

## Pilot Scale Automatic Bioreactor Configuration



### Vessel

Capacity	30L/50L/100L	5L-1000L, customizable
Working Volume	30%-75%	
Vessel Material	SUS316L/SUS304; smooth surface, no dead zones, easy to clean	
Surface Finish	Inner surface mirror polished, $Ra \leq 0.4 \mu\text{m}$ ; Outer surface polished, $Ra \leq 0.6 \mu\text{m}$	
Bioreactor inlets	Vessel Lid: Flame inoculation port (quick-open); four-in-one feed inlet (nutrient feed, antifoam, acid, alkali); off-gas port; sight glass port with LED light source Vessel Body: Sampling port; pH/DO and temperature ports; air inlet; discharge outlet; jacket water inlet and drain	

	Liquid Level View: Long-strip liquid level sight glass inside the vessel
Air inlet	air inlet Mode: Deep aeration; air inlet pipe enters from the upper side wall of the vessel; internal air pipe is detachable Gas Distribution: Equipped with gas sparger for uniform gas distribution without dead zones; easy to clean; meets high aerobic demand Backflow Protection: Equipped with non-return device to prevent material back-suction and contamination of inlet filter
Discharge	The bioreactor is equipped with a bottom drain outlet featuring a sanitary, dead-zone-free design. It is easy to clean, supports repeated sterilization, and allows complete discharge of the culture broth from the vessel.
Sampling	A flush-mounted, dead-zone-free sterile sampling valve assembly is adopted, enabling multiple in-situ sterile sampling without compromising process sterility.

### Agitation System

Agitation Type	The bioreactor is equipped with 3-stage, 6-blade impellers, with adjustable installation height. A mechanical defoaming impeller is also provided to effectively control foam formation during operation. The impeller type and configuration can be customized.
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### Control System

Hardware Configuration	Siemens PLC + 15-inch LCD touch screen
Control Software	Dedicated fermentation control software (independent intellectual property)
	Real-time and historical curves; supports 24-hour continuous monitoring and control
	Integrated fermentation process analysis software
Automatic Sterilization	Sterilization Mode: In-vessel steam sterilization; sterilization timing; over-temperature and over-pressure alarms Post-Sterilization Control: Automatic pressure holding and temperature control after sterilization to ensure sterility Filter Sterilization: Independent filter sterilization; set sterilization temperature and time; automatic drying after sterilization Sterilization Validation: Equipped with cold spot detection
Temperature Control	Display Accuracy: 0.3% FS $\pm 0.1$ °C Control Accuracy: $\pm 0.2$ °C Sensor: WIKA Germany Control Function : Dual-direction heating and cooling control;

	<p>equipped with constant-temperature water tank</p> <p>Data Management: Data logging, production curves, report analysis, remote data transmission</p>
pH	<p>Display Accuracy: 0.01 pH; measurement range: 0-12 pH</p> <p>Sensor: METTLER (Germany) / HAMILTON</p> <p>Control Function: Dual-direction acid and alkali addition; digital calibration</p> <p>Data Management: Data logging, production curves, report analysis, remote data transmission</p>
DO	<p>Display Accuracy: 0.1%; range: 0-200%</p> <p>Sensor: METTLER (Germany) / HAMILTON</p> <p>Control Function: Cascade control; linked control with agitation speed and aeration</p> <p>Data Management: Data logging, production curves, report analysis, remote data transmission</p>
Agitation Speed	<p>Speed Range: 0-800 rpm, customizable</p> <p>Data Management: Data logging, production curves, report analysis, remote data transmission</p>
Gas Flow	<p>Control Function: Mass flow controller for automatic inlet gas control (maximum aeration up to 2.0 vvm; continuously adjustable according to process requirements)</p> <p>Flow Meter: V ögtlin (Switzerland)/YOKOGAWA (Japan)</p>
Pressure	<p>Display Accuracy: 0.01 bar; range: 0-3 bar</p> <p>Sensor: BD (Germany)</p> <p>Control Function: Digital setpoint control for vessel pressure regulation</p> <p>Data Management: Data logging, production curves, report analysis, remote data transmission</p>
Feeding	<p>Control Mode: Automatic control</p> <p>Programmed Feeding: Time-based programmed feeding with adjustable variable speed</p> <p>Batch Feeding: Set feed rate, single batch volume, and feeding cycle</p> <p>Programmed Flow Feeding: Pre-set batch volume; multi-batch variable flow feeding based on time profile</p>
Peristaltic Pumps	<p>Quantity: Four units: acid addition, alkali addition, antifoam, and feeding</p>