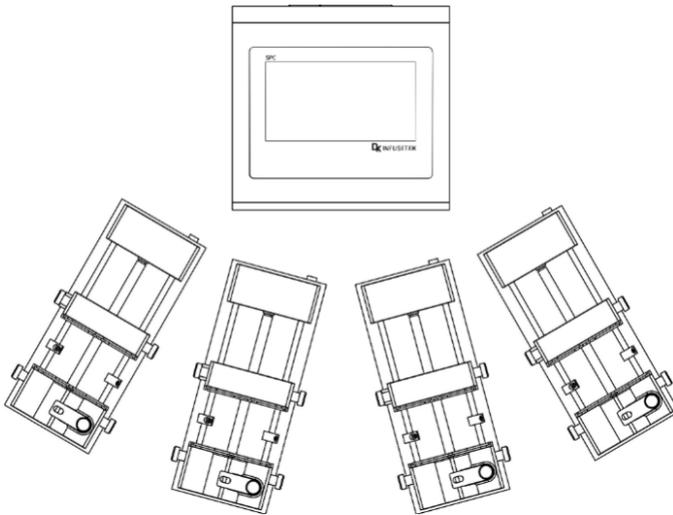# DK INFUSETEK

SPC Series Manual

⚠ 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

SPC series syringe pump are consist of one controller and multiple individual split syringe pump units, each syringe pump unit has two working modes: independent working mode and logic working mode.

In independent working mode, each syringe pump unit can be used as an independent unit to infuse or withdraw liquid. Multiple units work independently, can infuse or withdraw liquid with different speeds in same time.

In logic working mode, multiple syringe pump units work with preset logic relationship. Different liquids can be added in order and in different proportions to complete automated mixing work.

SPC system uses 7 inch industrial true color LCD screen display, touch screen control, and it has the function of t intelligent calibration and online micro adjusting. Rich external control modes for option, support RS485/RS232 communication interface, standard Modbus protocol to realize remote control. Suitable for high precision liquid infusion and withdraw.

2. Product Composition

It consists of one controller and multiple independent syringe pump units. The number of syringe pump units can be arbitrarily increased or decreased according to needs. And the effectiveness of the matched syringe pump units can be set at will to meet different production needs.

Connection note:

(1) All split syringe pump units are connected to one controller, and the controller has an independent control interface for each split syringe pump unit.

(2) Each controller can control maximum 8 syringe pump units.

2.1 Controller Interface Instruction
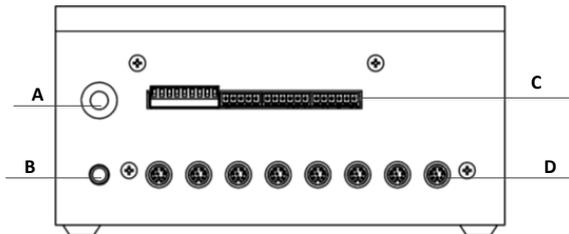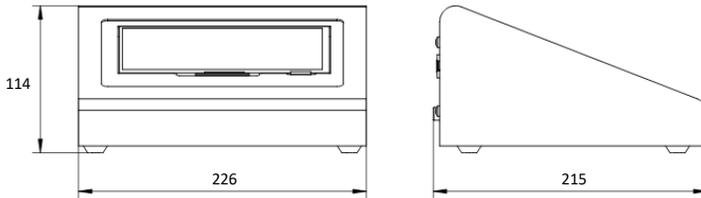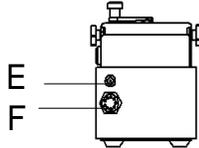

Controller Backside

Interface Instruction:

A: Power switch

B: Power socket

C: External control interface

D: Connecting syringe pump unit interface (F)

2.2 Syringe Pump Unit Connection Interface

Syringe Pump Unit Backside

E: DC 24V power supply interface

F: Connect controller interface (D)

2.3 Installation of syringe for the Split Syringe Pump
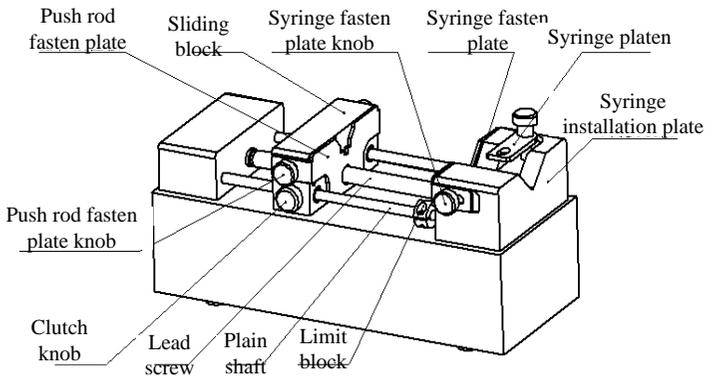
(1) Hold down [clutch knob] to disengage [sliding block] from [lead screw] and move to other positions manually (or use the fast forward and rewind buttons to move [sliding block]).

(2) Rotate two [Push rod fasten plate knob] on the side of the [Sliding Block] to open the [Push rod fasten plate]. Rotate the [Syringe fasten plate knob] on the side of the [Syringe mounting plate] to open the [Syringe fasten plate].

(3)   Lift and rotate the [Syringe platen], place the syringe, adjust the syringe to the appropriate position, and rotate the [Syringe platen] to hold the syringe.

(4)   Tighten the knobs to secure the syringe.

(5)   The syringe can be prevented from being damaged by adjusting the stop block. Especially glass syringe type syringes need to be adjusted and fix this stop block.

Note: When installing the glass syringe, push the slider toward the limit position after fixing the syringe, then move it about 1mm in the opposite direction, and fix the stop block with the wrench provided with the factory product. Then move the slider to the initial position of the syringe and enter the working state.

3. Controller Composition
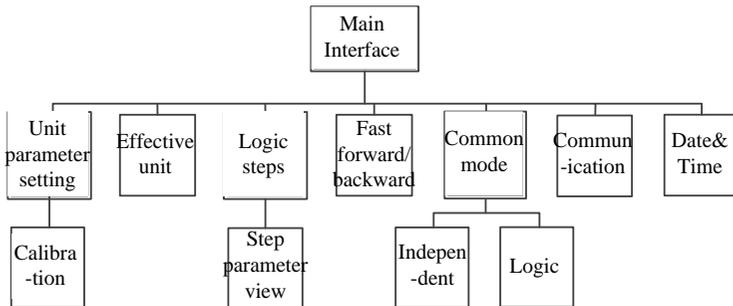
SPC controller operation instruction

(1)   **Select effective unit**: Enter [Effective unit] interface, select the syringe pump unit to be operated as effective unit. According to requirements, it can be set as independent effective unit or logic independent effective unit. (Note: Only if the unit is set as an effective unit, can set the parameters and operation control.)

(2)   **Unit parameter setting**: In main interface, click [syringe] image to enter unit parameter setting interface. In that interface, need to set syringe parameters, working mode and infusion parameters.

(3) **Start syringe pump unit**: After set up the parameters, back to main interface, click start button in main interface.

(4) Other functions can refer to detailed instruction for setting.

4. Operation Interface Instruction Structure Diagram

4.1 Booting interface

After turn on the pump, enter welcome interface, after 2.5 seconds system enter main interface automatically.

4.2 Main Interface

The structure diagram of main interface as the below figure shows
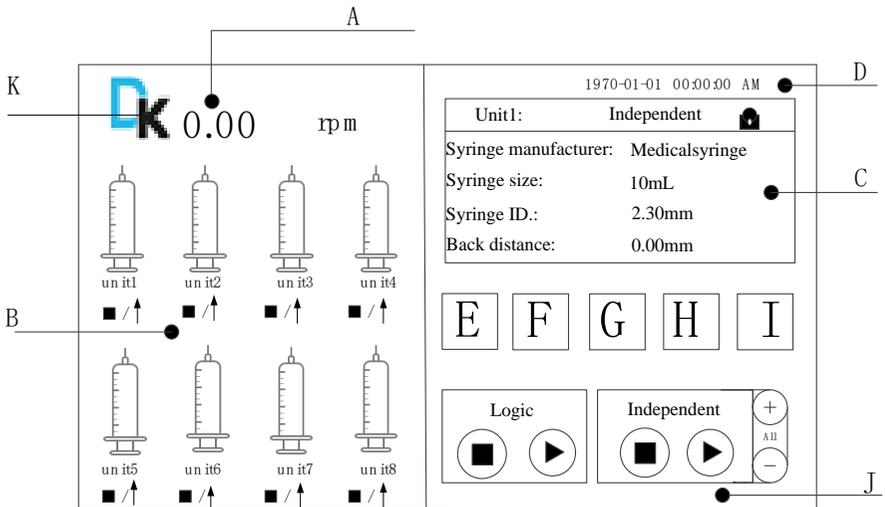
A. **Speed display**: The speed of selected as effective unit is shown polling every 5 seconds.

B. **Real-time animation display**: Display the running status of each units in real time. Animation shows monitoring results, and has the function of alarming. If a red alarm signal appeared on a syringe, the corresponding unit is blocked.

Please check the traffic jam condition of the syringe pump unit; when the unit is stopped, click the syringe to enter the corresponding unit parameter setting interface.

(1)   When the unit runs in independent working mode, click syringe to enter corresponding unit parameters viewing interface, can micro adjust the speed online.

(2)   When the unit runs in logic working mode, click syringe to enter viewing interface detailed parameter for corresponding steps, micro adjust the speed online.
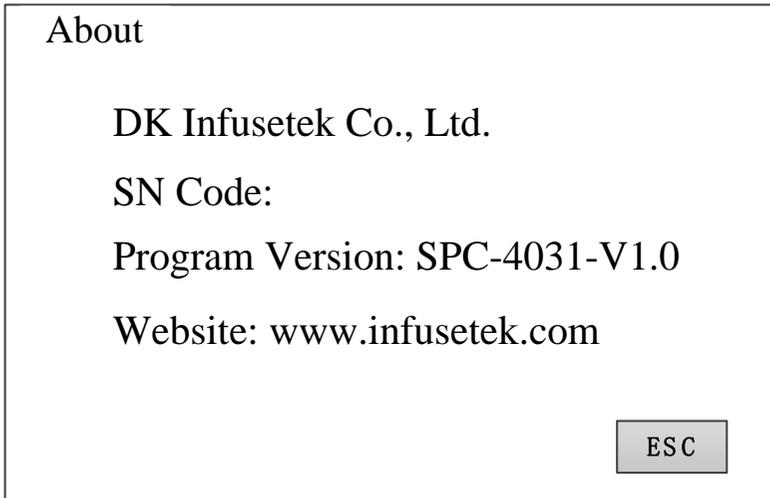
(3)   If the unit is not selected as effective unit, click syringe to indicate the unit is invalid.

C.   **Parameter display:** Every 5 seconds polling to display effective unit system settings parameter. Click the small lock icon in the upper right corner to lock the current unit and stop polling.

D.   **Date & time:** Real-time display the current date and time, click here to modify.

E.   **Effective unit button:** Click this button to enter effective unit selection interface.

F.   **Logic steps button:** Click this button to enter logic step viewing interface.

G.   **Fast forward/backward button**: Click this button to enter fast forward/ backward interface.

H.   **Common mode button**: Click this button to enter common mode interface.

I.   **Communication setting button**: Click this button to enter communication setting interface.

J.   **Start/stop selection area**: Select start or stop unit running in this area.

4.3 About Native

```
About

    DK Infusetek Co., Ltd.

    SN Code:

    Program Version: SPC-4031-V1.0

    Website: www.infusetek.com


                                        ESC
```

In main interface, click the DK at the k area to enter the interface, view the related information of the native.

4.4 Independent Working Parameter Setting Interface

Independent working parameter setting interface as below picture shows:

When the pump unit stops, click the syringe selected independent effective in main interface to enter independent parameter setting interface of corresponding unit.

A. **Unit No. display**: This area display the current setting unit number.

B. **Syringe parameter setting**: In this area, set the unit's syringe parameter, syringe manufacturer and syringe size. Please note that if change syringe size, then the operation parameters of this unit will be restored to factory.

C. **Customized**: In this area select whether need to customized syringe, click ⭕ to set whether to use custom syringe mode. In selected mode ◉ , click [customized] button to enter customized syringe setting interface, in this interface input the syringe inner diameter and length. Please note that if change syringe size, then the operation parameters of this unit will be restored to factory.

D.   **Working mode setting**: Set the unit working mode in this area.

E.   **Working parameter setting**: Set the unit working parameters in this area.

a.   Start delay: The time range is 0.1s-999.99 hours

b.   Repeat number: Limited times 1-9999 times, set to 0 is unlimited.

c.   Back distance: 0-5mm.

d.   Repeat pause: 0.1s-999.99 hours.

e.   Pause time: 0.1s-999.99 hours.

Reverse: That is, after the extraction is completed, run a certain distance in the opposite direction, which can be used to eliminate the mechanism gap. The Reverse range is 0mm-5mm (recommend 0.2mm); Mechanism clearance is the motion error during the return stroke caused by some complex factors including manufacturing, friction, etc., and is generally unavoidable.

F.   **Calibration button**: Click this button to enter independent working flow rate calibration interface to calibrate the current unit flow rate.

4.5 Independent Working Mode Flow Rate Calibration Interface

Independent operation flow calibration interface as the below picture show:
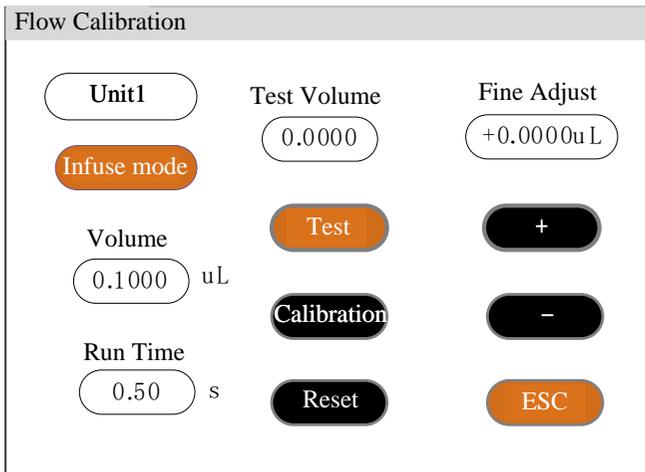
In independent working mode parameter setting interfaces, click '**CAL**' button to

enter calibration interface. First click drop down menu under '**CAL. No.**' select the group number of pump unit for calibration. (if the working mode is withdraw or infuse mode, this area displays working mode; if the working mode is withdraw-infuse or infuse-withdraw, then you need to select to calibrate withdraw or infuse. To ensure infuse accuracy, should calibrate each group separately). **Volume** and **Run time** are the previously set data, can not be changed. If the running time is greater than 9999 seconds, it will display >9999.

Before use the pump, calibration procedure as below:

A.   Select number of calibration group (withdraw-infuse mode or infuse-withdraw mode).

B.   Click '**Test**' button to start the test, the run time countdown display, when the run time is automatically stopped, a numeric keyboard for entering the actual test volume is automatically popped up, then enter the actual measured liquid volume. After clicking the OK button, it is asked whether to continue the test (it is recommended to test more than three times), select 'Yes', retest, select 'No' back to calibration interface.

C.   After multiple tests, the actual volume display area displays the average value of the actual volume of the test group. Click the '**calibration**' button, indicate calibration is successful.

D.   Test again to check whether the volume can meet requirement, if request high accuracy, click '**+**' or '**-**' button to micro adjust the volume.

E.   Click '**Reset**' button, the previous multiple tests are canceled and the parameters are restored to the parameters before calibration.

Note: Logic working mode calibration interface is similar to independent working mode calibration interface, operation is same.

4.6 Logic Working Mode Parameter Setting Interface

Logic working mode parameter setting interface as the below picture shows:

When in stop status for logic working mode, click the syringe is selected as logic working mode effective unit in main interface, enter the pump unit logic working mode parameter setting interface.

➢ **Syringe manufacturer**: Click syringe manufacturer to select the syringe manufacturer used on this unit.

➢ **Syringe size**: Click syringe size button, select the syringe size used on this unit.

➢ **Customize syringe button:** In this area select whether need to customized syringe, click ○ to set whether to use custom syringe mode. In selected mode ◉ , click [customized] button to enter customized syringe setting interface, in this interface input the syringe inner diameter and length. Please note that if change syringe size, then the steps parameters of this unit will be cleared.

➢ **Add steps:** Click this button to select step NO. to be set.

➢ **All steps:** Click this button, view all the step NO. existing in the unit, select a

step number, you can view the parameters of the step or modify its parameters.

➢ **TIME-TRIG**: Select time trigger, then the step will wait for the response start time after the previous step is completed and then start running.

➢ **EXT-TRIG**: Select external trigger, then this step will wait for the corresponding external start signal after the previous step is completed (need to connect the external control signal to the unit).

➢ **Calibration** button: Click 'CAL' button, enter logic working mode calibration interface, to ensure filling volume, need to calibrate each step separately. The detailed operation please refer to the independent working mode calibration procedure.

➢ **Withdraw mode, infuse mode button:** Each step must set the working mode.

4.7 Logic working mode flow calibration interface

Logic working mode flow calibration interface as the below picture shows:

Flow Calibration

Unit1	Test Volume	Fine Adjust
Step 01	0.0000	+0.0000uL
Volume	Test	+
3.0000 uL	Calibration	–
Run Time		
30.00 s	Reset	ESC
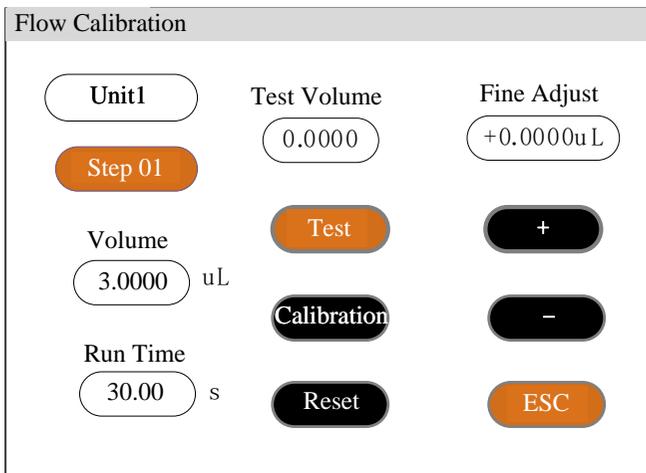
The logic operation calibration interface is similar to the independent operation calibration interface, and the operation method is the same

4.8 Effective Unit Interface

The effective unit as follow picture,

Please select effective units

Independent working

| Unit1 | Unit2 | Unit3 | Unit4 |

| Unit5 | Unit6 | Unit7 | Unit8 |

Logic working

| Unit1 | Unit2 | Unit3 | Unit4 | OK |

| Unit5 | Unit6 | Unit7 | Unit8 | ESC |

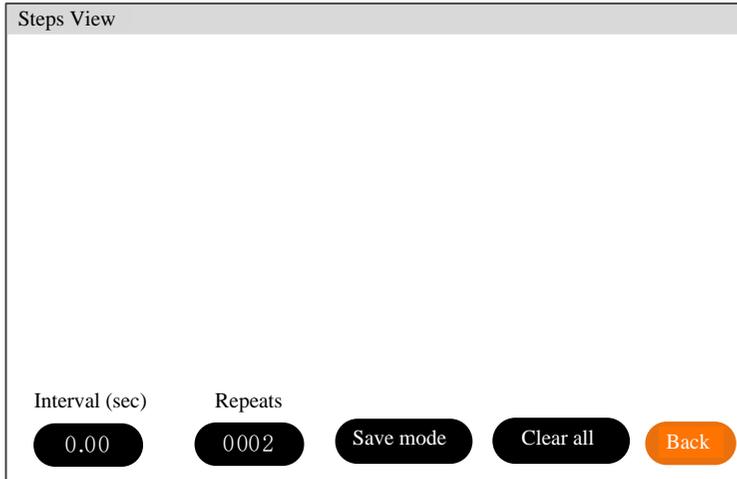Click **[Effective unit]** button in main interface, enter effective unit selection interface to set unit effectiveness. After setting, click OK button back to main interface. If a unit is running, or logic working is started, the currently running unit or logically active unit cannot be edited.

Note: Selecting effective unit is the first step of parameter setting, only the unit selected as effective unit can be operated.

4.9 Step Interface

The step interface as the below picture shows:

```
┌──────────────────────────────────────────────────────┐
│ Steps View                                             │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│   Interval (sec)      Repeats                          │
│   ┌──────────┐   ┌──────────┐  ┌──────────┐ ┌────────┐ ┌──────┐ │
│   │   0.00   │   │   0002   │  │Save mode │ │Clear all│ │ Back │ │
│   └──────────┘   └──────────┘  └──────────┘ └────────┘ └──────┘ │
└──────────────────────────────────────────────────────┘
```

Click **Step** button in main interface, enter step view interface. This interface can view all the steps of the current logic setting, set the **repeat times** and **interval time** of the entire logic, click the **save mode** button, you can save the current logic as a common mode, can save up to 5 groups. Click '**Clear**' button to clear all steps of the current logic. In the logic working start state, click each step in the interface to view the detailed parameters of the step and micro adjusting the current step online; in the logic running stop state, click each step to delete a step. Click '**Back**' button, back to main interface.

4.10 Parameters interface of view steps

Logic   Unit1   current steps 01

Syringe manufacturer	Syringe type
SG E	250uL

Delete

The interval time of steps is 8.00s

Trigger	Working method	Linear speed
Time-Trig	Infusion	1.44

+

−

| Volume (μL)	Time (s)	Flow rate (μL/min)
3.00	30.00	6.00

Back

Click Logic steps button in the main interface enter to view step interface. Click step NO. set in the left upper corner enter to parameter view interface.

Or at the starting status of logic operation, click on the corresponding logically valid syringe image and enter to parameter view interface.

4.11 Fast Forward/backward Interface
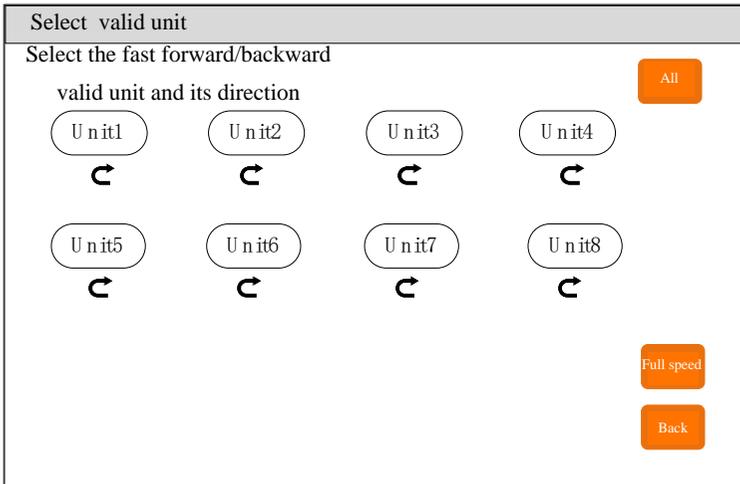
Click '**Fast Forward/backward**' button in main interface to enter the full speed interface. In this interface, after select unit direction and unit, then click '**Full speed**' button, the selected unit will run with selected direction and full speed. Click '**All**' button, then all unit is selected.

4.12 Common Mode Interface

Independent working mode common mode interface

Independent	Logic

Save mode   Parameter

Mode 01

Unit	Manufacturer	Syringe size	Back distance	Mode	Withdraw Vol.	Infusion Vol.

《   Calling   Delete   Clear   Back   》

Logic working mode common mode interface

Independent	Logic

Mode 01

Steps	Interval	Unit	TRIG-Mode	Working mode	Volume	Flow rate

《   Calling   Delete   Clear   Back   》

Click **MODE** button in main interface, enter common mode interface.

➢ Click '**Independent /logic**' button in top left corner to switch two interfaces.

➢ **Calling button**: Click this button to call this common mode, after calling, the operating parameters of the corresponding unit will be changed to the parameters of this common mode.

➢ **Delete button**: Select a common mode, click the delete button, a dialog box asking whether to delete is popped up, click 'Yes' to delete this mode.

➢ **Clear button**: Click this button, a dialog box asking whether to clear all is popped up, click 'Yes' to clear all modes.

➢ **Back button**: Click this button back to main interface.

➢ **"<<" and " >>"**: If there are multiple common modes, click this button to view the previous or next page of common modes.

➢ **Save Mode button** (independent common mode interface): Click this button to save the current parameters of all independent running units as common mode, which is convenient for users to call, to save the time of setting parameters. It can save up to 5 groups.

➢ **Parameter button** (independent common mode interface): After selecting an independent mode unit in the table below, click this button to view the detailed parameters of the independent operation unit.

4.13 External Control Setting Interface

```
External control setting

    Baud Rate                      Enable
     9600        ▼              On   Off

 Communication Interface
     RS232       ▼              Check Bit
                                Odd parity  ▼
   Slave address
     01                                    Back

 External control mode
   Pulse  Level
```

Click External setting button in main interface to enter external control setting interface. Set relative communication parameters.

This product support Modbus communication protocol—RTU mode. First choose the communication baud rate and communication port (RS485 or RS232). Click the Slave address button, and input the controller address No. (range is 1-32). Select the communication function to "ON" On Off . At this time, the pump can communicate with the host computer and receive the signal control from the host computer.

Note: After the setting is completed, the communication signal control is only received in main interface. In other setting interface, the communication control is invalid.

4.14 Time & Date Setting Interface

Date & Time

12-Hour

24-Hour

Set Date

Set Time

2012-3-15

8 :45 :35

Thursday

Back
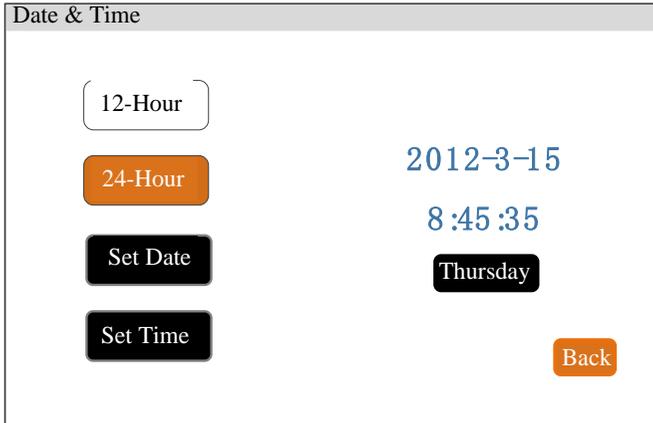
Click the Date&Time in the upper right corner of the main interface to enter the time and date setting interface.

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

Click the Date button to pop up the year setting numeric keyboard. Set the year range to 1970-2099. After setting, click 'ENT' to enter the month numeric keyboard and then the day numeric keyboard. Click the Time button to pop up the numeric keyboard and set the hour, minute, and second in sequence.

**4.15 Start/Stop Control Operation**

This area is located at the bottom left of the main interface.

➢ **Independent operation area**: Click '+' or '-' on the right side to select the unit needed to operate. 'All' is operating all the valid units in independent working mode.

➢ **Logic working area**: Click the start button, a step selection window will pop up. On this window you can select the first step you want to start when the logic mode starts. After the logic mode starts, click the start button again to

pause the current logic working.

5. External Control Interface Instruction

The green terminal wiring on the back of the controller is the external control interface, as shown in the picture below:
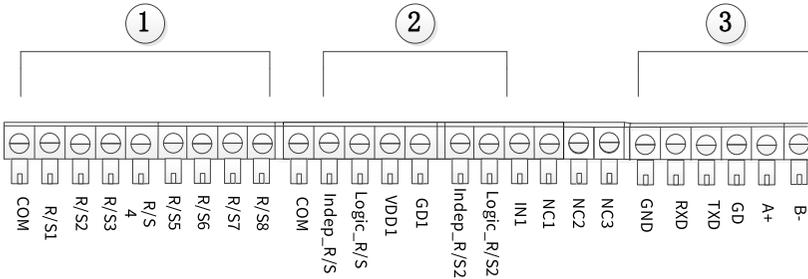
①   **Independent start/stop signal/logic external signal:** Active signal input(5V-24V VDC)

COM: Common port for external control signal input.

R/Sn: Pump unit n start/stop signal line (signal rising edge is valid, high level duration is 200ms).

②   **All start/ stop signals: Active signal input (5V-24V VDC)**

The signal is recognized as valid on the rising edge, and the minimum duration of high-level is 200ms.

COM: Common port for external control signal input.

Indep_R/S: All start/stop signal of independent working unit.

Logic_R/S: Logic All start/stop signal of working unit. (Default start from the first step)

All start/stop signal (passive signal input) and isolation 5V power input.

VDD1: Isolation 5V positive pole

GD1: Isolation 5V negative pole

Indep_R/S2: All independent effective unit start/stop signal, Indep_R/S2 and

GD1 are short circuited, start all independent effective unit, short-circuited again to stop all independent effective unit.

Logic_R/S2: Logic working start/stop signal. Logic_R/S2 and GD1 are short circuited, start logic working; short circuited again, stop logic working.

③ **Communication Port**

TXD, RXD, GND: RS232 communication interface, select RS232 in the communication setting interface, this interface is effective.

A, B, GD: RS485 communication interface, select RS485 in the communication setting interface, this interface is effective.

VDD1, GD1: 5V output signal.

Note: No matter choose RS232 or RS485, the communication protocol is all standard MODBUS protocol.

Notice that: When leaving factory, the wring port will be plugged in the external control interface, and if you need other external equipment equipped by our company, like, foot pedal switch, handling dispenser etc. First, please unplug the wiring port, and then plug the external control equipment.

6. Technical Specification

| Working mode (four types)	Infuse, Withdraw, Infuse/withdraw, Withdraw/infuse	Pump units	1-8 for option
Max stroke	90mm	Syringe types	10μL-60mL
Liner speed	1um/min-132mm/min	Rated linear thrust	≥16Kgf
Max and min speed	Max: 0.937sec/micro step Min: 0.035ms/micro step	Control accuracy	Stroke≥Maximum stroke 30%, Accuracy≤ ±0.5%
Rated linear thrust	≥16Kgf	Display	7 inch color screen
Memory	Re-power on, keep the parameters before power off	Calibration	Save calibration parameters independently for each channel
Signal input	Start/Stop	Communication port	RS485/RS232
Back distance	0.01-5mm	Voltage	Controller: DC5V Pump unit: DC24V

7. Function and Features

➢ Install multiple types of syringes, the same controller can control multiple different types of syringes to work at the same time, also work independently at different times.

➢ Precision angle control technology to achieve high-precision distribution.

➢ Color touch screen control, animation displays infusion status, and the same screen polling display system settings of 8 units.

➢ Intelligent calibration function, automatically calibrate the infusion amount before production to ensure the infusion accuracy.

➢ On-line fine-tuning function, it is convenient for you to fine-tune the liquid volume of a split syringe pump unit during the production process, with less infusion error.

➢ Multiple split syringe pump units can be expanded on one controller to maximize cost savings.

➢ Each unit is independently controlled, and different infusion parameters can be set, which can be started or stopped independently or simultaneously.

➢ Real-time monitoring, animated display of monitoring results, and alarm function to ensure safe production.

➢ Effective unit setting, one or several split syringe pump units can be turned on or off arbitrarily.

➢ The setting of the retreat distance can eliminate the air bubbles in the syringe and improve the filling accuracy.

➢ External control start and stop function, each channel can independently receive external control start and stop signals, and all effective channels can also be started and stopped at the same time, which can realize the unified operation of the controller.

➢ The controller can receive the independent block signal of each channel to realize the block alarm function and shutdown of the individual channel to ensure safe production.
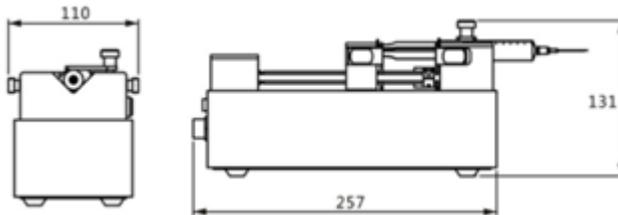
➤ Fast forward and fast backward function is used for the loading, cleaning of the syringe and the release of the protection status of traffic block.

➤ Adjust the position of stop block to prevent the syringe damaging. Especially for the syringe of glass injector type, the stop block needs to be adjusted and fixed.

8. Product Dimension Drawing

Unit: (mm)
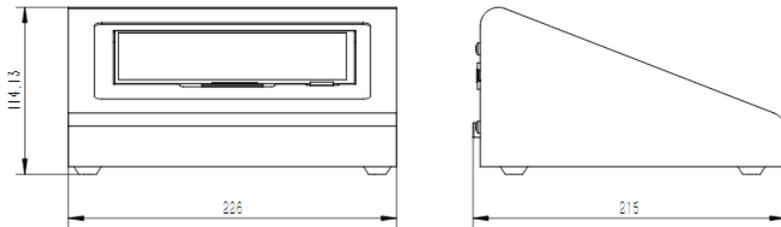
Controller

Syringe pump unit

9. **Maintenance**

➢ **Lead screw lubrication**: Before first use the syringe pump, please coat lubrication oil on the lead screw to ensure the lead screw can work normally. To extend the lifetime of lead screw, we suggest to coat lubrication oil every 3 or 5 days. Before coating lubrication oil, please clean the lead screw.

➢ 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.

➢ If liquid splash on the machine, 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.

➢ 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 and maintenance: during operation or after the completion of the operation, please keep the equipment clean, with a soft cloth to wipe the liquid splashing into the syringe pump.

➢ Cleaning note:

    1. In the cleaning process, please disconnect the power to avoid electric shock.

    2. Do not immerse the pump in the water

    3. Do not heat or high pressure treatment to the syringe pump.

    4. Do not lift the pump with the syringe and push seat.

➢ The edge must be inserted into the syringe pump side ring fixing groove, and pay attention to clean syringes.

➢ Regular check the parts and screws of syringe pump.

➢ 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 pump does not use for a long time, please clean it and coat lubrication oil on the lead screw, keep it in dry and ventilated environment.

➢ The company shall not bear the direct and indirect losses caused by the malfunction or improper operation of this product.

➢ Please be attention that the outlet of high-voltage static electricity shall not form tip discharge to the pump body if using in electrospinning.

10. **Warranty and After Sales Service**

We support 3 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 tubing and 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.