

Biostat[®] Cplus The Stainless Steel Fermenter | Bioreactor for Your Laboratory



Biostat® Cplus

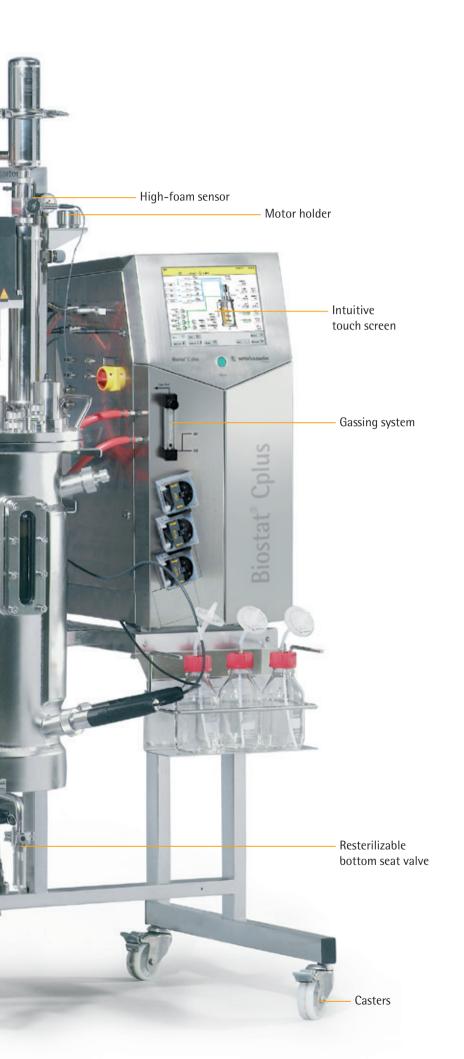
System Concept

The Biostat® Cplus is a Sterilizable-In-Place (SIP) Fermenter | Bioreactor developed for the cultivation of microorganisms and cell cultures. Culture vessels with operating volumes of 5 L, 10 L, 15 L, 20 L and 30 L are available. The system can be flexibly integrated into your laboratory. The culture vessel can be sterilized with electro or steam heating. It can easily be moved to another location using casters under the supply unit. With more than a thousand installations worldwide, the Biostat® Cplus is the most successful stainless steel bioreactor of its class and is now available in the revised 3rd generation with DCU controller.

Typical Applications

- Process development for vaccine, recombinant protein and monoclonal antibody production
- Process development for biofuels and for the production of secondary metabolites
- Process strategy development in batch, fed-batch, continuous or perfusion operation
- Scale-up and scale-down experiments
- Small scale production for e.g., diagnostic antibodies
- High cell density fermentation
- Suspension cultures and adherent cell culture with microcarriers
- Cultivation of filamentous organisms





Your Advantages

Cost-effective integration into existing infrastructure, choice between electro or steam heating for operation and sterilization

DCU control unit with simple, intuitive touch screen operation

Attractive additional functions such as gravimetric feed control, advanced DO controller, and integrated offgas analyzer

Compact, mobile design saves valuable laboratory space

Maintenance-free agitator motor and automatic sequences for sterilization and pressure hold test ensure excellent safety

Biostat® Cplus

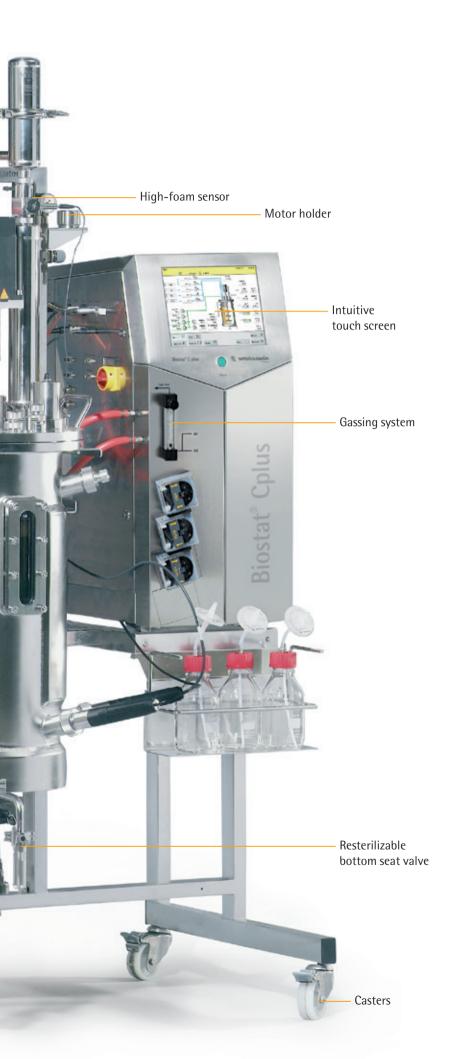
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Configurable Flexibility

The modular design allows individual system configuration in order to meet your application-specific requirements, from the basic configuration through to sophisticated equipment with e.g., resterilizable addition valve, automatic pressure control, containment sampling, integrated offgas measurement and much more.

Our application specialists are happy to support you and help configure your personal Biostat® Cplus for you.

Motor Holder

The motor holder is screwed to the frame. This helps you to position the motor easily and securely if the culture vessel needs to be opened.



Agitator Motor

The maintenance-free agitator motor provides low speeds for the gentle mixing of cell cultures and high speeds for the conduct of microbial high cell density cultivations.

The motor is gearfree; therefore it works almost without a sound. It is easy to handle due to the small dimensions and low weight.

Lid Lifting Device

The lid lifting device enables the easy removal of the lid and allows for simple and safe handling during cleaning work or when changing culture vessel accessories.



Culture Vessel

Culture vessels with maximum operating volumes of 5 L, 10 L, 15 L, 20 L and 30 L, and a height | diameter ratio (H:D) of 2:1 or 3:1 (5 L only 2:1) are available. Various lid and side ports enable the simple integration of additional sensors or addition valves.

Sampling Valve SVC 25

The sampling valve SVC 25 is used for finely regulated sampling from the culture vessel. The SVC 25 can be resterilized with steam for repeated aseptic sampling. A containment extension kit is also available for sterile and aerosol-free sampling.

Resterilizable Addition Port APC

The APC is a resterilizable valve group for installation into the culture vessel, which provides a sterile, secure connection of additions into the culture vessel. Thanks to the APC it is possible to use the same port for inoculation of the sterile culture vessel and later in the process for adding a substrate. It is easy to resterilize, safe and cost-effective. In addition, the APC is the perfect interface for the connection of disposable bags such as Flexboy® or Flexel®.

Casters

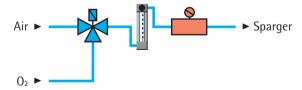
The casters mean that the system is completely mobile, whether this be for moving it to another laboratory or simply when cleaning the floor.

Biostat[®] Cplus Gassing Strategies

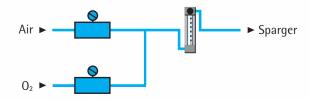
Flexible gassing options make the Biostat[®] Cplus a versatile tool for the most wide-ranging applications, from high cell density fermentation with high oxygen requirements through to cell culture with demanding gas mixing of up to four gases.

Microbial Applications

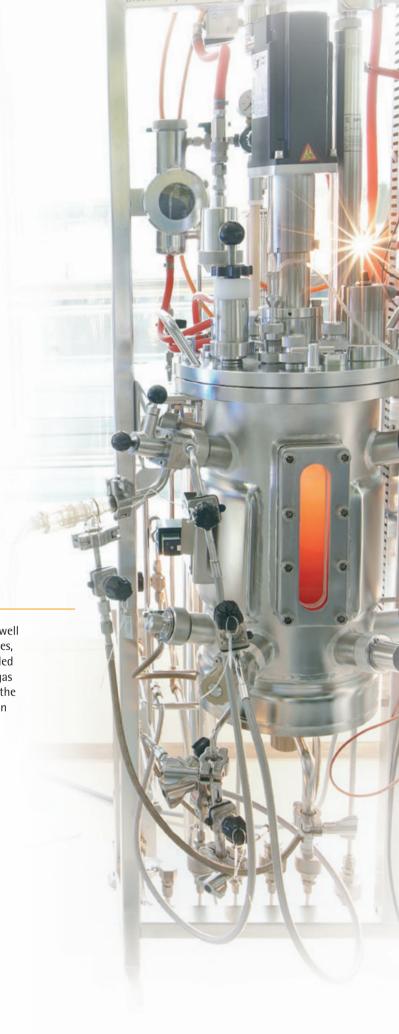
Various configurations allow for aeration with air or oxygen, as well as the traditional $\rm O_2$ enrichment function. For anaerobic processes, the air inlet can also be used for nitrogen. Solenoid valves installed as standard in combination with a flow meter ensure a reliable gas supply. Optional mass flow controllers offer precise batching of the individual gases, as is needed for example for balancing studies in combination with exhaust analysis.

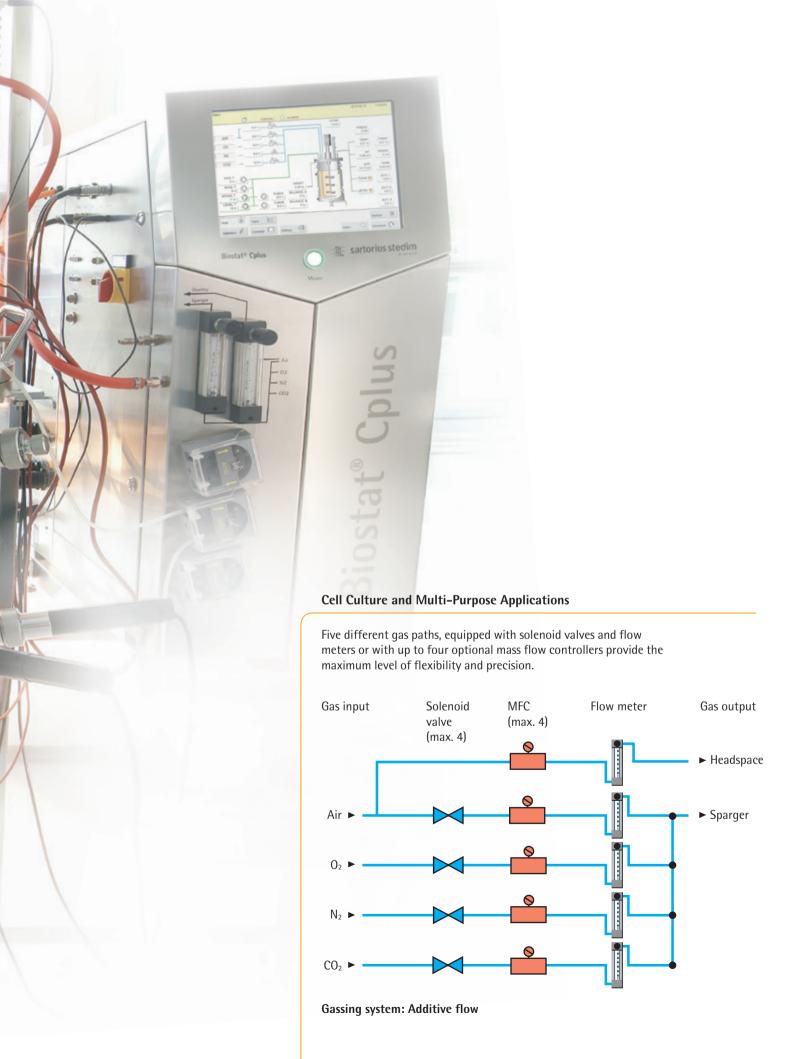


Gassing system: O₂-Enrichment



Gassing system: Gas flow ratio





DCU

Local Control

The DCU controller is one of the best proven, most secure and most flexible control solutions both in the upstream and in the downstream process. The DCU is the standard automation platform for our Biostat[®] bioreactors, SARTOFLOW[®] Crossflow filtration units, and FlexAct[®] configurable production solutions and is now also installed in the new Biostat[®] Cplus. In addition to the measurement and control tasks and the process control for the sterilization of the culture vessel, it is now possible to integrate up to four mass flow controllers and up to two scales or gravimetric feed controller. In addition, a pressure hold test sequence for the culture vessel and the "Advanced DO controller" is optionally available.

Advanced DO Controller

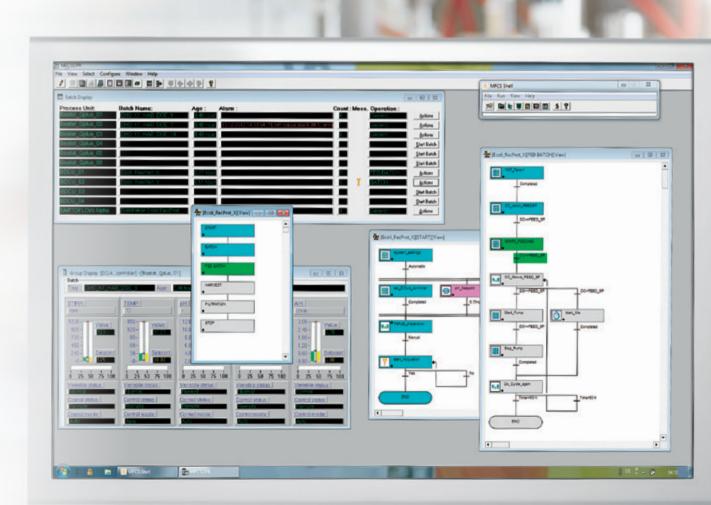
Biostat[®] Cplus. In comparison with the conventional DO control cascade, the advanced DO controller supports the The controller can be easily configured using the touch screen and results are graphically displayed as a polygonal curve, which is easily to understand. The result is maximum



BioPAT® MFCS

Superior Process Control

BioPAT® MFCS is the international standard software for the control of bio processes and related data recording. More then 25 years of experience has gone into the current version of BioPAT® MFCS. With more than 6,500 installations, it provides a reliable basis for your individual requirements. We supply the BioPAT® MFCS | DA version as standard with each bioreactor for data recording.



Overview of Basic Configurations MO: O₂ Enrichment

Package Overview

Control unit Digital controller, color display with touch screen Control capabilities Gemperature, DO (multi-stage cascade controller), stirrer speed DH control via addition of acid and base Gequence for culture vessel sterilization (full sterilization) Maintenance-free, low-noise agitator motor Flow meter Golenoid valve for O ₂ enrichment Integrated peristaltic pumps Process data recording	CP-M05L	10 L RCP-M10L	15 L RCP-M15L	RCP-M20L	RCP-M30L
Control unit Digital controller, color display with touch screen Control capabilities Femperature, DO (multi-stage cascade controller), stirrer speed OH control via addition of acid and base Fequence for culture vessel sterilization (full sterilization) Maintenance-free, low-noise agitator motor Flow meter Folenoid valve for O ₂ enrichment Integrated peristaltic pumps Process data recording	G -MOSL	nci -WIUL	•	NCI -IVIZUL	NCI -WISUL
Digital controller, color display with touch screen Control capabilities Femperature, DO (multi-stage cascade controller), stirrer speed OH control via addition of acid and base Sequence for culture vessel sterilization (full sterilization) Maintenance-free, low-noise agitator motor Flow meter Solenoid valve for O ₂ enrichment Integrated peristaltic pumps Process data recording			•		
Control capabilities Temperature, DO (multi-stage cascade controller), stirrer speed of control via addition of acid and base Sequence for culture vessel sterilization (full sterilization) Maintenance-free, low-noise agitator motor Flow meter Solenoid valve for O ₂ enrichment ontegrated peristaltic pumps Process data recording			•		
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Flow meter Solenoid valve for O ₂ enrichment ntegrated peristaltic pumps Process data recording					
Solenoid valve for O ₂ enrichment ntegrated peristaltic pumps Process data recording			•		
ntegrated peristaltic pumps Process data recording			•		
Process data recording			•		
			2 for pH	regulation (acid ar	nd base)
BioPAT® MFCS DA			•		
Supply unit O _I	pen frame desig	yn .			
Temperature control system Clo	losed loop system	n with recirculation	on pump and heat	exchanger for hea	iting and cooling
nstallation set			•		
IIITIIre vessei			essel with vertical	l sight glass and to	op agitation
(5	5 L stainless stee	el glass vessel)			
Stirrer shaft with single mechanical seal (SMS)			•		
6-blade disk impeller	2	3	3	3	3
Stainless steel filter housing for aeration and exhaust incl. sterile filter			•		
Pressure gauge –1 3 barg			•		
Aeration tube with Ring-sparger			•		
Exhaust cooler			•		
4 Baffels (removable)			•		
-Channel Sacova valve for needle free additions			•		
B-Channel Sacova valve for needle free additions			•		
amp for vessel illumination (not for 5L culture vessel)			•		
Storage bottles			2		
Resterilizable bottom seat valve for sampling and harvesting			•		
pH sensor, connection cable			•		
OO ₂ sensor, connection cable			•		
emperature sensor Pt 100			•		
Options					
Electric heating for culture vessel sterilization (full sterilization)			0		
Neighing system for culture vessel			0		
Pressure hold test for culture vessel			0		
Mass flow controller for air and oxygen			0		
id lifting device 10–30 L			0		
Antifoam control via sensor					
Advanced DO controller			0		
Jp to two gravimetric feed controllers,					
occuracy 7 kg balance: 5 g/h, accuracy 60 kg balance: 50 g/h			0		
Redox measurement			0		
Turbidity measurement			0		
Resterilizable addition valve APC 19 and APC 25			0		
Qualification documents			0		
Jp to two substrate controllers			0		
ntegrated or external substrate pumps			0		
Sampling value SVC 25 (resterilizable)			0		

Overview of Basic Configurations CC: Additive Flow

Package Overview

Culture vessel volumes	5 L	10 L	15 L	20 L	30 L			
Basic configuration	RCP-C05L	RCP-C10L	RCP-C15L	RCP-C20L	RCP-C30L			
Control unit		· ·	'	'	·			
Digital controller, color display with touch screen			•					
Control capabilities								
Temperature, DO (multi-stage cascade control), stirrer speed			•					
pH control via addition of acid CO ₂ and base			•					
Sequence for culture vessel sterilization (full sterilization)	•							
Maintenance-free, low-noise agitator motor			•					
Flow meter "Sparger"			• For ai	ir. O. N., CO.				
Flow meter "Overlay"	• For air, O ₂ N ₂ , CO ₂ • For air							
Solenoid valves for gas mixing of air, O ₂ , N ₂ , CO ₂				s flow controller o	ptional)			
Integrated peristaltic pumps				H regulation (acids				
Process data recording			2.0. p.	cga.ac.o (ac.a.	, and oddes,			
BioPAT® MFCS DA			•					
Supply unit	Open frame d	locian						
•••	-	-	a numan and baat	exchanger for hea	ting and acaling			
Temperature control system	Closed loop sy	stem, recirculation	n pump and neat o	exchanger for nea	ting and cooling			
Installation set	lankotad at-	nless stool ault		tical sight glass a	nd ton onitation			
Culture vessel		steel glass vess		ticai signt giass a	nd top agitation			
Stirrer shaft with double mechanical seal (DMS)			•					
Fluid buffer system DMS, compressed air pressurization			•					
3-blade segment impeller			2					
Stainless steel filter housing for 2 × aeration and exhaust incl. sterile filter			•					
Pressure gauge –1 3 barg			•					
Aeration tube with micro-sparger			•					
Exhaust cooler			•					
4 Baffels (removable)			•					
1-Channel Sacova valve for needle free additions			•					
3-Channel Sacova valve for needle free additions			•					
Lamp for vessel illumination (not for 5L culture vessel)			•					
Storage bottles			2					
Resterilizable floor bottom seat for sampling and harvesting			•					
pH sensor, connection cable			•					
pO ₂ sensor, connection cable			•					
Temperature sensor Pt 100			•					
Options								
Electric heating for culture vessel sterilization (full sterilization) and operation			0					
Weighing system for culture vessel			0					
Pressure hold test for culture vessel			0					
Culture vessel sterilization (empty and full sterilization)			0					
Lid lifting device 10–30 L			0					
Antifoam control via sensor			0					
Advanced DO controller			0					
Up to two gravimetric feed controllers, accuracy 7 kg balance: 50 g/h			0					
Redox measurement			0					
Turbidity measurement			0					
Resterilizable addition valve APC 19 and APC 25			0					
Qualification documents			0					
Up to two substrate controllers			0					
Integrated substrate pump			0					
Sampling value SVC 25 (resterilizable)			0					
	included ○ = option	al						

Biostat[®] Cplus – Technical Specifications

Technical Specifications

Culture vess	sel volumes	5 L	10 L	15 L		20 L		30 L	30 L	
mensions $[W \times H \times D]$ ["]		35.4 × 51.2 × 27.6 39.4 × 74.8 × 29.5		39.4 × 74	39.4 × 74.8 × 29.5		39.4 × 74.8 × 29.5		39.4 × 74.8 × 29.5	
	[m]	0.9 × 1.3 × 0.7	$0.9 \times 1.3 \times 0.7$ $1.0 \times 1.9 \times 0.75$ $1.0 \times 1.9 \times 0.75$		× 0.75	1.0 × 1.5	9 × 0.75	$1.0 \times 1.9 \times 0.75$		
Required door dimensions for	["]	31.5 × 51.2	31.5 × 78.7	31.5 × 78	31.5 × 78.7		31.5 × 78.7		31.5 × 78.7	
installation [W × H]	[m]	0.8 × 1.3	0.8 × 2		0.8 × 2		0.8 × 2		0.8 × 2	
System weight (approx.)	[kg]	130	210	215		215		230		
Ambient temperature relative humid					F). decreasin	ing linearly < 50 % at 40°C (104°F).				
(non-condensing)	,		· · · · · · · · · · · · · · · · · · ·	(,,	5		- ().		
Utilities requirements		Specification		Max.		Culture vessel ve		olumes		
				flow	5 L	10 L	15 L	20 L	30 L	
Process control air MO CC sparger overlay		4-6 barg 58-87 ps class 2 (ISO 8573-1)	sig, regulated,	[L/min]	7.5 0.5/5	15 1/10	23 1.5/15	30 2/20	45 3/30	
O ₂ MO sparger CC sparger		4 barg 58 psig, regu	[L/min]	7.5 0.5	15 1	15 1.5	30	45 3		
CO ₂ MO sparger		4 barg 58 psig, regu	[L/min]	N A	N A	N A	N A	N A		
CC sparger				0.5	1	1.5	2	3		
N ₂ MO sparger		4 barg 58 psig, regu	[L/min]	N A	N A	N A	N A	N A		
CC sparger				Fr. /1.3	0.5	1	1.5	2	3	
Utility steam		3 barg 29 psig, regu	•	[kg/h]	7	15	15	15	15	
Clean steam		2 barg 29 psig, regu	[kg/h]	3	5	5	5	5		
Coolant (supply line)		2 – 4 barg 29 – 58 ps regulated, (15°C) par	[L/min]	5	5	5	5	5		
Coolant (return line)		2 barg (29 psig) und	[L/min]	5	5	5	5	5		
Condensate		Ambient pressure (m	[L/min]	1	1	1	1	1		
Mains voltage (TNS net):			A, 400 VAC 50 Hz 16 A							
5 wire: $3 \times \text{phase}$, $1 \times \text{ground}$, $1 \times \text{neu}$	ıtral	all current sensitive								
Control unit		_	ntroller, gassing system,	and up to 4	pumps					
Control		Industry PC								
Housing material		Stainless steel AISI 3								
Display operation		Touch panel 10" tou	uch screen							
Interface to the host PC		Ethernet								
External inputs										
Scale connection		Maximum 2 x RS 23	2							
Analog inputs		Up to 3 (0 – 10 V)								
External substrate pumps		Up to 2 analog (0 – 1	0V)							
Gassing system										
Microbial application		O ₂ enrichment or ga	s flow ratio; maximum t	otal flow rat	e: 1.5 vvm					
Cell culture application		Additive flow; maxir	num aeration rate: Over	ay 1 vvm sp	oarger 0.1 vv	m				
Dual use application		Additive flow; maxir	num aeration rate: 1.5 v	vm						
Flow meter		Air calibrated; 4 bar	20°C							
Flow rates		0.6-60 mL/min up to	5-52 L/min							
Accuracy		+/- 4% FS	+/- 4% FS							
Thermal mass flow controller		Air N ₂ , O ₂ or CO ₂								
Flow range		0.6–30 mL/min up to 1–50 L/min								
Accuracy		+/- 1% FS								
Integrated pumps		Up to 4 (2 \times digital	l + 2 × digital speed re	gulated)						
Pump head – for silicone hoses with wall thickness 1.6 mm 1/16"		Watson Marlow 102								
Available versions		Digitally controlled ((20 rpm) or speed-contro	olled (5–50 r	pm)					
Flow rates Hose internal diameters	:	0.5 mm (1/50")	0.8 mm (1/32")	1.6 mm ('	3.2 mm	(1/8")	4.8 mm	(3/16")	
Flow rate: ml/revolution		0.02	0.05	0.22	,	0.81	, , - ,	1.66	., .,	

Supply unit	Open frame design										
Material surface roughness (product wetted parts)	Stainless steel AISI 316L Ra ≤ 0.8 μm (< 31.5 Ra)										
Temperature control system	Closed pressurized water temperature control system with recirculation pump, heat exchanger for cooling and heating, optional electric heating										
Operation (operation sterilization):	8°C above coolant temperature up to 90°C up to 130°C										
Heat exchanger (cooling stainless steel)	Stainless steel, copper soldered stainless steel, copper soldered; Option: Stainless steel welded										
Electric heating (option) 5L 10-30L	3 kW 6 I	κW									
Culture vessel	5 L 10 L 15 L 20 L 30 L							30 L			
H:D ratio	2:1	2:1	3:1	2:1	3:1	2:1	3:1	2:1	3:1		
Total volume	6.8 L	15 L	15 L	22 L	22 L	30 L	30 L	42 L	42 L		
Working volume	5 L	10 L	10 L	15 L	15 L	20 L	20 L	30 L	30 L		
Minimum operating volume*	1.6 L	4.5 L	3.5 L	5.5 L	4.5 L	7.7 L	5.5 L	9 L	7 L		
Weight of culture vessel lid with attachments approx. [kg]	11	12	15	19	17	21	20	26	26		
Permitted stirrer speed	20-	20-	20-	20-	20-	20-	20-	20-	20-		
Termited stiffer speed	1500	1500	1500	1000	1000	1000	1000	600	600		
Motor power [kW]	0.5	0.8	0.8	0.8	0.8	1.2	1.2	1.2	1.2		
Impeller to culture vessel diameter	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
[6-blade disk impeller]		011	0	0	0	011	011	0	01.		
Impeller to culture vessel diameter	0.5	0.5	N A	0.5	N A	0.5	N A	0.5	N A		
[3-blade segment impeller]					'				,		
	1 × ports for exhaust cooler 1 × ports for stirrer 1 × ports for safety valve (for ASME 19 mm port) 4 × 19 mm ports (5 L and 10-3): 5 × 19 mm ports (10-2-30 L)										
Upper port level (not for 5 L)	2 × grip 3 × 25 mm ports 1 × ports for burst disk (only ASME culture vessel) 1 × lengthwise view glass										
Lower port level	4 × 25 mm port 1 × sensor ports for Pt100										
Bottom	1 × floor	drain valve									
Jacket	1 × supply line 1 × return line										
Culture vessel design	Double-walled stainless steel vessel with Klöpper floor design and lengthwise view glass, stirrer from top 5 l Stainless steel glass vessel										
Material (product wetted)	Stainless steel AISI 316 L borosilicate glass EPDM (FDA)										
Surface (product wetted) culture vessel attachements				3 μm (< 31.5		polished					
Culture vessel design Vessel Jacket							oarg @ 150°	С			
Sensors measuring range readability		, &			3 0		J J				
pO ₂	Amneron	netric or ont	ic 0–100%	10/6 0 10/-							
pH		2–12 0.0		1 /0 0.170							
Foam level high foam			•	with opromia	inculation						
Temperature culture vessel temperature control system	Conductive, stainless steel body with ceramic insulation										
pH redox	Gel-filled -2000-2000 mV 1 mV										
Pressure measurement	Piezoresistive sensor -0.5–2 [barg] 1 mbar One-channel NIR absorption sensor, gap width 10 mm or 20 mm 0–6 AU 0.01 AU										
	One -I-	anal NID -	ountie:	11	la 10	20 1001-10	CALLLOOA	A I I			
Turbidity sensor Regulatory complience							6 AU 0.01 <i>i</i> or SELO (5L				

MO: Microbial application; CC: Cell culture application
* minimum volume for full sterilization 50% max. working volume

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