

# Elara ST

## Parallel autoclavable stirred photobioreactor

### Scope of supply

ELARA ST is a stirred jacketed photobioreactor ideal for phototrophic organisms such as Moss, Microalgae, Bacteria and plant cells.

The system consists of 4 L (total volume) autoclavable photobioreactor, bench-top, pre-assembled unit, supplied with all necessary tubes, valves and instruments, automation, control panel (HMI).

The system is designed for cultivation of phototrophic organisms including plant cells, bacteria, moss and microalgae. Its fully removable light module allows to use Elara as a traditional fermenter/bioreactor.

Light intensity is dimmable from 0–100% up to 3000  $\mu\text{mol}(\text{photon})/\text{m}^2$ , circadian cycle simulation is also available.

The control is based on a Supervisory Control and Data Acquisition control system.



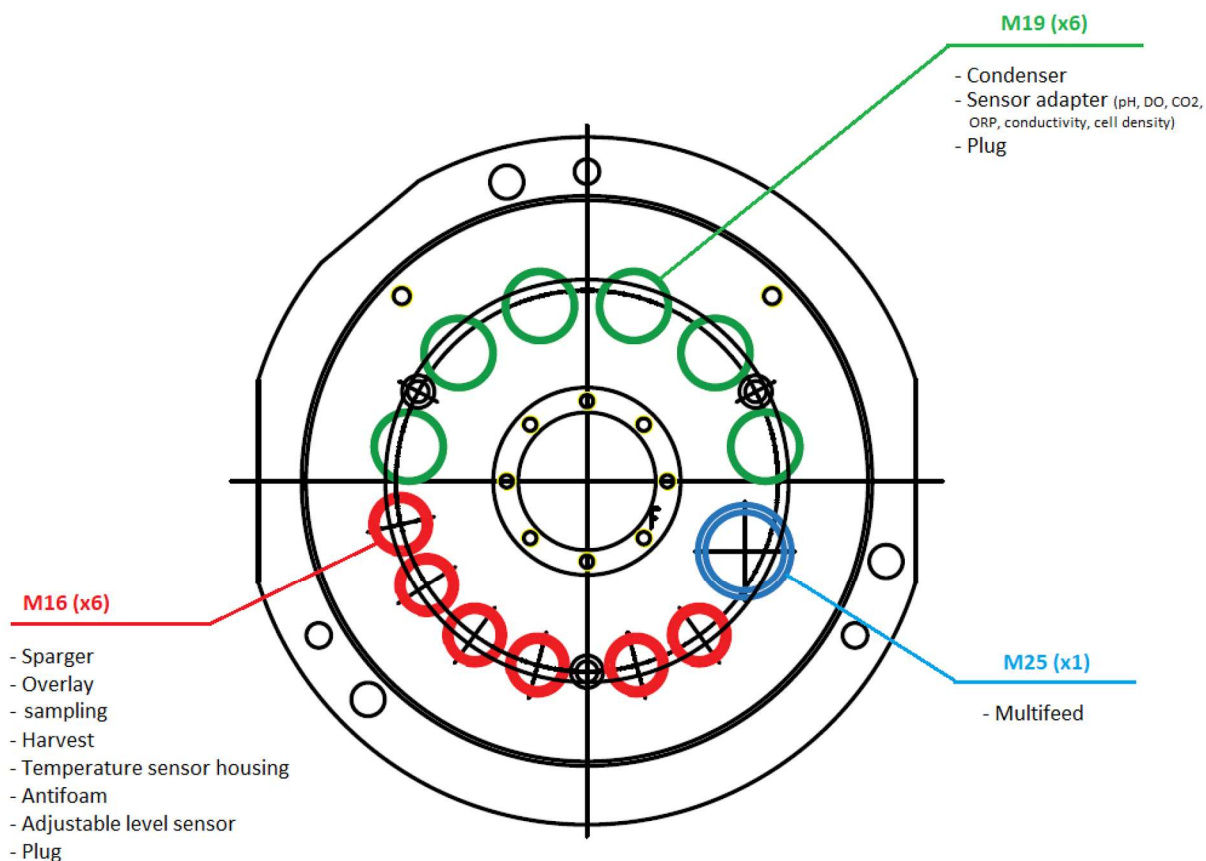
• INCLUDED

° OPTION

## Elara ST Data Sheet

### VESSEL

Total Volume	4.0 L
Working Volume (min-max)	1.0 – 3.0 L
Ratio D/H	1:3.25
Temperature range (vessel filled with water)	60 °C
Operating pressure (standard version) <u>Not controllable</u>	< 0.5 bar(g) with LEDA sterile sampling system < 0.3 bar(g)
Operating pressure (pressure version) <u>Controllable</u>	< 2.0 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/Harvesting n. 1 Temperature n. 1 Multifeed n. 2 Sensors DN12 (pH; dO <sub>2</sub> ; dCO <sub>2</sub> ..) n.1 Adjustable level sensor n.2 spare



Design	Borosilicate Glass Single Wall Vessel	
Materials	Vessel: Borosilicate Glass Others: AISI 316 L	
DIMENSIONS FOR AUTOCLAVE		
Height	705 mm	
Diameter	285 mm	
AGITATION		
Drive	• Brushless Motor Direct Assembly	
RPM	1-1800 RPM, Accuracy 1RPM	
Impeller type	Rushton, Marine or Pitched blade	
THERMOREGULATION		
Type	• Water Jacket and electrical heaters	
Control	PID Control for Heating and Cooling, Accuracy: 0.1°	
AERATION		
Gas control	• n.1 TMFC	Max. up to 5 TMFC
Gas mixing (AIR, N <sub>2</sub> , CO <sub>2</sub> , O <sub>2</sub> )	° numbers of TMFCs or n.4 solenoid valves	
Gas overlay	° TMFC	
Sparger	• Toro (ring) or Sintered (microbubbling)	
Input/Output 0.22 µm filters	•	
LIGHT MODULE		
Type and control	n.3 vertical bars with 6 white dynamic LEDs each Each LED consists of four chips: two dedicated to warm white light (2700 K) and two for cool white light (6500 K) - LED total power: 180W - LED brightness: 6120 lm Control assignable from software	
INTEGRATED PERISTALTIC PUMPS		
Quantity and type	• n.4 WM 114FD/DV	
Controller	Fixed Speed (regulated on/off) Function/Calibration assignable from software	
Speed	Watson Marlow 114FD/DV 60 rpm	
Flow rates <i>used H<sub>2</sub>O as liquid:</i> Marprene tubing, 1.6mm wall	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	

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PCS and SOFTWARE	
PCS (W x D x H)	• (35 cm x 35cm x 35 cm)
HMI	• Touch screen <b>PC</b> , 24" Color Monitor Power consumption 200W
Software	• Solaris Software Control Leonardo 3.0
Solaris Logic Parser Software	•
Data Extraction	• Through USB port or Ethernet/Wi-Fi
Graphs Trends, displaying in real time and in re-mote	•
On line Parameters Calibration	•
Warning and Alarms Management	• Dedicated mailing service upon request
Events Recording	•
Multipasspasswords Levels	•
OTHER ACCESSORIES	
LEDA Sterile Sampling System (up to 180 sterile samplings per batch)	◦ (option not available for Jupiter Pressure version)
Harvest/Sampling Tube (dip tube)	• ID 4mm
Sterile Additive Needle free connectors	• n. 4
COMMUNICATION	
n.4 Analog Input 0-10V and 0-20 mA/4-20mA  <i>Choice between:</i> - 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  <i>Choice between:</i> - 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)

## ELARA ST Controls (integrated in the PCS)

### TEMPERATURE

Sensor	PT100
Control range	0 – 150 °C
Probe 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 <sub>2</sub> ) for pH control

### dO<sub>2</sub>

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.

### LEVEL CONTROL Fixed lenght

Sensor	Solaris sensor (Fixed length)
Actuator	Peristaltic pump for the addition of antifoam solution or for feeding/harvesting

### LEVEL CONTROL Adjustbale height

Sensor	Solaris sensor (Fixed length)
Actuator	Peristaltic pump for the addition of antifoam solution or for feeding/harvesting

### REDOX (ORP)

Sensor	Digital sensor, Combination electrode
Length	425 mm
Measuring range	±1500 mV
Autoclavable	Yes, max. temperature 130 °C
Pressure range	0 - 6 bar
<b>CONDUCTIVITY</b>	
Sensor	Digital sensor
Length	425 mm
Measuring range	1 µS/cm to 300.000 µS/cm (unit of measurement: µS or mS)
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 dCO<sub>2</sub>, Cell Density, weight and peristaltic pumps.



## ELARA ST Controls (modular external box)

<b>dCO<sub>2</sub></b>	
Sensor	Analog sensor
Length	425 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
<b>TOTAL CELL DENSITY</b>	
Measuring range	0...6 AU
Accuracy	99.25%
Wave length	850 nm
Light source	LED

Optical path length	10 mm (5 or 10 mm upon request)
Sensor length (mm)	425 mm
Wetted material	Stainless steel 316L
Process temperature	0...90 °C, 141°C max.
Process pressure	max. 10 bar (150 psi)
Interfaces	RS485 Modbus
<b>VIALE CELL DENSITY</b>	
Measuring range	Capacitance: 0.0 to 400pF/cm
Cell Concentration Range (to be selected prior order confirmation)	Depends on cell sizes but typically: Yeast (6 µm): 106 cells/ml to 1010 Cells/ml Bacteria (1 µm): 109 cells/ml to 1013 Cells/ml Animal Cell (12 µm): 105 cells/ml to 109 Cells/ml Plant Cell (50 µm): 103 cells/ml to 107 Cells/ml
Accuracy	Typically better than ± 3% or ± 2% of the reading
Resolution	0.1 pF/cm
Precision	Typically <±0.5 pF/cm, no filter active
Stability	Better than ± 0.2 pF/cm at constant temperature with standard conductivity solution of ~12 mS/cm
Interfaces	RS485 Modbus
<b>WEIGHT</b>	
Digital Balance 36.0 kg (accuracy ± 0.1 g) Digital Balance 3.60 kg (accuracy ± 0.01 g)	
<b>ADDITIONAL EXTERNAL PERISTALTIC PUMPS</b>	
<b>WM 120 U Brushless</b>	
Type	WM 120 U Brushless
Controller	Variable speed Manual and automatic with function/calibration assignable from software
Speed	1-100rpm
Flow rates <i>used H<sub>2</sub>O as liquid:</i> (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
<b>WM 114 ST Stepper</b>	
Type	WM 114 ST

Controller	Manual and automatic with function/calibration assignable from software
Speed	0 – 100 RPM
Flow rates <i>used H<sub>2</sub>O as liquid:</i> (Marprene tubing, 1.6mm wall)	Stepper WM 114ST - ID 0.5 mm: 0.02 ml/rev - ID 0.8 mm: 0.04 ml/rev - ID 1.6 mm: 0.14 ml/rev - ID 2.4 mm: 0.29 ml/rev - ID 3.2 mm: 0.47 ml/rev - ID 4.0 mm: 0.67 ml/rev - ID 4.8 mm: 0.85 ml/rev



### Utilities and Service Connections

Utilities	Connection	Requirement
<b>Electrical</b>	Universal Power Supply 110 - 230 Vac 50-60Hz (1P + N + GND) 1.5 KW Cable & Plug	
<b>Facility Water (Inlet)</b>	Quick Connection For tube 4 x 6 mm	1.0 bar(g) 14.5-29.0 PSI(g)
<b>Process Gas</b>	Quick Connection For tube 4 x 6 mm	2.5-3.0 bar(g) 36.5-43.5 PSI(g)
<b>Exhaust</b>	Open	
<b>Water Out (Drain and condenser)</b>	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



## 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

ELARA 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

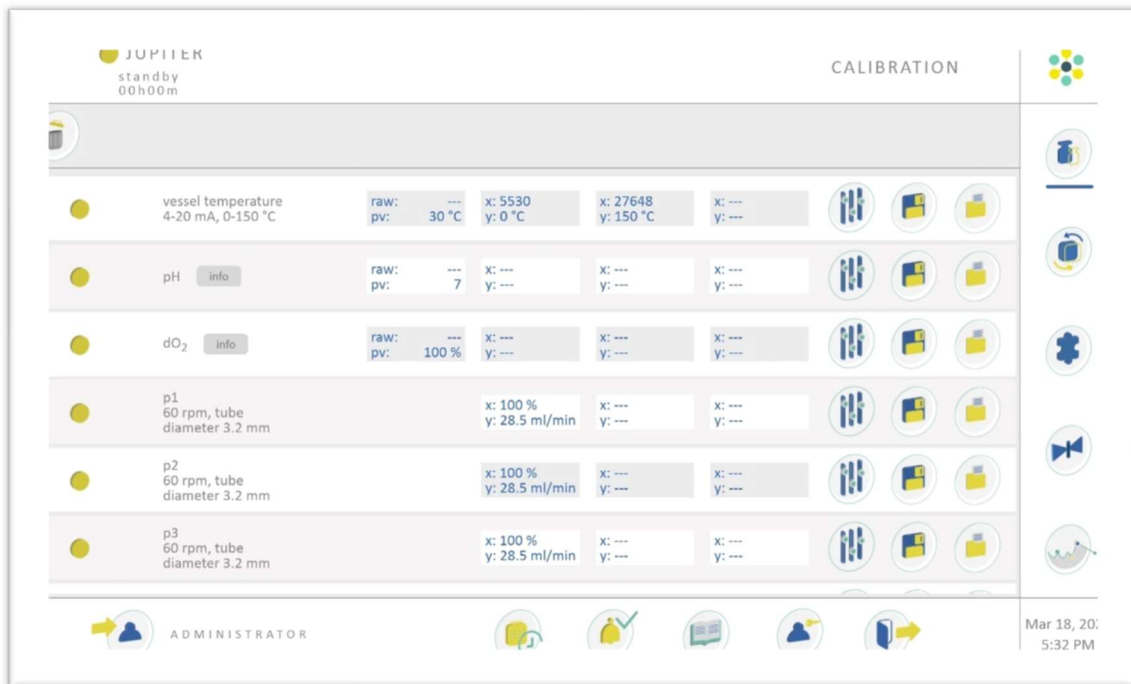
Solaris controlling software offers a simply laid out, yet powerful platform for experimental design planning and process control. The graphical user interface enables the intuitive selection and adjustment of control functions.

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
- Pressure control assignable from software
- Light system set up: The software allows automatic setup of wavelength and light intensity. Circadian cycle simulation available.

## Calibration



Sensors and Peristaltic pumps calibration  
Online calibration option (given reference)  
Offline calibration option (theoretical values)  
1, 2, or 3 points calibration  
Parallel calibration  
Probe info: diagnostic function

## Workflow



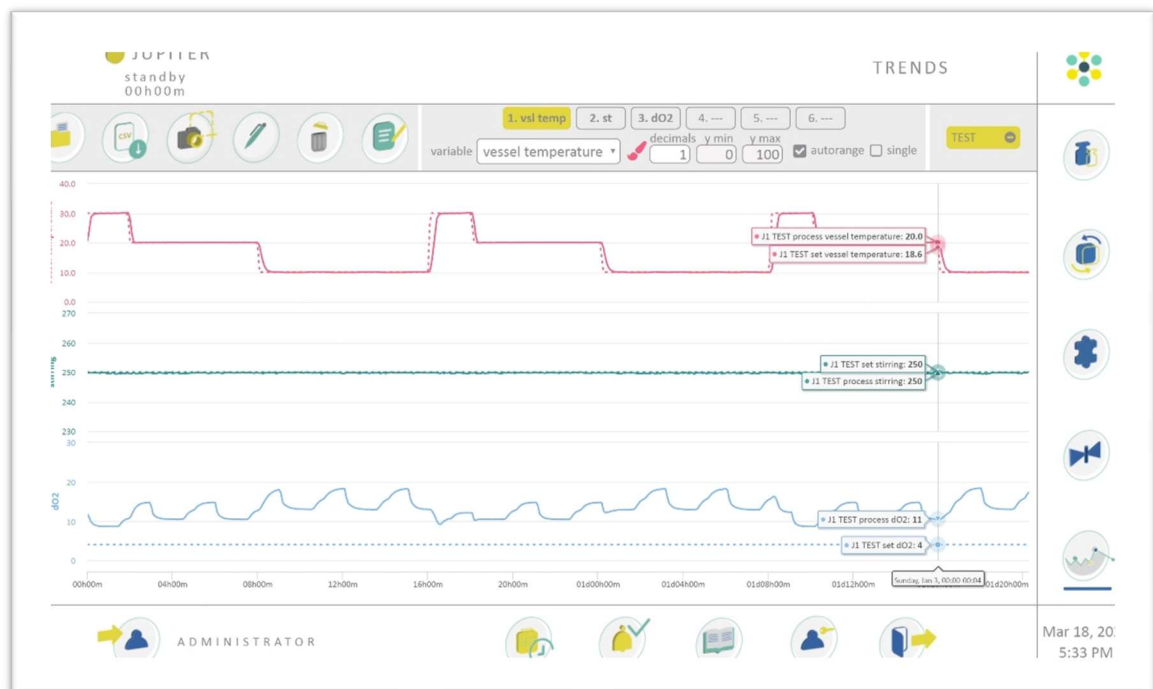
Phase Management: before cultivation, cultivation, customized (automatic switch)  
Set point: up to 100 set points in profile  
Apply to all function (parallel option)  
Process values  
Cascade control

## Synoptic



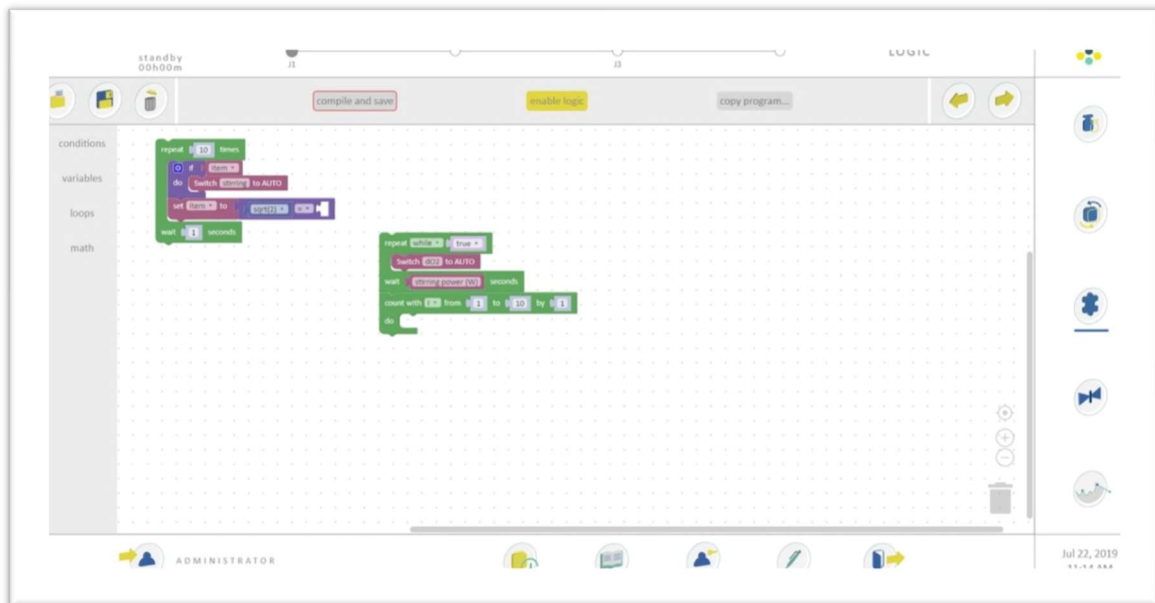
Process control visualization and manual control

## Trends



Real time trends  
Up to 6 parameters simultaneously  
Parallel view  
Phase display  
Data export in PDF or CSV format  
Data import (theoretical trends) in CSV format

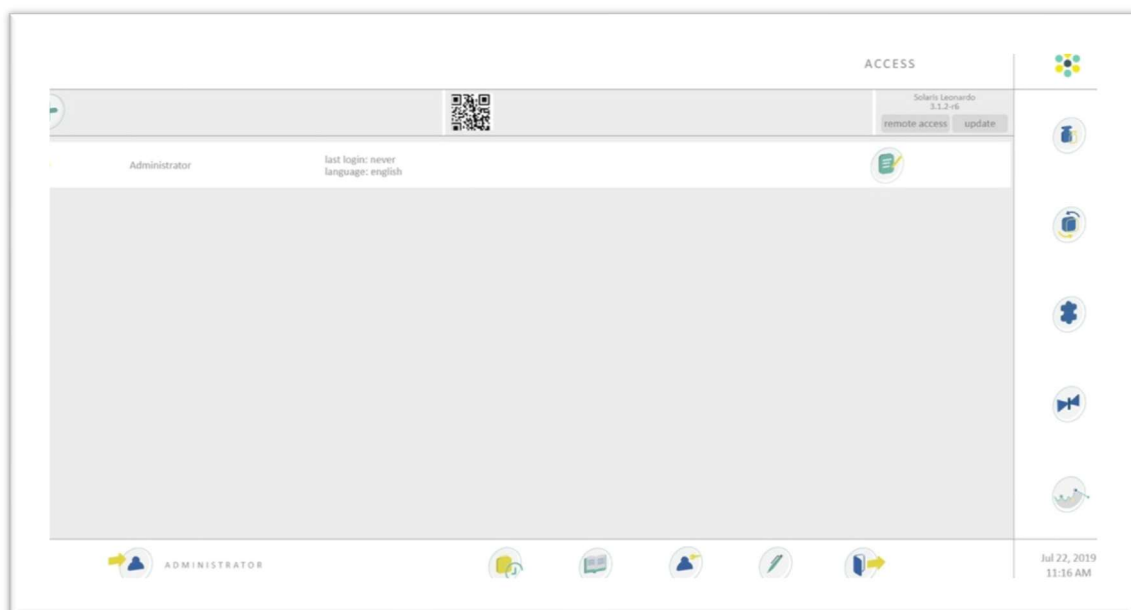
## Logic Parser



The Logic Parser allows the user to create customized logic functions through a dedicated, easy to use puzzle interface. Integrated with the automatic controls set in the Workflow page, the Logic Parser gives additional control when extra parameters are needed. Each logic block works in parallel with the others, allowing the user to use multiple logic functions simultaneously.

Each function can be constructed and applied to a single fermenter or multiple. They can be copied, pasted, disabled, rehabilitated, duplicated or deleted.

## Remote control



Create and manage all users (ID, password, operating language, privileges)

Remote control via QR code or dedicated portal

Remote access: pc, laptop