

# SYS-50/52 Syringe Pump

# **Operation Manual**

Please read this "Operation Manual" carefully and follow "Precautions for Use" before using the SYS-50/52 Syringe Pump.

MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD.

### Intellectual Property and Statement

The intellectual property right of this product and its Operation Manual belong to MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD. (hereinafter referred to as MEDCAPTAIN).

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#### Statements

MEDCAPTAIN reserves the right for final interpretation of this Operation Manual.

MEDCAPTAIN reserves the right to modify the contents of this operation manual for a more accurate and effective service quality. The modified contents should be reflected in the newly published operation manual version.

MEDCAPTAIN is responsible for safety, reliability and performance of this equipment only in the condition that:

- Use in accordance with the operation manual.
- All disassembly, replacement, test, modification and repair are conducted by qualified personnel approved by MEDCAPTAIN.
- All replacement parts, supporting accessories and consumables during the maintenance are provided by MEDCAPTAIN.
- Maintenance records for product are reserved.

#### **Version Information**

### V1.1

• Operation Manual: Second edition

• Software: V1

• Issued on: 2017-11

#### V1.2

• Operation Manual: Third edition

• Issued on: 2018-09

### V1.3

• Optimize picture quality.

• Issued on: 2019-4

### V1.4

- Changed the model and parameters of the built-in lithium battery. Added the AC/DC indicator and the battery indicator.
- Issued on: 2019-11

# Intellectual Property and Statement

### V1.5

• Added the description that the sound of the Battery Empty alarm cannot be paused and the sound of a low-level alarm can be paused.

• Issued on: 2020-02

V1.6

• Changed the parameters.

• Software: V2

• Issued on: 2020-07

V1.7

• Modify the production address

• Issued on:2021-03

### After-Sale Service

Thank you for using the syringe pump of MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD.

- During the warranty period, we provide free after-sale services except repairs due to the following causes:
  - Artificial damage.
  - Inappropriate use.
  - The voltage of supply network exceeds the prescribed range.
  - Irresistible natural disasters.
  - Replacement or use of parts, accessories and consumables without approval of MEDCAPTAIN.
  - Other troubles not caused by product itself.

After the warranty period, we continue to provide charged maintenance service. If you have any question when using the syringe pump, please contact your local distributor or MEDCAPTAIN directly at any time.

Contact our Customer Service Department:

After-sales service provider: MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD. After-sales service address: 12th Floor, Baiwang Research Building, No.5158 Shahe West Road, Xili, Nanshan, 518055 Shenzhen, Guangdong, PEOPLE'S REPUBLIC OF

**CHINA** 

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Website: http://www.medcaptain.com E-mail: MC.service@medcaptain.com

 MEDCAPTAIN MEDICAL TECHNOLOGY CO., LTD. and all local distributors have established after-sales service agencies that can effectively solve your problems in time.



 The device should be operated by trained medical personnel or under the instruction of trained medical personnel. The operator should have received training on how to use this product.

## Preface

### **Illustrations**

All the illustrations provided in this operation manual are for your reference only. The settings or data on the illustrations may differ from the actual settings or data of the product.

## **Conventions**

- *Italics: Indicates the quoted content.*
- User password: 1234

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### 1 Overview

### 1.1 Purpose

This product is intended to be used in conjunction with the syringe to control the dose of liquid infused into the patient's body in clinical departments.

### 1.2 Contraindication

None.

### 1.3 Product Features

MEDCAPTAIN SYS-50/52 is a micro-volume continuous-operation syringe pump. It ensures constant infusion rate and accurate dosing volume during prolonged infusion.

This syringe pump is used for continuous and micro-volume infusion of liquid or liquid medicine of little volume and high concentration, for example, infusion of chemotherapeutic agents, cardiovascular drugs, antineoplastic, oxytocic, anticoagulant, anesthetic agents, etc.

- All current disposable syringes conforming to the IEC standard for medical disposables are supported.
- Disposable syringes of 5ml, 10ml, 20ml, 30ml, and 50/60ml can be automatically identified.
- Eleven occlusion levels are available, and the pressure status of the tube is displayed.
- Large rate range (up to 2000ml/h for 50/60ml syringe).
- Calibration functions are provided for infusion accuracy.
- Safety design by monitoring infusion status of syringe.
- Multiple infusion modes.
- The infusion rate can be changed during infusion.
- Power-on self-test, including power supply, circuit, motors and sensors.
- WIFI function, supporting connection to the central monitoring system.
- Support wired communication with the central monitoring system through LAN.
- Nurse call function.
- Touchscreen, providing quick and convenient man-machine interface.
- Display night mode, reducing light interference to patients and environment.

### Overview

- Three types of power supply are supported: AC power supply, DC power supply, and internal lithium battery.
- Double/quadruple CPU, and redundancy design for key units, which will protect the patient from over-infusion and under-infusion.
- Two-way alarm for monitoring the main control circuit and motor drive circuit.
- Independent motor driving CPU and motor subdivided drive chip design, which will protect the patient from over-infusion and under-infusion.
- The SYS-52 dual-channel syringe pump in which the A and B channel can work independently or together in Relay mode.
- Setting of maintenance interval and automatic prompt of maintenance.
- Meet the requirement of EN1789 standard. Can be used in the road ambulances environment.

#### Note:

WIFI communication module, LAN communication module, nurse call and relay infusion functions are optional features.

In this manual, precautions are classified into warning and caution paragraphs according to their importance. The meanings are as follows:



The information is about safety and efficiency. Operation against the precautions may cause injuries.



The information is about guiding suggestions. Operation against the precautions may affect normal use of the product. Read carefully the warnings and cautions in this manual.



- The syringe pump must be operated by trained healthcare professionals.
- Prior to use, please check the status of the pump, power cable and other related accessories to ensure that the device can be used normally and safely.
- The syringe pump does not support air-in-line detection. Always purge air from the system before each use.
- Pay extra attention to twists of the infusion line when it is used for low-rate infusions. A lower infusion rate indicates a longer time from occurrence to detection of the occlusion, which may suspend the infusion for a long time.
- To avoid the risk of fire or explosion, do not use the syringe pump in a flammable or oxygenated environment.
- The altitude difference between the pump and heart position of the patient should not be larger than 100cm. A smaller altitude difference indicates a higher accuracy of the pressure sensor's result.
- In the event of tube twisting, filter condensation or tube occlusion during infusion, the internal pressure of the infusion tube increases. When the occlusion alarm is generated, the motor automatically rotates inversely to release the pressure in the tube (Anti-Bolus function), so that no extra bolus will be infused during the operation of clearing the occlusion alarm.
- It is recommended that you use the syringes specified by the manufacturer only.
- If a syringe of other brands is used or the syringe parameters are not defined correctly, the infusion accuracy may be affected.

- Only the syringe, tube, syringe needle and other medical parts complying with local regulations can be used on the syringe pump. Contact your local distributor for more information.
- Operating the syringe pump against the requirements, procedures, warnings or cautions provided in this manual may cause infusion failure, inadequate or excessive dosing, and/or other potential risks.
- There should be regular monitoring by trained healthcare professionals during use of the device.
- The power cable and other affiliated lines should be laid properly to prevent patients from being tripped and avoid electromagnetic interference.
- Electric equipment like high-frequency electric knife and mobile phone may have electromagnetic interference on the syringe pump.
- To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earthing.
- If the pump and its related accessories reach the end of their economic life time, they must be scrapped and disposed of in accordance with local laws or hospital regulations. Please contact your local representative for further details.
- Do not replace any component of this equipment without authorization of the manufacturer.
- When operating the pump or checking the pump's alarm systems, the operator should be in front of the device, no farther than 1 meter away.
- There is no patient circuit in this device. The output of the equipment is not allowed to be accessible to a patient.
- The operator shall not touch the pump and a patient simultaneously.
- Before using the pump, please double check the parameters on the appropriate screen before starting the infusion.
- To prevent infusion rate changes and infusing air into the patient's body, make sure no other infusion systems or accessories are connected to the patient line simultaneously.

# CAUTION:

- The applied part of the syringe pump is the infusion catheter and infusion tube.
- Infusion can be started only when the prescribed values on the prescription are the same as the values set on the syringe pump.
- Ensure that the syringe pump is fixed tightly on the stand and the stand is stable, or securely placed on a flat platform.

- Prevent the pump from colliding, dropping, mechanical vibration and other external forces to avoid damage to the pump.
- Before tapping the [Start] button, check if the infusion rate is correct, especially the position of the decimal point.
- Do not operate on the screen with sharp objects. Otherwise, the screen may be damaged.
- An occlusion alarm may be generated when high-viscosity liquid is infused at high rate through a thin intravenous needle. In this case, increase the occlusion level or decrease the infusion rate.
- Syringe pump should be placed without the reach of patients and unauthorized healthcare personnel.
- Avoid direct sunlight, high temperatures and high humidity.
- Do not autoclave the syringe pump.
- Before operating the pump powered by its built-in battery, check the battery to ensure that sufficient power is available. Recharge the battery if required.
- Ensure that a battery is installed in the syringe pump before operation. Otherwise, the system may stop working without reporting an alarm when external power is interrupted due to power failure or a short circuit, causing an unsafe condition.
- If the syringe pump cannot work as described in this manual for unknown reasons, stop it and report the details (including syringe model, infusion flow, serial number of syringe pump, and type of infusion liquid) to your local distributor or MEDCAPTAIN's customer service department.
- Do not disassemble or reconstruct the syringe pump.
- Liquid intrusion into the AC power socket, USB or nurse call socket may cause short circuit. While connecting the power cable, check if the connecting parts are dry. If liquid spills onto the syringe pump, clean the pump with a dry cloth, and use the pump after inspection by maintenance personnel.
- The maximum temperature at the applied part of the pump may reach  $42.2 \,^{\circ}$ C when the pump runs continuously under the highest environment temperate at the highest infusion rate.
- The highest pressure at the end of the infusion tube is not higher than 1900 mmHg in case of occlusion.
- The delay inherent in the determination of an ALARM CONDITION is about 100ms.

- The mean delay time from the onset of the ALARM CONDITION to the point that the representation of the ALARM CONDITION leaves the SIGNAL INPUT/OUTPUT PART is about 3.1s.
- After the pump is exposed to a defibrillation voltage, the recovery time of the pump is shorter than 1s (the pump functions properly during exposure to the defibrillation voltage).

### Symbols:

EC REP	Authorized Representative in the European Community
<b>C</b> € <sub>0123</sub>	CE Mark: conforms to essential requirements of the Medical Device Directive 93/42/EEC.
$\sim$	Manufacturing date
	Manufacturer
SN	Serial number
-	Defibrillation-proof type CF applied part
$\sim$	Alternating current
	Direct current
$\overline{\sim}$	Alternating current or Direct current
숙+ -	Battery
Ā	DISPOSAL: Do not dispose this product as unsorted municipal waste. Separate collection of such waste for special treatment is necessary.
$\triangle$	CAUTION! Read the accompanying document.
$\wedge$	General warning sign
	Refer to the operation manual.
IP34	Protected against solid foreign objects of 2.5 mm Ø and greater, Protected against splashing water.
$((\omega))$	Interferences may occur near devices with the below sign.

ON OFF	ON/OFF
НОМЕ	HOME
3	Nurse call
	Protective earth.
•	USB interface.
<u>††</u>	This way up
<u> </u>	Fragile, handle with care
7	Keep dry
类	Keep away from sunlight
22.0kPa	Atmospheric pressure limitation
-20°C	Temperature limit
10 %	Humidity limitation
	Stacking limit by number (n is 5, 7, for the specific value, see the product package box.)

Product name	Syringe pump/Dual-channel syringe pump
Model	SYS-50/SYS-52
	AC power supply:
	SYS-50: AC 100-240V,50/60 Hz, 40 VA input power
	SYS-52: AC 100-240V,50/60 Hz, 60 VA input power
	External DC power supply:
	SYS-50: DC 12 V, 1.5A
	SYS-52: DC 12 V, 3.0A
	Built-in battery: lithium battery
Power supply	Battery model: 18650-3S1P-02 2600mAh @10.8V
	Battery charging time:
	Config1:
	Power on: Less than 10 hours to full
	Power off: Less than 5hours to full
	Config2:
	Power on: Less than 20 hours to full
	Power off: Less than 10 hours to full
	Config1: one 2600mAh@10.8V battery
Battery configuration	Config2: two 2600mAh@10.8V batteries
	Note: default -Config1.
	SYS-50: Syringe Pump
	Config1: Not less than 10 hours
	Config2: Not less than 20 hours
	Note: Infusion at 5 ml/h with new battery under room
Battery operation	temperature
time	SYS-52: Dual-channel syringe pump
	Config1: Not less than 5 hours
	Config2: Not less than 10 hours
	Note: Infusion at 5 ml/h with new battery under room
	temperature

Compatible syringes	All syringes of 5ml, 10ml, 20ml, 30ml, and 50/60ml conform to
	the standard.
	Rate mode, Time mode, Weight mode, Sequence mode,
Infusion mode	Loading Dose mode, Trapezia mode, Micro mode, TIVA mode,
	and RELAY mode (only for SYS-52)
	0.10-100.0ml/h(5ml syringe)
	0.10-300.0ml/h(10ml syringe)
Infusion sotting names	0.10-600.0ml/h(20ml syringe)
Infusion setting range	0.10-900.0ml/h(30ml syringe)
	0.10-2000ml/h(50/60ml syringe)
	See the least increment in chart 6-3
	0.10 - 99.99ml(Least increment 0.01)
VTBI setting range	100.0 - 999.9ml(Least increment 0.1)
	1000 - 9999ml(Least increment 1)
Total volume display	0-9999.99ml
A course ov	Mechanical accuracy: ±0.5%
Accuracy	Accuracy (connected to a syringe): ±2%
KVO rate	0.1~5ml/h.KVO can be disabled when KVO rate is set to 0
	ml/h.
	KVO cannot be started if the KVO rate is set to a value greater
	than the infusion rate.
Oselysian level	225mmHg~975mmHg, 11 levels are available. Occlusion alarm
Occlusion level	accuracy of the syringe pump ≤±145mmHg.
Purge operation	100.0ml/h(5ml syringe)
	300.0ml/h(10ml syringe)
	600.0ml/h(20ml syringe)
	900.0ml/h(30ml syringe)
	2000ml/h(50/60ml syringe)

Bolus operation  0.10-100.0ml/h(5ml syringe) 0.10-300.0ml/h(10ml syringe) 0.10-900.0ml/h(30ml syringe) 0.10-900.0ml/h(30ml syringe) 0.10-2000ml/h(50/60ml syringe) Automatically calculate the bolus rate by bolus amount, cannot be lower than the current rate.  Bolus VTBI  0.10-5.00ml(5ml syringe) 0.10-10.00ml(10ml syringe) 0.10-20.00ml(20ml syringe) 0.10-30.00ml(30ml syringe) 0.10-50.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml syringe)  Time  00:00:01-99:59:59 (minimum increment: 1s)  Alarm  Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume: 10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function  (optional)  LAN function: Use LAN module to connect the central monitoring system.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Fressure altitude: 57 to 40 °C Humidity:15% to 95% RH, non-condensing Pressure altitude: 57,0kPa-106.0kPa		
0.10-600.0ml/h(20ml syringe) 0.10-900.0ml/h(30ml syringe) 0.10-2000ml/h(50/60ml syringe) Automatically calculate the bolus rate by bolus amount, cannot be lower than the current rate.  Bolus VTBI 0.10-5.00ml(5ml syringe) 0.10-10.00ml(10ml syringe) 0.10-20.00ml(20ml syringe) 0.10-30.00ml(30ml syringe) 0.10-50.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml/60ml syringe) 0.10-50.00ml(50ml/60ml/60ml syringe) 0.10-50.00ml(50ml/60ml/60ml/60ml/60ml/60ml/60ml/60ml/6	Bolus operation	0.10-100.0ml/h(5ml syringe)
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Bolus VTBI  0.10-5.00ml(5ml syringe) 0.10-20.00ml(20ml syringe) 0.10-20.00ml(30ml syringe) 0.10-30.00ml(50ml/60ml syringe) 0.10-50.00ml(50ml/60ml syringe)  Time  00:00:01-99:59:59 (minimum increment: 1s)  Alarm  Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function (optional)  UAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Automatically calculate the bolus rate by bolus amount, cannot
0.10-10.00ml(10ml syringe) 0.10-20.00ml(20ml syringe) 0.10-30.00ml(30ml syringe) 0.10-50.00ml(50ml/60ml syringe)  Time 00:00:01-99:59:59 (minimum increment: 1s)  Alarm Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume: 10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Temperature: 5 °C to 40 °C Humidity: 15% to 95% RH, non-condensing		be lower than the current rate.
O.10-20.00ml(20ml syringe) O.10-30.00ml(30ml syringe) O.10-50.00ml(50ml/60ml syringe) O.10-50.00ml(50ml/60ml syringe)  Time O0:00:01-99:59:59 (minimum increment: 1s)  Alarm Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing	Bolus VTBI	0.10-5.00ml(5ml syringe)
O.10-30.00ml(30ml syringe) O.10-50.00ml(50ml/60ml syringe)  Time O0:00:01-99:59:59 (minimum increment: 1s)  Alarm Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and (optional) infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		0.10-10.00ml(10ml syringe)
Time 00:00:01-99:59:59 (minimum increment: 1s)  Alarm Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists.  Event recording: A maximum of 2000 events can be stored for playback.  Sound volume:10 levels are available  Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function  Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing		0.10-20.00ml(20ml syringe)
Time 00:00:01-99:59:59 (minimum increment: 1s)  Alarm Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		0.10-30.00ml(30ml syringe)
Alarm  Near Finished, Finished, Syringe Empty, Syringe Near Empty, OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function  (optional)  Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		0.10-50.00ml(50ml/60ml syringe)
OCCL, Pressure Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing	Time	00:00:01-99:59:59 (minimum increment: 1s)
Battery, No Power Supply, Syringe Unknown, Syringe Install Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing	Alarm	Near Finished, Finished, Syringe Empty, Syringe Near Empty,
Error, Standby End, Syringe Start Fail (only for SYS-52), Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Special function Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists. Event recording: A maximum of 2000 events can be stored for playback. Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		OCCL, Pressure Alarm, Low Battery, Battery Empty, No
Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists.  Event recording: A maximum of 2000 events can be stored for playback.  Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Battery, No Power Supply, Syringe Unknown, Syringe Install
Special function  Repeat alarming: After the sound of an alarm is muted, this alarm is reported again two minutes later if it persists.  Event recording: A maximum of 2000 events can be stored for playback.  Sound volume:10 levels are available  Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function  Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 ℃ to 40 ℃  Humidity:15% to 95% RH, non-condensing		Error, Standby End, Syringe Start Fail (only for SYS-52),
alarm is reported again two minutes later if it persists.  Event recording: A maximum of 2000 events can be stored for playback.  Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Reminder Alarm, Tube Off(only 30, 50/60 ml syringe)
Event recording: A maximum of 2000 events can be stored for playback.  Sound volume: 10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing	Special function	Repeat alarming: After the sound of an alarm is muted, this
playback.  Sound volume:10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		alarm is reported again two minutes later if it persists.
Sound volume: 10 levels are available Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and (optional) infusion information network.  LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Event recording: A maximum of 2000 events can be stored for
Power supply switching: When AC/DC power supply is cut off, the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		playback.
the infusion pump automatically switches to built-in battery supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Sound volume:10 levels are available
supply.  WIFI function Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function LAN function: Use LAN module to connect the central monitoring system.  Drug Library A maximum of 2,000 drug types can be stored.  Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		Power supply switching: When AC/DC power supply is cut off,
WIFI function  (optional)  Connect to the central monitoring system, nurse pager, and infusion information network.  LAN function  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing		the infusion pump automatically switches to built-in battery
(optional) infusion information network.  LAN function  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing		supply.
LAN function  LAN function: Use LAN module to connect the central monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing	WIFI function	Connect to the central monitoring system, nurse pager, and
monitoring system.  Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing	(optional)	infusion information network.
Drug Library  A maximum of 2,000 drug types can be stored.  Operating conditions  Temperature: 5 °C to 40 °C  Humidity:15% to 95% RH, non-condensing	LAN function	LAN function: Use LAN module to connect the central
Operating conditions Temperature: 5 °C to 40 °C Humidity:15% to 95% RH, non-condensing		monitoring system.
Humidity:15% to 95% RH, non-condensing	Drug Library	A maximum of 2,000 drug types can be stored.
	Operating conditions	Temperature: 5 $^{\circ}$ C to 40 $^{\circ}$ C
Pressure altitude: 57.0kPa-106.0kPa		Humidity:15% to 95% RH, non-condensing
		Pressure altitude: 57.0kPa-106.0kPa

Operating Altitude	Not higher than 5000m
Storage and Shipping	Temperature: $-20~\mathrm{C}$ to $+55~\mathrm{C}$
conditions	Humidity: 10% to 95% RH, non-condensing
	Pressure altitude:22.0kPa-107.4kPa
Classification	<ol> <li>Class I/Internally powered equipment;</li> <li>Defibrillation-proof type CF applied part;</li> </ol>
	3. IP34;
	4. No sterilization requirement for pump
	5. Not category AP/APG equipment;
	6. Mode of operation: continuous
Dimensions	SYS-50: 362 x 126 x 151 mm (L x W x H)
	SYS-52: 366 x 148 x 216 mm (L x W x H)
Weight	SYS-50:About 1.8 kg (standard configuration)
	SYS-52:About 3.0 kg (standard configuration)
Service Life	10 years
Main safety	IEC60601-1 Medical electrical equipment-Part 1: General
standards	requirements for basic safety and essential performance
	IEC60601-2-24 Medical electrical equipment-Part 2-24:
	Particular requirements for the safety of infusion pumps and
	controllers
	IEC60601-1-8 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
	IEC60601-1-2 Medical electrical equipment-Part 1-2: General
	requirements for basic safety - Collateral standard:
	Electromagnetic compatibility requirements and tests
	EN 1789:2007+A2:2014(E) Medical vehicles and their
	equipment — Road ambulances

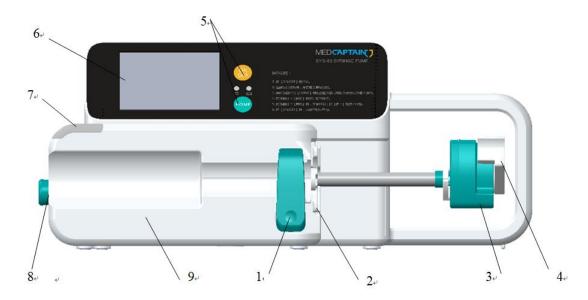
## **4 Product Description**

### 4.1 Operating Principle

The SYS-50/52 syringe pump mainly consists of the pump shell, display and operating system, monitoring system, alarm system, motor drive system, drive module, power supply system, WIFI communication module (optional), LAN communication module, and pole clamp (optional).

The SYS-50 syringe pump adopts a dual-processor structure (the SYS-52 adopts a four-processor structure), controls the motor precisely, drives the peristaltic sheet to infuse through the mechanical drive device, monitors the sensors and infusion process, and provides sound-light alarm signal.

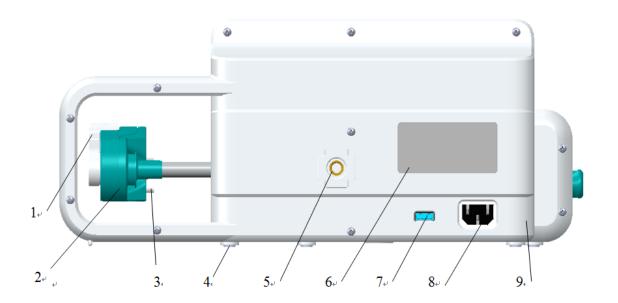
## 4.2 Composition of Syringe Pump SYS-50



- 1 Clamp
- 3 Slider
- 5 Operation button
- 7 Alarm indicator
- 9 Front housing

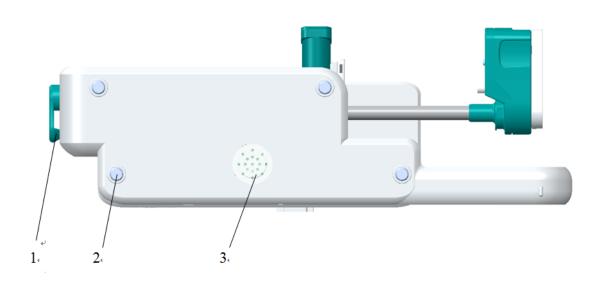
- 2 Syringe fixation
- 4 Clutch
- 6 Touchscreen
- 8 Tube clamp

# **Product Description**



- 1 Clutch
- 3 Syringe clamp
- 5 Threaded hole
- 7 External inlet
- 9 Back housing

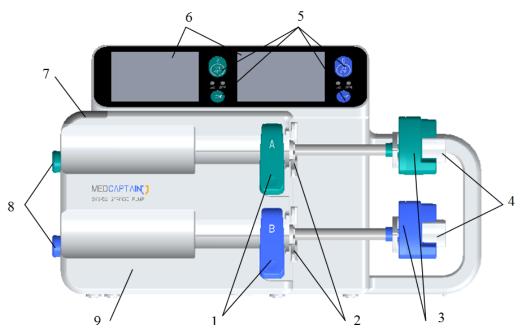
- 2 Slider
- 4 Floor mat
- 6 Label
- 8 AC power inlet



- 1 -Tube clamp
- 3 Buzzer

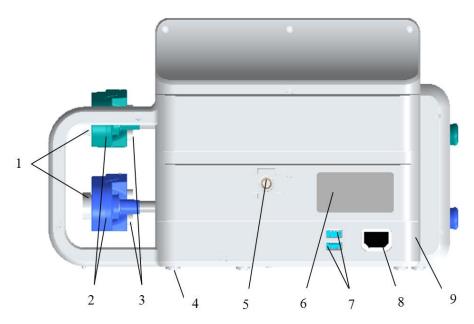
2 - Floor mat

# 4.3 Composition of Syringe Pump SYS-52



- 1 Clamp
- 3 Slider
- 5 Operation button
- 7 Alarm indicator
- 9 Front housing

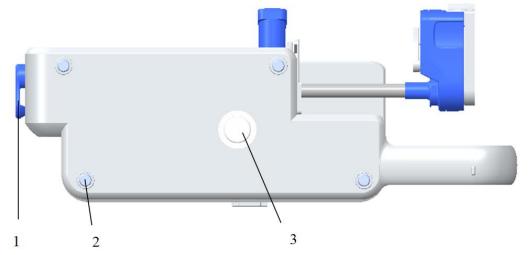
- 2 Syringe fixation
- 4 Clutch
- 6 Touchscreen
- 8 Tube clamp



1 - Clutch	2 - Slider
3 - Syringe clamp	4 - Floor mat
5 - Threaded hole	6 - Label

## **Product Description**

7 - External inlets	8 - AC power inlet
9- Back housing	



1 - Tube clamp	2 - Floor mat
3 - Buzzer	

# A CAUTION:

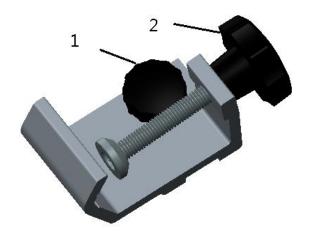
- Additional equipment connected to medical electrical equipment through the network/data coupling (USB or LAN port) must comply with the respective IEC or ISO standards (e.g. IEC 60950 and IEC 62368-1 for data processing equipment). In addition, all configurations shall comply with the requirements for medical electrical systems (see clause 16 of the 3Ed. of IEC 60601-1, respectively).
- Do not insert accessories not specified by the manufacturer into the external inlets.
- Anybody connecting additional equipment to medical electrical equipment configurations a medical system and is therefore responsible that the system complies with the requirements for medical electrical systems. Attention is drawn to the fact that local laws take priority over the above mentioned requirements. If in doubt, consult your local representative or the technical service department.
- The plug is used as disconnect device to the mains supply, do not to position the pump so that it is difficult to operate the disconnection device.

## **WARNING:**

SYS-52 is a dual-channel pump with two channels (channel A and channel B).
 There are also two screens, with the left screen designated for channel A and the right screen for channel B.

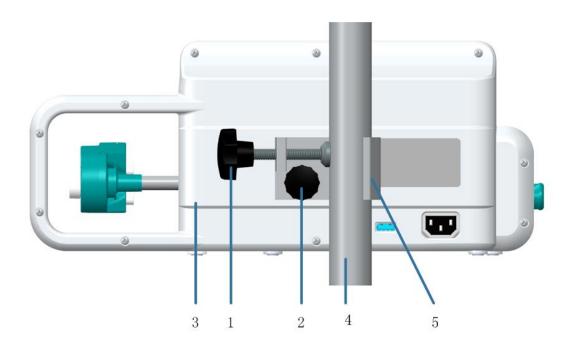
• Please confirm the parameter on the relative screen before injection.

## 4.4 Pole Clamp



1 - Mounting screw

2 - Mounting knob of infusion stand



- 1 Mounting knob of infusion stand
- 2 Mounting screw

3 - SYS-50 pump

4 - Drip stand

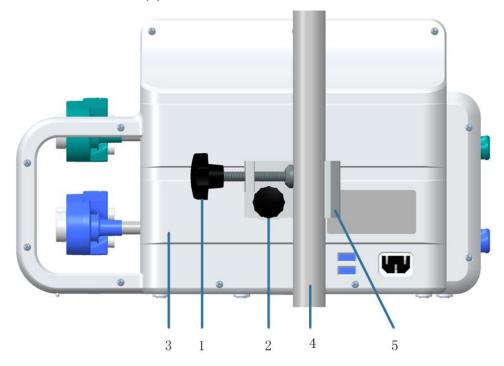
5 - Pole Clamp

Installation method depicted above:

1. Affix the mounting screw (2)into the threaded hole in the back of SYS-50 pump.

## **Product Description**

2. Hold the handle, and affix the pump to the drip stand (4)by tightening the mounting knob of infusion stand(1).



- 1 Mounting knob of infusion stand
- 2 Mounting screw

3 -SYS-52 pump

4 - Drip stand

5 - Pole Clamp

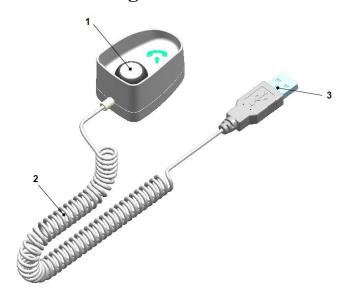
Installation method depicted above:

- 1. Affix the mounting screw (2) into the threaded hole in the back of SYS-50/52 pump.
- 2. Hold the handle, and affix the pump to the drip stand (4) by tightening the mounting knob of infusion stand(1).

### Note:

- The diameter of the drip stand should be 16~36mm. Any size beyond this range may cause insecure installation.
- Please ensure that the floor is solid and level. Don't fix other equipment on the IV
  pole to prevent the pole from falling over.
- During installation, ensure that the knob and mounting screw are tightened up.

## 4.5 Nurse Pager



1 - Button

2 - Cable

3 - Socket

## 4.6 Accompanying Accessories

1 - AC power cable x 1

2 - Pole clamp x 1

3 - Operation manual x 1

4 - Quick operation guide x 1

5 -Packing list x 1

# 4.7 Optional Accessories

Table 4-1 List of Optional Accessories

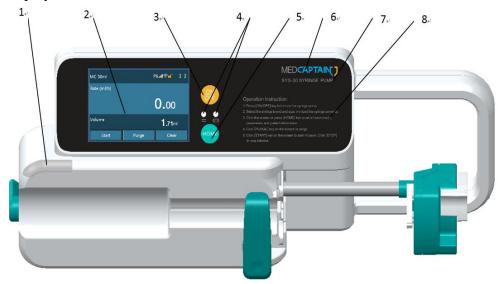
Options	Description
Power cable	Standard configuration by factory
Lithium battery pack	10.8V@2600mAh
Nurse pager	MP-2
Pole clamp	
LAN Module	LAN Communication Module
DC power cable	_

### 5 Preparations for Use

- Before using the syringe pump, read the operation procedures and precautions in this manual carefully.
- Before using the syringe pump for the first time, set the date and time to ensure that the pump history will be recorded correctly.
- Before using the syringe pump for the first time, select the brand of the syringe.
- Before using the syringe pump for the first time, recharge the built-in battery fully. If the syringe pump is off, the battery should be charged fully after being connected to an external power supply.
- Place the syringe pump on a stable platform.
- Alternatively, use the provided pole clamp to mount the syringe pump on an infusion stand.
  - Put the syringe pump on the pole clamp while aligning the retaining knob with the threaded hole, and rotate the handle to fix the syringe pump on the pole clamp.
  - Clamp the pole clamp on the infusion stand, adjust the syringe pump to an appropriate position, and tighten the retaining knob for infusion stand on the pole clamp.
- Connect external power supply.
  - Insert the supplied AC power cable into the AC inlet on the Left side of the syringe pump. Plug the cable into an AC power outlet with grounding terminal.
  - To power the syringe pump with external DC power supply, contact your local distributor for help.

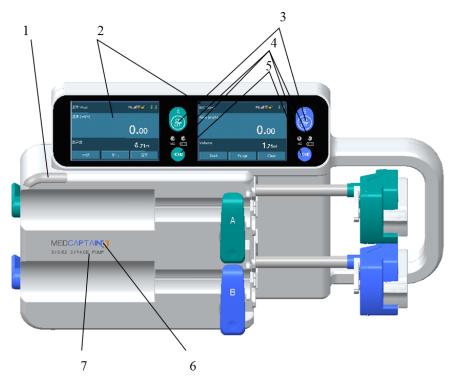
# **6.1 Display and Buttons**

• Display of SYS-50



1 - Alarm indicator	2 - TFT touchscreen
3 - ON/OFF button	4 - Indicator
5 - Home button	6 - Logo
7 - Product model	8 - Operation instruction

### • Display of SYS-52



1 - Alarm indicator	2 - Touchscreen
3 - ON/OFF button	4 - Indicator
5 - Home button	6 - Logo
7 - Product model	

The alarm indicator indicates alarms in two colors: red and yellow. This indicator indicates the alarm severity (high, medium, or low) by using different blinking methods. Green light indicates a correct function.

TFT touchscreen, resolution: 480\*320

Indicator: The AC/DC indicator on the left, the battery indicator on the right.

- AC/DC indicator: Used to indicate the AC or DC power status. This indicator is steady green when the device is connected to an AC or DC power supply.
- Battery indicator: Used to indicate the battery status. The battery indicator is steady green when the battery is being charged and blinking green when the battery is powering the device. Otherwise, the battery indicator is extinguished.

The display is divided into three areas: information area, work data area and function button area. See below for further description and explanation.

• Information area: Displays the syringe brand and specifications, occlusion pressure level, real-time pressure, external power supply, battery volume, and WIFI signal. Touch the brand and specifications zone to enter the page for syringe brand adjustment. Touch the occlusion pressure level to enter the page for occlusion level selection.



See below for further description.

**P2**Occlusion pressure level: 2

Real-time occlusion pressure. Five bars in total. A large number of illuminated bars indicates a higher pressure.

- External power source symbol. This symbol is displayed when the pump is connected to an external AC/DC power source.
- Screen lock symbol. Two states exist: lock and unlock.
- Battery volume and charging status. Four bars in total. A large number of illuminated bars indicates a higher remaining capacity.



Work data area: Displays the current infusion rate, and infusion volume or displays different infusion work data based on different infusion modes. The work data can be adjusted by touching the specific zone in different working modes.



Function button area: Displays such buttons as [Start], [Purge], [Clear], [Stop], and [Bolus]. Setting buttons such as numbers and letters appear on corresponding interfaces.



#### Buttons

In addition to touchscreen buttons, two buttons are available on the button panel: [HOME] and [ON/OFF].

■ [HOME]: Main menu button. Before infusion, press [HOME] once to enter a setting menu, such as Infusion set, System Set, History, Patient File, etc. To

- return to the infusion preparation screen, press [HOME] once again on any setting interface.
- [ON/OFF]: Button for switching on/off the pump. When the pump is off, press [ON/OFF] to switch it on. When the pump is on, press [ON/OFF] and tap the shutdown button on the display to shut down the pump or press and hold [ON/OFF] for 3 seconds to shutdown the pump forcibly.

### 6.2 Powering On the Pump



- Power on the pump and then install the syringe.
  - Press [ON/OFF] to switch it on.
  - The self-test starts.
  - After self-test finishes, the infusion preparation screen is displayed.
  - The screen displays patient information, syringe brand and occlusion level stored last time when the device is powered off.
  - If the self-test is abnormal, corresponding information is displayed in the information area.

Infusion preparation screen:

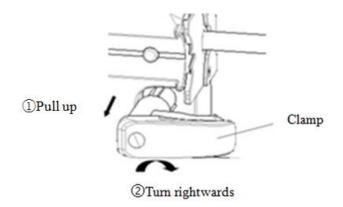




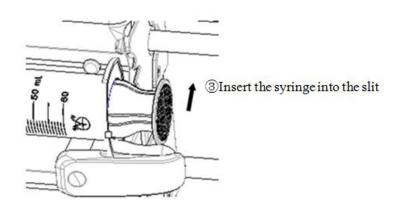
- After the pump is powered on, confirm that the loudspeaker and alarm indicator work properly. Check after the self-test is finished that no error messages appear. (Refer to Chapter 8 Troubleshooting.)
- Confirm that the syringe brand displayed is consistent with the brand of the syringe actually used.
- If the syringe brand set differs from the brand of the syringe actually used, the infusion accuracy and alarm function cannot be guaranteed.
- The total volume is cleared when the [Clear] button is tapped.

## **6.3 Syringe Installation**

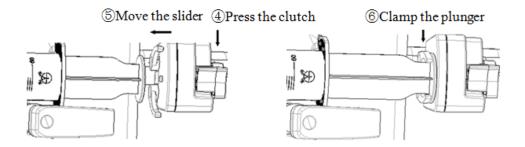
• Pull the clamp and turn it rightwards (①/②)



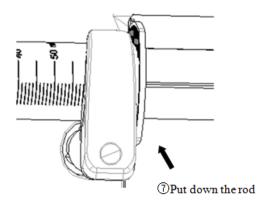
- Press the clutch and move the slider fully to the right.
- Attach the syringe. Insert the flange of the syringe into the slit (3)



Press the clutch, and move the slider until the contact pin of the slider hits the syringe plunger. (4/5)



■ Turn back the clamp and lower it slowly to hold the syringe securely (⑦).





- Ensure that no air bubble exists in the syringe.
- If the syringe flange is not properly installed in the slit, flow rate accuracy and alarm function cannot be guaranteed.

### 6.4 Purging



- After installing a syringe on the syringe pump, remove the air bubbles from the syringe IV line.
- Before purging the IV line, ensure that the IV line is not connected to a patient.
- Purging can be done only in non-infusion condition.
- Stop purging after ensuring that liquid is drained out from the needle.



- Tap [PURGE], the purge interface pops up. Tap [Stop], the purging stops.
- The green indicator flashes during purging.
- The purging rate varies with the syringe size. Refer to Table 6-1.

Table 6-1 Relationship between syringe size and purging rate

Syringe size	Purging rate (ml/h)
5	100.0

10	300.0
20	600.0
30	900.0
50/60	2000



- When high viscosity IV fluids are infused through a thin vein needle for purging, an occlusion alarm may be generated. In this case, please reduce the infusion rate manually.
- The volume used for purging will be added to the total volume delivered.
- The fast forward function can be used to remove any mechanical gap. If purging is not performed, a considerable delay may be incurred in the start of the infusion.
- Total volume cannot be cleared after the infusion starts without stopping the infusion.
- The volume under the fast forward function will not be calculated into the total volume.

## **6.5** Setting the Infusion Rate

• Tap the rate area on the touchscreen to enter the setting interface.



- Input the flow rate, and then tap [Confirm] to return to the infusion preparation screen.
- The flow rate varies with different syringe sizes. For details, see Table 6-2. Table 6-3 lists the relationship between the rate range and minimum increment.

Table 6-2 Relationship between syringe size and rate

Syringe size (ml)	Setting range (ml/h)
5	0.10-100.0
10	0.10-300.0
20	0.10-600.0
30	0.10-900.0
50/60	0.10-2000

Table 6-3Relationship between rate range and the minimum increment

Rate range(ml/h)	Minimum increment(ml/h)
0.10 - 99.99	0.01
100 - 999.9	0.1
1000 - 2000	1



- When a syringe of a different size is installed and the flow rate is out of range, please reset the rate to its maximum valid rate.
- To change the flow rate in the infusion process, the infusion does not need to be stopped. After changing the infusion rate and confirming the change during infusion, subsequent infusion is performed at the rate after the change.

### 6.6 Puncture

Insert the vein infusion needle into the patient's vein.

### **6.7 Starting Infusion**

Tap the [Start] button to start infusion at the setting rate. The green indicator light illuminates.



- Infusion can be started only when the prescribed values on the prescription are the same as the values set on the syringe pump.
- If no operation is performed after syringe installation for more than 2 minutes, the START-REMINDER alarm is generated.

## **6.8 Changing Rate During Infusion**

• Tap the rate display area on the screen during infusion.

## **Operating Instructions**



• After entering the rate and tapping [Confirm], the system returns to the original infusion interface and operates at the new rate; if you tap [Cancel], the system returns to the original infusion interface without change.



• If no operation is performed on the reference or rate setting interface for more than 10 seconds, the system returns to the infusion interface automatically.

#### 6.9 Bolus

• Choose "Manual Bolus", and set "Manual Bolus Limit". During the infusion, tap [Bolus] for 1s to enter the bolus interface. Bolus will continue as long as the button is pressed and will stop immediately when the button is released. The pump automatically stops manual bolus when reaching the manual bolus limit even if the user keeps on holding the button.

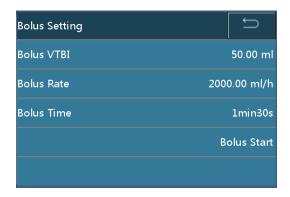


• Choose "Rapid quantitative Bolus", during the infusion, tap [Bolus] to enter the bolus VTBI interface, set the bolus volume, tap [Confirm] to start and tap [Bolus Stop] to stop the bolus and return to infusion interface.





• Choose "Automatic Bolus", during infusion; tap [Bolus] to enter the bolus setting interface. Set any two of Bolus VTBI, Bolus rate and Bolus Time, tap [Bolus Start] to enter the bolus interface, tap [Bolus Stop] to stop the bolus





Bolus rates are different depending on the syringe specification as follows.

Table 6-4Relationship between syringe size and bolus rate

Syringe size	Bolus rate	Minimum bolus	Maximum bolus
(ml)	(ml/h)	volume(ml)	volume(ml)
5	0.10 ~ 100.0	0.1	0.10 ~ 5.00
10	0.10 ~ 300.0	0.1	0.10 ~ 10.00
20	0.10 ~ 600.0	0.1	0.10 ~ 20.00
30	0.10 ~ 900.0	0.1	0.10 ~ 30.00
50/60	0.10~ 2000	0.1	0.10 ~ 50.00



- Current bolus volume is displayed when bolus is running.
- Bolus volume will be accumulated into the total volume.

## **6.10Stopping Infusion**

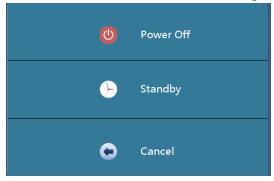
In the infusion process or after infusion, tap [Stop] to stop the operation.

## 6.11 Replacing Syringe

If the amount of solution in the syringe is getting low, repeat the steps in sections 6.3-6.6 to replace the syringe.

## **6.12Powering Off the Pump**

• Press the [ON/OFF] button, and tap [Power Off], [Standby] or [Cancel].



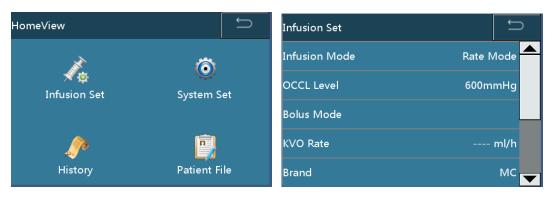
- Tap [Power Off] to shut down.
- Tap [Standby] to enter standby interface. The standby time can be modified.
- Tap [Cancel] to return to the previous interface.



- After the pump is powered off, all parameter settings will be automatically saved.
- Parts of parameters will not be saved if the device is forcibly shutdown.

## 7.1 Infusion Setting

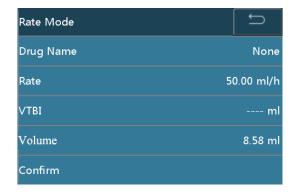
Press the [HOME] button to enter the setting interface, tap [Infusion Set] to enter the detailed infusion setting interface. Infusion Mode, OCCL level, bolus mode, KVO rate, brand, relay set, micro mode, near finished and recent therapy can be set and adjusted here.



#### 7.1.1 Infusion Mode

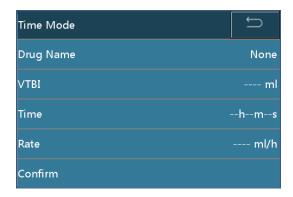
- Seven infusion modes are available: Rate, Time, Weight, Trapezia, Loading Dose, Sequence, and TIVA.
  - Rate mode

In Rate Mode, set the drug name, rate, and VTBI and tap [Confirm] to operate.



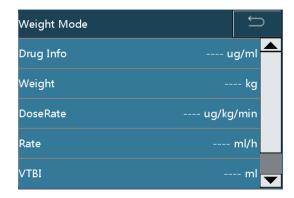
#### ■ Time mode

In time mode, set the drug name, VTBI, and Time and tap [Confirm] to operate.



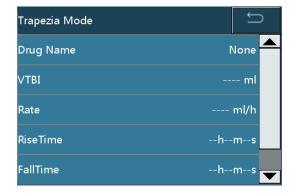
#### ■ Weight mode

In Weight mode, set the drug Info, Dose Rate, Weight, and VTBI, wait for the device to calculate the rate automatically, and then tap [Confirm] to operate.



#### Trapezia Mode

In Trapezia mode, set the drug name, VTBI, rate, rise time, and fall time, wait for automatic calculation of the rate, and then tap [Confirm] to operate.



#### ■ LoadingDose Mode

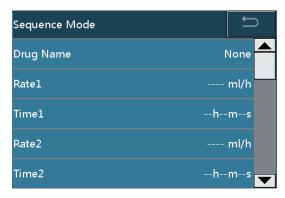
In LoadingDose mode, set the drug name, VTBI, maintain rate, loading rate, and loading time, wait for automatic calculation of the rate, and then tap [Confirm] to operate.



#### Sequence Mode

In Sequence Mode, set the drug name, 10 groups of sequence rate, and time and tap [Confirm] to operate in sequence.

Note: A sequence for which only the time is set but rate is not set is supported, which functions as a paused sequence of the infusion process.



#### TIVA Mode

In TIVA mode, set the drug info, loading dose, loading time, dose rate, and weight, wait for automatic calculation of the rate, and then tap [Confirm] to operate.



#### 7.1.2 Occlusion Level

• Eleven occlusion levels are available (Factory setting is level 6).

Table 7-1 Relationship between occlusion level and pressure

Occlusio n level	Display	Pressure (mmHg)	Pressure (kPa)	Pressure (bar)	Pressure (psi)
1	P 1	225	30	0.3	4.35
2	P 2	300	40	0.4	5.80
3	P 3	375	50	0.5	7.25
4	P 4	450	60	0.6	8.70
5	P 5	525	70	0.7	10.15
6	P 6	600	80	0.8	11.60
7	P 7	675	90	0.9	13.05
8	P 8	750	100	1.0	14.50
9	P 9	825	110	1.1	15.95
10	P 10	900	120	1.2	17.40
11	P 11	975	130	1.3	18.85



- When an occlusion alarm is generated, the motor automatically rotates inversely to release the pressure in the tube (Anti-Bolus function), so that no extra bolus will be infused during the operation of clearing the occlusion alarm.
- When you infuse viscous solutions with the Occlusion Level setting under 4 and the tubing is clear, occlusion alarm tends to be generated. Carefully observe the symbol in the upper information area, and change the occlusion level if more than 2 bars are illuminated.
- When you operate the pump with the Occlusion Level setting over 8, the in-line pressure builds up substantially until Occlusion alarm is generated. Always make sure that the IV line is securely connected to the syringe.
- An occlusion alarm may be generated when high-viscosity liquid is infused at high rate through a thin intravenous needle. In this case, increase the occlusion level or decrease the infusion rate.

#### 7.1.3 Bolus Mode

• Three bolus modes are available: Manual Bolus, Rapid quantitative Bolus and Automatic Bolus. Please refer to chapter 6.9 for further instructions.

#### 7.1.4 KVO

- KVO-rate can be adjusted from 0.1ml/h to 5ml/h (adjustment step: 0.01ml/h). The default rate is 1ml/h.
- Set the rate to 0.00 ml/h to disable the KVO function.



• KVO is initiated when the VTBI or infusion time is reached.

#### **7.1.5 Brand**

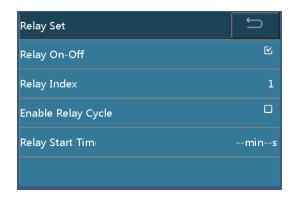
- You can choose the consumable brand in the following sequence: [Home]->[Infusion Set]->[Brand].
- Several brands of syringes of 5ml, 10ml, 20ml, 30ml, and 50/60ml have been preset and customized. Select the syringe accordingly for clinical use.



- Users must use the consumable brand which is specified by the manufacturer.
- To add in syringes of other brand, users are strongly recommended to contact the manufacturer or manufacturer's representative to set and test, so as to ensure the infusion accuracy.
- This syringe pump supports at least 30 syringe brands, and each brand includes 5 different sizes of syringes.

## 7.1.6 Relay Set (only for SYS-52)

• In relay mode, switch on relay, set the relay number, select Enable Relay Cycle, and set Relay Start Time.





- The relay number must be set in sequence from number 1.
- Relay Start Time is the time from completion of injection by a pump to start of injection by the next pump. Please set this parameter based on clinic requirement.

## 7.1.7 Micro Mode Setting

• After Micro Mode is selected, the maximum rate in Micro mode can be adjusted.



#### 7.1.8 Near Finished

• The Near Finished alarm is generated when infusion is almost completed. The duration from generation of this alarm to infusion completion can be adjusted from 1 min to 30 min (adjustment step: 1 min). By default, this alarm is generated 3 minutes before infusion completion.

## 7.1.9 Recent Therapy

• The therapies of the recent 20 times are recorded. The recorded therapy can be started directly by simple selection.

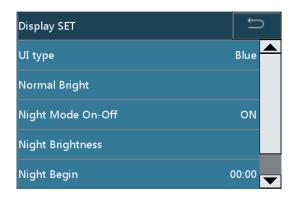
## 7.2 System Set

#### 7.2.1 Volume Set

• Ten volume levels are available (the factory setting is level 5).



- Do not set the alarm volume to a level lower than the ambient noise to ensure that alarms can be recognized correctly in time.
- The alarm system may fail when the alarm volume is set to an extreme value. Check alarm limit values based on clinical conditions.



## 7.2.2 Display Set

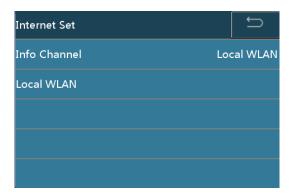
- Seven different color options are available for UI type.
- The brightness could be adjusted in [Normal Bright].
- All the parameters of the night mode could be adjusted here.



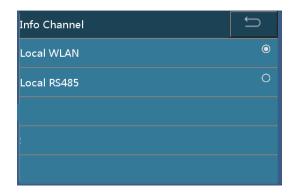
• In night mode, the setting range of start time is 17:00-09:00, and the setting range of finish time is the same as that of start time. By default, the start time is 00:00 and finish time is 00:00.

#### 7.2.3 Internet Set

[Info Channel] and [Local WLAN] can be chosen and set.

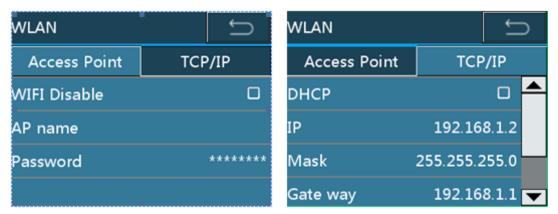


- Tap [Info Channel] to choose the channel type.
  - Choose [Local WLAN] to use local WLAN channel to connect to the network, and the local WLAN parameters can be set.
  - Choose [Local RS485] to use local RS485-LAN cable to connect to the network.





- The setting of [Local WLAN] and [Local RS485] must be done by the manufacturer's representatives. Please contact manufacturer or local distributer for further information.
- Only accessories or devices supplied or specified by the manufacturer are allowed to be connected to the pump. Otherwise, pump exception and other unpredictable hazards may be incurred.
- Tap [Local WLAN] to set the WLAN parameters.



• [WIFI Disable] must be deselected, the AP name of the network must be input, and the TCP/IP's information must be set.

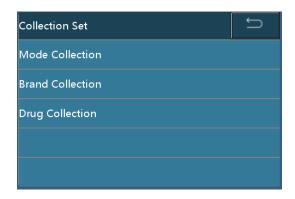
#### 7.2.4 Lock screen Set

- Tap [Screen Lock Password] to enable/disable the screen lock password function. When the function is enabled, a password is required to unlock the screen. When the function is disabled, no password is required to unlock the screen.
- Tap [Auto Lock] to set the screen auto lock function. This function could be set to: OFF, 15s, 30s, 1min, 2min, 5min, 10min, or 30min. The default value is OFF, indicating that the screen auto lock function is disabled.



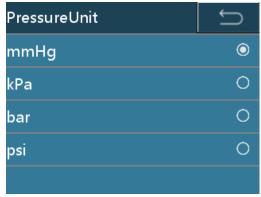
#### 7.2.5 Collection Set

- [Mode Collection]: Choose the frequently used infusion mode from the [Infusion mode] option. Once the frequently used infusion modes are chosen, the unnecessary modes will not appear in the list of 7.1.1 [Infusion mode] option. The default setting is "all the seven infusion modes are chosen", including Rate mode, Time mode, Weight mode, Trapezia mode, LoadingDose mode, Sequence mode and TIVA mode.
- [Brand Collection]: Choose the frequently used infusion set's brand from the [Brand] option. Once the frequently used brands are chosen, the unnecessary brands will not appear in the list of 7.1.5 [Brand] option. The default setting is "all the preloaded brands are chosen"
- [Drug Collection]: Choose the frequently used drugs from the drug library. Once the frequently used drugs are chosen, the chosen drugs will be shown on the top of the drug library list. The default setting is "none of the drug is chosen". The data of the drug library is not edited by the manufacturer.



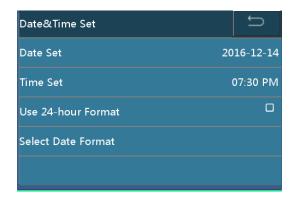
#### 7.2.6 Pressure Unit

• Choose the measurement unit for the pressure. The optional units are: mmHg, kPa, bar and psi. The default setting is mmHg.



#### 7.2.7 Date&Time Set

• Set the date, time, and their format.



#### 7.2.8 Maintenance

- Tap [Maintenance] option to do the [Language Select], [Touch Adjust], [Factory
   Data Reset], [Local Set]and check the version information.
- To check the version information, follow the route of: [Home] -> [System Set] -> [Maintenance] -> [Version Info].

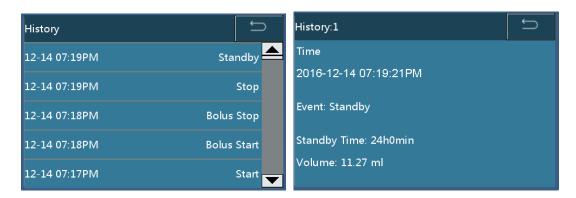
#### **7.2.9 Alarm Set**

- The parameters on [Alarm Set] include [Reminder Alarm], [Near Finished], and [Tube Off].
- [Reminder Alarm] provides two alarm levels: [Low] and [Middle]. The default level is [Low].
- [Near Finished] provides two alarm levels: [Low] and [Middle]. The default level is [Low].
- [Tube Off] provides two options: enable and disable. You can select this item to enable the Tube Off alarm.



 Alarm setting must be performed by professional technicians of the local distributor to ensure the alarm system priority of the device.

## 7.3 History



The history records are listed in Table 7-2.

Table 7-2 History records

Event	Record Parameters
Start up	Occurrence time
Shutdown	Occurrence time
Standby	Occurrence time, standby set time
Start	Occurrence time, rate, Volume
Bolus	Occurrence time, Bolus rate, Bolus way
Bolus stop	Occurrence time, Bolus rate, Bolus accumulated volume
Stop	Occurrence time, rate, accumulated volume
KVO	Occurrence time, accumulated volume, KVO rate
KVO stop	Occurrence time, KVO rate, KVO accumulated volume

Event	Record Parameters
Flow rate change	Occurrence time, Flow rate before and after change
Alarm	Occurrence time, alarm event, system trouble with trouble code
Purge	Occurrence time, purge rate, accumulated volume
Purge stop	Occurrence time, purge rate, purge accumulated volume



- When the syringe pump loses the power (both the mains supply and internal power supply), the alarm log will be auto saved in the memory and always saved no matter when the power is resumed. The system will auto load such alarm log upon power resumption.
- A maximum of 2000 history records can be saved. When the record number reaches the storage limit, the earliest record will be replaced by the new one.
- Alarm system can't be powered off separately by an operator unless the pump is powered off. The time of powering off is captured in the history records.

#### 7.4 Patient File

Tap [Patient File] to enter the patient file page. The [Department], [Room No.],
 [Bed No.] and [Patient Data] could be set up.



• Tap [Patient Data] option to enter patient data setting page. Choose [New] to build a new patient data and the previous patient data will be cleared automatically. Choose [Modify] to modify the current patient data.



## 7.5 Use Built-in Battery

- If no AC/DC power supply is available, the built-in battery powers the pump.
- When external power stops working, the built-in battery starts and the yellow indicator illuminates(low level alarm) with a short alarm sound.
- Before using the pump for the first time or using the pump after the pump is not used for a long time, please fully charge the battery.
- The approximate remaining power in the built-in battery is displayed by [battery] indicators. During battery operation, battery discharged is shown by a decreasing number of active indicators.
- When the syringe pump is connected to any external AC or DC power supply, the charging of the built-in battery starts automatically. When a battery is charging, a lightning symbol will be displayed at the left side of the battery symbol on the screen.

# A CAUTION:

- If AC or DC power is connected, the battery will be recharged automatically.
- Use AC power to charge the battery. If recharged by an external 12 VDC power supply, the battery cannot be fully charged (50% at most).
- SYS-52 only working with one channel (A or B), the duration of battery will be double.
- During infusion, when the pump is powered by the built-in battery, if a low-battery alarm occurs, tap [SILENCE] to silence the alarm. The alarm will repeat in two minutes, connect the pump to AC/DC power supply immediately. If battery empty alarm occurs, the silence does not function and syringe pump will stop.
- 3 minutes before the battery empty, the pump will automatically power off.

- The actual battery duration may be different and affected by the ambient temperature, flow rate, external communication, etc.
- If the battery is aging, the actual battery duration may be shorter. Periodically check the battery.
- The battery should be replaced with new one every two years to ensure the battery operation time.

# 7.6 Connecting to the Infusion Central Monitoring System (Optional)

Syringe pumps can be connected to the Infusion Central Monitoring Systemwhich can obtain performance data of all connected pumps remotely.



 Syringe pump cannot be operated through the Infusion Central Monitoring System.

## 7.7 Nurse Pager (Optional)

After syringe pump is connected to the central monitoring system, patient can press nurse pager in bed, and then the central monitoring system in nurse station would give out a sound tip and display patient's information in the screen, so that the nurse is alerted to the patient's need in time.

#### 7.8 Connect to LAN

Syringe pumps can be connected to the Infusion Central Monitoring System which can obtain performance data of all connected pumps remotely through the LAN communication module. Contact manufacturer or manufacturer's representatives for more details.

## 7.9 Drug Library(Optional)

The syringe pump has a drug library that can store at least 2000 drug types. A user can select the desired drug type from the drug library directly.

## 8 Troubleshooting

#### 8.1 Alarm

The syringe pump provides users with a variety of status information about itself and its injection process. If any abnormality is detected, the syringe pump generates an alarm and notifies users in the form of sound, light, and character.

All the alarms on this pump are of technical type.

Considering the importance of abnormal information, alarm information is classified into three levels from the viewpoint of security: low-level, mid-level, and high-level alarms. For audio and visual expressions of alarms at three levels, see Table 8-1. The alarm volume ranges from 45 dB to 80dB.

Table 8-1 Alarm severity and the audio and visual expressions of each level

Alarm	Sound	Light
Low-level alarm	Give out three beeps at intervals of 25 seconds.	The yellow indicator is steady on.
Mid-level alarm	Give out three beeps at intervals of 15 seconds.	The yellow indicator is flashing.
High-level alarm	Give out a series of beeps at intervals of 15 seconds.	The red indicator is flashing.

When an alarm (except Battery Empty) occurs, tap [SILENCE] to pause the alarm sound. But the buzzer beeps again if you do not eliminate the alarm within 2 minutes.



• The setting of the alarm will be saved when the power is cut. When the pump restarts from a power failure situation, the alarm setting will be reloaded to the system and remains the same as it was before the power failure.



#### WARNING:

• There will be a potential risk if the same or similar devices are using different alarm setting in any specialized region.

## 8.2 Faults and Troubleshooting

Table 8-2 Alarm symptom, alarm level, fault cause, and troubleshooting

Alarm	Alarm level	Causes	Troubleshooting
Symptoms			
No Power Supply	Low-level	No external AC/DC power supply is connected.	Immediately connect the AC power supply or the external DC power supply.
No Battery	Low-level	The syringe pump has no built-in battery or the built-in battery operates abnormally.	Replace the built-in battery.
Low Battery	Low-level	The built-in battery is running critically low.	Immediately connect an AC power supply or an external DC power supply.
Battery Empty	High-level	The battery is completely empty.	Immediately connect an AC power supply or an external DC power supply.
Near Finished	Low-level	The infusion is reached the Near Finished Alarm setting period.	Wait until the infusion finishes.
Pressure Alarm	Low-level	The occlusion pressure is high.	Check the infusion tube, and remove the cause, continue to inject
OCCL	High-level	<ul><li>1.The syringe IV line is occluded.</li><li>2.The OCCL level is too low for high viscosity drug's infusion.</li></ul>	Tap [Stop] to stop the injection. Check and remove the cause, continue to inject.

# Troubleshooting

Alarm	Alarm level	Causes	Troubleshooting
Symptoms			
SyringeNear Empty	Low-level	It takes less than three minutes to complete the infusion.	Wait until syringe is completely empty
Syringe Empty	High-level	The syringe is empty.	Tap [Stop] to clear the alarm.
Syringe Unknown	High-level	Syringe disengagement from slit during infusion.	Tap [Stop] to clear the alarm. Check if the syringe pump clamp or syringe is installed correctly.
Syringe Install Error	High-level	The slider is loose during the infusion or the slider is not installed in a right way.	Tap [Stop] to clear the alarm. Check if the holder is installed correctly.
Finished	High-level	The limit amount or the infusion time is complete	Tap [Stop] to clear the alarm.
Reminder Alarm	Low-level	Forget to operate the alarm (no button operation is made two minutes after the syringe is installed).	Tap any button to clear the alarm.
Standby End	Low-level	Standby mode is ending	Tap cancel to exit Standby mode.
Syringe Start Fail (only for SYS-52)	High-level	Syringe pump cannot be started under the relay mode.	Check the syringe pump, remove the problem that causes the failure to start.
Tube off (only 30, 50/60 ml syringe)	Middle-level	The extension tube of the syringe falls off.	Check whether the tube falls off. If yes, reinstall it. If no, tap [Stop] to eliminate the alarm and continue the infusion.

## 8.3 Errors and Troubleshooting

When the device is faulty, a corresponding error code appears on the interface and at high-level alarm is generated.

Table 8-3 Errors and troubleshooting

Error code	Alarm level	Troubleshooting
Sensor Error	High-level	Record the error code, power off the pump, and
Motor Error	High-level	contact manufacturer or manufacturer's
Circuitry Error	High-level	representatives.
Driver COM	High-level	
Error		
System Error	High-level	

#### 9 Maintenance

## 9.1 Cleaning and Disinfection

- Before cleaning the pump, be sure to turn off the power and disconnect the AC or
   DC power cables, disconnect the device from the patient.
- If any solution spills on the pump or the pump gets heavily soiled, wipe it with a wet soft cloth dampened with cold or lukewarm water.
- Use a piece of dry soft cloth to clean the AC power supply socket, USB socket or the nurse call socket, ensure that the socket is dry before using it.
- If the clamp or clutch needs to be removed for cleaning, contact your local distributor.
- Do not use organic solvent such as alcohol or thinner.
- If disinfection is necessary, use common disinfectors such as
   Chlorhexidinegluconate and Benzalkonium chloride. After using the agent with a
   soft cloth, wipe off it with a soft cloth dampened with water or warm water.

   When using the disinfecting agent, follow the caution of each agent.
- Do not autoclave the syringe pump.
- Never use a dryer or similar device to dry the syringe pump.
- If liquid spills onto the pump, check whether the pump still functions normally.
   Test the insulation and leakage current when necessary.
- Do not soak the syringe pump into water.



• Do not clean or disinfect the pump when it is running.

## 9.2 Periodic Maintenance

Perform a periodic maintenance inspection to ensure safe operation and the longest possible life of the syringe pump, and check the syringe pump once every 2 years. You can maintain some items by yourself and contact your local distributor to maintain some other items. Contact manufacturer or manufacturer's representatives if any doubts remain.

## 9.2.1 Checking the Appearance

- Appearance checking: There are no cracks or damages.
- Button operations: If you can press the buttons smoothly, they are available.

#### 9.2.2 Checking the Power Cable

- Check the appearance of the power cable. If the appearance is damaged and the plug and the socket are in poor contact, contact manufacturer or manufacturer's representatives for replacement in time.
- If you connect the syringe pump to the AC/DC power and there is no indication of powering on, contact manufacturer or manufacturer's representatives for maintenance in time.

#### 9.2.3 Checking the Infusion Rate

• Check the infusion flow once every 2 years by using the graduate and stopwatch. Checking condition:

Syringe	Infusion rate	Infusion time	Volume in graduate
MC /B.Braun50/60ml	60ml/h	10min	9.8-10.2ml

#### **9.2.4 Alarms**

Syringe Unknown

Pull of the syringe clamp during infusion, alarm information will be visible on the display and audible.

Syringe Install Error
 Press the clutch during infusion, alarm information will be visible on the display and audible.

Occlusion

Checking condition:

Syringe	Infusion rate	Occlusion level	Alarm time
MC /B.Braun50/60ml	25ml/h	600mmHg	Within 3 minutes



The syringe pump will perform a power-on self-test for the alarm system once powered on. You can judge whether the alarm system works properly as described below. If no, stop using the syringe pump and contact your distributor for repair soon.

## 9.2.5 Electric and Mechanical Safety

To ensure safety, test the insulation voltage, leakage current and earth resistance according to the IEC 60601-1.

## 9.2.6 Checking the Built-in Battery

#### Maintenance

- Perform the following inspections on the battery every half years, or after the pump is not used for a long time:
- Connect the syringe pump to the AC power supply to fully charge the battery.
- Turn on the power and install the syringe (50/60 ml syringe).
- Set the infusion rate to 5 ml/h and start the infusion. Record the start time.
- Operate the system until it stops infusing due to battery empty alarm.
  - If the continuous operation duration reaches 80% or more of the asserted battery operation time, the battery is in good condition.
  - If the continuous operation duration is shorter than half of the asserted battery operation time, the battery reaches the end of its service life. In this case, you must replace the battery. You are suggested to contact the local distributor for battery replacement.
  - Record how long can the operation last after a Low Battery alarm and Battery Empty alarm are triggered respectively. If the operation lasts for less than 30min after a Low Battery alarm is triggered or lasts for less than 3min after a Battery Empty alarm is triggered, contact the local distributor for battery replacement.
- After the battery level check is completed, recharge the battery for next use.



• Due to the inherent characteristics of aging battery life, to ensure the safety of the use of syringe pumps, after built-in battery is used 2 years, please contact the manufacturer or manufacturer's representative to replace the battery.

## 9.2.7 Replacing the Battery

- Remove the built-in battery.
  - Turn the power off and disconnect the power cable.
  - Use a screwdriver to loosen the battery cover fixing screws between the front panel and real panel.
  - Disconnect the battery cable connector.
  - Remove the battery.
- Install the built-in battery.
  - Insert the new battery into the battery compartment.
  - Insert the connector of the battery cable into the battery
  - Use a screwdriver to tighten the screws between the front panel and real panel.

#### Maintenance



• Replace the battery if the infusion pump is not likely to be used, especially the battery operation time becomes shorter.

# **WARNING:**

- The battery's replacement must be done by specialist who has been trained to perform such operations. The replacement of lithium batteries by inadequately trained personnel could result in an unacceptable risk hazard.
- Please strictly follow the instructions to replace the battery, and the battery should only be provided by the manufacturer. Using other batteries will result in a loss of warranty by the manufacturer as no safe operation can be guaranteed.
- Do not disassemble, short circuit or throw the battery into fire in case of the danger caused by linkage or explosion.
- Please follow local guidelines to dispose of the old battery.
- The battery shall be changed with new one every two years to assure the battery operation time.

#### 9.3 Maintenance

- If any problems arise, explain the situation to the manufacturer or manufacturer's representative and request repair of the pump.
- Never disassemble or try to repair the syringe pump yourself. Doing so may cause a serious malfunction. The manufacturer and the distributor will not take any responsibility for any syringe pump that has been disassembled, modified or used for any purpose other than that for which it is intended.
- If the syringe pump is dropped or subjected to (severe) impact, remove it from service even if it doesn't appear damaged externally. Request the manufacturer or manufacturer's representative to inspect it for any possible internal problem(s).
- When pump is intended used under the road ambulance environment, check the fixation system, maintain system before every use.

# CAUTION:

• Service engineers can request for the related service manual from the manufacturer if needed.



• The accessories' replacement must be done only by a trained service engineer

who has been trained to complete such operations.

• The pump should not be serviced or maintained while in use with the patient.

#### 9.4 Storage

- Avoid water spills.
- Never store in a hot and humid place.
- Store the pump away from excessive vibration, dustand corrosive gas.
- Store the pump out of direct sunlight as ultraviolet ray may result in discoloration.

## 9.5 Transportation

The syringe pump can be transported by common vehicles but should be protected from being hit, shaken, or excessive moisture like direct exposure to rain and snow. Transportation method shall be selected in accordance with the contract specifications specified in the original order of the syringe pumps.

## 9.6 Environmental Protection and Recycling

At the end of the product's service life, please contact the distributor of the product for appropriate recycling. Alternatively, dispose of the product and its battery according to the local laws and regulations.

#### 10 Flow Rate Characteristics

The following test is performed in accordance with the IEC60601-2-24:2012 standard. It is used to observe the infusion accuracy and the occlusion response. (For detailed test conditions, see the IEC60601-2-24:2012 standard.)



- The infusion accuracy and the occlusion response may be affected by the use conditions including the pressure, temperature, humidity, IV set, and infusion tube.
- The infusion accuracy does not reflect the clinical standards, for example, patients' age and weight and medicine taken.
- The experiment data only represents the measurement data in the lab.
- The maximum volume of liquid that might be infused by the syringe pump in a single fault condition must not exceed 5ml.

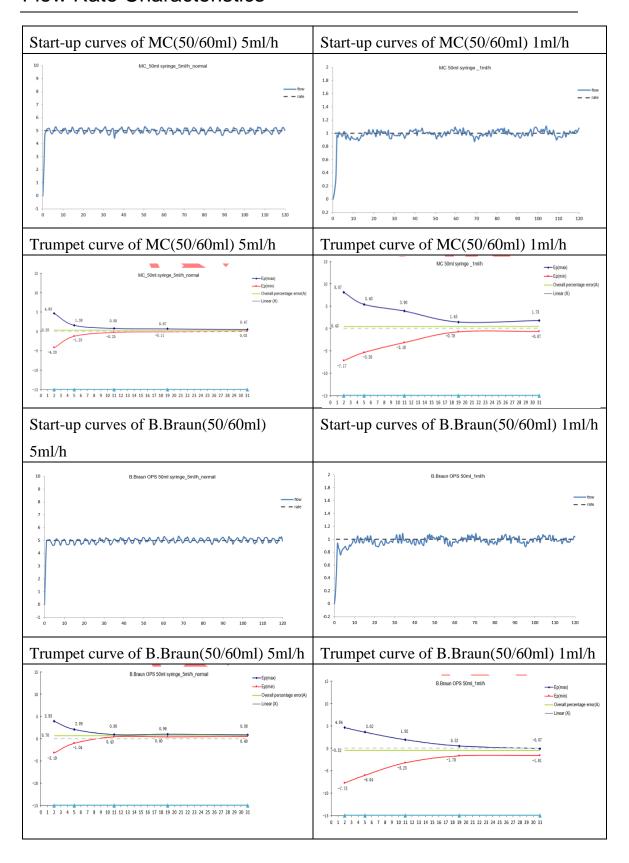
#### 10.1Flow Rate Characteristics

Start-up and Trumpet curves show the characteristics of the syringe pump after the injection begins and the injection changing status after the syringe pump reaches a normal flow rate.

The following test method is performed in accordance with the method mentioned in chapter 201.12.1.102 of the standard IEC 60601-2-24:2012.

- Accuracy test conditions:
  - $\blacksquare$  Temperature: 21 °C;
  - Relative humidity:60%;
  - Syringe type: MC (5ml, 10ml, 20ml, 30ml, 50/60ml), B.Braun (20ml, 50/60ml); 4 sets each.
  - Syringe pump: 1 set
  - Sampling interval: 0.5min
  - Test Period: 120min

#### Flow Rate Characteristics



#### **10.2Occlusion Characteristics**

The occlusion characteristics are described with the longest response time of occlusion alarm and its related bolus volume.

The following test method is accordance with the method mentioned in chapter 201.12.4.4.104 of the standard IEC 60601-2-24:2012.

• Occlusion test conditions:

■ Temperature:  $21 \, \text{°C}$ ;

■ Relative humidity: 65%;

■ Syringe type: MC (50/60ml); 1 set

■ Length of the infusion tube: 1m

Table 10-1The occlusion level, alarm delay time and pill amount under the rate of 5ml/h

Infusion	Occlusion	Occlusion pressure	Occlusion alarm	Bolus
rate	pressure level	(mmHg)	time(hh:mm:ss)	(ml)
5ml/h	P1	225±145	00:09:30	0.08
31111/11	P11	975±145	00:17:28	0.63

Table 10-2The occlusion level and alarm delay time under the rate of 1ml/h

Infusion	Occlusion pressure	Occlusion pressure	Occlusion alarm
rate	level	(mmHg)	time(hh:mm:ss)
1 1/1	P1	225±145	01:00:05
1ml/h	P11	975±145	02:01:38

Table 10-3The occlusion level and alarm delay time under the rate of 0.1ml/h

Infusion rate	Occlusion pressure	Occlusion pressure	Occlusion alarm
illiusion rate	level	(mmHg)	time(hh:mm:ss)
0.11/le	P1	225±145	08:24:20
0.1ml/h	P11	975±145	22:44:13



#### Unit conversion list

Description	Unit	Unit conversion
Pressure	kPa	1kPa=7.5mmHg
	psi	1psi=51.724mmHg
	bar	1bar=750mmHg

IEC 61000-3-3

## **Appendix A Electromagnetic Compatibility (EMC)**

The SYS-50/52 syringe pump conforms to EMC standard IEC 60601-1-2:2014.

ne 5 i 5-30/32 syringe pump conforms to EMC standard IEC 60601-1-2:2014.				
Guidance and manufacturer's declaration – electromagnetic emissions				
The SYS-50/52 syringe pump should be used under the regulation electromagnet				
environment. The user	environment. The user should operate the SYS-50/52 syringe pump under			
following electromagn	et environment.			
Emission	aanfamaanaa	Electrome and anying mant instructions		
measurement	conformance	Electromagnet environment-instructions		
Radio-frequency	Group 1	SYS-50/52 syringe pump only use radio-		
emission		frequency while operating its internal		
CISPR 11		functions, therefore, the radio-frequency is		
		much low and has little interference to the		
		electronic devices nearby.		
Radio-frequency	Class A	The SYS-50/52 syringe pump can be used		
emission		in any building including civil residence.		
CISPR 11				
Harmonic emission	Class A			
IEC61000-3-2				
Voltage fluctuation	conform			
and flashing				
	ĺ			

#### Guidance and manufacturer's declaration – electromagnetic immunity

The [SYS-50/52] is intended for use in the electromagnetic environment specified below. The customer or the user of the [SYS-50/52] should assure that it is used in such an environment.

IMMUNITY	IEC60601test	Compliance level	Electromagnetic
test	level		environment –guidance
Electrostatic	±8 kV contact	±8 kV contact	Floors should be wood,
discharge	discharge	discharge	concrete or ceramic tile. If
(ESD)	±15 kV air	±15 kV air	floors are covered with
IEC 61000-4-2	discharge	discharge	synthetic material, the
			relative humidity should be
			at least 30%.

## Appendix A

Electrical fast	±2 kV power	±2 kV power	Mains power quality
transient(EFT)	cable	cable	should be that of a typical
IEC61000-4-4	±1 kV I/O cable		commercial or hospital
Surge	±1 kV	±1 kV difference	environment.
IEC 61000-4-5	difference mode	mode	
	±2 kV common	±2 kV common	
	mode	mode	
The voltage	0% 0.5 cycle	0% 0.5 cycle	Mains power quality
dropping, short	At 0 °, 45 °, 90 °,	At 0 °, 45 °, 90 °,	should be that of a typical
interruption	135 °, 180 °,	135 °, 180 °,	commercial or hospital
and voltage	225 °, 270 °and	225 °, 270 °and	environment. If the user of
change	315 °,	315 °;	the[SYS-50/52] requires
IEC 61000-4-	0% 1 cycle	0% 1 cycle	continued operation during
11	And 70% 25/30	And 70% 25/30	power mains interruptions,
	cycles	cycles	it is recommended that the
	Single phase: at	Single phase: at	[SYS-50/52] be powered
	0 °	0 °	from an uninterruptible
	0% 300 cycle	0% 300 cycle	power supply or a battery.
Power	30A/m	30A/m	Power frequency magnetic
frequency			fields should be at levels
magnetic fields			characteristic of a typical
(50/60Hz)			location in a typical
IEC 61000-4-8			commercial or hospital
			environment

NOTE U<sub>T</sub> is the AC mains voltage prior to application of the test level.

#### Guidance and manufacturer's declaration – electromagnetic immunity

The [SYS-50/52] is intended for use in the electromagnetic environment specified below. The customer or the user of the [SYS-50/52] should assure that it is used in such an environment.

Immunit	IEC 60601	Compliance	Electromagnetic environment –
y Test	Test Level	Level	guidance
Conduct	3 Vrms	3 Vrms	Portable and mobile RF
ed RF	150 kHz to	150 kHz to	communications equipment should

IEC6100	80MHz;	80MHz;	be used no closer to any part of the
0-4-6	6 Vrms in ISM	6 Vrms in ISM	[SYS-50/52], including cables, than
	bands	bands	the recommended separation
	Between	Between	distance calculated from the
	0.15MHz and	0.15MHz and 80	equation applicable to the frequency
	80 MHz;	MHz;	of the transmitter.
	80% AM at 1	80% AM at 1	Recommended separation distance:
	kHz	kHz	$d = 1.2\sqrt{P}$
Radiated	3 V/m	3 V/m	$d = 1.2\sqrt{P}$ 80M~800MHz
RF	80 MHz – 2.7	80 MHz – 2.7	$d = 2.3\sqrt{P}$ 800M~2.5GHz
IEC6100	GHz;	GHz;	where Pis the maximum output
0-4-3	27V/m:380-	27V/m:380-	power rating of the transmitter in
	390MHz;	390MHz;	watts (W) according to the
	28V/m:430-	28V/m:430-	transmitter manufacturer and dis the
	470MHz;	470MHz;	recommended separation distance in
	9V/m:704-	9V/m:704-	metres (m).
	787MHz;	787MHz;	Field strengths from fixed RF
	28V/m:800-	28V/m:800-	transmitters, as determined by an
	960MHz;	960MHz;	electromagnetic site survey a,should
	28V/m:1700-	28V/m:1700-	be less than the compliance level in
	1990MHz;	1990MHz;	each frequency range <sup>b</sup> .
	28V/m:2400-	28V/m:2400-	Interference may occur in the
	2570MHz;	2570MHz;	vicinity of equipment marked with
	9V/m:5100-	9V/m:5100-	the following symbol:
	5800MHz;	5800MHz;	$\Big( (\bigodot) \Big)$

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.

<sup>a</sup>Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy.

## Appendix A

To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the [SYS-50/52] is used exceeds the applicable RF compliance level above, the [SYS-50/52] should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the [SYS-50/52].

<sup>b</sup>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 RF communications equipment and the [SYS-50/52]

The [SYS-50/52] is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the [SYS-50/52] can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the [SYS-50/52] as recommended below, according to the maximum output power of the communications equipment.

Rated maximum	Separation distance according to frequency of transmitter(m).		
output power of	150k~80MHz	80M~800MHz	800M~2.5GHz
transmitter (W)	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distanced in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where Pis 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 B Default Factory Settings**

This chapter lists some default factory settings of syringe pump. Users can not modify the default factory settings, but if necessary, they can recover the syringe pump to the default factory settings state.

#### **Parameters**

Parameters setting	The default factory setting
KVO flow rate	1ml/h
Pressure unit	mmHg
Occlusion pressure P6 600mmHg	
Near end	3min
Built-in consumable brand	MC(5,10, 20, 30, 50/60ml), B.Braun
Dunt-in consultable brand	OPS(20,50/60ml)

#### System time

System time and date	The default factory setting
Time	00:00
Date	2014-1-1
Time form	24 hours
Date form	Year-month-day

# **Appendix C Parameter Units**

Parameter Name	Unit
Acti Agent	ng, ug, mg, g, U, KU, IU, EU, mmol, mol, kcal, mIU, kIU, and
	mEq
Conc.	ng/ml, ug/ml, mg/ml, g/ml, U/ml, KU/ml, IU/ml, EU/ml,
	mmol/ml, mol/ml, kcal/ml, mIU/ml, kIU/ml, and mEq/ml
DoseRate	x/min, x/kg/min, x/h, x/kg/h
	(x is ng, ug, mg, g, U, KU, IU, EU, mmol, mol, kcal, mIU,
	kIU, or mEq.)
LoadingDose	ng/kg, ug/kg, mg/kg, g/kg, U/kg, KU/kg, IU/kg, EU/kg,
	mmol/kg, mol/kg, kcal/kg, mIU/kg, kIU/kg, and mEq/kg

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