U.S. SOLID

Laboratory Syringe Pump

Manual No. 13493

For research use only. Not for human clinical use.

Contents

1. Safety Overview

Important: Read this manual before operating the syringe pump. Use the pump only as described in this manual. Using the pump in a manner not specified may impair the protection provided by the equipment.

- Use only an approved power source and the supplied or approved power cord.
- Connect the pump to a properly grounded outlet. Do not defeat the protective ground.
- Make sure all cables and connectors are secure before operation.
- Do not open the enclosure or touch internal circuits unless authorized service personnel instruct you to do so.
- Do not use the pump if it appears damaged, unsafe, or unable to operate normally. Contact qualified service personnel.
- Keep fingers, tools, and loose objects away from the pusher block and end block while the pump is running.

Research-use limitation: This pump is intended for scientific research and laboratory use only. It is not intended for human clinical use.

2. Product Overview

The USS-SP syringe pump uses a 128 x 64 LCD to show parameters and operating status. A numeric membrane keypad and rotary encoder switch make parameter selection and setup straightforward.

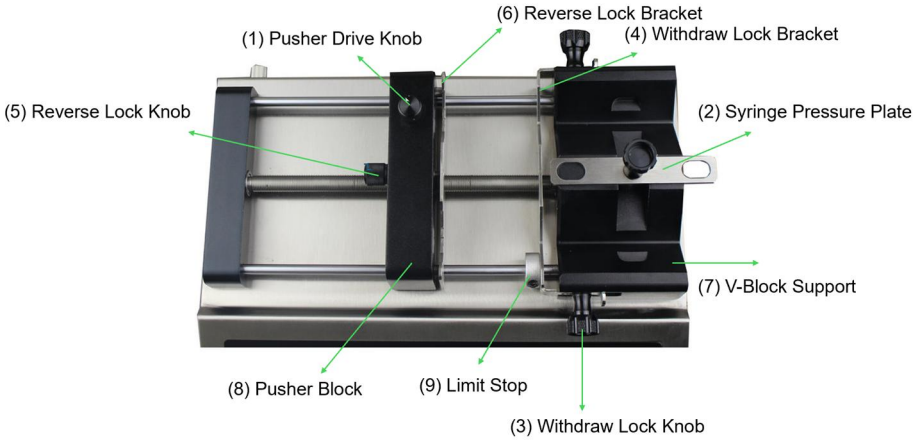
After the syringe and operating parameters have been set, press Start/Pause from the work screen to begin operation. Press Change to move between the work screen and the parameter setup screen.

Main Features

- Syringe selection by built-in manufacturer list or direct inner-diameter entry.
- Four user-defined syringe inner diameters can be stored.
- Infusion and withdrawal rates can be set independently and changed during operation.
- Target infusion and withdrawal volumes can be set separately. The pump stops automatically when the target volume is reached.
- Five operating modes: Infuse, Withdraw, Infuse then Withdraw, Withdraw then Infuse, and Continuous.
- RS485 communication and external input/output control are available.
- Stall detection stops the motor and displays a Stall message if movement is blocked.
- Parameters are stored in non-volatile EEPROM.
- Volume units and flow-rate units are selectable.
- Calibration can improve delivered-volume accuracy.

3. Installation and Syringe Loading

Loading Procedure



To simplify syringe installation, rotate the **Pusher Drive Knob** to disengage the **Pusher Block** from the lead screw. The **Pusher Block** can then be moved manually along the guide rods to the desired position. Alternatively, use the **Fast Forward** or **Fast Reverse** key to move the **Pusher Block**. After positioning, rotate the **Pusher Drive Knob** again to engage the **Pusher Block** with the lead screw.

1. Lift and rotate the **Syringe Pressure Plate**. Place the syringe barrel into the channel of the **V-Block Support**. Adjust the syringe to the desired position, then rotate the **Syringe Pressure Plate** back to secure the syringe.

2. Release the pusher assembly and slide the **Pusher Block** until it contacts the syringe plunger. Rotate the **Reverse Lock Knob** to position the plunger flange between the **Reverse Lock Bracket** and the **Pusher Block**, then continue tightening the **Reverse Lock Knob** to securely clamp the plunger flange. Finally, rotate the **Pusher Drive Knob** to engage the **Pusher Block** with the lead screw.

3. For withdrawal or repeated dispensing operations, the syringe must be securely mounted in the **V-Block Support**.

4. Loosen the **Withdraw Lock Knob**, place the syringe barrel flange into the **Withdraw Lock Bracket**, and tighten the **Withdraw Lock Knob** to secure the syringe.

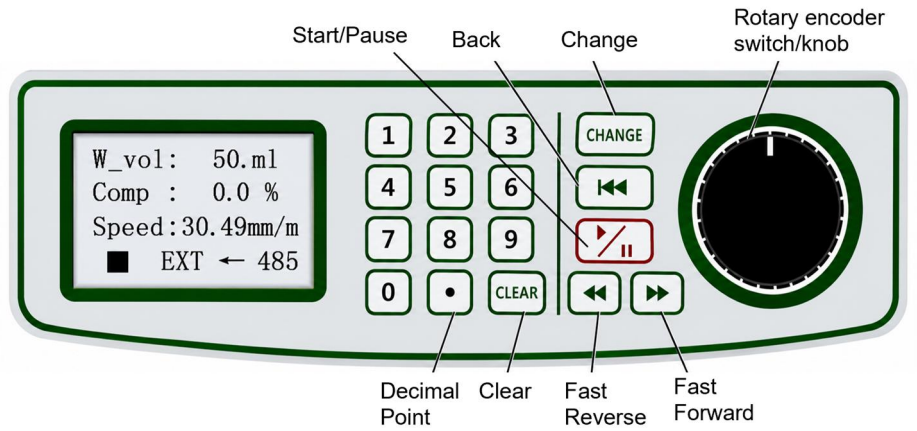
5. This mechanical design accommodates a wide range of syringe types.

6. On some glass syringes, the rounded plunger flange may prevent the **Reverse Lock Bracket** from securely clamping the plunger. During infusion, the plunger flange may slip upward above the **Reverse Lock Bracket**. Likewise, the rounded syringe barrel flange may cause the syringe barrel to slip out of the **V-Block Support** during infusion. To provide a flatter clamping surface and improve mounting reliability, place an O-ring or a metal ring on the syringe barrel.

7. A ring-shaped **Limit Stop** (Item 9 in the figure) is located between the middle slider and the **V-Block Support**. Its purpose is to prevent damage to the syringe caused by excessive pusher force. The **Limit Stop** can slide freely along the guide rods. After positioning it at the desired location, tighten the screw on the **Limit Stop** to secure it.

Loading notes: Load only syringes of the same size at the same time. Glass syringes are not recommended, except for glass sampling syringes. Syringe barrel-flange thickness and plunger-flange thickness consistency affect dispensing accuracy.

4. Display, Keys, and Menu Navigation



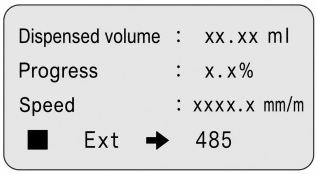
After power-up, the pump displays the initialization screen and then the language selection screen. Use the rotary encoder switch to select the display language. If no selection is made, the previously selected language remains highlighted and the pump enters the work screen after approximately 3 seconds.

Switch between the work screen and the parameter settings interface using the [Change] key. The displayed parameters vary depending on the selected mode; up to 14 setting items are available for modification.

Key Functions

Control	Function
RES rotary encoder	Rotate to select a menu item. Press to confirm a selection or setting.
0-9 and decimal point	Enter numeric values and decimal points.
Clear	Backspace; removes the last entered digit during numeric entry.
Change	Switches between the work screen and the parameter setup screen.
Back	Cancels the current operation or returns to the previous setup screen. After a stall, clears the stall warning display.
Start/Pause	Starts or pauses a process. During operation, opens the interrupt menu. Select Continue or Stop with RES and press RES to execute.
Fast Reverse	When stopped, withdraws at maximum speed while held. Other buttons are unresponsive when this key is pressed. Used for loading, flushing, and clearing a protection condition.
Fast Forward	When stopped, infuses at maximum speed while held. Other buttons are unresponsive when this key is pressed. Used for loading, flushing, and clearing a protection condition.

Work Screen



- Line 1 shows the target volume. During operation, delivered volume increases from zero until the target is reached.
- Line 2 shows operating progress.
- Line 3 shows the current linear speed.
- Line 4 shows operating status: ■ stop; ▶ run; EXT external-control enable indication; ←/→ direction arrows, flashes during operation; 485 communication enable indication.

5. Operating Modes and Parameter Setup

Syringe Inner Diameter

The pump must know the syringe inner diameter to dispense accurately. Once entered, the value is stored in EEPROM for later use.

Select a Syringe from the Built-in List

1. From the work screen, press Change to enter the parameter setup screen.
2. Press RES to highlight the first line, then press RES again to enter the syringe selection menu.
3. Choose Manufacturer List, select the syringe manufacturer and syringe size, then confirm with RES.
4. When the save dialog appears, choose Yes to save the setting, No to cancel the setting, or Cancel to return to syringe size selection.

Enter a User-Defined Syringe

5. Open the syringe selection screen and choose User Defined.
6. Select one of the four available memory positions.
7. Press RES to highlight the value field and enter the measured inner diameter with the numeric keypad.
8. Press RES to save. The valid entry range is 0.01 to 50.00 mm.

Parameter reset: If the syringe selection is changed or a user-defined inner diameter is changed, volume and flow-rate parameters are cleared. Re-enter the operating parameters before running the pump.

Mode Selection

From the work screen, press Change to enter parameter setup. Press RES to show the highlight bar, rotate RES to the Mode field, press RES, then rotate RES to select the desired mode. Press RES again to confirm.

Mode	Behavior
Infuse	Runs at the set infusion rate until the target infusion volume is reached, then stops automatically. If target volume is set to 0, the pump stops only by manual stop or stall detection.
Withdraw	Runs at the set withdrawal rate until the target withdrawal volume is reached, then stops automatically. If target volume is set to 0, the pump stops only by manual stop or stall detection.
Infuse then Withdraw	Infuses to the target volume, waits for the set pause time, then withdraws. Infusion and withdrawal volume/rate values are set separately. The pause time between infusion and withdrawal is also adjustable.
Withdraw then Infuse	Withdraws to the target volume, waits for the set pause time, then infuses. Withdrawal and infusion volume/rate values are set separately. The pause time between infusion and withdrawal is also adjustable.
Continuous	The pump repeats the infuse-then-withdraw cycle continuously. The infusion volume and withdrawal volume are set to the same value. The infusion flow rate and post-infusion pause time may be configured independently from the withdrawal flow rate and post-withdrawal pause time.

Display note: The work screen shows only the parameters relevant to the selected mode. For example, in Withdraw then Infuse mode, withdrawal parameters are shown during withdrawal and infusion parameters are shown after the withdrawal step completes.

Volume, Flow Rate, and Pause Time

- Volume: rotate RES to the Infusion Volume or Withdrawal Volume field, press RES, enter the value, then select uL or mL.
- Flow rate: rotate RES to the Infusion Rate or Withdrawal Rate field, press RES, enter the value, then select uL/hr, uL/min, mL/hr, or mL/min.
- Pause time: in Infuse then Withdraw and Withdraw then Infuse modes, the pause setting controls the stop time between direction changes. In Continuous mode, both infusion and withdrawal parameters include pause-time settings. Range: 0 to 9999 seconds, minimum resolution 0.1 second.
- Power-on run: if enabled and the pump is running in Infuse or Withdraw mode with volume set to 0, the pump can resume its previous running state after power is restored. If disabled, the pump remains stopped after power is restored.

Out-of-range rate: If the entered flow rate exceeds the maximum rate available under the current setup, the pump displays the maximum available rate and highlights the value field so a new value can be entered.

6. Calibration and Runtime Changes

Flow Calibration

Calibration adjusts the drive linear speed and can improve delivered-volume accuracy.

1. Rotate RES to highlight Flow Calibration and press RES.
2. When the test Time field is highlighted, press RES and adjust the test time. Range: 0.5 to 60 minutes.
3. Rotate RES to the measured Volume field, press RES, enter the measured delivered volume with the keypad, then press RES to confirm.

Viewing or Changing Parameters During Operation

- Press Change while the pump is running to open the parameter setup screen.
- Rotate RES to view all settings. Press Change again to return to the work screen without changes.
- If the flow-rate parameter is changed, the pump immediately continues at the new rate.
- If the target volume is changed, the pump stops when the new target volume is reached. If the new target volume is less than the volume already delivered, the pump stops immediately.
- If volume is set to 0 in Infuse or Withdraw mode, it cannot be changed during operation.

Clearing a Stall Protection State

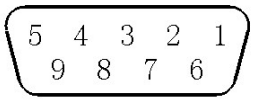
If a stall occurs, the motor stops to prevent further risk. Press Back to clear the stall display. Fast Forward or Fast Reverse may be used to move the pusher block and clear the obstruction.

7. External Control and RS485

External Control

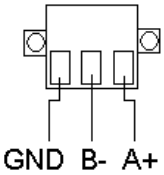
External control includes external start/stop control and direction control. The function can be enabled or disabled from the menu.

- Off: external-control inputs are ignored.
- Level: TTL input controls the pump start/stop state.
- Pulse: falling-edge trigger signal controls the pump start/stop state.



Pin	Description
3	External-control common terminal.
8	External pulse input for start/stop control, falling-edge triggered. Example: foot switch.
4	External level input for start/stop control. High-to-low starts operation and remains low while running; Turn to high stops operation. Examples: foot switch or timer.
2	Direction output, open-collector (OC gate) output. Closed during withdrawal and open during infusion. Also open when stopped.
7	Run indication, open-collector (OC gate) output. Closed while running.
9	Reverse control. Normal at TTL low level. In Infuse then Withdraw mode, TTL high reverses direction during operation.

RS485 Setup



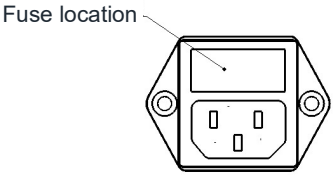
The RS485 terminal is located on the rear of the pump. One computer can control up to 30 pumps. Each pump on the bus must have a unique address. When RS485 control is active, the pump can still respond to keypad input.

Item	Value
Address range	1-30; factory default: 1
Baud rates	1200, 2400, or 9600 baud; factory default: 2400 baud
Communication format	1 start bit, 8 data bits, 1 even-parity bit, 1 stop bit

1. Set RS485 to Enable. Address and baud-rate settings will appear.
2. Rotate RES to Communication Address, press RES, select the address, then press RES to confirm.
3. Rotate RES to Baud Rate, press RES, select the baud rate, then press RES to confirm.

8. Fuse, Maintenance, and Storage

Fuse Replacement



The fuse is located in the power module on the rear of the pump. Disconnect the power cord before replacing the fuse.

Fuse specification	Value
Size and rating	5 x 20 mm, 250 V~, fast blow, 1 A

Maintenance

- Keep moving mechanical parts clean and lightly lubricated.
- Apply a small amount of suitable lubricating oil to the lead screw and guide rods when needed.
- Do not clean the pump with organic solvents.
- Use only a neutral cleaner to wipe the keypad and exterior surfaces.

Appendix A. Standard Syringe Inner Diameters

Use the values below when selecting a standard syringe from the built-in list. If your syringe is not listed, measure the inner diameter and enter it as a user-defined syringe.

Air-Tite All Plastic

Syringe size	Inner diameter (mm)
1 cc	4.70
2.5 cc	9.70
5 cc	12.48
10 cc	15.89
20 cc	20.00
30 cc	22.50
50 cc	28.90

Becton Dickinson Plastipak

Syringe size	Inner diameter (mm)
1 cc	4.70
3 cc	8.59
5 cc	11.99
10 cc	14.48
20 cc	19.05
30 cc	21.59
60 cc	26.60

Becton Dickinson Glass

Syringe size	Inner diameter (mm)
0.5 cc	4.64

Syringe size	Inner diameter (mm)
1 cc	4.64
2.5 cc	8.66
5 cc	11.86
10 cc	14.34
20 cc	19.13
30 cc	22.70
60 cc	28.60

Hamilton 1000-Series Gastight

Syringe size	Inner diameter (mm)
10 uL	0.46
25 uL	0.73
50 uL	1.03
100 uL	1.46
250 uL	2.30
500 uL	3.26
1 mL	4.61
2.5 mL	7.28
5 mL	10.30
10 mL	14.57
25 mL	23.03
50 mL	32.57

Popper & Sons Perfektum Glass

Syringe size	Inner diameter (mm)
0.25 cc	3.45
0.5 cc	3.45
1 cc	4.50
2 cc	8.92
3 cc	8.99

Syringe size	Inner diameter (mm)
5 cc	11.70
10 cc	14.70
20 cc	19.58
30 cc	22.70
50 cc	29.00

Ranfac

Syringe size	Inner diameter (mm)
2 cc	9.12
5 cc	12.34
10 cc	14.55
20 cc	19.86
30 cc	23.20
50 cc	27.60

Scientific Glass Engineering / SGE

Syringe size	Inner diameter (mm)
25 uL	0.73
50 uL	1.03
100 uL	1.46
250 uL	2.30
500 uL	3.26
1 mL	4.61
2.5 mL	7.28
5 mL	10.30
10 mL	14.57

Sherwood Monoject Plastic

Syringe size	Inner diameter (mm)
1 cc	4.65
3 cc	8.94
6 cc	12.70
12 cc	15.90
20 cc	20.40
35 cc	23.80
50 cc	26.60

Terumo

Syringe size	Inner diameter (mm)
1 cc	4.73
3 cc	9.00
5 cc	13.04
10 cc	15.79
20 cc	20.18
30 cc	23.36
60 cc	29.45

Unimetrics Series 9000

Syringe size	Inner diameter (mm)
10 uL	0.46
25 uL	0.73
50 uL	1.03
100 uL	1.46
250 uL	2.30
500 uL	3.26
1000 uL	4.61

Contact

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