MSP6
Vet Syringe Pump

User Manual

Contents

Chapter 1 Introduction

The MSP6 Syringe Pump (herein after referred to as “pump”) is a full featured syringe pump suitable for critical care and general infusion applications.

1.1 Intended Use

The pump is designed to meet the infusion requirements within the operating environment specified in this instruction for use including internal medicine, surgery, pediatrics, heart and blood vessel department, emergency department, gynecology department, tumor department, and operating room, ICU and CCU wards.

This pump is suitable for use by appropriately trained clinicians or nurses. The syringe Pump detects and monitors the injection speed in a real time manner to ensure the precision of control of infusion speed and flow as well as better infusion therapeutic effect.

This pump is able to deliver fluids and medications via intravenous routes. The intended patient population includes chemotherapy for cancer patients, cardio tonic infusion for heart failure patients, infusion therapy for old people, children and normal people

Contraindications:

The pump is only a medical device for Clinical adjuvant therapy, and there is no limitation of Contraindications. The setting of medicine dosage and parameter setting of the pump has to be made on the basis of the clinical diagnosis result and the specified properties of the medicine.

1.2 Precautions

(1) This device is not explosion-proof or portable.

(2) This device must be operated by medical professionals, such as doctors, nurses, etc., to avoid patients operating the device themselves.

(3) This device cannot be used in situations where mixed gases such as flammable anesthetic gases, oxygen, and ammonia oxide gases are present.

(4) Prevent patients from harm caused by overcurrent and undercurrent by setting parameters correctly and using calibrated syringes.

(5) Once abnormalities are detected, suspending use should be the preferred security measure.

(6) When using, stay away from objects that can generate strong electromagnetic waves or noise to avoid causing wrong operation, such as nuclear magnetic resonance equipment, microwave generators, radiation equipment (X-ray machines, CT machines, etc.).

(7) Avoid getting this device close to high-frequency surgical instruments to prevent wrong operation, at least 25cm away from high-frequency surgical instruments (such as knife holders, knife cables, electrode feeder boards, etc.); at least 1m away from mobile phones.

(8) It is not allowed to use voltages other than those specified on the nameplate of this device, otherwise it may cause damage or even fire.

(9) Do not put the battery into fire or heat it up, otherwise it may cause battery leakage, fire or even explosion.

(10) Do not tear off the outer skin of the battery, otherwise it may cause explosion or dangerous chemical burns.

(11) When inserting or unplugging AC power lines, be sure to grip the plug tightly and do not touch the AC plug with wet hands.

(12) It is recommended not to share this device with other electrical devices in the same socket. The AC wires should be connected to a convenient position for plugging and disconnecting.

(13) Do not disassemble or modify this equipment without authorization.

(14) This equipment should be checked daily. If it is not used for a long time, it must be confirmed that all functions are intact before reuse.

(15) If any abnormalities or loss of certain functions are found, please stop using and contact the supplier soon. Otherwise, the manufacturer/seller shall not be responsible for any loss, damage or injury caused.

(16) Avoid vibration, impact, direct sunlight or strong light.

(17) Avoid direct blowing of hot and humid air from heaters, electric stoves, humidifiers, etc.

(18) Places to avoid: places where chemicals are stored, dusty, vibrating/shaking, and damp.

(19) Avoid reusing disposable syringes or re disinfecting them. After use, handle these syringes according to appropriate instructions.

(20) Please follow the working environment and transportation storage conditions specified in this manual. Failure to operate according to the operating instructions may cause equipment failure and personnel injury.

(21) The characteristics of infusion pumps, syringes, and consumables may affect the physiological effects of drugs. Please confirm that these characteristics comply with the prescription of the drug, the horn curve, and the occlusion alarm time set according to the injection flow rate.

(22) Please monitor this device at all times during syringe, check the remaining liquid volume in the syringe, and do not rely solely on the alarm function of this device.

(23) If an internal fault is detected, the machine will automatically stop working and sound an alarm. The maximum capacity that can be transmitted under a single fault state is 3.0ml.

(24) The accompanying syringes and infusion tubing should have a medical device product registration certificate, and the specifications of the syringes that can be used include 1ml, 2ml, 5ml, 10ml, 20ml, 30ml, and 50ml. They should be calibrated before use. Using unsuitable syringes and infusion tubes can cause inaccurate infusion rate or dosage, causing harm to patients.

(25) This device can only be connected to a power socket with protective grounding. If the power socket is not connected to a grounding wire, please do not use the socket and use a rechargeable battery to power the device.

(26) Do not open the case of the device; otherwise there may be a risk of electric shock. The maintenance or upgrade of equipment must be carried out by trained and authorized maintenance personnel from the company, and must be carried out under the condition of disconnecting the AC power supply. Maintenance by unauthorized personnel might have an impact on the safety, performance, and functionality of the product.

(27) It is necessary to closely monitor the actual clinical condition of the patient and the working condition of the infusion pump on a regular basis, and set the alarm volume and alarm limit according to the actual situation. We cannot rely solely on auditory alarm systems to administer intravenous fluids to patients. Adjusting the alarm volume to a lower level may pose a danger to the patient. When the alarm volume is lower than the surrounding environment volume, it will affect the operator's recognition of the alarm.

(28) Please be careful with the security power cords and cables of various accessories to avoid choking patients, entanglement of cables, or electrical interference.
(29) Before connecting the device to the power supply, please confirm that the voltage and frequency of the power supply meet the requirements specified on the device label or in the instruction manual.
(30) Please install and carry the infusion pump properly to prevent the equipment from falling, colliding, being damaged by strong vibrations or other mechanical forces. After the device falls, the user must confirm whether the device can work properly, otherwise the device cannot be used.
(31) Before use, users must check the equipment, connecting wires, and accessories to ensure that they can work properly and safely.
(32) When using this device, other infusion systems or accessories that are not approved by our company are not allowed to be connected to the patient's pipeline, otherwise it may cause danger.
(33) It is recommended to use the manufacturer's built-in syringe brand for this device. If using a non-built-in syringe brand, it is necessary to first confirm the relevant infusion performance (accuracy, pressure) on the syringe pump, and contact our company for calibration services. After confirmation, the syringe can be used. Otherwise, our company is not responsible for the infusion performance and related alarm functions of the equipment.
(34) During the infusion process, occlusions caused by pipe knots, filter condensation, etc. can lead to an increase in internal pressure in the infusion pipeline. Eliminating occlusions at this time may result in excessive injection of medication into the patient's body, and appropriate preventive measures should be taken.
(35) Do not touch the patient and device interface at the same time, otherwise patient injury may occur due to leakage current.
(36) Before operating this device, please be sure to read and understand all safety instructions, precautions, and warnings to avoid possible injury or equipment damage.
Important statement:
Ignoring any safety warning information in this accompanying document will be considered as exceeding any further reasonable risk control measures. The user shall be responsible for any consequences resulting from the doctor's failure to comply with safety instructions. We strongly recommend that you strictly follow the above safety guidelines to ensure your and others' personal safety as well as the normal operation of the product.

1.3 Warranty

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.
Exemption：
The manufacturer 's obligation or liability under this warranty does not include any transportation or other charges or liability for direct, indirect or consequential damages or delay resulting from the improper use or application of the product or the use of parts not approved by the manufacturer or repairs by people other than the manufacturer authorized personnel.
This warranty shall not extend to:

- Malfunction or damage caused by improper use or man-made failure.

- Malfunction or damage caused by unstable or out-of-range power input.
- Malfunction or damage caused by force majeure such as fire and earthquake.
- Malfunction or damage caused by improper operation or repair by unqualified or unauthorized service people.
- Malfunction of the instrument or part whose serial number is not legible enough.
- Others not caused by instrument or part itself.

1.4 Main Component

The main components include the following:

- **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 Micro (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.

1.5 Software documentation

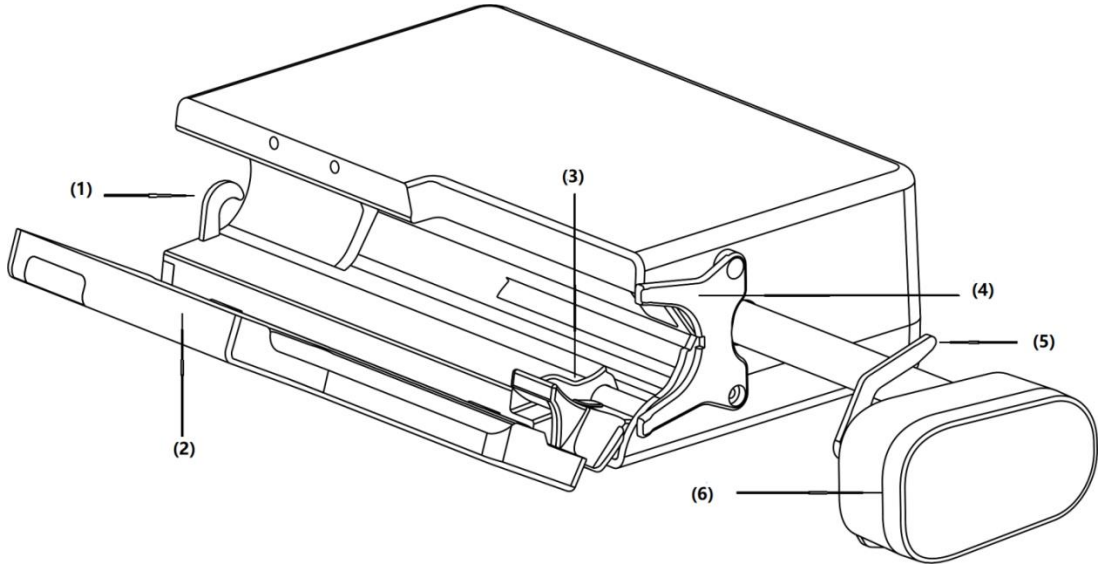
(1) Software name: MSP6 Syringe Pump

(2) Model specifications: MSP6

(3) Release version: V1

Chapter 2 External Features

2.1 Front features

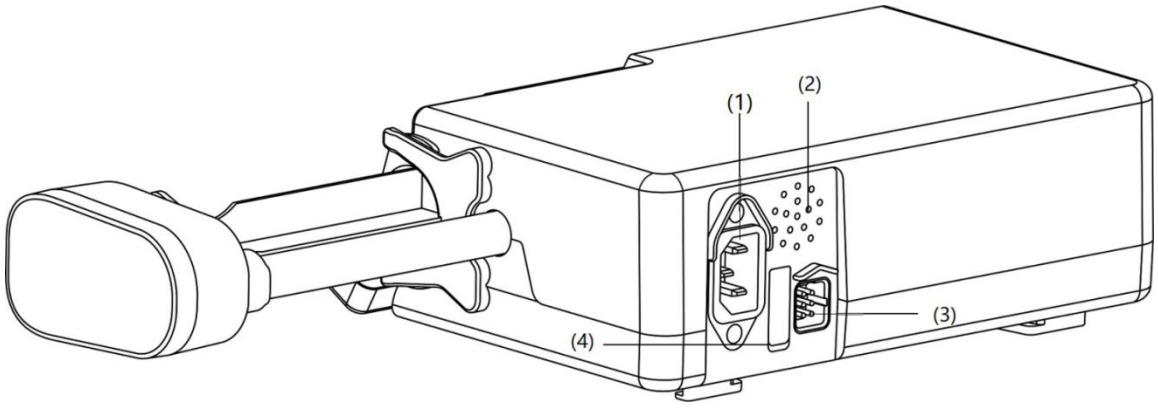


(1) Extension pipe fixing hook (2) pump door

(3) Syringe fixing clip (4) Syringe card slot

(5) Syringe Claw (6) Push Head

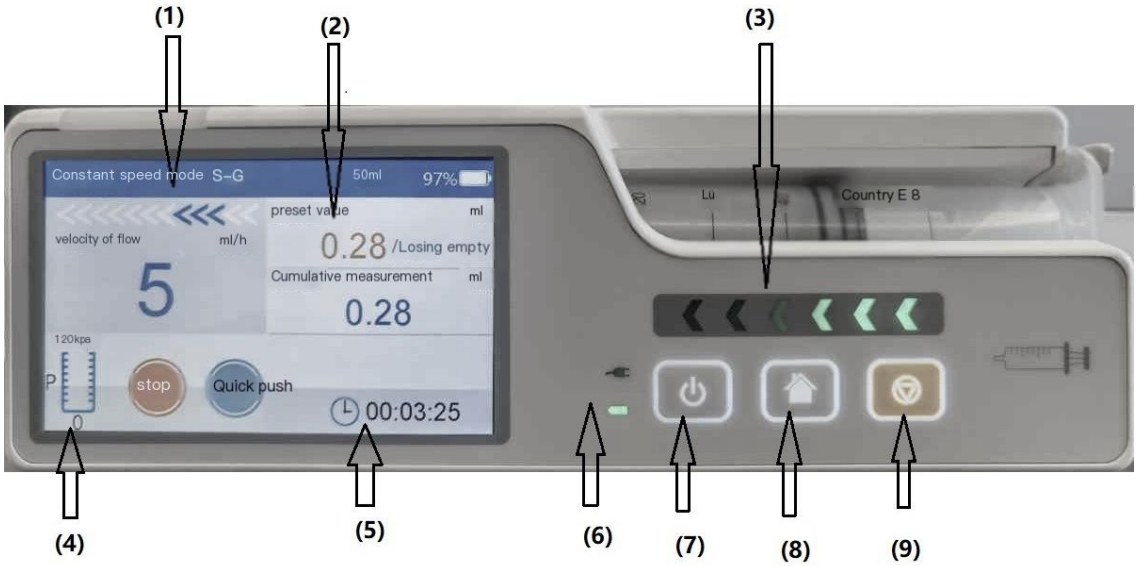
2.2 Back features



(1) AC power port (2) speaker

(3) Multi-function interface (4) USB interface

2.3 Main display interface and button panel



(1) System Information Area

Display operating mode, alarm status, injector brand and specifications, remaining battery capacity

(2) Infusion status display area

Display the main infusion parameters

(3) Infusion operation display bar

(4) Dynamic occlusion pressure display area: Display the pressure status of the infusion pipeline through different icons.

Green bar icon: Normal pressure

Yellow bar icon: approaching occlusion alarm pressure

Red bar icon: reaching occlusion alarm pressure

(5) Time information

Display the duration of injection or remaining time

(6) Connect to power or use battery status display

(7) Turn on/off

(8) Return to the main menu or return to the infusion parameter setting interface

(9) Stop infusion

2.4 Symbol Explanation

Warning symbol.	Grounding protection.
CF type allied parts	Refer to the user manual.
LOT Production batch number	SN Serial number.

Production date.	Manufacturer.
IP34 Waterproof rating of the device.	Alarm is paused
Turn On/Off	Stop
Battery indicator	AC indicator
MD Medical Device	UDI Unique Device Identification

2.5 Use of touch screen

You can input information through the touch screen. Simply click on the touch screen to easily and quickly complete some operations.

To prevent accidental operation of the touch screen, this device can automatically enter the lock screen state when there is no operation within the set lock screen time. The automatic screen lock function switch and start time can be adjusted in the main menu - function settings.

After the touch screen is locked, an unlock slider appears on the touch screen. At this point, follow the on-screen prompts to slide the slider to unlock the touch screen.

⚠ **Caution:** The touch screen must be wiped dry before use when exposed to rain or splashes of water.

2.6 Using a Soft Keyboard

This device provides a soft keyboard for information input, with the following functions:

(1) Select characters on the keyboard for input.

(2) Use the delete key '**X**' to delete the previous character.

(3) Use the up key ⇧ to switch between uppercase and lowercase letters in English.

(4) Press the confirm button to confirm the input is complete and close the software keyboard.

Chapter 3 Basic Operations

3.1 Equipment install and startup

(1) Install environment:

The operating environment of this device must comply with the environmental specifications specified in this manual.

The usage environment of the equipment should also reasonably avoid the presence of noise, vibration, dust, corrosive or flammable, explosive substances, etc.

If installed inside a stacked chassis, sufficient space should be left in front and behind the stacked chassis for easy operation, maintenance, and repair. In order to ensure smooth air circulation and achieve good heat dissipation, a gap of at least 5cm should be left around the equipment.

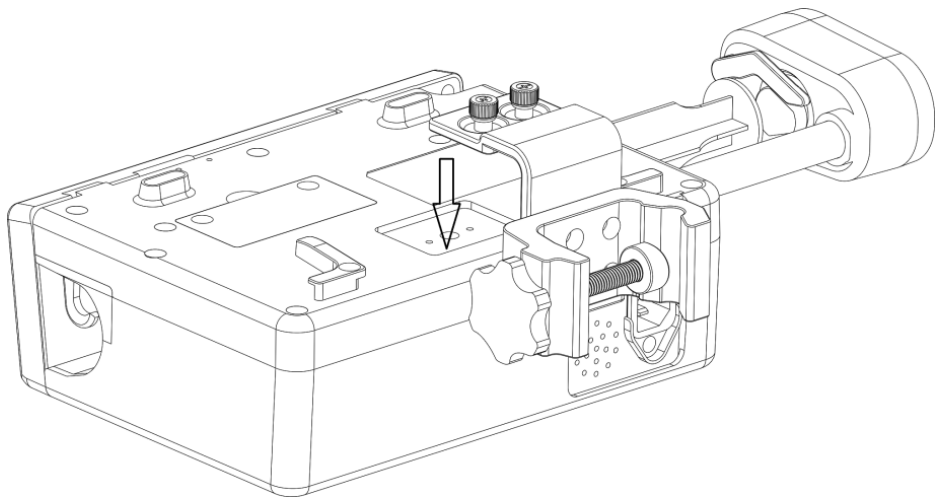
When devices are transferred from one environment to another, condensation may occur due to temperature or humidity differences. At this point, it is necessary to wait for the condensation situation to disappear before using it.

CAUTION:

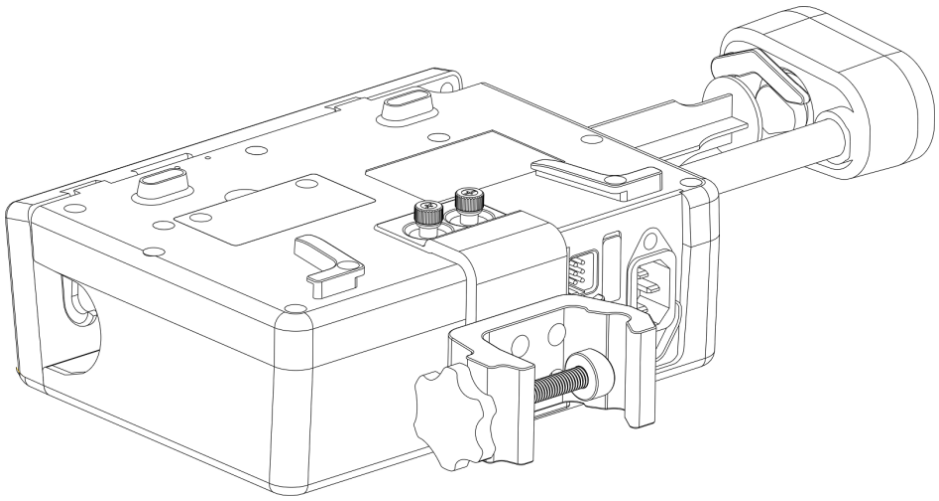
Please ensure that the equipment operates within the specified environmental requirements, otherwise it will not meet the technical specifications claimed in this manual and may result in unforeseeable consequences such as equipment damage.

(2) Install the fastening clip:

When it is necessary to install the pump onto the horizontal or vertical pole of the suspension tower or IV stand, a fastening clip is required. Please refer to the following diagram for the install method of the fastening clip. The fastening screw is located on the bottom of the equipment.



After installing the fastening clip, as shown in the following figure:



Fasten the pump to the pole of the suspension tower or infusion stand; maintain the stability of the machine and infusion stand, ensuring that the pump is placed horizontally.

When stacking multiple pumps and needing to transport stacked devices together without dock, a stacking bracket can be used, which needs to be purchased separately.

⚠ CAUTION:

1. Before fixing this equipment, the stability of the fixing bracket should be checked. When installing multiple stacked pumps, it is necessary to install fastening clips for each pump before sequentially fixing them to the suspension tower or IV stand.
2. When using a stacking bracket, up to 3 pumps can be combined and stacked together.

(3) Connect the power supply:

Insert one end of the power cord into the AC power port on the back of the infusion pump, and the other end into an AC power outlet. (Note: Only use the AC power cord attached to this device.)

(4) Power on:

Confirm that the device has been placed on a stable horizontal surface, or securely installed on the infusion rod with fastening clips, or placed in the slot of the dock. Long press the key for three seconds, the device screen will light up, the syringe push head will automatically move to the maximum position to the right, and the claw will open; At the same time, the device will perform a power on self-test to check if the display screen is functioning properly. If there are no alarms, the device will enter the parameter settings interface. If you are unable to handle the error, please contact the manufacturer or distributor.

⚠ CAUTION:

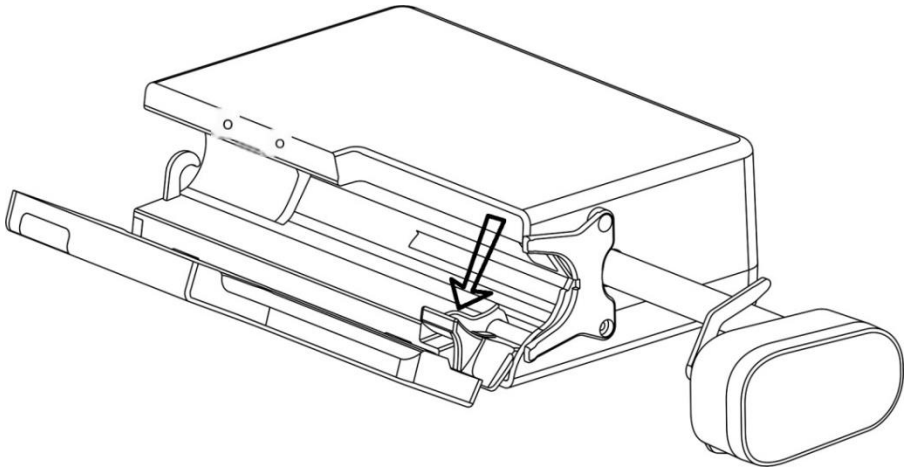
When AC power is not connected or there is a power outage, the machine automatically switches to battery power, the battery indicator light is on, the power indicator light is off, and there is an audible and visual alarm, indicating that the user has lost AC power. The user can press "alarm clear" to clear the alarm.

1. Under normal circumstances, AC power should be preferred as the working power source, and the battery is only a backup power source.
2. After turning on, the machine automatically manages the battery. If the battery is low, it will automatically charge. The remaining battery level is displayed in the upper right corner of the screen.

3. Do not touch the power plug with wet hands. If there is any liquid medicine or other residue in or around the interface of the power cord, power socket, plug or the AC power interface of the device, it should be thoroughly cleaned and completely dried before plugging in the power supply; otherwise it may cause a safety accident.
4. Please closely monitor the self-checking process to ensure that both the speaker and alarm light have successfully self-checked. Otherwise, please do not attempt to use the pump and contact our company.
5. To ensure a clear view of the main interface of this device, it is recommended to operate and use this device within a distance of one meter.

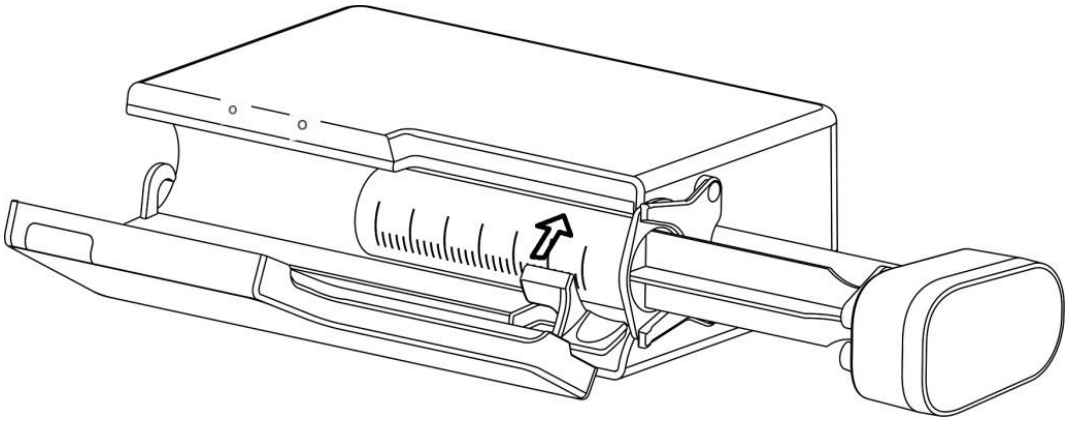
3.2 Install Syringes

(1) Open the pump door and pull open the syringe clamp.



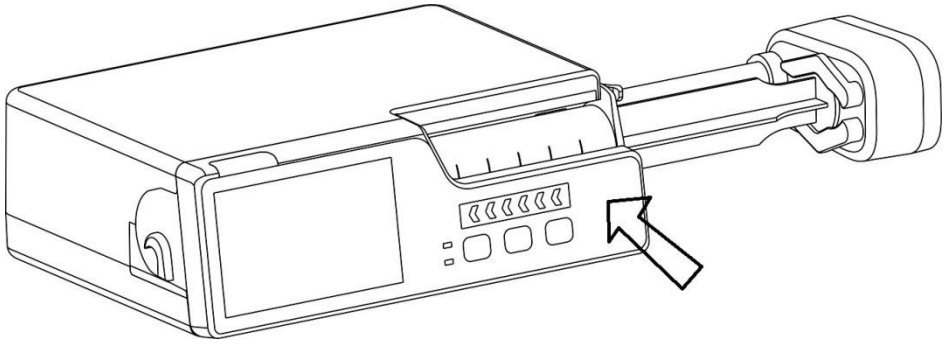
(2) Connect the extension tubing of the infusion pump correctly.

(3) Place the syringe into the syringe slot, ensuring that the flange of the syringe barrel is in the syringe card slot, and then push the syringe clamp upwards to clamp the syringe barrel. After the syringe is placed in place, the device's push head automatically advances to the left. When the push head touches the end of the syringe piston, the syringe claw automatically grasps the flange of the syringe piston.



(4) Place the syringe extension tube into the extension tube fixing hook.

(5) Close the pump door.



(6) After installing the syringe, it is necessary to confirm whether it is installed properly. After successful install, this device can automatically recognize the specifications of the syringe and display the recognized specifications in the brand selection area.

⚠CAUTION:

1. Ensure the correct install of the syringe, with the flange of the syringe placed in the syringe slot and the syringe claw clamp gripping the flange of the syringe piston. Incorrect install of syringes may result in uncontrollable infusion.
2. Use this device within a range of 0.5-1 meters above and below the patient's heart height. The smaller the height difference between this device and the patient, the more accurate the pressure detection in the infusion line. To ensure the accuracy of flow rate and alarm, it is necessary to confirm that the brand and specifications of the syringe have been calibrated in this device before using it.
3. After installing the syringe, it is necessary to carefully check the connection between the syringe and the extension tube to ensure that the connection is reliable and there is no leakage.
4. Before installing or replacing the syringe, ensure that the connection between the device and the patient end is closed, and always closely observe the device to avoid possible uncontrollable infusion.
5. The syringe extension tube needs to be placed in the extension tube hook to prevent external forces from pulling the syringe off.
6. The syringe should be as close as possible to the patient to avoid accidental infusion flow caused by height differences.
7. Disposable attachments can only be used once, and repeated use may result in performance degradation or cross infection.

3.3 Start infusion

After the successful install of the syringe, the device automatically enters the settings interface:

(1) Select the brand and model of the syringe, and click to confirm that the model displayed on the screen is consistent with the brand and model of the syringe currently in use. If the syringe brand displayed at the top of the screen does not match the actual one, simply click on the display area and then select the syringe brand

(2) The current infusion mode of the device is displayed at the top left of the screen. If you need to change it, simply click on the infusion mode display area and select the desired infusion mode. For an introduction to infusion modes, please refer to section 3.13 on infusion modes.

(3) Set infusion parameters.

(4) If necessary, prime once. Please refer to section 3.4 for prime.

(5) Connect the infusion line to the patient.

(6) Confirm that the infusion parameter settings are consistent with the medical advice.

(7) Start infusion.

 WARNING:

1. Before connecting the patient, it is necessary to ensure that the infusion line has been vented and installed on this device.
2. The pump door cannot be opened during infusion.
3. Regularly monitor the connection between the syringe, extension tube, and pump and the patient, as well as medication information, and administer the infusion according to the instructions in this manual.

3.4 Prime

Before starting the infusion, it is necessary to quickly remove any air bubbles from the syringe and extension tube. If manual prime is not performed before installing the syringe, the following steps need to be followed for prime.

(1) Confirm that the infusion line is not connected to the patient.

(2) Click the 'Prime' button on the screen

(3) Press the 'Confirm' button to start the prime.

(4) Press the 'Stop' button or  stop the prime.

(5) The prime flow rate and maximum limit can be adjusted in [Main Menu] - [Parameter Setting]

CAUTION:

The infusion volume of prime will not be included in the cumulative infusion volume.

3.5 Bolus

When treatment is needed, the bolus function can be used to accelerate the delivery of a certain amount of medication to patient. When performing bolus, ensure that the pump is properly connected to the patient. The infusion volume of bolus will be included in the total infusion volume.

3.5.1 Setting Bolus Flow Rate

Select 'Main Menu' ->'Parameter Settings' ->' Bolus Flow Rate 'to set the parameters in the parameter settings

interface; Alternatively, on the infusion operation interface, press 【 Bolus 】 → select 【 Flow Rate 】 and set it in the pop-up soft keyboard.

3.5.2 Automatic Bolus

Perform automatic bolus on the infusion operation interface according to the following steps:

(1) Select the 'Bolus button on the main interface.

(2) Select 'Flow rate' and set the bolus flow rate in the pop-up software keyboard.

(3) Click to select the preset amount for bolus or customize the preset amount for Bolus

(4) Select the 'Bolus' button to start automatic bolus.

(5) After reaching the preset bolus volume, the pump automatically exits the bolus and continues the previous infusion. If necessary, select the 【 Return 】 key to stop this bolus.

3.5.3 Manual Bolus

Perform manual bolus on the infusion operation interface according to the following steps:

(1) Press and hold the 'Bolus' button on the main interface for two seconds to start manual bolus.

(2) Release the 'Bolus' button to end the manual bolus, and the pump will continue with the previous infusion.

(3) When the fast push reaches the pre-set limit, this device automatically stops manual fast push.

3.6 Online Titration

During the infusion operation, the flow rate and dosage flow rate can be changed without interrupting the infusion, i.e. online titration;

Select the parameter area that needs to be changed in the infusion operation interface, reset the infusion parameters in the pop-up window, and confirm that the modified parameter values are consistent with the medical order.

3.7 Keep veins open (KVO)

After the pump completes the preset amount, it can continue to operate at the set low flow rate to keep the patient's veins open and prevent backflow or vascular occlusion.

The default KVO flow rate is 1ml/h, or you can set the KVO flow rate by selecting [Main Menu] >[Parameter Settings] >[KVO Settings]. If set to zero, KVO will not start after the preset infusion volume is completed.

CAUTION:

1. If the set KVO flow rate is greater than the current infusion flow rate, the pump will continue infusion at the current flow rate after the preset amount of infusion is completed.
2. The infusion volume of KVO will be included in the cumulative infusion volume.

3.8 Stop infusion

(1) Select 'Stop' or press the button on the main interface to stop infusion.

(2) Clamp the syringe extension tube with a clip and disconnect it from the patient.

(3) Open the pump door and remove the syringe extension tube from the extension tube fixing hook.

(4) Open the syringe clamp, the syringe claw will automatically open, and the push head will move to the maximum position to the right.

(5) Remove the syringe.

3.9 Infused Volume

Infused volume refers to how much fluid a pump has infused into a patient over a certain period of time.

In the parameter setting interface, click on the display area of VOLUME and press [OK] to clear all volume; or clear the infused volume in the [Main Menu] - [Parameter Settings] - [Volume Settings].

Infused volume cannot be cleared during infusion.

3.10 Standby

(1) If you do not need to use this device for infusion temporarily and do not want to turn it off, you can use standby mode. After infusion, click the power button, and then select [Standby] in the pop-up dialog box to enter standby mode.

(2) The default standby time is 30 minutes, or you can choose [Settings] to set the time for the device to exit standby mode. When the set standby time is reached, this device automatically exits standby mode. The standby time can be set to a maximum of 24 hours.

(3) If you need to manually exit standby mode, select [Cancel] and then [Confirm].

3.11 Remove the syringe

(1) Select 'Stop' or press the button on the main interface to stop infusion.

(2) Disconnect the extension tube from the patient.

(3) Open the pump door.

(4) Remove the syringe extension tube from the extension tube fixing hook.

(5) Open the syringe clamp and remove the syringe.

(6) Select the next step as needed

- Continuing treatment: Refer to section 3.2 for installing the syringe and section 3.3 for starting infusion
- Enter standby mode: refer to 3.10 standby mode
- Shutdown: Refer to 3.12 Shutdown

WARNING:

1. Replace the syringe extension tube according to the recommended time on the packaging or hospital management requirements.
2. To prevent liquid from flowing due to gravity, it is necessary to confirm that the fluid path between the infusion tube and the patient end has been disconnected before removing the syringe.

3.12 Shutdown

Please perform the following checks before shutting down:

1. Confirm that the patient's infusion can be terminated.
2. Confirm that the connection between the device and the patient end has been disconnected.
3. Confirm that the syringe has been removed.

Press the power button, and then select 'Shut Down' in the pop-up dialog box to turn off this device.

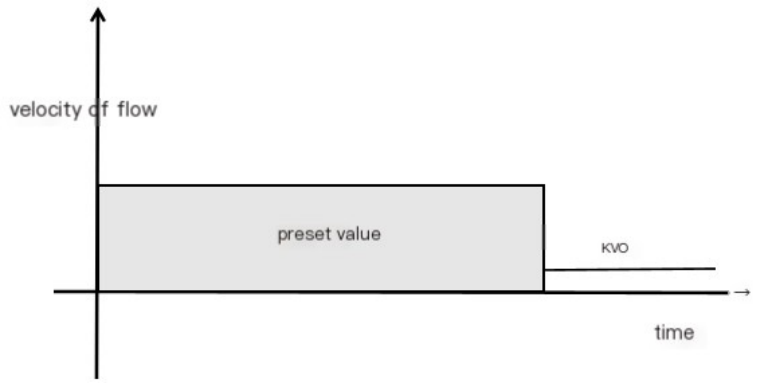
In some special circumstances where the device cannot be shut down properly, you can unplug the power cord and press and hold the power switch for no less than 10 seconds to forcibly shut down the device. Forced shutdown may cause data loss or damage to the device, and is not recommended for use.

3.13 Infusion mode

3.13.1 Rate mode

The flow rate mode is applicable to drugs that are continuously infused at a certain flow rate (ml/h) as specified by medical orders.

The flow rate mode can set the flow rate, VTBI(Volume to be infused), and infusion time. After setting two of the parameters, this device can automatically calculate the third parameter.



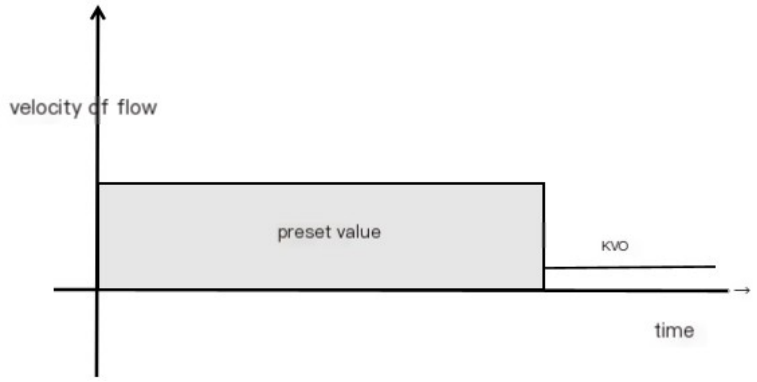
Caution：

Setting the preset amount to zero defaults to pushing the syringe empty, and the infusion time cannot be set. The displayed time is the duration after the infusion starts.

3.13.2 Time Mode

The time mode is applicable to drugs that are continuously infused at a certain flow rate (ml/h) as specified by medical orders.

The time mode can set the infusion time, VTBI, and flow rate. After setting two of the parameters, this device can automatically calculate the third parameter.



Caution:

In this mode, the preset amount cannot be set to zero, and the displayed time after operation is the remaining time for infusion.

3.13.3 Weight Mode

The weight model is clinically applicable to pediatrics and requires assessment of medication dosage based on weight. First, complete the input of dosage units, body weight, drug dosage, and solution dosage. The drug concentration will be automatically calculated and displayed based on the input information. After confirming the above inputs, set the dose rate and preset amount. This device can automatically calculate the flow rate. After confirming all parameters, press 【 Start 】 to proceed with the infusion. Setting the VTBI as zero defaults to pushing the syringe empty.

Caution:

(1) Concentration: Automatically calculated based on the formula of dosage/liquid volume.

(2) Flow rate: automatically calculated based on the formula of (dose rate * body weight)/concentration.

3.13.4 Dose Mode

In dosage mode, it can be used by entering medical orders. First, input the dosage unit, drug amount, and solution amount, and the drug concentration will be automatically calculated and displayed based on the inputs . After confirming the above inputs, set the dose rate and VTBI. This device can automatically calculate the flow rate. After confirming that there are no errors, press [start] to proceed with the infusion. Setting the VTBI as zero defaults to pushing the syringe empty.

Caution:

1. Concentration: Automatically calculated based on the formula of dosage/liquid volume.

2. Flow rate: automatically calculated based on the formula of dose rate/concentration.

3.13.5 Mixed Mode

The mixed mode is composed of multiple infusion parameter settings combined.
First, input the dosage unit, drug amount, and solution amount, and the drug concentration will be automatically calculated and displayed based on the input information.
After confirming the above inputs, set the [flow rate] and [intermittent preset amount] for the infusion phase as well as the [interval time] and [maintaining flow rate] for the maintaining phase.
Confirming that all parameters are correct, infusion can be performed by pressing [Start].
Caution:

1. Concentration: Automatically calculated based on the formula of dosage/liquid volume.
2. Flow rate: automatically calculated based on the formula of dose rate/concentration.

3.13.6 Switching Mode

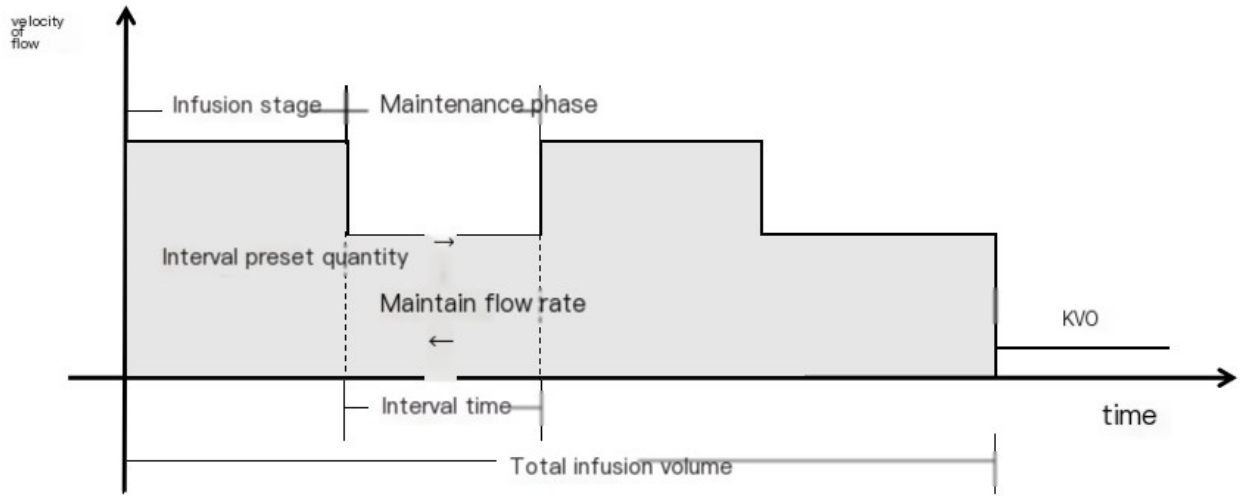
Switching mode refers to dose mode is switched to rate mode during infusion process.
First, complete the input of dosage units, body weight, drug amount and solution amount. The drug concentration will be automatically calculated and displayed based on the input information.
After confirming the above inputs, you can then set the [Initial Dose Rate], [Initial Dose], and [Main Flow Rate].
After confirming that all parameters are correct, infusion can be performed by pressing [Start].
Caution:

1. Concentration: Automatically calculated based on the formula of dosage/liquid volume.
2. Flow rate: automatically calculated based on the formula of (dose rate * body weight)/concentration.
3. During the first dose stage of rapid infusion, if the preset amount exceeds the remaining amount of the first dose, the rapid infusion will automatically stop after completing the remaining amount of the first dose, and the device will directly start the infusion at the main flow rate.

3.13.7 Intermittent Mode

In intermittent administration mode, the infusion phase and maintenance phase can be automatically cycled until the infusion is completed. Intermittent administration mode is suitable for the infusion of long-acting analgesics.

- Infusion stage: After completing high flow rate infusion with the set flow rate and intermittent preset volume, it automatically enters the maintenance stage.
- Maintenance phase: Complete low flow rate infusion with the set interval time and maintenance flow rate. When the flow rate is not set, no infusion is given during the maintenance phase.



Caution:

The total infusion volume and maintenance flow rate are optional settings. When the maintenance flow rate is not set, no infusion is given during the maintenance phase. When the total amount of infusion is not set, stop infusion after the syringe is empty.

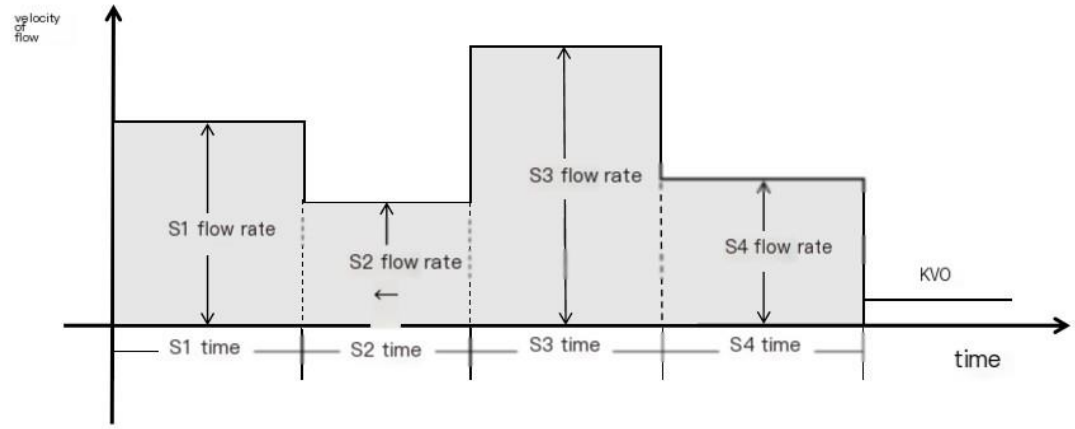
3.13.8 Stage Mode

In the mode, multiple different stages can be set, and each stage defines the infusion parameters (flow rate, VTBI and time) for an infusion stage. This device sequentially divides the infusion into stages according to the settings.

Up to three stages can be set, and the VTBI for the second or third stage can be set to zero, so there are only one stage left.

In sequential mode, after setting two parameters of flow rate, preset quantity, and time, this device can automatically calculate the third parameter.

During infusion operation, you can press' Stop 'to change the flow rate or time of the current stage, but you cannot change the VTBI of the current stage, otherwise the device will restart the infusion of this stage. Changing the parameter settings for the next stage will not affect the infusion of the current stage.



Caution:

When performing fast inference in the current stage, if the preset amount exceeds the remaining amount of the current stage, the fast inference will automatically stop after completing the remaining amount of the current stage, and the device will directly start the infusion of the next stage.

3.13.9 Loading Dose Mode

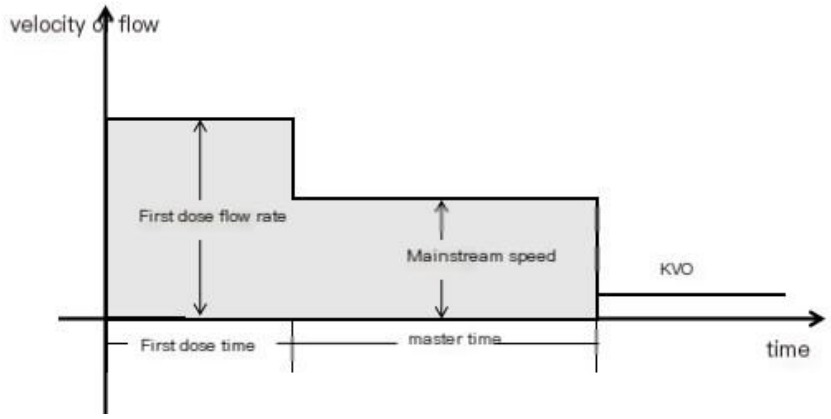
The loading dose mode divides the total infusion volume into two stages:

Complete the first dose with the first dose flow rate.

Complete the remaining infusion volume (VTBI minus the first dose) at the maintain flow rate..

Firstly, enter the total infusion volume, first dose, and flow rate during the first dose stage. Then, on the next page, enter the maintain flow rate and clear the accumulated volume if necessary.

After confirming that all parameters are correct, syringe can be performed by pressing [Start].



Caution:

During the first dose stage of rapid infusion, if the preset amount exceeds the remaining amount of the first dose, the rapid infusion will automatically stop after completing the remaining amount of the first dose, and the device will directly start the infusion at the main flow rate.

3.13.10 Micro Mode

Micro mode is mainly used clinically for low flow infusion in children and newborns.

In micro mode, the flow rate, preset amount, and remaining time can be set. By inputting two of these parameters, the device can automatically calculate the third parameter.

The range of flow rate and preset quantity settings for the micro mode is as follows:

Flow rate: 0.10~100ml/h

VTBI: 0.01~1000ml

Caution:

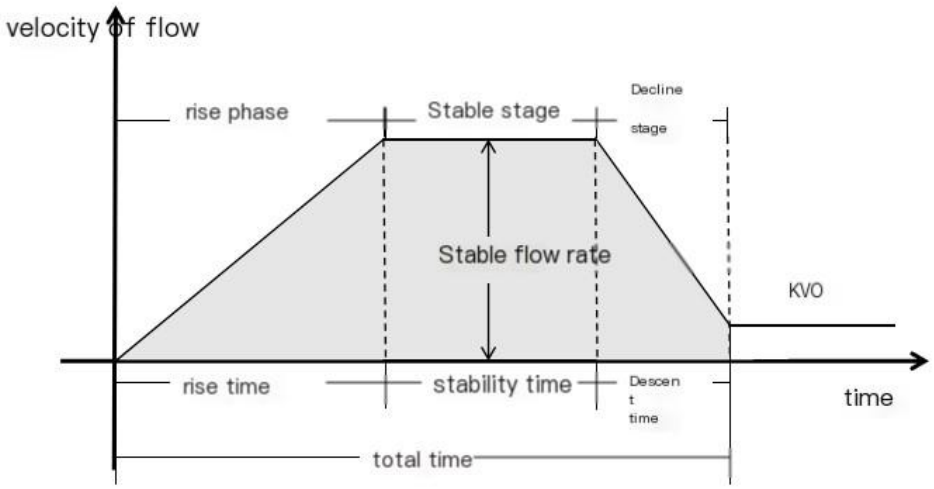
In micro mode, the flow rate must be set before starting the infusion, and the preset amount and remaining time can be selected and set as needed.

3.13.11 Gradient Mode

The gradient mode involves infusion during the process of increasing or decreasing flow rate, including the following three stages

- Rising stage: Within the preset rising time, the infusion flow rate rises linearly until reaching the preset stable flow rate, and then automatically enters the stable stage.
- Stable stage: Administer infusion at a stable flow rate.
- Descent stage: After the infusion is completed in the stable stage, the infusion flow rate decreases linearly within the set descent time until the preset infusion volume is achieved.

Start infusion after inputting the total preset amount, total time, rise time, and fall time.



Caution:

If Rise time+ fall time ≤ total time, the stable flow rate can only be obtained through calculation and cannot be inputted.

3.13.12 Drug Library Mode

The drug library model can simplify the operation process of infusion and reduce the risks caused by operational errors.

In the drug library mode, first select the drug type and drug name, then set the drug amount and solution amount for confirmation. Based on the required dosage rate, the infusion pump automatically calculates the flow rate.

Caution:

(1) To use the drug library mode, a password is required to access the 'Manufacturer Maintenance' setting

(2) This device can limit the parameters of [drug amount], [solution amount], and [dose rate] based on the parameter limit values stored in the drug library management software.

3.14 Mute function

When it is necessary to mute in the alarm state, pressing the  button can temporarily eliminate the alarm sound (the mute button sound indicator light is on) while the LED light on the top of the device still flashes. The mute period shall not exceed 2 minutes. If the alarm source cannot be resolved, the alarm shall sound again.

3.15 Powered by built-in battery

When the AC power is not connected and the device is turned on, the machine automatically uses battery power. When the battery light is on, the power light does not light up, and there is an audible and visual alarm. The LCD screen has a corresponding alarm message indicating "AC power lost", which prompts the user that the AC power is interrupted. The user can clear the alarm.

When the AC power is suddenly cut off after the device is turned on, the machine automatically switches to battery power supply. When the battery light is on, the power light goes out, and there is an audible and visual alarm. The LCD screen has a corresponding alarm message indicating "AC power lost", which prompts the user that the AC power is interrupted and the device continues to run. The user can clear the alarm.

The alarm sound and light prompt when the battery level is low, and corresponding alarm information shall be displayed on the LCD screen (with an icon showing "low battery ");the device shall continue the infusion and continue to sound the alarm for more than 30 minutes before stopping the injection. When the screen shows "battery level is out", the injection stops, and the device shall automatically shuts down after around 3 minutes.

3.16 Using DOCK

This device only supports use in conjunction with the infusion information collection system (hereinafter referred to as Dock) produced by our company.

3.16.1 Connecting Dock

When insert the pump into Dock, keep bottom of the pump aligned with the slot of the plug-in box and push the pump into the box. When the pump body is locked, a "click" sound will be heard.

To pull the pump out of the box, turn the unlocking knob of the plug-in box unit to the vertical position, and then remove the pump.

After inserting this device into the Dock, the alarm sound of this pump shall be turned off. When an alarm occurs, the alarm sound of this pump is emitted by the Dock, and both the alarm light of this device and the alarm light of the Dock flash.

3.16.2 Dock Sequence Infusion

When multiple pumps are inserted into the Dock, the sequence infusion function can be used to administer infusion in sequence. Pumps on a single dock or pumps on different docks can be connected in sequence. Sequence infusion supports the modes: flow rate mode, micro mode, time mode, weight mode.

After the sequence connection is established, the sequential number of the pump in the sequence can be viewed in the information area of the pump. For example, "2" indicates that the current pump sequential number in the loop sequence connection is 2. After the establishment of sequence infusion, the pump sequential number in the link cannot be adjusted.

3.16.3 Dock Sequence Infusion Settings

The settings for sequence infusion are as follows:

(1) Insert at least two or more pumps into the Dock.

(2) Press 【 Main Menu 】 - 【 Function Settings 】 - 【 Sequence Settings 】 - 【 Start 】 on the first pump in the sequence infusion plan

(3) Other pumps that support sequence connection will automatically pop up an sequence confirmation box. Select 'Yes' on the pump that needs to enter the sequence link and enter the sequential number as you plan.

(4) Select 'OK' on the first pump that initiates the connection to complete the connection. After successful sequence connection, the devices in the sequence will show the sequence icon and sequential number.

(5) Start infusion of the first pump in the chain, and the other subsequent infusion devices display "successfully connected, waiting for infusion".

(6) After starting the infusion, multiple pumps connected sequence shall perform infusion in the order determined by user. After the infusion of the last pump sequence is completed, the entire online infusion ends.

3.16.4 Cancel Dock Connection

After establishing a sequence connection, if you need to cancel the connection, you can click on the display icon of the current infusion device information display area with your finger and select [Cancel Connection].

Pulling out the pump that is still in the sequence from the Dock during sequence infusion will cancel the entire sequence infusion, the device will display sequence failure, and the Dock will sound an alarm.

3.17 Pump to pump connection

When multiple pumps are stacked together for sequence use, this device only supports use in conjunction with the multifunctional connecting wires produced by our company. Connect the multifunctional cables to the multifunctional interfaces of the pump.

You can use the sequence function to administer fluids in sequence. Support sequence infusion modes: flow rate

mode, micro mode, time mode, weight mode.

3.17.1 Pump to pump sequence infusion setting

The settings for sequence infusion are as follows:

(1) Connect at least two or more pumps in sequence.

(2) Press 【 Main Menu 】 - 【 Function Settings 】 - 【 Sequence Settings 】 - 【 Start】 on the first pump in the sequence plan

(3) Other pumps that support online connection will automatically pop up an online confirmation box. Select 'Yes' on the pump that needs to enter the sequence link to agree, and enter the sequential number of the pump in the sequence link.

(4) Select 'OK' on the first pump that initiates the connection of pumps. After successful sequence connection, the devices in the sequence will show sequential icon and sequential number.

(5) Start the infusion of the first pump in the chain, and the other subsequent infusion devices display "successfully connected, waiting for infusion".

(6) After starting the infusion, multiple pumps connected in sequence will perform infusion in the order determined. After the last pump complete infusion, the entire sequence infusion ends.

3.17.2 Cancel pump to pump connection

After establishing an online connection, if you need to cancel the connection, you can tap on the sequence infusion icon of the current infusion device and select [Cancel Connection].

When performing sequence infusion, directly unplugging the multifunctional connection line on the pump will cancel the entire sequence infusion and the device will display sequence failure.

3.18 Connect to the central monitoring system

This device can be connected to the central monitoring system through wireless network or Dock.

This device has the following functions when connected to the central monitoring system:

- Send infusion information, alarm information, and equipment information to the central monitoring system.
- Support the synchronization of patient information data between the central monitoring system and this device.

The connection steps between this device and the central monitoring system are detailed in section 5.6.8.5 WiFi settings.

Caution:

The normal communication between this device and the central monitoring system depends on whether the network connection is successful. If the communication is interrupted, the operator will not be able to access the central monitoring system in real-time.

Chapter 4 Alarm

4.1 Alarm Mode

The device will provide the following light and sound alarms, as well as text or graphic reminders to the user:
(1) Light alarm, high-level alarm red light flashes, medium level alarm yellow light flashes, low-level alarm yellow light stays on.

Alarm level	Alarm lighter color	Alarm lighter flashing frequency	Alarm Message	Alarm level indicator
Advanced alarm	red	2.0±0.6Hz	Black text in red background	！！！
Intermediate alarm	yellow	2.0±0.6Hz	Black text in yellow background	！！
low alarm	yellow	No flashing	Black text in yellow background	！

(2) Sound alarm, adjustable alarm volume, with a minimum sound pressure level of no less than 45dB (A) and a maximum sound pressure level of no more than 60 dB (A).

(3) When the alarm occurs, the main screen displays the alarm information. The alarm interface contains help information or images to help you identify the cause of the alarm.

4.2 Alarm Types

No operation, AC Lost, Finished KVO, end of standby, Near Empty, battery abnormality, Clamp Err, Near completion, infusion finished, Motor Err, Occlusion, low battery, battery lost, system err, sequence infusion failure, Pusher error, claw failure, etc.

4.3 Alarm Solutions

When the device emits an alarm or warning sound (except in case of equipment malfunction), press to  pause the alarm sound, and press the [Alarm Clear] button to eliminate the alarm state.
Here are some common troubleshooting methods. If there are any abnormal situations that cannot be resolved by yourself, please stop using and contact the supplier as soon as possible.

Alarm Message	Alarm level	Response delay	Possible reasons	Troubleshooting
No operation	low	<100ms	The device is paused and time of pause is out.	Press' Alarm Clear 'to eliminate the alarm and continue using or shut down the device
Low battery	low	<500ms	The built-in battery is running low.	Please connect the AC power for charging as soon as possible.
KVO Injecting	low	<500ms	KVO injection is running.	The alarm shall automatically end after KVO injection running for 30 minutes, or stop KVO infusion.
New Empty	low	<100ms	The medicine liquid in syringe is near empty	Press' Alarm Clear 'to clear the alarm and continue infusion
End of standby	low	500ms	The standby time has reached the set value	Press the clear button to eliminate the alarm.
AC Lost	low	<3s	AC power is lost automatically switched to internal battery power supply	The device is not connected to AC power or the power cord is loose
Battery Lost	low	<500ms	The battery connection wire is loose and has poor contact; Or the device has been stored for too long and the battery has no voltage; the battery is damaged.	Check if the battery wiring is properly connected; Shut down and charge for ten minutes before restarting; Replace the battery.
Near completion	low	<500ms	The injection amount approaches the preset amount	Press' Alarm Clear 'to clear the alarm and continue injection
Clamp Err	high	<500ms	During the infusion process, the syringe comes off	Check if the syringe is securely fixed and if the clamp is in place.
Infusion finished	high	<100ms	The injected amount is equal to the preset amount	Press the 'Alarm Clear' button to eliminate the alarm. If you need to stop KVO, press the stop button.
Pusher Error	high	<500ms	The syringe is not installed or installed improperly; During the infusion process, the handle of the syringe is detached from the pusher.	The handle of the syringe is not fixed on the pusher; The sensor button on the pusher is not pressed down by the syringe handle.
Empty	high	<100ms	The medicine liquid in the syringe has been completely pushed out	Press' Alarm Clear 'to eliminate the alarm ;

Occlusion	high	<500ms	Pressure in pipeline reaches the occlusion threshold	Clear the occlusion in the pipeline.
Motor Err.	high	<500ms	Motor malfunction or jamming; driven chip damaged; motor sensor damaged	Contact the dealer or manufacturer
Claw Err,	high	<500ms	The claw on pusher is not in place.	Check if the claw clamps is obstructed by external objects, Try manually move the claw clamps. If the fault persists, please contact the dealer
system failure	high	<500ms	Pump system malfunction, equipment hardware failure, etc.	Stop using the pump and contact dealer
Sequence infusion failure	high	<500ms	The communication between the pump and Dock or the communication between pumps is interrupted. The upstream pump in sequence has completed the infusion while the downstream pump does not meet the conditions to starting the infusion.	Check the connection between the pump and the dock, as well as the connection between the cargo pumps. Check if the downstream pump is ready for infusion.

Caution:

1. When multiple alarms occur simultaneously, the alarm information is displayed simultaneously on the alarm information interface, and the alarm light and alarm sound are displayed according to the highest level among all current alarms.
2. Using different alarm settings and default settings for the same or similar equipment in the same area (such as intensive care unit or operating room) may pose potential risks.
3. When the power loss time does not exceed 30 seconds, the alarm settings before the power loss should be automatically restored.

Chapter 5 Main Menu Settings

5.1 Main Menu Settings

Menu item	Description
Infusion mode	Refer to section 3.13 for infusion mode
Parameter settings	Set common infusion parameters for each infusion mode.
Consumables brand	Manage and calibrate infusion set brands
Function settings	See 5.4 Function Settings for details
patient management	Ward, bed, and pet patient information
System settings	Refer to 5.6 System Settings for details

5.2 Parameter Settings

5.2.1 Bolus Settings (Bolus)

Set Bolus flow rate and Bolus limit

menu item	Default value	set range	description
Bolus rate	1ml syringe: 50ml/h	1ml syringe: 0.01-50ml/h	
	2ml syringe: 150ml/h	2ml syringe: 0.01-150ml/h	
	5ml syringe: 300ml/h	5ml syringe: 0.1-300ml/h	
	10ml syringe: 800ml/h	10ml syringe: 0.1-800ml/h	
	20ml syringe: 1200ml/h	20ml syringe: 0.1-1200ml/h	
	30ml syringe: 1500ml/h	30ml syringe: 0.1-1500ml/h	
	50ml syringe: 2300ml/h	50ml syringe: 0.1-2300ml/h	
Bolus limit quantity	1ml syringe: 1ml	1ml syringe: 0.1-1ml	
	2ml syringe: 2ml	2ml syringe: 0.1-2ml	
	5ml syringe: 5ml	5ml syringe: 0.1-5ml	
	10ml syringe: 10ml	10ml syringe: 0.1-10ml	
	20ml syringe: 20ml	20ml syringe: 0.1-20ml	

	30ml syringe: 30ml	30ml syringe: 0.1-30ml	
	50ml syringe: 50ml	50ml syringe: 0.1-50ml	

5.2.2 Prime settings

Set prime flow rate and prime limit

menu item	Default value	set range	description
Prime flow rate	1ml syringe: 50ml/h	1ml syringe: 1-50ml/h	
	2ml syringe: 150ml/h	2ml syringe: 1-150ml/h	
	5ml syringe: 300ml/h	5ml syringe: 1~300ml/h	
	10ml syringe: 800ml/h	10ml syringe: 1-800ml/h	
	20ml syringe: 1200ml/h	20ml syringe: 1-1200ml/h	
	30ml syringe: 1500ml/h	30ml syringe: 1-1500ml/h	
	50ml syringe: 2300ml/h	50ml syringe: 1-2300ml/h	
Prime limit quantity	1ml syringe: 0.2ml	1ml syringe: 0.1-0.2ml	
	2ml syringe: 0.3ml	2ml syringe: 0.1-0.3ml	
	5ml syringe: 0.5ml	5ml syringe: 0.1-0.5ml	
	10ml syringe: 1ml	10ml syringe: 0.1-1ml	
	20ml syringe: 2ml	20ml syringe: 0.1-2ml	
	30ml syringe: 3ml	30ml syringe: 0.1-3ml	
	50ml syringe: 5ml	50ml syringe: 0.1-5ml	

5.2.3 KVO Setting

The KVO flow rate setting range is 0-5ml/h. If the value is set to zero, KVO will not start after VTBI is completed.

5.2.4 Volume Settings

Used to clear total infused volume

5.2.5 Pressure level

When the device detects occlusion during infusion and the pressure exceeds the set threshold, it will issue a

'occlusion' alarm. The pressure alarm threshold can be adjusted in 15 levels. Use the "+" and "-" keys to select the appropriate alarm threshold.

5.2.6 Pressure Unit

Select the applicable pressure display units, including KPa, mmHg, Bar, and Psi.

5.3 Syringe

5.3.1 Syringe brand selection

Select the brand that matches the current consumables in the consumables brand list. To add a new brand, you need to go to [System Settings] - [User Maintenance] - [Consumables Maintenance] - [New Consumables].You can choose between automatic calibration or manual calibration to calibrate consumables.

5.3.2 Manual Calibration

After selecting the brand, confirm that the pipe type is consistent with the actual use, then enter the data of scale length and handle height, and save the data after entering.
Users can reduce errors by entering the calibration value of the scale length after measuring the accuracy of the syringe. The calibration value of the scale length is equal to the actual syringe volume completed divided by the preset volume multiplied by 100. After entering the calibration value for scale length, the scale length data will change.

5.3.3 Automatic Calibration

(1) After selecting the brand, confirm that the pipe type is consistent with the actual use,

(2) Pull out the pusher rod of the syringe until the head of the pusher rod exceeds the maximum mark of the syringe (more than 5 millimeters), and then install the syringe onto the infusion pump;

(3) Press and hold the 'prime' button until the tip of the syringe pusher rod reaches the maximum mark of the syringe, which is in the same position as the tip of the pusher rod;

(4) Press [Start] to start automatic calibration, which lasts for 1-2 minutes. After calibration is completed, [Save] the data.

Caution:

1. The "scale length" value refers to the length between the 0 ml scale line of the syringe barrel and its nominal size scale, expressed in millimeters. This length value can be obtained from the syringe manufacturer or measured by oneself.
2. The "handle height" value refers to the length between the pusher handle and the flange, expressed in millimeters. This length value needs to be measured by the user themselves.

3. To ensure syringe accuracy, it is recommended that users use automatic calibration.
4. It is recommended that users perform calibration every two months to ensure accuracy.

5.4 Function Settings

5.4.1 No operation alarm time setting

Enter the main menu, select [Function Settings], choose the no operation alarm time that needs to be set, up to 30 minutes, or choose to turn it off.

5.4.2 Near end of infusion Alarm time setting

Enter the main menu, select [Function Settings], choose the near end of infusion alarm time that needs to be set, up to 30 minutes, or choose to turn it off.

5.4.3 Lock Screen Settings

(1) Select to turn on or off this function. After turning on this function, if there is no operation during the infusion process, the button operation will be automatically locked after the set time;
(2) Set the time for starting the lock screen without any operation during the infusion process, with a minimum of 15 seconds and a maximum of 5 minutes;
(3) When setting whether to unlock, enter a password, which defaults to 1234.

5.4.4 Multiple pumps sequence infusion

See 3.16 for details on using Dock and 3.17 for connecting pumps.

5.5 Patient Management

Patient information can be input into the device being used, including department, room number, bed number, medical record number, patient name, gender, patient type, height, weight, date of birth, etc.

5.6 System Settings

5.6.1 Display Settings

The brightness of the screen can be set to 8 levels; The brightness of the alarm light, button backlight, and infusion operation indicator bar is set in 8 levels of light brightness.

5.6.2 Volume Settings

The alarm volume can be set by entering the password "1234". The volume can be adjusted to 8 levels, and the appropriate value can be selected using the "+" and "-" keys.

5.6.3 Date and Time

Set the current date and time.

5.6.4 Night Mode

Set the alarm volume, screen brightness, alarm lights, button backlight, and infusion operation indicator bar brightness in night mode, as well as the start and end times. After enabling this function, the device will automatically adjust the volume and brightness to the set values within the specified time period, and restore the original set values after the end time.

5.6.5 Log

View the historical records of equipment on/off, infusion, and alarm in reverse order.
Caution:

1. Electronic memory function retention time after shutdown: 3 years
2. The device alarm system has no impact on the stored historical records after a complete power loss (from grid power and/or internal power).
3. This device can store alarm records. The alarm record will be retained when the device is turned off. The shutdown event is also recorded.
4. This device can store up to 30000 logs. If the storage space is full, the new logs overwrite the earlier records.

5.6.6 Battery Information

Check the battery voltage, charging current, charging time, and voltage of the charging power source.

5.6.7 System Information

View product name, product model, software and hardware versions.

5.6.8 User Maintenance

User password is required to enter, password protected settings must be set, and changing user maintenance settings must be done by authorized personnel. If you need to obtain a password to access these functions, please contact the relevant personnel.

5.6.8.1 Language Selection

Set the language of user requirements.

5.6.8.2 Consumables setting

Here, you can set 【 Add Consumables 】, 【 Calibrate Consumables 】, 【 Edit Consumables 】, 【 Delete Consumables 】, and 【 Common Consumables Configuration 】.
Caution:
If calibration is required, contact our manufacturer's maintenance personnel for assistance.

5.6.8.3 Functional Module Management

(1) Set the special specification switch for the syringe, which allows for the use of 1ml syringes. The default setting is [off].

(2) Set a special specification switch for pressure alarm, which can detect a pressure of 20kPa. The default setting is [off].

(3) Shutdown shall automatically clear the information of the patient. The default setting is [No]. If it is set to [Yes], the pump will automatically clear the patient information after shutdown.

5.6.8.4 Importing Drug Library Information

After generating drug library information in the drug library management software, it can be imported into this device. Before importing, please ensure that the current drug library information is properly saved. After importing a new drug library, the current information will be overwritten.
To import drug information, the steps are as follows:
(1) Insert the USB drive loaded with drug library information into the USB interface of the board device.

(2) Press【 Main Menu 】- select【 System Settings 】- select【 User Maintenance 】- enter administrator password - select 【 OK 】 on the device.

(3) Select 'Import Drug Library Information' - choose 'OK'.

(4) After the interface prompts successful import, select [OK].

(5) Press the power button, and then select 'Shut Down' in the pop-up dialog box to turn off this device. The medication library is activated during the shutdown process.

Restarting this device, if the drug library activation fails, the system will prompt.

The drug library has the following functions:

■ Can store at least 5000 drug names.

■ 30 colors can be used to identify drugs.

■ Support at least 30 drug classifications.

Caution:

The department where this device is used is responsible for checking the imported drug library information to ensure that the imported drug library is correct.

5.6.8.5 WiFi Settings

(1) Set the device information displayed in the network, including product serial number, department name, and bed number.

(2) Enter the name, network password, and server IP address of the WiFi network to be joined. After entering, tab 'Connect to Network' to connect to WiFi network.

(3) After clicking, perform a network test to see if the server receives the information sent by the device.

(4) Disconnect the device from the network after clicking.

Caution:

1. The design, install, debugging, and maintenance of wireless network layout must be carried out by authorized maintenance personnel of our company.
2. Wireless network deployment must comply with local laws.
3. To ensure network security and stability, all data communication related to network functions must use a hospital specific closed network. Hospitals should ensure the security of the dedicated network.
4. Ensure the security of network encrypted information, such as passwords, and prevent unauthorized personnel from accessing encrypted information.
5. Do not connect non-medical devices in the network.
6. When the wireless signal is weak, there may be a risk of data loss in the central monitoring system.
7. Radio frequency interference may cause wireless network disconnection.
8. Disconnecting the network may result in data loss and functional failure of the central monitoring system. Once a network outage is detected, please check the patient and resolve the issue as soon as possible.

9. Ensure that the IP address of this device is set correctly. Changing network settings may result in network disconnection. If you have any issues with IP settings, please contact the repair personnel.

5.6.8.6 Changing User Password

User maintenance password can be modified.

5.6.9 Manufacturer Maintenance

Manufacturer password is required to enter for restoring factory settings, parameter calibration and system testing. It is recommended that the system maintenance work be completed by the manufacturer's engineer.

Chapter 6 Maintenance

If the user needs to repair specified equipment components, our company can provide relevant circuit diagrams, component lists, drawing annotations, calibration details, or other necessary information to assist qualified technical personnel in repairing equipment components designated by the manufacturer.

Caution:

1. Stop using the equipment for maintenance and upkeep.
2. Do not make any changes to this device on your own.
3. All safety inspections or maintenance work that requires dismantling equipment should be carried out by professional maintenance personnel. Non-professional operations may cause equipment failure and may endanger personal safety
4. When administering intravenous infusion to patients, maintenance and upkeep of this equipment and its surroundings are not allowed.
5. If you find any problems with the device (such as product labels falling off, etc.), please contact the maintenance personnel.
6. If calibration is required, please contact our company's maintenance personnel.

6.1 Daily cleaning and disinfection

(1) Cleaning: Use a warm and clean soft cloth to wipe the outer surface of the equipment, being careful not to pour liquid onto the equipment or accessories or into the interior of the equipment.

(2) Disinfection: Use 75% ethanol cotton to wipe the entire surface of the product twice, with a duration of 3 minutes.

Caution;

1. Before cleaning, please disconnect the AC power cord of the infusion pump. Avoid using organic liquids such as diluents and alcohol for cleaning.
2. Do not immerse equipment or accessories in liquids.
3. When cleaning or disinfecting equipment or accessories, avoid metal parts and interfaces on the equipment or accessories to prevent corrosion.
4. If liquid is accidently poured onto equipment or attachments, please immediately disconnect the power, wipe off the liquid, and contact maintenance personnel or our company.
5. Do not use abrasive materials such as steel wool or silver polishing agents, as well as any strong solvents such as acetone or cleaning agents containing acetone components for cleaning.
6. After cleaning and disinfecting, please carefully inspect the equipment and accessories. If any signs of aging or damage are found, please stop using immediately.

6.2 Battery Maintenance

6.2.1 Battery usage

This device is equipped with a built-in lithium battery. When AC power is lost, this device automatically switches to internal battery power supply. This device can switch between external power supply and battery power supply without interruption. When connected to an external power supply, this device prioritizes external power supply.
When using it for the first time, please confirm that it is rechargeable before turning it off or continuing to charge for 12 hours.
After several charging/power consumption processes, the battery capacity can reach its maximum value.
If the number of charging/power consumption cycles increases, the battery level will decrease accordingly. If the battery is repeatedly charged without sufficient discharge, it will lead to a decrease in battery capacity; It is recommended to use the internal battery every 4 weeks, and wait until the device has issued a 'battery depleted' alarm signal for each use.
If the device is not used for a long time, the battery should be removed; otherwise the battery may be over discharged, causing damage to the battery.
Caution:
The battery has a lifespan of two years, and it is recommended to replace the battery with a new one in advance. Waste materials (batteries, electronic appliances) should be disposed of according to local regulations and recycled as much as possible. Waste should not be treated as household waste.

6.2.2 Charging

If there is a low-voltage alarm, AC power needs to be connected and the machine will automatically charge.
If it is used for the first time or stored for a long time before reuse, please charge it first. Charging method:

(1) Connect the AC power supply, and the AC indicator light will turn on; Press the power button to turn on the machine, the power light will turn on, and the battery symbol in the upper right corner of the LCD screen will display the charging pattern.

(2) Press the power button for about 2 seconds to turn off the machine, and continue charging. After about 8 hours, the charging is completed.

Caution:

1. Only this device can be used to charge the battery.
2. When used together with DOCK, this device can also be charged if DOCK is connected to AC power.
3. Before using the built-in battery for work, please check the battery to ensure it has sufficient power. Recharge the battery when needed.

6.2.3 Battery Replacement

This device comes with a battery installed at the factory. Replacing the battery requires qualified technicians to complete it. Unscrew the screws on the bottom shell plate that secure the upper shell, and after removing the upper shell, the battery can be seen. Pull out the connector and remove the battery. Insert the new battery, insert the connector, cover the upper shell, and tighten the fixing screws of the bottom shell,

Caution:

1. Do not place the battery near flames or high temperature sources.
2. The battery requires specialized batteries provided by our company.
3. The battery has a lifespan of two years, and it is recommended to replace the battery with a new one in advance.
4. Untrained personnel installing and smoothing batteries may pose risks such as overheating, fire, or explosion.

6.2.4 Battery Optimization

The lifespan of a battery depends on the frequency and duration of its use. If used and stored properly, the lifespan of lithium batteries is approximately 2 years. Improper use of batteries may shorten their lifespan. It is recommended to replace the battery every two years. The performance of the battery will decrease with increasing usage time, and it is recommended to optimize the battery every two months.

The steps for battery optimization are as follows:

(1) Disconnect the device from the patient.

(2) Turn off this device and connect it to an external power source.

(3) Continuously charge the battery until it is fully charged.

(4) Disconnect the external power supply and turn on this device. Use batteries to power this device until the battery is depleted, and the device will automatically shut down.

(5) If you want to use the battery, fully charge it again

Caution:

1. If battery maintenance is not carried out for a long time, it may cause inaccurate battery level display, leading to incorrect judgment of battery working time. In addition, if the battery is left fully charged for a long time without regular maintenance, it will accelerate battery aging and lead to premature failure.
2. Please do not use this device for infusion during the battery optimization process.
3. Please do not interrupt charging or discharging during the battery optimization process.

6.3 Training

This manual serves as one of the training materials and is provided by our technical personnel or authorized personnel for training. It is recommended to undergo pre use training and at least one training session per year.

Chapter 7 Technical Specifications

7.1 Power Supply

Please provide an AC power cord along with this infusion pump.

AC power supply: AC 100-240V, 50/60Hz.

7.2 Battery

Please do not short-circuit the positive and negative terminals of the battery;

Features: Lithium battery, 11.1V, 2600mAh.

Battery working time: ≥ 7 hours (when injecting with a 50ml syringe at a flow rate of 3ml/h when the new battery is fully charged).

7.3 Applicable syringes

This syringe pump can use seven specifications of syringes: 1ml, 2ml, 5ml, 10ml, 20ml, 30ml, and 50ml.

This device is equipped with multiple common syringe brands for easy user selection. Only syringes that meet the pump standards can be used on this infusion pump. The following table lists the recommended syringes for use:

Recommended syringe information for use

Syringe name	model	Manufacturer
Disposable sterile syringe	1ml,2ml,5ml,10ml,20ml,30ml，50ml	TooToo MediTech Co. Ltd.

Caution: If using a customized brand syringe, there may be a decrease in syringe accuracy due to inaccurate scale length input.

7.4 Flow rate range

Syringe capacity specification (ml)	1	2	5	10	20	30	50
Flow rate (ml/h)	0.01~50	0.01 ～ 150	0.1 ～ 300	0.1 ～ 800	0.1 ～ 1200	0.1 ～ 1500	0.1 ～ 2300
Prime flow rate (ml/h)	1~50	1～150	1～300	1～800	1～1200	1～1500	1～2300
Bolus flow rate (ml/h)	0.01~50	0.01 ～ 150	0.1 ～ 300	0.1 ～ 800	0.1 ～ 1200	0.1 ～ 1500	0.1 ～ 2300

Caution:

1. The minimum step is 0.01ml/h.

2. The infusion accuracy of the infusion system (infusion pump plus syringe) is affected by the inner and outer diameters, materials, etc. of the syringes used: therefore, there may be differences in the infusion accuracy of different brands/models of infusion devices.
3. The claimed infusion accuracy of the infusion pump is based on a disposable syringe with a temperature of 25 ℃± 2 ℃.

7.5 Other syringe parameter setting range

KVO flow rate	0～5ml/h, Set to zero to disable the function
Scope of infusion time setting	00:00:01~99:59:59 (h: min: sec), minimum step 1 second
Preset setting range	0～9999.99 ml，When set to 0, which means' empty ', it means that the liquid in the syringe has been injected until it is completely emptied
Weight setting range	0.1～500kg
Dosage setting range	0.01～9999
Range of liquid capacity setting	0.1～9999ml

7.6 Accuracy

The syringe accuracy at a rate of ≥ 1ml/h should not exceed ± 2%, the syringe accuracy at a rate of ＜ 1ml/h should not exceed ±5%, and the Bolus flow rate infusion accuracy should not exceed ±2%.

Caution:

1. The infusion accuracy of the infusion system (infusion pump plus syringe)) is affected by the inner and outer diameters, materials, etc. of the syringes used. Therefore, there may be differences in the infusion accuracy of different brands/models of infusion devices.
2. The claimed infusion accuracy of the infusion pump is based on a disposable syringe with a temperature of $25^{o}C \pm 2^{o}C$
3. Please ensure the safe fixation of this device. Changes in the install position and severe vibrations may affect the accuracy of infusion.
4. Please ensure that the equipment operates within the specified environmental requirements, otherwise it may not meet the accuracy and other technical specifications claimed in this manual, and may result in unforeseeable consequences such as equipment damage.

7.7 Display range of cumulative infused volume

0～9999.9ml

7.8 Occlusion pressure level setting

The occlusion pressure threshold is divided into 15 levels, and the maximum infusion pressure that the machine can generate is 150kPa, which can be displayed in 4 units. The threshold values that can be set for each gear are shown in the table below:

Pressure gear	kPa	mmHg	bar	psi
1	30	150	0.2	2.9
2	35	187.5	0.25	3.625
3	40	225	0.3	4.35
4	45	262.5	0.35	5.075
5	50	300	0.4	5.8
6	55	337.5	0.45	6.525
7	60	375	0.5	7.25
8	65	412.5	0.55	7.975
9	70	450	0.6	8.7
10	80	525	0.7	10.15
11	90	600	0.8	11.6
12	100	675	0.9	13.05
13	110	750	1	14.5
14	120	825	1.1	15.95
15	130	900	1.2	17.4

For 1ml syringes with a flow rate ≥ 0.1ml/h, there is only a occlusion pressure range of 70 ±20kPa.

When the flow rate of 1ml and 2ml syringes is less than 0.1ml/h, there is only a occlusion pressure range of 20 ± 15kPa.

7.9 Occlusion alarm response time and possible bolus volume

The data provided here is measured based on clinical trials and is used as a reference.

Before the occlusion is relieved, the device uses the method of controlling the stepper motor to reverse to withdraw the medication and relieve the occlusion pressure based on the syringe flow rate and occlusion level.

Type	rate of flow	Occlusion alarm upper limit				notes
		1st gear (20 ±15kPa)		15 gears (130 ±20kPa)		
		response time	Possible bolus volume	response time	Possible bolus volume	
2ml	5ml/h	≤5min	≤0.6ml	≤20min	≤1.0ml	The longest response time and bolus volume are both affected by the experimental conditions when using a syringe from the Double Pigeon brand
	1ml/h	≤15min	≤0.6ml	≤2h	≤1.0ml	
	0.01ml/h	≤7h	≤0.6ml			
5 ml	5ml/h	≤5min	≤0.6ml	≤20min	≤1.0ml	
	1ml/h	≤15min	≤0.6ml	≤2h	≤1.0ml	
	0.1ml/h	≤4h	≤0.6ml	≤7h	≤1.0ml	
10 ml	5ml/h	≤5min	≤0.6ml	≤20min	≤1.0ml	
	1ml/h	≤15min	≤0.6ml	≤2h	≤1.0ml	
	0.1ml/h	≤4h	≤0.6ml	≤8h	≤1.0ml	
20 ml	5ml/h	≤15min	≤0.6ml	≤20min	≤1.0ml	
	1ml/h	≤2h	≤0.6ml	≤2h	≤1.0ml	
	0.1ml/h	≤5h	≤0.6ml	≤13h	≤1.0ml	
30ml	5ml/h	≤15min	≤0.6ml	≤20min	≤1.0ml	
	1ml/h	≤2h	≤0.6ml	≤2h	≤1.0ml	
	0.1ml/h	≤5h	≤0.6ml	≤16h	≤1.0ml	
50ml	5ml/h	≤1h	≤2.0ml	≤1h	≤3.0ml	
	1ml/h	≤3h	≤2.0ml	≤3h	≤3.0ml	
	0.1ml/h	≤8h	≤0.6ml	≤32h	≤1.0ml	

Type	rate of flow	Occlusion alarm upper limit				notes
		(20 ±15kPa) gear		(70 ±20kPa) gear		
		response time	Possible Bolus Volume	response time	Possible Bolus Volume	
1ml	5ml/h			≤20min	≤1.0ml	

	1ml/h			≤2h	≤1.0ml	
	0.01ml/h	≤14h	≤0.6ml			

Caution:

1. The occlusion pressure detected by the infusion system (infusion pump plus syringe) is affected by the inner and outer diameters, materials, etc. of the syringe used. Therefore, there may be differences in the occlusion pressure when choosing different brands/models of syringes.
2. The claimed occlusion pressure of the infusion pump is based on a disposable syringe with an ambient temperature of $25^{o}C \pm 2^{o}C$.
3. The above data testing is based on a disposable syringe with a temperature of $25^{o}C \pm 2^{o}C$.
4. The occlusion alarm pressure, delay time, and high-dose volume are all affected by test conditions, temperature, and pipeline length.
5. When using low flow rate infusion, it is not recommended to use large-sized syringes. For example, using a 50m1 syringe and setting the occlusion pressure to the lowest and highest at a flow rate of 0.1ml/h, the occlusion alarm response time may reach more than 8h and 32h, respectively. Therefore, if low flow rate infusion is necessary, it is recommended to use smaller sized syringes to ensure timely occlusion detection.

7.10 Product Classification

According to the medical device product classification rule, the product is in Class IIb,
According to the safety classification of medical electrical equipment, this device belongs to Class I, with internal power supply, CF type, portable, IP34 type anti drip equipment.

7.11 Display Screen

screen type	screen size	resolution
Capacitive screen	4 inches	≥ 480 × 800 pixels

7.12 Dimensions and Weight

270mm × 155mm × 80mm, approximately 1.8Kg.

7.13 Work Environment

Working temperature: +5 ℃~+40 ℃
Relative humidity: 20% to 90%, no condensation

Atmospheric pressure**: 70kPa to 106kPa**

7.14 Transportation and Storage Conditions

Please transport and store in the following environment:

Temperature: -20 ℃ to+55 ℃ Relative humidity: 10% to 90%, no condensation. Atmospheric pressure: 70kPa to 106kPa.

Do not store in the following environment:

(1) Direct sunlight/strong light.

(2) Places that are directly blown by cold and humid (hot) air currents such as fans, air conditioners, electric stoves, heaters, humidifiers, etc.

(3) Chemical warehouses or places with harmful gases.

(4) Places with water seepage, splashing, excessive dust, or excessive vibration.

(5) The floor where it is located is uneven.

7.15 Product usage period

(1) Product production date: see the body label;

(2) Product lifespan: 10 years. After the equipment reaches its expiration date, it should be scrapped according to local regulations.

Caution:

The disposal of components, batteries, packaging materials, and accessories must comply with local regulations or the hospital's waste disposal system.

7.16 Wireless Network

Wireless module model	ATK-MW8266D
Wireless Protocol	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n
Transmission power	11dBm~18dBm
Working frequency range	2.412GHz ~ 2.484GHz
Wireless rate	IEEE 802.11b: up to 11Mbps IEEE 802.11g: up to 54Mbps IEEE 802.11n: Up to HT20 (MCS7)
Working mode	Realize data transmission and reception through interconnection with AP

Security mechanism	Security mechanisms: WEP, WPA-PSK, WPA2-PSK Encryption types: WEP64, WEP128, TKIP, AES
capacity	Each AP can support up to 50 pumps connected

Caution:

1. When the wireless signal is weak, there may be a risk of data loss on the server.
2. Radio frequency interference may cause wireless network disconnection.
3. Disconnecting the network may result in server data loss. Once a network outage is detected, please check the patient and resolve the issue as soon as possible.
4. Ensure that the IP address of this device is set correctly. Changing network settings may result in network disconnection. When changing network settings, it is necessary to re-enter the IP address and password.

7.17 Accessories List

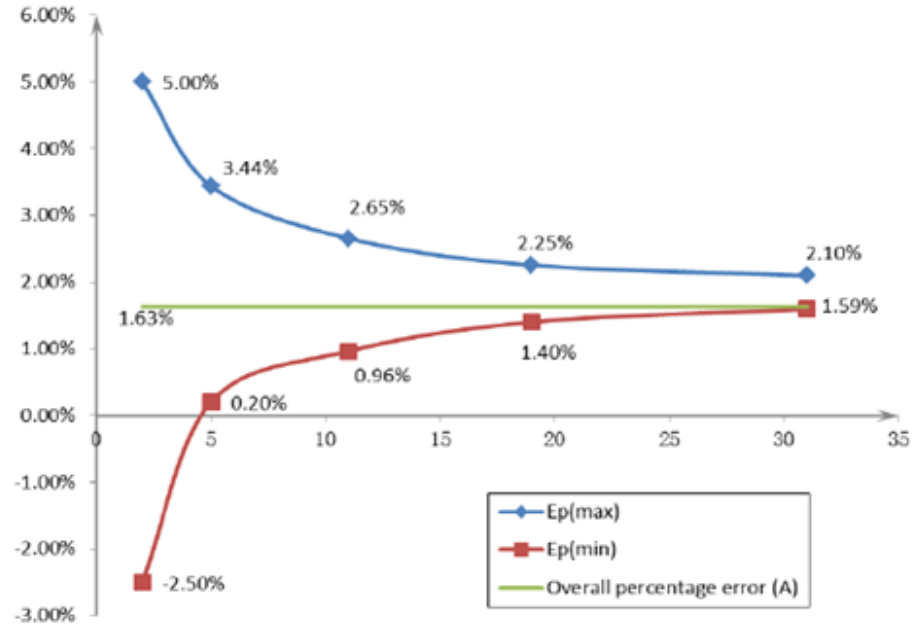
Accessory	Quantity	Replacement cycle	Replacement method
power line	1	10 years	Contact the manufacturer for replacement
Removable fixed clip	1	five years	Contact the manufacturer for replacement
built-in battery	1	two years	Refer to 6.2 (3)

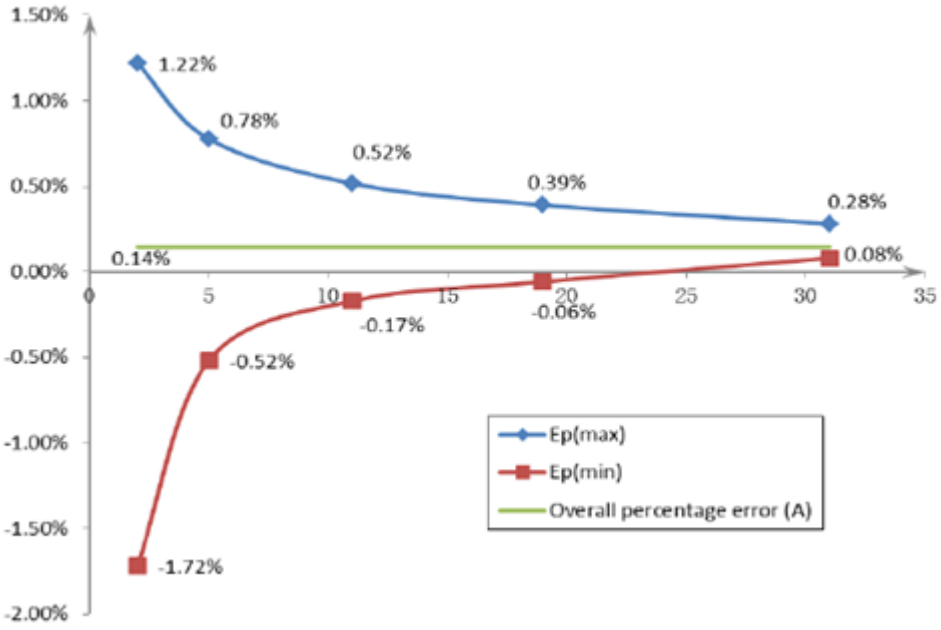
7.18 Infusion Accuracy Diagram

1. Trumpet Curve

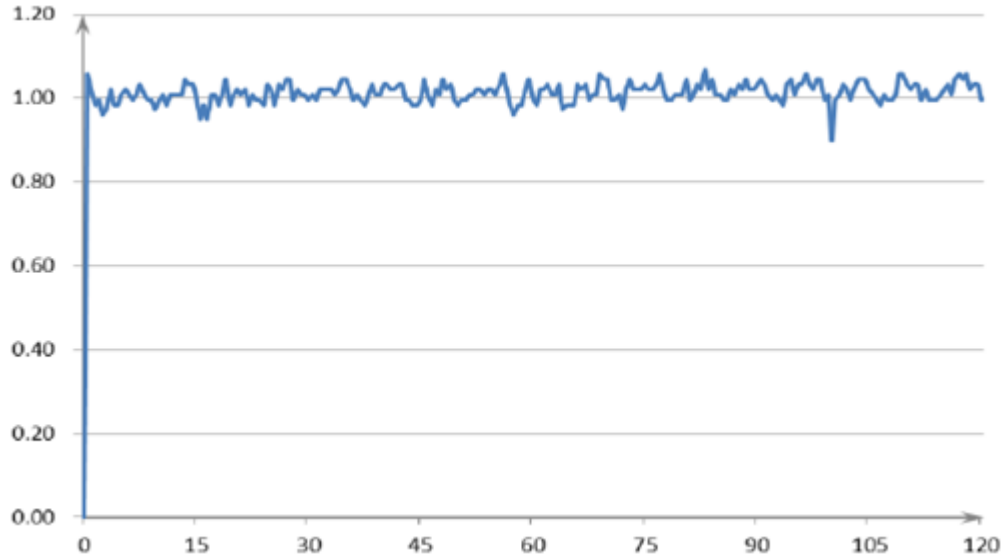
Trumpet curve indicates the trend of the max and min deviations of the syringe and pump. The detection proposals introduced for obtaining results in this aspect are based on EN60601-2-24. For more detailed information, please refer to this publication.

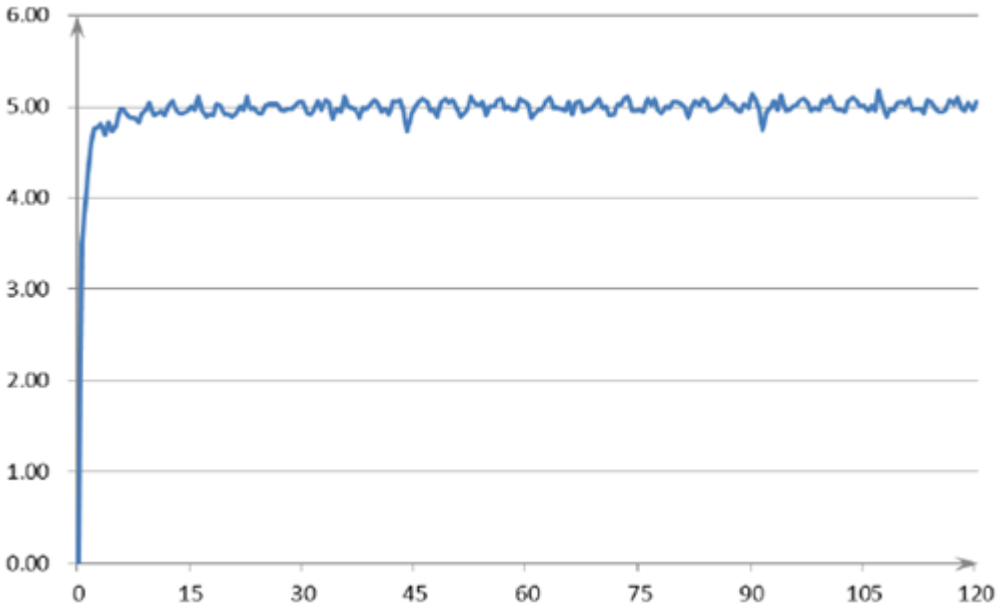
The following curve represents the results using 50ml Double Pigeon syringe in the test; and it is considered as only one basis of the overall performance of the syringe pump. For more related information, contact the supplier.





2. Start-up and Real-time Curve (Startup Curve)





Caution:

1 The accuracy of infusion does not reflect clinical standards, such as the patient's age and weight, as well as the medication used.

2 The accuracy of infusion may be affected by the environment in which the equipment is used (pressure, temperature, humidity, syringes used, infusion lines, etc.).

3 The claimed infusion accuracy of the infusion pump is based on a disposable syringe with a temperature of 25°C ±2°C.

7.19 Environmental Protection

Please do not dispose of this device and its accessories as ordinary household waste.

Please comply with local regulations regarding the handling of this device and its accessories, and support recycling actions.

Name and content of harmful substances in the product

Component Name	Hazardous substances					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
host	X	O	O	O	O	O
battery	X	O	O	O	O	O
power line	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: The content of the hazardous substance in all homogeneous materials of the component is below the limit requirements specified in SJ/T 11363-2006.

X: This indicates that the content of the hazardous substance in at least one homogeneous material of the component exceeds the limit requirements specified in SJ/T 11363-2006, and there is currently no mature alternative solution in the industry that meets the environmental requirements of the EU RoHS directive.

Chapter 8 Manufacturer's Statement on EMC

Caution:

1. This product needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided, and this unit can be affected by portable and mobile RF communications equipment.
2. * Do not use a mobile phone or other devices that emit electromagnetic fields, near the unit. This may result in incorrect operation of the unit.
3. Caution: This unit has been thoroughly tested and inspected to assure proper performance and operation!
4. * Caution: this machine should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, this machine should be observed to verify normal operation in the configuration in which it will be used

<table>
<tr><td colspan="3">Guidance and manufacture’s declaration – electromagnetic emission</td></tr>
<tr><td colspan="3">The MSP6 SYRINGE PUMP is intended for use in the electromagnetic environment specified below. The customer of the user of the SYRINGE PUMP should assure that it is used in such an environment.</td></tr>
<tr><td>Emission test</td><td>Compliance</td><td>Electromagnetic environment – guidance</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Group 1</td><td>The SYRINGE PUMP use RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.</td></tr>
<tr><td>RF emission
CISPR 11</td><td>Class B</td><td rowspan="3">The SYRINGE PUMP is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td></tr>
<tr><td>Harmonic emissions
IEC 61000-3-2</td><td>Class A</td></tr>
<tr><td>Voltage fluctuations/ flicker emissions
IEC 61000-3-3</td><td>Complies</td></tr>
</table>

Guidance and manufacture's declaration – electromagnetic immunity			
The MSP6 SYRINGE PUMP is intended for use in the electromagnetic environment specified below. The customer or the user of SYRINGE PUMP should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±15 kV air	±8 kV contact ±15 kV air	Floors should be wood, concrete or ceramic tile. If floor are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines	±2kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV line(s) to line(s)	±1 kV differential mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 sec	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the SYRINGE PUMP requires continued operation during power mains interruptions, it is recommended that the SYRINGE PUMP be powered from an uninterruptible power supply or a battery.
Power frequency (50Hz/60Hz) magnetic field IEC 61000-4-8	400A/m	400A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacture's declaration – electromagnetic immunity			
The MSP6 SYRINGE PUMP *is* intended for use in the electromagnetic environment specified below. The customer or the user of SYRINGE PUMP should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 V_{rms} 150 kHz to 80 MHz Outside ISM bands[a]	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the SYRINGE PUMP, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance
Radiated RF IEC 61000-4-3	10 V_{rms} 150 kHz to 80 MHz in ISM bands[a] 10 V/m 26 MHz to 2.5 GHz	10 Vrms 10 V/m	26 MHz to 800 MHz 800 MHz to 2.5 GHz Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol
NOTE 1 At 26 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

[a] The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz;13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz.

[b] The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2,5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 has been incorporated into the formulae used in calculating the recommended separation distance for transmitters in these frequency ranges.

[c] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the SYRINGE PUMP is used exceeds the applicable RF compliance level above, the SYRINGE PUMP should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the SYRINGE PUMP.

[d] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 10 V/m.

Recommended separation distances between
portable and mobile RF communications equipment and the SYRINGE PUMP .

The MSP6 SYRINGE PUMP *is* intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the SYRINGE PUMP can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the SYRINGE PUMP as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (W)	Separation distance according to frequency of transmitter (m)			
	150 KHz to 80 MHz outside ISM band	150 KHz to 80 MHz in ISM band	26 MHz to 800 MHz	800 MHz to 2.5 GHz
0.01	0.12	0.12	0.12	0.23
0.1	0.37	0.38	0.38	0.73
1	1.17	1.20	1.20	2.30
10	3.69	3.80	3.80	7.30
100	11.67	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz.

NOTE 3 An additional factor of 10/3 has been incorporated into the formulae used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2,5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

NOTE 4 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Recommended isolation distance between portable and mobile RF communication equipment and MSP6 syringe pump.

The MSP6 syringe pump is expected to be used in an electromagnetic environment with controlled radiation RF interference. Based on the maximum output power of the communication equipment, buyers or users of syringe pumps can prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication devices (transmitters) and the syringe pumps as recommended below.

Rated maximum output power of transmitter/W	Isolation distance for different frequencies of the corresponding		
	150 kHz ～ 80 MHz d = $1.2\sqrt{P}$	80 MHz ～ 800 MHz d = $1.2\sqrt{P}$	800 MHz ～ 2.5 GHz 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

For the rated maximum output power of transmitters not listed in the above table, it is recommended to isolate the distance *d* in meters (m), which can be determined using the formula in the corresponding transmitter frequency column. Here, *P* is the maximum output rated power of the transmitter provided by the transmitter manufacturer, in watts (W).

Note 1: At frequencies of 80 MHz and 800 MHz, use formulas in the higher frequency range.

Note 2: These guidelines may not be suitable for all situations, as electromagnetic propagation is affected by the absorption and reflection of buildings, objects, and human bodies.