Content

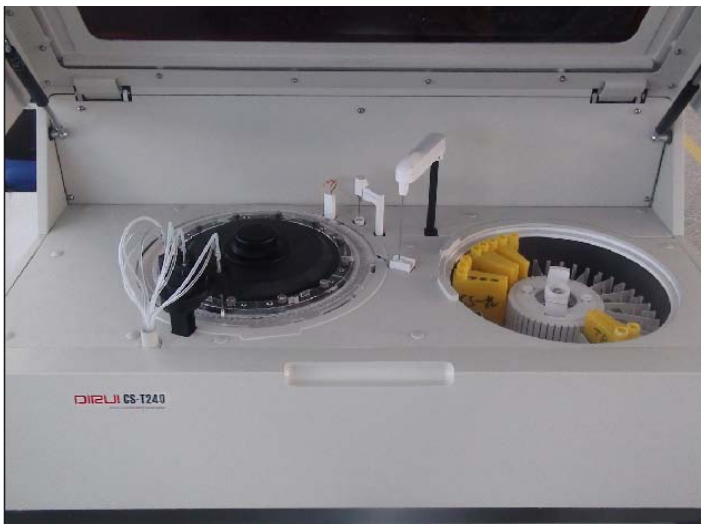
Chapter Ⅰ Instrument Specification

1.1 CS-T240 Model Specification

1.1.1 Product Composition：

The analytical part (host), operation part (computer system), the result output part, accessories and consumables.

Product applicable scope: used for quantitative analysis of serum, plasma, urine, cerebrospinal fluid and other clinical chemical constituents of sample.

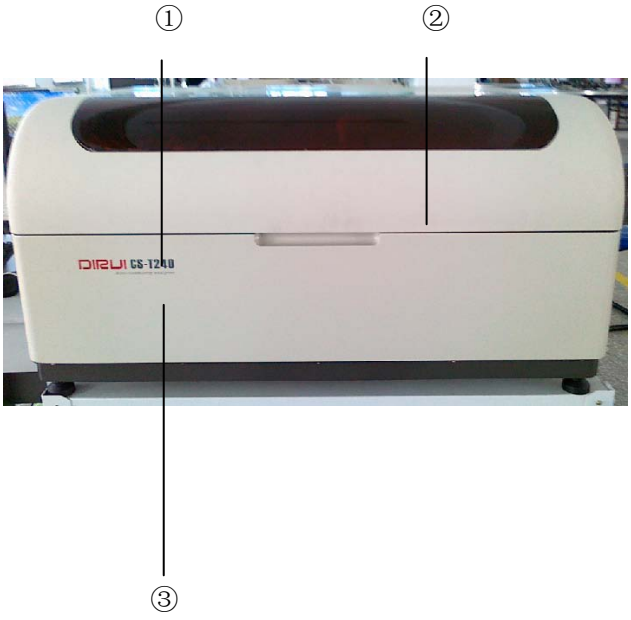


1.1.2 Front

① Model Logo

② Upper Cover

③ Front Cover



1.1.3 Rear

① Purified Water Inlet

② Low Concentrate Waste Outlet

③ High Concentrate Waste Outlet

④ Detergent Inlet

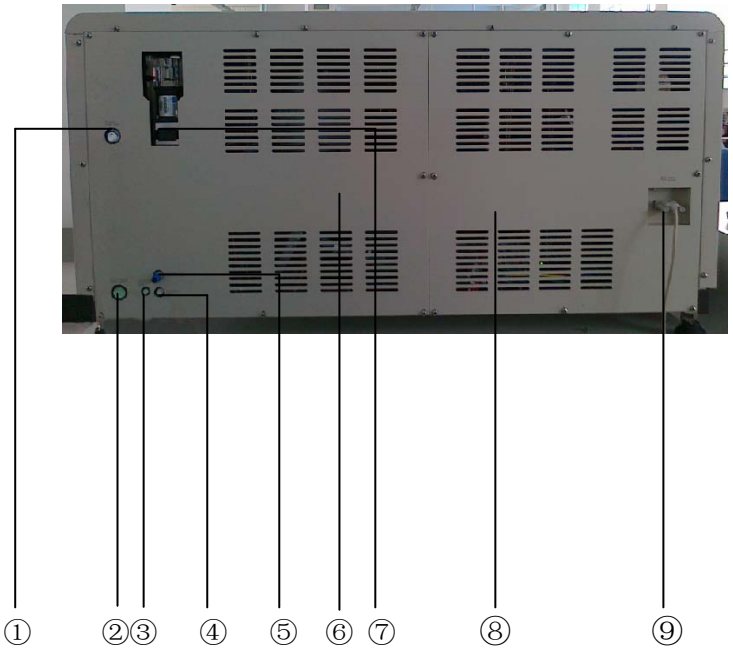
⑤ Detergent Level Sensor Port

⑥ Left Back Cover

⑦ Syringe Pump

⑧ Right Back Cover

⑨ RS232 Port



1.1.4 Working Table

① Reaction Cuvette Rinsing Unit

② Reaction Disk Unit

③ Reaction Tank Liquid Level Detection

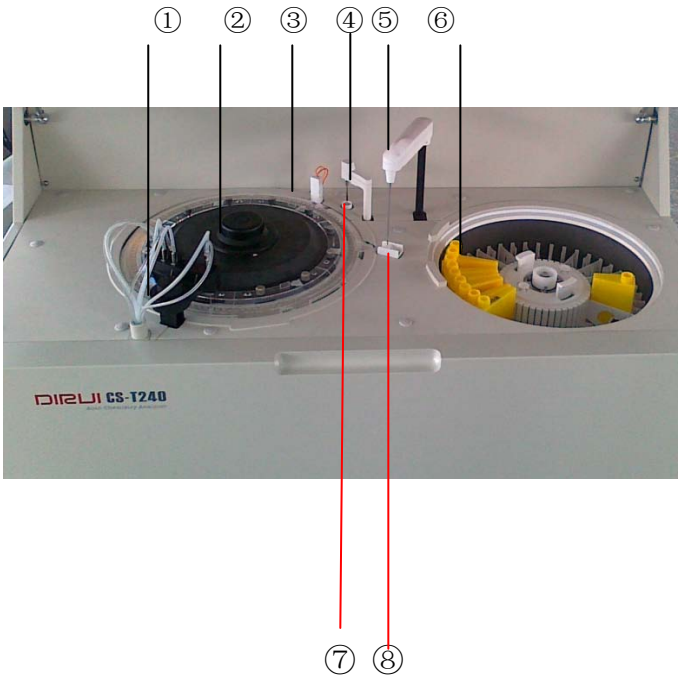
④ Stirring Unit

⑤ Sample &Reagent Adding Unit

⑥ Sample & Reagent Disk

⑦ Mixer Rinsing Tank

⑧ Probe Rinsing Tank



1.1.5 Rightside

① Main Switch

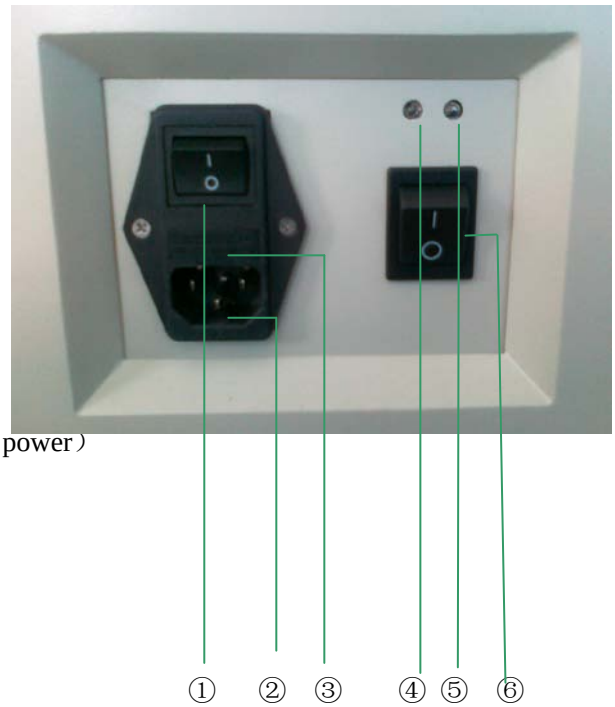
② Power Socket

③ Fuse Installation Place

④ Main Power Indicator（Red）

⑤ Refrigeration Power Indicator（Green）

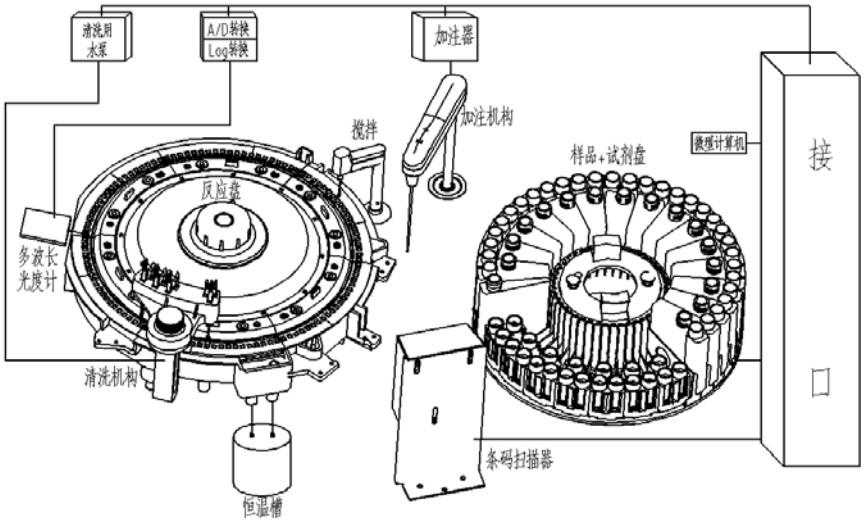
⑥ Analysis Unit Switch（exclude refrigeration power）



1.2 Analysis Unit

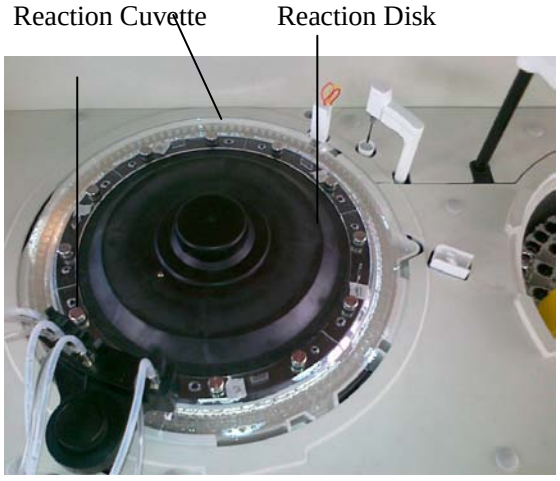
The working speed of CS-T240 auto-chemistry analyzer is 240 tests / hour at constant speed (single / double-reagent item), whose working period is 15 seconds. Instrument overall structure adopts the project of "2-disks + 1-probe + 1-stirring rod"—one reaction disk, one sample & reagent disk, one stirring rod, one sample & reagent probe used for adding reagent and sample, one stirring rod used for mixing. "Grating + diode array" approach is adopted in optical measurement unit for real-time optical collection of reaction cuvette. The 8-stop 12-step automatically rinsing of the reaction cuvette is carried out during testing process.

1.2.1 Structure



1.2.2 Reaction Unit

Reaction cuvette：120，optical path: 6mm
20×6 sets hard optical plastic cuvette
Incubation bath
Digital liquid sensor
8-stop 12-step rinsing of colorimetric cup



1.2.3 Probe and Stirring Unit

Probe unit：1

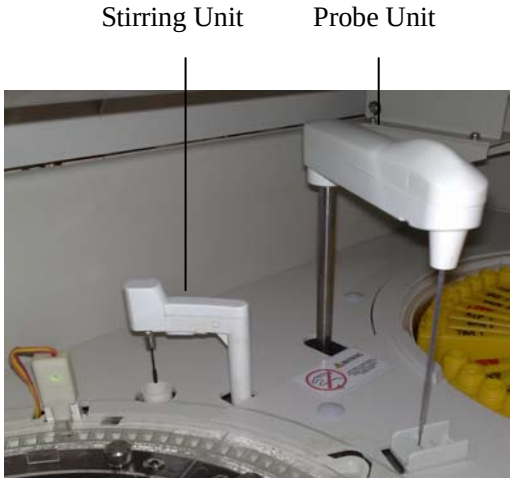
sample & reagent probe

High-precision digital liquid detector

Stirring Unit：1

High-speed hollow cup motor

Surface high-intensity Teflon coating



1.2.4 Control unit1

Circuit panel boxes: 5 panels

Order: from left to right

ISE control panel（Optional）

Sample reagent disk control panel

Rinsing & stirring control panel

Reaction disk control panel

Main control panel

②Switching Power Supply Box: 3

Order： form outside to inside

＋12V（lamp）

＋5V（digital circuit）±12V（simulation）

＋24V（motor, valve）

③ Circuit panel box power supply interface

④ halogen lamp power supply control interface（＋12V）

⑤ Cooling unit power interface（220V）

⑥ Fan power interface（220V）

⑦ Solid state relay panel interface（220V）

1.2.5 Control Unit 2

Semiconductor refrigeration system：

①＋12V refrigerator power
②＋5V control panel power
③Fan（15W/220W）
④Control panel（with status indication）

1.3 Function Overview

Main work flow：

1. All mechanical moving parts initialization.
2. 3 times water blank measure is implemented after six time automatic rinsing
3. Sample reagent probe assimilates quantitive reagent when it descents to reagent sample disk after the sample reagent disk rotates to designated R1 reagent position. And then, sample reagent probe assimilates quantitive sample when it descents to reagent sample disk after the sample reagent disk rotates to designated sample position.
4. After 8-stop 12-step rinsing, reaction cuvette stops at the sampling position, and sample reagent probe rotates to reaction disk and descends to reaction cuvette to discharge the mix liquid(reagent and sample), the reagent 1 and sample adding is finished.
5. Reaction cuvette is stirred immediately when it rotates to R1stirring position.
6. Sample＋R1 reagent react in reaction cuvette or temperatured.
7. If it is double reagent item test, sample reagent disk rotates to the designated R2 reagent position and sample reagent probe descends to sample reagent disk to assimilate quantitive reagent after a set period (6 mins).
8. The sample&reagent probe discharges R2 into reaction cuvette when it rotates to reaction disk.
9. Finishing R2 reagent adding, reaction cuvette is stirred after its one circle (R2 stirring position) rotation.
10. Reaction cuvette carries out the collection of absorbance data when it passes the optical unit in every period.
11.The reaction cuvette is rinsed automatically after reaction when passing the rinsing unit, and 15 minutes have been elapsed since sampling to rinsing.

Table 1-3-1 Main Function of Each Unit

Name	**Main function**
Sample&reagent probe unit	Execute sample, reagent assimilation and discharge of all biochemical items and ISEitems
Sample&reagent disk unit	Total 21 sample positions for carrying all test samples, standard solution and control, 46 reagent positions for carrying test reagent and detergent
Reaction disk unit	Total 120 reaction cuvettes used as container of reaction and colorimetry test.
Reagent stirring unit	Stirring when reagent is added into reaction cuvette.
Optical system groupware	Measure 12 wavelength absorbance by grating system
Auto-rinsing unit	Rinse reaction cuvette automatically by 8-stop 12-step
ISE unit （optional）	Carry out ISE measurement (K、Na、Cl）
Barcode	Total 1 for scanning reagent and sample bottles in sample reagent disk

Chapter 2 Installation

2.1 Space Requirement：

To make sure the space of maintenance, operation and repair, please follow the instruction as below:

- Space between left (right) side of analyzer and the wall should ⩾50cm
- Space between rear board of analyzer and the wall should ⩾50cm
- Space in front of analyzer should⩾100cm
- Make sure there is enough space for waste device and purified water equipment.

2.2 Power supply requirement：

- Power supply: AC220V±22V 50Hz/60Hz
- Power: 650VA
- Circuit breaker: 250V, 20A

A well grounded power supply socket is a must. Large electrical appliance such as air condition, refrigerator, even cannot use the same socket with analyzer.

△! Warning:

Incorrect grounding may cause electric shock or instrument damage.

Input voltage should conform to requirement. 3KVA-line UPS power supply is advised.

2.3 Environment requirement

- Working temperature: 15℃～32℃
- Relative humidity: 32 %～85%
- Atmospheric pressure: 76kPa～106kPa
- Environment should with no dust, vibration, major noise source and power interference
- Do not put the analyzer in the vicinity of brush motor, flicker fluorescent tube and other constant on-off electrical equipment.
- Hard and flat ground is a must for the instrument.
- Avoid direct sunlight, do not put the analyzer in front of heat source and wind source
- Keep good ventilation.

△! warning：

Normal running and accurate result can not be guaranteed if instrument works beyond the requirements mentioned above.

Please use air conditioner if the temperature or humidity can not meet the requirement above. The heat generated during working process by the instrument will be emitted at the rear of the instrument. Good ventilation should be kept well and ventilation equipment can be adopted if necessary, but direct air current should be avoided, or inaccuracy of instrument test may be caused.

2.4 Purified water equipment：

① water should be obtained from tap water pipe
② water conductivity should within 1uS/cm
③ water supply volume should reach 40L/h or more
④ The hydraulic pressure should within 49-343 Kpa

2.5 Instrument Installation Flow：

Make sure the installation place, space, electrical environment, installation room temperature and purified water equipment can conform to requirements
Make sure instrument installation tools needed are complete and reagent and QC liquid are enough.
Please check the prepared items according to packing list when open the package; please write them down on the check report if any missing.
Place instrument in appropriate position, and mount with computer host, display and printer.
Connect water supply and waste liquid outlet equipment.
Infuse CS-anti-bacterial detergent into the 45th position of sample reagent disk.
Check whether the power and data wires are well connected
Install sample reagent probe and reaction cuvette
Check whether the sample reagent probe can move up and down flexibly

Get through the pure water machine, computer host, display and analytical unit power supply, and enter CS auto-chemistry analyzer systematic application software. Initial user name: 001, initial password: 001.
After enter software, follow the steps below in “Maintenance” interface.
（a）Injection pump exhaust
Execute injection pump exhaust to expel air in pipeline.
（b）Cleaning liquid pipeline exhaust
Executing irrigation detergent pipeline exhaust is infusing detergent into pipeline to expel air in pipeline.
（c）Reagent&sample probe horizontal check
Make sure sample&reagent probe is right above reaction cuvette, rinsing groove and reagent bottle.
Place two standard cups at outer circle position 43, inner circle 44 respectively in the sample& reagent disk, and put two blank bottle in inner circle 2 and outer circle 1.Make sure the sample& reagent probe is above reaction cuvette, rinsing groove, standard cup by implementing reagent sample probe horizontal check.
（d）Stirring rod horizontal check
In order to make sure the stirring rod is above the reaction cup, rinsing groove.

（e）Mechanical movement check

Execute 20 times mechanical movement checks to make sure whether the washing block of rinsing mechanism nozzle abrases the reaction cuvette or not and each mechanism runs normally or not.

（f）Rinse reaction cup+ ISE

Select rinsing reaction cuvette in “Maintenance” interface, and execute rinsing reaction cuvette + ISE if ISE equipment is collocated.

（g）Light quantity check

Light quantity result should be attached to installation check report with its value no more than 18000.

（h）Cup blank test

No.1 cup blank value should be within 18000, and 2-120 reaction cup check value should be within 18000 ±800.

2.6 Clinical item test

Edit chemical parameters; register reagent info.; testing rate assay ALT, point assay, two-point rate BUN; calculate the difference of parameter and the result of test should be attached to installation check report.

2.7 Train Medical Personnel

2.8 Fill the Installation Check Report Detailedly.

Chapter 3 Performance and Test Flow

3.1 Main Performance Index

3.1.1 Instrument standard specification

Performance Index		Standard Specification
Characteristics	Wavelength range	Grating rear spectrophotometry system, simultaneous photometric processing of 12 wavelength: 340、380、405、450、480、505、546、570、600、660、700、750nm
	Wavelength precision	±2nm
	Reaction temperature	37℃±0.1℃
	Test item	Simultaneously testing 60 colorimetric items and 3 ISE items at most
	Test method	Rate assay ,end-point assay, 2-point assay.
	Test speed	Constant speed, 240 tests/ hour (360 tests/ hour speed with ISE)

Reagent sample system	Sample & reagent disk,sample position, reagent position	Reagent & sample disk with refrigerator, semiconductor cooling system.Total 67 positions(21 routine samples, 45 reagent positions “CS-bacterial phosphate-free detergent”, 1 detergent position)
	Sample type	Serum, plasma, Urine, cerebrospinal fluid, ascites and other body fluids
	Sample volume	3～35ul，0.1μl incremental
	Test tube	Test tube Φ（12－16）mm×（75－100）mm(±1 mm) Standard cupΦ14mm×37mm(±1 mm)
	Remaining sample volume	More than 100μl
	Sample&reagent probe	With liquid level detection and collision detection function
	Sample&reagent probe rinsing	Inner, outer wall rinsing
	Sample&reagent liquid level sensor	Digital liquid detecting, integration with sample&reagent probe
	Reagent volume	10～350ul，1μl incremental
	Reagent bottle	20mL 、70mL、100mL
	Remaining reagent volume	More than 3mL
	Reagent storage temperature	5℃～15℃

	Barcode information	type： code 128 Size： width: 8-12mm; alid length : within 40mm; start blank and finish blank: within 3mm when cutting. Sticking requirement:the lower edge of barcode should be within 15mm-20mm away from the test tube bottom to make sure right reading barcode,and make sure the barcode is aligned with sample position gap when putting the test rack.
Reacti on System	Reaction cuvette mode	Discrete
	Reaction cuvette optical path	6mm
	Reaction cuvette number	6 sets, 20 for each， total 120
	Reaction time	15 mins
	Reaction liquid volume	150～550ul
	Light source	20W/12V Long-life quartz halogen lamp
	Absorbance range	0～3.3ABS
	QC	QC interval, monthly QC
	Automatic rinsing	Automatically rinsing reaction cuvette, sample& reagent probe, stirring rod.
	Stirring system	separately stirring after adding
Data system	port	TCP/IP network port，standard RS-232 and USB 2.0 port
	Printer	Stylus printer, supporting the user-defined mode for report sheet
	Connecting LIS/HIS system	LIS/HIS system available
Instrument system	weight	About 120Kg
	Dimensions	998*752*515 (length×width×height)

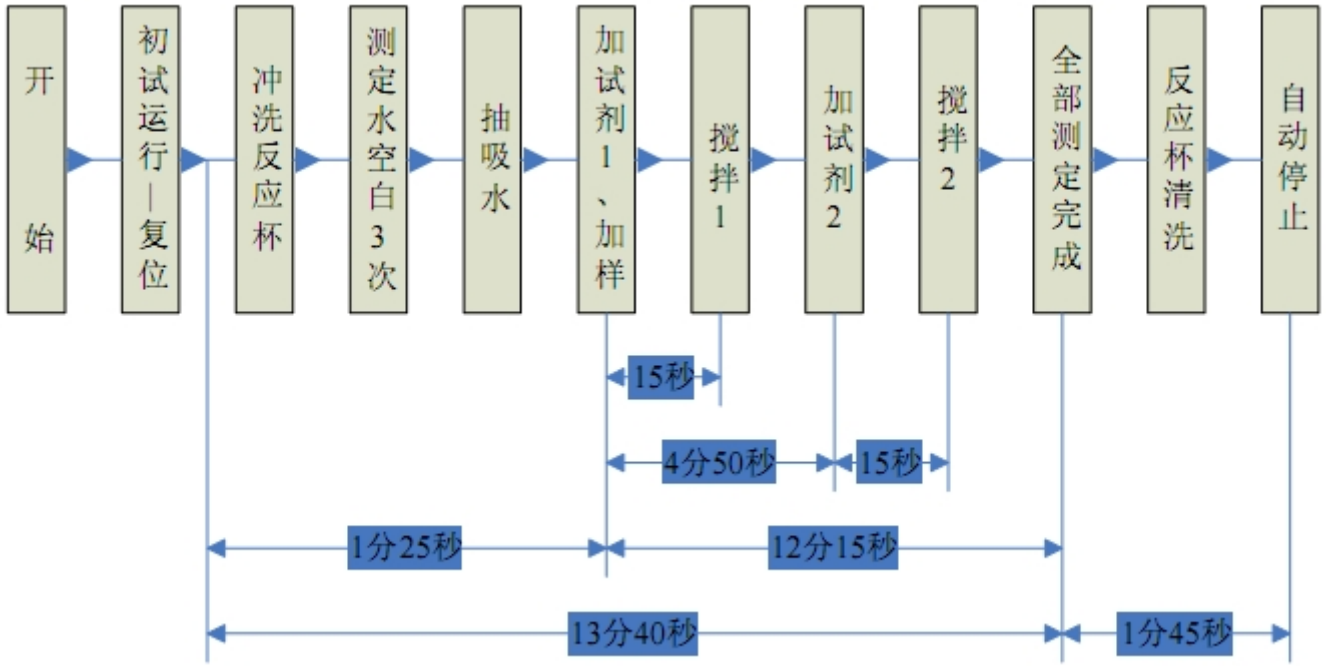
	power（VA）	650VA
	Water consumption	5L//小时
Installation requirement	power	220V/230V，50Hz/60Hz，1000VA
	Using environment	Systems storage temperature： 0℃～40℃， volatility: <±2℃/H; storage humidity:30%RH～80%R ， non-condensing ； at working, temperature:15℃～30℃， volatility<±2℃/H; atworking, relative humidity:35%RH ～80%RH ， non-condensing ； not higher than 2000 meters above sea level.

3.1.2 Testing speed

Test conditions	Degree of reduced ability to process (estimated)
Retest after sample prediluted	80 tests/h（all tests after predilution ）
Use avoiding cross contamination function	120 tests/h at least（reaction cuvette、sample reagent probe）
R1 and R2 items are used simultaneously in testing	240 tests/h at least

3.2 Test Flow

3.2.1 典型测试流程



3.2.2 Test Flow Instruction

1. Periodic movement sequence of sample reagent probe

a. Switch the pump to zero, internal and external wall rinsing

b.Inhale 3ul air.

c.Rotate to the position above the sample reagent disk

d.Descend till the sample&reagent probe point into liquid level about 2mm

e. Assimilate quantitive volume + push back redundant sample

f.Move to above the rinsing pool from the reagent bottle to rinse the external wall.

g. Inhale 3ul air

h. Move to above the sample&reagent disk

i. Assimilate quantitive volume sample

j.Move to above the reaction disk from sample cup or tube

k.Add sample and reagent into the reaction cuvette

l. Rotate to above the rinsing pool from reaction cuvette

→ (next periodic movement sequence).

2. Stirring rod periodic movement sequence：

a．Rotate to above reaction disk

b．Descend into reaction cuvette

c．Mix reaction liquid

d．Rise from reaction cuvette and rotate to rinsing bath

e．Descend into rinsing bath

f．Stirring rod rinsing

g．Rise from rinsing bath

3. Movement and time sequence of reaction disk

A track includes total 120 reaction cuvettes in reaction disk, and rotates in a fixed way when testing. The reaction cup always rotates and stops 4 times counterclockwise, total 36＋4＋82=122 （rotation and stop sequence 36－4－82）patches, in every working period, 15 seconds elapsed.

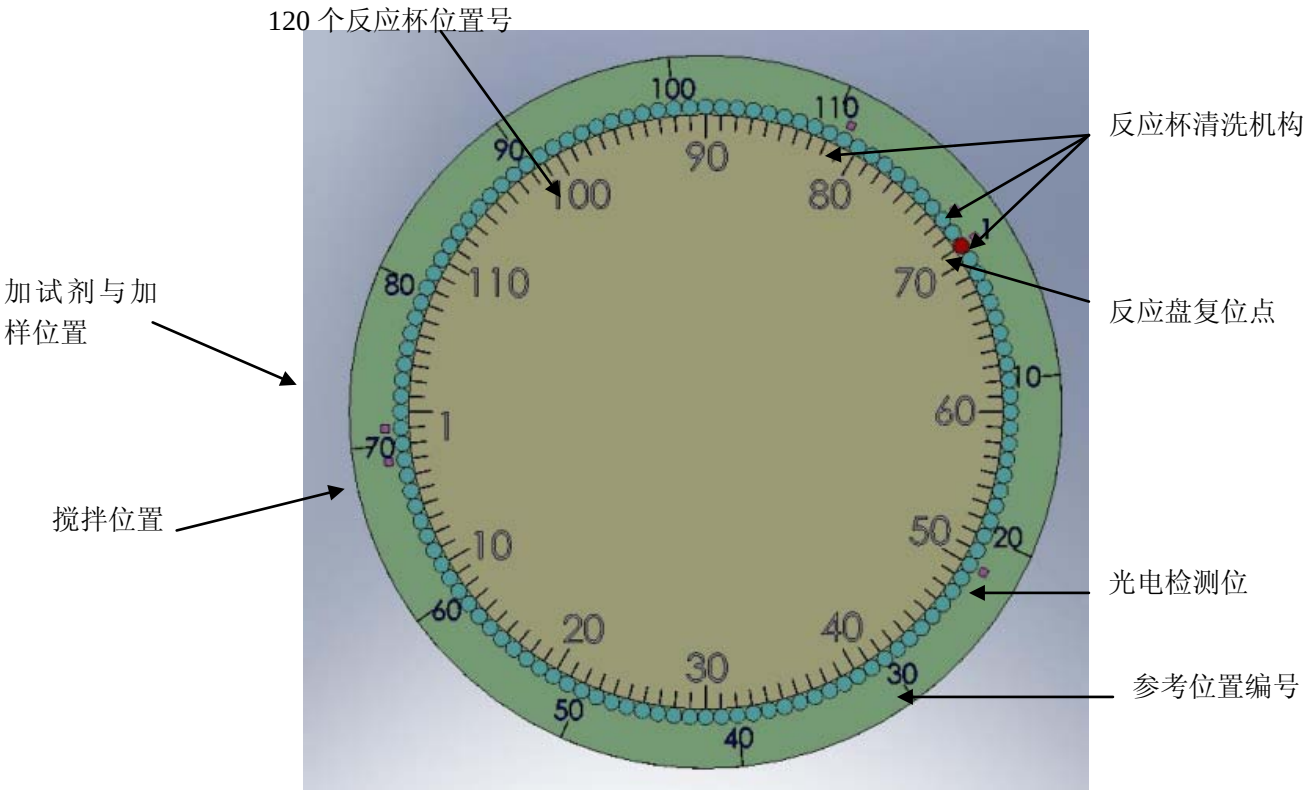


figure 3-2 Position of reaction disk and probe

Outer circle figure: No. of reaction cuvette；inner circle figure: No. of mechanism position.

Reset point is in 71 position of reaction disk.

Reagent1、2 and sample probe is in NO.1 position, stirring is in No.3 position.

Reaction cuvette rinsing unit: NO.71、73、81 position

Reaction cuvette rinsing sequence:

1 → 3 → 5 → 7 → 9 → …… →117 → 119 （18 mins，60 times）

2 → 4 → 6 → 8 → 10 → …… → 118 → 120 （18 mins，60 times）

i. Reaction Cuvette Rinsing Movement Sequence

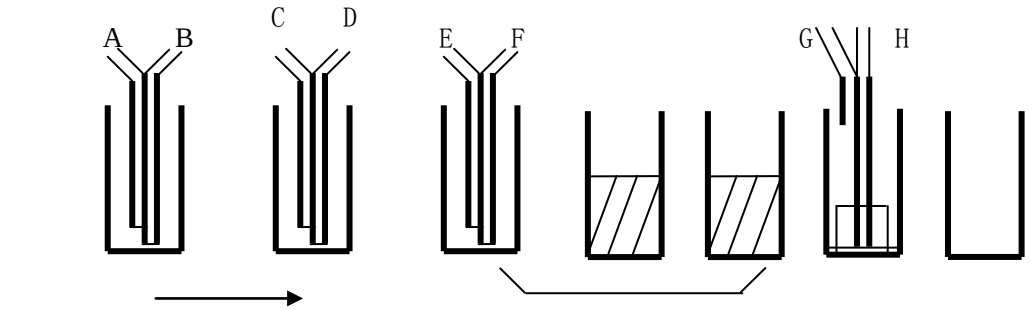


figure 3-3 Reaction cuvette rinsing probe position

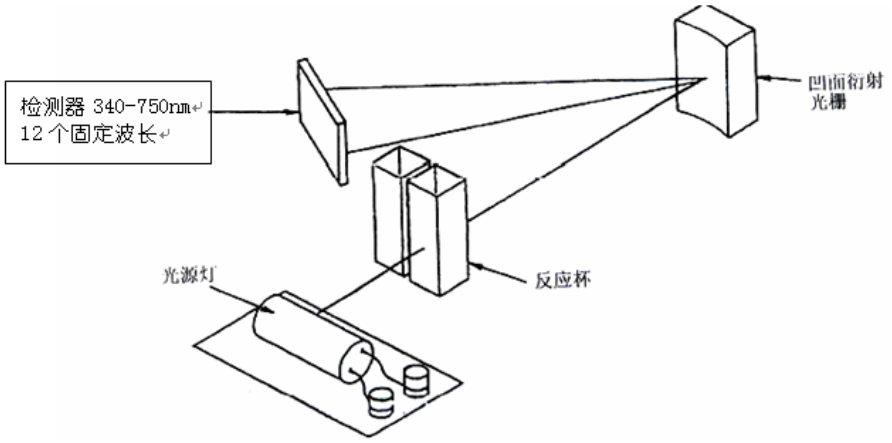
Above figure shows that 8 steps are needed when rinsing reaction cuvette. (3 times cell blank test is added) , therefore, to finish rinsing one reaction cuvette, 12 steps are needed:

ii. Optical measurement movement sequence

Photometry in the entire process is adopted. In 13-minute reaction time, the continuous determination of the absorbance of reaction solution is carried out. Reaction disk rotates 1 plus 2 pitches, about 15 seconds, absorbance values are measured out when the 120 reaction cups passing optical axis of the photometer one by one.

Each reaction Cup in 3-minute reaction time was measured 12 times (12 photometric points), 4-minute reaction time was measured 16 times (16 photometric points), 5-minute reaction time was measured 20 times (20 photometric points), 10-minute reaction time was measured 40 times (40 photometric points), 13-minute reaction time was measured 49 times (49 photometric points).

Light starting from the light source was focused by the lens, and passed the reaction cup first, and then was disparted by concave grating. After spectrophotometry, each wavelength were received by 12 fixed photoelectric sensors simultaneously, and were amplified 12 amplifiers, after Log transformation to derive the rate of change of absorbance or absorbance. When dual-wavelength testing is used, the concentration value is calculated by the difference of the main and sub-wavelength absorbance or that of absorbance change rate, and therefore dual-wavelength testing can not only compensate the blood lipid, hemolytic, jaundice sample test, but also compensate on the result impacted by voltage changes, so that measurement is more accurate, more stable.


检测器 340-750nm
12 个固定波长
凹面衍射
光栅
光源灯
反应杯

Chapter 4. Module Introduction

4.1 Sample&reagent probe unit

4.1.1 Function introduction

Sample&reagent probe can realize the assimilation from the sample test tube and reagent bottle and add into reaction cuvette.

In addition, main function of reagent&sample probe component: liquid level detecting and collision detection in movement process, probe block detecting function.

Other subsidiary function includes mechanical limit, power-down self-locking function.

Probe working position:

Reagent&sample probe component: rinsing bath→sample&reagent disk assimilating position→reaction disk/ISE sampling position;

Probe drive mechanism plays a key role of reagents and samples adding. The way of probe are only up-down and circular moving, so two step motors are necessary to drive.

4.1.2 Composition

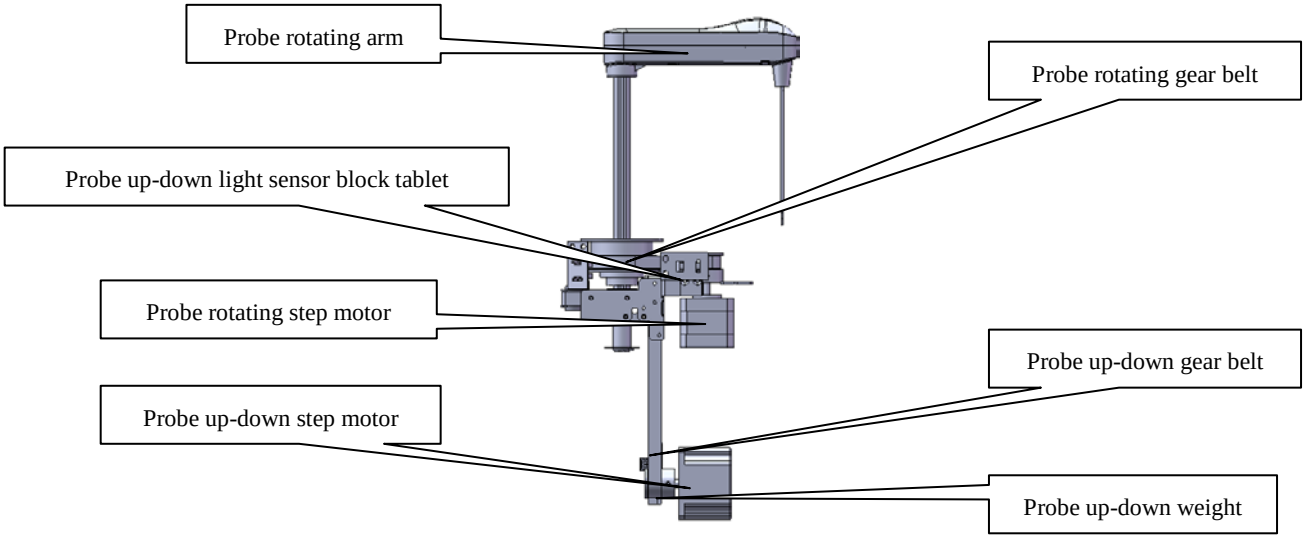


Figure 4-1 probe components configuration

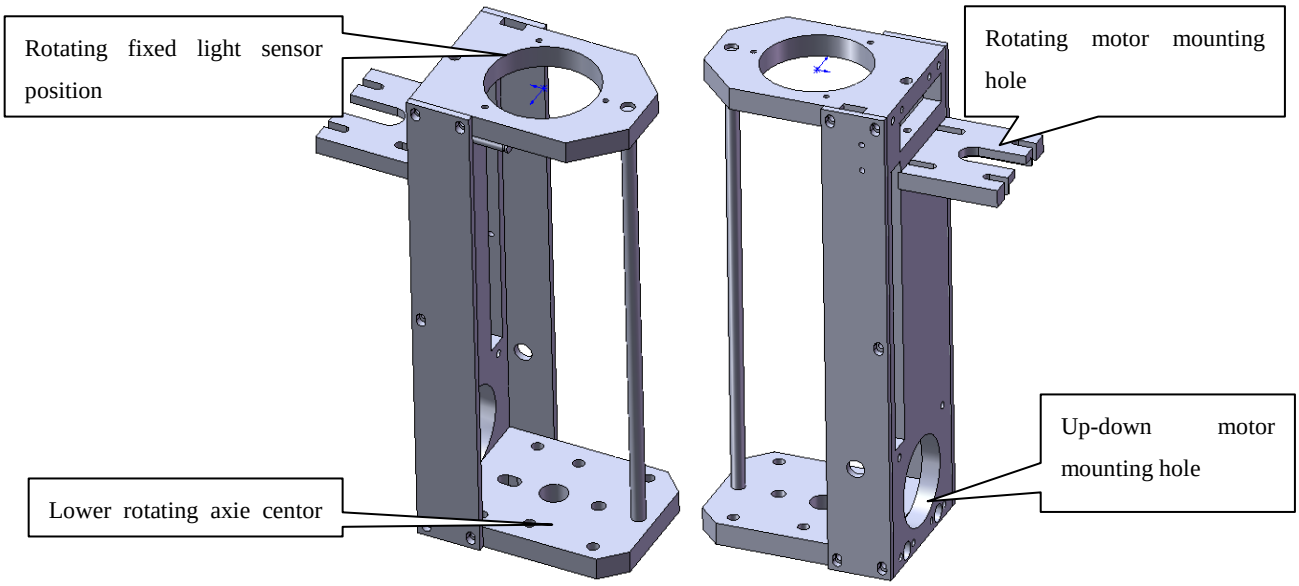
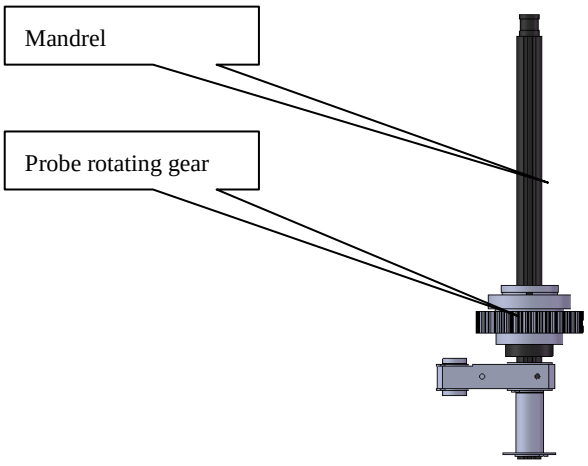


figure 4-2 Probe body and rotating body



Rotating probe drive ratio is 12:34, using 0.9° stepper motor and 8 segment controller. Control accuracy can achieve 0.0398°.

Up-down main gear driver diameter is 19.1mm, the 60mm for the perimeter, also using 0.9° stepper motor and 8 segment controller.Up-down control accuracy can achieve 0.01875mm.

4.2 Rotating mechanism unit

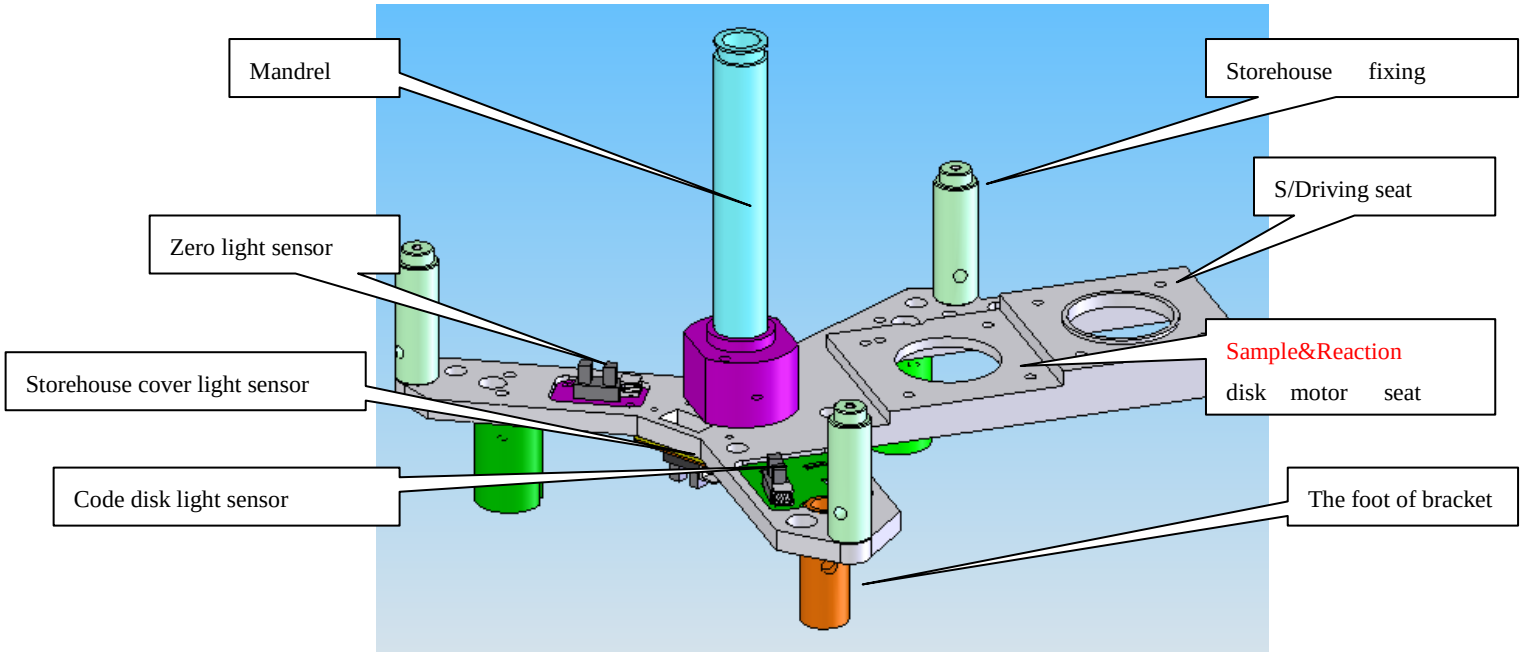
4.2.1 Function Introduction

The main function of rotating mechanism is bearing of the sample warehouse,reagent warehouse and reaction disk, and drive it to rotate, so that sample and reagent carried in reaction cup rotate to the designated location to finish sampling, mixing and other work.

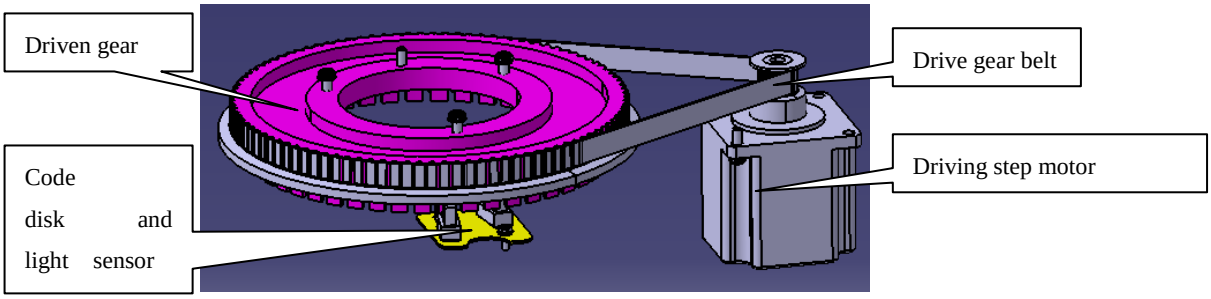
4.2.2 Rotating mechanism composition

1, Reagent&sample turntable: The sample&reagent storehouse, disk rotating bracket, step motor-driven components

2, The reaction disk turntable: reaction plate, the reaction cuvette, incubation bath, disk rotating bracket, step motor-driven components

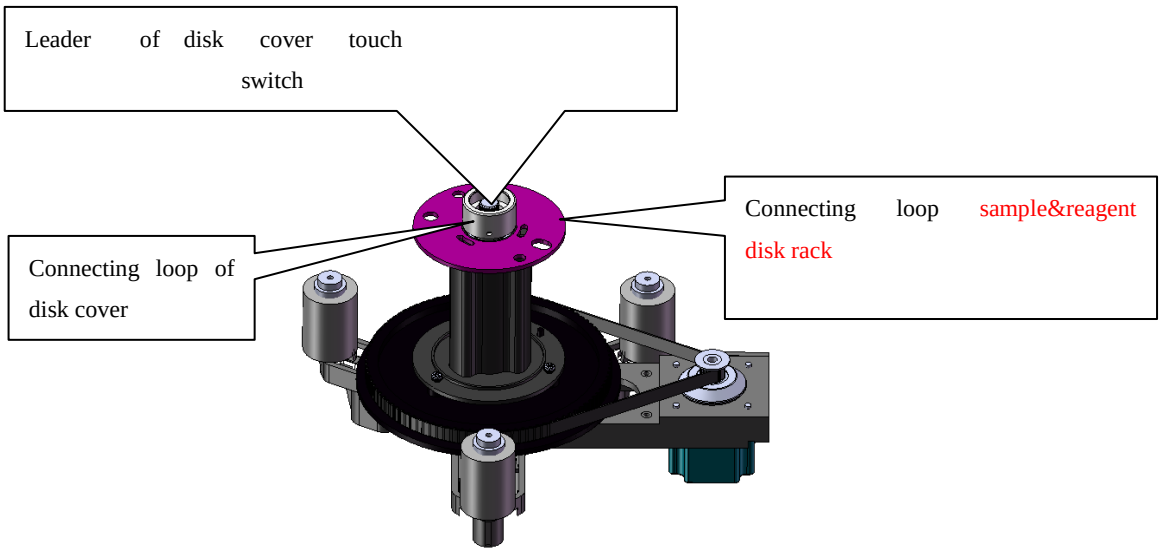


4-4 Disk rotating bracket

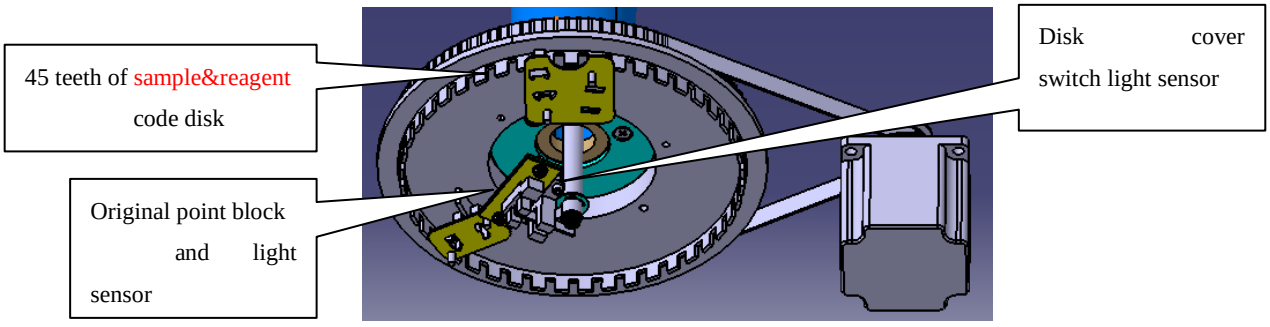


4-5 sample &reagent disk motor driver configuration

System transmission ratio is 10:1.Because of using 0.9 °step motor with 8 segment driver circuit, the wheel rotation accuracy can achieve 0.01125°.



4-6 Sample/reagent disk assembly configuration



4-7 sample &reagent disk transmission code disk configuration

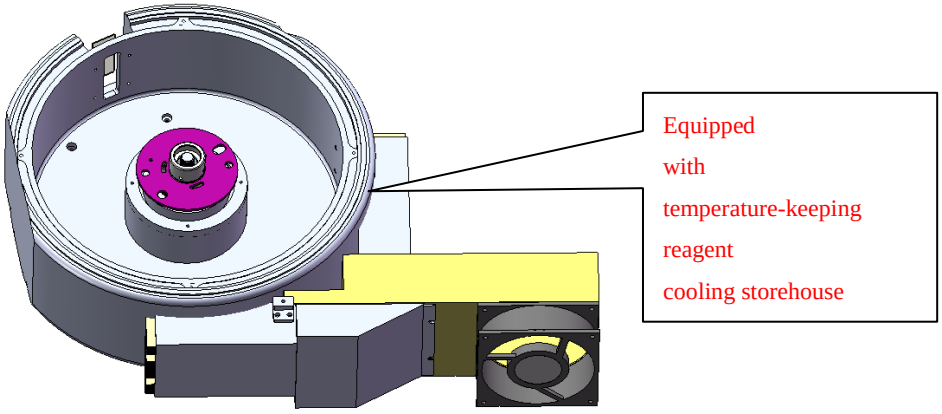
4.3 Refrigerator Unit

4.3.1 Function Introduction

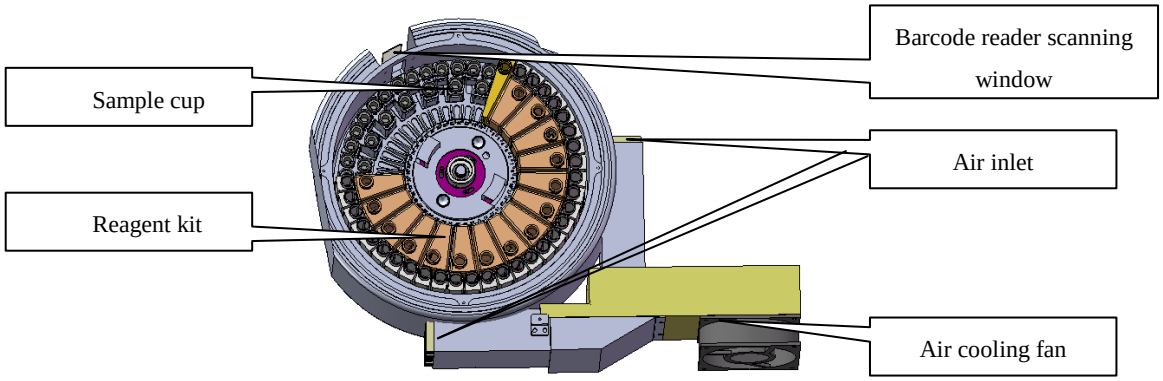
The reagent&sample storehouse with refrigerator adopting semiconductor refrigeration, the

temperature maintains at 6 degrees -10 degrees, 21 sample positions and 46 reagent positions (the 45th fixed position for placing phosphor-free CS-anti-bacterial detergent)

4.3.2 Refrigeration system configuration and installation



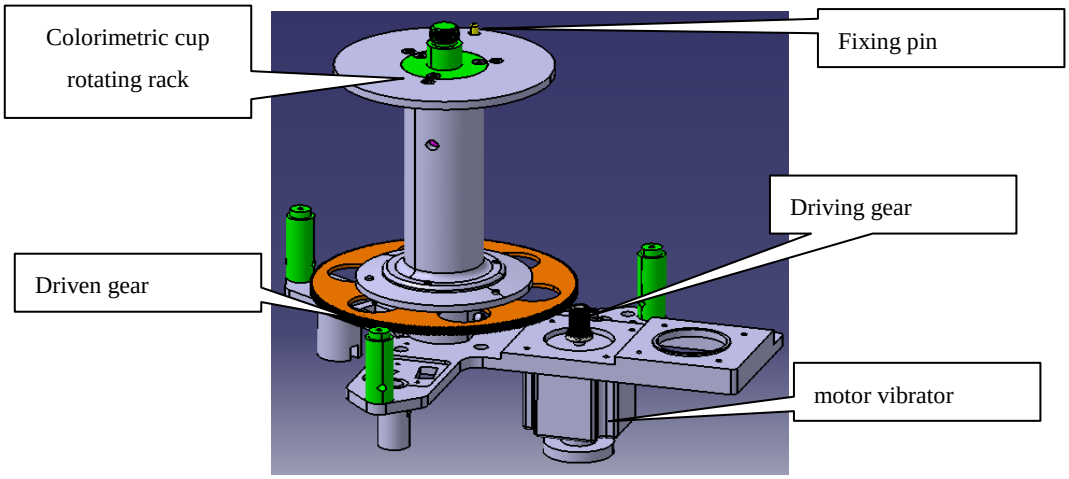
4-8 Reagent cooling storehouse and sample&reagent disk rack assembly configuration



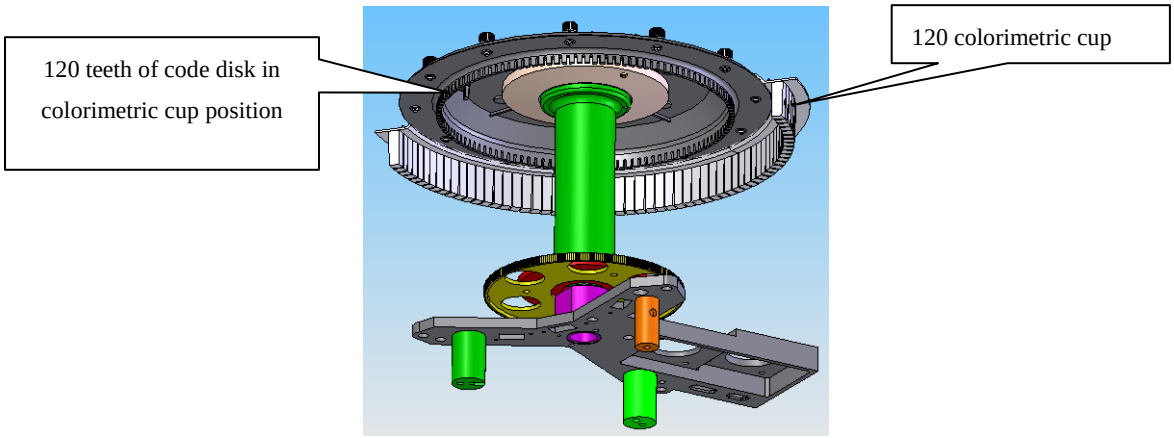
4-9 reagent cooling storehouse and sample&reagent disk rack assembly configuration

4.4 Reaction disk unit

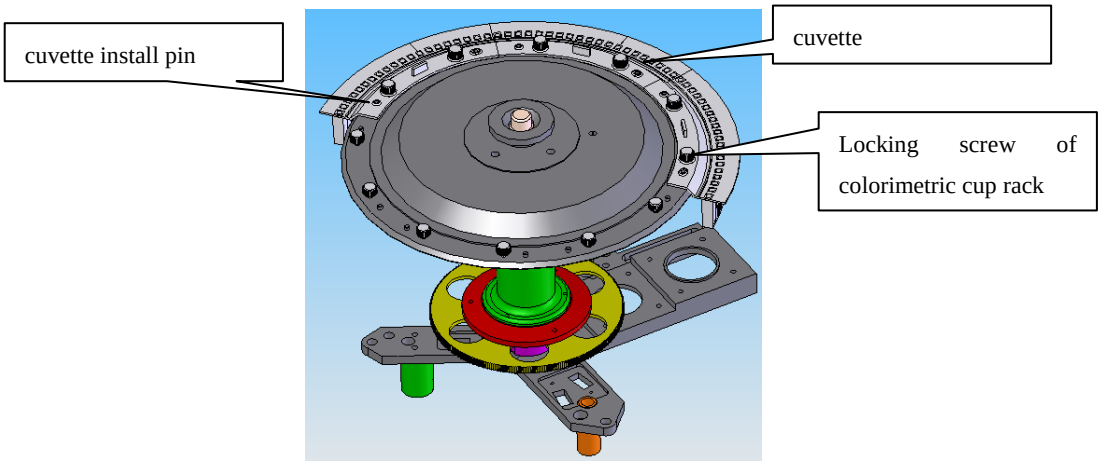
Gear drive adopted reaction disk due to the relatively high positioning precision.



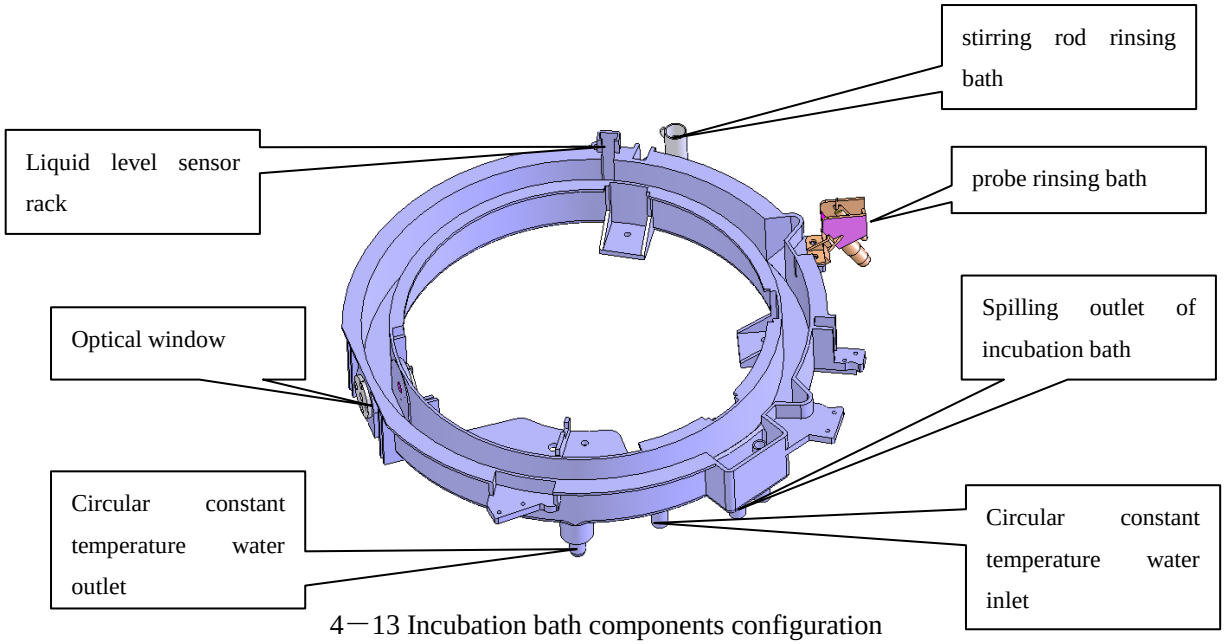
4-10 reaction disk assembly configuration



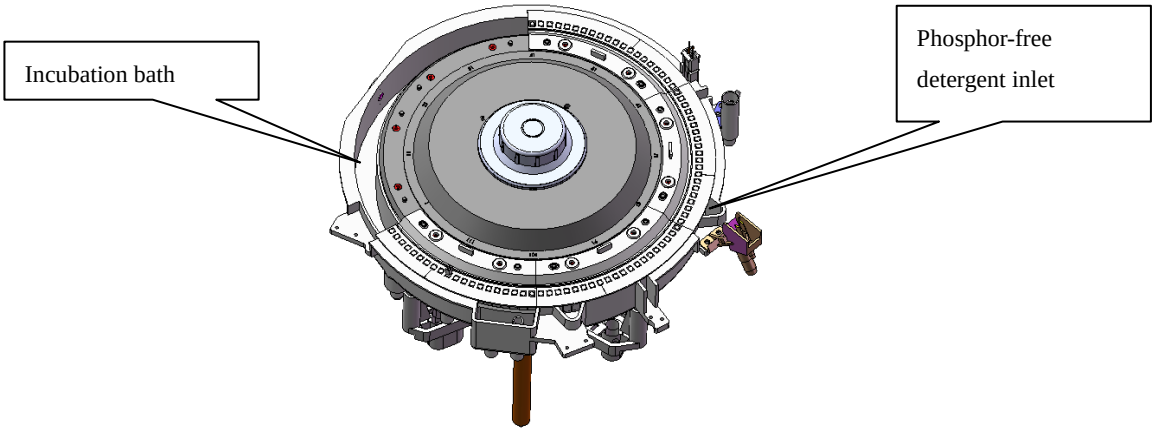
4－11 reaction cup installation disk assembly configuration（1）



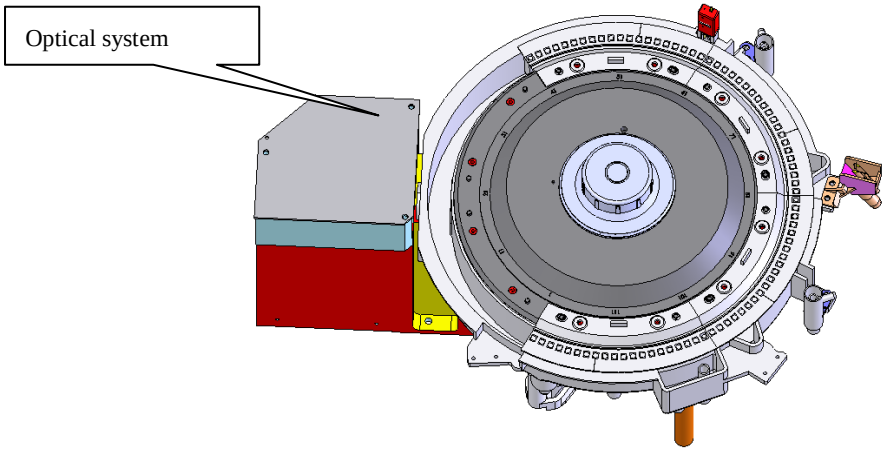
4－12 reaction cup installation disk assembly configuration（2）



4－13 Incubation bath components configuration



4－14 reaction disk with incubation bath components assembly configuration

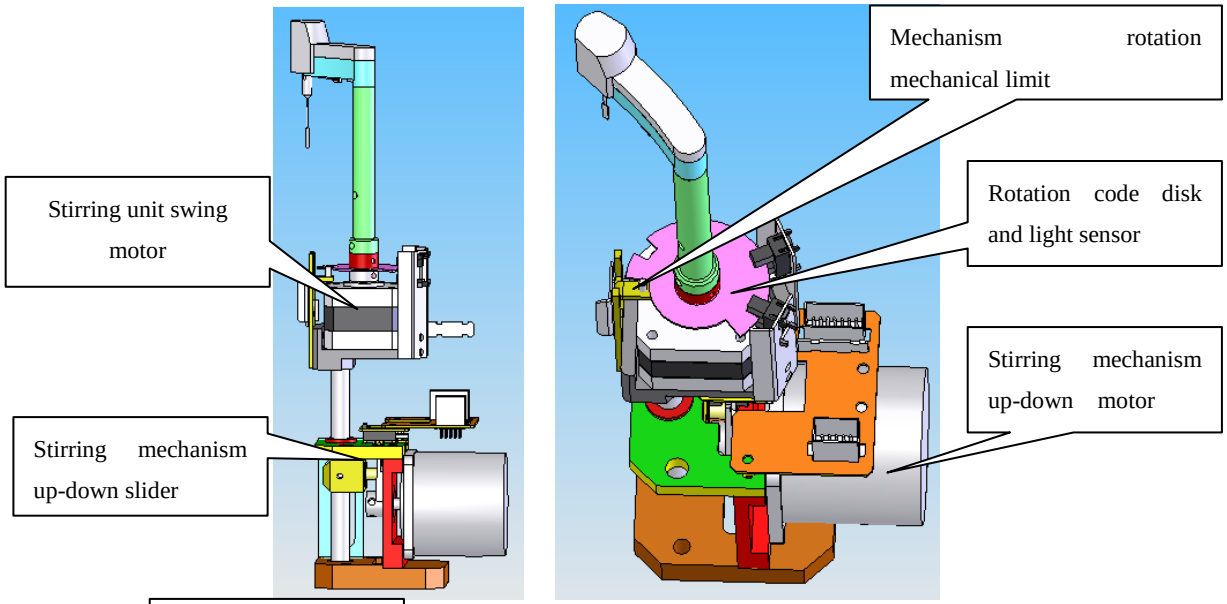


4－15　reaction disk and optical system components assembly configuration

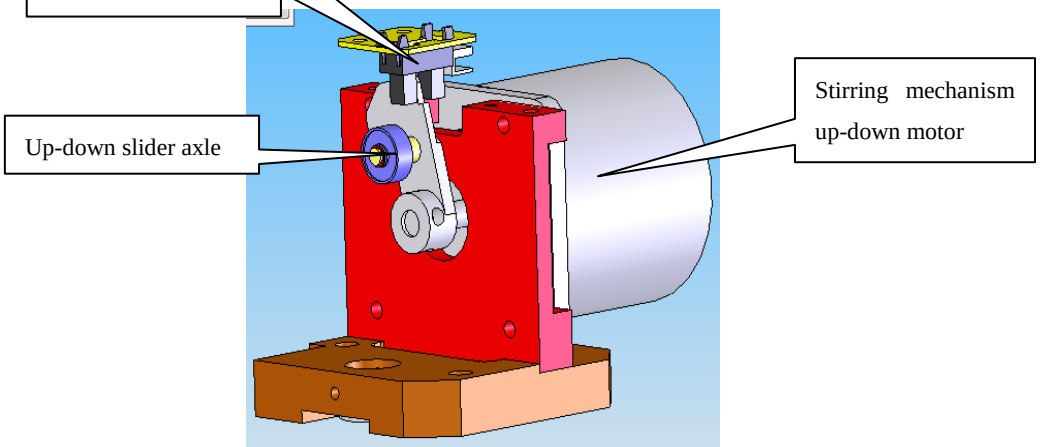
4.4 Stirring Unit

Stir and mix reagent and sample after adding them。

Rotating mechanism of stirring and rotating arm adopts the direct drive way of step motor output axle, using 8 segment drive circuit of 0.9 ° motor, and the controlaccuracy can achieve 0.1125 °. The largest angle is limited by the open angle of rotatation code disk mechanical limit. And positioning is determined separately by the left and right light sensors.

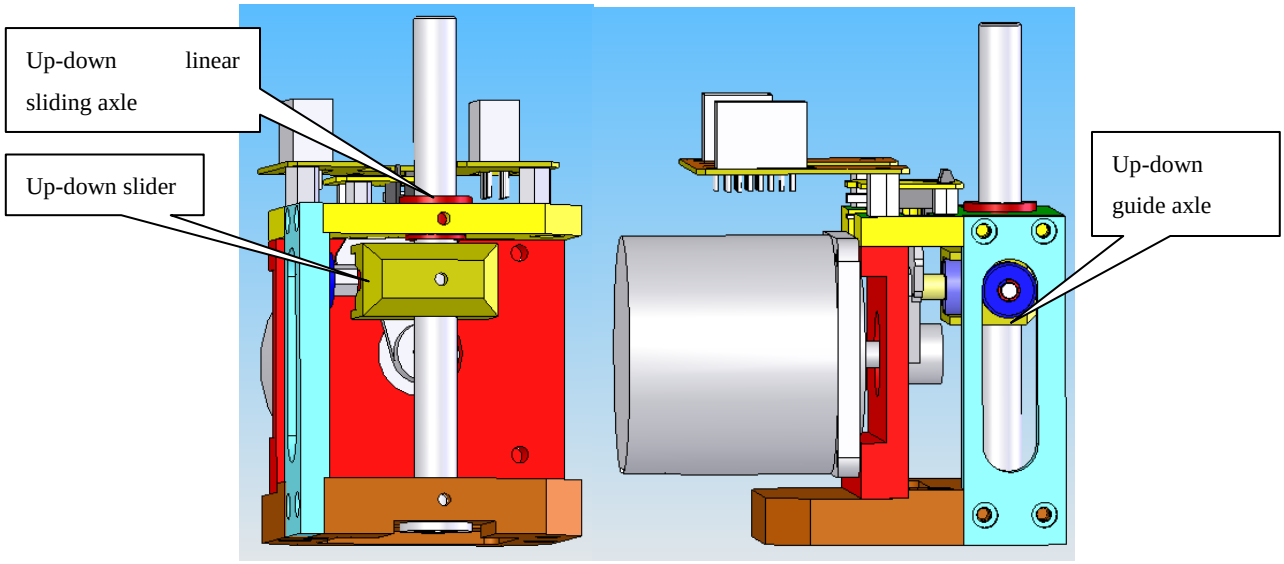


4－16 Stirring components configuration



4－17 stirring up-down driver configuration

Curve axle and curve handle drive is adopted by stirring up-down mechanism .



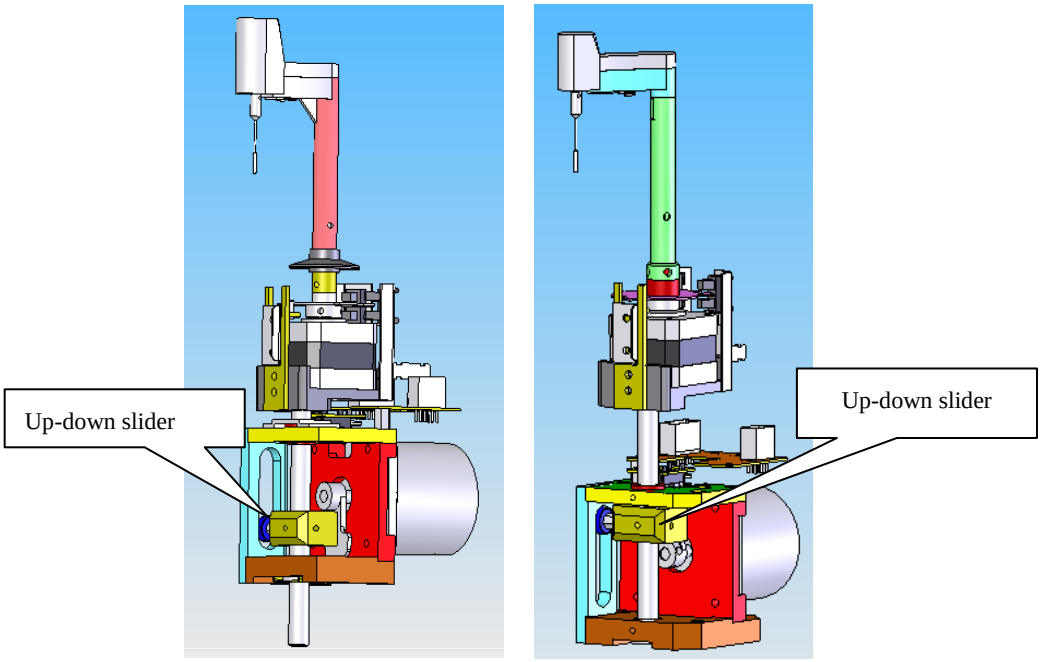
4－18　stirring up-down slider drive configuration

Because of mixing body movements are used by way of the crankshaft crank, so the movements of the positioning accuracy at different locations different. Landing and taking-off between the location of the speed of the highest, lowest accuracy, and precision at both ends of the highest, the lowest speed.

Electrical axis from the axis of the slider bearings the size is 16.5mm, crank in horizontal position, the landing position accuracy is 0.032mm.

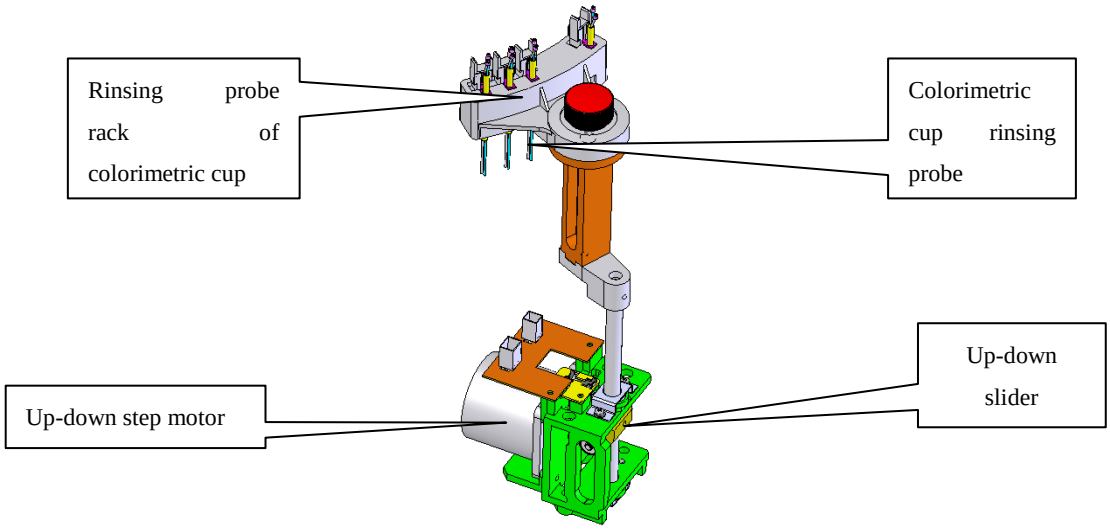
Due to curve axle and curve handle drive is adopted by stirring up-down mechanism, the up-down positioning precision are different at different position. The speed is the highest and precision is lowest at the middle, however the precision is highest and speed is lowest at the two ends.

The size of Motor axis from the axis of the slider bearings is 16.5mm, when curve handle locates horizontally; the up-down position precision is 0.032mm.



4－19　stirring mechanism up and down positions

4.6 Colorimetric cup rinsing mechanism

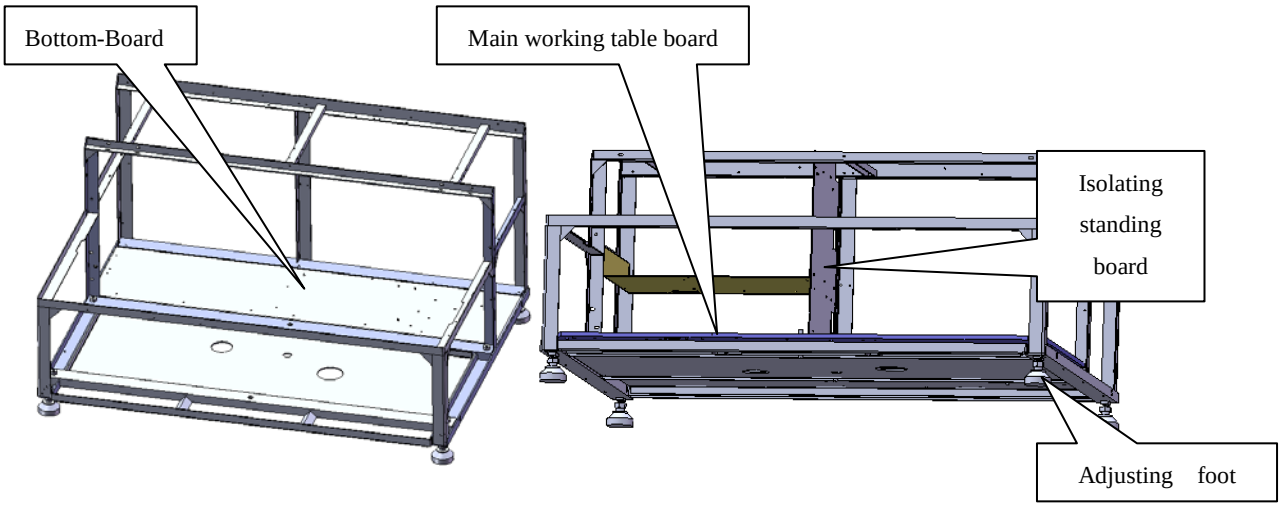


4－20

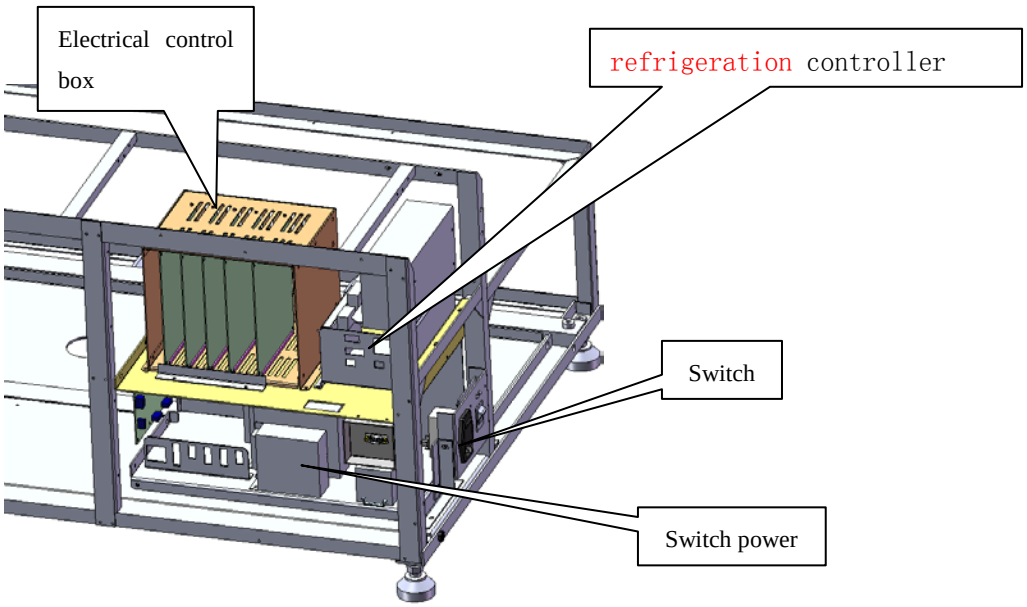
Only one-dimensional movementavailable to colorimetric cup rinsing mechanism,and driving mechanism adopts the up-down driving mechanism of stirring rod.

4.7 Rack

Rack includes the main rack, electrical, gas liquid valve and water tanks and other racks.



4－21　Main rack configuration


Electrical control box
refrigeration controller
Switch
Switch power

4—22

Chapter 5. Instrument Fluid Pipeline

5.1 Main function of liquid line

The CS-T240 liquid line system can be divided into four parts: water inlet tank, 37 degrees centigrade temperature, colorimetric cup cleaning, the inner and outer arms and stirring rod cleaning.

1. CS-T240 liquid line system includes sampling subsystem and cleaning subsystem.

2. Sampling subsystem uses one probe plus one stirring rod and one injector. The injector use 500uL

3. The inner and outer wall cleaning of probe and stirring rod uses barotropic driving.

4.Cleaning bath: two cleaning bathes plus waste liquor in the reagent storehouse, together with the flooding waste liquor in the reaction disk etc.

5. The reaction cuvette cleaning uses the way named 8-stop 12-step.

6.Water supply: uses the special outboard water-supply equipment and the special water-supplying machine.

7. Waste liquor: reticulate pattern pipe as low concentrate waste pipe with inside diameter of 12mm, wall thickness 3mm, high concentrate waste pipe is also reticulate pattern pipe with inside diameter is 8mm and wall thickness is 2mm

8. Source of power: the power of cleaning comes from the magnetic pump..

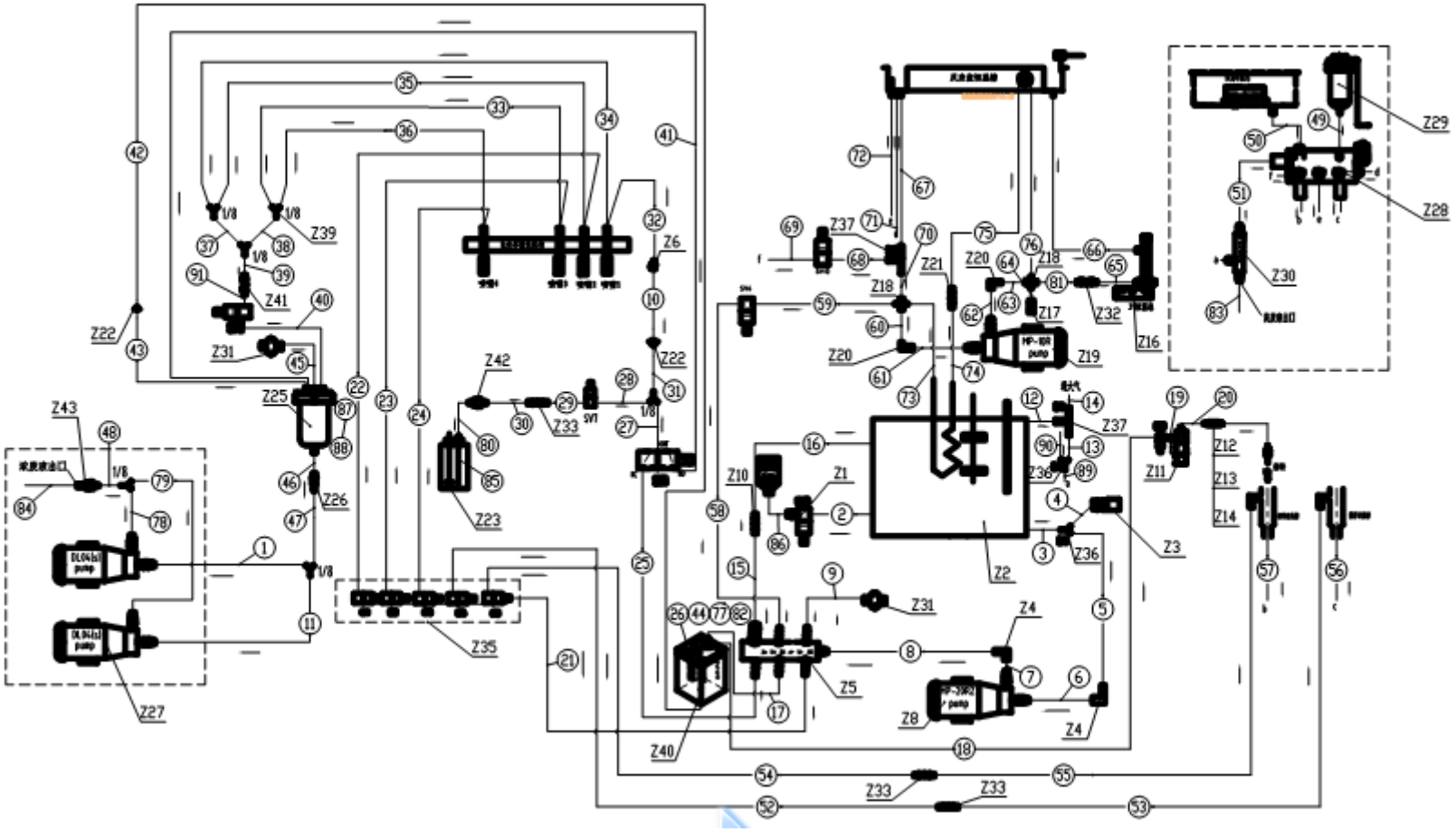
9. The cleaning of reaction cup should use one detergent..

10. The vacuum degree for vacuum pump assimilating$\geqslant -70\mathrm{kPa}$

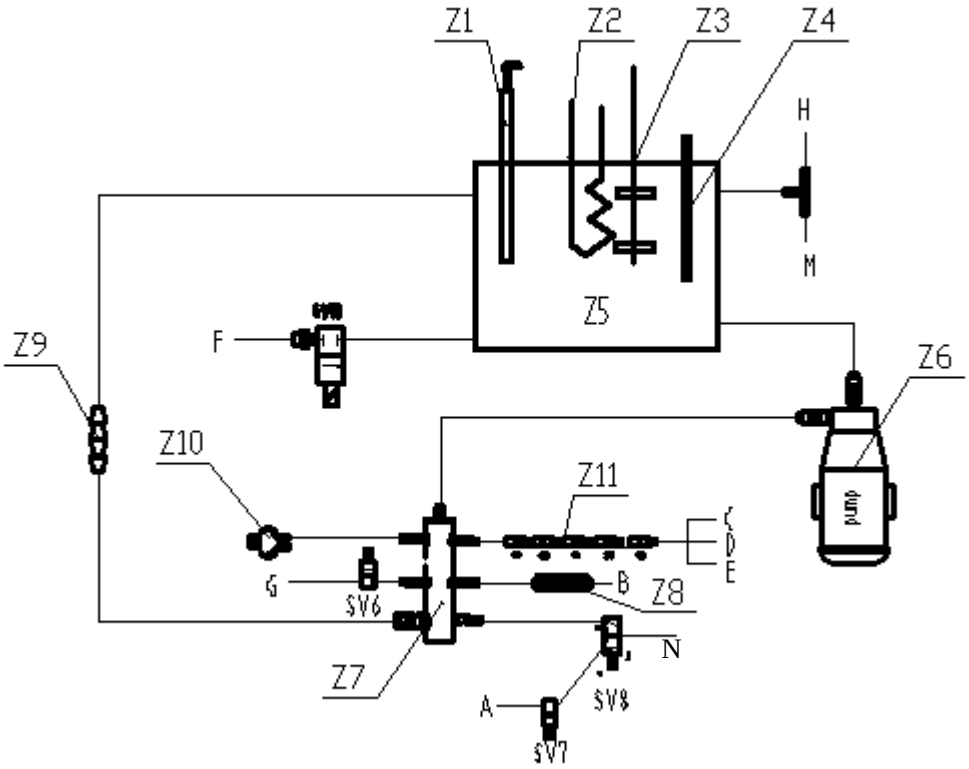
11. The inner and outer wall cleaning of probe uses independent solenoid valve while the stirring rod use one solenoid valve.

5.2 Liquid Line Principle

5.2.1 CS－T240 Liquid line principle sketch map



5.2.1 liquid line of water inlet tank



Explanation：

Z1——heater； Z2——lamp coller； Z3——float； Z4——temperature sensor；

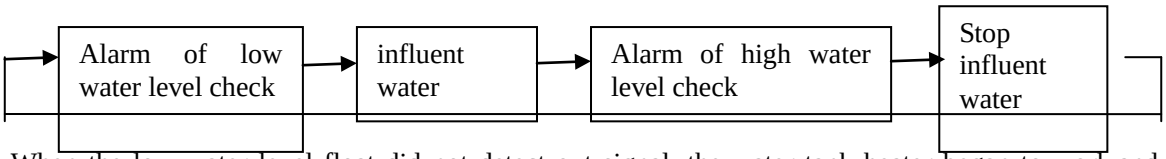
Z5——water tank； Z6——magnetic pump； Z7——water seven-pass；Z8——air discharger

Z9——flow controller；Z10——pressure sensor；Z11——5 valve plate assembly；A——detergent；

B——probe inner wall rinsing；C——Cuvette rinsing；D——stirring rod rinsing；E——probe external wall rinsing ； F——water inlet ； G——incubation bath inlet ； H——air outlet ；

M——overflow outlet； N——cuvette rinsing

1, When the low water level float detects out the signal, open the inlet valve SV13, and water tank begins to be infused water until the high water level float detects out signal, then turn off SV13 to stop the water. Influent flow is as follows:



2, When the low water level float did not detect out signal, the water tank heater began to work,and temperature control started. Magnetic pump began to work simultaneously.

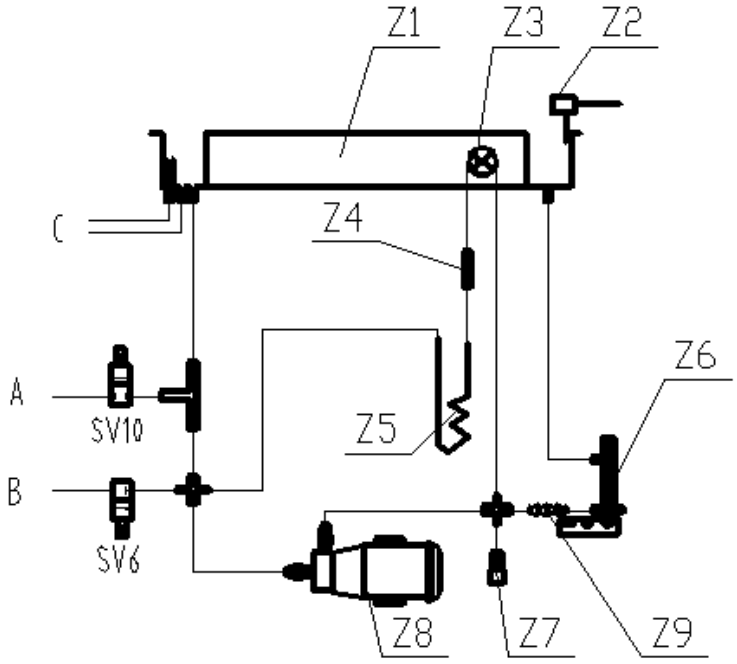
3, Output water pressure of water tank is controlled by the magnetic pump and fixed damper regulator. Magnetic pump head is 4.6 m（50Hz）. Control water pressure is around 0.45kgf/cm2.

4,The tank water is pumped into the seven-pass through magnetic pump: the first pass to the

five-valve plate assembly, used for cuvette rinsing, stirring rinsing and external wall rinsing of the probe; second pass through the degassing device for the internal wall rinsing of the probe; third pass with the detergent used for the first probe rinsing of rinsing unit; fourth pass for the incubation bath; fifth pass access to pressure sensor for detecting the tank pressure; sixth pass for regulating the water tank pressure.
5, When abnormality occurs to the float, possibly water tank remains the status of inputting water. When the water tank is full of water, SV13 not shut down, tank outflow water spills out from the overflow pipe into the waste liquid pipe.

5.2.2 Constant temperature system liquid line

This system offers precise constant 37 degrees water to the incubation bath of reaction disk, and cools the high temperature light source simultaneously. This system consists of magnetic pump, incubation bath water inlet valve, incubation bath water outlet valve, liquid level detector and temperature controller consists of the heater, temperature detector and the shell.



Explanation：Z1——incubation bath； Z2——liquid level detector； Z3——halogen lamp； Z4——flow controller；Z5——lamp cooler；Z6——constant temperature unit； Z7——block； Z8——magnetic pump；Z9——flow controller； A——incubation bath water outlet； B——incubation bath water inlet；C——overflow outlet

1, Open the inlet valve SV6 and turn off outlet valve SV10 to infuse water into incubation bath, simultaneously with reagent&sample probe adding phosphor-free anti-bacterial rinsing liquid to the incubation bath, liquid level detector determining whether to stop water.

2, Turn off outlet valve and inlet valve, and start the water circulation magnetic pump and temperature

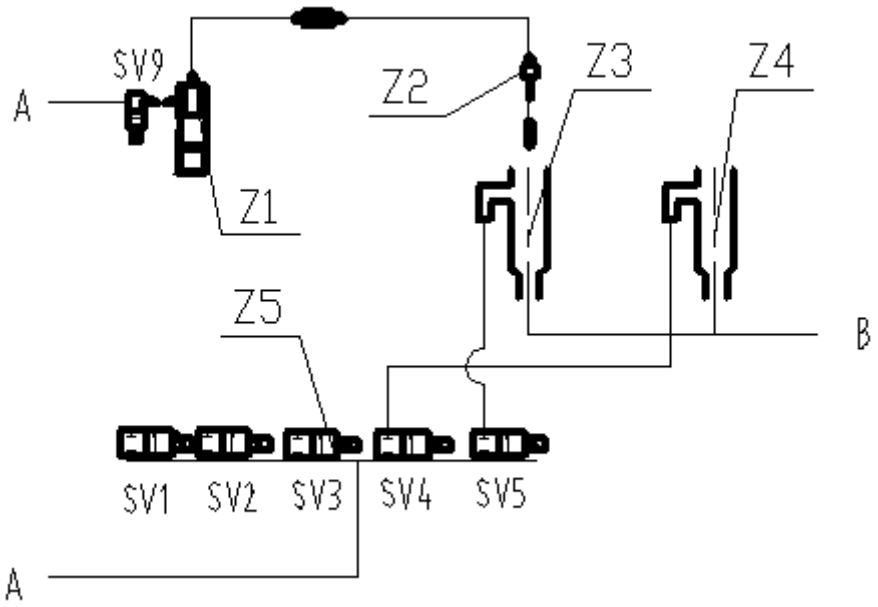
controller. In order to improve the adjusting performance of the PID temperature controller in high temperature environment, the system is added the cooling device through the water tank to get a small amount of temperature cooled.

3, Turn off magnetic pump and temperature controller, open the drain valve SV10, time to turn off the drain valve when the incubation bath is draining.

5.2.3 Probe internal and external wall rinsing

1,Open valve SV9 can get the inner wall of reagent sample probe rinsed. Probe position should be at the top of the corresponding cleaning trough when cleaning so that waste liquid can get out of the instrument.

2,Open the valves SV4 and SV5 to rinse the external wall of sample&reagent probe and stirring rod. Fixing pressure adjusting piston is adopted to every external wall rinsing pipeline to avoid rinsing water spilling out of rinsing bath.



Explanation：Z1——syringe pump unit；Z2——sample reagent probe；Z3——probe rinsing bath；Z4——stirring rob rinsing bath；Z5——five-valve plate unit；A——water tank；B——waste outlet

5.2.4 Colorimetric cup rinsing liquid line

In order to achieve the cleaning effectively, colorimetric cup rinsing adopts warm water. In order to improve cleaning speed, colorimetric cup adopts hydraulic valve switch and vacuum liquid exhaust.

1, warm water provided by heating tank of inlet water is about 34 ℃. Water pressure is produced by

magnetic pump from the water tank and adjusted by voltage regulator to the stable pressure, about 0.45kgf/cm2.

2, vacuum pump, vacuum tank and pressure detector composes vacuum source with pressure value about -0.7kgf/cm2. Vacuum tank has the function of stable vacuum pressure.

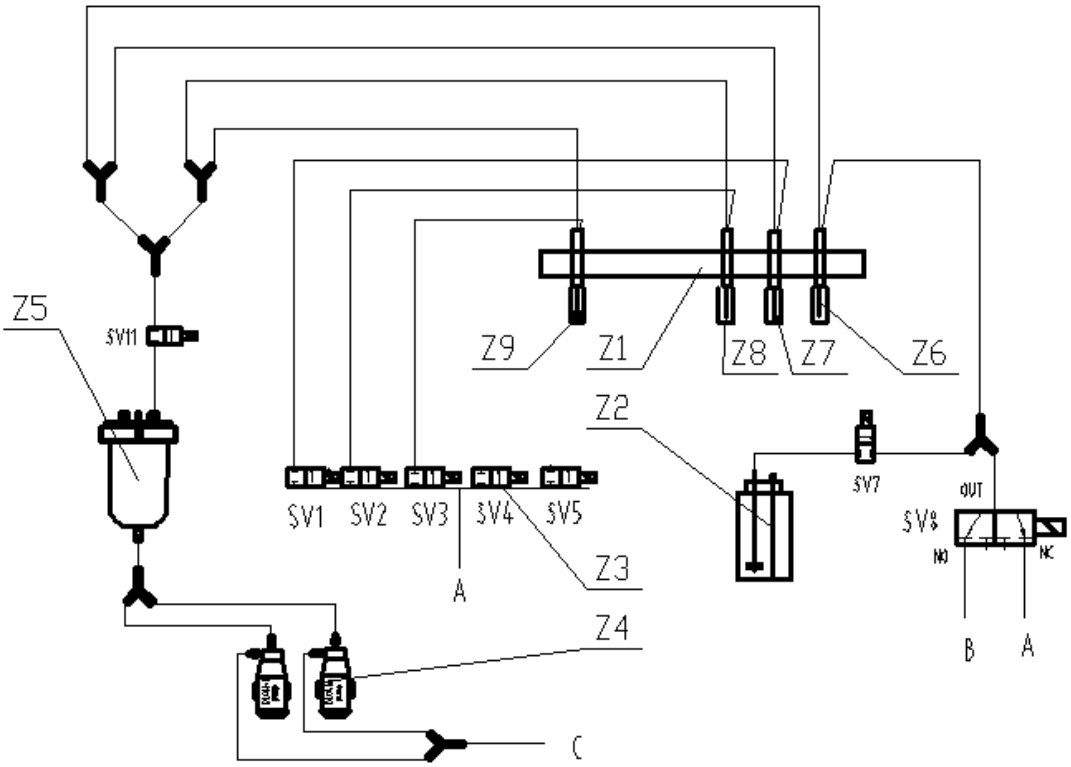
3,Vacuum liquid discharging is high concentrate liquid – reaction liquid including concentrated patient sample and reagent,requiring separate collection.

4, when the colorimetric cup cleaning mechanism descends, turn off valves open the valve SV11. It tarts assimilating sample under the vacuum pressure, and the liquid of colorimetric cup will be discharged after a short period of time when the rinsing mechanism arrives at the bottom of Colorimetric Cup.

5, cleaning liquid and ionized water adding is completed by the SV1、SV2、SV3、SV7 and SV8 which are timed. Because the vacuum liquid discharging begins to work simultaneously when adding liquid to discharge redundant liquid, the liquid will not spill outside colorimetric cup.

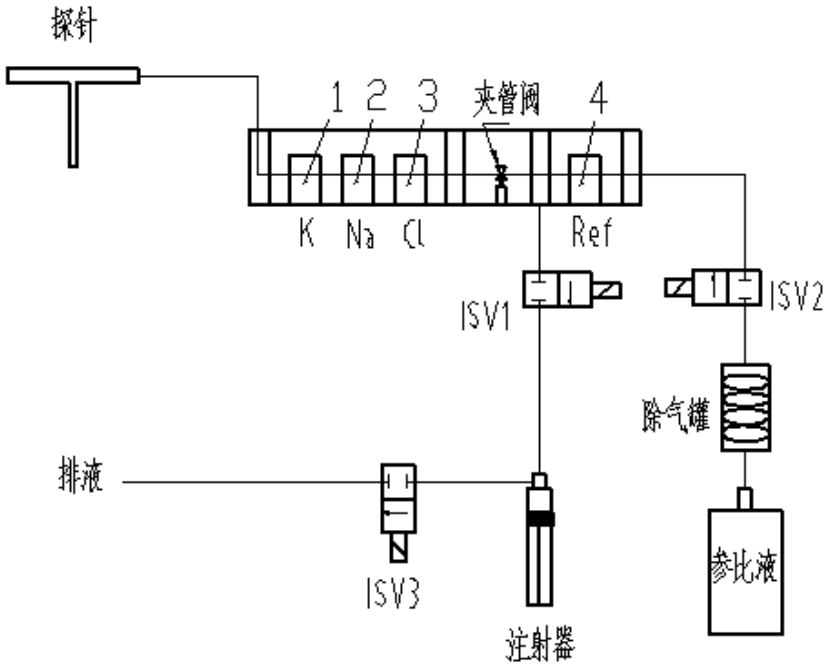
6, SV7 and SV8 valves are responsible for adding cleaning liquid.

SV8 valve is three links, NO port connect with vacuum tank, NC connect with water seven pass.Before adding or after the previous adding, open the valve SV7, but valve SV8 is at COM and NO conduction status (power off status). Because there is a one-way valve in the 3-way top pipeline, cleaning fluid flows into the middle pipeline of the SV7 and SV8 valves, and time valve SV7, cleaning liquid will remain in pipeline. Open valve SV8 when adding, cleaning liquid will be added into colorimetric cup through one- way valve under the pressure. About 500ul cleaning liquid is consumed each time.



Explanation：Z1——cuvette rinsing unit；Z2——detergent component；Z3——five-valve plate unit；Z4——vacuum pump unit；Z5——liquid collection vaccum tank unit；Z6——nozzle1；Z7——nozzle 2；Z8——nozzle 3；Z9——nozzle 4；A——water tank；B——iquid collection vaccum tank；C——high concentrate waste outlet

5.2.5 ISE Part


探针
1
2
3
夹管阀
4
K
Na
Cl
Ref
ISV1
ISV2
除气罐
排液
ISV3
注射器
参比液

Chapter 6 Instrument Hardware Circuit

6.1 Hardware configuration

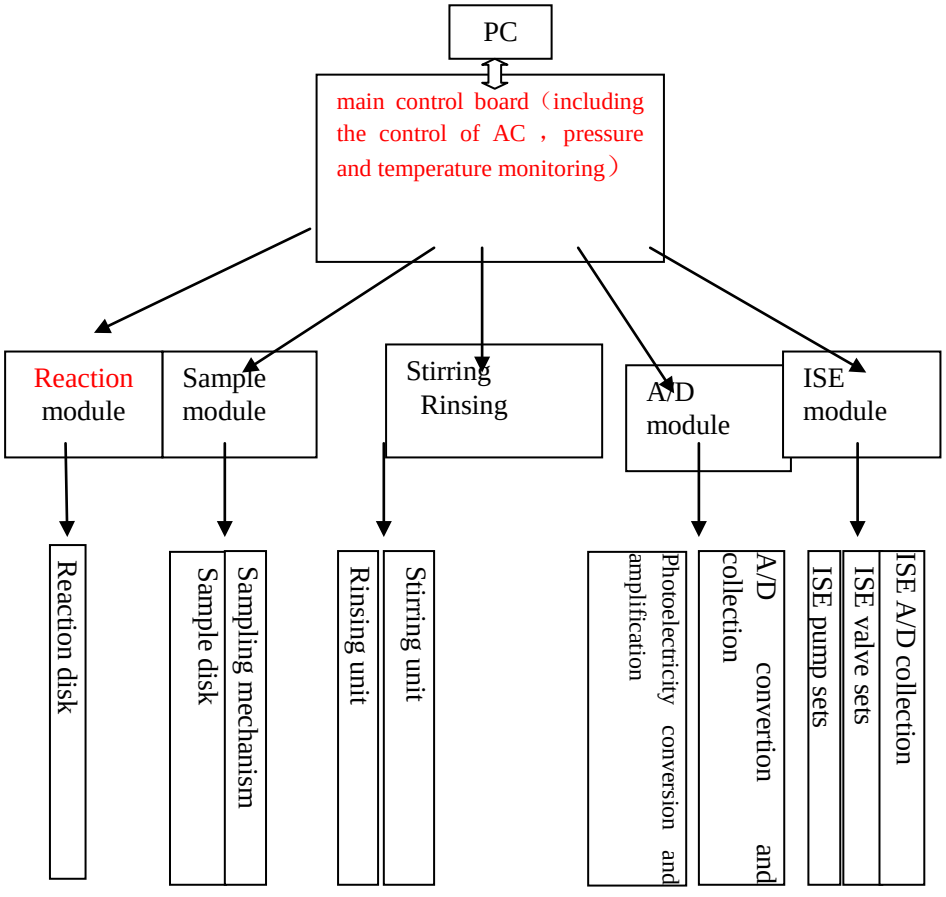


Figure 6-1 Hardware main frame

6.2 Security Note:

At working, touching hardware panel with hand or any other objects is forbidden.

In order to dismount panels, operation is only allowed when cut off power (220V, AC).

6.3 Circuit board and function list

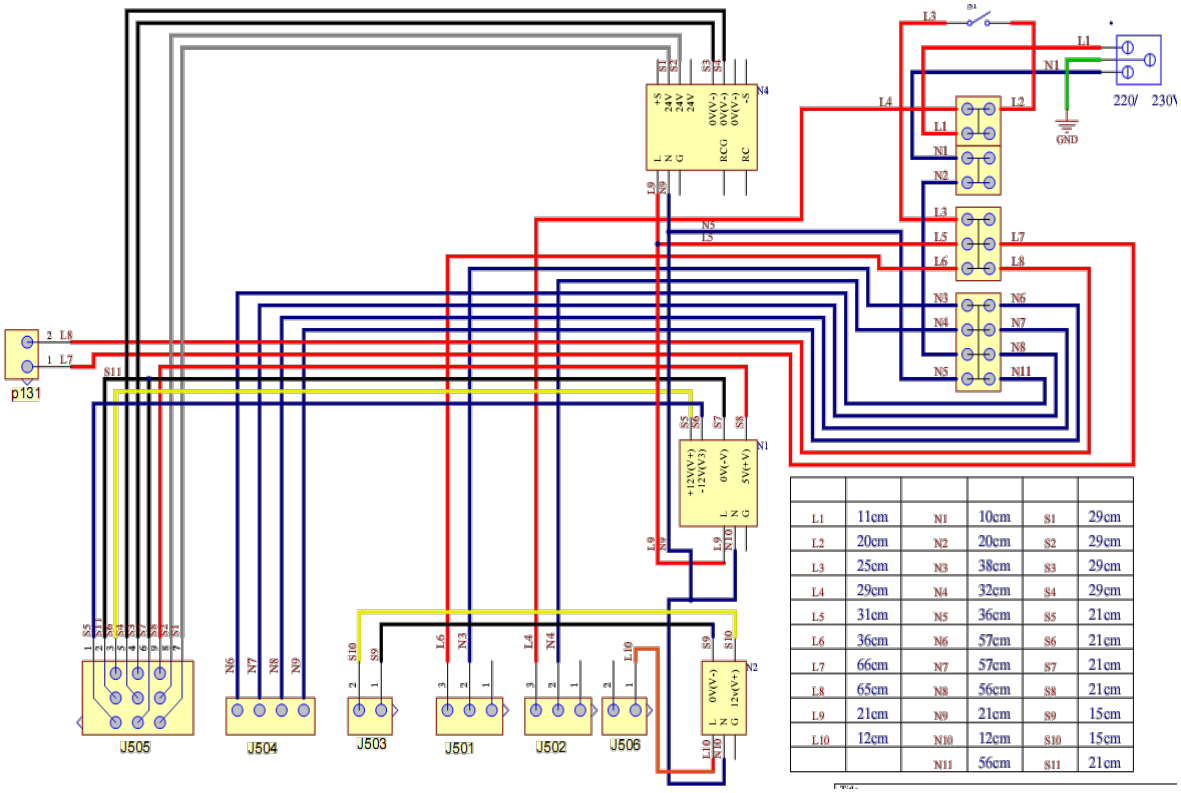
PCB Name	Function Description	Circuit board No.
Main control board	1. Carrying on the communications between upper and lower machine, and that with cooling board. 2. Magnetic valve control：SV6、SV10、SV13 3. Monitoring of high and low temperature water tanks 4. Monitoring of incubation bath and vacuum tank liquid level 5. AD board data processing 6. Solid-state relay board control	
Reaction disk Circuit board	1. Communications with the main control board 2. The reaction disk rotation mechanism control	
Reagent&sample disk circuit board	1. Communication with the main control board 2. Sample&reagent probe mechanism control 3. Sample&reagent disk control 4. Injection pump control 5. Magnetic valve control: SV5、SV9	
Stirring board rinsing	1. Communication with the main control board 2. Stirring mechanism control 3. Rinsing mechanism control 4. Magnetic valve control: SV1、SV2、SV3、SV4、SV7、SV8、SV11	
AD board	12 AD-wavelength data collection	

ISE Circuit board	1. Communication with the main control board 2. ISE pump motor control 4. Magnetic valve control: ISV1、ISV2、ISV3、ISV4 5. ISE preamp board data collection	
Solid relay board	1. 37℃constant temperature heater control（200W） 2. Water tank heater control（200W） 3. Gear pump control 4. Water circulation pump 7. Halogen lamp control	
refrigeration board	1.Semiconductor refrigeration control and temperature display 2.Semiconductor current monitoring and current value display 3. Fan control	
Level detecting board	1. Sample reagent probe liquid level detection 2. Incubation bath liquid level detection 3. Alkaline detergent liquid level detection 4. Vacuum liquid level detection	
ISE Preamp board	K、Na、Cl electrode preamp	
Mother board	1. Providing reaction disk board, sample reagent board, rinsing stirring board, main control board, ISE board with connection and power supply. 2. Communication among circuit panel	

6.4 Instrument electrical principle wiring and function

6.4.1 Communication system and switch power

1. Wiring



L1	11cm	N1	10cm	S1	29cm
L2	20cm	N2	20cm	S2	29cm
L3	25cm	N3	38cm	S3	29cm
L4	29cm	N4	32cm	S4	29cm
L5	31cm	N5	36cm	S5	21cm
L6	36cm	N6	57cm	S6	21cm
L7	66cm	N7	57cm	S7	21cm
L8	65cm	N8	56cm	S8	21cm
L9	21cm	N9	21cm	S9	15cm
L10	12cm	N10	12cm	S10	15cm
		N11	56cm	S11	21cm

2. Function

As shown in above figure:

Power input: ~220V

L1、N1: AC power filter　　S1:　power switch

G1: power filter connecting with the ground of bottom-board

P131: AC port of solid state relay board

J501: fan port of AC system　　J502: AC power port of cooling system

J503: power Supply Port of Halogen lamp　　J504: Zero line port

J505: power switch of circuit board box　　J506: power port of solid state relay board

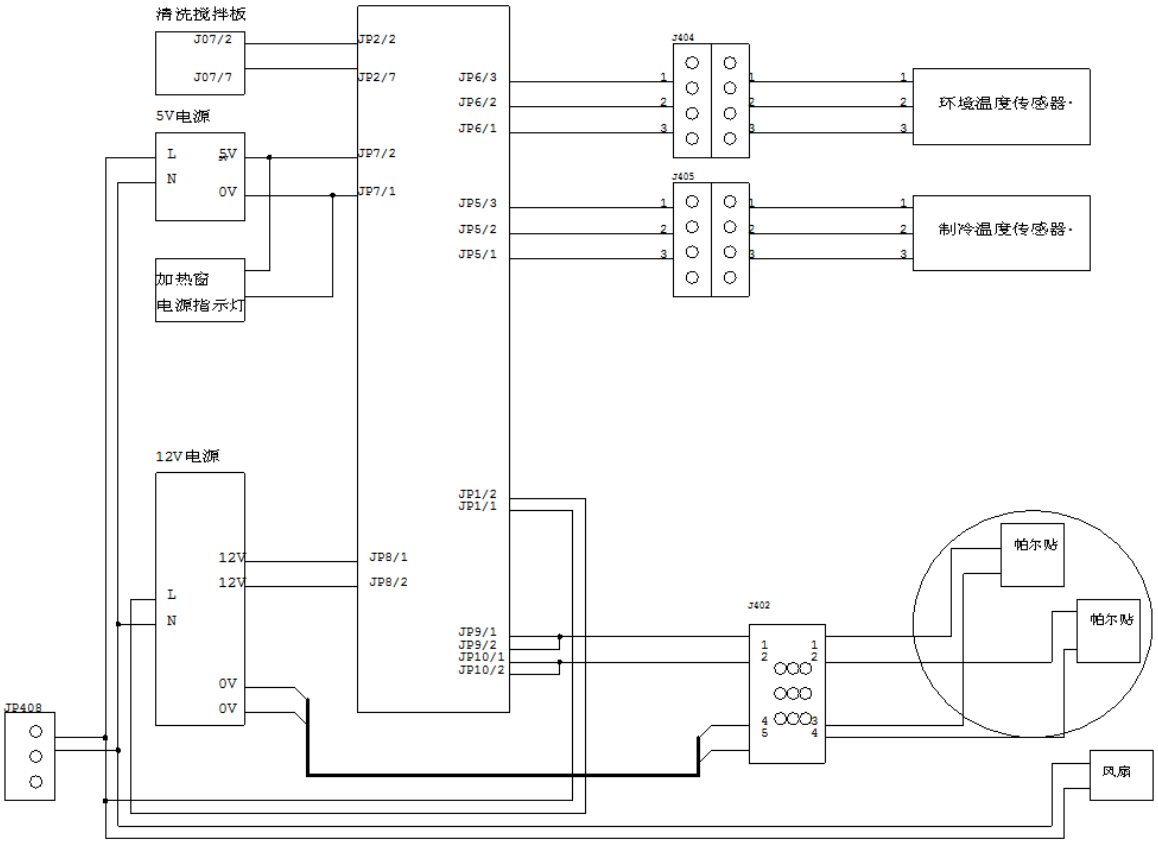
N1:±12V, 5V switch power, power supply for the mother board of circuit board

N2: 12V switch power，power supply for halogen lamp

N4: 24V switch power，power supply for step motor

6.4.2 Refrigeration system

1. Wiring



2. Function

Refrigeration system is composed of semiconductor refrigeration module, radiator, fan.

The main function of refrigeration board is controlling the semiconductor refrigeration module, to keep the reagent disk temperature within 6-10℃.

As shown in the figure :

U1：refrigeration control board is the CPU of refrigeration system. It controls the working of refrigeration system on the basis of the reagent disk temperature detected by temperature sensor. Semiconductor refrigeration module and fan are controllable. The refrigeration control board starts when the temperature beyond 6-10℃ to adjust the temperature. It also communicates with the main control board.

DS18B20：the sensor used to detect the reagent disk and environment temperature

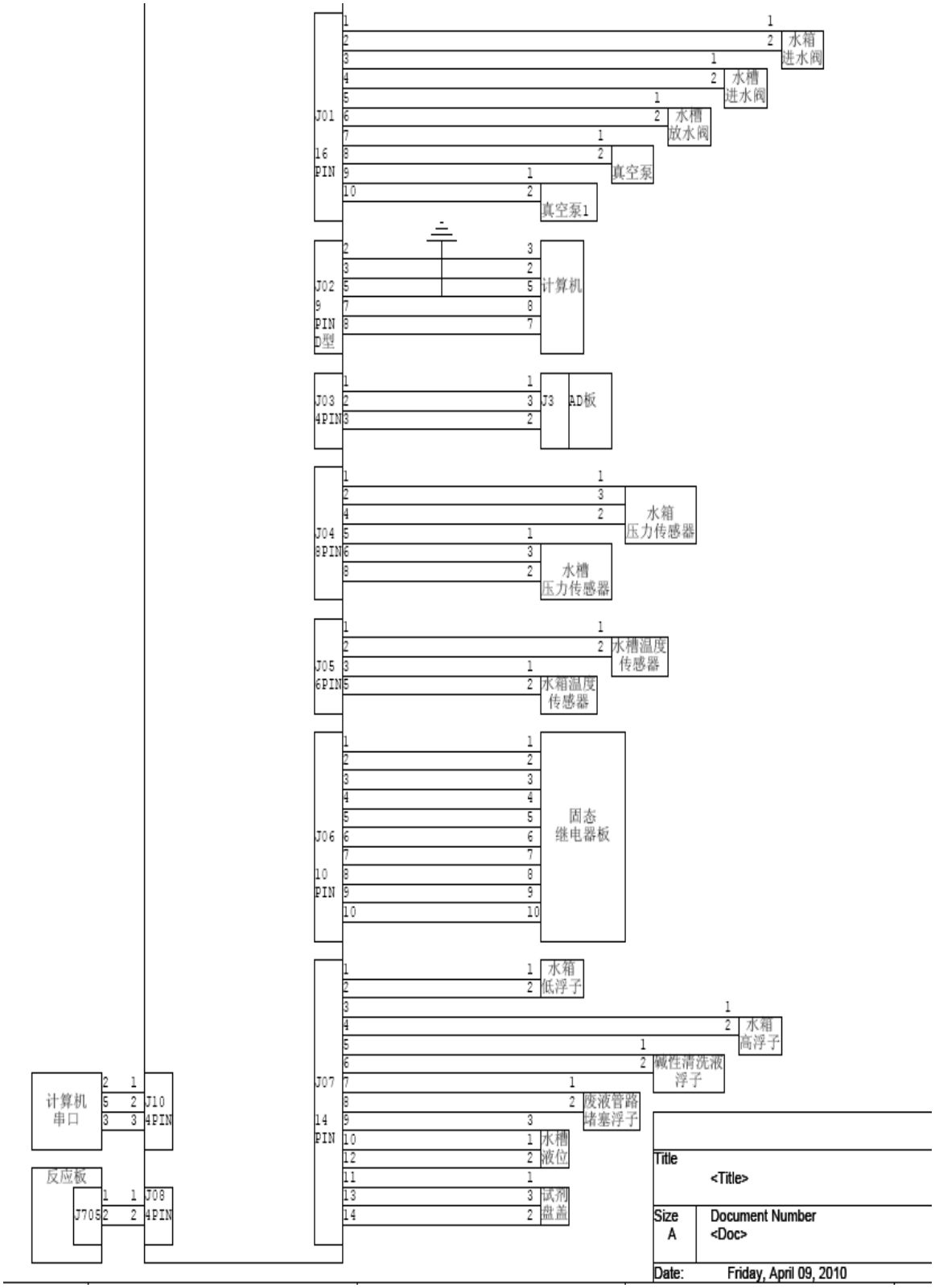
D1－D2：semiconductor cooling module（Peltier）

N3：12V switch power

N2：5V switch power

6.4.3 Main control board

1.Wiring


J01
16
PIN
水箱
进水阀
水槽
进水阀
水槽
放水阀
真空泵
真空泵1
J02
9
PIN
D型
计算机
J03
4PIN
J3
AD板
J04
8PIN
水箱
压力传感器
水槽
压力传感器
J05
6PIN
水槽温度
传感器
水箱温度
传感器
J06
10
PIN
固态
继电器板
J07
14
PIN
水箱
低浮子
水箱
高浮子
碱性清洗液
浮子
废液管路
堵塞浮子
水槽
液位
试剂
盘盖
计算机
串口
J10
4PIN
反应板
J708
J08
4PIN
Title
<Title>
Size
A
Document Number
<Doc>
Date:
Friday, April 09, 2010

2. Function

Communicate with PC through serial port to transmit data, command and alarm information.

Transmit data and command with reaction disk board, sample&reagent disk board, ISE board, refrigeration board and AD board communication through mother board.

As shown in figure:

Solenoid Valve:

Refer to 5.2.1

SV6 －water inlet valve of incubation bath

SV10－ water outlet valve of incubation bath

SV13－water inlet valve of water tank

J01：control port of vacuum pump, valve.

J02：communication port with computer（COM port）

J03：AD board data collection port

J04：pressure sensor of water tank, incubation bath.

J05：temperature sensor of water tank, incubation bath.

J06：solid state relay board port .

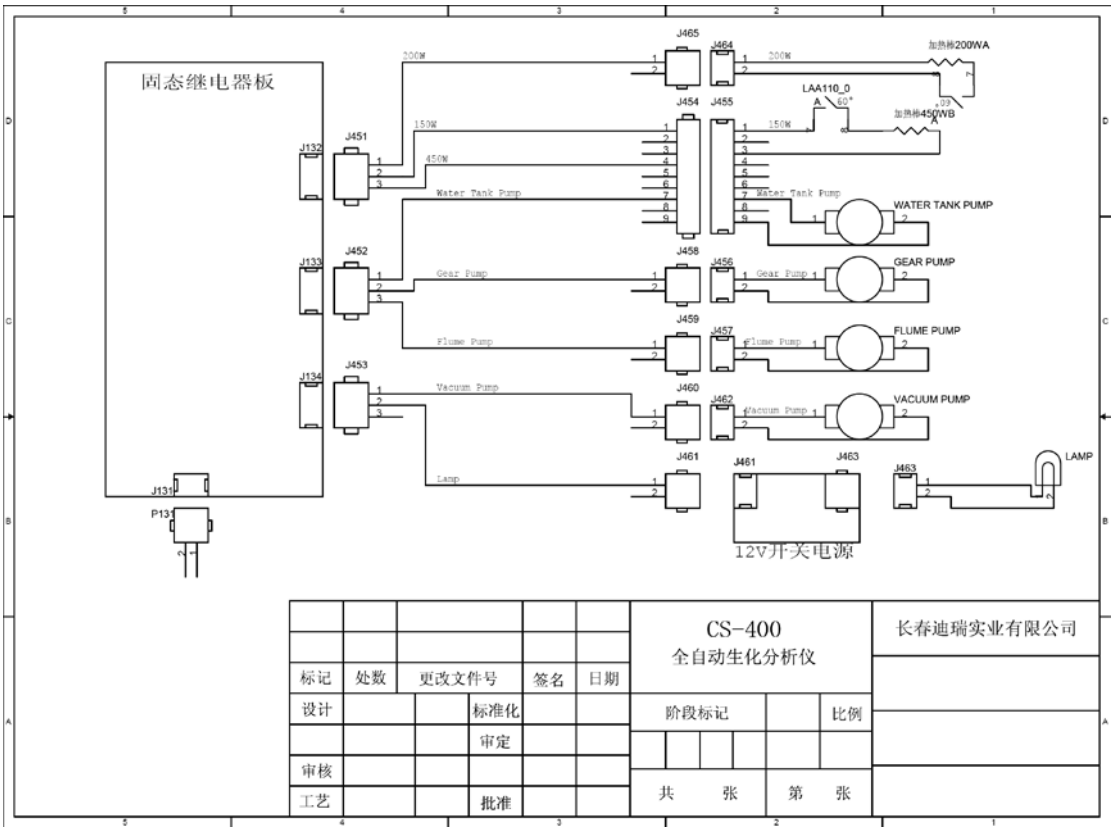
J07：float and liquid level signal interface.

J10：serial port monitor communication port.

J705：optocoupler signal interface of reaction disk.

6.4.4 Solid state relay board

1. Wiring



2. Function

Its main function is to control the solid state relay through main board to turn on and turn off the pump ，motor, heater and lamp.

As shown in figure ：

Heater 200WA：water heater of incubation bath

WATER TANK PUMP：water circulation pump of water tank

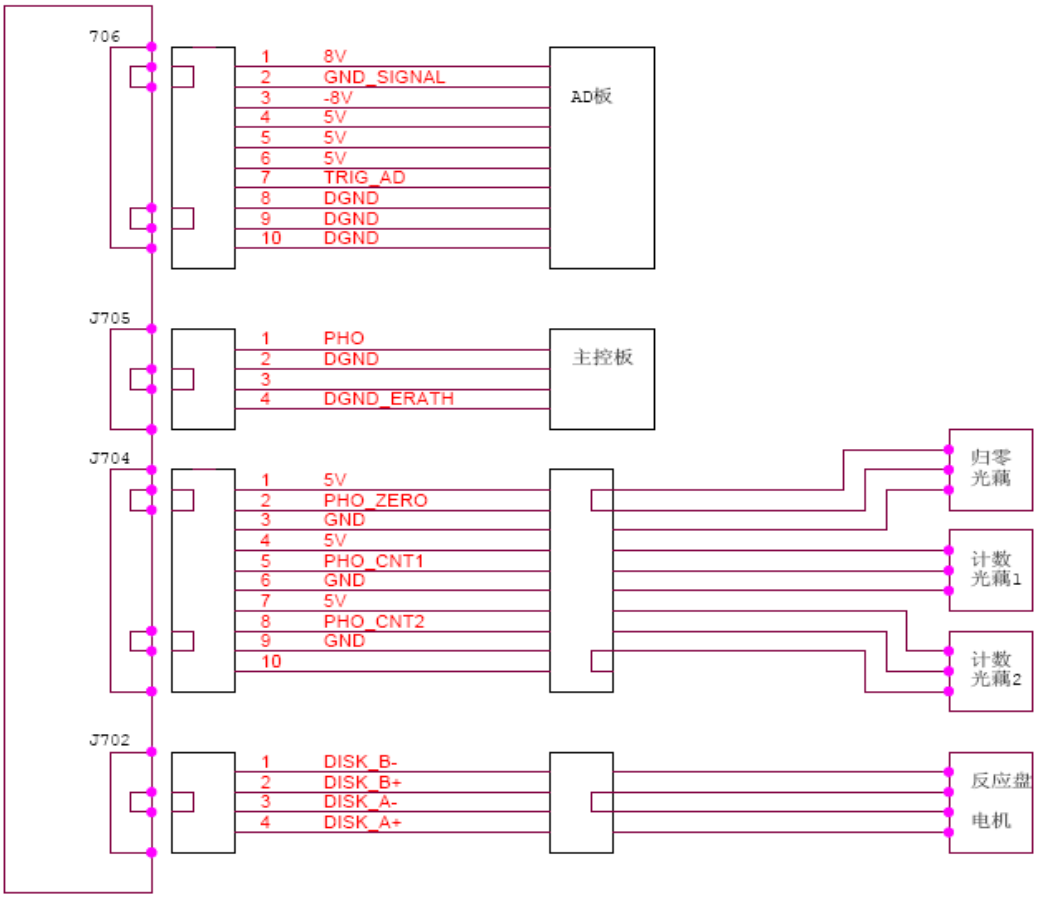
GEAR PUMP：gear pump

FLUME PUMP：water circulation pump of incubation bath

LAMP：Halogen lamp

6.4.5 Circuit board of reaction disk

1. Wiring



反应盘电机连线图

2. Function

The main function of circuit board of reaction disk is to receive the command from the main control board, communicate with the main control board, transmit data and alarm command.

Controlling sample&reagent unit includes sample&reagent disk rotation, probe unit running.

Barcode scanning of sample&reagent disk

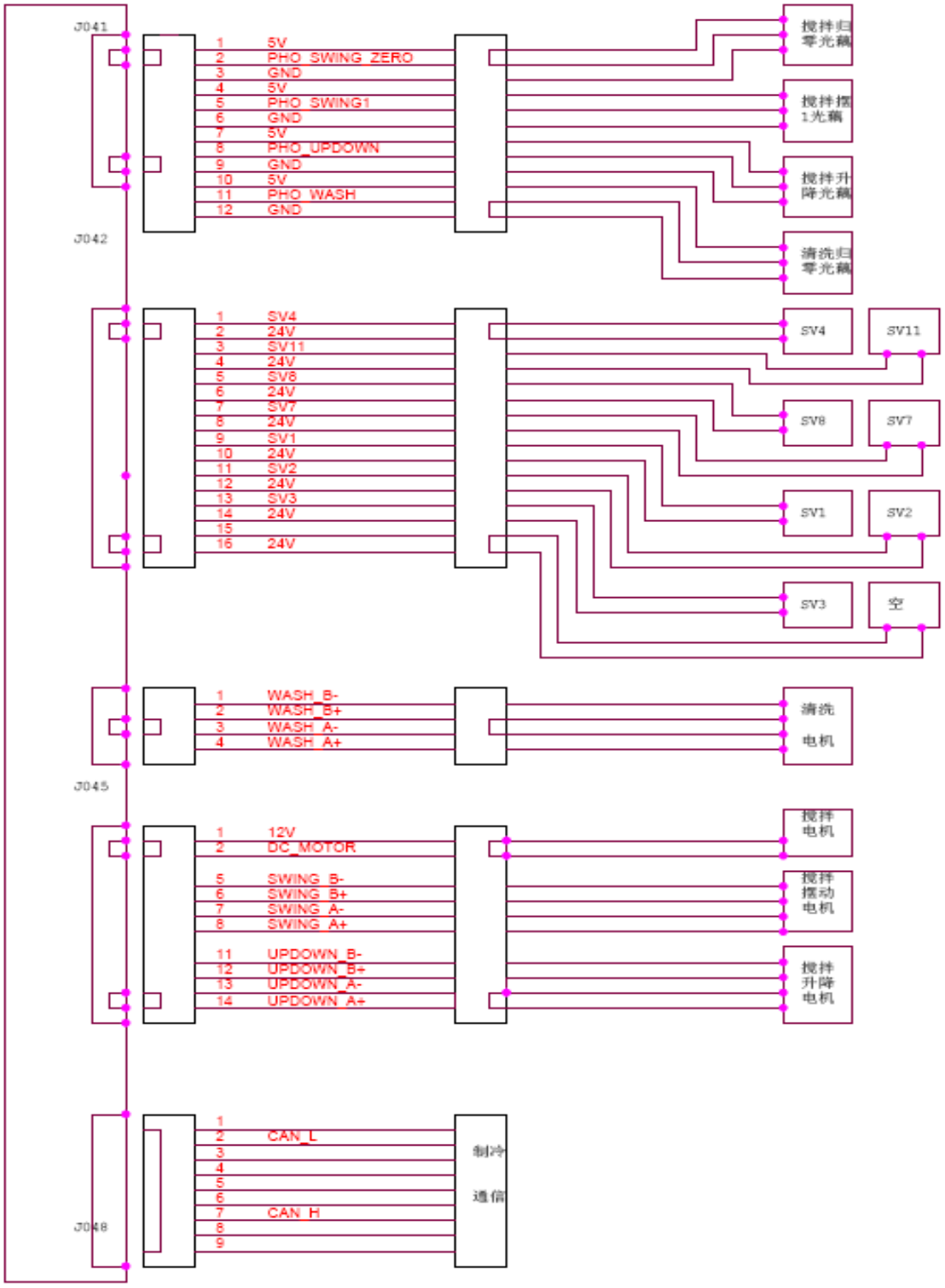
J702：motor drive port of reaction disk

J704：signal receiving port of reaction disk clear optocoupler, count optocoupler. J705：output port of reaction disk count optocoupler

J706：output control signal port with AD board

6.4.6 Rinsing mixing circuit board

1. Wiring



清洗搅拌电路连线图

2. Function

The main function of rinsing mixing circuit board is to receive the command from the main control board, communicate with the main control board, transmit data and alarm command.

Controlling sample&reagent unit includes sample&reagent disk rotation, probe unit running.

Barcode scanning of sample&reagent disk

As shown in figure：

J041: signal port of rinsing mixing optocoupler

J042: drive port of solenoid valve

J045: stirring motor control port.

J048: communication port with cooling board

Solenoid valve：refer to 5.2.1

SV1：cuvette rinsing probe（the second one）control solenoid valve

SV2：cuvette rinsing probe（the third one）control solenoid valve

SV3：cuvette rinsing probe（the fourth one）control solenoid valve

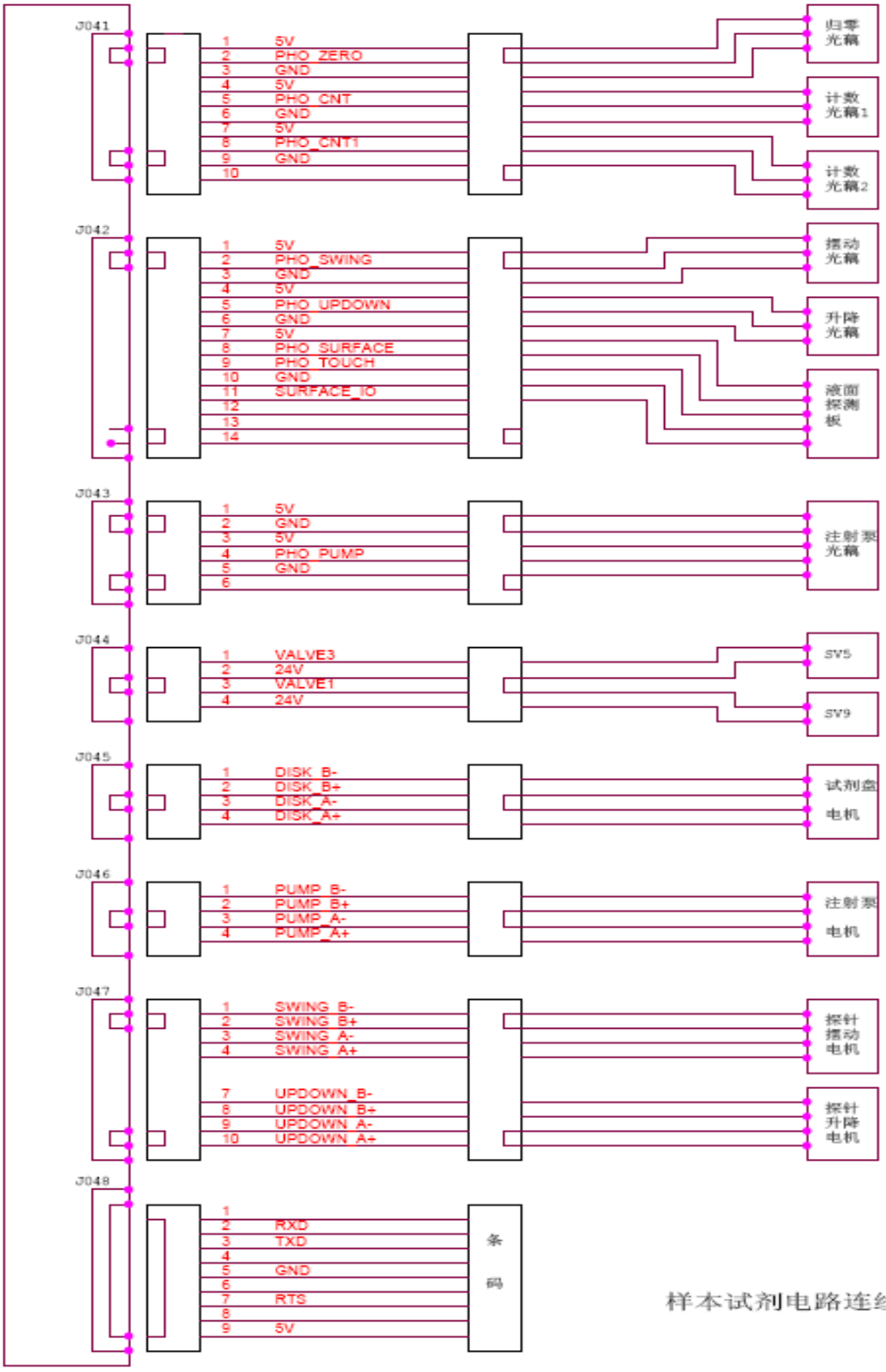
SV4：stirring rod rinsing control solenoid valve

SV7，SV8：cuvette rinsing probe（the first one）control solenoid valve

SV11：cuvette vacuum control solenoid valve

6.4.7 Circuit board of sample&reagent disk

1. Wiring



样本试剂电路连线图

2. Function

Receive the command from the main control board, communicate with the main control board, transmit data and alarm command.

Controlling sample&reagent unit includes sample&reagent disk rotation, probe unit running.

Barcode scanning of sample&reagent disk

As shown in figure ：

J041: signal port of sample&reagent disk optocoupler

J042: signal inlet port of probe position limit optocoupler and liquid level detection optocoupler

J043: signal inlet port of injection pump optocoupler

J044: SV5,SV9 drive signal port of solenoid valve

J045: motor drive port of sample&reagent disk

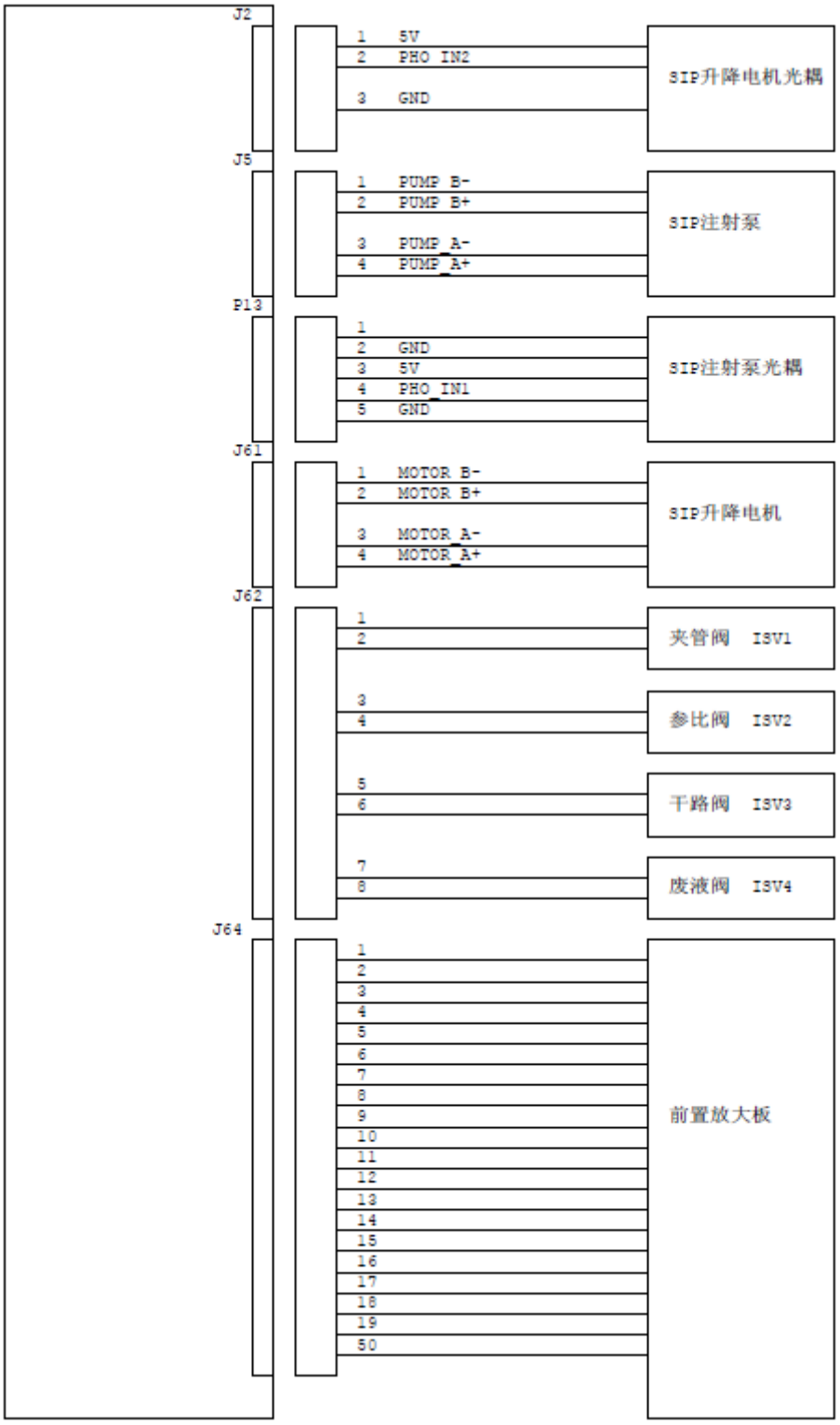
J046: motor drive port of injection pump

J047: motor drive port of probe

J048: communication port of barcode scanning

6.4.8 ISE circuit board

1. Wiring



2. Function

The instrument add calibrator into the reaction cuvette.The SIP injection pump aspirate the calibrator, and pump it into the Na、K、Cl electrode pipeline of the reaction tank. Test the electric potential on the basis of reference electrode. The sample probe aspirates sample and diluent, and pump it into the reaction cuvette. Test the electric potential, and the concentration can be calculated.

J2：optocoupler port of aspirate nozzle elevator mechanism

J5：motor port of proportioning pump

P13：optocoupler port of proportioning pump

J61：motor port of aspirate nozzle elevator mechanism

J62：solenoid valve port

J64：preamplifier board port

ISE preamplifier board：amplify electrode signal

Chapter 7 Maintenance

In order to ensure reliable system performance, excellent working status and span, please conduct system operation and regular maintenance strictly in accordance with the requirements in the service manual. Learning maintenance and overhaul of this chapter is also very important and in-depth study will enable the instrument to achieve the best running status and exert the best performance.

Warning:

Do not carry out maintenance this chapter doesn't mention. Otherwise, it could lead to system damage and personal injury.

Do not touch any other parts except user self-operation and maintenance which are clear recorded.

Unauthorized repair of the system may lead to system damage and personal injury, and commitment term of the repair contract is no longer valid.

Upon completion of maintenance work, make sure the system is working normally.

Do not splash water, reagent and other liquid onto the system's mechanical or electrical parts.

Biological contamination danger :

In the process of maintenance work, be sure to wear gloves, put on work clothes to prevent them from being infected and, if necessary, wear protective glasses.

7.1 Maintenace preparation

Tools, high concentrate detergent and alcohol maybe used in maintenance.

1.Tools

- One set of hexagon wrench
- Cruciform Screwdriver (large, medium and small)
- Injection needle hose
- Small tweezers
- Clean gauze

2. High concentrate detergent

- Acid detergent，0.1mol/L hydrochloric acid
- Alkaline detergent，0.5％(V/V) sodium hypochlorite

Warning:

Acidic high concentrate detergent and alkaline high concentrate detergent mixed generate poisonous gas. Do not mix them.

Caution:

Following high concentrate detergent designated by Dirui:

Acidic high concentrate detergent: 0.1mol / l hydrochloric acid; alkaline high concentrate detergent: 0.5% (V / V) sodium hypochlorite.

Please use the high concentrate detergent designated by Dirui. If undesignated types of high concentrate detergent are used, inappropriate analysis results might be received.

Dirui recommends the use of alternating acidic and alkaline high concentrate detergent, for example, use acidic high concentrate detergent after power on, then use alkaline high concentrate detergent next time after power on.

7.2 Daily maintenance

7.2.1 Check injection pump

The purpose of checking the injection pump is check whether leakage exists.

1 Make sure that Power of analysis part has been switched off.

2 The injection pump can be seen in figure.

3 Observe whether the injection pump is leaking.

If so, check the leakage causes, and check the pipeline and connector timely.

7.2.2 Check/rinse sample & reagent probe

1 In online status, click “Instrument resetting” in “Maintenance”, and instrument executes resetting.

2 When cleaning samle**&**reagent probe, carefully observe whether the outflow of sample**&**reagent probe internal wall is continuous, whether the direction of flow is consistent with the sample**&**reagent probe and the outflow of external wall is continuous, and whether water volume is normal.
If not normal, clean sample**&**reagent probe(refer to 7.3.1)

If still not normal, check the corresponding liquid line channel; check whether water supply of water tank and water pressure is normal.

7.2.3 Rinsing stirring rod

1 In online status, click “Instrument resetting” in “Maintenance”, and instrument executes resetting.

2 When cleaning, carefully observe whether the stirring rod works normally, If not normal, check the corresponding liquid line channel, check whether water supply of water tank and water pressure is normal.

7.2.4 Rinse rinsing mechanism

1 In online status, click “Rinse reaction cuvette” in “Maintenance”, and instrument executes reaction cuvette rinsing.

2 When rinsing, carefully observe rinsing probe working and whether probe infusing is normal and assimilating is completely.

If infusing abnormal, check pressure value of water infusing pressure gauge

If assimilating abnormal, check pressure value of assimilating vacuum

7.2.5 Check waste connection and discharging

1

Biological contamination danger:

During waste water operation, please put on gloves, put on work clothes and if necessary, wear protective glasses.

Check whether liquid waste disposal system is normal every day, and maintain waste liquid pipe is not bent and discharges smoothly and high and low concentration waste liquid are disposed properly (refer to local standards of dispose waste liquid).

7.2.6 Rinse instrument surface

1 Check whether liquid waste disposal system is normal every day, and maintain waste liquid pipe is not bent and discharges smoothly and high and low concentration waste liquid are disposed properly (refer to local standards of dispose waste liquid).

7.2.7 Check printer and printing paper

1 Check printer power supply indicator, preparation indicator and printing paper daily.

7.3 Weekly maintenance

7.3.1 Rinse sample reagent probe

Warning:

Please be careful to avoid hands from being scratched

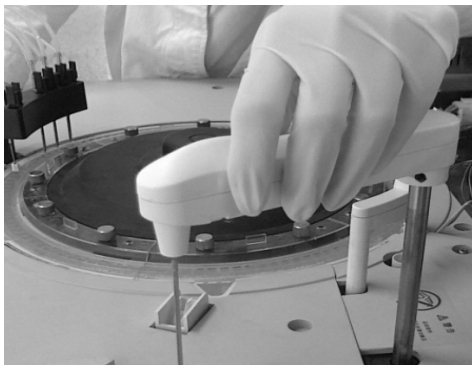
Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best.

Do not dispose the gauze used to clean sample probe at your own will, please follow the relevant provisions for proper disposal.

1 Make sure the analysis part power supply is switched off.

2 Lift the rotating arms of samle&reagent probe by hands to the top position, and rotate it to the top of sample&reagent storehouse for convenient operation.



3

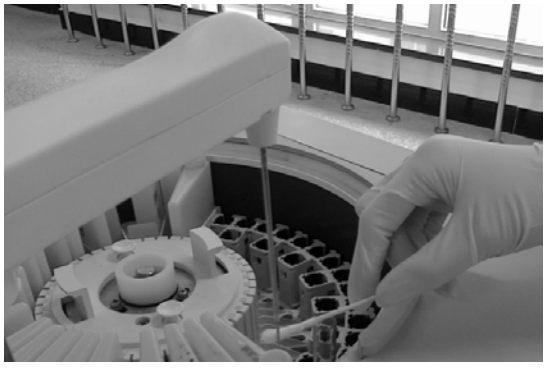
Caution:

When cleaning, do not touch directly the probe surface to prevent probe scratch; avoid too much hand force to prevent deformation of the samle&reagent probe.

Note:

Acidic and alkaline detergent can be used alternatively, for instance, acidic detergent is used at previous time maintenance, use alkaline detergent at this time maintenance.

Wipe the external walls of sample&reagent probe lightly with cotton stick moisturized with alcohol, especially the point of probe, until no impurities left at all.



4 Wipe sample&reagent probe with the gauze dipped with deionized water.

5 After cleaning, lift the rotating arms of sample&reagent probe to the top position, and rotate the rotating arm of sample&reagent probe to locate the sample&reagent probe above the rinsing bath of sample&reagent probe.

Caution:

After cleaning the surface of a sample&reagent probe, please make sure sample&reagent probe must be rotated to the top of sample&reagent probe rinsing bath.

6 Switch on the power of analysis part and wait 30 seconds, enter the "maintenance - routine maintenance" column to implement “instrument resetting", the system will automatically reset the sample**&**reagent probe and rinse them with deionized water.

7.3.2 Rinse stirring rod

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best.

Do not dispose the gauze used to clean stirring rod at your own will, please follow the relevant provisions for proper disposal.

1 Make sure the analysis part power supply is switched off.

2 Lift the stirring rod by hands to the top position, and rotate its rotating arm to a position for convenient operation.

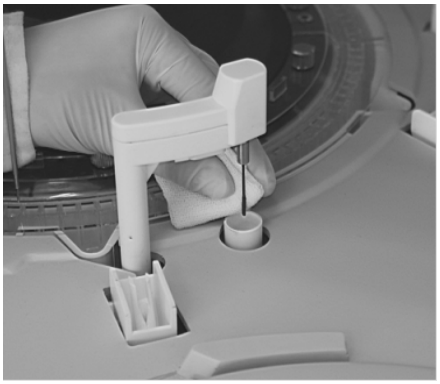
Caution:

When cleaning, do not touch the stirring rod surface directly to prevent scratch; avoid too much hand force to prevent deformation of the sample**&**reagent probe.

Note:

Acidic and alkaline detergent can be used alternatively, for instance, acidic detergent is used at previous time maintenance, use alkaline detergent at this time maintenance.

Wipe the surface of stirring rod lightly with cotton stick moisturized with alcohol, especially the point of probe, until no impurities left at all.



4 Wipe stirring rod with the gauze dipped with deionized water

5 After cleaning, lift the rotating arm of stirring rod to the top position, and rotate the rotating arm of stirring rod to locate the stirring rod to the top of the rinsing bath.

6 Switch on the power of analysis part and wait 30 seconds, enter the "maintenance - routine maintenance" column to implement “instrument resetting", the system will automatically reset the sample&reagent probe and rinse them with deionized water.

7.3.3 Sample/ barcode window rinsing

Caution:

Do not gaze scanning laser light, or it may cause eyes injury

1 Make sure the analysis part power is switched off.

2 Remove the reagent sample disk cover, and then remove the sample&reagent disk.

3 Wipe the scanning glass window lightly with gauze dipped with deionized water.

4 Remount the sample&reagent disk and cover them.

5 Switch on the analysis part and wait 30 seconds, the system will reset automatically.

7.3.4 Rinse reaction cuvette

The contamination of sample&reagent probe, stirring rod and reaction cuvette will affect the accuracy of measurement. The reaction cuvette requires intensive rinsing.

1 Place 70 ml detergent (1mol of hydrochloric acid or 0.5% NaOH solution, use the two types of solution alternatively, one week one solution) at the 45th detergent position of sample&reagent disk.

2 Click “Maintenance” functional key to enter “System maintenance” menu, and select “Rinse reaction cuvette” to execute.

7.4 Monthly maintenance

7.4.1 Rinse sample&reagent probe rinsing bath

Warning:

Please be careful to avoid being scratched by probe.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best.

Do not dispose the gauze used to clean sample**&**reagent probe.rinsing bath at your own will, please follow the relevant provisions for proper disposal.

1 Make sure the analysis part power is switched off.

2 Lift the rotating arm of sample&reagent probe by hands to the its top position, and rotate its rotating arm to keep reagent&sample probe away from rinsing bath for convenient operation.

3 Clean the inside and appearance of sample&reagent probe rinsing bath with clean cotton stick.

4 After cleaning, lift the rotating arm of sample&reagent probe to the top position, and rotate the rotating arm of sample&reagent probe to locate the probe to the top of the rinsing bath.

Caution:

After the work of sample&reagent probe surface rinsing, please make sure to rotate reagent&sample probe to the top of reagent&sample probe rinsing bath.

5 Switch on the power of analysis part and wait 30 seconds, enter the "maintenance - routine maintenance" column to implement “instrument resetting", the system will automatically reset the sample&reagent probe.

7.4.2 Rinse stirring rod rinsing bath

Warning:

Please be careful to avoid being scratched.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best.

Do not dispose the gauze used to clean **stirring rod** at your own will, please follow the relevant provisions for proper disposal.

1 Make sure the analysis part power is switched off.

2 Lift the stirring arm to the top position by hand to one side of rinsing bath.

3 Wipe stirring rod with clean soft gauze.

7.5 Every 6 months maintenance

7.5.1 Check light source lamp

Lamp light source of optical system will gradually be aged in use, and will cause an increase in noise during measurement. If the cuvette blank and light source intensity attenuation is out of range or the working time of light source lamp accumulates over 2000 hours, the light source lamp should be checked.

Caution：

Please use consumables recommended by DIRUI company, using other consumables may cause system performance degradation.

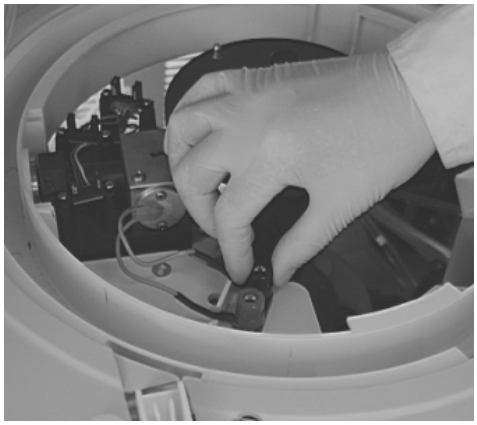
Do not touch the light source lamp shell surface and lens in front of the light source lamp by hand, because it may change the characteristics of the light source. If you accidentally make noodle stained with filth, absorbent cotton dipped by absolute alcohol can be used to clean it.

1 Turn off the system main power, so that the light source box and light source lamp will be cooled for at least 15 minutes.

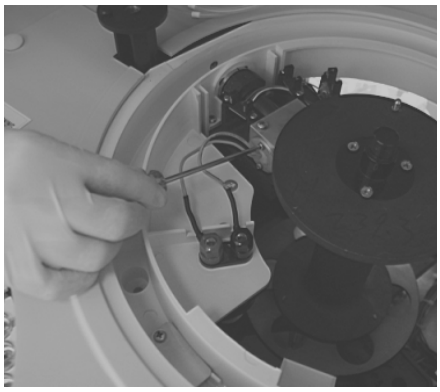
Warning:

High-temperature light source lamp and light box will cause burn. Operation is carried out only after the light source and light source lamp are cooled.

2 Loosen the fixing screws of rinsing mechanism; remove the rinsing mechanism of reaction cuvette. Loosen the setscrews of reaction disk and remove the reaction disk. Place the reaction cuvette at dry and clean position. Loosen the two fixing wire connecting poles of halogen and remove down-lead.



3 Loosen the two screws fixing light source seat to remove halogen lamp.



4 Mount a new halogen lamp according to the above opposite steps; pay attention to tighten the screws. The cooling rubber hose in the lamp room can not be twisted and down-lead can not be loosed or cocked.

5 Remount the reaction disk, the reaction cuvette and rinsing mechanism; switch on the power supply of analysis part. After standby mode, single-click “Next” in “System maintenance” window; infuse purified water into reaction groove. After instrument standby mode, execute light quantity check function. Check the back of halogen lamp if the light quantity conforms to the requirement to start test.

7.6 Every year maintenance

7.6.1 Check water of cooling system

7.7 Irregular check

7.7.1 Rinse sample reagent probe

If the water flow is not normal when rinsing sample&reagent probe, sample&reagent probe,the probe may have been blocked and cleaning is needed to reagent&sample probe.

Warning:

Please be careful to avoid being scratched.

Biological contamination danger:

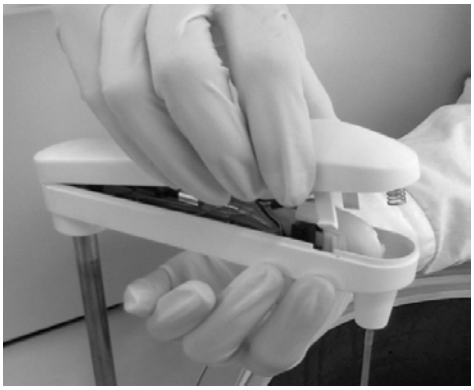
In operation, please put on gloves, work cloths, and put on protective glasses for the best.

1 Make sure the analysis part power is switched off.

2 Remove sample&reagent disk cover and then sample&reagent disk

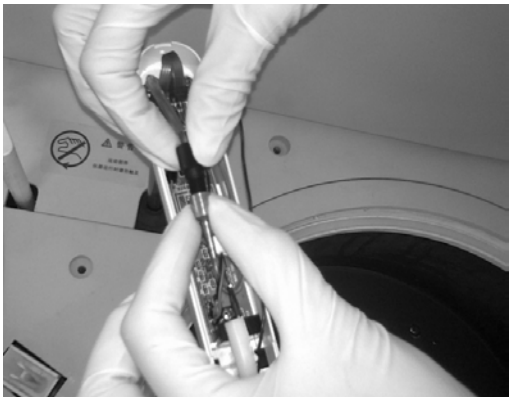
3 Lift the rotating arm of sample&reagent probe by hands to its top position, and rotate its rotating arm to keep sample&reagent probe away from rinsing bath for convenient operation.

4 Hold shell claw of probe rotating arm with fingers and lift to remove.



5

6 Loosen pipeline interface



7

warning:

Carefully place dismounted sample reagent&probe and prevent it scratching human body and sample&reagent probe damage.

Note:

Take out sample reagent&probe from the rotating arm and be careful to operate to avoid the damage of probe point caused by touching rotating arm.

Note:

Sample&reagent probe is precisely processed to ensure the sample and reagent adding precision. If the probe point is damaged or bent, checking sample&reagent probe is a must, or no guarantee can be made for test precision.

7.7.2 Clean sample&reagent probe

Warning:

Please be careful to avoid being scratched by probe.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best.

Do not dispose the gauze used to clean sample&reagent probe at your own will, please follow the relevant provisions for proper disposal.

1 Put a stainless steel wire through the sample&reagent probe point to clean the impurity in the probe.

Caution：

Sample&reagent probe is precisely processed to ensure the sample and reagent adding precision. If the probe point is damaged or bent, checking reagent&sample probe is a must, or no guarantee can be made for test precision.

7.7.3 Install sample&reagent probe

Warning:

Please be careful to avoid being scratched by probe.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best

Dismounting sequence is opposite to that of sample&reagent probe.

Caution:

Sample&reagent probe is precisely processed to ensure the sample and reagent adding precision. If the probe point is damaged or bent, checking sample reagent probe is a must, or no guarantee can be made for test precision.

7.7.4 Rinse sample&reagent probe

When it is found that the water level of rinsing bath is too high when rinsing sample&reagent probe because of no discharging available, which may be caused by the blocked leaking hole. Cleaning sample &reagent rinsing bath is necessary.

Warning：

Please be careful to avoid being scratched by probe.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best

1 Make sure the analysis part power is switched off.

2 Lift the rotating arm of sample&reagent probe by hands to its top position, and rotate its rotating arm to keep sample&reagent probe away from rinsing bath for convenient operation.

3 Infuse about 1ml alkaline detergent of 0.5% (V / V) sodium hypochlorite or 84 disinfectant into rinsing bath for 10 minutes.

4 Switch on the power supply of analysis part

5 Lift the rotating arm of sample&reagent probe by hands to its top position, and rotate its rotating arm to keep sample&reagent probe above the rinsing bath of sample&reagent probe.

Caution:

Please rotate the sample&reagent probe to the top of sample& reagent probe rinsing bath after clean rinsing bath of sample &reagent probe.

6 Select and execute “Instrument resetting” after enter “Maintenance-routine maintenance”, and the system will reset sample &reagent probe and rinsing bath will be rinsed with deionized water automatically. Observe the outflow of reagent&sample probe rinsing bath.

7.7.5 Rinse stirring rod

If the stirring rod is damaged, please check stirring rod in accordance with following steps strictly.

Warning：

Please be careful to avoid being scratched by probe.

Any touch is forbidden except at the knurling of it only by hand when checking, and prevent any scratch on the flat part of stirring part.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best

Please deal with removed stirring rod properly.

Caution:

Please use consumables recommended by DIRUI company, using other consumables may cause system performance degradation.

1 Make sure the analysis part power is switched off.

2 Prepare a new stirring rod and wipe the flat part of it with gauze or cotton stick dipped with cleaning liquid, and then wipe it with gauze dipped with deionized water.

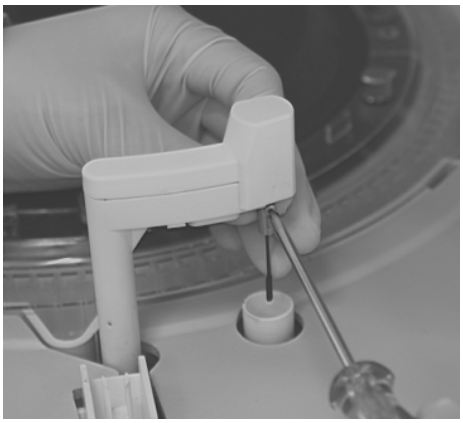
3 Lift the rotating arm of stirring rod by hands to its top position, and rotate its rotating arm for convenient operation.

4

Caution:

When pulling out stirring rod, make sure the direction of force is vertical to that of axis of rotating arm. Lateral force may damage the axis or stirring rod.

Remove stirring rod after loosen the two fixing screws.



5 Prepare a new stirring rod, and wipe the front of the stirring rod with gauze dipped with 2% -antibacterial detergent.

6 When mounting new stirring rod, insert stirring rod till the bottom of motor axis and tighten it with M2 screw.

Caution:

When inserting stirring rod, make sure the direction of force is vertical to that of axis of rotating arm. Lateral force may damage the axis or stirring rod.

Pushing the stirring rod completely

7 After stirring rod check, visually check whether stirring rod and its rotating arm are vertical with each other.

If not vertical, return to step 5 and remount the stirring rod.

If vertical, continue to next.

8 Lift the rotating arm of stirring rod by hands to its top position, and rotate its rotating arm to the top of its rinsing bath.

Caution:

Please make sure to rotate stirring rod to its rinsing bath top after mount it.

9 Switch on the power of analysis part and wait 30 seconds, enter the "maintenance - routine maintenance" column to implement “instrument resetting", the system will automatically reset the sample&reagent probe and rinse it with deionized water. Observe the outflow of reagent&sample probe.

7.8.6 Check reaction cuvette

Warning：

Please be careful to avoid being scratched by sample&reagent probe.

Place each probe and pole into proper position for convenience.

Biological contamination danger:

In operation, please put on gloves, work cloths, and put on protective glasses for the best

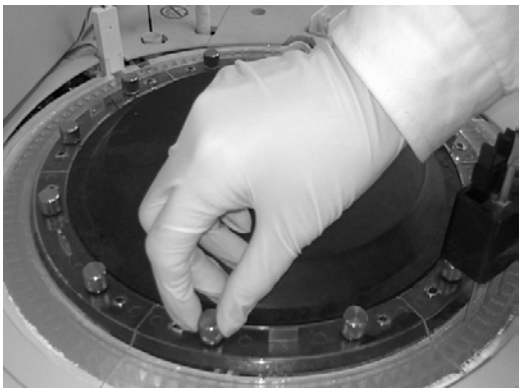
Please deal with removed reaction cuvette properly which is broken.

Caution：

Please use consumables recommended by DIRUI company, using other consumables may cause system performance degradation.

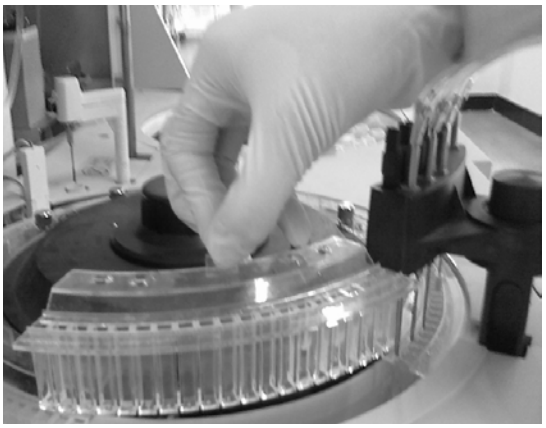
1 Make sure the analysis part power is switched off.

2



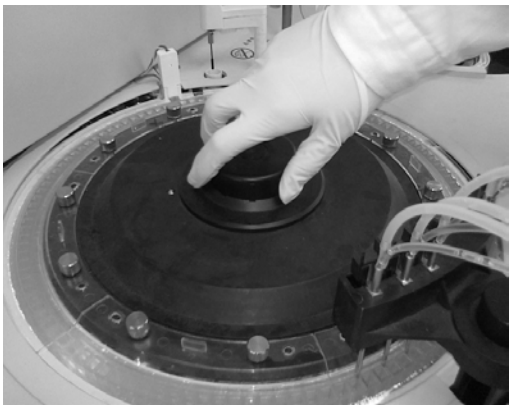
Put on protective gloves to remove fixing screws.

3 Rotate reaction disk by hand and remove the reaction cuvette sequently. Take out reaction cuvette while rotating it.



4 Rinse the new reaction cuvette dipped in with water; rinse inside and outside of reaction cuvette and no scratch is allowed.

5 Rotate reaction disk by hands, and mount new reaction cuvette on reaction disk and check the six sets reaction cuvette simultaneously.



6 Mount reaction disk with the opposite steps and make sure the fixing screw of reaction disk is tight.

7 Switch on the power of analysis part

Select and execute “cuvette blank test” after click “System maintenance”, and observe execution result and reaction status.

Chapter 8 Analysis Method

CS-T240 adopts three analysis methods as follows:

End point analysis method

Two-points analysis method

Rate analysis method

8.1 Analysis principle

The analysis principle of auto-chemistry analyzer is based on the Beer-Lambert law that material absorpts light selectively.

The main principle is: When monochromatic light with specific wavelength passes through the cuvette with sample, the monochromatic light absorbency and sample liquid concentration vary in positivw proportion as the distance of the light possing through the liquid.

$$A = \lg\ (1/T) = \lg\ (\frac{I_0}{I_t}) = \varepsilon\ b\ c$$

A －Absorbency of the light when passes through liquid

T －Transmitted intensity and incident intensity ratio: transmittance I_t/I_0;

I_0 － Incident intensity

I_t － Transmitted intensity

ε － Molar absorption coefficient of solution（ml×mmol－1×cm－1）;

c － Mol concentration of the solution（mmol/ml）;

b － Solution layer thickness（cm）;

Solution layer thickness (b): Optical path, which is fixed by instrument. Molar absorption coefficient (ε) is the correlation coefficient of the wavelength, solution and solution temperature. Linear relationship is displayed between solution thickness and absorbency when in stable temperature and single wavelength（ε value is given on the reagent bottle by factory）

If the sample liquid adequate distribution, interaction between liquid and incidence monochromatic light only happens during absorbing process. No fluorescence, disperse and photochemical appear. No interaction between substances in the solution while absorbing process. The absorbency possess conducts nature, and this condition conforms to the Beer-Lambert law

8.2 Types of analysis methods

Method	Photometry point	Cell Blank	Absorbance Formula	Remark
1-point End point analysis method	L - 0 - 0 - 0 1＜L≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{A_L+A_{L-1}}{2}$	
2-points analysis method	L - M - 0- 0 1＜L＜M≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{(A_M+A_{M-1})-k(A_L+A_{L-1})}{2}$	
2-points Rate analysis method	L - M - 0 - 0 1＜L＜M≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{\frac{A_M+A_{M-1}}{2}-\frac{A_L+A_{L-1}}{2}}{t}$	Time (minutes) between metering points L, M
Rate method A	L - M - 0 - 0 1＜L＜M≦49 L +2＜M	$\frac{B_1+B_2+B_3}{3}$	△A（M-L）	
1-point rate double items analysis method	Fist half L - 0 - 0 - 0 1 ＜ M ＜ N≦L ＜ P ＜ Q≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{A_L+A_{L-1}}{2}$	
	Second half M - N - P - Q 1 ＜ M ＜ N≦L ＜ P ＜ Q≦49 M+2＜N , P+2＜Q	$\frac{B_1+B_2+B_3}{3}$	△（AQ- P）-k△（AN -M）	

3-points double items	Fist half L - 0 - 0 - 0 1＜L≦M＜N≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{A_L+A_{L-1}}{2}$	
	Second half M - N - 0 - 0 1＜L≦M＜N≦49	$\frac{B_1+B_2+B_3}{3}$	$\frac{(A_N+A_{N-1})-k(A_M+A_{M-1})}{2}$	
Rate B double items analysis method Assay (mode 1)	Fist half L - M - 0 - 0 3≦L＜M＜N＜P≦49 L +2＜M	$\frac{B_1+B_2+B_3}{3}$	△A (M-L)	
	Second half N - P - 0 - 0 3≦L＜M＜N＜P≦49 N+2＜P	$\frac{B_1+B_2+B_3}{3}$	When it is different from the first half part wavelength of the project △ A (P-N) When it is the same with the second part of wavelength of the project: △A (P-N) - k △A (M-L)	Two conditions
Rate B double items analysis method Assay (mode 2)	Fist half part of the project L - M - 0 - 0 3≦L＜M＜N＜P＜Q＜R≦49 L +2＜M	$\frac{B_1+B_2+B_3}{3}$	△A (M-L)	
	Second half part of the project N - P -Q - R 3≦L＜M＜N＜P＜Q＜R≦49 N+2＜P , Q+2＜R	$\frac{B_1+B_2+B_3}{3}$	△A(R-Q) - k△A(P-N)	

L,m,n,p,q,r : Photometric points

Rn : Volume of the reagent, n=1 to 4

B_1、B_2 B_3 : Through cell blank

(B1,B2,B3)/3 : Average value of three times passing through cell blanks

Ax : Absorbance at photometric point x

△A(m-L) : Change in absorbance per minute between photometric points L and M

k : Liquid volume correction factor

$$k = \frac{S + \sum_{j=1}^{a} Rj}{S + \sum_{i=1}^{b} Ri}$$

S : Sample volume

Rj 、Ri: a is the volumn of reagents without correction

b is the volumn of reagents with correction

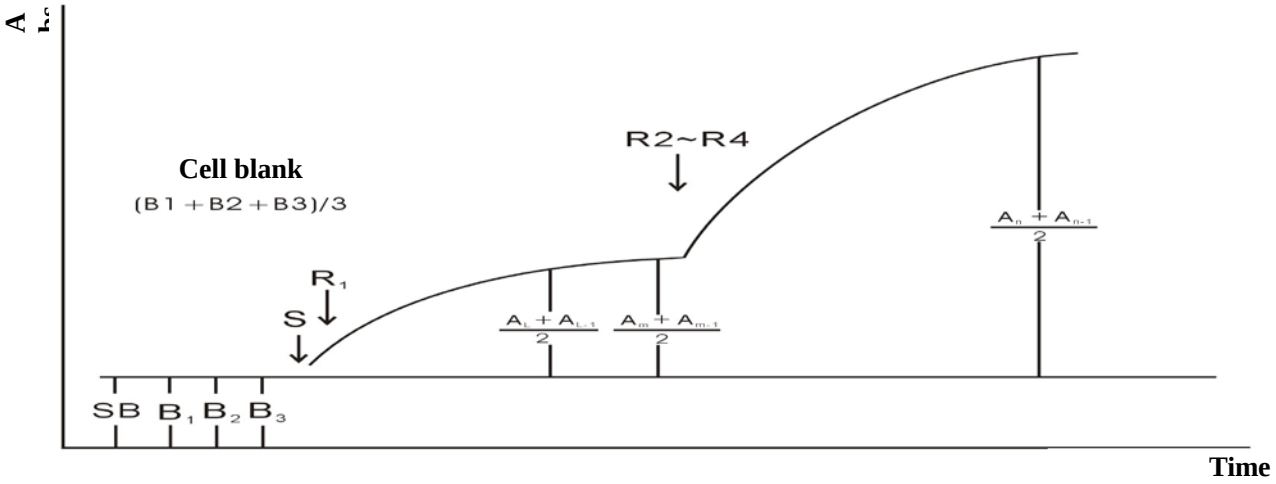
Note 1: After adding reagent 2, the 5th metering point does not immediately stir. But after the reaction disk rotates one circle around plus 2 reaction cuvettes and then pause, it need to rotate another 22 reaction cuvettes, after which will pause and then stir.
Note 2: During photometry , the reaction liquid should be more than or equal to 150μL, and less than or equal to 450μL.
Note 3: Be sure to enter "0(zero)" when there will be no photomitric point.

Endpoint analysis method

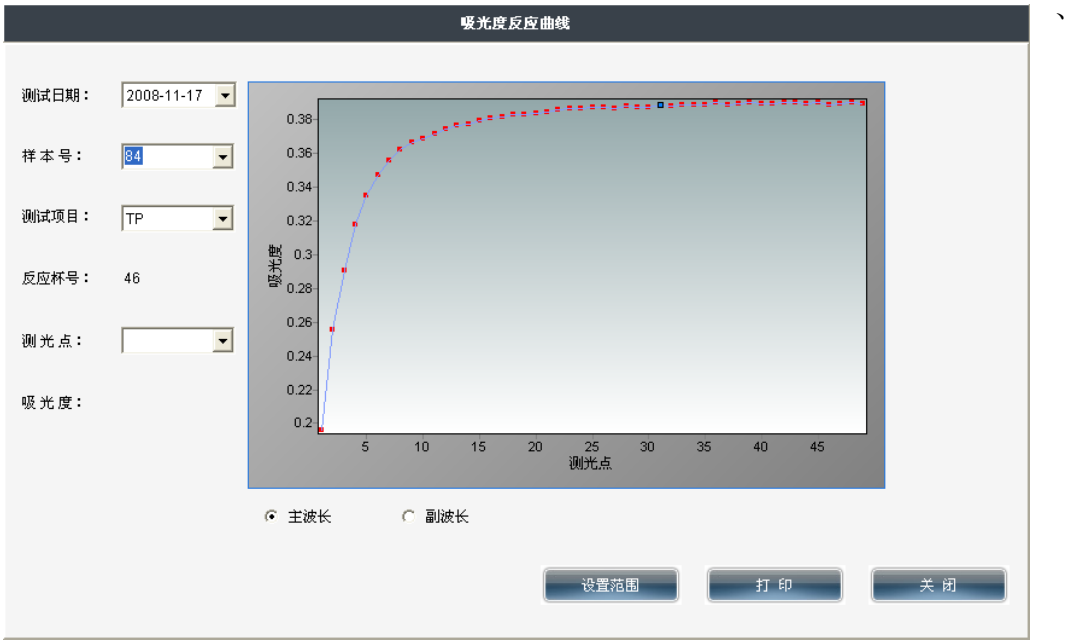
Endpoint analysis method is reaction takes a period of time to reach equilibrium, due to reaction balance constants are big, all substrates (tested substance) are transformed into product, and no increase (decrease) of reaction solution absorbance will occur, and the degree of absorbance increase (decrease) and the concentration of tested substance is directly proportional. This method is called “endpoint analysis method” or balance analysis method to be more accurately, which is the ideal analysis method mode. .

The endpoint analysis method is not sensitive to small changes of conditions (such as enzyme amount, pH, temperature, etc.) as long as this change does not affect the balance in a certain period of time.

figure 8-1 endpoint assay reaction curve



Example 1：TBIL－Total bilirubin reagent kit (Surfactant / diazonium salt method)



wavelength	Main 550nm，sub 660nm	Absorbance range	0～2A；
test mode	Endpoint analysis method	Optical path	10mm
reagent	1：250uL	sample	10uL
Single reagent	reagent A:B＝50:1	Mixing storage	
temperature	37℃	incubation	10min
reaction	10min	“0”	550nm，blank pipe
sensitivity	5mA equals to 1umol/L	Linearity range	300umol/L（18mg/dL）
calibrator	89.6umol/L，0.425A	Unit	1umol/L＝0.0585mg/dL

		conversion	
Reference value	Adult；5.1～19umol/L（0.3～1.1mg/dL） Newly born：20～200umol/L（1.2～12mg/dL）		

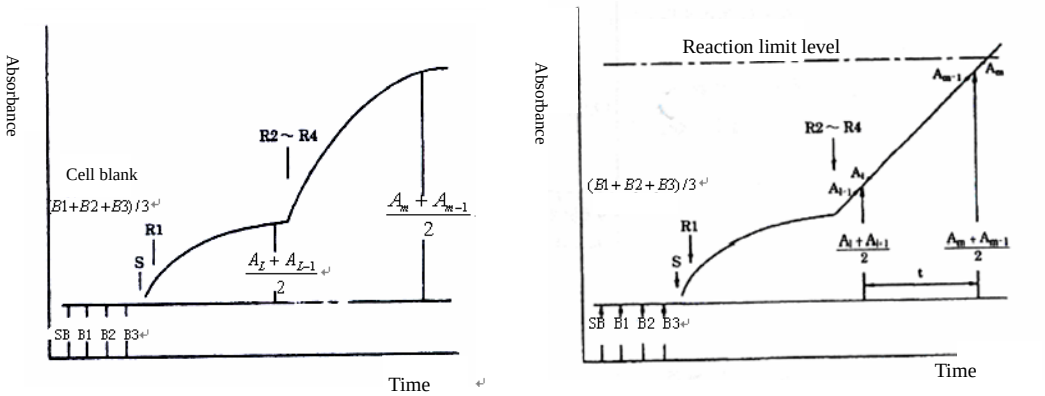
Example 2、UA（uric acid）—Uric acid liquid reagent kit

wavelength	Main 520nm （ 500,550 optional）	Absorbance range	0～2A
Test mode	Endpoint analysis method	Optical path	10mm
Reagent	1：200uL；2：50uL	sample	4uL
Single reagent	4 parts of reagent 1 part of reagent 2	Mixing storage	2～8℃ 5 days stablity
temperature	37℃（30℃, 25℃）	incubation	5min（6min , 8min ）
reaction	5min	adjust “0”	520nm，blank pipe
sensitivity	0.42mA equals to1umol/L	Linearity range	1.5mmol/L（25mg/dL）
calibration	0.72mmol/L，0.302A	Unit conversion	1mmol/L＝16.8mg/dL
Reference value	child：0.12～0.33mmol/L（2.0～5.5mg/dL）； Male：0.21～0.43mmol/L（3.5～7.2mg/dL）； female：0.15～0.36mmol/L（2.5～6.0mg/dL）； urine ： 14.9～44.6mmol/L（250～750mg/dL）；		

8.4 Two Points analysis method

Two points analysis method (fixed time assay) is also named as first class dynamics analysis method, which means during a certain period time of reaction, reaction speed is in direct proportion to the simple power of substrate concentration in specified time, namely v=k[S]. Due to the reduction of substrate, the whole reaction speed is decreasing gradually, which shows the increase (decrease) of absorbance. Because it takes a very long time to reach balance, it can be monitored at any time theoretically, but due to the complexity of serum ingredient, it must take a certain period of time to enter into stable reaction phase.

Figure 8-2 2-point assay reaction curve



Two points end point analysis　　two points rate analysis

8.5 Rate Analysis

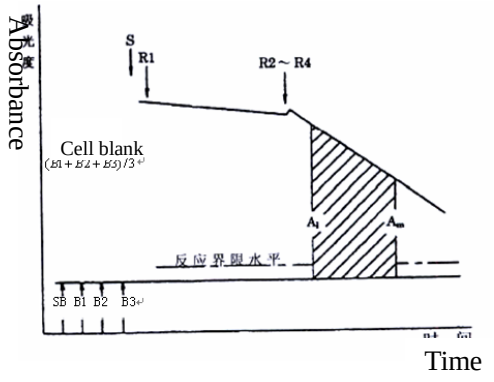
Rate analysis, also known as zero-class dynamics analysis, refers to the reaction rate is directly proportional to the zero power of substrate concentration, which has nothing to do with the substrate concentration. Hence, the reactants can generate a certain product at constant speed throughout the reaction process, resulting in even decrease or increase of absorbance of measured solution at a wavelength, and the decrease or increase speed (△ A / min) is directly proportional to the activity or concentration of the tested substance (catalytic material). Dynamics assay is also called as the continuous monitoring assay, mainly used for the measurement of enzyme activity.

In fact, because substrate concentration is not high enough, with the reaction proceeds, the reaction is no longer zero class when substrate is consumed to a certain extent, Therefore, zero-class dynamics analysisn is targeted at a certain period of time; Because reaction time to reach balance is very long, it can be monitored at any time theoretically, but because of the complexity of serum ingredient and much reaction, therefore, it takes a certain period of time to enter in stable reaction phase. So all reagent manufactures have strict requirements to thesse two time periods

Dynamics analysis is based on the changes between specified photometric points to obtain the absorbance concentration or activity value.

Metering point in accordance with the input form, dynamics method can be divided into single-band and dual-band dynamics analysis.

Figure 8-3 Rate assay reaction curve



Example 3: ALT/GPT — Alanine aminotransferase （IFCC）

wavelength	Main 340nm	Absorbance range	0～2A
Test mode	Rate assay	Optical path	10mm
Reagent	1：240uL；2：60uL	sample	15uL
Single reagent	4 reagent 1and 1reagent 2	Mixing storage	2～8℃ 5days stability
temperature	37℃	incubation	5min
reaction	60s delay，measure 60－120s	“0”	340nm，blank pipe
sensitivity	0.30mA/min equals to 1.0U/L	Linearity range	450U/L（7.5ukat/L）
calibration		Unit conversion	1U/L＝16.67×10-3ukat/L
Reference value	37℃：Male：<40U/L（<0.67ukat/L）；Female：<31U/L（<0.52ukat/L）		

Calculating method:

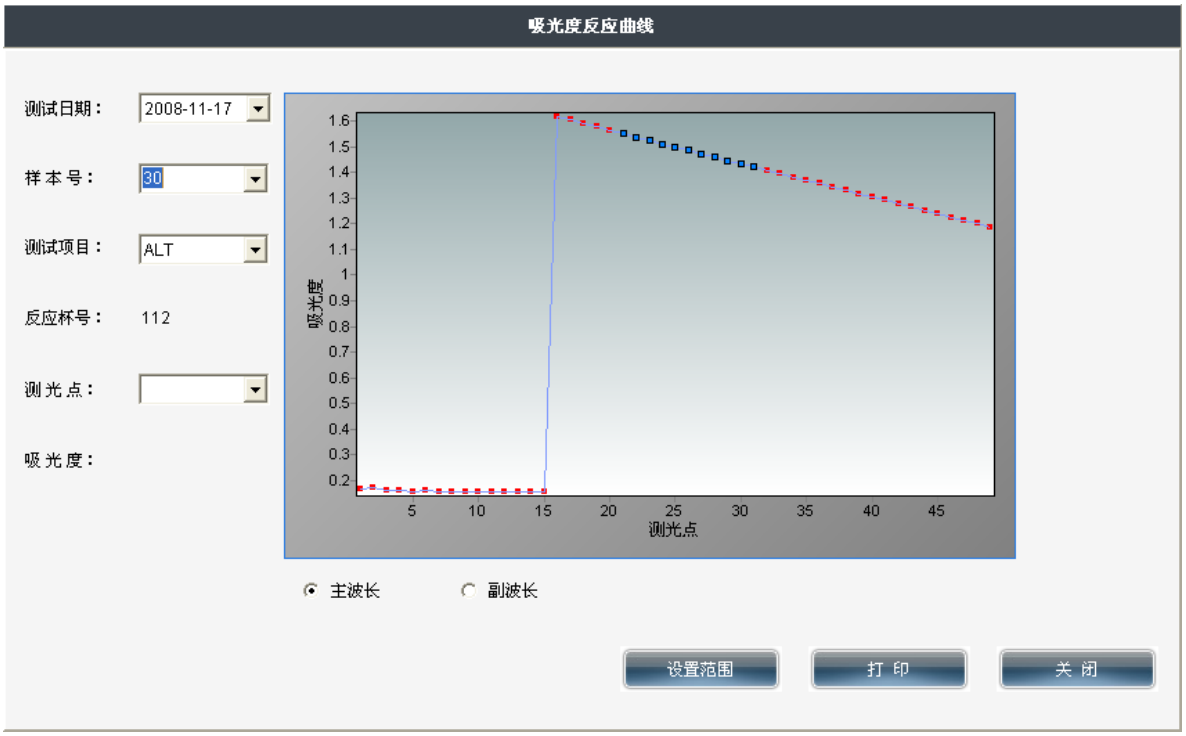
$$ALT（U/L）=\frac{\Delta A/\min * TV * 1000}{6.22 * SV * P}$$

TV＝The total reaction volume (mL)

SV＝sample volume（mL）

P＝optical path of colorimetric cup（cm）

6.22＝NADH position mmol extinction coefficient at 340nm （334nm：6.18，365nm：3.40）



8.6 Principle of electrolyte measurement

8.6.1 Principle

Internal standard solution is firstly added into the instrument reaction cuvettes, and assimilates it and discharges it into the Na, K, and Cl electrode solution line through the SIP injection pump to measure its electrode potential which is relative to reference electrode potential. Then needle draws the samples and then sample is diluted then added to the reaction cuvette. To test liquid electric potential mixed with electric potential, the calculation of the concentration comes out.

8.6.2 Principle of generating electrode potential

Electrode potential is obtained by Nernst's formula.

$$E = E_0 + 2.303 \times \frac{RT}{nF} \times l\,\mathrm{og}(ai) \quad \cdots\cdots (1)$$

$$ai = f \times Ci \quad \cdots\cdots (2)$$

E_0 : The standard potential of the measured system

R: gas constant (8.314510 J × mol-1 × K-1)

T: absolute temperature (t ℃ +273.15) (K)

F: Faraday constant (9.6485309 × 104 C × mol-1)

ai: Ion (i) activity

f: activity coefficient

Ci: concentration

n: a given ion (i) the charge number (Cation is positive, anion is negative)

8.6.3 Test method

Working curve preparation, the internal standard solution concentration measurement, concentration calculation, and result modification are explained as follow.

8.6.3.1 Working curve preparation

Measure low concentration slope of liquid (S1) and high concentration slope liquid (S2), and determine slope value (sensitivity) of K, Na, Cl the electrode.

$$SL = \frac{E(H) - E(L)}{\log \frac{C(H)}{C(L)}} \quad \text{.....} \quad (3)$$

SL: slope value (slope)

E (H): the potential of high concentration slope solution

E (L): the potential of low concentration slope solution

C (H): high concentration of the concentration slope solution (input value)

C (L): low concentration of the concentration slope solution (input value)

8.6.3.2 The measurement of internal liquid concentration

$$C(IS) = C(L) \times 10^{\frac{E(IS) - E(L)}{SL}} \quad \text{.....} \quad (4)$$

C (IS): the concentration of internal standard solution

E (IS): the potential of internal standard solution

8.6.3.3 concentration calculation

The calculation of routine sample, STAT sample, and concentration of quality control liquid is based on the concentration of internal standard solution. Internal standard solution is different with the different sample.

$$C(S) = C(IS) \times 10^{\frac{E(S)-E(IS)}{SL}} \quad \text{.....} \quad (5)$$

C(S) : Sample concentration

E(S): Sample potential

8.6.3.4 result modification

Test calibrator (calibrator S3)of serum category after calibration to calculate its concentration, and the difference between the tested concentration and input value is used as compensation value to increase or decrease sample quantitative value.

$$C(VALUE) = C(C) - C(X) \quad \text{.....} \quad (6)$$

C (VALUE): compensation value (compensation value)

C (C): Concentration input value of the serum calibrator

C (X): Concentration tested value of the serum calibrator

$$C'(S) = IF\{C(S) + C(VALUE)\} \quad \text{.. ... ...} \quad (7)$$

C ’(S): modified sample concentration

IF: Instrument constant (usually 1.0)

8.6.3.5 Standard specification of electrolyte

Item	specification
Sample volume	15ul

Diluent volume	600ul
Processing ability	100samples/h（only measuring electrolyte）
Measuring range	Na + 20 ~ 200mmol / L (when only serum) 10 ~ 400mmol / L (when measuring urine) K + 1.0 ~ 15.0mmol / L (when only serum) 1 ~ 200mmol / L (when measuring urine) Cl-20 ~ 200mmol / L (when only serum) 10 ~ 400mmol / L (when measuring urine)
Reagent consumption volume	Internal standard solution 600ul/sample (only for continuous determination of electrolyte) Diluent 600ul /sample Reference Electrode Solution 130 ul / sample

Note:

Internal standard solution will be added one time in order to activate the electrode if there is no electrolyte analysis for more than 10 minutes.

Chapter 9 Troubleshooting List

9.1 Stirring mechanism malfunction analysis

Alarm Code	Description	Detailed description	Solution
1-1	stirring mechanism abnormal	stirring mechanism fails to reach the top of rinsing bath side.	➢ In the CS-T240 software, enter "system maintenance" interface after getting on-line, implement "mechanical movement check", and observe the stirring rod running status **Malfunction 1**: stirring mechanism doesn't move **Solution:** 1, Check stirring mechanism up-down movements, mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally **Malfunction 2**: stirring mechanism can reach the top, but can not check the zero position. **solution**: Manually make stirring mechanism repeatedly rise to peak, DC files transferred to the multimeter, plug the negative point of the first 6-core P02, P02 positive pole core plugs 5 1、Multimeter readings between the positive changes in 5V and 0 (1) Check whether the conductivity from adapter to reaction disk circuit board is good and both ends of connector are connected well. (2) Check input part circuit of reaction disk circuit board light sensor signal.

			2、No change on multimeter reading (1) Check conductors Check whether the P02 plug 4,5,6 core well-connected, the connection is connected at both ends of good (2) Check the coupler signal Check voltage between P02 plug 4,6 feet, if the voltage is not 5v, check the connection plug is connected good. If the voltage is 5v, check the J02 socket 5 feet of potential, rising to peak when the potential was high or low potential. If the potential is not normal, check the coupler **Malfunction 3**: Stirring mechanism cannot reach the zero position. **solution**: Mechanical repair
1-3	Stirring mechanism abnormal	stirring mechanism can leave the top when it descents	➢ In the CS-T240 software, enter into the "system maintenance" interface after on-line, implement "mechanical movement check", and observe the stirring rod running status **Malfunction 1**: stirring mechanism stops **solution**: 1, Check stirring mechanism up-down movements, mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally **Malfunction 2**: stirring mechanism can reach the top but not leave **Solution** : the same to 1－1 Malfunction 2
1-4	Stirring mechanism abnormal	stirring mechanism fails to reach the rinsing bath when it moves to rinsing bath.	➢ In the CS-T240 software, enter into the "system maintenance" interface after on-line, implement "mechanical movement check", and observe the stirring rod running status **Malfunction 1**: **:** stirring mechanism doesn't move **Solution**: 1, Check stirring mechanism up-down movements,

			mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally 5、Check whether the it is at top position, check whether up-down zero light sensor works normally at top position. **Malfunction 2**: stirring mechanism can sway, but can not reach rinsing bath. **Solution**: 1、check whether the installation of left and right limit light sensors is correct. 2、When the instrument is turned on, manualy sway the stirring mechanism to observe the right limit coupler, transferr the multimeter to DC, negative points P02 core plug No.9, then plug positive P02 to the first pole core No.8. (1) Multimeter readings changes between 5V and 0, the light sensor, lead and adaptor are normal. 1) Check conductors Check whether the P02 plug 7,8,9 core well-connected, the connection is connected at both ends of good 2) Check the reaction plate coupler circuit board part of the circuit signal input (2) No change multimeter reading 1) Check conductors Check whether the P02 plug 7,8,9 core well-connected, the connection is connected at both ends of good 2) Check the coupler signal Check voltage between P02 plug 7,9 feet, if the voltage is not 5v, check the connection plug is connected good. If the voltage is 5v, check the J02 socket 8-foot potential, up to the peak when the potential was high or low potential. If the potential is not normal, check the coupler.

1-5	Stirring mechanism abnormal	stirring mechanism fails to reach the reaction cup when it moves to reaction cup.	➢ In CS-T240 software, enter into the "system maintenance" interface after on-line, implement "mechanical movement check", and observe the stirring rod running status **Malfunction 1**: stirring mechanism doesn't move **Solution:** 1, Check stirring mechanism up-down movements, mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally 5、Check whether the it is at top position, check whether up-down zero light sensor works normally at top position. **Malfunction 2:** Stirring mechanism can realize its sway movement, but can not reach the reaction cuvette. **Solution:** 1、check whether the installation of left and right limit light sensors is correct. 2、When the instrument is turned on, manually swing the stirring mechanism to observe the left limit coupler, transfer the multimeter to DC, negative points, 12 of the plug core P02, P02 plug is the 11th pole core. . (1) multimeter reading in is between 5V and 0 change, indicating coupler, lead normal 1) Check conductors Check whether the P02 plug 10,11,12 core well-connected, the connection is connected at both ends of good 2) Check the reaction plate coupler circuit board part of the circuit signal input (2) multimeter reading of no change 1) Check conductors Check whether the P02 plug 10,11,12 core well-connected, the connection is connected at both ends of good 2) Check the coupler signal Check voltage between P02 pin plugs 10,12, if the voltage is not 5v, check the connection plug is connected good. If the voltage is 5v, check the J02 socket 11 feet of potential, rising to peak when the potential was high or low potential. If the potential is not normal, check the coupler.

1-6	Stirring mechanism abnormal	When resetting, Stirring mechanism failed to reach rinsing bath.	The solution is the same as 1-4
1-7	Stirring mechanism abnormal	When resetting, Stirring mechanism failed to leave rinsing bath.	➢ Enter into system maintenance window and execute "Mechanical movement check". Observe the running status of stirring rod. **Malfunction 1**: stirring mechanism doesn't move The solution is the same as 1-4 **Malfunction 2:** Stirring mechanism can realize its sway movement to rinsing bath, but can not leave it. The solution is the same as 1-4
1-8	Stirring mechanism abnormal	Stirring mechanism failed to reach the top when rotating.	➢ If stirring mechanism failed to reach the top when rotating, the solution is the same as 1-1

9.2 Rinsing mechanism of reaction cup

Alarm Code	Description	Detailed description	Solution
3-1	Rinsing mechanism of reaction cup abnormal	Rinsing mechanism of reaction cup fails to reach the top	➢ Enter into system maintenance window and execute "Mechanical movement check". Observe the running status of stirring rod. **Malfunction 1**: Rinsing mechanism doesn't move **Solution:** 1, Check rinsing mechanism sway movements, mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally

			Malfunction 2： Rinsing mechanism can reach the top, but can not check the zero position. **solution**： Manually make rinsing mechanism repeatedly rise to peak, transferred the multimeter To DC, plug the negative point of the first three core P02, P02 plugs are 2 pole core. 1、Multimeter readings between the positive changes in 5V and 0, indicating coupler, lead normal 1) Check conductorsCheck 1,2,3 P02 core plug is connected well and good connections at both ends is connected 2) Check the reaction plate coupler circuit board part of the circuit signal input 2、 No change on multimeter reading 1) Check conductors Check 1,2,3 P02 core plug is connected well and good connections at both ends is connected 2) Check the coupler signal Check voltage between P02 plug 1,3 feet, if the voltage is not 5v, check the connection plug is connected good. If the voltage is 5v, check the J02 socket 2 feet of potential, rising to peak when the potential was high, or low potential. If the potential is not normal, check the coupler **Malfunction 3**：Rinsing mechanism can not reach the zero position. **solution**： Mechanical repair
3-2	Rinsing mechanism abnormal	Rinsing mechanism of reaction cup fails to leave the top when descending.	➢ Enter into system maintenance window and execute “Mechanical movement check”. Observe the running status of stirring rod. **Malfunction 1**： stirring mechanism doesn’t move **Solution:** 1, Check stirring mechanism up-down movements, mechanical repair is required if resistance is big. 2, check whether both ends of connector of the motor are connected well. 3, check whether the conductivity of motor lead wire is good. 4, check the motor drive module of circuit board is working normally

			Malfunction 2: Rinsing mechanism of reaction cup cannot reach the top **solution**: the same to that of malfunction 2 in 3-1

9.3 Reaction disk malfunction analysis

Alarm Code	Description	Detailed description	Solution
4-1	Reaction disk abnormal	Reaction disk fails to rotate to the designated position.	**Malfunction**: The quantity counted by reaction cup light sensor does not conform to real quantity of cup rotated. **solution**: Check whether the signal status of counting light sensor is normal. （1）check whether the conductivity from counting light sensor 1 to lead wire is good. （2）check whether the counting light sensor 1 is ok. （3）Check input part circuit of reaction disk circuit board light sensor signal.
4-2	Reaction disk abnormal	Reaction disk fails to stop at the designated position	**Malfunction**: Reaction disk fails to stop at the position matching with light sensor. **solution**: the same as 4－1
4-3	Reaction disk abnormal	Reaction disk fails to stop at the zero position when resetting.	**Malfunction**: Reaction disk fails to stop at the zero position after resetting or the light sensor of zero position did not check resetting point. **solution**: Check whether the signal status of counting light sensor is normal. （1）check whether the conductivity from zero light sensor to lead wire is good and the both ends of connector are connected well. （2）check whether the zero light sensor 1 is ok （3）Check input part circuit of reaction disk circuit board light sensor signal.
4-6	cleaning liquid level low	Liquid level of alkaline cleaning liquid kit low.	Add cleaning liquid into cleaning liquid kit.

9.4 Sample probe mechanism malfunction analysis

Alarm Code	Description	Detailed description	Solution
5-3	Sample abnormal.	Sample probe malfuntions while descending	Enter system maintenance window, execute "mechanical inspection." Observe running probe arm **Malfunction 1**: no liquid in sample cup **Solution:** (1) confirm whether there are samples left int the sample cup. **Malfunction 2**: there are liquid in the sample cup **Solution:** (1) confirm the correct location of the sample cup. (2) check and confirm whether the detection board of the liquid is working ok
5-13	Sample abnormal.	Sample probe cannot find reaction cuvette	**Malfunction 1**: no putting of the sample cup in the sample position **Solution:** Alarm **Malfunction 2**: putting of the sample cup in the sample position **Solution:** (1) Check whether there are sampel cup in the current sample tray. (2) check and confirm whether the detection board of the liquid is working ok

9.8 Reagent probe mechanism malfunction analysis

Alarm Code	Description	Detailed description	Solution
8-1	Reagent probe abnormal.	Sample&reagent probe couldn't reach the top while rising	Enter system maintenance window of the operation system, execute "reset". Observe probe running status **Malfunction 1**: The arm of the probe couldn't move **Solution:** 1 Manually move the probe mechanism, need mechanical repair if resistance is big 2, check whether the motor connector body is connected at both ends in a good well function way 3, check whether the connection of electrical conductor is good 4, check the sample&reagent motor drive circuit board **Malfunction 2**:The probe arm to the coupler's position

			can run, but the photo sensor cannot detect any signal **Solution**: Manually make the probe body go up to the peak repeatedly, transfer the multimeter to DC, negative points the first 6-core plugs P042, P042 positive pole core plugs 5. 1, multimeter readings between the positive changes from 5V to 0, indicating photo sensor and lead are normal (1) Check conductors Check whether the sample probe's photo sensor J202 to the reagent disc circuit board (P042) is in good connection, and whether the both ends of the connectors are good. (2) Check the input of the sample reagent disc circuit board's photo sensor. 2, No change on multimeter reading (1) Check conductors Check P042 plugs 4,5,6 core is connected well, connection of both ends is good. (2) Check the photo sensor Check voltage between P042 pin plugs 4,6, if the voltage is not 5v, check the connection plug is connected well. If the voltage is 5v, check the J042 socket 11 feet's potential. Rising to the peak when the potential is high, if not, the potential is low. If the potential is not normal, check the photo sensor.
8-2	Reagent probe abnormal.	Probe senses the liquid touches the side	**Malfunction**: When Sample&reagent probe's running, it's touching the side of the reagent cup or the botom of the cup **Solution:** Observe the Sample&reagent probe's running status (1) If the Sample&reagent probe is touching the side of the cup while it's running, need to ajust the position of the Sample&reagent probe's and the position of the cup (2)If the probe directly touches the botom of the cup while it's running, check whether there is reagent in the reagent cup. If not, need to add reagent and then check. If yes, need to check the circuit board of the liquid surface, check whether the sensitivity of the Sample&reagent probe is working normally.
8-3	Reagent probe abnormal.	Sample&reagent probe couldn't leave the top while descending	Enter system maintenance window of the operation system, execute "reset". Observe probe running status **Malfunction 1**: The arm of the probe couldn't move **Solution:** 1 Manually move the probe mechanism, need mechanical repair if resistance is big 2, check whether the motor connector body is connected at both ends in a good well function way 3, check whether the connection of electrical conductor is good

			4, check the sample&reagent motor drive circuit board **Malfunction 2**: probe arm to the coupler's position can run, but the photo sensor cannot detect any signal **Solution:** 1, multimeter readings between the positive changes from 5V to 0, indicating photo sensor and lead are normal (1) Check conductors Check whether the Sample&reagent probe's photo sensor J202 to the reagent disc circuit board (P042) is in good connection, and whether the both ends of the connectors are good. (2) Check the input of the sample&reagent disc circuit board's photo sensor. 2, No change on multimeter reading (1) Check conductors Check P042 plugs 4,5,6 core is connected well, connection of both ends is good. (2) Check the photo sensor Check voltage between P042 pin plugs 4,6, if the voltage is not 5v, check the connection plug is connected well. If the voltage is 5v, check the J042 socket 11 feet's potential. Rising to the peak when the potential is high, if not, the potential is low. If the potential is not normal, check the photo sensor.
8-4	Reagent probe abnormal.	Sample&reagent probe is in the effective status of touching and liquid detecting all the time	**Malfunction 1**: Sample&reagent probe is in the effective status of touching and liquid detecting all the time **Solution:** If the arm of the probe is not moving, repeatedly and manually pull up the probe (imitate the touching), repeatedly touch the tip of the probe gently(imitate the liquid detection), transfer the multimeter to DC, negative point of P042 plug No.10 core, positive point P042 plug No.9 core Initial State: Multimeter reads "0" Touching: Multimeter reads "1" 1. Multimeter reads between 5V and 0, indicates that the photo sensor and the lead are normal (1) Check the lead Check the connection of probe's photo sensor J202 to the sample&reagent circuit board (P042) check whether the connection of probe photo sensor J202 with sample&reagent dick circuit board wire （P042） is good or not, check the connection of the both ends. (2) check reagent dick circuit board

			2. No chang on multimeter readings (1) Check the liquid level detection of flexible cable is connected well, check the conductivity (2) Check the liquid level detection signal line (P042) is in good connection or not, check conductivity (3) Check whether the liquid level detector is well connected or not (4) measurement of P042 in the 8 (surface), 9 (touch) pin voltage is normal or not. When liquid surface is detected, P042-8 surface is high level When liquid surface is not detected, P042-8 surface is low level When touches, the photo sensor blocks, P042-9touch is high level, No touch, the photo sensor is without shelter, P042-9touch is low level. (5) Check the P042's 8 (surface), 9 (touch) feet whether 7 (+5 v) is short-circuit, so that potential is pulled up. (6) Check the liquid level detection board is working regularly, when the status is not , check the circuit board. Unplug the surface detection panel J6, J7 on the flexible cable, measuring J6, J7-level state of the foot, right to left (J7: 1 empty, 2touch, 3surface) (J6: 1 ground, 2 air, 3 +5 v, 4 blank) When liquid level is detected, J7-3surface is high, and the on-board indicator lights; When liquid is not detected, J7-3surface is low, on-board light goes out; When there's touch, the photo sensor blocks, and J7-2touch is high; When there's no touch, the photo sensor is not blocked, J7-2touch is low.
8-5	Reagent probe abnormal	When Sample&reagent probe changes its direction to cup side, and couldn'f find reaction disk's position. (Sample&reagent probe swings can not be set back as zero)	Enter CS-T240 operation system, system maintenance window, execute "mechanical movement". Observe sample&reagent probe running status. **Malfunction 1**: Sample&reagent probe couldn't sway. **Solution**: 1. Manually sway the mechanism, need mechanical repair if resistance is big 2. Check both ends of the motor connector are connected well 3, Check whether the conductivity of the conductor's lead are good 4, Check the sample&reagent disc motor drive circuit board

			5, Check if the up down and back to zero of photo sensor are working normally **Malfunction 2**: When the arm sways to reaction disk position, photo sensor couldn't detect signal **Solution**: Manually make the probe mechanism rise to peak repeatedly, transfer the multimeter to DC, negative point P042 core plug No.3, positive point P042 plugs to core plug No. 2. 1, multimeter readings between the positive changes in 5V and 0, indicates photo sensor and lead are normal (1) Check conductors Check conductivity of probe photo sensor J202 to the reagent disc circuit board (P042) is connected good or not, check both ends of the connector are connected well or not. (2) Check sample&reagent disc circuit board's photo sensor's input electric circuit 2, No change on multimeter reading (1) Check lead Check plug P042 core plug 1,2,3 is connected well or not and whether both ends of the connection wire is good or not (2) Check photo sensor signal Check voltage between P042 pin plugs 1,3, if the voltage is not 5v, check the connection plug is connected well or not. If the voltage is 5v, check the J042 socket 2 feet of potentials, when it is up to peak, when the potentials is high, if not, potential's low. If the potential is not normal, check photo sensor. **Malfunction 3**: Couldn't sway to reaction disk position **Solution:** mechanical repair
8-6	Reagent probe abnormal	When the Sample&reagent probe switches to another location, it couldn't leave reaction disk	Enter CS-T240 operation system, system maintenance window, execute "mechanical movement". Observe probe running status. **Malfunction 1:** Sample&reagent probe couldn't sway **Solution**: same as to 8-5 **Malfunction 2**: The arm can leave reaction disk position, however, the photo sensor couldn't detect any signal

			Solution： same as to 8-5
8-7	Reagent probe abnormal	When Sample&reagent probe rotates, it deciates from the peak	Probe couldn't rise to the peak, solution same as to 8-1.
8－8	Reagent probe abnormal	it couldn't detect liquid surface existence	**Malfunction**: When there is liquid in the reagent bottle, Sample&reagent probe cannot detect it **Solution:** 1, Check the liquid level detection reagent with the sample plate to connect the circuit board is the connection of a good guide, the connector ends are good 2, check the liquid level detection circuit board, test the sensitivity of the sample reagent is normal needle 3, check the sample reagent circuit board part of the electrical signal input
8-9	Reagent probe abnormal	Cannot reach the liquid drop height	**Malfunction**: Cannot reach the height of probe arm falling liquid reagent **Solution:** 1, Manually move the probe mechanism, if the resistance is big, mechanical repair is needed 2, Check the liquid level detection plate flexible cable is connected well or not 3, Check both ends of the electrical connector body is connected well 4, Check whether the connection of electrical conductor lead is good 5, Check whether there is malfuction of surface detection 6, Check the sample kit circuit board

9.10 Sample&reagent disk malfunction analysis

Alarm Code	Description	Detailed description	Solution
10-2	Sample&reagent disk abnormal	Sample& reagent disk is not stop at the specified	**Malfunction 1**: Sample&reagent disk doesn't move **Solution:** 1, Manually rotate the sample&reagent disk, if the resistance is big, mechanical repair is needed 2, Check both ends of the motor connector is connected

		location	well 3, Check the conductivity of the electrical conductor lead is good 4, Check sample&reagent circuit board's motor drive circuit board kit part **Malfunction 2**: When sample&reagent disc rotates to the specified location, the sample&reagent disk does not stop at the specified position, or when turns to specified location, the photo sensor couldn't detect it, or the signal of the photo sensor is not correct **Solution:** Manually rotate the sample&reagent disk, transfer the multimeter to DC, negative points P041, core plug No.6, positive points P041, core plugs No.5 1, Multimeter readings between the positive changes in 5V and 0, indicates photo sensor and lead are normal (1) Check lead Check the conductivity of probe photo sensor J047 to sample&reagent disk circuit board lead (P041) is good or not, check both ends of connector is connected good or not (2) Check photo sensor's electric circuit input of sample& reagent disk's circuit board 2, No change on multimeter reading (1) Check wire Check P041 plugs 4,5,6 core is connected well, a good connection is connected at both ends (2) Check the photo sensor signal Check voltage between P041 pin plugs 4,6, if voltage is not 5v, check the whether the connection plug is connected well or not. If the voltage is 5v, check the J041 socket 5 feet of potential, raise up to the peak when the potential is high, if not, the potential is low. If the potential is not normal, check the photo sensor.
10-3	Sample&reagent disk abnormal	Cannot find the sample& reagent disk position of back to zero	Enter into system maintenance window, execute "mechanical movement check", observe disk retoating status **Malfunction 1**: The sample&reagent disk doesn't move **Solution:** 1. Manually rotate the sample&reagent disk, need mechanical repair if the resistance is big 2. Check both ends of the motor connector are connected

			well of this mechanism 3, Check whether the conductivity of the conductor's lead are good 4, Check the circuit board of the sample reagent disk **Malfunction 2:** Sample reagent disk rotates, back couldn't find the position of back to zero **Solution:** Manually rotate the sample&reagent disk, transfer the multimeter to DC, negative points P041 core plug No.3, positive points P041 core plug No.2 1. If multimeter reading is between positive 0 to 5V, indicates that the photo sensor and the lead are normal (1)Check the lead Check the conductivity of probe photo sensor J047 to the sample reagent disk's circuit board lead (P041) is good or not, check both ends of the connector are connected well or not (2)Check photo sensor's electric circuit input of sample& reagent disk Check voltage between P041 pin plugs 1,3, if voltage is not 5v, check whether the connection plug is connected well or not. If the voltage is 5v, check the J041 socket 2 feet of potential, raise up to the peak when the potential is high, if not, the potential is low. If the potential is not normal, check photo sensor.
10-4	Sample&reagent disk barcode reader abnormal	Couldn't find sample reagent barcode reader	**Malfunction 1**: Sample&reagent disk couldn't find barcode reader **Solution:** 1, Check whether the barcode reader is well connected to the instrument 2, Check whether the barcode reader is broken Please reset the barcode reader, if it still doesn't work, check barcode reader. If it starts to work normally, indicates that there is no problem on the barcode reader. It might be the problem of digital wire or circuit board.
10-7	Sampel&reagent disk turntable motor steps abnormal	Motor running steps are incompatible with the given steps number	**Malfunction 1**: Current turntable position error **Solution:** 1,Check whether there are friction between sample reagent disk shelf and sample reagent refrigeration warehouse 2,Check whether sample&reagent disk fram has obstacles that affect rotation

9.12 Injection pump malfunction analysis

Alarm Code	Description	Detailed description	Solution
14-1	Syringe pump abnormal	Syringe pump doesn't rise up to the top	**Malfunction 1**: Syringe pump doesn't move or it couldn't rise up to the top **Solution:** 1. When the instrument is working, the syringe pump doesn't work (1) Check both ends of the mechanism's motor are connected well (2) Check thec conductivity of the motor lead is well (3) Check cicrcuit board's motor drive lead
14-2	Syringe pump abnormal	Syringe pump couldn't leave the top	**Malfunction 1**: Pump couldn't move or it cannot leave the top **Solution:** 1. Observe the moving status of the syring pump while it's working (1) Check both ends of this mechanism motor are connected well (2) Check the conductivity of the motor lead is good or not (3) Check circuit board's driving motor 2. While the instrument is working, if the motor is working ok, and it can leave the photo sensor position (1) Check whether the photo sensor is in good condiction (2) Check the conductivity of the lead connects the photo sensor and the power adapter plate is good or not, check both ends of the connector are connected well or not. (3) Check the signal of the photo sensor Check voltage between P043 pin plugs 1,5, if the voltage is not 5v, check the plug P043 is in good connection; if the voltage is 5v, check the potential of P043 4-pin socket. While the pump is back to zero (vomiting), then the potential is high, if not, the potential is low. If the potential is normal, check the adapter plate; if it's abnormal, check photo sensor.

9.14 Incubation bath malfunction analysis

Alarm Code	Description	Detailed description	Solution
20-1	Incubation bath temperature abnormal	The temperature of incubation bath is above 45℃	(1) Make sure the cooling fan of the instrument is rotating normally (2) Check the temperature sensor is working normally (3) Check the connector part of the temperature sensor on the main control board (4) Replace the main control board or the temperature sensor
20-2	Incubation bath temperature abnormal	The temperature of the incubation bath is out of the scope of 37℃ ±5℃ (Only check when the instrument under operation)	(1) Make sure the room temperature is in the scope of 15-32 (2) Make sure the cooling fan of the instrument is rotating narmally (3) Make sure the water is cycling in the incubation bath (4) Replace main control board or the temperature sensor

9.15 ISE Failure Analysis

0-31	Note	ISE is over measuring lowe limit	ISE QC is over measuring lower limit, the current QC has no result.	（1）Please check whether the Control volume, reagent volume is adequate, and whether the position is correct
0-32	Note	ISE is over measuring upper limit	ISE QC is over measuring upper limit, the current QC has no	（1）Please check whether the Control volume, reagent volume is adequate, and whether the position is correct

			result.	
0-33	Note	ISE is over measuring lower limit	ISE Calibration is over measuring lower limit, the current Calibration has no result.	（1）Please check whether the Calibrator volume, reagent volume is adequate, and whether the position is correct
0-34	Note	ISE is over measuring upper limit	ISE Calibration is over measuring upper limit, the current Calibration has no result.	（1）Please check whether the Calibrator volume, reagent volume is adequate, and whether the position is correct
0-35	Note	ISE is over measuring range	ISE sample is over measuring upper or lower limit, no test result.	（1）Please check whether the sample volume, reagent volume is adequate, and whether the position is correct
19-1	Note	Electrolyte function stops	Electrolyte system stops working due to the issued alarm. Note: the stop status of adding sample means to restart.	（1）Enter into system maintenance, and execute "Resetting”, and then execute “Mechanical movement check”
37-1	Note	ISE reference liquid is inadequate	Remaining volume of reference solution is inadequate (less then the user designed	（1）add ISE reference solution （2）Enter into system maintenance window, and execute "ISE reference solution reagent pipeline rinsing” （3）Execute ISE calibration

			volume)	
38-1	Note	ISE internal standard liquid is inadequate	remaining volume of internal standard solution is inadequate (less then the user designed volume)	（1）add ISE internal standard solution （2）Enter into system maintenance, and execute "ISE internal standard solution reagent pipeline rinsing” （3）Execute ISE calibration
39-1	Note	ISE diluent is inadequate	remaining volume of diluent is inadequate (less then the user designed volume)	（1）add ISE diluent （2）Enter into system maintenance, and execute "ISE diluent reagent pipeline rinsing” （3）Execute ISE calibration
60-1	Note	ISE LEVEL error	In the 5-measuring point potential of internal standard solution, the average value (EAV)of three potentials is over the following range （internal standard solution）K: -90.0mv≤EAV≤-10mv	(1) Enter into system maintenance window, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.
60-2	Note	ISE LEVEL error	In the 5-measuring point	(1) Enter into system maintenance, and execute "ISE check."

			potential of internal standard solution, the average value (EAV)of three potentials is over the following range （internal standard solution）K：-90.0mv≤EAV≤-10mv	(2) please refer to " electrolyte device maintenance " in the "user manual" for detail.
60-3	Note	ISE LEVEL error	In the 5-measuring point potential of internal standard solution, the average value (EAV)of three potentials is over the following range （internal standard solution）Cl：80.0mv≤EAV≤160mv	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.
61-1	Note	ISE Noise error	In the 5-measuring point potential of internal standard	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for

			solution, the difference （FI） of the maximum and minimum is within following range Na：0.7mv≤|FIV（2）-FIV（4）|	detail.
61-2	Note	ISE Noise error	In the 5-measuring point potential of internal standard solution, the difference （FIV） of the maximum and minimum is within following range (internal standard, sample) K：1.0mv≤|FIV（2）-FIV（4）	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.
61-3	Note	ISE Noise error	In the 5-measuring point potential of internal standard solution, the difference （FIV） of the	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.

			maximum and minimum is within following range (internal standard, sample) Cl：0.8mv≤|FIV（2）-FIV（4）|	
62-1	Note	ISE Prepare abnormal	The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is as following Na：（1）32.0mv≤SLOPE≤37mv or 68.1mv≤SLOPE	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.
62-2	Note	ISE Prepare abnormal	The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail.

			as following K: (1) 32.0mv≤SLOPE≤37mv or68.1mv≤SLOPE	
62-3	Note	ISE Prepare abnormal	The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is as following Cl: (1) -30mv≤SLOPE≤-25mv or-68.1mv≥SLOPE	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. □
63-1	Note	ISE slope value (SLOPE) abnormal	(1) The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is as following: Na: (1) SLOPE < 32.0mv (2) current	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.

			ISE calibration result is not updated	
63-2	Note	ISE slope value (SLOPE) abnormal	(1) The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is as following:K: (1) SLOPE < 32mv (2) current ISE calibration result is not updated	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.
63-3	Note	ISE SLOPE abnormal	(1) The slope value of calibration result is within following range or the impact of electrode is low (cross-contamination rate (A) is as following:Cl: (1) SLOPE > -25.0mv (2) current ISE	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.

			calibration result is not updated	
64-1	Note	ISE the concentration of internal solution abnormity	（1）the concentration of internal solution（C（IS））is within following range :Na：C（IS）＜120.0mmol/l or 190.0mmol/＜C（IS） （2）current ISE calibration result is not updated	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.
64-2	Note	ISE the concentration of internal solution abnormity	（1）the concentration of internal solution（C（IS））is within following range .K：C（IS）＜3.0mmol/l or 8.0mmol/＜C（IS） （2）current IS calibration result is not updated	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.
64-3	Note	ISE the concentration of internal solution	（1）the concentration of internal solution（C	(1) Enter into system maintenance, and execute "ISE check." (2) please refer to " electrolyte device

		abnormity	（IS）) is within following range Cl：C（IS）＜80.0mmol/l or 140.0mmol/＜C（IS） （2）current ISE calibration result is not updated	maintenance " in the "user manual" for detail. (3) Please re-execute ISE calibration.
		ISE required calibration	Because of the implementation of the ISE maintenance (ISE cleaning, complete cleaning), it is necessary to implement ISE calibration	Executive ISE calibration

Alarm Code	Description	Detailed description	Solution
18-1	SIP injection pump abnormal	SIP injection pump fails to reach the top	**Malfunction 1**： pump stops or fails to reach the top **solution**： observe running status of pump: 1.when working, injection pump is not running. (1) Check whether both ends of connector of the motor are connected well. (2) Check whether the conductivity of motor lead wire is good. (3)check motor drive circuit of circuit board 2. when working, injection pump is running： (1) check light sensor (2) Check whether the conductivity of light sensor to adapter and ISE circuit board is good and both ends of connector are connected well. (3) check light sensor signal check voltage between P901A plug pin 1，3 (measured when plug it into plug seat), if the voltage is 5v, check potential (measured when plug it into plug seat)of P901A plug pin 2，3; The potential is high when reaching to the zero position(discharging liquid), otherwise the potential is low. If the potential is normal, Check whether the conductivity of light sensor to adapter and ISE circuit board is good; if not normal, replace the light sensor If the voltage is not 5v, check voltage between P190 plug pin 1，3; if voltage is 5v, replace light sensor adapter. If the voltage is not 5v, check input circuit of ISE circuit board.

Alarm Code	Description	Detailed description	Solution
18-2	SIP injection pump abnormity	SIP injection pump fails to leave the top	**Malfunction 1**: injection pump stops or fails to leave the top **solution**: observe running status of pump 1.when working, injection pump is not running. (1) Check whether both ends of connector of the motor are connected well. (2) Check whether the conductivity of motor lead wire is good. (3)check motor drive circuit of circuit board 2. when working, injection pump is running: (1) check light sensor (2) Check whether the conductivity of light sensor to adapter and ISE circuit board is good and both ends of connector are connected well. (3) check light sensor signal check voltage between P901A plug pin 2，3 (measured when plug it into plug seat), if the voltage is 5v, check potential (measured when plug it into plug seat)of P901A plug pin 2，3; The potential is high when reaching to the zero position(discharging liquid), otherwise the potential is low. If the potential is normal, Check whether the conductivity of light sensor to adapter and ISE circuit board is good; if not normal, replace the light sensor If the voltage is not 5v, check voltage between P190 plug pin 1，3; if voltage is 5v, replace light sensor adapter. If the voltage is not 5v, check input circuit of ISE circuit board.

Alarm Code	Description	Detailed description	Solution
16-1	The nozzle of electrolyte SIP abnormal	SIP nozzle fails to reach the bottom	**Malfunction 1**: Motor stops or fails to leave the top (1) Check whether both ends of connector of the motor are connected well. (2) Check whether the conductivity of the motor lead wire is good. (3)check motor drive circuit of sample reagent disk circuit board (4) Inspect whether the rise and fall zero light sensor is working well. **Malfunction 2**: The motor swing to the required position, but the signal is not detected by the light sensor. Solution:Manually enable the unit repeatedly rise to top, transfer the multimeter to DC, negative points, 3rd core of plug P142, positive point ,2nd core of P142 plug. 1.If the value of multimeter changing between 5 V –OV, the light sensor and the wire is working normally. （1）Check the wire Check whether the conductivity of probe light sensor （P142） to wire J2 of ISE circuit board is good and both ends of connector are connected well. （2）Check the light sensor input circuit of sample reagent disk circuit board. 2. The value of multimeter is not changing. （1）Check the wire Check whether the 1.2.3 core of P142 plug is connected well, and whether the two ends connected well. （2）Check light sensor signal

			Check voltage between P142A plug pin 1，3, if the voltage is not 5v, check the connection of plug. If the voltage is 5v, check potential of P142 plug pin 2. The potential is high when reaching to the top position, otherwise the potential is low. If not normal, check the light sensor

Alarm Code	Description	Detailed description	Solution
16-2	The nozzle of electrolyte SIP abnormal	SIP nozzle fails to reach the top	**Malfunction 1：** The motor stops or fails to leave the bottom. (1) Check whether both ends of connector of the motor are connected well. (2) Check whether the conductivity of the motor lead wire is good. (3)check motor drive circuit of sample reagent disk circuit board (4) Inspect whether the rise and fall zero light sensor is working well. **Malfunction 2：** The motor swing to the required position, but the signal is not detected by the light sensor. Solution:Manually enable the unit repeatedly rise to top, transfer the multimeter to DC, negative points, 3rd core of plug P142, positive point ,2nd core of P142 plug. 1.If the value of multimeter changing between 5 V –OV, the light sensor and the wire is working normally. （1）Check the wire Check whether the conductivity of probe light sensor （P142） to wire J2 of ISE circuit board is good and both ends of connector are connected well.

			（2）Check the light sensor input circuit of sample reagent disk circuit board. 2. The value of multimeter is not changing. （1）Check the wire Check whether the 1.2.3 core of P142 plug is connected well, and whether the two ends connected well. （2）Check light sensor signal Check voltage between P142A plug pin 1，3, if the voltage is not 5v, check the connection of plug. If the voltage is 5v, check potential of P142 plug pin 2. The potential is high when reaching to the top position, otherwise the potential is low. If not normal, check the light sensor.

9.16 Resetting and other failure analysis

Alarm Code	Description	Detailed description	Solution
143-1	Time synchronization failure	Sending time synchronization order failure	Check the communications of control board and sub-boards respectively.
143-2	Water adding overtime error	Water tank liquid system malfunction, water adding overtime error	Check whether the water supply machine, magnetic valve, pipeline and filter are working normally, and check whether the water supply pipe has air, and check whether the floater is normal, and check whether relevant electrical units of floater and control board are normal.
143-3	AD board reset failure	AD board detects malfunction when resetting, AD board reset	Use control panel monitoring software to monitor the fault information to see if there is AD communication error. Repair AD board if there is AD communication error to debug.

		failure.	
143-4	Reaction disk reset failure	Reaction disk detects malfunction when resetting, Reaction disk reset failure	Lower machine monitoring software monitors error information, and analyze the reaction disk board-related failure to eliminate the error
143-5	Sample& reagent disk reset failure	Sample& reagent disk detects malfunction when resetting, sample& reagent disk fails to reset	Use lower machine monitoring software to monitor error information, and refer to the related information of sample&reagent disk board to debug.
143-8	Water discharging failure of reaction bath	Water discharging failure of reaction bath	Check whether the indication of reaction bath liquid level detector is right; check whether there is remaining water in reaction bath, and check reaction bath water outlet pipeline if there is remaining water in it; check whether relevant electrical units of liquid level detection and control board are normal.
143-9	Adding detergent overtime error	Sample& reagent probe fails to add detergent completely in the specified time	Connect the main control board debugging program to electrify the machine; observe machine electrifying flow; observe whether the 6 times the normal cleansing movement of detergents reagent is finished in the phase of adding detergents. Corresponding control board of reagent&sample probe should be repaired if the reagent&sample probe did not achieve normal movement.
143-10	liquid level detection failure	fails to detect liquid level when adding detergent	Refer to liquid detection error analysis to debug
143-12	Liquid level detection failure of reaction bath	Liquid level detection failure of reaction bath	Check the liquid level of reaction bath, and check whether the liquid level detector of reaction bath works normally; check whether relevant electrical units of liquid level detection and control board are normal.

143-13	Reaction bath liquid level malfunction	Reaction bath liquid level malfunction	Check whether the liquid level detector of reaction bath is clean, whether there is water in reaction bath, whether water level reaches the position where the detector can detect, and check liquid level detector in reaction bath is working normally; check whether relevant electrical units of liquid level detection and control board are normal.
143-14	Bar code scanning overtime error	Bar code scanning overtime error	Use lower machine monitoring software to monitor error information, and refer to the related error information of reagent&sample disks to debug.
143-15	Pipeline exhaust overtime error	Pipeline exhaust overtime error	Execute the main board debugging program to monitor, and re-execute pipeline air exhausting and observe whether air exhausting is carried out by reagent and sample injection pumps and the implementation is complete. Use lower machine monitoring software to monitor error information, and refer to the related error information of reagent &sample disks to debug.
143-16	sample &reaction disk start failure	sample &reaction disk start failure	Use lower machine monitoring software to monitor error information, and refer to the related error information of reaction disk to debug.
143-17	Reaction disk stop failure	Reaction disk stop failure	Use lower machine monitoring software to monitor error information, and refer to the related error information of reaction disk to debug.
143-18	Sample& reagent probe blocked	Sample& reagent probe blocked	Maintenance operation of the sample&reagent probe. Check whether the pressure sensor and magnetic valve of sample&reagent probe pipeline are normal; check whether relevant electrical units of pressure detection and control board are normal.
143-19	Previous sample adding failure	Previous sample adding failure	Use lower machine monitoring software to monitor error information, and refer to the related error information of sample disk to debug.
143-20	Previous reagent adding failure	Previous reagent adding failure	Use lower machine monitoring software to monitor error information, and refer to the related error information of reagent to debug.
143-24	Previous stirringfailure	Previous stirring failure	Use lower machine monitoring software to monitor error information, and refer to the related error

			information of reaction disk to debug.
143-28	Waste liquid bottle full	Waste liquid bottle full	Check whether waste liquid bottle is full; check whether the sensor in waste liquid bottle is normal; check whether relevant electrical units of the floater in waste liquid bottle and control board are normal.
143-29	Floater switch error	Switch malfunction, high-level floater detects the signal, but low-level floater fails.	Check whether the floaters of high and low liquid level and the signal cable connecting floater to main control board are normal; check whether relevant electrical units of floater detection and control board are normal.
143-30	Reagent level scanning overtime error	Reagent level scanning overtime error	Use lower machine monitoring software to monitor error information, and refer to the related error information of reagent board to debug.
143-31	Vacuum Pump Failure	Vacuum Pump negative pressure low	Check whether the vacuum pump and vacuum pump switch are normal; check whether relevant electrical units of vacuum pump switch and control board are normal.
143-32	Sample barcode scanning overtime in testing	Sample barcode scanning overtime in testing	Use lower machine monitoring software to monitor error information, and refer to the related error information of sample board to debug.
143-33	ISE reset failure	ISE detects malfunction in resetting; resetting failed.	Observe whether there is ISE alarm information; Use lower machine monitoring software to monitor error information, and refer to the related error information of ISE board to debug.
143-34	ISE check maintenance movement overtime	ISE check maintenance movement overtime	Observe whether there is ISE alarm information; Use lower machine monitoring software to monitor error information, and refer to the related error information of ISE board to debug.
143-35	ISE pipeline rinsing overtime	ISE pipeline rinsing is over specified time	Observe whether there is ISE alarm information; Use lower machine monitoring software to monitor error information, and refer to the related error information of ISE board to debug.

143-36	ISE malfunction in testing	ISE malfunction when testing, follow-up ISE stops	Observe whether there is ISE alarm information; Use lower machine monitoring software to monitor error information, and refer to the related error information of ISE board to debug.
143-37	Gear pump failure	Gear pump pressure low	Check gear pump and pressure sensor of sample pipeline are normal. Check whether the read value of pressure sensor which is running is more than 2500 by using main control board debugging software; check whether relevant electrical units of pressure sensor and control board are normal.
143-42	Sending reagent mapping information failure	Sending reagent mapping information failure, adding reagent may fail.	Refer to instrument module error analysis
143-43	cooling water overtime	When the water tank temperature is over 36.5 degrees, add cold water into the tank into to cool down. Temperature could not drop to 35.5 degrees in one minute, which means cold water temperature is too high.	Execute the main board debugging program to observe whether the display of temperature is normal and room temperature is high; check the water supply pipeline of water tank is normal; check whether relevant electrical units of temperature sensor and control board are normal.
143-44	Analyzer module malfunction	Malfunction among modules	Execute the main board debugging program to monitor whether the communications of main board and sub-boards are normal; check whether relevant electrical units of sub-boards communications and control board are normal.

143-45	Continuous emergence of dirty cups	Continuous emergence of 5 dirty cups	Check whether light source, water quality of incubation bath, reaction cup and counting light sensor of reaction disk are normal; test data collecting board lines by using the testing program of data collecting board.
143-46	AD data malfunction	AD data mixed	Execute the main board debugging program to monitor whether the communications of main control board and AD board is normal, and analyze error; check whether counting light sensor is normal.
143-47	IES malfunction in testing	ISE measuring internal standard liquid failure	Use lower machine monitoring software to monitor error information, and refer to the related error information of ISE board to debug.
143-48	Version number reading overtime	Version number reading overtime	Execute the main board debugging program to monitor whether the communications is normal, and analyze error; check whether relevant electrical units of sub-boards communications and control board are normal.

9.17 Refrigeration system

Alarm Code	Description	Detailed description	Solution
144-1	refrigeration system abnormal	refrigeration time abnormal	(1)check whether sample&reagent disk cover is covered, whether the ambient temperature is in line with environmental requirements of instrument. (2) observe the temperature displayed on digital pipe of refrigeration system and Peltier current value are normal. If abnormal: Please check Peltier and refrigeration circuit board

144-2	refrigeration system abnormal	refrigeration current abnormal	（1）observe whether current value displayed on digital pipe of refrigeration system is normal. （2）Make sure which current is abnormal, and cope with it after check the corresponding abnormal Peltier and circuit board.
144-3	refrigeration system abnormal	refrigeration chip abnormal	（1）observe which chip is abnormal （2）cope with the corresponding abnormal chip
144-5	refrigeration communicatio n abnormal	refrigeration status abnormal	（1）check the communications wiring of refrigeration board and main board （2）check the communications interface circuit of refrigeration board （3）check the communications interface circuit of main board
145-1	The 1st line refrigeration chip malfunction	The 1st line refrigeration current <5A	Check the 1st line refrigeration Peltier and cooling chip
145-2	The 2nd line refrigeration chip malfunction	The 2nd line refrigeration current <5A	Check the 2nd line refrigeration Peltier and refrigeration chip

9.18 AD Collector

Alarm Code	Description	Detailed description	Solution
146-1	The 1st line AD collector	The measuring value of the	Check the AD collection board and preamp board

	malfunction	1st line AD collector is over normal range	
146-2	The 2nd line AD collector malfunction	The measuring value of the 2nd line AD collector is over normal range	Check the AD collection board and preamp board
146-3	The 3rd line AD collector malfunction	The measuring value of the 3rd line AD collector is over normal range	Check the AD collection board and preamp board
146-4	The 4th line AD collector malfunction	The measuring value of the 4th line AD collector is over normal range	Check the AD collection board and preamp board
146-5	The fifth line AD collector malfunction	The measuring value of the fifth line AD collector is over normal range	Check the AD collection board and preamp board
146-6	The sixth line AD collector malfunction	The measuring value of the sixth line AD collector is over normal range	Check the AD collection board and preamp board

146-7	The seventh line AD collector malfunction	The measuring value of the seventh line AD collector is over normal range	Check the AD collection board and preamp board
146-8	The eighth line AD collector malfunction	The measuring value of the eighth line AD collector is over normal range	Check the AD collection board and preamp board
146-9	The ninth line AD collector malfunction	The measuring value of the ninth line AD collector is over normal range	Check the AD collection board and preamp board
146-10	The tenth line AD collector malfunction	The measuring value of the tenth line AD collector is over normal range	Check the AD collection board and preamp board
146-11	The 11th line AD collector malfunction	The measuring value of the 11th line AD collector is over normal range	Check the AD collection board and preamp board
146-12	The 12th line AD collector malfunction	The measuring value of the 12th line AD collector is	Check the AD collection board and preamp board

		over normal range	