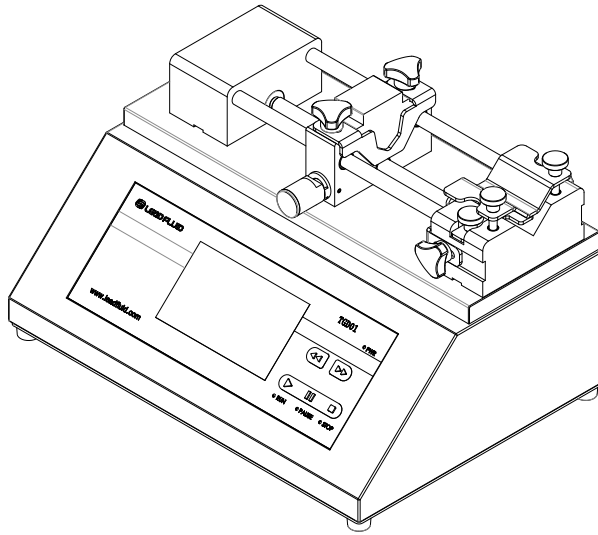
TGD01 Precision High Pressure Laboratory Syringe Pump Operation Manual



BAODING LEAD FLUID TECHNOLOGY CO.,LTD.

Safety Caution

Please read the following safety precautions to ensure that the correct use of syringe pump. Wrong operation may cause dangerous situation, and cause personnel injury or equipment damage.

Danger: Please use the power as the same as the nameplate on the equipment, or it will damage the equipment!

Please do not remove or remold the equipment, or it will cause the malfunction, even the electrical shock!

About the maintenance of the equipment, please contact with the dealers or the company.

Danger: in the process of the syringe pump operation, please don't near the screw of the rotating parts, prevent the fingers and clothing were involved in machinery agency!

Danger: When installing the syringe, adjust the limit block to the appropriate position at the same time to prevent accidental damage to the syringe!

Our company is not responsible for losses caused by damaged syringes, especially including leakage of toxic and harmful and valuable liquids.

Please power off and choose the good ground wire, when install and knock down the external control equipment, prevent damaging the equipment and the electric shock!

Warning: This product is not designed for, not intended for use in patient connected applications, including but not limited to medical and dental use.

Catalogue

Description

TGD01 is a single channel high pressure syringe pump, transmission of linear thrust> 200lbs in a wide range of flow rate, support five working modes such as infuse and withdraw. RS485 communication, compatibility MODBUS protocol, all metal shell, wide range power input, adapt to various occasions.

TGD01 apply single syringe 0.5ul-140ml, linear velocity 0.36μm/min - 190mm/min

Applications

- High thrust injection
- High viscosity liquid injection
- Micro injection
- Injection into high pressure vessel

Function and Feature

- Variable working mode.
- Color LCD touch screen, fast and convenient operation.
- Support screen lock, key mute operation.
- Button with indicator light, clearly working state.
- Support for a variety of syringes.
- It is very suitable for stainless steel syringe
- Accurate and stable flow rate

- Accuracy and stability of liquid injection
- Easy to complex programming without computer
- Prestore multi-group of data.
- The high accuracy control.
- Syringe protection and blockage alarm
- RS485 communication，support Modbus protocol.
- The external signal control start-stop and direction.
- Wide range power input.
- All metal shell.

Components and Connectors

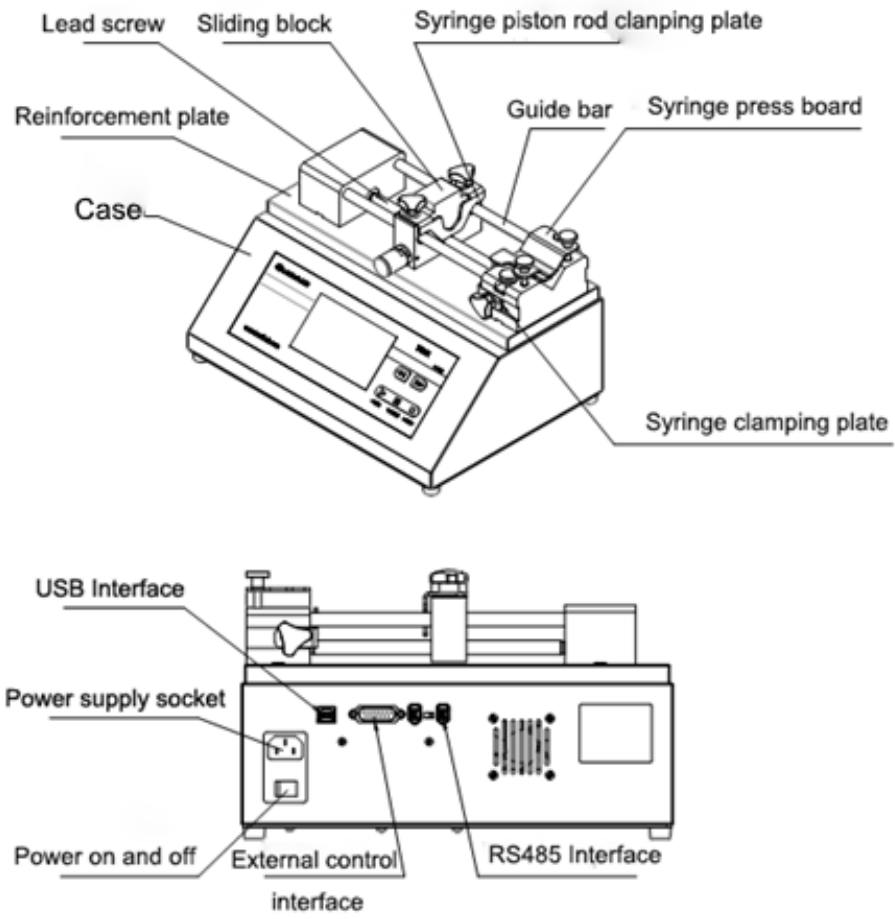


Figure 1 Components and Connectors

Display Panel and Operating Keypads

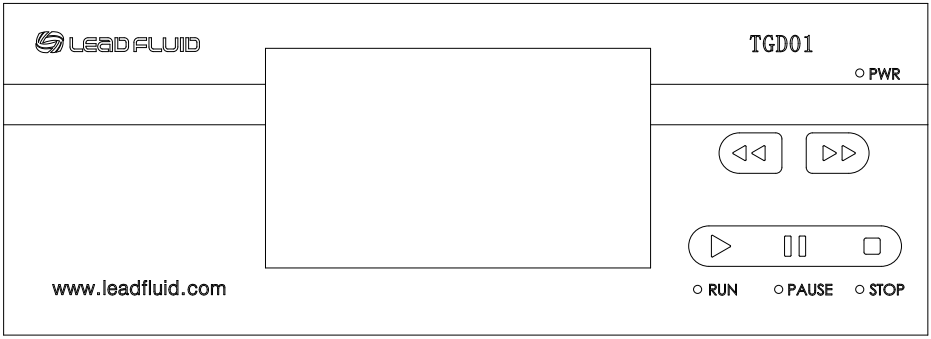


Figure 2 Display pane

Keypads

：Start key: Use to start or continue to set the movement process.

：Pause key: Pause the working process.

：Stop key: Stop working process, reset working process.

：Fast forward key: In stop state, long press this button to top speed rapid advance.

：Come back key: In stop state, long press this button to top speed quick return.

Blue indicator light: Power light, this mean power had been opened.

Green indicator light: When the movement process starts, the indicator is

on.

Yellow indicator light: Pause lights, the process of movement in pause mode, the indicator is on.

Red indicator light: When running process to terminate or to finish, the indicator is on for a long time.

When the motor stall, the light is flashing.

Touch Screen Display

- **Numerical value input**

Click on the numbers, numerical input dialog The diagram blow.

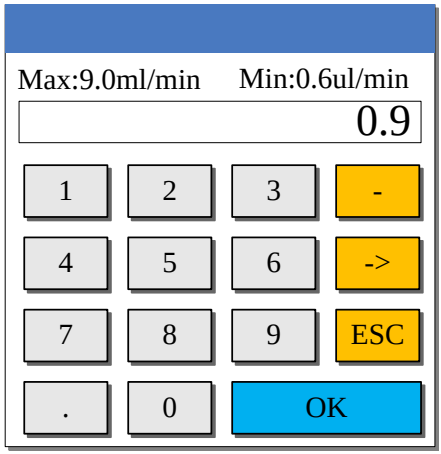


Figure 3 Flow Input Window

MAX：Display the input values of the maximum.

MIN：Display the input values of the minimum.

-> :Delete the last input number.

ESC：Give up the current input values.

OK：Confirm the current input values.

- **Keypad instruction**


The return key: Return to the previous interface.


Confirmation key: Current value and save.


Give up key: Give up current changes, not saved.


The next page: Get to the next page.


Back: Return to the previous page.

- **Main interface instruction**

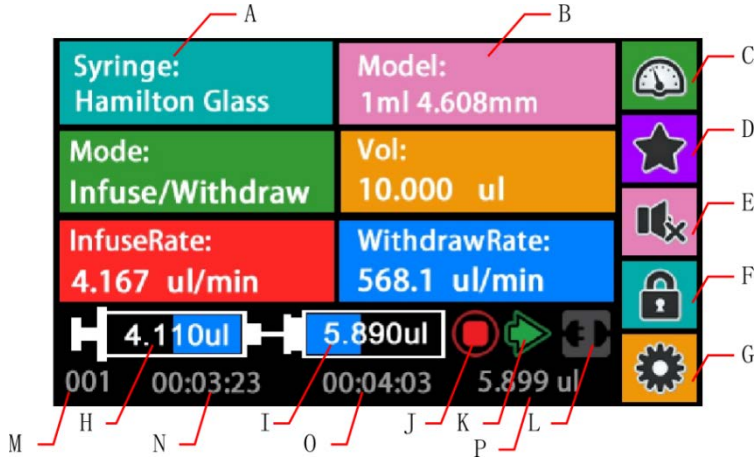


Figure 4 Main interface specification

A 

Display syringe manufacturers. Click here to enter the injector manufacturers choose interface, the following figure. If display the Custom, it is user-defined syringe.

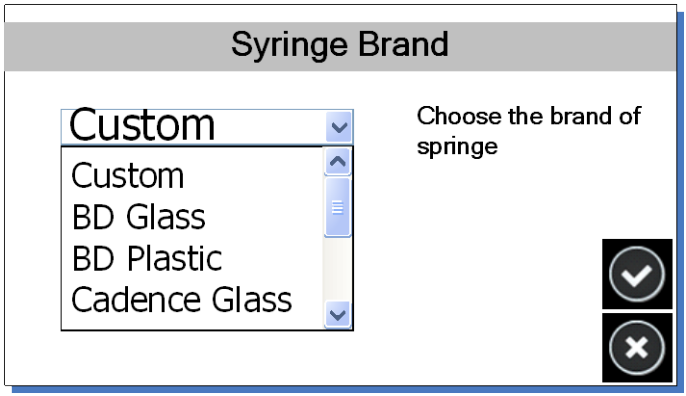


Figure 5 Syringe manufacturer choose interface

B: 

Show syringe specification, the inner diameter of the syringe and the syringe volume respectively. Click into the syringe specification selection interface, as the below chart.

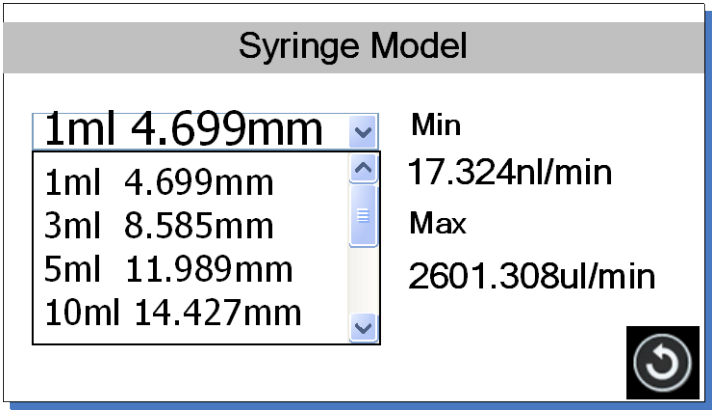


Figure 6 Syringe model choose interface

If syringe manufacturer selection for Custom, click Custom syringe set into the interface, as below chart.

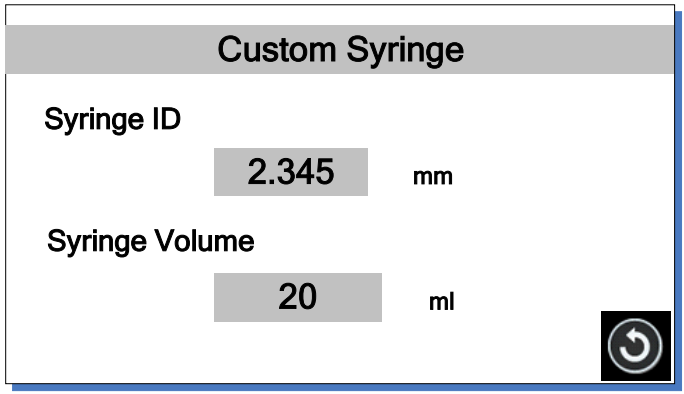


Figure 7 Custom syringe interface

C: 

Process parameter setting, click icon enter into process parameter setting as below chart

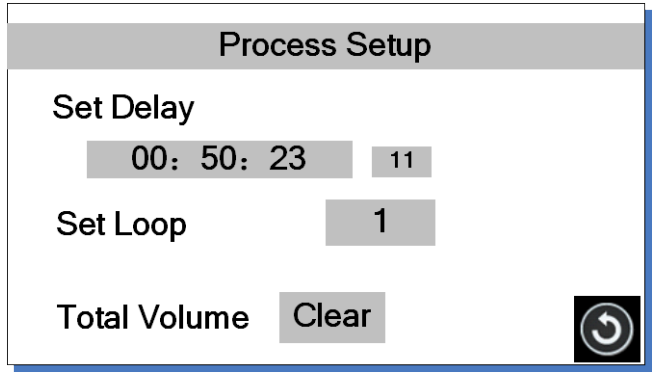


Figure 8 Process parameter setting interface

- Set in motion of delay: delay, set the process of motion, first delay then operation.
- The number of repeat: set the operation process of the number of repeat.

- The accumulative fluid volume: to clean accumulated fluid volume into zero.

D: 

Fast setting, click the icon to enter quick setting interface, quick call restore of three groups of different data, the following figure .

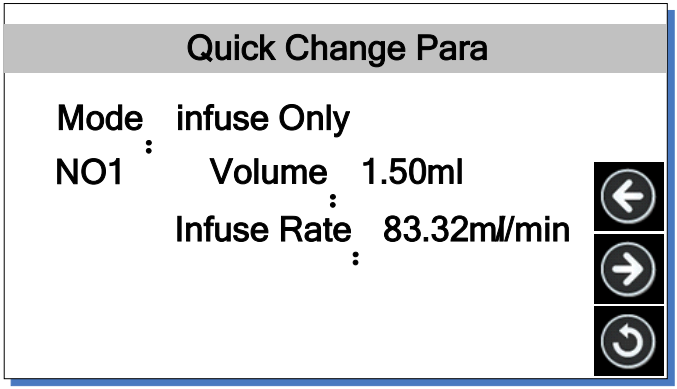


Figure 9 Fast setting interface

E: The mute button. Touch the key and alarm sound turned on or off. Icons are as follows.

 warning ton open  warning ton close

Figure 10 warning ton icon

F: Lock Key. Lock screen, the parameter modification is prohibited. Icons as follows.

 Unlock mode  Lock mode

Figure 11 Lock Key

G: 

System settings, click the icon to enter the system settings menu, you can re-choose corresponding menu to modify parameters.

H: 

According to currently liquid in the syringe, blue strip shows the progress of the current fluid volume.

I: 

Show the current amount of liquid outer container, blue strip display the current progress of fluid volume.

J: Running state. Show the current motor running state. Specific icon is displayed below.

 motor is running  motor stop  motor stall

 fast forward  fast backward

K: Running direction. According to the currently running direction.

 infuse  withdraw

L: Communication mode. Show the current status of communication.

 communication interrupt  communication connection

M: Show the current operation of the rest of The Times.

N: Displays the current movement process time has been used.

O: Display the current movement process the rest of the time.

P: Display the current total amount of liquid.

Q: 

Working mode: set the current working mode, click here to choose working mode into the interface, the following figure.

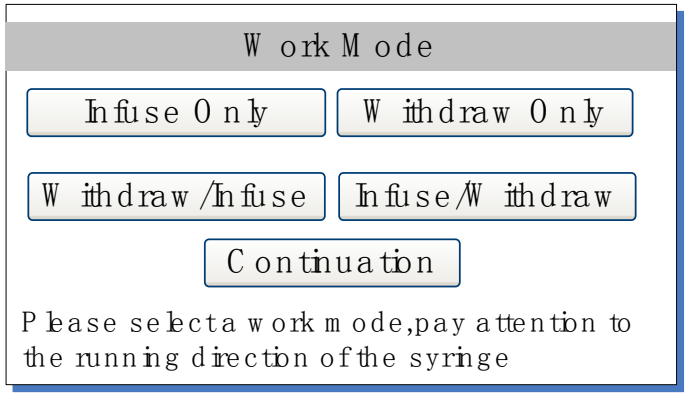


Figure 12 Work mode interface

- Infuse only: Only runs in the infusion direction. If set the number of cycles, the process of multiple infuse can be performed.

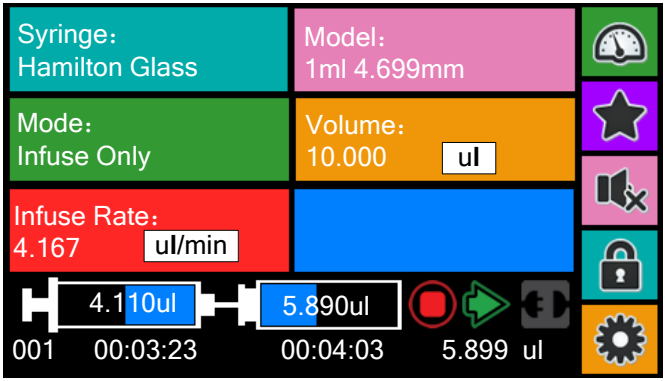


Figure 13 the process of infuse display interface

- Withdraw only: Only runs in the withdraw direction. If the number of cycles is set, the process of multiple withdraw can be performed.

Figure 14 the process of withdraw display interface

- Withdraw/Infuse: The pump runs first in the withdraw direction and then automatically changes to the infusion direction. If set the number of cycles, the multiple process can be performed.

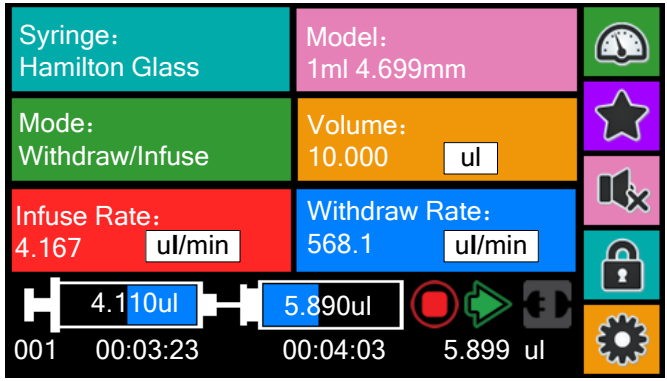


Figure 15 the process of withdraw infuse display interface

- Infuse/Withdraw: The pump runs first in the infuse direction and then

withdraw. If set the number of cycles, the multiple process can be performed.

Figure 16 the process of infuse withdraw display interface

- Continuation: Complete the motion process by external signal or communication. Optional control mode, pulse or level.

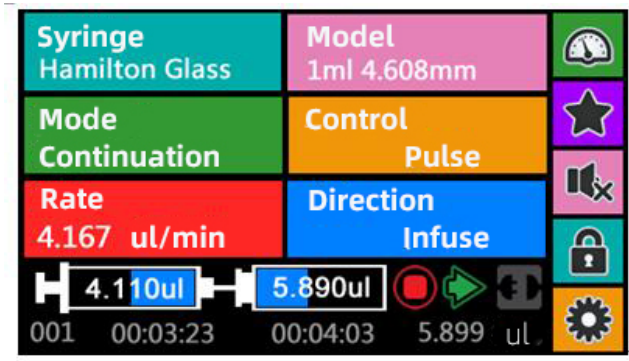


Figure 17 continuation display interface

R: 

Flow volume: set withdrawal or infusion of fluid volume. Click can input numerical value, click liquid unit switch available in μL and mL.

S: : 

Infuse rate/withdrawal rate: set infusion or withdrawal speed, click on the flow rate value can be input values. Click on the velocity of flow units can be in nL/min, μL/min, mL/min.

Note: if the show “super cap” or “super limit” shows that velocity adjustment range, please input the number again or switch unit change.

T: 

Control mode: set the control mode of external signal, namely pulse control or level control. See external control mode for details.

- **System setting**

  Under the main control interface and downtime, according to system setting icon  to enter, the interface is as follows.

Figure 18 System setting interface

Calibrate: according to the custom syringe to calibration of flow volume. According to the wizard prompt, through balance or measuring cylinder

weighing of transmission fluid, to make the display value and the actual flow accurately.

Communications: set the communication rate, transmission mode or change the address. To change the communication rate and transfer mode click to select the project, to change the address, click on the address, then pop-up window input values. Need to restart the drives, the values can take effect.

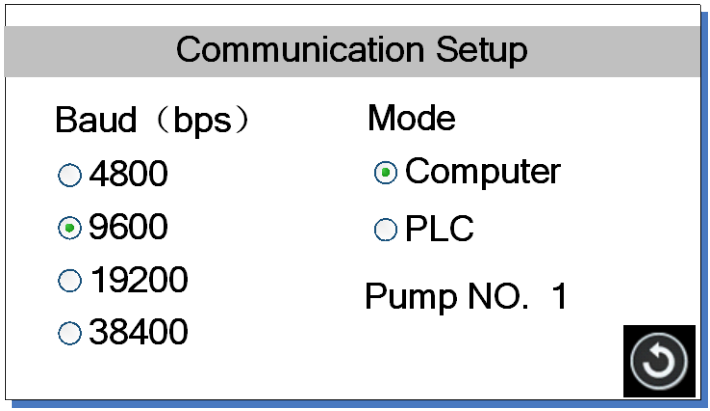


Figure 19 Communication setup interface

Parameters: set the parameters of the commonly used, specific as follows.

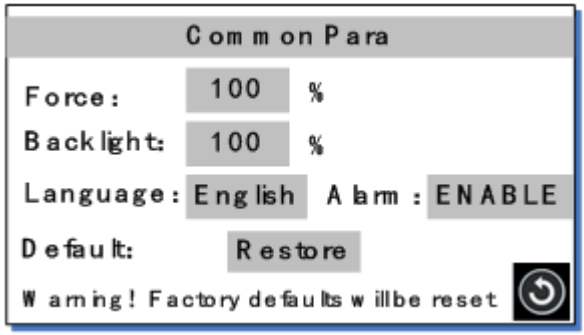


Figure 20 Common parameter setting interface

- Syringe linear thrust: according to different materials, different size of

thrust, prevent damaged the syringe in use process. Click on the numerical value can be modified.

- LCD backlight: as your willing the brightness of the LCD backlight, click on the numerical value can be modified
- Language: choose the language, Chinese or English.
- Blockage alarm: Set the function of blockage alarm to turn on or off.
- Restore the default value: the restoration of all the parameters to factory default. Restart the drive.

Information: display the syringe pump product model, software version, environment temperature, the open time, running time, boot number and serial number information.

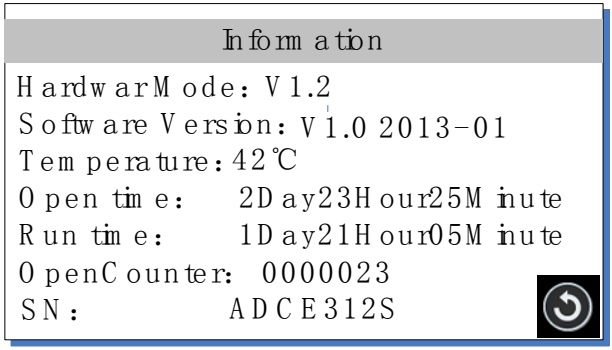


Figure 21 Information interface

Description: the company's contact information and brief introduction.

Password: Remove and modify the password screen lock**.**

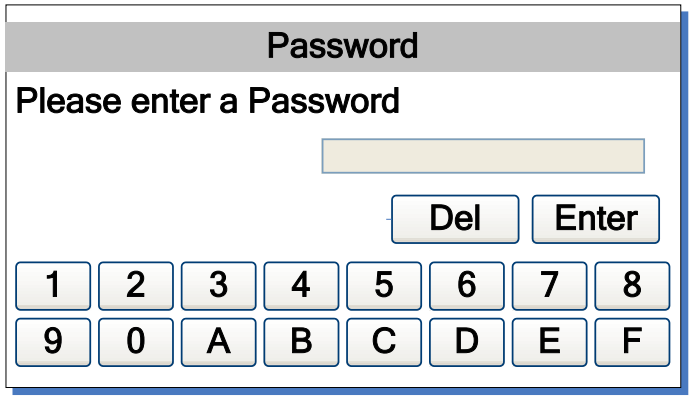
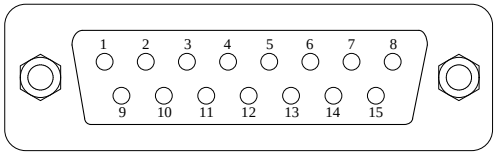


Figure 22 Password setting interface

External control interface description

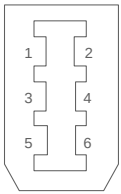


- **DB15 interface**

DB15	English notes	Specification
1		
2	B	Communication interface, B pole of RS485
3	A	Communication interface, A pole of RS485
4	VCC_W	External voltage input
5		
6	CW_IN	External input signal to control direction
7		
8	COM	Ground of external power
9		
10	+24V	Positive of internal +24V power source
11	GND	Ground of Internal power source
12	CW	Internal output signal to control direction

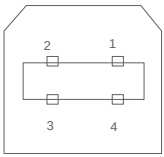
13	RS_IN	External start/stop signal input terminal
14		
15	RS	Internal start/stop signal output terminal

- **RS485 port**



Numbers	English note	Specification
1		
2		
3	B	RS485 Negative pole
4	A	RS485 Positive pole
5		
6		

- **USB port**



Numbers	English note	Specification
1	+5V	+5V Power
2	DATA-	DATA -
3	DATA+	DATA +
4	GND	Ground

Operating Instructions

The Preparatory Work

- Open the syringe pump outer packing, please compare the packing list, check whether all the parts is wrong or damaged, if found the problem, please contact the manufacturer or agent.
- Read the instruction carefully and put it in the hand or collect in a fixed site collect in order to check at any time.
- Place the syringe pump in a level table, the back of the distance barrier to keep a distance of more than 200mm.

Syringe Installation

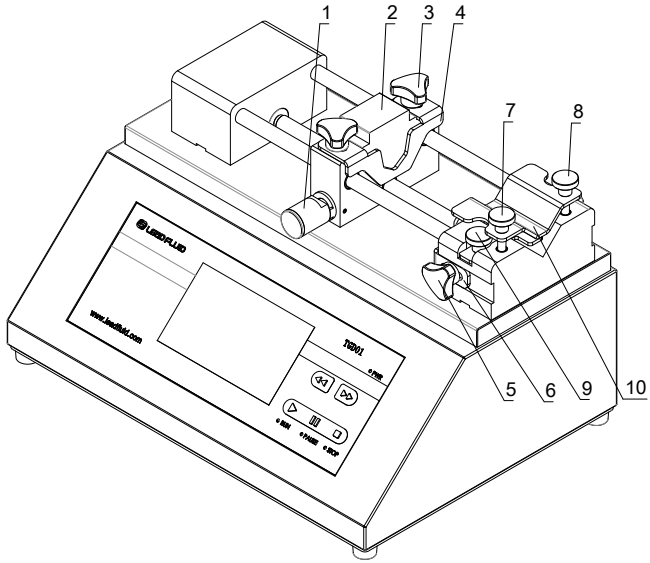


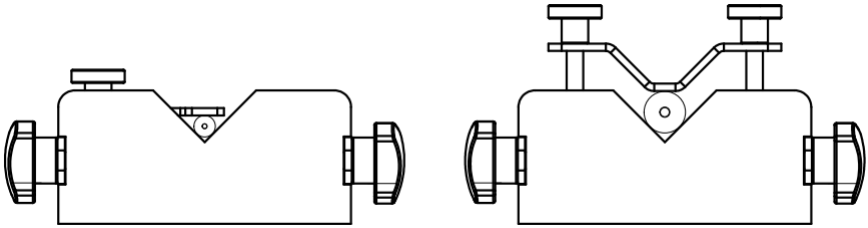
Figure 23 Syringe installation figure

1. Rotate part (1) 90 degrees to separate the half nut from the screw rod,

and adjust the part (2) to a proper position.

2. Loosen part (3) and adjust part (4) to proper position.
3. Loosen part (5) and adjust part (6) to proper position.
4. Remove part (7) (8) and then part (10).
5. Remove part (9).
6. Place the syringe in the groove of the right fixed seat, and at the same time, clip the tail wing of the syringe push rod into the part (4) and press it tightly, and tighten the part (3).
7. Clip the guard wing of syringe needle barrel into the part (6) and press it tightly, and tighten the part (5).
8. Press the part (9) or the part (10) according to the outer diameter of the syringe syringe and its material.
9. Tighten the piece (1) and rotate it 90 degrees.

Note: Glass syringe with small outer diameter of syringe can be pressed with part (9), stainless steel syringe with larger outer diameter of syringe can be pressed with part (10), and part (10) can be turned over 180 degrees for use.



Glass syringe Stainless steel syringe

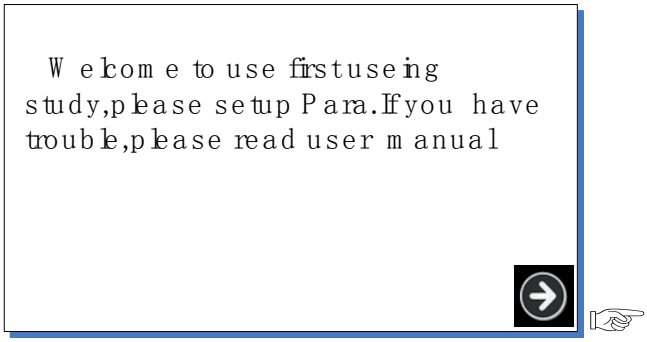
Figure 24 Syringe installation figure

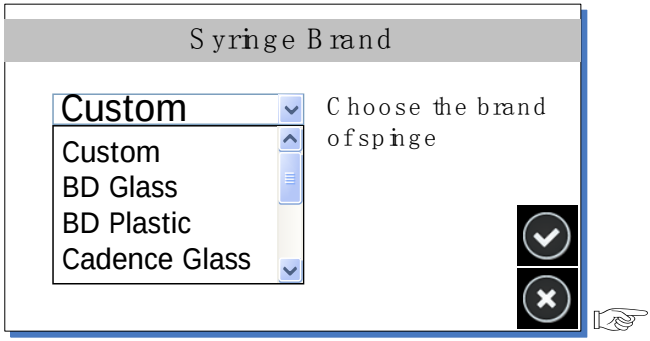
The Power Supply Connection

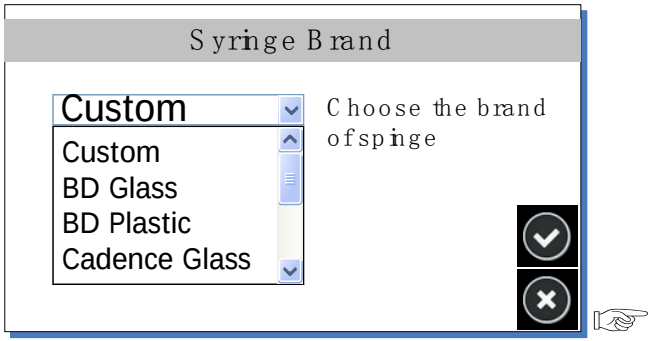
The power of the power supply should be used with the chassis at the back of the nameplate marking. It will be accompanied with the power switch at the back of the power supply cord into the drive.

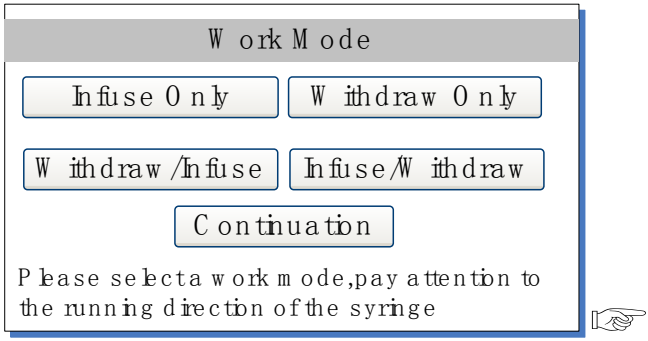
Initialization

Boot after commissioning or restore the default value for the first time, the system first enter the boot wizard interface, system running in turn syringe manufacturers-syringe size selection-working mode, the users according to the allocation is set up and operation. After the completion of the set boot will not perform this step.




Syringe Brand
Custom
Custom
BD Glass
BD Plastic
Cadence Glass
Choose the brand ofspinge


Syringe Brand
Custom
Custom
BD Glass
BD Plastic
Cadence Glass
Choose the brand ofspinge


Work Mode
Infuse Only
Withdraw Only
Withdraw/Infuse
Infuse/Withdraw
Continuation
Please select a work mode,pay attention to the running direction of the syringe

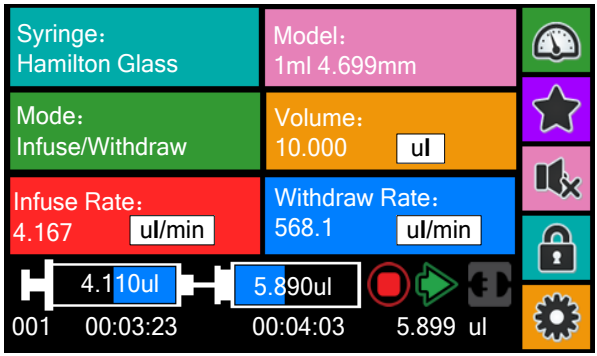


Figure 25Initialization

Operation Guide

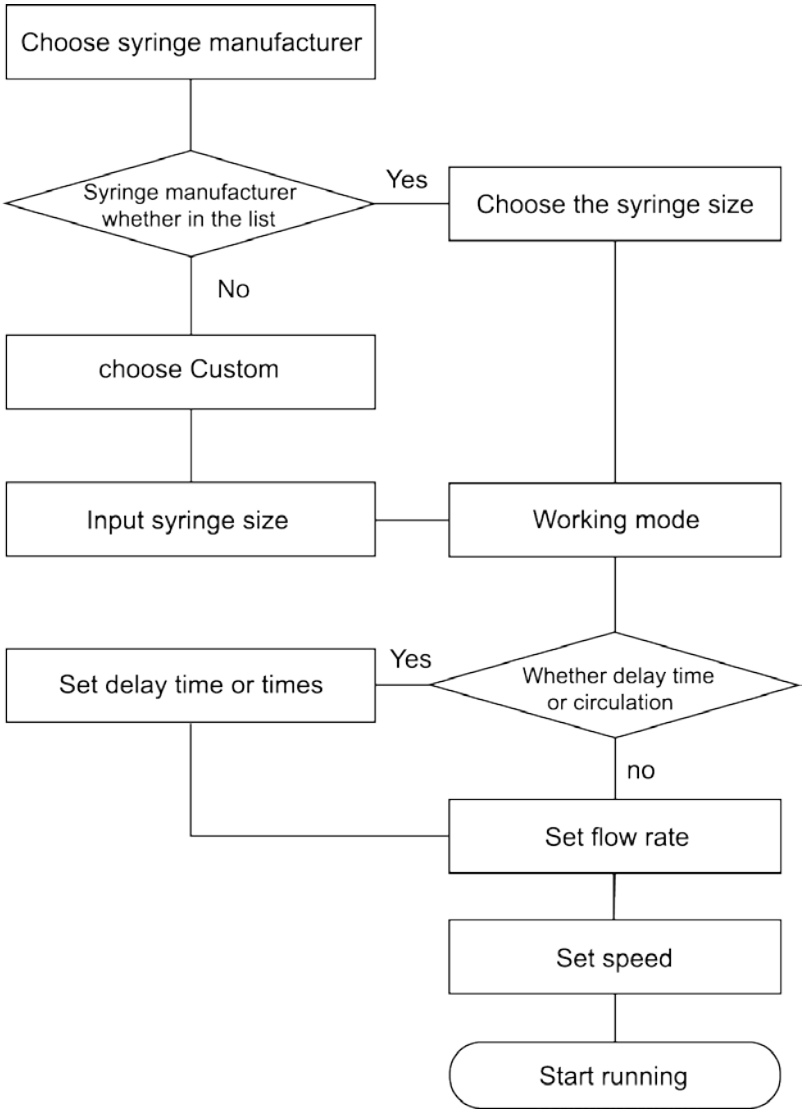


Figure 26 Operation guide

1. Choose syringe

Click under the main interface 

, in a syringe vendor selection interface, choose the syringe used brand, without the brand, please select Custom, chick again  to return the main interface.

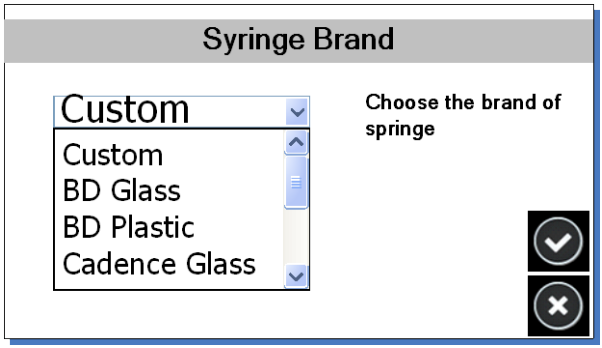


Figure 27 Syringe Brand interface

Click 

in the syringe specification selection interface, select the corresponding specifications, the syringe to the left side of the display in the volume and the syringe needle tube inner diameter, on the right selection of syringe is maximum flow rate and minimum flow rate.

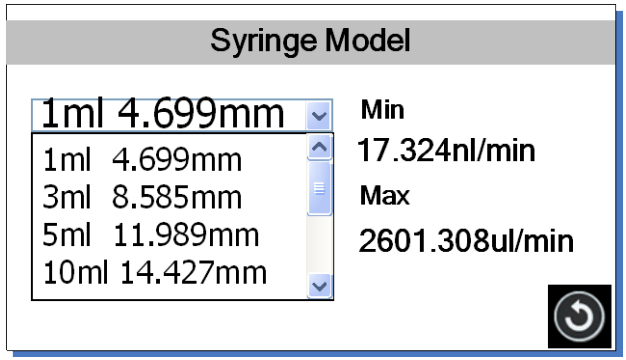


Figure 28 Syringe model choose interface

If syringe vendor selection for the Custom, click Custom syringe set into the interface, the following figure.

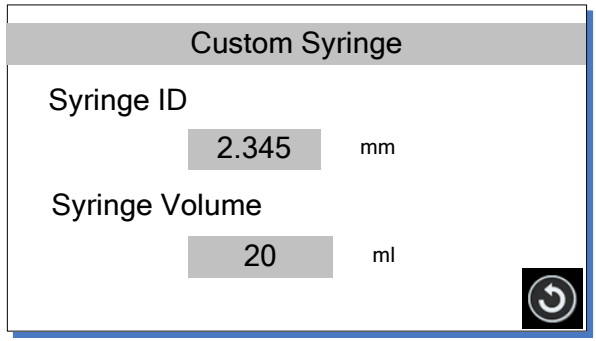


Figure 29 Custom syringe interface

Click on the location of the corresponding input custom syringe internal diameter and specifications.

Note：the specification of the syringe unit can switch between mL and uL.

1. Choose working mode

Click on the main interface working mode on the square.

Mode:
Infuse/Withdraw

In the working mode of interface, choose the right work mode.

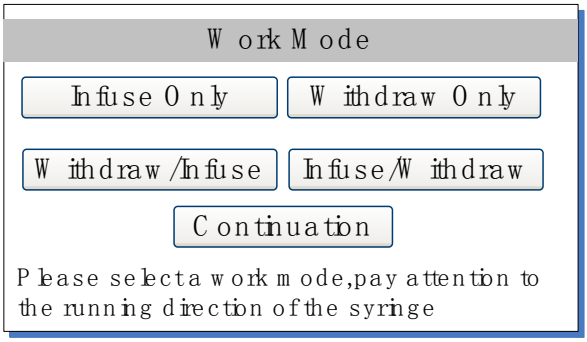


Figure30 Work mode interface

If you need to set up in the process of delay or repetitions, click on the right side of  the main interface process Settings.

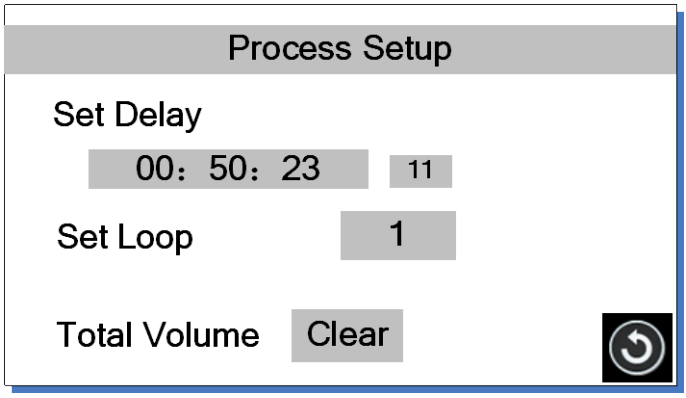


Figure 31 Process setting interface

Its movement process schematic diagram as follows

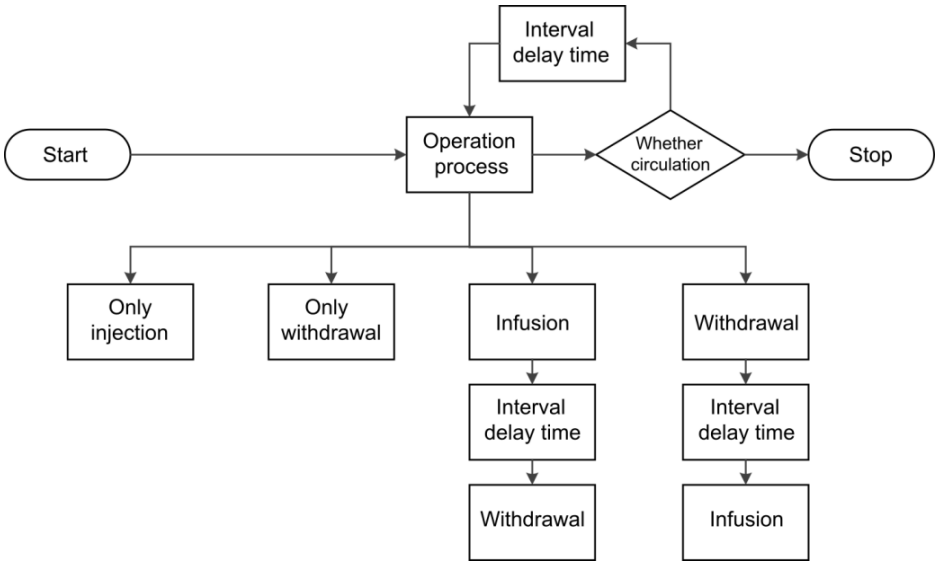


Figure 32 Movement process schematic diagram

2. Set the fluid volume and flow rate

   Set infuse or withdraw flow rate, click on the flow rate value can be input values. Click on the flow rate unit to switch between nL/min, uL/min, mL/min.

Set infuse or withdraw flow rate, click on the flow rate value can be input values. Click on the flow rate unit to switch between nL/min, uL/min, mL/min.

3. Start running

   Press start button  to start running set movement process, the green indicator on, when running over, and the red indicator on.

In the process of running, press the pause button to suspend the current movement process, the yellow indicator on, restart button may continue to perform the movement process of unfinished, if you press the stop button to terminate the movement process, the red light is on, the parameter of the movement process reset.

In the process of operation, push block access to limit block or by external block, syringe pump alarm, main interface status display buzzer stopped ringing, red light flashing. Press the stop button to remove the alarm, and then press the start button to start the process.

Multiple sets of data storage and calls

- Data storage

  Main interface to choose the work mode, and then click on the quick set icon, fast set into the interface.

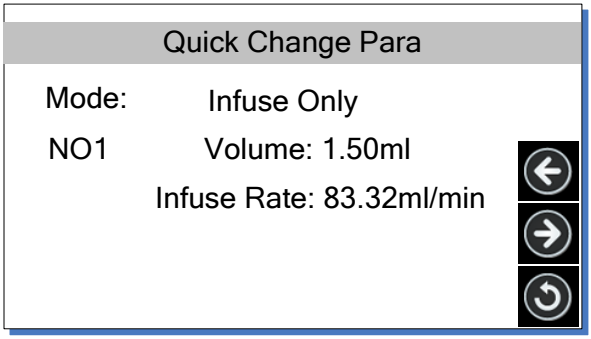


Figure 33 Quick change parameter interface

Choose by page key which group to save (system initialization

is the first group),and then click the back button  to return to the main interface, fluid volume and velocity of the set, the set of data has been saved.

Repeat the above steps, through page key  change groups, can save the other two groups of data.

- The data call

  Click fast setting icon  , with a fast setting interface, through the page key  to call the set of data, then click on the return key  , main interface of data is updated.

Flow Rate Calibration

Through the balance or measuring cylinder to get the actual transmission of liquid weighing, complete the custom syringe flow calibration.

Specific operation as follows:

1) Install the syringe, ready for balance or measuring cylinder, measuring cups.
2) To set the main interface in custom syringe, and input the inner diameter and specifications of the custom syringe (specific reference to choose the syringe).
3) Under state of downtime, press retreat  quickly let syringes filled with liquid.
4) According to the system setting icon  into the system

parameters, choose the wizard icon.

Figure 34 System parameter setting interface

5) Enter the calibration guide interface, the system displays the current syringe to calibration of flow rate and liquid volume. Flow rate is the speed of the liquid transmission and fluid volume refers to the transmission fluid volume.

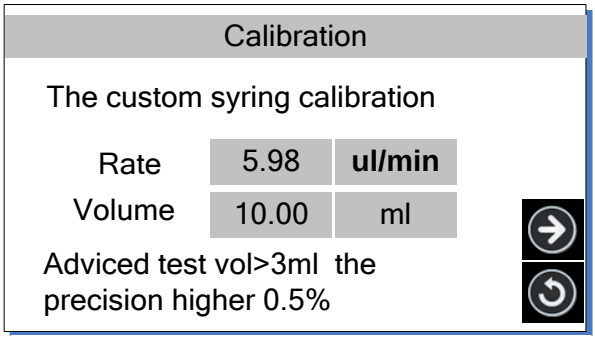


Figure 35 Flow rate calibration interface

Both numerical value and unit can be directly click to modify, and then click the next button  to start the test interface. Click the exit button  to exit the guide to return to the interface of system parameters.

- **Note: in order to guarantee the test precision, fluid quantity not less than the numerical system that recommended.**

1) Testing interface as below

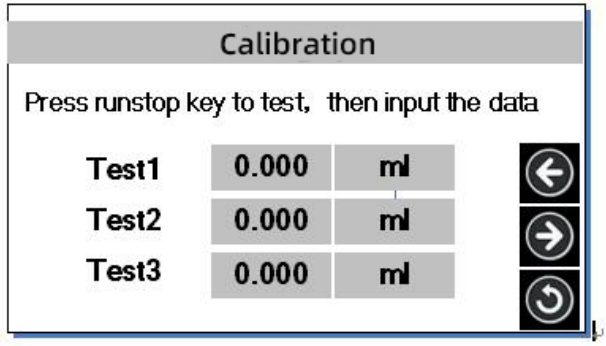


Figure 36 Testing interface

Ready for measuring cylinder or a beaker, confirm has been filled with liquid in the syringe, press the start button , syringe began to transfer the liquid, wait for after the completion of the syringe pump stop transferring automatically, with scales or measuring cylinder weighing liquid, record its value. Can repeat the above process, weighing multiple transmission liquid, fill in the numerical test 1, test 2 and test 3, pay attention to their unit is correct, then click enter into correction calculation interface.

If you want to modify the test flow rate and liquid volume, you can click to previous step, re-input values. Click the exit button to exit the calibration guide then return to the interface of system parameter.

Notes: in the process of the test, if there is an accident, suspension

test press the stop button , after then press the start key to test again.

Testing value may choose to enter one group or several groups of data, the system adjust the average value automatically.

2) The system calculate correction coefficient automatically and display the original reference coefficient. If no problem, press the key system, then it will save the new coefficient. In the previous step to retest, press exit without saving the new coefficient, to return to the interface of system parameters.

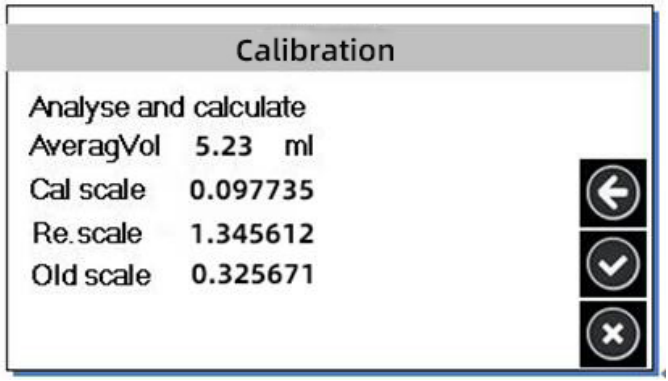


Figure 37 Data Analysis Interface

If without input data，show the diagram as below, please click the last step to retest.

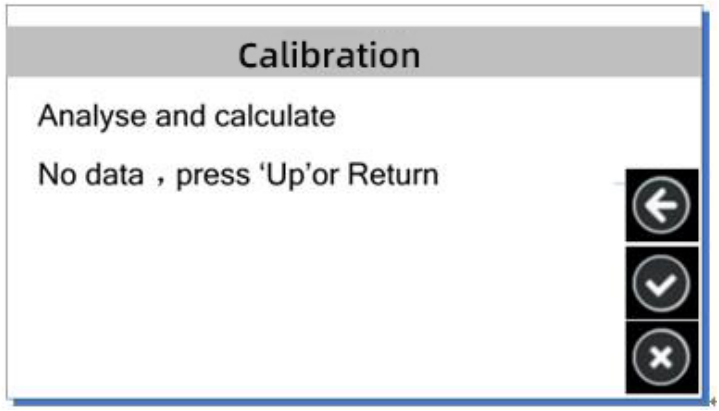


Figure 38 No data analysis interface

Lock password

Through setting a password, to prevent others to modify the setting data of syringe pump.

- Lock

Under the main interface, unlocked state  ， click the lock icon, the icon changes to  ， at this moment the screen is locked.

- Unlock

Under the main interface， click the lock icon  ，enter the password input interface，enter the correct password， click ok to unlock, or continue to keep it locked.

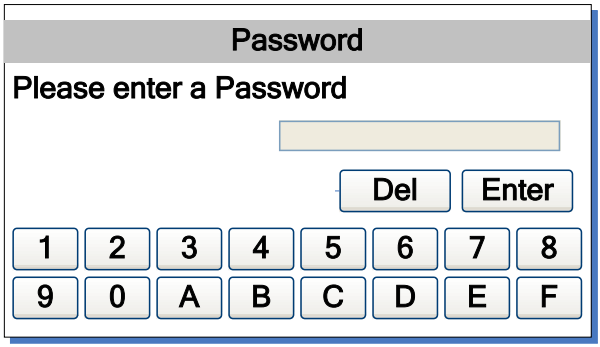


Figure 39 Password setting interface

The initial password is empty

- Change password

After input the correct password to unlock, system settings icon  into the system parameters, select the password icon.

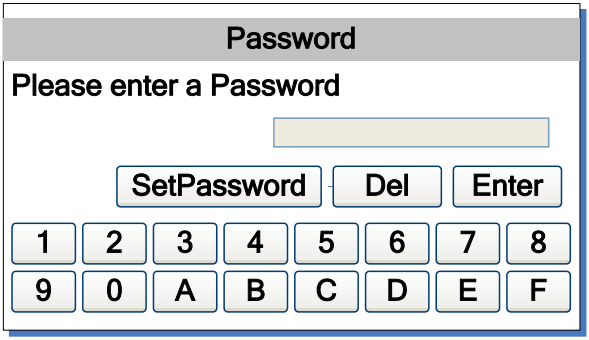


Figure 40 Change password interface

Enter a new password, then click the change password button, and then click OK button, go back upper menu.

Note: please keep in mind that the modified password, if forget the password, please contact the manufacture.

External Control Mode

External control signal to start and stop.

- Under the cut off power mode, according to the following wiring diagram connect circuit, then connect the DB15 interface with the back interface of the pump.

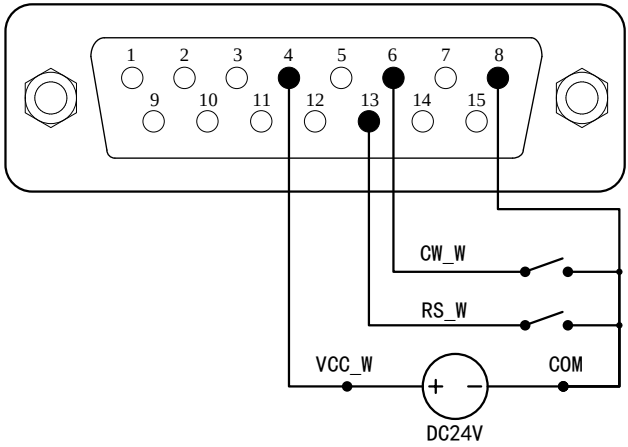


Figure 41 Control Start/Stop with external 24V Power Source

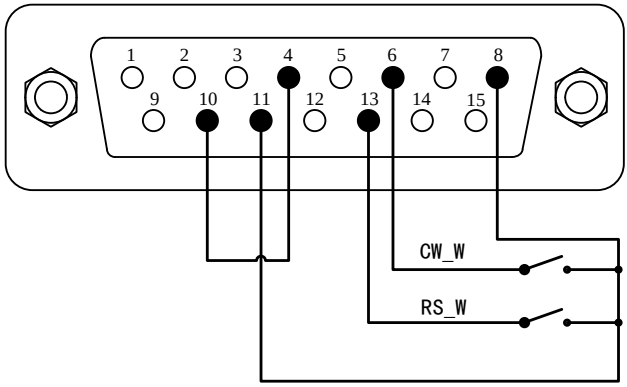


Figure 42 Control Start/Stop with Internal 24V Power Source

- Open the power switch, the screen shows the control interface.

- Set the parameters of the motion control.
- With infuse only, withdraw only, withdraw/infuse, infuse/withdraw mode, the switch of the external RS_IN is closed, and the syringe pump starts to run. Once the switch of the external RS_IN is closed again, the syringe pump will terminate the operation process.
- Under the continuous mode pulse controlled state, the switch of the external RS_IN is closed, and the syringe pump starts the running process. Once the switch of the external RS_IN is closed again, the syringe pump will terminate the operation process.
- Under the continuous mode level controlled state, the switch of the external RS_IN is always closed, the syringe pump runs, the external RS_IN switch is disconnected, the syringe pump stops running, the switch of the external CW_IN is switched off, the syringe pump is the direction of infusion, the external CW_IN switch is always closed, the syringe pump is the direction of withdraw.

Foot Switch

- Under the cut off power mode, according to the following wiring diagram connect circuit, then connect the DB15 interface with the back interface of the pump.

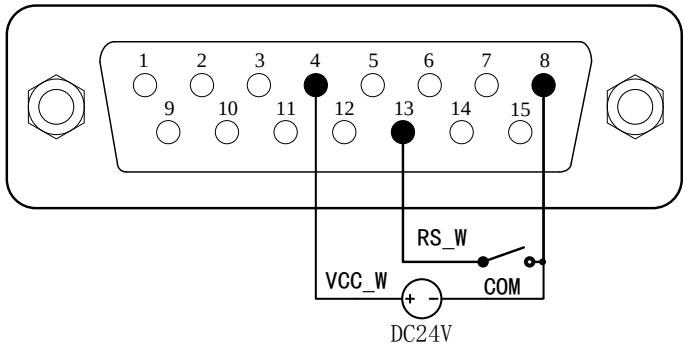


Figure 43 Control Start/stop with External 24V Power Source

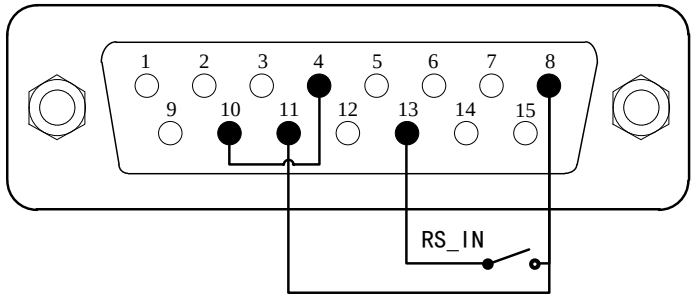


Figure 44 Control start/Stop with Internal 24V Power Source

- Turn on the power switch, the screen shows the control interface.
- Set the parameters of the pump motion control.
- With infuse only, withdraw only, withdraw/infuse, infuse/withdraw mode, the switch of the external RS_IN is closed, the syringe pump starts to run. Once the switch of the external RS_IN is closed again, the syringe pump will terminate the operation process.
- Under the continuous mode pulse controlled state, the switch of the external RS_IN is closed, and the syringe pump starts the running process. Once the switch of the external RS_IN is closed again, the syringe pump will terminate the operation process.
- Under the continuous mode level controlled state, the switch of the

external RS_IN is always closed, the syringe pump runs, the external RS_IN switch is disconnected, the syringe pump stops running.

Communication Mode

RS485 communication, support the MODBUS protocol, can control the various functions of the pump. Address specific parameters and reference to Lead Fluid communication technology standard support instructions.

Under the cut off power mode, according to the following wiring diagram connect circuit, then connect the DB15 interface with the back interface of the pump.

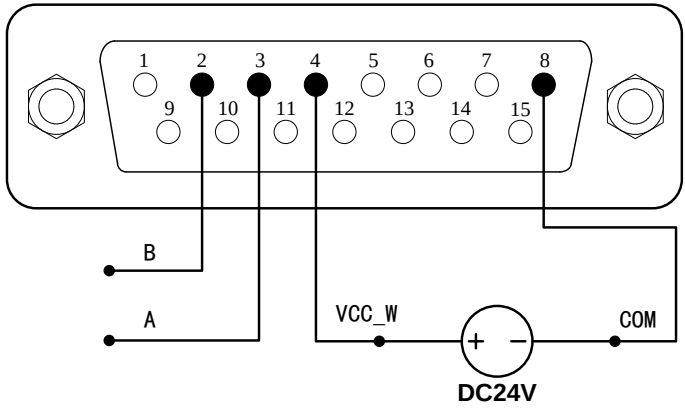


Figure 45 Communication with External 24V Power Source

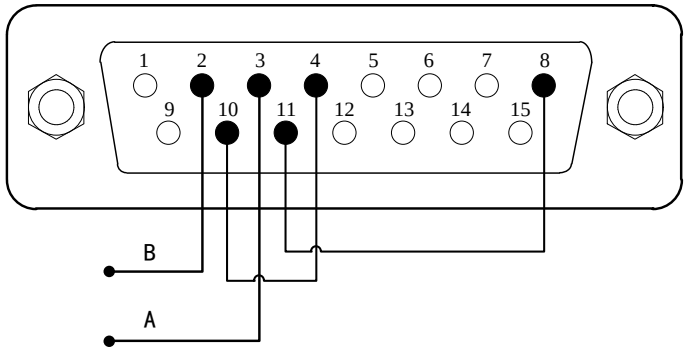


Figure 46 Communication with Internal 24V Power Source

- Open the power switch, the screen display control interface
- Communication icon closed, mean communication is normal, otherwise the communication interrupt.

   Communication interrupt  Communication connectivity
- Through communication to control pump's various functions.

Malfunction and Maintenance

Guarantee Repair and After-sales

The product has guarantee period as one year. But during the guarantee period, the company would be not responsible for the warranty, if the product has the improper operation or the man-made damage. Over the guarantee period, only the material and labor costs will be charged at cost price.

Routine Maintenance

- Regularly check the slider on the lead screw and guide bar is normal operation, and odd oil to maintenance.
- The syringe pump cannot wash with water, if you find the fluid overflow in the process of running, should be timely to dry or drying liquid.
- Do not use chemical solvents to clean the syringe pump housing.

Minor Malfunction

No.	Type of Malfunction	Malfunction Description	Solution
1	hardware	No display of the drive	1. Check the lines connected well 2. The fuse is good, or change with the 1A time-delay fuse. 3. The lines in internal equipment connected well. 4. Check the LCD panel and the main control board connection is loose or not.
2	hardware	The motor not work	1. Check the motor and the driver connected well. 2. Check the voltage corresponding with the nameplate.
3	hardware	The motor trembling	1. Check the motor and the driver connected well. 2. Motor overload, check the mechanical transmission is good or not.

4	hardware	The motor rolling in one direction	1. The line loose or not connected the driver and the main control board.
5	hardware	The keypad not work	1.Check the keypad and the main board connected well. 2.Check the keypad broken or not.
6	hardware	External control not work	1. Check the lines connected right or not. 2. Check external power on or off. 3. Check the external board fixed well.
7	hardware	Communication not work	1. Check the lines connected right or not. 2. Check external power on or off. 3. Check the communication board fixed well.
8	hardware	Operation noise loud	1. Check the motor and the main control board connected well.
9	software	Dispensing is wrong	1. Press fast forward fast rewind button to open pump, enter into the touch screen calibration procedure.
10	software	Flow rate is not right	1. For the flow calibration
11	software	Communication not work	1. Use the soft provided by Lead Fluid reset up the address. 2. Check up whether two pump use the same address on bus.

If the malfunction can not be solved, please contact with the manufacturer.

Dimension

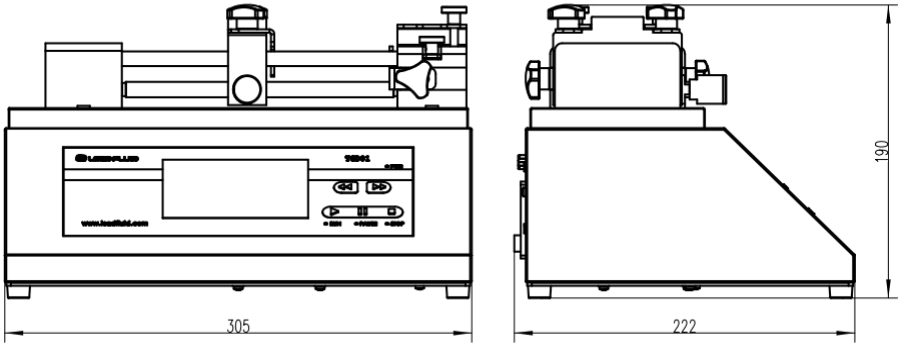
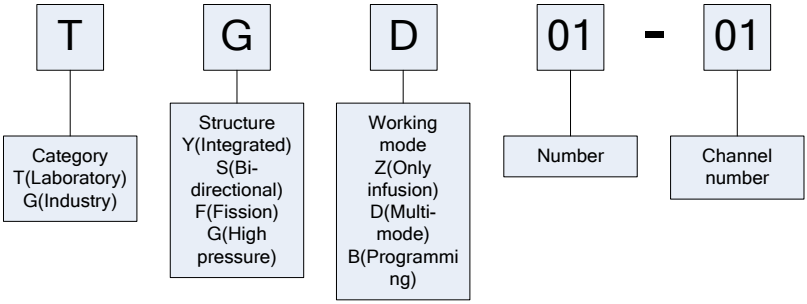


Figure 47 Dimension

Naming Rule

Syrige pump naming rules



Technology Parameters

Product model	TGD01-01
Working mode	infuse, withdraw, infuse /withdraw, withdraw/infuse, continuous mode
Channel	1
Stroke of pump	140mm
Pusher advance	0.156μmm/ustep
Linear speed	0.36μmm/min-190mm/min
Linear speed adjustment resolution	0.36μmm/min
Accuracy	error＜±0.35% (>30% of pump stroke)
Maximum rated linear force	91kg (100% thrust)
Thrust regulation	1-100% arbitrary adjustable
Syringe size	0.5μl-140ml
Syringe selection	built-in main manufacturers, the main model syringe to choose, can use custom syringe, direct input syringe size and diameter.
Flow calibration	through the calibration procedure to obtain more accurate fluid volume
Display	4.3-inch color LCD with screen display and transfusion volume, residual fluid volume, flow, operation direction, syringe specification, etc. Animation display operation status.
Operation mode	touch screen + button
Power-off memory	storing the running parameters automatically
Other functions	Pause and stop; key tone prompt; lock parameter; fast forward and fast backward

Status signal	Output: 1 channel indicates start stop state, 1 channel indicates direction state
Control signal	Input: 1 channel start stop signal, 1 channel direction signal
Communication interface	RS485, MODBUS Protocol
Dimension	305×222×190
Weight	6.3kg
Shell material	sheet metal spray
IP grade	IP31
Power supply	AC100V-240V 50/60HZ
Work environment	5-40℃
Relative humidity	＜80%

Syringe manufacture and specification

Air–Tite HSW Norm-Ject

Spec	ID
1 ml	4.69 mm
2.5	9.65
5	12.45
10	15.9
20	20.05
30	22.9
50	29.2

Becton Dickinson Plastic

Spec	ID
1 ml	4.699 mm
3	8.585
5	11.989
10	14.427
20	19.05
30	21.59

SGE Scientific Glass

Spec	ID
5 µl	0.343 mm
10	0.485
25	0.728
50	1.03
100	1.457
250	2.303
500	3.257
1 ml	4.606 mm
2.5	7.284
5	10.301
10	14.567
25	23
50	27.5
100	35

Hamilton Glass

Spec	ID

Cadence Science, Inc. Glass

Spec	ID
0.25 ml	3.47 mm
0.5	3.62
1	4.82
2	8.91
3	8.91
5	11.71
10	14.65
20	19.56
30	22.7
50	28.02
100	35.7

Becton Dickinson Glass

Spec	ID
0.5 ml	4.64 mm
1	4.64

50	26.594
60	26.594

Terumo

Spec	ID
1 ml	4.70 mm
3	8.95
5	13
10	15.8
20	20.15
30	23.1
60	29.1

Lead Fluid Glass

Spec	ID
1ml	6.716mm
2	8.925
5	11.732
10	14.678
20	19.601
30	22.691
50	28.04

Harvard

Metal

Spec	ID
2.5ml	4.85mm
8	9.53
20	19.13
50	28.6
100	34.9

0.5 µl	0.103 mm
1	0.146
2	0.206
5	0.343
10	0.485
25	0.729
50	1.03
100	1.457
250	2.304
500	3.256
1 ml	4.608 mm
1.25	5.151
2.5	7.285
5	10.3
10	14.567
25	23.033
50	32.573
100	32.573

Lead Fluid

Metal

Spec	ID
2.5ml	4.85mm
8	9.53
20	19.13
50	28.6
100	34.9

2.5	8.66
5	11.86
10	14.34
20	19.13
30	22.7
50	28.6
100	34.9

Sherwood–Monoject

Plastic

Spec	ID
1 ml	4.65 mm
3	8.94
6	12.70
12	15.90
20	20.40
35	23.80
60	26.60
140	38.40

Flow rate chart

Normal syringe Max Min flow					
Spec	**ID**	**Min flow rate**	**Unit**	**Max flow rate**	**Unit**
0.5µl	0.103	3.000	pl/min	1.583	µl/min

1 μl	0.146	6.027	pl/min	3.181	μl/min
2 μl	0.206	11.998	pl/min	6.333	μl/min
5 μl	0.343	33.264	pl/min	17.556	μl/min
10μl	0.485	66.508	pl/min	35.102	μl/min
25μl	0.729	150.261	pl/min	79.305	μl/min
50μl	1.030	299.962	pl/min	158.313	μl/min
100μl	1.457	600.221	pl/min	316.784	μl/min
250μl	2.304	1.501	nl/min	792.152	μl/min
500μl	3.256	2.998	nl/min	1.582	ml/min
1000 μl	4.608	6.004	nl/min	3.169	ml/min
1ml	4.699	6.243	nl/min	3.295	ml/min
2.5ml	4.851	6.654	nl/min	3.512	ml/min
3ml	8.585	20.839	nl/min	10.998	ml/min
5ml	11.989	40.640	nl/min	21.449	ml/min
8ml	9.525	25.652	nl/min	13.539	ml/min
10ml	14.427	58.850	nl/min	31.060	ml/min
20ml	19.050	102.608	nl/min	54.154	ml/min
30ml	21.590	131.795	nl/min	69.558	ml/min
50ml	26.594	199.968	nl/min	105.538	ml/min
100 ml	34.900	344.384	nl/min	181.758	ml/min
140 ml	37.950	407.208	nl/min	214.915	ml/min

Note:

The above flow data are obtained by testing pure water under normal temperature and pressure. The actual use is affected by specific factors such as pressure and medium characteristics, which is for reference only.

Version History

Date	Version	Changes
2020.10.10	V1.0	Initial release version

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