User Manual

Digital Infusion Pump

2802674 - 2802675 - 2802676

Version:V1.0

CE

Content

Chapter 1 Safety Instructions

1.1 Warnings

- Please check the device, connect wire and accessories before use to ensure that it can work normally and safely. Please stop immediately and contact our after sales service department if there is anything abnormal. Besides, it is possible to cause fault or malfunction of device if there is adhesion or intrusion of medicinal fluid. Therefore, please clean the device after use and store it properly.

- This device cannot be used for blood transfusion.

- It is not allowed to use the device in the environment with anesthetic and other inflammable or explosive subjects to avoid fire or explosion.

- It is not allowed to store or use the device in the environment with active chemical gas (include gas for disinfecting) and moist environment since it may affect the components inside the infusion pumps and may cause components performance degradation or damage.

- The operator shall ensure the preset infusion parameters of this device are the same as the parameters in medical advice before infusion starts.

- Please install the infusion set in accordance with the indicated direction of the device and ensure that the infusion tubes cross the peristaltic device smoothly and straightly. Otherwise, it may cause blood flow back or fail to reach the expected performance.

- Please do not only rely on the alarm system, periodic check is needed to avoid accidents.

- Fix this device on the infusion stand tightly and ensure the stability of the infusion stand. Be careful in moving the infusion stand and the device to avoid the device dropping, stand falling or knocking the surrounding objects.

- The pressure in the infusion set will increase if the infusion flow is obstructed for reasons such as the infusion tubes are twisted, filter or needle is obstructed, or there are blood clots in the needle. In removing the obstruction, it may cause “bolus infusion” (temporary excess infusion) to the animal. The correct method is to hold or clamp the infusion tube near the puncturing position tightly, and open the door to release the pressure in the infusion tube. Then the infusion tube can be loosened to solve the problem of occlusion and infusion can be restarted. If infusion is restarted before the occlusion problem is solved, it may cause constant occlusion alarm, and the pressure in the infusion tube may increase continuously, which may cause the infusion tube break or cut off, or even hurt the animal.

- This device infuses medicinal fluid by peristaltic extrusion on the infusion tube. However, it cannot recognize the leakage caused by infusion tube cut-off or break. Therefore, it is necessary to conduct periodic check to avoid the faults during working.

- In order to ensure the correct operation, please check the dripping state of the medicinal fluid and the residual medicinal fluid in the intravenous infusion bag periodically during infusion. Since the device doesn't measure the quantity of infusion fluid directly, it is possible that the device cannot detect the free infusion flow occurs in the special situations. For the demands of tolerance, it is possible that the device cannot detect the free infusion flow with number less than the specific value even when a drop sensor is adopted

- This device has the occlusion detection function, which is used for detecting and alarming when the infusion needle does not puncture into vein correctly or the needle deviates from the position in the vein in infusion. However, it only alarms when the occlusion pressure has reached a certain numerical level. Before it alarms, the punctured part may be reddish, swell or bleed. Besides, it is possible that the device will not alarm after a long period if the actual occlusion pressure is still lower than the alarm threshold value. Therefore, it is necessary to conduct periodical check of the punctured part. Please take suitable measures immediately if there is anything abnormal about the puncturing part, such as puncture again.

- It is required to adopt infusion sets, tubes, needles and other medical components that meet the requirements from local laws and regulations and the User Manual. It is suggested to adopt the infusion sets with brands defaulted in the device. The infusion accuracy cannot be guaranteed if unsuitable infusion sets are adopted. Since the drop sensor adopts infrared sensing technology, please do not use light shielding tubes with drop sensor function on. Otherwise, the drip sensor mode may fail.

- It is not allowed to disassemble or refit this device or use it for other purposes except normal infusion.

- No one is allowed to repair the device except the authorized repair technician.

- It is not permitted to maintain the power cord, screen or propelling parts while the infusion pump is in operation.

- To avoid risk of electric shock,this device must be connected to the supply main with protective ground.

1.2 Cautions

⚠

- Before the first use, or reuse after the device is idle for a long period, please charge the device with AC power supply. If it is not fully charged, the device cannot keep working with built-in battery power supply if there is power failure.

- The device shall not be used in the environment with radiological apparatus, magnetic resonance equipment, or hyperbaric oxygen therapy.

- The devices used near the infusion pump must meet corresponding EMC requirements, or it may affect the performance of the infusion pump.

- Please use AC power supply if possible since it can prolong the service life of the battery to some degree. Please ensure that the infusion pump is connected with the supply main with protective ground when AC power supply is used. Only the AC power cord supplied with this device shall be adopted. Please pay attention to the plug position of the power cord to ensure that it can be disconnected at any time if necessary. The built-in battery can only be used as an assistant power supply when it cannot be connected with the protective ground of the AC power supply, or it cannot be used normally (power failure or in-transport infusion).

- Before the device is connected with the power supply, please keep the power socket and plug dry. The power voltage and frequency shall meet the requirements listed in the device label and the User Manual.

- The device is equipped with the audible and visual alarm system. The red and yellow alarm indicators will light by turns to check if the alarm system can work normally, while the speaker will makes the sound “beep”.

- Please keep the device away from the AC power socket for some distance to avoid medicinal fluid splashing or dropping in the socket. Otherwise, it may cause the fault of short circuit.

- Please use the medicinal fluid after it has reached or close to room temperature. When the medicinal fluid is used at low temperature, it will generate some air bubbles from the air dissolved in the medicinal fluid and result in frequent air bubble alarm.

- It is not allowed to press and operate the button with sharp objects such as pencil tip or nail, or it may cause damage to button or surface film.

- Please do not use the infusion tube at the same pumping position for over 8 hours. The infusion tube may distort after being used for a long period, which will cause flow rate error. It is suggested to change the pumping position or replace the infusion set every 8 hours.

- Please close the flow rate adjuster of the infusion set tightly before taking out the infusion set to avoid infusion free flow.

- During low flow rate infusion, please pay close attention to avoid occlusion. The lower the infusion flow rate is, the longer the time it is needed to detect the occlusion. Before the occlusion is detected, it may cause infusion stop during this period.

- If the device has been dropped or bumped, please stop use immediately and contact our after

sales service department. The components inside the device may be damaged even though the appearance is not damaged and no abnormality occurs in working.

- When the pump is used, it is not allowed to install other infusion control device on the same infusion Tube. Otherwise, it may cause danger.

- Identical or similar equipment used in any separate areas, e.g. intensive care unit, cardiac operating room, etc., can be potentially dangerous if different alarm presets are used.

Chapter 2 Overview

2.1 Product Specifications

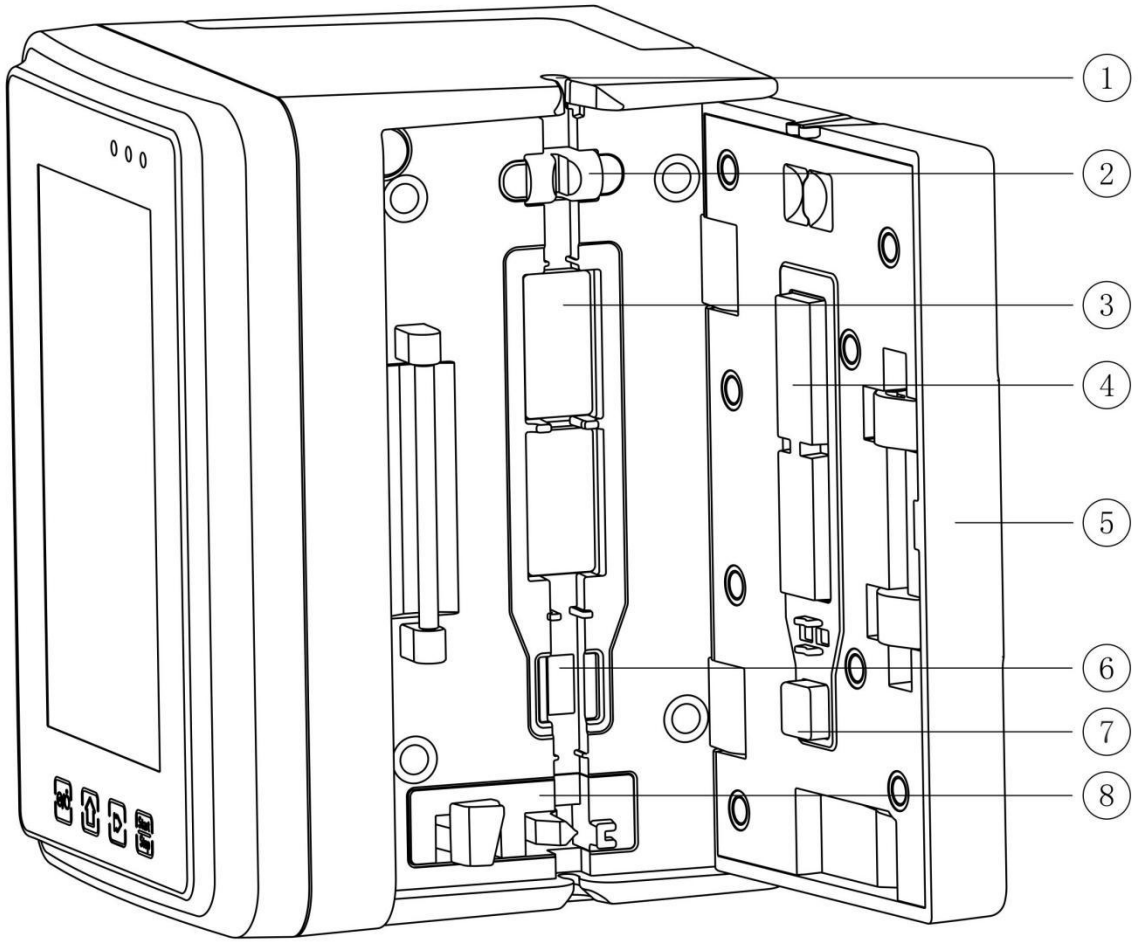
Safety Classification	
Electric Protection Type	Class I
Electric Protection Level	Defibrillation proof type CF applied Part.
Applied Parts	The applied Part is the infusion set
Ingress Protection	IP34 (protected from tools and wires greater than 2.5 millimeters and protected from water spray from any direction.)
Working mode	Continuous
Classification	Portable device
Specification Parameters	
Infusion set specification	20 drops
System Accuracy	±5%
Drip Infusion Rate Accuracy	±10% or ±1drop/min which is larger
Infusion Rate	0.10-1500 ml/h
Drip mode range	1~500 drops/min
Bolus Rate	0.1-1500 ml/h
Bolus preset value	0.1-50 ml
KVO Rate	0-5.00 ml/h 0ml/h indicates its in the off state
Micro mode setting range	100-1500 ml/h
Flow rate increment	0.01ml/h (0.1-99.99ml/h) 0.1ml/h(100-999.9ml/h) 1ml/h(1000-1500ml/h)
Weight (Body weight)	0.1-550kg
Conc. Unit	ng/ml,ug/ml, mg/ml, g/ml, U/ml, KU/ml, IU/ml, IE/ml, mmol/ml, mol/ml,

(Concentration unit)	kcal/ml
Dose rate unit	ng/min,ng/h,ng/kg/min,ng/kg/h,μg/min,μg/h,μg/kg/min,μg/kg/h, mg/min,mg/h,mg/kg/min, mg/kg/h etc.
VTBI	0-9999.99 ml, minimum step is 0.01ml
Total Volume Infused	0-9999.99 ml, minimum step is 0.01ml
Time Range	1min-99hr59min
Fuse	Class T fuse 2A 250V
Dimensions	105(W)*109(D)*142(H) mm (Pole Clamp not included)
Weight	1.4kg
Power Supply	
AC power supply	100-240V 50/60Hz
Input power	50VA
DC power supply	12V, 2A; DC chargers conforming to IEC 60950-1/IEC 62368-1 or other relevant safety standards shall be used.
Battery Specifications	Specification: 7.4V 2500mAh Charging time: single battery less than 2.5hrs, two batteries less than 5hrs (under OFF status) Working time: single battery over 4.5hrs, two batteries over 9hrs. (after completely charging battery/ batteries, when the environment temperature is 25°C and flow rate is 25ml/h, the constantly working time)
Alarm	
Alarm signal sound pressure level	When the sound is set at lowest level, alarm signal sound pressure level ≥45dB(A) When the sound is set at highest level, alarm signal sound pressure level ≤80dB(A)
Alarm information	VTBI near end,VTBI infused, Pressure high, Battery nearly empty, Battery empty, No battery inserted, No power supply, Pump idle, Standby time expired, KVO finished, No drop sensor connection, Drop speed error, Air bubble, Door Open
Environment	
Non AP/APG type device	Do not use it in the environment with inflammable anesthetic gas mixed with air, or inflammable anesthetic gas mixed with oxygen or nitrous oxide
Operating	(1) temperature: 5-40℃ (2) humidity: 15-95%, non-condensable (3) atmospheric pressure: 57-106kPa
Transport & Storage	(1) temperature: -20-55℃ (2) humidity: 10-95%, non-condensable

	(3) atmospheric pressure: 50-106kPa
Safety Standard	
Main Safety Standards	IEC 60601-1:2005+A1:2012+A2:2020 Medical Electrical device, Part 1: General Requirements for basic safety and essential performance IEC60601-2-24:2012 Medical electrical device–Part 2-24: Particular requirements for the safety of infusion pumps and controllers IEC60601-1-8:2006+A1:2012+A2:2020 Medical electrical device –Part 1-8: General requirements for basic safety and essential performance –Collateral Standard: General requirements, tests and guidance for alarm systems in medical electrical device and medical electrical systems IEC 60601-1-2:2014+A1:2020 Medical Electrical device - Part1-2: General requirements for basic safety and essential performance-Collateral standard: Electromagnetic compatibility-Requirements and tests

Chapter 3 Appearance

3.1 Front View



① Tubing guide

② Pump door air bubble sensor (for air bubbles detection in the infusion line)

③ Pump tablets

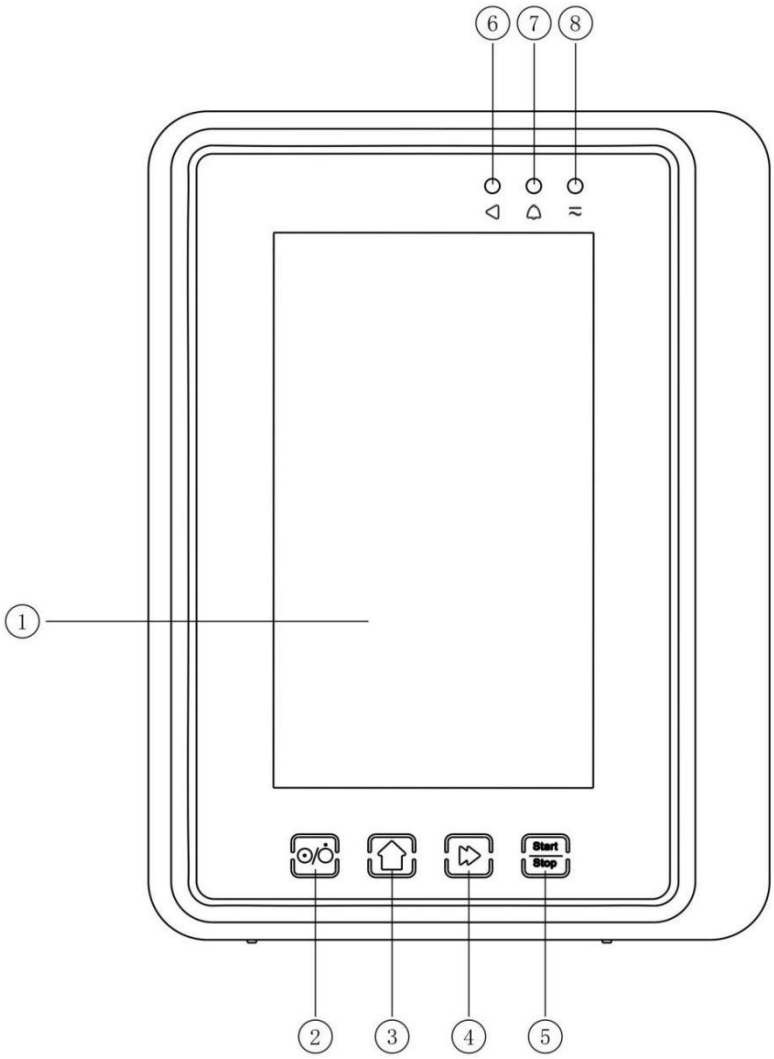
④⑦ Pressure Plate

⑤ Pump door

⑥ Pressure sensor (for occlusion detection)

⑧ Anti-free flow clamp

3.2 Operation Panel



① Touch Screen

②【Power】

Pump power switch, short pressing the power button to enter the shutdown setting interface, the user can set shutdown, standby (time) or cancel.

Long pressing the power button until the screen turns off.

③【Home】

Enter system home page.

④ 【Bolus/Purge】

⑤【Start/stop】

⑥ Running indicate light

⑦ Alarm indicator

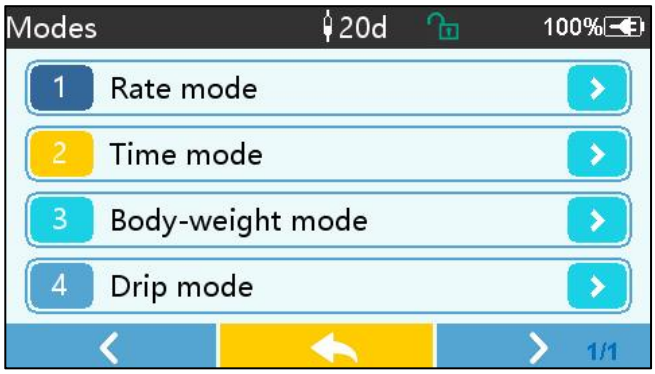
While pump alarms, indicator light glitter, with different frequency and color to show different alarm level, more information please **refer to Chapter 9.1**

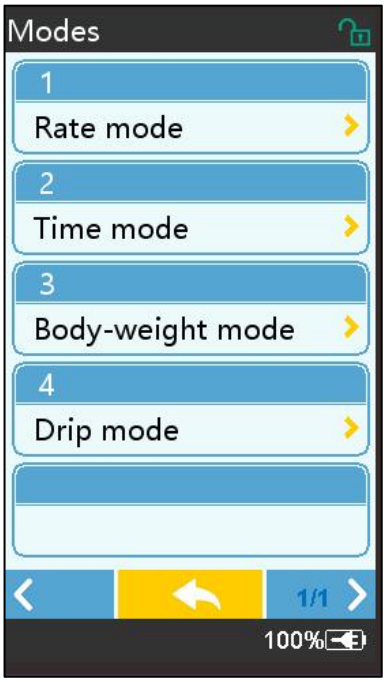
⑧ AC indicate light

When connecting with AC power supply, AC indicator lights on.

3.3 Display Screen

The display screen interface layout composes of title bar and typical interface. (manually switch between landscape and portrait)





3.3.1 Title Bar

The title bar displays real-time information. Except for『Brand Select』,others are not selectable. The name of current editing parameter is displayed at the left upper corner.

Table 3.3.1-1: Title Bar Icon

Icon	Meaning	Description
	Infusion set indication icon	Infusion set indication icon
	Lock screen indication icon	Unlock state icon is
	WIFI indication icon	Indicate WIFI connection state.
	Battery charging indication icon	Display the current battery charging state

	Battery status indication icon	The value of the remaining capacity of battery is displayed with the percentage at the left side. For the remaining capacity of battery always changes, one of the following states will be displayed: 

3.3.2 Typical Interface

Before and during infusion, the following interfaces will be shown in the typical interface: main interface, working interface, alarm interface, prompt interface, control panel, parameters setting, input method, standby interface etc.

3.3.2.1 Typical Interface Icons

Table3.3.2.1-1

Icon	Meaning	Description
	Audio Paused	Indicated that the ALARM SYSTEM is in the AUDIO PAUSED state.
	Alarm confirmation	The alarm condition is in the responsibility accepted state.
	Start	start infusion
	Stop	Stop infusion
	Bolus/Purge	1. During infusion, it means『Bolus』, select it to start fast infusion 2. Before infusion starting, it means『Purge』, select it to exhaust air from the infusion set.
	Home	Return to the main interface

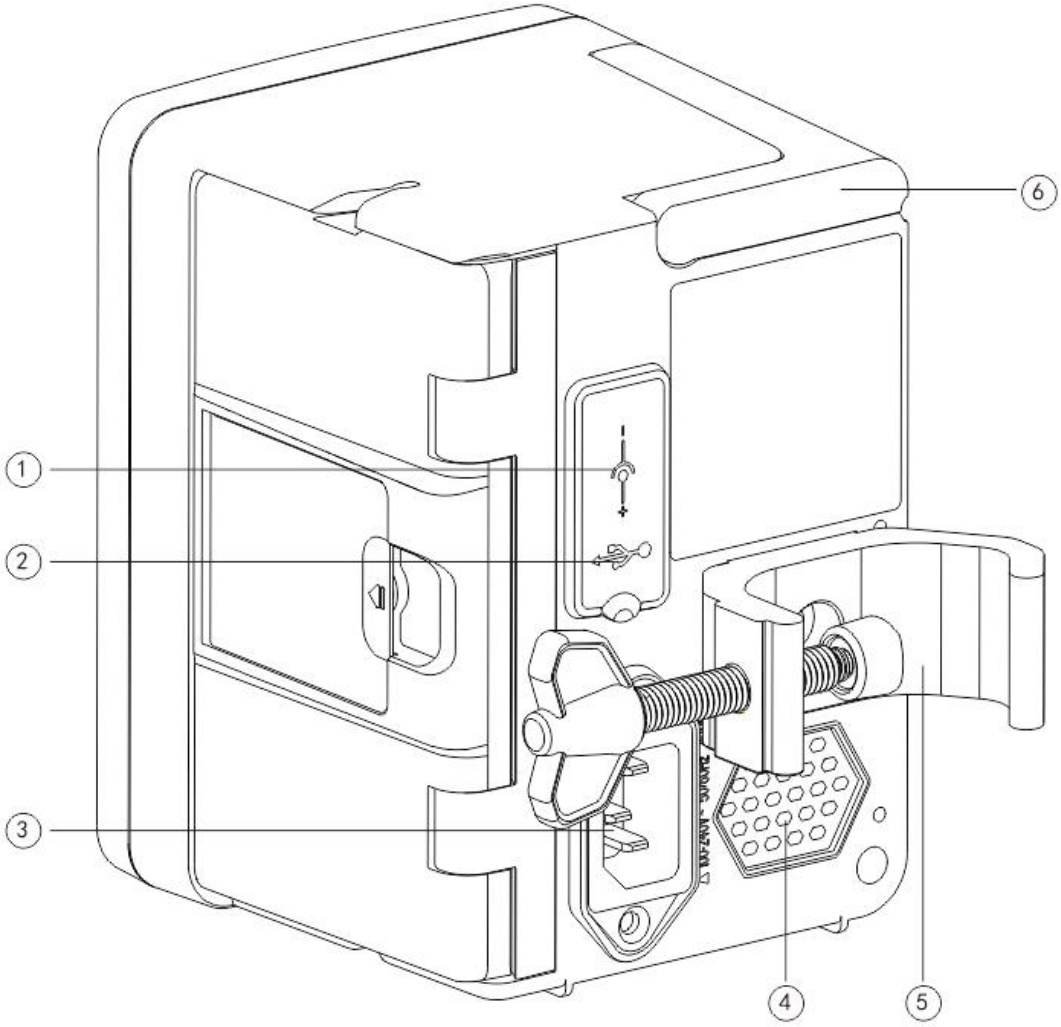
3.3.2.2 Input Method Interface

The input method interface is composed of the title bar, input box and edit area.

1) Title bar: display the name of current editing parameter.
2) Input box: real-time display of the input content.
3) Edit area: it consists numeric, alphabetic and symbolic keys, which can be switched in sequence by successive selects

Icon	Meaning	Description
	Clear key	Select to clear the input content.
	Backspace	Select to delete one character
	Cancel	Select to exit without saving content
	Confirm	Select to save and exit
	Capital and lower Case switch	Select to switch the capital and lowercase of English letters

3.4 Rear View



① DC Input Port, external 12V DC power supply

② Multi-function USB Port

The USB Port can used for:

- Software upgrade. Turn off the pump and connect it to the computer with a USB cable ,then upgrade the pump software using a dedicated upgrade tool (PC software).
- Data export. The USB port is converted into RS232 standard interface through a dedicated conversion cable, and can be connected to the computer through RS232.

⚠ **Caution:** It is necessary to purchase a computer that has passed relevant security verification through formal channels for software upgrade and data export. Otherwise, it may introduce dangerous voltages exceeding 5V and cause harm to the infusion pump or human body.

- Drop sensor connection. It shall be used with drop sensor supplied by distributor.

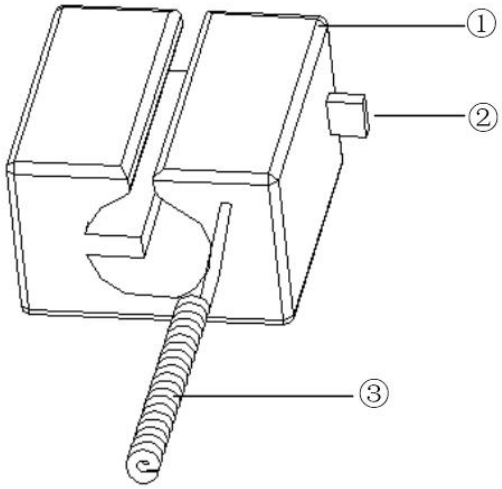
③ A/C Adapter Port, external 100-240V 50/60Hz AC power supply

④ Loudspeaker

⑤ Pole Clamp, using for fixing the equipment on the infusion stand

⑥ Handle

3.5 Drop Sensor



① Housing

② Slider

Push the slider to left direction to adjust the spacing, loosen and the slider will return automatically.

③ Cable

Connect with drop sensor port

Chapter 4 Installation

4.1 Unpack and Check

1) Please check the appearance before unpacking, if broken, please contact the distributor or our after-sale service department quickly.

2) Please carefully open the package to avoid damage of the device and relevant accessories.

3) After unpacking, please check according to the packing list. Please contact distributor as soon as possible if there is any lack or damage of accessories.

4) Please keep relevant accessories, warranty card and User Manual.

5) Please keep the packing case and materials for future transportation or storage.

⚠ **Caution:** Please put the packing materials out of reach of children. Please obey local laws and regulations and the waste treatment system in hospitals for disposal of packing materials.

4.2 Installation

⚠ **Caution**:

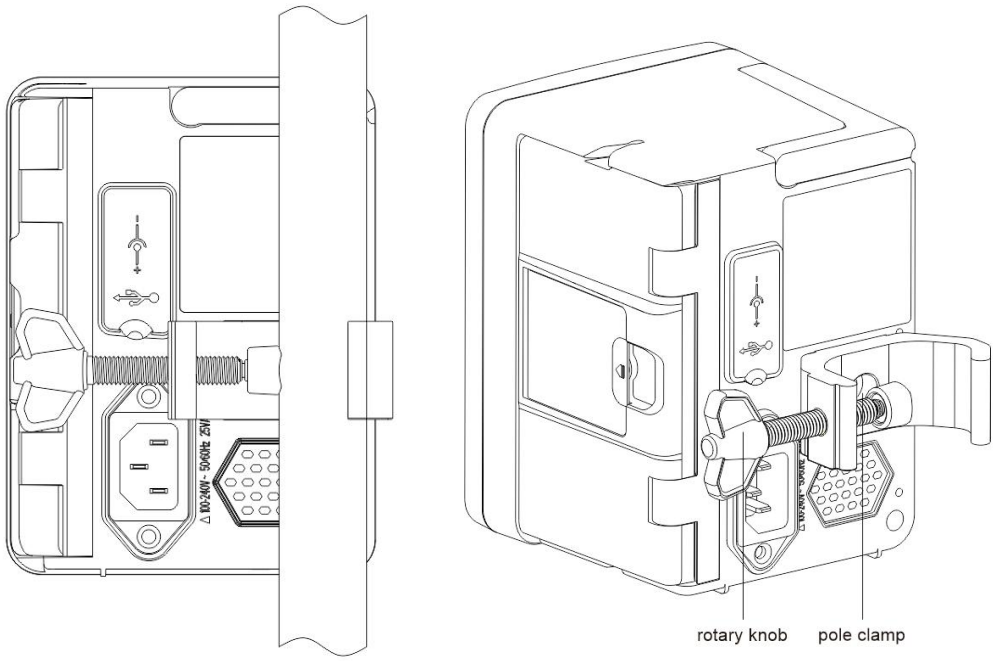
- The device shall be installed by designated technicians.
- All devices that connect with this device must pass the certification of designated IEC standards (for example: IEC 60950 information technology device safety and IEC 60601-1 medical electric device safety). All devices must be connected according to the requirements in valid version of IEC 60601-1 standards. The technician who takes charge of connecting additional devices with the device interface shall be responsible for meeting requirements in the IEC 60601-1 standards. Please contact our company if you have any question.
- When the device is connected to other electrical devices to form a combination with a special function, please contact our company or the electrical expert in hospital to ensure that the necessary safety of all devices in the combination is not jeopardized if it is not sure whether there is a danger.
- This device must be used and stored in the environment specified by our company.

4.2.1 Install the Infusion Pump

(1) Rotate the pole clamp screw (knob) and unscrew to leave the space.

(2) Lock the Pole Clamp on the infusion stand, adjust the position of the infusion pump, tighten the pole clamp to fix the infusion pump on the infusion stand (shown in the below). Hold the infusion pump when the pole clamp is being tightened; loose your hand after it is tightened and avoid falling.

(3) The pole clamp is defaulted as supporting a vertical pole. To adjust the direction of pole clamp, please remove the bolt from the pole clamp with screwdriver, take out the pole clamp and adjust the direction, then tighten the bolt.



4.2.2 Install the Drop Sensor

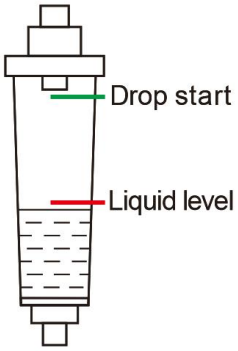
(1) Insert the drop sensor plug into the drop sensor port of this device and ensure tight connection.

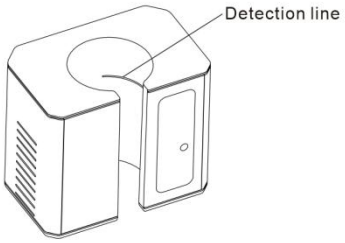
(2) Drop position should be above the green line when start.

(3) Liquid level should be below the red line.

Warning:

- The medicinal liquid in the drip cup must be less than 1/3 of its volume.
- The drop sensor shall be vertical and higher than liquid level.
- Since the drop sensor adopts infrared sensing technology, please do not use light shielding tubes with drop sensor function on. Otherwise, the drip sensor mode may fail.
- During installation, the detection scope of the drop sensor should be located in the centre between the red line and the green line in the picture below.





Chapter 5 Basic Operation

5.1 Operation Flow

1) Mount the infusion pump on the IV stand: **refer to Chapter 4.2.1**

2) Power on: press  for two seconds to power on and start self-test. **Refer to Chapter 5.2.2**

3）Install Infusion set: **refer to Chapter 5.2.3**

4） Confirm Infusion set brand name: Select infusion set brand or add a new brand

5）Remove air bubble from the line: **refer to Chapter 5.2.4**

6）Select infusion mode: Select infusion modes according to requirements

7）Set infusion parameters: set infusion parameters according to requirements

8）Connect the infusion set to the animal

9）Start infusion: press  to start infusion

10）Infusion finish **refer to Chapter 5.2.8**

11）Remove the Infusion set **refer to Chapter 5.2.10**

12）Power off or Standby mode **refer to Chapter 5.2.11**

5.2 Infusion Operation

5.2.1 Installation

Mount the device on the infusion stand according to **Chapter 4.2.1**. Connect it with AC power supply. Check if the AC indicator lights. The battery charge will start once it is connected with AC power.

5.2.2 Start and Self-Test

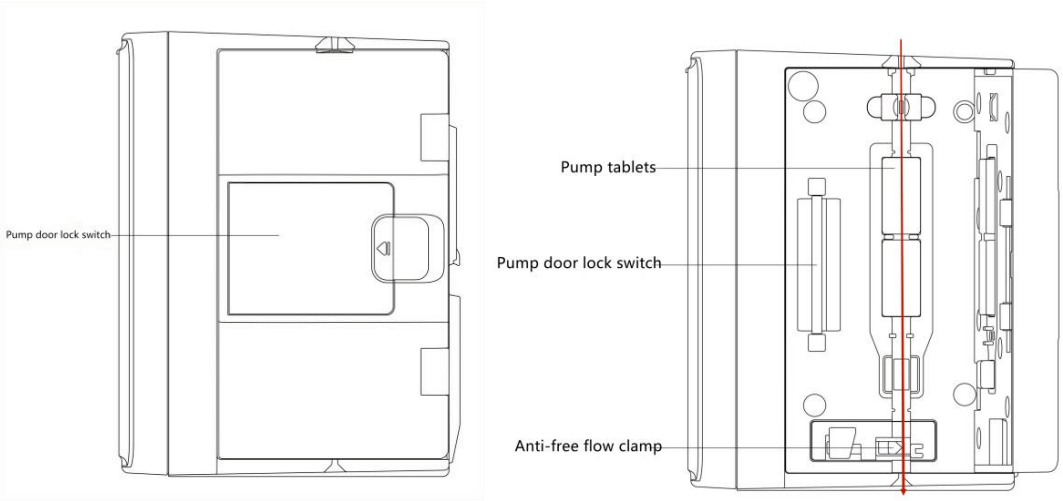
1) Press  for two seconds to power on the device.

2) After power on, the system will automatically check the motor, sensor, battery, memory, CPU communication and alarm indicator etc.

3) After it passes self-test, the pump enters into rate mode interface.

Warning: If self-test fails, it is possible that the pump does not operate properly or is damaged, it is not allowed to use the pump for infusion, Please contact distributor as soon as possible.

5.2.3 Install Infusion Set



1) Connect the infusion set with the infusion bottle.
2) Extrude the drip chamber, open the roller clamp when the fluid has reached the position of the 1/2 drip chamber,
3) Fill medicinal fluid to the tube injection needle to remove air, then close the roller clamp.
4) Pull the lock switch in the middle of the pump door from the right side, then open the door.
5) Push up anti-free flow clamp to open the clamp.
6) Install the infusion set into the infusion set slot according to the indicated direction, press the infusion set in the pump inwards to make it attach to the peristaltic pump. Ensure that shown in Drawing are installed correctly. If the infusion set is not installed in the right position, it will show a prompt on the screen.
7) Manually push the pump door with both left and right thumbs, it will make a sound of “click” after it is closed properly.
8) Select『Settings』→ 『IV Admin Brands』to select infusion set brand.

Warning:

- It is suggested to use the infusion sets with brands defaulted in this system.
- Please confirm that the displayed infusion set brand and specification is the same with the one actually used.
- Although the device supports customizing the infusion set, it is strongly recommended that users contact distributor for setting and testing by the professional technicians of our company in order to ensure the infusion accuracy.

9) Install drop sensor

Please install it according to Chapter 4.2.2. After installation, select『Settings』→『Drop sensor』to activate the function of drop sensor.

Caution： The drop sensor function is defaulted as OFF and can be manually activated by the user when the drop sensor is adopted.

5.2.4 Purge Air

There are two ways: manual purge and automatic purge. Users can choose the method according to their needs. The flow generated by the purge is not included in the Total Volume Infused.

(1) Manual purge: pressing button【Purge】 for long period, the device will purge air according to the default flow rate in the system. It will return to the interface of setting parameter after it is released.

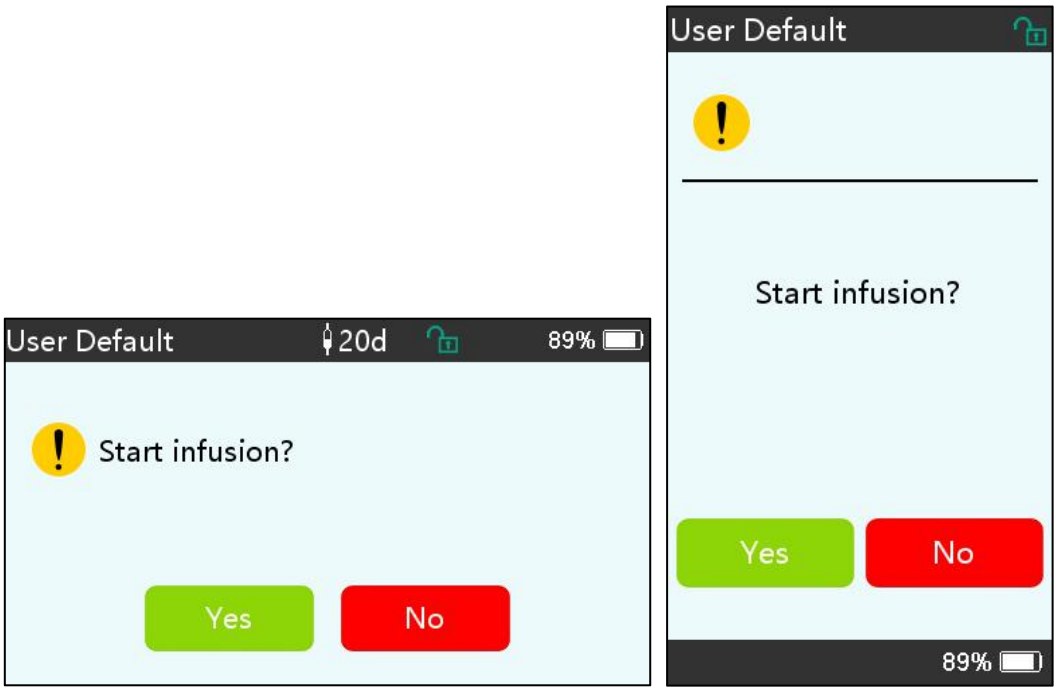
(2) Automatic purge: In the interface of parameters setting, select 『Purge』 button on the display and select "Yes" in the pop-up prompt box. Select "Stop" when the air bubbles in the infusion line are eliminated.

⚠ **Caution：**

- Before purge air, double check to confirm the infusion set is **not connected** with the animal.
- Purge rate is the max rate, when purge volume ≥5ml, purge will automatically stop.

5.2.5 Start Infusion

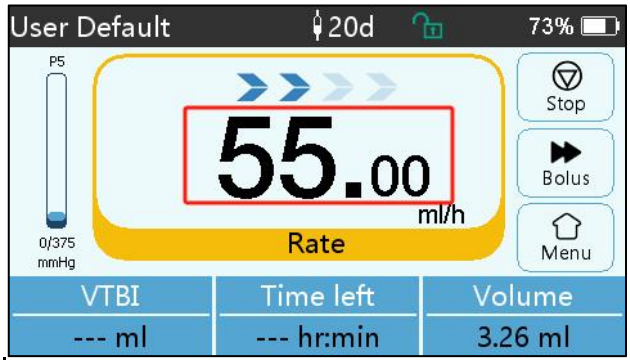
Connect the infusion set to the animal, confirm if the parameter settings are correct, Please purge before the infusion, then select [Start] button , select [Yes] on the pop-up prompt interface to start the infusion.



5.2.6 Change the Rate During Infusion

During the infusion process, change the value of rate, dose rate or drip rate on the running interface. The flow rate will be changed online and the infusion can continue at the changed flow

rate.

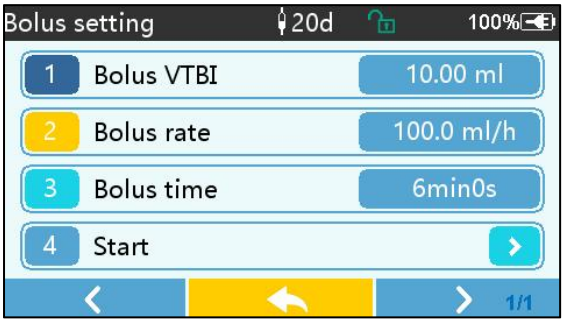


5.2.7 Bolus Application

During operation, there are two Bolus modes: Manual bolus and Automatic bolus. The user can select either mode and the Bolus volume is included in the total infusion volume.

(1) **Manual bolus**: long-press the 【Bolus】 button on panel, pump will work at the max flow rate defaulted in the system. Release the button, the the pump will return to the previously set infusion rate.

(2) **Automatic bolus**: In the running interface, select 『Bolus』 on touch screen, set two parameters among bolus infusion volume, rate and time, then select『Start』. The device will make a sound of beep at every 1ml infused. After bolus infusion finished, the device returns to the previously set infusion rate.



5.2.8 Finish Infusion

When the infusion time of the remaining liquid is close to preset volume to be infused completion time, the pump will alarm. If it is ignored, the system will keep alarming until VTBI infusion is completed. For more information, please refer to **Chapter 7.1.10**

When VTBI is completed, the alarm is activated. If KVO function is ON, it will start KVO function automatically. Select『OK』in the alarm interface to stop KVO and remove alarm.

The working time defaulted in the KVO system is 30 mins. When 30 mins is reached, it will activate KVO completion alarm and stop infusion.
Please refer **Chapter 7.1.4** to set KVO rate.

5.2.9 Stop Infusion

During infusion, select to stop infusion. It will return to the parameter setting interface, which displays Total Volume Infused and adjustable parameters.

5.2.10 Remove the Infusion Set

Disconnect the extension line of Infusion set from the animal, then remove the Infusion sets.
If Infusion set needs to be replaced, please refer to **Chapter 5.2.3** for installation steps.

5.2.11 Power OFF or Standby

Method 1: long-press the 【Power】Button till the screen is OFF, the device is OFF.

Method 2: short-press the 【Power】Button to enter into OFF interface.

(1) Turn off the device: select『Power off』icon, the device will turn OFF.

(2) Standby: select『Standby』icon to enter into standby time setting interface.
In standby mode, the brightness of the screen will be set to the lowest level. It will return to normal brightness after the standby mode is finished.

(3) Cancel: select『Cancel』, it will return to the interface before OFF setting.

Note: The standby mode is only available when the device is in the non-working state.

5.2.12 Replace Infusion Set/Infusion Container

Please replace the infusion set according to the steps below:
- Close the flow rate adjuster of the infusion set assembly, open the door, and remove the old infusion set assembly.
- According to **Chapter 5.2.3**, pre-fill and install the new infusion set assembly.
- Restart infusion according to the infusion steps above.

Please replace the medicinal fluid container according to the steps below:
- Close the flow rate adjuster of the infusion set assembly.
- Remove the medicinal fluid container from the infusion set assembly.
- Connect the infusion set with the new medicinal fluid container.
- Restart infusion after infusion set assembly is replaced according to the steps above.

Warning: The infusion set will distort if it works for a long period, which will result in poor

accuracy or flow rate error, it is suggested to replace the pumping position or infusion set assembly after 8 hours continuous working.

Chapter 6 Set Infusion Parameters

6.1 Introduction to Infusion Parameters Setting

(1) The drug information can only be displayed in the infusion running interface when the drug library is activated.

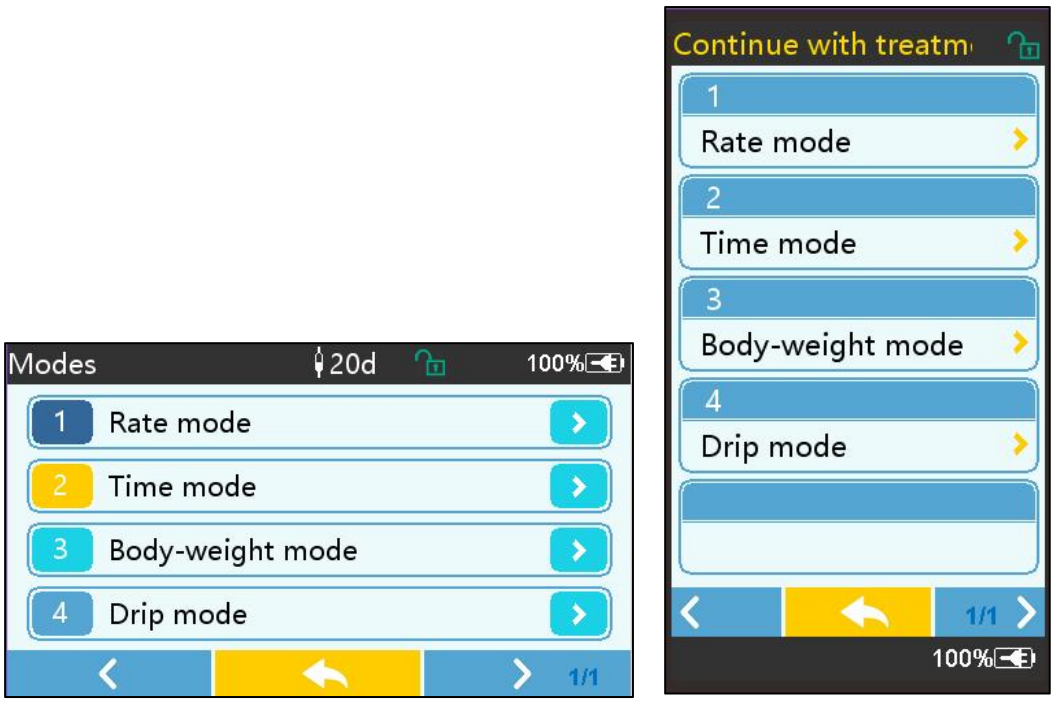
Select『Settings』icon in the main interface to enter sub-menu, find 『Drug Library』menu item, set the ON/OFF state of drug library and select drug. Please refer to this User Manual **Chapter 7.1.3** for details.

(2) For both rate entered during infusion parameter setting and rate calculated by the system, the range of which is within the system default flow rate range of the currently used infusion set specification.

(3) If VTBI (volume to be infused) is not set, it is defaulted that the fluid/drug in the syringe will be completely infused.

6.2 Infusion Mode Setting

After starting the device and finishing self-test, the device enters into the parameters setting interface of rate mode automatically. If you want to select other modes, please select『Menu』icon to enter into the main interface, and then select『Modes』icon to enter into the mode selection menu interface and select preset infusion mode.



6.2.1 Rate Mode

In this mode, two parameters can be set: Rate and VTBI (Volume to be infused) . When two of the parameters are set, the system will calculate the third parameter automatically. If the VTBI is 0, the device will work at the set rate unit it stops after alarm.

6.2.2 Time Mode

In this mode, two parameters can be set: VTBI (Volume to be infused) and Time, the system will automatically calculate the speed, speed = Volume(ml) /time(min)

6.2.3 Body Weight Mode

In this mode, several parameters can be set: the weight (body weight), Acti agentia (drug mass), Conc. unit (concentration unit), Volume (fluid volume),Conc. Dose rate, Dose unit, VTBI.
The system will calculate the flow rate automatically from the specified dose rate according to related formula {dose rate × weight}/{Acti agentia (drug mass)/Volume(fluid volume)}, and the time equals to VTBI /flow rate.

6.2.4 Drip Mode

In this mode, two parameters can be set: VTBI and drop rate. The system will automatically calculate the infusion flow rate and time.

Note: The flow rate in drip mode is calculated according to the specification of the defaulted infusion set. Before adopting the drip mode, please confirm that the specification of the infusion set is the same with the specification displayed in the interface title bar. If it is not the same, please contact the device maintenance technicians to modify. Otherwise, it may cause large deviation of flow rate.

Chapter 7 System Setting

7.1 Settings

Select『Settings』icon in the main interface to enter into parameters setting interface.

7.1.1 IV Admin Brands

Install the infusion set first, then select『IV admin brands』to enter into the IV brand selecting interface and select the preset brand option .
The system built-in infusion set brand: User Default (Boon), B. Braun. Other infusion set models can be added by creating new brands and calibrated as described in section 10.2.

Note: Different brands of infusion sets may cause deviation in flow rates. Before using a IV SET, please confirm if the displayed information in the interface is the same as the actually used infusion set.

7.1.2 Cage No.

Select『Cage No.』option, enter the cage number (range 0-255), increment is 1.

7.1.3 Drug Library

Select the preset drug name and the name will be displayed in infusion running interface.

The function can be turned on or off.

（1）Digital Infusion Pump support 32 items of drugs, without upper and lower limits.

7.1.4 KVO Rate

Select『KVO rate』and input the numerical value. Select『OK』after confirmation.
Please refer to **Chapter 2.1** for the adjustable KVO range.

7.1.5 Bolus Rate

Set the default Bolus rate. Please refer to **Chapter 2.1** for the range of bolus rate.

7.1.6 Occlusion Pressure

Select『Occlusion pressure』to enter into occlusion pressure level setting interface. Roll the long box to the preset level and select『OK』after confirmation.
The higher the preset level is, the higher the occlusion level is. It is suggested to select suitable occlusion pressure according to actual requirements.

Warning:

- When medicinal fluid with high viscosity is adopted and the occlusion pressure is set at low level, it is possible that the system will show occlusion alarm even when the line is not obstructed. In this situation, please observe the pressure indication icon in the display screen and operation of infusion set carefully, and rise the occlusion pressure if needed.

- When the occlusion pressure is set at high level, it may cause the animal uncomfortable. After rising the occlusion pressure, please carefully observe the condition of the animal, and take measures immediately if there's anything abnormal.

- When the device has faults, the max pressure generated by the infusion set is 300kPa. Under single fault state, the max infusion volume is 2ml.

(Table: Relation between Occlusion level and Pressure)

Applicable Model: Digital Infusion Pump Occlusion Pressure Level: 3 levels					
Level	Pressure Intensity (mmHg)	Level	Pressure Intensity (mmHg)	Level	Pressure Intensity (mmHg)
1	300	2	600	3	900

7.1.7 Pressure Unit

Select『Pressure unit』to enter into pressure unit selection interface, there are four units: mmHg, kPa, bar and PSI. Select the preset unit and then set the value.

Note: Please confirm carefully before changing current pressure unit.

Unit Mark	Unit Conversion
kPa	1 kPa=7.5mmHg=0.145psi=0.01bar
PSI	1psi=51.714mmHg=6.895kpa=0.068bar
Bar	1bar=750.06mmHg=14.503psi=100kPa

7.1.8 Bubbles Size

Select『Bubbles size』to enter into air bubble size setting interface. Roll the long box to the preset level, confirm and then select『OK』.

The detected air bubble can be classified into 7 levels. It is suggested to select suitable level according to the actual requirements.

Air Bubble detector level	Alarm Threshold
Level 1	50ul
Level 2	100ul
Level 3	200ul
Level 4	300ul
Level 5	450ul
Level 6	600ul
Level7	800ul

⚠ **Caution:** Please adjust the bubble test level according to the medication and the condition of animal.

7.1.9 Pump Idle Alert

Select『Pump idle alert』to enter into pump idle alarm time setting interface. Select the preset time option to set the time. The available pump idle alert time is 2min, 5min, 10min, 15min, 20min or 30min.

The Pump Idle Alert refers to the alarm that will be activated if there is no push on keys within the preset idle alert time when the device are in the non-infusion and non-alarm state.

7.1.10 Finish Pre-Alarm

Select『Finish pre-alarm』to enter into the time setting interface. Select the preset time option to set the time. The available finish pre-alarm time are 2min, 5min, 10min, 15min, 20min and 30min.

The Time for pre-alarm refers to the time it takes when the medicinal fluid infused volume is close to the preset value, which triggers near completion alarm.

7.1.11 Drop Sensor

Select『Drop sensor』to set ON or OFF.

The “Drop error ” alarm function is only available when the drop sensor is installed.

Note: The drop sensor function is defaulted as OFF. It can be manually turned on by the user when the drop sensor has been installed. If the function is ON and the drop sensor is not installed, the system will show alarm of “drop sensor connection” .

7.1.12 Drop Sensor Level

The sensitivity of the drop sensor can be classified into three levels. The higher the level is, the more sensitive the detection will be. In the lower level, it will only alarm when there is not any drop.

7.1.13 Micro Mode

Select『Micro mode』to enter into setting interface. The function can be set as ON or OFF. In the ON mode, the rate limit can be set, which will limit infusion rate in any infusion mode. The available range of micro mode is between 100 and 1500ml/h and the minimum step is 1ml/h.

7.1.14 Reset Total Volume

Select『Reset total volume』and then『Yes』in the prompt box to confirm reset. Otherwise, please select『No』.

7.2 General

In the main interface, select『General』to enter into the General device setting interface.

7.2.1 Rotate Screen

Select『Rotate Screen ON/OFF』, when selecting ON, the screen will rotate freely in landscape or vertical direction.

7.2.2 Date& Time

Select『Date &Time』to enter into the date and time setting interface. It allows the set of date, time and format in the interface.

When setting date and time, input the numerical value directly. For example, to preset the date “2018/08/31”, input “8-31-2018”; to preset the time “13: 34”, input “1334”.

The time can be displayed in 24h format or 12h format. The date can be displayed in British type, American type or Chinese type. Please set according to your requirements.

7.2.3 Brightness

Select『Brightness』to enter into setting interface. The brightness can be classified into 10 levels.

7.2.4 Sound

Select『Sound』 to enter into the setting interface. The volume can be classified into 10 levels. The lowest volume should be no less than 45 dB, and the highest volume should be no more than 80 dB. Roll the long box to the preset value and select『OK』after confirmation.

⚠ **Caution:** If the sound level of the alarm signal is lower than the environmental noise, the operator's capacity of identifying the alarm status will be affected.

7.2.5 Screen Lock

Select『Screen lock』to enter into the setting interface, select ON or OFF.
The available automatic lock screen time are 15s, 30s, 1min, 2min, 5min, 10min or 30min etc., which means that the device will lock the screen automatically if the touch screen is not touched or the button is not pressed within certain period of time after the device runs .
Unlock: select『Cancel』in the lock screen interface.

Note: The device will unlock automatically if there's a high Level alarm.

7.2.6 Night Mode

Select『Night mode』to enter into the ON and OFF setting interface. Set the start and end time of the night mode and brightness. The system will adjust the brightness automatically to the value defined by the User at night.

7.2.7 Battery Capacity Display

When the function is turned on, the battery life will be shown in the upper right corner of the screen. It will show the percentage of remaining capacity if it is turned off .

7.3 System

Select『System』in the menu interface to enter into the system information setting interface.

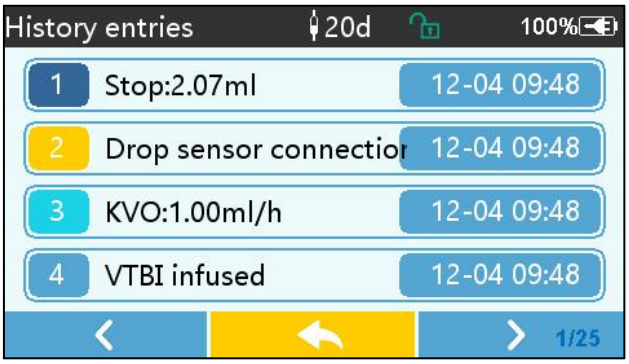
7.3.1 Language

This device supports simplified Chinese, English, Spanish, Portuguese etc.

Chapter 8 Other Functions

8.1 History Entries

Select 『Records』in the main interface, select the "History entries" into history records query interface. The device supports over 5,000 history records, which display the event name, event date and time (permanent preservation). When it is full, the new records will cover the old records with first in first out principle.



8.2 Last Therapy

Select『Last therapies』in the main interface to enter therapy records query interface.

(1) This interface displays the last 20 treatment records. Users can select any one as the current infusion plan, and start infusion after confirming the parameters.

(2) The system can store up to 20 treatment records. When the records are full, the new records will overwrite the old records.

8.3 Anti-Bolus

When the occlusion alarm is triggered, the motor will reverse automatically to decrease the pressure within IV tube. It will avoid additional harm caused to animals after the occlusion.

8.4 Electronic Memory Function

After power off, the electronic memory function can save for no less than 10 years.

Chapter 9Alarm Prompt and Troubleshooting

9.1 Introduction to Alarm Level

During infusion preparation and infusion, the device will alarm when the set alarm threshold is reached or exceeded. It will prompt with sound, light and text. According to the importance of alarm information, the emergency and safety, the alarms are classified into three levels: high, middle and low. Please refer to table below for details:

Alarm Level	Sound Signal Interval	Light color /flash frequency
High alarm	10s	Red indicator flashes /2.0±0.6Hz
Middle alarm	15s	Yellow indicator flashes / 0.6±0.2Hz
Low alarm	20s	Yellow indicator constant ON

If there is an alarm, the system will prompt the alarm interface. If the alarm level is high, select『OK』to stop the alarm and then exit the alarm interface. If the alarm level is middle or low, select『OK』, the sound signal will stop and then exit the alarm interface.

Select『Mute』to mute the alarm. If the alarm is not eliminated, the alarm will be sound again after 2 minutes.

Warning: Some alarm threshold can be set by the user, such as occlusion pressure, pump idle alarm,VTBI infused pre-alarm and alarm sound volume etc. The users shall confirm the parameters when they set the alarm threshold value. Otherwise, it may influence the alarm function or infusion safety.

9.2 Multilevel Alarm Rules

If several alarms are triggered simultaneously, the system will alarm according to the rules below:

Table 9.2-1

Multilevel Alarm	Rules
Several alarms of different levels are triggered simultaneously	Display the highest level alarms with sound, light and text. Display middle alarm after all alarms of highest level are eliminated.
Several alarms of the same level are triggered simultaneously	Alarm is displayed by turns, the time interval is 1s

When it alarms, the corresponding alarm information will be displayed on the title of the screen. Refer to **Appendix A** for more information.

9.3 Alarm Treatment

Warning: ● When there is an alarm, please check the conditions of the animal and solve the problem reminded by the alarms before continuing working.

Please refer to **Appendix A** for the alarm solution.

9.4 Fault Analysis and Solution

When there is a fault, the alarm information will be shown on the infusion pump screen. It is the high level alarm. Please take countermeasures to the fault and then eliminate the fault alarm. If the fault can not be eliminated, please stop using the device and contact our company for repair and test of the device. It is forbidden to put it into operation before the device has passed the inspection. Otherwise, it may cause unpredictable harm if it works with fault.

If the device is on fire/burns for unknown reason, or there are any abnormal situations, the user shall immediately cut off power supply and contact our customer service department.

Chapter 10 Maintenance

10.1 Cleaning and Disinfecting

Warning:

- Please cut off power supply and unplug the DC /AC power cord before cleaning the device.
- During cleaning and disinfecting, please keep the device horizontal and upwards to protect the device and accessories from fluid.

10.1.1 Cleaning

(1) The daily maintenance is mainly to clean the shell and pump body. It is inevitable that medicinal fluid may leak into the device during infusion. Some medicinal fluid may corrode the pump and cause faults. Therefore, please clean the device timely after infusion. First,wipe it with 75% alcohol or water,clean with damp and soft cloth,and then let it dry naturally.

(2) For the device interface, please wipe it with dry and soft cloth and confirm the interface is dry before use.

(3) Please do not soak the device in water. Although this device is waterproof to some degree, please check if the pump works normally when fluid splashes on the device. Please perform insulation and electric leakage test if needed.

10.1.2 Disinfecting

(1) Disinfection may cause harm to the pump, it is suggested to disinfect the pump if necessary.

Please disinfect the device with common disinfecting agents such as 50% sodium hypochlorite, cidex 2% glutaraldehyde + activating agent, 75% ethanol or 70% isopropyl alcohol etc. Please follow the instructions of the disinfecting agent.

(2) Clean the device before disinfecting is recommended.

(3) Do not sterilize the device with high pressure steam sterilizer, do not dry the device with dryer or similar product.

Warning: Please do not adopt Cidex OPA ortho phthalaldehyde, methyl ethyl ketone or similar solvent, otherwise, it may corrode the device.

10.2 Add New Brand and Calibration

In the 『System』 sub-menu, select『Brand maintenance』 to enter into brand setting interface. Users can add new brand, delete existed brand or make calibration.

Warning:

- It is suggested to contact our company or local dealer for customized operation or calibration by professional technicians. Otherwise, the infusion accuracy cannot be guaranteed.
- The built-in brand of the system shall not be deleted.

(1) Add new brand

If the actually used syringe brand is not built in the system, please add the new syringe brand in this interface,set syringe brand name and specification etc.

(2) Delete brand

Enter into『Delete』interface, select it to delete user-defined infusion set brands.

(3) Calibrattion

⚠**Caution:**

Calibration is needed at the circumstances below:

- When the pump is used for the first time;
- When new brand of syringe is added for the first time;
- After period maintenance is conducted.

The following materials shall be prepared before calibration:

Material preparation: infusion pump, a brand-new infusion set, a 20ml measuring cup or 20ml syringe, electronic balance

Calibration Steps:

1) Install infusion set as required and remove air bubbles;
2) Put the needle into the measuring cup to collect the liquid.
3) Start calibration according to the interface prompts, and start the infusion.
4) The device will stop automatically after 5 minutes operation, calculate the liquid volume by reading the line on the measuring cup or weighing it;
5) Input the data to the device and complete calibration.
6) Exit calibration, select the calibrated brand as current brand. Verify the infusion accuracy at flow rates of 25ml/h and 150ml/h respectively, the measured infusion accuracy shall conform to the accuracy value specified in the Table of Chapter 2.1.

10.3 Recycle

The normal service life of this equipment is 10 years. The actual lifespan may vary depending on the frequency of use and maintenance practices. Equipment exceeding its service life must be decommissioned and scrapped. Please contact the manufacturer or distributor for further information.

1、Decommissioned equipment may be returned to the original distributor or manufacturer.

2、Used lithium polymer batteries should follow the same disposal method or be handled in compliance with applicable local laws and regulations.

3、Follow the equipment decommissioning procedures established by your medical institution.

4、Recycling must adhere to all local laws and regulations.

Chapter 11 Appendix

Appendix A Alarm and Solution

No.	Alarm Type	Alarm Level	Reason	Solution
1	VTBI near end	Low	During infusion, the remaining time reaches or is less than the set nearing completion time	This alarm can't be eliminated until infusion completes
2	VTBI infused	High	The preset value infusion Completion	Press 【Stop】button to stop alarm
3	Pressure high	High	1. Line occlusion during infusion	Manually remove the cause of occlusion, Press【Start】button to continue infusion
			2. Viscosity of medicinal Fluid in the actual infusion set is high, while the system occlusion level is set too low	Increase the alarm Level, Press 【Start】button to continue infusion
			3. The pressure sensor is damaged	Please contact the dealer or manufacturer for repair
4	Battery near empty	Low	1. If power is supplied only with the built-in battery, when there is low battery, the alarm will last over 30min.	The alarm automatically eliminates after it is connected with the external power supply.
			2. Battery ageing or fault of device charging circuit.	Please contact the dealer or manufacturer for repair.
5	Battery empty	High	1.If only the internal battery is used for power supply and the battery power is close to depletion, the alarm lasts over 3 minutes.	Immediately connect with external power supply.
			2. Battery ageing or fault of device charging circuit.	Please contact the dealer or manufacturer for repair.
6	No battery inserted	Low	Battery is removed	Before the battery is installed, please turn off the device and disconnect with the AC power supply.
7	Battery in use	Low	Under ON state, AC power supply is adopted, but the AC power cord is disconnected during the process	The alarm automatically eliminates after it is connected with external power supply.
8	No battery	High	Battery is removed,both the	Reinstall the battery or connect

	and No power supply		AC power cord and DC charger are disconnected.	with the external power supply
9	Pump idle alert	Low	After infusion set is installed, in non-working or no alarm state, there is no operation during the time set in the system	Select any button to stop
10	Standby time expired	Middle	In standby mode, after standby time ends	Select 『OK』button to stop alarm
11	KVO finished	High	KVO working time reaches 30min, infusion pump stops working	Press 【Stop】button to stop alarm
12	Drop sensor connection	Low	When the drop sensor function is turned on, the device is not connected with the drop sensor	Connect with the drop sensor, or turn off the drop sensor function in the menu
13	Drop error	High	The inclination angle of the drip cup is too big or drop sensor is installed lower than the drip cup fluid level	Check the installation of drop sensor or drip cup fluid level, Press 【Stop】button to stop alarm
			The specification of infusion set is not the same with the specification displayed in the interface, which causes drop rate error.	Check if the infusion set specification is the same with displayed parameters. If they are different, it shall be modified by professional maintenance technicians
14	Air bubble	High	Air bubble in the infusion set	Press 【Stop】button to stop alarm, disconnect the line from the animal, exhaust air with air exhaust function, or open the infusion pump door to manually remove the air bubbles
15	Door Open	High	During infusion, the infusion pump door is opened	Press 【Stop】button to stop alarm.
16	System Error (NO. 1-15)	High	Internal failure or software fault	Turn off and Restart the pump, if the alarm still exist, please contact the dealer or manufacturer for repair

Note: When alarm rings, select the 『Mute』icon on the screen to temporarily stop sound alarm for 2min.

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