RWD

R-480 Nanoliter Injection Pump

User Manual **A**

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The product fails to be used correctly according to the user manual.

Contents

1-Introduction

First of all, thank you for choosing the R-480 Nanoliter Injection Pump produced by RWD!

Please be sure to carefully read all the randomly distributed information before installing and using this product for the first time, which will help you use the product better.

RWD Life Science Co., Ltd. is committed to continuously improving product functions and service quality, and reserves the right to make changes to any product described in this manual and the content of this manual without prior notice.

For the latest product information, please contact us by telephone or mail, or visit our website (www.rwdstco.com). Please contact RWD if you find any inconsistency between the actual product and the information contained herein during the use of the device, or you have any questions or suggestions.

This manual applies to:

- Nanoliter Injection Pump Model: R-480

1.1 Overview

The Nanoliter Injection Pump is an instrument that can quantitatively and at a fixed speed perform micro-injection or aspiration of oocytes, animal larvae, protozoa, animal brain or eyeballs, etc., which is mainly used in the field of neuroscience and cytology. In neuroscience research, it is mainly used for the injection of viruses or tracers into the brain. In the field of cell research, it is mainly used for the injection of nucleic acid substances, protein samples, dyes and other substances into oocytes and embryos, including the injection into or aspiration from xenopus eggs and young toads, and the injection into or aspiration from the fish eggs and embryos such as zebrafish. In addition, it can also be used for pest control, plant insect control and other agricultural research, including the injection or aspiration of specific substances for insect embryos, larvae, etc.

To avoid injury to the operator and damage to the instrument, please read the section "**2-Important information and security**" carefully. If you have any questions or suggestions on safety, please contact us for after-sales service support.

The device should be operated and managed by trained professionals!

This device is only used for laboratory research!

1.2 Features

- The injection accuracy is high and the operation is stable.
- Good leakproofness ensures that liquid leakage will not occur during injection.
- The screen brightness can be adjusted to meet the light intensity needs of different experimental occasions.
- The injection range is large, and it is currently the product with the widest range on the market.
- The function of reten time setup is added. A timer is no longer required for retention after injection.
- The function of power-failure saving is added. If there is a sudden power failure when the injection is not completed, you can choose whether to continue the uncompleted program when you turn on the device again.
- The pump body of the injection unit is small in size and easy to use.
- The connection cable of the injection unit is soft to avoid the shaking of the injection unit caused by the experiment, and it has a design of anti-dislocation.

1.3 Application Conditions

Please prepare the device operating environment under the conditions listed in the table below to ensure the operation and safety of the device.

The product performance is guaranteed under the conditions of 20-25 ℃, temperature change ≤2 ℃, and humidity 65±5%.

Operating conditions	Temperature: 4-40 ℃
	Humidity: 20% -80% RH (non-condensing)
Storage conditions	Temperature: -20-60 ℃
	Humidity: ≤ 95% RH
	Air pressure: 70-110 kPa
Working power supply	AC: 100-240 V AC, 50-60 Hz Adapter output DC: 12 V DC, 2 A

1.4 Product parameters

Control unit size (length × width × height)	170×120×45 mm
Injection unit size (length)	20 cm
Length of connection cable between injection unit and control unit	100 cm
Length of connection cable between footswitch and control unit (optional accessories)	200 cm
Display	5.0 inch capacitive touch screen resolution: 800×480 px
Weight	Control unit 0.8 kg; Injection unit 0.2 kg; Footswitch 1.5 kg

Minimum injection rate	1 nl/s
Maximum injection rate	200 nl/s
Rate minimum resolution	1 nl/s
Fill rate	10-200 nl/s
Empty rate	10-200 nl/s or 600-12000 nl/min
Reset rate	200 nl/s or 12000 nl/min
Minimum injection volume	0.6 nl
Maximum injection volume	5000.0 nl
Minimum volume resolution	0.1 nl
Plunger travel distance	28 mm
Cycle	1-8000
Delay	1-999 s
Glass electrode Dimension	O.D. 1.14 mm, I.D. 0.53 mm

1.5 Components

Name	**Configuration**	**Quantity**	**Purpose**
Injection unit	Standard	1	Used for connecting glass electrodes, performing injections and other operations
Control unit	Standard	1	Used for setting parameters and controlling the injection unit to perform corresponding operations
Connection cable	Standard	1	Used for connecting the injection unit to the control unit
3.5-inch (8.89 cm) glass electrode	Standard	100	Outer diameter: 1.14 mm; inner diameter: 0.53 mm
7-inch (17.78 cm) glass electrode	Standard	100	Outer diameter: 1.14 mm; inner diameter: 0.53 mm
General fixing accessories	Standard	1	Used in combination with brain stereotaxic instrument and micromanipulator
Power adapter	Standard	1	Connect power supply
Filling needle	Standard	1	Used for filling oil
Sealing material	Standard	1	Used for replacing the sealing material inside the injection unit
Footswitch and connection cable	Optional	1	Model: R480-FS, Used for controlling the inject, empty and other operations of the injection unit
Mineral oil	Optional	1	Model: R480-MO, Filled in the electrode: 100ml
Special fixing accessories for micromanipulator	Optional	1	Model: R480-AFM, With special accessories for RWD Motorized Micromanipulator

2-Important information and security

2.1 Safety classification

Safety grade: Grade I
Waterproof and dustproof grade: IPX0

2.2 General Safety

1) Electromagnetic compatibility. The electromagnetic compatibility standard applicable to this device is EN 61326-1/EN 55011, which is designed and tested according to Group 1 Class A in CISPR11.
   Warning! Due to the conduction disturbance and radiation disturbance of the device, Class A device is not suitable for residential environment, and it cannot provide sufficient protection for radio reception in this environment.
2) Electrical safety. The applicable electrical safety standard for this device is IEC61010-1.
3) The device should be placed in a stable, safe and well ventilated conditions, and should be protected from excessive dust, vibration, strong magnetic field, direct sunlight, ventilation, excessive humidity or huge temperature fluctuations.
4) This device is only allowed to be used by trained professionals and operated within the applicable range. Do not use unauthorized accessories or attachments to operate the device. Non-conforming operation may lead to device damage and personal injury. It is recommended to use mineral oil as the filling oil, and it is prohibited to use high-viscosity oils such as wax oil to fill the glass electrode.
5) This device is not recommended for use at altitudes greater than 2000 m.
6) The device should be kept away from combustibles and flammables, away from hazardous materials, and do not use harmful substances on the electrode tip.
7) The electrodes after use should be put into the sharps box and sealed to ensure the safety of personnel.
8) This device is a precision instrument. Avoid its falling from a high place.
9) Glass electrode size requirements: I.D. 0.53 mm, O.D. 1.14 mm. If other glass electrodes are used, the injection effect will be affected.

2.3 Electrical safety

To ensure safety, the following regulations need to be followed:

1) The device must use a matching power supply. If you are not sure of the type of power supply provided, please consult an authoritative power supplier or local power company.
2) Before each use, make sure that the power adapter cable is not damaged or severely bent. If it is damaged, please replace it in time before using the device.
3) In order to reduce the electromagnetic coupling effect between this device and other device in the laboratory, please use the power cable and connection cables that are provided with this device, and do not use other types of connection cables.
4) Whenever discovering potentially unsafe operation, turn off the main power and unplug the power cord from the socket.
5) Do not open the enclosure without authorization as this may result in electric shock and damage the device.
6) This device does not support hot plugging, and the connection cable between the injection unit and the control unit cannot be plugged or unplugged under power.
7) The device should not be exposed to rain or damp environment. If liquid comes into contact with the circuit part, immediately turn off the power and pull out the plug.

3-Product structure and interface

Figure 3-1

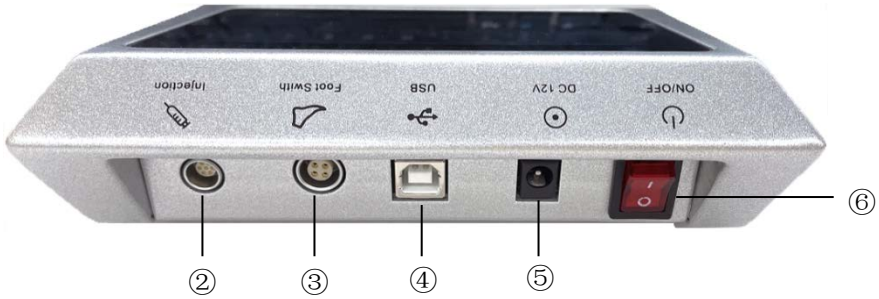


Figure 3-2

Figure 3-3

No.	Name	Quantity	Function
①	Control unit	1	Used for setting parameters and controlling the injection unit to perform corresponding operations
②	Injection unit interface	1	Connect the injection unit
③	Footswitch interface	1	Connect the footswitch
④	USB interface	1	USB-B type interface, used for upgrading the program
⑤	Power interface	1	Connect the power adapter
⑥	Power switch	1	Turn on/off the main power of the control unit
⑦	Injection unit	1	Used for connecting glass electrodes, performing injections and other operations

4-Unpack and install

4.1 Unpack

Before unpacking, please check the outer packaging carefully. If you find any damage, bumps, etc., please contact RWD as soon as possible. After confirmation, you can proceed to the next step;

Take all items out of the shipping box and properly keep the original packaging articles for future transportation;

Please check whether the delivered materials and quantity are consistent with the order, and carefully inspect the materials. If there is any damage, bumps, etc., please contact RWD as soon as possible. Using non-designated accessories and attachments may cause device damage and personal injury. If any accessories and attachments are damaged or lost during use, please contact RWD.

Figure 4-1

Figure 4-2

4.2 Connec the injection unit

> **Note:** It is recommended to connect the injection unit before turning the control unit on, otherwise the saved data may be lost.

When connecting the injection unit, insert one end of the connection cable into the injection unit and the other end into the injection unit interface of the control unit. Do not insert forcibly when inserting. The red dots must be aligned, otherwise the plug and the socket will be damaged.

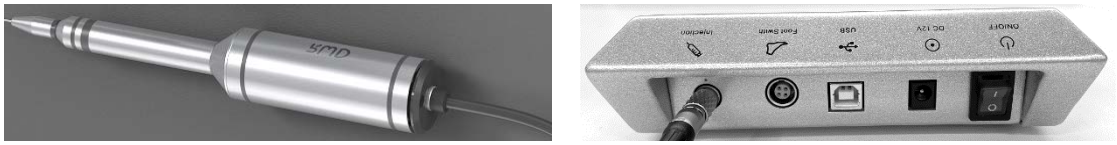


Figure 4-3

When taking out the plug, do not turn it. As shown in Figure 4-4, pinch the pattern of the plug with your fingers, press it inward slightly, and then pull it out.

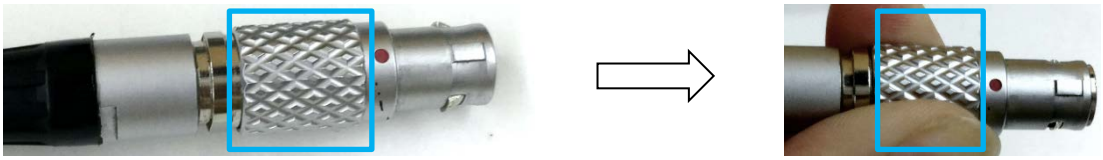


Figure 4-4

4.3 Connect the footswitch

If the footswitch (Model: R480-FS) is purchased, connect the footswitch connection cable to the footswitch interface of the control unit. Do not insert forcibly when inserting. The red dots must be aligned, otherwise the plug and the socket will be damaged.

Figure 4-5

When taking out the plug, don't turn it, pinch the pattern of the plug with your fingers, press it inward slightly, and then pull it out.

4.4 General fixing accessories

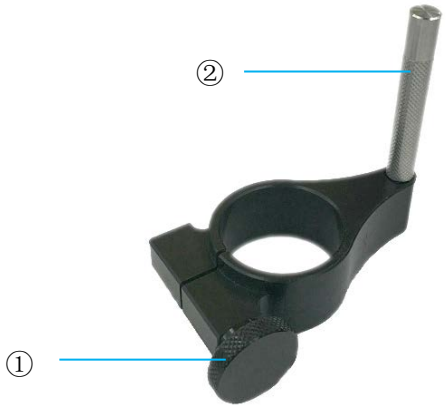


Figure 4-6

As shown in Figure 4-6, it is general fixing accessories, ① used to adjust the position of the injection unit. ② can be used with the RWD 68207 V-shaped connector to fix the injection unit to the operating arm of the stereotaxic apparatus, and ② is used to fix the injection unit to the dovetail base of the micromanipulator with the help of special fixing accessories for micromanipulator.

4.5 Special fixing accessories for micromanipulator

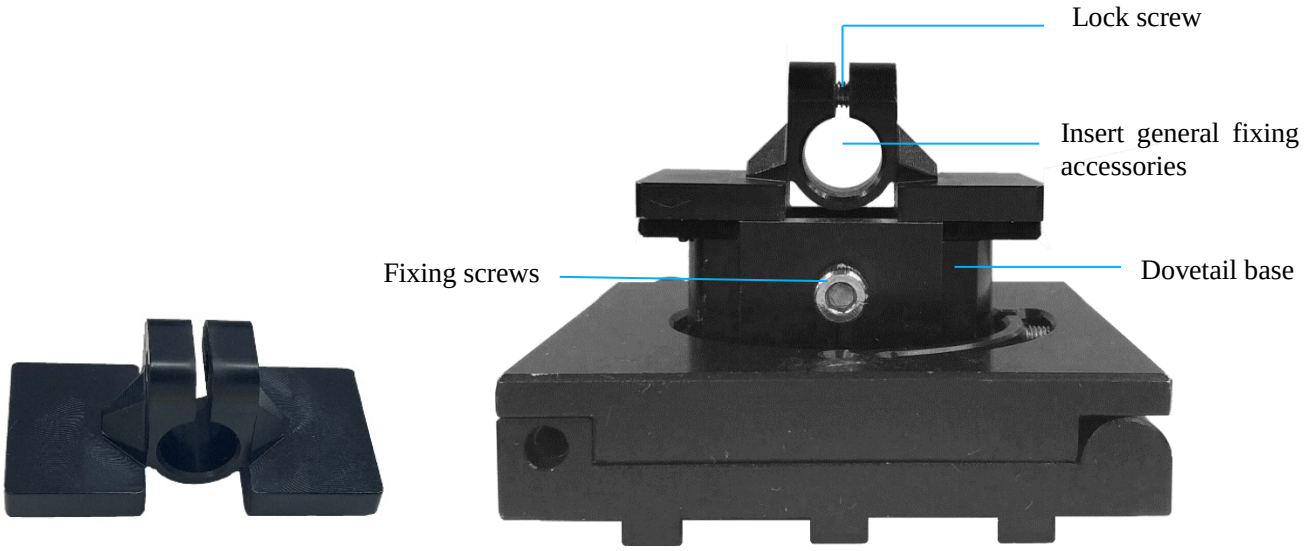


Figure 4-7

This accessories is special accessories for the RWD Motorized Micromanipulator. If the accessories is purchased, please follow the steps below to install the special fixing accessories (Model: R480-AFM) on the dovetail base of the micromanipulator.

1) First, loosen the fixing screws on the dovetail base of the micromanipulator.
2) Install the special fixing accessories on the groove of the dovetail base, and tighten the fixing screws to lock the special fixing accessories.
3) Finally, insert the general fixing accessories into the special fixing accessories, and fix it with the lock screw after adjusting the position.

4.6 Glass electrode

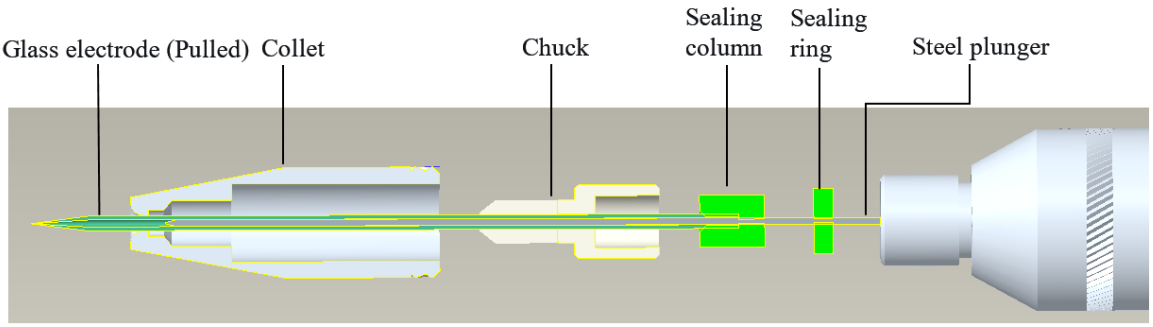


Figure 4-8

The structure of the injection unit is as shown in Figure 4-8. It is recommended to install the glass electrode according to the following steps.

Note: There are a large hole and a small hole on both sides of the sealing column. When the sealing column is installed, the steel plunger should be inserted through the small hole first, and then through the large hole.

1) Use the micropipette puller to pull the glass electrode. It is recommended to use the RWD MP-500 Micropipette Puller.
2) Backfill the pulled glass electrode with mineral oil (Model: R480-MO) by a filling needle. For some operation experiments, it is also possible to directly fill the glass electrode with the injection liquid or directly withdraw the injection liquid without filling the mineral oil first.

   Note: No air can be left in the electrode.
3) Click 

on the [Manual] interface of the control unit as shown in Figure 5-2, and the empty program can be ended when the steel plunger is exposed, as shown in Figure 4-9.

Figure 4-9

4) Loosen the collet slightly, as shown in Figure 4-10.

Figure 4-10

5) Put the filled glass electrode into the exposed steel plunger and slowly insert it into the bottom. Be careful to move gently and slowly during operation to avoid bubbles from entering. As shown in Figure 4-11.

Figure 4-11

6) Tighten the collet.

5-Simple operation guide

1) Connect the power adapter to the power interface of the control unit.
2) Press the power switch of the control unit, and the system will display the booting interface as shown in Figure 5-1.

Figure 5-1

3) Enter the [Manual] interface as shown in Figure 5-2. Set the empty rate and empty volume. Click 

to empty the backfilled mineral oil in the electrode to the target volume at the empty rate.

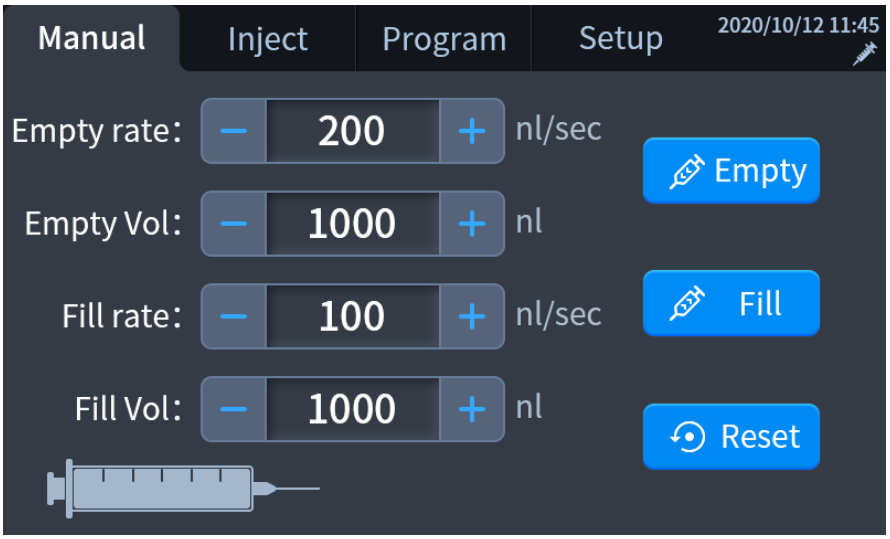


Figure 5-2

4) During the emptying process, the emptying progress will be displayed in real time on the [Manual] interface, as shown in Figure 5-3.

indicates the current emptied volume.

indicates the percentage of the current emptying process.

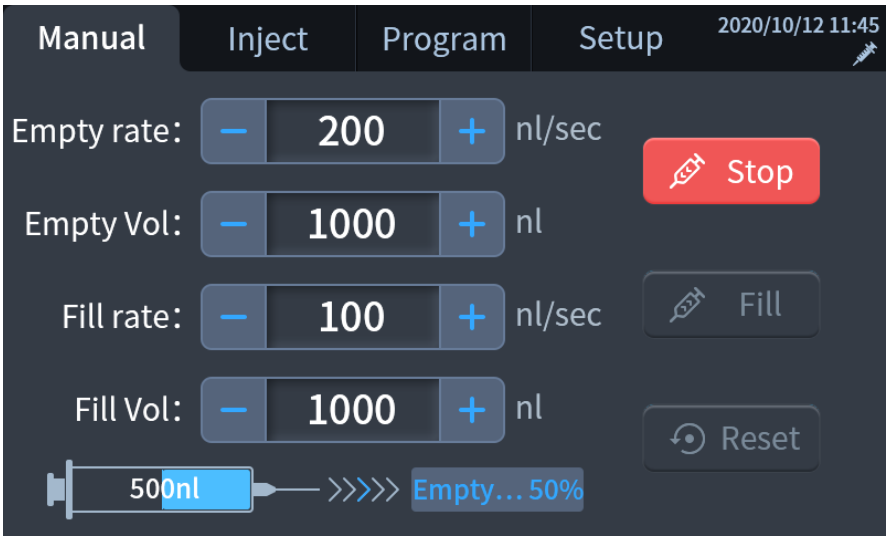


Figure 5-3

5) After the emptying is completed, the user will hear a beep and the progress percentage is 100%, as shown in Figure 5-4.

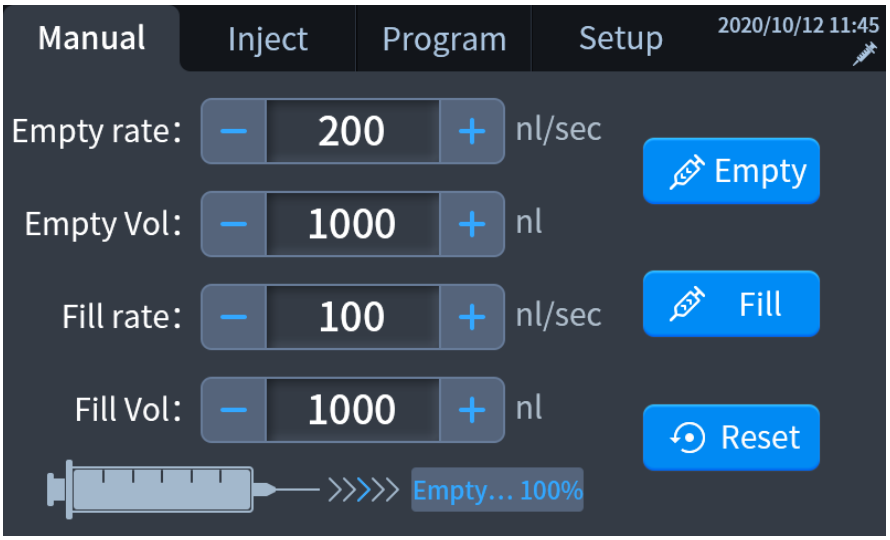


Figure 5-4

6) Set the fill rate and fill volume. Place the tip of the electrode in the required reagent, and click 

to aspirate the reagent at the fill rate and fill volume.

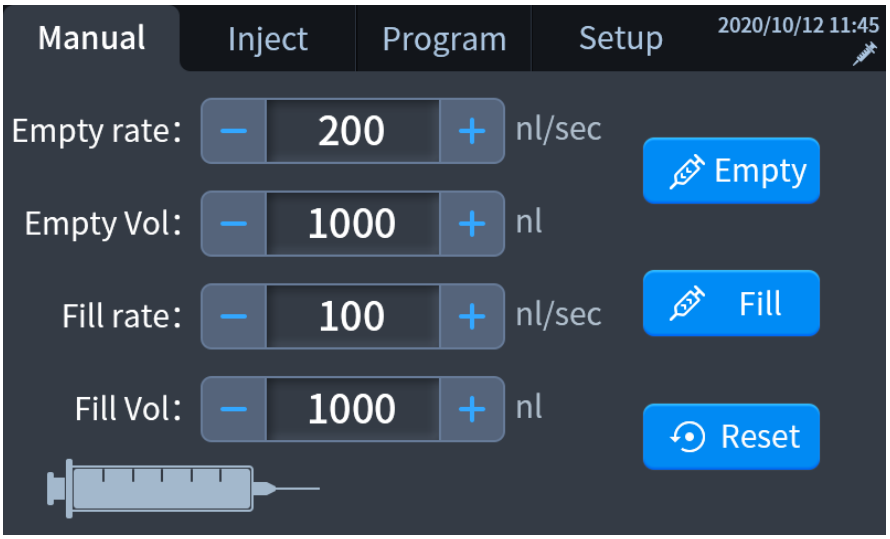


Figure 5-5

7) During the filling process, the filling progress will be displayed in real time in the [Manual] interface, as shown in Figure 5-6.

indicates the currently filled volume.

represents the percentage of the current filling process.

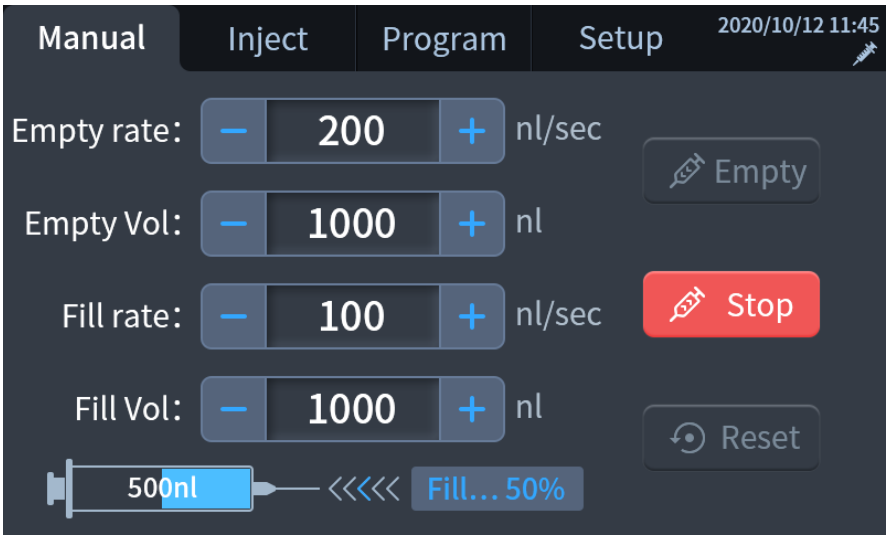


Figure 5-6

8) After the filling is completed, the user will hear a beep and the progress percentage is 100%, as shown in Figure 5-7.

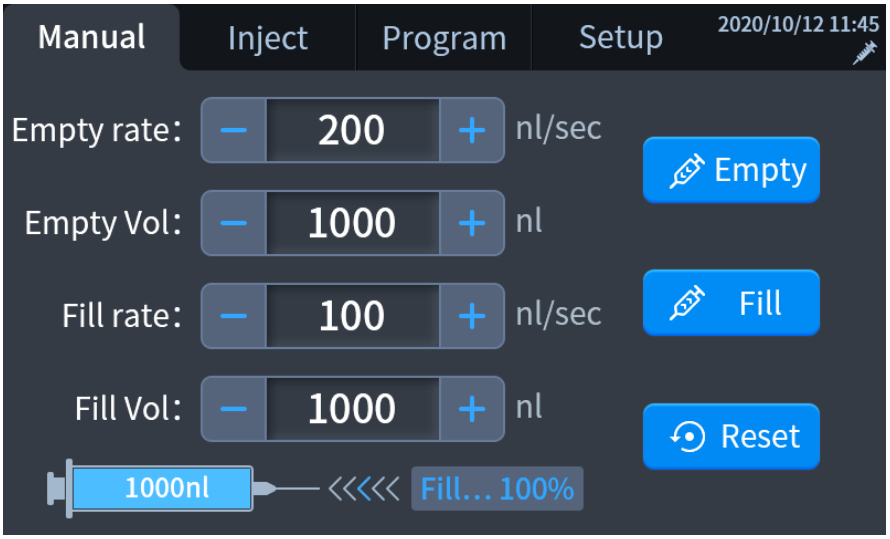


Figure 5-7

9) Click to enter the [Inject] interface as shown in Figure 5-8, set the injection volume, injection rate and retention time, and click  to inject the reagent in the target area.

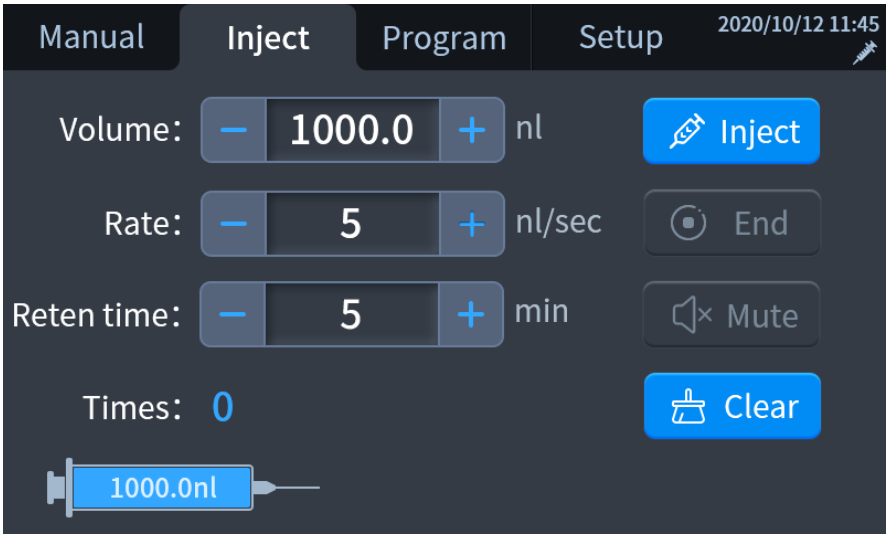


Figure 5-8

10) During the injection process, the injection progress is displayed in real time on the [Inject] interface, as shown in Figure 5-9.

indicates the current remaining injection volume.

indicates the percentage of the current injection process.

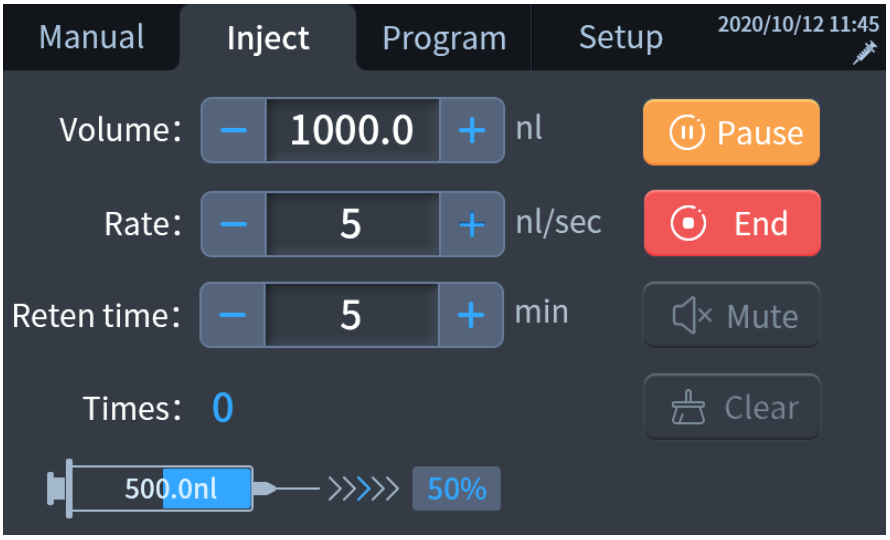


Figure 5-9

11) After the injection is completed, the user will hear a beep and the progress percentage is 100%, as shown in Figure 5-10.

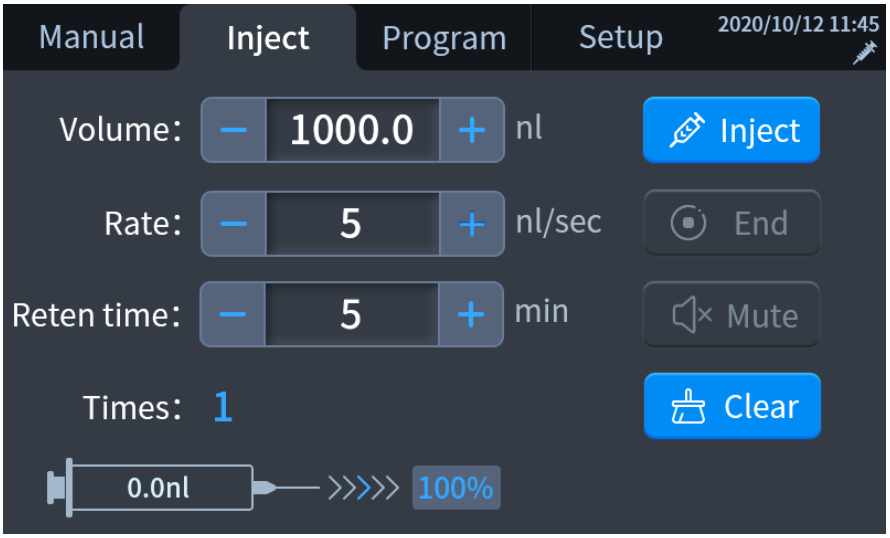


Figure 5-10

12) If the [Reten time] set in Figure 5-8 in the [Inject] interface is 0, the operation ends.

13) If the [Reten time] is not 0, enter the retention time, and the plunger no longer moves.

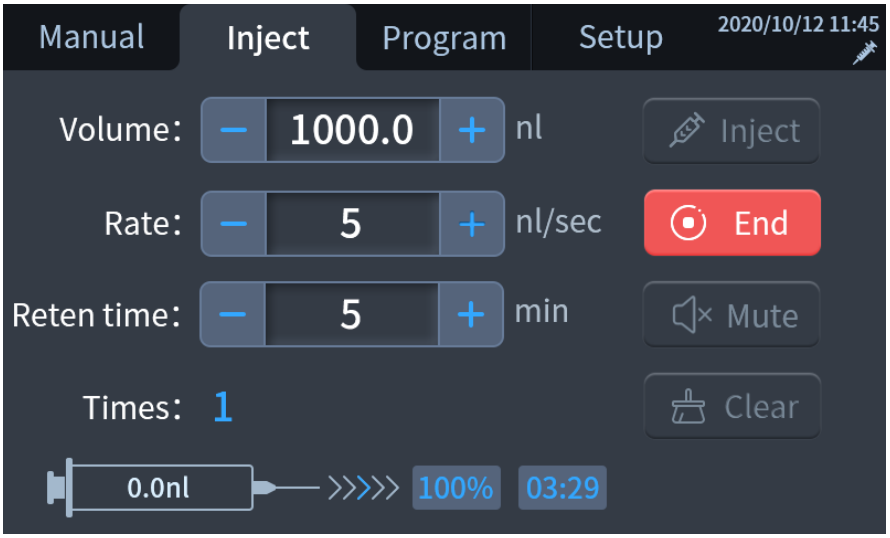


Figure 5-11

After the countdown of the retention time is completed, the user will hear a beep, and can press the 

key to cancel the beep prompt, or wait for 1 minute before the beep prompt stops automatically. The operation is over.

6-Control unit function

6.1 Manual

Enter the [Manual] interface, you should first empty the backfilled mineral oil in the electrode to the target volume, and then fill the required reagents.

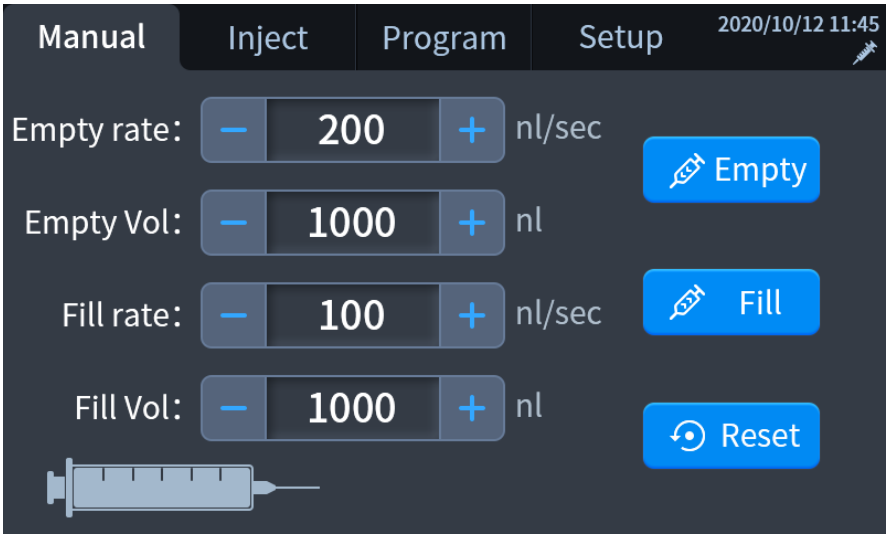


Figure 6-1

Parameters	Descriptions
Empty rate	Editable, the range is 10-200 nl/sec or 600-12000 nl/min, the minimum step is 1 nl/sec or 1 nl/min
Empty Vol	Editable, the range is 0.6-5280.0 nl, the minimum step is 0.1 nl
Fill rate	Editable, the range is 10-200 nl/sec or 600-12000 nl/min, the minimum step is 1 nl/sec or 1 nl/min
Fill Vol	Editable, the range is 0.6-5280.0 nl, the minimum step is 0.1 nl

1) Click 

to empty the backfilled mineral oil in the electrode to the target volume at the empty rate, as shown in Figure 6-2 to display the emptying progress in real time.

Click 

to stop emptying.

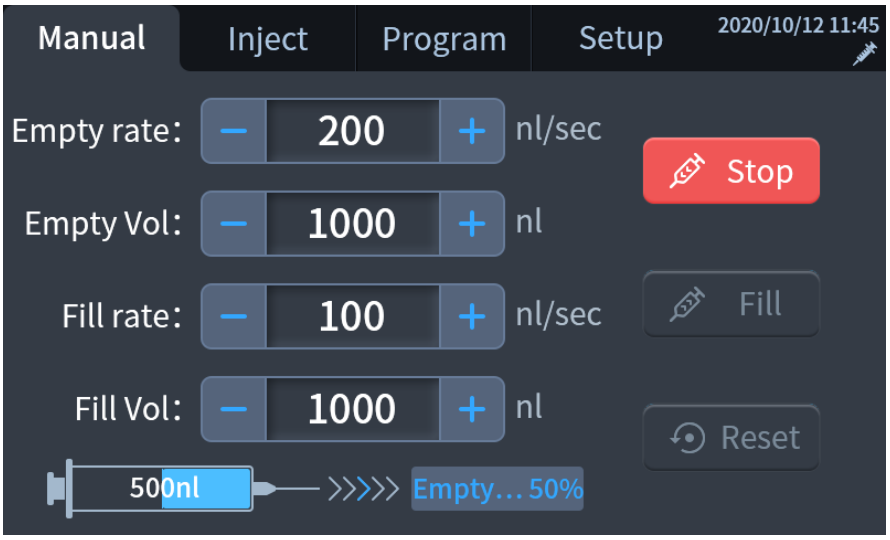
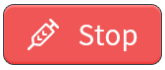


Figure 6-2

2) Place the electrode tip in the required reagent, click 

to aspirate the reagent at the fill rate and fill volume, as shown in Figure 6-3 to display the filling progress in real time.

Click 

to stop filling.

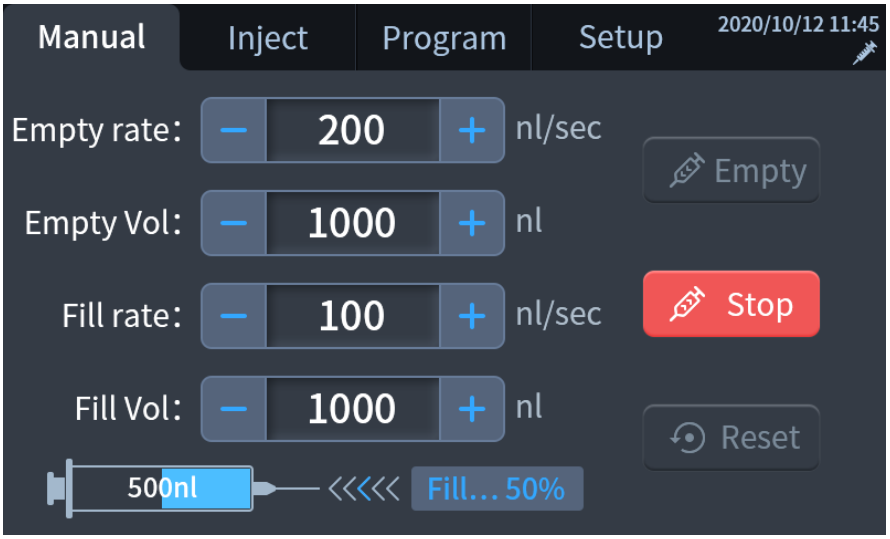


Figure 6-3

3) Click 

to return the steel plunger to the initial position, as shown in Figure 6-4.

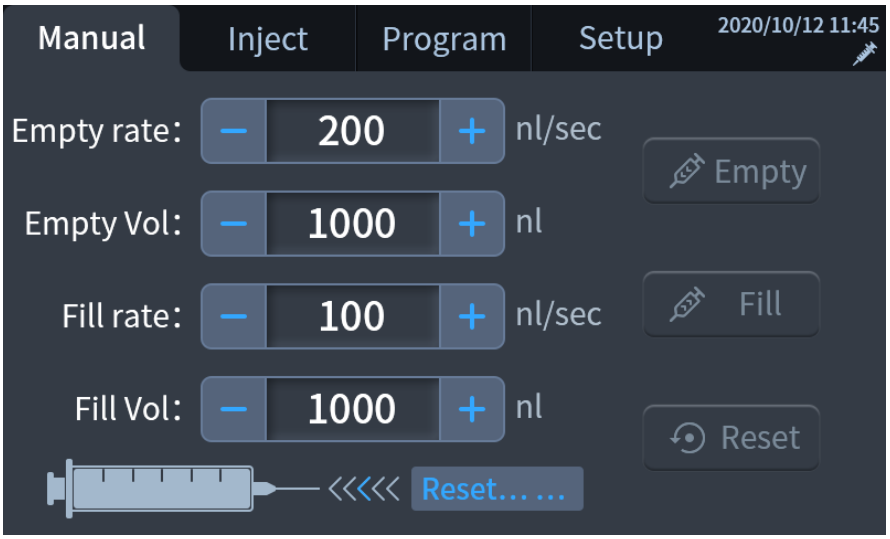


Figure 6-4

6.2 Inject

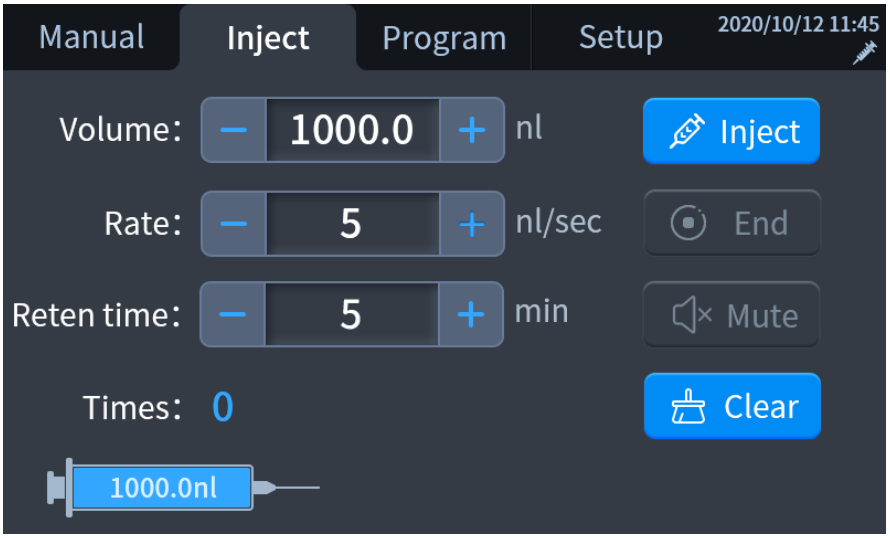


Figure 6-5

Parameters	Functions	Descriptions
Volume	Set the target injection volume	The range is 0.6-5000.0 nl, the minimum step is 0.1 nl
Rate	Set the target injection rate	The range is 1-200 nl/sec or 60-12000 nl/min, the minimum step is 1 nl/sec or 1 nl/min
Reten time	After the injection, the time during which the steel plunger does not move	The range is 0-30 min, the minimum step is 1 min
Times	Real-time display of injection times	/

1) Click 

to inject the filling reagent in the target area, as shown in Figure 6-6 to display the injection progress in real time.

Click 

to pause the program.

Click 

to end the injection.

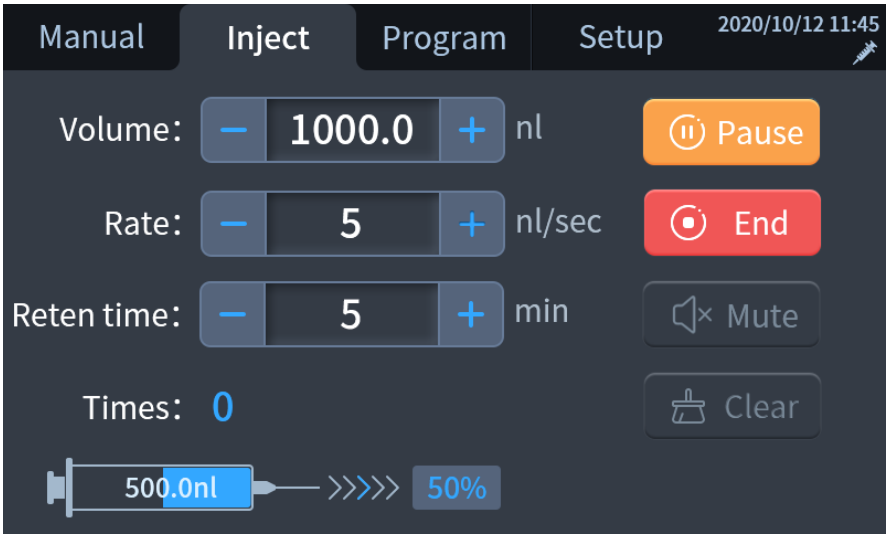


Figure 6-6

2) If the retention time is 0, the injection is over and the system will automatically record the number of injections, as shown in Figure 6-7.

Click 

to clear the injection times.

The injection times will be automatically cleared after exiting the [Inject] interface.

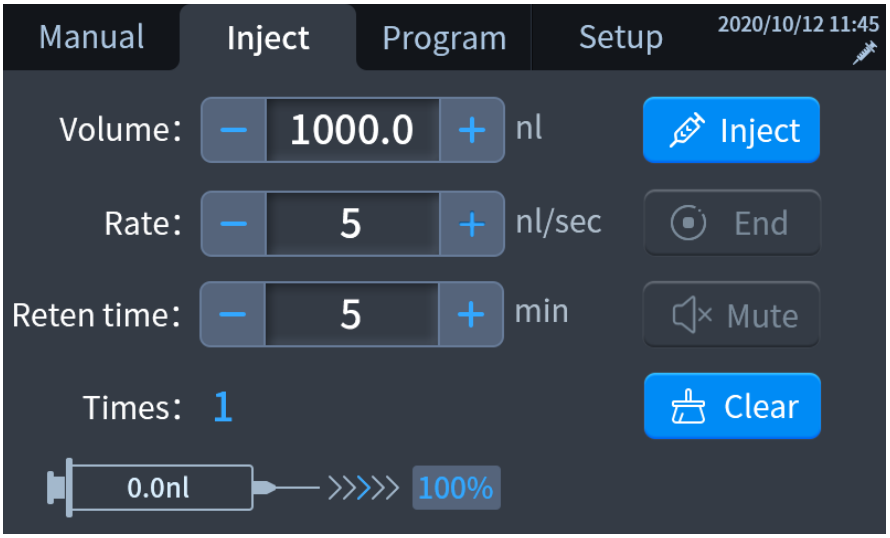


Figure 6-7

3) If the retention time is not 0, then enter the retention time interface, the retention countdown is displayed as shown in Figure 6-8.

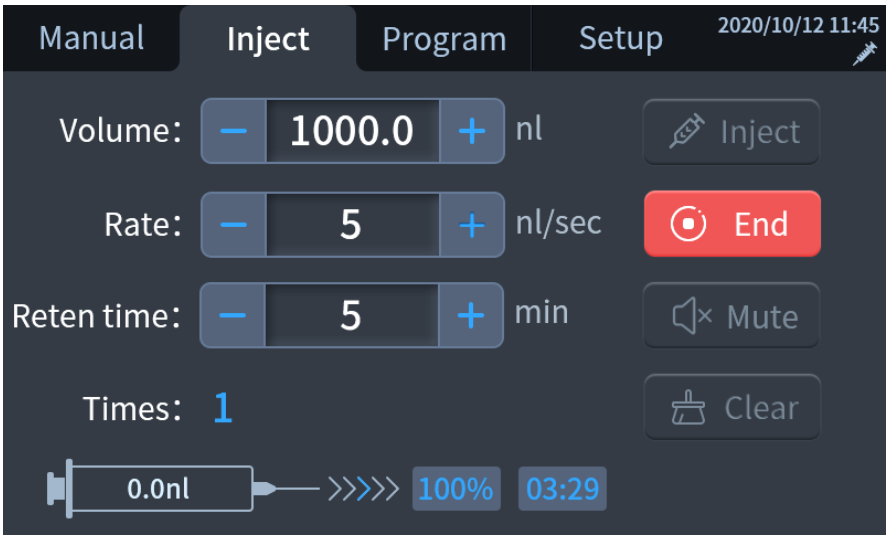


Figure 6-8

Click 

to stop the countdown of retention.

After the retention time is over, the beep will last for 1 minute, as shown in Figure 6-9.

Click 

to turn off the beep at any time and return to the [Inject] interface as shown in Figure 6-5.

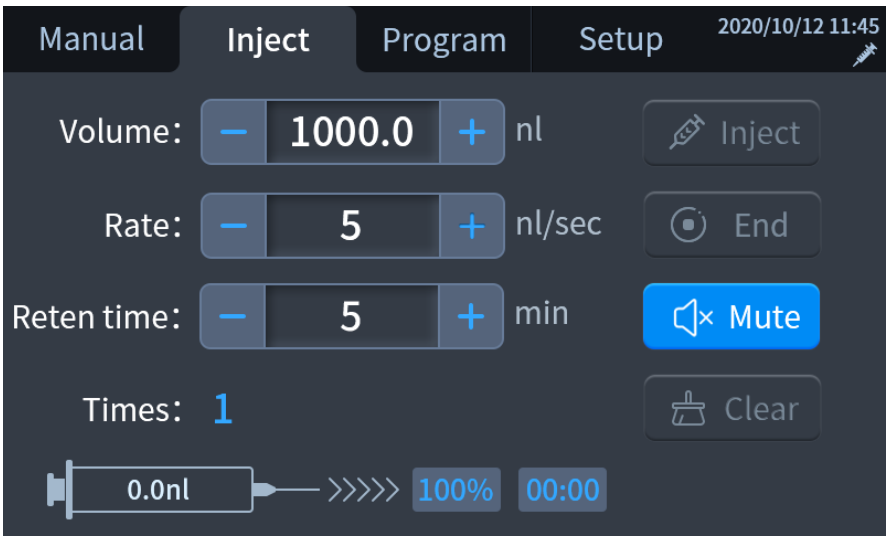

Manual
Inject
Program
Setup
2020/10/12 11:45
Volume:
1000.0
nl
Inject
Rate:
5
nl/sec
End
Reten time:
5
min
Mute
Times:
1
Clear
0.0nl
100%
00:00

Figure 6-9

6.3 Program

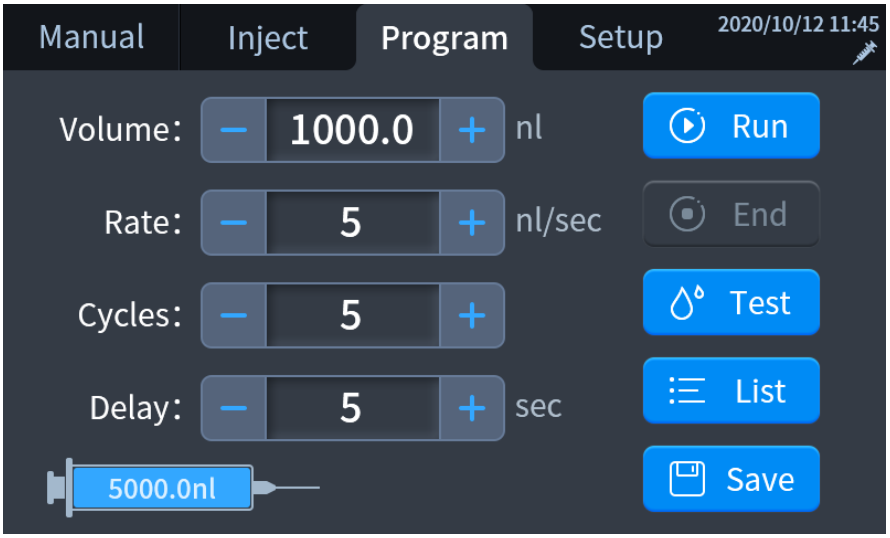


Figure 6-10

Parameters	Functions	Descriptions
Volume	Set the target injection volume	Range: 0.6-5000.0 nl, the minimum step is 0.1 nl
Rate	Set the target injection rate	Range: 1-200 nl/sec or 60-12000 nl/min, the minimum step is 1 nl/sec or 1 nl/min
Cycles	Number of repeated injections, total injection volume = Volume × Cycles	Range: 1-8000, the minimum step is 1
Delay	The length of the interval between two cycles	Range: 1-999 sec, the minimum step is 1 sec

1) Click 

to run the program to perform the injection, as shown in Figure 6-11, the injection progress will be displayed in real time.

indicates the current remaining injection volume.

indicates the ratio of the current injection times to the cycles.

represents the current process percentage.

Click 

to pause the program.

Click 

to end the operation.

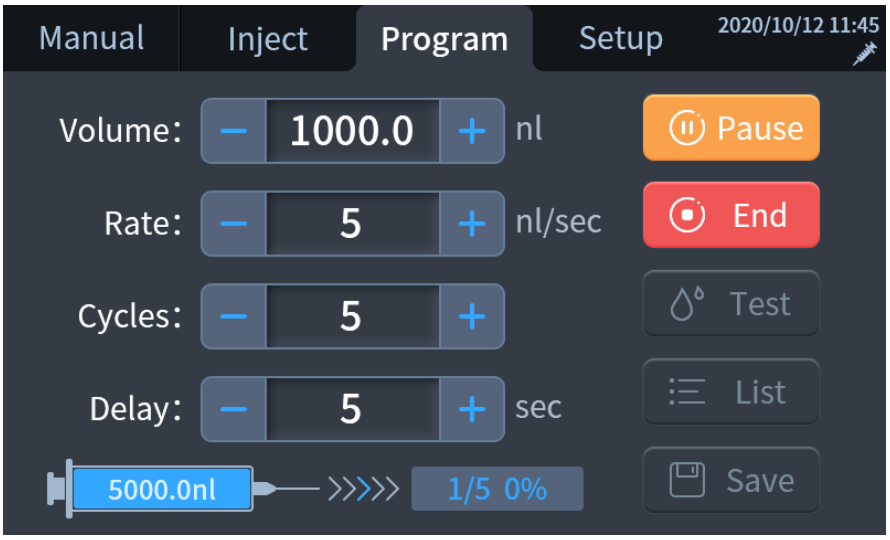


Figure 6-11

2) Click Test to run the first step in the cycle, as shown in Figure 6-12.

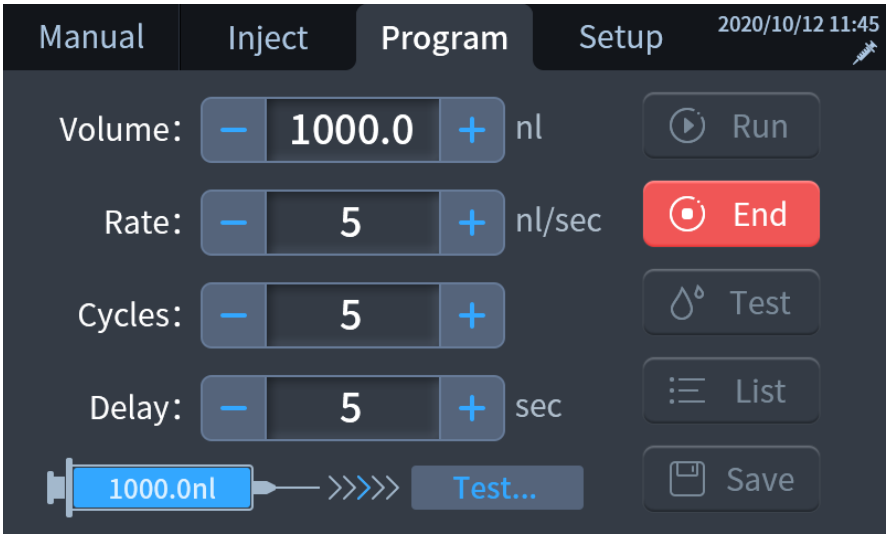


Figure 6-12

3) Click List to enter the [Program list] interface as shown in Figure 6-13.

Figure 6-13

Click Call to call the selected program and enter the [Program] interface as shown in Figure 6-10.

Click New to enter the [New program] interface, and click Edit to enter the [Edit program] interface as shown in Figure 6-14.

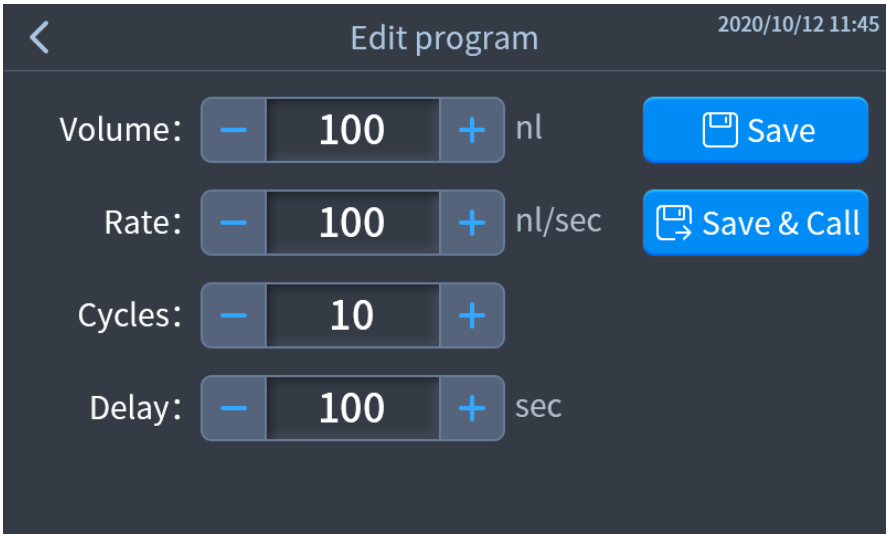


Figure 6-14

Click Delete to delete the selected program.

6.4 Setup

Enter the [Setup] interface, set the rate unit, system language, date and time, check the software version and adjust the screen brightness.

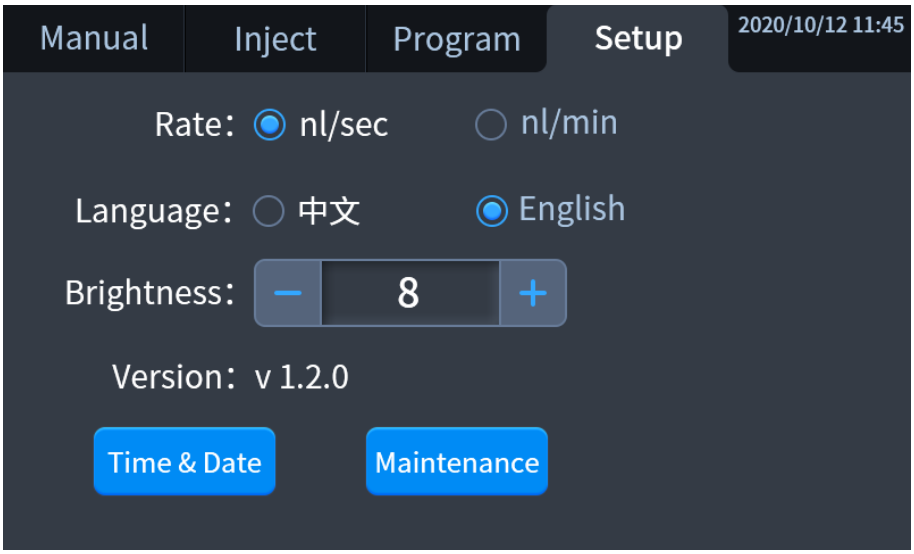


Figure 6-15

Click  to enter the [Time & Date] interface as shown in Figure 6-16.

Click  to decrease/increase the date and time value, long press to quickly decrease/increase the value.

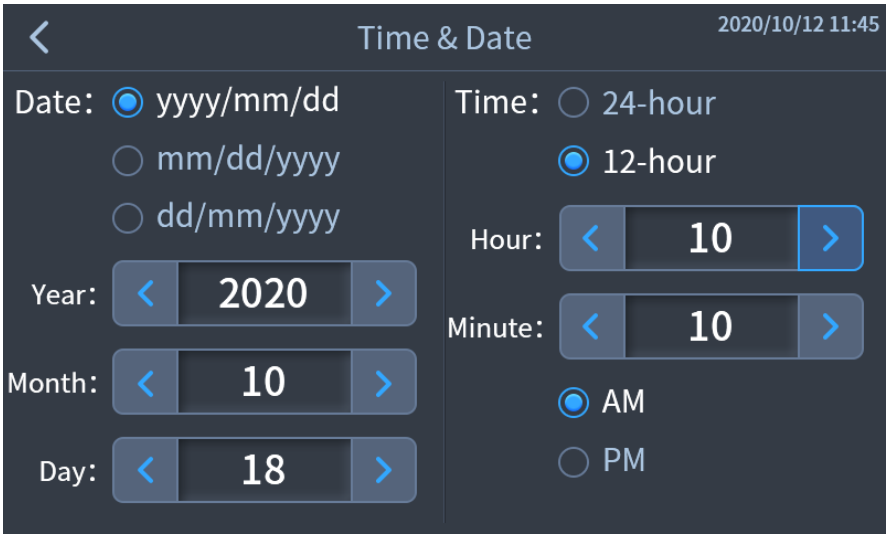


Figure 6-16

7-Footswitch operation

1) Empty

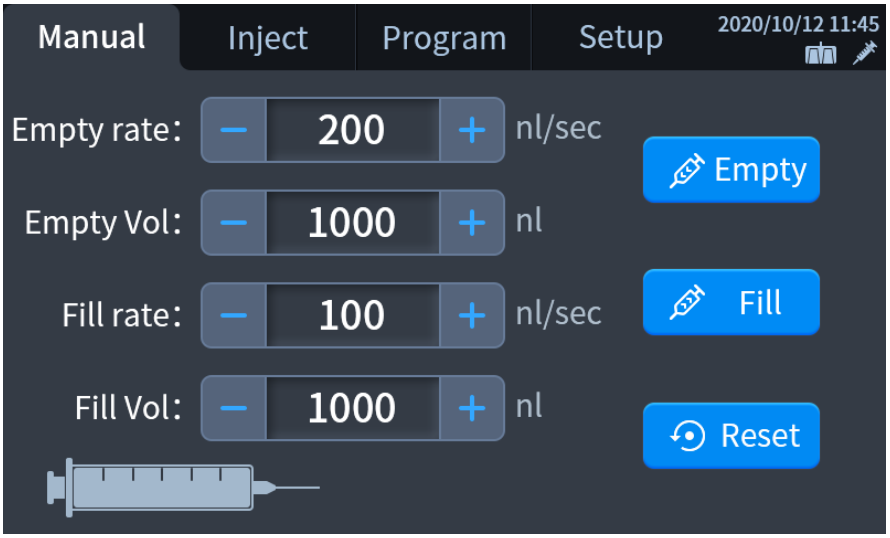


Figure 7-1

On the [Manual] interface as shown in Figure 7-1, press and hold the right footswitch for a long time to perform emptying. When the emptying is completed, a beep will be heard. Release the right footswitch to stop emptying.

The footswitch and the control unit are independent of each other during a process, that is, when the right footswitch is pressed for a long time to empty, if you want to stop the emptying, you can only release the right footswitch, and it is unable to stop emptying by clicking the button 

on the control unit.

2) Fill

On the [Manual] interface as shown in Figure 7-1, press and hold the left footswitch for a long time to fill, and a beep will be heard when the filling is completed.

Release the left footswitch to stop filling.

The footswitch and the control unit are independent of each other during a process, that is, when the left footswitch is pressed for a long time to fill, if you want to stop filling, you can only release the left footswitch, and it is unable to stop filling by clicking the button 

on the control unit.

3) Inject

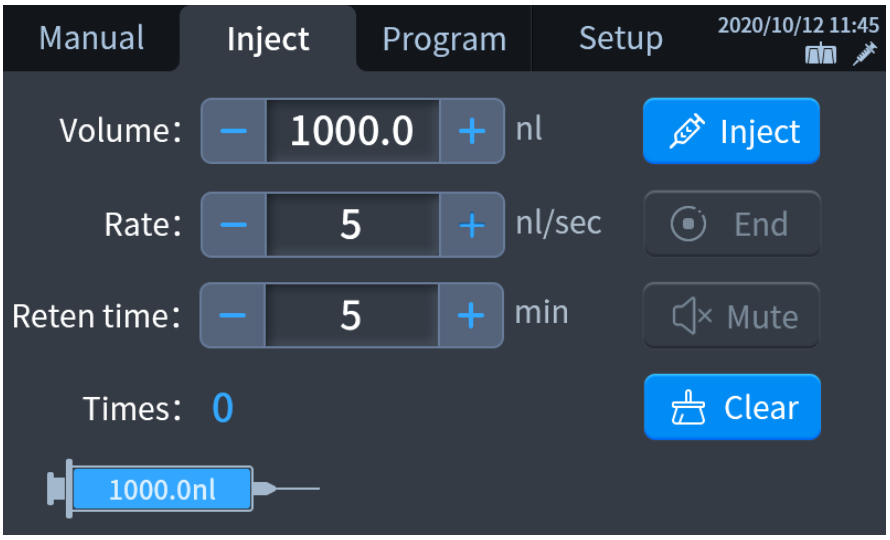


Figure 7-2

On the [Inject] interface as shown in Figure 7-2, press and hold the right footswitch for a long time to inject. After the injection is completed, a beep is heard.

Release the right footswitch to pause the injection.

When the injection is paused, press and hold the right footswitch again to continue the injection; step on the left footswitch to end the injection without a beep.

8-Troubleshooting

Issues	**Reasons**	**Solutions**
Insufficient injection reagent!	Insufficient injection reagent	Close the pop-up window, stop the injection or program, and refill the reagent
Abnormal voltage. Please restart! Please contact technical support if the issue persists after restart.	Abnormal voltage	1) Stop the injection; 2) Disconnect the power supply and restart the device; 3) If the the issue persists, please contact RWD after-sales personnel
Please restart after connecting the injection unit.	The injection unit disconnected	1) Disconnect the power supply; 2) Reconnect the injection unit; 3) Restart the device;
Footswitch not connected!	Footswitch disconnected	Reconnect the footswitch
Abnormal storage!	Data verification failed at booting	Just close the pop-up window

9-Maintenance

9.1 Clean and Maintenance

- This device should be placed steadily and horizontally to avoid vibration or collision during the movement;
- Do not place heavy objects on the device;
- Do not hit hard or use sharp objects to mark the device;
- Clean regularly to avoid dust accumulation, usually wipe the surface of the control unit and injection unit with a dry cloth, wipe the touch screen with lens paper, and do not wipe the touch screen with chemicals other than alcohol;
- Unscrew the collet and wipe off the remaining mineral oil with a dry cloth.
- If necessary, wipe the steel plunger with alcohol.
- If you will not use the device for a long time, please unplug the power cord, place the device in a suitable storage environment, and slightly loosen the collet;
- When the device parts are damaged, please contact RWD for inspection and maintenance. Personnel who are not authorized by RWD cannot disassemble the device to avoid injury to the operator or damage to the device.

10-Product Warranty

The warranty period of this device is one year, starting from the date of leaving the factory. During the warranty period, if the device cannot be used normally due to defects in materials and workmanship, the company undertakes after-sales service such as device maintenance and component replacement.

Any device damage caused by incorrect use or out-of-range use is out of the scope of the warranty, and in case of any need for repairs or parts replacement, the costs incurred should be borne by the user.

If the device returned for repair is found to have been disassembled without authorization of RWD upon arrival, RWD will not provide after-sales services such as quality warranty, free maintenance and parts replacement.

The warranty statement (including its limitations) is issued exclusively by RWD and covers all other warranty conditions.

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