



Syringe Pump

BYZ-810/BYZ-810D

Operating Manual



Please read it carefully before using this product.

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I. Introduction

1.1 Working Principle and Intended Use

Syringe Pump is a kind of micro Syringe Pump with certain rate and constant volume. Through microprocessor's accurate control over precision stepper motor, it produces horizontal movement thrust via mechanical driving devices to drive the piston rod of syringe. The syringe pump has various kinds of sensors which can accurately control the injection rate of disposable syringe and monitor the injection process. Therefore, it is a kind of high-precision intelligent syringe pump.

This instrument is especially suitable for clinical treatment that needs long-time accurate control of injection rate and supervision of injection process. It can be widely applied in traditional intravenous, anesthetic, anticoagulant injection and chemotherapy for patients. It can also be applied in ICU and CCU etc.

1.2 Features

- Audible and visual alarm for occlusion, empty, near empty, low battery, end of injection, syringe loose, wrong setting etc.;
- HD LCD Display, high capacity words, friendly user interface, dynamically display working status;
- Compatible with 10ml, 20ml, 30ml, 50/60ml syringe of any brands after correct calibration;
- Preset solution volume to greatly reduce the workload of nurses;
- Three work modes: Rate mode, Time Volume mode, Dosage Weight mode;
- Three levels of occlusion: high, medium and low;
- Purge and Bolus function;
- KVO (keep-vein-open) automatically opens as injection is completed;
- Freely Stackable: freely stack one syringe pump onto another to provide multiple solutions, which have a wide range of clinical applications;
- Power Source: 100~240Vac, 50/60Hz; Internal Battery;
- One-key operation makes setup easy and simple; Syringe Plunger Grabble Detector, operable with one hand in a No-Germ Environment;
- Automatically record the settings of last injection ([BYZ-810D can store](#)

2000pcs injection records).

1.3 Specifications

Injection Rate: 50/60ml Syringe: 0.1ml/h~999.9ml/h (0.1ml/h step)
1,000ml/h~1,500ml/h (1ml/h step)
30ml Syringe: 0.1ml/h~900.0ml/h (0.1ml/h step)
20ml Syringe: 0.1ml/h~600.0ml/h (0.1ml/h step)
10ml Syringe: 0.1ml/h~300.0ml/h (0.1ml/h step)

Flow Rate Accuracy: Within $\pm 3\%$ (after correct calibration)

Mechanical Precision: Within $\pm 2\%$

Bolus Rate: 50/60ml Syringe: 1,200ml/h
30 ml Syringe: 720ml/h
20 ml Syringe: 480ml/h
10 ml Syringe: 240ml/h

Purge Rate: 50/60ml Syringe: 1,500ml/h
30ml Syringe: 900ml/h
20ml Syringe: 600ml/h
10ml Syringe: 300ml/h

KVO Rate: 0.1ml/h~5ml/h (0.1ml/h step)

Volume Limit: 0.1ml~9999.9ml

Total Injection Volume: 0.1ml~9999.9ml (0.1ml step)

Occlusion: High: 800mmHg ± 200 mmHg (106.7kPa ± 26.7 kPa)
Medium: 500mmHg ± 100 mmHg (66.7kPa ± 13.3 kPa)
Low: 300mmHg ± 100 mmHg (40.7kPa ± 13.3 kPa)

Alarms: Injection is blocked, Injection finish, Injection soon finish, Limited finished, FF injection, Syringe falls off, Syringe improperly installed, Wrong setting, AC power has been pulled out, Low battery, Forget to operate, etc.

Power Source: 100~240Vac, 50/60Hz; Internal rechargeable Li battery, capacity $\geq 1,600$ mAh, voltage=11.1V, 4 hours backup time at the rate of 5ml/h (appointed medium rate in GB 9706.27-2005) for the new battery charged for 12hours.

Fuse: F2AL/250V, 2pcs installed

Power Consumption: 30VA

IP Classification: IPX4

Equipment Classification: Class II, internal power supply, Type CF

Operating Condition: Ambient temperature: +5°C~+40°C;

Relative humidity: 20%~90%

Atmospheric pressure: 86.0kPa~106.0kPa

Transport & Storage Condition: Ambient temperature: -30°C~+55°C

Relative humidity: ≤95%





Dimension: 280mm (L) × 210mm (W) × 130mm (H)

Net Weight: 2.2kg

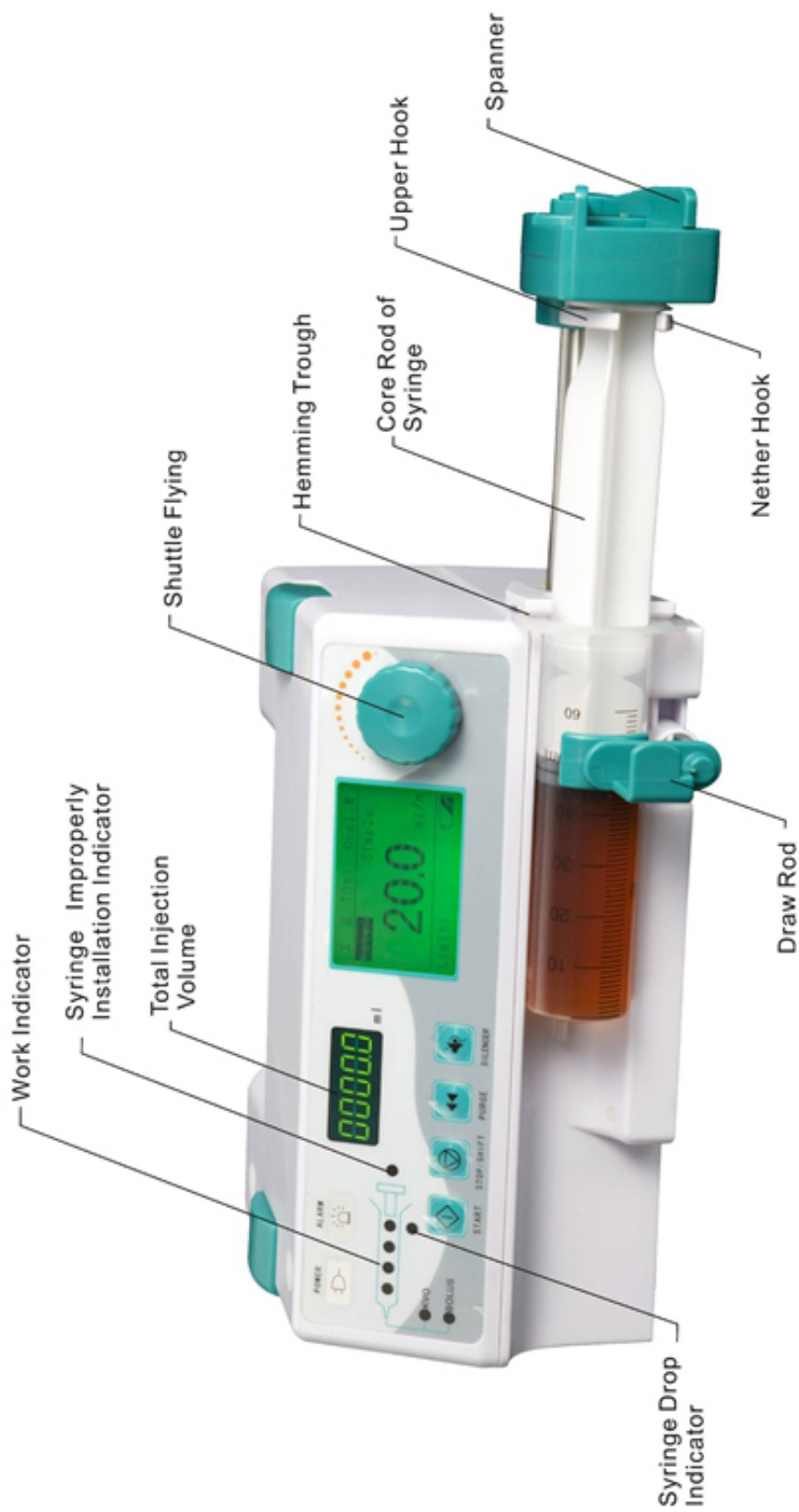
Syringe: Compatible with 10ml, 20ml, 30ml, 50/60ml syringe of any brands after correct calibration

Note: Disposable syringes and extension tubes sterilized by ethylene oxide that are used with this product shall comply with the standards of *GB15810 – 2001 Sterile Hypodermic Syringes for Single Use*. The syringes or extension tubes which do not comply with the standards may lead to incorrect injection rate, drug residues and other possible hazard.

1.4 Symbol Description

Symbol	Description
	Type CF Applied Part
	Class II Double Insulated
IPX4	Drip Proof
	Symbol for the electrical devices according to Directive 2002/96/EC. The device, accessories and the packaging have to be disposed correctly at the end of the usage. Please follow Local Ordinances or Regulations for disposal.
	93/42/EEC

1.5 Appearance



II. Installation

1. **Pump installation:** This product can neither be used as portable device, nor be placed on the sick bed during use. Users should place the syringe pump on the table or fix to the infusion support by tightening the screw handle. Before use, please make sure the syringe pump is firmly installed and the infusion support is stable.

2. Connect AC power with the three-pin plug power core supplied with the product. And use the internal battery only in the case of AC power failure. The AC power indicator will be ON when the AC power is used and it will black out when the internal battery is used.

3. **Syringe installation:** Fill the liquid medicine into the syringe and connect the syringe with extension tube and scalp needle first; then pull out the draw rod and rotate it counterclockwise 90°, clench the spanner and move backward, place the syringe onto the pump; finally rotate the draw rod clockwise 90° to clamp the syringe. Please note the syringe drop indicator will be ON for syringe loose. And please make sure the hemming of the syringe is inserted into the hemming trough of the pump and the end of the syringe core rod is well connected to the sensor that on the middle of the upper and nether hooks. Otherwise, the syringe improperly installation indicator will be ON.

4. **Syringe reinstallation:** Please press “Stop/Shift” key before reinstallation the tube or syringe first; then follow the above instructions to install it.

Notes:

- After the syringe is installed onto the syringe pump but before the needle is inserted into the patient, put the needle head vertically up to prevent the liquid medicine from flowing out by itself.
- Cleaning the extension tube is necessary. Manual handling is needed if cleaning the tube cannot be finished by purging at the single fault.
- All parameter settings are locked and can not be adjusted during injection. Users can reset the parameters only after the syringe pump stopped.

III. Operation

3.1 Calibration

Please do Calibration when any new brand syringe (10ml, 20ml, 30ml and 50/60ml) is being used for the first time. The calibration will allow the syringe

pump to measure the parameters of that syringe and store them automatically. There is no need to calibrate again when the same brand of syringe is used later.

Steps:

1. Pull the syringe (empty or filled with medicine) to the position of the largest scale at shutdown (e.g. pull the 30ml syringe to the scale of 30ml) and install the syringe properly.
2. Press “Start” key and hold on, simultaneously turn on the power switch at the back of the syringe pump, see the interface as Figure 1.
3. Press “Stop/Shift” key to move the cursor and rotate “Shuttle Flying” key to input the password “012.0”. Press “Shuttle Flying” key to enter into the custom interface as Figure 2.
4. Press “Shuttle Flying” key and rotate it to select Class A, B or C and press it again to confirm the selection. Rotate “Shuttle Flying” key to move the cursor to “OK” and press it to start the calibration, see the interface as Figure 3.
5. The calibration will be finished in a few minutes, entering into the main interface as Figure 4. Thus, the parameters of this syringe are stored into the syringe pump automatically.



Figure 1

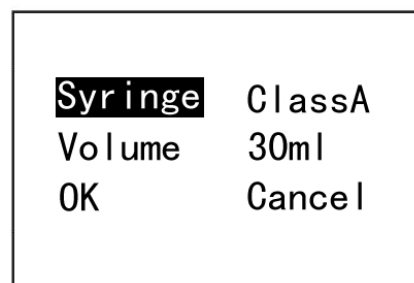


Figure 2

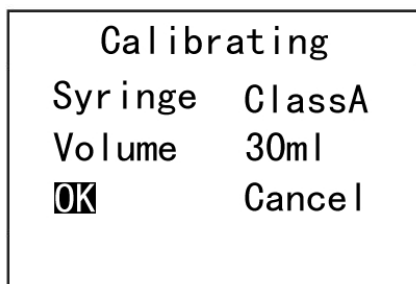


Figure 3

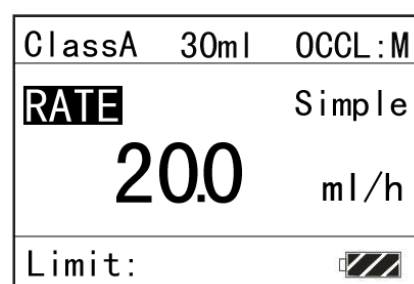


Figure 4

3.2 Parameter Setting

Turn on the power switch, the syringe pump will give alarm “AC power has been pulled out” to remind users if it is not connected to AC power, the interface is show as Figure 4. Press “Stop/Shift” key and hold on, simultaneously press “Shuttle Flying” key, it enters into the interface as Figure 5.

OK	
Volume	■■■■■■
OCCL	M
Syringe	ClassA
Mode	Simple

Figure 5

OK	
Volume	■■■■■■
OCCL	M
Syringe	ClassA
Mode	Vol/W

Figure 6

Voice Volume: Rotate “Shuttle Flying” key to move the cursor to “Volume” as Figure 6. Press “Shuttle Flying” key first and then rotate it to adjust the voice volume. Press “Shuttle Flying” key again to confirm it and come to next parameter setting.

Occlusion: Follow the same instructions as above to select occlusion level: H (high), M (medium) or L (low).

Syringe Brand: Follow the same instructions as above to select syringe brand: Class A, B or C. There are 3 recommended brands in total, while syringe of other brands can also be used after calibration.

Work Mode: Follow the same instructions as above to select work mode: Simple, Vol/T or Vol/W. After finishing parameter setting, rotate “Shuttle Flying” key to move the cursor to “OK” as Figure 5 and press it to save the setting, entering into the main interface as Figure 4.

- **Simple Mode:** At the main interface as Figure 4, press “Shuttle Flying” key and rotate it to adjust the injection rate as Figure 7. The “Stop/Shift” key can also be used to move the cursor. Press “Start” key to start working.

At the main interface as Figure 4, rotate “Shuttle Flying” key to move the cursor to “Limit” and press it to see the interface as Figure 8, limit volume can be preset by “Shuttle Flying” and “Stop/Shift” keys.

ClassA	30ml	OCCL:M
RATE		Simple
020.0		ml/h
Limit:		

Figure 7

ClassA	30ml	OCCL:M
RATE		Simple
20.0		ml/h
Limit:	00000 ml	

Figure 8

- **Vol/T (Time and Volume) Mode:** At the main interface as Figure 9, press “Shuttle Flying” key to enter into another interface as Figure 10. The injection rate will be calculated automatically through setting the Time and Volume by “Shuttle Flying” and “Stop/Shift” keys. Rotate “Shuttle Flying” key to move the cursor to “OK” and press it to save the setting.

Follow the same instructions in Simple Mode to set the limit volume.

ClassA	30ml	OCCL:M
RATE		Vol/T
20.0		ml/h
Limit:		

Figure 9

	Cancel	OK
Time	0060	min
Volume	20.0	ml
RATE	20.0	ml/h

Figure 10

- **Vol/W (Dosage and Weight) Mode:** At the main interface as Figure 11, press “Shuttle Flying” key to enter into another interface as Figure 12. The injection rate will be calculated automatically through setting the Drugs (medicine amount), patient Weight, liquid Volume, Dosage and dosage unit (ng/kg/min, ug/kg/min, mg/kg/min, g/kg/min, ug/kg/h, mg/kg/h, g/kg/h) by “Shuttle Flying” and “Stop/Shift” keys. Rotate “Shuttle Flying” key to move the cursor to “OK” and press it to save the setting.

Follow the same instructions in Simple Mode to set the limit volume.

ClassA	30ml	OCCL:M
RATE		Vol/W
120.0		ml/h
Limit:		

Figure 11

		OK
Drugs	50.00	mg
Weight	50.0	kg
Volume	20.0	ml
Dosage	6.000	mg/kg/h
Rate	120.0	ml/h

Figure 12

Notes:

- To ensure safety during the injection, please check all the parameters one by one after setting, which is to make sure the parameters conform to clinical treatment. If the parameters exceed specified range, the syringe pump will give alarm “Wrong setting” to remind users to reset.
- The syringe pump can record the settings of last injection automatically. There is no need further setting for injection under the same parameters.

Drug Library (only for BYZ-810D): Rotate “Shuttle Flying” key at the main interface as Figure 13 to move the cursor to “Drug library” and press it to enter into the interface as Figure 14. Rotate “Shuttle Flying” key to move the cursor to the related drug category, like Angiocarpy. Press “Shuttle Flying” key to enter into the interface as Figure 15. Rotate “Shuttle Flying” key to move the cursor to the related drug, like Isoket as Figure 16. Press “Shuttle Flying” key to return into the main interface in “Simple” mode. If it is in “Vol/T” or “Vol/W” mode, the syringe pump will enter into related injection rate setting interface and then return into the main interface.

Note (Cancel the drug): Follow the same instructions as above to enter into the interface as Figure 14, rotate “Shuttle Flying” key to move the cursor to “Cancel” and press it to cancel the drug selection.

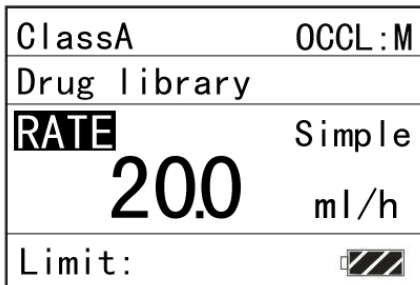


Figure 13

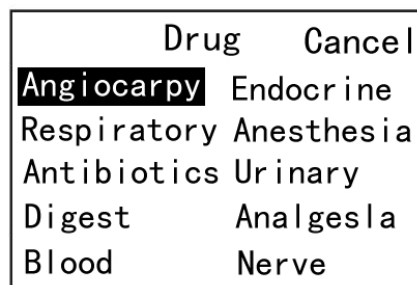


Figure 14

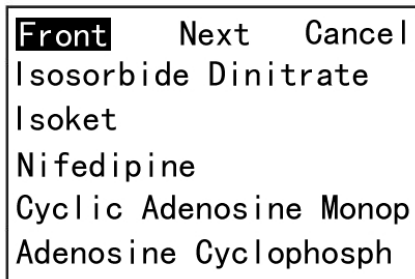


Figure 15

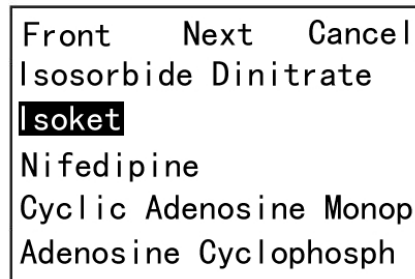


Figure 16

Time (only for BYZ-810D): Press “Stop/Shift” key and hold on, simultaneously press “Shuttle Flying” key at the main interface as Figure 13, it enters into the interface as Figure 17. Rotate “Shuttle Flying” key to move the cursor to “Time” and press it to enter into the interface as Figure 18. After setting the time by rotate and press “Shuttle Flying” key, rotate “Shuttle Flying” key to move the cursor to “OK” and press it to return into the interface as Figure 17.

OK	
Volume	■■■■■■■■
OCCL	M
Syringe	ClassA
Mode	Simple
Record	
Time	

Figure 17

Hr.	Min.	
10	05	
Day	Mon.	Year
02	07	2014
OK	Cancel	

Figure 18

Record (only for BYZ-810D): Follow the same instructions as above to enter into the interface as Figure 17. Rotate “Shuttle Flying” key to move the cursor to “Record” and press it to enter into the interface as Figure 19/20. Rotate “Shuttle Flying” key to check the different records and press it to return into the interface as Figure 17.

Record	0001/0002
02/07/2014	09:54
Isosorbide Dinitrate	
RATE: 20.0	IV: 1.0
02/07/2014	09:57

Figure 19

Record	0002/0002
02/07/2014	09:57
Isoket	
RATE: 20.0	IV: 0.5
02/07/2014	09:59

Figure 20

3.3 Purge

Press “Purge” key twice without release at the second time to remove the bubbles in the syringe and extension tube until liquid medicine appears at the tip of the needle. During the purging operation, the liquid medicine will not be added into the total injection volume.

Note: Make sure all the bubbles in the syringe and extension tube are removed before injection. Otherwise, there may be dangers.

3.4 KVO (keep-vein-open)

When the preset limit volume is finished under the normal injection, the syringe pump will alarm and turn into KVO automatically, keeping the injection tube open in case of haemal circumfluence.

KVO Rate Adjustment: Follow the same instructions as calibration to enter into the interface as Figure 1. Press “Stop/Shift” key to move the cursor and rotate “Shuttle Flying” key to input the password “010.0”. Press “Shuttle Flying” key to store the KVO rate. It comes into main interface automatically.

3.5 Bolus

When the syringe pump is under normal working condition, press “Purge” (Bolus) key twice without release at the second time, it comes into Bolus Mode. Releasing the key, the syringe pump will continue to work at the preset rate. During the Bolus Mode, the liquid medicine will be automatically added into the total injection volume.

3.6 Clear

Simultaneously press “Stop/Shift” key and “Silencer” key, the total injection volume shown on the digital display screen will be cleared to zero.

3.7 Restore Factory Settings

Follow the same instructions as calibration to enter into the interface as Figure 1. Press “Stop/Shift” key to move the cursor and rotate “Shuttle Flying” key to input the password “120.0”. Press “Shuttle Flying” key to restore factory settings. It comes into main interface automatically.

IV. Alarms and Disposition

The syringe pump will give audible and visual alarms when the alarms happen. Please deal with alarms immediately. The causes and solutions are given as below:

1. Injection begins. — Syringe pump will give alarm “*Injection begins*” when injection begins.

2. Please note injection soon finishes. — Syringe pump will give alarm *“Please note injection soon finishes”* to remind that the syringe is near to empty. Clear the audible alarm by pressing “Silencer” key.

3. Injection finishes. — Syringe pump will give alarm *“Injection finishes”* and switch to KVO automatically when the syringe is empty. Clear the audible alarm by pressing “Silencer” key or pressing “Stop/Shift” key to return to the main interface.

4. Injection of limited amount finished. — Syringe pump will give alarm *“Injection of limited amount finished”* when the preset limit volume is finished. Clear the audible alarm by pressing “Silencer” key or pressing “Stop/Shift” key to return to the main interface.

Note: If the limit volume is not preset, it means the injection volume is the whole liquid in the syringe.

5. Injection is blocked. — When the alarm *“Injection is blocked”* occurs, the syringe pump will stop working automatically. Please check the extension tube and the needle head etc. to clear the alarms. Clear the audible alarm by pressing “Silencer” key or pressing “Stop/Shift” key to return to the main interface.

✘ **Alarm Threshold and Triggering Time:** The occlusion pressure limit of the alarm is: Low (40.7kPa ± 13.3kPa), medium (66.7kPa ± 13.3kPa) and high (106.7kPa ± 26.7kPa). When the syringe pump works at a medium rate (5ml/h) or the lowest rate (0.1ml/h), the triggering time of alarm is as below table. Select a proper level of blockage alarm pressure after the occlusion fault is cleared. The maximum injection pressure during working is 180kPa.

Injection Rate (ml/h)	Occlusion Level	Occlusion (mmHg)	Triggering Time
5	Low	300	< 0h10min47sec
5	Medium	500	< 0h16min55sec
5	High	800	< 0h23min43sec
0.1	Low	300	< 0h57min49sec
0.1	Medium	500	< 1h24min29sec

0.1	High	800	< 1h41min17sec
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Notes:

- When the syringe pump works at a speed of 5ml/h, the pill dosage does not exceed 1ml when the selected alarm pressure level is low and it does not exceed 2ml when the selected alarm pressure level is high.
- When the alarm “Injection is blocked’ has been triggered, pull the spanner to keep it about 1mm away from the end of the syringe first and then process troubleshooting. It will be good to reduce the pill dosage caused by blockage.

6. This is the current volume. — When adjusting the voice volume, the alarm *“This is the current volume”* will be triggered in each volume.

7. Syringe falls off. — If the syringe looses, the syringe pump will stop working and the alarm *“Syringe falls off”* will be triggered and the Syringe Drop Indicator will be ON. Clear the audible alarm by pressing “Silencer” key or pressing “Stop/Shift” key to return to the main interface.

8. Syringe is improperly installed. — If the end of the syringe is not well connected to the sensor that on the middle of the upper hook and nether hook, the syringe pump will stop working and the alarm *“Syringe is improperly installed”* will be triggered and the Syringe Improperly Installation Indicator will be ON. Clear the audible alarm by pressing “Silencer” key or pressing “Stop/Shift” key to return to the main interface.

9. Wrong setting. — If the setted parameters exceed the specified range, the syringe pump will stop working and give alarm *“Wrong setting”* to remind users to reset.

10. Please do not forget the operations. — If the syringe pump is not be started after proper installation for more than 2 minutes, the alarm *“Please do not forget the operations”* will be triggered to remind users to start the injection.

11. AC power has been pulled out. — Syringe pump will give alarm *“AC power has been pulled out”* when turning on it without connecting the AC power or disconnect the AC power during injection.

12. Low battery! Please connect external power. — When the battery voltage is low, the battery cursor on the panel will blink intermittently and the syringe pump will give alarm *“Low battery, please connect external power”*. Press “Silencer” key to clear the audible alarm. The syringe pump can still

work for about 30min at the rate of 5ml/h and will stop working automatically at least 3 minutes before power off. The syringe pump will continue to work only after connecting the AC power. At the same time, the AC power indicator will light up and the internal battery will be charged.

V. Maintenance

- Please read the operating manual carefully before using the syringe pump.
- Please keep the syringe pump dry and clean it with wet rag with cleanser. Do not wash it with organic solvent, such as benzene and butanone etc.
- Please use the syringe recommended by the manufacturer or after correct calibration to ensure precision.
- Please don't use the high frequency interference equipments near to the syringe pump, like mobile phone etc.
- The syringe pump should be away from vibrations, dust, corrosive or explosive atmosphere, extreme temperature or excessive humidity & all large electrical appliances etc.
- Please don't install any other control equipments on the same injection tube during working. Otherwise, there might be dangers.
- The force to the injection tube should not exceed 5N. Otherwise, there might be dangers.
- Please make sure the hemming of the syringe is inserted into the hemming trough of the syringe pump. Otherwise, it may do harm to the patient due to no medicine output or overdosage caused by siphonage.
- The charge-discharge times of the internal battery is about 500 times. The syringe pump can work for more than 4 hours at power failure if the battery has been charged for 6~8hours. However, the backup time will be affected by battery usage time, environment and incomplete charging, etc.
- Please conduct charge-discharge inspection for the battery once per month. Please timely connect the AC power when low battery alarm occurs. Please use the AC power as often as possible and the internal battery is only used at AC power failure. Battery replacement should be operated by qualified service engineer.
- Please contact qualified service engineer for fuse replacement when the fuse is broken.

- Only professionals and trained people can repair the product. Please contact manufacturer or distributors if the operation key cannot be up again.
- Please replace the upper and nether hooks if they are distorted or broken. Otherwise, siphonage will happen. The residual medicine in the syringe will flow into the patient body by itself, thus the overdosage may do harm to the patient.
- Please stop working and contact manufacturer or distributors if the syringe pump is fault. The maximum injection volume is 1ml at the single fault condition.
- The syringe pump must be grounded as other equipments.
- The performance of the syringe pump has no relation to gravity.
- Environmental protection: When the life of the syringe pump (including spare parts, such as batteries) expires, please deal with them according to related environmental regulations.

VI. Troubleshooting

Faults	Possible Causes	Possible Remedies
No response after switch-on or black or words missing during setting	<ol style="list-style-type: none"> 1. Low battery 2. Fuse melt 3. LCD display breakage 4. System halted 	<ol style="list-style-type: none"> 1. Check the connection of AC power 2. Reboot the pump after shutdown 3. Contact authorized service agent 4. Restore factory settings
Low battery alarm after startup	<ol style="list-style-type: none"> 1. Battery is not timely charged after use 2. Pump is idle for too long 	Charge the battery at shutdown
	<ol style="list-style-type: none"> 1. Improperly use the battery 2. Out of battery life 	Replace battery
The pole/rod can not be moved smoothly.	There is medicine that stick to the main shipper pole/rod of the syringe pump.	Wipe it with alcohol
Injection rate is inaccurate.	The syringe brand is not the recommended or the syringe is not correctly calibrated.	Correctly calibrate the syringe

	The hemming of the syringe is not inserted into the hemming trough of the syringe pump.	Correctly reinstall the syringe
There is back blood when injection begins.	1. The syringe pump is not started after needle head is inserted into patient. 2. The mechanical interval is not eliminated.	1. Start the syringe pump 2. Press “Purge” key to push the blood into the vein
Other faults		Restore factory settings

VII. Warranty

- Warranty for the syringe pump is two years from the date of purchase. We only charge maintenance costs that's not caused by product quality.
- Warranty for the battery is six months from the date of purchase.
- Considering the life of components and safety, medical devices should not be used longer than 7 years. Expired products should be discarded according to corresponding regulations.

VIII. Packing List

Item	Quantity/unit
Syringe Pump	1
Operating Manual	1
Power Cord	1

IX. Manufacturer

Changsha Beyond Medical Devices Co., Ltd.

Address: Beyond Zone, Lijiacun Rd, Xueshi Street, Yuelu District, Changsha, China.

Hotline : 400-006-7111

After Service: 86 731 88862455

Fax: 86 731 88940857

Post Code:410208

Website: www.csbeyond.com

Email: pump-pub@csbeyond.com

X. EC Rep Information

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