



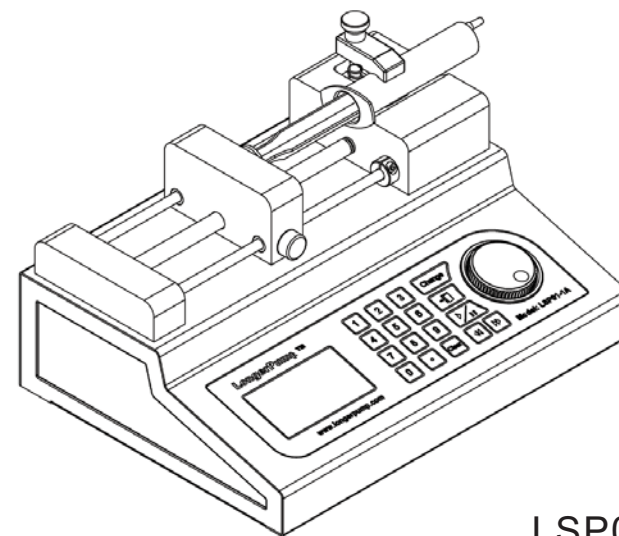
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Longer Syringe Pump Operating Manual



**SYRINGE PUMP
OPERATING MANUAL**



LSP01-1C

Baoding Longer Precision Pump Co.,Ltd.

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.
- 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.
- When the pump is in high voltage static environment, such as electrospinning, please pay attention to the power supply of the pump.
High voltage static may damage the pump. Please isolate the power supply.
- Our company can provide isolated power supply of the syringe pump.

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	LSP01-1C
Max. No. of Syringes	1
Syringe Size	10 μ L–10mL (When the syringe size is more than 10 mL, the max. distance of the syringe can not be reached for one time infusion)
Drive Mechanism	Microprocessor controlled stepper motor 1/16 microstepping, driving a leadscrew through a belt and pulley drive mechanism
Advance per Microstep	0.156 μ m (1/16step)
Infusion Volume per Microstep	0.026 μ L (10mL BD Syringe 1/16step)
Max. Linear Rate	65 mm/min
Min. Linear Rate	5 μ m/min
Max. Step Rate	433.3 steps/sec
Min. Step Rate	1 step/30sec
Flow Rate	0.834 μ L/min–10.80mL/min (10mL Syringe)
Linear Force	9kg
Display	128 $\times$ 64 graphic LCD
Fuse	50 $\times$ 20mm, 250V $\sim$, Fast, 1A
Power	100V–240V AC
Operating Condition	Temperature 5 $^{\circ}$ C–40 $^{\circ}$ C Relative humidity: 20%–80%
Dimensions	280 $\times$ 220 $\times$ 140mm
Weight	3.6kg

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.

Features

Press the Change key to switch the interface to parameters setting interface to set, modify or look through 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, other parameters such as volume, flow rates, loop number, pause time, etc. can be entered.

❖ 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.

❖ Flowrates

Flowrates must be set and can be changed while the pump is running.

❖ Volume

A target volume can be entered, 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 which the pump has dispensed is more than the new entered volume, the pump stops.

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.

❖ Loop number

Loop number “1” means finishing target volume for one time (push or pull). When the loop number is “0”, the pump runs continuously and stops manually or when the pump stalls. Loop number displays “----” on the interface. When the loop number is more than “1”, such as “10”, loop number displays “10”, the pump finishes target volume for one time, the direction changes and the loop number minus 1 until the whole process finishes and all the parameters return to the set values.

❖ Pause time

Time interval between two times finishing target volume. The pause time is between 0.001min to 9999min.

❖ 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.

 Note: The pusher block may not disengage the leadscrew manually. Use Fast Forward / Fast Reverse key to clear the state.

❖ 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 ($\mu\text{l}/\text{ml}$, $\mu\text{l}/\text{hr}$, mL/min or mL /hr) can be changed if required.

❖ Calibration

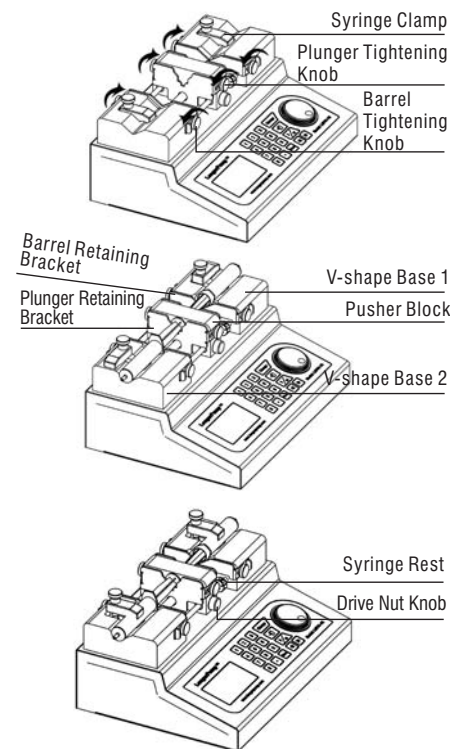
The flowrate can be calibrated for more accurate dispense volume.

Operating Instructions

❖ Power Switch

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

❖ Syringe loading



Note:

- This product is a push-pull syringe pumps
- Recommended syringe sizes are from 10 μl to 10ml
- Normally, the two syringes are the same size.

1 Loose the four pcs Barrel Tightening Knobs and two pcs Plunger Tightening Knobs. Raise and rotate the two pcs Syringe Clamps.

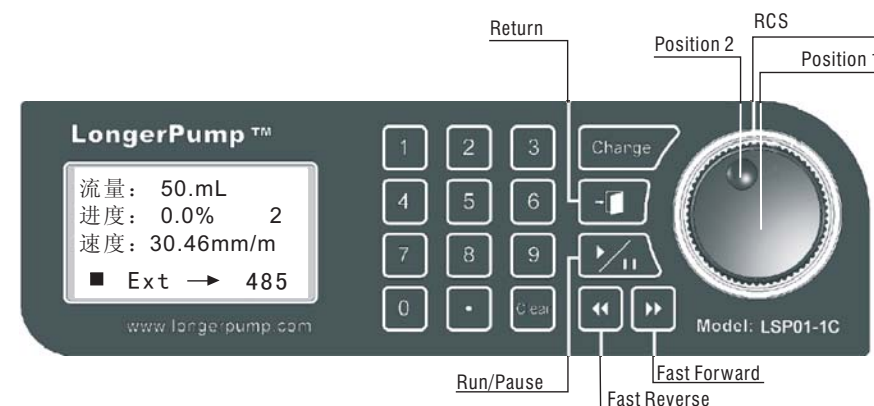
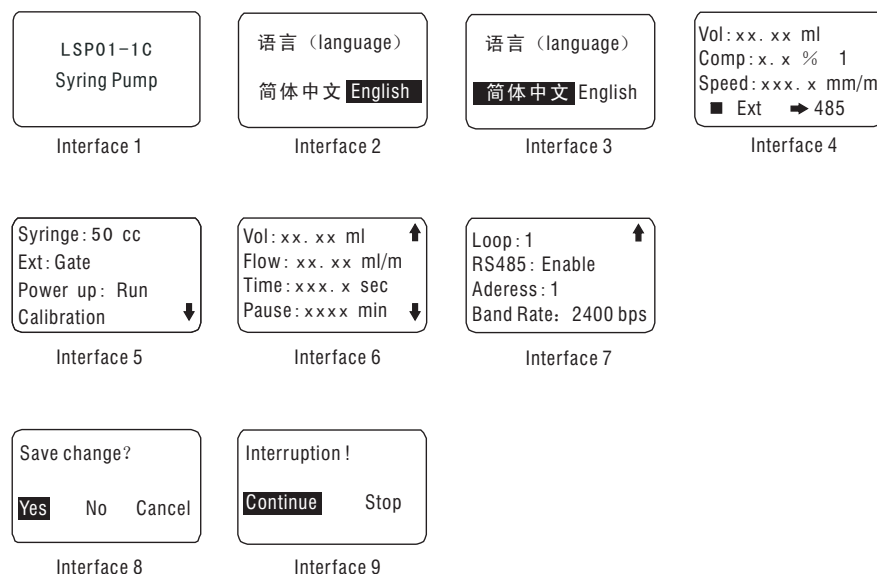
2 Place two pcs syringes in the V-shape Base 1 and V-shape Base 2. With the syringes in place release the Spring Clamps so that it clamp down on the barrel and hold it securely in place. Slide the two Barrel Retaining Brackets to make them pressed firmly against the syringe barrel flanges. Tighten the Barrel Tightening Knobs. Slide the two Plunger Retaining Brackets to make them pressed firmly against the plunger flanges. Tighten the Plunger Tightening Knobs.

3 Press the Drive Nut Knob and make the Pusher Block disengage the leadscrew and push or pull the syringes manually. 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.

Syringe Rests are to prevent the syringe from damaging. They can slide along the guide rods. Make them in the proper position and tighten the screws.

❖ 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 Coded Switch (RCS)** 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 five 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 running direction and flashes when running; 485 indicates RS485 control available.
- Pressing **Change** key repeatedly will always change the display between the running interface and the main menu. The main menu is displayed in interface 5 to 7. Press and turn the **Rotary Coded Switch (RCS)** to select and change the parameters.



❖ Keypad functions

The parameters can be selected and set by membrane keypads and **RCS**.

RCS Rotary Coded Switch. Turn the **RCS** for menu selection or parameters setting. Press the **RCS** for confirmation.

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

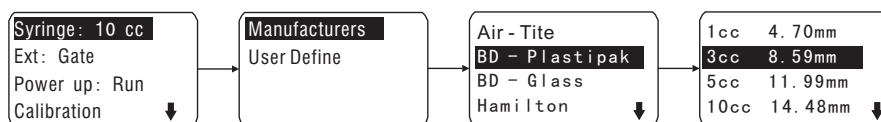
- 0 - 9,** Numerical and decimal entry keys when setting parameters.
- Clear** Used to clear the last entered numerical when setting parameters.
- Change** Used to change the display between the running interface and the main menu.
- Return** Cancel current operation and return to previous menu in multilevel 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 **RCS** to continue or stop the operation.
- Fast Forward** In stop state, pressing the key the pump goes forward 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 Reverse** In stop state, pressing the key the pump goes reversely 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. The less the error between the selected syringe barrel inner diameter and the actual syringe barrel inner diameter, the higher the dispensing accuracy of the syringe pump. Once entered this data is stored in **EEPROM** and need be modified only when a different syringe is used.

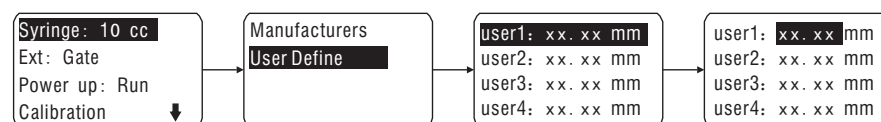
• Manufacturer

In running interface, press **Change** to enter parameters setting interface. Press **RCS**, the first line is highlighted. Press **RCS** again to next interface, press **RCS** to select Manufacturers. Turn **RCS** to select syringe manufacturer. Press **RCS** to enter syringe sizes interface. Turn the **RCS** to select the syringe used. Press **RCS** 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 return to syringe sizes interface.

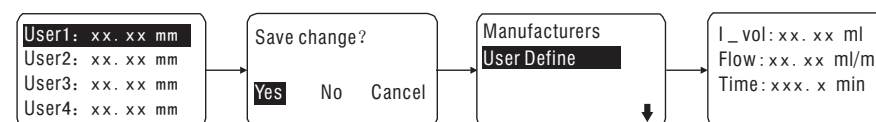


• User define

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 **RCS** to select User Define. Press **RCS** to enter user defined syringes interface. Four inner diameters of syringe barrel can be entered. Press **RCS** to make the numerical value position highlighted. Enter the inner diameter by membrane keypad. Press the **RCS** to save the numerical value then the whole line is highlighted. The value range is from 0.01 to 50.00.



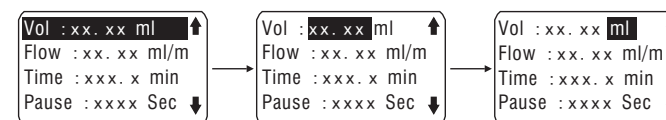
Turn the **RCS** to select the syringe used. Press **Return** to enter Interface 8. Select **Yes** to save change and return the previous menu, or select **No** to return the previous menu without changing, or select **Cancel** to select the syringe used again. After selection the syringe, press **Return** to enter previous menu. Press **Return** again to enter parameters setting interface. The volume and flow rates need to be reset. If the syringe does not change, press **Return** to interface 5. Press **Change** to switch to running interface.



 **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 **RCS** to highlight the volume setting line. Press **RCS** to make the numerical value position highlighted. Enter targeted volume from the membrane keypad. Press **RCS** to set volume unit. Turn **RCS** to scroll through the list and press **RCS** 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.

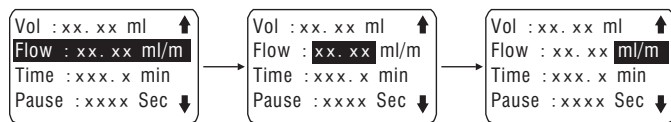


 **Note:** When the volume setting is zero, the LCD will display the flowrate setting and the pump will run until manually stopped or a stall occurs.

❖ Flowrate setting

In parameters setting interface, turn and press **RCS** to highlight the flowrate setting line. Press **RCS** to make the numerical value position highlighted. Enter the flowrate required from the membrane keypad. Press **RCS** to set flowrate unit. Turn **RCS** to scroll through the list and press **RCS** 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.

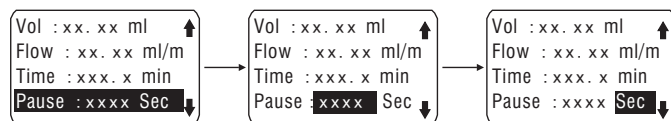
After setting of volume and flowrate, the dispensing time can be calculated and displayed automatically.



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.

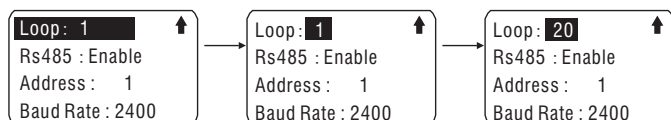
❖ Pause time setting

In parameters setting interface, turn and press **RCS** to highlight the pause time setting line. Press **RCS** to make the numerical value position highlighted. Enter the pause time required from the membrane keypad. Press **RCS** to confirm. The pause time unit is min and the value range is from 0.001 to 9999.



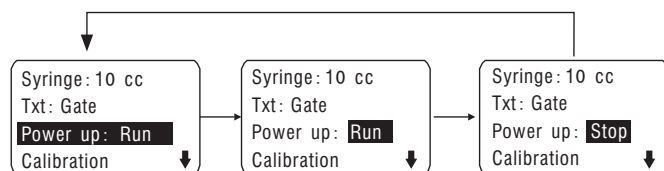
❖ Loop number setting

In parameters setting interface, turn and press **RCS** to highlight the loop number setting line. Press **RCS** to make the numerical value position highlighted. Enter the loop number required from the membrane keypad. Press **RCS** to confirm. The value range is from 0 to 9999. "0" means running continuously.



❖ Power up

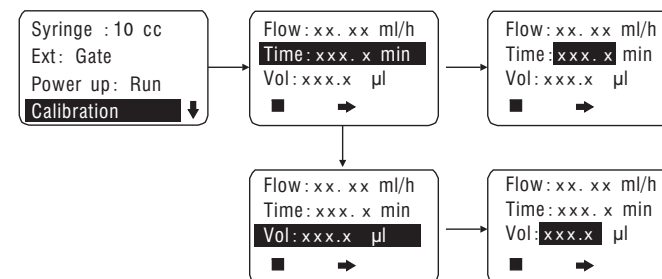
This option is only applicable when no dispense volume is selected. When power returns after an interruption the pump can resume operation (select Run) or remain stopped (select Stop).



❖ Calibration

The flowrate can be calibrated for more accurate dispense volume.

- In parameters setting interface, press and turn **RCS** to highlight the Calibration line. Press **RCS** to enter calibration interface.
- Testing time line is highlighted. Press **RCS** to highlight the numerical value position. Turn **RCS** to select the testing time. The testing time is from 0.5 minutes to 60 hours. Press **RCS** to confirm.
- Press **Run/Pause** key to start the testing. The pump stops automatically when the time is up.
- After testing, turn **RCS** to highlight the testing volume line. Press **RCS** to highlight the numerical value position. Enter the actual volume from the membrane keypad. Press **RCS** to confirm.
- 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 **RCS** 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 stops 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

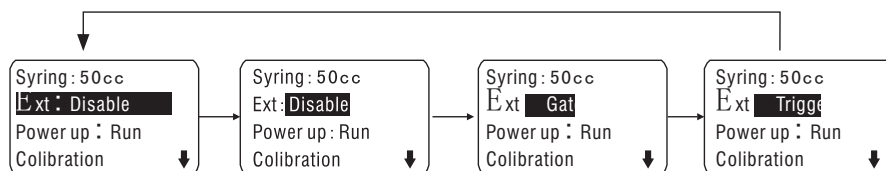
External control run/stop control can be enabled or disabled.

- In parameters setting interface, press and turn **RCS** to highlight the external control line.
- Press **RCS** to highlight the parameter. Turn **RCS** to select the needed parameter. Press **RCS** for confirmation.

Disable: disable the external control input, that is, the input is invalid.

TTL: TTL input controls the start and stop of the pump.

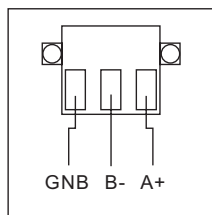
Trigger: falling edge input controls the start and stop of the pump.



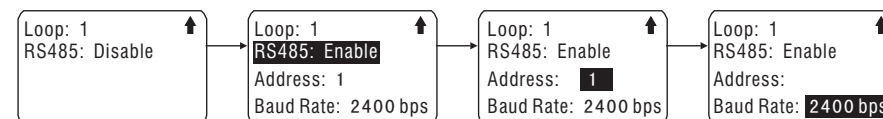
❖ RS485 setup

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>.

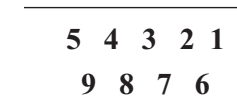


In parameters setting interface, press and turn **RCS** to highlight the RS485 line. Set RS485 enabled. The LCD displays communication address and band rate. Turn **RCS** to make the address highlighted. Press **RCS** to highlight the numerical value. Turn **RCS** to set the communication address. Press **RCS** again to confirm and save the setting. Turn **RCS** to highlight the band rate. Press **RCS** to make the numerical value highlighted. Turn **RCS** to select the band rate. Press **RCS** again to confirm and save the selection.



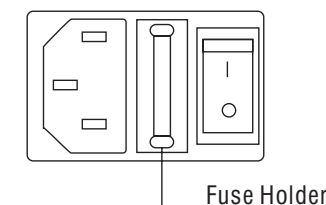
External control interface

- 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
- 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, 1A



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	(6) Ranfac	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
(2) Becton Dickinson Interim, WW design, Plastipak	1 cc	4.70 mm	(7) Scientific Glass Engineering SGE	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
				5	10.30
				10	14.57
(3) Becton Dickson Glass - all types	0.5 cc	4.64 mm	(8) Sherwood - Monojet Plastic	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			
(4) Hamilton 1000-Series Gastight	10 µl	0.46 mm	(9) Terumo	1 cc	4.73 mm
	25	0.73		3	9.00
	50	1.03		5	13.04
	100	1.46		10	15.79
	250	2.30		20	20.18
	500	3.26		30	23.36
	1 ml	4.61 mm		60	29.45
	2.5	7.28			
	5	10.30			
	10	14.57			
(5) Popper & Sons, Inc. Perfektum glass	25	23.03	(10) Unimetrics Series 9000	10 µl	0.46 mm
	50	32.57		25	0.73
				50	1.03
				100	1.46
				250	2.30
				500	3.26
				1000	4.61
	0.25	3.45 mm			
	0.5	3.45			
	1	4.50			
	2	8.92			
	3	8.99			
	5	11.70			

Standard minimum and maximum flow rates

Syringe Specification	Barrel Inner Diameter	Min. Flow Rate	Max. Flow Rate
10 µL	0.46 mm	0.049 µL/hr	10.80 µL/min
25 µL	0.73 mm	0.125 µL/hr	27.20 µL/min
50 µL	1.03 mm	0.249 µL/hr	54.16 µL/min
100 µL	1.46 mm	0.502 µL/hr	108.8 µL/min
250 µL	2.30 mm	1.246 µL/hr	270.1 µL/min
500 µL	3.26 mm	2.504 µL/hr	542.6 µL/min
1 mL	4.61 mm	5.007 µL/hr	1085 µL/min
2.5 mL	7.28 mm	12.49 µL/hr	2706 µL/min
3 mL	8.59 mm	17.39 µL/hr	3767 µL/min
5 mL	10.30 mm	25.00 µL/hr	325 mL/hr
10 mL	14.57 mm	50.02 µL/hr	650 mL/hr
20 mL	19.05 mm	85.51 µL/hr	1112 mL/hr
30 mL	21.59 mm	109.8 µL/hr	1428 mL/hr
50 mL	28.90 mm	196.8 µL/hr	2558 mL/hr
60 mL	26.60 mm	166.7 µL/hr	2167 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.

