SYRINGE PUMP

USER MANUAL

Art. Nr. 402088

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CE 0197

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- Relevant electrical equipment meets national standards and requirements of this Operator's Manual.
- Please operate the product as per the Operator's Manual.

⚠ WARNING

- **The device must be operated by professional clinicians or under the guidance of professional clinicians. The users must receive adequate product training. No unauthorized or untrained personnel should carry out any operation.**

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Preface

Manual Purpose

This Operator's Manual ("Operator's Manual") describes the product's application, function and operation in details. Please read this Operator's Manual carefully and understand the content before use to ensure the proper usage and guarantee the safety of the patient and the user.

This Operator's Manual describes the product as per the most complete configuration. Some content of this manual may not be applicable for the product on your hand. Please contact us for any questions.

Please keep this Operator's Manual beside the syringe pump in order to consult it conveniently.

Intended Audience

This Operator's Manual is only applicable for well-trained clinical people.

Illustrations

All illustrations in this Operator's Manual are used for reference only. Its settings or data may be not entirely consistent with the actual displayed info on the product.

Conventions

- ***Italic*** text is used in this manual to quote the referenced chapters or sections.
- The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level of severity.

Contents

1 Safety

1.1 Safety Information

The safety statements presented in this chapter refer to the basic safety information that the operator shall pay attention to and abide by. There are additional safety statements in other chapters or sections, which may be the same as or similar to the followings, or specific to the operations.

⚠ DANGER

- **Indicates an imminent hazard that, if not avoided, will result in death or serious injury.**

⚠ WARNING

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.**

⚠ CAUTION

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.**

NOTE

- **Provides application tips or other useful information to ensure that you get the most from your product.**

1.1.1 Dangers

There are no dangers that refer to the product in general. Specific “Danger” statements may be given in the respective sections of this manual.

1.1.2 Warnings

⚠WARNING

- **This syringe pump is used for clinic syringe, and it can only be used by professional clinicians, medical electrical experts, or well- trained nurses on specific occasions.**
- **Syringe pump and its accessories must be inspected before use to guarantee its normal and safe operation.**
- **Avoid using this syringe pump in the flammable or explosive atmosphere in case of fire outbreak or explosion.**
- **Syringe alarms must be set based on the actual situation of the patients. Do not rely on the audible alarm system in the syringe supervision only. Pay close attention to the actual clinical situation of the patient. Do not use this syringe pump in case of alarms.**
- **This syringe pump can not detect any abnormal flow rate. Keep observing the remained liquid volume in the syringe and make sure the syringe pump works at the specified flow rate.**
- **The pressure detector may not work normally in high-pressure environment, especially in hyperbaric oxygen therapy.**
- **Make sure the blood vessel is well protected before syringe.**
- **In the syringe tube, the occlusion caused by tube knot and filter coagulation or intubations may lead to the rise of the inner pressure of the syringe tube. At this moment, the effort to eliminate the occlusion may cause too much liquid to be infused into the patient's body with a large dose. Proper measures should be taken to prevent this phenomenon. For example, to clamp the syringe tube before occlusion elimination.**
- **This syringe pump should be used at about 65 CM from the patient's heart.**
- **When another set of syringe system or accessories are connected to the extension tube of this syringe pump in order to be parallel, then the operation of this pump may not meet its specifications.**
- **Only standard components, connectors and disposable products can be used with this pump. Subsidiary items are not allowed to be attached to the pump and its accessories. Reconstruction of the pumps is not allowed.**
- **The accuracy will not be maintained when the pump is used with the non-standard syringe or the parameters of the syringe are not set accurately. The maximum deviation may reach 40% or above.**
- **This syringe pump belongs to Class II. The supplied Type I power cord PE earth terminal should not be used as ground protection and functional earthing.**
- **Do not open the case of the syringe pump, otherwise there might be**

electric shock. The syringe pump must be maintained or updated by maintenance staff trained and authorized by our company.

- **Packing materials must be disposed in accordance with the relevant local statutes or the waste disposal regulations of the hospital. They must be kept out of the reach of children.**
- **If the clip on the push-pull box of the syringe pump is damaged and can not fasten the handle of the syringe, please stop using such syringe pump immediately. Otherwise, the liquid medicine in the syringe may flow by itself due to syphonage caused by gravity, and may cause severe injury or even death of the patient.**

1.1.3 Cautions

⚠CAUTION

- **Please use the accessories specified in this Operator's Manual to guarantee the safety of the patient.**
- **Cables must be connected carefully to reduce the possibility of the patient getting intertwined or choked.**
- **Make sure the syringe piston is tightly and accurately installed to the clutch, and insert the syringe flange into the slot.**
- **Disposable accessories can only be used once. Repeated use may lead to declined performance or cross-infection.**
- **Disposable accessories should be disposed according to the regulations of the hospital after they are used.**
- **Before operating this product, check if the parameters of syringes in use have been set in the machine. Otherwise, the accuracy of flow rate and alarms can not be guaranteed.**
- **Replace the syringe set after syringe exceeds 24 hours.**
- **This syringe pump or its accessories must be disposed in accordance with local statutes or hospital regulations when they are about to reach their expiry date. Please contact the distributor that sells the product to you or the manufacturer if there is any inquiry.**
- **Electromagnetic field may influence the performance of the syringe pump. Therefore, equipments or devices used near the syringe pump must meet the EMC standard. Mobile phones, X ray or MRI equipments are all potential interference sources because of their high-intensive electromagnetic radiation.**
- **Avoid the direct sunshine, high temperature or humidity.**
- **Avoid exposing this syringe pump to high-pressure sterilization or chemical materials.**
- **Check the built-in battery before use to make sure the power is enough. Recharge the battery if necessary.**
- **Before the syringe pump is connected to the power supply, make sure the voltage and frequency of the power supply meet the label of the pump or the specific requirements in this Operator's Manual.**
- **When you start a syringe pump that has not been used for a long time (more than one month) or a syringe pump with very low battery, it may take a few minutes for the battery alarm signal to reset after the syringe pump is connected to the AC power. If the low battery alarm persists five minutes after connection with power, the battery may be faulty. Please contact the distributor or the manufacturer.**
- **If the syringe pump fails to work as specified in the Operator's Manual due to any uncertainty, please stop syringe, and report the situation (including syringe accessories used with the pump, syringe volume, syringe rate, SN No., liquid type, etc.) to your local distributor or the manufacturer.**

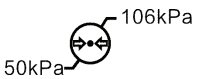
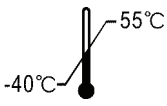
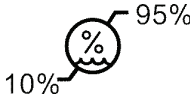
1.1.4 Notes

NOTES

- **Please keep this Operator's Manual along with the syringe pump for the convenient and timely reference.**
- **Please install the syringe pump to the place convenient for observation, operation and maintenance.**
- **This Operator's Manual describes all the configuration and functions of the syringe pump. The syringe pump you buy may not have some of the configuration or functions.**
- **The SN No. of this syringe pump has been set. Users are not allowed to change it.**

1.2 Equipment Symbols

1.2.1 Symbols and connotations

	Note! Please refer to the Instruction manual		Class II Equipment
	Type BF applied parts	IPX3	Anti-Drenching
	Alternating Current Power Supply (AC)		Direct Current Power Supply (DC)
LOT	Batch No.	SN	Serial No.
	Date of Production		Manufacturer
	Pollution-Free Treatment		Wireless Transceiver
	Select		Bolus
	Clear		Alarm silence
	Start		Stop
	Confirm		Set
	Step adjustment		Turn on/off
	Transport package should avoid rain		Battery indicator light
	Transport should be straight upward		Fragile items, handle with care
	The transport packages environmental pressures limited range of 50 ~ 106kPa		The same packing stacked up to 5-layers
	The transport package temperature limits of -40 ~ 50oC		Transport packages limit the range of 10% to 95% humidity
EC REP	Authorized Representative in the European Community.		
CE 0197	This product meets the EU Medical Device Directive 93/42/EEC and the basic requirements in Directive Appendix I, and hence has the CE mark.		

2 The Basics

2.1 Product Introduction

2.1.1 Application Scope

This syringe pump is used in wards, operation rooms, and observation rooms for accurate and continuous injection of drugs to patients.

⚠ WARNING

- **Check the syringe pump and its accessories before use to ensure its normal and safe operation.**

⚠CAUTION

- **The operation environment and power supply of this syringe pump must meet the requirements in *A. Product Specification*.**

2.1.2 Contraindications

None

2.1.3 Product Structure, Composition and Performance

SK-500Ⅰ Syringe Pump consists of the host computer and the built-in battery, etc.

SK-500Ⅰ Syringe Pump contains the following parts:

- **Master Control System:** the core of the whole system, which gives intellectualized control and management over the whole system and processes detection signals. In this system, two single-chip Micyoco (SCM) systems are adopted for mutual backup copy and supervision. When one SCM goes wrong, the other one will give a timely warning signal and cut the power of the host computer to stop the pump with the purpose to ensure the patient's safety.
- **Pump Device:** the power source for liquid transfer. Driven by step motor, the lead screw moves the syringe piston forward.

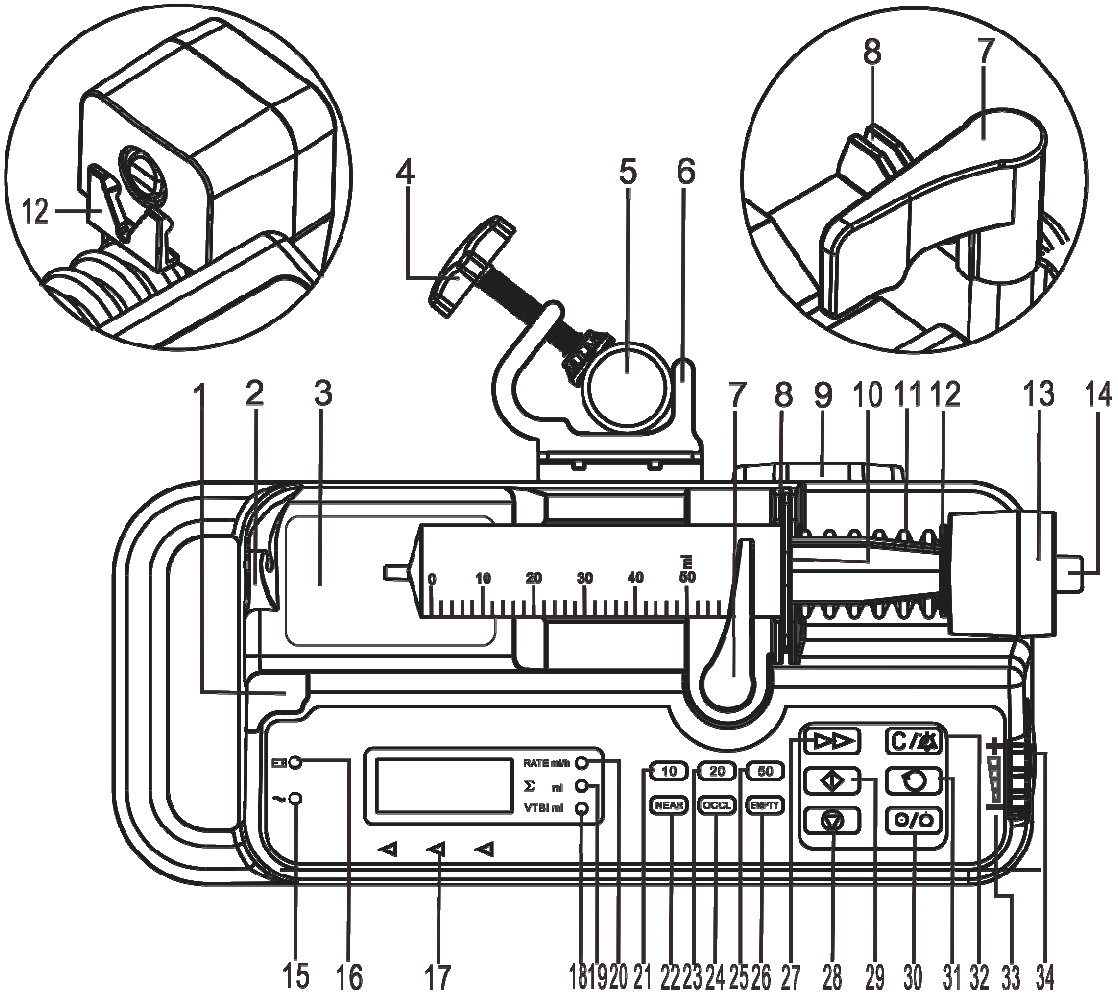
- **Detection Device:** the device includes various kinds of sensors, like displacement sensor (defect the flow rate), pressure sensor (detect the pressure in the syringe), etc.
- **Alarm Device:** the device mainly includes visible and audible alarms, drawing the user's attention to the correct operation.
- **Input and Display Device**: the input device is in charge of setting injection parameters, such as flow rate, etc.; while the display device is in charge of displaying all the parameters and the current working status.
- **Built-in Battery:** the battery sustains the operation of the syringe pump when there is no AC power supply.

The performance of SK-500Ⅰ Syringe Pump:

- Accurate control of flow rate.
- Accurate control of injection volume.
- Good linearity of fluid flow.
- Timely alarms for over,syringe empty, occlusion, disengage, system err, bat exhaust, bat low, non operate, near and AC disconnect, etc.

2.2 Appearance

2.2.1 Front Panel



1. Alarm indicator lights

- Red light flashes for high level alarm.
- Yellow light flashes for medium level alarm.
- Yellow light is on for low level alarm.

2. Hanger of the extension tube is used to fix the extension tube.

3. Quick operation instructions to guide the quick operation.

4. Adjusting knob

It is used to fix the syringe pump to the support.

5. Infusion support

It is used to fix the infusion pump.

6. Clip

Fix the syringe pump to the support.

7. Hand lever

- Check the specification of the syringe and fix the syringe
- Fix the syringe to prevent it from disengagement.

8. Groove

Fix the flange of the syringe.

9. Waterproof brim

Prevent the liquid medicine from flowing into the interface of AC power.

10. Flange of the syringe.

11. Waterproof cover

Prevent the liquid medicine from flowing into the inside of the syringe pump.

12. Fastener

Fix the handspike of the syrigne.

13. Push-pull box

Push the hand lever of the syringe.

14. Button of the push-pull box

Press this button to pull the push-pull box to the proper position for the installation of the syringe.

15. AC power indicator light

The light is yellow when the syringe pump is connected to AC power.

16. Battery indicator light

- When the battery is not being charged, according to the capacity of the battery, green light is on when the battery is high; yellow light is on when the battery is medium; red light is on when the battery is low; red light flashes when the battery is exhausted.
- When the battery is being charged, green light, yellow light and red light flash alternatively. When the battery is fully charged, green light is on.

17. Running indicator light:

When the syringe pump is running, the indicator light flashes from right to left. When the syringe is not running, the indicator light is off.

18. PreS indicator light

If this indicator light is on, it means that the value on the display is PreS.

19. Sum indicator light

If this indicator light is on, it means the value on the display is sum.

20. Rate indicator light

If this indicator light is on, it means the value on the display is the injection rate.

NOTE

- **When rate indictor light, sum indicator light and PreS indicator light are on at the same time, the value on the display is Bed No.**

21. 10ml syringe indicator light

When the syringe pump tests 10ml syringe, this indicator light is on.

22. Near alarm indicator light

If this indictor light is on, alarm occurs which indicates the PreS is about to be completed.

23. 20ml syringe indicator light

When the syringe pump tests 10ml syringe, this indicator light is on.

24. Occlusion alarm indicator light

If this indicator light is on, it means occlusion occurs and the injection should be stopped.

25. 50ml syringe indicator light

When the syringe pump tests 50ml syringe, this indicator light is on.

26. Syringe empty alarm indicator light

If this indicator light is on, it means the syringe is about to be empty.

27. Bolus key

During injection, keep pressing this key to start bolus injection. Stop pressing this key to return to the previous injection rate.

28. Stop key

During injection, press this key to stop the injection ; if alarm occurs, press it to eliminate the alarm(except the alarm of BAT.LOW)

29. Start key

After the correct installation of the syringe, press this key to start the injection.

30. Power key

- Power on: press this key and then stop pressing.
- Power off: keep pressing this key for a long time until the power-on interface appears.

31. Select key

Press this key and the display will show the injection rate, sum, PreS and Bed No alternatively.

32. Clear key

- In the status of stop, press this key to clear the sum.
- When alarm occurs, press this key to pause the alarm sound for 2 minutes (except the alarm of BAT.LOW)

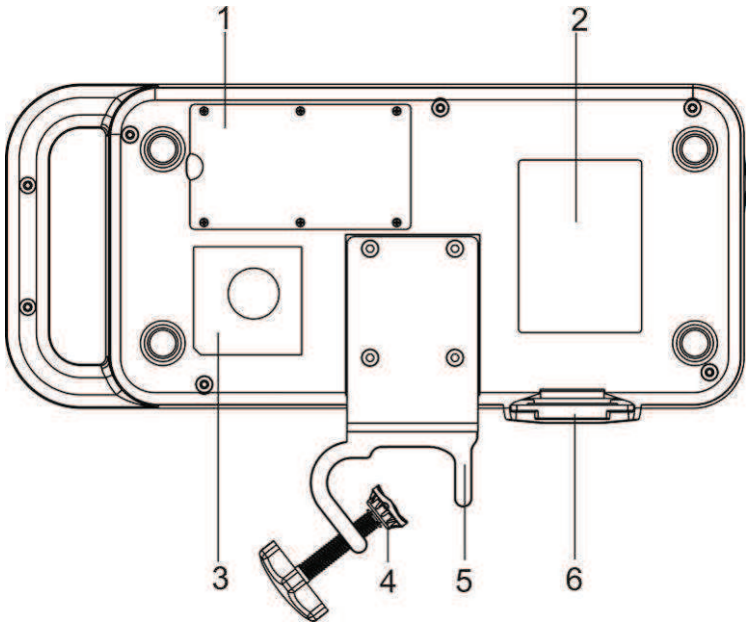
33. Stepping adjusting indicator

Indicate the direction of the stepping.

34. Ajusting knob

- Turn to adjust the value.
- Press to save the setting.

2.2.2 Back panel



1. Battery cover

2. Product label

3. Loudspeaker

4. Knob

It is used together with the fastener to fix the syringe pump to the support.

5. Fastener

Fix the syringe pump to the support.

6. AC power interface

2.3 Battery

2.3.1 Overview

The syringe pump uses built-in rechargeable battery (“battery”) to guarantee the normal use of the pump when patients transfer or electricity fails in hospital. The battery will charge itself automatically once the pump is connected to the AC power and in Power on situation. The pump shall work with its battery in case of sudden electricity break down.

The battery can be used for a certain period. At least 30 minutes before the battery is exhausted, the syringe pump will start the alarm of BAT.LOW with continuous alarm sounds and indicators. At least 3 minutes before the battery is exhausted, the syringe pump will start the alarm of BAT.EXHAUST with continuous short sounds and indicators, and stop running.

Battery indicator light indicates the status of battery capacity:

- When the battery is not being charged, according to the capacity of the battery, if green light is on, that means the battery has high capacity. If yellow light is on, that means the battery has medium capacity. If red light is on, that means the battery has low capacity. When the battery is exhausted, red light flashes.
- Green light, yellow light and red light flash alternatively when the battery is being charged. Green light is on when the battery is fully charged.

NOTE

- **8-14 hours are required to have the battery fully charged.**
- **Please discharge the battery every three months to prevent damage of the battery if the product is not used for a long time.**
- **Battery is a consumable part. Please replace it when it is nearly exhausted.**
- **In case the battery needs to be replaced, please contact the local distributor or the manufacturer.**

2.3.2 Battery Guidelines

The life span of the battery depends on its usage frequency and environment. If proper usage and maintenance are adopted, its life span is 3 years. Otherwise, its life span will be reduced. The battery shall be replaced every 3 years.

For safe usage and extend the life span of the battery, please follow the battery guidelines:

- Yearly battery check is needed. Before the pump is sent for maintenance or you doubt the battery is the cause for error, the battery check is needed.
- Optimize the battery every three months in use (or storage), or when the running time of the syringe pump is significantly shortened.
- Using 1C current (1C current shall be larger than the working current of the working plate, the max charging current of the protection plate is the working current of protection plate) 8.4v limited voltage to charge the battery for 0.5hour in order to guarantee that the battery is stored with electricity.

⚠WARNING

- **Use the battery provided by the manufacturer.**
- **Please replace the battery once the battery is damaged or leaking.**
- **Damaged battery shall not be used on the syringe pump.**
- **The used battery shall be returned to the distributor or manufacturer, or be disposed according to applicable laws.**

2.3.3 Battery Maintenance

2.3.3.1 Optimizing a Battery

Optimize the battery when it is used for the first time. A complete optimizing cycle includes: continuously charge the battery until the battery is fully charged, then discharge the battery until the pump powers off automatically. Then charge the battery continuously again until the battery is fully charged. During the usage, a regular optimization should be made to extend its life span.

NOTE

- **The actual battery capacity will reduce after the battery is used for some time. If the battery capacity is shortened obviously during optimizing, please replace the battery.**

Please follow the steps below during optimizing:

1. Disconnect the syringe pump and the patients, and stop the injection.
2. Connect the syringe pump to the AC power and charge the battery continuously for 12 hours.
3. Disconnect the syringe pump and the AC power, and use the battery as the power supply until the syringe pump powers off automatically.
4. Connect the syringe pump to the AC power and charge the battery continuously for 12 hours
5. Optimizing battery performance is completed.

2.3.3.2 Checking a Battery

Regular check for the battery is needed due to the reason that the battery function will decrease during usage. Please follow the steps below when checking battery function:

1. Connect the pump to the AC power and charge the battery continuously for 8 to 14 hours.
2. Start the syringe pump and install the 50ml syringe.
3. Set the rate of the syringe 5ml/h and start injection.
4. Continuously run the syringe pump until it powers off because of battery exhaust.
   - ◆ If the battery works for over 200 minutes, the battery is in fine condition.
   - ◆ If the battery works for 60 to 200 minutes, the battery is close to the end of its life.
   - ◆ If the battery works for less than 60 minutes, the battery needs to be replaced.
5. Please charge the battery for future usage after checking.

NOTE

- **If the using time of the battery is too short after full-charge, there might be a damage of the battery. The power supply time of the battery depends on the using frequency of the pump and its setting parameters. E.g. the display is in backlight mode.**
- **If the battery has obvious damage (bumps, deformation, leakage) or can not reach the capacity, it should be replaced and recycled.**

2.3.4 Battery Recycling

If the battery has obvious damage (bumps, deformation, and leakage) or can not reach the capacity, it should be replaced and recycled. Please follow the applicable laws during the battery recycling.

⚠WARNING

- **The battery must not be disassembled, thrown into fire or short circuited. The burning, explosion and leakage of the battery may cause personal injury.**

3 Installation and Maintenance

3.1 Installation

⚠WARNING

- **The software copyright of this syringe pump belongs to our company. Any infringement act such as falsification, reproduction or exchanging by any means or in any form by any organization or individual is not allowed without permission.**

3.1.1 Out of Box Audit (OOBA)

Before opening the box, please check the package carefully to find if there is any damage to the products during transportation. If there is any damage, please contact the forwarder or our company immediately.

If the package is intact, please open the package in right way, take out the syringe pump and its accessories with care, and check them out in accordance with the packing list. Please examine if there is any mechanical damage to the pump and whether the package includes all things on the packing list. Please contact our customer service department immediately if there is any inquiry.

⚠WARNING

- **Please keep the packing materials out of the reach of children. The packing materials must be disposed in compliance with the local laws and regulations or the hospital policy on waste treatment.**

NOTE

- **Please keep the packing case and packing materials for the future use.**
- **Please contact the sales agent or our company if any of the spare parts is missing when you open the package.**

3.1.2 Environmental Requirements

The service environment of this syringe pump must meet the requirements in ***A.2 Product Specifications.***

The service environment of this syringe pump should also be appropriately protected from noise, vibration, dust, or corrosive, inflammable or explosive, Substances. There should be 2 inch (5cm) inters pace around the syringe pump to make sure the air moves freely.

When the syringe pump is transferred from one place to another, the difference in temperature and humidity may cause condensation to the syringe pump. In this case, please do not turn on the pump until there is no condensation.

3.1.3 Power Supply Requirements

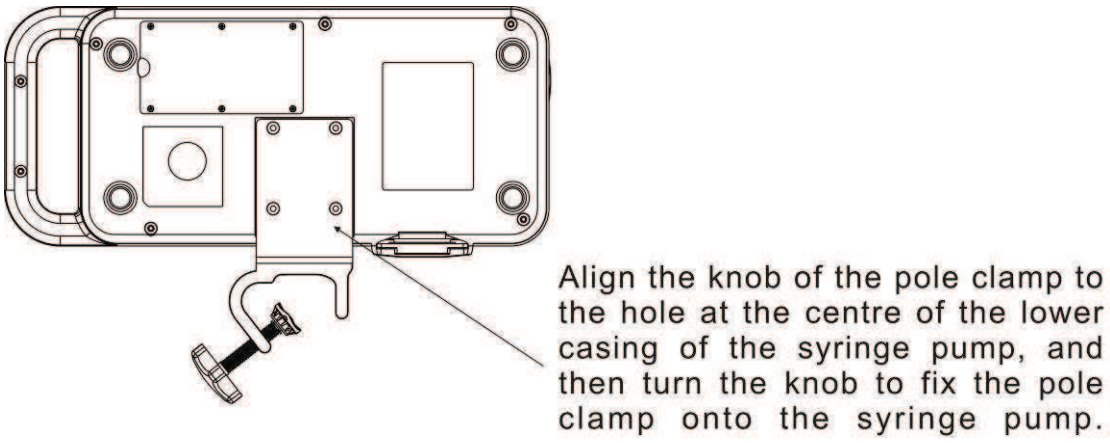
The power supply of this syringe pump must meet the requirements in ***A.3 Product Specifications.***

⚠WARNING

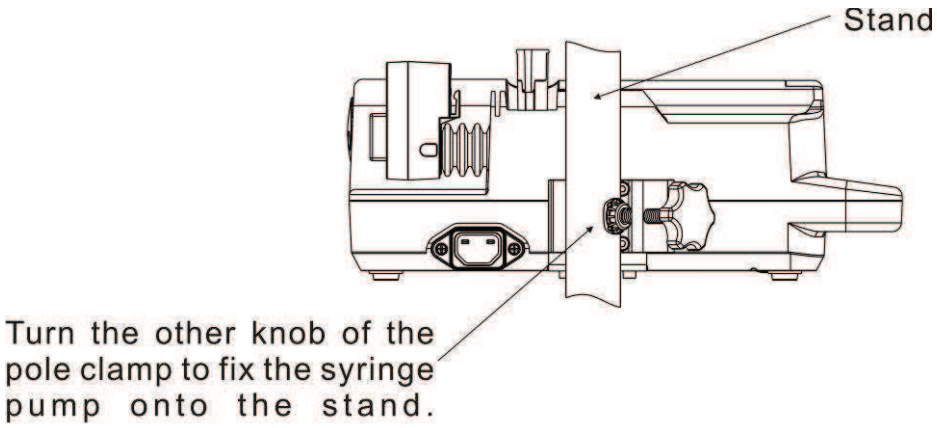
- **Make sure the working environment and power supply meet the environmental requirement and the power supply requirement listed above. Otherwise, the syringe pump will not meet the technical specifications claimed in *A Product Specifications*, and it may also cause the unexpected consequence such as device damage.**
- **The power supply must be selected in accordance with the settings of the system power voltage. Otherwise, it may cause sever damage to the system.**

3.1.4 IV stand setting

1. This syringe pump should be used at a horizontal level.
2. Align the knob of the pole clamp to the hole at the centre of the lower casing of the syringe pump, and then turn the knob to fix the pole clamp onto the syringe pump
3. Check the stability of the stand
4. Turn the other knob of the pole clamp to fix the syringe pump onto the stand.



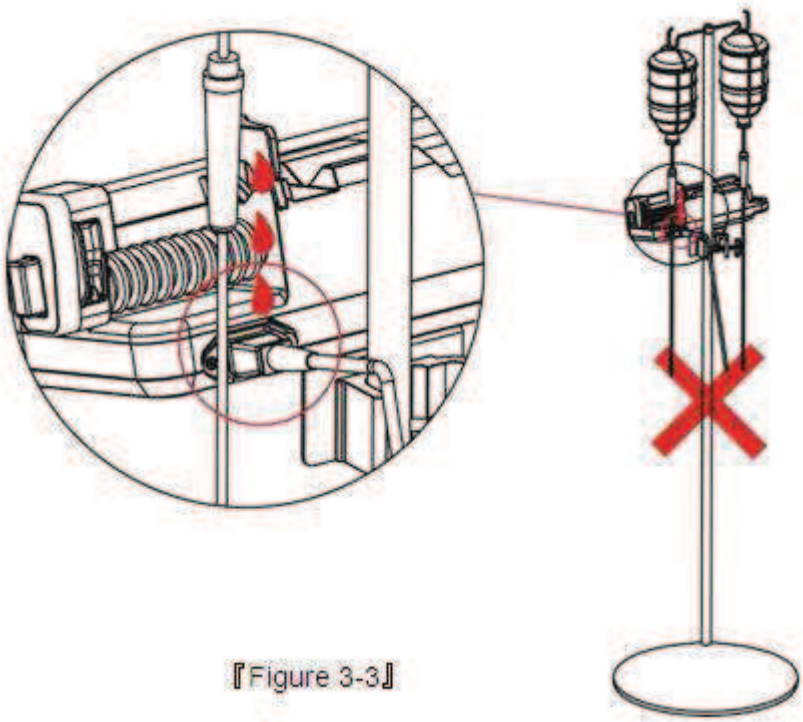
『Figure 3-1』



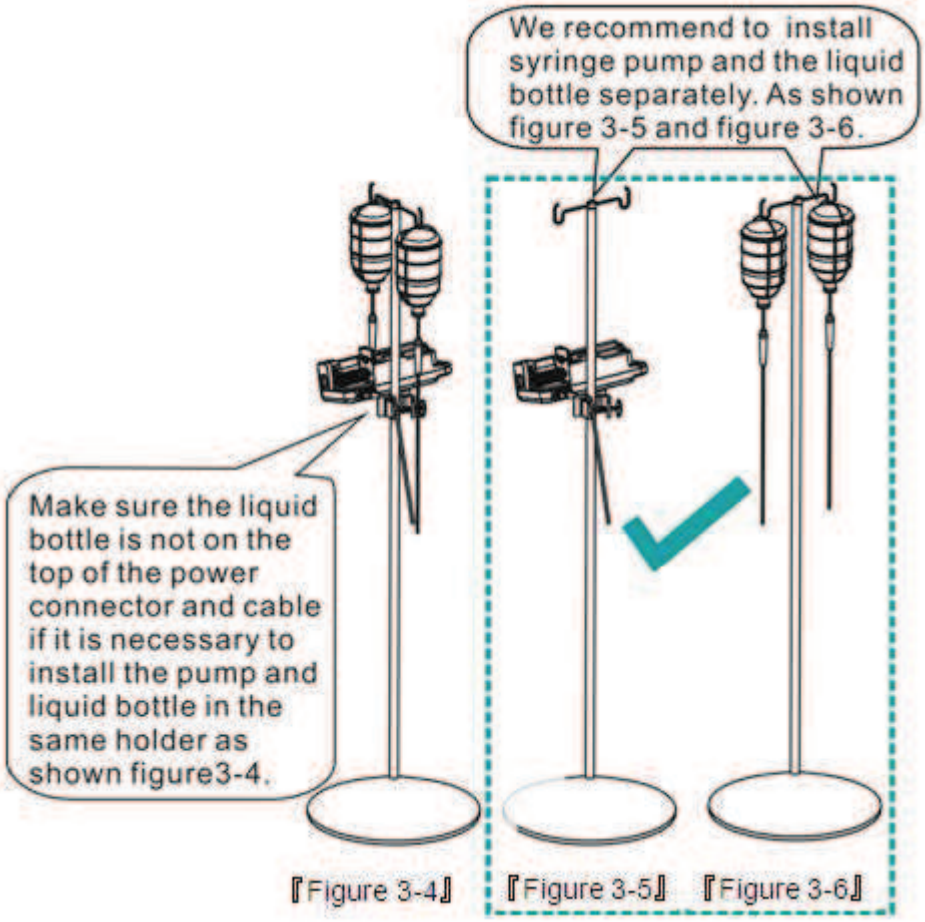
『Figure 3-2』

⚠ WARNING

- **Please don't hang the liquid bottle on the top of the syringe pump to keep medicine liquid from dripping causing the power short circuit.**



『Figure 3-3』



『Figure 3-4』 『Figure 3-5』 『Figure 3-6』

3.2 Maintenance

⚠WARNING

- **The hospital or medical establishment using this syringe pump must set up a complete maintenance plan. Otherwise, it may cause device failure or some unexpected consequence, and even threaten the personal safety.**
- **All the safety inspection or the maintenance work which involves the disassembling the device must be preceded by the professional maintenance personnel. The operation of any unqualified people may cause device failure and even threaten the personal safety.**
- **Please contact the distributor or our company immediately if you find any problem of the pump.**

3.2.1 Inspection

The pump must be given an overall inspection before use, after 6~12 months' continuous use, or after maintenance or updating to ensure the normal operation and work.

The inspection standards are:

- The environment and power supply meet the requirements
- The battery performance
- The power cord has no abrasion and is well performed in electric insulation.
- Pass the leakage current test.
- The devices and accessories have no mechanical damage
- The accessories used with the pump are specified.
- The alarm system is well functioned.
- No leakage after installation of the syringe tube
- The pump works well under all syringe modes.

If there is any pump damage or abnormal phenomena, please do not use the syringe pump, and immediately contact the distributor or our company.

3.2.2 Cleaning

The pump must be cleaned or disinfected with the materials and methods listed in this chapter. Otherwise, our company will not take the responsibility for any damage or accident caused by the cleaning and disinfection with other materials and methods.

Our company will not take any responsibility for the effectiveness of the infection control with the following chemicals or methods. Please contact the infection prevention department of the hospital or epidemic experts for the method of infection control.

Please keep your devices and accessories away from the dust, and comply with the following provisions to prevent the device damage:

- Please dilute the cleanser and disinfectant in accordance with the manufacturer's indication, or with their concentration as low as possible.
- Do not submerge the pump in the liquid.
- Do not dump the liquid on the device or its accessories
- Prevent liquid from the pump body.
- Do not use the abrasive material (such as steel wool or silver polishing agent) and any strong dissolvent similar to acetone and acetone to prevent ouster shell damaged.

⚠WARNING

- **Please turn off the power and disconnect the AC power supply before cleaning the device.**

⚠CAUTION

- **Please turn off the power and disconnect the AC power supply before cleaning the device. If the liquid is dumped on the syringe pump or its accessories by accident and make the syringe pump not work; please contact with the agent or manufacturer.**

The device should be cleaned regularly. The cleaning frequentness should be improved in areas with serious environmental pollution or heavy wind and sand. Please consult or refer to the specific regulations about device cleaning in the hospital.

The recommended cleansers are:

- Warm water
- Diluted soap water
- Diluted aqua ammonia

- Sodium hypochlorite (bleaching power for washing)
- Hydrogen peroxide (3%)
- Ethanol (70%)
- Isopropanol (70%)

When cleaning the device:

1. Turn off the power, and disconnect the power cord.
2. Wipe the case with soft cotton balls adsorbing the cleanser.
3. Wipe the surface of the device with soft cloth adsorbing 70% of ethanol.
4. Keep the device in the cool and ventilated environment to dry up.

The above steps are for reference only. Disinfection effects should be checked with the correct method

⚠CAUTION

- **Do not use gas (EtO) or formaldehyde for sterilization.**

3.2.3 Preventive Maintenance

1. Check the Syringe Rate.

Using measuring cylinder and stopwatch to check the syringe volume for every 6 month.

2. Maintain the Battery Performance

Please refer to 2.3.3 Battery Maintenance

3. Regular Maintenance

Interval	Routine Maintenance Procedures
According to the hospital policy	Thoroughly clean the feeding pump shell before or after long period of storage.
Check to the pump at least once a year.	1. Check the AC power plug and power cord. 2. Run the machine until it gives a low battery alarm. Then charge the battery to ensure it works and recharge well. 3. Check if the machine leakage after correct installation of feeding set

3.2.4 Pollution-Free Treatment and Recycling

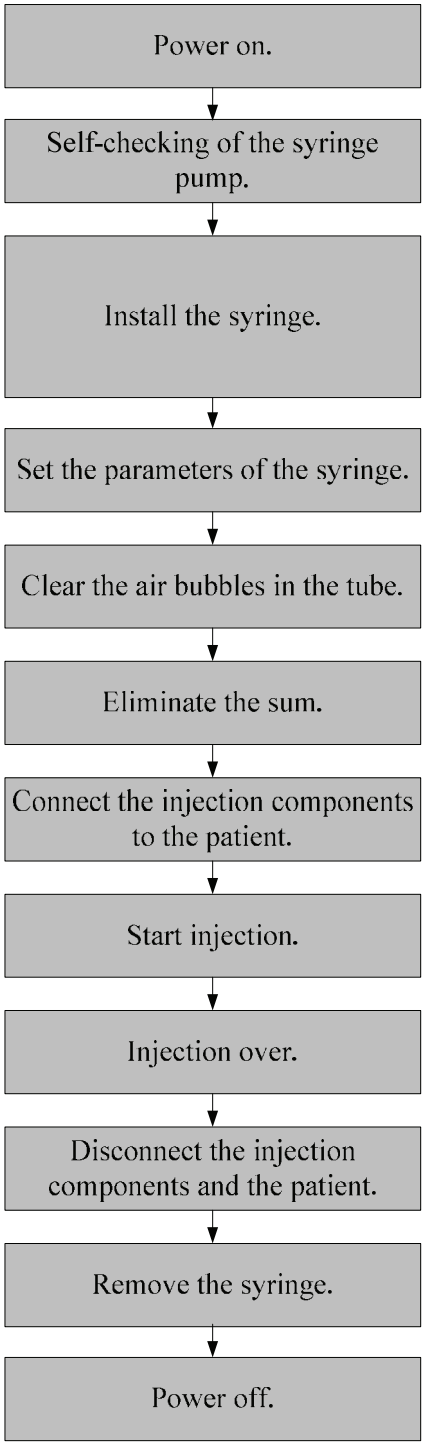
The service life of this product is 3 years. The pump exceeding its service life should be discarded. Please contact the manufacturer or distributor for more relevant information.

You can make the following treatments:

1. SK-500 Ⅰ syringe pump that has been scrapped could be sent back to its distributors or manufacturer for proper recycling.
2. Used-up lithium polymer batteries could be delivered to its distributor or manufacturer for disposition, or treated according to corresponding regulations.

4 Operation Guide

4.1 Operation flow chart



Press ⊙/Ò key;

The syringe pump starts self-checking and displays the interface of power-on.

1. Raise the hand lever and turn left to 90 degree; 2. press the button of the push-pull box and pull the push-pull box to the appropriate position; 3. Install the syringe with liquid medicine in the groove and fix the handspike to the groove of the push-pull box. The flange is fixed to the buckle; 4. Turn the hand lever right to 90 degree to make it return to the original position and press the syringe tightly.

Set the parameters according to the clinical requirements.

Check whether there are extra air bubbles in the extension tube. If there are, press ◇ Key to start the syringe pump and then press ▽ key after clearing the air bubbles.

Press C/🔔 key to eliminate the sum.

Connect the injection components to the patient.

Press ◇ key.

Press ▽ key.

Make sure to stop the injection and disconnect the injection components and the patient.

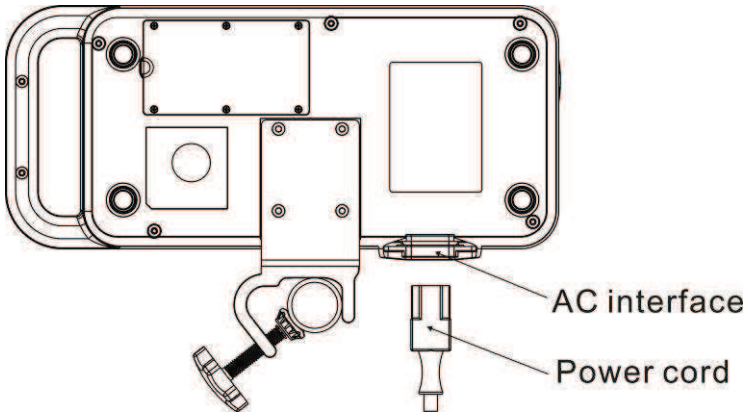
Raise the hold lever and turn 90 degree to the left. Remove the syringe and make the hand lever to the original position.

Press ⊙/Ò key.

4.2 Operation Steps

4.2.1 Connect to AC power

Insert the power cord into the AC interface of the syringe pump as shown in Figure 4-1.



『Figure 4-1』

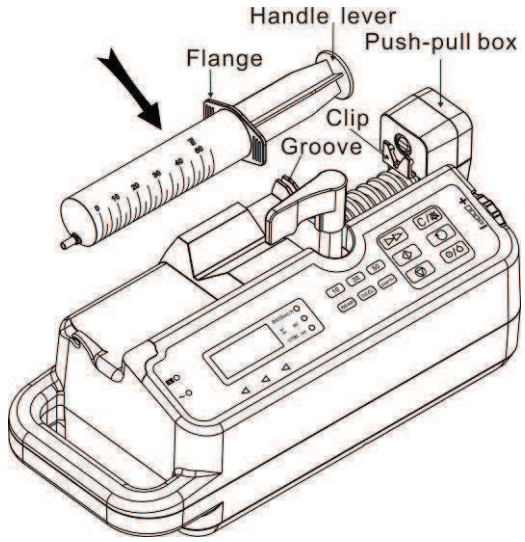
4.2.2 Start syringe pump

Please take the following steps to start the syringe pump after it is installed:

1. Please refer to ***3.2.1 Inspection*** to make safety inspection before turning on the pump.
2. Press ⊙/Ò key, and the syringe pump will conduct the self-checking and all the indicator lights flash alternatively.
3. The pump finishes self-checking within several seconds and enters the main interface.
4. The user can operate this syringe pump through operation panel.

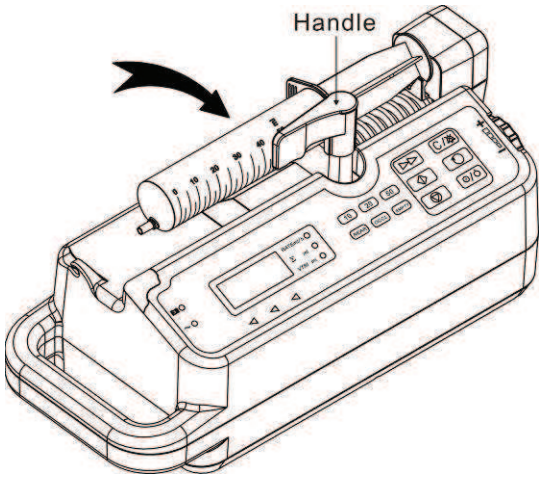
When the syringe pump is connected to AC power, the syringe pump can be charged whether it is turned on or off.

4.2.3 Install the syringe



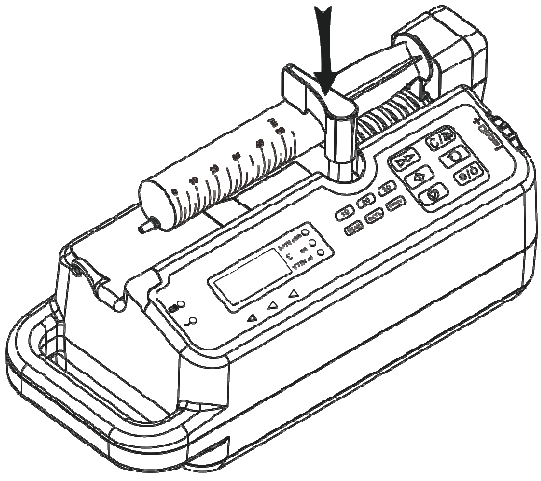
『Figure 4-2』

1. Pull the hand lever of the syringe pump up to its top and then turn it counterclockwise by 90 degree, press the key of the push-pull box to a suitable position as shown in Figure 4-2.



『Figure 4-3』

2. Put the syringe with liquid in its installation mounting groove. The handle and flange of the syringe must be installed into the groove of the push-pull box.



『Figure 4-4』

3. Turn the hand lever of the syringe lever clockwise by 90 degree to its original position and make it press the syringe. The display panel will show the type of the syringe as shown in Figure 4-4.

⚠WARNING

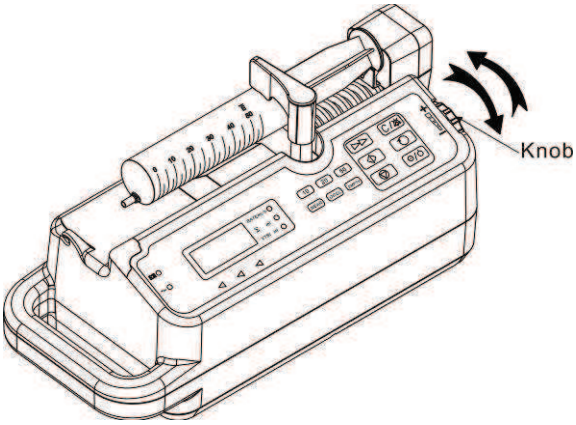
- **Check and make sure that the syringe and the tube do not contain any air bubble.**
- **Do not use the push-pull box to pull the piston of the syringe. Otherwise, it may damage the clip.**
- **If the clip on the push-pull box of the syringe pump is damaged and can not fasten the handle of the syringe, please stop using such syringe pump immediately. Otherwise, the liquid medicine in the syringe may flow by itself due to syphonage caused by gravity, and may cause severe injury or even death of the patient.**
- **The handle and flange of the syringe must be installed into the groove before injection. Otherwise, improper operation may cause unexpected consequences, or even cause severe injury to patients.**

4.2.4 Input the parameters

As shown in Figure 4-5, input the parameters according to the following steps:

1. Press  key and the related indicator lights are on: rate, sum, PreS and Bed No.
2. Turn the adjusting knob to adjust the data as shown in Figure 4-6.

『Figure 4-5』



『Figure 4-6』

NOTE

- **When the indicator lights of rate, sum and PreS are on, it means the data on the display panel is the Bed No.**
- **If the adjusting knob is turned clockwise, the data increases; if the adjusting knob is turned anti-clockwise, the data reduces.**

4.2.5 Clear the sum

1. Make sure the syringe pump under the stop status.
2. Press  hey, as shown in Figure 4-7 the indicator light is on to show the sum on the display panel.
3. Press  key to eliminate the sum.

『Figure 4-7』

NOTE

- **The sum can be eliminated only when the syringe pump is under stop status.**

4.2.6 Start injection

1. Confirm that the syringe is installed correctly, all the parameters are set properly and the corresponding indicator lights are on before injection.
2. Press  hey. The push-pull box pushes the syringe piston and handle spike to move from right to left. The operation indicator lights will flash alternatively from right to left to start injection.

NOTE

- **The faster the operation indicator light flashes, the higher the rate is.**
- **If there is no need to accumulate the previous sum, press  key to eliminate all the previous sum.**

4.2.7 Injection completed

1. 3 minutes before the injection is completed, the near-completion indicator light flashes and gives the alarm sound to alert the user that the injection is about to be completed.
2. When the injection volume reaches the PreS, the injection is completed. The alarm indicator light flashes and the system runs in KVO mode, showing End and giving alarm sound to alert the user that the injection is about to be completed. Then press key to stop injection.

NOTE

- **In case of getting close to alarm, press C/ key to pause the alarm sound for 2 minutes. The alarm sound will continue 2 minutes later if nothing is done.**
- **In case of alarm, press C/ key to pause the alarm sound for 2 minutes and press key to stop the injection and eliminate the alarm.**

4.2.8 Shutdown

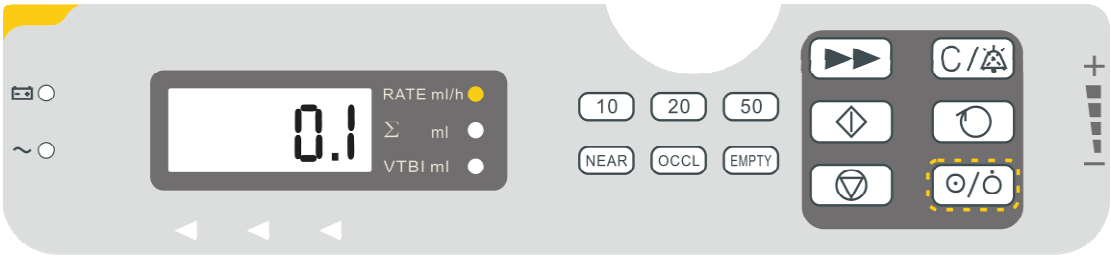
Shut down the syringe pump following the steps below:

1. Make sure to complete the injection.
2. Disconnect the tube between the syringe pump and the patient.
3. Press ⊙/Ò key for a long time, and when the progress bar is completed, the syringe pump will be shut down.

5 Function and Interface

5.1 Main Menu

Press ⊙/Ò key to start the syringe pump and enter the default main menu interface as shown in Figure 5-1.



『Figure5-1』

Press ↻ key to successively choose rate, sum, PreS and Bed N. When the corresponding indicator lights are on, turn the knob to adjust the value.

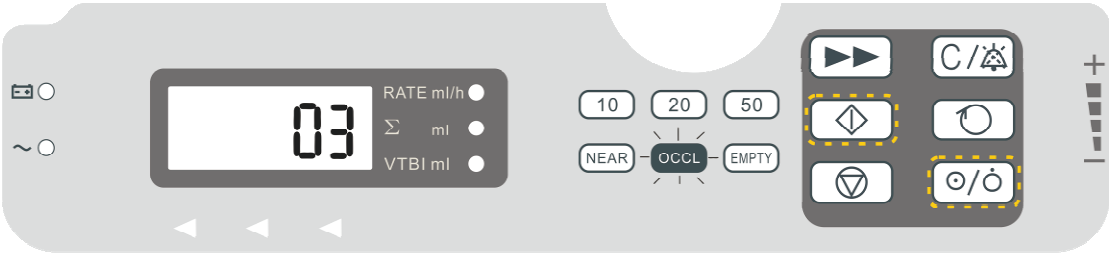
NOTE

- **If the indicator lights of rate, sum and PreS are all on, the value shown on the display is Bed No.**

5.2 SysSetting

5.2.1 Occl.Level Setting

When the syringe pump is in the status of power off, keep pressing ◈ key and ⊙/Ò key until all the six indicator lights 10 20 50 NEAR OCCL EMPTY are on. Then enter the interface of Occ.Level Setting as shown in Figure 5-2 and the corresponding occlusion alarm indicator light is on to show the current occlusion level. Then turn the knob to set the occlusion level and press the adjusting knob to save the setting and return to the main menu.



『Figure 5-2』

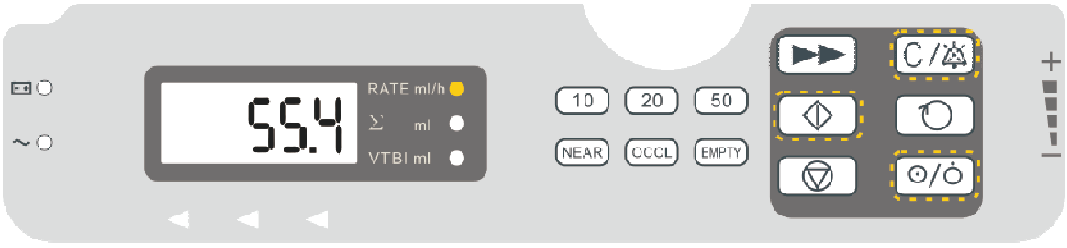
NOTE

- **The lower the occlusion level is, the higher the alarm sensitivity is.**

5.2.2 KVO Rate Setting

When the infusion is completed, the system will continue to rum in KVO mode and show the completion alarm and KVO rate. The KVO sum will be added to the total sum and not be shown individually.

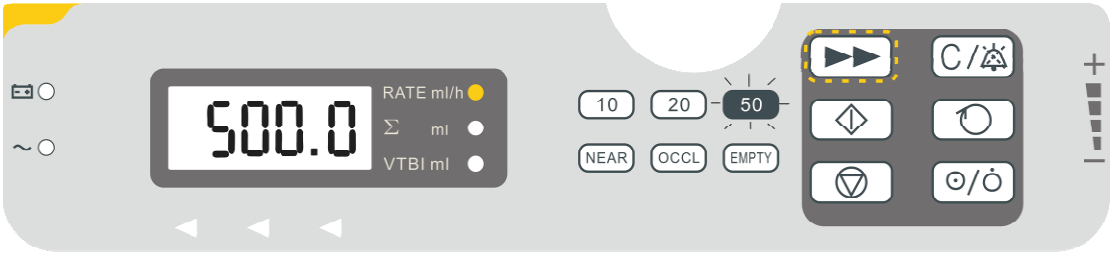
When the syringe pump is in the status of power off, keep pressing C/🔕 key and ◇ key and then press ⊙/Ò key until all the six indicator lights 10 20 50 NEAR OCCL EMPTY are on. Then enter the interface of KVO Rate Setting as shown in Figure 5. The default KVO rate is 1.0ml/h and the range is 0.1～5.0ml/h which can be adjusted.



『Figure 5-3』

5.3 Bolus Injection

If bolus injection is required and the current rate is lower than the syringe's bolus rate, keep pressing ►► key and the syringe pump will inject at the syringe's bolus rat as shown in Figure 5-4. When you stop pressing ►► key, it returns to the previous rate.



『Figure 5-4』

NOTE

- **The corresponding bolus rate of 10ml type syringe is 100ml/h.**
- **The corresponding bolus rate of 20ml type syringe is 200ml/h.**
- **The corresponding bolus rate of 50ml type syringe is 500ml/h.**

5.4 Non-operation Function

Under the status of the main menu and the parameter setting (rate, Bed No and PreS) without operation more than 2 minutes, the syringe pump will give non-operation alarm and show AtEn to alert the user to make timely operation. The alarm will be eliminated once the operation starts.

5.5 Anti-BOLUS

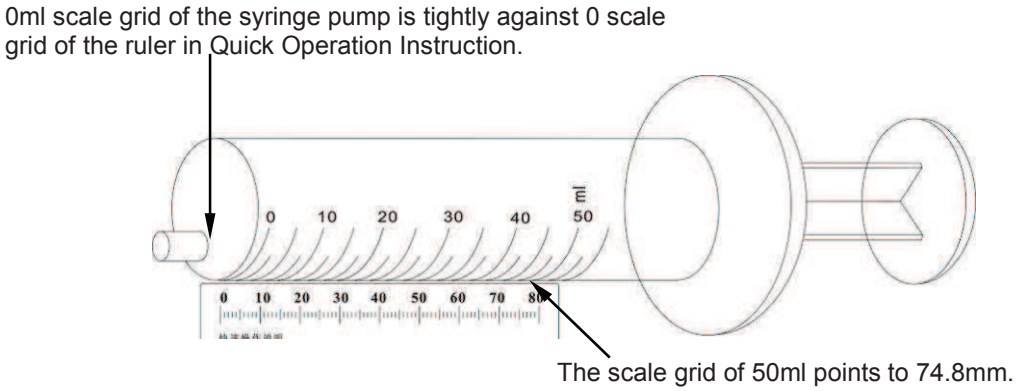
If occlusion occurs in injection, the occlusion alarm will be started and the motor will enter anti-bolus status. The motor will not stop running until the limited value of pressure is reached under the anti-bolus status.

5.6 Syringe Calibrating

The syringe pump is calibrated by DOVE disposable syringe which is also taken as Factor Setting of the syringe pump. When you change the brand of the syringe and find the accuracy incorrect, you need to calibrate the syringe again according to the following steps:

Step one: measure the length of the syringe (take 50ml type syringe as an example)

Firstly put the 50ml syringe on the ruler and measure and record the length of the syringe as shown in Figure 5-5 (The length of the syringe is about 74.8mm). Other types of syringes can be measured in this way.



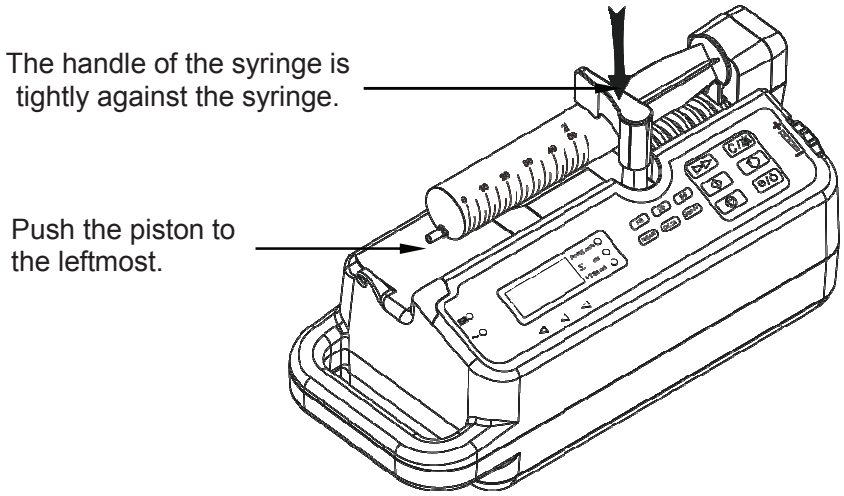
『Figure 5-5』

⚠WARNING

- **10ml syringe is measured within the length range of 0~10ml.**
- **20ml syringe is measured within the length range of 0~20ml.**
- **50ml syringe is measured within the length range of 0~50ml.**

Step two: install the syringe

As shown in Figure 5-6, push the piston of the syringe to the leftmost and fix the syringe onto the groove of the syringe pump. Push the push-pull box to the leftmost tightly against the piston and make the handspike of the syringe tightly against the syringe.

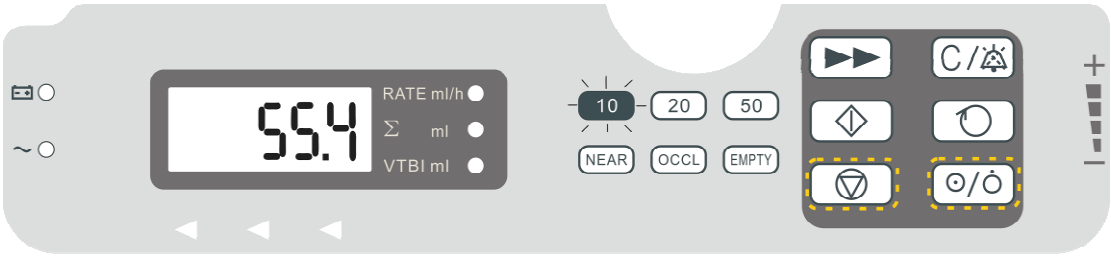


『Figure 5-6』

Step three: set the parameters of the syringe

1) Set the 10ml syringe

When the syringe pump is under the status of power off, keep pressing key and then press key until all the six indicator lights 10 20 50 NEAR OCCL EMPTY are on. Then the syringe pump will enter the setting interface of the 10ml syringe as shown in Figure 5-7 and the corresponding 10ml indicator light is on. Then turn the adjusting knob to set the value to the length of the syringe measured in Step one and press the adjusting knob to save the setting.



『Figure 5-7』

2) Set the 20ml syringe

When the syringe is under the status of power off, keep pressing ►► key and then press ⊙/Ò hey until all the six indicator lights 10 20 50 NEAR OCCL EMPTY are on. The syringe pump will enter the setting interface of the 20ml syringe as shown in Figure 5-8 and the corresponding 20ml indicator light is on. Then turn the adjusting knob to set the value to the length of the syringe measured in Step one and press the adjusting knob to save the setting.

『Figure 5-8』

3) Set the 50ml type syringe

When the syringe pump is under the status of power off, keep pressing C/ key and then press ⊙/Ò key until all the six indicator lights 10 20 50 NEAR OCCL EMPTY are on. The syringe pump will enter the setting interface of the 50 ml syringe as shown in Figure 5-9. Then turn the adjusting knob to set the value to the length of the syringe measured in Step one and press the adjusting knob to save the setting.

『Figure 5-9』

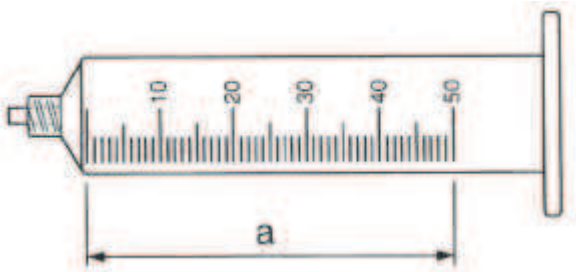
5.7 Syringe Brand

This syringe pump is calibrated by DOVE disposable syringe. Only 10ml syringe, 20ml syringe and 50ml syringe which meet the national standard can be used in this syringe pump. If other syringe brands which meet the national standard are used in the syringe pump, set the parameters of the syringe by referring to the 5.6 Syringe Calibrating. The use of syringes which don't meet the national standard or the incorrect setting of the parameters will affect the injection accuracy.

DOVE	10ml	20ml	50ml
	√	√	√

DOVE	References a(mm)		
	10ml	20ml	50ml
	52.9	62.1	74.8

Note: "a" refers to the length between the 0ml calibration line and the nominal size.



6 Alarms

6.1 Overview

Alarm is a warning indication given by the syringe pump through sound or light indicators to alert the medical care personnel in case of unexpected accidents (abnormal circumstance, disengagement) in the near-completion, completion or the process of the injection, or when the injection cannot continue due to the malfunction of the syringe pump.

⚠WARNING

- **There is a potential hazard for the same or similar devices to have different preset alarm in any single area.**

6.2 Alarm Level

Alarm level	Color of alarm lights	Cycle of sound indicators	Flashing frequency of lights	Duty ratio
High	Red	10 seconds	2.0±0.6Hz	20%-60%
Medium	Yellow	15 seconds	0.6±0.2	20%-60%
Low	Yellow	20 seconds	On	100%

6.3 Alarm Mode

The syringe pump will give visual and audible alarms to alert the users as below:

- Visual alarm
- Audible alarm
- Alarm information

The visual alarm and audible alarm identify the alarm modes in different ways.

6.3.1 Visual alarm

Visual alarm means that the alarm indicator light flashes in case of alarm and indicator lights of different colors will flash according to the type of alarm.

6.3.2 Audible alarm

Audible alarm means that the syringe pump gives alarm of different levels through different sound qualities in case of alarm.

- Single alarm: the single alarm sound circulates.
- Multiple alarm: multiple alarm will be given circularly.

6.3.3 Alarm information

Alarm information refers to the corresponding alarm indicator shown in status column.

- If new alarm occurs, visual alarm, audible alarm or circulating letters will be shown.
- When a pressure value surpasses the preset alarm limi, alarm will be given.

Alarm type includes:

- OVER
- SYRINGE EMPTY
- OCCLUSION
- DISENGAGE
- SYSTEM ERR
- BAT.EXHAUST
- BAT.LOW
- NON OPERATE
- NEAR
- AC DISCONNECT

6.4 Alarm countermeasures

⚠WARNING

- **When alarm occurs, check the patients first.**

When the syringe pump gives alarm, take countermeasures following the steps as below :

1. Check the patients' conditions.
2. Confirm the alarm parameters and alarm type.
3. Identify the cause of the alarm.
4. Solve the cause of the alarm.
5. Check whether the alarm has been eliminated.

NOTE

- **Regarding the detailed countermeasures, please refer to *Appendix C-Alarm information*.**

FOR YOUR NOTES

A Product Specification

A.1 Safety Specification

Parameters	Specification
SFDA Classification	Class II
Type of Shock Protection	Class II, including inner power supply device
Degree of Shock Protection	Type BF, application part without quiver discharge effect
Classification of Waterproof	IPX3
Operating Mode	Continuous operation
Degree of Mobility	Portable device

A.2 Environmental Specification

Parameters	Specification
Operating Temperature	5～40ºC
Operating Humidity	20～80%, non-condensing
Operating Atmospheric Pressure	86～106kPa
Storage and Transportation Temperature	-20～50ºC
Storage and Transportation Humidity	10～95%, non-condensing
Storage and Transportation Atmospheric Pressure	50～106kPa
Storage Condition Statement	Non-corrosive gases and well-ventilated room

A.3 Power Supply Specification

Parameters	Specification
AC Power Supply	
Input Voltage	100～240V
Input Current	0.25～0.11A
Frequency	50/60Hz
Battery	
Quantity	1 piece
Type	Rechargeable Battery
Voltage	DC 7.4V
Capacity	1600mAh
Max. Power and Service Time	25VA，running no less than 4 hours at the rate of 5ml/h after being fully charged.
Charging Time	The battery shall charge automatically when the pump is connected to the AC power and in power on situation (It takes 8-14 hours for the battery to get fully charged).

A.4 Hardware Specification

Parameters	Specification
Complete appliance	
Size	310 mm×125 mm×115mm (Length×Width×Height))
Weight	≈1.8kg
LCD (Liquid Crystal Display)	
Type	LCD
Size	2.0 inches
Indicator Light	
Quantity	11 pieces
Fuse wire	
Withstand Voltage and Withstand Current Value	T 2A 250V～
AC Power Port	
Quantity	1 piece

A.5 Basic Parameters of Syringe Pump

Parameters	Specifications
Syringe specification requirement	Comply with GB 15810-2001 Disposable Sterilized Syringe
Syringe size (ml)	10, 20, 50
Max injection rate	500ml/h(it varies according to the types of the syringes)
Injection rate range (ml/h)	10ml syringe: (0.1～100ml/h) 20ml syringe: (0.1～200ml/h) 50ml syringe: (0.1～500ml/h)
Accuracy	±5％
Step increment (ml/h)	0.1
Bolus rate (ml/h)	10ml syringe: 100 20ml syringe: 200 50ml syringe: 500
Bolus accuracy	±20％
KVO rate	0.1～5.0ml/h; the default value is 1.0ml/h (Enter the KVO mode after the completion of running.)
Injection pressure	The maximum pressure that can be generated is 160kPa. The pressure threshold scope for occlusion alarm is (40~160) kPa. The injection rate is 5ml/h when the pressure threshold is minimum. The maximum time of occlusion alarm is 22 minutes.
Preset scope of injection volume	0.1～999.9 ml
Accumulated volume (ml)	0.1～999.9
Indicating information	Rate, sum, PreS, Bed No etc.
Alarm function	OVER, SYRINGE EMPTY, OCCLUSION, DISENGAGE, SYSTEM ERR, BAT.EXHAUST, BAT.LOW, Non-operation, NEAR, AC Disconnect.

A.6 Pressures that trigger an occlusion alarm, maximum alarm delays, and permissible maximum volumes per syringe

Reference occlusion value (Kpa)	Rate (ml/h)	Actually measured value of pressure (Kpa)	Alarm time (Min)	High dose volume (ml)
70±30	5ml	52.8	00:11:43	0.39
	100ml	52.67	00:00:37	0.48
	500ml	59.33	00:00:08	0.57
100±30	5ml	76.93	00:16:56	0.84
	100ml	75.33	00:00:51	0.89
	500ml	79.73	00:00:10	0.88
130±30	5ml	100.4	00:22:08	1.24
	100ml	103.8	00:01:05	1.30
	500ml	116.8	00:00:14	1.43

NOTE

- **Test condition of the above data:**
  - **FLUKE IDA4 PLUS tester**
  - **Syringe brand: Dove**
  - **Extension tube brand: BAOAN**
- **The occlusion pressure value, maximum delayed time and maximum dosage volume will be affected by test conditions.**

A.7 Infusion accuracy table

The following accuracy chart indicates the variation of the infusion from the beginning of the injection to the achievement of normal infusion volume.

A.7.1 Accuracy curve

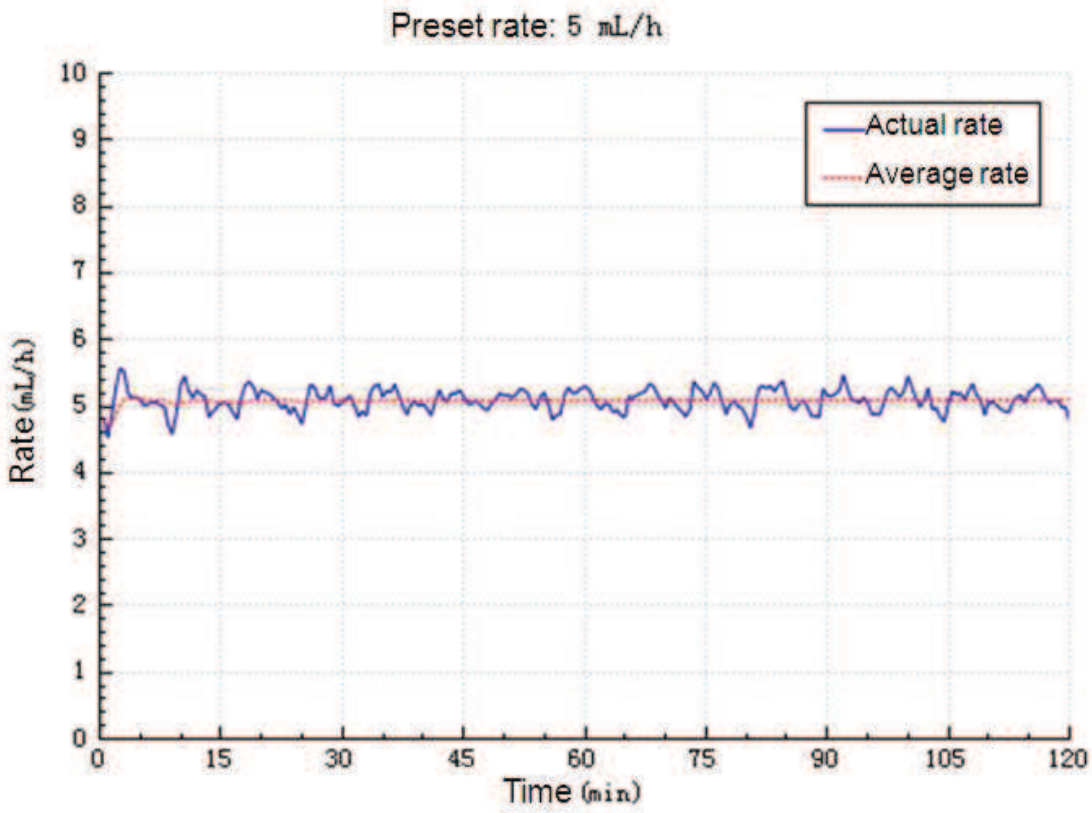
The accuracy curve is based on the data from two hours' measurements of the cycle.

Sampling rate: 5ml/h

Sampling interval: Δt =0.5 min

Test cycle: T=120 min

Infusion rate: Q (m/h)



A.7.2 Horn-shaped curve

The deviation of the infusion rate in a short term: (p△t)

Sampling rate: 5ml/h

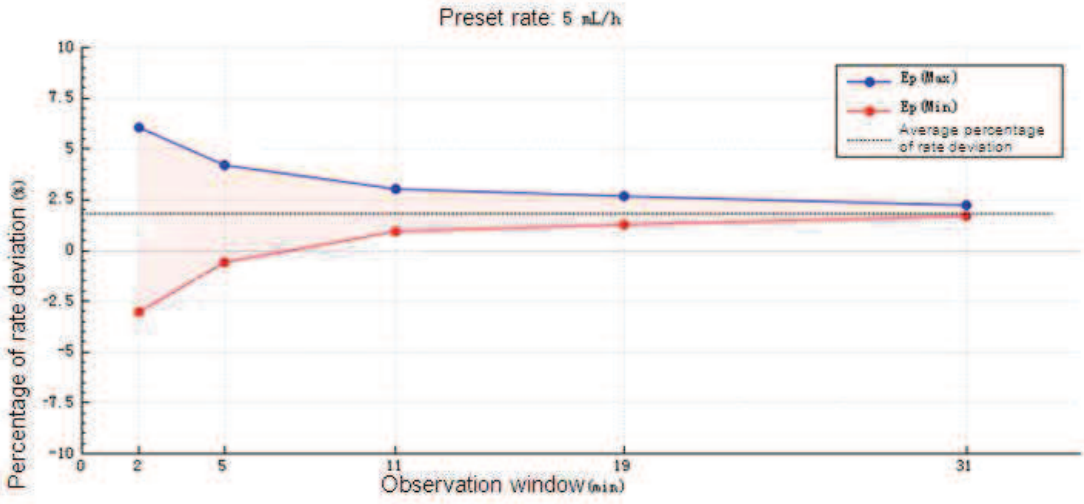
Sampling interval: △t =0.5 min

Observation window duration: p△t =2min,5min,11min,19min,31min

Maximum deviation within the designated duration: EPmax (%)

Minimum deviation within the designated duration:EPmin (%)

Average percentage of rate deviation: A (%)



NOTE

- **Infusion accuracy does not reflect the clinical criteria such as the age and weight of the patients and the usage of medication.**
- **Infusion accuracy may be affected by the working environment of the syringe pump (such as pressure, temperature, humidity and other infusion components).**

B EMC

This syringe pump meets the EMC standard EN 60601-1-2.

Note

- **Using the accessories, sensors and cables beyond the specified range may increase the electromagnetic emission of syringe pump or reduce the electromagnetic immunity.**
- **The syringe pump must not be closed or stacked with other equipments. When syringe pumps have to be used with other equipment, closely observe them to ensure normal operation.**
- **It needs special protection for the EMC of the syringe pump. And the installation and maintenance of machine should be under the following EMC environment:**
- **Syringe pump should not be used with MRI (magnetic resonance imaging) or similar devices, otherwise electromagnetic interference may cause malfunction or breakdown.**
- **Even the other devices comply with the emission requirements of CISPR, they may also interfere with the syringe pump.**
- **When the input signal amplitude is lower than the minimum amplitude in technical specifications, it may lead to inaccurate measurements.**
- **Portable and mobile RF communications equipment can affect the performance of monitor.**

Electromagnetic Emission Guidance and Statement		
The syringe pump should be used under stipulated electromagnetic environment. Customer or user should ensure using syringe pump under the following stipulated electromagnetic environment.		
Emission Testing	**Compliance**	**Electromagnetic Environment - Guidance**
Radio-frequency emission CISPR 11	Group 1	This syringe pump uses RF energy only when running its internal functions. Therefore, its RF emission is very low and will not produce any electromagnetic interference which affects the nearby electronic equipment.
RF Emission CISPR 11	Class B	This Syringe Pump is applicable for non-family and not directly connected to residential public low-voltage power supply network.
Harmonic emission IEC61000-3-2	Not applicable	
Voltage fluctuation and flashing IEC 61000-3-3	Applicable	

Guidance and Statement of Electromagnetic Immunity			
The syringe pump should be used under stipulated electromagnetic environment. Customer or user shall ensure using syringe pump under the following stipulated electromagnetic environment.			
Immunity test	**IEC60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact discharge ±8 kV air discharge	±6 kV contact discharge ±8 kV air discharge	The ground must be woodiness, concrete or ceramic tile. If floor is covered with synthetic materials, the relative humidity should be at least 30%.
Electricity rapid pulse group (EFT) IEC 61000-4-4	±2 kV power cord ±1 kV I/O cable	±2 kV power cord	Nets power quality must be a typical business or hospital environment.
Surge IEC 61000-4-5	±1 kV differential-mode ±2 kV common-mode	±1 kV differential-mode ±2 kV common-mode	
Voltage drop, short supply interruption and voltage change IEC 61000-4-11	＜5% U_T (drop＞95% U_T) 0.5 cycle 40% U_T (drop 60% U_T) 5 cycle 70% U_T (drop 30% U_T) 25 cycle ＜5% U_T (drop＞95% U_T) 5 seconds	＜5% U_T (drop＞95% U_T) 0.5 cycle 40% U_T (drop 60% U_T) 5 cycle 70% U_T (drop 30% U_T) 25 cycle ＜5% U_T (drop＞95% U_T) 5 seconds	Nets power quality must be a typical business or hospital environment. If the syringe pump needs continuous working during a break in the nets power, we recommend uninterrupted UPS power supply.
Industrial frequency magnetic field (50Hz /60Hz) IEC 61000-4-8	3 A/m	Not applicable	Not applicable
Note: U_T refers to the exchange net voltage before exerting test voltage			

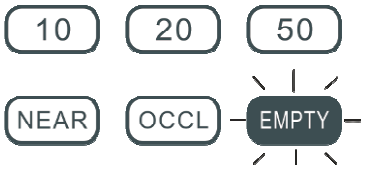
<table>
<tr><th colspan="4">Guidance and Statement of Electromagnetic Immunity</th></tr>
<tr><td colspan="4">The syringe pump should be used under stipulated electromagnetic environment. Customer or user shall ensure using syringe pump under the following stipulated electromagnetic environment.</td></tr>
<tr><th>Immunity Test</th><th>IEC 60601 Test Level</th><th>Compliance Level</th><th>Electromagnetic Environment - guidance</th></tr>
<tr><td>Conduction immunity
IEC61000-4-6</td><td>3 Vrms
150k~80MHz</td><td>3 V</td><td rowspan="2">Portable and mobile RF communications equipment must be used outside the equipment and / or systems (including cable) of any parts the prescribed distance. The separation distance is based on the transmitter frequency to choose the right formula calculated. The suggested calculation formula of isolation distance is:
3V
$d = 1.2\sqrt{P}$ 80M～800MHz
$d = 2.3\sqrt{P}$ 800M～2.5GHz
Among them, P is the Nominal maximum output power of transmitters, its unit is watt; d is the recommended distance, its unit is meter.
The field strength of RF transmitter obtained in electromagnetic field measurements a in every frequency range b must be less than line level.
It may appear interference by the equipment marked the following sign:
  </td></tr>
<tr><td>Radiation immunity
IEC61000-4-3</td><td>3V/m
80M~2.5GHz</td><td>3V/m</td></tr>
<tr><td colspan="4">Note 1: Use higher frequency band formula between 80 MHz and 800 MHz
Note 2: The above guidance does not apply to all cases, because material structure, objects and persons can absorb and reflect the electromagnetic wave and then affect the electromagnetic transmission.</td></tr>
<tr><td colspan="4">a The field strength of Radio (honeycomb and wireless) mobile phone’s base stations and ground mobile radio receivers, the antenna devices, FM and AM radio, television broadcast is unable to use pure theory for the accurate estimation.
In order to evaluate the electromagnetic environment produced by fixed RF transmitters, we should consider method of electromagnetic field measurement. If the measured field strength of working environment of syringe pump exceeded the stipulated RF level, we must observe whether syringe pump can work normally. Once abnormal situation was found, we must take corresponding measures, such as changing the direction of syringe pump or moving it to other places.
b When the frequency range is between 150 k and 80 Mhz, the field strength shall be less than 3 V/m.</td></tr>
</table>

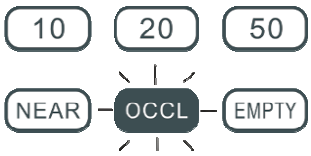
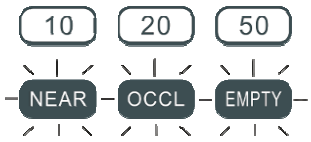
Recommended Distance Between Syringe pump and Portable/Mobile RF Communication Equipment			
The syringe pump can be used in the electromagnetic environment where RF interference can be controlled. In order to avoid electromagnetic interference, the customer or user should ensure that the syringe pump and portable/mobile RF communications equipment maintain the minimum recommended distance. The following recommended distance is calculated according to the maximum output power of communication equipment.			
The transmitter's maximum output power (W)	**Calculate isolation distance according to the transmitter frequency (m)**		
	150k~80MHz $d = 1.2\sqrt{P}$	80M~800MHz $d = 1.2\sqrt{P}$	800M~2.5GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
If the transmitter's maximum output power is not within the above range, we can estimate isolation distance by corresponding equation in column. P in the equation is the maximum output power given by transmitter manufacturer. The unit is watt. Note 1: Use the higher frequency band formula between 80 M and 800 MHz. Note 2: The above guidance does not apply to all cases, because material structure, objects and persons can absorb and reflect the electromagnetic wave and then affect the electromagnetic transmission.			

C Alarm information

C.1 Alarm information

Note: Column A indicates whether it can be totally eliminated; Column B indicates whether the acousto-optic can be eliminated; Column L indicates the alarm level.

Alarm information	Indicating information	A	B	L	Cause	Solutions
OVER		Y	Y	HIGH	The injection time reaches preset time or the sum amounts to the PreS. When the injection is over, the syringe runs at KVO rate and will stop if the rate reaches the KVO rate limit.	Press  key and the syringe pump will stop and the alarm will be eliminated.
SYRINGE EMPTY		Y	Y	HIGH	The syringe is empty.	Press  key and the syringe pump will stop and the alarm will be eliminated.

Alarm information	Indicating information	A	B	L	Cause	Solutions
OCCLUSION		Y	Y	HIGH	When the injection is affected by the occlusion or knotted tube or the tube pressure reaches the alarm pressure upper limit, alarm is given. The syringe pump will enter anti-bolus status and stop running after reaching the limit value of anti-bolus.	Press key and the syringe pump will stop injection and eliminated alarm. After the solving the occlusion, press key to start the injection again.
					The occlusion is too sensitive.	Lower the alarm value of occlusion.
					Sensor error	Contact the manufacturer.
DISENGAGE		Y	Y	Y	The syringe is disengaged or is not installed properly.	Reinstall the syringe.
					Sensor error	Contact the manufacturer.
					Wrong parameter setting of the syringe pump.	Refer to 5.6 Syringe Adjust and reset the parameters of the syringe.

Alarm information	Indicating information	A	B	L	Cause	Solutions
SYSTEM ERR		Y	Y	HIGH	Wrong inside connection and hardware error.	Press key to stop the injection and eliminate the alarm. Then press key to start the injection again. Contact the manufacturer if the alarm occurs again
					Motor error	Press key to stop the injection and eliminate the alarm. Then press key to start the injection again. Contact the manufacturer if the alarm occurs again
					The potentiometer is faulty.	
BAT.EXHAUST	flashes	N	N	HIGH	The battery is nearly exhausted.	Connect to AC power to fully charge the battery.
BAT.LOW	on	N	N	MEDIUM	The battery is too low and will be exhausted at least 30 min later.	Connect to AC power to fully charge the battery.
Non-operation		Y	Y	MEDIUM	If the injection is started by the pressing of the key, there will be non-operation and no alarm within the preset time.	Press key to start the syringe pump.

Alarm information	Indicating information	A	B	L	Cause	Solutions
NEAR		Y	Y	LOW	The syringe is about to be empty.	Press C/🔕 key to pause the alarm sound for 2 minutes (if the alarm is not solved 2 minutes later, the alarm sound will continue again) and prepare liquid medicine.
					The injection is about to complete the preset volume.	Press C/🔕 key to pause the alarm sound for 2 minutes (if the alarm is not solved 2 minutes later, the alarm sound will continue again) and prepare to complete the injection.
AC Disconnect	/	Y	Y	LOW	AC Disconnect, no language indications but lights and sounds.	Connect to AC power.

C.2 Prompt Message

None

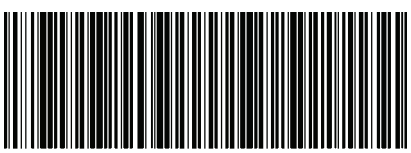
D Symbols and Terminology

D.1 Units

Abbreviation	Meaning
min	Minute
h	Hour
Hz	Hertz
mg	Milligrams
g	Gram
kg	Kilogram
kPa	Kilopascal
ml	Milliliter

D.2 Terminology

Abbreviation	Meaning
MRI	Magnatic resonance imaging
AC	Altenating current
DC	Direct current
EMC	Electromagnetic compatibility
KVO	Keep vein open
ERROR	Error
IEC	International Electrotechnical Commission
ISO	International organization for Standardization
LED	light emitting diode
CPU	central processing unit
RAM	random access memory
ROM	read-only memory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