CONTENT

Chapter 1 Safety Instructions

1.1 Important tips

Please read this manual carefully before using the equipment.

Please keep this manual for reference.

This manual is compiled in accordance with YY0709-2009, GB9706.27-2005 and GB9706.1-2007 standards. The information in this manual is subject to change without any prior notice.

Due to the product update, the product you get may not be completely consistent with the description in the manual. We apologize for this.

1.2 Safety tips

⚠Warning	The dangerous or unsafe operation, if not avoided, may cause death, serious injury or property loss.
Note	Emphasize important precautions, provide instructions or explanations for better use of this product.

1.2.1 Warning

❖ The equipment can only be used by professional clinicians or trained medical electrical experts on designated occasions;

❖ If not operated correctly, it may cause serious injury or serious loss ;

❖ Please check whether the blood vessels are protected before starting the injection;

❖ Before using the equipment, the user must check the syringe pump and its accessories to ensure that they can work normally and safely;

❖ Please install or carry the syringe pump properly to prevent the syringe pump from falling, colliding, being damaged by strong vibration or other external mechanical force.

❖ Don't open the equipment shell, otherwise there is a risk of electric shock. If the syringe pump needs to be repaired, it must be carried out by the professional and technical maintenance personnel authorized by the manufacturer, otherwise the product safety, performance and function may be affected.

❖ It is strictly forbidden to use when the equipment alarms;

❖ The operation status of the device should be monitored regularly by professional medical staff, and the alarm and prompt function of the device should not be completely relied on during injection.

❖ Avoid cross use or reuse of disposable syringes. After use, please handle the syringe correctly according to the instructions.

❖ When the parameters of the syringe are set incorrectly or the syringe does not meet the requirements of the national standard, the accuracy can not be guaranteed, and the maximum error may be more than 40%.

❖ The syringe pump is used within 65cm above and below the heart height.

❖ The equipment shall not be used together with similar conductance equipment, otherwise the system may fail due to electromagnetic interference;

❖ The electromagnetic field will affect the performance of the syringe pump, so the equipment used near the syringe pump must meet the corresponding EMC requirements. Mobile phones, X-ray or MRI equipment may be interference sources;

❖ It is forbidden to use the equipment in the environment with inflammable, explosive and corrosive materials;

❖ Under high pressure environment, pipeline blockage detection may not work normally;

❖ The device does not support bubble detection function, so it should be ensured that there are no bubbles in the infusion pipeline before use;

❖ Please place the power cord and various accessories carefully to avoid suffocation of or entanglement, and if the wires are entangled or they may receive electrical interference;

❖ The internal pressure of the infusion tube will increase due to the knotting of the infusion tube, the condensation of the filter or the blockage of the intubation tube. If the blockage is eliminated at this time, the liquid medicine may be injected in large dose, and appropriate measures should be taken;

❖ When the push-pull clamp of the syringe pump is damaged and the syringe handle cannot be fixed, please stop using the syringe pump immediately. Otherwise, due to the siphonic effect caused by gravity, the liquid medicine will flow automatically, which will cause serious harm;

❖ The device does not have the function of abnormal flow detection. During the injection, the remaining solution volume of the syringe should be checked regularly to ensure that the injection can reach the specified flow rate of the equipment;

❖ During the use of the equipment, it is forbidden to maintain any parts of the injection pump.

❖ Warning! Modification of this equipment is not allowed!

1.2.2 Notice

❖ Please place this manual near the syringe pump so that it can be easily and timely consulted when necessary;

❖ To ensure the safety, please use the accessories specified in this manual;

❖ Before operating the equipment, make sure to check whether the brand parameters of the syringe are entered. Otherwise, the working accuracy of the syringe pump will not be guaranteed;

❖ Please avoid using sharp tools to operate the panel keys, otherwise the panel surface will be damaged;

❖ Please avoid using the syringe pump in the environment of direct sunlight, abnormal high temperature or high humidity;

❖ Use a soft cloth wet with warm water to wipe off the infusion liquid from the external surface of the equipment;

❖ Avoid autoclaving the equipment or exposing it to chemicals;

❖ When using AC power, please use the power cord provided in the packing box;

❖ If the equipment does not work according to the operation manual and the reason is unknown, stop operating the equipment and contact the dealer;

❖ Please check the battery to make sure it has enough power before using the battery; If necessary, recharge the battery;

❖ Before connecting the power supply to the syringe pump, please confirm that the voltage and frequency of the power supply meet the requirements specified in the label of the syringe pump or this manual;

❖ For continuous infusion of fluid for more than 24 hours, a new infusion component should be used.

❖ When the equipment or accessories are about to exceed their service life, they must be disposed of according to the relevant local regulations or hospital regulations. If you have any questions, please contact the dealer;

❖ When using the mains power supply, please make sure that the alternating current is easily disconnected, so that the power can be cut off in time in case of danger.

Chapter 2 Introduction

2.1 General overview

The syringe pump is a medical syringe pump with high intelligence, high safety and easy operation. It is equipped with liquid crystal display screen, which can accurately display all kinds of working parameters in real time; Sound, light and text alarm functions are complete; User-friendly control, stable operation, high precision; And can automatically detect the syringe specifications. The product is embedded with rechargeable battery, which can work continuously for more than 4 hours at the speed of 5 ml/h when fully charged.

2.2 Scope of application and contraindications

This syringe pump is used in conjunction with specific syringe apparatus for prolonged and constant rate administration of drugs and precise administration of drugs for infusion in the vein.

Contraindications: None.

2.3 Working principle

The syringe pump consists of pump shell, motor drive system, input system, storage system, control system, display system, sensor detection system and alarm system.

The sensor detection system is mainly a pressure sensor, and the motor drive system is the power source of the whole system. The stepper motor drives the screw to push the syringe forward; The control system and input system are the command center, which can set the injection speed and preset total amount and other working parameters according to the needs.

It controls the rotation of the motor through the microcontroller control system, detects the running status in real time, processes the alarm information, accurately displays the alarm information on the LCD screen, and intelligently calculates the injection completion time and the current accumulated amount. Among them, the sensor detection system and alarm system ensure the safe operation of the whole system. When the pipeline is blocked or the pipeline falls off during the operation of the syringe pump, the sound and light alarm will be sent out in time and the injection will be stopped.

2.4 Syringe pump characteristics

a. The operator can set the injection speed and preset amount by himself;

b. It has high priority alarm of pressure blocking, syringe falling off, syringe not installed, abnormal motor operation, pressure failure, injection completed into KVO, battery depletion and low priority alarm of injection nearly completed, low battery and standby prompt;

c. It has the function of quick injection, which is convenient for temporary and rapid administration;

d. Enter KVO mode when the injection is completed;

e. The pump is equipped with rechargeable battery, which can automatically switch the battery power supply when the power is off, and has the function of automatic charging when the power is on;

f. LCD displays a variety of sound, light and text prompts;

g. The preset parameters are protected during injection to prevent modification;

h. It can be equipped with disposable syringes in line with national standards, and the accuracy

can be guaranteed by adjusting the parameters;

i. The instrument has the system setting encryption function to prevent non-operators from touching it by mistake.

2.5 Technical parameters

Table 1 Technical parameters

Syringe specification requirements	10 ml, 20 ml, 30 ml, 50 ml in accordance with national regulations;
Injection speed range	0.1 ml/h ～ 200 ml/h（10 ml syringe） 0.1 ml/h ～ 400 ml/h (20 ml syringe） 0.1 ml/h ～ 600 ml/h（30 ml syringe） 0.1 ml/h ～ 1200 ml/h(50 ml syringe) Increment: 0.1 ml/h
Quick injection speed	200 ml/h （10 ml syringe） 600 ml/h （30 ml syringe） 400 ml/h （20 ml syringe） 1200 ml/h （50 ml syringe）
Injection precision	±3%, including the national standard syringe precision of ±3%
Blocking alarm pressure range	Low gear: 40 kPa ± 16 kPa middle gear: 70 kPa ± 30 kPa high gear: 100 kPa ± 35 kPa
Maximum infusion pressure	0.135 MPa
KVO flow rate	0.1 mL/h
The maximum quantity that can be delivered under single fault condition	4 ml
Security classification	Type II, internal power type BF
The degree of protection for incoming liquid	IPX2
Operation mode	Continuous operation
Alarm and prompt function	①Pipe blockage ②Syringe dislodged ③Abnormal motor operation ④Pressure failure ⑤Syringe completed into KVO ⑥Syringe not installed ⑦Battery depletion ⑧Syringe near completion ⑨Low battery ⑩Standby prompt
Maximum power consumption	25 VA, at least 4 hours of continuous operation at 5 ml/h syringe rate after a full charge
Power	AC: 100 V-240 V, 50/60 Hz

Battery	Rechargeable lithium-ion battery, 7.4 V / 5000 mAh
Use of environmental conditions	① Ambient temperature: 5 ℃ ～ 40 ℃ ② Atmospheric pressure range: 860 h Pa～1060 h Pa ③ Relative humidity: 20% ～ 90%
Storage conditions	① Ambient temperature: -30 ℃ ～ +55 ℃ ② Relative humidity: 5% ～ 96%, non condensing ③ Atmospheric pressure range: 500 hPa ～ 1060 hPa ④ No corrosive gas ⑤ Good ventilation
Dimension	305 mm*132 mm*114 mm(L×W×H)
Weight	1.7 kg

⚠ **Warning: Please ensure that the equipment works under the specified environmental and power requirements, otherwise it may not achieve the expected performance of the product, and may cause unexpected consequences such as equipment failure.**

Note: Please store and transport the equipment under the specified environmental requirements, otherwise serious damage may be caused to the equipment.

Chapter 3 Package Introduction

3.1 Standard configuration in the package

Table 2 Package configuration

| Standard configuration	Syringe pump	bracket assembly	Power cable	Manual
Quantity	1	1	1	1

Note: If you open the package and find that some accessories are missing, please contact the purchase office as soon as possible.

3.2 Signs and meanings

Table 3 Signs and meanings

Sign	Description
	Refer to the attached documents
	Indicating "Note", refer to the attached document
	Manufacturer
SN	Product Number
	BF type application section
IPX2	Grade of anti-entry liquid
	Production date
	Class II equipment
	The environmental pressure of transport package is limited to 500 hPa～1060 hPa
	The limited temperature range of transport package is -30 ℃～+55 ℃
	The humidity limit of transport package is 5% - 96%
	Vertically upward in transportation

	The transport package contains fragile items, should be handled carefully and gently.
	Transport packages should be protected from rain
	Stacking up to 8 layers of the same package
	AC
	Multi-function interface
	WEEE (2012/19/EU).

Note: The device you purchased may not have all the above signs.

Chapter 4 Product Appearance

4.1 Overall view:
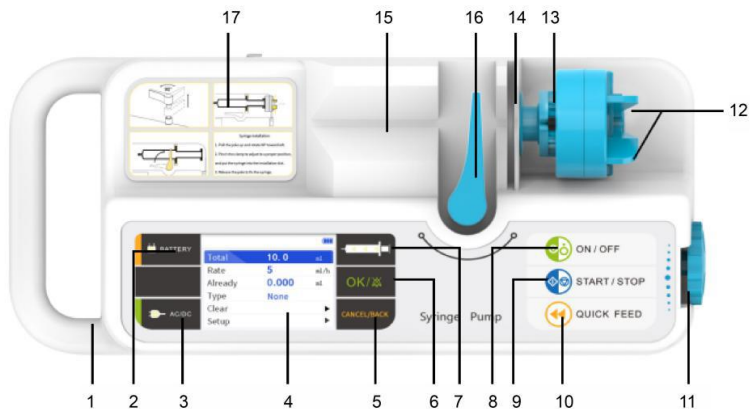
4.2 Functions introduction

Table 4 Functions introduction

Serial No.	Name	Function
1	Handle	Used for transportation.
2	Battery charging indicator	When the battery is charging, green is always on; when it is full, it is off.
3	Power supply type indicator	It is always green when AC power supply is used, and yellow when battery power supply is used.
4	LCD screen	Display injection parameters, system settings and alarm information.
5	"CANCEL/BACK"	1. Return to the previous interface; 2. After the cursor selects "Cancel" on the LCD screen, press to cancel the setting.
6	"OK"/Alarm clear key	1. Enter the option parameter setting and confirm to save the setting; 2. After the alarm occurs, the alarm can be cleared by long pressing the key.
7	Operation status indicator	When it works normally, it will display green waterfall light. When there is an alarm, it will be used as an alarm indicator. It will display red flashing light or green light is always on.

8	"ON/OFF"	Start or stop the syringe pump.
9	"START/STOP"	Start / stop injection.
10	"QUICK FEED"	Press the key before injection to flush the syringe pipeline; It is forbidden to use the key during injection; Press the key briefly to enter "high speed feed" and then long press to start quick feed; Release the key to stop injection.
11	Knob (shuttle)	1. Control cursor movement; 2. When pressed, it can be used as the confirmation key, which can be confirmed and selected by the cursor; Select the specific operation: Rotate the shuttle to control the cursor, select the option to be set, press the shuttle to enter the function item setting, after the setting is completed, the shuttle will select "OK", and press again, the parameter setting will be successful and return to the upper level interface.
12	Push-puller clip	Pinch the push-puller clip to adjust the push-pull to the proper position.
13	Syringe installation detection device	Check whether the syringe is installed correctly; When installing, make sure that the syringe handle is close to the puller, otherwise the warning of "no syringe installed" may appear in the injection state; And to avoid errors.
14	Syringe mounting slot 1	Place the syringe.
15	Syringe mounting slot 2	Place the syringe.
16	Pressure bar	Fix the syringe to avoid loosening or falling off;
17	Operating instructions	Operating instructions for syringe installation

Chapter 5 Operation Process：Step 1 Syringe pump placement

Place the syringe pump horizontally on the table or use the universal bracket to fix the syringe pump on the infusion frame. The appearance of bracket is shown as Figure 5.1

Figure 5.1 Bracket

Note: When fixing the syringe pump , make sure to tighten the long handle screw to prevent the syringe pump from sliding or shaking from the bracket in use.

Step 2 Connect the power supply

Insert one end of the power cord into the power socket of the syringe pump, and connect the other end to the AC: 100 V-240 V, 50/60 Hz power supply.

Step 3 Start up

Press the "ON/OFF" key to turn on the syringe pump.

When the battery is powered, the power supply type indicator is yellow, and the LCD power supply type is the icon of the current battery capacity [icon] . The main interface is shown in Figure 5.2.

When the utility power supply, press the "ON /OFF" key [icon] to start, the power supply type indicator [icon] is green. If the battery is not fully charged, the battery power indicator [icon] is green, that is, the battery is charging; When the battery is fully charged, the battery power indicator is off. The device turns on and enters the main interface, and the screen power supply type is [icon] .The main interface is shown in Figure 5.3.

The preset total amount, injection speed and cumulative total amount displayed in the main interface are the values set before the last power off.

Figure 5.2 Main interface of battery power supply

Figure 5.3 Main interface of municipal power supply

If there is no operation within 30 s after startup, the syringe pump will trigger the standby prompt, and the display will show "Start Injection?" With sound prompt, the indicator light is always on in green, as shown in Figure 5.4,
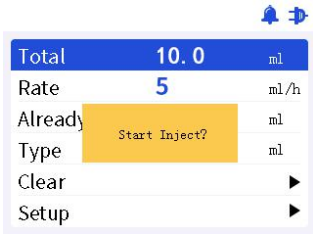

Figure 5.4 Standby prompt

Note: When the syringe pump is powered on, the system will detect whether the alarm sound and the function of the alarm light are normal.

When you start the machine, you can hear a "Dang" alarm sound, and the alarm light flashes red once. The purpose of this function is to verify whether the alarm function of the system is normal. Therefore, the user should observe the result when starting the system. If the audio-visual alarm is abnormal, it means that the system can not monitor. Therefore, the user must contact the manufacturer and the maintenance center.

Step 4 Install the syringe

1. Pull up the pressure bar of the syringe to a rotate position and rotate it 90 degrees counterclockwise;
2. Pinch the push-puller clip to adjust the push-pull to the proper position.
3. Put the syringe with liquid medicine into the installation slot;
4. Turn the pressure bar of the syringe back to the original position to release and press the syringe. At this time, the "syringe specification" column on the screen will display the corresponding syringe specification.

After injection, if the syringe push handle is not close to the pusher (the syringe installation detection device is not pressed), the syringe pump will trigger the alarm of syringe not installed, and the display screen will show "Syringe not installed!", and accompanied by sound alarm, the operation indicator is red flashing. The warning of syringe falling off is shown in Figure 5.5;

After the injection, if the syringe pump pressure bar is pulled up or rotated, the syringe pump will trigger the alarm of syringe falling off, and the display screen will display "Syringe falls off!", and accompanied by sound alarm, the operation indicator is red flashing. The warning of syringe falling off is shown in Figure 5.6;
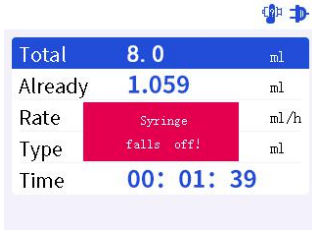

Figure 5.5 Syringe not installed alarm   Figure 5.6 Syringe falls off alarm

Note: The air in the syringe must be discharged manually before injection.

Step 5 High-dose flushing

After the syringe is installed, quick speed injection is conducted again to make the injection tube, hose and needle full of liquid medicine.

⚠Warning: The syringe pump must be prepared for a certain period of time, otherwise it may not work normally, so it must be filled before setting the parameters. The abnormal operation of the motor is not detected under the condition of high-dose flushing.

Step 6 Injection parameter setting

The main interface includes six items: Preset total amount, injection speed, cumulative total amount, injection type, total amount reset and system settings. The parameters need to be modified before injection, and the steps are as follows:

1. On the main interface, rotate the shuttle control cursor, select "preset total amount", and press the "OK" key ⬛OK/☀ on the shuttle or key film to enter the "preset total amount" setting interface;

2. Rotate the shuttle. Select the number with the cursor and press the shuttle. When the ▲▼ appears above the selected number appears, rotate the shuttle to change the value. After modification, press the shuttle again.

Repeat the above operation to modify the value of "preset total amount".

3. After setting, rotate the shuttle, move the cursor to the "OK" key, and press the shuttle or "OK" key to complete the numerical modification. If you want to cancel this modification, move the cursor to the "Cancel" key, press "shuttle" or "CANCEL/BACK"⬛CANCEL/BACK to cancel this modification and return to the main interface. The preset total amount setting is shown in Figure 5.7.

Figure 5.7 Preset total amount setting

Note: The "preset total amount" value must be less than the liquid quantity in the current injection tube. When the setting is unreasonable, a prompt box will pop up. At this time, you need to reset the "preset total amount" value. The preset total amount prompt

box is shown in Figure 5.8.
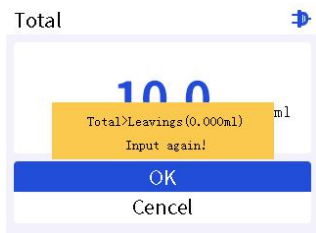
Figure 5.8 Preset total amount setting prompt

The setting method of injection speed is the same as that of preset total amount.

Step 7 Set up injection brand

Before injection, check whether the brand of syringe used is consistent with that of syringe set by syringe pump. If not, set it. Otherwise, the accuracy of syringe pump cannot be guaranteed. Rotate the shuttle, turn the cursor to "injection type", press the shuttle or "OK" key to enter the injection brand modification interface. Press the "OK" key or the shuttle to change the brand of syringe by rotating the shuttle. After the modification, press the "OK" key to complete the modification. The injection type modification interface is shown in Figure 5.9.
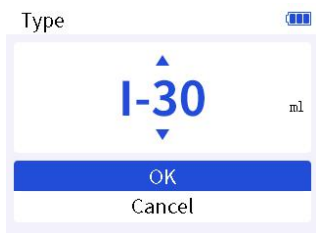
Figure 5.9 Injection type

Note: This device can automatically detect the type of syringe installed. After the syringe is installed, only the syringe brand can be changed in this interface.

Step 8 Clear the accumulated amount

To ensure that the syringe pump is stopped, rotate the shuttle to select "Clear zero", press the shuttle or "OK" key to enter the clear zero interface, rotate the shuttle, select the "OK" key with the cursor, press the shuttle or "OK" key to clear the injection total; Select the "CANCEL/BACK" key with the cursor, press the shuttle or "CANCEL/BACK" key to cancel the clear. The total clearing operation is shown in Figure 5.10.

Figure 5.10 Clear zero interface

Step 9 Start the injection

Confirm whether the installation and setting are correct, press the "START/STOP" key to directly enter the injection interface to start injection.

Note: If it is not necessary to accumulate the previous accumulated infusion volume, the accumulated volume should be cleared before starting.

Step 10 Operation

During the operation, the interface displays the preset total amount, cumulative total amount, injection speed, injection type, remaining time and power supply type, as shown in Figure 5.11. During the injection process, the operation indicator indicates the operation status.

Total	8.0	ml
Already	1.059	ml
Rate	156.0	ml/h
Type	II-50	ml
Time	00: 01: 39	

Figure 5.11 Injection interface

Electronic memory

If the machine is stopped midway or shut down normally, the injection speed, total injection amount and cumulative injection amount before shutting down will be saved to ensure that the injection can be continued when the machine is turned on next time.
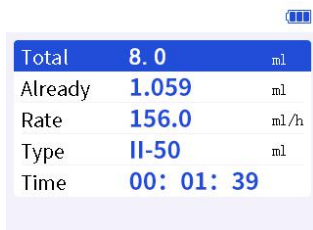
Step 11 Stop and completion

1. In the injection interface, press the "START/STOP" key to stop the injection and return to the main interface;

2. Within 3 minutes before the completion of the injection, the syringe pump will give an alarm every 20s or so, accompanied by an audible alarm, and the display screen will display "Injection will over" and " 🔻 " prompt information. The alarm interface is shown as Figure 5.12.

3. After injection, it will automatically enter the KVO mode, and the prompt interface is shown as Figure 5.13.

Figure 5.12 Injection will over   Figure 5.13 Enter KVO mode

Step 12 Shutdown

Press the "ON/OFF" key to turn off   the syringe pump.

In the main interface, if the connecting wire of the pressure sensor falls off or the pressure

sensor fails, the syringe pump will pop up the "Pressure abnormal" interface, accompanied by sound and light alarm, and the operation indicator will flash red. When this alarm occurs, please shut down and restart or contact the dealer or manufacturer for handling. The alarm interface is shown in Figure 5.14;

In the injection interface, if the connecting wire of the pressure sensor falls off or the pressure sensor fails, the syringe pump will trigger a "Pressure abnormal" alarm, and the syringe pump will automatically shut down after a sound and light alarm. When this alarm occurs, please shut down and restart or contact the dealer or manufacturer for handling. The alarm interface is shown in Figure 5.15;

Figure 5.14 Main interface
pressure abnormal
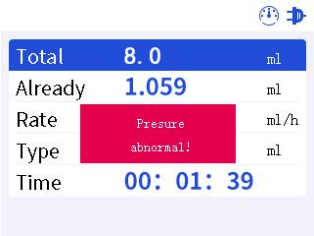
Figure 5.14 Injection interface
pressure abnormal

Chapter 6 System Setup

Select "system setup" in the main interface, press "OK" or "shuttle" key to enter the password input interface, and enter the password "8888" to enter the system setup interface. This interface includes distance setup, speed calibration, press threshold, language setup, key sound switch and reset.

The system setup interface is shown in Figure 6.1.

Figure 6.1 System setup interface

6.1 Distance setup

Rotate the shuttle, select "Distance setup" with the cursor, and press the shuttle or "OK" key to enter the "Distance setup" interface. This interface includes the name of the manufacturer, injection model and effective distance. The distance setup interface view is shown in 6.2.
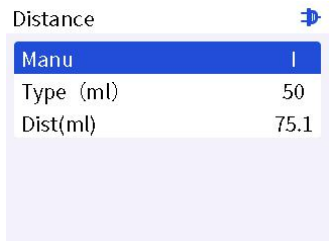
Figure 6.2 Distance setup interface

The operation steps of user to perform distance setup are as follows:

1. Power on;

2. In the distance setup interface, rotate the shuttle to select "Manufacturer name", press the shuttle or "OK" key and rotate the shuttle again to modify the manufacturer. (This instrument does not provide the library of syringe manufacturers. It can only store the model parameters of syringes from five manufacturers. Here, the names of manufacturers are represented by I, II, III, IV and V. By default, I stores the parameters of Jerry syringe and II stores the model of Ande syringe.)

1.Note: **1. If the user uses the syringe of Ande or Jerry brand, just adjust the name of the manufacturer correctly;**

2. If the model of syringe used by the user is not stored in the instrument, it is necessary to enter the parameters in advance (or contact the dealer to enter them), otherwise the accuracy of syringe pump can not be guaranteed in use, and the

maximum error can reach more than 40%.

The parameter entry steps are as follows:

1. According to the above steps, adjust the name of the manufacturer to the option with no dist entered;

2. Measure the dist of the syringe according to the scale on the syringe pump shell or the scale with an accuracy of 0.5 mm. The measurement method is shown in Figure 10.3;

3. Rotate the shuttle, select "Injection model" with the cursor, press the shuttle or "OK" key to select the syringe specification; (Syringe models include 10 ml, 20 ml, 30 ml and 50 ml);

4. After selecting the syringe specification, rotate the shuttle, select the "Dist", press the shuttle or "OK" key to input the measured value correctly;

5. After modification, press "OK" to pop up "Are you sure to change dist?" Press "OK" again to change it successfully. If you press "CANCEL/BACK", It will return to the "Distance setup" interface without saving the changed value.

Note: The maximum dist is 100.00 mm. The minimum dist is 50.00 mm, if the input data is not in this range, it will pop-up "Dist > Max dist (100.00 mm), please input again!" or "Dist < Max dist (50.00 mm), please input again !", and the warning is shown in Figure 6.3.
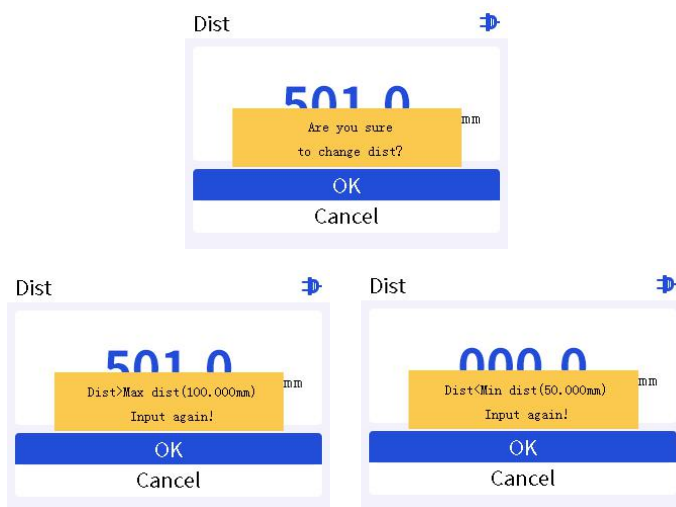
Figure 6.3　Distance setup interface

6.2 Speed calibration

Enter the "Speed calibration" interface, rotate the shuttle to change the value. After the modification, turn the cursor to "OK", press the shuttle or "OK" key to complete the value modification and return to the "System setup" interface. If you want to cancel the modification, turn the cursor to "Cancel" and press shuttle or "CANCEL/BACK".

Note: The calibration ratio ranges from 0.50 to 1.50. If the modified value is less than or beyond this range, the warning "Calibration ratio < Min ratio (0.50), please input again!" or "Calibration ratio > Max ratio (1.50), please input again!" will pop up. The warning is

shown in Figure 6.4.
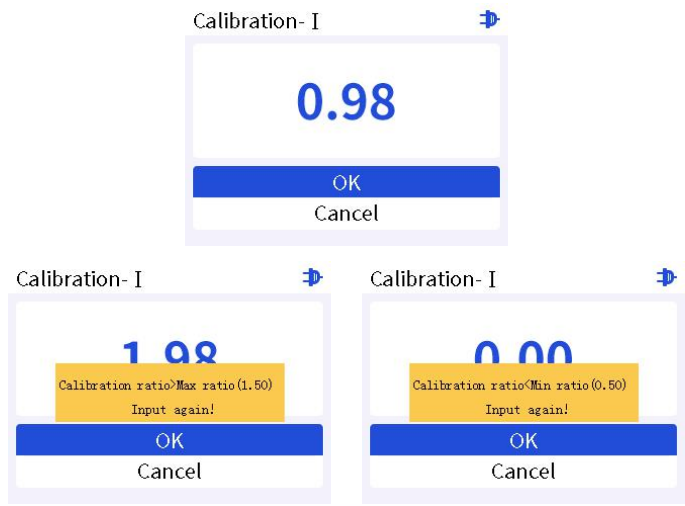
Figure 6.4 **Speed calibration interface**

Injection accuracy=

$$\frac{\text{theoretical flow volume} - \text{measured flow volume}}{\text{theoretical flow volume}} * 100\%$$

6.3 Press threshold

There are three levels of press threshold: low, medium and high, which are indicated by numbers 1, 2 and 3 respectively. The press threshold interface is shown in Figure 6.5.
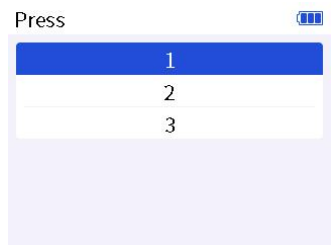
Figure 6.5 Press threshold interface

Syringe pump press blocking alarm value: low gear: 40 kPa ± 16 kPa, medium gear: 70 kPa ± 30 kPa, high gear: 100 kPa ± 35 kPa. When the press in the pipeline reaches the default set alarm value during injection, the syringe pump will trigger the syringe blocking alarm. The syringe blocking alarm information is shown in Figure 6.6.

Figure 6.6 Syringe blocking alarm

Note: The threshold is by default, if the press detection system failure, please stop using, and contact the dealer.

6.4 Language setup

In the "System setup" interface, select the "Language setup" option, press the shuttle or "OK" key to enter the "Language setup" interface. The instrument can select " Chinese" or "English". After selecting one, press the shuttle or "OK" key to change the language. The language setup interface is shown in Figure 6.7.
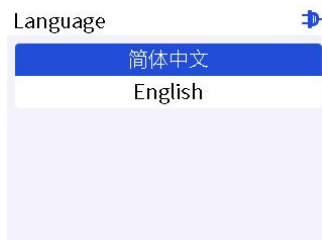
Figure 6.7 Language setup interface

6.5 Key sound switch

In the "System setup" interface, rotate the shuttle, select the key sound control, and press the shuttle or "OK" key to enter the key sound control interface. Select "On" or "Off" for rotating shuttle, and press "OK" key to set successfully. The key sound setup is shown in Figure 6.8.
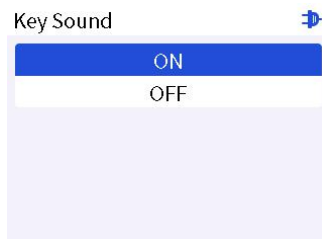
Figure 6.8 Key sound setup interface

6.6 Reset

Select "Reset" in "System setup" interface, press "OK" key to reset; Press "CANCEL/BACK" key to return to "System setup interface". As shown in Figure 6.9.

Figure 6.9 Reset interface

Chapter 7 System Icon Meaning

The indicator icons and their meanings in the interface during the operation of the system are shown in the following table:

Table 5 System icon meaning

Icon number	Icon display	Icon meaning
1		Syringe blocking
2		Press failure
3		The syringe falls off
4		Syringe not installed
5		Abnormal operation of motor
6		External power supply
7		Standby prompt
8		Alarm silencing
9		Injection will over
10		Full battery
11		Battery three cells
12		Battery two cells
13		Battery one cells
14		Low battery

Chapter 8 Alarm Prompt Description

There are two levels of alarms for this syringe pump, high priority alarms and low priority alarms. A high-priority alarm indicates the user's life is in danger or a serious technical problem with the syringe pump, which is the most serious alarm. Low priority alarms indicate only general warnings. The level of all technical alarms and the level of general alarms are set by the system and may not be changed. The operator should check that the current alarm setup is applicable. This syringe pump alarm responds immediately once triggered, with no alarm delay. The alarm light indication and alarm sound indication are audible within 4m of the syringe pump.

When a high-priority alarm occurs (except for power-down alarms), the syringe pump speaker emits an alarm sound and the screen displays the cause of the alarm. A long press of the "OK" key will release the alarm, a short press of the "OK" key will pause the alarm sound, and the alarm sound will resume after 2 minutes.

Table 6 Alarm prompt description

Alarm type	Alarm level	Alarm classification	Alarm description	Sound characteristic	Light characteristic
Blocking alarm	High priority alarm	Technical alarm	In the process of injection, when the blocking degree of syringe pipeline reaches the set press threshold, "Pipeline blocking!" occurs alarm; And accompanied by sound and light alarm, long press the "OK" key to remove the alarm information.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.
Syringe off alarm	High priority alarm	Technical alarm	In the process of injection, if the syringe is not detected by the syringe installation detection button, the main interface will pop up "Pipe	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.

			falling off!" warning, at the same time stop injection; And accompanied by sound and light alarm, long press "OK" key can remove the alarm information.		
Syringe not installed	High priority alarm	Technical alarm	When installing the syringe, if the push-pull device is not close to the syringe handle, the injection will start at this time, and the main interface will pop up "No syringe installed!" warning; And accompanied by sound and light alarm, long press the "OK" key to remove the alarm information.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.
Injection completion alarm	High priority alarm	General alarm	When the injection is completed, the interface prompts "Injection has been completed, enter the KVO state!"; And accompanied by sound and light alarm, press "START/ STOP" to exit KVO mode.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.

Abnormal operation alarm	High priority alarms	Technical alarm	When the operation is not controlled or the motor does not run, the "Motor abnormal" will pop up alarm, stop injection at the same time; And accompanied by sound and light alarm, long press the "OK" key to remove the alarm information.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.
Press failure alarm	High priority alarm	Technical alarm	If the press sensor fails or the connecting line of the press sensor fails, the alarm message of "Press failure" will be prompted, and the system will shut down automatically after 3S.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.
Battery depletion	High priority alarm	General alarm	When the battery power reaches the minimum voltage of the battery, the "Battery power exhausted" alarm will pop up, accompanied by sound and light alarm.	The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The indicator light is flashing red.

The injection is nearly complete	Low priority alarm	General alarm	When there are still three minutes to the end of injection, prompt "Injection is about to end" every 20 seconds with sound alarm.	The mode is "Dang---Dang---Dang".	The indicator light is always on in green.
Low battery	Low priority alarm	General alarm	When the battery power reaches the lower voltage of the battery, the alarm of "Low battery " will pop up, and the indicator light will turn green and always on; And accompanied by sound alarm, press the "OK" key briefly to silence.	The alarm mode is "Dang---Dang---Dang". The prompt sound of silencing mode is "Dang".	The indicator light is always on in green.
Standby prompt	Low priority alarm	General alarm	When the syringe pump is not injected and there is no operation for a certain period of time, pop up "Start injection?" At the same time, the indicator light turns green and always on, accompanied by sound alarm.	The mode is "Dang---Dang---Dang".	The indicator light is always on in green.

			When the external power supply and the internal lithium battery (7.4V / 5000 mAh) can not supply power for the syringe pump, the standby battery (3.7V / 250 mAh) of the syringe pump supplies power for the MCU and the loudspeaker, and sends out the sound alarm of main power failure for 3 minutes, and the LCD goes out. During the alarm period, after the main power supply is restored, the device will be turned on again.		
Power failure alarm	High priority alarm			The mode is "Dang Dang Dang ----- Dang Dang, Dang Dang Dang ----- Dang Dang".	The display is off and the indicator light is flashing red.

Table 7 Alarm prompt

Alarm type	Alarm level	Alarm classification	Light characteristic	Alarm sound interval	Alarm information	Alarm level signal	Duty Cycle
Blocking alarm	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds （±2 seconds）	White text Red background	Red background	50%
Syringe off alarm	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing	5 seconds （±2 seconds）	White text Red background	Red background	50%

			frequency: 2.0 ± 0.6 Hz				
Syringe not installed	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds（±2 seconds）	White text Red background	Red background	50%
Injection completion alarm	High priority alarm	General alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds（±2 seconds）	White text Red background	Red background	50%
Abnormal operation alarm	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds（±2 seconds）	White text Red background	Red background	50%
Press failure alarm	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds（±2 seconds）	Blue text White background	Red background	50%
Battery depletion	High priority alarm	General alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	5 seconds（±2 seconds）	White text Red background	Red background	50%
The injection is nearly complete	Low priority alarm	General alarm	The indicator light is always on in green.	5 seconds（±2 seconds）	Black text Yellow background	Yellow background	100%

	Low priority alarm	General alarm	The indicator light is always on in green.	20 seconds（±2 seconds）	Black text Yellow background	Yellow background	100%
Low battery	Low priority alarm	General alarm	The indicator light is always on in green.	20 seconds（±2 seconds）	Black text Yellow background	Yellow background	100%
Standby prompt	Low priority alarm	General alarm	The indicator light is always on in green.	20 seconds（±2 seconds）	Black text Yellow background	Yellow background	100%
Power failure alarm	High priority alarm	Technical alarm	The indicator light is flashing red. Flashing frequency: 2.0 ± 0.6 Hz	20 seconds（±2 seconds）	The display is off	The display is off	50%

Note: It is potentially dangerous to use different alarm presets for the same or similar devices in any single zone.

The alarm system related setup will not be changed after this syringe pump is powered off and power is restored.

When the power off time is less than 30 s, the alarm setup before power off will be automatically restored.

When the main power is disconnected, it enters the backup battery-powered alarm mode, and the syringe pump stops working while an audible alarm is sounded and the screen goes off.

The low battery alarm has a prompt signal with an interval of about 10 s. The prompt signal is automatically turned off after 2 minutes or manually disconnected by plugging in AC power.

When the syringe pump is in KVO mode, it can only be exited by pressing the "START/STOP" button. Short or long presses of the "OK" key will not exit.

The audible alarm can produce a sound press level of at least 65 dB(A) at a distance of 1 m.

The syringe pump has a password to prevent the alarm threshold from being changed and stored at will.

⚠ **WARNING: When an alarm occurs in the device during use, the user's condition should be checked first.**

Steps to check for alarms.

1. The operator should always pay attention to the alarm of the device in the process of using the device;

2. Check the alarm information prompt of the display interface in time after finding the alarm reminder, analyze the alarm type according to the alarm information and make corresponding treatment according to Table 6.

Chapter 9 Fault Phenomena, Causes and Solutions

Table 8 Common faults and solutions

Fault phenomena	Possible causes	Solutions
The syringe pump can not be started normally.	1. The battery is not charged and the power is not connected; 2. Unknown reasons.	1. Connect the powerline; 2. Please contact manufacturer.
The syringe pump does not run after pressing the "START/STOP" key.	1. The syringe is not installed properly. 2. Syringe specification parameters are not set properly.	1. Reinstall the syringe and check if the syringe indication is correct. 2. Reset the syringe parameters.
The cursor does not change with the rotation of the shuttle.	1. The knob is disconnected from the main board. 2. The syringe pump is running and cannot be set.	1. Reconnect the knob with the main board. 2. Press the "START/STOP" key to stop the syringe pump, rotate the shuttle to select "Injection speed", press the "OK" key or the shuttle knob to enter the setup speed state, and then rotate the shuttle to set the parameters.
Blocking alarm occurs soon after operation, and the injection pump stops running.	The internal press sensor is damaged.	Contact the manufacturer.
Syringe specifications do not match the actual specifications.	1. The press bar of the syringe may not be pressed tightly; 2. The specifications of syringe are not set well.	1. Re-install the syringe and press it down slightly with hands. 2. Reset the syringe specifications.

Note: The company can provide part of the relevant circuit diagram and component list for the reasonable needs of the designated maintenance station or maintenance personnel.

Chapter 10 Infusion Characteristics

10.1 Infusion accuracy diagram

The infusion accuracy diagram indicates the performance after the start of infusion and the infusion variation that occurs over a period of time after the normal infusion flow rate is reached.

Infusion accuracy may be affected by the environment in which the device is used (press, temperature, humidity, syringe, infusion line, etc.).

10.1.1 Start-up curve

The plot is based on the data collected during the two-hour measurement period. Sampling interval: $\Delta t = 0.5$ min, longitudinal infusion flow: Q (ml/h), transverse experiment period: T = 120 min. As shown in Figure 10.1.
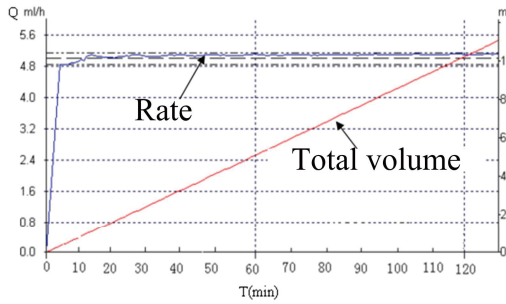
Figure 10.1 Start-up curve

10.1.2 Horn diagram curve

Infusion flow error E (%); Sampling interval: $\triangle t = 0.5$ min;

Observe the minimum measurement error within the specified duration: EP_{min} (%);

The maximum measurement error of observation window within the specified duration: EP_{max} (%);

Duration of observation window: P = 2, 5, 11, 19, 31 min;

The overall average percentage of measured flow error: A (%);   As shown in Figure 10.2.
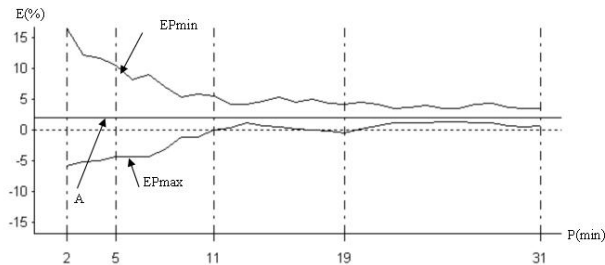
Figure 10.2 Horn diagram curve

10.2 Time to reach press blockage and amount of fluid produced

Table 9 Time to reach press blockage and amount of fluid produced

Alarm press range	Type of syringe	Injection rate (ml/h)	Time to reach alarm (min)	Amount of liquid produced （ml）
High gear 100 kPa± 35 kPa	10	1	10	0.69
		5	43	0.65
	20	1	15	0.64
		5	83	0.66
	30	1	59	0.79
		5	11	0.8
	50	1	242	3.83
		5	48	3.87
Medium gear 70 kPa ± 25 kPa	10	1	35	0.56
		5	8	0.58
	20	1	33	0.53
		5	8	0.55
	30	1	40	0.59
		5	8	0.57
	50	1	188	2.72
		5	31	3.12
Low gear 40 kPa ± 16 kPa	10	1	27	0.32
		5	5	0.32
	20	1	21	0.28
		5	5	0.34
	30	1	25	0.39
		5	5	0.35
	50	1	66	1.05
		5	16	0.95

Table 10 Time to reach abnormal operation alarm

Injection rate （ml/h）	5	100	500	1200
Time to reach alarm	9 min	27 sec	7 sec	4.1sec

Note: The above experimental data are measured by 50 ml syringe, which are affected by the experimental conditions and environment.

Note: Appropriate measures should be taken to prevent excess fluid from being injected . For example, clamp the tubing until the cause of the obstruction has been eliminated.

10.3 Brand and specification of the syringe used at the factory

This instrument is calibrated with Jerry brand syringe and Ande syringe of Shandong WEGO by default. Only 10 ml, 20 ml, 30 ml and 50 ml syringes that meet the national standard can be used on this pump. It is suggested that this instrument should be used together with Jerry or Ande syringes. If other brands of syringes are used, the registration certificate of medical device should be obtained. At the same time, please refer to " 6.1 Distance setup" in the manual for calibration, or contact the manufacturer for setup calibration, so as not to affect the injection accuracy.

Table 11 Jerry brand syringe specification parameters

Syringe specification（ml）	10	20	30	50
Distance within the range of measurement a（mm）	57	70	80	76

Table 12 Ande brand syringe specification parameters

Syringe specification（ml）	10	20	30	50
Distance within the range of measurement a（mm）	57.50	69.00	77.50	74.50

⚠**WARING: When the syringe does not meet the requirements of national standards or when the syringe parameters are not set correctly, its accuracy will not be guaranteed and the maximum fault may reach more than 40%.**

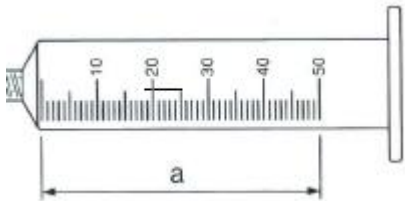The distance a in the range is shown in Figure10.3.

Figure 10.3

Note: The effective range of the syringe used in this syringe pump is up to 50 ml, i.e.: range 60 ml syringe in measuring the effective distance, the measurement range is 0~50 ml.

Chapter 11 Repair & Maintenance

Proper maintenance and care can extend the life of the syringe pump.

❖ **Cleaning**

1) Do not immerse the syringe pump in liquid.

2) Before cleaning, turn off the power and cut off the AC and DC power lines.

3) Do not use high-press steam sterilizer to disinfect the syringe pump. Wipe the machine shell with 75% alcohol dipped in cotton ball for disinfection. After disinfection, ventilate the room for 2 hours.

4) Keep the machine clean at all times. When cleaning, gently wipe the syringe pump with a soft cloth soaked in mild soapy water, and finally wipe it with a dry cloth.

5) Avoid using solvents similar to xylene, acetone or the like to clean the syringe pump, so as not to cause damage to the shell.

6) Do not use strong chemicals, cleaning agents, detergents to clean the syringe pump.

❖ **Transportation and storage conditions:**

1) Ambient temperature: -30 ℃～+55 ℃.

2) Humidity range: 5% to 96%, non-condensing.

3）Atmospheric press: 500 hPa～1060 hPa.

4）No corrosive gas.

5）Good ventilation.

❖ **Maintenance**

1) Check the AC power plug and wire at least once a year.

2) Run the machine until the low voltage alarm sounds, and then charge the battery to confirm whether the function is normal.

3) The surface of syringe pump should be cleaned thoroughly before and after long-term storage.

4) It is forbidden to dismantle the syringe pump by non-professionals.

5) Do not throw, knock or vibrate the syringe pump.

6) If the syringe pump or any other accessories do not work properly, take them to the designated maintenance organization for inspection.

7) Battery performance maintenance:

● The lithium battery is a consumable product. When it is exhausted, it must be replaced. If you want to replace the battery, please contact the dealer or manufacturer from whom you purchased this product. Model: Lithium Battery (7.4 V / 5000 mAh).

● In order to ensure the performance of the battery and prolong the service life of the battery, the medical staff should conduct a battery exhaustion test on the syringe pump once a month to exhaust the battery until the syringe pump automatically turns off. After the battery is exhausted, the syringe pump must be charged until the charging indicator light (off) shows full charge for the next use

● Every four months, the battery needs to be checked as follows:

(1) Connect the AC power supply and charge the battery until the charging indicator shows full charge.

(2) Turn on the syringe pump and install a 50ml syringe.

(3) Set the injection speed to 5ml / h and start the injection.

(4) Run the syringe pump continuously until the machine is automatically shut down due to low battery power.

● If the time from syringe pump start of injection to shutdown is 200 minutes or longer; The duration of the low battery alarm to depleted battery alarm is more than 30 minutes; And the duration of the depleted battery alarm to automatic shutdown is more than 3 minutes, the battery is in good condition.

● If one or more of the above durations are not met, the battery is near the end of its service life, please contact the dealer or manufacturer for battery replacement.

(5) After the battery is checked, the battery must be charged until the charging indicator light is full for next use.

The service life of the battery depends on the frequency and time of use. The cycle life of the lithium battery is 300 times. If the cycle life is more than 300 times, it is recommended to replace the battery or conduct the above inspection every month. If the battery is properly maintained and stored, the service life of lithium battery is about 3 years. If not used properly, life may be shortened. We recommend that lithium batteries that have been used for more than 3 years be replaced or checked monthly.

8）Syringe calibration

When you find that the accuracy is not accurate or the use interval is more than 6 months, a syringe calibration of the syringe pump is required:

a Use laboratory tertiary water for testing, first assemble the 20ml syringe and injection hose together and draw the appropriate amount of liquid from the syringe together with the injection hose, then properly attach the syringe with the liquid to the syringe pump and connect the other end of the injection hose in a 5 ml measuring cylinder (accuracy of 0.1 ml).

b Set the injection rate to 5 ml/h, set the total prefabricated amount to 6ml, start the injection and use a stopwatch to time it, observe the amount of liquid in the measuring cylinder to stop timing when it reaches 5 ml, and read the time.

c If the reading time is between 58 minutes and 12 seconds and 1 hour, 1 minute and 48 seconds, the injection accuracy of the syringe pump is satisfied and can continue to be used; Otherwise, refer to the instructions of "6.1 Distance setup" in the manual for calibration and calibrate again.

9）Syringe calibration

If the calibration still does not meet the injection accuracy requirements of the syringe pump, please contact the manufacturer to solve the problem.

❖ **Pollution-free disposal, recycling**

The service life of this product is 10 years. Machines beyond the service life must be scrapped. Please contact the manufacturer or dealer for more information.

1) The syringe pump that is no longer in use can be sent back to the dealer or manufacturer when you purchase this product for proper recycling.

2) Used lithium batteries can be sent back to the dealer or manufacturer from whom you

purchased the product for disposal, or disposed of in accordance with relevant laws and regulations. Do not disassemble the battery, put it into the fire, put it into water or short circuit it, otherwise there will be a risk of combustion, explosion, leakage or injury.

Chapter 12 Electromagnetic compatibility and interference

This pump is protected against the effects of external interference, including high energy radio frequency emissions, magnetic field and electrostatic discharge, but avoid use the cellular telephones in a distance of 0.5 m near the equipment.

Avoid use the pump and Surgical Unit or similar equipments together, to avoid equipment failure or collapse caused by electromagnetic interference.

When operate to the pump, don't use the equipment produced electromagnetic field near the pump, to avoid equipment failure or collapse caused by electromagnetic interference.