LiDA500

Random Access Analyzer

Service Manual

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1. Introduction

1.1 Introduction

1.1.1 Model

LiDA500

1.1.2 Features

LiDA500 is a discrete automated chemistry analyzer that tests sample with the 3 different methods: colorimetric, turbidimetric, ion selective electrode (optional), in quantitative analysis of chemical composition of clinical samples: blood serum, blood plasma, urine, cerebrospinal fluid, etc.

1. Automated, random, optional, discrete, priority given to emergency sample, and fully open on analysis parameters and reagents;
2. Up to 78 colorimetric items and 3 ISE items (K, Na and Cl; optional) can be in progress at the same time;
3. The analysis methods include end-point method, two-point method, kinetics method, etc. It supports Single/dual-wavelength test and three/four-reagent test;
4. Many Calibration calculation methods are in the choose list: One point calibration, two-point calibration, multi-point linear calibration or nonlinear calibration, etc.

1.2 Structure of the Instrument

Figure 1-1 LiDA500 Automated Chemistry Analyzer

LiDA500 is composed of the analysis section (The instrument itself), operation section (computer system), result output section (printer), accessories and consumables.

1.2.1 Analysis Section

The analysis section is mainly composed of the sampling system (including sample disk, sample probe, reagent disk, reagent probes, etc.), Mixing and reaction system (including mixer, reaction disk, etc.), optical measurement system (including optical and signal processing Unit), Reaction cuvette cleaning system (including automatic cleaning station, etc.), liquid path system insides the machine, control system that drives various mechanic part (Including hardware and low-level driver software), etc. The barcode scanning system and electrolyte module are optional.

The front view of the analysis section is shown in the below figure.

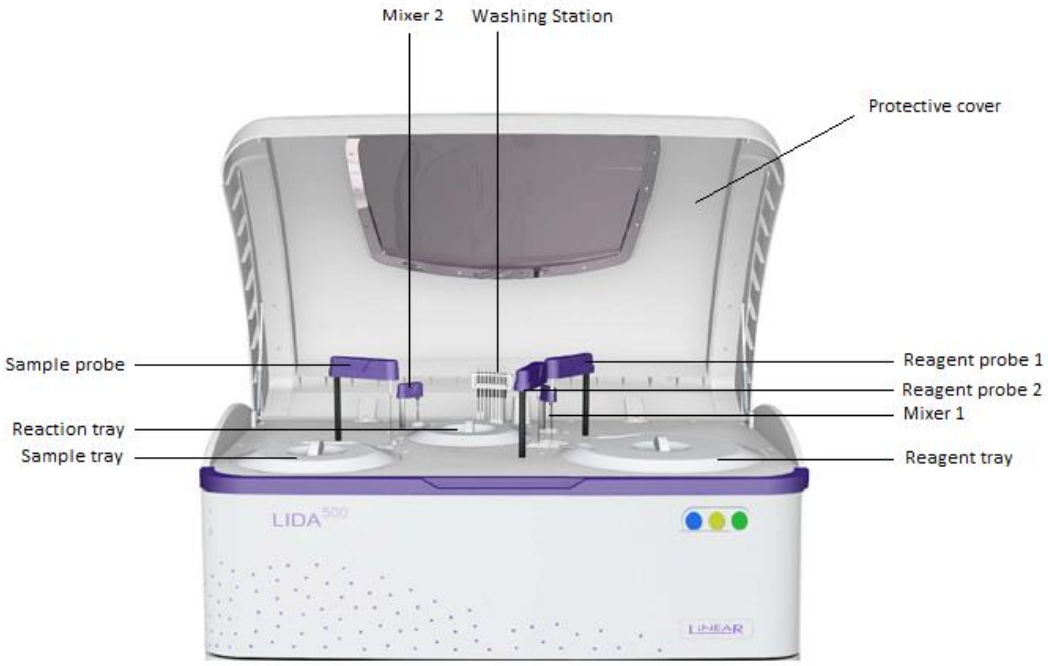


Figure 1-2 Front View of Analysis Section

The connectors of the liquid paths At the rear of the analysis section include:

- High Concentration Waste Liquid Sensor: Connected to the signal cable of the level sensor for the high concentration waste liquid container;
- Cleaning Agent Sensor: Connected to the signal cable of the level sensor for the washing solution container;
- Low Concentration Waste Liquid 1 Sensor: Connected to the level sensor for the low concentration waste liquid 1 container. The connection is not needed when the low concentration waste liquid is directly discharged to the trough;
- High Concentration Waste Liquid: Outlet of high concentration waste liquid, connected to

the high concentration waste liquid tube;

- Cleaning Agent: Inlet of cleaning agent for the analysis section, connected to the cleaning agent container tube;
- Low Concentration Waste Liquid 1: Connected to the Big low-concentration waste tube;
- Low Concentration Waste Liquid 2: Connected to the small low-concentration waste tube;
- Deionized Water: Main inlet of deionized water for the analysis section, connected to the deionized water entry tube of Water machine.

The layout of the connectors of the liquid paths on the back of the analysis section is shown in the figure below.

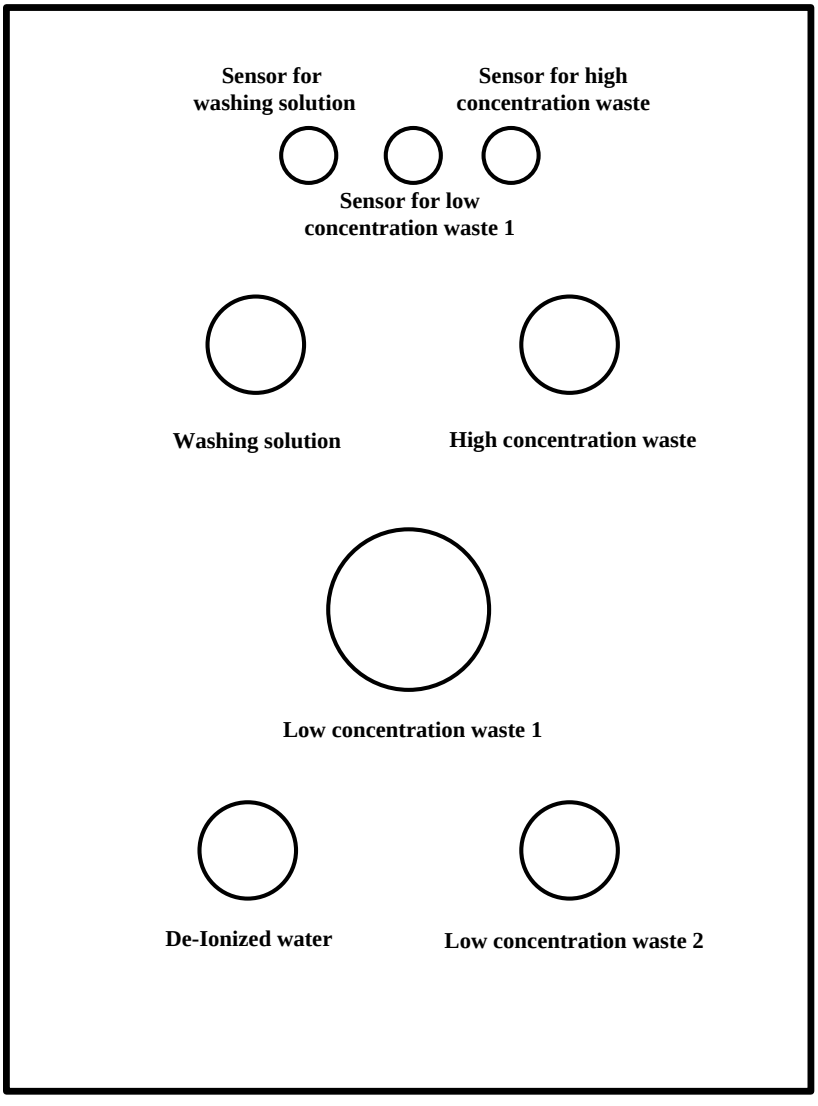


Figure 1-3 Connectors of Liquid Paths on the Back of Analysis Section

The serial port and power jack on the back of the analysis section are shown in the figure below.

Figure 1-4 Serial Port and Power Jack on the Back of Analysis Section

- Serial Port: Connected to RS-232 cable, through which the operation section is communicated with the analysis section;
- Power Jack: Connected to the electric cable.

1.2.2 Sampling System

The sampling system of LiDA500 mainly includes the sample probe, reagent probe , sample disk, reagent disk, etc.

1.2.2.1 Structure of Sample Probe

Figure 1-5 Structure of Sample Probe

The sample probe is mainly used for the collection and delivery of samples for analysis and is composed of the sample probe, sample probe rocker arm, sample probe drive shaft, sample syringe, the related liquid paths, etc.

1.2.2.2 Functions of Sample Probe

- Sample Collection: The sample probe is mainly used to absorb quantitative sample from the sample test tube and deliver the sample to the reaction cuvette. the sample volume is:
  - For biochemical items: 2μl~45μl, increasing progressively by 0.1μl;
  - For electrolyte items: 70μl (blood serum or blood plasma), 140μl (diluted urine) (added twice, 70μl each).
- Cleaning of Sample Probe: The sample probe includes a cleaning system that cleans the outer wall of the probe with the fountain type , cleans the inner wall of the probe with high pressure water, and supports strong acid and alkali cleaning;

- Collision Avoidance Test: The sample probe has the horizontal and vertical collision avoidance function. When it encounters an obstacle in the horizontal or vertical direction, the collision avoidance function will be started to prevent the sample probe from being damaged;
- Liquid Level Detection and Tracking Depending on Volume: The sample probe can detect the liquid level automatically and determine the move-down depth of the sample probe below the liquid level according to the volume of liquid absorbed ,which realize the function of tracking depending on volume.

1.2.2.3 Structure of Reagent Probe

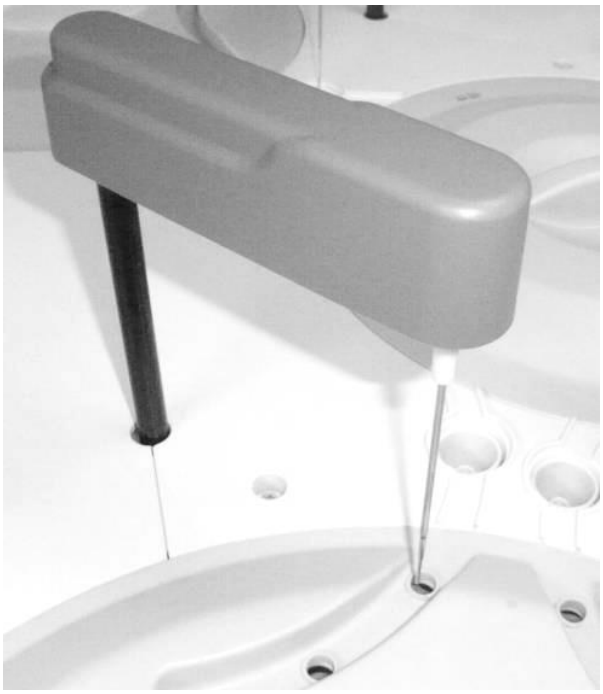


Figure 1-6 Structure of Reagent Probe

LiDA500 includes two reagent probe - R1 and R2 which have exactly the same structure. They are mainly used to collect and deliver reagents. A reagent probe is composed of the reagent probe, reagent probe rocker arm, reagent probe drive shaft, reagent syringe, corresponding liquid paths, etc.

1.2.2.4 Functions of Reagent Probe

- Reagent Collection: The reagent probe Unit is mainly used to absorb quantitative reagent from the reagent bottle and deliver the reagent to the test cuvette. The reagent probe moves repeatedly in the order of reagent bottle, reaction disk, and reagent probe washing hole to complete the function of reagent adding, in which,
  - R1 is used to absorb reagent No. 1(3), with the volume of 150μl~350μl, increasing

progressively by 1μl;

- R2 is used to absorb reagent No. 2(4), with the volume of 20μl~250μl, increasing progressively by 1μl.

- Cleaning of Reagent Probe: The reagent probe Unit includes a cleaning system that cleans the outer wall of the probe in the fountain type way, cleans the inner wall of the probe with high pressure water, and supports strong acid and alkali cleaning;
- Collision Avoidance Test: The reagent probe has the horizontal and vertical collision avoidance function. When it encounters an obstacle in the horizontal or vertical direction, the collision avoidance function will be started to prevent the reagent probe from being damaged;
- Liquid Level Detection and Tracking Depending on Volume: The reagent probe can detect the liquid level automatically and determine the depth of the reagent probe below the liquid level according to the volume of liquid absorbed, which realize the function of tracking depending on volume.

1.2.2.5 Structure of Sample Disk Unit

Figure 1-7 Structure of Sample Disk

The sample disk Unit mainly includes the sample disk and its drive system, sample pot, sample barcode scanner, etc.

1.2.2.6 Functions of Sample Disk Unit

- The sample disk is the holder where the sample test tubes are carried. It can rotate counterclockwise according to the set position when it is driven by its drive system. During working, each sample test tube rotates to the sampling position of the sample probe to wait for the sample probe to absorb the sample.

Caution: To add sample during the test operation, be sure to stop the rotation of the sample disk first, and do not add sample to the area where the sample probe moves back and forth, otherwise, the sample probe may be collided.

- The sample disk is divided into the outer, middle and inner circles. Each of the outer and middle circles has 35 sample positions, and the inner circle has 30 sample positions;
- The sample disk has a total of 100 sample positions, in which, sample positions 97-100 are for ISE cleanser (D1), acid cleanser (D2), alkaline cleanser (D3), and deionized water (W);
- Virtual Sample Disk: The LiDA500 system software allows the setup of up to 7 virtual sample disks at the same time, one of which can be selected as the current sample disk.
- Sample containers, such as original blood collection tube, centrifuge tube, plastic test tube, small sample cup, etc., can be put on the sample disk. The following sample containers are compatible with the sample disk:
  - Standard Test Tubes: Φ12×68.5, Φ12×99, Φ12.7×75, Φ12.7×100, Φ13×75, and Φ13×100;
  - Original Blood Collection Tubes: Φ12×68.5, Φ12×99, Φ12.7×75, Φ12.7×100, Φ13×75, and Φ13×100;
  - Small Sample Cups: Φ10×37 and Φ12×3.
- The body of the sample disk can be picked and placed freely for you to replace the whole disk of samples easily.
  - Pick: Loosen the two fixing screws on the sample disk, hold the handle of the disk, and lift and take it out vertically.
  - Place: Hold the handle of the sample disk, aim the pin hole on the disk at the pin position on the disk base, place down the disk vertically, and tighten the two fixing screws on the disk.
- The sample barcode scanner is an optional component.
  - The sample barcode has 3~27 digits, supports the NCCLS standard, and is compatible with various barcode application environments.
  - You can set the format of sample barcode and select a barcode system.
  - When the fixed barcode scanning fails, the handheld barcode identification system can be used for supplementary scanning or manual barcode input can be used to perfect the scanning of sample barcode.

1.2.2.7 Structure of Reagent Disk Unit

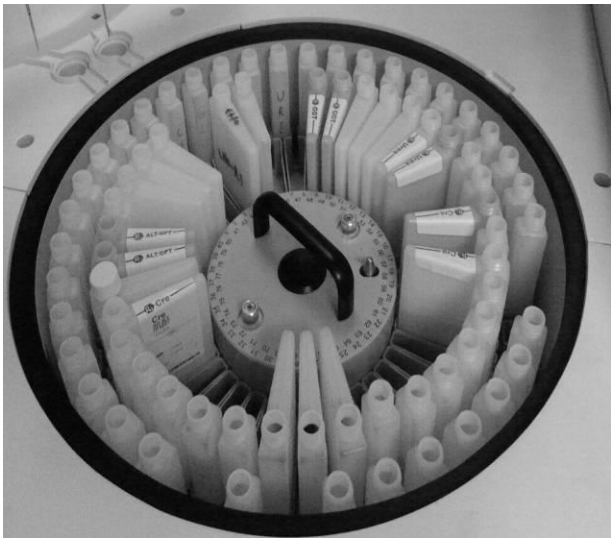


Figure 1-8 Structure of Reagent Disk Unit

The reagent disk Unit mainly includes the reagent disk and its drive system, reagent chamber, reagent refrigeration system, reagent barcode scanner, etc.

1.2.2.8 Functions of Reagent Disk Unit

- The reagent disk is the holder where the reagent bottles are carried. Its drive system can rotate each reagent bottle to the sampling position of the reagent probe according to the system setting to wait for reagent absorption.
- The reagent refrigeration system is used to guarantee the reagent in the reagent disk is always stored in the low temperature environment to keep the reagent stable and reduce volatilization.
- The reagent disk is divided into the inner and outer circles, each of which includes 40 reagent positions. The compatible reagent bottles are: LiNEAR outer circle bottle 32ml, LiNEAR inner circle bottle 79ml, and Hitachi 60~70ml reagent bottle.
- The reagent disk has a total of 80 reagent positions, in which, reagent positions 79 and 80 are for strong cleanser (D) and deionized water (W) respectively;
- Any type of reagent (R1/R2/R3/R4) of a test item is allowed to be put at any reagent position in the reagent disk;
- Two virtual reagent disks (80 positions) can be set. During a test, the system can dynamically prompt for replacement of reagent disk;
- The reagent refrigeration system can provide 24-hour uninterrupted refrigeration, with the storage temperature of 2~10℃;
- The body of the reagent disk can be picked and placed freely for you to replace the whole

disk of reagents easily.

- Pick: Loosen the two fixing screws on the reagent disk, hold the handle of the disk, and lift and take it out vertically.
- Place: Hold the handle of the reagent disk, aim the pin hole on the disk at the pin position on the disk base, place down the disk vertically, and tighten the two fixing screws on the disk.

■ The reagent barcode scanner is an optional component.

- The reagent barcode has 10~30 digits, supports the NCCLS standard, and is compatible with various barcode application environments.
- You can set the format of reagent barcode and select a barcode system.
- When the fixed barcode scanning fails, the handheld barcode identification system can be used for supplementary scanning or manual barcode input can be used to perfect the scanning of reagent barcode.

1.2.3 Mixing and Reaction System

The Mixing and reaction system is used to promote the full Mixing of the sample and reagent and provides a constant temperature reaction environment. The system includes the mixer Unit, reaction disk Unit, etc.

1.2.3.1 Structure of Mixer Unit

LiDA500 has two mixer Units - M1 and M2 which have exactly the same structure. A mixer Unit is mainly composed of the mixer, rocker arm, and drive shaft.

Figure 1-9 Structure of Mixer Unit

When the mixing is finished, the mixer automatically moves to the mixer cleaning pool for cleaning to prevent carrying contaminants.

1.2.3.2 Functions of Mixer Unit

- For a single-reagent item test, M1 begins the mixing process after the sample is added, and M2 does not move;
- For a double-reagent item test, M1 begins the mixing process after the sample is added, and M2 begins the mixing process after reagent 2 is added;
- For a three-reagent item test, M1 begins the mixing process after the sample is added, and M2 begins the mixing process after reagents 2-3 are added;
- For a four-reagent item test, M1 begins the mixing process after the sample is added, and M2 begins the mixing process after reagents 2-4 are added.

1.2.3.3 Structure of Reaction Disk Unit

The reaction disk Unit includes the reaction disk and its drive mechanism, test cuvette, and heating membrane. The test cuvette is mounted on the reaction disk and is heated for warm bath with the heating Membrane under the reaction disk. Its structure is shown in the figure below:

Figure 1-10 Structure of Reaction Disk Unit

1.2.3.4 Functions of Reaction Disk Unit

- The reaction disk has a total of 100 test cuvette positions that are arranged on a single circle. During the test and analysis, the reaction disk rotates counterclockwise only and stops the specified test cuvette at the sample adding position, reagent adding position, mixing position, and automatic cleaning position according to the setting of the software.

- The test cuvettes are put on the reaction disk and are used as reaction containers and for colorimetric measurement. The optical path of the test cuvettes is 5mm. The standard test cuvettes are made of organic glass. Quartz test cuvettes of the same specification are compatible.
- The total volume of reaction liquid is 150~500μl. When each test is ended, the test cuvettes are automatically cleaned by 8 stage;
- The reaction disk heats the test cuvettes in the direct solid heating way, with the reaction temperature of 37±0.3℃.

1.2.3.5 Optical Measurement System

The optical measurement system is used to measure the absorbance of the reaction liquid in the test cuvette and includes the optical Unit, signal processing board, etc.

1.2.3.6 Structure of Optical Unit

The optical Unit is located inside the machine of the analysis section and includes the light source base, light splitting box, focusing barrel, grating Unit, receiver board, etc., as shown in the figure.

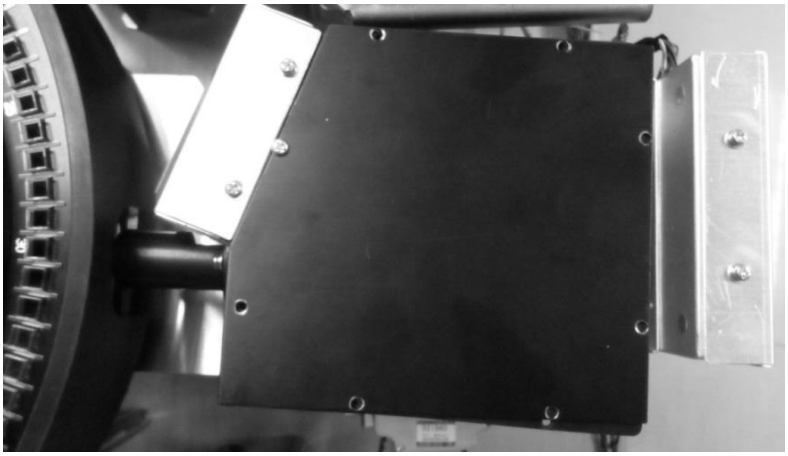


Figure 1-11 Structure of Optical Unit

1.2.3.7 Functions of Optical Unit

- The light path is measured with the flat-field holographic concave grating in the rear light splitting way. The absorbance of up to 12 wavelengths can be measured;
- The lamp is a 12V/20W halogen tungsten lamp, with water cooling type heat dissipation to guarantee stable light source;
- Range of Absorbance: 0~3A; Resolution: 0.0001A;
- 12 wavelengths: 340nm, 405nm, 450nm, 505nm, 540nm, 570nm, 600nm, 635nm, 670nm, 700nm, 760nm, and 795nm.

1.2.3.8 Automatic Test Cuvette Cleaning Mechanism

There is a multi-stage automatic test cuvette cleaning mechanism above the reaction disk of LiDA500 that is used to clean and dry the test cuvettes after testing.

1.2.3.9 Composition of Automatic Cleaning Mechanism

The automatic cleaning mechanism includes the wiping head, cleaning needle, running gear, tube system coordinating liquid absorption and discharge, etc., as shown in the figure:

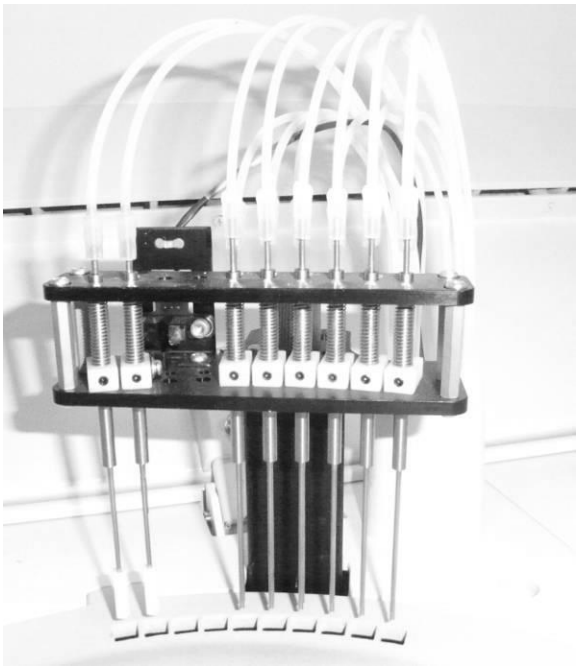


Figure 1-12 Automatic Test Cuvette Cleaning Mechanism

1.2.3.10 Functions of Automatic Cleaning Mechanism

- The automatic test cuvette cleaning mechanism can clean and dry the test cuvettes after testing during the analysis and test to ensure there is no cross contamination of the test cuvettes during the test;
- The test cuvettes are cleaned by stage, i.e. cleaning with cleanser, cleaning with deionized water, and drying with wiping head;
- The cleansers include alkaline cleanser and deionized water which are preheated;
- The cleaning wastewater of different concentrations flow separately to effectively control environmental pollution.

1.2.4 Liquid Path System

The liquid path system is used to deliver the liquid inside the whole machine and control the flow and direction of the liquid. It is composed of various pumps and valves.

1.2.4.1 Layout of Liquid Path Separator

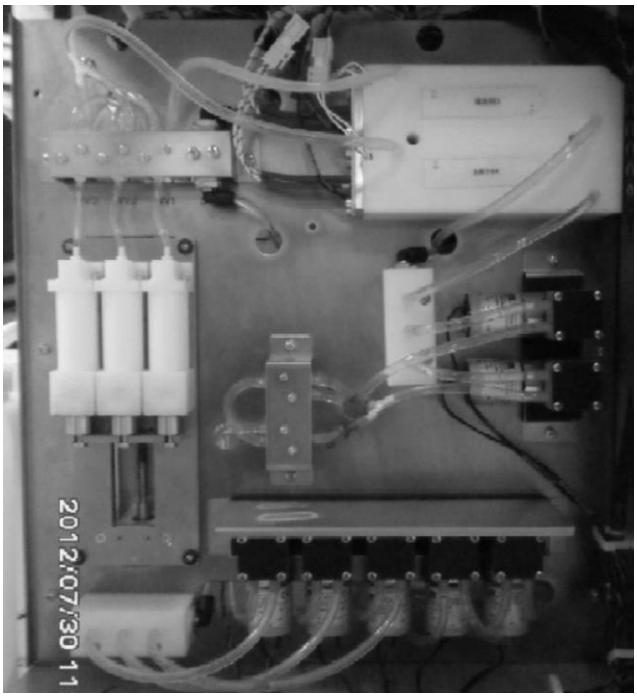


Figure 1-13 Layout of Liquid Path Separator

1.2.4.2 Functions of Liquid Path System

- The liquid path system is mainly used to deliver cleansers for the test cuvettes, sample probe, mixer, etc. and absorb and discharge cleaning wastewater;
- The liquid pump and syringe Unit in the liquid path system provide driving force for liquid delivery;
- The valves in the liquid path system are mainly used to control the direction of liquid or air.

1.3 Scope

Applicable to quantitative analysis of various samples with liquid reagents.

1.4 Technical Parameters

Type	Automated, random, optional, discrete; priority given to STAT sample; fully open analysis parameters and reagents
Principles of Analysis	Colorimetry, turbidimetry, ISE module (optional)
Analysis Method	End-point method, two-point method, kinetics method; single/ dual-wavelength test and three/four-reagent test support

Calibration Method	One point calibration, two-point calibration, multi-point linear calibration, nonlinear calibration, etc.
Items in Simultaneous Analysis	Up to 78 colorimetric items and 3 ISE items (K, Na and Cl; optional) in progress at the same time
Sample Positions	100 sample positions
Spec. of Test Tube	Standard test tube, original blood collection tube, and small sample cup
Sample Volume	2~45μl, increasing progressively by 0.1μl
Sample Barcode	Optional fixed barcode scanner
Sample Adding Technology	Automatic liquid level detection, tracking depending on volume, 3D collision avoidance
Automatic Sample Retest	Equivalent, increment and decrement retests, and 3~150 times dilution retest
Carry-over of Sample Probe	Cleaned automatically, carry-over ≤ 0.1%
Reagent Probe	Two reagent probes for R1(R3) and R2(R4) respectively; liquid level detection, tracking depending on volume, 3D collision avoidance
Reagent Position	80 reagent positions
Spec. of Reagent Vial	25ml and 70ml support; compatible with Hitachi reagent bottles
Volume of Reagent	R1: 150~350μl, R2: 20~250μl, increasing progressively by 1μl
Refrigeration of Reagent	2~10℃, 24-hour uninterrupted refrigeration
Reagent Barcode	Optional fixed barcode scanner
Carry-over of Reagent Probe	Cleaned automatically, carry-over ≤ 0.1%
Test cuvette	100 test cuvettes made of organic glass with the optical path of 5mm. Quartz test cuvettes of the same specification are compatible.
Volume of Reaction Liquid	150~500μl
Temperature Control of Reaction Disk	Direct solid heating, free from daily maintenance
Temperature of Reaction	Room temperature, 30℃, 37℃, temperature fluctuation ±0.2℃
Way of Mixing	Two mixers that begin the Mixing process after the sample and reagent are added respectively.
Cleaning of Test Cuvettes	8-stage automatic cleaning, preheating of cleanser, warning of minimal volume of cleanser
Light Source	Halogen lamp

Way of Light Splitting	Flat-field holographic concave grating, in the rear light splitting way
Wavelength	12 wavelengths, precision ±2nm
Detector	Photodiode array
Linear Range	0~2.5A
Input Equipment	Branded PC, Chinese and English versions of multimedia analysis and control software
Output Equipment	Wide-screen LCD, printer
Interface	RS232 serial port
Tube Connector	Connected to specific water machine, waste liquids of different concentrations discharged separately, with the minimal volume warning function
Power Supply	a.c.100V-240V, 50Hz/60Hz
Peak Water Consumption	≤ 20L/H
Working Environment	Temperature: 10℃~30℃; RH: 40%~85%, altitude below 2000 meters
Storage Environment	Well-ventilated environment with temperature of 0℃~40℃, RH ≤ 85%, without corrosive gas

Chapter 2 Introduction to Whole Machine Testing

2.1 Principle of Testing

LiDA500 adopts the colorimetry and ion selective electrode method (optional) for quantitative analysis of chemical composition of clinical samples of blood serum, blood plasma, urine, cerebrospinal fluid, etc.

The theoretical basis of the colorimetry is the Lamb-beer law: A = ε CL (ε is absorptivity; C is concentration; L is optical path (cm)), A = -lgT = lg I0/Ie (I0 is transmission light intensity of blank; Ie is transmission light intensity of solution). The transmission light intensity produces voltage signals after photodiode induction. The voltage signals are converted to digital signals AD via analog signals. The calculation formula for absorbance of LiDA500 is: A = 2*lg[(AD blank - dark current)/(AD - dark current)], in which, AD blank represents the light intensity value of the water blank; dark current represents the background light intensity value of the system; AD represents the light intensity value of the solution. As LiDA500 adopts cuvette with the optical path of 5mm, the absorbance value is multiplied by 2.

With the ion selective electrode method, K, Na and Cl can be tested. Three different electrodes are exchanged with the K-ion, Na-ion and Cl-ion in the sample respectively to generate electric potential changes. The ion concentration has a linear relation with electric potential changes. Therefore, quantitative measurement of concentrations of ions in the sample is conducted through electric potential changes.

$$E_x - E_s = S \log (C_x / C_s) \text{ or } C_x = C_s \times 10^{\wedge} [(E_x - E_s)/S]$$

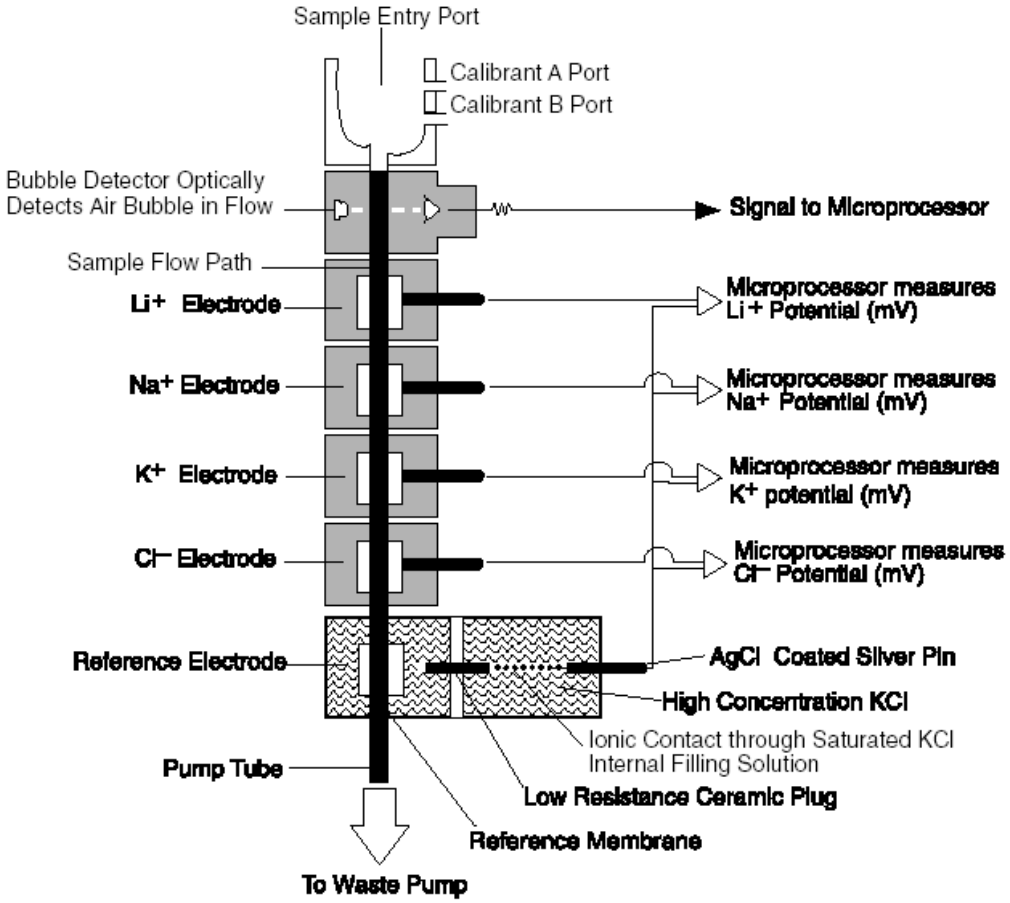
E_x = Electric potential measured for the sample

E_s = Electric potential measured for the standard solution

S = Calibration slope

C_x = Concentration of ion in the sample

C_s = Concentration of ion in the standard solution



When the optional ISE Unit is installed in LiDA500, only Na, K and Cl channels are used, without the Li channel. The spacer electrode is adopted instead.

2.2 Testing Methods

LiDA500 adopts three analysis methods, i.e.:

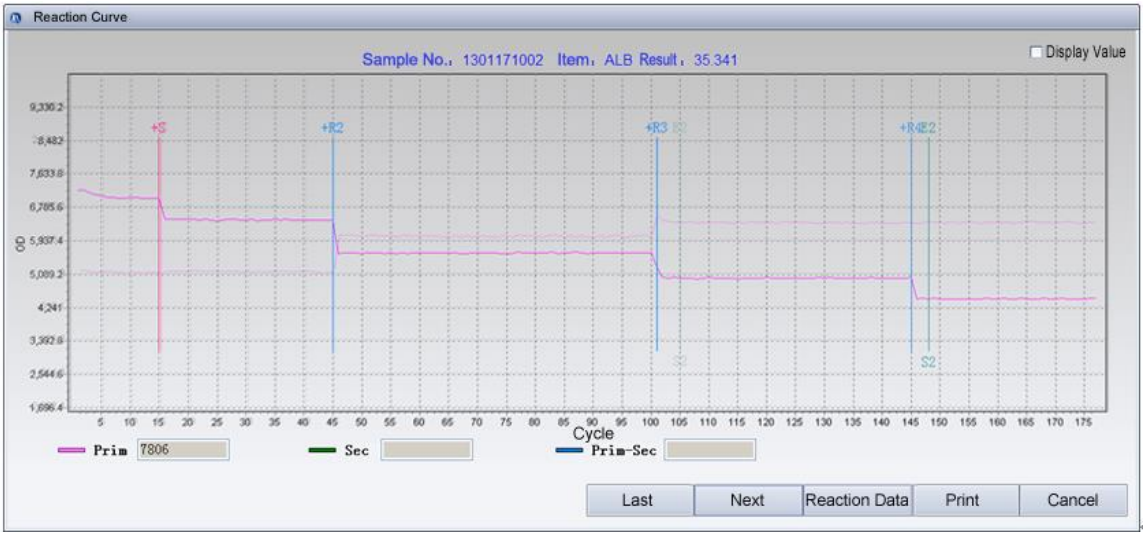
- end-point method
- two-point method
- kinetics method

2.3 Typical Reaction Curves

Single-reagent test

Double-reagent test

Three-reagent test



Four-reagent test

Chapter 3 Installation

3.1 Installation Requirements

3.1.1 Environment Requirements

3.1.1.1 Requirements of Storage Environment:

- Temperature: 0-40℃
- Humidity: 30%-80%, no condensation
- Atmospheric Pressure: 500hPa ~ 1060hPa
- Altitude: -400m ~ 5500m

3.1.1.2 Requirements of Working Environment

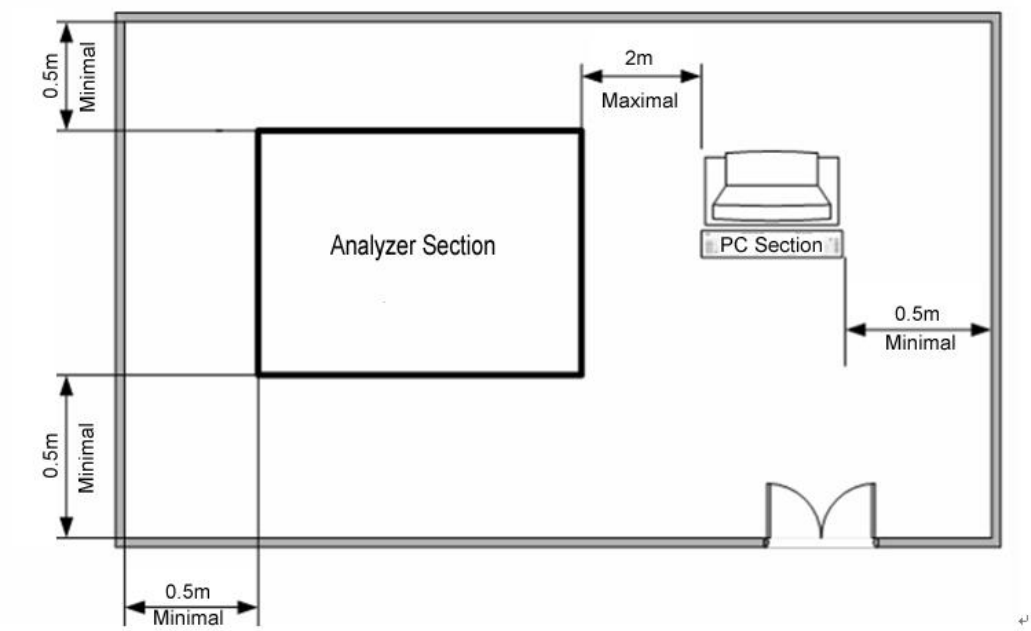
- Temperature: 10-30℃
- Humidity: 40%-85%, no condensation
- Atmospheric Pressure: 86kPa ~ 106kPa
- Altitude: -400m ~ 2000m

3.1.1.3 Requirements of Installation Site

LiDA500 must be installed by professionals. In order to ensure the instrument works normally, put it in a workplace meeting the following requirements

- Level ground or desk (inclination < 1/200); load bearing ≥ 300Kg
- No direct sunshine;
- No large amounts of dust;
- No strong electromagnetic radiation;
- Easy power off operation;
- A level, solid desk that is big enough;
- With good ventilation;
- Avoid moist and high temperature; avoid violent vibration and impact.
- After installation, try to avoid frequent movement. To move the instrument, use a stable cart. The angle of inclination should not be greater than 15° when the instrument is being moved

Please place the analysis section and operation section as shown in the figure below. The gap between the analysis section and wall must not be less than 0.5m.



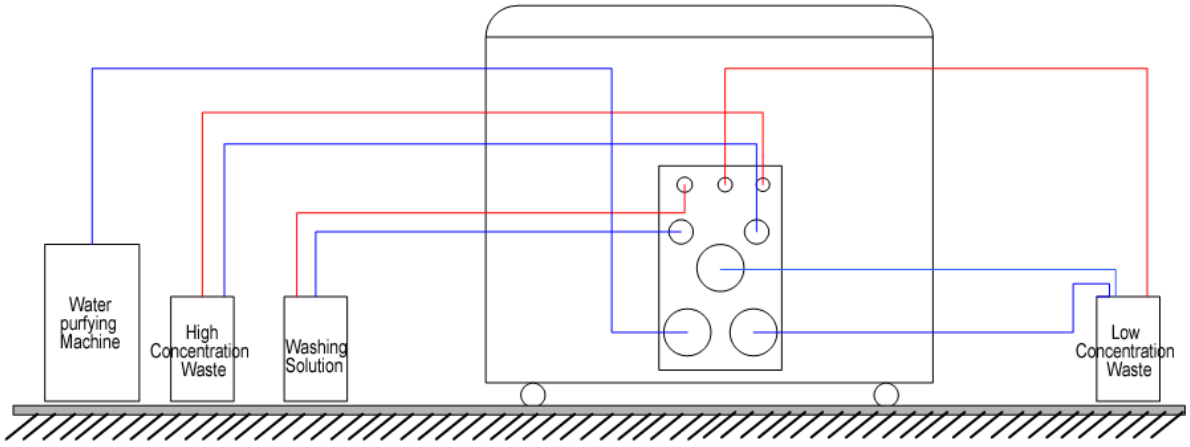
3.1.1.4 Requirements of Power Supply

Voltage of Power Supply: a.c.100 V -240V; Voltage Fluctuation ≤ ±10%

Frequency: 50Hz/60Hz

Power: 1500W

Fuse: T10AL 250V Φ5X20



Warning: (1) The AC power supply must be grounded properly (zero to earth voltage < 5V).

(2) Check that the input voltage complies with the requirements of the instrument. The AC power supply must be stable. Sharing a power supply with high power electrical appliances is prohibited. It is better to be equipped with a regulated power supply.

(3) Before connecting the electric cable, check that the switch of the instrument is off.

(4) In case of smog, peculiar smell or abnormal noise, immediately turn off the power and contact the retailer.
(5) To unplug the electric cable, grasp the plug, rather than the cord.

3.1.1.5 Requirements of Water Supply and Discharge

Difference in height between waste liquid discharge outlet and ground ≤ 100mm;
The quality of water supplied must meet CAP Class II Water Requirements.
The temperature of water supplied must be 5-50℃.

Connect the liquid paths correctly as shown in the figure below. If there is a water discharge system in the room, the low concentration waste liquid can be directly discharged to the water discharge system

Warning: When connecting the drain tube, do not fold or compress the drain tube.
Caution: The high concentration waste liquid outlet joint on the back of the analysis section must be inserted in place, otherwise the automatic cleaning system will overflow.
Biohazard: Be sure to wear gloves and work clothes during operation to prevent infection.

3.2 Installation Process

3.2.1 Unboxing

1. Put the whole machine on the level ground, remove the 4 sides and top cover of the outer box with a slot-type screwdriver and a hammer, and remove the buffers for storage;

Figure 3.2.1.1

2. Remove the 4 fixing plates that fix the machine with 2 wrenches;

Figure 3.2.1.2

3. Loosen the 4 anchor nuts with a wrench, and rotate the anchor up to the maximum height;

Figure 3.2.1.3

4. Loosen the 4 bolts that fix the slope board and put the slope board on the side of the machine, close to the bottom plate of the box;

Figure 3.2.1.4

5. Two persons push the whole machine from one side of the slope board, slide the machine slowly to the level ground, put it at an appropriate position, and unscrew the 4 anchors till the machine touches the ground.

Figure 3.2.1.5

6. Open the big flap of the whole machine and remove the buffers for storage.

Figure 3.2.1.6

3.2.2 Installation

1. Unpack the computer, put it on the computer operation desk, connect the keyboard, mouse, data cable for display, electric cable for display and electric cable for mainframe;
2. Unpack the accessories and take out the serial port cable and international electric cable from the small accessory box. Check that the 2 switches of the whole machine are off, connect the electric cable to the power input port on the left bottom corner of the back of the whole machine, and insert the power plug into the appropriate power socket. Connect one end of the serial port cable to the serial port of the whole machine and the other end to the serial port of the computer;

Figure 3.2.2.1

3. Take the cleanser bottle, high concentration waste liquid bottle and low concentration waste liquid bottle out of the accessory box, put them on the back side of the machine, cap the bottles with the corresponding caps from the small accessory box and tighten the caps, connect the sensors on the caps to the three corresponding jacks, and connect the tubes to the corresponding plugs;

Figure 3.2.2.2

Chapter 4 Hardware and Electric Devices

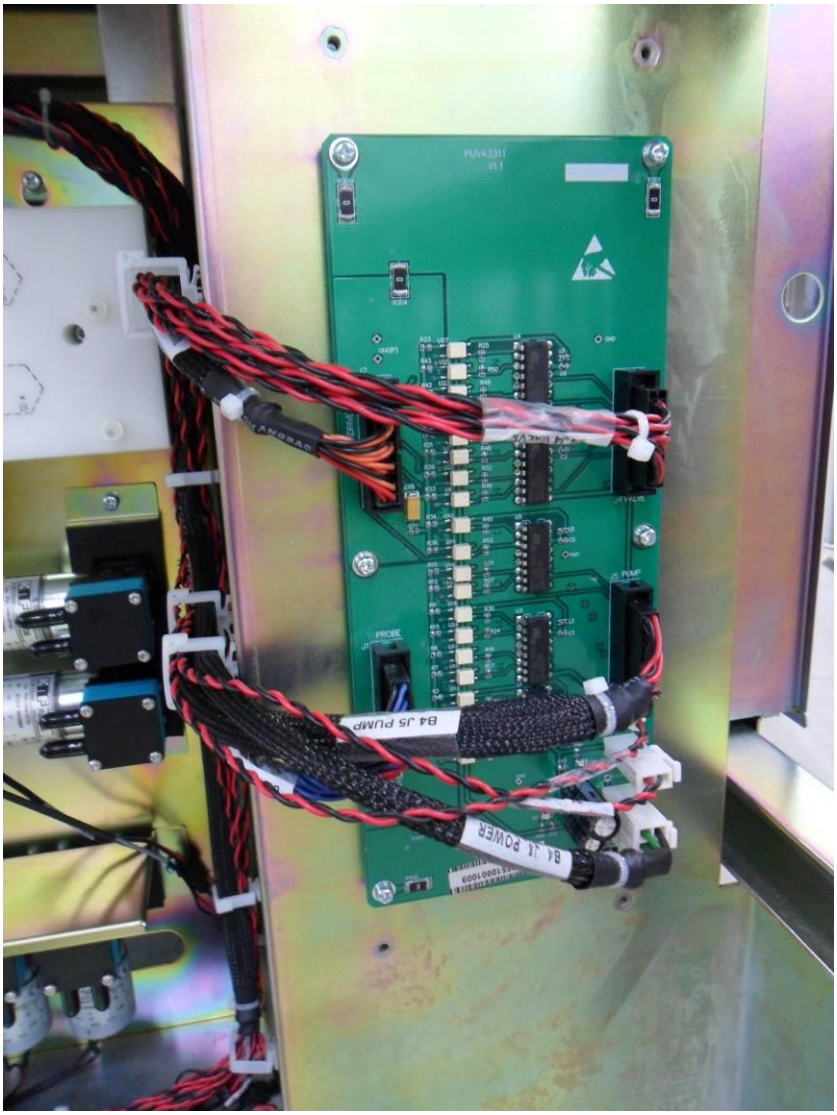
4.1 List of Boards on LiDA500

1. Main control Board
2. Disk control Board
3. Probe driver board
4. AD receiving board
5. Photoelectric conversion board
6. Pump and valve driver board
7. Refrigeration board
8. Liquid level detection board
9. Adapter plates: Heating Membrane adapter plate, reaction disk temperature control adapter plate, opto-coupler fixing plate, waste liquid and cleanser warning plate

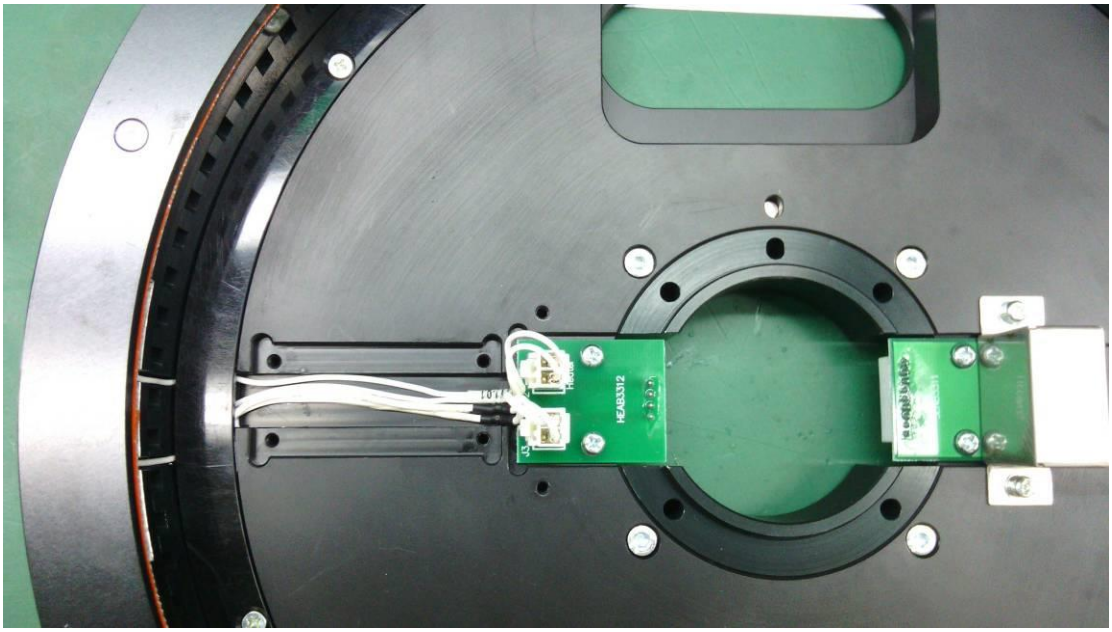
4.2 Distribution of Boards on the Instrument

Main control Board, disk control Board, probe driver board and refrigeration board: On the left side of the instrument

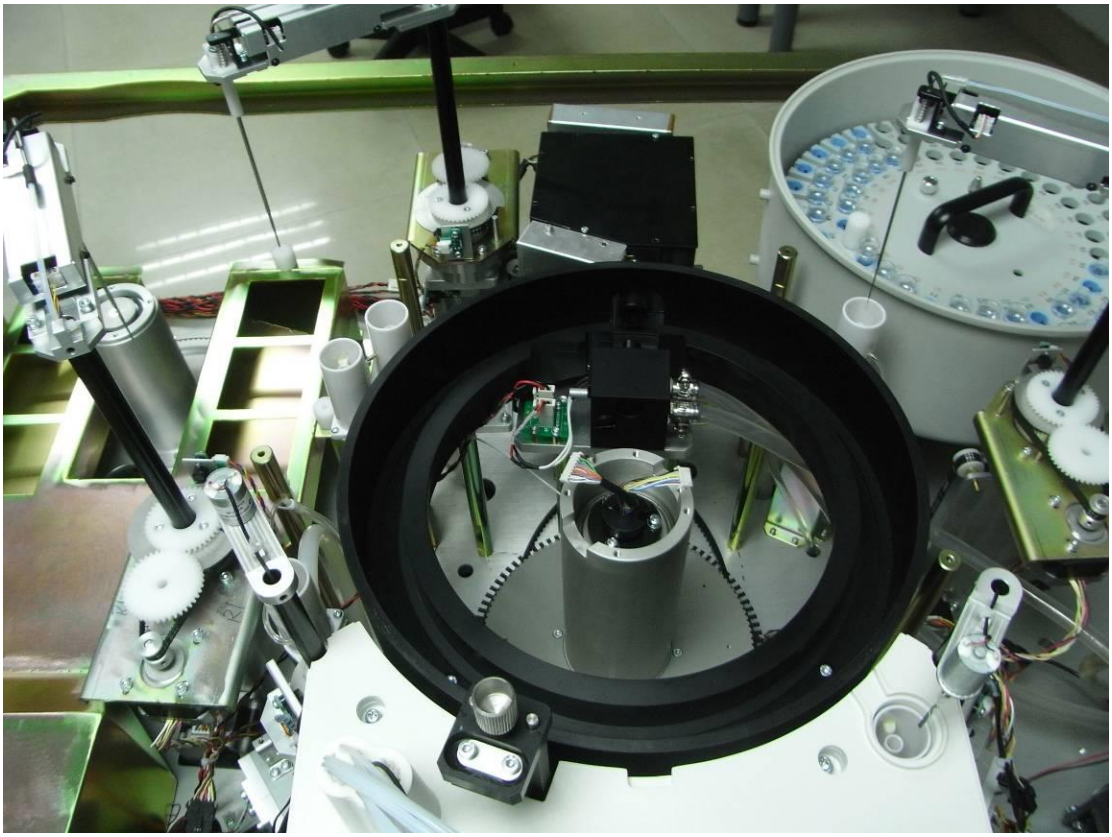
Pump and valve driver board: On the right side of the instrument



Reaction disk temperature control adapter plate and heating Membrane adapter plate: On the reaction disk



Lamp adapter plate: Under the reaction disk



Optocoupler fixing plates: At different positions in the instrument.

4.3 Main Control Board

4.3.1 Functions

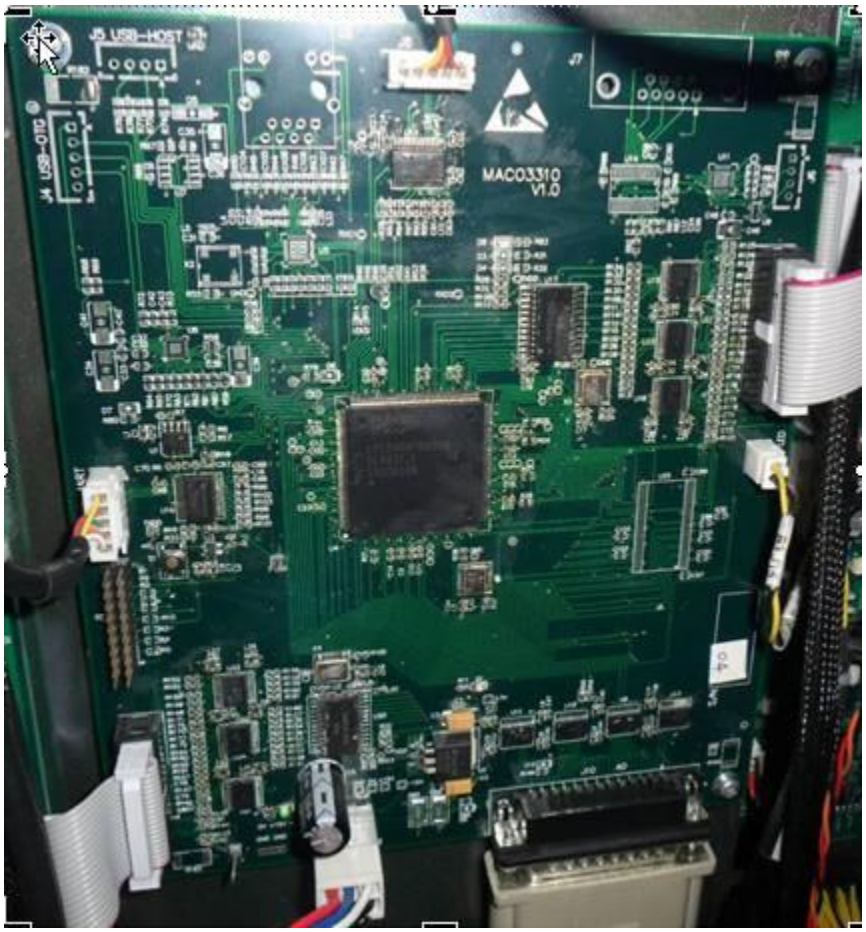
Receives commands or data from the upper computer (PC), breaks down the commands into specific commands, sends the specific commands to the lower computer (probe control Board and disk control Board), and returns the commands or data from the lower computer to the upper computer; receives data from the AD receiving board, pre-processes the data, and returns the pre-processed data to the upper computer.

4.3.2 Definition of Ports and Pins

1. PC port
2. Probe control Board port
3. Disk control Board port
4. AD receiving board port (J10)
5. ISE port (J8)
6. Power port (J2)

4.3.3 Diagram of Material Object

4.4 Disk Control Board



4.4.1 Functions

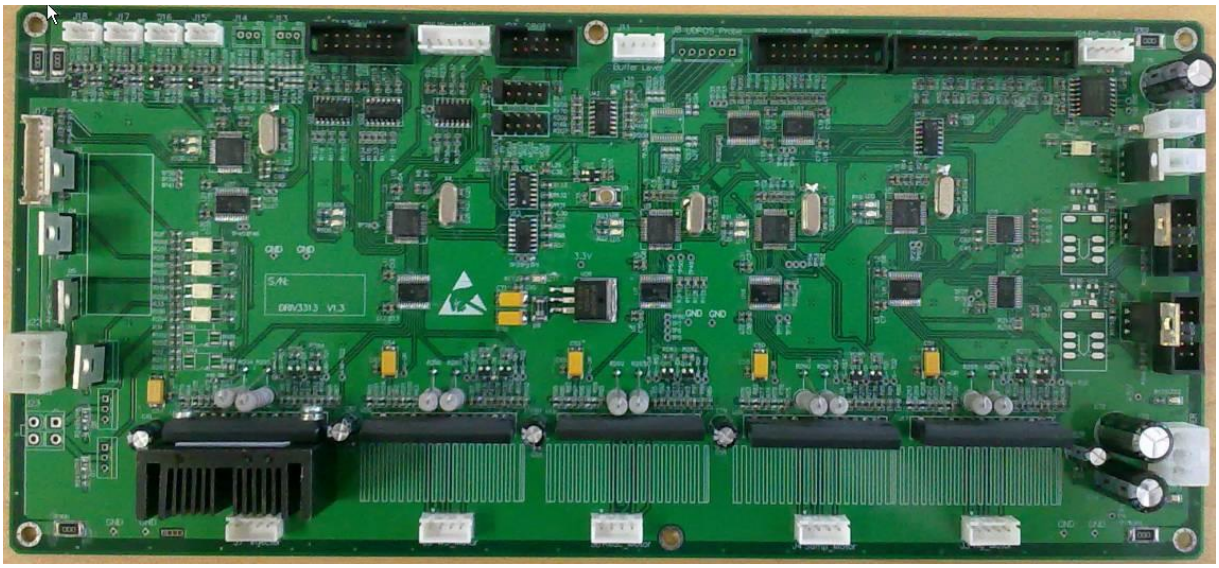
It Controls motors for the sample disk, reagent disk and reaction disk, and It also control motor for automatic cleaning and pumps and valves, and control temperature.

4.4.2 Definition of Ports and Pins

1. Middle-level computer board port (J19 COMMUNICATION)
2. Probe control Board port (J8 UDPOS_OUTPUT)
3. Reaction disk slip ring port (J12 Slipring)
4. Pump and valve driver board port (J10 PUMP-VALVE)
5. Heater (J22 Heater)
6. Power input (J20 POWER)
7. Position detection (J1 POS_Sensor)
8. MCU JTAG jumper 1(JP1 C2D)
9. MCU JTAG jumper 2 (JP2 C2CK)
10. MCU JTAG (JP3 JTAG)
11. Reagent disk rotation motor (J3 Rg_Motor)

12. Sample disk rotation motor (J4 Samp_Motor)
13. Reaction disk rotation motor (J6 Reac_Motor)
14. Automatic cleaning syringe motor (J7 Injecter)
15. Automatic cleaning up/down motor (J9 WS_Motor)
16. Ambient temperature sensor (J15 CIR)
17. Barcode scanner heating sensor (J16 CODE)
18. Cleanser preheating sensor 1 (J17 W1）
19. Cleanser preheating sensor 2 (J18 W2)
20. Buffer vial liquid level sensor (J11 Buffer Lever)
21. Buffer vial liquid level sensor (J26 Waste & Water)
22. Reagent disk barcode scanner (J2 R-Scanner)
23. Reagent disk barcode scanner (J5 S-Scanner)
24. Lamp power supply (J24 POWER-LAMP)
25. Lamp (J25 LAMP)

4.4.3 Diagram of Material Object



4.5 Probe Driver Board

4.5.1 Functions

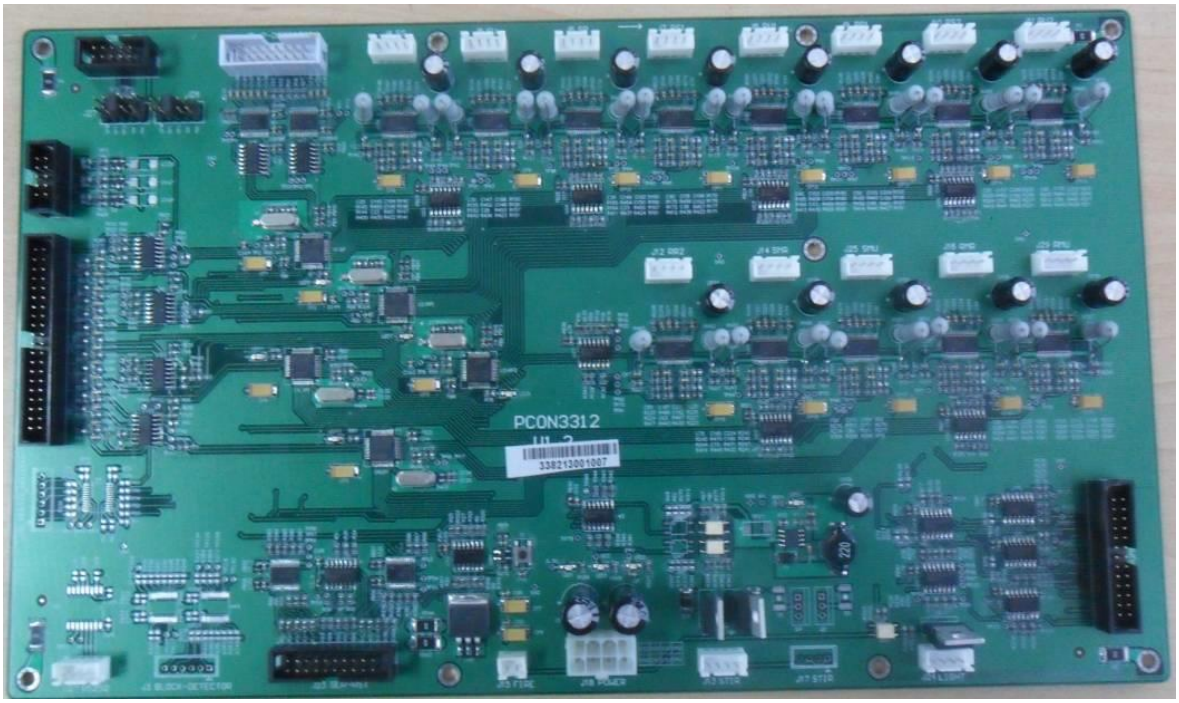
Its function is Movement control of three arms (sample arm, reagent 1 arm and reagent 2 arm); suction and inner and outer wall cleaning of three probes (sample probe, reagent probe 1 and reagent probe 2); movement control and cleaning of two mixers (mixer 1 and mixer 2)

4.5.2 Definition of Ports and Pins

1. J23 SER-RST (Main control Board port)
2. J20 UDPOS_OUTPUT (Disk control Board port)
3. J2 P-DETECTOR (Liquid level detection board port)

4. J21 PUMP-VALVE (Pump and valve driver board port)
5. J1 CLASH-HO (Horizontal collision avoidance for three probes)
6. J18 POWER (Power input)
7. J19 POS_Sensor (Position detection)
8. J26 C2D (MCU JTAG jumper 1)
9. J27 C2CK (MCU JTAG jumper 2)
10. J28 JTAG (MCU JTAG)
11. J4 SS (Sample injection motor)
12. J5 SU (Sample probe up/down movement motor)
13. J6 SR (Sample probe rotation movement motor)
14. J7 RS1 (Reagent 1 injection motor)
15. J8 RU1 (Reagent 1 up/down movement motor)
16. J9 RR1 (Reagent 1 rotation movement motor)
17. J10 RS2 (Reagent 2 injection motor)
18. J11 RU2 (Reagent 2 up/down movement motor)
19. J12 RR2 (Reagent 2 rotation movement motor)
20. J13 SMU (Sample mixer up/down movement motor)
21. J14 RMR (Sample mixer rotation movement motor)
22. J15 RMU (Reagent mixer up/down movement motor)
23. J16 RMR (Reagent mixer rotation movement motor)
24. J17 STIR (DC mixing motor)

4.5.3 Diagram of Material Object



4.6 AD Receiving Board

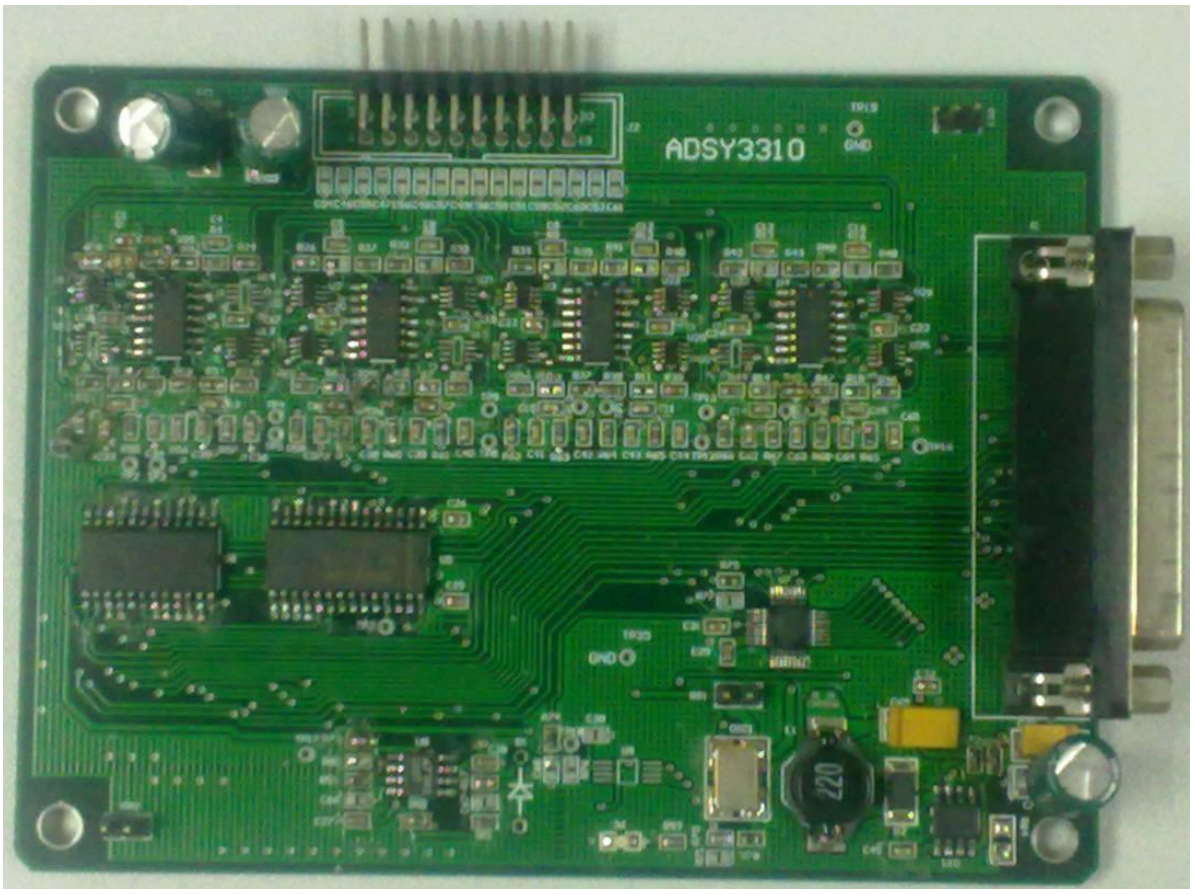
4.6.1 Functions

The AD receiving board processes the optoelectronic signals of 12 different wavelengths of the light path from the optical grating after passing through the test cuvette. Analog signals are converted to digital signals (AD conversion).

4.6.2 Definition of Ports and Pins

1. Photoelectric conversion board port J2
2. Middle computer port J1

4.6.3 Diagram of Material Object



4.7 Photoelectric Conversion Board

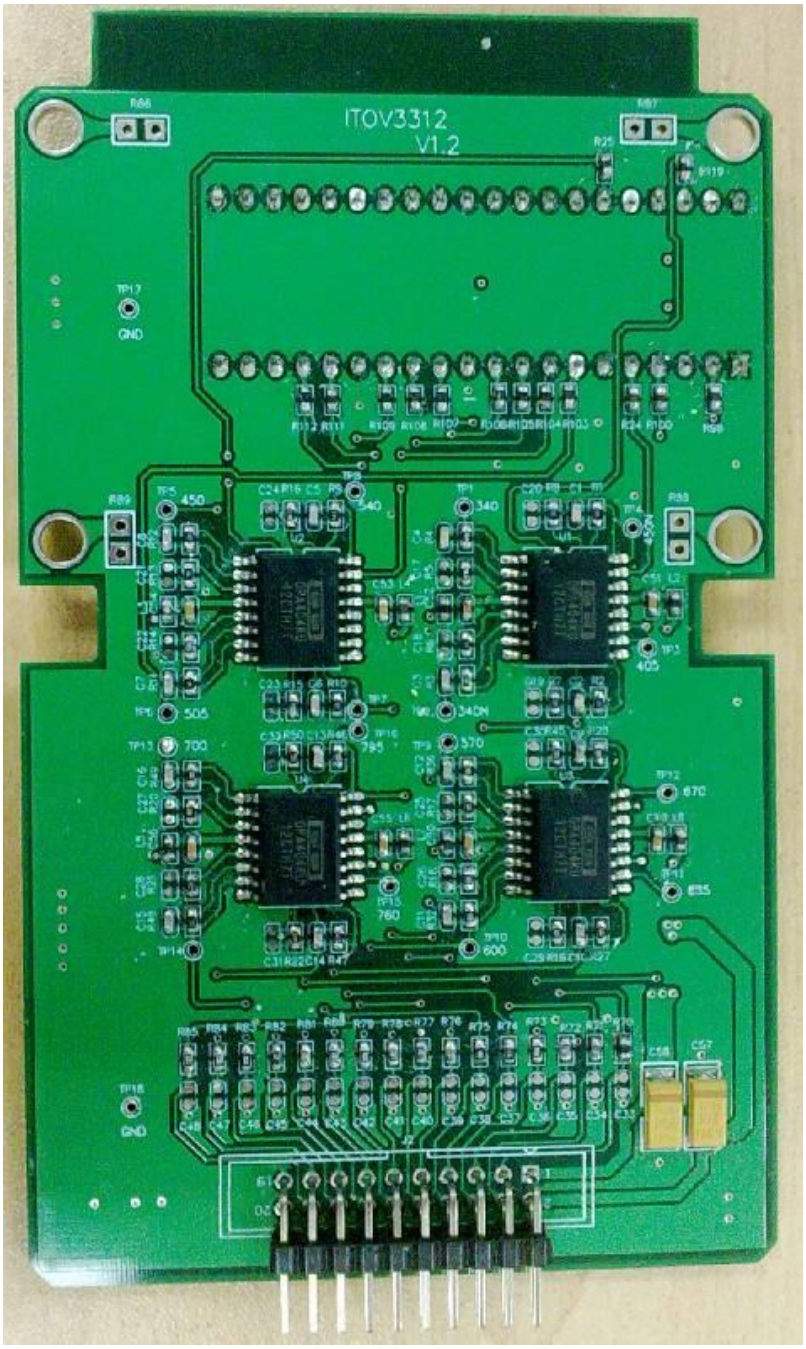
4.7.1 Functions

The photoelectric amplification board converts 12 channels of optical signal to voltage signals and transmits the voltage signals to the AD receiving board for AD receiving.

4.7.2 Definition of Ports and Pins

1. AD receiving board port J2

4.7.3 Diagram of Material Object



4.8 Pump and Valve Driver Board

4.8.1 Functions

Receives the pump and valve signals of the disk control Board and probe driver board, and opens or closes pumps and valves.

4.8.2 Definition of Ports and Pins

1. Power input port J3

Pin	Pin Signal	Pin Signal Name
1	+5V	+5V Voltage Input
2	+12V	+12V Voltage Input
3	+12V	+12V Voltage Input
4	GND	GND
5	GND	GND
6	GND	GND

2. Pump port J5

Pin	Signal Name	Pin	Signal Name
1	+12V	2	WP2(Drain Pump for Auto Washing Step 3-4)
3	+12V	4	WP1(Drain Pump for Auto Washing Step 1-2)
5	+12V	6	WP4(Drain Pump for Auto Washing Step 7)
7	+12V	8	WP3(Drain Pump for Auto Washing Step 5-6)
9	+12V	10	/(Empty, Reserved)
11	+12V	12	WP5(Drain Pump for Auto Washing Step 8)
13	+12V	14	WV2(Dispensing Valve for Auto washing step 3-4)
15	+12V	16	WV1(Dispensing Valve for Auto washing step 1-2)

17	+12V	18	WV3(Dispensing Valve for Auto washing step 5-6)
19	+12V	20	SV4(Main Valve for the Machine distilled water input)

3. Valve port J4

Pin	Signal Name	Pin	Signal Name
1	+12V	2	SV1(2-way valve for Sample Probe inner washing)
3	+12V	4	SV6(2-way valve for Reagent Probe 2 outer washing)
5	+12V	6	/(Empty, Reserved)
7	+12V	8	SV2(2-way valve for Reagent Probe 1 inner washing)
9	+12V	10	SV5(2-way valve for reagent probe 1,2 Outer washing)
11	+12V	12	SP1（Pump for 3 probes Outer washing）
13	+12V	14	SV3(2-way valve for Probe Inner washing)
15	+12V	16	/(Empty, Reserved)
17	+12V	18	MP1(Mixer Washing Pump)
19	+12V	20	/(Empty, Reserved)

4. Lamp fan port J6

Pin	Signal Name	Pin	Signal Name
1	+12V	2	GND

5. Lamp refrigeration pump port J7

Pin	Signal Name	Pin	Signal Name
1	+12V	2	GND

4.8.3 Diagram of Material Object

4.9 Refrigeration Board

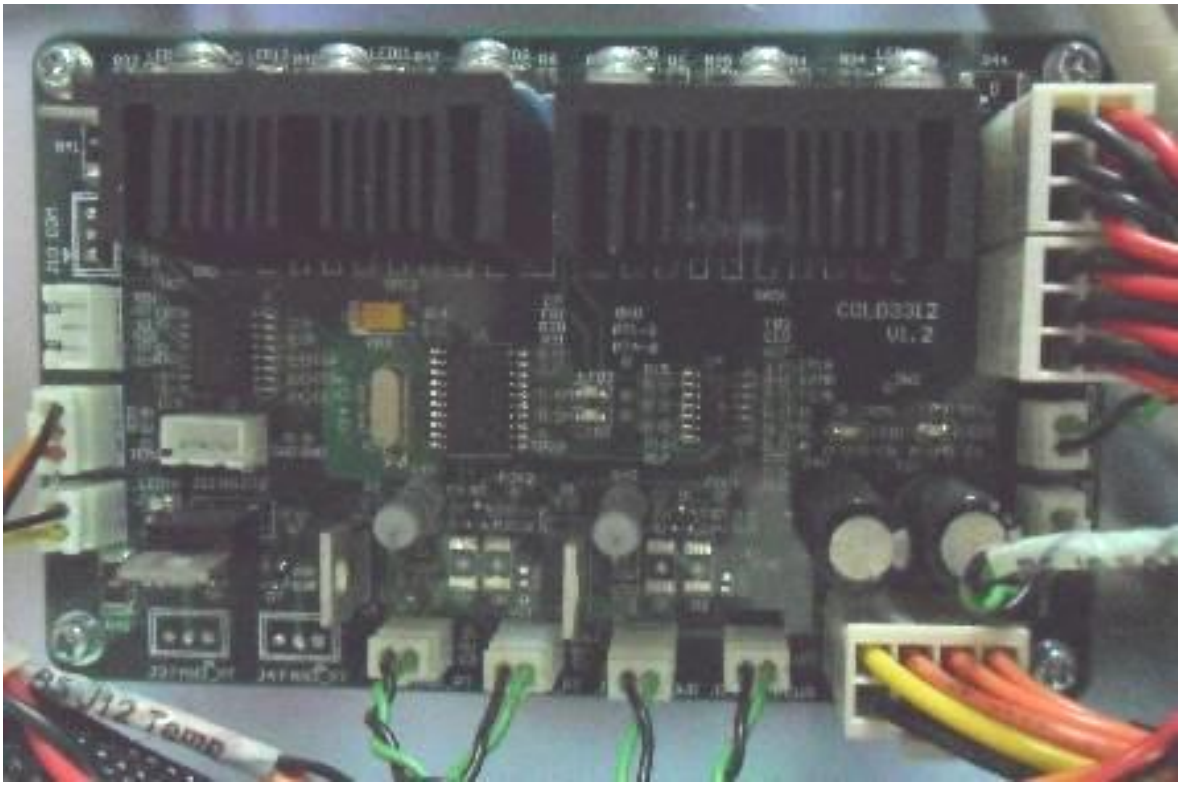
4.9.1 Functions

The refrigeration board mainly realizes the functions of reagent disk refrigeration and heat dissipation with fan. The board adopts independent power supply and switch. The Peltier refrigerator and all fans are started at the same time. The refrigeration temperature range of reagents is 2~10℃ for uninterrupted refrigeration.

4.9.2 Definition of Ports and Pins

1. FAN2_PT (2 line cooling fan 1)
2. J1 FAN2_PT (2 line cooling fan 2)
3. J3 FAN3_PT (3 line cooling fan 1)
4. J4 FAN3_PT (3 line cooling fan 2)
5. J5 FAN_PCB (PCB fan)
6. J6 FAN_PCB (PCB fan)
7. J7 FAN_POWER (Power supply fan 1)
8. J8 FAN_POWER (Power supply fan 2)
9. J9 SER (UART)
10. J12 TEMP (Temperature detection)
11. J13 Peltier1 (Peltier set 1)
12. J16 Peltier (Peltier set 2)
13. J14 LAMP (Indicator)
14. J15 POWER (Power supply)

4.9.3 Diagram of Material Object



4.10 Other Boards

4.10.1 Liquid Level Detection Board

The three probes detect whether there is available quantity of reagent or sample. The PCBA uses the liquid level detection board for Chemray 240.

4.10.2 Heating Membrane Adapter Board

The heating Membrane is fixed on the reaction disk which is rotating. The power control wire for the heating Membrane is connected to the heating Membrane adapter plate from the disk control Board through the slip ring. The heating Membrane adapter plate transmits the signal to the heating Membrane.

4.10.3 Reaction Disk Temperature Control Adapter Board

The reaction disk temperature control sensor is mounted on the reaction disk and rotates with the rotation of the reaction disk. The slip ring connected to adapter plate transmits the temperature signal to the disk control Board.

4.10.4 Optocoupler Fixing Board

As the optocoupler position sensor used is not supplied with a cable and needs welding. For convenient installation and replacement, an optocoupler fixing plate is added which is mainly used to detect the position signal of the motor.

4.10.5 Waste Liquid and Cleanser Warning Board

In order to detect the inadequacy of cleanser and the fullness of waste liquid container, a float-type sensor is added which is connected to the waste liquid and cleanser warning plate on the back of the machine. The waste liquid and cleanser warning plate for Chemray 240 is used.

4.10.6 Lamp Adapter Board

For convenient replacement of the lamp, an adapter plate is added between the power supply and the lamp, which is mounted under the reaction disk.

Chapter 5 Optics

5.1 Structural Drawing of Optical Unit

A single optical Unit is divided into 4 units in a simple way.

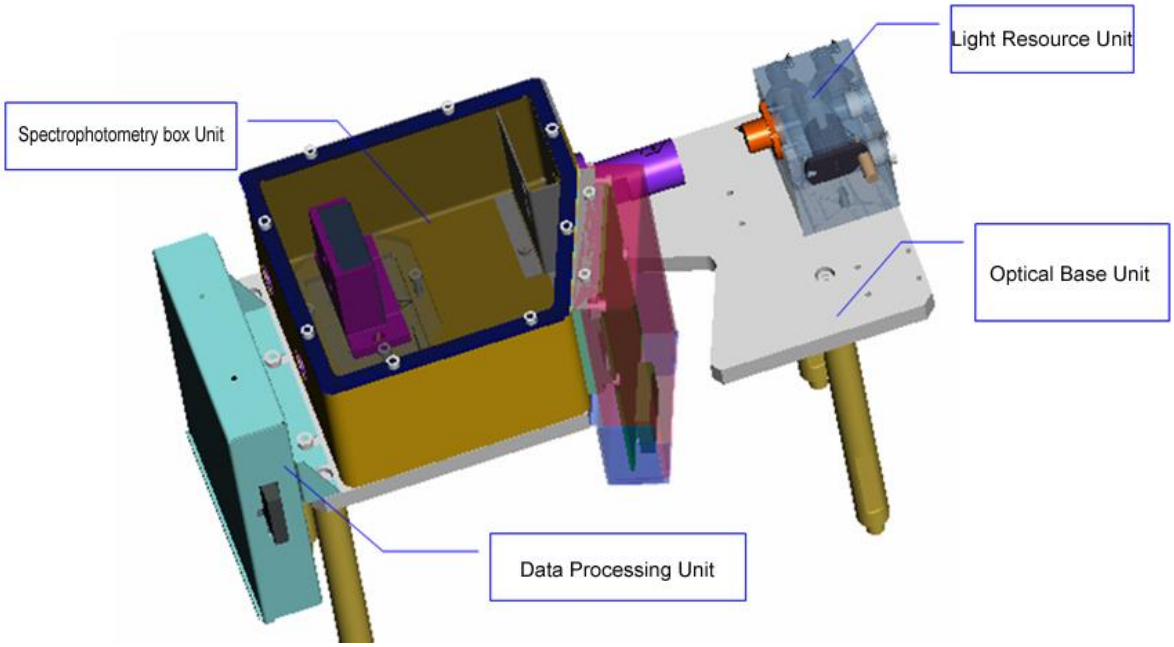


Figure 1

5.2 Functions of the Components

- Optical Mount Unit: Fixes the whole optical Unit on the big plate of the instrument;
- Light Source Unit: This unit includes a lamp holder and a collimating lens and can emit polychromatic light after it is powered on;
- Splitter Box Unit: This unit includes a focus lens, a splitter component and a detector component; the polychromatic light emitted by the light source unit is focused and, through grating dispersion in the splitter component, is reflected to the receiving surface of the detector;
- Data Processing Unit: The test data are amplified, filtered, etc.

Chapter 6 Component Replacement

6.1 List of Tools Used

During maintenance, the following tools, cleanser, alcohol, etc. may be used.

- Tools: A set of allen wrench, cross screwdriver, slot-type screwdriver, gauze, and 2 monkey wrenches
- Cleanser: Cleanser designated by LiNEAR
- Others: Alcohol

6.2 Removal of Shell and Board

6.2.1 Removal of Left and Right Doors

1. Remove the 2 rubber plugs at the bottom of the side door manually (circled in red in Figure 8.2.1.1);
2. Loosen and remove the 2 screws in the plug holes with the cross screwdriver;

8.2.1.1

3. Lift the side door away the clip-on mount to remove the side door.

6.2.2 Removal of Rear Side Plate-1 and Rear Side Plate-2 (Figure 8.2.2.1)

Remove all screws that fix the rear side plate-1 and rear side plate-2 and one earthing

rod with the cross screwdriver to remove the rear side plate-1 and rear side plate-2.

Figure 8.2.2.1

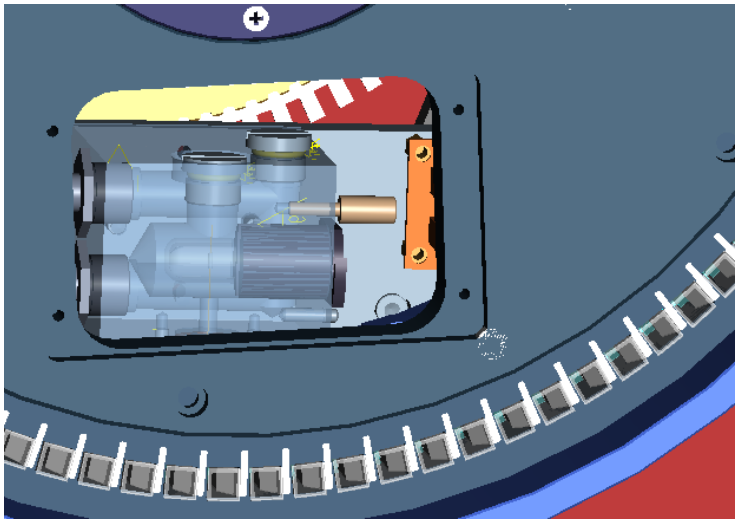
6.2.3 Removal of Left Bottom Front Cover Plate (Figure 8.2.3.1)

Remove the 4 screws that fix the left bottom front cover plate with the cross screwdriver to remove the cover.

6.3 Replacement of Lamp Unit

1. Loosen the 4 fixing screws of the lifting handle of the reaction disk, remove the lifting handle by hand, and put it aside;
2. Rotate the lifting handle of the reaction disk to the lamp holder;

3. Unplug the power plug of the lamp, loosen the fixing screw of the lamp (without removal), rotate the lamp counterclockwise by 90 degrees, and pull the lamp out horizontally;



4. Insert the new lamp into the lamp holder, rotate the lamp clockwise by 90 degrees till it clicks into place, and tighten the screws;
5. Insert the plug of the lamp into the socket on the voltage conversion board of the lamp. Make sure to press the wire of the lamp down, with the highest point not exceeding the top surface of the lamp holder.

6.4 Replacement Syringe Unit

6.4.1 How to Replace the Reagent Syringe Unit

1. Open the front door of the machine, remove the 4 fixing screws of the baffle of the reagent syringe with the cross screwdriver, remove the baffle, and put it aside;

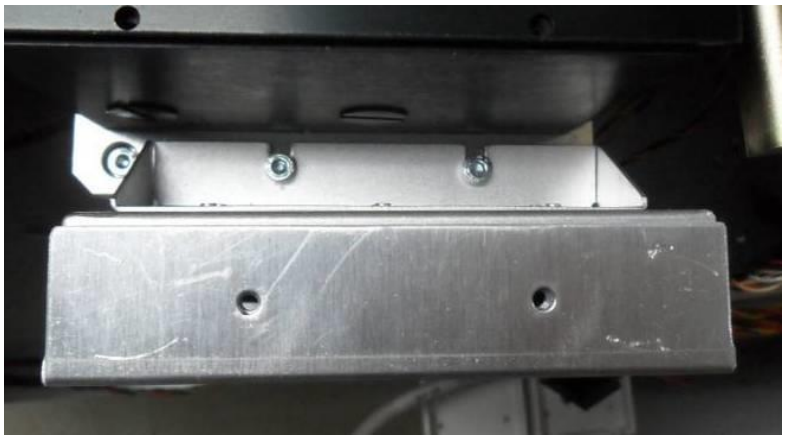
2. Remove the 4 screws that fix the reagent syringe with the cross screwdriver, unplug the reagent syringe Unit by hand, and unplug the optocoupler connecting cable, solenoid valve connection cable and motor connection cable respectively;
3. Connect the optocoupler connecting cable, solenoid valve connection cable and motor connection cable to the new syringe respectively;
4. Fix the new syringe to the original position with the 4 screws;
5. Fix the baffle of the reagent syringe to the original position.

6.4.2 How to Replace the Sample Syringe Unit

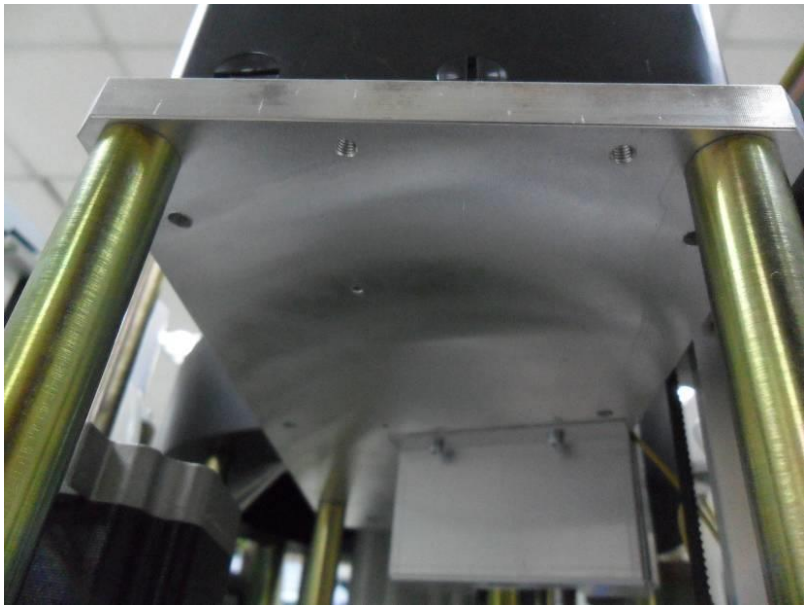
Refer to the method for replacing the reagent syringe Unit.

6.5 Replacement of Light Splitting Box Unit for Light Path

1. Remove the 3 rubber plugs on the workbench surface-12;
2. Remove the 3 screws that fix the workbench surface-12 with the cross screwdriver, pull the workbench surface-12 forward, unplug the connection cable of the Board indicator, and put the workbench surface-12 aside;
3. Remove the 4 screws that fix the workbench surface-4 with the cross screwdriver,, and lift the workbench surface-4;
4. Remove the 2 fixing screws on the photoelectric conversion board with the allen wrench, unplug the data connection cable of the board, remove the board, and put it aside;



5. Unscrew the 4 screws that fix the light splitting box at the bottom of the bottom plate of the optical system with the allen wrench, and lift the light splitting box;



6. Put the new light splitting box on the bottom plate of the optical system, align with the dowel pin, and fix it with 4 socket head cap screws;
7. Fix the photoelectric conversion board with 2 soket head cap screws;
8. Assemble the shell to the original position.

6.6 Replacement of Pump and Valve Units

6.6.1 How to Replace Pumps (MP, SP)

1. Remove the left door of the machine;

2. Prepare an appropriate vessel to retain water and put it under the pump, cut the cable ties with the diagonal pliers, unplug the liquid path tube, receive the water flowing from the pump and tube, and remove the vessel when there is no water flowing out;
3. Remove the 2 fixing screws on the pump and valve fixing plate-2 with the cross screwdriver, unplug the pump and valve fixing plate-2, and unplug the pump connection cable;
4. Remove the pump with the cross screwdriver and mount the new pump on the pump and valve fixing plate-2;
5. Connect the pump connection cable to the pump and pay attention to the corresponding number;
6. Mount the pump and valve fixing plate-2 on the liquid path Unit fixing plate.

6.6.2 How to Replace Pumps (SP1, SP2, SP3, SP4 and SP5)

Refer to the method for replacing pumps (MP, SP).

6.6.3 How to Replace Valves (SV5, SV6)

Refer to the method for replacing pumps (MP, SP).

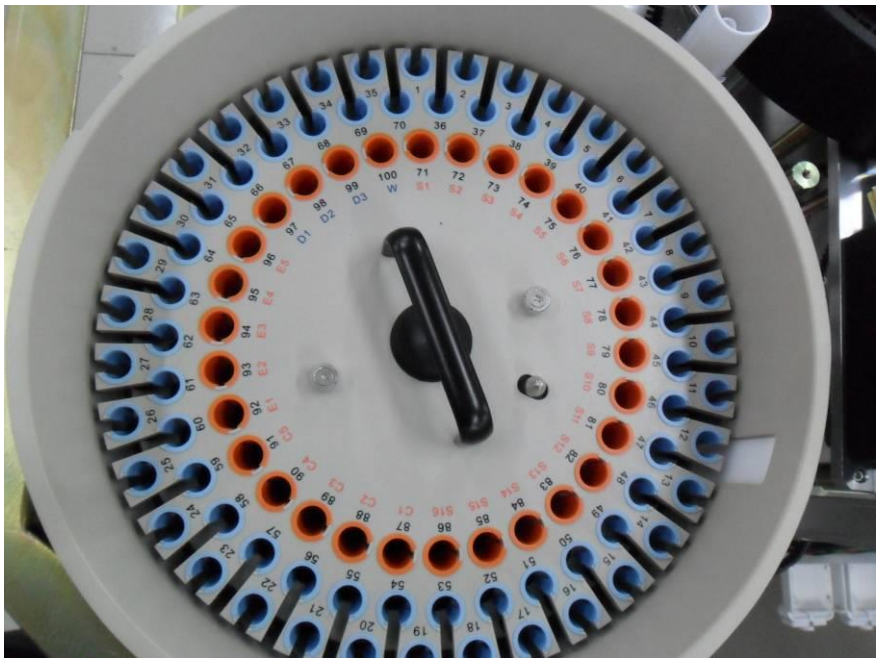
6.6.4 How to Replace Valves (SV1, SV2, SV3 and SV4)

Refer to the method for replacing pumps (MP, SP).

6.7 Replacement of Disk Unit

6.7.1 Replacement of Sample Disk

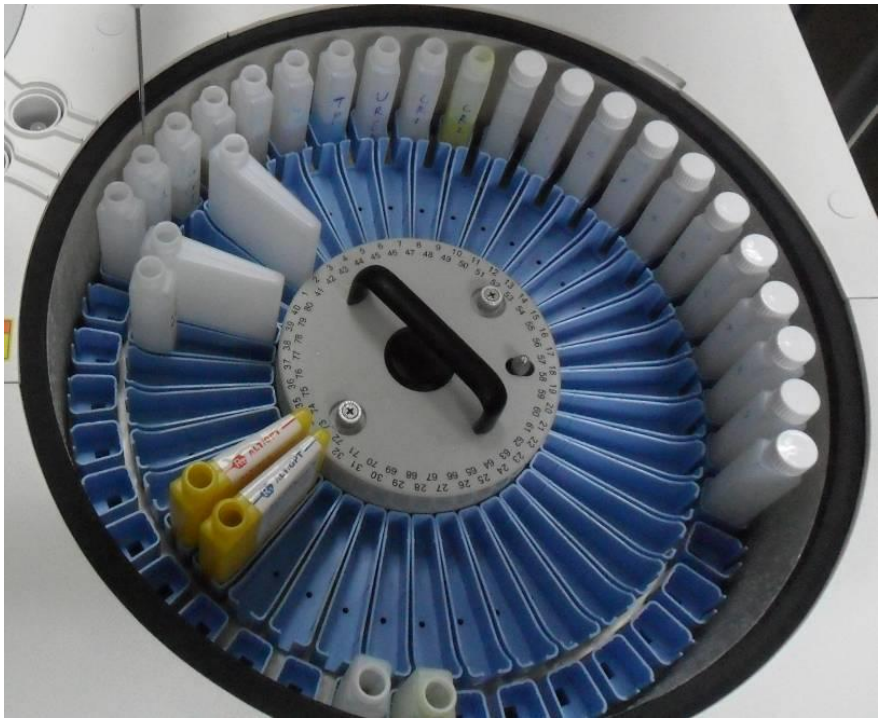
1. Open the sample disk cover and unscrew the 2 spring screws of the sample disk;



2. Lift the lifting handle and take out the sample disk;
3. Align the new sample disk Unit with the dowel pin and put it into the sample pot;
4. Tighten the 2 spring screws, and the replacement is finished.

6.7.2 Replacement of Regent Disk

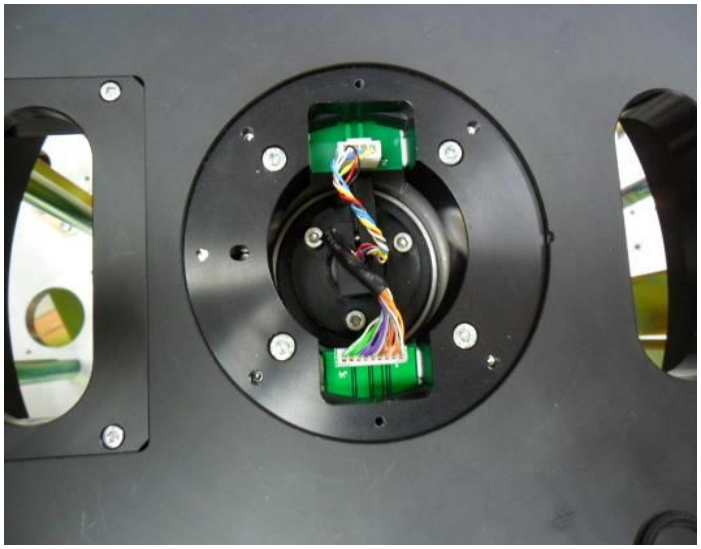
1. Open the reagent disk cover and unscrew the 2 spring screws of the reagent disk;



2. Lift the lifting handle and take out the reagent disk;
3. Align the new reagent disk Unit with the dowel pin and put it into the reagent pot;
4. Tighten the 2 spring screws, and the replacement is finished.

6.7.3 Replacement of Reaction Disk

1. Remove the 2 fixing screws on the slip ring cover plate with the cross screwdriver and remove the cover;
2. Unscrew the 4 fixing screws shown in the figure with the allen wrench;
3. Withhold the 2 U-grooves of the reaction disk by two hands and lift the reaction disk Unit;
4. Put in the new reaction disk Unit by aligning with the dowel pin on the rotation axis of the reaction disk and fasten it with the 4 fixing screws;
5. Mount the slip ring cover plate and fix it with 2 sunk screws.

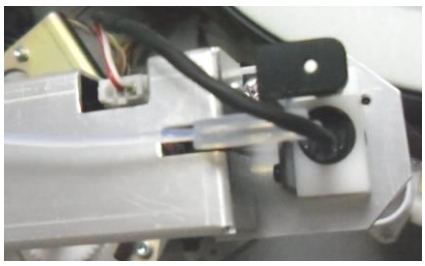


6.8 Replacement of Sample Adding Probe Unit (Take the sample probe Unit as an example)

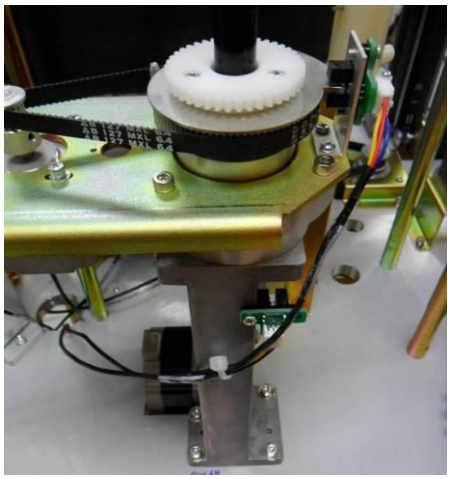
6.8.1 How to Replace the Sample Probe Unit

1. Remove the fixing screws of the decorative metal plate on the workbench, rear side plate-1 and rear side plate-2 with the cross screwdriver, remove the earthing rod with the wrench, remove the decorative metal plate, rear side plate-1 and rear side plate-2, and put them aside;
2. Remove the rubber mats on the workbench surface-1, workbench surface-2, workbench surface-4 and workbench surface-12, remove the fixing screws with the cross screwdriver, remove the 4 workbench surfaces, and put them aside;
3. Release the buckle of the rocker arm cover of the sample probe by hand and remove the rocker arm cover;
4. Unplug the connecting base between the liquid level detection board connection cable and the board with the tweezers, and unplug the connection point between the liquid level detection board connection cable and the liquid level detection connection cable from the bottom of the machine;

5. Unplug the white connector of the tube by hand (black tube for reagent probe);



6. Cut the cable ties with the diagonal pliers and draw the tube from the bottom of the big bottom plate;
7. Remove the 4 fixing screws of the sample probe Unit with the allen wrench and remove the sample probe Unit;



8. Put the new Unit to the original position and fix it with 4 screws;
9. Connect the liquid level detection board connection cable to the liquid level detection connection cable at the bottom of the big bottom plate and pull the liquid path tube through the conduit from the bottom to the liquid level detection board;
10. Connect the tube to the short rubber tube, insert the plug of the liquid level detection board connection cable into the liquid level detection board socket, insert one cable tie into the via hole of swing arm bottom plate 1, and tighten the cable and liquid path tube;
11. Fasten the rocker arm cover of the sample probe to the swing arm bottom plate 2 by aligning with the buckle;
12. Fix the shell and rear side of the machine on the frame.

6.8.2 How to Replace the Reagent Probe Unit

Similar to the method for the sample probe.

6.9 Replacement of Computer Unit

1. Loosen and remove the serial port cable of the computer;
2. Put the new computer to the specified position and make connections;
3. Connect the serial port cable to the serial port on the mainframe.

Chapter 7 Failure Treatment

7.1 Common Faults and Solutions

7.1.1 Abnormalities of Results

If, during a test, the result is abnormal (including out of the reference range, out of the linear range, substrate exhaust, nonlinear, no calculation interval, prozone check exceeding limit, etc.), whether a retest is required can be determined according to the actual needs (standard retest, predilution retest, increment retest, and decrement retest). A retest can be conducted manually (select the abnormal test result on the “Test Status” – “Test List” interface, click “Retest”, specify the retest method, and click “OK”); or you can set “Automatic Retest Setting” in the “System Setup” – “System Control Parameter” interface in advance.

7.1.2 Reagent Missing

When a certain reagent is missing during a test, the system will give up all tests corresponding to the item automatically. To continue the test of the item, supplement the reagent and click “Refresh Minimal Volume” on the “Test Status” – “Reagent Disk” interface. Then, the test of the item will be restored automatically.

7.1.3 Sample Missing

When a certain sample is missing during a test, the system will give up all tests corresponding to the sample automatically. To continue the test of the sample, make supplement and click “Refresh Minimal Volume” on the “Test Status” – “Sample Disk” interface. Then, the test of the sample will be restored automatically.

7.1.4 Collision Leading to Test Failure

When the sample probe or reagent probe is collided during a test, the corresponding test will be cancelled automatically. If “Do a retest automatically when the test fails” is selected on the “System Setup” – “System Control Parameter” interface, the system will do a retest automatically. If collision occurs at the same position three times in a row, the system will give up the corresponding test automatically.

7.1.5 Abnormality of Sample Probe/Reagent Probe Unit

When the sample probe/reagent probe fails and is not restored during a test, the system will stop all tests corresponding to the sample probe/reagent probe automatically. Here, the sample probe/reagent probe unit has failed. Enter the “Maintenance” – “Daily Maintenance”

interface, select the sample probe/reagent probe unit, and click “Failure Restoration”. If the restoration is successful, the sample probe/reagent probe will restore the normal status, and the system will continue the sample adding and test that have not been finished.

7.1.6 Cleanser/ Deionized Water Insufficient, Waste Liquid Full

If the cleanser is insufficient, the deionized water is insufficient or the waste liquid is full during a test, the software will display the prompt message. You can make the corresponding treatment immediately, otherwise the system will stop the test automatically after 20 test cycles.

7.1.7 System Failure

In the following cases when the system software is running, “System Failure” will appear on the left top corner of the software and the software status indictor on the front of the machine will go out.

A “stop level” failure occurs (see the Failure Code Table);

The cleanser is insufficient and is not supplemented timely;

The deionized water is insufficient and is not supplemented timely;

The high concentration/low concentration waste liquid is full and is not treated timely;

The communication fails;

When the software status is “System Failure”, the daily test can’t be conducted. If the failure has been removed, restart the system software or enter the “Daily Maintenance” interface to execute “Start Initialization”. The daily test can be conducted only when the software status is “Ready”.

7.2 Failure Code Table

Unit	Failure Code/Content	Failure Level	Treatment Measure
Main Processing Unit	001: Command error	Stop level	Check the connection of serial cables. Restart the instrument and PC; Check whether the board matches with the program version; If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	002: Parameter error	Stop level	
	003: Abnormality of self-check	Stop level	
	004: Communication failure	Stop level	
	005: The system is busy and cannot respond to other operations.	Stop level	
	006: Error of host memory	Stop level	
	007: The command sent to the	Stop level	

	upper computer is not responded or the response is wrong.		
	008: The command sent to the lower computer is not responded or the response is wrong.	Stop level	
	009: Error of communication frame sent by upper computer	Stop level	
	010: Error of communication frame sent by lower computer	Stop level	
	101: Time out sending command to R1 module	Stop level	Check the connection of the control line of the reagent probe 1 module; check whether the board matches with the program version.
	102: Time out R1 module executing command	Stop level	
	201: Time out sending command to R2 module	Stop level	Check the connection of the control line of reagent probe 2 module; check whether the board matches with the program version.
	202: Time out R2 module executing command	Stop level	
	301: Time out sending command to sample probe module	Stop level	Check the connection of the control line of the sample probe module; check whether the board matches with the program version.
	302: Time out sample probe module executing command	Stop level	
	401: Time out sending command to M1 module	Stop level	Check the connection of the control line of the sample mixer module; check whether the board matches with the program version.
	402: Time out M1 module executing command	Stop level	
	501: Time out sending command to M2 module	Stop level	Check the connection of the control line of the reagent mixer module; Check whether the board matches
	502: Time out M2 module	Stop level	

	executing command		with the program version.
	601: Time out sending command to reaction disk module	Stop level	Check the connection of the control line of the reaction disk module; check whether the board matches with the program version.
	602: Time out reaction disk module executing command	Stop level	
	701: Time out sending command to sample disk module	Stop level	Check the connection of the control line of the sample disk module; check whether the board matches with the program version.
	702: Time out sample disk module executing command	Stop level	
	801: Time out sending command to reagent disk module	Stop level	Check the connection of the control line of the reagent disk module; check whether the board matches with the program version.
	802: Time out reagent disk module executing command	Stop level	
	901: Time out sending command to automatic cleaning module	Stop level	Check the connection of the control line of the automatic cleaning module; Check whether the board matches with the program version.
	902: Time out automatic cleaning module executing command	Stop level	
	951: Time out sending command to temperature control module	Stop level	Check the connection of the control line of the temperature control module; Check whether the board matches with the program version.
	952: Time out temperature control module executing command	Stop level	
Sample Probe	1001: Command error	Stop level	Restart the instrument PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears,
	1002: Parameter error	Stop level	
	1003: Abnormality of self-check	Stop level	
	1004: Communication failure	Stop level	

	1005: Command cannot be executed normally	Stop level	contact the After Service Unit.
	1006: Abnormality of vertical movement (in test cuvette, not restored)	Stop level	Check whether the cover of the sample test rube is removed; Check whether the sample is missing in the sample cup; Check whether the covers of reaction disk and sample disk are closed; Check whether there is any foreign object on the movement trace of the sample probe; Check whether the appearance of the sample probe is normal; Check whether the positions of the sample probe are in the center; After the sample probe is vertically jacked up and loosened, check whether the sample probe can be reset freely.
	1007: Abnormality of vertical movement (in sample cup, not restored)	Pause level	
	1008: Abnormality of vertical movement (in cleaning pool, not restored)	Pause level	
	1009: Abnormality of vertical movement (in ISE sample application opening, not restored)	Pause level	
	1010: Abnormality of vertical movement (other positions, not restored)	Pause level	
	1011: Abnormality of vertical movement (restored)	Cancel level	
	1012: Vertical probe collision (not restored)	Stop level	
	1013: Vertical probe collision (restored)	Cancel level	
	1014: Vertical reset signal not detected	Stop level	Turn off the power supply of the analysis section, hold the rocker arm of the sample probe by hand, and move the sample probe to the intermediate height. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.

	1015: Abnormality of horizontal movement (not restored)	Pause level	Check whether there is any foreign object on the movement trace of the sample probe.
	1016: Abnormality of horizontal movement (restored)	Cancel level	
	1017: Horizontal probe collision (not restored)	Pause level	Check whether there is any foreign object on the movement trace of the sample probe.
	1018: Horizontal probe collision (restored)	Cancel level	
	1019: Horizontal reset signal not detected	Pause level	Turn off the power supply of the analysis section, hold the rocker arm of the sample probe by hand, and move the sample probe to above the cleaning pool. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	1020: Abnormality of syringe	Pause level	Open the front cabinet door of the machine to see whether the syringe is abnormal. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	1021: No liquid	Cancel level	Check, when the sample probe is being cleaned, whether the flow rate of the deionized water in the sample probe cleaning pool is normal; Check whether there is sufficient sample in the sample cup.
Reagent Probe 1	2001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches
	2002: Parameter error	Stop level	

	2003: Abnormality of self-check	Stop level	with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	2004: Communication failure	Stop level	
	2005: Command cannot be executed normally	Stop level	
	2006: Abnormality of vertical movement (in test cuvette, not restored)	Stop level	Check whether the reagent vial cover is opened; Check whether reagent is missing in the reagent vial; Check whether the covers of the reaction disk and reagent disk are closed; Check whether there is any foreign object on the movement trace of the reagent probe; Check whether the appearance of the sample probe is normal; Check whether the positions of the reagent probe are in the center; After the reagent probe is vertically jacked up and loosened, check whether the reagent probe can be reset freely.
	2007: Abnormality of vertical movement (in reagent vial, not restored)	Pause level	
	2008: Abnormality of vertical movement (in cleaning pool, not restored)	Pause level	
	2009: Abnormality of vertical movement (other positions, not restored)	Pause level	
	2010: Abnormality of vertical movement (restored)	Cancel level	
	2011: Vertical probe collision (not restored)	Stop level	
	2012: Vertical probe collision (restored)	Cancel level	
	2013: Vertical reset signal not detected	Stop level	Turn off the power supply of the analysis section, hold the rocker arm of the reagent probe by hand, and move the reagent probe to the intermediate height. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	2014: Abnormality of	Pause	Check whether there is any foreign

	horizontal movement (not restored)	level	object on the movement trace of the reagent probe.
	2015: Abnormality of horizontal movement (restored)	Cancel level	
	2016: Horizontal probe collision (not restored)	Pause level	Check whether there is any foreign object on the movement trace of the reagent probe.
	2017: Horizontal probe collision (restored)	Cancel level	
	2018: Horizontal reset signal not detected	Pause level	Turn off the power supply of the analysis section, hold the rocker arm of the reagent probe by hand, and move the reagent probe to above the cleaning pool. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	2019: Abnormality of syringe	Pause level	Open the front cabinet door of the machine to see whether the syringe is abnormal. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	2020: No liquid	Cancel level	Check, when the reagent probe is being cleaned, whether the flow rate of the deionized water in the reagent probe cleaning pool is normal; Check whether there is sufficient reagent in the reagent vial.
Reagent Probe 2	3001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the
	3002: Parameter error	Stop level	
	3003: Abnormality of self-	Stop level	

	check		instrument and software are restarted, the failure still appears, contact the After Service Unit.
	3004: Communication failure	Stop level	
	3005: Command cannot be executed normally	Stop level	
	3006: Abnormality of vertical movement (in test cuvette, not restored)	Stop level	Check whether the reagent vial cover is opened; Check whether reagent is missing in the reagent vial; Check whether the covers of the reaction disk and reagent disk are closed; Check whether there is any foreign object on the movement trace of the reagent probe; Check whether the appearance of the reagent probe is normal; Check whether the positions of the reagent probe are in the center; After the reagent probe is vertically jacked up and loosened, check whether the reagent probe can be reset freely.
	3007: Abnormality of vertical movement (in reagent vial, not restored)	Pause level	
	3008: Abnormality of vertical movement (in cleaning pool, not restored)	Pause level	
	3009: Abnormality of vertical movement (other positions, not restored)	Pause level	
	3010: Abnormality of vertical movement (restored)	Cancel level	
	3011: Vertical probe collision (not restored)	Stop level	
	3012: Vertical probe collision (restored)	Cancel level	
	3013: Vertical reset signal not detected	Stop level	Turn off the power supply of the analysis section, hold the rocker arm of the reagent probe by hand, and move the reagent probe to the intermediate height. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	3014: Abnormality of horizontal movement (not	Pause level	Check whether there is any foreign object on the movement trace of the

	restored)		reagent probe.
	3015: Abnormality of horizontal movement (restored)	Cancel level	
	3016: Horizontal probe collision (not restored)	Pause level	Check whether there is any foreign object on the movement trace of the reagent probe.
	3017: Horizontal probe collision (restored)	Cancel level	
	3018: Horizontal reset signal not detected	Pause level	Turn off the power supply of the analysis section, hold the rocker arm of the reagent probe by hand, and move the reagent probe to above the cleaning pool. Then turn on the power supply of the analysis section. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	3019: Abnormality of syringe	Stop level	Open the front cabinet door of the machine to see whether the syringe is abnormal. If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	3020: No liquid	Cancel level	Check, when the reagent probe is being cleaned, whether the flow rate of the deionized water in the reagent probe cleaning pool is normal; Check whether there is sufficient reagent in the reagent vial.
Sample Disk Unit	4001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are
	4002: Parameter error	Stop level	
	4003: Abnormality of self-check	Stop level	

	4004: Communication failure	Stop level	restarted, the failure still appears, contact the After Service Unit.
	4005: Command cannot be executed normally	Stop level	
	4006: Reset impossible	Pause level	
	4007: Lost step in movement	Pause level	
Reagent Disk Unit	5001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	5002: Parameter error	Stop level	
	5003: Abnormality of self-check	Stop level	
	5004: Communication failure	Stop level	
	5005: Command cannot be executed normally	Stop level	
	5006: Reset impossible	Pause level	
	5007: Lost step in movement	Pause level	
Reaction Disk Unit	6001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	6002: Parameter error	Stop level	
	6003: Abnormality of self-check	Stop level	
	6004: Communication failure	Stop level	
	6005: Command cannot be executed normally	Stop level	
	6006: Reset impossible	Pause level	
	6007: Lost step in movement	Pause level	
Sample Mixer	7001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears,
	7002: Parameter error	Stop level	
	7003: Abnormality of self-check	Stop level	
	7004: Communication failure	Stop level	

	7005: Command cannot be executed normally	Stop level	contact the After Service Unit.
	7006: Abnormality of vertical movement (in test cuvette, not restored)	Stop level	Check whether the cover of the reaction disk is closed; Check whether there is any foreign object on the movement trace of the mixer; Check whether the mixer is loose; Check whether the positions of the mixer are in the center.
	7007: Abnormality of vertical movement (in cleaning pool, not restored)	Pause level	
	7008: Abnormality of vertical movement (other positions, not restored)	Pause level	
	7009: Abnormality of vertical movement (restored)	Cancel level	
	7010: Vertical reset signal not detected	Stop level	If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	7011: Horizontal reset signal not detected	Pause level	
Reagent Mixer	8001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	8002: Parameter error	Stop level	
	8003: Abnormality of self-check	Stop level	
	8004: Communication failure	Stop level	
	8005: Command cannot be executed normally	Stop level	
	8006: Abnormality of vertical movement (in test cuvette, not restored)	Stop level	Check whether the cover of the reaction disk is closed; Check whether there is any foreign object on the movement trace of the mixer; Check whether the mixer is loose; Check whether the positions of the mixer are in the center.
	8007: Abnormality of vertical movement (in cleaning pool, not restored)	Pause level	
	8008: Abnormality of vertical movement (other positions, not restored)	Pause level	
	8009: Abnormality of vertical	Cancel	

	movement (restored)	level	
	8010: Vertical reset signal not detected	Stop level	If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	8011: Horizontal reset signal not detected	Pause level	
Automatic Cleaning Unit	9001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	9002: Parameter error	Stop level	
	9003: Abnormality of self-check	Stop level	
	9004: Communication failure	Stop level	
	9005: Command cannot be executed normally	Stop level	
	9006: Abnormality of vertical movement (not restored)	Stop level	Check whether the cover of the reaction disk is closed; Check whether there is any foreign object in the test cuvette; Check whether the position of the wiping head in the test cuvette is in the center. Check whether the bounced steel probe can be reset freely at the various stages of automatic cleaning.
	9007: Vertical collision	Stop level	
	9008: Abnormality of vertical movement (restored)	Cancel level	
	9009: Vertical reset signal not detected	Stop level	If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	9010: Abnormality in automatic cleaning of syringe	Pause level	If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
Temperature Control Unit	10001: Command error	Stop level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	10002: Parameter error	Stop level	
	10003: Abnormality of self-check	Stop level	
	10004: Communication failure	Stop level	
	10005: Command cannot be	Stop level	

	executed normally		
	10006: Overheat of reaction disk	Warning level	Turn off the instrument and contact the After Service Unit.
	10007: Abnormality of reaction disk temperature sensor	Warning level	
	10008: Overheat of cleanser	Warning level	
	10009: Abnormality of cleanser temperature sensor	Warning level	
	10010: Preheating temperature of reagent 1 too high	Warning level	
	10011: Abnormality of reagent 1 preheating temperature sensor	Warning level	
	10012: Preheating temperature of reagent 2 too high	Warning level	
	10013: Abnormality of reagent 2 preheating temperature sensor	Warning level	
	10014: Temperature fluctuation of reaction disk too big	Warning level	
	10015: Reaction disk temperature cannot become stable for too long	Warning level	
	10016: Abnormality of reagent cooling fan	Warning level	Check whether the cooling fan runs normally. If it is abnormal, turn off the instrument and contact the After Service Unit.
ISE Unit	11001: Command error	Restrict level	Restart the instrument and PC; Check whether the board matches with the program version; if, after the
	11002: Parameter error	Restrict	

		level	instrument and software are restarted, the failure still appears, contact the After Service Unit.
	11003: Abnormality of self-check	Restrict level	
	11004: Communication failure	Restrict level	
	11005: Command cannot be executed normally	Restrict level	
	11006: Na electrode slope exceeding standard range	Pause level	If, after recalibration, the failure still appears, check whether the electrode needs replacement or contact the After Service Unit.
	11007: K electrode slope exceeding standard range	Pause level	
	11008: Cl electrode slope exceeding standard range	Pause level	
	11009: Na electrode noise error	Pause level	
	11010: K electrode noise error	Pause level	
	11011: Cl electrode noise error	Pause level	
	11012: Noise error of all electrodes	Pause level	
	11013: Voltage drift error of Na electrode	Pause level	
	11014: Voltage drift error of K electrode	Pause level	
	11015: Voltage drift error of Cl electrode	Pause level	
	11016: Voltage drift error of all electrodes	Pause level	
	11013: Voltage overflow error of Na electrode	Cancel level	
	11014: Voltage overflow error of K electrode	Cancel level	
	11015: Voltage overflow error	Cancel	

	of Cl electrode	level	
	11016: Voltage overflow error of all electrodes	Cancel level	
	11017: Na electrode sample test exceeding measurement range	Cancel level	
	11018: K electrode sample test exceeding measurement range	Cancel level	
	11019: Cl electrode sample test exceeding measurement range	Cancel level	
	11020: Sample has air	Cancel level	Check whether there is air leakage in the tube of the sample probe; Check whether there is bubble in the sample or cleanser; If the same failure appears repeatedly, contact the After Service Unit.
	11021: Calibration solution A has air	Cancel level	
	11022: Calibration solution A has air	Cancel level	
	11023: Cleanser has air	Cancel level	
	11024: No liquid in tube	Cancel level	Check whether the pump module of ISE works normally; Check whether the pump line is damaged or loose.
	11025: Calibration failure	Cancel level	If, calibration failure still appears after repeated calibrations, check whether the ISE reagent is used up or out of date; Check whether the electrode needs replacement.
	11026: Calibration value storage error	Cancel level	Check whether the ISE reagent is used up; Check whether the ISE tube and peristaltic pump are normal; If, after the instrument and software are restarted, the failure still appears,
	11027: Failure of bubble detector	Restrict level	
	11028: Command execution error	Restrict level	

			contact the After Service Unit.
	11029: Reagent module does not exist	Restrict level	Check whether the ISE reagent pack is connected normally.
Sample Barcode Unit	12001: Command error	Restrict level	Restart the instrument and PC; Check whether the board matches with the program version; If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	12002: Parameter error	Restrict level	
	12003: Abnormality of self-check	Restrict level	
	12004: Communication failure	Restrict level	
	12005: Barcode check error	Cancel level	Check whether the sample barcode is affixed correctly; Check whether the barcode is stained; Check whether the sample barcode setup is correct.
	12006: Barcode information error	Cancel level	
Reagent Barcode Unit	13001: Command error	Restrict level	Restart the instrument and PC; Check whether the board matches with the program version; If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	13002: Parameter error	Restrict level	
	13003: Abnormality of self-check	Restrict level	
	13004: Communication failure	Restrict level	
	13005: Barcode check error	Cancel level	Check whether the reagent barcode is affixed correctly; Check whether the barcode is stained; Check whether the reagent barcode setup is correct.
	13006: Barcode information error	Cancel level	
Other Failures	14001: Photoelectric acquisition error	Stop level	Restart the instrument and PC; Check whether the board matches

	14002: Abnormality of photoelectric data	Stop level	with the program version; If, after the instrument and software are restarted, the failure still appears, contact the After Service Unit.
	14003 Abnormality of photoelectric acquisition communication	Stop level	
	14004: Cleanser insufficient	Warning level	Check whether the cleanser is sufficient and the tube is connected normally.
	14005: Deionized water insufficient	Warning level	Check whether the deionized water machine works normally and the reading of the pressure gauge is normal.
	14006: High concentration waste liquid full	Warning level	Empty the high concentration waste liquid.
	14007: Low concentration waste liquid full	Warning level	Empty the low concentration waste liquid.
Software System Failure	20001: Exceeding 4SD once	Warning level	Check whether the QC setup parameters are reasonable; Check whether the item setup parameters are correct; Check whether the QC sample is valid; Check whether the reagent is valid; Check whether the calibration results are accurate.
	20002: Exceeding 3SD once	Warning level	
	20003: Exceeding 2SD once	Warning level	
	20004: Two results in a row exceeding 2SD	Warning level	
	20005: Three results in a row exceeding 2SD	Warning level	
	20006: Five results in a row on one side of the target value	Warning level	
	20007: Seven results in a row on one side of the target value	Warning level	
	20008: Invalid calibration	Warning level	Check whether the standard setup parameters are correct; Check whether the item setup parameters are correct;

			Check whether the standard sample is valid; Check whether the reagent is valid.
	20009: Error saving data	Warning level	
	20010: Barcode same as barcode in another worksheet	Warning level	
	20011: Scanning failure. Error obtaining information from LIS system!	Warning level	
	20012: Scanning failure. Time out of LIS system's transmission!	Warning level	
	20013: Scanning failure. No corresponding sample information obtained!	Warning level	
	20014: Scanning failure. Abnormality of LIS system's information transmission!	Warning level	
	20015: Scanning failure. Test type not matching!	Warning level	
	20016: Scanning failure. Submission date format error. Judgment impossible!	Warning level	
	20017: Scanning failure. Submission date format error. Judgment impossible!	Warning level	
	20018: Scanning failure. Sample type cannot be judged!	Warning level	
	20019: Scanning failure. Sample type not matching with data dictionary. Judgment impossible!	Warning level	

	20020: Scanning failure. Profile number cannot be judged!	Warning level	
	20021: Scanning failure. Container type not matching!	Warning level	
	20022: Scanning failure. Total length of barcode not matching with system setup!	Warning level	
	20023: Scanning failure. Abnormality of barcode scanning!	Warning level	
	20024: Scanning failure. Item number type not matching!	Warning level	
	20025: Scanning failure. Reagent type cannot be judged!	Warning level	
	20026: Scanning failure. Reagent type > 4. Judgment impossible!	Warning level	
	20027: Scanning failure. Reagent vial type cannot be judged!	Warning level	
	20028: Scanning failure. Reagent vial type not matching with data dictionary. Judgment impossible!	Warning level	
	20029: Scanning failure. Expiry date format error. Judgment impossible!	Warning level	
	20030: Scanning failure. Expiry date format error. Judgment impossible!	Warning level	
	20031: Scanning failure. Item number not matching with item name!	Warning level	

	20032: Scanning failure. Reagent type information not matching with reagent setup of item!	Warning level	
	20033: Minimal volume detection failure!	Warning level	
	20034: Scanning failure. Item number and item name of this barcode does not exist in item setup!	Warning level	
	20035: Scanning failure. No reagent item information obtained!	Warning level	
	20036: Accumulation and out-of-control. Please find cause of out-of-control. After correction, clear cumulative sum in QC rule setup.	Warning level	

Chapter 8 Data Communication

LiDA500 supports the two-way data transmission function, that is, sample information and test results can be transmitted to the LIS server and sample application information can be obtained from the LIS server. TCP/IP connection is used for transmission. The data protocol is created according to HL7 2.3.1. For the detailed data transmission format, refer to the LIS Connector Manual.pdf.