Bioreactor

BR500-Series

V.20221208

Laboratory to Production

LAB1ST
Laboratory and Processing Equipment

BR500 series bioreactor is an integrated control system available both for microbial and cell culture applications for stainless steel vessels, standard with the capacities from 10L to 200L. Customized bioreactors are available for engineering solutions up to 400ton. As part of the comprehensive bioreactor portfolio, those stainless steel fermenters can be easily integrated as a component of multi-stage systems.

Standard BR500 Series system guarantees short lead time, around 2 months. It features various basic design and assembly to facilitate the fermentation and culture process, such as automatic sterilization in place (SIP), temperature/PH/DO/agitation speed control capabilities, gas control by rotameter or TMFC, jacket heater, etc.

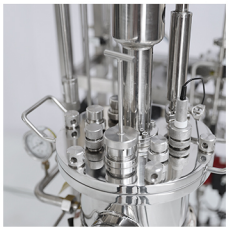
Based on every need and budget, the BR500 series allows multiple configurations with more functions, like lid lifting device, cleaning in place (CIP), dual pH and DO measurement capability, more gas mixing options, automatic vessel pressure control, redox/cleanliness/exhaust detection analysis...and automatic or manual addition arrays as well as other accessories.

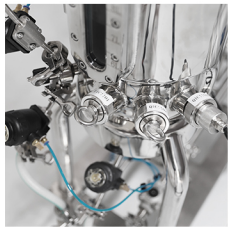
Software and hardware powers the brilliant system

- Control tower with integrated software
- Culture vessel with functional ports and pipelines

The control tower features at least four built-in peristaltic pumps, with different functions for microbial research (BR500-M) and cell culture (BR500-C) respectively. Meanwhile, it's available both in single (BR500-M1) and dual vessels (BR500-M2) configuration. It can control two same or different volume vessels to work independently at the same time, which greatly increases the flexibility and efficiency.

Stainless steel jacketed culture vessel comes with low noise agitation motor and top drive mechanical sealing. The vessel is designed to eliminate blind spots, with ≤0.4um tank accuracy, large open lid, and bottom sanitary radial discharging valve, which makes it easy to clean and maintain. With 2:1 or 3:1 aspect height to diameter ratio and 3-layer impellers, the culture vessel is ideal for homogenous heat and mass transfer.



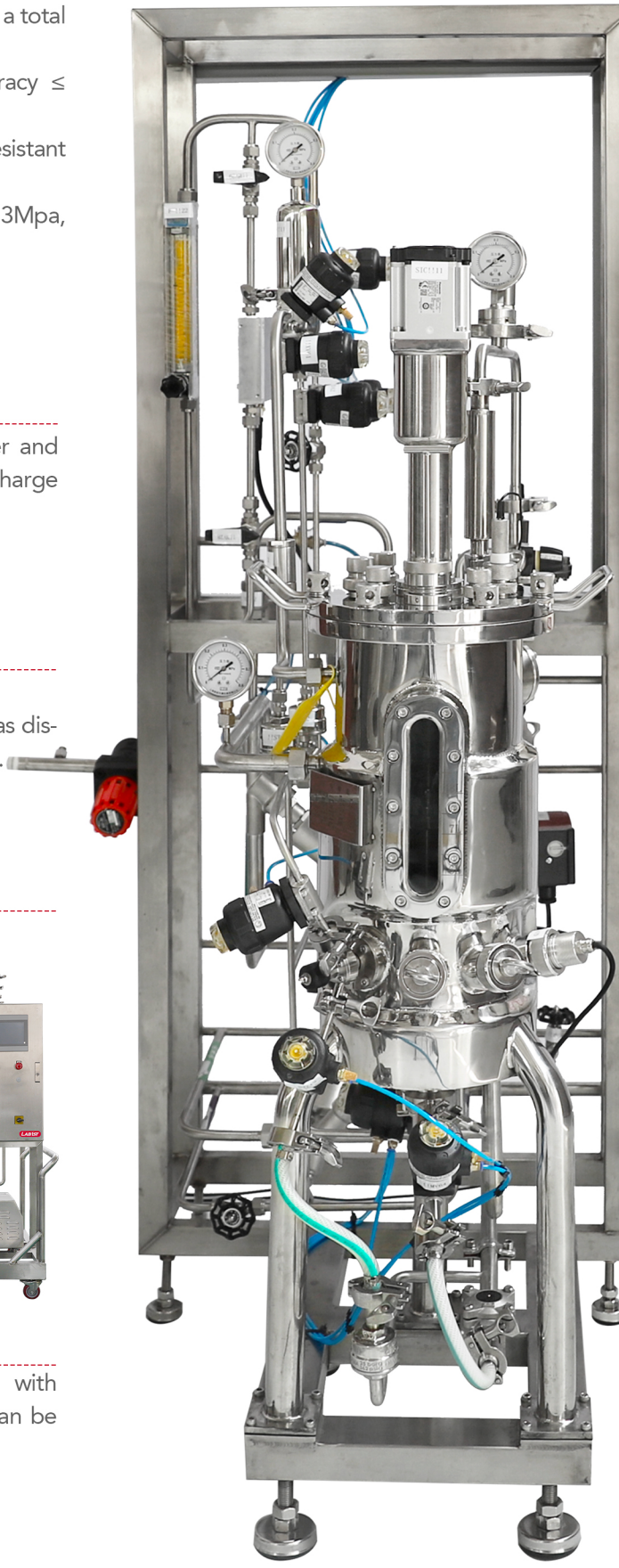


Features

- Single or Dual Configurations
- Available in incremental sizes from 10L to 200L
- Standard configuration for short lead time or customize unique systems with extensive options
- Powerful industrial control system with 10" color touch screen
- Automatic Sterilization in Place (SIP) included
- Automatic Cleaning in Place (CIP) optional; mobile CIP unit with independent controller
- Superior gas mixing with one or four flow meters, TMFC (Thermal Mass Flow Controller) for options
- 4 integrated peristaltic pumps per vessel with fixed speed control and optional variable speed
- With filter to prevent contamination air from getting to the system
- Measurement and control opportunities of pH, DO, temperature, foam, agitation, vessel pressure, gas mixing
- Optional measurement: level, vessel weight, weight of storage vessels
- Optional function: substrate addition, gas mixing strategy, agitation (bottom mechanical or magnetic), additional feed pump, variable speed pump, TMFC, cover lifting, dual PH/DO sensors, upper controller
- Optional detection: exhaust, redox, turbidity, CO2, online live cell, cleanliness, methanol and ethanol content online detection, etc.
- Qualification documentation available

Culture Vessel

Available culture vessels from 10L, 20L, 30L, 50L, 100L and 200L , with a total volume aspect ratio of (H:D) 2:1 or 3:1, up to 75% working volume.
Material: SS316L, Surface treatment: mirror polishing; Tank accuracy ≤ 0.4um, external surface accuracy <0.8um.
Large angle observation mirror for liquid level in the tank, which is resistant to corrosion, high temperature and high pressure
Culture vessel's design temperature: 150°C, design pressure: 0.3Mpa, jacket pressure: 0.4Mpa
LED light for convenient viewing inside the culture tank.



Sterilization in Place (SIP)

Easy to operate, in-situ sterilization includes fermenter, intake filter and pipeline, exhaust pipeline; Sampling valve, inoculation port and discharge valve can be sterilized manually or automatically.

Inlet Air Filter & Exhaust Condenser

Air filter to prevent contamination air from getting to the system.
With exhaust gas discharge condenser, specially designed exhaust gas discharge pipeline, slope ≥3°, no accumulation of liquid and no bacteria.

Cleaning in Place (CIP)

The BR500 series system offers advanced CIP solutions. The culture vessel is prepared with CIP interface. It also allows a mobile CIP cleaning station with its own control system, allowing the operator to selectively, effectively, repeatedly and automatically clean the system, including fermentation tanks, piping and valves etc.

Agitation

Top mechanical drive stirring allows good sealing performance, with high-performance stirring paddles, and different types of paddles can be used according to characteristic requirements.
Options: Bottom mechanical stirring or bottom/top magnetic stirring

Integrated Touchscreen

- Easy-to-read 10 inch integrated touchscreen monitor.
- In the process parameter, history record and curve display interface, the display interval can be freely selected to obtain detailed data at each time point.
- Real-time display of the fermentation status in the tank.
- Multiple vessels can be showed on one screen, which can smoothly switch and view the status of the tank, and simplify the operation and setting steps.

Data Storage and Protection

- Data transfer: USB disk
- Data protection: Overlimit alarm function; The real-time curve can be restored as it is when power is cut off and restarted.
- Three level of password permissions: operator (OPE), team leader (MON), and administrator (SYS).
- All alarm issues can be recorded and audited.

Gassing Systems

Application-appropriate spargers are available for microbiology and cell culture. The system selects corresponding gassing strategies for different sizes and types of fermenters. And the gas flow rate can be adjusted manually by a precision rotameter or automatically by an optional TMFC.

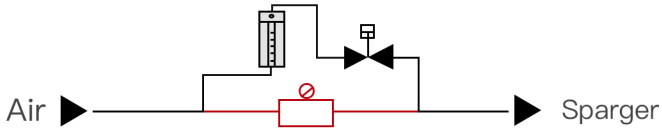
Feeding Peristaltic Pumps

- Four built-in configurable pumps for each vessel
- Those pumps are set as either alkali, acid, antifoam and feed
- Constant-rate pump with 60rpm
- Additionally, external pumps for feeding can be easily connected upon request



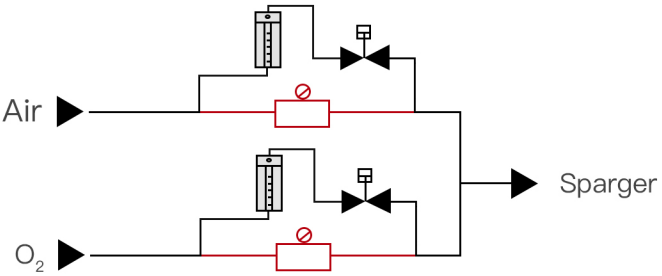

Airflow

Utilizing one air flow path, the flow meter intuitively indicates and controls sparger flow rate. An optional mass flow controller can be integrated to control and measure the flow range by manual regulation or automatically in combination with a DO controller.



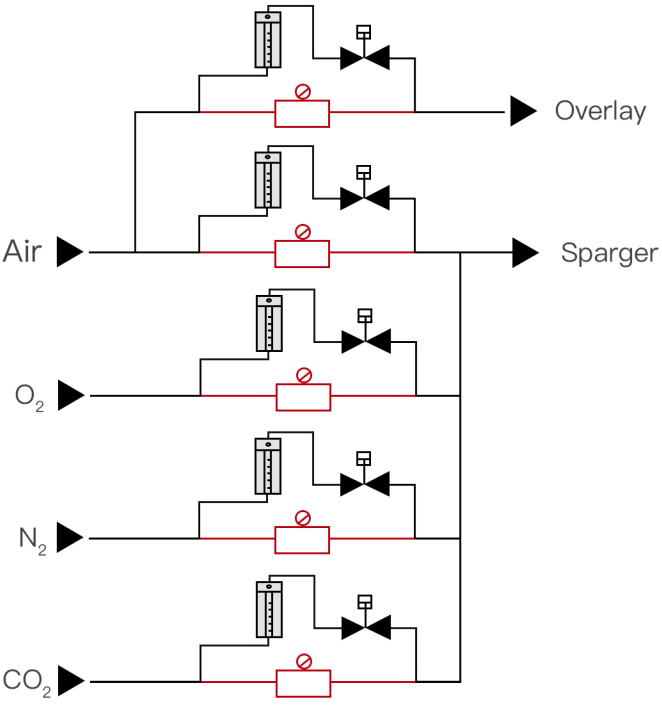
O_2-Enrichment

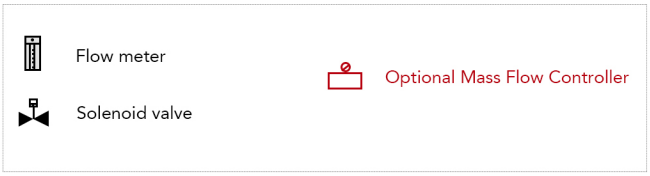
Utilizing two flow paths for air and O2 flow, the flow meter intuitively indicates and allows manual adjustment of the sparger flow rate. O2 is pulsed through a solenoid valve and flows only as needed to maintain the Dissolved Oxygen (DO) set point. A mass flow controller can be integrated to measure and control the total gas flow range by manual adjustment or automatically combined with a DO control-



Advanced Gas Flow

Up to 5 gas flow paths. Air goes into overlay through a flow meter and a solenoid valve. At the same time, solenoid valves select air, O2, N2 and CO2 to flow to the sparger. There are two ways to adjust the flow rate. The flow meter can intuitively set the flow rate of each gas path independently and use the solenoid valve as the gas path switch. The optional mass flow meter can automatically measure and control the gas path flow, which makes it possible to set and stabilize the overlay and sparger.





Quality and Documentation

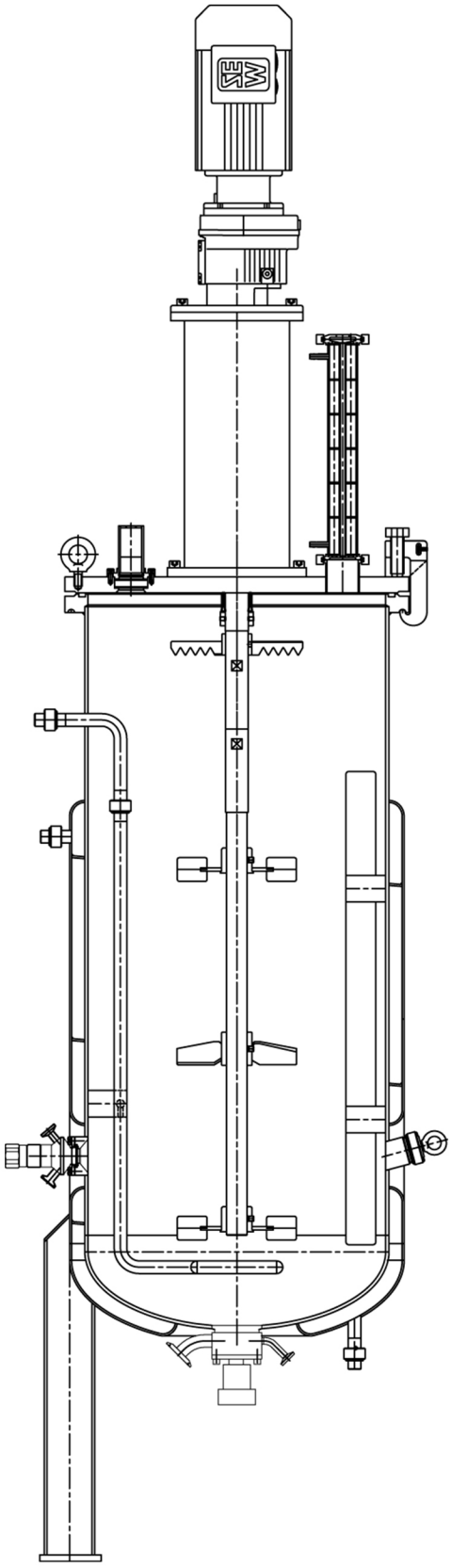
Strict quality control process, like Tank flaw X-ray detection, air tightness testing, sensors testing, sterilization procedure test...Furthermore, we also have relevant patents and provide related documents like, IQ, OQ, PQ, SAT, FAT...

Documentation Available upon Request

Material Certificate
Production Control Table
Welding Record
Pressure Testing Report
Operation Manual
Equipment Outline Chart
P&ID Chart
Layout
Electrical Loop Chart
Ra Testing Report
.....

General Test Listing

Calibration confirmation of instrumentation
Document/drawing confirmation
Confirmation of PID
Confirmation of key components
Inspection and confirmation of electrical schematic diagram
Spray ball coverage test
System air tightness test
Human-machine interface confirmation
Inspection of the operation of the fermenter system
Confirmation of level 3 authority
Alarm function confirmation
Data recording and backup confirmation
Temperature control testing
Testing of stiring system controls
Testing for pH control
Testing for DO control
Power outage and restoration testing
Ports testing
Audit trail functional confirmation
Sterilization procedure test



Main Components

Name	Description	Brand
Tank body	The tank body is made of TISCO stainless steel 316L+304 jacket+304 thermal insulation layer	
Stirring motor	AC geared motor	SEW
Tank Accessories	Observation mirror, process interface and other accessories	
Stainless steel control box	304 stainless steel chassis matte brushed treatment	
Bioreactor PLC controller	Control module	Siemens
filter pressure reducing valve	AW30-03BG-A	
Pressure Switch	3C-IS10M-30	
Pressure relief valve	Release pressure 0.27MPa	
Relay	Relay	Schneider
Pressure gauge	Sanitary diaphragm pressure gauge 0-0.4Mpa, 0-0.6Mpa	
Pressure Sensor	0-6bar	HUBA
Temperature electrode	Class A precision, SS316L, electropolished 0.4um, 0-150°C	Germany
peristaltic pump	Automatic, manual, segmented control	Watson marlow
Diaphragm valve	Matching according to pipe diameter	BURKERT
Tank Bottom Diaphragm Valve	AISI 316L Wall-mounted Diaphragm, Pneumatic, DN20-DN10	BURKERT
Pneumatic Diaphragm Valve	DN15	BURKERT
Thermal Mass Flow Meter	For high precision control	BURKERT
Valve Island	Valve automatic control	
One-way valve	Prevent reverse flow of gas	
Stainless steel filter shell	316L stainless steel filter sleeve, single core 3 inch	
Hydrophobic filter element	Hydrophobic Sterile Filter, 3"	
Spray ball	316L, 360° cleaning, 3/4" BPE standard, pin type	XINLAN
PH electrode	InPro3253/SG/120	Mettler, Hamilton
PH cable	AK9/1m	Mettler, Hamilton
DO electrode	InPro6860/12/120	Mettler, Hamilton
DO cable	VP8-ST/1m	Mettler, Hamilton
Aseptic sampling valve	Individually sterilizable 316L	
Sterile feeding Valve	Individually sterilizable, four-valve manifold	BURKERT
Cooling solenoid valve and circulating pump		Grundfos






BR500-M Series： O2 - Enrichment

Model	BR500-M1-10L	BR500-M1-20L	BR500-M1-30L	BR500-M1-50L	BR500-M1-100L	BR500-M1-200L
Culture vessel total volume	11.5L	21.2L	28.8L	51.3L	119.5L	198L
Working volume	8.6L	15.9L	21.6L	38.5L	89.6L	148.5L
H:D radio 2:1 | 3:1	● | ●					
Control Unit	Single vessel control [Option: twin configuration (dual vessels) or more]					
Digital controller, color display with touch screen	●					
Control Capabilities						
Temperature, DO, agitation speed	●					
Foam sensor, foam alarm	●					
Vessel pressure measurement | auto control	● | ○					
Auto sterilization in place	●					
Control PH by adding acid/alkali	●					
Gassing strategy	Air / O2, sparger					
Flow meter	Rotameter [optional TMFC]					
Low noise stirring motor	●					
Peristaltic pump	4 for acid, alkali, antifoam, feed [Up to 6 pumps]; fixed speed [optional variable]					
Process Control System						
Temperature control system	Closed loop system for heating and cooling					
Automatic sterilization pipe with valve	●					
Culture Vessel	Jacketed Stainless Steel Vessel with Sight Glass and Top Mechanical Agitation					
Stirrer shaft with top single mechanical seal	●					
Impeller	6-blade Rushton impeller, 3pcs					
Stainless steel filter housing for air inlet and exhaust filter	●					
Pressure gauge	● [0~0.4Mpa]					
Aeration tube with ring sparger	●					
Exhaust Cooler	●					
4-baffles [removable]	●					
Resterilizable sampling valve	●					
Lamp for vessel illumination	●					
Bottom discharging valve	●					
Integrated pipeline	●					
Storage bottles [4pcs]	●					
PH electrode, cable	●					
DO electrode, cable	●					
Temperature sensor Pt 100	●					
Foam electrode, cable	●					
Options						
Stirrer shaft with double mechanical seal | single magnetic seal	○ | ○					
Mobile CIP station with independent controller	○					
Cleaning in Place	○					
Vessel weight measurement | auto control	○ | ○					
Auto vessel pressure control	○					
Lid lifting device	○					
Dual PH sensors | Dual DO sensors	○ | ○					
Variable speed pump	○					
Cleanliness detection	○					
Turbidity detection	○					
Redox detection	○					
Exhaust detection	○					
Liquid level monitoring	○					
Methanol and ethanol content online detection	○					
Qualification Documents	○					

● = included ○ = option — = unavailable

BR500-C Series： Advanced Gas Flow

Model	BR500-C1-10L	BR500-C1-20L	BR500-C1-30L	BR500-C1-50L	BR500-C1-100L	BR500-C1-200L
Culture vessel total volume	11.5L	21.2L	28.8L	51.3L	119.5L	198L
Working volume	8.6L	15.9L	21.6L	38.5L	89.6L	148.5L
H:D radio 2:1	●					
Control Unit	Single vessel control [Option: twin configuration (dual vessels) or more]					
Digital controller, color display with touch screen	●					
Control Capabilities						
Temperature, DO, agitation speed	●					
Foam sensor, foam alarm	●					
Vessel pressure measurement | auto control	● | ○					
Auto sterilization in place	●					
Control PH by adding acid/alkali/CO_2	●					
Gassing strategy	Air, O2, CO2, N2, sparger + overlay					
Flow meter	Rotameter [optional TMFC]					
Low noise stirring motor	●					
Peristaltic pump	4 for acid, alkali, antifoam, feed [Up to 6 pumps]; fixed speed [optional variable]					
Process Control System						
Temperature control system	Closed loop system for heating and cooling					
Automatic sterilization pipe with valve	●					
Culture Vessel	Jacketed Stainless Steel Vessel with Sight Glass and Top Mechanical Agitation					
Stirrer shaft with top single mechanical seal	●					
Impeller	3-blade segment impeller, 3pcs					
Stainless steel filter housing for air inlet and exhaust filter	●					
Pressure gauge	● [0~0.4Mpa]					
Aeration tube with ring sparger	●					
Exhaust Cooler	●					
4-baffles [removable]	●					
Resterilizable sampling valve	●					
Lamp for vessel illumination	●					
Bottom discharging valve	●					
Integrated pipeline	●					
Storage bottles [4pcs]	●					
PH electrode, cable	●					
DO electrode, cable	●					
Temperature sensor Pt 100	●					
Foam electrode, cable	●					
Options						
Stirrer shaft with double mechanical seal | single magnetic seal	○ | ○					
Mobile CIP station with independent controller	○					
Cleaning in Place	○					
Vessel weight measurement | auto control	○ | ○					
Auto vessel pressure control	○					
Lid lifting device	○					
Dual PH sensors | Dual DO sensors	○ | ○					
Variable speed pump	○					
Cleanliness detection	○					
Turbidity detection	○					
Redox detection	○					
Exhaust detection	○					
Liquid level monitoring	○					
Methanol and ethanol content online detection	○					
Qualification Documents	○					

● = included ○ = option — = unavailable

Technical Specification

Culture Vessel	10L	20L	30L	50L	100L	200L
Space requirement Single [m] [W × H × D]	0.8×1.3×0.8 31.5×51.2×31.5	0.9×1.6×0.8 35.4×63×31.5	0.9×1.7×0.9 35.4×67×35.4	1.0×1.9×0.9 39.4×74.8×35.4	1.0×2.1×1.0 39.4×82.7×39.4	1.2×2.5×1.0 47.2×98.4×39.4
Space requirement Twin [m] [W × H × D]	1.4×1.3×0.8 55.1×51.2×31.5	1.6×1.6×0.8 63.0×63×31.5	1.6×1.7×0.9 63.0×67×35.4	1.9×1.9×0.9 74.8×74.8×35.4	2.0×2.1×1.0 78.7×82.7×39.4	2.4×2.5×1.0 94.4×98.4×39.4
Culture vessel weight Single [kg]	45	72	77	109	169	245
Ambient temperature | Relative humidity	5~40°C | 85%					
Utilities Requirements [Reference]						
Process Air, M | C	3bar | 3bar					
O_2 Sparger, M | C	3bar | 3bar					
N_2 Sparger, M | C	N/A | 3bar					
CO_2 Sparger, M | C	N/A | 3bar					
Utility steam, Pressure | Steam	3bar | 20Kg/h	3bar | 20Kg/h	3bar | 20Kg/h	3bar | 20Kg/h	3bar | 20Kg/h	3bar | 40Kg/h
Cooling water, Pressure | Flow	3bar | 5L/min	3bar | 5L/min	3bar | 5L/min	3bar | 15L/min	3bar | 25L/min	3bar | 50L/min
CIP, Pressure | Flow	1.5bar | 33L/min	1.5bar | 33L/min	1.5bar | 33L/min	1.5bar | 33L/min	1.5bar | 43L/min	1.5bar | 70L/min
Instrument air	6bar					
Power supply	208 VAC or 400 VAC					
Control Unit						
Controller	Industrial PC or PLC					
Display | Operation	Touch Panel 10" | Touch screen					
Communication	Ethernet network					
Housing Material	SUS304					
Dimension | Weight	400×300×1500mm | 45Kg					
External Connection						
USB	1 x data copy and export					
Other connections	1 x RS485 or upon request					
Sensor type	PT100					
Gassing System						
Microbial application	Max. total flow rate：1.5vvm					
Cell culture application	Max. total flow rate: Sparger 0.1vvm | overlay 1vvm					
Both application	Max. total flow rate: 1.5vvm					
Flow meter	Air calibrated: 1.2bar 20°C					
Flow Rate	0.5SLPM, 1.0SLPM, 2.5SLPM, 5.0SLPM, 10SLPM, 25SLPM [customizable]					
Accuracy	+/- 1% FS					
Peristaltic pumps	4 pumps [Up to 6 pumps]					
Constant-rate pump	60rpm [Watson Marlow]					
Rotation speed, Bore	0.5 mm (1/50")	0.8 mm (1/32")	1.6 mm (1/16")	3.2 mm (1/8")	4.8 mm (3/16")	8.0 mm (5/16")
Flow range [ml/revolution]	0.02	0.05	0.22	0.81	1.66	6.64
Temperature Control						
Temperature control system	Closed-loop constant temperature system with circulation pump, electric heater, water chiller [optional]					
Temperature control range	8°C above coolant to 40°C above ambient [0 to 65°C absolute temperature]					

Culture Vessel	10L		20L		30L		50L		100L		200L	
H:D ratio	2:1	3:1	2:1	3:1	2:1	3:1	2:1	3:1	2:1	3:1	2:1	3:1
Total volume	11.5L		21.2L		28.8L		51.3L		119.5L		198L	
Working volume	8.6L		15.9L		21.6L		38.5L		89.6L		148.5L	
Minimal working volume	2.9L		5.3L		7.2L		12.8L		29.9L		49.5L	
Agitation speed [rpm]	5~1000		5~1000		5~1000		5~800		5~700		5~400	
Motor power [Kw]	0.75		1		1		0.75		1.5		2.2	
Impeller to vessel diameter [6-blade Rushton impeller]	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Impeller to vessel diameter [3-blade segment impeller]	0.5	N/A	0.5	N/A	0.5	N/A	0.5	N/A	0.5	N/A	0.5	N/A

Lid ports	1 × sight glass for illumination 1 × sampling port	1 × inoculation port 1 × port for exhaust	4 × port for feeding 1 × agitation flange
Upper side wall	1 × vertical sight glass 1 × port for cooling water out	1 × aeration port 1 × port for rupture disc	
Lower side wall	1 × sampling port	4 × sensor	
Bottom	1 × sampling valve	1 × port for cooling water in	
Vessel design	Jacketed stainless steel vessel with torospherical bottom, vertical sight glass and agitation system		
Material [product wetted parts]	SUS316L | Borosilicate glass | EPDM [FDA approved]		
Surface finish [wetted part| outer surface]	Ra ＜0.4 μm | Ra ＜0.8 μm		
Pressure design criteria, vessel | jacket	0~3bar @ 150°C | 0~3bar @ 150°C		
Sensors |Measurement |Resolution			
Dissolved oxygen	Polarographic or optical | 0– 150% | 1% | +/- 0.1%		
PH	Gel filled | 2– 12 | +/- 0.01 pH		
Foam | Level | High Foam	Conductive probe		
Temperature	PT100 | 0~150°C | +/- 0.1°C		
Pressure	Piezoresistive sensor|-0.5–2 [barg]|1 mbar		
Regulatory compliance	CE; ASME optional; UL optional		