

 **Important Information:**

Please read operating manual carefully before operation.

 **Warning:**

- Use only the line cord shipped with the product and make sure line cord is certified for country of use.
- A pinch hazard may exist between the Pusher Block and End Blocks. Avoid placing fingers between these points while the pump is running.
- Over-push or over-draw the syringe may result in the fluid sprayed. Use appropriate measures to protect operator and equipment. Be careful during operation.
- When the fluid sprays out on the drive unit please shut down the power supply immediately and clean the drive unit, then turn on the power supply.
- If a trouble happens please contact us or our dealer. Don't repair the equipment by yourself.
- Be careful when inserting or pulling out the connection wire between controller and drive unit to prevent the plug from damaging.

If the power line or the plug are worn or damaged please pull out the plug.

- Please shut down the power supply before connecting the external control equipment.

 **Note:**

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	LSP01-1A	LSP01-2A	LSP04-1A
Max. No. of Syringes	1	1	4
Syringe Size	10 μ L - 60mL	10 μ L - 60mL	10 μ L - 10mL
Advance per Microstep	0.156 μ m (1/16step)	0.03125 μ m (1/16step)	0.156 μ m (1/16step)
Infusion Volume Per Microstep	0.0867 μ L (60mLBD Syringe)	0.01734 μ L (60mLBD Syringe)	0.0257 μ L (10mLBD Syringe)
Max. Linear Rate	65 mm/min	13 mm/min	130 mm/min
Min. Linear Rate	5 μ m/min	1 μ m/min	5 μ m/min
Flow Rate	2.779 μ L/min - 36.12 mL/min (60mL BD Syringe)	0.556 μ L/min - 7.224 mL/min (60mL BD Syringe)	2.779 μ L/min - 72.24 mL/min (60mL BD Syringe)
Dimensions	280 \times 210 \times 140 mm	280 \times 210 \times 140 mm	280 \times 250 \times 140 mm
Weight	3.6 Kg	3.6 Kg	4.5 Kg
Working Mode	Infusion		
Linear Force	> 9kg		
Max. Step Rate	6933 (1/16step)/sec		
Min. Step Rate	16 (1/16 step)/30sec		
Accuracy	$\leq \pm 0.5\%$ error in the condition of > 30% of max. infusion distance		
Setting Mode	Rotary coded switch and membrane keypad		
Display	128 \times 64 graphic LCD		
Power	AC100 – 240V		
Operating Condition	Temperature 5 $^{\circ}$ C–40 $^{\circ}$ C Relative humidity: 20% - 80%		

General Description

128*64 graphic LCD display the parameters and working states. Membrane keypad and rotary coded switch make the parameters selection and setting easily. The interface is friendly. Suitable for high accuracy and small flow rate liquid transferring.

You can select syringe from a table in memory or enter the syringe diameter directly. After selecting the syringe or entering the syringe diameter, the dispensing volume and flow rates can be entered. Then return to the working interface and press the start/stop key, the pump begins running.

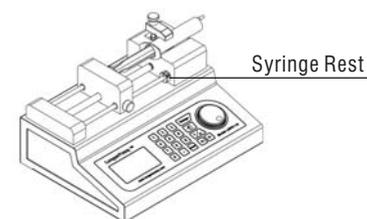
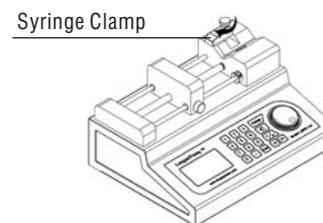
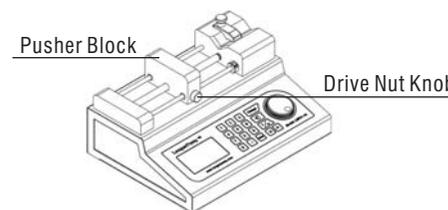
Features

- ❖ Syringe identification
 - Look up Table
The pump contains a table of standard syringes arranged by manufacturer and size. Once the syringe is identified in the table the pump automatically enters the appropriate diameter.
 - Direct Entry
If the syringe used is not included in the table of standard syringes, the internal diameter of the syringe barrel can be measured in millimeters and entered directly from the keypad. And four user-defined syringes internal diameter can be stored.
- ❖ Infusion flowrates
Infusion flowrates must be set and can be changed while the pump is running.
- ❖ Volume
A target volume can be entered for infusion, and the pump automatically stops when this volume is reached. The pump displays target dispense volume, linear speed and progress that reads from an initial zero percent to one hundred percent as the dispense proceeds to the target volume. The target volume can be changed as the pump continues to operate.
When the volume and the flow rates are set, the pump automatically stops when the volume is reached.
When the volume setting is "0", the pump stops manually or when the pump stalls.
- ❖ RS485 interface
Multiple pumps can be controlled in bus structure by a single PC.

- ❖ External control interface
Input and output controls are available, such as, 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 then 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 with the **Return** key or **Fast Forward / Fast Reverse** key.
- ❖ Power Disruption
When power is returned after a temporary power disruption the pump can be programmed to resume operation or remain stopped.
However, if a dispense volume is set then the pump always remains stopped.
- ❖ Non-volatile memory
All operational settings are stored in non-volatile memory for convenience.
- ❖ Selection of flow and volume units
Units of volume (μ l or ml) and flowrate (μ l/ml, μ l/hr, mL/min or mL /hr) can be changed if required.
- ❖ Calibration
The flowrate can be calibrated for more accurate dispense volume.

Operating Instructions

- ❖ Power Switch
The power switch is located on the right corner of the rear panel.
- ❖ Syringe loading for LSP01-1A, LSP01-2A



1 a. Press the **Drive Nut Knob** to release the drive nut from the leadscrew and pull the **Pusher Block** to the right position.
b. Use the **Fast Forward Key** or **Fast Reverse Key** to move the **Pusher Block**.

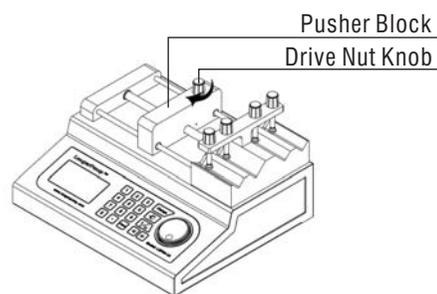
2 Raise and rotate the **Spring Clamp** and place the syringe barrel in the "V" of the syringe holder. With the syringe in place release the **Spring Clamp** so that it clamps down on the barrel and holds it securely in place.

3 Press the **Drive Nut Knob** and slide the **Pusher Block** until the block pressed firmly against the syringe plunger. Release the **Drive Nut Knob** to re-engage the drive nut. Use the **Fast Forward Key** or **Fast Reverse Key** to move the **Pusher Block** to make the drive nut engage the leadscrew properly.

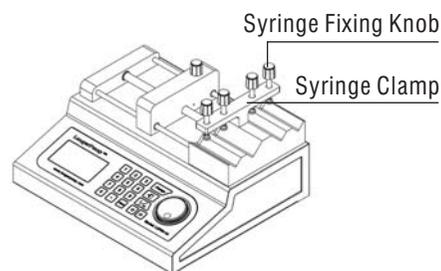
Note:

- Move the **Pusher Block** manually and then release the **Drive Nut Knob**. The drive nut may engage the leadscrew improperly. Slide the **Pusher Block** back and forth or use the **Fast Forward Key** or **Fast Reverse Key** to make the knob was ejected entirely to ensure the drive nut engage the leadscrew properly.
- Syringe Rest is to prevent the syringe from damaging. It can slide along the guide rod. Make it in the proper position and tighten the screw.
- For some glass syringes, the rounded corners of the syringe barrel flange cause a tendency for the syringe barrel to ride up out of the end block. To give a more secure, flatter surface to clamp against, an O-ring or metal collar can be placed over the barrel and pressed against the flange.

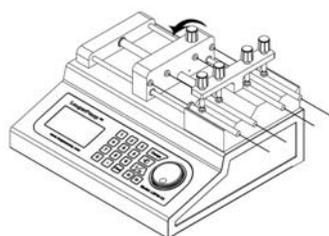
❖ Syringe loading for LSP04-1A



- 1** a. Press the **Drive Nut Knob** to release the drive nut from the leadscrew and pull the **Pusher Block** to the right position.
 b. Use the **Fast Forward Key** or **Fast Reverse Key** to move the **Pusher Block**.



- 2** Loosen the four **Syringe Fixing Knobs**. Load and adjust the syringe to the proper position. Tighten the four **Syringe Fixing Knobs** and press the syringes.



- 3** Turn the **Drive Nut Knob** according to the arrow head direction and make the drive nut engage the leadscrew. Then the pump is in the working state.

 **Note:**

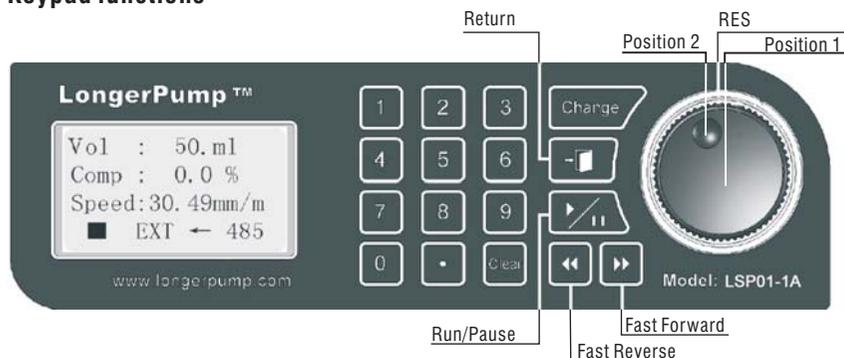
- The working mode for LSP04-1A is only infusion. Acceptable syringe (or sample injector) is from 10 μ l to 10 ml. Glass syringe is not recommended, but glass sample injector is acceptable.
- Syringe Rest is to prevent the syringe from damaging. It can slide along the guide rod. Make it in the proper position and tighten the screw.

Menu features

- When the pump is turned on, the LCD will display the initializing interface (Interface 1) first and then the language selection interface (Interface 2). Turn the **Rotary Encoded Switch (RES)** to select the language (Interface 3). Chinese and English can be selected. The selected language is highlighted. If the user doesn't select the language, the language which selected last time is highlighted. The pump will enter working interface directly after three seconds.
- In the running interface, the first line displays the current target dispense volume when motor stopped or increasing volume when motor running. The second line displays the volume that has been completed in percent. The third line displays current linear speed. The fourth line displays status of pump:
 ■ indicates stop, ► indicates run; **EXT** indicates external control available; → indicates infusion and flashes when running; 485 indicates RS485 remote control available.
- Pressing **Change** key repeatedly will always change the display between the running interface and the main menu. The main menu consists of thirteen options, as displayed in interface 4 to 7. Press the **Rotary Encoded Switch (RES)** to select and change the parameters.

LSP01-1A Syring Pump	语言 (language) 简体中文 English	语言 (language) 简体中文 English	Flow: xx. xx ml Comp : x. x % Speed : xxx. xmm/m ■ Ext → 485
Interface 1	Interface 2	Interface 3	Interface 4
Syringe : xxxcc Ext. : Disable Power up: Run Calibration ↓	Vol : xx. xx ml ↑ Flow : xx. xx ml/m Time : xxx. x min ↓	RS485 : Enable ↑ Address: x Baud Rate: xxxx	
Interface 5	Interface 6	Interface 7	
Save change ? Yes No Cancel	Interruption! Continue Stop		
Interface 8	Interface 9		

Keypad functions



❖ The parameters can be selected and set by membrane keypads and **RES**. **RES** Rotary Encoded Switch. Turn the **RES** for menu selection or parameters setting. Press the **RES** for confirmation.

 Note: Put the finger in Position 1 (the center of the switch) to press the **RES**. Put the finger in Position 2 to turn the **RES**.

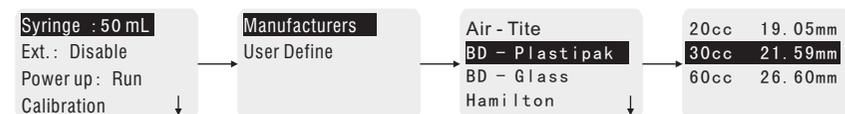
- **0 - 9**,. Numerical and decimal entry keys when setting parameters.
- **Clear** Used to clear the last entered numerical when setting parameters.
- **Change** Used to change the display between the running interface and the main menu.
- **Return** Cancel current operation and return to previous menu in multilevel menus. Use this key to clear the alarming prompt message when the pump is blocked.
- **Run/Pause** Starts the motor or acts as a pause. When running, press the key the motor stops, an interruption interface (interface 9) will be displayed, using the RES to continue or stop the operation.
- **Fast Reverse** In stop state, pressing the key the pump withdraws at the max. 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, pressing the key the pump infuses at the max. 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.

❖ Syringe setting

The pump must be calibrated by identifying the internal diameter of the syringe used. Once entered this data is stored in EEPROM and need be modified only when a different syringe is used.

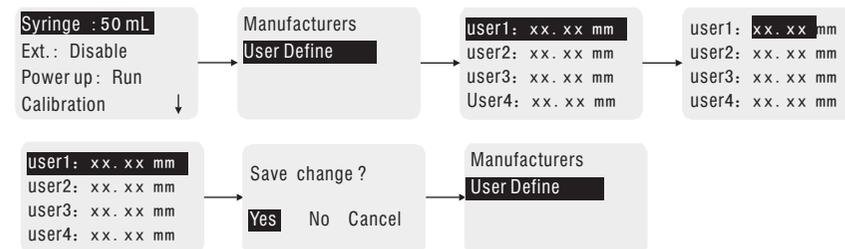
• Manufacturer

In running interface, press **Change** to enter parameters setting interface. Press **RES**, the first line is highlighted. Press **RES** again to next interface, press **RES** to select Manufacturers. Press **RES** to enter manufacturers list. Turn **RES** to select syringe manufacturer. Press **RES** to enter syringe sizes interface. Turn the **RES** to select the syringe used. Press **RES** to enter Interface 8. Select Yes to save change and return the previous menu, or select No to return the previous menu without changing, or select Cancel to select the syringe used again.



• User define

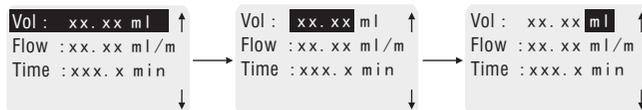
If the syringe used is not listed in the table of standard syringes, then the internal diameter of the syringe barrel must be measured and entered directly. Turn **RES** to select User Define. Press **RES** to enter use defined syringes interface. Four inner diameters of syringe barrel can be entered. Press **RES** to make the numerical value position highlighted. Enter the inner diameter by membrane keypad. Press the **RES** to save the numerical value then the whole line is highlighted. The value range is from 0.01 to 50.00. Turn the **RES** to select the syringe used. Press **Return** to enter Interface 8. Select Yes to save change and return the previous menu, or select No to return the previous menu without changing, or select Cancel to select the syringe used again.



 **Note:** If the syringe or diameter changed the volume, flow rate settings are set to zero. The new parameters need to be reset.

❖ Volume setting

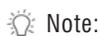
In parameters setting interface, turn and press **RES** to highlight the volume setting line. Press **RES** to make the numerical value position highlighted. Enter targeted volume from the membrane keypad. Press **RES** to set volume unit. Turn **RES** to scroll through the list and press **RES** to select the unit required. Possible volume units are μl and ml, i.e. microliter and milliliter. The highlighted display indicates that this parameter can be changed.



Note: When the volume setting is zero, the LCD will display the flowrate setting and the pump will run until manually stopped or a stall occurs.

❖ Flowrate setting

In parameters setting interface, turn and press **RES** to highlight the flowrate setting line. Press **RES** to make the numerical value position highlighted. Enter the flowrate required from the membrane keypad. Press **RES** to set flowrate unit. Turn **RES** to scroll through the list and press **RES** to select the unit required. Possible flowrate units are $\mu\text{l}/\text{h}$, $\mu\text{l}/\text{m}$, ml/h, ml/m. The highlighted display indicates that this parameter can be changed.



Note: If the number entered exceeds the maximum flowrate possible then the pump prompts the maximum feasible flowrate at the Time position. To continue enter a flowrate smaller than the maximum.

❖ Power up

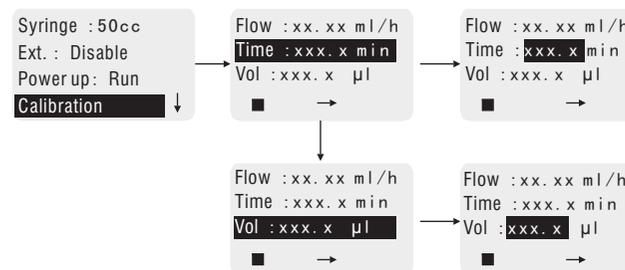
This option is only applicable when no dispense volume is selected. When power returns after an interruption the pump can resume operation (select Run) or remain stopped (select Stop).



❖ Calibration

The flowrate can be calibrated for more accurate dispense volume.

1. In parameters setting interface, press and turn **RES** to highlight the Calibration line. Press **RES** to enter calibration interface.
2. Testing time line is highlighted. Press **RES** to highlight the numerical value position. Turn **RES** to select the testing time. The testing time is from 0.5 minutes to 60 hours. Press **RES** to confirm.
3. Press **Run/Pause** key to start the testing. After testing, turn **RES** to highlight the testing volume line. Press **RES** to highlight the numerical value position. Enter the actual volume from the membrane keypad. Press **RES** to confirm.
4. After calibration, the linear speed of the Pusher Block changes to increase the accuracy of the dispense volume.



❖ Change or review volume and flowrate setting while running

While the pump running, press **Change** to return to parameters setting interface. Turn **RES** to review the dispense volume and flowrate setting. If no volume and flowrate change, press **Change** to return to working interface. If the flowrate changes, the pump immediately changes to the new flowrate. If the dispense volume changes, the volume continues to increase, uninterrupted by the review process, to new target dispense volume when it will stop automatically. If the volume is changed to a volume smaller than the volume already accumulated then the pump will stop as soon as the new, smaller target volume is entered. If the volume is 0, the volume can not be changed while running.

❖ Clear a stall condition

Should a stall occur the pump motor is stopped to prevent damage.

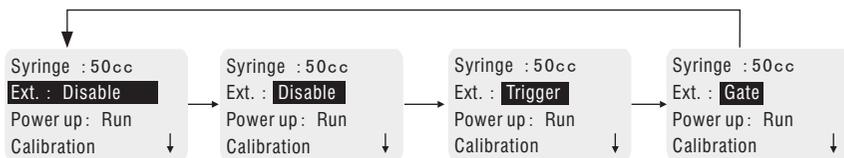
To clear the display press **Return**.

To move the stalled mechanism use the **Fast Forward** or **Fast Reverse** to move the pusher block. Using the **fast forward** or **fast reverse** feature is not only the simplest way to deal with the stall it also reduces potential damage to the cam mechanism which releases the halfnut from the leadscrew.

❖ External control function

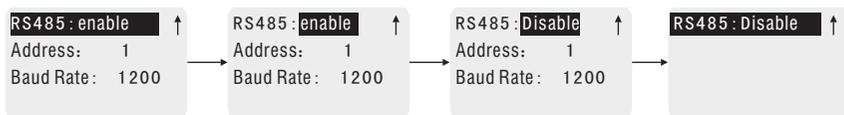
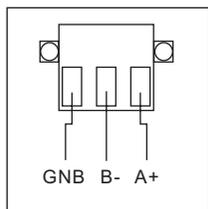
External control run/stop control can be enabled or disabled.

1. In parameters setting interface, press and turn **RES** to highlight the external control line.
2. Press **RES** to highlight the parameter. Turn RES to select the needed parameter.
 Disable: disable the external control input, that is, the input is invalid.
 TTL: TTL input controls the start and stop of the pump.
 Trigger: falling edge input controls the start and stop of the pump.

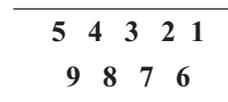


❖ RS485 setup

- The RS485 connections are made through terminal connectors, located on the rear panel. A single PC can control up to 30 pumps. When controlled by a PC each pump must be assigned an individual address. When controlled via RS485 the pump will still respond to keypad commands. All RS485 commands settings, similar to keypad settings, are stored in EEPROM. When RS485 is enabled, RS485 interface will display communication address and band rate. The communication address is from 1 to 30. The default address is 1. The band rate is 1200 bps, 2400 bps and 9600 bps. The default band rate is 2400 bps.
- RS485 format: 1 start bit, 8 data bits, 1 even parity, 1 stop. For detailed RS485 commands please see <Longer's RS485 Protocol for LSP>.
- In parameters setting interface, press and turn **RES** to highlight the RS485 line. Set RS485 enabled. The LCD displays communication address and band rate. Turn RES to make the address highlighted. Press RES to highlight the numerical value. Turn RES to set the communication address. Press RES again to confirm and save the setting. Turn RES to highlight the band rate. Press RES to make the numerical value highlighted. Turn RES to select the band rate. Press RES again to confirm and save the selection.



External control interface

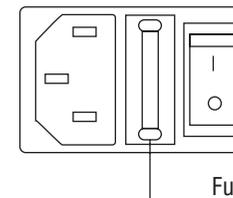


• Pin definition

- 3 COM, ground ref.
- 8 Trigger, TTL input, falling edge start/stop 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 Directional output, OC gate output, open infusion, close withdrawal (stays open when stopped)
- 7 Run indicator, OC gate output, open running, close stopped

Fuse

The fuses are located in the power entry module on the rear panel. The linecord must be removed first to gain access to the fuse holder. Fuse specification: 5 x 20 mm, 250V~ Fast blow, 1 A



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.

Warranty

The warranty period for this product is one year. If repair or adjustment is necessary within the warranty period, the problem will be corrected at no charge if it is not due to misuse or abuse on your part, as determined by the manufacturer. Repair costs outside the warranty period, or those resulting from product misuse or abuse, may be invoiced to you.

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	
(2)	Becton Dickinson		(7)	Scientific Glass Engineering		
	Interim, WW design, Plastipak			SGE		
	1 cc	4.70 mm		25 µl	0.73 mm	
	3	8.59		50	1.03	
	5	11.99		100	1.46	
	10	14.48		250	2.30	
	20	19.05		500	3.26	
	30	21.59		1 ml	4.61 mm	
	60	26.60		2.5	7.28	
	(3)	Becton Dickson		(8)	Sherwood - Monojet Plastic	
Glass - all types		1 cc				
0.5 cc		4.64 mm	3		8.94	
1		4.64	6		12.70	
2.5		8.66	12		15.90	
5		11.86	20		20.40	
10		14.34	35		23.80	
20		19.13	50		26.60	
30		22.70	(9)		Terumo	
60		28.60			1 cc	4.73 mm
(4)	Hamilton		(10)	Unimetrics		
	1000-Series Gastight			Series 9000		
	10 µl	0.46 mm		10 µl	0.46 mm	
	25	0.73		25	0.73	
	50	1.03		50	1.03	
	100	1.46		100	1.46	
	250	2.30		250	2.30	
	500	3.26		500	3.26	
	1 ml	4.61 mm		1000	4.61	
	2.5	7.28				
(5)	Popper & Sons, Inc.					
	Perfektum glass					
	0.25	3.45 mm				

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	21.10 µL/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	2.3 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	10.3 mm	0.414 µL/hr	634 mL/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	28.9 mm	3.277 µL/hr	4998 mL/hr
60 mL	26.6 mm	2.757 µL/hr	4234 mL/hr

- Syringes from different manufacturers can have slightly different limits. This is a reference diameter used for calculate the flow rate.



Note:

This pump is not registered with the FDA and is not for clinical use on human beings.



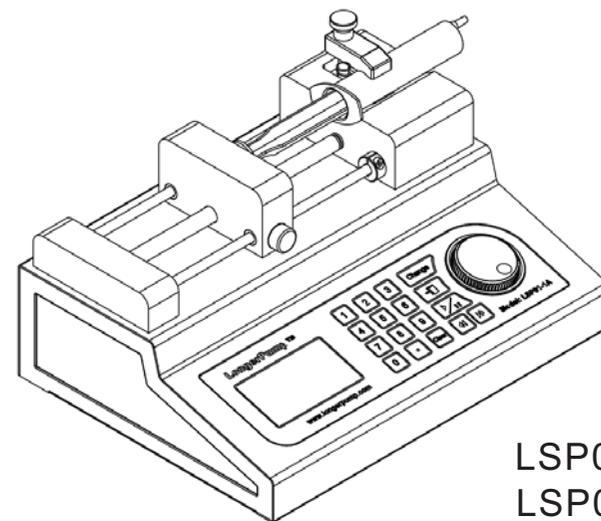
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Longer Syringe Pump Operating Manual



**SYRINGE PUMP
OPERATING MANUAL**



LSP01-1A
LSP01-2A
LSP04-1A

Baoding Longer Precision Pump Co.,Ltd.