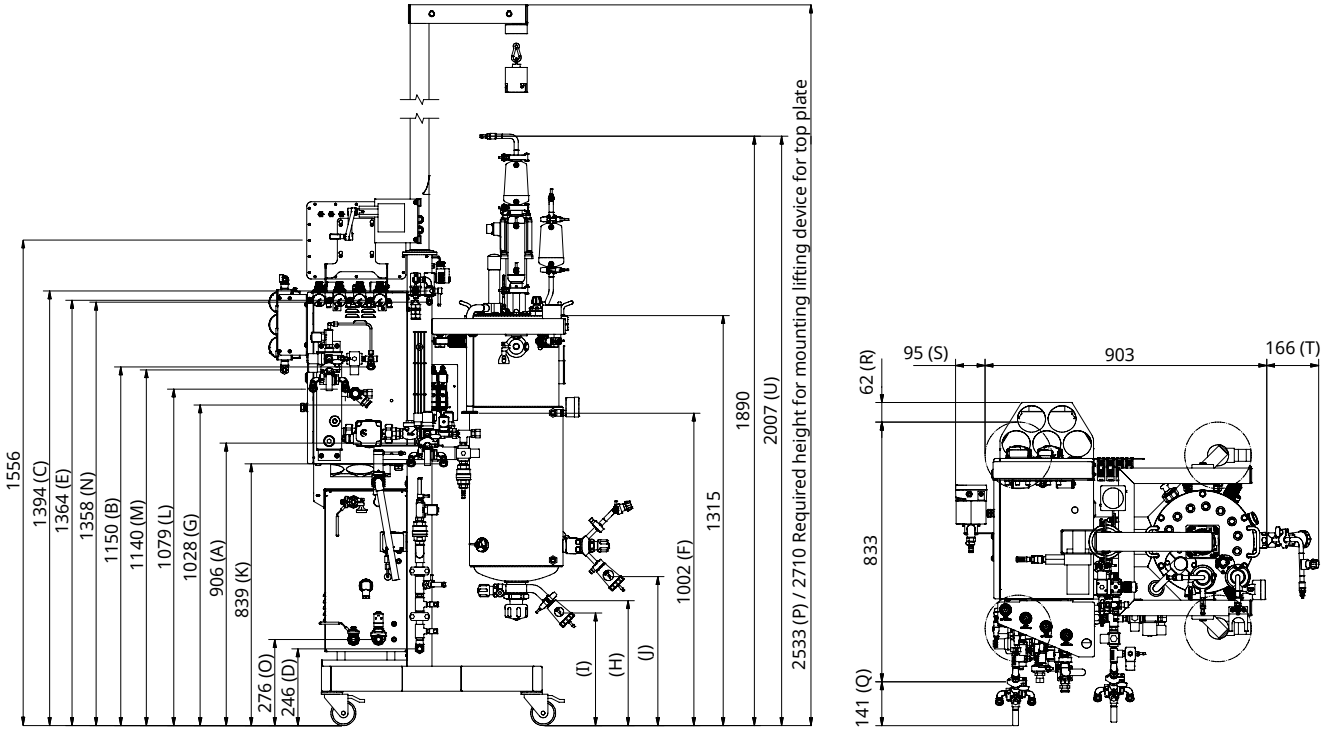
INFORS HT
We bring life to your laboratory

Techfors-S 2

Is the first step always the hardest? Not with the Techfors-S 2. The Techfors-S 2 contains exactly the same components as our bench-top bioreactors. This ranges from the pumps via the gassing line to the touch screen controller and the associated software. Both beginners as well as process experts will be able to manage easily.

Dimensions



A Tap water in
B Tap water out / clean steam
C Exit gas
D Contaminated condensate out
E Air in / O_2 in / N_2 in / CO_2 in
F Safety valve (vessel)
G Safety valve (temp. control system)
H Harvest: (10 L: 730, 20 L: 594, 30 L: 401)
I Optional: Sample (harvest valve): (10 L: 690, 20 L: 554, 30 L: 361)
J Optional: Sample (sample valve): (10 L: 793, 20 L: 670, 30 L: 478)
K Optional: Tap water in / chilled water in
L Optional: Tap water out / chilled water out
M Optional: Exit gas analysis
N Exit gas
O Optional: Water in / out (steam generator)
P Optional: Lifting device for top plate
Q Optional: Manual switchover tap / chilled water
R Optional: Steam generator
S Optional: Gas analysis
T Optional: Sample valve
U Optional: High foam

Vessel

Vessel sizes and dimensions	10 L WV	20 L WV	30 L WV
Total volume (TV), L	15	30	45
Max. working volume, L	10	20	30
Min. working volume, L	3.4	5.7	7.0
Total volume vessel jacket, L	1.3	2.0	3.3
Height, mm [1]	498	633	826
Inside diameter, mm	200	250	267
Ratio H/D	2.5 : 1	2.5 : 1	3.0 : 1

[1] *without top plate and harvest valve*

Limits		
Temperature range	Vessel	-10 °C to +150 °C
	Vessel jacket	-10 °C to +150 °C
Pressure range	Vessel	-1 bar(g) to +4 bar(g)
	Vessel jacket	-1 bar(g) to +4 bar(g)

Materials		
Parts in contact with medium	Material	AISI 316L
	Surface roughness	Ra ≤ 0.6 µm, electropolished
Parts not in contact with medium	Material	AISI 304
	Surface roughness	Ra ≤ 1.2 µm, electropolished

Regulatory compliance	
Applied pressure equipment standard	Alternatively "Pressure Equipment Directive 2014/68/EU" or "ASME Boiler and Pressure Vessel Code"

Vessel top plate ports		Quantity		
		10 L WV	20 L WV	30 L WV
19 mm Rd 28x18"	Accessories	8	9	9
ID = 28 mm	Exit gas	1	1	1
ID = 12 mm	Gas inlet	1	1	1
Tri-Clamp 1 1/2"	Safety valve	1	---	---
Tri-Clamp 1 1/2" with NA connect	Safety valve	---	1	1

Lateral ports		Quantity		
		10 L WV	20 L WV	30 L WV
Ingold nozzle (15°) ID = 25 mm / G1-1/4"	Sensors	4	4	5
Ingold nozzle (0°) ID = 25 mm / G1-1/4"	Sample valve	1	1	1
ID = 15 mm, angled 3°	Temp. sensor	1	1	1
Tri-Clamp 1-1/2"	CIP lances	2	2	2
19 mm Rd 28x18"	Manometer	1	---	---

Bottom valve Rattiinox (harvest halve)		
Actuator		Manual
Process connection	Harvesting	Tri-Clamp 1" (22.1 mm)
	Sampling (optional)	Sample set with needle OD = 6 mm, ID = 4 mm

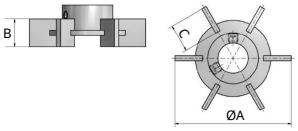
Sample valve Rattiinox (optional)	
Actuator	Manual
Process connection	Needle OD = 6 mm, ID = 4 mm (or directly on sample valve with Tri-Clamp 1/2", ID = 9.4 mm)

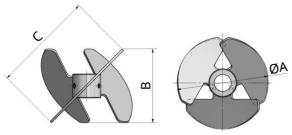
Stirrer

General		
Drive		Top drive
Sealing		Simple mechanical seal
Direction of rotation of stirrer shaft		Clockwise (top view)
Motor type		AC servomotor, brushless
Range rotation speed [1]	10 L WV	20 min^{-1} to 1500 min^{-1}
	20 and 30 L WV	20 min^{-1} to 1200 min^{-1}
Accuracy control	at ≤ 1000 min^{-1}	± 5 min^{-1}
	at > 1000 min^{-1}	1 % setpoint

[1] *Speed ranges apply in liquid with viscosity similar to water, without gassing, with 2 or 3 Rushton impellers and at full working volume.*

Impellers		
Type	Standard	Rushton impeller, 6 blades
	Option	Pitched blade impeller, 3 blades, angled 45° (up- and downward flow available)
Material, surface		AISI 316L, Ra 0.8 µm, electropolished
Quantity		10 L WV: 2; 20 and 30 L WV: 3

Dimensions rushton impellers		10 L WV	20 L WV	30 L WV
	A	66 mm	80 mm	89 mm
	B	13 mm	16 mm	18 mm
	C	16 mm	20 mm	23 mm

Dimensions pitched blade impellers		10 L WV	20 L WV	30 L WV
	A	100 mm	125 mm	133 mm
	B	79 mm	100 mm	107 mm
	C	110 mm	140 mm	150 mm

Gassing System

General specifications	
Gas entry	Ring sparger
Specific gassing rate [1]	2 vvm
Gas(ses)	Air, O_2, N_2, CO_2

[1] *calculated for the max. working volume for all vessel sizes*

Gassing strategy variant Standard	
Gas flow control	1 MFC
Accuracy measurement and control	± 2.0 % FS
Gas mix control (only relevant for multi-gas configurations)	1 solenoid valve per gas

Gassing strategy variant High End	
Gas flow control	1 MFC per gas
Accuracy measurement and control	± 2.0 % FS
Gas mix control (only relevant for multi-gas configurations)	via MFCs

Components	
Mass Flow Controller (MFC), model	Red-y smart series, Hi-Performance
Filter, model	Novasip, C3PFRP1A
Steam trap, type	Thermal steam trap

Control ranges MFCs		
Vessel size	MFCs Air, N_2, and O_2	MFC CO_2
10 L WV	0.20 to 20.0 L min^{-1}	0.10 to 10.0 L min^{-1}
20 L WV	0.40 to 40.0 L min^{-1}	0.20 to 20.0 L min^{-1}
30 L WV	0.60 to 60.0 L min^{-1}	0.30 to 30.0 L min^{-1}

Temperature Control System

Temperature control	Open loop water circuit (standard)	Heating: with clean steam or electrical heating cartridge Cooling: with tap or chilled water fed directly into the vessel jacket
	Closed loop water circuit (option)	Heating: with clean steam and heat exchanger Cooling: with tap or chilled water and heat exchanger
Sterilization		Automatic with clean steam
Sensor		Pt100 class A
Temperature range	Sterilization	110 °C to 125 °C
	Cultivation [1]	20 °C to 79 °C
Accuracy measurement and control (cultivation)	at ≤ 60 °C	± 0.3 °C
	at > 60 °C	± 0.5 °C
Available options		Steam generator
		Chiller
		Switching from tap to chilled water via manual ball valves

[1] *The minimum temperature depends on the ambient temperature, the cooling system used, stirrer speed and viscosity of the medium.*

Steam generator (optional)	Variant 6 kW	Variant 10 kW
Power	6 kW	10 kW
Max. steam power	8 kg/h	14 kg/h
Suitable for vessel volume	10 L	20 and 30 L
Mains supply	400 V (± 5 %) / 50/60 Hz	

Chilller (optional)	
Max. cooling capacity	1.7 kW
Mains supply	230 V / 50/60 Hz

Exit Gas System

Components	
Exit gas cooler, material	Stainless steel
Filter, model	Novasip, C3PFRP1A
Steam trap, type	Thermal steam trap

pH Control

General	
Control	Peristaltic pumps *Acid* and *Base*
Control range	pH 2 to 12
Accuracy measurement	pH ± 0.1

Measurement system HAMILTON (digital)	
Sensor type	Easyferm Plus ARC
Measurement range	pH 0 to 14

Measurement system METTLER (digital)	
Sensor type	InPro 3253i, ISM
Measurement range	pH 0 to 12

Measurement system METTLER (analog)	
Sensor type	405-DPAS-SC-K8S/120
Measurement range	pH 0 to 12

pO_2 Control

General	
Control via cascade	Stirrer, gas flow, gas mixture (addition of O_2)
Control range	0 %-sat. to 100 %-sat.
Accuracy measurement	± 1 %

Measurement system HAMILTON (digital)	
Sensor type	Visiferm DO ARC / RS485-ECS
Measurement range	0 %-sat. to 300 %-sat.

Measurement system METTLER (digital)	
Sensor type	InPro6860i, ISM
Allowed temperature range	0 °C to 60 °C
Measurement range	0 %-sat. to 285 %-sat.

Measurement system METTLER (analog)	
Sensor type	InPro 6820/25/080
Measurement range	0 %-sat. to 150 %-sat.

Antifoam Control

Sensor	Standard	Conductive, stainless steel, height adjustable (sensor and dosing needle in one)
	Option	Conductive, ceramic, height adjustable (only sensor; inno-culation needle or push valve for dosing needed)
Control		Peristaltic pump *Antifoam*
Display		0 (no foam) / 100 (foam)

Pumps

Integrated Pumps

General		
Type		Peristaltic pump with 4-roll pump head 114DV
Quantity digital		3 (Acid, Base, Antifoam)
Quantity analog	Standard	1 (Feed)
	Option	2 (Feed 2 and Feed 3)
Rotation speed digital (fixed speed)		200 min^{-1}
Rotation speed analog (adjustable within range of 0 % to 100 %, increment 0.1 %)		0 min^{-1} to 200 min^{-1}
Accuracy		± 5 min^{-1}
Pump hoses	Sizes (ID)	0.5 mm to 4.8 mm
	Wall thickness	1.6 mm

Flow rates in mL min^{-1} *(values valid for new marprene pump hoses)*		
Inside diameter hose	1 % speed	100 % speed
0.5 mm	0.038	3.917
1.6 mm	0.26	27.2
3.2 mm (Standard)	0.85	84.97
4.8 mm	1.7	172.2

External Pumps (Option)

A: Masterflex L/S Cytoflow, 3-roll pump head
B: Watson Marlow 120U

	A	B
Max. rotation speed, min^{-1}	600	200
Setting range, %	0 to 100	0 to 100
Increment, %	0.1	0.1
Min. flow rate, mL min^{-1}	0.06	0.002
Max. flow rate, mL min^{-1}	3400	190

Vessel Pressure Display (Manometer)

Connection	19 mm port
O-ring material	EPDM
Measurement range	-1 bar(g) to +5 bar(g)

Pressure Safety

Safety valve vessel	Type	Clean service spring-loaded safety valve
	Response pressure	4 bar(g)
Safety valve temperature control circuit	Type	Standard safety valve, angle type, spring-loaded
	Response pressure	3 bar(g)

Operating Panel

HMI	15.6" color touch screen
Ingress protection	IP 66

Level Detection (Optional)

Sensor	Standard	Conductive, stainless steel, height adjustable
	Option	Conductive, ceramic, height adjustable
Display		0 (no liquid) / 100 (liquid)

Turbidity Measurement (Optional)

Sensor type	ASD25-N
Optical path lengths	OPL01 (highest cell densities) OPL05 (higher cell densities) OPL10 (lower cell densities)
Measurement range absorption	0 CU to 4 CU

Permissive Measurement (Optional)

Sensor type	ABER Futura [1]
Measurement range permittivity	0 pF cm^{-1} to 400 pF cm^{-1}
Measurement range conductivity	0 mS cm^{-1} to 40 mS cm^{-1}

[1] *Only installation and configuration services for the bioreactor will be provided; the ABER system must be ordered from the manufacturer.*

Exit Gas Analysis (Optional)

		CO_2	O_2
Ranges, Vol. %	BlueInOne Ferm	0 to 10	1 to 50
	BlueInOne Cell	0 to 10	0 to 100
	BlueVary (cartridge ZrO_2)	0 to 10	0.1 to 50
	BlueVary (cartridge eC)	0 to 25	0 to 25
		0 to 10	0 to 100

Sensor accuracy	BlueInOne Ferm, BlueInOne Cell	± 3 % of value, < ± 0.2 % of range
	BlueVary CO_2	± 3 % of value, ± 0.2 % of range; ± 5 % of value, ± 0.5 % of range for 50 % range
	BlueVary O_2 (eC and ZrO_2)	± 3 % of value, ± 0.2 % of range
Sensor drift	BlueInOne Ferm, BlueInOne Cell	< ± 2 % value / year
	BlueVary	0.2 % value / month

pCO_2 Measurement (Optional)

Sensor type		InPro5000i, ISM (digital)
Transmitter type		M400
Measurement range		0 hPa to 1000 hPa
Process connection	Standard	Ingold nozzle ID = 25 mm
	Option	19 mm port in top plate

Redox Measurement (Optional)

Sensor type		Easyferm Plus ORP ARC
Measurement range		-1500 mV to +1500 mV
Accuracy		± 10 mV
Process connection	Standard	Ingold nozzle ID = 25 mm
	Option	19 mm port in top plate

Pressure Control (Optional)

Sensor	Piezo-resistive pressure transmitter
Measurement range	0 bar(g) to 2 bar(g)
Control	Proportional valve with electronic open-loop control
Control range	0 bar(g) to 1.5 bar(g)
Accuracy measurement and control	± 0.1 bar(g)

Weight Measurement (Optional)

Sensor type	Bending rod load cell, 3 x
Accuracy measurement	± 100 g

Foam Detection Exit Gas (Optional)

Sensor	Conductive
Display	0 (no foam) / 100 (foam) with alarm
Action	Alarm *High foam detected* is triggered, gassing is switched off

Balances (Optional)

A: Mettler MA6002
B: Mettler MA32001L
C: Kern FKB 6K0.02-B
D: Kern DS 30K0.1-A

	A	B	C	D
Max. capacity, kg	6.2	32.2	6	30
Readability, g	0.1	0.1	0.02	0.1
Power supply	100 to 240 V, 50/60 Hz, 0.3 A			

Note: In order to use one of the supported balances, the balance must be prepared and configured by INFORS HT.

Peripherals (Optional)

Resterilizable feed line: allows a sterile connection between the bioreactor and a container sterile addition of liquid into the bioreactor.
Resterilizable transfer line: allows a sterile connection between the bioreactor and an external tank or bioreactor to transfer the content of the bioreactor.

Operating Conditions

Ambient temperature	5 °C to 35 °C
Ambient humidity	20 % to 90 %, non-condensing
Altitude operating location	max. 2000 m.a.s.l
Pollution degree as per EN 61010-1	2
Minimum distance	150 mm

Interfaces

9-pin D-SUB, RS232	Balance input
USB 2.0	Backups/service purposes
Ethernet, RJ45	To integrate the device into a network

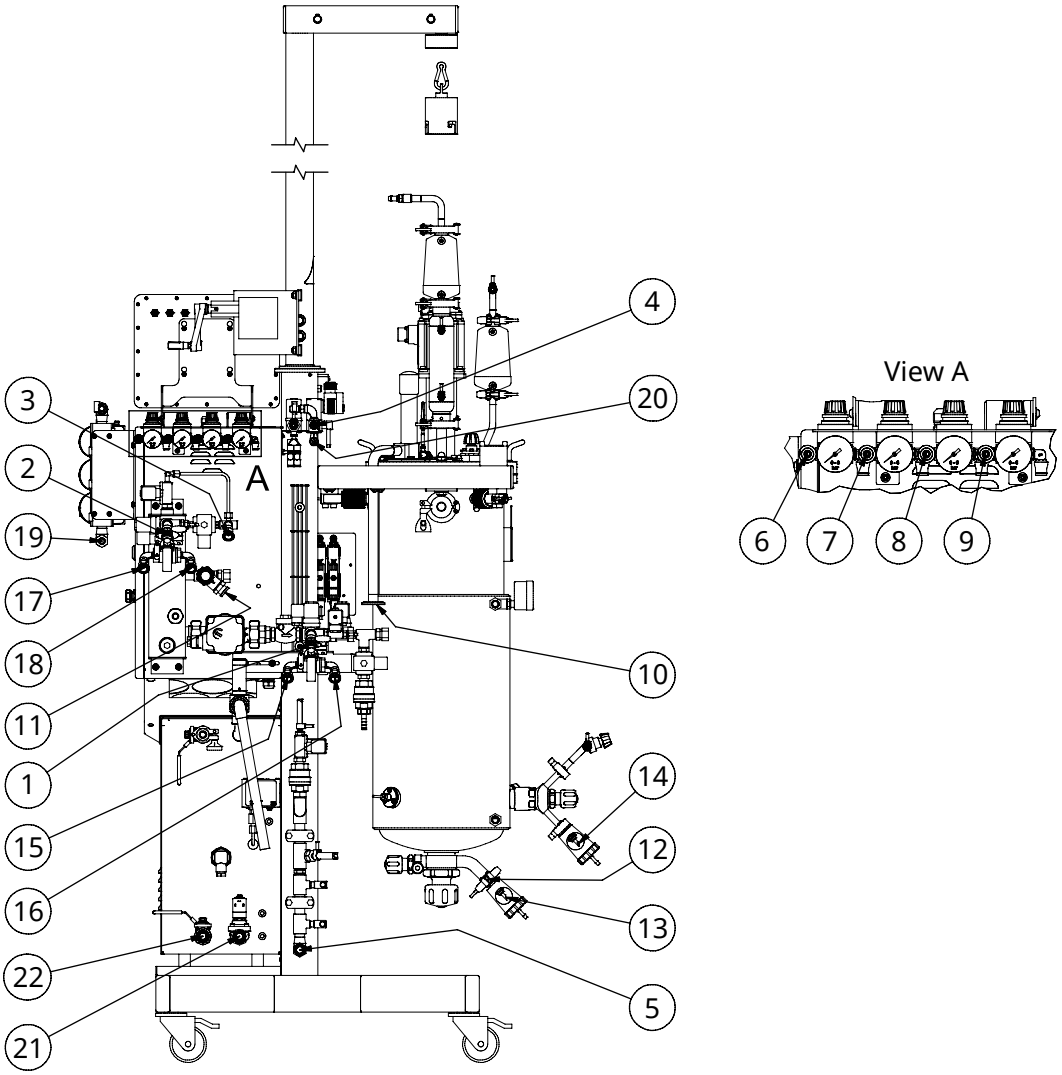
Various

Sound pressure	< 70 dB (A)
IP rating instrumentation cabinet	IP43

Electrical Connection Values

Mains voltage (1 phase, L1 + N (neutral) + PE (earth))		220 V to 240 V
Mains frequency		50 Hz / 60 Hz
Max. current consumption		15 A
Leakage current		> 3.5 mA
Connector	USA and Canada	NEMA L6-20P 20A
	Rest of the world	CEE16/3

Connections/Utilities



Pos.	Connection	Connection type	Pressure, bar(g)	Requirements
1	Tap water in	Tri-Clamp 3/4"	2.0 to 2.5	■ $CaCO_3$ concentration 0 mmol L^{-1} to 1.5 mmol L^{-1}
2	Tap water out	Tri-Clamp 3/4"	No backpressure	■ The drain must be heat resistant (max. 100 °C).
3	Clean steam in	Tri-Clamp 3/4"	2.0 to 2.2	■ Steam must be dry at the specified operating pressure and with the correct flow rate for the size of the bioreactor to be sterilized. ■ Clean steam quality and can pass through a 5 micron filter.
4	Exit gas	Hose nozzle DN13	No backpressure	■ Must be dissipated securely with a suitable, gas-tight hose.
5	Condensate (contaminated) out	Tri-Clamp 3/4"	No backpressure	■ The drain must be heat resistant (max. 100 °C). ■ Contaminated liquids must be drained safely and disposed of in an environmentally friendly manner.
6	Air in	Hose nozzle DN8	4.0 to 6.0	■ Process gases must be dry, clean, and free of oil and dust. ■ Recommended compressed air quality for process air (as per DIN ISO 8573-1): class 1.2.1
7	O_2 in	Hose nozzle DN8	4.0 to 6.0	
8	N_2 in	Hose nozzle DN8	4.0 to 6.0	
9	CO_2 in	Hose nozzle DN8	4.0 to 6.0	
10	Safety valve (Vessel)	Tri-Clamp DN15	No backpressure	

Pos.	Connection	Connection type	Pressure, bar(g)	Requirements
11	Safety valve (Temp. control system)	Tri-Clamp 3/4"	No backpressure	
12	Harvest	Tri-Clamp 1"	---	
13	Sample (Harvest valve)	Needle 6 mm	---	
14	Sample (Sample valve)	Needle 6 mm	---	
15	Tap water in (option)	Tri-Clamp 3/4"	2.0 to 2.5	■ $CaCO_3$ concentration 0 mmol L^{-1} to 1.5 mmol L^{-1}
16	Chilled water in (option)	Tri-Clamp 3/4"	2.0 to 2.5	
17	Tap water out (option)	Tri-Clamp 3/4"	No backpressure	■ The drain must be heat resistant (max. 100 °C).
18	Chilled water out (option)	Tri-Clamp 3/4"	No backpressure	
19	Exit gas (Gas analysis)	Hose nozzle DN13	No backpressure	
20	Exit gas	Hose nozzle DN13	No backpressure	
21	Water in steam generator (option)	Tri-Clamp 3/4"	Min. 3.0	■ $CaCO_3$ concentration 0 mmol L^{-1} up to a max. of 0.53497 mmol L^{-1}
22	Water out steam generator (option)	Tri-Clamp 3/4"	No backpressure	

eve®

eve® is a platform software for planning, execution and analysis of bioprocesses. eve® allows you to record bioprocess data and store it in a central database. The software offers workflows from simple bioprocesses to the planning and execution of complex strategies with various phases.

eve® makes it possible to generate and store bioprocess knowledge. Various libraries for storing information on organisms and culture media are available. Thanks to soft-sensors, additional knowledge can be generated.

In addition to INFORS HT products, biotech machines and analysis devices from third-part manufacturers can be connected. This makes it possible to holistically control, monitor and analyse bioprocesses using a single software.

eve® is installed on a centralised server. Access takes place via a browser, no client side installation is required. Bioprocess data is therefore available directly via the browser and independent of the operating system.

Various packages of the software are available. This makes it possible to adapt it to the individual needs and requirements of its users. eve® (in the premium version) is also suitable for working in a validated environment as per FDA CFR 21 Part 11.