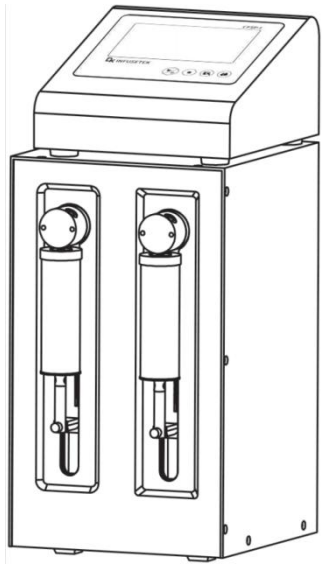
DK Infusetek Syringe Pump
Manual of CFSP-I



DK INFUSETEK CO., LTD.

Note:

- Please read the manual carefully before operating the product.

Warning:

- Connect the power cord to the wall socket directly, and avoid using the extended electric wire.
- If the power cord or plug had wear and other damage, please disconnect the plug. (Hold the plug instead of the wire)
- If following situations happened, please turn off the power supply and disconnect the plug. (Hold the plug instead of the wire)
  1. Fluid splash on the pump.
  2. You think the pump need to maintain or repair.
- The user's power socket must have ground wire, and have reliable grounding.

Note: The foot pedal switch and other external control plugs must be connected or disconnected in the power-off status to prevent the external control interface from being burned.

Catalogue

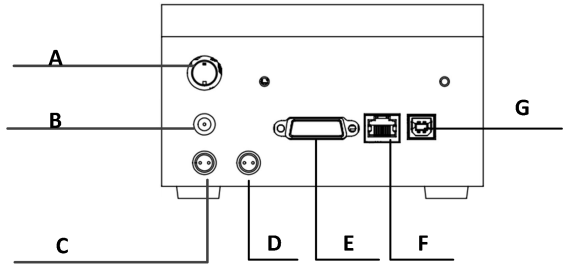
1. Product Introduction

CFSP-I series are consist of one controller and one syringe pump filling unit. The controller adopts 4.3 inch industrial true color LCD display, and it has the imported keypad and the function of changing the filling volume online. The syringe pump unit can realize the function of continuous infusion and withdraw, continuous dispensing for the syringe pump. It is suitable for continuous high precision infuse and withdraw liquids.

2. Product Composition

One controller and one continuous filling unit.

2.1 Controller interface instruction



The back side of the controller

A: Power switch

B: DC5V power socket

C: 3-core aviation plug, connecting to filling unit interface (G)

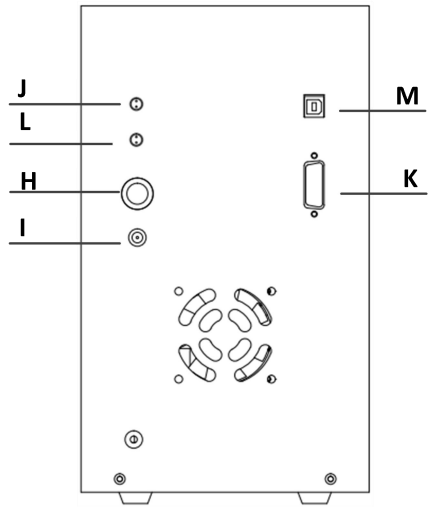
D: 2-core aviation plug, foot pedal interface

E: DB15 pin interface, including external control and RS232 communication interface

F: RJ45 interface, RS 485 communication interface

G: Reserved interface

2.2 Filling unit interface instruction



The back side of the filling unit

H: Power supply switch

I: DC24V power socket

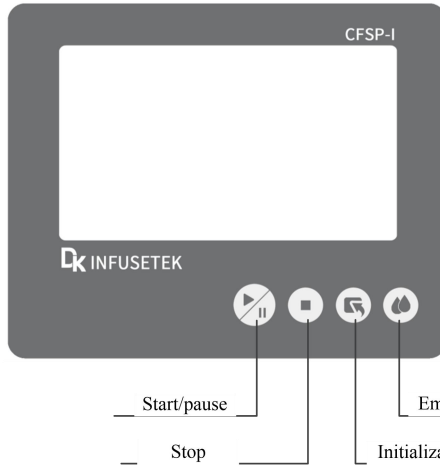
J: 2-core aviation plug, foot pedal interface

K: DB15 pin interface, external control interface

L: 3-core aviation plug, connecting controller interface (C)

M: Reserved interface

2.3 Membrane keypad instruction



- **Start/pause**: After complete initialization, click this button, the filling unit starts running, click this button again, the filling unit pauses running.
- **Stop**: In the running process, click this button, stop the filling unit running; After filling unit stopping, it need to be re-initialized before running again. Keep pressing this button and turn on the power supply at the same time, all parameters of the device will be cleared.
- **Initialization**: Click this button, the filling unit will initialize, and push rod returns to zero position.

The following situations need to be initialized

- After the filling unit is powered on for the first time;
- After clicking the stop button during operation;
- After an overload alarm occurs;
- After modifying the system parameters, such as: syringe model, syringe thrust, outlet direction

- **Empty:** Click this button, the filling unit runs with setting empty speed, it is used to clean or filling the tubing.

2.4 Installation instruction

2.4.1 Install the valve, follow these steps:

(1) Place the filling unit vertically on the workbench, facing the front panel.

(2) Adjusting the upper semicircle of the filling unit, insert it into connecting groove of the rotary valve.

(3) Rotate the valve to make the valve tubing interface is on the top and the syringe interface is on the bottom.

(4) Turn the valve body gently to make the fixed hole of the valve is aligned with the front panel hole of the pump.

(5) Insert two cross countersunk head screws into the mounting hole, screw until it contacts the valve body, and then tighten them.

2.4.2 Install the syringe pump, follow these steps:

(1) Unscrew the piston lock screws.

(2) Click the **Initialization** button, initialize the pump.

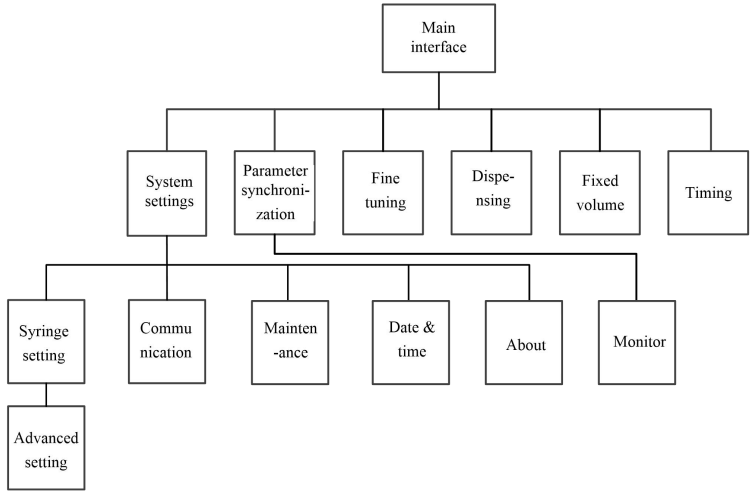
(3) Click the **Start/Pause** button, make both two pistons of the machine be lower. After falling to the half position to click **Stop** button.

(4) Thread the syringe piston into the piston puller.

(5) Tighten the syringe to the valve.

(6) Tighten the piston fixed screws, to ensure that syringe piston is fixed in place.

3. Controller Interface Structure



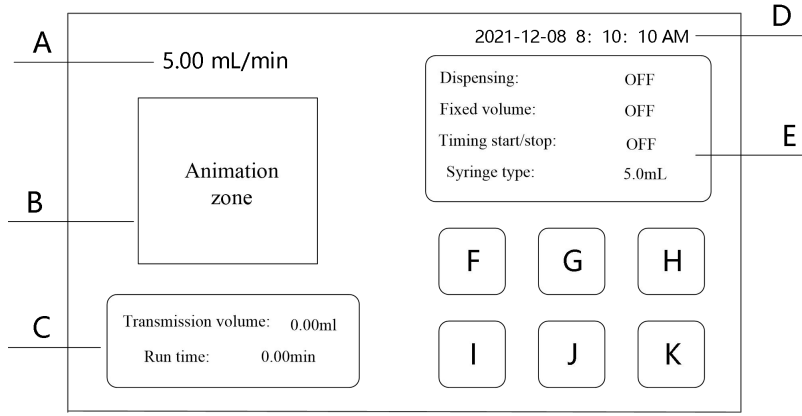
4. Controller Operation Interface

4.1 Booting interface

When power on, enter to the welcome interface, and the system will enter the main interface automatically after 2.5s.

4.2 Main interface

The main interface structure as follows:



A. **Real time flow display:** In transferring and fixed volume mode, showing current flow in real time, click there to change it; In dispensing mode, showing theoretical filling volume in real time.

B. **Animation display:** Operate animation, displaying current working status in real time.

C. **Running parameters:** Running parameters and countdown displays, the parameters displayed in each running mode are different.

D. **Date and time display:** Display date and time, yon can change it in system settings.

E. **Working mode display:** Display current choosing working mode and selecting syringe type in there.

F. **System settings:** Click the button to enter to the system settings interface.

G. **Parameter synchronization:** Click the button to enter to the parameter synchronization interface.

H. **Fine tuning:** Click the button to enter to the flow adjust interface.

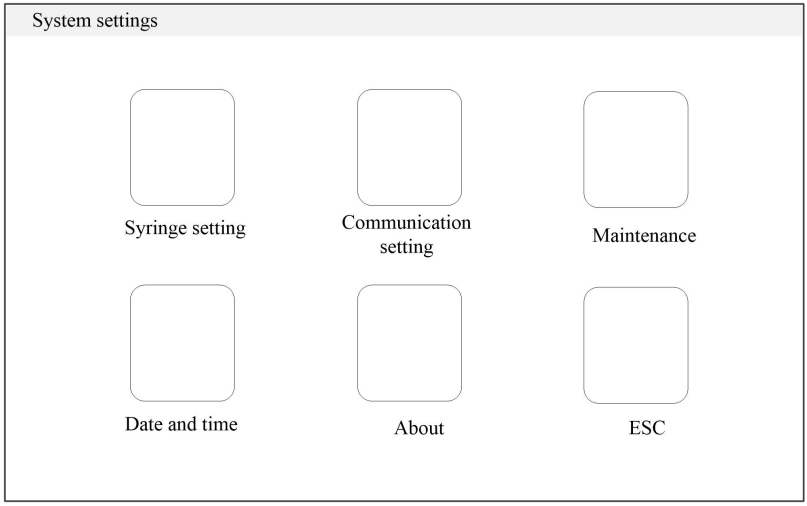
I. **Dispensing:** Click the button to enter to the parameter setting interface for dispensing.

J. **Fixed volume:** Click the button to enter to the fixed volume parameter setting interface.

K. **Timing start/stop:** Click the button to enter to the timing start/stop parameter setting interface.

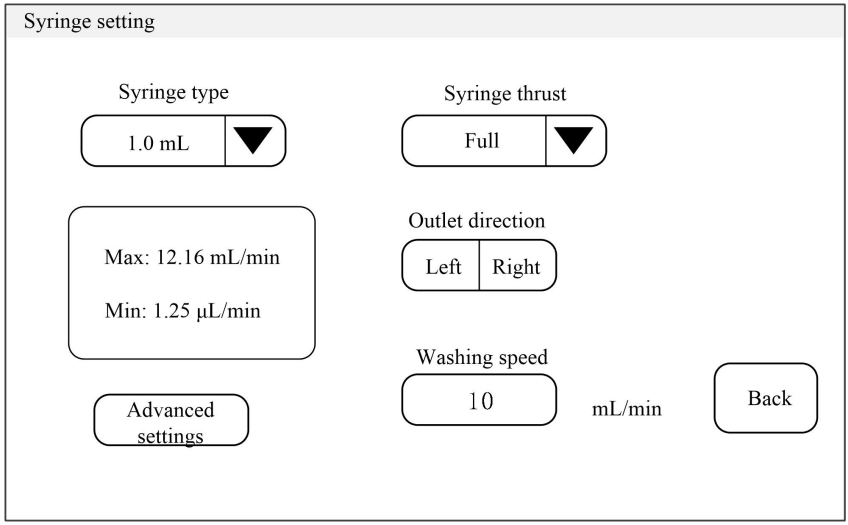
4.3 System settings interface

The system settings interface as the below figure show



4.3.1 Syringe setting interface

Syringe setting interface is shown in the figure below



Setting syringe type, syringe thrust, outlet direction and washing speed parameter etc in this interface.

There are three options for syringe thrust, full, 1/2, 1/3. When you choose full, push rod thrust >=30kgf; When you choose 1/2, push rod thrust >=15kgf; When you choose 1/3, push rod thrust >=10kgf. After you change the syringe type each time, it will recommend suitable syringe thrust (modify syringe thrust automatically) according to choosing syringe type. Users choose syringe thrust according to their demands.

The appropriate thrust shall be selected according to the model of the syringe installed, otherwise the syringe may be damaged.

Syringe	Drive
1.0mL and above	Full strength
250, 500uL	1/2 strength
50, 100uL	1/3 strength

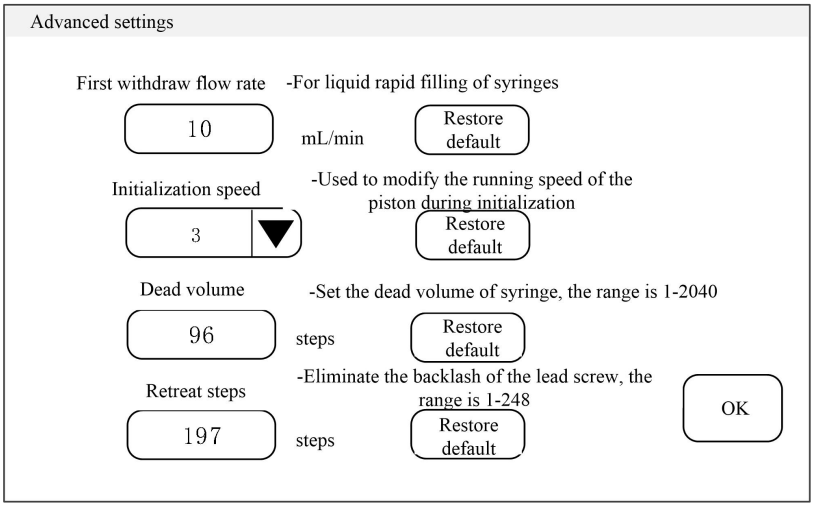
Recommended driving forces for different syringes

The outlet direction can change the direction of outflow, left/right means facing the syringe. When the button displayed as below picture

It means that the current setting is that the exit direction is right, otherwise, it means the setting exit direction is left.

The cleaning speed sets the speed of the cleaning function, after changing syringe, the cleaning speed will re-calculate.

In this interface, click Advanced setting button, enter to the advanced settings interface, as below shows



First withdraw flow rate: It is used to set the withdraw speed at the beginning of the run. At the lower setting flow situation, it can quickly fill the syringe. Please set this value reasonably. Excessive withdraw flow may cause abnormal operation.

Initialization speed: It is used to set the operation speed of plunger during initialization. There are six levels. The higher the level, the faster the speed, the default is the highest level 6. When the pipeline resistance is relatively large, the initialization speed can be appropriately reduced so that the initialization can be completed normally.

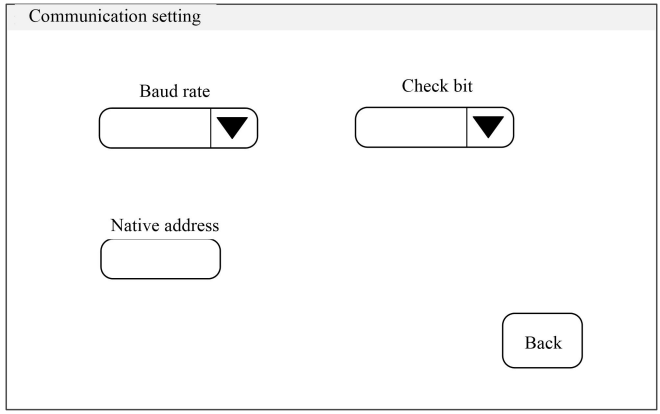
Dead volume: It is used to set initialization back to zero, and the distance of syringe pump plunger from top. Please keep the default value and don't modify it in general. And the reasonable dead volume can prolong the life of syringe. The input range is 1-2040.

Retreat steps: Eliminate the backlash of the lead screw. Please keep the default value and don't modify it in general. The input range is 1-248.

Click **Restore default** button to restore the corresponding parameters to default value.

4.3.2 Communication setting interface

Communication setting interface is shown in the figure below



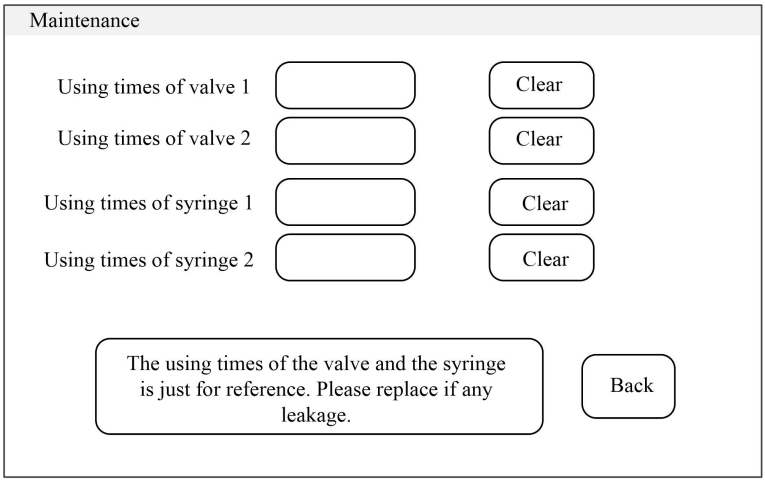
Setting communication baud rate in this interface, the baud rate range: 1200, 2400, 4800, 9600, 19200.

Setting communication check bit in this interface, check bit settings: Odd check, Parity check, No check.

Setting communication address in native address, the address range: 1-32.

4.3.3 Maintenance interface

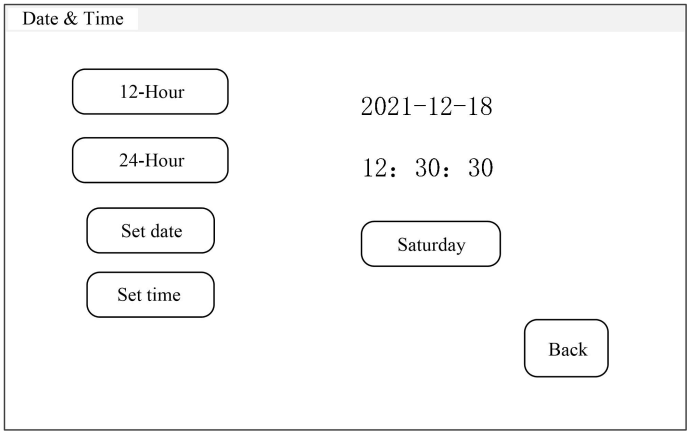
Maintenance interface is shown in the figure below



In this interface, you can check the using times of direction valve and syringe, provide reference for maintenance of valves and syringes. Click **clear** button to clear the number to zero.

4.3.4 Date and time interface

Date and time setting interface is shown in the figure below



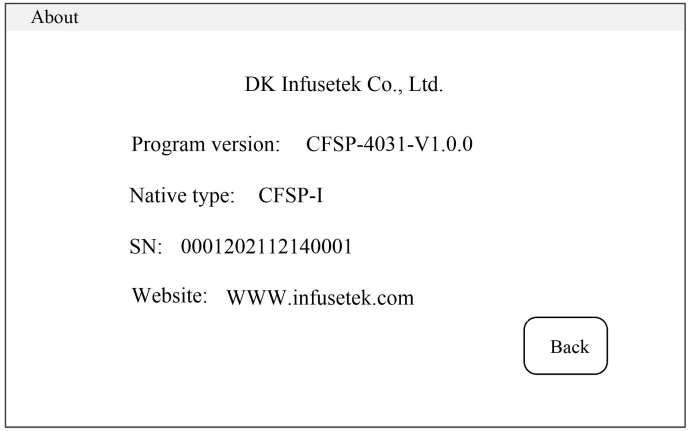
In this interface, set the current date and time, displayed in the upper right corner of the main interface.

Click **Set date** button, the numeric keypad is popped up for setting the year, the range is 1970-2099, after setting, click **OK** button to enter the setting month numeric keypad, and then setting day.

Click **Set time** button, pop up the numeric keypad, set hour, minute and second in sequence.

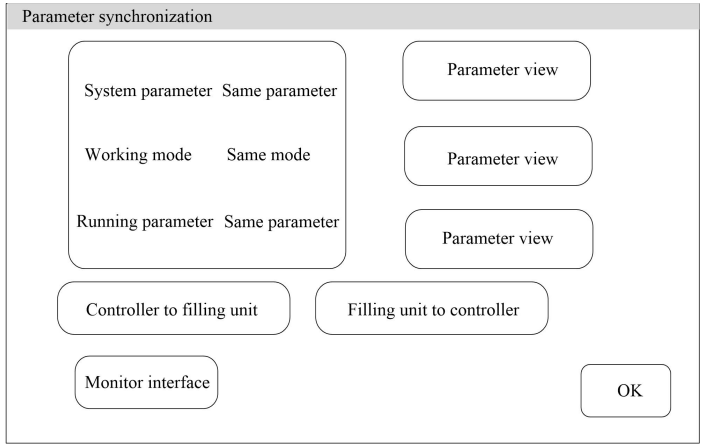
4.3.5 About interface

About interface is shown in the figure below



In this interface, you can check the syringe pump information and company information.

4.4 Parameter synchronization



In main interface, click parameter synchronization button, to enter the synchronization interface.

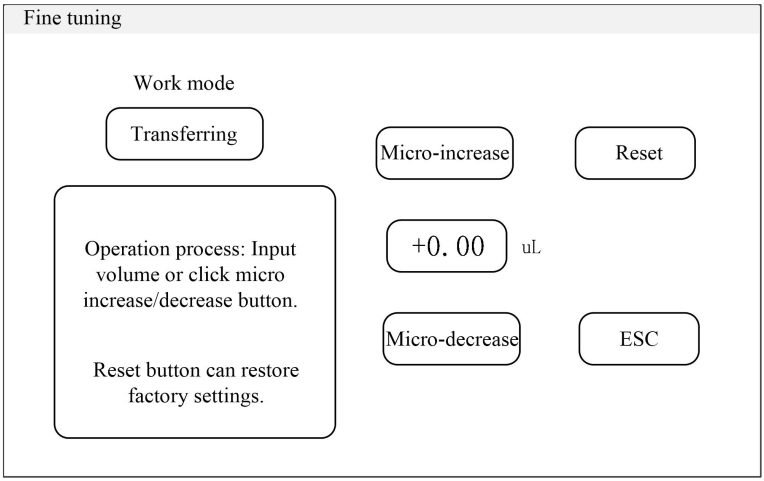
In this interface, you can compare whether the parameters between the controller and the filling unit are the same. Click parameter view button to check parameters of controller and filling unit.

If the parameters are not same, click **controller to filling unit** button, the operating parameters of the controller can be synchronized to the filling unit; Click **filling unit to controller** button, the parameters of filling unit can be synchronized to the controller.

Click the Monitoring interface button in this interface enter to the monitoring interface that every plungers and valves status can be viewed in this interface.

4.5 Fine tuning interface

Fine tuning interface is shown in the figure below



Click **Fine tuning** button in main interface to enter fine tuning interface.

In work mode, display the current working mode for the pump.

Click **micro-increase**, **micro-decrease** button to adjust pump flow (under

transferring) or volume (under dispensing and fixed volume mode); Click **Input box**, to adjust the volume deviation directly.

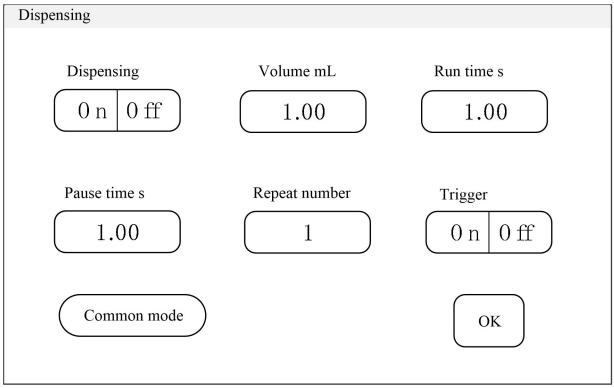
Click **Reset** button to restore factory settings for calibrating parameters.

Click **ESC** button to save the calibration parameters and escape.

Note: The calibration of dispensing and fixed volume must be done before production, the fine tuning interface can not be in during the pump working. In transferring, it can fine tuning during working or stopping.

4.6 Dispensing interface

Dispensing interface is shown in the figure below



Click **Dispensing** button in main interface to enter to setting parameter interface of the dispensing.

Click dispensing enable button, turn on function of dispensing. When the button displays 

, it means that the function of dispensing is turned on, otherwise, it means that the dispensing function is turned off.

Set **Volume**, **Run time**, **Pause time** etc.

The range of input volume is 0.01uL-25mL;

The range of input run time is 0.1s-9999s;

The range of pause time is 0.1s-9999s.

The range of repeat number is 1-9999 times, enter 0 for infinite times.

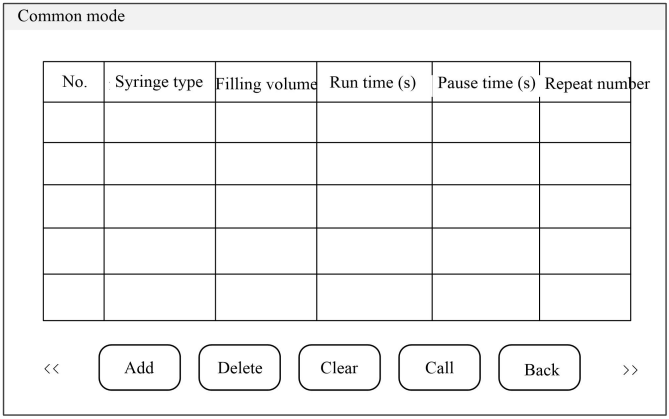
Note: The input value of volume can not be greater than the capacity of the current syringe.

Afte turning on the function of **Trigger**, the pause time can not be used, and wait for the external start signal before the pump starts the next filling. When the button displays 

, it means that the function of trigger is turned on, otherwise, it means that the function is turned off.

Click **OK** button, save input parameter and escape.

Common mode is shown in the figure below



In dispensing mode click the **Common mode** button to enter to the common mode interface.

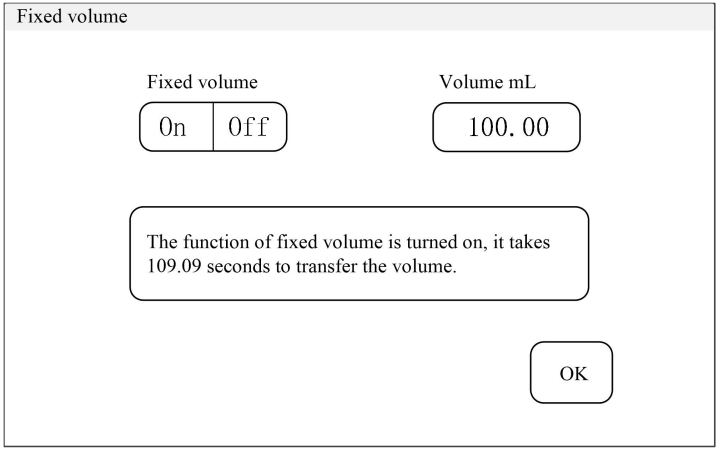
- **Add button**: Click this button to save the current operating parameters to common mode. Up to 60 modes can be stored.
- **Delete button**: Select one common mode, click **Delete** button, a dialog box

asking whether to delete pops up, then click “yes” to delete this mode.

- **Clear button**: Click this button, a dialog box asking whether to clear all pops up, click “yes” to clear all the modes.
- **Call button**: Select one saved mode, then click **call** button, a dialog box asking whether call common mode pops up, then click “yes” to back to main interface, the operating parameters are the parameters in the selected common mode.
- **Back button**: Click this button to back to main interface.
- **“<<”, ”>>” button**: View previous or next common mode.

4.7 Fixed volume interface

Fixed volume interface is shown in the figure below



Click Fixed volume button to enter to set parameter interface for the fixed volume in main interface.

Click Fixed volume enable button, turn on the function of fixed volume. When the button displays 

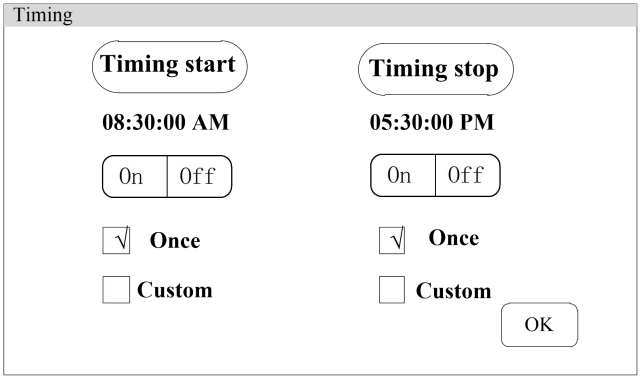
, it means that the fixed volume is turned on, otherwise it means that the fixed volume is turned off.

After turning on the fixed volume, then input **volume**, it will display run time that automatically calculated estimated at below. The input range of **set volume** is 0.01uL-9999mL.

Click **OK** button, save parameter and escape.

4.8 Timing start/stop interface

The timing start/stop is shown in the figure below



You can start pump, stop time freely in this function. After current time reach to the set time, it will automatically start or stop motor.

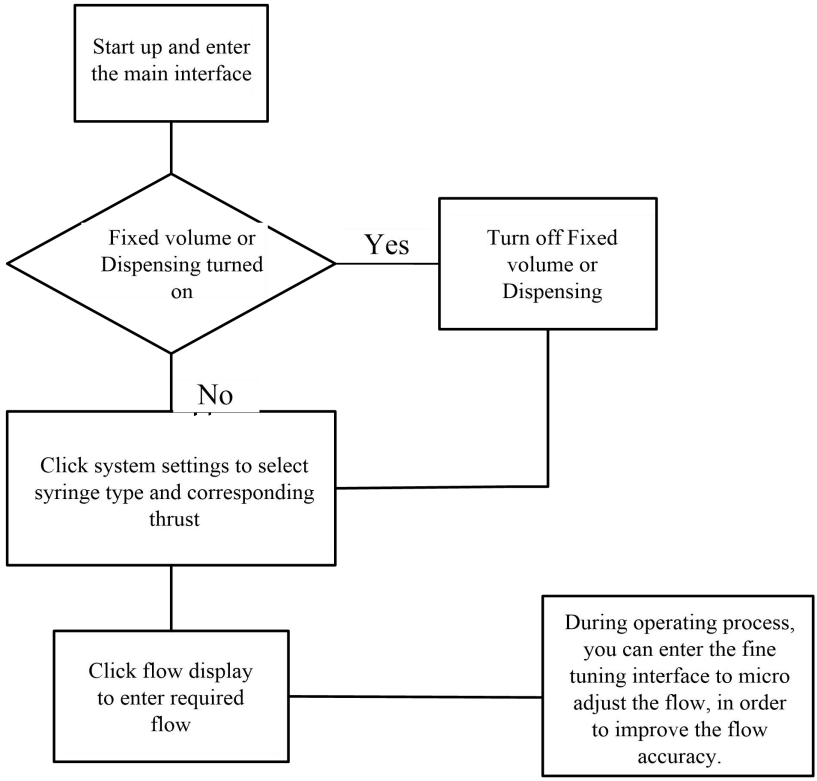
Timing function is disabled when fixed volume or dispensing function are turned on.

When the button displays 

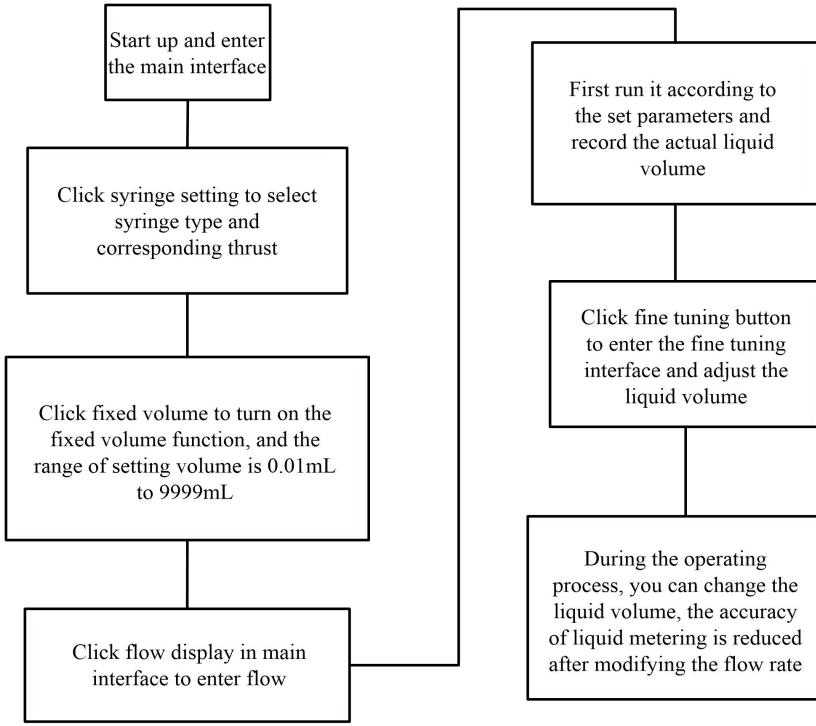
, it means that the timing start/timing stop is turned on, otherwise it means turning off.

5. Main Function Operating Process

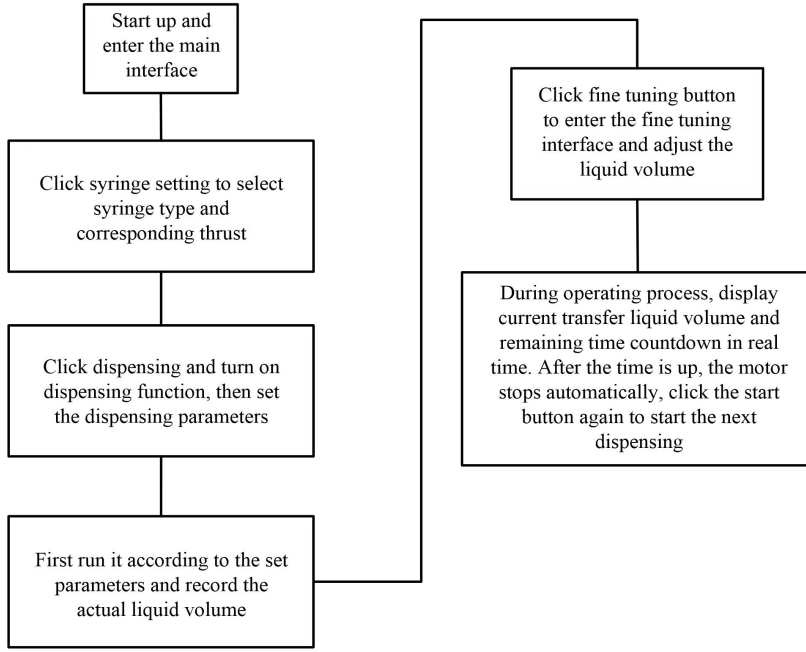
5.1 General flow rate transfer



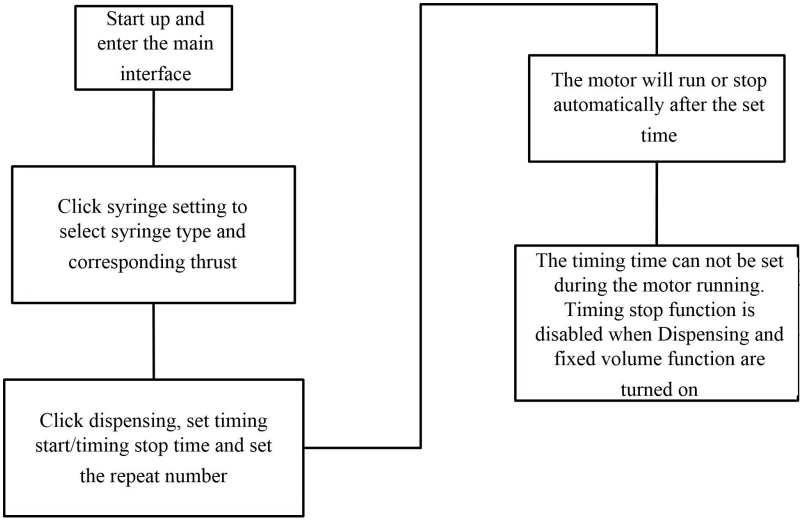
5.2 Fixed volume



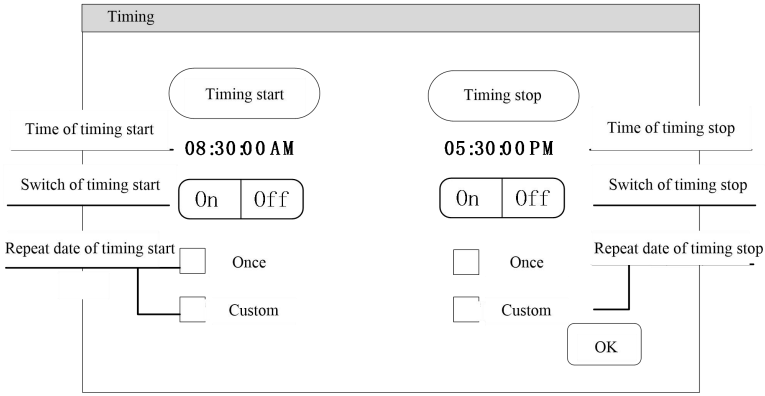
5.3 Dispensing



5.4 Timing



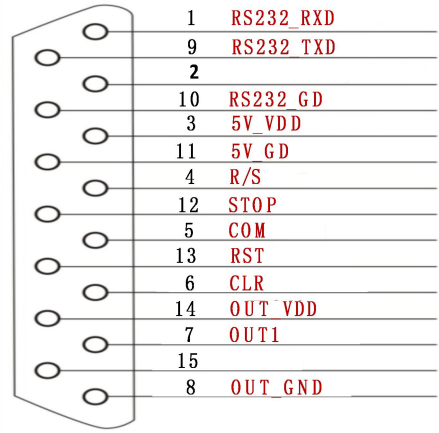
In the flow rate transfer mode, set the pump to run automatically every Monday to Friday at 8:30 am, the pump to stop automatically at 5:30 pm. The setting page is shown below figure:



Click the **time of timing start** to set the timing start time to 8:30, click **switch of timing start** to set to ON. Then click **custom** of repeat date, the Set Repeat Date window will pop up, set as follows:

6. External Control Instruction

6.1 The host computer external control interface



(1) Communication port

RS232_RXD, RS232_TXD, RS232_GND: RS232 communication port

(2) External control interface (active signal input, 5-24VDC input)

COM: The common terminal of external control signal input

R/S: External control start/stop signal input

STOP: External control stop signal input

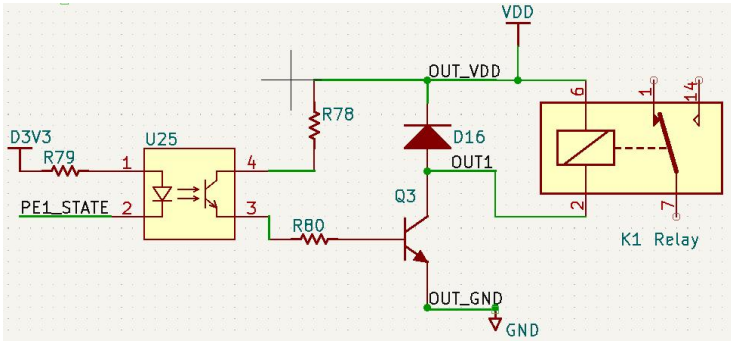
RST: External control initialization signal input

CLR: External control clean/stop cleaning signal input

(3) Perfusion state output

OUT1: Indicates whether liquid is being filled

The wiring diagram is shown below

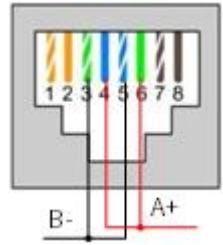


When the syringe pump starts to perform the perfusion action, the relay is closed; after the syringe pump stops the perfusion action, the relay is turned off.

(4) Internally isolated 5V output

5V_VDD, 5V_GD: internally isolated 5V signal

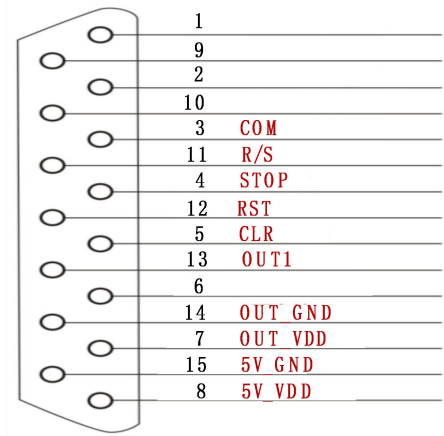
6.2 Host computer RS485 interface instruction



A+, B-: RS485 communication interface

Note: Both RS232 and RS485 are the Modbus communication protocol RTU mode.

6.3 External control interface of lower computer



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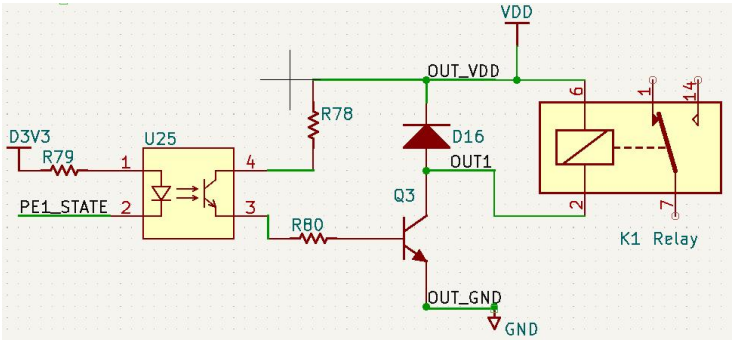


When the syringe pump starts to perform the perfusion action, the relay is closed; after the syringe pump stops the perfusion action, the relay is turned off.

(3) Internally isolated 5V output

5V_VDD, 5V_GD: internally isolated 5V signal

It should be noted that: When leaving the factory, the dust plug will be inserted on the external control interface. If you need to use other external control equipment of our company, such as foot switch, hand-held liquid separator, etc., please unplug the dust plug first, and then insert the external control equipment.

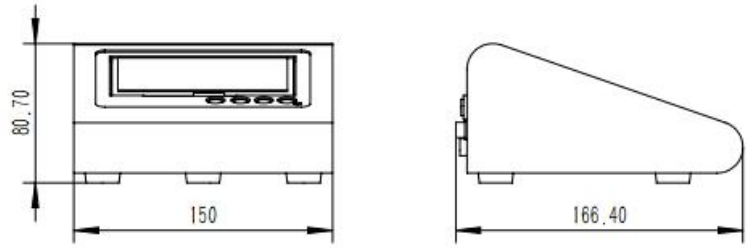
7. Technical Specifications

Flow range	0.06μL/min-70mL/min (The liquid is pure water and the length of the pipeline at the liquid inlet end is less than 1m, inner diameter 1.6mm)	Maximum pressure of liquid path	0.68Mpa
Accuracy	≤±0.05% (At maximum stroke, syringe above 500ul, purified water at room temperature)	Type of reversing valve	3 port 120°valve
Communication interface	RS232, RS485 supports Modbus protocol, RTU mode	Tubing interface	1/4''-28 (British system)
External control signal	Passive switch signal: supports start/pause function, like connecting foot pedal switch Active switch signal: support start/pause, stop, clean, reset, 5-24V universal	Syringe specification	50uL, 100uL, 250uL, 500uL, 1.0mL, 2.5mL, 5.0mL, 10mL, 25mL
Output interface	Indicates liquid output status (open collector output)	Applicable power supply	filling unit: Standard 24V adapter Controller: Standard 5V adapter
Display method	4.3inch industrial true color LCD screen	Working ambient temperature	15℃~40℃
Operation method	Touch screen and pure imported keypad	Relative humidity of working environment	<80% (no condensation)

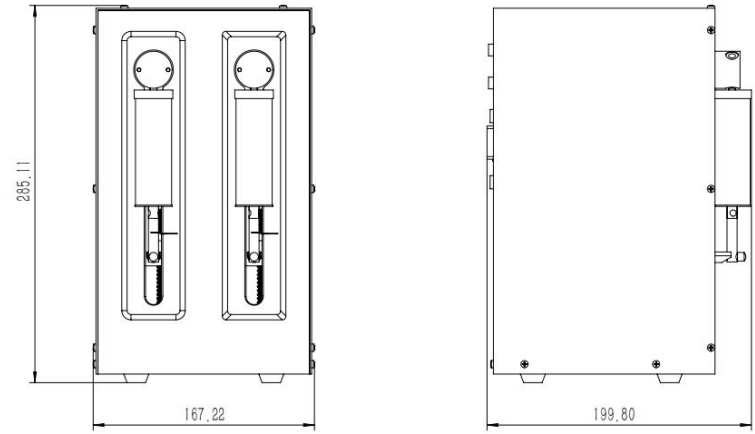
8. Dimension Drawing

Unit: (mm)

Controller dimension drawing



Filling unit dimension drawing



9. Maintenance

- Lubrication of the screw: Before the first use, lubricating oil should be applied to the screw to ensure the normal operation of the screw. In order to prolong the service life of the screw, it is recommended to apply lubricating oil once every 3-5 days. The screw should be cleaned before lubricating;
- Check the running status of machine before starting it, normal operation can be put into use;
- Check for leakage, and correct fault which can be appeared;
- Please turn off the power supply and unplug the power socket (Hold the socket instead of power cord) when liquid splashed on pump. Check whether liquid flows into the machine, if it does, please contact the manufacture;
- If it is used for electrospinning, be careful not to discharge the tip of the pump body from the outlet of high-voltage static electricity, otherwise it will damage the equipment;
- The foot pedal switch and other external control plugs must be connected or disconnected in the power-off status to prevent the external control interface from being burned;
- The user's power socket must have ground wire, and have reliable grounding;
- Cleaning maintenance: During operation or after operation, please keep the machine being clean, wipe off the liquid splashed on the syringe pump with a soft wet cloth；
- Cleaning precautions:
  (1) Please disconnect the power supply during cleaning to avoid electric shock;
  (2) Don not immerse the pump in water;
  (3) Don not heat the syringe pump at high pressure;
  (4) Do not lift the pump with the syringe and pusher.
- The syringe rim must be inserted into rim fixed groove of the syringe pump, and keep the syringe clean;
- Check whether the parts and screws of the syringe pump regularly for

looseness;

- This product has no waterproof measures. Please take protective measures when using in water environment;
- This product does not have special certification such as medical certification. When it needs to be used in special fields such as medical and military, please self-certify;
- If the machine is not used for a long time, wipe it clean and apply lubricating oil to the screw, and store it in a dry and ventilated environment;
- The company shall not bear the direct and indirect losses caused by the malfunction or improper operation of this product.

10. Warranty and After Sales Service

We support 1 years warranty for the pumps, subject to the exceptions below. Our company shall not be liable for any loss, damage, or expense directly or indirectly related to or arising out of the use of its products. This warranty does not obligate our company to bear any costs of removal, installation, transportation, or other charges which may arise in connection with a warranty claim.

If the pump fails during the warranty period, after confirmation by our technical department, we will provide spare parts free of charge. Customers will need to bear the shipping cost.

Exceptions:

- The warranty shall not apply to repairs or service necessitated by normal wear and tear or for lack of reasonable and proper maintenance.
- All pumping accessories as consumable items are excluded.
- Electrical surge as a cause of failure is excluded.
- Chemical attack is excluded.
- Improper operation or man-made damage as a cause of failure is excluded.