Laboratory Syringe Pump

Manual No.13451

Applicable Models

USS-SP00001, USS-SP00002

USS-SP00016

For research use only. Not for human clinical use.

Contents

1. Safety Information

Read this manual carefully before using the syringe pump. Use the product only as described in this manual. Incorrect use may reduce the protection provided by the product and may damage the pump or connected equipment.

- Use only an approved power supply and power cord suitable for the country of use.
- Make sure the power cord is reliably grounded. The product is grounded through the power cord.
- Make all electrical and fluidic connections correctly and securely before operation.
- Do not open the enclosure or touch internal circuits unless authorized service personnel instruct you to do so.
- Do not use the product if it appears damaged, unsafe, or unable to operate normally. Contact qualified service personnel.
- Keep fingers away from the moving pusher/plunger area and end block while the pump is running.

Important: This pump is intended for scientific research use only. It must not be used for human clinical experiments or medical treatment.

2. Product Overview

The syringe pump uses a 128 x 64 LCD to display parameters and working status. A membrane keypad and rotary encoder allow fast menu selection, parameter entry, and operation control.

After the operating parameters are set, press Start/Stop on the work screen to begin operation. To set, review, or change parameters, use the menu and rotary knob to select the syringe, enter the syringe inner diameter when needed, and set the dispense volume and flow-related parameters.

Key Features

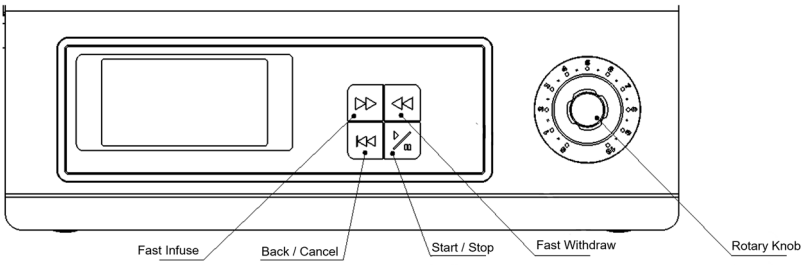
- Built-in standard syringe list with automatic inner-diameter entry.
- Save up to four user-defined syringe inner-diameter values for syringes not included in the list.
- Separate infuse and withdraw flow settings, with the ability to change relevant parameters during operation.
- Five operating modes with stored parameters for each mode.
- Target volume stop: the pump can stop automatically when the set volume is reached.
- RS485 interface for connection to a host controller.

- External control interface for start/stop, direction, run indication, foot switch or timer control, and valve or relay integration.
- Optical encoder stall detection with automatic stop and on-screen Stall message.
- Nonvolatile parameter storage for repeat use.
- Selectable volume and flow units.
- Calibration procedure for improved volume accuracy.

3. Product Parts and Controls

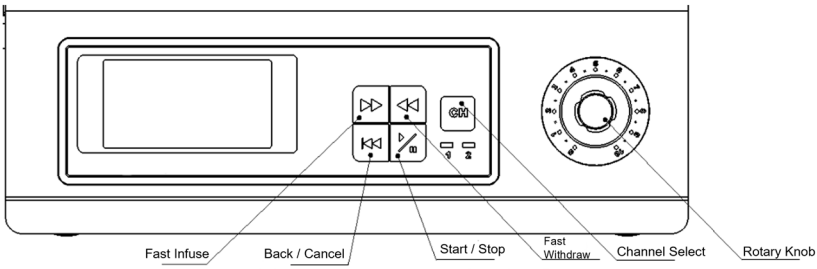
Front Panel

For USS-SP00001 and USS-SP00002:



The front panel contains the LCD, fast-move keys, Back/Cancel key, Start/Stop key, and rotary knob.

For USS-SP00016:



The front panel contains the LCD, fast-move keys, Back/Cancel key, Start/Stop key, Channel Select key, and rotary knob.

Control	Function
Start/Stop	Press once to switch between running and stopped states. In multi-channel display mode, pausing an active process opens a confirmation dialog.
Fast Infuse	In multi-channel display mode, press and hold this key to infuse (push operation) on all enabled channels at maximum linear speed; in single-channel display mode, press and hold this key to infuse (push operation) on the current channel at maximum linear speed. Release the key to stop movement. This key is not available while a channel is running. Other keys are disabled while this key is held.
Fast Withdraw	In multi-channel display mode, press and hold this key to withdraw (pull operation) on all enabled channels at maximum linear speed; in single-channel display mode, press and hold this key to withdraw (pull operation) on the current channel at maximum linear speed. Release the key to stop movement. This key is not available while a channel is running. Other keys are disabled while this key is held.
Rotary Knob	Rotate to select menu items or change numeric values. Press the knob to confirm the selected item or value.
Back/Cancel	Cancel the current operation or return to the previous menu.
Channel Select	Switches from multi-channel display mode to single-channel display mode and allows switching between channels.

Pump Head

Secure the syringe barrel with the syringe clamp plate and secure the plunger with the plunger clamp plate before operation.

4. Operating Modes

Mode	Behavior
Infuse	When both the target volume and flow rate are set, the pump automatically stops when the target volume is reached. If the target volume is set to 0, the pump will continue running until it is stopped manually or a stall is detected.
Withdraw	When both the target volume and flow rate are set, the pump automatically stops when the target volume is reached. If the target volume is set to 0, the pump will continue running until it is stopped manually or a stall is detected.
Infuse then Withdraw	After infusion finishes, the pump waits for the set pause time and then starts withdrawal. Infuse and withdraw volume/flow rate values are set separately. The pause time between infusion and withdrawal is also adjustable.
Withdraw then Infuse	After withdrawal finishes, the pump waits for the set pause time and then starts infusion. Withdraw and infuse volume/flow rate values are set separately. The pause time between withdrawal and infusion 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.

5. Basic Setup Workflow

1. Install and secure the syringe. Confirm that the syringe barrel and plunger are clamped firmly.
2. Select a syringe from the standard list. If the syringe is not listed, measure the inner diameter and enter it manually.
3. Set the operating mode.
4. Set the dispense volume, infuse time, withdraw time, cycle count, and interval/pause time as required by the selected mode.
5. Confirm the parameters on the work screen.
6. Press Start/Stop to begin operation.
7. Press Start/Stop again to stop or pause operation when needed.

6. Syringe Selection

Select from the Standard List

The parameter menu includes a standard syringe list. When a syringe is selected from the list, the corresponding inner diameter is entered into the program automatically.

Enter Inner Diameter Manually

If the syringe is not included in the list, measure the syringe inner diameter and enter the value directly. The pump can store four user-defined syringe inner-diameter values (0.01 mm – 40 mm).

7. Dispense Parameter Settings

Dispense parameters include dispense volume, infuse time, withdraw time, cycle count, and interval/pause time.

Parameter	Range / Options	Notes
Dispense volume	1 nL to 99.99 mL; units: nL, 0.01 uL, 0.1 uL, uL, 0.01 mL	Volume per single infuse or withdraw action.
Infuse time	0.1 sec to 999.9 hr; units: sec, min, hr	Time required for one infusion.
Withdraw time	0.1 sec to 999.9 hr; units: sec, min, hr	Time required for one withdrawal.
Cycle count	1 to 999	In Infuse then Withdraw and Withdraw then Infuse modes, one complete infuse/withdraw pair counts as one cycle.
Pause time	0.1 to 999 min	Pause time between two dispensing cycles.

Volume limit: If the single dispense volume or total dispense volume exceeds the selected syringe capacity, the screen displays Total Volume Out of Range. Replace the syringe or adjust the dispense volume or cycle count.

Speed limit: If the pump cannot complete the set volume within the set infuse or withdraw time, the screen displays Infuse Speed Out of Range or Withdraw Speed Out of Range. Adjust the time or dispense volume.

8. Stall Detection and Power Interruption

Stall Detection

The pump uses an optical encoder to monitor motor movement. If excessive resistance or external interference blocks infusion or withdrawal, the pump stops automatically and displays Stall. Clear the Stall message with Back/Cancel or the fast-move keys after the obstruction has been resolved.

Power Interruption

After power is restored, the user may choose to continue or stop operation. If a dispense volume was set, the pump stops after power is restored.

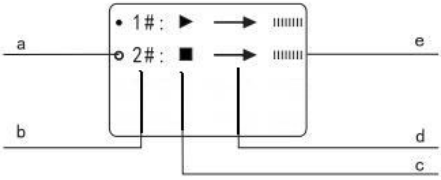
9. Calibration Procedure

Use the calibration procedure when dispense volume accuracy needs adjustment. The procedure adjusts actuator linear speed to improve delivered volume accuracy.

- Calibration volume: after entering the volume setting screen, rotate the knob to select 10%, 50%, or 80% of the currently selected syringe capacity. For a user-defined syringe, the default calibration volume is the set volume.
- Calibration time: the pump uses a fixed 1-minute calibration time. This value cannot be changed by the user.
- Measured value: after the calibration volume is set, press Start/Stop to run. When the run stops, enter the measured volume.

10. Display Mode Selection

Work Screen Display for USS-SP00016 ONLY:



a. Function Indicator: Indicates whether a channel is enabled or disabled.

- ● Indicates the current channel is enabled.
- ○ Indicates the current channel is disabled.

The disabled channel status is independent of channel switching and remains unchanged during system operation.

b. Channel Indicator: Displays the channel number.

c. Pause Status: Indicates the display status during operation. When stopped, the symbol is ■; when running, the symbol is ▶; when paused, the symbol is ⏸.

d. Direction of Motion: Indicates the operating direction. During infusion, ⟶ is displayed; during withdrawal, ⟵ is displayed.

e. Operation Mode: Displays the current operating mode. In the **Infuse**, **Withdraw**, **Infuse then Withdraw**, and **Withdraw then Infuse** modes, ||||||| is displayed. In **Continuous** mode, ⟲ is displayed.

Multi-Channel Function Settings for USS-SP00016 ONLY:

Select Active Channels

Select the channels to be activated.

- ● indicates the channel is enabled as an active channel.
- ○ indicates the channel is disabled and will not operate.

Only enabled channels will execute the programmed operation.

Select Follow Parameters

Select one channel whose execution parameters will be used as the **follow parameters**. Other enabled channels will automatically use the same follow parameters and operate accordingly.

- ● indicates the channel is selected as the follow channel.
- ○ indicates it is not selected.

Only one follow channel can be selected. This setting is optional.

Start Delay Time

Set the start delay time for each channel. The execution units will start sequentially according to the configured delay.

Available time units: **sec**, **min**, or **hour**.
Setting range: **0.1–999.9**.

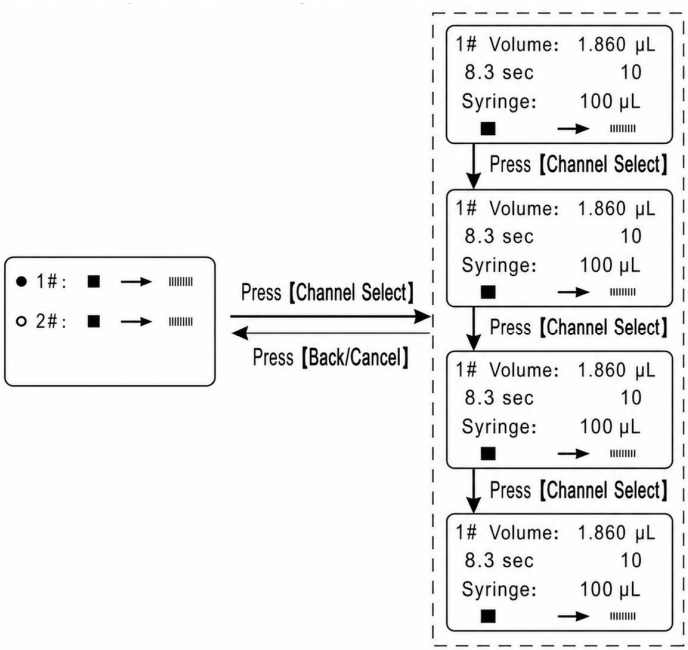
Controller Address

When controlling the pump via the **RS485 communication interface**, each channel controller must be assigned a unique controller address. This address serves as the controller's identification number.

Available address range: **1–30**.
Default address: **1**.

Enter Single-Channel Operation Screen

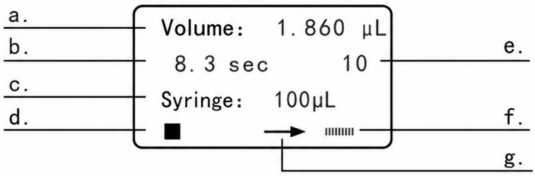
After initialization is complete, the **Multi-Channel Operation** screen is displayed. Press the **[Channel Select]** button to enter the **Single-Channel Operation** screen.



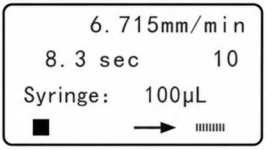
Single Channel Operation Interface for USS-SP00001, USS-SP00002, and USS-SP00016:

❖ **The single channel operation interface includes three display modes:**

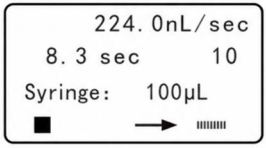
- **Volume display**



- **Linear Speed display**



- **Flow rate display**



a. Display Mode: Displays the current dispensed volume, flow rate, or linear velocity.

b. Time: Displays the time required for the current operation. During operation, it is displayed as a countdown timer.

c. Syringe: Displays the currently selected syringe specification.

d. Pause Status: Indicates the display status during operation. When stopped, the symbol is ■; when running, the symbol is ▶; when paused, the symbol is ❚❚.

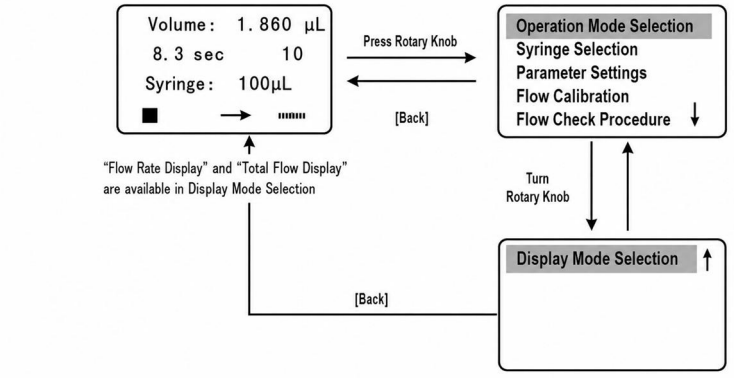
e. Dispensed Count: Displays the number of dispensing cycles. During operation, it is displayed as a countdown value (except in **Continuous** mode).

f. Operation Mode: Displays the current operating mode. In the **Infuse**, **Withdraw**, **Infuse then Withdraw**, and **Withdraw then Infuse** modes, ||||||||| is displayed. In **Continuous** mode, ▭ is displayed.

g. Direction of Motion: Indicates the operating direction. During infusion, ⟶ is displayed; during withdrawal, ⟵ is displayed.

Single Channel Function Settings

The single channel function settings include 5 function settings (see figure below).



11. Compatible Syringes

Glass Sampling Syringes

Specification	5 uL	10 uL	25 uL	50 uL	100 uL	250 uL	500 uL	1000 uL
Inner diameter (mm)	0.35	0.5	0.8	1.1	1.6	2.3	3.25	4.61
Effective stroke (mm)	51.97	50.93	49.74	52.61	49.74	60.17	60.27	59.91
Flow range (/min)	0.764 nL - 7.64 uL	1.559 nL - 15.59 uL	3.989 nL - 39.89 uL	7.544 nL - 75.44 uL	15.96 nL - 159.6 uL	32.98 nL - 329.8 uL	65.85 nL - 658.5 uL	132.5 nL - 1325 uL

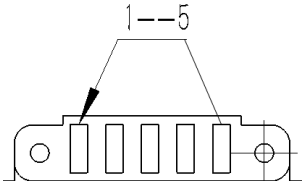
Plastic Syringes

Specification	1 mL	2 mL	5 mL	10 mL	20 mL	30 mL	60 mL
Inner diameter (mm)	4.7	9.0	13.1	14.8	19	23	29.1
Effective stroke (mm)	57	31.2	37.1	58.2	70.1	72.0	89.96
Flow range (/min)	0.139 uL - 1.39 mL	0.509 uL - 5.09 mL	1.07 uL - 10.7 mL	1.364 uL - 13.64 mL	2.265 uL - 22.65 mL	3.307 uL - 33.07 mL	5.294 uL - 52.94 mL

12. Communication and External Control

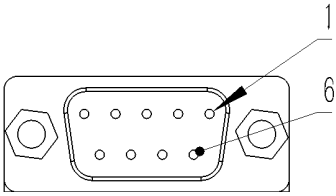
RS485 Interface

The RS485 communication bus can be connected to a host controller.



Pin	Function
1	Reserved
2	Reserved
3	Ground / internal power signal ground
4	RS485(B)
5	RS485(A)

External Control Interface



For USS-SP00001 and USS-SP00002:

Pin	Function
1	Start/Stop, OC output
2	Forward/Reverse, OC output
3	Not connected
6	Start/Stop signal ground
7	Forward/Reverse signal ground

For USS-SP00016:

Pin	Function
1	1 Channel Start/Stop, OC output
2	1 Channel Forward/Reverse, OC output
3	Not connected
4	2 Channel Start/Stop, OC output
5	2 Channel Forward/Reverse, OC output
6	1 Channel Start/Stop signal ground
7	1 Channel Forward/Reverse signal ground
8	2 Channel Start/Stop signal ground
9	2 Channel Forward/Reverse signal ground

Contact

Feel free to visit our website: www.ussolid.com

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