ASP100 Series Digital Syringe Pump
Operating Manual

Version E01

Contents

Statements

The contents of this manual and the specifications of the pump are subject to change without notice.
Depending on the pump model and software version you are using, the screenshots or function descriptions in this manual may be different, please refer to the functions of the current software version.
Before using the pump, please review all relevant documentation concerning safety guidance and proper operation.

1. Precautions

Please read the following safety precautions to ensure proper use of the pump. If the pump is used in an unspecified manner, the protection provided by the pump may be damaged.

（1）Please use a power supply that meets the requirements. Voltage for the pump: 24VDC. Voltage for the power adapter provided by Longer Pump: AC90V-260V.

（2）Please use the power cord and AC/DC power adapter specified for the pump, and ensure the power cord and AC/DC power adapter are safety certified.

（3）Before using the pump, ensure that the ground wire of the power cord is reliably grounded to ensure personal safety.

（4）Fluid may spray from the syringe. Take reasonable practicable measures to ensure personal safety.

（5）When liquid overflow into the pump drive occurs, immediately turn off power to the device before cleaning.

（6）Do not disassemble, modify or repair the product by yourself. Contact the distributor or Longer Pump if the product needs repair.

（7）If the pump was transported in an environment below 0 degrees, please place the pump at room temperature (not lower than 0 degrees) before starting.

2. Product Introduction

2.1 Technical Specifications

Product Model	**ASP11-1A**	**ASP11-1AP**	**ASP11-2AP**	**ASP12-1B**	**ASP12-2B**
Work mode	Single infuse, multiple infuse			Single infuse, multiple infuse, single withdraw, infuse/withdraw(continuous), withdraw/infuse(continuous)	
Number of syringes	1	1	2	1	2
Syringe options	0.5uL-60mL			0.5uL-150mL	
Flow rate for reference	3.3pL/min-120.0mL/min	0.9pL/min-29.5mL/min		3.3pL/min-226.0mL/min	
Stroke	110mm			140mm	
Pusher advance per microstep	0.0326μm/microstep	0.0088μm/microstep		0.0326μm/microstep	
Linear speed	0.416um/min-180mm/min	0.1126um/min-35.4mm/min		0.416um/min-180mm/min	
Linear speed resolution	0.416um/min	0.1126um/min		0.416um/min	
Linear travel accuracy	≦±0.35% (when travel≧30% of stroke）				
Linear travel CV	CV≦0.03% (when travel≧30% of stroke）				
Linear force (max.)	320N(can be set 20%-100%)				
Built-in syringe	Common syringe brands and models on the market				
User-defined syringe	Store 20 user-defined syringes: travel≤110mm，6.75mm≤OD≤31mm			Store 20 user-defined syringes: travel≤140mm，6.75mm≤OD≤43mm	
Calibration	Improve flow rate/ volume precision and accuracy by calibrating the user-defined syringe				
Display	4.3 inch LCD for parameters and pump status				
Parameter method	20 parameter methods can be stored and easily recalled				
Control mode	Touchscreen control, external control, communication control, footswitch control, Labview control				

External control	Two control inputs: switch signals or level signals for start/stop and emergency stop Two status outputs: can be configured as start/stop, direction or fault alarm				
Communication control	RS485, Modbus RTU or Longer OEM protocol				
Real-time adjustment	The flow rate can be adjusted while the pump is running				
Audible alert	Beep sound can indicate keypad clicks, nearing completion of work, work completion, and fault alarm				
Indicator light	Green-running，Blue-standby，Red-Warning				
Screen lock	The touch screen can be locked to prevent misoperation				
Vertical display	The display will rotate 90 degrees to support vertical operation.				
Pump status when power up	Stop				
Fast forward/reverse	Infuse or withdraw at full speed				
EMC	NB CE/UKCA certified				
Dimensions (LxWxH)	240mm×180mm×137mm			280mm×212mm×160mm	
Power supply for adapter	AC 90V-260V			AC 90V-260V	
Power supply for pump	DC24V/15W	DC24V/10W		DC24V/15W	
Temperature	0 - 40°C				
Humidity	≤80%RH, No condensation				
Weight	2.8kg	2.9kg	2.85kg	3.65kg	3.65kg

2.2 Syringe Spec and Flow Rate for Reference

Product Model		ASP11-1A	ASP11-1AP ASP11-2AP	ASP12-1B ASP12-2B
Syringe	Syringe ID (mm)	Flow rate for reference		
0.5uL	0.10	0.0033nL/min-0.0014mL/min	0.0009nL/min-0.0003mL/min	0.0033nL/min-0.0014mL/min
5uL	0.35	0.040nL/min-0.0173mL/min	0.0108nL/min-0.0034mL/min	0.040nL/min-0.0173mL/min
10uL	0.50	0.0816nL/min-0.0353mL/min	0.0221nL/min-0.0069mL/min	0.0816nL/min-0.0353mL/min
25uL	0.80	0.2090nL/min-0.0904mL/min	0.0566nL/min-0.0178mL/min	0.2090nL/min-0.0904mL/min
50uL	1.10	0.3951nL/min-0.1710mL/min	0.1070nL/min-0.0336mL/min	0.3951nL/min-0.1710mL/min
100uL	1.60	0.8360nL/min-0.3617mL/min	0.2263nL/min-0.0711mL/min	0.8360nL/min-0.3617mL/min
250uL	2.30	1.7275nL/min-0.7475mL/min	0.4676nL/min-0.1470mL/min	1.7275nL/min-0.7475mL/min
500uL	3.25	3.4493nL/min-1.4925mL/min	0.9336nL/min-0.2935mL/min	3.4493nL/min-1.4925mL/min
1mL	4.72	7.2752nL/min-3.1479mL/min	1.9692nL/min-0.6191mL/min	7.2752nL/min-3.1479mL/min
5mL	13.10	56.041nL/min-24.248mL/min	15.169nL/min-4.7689mL/min	56.041nL/min-24.248mL/min
10mL	16.60	89.987nL/min-38.937mL/min	24.357nL/min-7.6575mL/min	89.987nL/min-38.937mL/min
20mL	19.00	117.89nL/min-51.009mL/min	31.909nL/min-10.032mL/min	117.89nL/min-51.009mL/min
30mL	23.00	172.75nL/min-74.748mL/min	46.759nL/min-14.700mL/min	172.75nL/min-74.748mL/min
60mL	29.14	277.30nL/min-119.98mL/min	75.056nL/min-23.597mL/min	277.30nL/min-119.98mL/min
100mL	31.00	-	-	313.82nL/min-135.79mL/min
150mL	40.00	-	-	522.50nL/min-226.08mL/min

Note 1：Please refer to below table for the stroke and barrel's OD of the application syringes：

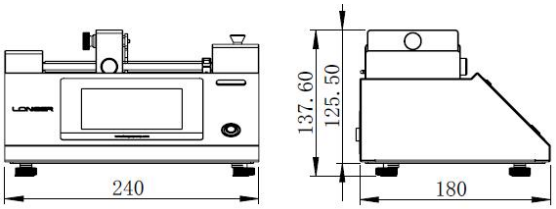
Pump Model	**ASP11-1A** **ASP11-1AP** **ASP11-2AP**	**ASP12-1B** **ASP12-2B**
Syringe requirements	Stroke≤110mm，6.75mm≤Barrel's OD≤31mm	Stroke≤140mm， 6.75mm≤Barrel's OD≤43mm

Note 2：The syringe may not be securely fixed on the pump if the barrel flange or the plunger flange is too small. Please refer to the dimensions of the commonly used syringe models below:

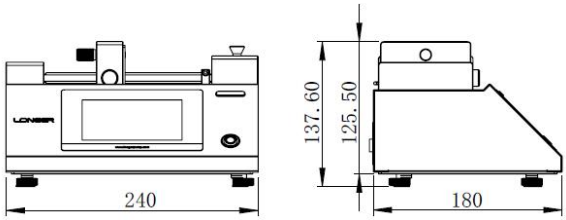
a. Disposable medical plastic syringe
b. Hamilton syringes：700 series or 1700 series (point style: 2,3,5)
c. BD syringes with Luer-needle： 300841（1mL） 301940（2mL） 301942（5mL） 301947（10mL） 301948（20mL）300143（60mL）
d. BD syringes with Luer-Lok™ Tip： 309628（1mL）302113（3mL）302135（5mL）302149（10mL）

2.3 Dimensions

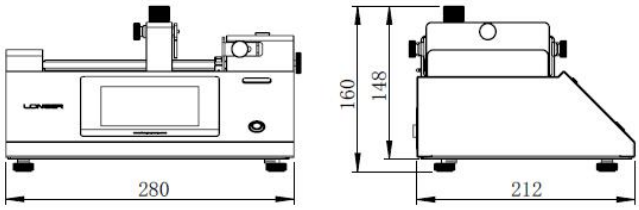
ASP11-1A &ASP11-1AP



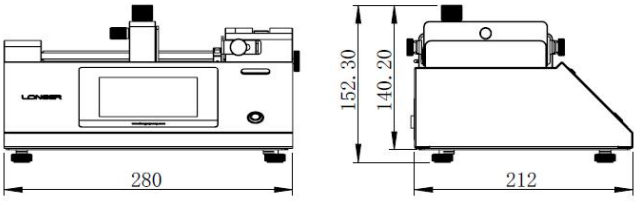
ASP11-2AP



ASP12-1B



ASP12-2B

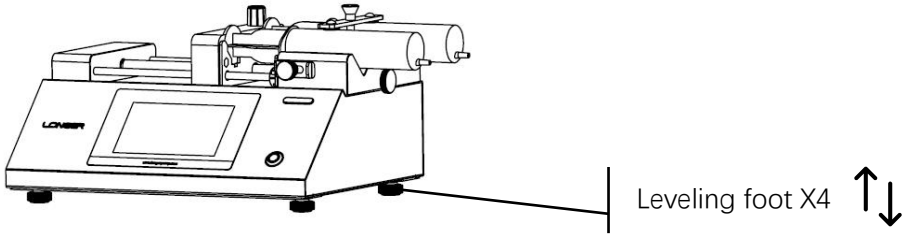


3 Operating Instructions

3.1 Pump Installation

3.1.1 Pump Levelling

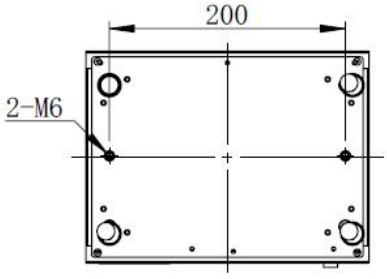
After placing the syringe pump on the working surface, if it is not stable, the height of the four leveling feet at the bottom can be adjusted individually to level the pump.



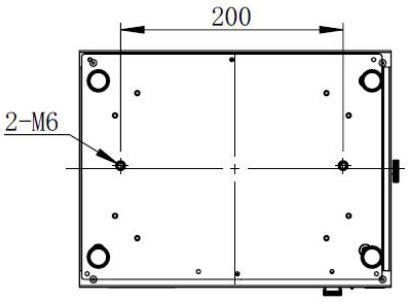
Note: First tighten all four levelling feet, and then adjust specific feet as needed to stabilize the syringe pump.

3.1.2 Pump Installation

The pump base features two independent M6 threaded mounting holes. If the syringe pump needs to be securely mounted on equipment, refer to the following dimensions for bracket drilling and use M6 screws for installation and fixation.



ASP11-1A/ASP11-1AP/ASP11-2AP

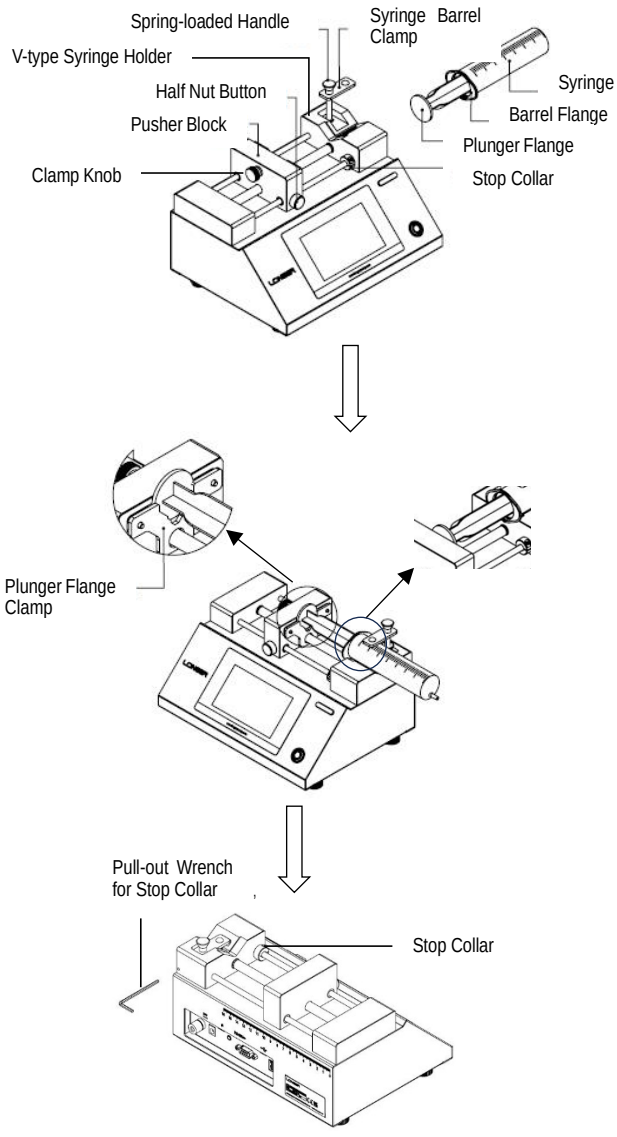


ASP12-1B/ASP12-2B

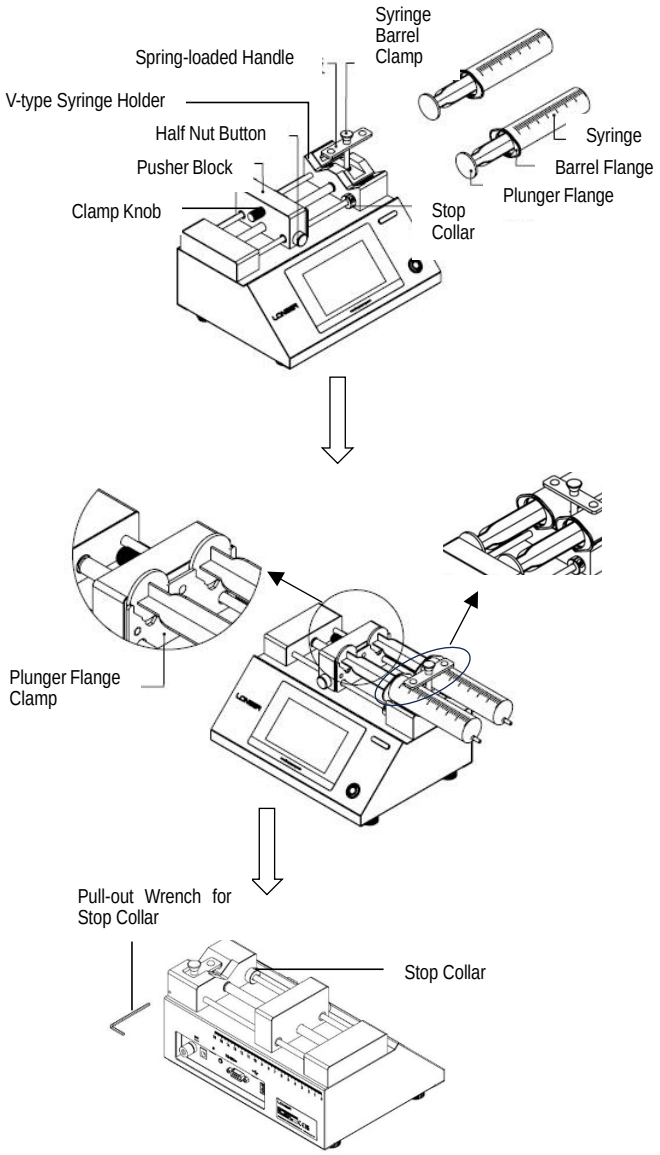
3.2 Syringe Loading

3.2.1 ASP11-1A/ASP11-1AP/ASP11-2AP Syringe Loading

ASP11-1A/ASP11-1AP



ASP11-2AP



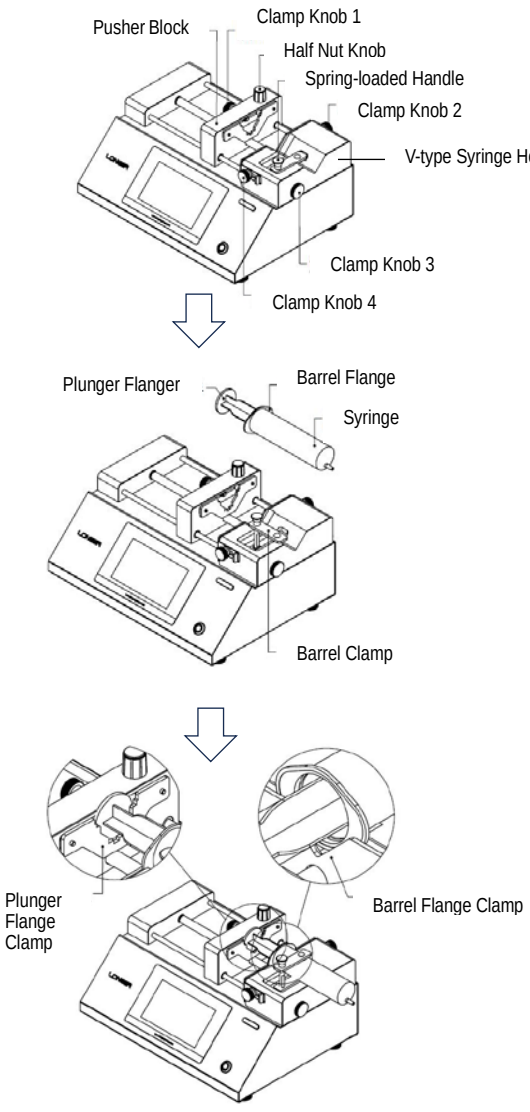
Syringe loading process:

1. Press the half nut button on the pusher block, or use the “Fast Forward”/”Fast Reverse” on the touch screen, to move the pusher block to the appropriate position. Ensure the distance between pusher block and syringe holder is equal to the distance between the plunger flange and the barrel flange.
2. Unscrew the clamp knob to loosen the plunger flange clamp.
3. Raise the spring-loaded handle and syringe barrel clamp, and rotate 90° away from the V-type syringe holder.
4. Place the syringe in the “V” of the syringe holder and adjust its position so that the barrel flange is against the syringe holder. The plunger flange should be positioned within the gap between the plunger flange clamp and the pusher block.
5. Adjust the pusher block position by tapping the “Fast Forward”/”Fast Reverse” on the touch screen. The barrel flange should be tight against the syringe holder and the plunger flange should be tight against the pusher block.
6. Raise and rotate the spring-loaded handle, so that the syringe barrel clamp is tight against the syringe barrel. Screw the clamp knob to secure the plunger flange.
7. Tighten the stop collar to protect the syringe from damage, especially when using a glass syringe.

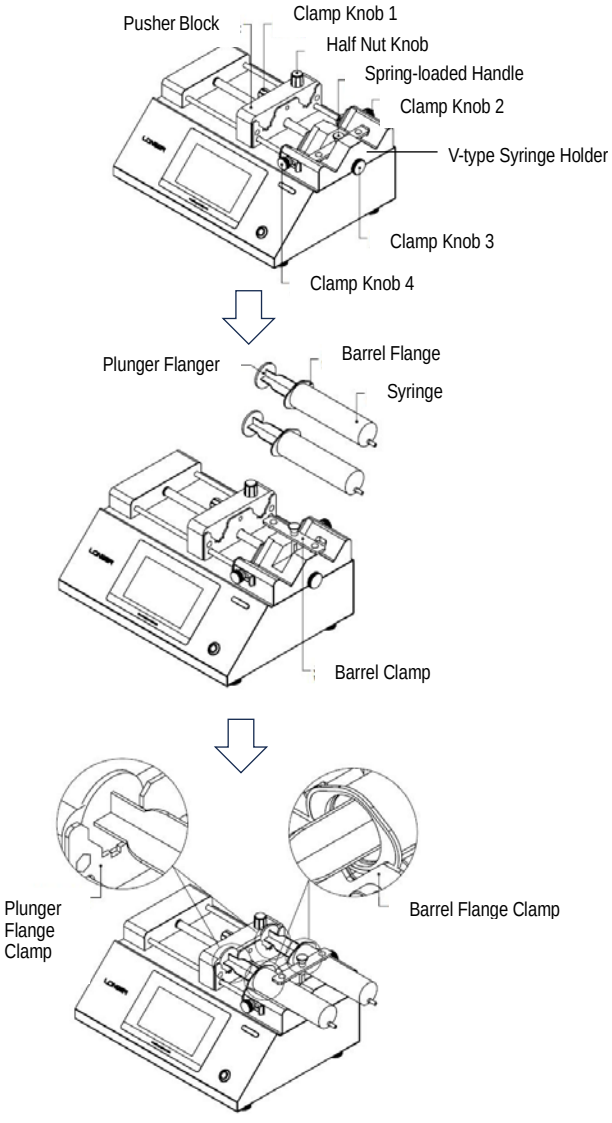
   Note: The stop collar restricts the minimum distance between the pusher block and the syringe holder. If the distance is smaller than the distance between the plunger flange and the barrel flange when the syringe is fully emptied, the pusher block will continue to move forward, potentially causing the syringe barrel to crack.

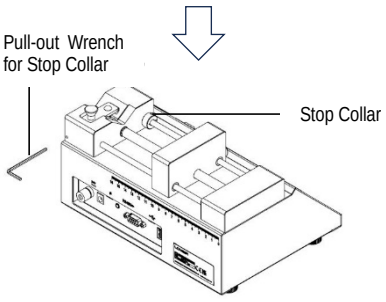
3.2.2 ASP12-1B/ASP12-2B Syringe Loading

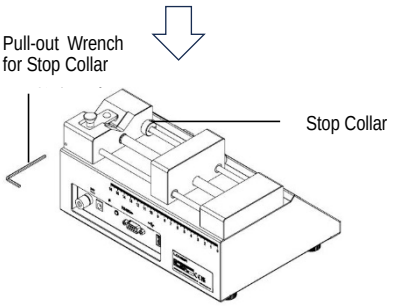
ASP12-1B



ASP12-2B







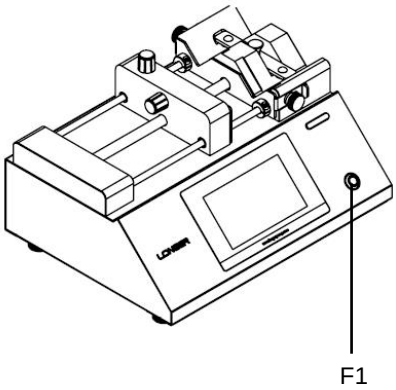
Syringe loading process:

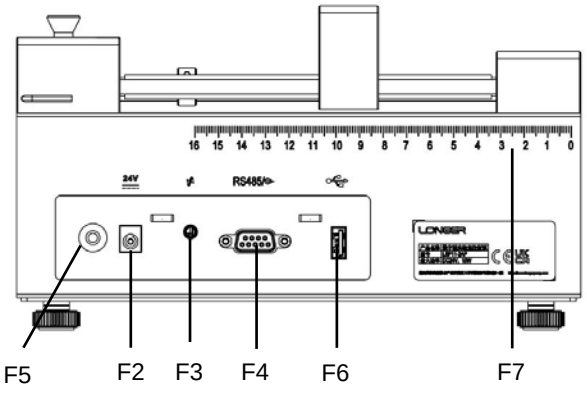
1. Turn the half nut knob to the unlock position to release the pusher block, or use the “Fast Forward”/”Fast Reverse” on the touch screen, to move the pusher block to the appropriate position. Ensure the distance between pusher block and syringe holder is equal to the distance between the plunger flange and the barrel flange.
2. Unscrew the clamp knob 1 to loosen the plunger flange clamp. Unscrew the clamp knob 2 and 4 to loosen the barrel flange clamp.
3. Unscrew the clamp knob 3, then raise the spring-loaded handle and syringe barrel clamp, and rotate 90° away from the V-type syringe holder.
4. Place the syringe in the “V” of the syringe holder and adjust its position so that the barrel flange is against the syringe holder. The plunger flange should be positioned within the gap between the plunger flange clamp and the pusher block.
5. Adjust the pusher block position by tapping the “Fast Forward”/”Fast Reverse” on the touch screen. The barrel flange should be tight against the syringe holder and the plunger flange is tight against the pusher block.
6. Raise and rotate the spring-loaded handle, so that the syringe barrel clamp is against the syringe barrel. Screw the clamp knob 1 to secure the plunger flange. Screw the clamp knob 2 and 4 to secure the barrel flange. Screw the clamp knob 3 to secure the syringe barrel clamp and handle.
7. Tighten the stop collar to protect the syringe from damage, especially when using glass syringe.

Note 1: The stop collar is used to restrict the minimum distance between the pusher block and the syringe holder. If the distance is smaller than the gap between the plunger flange and the barrel flange when the syringe is fully emptied, the pusher block will continue to move forward, potentially causing the syringe barrel to crack.
Note2: Do not overtighten the 4 clamp knobs, especially when using glass syringes.

3. 3 Pump Interfaces and Wiring Instructions

3.3.1 Pump Interfaces

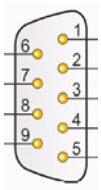
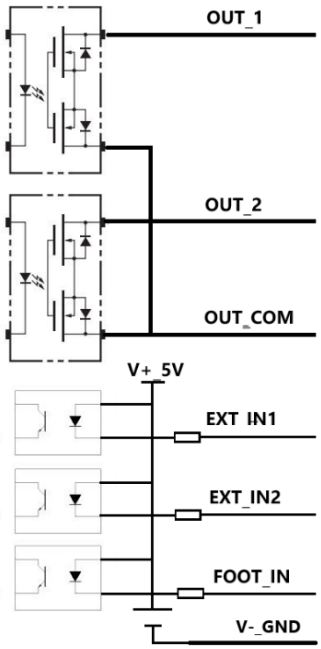




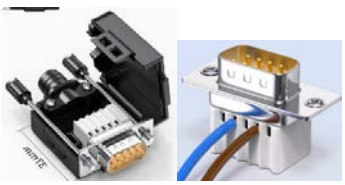
Item	Interfaces	Function	Type
F1	Power button & indicator light	Power-on and power-off button. The light can display different colors to indicate different pump statuses.	
F2	Power input	For DC24V connection or power adaptor connection	DC5.5-2.1
F3	Footswitch connector	For footswitch connection	φ3.5mm audio jack
F4	Remote control connector	For RS485 connection, I/O signals connection	DB9-F
F5	Grounding knob	Reliable grounding of the pump will prevent the misoperation and damage from electromagnetic interference.	M4 nut
F6	USB port	For software upgrade	USB-A 2.0
F7	Length scale	For syringe stroke measurement	

Note: The dust covers on the F3, F4 and F6 interfaces effectively prevent the entrance of liquid and small particles. When the interfaces are not in use, please cover them with the dust covers.

3.3.2 Remote Control Connector (F4)

Connector	Pin No.	Definition	Description	Circuit Diagram Inside the Pump
RS485/⊖   Facing the pin side of the DB9-M connection	1	RS485-A	RS485-A	
	2	OUT_1	Status output 1	
	3	OUT_COM	Output signal ground	
	4	EXT_IN2	Emergency stop input	
	5	V-_GND	Input signal ground	
	6	RS485-B	RS485-B	
	7	OUT_2	Status output 2	
	8	EXT_IN1	Start/stop input	
	9	V+_5V	Output 5V auxiliary power, with a max current of 50mA	

Note: use a DB9-M connector for the signal connection. Contact Longer Pump for the below DB9 connector module.



3.3.2.1 Start/Stop Inputs

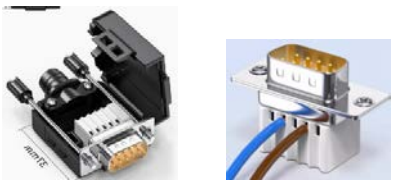
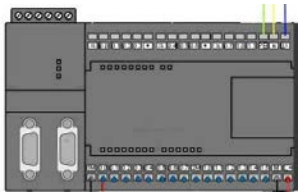
- The pins of EXT_IN1 and V-_GND inputs the start/stop signal.
- The pins of EXT_IN2 and V-_GND inputs the emergency stop signal.
- The external control function can be enabled and the control logic can be configured on the touch screen “System Setup”->“External Control”. Refer to Chapter 3.4.6.6 for the details.
- The start/stop control logic can be configured as:
  - Low level signal to start (high level signal to stop)
  - High level signal to start (low level signal to stop)
  - Rising edge signal to start (the pump’s start and stop status switch upon receiving a rising edge signal)
  - Falling edge signal to start (the pump’s start and stop status switch upon receiving a falling edge signal)
- The emergency stop control logic can be configured as:
  - Low level signal to stop
  - High level signal to stop
- The compatible input signal types: OC node signal, relay contact signal, level signal
  - OC node signal：When the node is closed, it represents a low-level signal; when the node is open, it represents a high-level signal. A rising edge signal occurs when the node transitions from closed to open, and a falling edge signal occurs when the node transitions from open to closed.
  - Relay contact signal：When the contact is closed, it represents a low-level signal; when the contact is open, it represents a high-level signal. A rising edge signal occurs when the contact transitions from closed to open, and a falling edge signal occurs when the contact transitions from open to closed.
  - Level signal: voltage <1.5V represents a low-level signal; 5V<voltage<12V represents a high-level signal

3.3.2.2 Status Outputs

- OUT_1 and OUT_2 are relay signals, which can be configured as start/stop, running direction or fault alarm.
- The status output function can be enabled and the signal logic can be configured on the touch screen “System Setup”-> “Output”. Refer to Chapter 3.4.6.8 for the details.
- The output signal logic can be configured as:
  - Open: the output relay will be open when the pump is running, or running in the infusion direction, or having a fault alarm.
  - Close: the output relay will be closed when the pump is running, or running in the infusion direction, or having a fault alarm.
- The capacity of the output relays: Vmax ＜ 24VDC，Imax ＜ 0.1A

3.3.2.3 Wiring Instruction for Communication Control

- Use a DB9-M connector module to connect the pump to PLC or other controllers

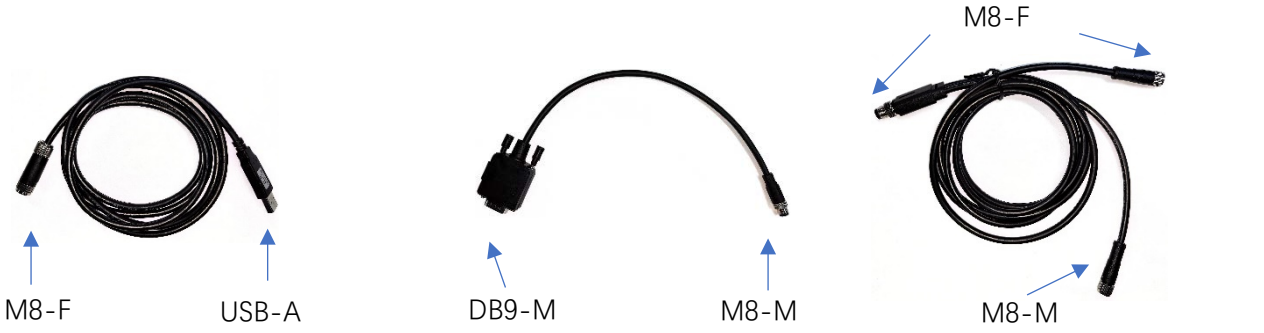
DB9-M Connector Module	Pin No.	Definition	Description	PLC
	1	RS485-A	RS485-A	
	5	V-_GND	GND	
	6	RS485-B	RS485-B	

- The communication control function can be enabled on the touch screen “System Setup”-> “Comm”. The communication control parameters(baud rate, address, parity, channel ID) also can be configured on the

touch screen. Refer to Chapter 3.4.6.5 for the details.

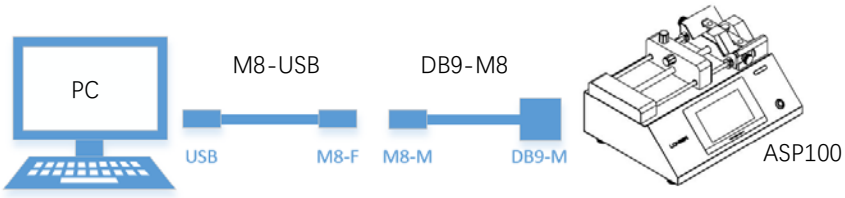
- Communication Protocol: Modbus RTU or Longer Pump OEM protocol
- Baud rate:
  - Modbus RTU: 9600bps,19200bps, 38400bps or 115200bps(default setting)
  - Longer Pump OEM protocol: 1200bps(default setting)，2400bps,9600bps
- Pump address：
  - Modbus RTU: 1-247(default address is 1)
  - Longer Pump OEM protocol: 1-31(default address is 1)
  - Modbus RTU protocol supports Group Mode control. Pumps with the same pump address are considered part of the same group. Pumps within the same group must be assigned a unique channel ID (1-10). The pumps in the same group can be controlled by the same command to start or stop synchronously. Each pump can have its own parameters and be controlled independently.

- The communication control cables:

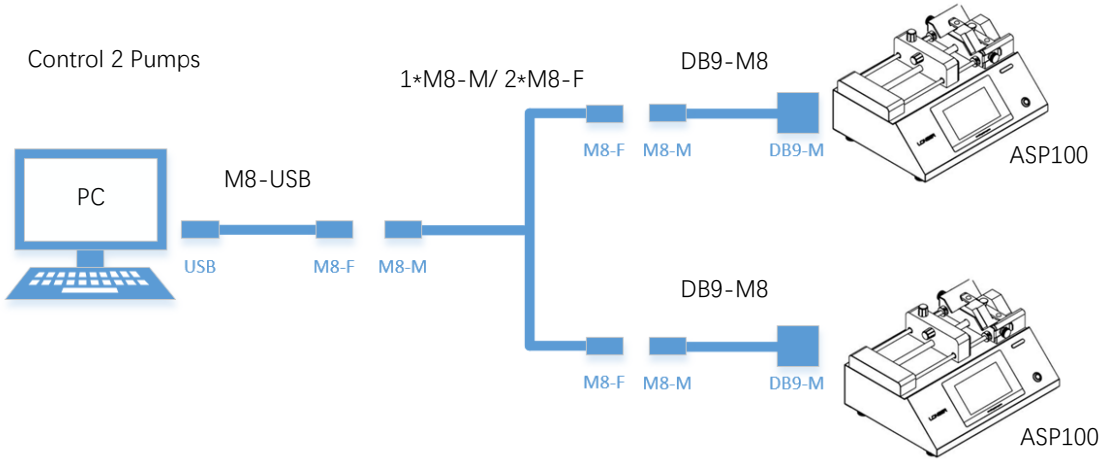


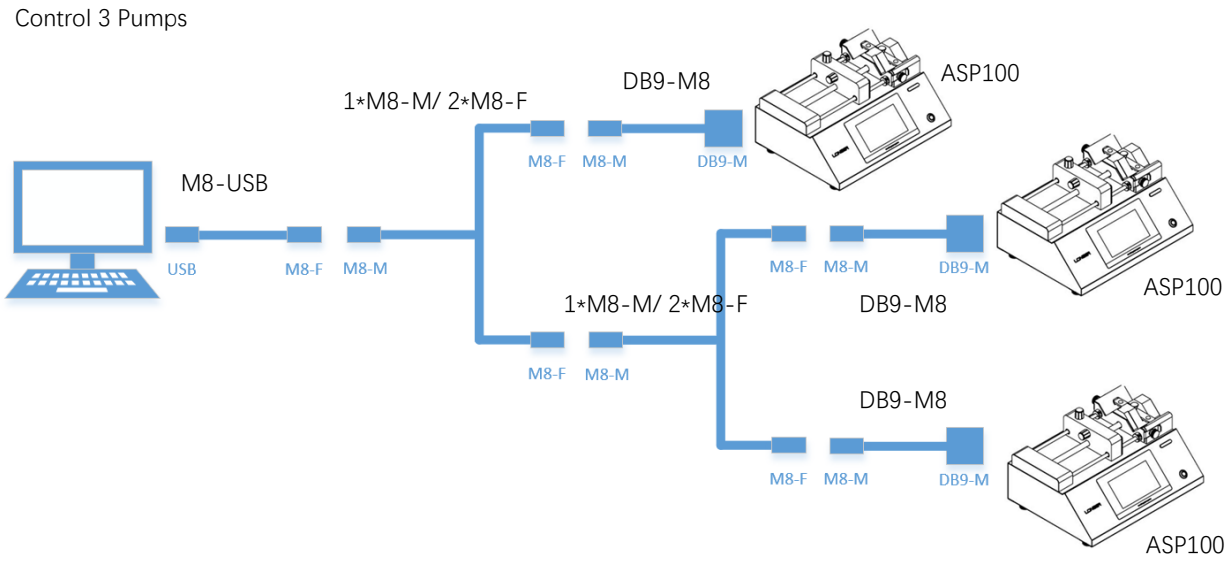
M8-USB Cable　　DB9-M8 Cable　　1*M8-M/ 2*M8-F Adapter Cable

- Connect the M8-USB cable to the PC's USB port (version 2.0 and above). The serial device will be recognized after installing the FT232RQ driver on the PC.
- Connect the DB9-M8 cable to the DB9 port of the pump, then connect the M8-M connector to the M8-F connector of the M8-USB cable.



- If more than one pump will be controlled by the same PC simultaneously, each pump needs to connect one DB9-M8 cable, then use 1*M8-M/ 2*M8-F adapter cable to connect the pumps to the M8-USB cable of the PC. If a single PC needs to control n units of pumps, n-1 units of 1*M8-M/ 2*M8-F adapter cables are required.

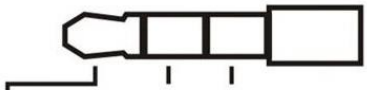




- Enable the communication control function and set the communication parameters (baud rate, address, parity, channel ID) on the touch screen “System Setup”->”Comm”. Please refer to Chapter 3.4.6.5 for details.
- If the control pump by LabVIEW on PC, please contact Longer Pump for the pump Demos or Drivers.

3.3.3 Footswitch Connector（F3）

- The port for footswitch is 3.5mm audio jack. Choose a footswitch accessory from Longer Pump or connect your footswitch according to the definition below:

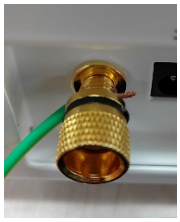


FOOT_IN V-_GND

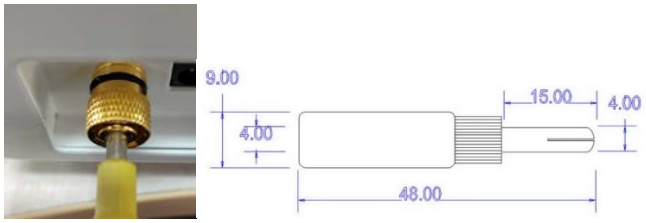
- The footswitch control can be enabled and control logic can be configured on the touchscreen “System Setup”-> “Foot SW”. Refer to Chapter 3.4.6.7 for the details.
- The control logic can be configured as:
  - Level: Press the footswitch to start the pump, and release the footswitch to stop the pump.
  - Pulse: Each time the footswitch is pressed, the pump’s running and stopping status is toggled.

3.3.4 Grounding the Pump

- The pump is equipped with a grounding knob. Reliable grounding of the pump will prevent the misoperation and damage from electromagnetic interference. It is recommended to ground the pump in environments where electrostatic discharge occurs frequently, such as in applications of electrospinning and electrostatic spraying. Make sure the ground knob is connected to earth ground and the resistance is less than 0.1Ω.
- Do not need to ground the pump in a normal lab environment.



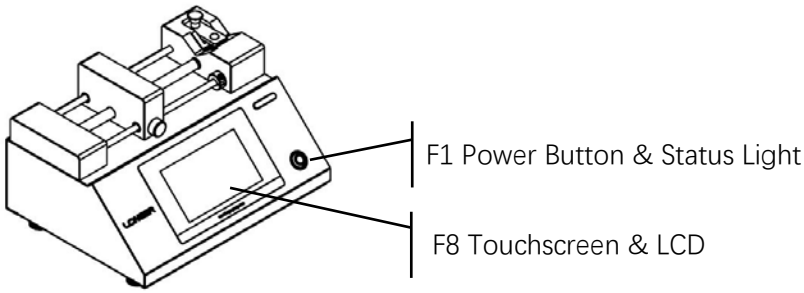
Grounding method 1:
insert the grounding cable through the hole on the grounding knob.



Grounding method 2:
Insert an 4mm elastic rubber plug into the grounding knob.

3.4 Touchscreen Operation

3.4.1 Layout of HMI



3.4.2 Power Connection

- **Power Connection：**

Connect the DC24V power supply or plug in the AC/DC power adapter to the Power Input (F2) to power the pump.
Power supply for the adapter: AC 90V-260V
Power supply for the pump: DC24V

- **Power On**

After the pump is powered, press and hold the "Power Button" (F1) for more than 2 seconds. The LCD (F8) will show the welcome screen. After the system initialization, the main running screen will be displayed.

- **Power Off**

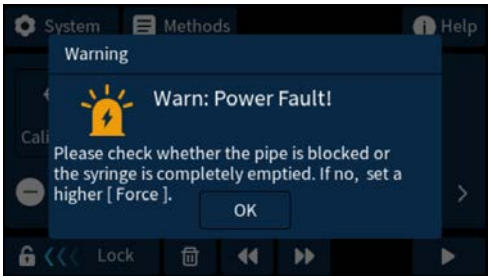
1. Press and hold the "Power Button" (F1) for more than 2 seconds to prompt the dialog box.

Tap **[ShutDown]** to terminate all tasks and quickly shut down the pump.

2. Press and hold the "Power Button" (F1) for more than 5 seconds to terminate all tasks and shut down the pump directly.

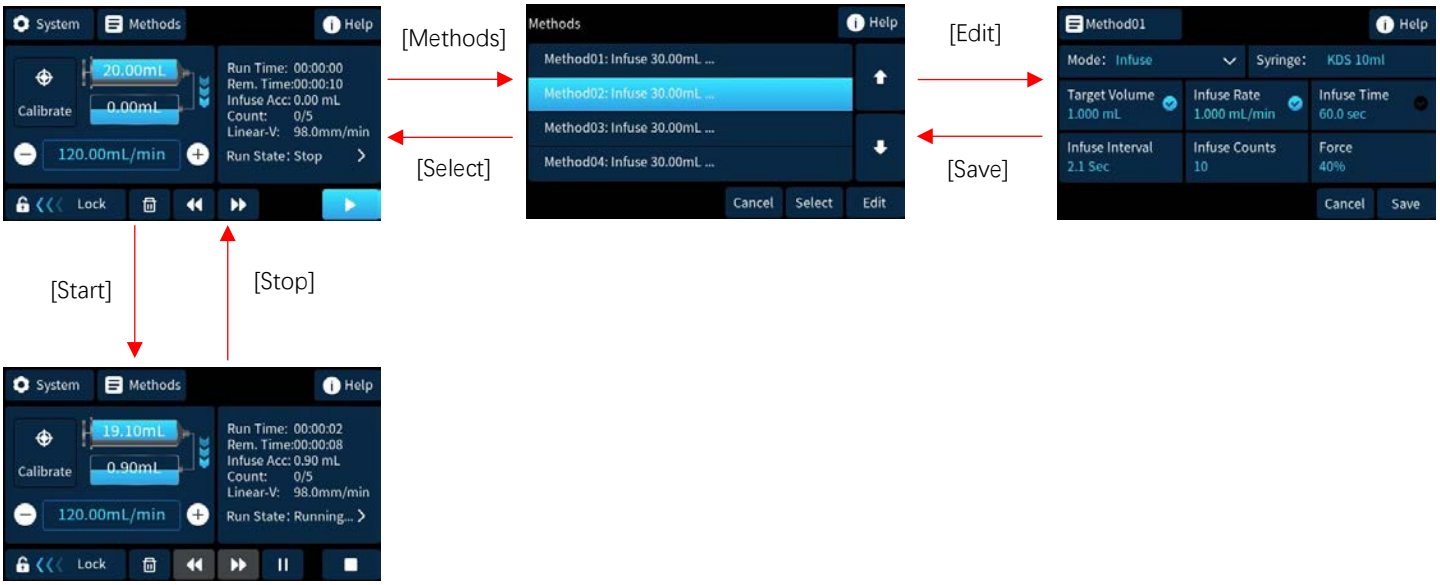
3.4.3 Indicator Light

- The light on the power button can display different colors to indicate different pump statuses.
  Blue: Standby
  Green: Running（include the pause status）
  Red: Warning
- **Fault Alert:**
  When the pump encounters a fault, a fault alert screen will pop up. Tap the [OK] button to return to the previous screen, and resolve the issue according to the prompt information. If the fault is resolved, the fault alert screen will no longer appear. If the fault persists, the fault alter screen will continue to pop up.



3.4.4 Quick Start for Common Functions

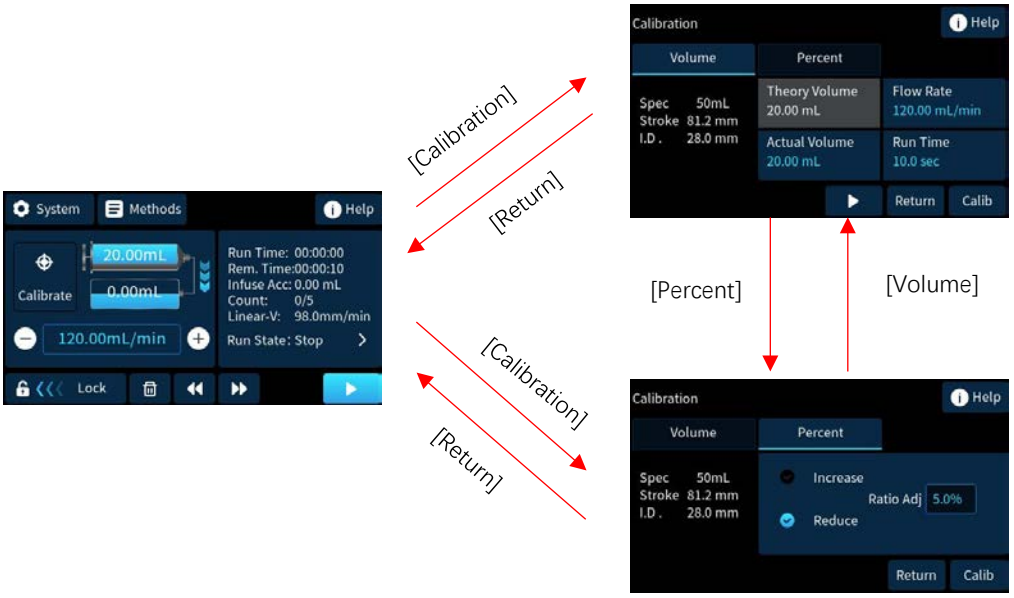
3.4.4.1 Selecting Method and Running the Pump



3.4.4.2 Setting the User-defined Syringes

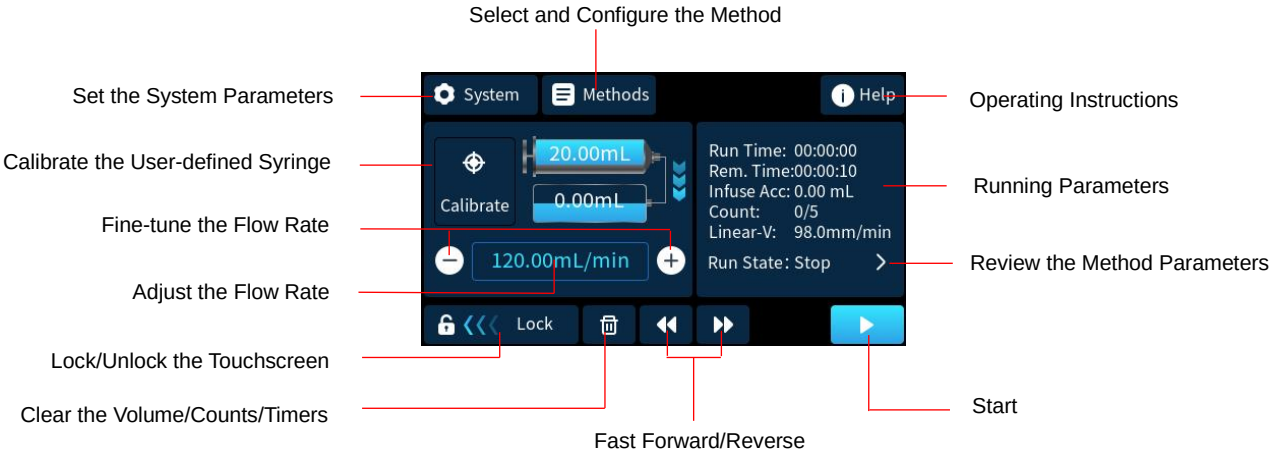
3.4.4.3 User-defined Syringe Calibration

The calibration is only valid for the user-defined syringe in the currently selected method.

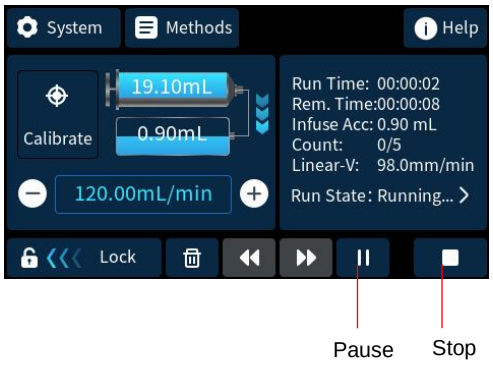


3.4.4.4 Setting the Communication Control Function

3.4.5 Run Screen Introduction



Standby Status



Running Status

3.4.5.1 Control Buttons

- Start 

  Tap start button  to start running the selected method. Then start button will change to stop button  .

- Pause 

  The pause button  will display after the pump starts running. Tap pause button to pause the pump and

the pause button will change to resume button  .

- Resume 

  When the pump is paused, tap resume button  to continue the selected method, and the resume button will change back to pause button  .

- Stop 

  When the pump is running or paused, tap stop button  to stop running the selected method.

- Fast Forward 

  When the pump is on standby, press and hold the fast forward button  , the pump will run at full speed with the infusion direction.

- Fast Reverse 

  When the pump is on standby, press and hold the fast reverse button  , the pump will run at full speed with the withdraw direction.

3.4.5.2 Menu Buttons

- [System]
  Tap [System] button to enter the system parameters setting screen. The parameters can be set: communication control, external control, footswitch control, status output, audible alarm, display brightness, factory reset, software upgrade, product information, and flow rate fine-tune step value setting. Refer to Chapter 3.4.6 for the details.
- [Methods]
  Tap [Methods] button to enter the method selection and configuration screen. Refer to Chapter 3.4.6.1 for the details of method setting and selection,
- [Calibration]
  Tap [Calibration] button to enter the calibration screen for the user-defined syringe in the selected method. Refer to Chapter 3.4.7 for details.
- [Help]
  Tap [Help] button to display the operating instructions for the current screen.

3.4.5.3 Special Function Buttons

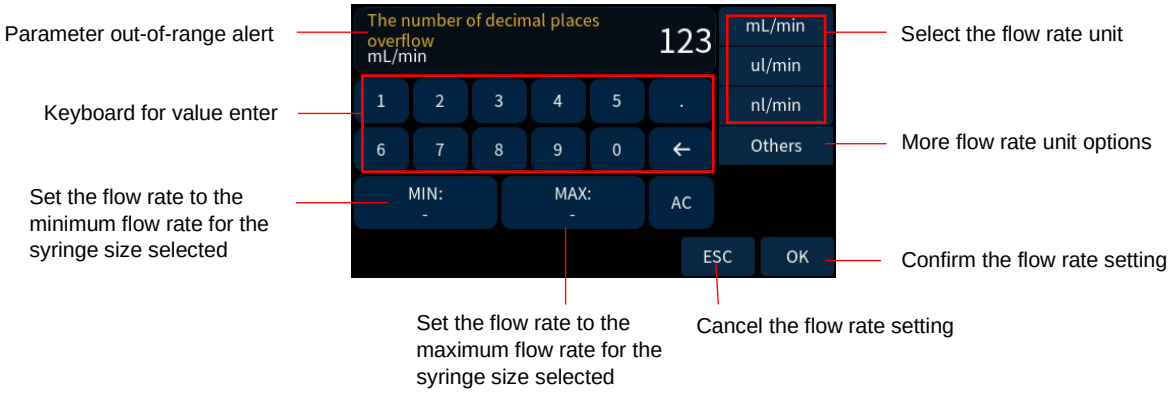
- Clear 

  Tap clear button  to clear the counts, timers and accumulated volume.

- Adjust the current flow rate 

  Whenever the pump is running or stop, tap the current flow rate field  to open the

flow rate setting keyboard.



- Fine-tune flow rate button

  Tap fine-tune flow rate button to increase the current flow rate by a step value. Refer to Chapter 3.4.6.14 to set the step value.

- Fine-tune flow rate button

  Tap flow rate adjust button to decrease the current flow rate by a step value. Refer to Chapter 3.4.6.14 to set the step value.

- Lock the touchscreen

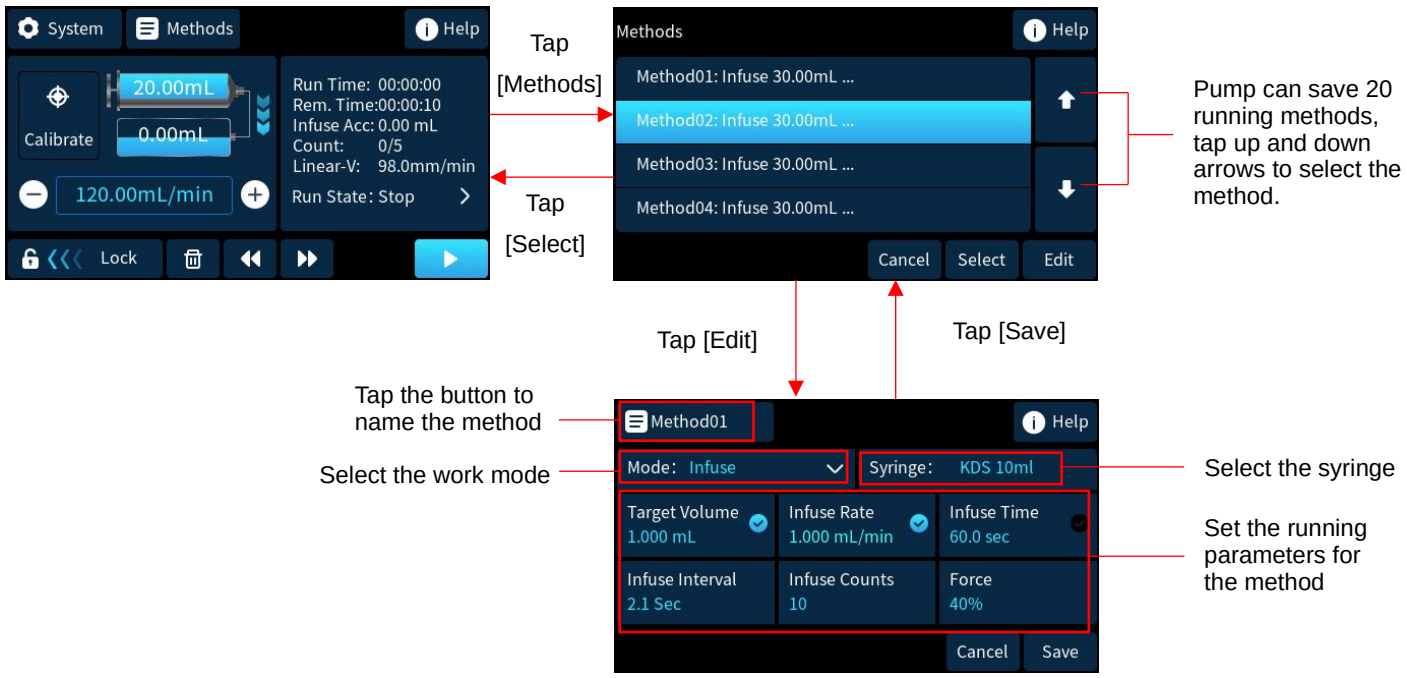
  When the touchscreen is unlocked, slide the screen lock slider to lock the touchscreen and all the buttons on the touchscreen are disabled.

- Unlock the touchscreen

  When the touchscreen is locked, slide the screen unlock slider to unlock the touchscreen.

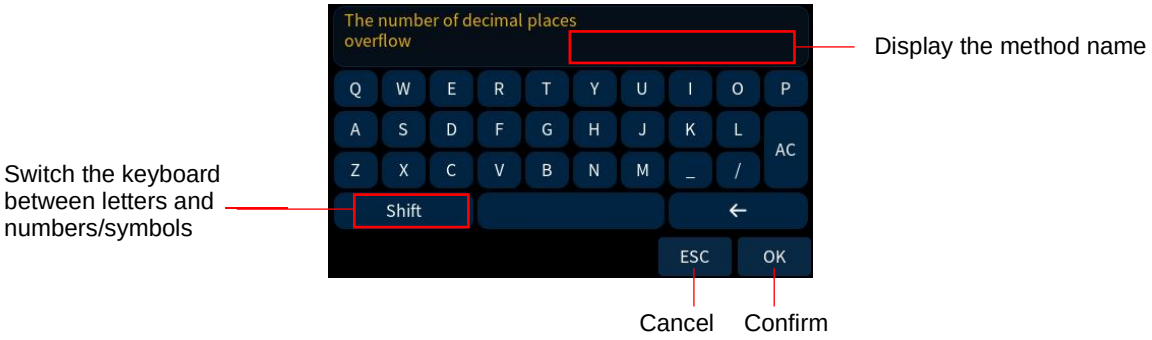
3.4.6 Setting Parameters

3.4.6.1 Method Selection and Configuration



3.4.6.2 Method Name Editing

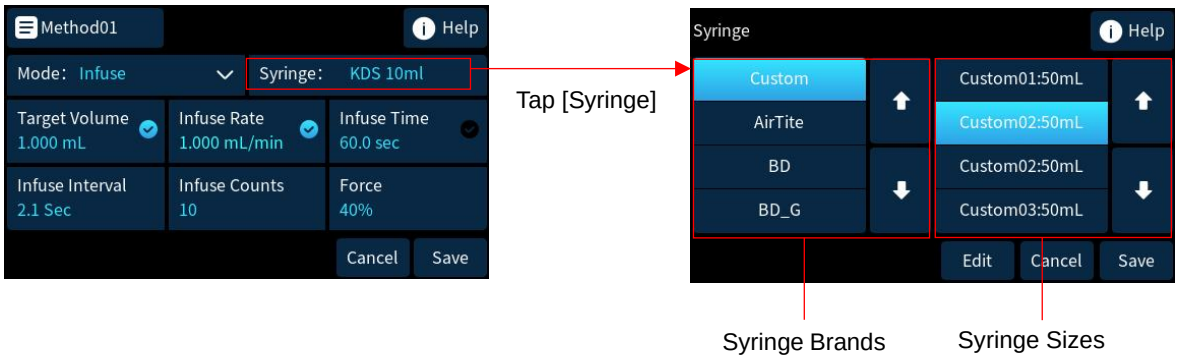
Tap [Method Name] to enter the method name editing screen.



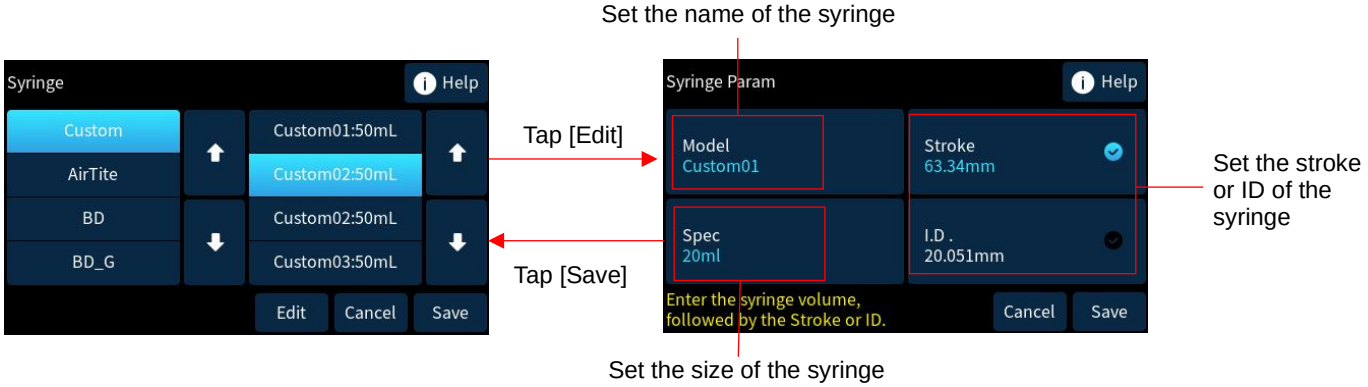
- Edit the method name with letters, numbers and symbols. Tap [Shift] button to toggle between the letter layout and number/symbol layout on the keyboard.
- The maximum number of characters for the method name is 8. After editing, press [OK] button to apply the changes and return to the previous setting screen. Press [ESC] button to cancel the changes and return to the previous screen.

3.4.6.3 Syringe Selection

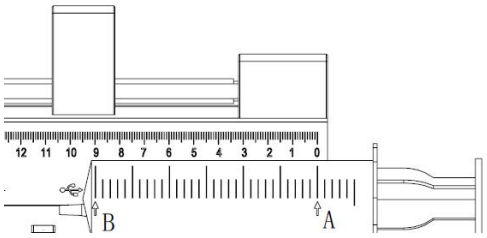
Tap the [Syringe] button on the method editing screen to enter the syringe selection screen.



- Various syringe options from different brands and specifications are available in the syringe list. The parameters for these syringes can not be calibrated. If the actual infused or withdrawn liquid volume differs from the target volume, it indicates that the selected syringe ID does not exactly match the ID of the syringe in use. In this case, setup a user-defined syringe (“Custom” option) and calibrate the syringe according to Chapter 3.4.7. (20 user-defined syringes can be saved on the pump.)
- Select “Custom” option and setup a user-defined syringe if the syringe manufacturer is not listed and calibrate the syringe according to Chapter 3.4.7.
- Tap [Save] button to save the syringe selection and return to the method editing screen.
- When select “Custom” option for the user-defined syringes, tap [Edit] to enter the user-defined syringe setting screen.



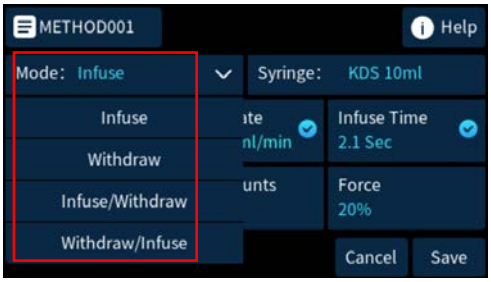
- Tap [Model] button to enter the syringe name editing screen. The maximum number of characters for the syringe name is 8.
- Tap [Spec] button to enter the syringe size setting screen. Enter the syringe volume corresponding to the syringe's max scale line.
- Select the "Stroke" or "ID" by activating the checkbox , and tapping the corresponding button to enter the setting screen. The ID is provided by the syringe manufacturer. The Stroke can be measured using the scale printed on the rear housing of the pump. Refer to the picture below: measure the length between the syringe's 0 scale (line B) and the volume scale (line A).



- Tap [Save] button to save the parameters for the user-defined syringe and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.4 Work Mode Selection and Parameters Setting

Tap [Mode] button on the method editing screen to set the pump work mode.



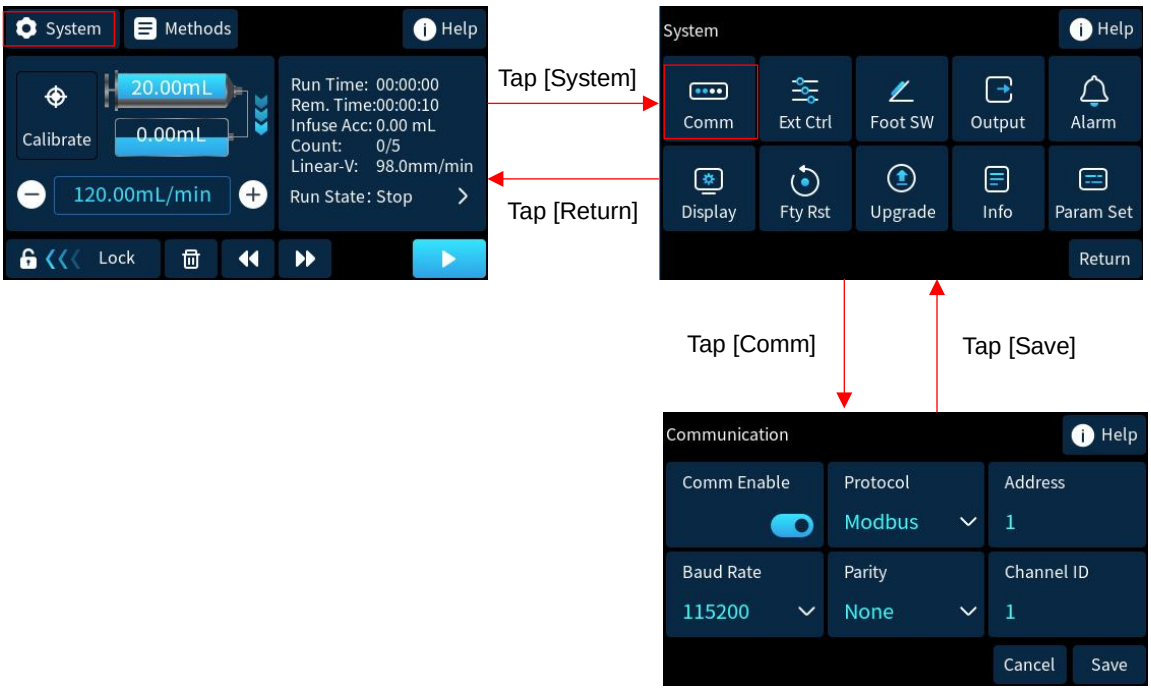
- Work mode instructions:
  - Infuse only: The syringe plunger moves forward only according to the set parameters, and the pump will stop automatically once the target volume is achieved. When the infusion count is more than 1, the pump will perform multiple infusions at the specified interval, and each infusion volume = Target Volume.
  - Withdraw only：The syringe plunger moves reverse only according to the set parameters, and the pump will stop automatically once the target volume is achieved.
  - Infuse/Withdraw (continuous)： The pump will first perform an infusion at the set infuse flow rate until the target volume is reached, then pause for the I/W interval. After that, it will perform a withdrawal at the withdraw flow rate until the target volume is reached, then pause for the cycle interval. This process continues until the cycle count is complete.
  - Withdraw/Infuse (continuous)：The pump will first perform a withdrawal at the set withdraw flow rate until the target volume is reached, then pause for the W/I interval. After that, it will perform an infusion at the infuse flow rate until the target volume is reached, then pause for the cycle interval. This process continues until the cycle count is complete.
- The parameters for different work modes are different:

Parameters	**Description**	**Setting range**	**Infuse**	**Withdraw**	**Infuse/Withdraw (continuous)**	**Withdraw/Infuse (continuous)**
Target Volume	The volume to be infused or withdrawn. (When the infuse count is more than 1, the target volume represents the volume per infusion.)	0.1% to 100% of the selected syringe volume	√	√	√	√
Infuse Count	The number of evenly dispensed infusions.	1 to syringe volume/ target volume	√			
Infuse Rate	The flow rate for infusion.	Min to max flow rate corresponding to the selected syringe.	√		√	√
Withdraw Rate	The flow rate for withdrawal.	Min to max flow rate corresponding to the selected syringe.		√	√	√
Infuse Interval	The interval time between each infusion. Can not be set when the infuse count is 1.					
I/W Interval	Valid in Infuse/Withdraw (continuous) mode. The interval time between infusion and withdrawal.	1s-1000h	√		√	√
W/I Interval	Valid in Withdraw/Infuse (continuous) mode. The interval time between withdrawal and infusion.					
Cycle Interval	Infuse/Withdraw (continuous) mode: the interval time between the withdrawal and infusion. Withdraw/Infuse (continuous) mode: the interval time between the infusion and withdrawal.	1s-1000h			√	√
Cycle Count	The number of repeated cycles in continuous mode. 1 means single cycle. 0 means unlimited cycles.	0-3000			√	√
Force	The drive force limit	20%-100%	√	√	√	√

- The default drive force limit is determined by the ID of the selected syringe. If the drive force limit is less than the friction of the syringe plunger plus the liquid pressure inside the syringe, the pump will alert “Motor Stall”. In this case, the drive force limit should be increased. The drive force limit should be set to a value that allows normal operation of the syringe plunger, without being excessively high. If the drive force limit is too high, and a blockage occurs in the liquid path, the pressure inside the syringe will increase as the plunger moves forward, potentially causing a glass syringe to rupture.
- The drive force limit when pump working at fast forward/reverse will be the same as the force setting in the method.

- Tap [Save] button to save the parameters for the selected method and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.5 Communication Control Setting

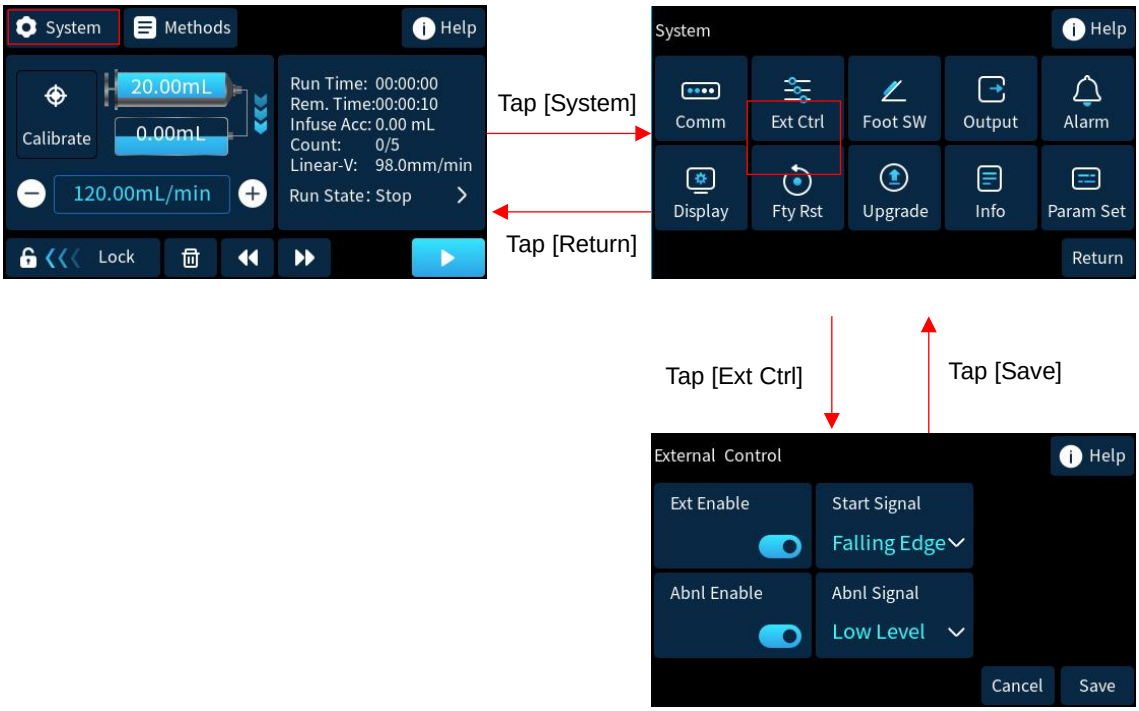


- After enabling the communication control function, the pump can be controlled by communication control commands. Refer to Chapter 3.3.2 for the RS485 interface definition. When the communication control function is enabled, manual control via the touchscreen remains effective.
- Protocol: support Modbus RTU protocol and Longer Pump OEM protocol. Refer to the appendix for the protocol details.
- The function of Modbus RTU protocol and Longer Pump OEM protocol:

	Modbus RTU	**Longer Pump OEM**
Pump address	1-247（default: 1）	1-31（default: 1）
Baud rate	9600bps，19200bps，38400bps，115200bps（default setting）	1200bps，2400bps(default setting)，9600bps
Parity	ODD, EVEN, NONE	ODD, EVEN, NONE
Control mode	None Group mode: Different pumps on the same RS485 bus are assigned unique pump addresses, and the Channel ID needs to be set to 1. Group mode: Different pumps in the same group are assigned the same pump address and a unique Channel ID (1-10) . One pump must have its Channel ID set to 1. The pumps in the same group can be controlled by the same command to start or stop synchronously.	N/A
Control function	All register functions	Some register functions

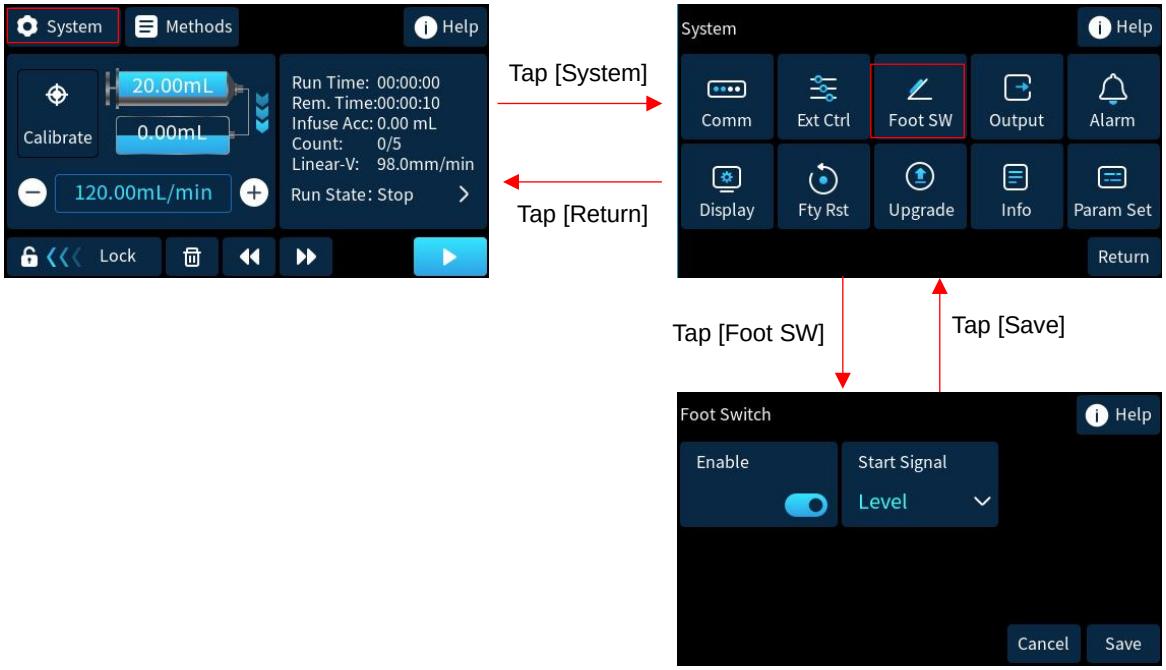
- Tap [Save] button to save the parameters for the communication control function and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.6 External Control Setting



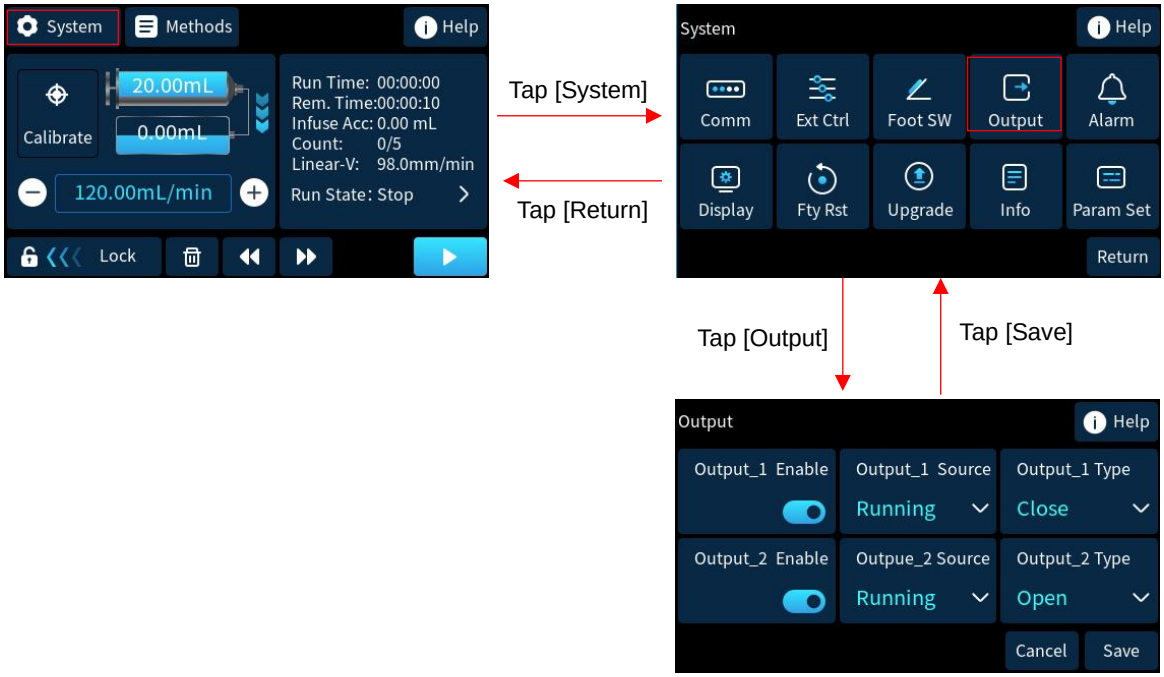
- After enabling the external control function, the pump's start/stop and emergency stop can be controlled by external signals. Refer to Chapter 3.3.2 for the pins definition of EXT_IN1, EXT_IN2 and V-_GND. When the external control function is enabled, manual control via the touchscreen remains effective.
- The start/stop control logic can be configured as:
  - Low Level: low level signal to start, high level signal to stop
  - High Level: High level signal to start, low level signal to stop
  - Rising Edge: the pump's start and stop status switch upon receiving a rising edge signal
  - Falling Edge: the pump's start and stop status switch upon receiving a falling edge signal
- The emergency stop control logic can be configured as:
  - Low level signal to stop
  - High level signal to stop
- The compatible input signal types: OC node signal, relay contact signal, level signal
  - OC node signal：When the node is closed, it represents a low-level signal; when the node is open, it represents a high-level signal. A rising edge signal occurs when the node transitions from closed to open, and a falling edge signal occurs when the node transitions from open to closed.
  - Relay contact signal：When the contact is closed, it represents a low-level signal; when the contact is open, it represents a high-level signal. A rising edge signal occurs when the contact transitions from closed to open, and a falling edge signal occurs when the contact transitions from open to closed.
  - Level signal: voltage <1.5V represents a low-level signal; 5V<voltage<12V represents a high-level signal
- Tap [Save] button to save the parameters for the external control function and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.7 Footswitch Control Setting



- Enable：after enabling the footswitch control function, the pump's start/stop can be controlled by a footswitch. Refer to Chapter 3.3.3 for the footswitch connector. When the footswitch control function is enabled, manual control via the touchscreen remains effective.
- The control logic can be configured as:
  - Level: Press the footswitch to start the pump, and release the footswitch to stop the pump.
  - Pulse: Each time the footswitch is pressed, the pump's running and stopping status is toggled.
- Tap [Save] button to save the parameters for the footswitch control and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.8 Pump Status Output Setting

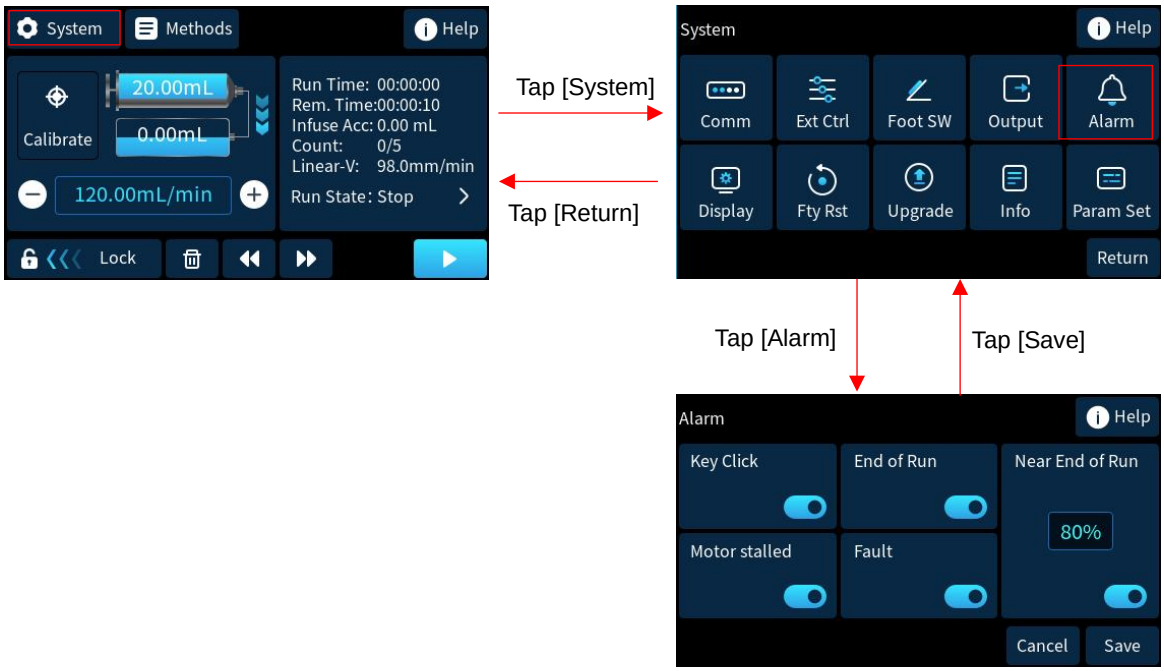


- Enable: after enabling the status output function, the pump outputs can be configured as start/stop status, running direction or fault alarm. Refer to Chapter 3.3.2 for the pins definition OUT_1 and OUT_2
- The Output Source can be configured as Running, Infusion and Fault.
- The Output Type (output signal logic) can be configured as:

- Open: the output relay will be open when the pump is running, or running in the infusion direction, or having a fault alarm.
- Close: the output relay will be closed when the pump is running, or running in the infusion direction, or having a fault alarm.

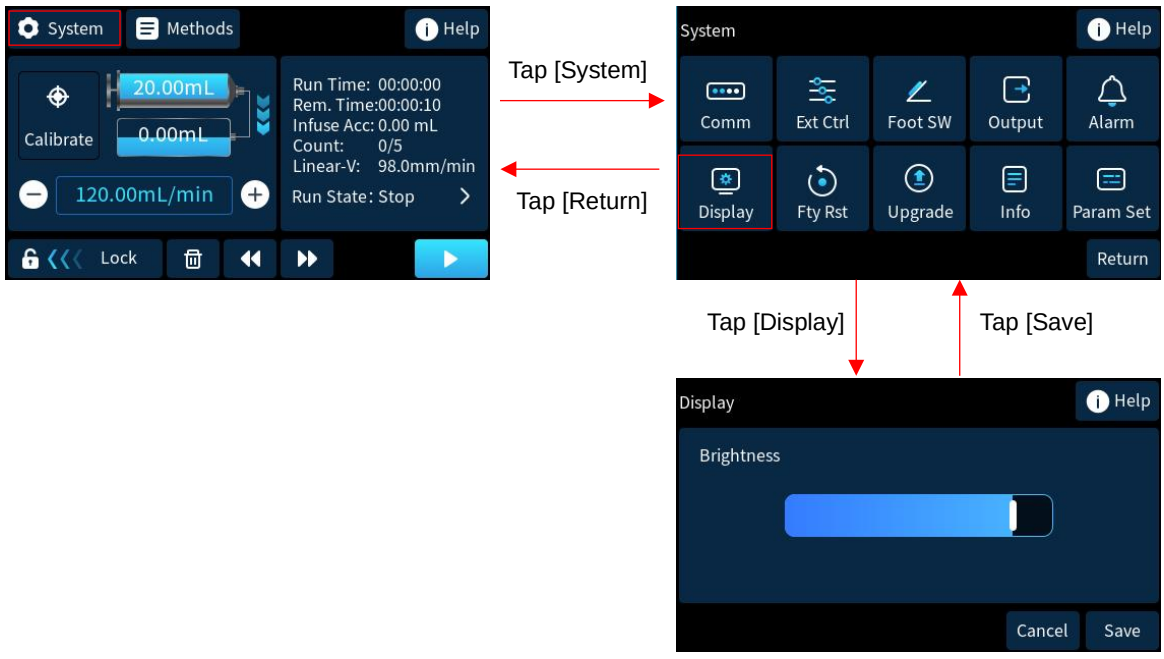
- The capacity of the output relays: Vmax ＜ 24VDC，Imax ＜ 0.1A
- Tap [Save] button to save the parameters for the status output function and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.9 Audible Alarms Setting



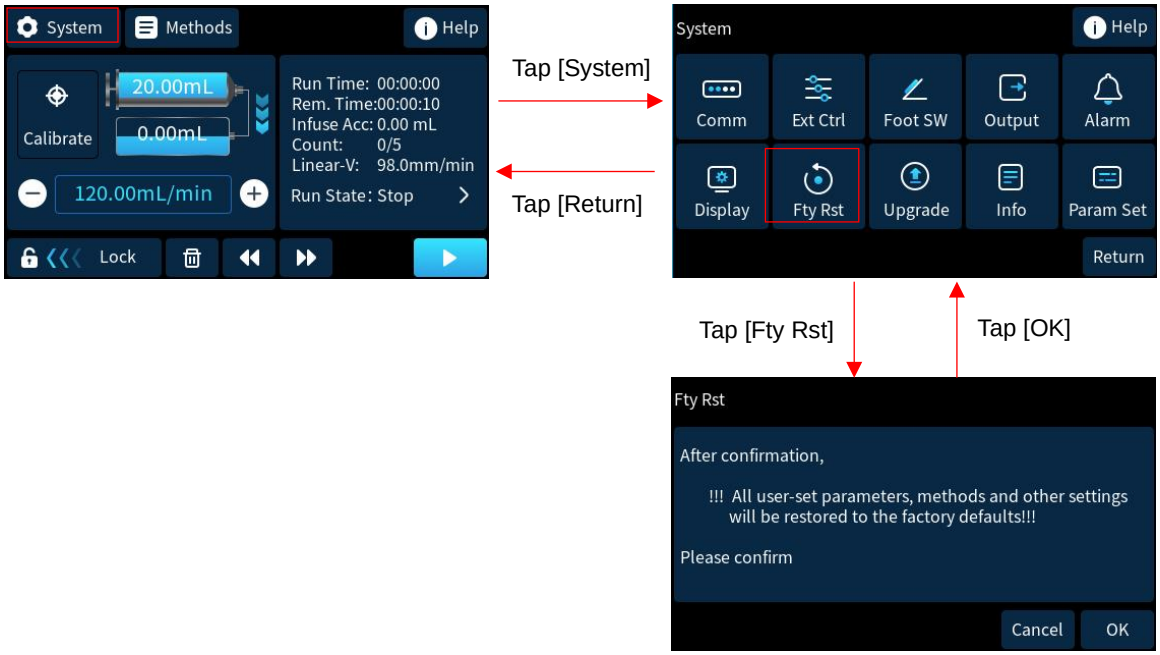
- Beep sound can indicate keypad clicks, near end of run (setting range: 50%-99% of the selected method), end of run, motor stall, and fault alarm.
- When enabled, the pump will provide an audible alarm when corresponding condition is met.
- Tap [Save] button to save the settings for the audible alarm function and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.10 Display Brightness Setting



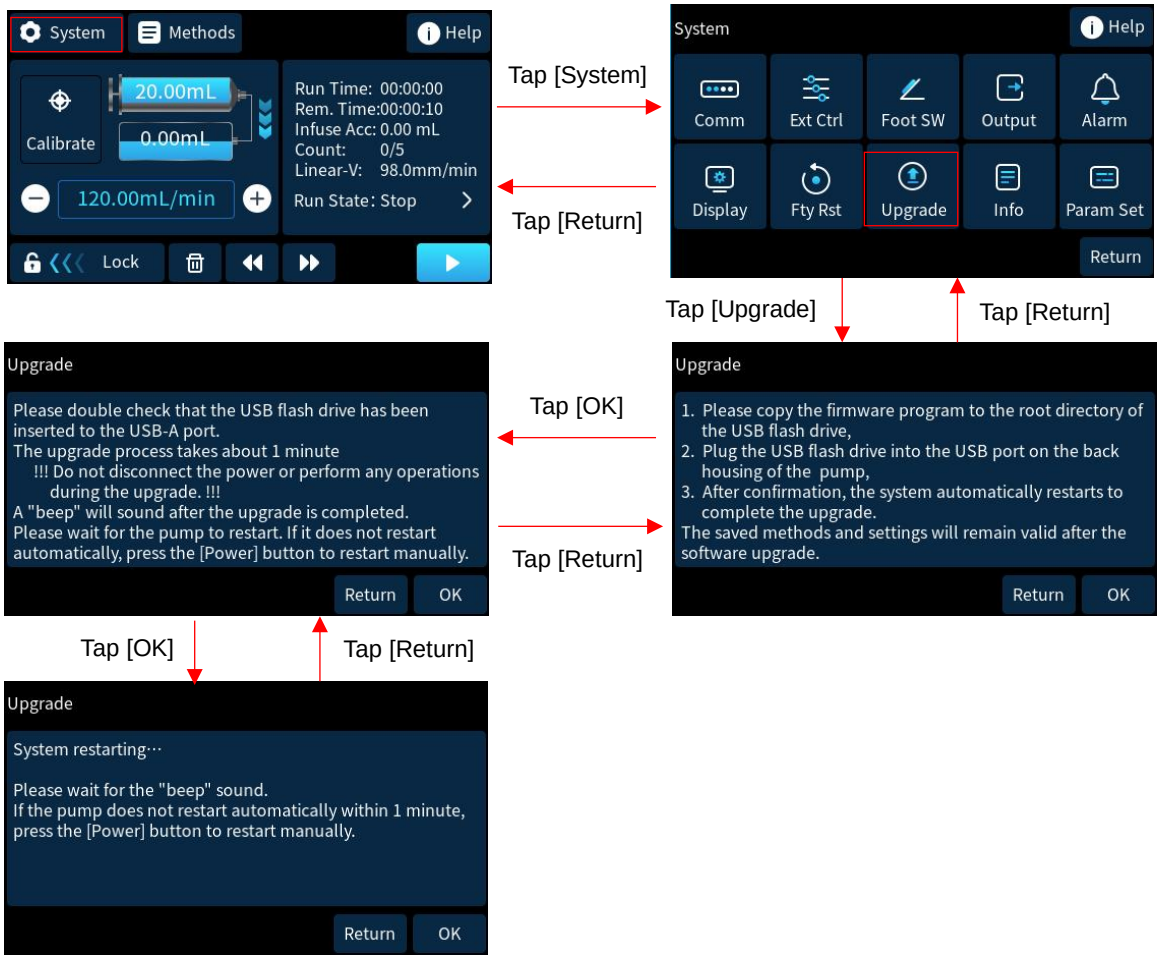
- Drag the brightness slider to adjust the display brightness.
- Tap [Save] button to save the settings for the display brightness and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.6.11 Factory Reset



- Tap [OK] button to reset all parameters to the factory default settings.
- Tap [Cancel] to cancel and return to the previous screen.

3.4.6.12 Software Upgrade



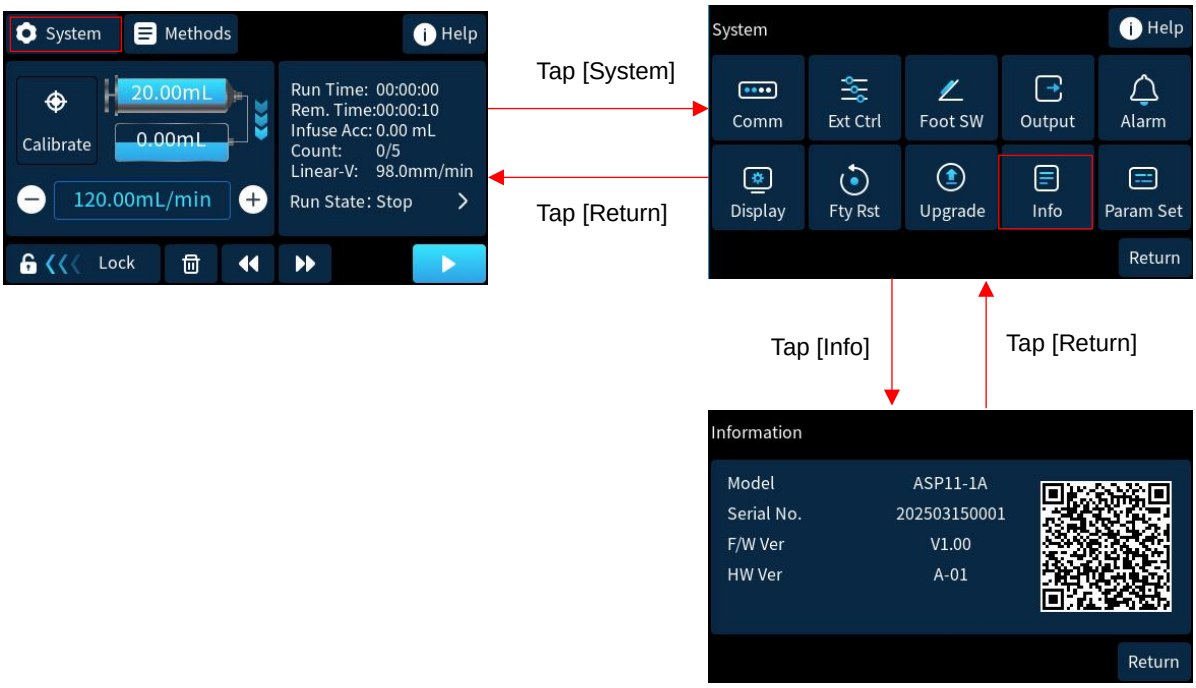
- Insert the USB flash drive containing the latest software file in the root directory into the USB-A port of the pump. Do not change the file name.
- Tap [Return] button to cancel the upgrade and return to the previous screen.
- Tap [OK] button to initiate the software upgrade. The system will automatically reboot upon completion.

Note 1: The upgrade process takes about 1 minute. Do not disconnect the power or perform any operations during the upgrade.

Note 2: Please contact Longer Pump for technical support if the software upgrade takes more than 2 minutes and the pump can not reboot automatically.

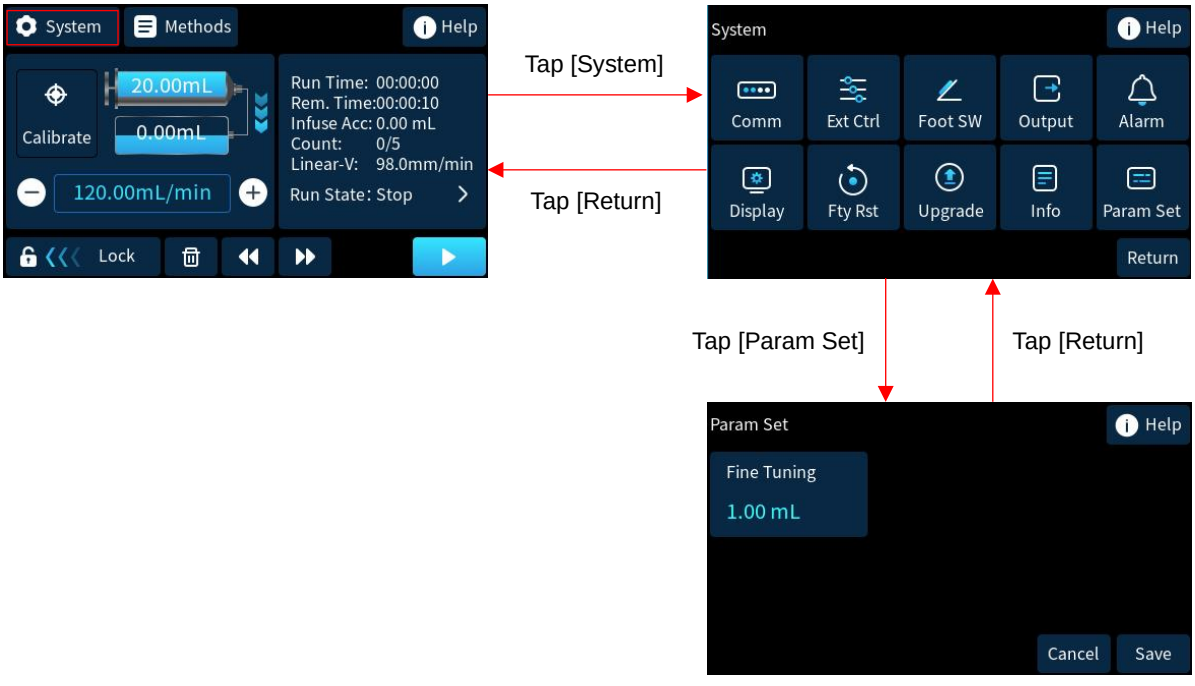
Note 3: The saved methods and settings will remain valid after the software upgrade.

3.4.6.13 Pump Information Check



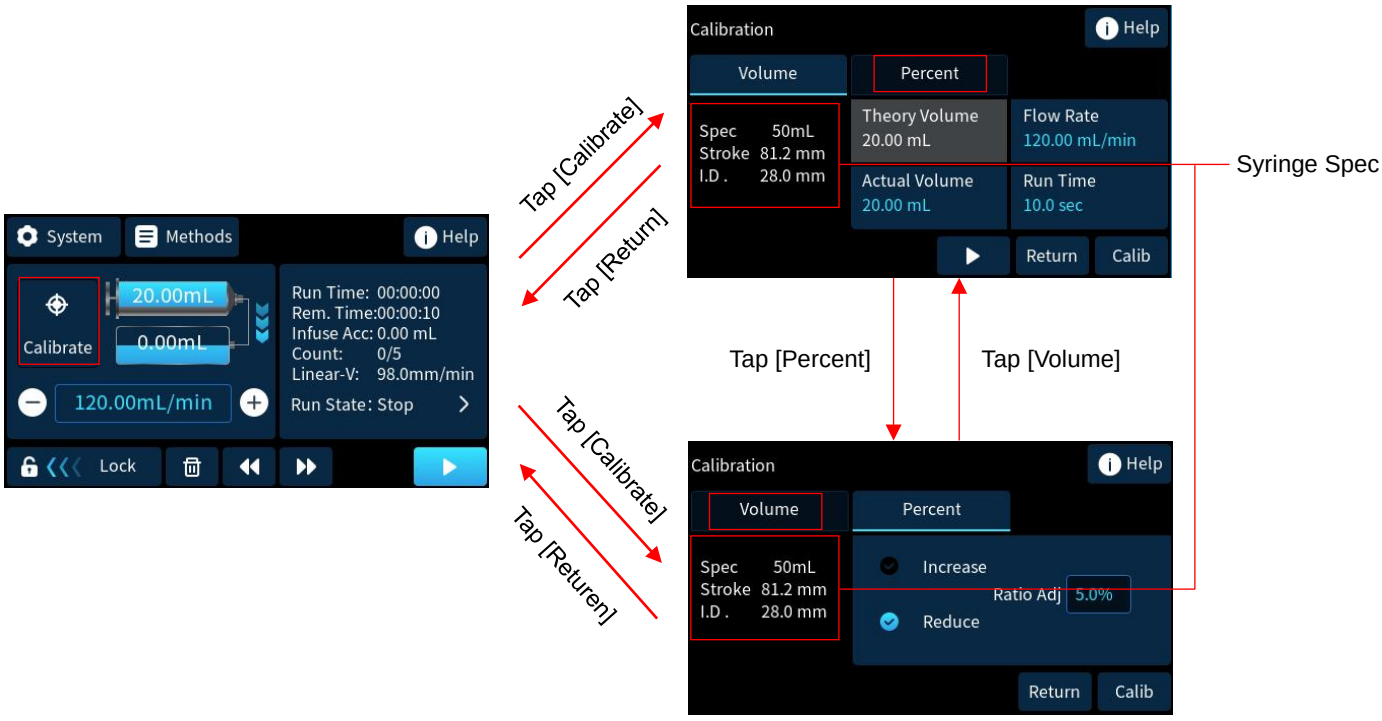
- The pump information can be checked: product model, serial no., firmware version, hardware version. The firmware can be upgraded to the latest version according to Chapter 3.4.6.12.

3.4.6.14 Flow Rate Fine-Tune Value Setting



- Fine Tuning: the step value by which the flow rate increases or decreases each time the ⊕ or ⊖ button is tapped on the main running screen.
- Tap [Save] button to save the settings and return to the previous screen. Tap [Cancel] button to cancel the changes and return to the previous screen.

3.4.7 User-defined Syringe Calibration



- When using a user-defined syringe, discrepancies between the set "Stroke" or "ID" and the actual syringe parameters may cause deviations between the actual and target volumes. Calibrating the syringe improves the accuracy, and the calibrated “Stroke” or “ID” will be saved to the selected user-defined syringe.
- Tap [Volume] to calibrate the syringe with actual measured volumes, which allows for precise calibration.
  Tap [Percent] to calibrate the syringe with percentage data, which provides an approximate calibration.

3.4.7.1 Calibration with Volumes

- Calibration without pump running：
  If the pump has already run and the actual volume is known (the flow rate and running time should be the same as the values on the calibration screen.), tap [Actual Volume] and input the value, then tap [Calibrate] to calibrate the syringe directly.

- Calibration with pump running:
  Set the [Flow Rate] and [Run Time] (The default settings are the same as those of the selected method). Tap the start button ▶, the pump start to infuse. During the pump running, the Theory Volume updates in real-time based on the actual running time (theory volume= flow rate * actual running time).The pump will automatically stop once the Run Time is reached. It can also be stopped at any time by tapping the stop button ■. When the pump is stopped, tap [Actual Volume] to input the measured value, then tap [Calibrate] to calibrate the syringe.

- After calibration, the calibrated parameters will be displayed in the syringe spec field.

✧ Note 1: If the current [Flow Rate] and [Run Time] parameters on the calibration screen are not convenient for measuring the actual volume or the running time is too long, adjust the flow rate or run time before starting

calibration running. To ensure effective calibration, it is recommended to have the Theory Volume (theory volume= flow rate * run time) exceed 30% of the syringe volume.

✧ Note 2: If the calibrated Stroke or ID exceeds the pump's limits, an "Invalid Calibration" message will appear, and the stroke and ID will remain unchanged. Ensure that the setting syringe volume matches the actual syringe volume in use, recalibrate and input the actual measured volume accurately.

3.4.7.2 Calibration with Percentage Data

- Select Increase or Decrease by activating the checkbox .
- Input the [Ratio Adj] value (the infused volume needs to be increased or decreased by a percentage of the pre-calibration volume while keeping the flow rate and run time unchanged.), setting range: 0% - 20%.
- Tap [Calibrate] to calibrate. After calibration, the infuse volume = pre-calibration volume * (1+ increase %) or (1- decrease %). The calibrated parameters will be displayed in the syringe spec field.

4 LabVIEW Drivers Instruction

4.1 Serial Port Connection

Connect pump to the USB port on the host PC with a designated cable.

4.2 Communication Parameters Setting

Configure the pump's communication parameters to match those set on the host PC.

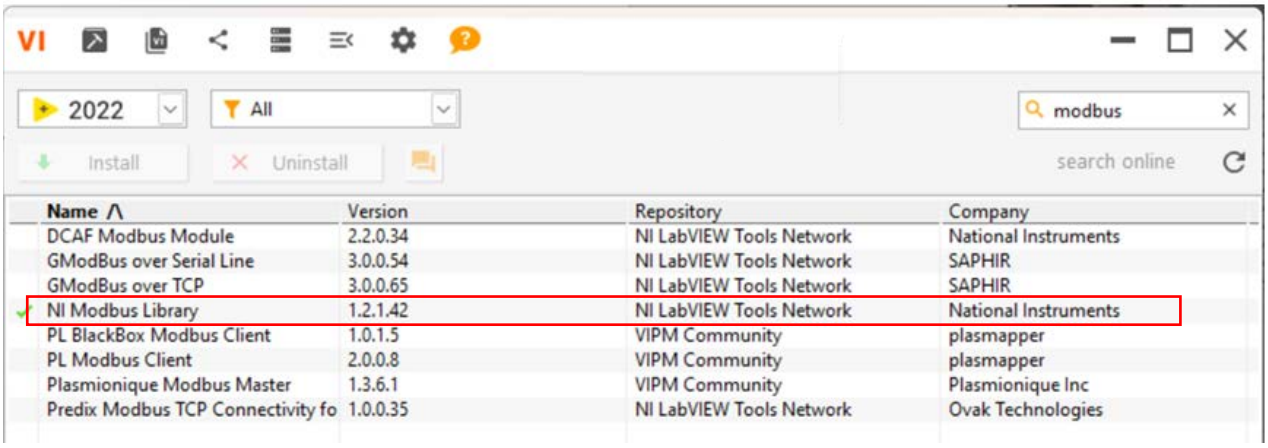
4.3 LabVIEW Version Requirement

The LabVIEW version compatible with the pump drivers: LabVIEW 2024, 2023, 2021, 2018, 2017, 2016, 2015, 8.2.

4.4 LabVIEW Driver Library

The ASP100 series syringe pump driver supports Modbus RTU protocol. The LabVIEW needs Modbus library support. Please install NI Modbus Library before running the pump drivers. The installation steps are as below:

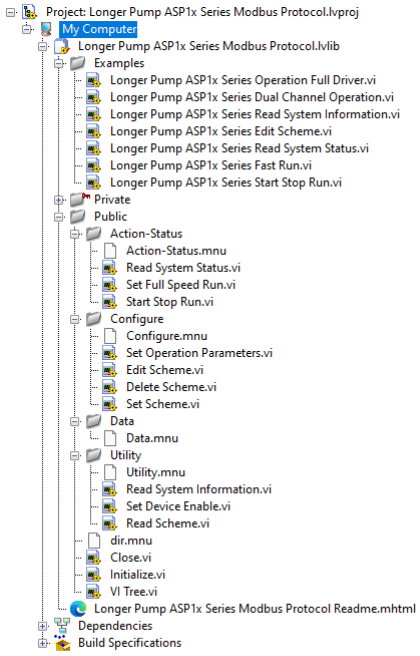
- Open software "VI Package Manager (VIPM)" and search key word "Modbus".
- Select item " NI Modbus Library", and click "Install" to start installation.



Note: Please restart the PC after the Modbus Library installation.

4.5 LabVIEW Pump Driver Directory

Please contact Longer Pump for the LabVIEW drivers of ASP100 series pump.
The directory of the LabVIEW instrument driver includes:
Examples: ASP100 pump driver demos
Private: component VI program
Public: application VI program



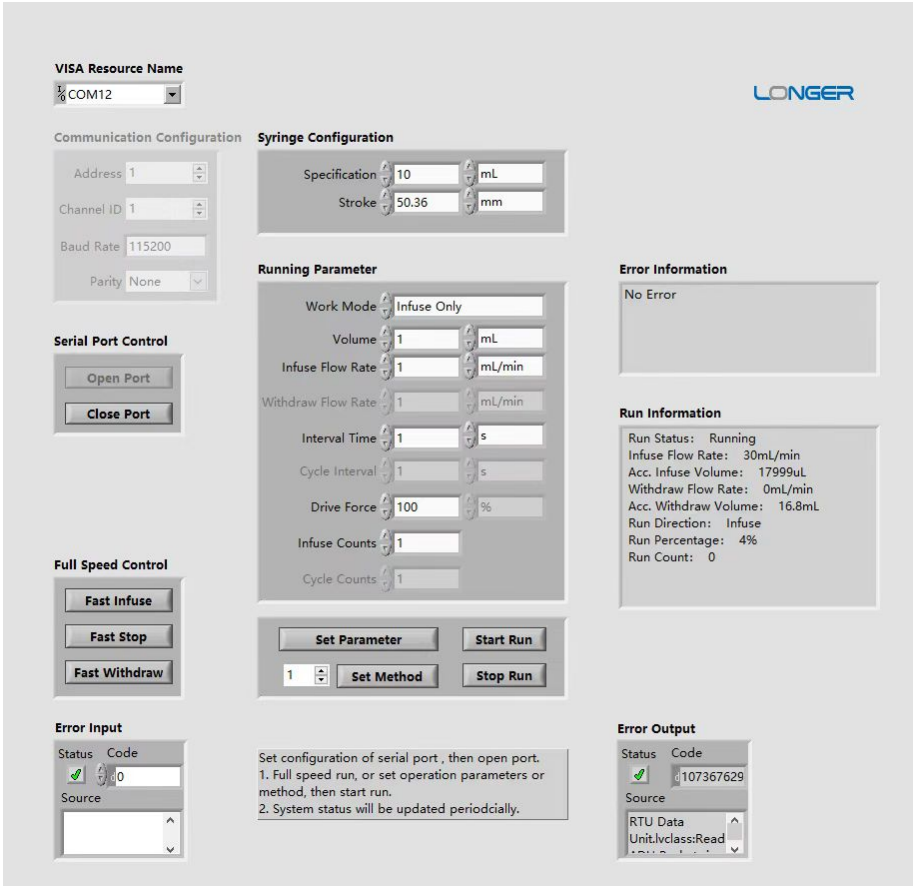
4.6 LabVIEW VI Program

The application VI program integrates multiple component VI programs: Initialize，Configure，Action & Status，Data，Utility，Close

4.7 LabVIEW Pump Control Demo

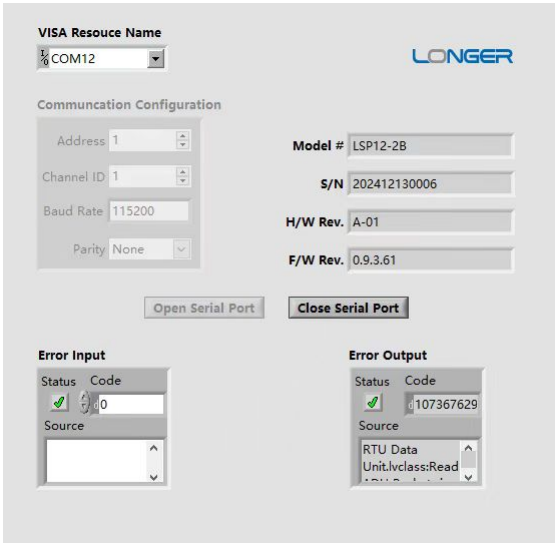
4.7.1 Set Parameters and Control the Pump

The demo includes: parameters setting and download to the pump, pump start/stop, fast forward and fast reverse running, pump running status reading.



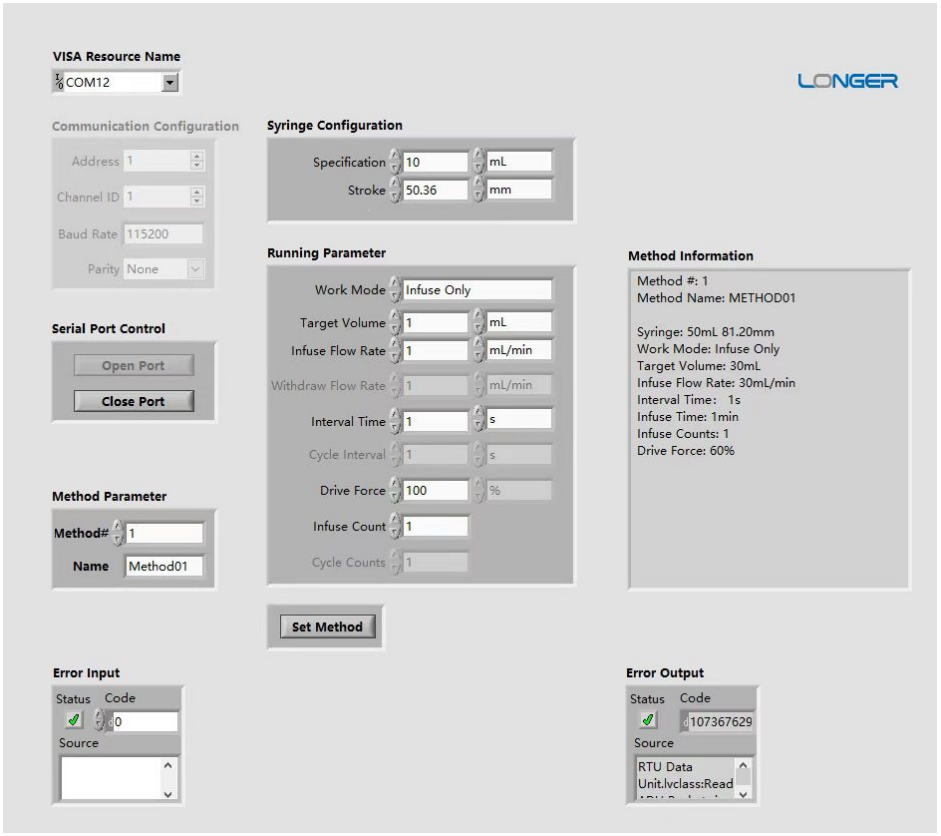
4.7.2 System Information Reading

Read the pump model, serial number, hardware/firmware version.



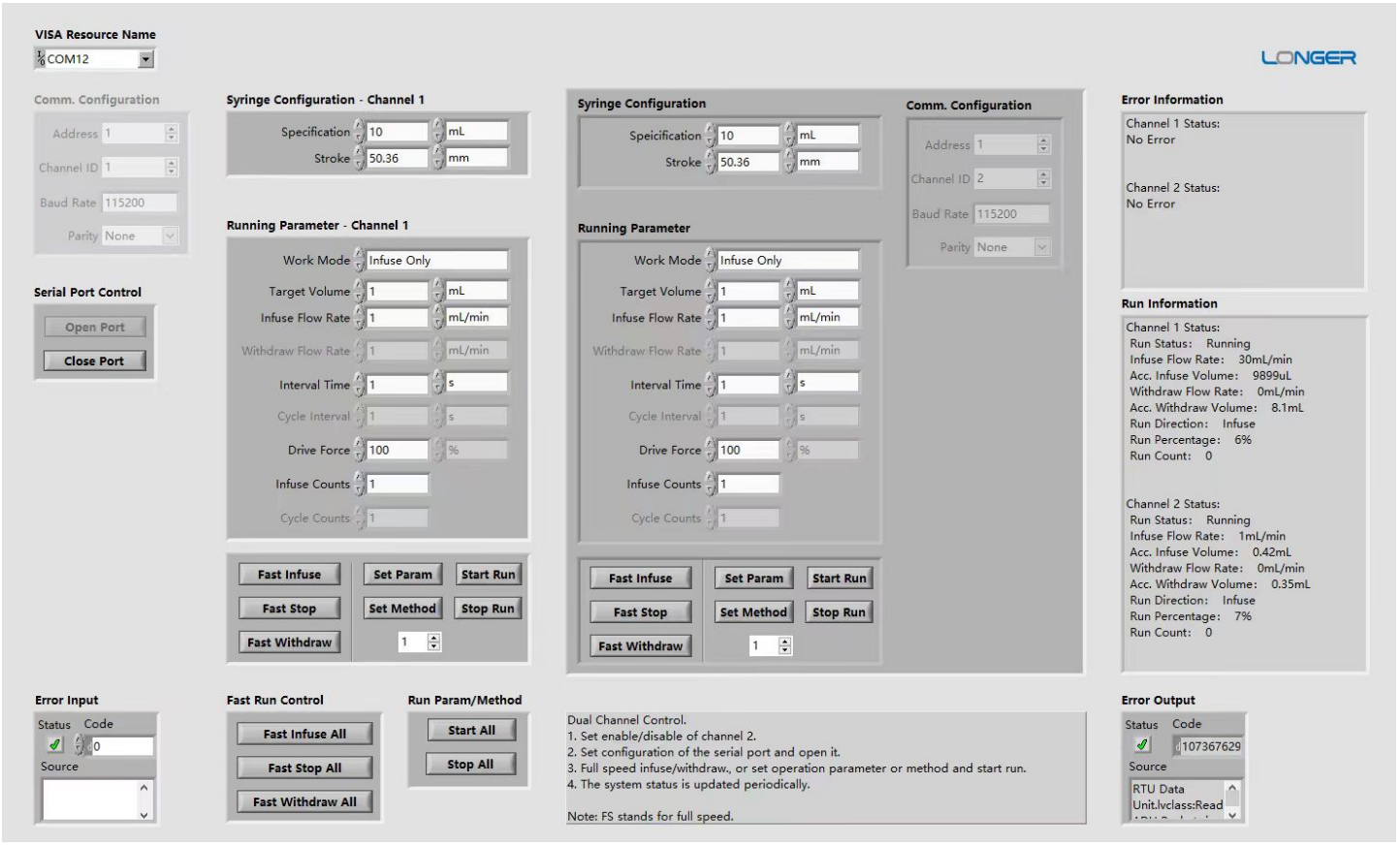
4.7.3 Method Handling

Set the method parameters, download the method to the pump, delete the method, read back and update the method parameters.



4.7.4 Dual-channel Control

Control two pumps at the same time. Including: parameters setting, download to the pump, start/stop control.



5 Troubleshooting

Motor stall: Please check whether the tubing is blocked, the syringe is completely emptied, or the setting "Force" in the method is too small.
Device fault: If the device fault happens, contact Longer Pump after-sales service.
Parameter out of range: please reset the parameters within the specified range provided on the screen.

Appendix A: Modbus RTU Register Definition

None Group mode:

Different pumps on the same RS485 bus are assigned unique pump addresses, and the Channel ID needs to be set to 1. The pumps will be controlled based on their addresses. The control commands only can use the register address range for “Common Parameters for Multi-Channel” , “Pump Status” or “Parameters for Channel ID 1”.

Group Mode:

Different pumps in the same group are assigned the same pump address and a unique Channel ID (1-10). One pump must have its Channel ID set to 1, the remaining Channel IDs do not need to be sequential.

When the control command uses the register address range for “Common Parameters for Multi-Channel”, all pumps with the same device address as the command can execute the same instruction. However, only the pump with a “Channel ID” of 1 will respond to the command (when read the pump status with the registers of “ Pump Status”, only pump with Channel ID 1 will respond).

When the control command uses the register address range for “Parameters for Channel ID ‘N’”, only the pump with the same device address as the command and a “Channel ID” of “N” can execute the instruction and respond to the command.

Parameter Type	Function	Variable	Register Address	Data Type	Read/ Write	Factory Setting	Description
Common Parameters for Multi-Channel	System	Start/stop	0x0001	uint_16	R/W	0	0: stop 1: start
	System	Running at full speed	0x0006	uint_16	R/W	0	Fast forward and reverse: 0: stop 1: fast forward at full speed 2: fast reverse at full speed
	System	Pause/Resume	0x000D	uint_16	W	0	Pause/ Resume: 1: pause 2: resume
	Basic mode	The method number to be activated	0x005E	uint_16	R/W	0	Range: 1 -20 The registers from 0x0060 to 0x007D will used to configure the parameters for the current activated method.
	The current activated method	Work mode	0x0060	uint_16	R/W	1	1: infuse only 2: withdraw only 3: infuse/withdraw (continuous) 4: withdraw/infuse (continuous)
	The current activated method	Syringe volume	0x0061	uint_16	R/W	50	Range: 1~9999
	The current activated method	Syringe volume unit	0x0062	uint_16	R/W	103	Refer to “Volume Unit Conversion Table”
	The current activated method	Syringe cross-sectional area value	0x0063	uint_16	R/W	6157	Range: 1~9999
	The current activated method	Syringe cross-sectional area unit	0x0064	uint_16	R/W	99	Refer to "Section Area Unit Conversion Table""

	The current activated method	Target volume	0x0068	uint_16	R/W	30000	Range: 1~9999
	The current activated method	Target volume unit	0x0069	uint_16	R/W	100	Refer to “Volume Unit Conversion Table”
	The current activated method	Infusion flow rate	0x006A	uint_16	R/W	30000	Range: 1~9999
	The current activated method	Infusion flow rate unit	0x006B	uint_16	R/W	100	Refer to “Flow Rate Unit Conversion Table”
	The current activated method	Withdrawal flow rate	0x006C	uint_16	R/W	30000	Range: 1~9999
	The current activated method	Withdrawal flow rate unit	0x006D	uint_16	R/W	100	Refer to “Flow Rate Unit Conversion Table”
	The current activated method	Drive force limit	0x006E	uint_16	R/W	80	Range: 0-100 Represents 0-100% of max force (320N)
	The current activated method	Interval time	0x0070	uint_16	R/W	100	Range: 1s-1000h I/W mode：I->W interval W/I mode：W->I interval
	The current activated method	Interval time unit	0x0071	uint_16	R/W	98	Refer to “Time Unit Conversion Table”
	The current activated method	Cycle interval	0x0072	uint_16	R/W	100	Range: 1s-1000h I/W mode：W->I interval W/I mode：I->W interval
	The current activated method	Cycle interval unit	0x0073	uint_16	R/W	98	Refer to “Time Unit Conversion Table”
	The current activated method	Cycle counts	0x0074	uint_16	R/W	1	0-30000, 0 means unlimited cycles
	The current activated method	Infuse time	0x0075	uint_16	R/W	1	1~9999
	The current activated method	Infuse time unit	0x0076	uint_16	R/W	1	Refer to “Time Unit Conversion Table”
	The current activated method	Withdraw time	0x0077	uint_16	R/W	1	1~9999
	The current activated method	Withdraw time unit	0x0078	uint_16	R/W	1	Refer to “Time Unit Conversion Table”

	The current activated method	Method name	0x0079	uint_16	R/W		ASCII Code of letters, numbers and symbols. Max number of characters is 8, end with 0D.
	The current activated method		0x007A	uint_16	R/W		
	The current activated method		0x007B	uint_16	R/W		
	The current activated method		0x007C	uint_16	R/W		
	The current activated method		0x007D	uint_16	R/W		
	The method to be configured	The method number to be configured	0x026E	uint_16	R/W	0	Range: 1 - 20 Inactivate method number. All the methods parameters can be configured before activation. The registers from 0x0270 to 0x028D will used to configure the parameters for the selected method.
	The method to be configured	Work mode	0x0270	uint_16	R/W	1	1: infuse only 2: withdraw only 3: infuse/withdraw (continuous) 4: withdraw/infuse (continuous)
	The method to be configured	Syringe volume	0x0271	uint_16	R/W	50	Range: 1~9999
	The method to be configured	Syringe volume unit	0x0272	uint_16	R/W	103	Refer to “Volume Unit Conversion Table”
	The method to be configured	Syringe cross-sectional area value	0x0273	uint_16	R/W	6157	Range: 1~9999
	The method to be configured	Syringe cross-sectional area unit	0x0274	uint_16	R/W	99	Refer to "Section Area Unit Conversion Table""
	The method to be configured	Target volume	0x0278	uint_16	R/W	30000	Range: 1~9999
	The method to be configured	Target volume unit	0x0279	uint_16	R/W	100	Refer to “Volume Unit Conversion Table”
	The method to be configured	Infusion flow rate	0x027A	uint_16	R/W	30000	Range: 1~9999
	The method to be configured	Infusion flow rate unit	0x027B	uint_16	R/W	100	Refer to “Flow Rate Unit Conversion Table”
	The method to be configured	Withdrawal flow rate	0x027C	uint_16	R/W	30000	Range: 1~9999
	The method to be configured	Withdrawal flow rate unit	0x027D	uint_16	R/W	100	Refer to “Flow Rate Unit Conversion Table”

	The method to be configured	Drive force limit	0x027E	uint_16	R/W	80	Range: 0-100 Represents 0-100% of max force (320N)
	The method to be configured	Interval time	0x0280	uint_16	R/W	100	Range: 1s-1000h I/W mode：I->W interval W/I mode：W->I interval
	The method to be configured	Interval time unit	0x0281	uint_16	R/W	98	Refer to “Time Unit Conversion Table”
	The method to be configured	Cycle interval	0x0282	uint_16	R/W	100	Range: 1s-1000h I/W mode：W->I interval W/I mode：I->W interval
	The method to be configured	Cycle interval unit	0x0283	uint_16	R/W	98	Refer to “Time Unit Conversion Table”
	The method to be configured	Cycle counts	0x0284	uint_16	R/W	1	0-30000, 0 means unlimited cycles
	The method to be configured	Infuse time	0x0285	uint_16	R/W	1	1~9999
	The method to be configured	Infuse time unit	0x0286	uint_16	R/W	1	Refer to “Time Unit Conversion Table”
	The method to be configured	Withdraw time	0x0287	uint_16	R/W	1	1~9999
	The method to be configured	Withdraw time unit	0x0288	uint_16	R/W	1	Refer to “Time Unit Conversion Table”
	The method to be configured	Method name	0x0289	uint_16	R/W		ASCII Code of letters, numbers and symbols. Max number of characters is 8, end with 0D.
			0x028A	uint_16	R/W		
			0x028B	uint_16	R/W		
			0x028C	uint_16	R/W		
			0x028D	uint_16	R/W		
Pump status (In Group Mode, the response status is the status of the pump with Channel ID 1)	Pump status	Pump status (most significant byte) - Error code	0x0100	uint_16	R		bit0: motor stall bit1: device fault bit2: low voltage
	Pump status	Pump status (least significant byte) - running status	0x0101	uint_16	R		b15-b12：idex for pump model b3-b0：running status 0 : standby（reserved） 1 : running（0001） 2 : pause（0010） 3 : stop（0011） 4 : interval time（0100）（multiple infusion interval, interval time I->W in I/W mode, interval time W->I in W/I mode） 5: cycle interval time（0101）（interval time W->I in I/W mode, interval time I->W in W/I mode）
	Pump status	Real-time infuse flow rate	0x0102	uint_16	R		
	Pump status	Real-time infuse flow rate unit	0x0103	uint_16	R		

	Pump status	Accumulated infuse volume	0x0104	uint_16	R		
	Pump status	Accumulated infuse volume unit	0x0105	uint_16	R		
	Pump status	Real-time withdraw flow rate	0x0106	uint_16	R		
	Pump status	Real-time withdraw flow rate unit	0x0107	uint_16	R		
	Pump status	Accumulated withdraw volume	0x0108	uint_16	R		
	Pump status	Accumulated withdraw volume unit	0x0109	uint_16	R		
	Pump status	Running direction	0x010A	uint_16	R		1: infuse 2: withdraw
	Pump status	Task completed %	0x010B	uint_16	R		
	Pump status	The completed infuse counts/ cycle counts (most significant byte)	0x010C	uint_16	R		The accumulated counts that has been completed
	Pump status	The completed infuse counts/ cycle counts (least significant byte)	0x010D	uint_16	R		
	Pump status	Reserved	0x010E	uint_16	R		Default: 0
	Pump status	Linear speed-most significant byte	0x010F	uint_16	R		The linear speed of the plunger= "Linear speed-most significant byte" * 65536 + "Linear speed- least significant byte" /(10^-7) Unit is 10^-7 mm/min
	Pump status	Linear speed-least significant byte	0x0110	uint_16	R		

When different pumps are assigned the same pump address and a unique Channel ID (1-10), the pumps can be controlled by the commands using the registers of “Common Parameters for Multi-Channel” , or using its own designated registers. Their own designated registers have the same definition as the “Common Parameters for Multi-Channel” and “Pump Status”. Refer to below table for their own registers range (offset address)

Parameters for Channel ID 1	Start address	0x2000	The pump with “Channel ID” = 1 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x2000.
	End address	0x23FF	
Parameters for Channel ID 2	Start address	0x2400	The pump with “Channel ID” = 2 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400
	End address	0x27FF	

			(the “Common Parameters for Multi-Channel”), but the register address has offset 0x2400.
Parameters for Channel ID 3	Start address	0x2800	The pump with “Channel ID” = 3 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x2800.
	End address	0x2BFF	
Parameters for Channel ID 4	Start address	0x2C00	The pump with “Channel ID” = 4 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x2C00.
	End address	0x2FFF	
Parameters for Channel ID 5	Start address	0x3000	The pump with “Channel ID” = 5 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x3000.
	End address	0x33FF	
Parameters for Channel ID 6	Start address	0x3400	The pump with “Channel ID” = 6 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x3400.
	End address	0x37FF	
Parameters for Channel ID 7	Start address	0x3800	The pump with “Channel ID” = 7 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x3800.
	End address	0x3BFF	
Parameters for Channel ID 8	Start address	0x3C00	The pump with “Channel ID” = 8 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x3C00.
	End address	0x3FFF	
Parameters for Channel ID 9	Start address	0x4000	The pump with “Channel ID” = 9 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x4000.
	End address	0x43FF	
Parameters for Channel ID 10	Start address	0x4400	The pump with “Channel ID” = 10 will execute and respond to the commands using these registers. The parameter definition is the same as the registers 0x0000-0x0400 (the “Common Parameters for Multi-Channel”), but the register address has offset 0x4400.
	End address	0x47FF	

Appendix B: Unit Conversions

	Register Value	Unit	Register Value	Unit	Register Value	Unit
Flow Rate Unit Conversion Table	94	1pL/min	194	1pL/s	294	1pL/h
	95	10pL/min	195	10pL/s	295	10pL/h
	96	100pL/min	196	100pL/s	296	100pL/h
	97	1nL/min	197	1nL/s	297	1nL/h
	98	10nL/min	198	10nL/s	298	10nL/h
	99	100nL/min	199	100nL/s	299	100nL/h
	100	1uL/min	200	1uL/s	300	1uL/h
	101	10uL/min	201	10uL/s	301	10uL/h
	102	100uL/min	202	100uL/s	302	100uL/h
	103	mL/min	203	1mL/s	303	1mL/h
	104	10mL/min	204	10mL/s	304	10mL/h
	105	100mL/min	205	100mL/s	305	100mL/h
	106	1L/min	206	1L/s	306	1L/h

	Register Value	Unit
Volume Unit Conversion Table	92	0.01pL
	93	0.1pL
	94	1pL
	95	0.01nL
	96	0.1nL
	97	1nL
	98	0.01uL
	99	0.1uL
	100	1uL
	101	10uL
	102	100uL
	103	1mL
	104	10mL
	105	100mL
	106	1L

	Register Value	Unit
Time Unit Conversion Table	97	1millisecond
	98	0.01second
	99	0.1second
	100	1second
	101	0.1minute
	102	1minute
	103	0.1hour
	104	1hour

	Register Value	Unit
Speed Unit Conversion Table	96	0.0001rpm/s
	97	0.001rpm/s
	98	0.01rpm/s

	99	0.1rpm/s
	100	1rpm/s
	101	10rpm/s
	102	100rpm/s
Section Area Unit Conversion Table	94	10^-6mm^2
	95	10^-5mm^2
	96	10^-4mm^2
	97	10^-3mm^2
	98	0.01mm^2
	99	0.1mm^2
	100	1mm^2

Advice: the input values of the method parameters in the registers are within the valid range of the controller.

Appendix C: Factory Default Settings

Type	Parameters	Default Setting	Note
Running Parameters	Control mode	Touchscreen control	
	Method	Method 1 (Infuse)	
	Start/stop	Stop	
	Fast Forward	Stop	
	Fast Reverse	Stop	
User-defined Syringe	Name	CUSTOM1	20 syringes, named from CUSTOM1 to CUSTOM20
	Volume	50 mL	
	ID	28.0 mm	
	Stroke	81.2 mm	
Method Parameters	Name	METHOD01	20 methods, named from METHOD01 to METHOD20
	Work mode	Infuse only	
	Infuse mode	VOL/FLOW	
	Syringe	User-defined 50 ml (No 1)	
	Target volume	10 mL	
	Infuse flow rate	10 mL/min	
	Infuse interval	1.00 sec	
	Infuse counts	1	
	Drive force limit	60%	
System Parameters	Communication control	Disabled	
	Protocol	Modbus RTU	
	Address	1	
	Baud rate	115200 bps	
	Parity	None	
	Channel ID	1	
	Footswitch control	Disabled	
	Footswitch control signal	Level signal	
	External start/stop control	Disabled	
	External start control signal	Low level signal	
	Emergency stop	Disabled	
	Emergency stop control signal	Low level signal	
	Output_1 status	Disabled	
	Output_1 source	Start/stop	
	Output_1 type	Open	
	Output_2 status	Disabled	
	Output_2 source	Start/stop	
	Output_2 type	Open	
	Display brightness	100%	
	Key click audible alert	Enabled	
	Motor stall audible alert	Disabled	
	End of run audible alert	Enabled	
	Fault audible alert	Disabled	
	Near end of run audible alert	Disabled	
	Near end of run value	80%	
	Flow rate fine-tune value	1 mL/min	

Factory Default Parameters	ASP11-1A	ASP11-1AP	ASP11-2AP	ASP12-1B	ASP12-2B
Syringe spec	Hamilton/100uL	Hamilton/100uL	Hamilton/1mL	Hamilton/100uL	Hamilton/100uL
Work mode	Infuse only	Infuse only	Infuse only	Infuse only	Infuse only
Flow rate	100uL/min	100uL/min	1mL/min	100uLmin	100uL/min
Target volume	100uL	100uL	1mL	100uL	100uL
Drive force limit	30%	30%	30%	30%	30%
Interval time	-	-	-	-	-
Cycle interval	-	-	-	-	-
Infuse counts	1	1	1	1	1
Cycle counts	-	-	-	-	-

Appendix D: Syringe List

Syringe Brand	Volume（uL）	Stroke（mm）	ID（mm）	Min Flow Rate（nL/Min）		Max Flow Rate（uL/Min）	
				ASP11-1AP ASP11-2AP	ASP11-1A (max 60mL) ASP12-1B ASP12-2B	ASP11-1AP ASP11-2AP	ASP11-1A (max 60mL) ASP12-1B ASP12-2B
Air-Tite	1000	57.880	4.690	1.417	7.199	612.182	3109.883
Air-Tite	2500	34.180	9.650	5.999	30.476	2591.652	13165.594
Air-Tite	5000	41.070	12.450	9.986	50.726	4313.741	21913.806
Air-Tite	10000	50.360	15.901	16.287	82.738	7035.955	35742.653
Air-Tite	20000	63.340	20.051	25.899	131.565	11188.213	56836.123
Air-Tite	30000	72.840	22.900	33.781	171.609	14593.522	74135.091
Air-Tite	50000	74.660	29.201	54.930	279.043	23729.622	120546.477
Becon Dickinson	1000	57.660	4.699	1.422	7.226	614.517	3121.748
Becon Dickinson	3000	51.830	8.585	4.748	24.117	2050.921	10418.676
Becon Dickinson	5000	44.290	11.989	9.260	47.038	4000.121	20320.614
Becon Dickinson	10000	61.170	14.427	13.409	68.116	5792.557	29426.189
Becon Dickinson	20000	70.170	19.050	23.378	118.759	10099.208	51303.976
Becon Dickinson	30000	81.950	21.589	30.026	152.532	12971.228	65893.838
Becon Dickinson	50000	90.010	26.595	45.562	231.456	19682.852	99988.890
Becon Dickinson	60000	108.020	26.594	45.559	231.439	19681.395	99981.485
Becon Dickinson (G)	500	29.570	4.640	1.387	7.045	599.139	3043.625
Becon Dickinson (G)	1000	59.140	4.640	1.387	7.045	599.139	3043.625
Becon Dickinson (G)	3000	50.930	8.660	4.831	24.543	2087.163	10602.788
Becon Dickinson (G)	5000	45.260	11.860	9.061	46.030	3914.391	19885.108
Becon Dickinson (G)	10000	61.920	14.340	13.246	67.291	5722.395	29069.767
Becon Dickinson (G)	20000	69.580	19.131	23.576	119.766	10184.844	51739.005
Becon Dickinson (G)	30000	74.130	22.700	33.193	168.623	14339.567	72845.002
Becon Dickinson (G)	60000	93.400	28.599	52.690	267.666	22762.144	115631.692
Hamilton	5	54.110	0.343	0.008	0.039	3.274	16.633

Hamilton	10	54.130	0.485	0.015	0.077	6.546	33.253
Hamilton	25	59.900	0.729	0.034	0.174	14.788	75.125
Hamilton	50	60.010	1.030	0.068	0.347	29.523	149.975
Hamilton	100	59.980	1.457	0.137	0.695	59.075	300.100
Hamilton	250	59.960	2.304	0.342	1.737	147.736	750.500
Hamilton	500	60.050	3.256	0.683	3.469	295.030	1498.751
Hamilton	1000	59.960	4.608	1.368	6.949	590.945	3002.001
Hamilton	1250	59.980	5.151	1.709	8.683	738.435	3751.250
Hamilton	2500	59.980	7.285	3.419	17.367	1476.870	7502.501
Hamilton	5000	60.010	10.300	6.834	34.716	2952.264	14997.500
Hamilton	10000	60.000	14.567	13.670	69.444	5905.512	30000.000
Hamilton	25000	60.000	23.033	34.175	173.611	14763.780	75000.000
Hamilton	50000	60.010	32.571	68.339	347.164	29522.639	149975.004
Popper&sons	250	26.740	3.450	0.767	3.896	331.274	1682.872
Popper&sons	500	53.490	3.450	0.767	3.895	331.212	1682.557
Popper&sons	1000	62.880	4.500	1.304	6.626	563.503	2862.595
Popper&sons	2000	32.000	8.921	5.126	26.042	2214.567	11250.000
Popper&sons	3000	47.260	8.990	5.207	26.449	2249.243	11426.153
Popper&sons	5000	46.510	11.699	8.818	44.793	3809.188	19350.677
Popper&sons	10000	58.920	14.700	13.921	70.717	6013.759	30549.898
Popper&sons	20000	66.420	19.580	24.698	125.464	10669.398	54200.542
Popper&sons	30000	74.130	22.700	33.193	168.623	14339.567	72845.002
Popper&sons	50000	75.700	29.000	54.175	275.209	23403.614	118890.357
Ranfac	2000	30.620	9.119	5.357	27.215	2314.374	11757.022
Ranfac	5000	41.810	12.340	9.809	49.829	4237.392	21525.951
Ranfac	10000	60.140	14.550	13.638	69.283	5891.764	29930.163
Ranfac	20000	64.560	19.860	25.409	129.079	10976.788	55762.082
Ranfac	30000	70.970	23.199	34.671	176.131	14978.049	76088.488
Ranfac	50000	83.570	27.600	49.073	249.292	21199.636	107694.149
Shanghai Gaoge	5	51.970	0.350	0.008	0.040	3.409	17.318
Shanghai Gaoge	10	50.930	0.500	0.016	0.082	6.957	35.343
Shanghai Gaoge	25	49.740	0.800	0.041	0.209	17.809	90.470
Shanghai Gaoge	50	52.610	1.100	0.078	0.396	33.675	171.070

Shanghai Gaoge	100	49.740	1.600	0.165	0.838	71.237	361.882
Shanghai Gaoge	250	60.170	2.300	0.341	1.731	147.221	747.881
Shanghai Gaoge	500	60.270	3.250	0.680	3.457	293.953	1493.280
Shanghai Gaoge	1000	59.910	4.610	1.369	6.955	591.438	3004.507
Sherwood Monojet	1000	58.880	4.650	1.393	7.077	601.784	3057.065
Sherwood Monojet	3000	47.790	8.940	5.149	26.156	2224.298	11299.435
Sherwood Monojet	6000	47.360	12.701	10.391	52.787	4488.987	22804.054
Sherwood Monojet	12000	60.440	15.899	16.285	82.727	7035.024	35737.922
Sherwood Monojet	20000	61.190	20.400	26.809	136.188	11581.327	58833.143
Sherwood Monojet	35000	78.670	23.800	36.491	185.374	15764.046	80081.352
Sherwood Monojet	50000	89.970	26.601	45.582	231.559	19691.603	100033.344
SGE	5	54.110	0.343	0.008	0.039	3.274	16.633
SGE	10	54.130	0.485	0.015	0.077	6.546	33.253
SGE	50	60.010	1.030	0.068	0.347	29.523	149.975
SGE	25	60.060	0.728	0.034	0.173	14.749	74.925
SGE	100	59.980	1.457	0.137	0.695	59.075	300.100
SGE	250	60.020	2.303	0.342	1.736	147.589	749.750
SGE	500	60.010	3.257	0.683	3.472	295.226	1499.750
SGE	1000	60.020	4.606	1.367	6.942	590.354	2999.000
SGE	2500	59.990	7.284	3.418	17.364	1476.624	7501.250
SGE	5000	60.000	10.301	6.835	34.722	2952.756	15000.000
SGE	10000	60.000	14.567	13.670	69.444	5905.512	30000.000
SGE	25000	60.170	23.000	34.079	173.121	14722.067	74788.100
SGE	50000	84.180	27.500	48.718	247.486	21046.015	106913.756
Terumo	1000	56.910	4.730	1.441	7.322	622.616	3162.889
Terumo	3000	47.160	9.000	5.218	26.506	2254.012	11450.382
Terumo	5000	37.440	13.040	10.954	55.645	4731.981	24038.462
Terumo	10000	51.070	15.790	16.061	81.587	6938.138	35245.741
Terumo	20000	62.530	20.180	26.234	133.269	11333.143	57572.365
Terumo	30000	70.000	23.360	35.152	178.571	15185.602	77142.857
Terumo	60000	88.080	29.450	55.873	283.833	24136.969	122615.804
Unimertrics	10	60.170	0.460	0.014	0.069	5.889	29.915
Unimertrics	25	59.730	0.730	0.034	0.174	14.831	75.339

Unimertrics	50	60.010	1.030	0.068	0.347	29.523	149.975
Unimertrics	100	59.730	1.460	0.137	0.698	59.322	301.356
Unimertrics	250	60.170	2.300	0.341	1.731	147.221	747.881
Unimertrics	500	59.900	3.260	0.685	3.478	295.769	1502.504
Unimertrics	1000	59.910	4.610	1.369	6.955	591.438	3004.507
XinHuaYiLiao	1000	57.150	4.720	1.435	7.291	620.001	3149.606
XinHuaYiLiao	2000	27.040	9.704	6.067	30.819	2620.789	13313.609
XinHuaYiLiao	5000	37.100	13.099	11.054	56.155	4775.346	24258.760
XinHuaYiLiao	10000	46.210	16.599	17.750	90.168	7667.836	38952.608
XinHuaYiLiao	20000	70.540	19.000	23.255	118.136	10046.235	51034.874
XinHuaYiLiao	30000	72.210	22.999	34.076	173.106	14720.844	74781.886
XinHuaYiLiao	60000	89.970	29.139	54.699	277.870	23629.924	120040.013