PETfusion

VETERINARY SYRINGE PUMP

IPR220

USER MANUAL

IPR
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PREFACE

1. The Overview of the User Manual

This manual is for the sole use of the PETfusion™ (IPR220) veterinary syringe pump, affiliated with Infusion Pump Repair Corp.

This User Manual describes the product's extensive configurations, accessories, and functions that may not occur in the User's device. For more detailed information, please contact Infusion Pump Repair Corp.

2. The Operator of the User Manual

This manual is intended for professionally trained veterinary nurses/doctors, veterinary anesthesiologists, and certified veterinary equipment technicians.

3. Instructions for the User Manual

This User Manual covers the basic information on the safety and effectiveness of the product for guiding the operator to install correctly, test, operate, use, and maintain the product. Please read this manual thoroughly before using and utilizing the product perfectly. We encourage users to keep the User Manual for future use.

IPR will take responsibility for the reliability and performance of the equipment if all the following conditions are met:

● The equipment is used according to this User Manual.

●The equipment has only been disassembled, assembled, replaced, tested, improved, and repaired by the professional technicians of our company.

● IPR provides all components and accessories as well as consumables for repairing.

● All relevant electric devices meet the international standard IEC/EN 60601-1 and this Manual.

4. Terminology

【】 means mechanical button

『』 means touch button

( ) further information

- means inapplicable

√ means accordant

→ means operation steps

Bolus: Infuse large volumes of liquid in a short time.

KVO: Keep Vein Open, provides a constant flow to prevent blood/needle blockage.

Anti-bolus: Motor automatically reverts when the extension line has high pressure.

IRDA: Infrared Communication

DPS: Dynamic Pressure Show, used to indicate real-time detection and notification of any blocking pressure.

Warning /Attention/Caution: There is a possibility of physical injury, death, or property loss if the concerns/cautions in the Warning section occur.

Note: By failing to follow the supplementary or prompt information on the operation instructions, the User may cause damage to the equipment, which may lead to error or property loss.

Accessories: There are optional components necessary and (or) suitable for use with this syringe pump. Accessories help achieve the expected purpose, provide convenience for attaining the desired purpose, improve the expected purpose, and (or) increase the additional functions of the equipment.

5. Copyright

This User Manual will be revised and subject to product improvement, law updating, or instructions improving based on the preconditions of meeting-related laws and regulations. All modified records will be stated in the new version.

TABLE OF CONTENTS

PREFACE 3

1. The Overview of the User Manual 3
2. The Operator of the User Manual 3
3. Instructions for the User Manual 3
4. Terminology 3
5. Copyright 4

Chapter 1 - Safety Instructions 9

1.1 Warnings 9

1.2 Cautions 11

1.3 Dialogue Window 12

1.4 Symbols 12

Chapter 2 – Overview 13

2.1 Application Scope 13

2.2 Operating Conditions 13

2.3 Intended Patients 13

2.4 Specifications 13

2.5 Purpose 13

2.6 Design and Performance 13

2.06.1 Design and Performance 13

2.06.2 Functional Specifications 13

2.7 Product Specification 14

Chapter 3 – Appearance 18

3.1 Front View 18

3.2 Right Front View 19

3.3 Operation Panel 20

3.4 Display Screen 21

3.04.1 Title Bar 21

3.04.2 Typical Options 21

3.5 Rear View 24

Chapter 4 – Installation 25

4.1 Unpacking and Checking 25

4.2 Installation 25

4.02.1 Installing the Syringe Pump 26

Chapter 5 – Preparation and Precautions Before Use 27

5.1 Use Preparation 27

5.2 Operation Cautions 27

Chapter 6 – Basic Operation 28

6.1 Operation Flow 28

6.2 Infusion Operation 28

6.02.1 Mounting Installation 28
6.02.2 Starting and Self-Test 28
6.02.3 Installing the Syringe 28
6.02.4 Set Infusion Parameter 29
6.02.5 Purge Air 32
6.02.6 Start Infusion 33
6.02.7 Changing Infusing Parameters During Infusion 33
6.02.8 Bolus 33
6.02.9 Infusion Completion 33
6.02.10 Stop Infusion 34
6.02.11 Removing the Syringe 34
6.02.12 Power off or Standby 34
Chapter 7 - System Setting 35
7.1 Settings 35
7.01.1 Drug library 35
7.01.2 KVO rate 35
7.01.3 Bolus rate 35
7.01.4 Occlusion Pressure 35
7.01.5 DPS (Dynamic Pressure System) 37
7.01.6 Finish Pre-Alarm 37
7.01.7 Reminder alarm 37
7.01.8 Weight unit 38
7.01.9 Pressure Unit 38
7.01.10 Micro Mode 38
7.01.11 Commonly Used Syringe Brand 38
7.01.12 Reset Total Volume 39
7.2 General 39
7.02.1 Network 39
7.02.2 Sound 40
7.02.3 Date &Time 40
7.02.4 Screen Lock 40
7.02.5 Brightness 40
7.02.6 Night mode 41
7.02.7 Nurse call 41
7.02.8 Nurse call Alarm Level 41
7.02.9 Battery Capacity Display 41
7.3 Patient 41
7.03.1 Patient Information 41
7.03.2 Prescription 41
7.4 Records 41

7.04.1 History entries 41
7.04.2 Last therapies 41
7.04.3 Export history records 42
7.04.4 Clear all records 42
7.5 System 42
7.05.1 Language 42
7.05.2 Factory Default 42
7.05.3 S.N. (Serial Number) 42
7.05.4 Version 42
7.05.5 Maintenance 42
7.6 Electronic Memory Function 42
Chapter 8 - Alarm Prompt and Troubleshooting 43
8.1 Introduction to Alarm Level 43
8.2 Multi-level Alarm Rules 44
8.3 Alarm Treatment 44
8.4 Malfunction Analysis and Solution 44
Chapter 9 - Maintenance 45
9.1 Cleaning, disinfecting, and sterilizing 45
9.01.1 Cleaning 45
9.01.2 Disinfecting 45
9.2 Periodical maintenance 45
9.02.1 Check the Appearance 46
9.02.2 Performance Check 46
9.02.3 Maintenance Plan 46
9.3 Add New Brand and Calibration 46
9.03.1 Calibrating Steps: 47
9.4 Repair 49
9.4.1 Normal Repair Process 49
9.4.2 Maintenance for Long Term Store 49
9.5 Equipment Components/Accessories 49
9.6 Production Date 50
9.7 Recycling 50
Chapter 10 - Battery 51
10.1 Check the Battery Performance 51
10.2 Replacing the Battery 51
Chapter 11 - Customer Service 52
Chapter 12 - Appendix 53
Appendix A Start-Up Graphs and Trumpet Curves 53
Appendix B Occlusion Response Property 56
Appendix C Alarm and Solution 57

Appendix D EMC Electro Magnetic Compatibility Declaration 60
Appendix E Wireless Module Information* 65
Appendix F Factory Default Setting 66

Chapter 1 - Safety Instructions

1.1 Warnings

- Before using, please check the equipment, connecting wire, and accessories to ensure that it can work essentially and safely. If anything is abnormal, immediately stop working and contact our customer service department. Additionally, the adhesion or intrusion of fluid/drug may cause the equipment to fault and malfunction. Therefore, we suggest cleaning the equipment after use and storing it correctly.
- This equipment must be operated by trained professional or medical-care personnel.
- This equipment is not applicable for blood transfusion.
- To avoid any fire or explosion, do not put and use the equipment in the environment with both anesthetic and other flammable/explosive articles.
- Do not store or use the equipment in the environment with any active chemical gas (including gas for disinfecting) and moist environments. Unideal environments may influence the syringe pumps' inside components and cause a performance drop or damage to the inside parts.
- The operator shall guarantee that the set infusion parameters of this equipment are the same as the medical advice before starting the infusion.
- Please correctly install the syringe according to the infusion indication direction of this equipment. Ensure that the syringe and the extension line are smoothly and straightly cross the mechanism of the device. Otherwise, it may harm the patient or fail to reach the expected performance.
- Please do not only depend on the information prompt during use. Please periodically check the device to avoid accidents.
- We suggest that devices be fixed on an infusion stand to ensure the stability of the infusion device. We also advise users to be careful when moving the infusion stand to avoid the equipment from dropping or falling and damaging the surrounding objects.
- If the extension line is twisted, the filter or needle is obstructed, or blood in the needle obstructs the infusion, the line's pressure will rise. During occlusion adjustments, the pressure may cause a "bolus injection" (temporary excess of infusion) to the patient. The correct method to resolve an occlusion is to tightly hold or clamp the line near the puncturing position and remove the syringe to drop the pressure in the infusion line. If the infusion is restarted and the occlusion error exists, it may increase line pressure, breaking or cutting off the infusion tube and (or) hurting the animal.
- This equipment injects fluids/drugs by pushing the syringe and cannot detect any leakage if the extension line is cut off or broken. Therefore, please periodically check the device and the syringe to avoid any fault during the working period.
- During infusion, please periodically check to ensure the infusion is working. This equipment doesn't precisely measure the quantity of infusion fluid; therefore, it can't detect any missing intake under extreme conditions.

- This equipment has the occlusion detection function for detecting and alarming when the infusion needle deviates from the position in the vein or if the needle is not correctly inserted in the vein. However, the pump will only alarms when the occlusion pressure has reached a particular numerical value. The cannula site may become reddish, swell, or bleed. Additionally, in the chance, the device doesn't alarm for an extended period if the actual occlusion pressure is lower than the alarm threshold value, 6*. Therefore, please periodically check the cannula position. If there's any abnormal phenomenon, please take suitable measures to resolve the abnormality.
- Only use syringes, extension lines, infusion needles, and other medical components that meet the local laws and regulations and the requirements covered in this User Manual. We highly suggest utilizing the syringe programmed with the equipment. We can't ensure infusion accuracy if an unsuitable syringe is used.
- Do not disassemble or refit this equipment or use it for other purposes except standard infusion.
- No one is allowed to repair this equipment except our company or an authorized repair technician of our company.
- Maintenance or replacement of spare parts is prohibited during the clinical use of the equipment.
- This equipment must only be connected to A.C. with ground protection to avoid the risk of electric shock.

1.2 Cautions

⚠

- Before its first use after purchase, or if this equipment is not used for an extended period, please charge the pump with the A.C. power supply. The equipment can't fully function with just the built-in battery power supply.
- This equipment cannot be used in rooms with radiological installation, magnetic resonance equipment, and high-pressure oxygen therapy.
- Do not position this Medical Electrical Equipment to make it inaccessible for disconnection of the device.
- The DC power supply is only suitable for applications requiring a backup power supply. Only use the D.C. power supply line provided.
- Other devices near this equipment must meet corresponding EMC requirements. Otherwise, it may influence the performance of this equipment.
- Under general conditions, please use A.C.'s power supply as much as possible since it can prolong the battery's service life to a certain degree. When using an A.C. power supply, ensure that the grounding wire is relatively close to the ground, and only the A.C. power wire attached with this equipment is used. The built-in battery can only be used as the assistant of the power supply.
- Please keep the power socket and plug dry before connecting this equipment with the power supply. We also recommend that the power voltage and frequency meet the requirements listed in the equipment label and this User Manual.
- This device is equipped with an audible and visual alarm system. When the device turns on, the red and yellow alarm indicators will light up to show that the alarm system is usually working, and the speaker makes the "beep" sounds.
- Please keep the device away from the A.C. power socket. We recommend a certain distance to avoid fluid/drug splashing or dropping in the outlet as it may short circuit and (or) cause electrical damage.
- Please use the fluid/drug at or near room temperature; when the fluid/drug is used at low temperature, the air dissolved in the fluid/drug may cause more air bubbles and more frequent air bubble alarms.
- Do not press or operate the device's buttons with a sharp object (pencil tip and nail. Sharp objects may cause early damages to the switch and (or) the surface film of the device.
- Please close the extension line before taking it out. This action will help users to avoid liquid leakage.
- Under the condition of a low flow rate infusion, please pay special attention to occlusion. The lower the infusion flow rate, the longer the time of detecting occlusion, which may cause a longer infusion process.
- If the equipment is damaged from a drop or impact, please immediately stop using it, and contact our customer service department. The damage may cause the inside components to be damaged even when the appearance is not damaged.
- We recommend using the accessories specified in this manual to ensure patient safety.

1.3 Dialogue Window

Dialogue window displays options, including operation selections, operation confirmations, and further information. For instance：

Figure1.3-1 Operations Selection window

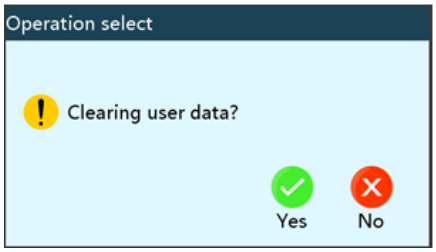
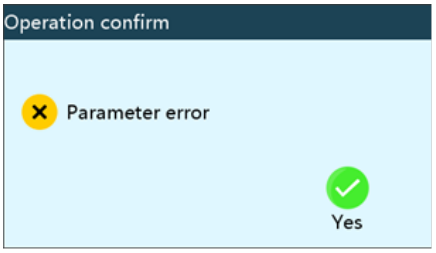


Figure 1.3-2 Parameter error reminder



1.4 Symbols

Not all the below symbols may exist in the product.

Table 1.4-1

Marks	Description	Marks	Description
LOT	Batch code		Protective earth (ground)
SN	Serial number	IP24	Water-resistant Degree
	Caution		Both direct and alternating current
	Defibrillation-proof type C.F. applied part		Handle with care
	Date of Manufacture		Manufacturer
20	Environment-friendly use period (20 a)		Non-ionizing electro-magnetic radiation
	Input / output		Input
	Unlock		Lock
	Fragile items		This side up
	Please refer to the instruction manual/manual		Stand-by

Chapter 2 – Overview

2.1 Application Scope

The syringe pump is used together with a syringe to control the dose of liquid infused into the patient's body, i.e., syringe infusion.

2.2 Operating Conditions

Animal Hospital, Pet clinics.

2.3 Intended Patients

Animals.

2.4 Specifications

This equipment is not applicable to blood transfusion.

2.5 Purpose

This equipment is an instrument that moves in a linear motion with a microcontroller-based system that drives a step motor. This system allows the pump to have a wide range of pumping rates configured to the volume inside a loaded syringe. A lead screw and drive-nut mechanism will push the syringe plunger to infuse the drugs into the patient. This device can guarantee the delivery of fluid/drugs safely into the patient at an even pace and dosage.

2.6 Design and Performance

2.06.1 Design and Performance

The syringe pump consists of a central unit and a built-in battery. To ensure infusion safety, we have also implemented a double CPU. This syringe pump provides several infusion modes, such as ml/h mode, bodyweight mode, TIVA mode, loading dose mode, sequence mode, ramp up/down mode, and relay mode. In addition, it also has functions such as history records, drug library, anti-bolus, alarm, and so on.

2.06.2 Functional Specifications

Function		
Infusion Mode	ml/h mode	√
	Bodyweight mode	√
	TIVA mode	Optional
	Loading- Dose mode	Optional
	Sequence mode	Optional
	Ramp up/down Mode	Optional
	Drug Library mode	Optional
	Relay mode	Optional
Drug Library	Drug name display	√
	Drug dose upper/lower limit	Optional
	Drug names	≥30

IrDA	Optional
IrDA and workstation communication	Optional
WIFI module	Optional
Occlusion alarm level	4 or 12 levels (Optional)

⚠This User Manual defines the most configurations and most complete functions. Due to model differences or optional components, not all parts are equipped in the purchased product.

2.7 Product Specification

Safety Classification	
Electric Class Type	Class I
Electric Level	Type CF Defibrillation Proof Applied
Water-Resistant Class	IP24
Working Mode	Continuous Operation
Classification	Portable equipment, non-portable during infusion*
Specification Parameters	
Compatible Syringes	5ml, 10ml, 20ml, 30ml , 50/60ml
System Accuracy	≥ 1ml/h, ±2% (Mechanical Accuracy ±1%)
Infusion Rates	Syringe size 5ml: (0.01-100) ml/h Syringe size 10ml: (0.01-200) ml/h Syringe size 20ml: (0.01-400) ml/h Syringe size 30ml: (0.01-600) ml/h Syringe size 50ml: (0.01-1500)ml/h
Bolus Rate （Bolus）	Syringe size 5ml: (0.1-100) ml/h Syringe size 10ml: (0.1-200) ml/h Syringe size 20ml: (0.1-400) ml/h Syringe size 30ml: (0.1-600) ml/h

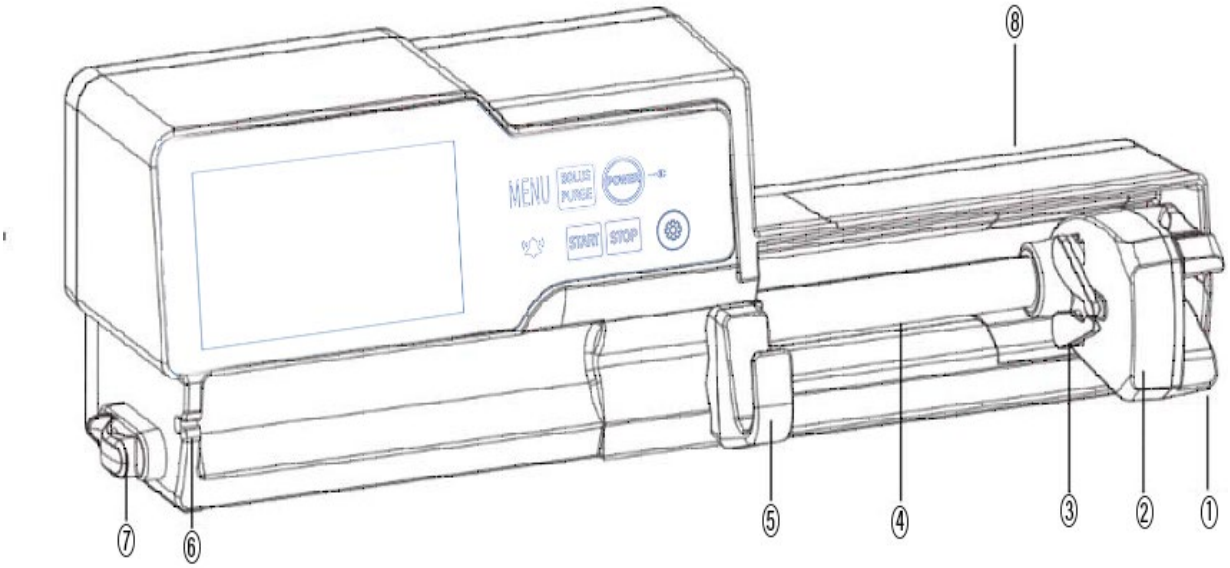
	Syringe size 50ml: (0.1-1500)ml/h
Purge Rate	Syringe size 5ml: 100 ml/h Syringe size 10ml: 200 ml/h Syringe size 20ml: 400 ml/h Syringe size 30ml: 600 ml/h Syringe size 50ml: 1500 ml/h
KVO Rate	0～5.00ml/h, minimum step is 0.01ml/h
KVO Rate Accuracy	≤±10%
Micro Mode Setting Range	100ml/h-max rate
Minimum Flow Rate Increment	0.01 ml/h
Bolus Volume	Syringe size 5ml: Minimum 0.1ml, max 5ml Syringe size 10ml: Minimum 0.1ml, max 10ml Syringe size 20ml: Minimum 0.1ml, max 20ml Syringe size 30ml: Minimum 0.1ml, max 30ml Syringe size 50ml: Minimum 0.1ml, max 50ml
VTBI	0.01 - 99999
Total Volume	0.01 – 9999.99ml
Time Range	1 min – 99 hrs. 59 min
Fuse Type	T2AL 250V
Dimensions	15.7 x 3.7 x 4.7 inches
Weight	Approx. 3.75 lbs.
Power Supply	
A.C. power supply	100V-240V A.C., 50Hz/60Hz
Input power	50VA
D.C. power supply	DC 11V-16V

Battery	
Battery Model	DC 203
Rated battery voltage	11.1V
Battery capacity	2600mAh
Charging time	Off status ≤ 5 hrs. or
Running time	Use the new battery after it's been fully charged. ≥ 12 hrs. (Temperature is 25℃ and flow rate is 5ml/h, this is a constant working time)
Alarm	
Alarm signal's sound pressure level	When the sound is set at the lowest level, the alarm signal's sound pressure level ≥ 50 dB(A) When the sound is set at the highest level, the alarm signal's sound pressure level ≤ 80 dB(A)
Alarm information	VTBI near end, Syringe Near Empty, VTBI Completed, Syringe Empty, Pressure High, Occlusion Pre-Alarm, Battery Nearly Empty, Battery Empty, No Power Supply, Check Syringe Installation, Reminder Alarm, Standby Time Expired, KVO Finished, Drop-in Pressure, Drug Dose Limits Exceeded, System Error.
Environment	
Non-AP/APG type equipment	Please do not use it in the environment with a flammable anesthetic gas mixed with air or a combustible anesthetic gas mixed with oxygen or nitrous oxide
Operating	(1) Temperature: 41 - 104 °F (2) Humidity: 20-90%, non-Condensable (3) Atmospheric Pressure: 86-106kPa
Transport & Storage	(1) Temperature: -4 - 140 °F (2) Humidity: 10-95%, non-Condensable

	(3) Atmospheric Pressure: 50-106kPa
Main Safety Standards	IEC 60601-1:2005+A1:2012 Medical Electrical Equipment, Part 1: General Requirements for basic safety and essential performance IEC60601-2-24:2012 Medical Electrical Equipment – Part 2-24: Requirements for the safety of syringe pumps and controllers IEC60601-1-8：2006+A1：2012 Medical Electrical Equipment –Part 1-8: General requirements for basic safety and essential performance –Collateral Standard: General requirements, tests, and guidance for alarm systems in medical electrical equipment and medical electrical systems EN60601-1-2:2007+AC:2010 Medical Electrical Equipment - 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. Handle Clip

   Controls the syringe plunger for push-pull sliding box and clip.

2. Slider Box
3. Syringe Clip
4. Lead – Screw Mechanism
5. Syringe Fixture Lever

   Pull forward, then turn right, install the syringe into the slot.

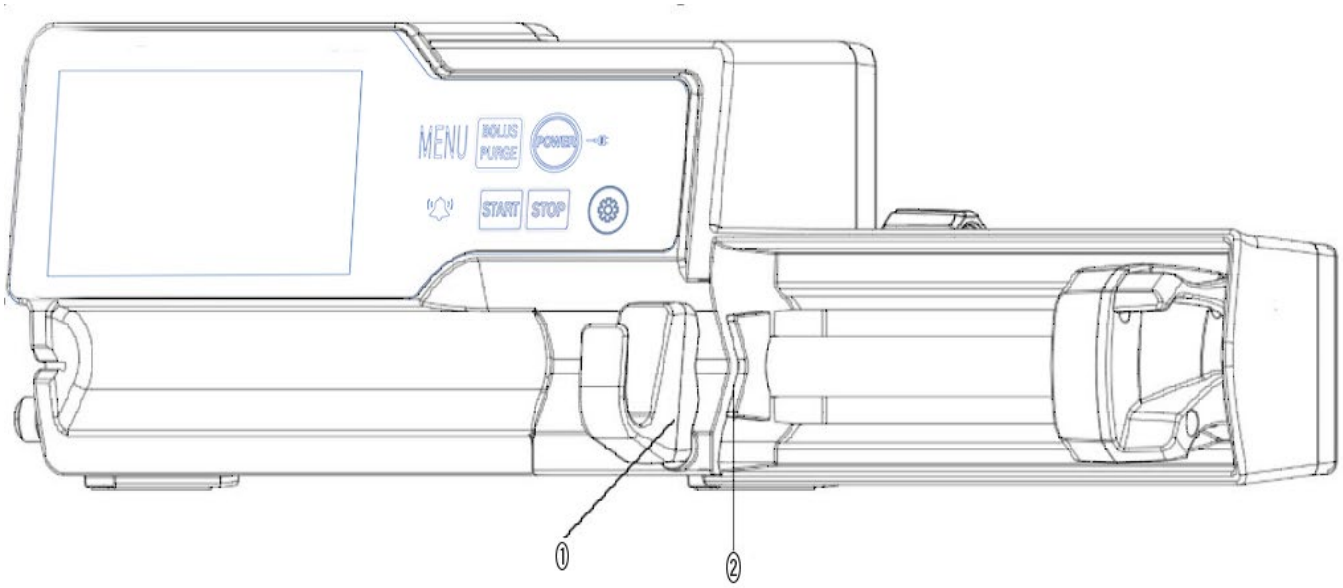
6. Extension Tube Hook
7. Tube Line Clamp

   Keep the extension line straight and in position.

8. Syringe Protected Cover

⚠ Note: <u>The Water-resistant film is recommended to be replaced once every two years.</u>

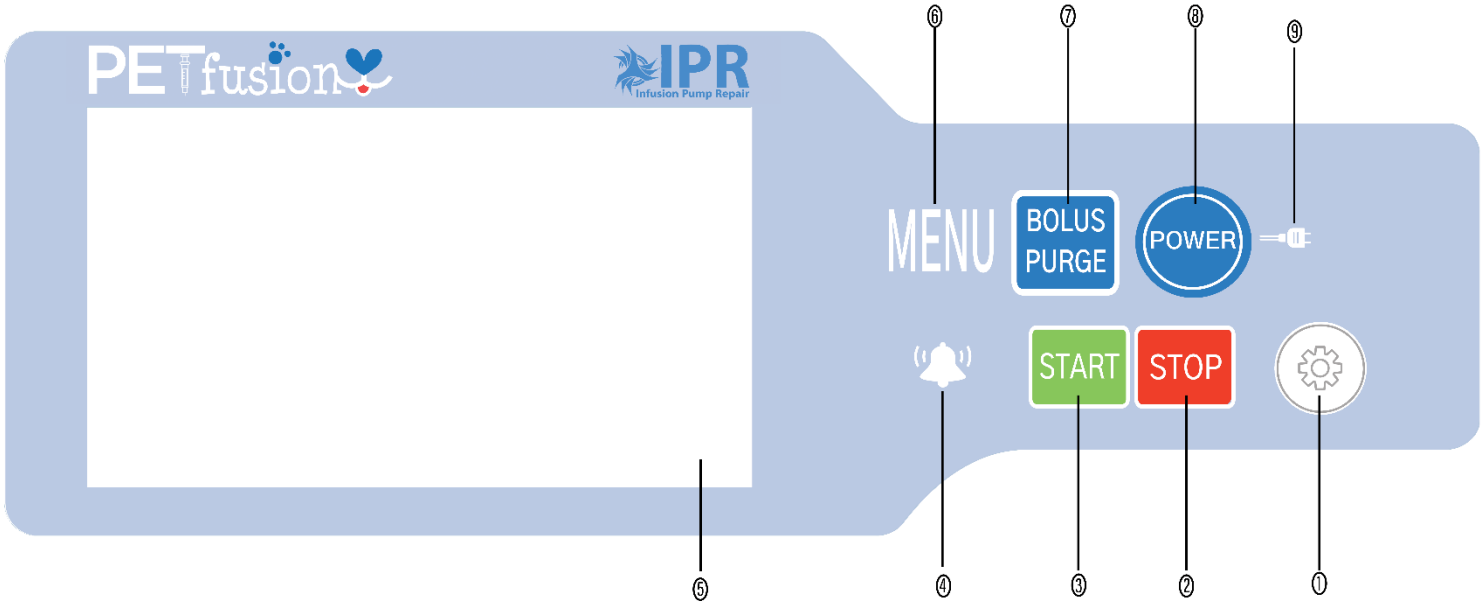
3.2 Right Front View



1. Syringe Fixture Lever
2. Flange Plate

   Pull the fixture lever and put the syringe flange into the slot.

3.3 Operation Panel



1. 【Fn】
   TBD Settings

2. 【Stop】
   Stop infusion and operation.

3. 【Start】
4. After setting all parameters, press 【Start】 to begin infusion.

5. Alarm indicator
   While pump alarms, indicator light flashes with different frequency and color, more information, please refer to Chapter 9.2

6. 4.3 inches TFT(LCD) touch screen

7. 【Home】
   Enter system home page.

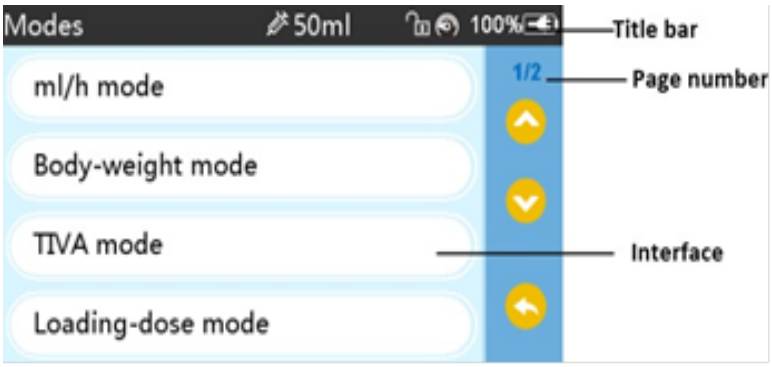
8. 【Bolus/Purge】

9. 【 Power 】
   The pump's power switch. Press and hold the power button to switch ON/OFF or place it into Stand-by mode.

10. A.C. indicator

3.4 Display Screen

The display screen layout consists of a title bar and typical interface options.



3.04.1 Title Bar

The title bar displays real-time information and is not touchable. The left upper corner indicates the name of the current editing parameter.

Table 3.04.1-1

Icon	Paraphrase	Description
	Syringe Set	Brand Name of Syringe
	Workstation Access	Displays only the equipment has accessed the infusion workstation correctly, please refer to “Infusion Workstation User Manual” for details.
	Lock Screen	Unlock state icon is
	Battery Charging	Light on indicates the battery is charging.
	Wi-fi	Indicates a wi-fi connection state.
	Pressure Indicator	Icon display is the pressure change of the current infusion in real-time. When the infusion line pressure changes, the pointer turns clockwise. When the line pressure reaches or exceeds the occlusion level and default pressure value, it alarms for occlusion.
	Battery status	A numerical percentage or time value is displayed on the left side of the screen. The remained battery life may change. It may show the following states:

3.04.2 Typical Options

Before and during infusion, the standard menu options will display the following: main menu, working opportunities, alarm options, prompt options, control panel, parameters setting, input method, standby options, etc.

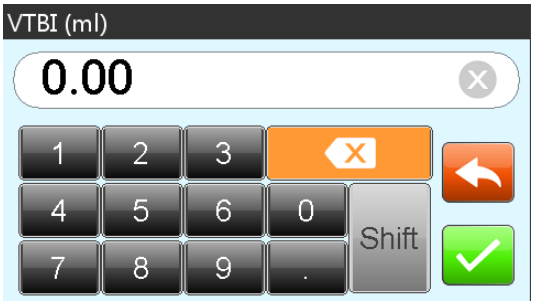
3.04.2.1 Typical Interface Icon Paraphrase

Table 3.04.2-1

Icon	Paraphrase	Description
	Start	Click this icon, start the infusion.
	Stop	Click this icon, stop the infusion.
	Bolus/Purge	1. During infusion, the『Bolus』function starts a fast infusion. 2. Before infusion starts, the 『Purge』function exhausts air from the syringe and line.
	Home	Click this icon to return to the main menu.
#(X)/#(Y)	Page indication	X is the current page; Y is the total number of pages.
	Up	Click this icon to return to the back page.
	Down	Click this icon to enter the next page.
	Return	Click this icon to return to the back menu
	Left	In the infusion parameters setting menu, click this icon to turn to the left page.
	Right	Click this icon in the infusion parameters setting menu to turn to the right page.
	Single-Selection Choice	The means parameter is selected.
	ON	Mean this function is ON
	OFF	Mean this function is OFF.

3.04.2.2 Input Method Options

When the input method is chosen, the menu will display the title bar, an input box, and an editing box.



1. Title bar: display the name of the current editing parameter.
2. Input box: the real-time display of the input content.

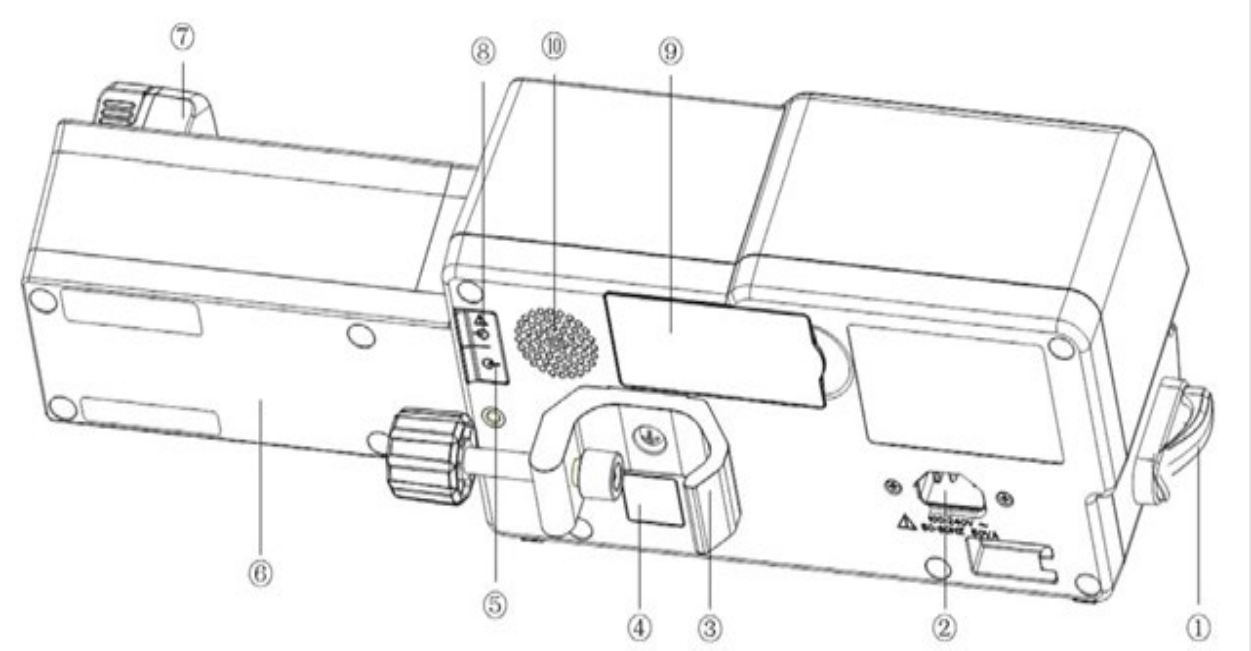
3. Editing box: It comprises the main button area and function button area.

The main button area composes the numerical value, letters, and icons. Click it to change the sequence.

The function button area composes of clear button, backspace button, 『』, 『  』 and 『Shift』.

Icon	Paraphrase	Description
	Clear button	Click it to clear input
	Backspace button	Click it to backspace delete
Shift	Shift button	Click it to switch the capital and lowercase English letters
	Cancel button	Click it to cancel editing and exit
	Enter button	Click it to save the input and exit

3.5 Rear View



1. Extension Line Clamp

   Keeps the syringe extension line straight and neat.

2. A/C Adapter Port

   External 100-240V 50/60Hz A.C. power supply

3. Pole Clamp

   Used for mounting the equipment on the infusion stand

4. IrDA

   Used for communicating with infusion workstation (Optional)

5. USB Port

   A port for software upgrade

6. Syringe Protection Cover

   Protects heavily dosed syringes from falling

7. Slider

8. USB Port

   Additional USB port for future use.

9. Battery Compartment

   Built-in Lithium-ion Battery

10. Loudspeaker

Chapter 4 – Installation

4.1 Unpacking and Checking

1. Please check the appearance before unpacking. Please get in touch with the transportation company or our customer service department quickly if broken.
2. Please carefully open the package to avoid damaging the equipment and relevant accessories.
3. After unpacking, please check according to the packing list. If there're insufficient or damaged accessories, contact our company.
4. Please keep all relevant accessories. (ex. User Manual)
5. Please keep the packing case and materials for future transportation or storage.

⚠ Warning: Please put the packing materials out of reach of children. Please obey local laws and regulations or hospital waste treatment systems to handle the packing materials.

4.2 Installation

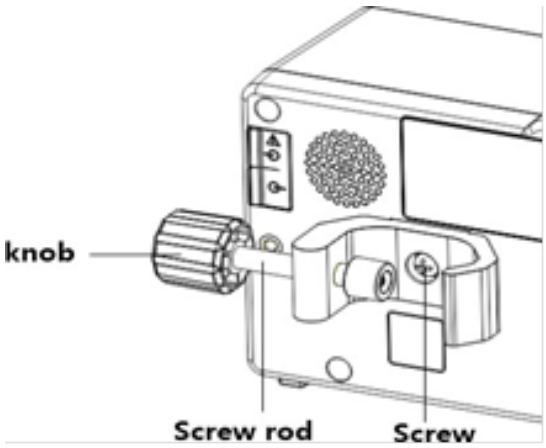
⚠ Warning：

- The designated technicians of our company should install this equipment.
- All devices that connect to this pump must pass the designated IEC standards (for example, the IEC60950 Information Technology Equipment Safety and IEC60601-1 Medical Electric Device Safety) certification. All devices must be connected according to the correct version of the IEC60601-1-1 system. The technician who performs and connects the additional devices with this equipment is responsible for complying with the IEC60601-1-1 standard. Please contact our company if you have any general inquiry.
- Please check with a technician when connecting this equipment with other electric devices to perform functions. Verification is recommended. Please contact our company or a hospital technician to ensure that all necessary safety precautions are taken so that all devices in combination won't be destroyed.
- This equipment must be used and stored in an environment regulated by our company.

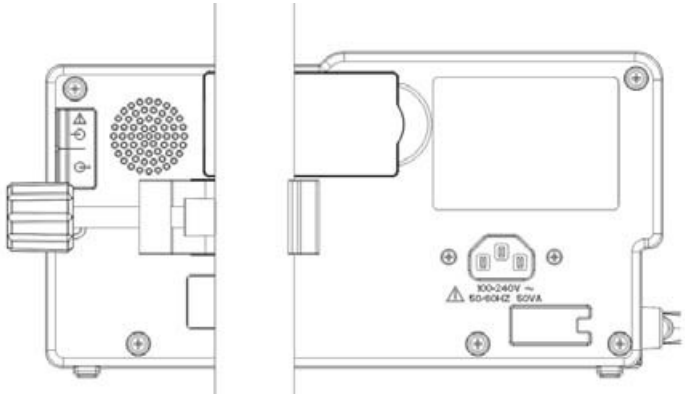
4.02.1 Installing the Syringe Pump

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 syringe pump, tighten the pole clamp to fix the syringe pump on the infusion stand (shown in the drawing). Hold the syringe pump when tightening the fixing clamp; only let go after tightening to avoid falling.



3. The pole clamp supports the vertical pole at default state. To adjust the pole clamp direction, please remove the bolt from the pole clamp with a screwdriver, take out the pole clamp, change the direction, and then tighten the bolt.



Chapter 5 – Preparation and Precautions Before Use

5.1 Use Preparation

When using new equipment, or reusing after storing for a period, or reusing after repair, please confirm that:

- The equipment's appearance is clean and in good condition without cracks and leakage.
- The moving components are smooth and functional. For example, the pump door can be opened and closed smoothly, and the buttons work.
- The touch screen can be operated smoothly and effectively.
- The power cable is installed tightly and can't be easily damaged when pulling.
- Set and check the system time to ensure that the history records will be correctly recorded.
- *In exceptional cases only* The built-in battery will supply Power. Before using it, please charge it to complete and ensure that the battery keeps working adequately.
- Carefully read the Warnings, Cautions, and Operation Steps listed in this User Manual.

5.2 Operation Cautions

⚠ Cautions:

- Avoid direct sunlight, high temperature, or high humidity.
- The equipment shall be put at less than 0.65 m to the animal's height.
- The parameters can only be set or changed by trained and professional personnel.
- Avoid the equipment working with fault to avoid medical negligence, which may hurt the animal's health and even life.
- If the working environment temperature exceeds the designated range, it may drop the equipment's infusion accuracy or cause abnormal work.
- The viscosity and specific gravity of infusion fluid will influence the infusion accuracy.

Chapter 6 – Basic Operation

6.1 Operation Flow

¤ Mount the syringe pump on the IV stand

¤ Power on

¤ Install syringe

¤ Select syringe brand or add a new brand

¤ Select infusion mode

¤ Set infusion Parameters

¤ Remove air bubble(s) in the line

¤ Connect infusion line with patient

¤ Start infusion

¤ Infusion finish

¤ Remove syringe

¤ Power off or Standby

6.2 Infusion Operation

6.02.1 Mounting Installation

Mount the device on the infusion stand according to Chapter 4.02.1, connect with the A.C. power supply and check the A.C. indicator lights.

6.02.2 Starting and Self-Test

1. Press 

to Power on the equipment.
2. After the Power is on, the system will automatically check the motor, sensor, battery, memorizer, CPU communication, and alarm indicator.
3. After the self-test is successful, the screen will prompt: “New treatment” and “Last treatment.”

   Select “New Treatment” to go directly to the ml/h mode-setting.

   Select “Last treatment” to enter the last usage mode parameter setting.

 Warning: If the self-test item does not pass, please contact the company. Do not continue using the equipment.

6.02.3 Installing the Syringe

1. Hold the clutch and pull the slider to the right side.
2. Pull the syringe fixture lever and turn it to the right.
3. Insert the syringe flange into the slot and clip the plunger firmly.
4. Align the extension line of the syringe and put the extension line through the tube guide, leaving excess on the extension hook.

5. The syringe pump will automatically recognize the syringe brand and size if installed successfully. If failed, please repeat the steps as mentioned above.

⚠ Warning:

- The flange of the syringe should be firmly inserted and not jutting on the outside of the flange plate.
- Before using the syringe pump, please confirm the brand specifications of the syringe. This information must be established. The brand of syringe pump should be calibrated to the equipment, so if there are no settings for the syringe used, the rate and the alarms may not be accurate.

6.02.4 Set Infusion Parameter

Enter the 『Modes』 interface, select infusion mode, then set infusion parameters.

The flow rate range will depend on the current syringe specification for both the manually entered infusion rate and the rate calculated by the pump system.

If a VTBI is not given, the pump will complete the fluid/drugs left in the syringe.

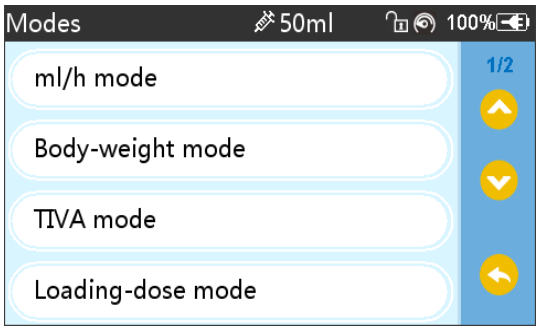
6.02.4.1 Infusion Parameters Setting Range

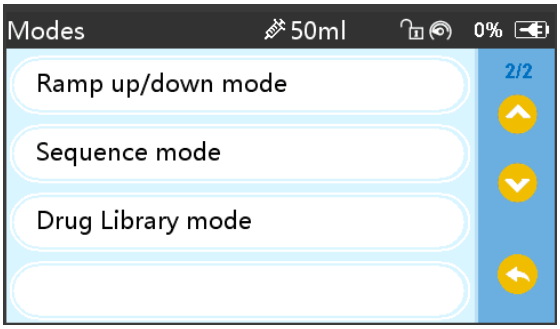
Infusion Mode	Infusion Parameter	Parameter Range
ml /h mode	VTBI	0.01-9999ml
	Rate	(0.01-100)ml/h for 5 ml syringes (0.01-200)ml/h for 10 ml syringes (0.01-400)ml/h for 20 ml syringes (0.01-600)ml/h for 30 ml syringes (0.01-1500)ml/h for 50 ml syringes
	Time	1 min – 99 hrs. 59 min
	Weight(Bodyweight)	0.1- 661 lbs.
		0.2-
	Acti agentia(Drug mass)	0.01-99999
	Conc.unit (Concentration unit)	ng/ml, ug/ml, mg/ml, g/ml, U/ml, kU/ml, IU/ml, IE/ml, mmol/ml, mol/ml, kcal/ml
	Volume(Fluid amount)	0.01-9999ml
	Dose rate	0.01-9999
Body weight mode	Dose rate unit	ng/min, ug/min, mg/min, g/min, U/min, KU/min, IU/min, IE/min, mmol/min, mol/min, kcal/min, ug/h, mg/h, g/h, U/h, KU/h, IU/h, IE/h, mmol/h, mol/h, kcal/h, ug/kg/min, mg/kg/min, g/kg/min, U/kg/min, KU/kg/min, IU/kg/min, IE/kg/min, mmol/kg/min, mol/kg/min, kcal/kg/min, ug/kg/h, mg/kg/h, g/kg/h, U/kg/h, KU/kg/h, IU/kg/h, IE/kg/h, mmol/kg/h, mol/kg/h, kcal/kg/h
	Acti Agentia(Drug mass),	
	Concentration unit	
	Volume (Fluid amount)	

TIVA mode	Weight,	The same as Body Weight mode
	Loading rate Unit	
	Loading Rate,	
	Loading Time	
	Maintaining Rate Unit	
	Maintaining Rate	
	Maintaining Time	
Loading Dose mode	VTBI	The same as ml/h mode
	Maintain Rate	
	Loading Rate	
	Loading Time	
Ramp Up/Down mode	VTBI	The same as ml/h mode
	Rate	
	Rise Time	
	Fall Time	
Sequence Mode	Rate	The same as ml/h mode
	Time	
Drug Library mode	Weight	The same as body weight mode
	Concentration	
	Dose Rate	
	VTBI	

6.02.4.2 Infusion Mode Settings

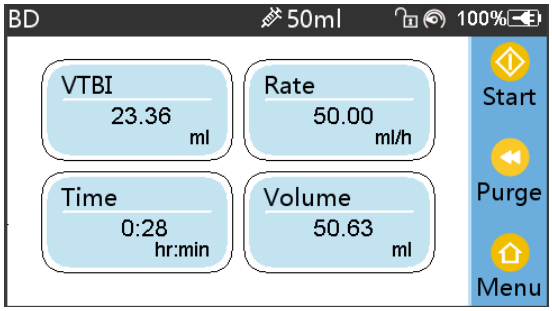
Before and after the automated self-test, the pump will automatically enter ml/h mode and the ml/h parameter display. If you would like to select other modes, click the 『Menu』 to enter the main menu and then click the 『Modes』 button to enter the modes option menu. Select the preset mode options and then enter the set parameters.





6.02.4.3 ml/h Mode

This mode allows you to set three parameters: Rate, VTBI (Volume to be Infused), and Time. The system will automatically calculate the third when you put two of the three parameters. If VTBI is set to 0, the equipment will work at the set rate until an alarm stops the infusions.



6.02.4.4 Body Weight Mode

The Weight (bodyweight) mode will require you to set the patient's weight, the concentration unit (Conc. unit), the drug mass (Acti Agentia), the Fluid Volume (Volume), the Dose rate, the Dose unit, and the VTBI.

The system will automatically calculate the flow rate from the specified dose rate (ug/kg/min, mg/kg/min, ug/kg/h, mg/kg/h…etc.) The related formula is referred as {dose rate × weight}/{Acti agentia(drug mass)/Volume(fluid volume)}. The time is automatically calculated by (VTBI) /(flow rate).

Example: the dose rate unit(ug/kg/min)

$$flow\ \text{rate (ml/h)} = \frac{Dose\ rate(ug/kg/\min) \times Weight(kg) \times Volume(ml)}{\text{Acti agentia(mg)} \times 1000} \times 60$$

Example: the dose rate unit(mg/kg/h)

$$flow\ \text{rate (ml/h)} = \frac{Dose\ rate(mg/kg/h) \times Weight(kg) \times Volume(ml)}{\text{Acti agentia(mg)}}$$

6.02.4.5 TIVA Mode

Under TIVA mode, set the basic parameters of the concentration unit (Conc. unit), drug mass (Acti Agentia), Fluid Volume(Volume), Weight, and then set a loading stage - set the loading dose rate and loading time. After you need to set a maintenance stage – set the maintaining dose and units. The system will automatically calculate the fluid rate and start running. The first run is the Loading-dose Rate. After the loading time, it will change to the Maintaining dose, which the system automatically calculates. This mode will run until it is manually stopped or the pump stops by an alarm.

6.02.4.6 Loading-dose Mode

The loading-dose mode means infusion with a Loading flow rate according to a Loading time. After reaching the Loading time, it works at the set maintain rate until the VTBI (Volume to be infused).

Loading dose VTBI = Loading rate × Loading time

Maintain time = (VTBI -Loading VTBI) /Maintain rate

Under this mode, set the VTBI, maintain rate, loading rate, loading time, and the system will automatically calculate loading dose VTBI and the maintaining time.

⚠ Note: VTBI must be greater than the loading dose VTBI; otherwise, the excess part can't be set when the setting exceeds the limit.

6.02.4.6 Ramp up/down mode

Ramp up/down mode means the pump will automatically increase or decrease the flow rate until reaching a stable flow rate within the rise and fall times of the equipment. Even after a steady flow is held for a time, it may also automatically rise or fall within the set rise/fall times. The rising or dropping stage is executed in 9 phases.

Under this mode, the User will need to set VTBI, a steady stage rate, rise time, and fall time. The system will automatically calculate the rising and dropping rate.

6.02.4.6 Sequence Mode

Sequence mode means to infuse according to the set sequence after setting the rate and time of different sequence groups. At most, five sequences can be set in this mode.

6.02.4.7 Relay Mode

This function is available with the infrared communication function. After combining this equipment with another unit and an infusion workstation, made by our company.

6.02.4.8 Drug Library Mode

In the settings menu, find the『Drug Library』option and enter. Confirm the drug name and select the drug to be infused. If 『None』 is shown, the drug library is OFF) Please refer to Chapter 7.01.1 for more details. Click drug names and follow the instructions to input infusion parameters.

DERS applies to this mode, limiting the drug dose rate. "Drug dose limits exceeded" alarm will be triggered if an accumulated dose exceeds the preset dose limits in a specific time.

⚠ Note: This device supports a self-defined or customized drug information edit function. If required, please contact the authorized party.

6.02.5 Purge Air

To prevent the pump from infusing air into the patient's body, the User must purge the air bubbles from the syringe before infusion. Under the parameters setting menu, short press【Bolus】button to enter the purge setting, and purge according to the menu instructions to clear the bubbles in the infusion line.

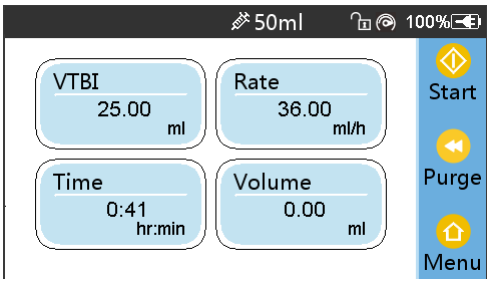
The total purge volume is not calculated in the Total Volume Infused.

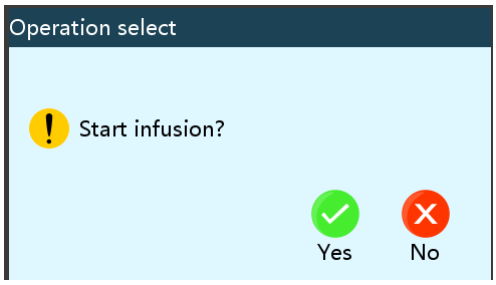
⚠ Cautions: Before purging air, please confirm the infusion line is **not connected** to a patient.

Purge Rate is the max rate of the syringe size; when purge volume ≥ 5ml, purge will automatically stop.

6.02.6 Start Infusion

Connect extension line with the patient and confirm infusion parameters. Press the 【Start】 button to start the infusion.





6.02.7 Changing Infusing Parameters During Infusion

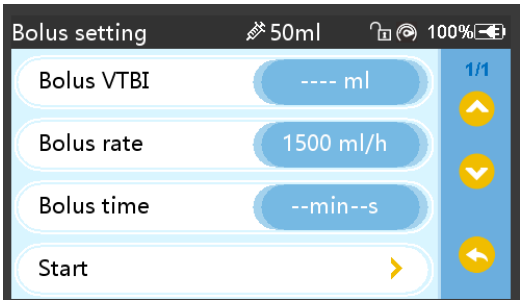
Click the flow rate value on the infusion menu during the infusion process. This menu will allow you to change and reset the flow rate. After confirmation, click to continue the infusion.

Note: Only the ml/h Mode and Bodyweight Mode supports rate modification during infusion. During the infusing menu display, click the menu button and enter the changed setting for VTBI, Time, and Reset Total Volume.

Note: Only the ml/h mode has VTBI, Time, and Reset total volume during infusion.

6.02.8 Bolus

Bolus functions have two operation modes: Manual bolus and Automatic bolus.



1. Manual Bolus: Press and hold the 【Bolus】 button to enter the fast infusion mode. Upon release of the button, the pump will run back to its previous set infusion rate.
2. Automatic Bolus: During infusion, short press the 【Bolus】 button to set any two parameters- volume, speed, and time, this will fast-forward an infusion. When ready, click 【Start】. After the bolus set volume is completed, the device returns to the initial infusion rate.

Note: A beep sound can be heard in every 1 ml infusion under the bolus modes.

6.02.9 Infusion Completion

When the infusion is near completion, the pump will alarm. If a user ignores it, the system will keep alarming until the infusion is finished.

After VTBI is completed, it activates VTBI infused alarm; if the KVO function is ON, the equipment automatically starts the KVO function, click in the alarm interface to stop KVO, and end the alarm.

The default working time of the KVO system is 30min. After reaching the time, it will activate the KVO completion alarm and stop the infusion.

Please refer to Chapter 7.01.2 for KVO settings.

6.02.10 Stop Infusion

During Infusion or after Infusion, click【Stop】, the infusion will stop. The display screen will identify the Total Volume Infused and adjustable parameters.

6.02.11 Removing the Syringe

First, disconnect the extension line from the patient, then remove the syringe set from the equipment. To replace the syringe, please refer to Chapter 6.02.3.

6.02.12 Power off or Standby

Method 1: Hold the 

【Power】 button until the screen is OFF and the equipment is OFF.

Method 2: Press the 

【Power】button to enter OFF options.

1. To turn off the equipment: click 『Power off』 icon, and the equipment will turn OFF.
2. For Standby mode: click the 『Standby』 icon to enter the standby settings and modify the set time for Standby.

   Standby time ranges from 1 min – 99 hrs59 min

   Under the standby state, the screen brightness will be the lowest. After the Standby mode is ended, the screen brightness will be recovered.
3. Cancel: click『Cancel』 and return to the Menu before OFF setting.

⚠ Note: If there is no operation, the device will automatically enter the standby mode. The equipment has a standby function only under the non-working state.

Chapter 7 - System Setting

7.1 Settings

Click the 『Settings』icon displayed on the main menu to enter any parameters setting options.

7.01.1 Drug library

Click 『Settings』 in the main menu to find the『Drug Library』， click to enter and then set the ON/OFF state of drug library and select the drug option.

7.01.1.1 Introduction to Drug library

This device supports over 2000 drug names, which our company can import with an external tool. Our company also can change some functions such as upper and lower limit, concentration and more.

Select the fluid/drugs and then import the parameters, the User may change the parameters, including the concentration and dosage rate, but the parameters won't be saved.

This pump can save up to 30 drugs and be updated/changed any time but only after turning off the machine once edited. This function does not have an upper and lower limit.

7.01.1.2 Setting Drug library

This function can be selected as ON or OFF.

Once this function is turned on, click the fluid/drug name with its preset value. The chosen medicine will be displayed in the running infusion menu after the drug library function is turned on and fluid/drug is selected.

7.01.2 KVO rate

Click『KVO rate』, input the numerical value, confirm value, and click  .

Please refer to Chapter 2.7 for the adjustable KVO range.

⚠ Note: KVO will be closed if the KVO rate is 0ml/h.

7.01.3 Bolus rate

Click『Bolus rate』, input the numerical value; after confirming, click  .

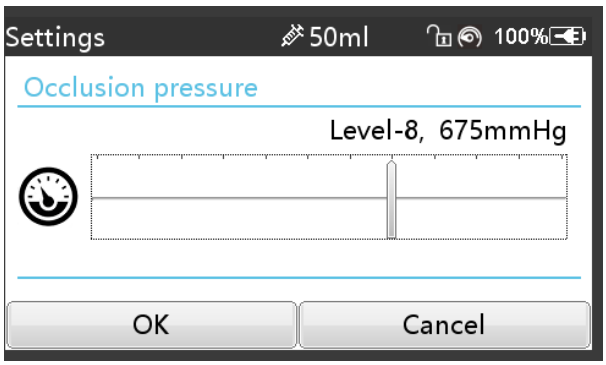
Please refer to Chapter 2.7 for the adjustable Bolus rate range.

7.01.4 Occlusion Pressure

Click『Occlusion pressure』to enter the occlusion pressure level setting, move the long box from the preset level; after confirmation, click  .

The higher the chosen click level, the higher the occlusion level. We suggest selecting suitable occlusion pressure according to actual requirements.

DPS (Dynamic Pressure Show) is turned on by default, and the line pressure is graphically and dynamically visible during infusing status.



Warning：

- When infusing fluid/drug of high viscosity and the occlusion pressure is set at a low level, the system may sound the occlusion alarm even when the line is not blocked. Under this condition, please carefully observe the pressure indication icon in the display screen and the infusion line. Raise the occlusion pressure if needed.
- When the blocking pressure is set to a high degree, the immense pressure inside may pull the extension tube away from the connection of the syringe. Please confirm that the extension tube is securely attached to the syringe.
- When the occlusion pressure is set at a high level, it may cause the animal to feel uncomfortable; after raising the occlusion pressure, please carefully observe its condition. Immediately take measures if there's any abnormality.
- Under the equipment fault state, the max pressure generated by the infusion line is 3000 kPa. Under a single fault state, the max infusion volume is 2ml.
- If not used for syringe infusion, for example, Intra-arterial Infusion, TPN (Total Parenteral Nutrition), or EN (Enteral Nutrition) treatment, the occlusion level should be adjusted to higher levels.

Table: Relation of Occlusion Level and Pressure

Occlusion Pressure Level: 4 levels				
Level	Pressure Intensity (mmHg)	Pressure Intensity (Kpa)	Pressure Intensity (bar)	Pressure Intensity (psi)
1	225	30	0.3	4.35
2	450	60	0.6	8.7
3	675	90	0.9	13.05
4	900	120	1.2	17.4
Occlusion Pressure Level: 12 levels				
Level	Pressure Intensity (mmHg)	Pressure Intensity (Kpa)	Pressure Intensity (bar)	Pressure Intensity (psi)
1	75	10	0.1	1.45
2	150	20	0.2	2.9
3	225	30	0.3	4.35
4	300	40	0.4	5.8
5	375	50	0.5	7.25
6	450	60	0.6	8.7
7	525	70	0.7	10.15
8	600	80	0.8	11.6
9	675	90	0.9	13.05
10	750	100	1	14.5
11	825	110	1.1	15.95
12	900	120	1.2	17.4

⚠ Note: When the line occlusion activates the occlusion alarm, the system will automatically trigger the anti-bolus function to drop the line pressure and avoid additional impact bolus to the animal after contacting the occlusion. Liquid leakage will be less than 0.2ml, and line pressure will be less than 300mmHg.

7.01.5 DPS (Dynamic Pressure System)

Line pressure is graphically and dynamically visible when switched on during infusing. A “Drop in Pressure” alarm will be triggered while pressure inline drops suddenly.

⚠ Note: This can also be caused by a disconnection of the extension line or with the patient.

7.01.6 Finish Pre-Alarm

Pre-alarm refers to the time of infusion nearing completion. The alarm signifies when the fluid/drug-infused volume nearly reaches the preset value.

Click『Finish pre-alarm』to enter the pre-alarm setting, select ON or OFF, click the preset time option and change the desired icon into ◎.

The adjustable time range for pre-alarm is 2 min, 5 min, 10 min, 15 min, 20 min, 30 min.

7.01.7 Reminder alarm

Click 『Reminder alarm』to enter a time for reminder alarm setting, select ON or OFF, click the preset time option, and change the desired option into ◎.

The adjustable range of time for the Reminder alarm is 2min, 5min, 10min, 15min, 20min, 30min.

There is no reminder alarm state when the equipment is under no infusion or a syringe is not installed.

7.01.8 Weight unit

Click『Weight unit』to enter the bodyweight menu, click the preset body weight unit option, and then the desired option should change to .

Note: The current software version only supports unit kg.

Unit Mark	Unit Conversion
kg	1 lbs. = 0.4535 kg

7.01.9 Pressure Unit

Click『Pressure unit』to enter the pressure unit select menu; four-unit options are available: mmHg, kPa, bar, psi, click the desired unit option.

Note: Please carefully confirm when changing the current pressure unit.

Unit Mark	Unit Conversion
kPa	1 kPa=7.5 mm Hg=0.145 psi=0.01 bar
PSI	1 psi=51.724 mm Hg=6.897 kpa = 0.069 bar
Bar	1bar=750 mm Hg=14.5 psi = 100 kPa

7.01.10 Micro Mode

Click『Micro mode』to enter the micro mode selection menu. ON/OFF is an optional function. Under the ON mode, set the rate limit, then the infusion rate under any infusion mode is not allowed to exceed this limit.

Syringe Size	Max Rate Range
5ml	100ml/h
10ml	100-200 ml/h
20ml	100-400 ml/h
30ml	100-600 ml/h
50ml	100-1500 ml/h

7.01.11 Commonly Used Syringe Brand

To change the Syringe brand for the infusion pump.

1. Install the Syringe. Click 『Commonly used Syringe Brand』to enter the Syringe option menu, confirm the syringe brand by clicking the specified brand.

The system built-in syringe brands are B.Braun, BD, Terumo.

Note: The syringes of different brands may cause flow rate deviations. When used, please confirm if the displayed information on the screen is congruent with the actual syringe brand.

7.01.12 Reset Total Volume

Click『Reset total volume』, the menu will display a confirmation message. Click to confirm the reset. Otherwise, please click .

7.2 General

In the main menu display, click『General』to enter the general setting options.

7.02.1 Network

This equipment supports wireless or wire interconnection. When equipped with a wireless module and connects with the internet through wi-fi, the equipment screen will display an icon.

Click『Network』from the main menu setting to set the response.

Supported by an HL7 protocol, it can transfer UDP data to its dedicated network system visa Wi-fi. The data will include the device's serial number, status, alarms, VTBI, accumulated volume, remaining time, programmed Rate, pressure level, real-time pressure, real-time Rate, and patient information.

Notes:

- Our company's professional technicians can only put this function.
- After activating the interconnection function, the equipment can periodically transmit data to the central monitor system (outside the room). The data is only for displaying and doesn't provide any suggestions on therapy.

7.02.1.1 Connection Mode

The connection mode also supports WLAN mode and serial port modes. Select accordingly to actual requirements.

7.02.1.2 Relay

For connection relay, set the relay mode switch and relay sequence number.

7.02.1.3 WLAN

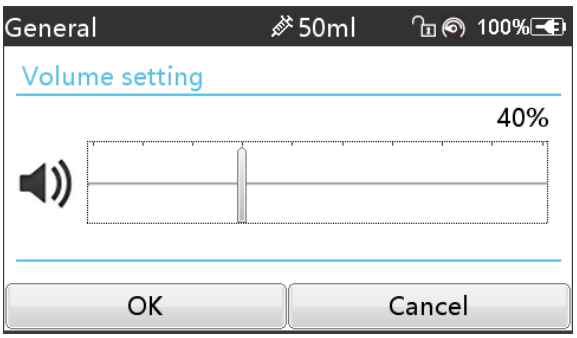
When the wi-fi function is in use, turn on the WLAN switch of the equipment, set the name and password of the access point, and configure the TCP/IP parameters.

Notes:

- The wireless access must be set by the professional technician recognized by our company.
- The transmitted data of this equipment doesn't provide any suggestion on therapy, and this data shall not be used for calculating the therapeutic schedule.

- When the data is adopted by the third party's equipment or software, it is only for display and shall not be used for alarming or calculating.

7.02.2 Sound



Click『Sound』to enter the sound setting menu. The volume has ten level settings. The lowest volume is ≥50 dB, and the highest volume is ≤80 dB. Move the long box from the preset level, confirm and click .

7.02.3 Date &Time

Click『Date &Time』in the settings menu to enter the correct date and time into the device. This setting allows users to set the device's date, time, and format.

When setting date and time, directly input the numerical value into the input. For example, to preset one date "2022-02-13", input "20220213"; to preset the time "12: 34", input "1234".

The time can be displayed in 24 hr. format or 12 hr. format, the date can be shown in Euro-American style or Eastern-Asian style, please set accordingly.

7.02.4 Screen Lock

Click『Screen lock』to enter the automatic lock screen setting menu, select ON or OFF.

Automatic lock screen time can be set at 15 secs, 30 secs, 1 min, 2 min, 5 min, 10 min or 30 min and so on, which means that the equipment will automatically lock the screen if it is not touched, or the button is pressed within corresponding time after starting. If the screen or keypad is locked, no operation can be conducted.

After turning on 『Screen lock』function during infusing, press【Power】key to lock or unlock the device manually.

To unlock: Press any keypad or click the screen. A reminder of unlocking will pop up; click to confirm.

Note: The equipment will automatically unlock if there is a High-Level alarm.

7.02.5 Brightness

Click 『Brightness』to enter the display brightness setting menu. The brightness setting has ten levels.

This device has an automatic brightness adjustment function dependent on an external power supply. When there is no external power and the pump's Power is supplied by a battery and not operated within 3 minutes, the system will automatically

adjust to the lowest brightness level. Then when touched or a button is pressed, or if there is an alarm, it will automatically recover the brightness.

7.02.6 Night mode

Click 『Night mode』 to enter the night mode switch menu. Set the start and end times of the night mode and the night brightness. The system automatically adjusts the brightness to the user-defined value at night.

7.02.7 Nurse call

Click『Nurse call』to select functions ON and OFF.

⚠ Notes:

The nurse call function must be used with a special cable.

The User should depend not only on the nurse call function as the primary alarm notice but also on identifying the alarm according to the equipment and the animal state.

7.02.8 Nurse call Alarm Level

Click『Nurse Call Alarm Level』to select different alarm levels.

7.02.9 Battery Capacity Display

Display of battery capacity under h:m or percentage status can be switched. This display will change the title bar display accordingly.

7.3 Patient

Click『Patient』in the main menu to enter the patient setting menu.

7.03.1 Patient Information

Click『Patient』to enter the patient information setting menu. Users can set bed numbers, MRNs, names, genders, ages, body weights, and heights.

7.03.2 Prescription

Click 『Patient』to enter the patient information menu and find the 『 Prescription 』option, click to enter. Set the medical advice I.D., medical advice information, start time, and state if available.

7.4 Records

Click『Records』in the main menu to enter records settings.

7.04.1 History entries

Click the 『History entries』button to see the records list. The equipment can save over 5000 historical records and display event names, dates, and times. When entries are full, the new records will cover the old records by turn.

7.04.2 Last therapies

Click 『Records』 in the main menu to enter the submenu and click the “Last therapies” menu to view the last therapy record.

(1) This submenu will display the latest 20 medical records. After confirming the parameters, a user may select a congruent infusion plan and start the infusion.

(2) The System can save 20 medical records at most. When it is full, the new records will cover the old records by turn.

7.04.3 Export history records

With the P.C. tool, connect this equipment to a P.C.

After the equipment has achieved connection with P.C., the P.C. can automatically read the data in the device.

We encourage users to create a history record folder in the P.C. to export the data into that folder.

Note: Please do not export data when the equipment is working.

7.04.4 Clear all records

Click 『Clear all records』 to clear all history records and therapy records.

7.5 System

Click『System』 under the main menu and enter the system setting interface

7.05.1 Language

This equipment supports English, simplified Chinese, and more. Click『Language』 to change device language.

7.05.2 Factory Default

Click『Factory default』 to clear all User-defined options and this function is open to the User.

7.05.3 S.N. (Serial Number)

Check the serial number of the equipment. A user cannot modify the serial number.

7.05.4 Version

Check the software version in this interface.

7.05.5 Maintenance

Call IPR for any preventive maintenance or issues. For more details, please refer to Chapter 11.

7.6 Electronic Memory Function

After the device is turned off or loses all its power, the history and alarm settings of the device storage are not affected, and the electronic memory function is saved for no less than five years.

When the power failure time is ≤ the 30s, the alarm setting will automatically recover before power failure.

Chapter 8 - Alarm Prompt and Troubleshooting

8.1 Introduction to Alarm Level

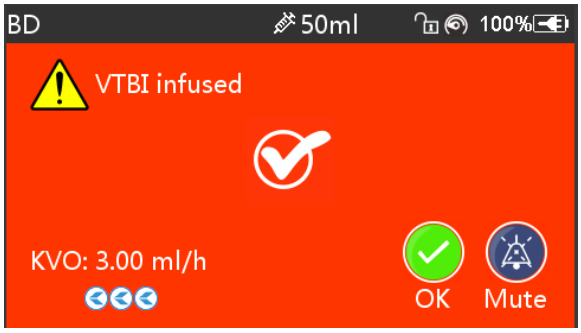
This equipment will alarm when reaching or exceeding the set alarm threshold values. During infusion preparation and infusion, alarms will prompt with sound, light, and text. According to the importance of alarm information, emergency and safety, the alarm will be divided into high, medium, and low. Please refer to the table below for details:

Table8.1-1

Alarm Level	Sound Signal Interval	Sound Signal Interval	Light color /flash frequency
High alarm	10s	Di di di-di di, Di di di-di di	Red indicator flashes /2.0±0.6Hz
Medium alarm	15s	Di di di	Yellow indicator flashes / 0.6±0.2Hz
Low alarm	25s	Di di di	Yellow indicator lights on

If there is an alarm, the system will display an alarm prompt. Click to exit the alarm prompt.

Click to mute. If the alarm is not muted, an alarm sound will be sent out 2 minutes later.



Warning: Some alarm thresholds of this device can be set by the User without password protection restrictions: occlusion pressure, reminder alarm, VTBI infused pre-alarm, alarm sound volume, and Standby time. The User shall confirm the parameters when setting the alarm threshold value; otherwise, it may influence the alarm function or infusion safety.

8.2 Multi-level Alarm Rules

When there are several alarms, the system will alarm according to the following rules:

Table 8.2-1

Multi-level Alarm	Rules
Several alarms of different levels generate simultaneously	Display the alarms of the highest level with sound, light, and text, report medium alarm after eliminating all alarms of the highest level
Several alarms of the same level generate simultaneously	Alarm circularly by turns; the time interval is 3s for each.

8.3 Alarm Treatment

⚠ Warning: When there's an alarm, please check the conditions of the animal, remove the reason for the alarm, and then continue working.

Please refer to Appendix C for the alarm solution.

8.4 Malfunction Analysis and Solution

When there is a malfunction, the syringe pump screen will display the malfunction alarm information; this item is a high-level alarm. Please eliminate the malfunction alarm according to the prompt. If it can't be eliminated, please stop the equipment, contact our company to repair and test it, and do not put it into operation before the equipment has passed the inspection. Otherwise, it may cause unpredictable harm if it works with a malfunction.

Suppose the equipment is on fire/burns for an unknown reason or has any other abnormal conditions. In that case, the User shall immediately cut off the power supply and contact our customer service department.

Chapter 9 - Maintenance

9.1 Cleaning, disinfecting, and sterilizing

⚠ Warning

- Please cut off the power supply and unplug the AC/DC power wire before cleaning the equipment.
- Please keep the equipment horizontal and upwards during cleaning and disinfecting to protect the equipment and accessories from a fluid.

9.01.1 Cleaning

1. The daily maintenance is mainly to clean the housing and pump body as fluids/drugs may inevitably flow in the equipment during infusion. But some fluids/drugs may corrode the pump and cause a fault. After the infusion, please clean the equipment. Wipe it with moist, clean, soft fabric, and please dry naturally.
2. When cleaning the equipment interface, please wipe it with dry and soft fabric and confirm the interface is dry before using it.
3. Please do not soak the equipment in water. Although this equipment has certain water-resistant functions, please check beforehand and ensure it still works when fluid splashes on the equipment. Perform a test infusion and electric leakage test, if needed.

9.01.2 Disinfecting

1. Disinfecting may cause harm of a certain degree to the equipment. We suggest disinfecting the equipment only if it is needed.
2. Please disinfect the equipment with common disinfecting agents such as 70% ethanol, 70% isopropyl alcohol, etc. Please follow the instructions of the disinfecting agent.
3. After disinfecting, wet wipe with a soft fabric and warm water. With another dry cloth and wipe the equipment thoroughly.
4. Do not sterilize the equipment with a high-pressure steam sterilizer, do not dry the equipment with a dryer or similar product.

⚠ Warning: Please do not adopt Cidex OPA orthophthalaldehyde, methyl ethyl ketone, or a similar solvent. Otherwise, it may corrode the equipment.

9.2 Periodical maintenance

⚠ Notes:

- With this device, please set up a complete maintenance plan. Otherwise, it may cause the equipment malfunction or fault and may hurt the physical safety of others.
- To ensure the safe use and prolong the equipment’s service life, we suggest periodically maintaining and checking it once every six months. The User shall hold some items, and some parts shall be maintained by the dealer of the equipment, IPR.
- Please timely contact our company if the equipment is found defective.

9.02.1 Check the Appearance

1. The appearance of the equipment should be clean and under excellent condition without crack and water leakage.
2. The buttons are flexible and effective without invalid use; the touch screen's sensitivity is normal.
3. The slider of the syringe pump is flexible in movement, and the clamp is functioning.
4. The power wire is in good condition and installed tightly.
5. After connecting with the external power supply, check whether the A.C. and D.C. indicators of the device and the battery indicator are lit.
6. Adopt the accessories designated by our company.
7. The environment meets the requirements.

9.02.2 Performance Check

- Self-test and normal infusion function.
- The alarm function is normal
- Battery performance.

9.02.3 Maintenance Plan

The following check/maintenance items must be performed by the professional technician recognized by our company. If the following maintenances are necessary, please contact our company. Please clean and disinfect the equipment before testing or maintaining it.

Maintenance Items	Cycle
Safety check according to IEC 60601-1	Once every two years, check and replace the printed circuit board assembly or if the equipment has been dropped or knocked.
Preventive system maintenance items (pressure calibrate, sensor calibrate, pump)	Once every two years, when the occlusion alarm or infusion accuracy is doubted to be abnormal
Brand of user-defined infusion apparatus, infusion accuracy calibration	Using the equipment for the first time, using a syringe brand for the first time, reusing the equipment after stopping for a very long period.

9.3 Add New Brand and Calibration

In the 『System』 submenu, click 『maintenance』 to enter the brand setting menu, this allows you to create a brand, delete, and calibrate any syringe brand.

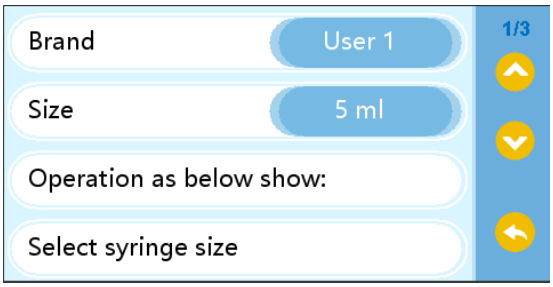
⚠ Warning: We suggest contacting our company to customize and calibrate sets with our professional technicians. Otherwise, there is no guarantee of infusion accuracy.

⚠ Note: The built-in brand of the system cannot be deleted.

⚠ Note: If the existing syringe brand is not listed in the system, please create, and test the syringe brand with the pump.

1. Add new brand

    a. Click『Add new brand』to enter the new brand interface, edit syringe brand name, specifications, and other information.



2. Delete

    Enter the『Delete』option and click delete the user-defined syringe brand.

3. Calibrate

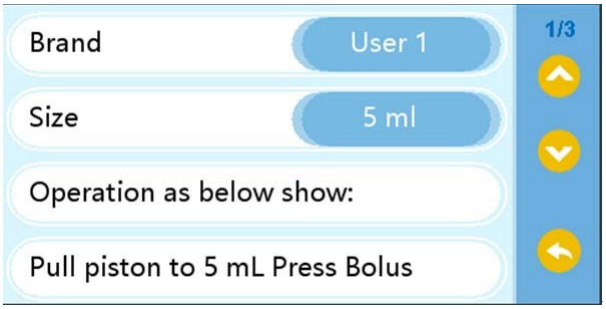
    ⚠ Note

    - With the first-time use of the pump, it will need calibration.
    - When adding a new syringe brand, the pump will need calibration.
    - When accuracy is not correct, the pump needs calibration.

9.03.1 Calibrating Steps:

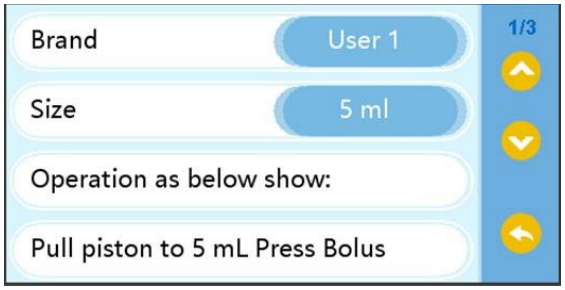
Automatic:

1. Select the brand name.



2. Select Syringe size.

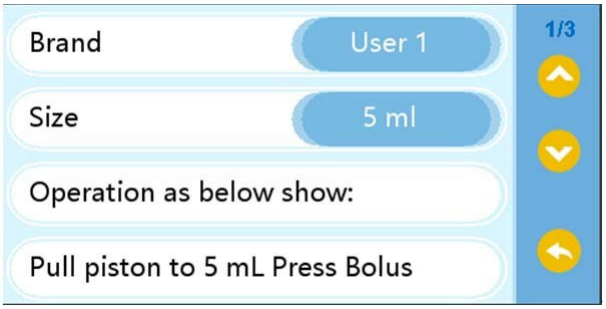
3. Install syringe, pull the syringe plunger beyond size scale line slightly. Press and hold【Bolus】until the correct syringe volume is chosen.



4. Press『Start』to start Calibration.
5. Calibration completed.

Manual:

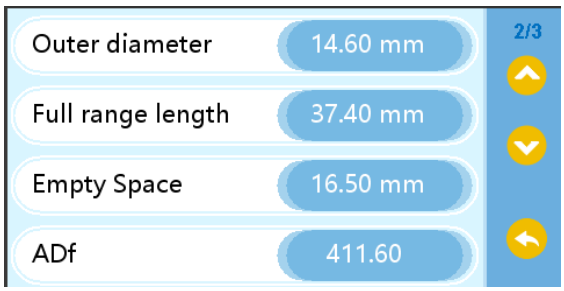
1. Select the brand name.



2. Select Syringe size.

3. Click the to move to the second page.

4. Click and enter parameters for “Outer Diameter,” “Full Range Length,” and “Empty Space.”



5. Calibration Completed.

9.4 Repair

⚠ Warning: The maintenance of equipment and the replacement of components shall be carried out by professionals of the company. When the power module is replaced, particular attention shall be paid to detecting the power supply. Observe whether there is a false alarm, connect the A.C. power supply, and charge the battery normally.

9.4.1 Normal Repair Process

Please contact our company to repair if there’s any fault, do not disassemble and repair the equipment. After repair, please perform a comprehensive test for the equipment. Please contact our company if an authorized repair technician if needed.

9.4.2 Maintenance for Long Term Store

Suppose the device won’t be used for an extended period. In that case, we encourage removing the battery, packing it with its original packaging, and storing it in a shady, cool, dry place without direct sunlight.

Please note the following operations are necessary for using it again:

1. Verify flow rate accuracy to avoid unconformity between the syringe parameters set in the equipment and the actual parameters after. There may be an infusion error if it hasn’t been used for an extended period or other reasons. This error may influence the therapeutic effects and even cause medical negligence.
2. We highly encourage performing an occlusion alarm test.
3. Experiment with the battery discharging and charging duration to confirm that the battery is also usable.

9.5 Equipment Components/Accessories

⚠ Warning: Only the components and accessories designated by our company shall be adopted. Otherwise, it may damage the equipment or drop the equipment performance.

During the average service life of the equipment, the battery and water-resistant membranes are consumables. As a suggestion, it is best to replace them once every two years. Please contact our company to replace them.

Variety	Name
Optional configuration	Wi-fi module
	IrDA module

Optional Accessory	Locking mechanism
Equipment Components	Battery
	Pole clamp
	Power wire
	Handle

9.6 Production Date

Please refer to the label of the product.

9.7 Recycling

The average service life of this equipment is five years and depends on the use frequency and maintenance. The equipment must be rejected after reaching its service life. Please contact our company to get more detailed information.

1. We suggest the obsolete equipment be returned to our company.
2. According to the applicable laws and regulations, the used lithium-ion polymer battery needs to be thrown at a hazardous waste facility.
3. Regarding consumables, please handle them according to the waste system of your facility.

Chapter 10 - Battery

This equipment is equipped with a rechargeable lithium-ion polymer battery to ensure a standard infusion if the equipment is moved, or the external power supply is cut off.

When connecting an external power supply, whether the equipment is powered on or not, the battery will charge. When charging, the equipment screen displays the battery charging indication icon  . In extraordinary instances, only a built-in battery is implemented to supply Power. When the remaining battery is less than 20%, please connect the equipment with an external power supply to charge the battery.

⚠ Warning: Only the battery designated by our company shall be adopted.

10.1 Check the Battery Performance

The performance of the built-in battery may drop according to the using duration. It is a suggestion to check the battery at least once a month.

1. Disconnect the equipment from the animal and stop all infusions.
2. Supply public Power to the equipment to charge the battery for at least 5 hours.
3. Supply power to the syringe pump only with the battery, infusion at the rate of 5ml/h, test the time till the battery runs down and the equipment is off.
4. If the battery power supply time is significantly lower than the time stated in the specification, consider replacing the battery by contacting us.
    - When testing if the infusion time exceeds ten hours and completes infusion, the battery is in good condition.
    - When testing if the infusion time exceeds seven hours but less than ten hours, the battery has deteriorated but can be used temporarily.
    - If the infusion time is less than seven hours and the battery cannot complete an infusion, please replace the battery.

10.2 Replacing the Battery

It is recommended to replace the battery every two years; it is suggested to replace the battery by our company.

⚠ Warning: Untrained personnel is forbidden to replace the battery; otherwise, it may cause the battery to burn, explode, leak, and cause personal injury.

Chapter 11 - Customer Service

This product includes a 1-year warranty after purchase. The warranty period is from the date it is in the User's possession. The equipment damages caused by the following are not covered under the warranty service.

1. Fault caused by incorrect operation, unauthorized refitting, or repair.
2. Damages caused by incorrect operation during the transportation process, after purchase.
3. The fault and damages caused by fire, salt injury, toxic gas, earthquake, windstorm, flood, abnormal voltage, and other natural disasters.

Our company provides repair services for the damages or faults mentioned above but with repair costs.

Chapter 12 - Appendix

Appendix A Start-Up Graphs and Trumpet Curves

Appendix A.1 Start-up Graphs

Brand and specification of syringe: Double-Dove

Size: 50 ml

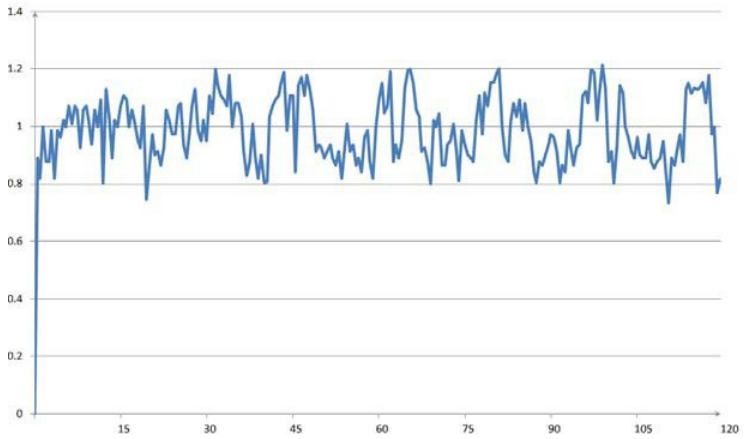
Number of Sampling equipment: 3 sets

Number of sampling syringes: 3

Flow Rate: 1ml/h

Measurement Interval: Δ t = 0.5min

Measurement duration: T = 2h



Graph 1 Start-up graph: Flow rate 1 (ml/h) against time (min) plotted from data gathered during the first two hours of the test period.

Brand and specification of syringe: Double-Dove

Size: 50 ml

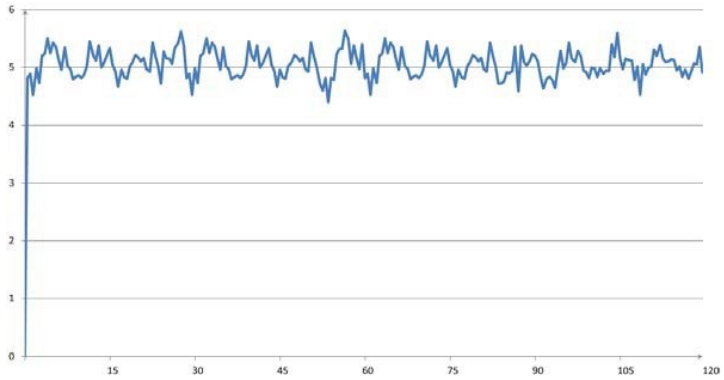
Number of Sampling equipment: 3 sets

Number of sampling syringes: 3

Flow Rate: ml/h

Measurement Interval: Δ t = 0.5min

Measurement duration: T = 2h



Graph 2 Start-up graph: Flow rate 5 (ml/h) against time (min) plotted from data gathered during the first two hours of the test period

Appendix A.2 Trumpet Curves

Brand and specification of syringe: Double-Dove

Size: 50ml

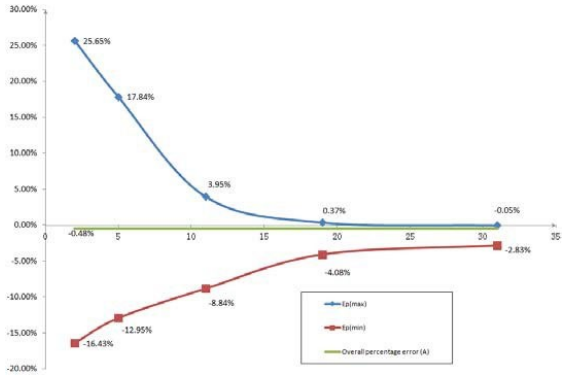
Number of Sampling equipment: 3 sets

Number of sampling syringes: 3

Flow Rate: 1ml/h

Measurement Interval: Δ t = 0.5min

Measurement duration: T = 2h



Graph 3 Trumpet curve: Percentage variation Ep against observation window duration P (min) and the overall mean percentage error A plotted from data gathered during the second hour of the test period

Brand and specification of syringe: Double-Dove

Size: 50ml

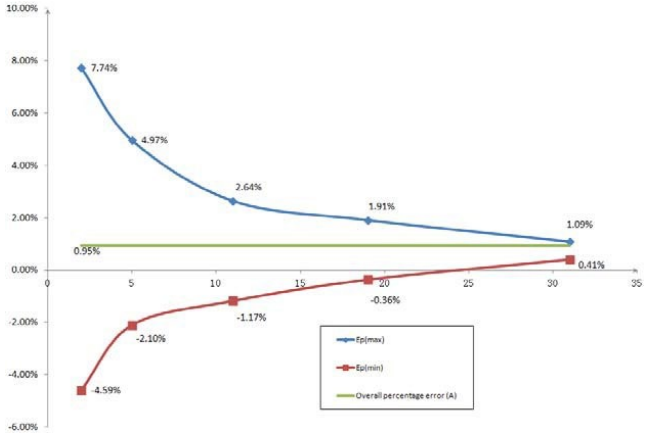
Number of Sampling equipment: 3 sets

Number of sampling syringes: 3

Flow Rate: 5ml/h

Measurement Interval: Δ t = 0.5min

Measurement duration: T = 2h



Graph 4 Trumpet curve: Percentage variation Ep against observation window duration P (min) and the overall mean percentage error A plotted from data gathered during the second hour of the test period

⚠ Note: Infusion accuracy may be affected by the syringe pump environment, such as pressure, temperature, humidity, infusion consumables, and so on.

Appendix B Occlusion Response Property

1. Delay and Possible Dose (Occlusion Pressure Level: 4 Levels)

Flow Rate (ml/h)	Occlusion Pressure (mmHg)		Time to occlusion alarm(min)	Max bolus (ml)
1	Low	75	0h22min40sec	0.046
	High	900	2h20min0sec	0.109
5	Low	75	0h11min55sec	0.053
	High	900	0h29min43sec	0.086

2. Delay and Possible Dose (Occlusion Pressure Level 12 Levels)

Flow Rate (ml/h)	Occlusion Pressure (mmHg)		Time to occlusion alarm (min)	Max bolus (ml)
1	Low	225	0h49min18sec	0.039
	High	900	2h11min0sec	0.085
5	Low	225	0h14min20sec	0.040
	High	900	0h29min46sec	0.077

⚠ Notes:

The alarm pressure intensity error for (2) is ±15% or ±100 mmHg; the higher value shall be taken.

The alarm pressure intensity error for (1) is ±20% or ± 150 mmHg; the higher value shall be taken.

⚠ Notes:

Conditions for above testing data: Syringe Brand: Double-Dove; Size: 50 ml.

The test conditions, temperature, and line length influence the occlusion alarm pressure, alarm delay time, and bolus.

The above data is the typical value under the test conditions. Please see the test data of the product for the actual data. The data may be different when the test conditions are different

Appendix C Alarm and Solution

Alarm Type	Alarm Level	Reason	Solution
VTBI infused	High	The preset value infusion completion.	Press 【Stop】 button to stop the alarm.
Syringe Empty	High	The fluid/drugs in the syringe are empty.	Press 【Stop】 button to stop the alarm.
Pressure high	High	1. Line occlusion during infusion.	Click 『Mute』 to silence. Manually solve the problem of occlusion. Press【Start】 button to continue the infusion.
		2. Fluid/drug in the actual infusion line of high viscosity, while the system occlusion level is set too low.	Rise the alarm Level, Press 【Start】 button to restart infusion.
		3. The pressure sensor is damaged.	Please contact the dealer or manufacturer for repair
Battery empty	High	When Power is supplied by the built-in battery only, under low battery, the alarm duration is >30min.	Immediately connect with the external power supply.
		2. Battery aging or the equipment charging circuit is faulty.	Please get in touch with the dealer or manufacturer for repair.
Check Syringe	High	Syringe drop-off during infusion.	Reinstall the syringe.

Alarm Type	Alarm Level	Reason	Solution
KVO finished	High	KVO working time reached 30min; infusion pump stopped working.	Press【Stop】button to stop the alarm
Drug dose limits exceeded	High	While using drugs in the drug library to infuse, an alarm will be triggered if the max dose in a specific time has exceeded the preset limits.	Press 【Stop】button to stop the alarm.
System error	High	The error alarm will give a code number if a system self-check fails or an internal fault.	Restart the device to check whether the alarm is eliminated. If it still exists, contact our company.
VTBI near end	Medium	During infusion, the remaining time reached or is less than the set nearing completion time.	This alarm can’t be eliminated; wait till infusion completes.
Syringe nearly empty	Medium	The syringe is near empty, calculated by the current flow rate’s remaining medicine in the syringe.	This alarm can’t be eliminated; wait till the syringe is empty.
Occlusion Pre-Alarm	Medium	Line pressure is close to the preset occlusion pressure level.	Check if there is an occlusion in the line and click OK to eliminate the alarm.
Drop-In Pressure	Medium	Pressure in line is dropped suddenly.	Check extension line or patient connection. Click OK to eliminate the alarm.

Alarm Type	Alarm Level	Reason	Solution
Battery Nearly Empty	Medium	1. When Power is supplied only with the built-in battery, under low battery, the alarm duration is >30min.	The alarm is automatically eliminated after connecting the external power supply.
		2. Battery aging or the equipment charging circuit is a fault.	
No Battery Inserted	Medium	The battery is removed.	Keep connecting with an external power supply reinstall the battery.
Reminder alarm	Medium	After installing the syringe tube, under a non-working or alarm state, it is not operated within the set time of the system.	Click any button to stop.
Standby time expired	Medium	During Standby or after reaching the standby time.	Press 【Stop】 button to stop the alarm.
No power supply	Low	Under ON state, A.C. power supply is adopted, but the A.C. power wire is dropped during the process.	The alarm is automatically eliminated after connecting the external power supply.

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

Appendix D EMC Electro Magnetic Compatibility Declaration

This product needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided. This unit can be affected by portable and mobile R.F. communications equipment.

⚠ Cautions:

- This unit has been thoroughly tested and inspected to assure proper performance and operation!
- This machine should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, this machine should be observed to verify regular operation in the configuration in which it will be used.

⚠ Warnings:

The use of ACCESSORIES, transducers, and cables other than those specified, except for accessories, transducers, and cables sold by the Infusion Pump Repair as replacement parts for internal components, may result in increased EMISSIONS or decreased IMMUNITY of the syringe pump.

Guidance and manufacture's declaration – electromagnetic emission		
The Syringe pump is intended for use in the electromagnetic environment specified below. The customer or the Syringe pump user should ensure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment – guidance**
R.F. emissions CISPR 11	Group 1	The Syringe pump uses R.F. energy only for its internal function. Therefore, its R.F. emissions are very low and are not likely to cause any interference in nearby electronic equipment.
R.F. emissions CISPR 11	Class A	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
Harmonic emissions IEC 61000-3-2	Not applicable	

Voltage fluctuations/ flicker emissions IEC 61000-3-3	Not applicable	supplies buildings used for domestic purposes.

Guidance and manufacture's declaration – electromagnetic immunity

The Syringe pump is intended for use in the electromagnetic environment specified below. The customer or the Syringe pump user should ensure 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	±6 kV contact ±8 kV air	±8 kV contact ±15 kV air	Floors should be wood, concrete, or ceramic tile. If the floor is covered with synthetic material, the relative humidity should be 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 K.V. for input/output lines	±2kV for power supply lines	The main power quality should be a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV line(s) to line(s) ±2 KV line(s)to earth	± 1 kV line(s) to line(s) ±2 KV line(s)to earth	The main power quality should be 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)	<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	The main power quality should be a typical commercial or hospital environment. Suppose the Syringe pump user requires continued operation during power mains interruptions. In that case, it is recommended that the syringe pump be powered from an uninterruptible power supply or a battery.

	for 5 sec	(>95% dip in UT)for 5 sec	
Power frequency (50Hz/60Hz) magnetic field IEC 61000-4-8	3 A/m	400A/m	Power frequency magnetic fields should be at levels characteristic of a specific location in a typical commercial or hospital environment.

NOTE: U.T. is the A.C. mains voltage before applying the test level.

Guidance and manufacture's declaration – electromagnetic immunity

The Syringe pump is intended for use in the electromagnetic environment specified below. The customer or the Syringe pump user should ensure 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 Vrms 150 kHz to 80 MHz	10 Vrms	Portable and mobile R.F. 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 transmitter's frequency. Recommended separation distance $d = 1.167\sqrt{P}$ $d = 1.167\sqrt{P}$ 80 MHz to 800 MHz $d = 2.333\sqrt{P}$ 800 MHz to 2.5 GHz
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	10 V/m	

			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 meters (m). As determined by an electromagnetic site survey, field strengths from fixed R.F. transmitters 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 80 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 Field strength from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and F.M. radio broadcast, and T.V. broadcast cannot be predicted theoretically with accuracy. An electromagnetic site survey should be considered to assess the electromagnetic environment due to fixed R.F. transmitters. Suppose the measured field strength in the location where the Syringe pump is used exceeds the appropriate RE compliance level above. In that case, the Syringe pump should be observed to verify regular operation. If abnormal performance is regarded, additional measures may be necessary, such as reorienting or relocating the Syringe pump.

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended separation distances between

portable and mobile R.F. communications equipment and the Syringe pump.

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

The rated maximum output power of the transmitter (W)	Separation distance according to the frequency of the transmitter (m)		
	150 KHz to 80 MHz $d = 1.167\sqrt{P}$	80 MHz to 800 MHz $d = 1.167\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.333\sqrt{P}$
0.01	0.117	0.117	0.233
0.1	0.369	0.369	0.738
1	1.167	1.167	2.333
10	3.689	3.689	7.379
100	11.667	11.667	23.333

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated 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 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Appendix E Wireless Module Information*

Parameter Name	Parameter Value
Frequency Range	2.412GHz-2.482GHz
Modulating Type	OFDM,CCK,DSSS
Effective Radiating Power	<20dBm

Appendix F Factory Default Setting

Parameters	Default Setting	Parameters	Default Setting
KVO rate	1ml/h	Sound	40%
Occlusion pressure	450 mmHg	Screen lock	ON
Finish pre-alarm	2 min	Brightness	90%
Reminder alarm	2 min	Night mode	OFF
Pressure unit	mmHg	Nurse call	OFF
Micro Mode	OFF	Drug Library	OFF
Commonly used Syringe Brand	B.D.	Relay Mode	OFF

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