the cultivation of bacteria, mammalian cells, and micro-algae, using a common basic solution.

We also manufacture pilot scale bioreactors made of components such as vessels, technological stands, and control cabinets, and each of these can be supplied as a separate product. **With extensive experience in implementing our pilot scale bioreactors in fully automated production lines** for various applications, such as vaccines, enzymes, bio-fertilizers, and bioremediation, we have installed production facilities with up to 15 bioreactors, using volumes up to 20 m³.

Our bioreactors are equipped with novel magnetic coupling mixers and ensure compliance with GMP rules by using SCADA software according to the requirements of CFR Title 21 Part 11 from the US Food and Drug Administration. We also provide our equipment with IQ (Installation Qualification) and PQ (Performance Qualification) to ensure top-quality performance.

Join us and discover the innovation behind our bioreactors, where quality and performance meet the highest standards.

2. LABORATORY TWIN BIOREACTOR EDF-1.2

Introducing EDF-1.2, the latest innovation in twin bioreactors designed for both research and process development in fermentation. Our compact, ergonomic, and robust twin bioreactor is the ideal solution for your laboratory needs.



Our bioreactor vessel temperature control system is equipped with a **Peltier element**, which **eliminates the need to connect the vessel to a cooling water source**, resulting in improved temperature control. The magnetic coupled drive system creates a superior sterile environment, ensuring optimal conditions for your experiments.

With **Peltier element cooled condensers**, our bioreactor provides exceptional exhaust gas cooling without the need for circulation water. The fan-driven heat exchange system is robust and powerful enough to cool and condense even high-temperature processes.

Our twin bioreactor has been designed with durability in mind, **ensuring reliable performance and a long lifespan**. Join the cutting-edge of research and development with EDF-1.2, the innovative twin bioreactor for all your fermentation and cell culture needs.



2.1 TECHNICAL SPECIFICATION

Model		EDF-1.2
Application		Microbiology
Vessel	Total volume (L)	0.9
	Working volume (L)	0.4 - 0.7
	Diameter/ Height (mm)	85/165
Aeration	Control	Rotameter, MFC (option)
	Gas supply	Air, + O ₂ (option)
	Flow range, L/min	0.1 – 2
	Sparger	Ring sparger
	Filters	D37 mm 0.2 µm PTFE
	Exhaust gas condenser	Peltier cooling
Mixing	Drive	Top magnetic coupling
	Rotation speed range (rpm)	50 - 1800
	Agitator	2 Rushton turbines
Control	Controller	Siemens Simatic S7 - 1500
	Operator panel	Touch screen 12"
	Temperature	Peltier heating/cooling Control range: 10 °C – 60 °C Accuracy: (measurement) +/- 0.1 °C (control) +/- 0.2 °C
	pH	Hamilton or Mettler Toledo sensors (different options, including Arc). Acid/ Base 0 - 14 +/- 0.01pH units
	pO ₂	Hamilton or Mettler Toledo sensors (different options, including Arc). Control: mixing + O ₂ 0 - 150 % +/- 1%
	Foam / Level	Conductivity sensor
	Feeding	0.07 - 20 ml/min according adjusted profile
	Peristaltic pumps	3 built – in peristaltic pumps. External pumps (option)
Dimensions	Overall (mm)	540 (W) x 350(H) x 410(D)
Autoclaving	Required place (mm)	260 (H) x 150 (D)

3. LABORATORY BIOREACTOR EDF-5.5

The EDF-5.5 is a series of autoclavable glass bioreactors with a working volume of up to 4.5 L (total volume of 6.2 L and an inside diameter of 150 mm).



EDF 5.5 with jacketed glass vessel (JG)



Metallic double bottom vessel (CC)

EDF-5.5 laboratory bioreactor series has two configurations and two vessel options:

- Metallic double bottom vessel with sterilizable sampling valve (DB)
- Classic jacketed glass vessel (JG)
- Configuration for cultivating bacteria, yeasts, and mycelial cultures (MO)
- Configuration for cultivating mammalian and plant cells (CC)

The EDF-5.5 series features a **compact, ergonomic, and robust design**, with a glass cylinder vessel mounted between the upper lid and the metallic jacketed bottom.

The bioreactor is **easy to maintain** and facilitates basic operations and preparatory processes such as washing and autoclaving.

High customizability and reliability for a complex fermentations!



SIEMENS PLC provides high reliability and vast customizability options for any application. Option to program ANY sensor to bioreactor

LABORATORY BIOREACTOR FOR MICROBIOLOGY AND CELL CULTURES			
Model		EDF-5.5-JG/DB	
Application		Microbiology (MO)	Cell cultures (CC)
Vessel	Total volume (L)	6.2	
	Working volume (L)	2 – 4.5	
	Diameter/ Height (mm)	150/350	
Aeration	Control	Rotameter, TMFC (option)	
	Gas supply	Air, + O ₂ (option)	Air/CO ₂ , + O ₂ , N ₂ (option) Air/CO ₂ in headspace
	Flow range, L/min	0.5 – 8.8	0.1 - 2 (other - option)
	Sparger	Ring sparger	Microsparger
	Filters	D51 mm 0.2 µm PTFE	
	Exhaust gas condensor	Cooling from water line or chiller	
Mixing	Drive	Top magnetic coupling	
	Rotation speed range (rpm)	40 - 1200	40 - 500
	Mixer	2 Rushton turbines	2 pitched blade impellers
Control	Controller	Siemens Simatic S7 - 1500	
	Operator panel	Touch screen BeeTronics, 15TS7 15" LED	
	Temperature	Control range: from 5 °C above cooling water – till 80 °C Accuracy: (measurement) +/- 0.1 °C , (control) +/- 0.2 °C	
	pH	Hamilton sensors (different options, including Arc). Acid/ Base 0 - 14 +/- 0.01pH units	
	pO ₂	Hamilton sensors (different options, including Arc). Control: mixing + O ₂ 0 - 150 % +/- 1%	
	Foam / Level	Conductivity sensor	Option
	Feeding	0.2 - 40 ml/min according adjusted profile	0.2 - 40 ml/min according adjusted profile
	Peristaltic pumps	4 built – in peristaltic pumps. External pumps (option)	
Dimensions	Total (mm)	930 (W) x 800(H) x 600(D)	
Autoclaving	Required place (mm)	590 (H) x 270 (D)	

Options:

- Gas mixing system (O₂, N₂, CO₂)
 - PC SCADA program for process monitoring and control
 - Additional sensors (redox, O₂ and CO₂ in exhaust gas, gas flow rates, optical density, etc.)
 - Model-based fed-batch control using MATLAB
- Customized solutions for different microorganism cultivation tasks (sensor and software algorithm programming)

4. LABORATORY BIOREACTOR EDF-15.1

The laboratory bioreactor EDF-15.1 is an extended version of the EDF-5.5 series, with a larger vessel size of 15L, making it suitable for pre-pilot scale experiments.

The bioreactor is designed to accommodate a wide range of microorganisms and cell cultures with two distinct configurations

Its compact and ergonomic design makes it easy to operate and maintain, while its autoclavable glass vessel ensures the safety and integrity of the experiment.

The EDF-15.1 is an ideal choice for researchers and scientists looking to scale up their experiments from the lab to the pre-pilot stage.



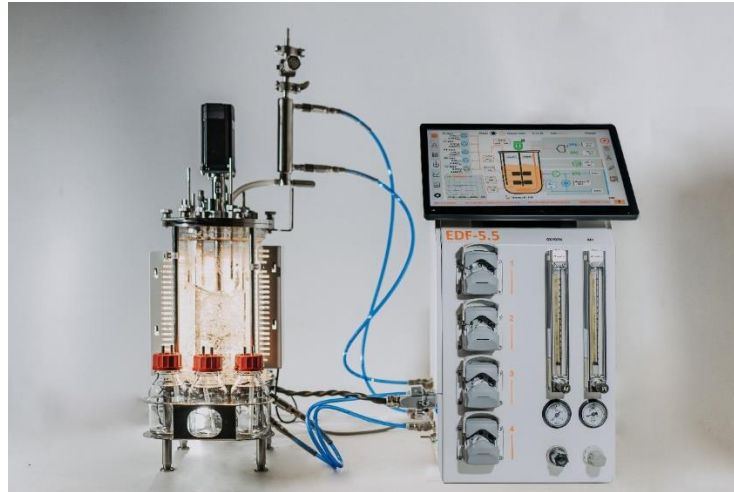
4.1 TECHNICAL SPECIFICATION

Model		EDF-15.1-MO	EDF-15.1-CC
Application		Microbiology	Cell cultures
Vessel	Total volume (L)	16	
	Working volume (L)	5 - 11	
	Diameter/ Height (mm)	200/500	
Aeration	Control	Rotameter, TMFC (option)	
	Gas supply	Air, + O ₂ (option)	Air/CO ₂ , + O ₂ , N ₂ (option) Air/CO ₂ in headspace
	Flow range, L/min	1 - 20	0.2 - 5 (other - option)
	Sparger	Ring sparger	Microsparger
	Filters	D51 mm 0.2 µm PTFE	
	Exhaust gas condensor	Cooling from water line or chiller	
Mixing	Drive	Top magnetic coupling	
	Rotation speed range (rpm)	40 - 650	40 - 400
	Mixer	3 Rushton turbines	3 pitched blade impellers
Control	Controller	Siemens Simatic S7 - 1500	
	Operator panel	Touch screen BeeTronics, 15TS7 15" LED	
	Temperature	Control range: from 5 °C above cooling water – till 50 °C Accuracy: (measurement) +/- 0.1 °C (control) +/- 0.2 °C	
	pH	Hamilton sensors (different options, including Arc). Acid/ Base Base/CO ₂ 0 - 14 +/- 0.01pH units	
	pO ₂	Hamilton sensors (different options, including Arc). Control: mixing + O ₂ (option). 0 - 150 % +/- 1%	
	Foam / Level	Conductivity sensor	Option
	Feeding	0.3 - 100 ml/min according adjusted profile	
	Peristaltic pumps	4 built – in peristaltic pumps. External pumps (option)	
Dimensions	Total (mm)	1000 (W) x 970(H) x 600(D)	
Autoclaving	Required place (mm)	760 (H) x 320 (D)	



5. PHOTOBIOREACTOR EDF-5.5-DB-PBR

The EDF-5.5-DB-PBR is an autoclavable glass photobioreactor with a working volume of 2 - 4.5 L (total volume of 6.2 L and an inside diameter of 150 mm). This bioreactor is specifically designed for precise phototrophic cultivation of algae and cyanobacteria.

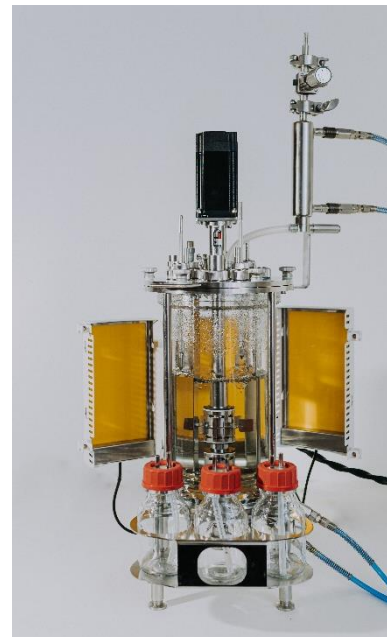


The glass construction allows for optimal light transmission, while the autoclavable feature ensures the safety and sterility of the experiment.

The EDF-5.5-DB-PBR is an excellent choice for researchers and scientists looking to cultivate phototrophic microorganisms with accuracy and precision.

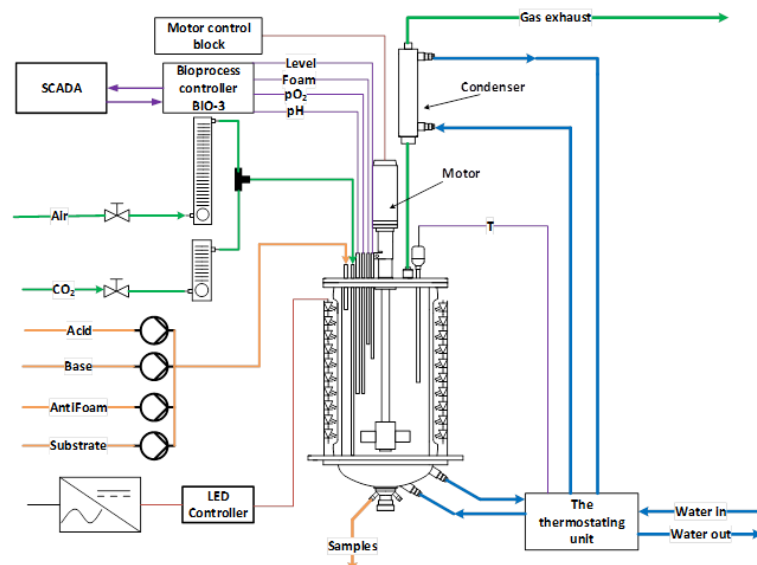
The vessel features a programmable LED array that is easy to remove, allowing for a fast and clean setup. The LED array provides optimal light conditions for photosynthesis, enabling researchers and scientists to cultivate microorganisms with precision and accuracy.

The photobioreactor is available in two options: as a photobioreactor vessel designed to facilitate the growth of phototrophic microorganisms, and as a combination of photobioreactor and microorganism culture vessel designed to accommodate a wide range of microorganisms for both phototrophic and heterotrophic processes. Both options feature programmable LED arrays



5.1 TECHNICAL SPECIFICATION

Model		EDF-5.5-DB-PBR	EDF-5.5-DB-PBRMO
Application		Photobioreactor	Photobioreactor and Microbiology combo
Vessel	Total volume (L)	16	
	Working volume (L)	5 - 11	
	Diameter/ Height (mm)	150/350	
LED Lighting		Removeable LED Light. Intensity control range – 0 – 500 $\mu\text{mol}/\text{m}^2/\text{s}$. Screen surface – 1350 cm^2 .	
Aeration	Control	Rotameter, TMFC (option)	
	Gas supply	Air, + O ₂ (option)	Air/CO ₂ , + O ₂ , N ₂ (option) Air/CO ₂ in headspace
	Flow range, L/min	1 – 8.8	0.2 - 5 (other - option)
	Sparger	Ring sparger	Microsparger
	Filters	D51 mm 0.2 μm PTFE	
	Exhaust gas condenser	Cooling from water line or chiller	
Mixing	Drive	Top magnetic coupling	
	Rotation speed range (rpm)	40 - 1200	40 - 1200
	Mixer	3 Rushton turbines	3 pitched blade impellers
Control	Controller	Siemens Simatic S7 - 1500	
	Operator panel	Touch screen BeeTronics, 15TS7 15" LED	
	Temperature	Control range: from 5 °C above cooling water – till 50 °C Accuracy: (measurement) +/- 0.1 °C (control) +/- 0.2 °C	
	pH	Hamilton sensors (different options, including Arc). Acid/ Base Base/CO ₂ 0 - 14 +/- 0.01pH units	
	pO ₂	Hamilton sensors (different options, including Arc). Control: mixing + O ₂ (option). 0 - 150 % +/- 1%	
	Foam / Level	Conductivity sensor	Option
	Feeding	0.3 - 100 ml/min according adjusted profile	
	Peristaltic pumps	4 built – in peristaltic pumps. External pumps (option)	
Dimensions	Total (mm)	930 (W) x 800(H) x 600(D)	
Autoclaving	Required place (mm)	590 (H) x 270 (D)	



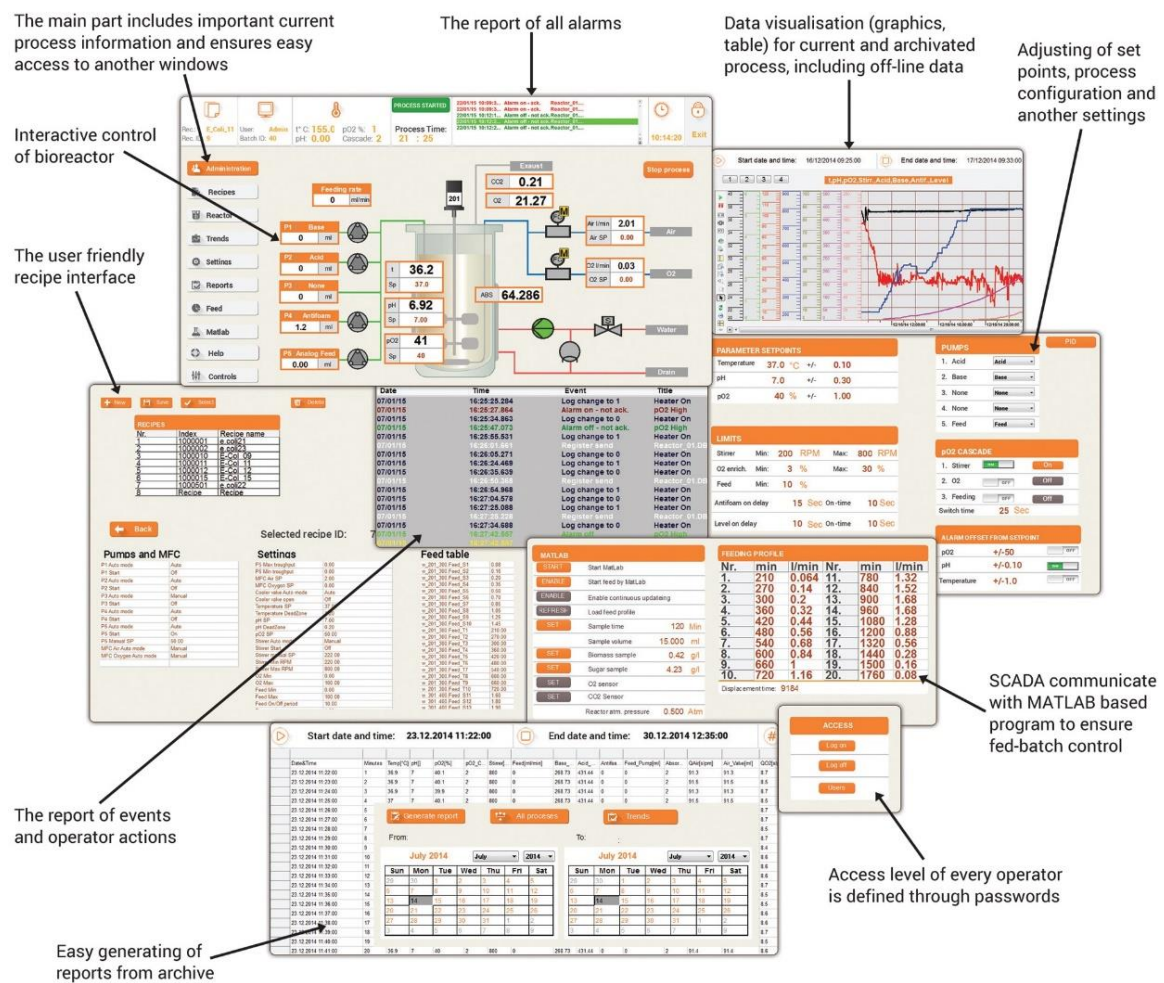
6. SCADA FOR LABORATORY BIOREACTORS BioRe

BioRe is a user-friendly SCADA software designed to control and store data from laboratory fermentation processes. It allows for the integration of additional sensors, balances, and devices, and can operate on a single PC, network, or remotely via the internet.

BioRe can control one or several bioreactors and can communicate with MATLAB-based programs via an OPC server. The software features a user interface that is compliant with 21 CFR Part 11, ensuring the evaluation, review, approval, and archiving of process data without the use of paper and minimizing the possibility of falsification.

BioRe is developed using the ARC Informatique PC Vue industrial development package.

The examples of screen shots explaining the possibilities of BioRe:



The program drivers ensure the communication between the software and many popular PLC. The communication can be provided also with the help of OPC server, which gives the possibility to connect software with wide range of control units. We are open to adapt the program for special requirements of the Customer.

7. PROCESS DEVELOPMENT SERVICES

Higher biomass concentration means less capital investments and lower energy costs for manufacturers. By increasing process efficiency, the same amount of viable product can be produced with lower costs.

Our team has expertise in developing efficient process parameter control strategies for increasing product yield. We also conduct medium optimization and fed-batch strategy/control development to ensure maximum productivity.

The process improvement services also include modelling of hosts to identify crucial metabolic pathways and possible bottlenecks. We mediate metabolic fluxes via medium supplementation by identifying and supplying specific inhibitors/inducers. We also offer quorum quenching services to improve the efficiency of the production process.

Process development possibilities:

- Medium optimization and fed-batch strategy/control development;
- Development of efficient process parameter control strategies for increasing product yield;
- Process analytical characterization (product composition, analysis of side streams, by-products, etc.);

Given the sensitive nature of the information exchanged between our clients and Bioreactors.net AS, we place the utmost importance on ensuring the protection of our partners' intellectual property. To achieve this, we require the signing of non-disclosure agreements and strictly adhere to our internal information protection policies.

With our process improvement services, we aim to help manufacturers achieve better product yield, reduce capital investments and lower energy costs.

Our success in fed-batch strategy/control development is a testament to our expertise in process improvement. Contact us to learn more about how we can help you improve your production process

The following fed-batch cultivation designs have been optimized for the production of specific recombinant proteins, small-molecule metabolites, biosurfactants, secondary metabolites, and biomass:

- *E. coli*: OD540 = 220 A.U., grown on semi-synthetic media with substrate concentration control (Cglucose < 0.5 g/L) for the production of pET-NGF and HBsAg.
- *P. pastoris*: OD600 = 400 A.U., grown on synthetic media with methanol concentration control (CEthOH < 1 g/L) for the production of HBsAg.
- *K. marxianus*: OD540 = 210 A.U., grown on synthetic media with glucose concentration control (Cglucose < 0.5 g/L) for the production of small-molecule metabolites.
- *S. bombicola*: OD600 = 200 A.U., grown on synthetic media with glucose concentration control (Cglucose < 0.5 g/L) for the production of sophorolipids from waste oil streams.
- *S. cerevisiae*: OD600 = 200 A.U., grown on synthetic media with glucose concentration control (Cglucose < 0.5 g/L) for the production of secondary metabolites and biomass.

**WE CAN PROVIDE TECHNOLOGY DEVELOPMENT
SERVICES & ALREADY CONFIGURED SYSTEM FOR
YOU!**

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