KellyMed®

KL-602 Syringe Pump

Service Manual

Beijing KellyMed Co., Ltd.

Importance

This manual provides information needed to service the Syringe Pump. This manual is intended for use by certified biomedical engineering technicians or personnel with equivalent experience and training in servicing this type of equipment. It is recommended that the user complete the training class geared specifically to the Syringe Pump.

Revision History

The following revision history table summarizes changes in this document.

Revision No.	Revision Date	Description of Changes
1.0	21/05/2010/	Initial version.
1.1	16/04/2015	Update pictures of front cover, front view and rear view.
1.2	31/12/2021	English grammar correction. Update EC representative of back cover.

Contents

1. Description of pump

1.1   Specifications

| POWER REQUIREMENTS	230V AC, 50Hz 8 * AA NIMH battery 9.6VDC
BATTERY LIFE	1.5~2 years
POWER CONSUMPTION	≤ 15VA
FLOW RATE	0.1 ~ 99.9mL/h (in 0.1mL/h increments) 100 ~ 1300mL/h (in 1mL/h increments) 0.1~400mL/h for 10mL syringes. 0.1~600mL/h for 20mL syringes. 0.1~800mL/h for 30mL syringes. 0.1~1300mL/h for 50mL syringes.
ACCURACY	±2%
VOLUME	0.001 ~ 99.999ml (in 0.001ml increments) 100.00 ~ 999.99ml (in 0.01ml increments) 1000.0 ~ 9999.9ml (in 0.1ml increments)
DELIVERY LIMIT	0.1 ~ 99.9ml（in 0.1ml increments） 100 ~ 9999ml（in 1ml increments）
KVO	0.1mL/h~1.0ml/h (user selected)
SYRINGE SPECIFICATION	10ml, 20ml, 30ml, 50ml
ANTI-BOLUS	Release pressure when pump get occluded
BOLUS	1 ml ~ 5ml
BOLUS RATE	Maximum Rate of each syringe type
OPERATION CONDITIONS	5~40℃, 20~90% RH (no condensation)
STORAGE CONDITIONS	-20~55℃, ≤93% RH (no condensation)
WARRANTY	1 years

Table 1.1 Specifications

1.2   Front view
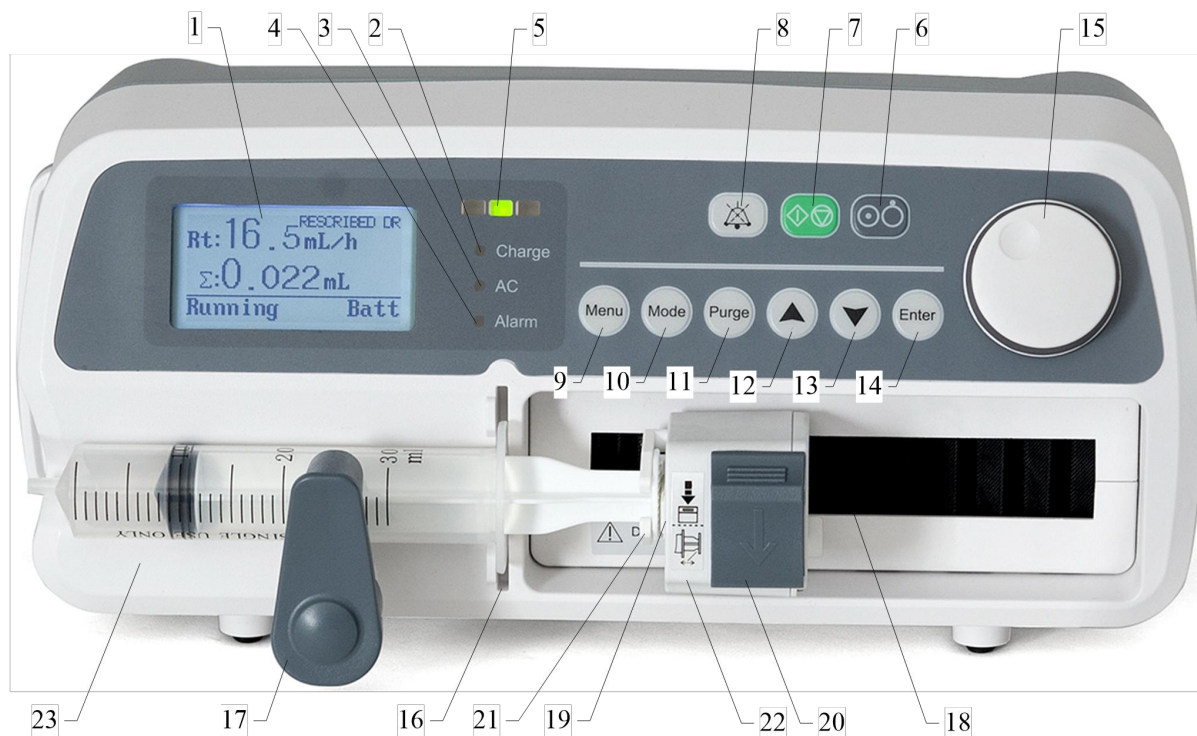
Figure 1.1 Front view

1	LCD DISPLAY	2	CHARGE LED	3	AC LED
4	ALARM LED	5	WORKING LED	6	[ON/OFF]KEY
7	[START/STOP] KEY	8	[SILENCE]KEY	9	[MENU]KEY
10	[MODE]KEY	11	[PURGE] KEY	12	[UP]KEY
13	[DOWN]KEY	14	[ENTER]KEY	15	[SHUTTLE]KEY
16	SYRINGE INSTALL SLOT	17	SYRINGE PLATE	18	WATERPROOF CLOTH
19	PRESSURE SENSOR	20	OPEN NUT	21	PLUNGER HOOK
22	PUSHER	23	V SHAPE SLOT		

1.3　Rear view
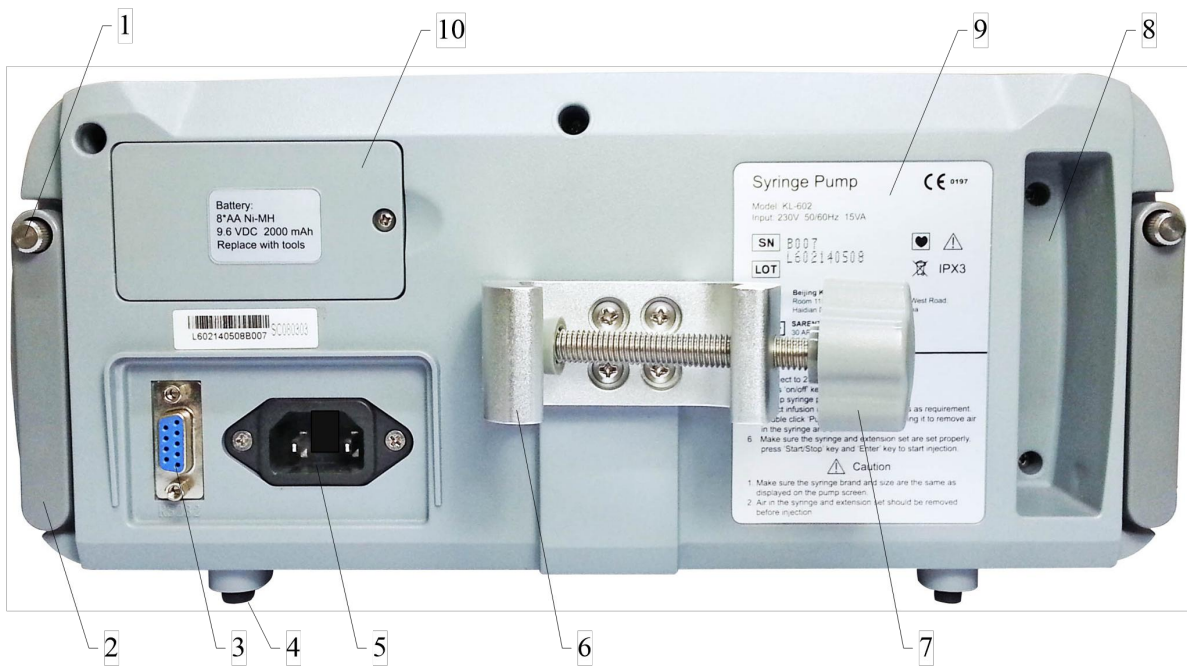
Figure 1.2 Rear view

1	CASCADE SCREWS	2	CASCADE BAR	3	PUMP FEET
4	BATTERY COVER	5	MODEL TAG	6	PUMP HANDLE
7	COMMUNICATE PORT	8	AC POWER INLET	9	CLAMP SCREW
10	CLAMP FOLDING SWITCH	11	POLE CLAMP	12	HAND WHEEL

1.4　Syringe view
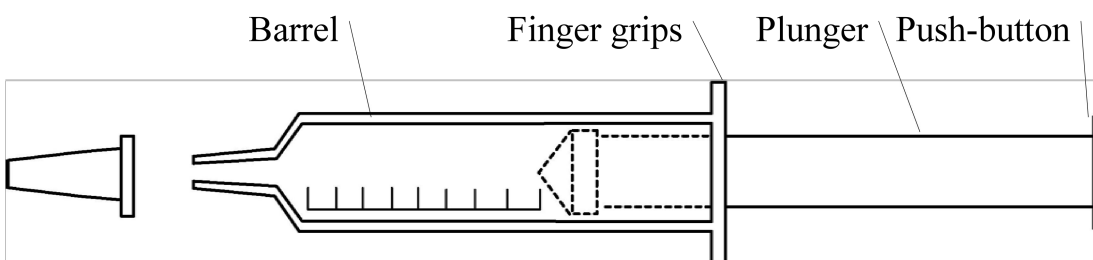
Figure 1.3 Syringe view
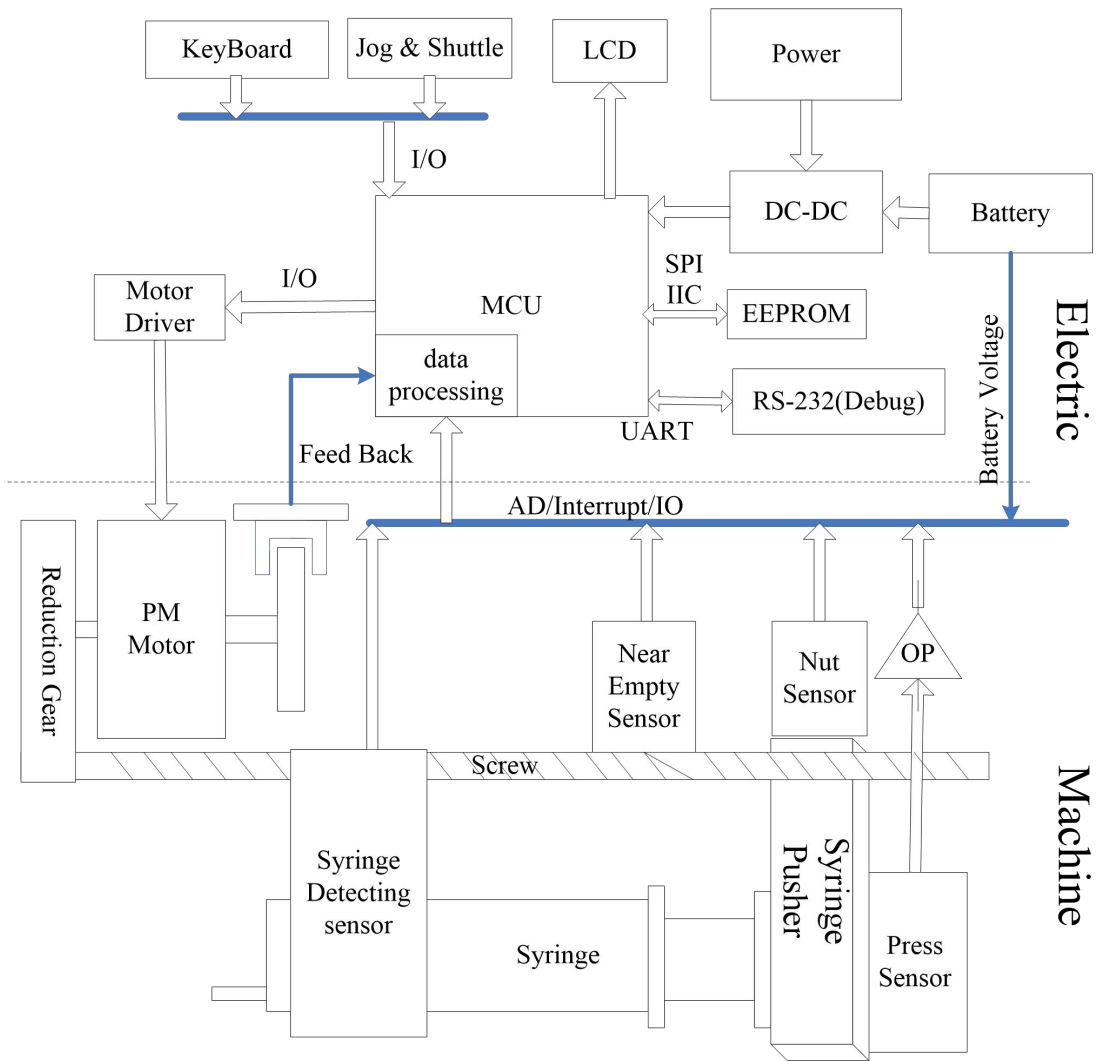
2. System block diagram

KeyBoard | Jog & Shuttle | LCD | Power

I/O

Motor Driver

I/O

MCU

data processing

SPI IIC

EEPROM

RS-232(Debug)

UART

DC-DC | Battery

Battery Voltage

Electric

Feed Back

AD/Interrupt/IO

Reduction Gear

PM Motor

Screw

Near Empty Sensor

Nut Sensor

OP

Machine

Syringe Detecting sensor

Syringe

Syringe Pusher

Press Sensor

Figure 2.1 System block diagram

3. Tools and equipments (for service and test)

1	Power	Power cord
2	Replace Battery	New battery（8 * AA NIMH battery 9.6VDC） Cross-screwdriver
3	Replace fuses	Cross-screwdriver An electric soldering iron One fuse（2A 250V）
4	Disassembly	Cross-screwdriver

4. Troubleshooting

No.	The symptom of failure	Cause	Solution
1	Occlusion alarm	Alarm when the pump working	1、Calibrate pressure sensor (See Chapter 11) 2、Check and see if there is stuff in the pipe(remove) 3、Check the plane of PRESSURE SENSOR(Front view 1.1 (19)) Whether above shell(if not, replace Pressure Sensor) 4、Check with the value of Pressure sensor change when press it with finger(if not, replace Pressure Sensor)
2	Occlusion but not alarm	The set value is too sensitive	1、Adjust the sensitive of occlusion alarm 2、Calibrate pressure sensor(See Chapter 11)
		Bad connection in the circuit board	Check the connecting point and reinstall in the original status(see Chapter 7)
		Bad Pressure sensor	Replace a new one
3	Abnormal LCD & LED display	Failure of the system	Replace a new main board
		Bad LCD	Replace a new one
		The indicator fails to work	Replace a new lamp or send back the circuit board and repair
4	Key fails to work	Bad key	Replace a new key

5	Low battery alarm	The battery out	Connect to the AC and charge the battery
		No AC display or low battery alarm	Check the power supply circuit(see Chapter 5)
6	The pump fail to work	Motor is weak or fail to work	Replace a new motor
		Failure in the Driver IC or circuit board	Check the circuit board and replace a new driver IC
7	Injection accuracy big error	Injection accuracy above 2%	Repeat defining a custom syringe.(see Chapter 10)
8	Fix error alarm	Install syringe error	repeat install syringe Press the [PURGE] key twice, and the second keep pressing is about two seconds
		Bad Pressure sensor	Replace a new one
9	Nut error alarm	NUT no installation position	Press the [PURGE] key twice, and the second keep pressing is about two seconds until the "Nut Err" disappeared on LCD
		Bad connection in the circuit board	Check the connecting point and reinstall in the original status(see Chapter 7)
10	Syringe Plate Detection error	Syringe detect board position error	Adjust the syringe detect board position(see Chapter 8)
11	Pump cannot be turned on.	AC power cord is not inserted properly	Check the AC power cord connection.
		Internal battery is out	Stop the operation of the pump and replace with a new battery through your local authorized dealer.
		The voltage of the internal battery is low.	Recharge the battery fully for more than 8 hours by connecting the pump to an AC power outlet and turn it on.

5. Check power supply

Connect AC plot

Step 1   If 230VAC absent, Please check the power supply socket connection to the board.

Step 2   If not 230V, please replace fuse.

Step 3   If not 14.75V-15V, please replace the power supply board.

Step 4   If not above 9.0V, please charging for the internal battery.
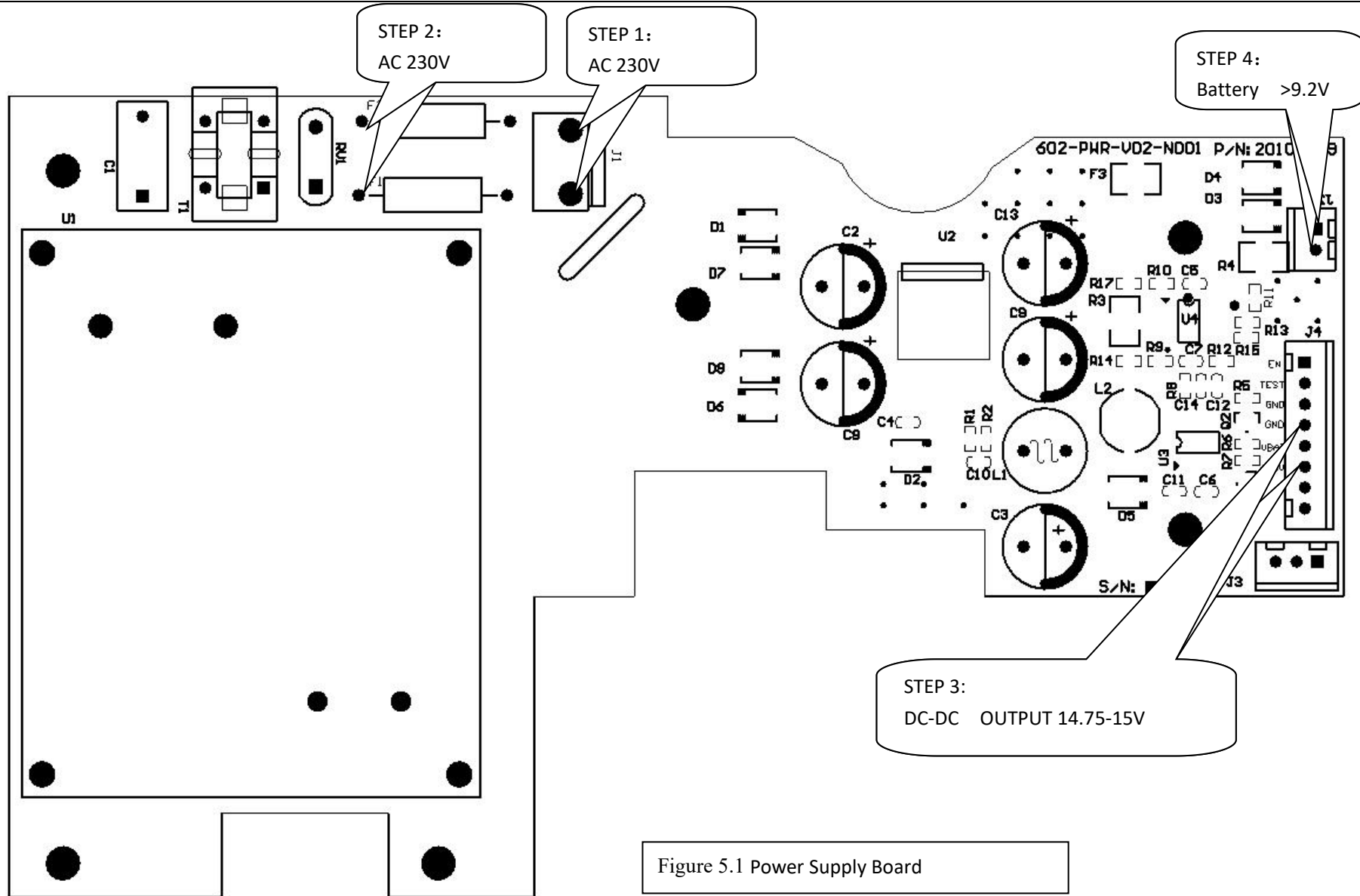
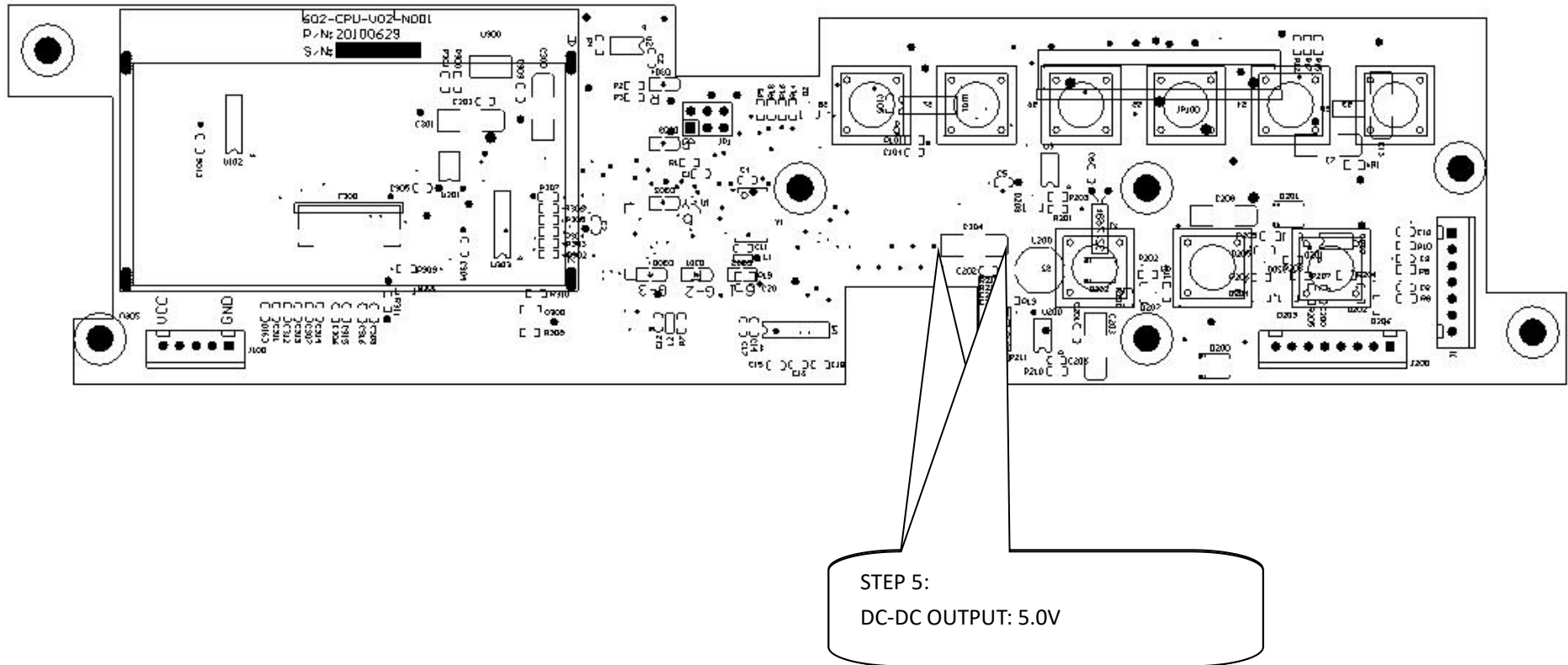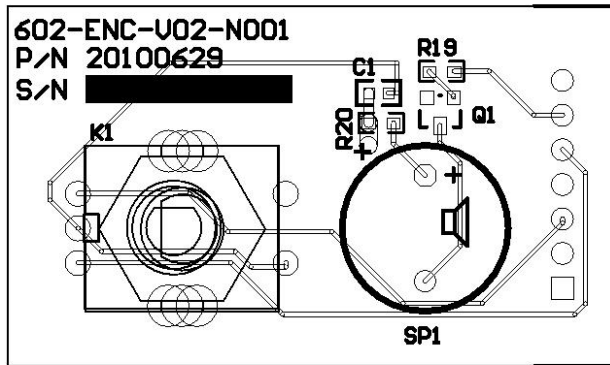Step 5   If not about 5.0V, please replace the main board.

STEP 2:
AC 230V

STEP 1:
AC 230V

STEP 4:
Battery   >9.2V

602-PWR-VD2-NDD1 P/N: 2010

STEP 3:
DC-DC   OUTPUT 14.75-15V

Figure 5.1 Power Supply Board

STEP 5:
DC-DC OUTPUT: 5.0V

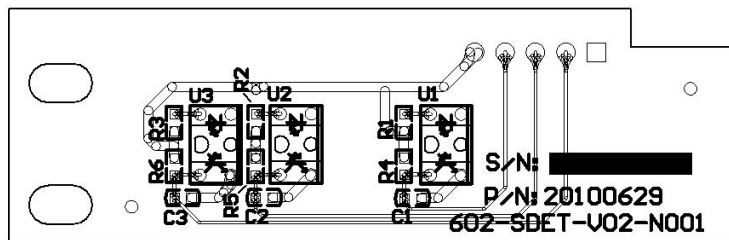Figure 5.2 Main board

Other boards in pump

Jog& shuttle board
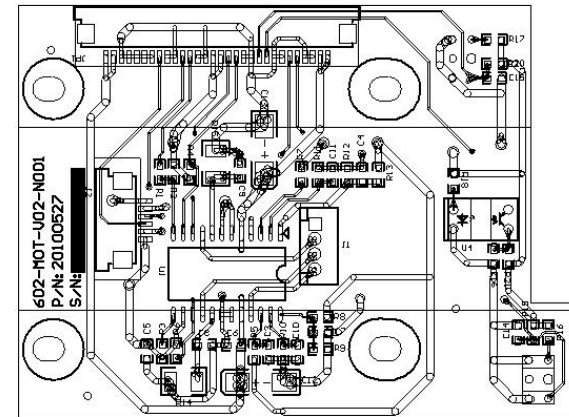
Motor driver board

Syringe detect board

6. Replace battery

Step 1   New battery (Internal battery must be supplied by the manufacturer)

Step 2   Open the cover of battery

Use a cross screwdriver

Step 3   Pull off the conjunction, take the failed battery out

Pull off the conjunction

Step 4   Replace a new battery in the battery position
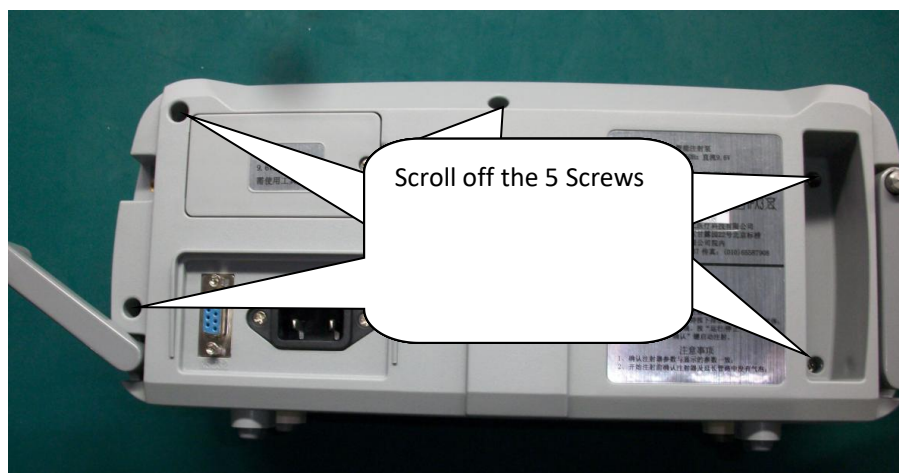

Step 5   Put the conjunction into the slot
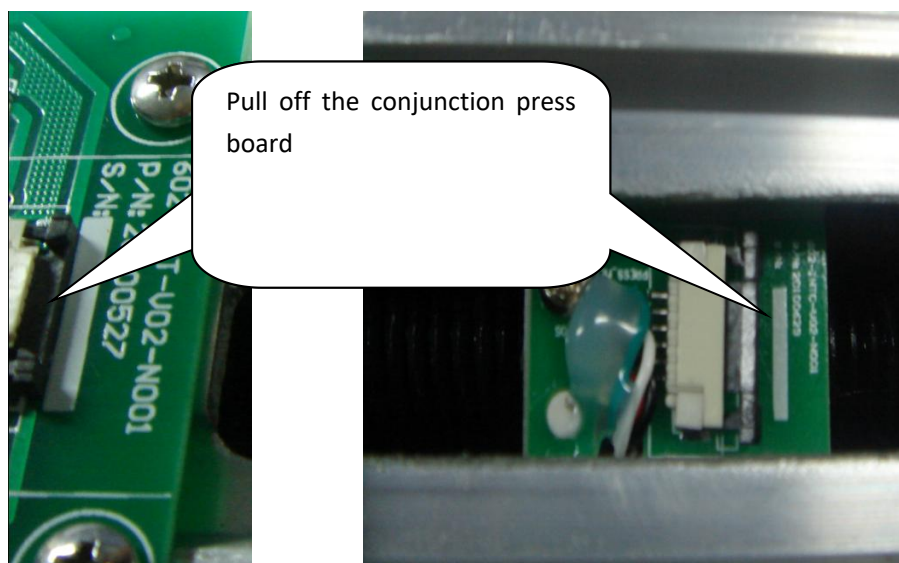
Step 6 Close the cover and fix it.

7. Replace FPC cable between motor board & inter-connection board

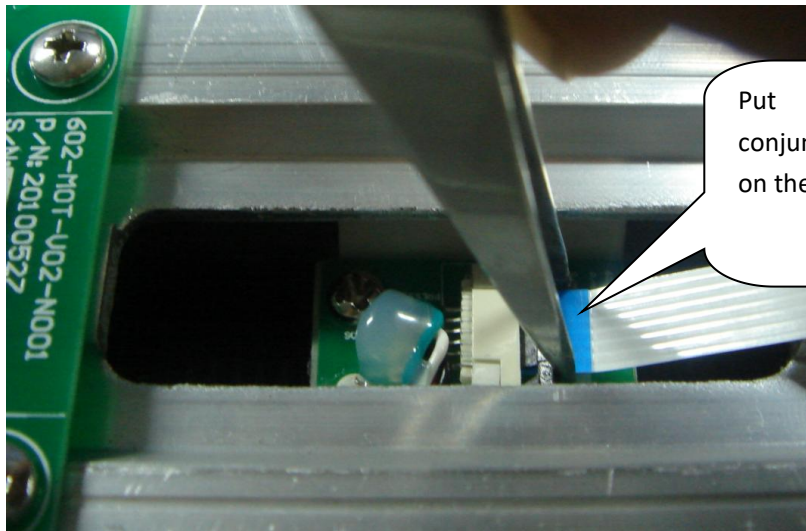Step 1   Prepare a new FPC cable (Must be supplied by manufacturer)

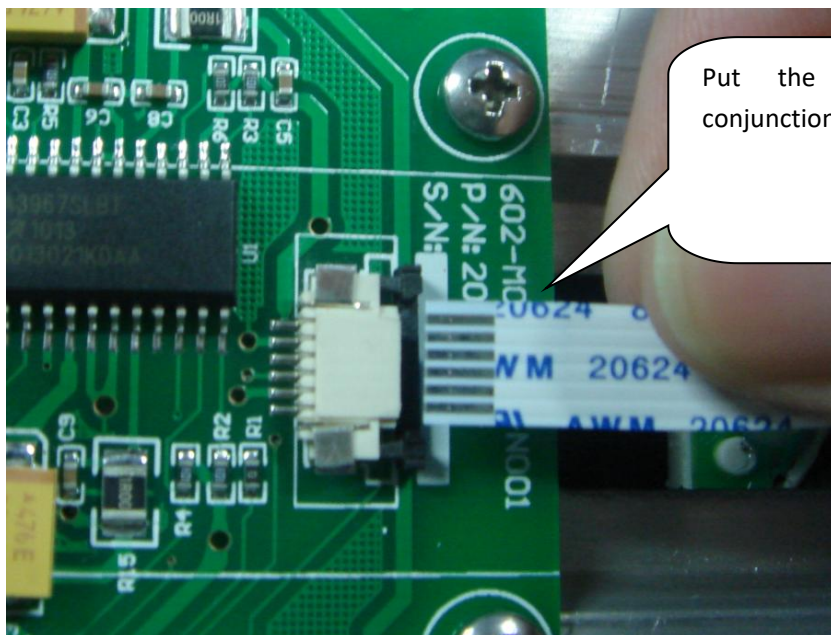Step 2   Open the shell

Step 3   Take off the defective FPC cable

Step 4   Replace a new FPC cable

Put the FPC into the conjunction by clip then put on the press board

Put the FPC into the conjunction

Push in the press board with the clips under the FPC cable

Step 5   Close the shell and fix it

8. Adjust the syringe detector board

Step 1   Open the shell

Step 2   Scroll the screws off with a cross screwdriver

using cross screwdriver

Adjust the position of syringe detector board in or out
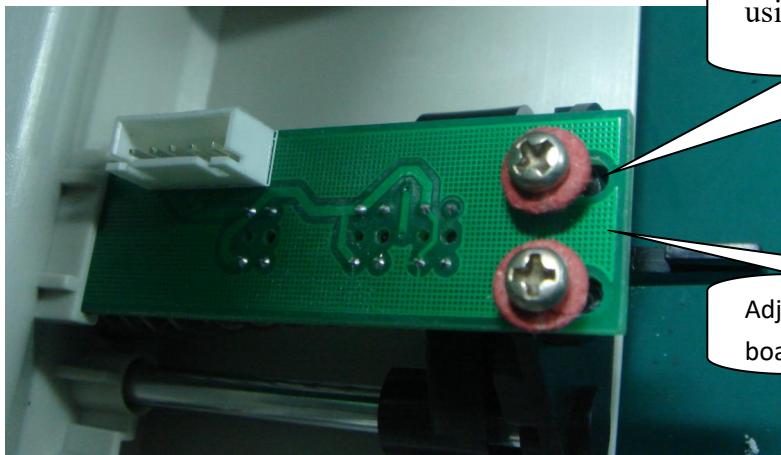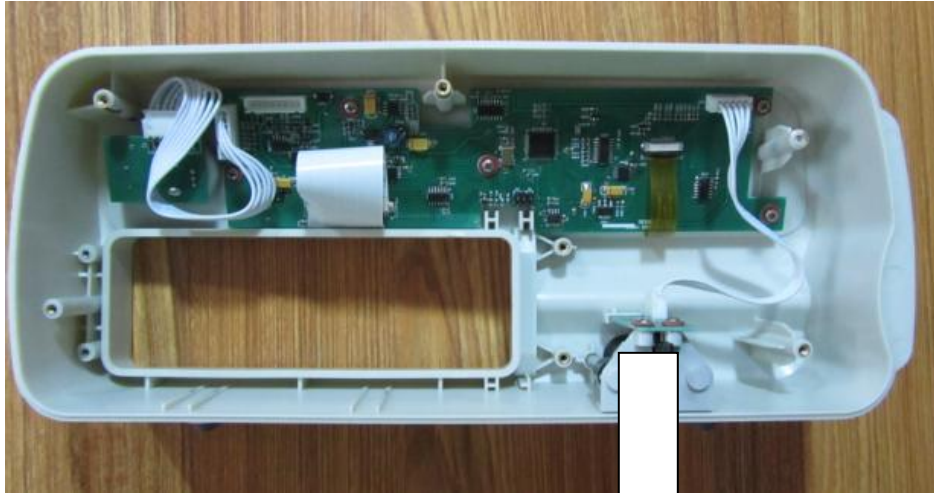
Step 3   Adjust the position of syringe detector board in or out

Step 4   Test the detector function status

Turn on the Syringe Pump then press [START/STOP]KEY into the bellowed interface

Syringe Size
May be 10ml
20ml 30ml 50ml

brand ： QIAOPAI	
nn ml Scale：78.2mm	
CONFIRM	CANCLE
M-Rate	BAT.

In this interface loaded different syringe size（10ml 20ml 30ml 50ml），can display syringe size correctly, if not display correctly, return STEP3, Adjust the position of syringe detector board in or

out slightly Until finding the correct position.

Step 5   After the detector function adjustment, fix the screws on.

Step 6 Close the shell and fix it

NOTE：

If adjust the position of syringe detector board in or out failed, please enlarge the holes in which the screw in by filing then copy the above steps.

9. Check software version

Through the following steps to check software version

1）Turn on the pump

2）Press [MENU] KEY to enter the main menu

Rate Mode(ml/h)	
VOL-Time Mode	
Weight Mode	▼
MENU	BAT.

3）Select "Special Setting" from main menu and press "enter" key to enter "Special Setting" menu

Default Setting	▲
Log	
Product Info.	▼
Special	BAT.

4）Select "Product Info" from "Special Setting" menu and press "enter" key to enter Product Information Display

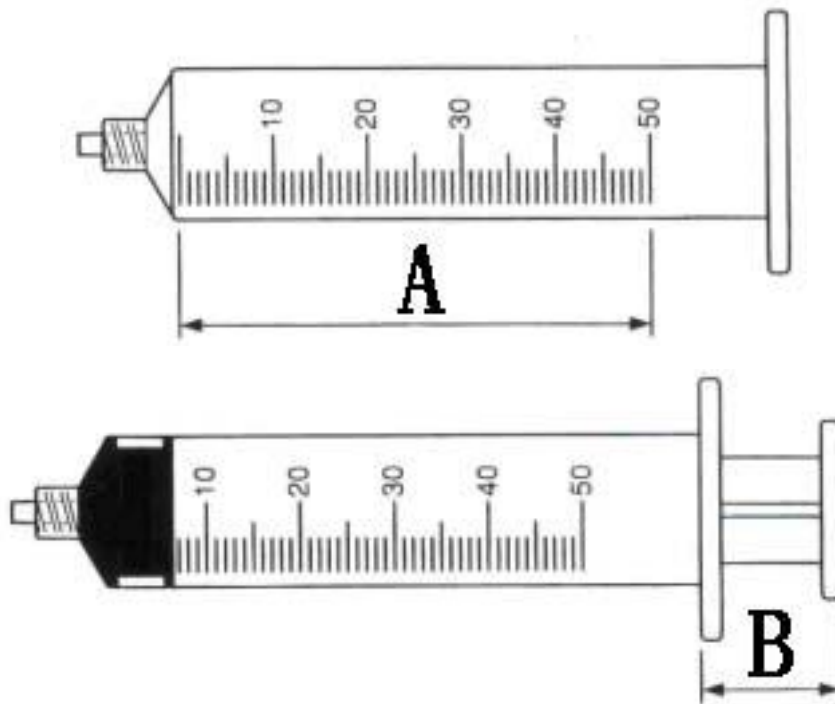| Ver. ： L602.01.05	
Date : XXXXXXXX	
S/N : XXXXXXXXX	▼
Product	BAT.

10. Syringe calibration

The Syringe Pump support custom two brand : custom 1, custom 2, Each of four types: syringe including 10ml, 20ml 30ml 50ml

Tools:

1.　Vernier caliper, or ruler

2.　syringe

Ready:

1）　Measure A (barrel length) and B (plunger length) and record.

2）　Install syringe (Example 10 ml)in pump (According to the instructions of the installation method of installation).

3）　Into custom syringe interface.

4）　When the brand for black when we show, Press [ENTER]KEY. Let custom 1 or 2 against the white custom, the diagram below:

Brand： CUSTOM 1	
A 76.00mm B 28.00mm	
Confirm	Cancel
Custom	BAT.

5）　Choose the name of self-define syringe(self-define 1 and self-define 2) by turning shuttle key. This selection custom 2, the diagram below:

```
Brand：  CUSTOM 2
A   76.00mm      B   28.00mm
Confirm                      Cancel

Custom                       BAT.
```

6）Press [ENTER]KEY. After confirm, turning shuttle key or use [UP]KEY [DOWN]KEY choose A . show as the diagram below:

```
Brand：  CUSTOM 1
A   76.00mm      B   28.00mm
Confirm                      Cancel

Custom                       BAT.
```

7）Input the value of A and Press [ENTER]KEY confirm.

Such as measuring the length of a syringe effective scale for 75.8 mm, syringe push handle length b for 25.8 mm A study is adjusted for 75.8, adjust the numerical values of item B for 25.8

8）Adopt the same method, set the data item B.

9）Confirm input. Syringe custom finish.

10）   Into syringes options, check the definition of syringe parameters are now stored. As shown in figure

```
Brand：  CUSTOM2
10ml      75.80      25.80
20ml      00.00      00.00
30ml      00.00      00.00
50ml      00.00      00.00

syringe                      BAT.
```

If you want to continue to define different types of syringe repeat the step 1) - step 8).

11. Occlusion calibration

Through the following steps to calibrate the pressure sensor:

1) Turn on the pump.

2) Press [MENU] KEY to enter the main menu.

Rate Mode(ml/h)	
VOL-Time Mode	
Weight Mode	▼
MENU	BAT.

3) Select "Special Setting" from main menu and press "enter" key to enter Special Setting menu.

Language	▲
Default Setting	
Maintenance	▼
Special	BAT.

4) Select "Maintenance" from Special Setting menu and press "enter" key to enter system Maintenance Interface.(For example calibrate pressure sensor for 10ml).

AC：367 BAT：375		
P:342	PUMP-1	Snn
K：20	MARK1	SAVE
Maintain.		BAT.

"nn" maybe is 10、20、 30 or 50.
S10 means 10ml syringe

5) Install syringe then connect syringe and manometer

6) Press [START/STOP] KEY of the pump when it displays as above picture shows. then motor of the pump starts running. meanwhile "PUMP-1" changes to "PUMP-2".

AC：367 BAT：375		
P:342	PUMP-2	S10
K：20	MARK1	SAVE
Maintain.		BAT.

7) Press [START/STOP] KEY of the pump When manometer displays 0.02MPa ,then press [DOWN] KEY Select "MARK1"as shown below.

```
AC：367   BAT：375

P:342    PUMP-1     S10

K：20  MARK1       SAVE

Maintain.              BAT.
```

8) Press [START/STOP] KEY of the pump when display above. then motor of the pump starts running. While "MARK1" into "MARK2".

```
AC：367   BAT：375

P:342    PUMP-1     S10

K：20   MARK2       SAVE

Maintain.              BAT.
```

9) Press [START/STOP] KEY of the pump When manometer displays 0.10MPa ,then press [DOWN] KEY Select "SAVE" as shown below.

```
AC：367   BAT：375

P:342    PUMP-1     S10

K：20   MARK1      SAVE

Maintain.              BAT.
```

10) Press [ENTER] KEY of the pump save the record. Calibrate pressure sensor for 10ml syringe finished.

Repeat the above step4 to step10 to calibration pressure sensor for 20ml, 30ml and 50ml syringe

12. Software upgrade

12.1   Tools and program

1)   RS232 Serial Port Connector Line.

2)   Problem for Software upgrade
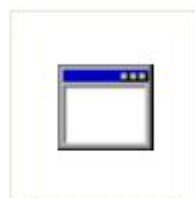
BootLoader
Control.exe   hc08sprg.exe
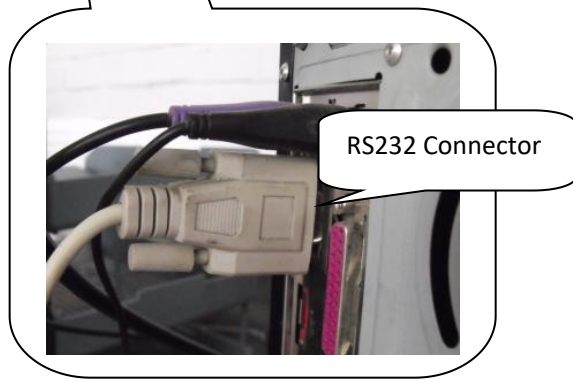
3)   Software (new version)

L602.01.05.abs.s19

12.2   Connect PC and pump with RS232

2.1)   Operating system required

Win 9X/Me /2000/XP/ (Windows XP professional edition is recommended)
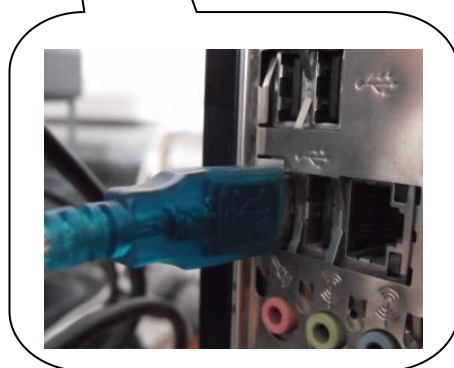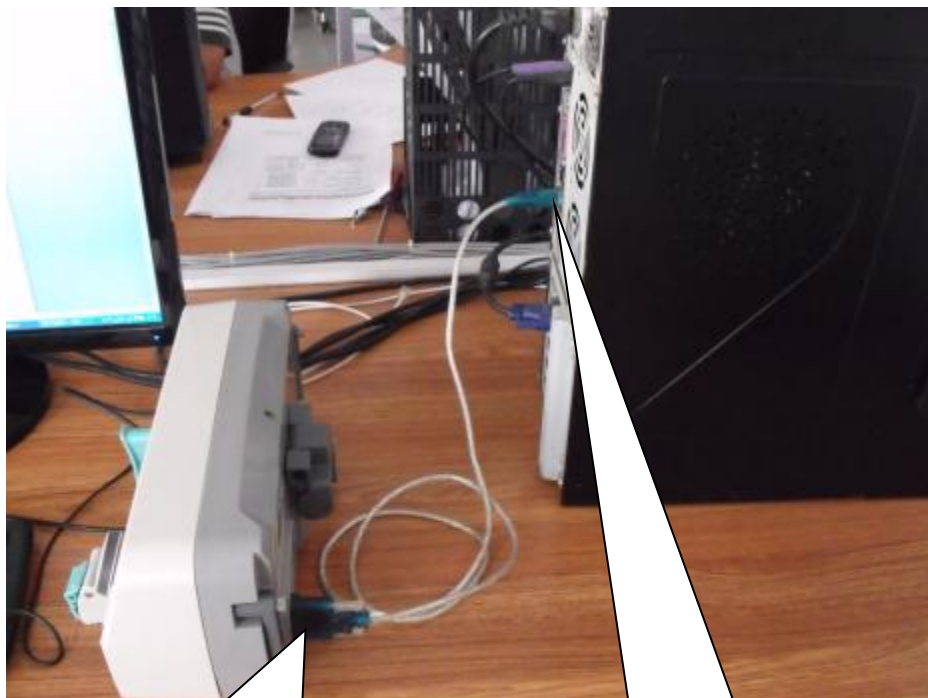
2.2)   Connect PC and the Syringe Pump with RS232.

RS232 Connector

⚠️ **WARNING**

A   Disconnect the AC power cord.

B   Turn off the Syringe Pump before connection

NOTE：

A   If there is not RS232 communication port, replace it by a "USB/RS232 line". Connection diagram as below.
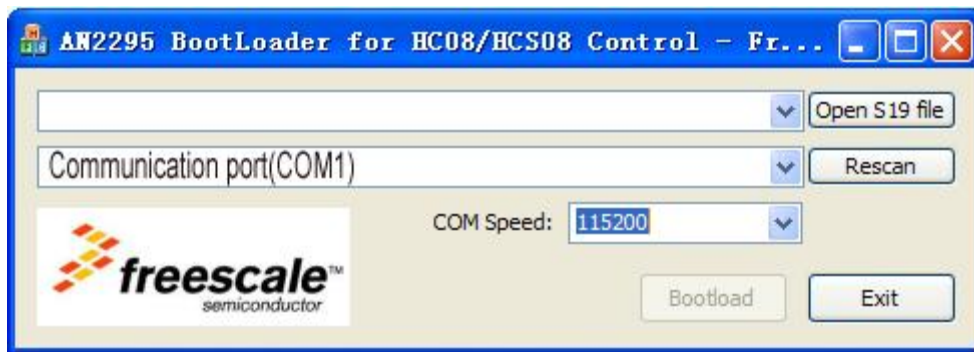
B   USB to serial line.

12.3   Software upgrade

Step 1   Connect PC and Syringe Pump with RS232.

Step 2   Double-click this icon ，Open the software upgrade tool--"Boot Loader Control.exe"，The tool's interface is as below.
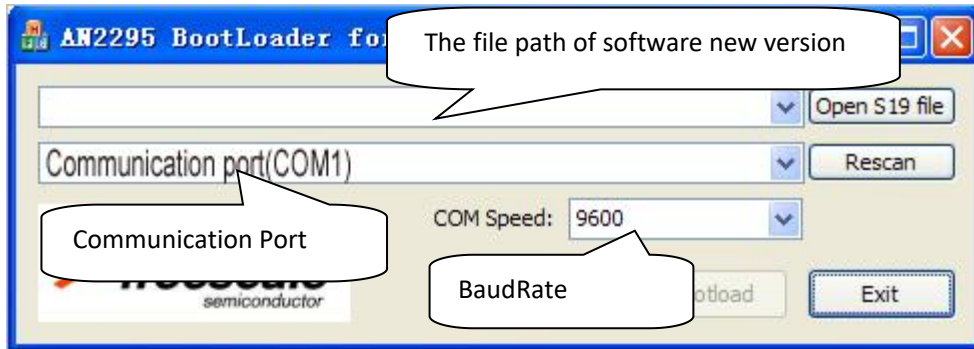
Step 3   Select COM Speed
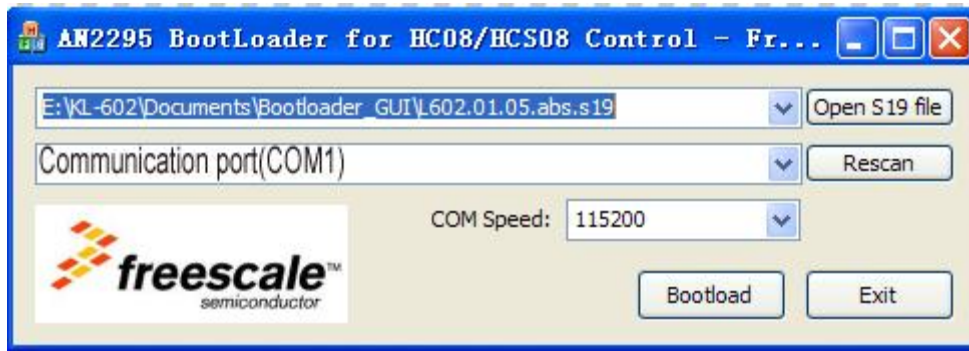
Select the "COM Speed" value "115200".as below.

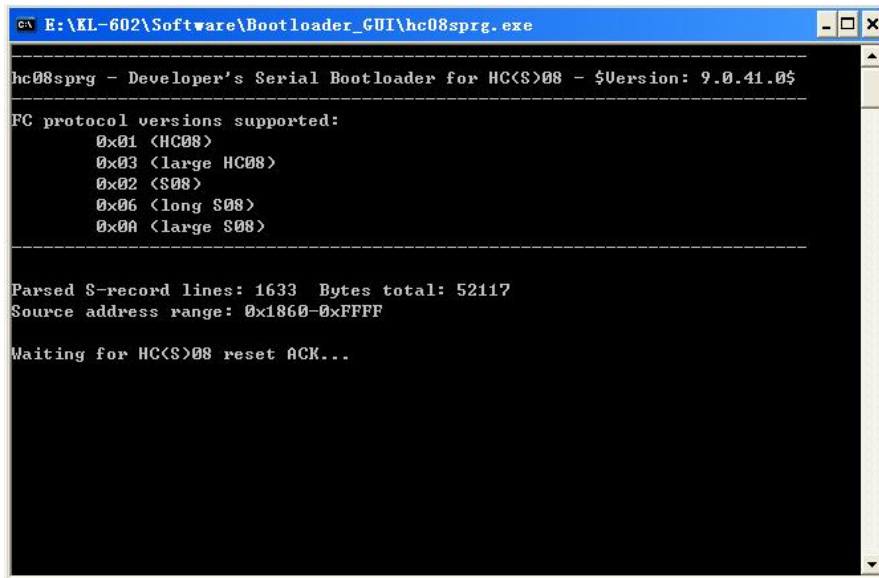Step 4   Select the Software program file（New   version）.

Click the "Open S19 file" button ，Select the file name " L602.01.05.abs.s19".
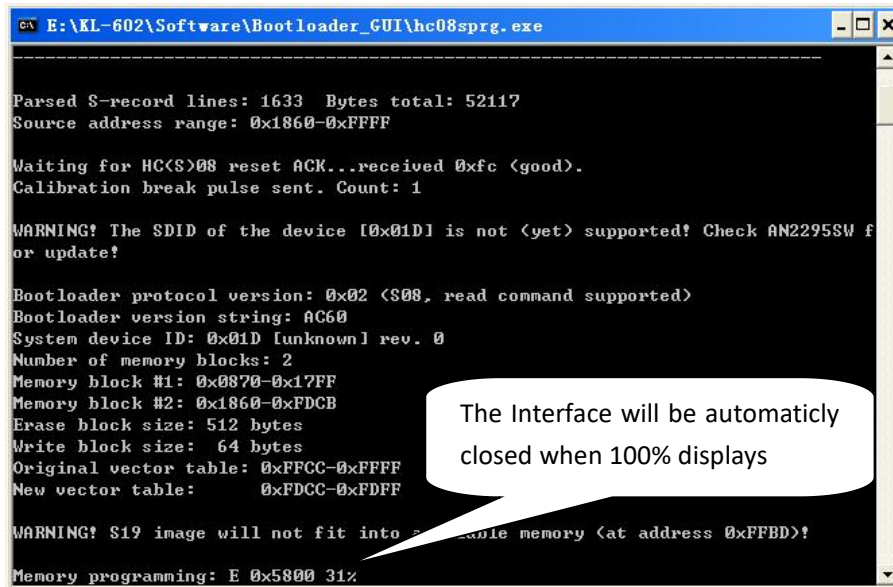
Step 5   The interface of selecting the software program file is as below.

Step 6   Click the button "Bootload", Enter downloading interface.

Step 7   Press the [ON/OFF] KEY of the pump (Keep holding, don't release) until waiting process is finished. Software upgrade is process as below.
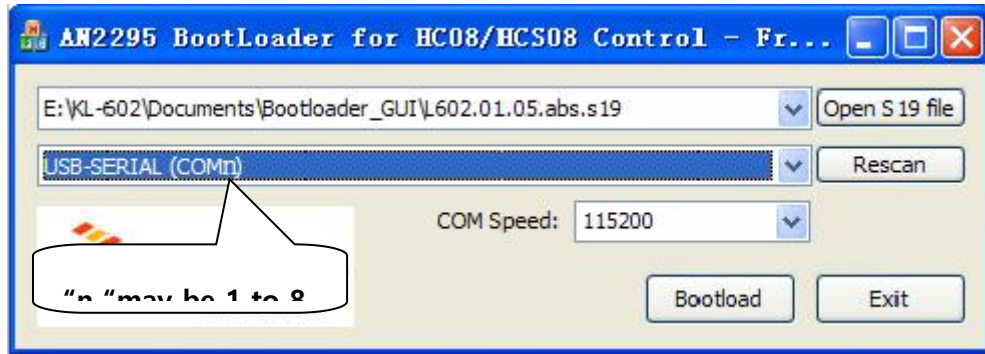

Please release the [ON/OFF] KEY of the pump when the interface closed automatically, software upgrading is finished.

NOTE:

1） If your computer has a firewall, please remove the restrictions on the upgrade tool
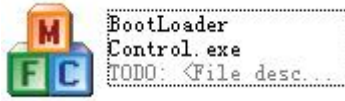
2） Double-click this icon when you use ” USB-RS232 line” to replace RS232， Open the software upgrade tool--“Boot Loader Control.exe”， The tool's interface is shown as below.

3） If failed to upgrade procedures,（ Such as: Release the [ON/OFF]KEY of the pump in the process of upgrading or RS232 etc.）, Please repeat the above step 1 to step 7 to upgrade again.

4） If upgrade procedures is failed the pump will not startup.

NOTE:

Occlusion alarm occura frequently after the software upgrade, please follow the method to calibrate pressure sensor.

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