Chemray120

Automated Chemistry Analyzer

Service Manual

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Website: www.rayto.com
Rev 1.1e

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Representation

Rayto reserves the right for the final explanation of the Service Manual.

Rayto will be responsible for the safety, reliability and performance of the product only when all the following requirements are met:

1 Assembly, expansion, re-debugging, improvement and repair should be conducted by persons recognized by Rayto;

2 The related electrical equipment complies with the national standards;

3 The product is repaired according to the Service Manual.

Repair

Scope of free repair:

Products within the scope of warranty coverage of Rayto can be repaired for free.

Scope of charged repair:

1 For products outside the scope of warranty coverage of Rayto, the repair is charged.

2 Even within the warranty period, products that need to be repaired due to: man-made damage; improper use; voltage of power grid exceeding the specified range of the product; irresistible natural disaster; replacement of fittings or consumables not allowed by Rayto or repair of the machine by persons not authorized by Rayto.

How to Use

Intended Audience of the Manual

The intended audience of the Manual is the customer service engineers of Rayto or servicemen trained and authorized by Rayto.

Note:

The user must pay attention to the information provided in the Manual. Only technicians specially trained by the manufacturer can operate the instrument properly.

How to Use the Manual

The user must carefully read the Manual to prevent potential losses and damages.

The user must read all alerts and warnings (in boldface).

Contents of the Manual

This is the Service Manual for Chemray 120 Automated Chemistry Analyzer. It describes the working principle and structure, installation steps, basic theory, maintenance and repair methods, troubleshooting, etc. of Chemray 120 Automated Chemistry Analyzer. Please repair the machine according to the instructions in the Manual.

Meaning of Symbols

Safety Symbols

The following table lists the safety symbols used in the Manual. These symbols are used with text.

Symbol	Meaning
⚠ Warning:	To remind the user to operate according to the instructions, otherwise personal injury may be caused.
☣ Risk of Biomaterial Centered Infection:	To remind the user to operate according to the instructions,

otherwise there will be risk of biomaterial centered infection.

⚠ Caution: To remind the user to operate according to the instructions, otherwise system damage may be caused or test results may be affected.

⚠ Note: To describe the important information in operation steps or other contents the user should pay attention to.

Description of Labels and Silk Screens

The meaning of the labels and silk screens on Chemray120 Automated Chemistry Analyzer are described as follows:

Serial number of the product


Manufacturing date of the product


Manufacturer

In vitro diagnostic equipment


Warning: Risk of biomaterial centered infection


Caution: Personal injury or instrument damage may be caused


Grounding protection

Environmental protection use period (20 years)

On (main power supply)


Off (main power supply)

Figures

The figures in the Manual are for explanation or giving typical examples only, and should not be used for other purposes.

Safety Precautions

In order to use the system safely, please carefully read the following safety precautions. Any operation in violation of the following safety precautions may cause system damage and personal injury.

Warning:

If the user fails to use the system according to Rayto's instruction, the preventive measures provided by the system will lose effectiveness.

Prevent Electric Shock

In order to prevent electric shock, please follow these precautions.

Warning:

When the main power supply of the analyzer is On, persons other than authorized servicemen must not open the surface shell.

If the reagent or sample spills into the instrument, failure of the instrument and electric shock may be caused. Do not put sample or reagent on the instrument.

Prevent Moving Parts from Causing Personal Injury

In order to prevent moving parts from causing personal injury when the system is working, follow these precautions.

Warning:

When the system is working, never touch the moving parts. Moving parts include sampling arm, grip arm, etc.

When the system is working, never reach inside the open parts with finger or hand.

Protect against risk of biomaterial centered infection

In order to protect against risk of biomaterial centered infection, follow these precautions.

Risk of biomaterial centered infection:

Incorrect use of the sample may cause infection. Never directly touch the sample, QC fluid, calibration fluid or mixture with hand. Be sure to wear gloves, work clothes and when necessary protective goggles to prevent infection in operation.

In case the sample is in contact with skin, immediately treat it according to the user work standards and consult a doctor.

Protect against Chemical Hazards

Warning:

Certain reagents and cleaning solutions may damage skin. Use reagents and cleaning solutions carefully, and prevent direct contact with hands and cloths. In case of contact with hands or cloths, immediately wash with soap and rinse with

water. In case of contact with eye, immediately rinse with plenty of clear water and consult an oculist.

Dispose Waste Cups

In order to prevent waste liquid from polluting environment and causing personal injury, follow these precautions in disposing waste cups.

Risk of Biomaterial Centered Infection:

Certain substances in reagents, QC fluid, calibration fluid, cleaning solutions and waste liquid are controlled by pollution control regulations and emission standards. Please abide by the local emission standards and consult the relevant reagent manufacturers.

To dispose waste cups, be sure to wear gloves, work cloths and when necessary protective goggles to prevent infection.

Dispose the Instrument

Dispose the waste analyzer according to the following requirement.

Warning:

Certain substances in the waste analyzer are controlled by pollution control regulations. Please dispose the waste analyzer in accordance with the local waste disposal standards.

Precautions for Use

In order to use the system correctly and effectively, please read the following precautions for use carefully.

Usage of the System

Warning:

The system is used for clinical diagnosis of liver, gall and kidney diseases, diabetes, and other endocrine diseases. To use the system outside this scope, please consult Rayto.

When making clinical judgment according to the analysis results, please also consider the clinical symptoms or other test results.

Operators

Warning:

The system can be operated and used by test professionals, doctors or laboratory technicians trained by Rayto or Rayto's agents only.

Operating Environment

Caution:

Install the system correctly in the installation environment specified in the Manual. Installation or use of the system in an environment other than the specified one may cause unreliable results and even system damage.

Prevent Electromagnetic Wave and Noise

Caution:

Never put equipment with abnormal noise near the system. Turn off equipment emitting electromagnetic wave, such as mobile phone, radio transceiver, etc., in the room where the system is located, and do not use other CRT displays near the system. Interference of noise and electromagnetic wave may cause failure of the system.

Never use other medical instruments near the system. The electromagnetic wave emitted by the system may cause failure of other medical instruments nearby.

System Use

Caution:

(1) Use the system according to the related instructions in the Manual. Incorrect use may cause incorrect measurement results and even system damage or personal injury.

(2) Before using the system for the first time, calibrate it and conduct quality control to confirm the system can work normally.

(3) To use the system, be sure to conduct the quality control procedure, otherwise the reliability of the results can't be ensured.

(4) During analysis, never open the light shield.

(5) During analysis, never replace reagents, samples or test cups.

(6) The RS-232 interface of the instrument is used to transmit test results, and can be connected to other computers with a standard serial port cable.

(7) Do not use USB flash disk with virus to prevent computer virus from destroying software and data. Do not use the computer for other purposes or connect it to Internet.

(8) Never touch the display, mouse or keyboard with wet hand or hand stained with chemicals.

(9) Never switch on the instrument again within 10 seconds after it is switched off, otherwise the system may enter the protected mode. If the system enters the protected mode, switch off the main power supply and then switch on it again.

Computer and Printer

Note:

For the precautions for use of the computer and printer, refer to their instructions.

External Equipment

Warning:

External equipment, such as computer, printer, etc., must pass CCC (S&E) certification. Use of external equipment not complying with the requirements may cause incorrect operation of the system or personal injury.

System Maintenance

Caution:

(1) Maintain the system according to the related instructions in the Manual. Incorrect maintenance measures may cause incorrect analysis results and even system damage or personal injury.

(2) Dust may accumulate on the surface if the instrument is put in a place for a long time. When cleaning the instrument, soak a clean, soft cloth in water and wring it, and gently wipe the surface of the instrument. When necessary, soak the cloth in a small amount of soap solution. Never use organic solvents, such as alcohol, etc. After the cleaning, wipe its surface dry with a dry cloth. Before the cleaning, switch off all power supplies of the system and unplug the plug. During the cleaning, take necessary measures to prevent water drop from entering the system, otherwise it may cause system damage or personal injury.

(3) After replacing the major components, such as sampling probe, Mixing motor and syringe component, calibration analysis must be conducted.

Parameter Setup

Caution:

Such parameters as sample volume, reagent volume, test time, etc. should be set for the system. When setting these parameters, follow the related instructions in the Manual and refer to the instructions supplied with the reagents.

Sample

Caution:

(1) Use blood plasma sample fully separated. Blood cells in the blood plasma sample may affect analysis results.

Drugs, anticoagulants, preservatives, etc. in the sample may interfere with certain analysis results.

Hemolysis, chyle particles, etc. in the sample may affect analysis results, and the sensitivity of items should be changed according to the test curve.

(2) Use correct sample storage measures. Incorrect sample storage measures may change the constituent structure of the sample and cause incorrect analysis results.

(3) In order to prevent volatilization of the sample, never leave the sample open for a long time. Volatilization of the sample may cause incorrect analysis results.

(4) Certain samples may not be analyzed according to the test parameters and the

reagent used. For such samples, consult the relevant reagent manufacturers.

(5) If certain samples need pretreatment for analysis, consult the relevant reagent manufacturers.

(6) There is requirement of sample volume for tests with the instrument. Determine the appropriate sample volume according to the related instructions in the Manual.

(7) Before analysis, check that the sample is put in the correct sample position, otherwise correct results may not be obtained.

Reagent, Calibration Fluid, and QC Fluid

Caution:

(1) Appropriate reagent, calibration fluid, and QC fluid are needed for analysis with the system.

(2) Use appropriate reagents according to the system. If you can't determine whether a reagent can be used, consult the reagent manufacturer or Rayto or Rayto's distributors.

(3) Use and store reagent, calibration fluid and QC fluid according to the instructions of the relevant reagent manufacturers. If the reagent, calibration fluid and QC fluid are not stored properly, correct test results and the best system performance may not be obtained even in the period of validity.

(4) After replacing a reagent, conduct calibration analysis. Otherwise correct analysis results may not be obtained.

(5) Cross-contamination of reagents may affect analysis results. For the information on cross-contamination of reagents, consult the relevant reagent manufacturers.

Data Backup

Note:

The system has the function of automatically storing data in the CF card of computer, however, if the data in the CF card are deleted or the CF card is damaged due to other reasons, data can't be restored. Please regularly make backup of analysis data and measurement parameters on other removable storage devices.

Table of Contents

Chapter 1 Introduction

1.1 Introduction

Chemray 120 is an analysis instrument for clinical biochemical tests developed by using photoelectric, automation and computer technologies. The analyzer adopts transmission colorimetry and calculates concentrations of samples according to the Beer-Lambert's Law.

Chemray 120 is easy to operate, has unique screens and perfect information exchange system, and is an ideal analyzer for clinical chemical laboratories.

You can operate Chemray 120 system as follows:

1. The instrument has total 26 reagent positions, and single reagent position and dual reagent position can be combined optionally.
2. Results can be displayed and printed in different ways, including patient report and data storage.
3. It is applicable to the end-point method, two-point method and kinetics method, and supports dual wavelength operation.
4. Measurement can be conducted by using a number of calculation methods, such as calibration method, factor method, etc.
5. Eight standard optical filters installed in the instrument, i.e. 340nm, 405nm, 450nm, 510nm, 546nm, 578nm, 630nm, and 670nm. The above wavelengths can be adjusted according to the needs of different users.
6. The system conducts detection and control continuously during operation to avoid error. Error messages will appear on the screen in case of abnormity, and the operator is prompted to select keys and operate correctly.

1.2 Structure of Mainframe

1.2.1 View of Whole Machine

The following is the overall appearance of Chemray 120 Automated Chemistry Analyzer:

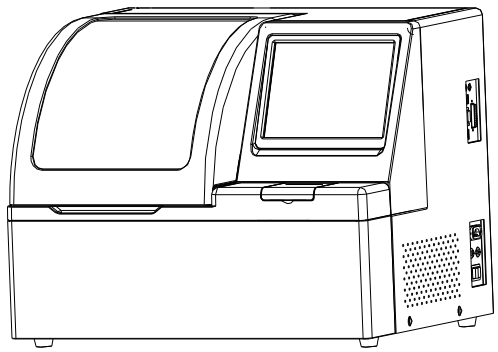

Figure 1-1 External View of the Whole Machine

1.2.2 Composition

The mechanical system of the whole machine of Chemray 120 Automated Chemistry Analyzer is composed of eight modules, i.e. rack, syringe, tray, sampling probe, power supply, light path, hydraulic circuit and computer components.

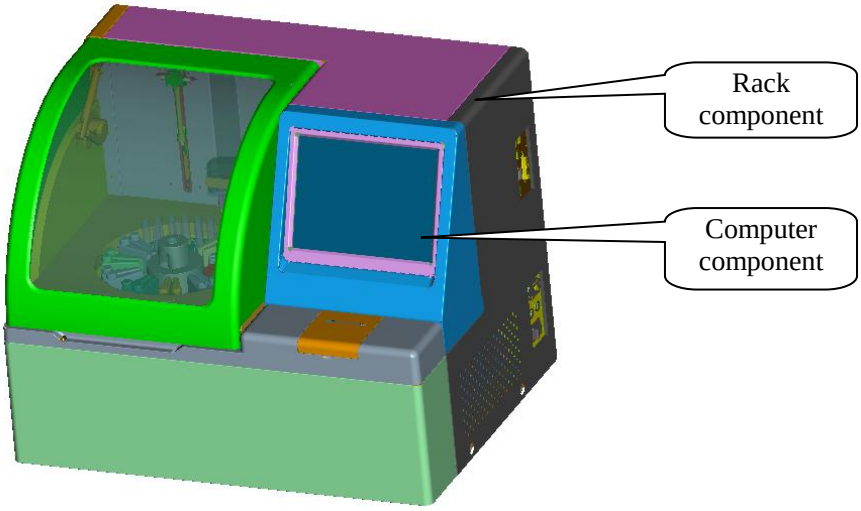

Figure 1-2 External Structure Diagram of Rack

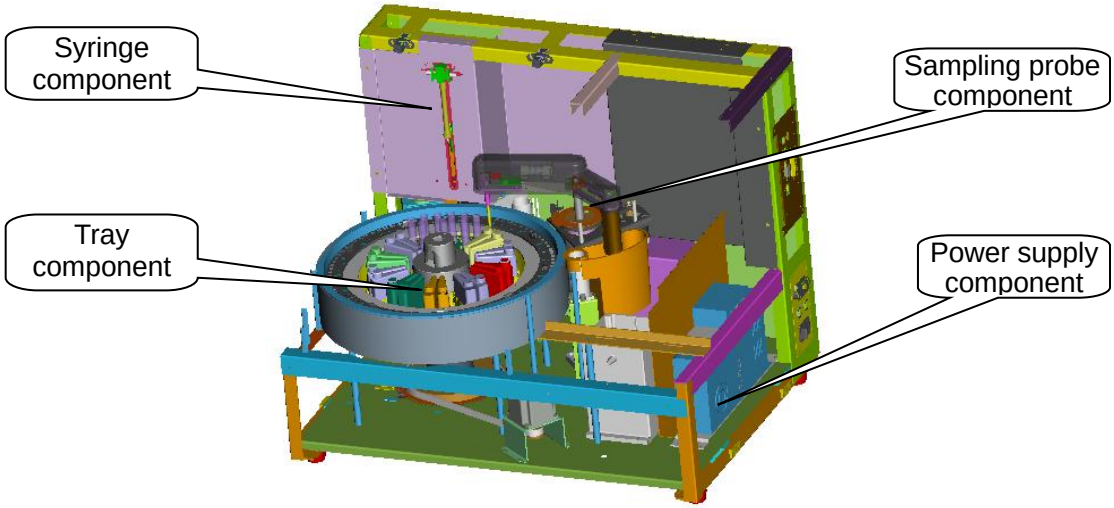

Figure 1-3 Internal Structure Diagram of the Whole Machine

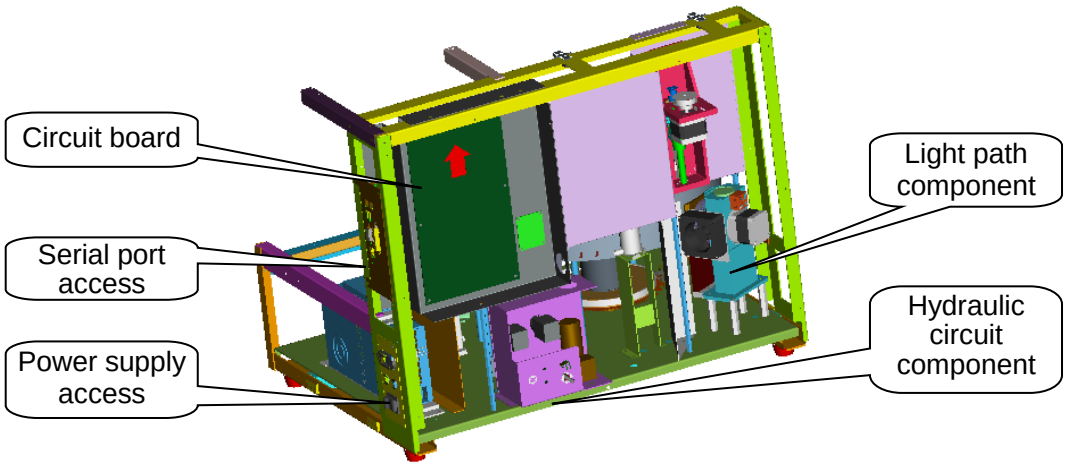

Figure 1-4 Rear Structure Diagram of the Whole Machine

1.2.3 Function Overview of Components

1.2.3.1 Test Procedure:

1. The sampling probe enters the bottle of reagent 1 and sucks up the reagent of the volume set;
2. The sampling probe is moved to the cleaning pool for cleaning;
3. The sampling probe is moved to the sample cup and sucks up the sample of the volume set;
4. The sampling probe is moved to sampling position and drains the reagent and sample;
5. The sampling probe component is rotated to the mixing position, and the mixer mixes the reagent and sample in the test cuvette.;
6. The sampling probe component is moved to the cleaning pool for cleaning again;
7. Add sample circularly according to the above steps.

1.2.4 Test Time Sequence of the Whole Machine

1.2.4.1 Layout:

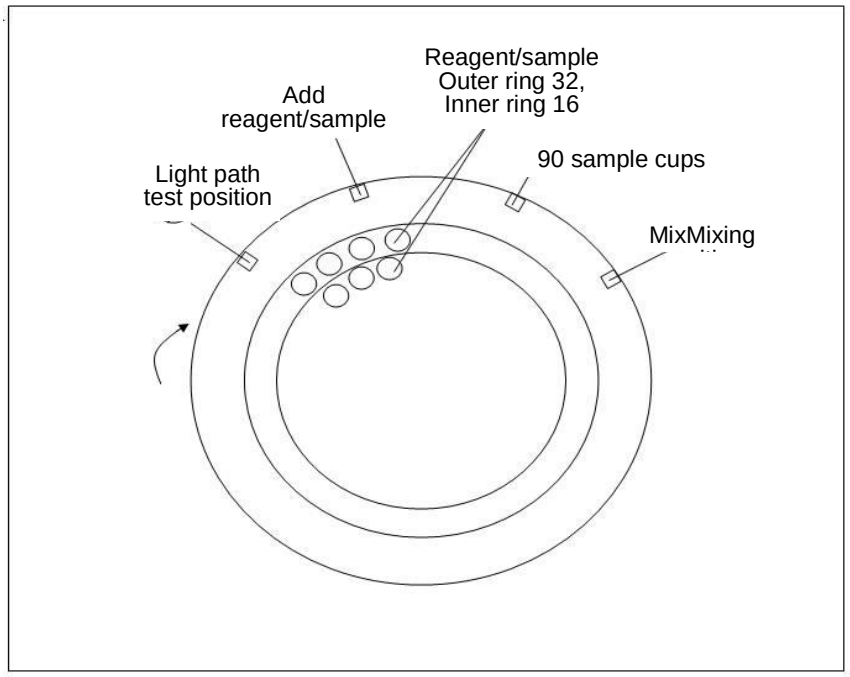

Figure 1-5 Layout

1.2.4.2 Test Process

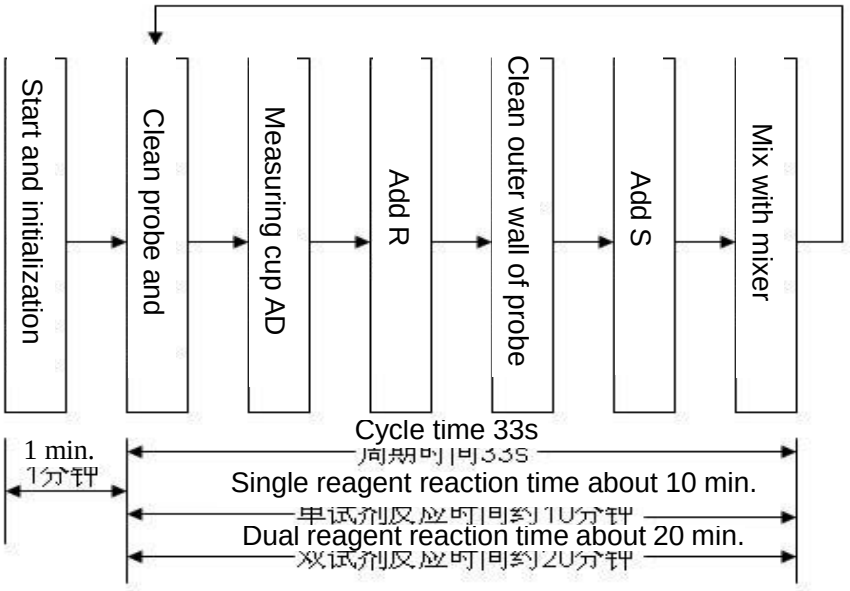

Figure 1-6 Layout

1.2.4.3 Workflow of Modules

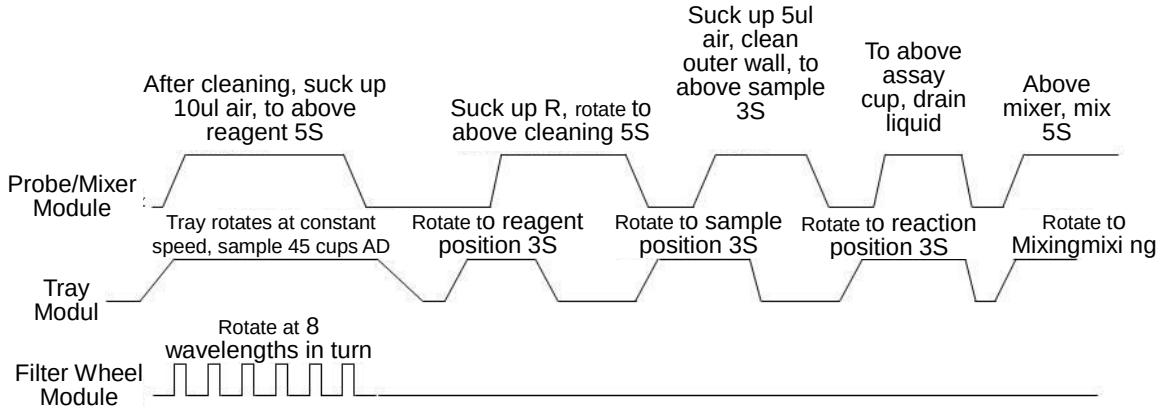

Figure 1-7 Flowchart of Modules

Description:

1. Chemray120 has a structure of single tray and single probe, without automatic cleaning. The reagent tray, sample tray and reaction tray share one spindle and are driven by one motor. The reagent/sample probe and mixer are integrated and share a set of driving system.
2. In the cycle test, add reagent and sample to the same test cuvette in the same cycle and mix to begin the reaction.
3. When the test is finished, replace the cuvette fold manually according to the prompt of the software.

1.2.4.4 Major Functions of Various Units:

Table 1-1 Functions of Various Units

Unit	Major Functions
Sampling and Mixing Unit	All reagent and sample sucking and drainage, as well as reagent and sample preheating and Mixing
Syringe Unit	Reagent and sample sucking and drainage
Light Path Unit	8 wavelengths light source screening, collecting photoelectric signals of test cuvettes
Tray Unit	Reagent and sample bearing, and liquid preheating in reaction positions
Power Supply Unit	Supplying power to the whole machine
Hydraulic Circuit Unit	Deionized water and waste liquid sucking and drainage, etc.

Chapter 2 Performance of the Whole Machine

2.1 Commonly Used Indicators

System

Optional, multi-channel, multi-item

Structure of the Whole Machine

Integrated

Sample Types

Regular biochemical items (such body fluid as serum, blood plasma, urine, cerebrospinal fluid, etc.)

Test Methods

End-point method, two-point method, kinetics method

Test Time

Maximum test time 600s

Reaction Temperature

37±0.3℃

Water Consumption

<3 L/hour

Test Items

End-point method: ALB, CHOL, GLU, TP, etc.;
Two-point method: CREA, UREA, etc.;
Kinetics method: ALT, GGT, etc.

Predilution

Diluted automatically according to test results, with the test cup as dilution container

Mode of Operation

Set through the main control software; set test by test; item combination provided

Data Processing

Storage and output of all kinds of data and charts

Dimension

l×b×h: 638 mm×474 mm×509 mm

Weight

45kg

Feature of Emergency Treatment

Insert emergency treatment at any time

Mode of Networking

LIS networking supported

2.2 Sample Position Indicators

Sample Rack Supported

Standard test tubes, original blood collection tubes, small sample cups

Maximum Number of Samples

26 sample positions

Small Sample Cup

Φ10×37, Φ12×37

Original Blood Collection Tubes

Φ12×68.5, Φ12×99, Φ12.7×75, Φ12.7×100, Φ13×75, Φ13×100;

Standard test tubes: Φ12×68.5, Φ12×99, Φ12.7×75, Φ12.7×100, Φ13×75, Φ13×100

Minimal Volume of Sample

Original blood collection tubes: liguid level height > 5mm; small sample cup: sample volume > 200uL

Stat Sample

Stat samples can be inserted at any time; any sample positions can be taken as emergency treatment positions; emergency treatment test results are obtained within 15 minutes.

2.3 Reagent Position Indicators

Reagent Position Assembly Mode

Specific reagent rack;

Number of Reagent Positions

Total 26 reagent positions. Reagent positions 25 and 26 are defined as deionized water and distilled water positions in general.

Reagent Bottle Specifications

The reagent tray can accommodate big and small reagent bottles with the volume of 40ml and 18ml respectively.

Remaining Volume of Reagent

18ml: Reagent volume > 1000uL; 40ml: Reagent volume > 2000uL

Reagent Mixing

With 1 reagent Mixing position

2.4 Sampling Unit Indicators

Sampling Probe

Shared by reagent and sample, capacity of 200μL, with preheating function

Sample Volume

3~45 μL, increasing by 0.5 μL;

Reagent Volume

30~450 μL, increasing by 1 μL;

No. 1 Reagent Volume: 180~450 μL, 1 μL;

No. 2 Reagent Volume: 130~250 μL, 1 μL

Volume of Reaction liquid

400 u L～450 u L;

Warning Function

With liquid level detection and vertical collision avoidance functions

2.5 Light Path Unit Indicators

Test cuvette Position

9-fold of 90 cup positions, 5mm optical path, material of PC, minimum reaction volume 200ul

Light Source Indicator

Halogen tungsten lamp + optical filter

Photoelectric Inspection Method

Photodiode inspection

AD Value Measurement Range

0～65535

2.6 Operation Indicators

Calibration Method

Factor method; single point calibration, multi-point straight line calibration; multi-point fold line calibration; double logarithmic curve calibration; parabola calibration

Display

10.4” LCD

OS

WindowsXP

Communication Port

RS232

Printer

Built-in printer

Data Entry

Touch screen, keyboard

Data Output

Display, built-in printer, external printer (optional), connection with LIS

Data Recording

CF card, USB port

2.7 Installation Conditions

Power Supply

220-240V~, 50Hz, 1000VA or 110/115V~, 60Hz, 1000VA

Use Environment

Storage Temperature 0℃～40℃, fluctuation <±2℃/H;

Storage Humidity 30%RH～80%RH, no condensation;

Working Temperature 15℃～30℃, fluctuation <±2℃/H;

Working Humidity 35%RH～80%RH, no condensation;

Altitude ≤ 3000 m

Chapter 3 Installation

3.1 Installation Requirements

3.1.1 Environment Requirements

- ●Altitude < 3000 m;
- ● Good ventilation;
- ● Dust free as far as possible;
- ● Avoid direct sunshine;
- ● Not near heat source and wind;
- ● No corrosive gas and combustible gas;
- ● No loud noise source and power interference;
- ● Not near brush type engine and electric contact equipment turned on/off frequently;
- ● Not near equipment emitting electromagnetic wave;
- ● Environment temperature 15℃～30℃, fluctuation of working temperature <±2℃/H;
- ● Environment humidity 35%RH～80%RH, no condensation;
- ● If the room temperature can't meet the requirement, air conditioner is required.

3.1.2 Requirements of Installation Site

- ● Width of work surface > 80cm;
- ● Length of work surface >160 cm;
- ● Height of work surface between 75cm and 80cm;
- ● Level work surface;
- ● Minimum load bearing of work surface 100Kg;
- ● No vibration of work surface;
- ● Distance between the instrument and wall > 20cm;

3.1.3 Requirements of Power Supply

- ●Power Supply: 220VAC, 50/60HZ, 1000VA, 3-core cable, good grounding;
- ● Separate grounding wire required;

- Zero to earth voltage < 5V;
- The AC power supply must be stable. Sharing a power supply with high power electrical appliances is prohibited. It is better to be equipped with a regulated power supply.

3.2 Installation Procedure

Note:

The analyzer has been fully inspected before leaving factory. When the analyzer arrives, check the appearance of the packing case and make sure the packing case has no obvious damage. If the packing case has damage, take a photo and immediately contact the agent.

3.2.1 Unpacking

- Tools: Straight screwdriver, iron hammer.

Note:

Caution:

Wear cloth gloves when unpacking the wooden case cover to prevent being cut by the sheet metal.

Figure 3-1 Photo of Outer Packing of the Whole Machine

Figure 3-2 Upper Cover Removal Photo

- Remove the upper cover;
- Take out the manual bag and reagent cups;
- Remove the upper cushion foam;
- Take the accessories (two bottles, one accessory bag, one bag of sample cups, and one case of test cups) out of the wooden case.

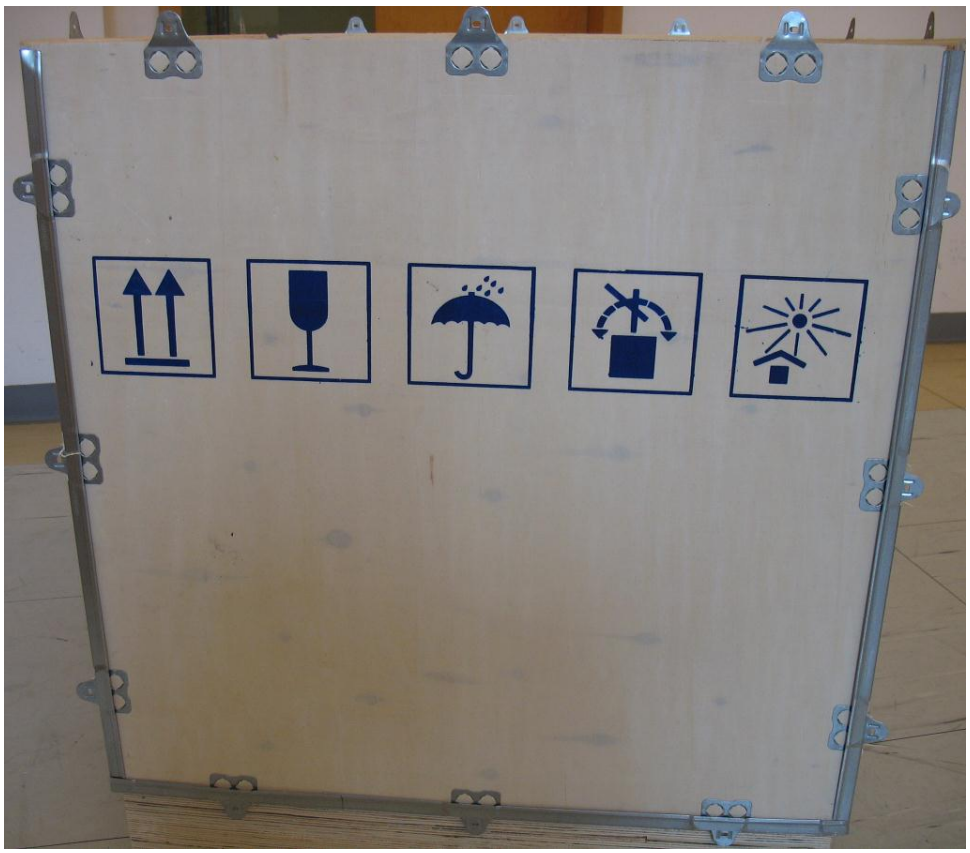

Figure 3-3 Side Plate Removal Photo

- Use the straight screwdriver to pry the bolts around the front, rear, left

and right side plates of the packing case;

Figure 3-4 Side Plate Removal Photo

- Remove various side plates;
- Raise the instrument onto the desk surface and remove the protective film around it;
- Check the accessories against the packing list.

Caution:

When raising the instrument, the application point of force must not the plastic piece on its front part to avoid breaking the plastic piece.

3.2.2 Installation

Figure 3-5 Flap Tape Removal Photo

- Tear off the transparent flap fixing tape.

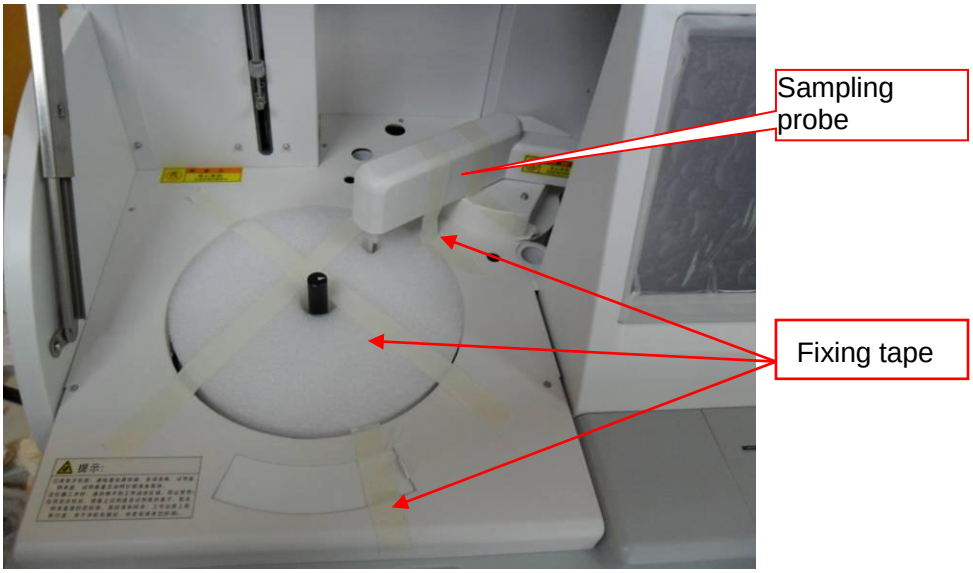

Figure 3-6 Panel Tape Removal Photo

- Open the transparent cover and tear off all fixing tapes. Carefully lift up the sampling probe component vertically and take the cushion foam out of the reaction tray.

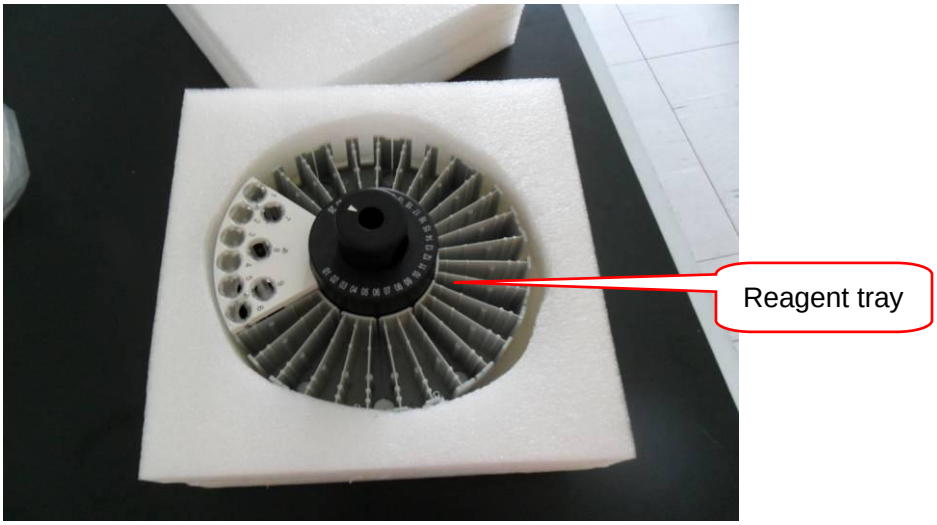

Figure 3-7 Sample/Reagent Position Packing Photo

- Take the packing foam out of the reagent tray and put it into the reaction tray bottom plate.

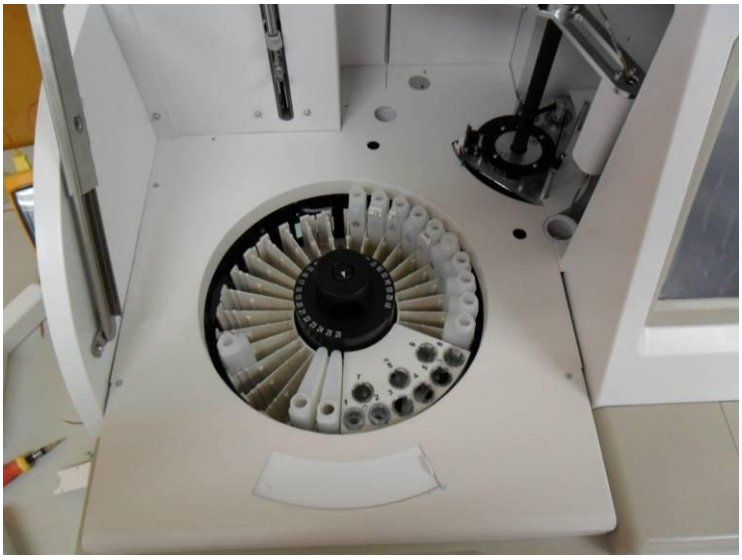

Figure 3-8 Sample/Reagent Position Installation Photo

3.2.3 Connection

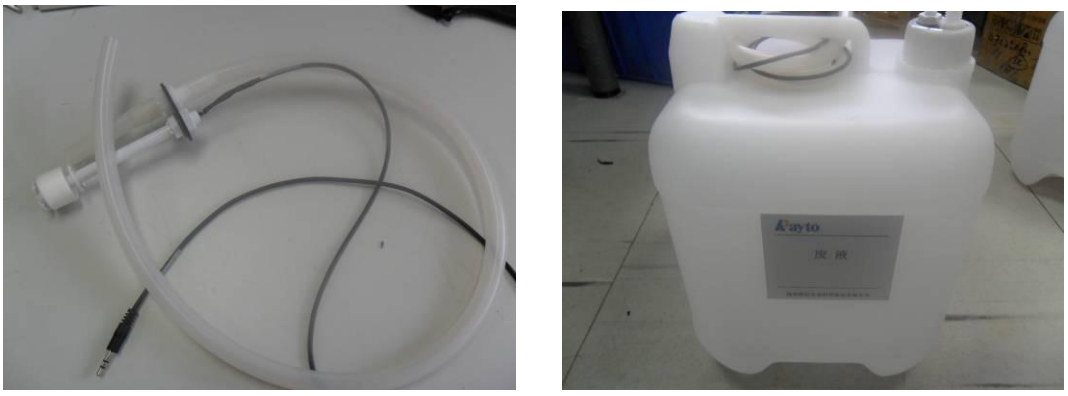

Figure 3-9 Waste Liquid Bottle Assembly Photos

- Take out the waste liquid bottle cap component (connected to thick pipe) and screw it on the waste liquid bottle.

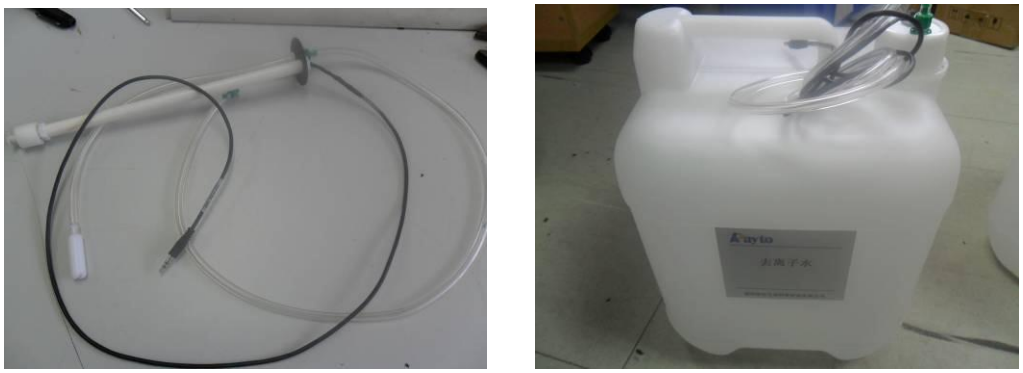

Figure 3-10 Deionized Water Bottle Assembly Photos

- Take out the deionized water bottle cap component (connected to thin pipe) and screw it on the deionized water bottle.

Figure 3-11 Bottle Component Connection Position Photo

- Connect the tubes on the deionized water bottle and waste liquid bottle to the pipe joints on the back of the instrument according to the prompt;
- Insert the liquid level sensor cables on the deionized water bottle and waste liquid bottle in the jacks on the back of the instrument according to the prompt;
- Insert the grounding wire in the grounding post on the back of the instrument and connect the other end to the ground lead.

Note:

The grounding must be proper. Poor grounding may cause instrument damage or abnormal test results.

Figure 3-12 Cable Connection Photo

- Connect the cable to the power interface on the left side of the instrument.

3.2.4 Switching On

1. Turn on the power switch of the instrument;

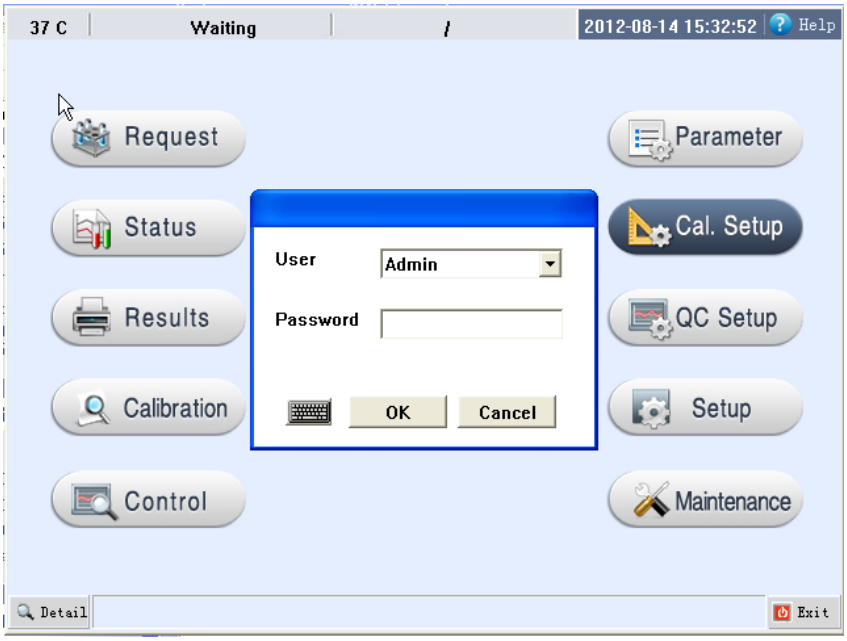

Figure 3-13 User Software Main Screen

2. On the user login screen, use the account number of customer service engineer for login. The user name is “default”, and the password is 888888.

3.2.5 Component Function Check

1. Click System and Operation to enter the daily maintenance screen;

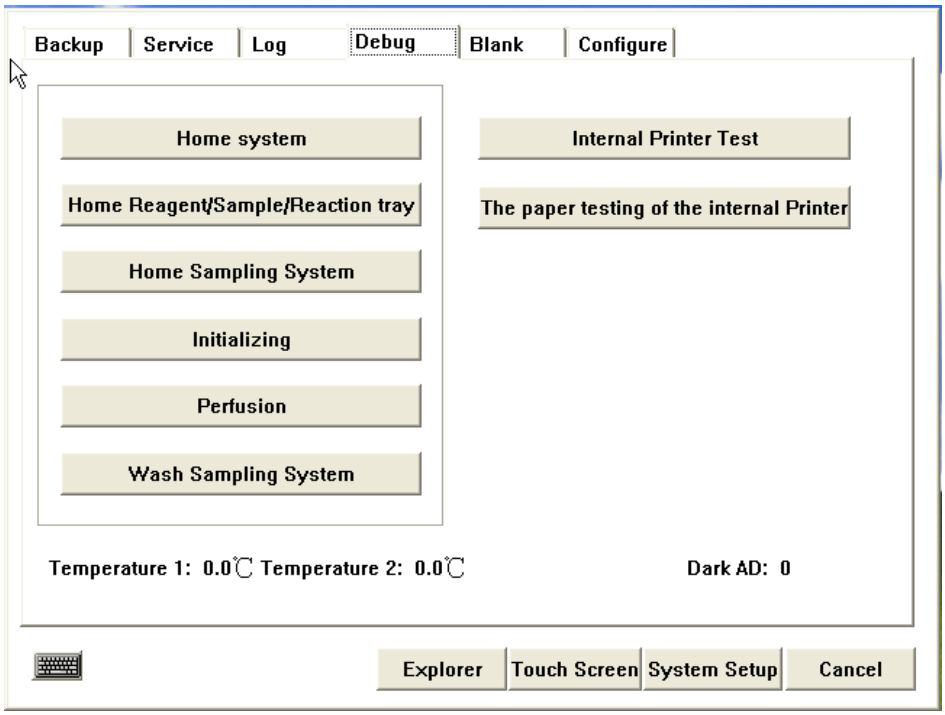

Figure 3-14 Maintenance Screen

2. Click Whole Machine Reset, and the reaction tray will rotate and the sampling probe will be inserted in the rinse tank;

3. Click Reagent/Sample/Reaction Tray Reset and check whether the rotation of the reaction tray is normal;
4. Click Sampling Unit Reset, and the sampling probe will be moved to between the rinse tank and sampling position;
5. Click Hydraulic Circuit Perfusion, and both the sampling probe and mixer will be in the rinse tank and water will gush from the rinse tank;
6. Click Clean Sampling Unit, both the sampling probe and mixer will be in the rinse tank and water will gush from the rinse tank;
7. Click Built-in Printing Test, and paper will be fed to the printer and text will be printed;
8. Click Built-in Printer Feed, and paper will be fed to the printer.

3.2.6 Item Setup

For the functions and setup of the software, see Chemray 120 Manual.

On the main screen, click Item Setup to enter the Item Setup page as shown in the figure:

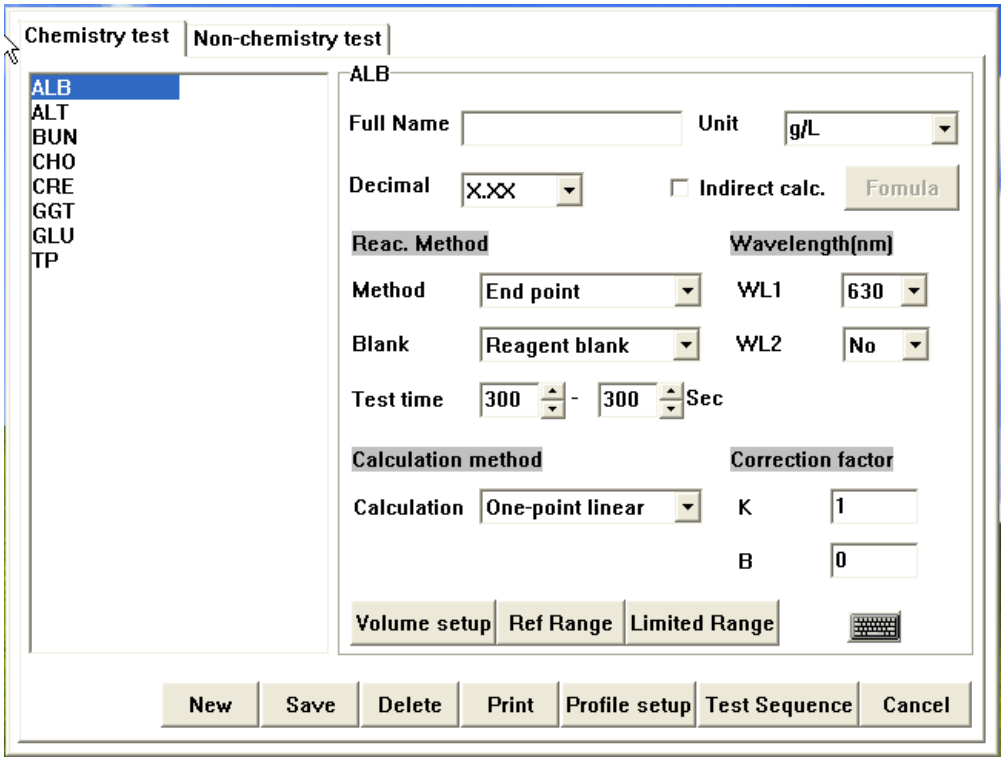

Figure 3-15 Item Setup Screen

1. Add Item: Press the Add key, input the name of the new item, input the parameters of the new item in turn, and press the Save key.
2. Modify Item: Select the item to be modified from the list, and the corresponding parameters will be displayed on the right. Move the cursor to the information to be

modified in turn, make modification, and press the Save key.

3. Delete Item: Select the item to be deleted from the list and press the Delete key.
4. Print Item Parameters: Select the item to be printed from the list and press the Print key.
5. Description of Item Parameters

1) Full Name: Input the full name or description information of the item.
2) Unit: Input or select the unit of the test results of the item.
3) Decimal Point: Select the number of digits after the decimal point of the item results on the general report to be printed, with a maximum of 3 digits after the decimal point.
4) Indirect Calculation: If the results of the item can be obtained through the calculation of other items, select Indirect Calculation and press the Calculation Formula button to enter the screen as shown in the figure:

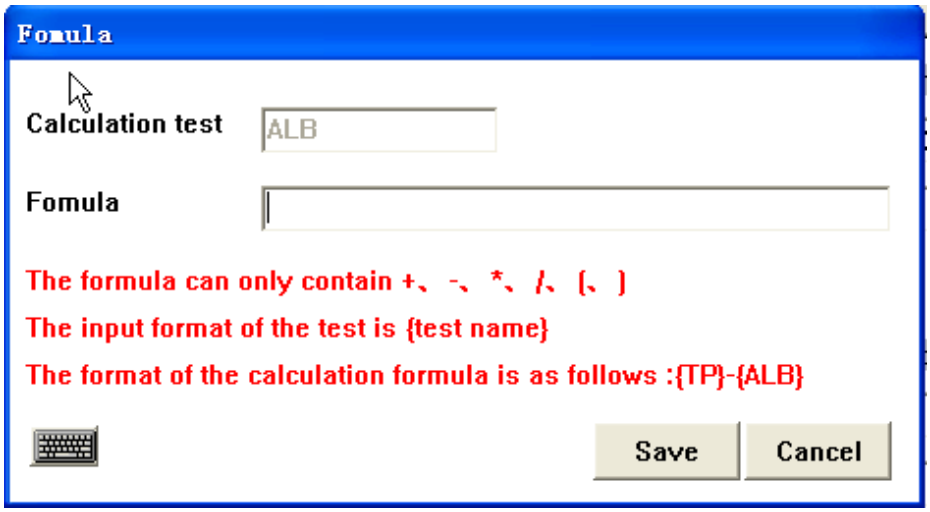

Figure 3-16 Calculation Formula Screen

Input a calculation formula in the Calculation Formula input box. If GLB can be calculated through the difference between TP and ALB, input {TP}-{ALB} in the calculation formula for the GLB item.

5) Wavelength: Wavelength set according to the instructions of the reagent. If the single wavelength test is adopted, set wavelength 1 only and select None for wavelength 2. However, in order to eliminate external interference, it is suggested to use the dual-wavelength test.
6) Test Method: Select End-point Method, Two-point Method, or Kinetics method.
7) Blank Test: Select None, Reagent Blank, or Sample Blank.
    - None: The blank value needs not to be reduced;
    - Reagent Blank: The reagent and sample volumes for normal tests are used, and the sample is substituted with distilled water or saline for measurement;
    - Sample Blank: The reagent and sample volumes for normal tests are used, and the reagent is substituted with distilled water.
8) Measurement Time: To set the start time and end time of measurement respectively.

The range of measurement time is 30-600 seconds.

9) Calculation Method: Select the corresponding calculation method according to the actual needs. When the Factor Method is selected, you can input factor values manually.

10) Correction Factor: In general, no correction is needed: K=1, B=0.,Linear correction factor of system test results: Result = Measurement result*K+B. However, for test items by using the factor method, the coefficient can be used to correct the error of the instrument.

11) Volume Setup

- Setup of Sample Volume for Initial Test: Input the sample volume. The range is 3-45μL, accurate to 0.1μL. If the sample of the item needs to be prediluted before the test, select the Predilute option and input the sample volume and diluent volume in the boxes below in turn, as shown in the figure:

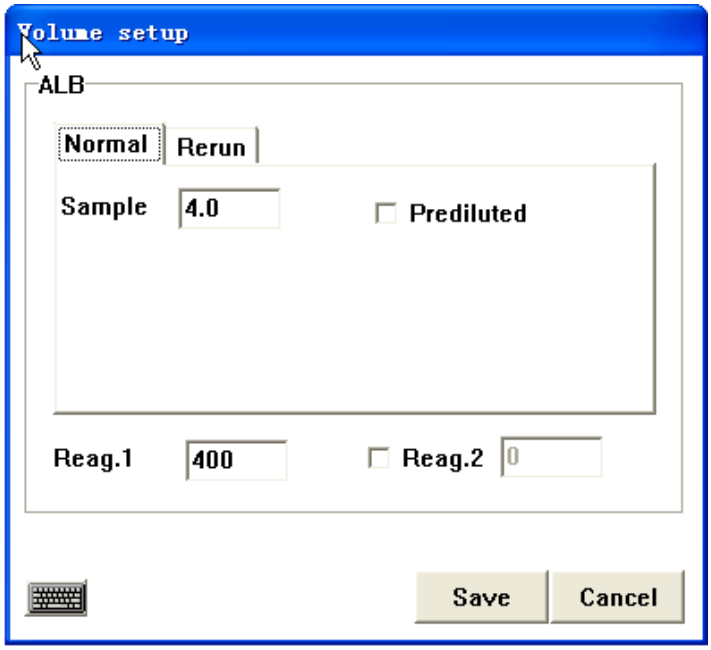

Figure 3-17 Reagent Volume Setup Initial Test Screen

- Setup of Sample Volume for Retest: When the test results exceed the linear range, retest may be conducted. In the retest, the specified sample volume is resucked up according to the test results on the high or low side. Input the sample volumes for retest for results on the high side and for results on the low side respectively. If the sample of the item needs to be prediluted before the retest for results on the high side, select the Predilute option and input the sample volume to be prediluted and diluent volume in the boxes below, as shown in the figure:

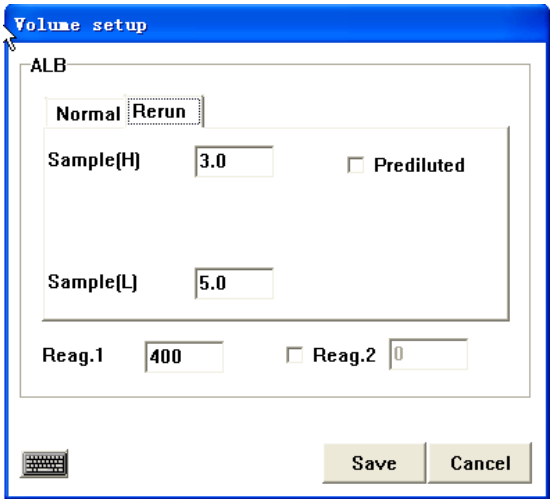

Figure 3-18 Reagent Volume Setup Retest Screen

12) Reference Range: Specify the division criterion of the reference range and the corresponding values of reference range according to the instructions of the reagent, as shown in the figure:

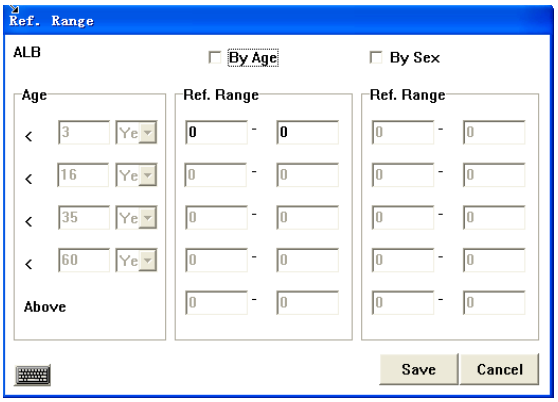

Figure 3-19 Reference Range Screen

13) Linear Range: To be set according to the instructions of the test item.

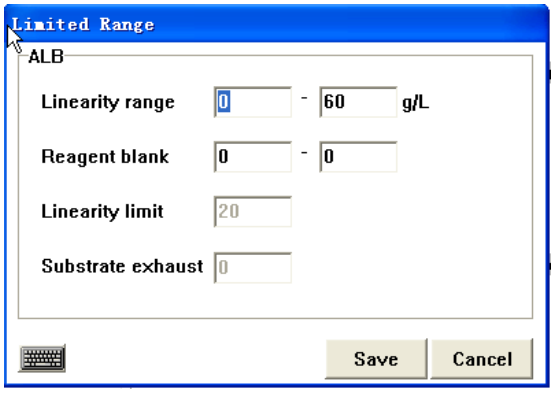

Figure 3-20 Linear Range Screen

3.2.7 Calibration Parameter Setup

On the main screen, click Standard Setup and Add Standard.

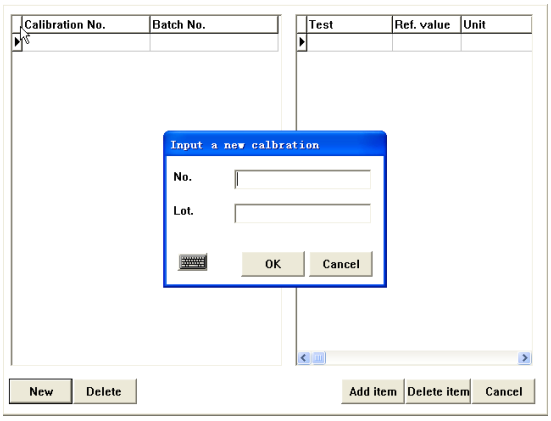

Figure 3-21 Annotation Setup Screen

1. Number and Batch Number: Number according to year, month and date, etc.;
2. Add Item: Click Add Item on the right side;
3. Add Item: To be set according to the value setting indicated on the standard substance.

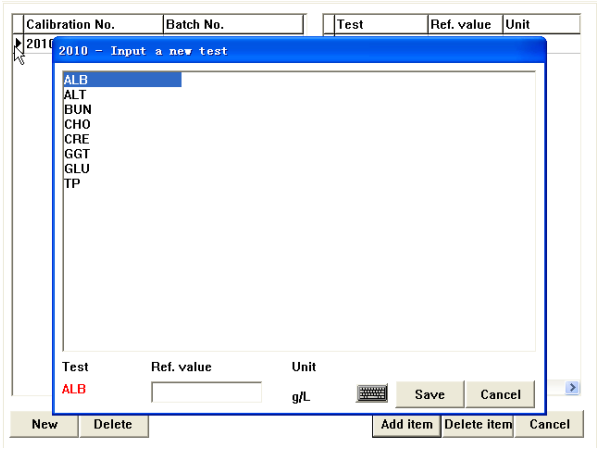

Figure 3-22 Standard Value Setup Screen

3.2.8 QC Parameter Setup

1. On the main screen, click QC Setup and Add Standard

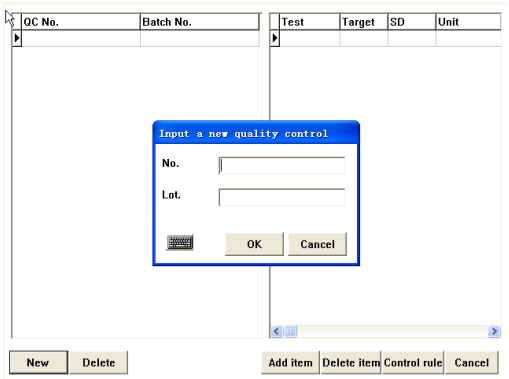

Figure 3-21 QC Setup Screen

2. Number and Batch Number: Number according to item name, and year, month and date, etc.;
3. Add Item: Click Add Item on the right side;
4. Add Item: According to the value indicated on the QC substance.

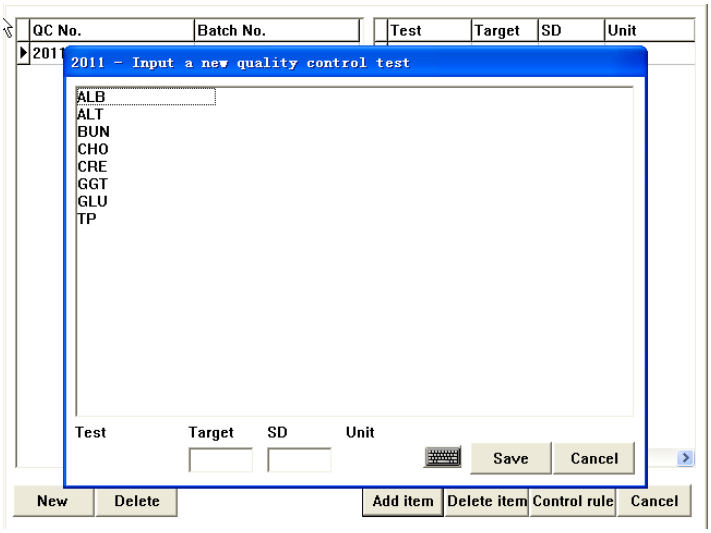

Figure 3-22 QC Substance Value Setup Screen

3.2.9 System Setup

On the main screen, click System Setup.

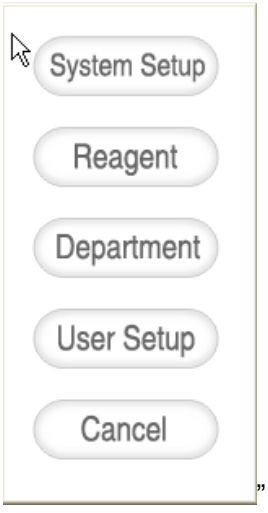

Figure 3-23 System Setup Screen

1. System Control Parameters:

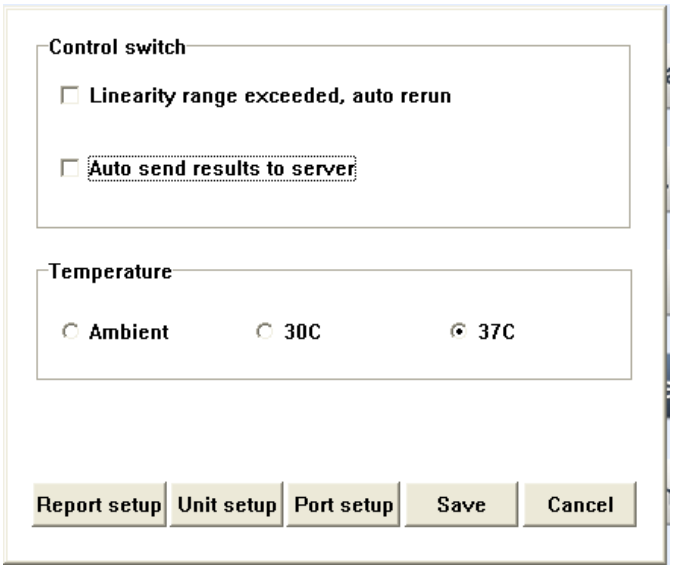

Figure 3-24 System Control Parameters Screen

Control Switch Setup

- If option 1 is selected and the test results exceed the linear range, when the initial test is finished, retest will be conducted automatically.
- If option 2 is selected, the test results will be sent to the maintenance unit specified by the system on real time basis. (The supporting receiving software needs to be installed on the maintenance unit.)

System Temperature

To set the target temperature of the reaction tray.

2. Report Setup

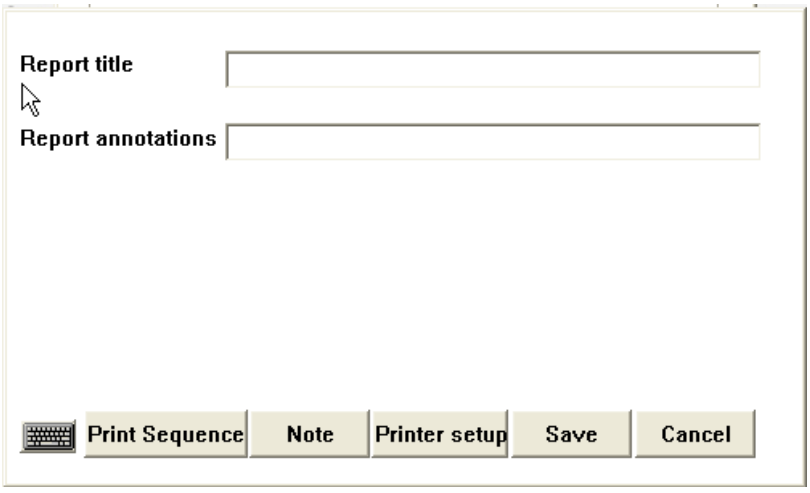

Figure 3-25 Report Setup Screen

Report Title: Set the title of the patient report, such as “Inspection Report of ×××× Hospital”.

Report Annotation: Set the remark of the patient report, such as “Note: The inspection results are for the sample only.”

3. Section Setup

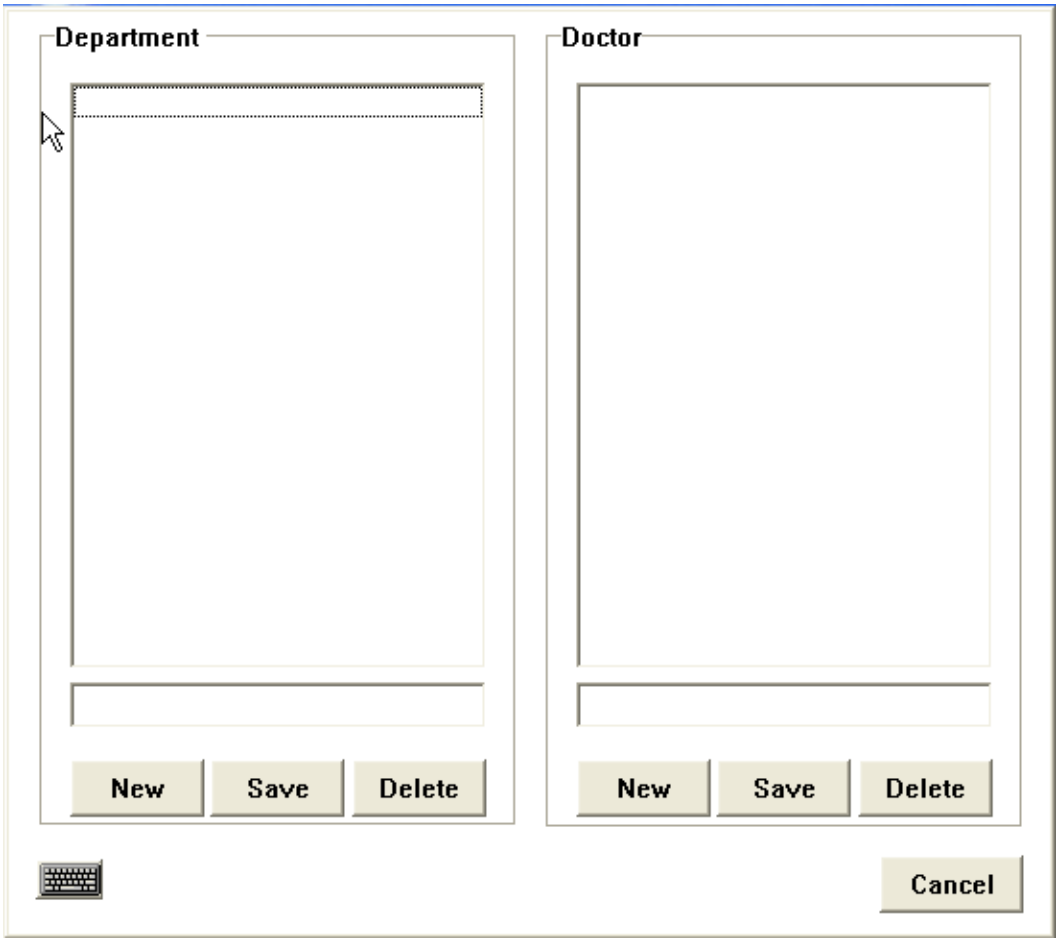

Figure 3-26 Section Setup Screen

Add Section: Below the section list, press the Add key to input the section name and press the Save key.

Delete Section: Select the section to be deleted from the section list and press the Delete key.

Add Doctor: Select a section, and all doctors in the section will be displayed in the doctor list. Below the doctor list, press the Add key, input the doctor name, and press the Save key.

Delete Doctor: Select a section, and all doctors in the section will be displayed in the doctor list. Select the doctor to be deleted from the doctor list and press the Delete key.

4. User Management

Select User Management from the System Setup menu to enter the screen as shown in the figure:

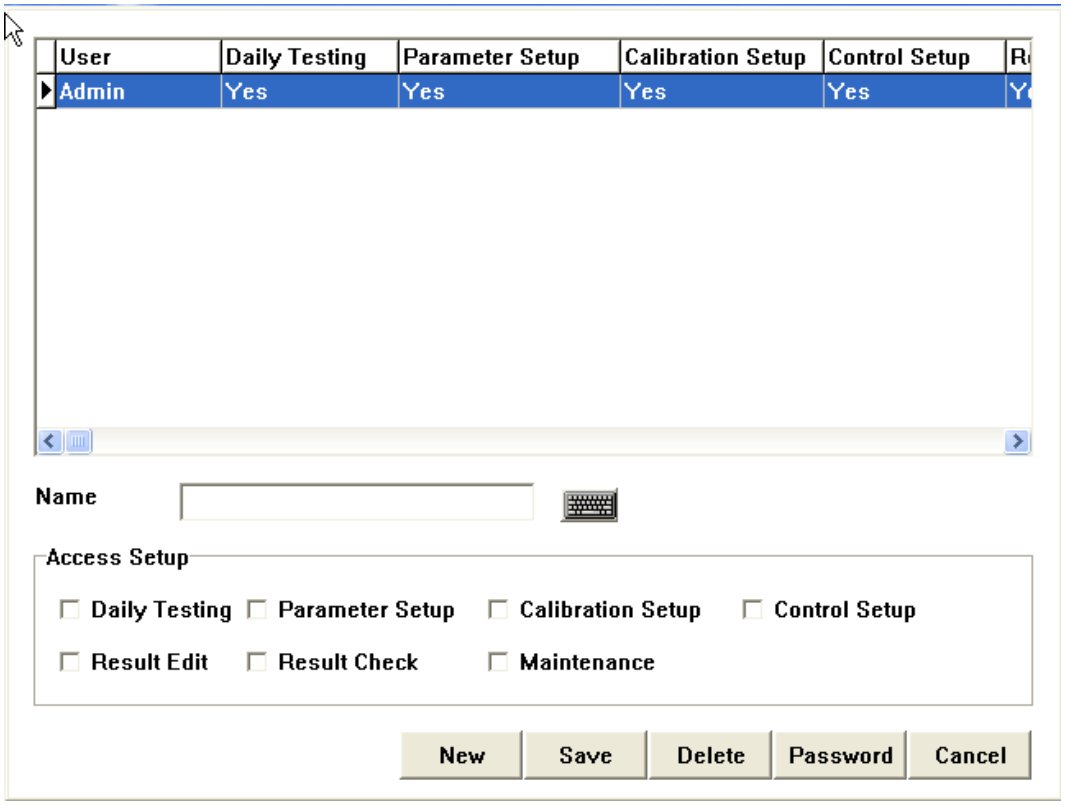

Figure 3-27 User Management Screen

Add User: Press the Add key, input the user name in the User Name input box, select and set the privilege, and press the Save key.

Modify User Privilege: Select a user from the list, reselect and set the privilege, and press the Save key.

Delete User: Select a user from the list and press the Delete key.

Modify Password: Select a user from the list and press the Modify Password key. The screen as shown in Figure 5-5 will appear. The original password is “888888”.

Figure 3-28 User Password Setup Screen

Input the password and new password, input the new password again for

confirmation, and press the Modify Password key.

5. Reagent Setup

Select Reagent Setup from the System Setup menu to enter the screen as shown in the figure:

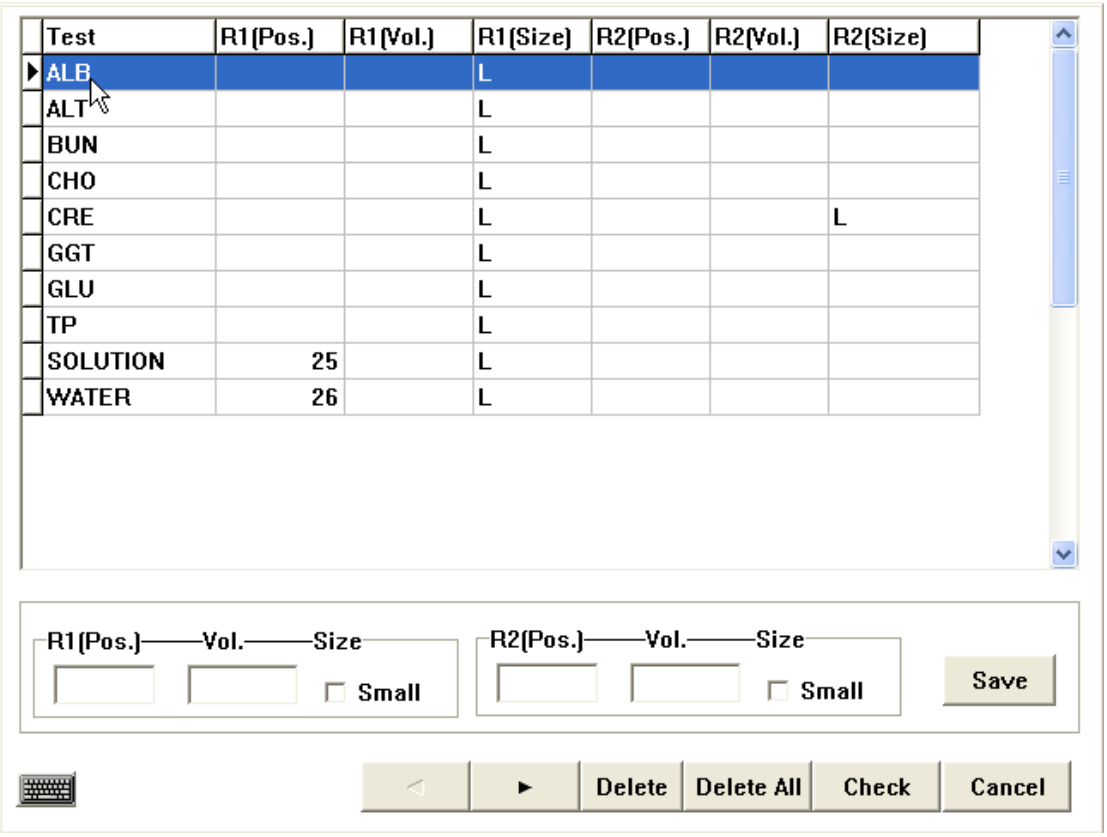

Figure 3-29 Reagent Position Setup Screen

Modify Reagent Information: Select an item, set the positions and remaining volume of reagent 1 and reagent 2 respectively and the model of the reagent bottle, and press the Save key.

Delete Reagent Information: Select an item and press the Delete key to delete the reagent information of the item. Press the Delete All key to delete all defined reagent information.

Reagent Test: Press the Reagent Test key, and the system will detect the remaining volume of the reagent for which the position has been specified.

3.2.10 Test

Click Sample Entry on the main menu to enter the Sample Application screen as shown in Figure 3-30:

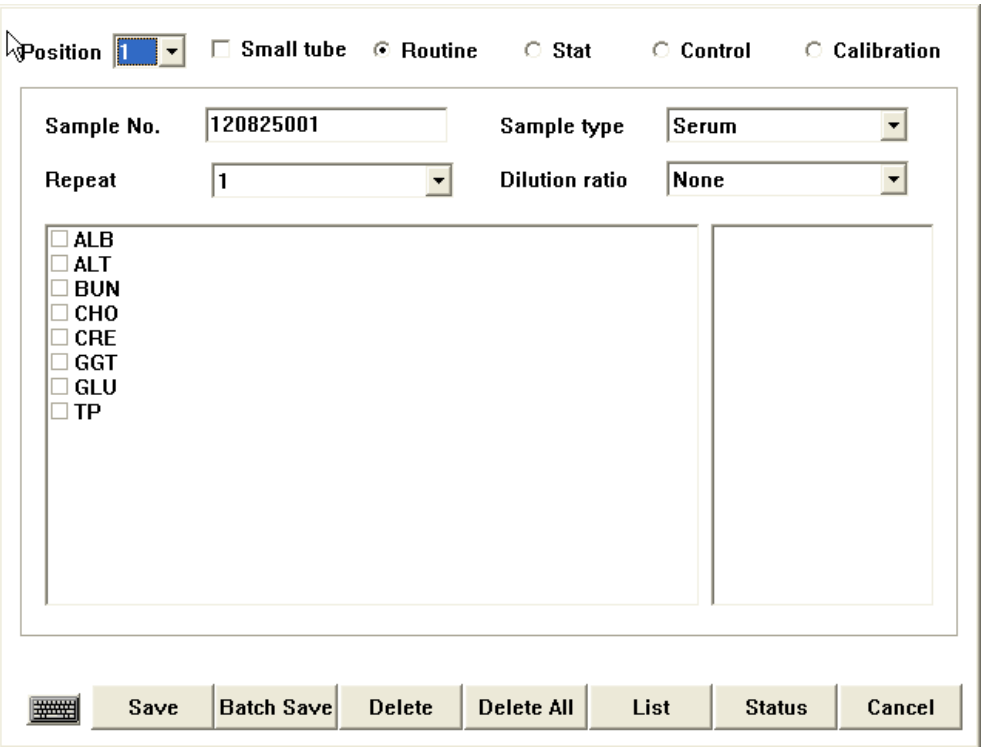

Figure 3-30 Sample Entry Screen

3.2.10.1 Sample Input

1. Sample Application

- **Edit a Sample**

Step 1: Select Sample Position. If small sample cup is adopted, select small Cup;

Step 2: Select the sample type Regular or Emergency Treatment;

Step 3: Input the sample number and specify the sample type;

Step 4: Select the repeat count and dilution ratio; (default repeat count: 1; default dilution ratio: Not Dilute)

Step 5: Select test items and test combinations;

Step 6: Press the Save key;

Step 7: Finish a sample application.

- **Edit Multiple Samples**

Step 1: Input the start sample number and specify the sample type;

Step 2: Select the repeat count and dilution ratio; (default repeat count: 1; default dilution ratio: Not Dilute)

Step 3: Select test items and test combinations;

Step 4: Press the Batch Save key, and the screen as shown in Figure 3-31will appear:

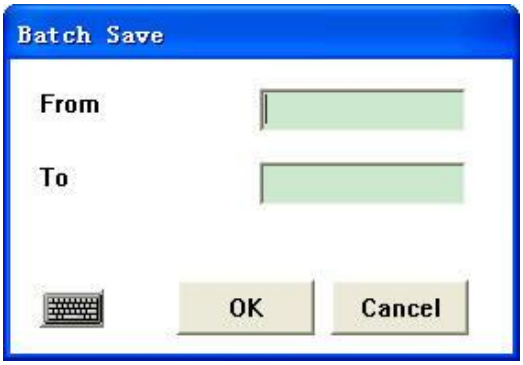

Figure 3-31 Multiple Samples Setup Screen

Step 5: Input the start sample position and end sample position, and press the OK key.

Step 6: Finish the batch sample application.

3.2.10.2 QC Substance Application

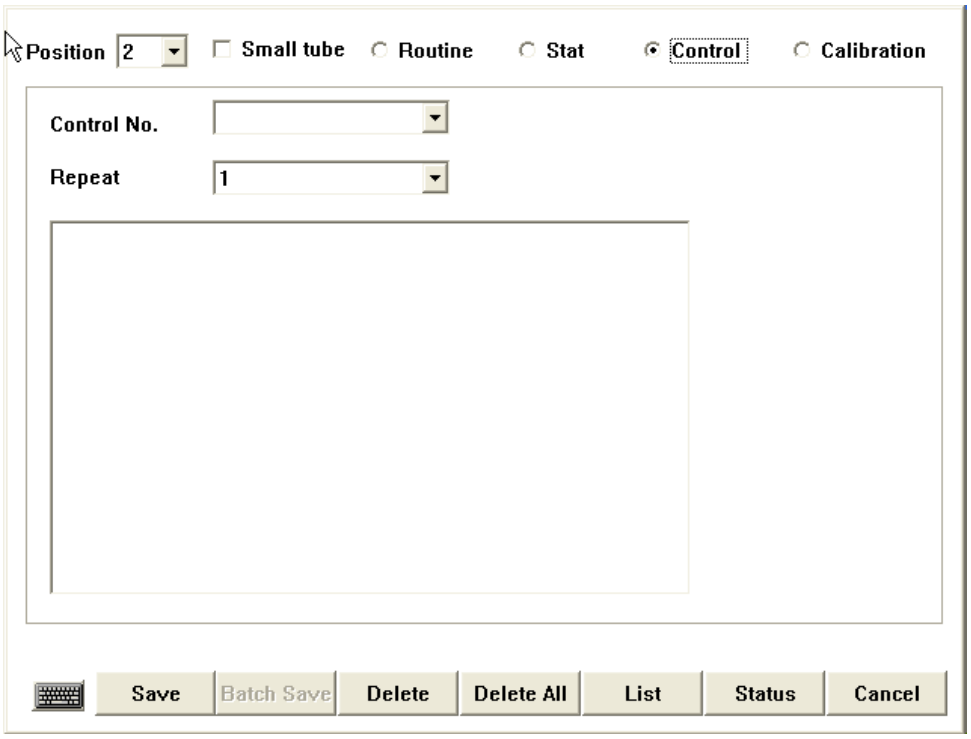

Figure 3-32 QC Substance Application Screen

Step 1: Select Sample Position. If small sample cup is adopted, select Small Cup;

Step 2: Select the sample type QC;

Step 3: Select the QC substance number, and the QC items included in the QC substance will be displayed in the right list;

Step 4: Select the repeat count;

Step 5: Select the QC items from the list;

Step 6: Press the Save key;

Step 7: Finish a QC substance application.

3.2.10.3 Standard Substance Application

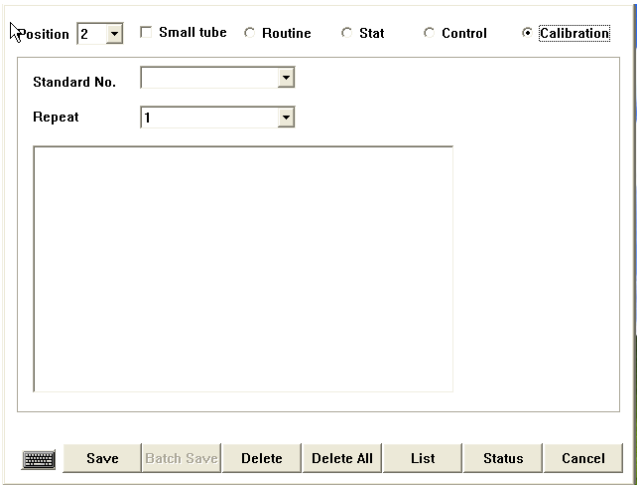

Figure 3-33 Standard Substance Application Screen

Step 1: Select Sample Position. If small sample cup is adopted, select Small Cup;

Step2: Select the sample type Standard;

Step 3: Select the standard substance number, and the calibration items included in the standard substance will be displayed in the right list;

Step 4: Select the repeat count;

Step 5: Select the calibration items from the list;

Step 6: Press the Save key;

Step 7: Finish a standard substance application.

3.2.10.4 Sample Test

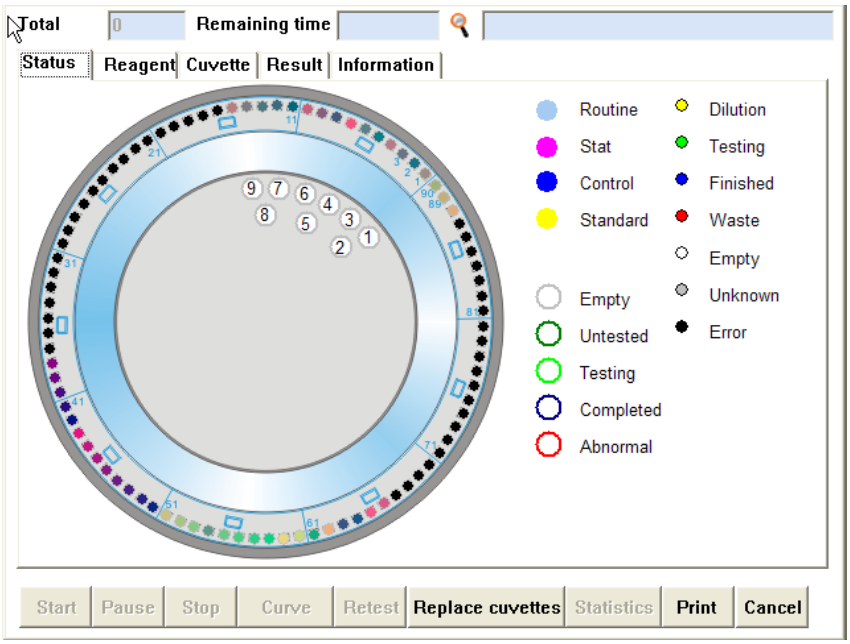

Figure 3-34 Test Main Screen

Click the Start key, and the prompt box as shown in the figure will appear:

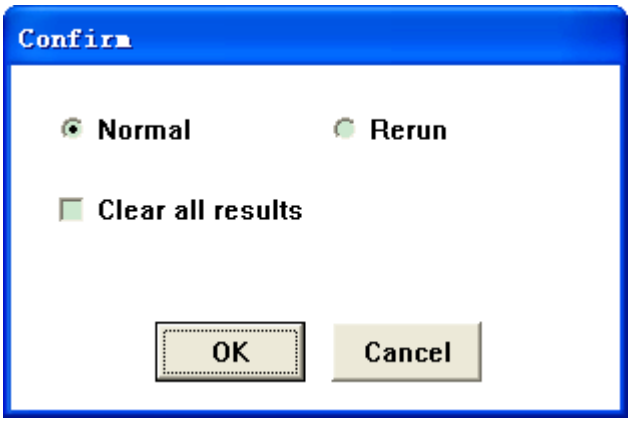

Figure 3-35 Start Status Screen

Initial Test: To conduct initial test of the tests not finished or retests in the current worksheet.

Retest: To conduct retest for the results exceeding the linear range of the finished tests in the current worksheet.

Clear Test Results: To clear the results of the finished tests in the current worksheet and restart all the clear tests.

Before confirming the start of the test, confirm the above information. To modify the information, press the Cancel key. Otherwise press the OK key, and the Test Sequencing screen will appear, as shown in the figure:

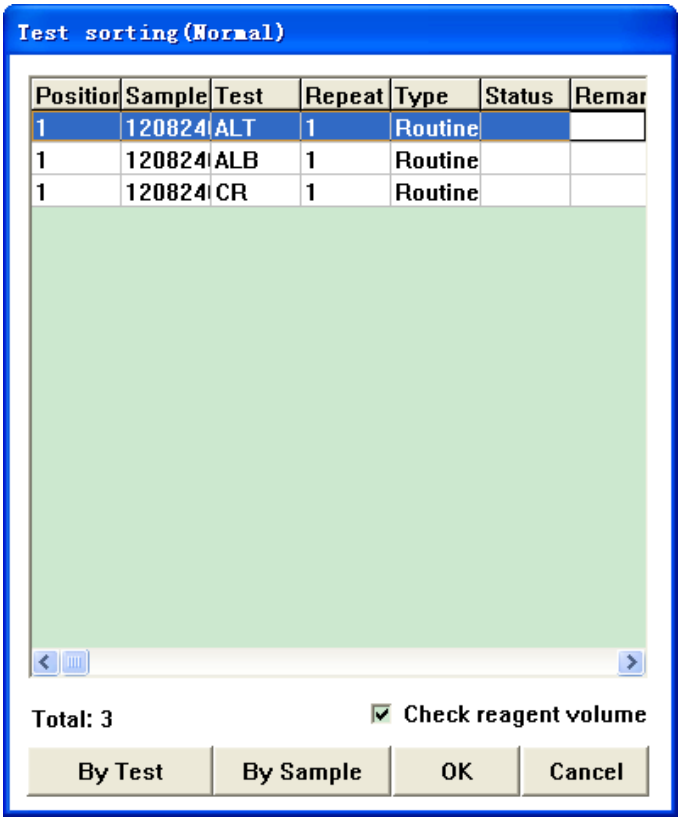

Figure 3-36 Test Sequencing Screen

The system sorts the tests according to the test sequence specified in Test Sequence Setup by default. If you want to readjust the sequence, you can press the “Sort by Item” key or “Sort by Sample” key or use the mouse to drag the tests in the list. After adjusting the test sequence, press the OK key to start the test; or press the Cancel key to give up the test.

3.2.10.5 Test Status

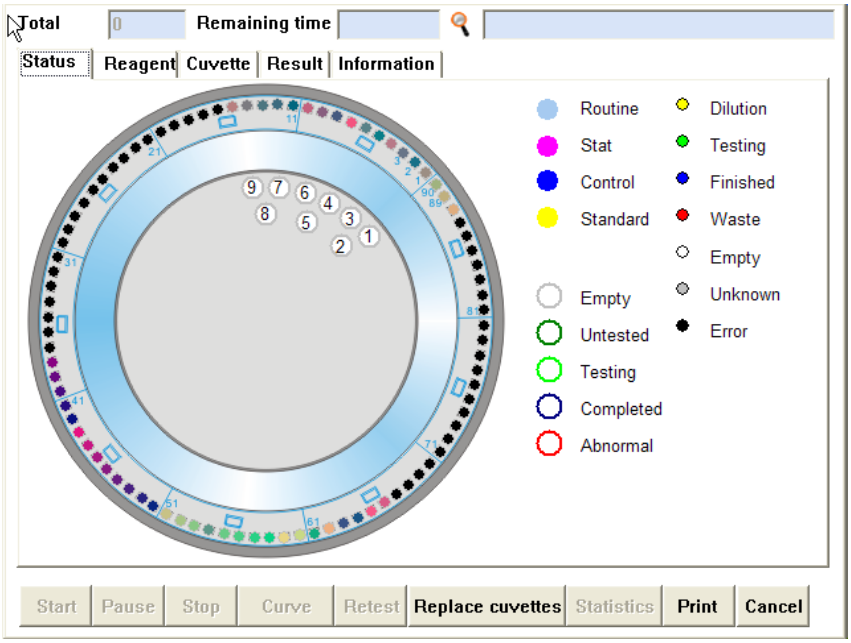

Figure 3-37 Test Status Screen

Number of Tests: Number of reactions of this test;

Remaining Time: Time needed for and remaining time of test;

Test Status:

Reagent: Test placement position, remaining volume, volume required, status displaying;

Test cuvette: Test cuvette position, item name, test status, test results displaying;

Results: Basically consistent with the data displayed for the test cuvette. Results are displayed earlier than the test cuvette by one cycle;

Message: Start time, end time, reagent/sample lack, etc. of a test.

Chapter 4 Introduction to Unit Modules

4.1 Tray Unit

4.1.1 Function Description

The reagent tray, sample tray and reaction chamber are integrated and driven by the same rotational spindle. Reagent and sample adding and reaction test are completed in the same tray. The main functions include reagent and sample placement, test cuvette placement, and keeping constant temperature of test cups.

The body of the reaction tray is made of plastic, and the bottom and both sides are made of adhesive insulation foam. The main function of the outer layer insulation is to ensure easy achievement of constant temperature control inside the reaction tray. If the insulation effect is poor, the heat exchange of the reaction tray will be fast, which is unfavorable to achievement of constant temperature.

The temperature of the reaction tray is mainly provided by the heating film at the inner bottom. Overheat protection is adopted, that is, when the heating air exceeds 75℃, power will be turned off to avoid accidents caused by overheat, such as fire, etc. The temperature control system is intelligent.

4.1.2 Composition and Structure

The tray unit is composed of sample/reagent position, test position, reaction position constant temperature chamber and motor sections.

The motor section is composed of motor, motor buffer plate, spindle motor frame, synchronous belt, etc.

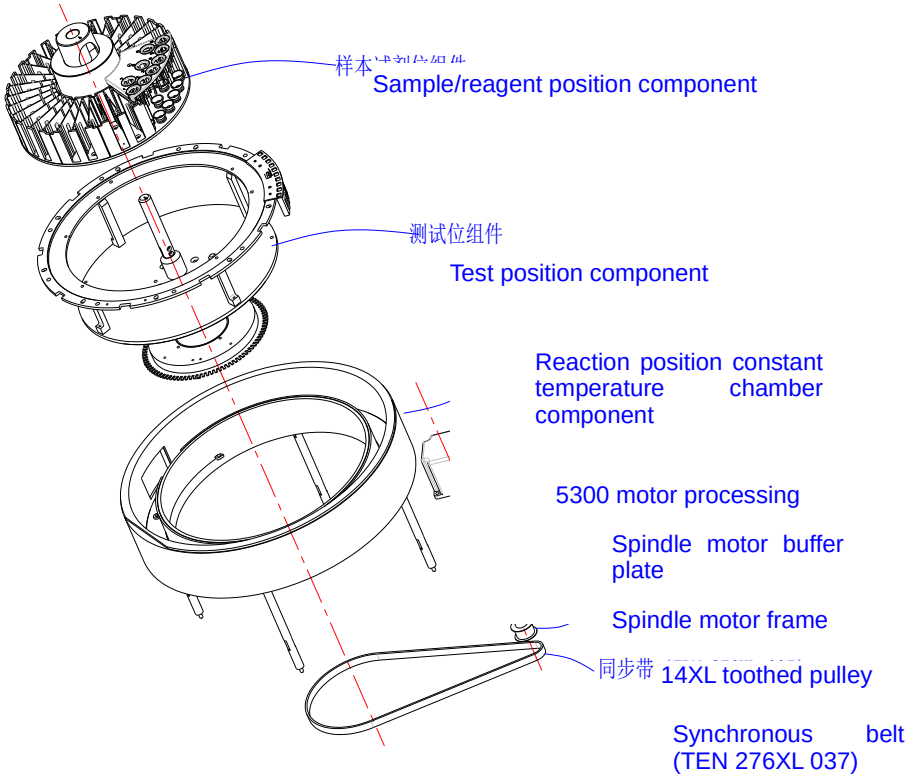

Figure 4-1 Tray Unit Explosive View

The reagent/sample position section is composed of handle label, reagent tray handle, reagent position support, sample position support, guide sleeve, reagent tray bottom plate, etc.

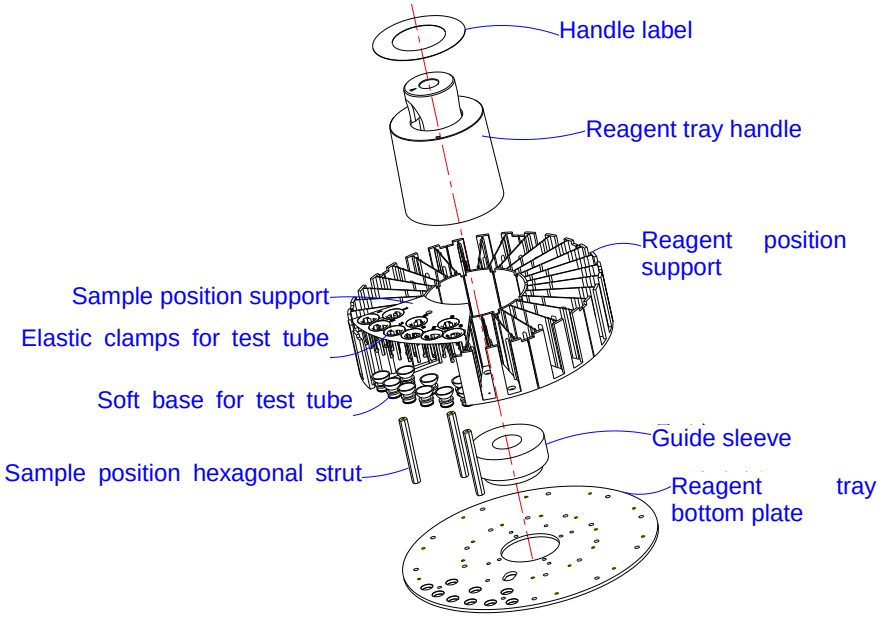

Figure 4-2 Reagent/Sample Position Section Explosive View

The test position section is composed of test cup, test cup holder, guide pin, reaction tray positioning pin, reaction tray strut, reaction tray bottom plate, etc.

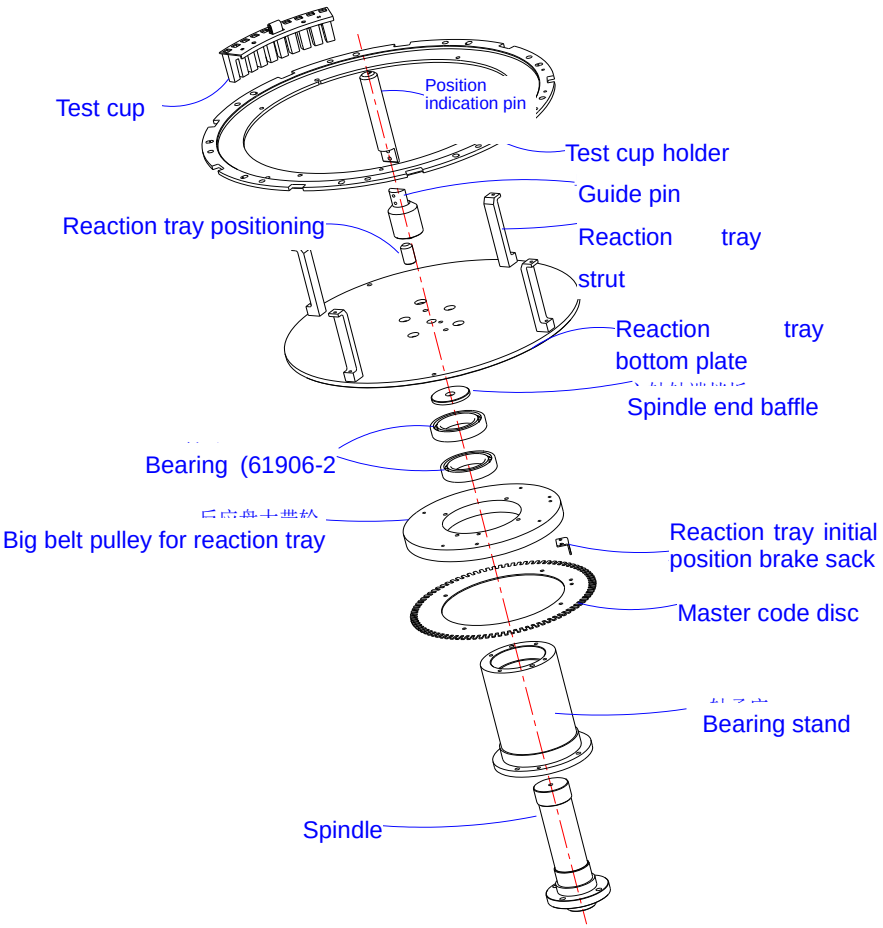

Figure 4-3 Test Position Section Explosive View

The reaction position constant temperature chamber section is composed of heating film, heating film pressing plate, reaction constant temperature chamber, insulation material, temperature sensor, etc.

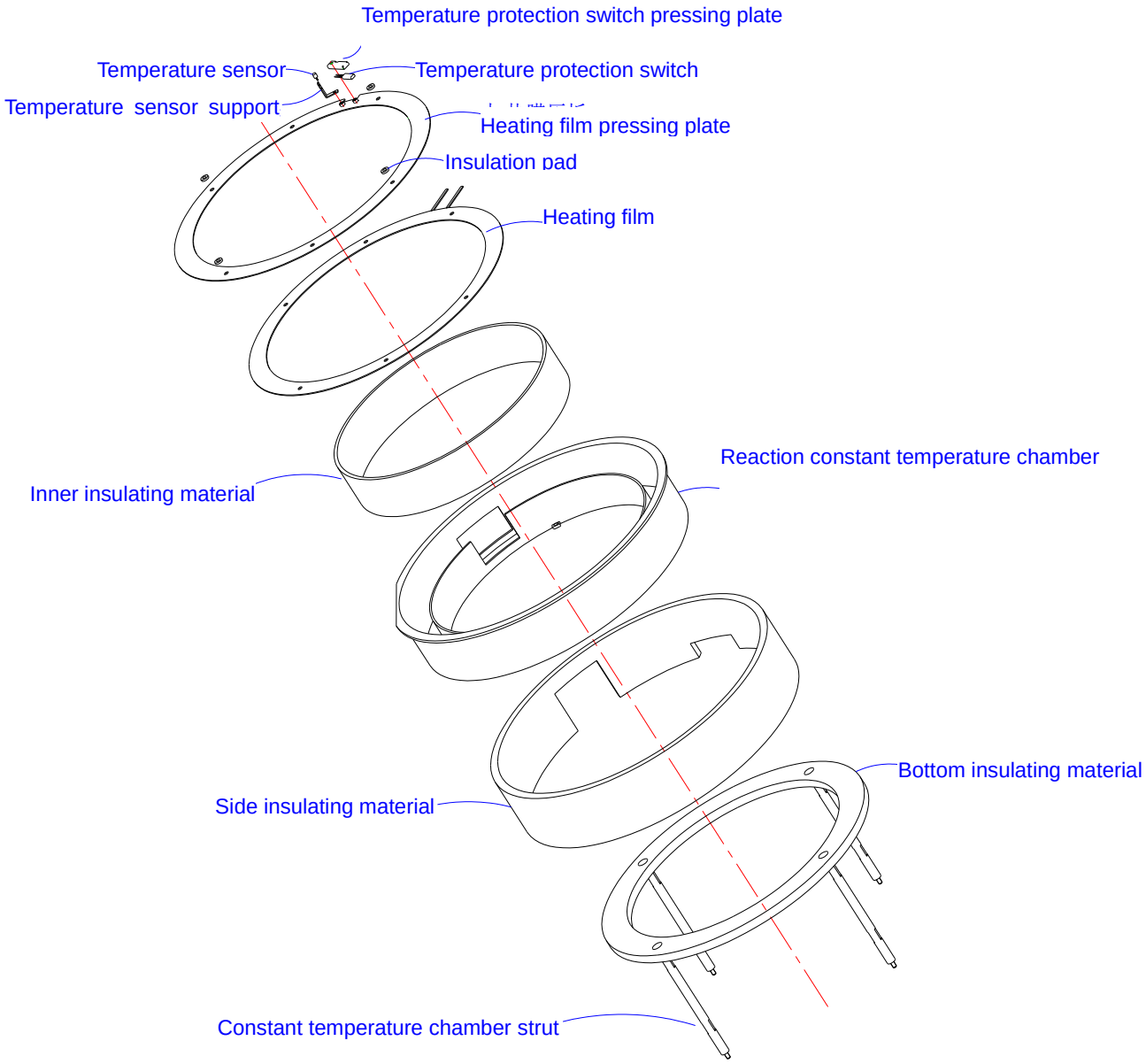

Figure 4-4 Reaction Position Constant Temperature Chamber Section Explosive View

4.2 Sampling and Mixing Unit

4.2.1 Function Description

The driving component for the sampling unit has an optocoupler in the horizontal and vertical directions respectively for determining the mechanical zero positions in horizontal and vertical directions. One stepping motor in horizontal and vertical directions respectively controls the horizontal and vertical movement of the sampling probe precisely, driven by the belt + belt pulley.

The sampling probe with the function of liquid sensor is in contact with the liquid to suck up the desired volume. When the reagent or sample is lacked, the instrument

will give prompt message automatically.

The reagent is preheated. When the reagent volume added is greater than 250μL, the refrigerated reagent passes through the preheating module, and the temperature is 30～35℃ when it is drained.

Reagent preheating needs over temperature protection. The temperature is controlled intelligently. The preheating temperature is controlled at 38.5±1℃; when it exceeds 75℃, the instrument will be switched off automatically.

Before the reagent is added to the test cuvette, it mainly obtains heat from the hose at the central heating section. Through the mixture of high temperature reagent and low temperature reagent, preheating is achieved.

In order to ensure the accuracy and repetition of the results, it is suggested that the volume of the sample be not less than 4μL.

4.2.2 Composition and Structure

The sampling and Mixing unit is composed of sampling arm component, sampling probe code disc, synchronous belt, wobble big belt pulley, splined connection shaft sleeve, optocoupler, splined shaft, drive, bearing stand, etc.

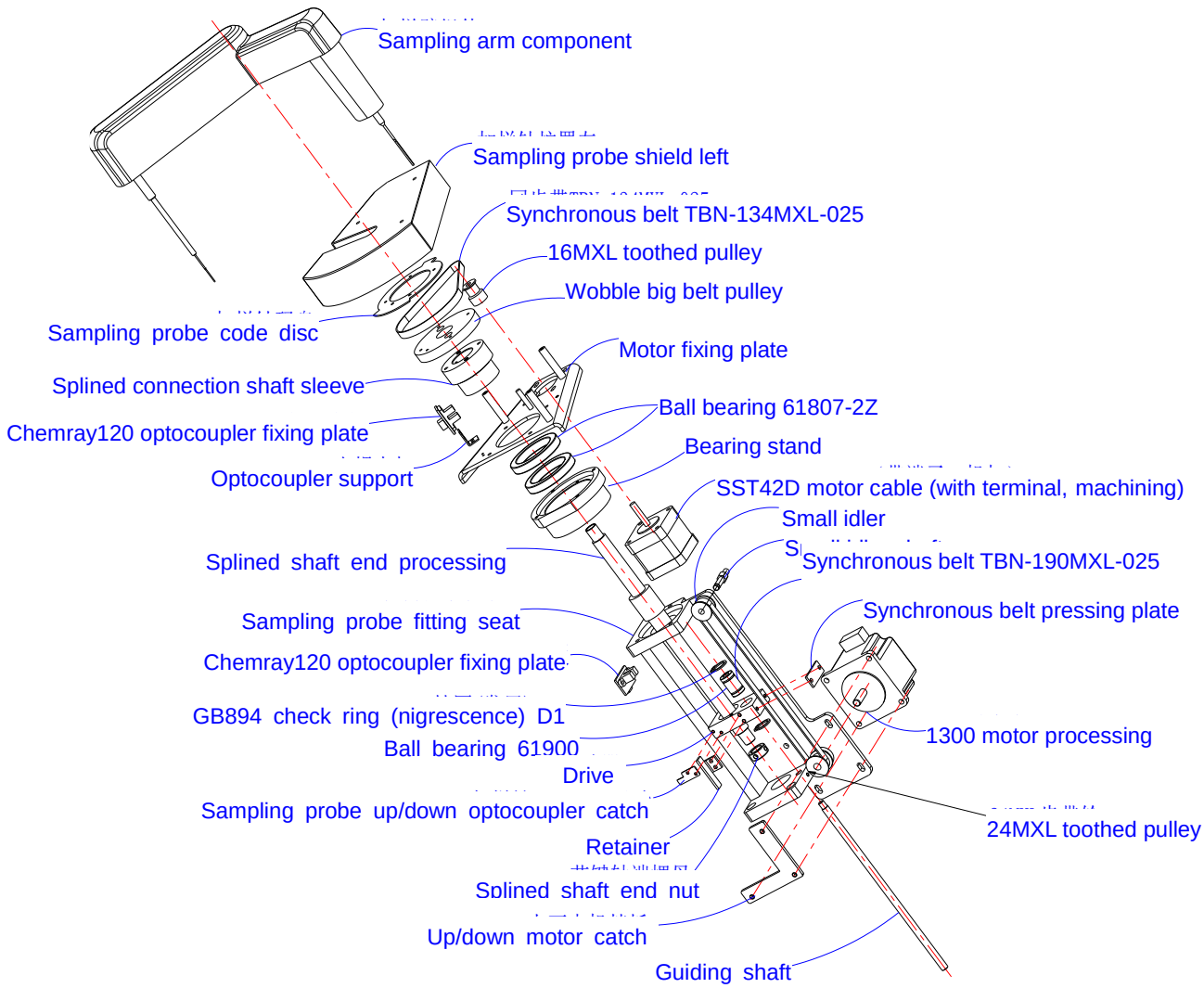

Figure 4-5 Sampling and Mixing Unit Explosive View

The sampling arm component is composed of sampling probe surface shell, spring guiding shaft, sampling probe fixing support, sample probe, liquid level detection plate, guide holder, etc.

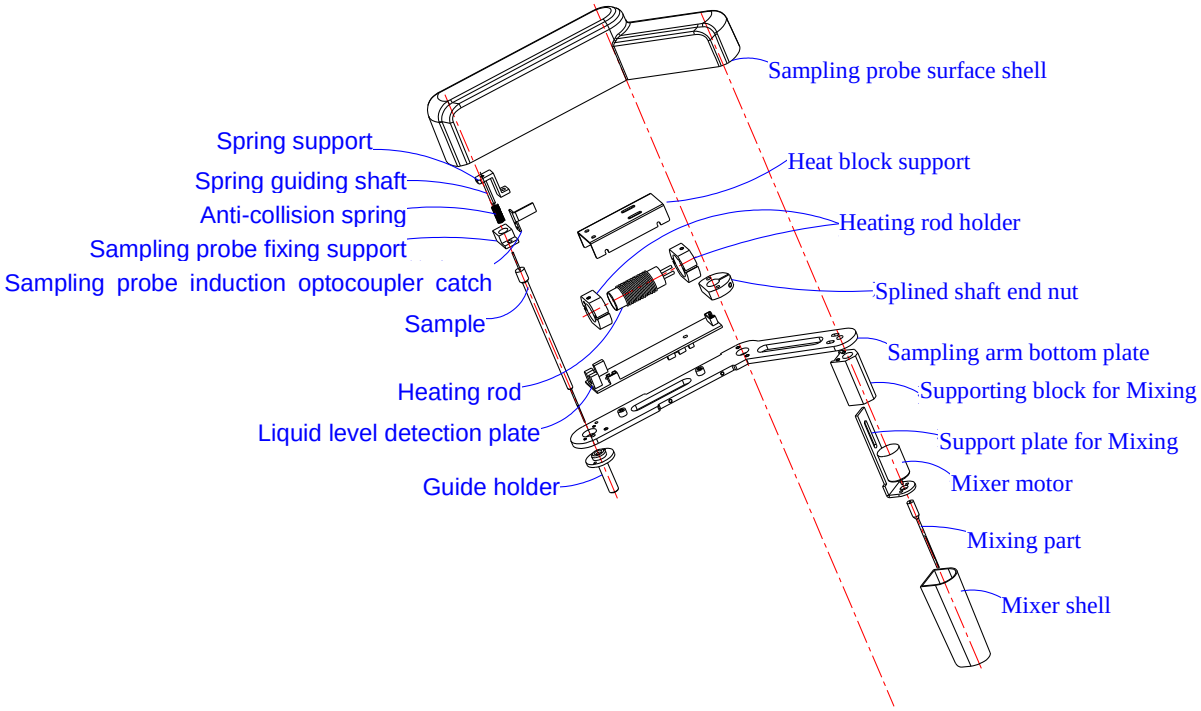

Figure 4-6 Sampling Arm Component Explosive View

4.3 Light Path Component

4.3.1 Function Description

The light path component is the core part of the instrument. The light source section uses the standard configuration, including 340, 405, 450, 510, 546, 578, 630 and 670 nm – total 8 wavelengths. The interference filter is pre-spectroscopic, with separate dark current detection channel. About 2000h long life tungsten halogen lamp (12 V, 20W) is used.

The test types include colorimetric method, immunoturbidimetry, etc. The analysis methods include end-point method, two-point method and kinetics method, with dual reagent and dual wavelength operation, etc. supported.

4.3.2 Composition and Structure

The light path component is composed of optical bench, photodiode, filter wheel, bulb and optical system support sections. The optical bench section is composed of optical bench, optical bench lens pressing ring, optical bench lens gasket, condenser lens, etc. The photodiode section is composed of IVAB photoelectric conversion board, photodiode sleeve，condenser lens, photodiode, etc. The filter wheel section is composed of filter wheel, optical filter, optical filter pressing spring, etc. The bulb section is composed of bulb, lamp holder, etc. The optical system support section is composed of fan, light path fan support, optical support vertical plate, optical support pillar, optical support transverse plate, etc.

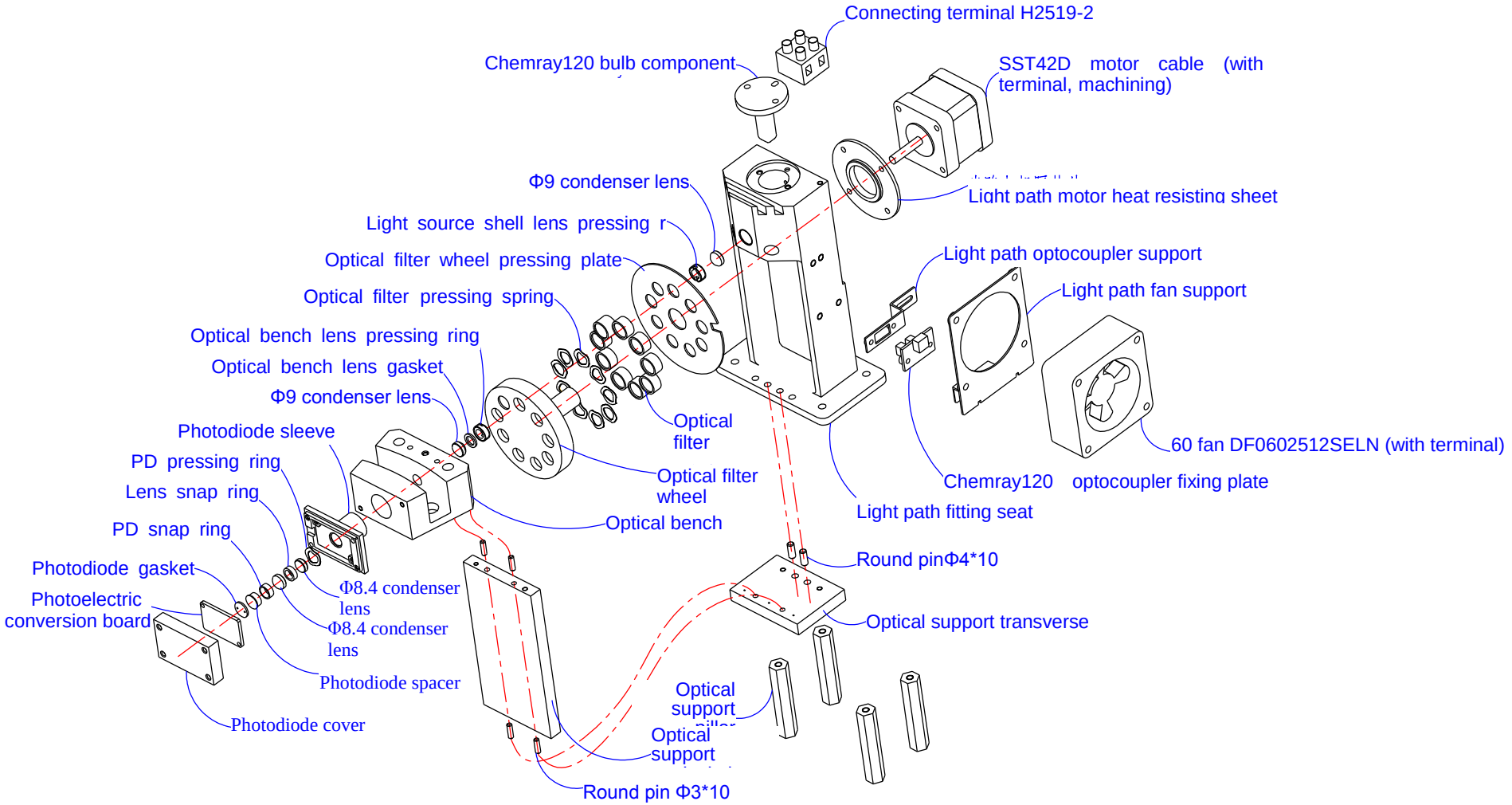

Figure 4-7 Optical Bench Unit Explosive View

4.4 Computer Unit

4.4.1 Function Description

The computer component is mainly used to run the software on the upper computer, send test commands to the middle and lower computers, process the test data transmitted by the middle computer, and display and print test results. Test data and operation software are stored in the CF card.

4.4.2 Composition and Structure

The computer unit is composed of touch screen, display, industrial control board, LED frame, touch screen control panel, industrial control main board, industrial control board, industrial control board protective cover, etc.

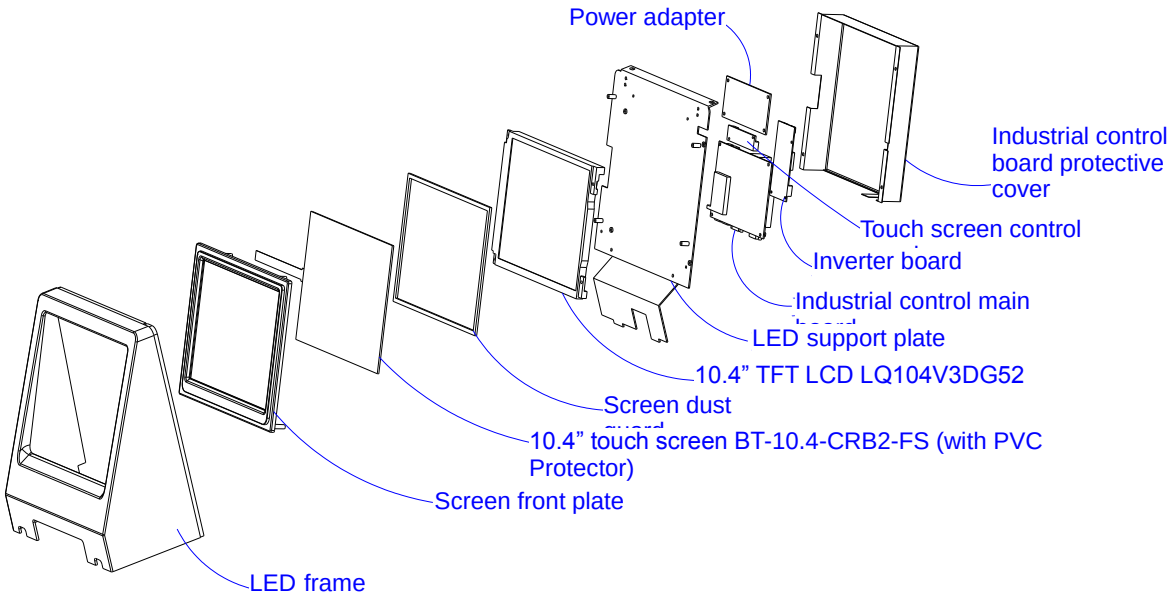

Figure 4-8 Computer Unit Explosive View

4.5 Syringe Component

4.5.1 Function Description

The syringe component is an important part in the sampling system of the instrument. The minimum sampling volume is 3 uL, and the maximum sampling volume is 450 uL. Its main function is sucking up sample and reagent of the set volume, and drain the reagent and sample in the specified test cuvette.

4.5.2 Composition and Structure

The syringe component is composed of stepping motor, electric syringe, syringe puller, ball screw, synchronous belt, etc.

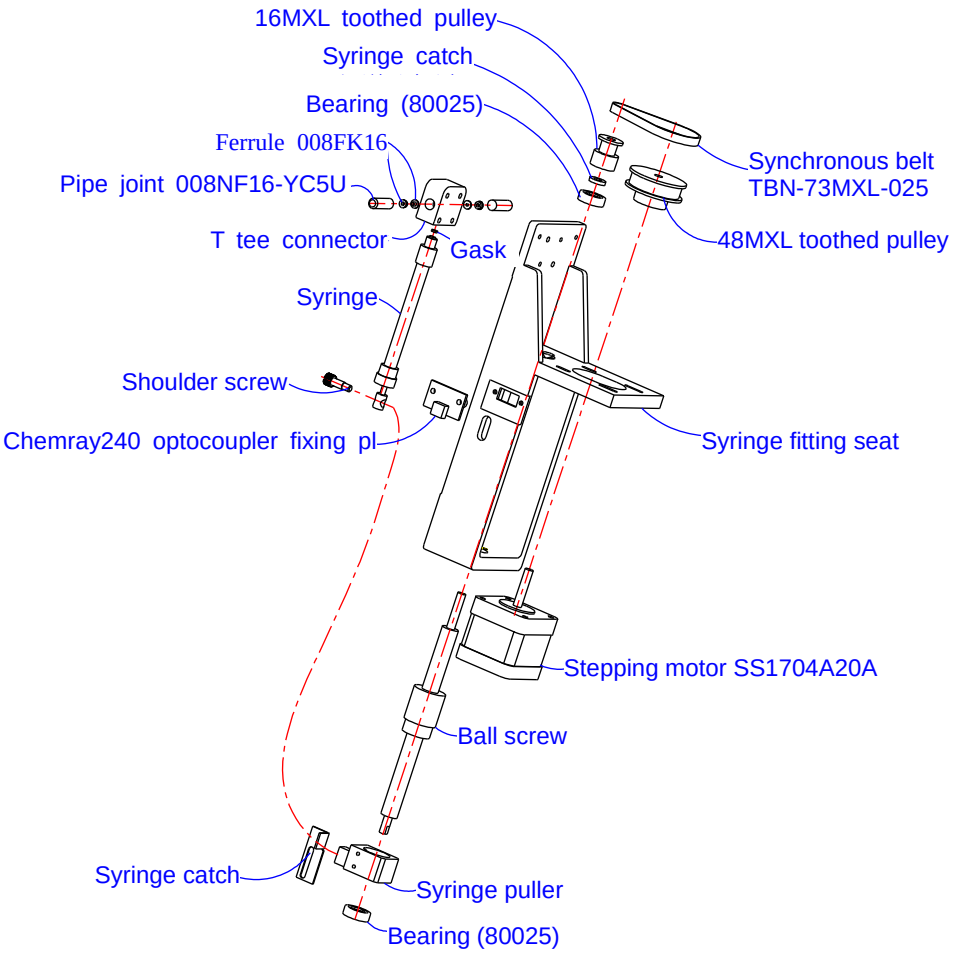

Figure 4-9 Syringe Unit Explosive View

Chapter 5 Hydraulic Circuit

5.1 Function Description

Perfusion, sampling, cleaning hydraulic circuit, draining waste liquid, liquid level detection, etc.

5.1.1 Working Principle of Hydraulic Circuit:

The instrument sucks up deionized water from the deionized water tank through the diaphragm pump. The liquid passes two valves, one connected to the rinse tank pipe and the other connected to the syringe pipe. When the syringe is working, the valve connected to it is opened, and the liquid passes through the syringe and is drained from the sampling probe to the rinse tank. After the instrument sends the cleaning command, the valve connected to the rinse tank is opened, and the liquid enters the central tank of the rinse tank, gushes up and flows to the outer tank of the rinse tank, flows to the wastewater pool, and is finally drained to the waste liquid tank.

5.1.2 Perfusion Function

The sampling probe and cleaning probe of the instrument are put in the rinse tank. The syringe, pump and two valves are working. The liquid flows in two ways, collects in the wastewater pool, and are drained to the waste liquid tank.

5.1.3 Sampling Function

The syringe of the instrument sucks up the sample and liquid to the sampling probe and the pipe connected with the sampling probe, and drains them in the test cuvette.

5.1.4 Cleaning Function

The cleaning function is divided into inner wall cleaning and outer wall cleaning of sampling probe.

Sampling probe inner wall cleaning: The liquid passes through the pump, valves and syringe, and is drained in the sampling probe.

Sampling probe outer wall cleaning: The liquid passes through the pump and valves, and gushes up from the central tank of the rinse tank to clean the outside of the sampling probe.

5.1.5 Liquid Level Detection Function

Liquid level detection is divided into deionized water level detection and waste liquid level detection.

Deionized water level detection: Warning is issued when the water level in the deionized water tank is lower than the required value, that is, warning is issued when the white floating ball of the liquid level sensor moves to the bottom.

Waste liquid level detection: Warning is issued when the water level in the waste liquid tank is higher than the required value, that is, warning is issued when the white

floating ball of the liquid level sensor moves to the top.

5.2 Major Components of the Hydraulic Circuit

The hydraulic circuit unit is composed of rinse tank, wastewater pool, deionized water tank, waste liquid tank, and pump and valve components.

1. Rinse tank component: Composed of rinse tank, rinse tank support, etc.
   Two gushing rinse tanks are used, one under the sampling probe and the other under the mixer.
2. Wastewater pool component: Composed of wastewater pool, wastewater pool cover, etc.
   The waste liquid from the two rinse tanks collects in the wastewater pool through the pipeline, and is drained to the waste liquid tank from the pipe under the pressure in the wastewater pool. Note that the top of the waste liquid tank must be lower than the workbench surface, otherwise the water is difficult to be drained from the wastewater pool.
3. Deionized water tank component: Composed of deionized water tank, bottle cap, deionized water bottle cover, cleaning bottle liquid level switch, countersunk head screw, etc.
4. Waste liquid tank component: Composed of waste liquid tank, bottle cap, waste liquid bottle cover, floating ball liquid level switch, etc.
5. Pump and valve component: Composed of diaphragm pump, electromagnetic valve, valve support, grounding wire pole, liquid level alarm board, etc.

Diaphragm pump: DC +12V power supply.

Electromagnetic valve: DC +12V power supply.

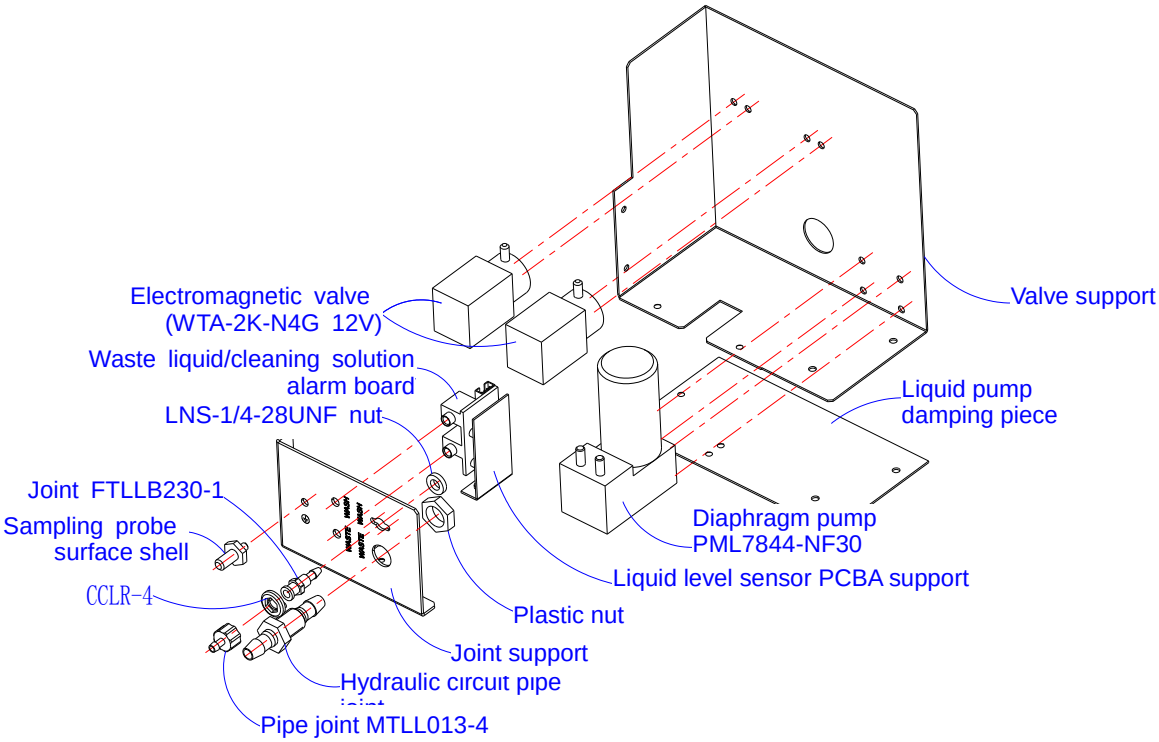

Figure 5-1 Pump and Valve Component Explosive View

5.3 Hydraulic Circuit Connection Diagram

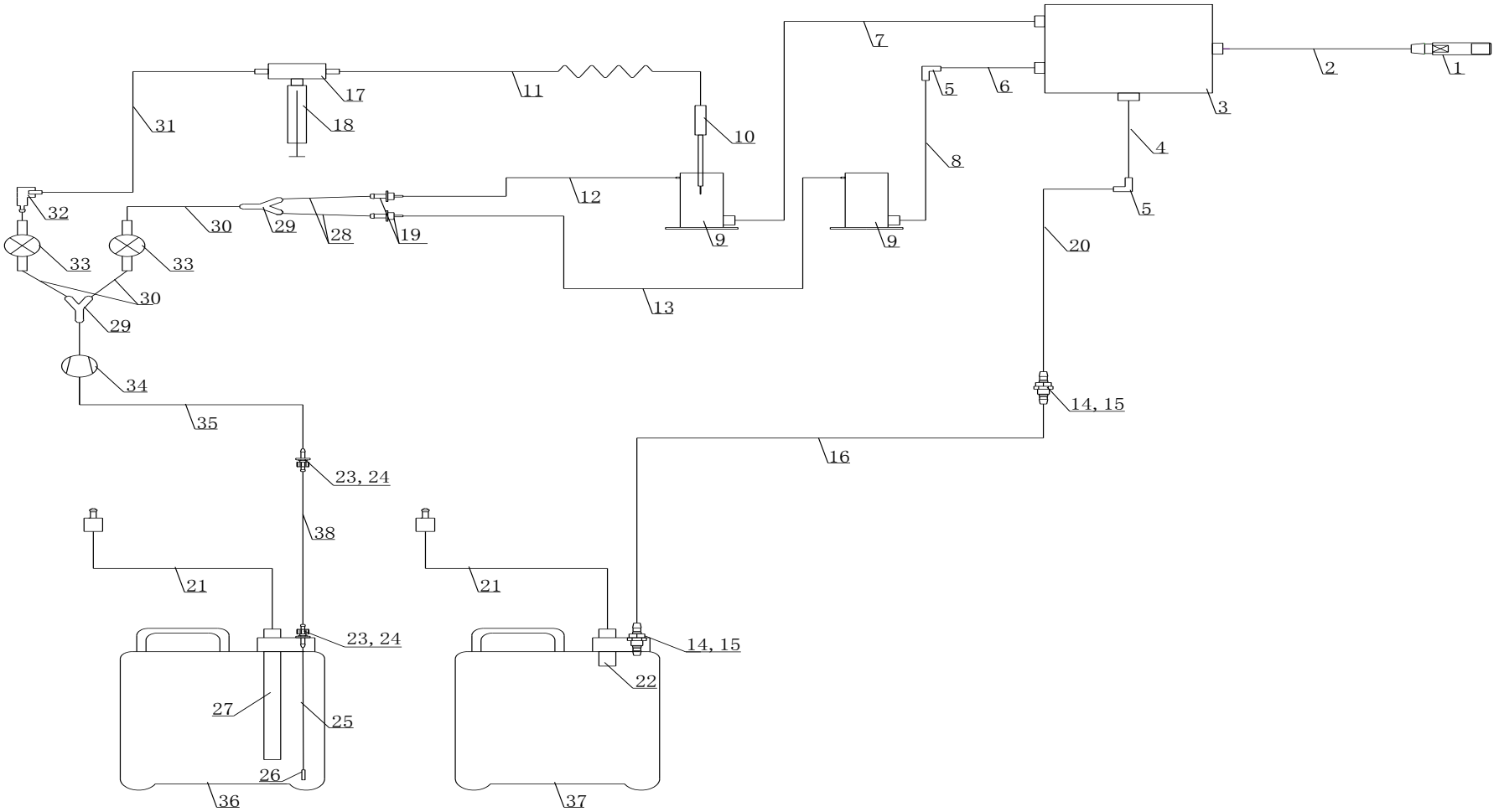

Figure 5-2 Hydraulic Circuit Connection Diagram

Hydraulic Circuit System BOM Table 5-1 Hydraulic Circuit System BOM

Table 5-1 Hydraulic Circuit System BOM

No.	Material Code	Material Name	Pipe Length
1	1-2-070-053-10	Pipe joint	
2	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	150mm
3	1-3-070-037-10	Wastewater pool	
4	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	40mm
5	1-8-080-008-00	L pipe joint (0925ELBP)	Total 2PCS
6	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	20mm
7	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	350mm
8	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	100mm
9	1-3-070-036-10	Rinse tank	Total 2PCS
10	1-8-070-003-10	Sample probe	
11	1-8-001-051-00	FEP pipe, 0.8*1.6mm	2000 mm
12	1-8-035-022-00	Inner diameter Φ1.30mm, Outer diameter Φ3.00mm, Saint-Gobain	350 mm
13	1-8-035-022-00	Inner diameter Φ1.30mm, Outer diameter Φ3.00mm, Saint-Gobain	550 mm
14	1-2-072-004-10	Hydraulic circuit pipe joint	Total 2PCS
15	1-2-072-006-10	Plastic nut	Total 2PCS
16	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	1200mm
17	1-8-013-087-11	T tee connector	
18	1-8-013-085-10	Syringe-17595(500ul)	
19	1-8-080-007-00	Value pipe joint (N430/420-1)	Total 2PCS
20	1-8-070-018-00	Waste liquid pipe (7x12 silicone pipe)	300mm
21	1-5-080-033-10	Liquid level detection alarm	Total 2PCS

		cable	
22	1-8-013-163-00	Floating ball liquid level switch FS1001	
23	1-8-003-010-00	CCLR-4 (green coded lock ring)	Total 2PCS
24	1-8-003-014-00	Joint FTLLB230-	Total 2PCS
25	1-8-070-011-10	Saint-Gobain hose ID=1/8" OD=1/4"	270mm
26	1-2-070-063-10	240 countersunk head screw	
27	1-8-080-006-10	Cleaning bottle liquid level switch	
28	1-8-035-022-00	Saint-Gobain hose ID=1/8" OD=1/4"	40 mm Total 2PCS
29	1-8-062-006-00	Pipe joint (Y230-1)	Total 2PCS
30	1-8-035-022-00	Saint-Gobain hose ID=1/8" OD=1/4"	60 mm Total 3PCS
31	1-8-001-051-00	FEP pipe, 0.8*1.6mm	800 mm
32	1-3-013-003-11	Pipe joint-1	
33	1-5-080-031-10	WTA-2K-N4G electromagnetic valve (	Total 2PCS
34	1-5-080-032-10	PML7844-NF30 pump (	
35	1-8-035-022-00	Saint-Gobain hose ID=1/8" OD=1/4"	90 mm Total 2PCS
36	/	Deionized water tank component	/
37	/	Waste liquid tank component	/
38	1-8-070-011-10	Saint-Gobain hose ID=1/8" OD=1/4"	1200mm

Chapter 6 Electricity of Hardware

6.1 Board List

Table 6-1 Board List

No.	Board Name	Major Functions
1	Liquid level detection board	The function of the liquid level detection board is liquid level detection when the sampling probe is sucking up reagent and sample. This is capacitor-based detection, that is, when the sampling probe moves upward and downward and moves downward from above the liquid level till it touches the liquid level, the capacitor of the sampling probe changes, and the adjusted voltage signal changes rapidly, thus reflects the information on the liquid level. The anti-collision signal detection of upward and downward movements of the sampling probe is produced by coordination of one optocoupler and one catch; it is connected to the main control board for signal judgment with 5pin flexible cable.
2	Optocoupler fixing plate	It is connected to the main control board with 3pin wiring harness for the main control board to collect the position signals of various fixed optocouplers.
3	IVAB photoelectric conversion board	The function of the photoelectric conversion board is conversion of current signals of photodiode to voltage signals and level 1 amplification, with A1=1.5 times.
4	ADCB photoelectric amplification board	The function of the photoelectric amplification board is level 2 amplification of photoelectric signals. The amplification factor is adjusted through the digital potentiometer, and the specific adjustment is set in the engineering debugging software. Amplification factor A2=1+(number of R/1k). The signals after level 1 and level 2 amplifications are input to the AD conversion chip for analog-to-digital conversion. The control signals are from the main control board, and the output signals are transmitted back to the main control board.
5	MACO31 main control board	The main control board receives the commands from the industrial control board, controls the modules (reagent/sample probe, syringe, reaction tray/reagent

		tray, filter wheel, heater, pump and valve, etc.) to execute the corresponding actions according to the test commands, and then returns the execution results to the industrial control board.
6	Power interface board	Signal transfer of industrial control board and display; 5V voltage conversion of built-in printer drive board and touch screen drive board.
7	Touch screen controller	Production of control signals of touch screen
8	Industrial control main board	Running OS and microcomputer software
9	Inverter board	Providing backlight voltage of display
10	Output port conversion board	Conversion of keyboard, mouse, USB port, and network port
11	Printer drive board	Production of drive signals of built-in printer
12	Waste liquid/cleaning solution alarm board	The board is connected to the liquid level alarm sensor of cleaning solution bottle and waste liquid bottle. The connector is designed as audio interface, and connected to the main control board through 3pin cable for signal processing of alarm circuit.

6.2 Distribution of Boards in the Instrument

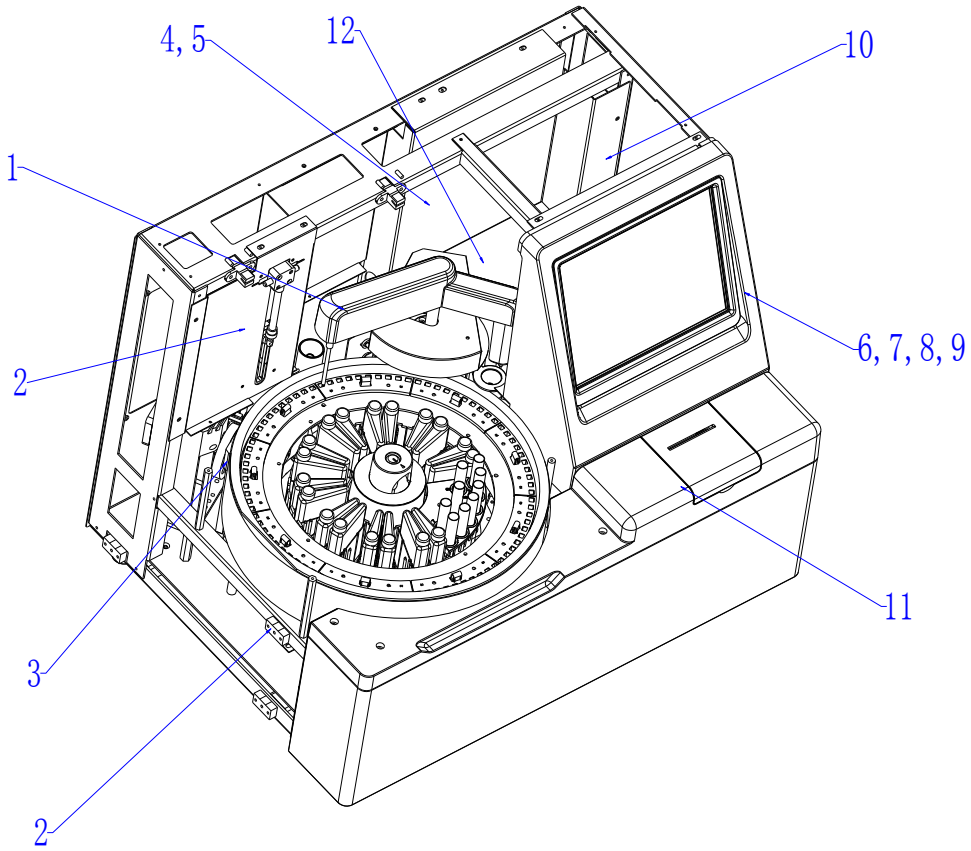

Figure 6-1 Board Distribution Diagram

6.3 Main Control Board

6.3.1 Function Description

The main control board receives commands from the industrial control board, controls the modules (reagent/sample probe, syringe, reaction tray/reagent tray, filter wheel, heater, pump and valve, etc.) to execute the corresponding actions according to the test commands, and then returns the execution results to the industrial control board.

6.3.2 Schematic Diagram

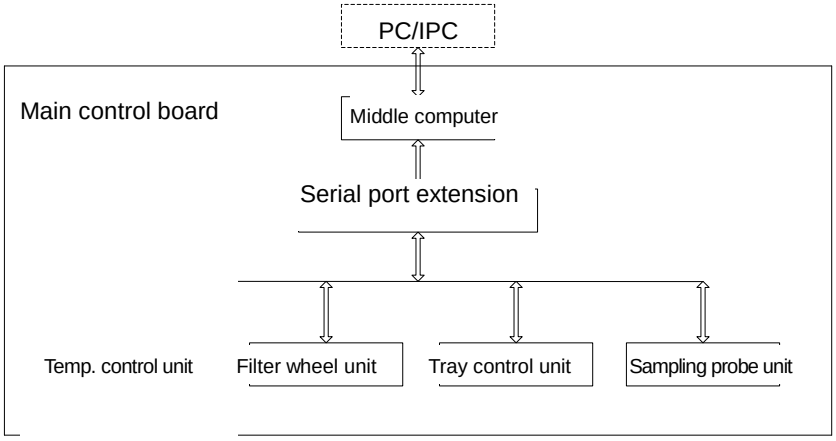

Figure 6-2 Main Control Board Schematic Diagram

6.3.3 Definition of Interface Pins

Table 6-2 Definition of Interface Pins for Main Control Board

Interface	Interface Description	Pin No.	Pin Description
J1	Connected to AD Receiving board	1	AD chip selection
		2	Digital potentiometer chip selection
		3	SPI clock
		4	MISO
		5	MOSI
		6	AD synchronizing signal
		7	5V power supply
		8	GND
J2	Reaction tray temperature sensor interface	1	NC
		2	Temperature sensor interface
		3	GND
J3	U3 download interface	1～10	/
J4	U4 download interface	1～10	/
J5	Reagent preheating temperature sensor interface	1	NC
		2	Temperature sensor signal
		3	GND
J6	Filter wheel motor interface	1	Motor A＋
		2	Motor A—
		3	Motor B＋
		4	Motor B－
J7	Syringe motor interface	1	Motor A＋
		2	Motor A—
		3	Motor B＋
		4	Motor B－
J8	Sample probe up/down	1	Motor A＋

	motor interface	2	Motor A—
		3	Motor B＋
		4	Motor B－
J9	Sample probe rotation motor interface	1	Motor A＋
		2	Motor A—
		3	Motor B＋
		4	Motor B－
J10	Reaction tray motor interface	1	Motor A＋
		2	Motor A—
		3	Motor B＋
		4	Motor B－
J11	Pump and valve interface	1	12V power supply
		2	Outer wall valve signal
		3	12V power supply
		4	Pump 1 signal
		5	12V power supply
		6	Inner wall valve signal
J13	Sensor signal interface	1	Sample probe up/down motor initial position sensor signal
		2	GND
		3	Power supply
		4	Filter wheel motor initial position sensor signal
		5	GND
		6	Power supply
		7	Sample probe rotation motor initial position sensor signal
		8	GND
		9	Power supply
		10	Reaction tray motor code disc sensor signal
		11	GND
		12	Power supply
		13	Syringe motor initial position sensor signal
		14	GND
		15	Power supply
		16	Reaction tray motor initial position sensor signal
		17	GND
		18	Power supply
		19	Cleaning solution floater sensor

			signal
		20	GND
		21	GND
		22	Waste liquid floater sensor signal
J14	Industrial control board serial port interface	1	Serial port receiving
		2	GND
		3	Serial port sending
		4	ISP
J15	Liquid level detection board interface	1	5V power supply
		2	Vertical anti-collision signal
		3	NC
		4	Liquid level detection signal
		5	GND
J16	Reaction tray heater interface	1	Control signal
		2	24V power supply
J17	Fan interface	1	12V power supply
		2	GND
J18	Reagent preheater interface	1	Control signal
		2	24V power supply
J19	Main control board power input	1	GND
		2	GND
		3	24V power supply
		4	24V power supply
J20	Mixing motor interface	1	6V power supply
		2	Control signal

6.3.4 Product Part Photo

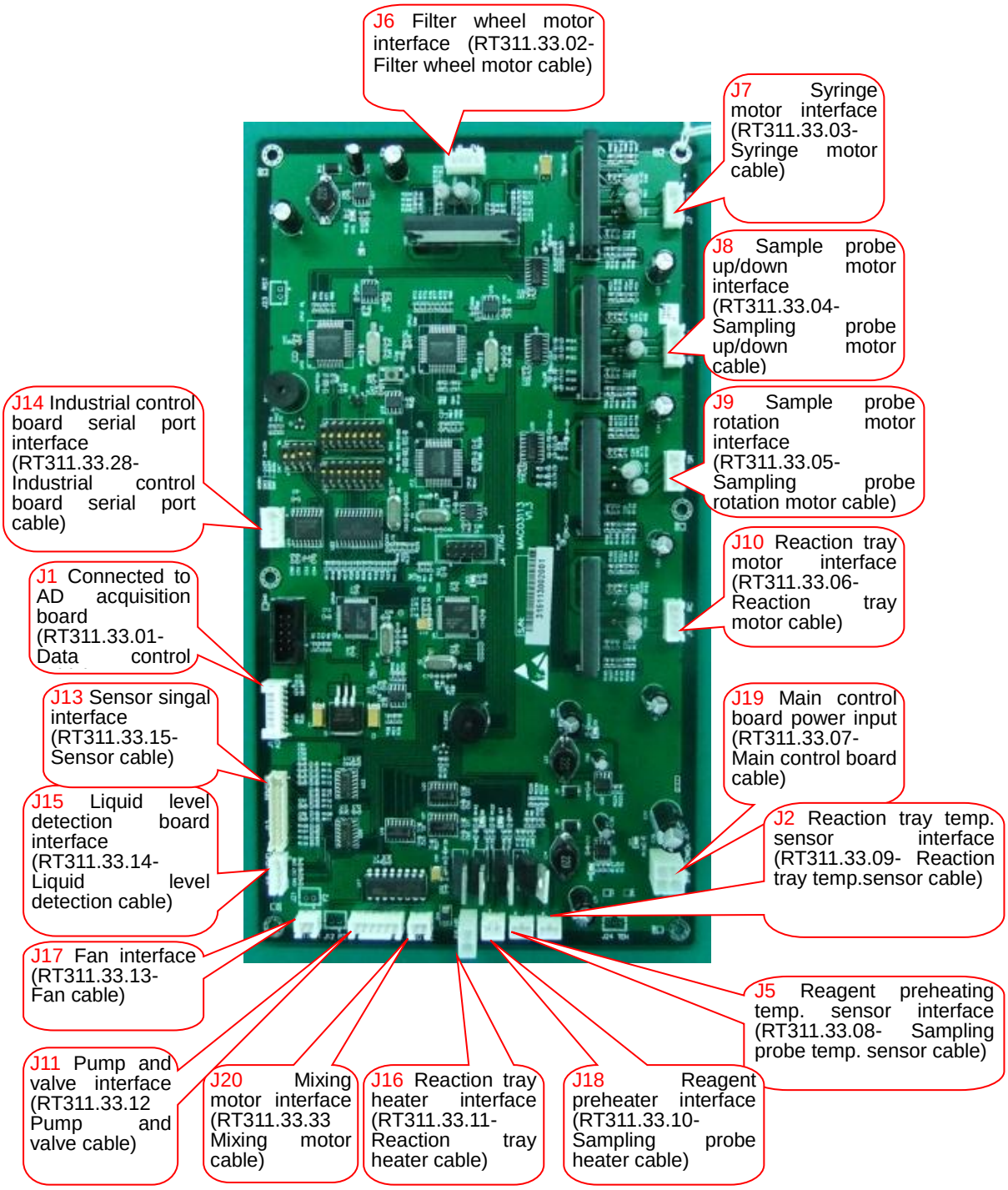

Figure 6-3 Real Product Photo of Main Control Board

6.4 Waste Liquid/Cleaning Solution Alarm Board

6.4.1 Function Description

The waste liquid/cleaning solution alarm board provides the interface between the waste liquid and cleaning solution sensors and the main control board.

6.4.2 Schematic Diagram

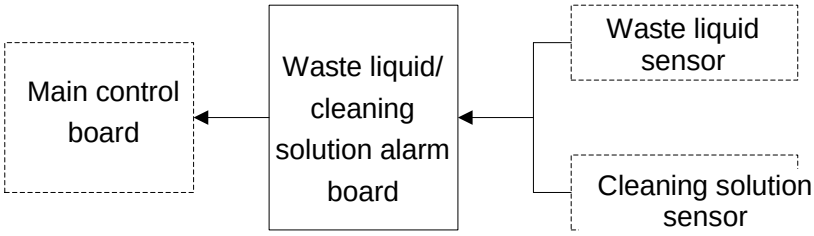

Figure 6-5 Waste Liquid/Cleaning Solution Alarm Board Schematic Diagram

6.4.3 Definition of Interface Pins

Table 6-3 Definition of Interface Pins for Waste Liquid/Cleaning Solution Alarm Board

Interface	Interface Description	Pin No.	Pin Description
J1	Interface with main control board	1	Cleaning solution floater sensor signal
		2	GND
		3	Waste liquid floater sensor signal
J2	Waste liquid floater sensor interface	1	GND
		2	Waste liquid floater sensor signal
		3	Waste liquid floater sensor signal
		4	GND
		5	NC
J3	Cleaning solution floater sensor interface	1	GND
		2	Cleaning solution floater sensor signal
		3	Cleaning solution floater sensor signal
		4	GND
		5	NC

6.4.4 Product Part Photo

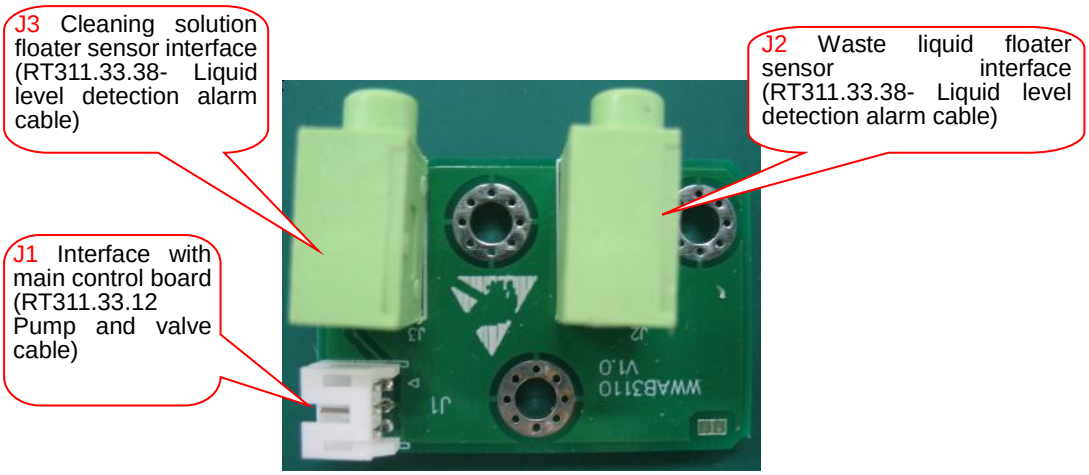

Figure 6-6 Real Product Photo of Waste Liquid/Cleaning Solution Alarm Board

6.5 Optocoupler Fixing Plate

6.5.1 Function Description

The optocoupler fixing plate is used to fix the optocoupler and provide interface.

6.5.2 Definition of Interface Pins

Table 6-4 Definition of Interface Pins for Optocoupler Fixing Plate

Interface	Interface Description	Pin No.	Pin Description
J1	Interface with main control board	1	Power supply
		2	GND
		3	Optocoupler sensor signal

6.6 IVAB Photoelectric Conversion Board

6.6.1 Function Description

The IVAB photoelectric conversion board is used to convert optical signals to electric signals.

6.6.2 Definition of Interface Pins

Table 6-5 Definition of Interface Pins for IVAB Photoelectric Conversion Board

Interface	Interface Description	Pin No.	Pin Description
J1	Interface with photoelectric amplification board	1	GND
		2	Signal
		3	Power supply

6.7 ADCB Photoelectric Amplification Board

6.7.1 Function Description

The ADCB photoelectric amplification board is used to amplify signals.

6.7.2 Definition of Interface Pins

Table 6-6 Definition of Interface Pins for ADCB Photoelectric Amplification Board

Interface	Interface Description	Pin No.	Pin Description
J2	Interface with photoelectric conversion board	1	GND
		2	Signal
		3	Power supply
J1	Interface with main control board	1	AD chip selection
		2	Digital potentiometer chip selection
		3	SPI clock
		4	MISO
		5	MOSI
		6	AD synchronizing signal
		7	5V power supply
		8	GND

6.7.3 Real Product Photo

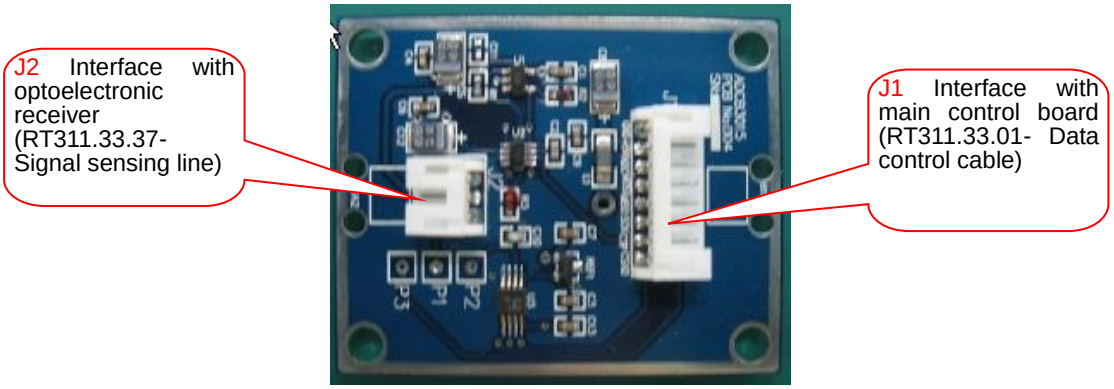

Figure 6-7 Real Product Photo of ADCB Photoelectric Amplification Board

6.8 Power Interface Board

6.8.1 Function Description

The power interface board provides interfaces to the industrial control board, high voltage switchboard and touch screen controller, and connects the serial port of the industrial control board externally for use by the printer and touch screen.

6.8.2 Definition of Interface Pins

Table 6-7 Definition of Interface Pins for Power Interface Board

Interface	Interface Description	Pin No.	Pin Description
J11	Power interface	1	GND
		2	＋24V power supply
J8	Interface with industrial control board	1	Power supply
		2	GND
		3	GND
		4	NC
J7	Interface with high voltage switchboard	1	Power supply
		2	GND
		3	Signal
		4	NC
J2	Interface with industrial control board serial port	1	COM4-RXD (preserved)
		2	COM4-TXD
		3	GND
		4	COM2-RXD (touch screen)
		5	COM2-TXD
		6	GND
		7	COM3-RXD (serial printer)
		8	COM3-TXD
		9	NC
		10	NC

J4	Interface with touch screen controller	1	COM2-RXD
		2	COM2-TXD
		3	GND
		4	Signal
		5	GND
J3	Interface with printer drive board	1	COM3-RXD
		2	COM3-TXD
		3	GND
		4	GND
		5	Signal

6.8.3 Real Product Photo

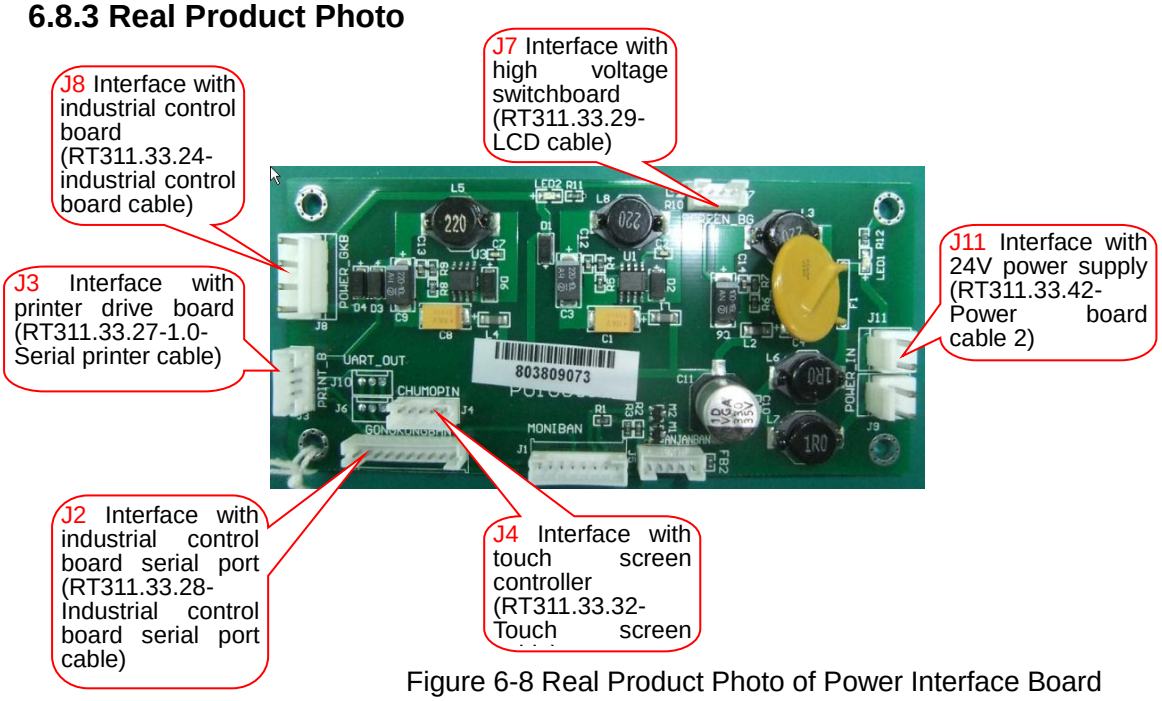

Figure 6-8 Real Product Photo of Power Interface Board

6.9 Output Port Interface Board

6.9.1 Function Description

The output port interface board provides interfaces to the mouse, keyboard, network port and USB port.

6.9.2 Definition of Interface Pins

Table 6-8 Definition of Interface Pins for Output Port Interface Board

Interface	Interface Description	Pin No.	Pin Description
J6	Network port	1	MDI0+/TX+
		2	MDI0-/TX-
		3	MDI1+/TX+
		4	MDI1-/TX-
J2	USB port 1	1	VCC
		2	UD1-
		3	UD1+
		4	GND
J3	USB port 2	1	VCC

		2	UD0-
		3	UD0+
		4	GND
J1	Mouse and keyboard	1	KS_DATA
		2	MS_DATA
		3	GND
		4	VCC
		5	KB_CLOCK
		6	MS_CLOCK

6.9.3 Real Product Photo

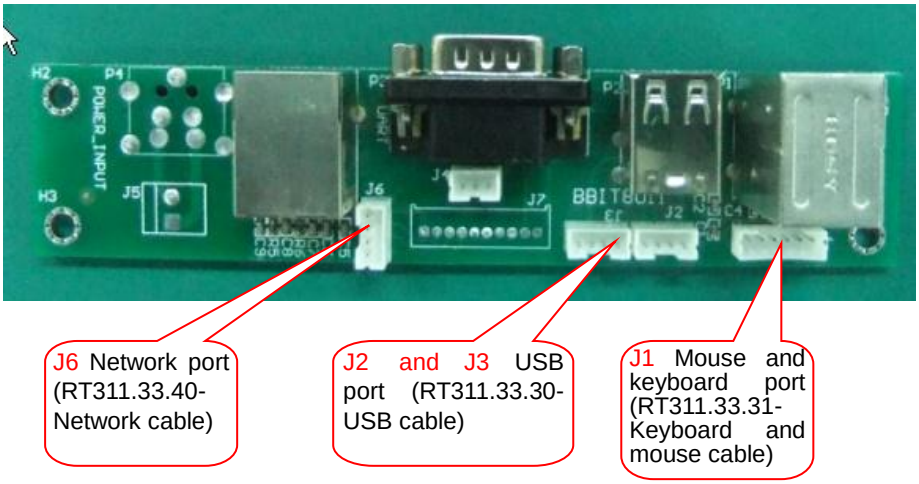

Figure 6-9 Real Product Photo of Output Port Interface Board

6.10 Real Product Photos of Other Boards

6.10.1 Liquid Level Detection Board

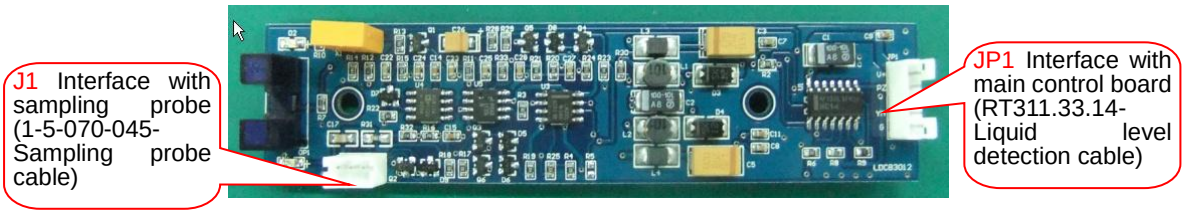

Figure 6-10 Real Product Photo of Liquid Level Detection Board

6.10.2 High Voltage Switchboard

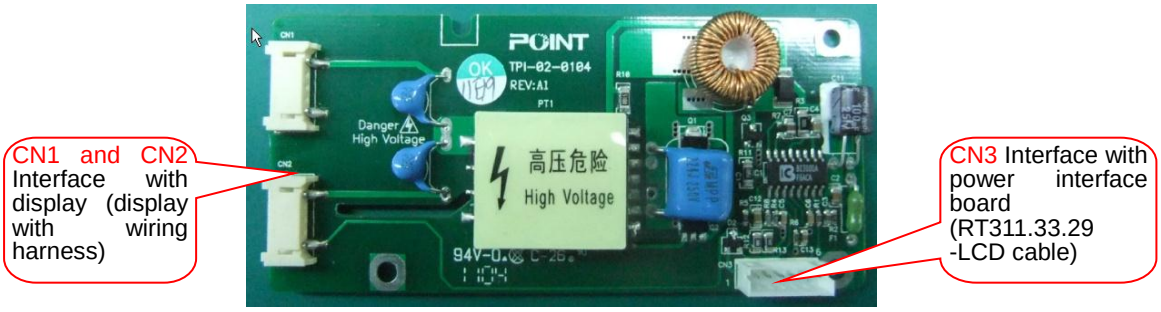

Figure 6-11 Real Product Photo of High Voltage Switchboard

6.10.3 Touch Screen Controller

Figure 6-12 Real Product Photo of Touch Screen Controller

6.10.4 Industrial Control Main Board

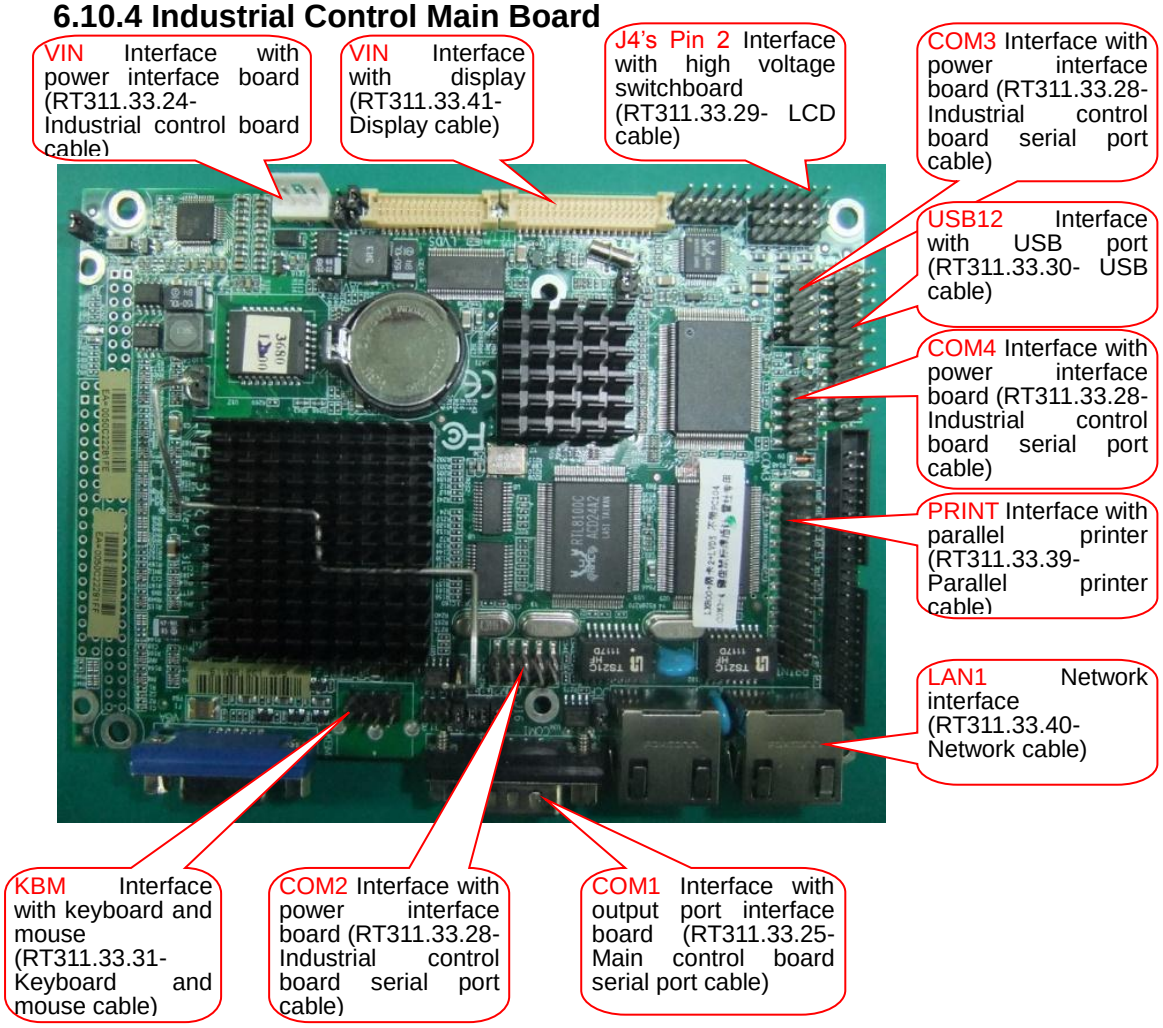

Figure 6-13 Real Product Photo of Industrial Control Main Board

Chapter 7 Component Replacement

7.1 List of Tools Used

- Cross screwdriver
- Straight screwdriver
- Internal hexagonal wrench
- Combination pliers
- Monkey wrench

7.2 Shell and Panel Removal

7.2.1 Rear Panel Removal

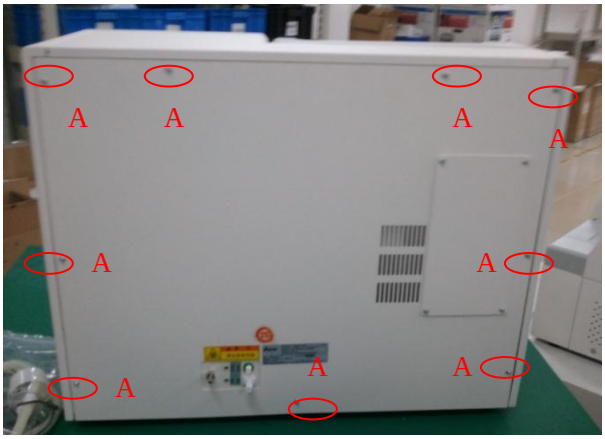

Figure 7-1 Rear Panel Removal Photo

- Use the cross screwdriver to remove the 9 screws on the rear panel and remove the rear panel.

7.2.2 Left Side Panel Removal

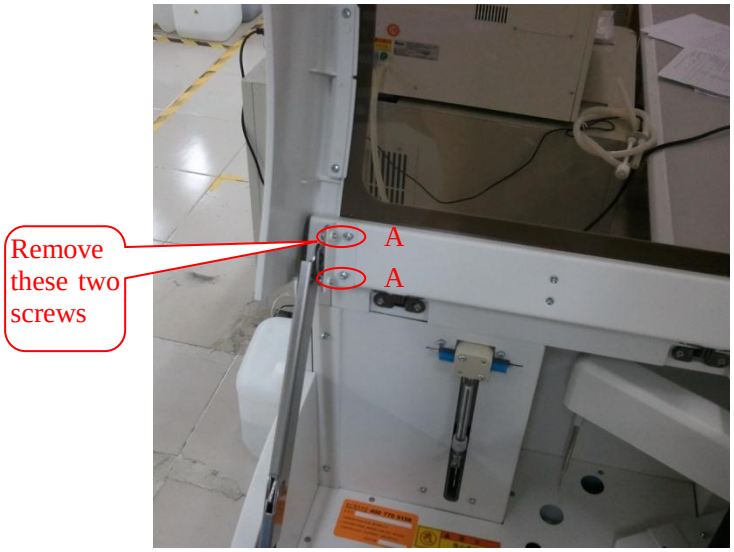

Figure 7-2 Expansion Link Removal Photo

- Open the flap, use the cross screwdriver to remove the 2 set screws on the expansion supporting arm.

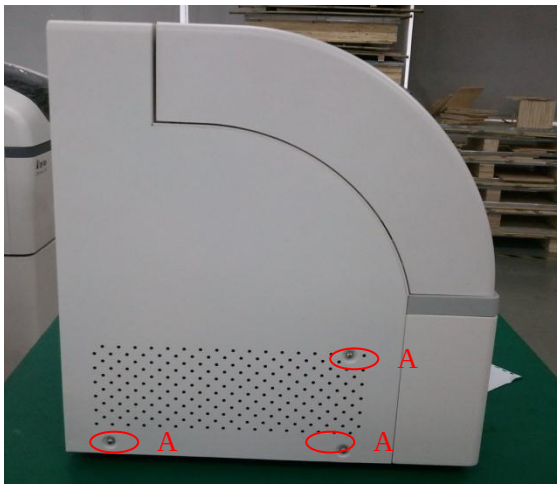

Figure 7-3 Left Side Panel Removal Photo

- Use the cross screwdriver to remove the 3 screws on the left side panel and remove the left side panel.

7.2.3 Right Side Panel Removal

Figure 7-4 Right Side Panel Removal Photo

- Use the cross screwdriver to remove the 3 screws on the right side panel and remove the right side panel.

7.2.4 Top Panel Removal

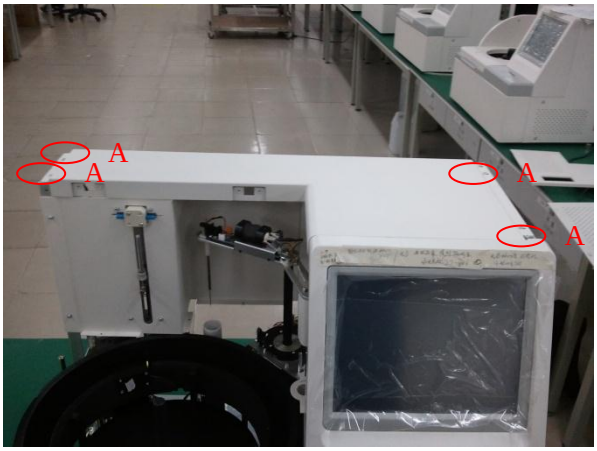

Figure 7-5 Top Panel Removal Photo

- Use the cross screwdriver to remove the 4 screws on the top panel and remove the top panel.

7.2.5 Display Component Removal

Figure 7-6 Display Removal Photo

- Unplug the main control board serial port cable connected to the main control board, the keyboard and mouse cables on the output port conversion board, network cable, USB cable, parallel printer cable, serial printer cable of the printer drive board, and power board cable 2 on the power supply;
- Use the cross screwdriver to remove the 2 screws as shown in the above figure and remove the display component.

7.2.6 Upper Cover and Rinse Tank Cover Removal

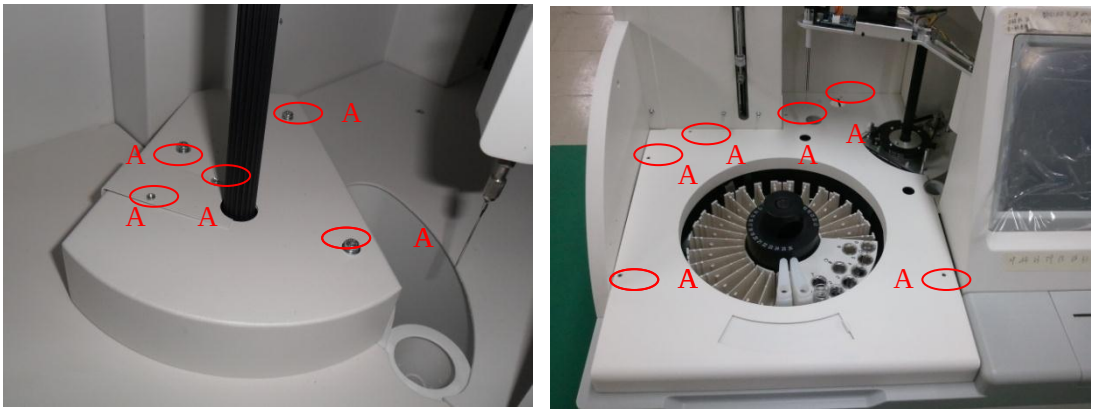

Figure 7-7 Upper Cover and Rinse Tank Cover Removal Photos

- Use the cross screwdriver to remove the 4 screws on the sampling probe protective cover left and sampling probe protective cover right as shown in the above figure and remove the cover.
- Use the cross screwdriver to remove the 10 screws on the upper cover and rinse tank cover as shown in the above figure and remove the covers. Do not impact the rotation optocoupler for sampling probe when removing the covers.

7.2.7 Front Panel Removal

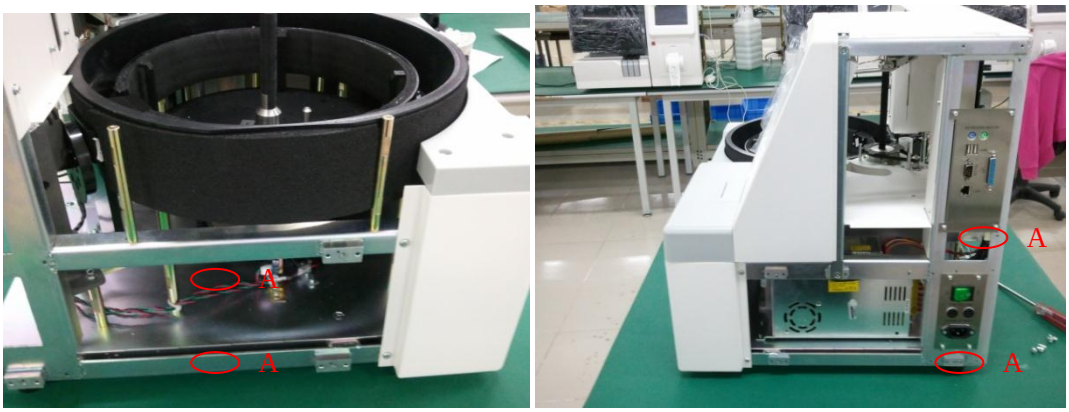

Figure 7-8 Front Panel Removal Photos

- Use the cross screwdriver to remove the 4 screws as shown in the above figure and remove the front panel.

7.2.8 Printer Surface Shell Component Removal

Figure 7-9 Printer Surface Shell Component Removal Photo

- Use the cross screwdriver to remove the 6 screws as shown with A in the above figure and remove the printer surface shell component.

7.3 Bulb Component Replacement

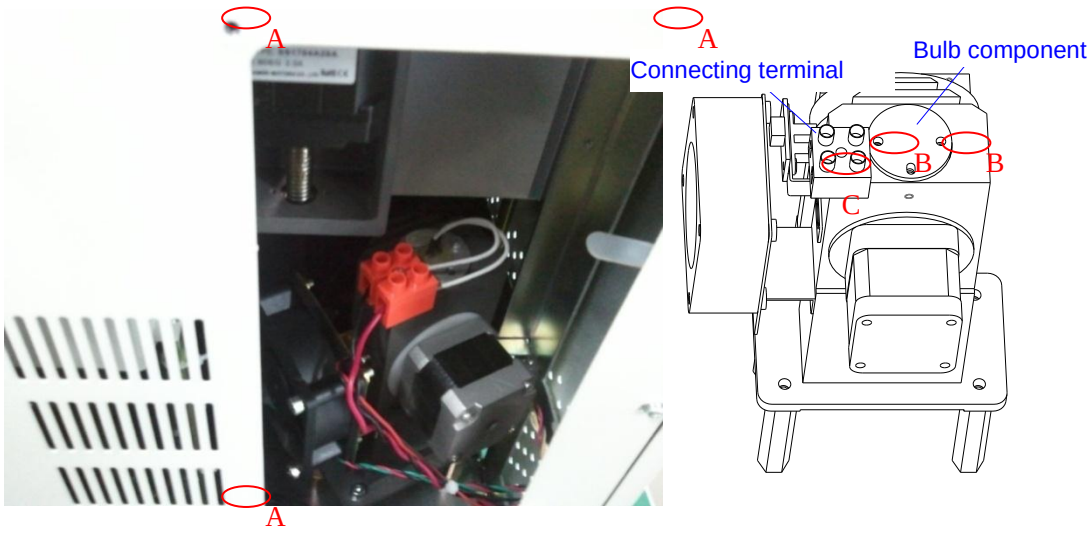

Figure 7-10 Bulb Component Replacement Diagram

- The lamp after use will become aging gradually, which causes energy decrement. If the system gives alarm prompt or the accumulated working time exceeds 1000 hours, the lamp should be replaced.
- Switch off the power and leave the bulb and light box to cool down for 30 minutes.

Note: Be sure to wait more than 30 minutes after switching off the machine. Be careful when touching the outer shell of the lamp even after 30 minutes, as the high temperature bulb and light box may cause skin burn.

- Use the cross screwdriver to remove the 4 screws on the rear panel catch as shown with A in the above figure and remove the rear panel catch;
- Use the cross screwdriver to loosen the 2 screws on the rear connection crimping terminal as shown with C in the above figure and take out the two bulb wires;
- Use the internal hexagonal wrench to remove the 2 screws on the fixed bulb component as shown with B in the above figure and take out the bulb component;
- When removing the lamp, even when the bulb is not hot, never touch the illuminating surface of the bulb with hand, as this may change the features of the light due to grease, dirt, etc. In case the illuminating surface is stained with grease or dirt, use a cotton swab dipped in percutaneous ethanol to wipe it clean.
- The lamp has been positioned with screws and does not need fine tuning. However, due to the difference between the bulbs, the luminous energy received should be adjusted. It is suggested to replace all test cuvettes here to avoid the abnormity of big difference between new and old cups. Approach 1: Switch on the instrument, enter “Chemray 120 Automated Chemistry Analyzer Management

Software”→“Test Status”→“Reaction Tray”, click the Replace Cuvette button, and replace the cuvettes according to the prompt messages. Approach 2: Enter “Chemray 120 Automated Chemistry Analyzer Management Software”→“Maintenance”→“Cuvette Blank” and click the Replace Cuvette button. Note that this approach needs user privilege. Approach 3: “Engineering Debugging Software”→“Cuvette Blank”→“Replace Cuvette”.

- The user usually operates by using Approach 1 and Approach 2. When the cuvette replacement is finished correctly, enter “Chemray 120 Automated Chemistry Analyzer Management Software”→“Maintenance”→“Cuvette Blank”, click the “Cuvette Blank Detection” button, record the rough light intensity AD value of various wavelengths, enter “Maintenance”→“Configuration”, and adjust the gain of various wavelengths to make the light intensity AD value of various wavelengths be about 50,000 (AD value of wavelengths greater than 510nm can be about 57,000). (If automatic gain configuration is unsuccessful, configure it manually. The AD value is in proportion to the gain configuration value.) When the configuration is finished, enter cuvette blank detection again and observe whether it is appropriate. The requirement can be reached after several approximations.
- After confirming there is no problem, close the rear cover catch.

Note: When adjusting the position of the lamp, do not point the light to your eyes, as strong light may injure human eyes.

7.4 Syringe Component Replacement

7.4.1 Syringe and Tee Replacement

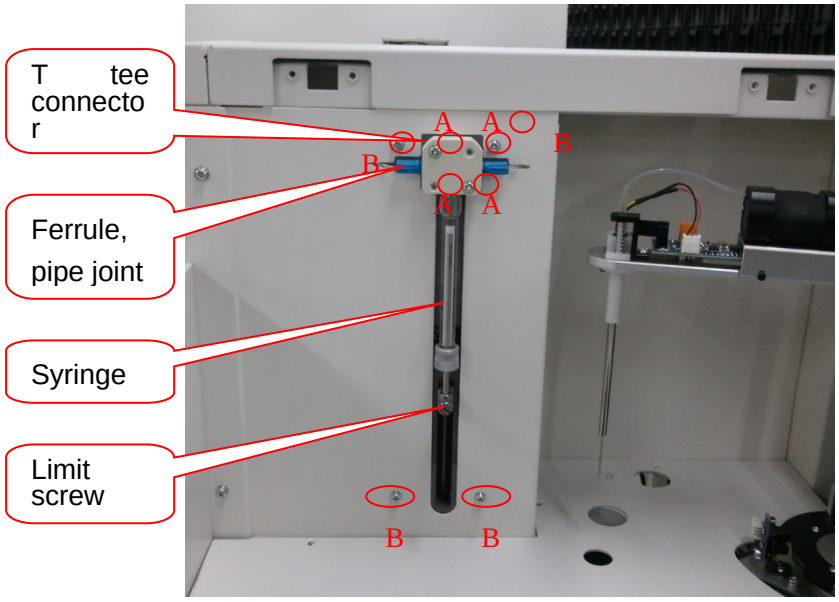

Figure 7-11 Syringe Component Replacement Photo

- Open the flap, use the cross screwdriver to remove the 4 screws as shown with A in the above figure, and use the straight screwdriver to remove the limit screw;
- Open the rear panel, cut off or push upward the pipeline binding wire connected with the syringe, and take out the syringe and tee;

- Remove the syringe and tee as shown in Figure 4-9;
- Replace with a new syringe and piston and check that the sealing gasket is put in place (be careful when screwing the syringe and try to protect the thread of the rotating element of the syringe for subsequent removal);
- Pay attention to the following when replacing the syringe:

1. When replacing with a new syringe, be sure to use the O ring and tighten it to ensure good tightness.

2. When replacing with a new syringe, strictly meet the requirement of “three points and one line”, that is, the set screw and syringe piston in the middle of the syringe mounting block must be on the same line when they are in the original position and lifting position. This is particularly important.

3. When replacing the tee, in addition to the syringe, the 2 pipe joints at the upper end are also involved, so be careful. If the connection tightness of the pipe joint is poor, the sampling performance may be affected.

7.4.2 Syringe Component Replacement

- Open the flap and use the cross screwdriver to remove the 4 screws as shown with B in the above figure;
- Open the rear panel and take out the whole syringe component backward;
- Unscrew the 2 pipe joints connected to the tee and remove the syringe component;
- Remove the various parts as shown in Figure 4-9. In which, the two toothed pulleys are fixed with set screw stuck with thread-locking adhesive which can be unscrewed after the thread-locking adhesive is heated.

7.5 Light Path Component Replacement

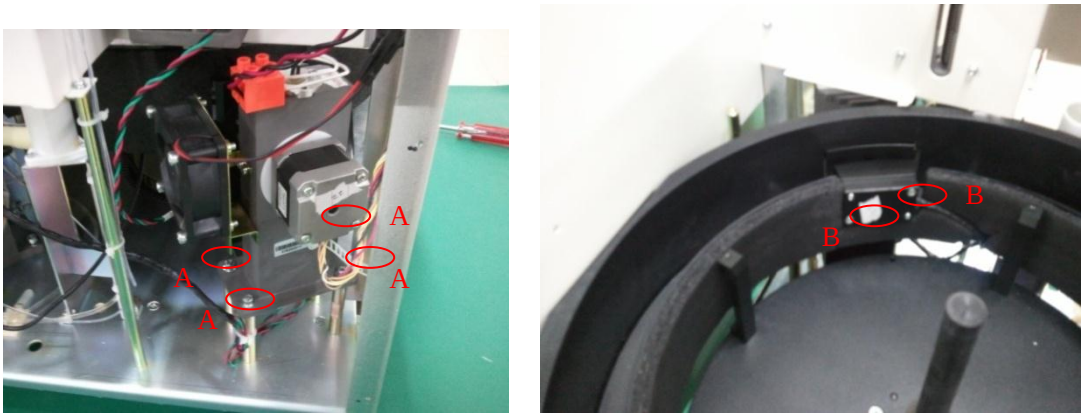

Figure 7-12 Light Path Component Replacement Photos

7.5.1 Optical Filter Replacement

- Remove the rear panel and left side panel by using the methods described in 7.2.1 and 7.2.2;
- Use the internal hexagonal wrench to remove the 4 screws as shown with A in the above figure;

- Use the short cross screwdriver to remove the 2 screws as shown with B in the above figure and take out the detection component;
- Unplug the wiring harness connected to the light path component, including optocoupler wire, fan wire, etc., and take out the light path component;
- Take out the filter wheel component as shown in Figure 4-7;
- Use the small cross screwdriver to remove the 3 screws on the filter wheel pressing plate, take out the optical filter to be replaced, and replace with a new optical filter.

When mounting the optical filter, do not touch the lens. If the lens is dirty, wipe it with lens cleaning cloth before mounting. Do not miss the pressing spring inside.

7.5.2 Photoelectric Conversion Board Replacement

- Unplug the photoelectric amplification board from the signal transmission line and cut out the binding wire of the signal transmission line;
- Use the short cross screwdriver to remove the 2 screws as shown with B in the above figure and take out the detection component;
- Remove the photoelectric conversion board component as shown in Figure 4-7 and carefully take out the wiring harness;
- After replacing the photoelectric conversion board, operate in reverse order;
- Wait till the temperature of the reaction tray falls to the extent skin will not be burnt before operation. Do not allow the optical parts to drop out of the component sleeve. Don not touch the receiving surface of the photodiode on the board with hand;
- If the exclusive method is used to find faults of the board, the board should be the last to replace as far as possible, as the replacement of the component may cause re-debugging of the related configuration parameters of the reaction tray, and persons other than fully trained engineers can’t ensure correct debugging.

7.5.3 Light Path Component Installation

- Remove the cover by using the method described in 7.2.6;
- When installing the light path, start the engineering debugging software and, according to the debugging described in the next chapter, adjust the light spot within 1/2 to the side of the sampling probe of No. 10 test cuvette in the whole machine reset mode;
- After the above requirements are ensured, use the screws to fix the light path component and install the detection component.

7.6 Pump and Valve Component Replacement

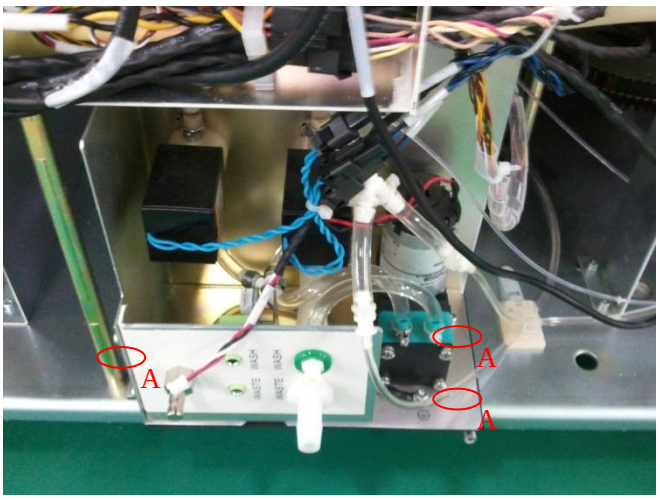

Figure 7-13 Pump and Valve Component Replacement Photo

- Remove the rear panel by using the method described in 7.2.1;
- Use the internal hexagonal wrench to remove the 3 screws as shown with A in the above figure;
- Unplug the pipeline connected to the wastewater pool and remove the pump and valve component;
- Replace the parts and components as required according to Figure 5-1 Pump and Valve Component Explosive View.

7.7 Tray Component Replacement

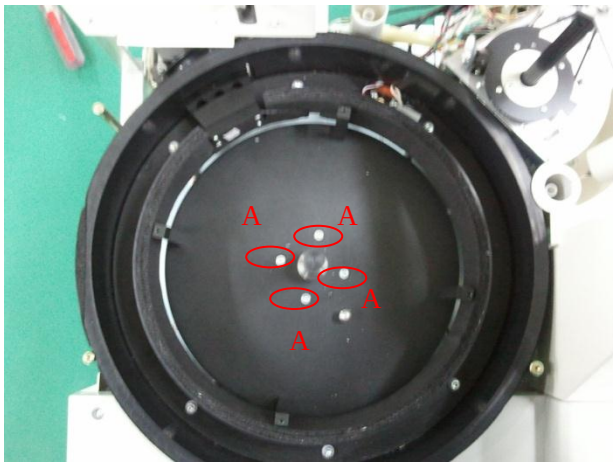

Figure 7-14 Tray Component Replacement Photo

- Remove the upper cover and rinse tank cover by using the method described in 7.2.6;
- Take out the sample/reagent position component;
- Use the cross screwdriver to remove the 4 screws as shown with A in the above figure and take out the test position component;
- Remove the light path component by using the method described in 7.3, use the

internal hexagonal wrench to remove the 4 screws fixing the constant temperature chamber, and take out the reaction constant temperature chamber component;

- Replace the parts and components as required according to Figures 4-2, 4-3 and 4-4.

7.8 Sampling Probe Component Replacement

7.8.1 Overall Sampling Probe Component Replacement

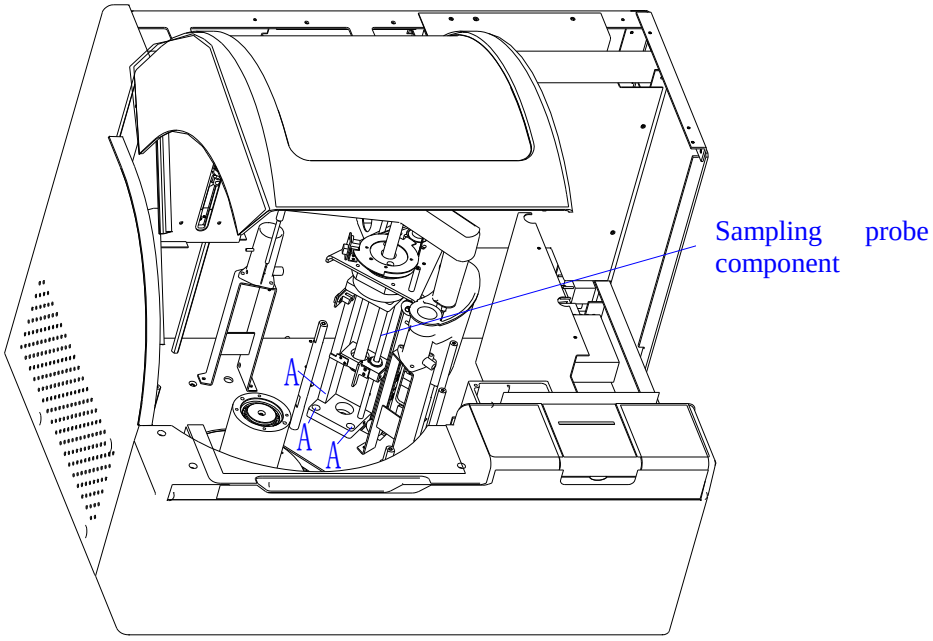

Figure 7-15 Overall Sampling Probe Component Replacement Diagram

- Remove the right side panel by using the method described in 7.2.3;
- Remove the top panel by using the method described in 7.2.4;
- Remove the display component by using the method described in 7.2.5;
- Remove the upper cover and rinse tank cover by using the method described in 7.2.6;
- Remove the light path component by using the method described in 7.5;
- Remove the pump and valve component by using the method described in 7.6;
- Remove the tray component by using the method described in 7.7;
- Use the internal hexagonal wrench to remove the 3 screws as shown with A in the above figure and remove the sampling probe component;
- Replace the parts and components as required according to Figure 4-5 Sampling and Mixing Unit Explosive View.

7.8.2 Sampling Probe Replacement

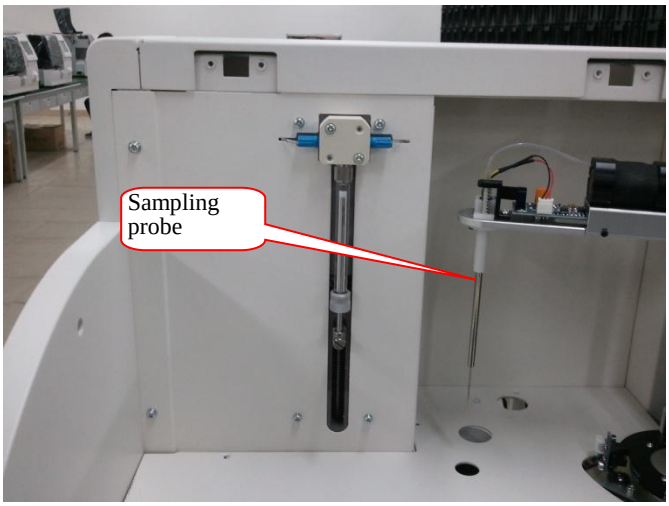

Figure 7-15 Sampling Probe Replacement Photo

- Remove the surface shell of the sampling probe;
- Remove the connection between the sampling probe and hydraulic circuit; gently hold the pipe joint on the sampling probe with fingers and slowly turn till the pipe joint comes off. Never allow the liquid in the pipeline to splash down on the board electric circuit;
- Turn the sampling arm to an angle suitable for removing the set screw on the sampling probe locking block and use the internal hexagonal wrench to remove the screw;
- Take the wiring harness terminal of the sampling probe out of the liquid level detection board, gently hold the side of the circuit board with one hand when removing the wiring harness plug, and gently unplug the plug with another hand. Do not apply too much force when unplugging the plug. This may damage the plug, socket or liquid level detection circuit board;
- Slowly draw the sampling probe upward from the rocker arm and guide sleeve. Prevent the probe point from impacting the rocker arm, otherwise damage may be caused;
- Refer to Figure 4-6 Sampling Arm Component Explosive View;
- Insert the substitute sampling probe downward in the sampling probe locking block and use the internal hexagonal wrench to tighten the set screw;
- Insert the wire plug on the top of the sampling probe in the socket on the liquid level detection circuit board, use one hand to gently hold the side of the circuit board, and gently unplug the plug with another hand. If you apply too much force when unplugging the plug, this may damage the plug, socket or liquid level detection circuit board.
- When placing the hydraulic circuit pipe inside the sampling probe, please note: 1. Never allow the liquid in the pipeline to splash down on the board electric circuit; 2. Do not apply too much force during the operation. Never bend the sampling probe.
- Add deionized water to the sample cup, allow the sampling probe to reset and

move to the liquid surface of the sample, and judge whether it detects the liquid level correctly.

7.8.3 Mixer Replacement

- Remove the surface shell of the sampling probe;
- Remove the old mixer, hold the upper and lower knobs of the mixer with hand till the mixer becomes loose, and unplug the mixer downward;
- Prepare the new mixer by using gauze or cotton swab dipped in cleaning agent or percutaneous ethanol to wipe the flat surface of the mixer;
- Hold the upper and lower knobs of the new mixer with hand and insert the whole mixer upward along the motor shaft;
- After replacing the mixer, visually inspect whether the mixer is bent. If there is no problem after the inspection, check the position of the mixer;
- Switch on the machine, judge whether the mixer is in the middle of the test cuvette/cleaning pool when the machine is working. In case of noise of wall collision in rotation, remove it for reinstallation;
- During the replacement, do not touch the flat part of the mixer with hand to prevent grease adhering or scratches;
- When unplugging and inserting the mixer, be sure to apply force vertically along the DC motor shaft, as lateral force may damage the motor shaft lever.

7.9 Computer Unit Replacement

Figure 7-16 Computer Unit Replacement Photo

- Remove the right side panel by using the method described in 7.2.3;
- Remove the top panel by using the method described in 7.2.4;
- Remove the display component by using the method described in 7.2.5;
- Replace the parts and components as required according to Figure 4-8 Computer Unit Explosive View;
- Note that the touch side of the touch screen should face outside when replacing the touch screen;

- To replace the memory card and memory, remove the industrial control board first.

7.10 Wiring Harness Replacement

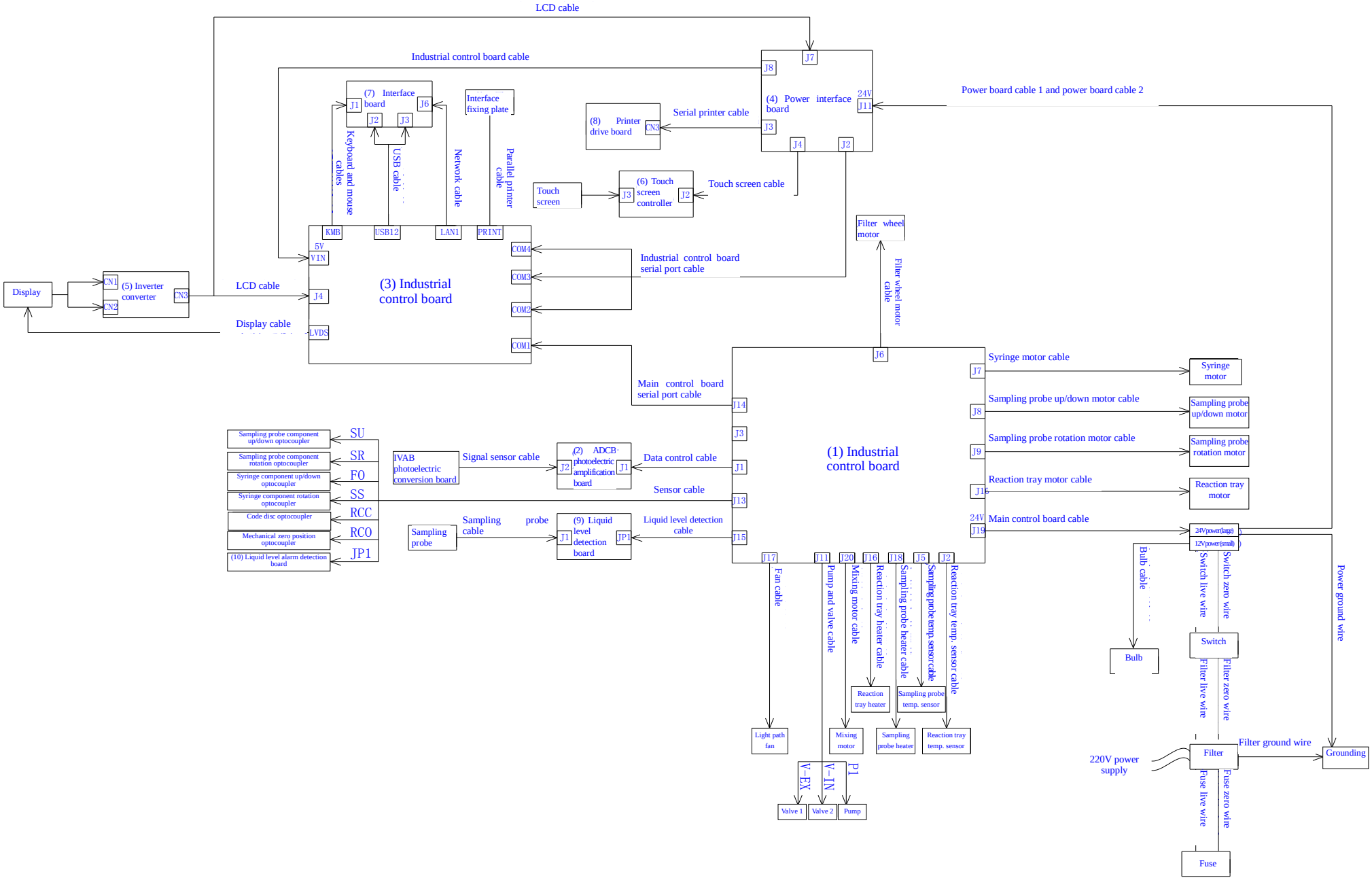

Figure 7-17 Wiring Harness Connection Replacement Photo

- Replace the wiring harness as required according to Figure 7-17 Wiring Harness Connection Replacement Photo;
- Before replacement, cut out the existing binding wire of the wiring harness, open the binding wire of the wiring buckle, and take out the wiring harness to be replaced;
- After replacement according to the corresponding position, bind the wiring harness by using the original binding method.
- Pay attention to the mark on the wiring harness in replacement. Never use wires with incorrect mark. If there is no wiring harness with correct mark, write the correct mark on paper, cover the original mark, and wind it with transparent tape.
- Never wag from side to side when inserting or unplugging the plug.

Table 7-1 Wiring Harness List

No.	Code	Description
1	1-5-080-001-10	Reaction tray temperature sensor cable
2	1-5-080-002-10	Reaction tray heater cable
3	1-5-080-003-10	Reaction tray motor cable
4	1-5-080-004-10	Sampling probe up/down motor cable
5	1-5-080-005-10	Sampling probe rotation motor cable
6	1-5-080-006-10	Sampling probe temperature sensor cable
7	1-5-080-007-10	Liquid level detection cable
8	1-5-080-008-10	Mixing motor cable
9	1-5-080-009-10	Sampling probe heater cable
10	1-5-080-010-10	Fan cable
11	1-5-080-011-10	Signal sensor cable
12	1-5-080-012-10	Bulb cable
13	1-5-080-013-10	Filter wheel motor cable
14	1-5-080-014-10	Industrial control board cable
15	1-5-080-015-10	Main control board serial port cable
16	1-5-080-016-10	Power board cable 1
17	1-5-080-017-10	Serial printer cable
18	1-5-080-018-10	Industrial control board serial port cable
19	1-5-080-019-10	LCD cable
20	1-5-080-020-10	USB cable
21	1-5-080-021-10	Keyboard and mouse cables
22	1-5-080-022-10	Touch screen cable
23	1-5-080-023-10	Display cable
24	1-5-080-024-10	Data control cable
25	1-5-080-025-10	Parallel printer cable
26	1-5-080-026-10	Network cable

27	1-5-080-027-10	Sensor cable
28	1-5-080-028-10	Power board cable 2
29	1-5-080-029-10	Syringe motor cable
30	1-5-080-030-10	Pump and valve cable
31	1-5-080-031-10	WTA-2K-N4G electromagnetic valve (with terminal)
32	1-5-080-032-10	PML7844-NF30 pump (with terminal)
33	1-5-080-033-10	Liquid level detection alarm cable
34	1-5-080-034-10	Filter live wire
35	1-5-080-035-10	Filter zero wire
36	1-5-080-036-10	Filter ground wire
37	1-5-080-037-10	Fuse live wire
38	1-5-080-038-10	Fuse zero wire
39	1-5-080-039-10	Switch live wire
40	1-5-080-040-10	Switch zero wire
41	1-5-080-041-10	Power ground wire
42	1-5-080-042-10	Main control board cable
43	1-5-070-045-11	Sampling probe cable

Chapter 8 Program Burning Standard

8.1 Upper Computer Software Burning

8.1.1 Windows System Installation

Method 1: Using the GHOST tool to clone WIN.GHO to the CF card

- Run the software GHOST.EXE on PC.

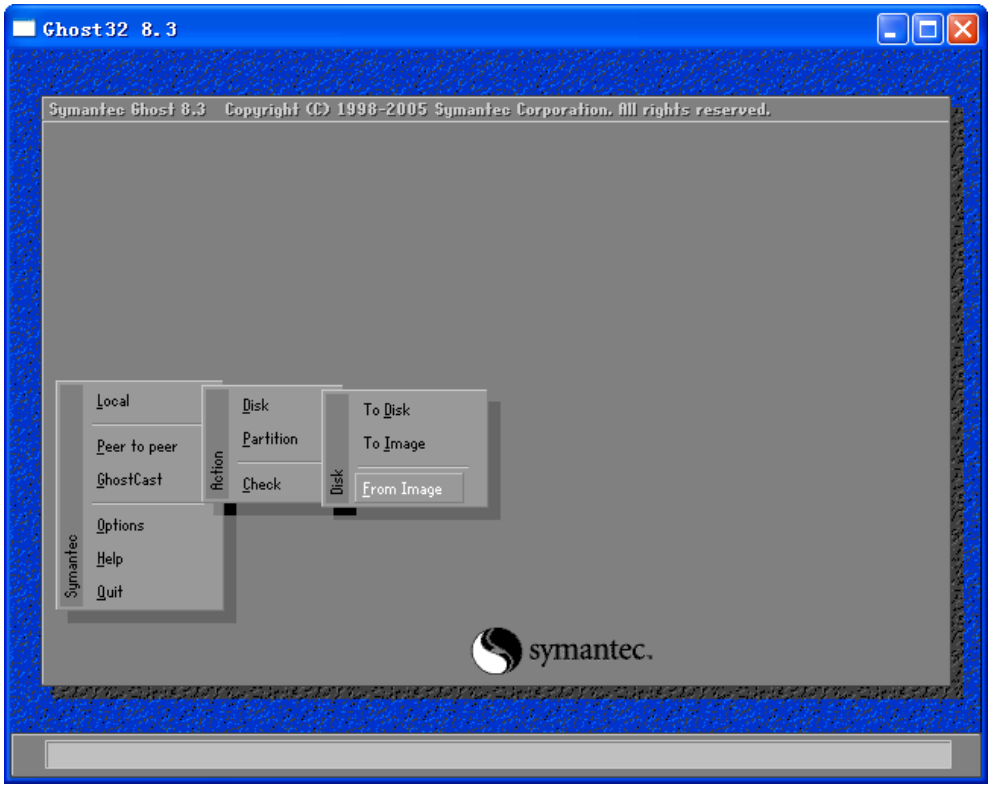

Figure 8-1 GHOST Software Screen

- Select “Local-Disk-From Image” to enter the source file selection window. From Explorer, specify the directory where the image file is located.

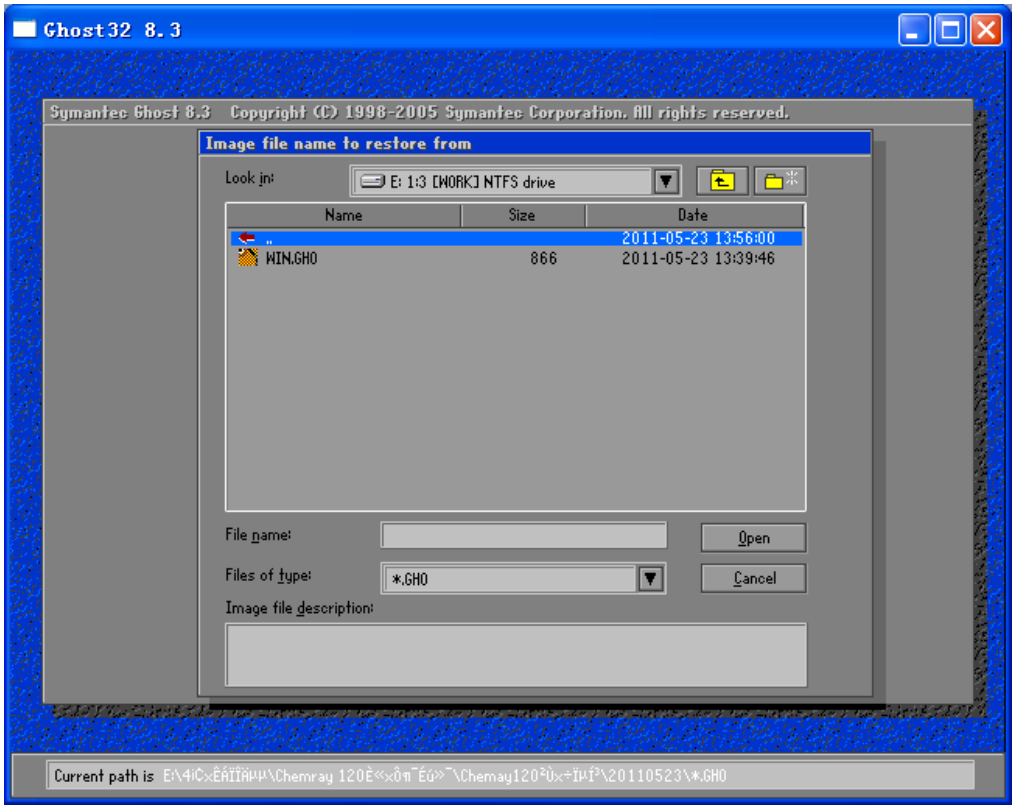

Figure 8-2 File Selection Window

- Select the image file WIN.GHO to enter the destination drive selection window as shown in the figure:

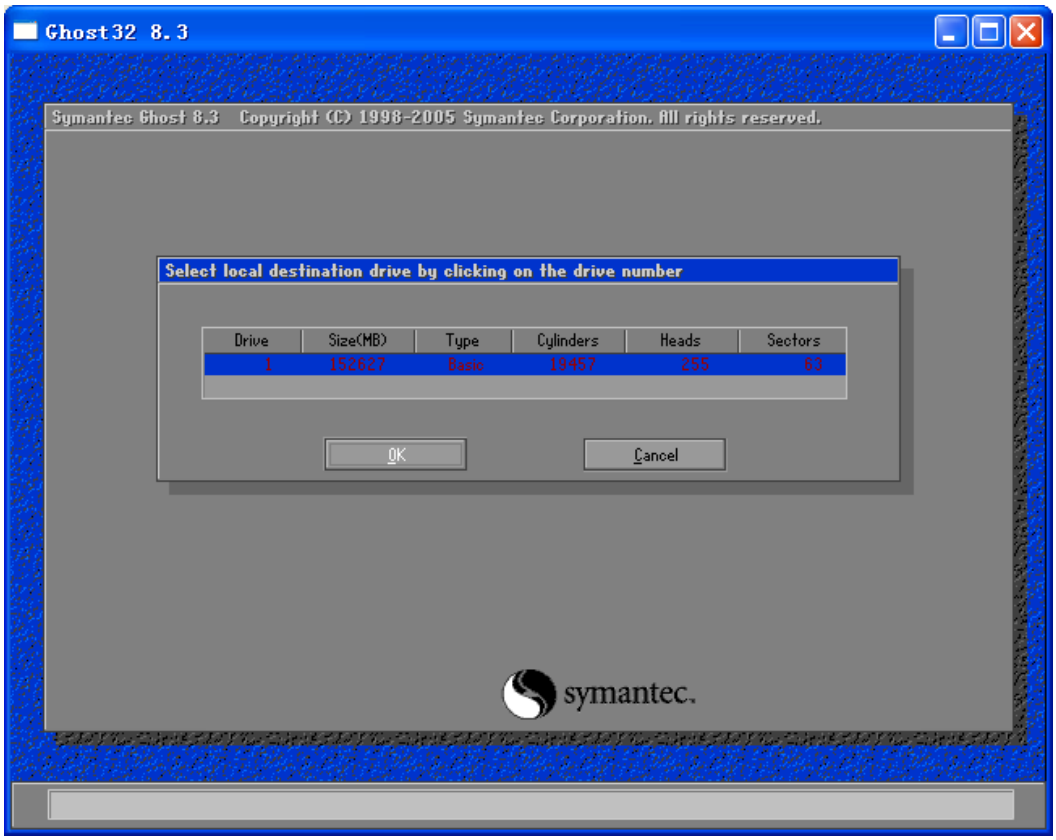

Figure 8-3 Destination Drive Selection Window

- Select the drive number corresponding to the CF card from the list and make confirmation to begin system cloning. When the cloning is finished, the software will display the success message. Insert the successfully cloned CF card in the instrument, and the software system will be started automatically after the instrument is switched on.

Method 2: Using the USB flash disk to start DOS and run SETUPEX.BAT

- Make the USB flash disk as a boot disk.
- Copy the files GHOST.EXE, SETUP.BAT and WIN.GHO in the USB flash disk and insert the USB flash disk to the USB port of the instrument.
- Switch on the instrument, press the Del key to enter Bios setup menu, select “Boot-“, set USB to 1st startup, and press the F10 key to save the setting.
- Restart the instrument, and the system enters the command prompt mode, with “D:\>” appearing. Input “SETUP” and press the Enter key. The system will complete the system cloning automatically.

8.1.2 Software Installation

- If the application is running, select “Shutdown - Quick Shutdown” to turn off the software.
- Press “Ctrl+Alt+Del” to start the Task Manager, select File, and input “Explore.exe” to open the Explorer window.
- Copy all contents under the Analyzer directory of the new version software to the directory C:\Analyzer. (If the new version is completely compatible with the old version, only the new Analyzer.exe can be copied to the directory C:\Analyzer.)

Chapter 9 Use of Engineering Debugging Software

9.1 Engineering Debugging Software Function Description

- Moving part mechanical position adjustment.
- Light path parameter adjustment and measurement.
- Instrument temperature parameter adjustment.
- Instrument component function check.

9.2 Engineering Debugging Software Login

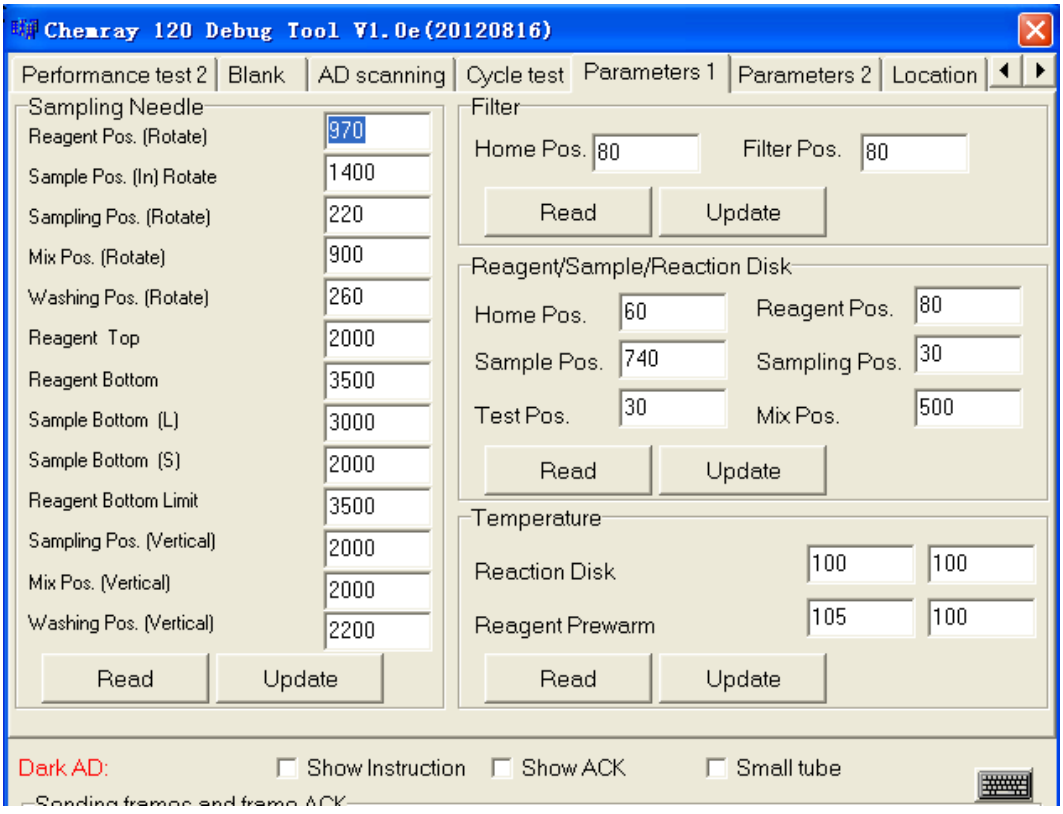

Figure 9-1 Engineering Debugging Software Screen

- Under the directory drive C, start Chemray120 Engineering Debugging Software. The initial password is “space”.

9.3 Filter Wheel Unit Adjustment

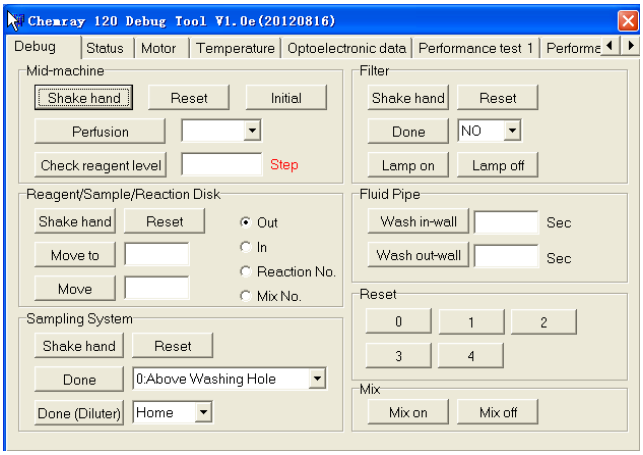

Figure 9-2 Filter Wheel Unit

- Requirements: When it is turned to the various wavelengths, the light beam is centered to the center of the optical filter.
- Steps:

1) Turn on the bulb, enter “Operating Command” on the Chemray120 Engineering Debugging Software screen, and specify any wavelength in “Filter Wheel Unit”, as shown in the figure;

2) From the side of the light path component, observe whether the convex lens on the body of the optical bench is centered to the two centers of the specified optical filter on the filter wheel;

3) If not, enter the “Parameter Configuration 1” screen as shown in Figure 3, modify the “Wavelength Hole Position” parameter in “Filter Wheel Unit”, click “Update Parameter”, and confirm the effect according to Steps 1 and 2.

9.4 Whole Machine Zero Position Adjustment:

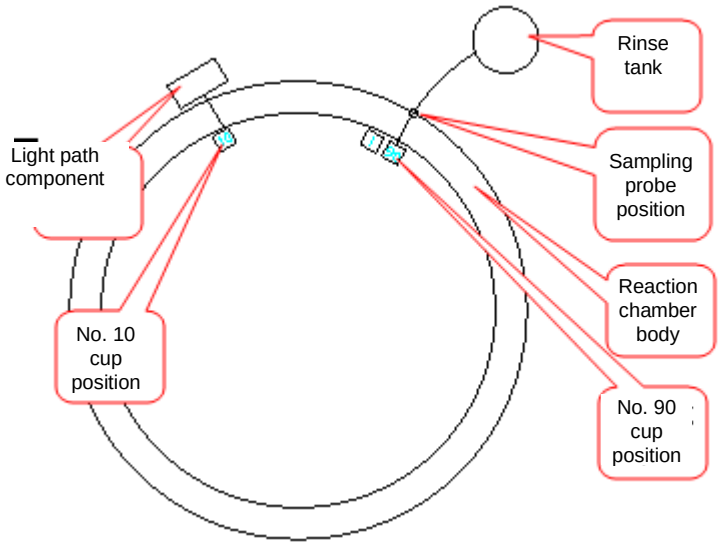

Figure 9-3 Mechanical Zero Position Diagram

- Requirements:

1) When “Sampling Probe Unit” and “Reagent/Sample/Reaction Tray Unit” are reset, the sampling probe is in the position as shown in Figure 8-3. When the sampling probe is being rotated, the rotating arc is in the middle between the rinse tank and No. 90 test cuvette;

2) The light spot of the light path is within 1/2 to the side of the sampling probe of No. 10 test cuvette.

- Steps:

1) Enter “Operating Command” on the Chemray120 Engineering Debugging Software screen and click “Reagent/Sample/Reaction Tray Unit” to reset. There is a through hole position on the surface of the test cup holder which is No. 1 cup position. Put a test cup on the left and right sides of the through hole respectively as No. 1 fold and No. 10 fold test cup;

2) On the “Operating Command” screen, click “Sampling Probe Unit” to reset. In the reset mode, just rotate the sampling arm to make the sampling probe point to the position as shown in Figure 6, i.e. the middle between the rinse tank and test cup, and select OK to lock the locking screw of the sampling arm;

3) In the “Reagent/Sample/Reaction Tray Unit” reset mode, check whether the sampling status of the sampling probe is in the middle of No. 90 test cup. If not, modify the “Mechanical Zero Position” parameter in “Reagent/Sample/Reaction Tray Unit” on the “Parameter Configuration 1” screen and click “Update Parameter”. On the “Operating Command” screen, click “Reagent/Sample/Reaction Tray Unit” to reset and check whether the sampling status of the sampling probe is in the middle of No. 90 test cup;

4) Make sure the sampling status of the sampling probe is in the middle of No. 90 test cup in the “Reagent/Sample/Reaction Tray Unit” reset mode and, in “Filter Wheel Unit” on the “Operating Command” screen, specify a wavelength that can be observed easily. Put a slip of white paper in No. 10 test cup, observe whether the light spot is within 1/2 to the side of the sampling probe of No. 10 test cup. The light spot must not be deflected off the test cup. Otherwise, loosen the 4 screws fixing the light path component and select OK to lock the screw;

5) When the above steps are finished, on the “Operating Command” screen, click “Reagent/Sample/Reaction Tray Unit” to reset, observe whether the code disc optocoupler shields the code disc tooth and use the multimeter to measure whether the voltage of one of the two welding spots (the terminal of the optocoupler is on the side of the light path component) at the upper end of the optocoupler is about 5V. If yes, it indicates the code disc optocoupler shields the code disc tooth.

9.5 Mechanical Position Adjustment:

9.5.1 Cleaning Position Adjustment:

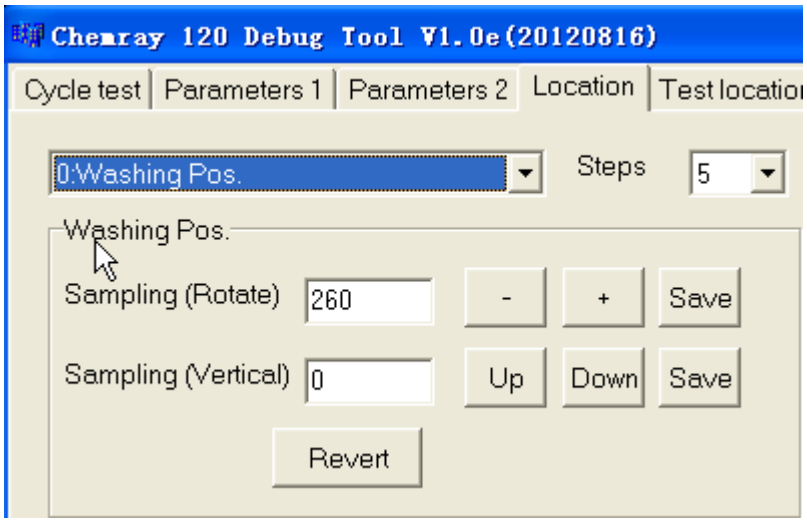

Figure 9-4 Cleaning Position Adjustment Screen

- Requirements:

1) When the whole machine is reset, the sampling probe and mixer are in the rinse tank;

2) The vertical position of the sampling probe is about 3mm below the middle hole of the rinse tank in cleaning plus 380 paces.

- Steps:

1) From the Chemray120 Engineering Debugging Software screen, enter “Mechanical Positioning” and select “Cleaning Position” on the screen as shown in Figure 7;

2) Adjust “Sampling Probe (Rotation)” through “-” and “+” to make the sampling probe and mixer be in the rinse tank. The ideal status is both are in the middle. If the sampling probe is in the middle and the mixer is in contact with the rinse tank, make adjustment by adjusting the 2 screws of the mixer fixing block. Select OK and click Save;

3) Lower the sampling probe to about 3mm in the middle hole of the rinse tank through “-” and “+” of “Sampling Probe (Vertical)” plus 380 paces. Select OK and click Save.

9.5.2 Reagent Position and Sample Position Outer Ring Adjustment:

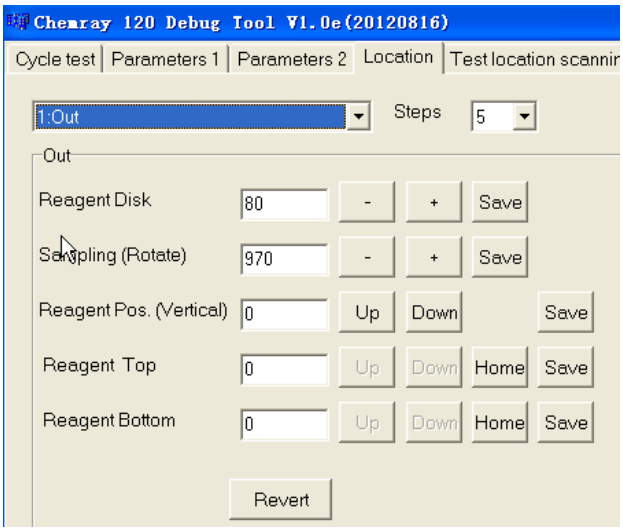

Figure 9-5 Reagent Position and Sample Position Outer Ring Adjustment Screen

- Requirements:

1) When sucking up reagent and outer ring sample, the sampling probe is in the middle of the reagent bottle;

2) “Reagent Position Vertical Correction” and “Maximum Paces of Reagent Level” are just the same and are adjusted to the paces for just in contact with the bottom of the reagent bottle;

3) “Minimum Paces for Reagent Level” is the number of paces for the sampling probe to be just in contact with the water level after adding 18ml distilled water to the 18ml reagent bottle.

- Steps:

1) Enter the “Mechanical Positioning” screen and select “Outer Ring” as shown in the figure;

2) Put the detection tool or a small sample cup in No. 1 sample position, adjust “-” and “+” of “Reagent Tray” and “Sampling Probe (Rotation)”, observe the position of the sampling probe by using “Up” and “Down” of “Reagent Position Vertical Correction”, and make the sampling probe be in the middle of the micro sample cup. Select OK and click “Save” of “Reagent Tray” and “Sampling Probe (Rotation)”. “Reagent Position Vertical Correction” is not saved temporarily.

3) Add 18ml distilled water to the 18ml reagent bottle and put the bottle in reagent position 1. Click “Reset” of “Minimum Paces for Reagent Level”, and the reagent tray will rotate to reagent position 1. Adjust “Up” and “Down” to make the sampling probe be just in contact with the liquid level of the 18ml distilled water. Select OK and click “Save”;

4) Put the empty reagent bottle in reagent tray 1, click “Reset” of “Maximum Paces for Reagent Level”, and adjust “Up” and “Down” to make the sampling probe be just in contact with the bottom of the cup. And then save the parameter. Modify the “Reagent Position Vertical Correction” parameter to the same value as “Maximum Paces for

Reagent Level", and then save the parameter,

9.5.3 Sample Position Inner Ring Adjustment:

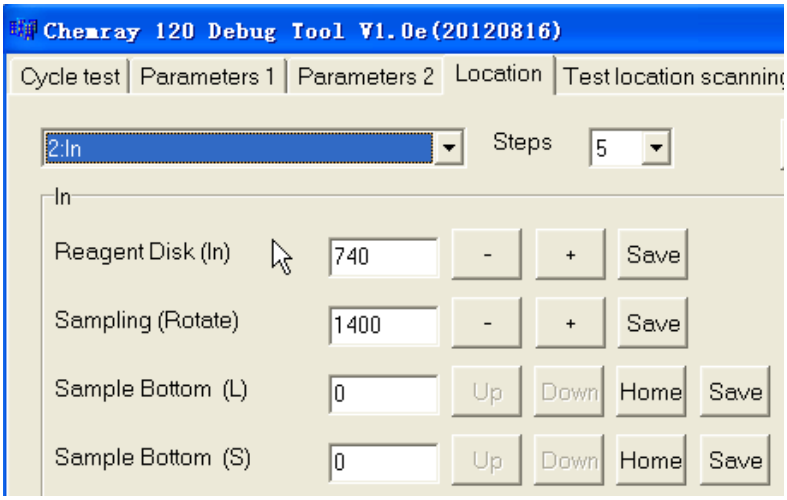

Figure 9-6 Sample Position Inner Ring Adjustment Screen

- Requirements:

1) When sucking up sample, the sampling probe is in the middle of the sample cup;
2) "Sample Position Vertical Correction (Small)" is the number of paces for a position 1mm away from the bottom of the sample cup;
3) "Sample Position Vertical Correction (Large)" is the number of paces for a position 5mm away from the bottom of the test tube.

- Steps:

1) Enter the "Mechanical Positioning" screen and select "Inner Ring", as shown in the figure;
2) Put a small sample cup in No. 7 sample position, adjust "-" and "+" of "Sample Tray (Inner Ring)" and "Sampling Probe (Rotation)", and make the sampling probe be in the middle of the small sample cup. Select OK and click "Save" of "Sample Tray (Inner Ring)" and "Sampling Probe (Rotation)";
3) Put a small sample cup in No. 7 sample position, click "Reset" of "Sample Position Vertical Correction (Large)", and adjust "Up" and "Down" to make the sampling probe be 1mm away from the bottom of the small sample cup. Select OK and click "Save";
4) Put a test tube in No. 7 sample position, click "Reset" of "Sample Position Vertical Correction (Small)", and adjust "Up" and "Down" to make the sampling probe be 5mm away from the bottom of the test tube. Select OK and click "Save".

9.5.4 Sampling Position Adjustment:

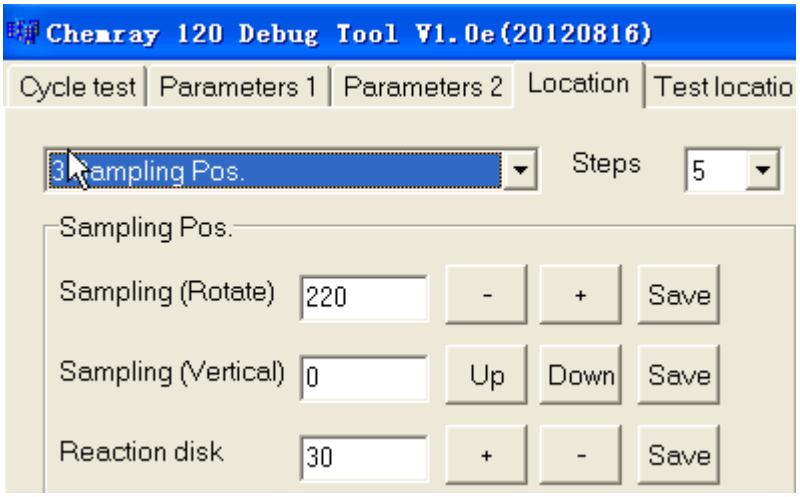

Figure 9-7 Sampling Position Adjustment Screen

- Requirements:

1) The sampling probe is in the middle of the test cup;

2) The vertical position of the sampling probe is 10 paces away from the bottom of the test cup;

- Steps:

1) Put the test cup in the test cup holder, enter the “Mechanical Positioning” screen, and select “Sampling Position”, as shown in the figure;

2) Adjust “-” and “+” of “Sampling Probe (Rotation)” and “Reaction Tray” to make the sampling probe be in the middle of the test cup. Select OK and click “Save” respectively;

3) Adjust “Up” and “Down” of “Sampling Probe (Vertical)” to make the sampling probe be in contact with the bottom of the test cup, move upward 10 paces, and click Save.

4) Enter the “Operating Command” screen, click “Reaction Position” of “Reagent/Sample/Reaction Tray Unit”, rotate to the corresponding test cuvette position “1, 25, 50, 75” respectively in “Rotate to Test cuvette Position”, select “In Reaction Tray” in “Sampling Probe Movement“ of “Sampling Probe Unit”, and check whether the four sampling probe positions are correct.

9.5.5 Mixing Position Adjustment:

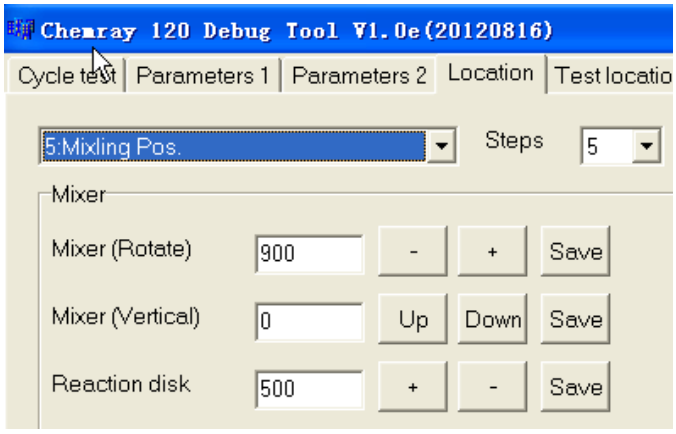

Figure 9-8 Mixing Position Adjustment Screen

- Requirements:

1) The mixer is in the middle of the test cup and does not collide with the cup when moving;

2) The vertical position of the mixer is 1mm away from the bottom of the test cup.

- Steps:

1) Put the test cup in the test cup holder, enter the “Mechanical Positioning” screen, and select “Mixing Position”, as shown in the figure;

2) Adjust “-” and “+” of “Mixing (Rotation)” and “Reaction Tray” to make the mixer be in the middle of the test cup, select OK, and click “Save” respectively;

3) Adjust “Up” and “Down” of “Mixing (Vertical)” to make the mixer be 1mm away from the bottom of the test cup, return to the “Operating Command” screen, and click “Mixing Unit” and “Start Mixing”. If there is no cup collision, click Save.

4) Enter the “Operating Command” screen, click “Mixing Position” of “Reagent/Sample/Reaction Tray Unit”, rotate to the corresponding test cuvette position “1, 25, 50, 75” respectively in “Rotate to Test cuvette Position”, select “In Mixing Position” in “Sampling Probe Movement“ of “Sampling Probe Unit”, and check whether the four Mixing positions are correct.

9.6 Synchronous Adjustment:

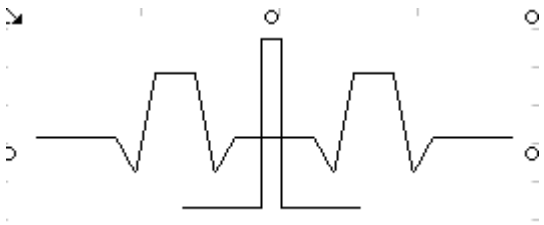

Figure 9-9 Synchronous Waveform Diagram

- Requirements:

Use the oscilloscope to collect waveform as shown in the figure.

- Steps:

1) Install the upper cover and install new clean cups on the test cuvette holder;

2) Open the two detectors of the oscilloscope and connect them to P2 and P3 sampling positions of the photoelectric amplification board respectively. In the “AD Acquisition” unit menu, click “Specified Cup Position AD Acquisition”. When the reaction tray begins to rotate, the microstep pulse on any cup should be in the middle of the flat section at the center of its photoelectric signal;

3) If it is not in the required position, change the value of the test position in “Reagent/Sample/Reaction Tray Unit” on the “Parameter Configuration 1” screen.

9.7 Special Parameters Description

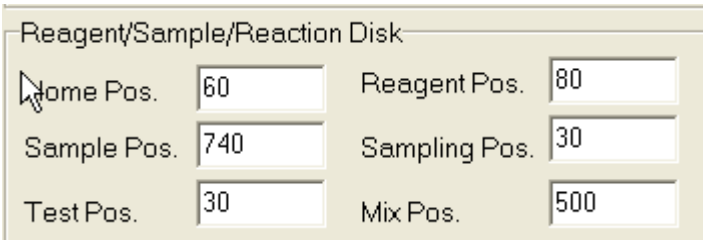

Figure 9-10 Important Parameters

- The sampling position is controlled to below 50, and between 25-30 is better;
- The test position is controlled to below 53, and below 35 is better;
- The Mixing position is controlled to about 1600;
- Mechanical zero position, reagent position and sample position have no special requirements;
- If the sampling position and test position do not comply with the above requirements, directly adjust the position of the code disc optocoupler.

9.8 Dark Current and Gain Adjustment:

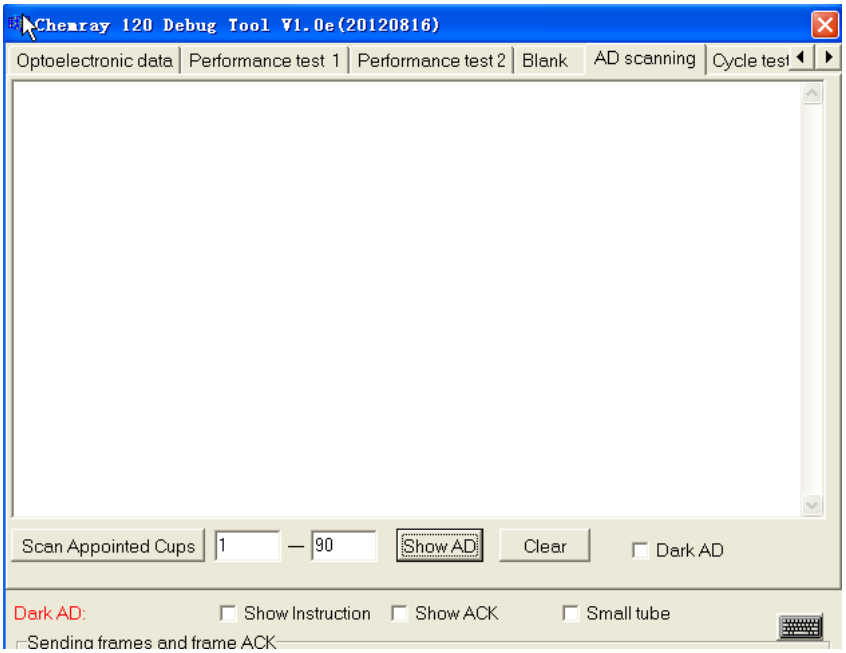

Figure 9-11 Dark Current and Gain Adjustment Screen

9.8.1 Dark Current Detection:

- Requirements:

The value of dark current is below 60.

- Steps:

1) Use black foam to patch the gap between the optical bench and constant temperature chamber, without light leak. Close the left and right side covers and the upper cover;

2) In “AD Acquisition”, tick Dark Current Detection and check whether the value of

dark current is below 60.

9.8.2 Gain Adjustment of Various Wavelengths:

- Requirements:

The AD value of various wavelengths is about 50,000.

- Steps:

1) Replace with completely new test cups, select 1-90 for the AD acquisition of the specified cup position in the “AD Acquisition” menu and click “Specified Cup Position AD Acquisition”;

2) After the detection, check whether the AD value of various wavelengths is about 50,000. If not, correct the gain value of the corresponding wavelength in “Optical Filter Parameter” in “Parameter Configuration 2”. After correcting the gain values of various wavelengths, set the gain value of dark current to 340nm.

9.9 Temperature Adjustment:

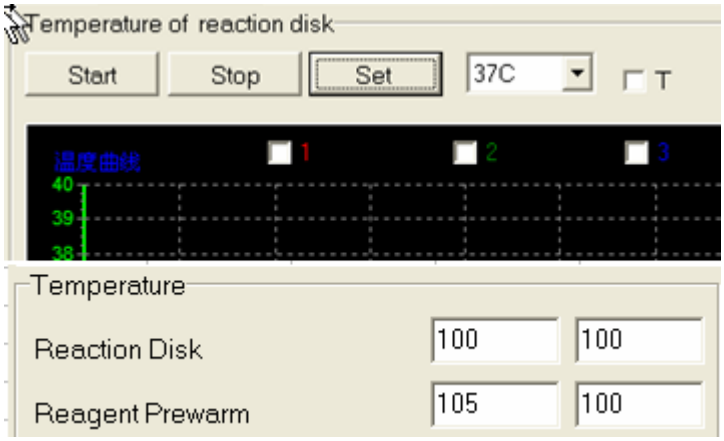

Figure 9-12 Temperature Adjustment Screen

- Requirements:

The temperature in the test cuvette is 37±0.3℃, and the preheat temperature of the reagent is 38.5±1℃.

- Steps:

1) On the “Temperature Test” screen as shown in the figure, click “Start Rotation”, click “Stop Rotation”, open the slip cover after the reaction tray stops, use the sampling gun to add 450UL distilled water to the test cup near the opening on the right side, and close the slip cover. Click “Stop Rotation” and let the tray to rotate for 20 minutes. Before measuring temperature, preheat the contact of the thermometer with hand. Click “Stop Rotation”. When the tray stops, open the slip cover and immediately insert the contact of the thermometer in the cup on the far right under the slip cover. Be sure to insert to the tip of the left upper concern. Get 1 stable value 5 seconds later (the stabilization time of 5 seconds is enough). If the temperature deviation is large, correct the “Reaction Tray Correction Control Parameter” of the temperature control unit. After one test, take out the thermometer and close the slip cover. Restart rotation and, after 20 seconds, test the temperature again by using the above method. Test 20 values by using this method.

2) On the screen as shown in Figure 9-12, select Path 1 (the effect of the other two paths is equivalent to that of Path 1), click “Temperature Acquisition”, and view the difference between the temperature indicated on the curve and the temperature measured with the thermometer. Input the value equal to the temperature difference *10 in “Reaction Tray Correction Parameter” on the screen as shown in Figure 9-12. Adjust the temperature indicated in this way, ensure the indicated temperature are the same to the measure temperature.. A simple method is: Write 101 and check whether the temperature indicated on the curve is higher or lower; if higher, decrease it; if lower, increase it. For example, if 120 is written, increase 20; if 20 is written, decrease 20.

3) Insert the thermometer under the foam on the heating rod to test the temperature. If the temperature is outside the range, correct “Reagent Preheat Correction Control Parameter” in the correction temperature control unit.

Chapter 10 Maintenance and Upkeep

In order to ensure the reliable performance, good working status and life of the system, please operate and regularly maintain the system strictly according to the requirements of the Service Manual. It is very important to understand the maintenance and overhauling knowledge described in this chapter. Study in greater depth will make the instrument reach the best running status and provide the best performance during use.

Risk of Biomaterial Centered Infection:

Be sure to wear gloves, work clothes and when necessary protective goggles to prevent infection in operation of the instrument.

10.1 Tools Used

- Cross screwdriver
- Straight screwdriver
- Internal hexagonal wrench
- Combination pliers
- Monkey wrench

10.2 Daily Maintenance

10.2.1 Hydraulic Circuit Inspection

1. Inspect whether the pipe joint is connected reliably.
2. Inspect whether the caps of the deionized water bottle and waste liquid bottle are screwed.
3. Inspect whether the pipe is bent or pressed.

10.2.2 Printer Inspection

Inspect whether the printing paper in the printer is used up or the external printer is connected properly.

10.3 Weekly Maintenance

10.3.1 Sampling Probe Cleaning

- Check that the instrument has been switched off;
- Use hand to rotate the sampling arm so as to scrub the sampling probe conveniently;
- Use gauze dipped in alcohol to gently wipe the external surface of the sampling probe till there is no dirty mark on the surface of the probe;
- Use gauze dipped in distilled water to wipe the sampling probe clean.

10.3.2 Mixer Cleaning

- Check that the instrument has been switched off;
- Use hand to rotate the sampling arm so as to scrub the mixer conveniently;
- Use gauze dipped in alcohol to gently wipe the external surface of the mixer till

there is no dirty mark on the surface of the mixer;

- Use gauze dipped in distilled water to wipe the mixer clean.
- 10.3.3 Rinse Tank Cleaning
- Check that the instrument has been switched off;
- Use hand to rotate the sampling arm, so that the sampling probe and mixer deviate from the rinse tank;
- Use clean gauze and cotton swab dipped in percutaneous ethanol to wipe the rinse tank clean.

10.3.4 Instrument External Surface Cleaning

- Check that the instrument has been switched off;
- Use clean gauze to wipe the panel of the instrument. When necessary, use gauze dipped in a small amount of clear water or disinfectant to wipe it;
- Pay special attention to the wiping of the sampling position, Mixing position and sampling probe clearance, etc.

10.4 Monthly Maintenance

10.4.1 Applying Lubricant on Sampling Probe Spline

- Check that the instrument has been switched off;
- Use clean soft gauze to wipe off the lubricant from the sampling probe spline;
- Use a small hair brush to apply lubricant on the sampling probe spline;
- Use hand to pull the sampling arm upward and downward and apply lubricant on the spline evenly.

10.4.2 Applying Lubricant on Ball Screw for Syringe

- Check that the instrument has been switched off;
- Use clean soft gauze to wipe off the lubricant from the ball screw;
- Use a small hair brush to apply lubricant on the ball screw;
- Use hand to turn the synchronous pulley and apply lubricant on the ball screw evenly.

10.5 Three-month Maintenance

10.5.1 Cleaning Fan for Light Path

- Check that the instrument has been switched off;
- Remove the rear panel by referring to 7.2.1;
- Use the internal hexagonal wrench to remove the 4 screws fixing the fan and remove the fan;
- Use a hair brush to clean the rear panel and fan, and remove the dust in the instrument;
- The side with label of the fan should face the rear panel. Fix the fan to the fan rack with 4 screws;
- Connect the wire of the fan and install the rear panel on the instrument;
- Tighten the set screws on the rear panel with the screwdriver.

10.5.2 Cleaning Fan for Power Supply

- Check that the instrument has been switched off;
- Remove the right side panel by referring to 7.2.3;
- Use a hair brush to clean the fan for power supply and remove the dust in the instrument;
- The side with label of the fan should face the rear panel. Fix the fan to the fan rack with 4 screws.
- Install the right side panel on the instrument;
- Tighten the set screws on the right side panel with a screwdriver.

10.5.3 Leak-proof Groove for Mixer

- Check that the instrument has been switched off;
- Use hand to rotate the sampling arm, so that the mixer is above the Mixing position;
- Use gauze dipped in percutaneous ethanol to gently wipe the internal surface of the leak-proof groove of the sampling probe till there is no dirty mark on the internal surface;
- Use gauze dipped in distilled water to wipe the internal surface of the leak-proof groove clean. When necessary, use disinfectant to wipe it.

10.6 Half-year Maintenance

10.6.1 Light Path Inspection

- Enter the AD acquisition unit of the engineering debugging software by referring to Chapter 8;
- Correct the gains of various wavelengths by referring to the debugging requirements described in 8.7.2.

10.7 Annual Maintenance

10.7.1 Replacing Fan for Reagent Position

- Check that the instrument has been switched off;
- Remove the rear panel by referring to 7.2.1;
- Use the internal hexagonal wrench to remove the 4 screws fixing the fan and remove the fan;
- The side with label of the substitute fan should face the rear panel. Fix the fan to the fan rack with 4 screws;
- Connect the wire of the fan and install the rear panel on the instrument;
- Tighten the set screws on the rear panel with the screwdriver.

10.8 Irregular Maintenance

10.8.1 Replacing Electromagnetic Valve

- Check that the instrument has been switched off;
- Remove the rear panel by referring to 7.2.1;

- Remove the pump and valve component by referring to 7.6;
- Loosen the two set screws of the electromagnetic valve, unplug the pipeline on both ends of the electromagnetic valve, and remove the electromagnetic valve;
- Connect the tubes on both ends of the substitute electromagnetic valve and fix the electromagnetic valve on the support;
- Insert the electromagnetic valve cable in the pump and valve cable;
- Install the rear panel of the instrument.

10.8.2 Replacing Diaphragm Pump

- Check that the instrument has been switched off;
- Remove the rear panel by referring to 7.2.1;
- Remove the pump and valve component by referring to 7.6;
- Loosen the two set screws of the diaphragm pump, unplug the tubes on both ends of the diaphragm pump, and remove the diaphragm pump;
- Connect the tubes on both ends of the substitute diaphragm pump and fix the diaphragm pump on the support;
- Insert the diaphragm pump cable in the pump and valve cable;
- Install the rear panel of the instrument.

Chapter 11 Troubleshooting

11.1 Common Faults and Solutions

Table 11-1 Common Faults and Solutions

Fault	Solution
The analyzer can't be started.	— Check whether the power plug is loose. — Check the fuse. — Check the voltage.
The bulb of the photometer does not light up.	— Check whether the power supply is normal before replacing the bulb. — If the instrument can be started normally, but the bulb does not light up, then replace the bulb.
The operational software can't be initialized.	— Switch off the machine and restart it after about 10 seconds.
The printer can't print.	— Check whether the printer is out of paper. — Check whether the connection is correct. — Check the printer settings in System Setup.
No liquid gushes out of the cleaning pool.	— Check whether the connected pump and valves work. — Check whether the connection of the pipeline of the cleaning pool is correct. — Check whether there is water in the deionized water tank.
Small liquid drop gushes out of the cleaning pool. Liquid splashes.	— This phenomenon happens at the early stage of perfusion if the hydraulic circuit is not used for a long time. — Check whether the pipeline of the cleaning pool is correctly connected or comes off and is damaged. — Check whether there is water in the deionized water tank. — The suction tube may be aged and damaged and should be replaced.
Absorbance/blank AD value is not displayed correctly.	— Check whether the lamp shines correctly. — Try to read the value with another wavelength for judgment. — Check whether the device on the light path is loose or installed incorrectly.

Poor repeatability of results	— Some test cuvettes are contaminated and should be replaced with new ones. — Check the liquid suction situation of the sampling probe. — Check the reagent parameter setting. — Replace the photometer bulb and adjust the gain. — The air tightness of the tee pipe connection of the syringe is poor. — The sample or reagent is contaminated or has deteriorated. — Check whether the volume of the sample tested is enough. — Check whether the remaining volume of the reagent used is enough.
The intake of the sampling probe is not constant.	— Check whether the sampling probe is blocked. — Check whether the air tightness of the tee pipe connection of the syringe.
The QC is not in the range of target values.	— Check the useful life the QC fluid and check that the QC fluid is not contaminated. — Check the item parameter setting and whether parameter modification is needed. — Retest by using another method. — Check the incubation temperature of the reaction tray and retest with new reagent or QC fluid.
There is much small liquid drops in the test cuvette.	— Check the air tightness of the tee pipe connection of the syringe. — Check whether the volume of the sample sucked is 450μL (to judge the stroke). — Check whether the syringe motor functions correctly (to judge the speed).
There is foam in the syringe.	— Check that the piston is tight, without air leakage. — Use Twain-20 solution to clean the syringe (2 drops/L of distilled water). — Replace the O-type gasket in the syringe. — Check the pipe connected with the syringe.
The sample is contaminated.	— Check the air tightness of the tee pipe connection of the syringe. — Clean properly or replace the sampling probe. — Clean the cleaning pool. — Check that there is no residual liquid on the sampling probe. — Check whether the deionized water is not stored for a long time and not contaminated. — If the sample cup is dirty, replace with new sample

	or use the sample once only.
The incubation chamber is not hot.	— Check the temperature setting and appropriately adjust the parameter to 37±0.3℃.
Liquid seeps under the analyzer.	— Check whether the waste liquid discharge pipe has not been inserted in the waste liquid tank. — The waste liquid overflows. — The pipeline of the cleaning pool is blocked.

11.2 Operating Troubles

Table 11-2 Fault Information

Code and Warning Message	Potential Causes
(0x11) Lack reagent	1) The reagent is lacked; 2) The setting of maximum number of paces of reagent level is unreasonable.
(0x13) Lack sample	1) The sample is lacked; 2) The setting of sample vertical correction is unreasonable.
(0x21) Reagent collision	1) The reagent bottle position is oblique; 2) The settings of the reagent tray and sampling probe positions are improper; 3) The optocoupler for sampling probe code disc and optocoupler for spindle code disc fail.
(0x23) Sample collision	1) The sample bottle position is oblique; 2) The settings of the reagent tray and sampling probe positions are improper; 3) The optocoupler for sampling probe code disc and optocoupler for spindle code disc fail.
(0x30) Sampling probe fault	1) Collision occurs during sampling, which can’t be restored; 2) No optocoupler is detected.
(0x40) Syringe fault	1) The syringe falls out step; 2) No optocoupler is detected.
(0x50) Mixer fault	1) The mixer falls out step; 2) The tray rotation is out of step; 3) No optocoupler is detected.
(0x60) Tray rotation fault	1) The tray rotation is out of step; 2) No optocoupler is detected.
(0x90) Dark current	The dark current is abnormal.

exceeds range. Test prohibited	
(0xA0) Filter wheel fault	1) The filter wheel is out of step; 2) No optocoupler is detected.
(0xFF) Software running prohibited…	Abnormality occurs, which can't be restored.

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