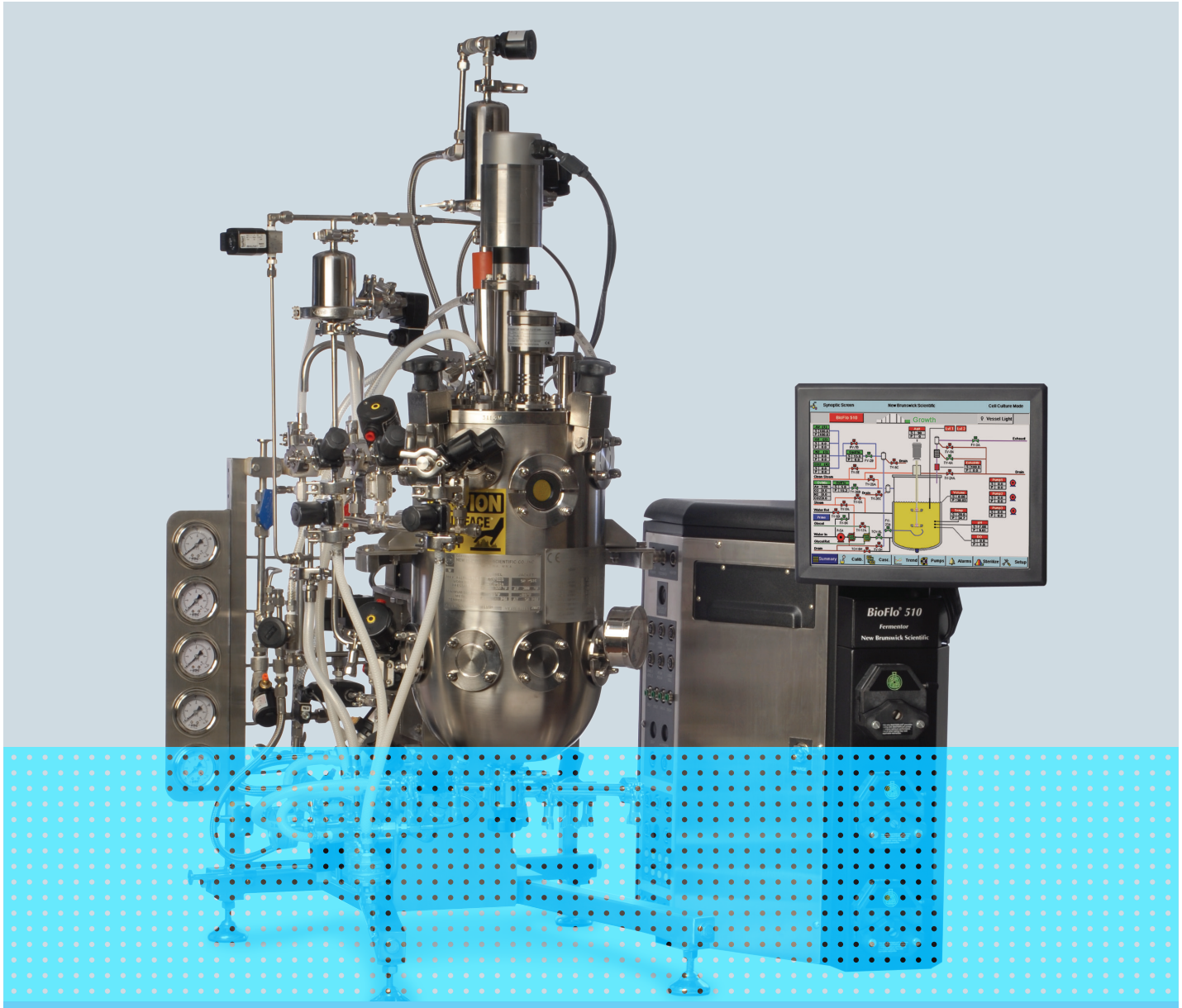
eppendorf



Customizable Control

BioFlo® 510 benchtop SIP fermentation system

Convenience, Flexibility, and Control

The BioFlo® 510 fermentation system is designed for rapid delivery and easy field customization, should your requirements change. Compact, versatile, and exceptionally capable. Quality at a very competitive price.

Modular design provides system flexibility

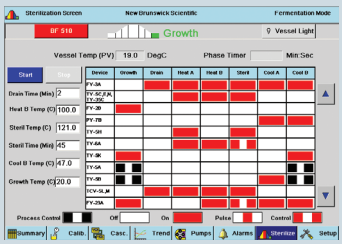
> Easily add or remove system components at any time, pre- or post-delivery to accommodate changes in your process requirements
> Numerous ports in the vessel headplate and sidewall provide flexibility to position sensors, spray balls, addition valves, pressure transducer and more
> Multiple gas flow options, up to two thermal mass flow controllers can be employed
> Capable of batch, fed-batch and continuous modes
> Three impeller options
> Optional SCADA software, validation packages, sprayballs for vessel clean-in-place, redundant pH/DO sensors

Advanced controller optimizes results

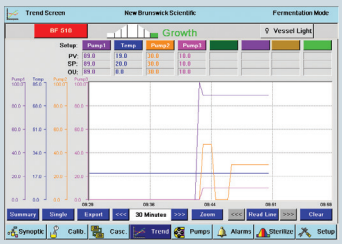
> Simultaneously regulate up to 32 process loops through the sophisticated RPC (Reactor Process Controller)
> Front-accessed, analog inputs and outputs allow you to integrate up to 14 sensors, analyzers, flow controllers or other external devices
> Security, built into the control system, offers two user groups unique userdefined passwords and auto log-out
> Touchscreen control screens are exceptionally easy to navigate, to simplify setup, calibration, sterilization and monitoring
> Store up to ten batch recipes; program and monitor sterilization cycles, gas flow, PI values, and more

Production-scale system that fits on the bench

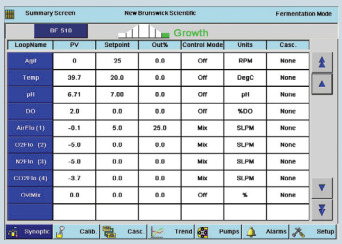
> At just 116 cm wide x 86 cm deep (45.5 x 34.0 in), the compact BioFlo® 510 can fit on a lab bench. Or, move and operate it on our sturdy, optional, stainless-steel mobile table
> Sterile vessel connections, flush with the vessel's interior, virtually eliminate deadlegs, minimizing contamination risk and simplifying cleaning
> Fully validatable, following V-Model guides for URS, FRS, DDS, IQ, OQ and trace matrix
> CE-certified and manufactured to meet cGMP guidelines



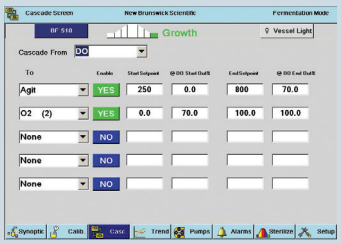
Enter and view sterilization parameters and valve sequences from the sterilization screen



Trend graphs make it simple to track and export data on up to eight process variables over a six day span



Simultaneously view up to 10 setpoints, current values, cascade loops and more on the Summary screen



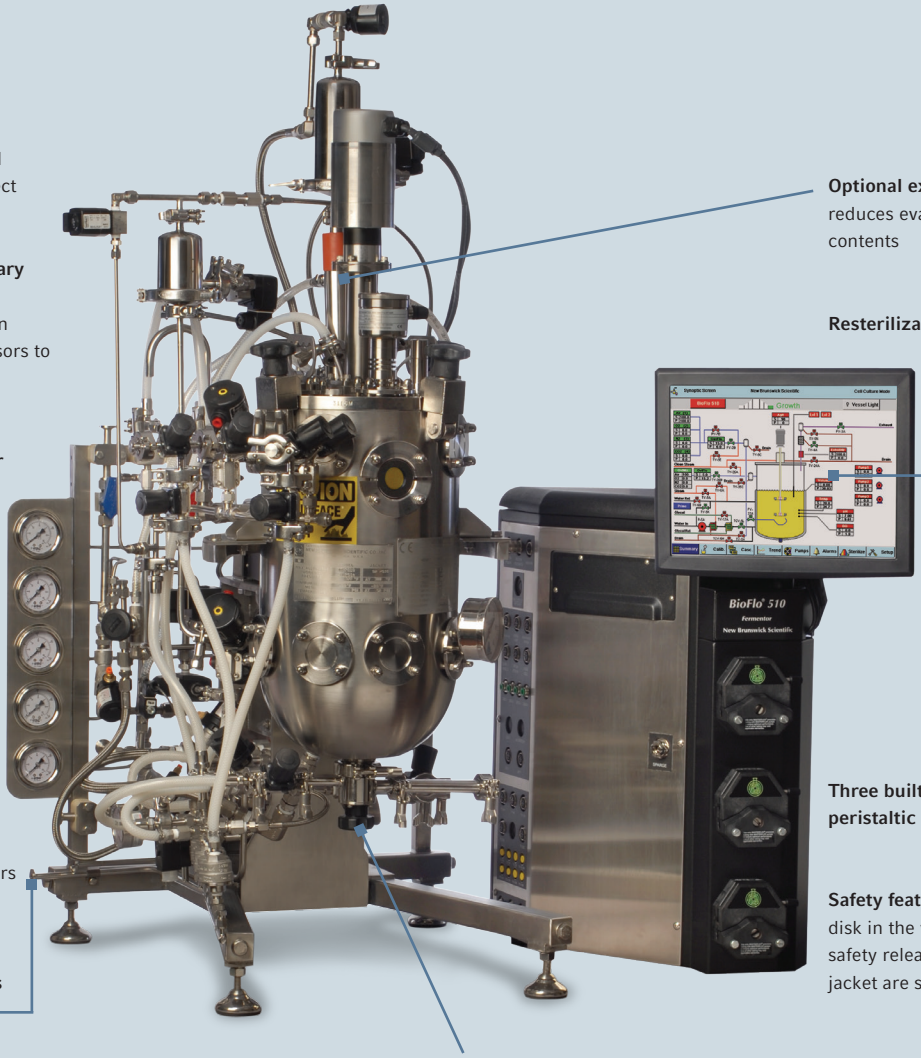
Cascade one or more variables (in this case agitation and O_2) to achieve sophisticated process control, based on the value of any other one or more variables

Advanced system includes benchtop control station with touchscreen interface, stainless steel vessel, and piping skid

Customize PI values for all process parameters or select factory defaults

Multiple Pg 13.5 and sanitary connection ports provide flexibility to position sensors and redundant sensors to meet your process needs

Double mechanical seal with rushton-type impeller



Optional exhaust gas condenser reduces evaporation of vessel contents

Resterilizable sample valve

Adjustable-angle, user-friendly 15 in (38 cm) touchscreen interface simplifies control and provides clear viewing of process parameters

Three built-in, assignable, peristaltic pumps

Safety features: A sanitary rupture disk in the vessel and an ASME safety release valve on the drain jacket are standard

Multiple gas flow options: Choose 1 or 2 thermal mass flow controllers (TMFC) in a variety of flow ranges

Sanitary or quick connects allow utilities to be connected in minutes

ASME and CE certified: Designed and built to ASME and CE standards

4 removable vessels baffles provided for enhancing mixing

Resterilizable drain valve enables sterile transfer of vessel contents

Built-in load cell measures vessel volume, enabling weight to be used to automate pump control for additions and harvesting

Optional glycol heat exchanger enables rapid cool-down; closed-loop, eco-friendly design reduces need for single-pass cooling water through the system

Resterilizable addition valve array: Each vessel can accommodate up to four addition ports for vessel additions (one addition port shown)

Optional impellers: Pitched blade impeller (left) for high aeration and low shear in insect and other cell cultures; **marine blade impeller** (right) for the growth of insect cells and other cultures

BioFlo® 510 fermentor specifications*

Vessel	Working volume	10.75 - 32.0 L		
	Total volume	40 L		
	Construction	> Aspect ratio: 2:1 > Material of construction: 316L stainless steel > Vessel access: Headplate	> Code ratings: ASME/CE > Vessel pressure: 40 PSIG (5.5 BAR), Full vacuum > Finish: 15 CLA (0.38 micrometer) Ra electropolished interior [standard]	
	Agitation	Drive: Top drive, double-mechanical seal		
	Speed	100 - 700 rpm		
	Impellers	(2) Rushton-type impellers		
	Baffles	Standard: (4) Removable, 316L stainless steel. Optional baffle plug kit		
Ports	Headplate	> (4) Pg 13.5 [light, Level 1 sensor/spare, Level 2 sensor/spare, septum/spare] > (4) 1.5 in NBS connect sanitary style [pressure transducer/spare, exhaust, and (2) spray balls/septums/spares]		
	Upper side wall	> (7) 1.5 in NBS connect sanitary style [gas overlay/spare, vessel rupture device, and (4) addition valves/spares] > (1) 3 in NBS connect sanitary style [vessel sight glass]		
	Lower side wall	> (7) 1.5 in NBS connect sanitary style [RTD, sample/spare, pressure gauge/spare, sparger/spare, and (3) DO/pH/redox or combinations thereof]		
	Bottom	(1) 1.5 in NBS connect sanitary style [radial diaphragm drain valve]		
Controller	Control station	Controls one vessel with 32 control loops. Stores 10 recipes and eight process variables for trend graphing. Includes an industrial touchscreen monitor/user interface, three built-in pumps, and connections for all utilities and communication signals		
	Touchscreen interface/display	38 cm (15 in) Industrial touchscreen interface/display		
Pumps	Standard, options, and control	Standard: Three built-in, assignable, peristaltic pumps. Control modes: Off, Prime, Base, Acid, Foam, Level 2 Wet, Level 2 Dry, Volume Add, Volume Harvest Optional: Two external variable-speed pumps can be added		
	Speed	Pumps 1, 2 and 3: 100 rpm Fixed-speed duty cycle, ability to view total pump flow rates		
Piping skid	Construction	> Material of construction: 316L stainless steel	> Gaskets/O-Rings: Class (VI) EPDM and silicon	
	Aeration	Standard: 1 thermal mass flow controller (TMFC) with flow rates up to 2 VVM and built in four-gas control (4 solenoid valves) Optional: 2nd TMFC for individual gas control		
	Gas inlet	Sparger/overlay filter housing with 0.2 µ absolute disposal filter. Overlay valve optional		
	Exhaust line	Standard: Line designed for minimal backpressure. Includes heater and 1.2 µ nominal exhaust filter and housing, with manual backpressure regulator Optional: Automatic backpressure control		
	Temperature control line	> All systems come with automatic sterilization program > Operating temperature control range 10 °C above water supply temperature to 80 °C > Line designed to achieve 1 °C/minute temperature rises, in the 30 °C - 50 °C range > Optional: Glycol/chiller heat exchanger designed to remove 100 watts/L		
	Load cell	Provided for measuring vessel volume		
Sensor	Options	> pH/DO sensor kits	> Redundant pH/DO sensor kits	> Redox sensor kit
Dimensions (W x D x H)		116 x 86 x 151 cm (45.5 x 34.0 x 59.5 in)		
Additional options		> Spray balls > Transfer lines > 1 or 7 port septum > Validation packages	> Foam/level kits > Sterile sampling kit > Additional sight glass	> Turbidity sensor/transmitter > Addition vessels > Scales for addition vessel > Vessel passivation > Utility prefilter/regulator kit > Marine and pitched-blade impellers
Utility requirements and connections	Process air/gases O_2, N_2, CO_2	30 PSIG (2.1 bar), 64 SLPM		
	Instrument air	80-100 PSIG (5.5 - 6.9 bar), 2 scfm (56.5 SLPM)		
	Process steam	35 PSIG (2.4 bar), 10 lb/hr (4.5 kg/hr)		
	Utility steam	35 PSIG (2.4 bar), 35 lb/hr (15.9 kg/hr)		
	Facility water	30 PSIG (2.1 bar), 2 GPM (7.57 L/min)		
	Water return	Less than 15 PSIG (1.0 bar) back pressure		
	Clean condensate	Gravity drain		
	Biowaste	Gravity drain		
	Glycol/chiller	30 PSIG (2.1 bar), 2 GPM (7.57 L/min)		
	Electric	208-230 V AC, single phase, 50/60 Hz, 15 A		

Eppendorf is ISO 13485 and 9001 certified. * Specifications subject to change without notice

Input/output connections and communication ports	External devices	Seven analog inputs and seven analog outputs for your external devices such as analyzers, sensors, external pumps, etc. (Reduce by 1 input and output for each additional TMFC added)
	2 USB ports	Import firmware/software upgrades and export trend data. Connect an optional 8-port serial box for accessories requiring serial connections
	Communications port	For optional BioCommand® SCADA software

Your local distributor: www.eppendorf.com/contact
Eppendorf SE · Barkhausenweg 1 · 22339 Hamburg Germany
eppendorf@eppendorf.com

www.eppendorf.com/bioflo510

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Compact Mobility

BioFlo® 610 mobile SIP fermentation systems

Compact and Comprehensive

The Eppendorf BioFlo® 610 fermentation systems – an exceptionally compact and versatile, industrial Mobile Pilot Plant Fermentor with choice of 50 and 100 L sterilizable-in-place vessels for R&D through small-scale production.

This modular system is offered with a comprehensive set of standard off-the-shelf options for initial delivery, as well as easy customization at any time, should your process require a different setup. The entire system is built-on a mobile skid that fits through virtually any doorway, making it easy to move and share between labs in research, pilot plant and cGMP environments.

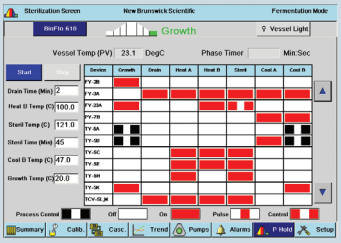
Modular design provides flexibility

> Easily add or remove system components at any time, pre- or post-delivery to accommodate changes in your process requirements
> Numerous ports in the vessel headplate and sidewall provide flexibility to position sensors, addition valves, pressure transducer and more
> Multiple gas flow options; choose one or two thermal mass flow controllers, in a variety of flow ranges.
> A wide variety of options are offered, including SCADA software, spray balls for vessel clean-in-place, redundant pH/DO sensors

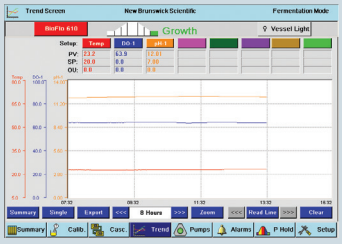
Advanced controller optimizes results

> Simultaneously regulate up to 32 process loops through the sophisticated RPC (Reactor Process Controller)
> Create, save, rename, delete and load up to 10 batch recipes to standardize your process and reduce operator variability
> Trend up to eight process parameters simultaneously on one screen and export process value data for analysis in Excel® via the USB port
> Built-in security features provide two user groups unique user-defined passwords and auto log-out

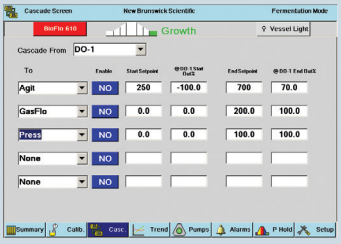
The BioFlo® 610's intuitive touchscreen interface makes advanced operations user friendly



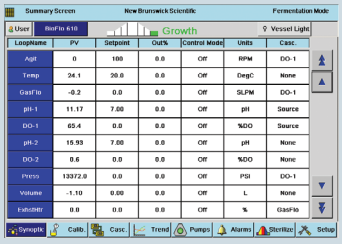
Enter and view sterilization parameters and valve sequences from the Sterilization Screen



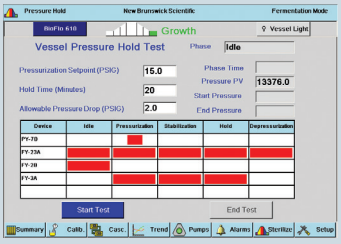
Trend graphs make it simple to track and export data on up to eight process variables over a six day span



Cascade one or more variables (in this case agitation, gas flow and pressure) to achieve sophisticated process control, based on the value of any other one or more variables



Simultaneously view up to 10 setpoints, current values, cascade loops and more on the Summary Screen



Reduce the time and effort needed to verify vessel integrity through the Pressure Hold Test Screen

Integrated system includes control station with touchscreen interface, 50 L or 100 L working volume, and mobile piping skid

Mobile design/compact skid

Optional exhaust gas condenser reduces evaporation of vessel contents

Built-in load cells provide a direct measure of vessel contents, enabling integrated control of pumps for harvesting or automatic addition

Multiple sensor options for pH, DO, redox, 2nd pH, and 2nd DO are offered

Two foam/level conductivity sensors

Multiple Pg 13.5 headplate ports and sanitary connection ports provide the flexibility to position sensors and redundant sensors wherever needed

Bottom drive with double mechanical seal and rushton style impeller are standard; low-shear pitched blade and marine impellers optional

Adjustable-angle, user-friendly 15 in (38 cm) touchscreen interface

Three built-in, assignable peristaltic pumps

Customizable PI values or factory defaults can be selected for most process parameters

Multiple analog inputs and outputs

Automatic vessel pressure controller

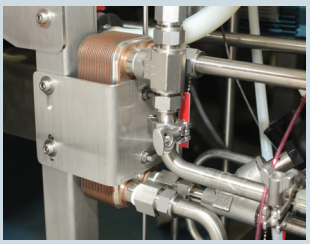
Sanitary fittings allow utilities to be connected in minutes

Resterilizable sample valve

Resterilizable drain valve enables sterile transfer of vessel contents

Safety features include a sanitary rupture disk in the vessel and an ASME safety release valve on the drain jacket

Resterilizable addition valve array facilitates making sterile additions; each vessel can accommodate up to four addition ports; one addition port shown



Optional glycol heat exchanger enables rapid cool-down; closed-loop, eco-friendly design eliminates need for single-pass cooling water in growth mode

Swing-away headplate makes it easy to access the vessel interior for cleaning

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BioFlo® 610 fermentor specifications*

		50 L	100 L
Vessel	Working volume	16 - 50 L	31 - 100 L
	Total volume	65 L	125 L
	Construction	> Aspect ratio: 3:1 > Material of construction: 316L stainless steel > Vessel access: Headplate	> Code Ratings: ASME/CE > Vessel Pressure: 50 PSIG (3.45 BAR), Full vacuum > Finish: 20 CLA (0.5 micrometer) Ra mechanically polished interior [standard]
	Agitation	Drive: Bottom drive, double-mechanical seal	
	Speed	50 - 700 rpm	50 - 500 rpm
	Impellers	(3) Rushton-type impellers standard. Low-shear marine and pitched blade optional	
	Baffles	(4) Removable, 316L stainless steel	
Ports	Headplate	> (3) Pg 13.5 [Level 1 sensor/spare, Level 2 sensor/spare, septum/spare] > (4) 1.5 in NBS connect sanitary style [pressure gauge, exhaust, and (2) spray balls/septums/spares] > (1) 2 in vessel light	
	Upper side wall	> (7) 1.5 in NBS connect sanitary style [pressure transducer/spare, gas overlay/spare, vessel rupture device, and (4) addition valves/spares] > (1) 3 in NBS connect sanitary style [vessel sight glass]	
	Lower side wall	> (7) 1.5 in NBS connect sanitary style [RTD, sample/spare, spare, sparger, and (3) DO/pH/redox or combinations thereof]	
	Bottom	(1) 1 in NBS connect sanitary style [radial diaphragm drain valve]	
Controller	Control station	Controls one vessel with 32 control loops. Stores 10 recipes and eight process variables for trend graphing. Includes an industrial touchscreen monitor/user interface, three built-in pumps, and connections for all utilities and communication signals	
	Touchscreen interface/display	38 cm (15 in) Industrial touchscreen interface/display	
Pumps	Standard, options, and control	Standard: Three built-in, assignable, peristaltic pumps. Control modes: Off, Prime, Base, Acid, Foam, Level 2 Wet, Level 2 Dry, Volume Add, Volume Harvest Optional: External variable-speed pumps can be added with totalizer and functionality of standard pumps	
	Speed	Pumps 1, 2 and 3: 100 rpm Fixed-speed duty cycle	
Piping skid	Construction	> Material of construction: 316L stainless steel	> Gaskets/O-Rings: Class (VI) EPDM and silicon
	Aeration	Standard: 1 thermal mass flow controller (TMFC) with single-gas control Optional: 1 TMFC with 2-gas control, 2 TMFCs (2-gas control)	
	Gas inlet	Sparger/overlay filter housing with 0.2 µ absolute disposal filter. Overlay valve optional	
	Exhaust line	Line designed for minimal backpressure. Includes heater and 1.2 µ nominal exhaust filter and housing Automatic backpressure control	
	Temperature control line	> All systems come with automatic pressure hold and sterilization program > Operating temperature control range 10 °C above water supply temperature to 90 °C > Line designed to achieve 1 °C/minute temperature rises, in the 30 °C - 50 °C range > Optional: Glycol/chiller heat exchanger designed to remove 100 watts/L	
	Load cell	Provided for measuring vessel volume	
Sensor	Options	> pH / DO sensor kits	> Redundant pH / DO sensor kits > Redox sensor kit
Dimensions (W x D x H)		122 x 86 x 239 cm (42 x 31.5 x 94 in)	
Additional options		> Spray balls > Foam/level kits > Transfer lines > Sterile sampling kit > 1 or 7 port septum > Utility filter/regulator kit > Validation packages > Bottle holder	> Turbidity sensor/transmitter > Addition valve connector kit > Addition vessels > Marine and pitched-blade impellers > Scales for addition vessel > Vessel passivation > Low pressure seal alarm > Additional sight glass
Utility requirements and connections	Process air	30 PSIG (2.1 bar), 75 SLPM	30 PSIG (2.1 bar), 150 SLPM
	Oxygen	30 PSIG (2.1 bar), 32 SLPM	30 PSIG (2.1 bar), 64 SLPM
	Instrument air	80-100 PSIG (5.5-6.9 bar), 2 scfm (56.5 SLPM)	
	Process steam	35 PSIG (2.4 bar), 10 lb/hr (4.5 kg/hr)	35 PSIG (2.4 bar), 20 lb/hr (9 kg/hr)
	Utility steam	35 PSIG (2.4 bar), 50 lb/hr (22.5 kg/hr)	35 PSIG (2.4 bar), 100 lb/hr (45 kg/hr)
	Facility water	30 PSIG (2.1 bar), 3 GPM (11.37 L/min)	30 PSIG (2.1 bar), 4 GPM (15.16 bar)
	Water return	Less than 15 (1.0 bar) PSIG back pressure	
	Clean condensate	Gravity drain	
	Biowaste	Gravity drain	
	Glycol/chiller	30 PSIG (2.1 bar), 4 GPM (15.16 bar)	30 PSIG (2.1 bar), 8 GPM (30.32 bar)
	Electric	208-230V AC, single phase, 50/60 Hz, 15 A	

Eppendorf is ISO 13485 and 9001 certified. * Specifications subject to change without notice.

Input/output connections and communication ports	External devices	Seven analog inputs and seven analog outputs for your external devices such as analyzers, sensors, external pumps, etc.
	2 USB ports	Import firmware/software upgrades and export trend data. Connect optional 8-port serial box for accessories
	Communications port	For optional BioCommand® SCADA software

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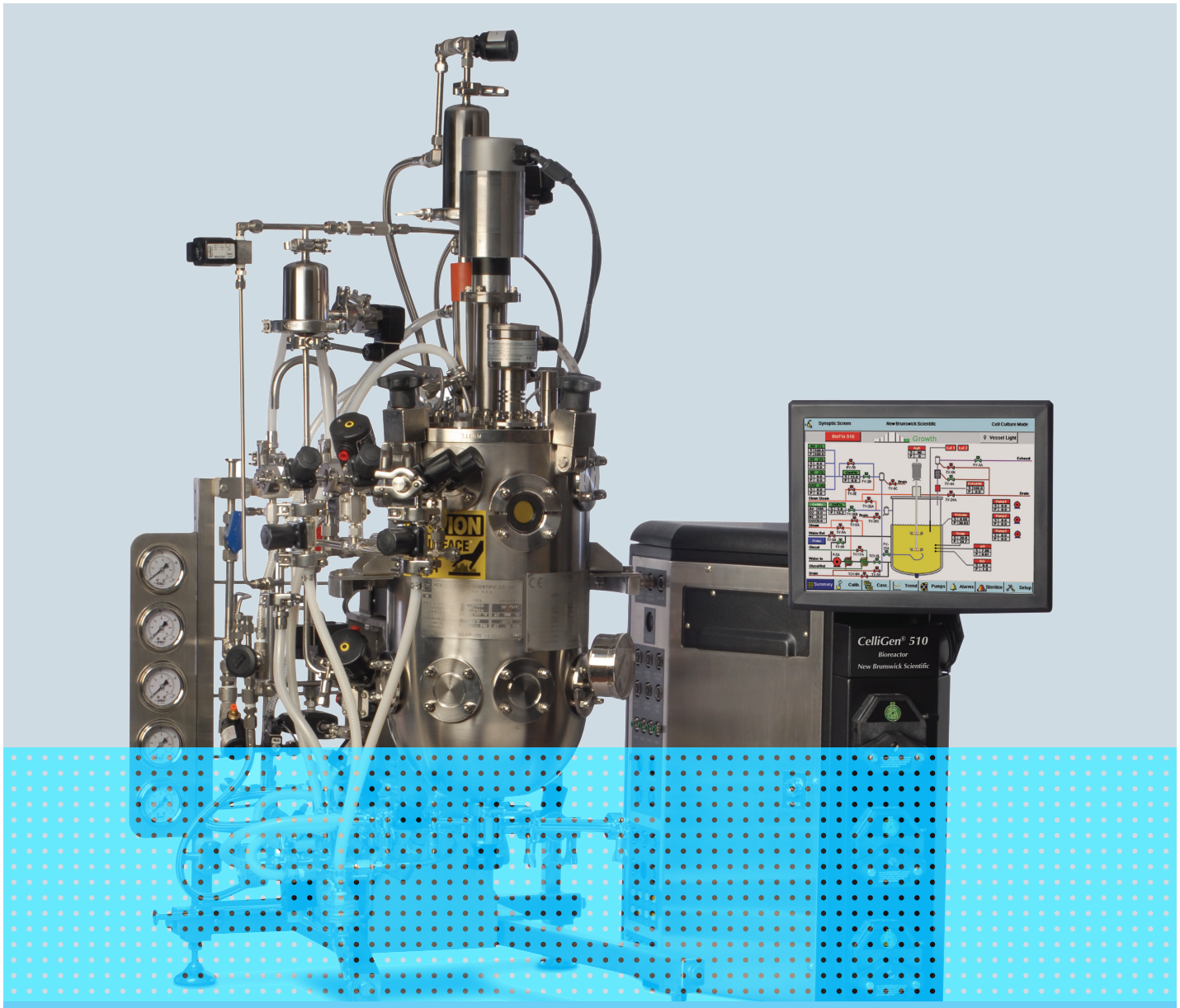


System Flexibility

CelliGen 510 benchtop SIP bioreactor system

Convenience, Flexibility, and Control

The CelliGen 510 bioreactor systems is designed for rapid delivery and easy field customization, should your requirements change. Compact, versatile, and exceptionally capable. Quality at a very competitive price.

Modular design provides system flexibility

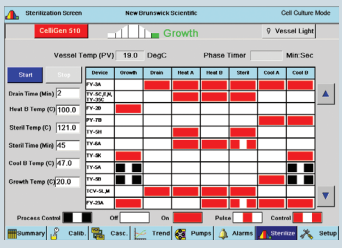
> Easily add or remove system components at any time, pre- or post-delivery to accommodate changes in your process requirements
> Numerous ports in the vessel headplate and sidewall provide flexibility to position sensors, spray balls, addition valves, pressure transducer and more
> Multiple gas flow options; choose up to four thermal mass flow controllers for process gasses; an additional TMFC can be added for gas overlay/air wash system
> Capable of batch, fed-batch and perfusion modes
> Multiple impeller options
> Optional SCADA software, validation packages, sprayballs for vessel clean-in-place, redundant pH/DO sensors

Advanced controller optimizes results

> Simultaneously regulate up to 32 process loops using our sophisticated RPC (Reactor Process Controller)
> Front-accessed, analog inputs and outputs allow you to integrate up to 14 sensors, analyzers, flow controllers or other external devices
> Security, built into the control system, offers two user groups unique userdefined passwords and auto log-out
> Touchscreen control screens are exceptionally easy to navigate to simplify setup, calibration, sterilization and monitoring
> Store up to ten batch recipes; program and monitor sterilization cycles, gas flow, PI values, and more

Production-scale system that fits on the bench

> At just 116 cm wide x 86 cm deep (45.5 x 34.0 in), the compact CelliGen 510 can fit on a lab bench; or move and operate it on our sturdy, optional, stainless-steel mobile table
> Sterile vessel connections, flush with the vessel's interior, virtually eliminate deadlegs, minimizing contamination risk and simplifying cleaning
> Fully validatable, following V-Model guides for URS, FRS, DDS, IQ, OQ and trace matrix
> CE-certified and manufactured to meet cGMP guidelines



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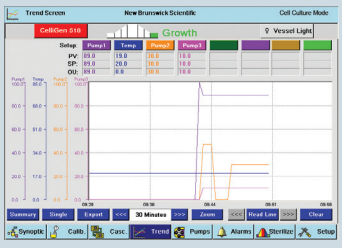

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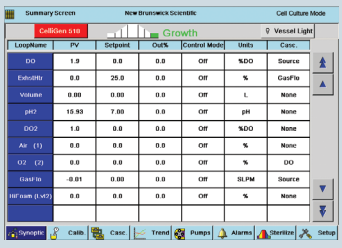
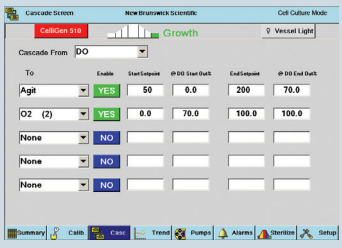
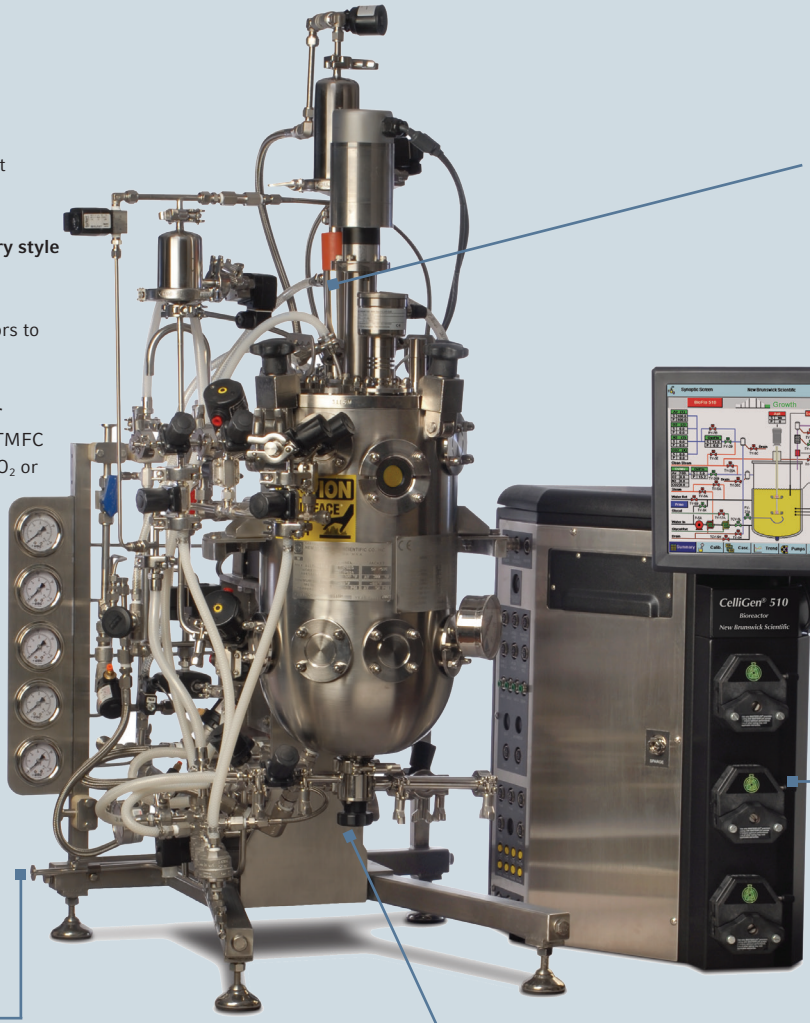


Simultaneously view up to 10 setpoints, current values, cascade loops and more on the Summary screen



Cascade one or more variables (in this case agitation and O_2) to achieve sophisticated process control, based on the value of any other one or more variables

Advanced system includes benchtop control station with touchscreen interface, stainless steel vessel, and piping skid



Customize PI values for all process parameters or select factory defaults

Multiple Pg 13.5 and sanitary style connection ports provide flexibility to position sensors and redundant sensors to meet your process needs

Independent overlay gas/air wash system with separate TMFC enables addition of air, O_2, CO_2 or N_2 into vessel headspace

Optional exhaust gas condenser reduces evaporation of vessel contents

Resterilizable sample valve

Adjustable-angle, user-friendly 15 in (38 cm) touchscreen interface simplifies control and provides clear viewing of process parameters

Three built-in, assignable, peristaltic pumps

Multiple gas flow options: Choose 1, 3, or 4 thermal Mass Flow Controllers (TMFC) in a variety of flow ranges

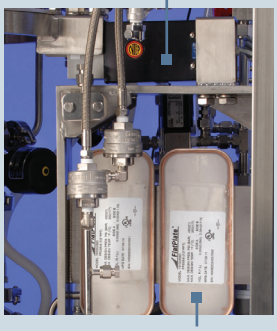
Sanitary or quick connects allow utilities to be connected in minutes

Safety features: A sanitary rupture disk in the vessel and an ASME safety release valve on the drain jacket are standard

Built-in load cell measures vessel volume, enabling weight to be used to automate pump control for additions and harvesting

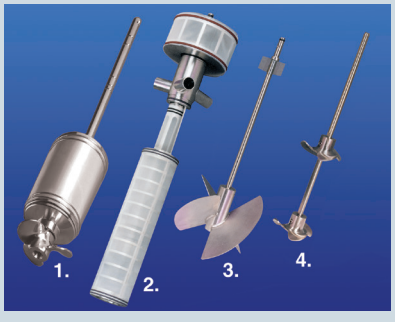
Resterilizable drain valve enables sterile transfer of vessel contents

ASME and CE certified: Designed and built to ASME and CE standards



Optional glycol heat exchanger enables rapid cool-down; closed-loop, eco-friendly design reduces need for single-pass cooling water through the system

Resterilizable addition valve array: Each vessel can accommodate up to four addition ports for vessel additions (one addition port shown)



Specialized impellers maximize yields: **1. Spin filter** with impeller for suspension or ADP cells in perfusion; **2. Cell-lift impeller** for low shear and high oxygenation in micro-carrier and suspension cultures; **3. Pitched blade impeller** for high aeration and low shear in insect and other cell cultures; **4. Marine impeller** for the growth of insect cells and other cultures

Packed-bed impeller optimizes yields of secreted products; basket is filled with Fibra-Cel® disks and used with a patented low shear draft tube impeller

CelliGen 510 bioreactor specifications*

Vessel	Working volume	10.75 - 32.0 L	
	Total volume	40 L	
	Construction	> Aspect ratio: 2:1 > Material of construction: 316L stainless steel > Vessel access: Headplate	> Code ratings: ASME/CE > Vessel pressure: 40 PSIG (5.5 BAR), Full vacuum > Finish: 15 CLA (0.38 micrometer) Ra electropolished interior [standard]
	Agitation/speed	Top drive, double-mechanical seal standard. 25 - 200 rpm Optional: Top magnetic drive. 25 - 130 rpm	
	Impeller systems	Choice of pitched blade, marine, packed-bed/basket, cell-lift and spin filter	
	Baffles	Optional: (4) Removable, 316L stainless steel baffles	
Ports	Headplate	> (4) Pg 13.5 [light, Level 1 sensor/spare, Level 2 sensor/spare, septum/spare] > (4) 1.5 in NBS connect sanitary style [pressure transducer/spare, exhaust, and (2) spray balls/septums/spares]	
	Upper side wall	> (7) 1.5 in NBS connect sanitary style [gas air wash/spare, gas overlay/spare, vessel rupture device, and (4) addition valves/spares] > (1) 3 in NBS connect sanitary style [vessel sight glass]	
	Lower side wall	> (7) 1.5 in NBS connect sanitary style [RTD, sample/spare, pressure gauge/spare, sparger/spare, and (3) DO/pH/redox or combinations thereof]	
	Bottom	(1) 1.5 in NBS connect sanitary style [radial diaphragm drain valve]	
Controller	Control station	Controls one vessel with 32 control loops. Stores 10 recipes and eight process variables for trend graphing. Includes an industrial touchscreen monitor/user interface, three built-in pumps, and connections for all utilities and communication signals	
	Touchscreen interface/display	38 cm (15 in) Industrial touchscreen interface/display	
Pumps	Standard, options, and control	Standard: Three built-in, assignable, peristaltic pumps. Control modes: Off, Prime, Base, Acid, Foam, Level 2 Wet, Level 2 Dry, Volume Add, Volume Harvest Optional: Two external variable-speed pumps can be added	
	Speed	Pumps 1, 2 and 3: 100 rpm Fixed-speed duty cycle, ability to view total pump flow rates	
Piping skid	Construction	> Material of construction: 316L stainless steel	> Gaskets/O-Rings: Class (VI) EPDM and silicon
	Aeration	Standard: 1 thermal mass flow controller (TMFC) with built in four-gas control (4 solenoid valves). Includes a stainless steel housing and 0.2 µ absolute filter element Optional: 3rd or 4th TMFCs for individual gas control	
	Gas overlay	Overlay with TMFC is provided with a stainless-steel housing and 0.2 µ absolute filter element	
	Exhaust line	Standard: Line designed for minimal backpressure. Includes heater and 0.2 µ absolute exhaust filter and housing, with manual backpressure regulator Optional: Automatic backpressure control	
	Temperature control line	> All systems come with automatic sterilization program > Operating temperature control range 10 °C above water supply temperature to 80 °C > Line designed to achieve 1 °C/minute temperature rises, in the 30 °C - 50 °C range > Optional: Glycol/chiller heat exchanger designed to remove 100 watts/L	
	Load cell	Provided for measuring vessel volume	
Sensor	Options	> pH/DO sensor kits	> Redundant pH/DO sensor kits > Redox sensor kit
Dimensions (W x D x H)		116 x 86 x 151 cm (45.5 x 34.0 x 59.5 in)	
Additional options		> Spray balls > Foam/level kits > Turbidity sensor/transmitter > Decanter > Transfer lines > Sterile sampling kit > Addition vessels > Mobile table > 1 or 7 port septum > Utility prefilter/regulator kit > Scales for addition vessel > Validation packages > Addition valve connector kit	
Utility requirements and connections	Process air/gases O_2, N_2, CO_2	Direct sparge: 30 PSIG (2.1 bar), 32 SLPM**	
		Cell-lift impeller systems: 30 PSIG (2.1 bar), 15 SLPM	
		Overlay options: 32 SLPM	
	Instrument air	80-100 PSIG (5.5 - 6.9 bar), 2 scfm (56.5 SLPM)	
	Process steam	35 PSIG (2.4 bar), 10 lb/hr (4.5 kg/hr)	
	Utility steam	35 PSIG (2.4 bar), 35 lb/hr (15.9 kg/hr)	
	Facility water	30 PSIG (2.1 bar), 1 GPM (3.79 L/min)	
	Water return	Less than 15 PSIG (1.0 bar) back pressure	
	Clean condensate	Gravity drain	
	Biowaste	Gravity drain	
	Glycol/chiller	30 PSIG (2.1 bar), 2 GPM (7.57 L/min)	
	Electric	208-230 V AC, single phase, 50/60 Hz, 15 A	

Eppendorf is ISO 13485 and 9001 certified. * Specifications subject to change without notice.
** Flow rates shown are for use with a single TMFC with 4 solenoid valves. Other options available. Ask your Eppendorf representative for details.

Input/output connections and communications ports	External devices	Seven analog inputs and seven analog outputs for your external devices such as analyzers, sensors, external pumps, etc. (Reduce by 1 input and output for each additional TMFC added)
	2 USB ports	Import firmware/software upgrades and export trend data. Connect an optional 8-port serial box for accessories requiring a serial connections
	Communications port	For optional BioCommand®/SCADA software

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