

BioBench Algae Flat Panel

COLORS your cultivation

First line service

Service and maintenance on shaker and bioreactors

Refurbishment & Revamping of old bioreactors



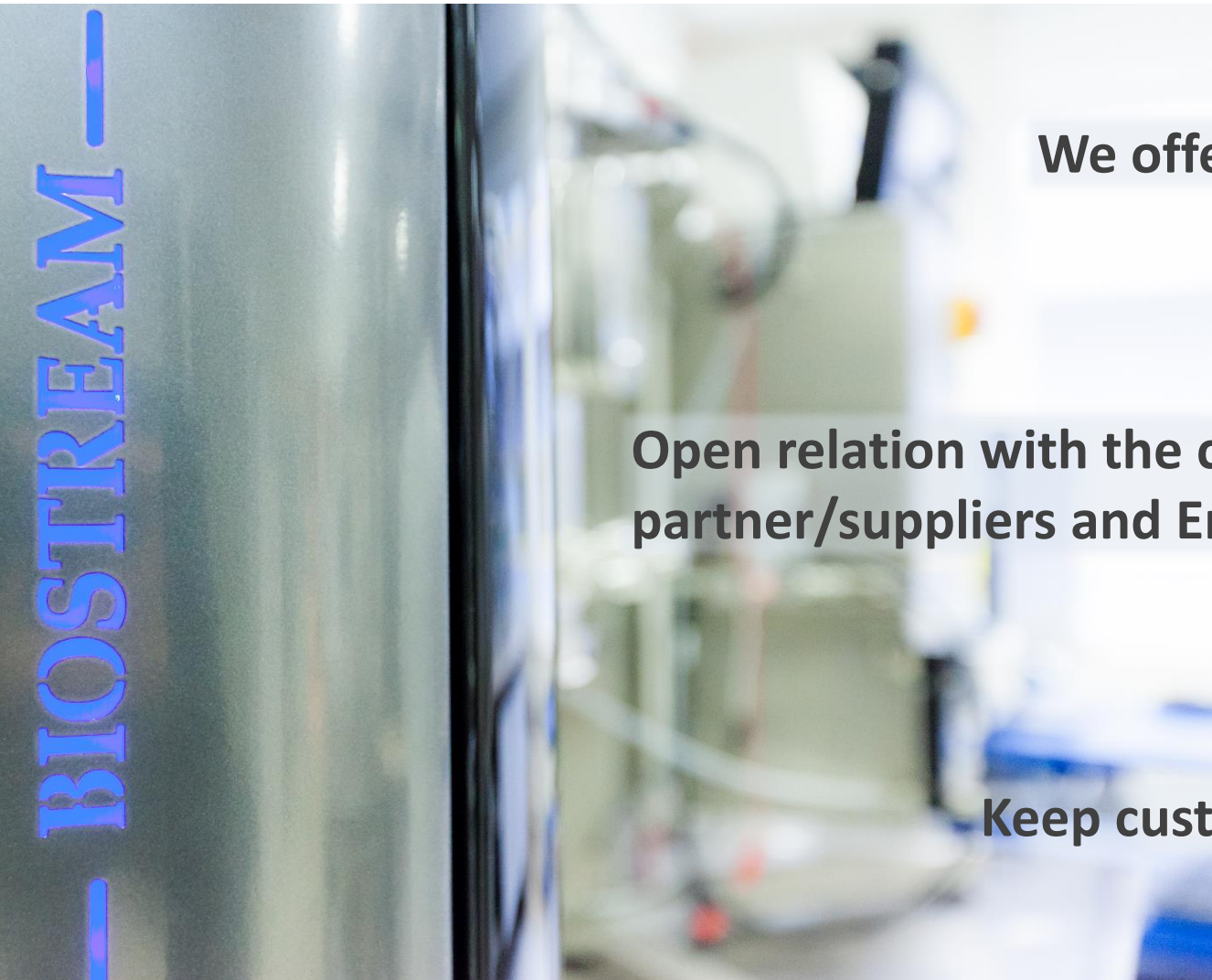
3D drawing → 3D printing → prototyping

History based on service



Specialities in bioreactors

Vision



We offer total solutions

Open relation with the customer/
partner/suppliers and Employee's

Keep customer satisfied

Application fields



Food & Biobased



Algae

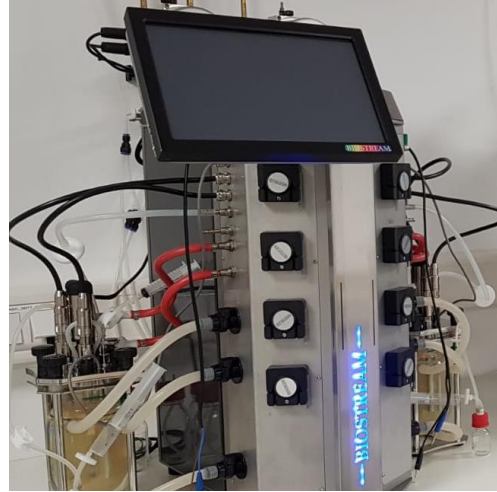


Cell culture

BIOSTREAM



Access multiple reactor



BioBench Twin



BioBench

Range of Bioreactors



Revamping

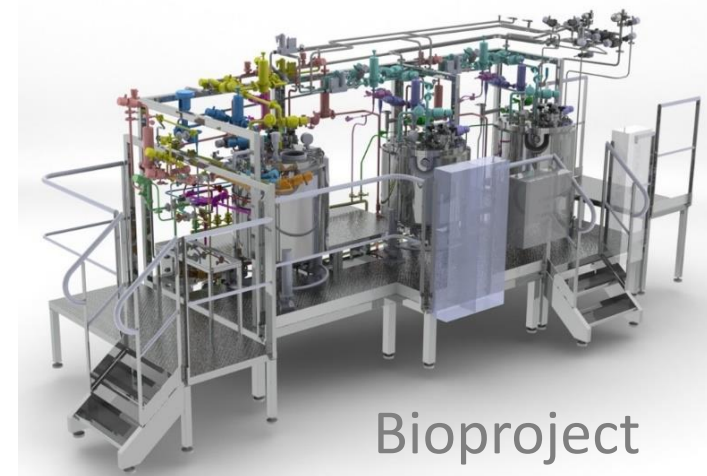


BioTwin
Single vessel

BioTwin
Double vessel



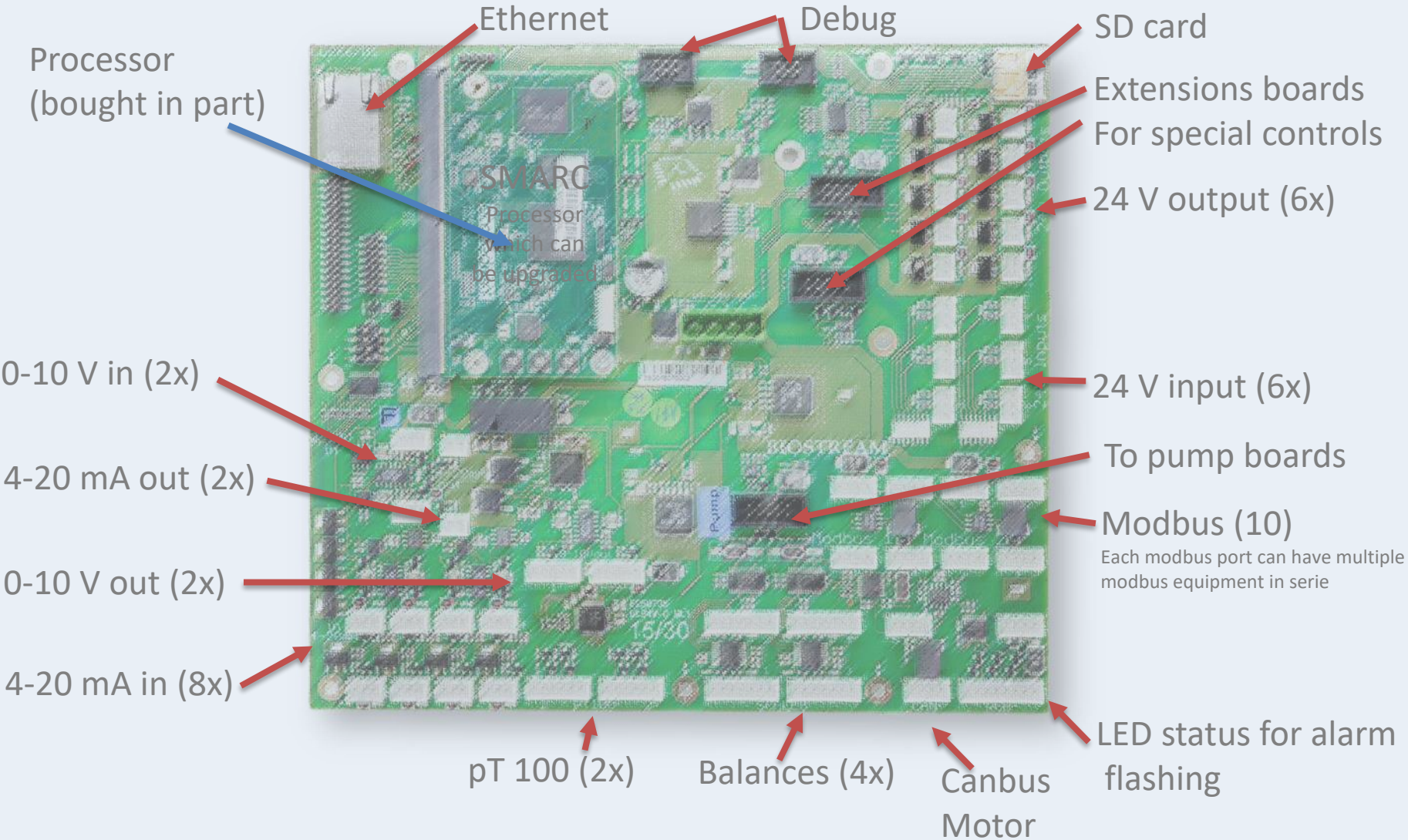
BioPilot



Bioproject

BIOSTREAM

Basic control print



Extension board possibilities

- Extra I/O channels
- Valve boards
- Connection of old equipment
- Custom made options

Connections of external equipment



All measurement devices and actuators with an in- or output can be connected

Integration of Sensors, actuators and PID control loops in a standard BioBench

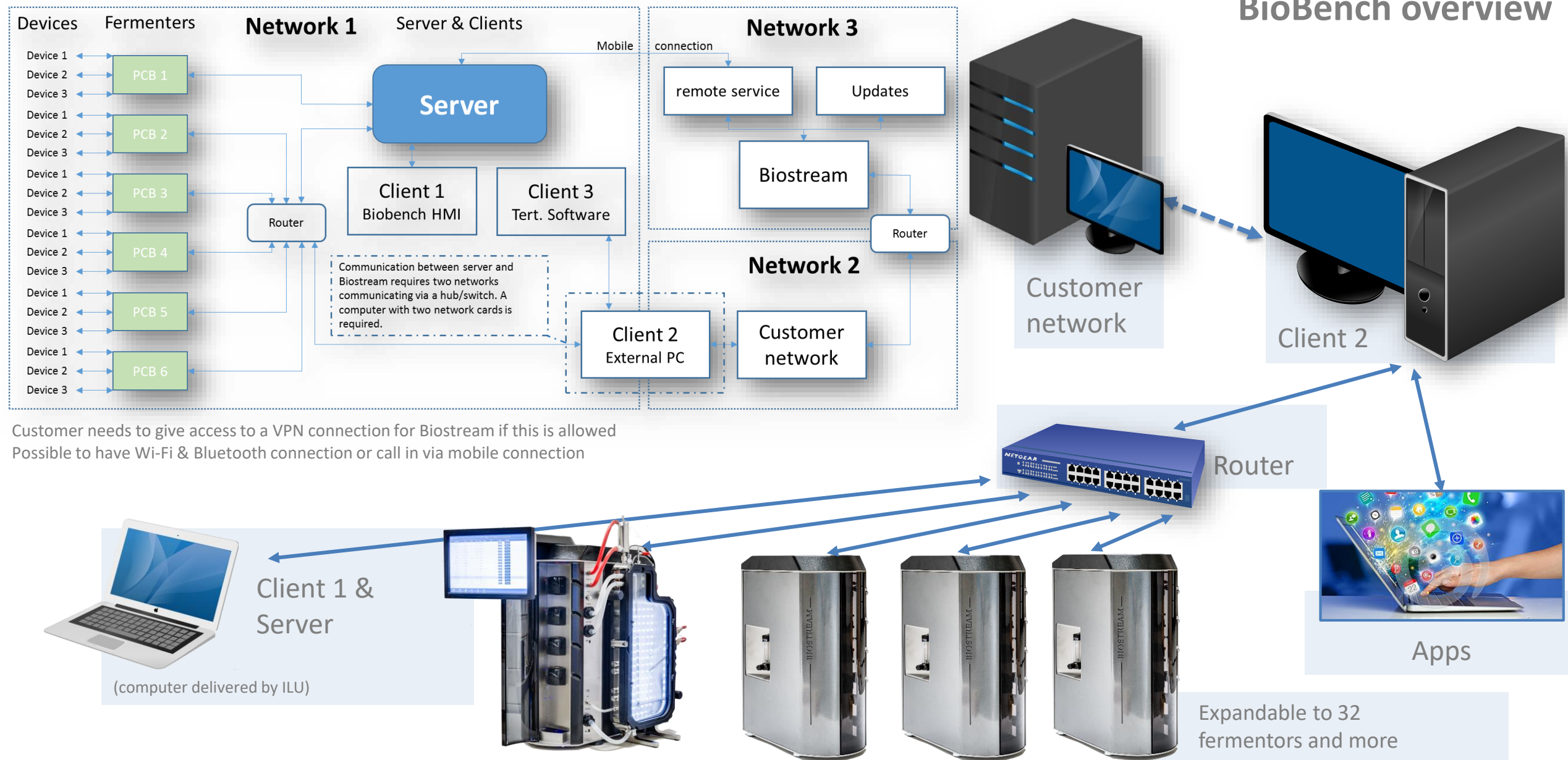
Setting	Number	Type of sensor&actuator
Modbus	64	For pO2, pH, MFC, Off gas and other digital sensors
0-10 V Output	2	For pumps, LED, pressure, gasmix
0-10 V input	2	Redox-sensor, Gas-sensor, OD, Pressure, load cells and more
4-20 mA output	4	For pumps, LED, pressure, gasmix
4-20 mA Input	4	Redox-sensor, Gas-sensor, OD, Pressure, load cells and more
24 volt Output	10	Valves, solid state relais, pumps
24 volt Input	6	Others
CAN Bus	1	Digital motor control
RS-232	4	Balances
PT-100 config	2	pT100 sensor
Connection to pump boards	5	Only for integrated pumps in the Biobench
RGB1		For alarming and camera option
Extension boards	2	

Extension boards can be used to get more I/O signals on the control board



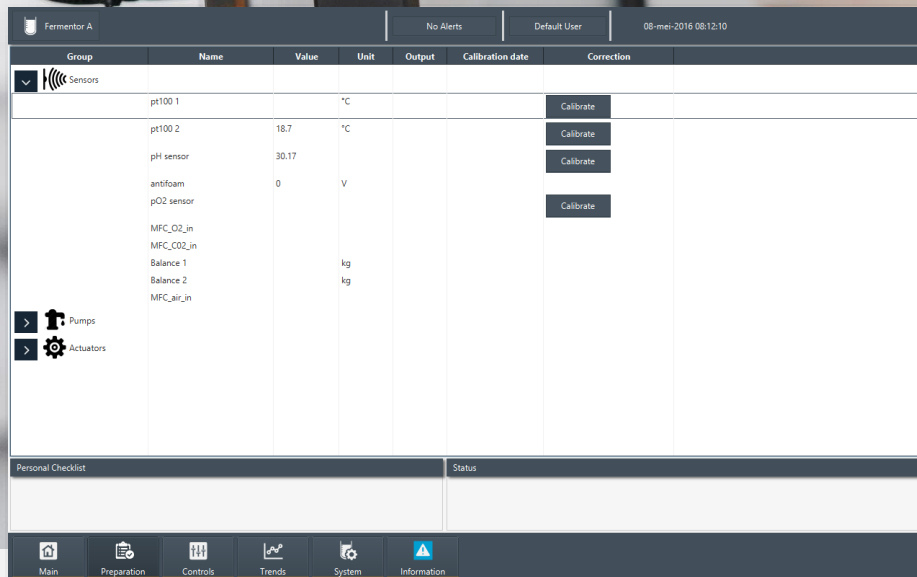
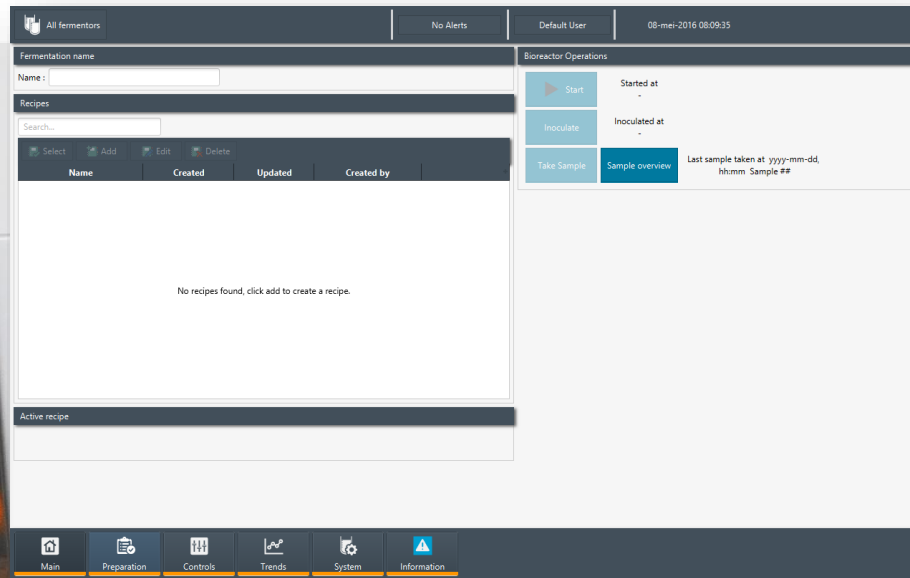
BIOSTREAM

BioBench overview



BOS Controlling & Logging Software

- Possible via Touch screen or via computer.
- BOS software can be installed on each computer
- Easy and free installation on PC and tablets
- Simple and intuitive use
- Overview of all bioreactors
- All kind of programming via recipes
- Cascade possibilities
- Sample tracking
- Alarming with confirmation



Fermentor A

No Alerts

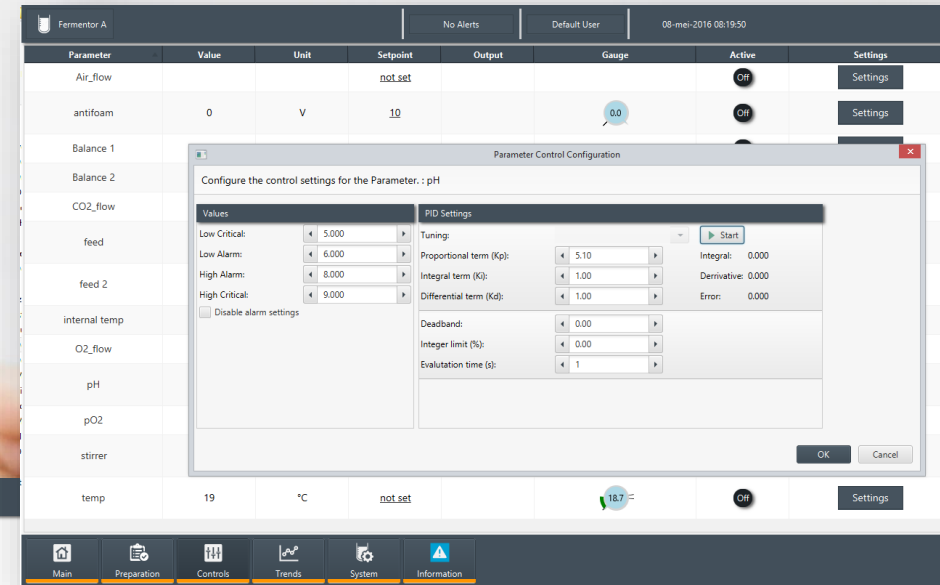
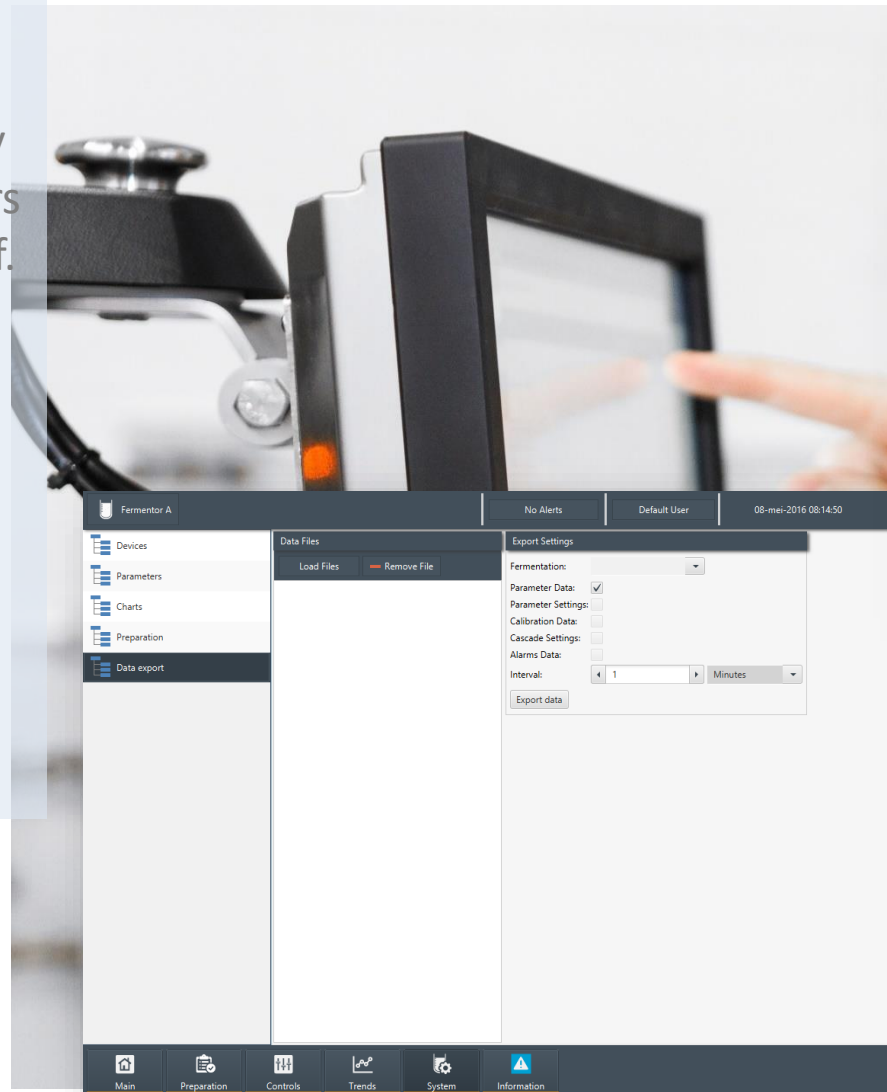
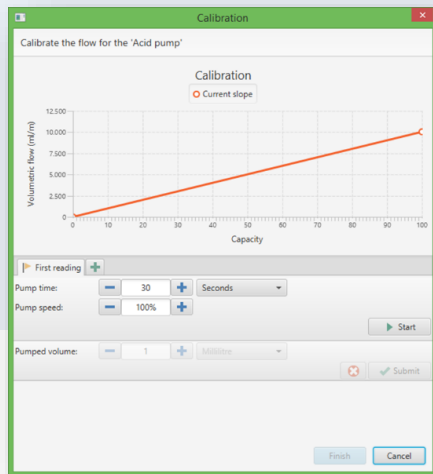
Default User

08-mei-2016 08:12:56

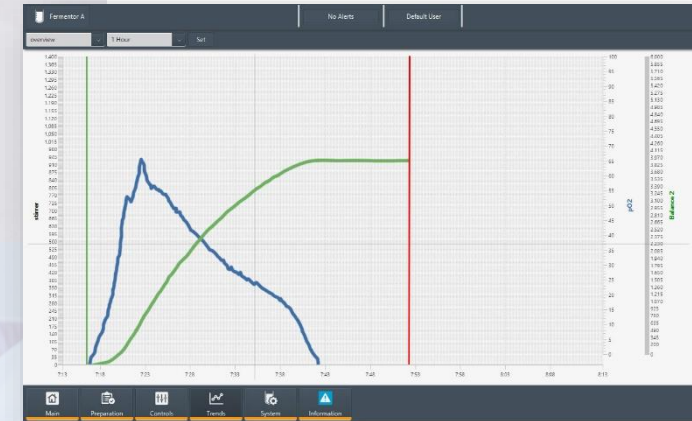
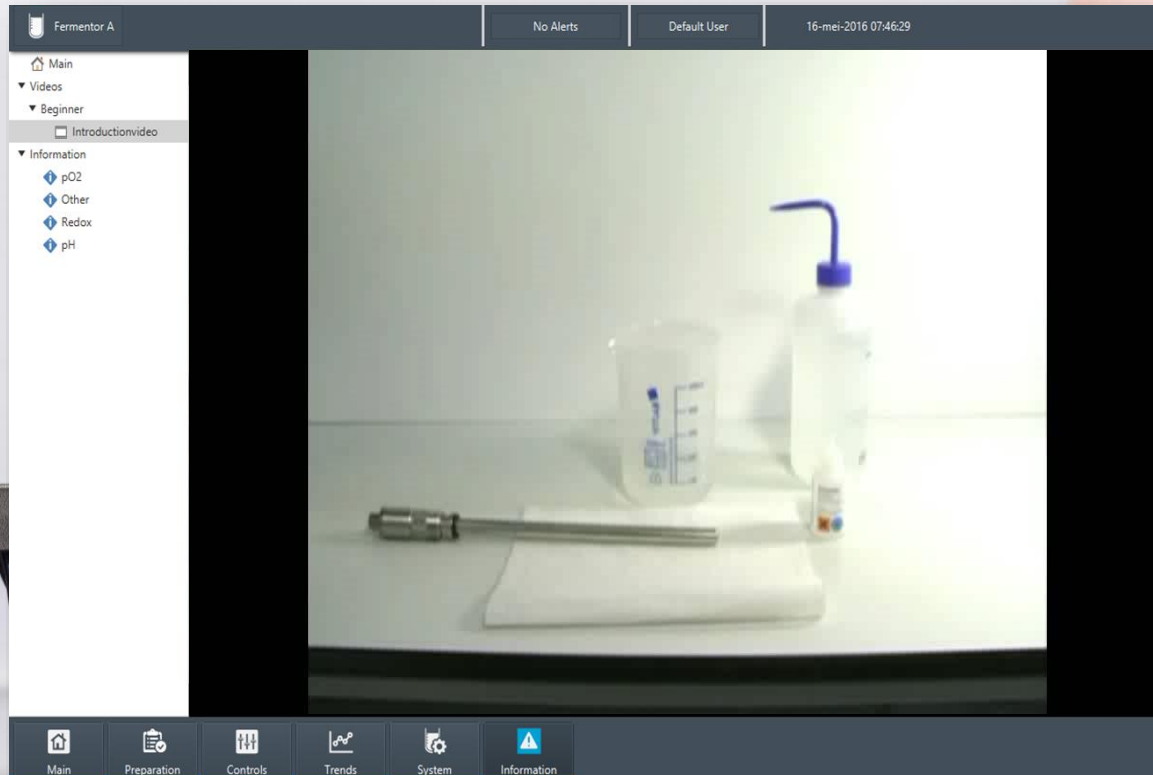
Parameter	Value	Unit	Setpoint	Output	Gauge	Active	Settings
Air_flow			not set			Off	Settings
antifoam	0	V	10		0.0	Off	Settings
Balance 1		kg	not set			Off	Settings
Balance 2		kg	not set			On	Settings
CO2_flow			not set			Off	Settings
feed	0		not set		0.0	Off	Settings
feed 2	0		not set		0.0	On	Settings
internal temp		°C	100			Off	Settings
O2_flow			0			Off	Settings
pH	30		14		30.2	Off	Settings
pO2			not set			Off	Settings
stirrer	0		not set		0.0	Off	Settings
temp	19	°C	not set		18.7	Off	Settings

BOS Controlling & Logging Software

- 📖 PID tuning of parameters
- 📖 Easy one, two point calibration with graphical view and accuracy
- 📖 Maintenance information sensors
- 📖 Adding external devices your self.
- 📖 Exporting functions to Excel or other programs
- 📖 Volume corrected feeding.



BOS Controlling & Logging Software



- Own defined on-line graphs
- Comparison with old data
- Multimedia integration like like YouTube movies
- Integration of protocols (SOPs)
- Specific programming for customer demands

Touch screen

- 9 inch touch screen computer
- Twistable arm and can be fixed in each position
- 2Ghz processor
- 256 GB SSD
- 1333 Mhz DDR3, 8 Gb internal memory
- Linux operating system



BIOSTREAM

Internal room Biobench

Motor holder

Space left side for
more measurements

Gas mix

Security with gas and
water pressure reducers

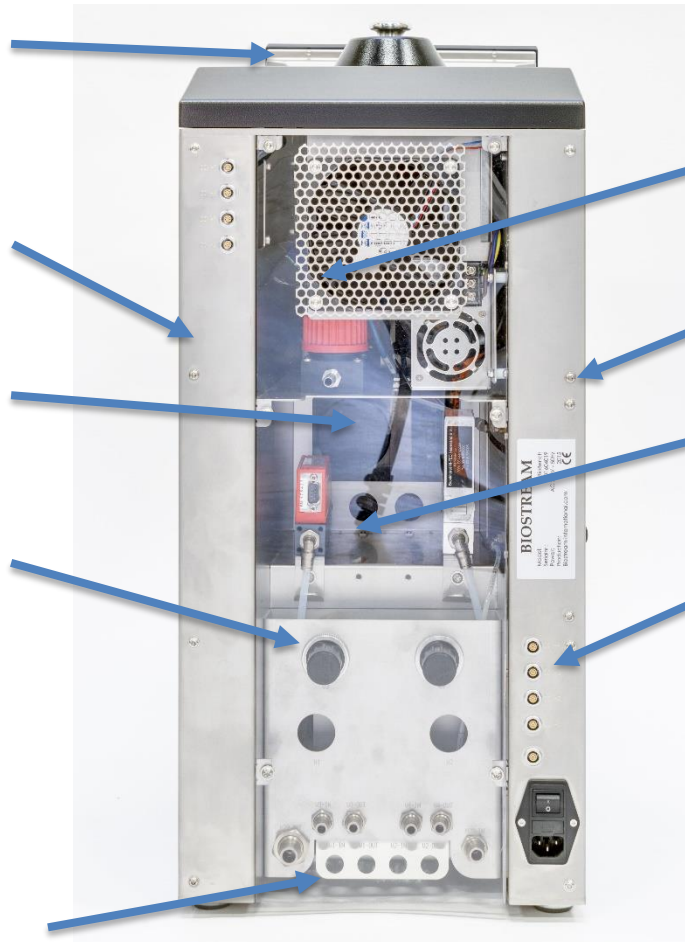
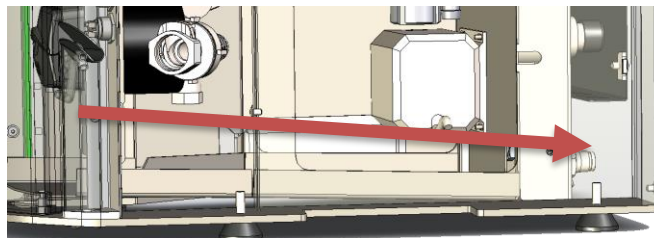
Water pan for leakage
pump tubing.
Output can be
connected to a waste line.

Room for gas analyzers
or other sensors

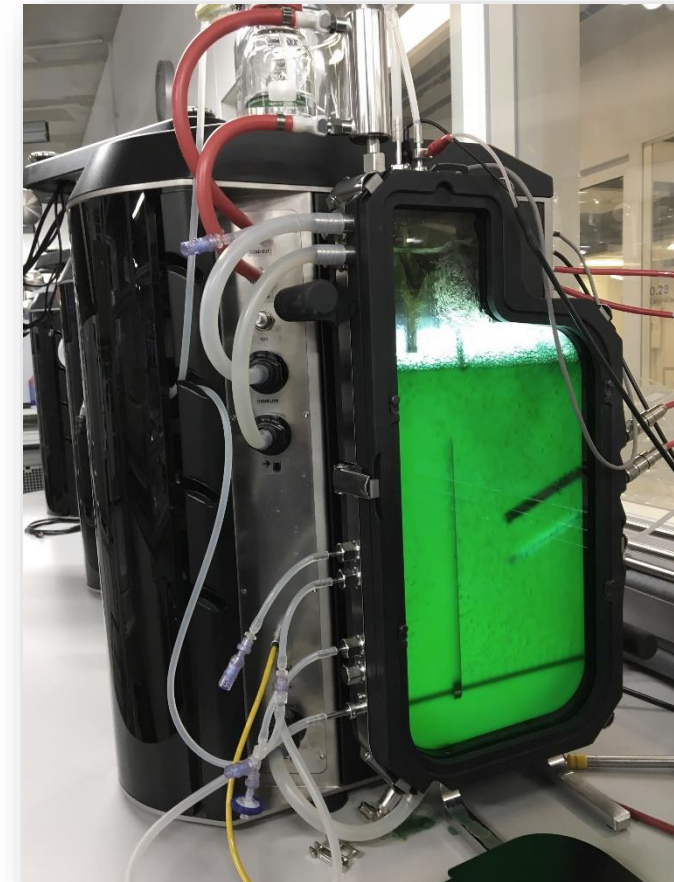
3 rotameters

4 mass flow controllers

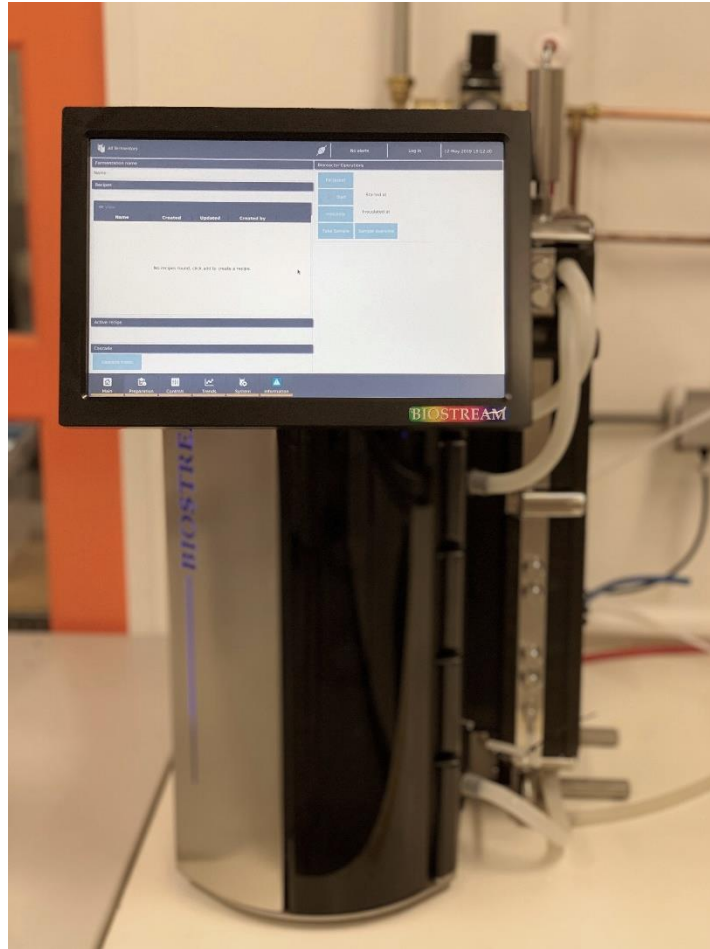
Network connections



Internal space is covered.



H=320 mm



H=670 mm

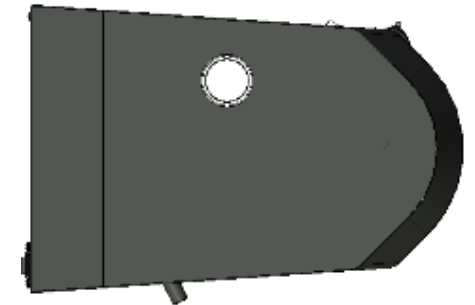


Dimensions base Algae unit

D=490 mm



W=250 mm



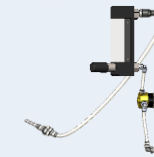
Gas flow strategy

Define your own gas mixing strategy

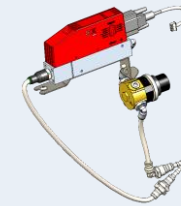


and more gasses

With flow meters:

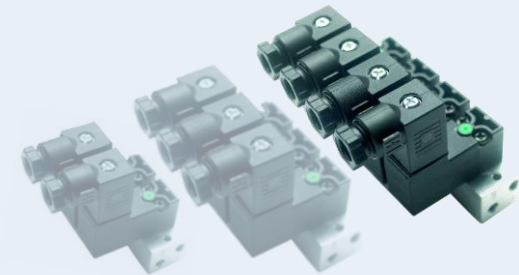


Rotameter

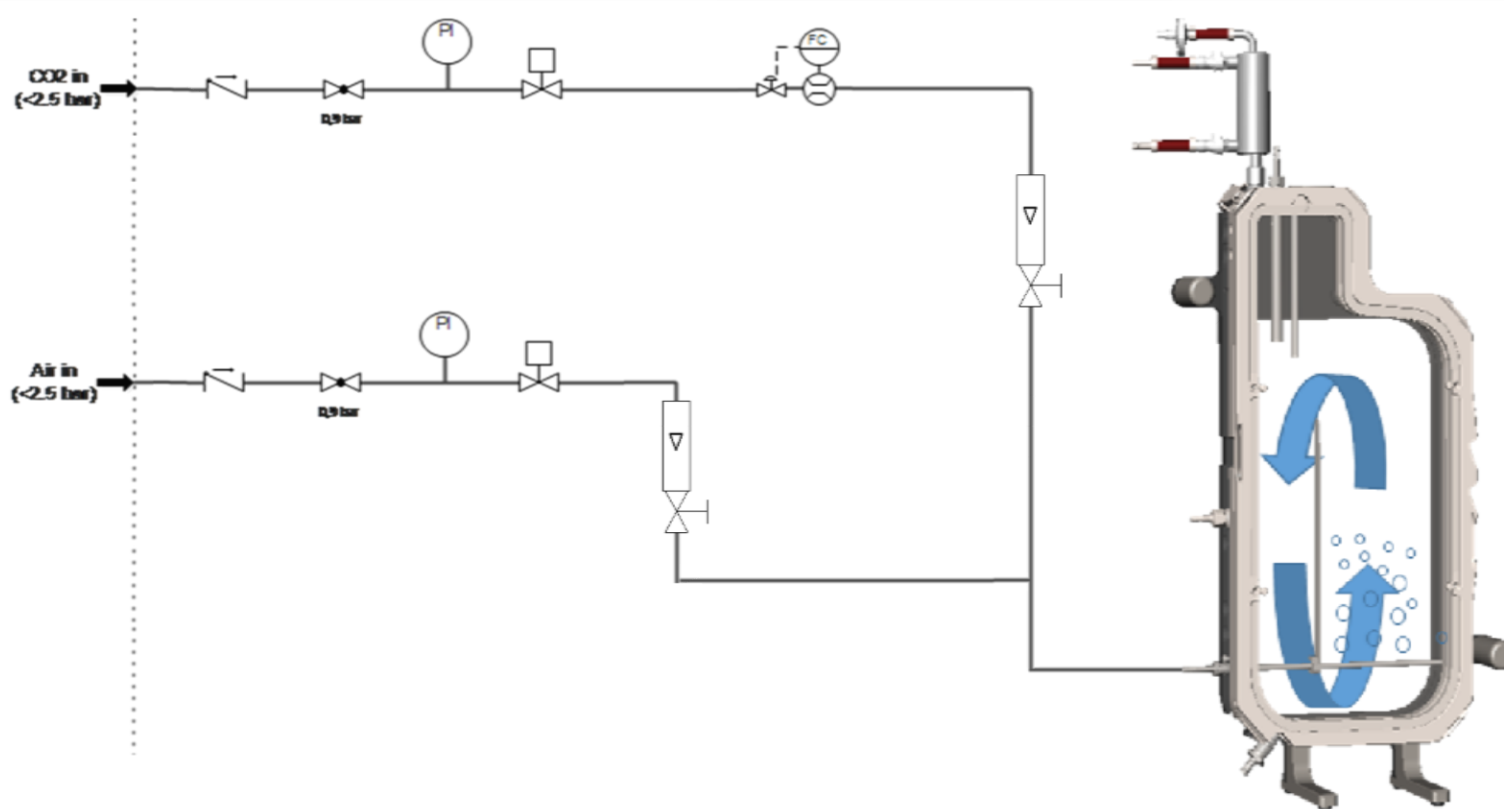
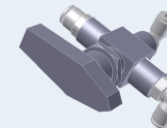


Mass flow controller

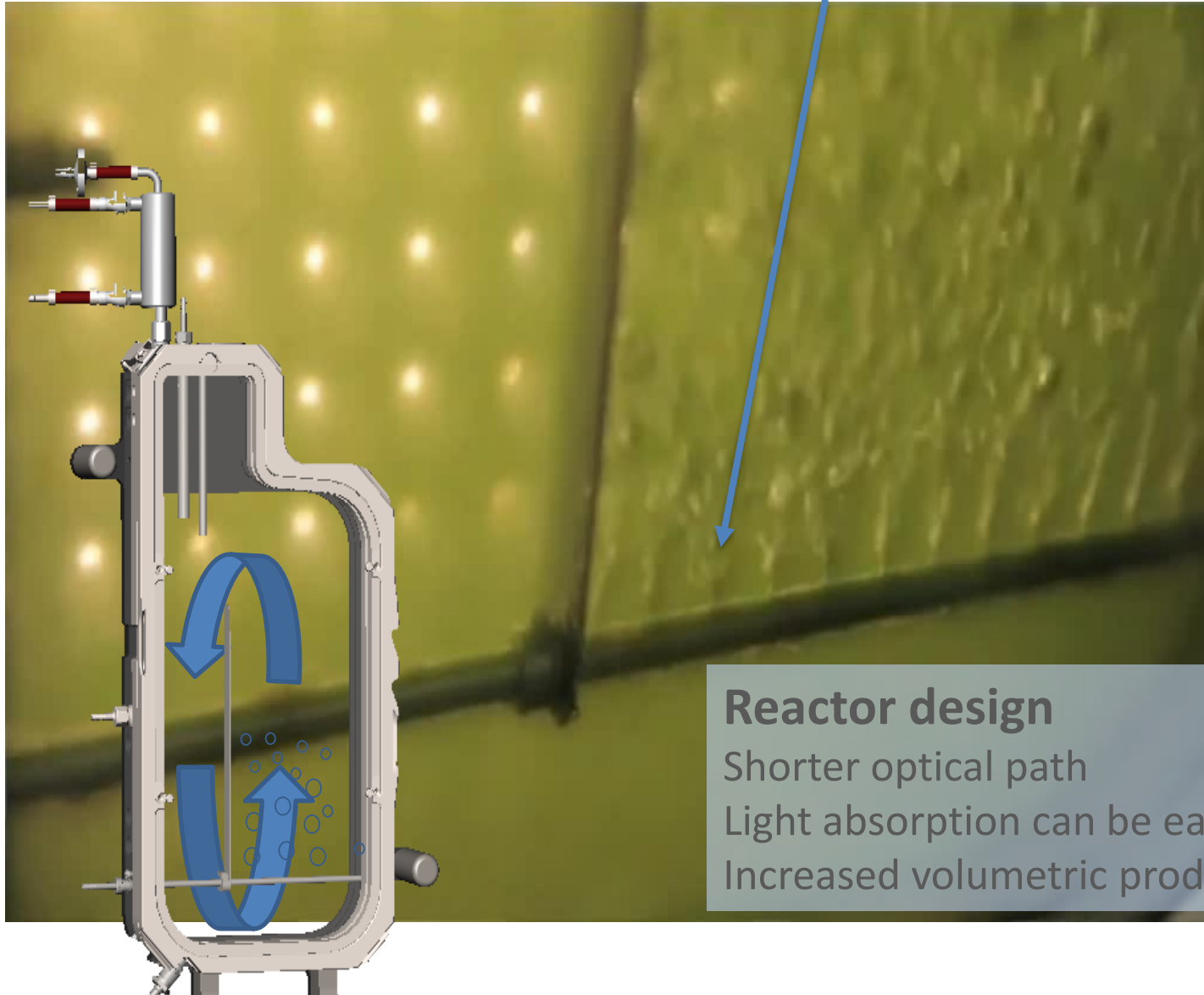
With valves



With manual switches for flexibility and calibration



Example: Two gas mixing



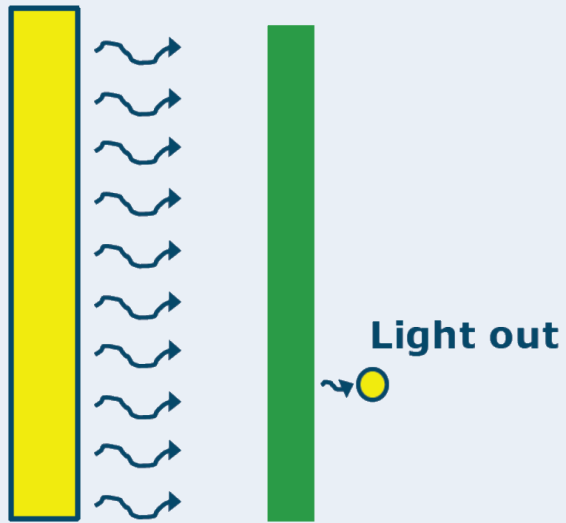
Reactor design

Shorter optical path
Light absorption can be easily quantified
Increased volumetric productivities



Chemostat / turbidostat experiments

Keeping the light at the back constant



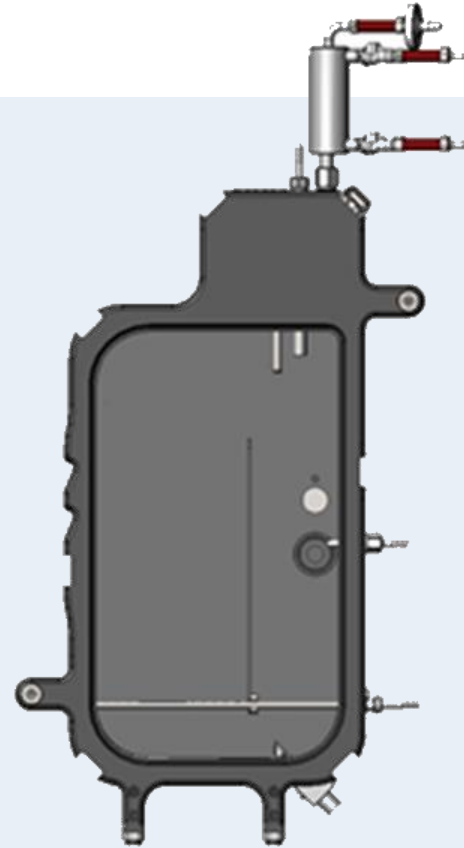
Continuous operation

lipid productivity by nutrient stress

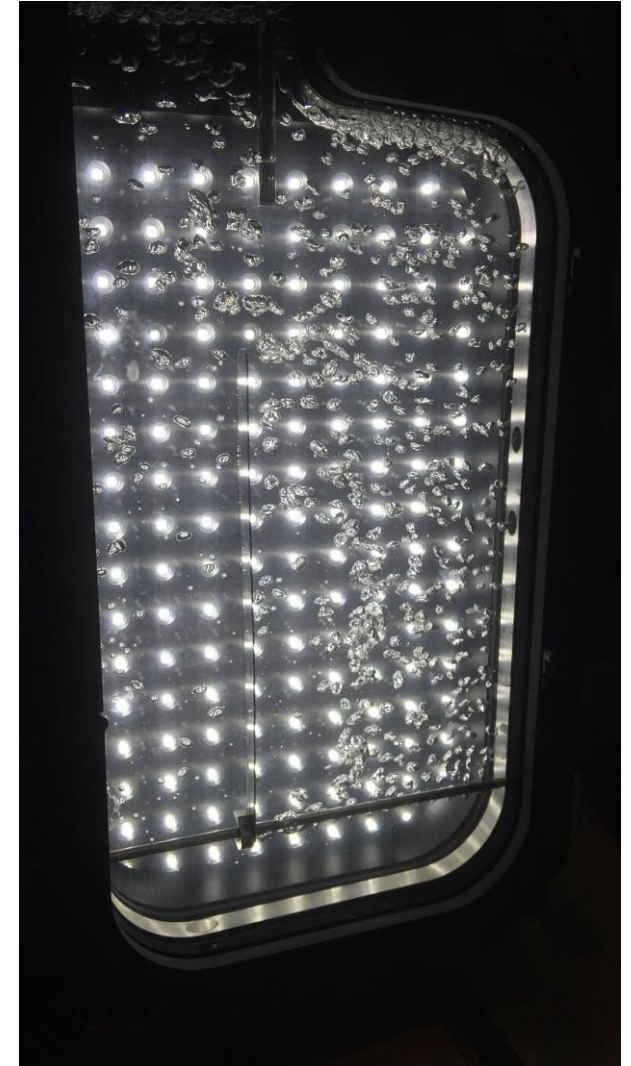
Compare productivity under low and high light intensities

Compare constant light vs. light/dark cycles

Compare constant cycles vs. real outdoor conditions



Algae fermentation





Pumps (also other pumps integration possible)

Free configurable for feed, base, acid, antifoam and more

Maximum 5 pumps in the cabinet. More pumps can be connected separate

Analog and On/off Pumps (own brand)

Flow rates (ml/min) Tubing 1.6mm wall

Tube bore (mm)	Speed (rpm)			
	(ml/rev)	100	400	600 (intermittent)
0.5	0.02	2.2	9.1	13.5
0.8	0.04	4.3	17	26
1.6	0.14	14	56	84
2.4	0.29	29	115	175
3.2	0.47	47.5	190	285
4.0	0.67	67	270	405
4.8	0.85	85	340	510

Bigger pump tubes are also possible up to 10 mm.

Pump possibilities:



Acid



Base



Anti foam



Feed 1



Feed 2



Analog and On/off Pumps Watson Marlow



Watson Marlow pumps (also other pumps integration possible)

Free configurable for feed, base, acid, antifoam and more

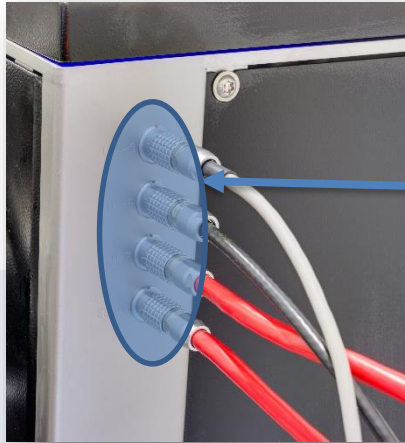
Maximum 5 pumps in the cabinet. More pumps can be connected separate

- Feed back if the pump is running.
- Direction control via touch screen
- When pump is running the pump will be lighted with LED



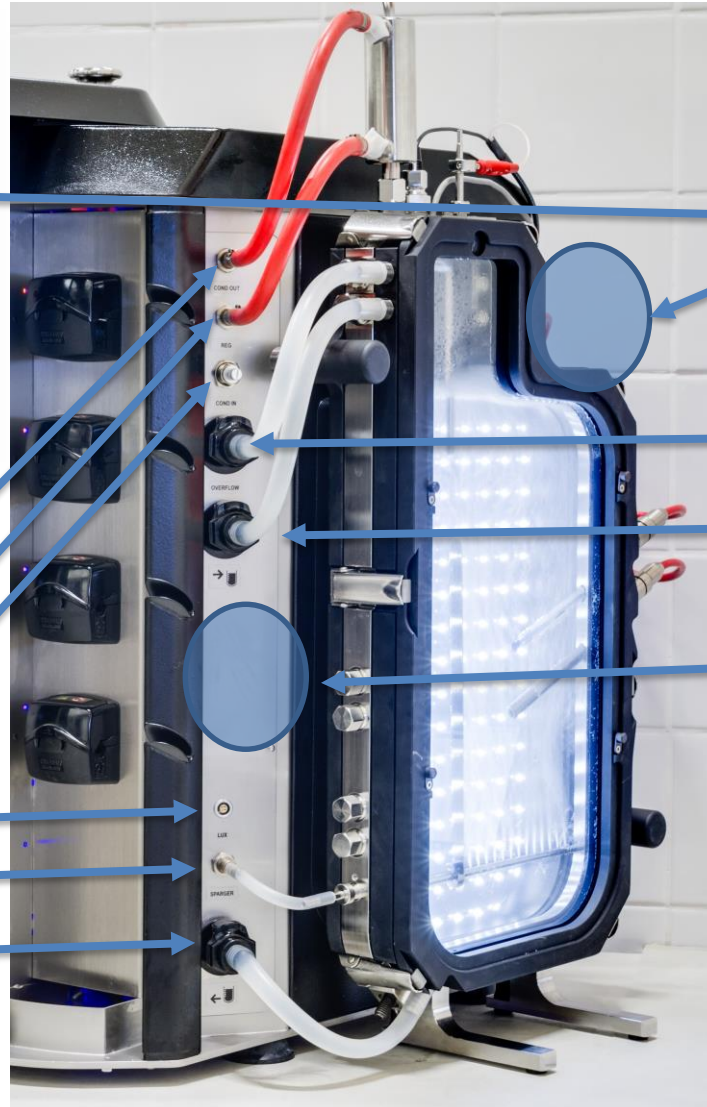
Manual switches. Left and right pumping

Connection to vessels



Condensor out
Condensor in
Control flow condensor

Light/OD/PAM
Air in
Water in jacket



Custom made panels. No open holes

pH, DO, Temp, Antifoam cables
Back side of the unit

Overflow water jacket

Water out jacket

Room for extra sensors and connectors
for Gas mix, head space, switches



Direct Light, OD control for flat panel



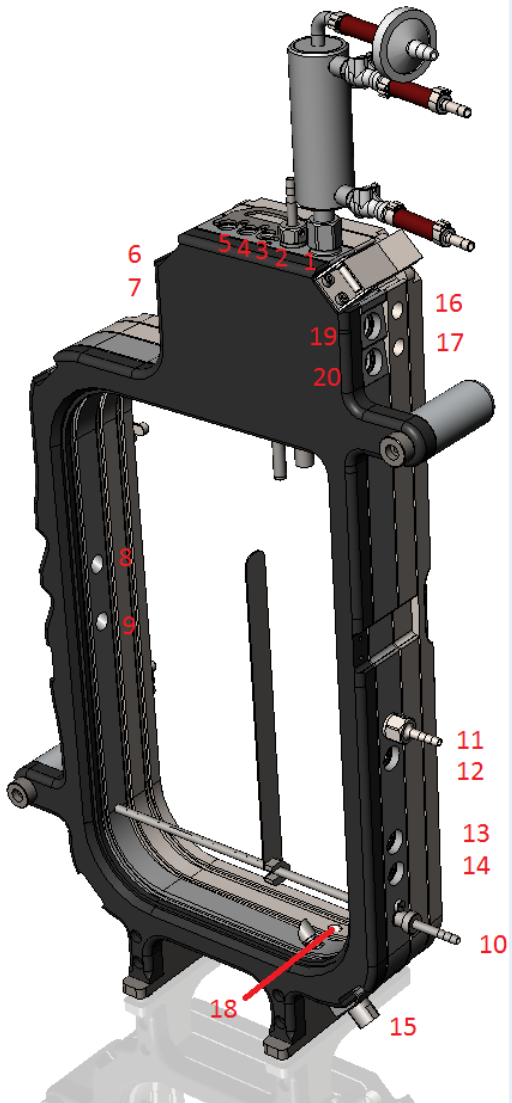
Light intensity
Control 0-100 %



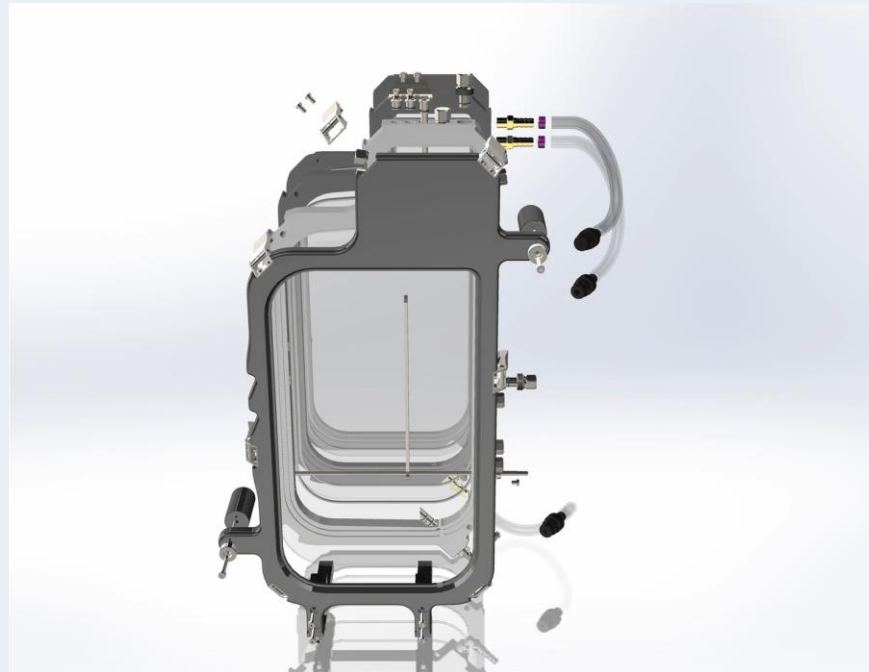
Calibration port

measurement
(more ports possible)





1.	Condensor	11.	Sample valve
2.	Chemostat	12.	Extra
3.	pT100	13.	Extra
4.	Medium inlet	14.	Extra
5.	Anti-foam	15.	Harvest valve / Drain
6.	Acid or base inlet	16.	Cooling / heating overflow
7.	Pressure release (>0.2 bar)	17.	Cooling / heating outlet
8.	pH sensor	18.	Cooling / heating inlet
9.	dO ₂ sensor	19.	Nitrate inlet
10.	Gas inlet	20.	Extra



Flat panel vessel



Water cooled LED panel for flatpanel

LED panel

Number of LEDs

160 Power-LEDs, Operation of 2 different LEDs

Characteristic wavelength

Warm white 450 and 620 nm. Will be dependable of customer wish which wavelength about 20%

Photoelectrical efficiency

Warm white

Color

Light intensity

Control range from 50-65 $\mu\text{mol}/\text{m}^2\text{s}$ to 3000 $\mu\text{mol}/\text{m}^2\text{s}$ (10 cm distance)

Dimming of light intensity

from 0 to 100% in steps of 1% via the bioreactor controller

Viewing angle (with reflectors)

120°

Cooling of the LEDs

Water cooling

Water flow temperature

2-20°C, must not exceed 30°C

Overheat protection

fully automatic via integrated NTC-resistor, switch-off temperature about 65°C.

Minimum distance to vessel

Automatic re-activation at a temperature lower than about 40°C

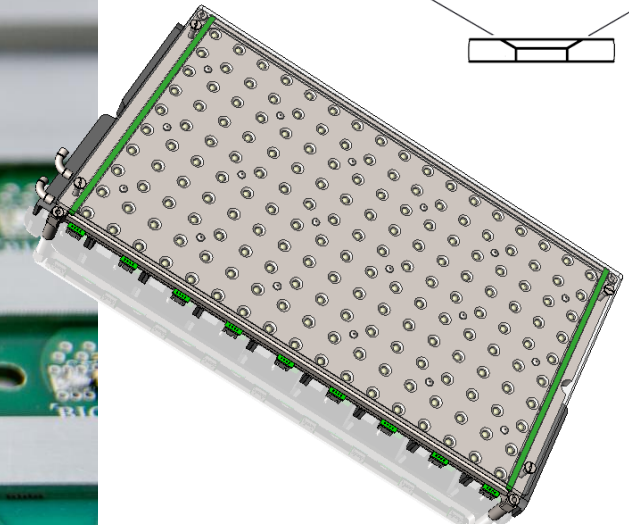
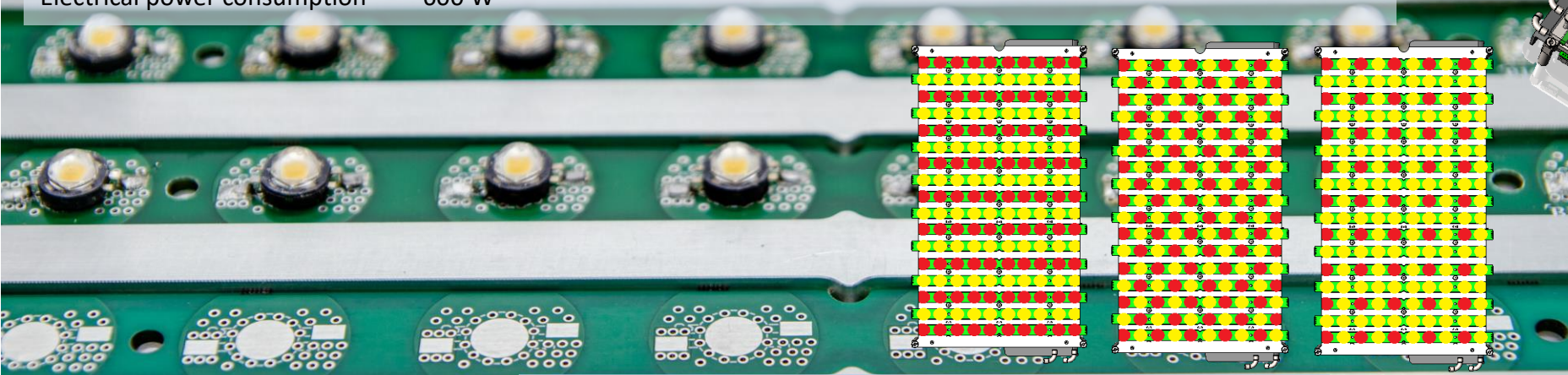
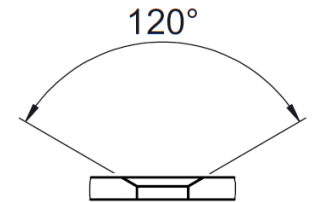
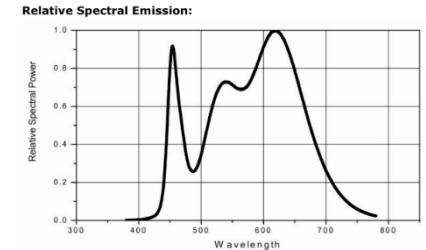
Expected lifetime of the LEDs

about 10 cm (for even light distribution)

Electrical power consumption

up to 75.000 h (9 years of continuous operation)

600 W



Type of LEDs are configurable also in future

Specification Standard LEDs

We have standard two LEDs integrated in the flat panel.
(you can choose your own LEDs and we incorporate them)

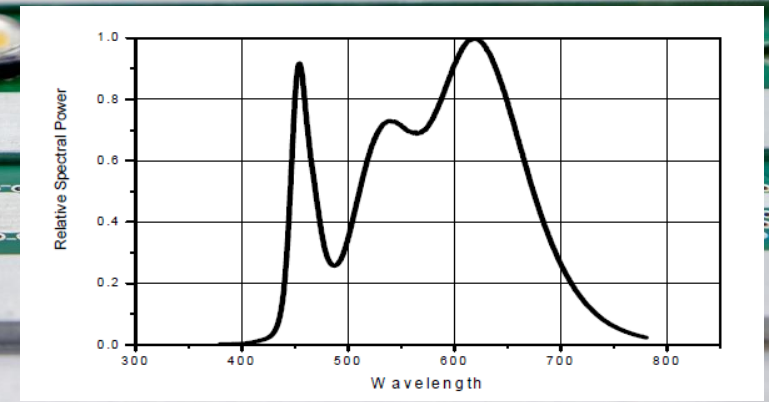
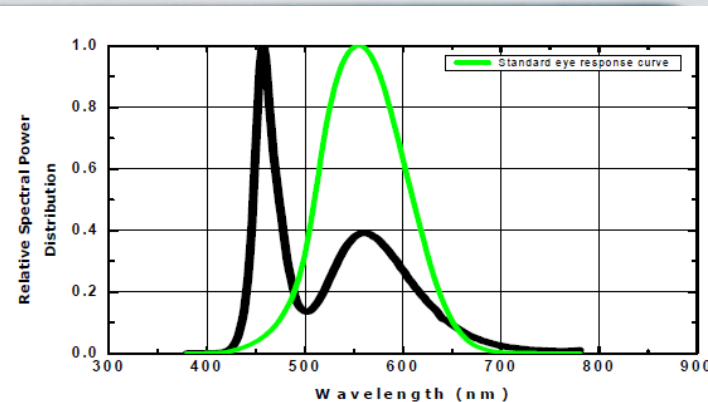
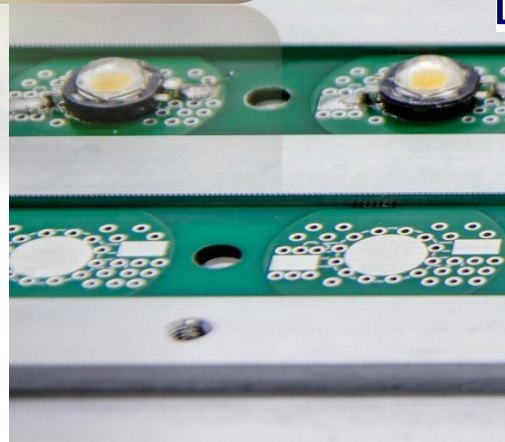
Pure cold white (W42180)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Luminous Flux ^[1]	T rank $\Phi_V^{[2]}$	70	80	91	lm
	U rank $\Phi_V^{[2]}$	91	100	-	lm
Correlated Color Temperature ^[3]	CCT	-	6300	-	K
CRI	R_a	65	70	-	-
Forward Voltage ^[4]	V_F	2.9	3.25	3.8	V
View Angle	$2\theta \frac{1}{2}$	132			deg.
Thermal resistance ^[5]	$R\theta_{J-B}$	8.5			°C /W
Thermal resistance ^[6]	$R\theta_{J-C}$	6.9			°C /W

Warm white (N42180)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Luminous Flux ^[1]	$\Phi_V^{[2]}$		53	-	lm
Correlated Color Temperature ^[3]	CCT		3000	-	K
CRI	R_a		93	-	-
Forward Voltage ^[4]	V_F	2.9	3.25	3.8	V
View Angle	$2\theta \frac{1}{2}$	124			deg.
Thermal resistance ^[5]	$R\theta_{J-B}$	8.5			°C /W
Thermal resistance ^[6]	$R\theta_{J-C}$	6.9			°C /W

Own type
of LED



Make the BioBench your own look

Different outside metallic colors



Type LED color and different outside covers



Specific customer look



Standard controller specifications



Controller

Design	Multi touch 9 inch screen with advanced control (in Option) or a separate PC Capable of communicating with 6 utility stations (more possible with each a separate vessel.
Function	Monitoring (data storage) and control



Mixing

Drive	Air lift
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Temperature:

Range	Water jacket vessel 5-8 °C above coolant (>0°C) from around 5°C above room temp to 70 °C.
Sensor	Pt-100 sensor (vessel and water system) Delta temperature control possible
Accuracy	+/- 0.2°C in range +10° to +60°C in fluids.
Control	PID control with cooling valve and water jacket heater
Tempe. security	Automatic safety thermostat



pH

Range	2 - 14
Control	PID. Base and Acid (or CO2 gas) addition to control pH. Setting of dead band
Sensor	Intelligent pH probe with calibration data, runs and more (depends on brand)



Standard controller specifications



DO

Range
Control
Sensor

0 – 150 %

PID

Intelligent DO probe with calibration data, runs and more (depends on brand)



Exhaust

Filter
Condenser

Standard 0,2 µm absolute filter (also other options available)
High condensation and can be dismantled completely.



Integrated Pumps

5 corrective reagent and Substrate pumps possible.
Standard 3 on/off (base, acid, foam) and 2 analog (feed)
Easy adjustable from analog ↔ digital
Additional integrated and external pumps possible.
Free configurable with a block at the back
Range from 0.001 to 347 ml/min with different tubings



Utilities

2 bar oil free gasses
0,5 - 3 bar water (normal tap water pressure)
The Biobench itself has pressure regulation internally for safety issues.



Aux. equipment

All kinds of external measurements can be integrated in the touch screen.



Electrical requir.

220 V; 5 Amp



First three months free assistance
of our lab technicians.



2 years and is extendable



Specifications of Biobench LED tube Bioreactors

Vessel (glass and stainless steel) for LED tubes

Total Volume	750 ml	1L	2 L	3,6 L	5 L	7,5 L	10 L	13 L
Working volume	180-500 ml	180 –800 ml	0,4 - 1,3 L	0,5 - 2,3 L	0,5 - 3,4 L	1,5 - 5 L	2,5 - 7 L	2,5 - 10,5 L
All type of vessels can be requested.								

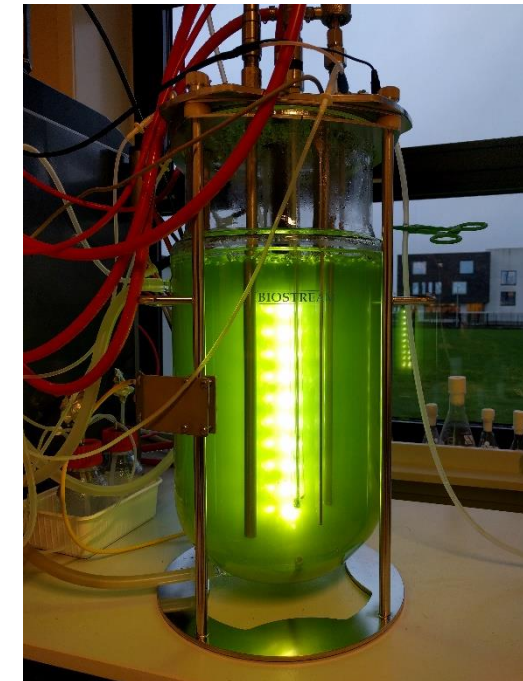
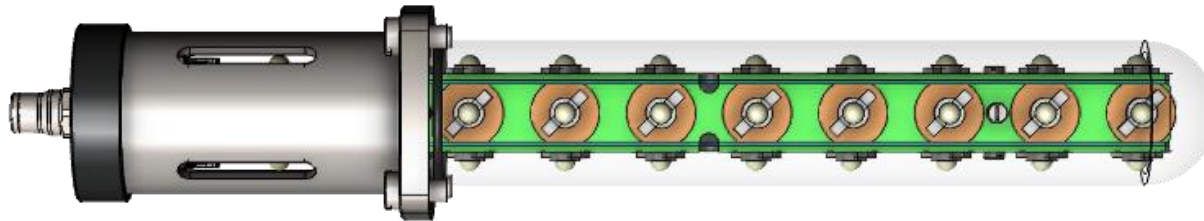
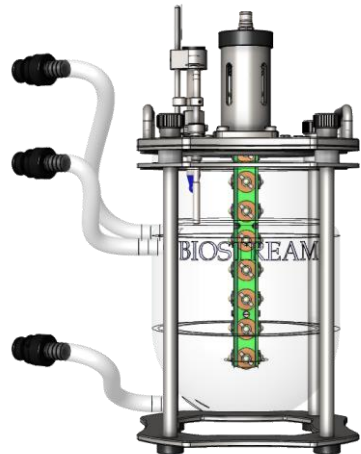
Type op ports (standard)

8 mm	4	4	-	-	-	-	-	-
10 mm	4	4	5	4	4	5	5	5
12 mm (PG13,5),	5	5	5	6	6	8	8	8
18 mm	-	-	1	1	1	1	1	1

Head plate is free configurable with more ports

Vessel type:

Round bottom and dished bottom
Single walled vessel and water-jacket vessel



Specifications of Biobench Air lift Bioreactor

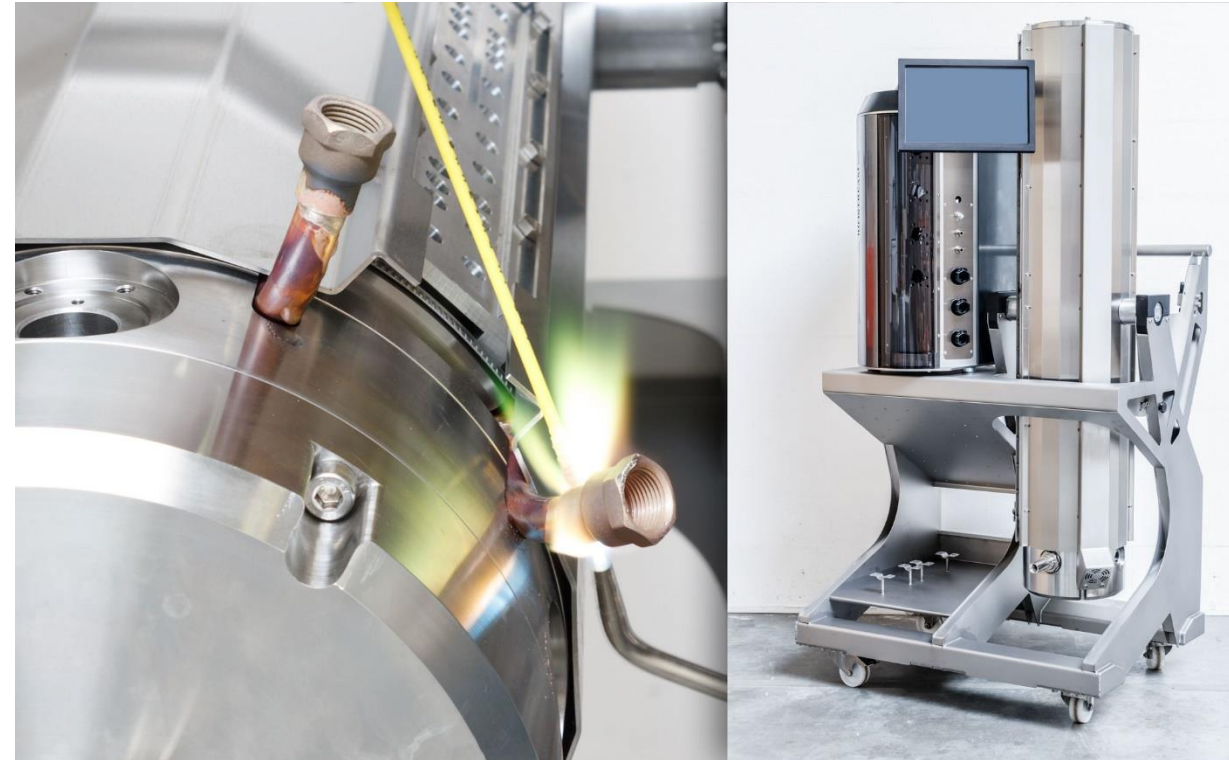
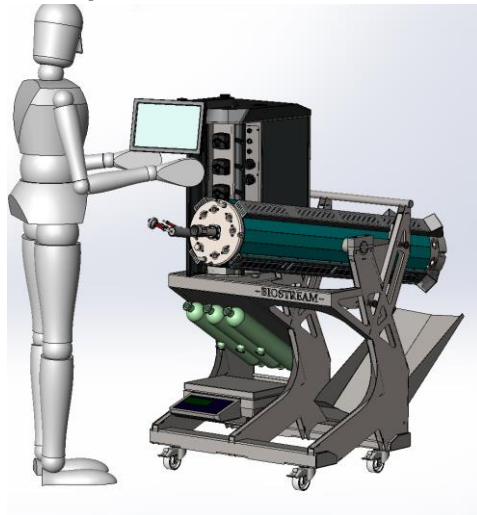
Stainless steel vessel

Total Volume	40L
Working volume	35 L

Type op ports (free configurable)

39 mm ports head plate	6
25 mm ports bottom side vessel	4
Harvest port	1

Continuous cultivation possible with filtration system



Specifications of Biobench Stirred tank

Glass Vessel for LED tubes

Total Volume	750 ml	1L	2 L	3,6 L	5 L	7,5 L
Working volume	180-500 ml	180 –800 ml	0,4 - 1,3 L	0,5 - 2,3 L	0,5 - 3,4 L	1,5 - 5 L

All type of vessels can be requested.

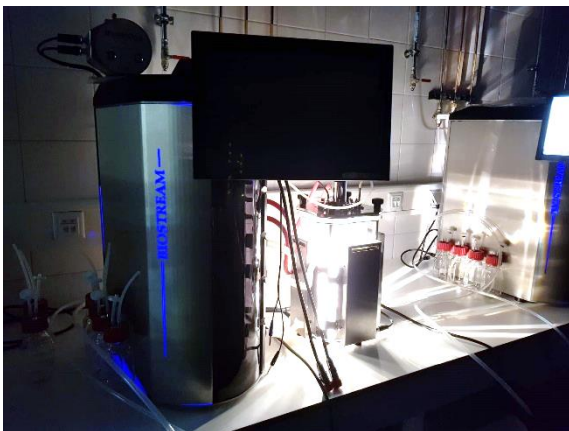
Type op ports (standard)

8 mm	4	4	-	-	-	-
10 mm	4	4	5	4	4	5
12 mm (PG13,5),		5	5	5	6	6
18 mm	-	-	1	1	1	1

Head plate is free configurable with more ports

Vessel type:

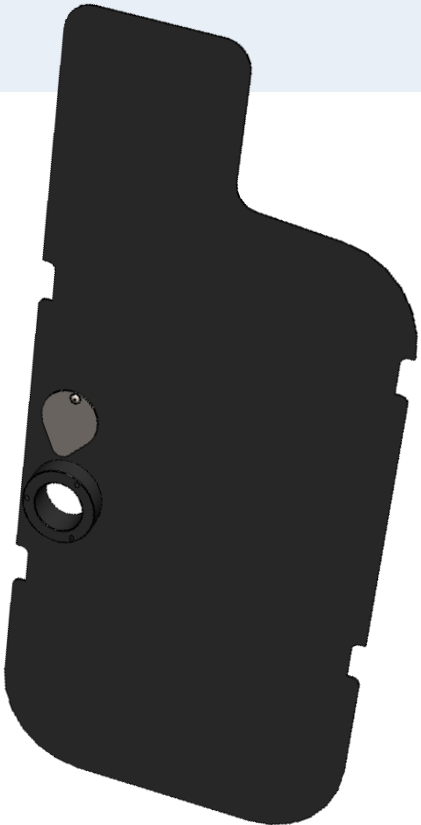
Round bottom and dished bottom
Single walled vessel and water-jacket vessel



Options for the LED panel system

Closing Cover with Sensor connection

For closing of the reactor. All the light will stay in the reactor and no light coming in from outside



Chemostate tube

For continuous mode and prevent foam in the effluent



Gas humidification vessel

Humidification of the ingoing gas