SOLARIS
BIOTECH SOLUTIONS

JUPITER

Parallel autoclavable fermenters/bioreactors

Scope of supply

This technical proposal describes a Solaris JUPITER 4.0.

For supervisory control and data acquisition Leonardo 3.0 is included.

The system consists of 4 L jacketed 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.

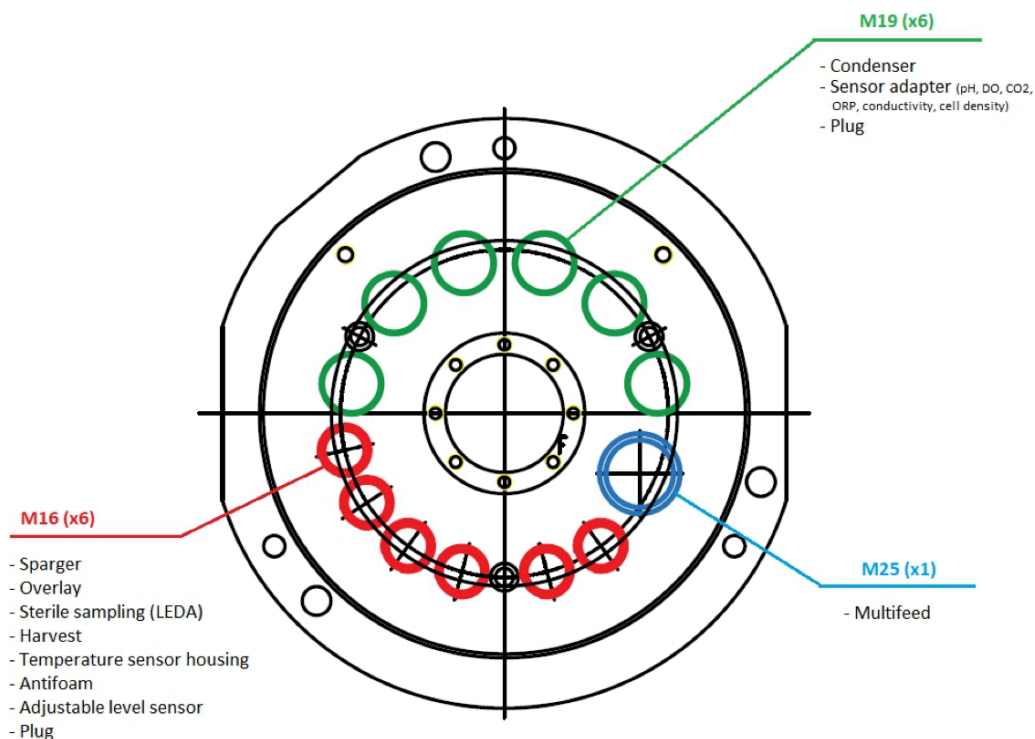The control is based on a SCADA control system.

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• INCLUDED ° OPTION	JUPITER 4.0 Data Sheet
VESSEL	
Total Volume	4,0 L
Working Volume (min-max)	0,6-2,8 L
Ratio D/H	1:3,25
Max temperature	70°C
Operating pressure	< 0,5 bar(g)
Headplate Ports (13)	n. 1 Agitation Group n. 1 Gas Sparger n. 1 Gas Overlay n. 1 Gas Out/Condenser n. 1 Sampling n. 1 Harvesting n. 1 Temperature n. 1 Multifeed n. 2 Sensors DN12 (pH; dO2; dCO2 ..) n.1 Adjustable level sensor n°2 Spare

M19 (x6)
- Condenser
- Sensor adapter (pH, DO, CO2, ORP, conductivity, cell density)
- Plug

M16 (x6)
- Sparger
- Overlay
- Sterile sampling (LEDA)
- Harvest
- Temperature sensor housing
- Antifoam
- Adjustable level sensor
- Plug

M25 (x1)
- Multifeed

Design	Borosilicate Glass Jacketed Vessel with elliptical bottom

Materials	Vessel: Borosilicate Glass Others: AISI 316 L
DIMENSIONS FOR AUTOCLAVE (with condenser)	
Height	705 mm
Diameter	285 mm
AGITATION	
Drive	• Brushless Motor Direct Assembly
RPM	1-1700 RPM, Accuracy 1RPM
Impeller	Rushton, Marine or Pitched blade Impeller
THERMOREGULATION	
Type	• Water Jacket and electrical heaters
Control	PID Control for Heating and Cooling, Accuracy: 0.1 °

AERATION		
Gas control	• TMFC	
Gas mixing (AIR, N_2, CO_2, O_2)	° numbers of TMFC or n.1 TMFC+n.4 solenoid valves	Max. up to 5 TMFC
Gas overlay	° TMFC	
Sparger	• Toro or Sintered Type	
Input/Output filters	•	
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 system (dip tube)	•
LEDA Sterile Sampling System	○
Harvest Tube	•
Sterile Additive Needle free connectors	• n.4
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 24V 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)

JUPITER 4.0 Controls (integrated in the PCS)	
TEMPERATURE	
Sensor	PT100
Reading range	0-150 °C
Accuracy	± 0.1 °C

pH	
Sensor	Digital sensor Combination electrode
Length	425 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	425 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 feeding/harvesting

LEVEL CONTROL	
Sensor	Solaris sensor (Adjustable length)
Actuator	Peristaltic pump for feeding/harvesting

REDOX (ORP)	
Sensor	Digital sensor Combination electrode
Length	425 mm
Measuring range	±2000 mV
Autoclavable	Yes, max. temperature 130 °C
Pressure range	≤ 6 bar

CONDUCTIVITY	
Sensor	Digital sensor

Length	425 mm
Measuring range	1 - 3000 µS/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, thermobox, weight and peristaltic pumps.

JUPITER 4.0 Controls (modular external box)	
dCO$_2$	
Sensor	Analog sensor
Length	320 mm
Control range	0,00-200% saturation
Autoclavable	Yes, max temperature 130 °C.
Probe accuracy	± (10 % of the reading + 10 mbar)
Pressure range	0.2 − 2 bar
CELL DENSITY	
Sensor	Digital sensor
Length	425 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
<u>Option 2</u>	Viable cell density based on capacitance Two ranges: $5 \cdot 10^5$ to $8 \cdot 10^8$ mammalian cells/ml 5 to 200 g/L dry weight
Pressure range	$0 - 3$ bar
Operation temperature	$0 - 60°C$ (max. sterilization temperature 135°C)
Autoclavable	Yes, max. temperature 135 °C
Probe accuracy	Mammalian cells in suspension $\pm 5 \cdot 10^4$ cells/ml - Fermentation ± 0.05 g/l dry weight

WEIGHT
Digital Balance (accuracy ± 0.1 g)

THERMOBOX	
Control system	Closed loop with electrical heater, heat exchanger and recirculating pump

EXTERNAL ADDITIONAL 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

JUPITER
INDICATIVE SPACE REQUIRED ON BENCH

75 CM WIDTH

110 CM LENGTH

Utilities and Service Connections

Utilities	Connection	Requirement
Electrical	Universal Power Supply 110 - 230 Vac 50-60Hz (1P + N + GND) 2 KW Cable & Plug	

Facility Water (Inlet)	Quick Connection For tube 4 x 6 mm	1,0 bar(g) 14,5-29,0 PSI(g)
Process Gas	Quick Connection For tube 4 x 6 mm	2,5-3,0 bar(g) 36,5-43,5 PSI(g)
Exhaust	Open	
Water Out (Drain)	Quick Connection For tube 4 x 6 mm	Open Drain

NB: the air supply MUST be oil free in order to avoid damages to the TMFCs

Chiller (option)

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

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

Chiller data sheet	
Working temperature range	-10 – 40 °C
Ambient temperature range	5 – 40 °C
Temperature stability	± 0.5 K

Filling volume range	4 – 8 L
Cooling output at 20°C measured with ethanol	0.60 kW
Cooling output at 10°C measured with ethanol	0.50 kW
Cooling output at 0°C measured with ethanol	0.36 kW
Cooling output at -10°C measured with ethanol	0.15 kW
Noise level	57 Db (A)
Power consumption	0.70 kW
Dimensions (WxDxH) in mm	350x480x595
Pump pressure max.	1.30 bar
Pump flow max. (pressure)	35 L/min
Pump connection thread	G 3/4 (Ø 15)

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

JUPITER is fitted with a Process Control System based on a 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, ect)

- 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 Configurator

- On line parameters calibration

- PID setting

- USB connection for free data extracting

- Remote control for after sale assistance. 100% assistance from our office

- 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.
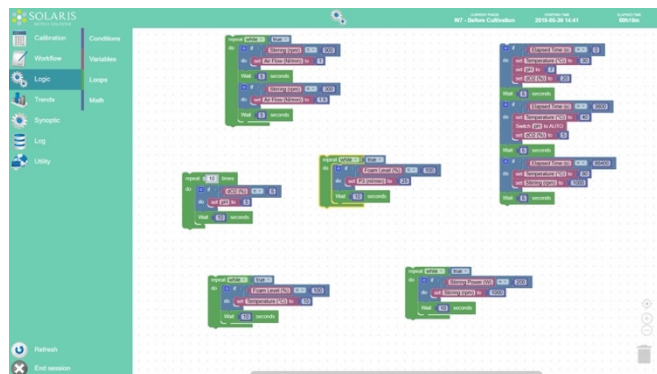
Do it parallel: smarter…faster

Leonardo can be used for process development (i.e. time-saving · parallel fermentation approaches). Up to 24 independent fermentations/cultivations can be carried out simultaneously.
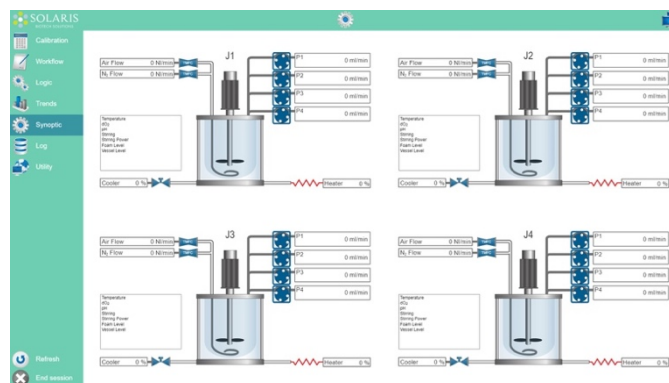
Example parallel synoptic

Do it wireless!

Increased mobility: users can roam around lab or reach the office without losing their connection with the running batch.