

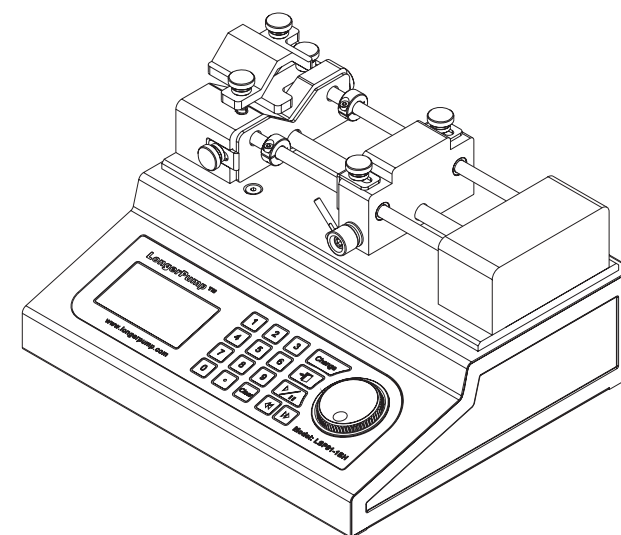


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Syringe Pump Operating Manual

**SYRINGE PUMP
OPERATING MANUAL**



LSP01-1BH

Baoding Longer Precision Pump Co.,Ltd.

Important Information:

Please read operating manual carefully before operation.

Warning:

- Adopting suitable power cord for the pump.
- There is an danger of being squeezed between, Avoid placing fingers between these point while the pump is running.
- Over-push or over draw the syringe may result in the liquid spilled. Use appropriate measures to protect operators and equipment. Operate with care.
- If liquid spilled on mechanism unit, operator need to turn off the power supply. To re-power up the pump after wiping the pump dry.
- If damage is happened on or to the pump, please contact longer company or longer's dealers. Don't repair pump by yourself.
- Unplug the power plug if there is damage or wear to the power cord or power plug.

Turn off the power supply before installing peripheral equipment.

- There are two protection measures need to be taken in electrospinning industry and other high voltage static industry, or pump will be serious damaged:
 - Do not put this product and other equipment which can occur high voltage static in same power circuit.
 - Make sure power cord has been grounded reliably and adopts isolating transformer. Power up the pump after isolating the power supply.
- Longer company can provide suitable isolating power supply for syringe pump.

 This pump is not for clinical use on human or veterinary patients. It is intended for research use only.

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Specification Table

Syringe pump type	LSP01-1BH
Syringe No.	1
Syringe type	Stainless Steel syringe
Syringe size	2.5ml-100ml
Drive mechanism	Micro processor control step motor to drive leadscrew, driving a leadscrew through a belt and pulley drive mechanism
Advance per micro-step	0.156 μm (1/16step)
Infusion volume per micro-step	0.149 μl (100ml stainless steel syringe 1/16 step)
Maximum linear speed	130 mm/min
Minimum linear speed	5 $\mu\text{m}/\text{min}$
Maximum stepping rate	13867 step/sec
Minimum stepping rate	1 step /30 sec
Flow rates	0.09 - 124.36(mL/min)
Linear force	45kg
Display	128 \times 64 LCD display
Fuse	50 \times 20mm, 250V, F 1A
Power supply	100V – 240V AC
Operating conditions	Temperature: 5-40°C (41°F- 104°F); Humidity: 20% - 80%, non-condensing
Dimensions (mm)	280 \times 250 \times 140mm
Weight	6.3kg

Instruction

This pump is a single channel high pressure syringe pump. The acceptable syringes are 2.5 L-100mL stainless steel syringes. Because of the extra linear force this pump is suitable for transferring viscous fluids or delivering the fluid to reactors in chemical applications.

General Description

Press Start/Stop key to run the syringe pump after setting all the parameters. Press Function key to switch interface to set, change or review the parameters. First select the syringe diameter from the list or input the syringe diameter; then input the parameters of dispensing volume and flow rate. Five working modes are available, different running parameters can be saved in each mode.

Features

❖ Syringe selection

- Select syringe from the list

The pump contains a table of standard syringes organized by manufacturer, and material then by size. material and size. Once the syringe is identified in the table, the pump automatically enters the appropriate diameter.

- Input syringe diameter

If the current syringe diameter is not included in the list. Users can measure the diameter of syringe and input the syringe diameter; pump can save four syringe diameters.

❖ Infusion and withdrawal flowrates

Infusion and withdrawal flowrates can be set to different values and can be changed during operation. Pump only display relative parameters after selecting a working mode.

❖ Volume

Infusion and withdrawal volumes can be set to different values, syringe pump automatically stops working when the pumps reach to the target value. The pump displays the dispensing volume, linear speed and working progress. Target volume can be check or amend during the operation.

❖ Operation mode

- Infusion
Pumps will be automatically stopped when a set target volume is reached after infusion volume and flow rate are set.
If set the dispensing volume is zero, the pump will run until manually stopped or stalls.
- Withdrawal
Pumps will be automatically stopped when a set target volume is reached after infusion volume and flow rate are set.

- Infusion/Withdrawal


Withdrawal mode is automatically started after the infusion operation is finished and a period of pause time. Infusion and withdrawal volume and flowrates can be set separately. Pause time between infusion and withdrawal can be set.

- Withdrawal/Infusion

Infusion mode is automatically started after the withdrawal operation is finished and a period of pause time. Infusion and withdrawal volume and flowrates can be set separately. Pause time between infusion and withdrawal can be set.

- Continuous working

Pump continuously repeat the cycle of Withdrawal/infusion mode. Withdrawal and infusion volumes are set to same value. The flowrates of withdrawal and succedent pause time can set to be different with the flowrate of infusion and its succedent pause time.

 Working interface display different parameters in different work modes, but it only displays relative parameters in a certain mode, for example, in withdrawal/infusion mode, working interface only display parameters of withdrawal mode first, then display parameters of infusion mode after withdrawal mode finished.

- ❖ **RS485 Interface**

Adopting RS485 data bus to connect pumps with the host computer.

- ❖ **TTL**

Input and output control are available, such as, direction change, run indicator, footswitch or timer control, and valve or relay actuation.

- ❖ **Stall Detection**

The motor is monitored by an optical encoder to confirm the programmed movement. If the back pressure increases due to jamming or flow restriction them the motor may stall. Stall detection by the encoder results in a pump shutdown. The display will read 'Stall'. The Stall message can be cleared by pressing **Return key** or **Fast Forward/Fast Reverse key**.

- ❖ **Power Failure**

When power is returned after a temporary power disruption the pump can be programmed to resume operation or remain stopped. The pump will remain stopped if a dispensing volume has been set.

- ❖ **Non-volatile storage**

All operational settings are stored in non-volatile memory (EEPROM), it will be easy for customer to use.

- ❖ **Selection of flow and volume unit**

Volume unit: μ l、 ml

Flow unit: μ l/min、 μ l/hr、 ml/min、 ml/hr

- ❖ **Pause time setting**

The pause time between infusion/withdrawal and withdrawal/infusion can be set.

- ❖ **Calibration**

The flowrate can be calibrated for more accurate dispense volume.

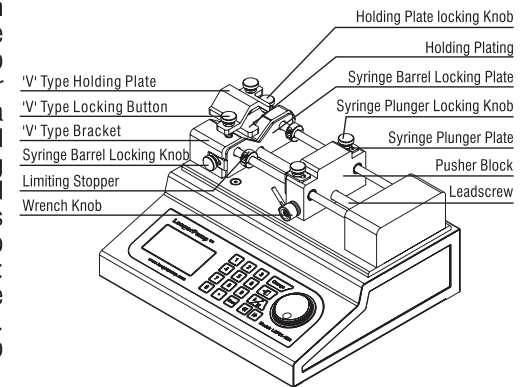
Operation Instruction

- ❖ **Power Switch**

The power switch is located on the right corner of the rear panel.

- ❖ **Syringe pump component**

This syringe pump is a high pressure syringe pump so there are a few special kits in order to safely load big syringe or stainless syringe. There are a syringe holding plate for small syringe and 'V' type holding plate for stainless syringe and big syringe whose capacity is more than 50ml. There are two kind of syringe loading modes: two loading modes can be installed together or separately. Below is the instruction for two loading mode.

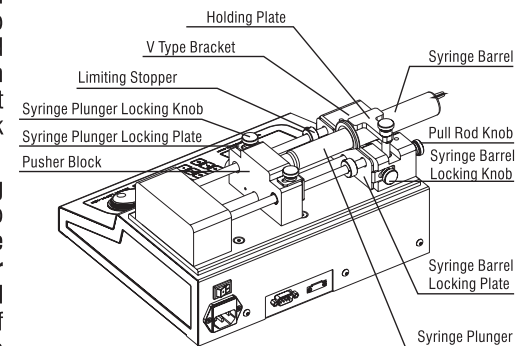


- ❖ **Syringe loading**

1 Turn **Wrench Knob** to right to disengage **Moving Block** and **Leadscrew**, push the **Moving Block** to suitable position, then turn **Wrench Knob** to left to engage **Moving Block** and **Leadscrew**. (Now operator can press Fast Forward/Fast Reverse key to put Pusher Block to suitable position)

2 Loose **Syringe Plunger Locking Knob** on the **Pusher Block** to have a gap between **Syringe Plunger Plate** and **Pusher Block**; Loose **Syringe Barrel Locking Knob** on both side of **Pusher Block** to have a gap between **Syringe Barrel Locking Plate** and '**V**' Type Bracket.

- **First mode: Small syringe installation**



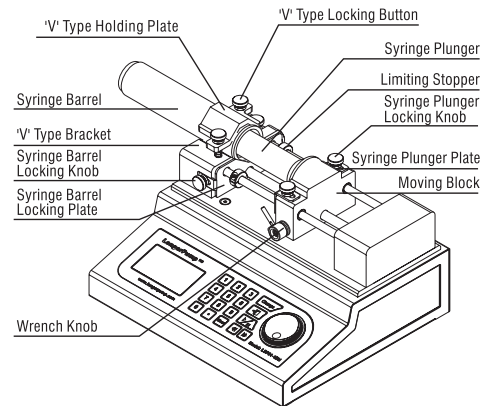
3 Loading small syringe:

Lift and turn **Holding Plate** put it on the **'V' Type Bracket**. Put syringe in the 'V' type slot of **'V' Type Bracket**, to adjust syringe to a suitable position, lift and turn **Holding Plate** to put it on the syringe, and then tighten **Pull Rod Knob** to lock **Holding Plate** for holding the syringe tightly.

Loading big syringe pump (>50ml):

Loose **'V' Type Plate Knob** to have a space between **'V' Type Bracket** and **'V' Type Holding Plate** to hold syringe, we recommend not to remove **'V' Type Plate Knob** and **'V' Type Holding Plate** in case to lose the spring. Put syringe in the **'V' Type slot** of **'V' Type Bracket**, adjust syringe in suitable position, turn **'V' Type Plate Knob** to tighten syringe.

- Second mode: Syringe whose capacity is more than 50ml and stainless syringe of 100ml.



4 Move Syringe Barrel Locking Plate to touch the flange of syringe barrel, equally turn **Syringe Barrel Locking Knob** to hold the flange of syringe barrel, move **Syringe Plunger Locking Plate** to hold flange of syringe plunger, hold syringe plunger tightly.

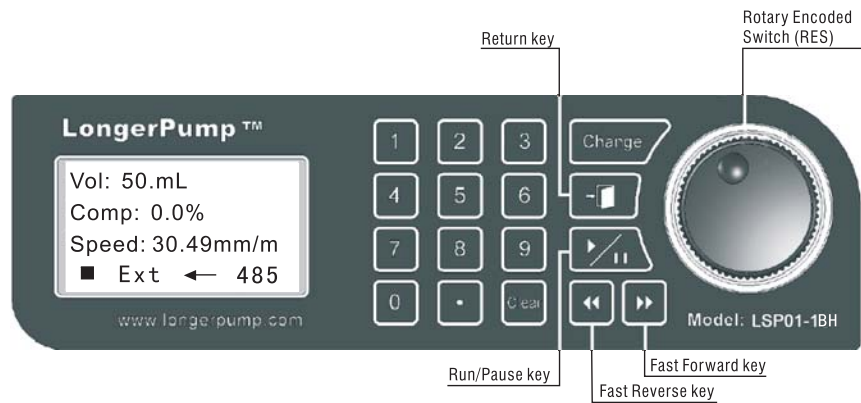
5 There are two round Limiting Stopper between **Pusher Block** and **'V' Type Bracket**, use two round **Syringe rest** to prevent the damage of syringe because of the linear force of syringe pump. **Syringe rest** can move freely on the rod. Tighten the screw on the **Syringe rest** to put it on a certain point of rod after operator confirms a position.

- 1、 This syringe pump is a 'Withdrawal/Infusion' high pressure syringe pump.
- 2、 Acceptable for 8ml-100ml stainless steel syringe and 10 μ l-40ml syringe or sample injector.
- 3、 Load one syringe only.
- 4、 Recommend not using glass syringe, glass sample injector is suitable.

❖ Menu Instruction

- Turn on the syringe pump, the LCD will display the initializing interface (Interface 1) first and then display the language selection interface (interface 2) and (interface 3), customer can select a suitable language for himself.
- In the working interface, the first line display target volume, the dispensing volume increase from zero to target volume when pump running. Second line displays target volume has been completed in percent. Third line displays current linear speed. Fourth line displays working status of pump: **■** stop indicator, **▼** running indicator, **EXT** external control enable indicator, **←/→** direction indicator which will flash while pump running, **485** enable communication indicator.
- Press **Change** key to switch working interface and parameters setting interface. Interface displays different parameters in different work mode: the main menu consist of sixteen options, as displayed in interface 5 to 8. The highlighted option can be selected to be changed.

LSP01-1BH Syringe Pump	语言 (language) 简体中文 English	语言 (language) 简体中文 English	I_vol: 50. ml Comp: 0. 0% Speed: 76. 23mm/m ■ Ext → 485
Interface 1	Interface 2	Interface 3	Interface 4
Syringe: 50cc Mode: Infusion Power up: Stop Calibration ↓	I_vol: 50. ml ↑ Flow: 20. ml/m Time: 150. 0sec Pause: 3. sec ↓	I_vol: 15. ml ↑ Flow: 10. ml/m Time: 90. 00sec Pause: 2. sec ↓	Ext. :Disable ↑ RS485:Enable Address:1 Baud Rate:2400↓
Interface 5	Interface 6	Interface 7	Interface 8
Save change? Yes No Cancel	Interruption! Continue Stop		
Interface 9	Interface 10		



❖ **Keypad functions**

Numerical keypad combined with **Rotary Encoded Switch** to select and set parameters.

Rotary Encoded Switch abbreviates as **RES**, turn **RES** to select menu, press **RES** to confirm the setting.

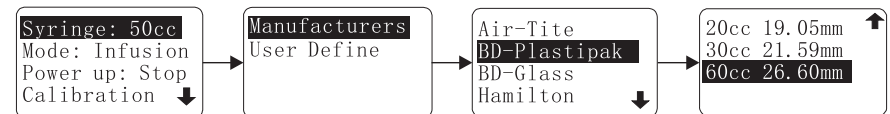
- **0 - 9,** entry keys for inputting Numerical and decimal when setting parameters.
- **Clear** Used to delete the last entered number when inputting number.
- **Change** Switch the display between the running interface and parameter setting interface.
- **Return** Cancel current operation and return to previous menu in multilevel menus.
- **Run/Pause** Starts the motor or acts as a pause. When running, press the key the motor stops, an interruption interface (interface 10) will be displayed, using the RES to continue or stop the operation.
- **Fast Reverse** In stop state, press the key withdraws at the maximum speed, when other keys are invalid. Loose the key the pump stops. This feature can be used for loading, purging and reversing out of a stall condition.
- **Fast Forward** In stop state, press the key the pump infuses at the maximum speed, when other keys are invalid. Loose the key the pump stops. This feature can be used for loading, purging and reversing out of a stall condition.

❖ **Setting diameter entry**

Operator need to input the accurate diameter of syringe barrel in order to get precise dispensing volume and diameter of syringe is saved in non volatile memory. It can be invoked in next application instead of repeating the input

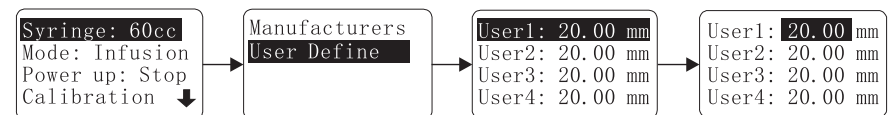
- Select syringe from the list defaulted in the pump

In working interface, press **Change** key to switch to parameter setting interface, press **RES** to highlight first line; press **RES** again into next interface, there are two options of **Manufacturers** and **User-define** are available. Turn **RES** to highlight **Manufacturers** and press **RES** again to enter **Manufacturers** list; turn **RES** to select syringe manufacturers (for example: BD-Plastipak), press **RES** to enter next interface and turn **RES** to select suitable syringe (for example: 60cc) then press **RES**, the pump will pop-up a dialog box (interface 9); select **Yes** then save the setting and return to previous menu, select **No** then cancel this setting and return to previous menu, select **Cancel** then back to syringe list.

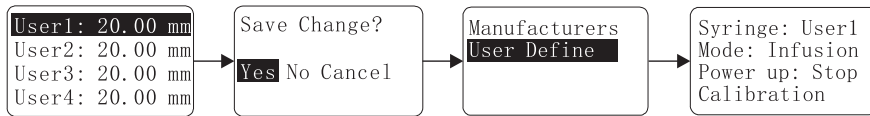



- **User Define**

If the syringe used is not listed in the table of standard syringes arranged by manufacturer, Operator can measure the internal diameter of the syringe and enter it into pump directly. First enter parameters setting interface, press **RES** to enter next interface, turn **RES** to highlight **User Define**, press **RES** to enter **User Define** interface which can be input four kinds of different diameter values. Press **RES** to highlight diameter value position then operator can input values using keypad. Pump will highlight this whole line after input and confirm the values. Input values must be between 0.01 and 50.00.



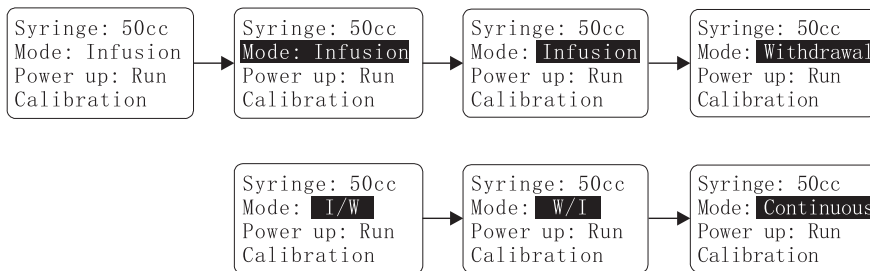
Four position of User Define interface can set syringe diameters in advance, turn **RES** to highlight **User1**, press **RES** to highlight value position only and input measured value. Press **RES** to pop-up a dialog box, select **Yes** to change the diameter of user1 to current value and return to previous interface; select **No** to cancel current value and return to previous interface; select **Cancel** to return former interface to set other user define diameters.



 The volume, flowrate and pause time setting are reset to zero after the syringe or diameter changed. Operator need to re-set the parameter of volume, flowrate and pause time before run the pump again.

❖ Mode Selection

In working interface, press **Change** key to enter parameter setting interface. Press **RES** key to highlight Mode option, press **RES** to highlight its parameters option, for example, Infusion; turn **RES** to select different options which include five modes of Infusion, Withdrawal, W/I, I/W, Continuous, press **RES** to highlight whole line for confirming the setting.



Different parameters can be set in different mode.

• Infusion

Pump runs to dispense liquid from syringe at the set flowrate, the pump will automatically stop when reach to target volume. In this mode, pump will pop-up a dialog box (interface 10) if pressing **Run/Pause** Key, turn **RES** to select **Continue** to resume the **Infusion** mode, and select **Stop** to terminate the **Infusion** mode.

• Withdrawal

Pump runs to fill the syringe at the set flowrate, the pump will automatically stop when reach to target volume. In this mode, pump will pop-up a dialog box (interface 10) if pressing **Run/Pause** Key, turn **RES** to select **Continue** to resume the **Infusion** mode, and select **Stop** to terminate the **Infusion** mode.

• W/I

Pump stops after it fills the syringe to target volume. Pump start to dispense liquid after a period of pause time. Different liquid volume and flowrate can be set in withdrawal mode and infusion mode. In W/I mode, pump will pop-up a dialog box (interface 10) if pressing **Run/Pause** Key, turn **RES** to select **Continue** to resume the W/I mode, and select **Stop** to terminate the W/I mode.

• I/W

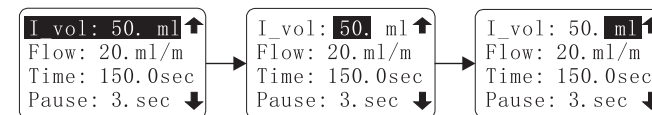
Pump stops after it dispense the liquid to target volume from the syringe. Pump start to fill liquid into syringe after a period of pause time. Different liquid volume and flowrate can be set in withdrawal mode and infusion mode. In I/W mode, pump will pop-up a dialog box (interface 10) if pressing **Run/Pause** Key, turn **RES** to select **Continue** to resume the I/W mode, and select **Stop** to terminate the I/W mode.

• Continuous

Circulate the mode of W/I periodically. Set same target volume in infusion mode and withdrawal mode. It can accomplish continuous operation equipped with suitable valve.

❖ Volume setting

Turn **RES** to highlight I_vol (infusion liquid), press **RES** to highlight value position only, operator can input target volume by pressing number and decimal on keypad and then press **RES** to highlight volume unit which can be amended.



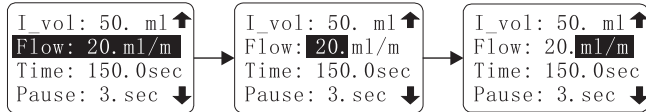
 When set target volume to zero.


- Set target volume to zero in withdrawal mode and infusion mode, working interface only displays flowrate, and pump runs until manually stopped or a stall occurred.

- Target volume must not set to zero in continuous mode, I/W mode and W/I mode.

❖ **Flowrate Setting**

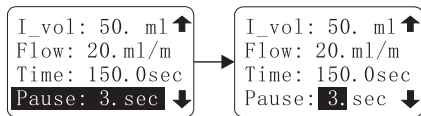
Turn **RES** to highlight withdrawal **Flow** (or infusion **Flow**), press **RES** to highlight value position, now operator can input flowrate using keypad and then press **RES** to highlight flow unit, turn **RES** to select different flow unit of μ l/h, μ l/m, ml/h, ml/m.



 If inputting flow rate exceeds the maximum flowrate, the pump will prompt the maximum flowrate in next line of Time Position. To enter a flowrate smaller than maximum flowrate.

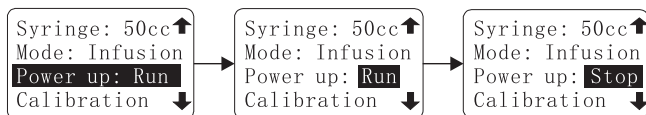
❖ **Pause Time Setting**

There is an option to set **Pause** Time in I/W mode and W/I mode. There is an option to set **Pause** Time in Continuous mode (the pause time set between withdrawal and infusion), the pause time can control transition time between infusion mode and withdrawal mode. The range of pause time is 0 to 9999 second, its resolution is 0.1 second.



❖ **Working option after power up**

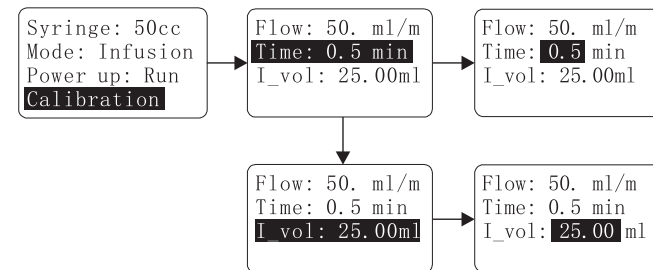
This option is only applicable when set target volume is Zero. When power returns after an interruption the pump can resume operation (select Run) or remain stopped (select Stop).



❖ **Calibration**

Get accurate flowrate through calibration.

1. Press **Change** key to switch to parameter setting interface, turn and press **RES** to enter Calibration interface.
2. **Time** option is highlighted, press **RES** to highlight time value and turn RES to adjust time value(0.5-60minutes).
3. After got measured liquid volume, turn RES to highlight **I_vol** (volume), press **RES** to highlight liquid value to input measured value using keypad, press **RES** to confirm.
4. Linear speed will be changed after calibration, the accuracy of infusion liquid volume will be improved.



❖ **Change or review the setting of volume and flowrate while running**

While the pump running press **Change** to return to the parameter setting interface. Turn RES to review all the setting, press **Change** to return working interface. If changing flowrate in parameter setting interface, the pump will run at new flowrate at once. If changing target volume in parameter setting interface, the pump will stop until reaching new target volume. If change new target volume is smaller than dispensed volume, the pump will stop at once. If target volume is set to zero, it is impossible to change target volume while pump running.

❖ **Clear a stall condition**

Pump motor stop running to prevent other dangerous in stall status.

Press **Return** Key to clear the sign of **Stall**.

Press **Fast Forward Key** or **Fast Backward** to move **Moving Block** in **Stall** status. This method is simple and to reduce the potential damage to cam mechanism when leadscrew disengaged with halfnut.

❖ **External control function**

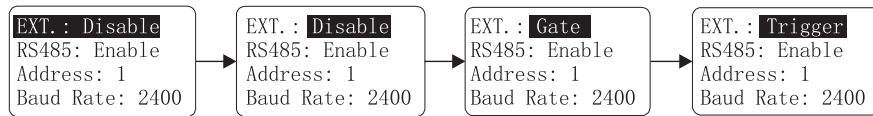
It includes External start/stop control and can be enabled or disabled through menu setting.

1. Turn **RES** to highlight Ext. (external control).
2. Press **RES** to highlight external control option.

Disable: Close external control function, external control is not available.

Gate: TTL input signal control the start/stop of the pump

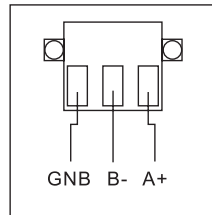
Trigger: Falling edge input controls the start/stop of the pump, TTL control the direction of the pump.



❖ RS485 setting

The RS485 connection is through terminal connectors which located on the rear panel of the pump.

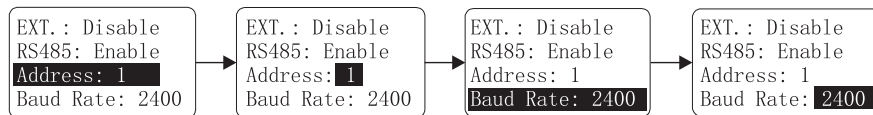
One PC can control up to 30 pumps. Each pump must be assigned an individual address and set to the same baud rate when controlled by one PC. When pump controlled via RS485 the pump will still respond to keypad command, All RS485 command setting, similar to keypad settings, are stored in non-volatile memory. The pump will display the pump address and baud rate when enabling the Rs485.



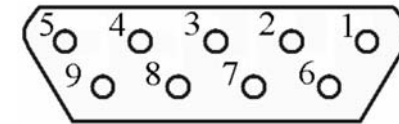
Pump address 1-30 are available, the defaulted pump address of pump is 1. There are three kinds of baud rate of 1200, 2400, 9600. The default baud rate is 2400.

RS485 format include one **Start bit**, **8 data bits**, **1 even parity**, **1 stop bit**. Pump uses simple two wire communications: A+ and b-, No handshaking. For defined RS485 commands please see <longer's RS485 Protocol>.

First enable RS485, address and baud option will appear, turn **RES** to highlight **Address** option, press **RES** to highlight address value, turn **RES** to set a suitable pump address, press **RES** to confirm and save the pump address. Turn **RES** to highlight **Baud** option, press RES to highlight Baud value, turn RES to select baud rate, press RES to confirm and confirm and save baud rate.



External Control Port Instruction

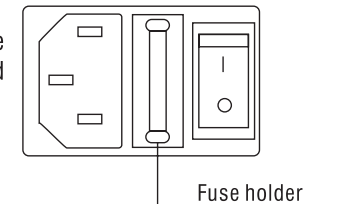


- Pin definition
 - 3.COM, ground ref.
 - 8.Trigger: TTL input, falling edge starts/stops pump e.g. footswitch.
 - 4.Gate: TTL input, change from high to low-starts; when running stays low, change to high-stops e.g. footswitch, timer.
 - 2.Direction output: OC gate output, oper-infuse, close refill (stays open when stopped)
 - 7.Run indicator: OC gate output, close-stopped, open-running
 - 9.Reverse direction: TTL input, normally low; change to high direction will be reversed. (only applies to infuse/withdraw mode)

Fuses

The fuses are located the power entry module on the rear panel. The linecord must be removed first to gain access to the fuse holder.

Fuses 5×20mm, 250V-slow blow, 0.5A



Maintenance

Maintenance is required only for the moving mechanical parts, which should be kept clean and lubricated. Occasionally, a small amount of light machine oil should be applied to the guide rods and a small amount of grease or oil to the leadscrew.

Solvents of any type should never be used to clean the pump. A mild detergent solution may be used to clean the keypad.

Standard table of syringe diameters

(1)	"Air-Tite "All Plastic	(6)	Ranfac
	1 cc 4.70 mm		2 cc 9.12 mm
	2.5 9.70		5 12.34
	5.0 12.48		10 14.55
	10 15.89		20 19.86
	20 20.00		30 23.20
	30 22.50		50 27.60
	50 28.90	(7)	Scientific Glass Engineering
(2)	Becton Dickinson		SGE
	Interim, WW design, Plastipak		25 µl 0.73 mm
	1 cc 4.70 mm		50 1.03
	3 8.59		100 1.46
	5 11.99		250 2.30
	10 14.48		500 3.26
	20 19.05		1 ml 4.61 mm
	30 21.59		2.5 7.28
	60 26.60		5 10.30
(3)	Becton Dickson		10 14.57
	Glass - all types	(8)	Sherwood - Monojet Plastic
	0.5 cc 4.64 mm		1 cc 4.65 mm
	1 4.64		3 8.94
	2.5 8.66		6 12.70
	5 11.86		12 15.90
	10 14.34		20 20.40
	20 19.13		35 23.80
	30 22.70		50 26.60
	60 28.60	(9)	Stainless Steel
(4)	Hamilton		KD Scientific
	1000-Series Gastight		2.5ml 4.79mm
	10 µl 0.46 mm		8 9.53
	25 0.73		20 19.13
	50 1.03		50 28.60
	100 1.46		100 34.90
	250 2.30		200 44.755
	500 3.26	(10)	Unimetrics
	1 ml 4.61 mm		Series 9000
	2.5 7.28		10 µl 0.46 mm
	5 10.30		25 0.73
	10 14.57		50 1.03
	25 23.03		100 1.46
	50 32.57		250 2.30
(5)	Popper & Sons, Inc.		500 3.26
	Perfektum glass		1000 4.61
	0.25 3.45 mm	(11)	Stainless Steel Syringe
	0.5 3.45		2.5ml 4.79mm
	1 4.50		8 9.53
	2 8.92		20 19.13
	3 8.99		50 28.60
	5 11.70		100 34.90
	10 14.70		
	20 19.58		
	30 22.70		
	50 29.00		

Standard minimum and maximum flow rates

Syringe Specification	Barrel Inner Diameter	Min. Flow Rate	Max. Flow Rate
10 µL	0.46 mm	0.001 µl/hr	21.10µl/min
25 µL	0.73 mm	0.003 µl/hr	53.15 µl/min
50 µL	1.03 mm	0.005 µl/hr	105.8 µl/min
100 µL	1.46 mm	0.009 µl/hr	212.6 µl/min
250 µL	2.30 mm	0.021 µl/hr	527.6 µl/min
500 µL	3.26 mm	0.042 µl/hr	1060 µl/min
1 mL	4.61 mm	0.083 µl/hr	2119 µl/min
2.5 mL	7.28 mm	0.207 µl/hr	5286 µl/min
3 mL	8.59 mm	0.288 µl/hr	7360 µl/min
5 mL	10.30 mm	0.414 µl/hr	634ml/hr
10 mL	14.57 mm	0.828 µl/hr	1270 ml/hr
20 mL	19.05 mm	1.414 µl/hr	2171 ml/hr
30 mL	21.59 mm	1.817 µl/hr	2789 ml/hr
50 mL	28.90 mm	3.277 µl/hr	4998 ml/hr
60 mL	26.60 mm	2.757 µl/hr	4234 ml/hr

- Remarks: Flow rate chart above is for reference only.