RWD

RWD Life Science Co.,Ltd

Syringe Pump

User Manual **D**

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Contents

1-Introduction

1.1 Overview

First of all, thank you for choosing the R462 Syringe pump!

Before the installation and application of this product for the first time, please read all attached materials to help you use this product in a better way.

RWD Life Science Co., Ltd. is committed to continually improving product features and service quality, and reserves the right to make changes to the user manual and any product mentioned herein without prior notice.

For the latest product information, please call or write us or visit our website (http://www.rwdstco.com/). Please contact RWD in the case of any inconsistency between actual conditions of product and the user manual, or any question or suggestion, during your application of equipment.

1.2 Safety

When operating the system, please read the "**2-System Safety**" section carefully to avoid damages to operators and the instrument during application.

If you have any question or suggestion regarding safety, please contact RWD for after-sales support.

The equipment is only used for animal experiments and preclinical researches. Application on humans is strictly prohibited!

This equipment should be operated and managed by trained professionals!

1.3 Comprehensive description

The syringe pump is a device that pumps a small amount of liquid into the body accurately, evenly and continuously. It can be classified into medical and non-medica, laboratory syringe pumps and industrial syringe pumps by use. The R462 syringe pump developed and produced by RWD is a non-medical laboratory syringe pump.

It consists of step motor and driver, lead screw and bracket, etc., with reciprocating screw and nut. The nut is connected to the piston of the syringe, and the product is precisely controlled

by software to realize high-precision and stable liquid transmission. The syringe pump can be commonly used for long time uniform infusion in life science research, which can not only greatly alleviate the labor intensity of the staff, but also accurately control the usage amount of various reagents.

1.4 Product features

- Light and compact structure, touch screen, user-friendly interface, and easy to handle
- High-precision injection, accurate control of capability, and the accuracy can reach ±0.35%
- Built-in inner syringe diameters of multiple brands, and increase in the universal inner diameter options of domestic plastic syringes for ease of operation
- Multi-step setting is added to meet the demand for different flow rate and modes in one experiment
- Custom programs can be saved. The movement modes commonly used can be named and saved for calling next time and avoid repeated setting of parameters
- The running interface has infusion animation tips to show the movement progress for observation

1.5 Environment requirements

The instrument operating environment is prepared according to the conditions listed below to ensure the operability and safety of the system.

Working environment	Temperature: 4℃~40℃
	Humidity: 20%-80% (non-condensing)
Storage environment	Temperature: -10℃~60℃
	Humidity: Relative humidity is no more than 95%
	Air pressure: 70kPa～110kPa
Operating voltage	Input 100-240 VAC, 50-60 Hz, output 24V 3A Supporting 110V/220V

1.6 Product parameters

Operating mode	Infusion / withdrawal
Infusion precision	±<0.35%
Stroke by step	No less than 0.046μm/step
Repeatability	±<0.05%
Syringe specification	0.5μL-60 mL
Minimum flow rate	0.0001μL/min (0.5μL syringe)
Maximum flow rate	102 mL/min (60mL syringe)
Drive mode	1.8 °step motor with 1/64 microstepping
Maximum linear thrust	23 kg
Operating noise	≤64dB

1.7 Product list

Configuration	**Items**	**Qty**	**Description**
Standard	Host	1	Syringe pump
Standard	Power adapter	1	Providing power supply
Standard	Power cable	1	For connection with power supply. National standard, American standard, European standard, British standard power lines for option

2-System safety

⚠ Please read the safety instructions carefully. For safety's sake, please be aware of the following:

- **Correct connection cables**
  Make sure all connection cables are safely and securely connected to the equipment.
- **Avoidance of all exposed electronic cables**
  Do not touch any electronics and wiring inside the equipment!
- **Shutdown due to suspected failure**
  In the case of equipment safety hazard or failure of normal operation, please contact the authorized technical support personnel.
- **Correct connection of equipment**
  Connect the equipment correctly to avoid operation difficulty or even disconnection of equipment due to incorrect connection.

2.1. Notes

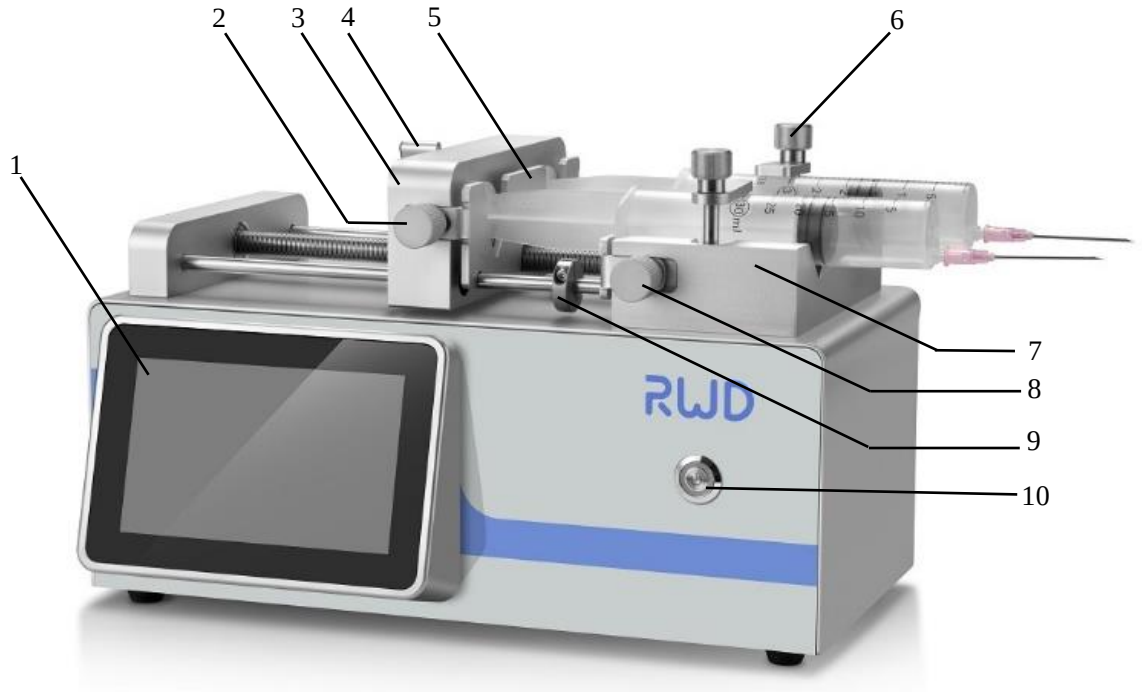
- Plug in the power cord to prevent improper power contact.
- Pay attention to shockproof, waterproof, moisture proof, pressure proof and fireproof measures.
- During moving and handling equipment, pay attention to handling strength to prevent damages to instrument or falling of instrument.
- It is strictly forbidden for untrained personnel to operate the equipment. Please use a reliable grounding device.
- The responsibility for equipment failure arising from any improper cleaning, maintenance and operation of the equipment should be borne by the user.
- If the equipment is disassembled without the authorization of RWD, we will no longer fulfill its commitments for quality assurance and technical maintenance services to the equipment. For any technical problems please contact the authorized personnel or RWD for supports.

2.2 Safety sign

The following signs may be included in this User Manual to warn users of potential hazards:

Property damage warning, this signs warns user that this operation may cause equipment damage.

3. Product structure and interface introduction



S/N	Part name	Description
1	Display screen	Display the operation interface
2	Locking nut	Lock up the push-pull fixation clamp (left)
3	Propulsion slider	Push/pull the piston rod of the syringe
4	Slider locking knob	Lock up/release propulsion slider
5	Push-pull fixation clamp	Fix the piston rod of the syringe
6	Syringe fixation clamp	Fix the body of the syringe
7	V-shaped groove	Fix the body of the syringe
8	Locking nut	Lock up the push-pull fixation clamp (right)
9	Spacing ring	Safety limit
10	Power switch	ON/OFF

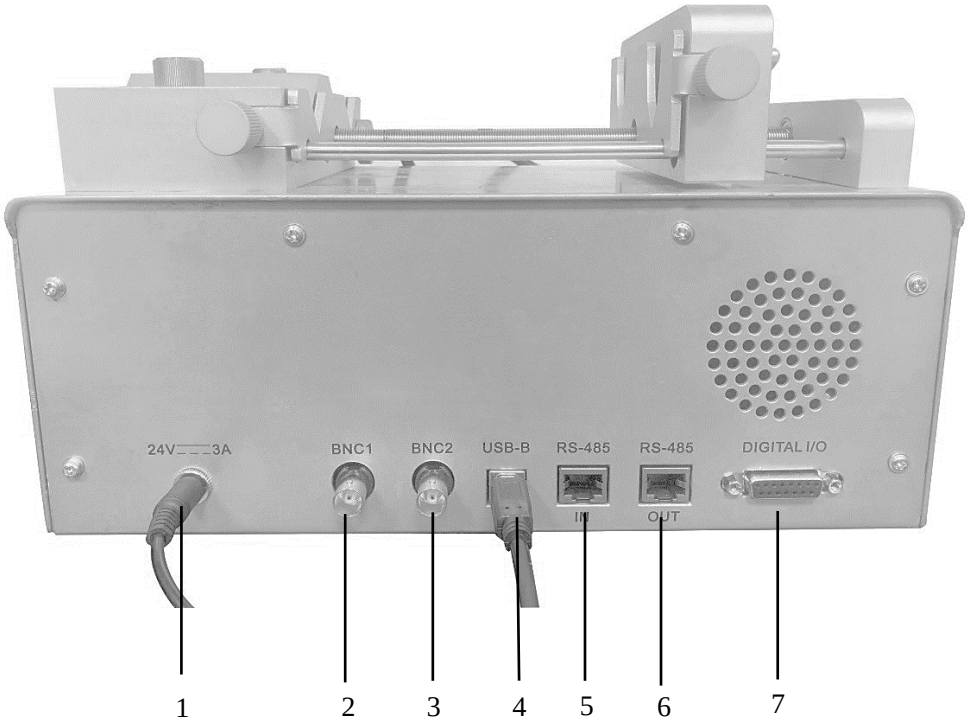
- **Syringe installation**

1) Firstly loosen the slider locking knob (4) in the indicated direction first, push the propulsion slider (3) to the far left;
2) Loosen the locking nut (2) and locking nut (8), and pull the push-pull fixation clamp (5) on both sides to the maximum position;
3) Lift the syringe fixation clamp (6), rotate it 90 degrees and put it down, then place the syringe into the V-shaped groove (7);
4) Adjust the push-pull fixation clamp (5) to make the body and tail of the syringe to it,

move the propulsion slider (3) according to the syringe position, and fix the end of the syringe push rod in the push-pull fixation clamp (5) and lock it up;

5) Adjust the position of locking nut (2) and locking nut (8) so that the syringe can be firmly fixed;
6) Finally, lock up the slider locking knob (4), lift the syringe fixation clamp (6), rotate 90 degrees and put it down, clamp the syringe, and then complete fixation.

- **Back interface**

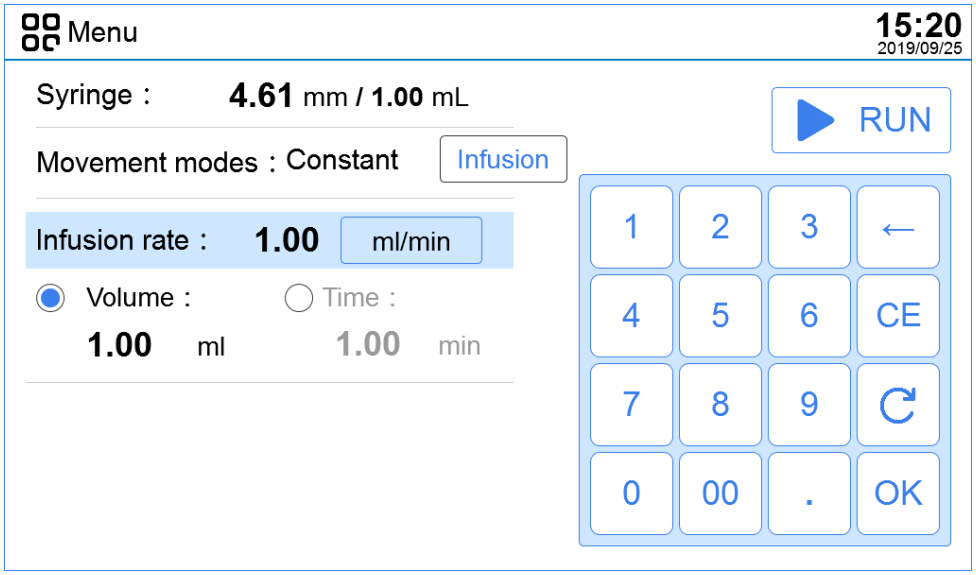


S/N	Interface name	Function
1	Power input port	Power supply
2	BNC1	Communicate with other equipment
3	BNC2	Communicate with other equipment
4	USB B type	PC communication (reserved interface)
5	RS485	Communication between pumps, input
6	RS485	Communication between pumps, output
7	15-needle D-sub connectors	TTL remote start/stop, digital signal I/O

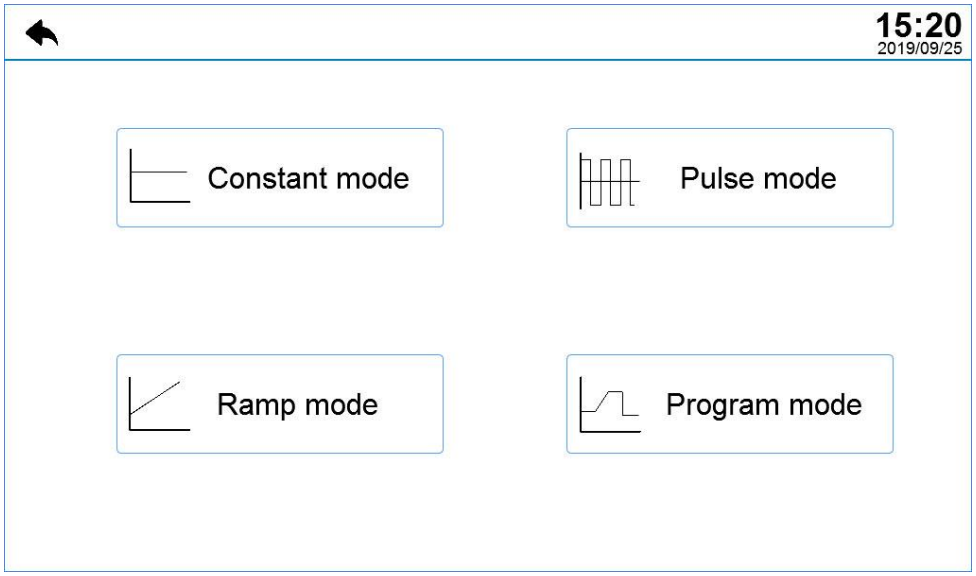
4-Function

4.1 Start-up

Press the power button to start up the equipment. After system initialization, it will automatically enter the following interface.



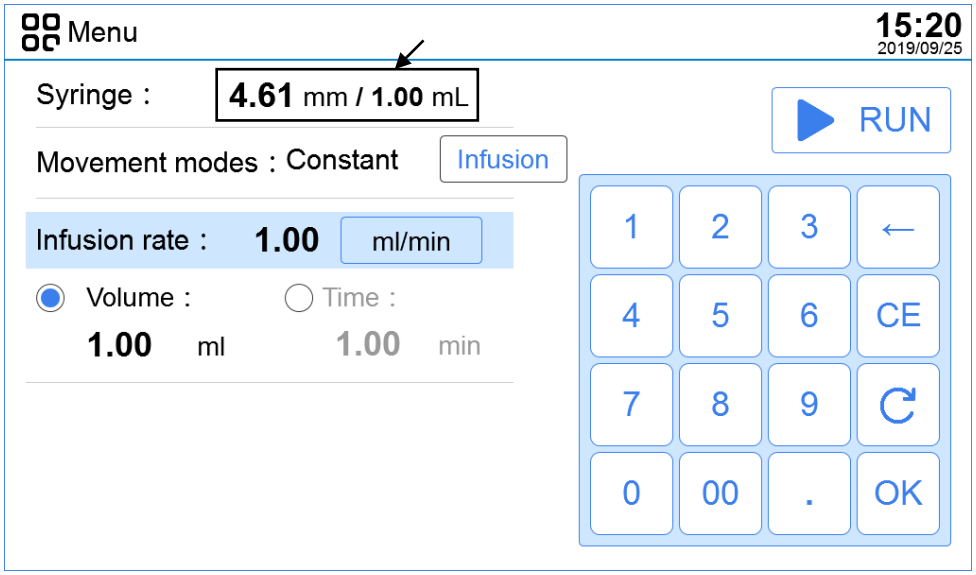
The syringe pump has four movement modes, including: Constant mode, ramp mode, pulse mode and program mode. After system initialization, the equipment enters the [Constant mode] interface by default. Click the [Constant mode] to enter the following interface to switch to the other three modes. Similarly, when in other three modes, click this mode to return to the selection interface and select other modes.



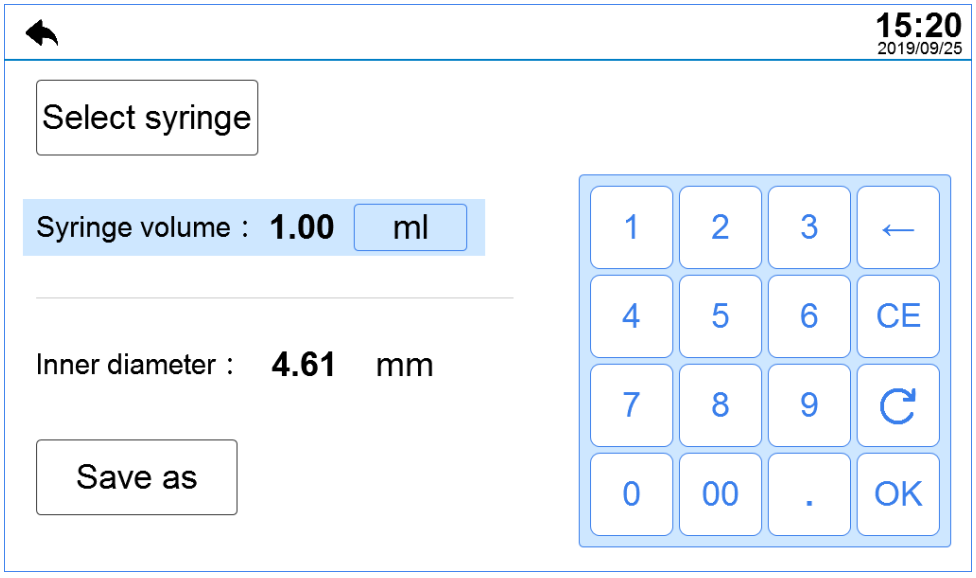
4.2 Parameter setting

Before the syringe pump running, set relevant parameters. The parameter settings in each movement mode are described as follows.

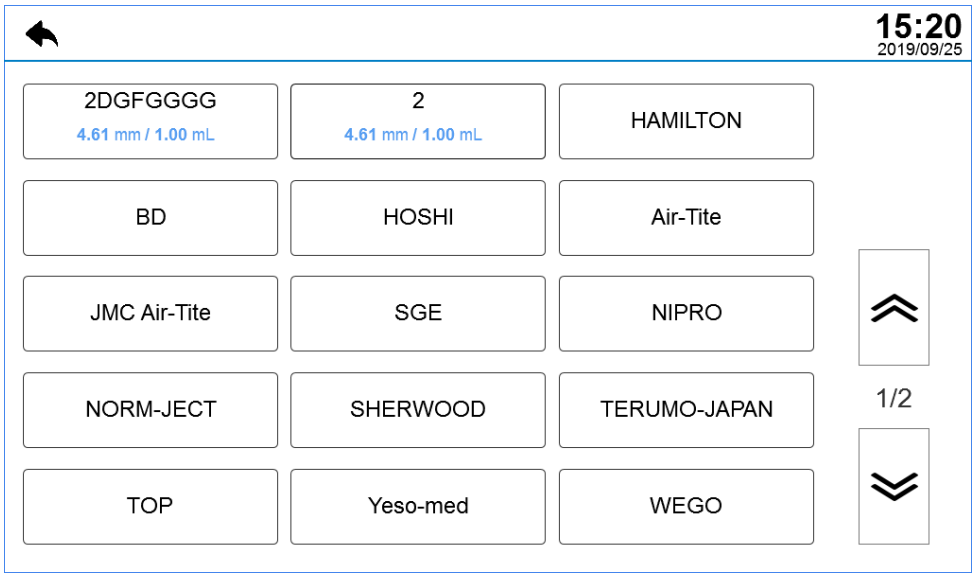
4.2.1 Constant mode



Click which in the black frame above to directly enter the syringe setting interface.



Click [Select Syringe] to select the brand and specifications of the syringe.



If the syringe used is not included in the default brand, manually set the specifications and inner diameter of the syringe used and then click Save as to save and name the manually set syringe parameters for the future calling. After setting, click [OK] to save the setting, and click to return to the previous interface.

Specification and inner diameter setting range of syringe: 0.5µL~60mL

Inner diameter setting range of syringe: 0.103~32.573mm

Note: For the entry of setting range of all parameters of this equipment, there will be tips popping up on the top of the software interface, without further description below.

Under the [Constant Mode], the default infusion direction is [Infusion]; click Infusion to switch to other three infusion directions:

Withdrawal, I→W and W→I in sequence, select as needed.

The parameter setting method corresponding to each direction is basically the same: then,

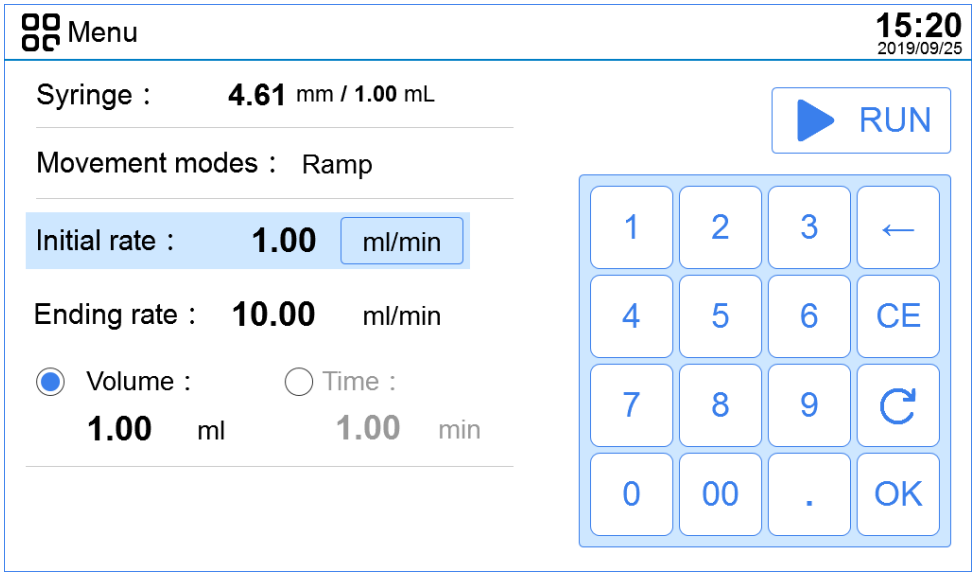
either set the **infusion / withdrawal rate**, the **infusion volume / withdrawal volume** or set the **time** (alternative) to complete setting.

After completing the above setting, click 

to start the running of the syringe pump.

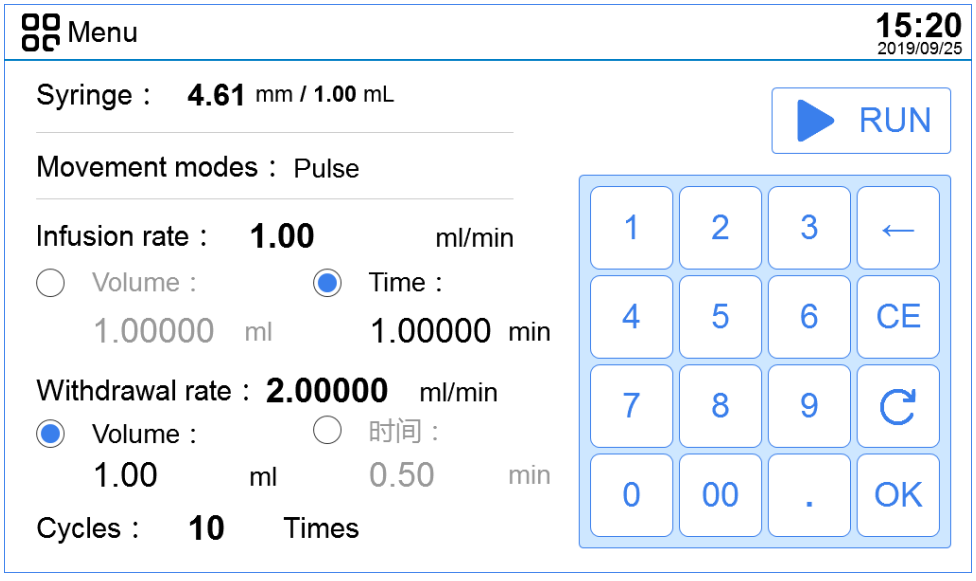
4.2.2 Ramp mode

Select and switch to the [Ramp Mode]. The syringe parameter setting is the same as above. In the ramp mode, the **Initial rate** and **ending rate** of the syringe pump need to be set. Select either the **volume** or the **time**, with the setting range same as the [Constant mode].



4.2.3 Pulse mode

Select and switch to the [Pulse Mode]. The syringe parameter setting is the same as above. In the pulse mode, the **infusion speed** / **withdrawal speed** and the **Cycles** times need to be set. Select either the **infusion volume** or the **time**, with the setting range same as the [Constant mode].



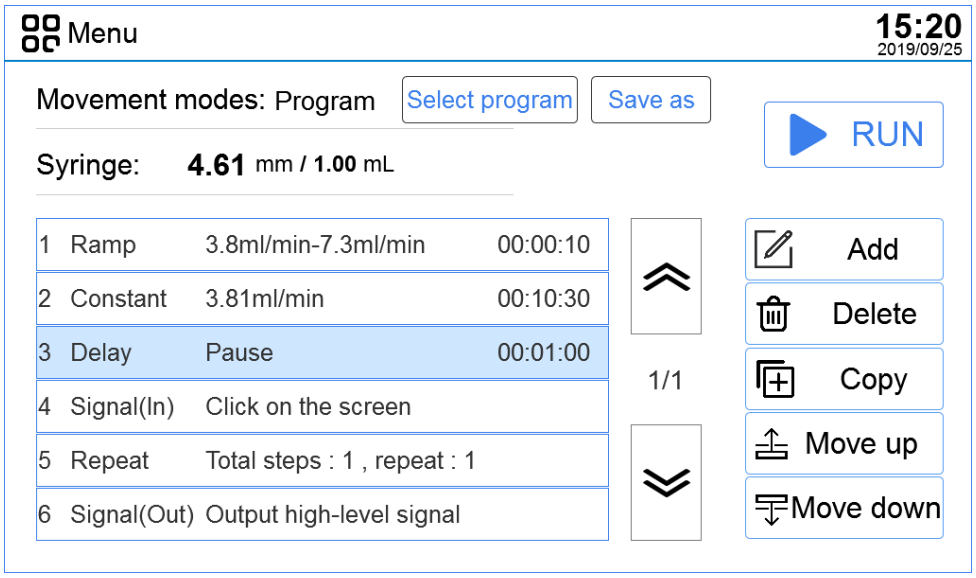
4.2.4 Program mode

Shift to the [Program mode]. Custom running step list can be added here for making the syringe pump to perform costom setting in sequence. Its setting is more complicated than the other three ones. Except that the syringe parameter setting method is the same as above, the rest of the settings are described as follows.

The [program mode] provides seven custom types such as Constant, Ramp, Repeat, Delay, Signal In, Signal Out, and Stop for selecting.

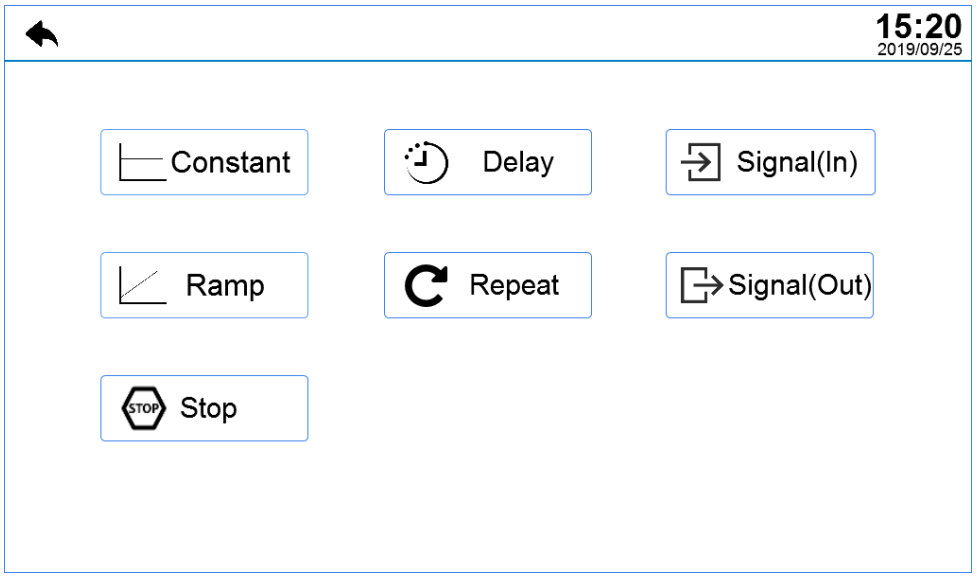
A maximum of 2000 steps can be set which includes the number of repetitions of the repetitive steps.

In the [Program mode], click the corresponding key to add, delete, copy steps. Either move the position of the selected program via the [Move up] and [Move down] keys in the figure below, or click to select the program once to change parameters.

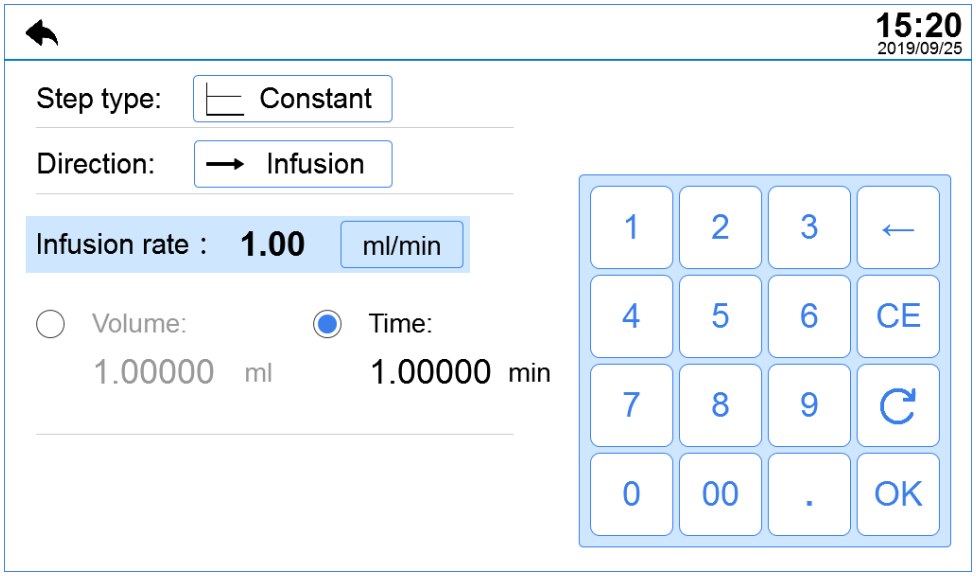


- **Add**

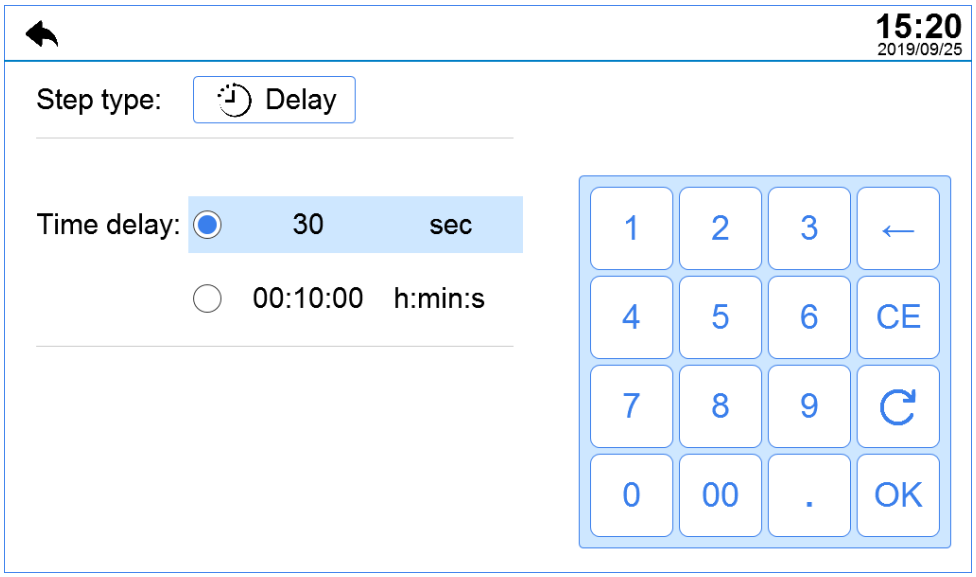
Click [Add] to enter the step addition interface and select the step type



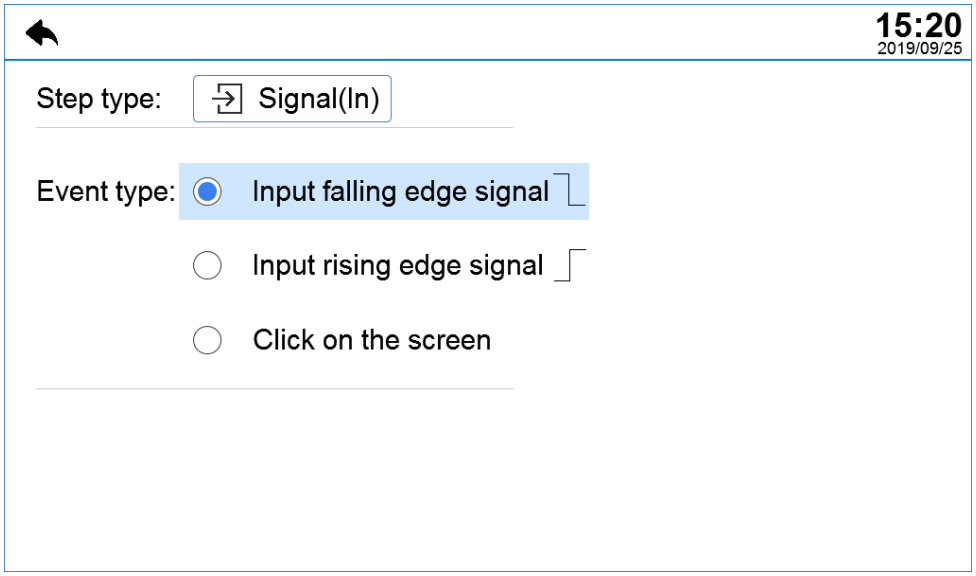
Click [Constant] to set constant steps. For the setting method, please refer to 4.2.1 Description of constant mode setting. Note that the direction of the constant mode here only includes **infusion** and **withdrawal**.



Click [Delay] to enter the following delay step setting interface. Input the custom delay time of this step with the numeric keyboard.

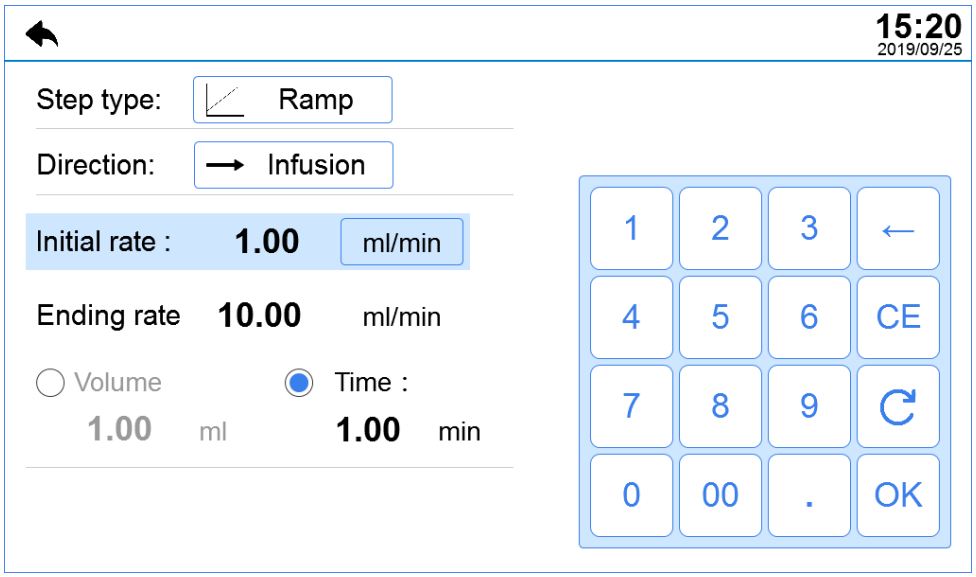


Click [Signal In] to enter the following interface. In this step, click to select the event type as the signal input. There are three event types in total: Input falling edge signal, Input rising edge signal, and Click on the screen.

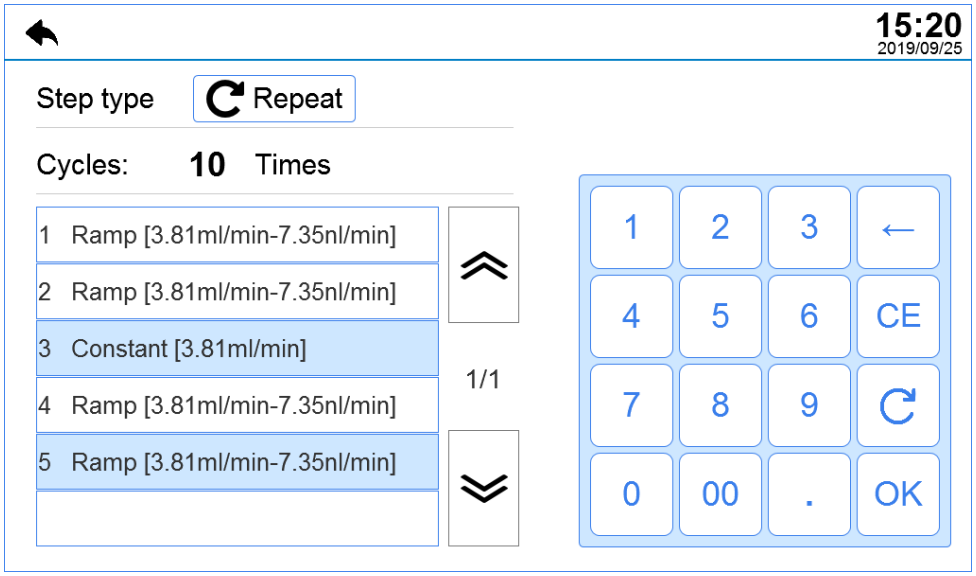


Click [Ramp] to enter the following ramp step setting interface. In this mode, the infusion direction includes: **infusion / withdrawal**.

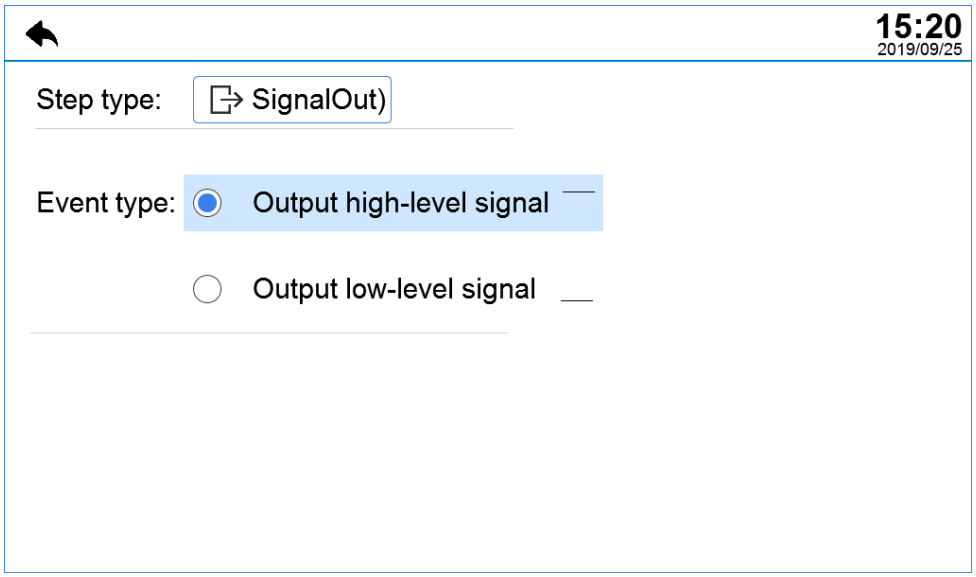
For the setting method, please refer to Section 4.2.2 [Ramp mode].



Click [Repeat] to enter the repeat step setting interface. Set [Cycles] in this interface which supports multiple steps section for repeating. (‘Repeat’ and ‘stop’ steps cannot be selected)



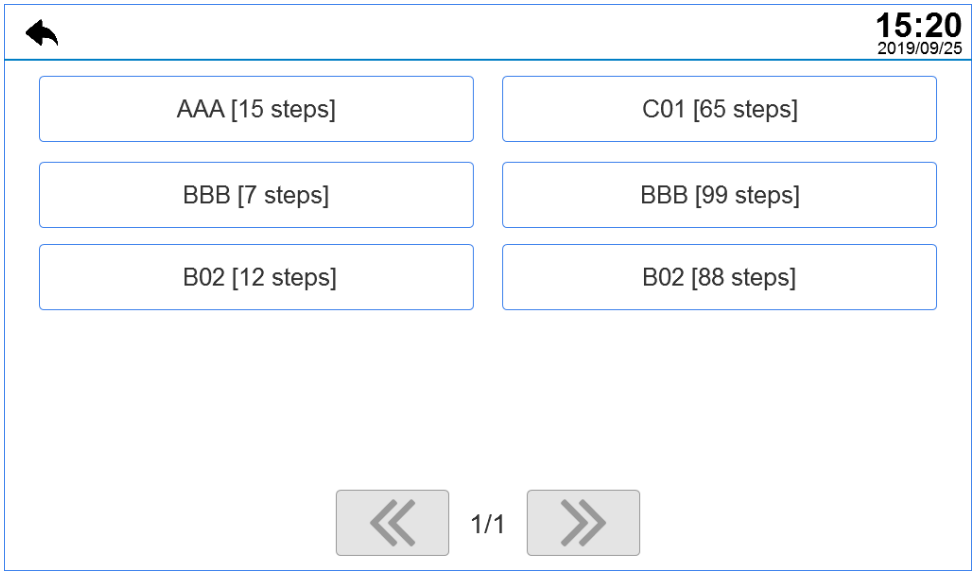
Click [Signal Out] to enter the following signal output interface. In this step, click to select the event type as the signal output. There are two output types in total: Output high-level signal, and output low-level signal.



Click [Stop] to immediately return to the program mode interface, and add a ‘stop’ step to the list without additional setting.

- **Select program**

Click [Select Program] to enter the program selection interface, on which all custom program names displayed for selection.



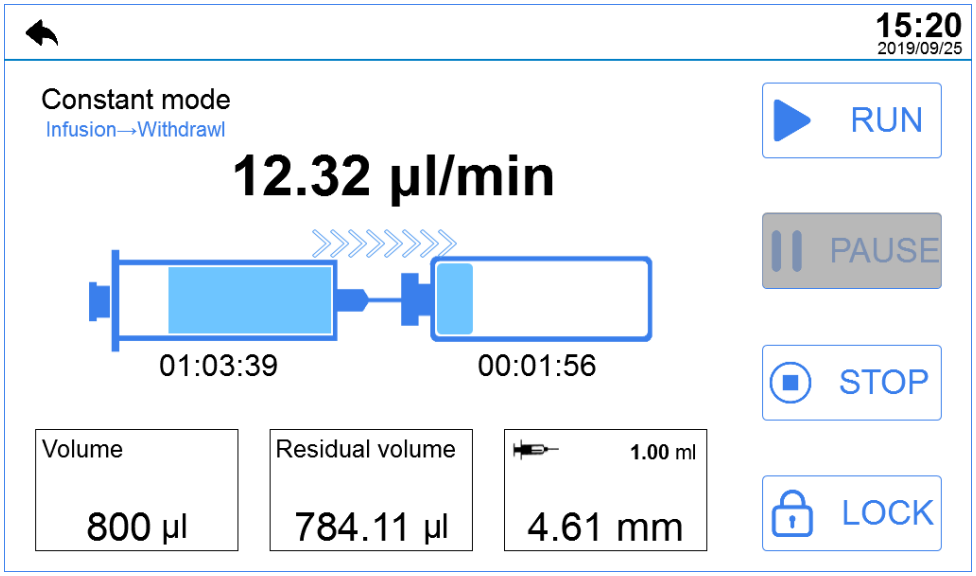
4.3 Run

Firstly select the movement modes and relevant operating parameters, and saves them, click the 

key on the corresponding mode interface. The running interface of the [Constant mode] is shown as follow.

In the running interface, the infusion or withdrawal direction of the syringe is obvious, also

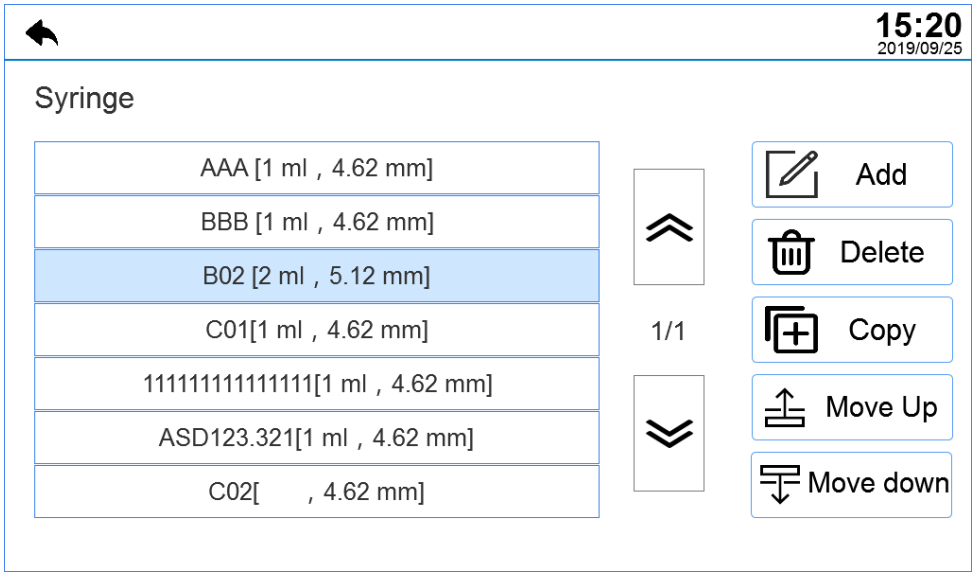
the amount of infusion / withdrawal, the remaining amount, and such parameters as brand, specifications and inner diameter of selected syringe. Click [pause] on this interface. If the equipment is powered off during running or pause, when it is started up next time, it will still return to the most recent and unfinished running data, such as syringe management, step management, system settings, date and time, so the trouble of data loss can be resolved.



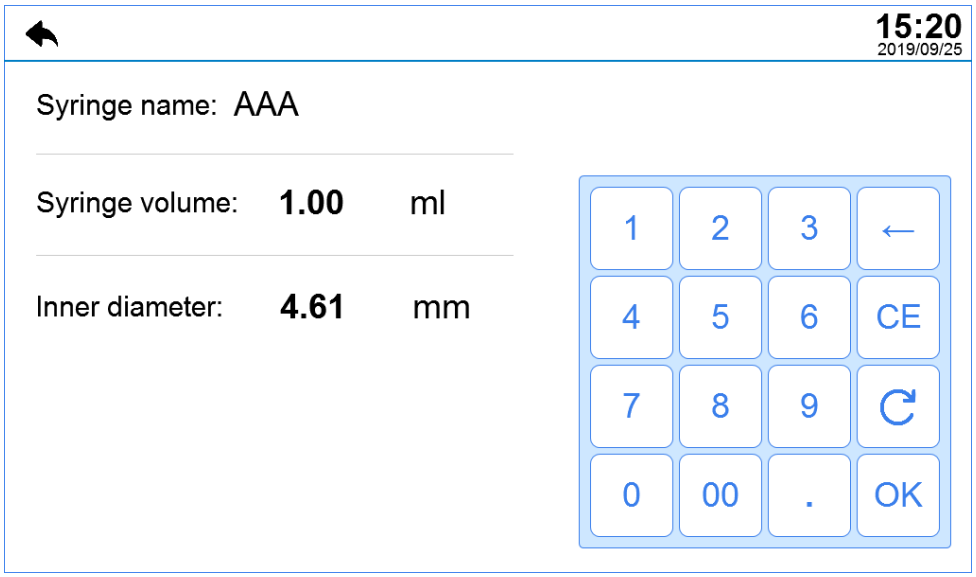
4.4 Menu interfaces

4.4.1 Syringe management

Click [Syringe] to enter the following interface

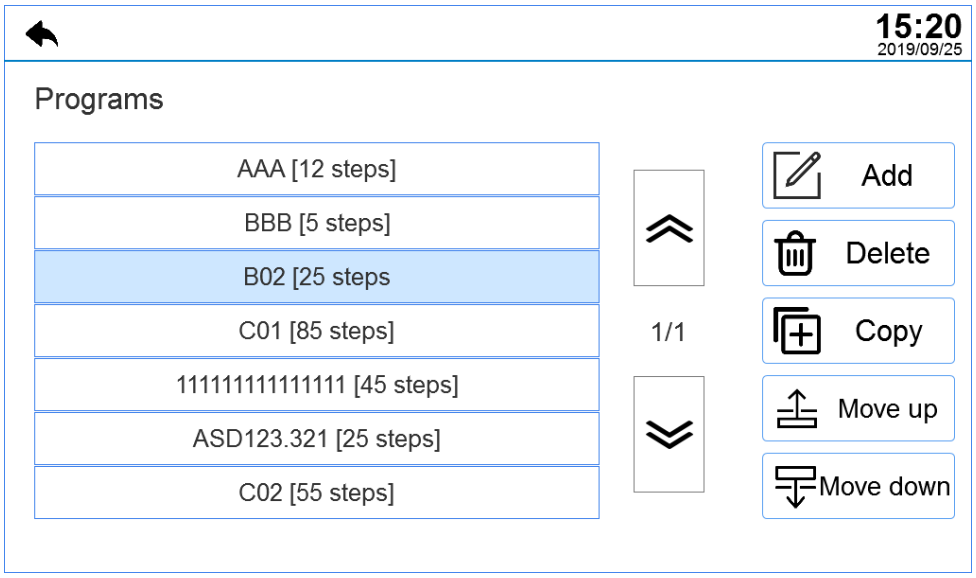


Click [Add] to add a new syringe name, specification and inner diameter parameter, and save them in the syringe management list. The reserved syringe parameter can be called directly when syringe is set.



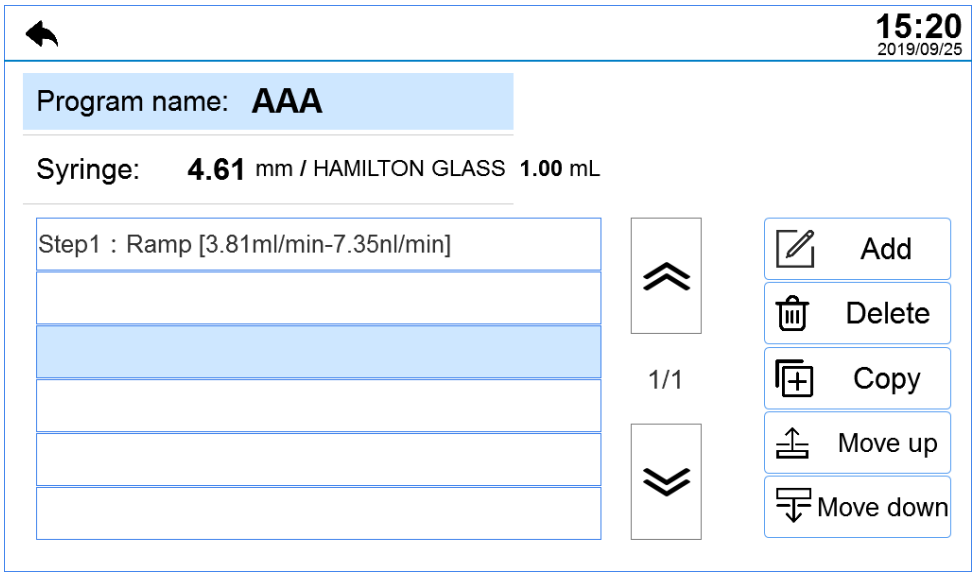
4.4.2 Programs management

This interface displays a list of saved custom programs. Add, delete and copy the programs on this interface. Up to 50 programs can be saved.



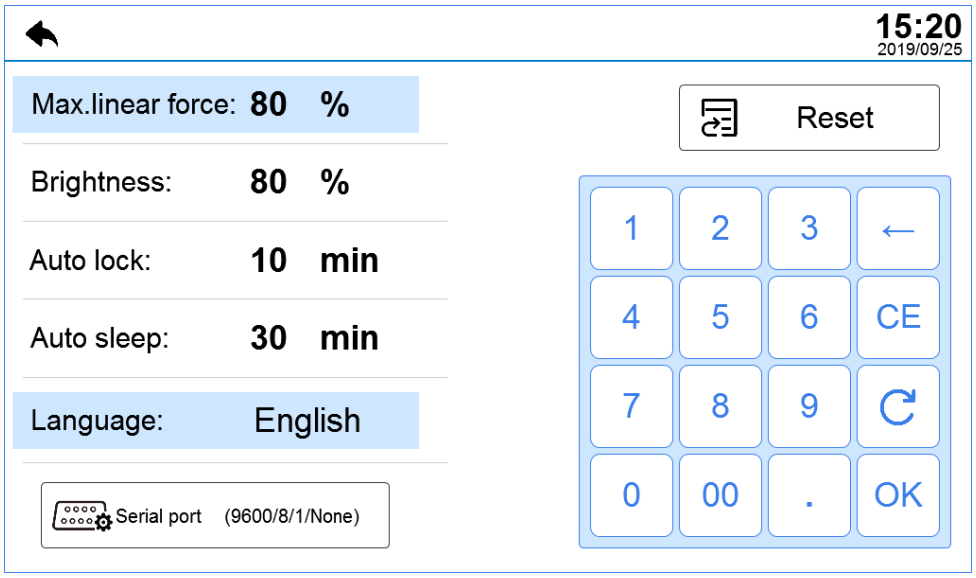
There is a selected program by default in the list, such as “B02 [25 Steps]” in the figure above; click this selected program and enter the program setting interface, as shown in the following figure. Move the position of the selected program via the [Move up] and [Move down] keys in the figure above, or click to select the program and set it.

The following program setting interfaces will display the syringe parameters of the current program; click and enter the syringe setting interface. Here you reset the program name.

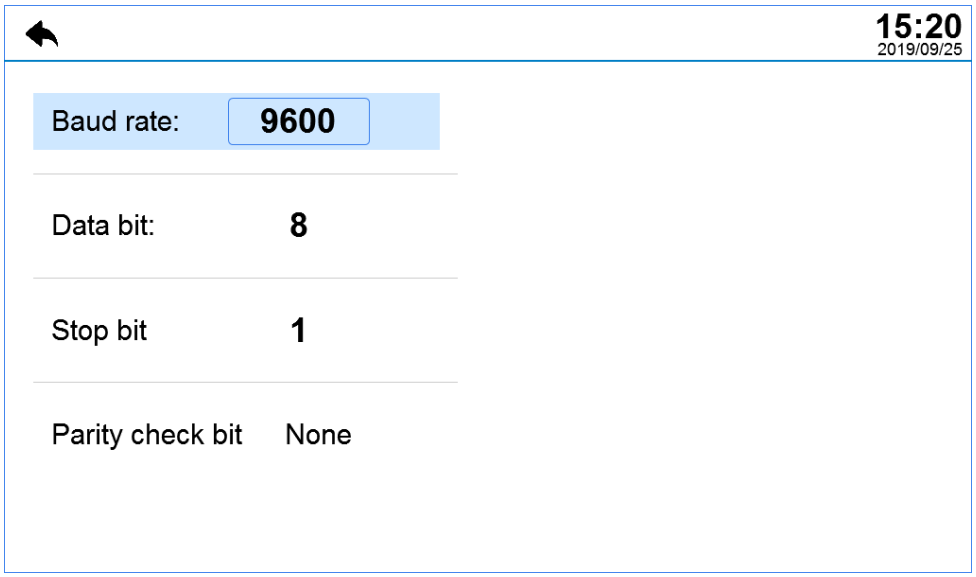


4.4.3 Setting

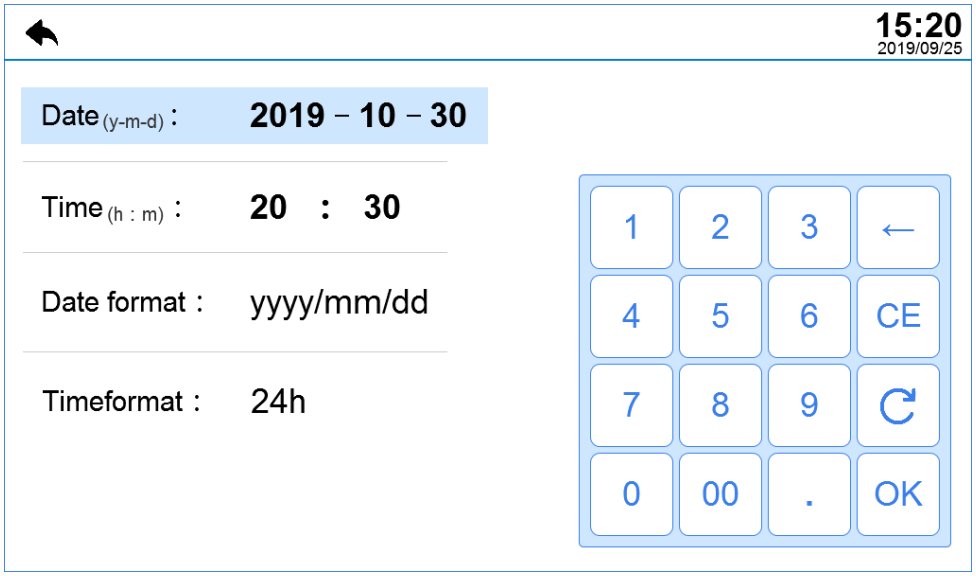
In the [Setting] interface, max.linear force, screen brightness, auto-lock, auto-sleep time, and system language can be set.



Click [Serial port] to enter the serial port setting interface



4.4.4 Date and time



4.4.5 Maintenance

Only be used for after sales personnel.

5-Alarm prompts

Alarm prompts	Cause	Treatment method
"Abnormal voltage!", and corresponding light and sound alarm	Abnormal voltage: Power supply voltage is not within 24V±5%	1) Check whether the power supply voltage is normal; 2) Check whether the power interface is plugged in firmly; 3) Check whether the power adapter is damaged.
"Motor stall!", and corresponding light and sound alarm	1) Working torque is not enough to drive load 2) Motor and conveyor belt are stuck by foreign matters	1) Check whether the maximum thrust is set correctly; 2) Check the abnormality of the input voltage; 3) Check whether the required thrust of the injected liquid exceeds the maximum thrust of the equipment or not; 4) Check whether the motor wiring is loose; 5) Check whether there are foreign matters blocking the conveyor belt or lead screw; 6) Check whether the spacing ring is set in a reasonable position.
"Abnormal motor drive chip!", and corresponding light and sound alarm	1) The motor driver chip is damaged 2) Abnormal power lines	1) Contact RWD after-sales personnel.

6-Troubleshooting

Problem	Possible Cause	Solution
Motor failure	1) Unstable power source voltage; 2) Unreasonable thrust setting; 3) Viscosity of infusion solution is too high; 4) The transmission element seizes up by foreign matter; 5) Other reasons.	1) Check the abnormality of the input voltage; 2) Check whether the maximum thrust is set correctly; 3) Check whether the injected liquid is too high viscosity, and whether the required thrust exceeds the maximum thrust of the equipment or not; 4) Check whether there are foreign objects blocking the conveyor belt or lead screw; 5) Contact RWD after-sales personnel.
The motor rotates, but the push rod foundation (syringe) fails to move	1) The nut release knob is not turned to the locked position.	1) Turn the nut release knob to the locked position to couple the nut to the lead screw.
Abnormal motor vibration	1) The motor has obvious vibration and abnormal noise.	1) Contact RWD after-sales personnel.

7-Maintenance

1) Do not scratch the equipment with hard or sharp objects;
2) Do not wipe the surface of equipment with chemical reagents but water;
3) Avoid vibration or collision of equipment during the handling process;
4) For every two months of use, the attached tools should be used to tighten the connecting screws among parts;
5) If the equipment is not used for a long time, unplug the power cord and place it in an appropriate storage environment.

8-Warranty

The warranty period of this instrument starts from the delivery date. During the warranty period, if the instrument cannot be used normally due to problems such as material and process defects, the Company should be responsible for providing after-sales services such as instrument maintenance and parts replacement.

Any damage caused by improper or over-range use is not covered by the warranty. If repair or replacement of parts is required, relevant costs will be borne by the user.

When the equipment to be reworked arrives, if it has been dismantled without authorization from RWD, the Company will not provide after-sales services such as warranty, free maintenance and parts replacement.

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

RWD Life Science

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