

## Illumination Instruction of 5L Plant cell Bioreactor



Link:

<https://www.laboao.com/products/glass-bioreactor-fermenter/glass-illumination-bioreactor>

Model	LBR-XGJG Series
Type	Plant Cell Illumination Bioreactor
Total volume	1/3/5/7/10/15L
Supported temperature range;	Cooling water temperature +5℃-50℃±0.2℃
Mixer rotation speed;	50-1000rpm
pH measurement range;	2-12
Approximate weight of the assembled bioreactors;	1-10L: About 95kg 15L: About 220kg
External dimensions of them.	1-10L: 67x83x96cm 15L:1150*810*1790
Vessel	stainless steel SUS316L+borosilicate Glass
Stirrer	Bottom Driven with Magnetic coupling (Top Driven and Airlift for optionl
Basic Features	Temperature,rpm,pH,DO,Antifoam,Feed,Aeration,Pressure
Advanced Features(optionl	Level,Weigh Feed,Multi-Feeds,Methanol &Ethanol,Exhaust O <sub>2</sub> &CO <sub>2</sub>
Features	Magnetically driven and powerful agitator without mechanical seal, suitable to cultures conducted in a long period and with ease of cleaning

No.	project	specific description
	5L tank system	<ul style="list-style-type: none"> <li>➤ Volume: The total volume is 5L, the maximum working volume is 70%.</li> <li>➤ Material: All stainless steel tank SUS316L (food sanitary grade) combined with part of borosilicate glass tank, convenient for teaching and demonstration, and easy to clean without dead corners inside</li> <li>➤ Diameter-to-height ratio: about 1:2 (diameter-to-height ratio can be customized according to requirements)</li> <li>➤ Surface treatment: internal and external mirror polishing, the accuracy of the tank is less than 0.4 um to reduce the chance of contamination, and the accuracy of the outer surface is less than 0.6 um.</li> <li>➤ Diameter-to-height ratio: about 1:2 (diameter-to-height ratio can be customized according to requirements)</li> <li>➤ Surface treatment: internal and external mirror polishing, the accuracy of the tank is less than 0.4 um to reduce the chance of contamination, and the accuracy of the outer surface is less than 0.6 um.</li> <li>➤ Tank body: design pressure 0.2Mpa, working pressure: 0.15Mpa</li> <li>➤ All interfaces are on the tank lid, easy to operate and large space utilization</li> </ul> <p>Tank cover sample:</p> 



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No.	project	specific description
	Intake system	<p>Consists of a rotor flowmeter, a sterile filter, a pressure regulator valve, etc.</p> <p>Design the flow rate of various gases according to the process requirements, and the maximum ventilation rate is designed according to 2 VVM</p> <p>Intake control: use a rotameter to manually control the intake</p> <p>Flow control: Rotameter manual control. Flow meter range: 0-8L/min.</p> <p>Design the flow rate of various gases according to the process requirements. The maximum ventilation rate is designed according to 2 VVM. The accuracy of the air filter element: 0.2um, the imported filter element ensures the sterility of the air entering the tank. The filter element is made of high temperature resistant, good hydrophobicity PTFE or Other suitable materials</p> <p>Intake method: Sanitary 316L stainless steel bottom annular gas distributor, professional design, uniform bubble distribution, and pores are not easy to be blocked</p>

No.	project	specific description
	light control	<p><u>There are 6 groups of detachable light sources installed on the glass part of the upper part of the reactor, which can independently control the switch to adjust the amount of light to meet the culture needs of most algae cells. The light control can be adjusted from 0-100% by PLC.</u></p> <p><u>Automatic control plan can also be set with different light time and density.</u></p>  <p>Option: 2-color combination ,and Illumination adjust one by one 3-color combination ,and Illumination adjust one by one</p>  
	Exhaust system	<p>With tail gas discharge condenser, hose connection, simple operation, no accumulation of liquid and no bacteria, manual control of the exhaust condensate spin clamp</p>



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No.	project	specific description
	Mixing system	<p>Mixing method: using upper mechanical stirring, using 316L stainless steel special stirring shaft material, precision processing, with ideal dynamic balance performance, proper ratio of upper and lower shafts, ensuring stable rotation speed and no deviation, good rigidity, and long-term use without deformation; the entire system is safe, stable and long-life.</p> <p>Stable and long life;</p> <ul style="list-style-type: none"> <li>➤ The parts in the tank are all installed on the tank lid, which is very convenient for maintenance and cleaning. The imported single-end mechanical seal is not easy to leak. The design of separating the motor and the tank body greatly reduces the weight of the tank body, and the operation is easier and more convenient, saving a lot of manpower.</li> <li>➤ Fermentation special blades, mixing form: six flat blades at the bottom, four-wide blade oblique blades in the middle, forming a two-stage blade system, the height of the blades is adjustable, there are both radial flow and axial flow, and the tank is stirred Good convection conditions can be formed inside, mechanically compressed defoaming paddle (first stage), 4 baffles per tank; different types of stirring paddles can also be replaced according to the special requirements of the fermentation process.</li> <li>➤ Servo motor, small size, fast response, no delay in starting PID               <ul style="list-style-type: none"> <li>– PID automatic control, stepless speed regulation, control speed: 50-1000rpm, control accuracy: <math>\pm 0.5\%</math> (servo motor can be used, small size, rapid response, no delay in starting)</li> </ul> </li> <li>➤ The controller can realize: DO related cascade, curve analysis, batch report analysis, alarm, data storage, sequence control (set according to the fermentation time zone, automatic variable control, at least 10 segments), etc.</li> </ul>
	Temperature detection control	<p>The jacketed water bath is electrically heated, the jacketed water is circulated, and the circulating pump control has the function of self-escaping air, water cut and over-temperature protection, and has good heat exchange efficiency.</p> <p>Temperature control adopts PID automatic control mode, and PID parameter adjustment can be realized on the control software. The Pt100 electrode can be sterilized repeatedly, and the electrode calibration function can be completely calibrated by the system software.</p> <p>Temperature control: cooling water temperature <math>+5^{\circ}\text{C}-50^{\circ}\text{C}\pm 0.2^{\circ}\text{C}</math>, display temperature: <math>0-150^{\circ}\text{C}\pm 0.1^{\circ}\text{C}</math></p> <p>Sequential control of the fermentation process (set according to the fermentation time zone, temperature automatic variable control, at least 10 stages)</p>



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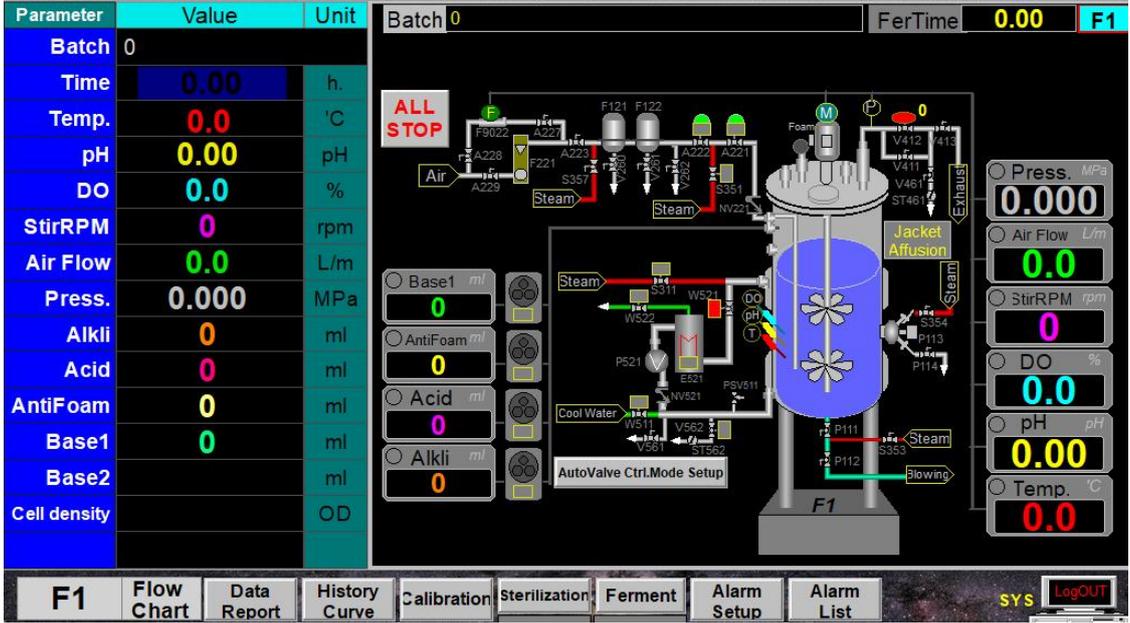
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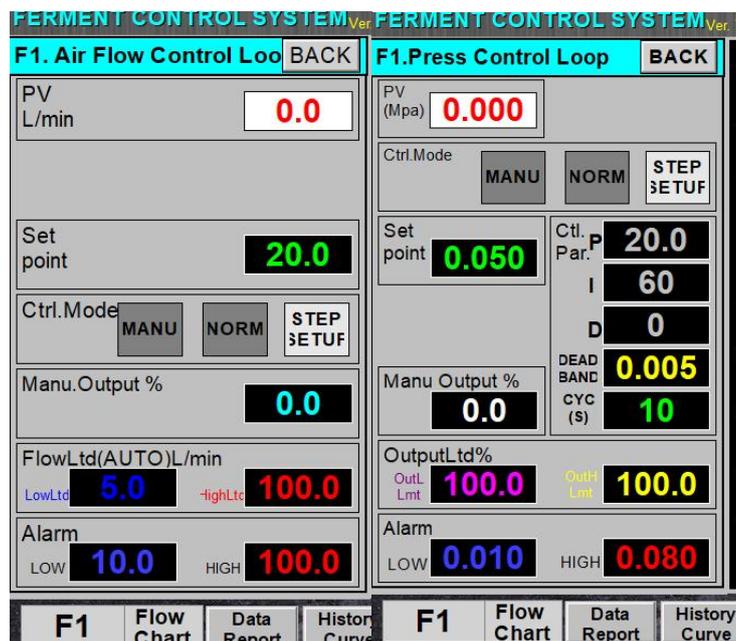
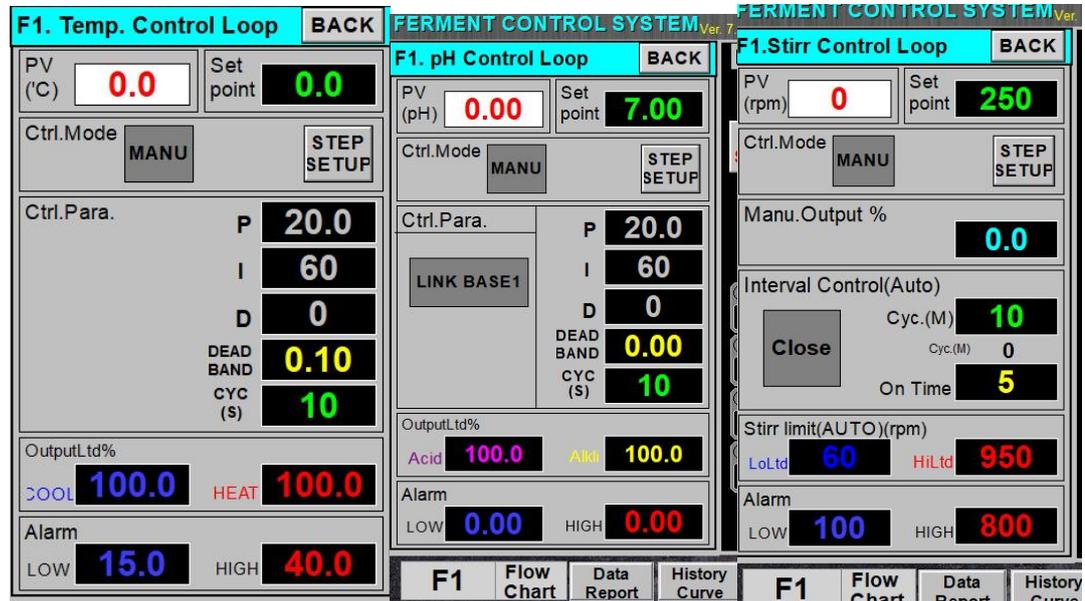
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No.	project	specific description
	pH control	<p>Using intelligent PID control, high control accuracy, not easy to produce fluctuations, Switzerland imported electrode and shielded wire detection, peristaltic pump switch to control the flow of acid and alkali, automatic control, automatic measurement. The electrode can be sterilized repeatedly, and the calibration function is completely calibrated by the system software.</p> <ol style="list-style-type: none"> <li>1. PH electrodes and wires imported from Switzerland</li> <li>2. Display range: 0.00~14.00±0.01, automatic control range: 2.00~12.00±0.02</li> <li>3. Online detection, automatic alarm, peristaltic pump automatically add acid and alkali</li> <li>4. PID intelligent fuzzy control.</li> </ol> <p>The controller can realize: Ph value curve analysis, acid addition, alkali addition volume curve analysis, batch report analysis, acid addition volume cumulative display record, alkali addition volume cumulative display record, sequence control (set according to fermentation time section, automatic variable Control, at least 10 paragraphs) etc.</p>
	DO control	<p>The DO electrode and VP shielded wire imported from Switzerland are tested, and the DO value , replenishment, air flow (if configured) and other parameters for associated control.</p> <p>Control range: 0~150%, ±3% fermentation process sequence control (according to fermentation time, DO automatic variable control, at least 10 stages)</p> <p>The controller can realize: curve analysis, batch report analysis, alarm, data storage, sequence control (set according to the fermentation time zone, automatic variable control, at least 10 segments), etc.</p>
	Feed control	<p>High-quality brand peristaltic pumps can be set to add materials, acids, alkalis, defoamers, etc., and the functions of each peristaltic pump can be switched.</p> <p>There are 4 peristaltic pumps equipped, and the flow rate is 0-50mL/min.</p> <p>Peristaltic pump switch control (manual, automatic, and off), automatic feeding and metering (according to fermentation time, automatic variable control of feeding, at least 10 stages)</p>
	Foam control	<p>With defoaming electrode, automatic detection of foam, peristaltic pump time ratio automatically add defoamer. The role of the peristaltic pump can be selected and set on the control interface, which makes the user more convenient and flexible in actual use. Equipped with specially designed replenishment pins to ensure the safe operation of replenishment.</p>
	spare parts	<p>There are 4 autoclavable glass bottles and accessories, Sartorius 0.2um Syringe filters (4), water pipes and accessories, silicone tube (20 meters), rubber stoppers, spring clips, fuses, Inoculation loop, feeding needle</p>
	Control System	<p>BIOTECH-7000 biological process controller (see controller introduction for details)</p>

## Control System

No.	parameter
BIOTECH-7000 biological process controller	<p>The BIOTECH-7000 biological process controller uses an industrial control computer combined with Siemens PLC control, MCGS touch screen control, and the performance of the screen is simple and clear, and the operation is simple and convenient</p>
	<p>Control parameters: temperature, speed, PH, DO, replenishment, defoaming and other parameters for detection, recording, and control settings; pH and DO electrodes can be easily calibrated through software; air flow, tank pressure</p>
	 <p>The screenshot displays the control interface for a fermentation tank. On the left, a table lists parameters and their current values: Batch (0), Time (0.00 h), Temp. (0.0 °C), pH (0.00), DO (0.0 %), StirRPM (0), Air Flow (0.0 L/m), Press. (0.000 MPa), Alkali (0 ml), Acid (0 ml), AntiFoam (0 ml), Base1 (0 ml), Base2 (0 ml), and Cell density (OD). The central part of the screen shows a detailed process diagram of a fermentation tank with various inputs like Air, Steam, and Cool Water, and outputs like Exhaust and Blowing. On the right, there are digital readouts for Press. (0.000 MPa), Air Flow (0.0 L/m), StirRPM (0 rpm), DO (0.0 %), pH (0.00), and Temp. (0.0 °C). At the bottom, there are several control buttons including 'F1', 'Flow Chart', 'Data Report', 'History Curve', 'Calibration', 'Sterilization', 'Ferment', 'Alarm Setup', 'Alarm List', 'SYS', and 'LogOUT'.</p>
	<p>Control the number of tanks: One controller can control multiple sets of fermentation tanks at the same time.</p>

It can control the stirring speed, the temperature of the medium in the tank, the Ph value, the DO value, etc.;



The upper and lower limits of temperature, rotation speed, Ph value, DO value, etc. can be set, and the limit alarm function is provided;

Parameter	Value	Unit	F1. Alarm Setup			
Batch	0		Temp.	LOW 15.0	HIGH 40.0	Alarm Status <input type="radio"/> Alarm OFF
Time	0.00	h.	pH	LOW 0.00	HIGH 0.00	Alarm Status <input type="radio"/> Alarm OFF
Temp.	0.0	°C	DO	LOW 20.0	HIGH 120.0	Alarm Status <input type="radio"/> Alarm OFF
pH	0.00	pH	StirRPM	LOW 100	HIGH 800	Alarm Status <input type="radio"/> Alarm OFF
DO	0.0	%	Air Flow	LOW 10.0	HIGH 100.0	Alarm Status <input type="radio"/> Alarm OFF
StirRPM	0	rpm	Press.	LOW 0.010	HIGH 0.080	Alarm Status <input type="radio"/> Alarm OFF
Air Flow	0.0	L/m	Alkii	HIGH 0	Alarm Status <input type="radio"/> Alarm OFF	Foam <input type="radio"/> Alarm OFF
Press.	0.000	MPa	Acid	HIGH 0	Alarm Status <input type="radio"/> Alarm OFF	
Alkii	0	ml	AntiFoam	HIGH 0	Alarm Status <input type="radio"/> Alarm OFF	
Acid	0	ml	Base1	HIGH 0	Alarm Status <input type="radio"/> Alarm OFF	
AntiFoam	0	ml				
Base1	0	ml				BACK
Base2	0	ml				
Ex.O2		%				
Ex.CO2		%				

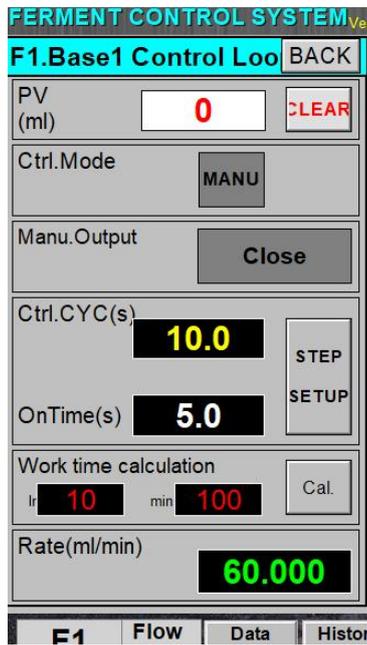
SYS

All alarm accidents can be recorded and consulted;

Parameter	Value	Unit	Alarm Data Report							
Batch	0		Number	Date	Time	Object name	Alarm type	arm val	alarm descriptio	<input type="button" value="Lightbulb"/> <input type="button" value="Up Arrow"/> <input type="button" value="Down Arrow"/> <input type="button" value="BACK"/>
Time	0.00	h.	0	2021/09/30	21:12:00	F1_FD	Upper limit ≥0			
Temp.	0.0	°C	1	2021/09/30	21:12:00	F1_AF	Upper limit ≥0			
pH	0.00	pH	2	2021/09/30	21:12:00	F1_PHS	Upper limit ≥0			
DO	0.0	%	3	2021/09/30	21:12:00	F1_PHU	Upper limit ≥0			
StirRPM	0	rpm	4	2021/09/30	21:12:00	F1_pH	Upper limit ≥0			
Air Flow	0.0	L/m	5	2021/09/30	21:12:00	F1_FD	Lower limit ≤0			
Press.	0.000	MPa	6	2021/09/30	21:12:00	F1_AF	Lower limit ≤0			
Alkii	0	ml	7	2021/09/30	21:12:00	F1_PHS	Lower limit ≤0			
Acid	0	ml	8	2021/09/30	21:12:00	F1_PHU	Lower limit ≤0			
AntiFoam	0	ml	9	2021/09/30	21:12:00	F1_P	Lower limit ≤0			
Base1	0	ml	10	2021/09/30	21:12:00	F1_F	Lower limit ≤0			
Base2	0	ml	11	2021/09/30	21:12:00	F1_ZS	Lower limit ≤0			
Cell density		OD	12	2021/09/30	21:12:00	F1_DO	Lower limit ≤0			
			13	2021/09/30	21:12:00	F1_pH	Lower limit ≤0			
			14	2021/09/30	21:12:00	F1_T	Lower limit ≤0			
			15	2021/09/30	21:05:54	F1_FD	Upper limit ≥0			
			16	2021/09/30	21:05:54	F1_AF	Upper limit ≥0			
			17	2021/09/30	21:05:54	F1_PHS	Upper limit ≥0			
			18	2021/09/30	21:05:54	F1_PHU	Upper limit ≥0			
			19	2021/09/30	21:05:54	F1_pH	Upper limit ≥0			
			20	2021/09/30	21:05:54	F1_FD	Lower limit ≤0			

SYS

It has the function of replenishment measurement; regular and quantitative replenishment;



**FERMENT CONTROL SYSTEM**

**F1.Base1 Control Loop** BACK

PV (ml) **0** CLEAR

Ctrl.Mode **MANU**

Manu.Output **Close**

Ctrl.CYC(s) **10.0** STEP

OnTime(s) **5.0** SETUP

Work time calculation  
 Ir **10** min **100** Cal.

Rate(ml/min) **60.000**

F1 | Flow | Data | Histor

The system has multiple related controls: the related control of speed and dissolved oxygen, the related control of feeding and dissolved oxygen, the related control of feeding and ph, etc.;



**F1.DO Control Loop** BACK Batch 0 FerTime 0.00 F1

PV (%) **0.0** Set point **50.0**

Ctrl.Mode **MANU** STEP SETUP

Ctrl.Para. P **20.0**  
 Cascade Ctrl with Speed I **60**  
 Cascade Ctrl with airFlow D **0**  
 LINK BASE1 DEAD BAND CYC (s) **10**

OutputLcd%  
 REV **100.0** **100.0**

Alarm LOW **20.0** HIGH **120.0**

**F1.DO Cascade Control with Stir Speed**

Cascade Control Switch: **Close**

ZQ **120.0** CountDown(s): **120**

Ctrl.Cyc(s): **120.0** with DO PID\_Out

BH **5.0** UNLINK

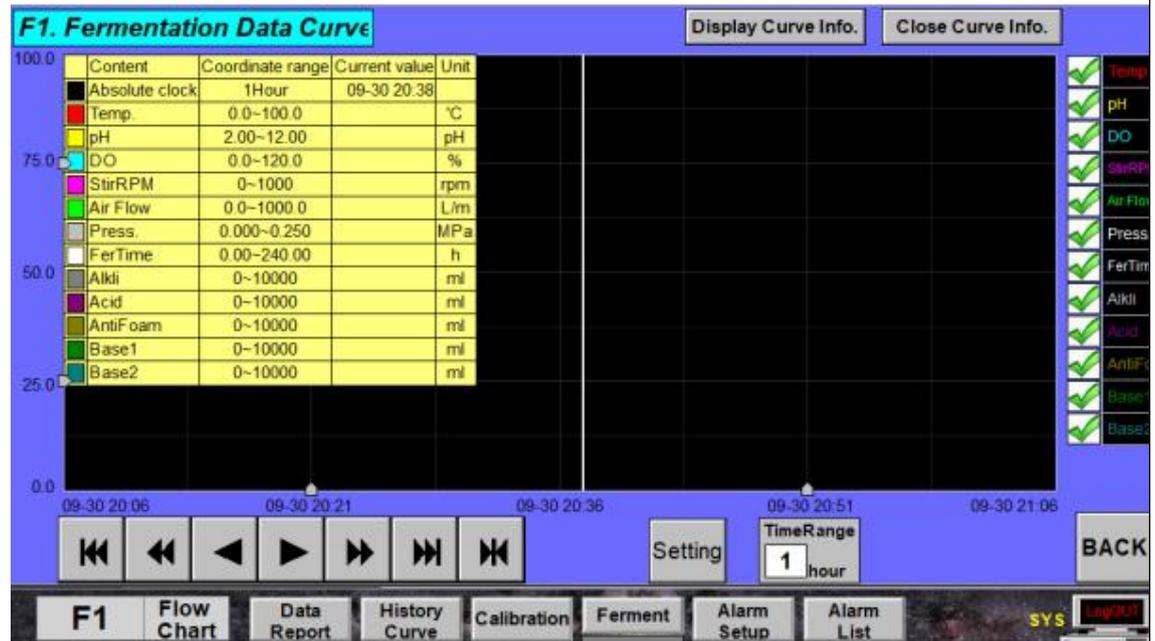
Note: Unlink with the DO PID\_Out, the speed setpoint Inc. or dec. by one step in a cycle.  
 Link with the DO PID\_Out, the speed setpoint Inc. or dec. by one step multiply DO.PIDOut(0-1.0) in a cycle.

Press: **0.000**  
 Air Flow: **0.0**  
 Stir RPM: **0**  
 DO: **0.0**  
 PH: **0.00**  
 Temp: **0.0**

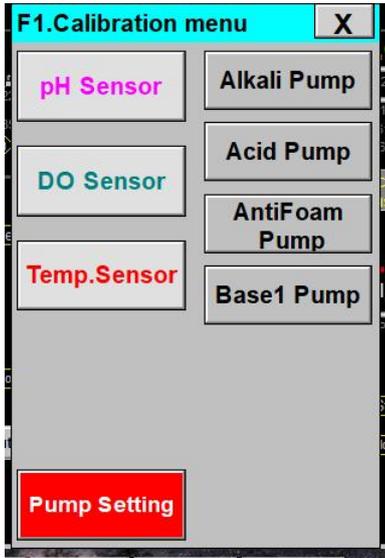
F1 | Flow Chart | Data Report | History Curve | Calibration | Sterilization | Ferment | Alarm Setup | Alarm List | SYS



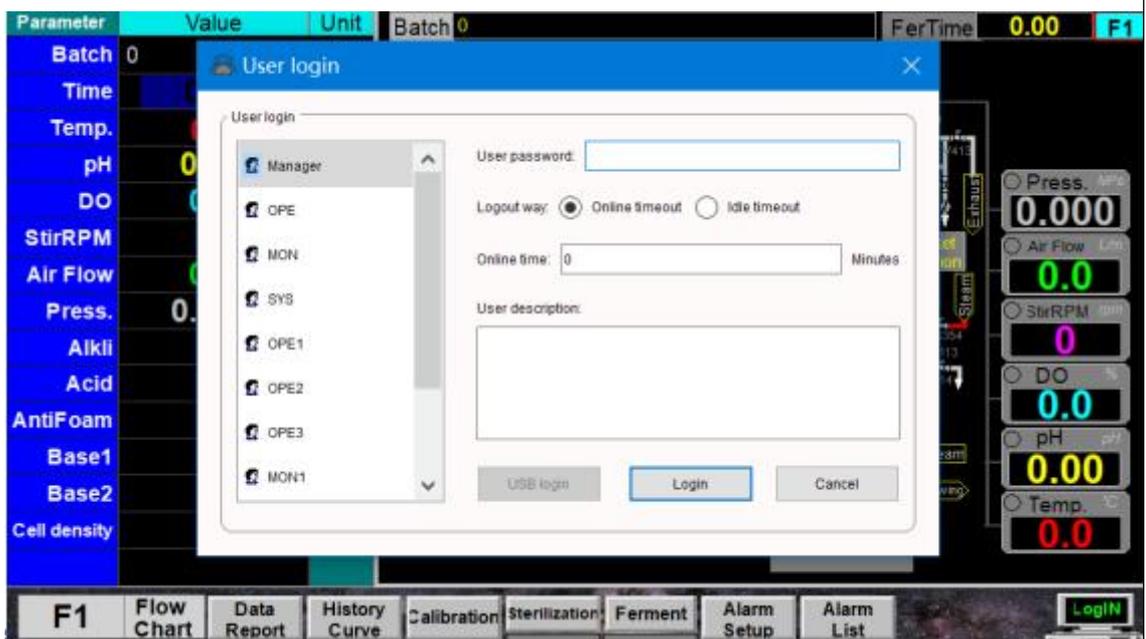
The system has the functions of real-time display, data recording, data analysis (bar graph, curve graph and batch report), output printing, password management, abnormal analysis and other functions of the running process, and a Chinese interface. The record screen can display multiple different curves at the same time, and more curves can be displayed in sequence if necessary;



The temperature, DO and PH sensors can be adjusted and adjusted, and the flow rate of each peristaltic pump can be calibrated.



Possess three-level management authority, operation has password protection function, the password is divided into operator and administrator level passwords



Data save

It can save at least 1000 batches of fermentation data, and can check the history. Store data by batch number, with audit trail function, optional export data storage format compatible with EXCEL, can be processed on the EXCEL platform, or exported to PDF format, the file cannot be modified.



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**F1.Ferment Setting**
Note: the fermenting batch number is the only one that can't be repeated!
Free Memory: 80629.000
F1 0.000

No.	Batch	Start Date	End Date	Timer	Memo	State
1	0	0	0	0	0	0

-5
0
0
0
0
0

↑
▲
▼
↓
↕
Lines: 0 / 1
EDIT
Delete
FERMENT

This record data export
Save to USB PDF file
Save to USB CSV file
BACK

F1
Flow Chart
Data Report
History Curve
Calibration
Ferment
Alarm Setup
Alarm List
SYS
LogOUT

**FERMENT CONTROL SYSTEM** Ver. 8.2.B6\_A2 User edit 10144
Date 2022-12-26 14:34:31
Exit

Parameter	Value	Unit
Batch	0	
Time	0.00	h.
Temp.	0.0	°C
pH	0.00	pH
DO	0.0	%
StirRPM	0	rpm
Air Flow	0.0	L/m
Press.	0.000	MPa
Alkali	0	ml
Acid	0	ml
AntiFoam	0	ml
Base1	0	ml
Base2	0	ml
Ex.O2		%
Ex.CO2		%

Batch 0
FerTime 0.00
F1

Valves mode Setting

- Base1 ml
- AntiFoam ml
- Acid ml
- Alkali ml

Tank Ste

Setting

Setup: 96.0 0.0 0.0

Real: 96.0 100.0 0.0

Lamp 1 Lamp 2 Lamp 3

Press. MPa: 0.000

Air Flow L/m: 0.0

StirRPM rpm: 0

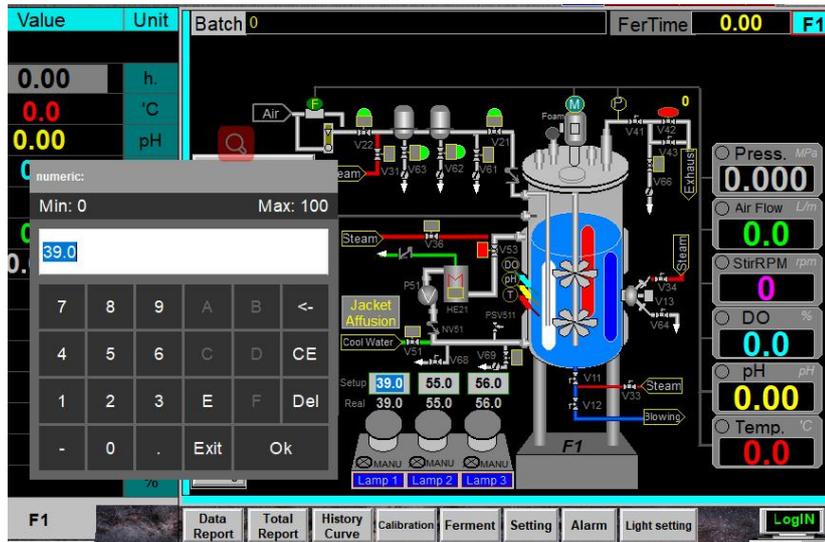
DO %: 0.0

pH pH: 0.00

Temp. °C: 0.0

1
F1
Data Report
Total Report
History Curve
Calibration
Ferment
Setting
Alarm
Light setting
SYS
LogOUT

**Illumination control**



**Instruction:**

1. Manual adjustment: real-time control by manual input(real-time input percentage), when button 2 is gray and off. (It is recommended that if you want to turn the light bright, try to adjust it at 30%-100%), as shown in Figure 1-2.

Note: The setup value in these blocks is also the default brightness value of the "intermittent time period" in Illumination plan setting.

2. Full brightness: If the gray button is clicked and it turns red, it means that the light is 100% full brightness.

3. Automatic adjustment: click light setting. Enter the automatic adjustment setting interface. As shown in below picture.

**Working time and mode setting:**

Project	1		2		3		4		Ctrl.Mode
	Working phase (hr.)		Working phase (hr.)		Working phase (hr.)		Working phase (hr.)		
	Start	End	Start	End	Start	End	Start	End	
	Intensity of light (%)		Intensity of light (%)		Intensity of light (%)		Intensity of light (%)		
Lamp 1	6.0	8.0	10.0	12.0	14.0	16.0	16.0	23.0	MANU
	50.0		0.0		33.0		44.0		
Lamp 2	9.0	24.0	0.0	9.0	0.0	0.0	0.0	0.0	MANU
	0.0		0.0		0.0		0.0		
Lamp 3	6.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	MANU
	0.0		0.0		0.0		0.0		

**Note**  
 Working time to one day (24 hours) as the cycle, 0 as the starting point, the work stage according to the time order!  
 The working mode is automatic and manual, automatic operation according to the working stage, manual is closed!  
 The button below opens to force open, that is, automatically closed also force open!

BACK

Data Report | Total Report | History Curve | Calibration | Ferment | Setting | Alarm | Light setting | LogIN

### Major component brand manufacturers

No.	The key components	Specification/Model	Brand origin
1.	Tank	5L, Borosilicate+ 316L	
2.	PH electrode	EASYFERM PLUS PHI K8 225	HAMILTON
3.	PH cable	Swiss imported Hamilton wire 3m	HAMILTON
4.	DO electrode	OXYFERM FDA VP 225 from Switzerland	HAMILTON
5.	DO cable	Swiss imported Hamilton wire 3m	HAMILTON
6.	DO cable	Swiss imported Hamilton wire 3m	HAMILTON
7.	Temperature sensor	Pt100	LABOAO
8.	Illunimation Adjuster	Single color	LABOAO
9.	Voltage Aparatus	Schneider	SCHNEIDER
10.	Stirring motor	servo motor	DORNA



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No.	The key components	Specification/Model	Brand origin
11.	Frequency converter	Danfoss	DANFOSS
12.	Intake flow meter	1:2VVM	CHINA
13.	Thermal mass flow meter -Option	0-50L/min	Vogtlin
14.	Air fine filter	0.22um	SHYM
15.	Temperature electrode	Pt100	LABOAO
16.	Peristaltic pump	OEM	LONGERPUMP
17.	Controller	Type 7000AS, stainless steel	LABOAO
18.	PLC	S7-200smart	Siemens
19.	HMI	10.5'	MCGS