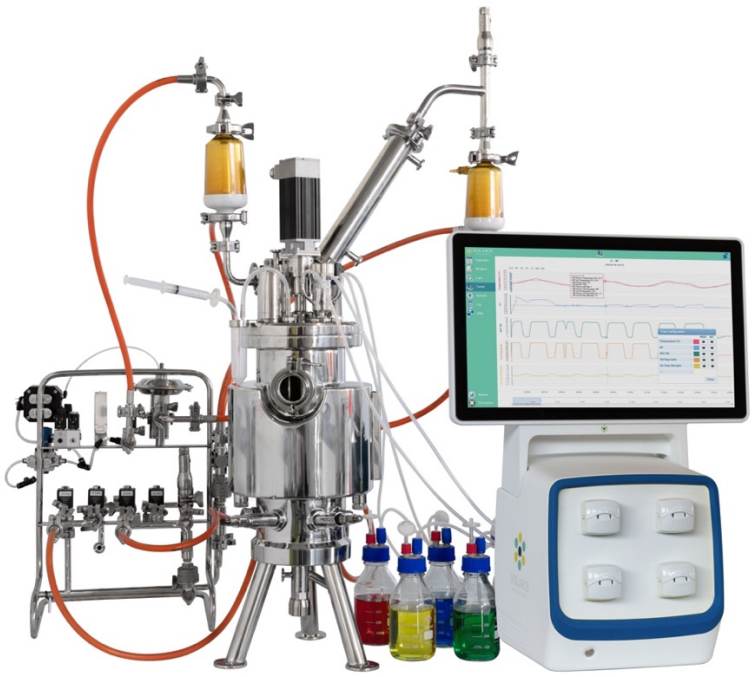
SOLARIS
BIOTECH SOLUTIONS

GENESIS

Parallel sterilizable in place fermenters/bioreactors

Scope of supply

This technical proposal describes a Solaris GENESIS 7.5.
For supervisory control and data acquisition Leonardo 3.0 is included.
The system consists of 7.5L fermenter/bioreactor (total volume), bench-top, pre-assembled unit, supplied with all necessary tubes, valves and instruments, automation, control panel (HMI).
The system is designed for aerobic and anaerobic cultivations/ fermentations, closed aseptic operations.
The control is based on a SCADA control system.



• INCLUDED

° OPTION

GENESIS 7.5 Data Sheet

VESSEL	
Total Volume	7.5 L
Working Volume (min-max)	1,10-5,45 L
Ratio D/H	1:2,5
Max temperature	135°C
Max Operating pressure	Up to 4.0 bar(g)
Design	Stainless Steel Jacketed Vessel Flat lid, with retractable bolts Torospherical bottom, totally drainable Jacket: around the vessels and on the bottom
Height	385 mm (1327 mm with condenser and legs)
Materials	Vessel: AISI 316L Others: AISI 304
Finishing	All parts in contact with the culture: Ra < 0,4 µm External (cylinder and insulation): Ra < 0,6 µm Mirror polished

PORTS AND CONNECTION	
Vessel Lid (11)	n.1 port, A.F. n.1 port, Level probe n.1 port, Safety valve + gas out n.1 port, SALAS-Solaris Sterile Liquid Addition System n.1 port, Stirrer n.1 port, sparger n.1 port, Pressure probe n.3 removable baffles n.1 sight glass + lamp
Upper side wall (2)	n.1 port, Overlay gas inlet n.1 circular sight glass
Lower side wall (6)	n.2 Hygienic Socket Solaris, n.2 spare probes ports n.1 port, sampling valve n.1 temp. housing, PT100 n.1 sight glass no
Vessel bottom (1)	n.1 port, harvest valve
Jacket in-out (8)	n.1 port, steam in n.1 port, steam out

	n.1 port, Water in n.1 port, Jacket in/out n.3 ports, Electrical heaters in n.1 port, Pt100 for jacket
AGITATION	
Drive	• Brushless Motor Direct Assembly
RPM	1-1500 RPM (bacterial), 1-500 (cell culture)
Impeller type	Rushton, Marine or Pitched blade
THERMOREGULATION	
Control	PID Control for Heating and Cooling, Accuracy: 0.1 Jacket Steam and electric heaters/cooling source
Sterilization	Automatically controlled SIP sequence Automatically pressurized in cooling phase

AERATION		
Gas control	• TMFC	Max. up to 4 TMFC
Gas mixing (AIR, N_2, CO_2, O_2)	° numbers of TMFC or n.1 TMFC+n.4 solenoid valves	
Gas overlay	° TMFC	
Sparger	• Toro or sintered Type	
Exhaust	Condenser and 0.2µm filter	
INTEGRATED PERISTALTIC PUMPS		
Quantity and type	• n.4 WM 114FD/DV	
Controller	Fixed Speed (regulated on/off) Application assignable from software	
Speed	60 rpm	
Flow rates	Watson Marlow 114FD/DV - ID 0.5 mm: 1.4 ml/min - ID 0.8 mm: 2.6 ml/min - ID 1.6 mm: 8.4 ml/min - ID 2.4 mm: 17.5 ml/min - ID 3.2 mm: 28.5 ml/min - ID 4.0 mm: 40.5 ml/min - ID 4.8 mm: 51 ml/min	
PCS and SOFTWARE		
PCS (W x D x H)	• (35cm x 37cm x h 36 cm)	

HMI	•Touch screen **PC**, 24" Color Monitor
Software	• SCADA Solaris Software Control Leonardo 3.0
Solaris Logic Parser Software	•
Solaris Fermentation Manager (offline data analysis)	•
Data Extraction	• Through USB port or Ethernet/Wi-Fi
Graphs Trends, displaying in real time and in remote	•
On line Parameters Calibration	•
Alarms Management	•
Events Recording	•
Multipasswords Levels	•
OTHER ACCESSORIES	
Sampling Valve	•
Sterile sampling system (sterilizable independently with steam)	◦
Harvest Valve	•
COMMUNICATION	
n.4 Analog Input 0-10V and 0-20 mA/4-20mA *Choice between:* - *n.2 channels 0-10V + n.2 channels 0-20 mA/4-20mA* - *n.4 channels 0-10V* - *n. 4 channels 0-20 mA/4-20mA*	◦ (ex. sensors powered by Solaris electrical cabinet)
n.4 Analog Output 0-10V and 0-20 mA/4-20mA *Choice between:* - *n.2 channels 0-10V + n.2 channels 0-20 mA/4-20mA* - *n.4 channels 0-10V* - *n. 4 channels 0-20 mA/4-20mA*	◦ (ex. pumps or valves with power supply independent from Solaris electrical cabinet)

GENESIS 7.5 Controls (integrated in the PCS)	
TEMPERATURE	
Sensor	PT100

Reading range	0 - 150°C
Accuracy	± 0.1 °C
pH	
Sensor	Digital sensor, Combination electrode
Length	120 mm
Control range	0 - 14 pH
Probe accuracy	0.01 pH
Probe sensitivity	57 to 59 mV/ pH at 25 °C
Autoclavable	Yes, max. temperature 130 °C
Pressure range	0 - 6 bar
Actuator	Actuation of peristaltic pumps for the addition of acid/base solutions, or TMFC (CO_2) for pH control
dO_2	
Sensor	Digital Optical sensor
Length	120 mm
Control range	0 - 300% air saturation
Probe accuracy	1 ± 0.05 %-vol, 21 ± 0.2 %-vol; 50 ± 0.5 %-vol
Autoclavable	Yes, max. temperature 130 °C
Pressure range	0 - 12 bar
Actuator	Cascade to RPM, Gas Control, feedings, etc.
ANTIFOAM CONTROL	
Sensor	Solaris sensor (Fixed length)
Actuator	Peristaltic pump for the addition of antifoam solution
LEVEL CONTROL	
Sensor	Solaris sensor (Adjustable length)
Actuator	Peristaltic pump for feeding/harvesting
REDOX (ORP)	
Sensor	Digital sensor, Combination electrode

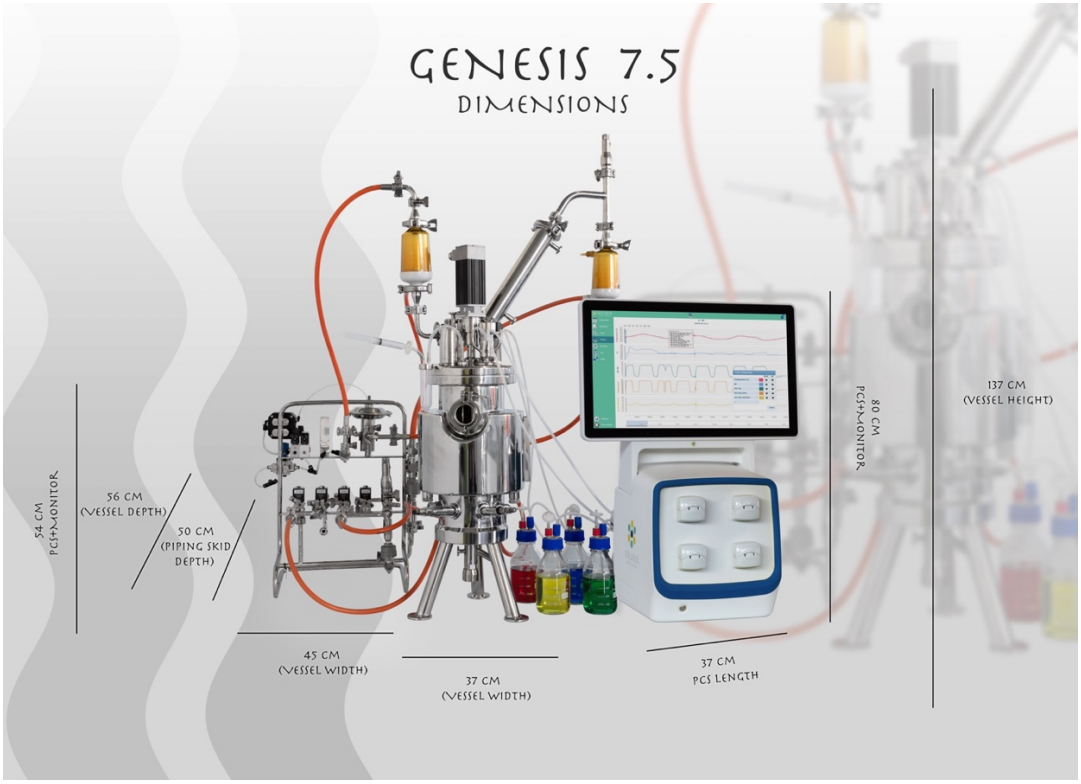
Length	120 mm
Measuring range	±1500 mV
Autoclavable	Yes, max. temperature 130 °C
Pressure range	0 - 6 bar
CONDUCTIVITY	
Sensor	Digital sensor
Length	120 mm
Measuring range	1 µS/cm to 300 mS/cm
Autoclavable	Yes, max. temperature 130 °C
Probe accuracy	± 3 % at 1 µS/cm to 100 mS/cm, ± 5 % at 100 to 300 mS/cm
Pressure range	0 - 20 bar

Modular additional parameters integrated in the supply including dCO2, Cell Density, weight and peristaltic pumps.

GENESIS 7.5 Controls (modular external box)	
dCO_2	
Sensor	Analog sensor
Length	120 mm
Control range	0-200% saturation
Autoclavable	Yes, max temperature 130 °C.
Probe accuracy	± (10 % of the reading + 10 mbar)
Pressure range	0 – 4 bar
CELL DENSITY	

Sensor	Digital sensor
Length	120 mm
Control system	Measuring resident in Leonardo 3.0 software
Option 1	Total cell density based on turbidity Two ranges: 10^5 to $7 \cdot 10^8$ mammalian cells/ml 0.5 to 100 g/L dry weight
Pressure range	0 – 10 bar
Operation temperature	0 – 80°C
Autoclavable	Yes, max. temperature 135 °C
Option 2	Viable cell density based on capacitance Two ranges: 5•105 to 8•108 mammalian cells/ml 5 to 200 g/L dry weight)
Pressure range	0 – 3 bar
Operation temperature	0 – 60°C
Autoclavable	Yes, max. temperature 135 °C
Probe accuracy	Mammalian cells in suspension ± $5 \cdot 10^4$ cells/ml - Fermentation ± 0.05 g/l dry weight
WEIGHT	
Digital Balance with load cells (accuracy ± 0.1 g)	
ADDITIONAL EXTERNAL PERISTALTIC PUMPS	
WM 120 U Brushless	
Quantity and type	n. of WM 120 U Brushless
Controller	Variable speed Manual and automatic with application assignable from software
Speed	1-200rpm
Flow rates (Marprene tubing, 1.6mm wall)	Watson Marlow 120U/DV - ID 0.5 mm: 0.02 - 4.0 ml/min - ID 0.8 mm: 0.04 - 8.0 ml/min - ID 1.6 mm: 0.14 - 28.0 ml/min - ID 2.4 mm: 0.29 - 58.0 ml/min - ID 3.2 mm: 0.47 - 94.0 ml/min - ID 4.0 mm: 0.67 - 130.0 ml/min - ID 4.8 mm: 0.85 - 170 ml/min
WM 313 FDM/D	
Quantity and type	n. of WM 313 FDM/D

Controller	Fixed Speed (regulated on/off) Application assignable from software
Speed	175 rpm
Flow rates (Marprene tubing, 1.6mm wall)	Watson Marlow 313 FDM/D - ID 0.5 mm: 6 ml/min - ID 0.8 mm: 13 ml/min - ID 1.6 mm: 48 ml/min - ID 3.2 mm: 175 ml/min - ID 4.8 mm: 385 ml/min - ID 6.4 mm: 630 ml/min - ID 8.0 mm: 875 ml/min
WM 313 OEM VBM-D	
Quantity and type	n. of 313OEM VBM-D
Controller	Variable speed Application assignable from software
Speed	1-360 rpm
Flow rates (Marprene tubing, 1.6mm wall)	Watson Marlow 313OEM VBM-D - ID 0.5 mm: 12 ml/min - ID 0.8 mm: 26 ml/min - ID 1.6 mm: 100 ml/min - ID 3.2 mm: 360 ml/min - ID 4.8 mm: 790 ml/min - ID 6.4 mm: 1296 ml/min - ID 8.0 mm: 1800 ml/min



Utilities and Service Connections

Utilities	Connection	Requirement
Electrical	**Genesis Steam Heated:** 110 - 230 V 50-60Hz (1P + N + GND) Single Phase 10 A; 2.5 KW	
	Genesis Electrically Heated: 220 – 380 V 50 – 60 Hz (3P + GND)	
	Genesis Steam & Electrically Heated: 110 - 230 V 50-60Hz (1P + N + GND) and 220 – 380 V 50 – 60 Hz (3P + GND)	
Instrument air	6 bar(g), oil free compressed – connection type: 6 mm quick connector	
Pressure steam	2,0 – 3,0 bar(g), 5µm filtered – connection type: TC ½ ''	
*Cooling water (jacket and condenser)	1,0 – 1,5 bar(g), 10 – 15 °C – connection type: 6mm quick connector or TC ½ ''	

(*) Verify that pressure regulator is set to 3 bar(g)
NB: the air supply MUST be oil free in order to avoid damages to the TMFCs

Chiller (option)

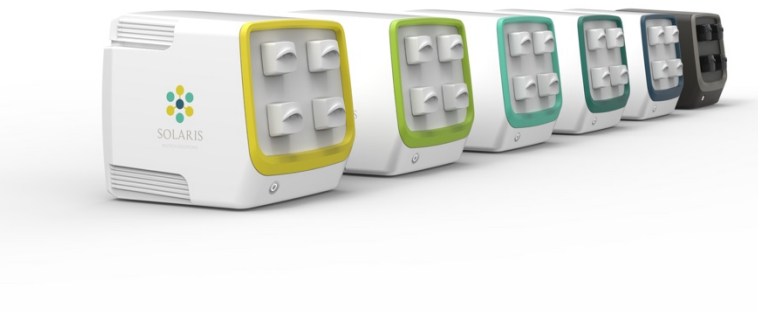
Optionally GENESIS can be equipped with a chiller for heat removal from your culture minimizing lab water usage during thermoregulation.

The image is for demonstration purposes only:
the layout of this model may vary

SOLARIS
BIOTECH SOLUTIONS

Chiller data sheet	
Working temperature range	-5 – 25 °C
Ambient temperature range	-15 – 50 °C
Temperature stability	± 2 K
Volume water reservoir	19 L
Cooling output at 25 °C water outlet temperature	2.80 kW
Cooling output at 20 °C water outlet temperature	2.80 kW
Cooling output at 15 °C water outlet temperature	2.50 kW
Cooling output at 10 °C water outlet temperature	2.10 kW
Cooling output at 5 °C water outlet temperature	1.80 kW
Cooling output at 0 °C water outlet temperature	1.50 kW
Cooling output at -5 °C water outlet temperature	1.20 kW
Application	External
Noise level	50.10 dB(A)
Power consumption	1.40 kW
Pump pressure max	3.40 bar
Pump flow max. (pressure)	42 L/min
Pump connection thread	Rp 1/2"

PCS - Process Control System



Solaris' modular product design strategy decreases the number of unique parts which reduces time of production. The result is a lean, smart and flexible PCS. In case of parallel fermentations/cultivations, the PCS can be stacked with a dedicated support, optimizing lab space.

General characteristics

GENESIS is fitted with a Process Control System working with web-based (Linux) software Leonardo 3.0 and Siemens S7 1200 PLC.
The HMI is a PC 24" touch screen.

LEONARDO 3.0: USER-FRIENDLY SOFTWARE

Solaris controlling software offers a simply laid out, yet powerful platform for experimental design planning and process control. The graphical user interface enables the intuitive selection and adjustment of control functions.
Extracted data is compatible with Window Excel, but in addition, Solaris offers a platform where fermentation data can be easily exported in real time and thus managed. This software is included in the supply and can be installed on an unlimited number of the client's PC or laptops.

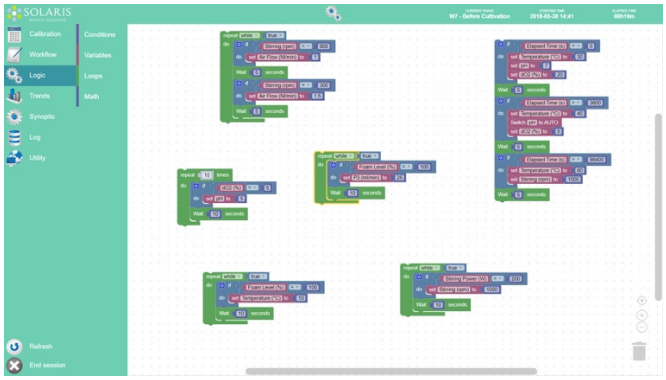
Features:

- Home with Multi-level password protection
- Workflow settings (warm up, calibration, cultivation, cleaning, additional custom phases, etc.)
- Synoptic page with manual operation of all the actuators (pumps, valves etc.), parallel synoptic comparison between units
- Continuous trend graphs representation to track, print and export data on up to 6 processes and set point variables. Different dynamic zooms and configurations in a time frame that can be set interactively
- Cascade and profile programs
- Parallel set point settings
- Parallel Parameters Calibration (off and on line)
- Parallel trend comparison between units
- Pumps configuration and calibration
- On line parameters calibration
- PID setting
- USB connection for free data extracting
- Remote control for after sale assistance; 100% assistance from our office
- Remote control for the user
- Possibility of saving up to recipes for repeat usage
- Print-out of hard copy of each screen

Solaris Logic Parser

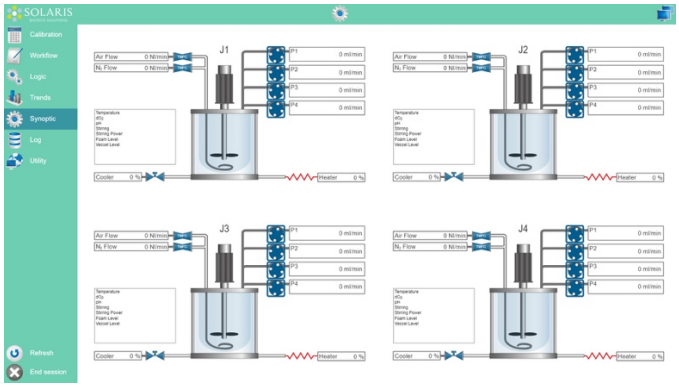
Solaris Logic Parser, integrated in Leonardo 3.0, gives to the user additional possibilities of

controls putting in relation all the variables involved in the fermentation process with common logic functions.
The communication between the software Leonardo 3.0 and the software Logic Parser is via exchange database.
The Logic Parser software lets the user write every kind of program, from simple business logic (like an actuator that turns on when a specific condition is met) to a complex program with nested loops.
It is possible to run multiple program blocks in parallel, each one having its separate thread and timing of execution.
Each logic diagram is automatically saved with the current recipe, but of course it is possible to store the program to a separate file and keep it for later use.



Do it parallel: smarter···faster

Leonardo allows intuitive and time-saving parallel operation. Up to 24 independent fermentations/cultivations can be carried out simultaneously.



Example parallel synoptic

Do it wireless!

Increase mobility: users have the option to access the platform remotely, via PC, tablet, and/or phone. Remote access is multi-level password protected.