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# 1. Overview

## 1.1 Structure

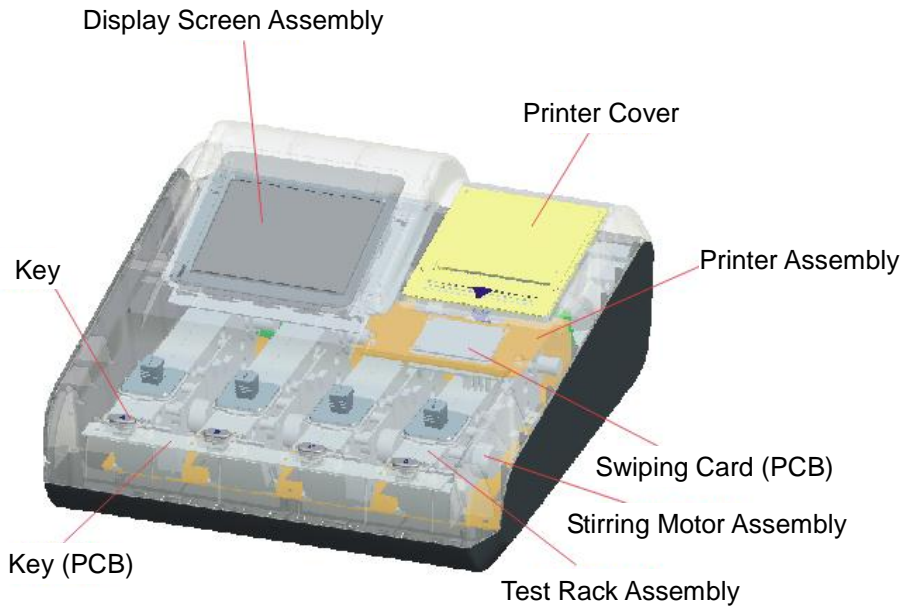


Figure 1-1 Device Structure Diagram

## 1.2 Device Block Diagram

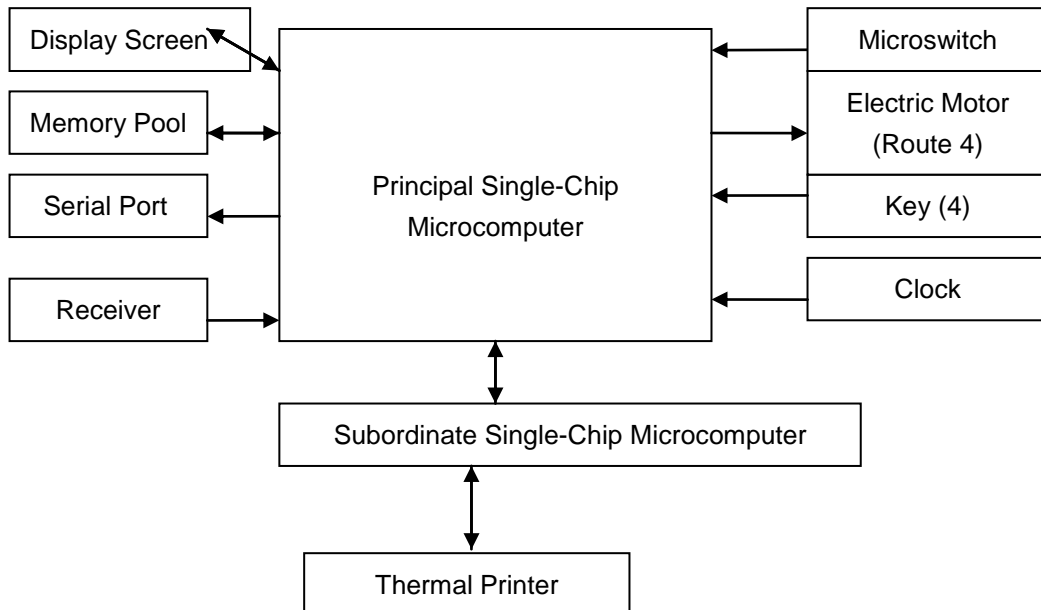


Figure 1-2 Device Block Diagram

## 1.3 Function and Composition of Each Part

### 1.3.1 Stirring System

The stirring system is composed of crescent iron, super magnet, stirring headstock, motor mounting plate and stirring motor (as shown in Figure 1-3-1 Stirring System Assembly Diagram). The main function of the stirring system is to establish a magnetic field by using magnet and 2 crescent irons, which will attract the magnetic stirrer and make its two ends polarized. The stirrer rotates as the motor rotates. The function of

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stirring and mixing reagents evenly is so achieved.



Figure 1-3-1 Stirring System Assembly Diagram

### 1.3.2 Test Rack System

The test rack system is composed of stirring system, heating block, heating sheet, shielding box, receiver board, laser rod, laser tube post, No. 1 and No. 2 spring button covers, compression spring, studs and regulating screws. Laser rod is an electronic component providing light source for the whole system. The heating sheet is mounted onto the heating block of aluminium alloy. After being electrified, the heating sheet starts heating, and conducts the heat to the heating block to heat the reagent. The whole system is to measure and transfer the data to the next level for comprehensive analysis. The system is as shown in Figure 1-3-2 Test Rack System Diagram.



Figure 1-3-2 Test Rack System Diagram

## 2. Program Upgrade

If program upgrade is needed for specific protein analyzer, install the needed software and connect the Burner by reference to program burning method, and then upgrade the single chip microcomputers of the main control board and the printer board according to the program upgrade requirements. (The program upgrade of the main control board can be achieved by serial port).

## 3. Maintenance and Service

### 3.1 Daily Maintenance

1. Clear any small stain or spill

Disconnect the device power plug and wipe the device carefully with a wet cloth. Avoid liquid splashing into the test cell. Keep the device dry before the use.

2. Protect the measuring channel and keep it clean

Do not splash liquid or other foreign matter into the measuring channel. Keep the measuring channel

clean. If it is left unused, place a blank measuring cup in each channel and prevent dust entering into the measuring channel.

## 3.2 Weekly Maintenance

Check the test channels every week, if there's sundries inside, clear it;

## 3.3 Service

### 3.3.1 Common System Failures

Failure	Possible Cause	Solution
No display on the screen	Power switch OFF	Turn on the power switch
	Power disconnected	Re-insert the attaching plug
	Display signal line loosened	Reconnect the display interface line
Display blurred or highlighted	LCD display contrast changes as the environment changes	Enter the contrast interface to adjust the device contrast
Printer not working	No printing paper	Load new printing paper
	Printing paper stuck after tearing	Clear the stuck part
	Thermal printing paper loaded reversely	Re-load the printing paper
	Printer interface line loosened	Reconnect the printer interface line
Test data too big or too small	Correction factor abnormal	Recover the correction factor to the original value 1.00
Temperature detection abnormal	Temperature detection voltage +1.2V abnormal	Measure the interface voltage with a multimeter. If there is any problem, check the related circuit.
	Wiring contact defective	If the cause is obvious, reconnect or replace the plug.
The device unable to be turned on	Fuse burned	Replace the fuse
	Switch OFF	Switch on
	Three-core power line failure	1. Reconnect the three-core power line 2. Replace the three-core power line
	Power output end poorly connected	Reconnect the power output line
Put in the cuvette, when the motor rotates, the button light shining	The copper powder on the hole surface makes the button light's two points short out.	Grind off the copper powder on the button hole's surface, or cut off a little of each side. Requirement: the two points of the button light shouldn't short out.
After the startup, the test interface displays "Pls. add in anti-serum"	The microswitch is squeezed by the heating block	Take down the microswitch, add in a spacer between the microswitch and the test block; or polish the contact surface of the microswitch and test block. The spacer thickness or polishing criteria is after putting in the cuvette, the motor could rotate, and the cuvette holding is not too loose.

Failure	Possible Cause	Solution
After being pressed down, the button can't bounce up or reach the designated place	No space between the hole and the button	Polish the hole, make a space between the hole and the button, but shouldn't be too big.

### 3.3.2 Device Operating Voltage Detection

Each operating voltage and circuit unit of this device is as shown in Table 1: Operating Voltage Test Point Comparison Table of Main Control Board

Table 1: Operating Voltage Test Point Comparison Table of Main Control Board

Serial No.	Test Point	Voltage	Function	Description
1	TP1	+3.3V	3.3V digital circuit power supply	Abnormity will lead to instrument startup failure
2	TP2	+2.5V	(ADS1259)External reference voltage	Abnormity will lead to test data error
3	TP3	+5V	3.3V switching circuit power supply	Abnormity will lead to instrument startup failure
4	TP4	-12V	-8V switching circuit power supply	Abnormity will lead to test data error
5	TP5	+8V	Analog circuit power supply	Abnormity will lead to test data error
6	TP6	-8V	Analog circuit power supply	Abnormity will lead to test data error
7	TP7	+12V	+8V switching circuit power supply	Abnormity will lead to test data error

### 3.3.3 Display Abnormity

The display unit of the device is composed of main control board, LCD driver board, display screen and touch tablet. The display screen is driven by SSD1963 chip in the LCD driver board and the touch tablet is driven by TSC2406 chip on the LCD driver board. Common failures include messy code display, blank screen, invalid touch and inaccurate touch positioning.

#### 1). Messy code display

This failure is mainly caused by abnormal data which is transmitted to LCD by LCD driver board. The possible cause is the poor contact between J1 socket of LCD driver board and LCD row line. The primary solution is disconnecting the row line in J1 and reconnecting it. If the problem remains, try to replace J1 socket.

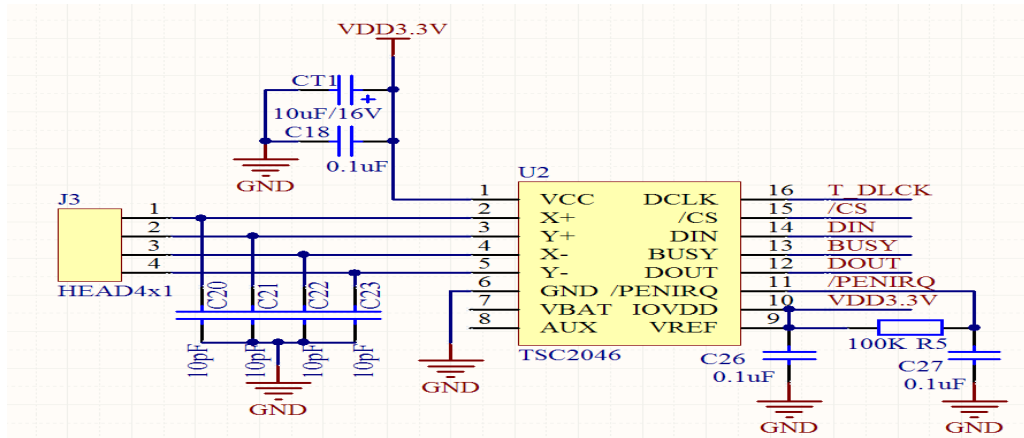
#### 2). Blank screen

This failure indicates that LCD does not work normally. The possible cause is the abnormal connection between main control board and LCD driver, or no oscillation starting of crystal oscillator. The primary solution

is to use an oscilloscope to check whether the crystal oscillator of LCD driver board starts oscillation. If yes, an abnormal connection between LCD driver board and main control board may occur. In this case, disassemble the connecting row between two boards and reassemble it. If the problem remains, try to replace the corresponding connecting seat.

### 3). Invalid touch

The touch tablet is mainly driven by TSC2406. Touch tablet crack, damage to touch row line or TSC2406 driver chip can all lead to invalid touch. The function circuit is as shown in figure 3-2-2 Touch Function Circuit.



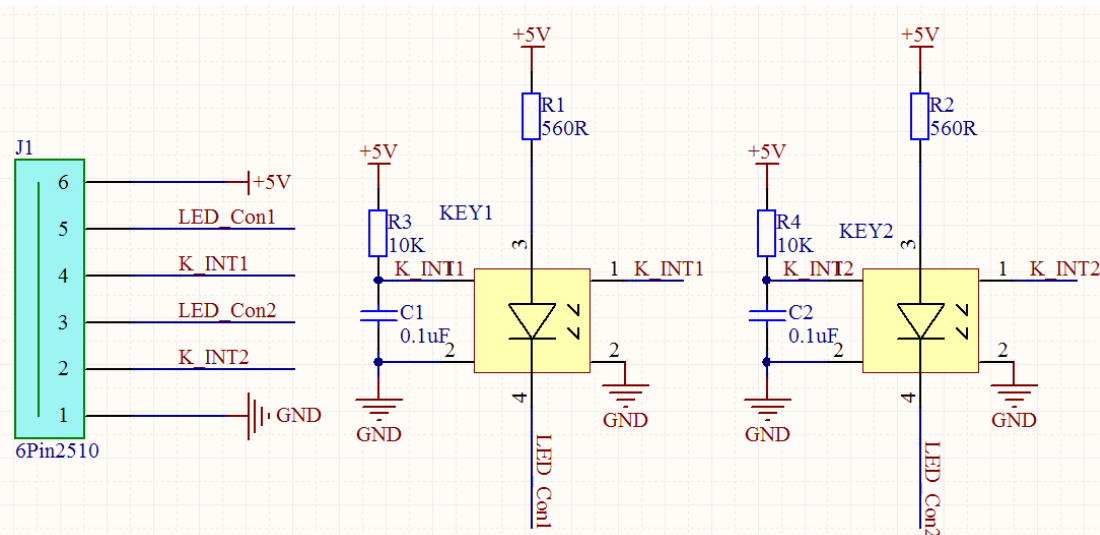
3-2-2 Touch Function Circuit

### 4). Inaccurate touch positioning

If this failure occurs, correct it by software.

### 3.3.4 Key Abnormity

“Illuminated Touch Switch” is used for the device keys. The circuit as shown in figure 3-2-3 Key Switch Circuit. While the switch is pressed and held on under normal condition, breakover between Pin 1 and Pin 2 of the switch (KEY1 or KEY2) is achieved. And while the switch is released, Pin 1 is disconnected with Pin 2. If too much dirt or foreign matter drops into the gap between the switch button and the housing, it may lead to a useless key.



3-2-3 Key Switch Circuit

### 3.3.5 Printer Abnormity

#### 1) A strip is printed out but no paper fed

The paper feed motor of thermal printer head is driven by U3(LB1838M). The main circuit as shown in Figure 3-1 Printer Motor Driving Circuit. Waveform of ENA pins (i.e. No.2, 13 pins of LB1838M) and IN pins

(i.e. No. 6,9 pins of LB1838M) can be measured with an oscilloscope during printing. Under the normal condition, impulse waveform will be output. If a waveform exists, U3 may be inappropriately soldered or the IC damaged.

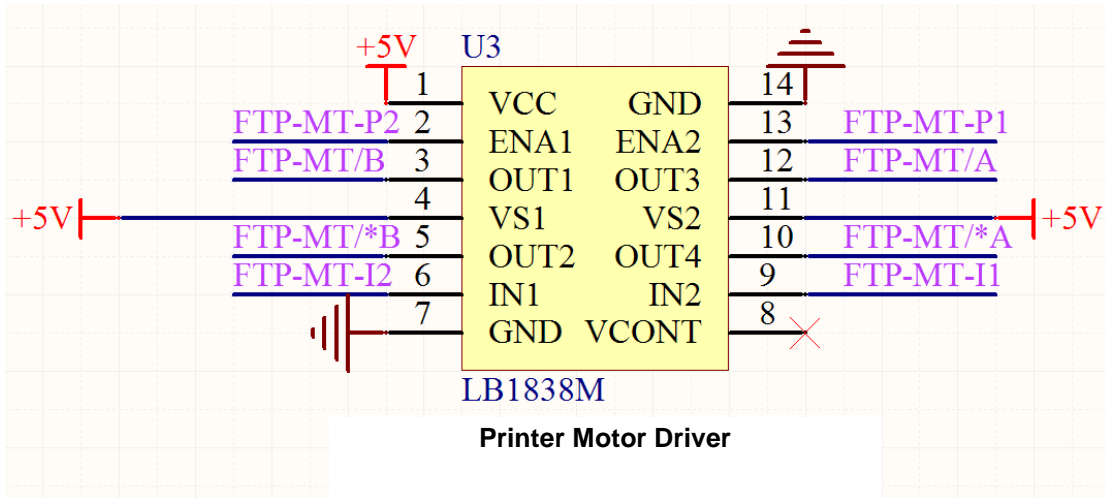


Figure 3-2-4-1 Printer Motor Driving Circuit

2) Font defect

A font defect is usually caused by defective print wiring connection. It can be solved by wiring reconnection. Replace the wiring withdrawal connector when necessary. If the heating control line of the printer is in poor contact, successive blank columns will appear.

3) No printing paper detected

If no paper is available during print, the words “Please replace paper” will display on the screen. If the words “Please replace paper” remains after correct setup of print paper, the print paper detective function may be abnormal. The print paper detective function is mainly achieved by U1 (LM393) of the printer board. The main circuit as shown in Figure 3-2-4-3 No Print Paper Detective Circuit. Under the normal condition, No. 2 pin of U1 (LM393) is in high level (approx. 4.5V~5V) and No. 1 pin in low level (approx. 0V~0.5V) when paper is available. No. 2 pin of U3 (LM393) is in low level (approx. 0V~0.5V) and No. 1 pin is in high level (approx. 3.3V) when paper is unavailable. If No. 2 (FTP-PHE) pin level of U1 (LM393) is normal but No. 1 pin (FTP-PPSEN) level is abnormal, U1 (LM393) may be damaged.

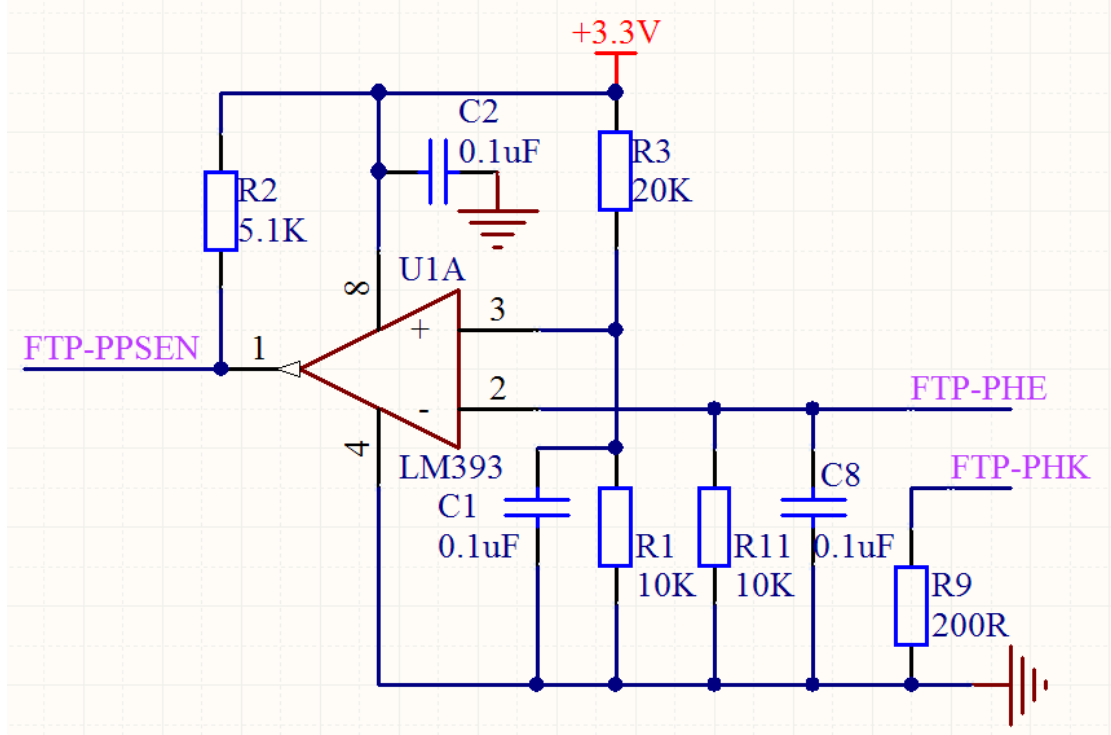


Figure 3-2-4-3 No Print Paper Detective Circuit

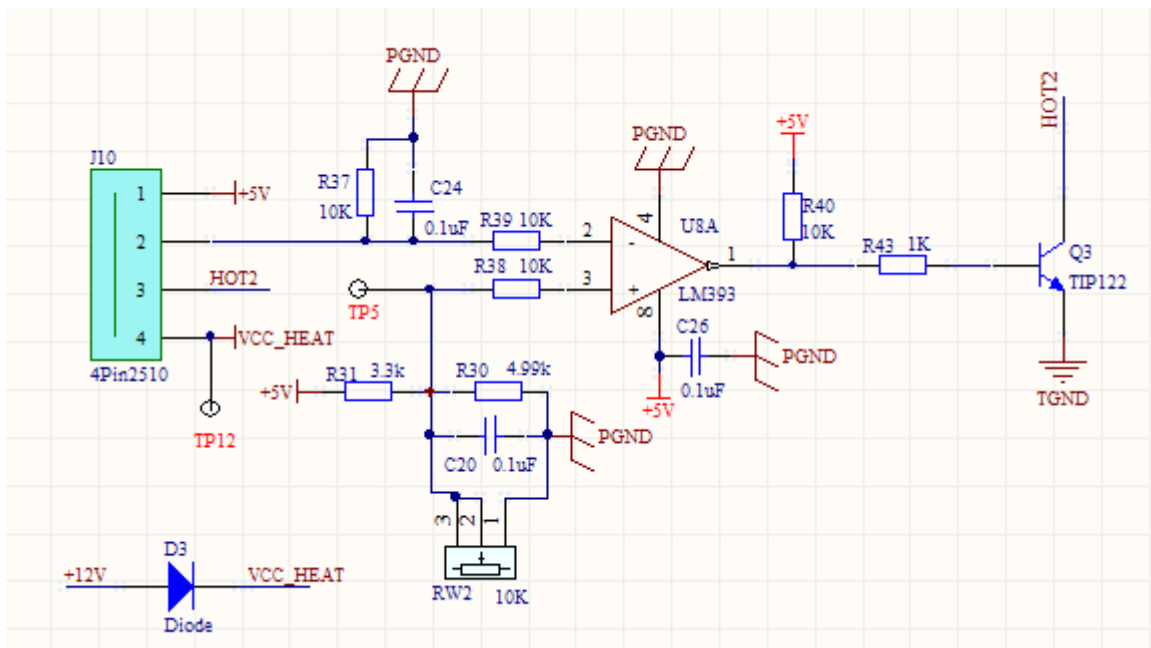
### 3.3.6 Stirring Abnormity

Stirring is achieved by the magnetic bead rotation driven by DC motor. The motor is driven by ULN2003 chip. When abnormal stirring occurs, it can be determined by interface exchange of motor and adapter plate to check whether the abnormity is caused by abnormal motor or abnormal control circuit. Generally, motor no rotation is caused by disconnected motor wiring. Test the red and black leads of the motor by multimeter. If the wiring is disconnected, the two leads will not conduct.

### 3.3.7 Heating Abnormity

The heating of the device is completely hardware controlled. The schematic diagram as shown in figure 3-2-6 Heating Control Circuit, where LM393 is a comparator. When the negative input voltage is higher than the positive input voltage, heating stops. The positive input voltage is controlled by potentiometer. The resistor R30 in the figure is not soldered. Other routes of heating control circuit are similar to Figure 3-2-6.





3-2-6 Heating Circuit

### 3.3.8 Sensor Abnormity

The sensor is composed of a microswitch which is normally off. When the measuring cup is put in, the pressure lever of the microswitch will be pressed down. When the microswitch is on, generally the failure is, the microswitch is damaged or incorrectly located and cannot upspring or be pressed down normally.

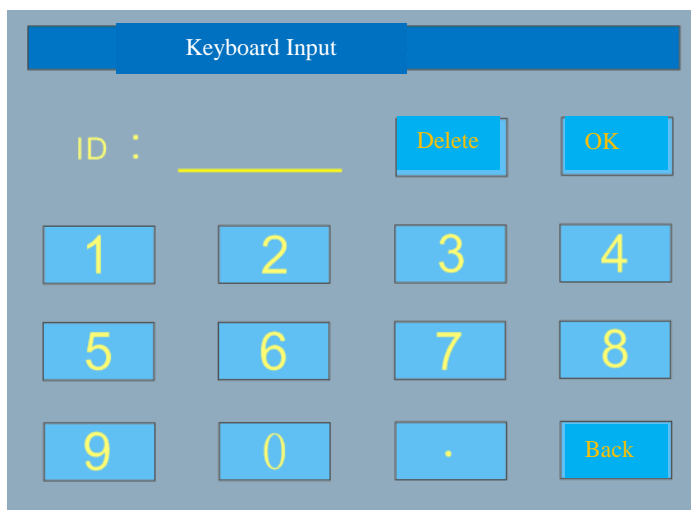
## 4. Software Settings

### 4.1 ADC Calibration

Click the user mode in the main measurement interface, enter a password to enter the channel adjustment interface, put the cuvette with a reacted concentration of 20mg/L into the test cell, wait 5 seconds to obtain ADC value for each channel. Through the "+" "-" button or laser potentionmeter to adjust the ADC value.

### 4.2 Input ID

Click the ID button in the main measurement interface to enter the keyboard input interface, and input ID number. If ID does not need modification, the system will save the last value automatically. Return to the main measurement interface and the input ID will display. ID number can also be input by scanning the barcode of sample with the online serial bar scanner.



### 4.3 Reset Settings

If the following condition occurs:

- 1) memory chip is replaced;
- 2) interface ID or serial number is abnormal;
- 3) measurement result needs reformatting;

The system reset should be executed.

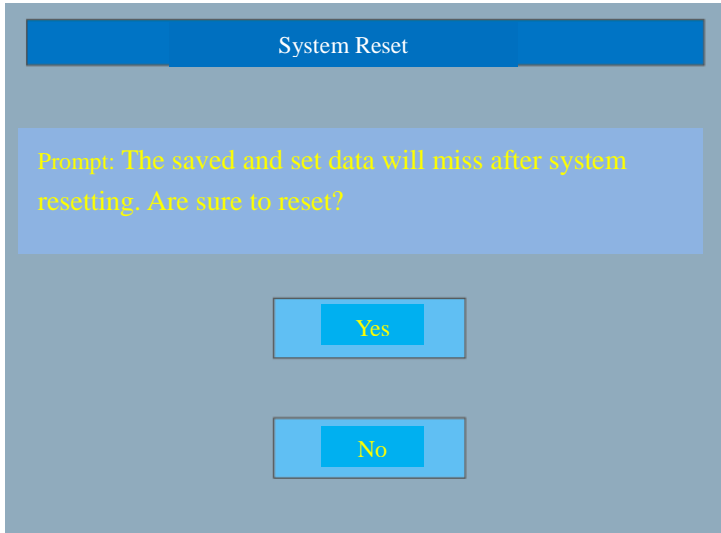


Fig. 4-2 System Reset

Enter the "System Reset" interface by "System Setting". Select reset or not. Conduct the operation with caution. After reset, the previous data will be all formatted. Swiping card is needed since the project measurement parameters are all formatted.

### 4.4 Serial Port Setting

If the data is not output from the serial port after a sample is measured or a result is printed out, enter the "Serial Port Setting" interface by "System Setting". Check whether the serial port is off, and whether the baud rate and parity check are the same as PC settings. If not, make consistent settings. Re-click "Print Result". If the data still cannot be received, check the serial line connection or even the circuit. Note: Cross-type serial line is used in this device.



Fig. 4-3 Serial Port Setting

## 4.5 Hidden Functions (only for engineers)

In the main measurement interface, click the user mode and a keyboard password input window appears. Input "860755" (6 digits) to enter the interface, where the test, potential tracking AD and channel adjustment AD can be edited. For details, refer to the Instructions of Software Function. It should be noted that editing test and main interface test are different. Editing test can be done without swiping card. Blank time and response time can be self-set but the measurement result can't be displayed, display the response amplitude.

## 5. Assembly and Disassembly of Common Mechanical Parts

### 5.1 Assembly and Disassembly of Test System

1. Statement:

- If the stirrer's not working, the motor not rotating/rotating abnormal/rotating with abnormal noise, etc., needs to disassemble the system motor to observe;
- If no cuvette input the test channel, but the interface prompts "Pls. add in anti-serum", needs to disassemble the test system's microswitch part to observe;

2. Disassembling steps:

- 1) Turn off the power;
- 2) Remove the four flat head screws with a screwdriver; (Fig. 1)

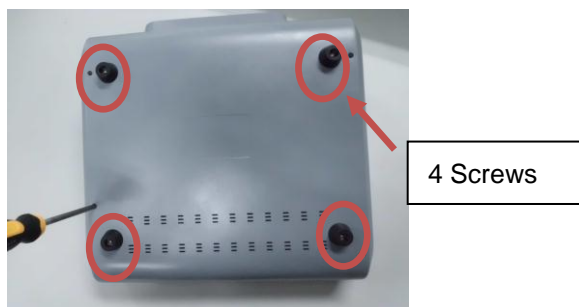


Fig. 1

- 3) Remove the upper shell assembly, loosen the test system fixed onto the lower shell with a cross screwdriver, then remove the test system; (Fig. 2)

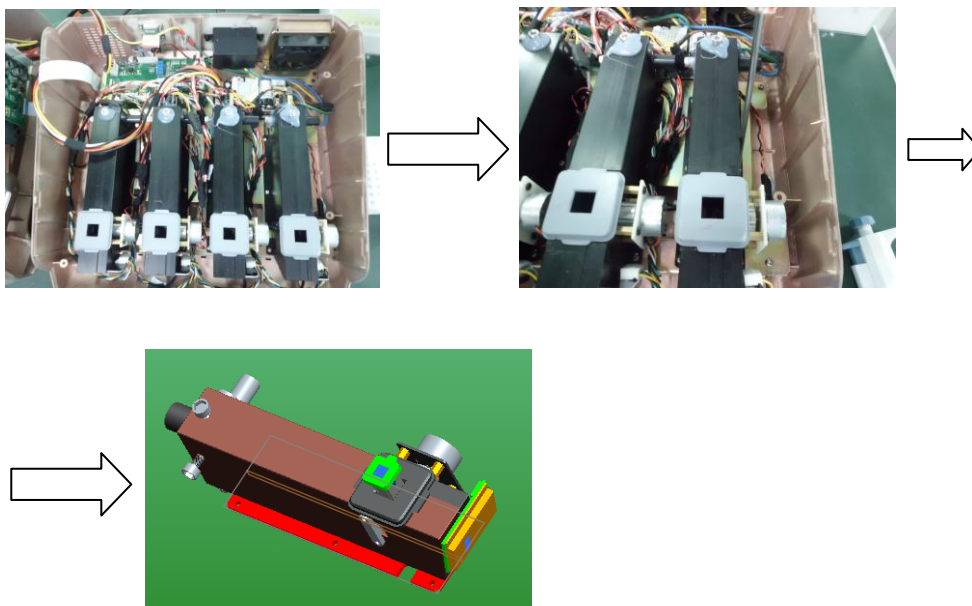
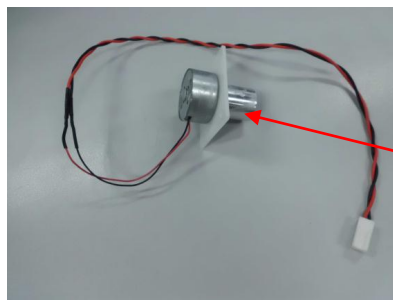


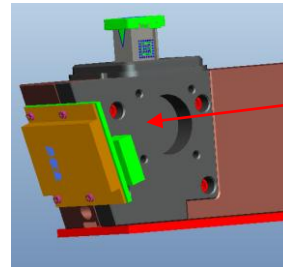
Fig. 2

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4). Loosen the four pan head screws on the motor mounting plate with a cross screwdriver and remove the stirring system(Fig. 4). Check if there is any metal debris absorbed at the magnet side, if any, clear it. Then check(Fig. 5) if there's any sundries at the motor position of the test rack. Then loosen the two M3\*8 cross pan head screws on the microswitch bracket with a cross screwdriver. Check if the microswitch is damaged. If yes, replace the microswitch promptly;



Magnet side



Motor hole

Fig. 4

Fig. 5

- 5). If none above situation occur, recheck carefully if the wiring is properly connected;
- 6). If no problems found, assemble back according to the assembly and disassembly procedures;
- 7). Clean and wipe the device surface;
- 8). The re-assembled test system should test the concentration of 50 and 20 QC to make sure the test accuracy.

**Note: Protect the laser rod's top area from force while in disassembling, in case of the laser position deviating.**

# Appendix 1: Device Wiring Diagram

