⚠️ **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.

Content

Specification Table

Syringe Pump	LSP02 - 1B	LSP10 - 1B
Max. No. of Syringes	2	10
Advance per Microstep	0.0867 μL（60mL Syringe）	0.0257 μL（10mL Syringe）
Syringe Size	10 μL - 140 mL	10 μL - 10 mL
Flow Rate	0.831 nL/min - 150.5mL/min	0.831 nL/min - 21.67mL/min
Dimensions	280 × 250 × 140 mm	280 × 330 × 140 mm
Weight	4.3 kg	5.3 kg
Working Mode	Infusion, withdrawal, I/W, W/I, continuous	
Linear Force	> 18 Kg	
Advance per Microstep	1/16step: 0.156 μm	
Max. Step Rate	13867 (1/16step)/sec	
Min. Step Rate	16 (1/16 step) /30sec	
Max. Linear Rate	130 mm/min	
Min. Linear Rate	5 μm/min	
Accuracy	≤ ± 0.5% error in the condition of > 30% of max. Infusion distance	
Setting Mode	Rotary encoded switch and membrane keypad	
Display	128 × 64 graphic LCD	
Power	AC100 - 240V	
Operating Condition	Temperature 5℃ – 40℃ Relative humidity < 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.

After setting all the parameters, press the **Run/Pause** key to start working in working interface. Press **Change** key to enter parameters setting interface to set, change or review the parameters. 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. There are five modes of operation available. Different parameters can be saved in each working mode.

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 and withdrawal flowrates**

The infusion flowrate and the withdrawal flowrate can be set independently and can be changed while the pump is running. After the operating mode selection is made the program will prompt only for the relevant parameters associated with that mode.

❖ **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.

❖ Modes of operation

- Infusion

  Flowrate and volume settings: pump infuses to the set volume and stops.

  Flowrate setting only: pump runs until manually stopped or stalls.

- Withdrawal

  Flowrate and volume settings: pump withdraws to the set volume and stops.

  Flowrate setting only: pump runs until manually stopped or stalls.

- Infusion/withdrawal

  Infusion automatically followed by withdrawal after the pause time elapsed. Flow rate and volume settings can be made independently for infusion and withdrawal, hence the pump can infuse at one flowrate and volume and then change to a different withdrawal flowrate and volume setting. The pause time between infusion and withdrawal can be set.

- Withdrawal/Infusion

  Withdrawal automatically followed by infusion after the pause time elapsed. Separate settings for flowrate and volume can be made for withdrawal and infusion. The pause time between withdrawal and infusion can be set.

- Continuous

  The pump cycles from infusion to withdrawal continuously. The volume is identical in infuse and withdrawal directions. Separate settings for flowrate and pause time can be made for withdrawal and infusion.

💡 **Note:** The displayed menu which prompts the operator for Flow and Volume settings changes with Mode selection. For convenience, only the relevant settings associated with the selected mode are prompted. For example, in the Withdrawal/Infusion mode the menu prompts for withdraw volume and flowrate, then followed by infuse volume and flowrate. In Infusion only mode, the menu prompts only for infusion volume and infusion flowrate. In the Continuous mode only one volume is prompted for followed by infusion and withdrawal flowrates.

❖ 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 (μl or ml) and flowrate (μl/ml, μl/hr, mL/min or mL /hr) can be changed if required.

❖ Setting of pause time

The pause times between infusion/withdrawal and withdrawal /infusion can be set.
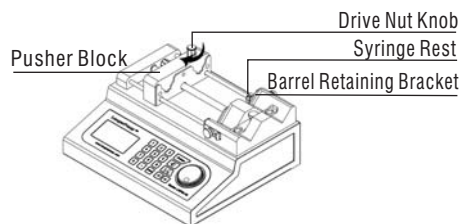
❖ Calibration

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 LSP02-1B

Drive Nut Knob
Syringe Rest
Pusher Block
Barrel Retaining Bracket

1 Turn the **Drive Nut Knob** to release the **Pusher Block** from the leadscrew and move the **Pusher Block** along the guide rods manually to the right position. Alternately, the **Fast forward**, **Fast reverse** feature can be used (press respective Arrow key).

Plunger Retaining Bracket
Syringe Clamp
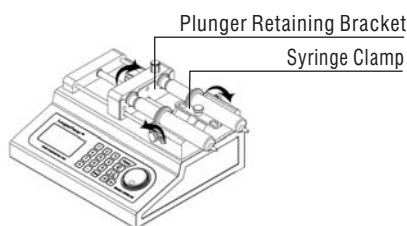
2 Turn the knobs according to the arrow heads directions to loose the **Barrel Retaining Bracket** and **Plunger Retaining Bracket**. Raise and rotate the **Spring Clamp** and place the syringe barrel in the "V" shape syringe holder. With the syringe in place release the **Spring Clamp** so that it clamps down on the barrel and holds it securely in place.
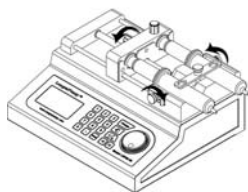
3 Turn the knobs according to the arrow heads directions to fix the syringe. Turn the **Drive Nut Knob** to re-engage the drive nut.

Note:

- Syringe Rest which is between **Pusher block** and "V" shape syringe holder 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 syringe holder in infusion mode. Similarly in withdrawal mode the rounded corners of the plunger head causes the head to ride up out of the retaining bracket. To give a more secure, flatter surface to clamp against, an O-ring or metal collar can be placed over the barrel or the plunger head and pressed against the flange or the plunger head.

❖ Syringe loading for LSP10-1B
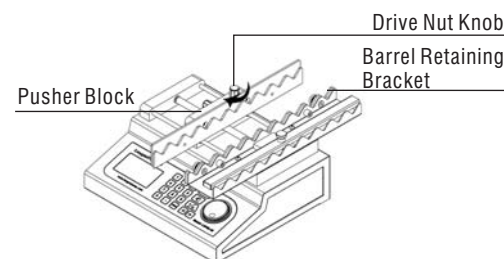
Drive Nut Knob
Barrel Retaining Bracket
Pusher Block

1 Turn the **Drive Nut Knob** to release the **Pusher Block** from the leadscrew and move the **Pusher Block** along the guide rods manually to the right position. Alternately, the **Fast forward**, **Fast reverse** feature can be used (press respective Arrow key).

Plunger Retaining Bracket
Syringe Clamp

2 Turn the knobs according to the arrow heads directions to loose the **Barrel Fixing Bracket** and **Plunger Fixing Bracket**. Raise and rotate the **Spring Clamp** and place the syringe barrel in the "V" shape 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.
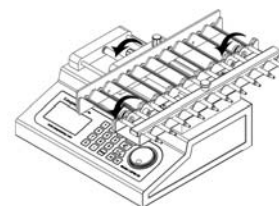
3 Turn the knobs according to the arrow heads directions to fix the syringe. Turn the **Drive Nut Knob** to re-engage the drive nut.
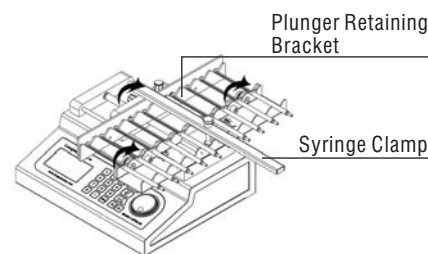
Note:

- This syringe pump is infusion/withdrawal pump
Acceptable syringe (or sample injector) is from 10 μl to 10 ml.
The sizes of the syringes (or sample injectors) must be the same. The max. number of syringes is 10 pieces.

- Glass syringe is not recommended, but glass sample injector is acceptable.
The thickness accuracy of the syringe barrel flange and the plunger head influences the accuracy of the syringe pump.
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 specified flowrate or 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 withdrawal/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 fourteen options, as displayed in interface 5 to 8. Press the rotary encoded switch (**RES**) to select and change the parameters.

LSP02-1B Syring Pump	语言（language） 简体中文 English
Interface 1	Interface 2

语言（language） 简体中文 English	I _ vol：　xx.xx ml Comp：　x.x % Speed：xxx.x mm/m ■ Ext　➡ 485
Interface 3	Interface 4

Syringe ：50 cc Mode： I/W Power up： Stop Calibration	I_vol：xx.xx ml Flow ： xx.xx ml/m Time ：xxx.x min Pause ：xxxx Sec
Interface 5	Interface 6

W_vol：xx.xx ml Flow ：xx.xx ml/m Time ：xxx.x min Pause ：xxxx Sec	Ext.： Trigger RS485： Enable Address： 1 Baud Rate：2400
Interface 7	Interface 8

Save change? Yes　No　Cancel	Interruption ! Continue　Stop
Interface 9	Interface 10

❖ Keypad functions

Return Key — Position 1 — Rotary Encoded Switch（RES） — Position 2 — Fast Forward — Fast Reverse — Run/Pause key

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 10) 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 sele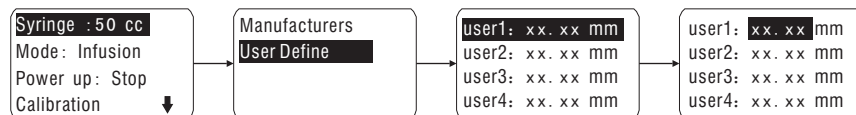ct Manufacturers. Press **RES** to enter manufacturers list. Turn **RES** to select syringe manufacturer. Press **RES** to enter syringe sizes interface. Turn the **RES** to select the syringe used. Press **RES** to enter Interface 9. Select Yes to save change and return the previous menu, or select No to return the previous menu without changing, or select Cancel to select the syringe used again.

```
Syringe : 50 cc          Manufacturers       Air - Tite           20cc   19.05 mm  ↑
Mode : Infusion          User Define         BD - Plastipak       30cc   21.59 mm
Power up : Stop                              BD - Glass           60cc   26.60 mm
Calibration        ↓                         Hamilton        ↓
```
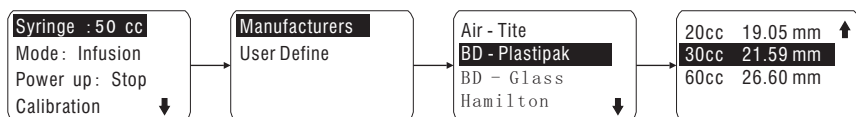
• User define

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.

```
Syringe : 50 cc          Manufacturers       user1: xx.xx mm      user1: xx.xx mm
Mode : Infusion          User Define         user2: xx.xx mm      user2: xx.xx mm
Power up : Stop                              user3: xx.xx mm      user3: xx.xx mm
Calibration        ↓                         user4: xx.xx mm      user4: xx.xx mm
```

Turn the **RES** to select the syringe used. Press **Return** to enter Interface 9. Select Yes to save change and return to the previous menu, or select No to return to the previous menu without changing, or select Cancel to select the syringe used again.
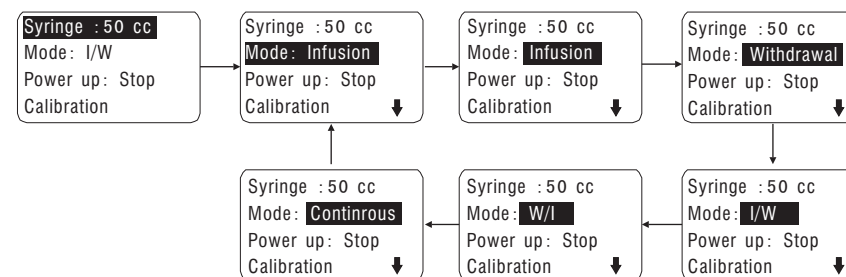
💡 **Note:**

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

❖ Mode selection

In running interface, press **Change** to enter parameter setting interface. Press and turn RES to select Mode and press RES to enter mode selection. Now turn RES again to scroll through the options and press RES to select the mode required.

Possible modes are: Infusion, Withdrawal, Infusion/Withdrawal, Withdrawal/Infusion, Continuous

```
Syringe : 50 cc      Syringe : 50 cc      Syringe : 50 cc      Syringe : 50 cc
Mode : I/W           Mode : Infusion      Mode : Infusion      Mode : Withdrawal
Power up : Stop      Power up : Stop      Power up : Stop      Power up : Stop
Calibration          Calibration   ↓      Calibration   ↓      Calibration   ↓

                     Syringe : 50 cc      Syringe : 50 cc      Syringe : 50 cc
                     Mode : Continrous    Mode : W/I           Mode : I/W
                     Power up : Stop      Power up : Stop      Power up : Stop
                     Calibration   ↓      Calibration   ↓      Calibration   ↓
```

💡 **Note:** Different parameters need to be set in different working modes.

• Infusion

Pump infuses at the set rate and stops automatically when the target volume is reached. During dispensing, press Run/Pause key, the motor will be stopped and interface 10 will be displayed, when you can select Continuous to continue the dispensing or select Stop to terminate dispensing.

• Withdrawal

Pump withdraws at the set rate to the set volume.

• Infusion / Withdrawal

The pump first infuses and when the target volume is reached it immediately changes direction and withdraws after the pause time elapsed. The volume settings for infusion and withdrawal can be different, as can the infusion and withdrawal flowrates.

• Withdrawal / Infusion

The pump runs first in the withdrawal direction and then automatically changes to the infusion direction after the pause time elapsed. Different settings of flowrate and volume for withdrawal and infusion are permitted.
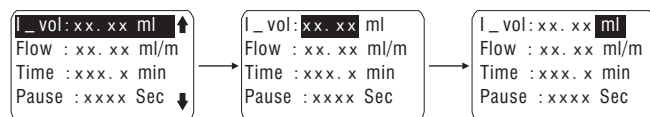
- Continuous

  The pump first infuses and then withdraws, and then cycles continuously. Only one volume setting for infusion and withdrawal is permitted. If the pump is matched to a valve, which is actuated by an OC gate from the pump, this mode can be used to infuse and then refill the pump for continuous operation.

  The menu now prompts for volume, flowrate and pause time settings relevant to the mode selected.

❖ Volume setting

  In parameters setting interface, turn and press **RES** to highlight the infusion volume or withdrawal 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.

```
I_vol:xx.xx ml  ↑      I_vol: xx.xx ml        I_vol:xx.xx ml
Flow  : xx.xx ml/m     Flow  : xx.xx ml/m     Flow  : xx.xx ml/m
Time  : xxx.x min      Time  : xxx.x min      Time  : xxx.x min
Pause :xxxx Sec ↓      Pause :xxxx Sec        Pause :xxxx Sec
```

💡 **Note:**

  When the volume setting is zero,
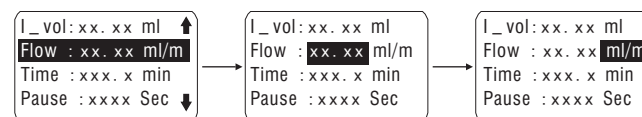
- Infusion or Withdrawal modes.

  Volume = 0 is interpreted as no volume and the pump will run until manually stopped or a stall occurs. The LCD will display the flowrate setting.

- Infusion/withdrawal, Withdrawal/infusion and Continuous modes.

  A volume setting must be entered. If no volume is entered the motor does not run.
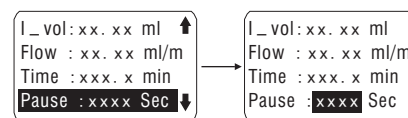
❖ Flowrate setting

  In parameters setting interface, turn and press **RES** to highlight the infusion flowrate or withdrawal 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 μl /h, μl/m, ml/h, ml/m. The highlighted display indicates that this parameter can be changed.

```
I_vol:xx.xx ml  ↑      I_vol:xx.xx ml         I_vol:xx.xx ml
Flow  : xx.xx ml/m     Flow  : xx.xx ml/m     Flow  : xx.xx ml/m
Time  : xxx.x min      Time  : xxx.x min      Time  : xxx.x min
Pause :xxxx Sec ↓      Pause :xxxx Sec        Pause :xxxx Sec
```

💡 **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.
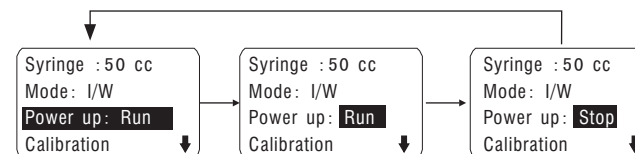
❖ Pause time setting

  In infusion/withdrawal mode, the pause time is set in infusion parameters setting interface. In withdrawal/Infusion mode, the pause time is set in withdrawal parameters setting interface. In continuous mode, the pause time need to be set both in infusion mode interface and in withdrawal mode interface. The unit of pause time is sec, i.e. second, and the range of pause time is from 0 to 9999sec in steps of 0.1sec.

```
I_vol:xx.xx ml  ↑      I_vol:xx.xx ml
Flow  : xx.xx ml/m     Flow  : xx.xx ml/m
Time  : xxx.x min      Time  : xxx.x min
Pause :xxxx Sec ↓      Pause :xxxx Sec
```

❖ Power up

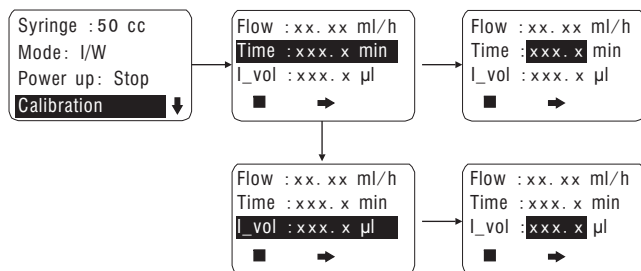 This option is only applicable when no dispense volume is selected. When power returns after an interruption the pump can resume operation (select Run) or remain stopped (select Stop).

```
Syringe :50 cc        Syringe :50 cc         Syringe :50 cc
Mode: I/W             Mode: I/W              Mode: I/W
Power up: Run         Power up: Run          Power up: Stop
Calibration  ↓        Calibration  ↓         Calibration  ↓
```

❖ 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.

```
Syringe : 50 cc          Flow : xx.xx ml/h         Flow : xx.xx ml/h
Mode : I/W               Time : xxx.x min          Time : xxx.x min
Power up : Stop          I_vol : xxx.x µl          I_vol : xxx.x µl
Calibration        ↓        ■        ➡               ■        ➡

                         Flow : xx.xx ml/h         Flow : xx.xx ml/h
                         Time : xxx.x min          Time : xxx.x min
                         I_vol : xxx.x µl          I_vol : xxx.x µl
                            ■        ➡               ■        ➡
```

❖ 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 in infusion or withdrawal mode, 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.
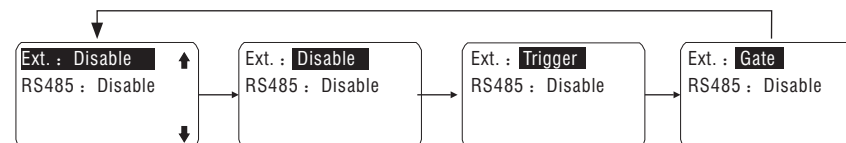
❖ External control function

External control function, including run/stop control input and direction control input 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.

```
Ext. : Disable   ↕      Ext. : Disable        Ext. : Trigger        Ext. : Gate
RS485 : Disable         RS485 : Disable       RS485 : Disable       RS485 : Disable
                 ↓
```

❖ 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.
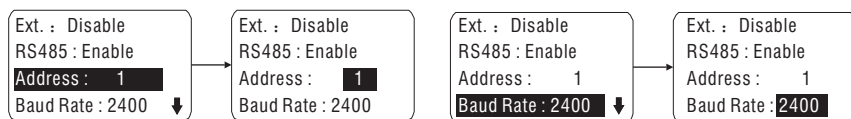
GNB B- A+
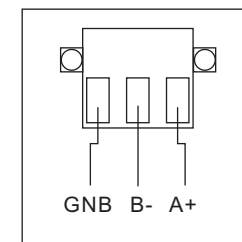
The communication address is from 1 to 30. The default address is 1. The band rate is 1200 bps, 2400 bps and 9600 bps. The default band rate is 2400 bps.
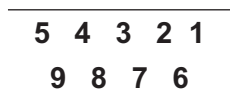
RS485 format: 1 start bit, 8 data bits, 1 even parity, 1 stop. For detailed RS485 commands please see <Longer's RS485 Protocol for LSP>.

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.

```
Ext. :  Disable          Ext. :  Disable          Ext. :  Disable          Ext. :  Disable
RS485 : Enable           RS485 : Enable           RS485 : Enable           RS485 : Enable
Address :    1      →     Address :      1         Address :      1    →    Address :      1
Baud Rate : 2400 ↓       Baud Rate : 2400         Baud Rate : 2400 ↓       Baud Rate : 2400
```

External control port

```
5  4  3  2  1
  9  8  7  6
```

❖ 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, close - stopped, open - running

9   Reverse Direction, TTL input, normally low; change to high reverses. (Only applies to infuse/ withdraw mode)

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

Fuse holder
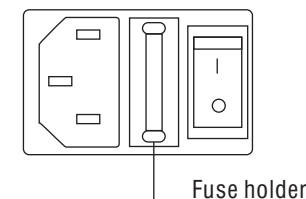
Maintenance

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

1 cc	4.70 mm
2.5	9.70
5.0	12.48
10	15.89
20	20.00
30	22.50
50	28.90

(2)   Becton Dickinson
Interim, WW design, Plastipak

1 cc	4.70 mm
3	8.59
5	11.99
10	14.48
20	19.05
30	21.59
60	26.60

(3)   Becton Dickson
Glass - all types

0.5 cc	4.64 mm
1	4.64
2.5	8.66
5	11.86
10	14.34
20	19.13
30	22.70
60	28.60

(4)   Hamilton
1000-Series Gastight

10 µl	0.46 mm
25	0.73
50	1.03
100	1.46
250	2.30
500	3.26
1 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57
25	23.03
50	32.57

(5)   Popper & Sons, Inc.
Perfektum glass

0.25	3.45 mm

(6)   Ranfac

2 cc	9.12 mm
5	12.34
10	14.55
20	19.86
30	23.20
50	27.60

(7)   Scientific Glass Engineering
SGE

25 µl	0.73 mm
50	1.03
100	1.46
250	2.30
500	3.26
1 ml	4.61 mm
2.5	7.28
5	10.30
10	14.57

(8)   Sherwood - Monojet Plastic

1 cc	4.65 mm
3	8.94
6	12.70
12	15.90
20	20.40
35	23.80
50	26.60

(9)   Terumo

1 cc	4.73 mm
3	9.00
5	13.04
10	15.79
20	20.18
30	23.36
60	29.45

(10)   Unimetrics
Series 9000

10 µl	0.46 mm
25	0.73
50	1.03
100	1.46
250	2.30
500	3.26
1000	4.61

Standard minimum and maximum flow rates

Syringe	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
100 mL	34.9 mm	4.746 µL/hr	7289 mL/hr
140 mL	38.4 mm	5.746 µL/hr	8824 mL/hr

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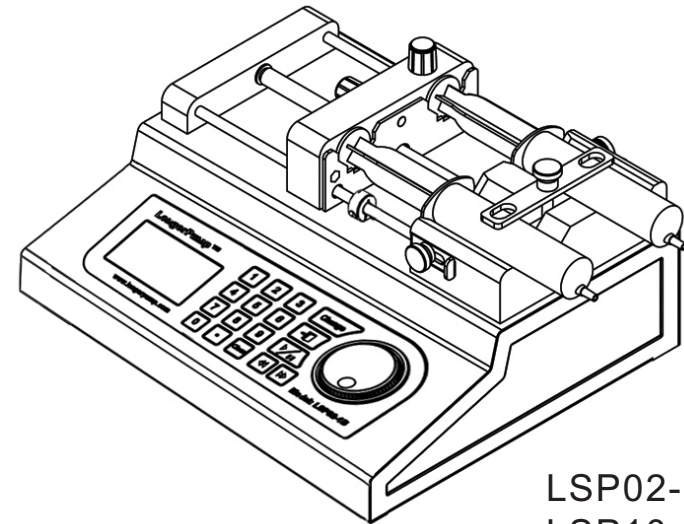 This is a reference diameter used for calculate the flow rate.

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

SYRINGE PUMP
OPERATING MANUAL

LSP02-1B
LSP10-1B

Baoding Longer Precision Pump Co.,Ltd.