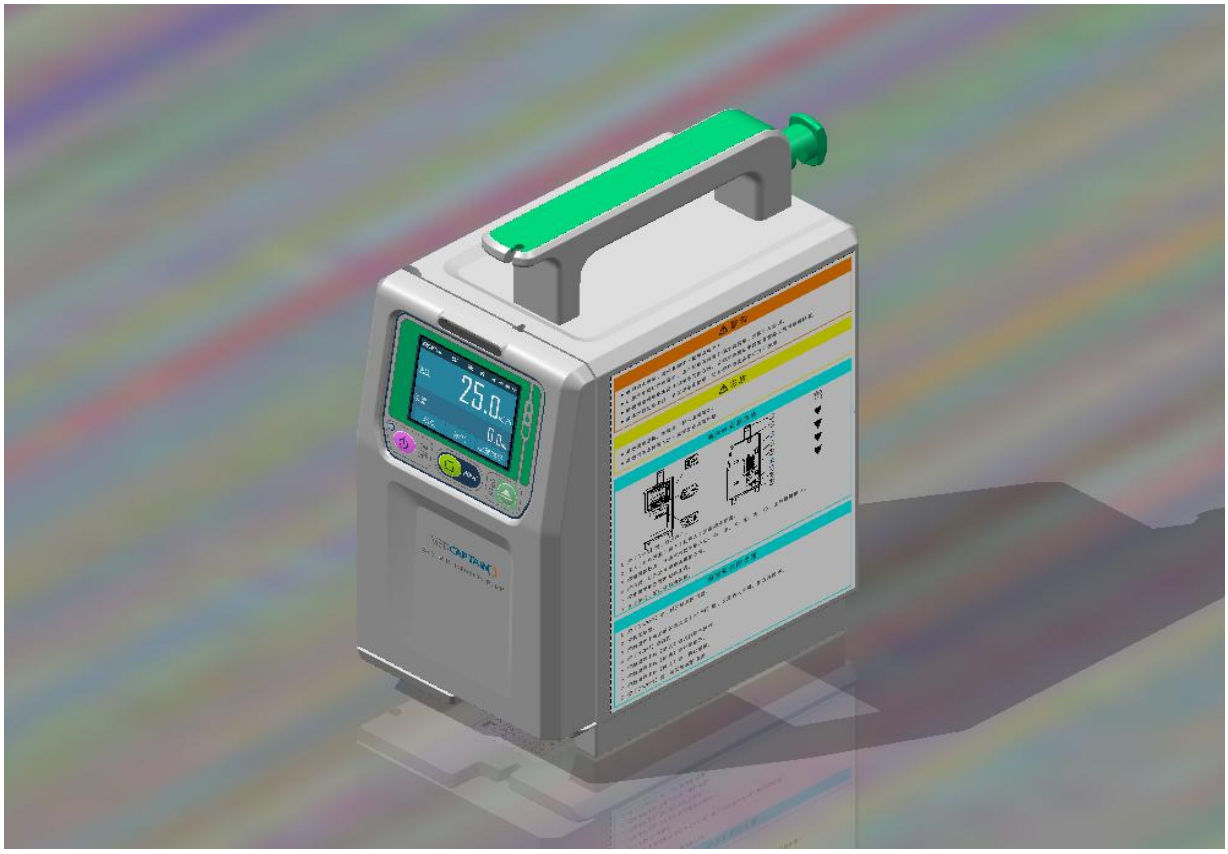
**SYS-6010 Infusion Pump**

# Service Manual



Version 2.0 English

麦科田
MEDCAPTAIN

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## Intellectual Property Rights

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- 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

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# Important information

## 1 Important Information

### 1.1 Service personnel

This service manual is for the information of service personnel only. Service may only be conducted by personnel who

- Has basic knowledge of electronic circuit and mechanical.
- Has basic knowledge of medical devices and clinic.
- Has received proper training of maintenance service of MEDCAPTAIN and has certain knowledge of device principle, structure, performance and operation.
- Has the necessary equipment and instruments.
- The permission of MEDCAPTAIN.

### 1.2 The Limitations of the Service Manual

This service manual describes all performance and configurations of the device. Some other devices performance and configurations are not included here. There are differences between the published manual and the actual status of the device, especially when device has been modified, a corresponding maintenance information is needed. Therefore, this service manual may be used together with some follow-up complementary information.

MEDCAPTAIN will complement the relevant information timely according to the actual situation of the device modification.

Service personnel should also refer to the Operation Manual.

### 1.3 Device Maintenance and Inspection

- The power supply of this device can reach to 100-240V. Maintenance against the requirements of the service manual may cause an electric shock hurt or death.
- Maintenance against these requirements of this service manual may seriously damage the device.
- The service personnel must be trained and permitted by MEDCAPTAIN.
- The maintenance must be of electrostatic discharge (ESD) protection conditions. Do not touch PCBA or semiconductors by hand without any protective measure.
- Do not operate on the display by using sharp objects. Otherwise, the display may be damaged.
- Do not disinfect the infusion pump by using the high-pressure steam sterilization method.
- Before internal battery operation, check the battery to ensure that sufficient power is available. Recharge, if required.
- 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 on the infusion pump, clean the pump with a dry cloth. And then check.

- Use the maintenance parts and accessories provided by MEDCAPTAIN to replace and maintain the device.
- Do not use the infusion pump in a flammable environment.
- High-frequency surgical equipment, mobile phone, wireless device and defibrillator may have interference on the infusion pump. Keep away from them while operating.
- After maintenance, have a safety test and cleaning according to this manual.

## 1.4 Quality control

MEDCAPTAIN satisfies ISO9001 and ISO13485 Certificate of Quality System. The relative products have also obtained the CE Certification, in line with the requirements of MMD instruction.

## 1.5 Safety instruction

Warnings:

- The power supply of this device can reach to 100-240V. Maintenance against the requirements of this Service Manual may cause an electric shock hurt or death.
- Maintenance against the requirements of this Service Manual may seriously damage the device.

## 1.6 List of abbreviated

| | |
|---|---|
| ESD | Electro-Static discharge |
| PCBA | Printed Circuit Board Assembly |
| ISO | International Standardization Organization |
| CE | Council of Europe |
| MDD | Medical Device Directive |
| IPX2 | Level of Protection from Liquid instruction |
| ON/OFF | ON/OFF key |
| HOME | Main Menu Key |
| CPU | Central Processing Unit |
| N/A (Not Applying) | Not Applying |

## 1.7 List of symbols

| Symbol | Description | Symbol | Description |
|---|---|---|---|
|  | CAUTION! Read the accompanying document. |  | Type CF equipment |
|  | Alternating current | IPX2 | Level of protection from liquid instruction |
|  | Direct current |  | ON/OFF |
|  | Manufacturer |  | Date of manufacture |
|  | HOME | | |

## 1.8 Contacts

a） When the infusion pump is used and maintained normally and regularly, we provide 18 months free maintenance (replacement of battery and appearance parts are not included). For failure caused by other factors, part replacement will be charged accordingly.

b） If you have any questions when using the infusion pump, please contact local distributor or directly contact us at any time.

The after-sales service contact details of Medcaptain Medical Technology Co., Ltd. are as follows:

Address: 12th Floor, Baiwang Research Building, No.5158 Shahe West Road, Xili, Nanshan District, Shenzhen, P.R.China

Telephone: 400-809-3369

Fax: 0755-26001651

Postal: 518055

Website:http://www.medcaptain.com

E-mail:MC.Service@medcaptain.com

# 2 System Introduction

## 2.1 Introduction

### 2.1.1 Purpose

This product is intended for hospitals to infuse liquid at constant speed or liquid medicine continuously through the veins of patients.

### 2.1.2 Product Features

MEDCAPTAIN SYS-6010 is a micro-continuous infusion pump. It ensures constant infusion speed and accurate dosing volume during long time infusion.

- Support all disposable IV sets conform to the standard.
- You can customize other IV sets conform to the standard.
- Three occlusion levels can be selected from three levels. The pressure status of tubing also display.
- The maximum infusion rate can be set to 1200mL /h
- Calibration function for infusion accuracy
- Safety design by monitoring infusion status.
- Multiple modes of infusion
- Multi-channel IV delivery system, realizing relay infusion function
- Touch screen, providing quick and convenient man-machine interface.
- Display night mode, reducing light interference to patients and environment.
- Connection to bar code scanner function.
- Providing three types of power supply: AC power supply, DC power supply, and internal lithium battery. The lithium battery can power the infusion pump for no less than 5 hours (when infusion is run at 25mL/h).
- Double CPU and redundancy design for key units.
- Two-way alarm for monitoring the main control circuit and motor drive circuit at any time.
- Independent motor driving CPU and motor subdivided drive chip design.
- Setting and automatic prompt of maintenance interval.
- Modular installation design enables multi-channel pumps among pumps.
- Handle, pole clamp, bar code scanner, relay infusion function are optional, depending on the user’s need.

## 2.2 The Composition of the Infusion Pump

The SYS-6010 infusion pump mainly consists of the pump shell, display and operating system, monitoring system, alarm system, motor drive system, tubing peristaltic module, power supply system, drop sensor, the handle (optional), and pole clamp (optional).

The infusion pump adopts dual 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 and light alarms.

## 2.3 Appearance

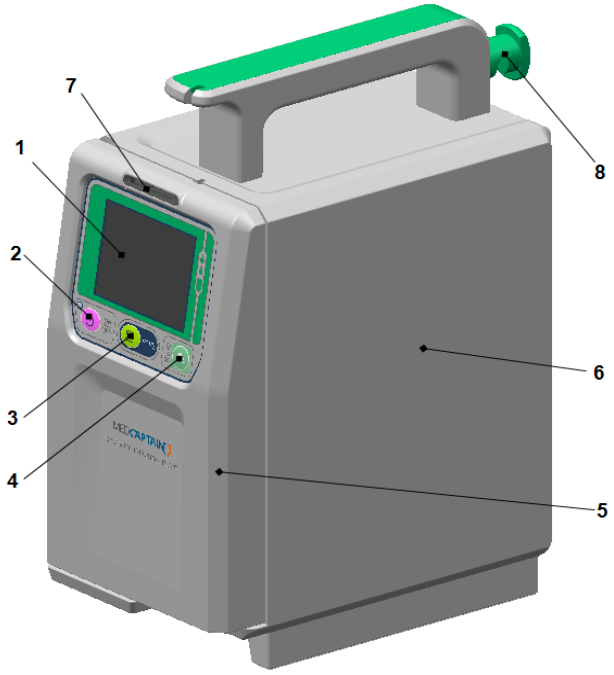
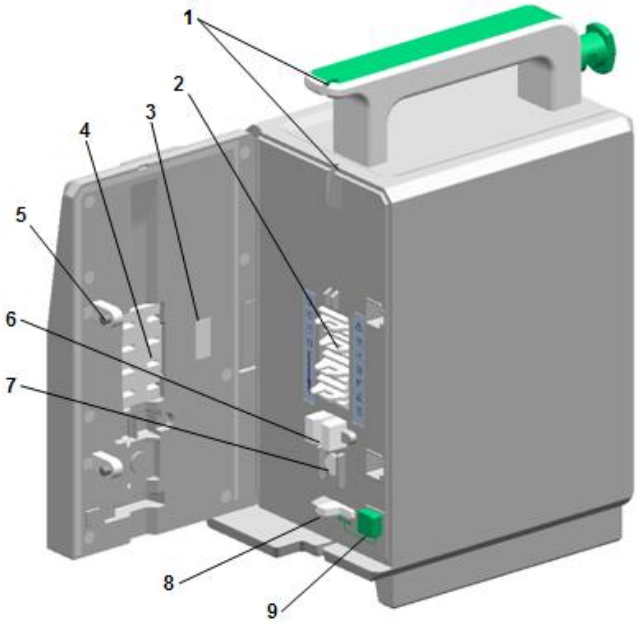



Figure 1

1 –Touchscreen | 2 – [HOME] key | 3 – [ON/OFF] key

4 -[OPEN] key | 5 – Pump door | 6 – Shell

7 – Alarm indicator | 8–Place shelf of drop sensor



| | | |
|---|---|---|
| 1 –IV groove | 2 –Peristaltic Pump Tablet | 3 –Lighting lamp |
| 4 –Depressor | 5 –Door catch | 6 –Air bubble sensor |
| 7 – Pressure sensor | 8 –Anti-Free-Flow clamp | 9 –Anti-Free-Flow Clamp Button |

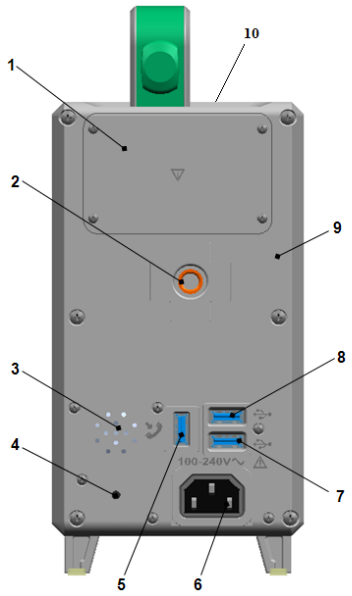
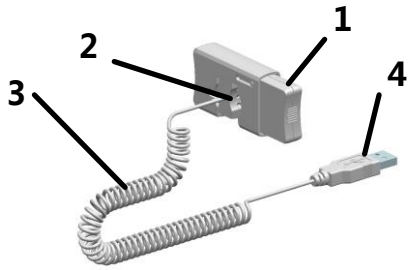



Figure 2

| | | |
|---|---|---|
| 1 –Cover of Battery | 2 –Pole clamp Hole | 3 – Loud speaker |
| 4 - Auxiliary Alarm | 5-external inlet 1 | 6 –AC power supply Inlet |
| 7 –External Inlet 2 | 8 –External Inlet 3 | 9 – Auxilary Alarm |
| 10 – Shell | | |

### 2.3.1 Drop Sensor




1 – Button 2 –Drop Hole 3 – Cable

4 – Socket

### 2.3.2 Pole Clamp

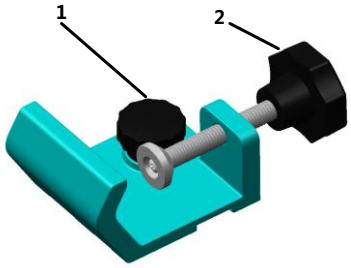



Figure 4

1 – Mounting Screw 2 - Mounting Knob of Infusion Stand

### 2.3.3 Nurse Pager

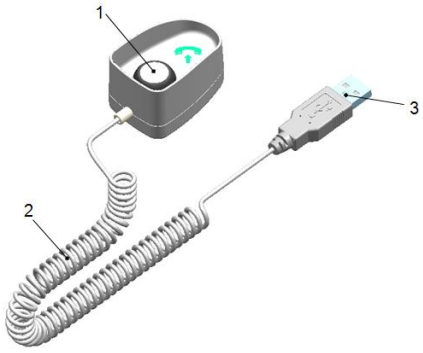



Figure 5

1 –Button 2 –Cable 3 –Socket

## 2.4 Circuit Block Diagram

The whole circuit block diagram of SYS-6010 is shown as Figure 6. The parts are as follows:

V2.0

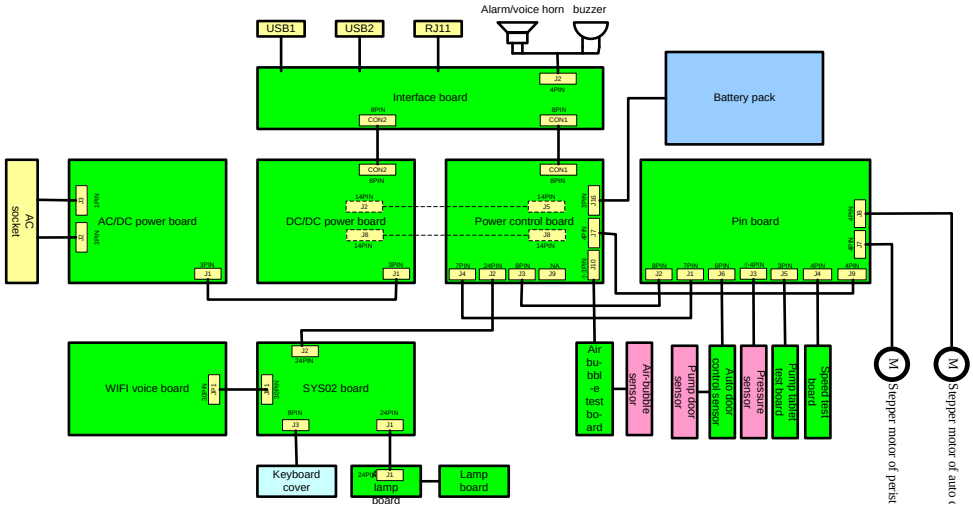



Figure 6

### 2.4.1 AC/DC Power Board

a. Circuit Introduction:

The AC/DC power board has adopted the medical level power supply with low leakage current and high-insulation voltage. It satisfies the requirements of EMC. The AC/DC power board has an input alternating voltage ranging from 90 to 240V, 50/60Hz, direct output voltage of 13.6V and the maximum output current of 2A. The AC/DC power board mainly consists of AC inlet, fuse, EMC filter circuit, rectifier, high voltage DC filter capacitor, switching tube, pulse width modulator, transformer, rectifier and absorbing circuit, DC filter circuit, stabilized light decoupling feedback control circuit, etc.

b. Main Testing Point

| No. | Testing point | Description | Range | Unit | Remark |
|---|---|---|---|---|---|
| 1 | TP9 | DC Output Voltage | 13.5-13.7 | V | |

c. Circuit Socket Number and Definition

| No. | Socket No. | Description | Pin-out Description | Range | Explanation |
|---|---|---|---|---|---|
| 1 | J1 | DC output voltage inlet | 1: DC output | 13.0~13.7V | Connect J1 in the DC/DC Power board |
| | | | 2:Voltage sampling | 2.78~2.94V | |
| | | | 3: Ground | Output DC ground | |
| 2 | J2 | AC input inlet | 1: Live line | AC L line input | Connect AC power input inlet |
| | | | 2: NC | / | |
| | | | 3: Neutral line | AC N line input | |
| 3 | J3 | Ground connecting inlet | 1: Ground | / | Connect AC power input inlet |

d. Caution:

- The AC/DC power board can reach to a high voltage of 400V. The workbench is required to be isolated and avoid touching the high voltage circuit parts. High voltage may cause electric shock hurts.
- While using a multimeter or oscilloscope to test, the pens cannot short out the live parts in the circuit board, or the circuit board would be damaged.
- While using an oscilloscope or multimeter powered by mains to test the circuit of mains in the AC/DC power board (primary non-isolated side circuit), the isolated differential voltage probe must be used to measure, or it will damage the board and test instrument.
- While using an oscilloscope multi-channel probe to test the circuit, all ground loops of the probe in the oscilloscope must be connected to the same potential point, or it will damage the board and test instrument.

### 2.4.2 The DC/DC Power Board

a. The Circuit Introduction

The DC/DC power board is from the AC/DC power board with main functions as follows:

(1) Management circuit of battery charge: the charging current of lithium battery is limited at around 200mA. As charging voltage boots, charging current gradually decreases. A fully charge for 1500mA battery generally needs 8-10 hours.

(2)18V stepper motor driving power supply: 18V DC power supply is provided to the stepping motor. The maximum current is 600mA.

(3)5V DC power supply: provides power supply to the digital circuit, CPU, the sensor circuit. A maximum input current is 3A.

(4)3.7V maintaining power supply: provides maintaining power supply to CPU and

clock circuit in the shutdown situation. The input is from battery.

(5)The stepper motor driving circuit: adopts the specialized stepper motor controlling circuit. Under the control of CPU, the speed, subdivision, current ratio and damping ratio can be adjusted, depending on requirements.

b. The Main Testing Points

| No. | Testing point | Description | Range | Unit | Remark |
|---|---|---|---|---|---|
| 1 | TP5 | 4.0V DC output voltage | 4.0-5.0 | V | |
| 2 | TP6 | 5V DC output voltage | 4.9-5.2 | V | |
| 3 | TP7 | 18V DC output voltage | 17.5-18.5 | V | |

c. Number and Definition of the Circuit Board Sockets

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 3 | Socket to inlet the DC output voltage | Connect J1 in the AC/DC board |
| 2 | J2 | 14 | Socket to connect the power board | Connect J5 in the power board |
| 3 | J8 | 14 | Socket to connect the power board | Connect J8 in the power board |
| 4 | CON2 | 8 | Socket to connect the interface board | Connect CON2 in the interface board |

### 2.4.3 The Power Board

a. The Circuit Introduction

The power control board has following main functions:

(1) Control the CPU circuit: controls on/off and stepper motor, receives and processes signals from the compression bar sensors, and communicates with interface CPU of SYS02 circuit.

(2)A function of signal switch board: collects signals from every sensor and all kinds of DC power, distributes the corresponding signal to SYS02 circuit board, DC/DC power board, stepper motor, alarm light and speaker, RS485 serial port and external interface, etc.

(3)Charging circuit and boosted circuit of the super-capacitor.

(4)MCU control circuit of buzzer alarm.

b. The Main Testing Points: none.

c. Number and Definition of the Circuit Board Sockets

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J2 | 24 | Socket to connect the | Connect J2 in the SYS02 board |

| | | | | |
|---|---|---|---|---|
| | | | SYS02 board | |
| 2 | J3 | 8 | Socket to connect the pressure&speed detection board of the infusion pump | Connect J2 in the pressure &speed detection board of the infusion pump |
| 3 | J4 | 7 | Socket to connect the pressure&speed detection board of the infusion pump | Connect J1 in the pressure &speed detection board of the infusion pump |
| 4 | J5 | 14 | Socket to connect the DC/DC board | Connect J2 in the DC/DC board |
| 5 | J7 | 4 | Socket to connect the pressure pressure&speed detection board of the infusion pump | Connect J7 in the pressure&speed detection board of the infusion pump |
| 6 | J8 | 14 | Socket to connect the DC/DC board | Connect J8 in the DC/DC board |
| 7 | J9 | 3 | Not used | Apply in the infusion pump |
| 8 | J10 | 3 | Socket to connect the bubble sensor | Connect bubble sensor |
| 9 | J16 | 3 | Socket to connect the power supply | Connect the battery pack plug |
| 10 | CON1 | 8 | Socket to connect the interface board | Connect in the CON1 interface board |

### 2.4.4 Battery Pack

a. Introduction

SYS-6010 adopts the 11.1V/1500mA lithium-ion battery pack. Connect battery pack to the power board with a connector. Disconnecting the connector, you can separate the battery pack and connecting wire.

b. The Main Testing Points

| No. | Testing point | Description | Range | Unit | Remark |
|---|---|---|---|---|---|
| 1 | Black-black wire | Short circuit test | The two wires should be shorted | | |
| 2 | Red-black wire | Battery pack voltage | 9-12.5 | V | Battery level influence the voltage |

Note: The quality of battery pack is not judged by its voltage. Connecting the infusion pump to test the actual operating time is needed.

c. Number and Definition of the Sockets

| No. | Socket | PIN | Description | Explanation |
|---|---|---|---|---|

| | | No. | | |
|---|---|---|---|---|
| 1 | / | 3 | Socket to connect the power board | Connect J16 in the power board |

### 2.4.5 Interface Board

a. Circuit Introduction

The interface circuit has following main functions:

(1) Provides the interface to connect SYS-6010 to peripherals, including the switching of power supply, correspondence, drop sensor signal, bar code scanner and the external power supply.

(2) Provides the speaker and buzzer driving circuit.

(3) Transfers the program recording signal of the power board CPU.

b. The Main Testing Points:none

c. Number and Definition of the Circuit Board Sockets

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J2 | 4 | Socket to connect speaker and buzzer | Connect speaker and buzzer |
| 2 | CON1 | 8 | Socket to connect power board | Connect CON1 in the power board |
| 3 | CON2 | 8 | Socket to connect DC/DC power board | Connect CON2 in the DC/DC power board |
| 4 | BUS1 | 5 | USB2.0 socket | The interface to connect peripherals including power input/output, correspondence and drop sensor; Connect MP-80 workstation, or individually connect the external power supply and drop sensor; Program update of CPU in the SYS02 board. |
| 5 | BUS2 | 10 | USB3.0 socket | The interface to connect peripherals including power input/output, correspondence, drop sensor, and nurse call. Program update of CPU in the SYS02 board. |
| 6 | BUS3 | 10 | USB3.0 socket | The interface to connect peripherals including power input/output, correspondence, drop sensor, and nurse call. Program update of CPU in the power board and SYS02 board. |

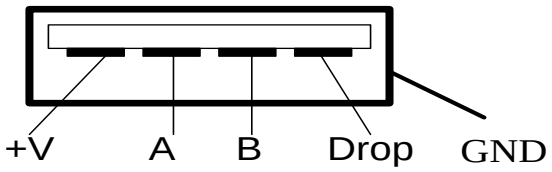
| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J2 | 4 | Socket to connect speaker and buzzer | Connect speaker and buzzer |
| 2 | CON1 | 8 | Socket to connect power board | Connect CON1 in the power board |
| 3 | CON2 | 8 | Socket to connect DC/DC power board | Connect CON2 in the DC/DC power board |

### 2.4.6 Interface Socket

a. Socket Introduction

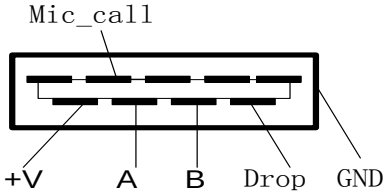
(1)USB1 socket (BUS1): USB2.0 socket interface. To connect the external DC power supply, bar code scanner of RS485 serial port, power supply of the intravenous workstation with RS485 correspondence, drop sensor signal, program update of SYS02 board CPU. The external power supply should be used with the matched cables. The DC input power is 9-15V and the current is 1A.

The definition of socket signal




(2)USB2 socket (BUS2): USB3.0 socket interface. To connect the external DC power supply, bar code scanner of RS485 serial port, drop sensor signal, nurse call, and program update of SYS02 board CPU. The external power supply should be used with the matched cables. The DC input power is 9-15V and the current is 1A.

The Definition of Socket Signal

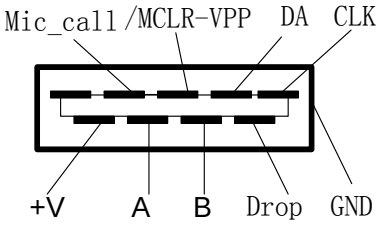



Remark: When the voltage of external power supply connecting to the USB1 and USB2 socket is over 13.6V, the external battery in SYS-6010 can be fully charged. If the voltage

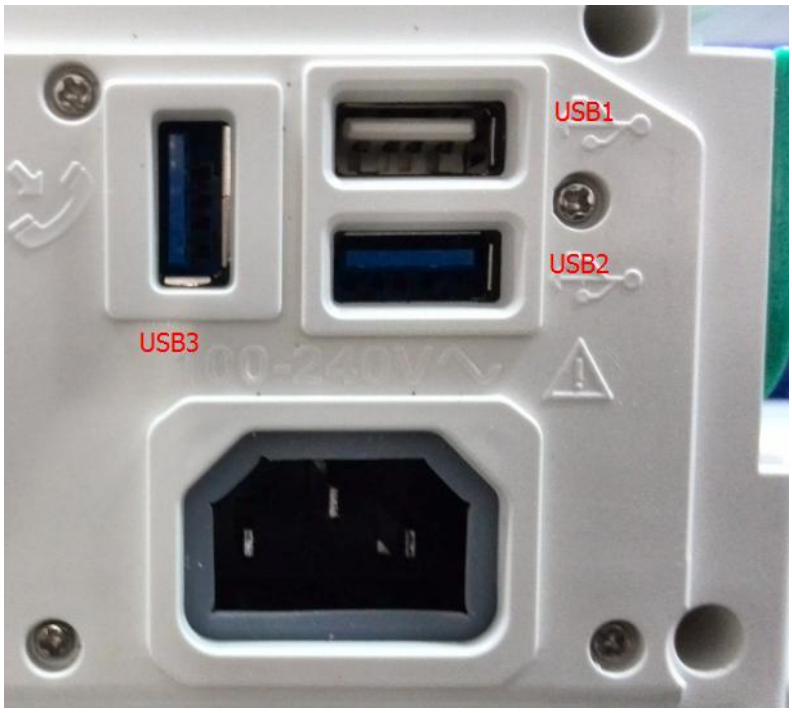
is under 13.6V, the battery may not be fully charged or not charged.

(3)USB3 socket (BUS3):USB3.0 socket interface. To connect the external 5V DC power supply, bar code scanner of RS485 serial port, drop sensor signal, nurse call, program update of the power board and SYS02 board CPU.

The Definition of Socket Signal




b. The Main Testing Points: none




### 2.4.7 SYS02 Board

a. Circuit Introduction

The SYS02 board has follows main functions:

(1)The man-machine interactive operation and management: the touch screen and keyboard input processing; interface and menu display; connecting to the power board serial ports, to obtain the infusion pump parameters, alarm information, the sensor signal display and alarm output; output the infusion parameters set by the user to power board to make a driving operation.

(3)2.4 inch TFT color display: with a resistance to touch. The screen resolution is 320X240 with FPC welded at the circuit board.

b. The main testing points: none

c. Number and definition of the sockets

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 24 | Socket to connect the alarm light board | Connect J1 in the alarm light board |
| 2 | J2 | 24 | Socket to connect the power board | Connect J2 in the power board |
| 3 | J3 | 8 | Socket to connect the button cover | Connect the button cover |

### 2.4.8 Button cover

a. Button cover introduction

(1) Buttons: [ON/OFF] for switching on/off,[HOME] for returning to main screen,[OPEN] for opening the pump door.

(2) Indicator light: 2 LED lights of green and yellow are built in the cover. While the machine is power off and AC inputting, yellow light works. While the power is on, green light works. The indicator lights works as follows:

| State of SYS-6010 | State of yellow light | State of green light |
|---|---|---|
| Power off and no AC | OFF | OFF |
| Power off and AC | ON | OFF |
| Power on | OFF | ON |

Remark: “ON” means light is on, “OFF” means light is out.

b. The main testing points:none

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | FPC block | 8 | Socket to connect SYS02 board | Connect J3 in the SYS02 board |

### 2.4.9 Alarm light board

a. The circuit introduction

3 groups of LED lights are installed in the alarm light board. The colors are green, yellow and red, each group of 2 LED lights, to indicate the states of working, high, middle and low level alarm. The states of indicators are as follows:

| State of indicators | Meaning of lights indicate |
|---|---|
| Green light flashing | The infusion pump is normally working, flash frequency indicates infusion speed |
| Yellow light illuminating | Lower level alarm |
| Yellow light flashing | Middle level alarm |

| | |
|---|---|
| Red light flashing | High level alarm |

b. The main testing points: none

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 24 | Socket to connect SYS02 board | Connect J1 in the SYS02 board |

### 2.4.10 The pressure& speed detection board

a. The circuit introduction

Main functions are as follows:

(1)Process the pressure sensor signals: amplify and filter signals from the pressure sensor, output to the power board.

(2)Collect and transfer signals: the peristaltic pump tablets signal, the stepper motor speed signal, the pump door-open signal, the pump door-off signal and the hall switch signal are all collected to the pressure& speed detection board through two cables to the power board.

(3)Switch the driving signal: switch the driving signals from the door-open motor and infusion motor through controlling the relay.

Note: the pressure sensor and the infusion pump pressure& speed detection board should be adjusted and tested together, therefore, they need to be replaced one to one correspondence, or there be a new debugging.

b. The main testing points: none

c. Number and definition of the sockets

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 7 | Socket to connect the power board | Connect J4 in the power board |
| 2 | J2 | 8 | Socket to connect the power board | Connect J3 in the power board |
| 3 | J3 | 4 | Socket to connect the pressure sensor | Connect the pressure sensor |
| 4 | J4 | 4 | Socket to connect the stepper motor speed board | Connect the stepper motor speed board |
| 5 | J5 | 3 | Socket to connect the pump tablets testing board | Connect the pump tablets testing board |
| 6 | J6 | 6 | Socket to connect the hall switch board | Connect the hall switch board |
| 7 | J7 | 4 | Socket to connect the power board | Connect J7 in the power board |
| 8 | J8 | 4 | Socket to connect the | Connect the open motor |

| | | | | |
|---|---|---|---|---|
| | | | open motor board | |
| 9 | J9 | 4 | Socket to connect the infusion motor board | Connect the infusion motor |

**2.4.11 The infusion motor**

a. The motor introduction: adopts a stepper motor with 42mm diameter and 48 steps, 2 phases driving.The working voltage is 18V.

b. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | / | 4 | Socket to connect the infusion pump pressure &speed detection board | Connect J8 in the infusion pump pressure&speed detection board |

**2.4.12 Stepper motor speed board**

a. The circuit introduction

Motor speed function: two light couplings collect the guiding and shading light signals A and B from the optical disc connecting on the stepper motor. You can judge the speed and rotating direction of the stepper motor according to the order of A and B and if there are A and B.

b. The testing points:none

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 4 | Socket to connect the infusion pump pressure &speed detection board | Connect J4 in the infusion pump pressure&speed detection board |

**2.4.13 The pump tablets position testing board**

a. The circuit introduction

The peristaltic pump position testing function: the light coupling collects the guiding light signals from the optical disc connecting on the peristaltic pump and judge the position of the peristaltic pump during the rotation.

b. The main testing points: none.

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | J1 | 3 | Socket to connect the infusion pump pressure &speed detection board | Connect J5 in the infusion pump pressure&speed detection board |

**2.4.14 The pressure sensor**

a. The pressure sensor introduction

The pressure sensor adopts the resistive Wheatstone bridge strain gauge pressure sensor. When strain gauge pressure changes, the bridge will be out of balance, the

voltage will output and the pressure signal is received.

Note: The pressure sensor is a very sensitive and precision device. Do not touch the surrounding parts or pull the connecting lines while dismounting.

b. The main testing points: none.

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | / | 4 | Socket to connect the infusion pump pressure &speed detection board | Connect J3 in the infusion pump pressure&speed detection board |

### 2.4.15 Bubble sensor

a. Bubble sensor introduction

The bubble sensor adopts the ultrasonic testing method. Its testing is not affected by the color of infusion line. It has high-sensitivity (greater than or equalto 30ul bubbles) and a fast response speed.

b. The main testing points: none.

c. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | / | 3 | Socket to connect the power board | Connect J10 in the power board |

### 2.4.16 Hall switch board

a. The circuit function introduction

(1) To output the open and close signals of the pump door through the two micro switch opening or closing. Then according to the distance between hall parts and hall switch to output signals and eventually output to the power board so as to judge the open or close of the pump door.

(2)Press the micro switch button to control the open and close the anti-free-flow clamp.

b. The main testing points: none.

c. Number and definition the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | / | 3 | Socket to connect the infusion pump pressure &speed detection board | Connect J6 in the infusion pump pressure &speed detection board |

### 2.4.17 The open motor

c. The motor introduction: adopts a stepper motor with 25mm diameter and 24 steps, 2

phases driving. The working voltage is 24V.

d. Number and definition of the socket

| No. | Socket | PIN No. | Description | Explanation |
|---|---|---|---|---|
| 1 | / | 4 | Socket to connect the infusion pump pressure &speed detection board | Connect J9 in the infusion pump pressure &speed detection board |

## 2.5 The software

The SYS-6010 consists of 3 softwares.

The power board software: to obtain all kinds of sensor signals, control and calculate of the stepper motor, obtain self-testing information and process the alarm information. It corresponds with the UI software and power failure alarm software.

The UI software: to be used in the monitor interface display, button operation, function setting and operating of the human-computer interaction, data storage, nurse call and voice function. It corresponds with the power board.

The power failure alarm software: under the situation of built-in battery failure and external power is cut-off, to control the device to output a light and voice high-level alarm. It corresponds with the power board.

## 2.6 Specifications

| | |
|---|---|
| **Power supply** | AC power supply: AC 100-240V,50/60 Hz, power, consumption 25 VA<br>External DC power supply: DC 12 V<br>Internal battery: lithium battery 11.1 V 1500 mAh<br>Time of continuous use: no less than 5 hours (for infusion at 25 mL /h with a new battery) |
| **Compatible IV sets** | All disposable infusion sets of 20d/mL and 60d/mL conform to the standards. |
| **Infusion mode** | 6 infusion modes: rate, drop, time, standard weight, weight, multi-rate |
| **Infusion setting range** | 0.1-1200.0mL /h or (1-400d/min) (20d/mL IV set)<br>0.1-200.0mL /h or (1-200d/min) (60d/mL IV set)<br>Least increment of 0.1 mL /h(or 1d/min) |
| **Total volume display** | 0.0-99999.9mL |
| **Accuracy** | ±5% |
| **Purge operation** | 400.0mL /h (20d/mL IV set)<br>200.0mL /h (60d/mL IV set) |
| **Bolus operation** | 35.0-1200.0mL /h(20d/mL IV set) |

| | |
|---|---|
| | 35.0-400.0mL /h(60d/mL IV set)<br>Auto-calculating the speed by the bolus volume |
| **KVO rate** | 0.1-5.0mL /h |
| **Occlusion level** | 11 levels are available<br>225mmHg~975mmHg，11 level<br>1:225mmHg<br>2:300mmHg<br>3:375mmHg<br>4:450mmHg<br>5:525mmHg<br>6:600mmHg<br>7:675mmHg<br>8:750mmHg<br>9:825mmHg<br>10:900mmHg<br>11:975mmHg |
| **Alarm** | Near End, Infusion End, Occlusion Alarm, Low Battery, Battery Empty, No Battery, No Power Supply, Door open, Air Bubble, No Drop Sensor, No Drop Signal, Drop Error, Reminder Alarm, and alarms during self-test and running. |
| **Special function** | **Repeat alarming:** If there is still alarm after mute alarm sound, it will alarm again in 2 minutes.<br>**Event recording:** can store and playback 1000 events maximum<br>**Alarm volume setting:** 5 levels of alarm voice are available.<br>**Power supply switching:** When AC/DC power supply is cut off, the infusion automatically switches to internal battery supply.<br>**Barcode scanning:** Input the patient information by barcode scanning. |
| **Operating conditions** | Ambient temperature: 5℃-40℃ Relative humidity: 15%-95%, nocondensation Atmospheric pressure: 70.0 kPa-106.0 kPa |
| **Storage conditions** | Ambient temperature: -20℃-60℃ Relative humidity: 10%-98%,<br>no condensation Atmospheric pressure: 22.0.0 kPa-107.4.0 kPa |
| **Classification** | Class I, Type CF, IPX2 |

# 3 Maintenance

## 3.1 Cleaning and Sterilizing

- Before cleaning the pump, be sure to turn off the power and disconnect the AC or DC power cables.
- If any solution spills on the pump or the pump gets heavily soiled, wipe it with 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 pusher and clutch need to be dismantled and cleaned, contact your distributors or manufacturer.
- Do not use organic solvent such as alcohol or thinner.
- If disinfection is necessary, using the common disinfectors such as Chlorhexidine gluconate 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.
- When sterilize the system，use EOG(Ethylene Oxide Gas) at the temperature of 50°C or less and relative humidity of 60% or less. After sterilize，ventilate the room for over 24 hours or place system in aerator for 8 hours. The above is only a guideline，use adequate method to check sterilization results.
- The infusion pump cannot be autoclaved.
- Never use a dryer or similar device to dry the infusion 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 infusion pump into water.

## 3.2 Periodic Maintenance

Perform a periodic maintenance inspection to ensure safe operation and the longest possible life of the infusion pump, and check the infusion pump once every six months. You can maintain some items by yourself and contact your local distributor to maintain some other items.

### 3.2.1 Checking the appearance (before every use)

- Appearance checking: There are no cracks and damages.
- Key operations: Keys response smoothly and effectively.
- No abnormal noise during the peristaltic plate working.

### 3.2.2 Checking the power cable (before every use)

- Check the appearance of the power cable. If the appearance is damaged and the plug and the socket are in poor contact, contact the distributor for replacement in time.
- Connect the infusion pump to the AC/DC power and there is no indication of powering on, contact the distributor for maintenance in time.

### 3.2.3 Checking the iInfusion rate (every 6 months)

Check the infusion flow once every 6 months by the graduate and timer.

Checking method: Use the preset brand IV set with a 60 mL /h rate, fill the infusion bag with distilled water and access the graduate. Start, run 10 minutes at a 60mL /h rate and observe the liquid volume in the graduate where 9.5-10.5mL is qualified.

### 3.2.4 Alarm (every 6 months)

1) Air bubble in tubing

Checking method: Simulate the infusion process and create a bubble by tilting the drip chamber during the infusion. There should be a visible alarm [Air Bubble] on the screen, red alarm light flashing, and audible alarm cycling every 15 seconds like beep-beep-beep …beep-beep…beep-beep-beep …beep-beep….

2) Occlusion

Checking method: Use the preset brand IV set with a 25 mL /h rate, set the occlusion 检 level to be P2, and then close the roller clamp of the IV set. Start the infusion. Within 1 minute, there should be a visible alarm [Occlusion] on the screen, red alarm light flashing, and audible alarm cycling every 15 seconds like beep-beep-beep …beep-beep…beep-beep-beep …beep-beep….

### 3.2.5 Electric and mechanical safety (every 12 months)

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

### 3.2.6 Checking the internal battery (every 6 months)

Perform the following inspections on the battery every 6 months:

- Connect to the AC power supply to recharge the battery for over 10 hours.
- Turn on the power.
- Set the infusion rate to 25 mL/h and start the infusion. Record the start time.
- Operate the system until it stops infusing due to low battery alarm. Record the finish time.

  （1）If the time from the start of the infusing to end of operation is 4 hours or more, the battery condition is good.

  （2）If the time from the start of the infusing to end of operation is 1 to 1.5 hours, the battery condition is reaching its service life.

  （3）If the time from the start of the infusing to end of operation is less than 1 hour, the battery has reached its service life. Replace the battery. You are advised to contact the distributor to replace the battery.
- When the battery lever check is complete, recharge the battery for next use.

### 3.3 Replacing the Battery

- **Remove an internal battery.**

  (1) Use a screwdriver to loosen the battery cover fixing screws at the bottom of the pump.

  (2) Remove the battery cover.

  (3) Disconnect the battery cable connector.

  (4) Remove the battery.

- **Install the internal battery**

  (1) Insert the connector of the battery cable into the battery.

  (2) Insert the new battery into the battery compartment.

  (3) Attach the battery cover.

  (4) Use a screwdriver to tighten the screws securing the battery cover.

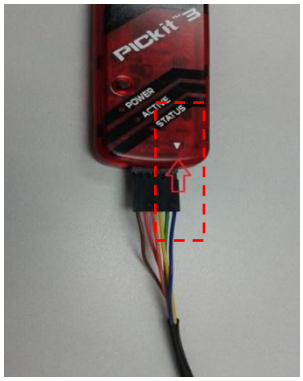
# 4 Software Upgrade

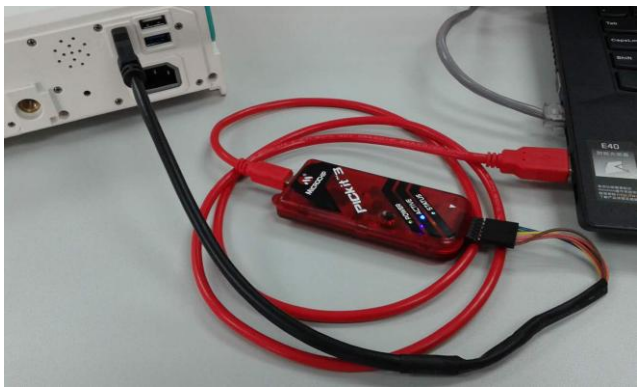
SYS-6010's software upgrade involves two parts, being the Driver and UI upgrade.

## 4.1 How to upgrade the driver software

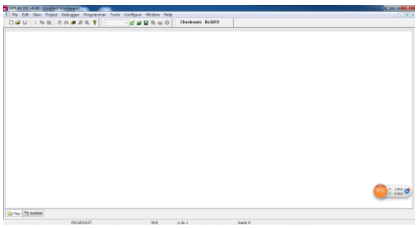
- Upgrade Tool:


- Connection: pay attention to the cable color(Blue color cable corresponds to a white triangle ) and USB port

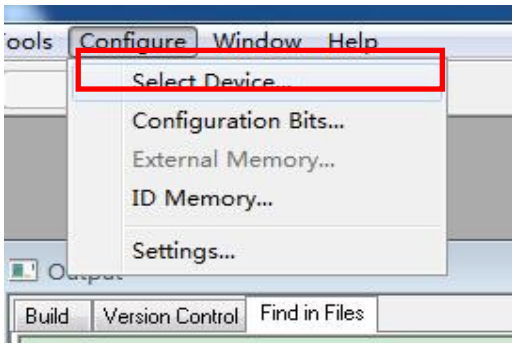


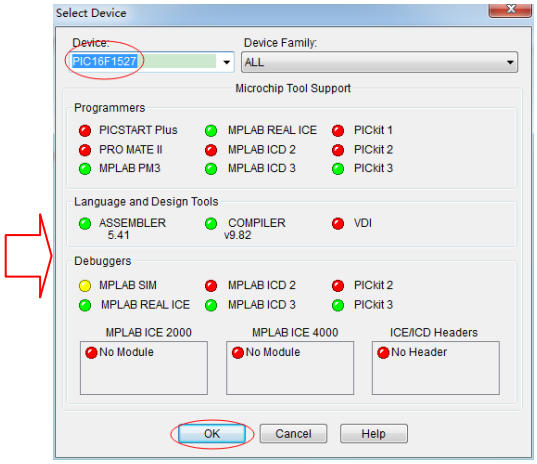



- Open the software "MPLAB IDE v8.86" on the desktop of windows；

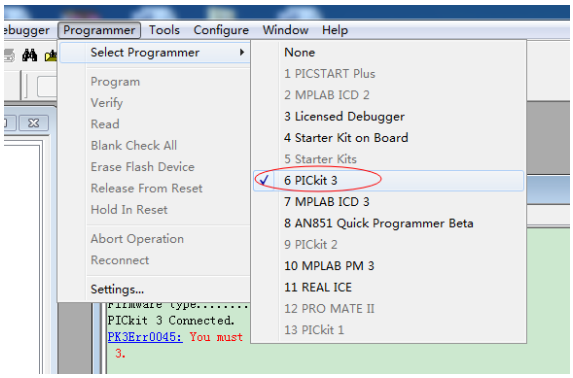


- In the menu bar, click on the "Configure" - > "Select Device", as shown in figure choice chip PIC16F1527, click OK to exit；

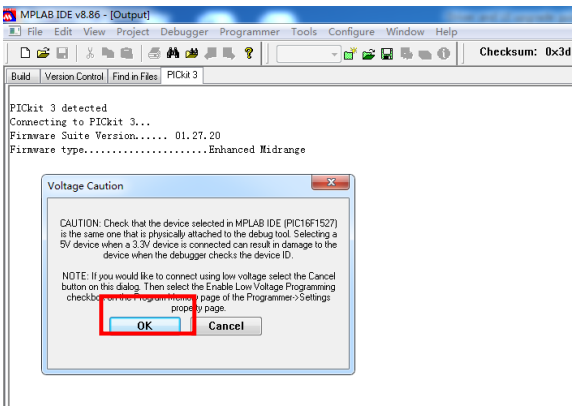


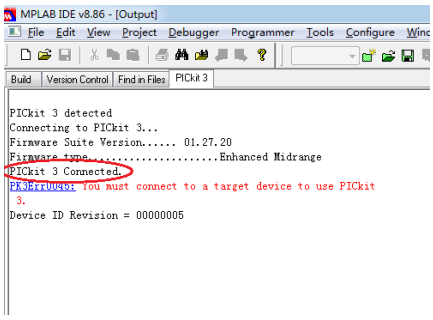

- In the menu bar, click on the "Programmer" - > "Select Programmer" - > Select "PICkit 3" connection PICkit 3；



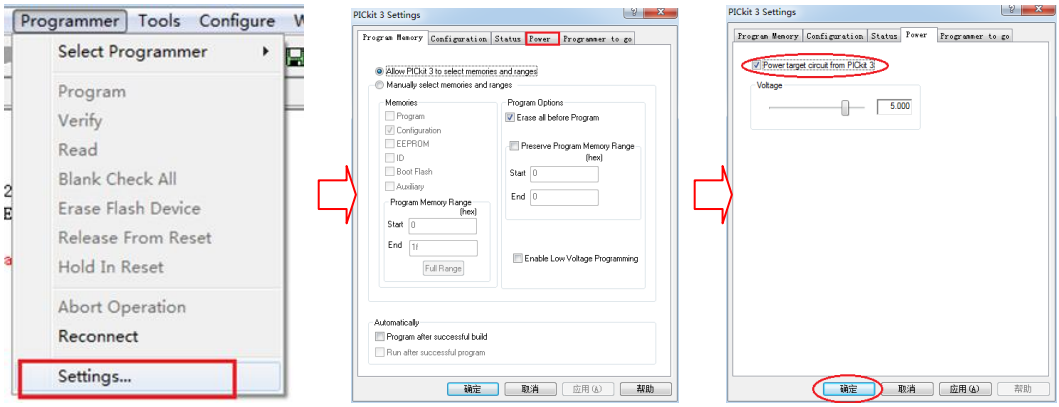

- Click ok



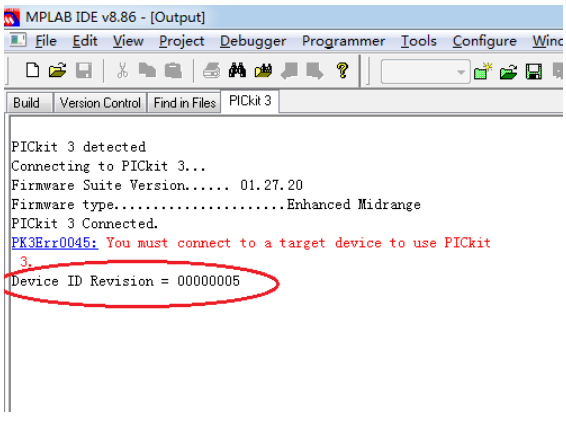
- PICkit 3 connection is successful, if not connected successfully check the connection is correct or not；



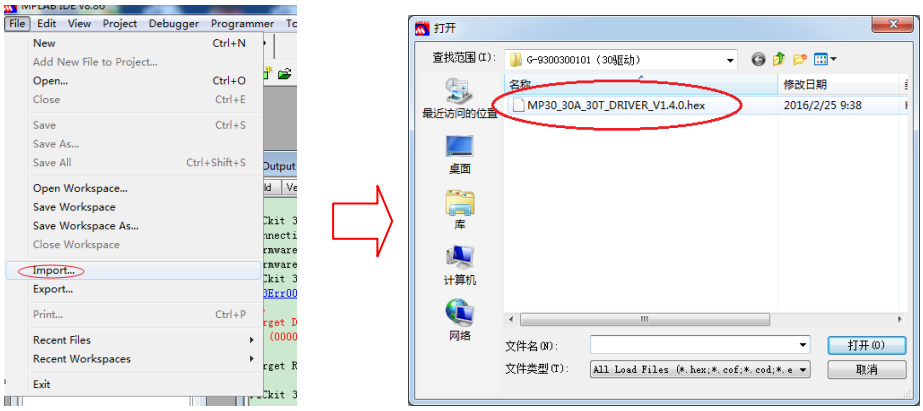

- In the menu bar, click on the "Programmer" => "Settings"=> "power", Click the item "power target circuit from PICkit 3"； then click “OK”



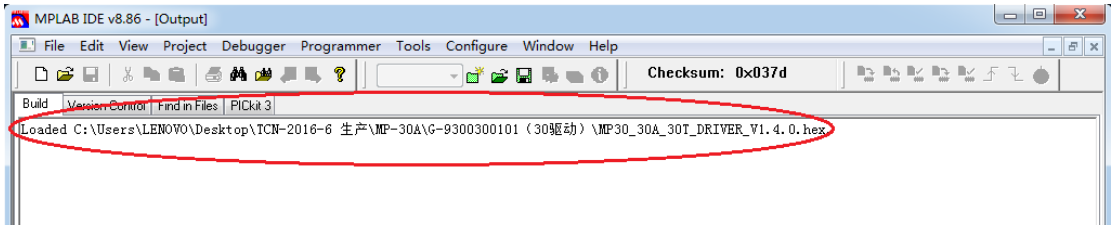

- After the success of the set display device ID；



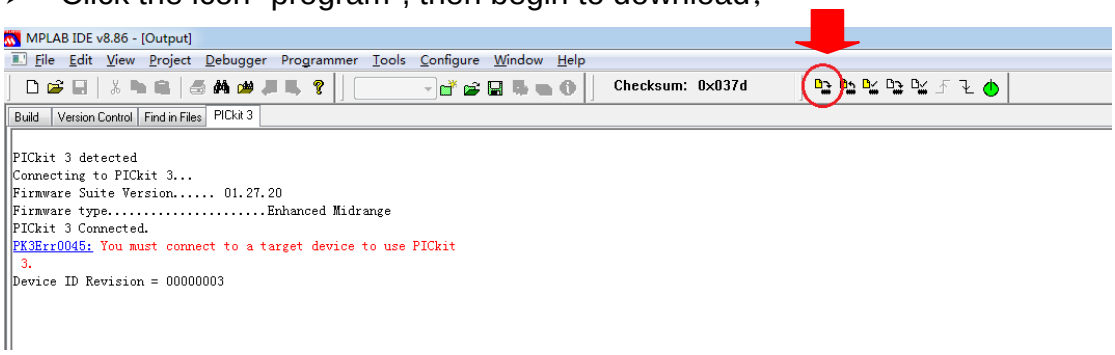

- From the menu bar "File" - > "Import" hex File Import products. Burn MP - 30, for example, find the corresponding version in the folder, and open；



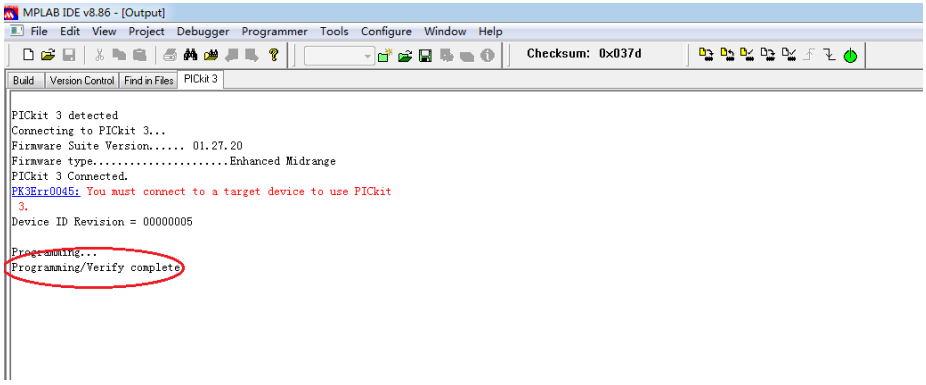

➢ Import success；




➢ Click the icon "program", then begin to download；

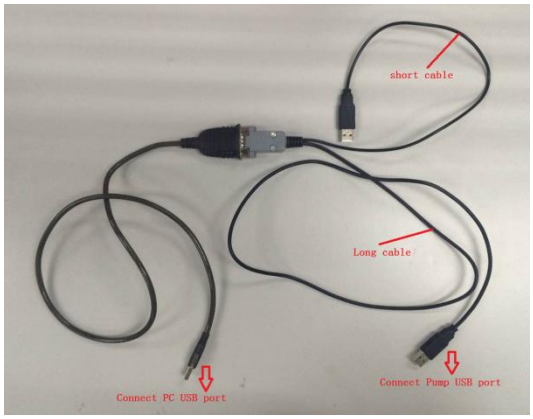



➢ The download is complete, the software prompts

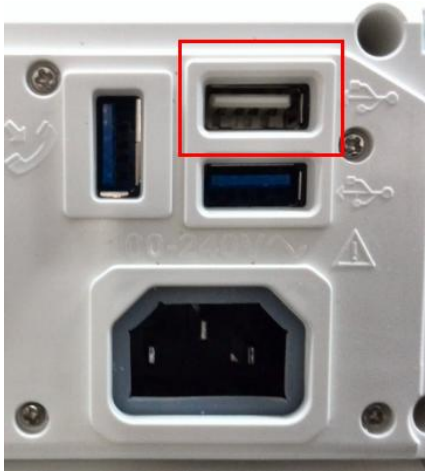


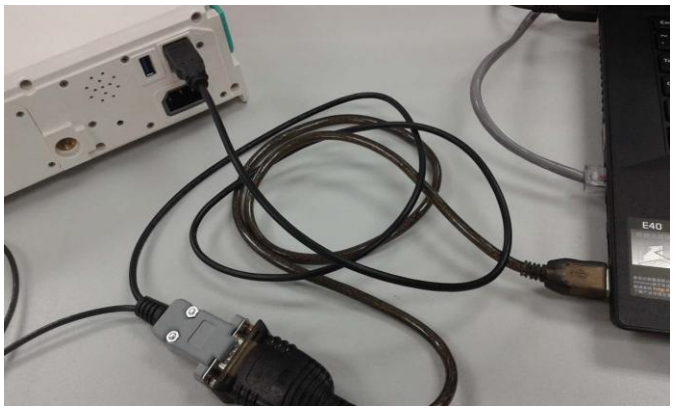
## 4.2 UI software Upgrade

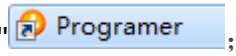
- Upgrade tool: please use long calbe to connect pump



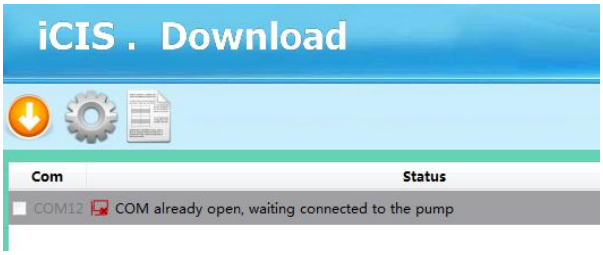

- Connect the upper USB port of pump；



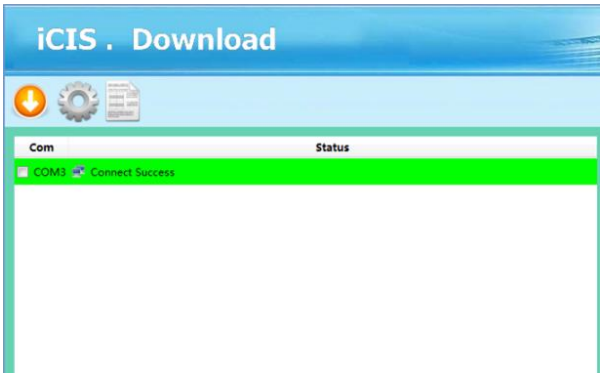


- Open the software "Programer. Exe" 

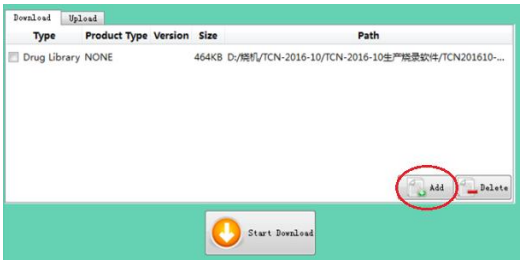
； Turned off pump；

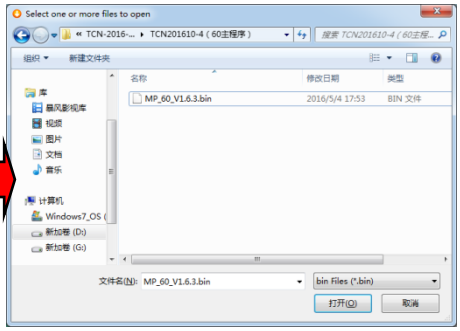



- Turn on the machine, then it would show “connect success”

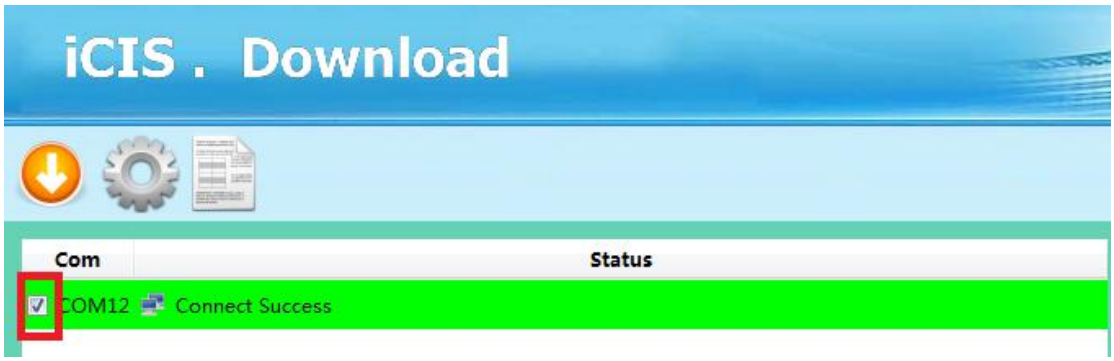


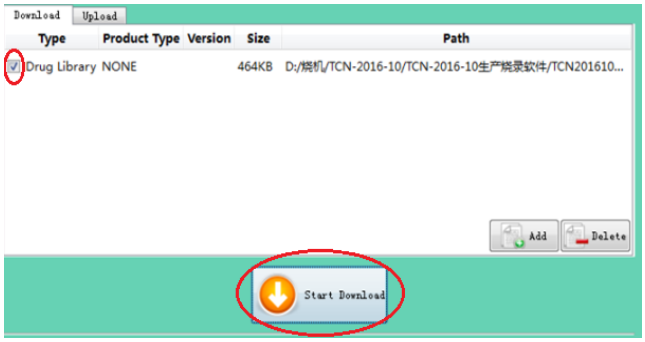

- In the Programer software, click "add", then open the upgrade file；



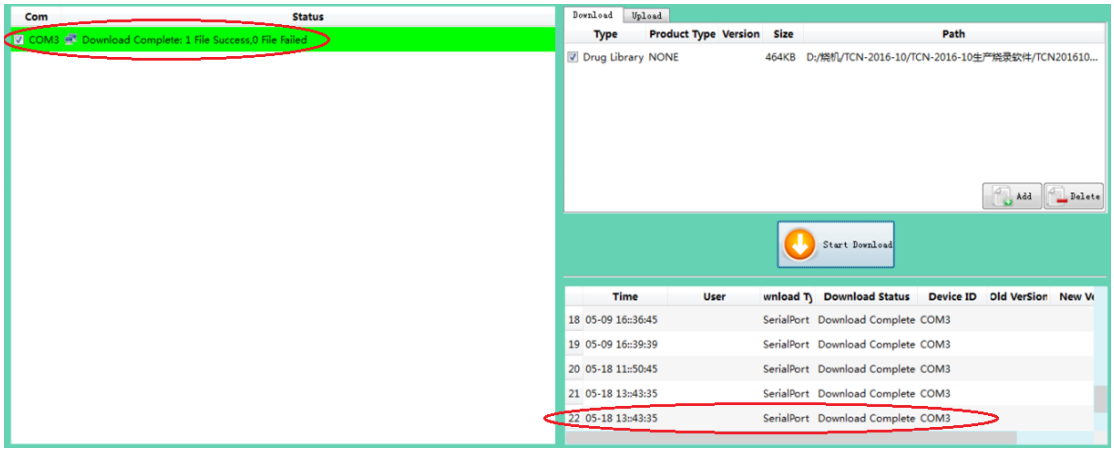




- Select the Com and upgrade file , click start download；






➢ Then it would show “download complete”;




# 5 Alarm, fault and troubleshooting

**Warning!**

- There are 90-240V AC high-voltage current inside the MP-60A and 400V DC high-voltage current produced by the switching power supply.A careless touching may cause serious personal injury to the service engineer when they are conducting the checks and troubleshooting.Please be strict in accordance with the requirements of the rules and regulations to maintain the device by professional maintainers.
- When using equipment to check power board or other parts, short-circuit or incorrect measurement may cause serious personal injury or a severe damage to the device.
- After every disassembling and maintenance, check the safety and function of the device.See details in section 7.

**The basic instruments of maintaining and checking**

- PC (to download software and fill in forms)
- Software download connector
- To be used infusion set
- Digital multimeter
- 20-50mL graduate(accurate to 0.2mL )
- Stopwatch or timing device

**Note!**

- **The graduate to inspect the infusion precision,is just used for general maintenance.**
- **The special materials for disassembling should refer to the requirements in the disassembling and installation chapter.**
- **The safety project inspection needs specialized testing equipments.After disassembling and installing the device, the safety of the pump must be tested.**

## 5.1 Alarm information

During normal operation, the pump generate visible and audible alarm to remind users to deal with the alarms in time.

The alarm can be categorized into clinical alarm and technical alarm.Clinical alarm is generated according to the operation state during the general using of the device.It is not equipment failure but to remind users to deal with the device working in time,such as when aninfusion is finished or a reminder alarm.A clinical alarm is sounded along with concrete wording of specific information on the screen.

A technical alarm is caused by abnormal data inside the device during normal use of the device. It can be an equipment failure or not, showing as ERR-XXXX.

### 5.1.1 The Alarm Levels

| Alarm | Sound | Light |
|---|---|---|
| Low-level alarm | Give out a beep at the time of every alarm. | The yellow indicator illuminates. |
| Mid-level alarm | Give out three beeps at intervals of 15 seconds. | Theyellow indicator flashing. |
| High-level alarm | Give out a series of beeps at intervals of 15 seconds. | The red indicator flashing. |
| Prompt message | Give out two short beeps. | The corresponding indicator flashing. |

### 5.1.2 The Clinical Alarms and Troubleshooting

| Alarm Symptoms | Alarm level | Causes | Troubleshooting |
|---|---|---|---|
| No Power Supply | Low | No external AC/DC power supply is connected. | Immediately connect the AC power supply or the external DC power supply. |
| No Battery | Middle | No internal battery or the internal battery operates | Install a (new) battery. |

| Alarm Symptoms | Alarm level | Causes | Troubleshooting |
|---|---|---|---|
| | | abnormally. | |
| Low Battery | Middle | The internal battery is running critically low. | Immediately connect an AC power supply or an external DC power supply. |
| Near End | Low | The infusion will finish within 3 minutes. | Wait until the infusion finishes. |
| Occlusion Alarm | High | 1. The tubing is occluded.<br>2. Low occlusion level has been set during high viscosity. | Click [STOP] to clear the alarm, troubleshoot, and then continue the infusion. |
| Door Open | High | Door is open during infusion. | Click [STOP] to clear the alarm. Check whether the pump door has been closed. |
| Air Alarm | High | 1. Air bubble in the infusion line.<br>2. The flatten tube is fixed inside the air bubble detector. | Click [STOP] to clear the alarm. Check the tubing to release the air bubble. |
| Infusion End | High | The VTBI or the infusion time set finishes. | Click [STOP] to clear the alarm. |
| Reminder Alarm | Middle | Operation forgotten (no operation on any key for 2 minutes after the IV set loaded. | Click any key to clear the alarm. |

### 5.1.3 Technology alarms and troubleshooting

| No. | Trouble | Possible Cause | Troubleshooting |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | ERR-0003 | Door position fault | Replace the hall switch board |
| 2 | ERR-0004 | Pressure sensor is falling or abnormal pressed. | Reinstall the tube again or Replace the pressure sensor and the infusion pressure speed auto driving board. |
| 3 | ERR-0005 | Stepper motor speed error | Replace the hall switch board or Replace the stepper motor |
| 4 | ERR-0006 | The 5V power supply voltage or 18V motor drive voltage is abnormal. | Replace DC/DC power board |
| 5 | ERR-0007 | Pump tablets fault | Replace the peristaltic pump tablets position test board |
| 6 | ERR-0008 | SYS02 board and power board correspondence fault | SYS02 board damaged or the cable disconnection |
| 7 | ERR-0009 | System fault | Update software |
| 8 | ERR-0010 | EEPROM fault | Replace the SYS02 board |

## 5.2 Common faults and Troubleshooting

The device fault checking:

| NO. | Failure phenomenon | Cause | Solution |
|---|---|---|---|
| 1 | Can not turn on pump | No AC power | Check AC power, panel indicator, replace battery |
| | | Key panel failure | Replace panel |
| | | FPC cable failure | Replace FPC cable |
| | | Power board failure | Replace power board |
| 2 | Black screen and alarm indicator is off | No AC power | Check AC power, panel indicator, replace battery |
| | | FPC cable failure | Replace FPC cable |
| | | SYS02 board failure | Replace SYS02 board |
| 3 | Black screen and alarm indicator is on | FPC cable failure | Replace FPC cable |
| | | SYS02 board failure | Replace SYS02 board |
| | | Touch screen failure | Replace touch screen |
| 4 | White screen | Touch screen failure | Replace touch screen |
| 5 | Touch screen is no | Touch screen not calibrate | Calibrate touch screen |

| | | | |
|---|---|---|---|
| | response when clicking | The surface of screen is dirty | Clean screen |
| | | Touch screen install incorrectly | Install screen correctly |
| | | FPC cable failure | Replace FPC cable |
| | | Touch screen failure | Replace screen |
| 6 | Air bubble alarm | IV Set with air bubbles | Get rid of air bubbles |
| | | IV Set damaged | Replace IV Set |
| | | Air bubble sensor failure | Replace air bubble sensor |
| 7 | Alarm of air bubble of No IV set when starting | IV set with air bubbles | Get rid of air bubbles |
| | | IV set install error | Install IV set correctly |
| | | Air bubble sensor failure | Replace air bubble sensor |
| 8 | Occlusion alarm | Blocking in IV set | Clear blocking |
| | | Select wrong brand | Select right brand |
| | | IV set of Custom brand not calibrate | Calibrate pressure value |

e it.

The disssembly and installation

# 6 The disassembling and installing

## 6.1 Attentions

Please do the disassembling in an anti-static environment. To avoid damage to the components, please wear wrist strap or other anti-static equipment.

Before each disassembling, please carefully record the fixed way and layout of the board connectors and their cables to ensure consistent before and after the disassembling.

During reinstallation, use screws removed from the original position, otherwise, it can cause a weak installing or damage to the position, involve other positions to be weakly installed or damaged and eventually damage the device; And during use after the reinstallation, the screws and components might fall off, thus causing unpredictable damage or injury to the product or human body.

Disassemble the device in a correct order. Incorrect order or forcible assembly might cause irreversible damage to the device.

Before separating the components, please be sure that all connections are plugged off. During separation, take care not to break the connection wire and damage the connectors.

Please store the removed screws and other parts by category for easy reach during

reinstalling, and avoid dropping, contaminating oer losing them.

During disassembly and reinstallation, pay attention to protecting the waterproof seal and do not pull the seal strip hard. Please do not miss or damage it during installation.

After assembling, check if there are extra screws or other components, If there are, a reassembling is needed.

**Warnings!**

- **Before and after each assembling, be sure to cut off the external AC power supply to avoid causing a human body injury.**
- **During assembling, avoid touching the circuit board and connection cables by sharp instruments and avoid shorting and breaking circuits, or it may cause a serious damage to the device.**

## 6.2 Assembly Tools

### 6.2.1 General Tools

- Philips Screwdriver
- M3 inner hexagon screwdriver M3
- Pliers
- M3 nut spanner M3
- Diagonal cutting nippers
- Anti-static wrist strap
- Several Nylon cable ties

### 6.2.2 Special instruments and materials

- Several screw cover caps

## 6.3 Disassembly

### 6.3.1 Remove the battery

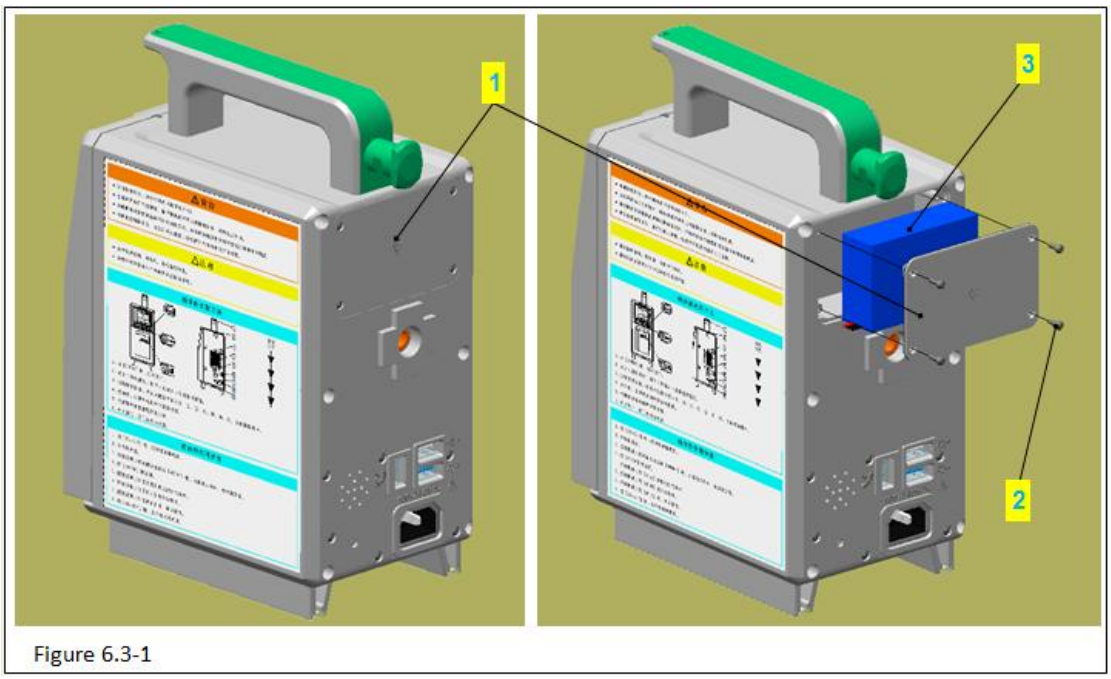


Figure 6.3-1

Figure 6.3-1 Note:
Code name

1 –Cover of battery
2 – PB2.3 tapping screw
3 –battery pack

1) Use phillips screwdriver to take out the 4 PB2.3 tapping screws (figure 6.3-1/code name 2) in the cover of battery (figure 6.3-1/code name 1).
2) Remove the cover of battery.
3) Take out the battery pack lightly (figure 6.3-1/code name 3)
Attention: pull out the battery pack lightly for there are connection wires between the battery pack and the device.
4) The connection wires connect the battery and the device by a connector .Press the block button in the connector and separate the plug and socket.

### 6.3.2 Remove the rear cover

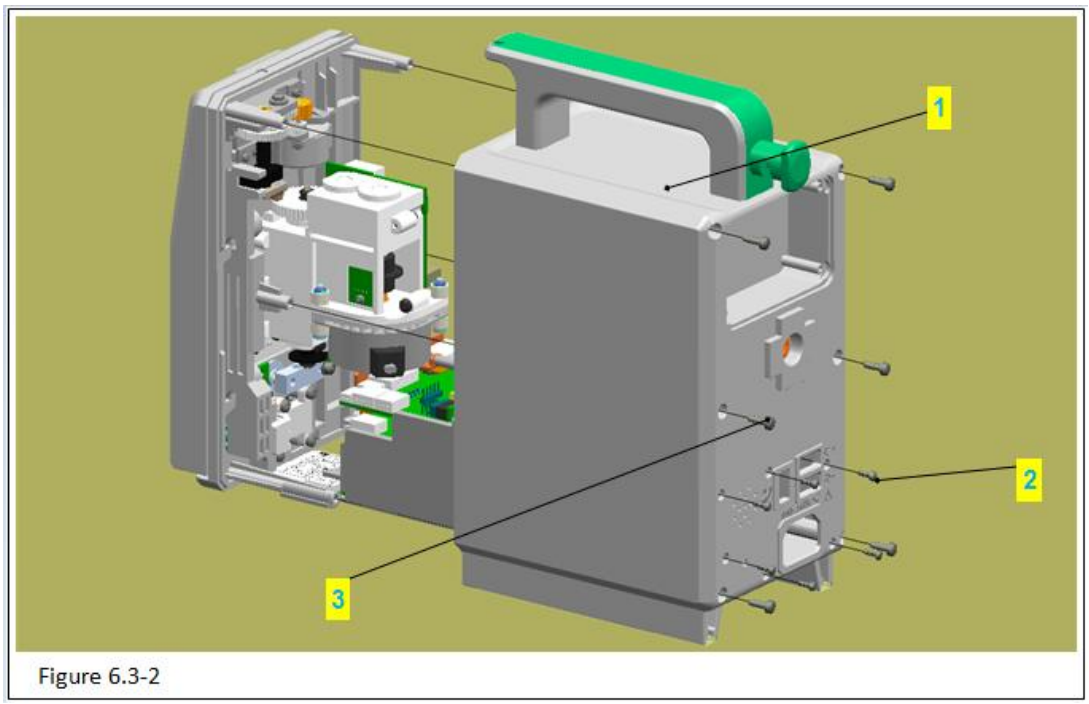


Figure 6.3-2

Figure 6.3-2 Notes:

Code Name

1 –Rear Cover

2 – PB2.3 PB2.3 tapping screw

3 – PT3.0 tapping screw

1) Use phillips screwdriver to take out the 6 PB2.3 tapping screws (figure 6.3-2/code name 2) in the rear cover (figure 6.3-2/code name 1).

2)Use phillips screwdriver to take out the 6 PT3.0tapping screws (figure 6.3-2/code name 3) in the rear cover.

3)Balance the rear cover with left hand, then use screwdriver with right hand to stick the inner side of the AC power socket. Use a uniform force to inner cover and separate the rear cover carefully.

Attention: be careful to remove the rear cover, avoid pulling out other components inside the device. After removing the rear cover, please take a picture first to know well the circuit connections and wire bindings.

### 6.3.3 Remove the Baffle

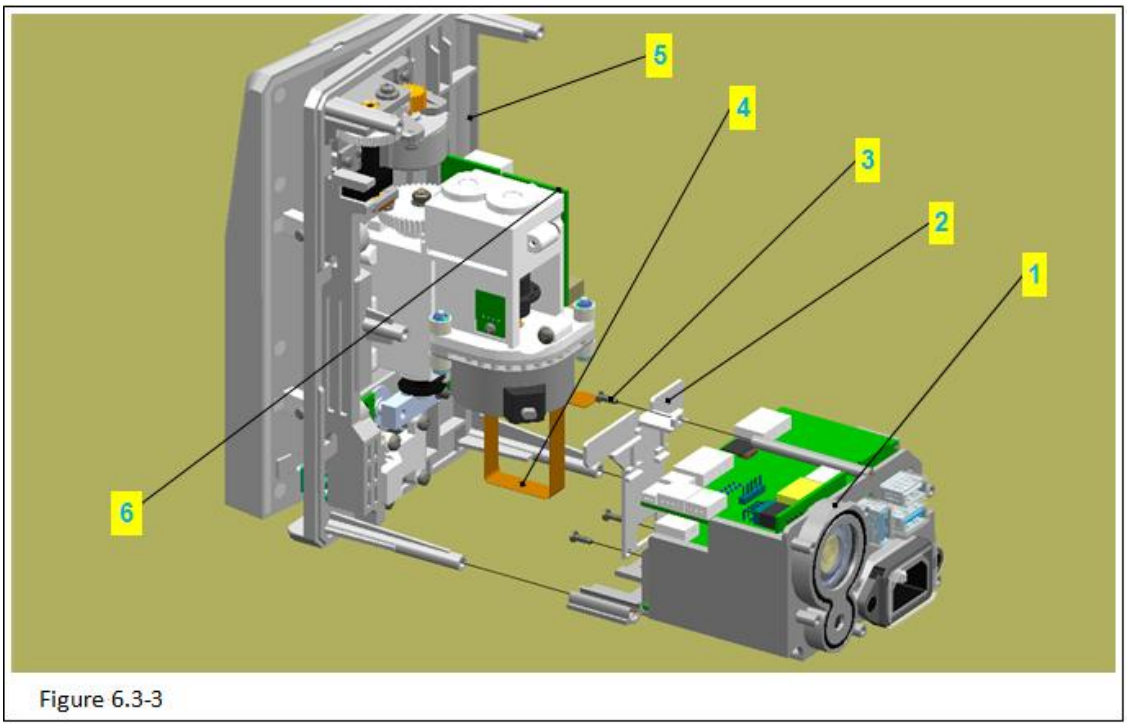


Figure 6.3-3

Figure 6.3-3 Notes

Code Name

1 –PCBA stand component

2 –PCBA stand board

3 –PB2.3 tapping screw

4–FRC flat cable

5 –Middle plate

Attention: please connect the power supply, press [OPEN] to open the pump door, then remove the battery.

1)Use the short edge of 2# inner hexagon spanner to push-out a certain space between baffle-axis (figure 6.3-3/code name 2) and round decorative cover (figure 6.3-3/code name 3), take out the round decorative cover.

2)Use pilers tip to clamp the pushed-out baffle-axis, pull it out completely.

3)Remove the baffle (figure 6.3-3/code name 1).

### 6.3.4 Remove the Bracket for PCB

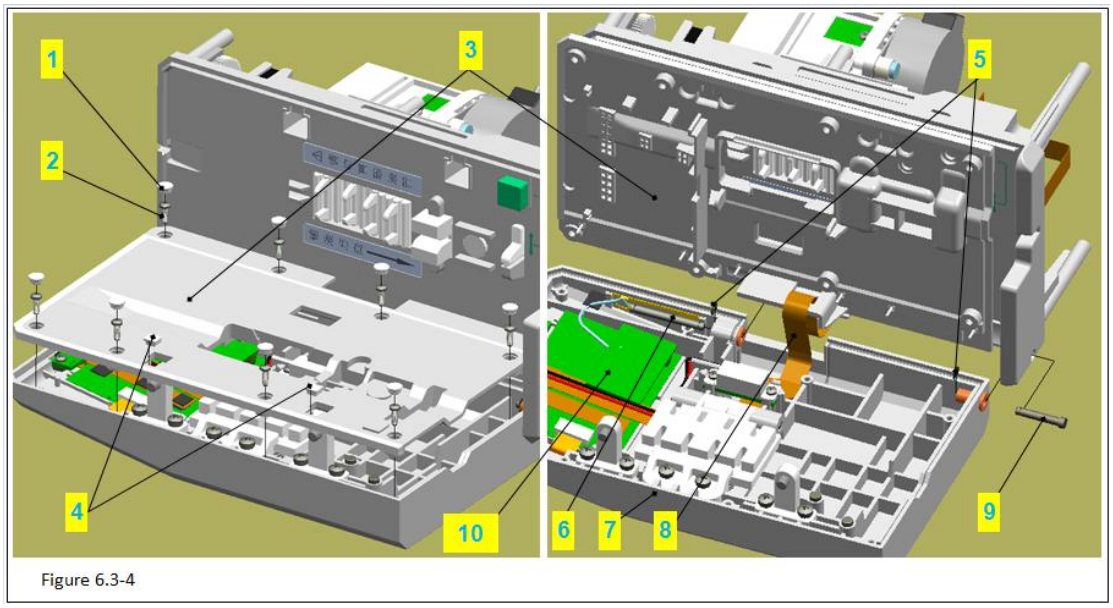


Figure 6.3-4

Figure 6.3-4 Notes:

Code Name

1 –Round Decorative Cover

2 – PB2.3 Tapping Screw

3 –Square Decorative Cover

4 –Cover Board

5 –Panel

6 – FPC Flat Cable

7 – Medium plate

8 –Flat Cable Sealing Groove

9 – PCB Bracket for PCB

1)Use pilers to take down the 9 round decorative covers (figure 6.3-4/code name 1) and 2 square decorative covers (figure 6.3-4/code name 3) in the cover board (figure 6.3-4/code name 4).

Attention: use pilers tip to insert between the decorative covers and stick them up, avoid breaking the cover board.

2)Use phillips screwdriver to remove the 7 PB2.3 tapping screws.

3)Take out the cover board lightly.

Attention: Do not miss the magnets in the cover board.

4)Remove the FRC flat cable (figure 6.3-4/code name 6) inside the cover board (figure 6.3-4/code name 5).

5)Remove the flat cable sealing groove (figure 6.3-4/code name 8) in the middle board (figure 6.3-4/code name 7).

6)Pull out the bracket for PCB (figure 6.3-4/code name9) lightly, and pull out the FPC flat cable at the same time.

Attention: take care the FPC flat cable not to be hung.

### 6.3.5 Remove the pump door components

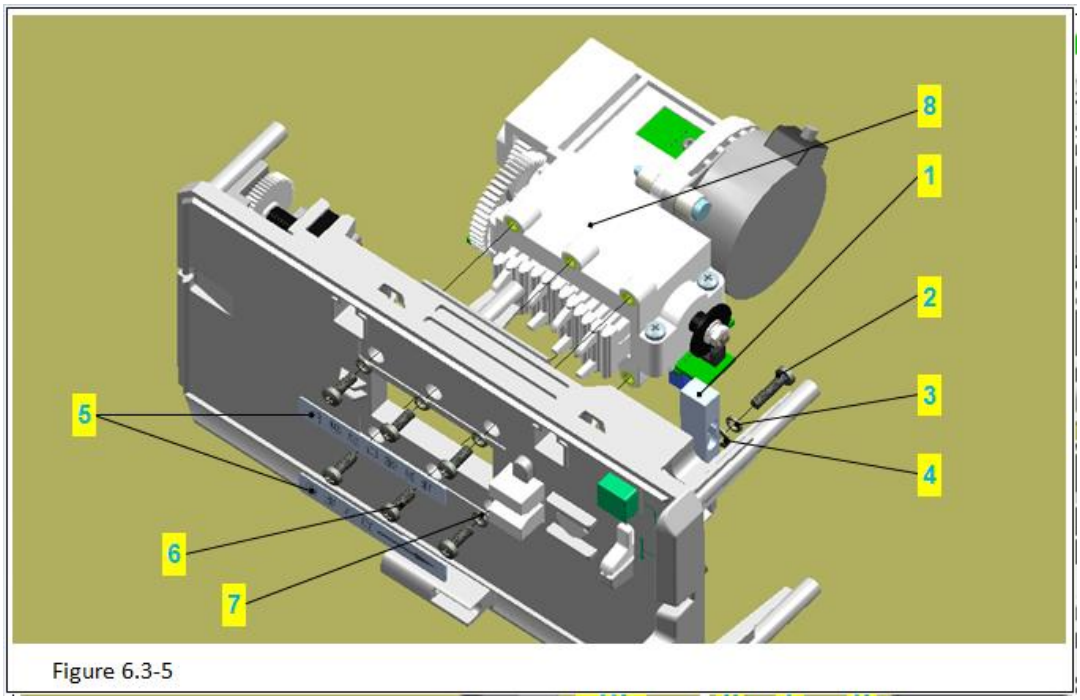


Figure 6.3-5

Figure 6.3-5 Notes:

Code Name

1 –Spring 2 –Door Shaft

1)Use pilers to take out the spring (figure 6.3-5/code name 2) in the door shaft (figure 6.3-5/code name 2).

Attention: move the door shaft for a certain distance in the direction of spring to ensure the pilers tip can stick in and stick up the spring. Take care not to scratch the surface of the door shaft, once the surface of the door shaft is scratched, it is easy to be stuck in the shaft sleeve.

2)Use pilers to take out the door shaft.

Attention: move the door shaft for a certain distance in the direction of spring, stick the pilers tip into the groove of the door shaft and pull it out. Take care not to scratch the surface of the door shaft.

3)Remove the cover board (figure 6.3-5/code name 5).

### 6.3.6 Remove Components of the Peristaltic Pump

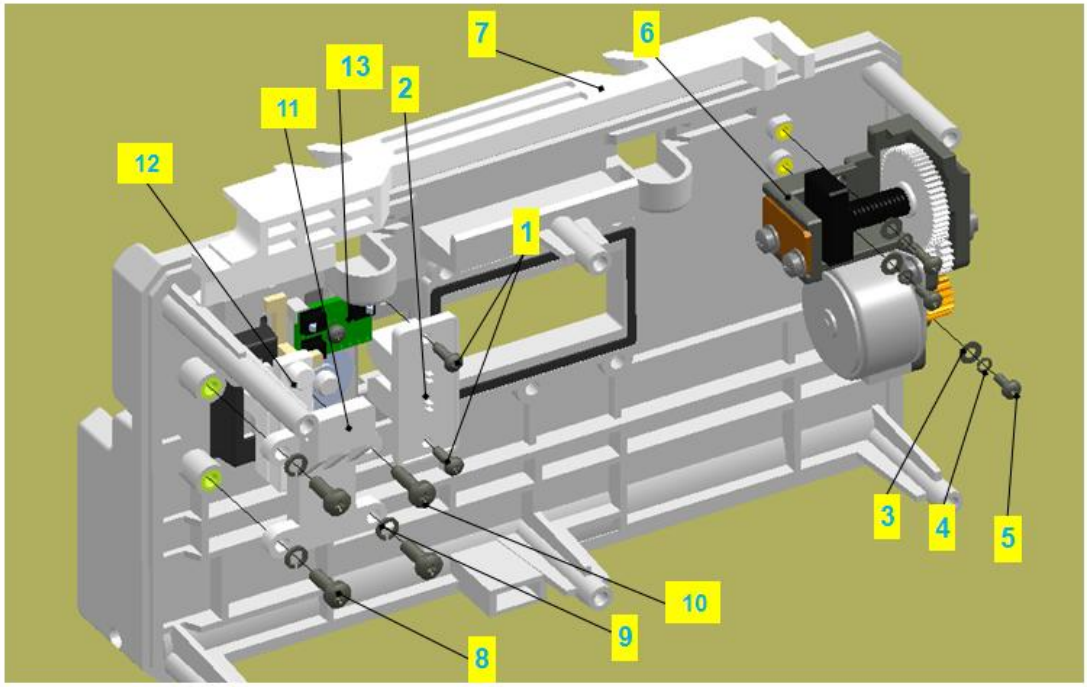


Figure 6.3-6

Figure 6.3-6 Notes:

Code Name

1 –Pressure sensor
2 –M4 Machine Screw
3 – M4 Spring Washer
4 – M4 Flat Washer
5 –Middle board Label
6 –M3.0 Machine Screw
7 – M3.0 Spring Washer
8 –Components of the Peristaltic pump

1) Use phillips screwdriver to take out the M4 machine screws (figure 6.3-6/code name 2) in the pressure sensor (figure 6.3-6/code name 3).

2)Remove the pressure sensor.

Attention: Do not break off the connection wire of the pressure sensor and take down the pressure from the board.

3)Use pilers to tear down the middle board label (figure 6.3-6/code name 5).

Attention: Do not break the surface.

4) Use phillips screwdriver to take out the 6 M3.0 machine screws (figure 6.3-6/code name 6).Remove the M3.0 spring washer (figure 6.3-6/code name 7).

5) Remove components of the peristaltic pump (figure 6.3-6/code name 8).

### 6.3.7 Remove the Door Drive and Components of the Middle board

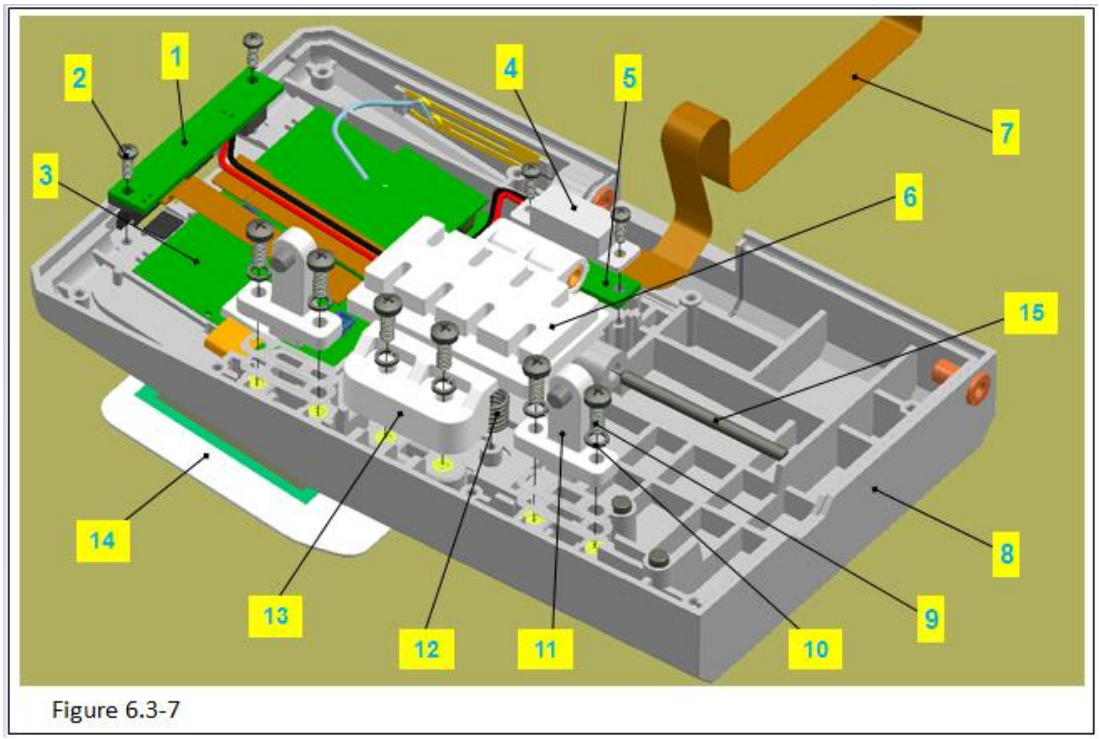


Figure 6.3-7

Figure 6.3-7 Notes:

Code Name

1 –Alarm lamp board
2 –PB2.3 tapping screw
3 –SYS02 module and display screen
4 – Lamp shade
5 –Lamp board
6 –Baffle
7 –FPC flat cable
8 –Panel
9 –M3 machine screw
10 –M3 spring washer
11 –Door catch
12 –Baffle spring
13 –Baffle block
14 –Membrane
15 –Baffle shaft

1)Use phillips screwdriver to remove 2 M3 machine screws (figure 6.3-7/code name 9) in the baffle block (figure 6.3-7/code name 13), take down the 2 M3 spring washer (figure 6.3-7/code name 10).

Attention: hand press on the baffle, avoid the baffle spring pushes out it.

2)Take down the baffle block.

3)Turn up the baffle (figure 6.3-7/code name 6),take down the 2 baffle springs(figure 6.3-7/code name 12).

4)Use pilers to take down the baffle shaft (figure 6.3-7/code name 15).

Attention: use the pilers tip to push out it backward for a length and pull put it.

5)Take down the baffle.

6)Use phillips screwdriver to remove the 2 PB2.3 tapping screws (figure 6.3-7/code name 2) in the lamp shade(figure 6.3-7/code name 4).

7)Take down the lamp shadeand lamp board (figure 6.3-7/code name 5).

8)Take down the FPC flat cable (figure 6.3-7/code name 7).

9)Remove the connection wire in the alarm lamp board (figure 6.3-7/code name 1)from

SYS02 module board (figure 6.3-7/code name 3) lightly.

10)Use phillips to remove the 2 PB2.3 tapping screws in the alarm lamp board and take down the alarm lamp board and lamp shadelightly.

11)Take out the SYS02 module board and display screen lightly.

Attention: put the display screen upward, avoid scratching or pollute it.

12) Use phillips to remove the 4 machine screws in the 2 door catches (figure 6.3-7/code name 11) and take down the 4 M3 spring washers.

Attention: do not miss the plastic chips under the door catch,2 pieces of each door catch.

13) Take down the door catch.

14) Tear down the membrane (figure 6.3-7/code name 14) from the panel (figure 6.3-7/code name 8).

***Note: the installation operation method: Reverse operation according to the steps above.***

# The Safety Test

## 7 The Safety Test

**Warning!**

- **The electric and safety test is used to check the abnormal electric hazards. If the hazards can not be discovered timely, it might cause injury to the patient and operator.**
- **The equipment of the electric and safety test adopts the safety analyzer, maintainers should master the usage.**
- **The electric and safety test completely complies with the standard of IEC/EN60601-1.**
- **Please conduct the electric and safety test in a normal circumstance (including temperature, humidity and atmosphere).**
- **The electric and safety test in the chapter takes the example of 601 safety analyzer. Different brands of the safety analyzer might have a different analysis.**
- **If the electric and safety test fails, please contract our after-sales service engineers.**

### 7.1 Electric Leakage Test of Enclosure

1. Connect the 601 safety analyzer to 264 VAC/60 Hz power source.
2. Connect the applied part of the tested equipment by using the applied part connection tooling. The SUM end of the connection tooling for applied part is connected to the RA end of the safety analyzer.

3. Via power cord, connect the tested equipment to the auxiliary power output port on 601 safety analyzer.
4. Connect one end of the red testing wire to the “Red input terminal” on the safety analyzer, and clip another end tightly onto the metal foil on the surface of tested equipment enclosure.
5. Turn on the power source of 601 safety analyzer and press “5－Enclosure leakage” on the panel of 601 safety analyzer to enter the enclosure leakage current testing interface.
6. The enclosure leakage current shall not exceed 100μA under normal conditions and shall not exceed 300μA in event of a single fault.

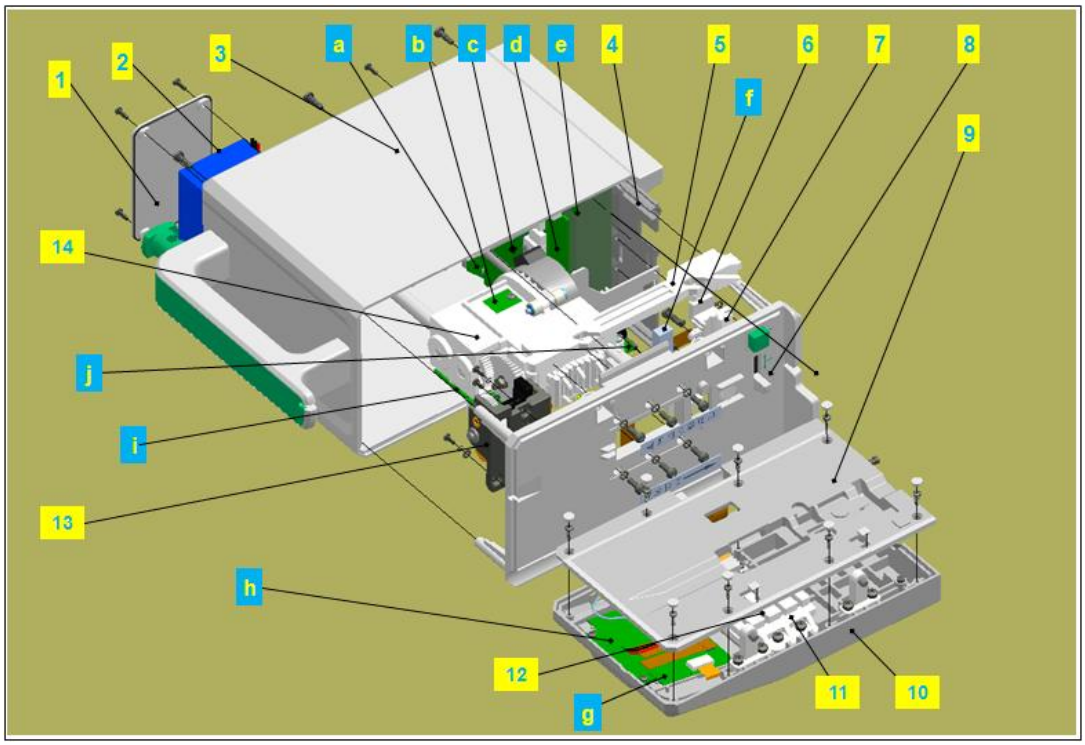
## 7.2 Electric Leakage Test of Ground

1. Connect the 601 safety analyzer to 264 VAC/60 Hz power source.
2. Connect the tested applied part to the the RA end of the safety analyzer.
3. Connect the 601 safety analyzer to 264 VAC/60 Hz power source.
4. Turn on the power source of 601 safety analyzer and press “4－Ground leakage” on the panel of 601 safety analyzer to enter the ground leakage current testing interface.
5. The enclosure leakage current shall not exceed 500μA under normal conditions and shall not exceed 1000μA in event of a single fault.

## 7.3 Electric Leakage Test of Patient

1. Connect the applied part of the tested equipment by using the applied part connection tooling. The SUM end of the connection tooling for applied part is connected to the RA end of the safety analyzer.
2. Via power cord, connect the tested equipment to the auxiliary power output port on 601 safety analyzer.
3. Turn on the power source of 601 safety analyzer and press “6－Patient leakage” on the panel of 601 safety analyzer.
4. Keep pressing “APPLIED PART” key to select AC or DC measuring. If DC is selected, “DC" is displayed behind the limit value.
5. The patient leakage current shall not exceed 10μA under normal conditions and shall not exceed 50μA in event of a single fault.

## 8 Maintenance Spare Parts List




Code Name

| No. | Part number | Description | No. | Part number | Description |
|---|---|---|---|---|---|
| 1 | 60Z0020261 | Cover of Battery | a | 7901000004 | Interface Board |
| 2 | 7404000006 | Battery | b | 9114002321 | Pressure&speed detecting board |
| 3 | 9114002441 | Rear Cover | c | 9114002252 | Power Controll Board |
| 4 | 9108008001 | PCB Bracket Component | d | 9114002242 | DC-DC Power Board |
| 5 | 60Z00204911 | Sliding Block | e | 9114002231 | AC-DC Power Board |
| 6 | 60Z0020531 | Cover of Anti-Free-Flow Clamp | f | 9114002321 | Pressure Sensor |
| 7 | 60Z0020191 | Anti-Free-Flow Clamp | g | 9114002282 | Alarm Lamp Board |
| 8 | 9114002480 | Middle Board | h | 9116000011 | SYS02 Module Board |
| 9 | 60Z0020131 | Cover Board | i | 9114002242 | Peristaltic Pump Control Board |
| 10 | 9108011001 | Panel | j | 9114006001 | Peristaltic Tablets Test Board |
| 11 | 9114002480 | Baffle Block | | 9114002262 | Interface Board |
| 12 | 9114002480 | Baffle | | 9114004001 | Hall Board |
| 13 | 9114002481 | Door Driver Component | | 7901000003 | Air Bubble Sensor |

# MADCAPTAIN TECHNOLOGY CO., LTD

The after-sales service address: 12th Floor, Baiwang Research Building, No.5158 Shahe West Road, Xili, Nanshan District, Shenzhen, P.R.China

Telephone: 0755-26953369

Fax: 0755-26001651

Postal: 518055

Website:http://www.medcaptain.com

E-mail:info@medcaptain.com